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Integrated Sci-Tech :

The Interdisciplinary Research Approach

Volume 1

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Preface

This book is all about the interdisciplinary research that integrates engineering, life and applied sciences, medical and biomedical engineering, agriculture engineering and food sciences. The aim was to provide the initial roadmap at a cross section basic research, technological and social developments, processes development, applications integrity, and real-world usage. The genuine motivation for the book was to provide a suitable reference text for those who interested in the multi and inter disciplinary studies which might be beneficial for basic and advance researches, enhancing the curriculum and enriching teaching and learning materials, mostly in the level of postgraduate studies.

In addition, the book was also planned to provide advanced orientation and understanding for related industries and governments to looking across industrial partnerships, business strategic, and policy and regulations. In general, the book is expected to be beneficial for a wide range of readers.

This book consists of twenty five chapters divided into four sections i.e., engineering, life and applied sciences, medical and biomedical engineering, agriculture and food science. Each chapter is a completely self-directed contribution in chained discussion which aims to bring academia, researcher, practitioners and students rise to speed with the novel developments within the particular area.

In order to enhance the reader experience, each book chapter contains its own abstract, instruction, main body, as well as conclusion sections. Moreover, bibliography resources are available at the end of each chapter.

To achieve all these aims and goals, the book should deliver a breadth of information. We are pleased and thankful for all distinguish authors and reviewers for their contribution that have made this book possible. We do hope that you will enjoy this book and find it as a useful guide and reference.

Editorial board:

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SECTION 1 : ENGINEERING

Special Contribution

Interdisciplinary Research Activities on Disaster Prevention and Mitigation at Kobe University by Forming Collaboration COE

Prof. Atsushi Iizuka [1,a]
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Abstract. Disaster prevention and mitigation researches are essentially interdisciplinary and have to be practical. The ultimate objective of the researches is to protect lives and living spaces from natural hazards and their contents widely vary from scientific areas to social affairs; i.e. emergency disaster rescue and life-saving, evacuation, shelter, crisis management, damage estimation, victim care during recovery and reconstruction, resilient living infrastructure, industrial infrastructure, temporary housing and reconstruction residential development, disaster tolerant promotion, methods of volunteer support, disaster preparation, damage estimation, hazard maps, disaster prevention education and so forth. How can the linkage and cooperation be realized between them? How can they be made converge on the ultimate objective? Here, introduced is a trial made to achieve the interdisciplinary researches at the stage of the disaster prevention and mitigation COE at the Kobe University Research Center for Urban Safety and Security, which has been established through collaboration with AICS, JAMSTEC and E-Defense with cooperation from the Kobe City Office, the Hyogo Prefectural Government and Kobe Shimbun (newspaper publisher).

Keywords : disaster, prevention, mitigation

Mechanical Characterization of Cells Exposed to Mechanical Loading

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Abstract. Vascular endothelial cells in vivo are exposed to complex mechanical forces including fluid shear stress, cyclic stretch and hydrostatic pressure. These mechanical forces are important factors in endothelial cell remodeling. So far, a lot of efforts have been done to study the effects of mechanical stimuli on cell remodeling; however, little is still known of how mechanical forces are transmitted through cells to activate intracellular signaling cascades leading to alterations in cell functions. To further address this issue, it should be required to know intracellular mechanical environment including mechanical properties of subcellular structural components such as actin filaments, nucleus and so forth. The objective of this talk is to present recent findings related to cell biomechanics, introducing mechanical tests of cell body as well as intracellular organelles.

Analyses of Mobile Positioning Data

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Abstract. Progress in the field of information sources, their digitization, visualization and analytical data extraction makes possible to enhance data about society behavior, demographic characteristics, etc. Mobile devices apart from their main purpose to support and provide various applications to their users also in parallel generate a big amount of signaling data that reflect the devices' usage and movement in a network. Due to high penetration and massive usage of mobile devices, these devices become then a unique source of information describing the behavior of users in space and in time. Positioning data allows data owners (mobile operates) to develop and to provide new innovative services that can be used in decision-making processes. In this talk, we will discuss how mobile users can be classified and mapped into an area of interest based on mobile positioning data. Furthermore, a utilization of such data to detect people traveling in public transport like busses and trains, and to determine where people get on and get off will be outlined.

Keywords : mobile, positioning data

Chapter 1

The Utilization of Sorghum Rod Powder as Filler to Enchance Mechanical Strength In Bioplastics Synthesis

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Abstract. This research aimed to utilize sorghum as a filler rod using variations of sorghum starch-chitosan formulations-filler with 10 wt% glycerol as a plasticizer. The physical and mechanical characteristics of bioplastics then analyzed by using Low Density Polyethylene (LDPE) as a reference. Variation of sorghum starch-chitosan formulations used were 10:0, 9.5:0.5, 8.5:1.5, 7.5:2.5, 6.5:3.5 and 5.5:4.5 (w/w), variations of the addition of sorghum stem powder filler were 0.25:0.5:1 g with gelatinization temperature on 95 , stirring speed of 375 rpm and temperature drying in an oven was 60 for 11 hours. Starch granule was sieved in 63 micron and stirred for 35 minutes. The best conditions obtained by variation of formulation starch: chitosan 7.5:2.5 (g/g) with 0.25 g filler addition and best tensile strength test was13.9957 Kpa.

Keywords: bioplastic, filler, glycerol, modulus young, sorghum starch

I. Introduction

Bioplastic made from starch still has a low mechanical strength properties. When starch was combined with a filler, it will form a biocomposite, and will affect the properties of the composites formed [1]. The addition of filler from cassava powder was intended to produce the strengthen film and able to fill the air bubbles appear in the film [2].The filler would increase the mechanical strength of the starch. Rod sorghum is one of the materials that can be used as a filler which has a composition of sucrose (10 to 14.40% sorghum liquor), sugar reduction (0.75 to 1.35% sorghum liquor) and starch (209-1764 ppm [3]. Except the starch and the amplifier, glycerol was needed as a plasticizer which can increase the flexibility of bio-composites and produce bioplastic with optimal mechanical properties, morphology and biodegradability.

II. Materials and methods

A. Materials

The materials used in this research include: Sorghum flour, sorghum rod powder, Chitosan, Glycerol, distilled water, acetic acid. Analytical equipment used: Universal Testing Machine, digital calipers, and Fourier transform infrared spectroscopy (FTIR) brand Shimadzu 8400 to identify function groups.

B. Methods

This research was conducted to determine the effect of sorghum rod powder filler on the mechanical strength of bioplastics which will be analyzed. Where the ratio of starch and chitosan formulation is 10:0, 9.5:0.5, 8.5:1.5, 7.5:2.5, 6.5:3.5, and 5.5:4.5 (g/g).

While the addition of sorghum rod powder filler variation were 0.25, 0.5 and 1 (g). the speed of stirring used was 375 rpm. Glycerol concentration was 10% of the total dry weight from 10 grams of starch and chitosan, where the mixing stirring time was 35 minutes. After the stirring and mixing then followed by drying in an oven at 60°C for 11 hours. The particle size of starch granules and sorghum rod powder filler used was 63 micron sieve escaped.

1) *Preparation of sorghum starch*

First sorghum washed and drained. After that sorghum dried in the sun until its gain constant weight. Then it was grinded with a soybeans grinding machine to become a sorghum flour. Afterwards dried sorghum flour back with the oven until its weight was constant. The dried sorghum flour was sifted with 63 micron sieve size and packaged in plastic bags to prevent any fungus or lice.

2) *Preparation of sorghum rod powder*

At first, sorghum rod was heated on the sun so that the water content of sorghum rod constant. Later, chopped the sorghum rod then grinded with grinder machine [5]. After becoming powder, then sieved with a 63 micron sieve size and packaged in plastic bags to prevent any fungus or lice.

3) *Synthesis of bioplastics*

Step for synthesis of bioplastics in this research follow the method from Weiping Ban [4] as follows: a mass of starch and chitosan with a ratio of 7.5: 2.5 (g/g) and the addition of fillers with a variation of 0.25 grams weighed using digital scales. Starch solution and chitosan solution made by adding distilled water in accordance with the amount of volume that has been calculated on a separate measuring cup. Hot Plate was turned on and set the temperature at 60^{o}C, sorghum solution in a 500 ml measuring cup was placed inside the hot plate, then chitosan solution was added to sorghum solution, and sorghum rod powder filler. After the hot plate was turned on, heat starch sorghum-chitosan solution mixture in hot plate for 35 minutes, after that added glycerol to starch sorghum-chitosan solution. Afterwards, bioplastics solution lifted and moved to the top of hot plate. Temperature and speed of hot plate set according to which will be used, it is on the T gelatination = 95°C and the speed = 375 rpm. Then a magnetic stirrer was inserted into the solution and the hot plate was turned on. During stirring and heating the mixture, mixing temperature should be controlled at 95°C. After 35 minutes, the hot plate was turned off, a measuring cup containing the solution was removed from the hot plate, and then the solution was ignored a minute until reach the room temperature. Solution of 25 ml was poured into the mold, then placed it into an oven for drying at 60^{o}C for 11 hours. After drying in oven, the mold was removed and put into a desiccator (conditioned for 24 hours), after that, the plastic was released from the mold and stored in a zip lock bag, and plastic was ready to analyze. These steps were repeated for variations of comparison mass (g/g) sorghum starch to chitosan were 10: 0, 9.5: 0.5, 8.5: 1.5, 6.5: 3.5, 5.5: 4.5.

4) *Mechanical properties analysis*

Characteristics of the mechanical properties of a material was influenced by many factors, one of them was the ratio of starch-cellulose. Shown by the difference in the value of tensile strength, percent elongation, and Young's modulus which is diverge in every bioplastics. Sample of plastic film was tested by using Universal Testing Machine (UTM) INSTRON. The test was carried out by the standard of ASTM D 882-97 [6] and also test was executed at 23^{o}C, 50% humidity, and the cross head speed was 20 mm.min^{-1}.

5) *Water absorption analysis*

Bioplastic films water absorption test that conducted was refer to a method of making bioplastics [4].

6). *Density analysis*

By using a digital balance, weigh a mass, m (g) sample which will be tested. Then fill 5 ml of water and weighed sample into 10 ml measuring cup. After 15 minutes, note the new water volume (v). The actual plastic volume calculated by the difference between the final volume of water and its initial. Analysis of Function Groups by FTIR, samples iwas cut into small piece and crushed together with KBr until smooth to form pellets.

III. Results and Discussion

A. Result

Fig. 1. Shows the best results of bioplastic films which have physical and mechanical properties resemble wih conventional plastics LDPE (Low Density Polyethylene). The differences of structure, color, and level of mechanical strength on a sheet of bioplastics due to various factors, including the addition of a different filler ratio and imperfect stirring. The best conditions was obtained in starch: chitosan: filler formulation variations was 7.5: 2.5: 0.25 (g/g).

The test results of mechanical properties of bioplastics was shown in Table 1. Ratio starch-chitosan affects the characteristics of the bioplastic films, such as mechanical properties, physical properties, and biodegradability, so these need tests, and it aimed to get optimum conditions in the synthesis of bioplastics which resembles LDPE (Low Density Polyethylene). Testing of mechanical properties consist of tensile strength test, elongation, and Young's modulus. Testing of the physical properties consist of density test and solubility test, and other testing against bioplastic films such as FTIR.

Fig. 1. Bioplastic with ratio starch-chitosan-filler formulation7,5 : 2,5 : 0,25 (g/g).

Table 1. Result of Research Data Tabulation

Ratio of Starch: Chitosan: Filler (g/g)	Water Absorption (%)	ρ (g/mL)	Tensile Strength (kPa)	Elongation (%)	Young's Modulus (kPa)
10:0:0,25	11,11	0,389	0	0	0
9,5 : 0,5 :0,25	61,53	0,248	0,4675	11,75	3,97
8,5:1,5:0,25	79,61	0,468	4,4343	18,82	23,55
7,5:2,5:0,25	83,67	0,291	13,9957	10,8	129,36
6,5:3,5:0,25	89,33	0,254	11,4612	20,6	55,61
5,5:4,5:0,25	48,75	0,478	8,5285	8,59	99,26
Standard of LDPE [6]		0,9	$6{,}89 \times 10^3$-$24{,}13 \times 10^3$	225-600	$10^5 – 2{,}5 \times 10^5$

B. *Effect of starch-chitosan formulation and filler on mechanical properties of bioplastics*

In Fig. 2, It can be seen the influence of the ratio of starch-chitosan-filler to the tensile strength bioplastic films. Tensile strength is one of the test to determine the maximum stress of a material. The highest tensile strength values in the variation of starch-chitosan formulations and filler at 7.5: 2.5: 0.25 (g/g) is 13.9957 Kpa.

It can be deduced that with the addition of chitosan will be able to increase the tensile strength values in the sample of bioplastics. This is based on that the more chitosan given so that the better affinity which causes the chemical bonds of bioplastics increasingly strong and difficult to cut because it requires large energy to break the bond [4].

There is also a factor that can affect the value of tensile strength of bioplastic sample, it is sorghum rod powder filler. In this research, the tensile strength is affected by the starch-chitosan formulations and filler. The strong intermolecular forces in chitosan makes it difficult to interact with other components.

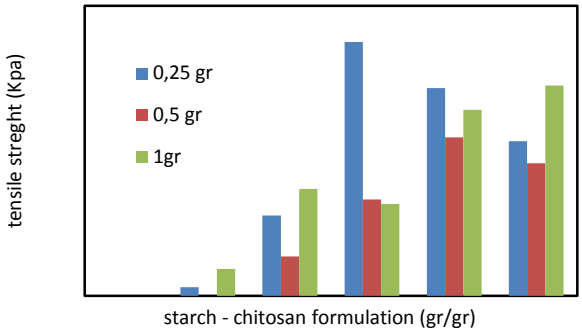

Fig. 2. The relationship between variation of starch: chitosan (g/g) and tensile strength of bioplastic with filler 0,25; 0,5; 1 gr.

Besides the combination of chitosan to starch are limited because chitosan is difficult to spread (dispersed), so that in addition of a lot of chitosan to the bioplastics solution, the value of tensile strength decreased due to the stronger intermolecular forces in chitosan makes it difficult to interact with other components.
Bioplastics which are made does not have the standards of LDPE tensile strength values. Percent extension is part of the mechanical properties which indicates elasticity or tenacity of a material when it is pulled up to break. Fig. 3 shows the effect of chitosan concentration against strains or percent extension of bioplastic films.

Based on the image, there is the best value of percent extension in the formulation 7.5: 2.5: 0.25 (g/g) with a value is 10.8%. It can be concluded that there are many factors that affect the value of the percent extension of bioplastics sample. One of them is the addition of chitosan factor which is proportional to the percent extension of the bioplastics sample.

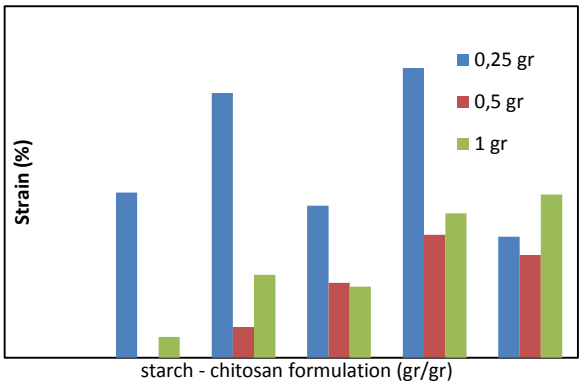

Fig. 3. The relationship between Variation of Starch : Chitosan (g/g) and strain of Bioplastic with filler 0,25; 0,5; 1 gr.

Young's modulus is obtained from the ratio between the tensile strength toward the percent extension (elongation at break). Young's modulus is often said as the size of the stiffness of a material.

Based on the Fig.3, It can be seen that the highest value for the Young's modulus is in the formulation of starch-chitosan-filler 7.5: 2.5: 0.25 (g/g) with a value is 129.36 kPa. Young's modulus values are vary greatly with the increase or decrease value by the formulation.

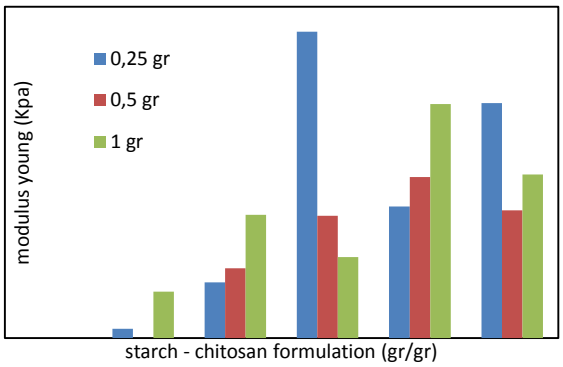

Fig. 4. The relationship between variation of starch: chitosan (g/g) and *Young's Modulus* of bioplastic with filler 0,25; 0,5; 1 gr.

C. *Effect of starch-chitosan formulation and filler on Physical Properties* of *Bioplastics*

The physical properties are properties that can be seen from the results and can change, for example, density, viscosity, and others. Physical properties test aim to determine the value of bioplastics solubility in water and the density of the bioplastics sample which is produced.

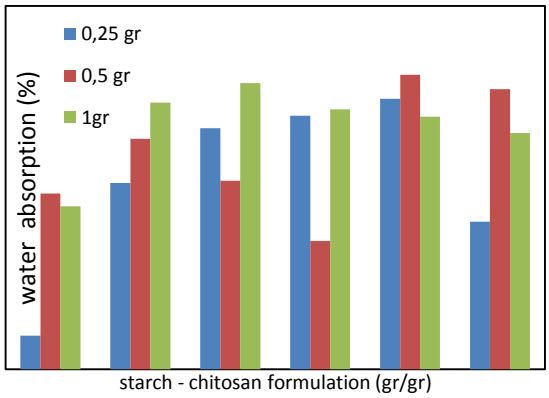

Fig. 5. . The relationship between ratio of starch : chitosan (g/g) and filler on water absorption of bioplastics

Based on Fig. 5, it can be seen that the best conditions on the water resistance test is in the formulation of starch-chitosan-filler at 6.5: 3.5: 0.25 (g/g) obtained in value at 89.33%. While for the value of the water resistance test that produces some water absorption is on starch-chitosan-filler formulations at 10:0:0.25 (g/g) obtained a value at 11.11%.

It can be concluded that the factors causing the high quality value of bioplastics sample against water absorption caused by the components. Chitosan with its hydrophobic characteristic is capable to give a great influence because they do not like water so it can modify the starch by grafting process or transplanting chitosan molecules into the starch molecules so chitosan is able to reduce the starch because of the hydrophilic characteristic.

Therefore the more chitosan given so the strength of bioplastic sample for absorption value will increase. Besides the addition of filler in the fabrication of bioplastic sample formulations are also able to affect the strength of the samples in the water absorption. Value test of the water resistance will increase along with adding the filler. In other cases, the addition of filler does not always increase the value of water resistance of

bioplastic sample. There is also the fact that with the addition of filler then the value of the water resistance is reduced. It is based on other factors, for example in the process of drying in the oven, where sometimes there are technical problem that the death of the electrical energy from PLN's channel. It has consequences in drying the bioplastics samples which are uneven so the initial sample weight will be different from other bioplastics sample.

Density (mass/volume) is the physical properties of a polymer. The more tightly a material, the better mechanical properties where the plastic film which is produced has a good tensile strength. This bioplastic density was determined using the increasing of fluid in the measuring cup. Effect of chitosan concentration on the density can be seen in Fig. 7.

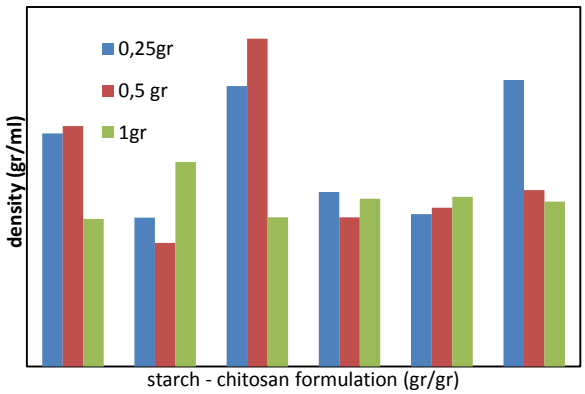

Fig. 6. The relationship between variation of starch: chitosan (g/g) and filler on density of bioplastics

Based on Fig. 6, it can be seen that there are the best conditions obtained from a density test ofbioplastics sample. Best condition on the formulation of starch-chitosan-filler are 7.5:2.5:0.25 (g/g) with values obtained at 0.291 (g/ml). From the result is density test of a bioplastics sample can be concluded that there are various factors in influencing the density of a bioplastics sample. This is based on the more dense molecular structure of the material, it will be stronger.

D. *Fourier Transfer Infra-Red (FTIR) analysis*

Based on the results of functional groups bioplastic samples test at various ratios of starch-chitosan, obtained the information several peaks appear. The emergence of a lot of peak indicates that in bioplastics there are many types of functional groups. Based on IR spectra bioplastics formulation of starch-chitosan-filler 7.5:2.5:0.25 (g/g) there is also a hydroxyl group (-OH) on the absorption area from 3567.04 to 3446.79 cm^{-1}, this group shows the breaking point. There is a group (C-OH) the absorption area is at 1078.02 cm^{-1} and there is also a amide group (C=0) the absorption area is from 1651.42 to 1561.43 cm^{-1}. And to the lowest point at 779.63 cm^{-1} the absorption area is phenyl group. The difference lies in the lowest point that there are group (C-Cl) for the variation of 10:0: 0.25 and phenyl group for variation of 7.5: 2.5: 0.25.

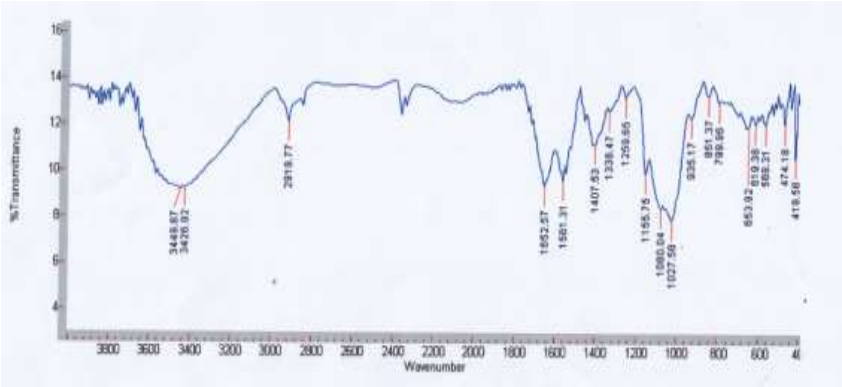

Fig. 7. Bioplastic FTIR Spectrum with Ratio Starch-Chitosan-Filler 6,5 : 2,5 : 0,5 (g/g)

IV. Conclusions

Characteristic of bioplastic that have resembled with LDPE is obtained on the starch: chitosan formulation variations 7,5 : 2,5 (g/g) with the addition of 0,25 g filler. The best tensile strength as mechanical strength characteristic of bioplastic film is 13,9957 Kpa.

List of Notation

Sym.	Definition	Unit
τ	Tensile Strength	MPa
F_{max}	Maximum Strain	N
A	Wide of Surface	(mm^2)
ε	Percent Elongation	%
L_1	Length of Bio Film	mm
L_0	Initial Length Film	mm
σ	Tensile Strength	MPa
W	Sample Weight	G
W_0	Int. Sample Weight	G
ρ	Density	g/ml
m	Sample Mass	g
v	Volume	ml

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Chapter 2

Radiometric Correlation to Sulphur and Iron Content at BM-179 Kalan-West Kalimantan Uranium Ore

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Abstract. The research aims to determine the correlation radiometeric against sulphur and iron content and its association with uranium content of BM-179-Kalan-West Kalimantan's uranium ore. The sample selection method using a ROS tool–NF-SPP; enrichment of sulfide minerals using flotation preparation; Iron content determination using with AAS-Spectr-AA-20(λ=248.3 nm) analysis; uranium content through spectral uranyl-Br-PADAP (λ=574 nm) analysis; sulphur content determined by ESCHKA modification method. Results of the study is a linear correlation between the radiometric uranium content to follow the equation y_1=3,5408x+1867.3; sulphur content decreased with radiometric increasing with the equation y_1=-0,8345x+18926; iron content decrease to radiometric increase with the equation y_2=-1,351x+31261. Increased sulphur content followed by iron content increase with trendline y_1 = 1,3175x2 + 5601. The results can be found that the ore will have a high uranium content with a minimum sulphur content in radiometric ≥ 4000 cps, and a high uranium content with a minimum iron content at radiometric ≥ 6000 cps.

Keywords: BM-179-Kalan uranium ore, ESCHKA, radiometric correlation, iron, sulphur.

I. Introduction

BM-179 uranium ore is an ore sampel from the tunnel at a depth of 179 meters that are in Kalan, Ela Sub-district, Melawi District, West Kalimantan Province. The ore is precisely located in the hill Eko-remaja sector. To reach this location can be reached by air or land as far as ± 500 km to the East from Pontianak to Nanga Pinoh City, followed by ground vehicle through the timber company road along ± 70 km to the south.

Uranium ore from the Eko-Remaja-Kalan sector is still not used by the Indonesian government for various purposes related to energy, whereas in this sector have a high enough uranium reserves with a reserve of about more than 12409 tonnes of U_3O_8 [17].

BATAN has made exploration tunnel along the 618 meters at the Eko-remaja sector for the purposes of research and development of nuclear energy. BATAN has succeeded in processing BM-179 ores becomes "yellow cake" (U_3O_8) at various stages of processing, starting from the physical preparation, leaching, solid-liquid separation, purification and precipitation.

Uranium deposits in the BM-179 Eko-remaja-Kalan ore contain minerals other than uranium (uraninite, Branerit. Davindit and Gummit), still contain other minerals association such as pyrite, pirholit, kalkoporit, cobaltite, lollingit, pentlandite, gerdorsfit, saflorit, sphalerite, molybdenite, ilmenite, magnetite and chlorite [16] in it contains many minerals sulfide [17] and elements of economic value in addition to uranium metal such as transition metals. In addition, the amount of sulfide minerals in the Eko-remaja ore also can be used as byproducts that can be a source of efficiency in the processing of uranium. Through physical preparation methods with ROS (radiometric ore sorting) can be assumed to be used to separate the high sulfide mineral ores and containing high-grade uranium ore. High grade sulphide ore with sulfide enrichment through flotation method of preparation, may be followed to create sulphuric acid that is used to reduce acid consumption in the leaching stage at uranium production.

Research related to the physical chemistry characteristics of the transition and sulfide elements present in the BM-179 Kalan-West Kalimantan uranium ore has not been widely known and yet to be published. Therefore, this study was intended to determine the radiometric correlation against sulphur and iron content and its relevance to the content of uranium in BM-179 Kalan-West Kalimantan uranium ore.

By knowing the correlation between the elements content present in the BM-179 Kalan uranium ore, the next benefit of the data results obtained can be used to assist decision-making related to uranium exploration in Kalan-West Kalimantan and streamline all phases of exploration and exploitation activities in the future.

Implementation of this study to analyze and find correlation to the content of potential elements such as uranium, iron and sulfide through ROS (radiometric ore sorting) on BM-179 Eko-remaja Kalan West Kalimantan uranium ore.

The method used for the sample selection used ROS (radiometric ore sorting) by means of SPP-NF, for the enrichment of sulphide mineral conducted with flotation preparation method, to determine the iron element content is analyzed by atomic absorption spectroscpy (AAS) method, and to observe the uranium content used spectrophotometers, as well as for the sulphur content determination is used gravimetric method.

II. Procedure

2.1. Equipment and material experiment

The equipment used is a furnace, metal / glass pipe / heat-resistant rubber, condenser, thermometer, oven, ph-meters, glassware (test tube, beaker Glass, measuring cup, erlenmeyer, pipette, etc.), heater, grandsaw, jaw crusher, disk milk, mortar grinder, -65 mesh sieve, flotation apparatus, goach cup, spectrophotometers, AAS.

Materials used are examples of BM-179-Eko remaja-Kalan uranium ore, oxygen gas, pure sulphur, litmus paper, Whatman filter paper # 42, ascorbic acid, triethanolamine, ethyl xantat 10%, NKY-SNB, fine oil , coarse filter paper, asbestos, methyl isobutyl ketone, HNO_3, concentrated sulphuric acid, TOPO, $Fe_2 (SO_4)_3$, U_3O_8 and H_2O_2, amyl xanthat, Na_2CO_3, ZnO, $BaCl_2$ 10%, 2,5N KOH, HNO_3 (6: 1), HF concentrated, universal litmus paper, alcohol, 2.5 N HNO_3, ascorbic acid 5%, 2% NaF, Br-Padap 0.05%, concentrated $HClO_4$, HCl (1: 1), the standard elements of the brand Titrisol (U, Fe), asetilene.

1) Flotation preparation: A total of 500 grams of BM-179 ore with mesh size 65, added water to produce pulp percent solid 30%, included in the German Wedag flotation tool using rpm 1400. Pulp stirred while at pH 8 with 10% sodium carbonate. Furthermore added promother xanthat reagent much as 0.15 mL Ana amyl and fronther pine oil as much as 0.05 mL and left stirred for 5 minutes. Float concentrate separated carefully at the reservoir. The time of separation is done 10 minutes. Furthermore, the concentrate was filtered, the solids are heated in an oven and weighed and analyzed further.

2) Sample Preparation: A sample is analyzed are BM-179 ores with radiometric <150 cps, 150-500 cps, 500-1000 cps, 1500-3000 cps, 3000-5000 cps, and 5000-15000 cps. Examples with each radiometric weighed as much as 1 gram, put in a Teflon beaker, added 12 mL HNO_3 for 30 minutes (do not boil) with a hot plate on 200^oC temperature, left 5 minutes, the solution was removed, added another 12 mL HF concentrated and 4 mL $HClO_4$ concentrated, evaporated to dryness. The solution was removed and allowed to cool, added another 4 mL $HClO_4$ concentrated, heated to dry. Furthermore, the temperature is lowered to approximately 100 °C and added 4 ml of HCl (1: 1) and 10 mL distilled water, heated on a hot plate until solved. The solution was put in a 100 mL volumetric flask is diluted with distilled water, pipette 1 ml is inserted in a flask of 100 ml from 100 mL sample solution, added 2 ml HCl concentrated, added 10 mL 10% $CsCl_2$, diluted with distilled water to mark a line on each radiometric to be measured by AAS.

2.2. Iron analysis using an atomic absorption spectroscpy

1) Preparation of standard solution: Fe standard solution is made of standard elements Titrisol brands. Standard Fe dissolved in 1000 mL volumetric flask with distilled water.

2) Analysis of iron: Created standar solution series in 0; 0.5; 1; 2; and 5 ppm of iron standard solution parent, measured by AAS Varian Spectr AA-20 Plus using Fe lamp

56-100027-00 No.JT574 series, photomultiflier 421.8 volts, the wavelength of 248.3 nm, slit width of 0.2 nm , flate-asetilene air, asitilene flow of 1.5 L / min with a flame oxidation.

2.3. Product Specification and Controls

1) Preparation of solution: (a) TOPO weighed 19.28 grams of TOPO dissolved in Cyclohexane, diluted to 1 liter, so get 0.05 M TOPO solution; (b) 5% solution of ascorbic acid; (c) Complex solution I: 25 grams titriplex IV, 5 grams NaF and 65 grams sulfosalicilat acid dissolved in 800 ml of distilled water while stirring. Added NaOH solution is added gradually until pH = 8.35, then the solution is diluted to 1000 ml with aquadees; (d) Solution Complex II. One part of complex solution diluted with one part distilled water, then the pH is set to be 8.35 with 40% NaOH; (e) buffer solution pH=8.35: as much as 149 grams (134.04 ml) of triethanolamine dissolved in 800 ml of distilled water, neutralized with $HClO_4$ to pH 8.35 and kept overnight, next day pH was adjusted back to 8.35 with $HClO_4$, diluted with distilled water to 1 liter; (f) Br-Padap 0.05%: Br-Padap 0.5 grams dissolved in one liter of alcohol.

2) Analysis of Uranium: (a) Weighed 2 g sample of ore that has been finely ground, put in a teflon beaker. Added 30 ml $HClO_4$ + HNO_3 (6: 1), and concentrated HF. The solution was slowly heated on a hot plate for 1 hour while closed. Then dried at temperature 250 °C to form a paste. Paste dissolved with 2.5 N HNO_3, put in a 50 mL volumetric flask; (b) 1 mL pipette inserted into the shake flask, added 2 mL 5% ascorbic acid, 2 mL 2% NaF and 5 mL of 0.05 N TOPO. The mixture was shaken for 2 minutes, then allowed 5 minutes to separate the organic phase from the aqueous phase well; (c) pipette 2 ml of the organic phase, put in a 25 mL volumetric flask, then added 1 ml solution of complex II, 1 ml of buffer solution pH 8.35, and 2 ml of Br-Padap 0.05%. At each addition of the reagent, the solution was shaken well. After 10 minutes, added alcohol so that the solution exactly 25 mL. Uranyl spectrum-Br-Padap measured with a spectrophotometer at a wavelength of 574 nm, blank worked as an example.

2.4. Sulphur Determination by the modification ESCHKA method

Weighed 1 g sintering reactant (a mixture of Na_2CO_3 and ZnO ratio of 3: 2) inserted into an empty porcelain cup. Weighed 2 g ore sample was mixed with 15 g of sintering reagent, then insert it into the cup that has been filled sintering reagent. Added another 2 g of a mixture of sintering sprinkled on the sample in the cup.. The cup is closed, then heated in a furnace at a temperature 800 ° C for 2 hours. Once cool, put in a glass beaker containing distilled water approximately 200 mL and then heated to boiling approximately 10 minutes. The solution is filtered, the residue washed with hot water several times so that the volume of approximately 400 mL. Filtrate added with concentrated HCl dropwise until the CO_2 depleted, then added HCl excess. The solution is heated to approximately 350 mL. Added 15 mL of 10% $BaCl_2$ while stirring to form a precipitate, sediment left overnight. The precipitate is filtered with Whatman filter paper No. 42, subsequently burnt at 800 °C.

III. Equations

Absorbance was measured using Atomic Absorption Spectroscopy using the equation:

$$A = -\log T \quad (1)$$

Where

A = Absorbance
T = Transmission

Beer's law states that the absorbance is directly proportional to the thick solution

$$-\int_{Io}^{I} \frac{dI}{I} = \int_{0}^{n} \frac{dS}{S} \quad (2)$$

Where

I = Reduction intensity
S = cross-sectional area that absorbs particles

Absorptivity and molar absorptivity measured by the equation:

$$A = \varepsilon * b. * c \quad (3)$$

Where:

A = Absorbance
ε = constant absorption
b = bold solution
c = concentration of the solution

In the settlement equation using non-homogeneous linear equation:

$$a1x1 + ... + akxk = b \quad (4)$$

With a1, ... , ak value of R, to be able to determine menentukan x1, ... , xk with values of R, and, if present, will give an answer. The results are obtained if b belongs to the ideal value generated by a1.

Sulphur content can be obtained from the determination of the weight of $BaSO_4$ prior with ESCHKA modification method, further calculations are:

Contents of $(SO_4)_2$- (in %) = [($(SO_4)_2$- / $BaSO_4$) x Weight $BaSO_4$ x 100%] / Heavy example.

Contents of S (in %) = [Weight Atom S / Molecular Weight $(SO_4)_2$-] x % $(SO_4)_2$- (5)

IV. Results and Discussion

The content of sulphur and iron elemental in BM-179 Eko-remaja ore is a major potential element in addition to the uranium. Analysis results of the lowest radiometric elemental average for 75 cps sulphur content was obtained 23452 ppm and an iron content is 40309.6 ppm whereas the uranium content is 470 ppm, whereas for the highest radiometric average of 10000 cps was obtained at sulphur content is 11450 ppm, the iron content is 18489,2 ppm, while the uranium content obtained for 35842 ppm.

The results showed that the higher the radiometric of BM-179 Kalan ore have greater uranium content, while the sulphur and iron content showed that the higher the radiometric BM-179 ore containing lower sulphur and iron content.

Such correlations can be presented in Figure 1 where the x-axis is the uranium content and the y-axis is the sulphur and Iron content.

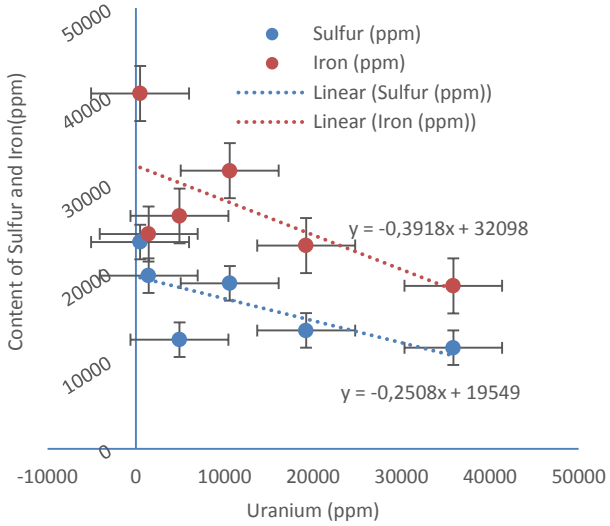

Fig 1. Graph uranium content of the sulphur and iron in BM-179 Kalan-West Kalimantan uranium ore

Figure 1 shows that the rise in uranium content will be followed by a decrease in sulphur and iron with trendline follow linear line equation y1 = -0,3918x + 32098, where $y_1$zz is the iron content and x is uranium content with a constant of iron content is 32098 ppm, whereas for the content sulphur follow trendline follow linear line equation y_2 = -0,2508x + 17328, where y_2 is sulphur and x is uranium content with the constant of sulphur content is 19549 ppm.

Correlation between sulphur and iron content in BM-179 Kalan West Kalimantan uranium ore show the relationship is directly proportional, meaning that the higher sulphur content and the higher the iron content contained in the ore. The relationship between sulphur and iron can be presented as Figure 2.

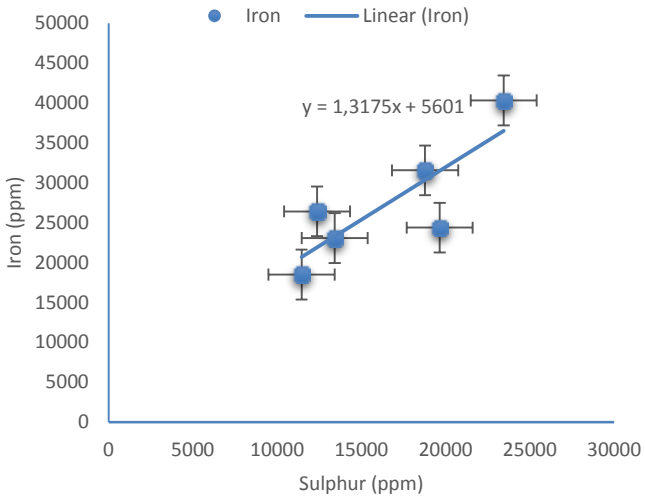

Fig 2. The sulphur content correlation of the iron content in the BM-179 Kalan West Kalimantan uranium ore

Figure 2 shows that the higher sulphur content will be followed by an increase in iron content by following the trendline linear line equation follows $y_1 = 1{,}3175x_2 + 5601$, where y_1 is the iron content and x_2 is the sulphur content, with constant of iron concentration is 5601 ppm.

The linear equation indicates that, in the BM-179 Kalan West Kalimantan uranium ore has a tendency relationship between the sulphur and iron content is the iron content has 1.3175 times larger than the content of sulphur. This indication may give the hypothesis that the BM-179 uranium ore has an iron compound which is quite high. There are many possibilities existing iron compounds, in addition to combining with sulphur to form

pyrite and iron (II) sulfide, can also form oxides in the form of hematite, limonite and magnetite, or to form carbonate compounds such as siderite, but it can form compounds such as silicates like taconit. Existing sulphur compounds can also be fused with uranium to form uranyl disulfide.

Radiometric relations with uranium content, sulphur and iron can be presented as Figure 3 below.

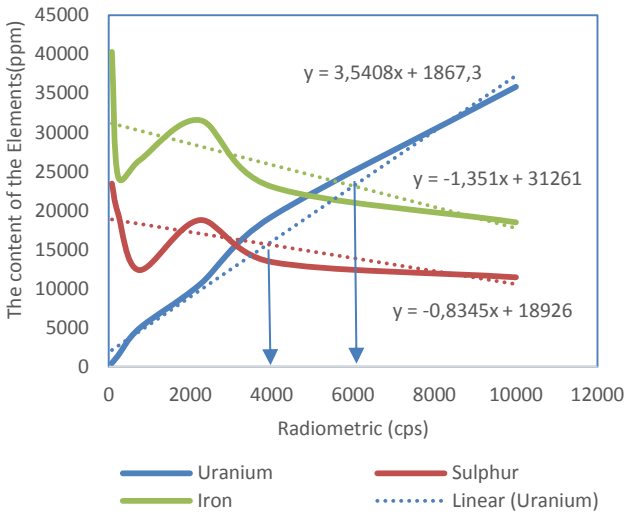

Figure 3. Graph relations of radiometric (cps) with a content of uranium, with sulphur and iron, and with sulphur and uranium.

Figure 3 shows that the content of uranium radiometric direct proportion to the equation y = 3,5408x + 1867.3, where y is the content of uranium and x is large radiometric, the higher radiometric information will be higher levels of uranium. Sulphur content follows the equation y=-0,8345x + 18926 against radiometric number, the higher radiometric provide information that will be even lower sulphur content. And Iron content to follow the equation y = -1,351x + 31 261 to the number of radiometric, meaning that the higher radiometric provide more information to low iron content. Figure 3 also provides information that intercept uranium and sulphur content shown on radiometric 4000 cps, so as to obtain a high uranium content in BM-179 Kalan West Kalimantan ores to minimize sulphur is at radiometric greater than or equal to 4000 cps. Intercept between uranium and iron content shown on radiometric 6000 cps, so as to obtain a high uranium content in the BM-179 Kalan West Kalimantan ore with an iron lies in the radiometric far greater than or equal to 6000 cps.

Please refer to the equations, tables and figures are as follows: (1) Equation (1), an excerpt made in accordance reference [1]; (2) Equation (2), an excerpt made in accordance references [2] - [4]; (3) Equation (3), an excerpt made in accordance reference [4] - [7]; (4) Equation (4), quotations in accordance with references [8]; (5) Equation (5), an excerpt made in accordance with references [1]; (6) Figure 1, Figure 2 and Figure 3, an excerpt made in accordance reference [8] - [17]; and (7) Table 1, an excerpt made in accordance references: [1] - [11].

V. Conclusion

The higher radiometric of BM-179 Kalan West Kalimantan uranium ore showed increased levels of uranium, therefore radiometric of BM-179 is directly proportional to the uranium content follows the equation y = 3,5408x + 1867.3, where y is the content of uranium and x is large radiometric.

The lower the sulphur content with increasing radiometric follow the equation y = -0,8345x + 18926. The iron content reduction of the radiometric will follow the equation y=-1,351x + 31261. The higher sulphur will be followed by an increase in iron content by following linear trendline equation $y_1 = 1,3175x_2 + 5601$, where y_1 is the iron content and x_2 is the content of sulphur, with constant iron content is 5601 ppm.

High uranium content in BM-179 Kalan West Kalimantan ores with to minimize sulphur is at radiometric greater than or equal to 4000 cps, high uranium content to minimize iron can be obtained at radiometric greater than or equal to 6000 cps.

Apendix

Appendix of results radiometric data of the analysis correlation with uranium, sulphur and iron content in bm-179 kalan west kalimantan uranium ore

The elements are analyzed in this study are the elements that are considered potential of major mineral include: sulfur, iron and uranium. Data analysis has been done may look like Table 1. Appendix A.

Table 1. Appendix A. The results of radiometric data and the uranium content, sulphur and iron in BM-179 Kalan-West Kalimantan ore

No	Central point Radiometric (cps)	Uranium (ppm)	Sulphur (ppm)	Besi (ppm)
1	75	470	23452	40309,6
2	225	1421	19648	24374,6
3	750	4919	12373	26413,7
4	2250	10595	18781	31552,3
5	4000	19213	13413	23055,7
6	10000	35842	11450	18489,2

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Chapter 3

Masterplan Road Network in the Border Region of Nunukan Regency of the North Kalimantan Province

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Abstract. The formation of the North Kalimantan Province especially Nunukan Regency, as one of the efforts in organizing the regional solutions in order to optimize the public service because it can shorten the span of control of the Government, making it more efficient and effective. Based on this, the need for adequate of traffic infrastructure andfacilities are necessary. The infrastructure and facilities in the form of network access roads and bridges in the whole transport system. Road and bridge infrastructure are essential for the realization of national development activities that support the development of production and services. It also support the development of a region to realize the harmony of region growth, urban and rural holistically organized, environmentally sustainable, and empower communities.

Keywords: Master Plan, Roads, Bridges, Nunukan, North Kalimantan

I. Introduction

Transportation is fundamental to economic development and the development of society and the growth of industrialization. With the transportation led to specialization or division of labor according to the expertise in accordance with the culture, customs and culture of a nation or the region. Where the road network is an important tool in the implementation of the transport. In line with the growth and development, then a region will not be separated from the presence of the transport sector which is the main supporter of the movement of people and goods, so the need for transport will be increased. The transport sector is the most important sector in the life of society and become the backbone of a country's economy in general.

One of the key elements in implementing transportation is the availability of good road network infrastructure and meet the development of the movement of people and goods, in particular in the province of North Kalimantan. The North Kalimantan province with an area of whole ± 75.467.70 km^2 and a total population of approximately 622.350 inhabitants has a network of road infrastructure that hasn't been fullest in optimizing public services especially in rural and border areas. Coupled with the general condition of the economy of Indonesia in the border region, among others, as follows:

a. Relatively isolated location (remote) with a low level of accessibility
b. Low levels of education and public health
c. The low level of socio-economic welfare of society border area (the number of poor and underdeveloped villages)
d. The scarcity of information about government and community development in the border areas

Condition of the territory

North Kalimantan Province is divided into five administrative regions consist of 1 (one) and 4 (four) districts, which are: Tarakan City, Bulungan Regency, Malinau Regency, Nunukan Regency, and Tana Tidung Regency originally was part of the province of East Kalimantan. Tanjung Selor is the capital city of North Kalimantan Province.

The formation of the province aims to encourage increased services in the areas of governance, development, community, as well as shortening the span of control in the Government especially in the area of the northern border. Expected also in the presence Of North Kalimantan Province can improve the economy of the North Kalimantan residents residing near the borders with neighbouring countries.

Geographically the province borders the countries of North Kalimantan Province Malaysia Sabah (North); West Kutai Regency, East Kutai, Kutai Kartanegara, and Berau (South); The Celebes Sea (East); and some parts of Borneo Malaysia Country Part (West). The area is also located in national and international cruise lines (Indonesia Islands/Sea Groove Archipelagic Sealand Passage) and exit (outlet) to the Asia-Pacific region. In geostrategic, North Kalimantan Provinve was the open gates to Malaysia (Sabah), Southern Philippines, and Brunei Darussalam.

At the time of Regional Expansion on 25 October 2012 by Regulation No. 20/2012, North Kalimantan Province has 38 subdistrictscomprising :

1) Tarakan City (4 sub-districts)
2) Malinau Regency (12 sub-districts)
3) Bulungan Regency (10 sub-districts)
4) Tana Tidung Regency (3 sub-districts)
5) Nunukan Regency (9 sub-districts)

During the period of ±1 (one) year until October 2013, the number of sub-districts undergoing expansion to 47 sub-districts, consisting of:

1) Tarakan City (4 sub-districts)
2) Malinau Regency (15 sub-districts)
3) Bulungan Regency (10 sub-districts)
4) TanaTidung Regency (3 sub-districts)
5) Nunukan Regency (15 sub-districts)

The North Kalimantan province has 2 (two) sub-districts bordering neighboring countries, North of Sabah (Malaysia) to the West, some parts of Borneo (Malaysia). The North Kalimantan area on 2 (two) of border districts namely 56.884,38 km2 comprises the area of the Malinau Regency 42.620,70 km2, and Nunukan Regency with a land area of 14.263,68 km2. Border area of Malinau 26.875, 03 km2 or 63,05% of the Malinau Regency, and the broad border area of Nunukan 10.928,78 km^2 or 76,61% of the area of Nunukan Regency.

Profile of Border Area of Nunukan Sub-district

Nunukan Regency is part of the province of North Borneo Province, along with the expansion of the new province of East Kalimantan province. Nunukan Regency is located in the capital city of Nunukan. The County in 2012 is made up of 15 sub-districts. The total area according to Nunukan Regency in can be seen in **Table 1**.

Table 1. Total area, number of villages and the capital per sub-district in Nunukan Regency

Sub-districts	*Unit*	*Total Area*	*Number of Villages*	*Capital*
Krayan	km^2	1.834,74	65	Long Bawan
Krayan Selatan	km^2	1.757,66	24	Long Layu
Lumbis	km^2	290,23	28	Mansalong
LumbisOgong	km^2	3.357,01	49	Samunti
Sembakung	km^2	2.042,66	20	Atap
Nunukan	km^2	564,50	5	Nunukan Barat
SeiMenggaris	km^2	850,48	4	Sri Nanti
Nunukan Selatan	km^2	181,77	4	Mansapa
Sebuku	km^2	1.608,48	10	Pembeliangan
TulinOnsoi	km^2	1.513,36	12	Sekikilan
Sebatik	km^2	51,07	4	TanjungKarang
SebatikTimur	km^2	39,17	4	SeiNyamuk
Sebatik Tengah	km^2	47,71	4	AjiKuning
Sebatik Utara	km^2	15,39	3	SeiPancang
Sebatik Barat	km^2	93,27	4	Binalawan

Source: BPS Nunukan Regency

II. Methodology

Road-handling activities are categorized in three types of programs, namely :

a. Programme of rehabilitation and maintenance of roads and bridges
b. Programme of building roads and bridges
c. Road and Bridge Improvement Program

The data is used, collected directly from primary or secondary field either through surveys and observations. Some of the activities of the survey conducted in the field include:

a. An inventory survey of the road network. Intended to provide a framework for priority handling and maintenance to carry out a systematic survey of the entire road network.
b. Review the previous programs. Before doing a detailed study will be conducted centrally and redenomination of program development and improvement of roads and bridges that have been done in previous years.
c. The collection of the Data sources. The majority of secondary data which is to be obtained from the Engineering Department of public works, the local Departments. Such data include the following :
   1) Spatial Plan area of North Kalimantan Province (RTRW Kalimantn Utara)
   2) Medium-term development plan of the North Kalimantan Province (RPJMD Kalimantan Utara)
   3) Master plan of the border regions of North Kalimantan Province
   4) Previous researchs and studies
   5) National Agency for Border Management (BNPP)
   6) Government regulations related to the border
   7) Road network inventory data

The other is socio-economic data, the physical condition of the area, the defense and security of NKRI within the scope of the border region, a system of transport conditions and the development plan of the region can be obtained from: BAPPEDA, Department of Agriculture, Department of Forest, Regional Office Of The Department Of Transportation, Department of Tourism, and the Department of Transmigration.

d. Preparation of Base Maps

The main purpose of this category is to correct the map base of the existing road network. These activities are required to photocopy the study area topographic map 1: 50.000 scale whenever possible. If topographic maps 1: 50.000 scale could not be retrieved will be used in a map with a smaller scale or a map of land use but can still be used for the determination of the location of his physical condition precisely, such as the great river, wide and most settlements are not part of the networks are still the same. Improvements and additions to the data can be done during the field surveys and the results will be redrawn on the appropriate scale.

e. Framework of the Population Data

It takes an estimated population served the standards proposed to determine the value of benefits if the roads will be improved from the condition cannot be traversed by vehicles or bad road conditions where vehicular traffic is very low, the road was upgraded into vehicle navigable throughout the year. This activity required to perform topographic maps 1: 50.000 scale indicating the names and approximate boundaries of each village/town sejajarnya with the path to the ruasnya, when possible. On the basic map made estimates of the involvement of each village/town against one or more extensive way based on the reality on the map, as well as the estimated population that can be served by roads and the result ditabulasikan undertook to facilitate the analysis of benefits.

f. Analysis of the Activity Centre

The purpose of this activity is to determine the location, characteristics and the relative size of all markets or events which simply means:

1) Help interpret network data path by specifying the activities of the centres needed to be centre of attraction to travel towards the Centre of the activity.

2) Help in determining the rate of interest on a road that is at the moment berangkali is experiencing traffic barriers according to the size and type of activity centres.

g. Framework of the Socio-Economic Data

To conduct a systematic study of the supporting framework required a form of socio-economic activities of the region information study, along with data on population, activity centers, data traffic and the road network. All this information is necessary to help interpret the data traffic, specify the heavy vehicle traffic that affect the design of the roughness, predict the level of change, and the upcoming traffic composition. Data checklist that can help in obtaining information required is:

1) The general statistics of the socio-economic
2) Project checklist transmigration and plantation data
3) Checklist of activities of the tourism sector data

III. Results and Discussions

Some problems on the existing road network in Nunukan Regency border regions such as (1) the lack of completeness of facilities such as road signs and road markings on the road who has been there, (2) Less the maximum functionality of the existing road conditions caused by the roughness of damaged roads, wide road that is not appropriate, non-working street drainage and interference addition high enough, and (3) The uneven development of the road network throughout the region. Thus causing some areas to be isolated.

Table 2. The Road Length in NunukanRegency

No	*Description*	*Volume*	*Unit*
1	Regency Road Length	522,68	km
2	Province Road Length	273,60	km
3	Villages/Local Road Length	25,984	km

Source :Nunukan Departement of Public Works

Table 3. The Road Length Based on Condition

No	*Description*	*Volume*	*Unit*
1	Good	409,23	km
2	Middle	187,45	km
3	Light Damage	38,55	km
4	Heavy Damage	59,74	km

Source :NunukanDepartement of Public Works

The construction of the road network is an important transport infrastructure to streamline the distribution of goods between regions as well as the increasing mobility of the population. As already explained above that it plans a major infrastructure network system in Nunukan Regency consists of:

1) Land Transportation Network System
2) Railways Transportation Network System
3) Sea transport Network System
4) Air transportation Network System

Plan of the development of the road network in Nunukan Regency, as follows:

a. National road network development plans in Nunukan Regency include:

1) National road network that serves artery
2) Segment Sebatik Island ring road is a national road that serves primary collector 1 (K-1).
3) National strategic road network.
4) The development of the National Strategic road network on roads Mansalong - Tau Lumbis and Nunukan Island Ring Road.
5) The development of theprovincial strategic road network, SeiManggaris - Tau Lumbis.

b. Network development roads plan in Nunukan regency such as construction, improvement and maintenance of district roads
c. The development plan of the bridge in Nunukan

d. Network Infrastructure Road Transport Traffic

e. The airport feeder in Nunukan is Juvai Semaring airport in sub-district Krayan and Long Layu airport in the sub-district of South Krayan. Special airports in Nunukan.

Based on the results of the survey in the border region of North Kalimantan province Nunukan district, it can be seen:

Table 4. The Level Of Travel Based On Intent To Travel

No	*Purpose of Travel*	*Number*	*Percentage*
1	Family visit	88	28,39
2	Business	18	5,81
3	Work	55	17,74
4	Tourism	28	9,03
5	Shopping	112	36,13
6	Others	9	2,90
Total		310	100,00

Table 5. The level of Travel Based on The Mode Used

No	*Mode*	*Number*	*Percentage*
1	Motorcycle	93	30,00
2	Cars	69	22,26
3	Boat/Speedboat	107	34,52
4	Ship	19	6,13
5	Public Transport	8	2,58
6	Others	14	4,52
Total		310	100

Table 6. The Level of People Travel Daily

No	*Number of Trips*	*Number*	*Percentage*
1	1 time	163	52,58
2	2 times	138	44,52
3	3 times	9	2,90
4	4 times		0,00
Total		310	100

Table 7. The Level ofTravel Based On TheTransportationCost

No	*Transportation Cost*	*Number*	*Percentage*
1	< Rp 50.000,-	89	28,71
2	Rp 50.000,- s/d Rp 250.000,-	137	44,19
3	Rp 250.000,- s/d Rp 500.000	45	14,52
4	> Rp 500.000,-	39	12,58
Total		310	100

Based on the results of data processing as shown in the **Table 4**, **Table 5**, **Table 6** and **Table 7**, it can be concluded that the level of most trips by purpose of travel is to shop, amounting to 36.13%. The most widely used modes for traveling is a boat/speedboat. This is because since the area to be achieved to cross the river/sea first. While the level of daily travel and transportation expenses incurred for each trip is the first time (roundtrip) amounted to 52.58% and 50.000, - up to Rp 250,000, - by 44.19%.

The Potential of The Region

Fig. 1 The Distribution of basic food and fuel oil in Nunukan Regency

From the Fig. 1 can be seen that the distribution of basic food and fuel oil in Nunukan Regency concentrated in Sub Krayan (Long Bawan), District of South Krayan (Long Layu), Binter, Mansalong, Sekaduyan Taka, Nunukan and Sei.Pancang. As for the distribution of basic food in Nunukan, centered in the city of Tarakan which is then distributed to Long Bawan, Long Layu, and then distributed to the South Nunukan.

The Road Network Development Scenarios

Alternative policy proposal and management of road network development that need to be done, include:

1. Alternative 1 (Do Nothing), Road Maintenance
   Development and management of the road network in the first alternative is based on the existing condition of the existing road conditions, based on the condition of the road network and road repair/maintenance of roads only.
2. Alternative 2 (Do Something), the construction of new roads and upgrading of roads (New Road Construction). Development and management of the road network this alternative 2, based on:

a. Development of road network based on the needs of the community.
b. Road Network Development Direction based policies / legislation.
c. Development of Road Network based Support Funding.

One of the key elements in implementing transportation is the availability of good road network infrastructure and meet the development of the movement of people and goods, especially in Nunukan Regency. Nunukan Regency as a District municipality in the province of North Kalimantan Province currently has a network of road infrastructure that hasn't been fullest to meet the movement of people and goods, especially in the border region, so that the limitations of the existing road network in compare with the growth in traffic that continues to experience significant increases cause a variety of problems. For the development and management of the road network alternative 2, the construction of new roads and the improvement of the road (New Road Construction). The construction of new roads and improvement of existing roads can be seen in the **Fig. 2** and **Fig. 3**.

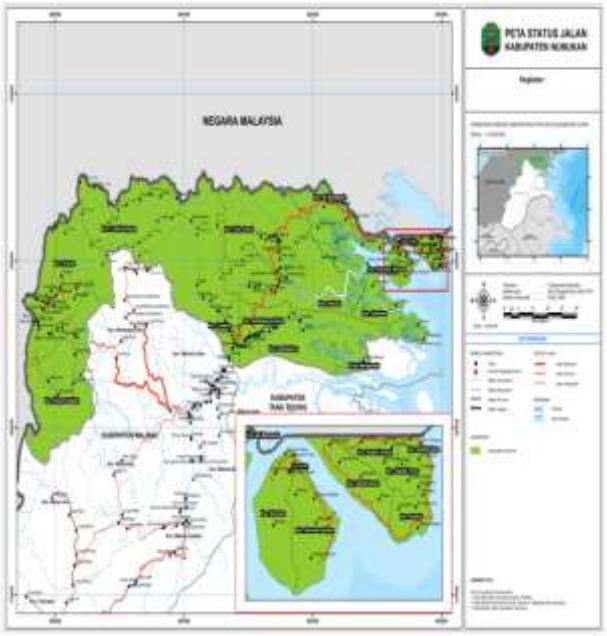

Fig. 2. Road Network Map of Nunukan Regency

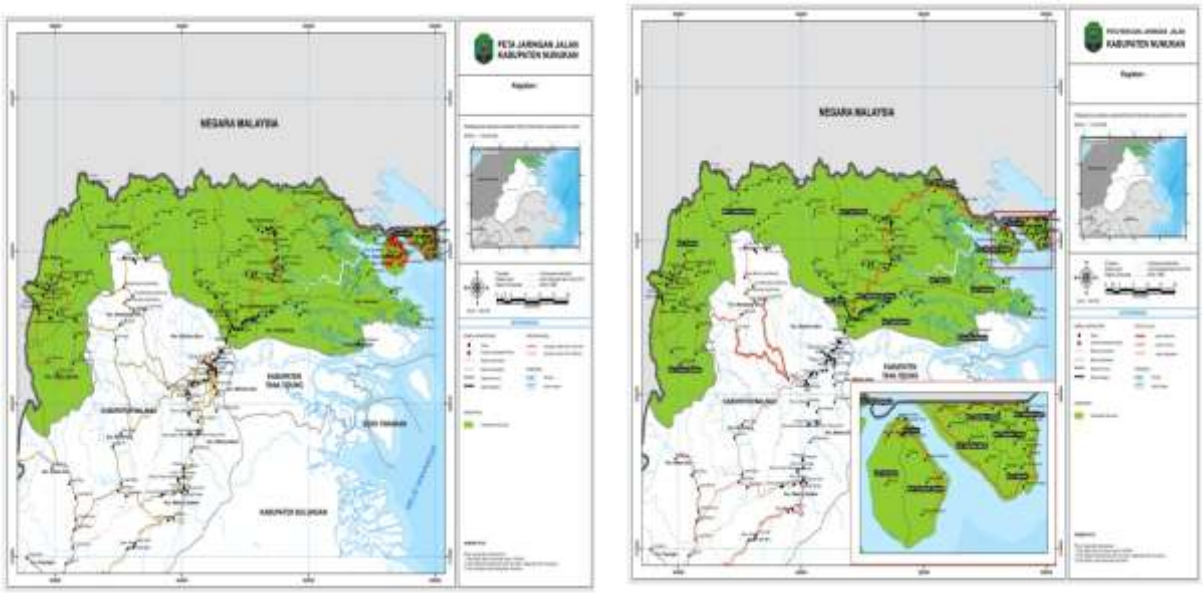

Fig. 3. Road Network MapPlan of Nunukan Regency

Status, Function and Roads Class The condition of network roads system hierarchy data in Nunukan Regency can be seen in the **Table 8.**

Table 8. Status, Function and Class of Roads in Nunukan Regency

No	*Roads*	*Road Function*	*Road Class*	*Road Status*
1.	Mensalong – Simpang Tiga Apas	The Primary Arteri	I	National
2.	Simpang Tiga Apas – Simanggaris	The Primary Arteri	I	National
3.	Simanggaris – Sei ular	The Primary Arteri	I	National
4.	Simanggaris – Batas Negara	The Primary Arteri	I	National
5.	Pa'Padni – Pa'Betung – Longa Api	Collector	IIB	Regency
6.	Long Api - Pa'Kebunan – Pa'Raye	Collector	IIB	Regency
7.	Long Api – Long Bawan – Terang Baru	Collector	IIB	Regency
8.	Long Bawan – Buduk Tumu	Collector	IIB	Regency
9.	Long Bawan – Long Nawang – Lembudud	Collector	IIB	Regency
10.	Long Nawang – Lembudud	Collector	IIB	Regency
11.	Lembudud – Long Layu – Long Rungan – Long Padi – Ba'Lihau	Collector	IIB	Regency
12.	Ba'liku – Binuan – Pa'kebuan	Collector	IIB	Regency
13.	Pa'Kebuan – Wa yagung	Collector	IIB	Regency
14.	Kecamatan Nunukan	Collector	IIA	Province
15.	Kecamatan Nunukan Selatan	Collector	IIA	Province
16.	Kecamatan Sebatik	Collector	IIA	Province
17.	Kecamatan Sebatik Barat	Collector	IIA	Province
18.	Kecamatan Sebatik Tengah	Collector	IIA	Province
19.	Kecamatan Sebatik Utara	Collector	IIA	Province
20.	Kecamatan Sebatik Timur	Collector	IIA	Province

Annual Program Priorities

The Priority Programme Annual Nunukan :

1. Increased accessibility and the construction of road networks in the border region of North Borneo.
   a. Objective: To improve the accessibility of the region
   b. Target: Improved accessibility of road network with the aim to further boost the economy and provide a better service to the public evenly
   c. Forms Activities: Conducting new road construction, road maintenance, road widening, improved quality, routine and periodic maintenance

2. Bridge Improvement Program
   a. Objective: To improve the accessibility
   b. Goal: Increasing the accessibility of the bridge with the aim to better connect villages connected
   c. Activities shape: Doing construction of new bridges, bridge repair, improved quality, routine and periodic maintenance

IV. Conclusions and Recommendations

After the collection, processing and analysis of data obtained from the field survey, the results are scripted on the map the development of the road network in Nunukan. This scenario is based on the development of the road network on the needs of the community, policy/legislation, and funding support. Road network development scenario chosen is the alternative scenario 2 (construction of new roads and the upgrading of roads / Road New Construction). This road network development scenario chosen, because the existing condition of the existing road network in Nunukan is not maximized.

To realize these scenarios need to be prepared strategy action plan systematic, logical, conducive, socialized periodic and continuous as it does an annual program priorities Medium Term and Long-Term :

1. Road Network Development Program in Nunukan
2. Bridge improvement program
3. Terminal development and service in Nunukan
4. Route network planning.
5. Preparation of road network information system / trajectory.
6. Determination of the causeway transport network

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Chapter 4

Migration in The Rural Impact : A Case Study of Bulupitu and Sepanjang Village, Malang Regency, Indonesia

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Abstract. Indonesia has long experiences for rural community development that have not only positive impact on social and economic but also have negative impact. One of the impacts of the failure of rural development is migration from rural area to urban area or to another country as international migration. This paper tries to identify the impacts of migration in the rural area. We use evaluative and qualitative analysis and implement correlation analysis for the analysis of remittance in two villages in Gondanglegi district, Malang Regency Indonesia. Base on the analysis, we found that the impact of remittance in Bulupitu village and Sepanjang village are different. In Bulupitu village remittance influence both of economic and infrastructure aspect. Economic variables are consists of transportation ownership, house ownership, and land ownership; and infrastructure are water access, telecommunication ownership, and religion building/mosque. In the Sepanjang village, the impact of remittance is only has impact on the economic aspects (house ownership, and land ownership).

Keywords: Evaluative, qualitative, correlation, and variables.

I. Introduction

Indonesia has long experiences for rural community development that have not only positive impact on social and economic but also have a negative impact on social, economic and environment system. The rural sector in Indonesia consist about 135 million people or 57% of the total population. Out of the total rural population, 45 % or 60.75 million are considered to be poor [1]. Government of Indonesia concerned to rural development and poverty alleviation program and provided financial assistance in various forms. The programs are grant, revolving fund, soft and commercial credit already implemented in a rural area through community organization with various levels of formality and activities.

In reality studies found that most programs failed and discontinued [2]. Claim succeed in rural development is from mainstream of development practitioners, but the problem in a rural area still happen where is there being low income, limited access to health and clean water and some threats to the human being. The failure of rural development tends to make the area become static and cannot attract young generation to stay and work in the village. The low income from the agricultural sector activities and uncertainty monthly income push inhabitant tries to find another sector outside from the agricultural sector. Migration is the one way to increase their income because the difference of disparity between the urban and rural economies.

For the first one, many migratory work, particularly for poorer migrants, is seasonal, temporary and remains within rural areas. Employment in areas of origin may be scarce or even unavailable; however, the daily earnings for migrants at destination may only marginally higher. Migrants undertake this work to maintain or slightly improve their situation at home. The second one is migratory work non seasonal; they work as international migration with duration of contract within one year for two years.

Both types of migration have more than one impact on the village. Firstly, the flow of money received directly by the family in the village, and the second is the reduction of the amount of labor that exists in villages, thereby reducing the village productive workforce. Third is the presence of labor migrants who have returned also having an impact on rural areas.

II. Methods

This research implements quantitative and qualitative methods to measure the impact of remittances in the rural area. Interview was conducting with the respondents in two districts consist of head holder and migrants in each household that has international migrant workers in their family.

2.1. Data collection

Data collection is the foundation of a research process. Data that obtained from the research location have a significant influence on the analysis and the result of the study. Therefore, the method of data collection must be precise in order to obtain valid data and must be in a systematic and standard procedure [3]. Data's collections performed by two methods, namely primary and secondary data collection. The data used in this research is the data that are descriptive and quantitative.

2.2. Evaluative analysis Methods

Evaluative analysis used in this research is the analysis of the correlation. Correlation analysis used to determine the effect of remittances for rural development (social, economic, and infrastructure). The independent variable (X) in this study is the use of remittances, and the dependent variable (Y) in this study was the development of the village consisting of social, economic and infrastructure (Y).

III. Literature Review

There are many studies about the impact of migration and remittances. Agarwal and Horowitz [4] argue that they have found evidence in favor of the altruism motive for remittances. Their claim is based on the inclusion in their analysis of the number of other migrants abroad from the same household. It is found that remittances are significantly negatively associated with the number of other migrants. Their conclusion that this finding favours the altruism rather than the insurance motive is based on the assumption in the construction of their model that the contract between a migrant and household is not affected by the presence of other migrants from the same household. However, this is only an assumption. We can think of contracts among family members where remittances may depend on the number of migrants. For example, an informal contract based on the “all for one, one for all” principle would lead to the same result as that found by Agarwal and Horowitz if difficulties were experienced by family members at different points in time.

The fact that existing evidence consistently shows that only a small fraction of remittances is used for enterprise financing [5]. The microeconomic literature identifies six different motives, not mutually exclusive, on why migrants transfer income to their families in their countries of origin: altruism, exchange, insurance, investment and inheritance.

In yet another version (Hoddinott, 1994 in [6]) that considers remittances within the family context, a remittance function is derived from a model in which migration decisions are seen as the outcome of maximization of a joint utility function of the prospective migrant and other family members, for example son and father.

Finally, the family may directly affect the migrant's remittance behavior because of the social norms that develop within the family and exercise pressure on its members to help each other in times of need. Also, family members may create or enhance feelings of guilt for those who would not otherwise help those in need [7].

IV. Results and Discussions

4.1. Indonesian Migrant Workers (IMWs or TKI) Characteristic in Bulupitu and Sepanjang Village

Indonesian migrant workers (TKI) have many contributions on Indonesia economic and rural development. According to the International Organization of Migration (IOM, 2010) and Ministry of Human Power and Settlement (2011), the number of migrant workers from Indonesia has been increasing over the years, from 380,690 in 2004, to 632,172 in 2009. In addition, remittances sent by these workers, which, according to IOM (2010), amounted to USD 6.6 billion in 2009, have been an important factor in the country's renewed economic growth in the past few years. According to a BI survey report, remittance inflow contributed to Indonesia's balance of payment in the amount of 27 per cent of all services, income, and current transfer value (IOM, 2010).

Remittance send directly to the family in the rural area, and family member can use it easily like a private income. The family who has international migration in their family could increase their income, or in other word they can securing their income, their health and their education.

This is the percentage of male and female Indonesian migrant workers from Bulipitu village and Sepanjang village. We can see that female migrant workers are higher in both villages.

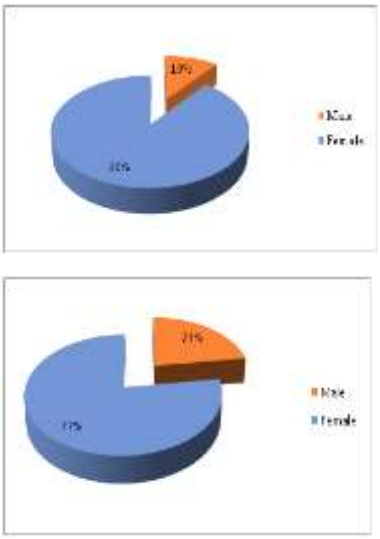

Fig 1. The percentage of Male and Female Indonesian migrant workers (Up Bulupitu village, Below Sepanjang village)

The number of women who become migrant workers is due to the high demand for work as domestic workers (domestic servants). In Bulupitu village, 90% of women employed as domestic workers and 10% of men worked as a chauffeur and private employees in the company. In the Sepanjang village, 25% of women worked as baby sitters, 52% of worked as domestic workers, while 23% of men worked as a driver is migrant worker and factory workers.

Inhabitants who worked as migrant workers in general have been working for many years as international migrant worker (Fig 2.)

Indonesian migrant workers from both villages sent remittance more than one time a year. In Bulupitu village, on average the workers are sending money 4-5 times a year and the total amount is 7.400.000 Indonesian Rupiah (IDR), and in Sepanjang village, they send remittance 3 until 4 times a year and with the total amount of 2.900.000 IDR. We can see from Fig. 2, there is some people work as migrant workers more than 5 year.

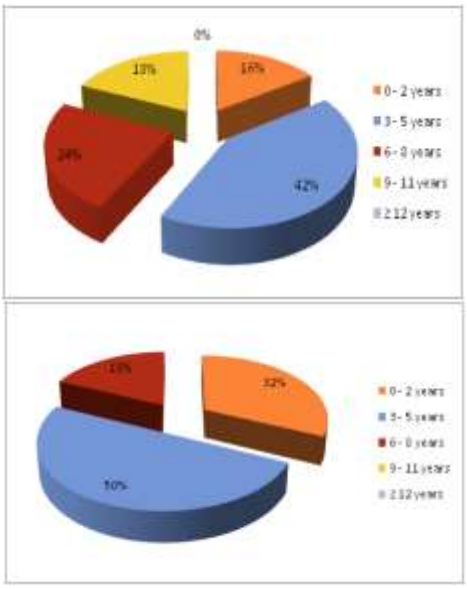

Fig 2. The length of Indonesian migrant workers worked as international migrant (Up Bulupitu village, Below Sepanjang village).

4.2 Correlation Analysis

Based on the test result of the correlation of all the variables, then in the Bulupitu village remittance has any connection or influence on the economy and infrastructure. This is because there are several variables of the economy and infrastructure that have relationships with remittance, but there are variables in two aspects do not have a relationship. As for the social aspect, remittance did not have a significant relationship. This is because none of the variables in the social aspect of having a relationship with remittance. Then it can be concluded if the remittance only affected the economy and infrastructure.

The results obtained in the Bulupitu village are different with the result from Sepanjang village. In the Bulupitu village, the remittance affects on the economic and infrastructure aspects. The sub-variables that have been affected by the remittance are of economic variables (assets ownership, transportation ownership, house ownership) and infrastructure (water access, telecommunication ownership, and religion building/mosque).

In Sepanjang village, based on the correlation analysis results, it can be concluded if the remittance effects only on the economic aspects. The sub-variables affected by the remittance are of economic variables (asset ownership and house ownership). Meanwhile, sub-variables of social variables and infrastructure are not affected. This indicates that the effect of remittances in the Sepanjang village is not equal in different variables because only two variables that have the effect of remittance.

From the correlation results, we can see the variables that have the greatest relationship with remittance. It can be seen from the value of the correlation coefficient. The greater value of the coefficient correlation shows the greater relationship between remittance and variables.

Table 1. The relationship between variables and coefficient correlation in Bulupitu and Sepanjang village

Bulupitu village			***Sepanjang village***		
Variables	CC	Rank	Variables	CC	Rank
Transportation ownership	0.786	1	House Asset ownership	0.549	1
House Asset ownership	0.598	2	Land ownership	0.466	2
Land ownership	0.597	3			
Religion building	0.395	4			
Clean water access	0.384	5			
Tolecomunication ownership	0.357	6			

In Bulupitu village remittance influence in 6 (six) variables, and in Sepanjang village only for 2 (two) variables. The highest coefficient correlation in Bulupitu village is the ownership of transportation and in Sepanjang village is house asset ownership.

V. Conclusion

Remittance has a wide influence in the rural areas. Based on the analysis, remittances have different effects on the two selected villages in this study. In Bulupitu village, remittances have a significant relationship between economic variables and variable infrastructure. However, of these two variables, remittances have a greater influence on the economy or more significant compared infrastructure. Economic variables have a significant relationship with the remittance is transportation ownership (Y7), Asset homes ownership (Y8), and land ownership (Y6), and from infrastructure are religion building (Y15), water use (Y13), and ownership of telecommunications facilities (Y12).

Base on correlation coefficient we can make a rank such as transportation ownership, home ownership, and land ownership, and from infrastructure are religion building, water use, and ownership of telecommunications facilities.

In Bulupitu village remittance influence in 6 (six) variables, and in Sepanjang village only for 2 (two) variables. The highest coefficient correlation in Bulupitu village is the ownership of transportation and in Sepanjang village is house asset ownership. It seems that remittance has more impact in Bulupitu village than in Sepanjang village.

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Chapter 5

$Ba_{0.5}Sr_{0.5}TiO_3$ based Photodiode Application as Light Sensor for Automatic Lighting Control Switch

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Abstract. Photodiode that was made from ferroelectric material, Barium Strontium Titanate (BST), was used as light sensor for automatic lighting control switch. BST based photodiode was placed in one leg of wheatstone bridge circuit to increase the sensor sensitivity. When light strike into the BST based photodiode sensor, the electric current flow through the BST sensor is increase. The electric current that flow through the BST sensor will also flow through the wheatstone bridge resistor at the same leg. This cause the voltage of the leg to increase otherwise the other leg‟s voltage will remain not change. This different voltage of the wheatstone bridge circuit output will then amplified by differential amplifier circuit. The op-amp used for the differential amplifier is TL-074 general purpose op-amp. The amplification of the differential amplifier is set to 27x. The output of the differential amplifier will then compared with a reference voltage by op-amp voltage comparator to get digital output: logic „High‟ for dark condition dan logic „Low‟ for daylight condition. Output from op-amp voltage comparator then feed to NPN transistor to drive a single pole double throw relay. The normally open output of the relay is connected to fluorescent lamp, so the lamp will turn on when dark and turn off when daylight condition. As a result, lighting switch can be controlled by BST sensor. The switch will turn on when less light intensity strike the sensor and turn off when the light intensity strike the sensor is increase.

Keywords: Photodiode, BST, light sensor, automatic switch, op-amp

I. Introduction

Ferroelectric thin films are potentially important materials for a variety of devices such as ferroelectric memories, infrared pyroelectric sensors and in other integrated technologies. Barium strontium titanate (BST) is currently one of the most interesting ferroelectric materials due to its high dielectric constant and composition-dependent Curie temperatur [1].

Barium Strontium Titanate ($Ba_xSr_{1-x}TiO_3$) being environment friendly, has high dielectric constant, low dissipation factor, compositional-dependent Curie temperature (Tc) and large electro-optical coefficient [2].The outstanding properties of perovskite oxides such as barium strontium titanate (BST) have recently aroused great interest with regard to their application as functional material for the development of chemical sensors and biosensors [3].

BST thin film can be created with a number of techniques, e.g. Chemical Solution Deposition (CSD), Pulsed Laser Deposition (PLD), sputtering and Metallo Organic Chemical Vapour Deposition (MOCVD) [4-6]. It has been demonstrated that Ba0.5Sr0.5Ti03 thin films were prepared by the CSD method on the substrate Si (100) p-type substrate can work as a light sensor and had photo diode characteristic [7, 8].

The purpose of this study is using $Ba_{0.5}Sr_{0.5}TiO_3$ based photodiode as a light sensor for automatic lighting control switch.

II. Experimental Method

In this study, BST thin film was grown on p-type silicon (100) substrate using Chemical Solution Deposition (CSD) method. The materials used in this experiment were Barium asetate powder [$Ba(CH_3COO)_2$] (99%), Strontium asetate powder [$Sr(CH_3COO)_2$] (99%), Titanium dioxide powder [TiO_2] (97.999%), and 2-Methoxy ethanol solvent [$H_3COCH_2CH_2OH$] (99%). All the materials were obtained from Sigma Aldrich.

First, the Silicon substrate was cut to the size of 1x1 cm^2 using a glass cutter. The substrate was then washed with aqua bidest distilled water for 30 seconds. Then the materials necessary (barium acetate, strontium acetate, and titanium dioxide) were weighed using Sartonius BL6100 analytical balance. Molar fraction of Ba and Sr was 0.5. The materials were then mixed and dissolved in 2.5 ml of 2-Methoxy ethanol. Furthermore, the solution that has been made was homogenized with Branson 2510 ultrasonicator for 90 minutes to obtain a homogeneous BST solution.

BST solution which has been homogeneous then dripped on the p-type silicon substrate and spun using a spin coater for 30 seconds at a speed of 3000 rpm. BST coating process on p-type silicon (100) substrate is repeated 3 times with one minute in-between breaks. BST thin film on p-type silicon (100) substrate then annealed using *Vulcan*$^{TM\text{-}3000}$ furnace for 22 hours at 850 ^oC temperature.

The next process was the contact deposition process. BST film that have been annealed were covered with aluminum foil with four square holes of 2x2 mm^2 in the part to be fitted with contact. The material used as a contact in this study was aluminium 99.999%. The deposition process was conducted using Metal Oxide Chemical Vapor Deposition (MOCVD) method.

The next step was building the wheatstone bridge and difference amplifier circuit to increase the sensitivity of the BST light sensor. The circuit is shown in Fig. 1. The wheatstone bridge output (V_1-V_2) was adjusted at 0V in very dark condition (at about 2 lux light intensity). Output from difference amplifier can be obtained from Equation 1 and internal resistance of BST sensor can be obtained from Equation 2.

$$V_{out1} = \frac{R_f}{R_i}(V_1 - V_2) \qquad (1)$$

with: $R_4 = R_6 = R_f$

$R_3 = R_5 = R_i$

$$R_{BST} = \frac{R_1(V_S - V_1)}{V_1} \qquad (2)$$

The output of the difference amplifier was then passed to the voltage comparator circuit to obtained a discrete output that distinguishes the dark and light conditions. Voltage comparator circuit was shown in Fig. 2. V_{ref} was adjusted at 1.5 volt, so the output voltage (V_{out2}) will be logic „high“ when V_{out1} below 1.5 volt.

The output of the voltage comparator was then used to drive a relay through the driver transistor, so that when conditions are dark, the fluorescent lamp will turn on and during bright conditions, the lamp will turn off. The relay circuit is shown in Fig. 3.

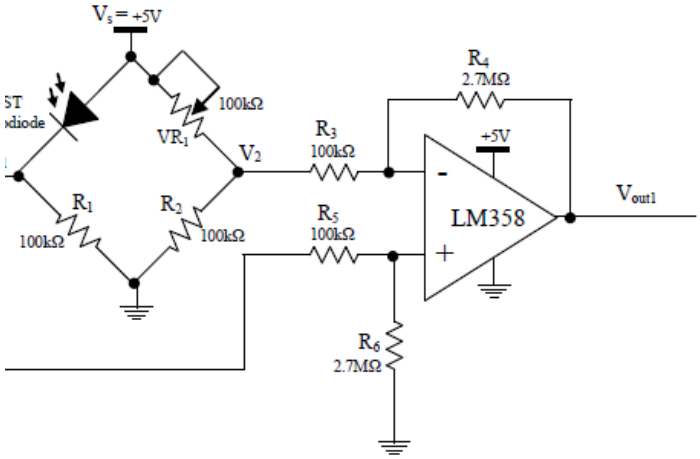

Fig. 1. Wheatstone bridge and difference amplifier circuit.

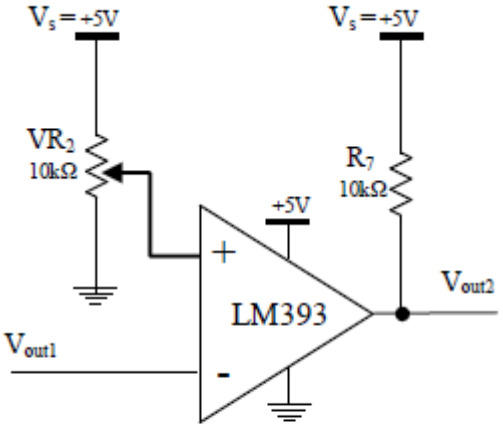

Fig. 2. Voltage comparator circuit.

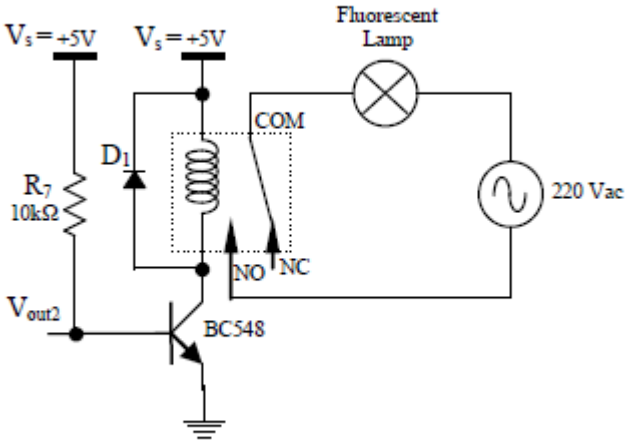

Fig. 3. Relay driver circuit.

III. Results And Discussions

The output voltage of the Wheatstone bridge circuit (V_1-V_2) measured in several levels of light intensity are given in Table 1. The results shown that when light intensity is increase, internal resistance of BST light sensor is decrease, resulting output voltage of the wheatstone bridge circuit to increase. Curve pattern of the BST internal resistance is shown in Fig. 4.

TABLE I
WHEATSTONE BRIDGE OUTPUT VOLTAGE

Light Intensity (lux)	$V_1 - V_2$ (volt)
50	0.006
100	0.036
150	0.06
200	0.08
250	0.09
300	0.098
350	0.108
400	0.12

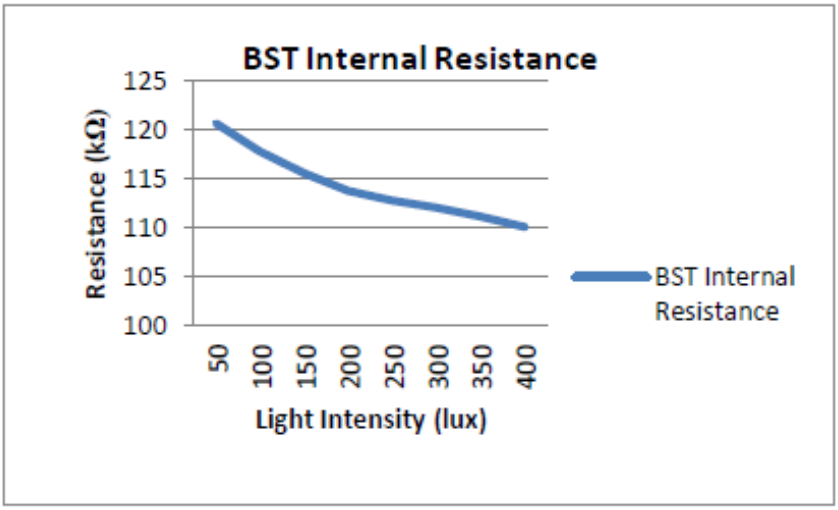

Fig. 4. BST Internal Resistance

Output voltage from the difference amplifier circuit are given in Table 2 and output voltage from voltage comparator circuit are given in Table 3. Difference amplifier output voltage shown that the amplification of difference amplifier circuit is 27x and voltage comparator output shown that when light intensity is 100 lux or lower, outputs of the voltage comparator are logic 'high' (=4.948 volt) and when the light intensity is 150 lux or higher, outputs of the voltage comparator are logic 'low' (0.054 volt).

TABLE II
DIFFERENCE AMPLIFIER OUTPUT VOLTAGE

$V_1 - V_2$ (volt)	$Vout_1$ (volt)	Amplification (x)
0.006	0.162	27
0.036	0.97	26.94444
0.06	1.62	27
0.08	2.161	27.0125
0.09	2.43	27
0.098	2.647	27.0102
0.108	2.915	26.99074
0.12	3.242	27.01667

TABLE III
VOLTAGE COMPARATOR OUTPUT VOLTAGE

Light Intensity (lux)	$Vout_1$ (volt)	$Vout_2$ (volt)
50	0.162	4.948
100	0.97	4.948
150	1.62	0.054
200	2.161	0.054
250	2.43	0.054
300	2.647	0.054
350	2.915	0.054
400	3.242	0.054

TABLE IV
OVERALL TEST RESULTS

Light intensity	Lamp condition
Dark condition (<135 lux)	ON
Light condition (≥135 lux)	OFF

Overall test results are shown in Table 4. From the overall test results, we obtained that lamp will turn on when ligh intensity is below 135 lux (dark condition) and will turn off when light intensity is 135 lux or higher (light condition).

IV. Conclusions

The change of the internal resistance of the BST sensor is very small, so the output voltage of the wheatstone bridge circuit need to be amplified by difference amplifier to achieve an applicable output voltage. From the overall test result, Barium Strontium Titanate (Ba0.5Sr0.5TiO3) based photodiode was successfully used as a light sensor for automatic lighting control switch.

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Chapter 6

Regulation of 12-pulse Rectifier Converter using ANFIS-based Controller in a HVDC Transmission System

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Abstract. High voltage direct current (HVDC) transmission is a better prospect choice compared to high voltage AC transmission. The HVDC is able to apply higher voltage level and without any reactive power losses. By supporting power electronic technology, the HVDC is simpler and cheaper to be realized. So, the problem in the HVDC system is how to control power flow in rectifier converter device effectively. In this research, regulating of firing delay angle is proposed by ANFIS-based controller (ANC) in 12-pulse rectifier. The ANC is applied because computation of the ANC is more effective than Mamdani fuzzy controller computation. The ANC is trained by data-learning in off-line mode. In normal operation, the maximum transmitted power by the HVDC is on the value of 1.0 pu with voltage and current DC at 1.0 pu when the firing delay angle at 26^{o}. Also, the ANC is able to compensate temporary short-circuit fault.

Keywords. ANFIS, controller, firing delay angle, HVDC, rectifier.

I. Introduction

High voltage direct current (HVDC) transmission system is usually used to deliver bulk of electric power over a long distance area by overhead conductors or submarine cables. The HVDC system has several advantages compared to high voltage alternating current (HVAC) system such as: location of electric power production are very far from location of consumer, long distance HVDC system do not need reactive power compensation as required by long distance of the HVAC system, to make an asynchronous interconnection and allows more capacity of power to be transmitted/delivered [1] [2]. Also, for a given conductor cross section, the HVDC transmission system can carry more current through this conductor compared to a conventional HVAC system[1].

In order to improve the performance of the HVDC system, some control schemes are applied to its such as: A feedback loop with PI controller is applied to the HVDC. The controller is able to mitigate voltage fluctuation during disturbing condition [3]. Also, PI controller is used to multi-infeed high voltage direct current (MIHVDC). Modified transfer function of HVDC also is introduce with small signal analysis based on linearisation model. Parameters of the PI controller in MIHVDC are optimized using genetic algorithm. The MIHVDC are equipped by PI controller and the optimized parameters are robust during fault condition [4].

Analytical method to calculate the efficiency of two and three-level VSC with average and root mean square of converter current is used to the HVDC system. This method is applied to estimate the losses of DC cable, coupling transformer, AC harmonic filter and conduction – switching at the converter. The analytical method and measuring software technique are compared in order to validate of the results [5]. Moreover, power flow strategy with multi-objective optimization for multi-terminal HVDC grid [6] is done by Carrizosa et al. Line commutated rectifier (LCC) and modular multi-level converter (MMC) are applied in hybrid HVDC topology to clear DC fault. Where, the LCC is adopted as rectifier side and the 2 (two) MMC moduls are adopt as inverter side. This topology is able to block current fault path by alpha-retard (α-retard) of the LCC and high power diode. Also, the system is able to restart after clearance of transient DC line fault [7]. A novel rapid protection whole-line principle to protect the HVDC transmission lines using oneend voltage signal was proposed in [8]. Where, this proposed protection method works by analysing measured voltage of the electric network to identify and distinguish between internal or external faults. Moreover, the proposed method operates rapidly, selectively and with high accuracy, under different fault conditions. Natural frequency of distributed parameter line model is applied to determine the fault location on light HVDC system [9]. Using spectral analysis of current by the prony algorithm, a short data window is sufficient to detect the natural frequency and fault location accurately. It is found that the accuracy of fault location over entire HVDC transmission line is not affected by fault resistance and fault type.

Some intelligent control such as: Neural network (NN), fuzzy and neuro-fuzzy control are applied successful in electrical and other engineering fields to replace the function of conventional control scheme in recent years. Proportional integral derivative-static var compensator (PID-SVC) based on recurrent NN has been applied to control chaos and voltage collapse in critical loading of a power system [10]. Moreover, ANFIS-based composite controller-SVC and PID-loop have been applied to control chaos, voltage collapse, and to regulate the load voltage at load bus. In this control scheme, the load bus is varied. In order to maintain the load voltage on the setting value, the reactive power compensation is provided by the SVC [11] [12]. ANFIS controller is applied to control and fault identification in converter of HVDC system. Where, this controller is able to improve dynamic response of the system [13]. Furthermore, ANFIS-based power system stabilizer has been applied to improve the stability of single machine based on feedback linearisation [14]. In this research, we focus on controlling rectifier of HVDC using ANFIS-based controller to replace the conventional controller. This paper is organized as follows: High voltage direct current (HVDC) is described in Section II. ANFIS-based rectifier controller design is detailed in Section III. Next, simulation result and analysis are presented in Section IV. And, the conclusion is provided in the last section.

II. HVDC Transmission Model

The advantage of HVDC is the ability to control the transmitted power rapidly. Proper design of the HVDC control is essential to ensure satisfactory performance of the overall AC/DC transmission systems [15]. Some aspects of power flow control in HVDC using flexible AC transmission system are described in [16] [17].

Consider a DC transmission system to be compared with a 3-phase AC system transmitting the same power, having the same percentage losses and using the same size conductor. Where the DC system is considered to have 2 (two) conductors at V_d to earth. These formulas are as follows [1]: Power in the AC system ($P_a = 3E_{ph}I_L$ assumed that $\cos\phi = 1.0$), power in the DC system ($P_d = 2V_{dL}I_d$), AC losses ($3I_L^2R$) and DC losses ($2I_d^2R$). Equating line losses,

$$3I_L^2R = 2I_d^2R$$

Or

$$I_d = (\sqrt{2}/\sqrt{3})I_L$$

equating powers,

$$V_{dL} = (\sqrt{3}/\sqrt{2})E_{ph}$$

where E_{ph}, I_L, P_a, V_{dL}, I_d, P_d and R are the AC voltage phase to neutral, AC line current, 3-phase AC real power, DC voltage, DC current, DC power and line resistance, respectively.

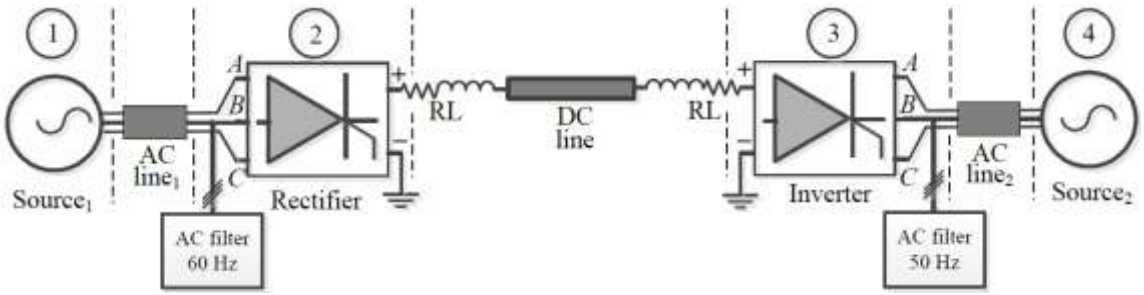

Fig. 1. Model of HVDC transmission system

The HVDC model in this research is taken from [18] and is shown in Fig. . 1. The system consist of 4 buses, step-up/down transformer, 3-phase rectifier/inverter, R_L series branch and 300 km long HVDC transmission. Bus parameters are as follows: Bus 1 consist of AC source with third harmonic, 5000 MVA equivalent, 500 kV, 80˚, 60 Hz. Bus 2: (Capacitor bank + 11^{th} + 13^{th} + 24^{th} harmonic filters)×150 MVAR and 3-phase rectifier. Bus 3: Three-phase inverter and 150 MVAR×(capacitor bank + 11^{th} + 13^{th} + 24^{th} harmonic filters). And, Bus 4: AC source with third harmonic, 1000 MVA equivalent, 345 kV, 80˚, 50 Hz. Branch parameters: AC $line_1$ 26.07 Ω and 48.86×10^{-3} H. The transmission DC line: 6.5 Ω, 1.2376 H and 4.32×10^{-6} F. And, the transmission AC $line_2$: 6.205 Ω and 13.96×10^{-3} H.

III. ANFIS-Based Control Design

Rectifier Converter and Its Controller

Rectifier converter is very important in HVDC system, that the rectifier converter is used to convert alternating current (AC) to direct current (DC). Therefore, the DC will be transmitted from sending-end to receiving-end through HVDC transmission system. Fig. 2 shows the 12-pulse firing controller unit of the rectifier converter. The controller unit produced $Pulse_Y$–R to trigger the respective thyristor-gate at 3-phase $A_yB_yC_y$ in star (Y) connected. Also, this controller unit produced $Pulse_D$–R to fire respective thyristor-gate at 3-phase $A_dB_dC_d$ in delta (Δ) connected. Moreover, the voltage/current from the both star and delta connected were used to generate DC voltage (V_{dL}–R)/current (I_d–R) in the DC side of the rectifier. In order to regulate the level of voltage/current rectifier converter is proper to appropriate of demand side needed, it is convenient to provide this rectifier converter by the controller unit.

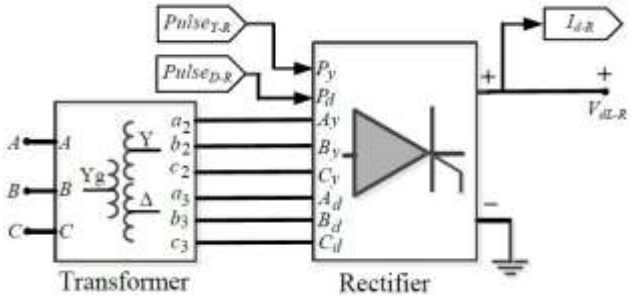

Fig. 2. Diagram block of the HVDC rectifier

The main function of rectifier controller unit is to produce firing delay angle (α_{ord}) signal. This signal is fed to the 12pulse firing control of the respective thyristor-valve in bridge converter. So, the 12-pulse firing controller generates trigger pulse, that this trigger pulse is used to on/off the thyristor-gate. Furthermore, this controller also produces two other output signals such as: Reference current (I_{dref}) and mode operation (Mode) of rectifier. The diagram block of conventional rectifier controller is shown in Fig. 3(a). Reference current (I_{dref}) is used as the target current level of rectifier, where the DC line current (I_d) should follow the (I_{dref}) on every time. And, the control mode is used to classify the operation of the rectifier into Mode 0: blocked mode, 1: current, 2: voltage , 3: α_{min}, 4: α_{max}, 5: forced α and Mode 6: γ mode.

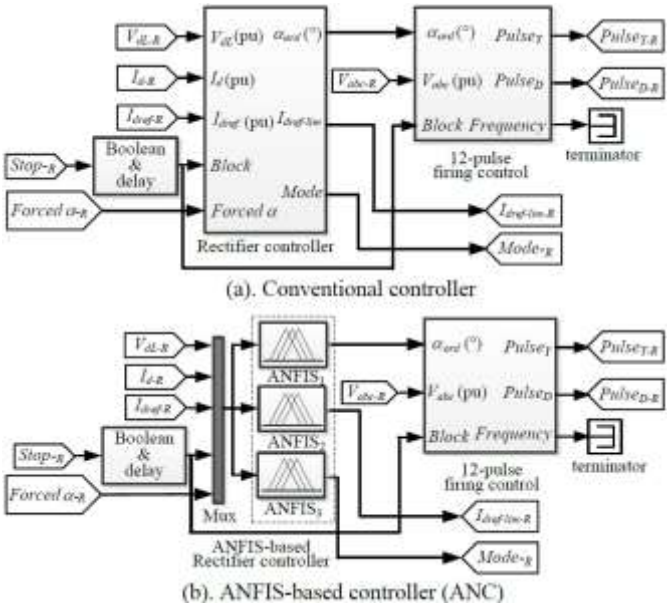

Fig. 3. Diagram block of 12-pulse rectifier controller

Training of ANFIS-based Controller

Before ANFIS-based controller (ANC) is applied to the HVDC converter, that the ANC is trained in some training processes. The data that used on training process were obtained by simulating the conventional controller. The conventional controller is shown in Fig. 3(a). On this training process, a 4000-data point was used to learn the ANFIS controller. Input of the ANC was 5 (five) input variables such as: V_{dL}, I_d, I_{dref}, block and forced α. Three (3) ANFIS models were used to implement the rectifier controller such as: $ANFIS_1$, $ANFIS_2$ and $ANFIS_3$. The output of respective ANFIS model were the α_{ord}, I_{dref}–R and mode operation of the rectifier (Mode R). The ANC diagram block of the rectifier converter is shown Fig. 3(b).

In this research only the $ANFIS_1$ topic is described, meanwhile $ANFIS_2$ and $ANFIS_3$ are not discussed. Structure of ANFIS controller was built by 5 (five) inputs Sugeno fuzzy model and 1 (one) output as shown in Fig. 4(a). The training process was conducted in off-line session and subtractive clustering method was used to generate fuzzy inference system (FIS). In this session, some parameters such as: Range of influence = 0.5, squash factor = 1.5, accept ratio = 0.5 and reject ratio = 0.15 were taken. Every input variables were consist of 4 (four) Gaussian membership functions, the I_d input was taken as example and shown in Fig. 4(b). After some training processes were conducted, control surface of respective input-output controller was obtained automatically. This session produced ten (10) sets of input-output control surface of the ANC. An example of the input-output control surface is a DC line voltage-DC current-firing delay (V_{dL}-$I_d\alpha_{ord}$). So, this control surface is shown in Fig. 4(c).

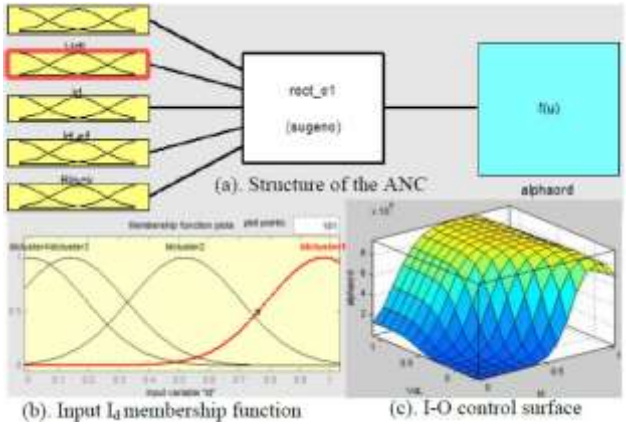

Fig. 4. Parameters of the ANFIS-based controller (ANC).

Table 1. Performance Of Anfis Controller At Normal Operation

period/ observed	t_0 (.02 s)	t_1 (0.3 s)	t_2 (1.4 s)	t_3 (1.6 s)	t_4 (1.7 s)
α_{ord} (°)	90.0-92.0	92.0-30.0	26.0-40.0	166.0	166.0
$V_{ph[p-p]}$ (pu)	1.135	1.135-0.96	0.96-1.135	1.135-0.99	1.135
$I_{L[p-p]}$ (pu)	0.5	0.5-11.9	11.9-0.0	0.0	0.0
V_{dL} (pu)	0.05-1.06	1.06-1.0	1.0-0.96	0.96-−0.25	−0.25
I_d (pu)	0.04	.04-1.0	1.0-0.0	0.0	0.0
P_d (pu)	0.0-0.0242	0.0242-0.0	1.0-0.0	0.0	0.0

IV. Simulation and Analysis

To demonstrate the performance and applicability of the proposed controller, the HVDC system equipped by that controller was examined using Matlab/Simulink 7.9.0.529 (R2009b) [19] on an Intel Core 2 Duo E6550 233 GHz PC computer and windows 7 64-bit (win64) operating system. The simulations were done as follows:

A. Performance of ANFIS-based Controller at Start/stop and Ramp-up/down

Scenario 1: the HVDC system was operated with some parameter as follows: At start-up both converters were deblocked and ramped-up to the minimum current (minimum steady-state current reference, MSCR) at 0.1 pu with an adjustable rate (start ramp rate, SRR) and application time (start ramp time, SRT) at 0.3333 pu/s and 0.02 s, respectively. Next, after the system stabilization the current was ramped-up to its final value (up-ramp final value, UFV) with an adjustable rate (up-ramp rate, UR) and execution time (up-ramp time, UT) at the final value of 1.0 pu, 9.0 pu/s and time of 0.3 s, respectively. Before stopping the converters (at stop time, ST) the current was ramped-down to the minimum current with an adjustable rate (down-ramp rate, DR) and execution time (down-ramp time, DT) at the value of −9.0 pu/s and at the time of 1.4 s, respectively. Finally, at stop time the reference was ramped-down to zero value at time of 1.6 s with the same rate used for the start ramp.

Fig. 5(a) and Table I show the firing delay angle (α_{ord}) control at this scenario. In this graphical result the α_{ord} for conventional controller (CVC) was added by 20° to differentiate the α_{ord} from the ANC result. It is shown that the α_{ord} was started at 90°. Next, the α_{ord} increased to 92 ° at time t_0.

So, the α_{ord} decreased to 30° at time t_1 and decreased again to 26° until time 1.2 s. The α_{ord} increased to 40° at time t_2, and increased again to 166° at time t_3. Fig. 5(b) shows the mode operation of rectifier in this scenario. Firstly, the rectifier was operated in Blocked Mode from time 0.0 s until time t_0, and the Blocked Mode operation was changed to Current Mode at time t_0 until 1.1 s. So, at time 1.1 s the rectifier was operated α_{min} Mode until time 1.25 s. Next, the rectifier was on Current Mode again until time t_3 and at time t_3 the rectifier operated was on Forced α Mode until t_4. Finally, the rectifier was operated at Blocked Mode from time t_4 to infinite time.

Fig. 6(a) and Table II show that V_{dL} increased at the values from 0.05 to 1.06 pu at times from t_0 to t_1, respectively. So, the V_{dL} decreased from 1.06 to 1.0 pu at times from t_1 to t_2. Next, the V_{dL} decreased again from 1.0 to 0.96 pu at times from t_2 to t_3, respectively. Finally, the V_{dL} decreased again from 0.96 to 0.25 pu at times from t_3 to t_4. Fig. 6(b) shows DC line current (I_d) compared to reference current (I_{dref}). Firstly, at time t_0 the I_d was at the value of 0.04 pu until time t_1. So, the I_d increased from 0.04 to 0.4 pu at time 4.0 s and increased again from 0.4 to 1.0 at time from 0.4 to 0.6 s. This I_d still at the value of 1.0 until t_2. And, the I_d decreased from 1.0 to 0.0 pu at times from t_2 to t_3.

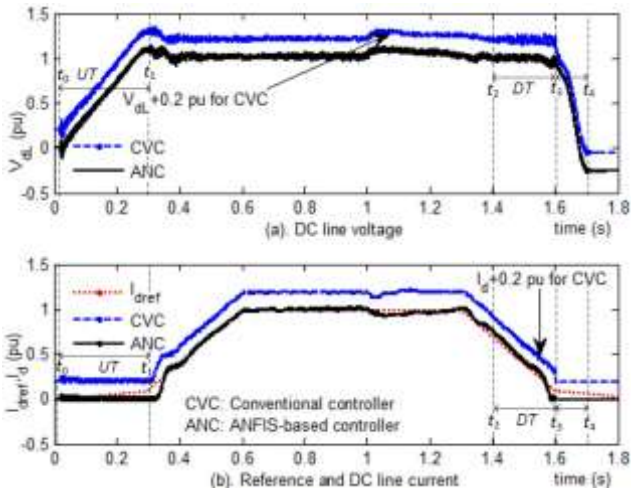

Fig. 6. The DC line voltage and current at normal operation.

Simulation shows that some results of proposed controller (ANC) in this scenario such as: Firing delay control, mode operation, voltage/current AC input and direct voltage/current output of rectifier are similar to the results of conventional controller (CVC). According to simulation results of the ANC, it is potential to replace the CVC by using ANC permanently. Moreover, to explore ability of the ANC on the HVDC at disturbances/faults condition that the topic will be explained in Scenario 2.

B. Performance of the Controller to cover disturbance/fault

Scenario 2: Four temporary disturbances/faults were forced to the HVDC system on different time. Location and time duration of the respective disturbance/fault are illustrated in Fig. 7. Control strategy of the rectifier to cover disturbance/fault is conducted by regulating the firing delay angle (α_{ord}) and by switching mode operation of this rectifier. Graphical visualization of the α_{ord} and mode operation are illustrated in Figs. 8(a) and (b), respectively. Firstly, positive pole to ground fault occurred at point F_1 of HVDC line from time 0.5 (t_{10}) to 0.6 s (t_{11}). The α_{ord} was regulated to the value of 16.5° at time t_{10}, and decreased to 16.2° from t_{11} until before t_{12}. Next disturbance, decreasing of reference current was occurred (F_2) at the value of −0.25 pu from time 0.75 t_{12} to 0.85 s (t_{13}).

In this condition, the α_{ord} increased sharply to 38.6° at time t_{12}, then at a moment it was decreased to 16.9° until time t_{13}. From time t_{13} to time a moment before 1.0 s (t_{14}) it was oscillated from 16.9° to 10.7°. Positive pole to ground fault occurred at point F_3 from time t_{14} to 1.1 s (t_{15}), the α_{ord} decreased to 8.0° at time t_{14}, the α_{ord} was increased to 11.0° at time t_{15}, then increased again to 12.0° before the time 1.2 s (t_{16}). Finally, three-phase fault to ground occurred at AC line$_2$ (F_4) from t_{16} to 1.3 s (t_{17}), the α_{ord} increased to 12.0° at time t_{16}, so the α_{ord} stayed at this value until time t_{17}. Completeness numerical result of the firing delay angle is listed in Table II.

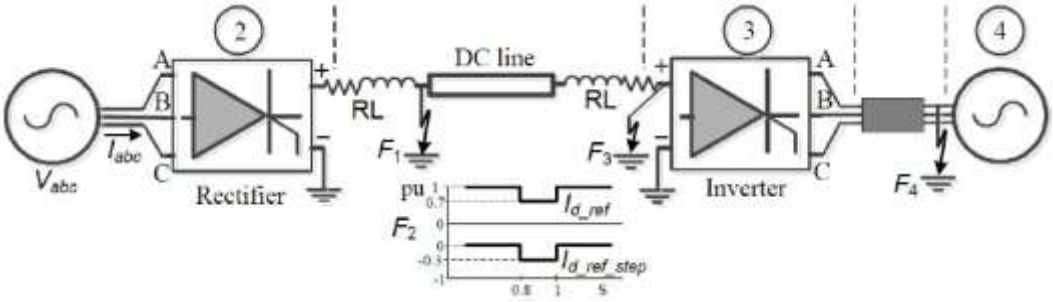

Fig. 7. The HVDC system is forced by disturbances/faults at F1, F2, F3 and F4 points.

From Fig. 8(b), it is shown that the rectifier was operated on α_{min} Mode at time from 0.0 s to 0.2499 s. From time 0.25 to 0.5299 s the rectifier operation was changed to Current Mode, then the rectifier operation was changed again to α_{min} Mode from time 0.53 to 0.5499 s. Next, from time 0.55 to 0.9099 the rectifier was on Current Mode, and it was in α_{min} or Mode Current alternately.

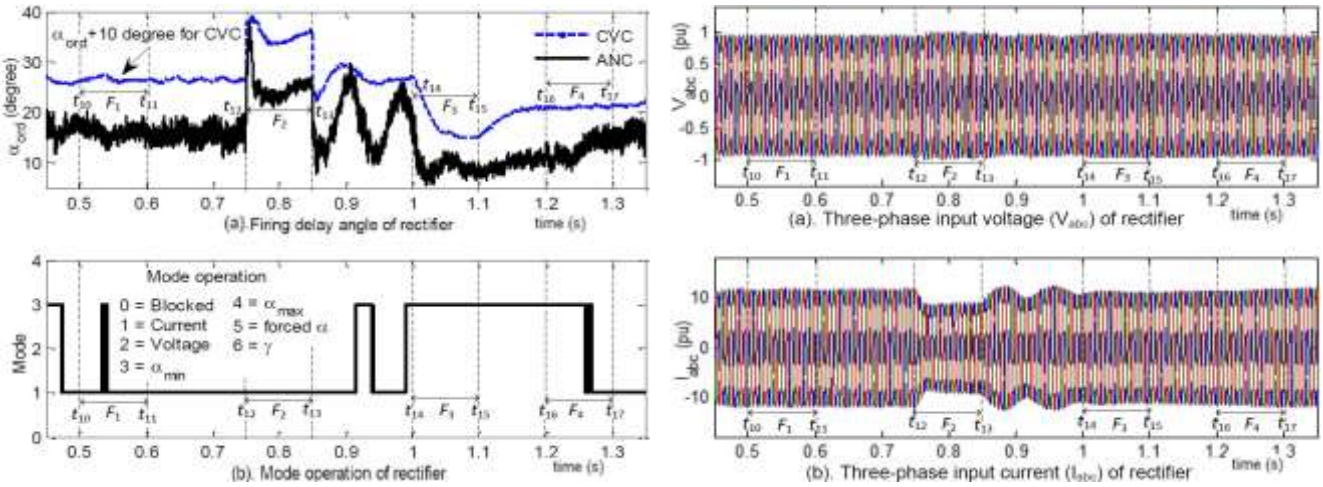

Fig. 8. Firing delay angle (αord) and mode operation of HVDC rectifier.

Fig. 9(a) shows the pattern of three-phase voltage input (V_{ph}) of rectifier. The voltage input varied from 0.99 to 0.92 pu for upper limit and lower limit, respectively. Dynamical of three-phase current input (I_L) is shown in Fig. 9(b) and listed in Table II. It is shown that the I_L was at the value of 11.3 pu at time t_{10}, this current increased to 11.89 pu at time t_{11} and increased again to 11.95 until time t_{12}. At time t_{12}, this current decreased from 11.95 to 9.01 pu at time t_{13}. At time t_{13}, this current oscillated in range of 11.0 - 11.20 pu until time t_{14}. From time t_{14}, t_{15}, t_{16}, and t_{17} this current increased from 11.10 to 11.20, 11.60, and 12.01 pu, respectively.

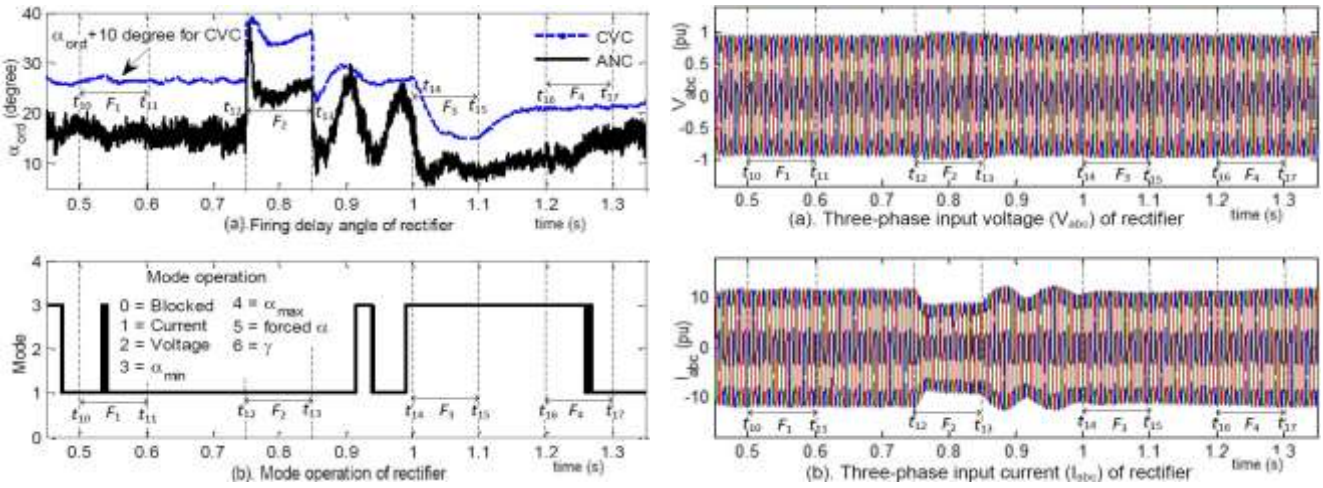

Fig. 9. Dynamical of AC input voltage and current.

Fig. 10(a) shows the pattern of DC line voltage (V_{dL}) for the conventional controller (CVC) and ANFIS-based controller (ANC). It is shown that the time at t_{10}, the V_{dL} was at the value of 1.0 pu, then this voltage decreased moderately to 0.99 and 0.98 pu at time t_{11} and until time t_{12}. At time t_{12}, this voltage decreased sharply to 0.822 pu, at a moment this voltage increased to 0.975 pu until time t_{13}. So, at time t_{13} this voltage increased sharply again to 1.15 pu and at a moment this voltage decreased and oscillated to 0.935 pu until t_{14}. At time t_{14} this voltage increased to 1.09 pu until time t_{15}, then this voltage decreased to 1.05 pu until time t_{16}. This voltage decreased again to 1.02 pu at time t_{16} and stayed in this voltage until t_{17}.

Dynamical of the reference current (I_{dref}), DC current (I_d) for the CVC and ANC are illustrated in Fig. 10(b). From Fig. 10(b) and Table II, it is shown that the I_d was at the value of 1.013 pu for time t_{10}, so the I_d decreased at a moment to 0.995 from time t_{11} to time t_{12}. Next, at time t_{12} the I_d decreased sharply to 0.775 pu, then it increased moderately to 0.780 until time t_{13}. At time t_{13}, the I_d increased and oscillated from 0.78 to 0.94 pu until time t_{14}, and at time t_{14} the I_d decreased to 0.77. Then, it increased to 0.945 and increased again to 0.948 pu for time t_{15} and time t_{16}, respectively. Finally, at the time t_{16} the I_d increased from 0.948 to 1.01 pu until time t_{17}. Simulation results in this scenario show that the DC currents produced by the CVC and ANC are able to follow the given reference current. The both controllers are working properly and they are giving good performances. Although, the I_d response of the ANC is still oscillate in severe disturbance case such as: When current reference is reduced to −0.25 pu (F_2). Some control strategies should be applied to improve the rectifier performance and to anticipate the I_d oscillation response when the rectifier is operated in severe disturbances/faults.

Table II Performance Of The Controller At Disturbances/Faults

Period (time) Observed value	t_{10} (0.5 s)	t_{11} (0.6 s)	t_{12} (0.75 s)	t_{13} (0.85 s)	t_{14} (1.0 s)	t_{15} (1.1 s)	t_{16} (1.2 s)	t_{17} (1.3 s)
α_{ord} (°)	16.5	16.5-16.2	16.2-38.6	38.6-16.9	16.9-8.0	8.0-11.0	11.0-12.0	12.0
$V_{ph[p-p]}$(pu)	0.965	0.965-0.945	0.93-0.99	0.99-0.92	0.96-0.98	0.975-0.968	0.968-0.961	0.056
$I_{L[p-p]}$(pu/100MVA)	11.3	11.89-11.95	11.95-9.01	9.01-11.10	11.10-11.20	11.20-11.60	11.60-12.01	12.01
V_{dL}(pu)	1.0	0.99-0.98	0.822-0.975	1.15-0.935	0.935-1.09	1.09-1.05	1.05-1.02	1.02
I_d(pu)	1.013	1.013-0.995	0.995-0.775	0.775-0.78	0.77-0.945	0.945-0.948	0.948-1.01	1.01
P_d(pu)	1.013	1.00287-0.7556	0.8179-0.7556	0.8913-0.7293	0.720-1.030	1.030-0.9954	0.9954-1.0302	1.0302

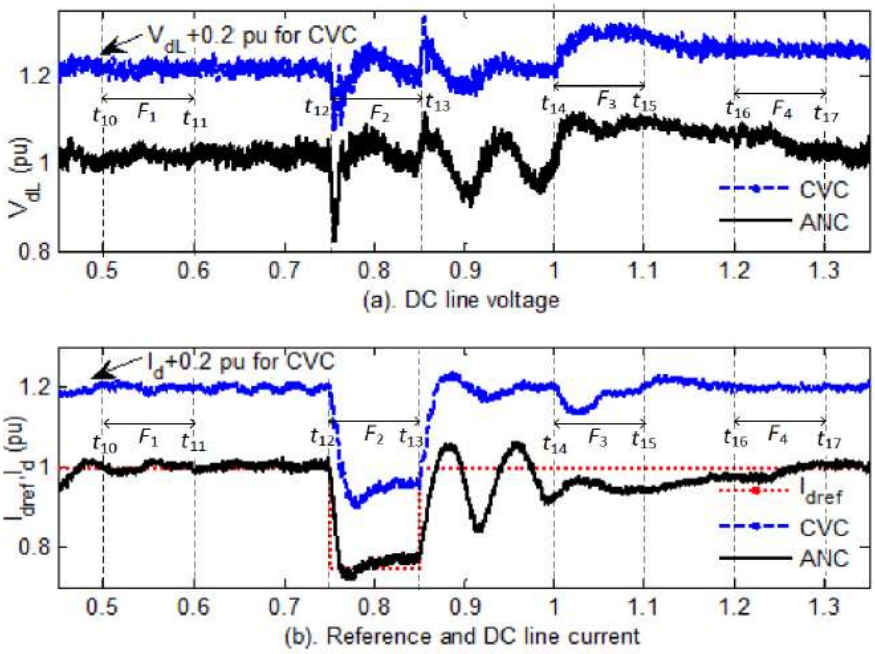

Fig. 10. Temporal of DC line voltage/current converter.

V. Conclusion

In this research ANFIS-based controller (ANC) is proposed to regulate the firing delay angle of 12-pulse rectifier HVDC. The ANFIS controller is implemented because computation complexity of the ANFIS controller is more efficient than that of fuzzy Mamdani controller. The ANC is built by training processes in off-line session with subtractive clustering method to generate membership function automatically. So, data training of the learning session are provided by simulating the HVDC with conventional controller in varied condition operations. During the learning processes, a 4000-point data set is used to learn the ANC controller per session. The structure of the ANC is built by five signal inputs (DC line voltage, DC current, reference current, block and forced α), and a firing delay angle signal as an output. The respective input of the ANFIS-based controller is represented by Gaussian membership function. Moreover, the output is described by linear membership function. Performance of the ANC is observed on the firing delay angle, mode operation, AC voltage/current input, DC line voltage, and DC current responses, respectively. Simulation results show that the

maximum power conversion is 1.0 pu at the firing delay angle 26˚, the DC voltage and current are at the values of 1.0 pu when the HVDC operated in normal condition. Furthermore, the ANC is also able to cover temporary short circuit AC/DC fault on the HVDC. Meanwhile, the ANC responses are still oscillate when the reference current is reduced. Some efforts should be done to damp the oscillation in the next research.

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Chapter 7

Estimation of Ground Rod Depth for Effective Performance during Installation in Different Soil Types in Ibadan, South – West Nigeria

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Abstract. Poor or high resistance connection to the ground is one of the leading cause of earthng system failure. The resistivity of the soil and the depth to which an earthing electrode is driven directly affects the design and performance of a grounding system and it's a major factor that determines the Earth resistance of the grounding electrode. To achieve a reasonably low resistance connection to the ground, it is pertinent to carried out geophysical investigation to determine the variation of resistivity of layers below the surface and the earth resistance of the grounding rod prior to earthing system installation for optimization of rod driving depth. The survey areas cover Botany and Agricultural Departments University of Ibadan with coordinates N 7o 26′ 58.4″ E 3o 53′ 47.9″ and N 7o 26′ 54.6″, E 3o 53′ 44.1″ respectively and Nigeria Corporation Clay Mining Site, Omi Adio with coordinate N 7o 25′ 48.1″ E 3o 44′ 47.2″. A total of nine (9) Schlumberger Vertical Electrical Sounding (VES) (three VES for each location) was carried out using Geo pulse Tigre Resistivity meter. Earth resistance for grounding electrode was calculated for each geological layer of all the VES points within the survey sites, taking into account the resistivity and the depth of each lithological unit. The calculated results was compared with the standard (10 Ω) of a single rod to determine the depth of an earthing rod. Soil moisture content and particle size was carried out. The VES results showed that the second lithological layers of VES 1, 2, and 3 of Botany and Agricultural department of University of Ibadan had resistivity and depth ranged from 14.5 to 25.1 Ω m and 2.9 to 4.5 m; 19.8 to 53.1 Ω m and 5.6 to 9.8m respectively while the resistivity and depth of the second lithological layer for VES 1 and 2 of Omi Adio were 8.6 Ω m, 7.7 Ω m and 4.5 m, 6.9 m respectively and that of the third lithological layer was 11.5 Ω m. Moisture contents results of Omi Adio, Agricultural and Botany Department ranged from 0.125 g/ g to 0.35 g/g, 0.020 g/g to 0.0869 g/g and 0.0465 g/g to 0.117 g/g respectively The particle size analyses results revealed that the topsoil of Omi Adio, Botany and Agricultural Departments as Clay, Sandy loam and Sand respectively. The recommended depth of Omi Adio, Botany and Agricultural Departments ranged from 2.3 to 6.9m, 2.9 to 4.5m and 5.6 to 9.8m respectively.

Keywords: Earth resistance, earthing systems, geophysical investigation, vertical electrical sounding.

I. Introduction

Grounding is the control of abnormal voltages or currents through the proper application of Ohm's law (John Pfeifer, 2001). Grounding is the key to safety that is the protection of personnel from shock or electrocution, fire, protection of equipment and facility from failure, fire and protection of electrical circuit from cable failures, Proper grounding manifest when power system work fast enough to eliminate or at least minimize damage.

The main objective of power system earthing is to provide a common voltage reference and low impedance fault current path to allow the protection system to reliably clear abnormal of fault conditions while limiting the grid voltage rise and transferring earth potentials to tolerable limits. To achieve this, a suitable low resistance connection to earth is crucial which often depends on factors such as soil resistivity, stratification, size and type of electrode used, depth to which the electrode is buried, moisture and chemical content of the soil. Grounding connection is accomplished by driving ground electrode into the earth. An earth electrode is a metal rod, metal pipe or metal conductors electrically connected to the Earth. The materials generally used for earth electrodes can be made of copper, aluminums, mild steel and galvanized iron. Out of all these materials copper is the most preferable material for earth electrodes because of its high conductivity and resistance to corrosion.

Dwarka et al., (2012) described the earth as a place of zero potential, a place where fault current can be directed to enable fuses to rupture. Buildings, Distribution transformers, lightning conductors that are found on tall buildings, etc. are all connected to the earth so that in the event of lightning strike, the current passes harmlessly to the ground and not into the structures or buildings, thus saving the buildings from damage. The magnitude of the fault current and its distribution in the soil and neutral conductors are of a prime importance to design safe grounding installation (Dawalibi, 1980). The ability of an earth electrode to conduct current effectively into the soil (earth) depends on the resistivity of the soil and the depth to which this electrode is buried (Gabriel et al., 2011) Most National and International Lighting Protection codes require an earth resistance of 10 Ω to be provided for a lighting protection installation (BSEN 2006, AS1991). According to ( ), soil resistivity measurements have a threefold purposes. First, such data is used to make sub- surface geophysical surveys and as an aid in identifying ore locations, depth to bedrock and other geological phenomena. Secondly, resistivity has a direct impact on the degree of corrosion in underground pipelines (a decrease in resistivity relates to an increase in corrosion activity and therefore dictates the protective treatment to be used) and thirdly, soil resistivity is the key factor that determine what resistance of a grounding electrode will be and to what depth it must be driven to obtain low ground resistance. The resistivity of the soil varies widely throughout the world and changes seasonally. Soil resistivity is determined by its content of electrolytes, which consist of moisture minerals and dissolved salts, hence electrical resistivity method can be used to determine soil resistivity. A dry soil has high resistivity if it contains no soluble salts. Soil resistivity varies with moisture content, temperature and depth. Since soil resistivity directly relates to moisture content and temperature, it is reasonable to assume that the resistance of any grounding system will vary throughout the different seasons of the year.

Since both temperature and moisture content become more stable at greater distances below the surface of the earth, it follows that for a grounding to be most effective at all times, should be constructed with the ground rod driven down to a considerable distance below the surface of the earth. Best results are obtained if the ground rod reaches the water table. Hence, geophysical investigation of resistivity of subsurface soil layers combined with soil properties such as texture and water content at the intended site will also provide information of the soil conditions at the survey areas and for determination of the depth to which an earthing rod could be installed to achieved low resistance connection to the earth for effective dissipation of current via grounding electrode into the ground. This work aimed at estimating the depth to which an earthing rod could be buried in different soil types.

II. The Study Areas

The study areas selected for this work were Botany and Agricultural Departments of the University of Ibadan with coordinates N 7o 26′ 58.4″ E 3o 53′ 47.9″ and N 7o 26′ 54.6″, E 3o 53′ 44.1″ respectively and Nigeria Corporation Clay Mining Site, Omi Adio in Ido local government area with coordinate N 7o 25′ 48.1″ E 3o 44′ 47.2″. Germin e – trex Geographic Positioning System (GPS) meter was used to determine the location and position of the study areas.

2.1. Geology of The Study Area

For meaningful interpretation of resistivity data, the knowledge of the geology of the study area is essential. The parent rock underlying an area largely influences the subsurface properties of the soil within the area. Ibadan is on the Precambrian basement complex of Nigeria, it is underlain by igneous and metamorphic rocks with few intrusions of granite rock. The University of Ibadan campus is underlain mainly by migmatite gneiss which is a mixed rock comprising of banded gneiss, augen gneiss and quartzite/quartz schist. Apart from augen gneiss that is well exposed, others are not so conspicuous except in localized areas in which case, they have weathered considerably. Omi Adio in Ido local government Ibadan is underlain by migmatite gneiss. The survey site at Omi Adio is the Nigeria corporation clay mining site. The residual clay deposit is derived from intense weathering of the migmatite gneiss rich in feldspar mineral.

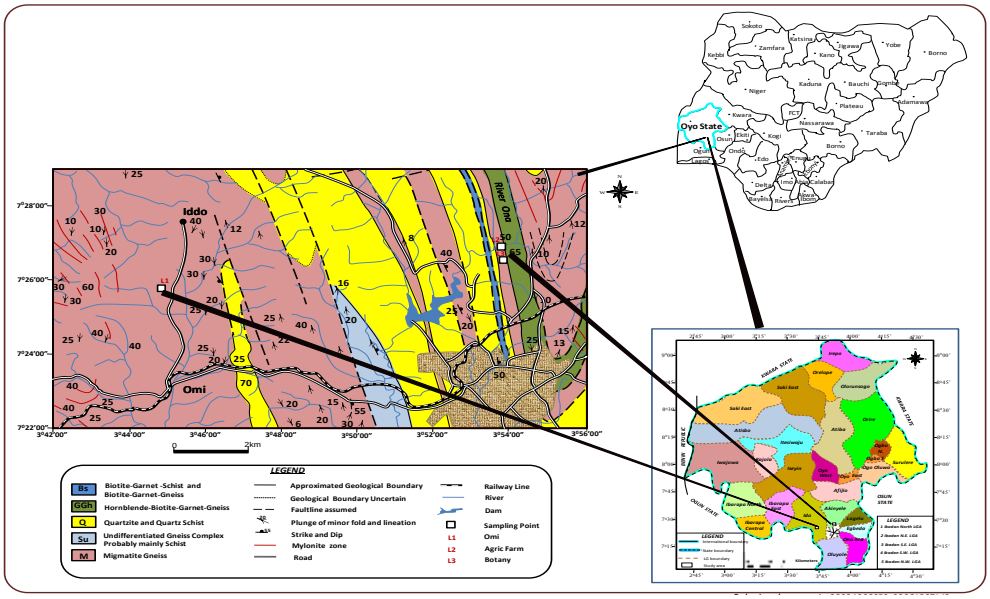


Fig.1: The geological map showing the study areas (Modified from Grant, 1971)

2.2. Theoretical Background

Variation in the resistivity of Earth materials either vertically or laterally produces distortion to the applied current and potential distribution measured on the surface. The purpose of electrical resistivity surveys is to determine the resistivity distribution of the sounding soil volume. In electrical resistivity method artificially generated electric currents are supplied to the soil and the resulting potential differences are measured. Potential difference patterns provide information on the form of subsurface heterogeneities and their electrical properties (Kearey et al., 2002). The current flow line distributions depend on the soil medium under investigation, they are concentrated in conductive volumes.

In electrical resistivity prospecting, four electrodes are usually employed. Two of these electrodes are used to supply a controlled electrical current to the ground, the developed potential is then measured using the second pair of electrodes. Deviations from the pattern of potential difference expected from homogeneous ground provide information on the form and electrical properties of subsurface under probe. The arrangement of these electrodes is shown in Fig.2. Where A and B are the current electrodes which act as source and sink respectively. C and D measured the potential difference between A and B. The apparent resistivity of the soil layer is calculated using

$$\rho a = \frac{\pi}{4} \frac{V}{I} \frac{(L^2 - a^2)}{a} \qquad (1)$$

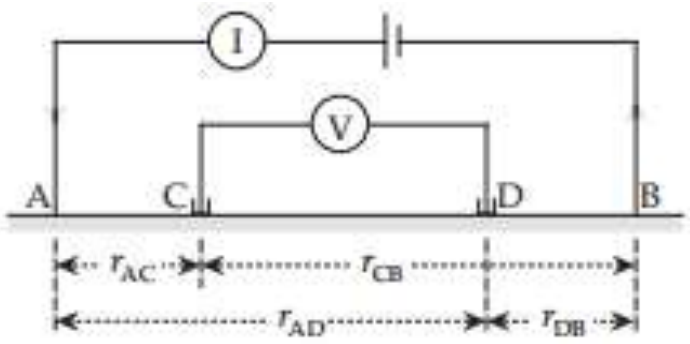


Fig.2: General four electrode configuration for resistivity measurement, consisting of a pair of current electrodes (A, B) and a pair of potential electrodes (C, D).

III. Methodology

A total of nine Vertical Electrical Sounding (VES) points using Schlumberger electrode configuration was carried out to determine the variation of subsurface resistivity with depth in the study area. Data were acquired with a digital resistance meter (Geo pulse Tigre) using a maximum current electrode spacing (AB/2) of 32 m. The field data was processed by plotting the variation of resistivity with increasing current electrode spacing on a bi logarithmic paper. The layered model obtained serve as an input into the computer using WIN RESIST 1.0 software for an inversion algorithm and later subjected to repeated iterations until a satisfactory fit to the field data was obtained

A total of forty – five (45) undisturbed soil cylindrical core samples (15 cm long ×7cm in diameter) (five samples from each VES point) were retrieved from the surface horizon of each VES points at 0–15, 15–30, 30-45, 45-60 and 60-75 cm depths to determine the moisture content in the three surveyed areas. Gravimetric water content (θw) of the samples was determined as the ratio of the mass of water in the soil sample to the mass of the oven dried soil (g/g).

The Earth resistance for a vertical rod of diameter 20mm and 25mm specification was calculated for each lithological unit of the VES points within the survey sites taking into account the resistivity and the depth of each lithological unit. The resistance to earth for a grounding rod driven into the soil was calculated for each lithological unit of the survey sites using the formulae for calculating the resistance to earth for a single vertical rod given by Chow et al. (1996) and Energy Networks Association (2003). The formula is given by:

$$R_g = \frac{\rho}{2\pi L}\left[\ln\left(\frac{8L}{d}\right) - 1\right] \qquad (2)$$

Where Rg is the earthing resistance of the vertical rod (Ω), ρ is the resistivity of the soil or geological layer (Ω m), L is the length of rod/strip (m), d is the diameter of the rod. The layer resistivity obtained from the soil model was substituted into equation 2, the depth of each geological layer represents the effective depth to which the electrode is to be buried, the obtained resistance to earth of an electrode for each lithological layer was

compared with standard to determine the layer suitable for earthing electrode and to what depth the electrode must be driven to achieve the desired earthing resistance of 10 Ω which is the standard or less with a single rod inserted into the ground.

IV. Results and Discussions

4.1. Supplier Selection

The percentage of sand silt and clay from the analysis of soil samples retrieved from the topsoil of survey areas is presented in table 4. The particle size analyses indicate the topsoil of Omi Adio, Botany and Agricultural department as clay, sandy loam and sand respectively.

The moisture content of soil samples retrieved from Omi Adio, Agricultural and Botany department ranges from 0.125 g/g to 0.35 g/g, 0.020 g/g – 0.0869 g/g, 0.0465 g/g – 0.117 g/g, respectively.

4.2. Curve Characteristics

Fig. s 3, 4 and 5 show the typical geo electric curves corresponding to VES data from Botany and Agricultural Departments and Omi Adio study areas respectively. Curve types identified are H and K types. The H type is most predominant constituting 88.8 % of the curves observed from the survey areas, the signature of the curve indicates that the resistivity falls to a minimum then increases again, this is due to an intermediate layer that is a better conductor than the top and bottom layer (Lowrie, 2007). The type K curve constitutes 22.2% of the curves from the study areas. The signature of the curve indicates that the resistivity rises to a maximum then decreases again which implies that the intermediate layer is highly resistive than the top and bottom layer.

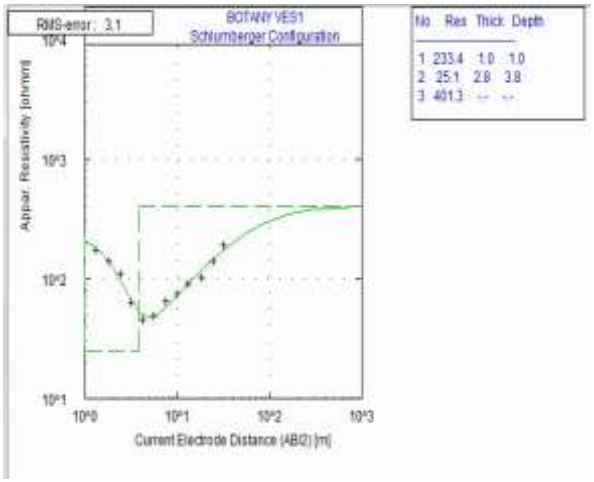
4.3. Geo electric and Lithological Characteristics

Table 1 shows the geo electric parameters and the calculated resistance to Earth of an electrode for each lithological unit at Botany sampling site. The resistivity of the topsoil ranges from 134 Ω m to 233 Ω m, the calculated resistance to Earth of an electrode ranges from 177 Ω to 185 Ω for VES point 1, 88 Ω to 92 Ω for VES point 2 and VES point 3 which is extremely higher than the required value of 10 Ω, the moisture content obtained from the laboratory analysis of the soil samples retrieved from the topsoil is low implying low conductivity, this will also affect the effectiveness of an earthing system.

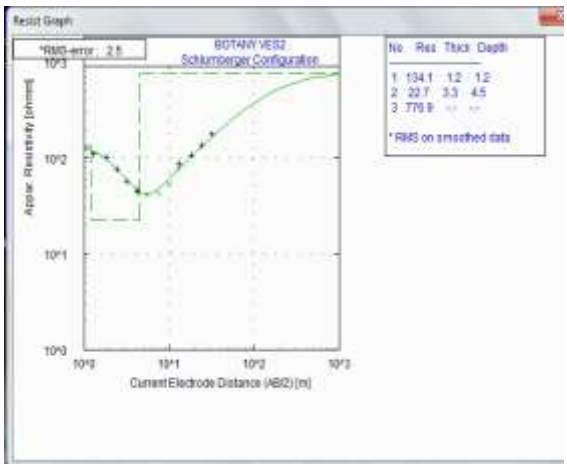
Table 1: Geoelectric parameters and electrode earth resistance Botany ves points

VES	*No of layers*	*Layer resistivity (Ω m)*	*Layer thickness (m)*	*Depth (m)*	*Rg (Ω) 20mm rod*	*Rg (Ω) 5mm rod*	*Recommended Depth for earthing rod (m)*	*GPS location*
1	3	233.4	1	1	185.39	177.10		7o 26′34.2″N 3o 53′47.8″E Elevation(212m)
		25.1	2.8	3.8	6.64	6.41	3.8m	
		401.3						
2	3	134.1	1.2	1.2	92.00	88.03		7o 26′33.227″N 3o 53′47.9″E Elevation(213m)
		22.7	3.3	4.5	5.21	5.03	4.5m	
		776.9						
3	3	116.9	1.0	1.0	92.85	88.70		7o 26′716″N 3o 53′47.78″E Elevation(207m)
		14.5	1.9	2.9	4.81	4.64	2.9m	
		387.9						

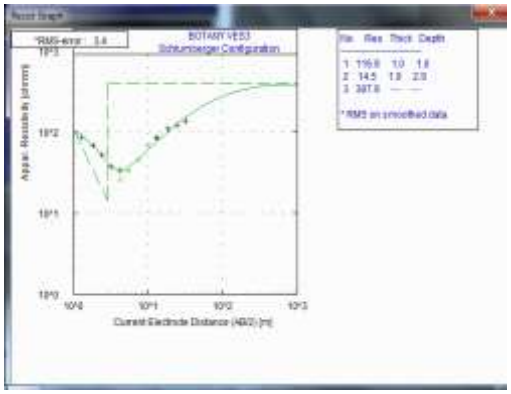
Based on this, the first layer is not proposed for earthing rod installation because it may not adequately discharge current to the subsurface. The resistivity value of the second lithological layer ranges from 14.5 Ω m to 25 Ω m indicating a highly conductive medium, the corresponding value of the calculated resistance to the Earth of an electrode ranges from 6.4 Ω to 6.5 Ω for VES point 1, 5 Ω to 5.2 Ω for VES point 2 and 4.6 Ω to 4.8 Ω for VES point 3 which is within the required value implying that an earthing rod buried within the second layer will dissipate charges effectively. Therefore an earthing rod should be driven to the second layer to a depth 3.8 m at VES 1, 4.5 m at VES point 2 and 2.9 m at VES point 3 of the survey area. Fig. 3a to 3c shows the geo electric section of Botany Department VES points, the geological sequence suggest that the subsurface is characterized sand, clay and partly weathered basement with varying resistivities and thicknesses.



(a) Log – Log plot of VES 1 (Botany).



(b) Log – Log plot of VES 2 (Botany).



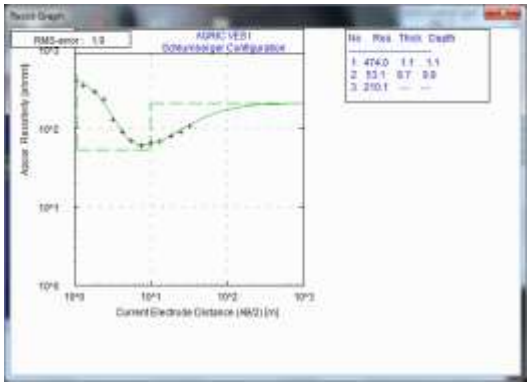
(c) Log – Log plot of VES 3 (Botany)

Fig 3.The geo electric section of Botany VES points

Table 2 shows the geo electric parameters and the calculated resistance to Earth of an electrode for each lithological unit at Agricultural Department sampling site. The resistivity of the topsoil ranges from 158.2 Ω m to 474 Ω m, the corresponding resistance to Earth of an electrode ranges from: 333 Ω to 348 Ω at VES point 1, 91 Ω to 95 Ω at VES point 2 127 Ω to 133 Ω at VES point 3 which is extremely higher than the required value (see Fig. 4a to 4c). A very low moisture content implying low electrical conductivity was observed at the topsoil, which may affect the performance of an earthing system.

Table 2: Geoelectric parameters and electrode earth resistance for Agricultural ves points

VES No	*No of layers*	*Layer resistivity (Ω m)*	*Layer thickness*	*Depth (m)*	*Rg (Ω) 20mm rod*	*Rg (Ω) 25mm rod*	*Recommended depth for earthing rod (m)*	*GPS Location*
1	3	474	1.1	1.1	348.81	333.51		7o,26′56.8″N 3o53′44.2″E Elevation(208)
		53.1	8.7	9.8	6.27	6.07	9.8m	
		210						
2	3	158.2	1.4	1.4	95.80	91.79		7o 26′ 54.6″N 3o53′44.1″ E Elevation (205m)
		19.8	4.2	5.6	3.77	3.65	5.6m	
		8818						
3	3	194.0	1.2	1.2	133.10	127.36	8.0m	7o 26′54.8″N 3o 53′44.2″E Elevation(210m)
		37.4	6.8	8.0	6.04	5.85		
		402.9						



4a: Log - Log plot of VES 1 (Agricultural)

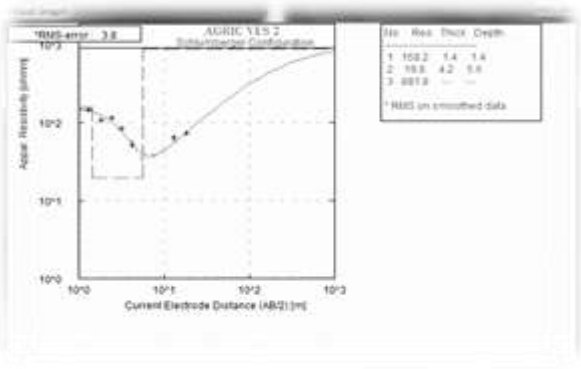
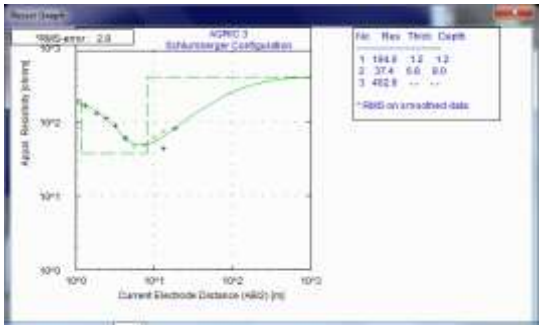


Fig.4b: Log - Log plot of VES 2 (Agricultural)

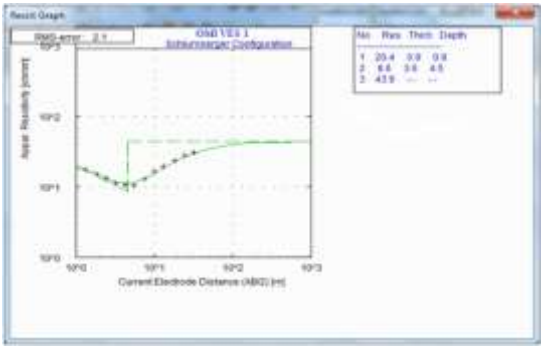


4c: Log - Log plot of VES 3 (Agricultural)

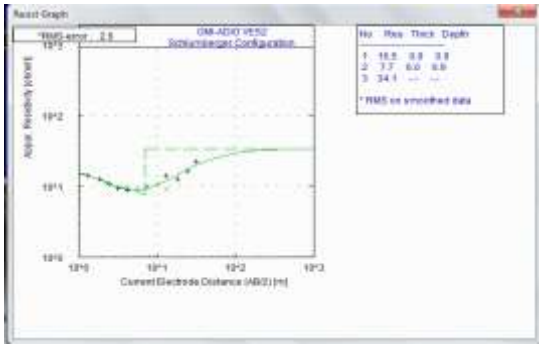
Based on this, the first layer is not proposed for earthing rod installation because it may not adequately discharge current to the subsurface. The resistivity value of the second lithological layer ranges from 19.8 Ω m to 53.1 Ω m indicating a conductive medium, the corresponding value of the calculated resistance to the Earth of an electrode ranges from 6 Ω to 6.2 Ω for VES point 1, 3.6 Ω to 3.7 Ω for VES point 2 and 5.8 Ω to 6 Ω for

VES point 3 which is within the required value implying that an earthing rod buried within the second layer will dissipate charges effectively to the subsurface via the rod. Therefore earthing rod should be driven to the second layer to a depth 9.8 m at VES point 1, 5.6 m at VES point 2 and 8.0 m at VES point 3 of the survey area.

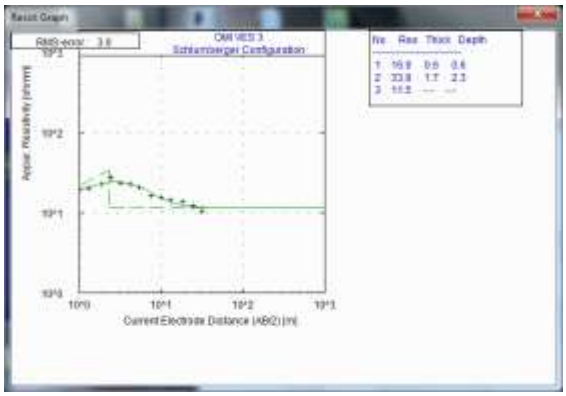
Fig. s 5a to 5c shows the geo electric section of Omi Adio VES points, which suggest that the subsurface is characterized by clayey medium with varying resistivities and thicknesses.



5a: Log – Log plot of VES 1 (Omi Adio)



5b: Log – Log plot of VES 2 (Omi Adio)



5c: Log – Log plot of VES 3 (Omi Adio)

Table 3 shows the geo electric parameters and the calculated resistance to Earth of an electrode for each lithological unit at Omi Adio sampling site, the resistivity of the topsoil ranges from 16 Ω m to 20 Ω m and the calculated resistance to Earth for an electrode at the topsoil ranges from 16 Ω to 17 Ω at VES point 1, 13 Ω to 14 Ω at VES point 2 and 19 Ω to 20 Ω at VES point 3 of Omi Adio, which is above 10 Ω. Based on this, the first layer may not enhance the performance of an earthing rod in dissipating current to the subsurface and hence not suggested for earthing rod installation. The second lithological layer at the survey site has resistivity value ranging from 8 Ω m to 33.8 Ω m implying a highly conductive medium, the corresponding resistance to Earth of an electrode is below 2 Ω at VES point 1 and VES point 2 which indicates that an earthing rod buried within the second layer will dissipate charges effectively to the subsurface via a grounding rod and therefore suggested for earthing rod installation. Hence an earthing rod should be driven to the second layer to a depth 4.5 m at VES point 1, and 6.9 m at VES point 2 of the survey area. It was observed that the moisture content obtained from the laboratory analysis of the soil samples retrieved from this sampling site is high which will also enhance the performance of the earthing system. The resistivity (33.8 Ω m) of layer 2 at VES point 3 is higher than the resistivity (11.5 Ω m) of the third layer, the second layer may not be the most suitable for burying an earthing rod. Hence an earthing rod should be driven beyond the second layer.

Table 3: Geoelectric parameters and electrode earth resistance for Omi Adio ves points

VES No	*No of layers*	*Layer resistivity (Ω m)*	*Layer thickness (m)*	*Depth (m)*	*Rg (Ω) 20mm rod*	*Rg (Ω) 25mm rod*	*Recommended Depth for earthing rod (m)*	*GPS location*
1	3	20.4	0.9	0.9	17.62	16.81		7o 25′48.1″N 3o 44′47.3″E Elevation(188m)
		8.6	3.6	4.5	1.97	1.91	4.5	
		43.9						
2	3	16.5	0.9	0.9	14.25	13.60		7o 25′148 .0″N 3o 44′ 46.6″ E Elevation (191)
		7.7	6.0	6.9	1.22	1.18	6.9m	
		34.1						
3	3	16.9	0.6	0.6	20.08	19.08		7o 25′48.0″N 3o 44′46.6″ E Elevation(188m)
		33.8	1.7	2.3	13.62	13.09	Beyond 2.3m	
		11.5						

Table 4: Result of particle size analysis.

LOCATION	*APROXIMATED PERCENTAGE OF SOIL SEPARATE*			*TEXTURAL CLASS*
	SAND %	SILT %	CLAY %	
OMI ADIO	22	14	64	CLAY
AGRIC	92	1.8	6.2	SAND
BOTANY	60	12	18	SANDY LOAM

V. Conclusion

A three layer model of VES data yields significant result for earthing systems design at the survey area, the result of the geophysical investigation shows that the second lithological layer which comprises of a highly conductive medium will enhance dissipation of charge from an earthing electrode, and hence suggested for an earthing rod installation. Based on qualitative interpretation of VES data, it was deduced that the second lithological layer with resistivity of 8.6 Ω m and corresponding depth of 4.5 m (VES point 1), resistivity of 7.7 Ω m with depth of 6.9 m (VES point 2) at Omi Adio; resistivity of 25.1 Ω m with depth of 3.8 m (VES point 1), resistivity of 22.7 Ω m with depth of 4.5m (VES point 2), resistivity of 14.5 Ω m with depth of 2.9m (VES point 3) at Botany sampling site; resistivity of 53.1 Ω m with depth of 9.8 m (VES point 1), resistivity of 19.8 Ω m with depth of 5.6 m (VES point 2), resistivity of 37.4 Ω m with depth of 8.0 m (VES point 3) at Agricultural Department sampling site are viable for earthing electrode installation. The lithological unit is characterized by a highly conductive clayey medium which will enhance the dissipation of current via an earthing rod to the ground. It was also deduced that layers with higher resistivity gives high Earth resistance of an electrode, since the Earth resistance of an electrode depend on the soil resistivity and the depth to which the electrode is to be buried, prior to the design and installation of a new grounding system, geophysical investigation of the proposed location should be done to determine the resistivity of the layers below the surface for optimization of rod driving depth.

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Chapter 8

Reaction Kinetics of Acetic Acid and Ethanol Esterification Catalyzed by ZSM-5 Catalyst

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Abstract. Kinetics of esterification of acetic acid and ethanol use solid catalyst ZSM-5 has been studied in this research. Experiments were carried out in a batch reactor, reactant ratio of sulfuric acid and ethanol 1:2, stirring at 1000 rpm, reaction time in 150 minutes and catalyst concentration 6 g/L. Variable varied is reaction temperature of 308^{o}K to 348^{o}K. Reaction kinetics data obtained use Matlab 7.8 software. From the experimental results, the greatest conversion is obtained at temperatures of 348^{o}K is 70.16%. Activation energy obtained from the calculation was 28,566.8 J/mol. The experimental data were compared with data from the calculation of Matlab is used to see the approach of the model used. It can be concluded that the modeling approach used in accordance with the experimental data.

Keywords: acetic acid, ethanol, esterification, reaction kinetics, ZSM-5 catalyst

I. Introduction

On the industrial scale, ethyl acetate produced from the esterification reaction between acetic acid (CH3COOH) and ethanol (C2H5OH) using sulfuric acid catalyst (H2SO4). Ethyl acetate is a compound resulting from the exchange of the hydroxyl group in acetic acid with a hydrocarbon group in ethanol. Ethyl acetate on an industrial scale is widely used as a solvent in industrial paints, thinner, material for plastics, adhesives, cosmetics, pharmaceutical and organic chemical industry. The overall reaction between acetic acid and ethyl alcohol over a catalytically ZSM-5 catalyst is as follows:

CH3COOH + C2H5OH C2H5COOCH3 + H2O...(1)

One example of an esterification reaction using sulfuric acid catalyst is esterification of free fatty acids and alcohol [1]. The highest conversion was obtained by 96% at a temperature of 328^{0}K with a ratio alcohol / free fatty acids was 6.13 and the concentration of catalyst 2.2% by mass. But the use of sulfuric acid as a catalyst has several weaknesses such the difficulty of separation of the product with the catalyst so that the waste treatment plant has a greater load in the presence of sulfuric acid inseparable in refining and high levels of corrosion in equipment.

Because there is a weakness in the sulfuric acid catalyst, then the next researcher using other alternative replacement for sulfuric acid catalyst. Esterification reaction of ethanol and acetic acid is done by using a catalyst Lewatit monoplus-100 [2]. The highest conversion of 87.3% was obtained at a temperature of 358^{0}K

and a catalyst concentration of 0.8 mass resin / mass ethanol. Esterification reaction of acetic acid and ethanol also been carried out using acid catalyst Amberlyst-15 resin from Rohm and Haas [3]. The highest conversion was obtained by 75% at a temperature of 353^0K with a mole ratio of acetic acid: ethanol is 1: 2 and a catalyst concentration of 5.4 gram per 100 grams of acetic acid. The kinetics of the reaction rate obtained from the study are:

$$k = 2.6x10^{14} e^{\left(\frac{104,129}{RT}\right)}$$

Kinetics of esterification reaction between acetic acid and methanol was studied using a catalyst and not using the catalyst [4]. The results obtained showed that the esterification reaction by using a catalyst is faster and give conversion 54% compared to the reaction that does not use a catalyst with a conversion of 14% within 180 minutes. The highest conversion using a catalyst obtained by 54% at a temperature of 328^0K with a mole ratio of acetic acid and methanol is 1: 3 as well as the weight of the catalyst at 10% by weight of acetic acid. In this research, used a stirrer speed of 1,000 rpm. In previous research has been learned about the resistance of the external mass that is by varying the stirring speed of 800 rpm to 1,200 rpm [4], because the stirring speed in excess of 800 rpm can eliminate external diffusion, internal diffusion ignored during the esterification reaction conditions. The result, for the reaction with stirring speeds above 1,000 rpm did not experience significant changes in the rate of reaction. So the esterification reaction was carried out with stirring speed of 1,000 rpm. The activation energy reactions using the catalyst obtained is 37,626 kJ / mol.

II. Materials and Methods

A. Chemical

Acetic acid and ethyl alcohol were supplied by Merck AG. Acetic acid of 99.5% (w/w) purity (Merck) and ethanol aqueous solution with a content of 96% w/w ethanol (Merck) were used as supplied.

B. Catalyst

The catalyst used is a catalyst ZSM-5, which has been synthesized from lignite bottom ash and rice husk. The synthesis of ZSM-5 performed in an autoclave at temperature of 180^0C with an autogenous pressure, the mole ratio parameter Na^+ / SiO_2 0.2 mol / mol, mole ratio H_2O / SiO_2 30 mol / mol, mole ratio TPABr / SiO_2 0.05 mol / mol , the mole ratio of SiO_2 / Al_2O_3 50 mol / mol and crystallization time of 48 hours using a template TPABr. Percent crystallinity of ZSM-5 product obtained by 86.95%. ZSM-5 catalyst concentration used adalam 6 g / L.

C. Reaktor Batch

The equipment used in this research is shown in Fig. 1. The reactor used is a three-neck flask with a volume of 1 L, equipped with a condenser, thermometer, hot plate and maghnetic stirrer.

Fig. 1. Research Equipment

D. Procedure

Acetic acid and ethanol was added into the reactor with a mix volume of 0.5 L, then the stirrer is moved so that the system is mixed. Samples were taken for analysis of the initial concentration of acetic acid, then the catalyst ZSM-5 was added and the reactor was shut down (reactor equipped with a thermometer). Hot plate turned on and the stirrer set at 1,000 rpm. The heater is adjusted to the desired temperature is reached which is 35^0C then 10 mL samples are taken every 15 minutes during 150 minutes. The experiment was repeated by varying the reaction temperature 45^0C, 55^0C, 65^0C and 75^0C. Each sample taken is analyzed to determine the conversion.

E. Result Analysis

The analysis of concentration acetic acid is done by using the titration method. Samples were taken and put in erlenmeyer, then add 3 drops of indicator PP. Furthermore, the sample is titrated with 0.1 N NaOH solution until the color changes from clear to pink. Be noted the volume of titrant, repeat the experiment two times and calculated initial concentration acetic acid using the formula:

$M_1 \times V_1 = M_2 \times V_2$ with :
V1 = volume of titrant solution (NaOH)
V2 = the volume of titrated solution (CH3COOH)
M1 = concentration the titrant solution (NaOH)
M2 = concentration of the solution being titrated (CH3COOH)

Conversion calculation based on the results of the reduction reaction between the initial acetic acid concentration of acetic acid reduced residual divided by the initial acetic acid.

$$X = \frac{A_o - A_t}{A_o}$$

with :

Ao = initial concentration acetic acid

At = concentration residual acetic acid every 15 minutes

F. Derivation of A Catalytic Rate Equation

In the esterification reaction reversible and irreversible mechanism used in this study. The reaction reversible mechanism can be written as follows [3] :

1. Adsorption of reactants to the surface of the catalyst

$$CH_3COOH + H' \underset{k_{-1}}{\overset{k_1}{\leftrightarrow}} CH_3COOH_2^+$$
$$(A) \quad + (C) \quad (AH)$$
$$-r_{A=} \frac{-dC_A}{dt} = k_1 C_A C_C - k_{-1} C_{AH} \quad \text{.....(2)}$$

2. The reaction at the catalyst surface

$$CH_3COOH_2^+ + C_2H_5OH \underset{k_{-2}}{\overset{k_2}{\leftrightarrow}} CH_2COOC_2H_5H^+ + H_2O$$
$$(AH) \quad + \quad (B) \quad (EH) \quad + \quad W$$

$$-r_{A=} \frac{-dC_{AH}}{dt} = k_1 C_A C_C - k_{-1} C_{AH} - k_2 C_{AH} C_B + k_{-2} C_{EH} C_W = 0 \quad \text{.....(3)}$$

3. Desorption products of the surface of the catalyst

$$CH_2COOC_2H_5H^+ \underset{k_{-3}}{\overset{k_3}{\leftrightarrow}} CH_3COOC_2H_5 + H^+$$
$$(EH) \quad (E) \quad + (C)$$

$$-r_{A=} \frac{-dC_{EH}}{dt} = k_2 C_{AH} C_B - k_{-2} C_{EH} C_W - k_3 C_{EH} + k_{-3} C_E C_C = 0 \quad \text{.....(4)}$$

From equation (2), (3) and (4) obtained rate equation :

$$\frac{-dC_A}{dt} = k_r \left(\frac{C_A C_B - \frac{C_E C_W}{K}}{C_B + C_W k_W} \right) \quad \text{.....(5)}$$

Where $K = \frac{k_1 k_2 k_3}{k_{-1} k_{-2} k_{-3}}$, K_W is the adsorption equilibrium constant of water. In this research $K_W = 0$. For initial rates ($C_E C_W/K=0$), so that the equation (5) becomes :

$$\frac{dX_A}{dt} = \frac{k_r}{C_{Ao}} (C_{Ao} - C_{Ao} X_A) \quad \text{.....(6)}$$

The reaction irreversible mechanism can be written as follows [5] :

1. Transfer of the reactant mass of fluid to the surface of the catalyst

$$-r_A = k_A am(C_A - C_{AS}) \quad \text{.....(7)}$$
$$-r_E = k_E am(C_E - C_{ES}) \quad \text{.....(8)}$$

2. The reaction on the surface of the catalyst

$$-r_{AX} = k_1 \left(mC_{AS} C_{ES} - \frac{mC_{EAS} C_{WS}}{k_e} \right) \quad \text{.....(9)}$$
$$-r_{EX} = -r_{AX} \quad \text{.....(10)}$$

Because ethanol is given excess, then the reaction to the left is assumed to be very small and can be ignored, so equation (9) into:

$$-r_{AX} = k_1 mC_{AS} C_{ES} \quad \text{.....(11)}$$

3. Transfer of product mass of liquid to the catalyst surface

$$-r_{EAS} = k_{EA} am(C_{EAS} - C_{EA}) \quad \text{.....(12)}$$
$$-r_{WS} = k_W am(C_{WS} - C_W) \quad \text{.....(13)}$$

If the reactions that take place in the same direction, the result does not affect the concentration the reaction rate [6]. For reactions that occur in the same direction and the desorption stage very quickly the equation (12) and (13) can be ignored. At steady state conditions :

$$C_{AS} = \frac{k_A am C_A}{(k_A am + k_1 m C_{ES})} \quad \text{.....(14)}$$

Where:

$$k_o = \frac{k_1 m C_{ES} k_A am}{k_A am + k_1 m C_{ES}} \quad \text{.....(15)}$$

$$\frac{1}{k_o} = \frac{k_A am + k_1 m C_{ES}}{k_1 m C_{ES} k_A am}$$

$$\frac{1}{k_o} = \frac{1}{k_1 m C_{ES}} + \frac{1}{k_A am} \quad \text{.....(16)}$$

Because ethanol is given excess then $K_r = k_1 m C_{ES}$, assuming :

$$k_c = k_A am$$

$$\frac{1}{k_o} = \frac{1}{k_r} + \frac{1}{k_c}$$

$$k_o = \frac{1}{\frac{1}{k_r} + \frac{1}{k_c}} \quad \text{.....(17)}$$

Because the speed of stirring is done at 1000 rpm, then $K_c = 0$, so that $K_o = K_r$

$$\frac{C_{AO} dX_A}{dt} = k_r (C_{Ao} - C_{Ao} X_A) \quad \text{.....(18)}$$

$$\frac{dX_A}{dt} = \frac{k_r}{C_{AO}} (C_{Ao} - C_{Ao} X_A) \quad \text{.....(19)}$$

The equation to find the reaction kinetics of reversible and irreversible mechanism which is obtained of a decrease in the formula is the same, that is equation (6) and (19). Kr value can be searched by means of minimizing the sum of square of errors (SSE) using Matlab program of conversion of acetic acid acetic acid calculated and conversion data.

$$SSE = \sum (X_{hitung} - X_{data})^2 \quad \text{.....(20)}$$

III. Results and Discussions

From the experiments obtained acetic acid conversion data as in Fig. 2.

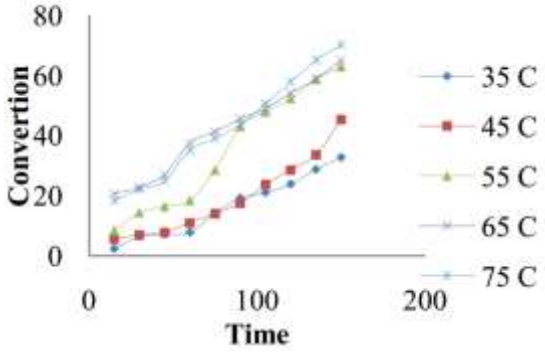

Fig. 2. Conversion Data Acetic Acid vs. Reaction Time Temperature Variation In each reaction

From Fig. 2 shows that the highest conversion at a temperature of 75^{0}C is 70.16% in a reaction time of 150 minutes. This happens because by increasing the reaction temperature, the energy possessed by the molecules of reactant increased so as to overcome the activation energy. This leads to collisions between molecules increased, resulting in increased reaction rates. This result is not much different from the experiments using a catalyst Amberlyst 15 [3]. The highest conversion obtained at a temperature of 80^{0}C is 75% in a reaction time

of 350 minutes. This means that the catalyst ZSM-5 is good enough to be used as a catalyst at esterification between acetic acid and ethanol.

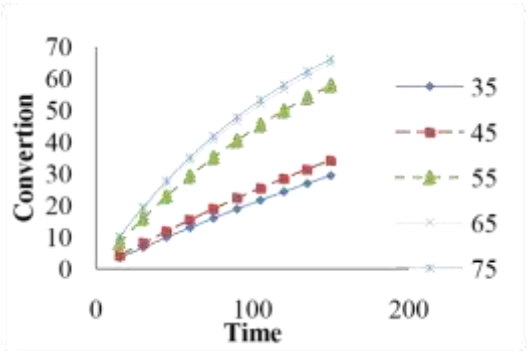

Fig. 3. Conversion Acetic Acid Reaction Time Calculate vs. Temperature Variation In each reaction

As seen in Fig. 3, the model used is good enough to describe the process that occurs during the reaction process. It can be seen from the results that calculate conversion value has a similarity with data conversion. So that the kr value obtained from the calculation at each temperature variation can be used to calculate the activation energy of the reaction.

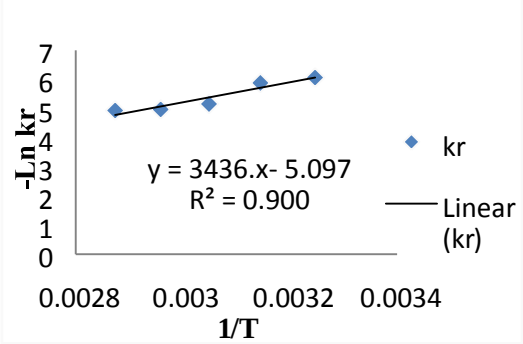

Fig. 4. Curve Relationship Between -Ln K and 1 / T

From the results linearized kr value at each temperature in Fig. 4, the reaction kinetics equation:

$$k_r = 163.5306 \exp\left(\frac{-28.566,8}{RT}\right) \quad \text{.....(21)}$$

Activation energy obtained in this study is 28,566.8 J / mol. Activation energy obtained in this study is smaller when compared to the activation energy is obtained by using a catalyst Amberlyst 15 [3] is 104, 129 J / mol.

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IV. Conclusions

From the research that has been done can be concluded that:

1. The catalyst ZSM-5 can be used as a catalyst at esterification of acetic acid and ethanol with the highest conversion is obtained at a temperature of 75^0C is 70.16%.
2. The activation energy obtained of the esterification reaction mechanism is 28,566.8 J / mol, the reaction kinetics:

$$k_r = 163.5306 \exp\left(\frac{-28.566,8}{RT}\right)$$

SYMBOL

A	= the surface area of the catalyst
r_A, r_E, r_{EAS}, r_{WS}	= Mass transfer speed
m	= catalyst mass per volume of solution
C_A, C_E	= concentration acetic acid and ethanol
C_{AS}, C_{ES}, C_{EAS}, C_{WS}	= concentration a the surface of the catalyst for the acetic acid, ethanol, ethyl acetate and water
r_{AX}	= acetic acid reaction speed
r_{EX}	= ethano reaction speed
k_A, k_E, k_{EA}, K_W	= mass transfer coefficient acetic acid, ethanol, ethyl acetate and water
k_e	= equilibrium constants
C_{Ao}	= initial acetic acid concentration
X_A	= conversion reaction
K_o	= constant overall
K_r, k	= the reaction rate constants
K_c	= mass transfer coefficient
t	= time
C_E	= concentration ethyl acetate
C_W	= the concentration of water
C_C	= catalyst concentration
CAH, CEH	= concentration acetic acid and ethanol on the surface of the catalyst
k1, k2, k3	= forward reaction rate constants
k-1, k-2, k-3	= backward reaction rate constants
K	= equilibrium constants
kw	= constant water absorption

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Chapter 9

Design of The Innovative Clothes Dryer by using "Triz" Approach

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Abstract. The global warming produces the erratic weather changes. This weather changes can have an impact on some activities of human life. One of them is difficulties to dry the wet clothes. Because of the weather was changed disorderly between rainy and no rain. This paper presents a design of the indoor clothes dryer so that the drying process will be more effective and more efficient in any condition. Teoriya Resheniya Izobreatatelskikh Zadatc (TRIZ) methods is used to improve a design of products based on contradictive attributes that users require. A paper based survey was conducted to identify the attributes of product and design parameter was determined subjectively to design a new clothes dryer. While statistical analysis was conducted to test the hypothesis developed. Results of this study shows that the indoor clothes dryer is effective and efficient in use at 5% significant level which includes six attributes. There are size, affordable price, durable material, type of heater, the capacity of the dryer, and a time drying process.

Keywords: Clothes Dryer, TRIZ, effective, efficient

I. Introduction

The temperature of the sunny during the day is in range between 33^0C - 39^0C [1]. At this condition is generally used for drying clothes. However, rapid changes in weather that caused by global warming yield natural drying not effective and efficient. It may cause some problem for active people although the available washing machine has a drying facility. But the results may still not meet users expectations. Based on this fact so it is important to provide an effective solution for this problem. The solution is to develop a design of clothes dryer which is more effective and efficient. The previous study on drying tools for garments has been conducted by [2], [3], [4]. [2] developed drying tools with using fan to dry clothes indoor. While [3] developed the aids for drying with the sensor for moving. And [4] developed a simple design of drying tools. It just use wheel in rope for hanging the clothes. In this study it was tried to develop the different drying tool based on TRIZ approach that is a creative method for the structured problem-solving process in design [5].

II. Research Method

A. Survey

Survey was conducted to identify the user criteria, the design parameter, and to validate the purposed design. Questionnaire were developed and distributed to more than 50 respondents. Their ages ranged from 20 to 50 years old. Only valid respond was used in this study.

B. TRIZ Method

The procedure for applying TRIZ in general are as follows [6]:

1. Select a technical problem
   In this step is to identify technical problem of the product and determine the contradiction between two or more technical problems.
2. Formulate a physical contradiction
   Physical contradiction is formulated based on technical problem. Then this contradiction determined is sought a solution.
3. Formulate an ideal solution
   In this step, improving and worsening features are identified. Then it should be decided how to enhance the desired factors and eliminate the an ecpected factors to formulate an ideal solution.
4. Find resources for the solution, making use of the capabilities of TRIZ
   To get an ideal solution, the inventive principles must be determined based on the matrix of contradictions between improving and worsening features. (See APPENDIX A)
5. Determine the "strength" of the solution and choose the best one
   In this step, the inventive principles identified at step 4 is selected the strongest one principle based on the problem solved.
6. Predict the development of the system considered within the problem
   Hereinafter in this step is to develop the new system and chooses a possible method to make a solution.
7. Analyze the solution process in order to prevent similar problems
   Analysis of the solutions obtained is conducted in this step to prevent an emergence of similar problems.

C. Statistical Analysis Method

In this study non-parametric statistical analysis was conducted to test validity and reliability of result of customer survey by using Spearmans's Rank Correlation for validity test and Cronbach alpha coefficient for reliability test [7], [8]. While Stuart Maxwell test is conducted to test the hipothesys on no difference between the developed design and customer requirement [9].

III. Result and Discussions

A. Customer Voice

Result of the customer surey was seen in Table I. It described six attributes that user is looking for. They are size of clothes dryer, affordable price, durable material, type of heating, the capacity of the clothes, and a time drying process. According to those attributes, users want the clothes dryer has adequate size for being able to placing in a room. As for the affordable price indicated that users want the tools can be bought in reasonable price. On the other hand, users want the clothes dryer can persist longer in use. Heater type indicated that users require not noisy in sound and safe to use. Capacity of dryer shows that users want tools can accommodate more clothes. Time drying process shows that users want tools that can dry clothes quickly.

Table I. Customer Attributes

No	Attributes
1	Size
2	Affordable Price
3	Durable material
4	Type of heater
5	Capacity of the dryer
6	Time drying process

B. Analysis of Inventive Principles Selected of Contradiction Matrix

Table II showed result of contradiction each attribute for inventive principles. Where attribute size is the principle 7 (Nesting) with sub-principle A is placing an object or system inside, placing any object or system in turn inside [5]. By using this princip the clothes dryer design with the length 85 cm, width 60 cm, height 120 cm so that it can accommodate 15 pieces of clothes.

Table II. Inventive intersections principles in contradiction matrix

No	Attributes	Improving Feature	Worsening Feature	Inventive Principles
1	Size	*Volume of non-moving object* (8)	*Shape* (12)	7, 2, 35
2	Affordable Price	*Amount of substance* (26)	*Strength* (14)	14, 35, 34, 10
3	Durable material	*Strength* (14)	*Accuracy of measurement* (28)	3, 27, 16
4	Type of heater	*Power* (21)	*Energy spent by moving object* (19)	16, 6, 19, 37
5	Capacity of the dryer	*Productivity* (39)	*Area of non-moving object* (6)	10, 35, 17, 7
6	Time drying process	*Durability of non-moving object* (16)	*Reliability* (27)	34, 27, 6, 40

An inventive principle appropriate to an affordable price is the principle 10 (Preliminary Action) with sub-principle A that is do before it is needed, the changes is needed an object or system, either fully or partially [5]. Based on this princip the price of this appliance ranges between Rp 1.000.000,00 - Rp 1.500.000,00.

Inventive principles are in accordance with the attributes of a durable material is principle 3 (Local Quality) with sub-principle B that make each part of an object or system function in conditions most suitable for the operation [5]. The material used is aluminium for framework and body. It because of this material is resistant to corrosion.

Inventive principles are in accordance with the attribute type of heater is the principle 6 (Universality) with sub-principle B that uses the standard features [5]. Heaters used on this instrument are incandescent lamps by 4 units for each lamp has a power of 100 watts. And use a fan to spread the heat to all parts.

Inventive principles appropriate to attribute capacity outfit is the principle 10 (Preliminary Action) with sub-principle B is pre object or system set up so that they can come into action from the most convenient place and without losing time for delivery [5]. The clothes dryer with adequate size have appropiate capacity for fifteen clothes and they were inserted into the drying chamber by using hanger with distance between 5 cm - 6 cm so that the clothes can absorb heat from the lamp with a flat.

Inventive principle in accordance with the attributes of a drying process is the principle 6 (Universality) with sub-principle B that uses the standard features [5]. According to experiment this dryer can work less than 6 hours. Thus this tool is more effective and efficient than the other.

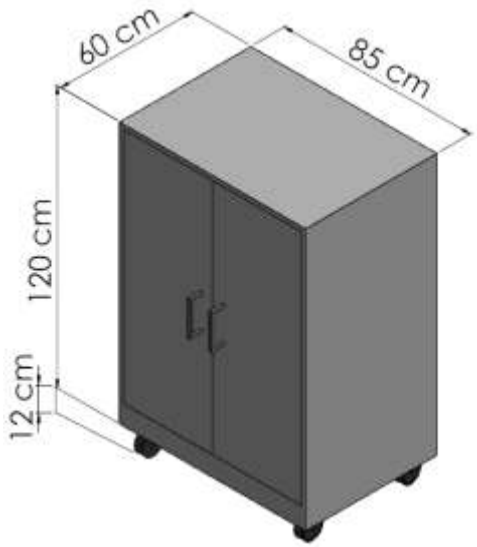

Fig 1. Design of clothes dryer

Fig. 2. Design of clothes dryer

Fig 3. Design of clothes dryer

C. Result of Validation

Table III showed result of homogenity test by using Stuart Maxwell Marginal test. The result is accepting the null hipothesys at 5% of significant level that is there is not a significant difference between the user's requirements and the proposed dryer design. Therefore the design developed is valid to statisfy user need.

Table III. Stuart Maxwell test of Marginal Homogeneity results

User's requirements	z values
Size	0.109
Affordable Price	0.378
Durable material	0.197
Type of heater	0.739
Capacity of the dryer	0.622
Time drying process	0.796

Furthermore Table IV present the result of difference test between the proposed design and the existing design by using wilcoxon test which it decides there is different between both above at 5% of significant level. Thus this design was better and more effective and more efficient to be implemented.

Table IV. Different Wilcoxon Test Results

User's requirements	*Asymp. Sig. (2-failed)*
Size	0.016
Affordable Price	0.021
Durable material	0.027
Type of heater	0.039
Capacity of the dryer	0.012
Time drying process	0.023

IV. Conclusion

It can conclude as follow:

1 Attributes of clothes dryer that user required are size, affordable price, durable material, type of heating, the capacity of the clothes, and a drying process.

2 Design parameters for the clothes dryer are a box shape with a length of 85 cm, width 60 cm, and a height of 120 cm and can accommodate 15 pieces of clothing apparel. The material used is aluminum for framework and body is. To get hot on this tool using incandescent bulbs with 4 pieces each power of 100 watts. Use fan for spreading hot air. Product of temperature is in range 39^{o}C - 42^{o}C. And this tool can be drying clothes in less than 6 hours.

3 The proposed design is valid to statisfy customer criteria and better.

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Chapter 10

Hydrofoil Boat For Indonesian Waters

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Abstract. Indonesia with many islands and relatively vast country needs a protection of its sea products and good sea transportation. This is in line with the government plan of maritime axe as well as sea toll. To fulfill the plan, operating high speed (fast) boat including hydrofoil boat will be useful. A couple of researches / studies on hydrofoils had been done and published. The objective is to see the possibility of constructing and operating hydrofoil boats across Indonesian waters optimally. This study was based mainly on experience of the author sailing hydrofoil boat from Macau to Hong Kong, China in April, 2014. Several aspects were analyzed, i.e. convenience, cabin facility, and economy. The method of comparison (with other fast boats, different type) and matching with Indonesian waters condition was used. Island shape (distance between cities/ports), & rules / regulations on the boat are accounted. It is found that there is a possibility of constructing and operating hydrofoil boat in Indonesia.
Keywords: Hydrofoil boat, Indonesian waters, construction, operating.

I. Introduction

In Wikipedia [8], the free encyclopedia, hydrofoil boat were used for both military and passenger – Canada, USSR, U.S, and Italy are the builder/operator for military while Russian and Ukraine built for passenger for more than 20 countries. The Boeing 929 of U.S. made, was widely used in Asia including Japan, Korean peninsula, Hong Kong and Macau for Passenger. Indonesia needs fast (speed) boat to secure marine products including fish. On top of that transporting passengers (between cities, islands as well as tourists), goods, etc. is very beneficial. Some papers of hydrofoil boat were published locally, nationally, and internationally (2011,2012 a, b, and 2013). Generally in the field of naval architecture, boat, ship, vessel, are marine vehicle – boat usually relatively small ranging from several passengers/crews to about hundred. Vessel may be used for up to four hundred passenger capacity [15]. Typical behavior of a hydrofoil boat is at higher speeds, hull (body) emerging from the water surface. In shipping or naval architecture, speed unit is knot. One knot equal to one nautical mile (about 1.82 km) / hr. Boat with speed of about 30 knots may be grouped into high speed sea vehicle.
The objective is to see the possibility of building and operating hydrofoil boat in Indonesia. To see the suitable operating area, the map of Indonesia, Fig.1 is included.

Fig 1. Map of Indonesia [3]

II. Material and Methods

Theory of hydrofoil boats consists of displacement type of Archimedes principle, at slow (low speed) and semi flying type of Bernoulli principle at high speeds, Fig.2 with Eq. 1 and Eq.2. General view of hydrofoil boat, indicated by Fig 3 (July, 2012).

In operational high speed, hull emerging on foils, can be seen in Fig. 4 'Jetfoil' took by the author.

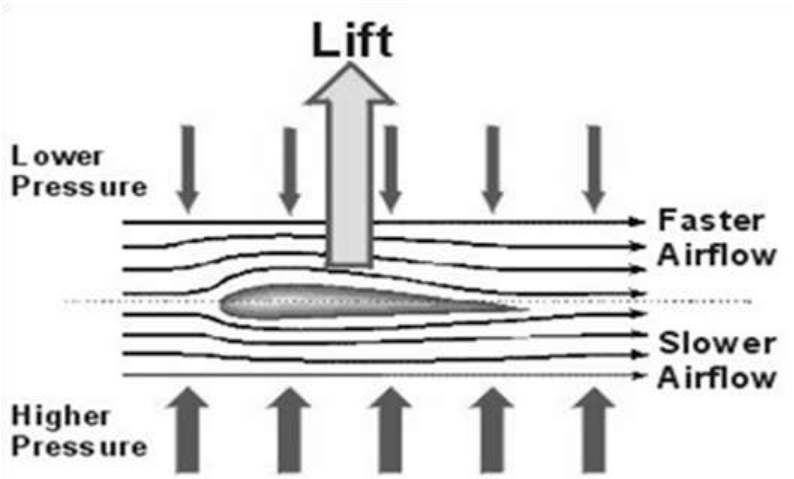

Fig. -2 Lifting force of foil [6]

III. Mathematical Statements and Theory

Force equal to mass times acceleration, in x-direction Eq. 1

$$\sum F_x = m\, a_x$$

$$a_x = \frac{du}{dt} \tag{1}$$

$$u = u\,(x, y, z, t)$$

Marine vehicle hydrofoil lifting the body to increase speeds, based on Bernoulli Equation, eq. 2 derived from Eq. 1.(Lowe, 1979) [2]

$$p_1 + \rho g h_1 + \frac{1}{2}\rho v_1^2 = p_2 + \rho g h_2 + \frac{1}{2}\rho v_2^2 \tag{2}$$

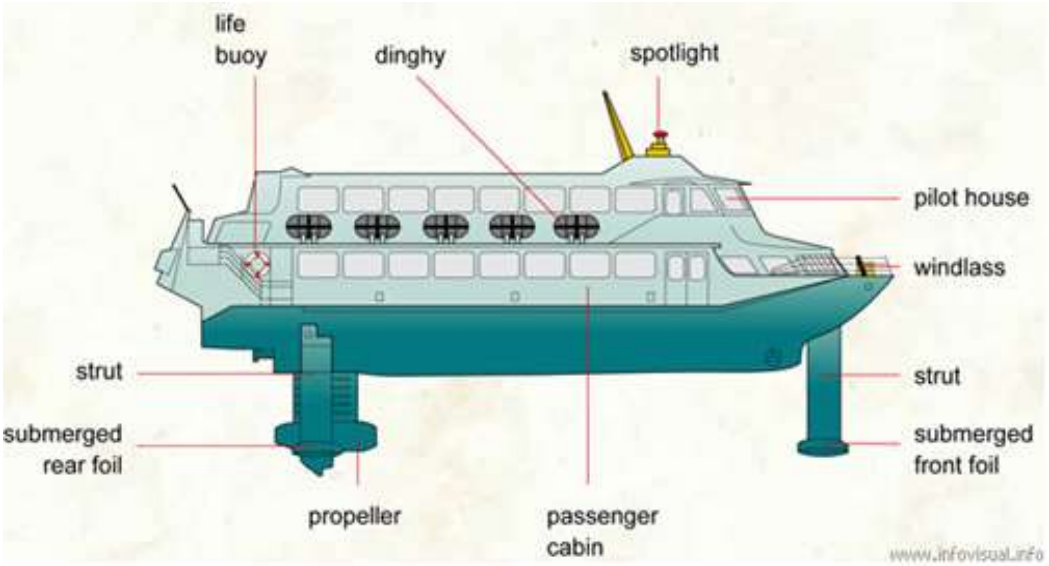

Fig. 3. General view, Fully submerged foil [7]

Fig. . 4 Hydrofoil Boat "Jetfoil " [15]

Fig. 5 shows the distance of about sixty km between Hong Kong and Macau. Hydrofoil boat sailing Macau – Hong Kong, China, April 2014, 1st (super) class [13], ticket for PTC324.00 (currency of macau), Fig.6 and Tricat 2nd (economy) class, ticket for HK$144.00, Hong Kong - Macau, about 1 hour single trip or 2 hours return.

Comparison with similar fast boats of three-maran (tricat), Fig 7 (displacement type). Data of Indonesian waters, island shapes, as well as shipyard capability are taken into account to get results.

Fig 5. Hong Kong and Macau [4]

Fig 6. Taking first class Jetfoil, Macau-Hong Kong April 2014 [13]

Fig. 7 Hydrofoil (right), Tricat (left) [13]

IV. Results and Discussions

Passengers need good seating/space and excellent services. Convenience (less motion) in medium wave sea of hydrofoil boat resulting from foil lifting ability, Fig. 4.

The author took Tricat, from Hong Kong to Macau, on same day as sailing the hydrofoil boat (Macau to Hong Kong), Fig. 6. I felt that on the hydrofoil boat were more convenience. As a matter of fact, tricat boat experiencing higher motion in oblique waves. Both Tricat and hydrofoil boats were belong to Turbo jet, Hong Kong based company [8,15]. Facility of seat and bath room / toilet were excellent.

Economically, ticket price for Hong Kong – Macau, one hour sail, first class, about Rp400.000,-, second, about Rp200.000,-.Batam –Singapore, ticket, Rp215.000,-, 45 minutes. Comparison indicates that the difference is not significant for economy class, meanings that it is possible to operate the boat in Indonesian waters, provided with good management. Facility of the hydrofoil boat, sailing Macau – Hong Kong is better than speed boat, sailing Batam – Singapore. Fast boat sailing Kupang – Rote island with the ticket price of about Rp3.000 / nautical mile may be as comparable supporting use of the boat in Indonesia.

Performance of hydrofoil boats, suitability in operation in certain area in Indonesia are considered. A couple of places, for instance between Makassar, South Sulawesi to Majene, West Sulawesi the boat will be suitable due to shorter distance (compared with land) and road conditions (Djabbar et al. 2012). Some other places in Indonesia are similar to the route.

The possibility of constructing the boat in Indonesia is high. Quite a few shipyard in Indonesia, for example PT PAL in Surabaya is able to construct the boat. Beside long experience it has advanced devices, Another shipyards are in Jakarta and Batam. In Batam more than 100 shipyards are capable of constructing various type of boats (ships) [14].

Just like general construction, by rules[1] boat structure must be strong enough during sailing in rough seas as well as safe navigation. The institution of classification society is in charge of the examination and certification of the boat. Most of maritime countries have the institution, the oldest is Lloyd Register (LR) in UK. In Indonesia it is called Biro Klasifikasi Indonesia (BKI). It has many rules, hydrofoil boat is categorized as high speed boat, and should be built under the rules for classification and construction of high speed craft. In the rules of edition 2000, there are two special requirements for scantling i.e. hydrofoil hull structures, and air-cushion vehicle hull. Some requirements for hydrofoil are the size of length same or less than 35 m, max speed 40 knots; hard chine hulls, significant dead rise bottom, bow foil within 1/3 length, foils of fixed or lifting type and partially submerged Vee (narrow or wide self stabilizing or completely submerged, horizontal non-self-stabilizing fitted with automatic stabilizing devices. . For other characteristics, the Society reserves the right to require appropriate additional calculations and models tank test. There are two requirements, i.e. longitudinal strength and local strength. Longitudinal strength covers allowable stresses -midship section modulus while the latter covers shell and deck plating (minimum thickness) ; bottom, side and deck structures ; primary transverse frames; watertight bulkheads; foils.

Since the building (advanced devices) and operational cost is high, for short term it is recommended to buy first, followed with Indonesian design and construction. Latest rules are 2015 edition [16] should be applied for efficient and effective new building hydrofoil boat.

Fig 8. Fully Submerged Hydrofoil Boat [5]

Specifications: Length, m 31.3; Crew, people 12; Range, km (24 tons of cargo) 200; Vessel's speed, knots 55. Fig. 8 Shows other hydrofoil boat, higher speed may used as a comparison in designing the suitable one for Indonesian waters

V. Conclusion and Recommendation

Hydrofoil boat is categorized as special craft of high speed, widely used around the globe. The study was based on the experience of the author sailing the boat between Hong Kong and Macau vise versa, in 2014. It was found that there is a possibility of operating and constructing hydrofoil boat in Indonesia. It is recommended to operate the boat by firstly buying and secondly building the boat in Indonesia. Study of the boat including boat price, operational cost, latest rules, edition 2015 will be meaningful.

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Chapter 11

Urban Community Behavioral on the Traffic Light and Implementation of Intelligence Traffic Control System

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Abstract. Communities behavioral in relation to the traffic, especially in intersections have nearly the same conditions. It often occurs when the red is still lit, motorists and tend not to care about the traffic regulations. Discipline lack is the main cause of violations. ITCS Application requires a high level of discipline of the user. This control would make the timing of lights in accordance with the density of vehicles on the road condition goals. ITCS is programmed to accurately provide time to switch the provision of lights and at the same time the camera will capture images of traffic violators and send the results to the police station for further action. The methodology was conducted using a literature and field research including data collection and on compared to conditions after the ITCS implementation. This will be a positive impact in application traffic police strictly enforce sanctions for speeding tickets indiscriminately.

Keywords: Behavior, Community, Camera Control, Riders discipline, Traffic Lights Control.

I. Introduction

In the transport system has two important aspects, namely the transportation facilities and infrastructure. If the transport facilities are not matched by the availability of transport infrastructure (road network) will give problems of transportation. Jakarta as the capital of the Republic of Indonesia, in terms of number and road users, is currently experiencing rapid growth, leading to increased demand for transportation infrastructure. From the literature study about the traffic problems that occur in traffic management, some problems in general, especially those that occur in big cities today, such as Depok or Medan. In both cities can be identified, that the traffic problem often occurs. (M Lubis, 2007, A.Priyono et.all, 2014).

1.1. On The Road

Some of the many problems that often occur on the side of the road and even in a crowded area like the market or education area resulting in bottlenecks, among others:

- Along the road there are parking private vehicles and freight vehicles were irregular.
- Because at the region crowded with passengers, then stopped the vehicles of public transport stops outside the predetermined area.
- Public transport pass regardless of traffic rules in force and even stop haphazardly to transport and drop off passengers and pedestrian defectors as shops visitors, markets visitor, schools, and other facilities.

- The development of the market visitors or terminal and inadequate access to the parking area that is outside the road and terminals, especially the direction of turn to the market and bus terminal as well as the inadequacy of the capacity thus causing the long queue to enter into or exit.
- Mixing of diverse types of vehicles are motor vehicles and motor as well as the transport of passengers and goods in the limited streets.
- The high volume of market visitors growing with available road capacity static or ratio.

This is illustrated in Fig. 1 below, which was parked along the road some private cars and motor vehicle body so narrow lanes of vehicle traffic. This Situation is shown every day in Depok City as urban city. It can be bad image for this community.

Fig. 1 Irregularities in the park on the road

This others is illustrated in Fig. 2 below, which was indicated the unregulated crossing. This can be wrong education for next generation, like child and student.

Fig.2 Irregularities in the park on the road

I.2 The Crossroads

Some problems occurred at the intersections which resulted in bottlenecks, including:

- The high number of conflicts in the region and a priority system inadequate.
- The poor Geometric roads and poor sight distance.
- Poor traffic flow canalization system.
- Not exactly a program lights green in the traffic light.
- The high ratio of the number of vehicles on the road compared to the capacity of one or more main track.
- The high volume of vehicles that turn right.

The above problems need to be resolved because it can cause traffic congestion, stress on road users and it can lead to accidents that endanger users and surrounding communities, as shown in Fig. 3 below. This Situation will be caused accidents or chaos on the street.

Fig. 3chaotic in traffic at a crossroads.

The Behavior of Driver on the crossroad must regulated by Traffic Light. Besides that, The Driver must have discipline character. Without this Character will be shown in Fig. 4. The Driver and Motorist stopped on outside area of Traffic Light. This Situation will be caused accidents or chaos on the street and very dangerous for the traffic flow.

Fig.4 Outside Area of traffic light at a crossroads

One of the important traffic problems to be resolved is the problem that occurred at a crossroads. Therefore, various methods are used to provide convenience to road users, especially at peak times such as the time of departure (morning) or time back (afternoon) from the office and time for lunch and Friday prayer time. Intersection location created with the aim to reduce the potential for conflict between one vehicle to another at the same time providing maximum comfort and ease of movement of the rate for vehicles coming from various positions.

According to the Ministry of Transportation Directorate General of Land Transportation (Abubakar, 1996), the intersection is a node on the network where the streets meet and intersect the vehicle track. The traffic on each branch of junction moves together with the other traffic. Intersections are the most important factor in determining the capacity and journey times in a road network, especially in urban areas with dense vehicle volume and height as well as in Depok. The intersection should be used together by the users, so that the intersection should be designed carefully, efficiency, safety, working speed, operating cost, and capacity.Traffic movements happened and their sequence can be handled in various ways. It depends on the type of intersection is required (Khisty JC. And KB Lall., 2003). This involves two things: technical and non-technical terms.

Break through the traffic light at the time of the red light in Jakarta seems to be a phenomenon that is assessed by most motorists as something normal if concerned not crashed into other people. Not only that, often many motorists were deliberately against the flow of traffic on the main road, because they want to save travel time, avoid traffic jams, or the nearer distance and other reasons that could be used as justification (AM. Fahham, 2014).

In the records of the Indonesian National Police (Polri), the number of deaths due to accidents in 2013 was 25 114 people. The magnitude of the numbers of deaths from such accidents should make motorists aware that changing behavior was better. Thus a motorist can comply with traffic lights, not against the traffic flow, not using mobile phones while driving, do not break through train doorstop, not running red lights, do not violate the rights of pedestrians, and so on as regulated in Republic Indonesia Number 22, 2009 regarding traffic and Road Transportation (AM Fahham, 2014).

In fact, various estimates suggest that if there is no way to anticipate the systematic and intelligent, then the problem of congestion will continue to be a very complex problem. It does not only interfere with the community activity but can also create problems in other sectors such as economic and social (Early Anggraini, 2013). Should any violation of traffic rules on the road can be given according to the rules applicable sanctions for violating law. Law No. 22 of 2009, article 105 explains that every person who uses obliged to behave in an orderly way and prevent things that could obstruct, endanger the security and safety of traffic and road transportation, or which can cause damage to roads and traffic jams.

1.3 Impact Traffic Jam

As a result of the traffic problems happened as described above, then the most serious effects. From one of the problems that traffic congestion occurs, causing some of the consequences is:

a. Environmental impact because of air pollution exhaust fumes which can damage the health of road users and the surrounding community. This is caused the vehicle which stopped or hindered in the long term due to traffic congestion. This is caused the vehicle which stopped or hindered in the long term due to traffic congestion.

b. Social impacts make the public service to be disrupted because of traffic congestion. The services of ambulances, fire engines and operational vehicles will be hampered. In addition, the number of accidents due to the high traffic, as in the notes to Polda Metro Jaya (M. Fahham, 2014), the number of deaths increased as a result of accidents in 2013 was 25 114 events (Tribune news.com, 2013).

c. Economic Impact where in 2010, there were direct economic losses of Rp. 45 198 trillion (DKI Jakarta, 2011) due to the wasteful use of fuel and waste of energy. That Impact increased drastically compared to the situation in 2008 which amounted to a total of Rp. 28.1 trillion (DKI Jakarta, 2011).

d. Increased vehicle travel time, distance becomes shorter, the air pollution and traffic accidents that cause disability or death.

II. Research Methodology

Distributive control systems engineering intelligent traffic in urban areas with many intersections is divided into four components. There are sensor video cameras, synchronizing control system, the traffic control using artificial intelligence and the expert system and user interface.

Sensor video cameras are as first component for recording Traffic Information document. The second component is a control system that is used in charge of synchronizing between adjacent intersections. The third component is the traffic control using an artificial intelligence. The fourth component is the expert system and interface. This study of control system is made in stages with the following steps:

- The first step is the equipment design with a camera sensor application. This camera is used to record the surrounding traffic situation and the determination of control rules.
- The second step is to design the expert systems application. The artificial intelligence using includes neural networks and genetic algorithms. It also discussed relating to the control of traffic lights at the intersection.
- The third step is to manufacture the control system simulation by taking a sample of a T-junction. In this case been the junction between the Margonda with Juanda Street in Depok.
- The fourth step as the last step is the study of the impact caused by the application of the intelligent control system.

Fig. 5 shows the parts of the control system concept are made. (Agus Priyono et al., 2005).

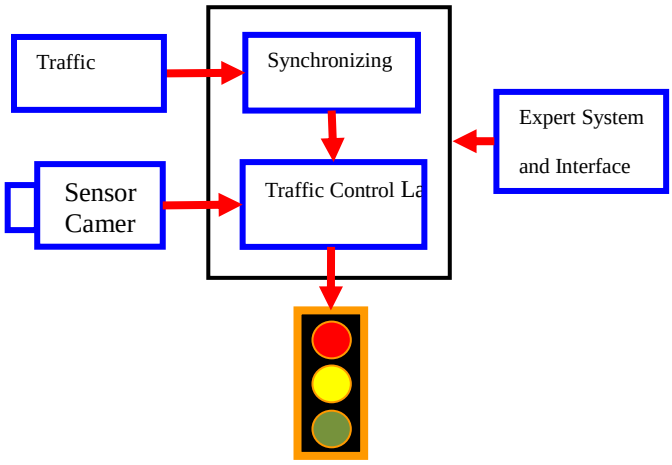

Fig. 5 Control system

Of progress in the field of Information and communication technology has resulted in a new branch in the field of Transportation. Several years ago, some projects Intelligent Transportation System (ITS) has been created and is operated in one area or areas in developed countries like the United States and Europe. Basically, intelligent traffic control system is a system that uses communication and information technology (ICT) as well as artificial intelligence to solve the traffic problems. The purpose of the implementation of the system is to obtain a systematic approach in the use of transportation facilities in the present or in the future. One of the components of the ITS system is the advanced traffic management systems (ATMs). This system provides the foundation for creating adaptive traffic control systems are more alert and able to work in real time. The ATMs goal is to control traffic lights at intersections, traffic control and integrated highway traffic management area such as in cities with many intersections. This system is known as the Urban Traffic Control Systems, (UTCs). Rule of the urban traffic light control is one example of a complex control system and require advanced concepts approach.

In its development, traffic control systems in urban developed along with the development of information and communication technology such. Third generation control system, can operate on line and using a calculation directly with each intersection control that operates independently to determine the calculation time by approximately continuously (Lan & Davis 1999). The third generation system is controlled by a distributive system approach in real time. In a distributive system, the local computer determines the phase of work time and time approximately based on traffic demand and is able to make adjustments to the local computer at another intersection adjacent. Distributive control system at the present time is regarded as the city's traffic control system is the best (Agus Priyono, 2005). Approach the distributive control system is to divide the task of managing the traffic problems that occur in complex control circuit to control a series of smaller ones. In this way, the problem can usually be solved individually by using the model in parallel strategies by local control computers. Distributive control systems provide better opportunities for every intersection in resolving problems. At the same time send information about the status, future strategies and the timing of time for a vehicle leaving the crossover to other neighboring local control him.

In the urban traffic control system, traffic data analysis of real-time is a target in the design of a modern transport system. Therefore, real-time adaptive traffic signal control system is an important part in the modern system. Analysis of the data traffic should describe the same picture as when a human (a police officer) reports the state and take the traffic parameters such as queues of vehicles, volume and vehicle speed calculation (Siyal & Fathy, 1999). In the strategy manufacture to control the traffic lights, the number of queues of vehicles and traffic volumes are critical inputs to the optimization of the calculation of working time traffic lights to turn on, both for systems that work offline or online (Lan & Davis 1999).

In the process, the system intelligently control traffic lights can be combined with the cameras using to monitor traffic violations such as shooting online from the plate number of vehicles running red lights, picture of the situation and conditions in the intersection. In addition, it can also record events such as accidents and so on and then report directly to the control room in the office of the traffic police. This system can also be added with the ability to detect the condition of the road surface as well as damage to the highways (traffic surveillance) which can be connected to the control room in the office of the Regional Public Works Department.

III. Results and Discussions

In the course of simulation studies using visual basic coupled with Matlab by entering parameters so constructed as to be able to represent the state of the existing traffic at the junction Margonda - Juanda Street in Depok. From result of observation be obtained preliminary results indicate an increase in the number of vehicles running on the main track and at the same time reducing the number of other vehicles waiting.

In the simulation time specified range approximately taken between 80-150 seconds, whereas the estimated time of red and green lights lit set at 2 seconds. It was based on the calculation of genetic algorithms after getting information from neural networks are calculated based on the length of the queue of vehicles in each track intersection. While working time yellow lights set of 2 seconds. From the study it was found that the existing control system compared with the simulation can be seen in Table 1 and 2 below.

From Table 1, related to the percentage ratio of the average travel time of vehicles in the traffic jam conditions, it was found that the average travel time is 66.64 seconds, while using a simulation system was found sebesar 24.68 seconds. In this case, the simulation can improve average travel time of 62.96% compared to existing systems. However, in circumstances not jammed, the average travel time is generated in the research, the system has is 20.84 seconds while the simulation result is 45.63 seconds. In this condition, the simulation results have average time larger trip 118.95% compared to existing systems.

Table 2 describes the average time the vehicle stops at a standstill state. The average time a vehicle stopped on the condition of the existing system was 97.72 seconds while the result of the simulation is 38.11 seconds. In this case, the simulation can improve the average vehicle stopped by 61% compared to existing systems.

In the current circumstances, the average time a vehicle stops on the results of research using existing systems is 17:22 seconds while the results of the simulation is 88.33 seconds. For this situation, the result of the simulation is 412.95% larger than the existing systems. The above results illustrate that the simulation results in a standstill state, the control system simulation gives better results in terms of average percentage of vehicle travel time and the average percentage of vehicles stopped. These results, will give effect to the improvement of the comfort of the rider, thereby reducing the stress caused long they have to wait for a red light is still lit while on the road that intersects there is no queue of vehicles.

IV. Conclusions

The conclusion goes here. In such circumstances it is quite simply placed a police officer to a crossroad, because traffic lights control system is sufficient to represent the presence of other police officers. Moreover, when the camera shows a good performance in photographing number plates or motor vehicles violating traffic rules by running red lights, which is expected to provide a deterrent effect, because it can directly be given penalties when they extend the vehicle registration. This study, still needs further research after the intelligent traffic control system based on artificial intelligence is implemented directly in the field or real traffic light.

This research could be developed not only to regulate traffic lights, but for the purposes of surveillances and can be used for reduce congestion on adjacent intersections in urban areas are jammed like in Depok, Jakarta, Bandung, Medan and Surabaya as well as in cities other large by utilizing GPS technology. However, that application becomes more influential impact on the behavior of motorists is certainly necessary sample orderly behavior by officials as well as a firm stance in upholding the rules.

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Chapter 12

K-Means Analysis in Mapping Concept Based on Geographic Information System

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Abstract. Mapping concept is clustering of geographical locations. For example, mapping of vacant land for building construction in an area.The absence of these system make difficulties in identifying and observing vacant land. Mapping concept is based on Geographic Information Systemwhere to cluster sub-area and land mapping used k-means method from clustering technique.In this research, the land mapping wasclustered into 3 clusters (C3) based onquantity category (plenty, mediocre, few) by using occupied land variable and vacant land size variable of each area. Clustering result showed 38 items in cluster 1, 4 items in cluster 2, and 17 items in cluster 3.
Keywords: Clustering, mapping, land,GeographicInformation System, K-Means

I. Introduction

Mapping is clustering of geographical locations related to highland, mountain range, natural resource, and unique socio-cultural population [8]. Land mapping fits in this concept. An area need a good data collecting system of vacant lands ready for construction. The absence of such system that provides information on vacant lands pose difficulties in identifying and observing lands.

This mapping concept based on Geographic Information System. According to Aronoff in [6] Geographic Information System is utilized to store and manipulate geographical information. Clustering of sub area and land mapping used k-means method of clustering technique. Land mapping divided into 3 clusters based on vacant land's size which categorized as "plenty, mediocre, few" by using occupied land variable (X1) and vacant land size for every area variable (X2). Trial conducted using silhouette coefficient method to determine accuracy of grouping in an area.

II. Literature Review

2.1. K-Means Clustering

Clustering is part of data mining technique. This discipline is part of other disciplines such as mathematics, data visualization, machine learning, and artificial intelligence [1]. Data clustering of similar characteristic in one partition is a general concept of clustering. Grouping is based on attribute similarity value of processed data. Clustering type divided into hierarchy and non-hierarchy. K-Means falls into non-hierarchy clustering. The equation below determine new cluster center:

$$C = \sum \frac{Xn}{Cn}.. \quad (1)$$

Equation 1 defined as sum of attribute value of specific cluster, where:

C : new cluster
Xn : attribute value
Cn : specific cluster

The formula below determine closest proximity:

$$D_{L2}(X_2, X_1) = \|X_2 - X_1\|_2 = \sqrt{\sum_{j=1}^{p}(X_{2j} - X_{1j})^2}.. \quad (2)$$

Where:

P : data dimension
| . | : absolute value

2.2. Geographic Information System (GIS)

Geographical information system according to Good Child is a component consisting of hardware, software, geographical data and human resource that work together effectively to insert, store, fix, renew, evaluate, manipulate, integrate, analyze, and display data in an geographical based information system [3]

III. Research Methodology

3.1. Supplier Selection

The urban planning department has access to add and fix data and also all information related with land including change and addition of public facility. They also can view vacant land information and report on land development on a specific period. System architecture can be depicted below:

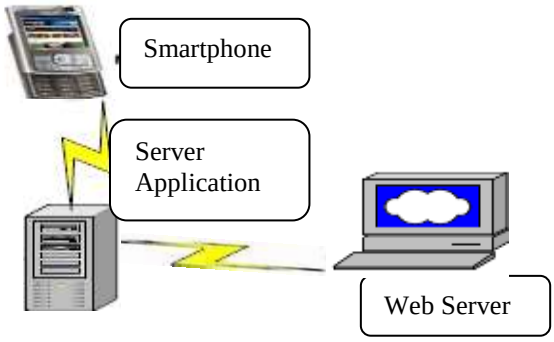

Fig 1. The system architecture

User can access information from mobile phone. Urban planning department as user 1 can manage data on web server.Below are application design for user 2 (citizens).

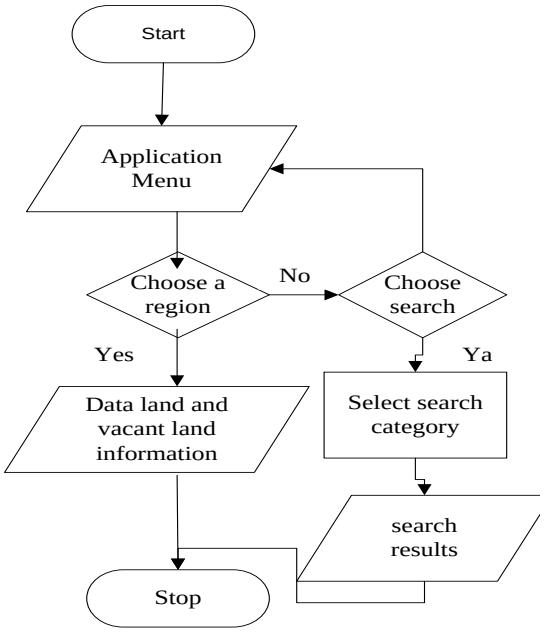

Fig 2. System flowchart for user 2 (citizens)

IV. Results and Discussions

The research object are 58 areas spread across some locations. The variable acting as research indicator are occupied land (X1) and overall vacant land size (X2). Land mapping divided into 3 clusters which are land's size categorized as "plenty, mediocre, few". As for calculation using hierarchy method:

Table 1. The New Cluster center

	X1	*X2*	
C1		30,43324	37,47216
C2		544,355	711,12
C3		128,3965	116,0435
Distance of each cluster relative to new cluster			
1	29,75768398	877,0563157	154,5744
2	44,88476785	892,1385439	169,8261
3	44,96363539	892,240358	169,8129
4	44,75119589	892,0342065	169,5697
5	37,96324106	809,3411335	89,40252
6	56,98879672	790,3261861	71,07941
7	173,6751551	674,1392663	54,54497
8	65,21513499	782,3099389	62,1417
9	539,5620629	307,7637206	418,5399
10	632,9095942	214,6585519	511,3842
11	1362,701072	515,444226	1241,39
12	854,1395359	7,926532975	733,0437
13	119,6303259	727,6967015	32,67315
14	7,370880868	854,2436928	132,9155

15	2,169922386	849,3145612	127,7294
16	29,86859484	877,089394	155,1038
17	9,868394761	837,5404987	115,7597
18	38,20554018	885,4268376	163,3241
19	20,65303261	849,6186228	133,9546
20	19,49492227	864,7448576	144,6497
21	13,11760319	857,5684982	137,5952
22	38,47077615	885,6877074	163,595
23	376,0754251	578,6446063	262,3636
24	189,8621011	710,1173779	93,05443
25	143,4772313	708,1086078	64,60471
26	49,46184542	803,211666	93,36248
27	182,4561606	786,2281033	141,2905
28	97,00075666	766,4472979	90,20187
29	41,81105681	806,1090934	83,94427
30	19,33663135	828,168718	106,3546
31	9,561961721	856,7260942	134,3935
32	15,4843614	862,6433286	140,0808
33	14,51922284	861,725995	139,2743
34	6,687462296	853,470404	131,0031
35	65,95603291	781,5171192	61,67327
36	119,3549965	729,3800769	13,63899
37	116,6007524	732,3545579	13,77614
38	160,322248	687,3194384	43,4611
39	148,8198325	698,5146601	38,33821
40	42,15240861	805,4115131	83,99349
41	44,27444084	803,6090937	81,55076
42	104,9361971	742,4151099	32,03323
43	80,75329734	766,9096364	47,39104
44	36,69573218	811,8735163	88,88977
45	29,35430261	819,122149	96,25032
46	82,24230532	766,4935939	43,84098
47	6,615842922	841,1035133	119,0088
48	7,425637748	841,6915013	119,0023
49	13,9838996	834,629566	111,8795
50	13,92203295	834,6716331	111,9331
51	16,8403394	864,1195739	141,7856
52	30,82009333	878,0988159	155,8785
53	33,17592605	880,4390792	158,2566
54	35,12177909	882,3935751	160,1406
55	16,98512959	830,3387402	109,4442
56	36,29947043	883,5421993	161,3936
57	35,5385257	882,7199103	160,7651
58	82,44464584	765,1571175	46,16223

Table 2 Results Cluster

No	*Location*	*Price*	*facilities*	*C1*	*C2*	*C3*
1	Simpang Tiga	12,6	13,65	*		
2	Tangkerang Utara	1,58	3,09	*		
3	Tangkerang Selatan	2	2,64	*		
4	Tangkerang Labuai	2,3	2,67	*		
5	Rintis	53	68	*		
6	Sekip	66	82	*		
7	Tanjung Rhu	145	168			*
8	Pesisir	74	86			*
9	Tangkerang Tengah	360,23	464,51		*	
10	Tangkerang Barat	421,65	534,99		*	
11	Maharatu	850,24	1125,99		*	
12	Sidomulyo Timur	545,3	718,99		*	
13	Wonorejo	101,1	134			*
14	Labuh Baru Timur	24,25	33,46	*		
15	Tampan	28,57	36,36	*		
16	Air Hitam	10,61	15,13	*		
17	Labuh Baru Barat	37,51	44,35	*		
18	Umbansari	5,32	8,68	*		
19	Muara Fajar	12,84	48,29	*		
20	Rumbai Bukit	12,89	28,97	*		
21	Palas	17,7	34,32	*		
22	Sri Menanti	5,1	8,52	*		
23	Meranti Pandak	388	154			*
24	Limbungan	215	82			*
25	Lembah Sari	90	168			*
26	Lembah Damai	40	86	*		
27	Limbungan Baru	209	0			*
28	Tebing Tinggi Okura	40	134			*
29	Simpang Empat	61	66	*		
30	Sumahilang	44,25	51	*		
31	Tanah Datar	26	29	*		
32	Kota Baru	22,8	24	*		
33	Sukaramai	23	25	*		
34	Kota Tinggi	28,75	31	*		
35	Cinta Raja	73,99	87			*
36	Suka Maju	115,69	121			*
37	Suka Mulia	114,76	118			*
38	Padang Bulan	135	159			*
39	Padang Terubuk	123	154			*
40	Sago	59,5	68	*		
41	Kampung Dalam	62,5	68	*		
42	Kampung Bandar	96,5	119			*
43	Kampung Baru	85	97			*
44	Jadirejo	59,4	60	*		
45	Kampung Tengah	53,98	55	*		
46	Kampung Melayu	91,1	93			*

47	Kedung Sari	36,03	41	*	
48	Harjosari	37,7	39	*	
49	Sukajadi	42,8	44	*	
50	Pulau Karam	42,73	44	*	
51	Simpang Baru	20,9	23,59	*	
52	Sidomulyo Barat	10,83	13,69	*	
53	Tuah Karya	9,07	12,09	*	
54	Delima	8,01	10,44	*	
55	Kulim	40,01	51,5	*	
56	Tangkerang Timur	6,8	9,92	*	
57	Rejosari	6,6	11,11	*	
58	Sail	85,6	98,74		*

Below are system interface from webserver end. Aside from observing land grouping identification and its attribute, it also used to manage data.Fig. 3displays the distribution of land usage and area's size for each area (Pekanbaru city as study case).

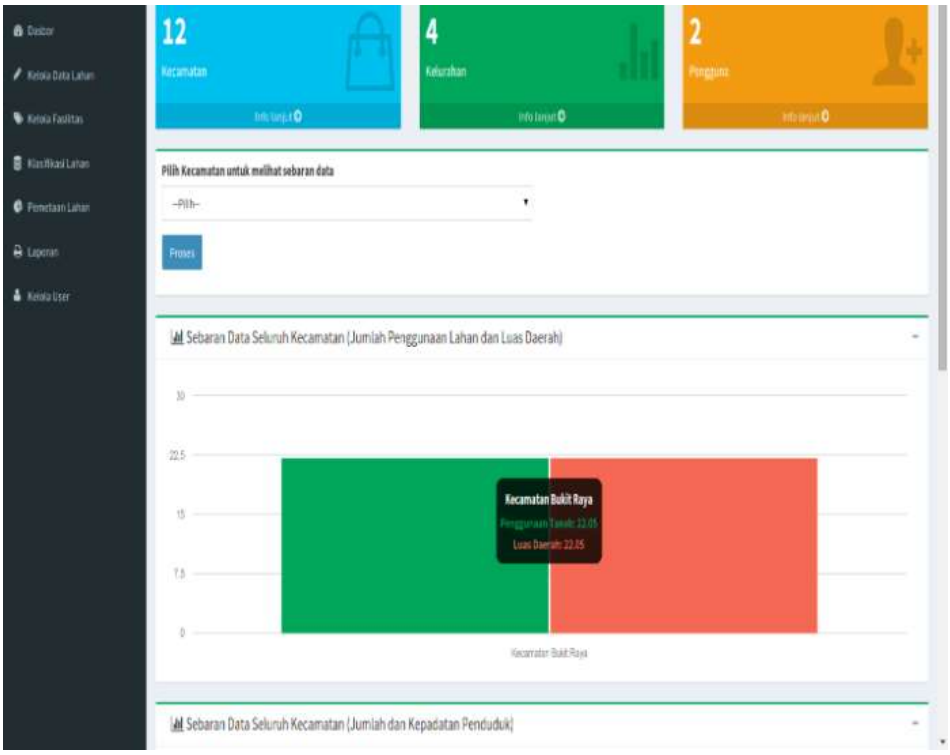

Fig 3 The distribution of land use

Detail of each area depicted per village to simplify usage for citizen so they can obtain relevant information as depicted in Fig. 4.

Fig. 4 Distribution information per village

Fig. 5 describes the unused land and land area as a whole in cluster 1, cluster 2 and cluster 3

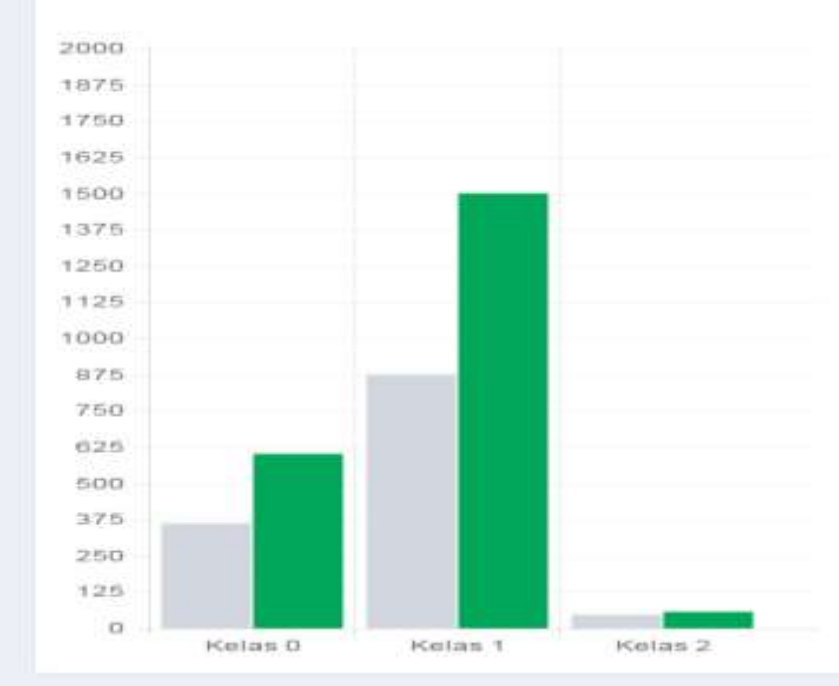

Fig 5 Unused Land

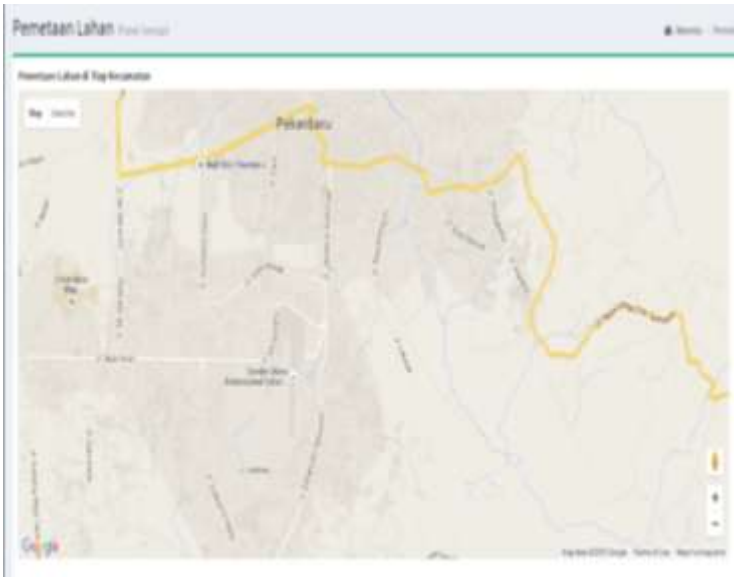

Fig 6. Land Mapping

V. Conclusions

This mapping concept is based on Geographic information System. Land mapping divided into 3 clusters or categories (plenty, mediocre, few)by using occupied land variable and vacant land size variable for each area. Result of clustering showed 38 items for cluster 1, 4 items for cluster 2, and 17 items for cluster 3. Citations

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Chapter 13

Dynamics of A Re-Parametrization of Two Dimensional Map

$$(x_{n+1}, y_{n+1}) = g_\mu(x_n, y_n) = \left(\frac{x_n(1-\mu x_n)}{y_n(x_n-\mu)}, x_n\right)$$

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Abstract. The discussion of two dimensional mapping in this paper is based on a member of a family of system derived from a ΔΔ-sine Gordon equation introduced by J.M. Tuwankotta in 2005. By replacing the role of integrals and parameter in a system of difference equations, we will generate a new mapping and compare the properties of the new mapping with the original one, i.e. measure preserving property, their symmetries and reversing symmetry. Furthermore, the dynamics of the new mapping is analyzed.

Keywords: (Re-parametrization, two dimensional mapping, measure preserving property, possession of symmetries, reversing symmetries).

I. Introduction

In 1989, Quispel, Robert, and Thompson introduced the 12- parameter family of mapping of the plane given by [1, 6].

$$x_{n+2} = \frac{g_1(x_{n+1}) - x_n g_2(x_{n+1})}{g_2(x_{n+1}) - x_n g_3(x_{n+1})} \tag{1}$$

where g_j, $j = 1, 2$ is given by

$$\begin{pmatrix} g_1(x_{n+1}) \\ g_2(x_{n+1}) \\ g_3(x_{n+1}) \end{pmatrix} = A_0 \begin{pmatrix} x_{n+1}^2 \\ x_{n+1} \\ 1 \end{pmatrix} \times A_1 \begin{pmatrix} x_{n+1}^2 \\ x_{n+1} \\ 1 \end{pmatrix} \tag{2}$$

with A_0 and A_1 denoting arbitrary symmeric 3×3 matrices is given by

$$A_i = \begin{pmatrix} \alpha_i & \beta_i & \gamma_i \\ \beta_i & \epsilon_i & \sigma_i \\ \gamma_i & \sigma_i & \kappa_i \end{pmatrix}; i = 1, 2. \tag{3}$$

The symmeric QRT mappings (1) is an integrable reversible mappings of the plane. The mapping have (anti) measure preserving property. [4, 5, 6] Each member of the mapping (1) posseses an invariant or integral (that is : there exists a function G : $R_2 \rightarrow R$ such that G (xn, xn+1) = G (xn+1, xn+2) for all natural number n) is defined by a ratio of biquadratic polynomial of the form

$$G(x,y)=\frac{\alpha_0x^2y^2+\beta_0\left(x^2y+xy^2\right)+\gamma_0\left(x^2+y^2\right)+\epsilon_0\left(x^2+y^2\right)+\sigma_0(x+y)+\kappa_0}{\alpha_1x^2y^2+\beta_1\left(x^2y+xy^2\right)+\gamma_1\left(x^2+y^2\right)+\epsilon_1\left(x^2+y^2\right)+\sigma_1(x+y)+\kappa_1} \tag{4}$$

The following example is a special form of the QRT mapping. The mapping in this example will be focused in this article.

Example

Setting the symmetric matrices A_0 and A_1 as the following form

$$A_0=\begin{pmatrix}0&-1&\mu\\-1&1&-1\\\mu&-1&0\end{pmatrix};A_1=\begin{pmatrix}0&0&0\\0&1&0\\0&0&0\end{pmatrix} \tag{5}$$

Hence, functions gi, i = 1, 2, 3 that corresponding to (2) can be written by

$$\begin{pmatrix}g_1\left(x_{n+1}\right)\\g_2\left(x_{n+1}\right)\\g_3\left(x_{n+1}\right)\end{pmatrix}=\begin{pmatrix}x_{n+1}^2-\mu x_{n+1}^3\\0\\\mu x_{n+1}-x_{n+1}^2\end{pmatrix} \tag{6}$$

By (5) and (6), we have the following mapping

$$x_{n+2}=\frac{x_{n+1}\left(1-\mu x_{n+1}\right)}{x_n\left(x_{n+1}-\mu\right)},\quad \mu\in\mathbb{R} \tag{7}$$

For this example, notice that mapping (7) is integrable mapping that known as two-dimensional mapping derived from ΔΔ sine Gordon equation.[1, 2]. In article [2], we have studied a three parameters family of mappings which is derived from generalized sine-Gordon equation:

$$\theta_1\left(V_{l,m+1}V_{l+1,m}-V_{l+1,m+1}V_{l,m}\right)+\theta_2V_{l+1,m+1}V_{l,m+1}V_{l+1,m}V_{l,m}=\theta_3. \tag{8}$$

A system of ordinary difference equations can be derived from (8) by restriction to traveling wave solution by setting

$$V_{l,m}=V_n,\ n=z_1l+z_2m,$$

where z_1 and z_2 are relatively prime integers. By substitution to (8) we derive

$$\theta_1\left(V_{n+z_2}V_{n+z_1}-V_{n+z_1+z_2}V_n\right)+\theta_2V_{n+z_1+z_2}V_{n+z_2}V_{n+z_1}V_n=\theta_3 \tag{9}$$

which represents an infinite hierarchy of mapping labelled by z_1 and z_2. For fixed z_1 and z_2, equations (9) is mapping from $R^{z1+z2}\longrightarrow R^{z1+z2}$. Note that, the mapping in [1] can be obtained from (9) by setting θ_2 and θ_3 equal to 1 and θ_1 = pq.

II. Main Result

2.1. The Properties of Two Dimensional Mapping Derived from ΔΔ sine Gordon. Case Study: $(x_{n+1},y_{n+1})=g_\mu\left(x_n,y_n\right)=\left(\frac{x_n(1-\mu x_n)}{y_n(x_n-\mu)},x_n\right)$

Let $z_1 = 1$, $z_2 = 2$, $\theta_1 = \mu\theta_2$, $\theta_3 = \theta_2$, and let us write

$$\gamma_n = \begin{pmatrix} V_{n+2}V_{n+1} \\ V_{n+1}V_n \end{pmatrix}$$

Of course, from (9), we have a two dimensional mapping below:

$$\gamma_{n+1} = g_\mu(\gamma_n) \tag{10}$$

Where

$$\begin{array}{rccc} g_\mu : & \mathbb{R}^2 & \longrightarrow & \mathbb{R}^2 \\ & (x,y) & \longmapsto & \left(\dfrac{x(1-\mu x)}{y(x-\mu)}, x\right) \end{array}$$

This mapping has an integral (that is : there exists a function $G : R^2 \to R$ such that $G(\gamma_{n+1}) = G(\gamma_n)$ for all natural number n). The explicit formula for the integral is

$$G_{(\mu,k)}(x,y) = \mu\left(\frac{x}{y} + \frac{y}{x} + 2k^2\right) - (x+y) - \left(\frac{1}{x} + \frac{1}{y}\right), \quad k \neq 0. \tag{11}$$

Thus, for all n ϵ N, the solution of (10) lies on a level set of $G_{(\mu,k)}(x, y)$.

It is easy to show that (x, y) = (±1, ±1) and (x, y) = (±1, ∓1) points are fixed points and periodic-2 points of the mapping (10), respectively. The map (10) has the following properties: • The map (10) has an integral (11).

The map (10) is measure preserving:

$$|D\, g_{(\mu,1)}(x,y)| = \frac{x - x^2\mu}{y^2(x-\mu)} = \frac{\varrho(x,y)}{\varrho\left(\frac{x(1-\mu x)}{y(x-\mu)}, x\right)}$$

where ϱ is given by

$$\varrho(x,y) = \frac{1}{xy}$$

It is easy to show that

$$\varrho\left(\frac{x(1-\mu x)}{y(x-\mu)}, x\right) = \frac{y(x-\mu)}{x^2(1-x\mu)}$$

There exists a reversing symmetry L such that $L \circ g_\mu \circ L^{-1} = g_\mu^{-1}$, namely

$$L(x, y) = (y, x)$$

In other words, the map (10) reversible because there exist L such that $g_\mu \circ L \circ g_\mu = L$. • There exists an involution S such that $S \circ g_\mu \circ S{-}1 = -g_\mu$:

$$S(x, y) = (x, -y) .$$

We have a relation between mapping (10) together with an involution L and (7), namely

$$x_{n+2} = \frac{x_{n+1}\left(1-\mu x_{n+1}\right)}{x_n\left(x_{n+1}-\mu\right)} \Leftrightarrow \; U_{SG} : x' = \tfrac{x(1-\mu x)}{y(x-\mu)}, y' = x; \quad L : x' = y, y' = x \tag{12}$$

It means two-dimensional mapping (10) that derived from ΔΔ−sine Gordon equations is a special case of 12-parameter family of QRT reversing symmeric integrable mapping. Note that twodimensional mapping (10) have singular lines (i.e. the line where the involutions are not defined),

and the symmetry line (i.e. the line fixed points of the involutions that make up the mapping), namely [5].

Singular lines : $yg_3(x) - g_2(x) = 0 \rightarrow y\,(x\mu + x^3) = 0.$

Symmetry lines : $y = x;\ y^2g_3(x) - 2yg_2(x) + g_1(x) = 0 \rightarrow x = y;\ x\,(x - x^2\mu + y^2(-x + \mu)) = 0$

2.2. Re-parametrization of $(x_{n+1}, y_{n+1}) = g_\mu\,(x_n, y_n) = \left(\frac{x_n(1-\mu x_n)}{y_n(x_n-\mu)}, x_n\right)$

Consider the integral $G_{(\mu,k)}(x,\ y)$ for mapping (10). Note that $G_{(\mu,k)}(x,\ y)$ is linear in μ. Because of $G_{(\mu,k)}(x,y) = G_{(\mu,k)}\left(\frac{x(1-\mu x)}{y(x-\mu)}, x\right)$, then $G_{(\mu,k)}(x,y) = 0 \Longrightarrow G_{(\mu,k)}\left(\frac{x(1-\mu x)}{y(x-\mu)}, x\right)$. Therefore, for $k = \frac{1}{\sqrt{2|\mu|}}$, we have

$$\mu = \mu(x,y) \;\; = \;\; \tfrac{x+y-xy+x^2y+xy^2}{x^2+y^2} \tag{13}$$

And it follows that the map (10) with the replacement μ = μ(x, y) satisfies $\mu\left(\frac{x(1-\mu x)}{y(x-\mu)}, x\right) = \mu(x,y).$ Explicitly, the map (10) with the replacement μ = μ(x, y) yields the map,

$$\hat{g}_{(\mu)}(x,y) = -\frac{x\left(x+x^3+x^2(-1+y)-y\right)}{x^3+x(-1+y)-y-x^2y}. \tag{14}$$

The map (14) has the following properties:

$\hat{g}(\mu, k)$ has an integral μ (x, y)

$$\mu(x,y) = \frac{x+y-xy+x^2y+xy^2}{x^2+y^2}. \tag{15}$$

$\hat{g}(\mu)$ measure-preserving, which means

$$|D\,\hat{g}_{(\mu)}| = -\frac{\varrho(x,y)}{\varrho\left(\frac{x(1-\mu x)}{y(x-\mu)}, x\right)} = \frac{x^2\left(2-2x+x^2-2x^3+2x^4\right)}{\left(x^3+x(-1+y)-y-x^2y\right)^2}$$

where $_\varrho$ is given by

$$\varrho(x,y) = \left[\partial_\mu G_{(\mu,k)}\right]^{-1} = \frac{1}{x^2+y^2}$$

It is easy to show that

$$\varrho\left(\frac{x\left(1-\mu x\right)}{y\left(x-\mu\right)},x\right)=\frac{\left(-x+x^3-y+xy-x^2y\right)^2}{x^2\left(2-2x+x^2-2x^3+2x^4\right)\left(x^2+y^2\right)}$$

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Chapter 14

Characterization of Methyl Ester Obtained from Nanochloropsis Occulata and Tetraselmis Chuii by using In-situ and Conventional Method

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Abstract. Maximum Fatty Acid Methyl Ester (FAME) yield of Nannochloropsis oculata and Tetraselmis chuii using variation of catalyst concentration was investigated. Research began with culturing microalgae and then was proceeded with oil extraction to obtain 60 grams of dried microalgae. Three variations of NaOH catalyst concentrations have been applied for each method, they are 1.5, 2.0, and 2.5% of microalgae oil weight in transesterification process. Yield of FAME in each microalgae species from in-situ method was not been determine because of impurities content in the product. In conventional method, yield of FAME was 88.50% with 2% NaOH catalyst concentration on Nannochloropsis oculata and 82.31% with 2% NaOH catalyst concentration on Tetraselmis chuii. The highest content of the methyl esters is undecanoic acid methyl ester in Nannochloropsis oculata and palmitic acid methyl ester in Tetraselmis chuii.

Keywords: FAME, Nannochloropsis oculata, Tetraselmis chuii, transesterification, yield

I. Introduction

Energy plays a vital role in our everyday lives and recording the decline in energy sources. Therefore, there are a lot of efforts to find other sources of energy especially the renewable sources. Then we talked about biofuels, their different classifications and types showing their advantages and disadvantages[1]. Biodiesel as a promising alternative energy source is receiving increased attention from energy experts. The high price of vegetable oil and land use competition between biodiesel feedstock and food production requires the existence of an alternative solution to produce cheaper biodiesel [2]. One of the solution to overcome this problem by producing biodiesel using microalgae raw materials. With the lipid content about more than 30% and productivity of microalgae 200 times more than other vegetable sources, microalgae have the potential to be used as an alternative source of biodiesel [3].

The commercial production of biodiesel derived from microalgal is still in the research and development stages, mainly due to the current prohibitive high costs associated with the biomass production and fuel conversion process. The schemes of research and development is optimization parameters of operation such as the reaction time, the ratio of alcohol and microalgae lipid, catalyst concentration, and reaction temperature.

In conventional transesterification, the extraction of microalgae lipid was carried out by percolation method using a mixture of polar and non-polar solvents, such as methanol and chloroform. The boiling point of the solvent is quite low and has approached the polarity of oil[4]. Oil that has been established, then processed using the batch method with agitator on the reaction conditions previously set.

Many developed research to find an efficient method in the extraction of microalgae have been carried out. However, extraction took a lot of time and require high cost. Therefore more attractive alternative is being

developed , namely the in-situ method or transesterification of biodiesel without the extraction step. In this research, the experiment was carried out not only about the potensial of microalgae species, but also catalyst concentration on in-situ and conventional transesterification method.

II. Research Methods

2.1. Materials

Samples of Nannochloropsis oculata and Tetraselmis chuii were collected from The great laboratory of mariculture development, Lampung, Indonesia. Microalgae was extracted using soxhlet method with kloroform:methanol and n-hexane as solvent [5]. Sodium hydroxide used for transesterification process as catalyst and sulfuric acid for esterification process as catalyst.

2.2. In-situ transesterification method

Microalgae and methanol in ratio of 1:8 was applied into a three-neck flask and stirred at 60°C and 600 rpm [7]. In-situ esterification reaction lasted for 90 minutes with the addition of 1% weight H2SO4 of microalgae lipid [1]. Before proceeding with in-situ transesterification reaction, the water formed from the esterification reaction was separated. Then, in-situ transesterification reaction took place for 60 minutes in the presence of NaOH, 1.5, 2.0, and 2.5% weight of microalgae lipid. Biodiesel product was collected and separated from the solvent.

2.3. Conventional transesterification method

20 grams of dried microalgae extracted by using Soxhlet. Solvent was put into the flask at the bottom of the extractor as much as 500 ml. The temperature applied was 70°C which exceeds the boiling point of the solvent. Extraction was carried out for 8 hours. Microalgal oil and solvents mixture was separated by using the vacuum evaporator for 15 minutes [1]. Furthermore, esterification and transesterification reactions was caaried out with process the same as in-situ method.

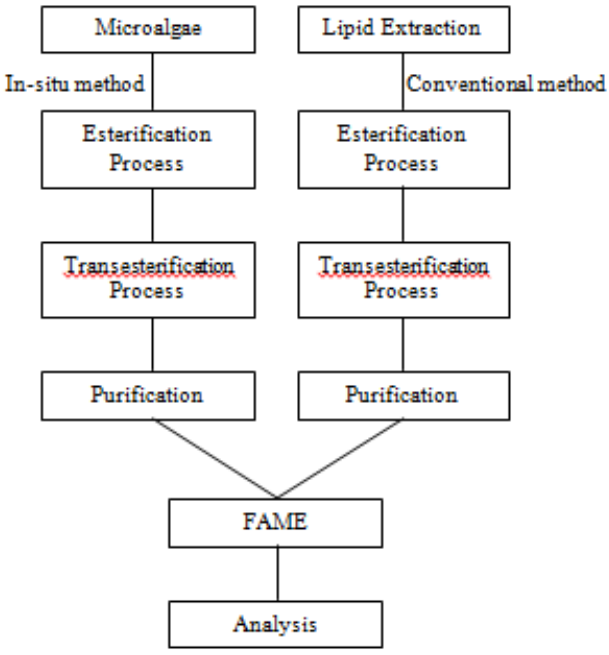

Fig. 1. Flow chart of fame processing

2.4. Yield Calculations

Yield is the amount of FAME product divided by the amount of initial mass of reactants.

$$\text{Yield} = \frac{\text{Mass of FAME}}{\text{Mass of Reactants}} \times 100\% \quad (1)$$

Mass of FAME = The mass of FAME as product after purification (gram)
Mass of Reactants = mass lipids extracted as raw material transesterification (gram)

2.5. Fame Analysis

Analysis of methyl esters was carried out with GC-MS Shimadzu. FAME samples from the results of the transesterification reaction was injected into the GC column by using the autosampler. Separation was performed using a column AGILENTJ% W DB-5, 30 mx 0.25 mm ID, with helium carrier gas, injector temperature 300oC, the temperature of the column 50°C, flow rate of 0.54 ml/min. The results of the analysis in the form of a mass spectrum compared with a known reference of 229 Willey and NIST 62 to determine the composition of fatty acids contained in the sample.

III. Results and Discussions

3.1. In-situ transesterification method

In the in-situ transesterification process, extraction was carried out for 15 minutes before adding methanol on sulphuric acid. Methanol is a polar solvent, while lipids are non polar compounds. This is caused the amount of lipid extracted as slightly as the amount of lipids that can be converted into methyl esters. In addition, chlorophyll also extracted together with oil and it is difficult to separate from the oil [8].

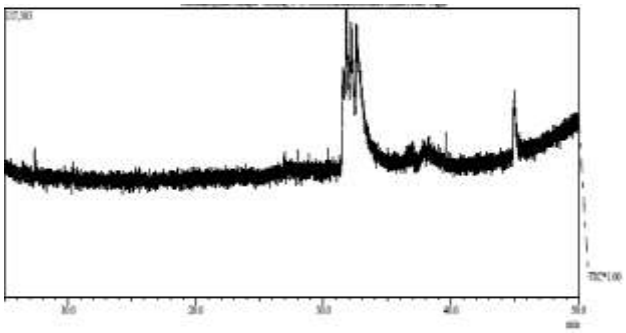

Fig. 2. GC-MS analyzer results for Nannochloropsis oculata

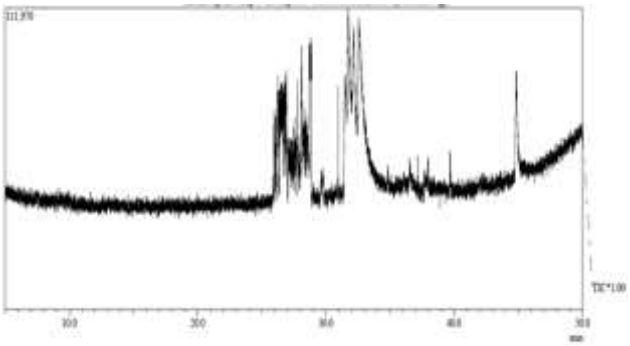

Fig. 3. GC-MS analyzer results for Tetraselmis chuii

Fig. 2 and 3 show the results of GC-MS analysis of the in-situ transesterification products for both microalgae. The Fig. shows that the spectrum of the results of GC-MS analysis was not able to analyze the sample, so that the composition of the methyl ester in the results of in-situ transesterification reaction can not be determined. The impurity causes the difficulty in analysis.

3.2. Conventional method

Suppliers approval list are needed to be documented as this process was came after initial assessment as part of supplier selection. Mostly in food industry the list of food supplier was categorized into high risk food supplier, medium risk food supplier or low risk food supplier. High risk supplier were mostly for frozen products, meat, fish, poultry and ready to eat foods (RTE), example of medium risk food is dry food, grain, flour,etc. In fact high risk food supplier were listed to be the most supplier that need to be controlled wither in the initial assessment or during delivery processed/incoming process. Through this list also we have to know whether they have food safety program or any appropriate quality control system

In the conventional method, lipids which resides in microalgae cells was extracted before the reaction process. Lipid was extracted from microalgae by using soxhlet.

Table I. Lipid Content Extracted From Microalgae

Run	*Nannochloropsis oculata*	*Tetraselmis chuii*
I	11.0%	10.3%
II	13.0%	10.0%
III	12.5%	10.0%

Cultivation and harvesting processes affect the difference in the results of lipid extraction. It can be seen from the Table above. In the beginning, we used dry microalgae from Lampung great laboratory of mariculture development, but oil extracted from microalgal was limited less than 5% of microalgal weight. Cultivation process is not performed at the optimum condition for the preparation of raw material for biodiesel which limited amount obtained. In addition, the possibility of errors in the harvesting of microalgae cells leads to reduced levels of lipid extracted. Then we cultivated microalgae in our lab. The oil extracted from microalgal more than 10% of microalgal weight, so optimum condition of microalgae cultivation affects the amount of oil extracted.

Reaction occurs in two stages which are esterification and transesterification. The extracted oil was evaporated under vacuum to release the solvent using rotary evaporator. Then, the oil produced from each algal species was mixed with a mixture of catalyst and methanol with stirring. Esterification must be carried out due to high content of fatty acid, that is more than 5%. Certain amount of algal biomass of each species was applied to produce oil and biodiesel.

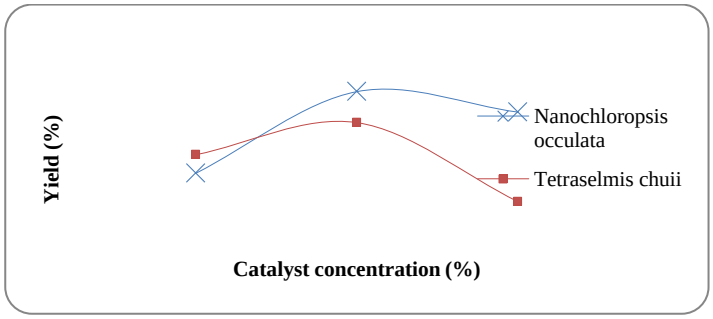

Fig. 4. The effect of catalyst concentration on yield of Nanochloropsis oculata and Tetraselmis chuii

As can be seen from Fig. 4, yield of methyl ester increase with increasing of catalyst concentration up to 2,0%. The concentration of catalyst in this state is able to optimally break the bond on lipids and exchange with methanol, thus forming FAME and glycerol. The mechanism of reaction can be seen from Fig. 5.

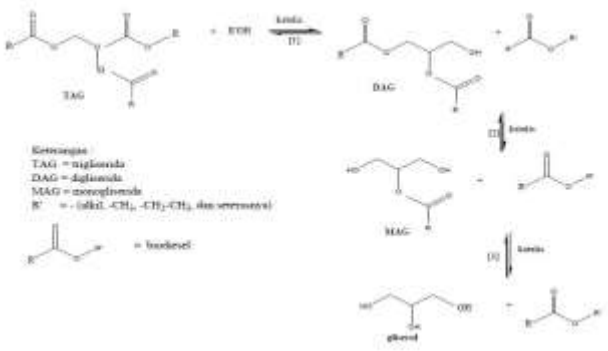

Fig. 5. The mechanism of transesterification reaction with base catalyst [6].

It can be seen from the picture the mechanism of the transesterification reaction. First step, NaOH catalyst will bind to alcohol and wait for the contact with triglycerides. After contact between alcohol and triglycerides, the Na + ions help break the bond contained triglycerides. Ties that have been disconnected react with alcohol and Na + ions back to form a compound NaOH.

It also occurs in the second step, in order to obtain the compound of alkyl esters (biodiesel). In the third Step H + ions resulting from the breakup of alcohol will bind to O--, thus forming glycerol. Limited amount of lipids formed into glycerol showed that the catalyst concentration is also appropriate and not excessive amount.

At a concentration of 1.5% catalyst, methyl ester produced is minimum. Less the amount of catalyst is not been able to optimally promote the lipid break the bond, so the reaction is slow. Thus the amount of lipids formed into methyl esters was not optimal. It takes a little longer to achieve optimum yield point. But it is not recommended as it will require more energy to grow over time, so it is not economical.

Another case in catalyst concentration of 2.5%, methyl ester produced much less than others. Excess catalyst reacts with lipids produce glycerol, so when washing the product with warm water much missing. Another possibility is minimum amount of free fatty acids converted in the esterification reaction. However, this is unlikely to happen because the two previous reactions do not happen.

The highest yield in both microalgae is obtained in the catalyst concentration of 2%, i.e. 88.5% in microalgae Nannochloropsis oculata and 82.3% in microalgae Tetraselmis chuii. Maximum yield of FAME obtained from Nannochloropsis oculata is slightly higher than Tetraselmis chuii.

3.3. Identification of biodiesel by GC-MS

The biodiesel produced from Nannochloropsis oculata and Tetraselmis chuii were analyzed and compared with standards of fatty acids and methyl ester by gas chromatography analyzer.

Based on the Fig. below, there are two peaks that indicate the presence of methyl ester component on both microalgae. Fig. 6 shows the result of GC-MS analysis from Nannochloropsis oculata.

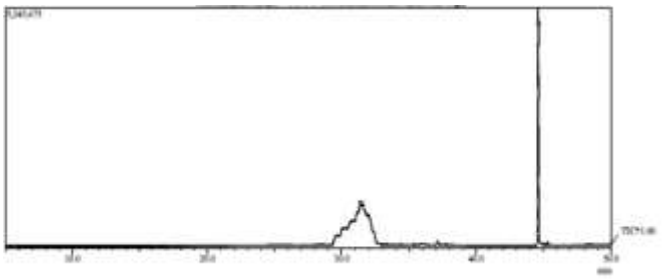

Fig. 6. GC-MS result for Nannochloropsis oculata FAME

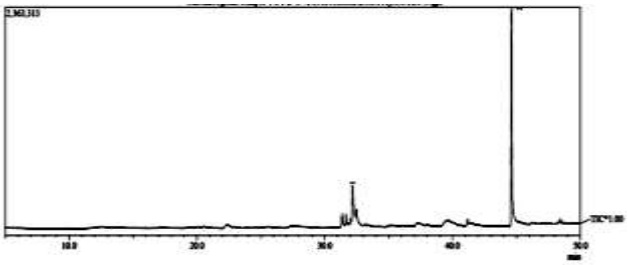

Fig. 7. GC-MS result for Tetraselmis chuii FAME

The results indicates that, the peak at R. time 31.390 corresponding to the presence of undecanoic acid methyl ester by 55.42% and at R. time 44.620 corresponding to the presence of glyceryl - 1,2 – isopropylidene – 3 - laurin by 44.58%.

GC-MS analysis result of Tetraselmis chuii methyl ester is shown in Fig. 7The first peak appeared at R. time 32.165 minutes. Based on the data bank of methyl ester, it shows that the peak is dodecanoic acid methyl ester by 18.42%. The second peak that appeared at the time R. 44.750 minutes corresponding to the presence of palmitic acid methyl ester by 81.58%.

IV. Conclusions

In the current study, both of algal species were used to extract oil and converted it into biodiesel. Oil extracted was transesterified to biodiesel using sodium hydroxide as a catalyst. The results of in-situ transesterification method cannot be identified. On the other hand, conventional method showed a better performance than in-situ for biodiesel production. Both of microalgae obtained maximum yield at 2% catalyst concentration. Nannochloropsis oculata gives highest yield that is 88.5%. The highest content of methyl ester from Nannochloropsis oculata is undecanoic acid methyl ester by 55.42% and the result from Tetraselmis chuii is palmitic acid methyl ester by 81.58%.

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Chapter 15

Making Photodiode Based on $Ba_{0.5}Sr_{0.5}TiO_3$ Thin Film on P-type Si (100) Substrate with Chemical Solution Deposition (CSD) Method

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Abstract. Ferroelectric thin film has been used in variety of applications for electronic and optical electricity. One of the material could be used in making a thin film is barium stronsium titanat (BST). BST can be made using simple device, with a cheaper cost and in a relatively short time. The making of Ba0.5Sr0.5TiO3 solution that grown on the type-p Si(100) substrat surface was done with Chemical Solution Deposition (CSD) method. Annealing Process with temperature 850 oC during 22 hours will produce different BST thin film characterisation in crystal structure, thickness and particle size. Photodiode based on BST on p-type Si(100) Substrat surface characteristic, on the test with Ketley 2400 I-V meter, show that photo diode is sensitive to light (Dark room: 2 Lux, Light room: 400 Lux).

Keywords: Photodiode, thin film, BST , CSD , I-V.

I. Introduction

There are three main advantages of Barium Strontium Titanate (BST)-based thin film light sensor. First, the ferroelectric BST material has high responsivity towards heat and light as compared to materials like LiTaO3 or NaNO2. Second, the operating condition range of such sensors is in room temperature condition and hence, the production process can be carried out in simple laboratories as it does not require any cooling system, this is unlike HgCdTe with its operating temperature of 77K, which is the temperature of liquid nitrogen. Third, commercially available sensors on the market are typically made of amorphous silicon material, therefore, the idea of production of sensors in crystallite form with ferroelectric BST material is very attractive and promising. The synthesis of BST material can be done with relatively simple devices, low cost and in a short time. This BST-based material has the potential to replace SiO2 in Metal Oxide Semiconductor (MOS) circuits [1,2].

Among the aforementioned ferroelectric materials above, BST is very attractive as it has very low optical loss, high dielectric constant and high load storage capacity [1], so it can used for Dynamic Ferroelectric Random Access Memory (DRAM) with the capacity of piezoelectric and piroelectric that allows storage capacity of up to 1Gbit [1-4]. Piezoelectric and piroelectric allows BST to be used for sensor applications [5]. At the same time, its electro-optic behaviour can be used in infra-red thermal switches [1]. These advantages of BST attract a lot of interest for it to be developed for new generation devices [6].

There are a number of techniques to create BST, e.g. Chemical Solution Deposition (CSD), Pulsed Laser Deposition (PLD), sputtering and Metallo Organic Chemical Vapour Deposition (MOCVD) [2,4,6,7]. Chemical Solution Deposition is known as a semiconductor film deposition method since 1869. In this method, thin film is made by depositing chemical solution on a substrate and then prepared by spin coating at a specific speed. The advantages of this method are that it is economical, simple, low temperature and faster processing time [2,4]. The main problem with this method is the stability of the solution as precipitation sometimes happen during storage.

The application of ferroelectric material for optoelectronics devices such as solar cells, photosensors and color sensors requires the optical characteristics data of the material, such as the absorbance and transmittance [2]. In this paper, the creation process of thin layer Ba0,5Sr0,5TiO3 (BST) is presented. The process involved the dripping of BST onto type-p silicone substrate using the Chemical Solution Deposition (CSD) method, followed by the spin coating process at a speed of 3000 rev/min for 30 seconds and annealing process at 8500C for 22 hours. The resulting thin film's optical properties were then characterised through measurement of its absorbance and reflectance. The objective of this study is to analyse the optical properties of BST thin film on a type-p Si (100) substrate in measurement of energy gap and refraction index.

II. Methodology

2.1. *Equipment and Materials*

Equipment used in this study include an analytic Sartonius BL6100 weighing machine, a spin coater, the UV-Vis Ocean Optics USB4000 spectroscope, a VulcanTM-3000 furnace and a Branson 2510 ultrasonic machine. The materials used include powder form of Barium Acetate [Ba(CH3COO)2, 99%], Strontium Acetate [Sr(CH3COO)2, 99%], Titanium Dioxide [TiO2, 97.999%] and the solvent 2-Metoksietanol [H3COCH2CH2OH, 99%]. All chemicals were obtained from Sigma Aldrich. Aqua bidest and p-type Si (100) substrate.

3.1. *Thin Film Preparation*

In this study, the substrate was Si (100) type-p that was cut using a glass cutter to 1x1 cm2 size. The substrate was then washed by using an aqua bidest for 30 seconds.

4.1. *Making Ba0.5Sr0.5TiO3 solution*

The BST solution that was grown on the surface of the Si substrate was made using the Chemical Solution Deposition (CSD) method, which is by mixing Barium Acetate, Strontium Acetate and Titanium Dioxide and was diluted in 2.5 ml 2-Metoksietanol. The molar fraction of the Barium Acetate was 0.5, the Stronsium Acetate was 0.5 and the Titanium Dioxide was 1. Next, the solution was homogenised with the ultrasonic machine for 90 minutes to get a homogeneous BST solution.

5.1. *Thin Film Growing Process*

The BST solution was then dripped onto the Si (100) type-p substrate and spun using a spin coater for 30 seconds with a speed of 3000 rpm. The coating process of BST on the Si (100) type-p substrate was done 3 times with spinning times of 30 seconds each and a 1-minute in-between breaks.

6.1. *Annealing Process*

The annealing process was done using the VulcanTM-3000 Furnace to form BST solution crystals on the substrate. The annealing process on the Si (100) type-p substrate was done in a temperature of 8500C for 22 hours with a temperature increase of 1.670C/minute.

7.1. *Contact Deposition Process*

After the annealing process, the next step was to prepare the contact deposition that included the closing of the film sample using aluminium foils and to leave a part that was to be installed the contact in the shape of a 2x2 mm2 square. The material of the contact used in this study was aluminium 99.999%. The deposition process was carried out with the metal oxide chemical vapour deposition (MOCVD) method.

8.1. *G. I-V Test*

I-V test was carried out to observe the current-voltage curve of the film and its sensitivity to lights. The I-V test was carried out with the Keithley 2400 I-V meter with voltage source range of -10 to 10 V.

III. Result and Discussions

The I-V tests were carried out in 2 conditions, namely dark (2 Lux) and bright (400 Lux). The results show that the BST film was sensitive to light. This was shown by the existence of curve shifting when tested on the different conditions, as shown in Fig. 1.

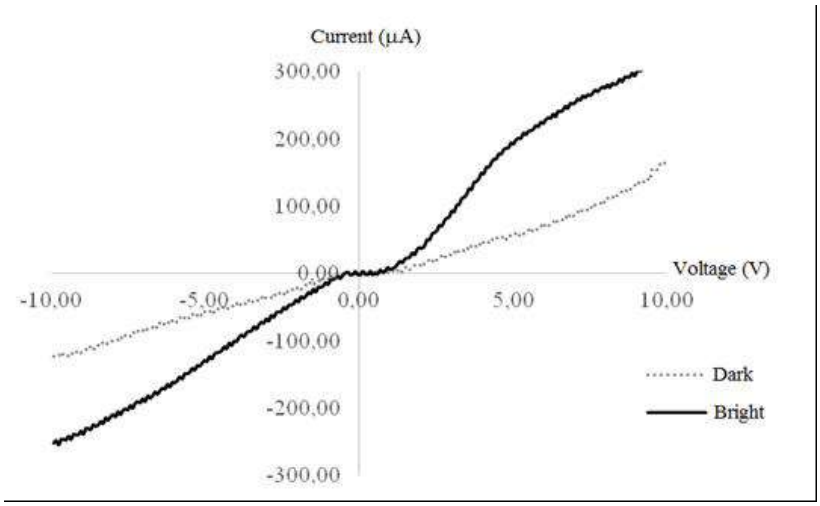

Fig. 1. F Curve I-V BST thin film in Dark and Bright condition.

From the Fig. , the current in dark condition was smaller than in bright condition. This was because the thin film's resistance was higher in dark condition and vice versa. This was because when the thin film was given energy in the form of light, electrons escaped from the valence band to the conduction band so the charge carrier number and the electrical conductivity increased.

The produced BST film was a combination of 2 types of semiconductor, namely the type-p and type-n semiconductors. The silicone substrate used was of the type-p semiconductor while the BST solution that was growth on the substrate was of type-n semiconductor. The combining was done during the crystal growth phase, which is during the annealing process. The pattern of the I-V curve in Fig. 1 shows that the produced BST thin film was a diode because the curve profile was similar to that of a diode curve. This shows that the basic principle of combining of p and n was working.

The results of the I-V tests showed that the knee voltage or the voltage when the current was beginning to increase was found to be 0.8 V as shown in table 1.

Table 1. Knee voltage thin film BST on dark and bright condition

Condition	*Knee voltage (Volt)*
Bright	0,8
Dark	0,8

IV. Conclusions

Ba0.5Sr0.5TiO3 (BST) thin film was successfully made by growing it on a Si (100) type-p substrate using the CSD method. The patter on Curve I-V shows that the produced BST thin film was a diode because the curve profile is similar to the characteristics of a diode curve. Testing showed that the BST thin film was sensitive to light so it can be applied for the next generation light sensor with a potential application as a switch**.**

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Chapter 16

Designing Direct Current Electric Circuit for Foster Creative Thinking

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Abstract. This paper aim to produce a design of direct current electric circuit teaching aid for foster creative thinking. The indicator of Creative thinking skill that measured is solving problem with different way. This study is research and development with instructional development model Four-D, but report in this study only until stage design direct current electric circuit. Consider from literature study identified that direct current electric circuit teaching aid from materials that are available in electronic store was needed for foster student's creative thinking. And then, produced a design of direct current electric circuit teaching aid with instruction to foster creative thinking.

Keywords: Teaching Aid, Electric Circuit, Creative thinking

I. Introduction

Physics is a part of science. Science is a problem solving activity conducted by humans who are motivated by a curiosity about the world around them and a desire to understand that world, or by a desire to manipulate the world in order to satisfy other wants or needs, or by both of these[2]. Based on this definition, science is a activity to solve a problem. In this case, the problem is everything that relates to daily nature phenomena.

Physics gives knowledge to students, and then the purpose of physics learning in school is a place to grow thinking skill and for solving problem in daily life. Physics learning in school need teach students for more specific purpose to give supply of knowledge, comprehension, and several skills to students that required for entering the more high level education along with developing science and technology. Physics learning was thought with scientific inquiry to grow thinking skill, work, scientific attitude, and communicate as one of life skill[6].

Creativity is the ability of someone to bring up something new, including idea and real work, produce a new thing or combined with things which already exist to produce a new thing that different from the previous. Creative thinking skill is required in making an innovation .Of course, to make students have creative thinking skill, students need to be familiar in solving the problems by creative way.

Someone can solve a problem with unusual way and easier to solve if he or her is creative. Creativity is the greatest gift of human intelligence. If the world becomes more complex, more creative we need to be to meet its challenges [10]. Creativity is a central source of meaning in our lives. Most of the things that are interesting, important, and human are the result of creativity [1]. Based on several definitions, someone who creative will solve problem with unusual way and more easy to solve. Creativity also needed for meet challenges.

Creative thinking provides looking into to events from different perspectives, suggesting multi choice solutions to problems. Creative thinking has four dimensions: Fluency (generating a large number of ideas), flexibility (generating ideas of different categories or approaches), novelty (generating unusual or rare ideas) and elaboration (generating ideas in detail)[10]. Teacher need to be creative in developing lab course as effort to develop student's creative thinking skill[15].Teacher has task to develop student's creative thinking skill, of course, there are many ways to develop student's creative thinking skill, one of it is doing lab course, with a certain way/procedure to foster creative thinking.

Problems appear when going to do Physics lab course in the school is unavailability of adequate facilities and infrastructure. Based on the observations that made by the researchers, note that the physics teaching aid is very inadequate. These condition has an impact on the activities of the Physics lab course is done very rarely. The second factor is that teachers who are less skilled in making a good practical guide. Teachers only use existing practical guidance from the book or from the internet. Results from other studies, it also shows that teachers are not optimal in designing and conducting physics lab course[14].

Physics course about direct current electric circuits commonly done with lectures methods and teacher center, and then electric current concepts are abstract and have high complexity, so it require a media in imparting these concepts in students[4]. Physics course about direct current electric circuits need to be taught with a media and also the practical lab course to make it more meaningful. Students only arrange electrical circuit according with the existing instruction on the practical guide or student's work sheets when arrange electric circuit activities. the electrical circuit that required to arrange was an usual series or parallel circuit.

The aim of this research is to produce a design of direct current electric circuit teaching aid to foster student's creative thinking skill. Creative thinking skill has some indicators, but in this study the indicators that will measured is the ability to solve unusual problems. Ability to solve unusual problems revealed by student's practice in constructing direct current electric circuits with complex problems and can be solved in several ways.

II. Method

This research is a research and development with instructional development model Four-D developed by Thiagarajan et al[13] with the stages are Define, Design, Develop, and Disseminate. However, this research only until the stage Design teaching aid of direct current electric circuit. Teaching aid that developed with materials that are available in electronic stores. Direct current electric circuits teaching aid also carried an instruction to practical lab course.

III. Results and Discussions

A. Define

This stage, researcher analyzed about problem in practical lab course based on other research which related with electric current practical lab course. And then, researcher analyzed about advantages and disadvantages of the standard direct current electric current teaching aid which usually used in schools.

Based on analysis that conducted to identify the problems in direct current electrical circuit physics course material is material is highly abstract and complex[8][12]. Concepts in electricity are invisible or cannot be seen, and it's difficult to learn and implemented in real life. A lot of students difficult in understanding electricity concepts, mainly on electric circuit. Because it required analogy and appropriate learning model[9]. In addition, students difficult to understanding the image of direct current electric circuit[3]. The purpose of the image and image of direct current electrical circuit made students difficult to interpret it[5]. Student's misconception on electric circuit are also becoming a problem in study of learning material in direct current electric circuit[16].

Learn by exploring, questioning, experimenting, manipulating, arrange things, testing, and modify the idea or solution tends to be preferred by many people. Students will be motivated to learn if they are allowed to use their creative thinking skills and their creative ways in processing information for acquiring knowledge and skills [7].

After the researcher analyze on existing standard teaching aid at school revealed that students difficult to associate electric current image with it. Students difficult to arrange circuit with using 216 holes construct circuit board. Because in electric circuit image of using wires, while if using 216 holes construct circuit board need connector to connected the holes. The principle is same, but it takes lot of time for students to get accustomed to using it.

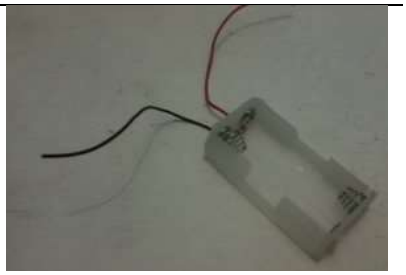
Creative thinking skill can be supported by doing some activity like moving in different way, unusual solutions to problems, exploring alternative and unusual solutions to problems ,and improvising with common objects in the Environment[11]. These activities are added to practical lab course to foster student's creative thinking.

B. Design

Based on analyze that held, and then researcher designing DC electric current with materials are:

TABLE I

MATERIALS

No	Material	Picture
1	Battery holder AA	
2	Switch	

3	Wire	
4	Crocodile clamp	
5	Bulb + bulb holder (5 pcs)	
6	Battery	

Tools and materials are available at an electronics store. Tools and materials were selected because of the tools and materials are easier to associate with electric circuit image. The advantages of these teahing aid are the material is cheap and easy to associate with electric circuit image. Then these materials can be done the following practical lab activities:

1. OHM's law and Kirchhoff's law practical lab course
Students make a small group with 5 or 6 member. Teacher give a worksheet that outlines the purpose and the table only to write down the observations. Then students need to think and write down the procedure with accompanied by a teacher. And then, students done the practical lab activities and discussion the conclusions based on results of practical lab course.

2. Problem that students must solved
Teachers give the problems of parallel and series circuit which need to be completed by students. Student and the members of his/her group must solve the problem. Here the following example of the problem:

a) Make a circuit with four bulbs, with the condition are one bulb lit brighter than the two bulbs that lit with the same brightness and one bulb not lit.

b) Make a circuit with five bulbs, with the condition are three bulbs on the same brightness and two bulb not lit up.

c) Make a circuit with five bulbs, with the condition are three bulbs have the same brightness and two bulb with different brightness than three bulbs

3. Make electric circuit based on image that drawn by teacher
Teacher can make a problem that students must make series and parallel according the condition that given by teacher. Students will make several type of circuit, and then teacher need to made performance assessment and instrument of creative thinking skill for asses circuit which made by students.

IV. Conclusions

Based on literature study was identified problem that direct current electric circuit teaching aid was needed direct current electric circuit teaching aid from materials that are available in electronic store was needed for foster creative thinking students. And then, produced a design of direct current electric circuit teaching aid with instruction to foster creative thinking. The benefit of this teaching aid are (1) the material is cheap, (2) foster creative thinking skill (3) easy to associate with electric circuit image.

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Chapter 17

Smart Monitoring Data Centre base on Mini Single Board Computer BCM 2835

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Abstract. Folded plate structures should be redefined as form-resistant structures in which the folded-plate action is a combination of transverse and longitudinal beam action[1] p.296. The early generation of folded plate structure is marked with true folded plate structures. As the number and the variety of building form increases, classification based on form took place and being developed. This leads to confusion. The confusion is shown from building examples. Roofing with either steel or pre-stressed concrete trusses were classified as folded structures. Origami could lead to another confusion, because it could be applied as either a building structure or as a non-structural member, such as ceilings. Based on the case of Sydney Opera House, and on other misleading folded structure building examples, a conclusion to stop the usage of the term "folded structures" has been recommended. Another recommendation is to separate building form categories from building structure classification.

Keywords*: Architecture, Building Structure, Construction, Folded Plate Structure, Form-resistant Structures.*

I. Introduction

University of Lampung (Unila) has 31.000 students, 1300 lecturers and 645 academic staff that used the internet daily. UPT TIK should provide internet services. It has Network Operation Centre (NOC), consists of several servers and network devices. The entire network infrastructure is managed by Divisi Infrastruktur with only 4 administrators. Unila is also facing on electricity problem. Located in the Southern of Sumatera Island Indonesia, some times the blackouts happens. Data center manager's must be able to provide excellent services to customers in electricity and internet connection. Electrical and internet problems must be maintained properly, and its quality must be monitored any time in order to carry out preventive and corrective measures in the event of disruption or unconditional incident.

This study makes an online system to monitor electrical quantities, temperature and bandwidth in data centers building, so the manager is able to take desicion against these conditions.
Mini single board computer Broadcom BCM2835 SoC, ARM11767JZF-S 700 MHz processor (Raspberry Pi model B) is a major component used in this study. Raspberry Pi serves as an interface to get the data of electrical quantities, temperature and bandwidth as well as save data.

II. Procedure

2.1. Smart Monitoring System

The Internet of Things (IoTs) can be described as connections of devices such as smart phone, personal computer, sensor, and actuator through to internet network, connected devices could produce information that can be used by human being or other systems [9]. The concept of smart monitoring enables the users to connect, control, and monitoring the system directly over the internet.

The next-generation monitoring should give the information required by users, information must be compact with SMART concept specific, measurable, achievable, relevant, time-bound [17].

2.2. Electrical Quantities

Electrical Voltage is the amount of work required to move an electrical charge from one point to another, while the electric current is defined as the amount of charge that flows due to the flow of electrons per unit time. Electrical Power is the amount of electric power that flows per unit time, calculated in units of joules /second or watts by using the following equation [6]:

$$\boldsymbol{P = VI}$$

where : P = Power (Watt or W)
V = Voltage (Volt or V)
I = Current (Ampere or A)

The theory above is for power systems of direct current, whereas the electric power system of alternating current, the power can be divided into three types, namely: the real power that the electric power used load or electrical equipment to do the work, this power is the product of voltage, current and power factor (cos ¢), apparent power is the product of voltage and current, while the reactive power is the power that is used to generate mechanical power and heat, this power is the product of voltage, current and power factor (sin ¢). Phasa angle ¢ greatly influenced by the type of load is attached, if the load is resistive then the current will same phase with voltage (¢ = 0), if the load is inductive phase currents will be left behind (lagging) of the phase voltage of 90° (¢ = 90°), while if the load is capacitive current phase will go ahead (leading) of the phase voltage of 90° (¢ = 90°). However, generally load is a combination of all three types of load, so that the current and voltage have a phase angle difference of ¢, so the power factor is cos ¢.

2.3. Room Temperature

Data centers building has servers that should be online for 24 hours potentially produces a heat temperature in the room. If the heat is excessive, it can causes the server to damage. Therefore the rooms must always be kept in accordance with the allowed standard conditions. According to the Cisco standardization temperature, the ideal temperature in data center room is at least 18oC and 27oC maximum [2].

2.4. Bandwidth

Bandwidth is often used as a synonym for data transfer rate, which is the amount of data that can be taken from a point to another within a certain period (generally within seconds). Bandwidth is usually measured in bps (bits per second). In general, the connection with large bandwidth/high capacity will be capable to deliver of large information. There are several terms associated with a bandwidth that is:

A. Bandwidth Monitoring System

Simple Network Management Protocol (SNMP) is a protocol with basic methods for controlling the TCP/IP network or network device. SNMP is designed to provide network management services, so that users can maintain and systematically monitor the computer network remotely.

B. Internet Control Message Protocol (ICMP)

ICMP is a network layer protocol that is used to report success or failure in the delivery of data. This can be indicated as part of a dense network, when data fails to be sent to the destination, and when data is deleted due to the allocation of time when delivery has been exhausted. ICMP announce the failure of the transmission to the sender, but ICMP cannot correct any of a transmission failure.

C. Packet Internet Groper (PING)

PING is a utility that can verify the TCP / IP installed, connecting to the NIC, configuration checking, and communication with the network. It is often used in TCP / IP configuration or there is something wrong with network connectivity.

2.5. Raspberry Pi

Raspberry Pi is an embedded computer that was developed by the Raspberry Pi Foundation, which has a function similar to the PC (Personal Computer) in general. Mini Computer model has two types, namely type A and type B. The difference among them is in memory, the number of USB ports, and network adapter. Raspberry Pi comes with the General Purpose Input/output (GPIO) pins that each of its can be set as an input or output. Through GPIO, Raspberry can accept various inputs to do the programming. Input can be a wide variety of sensors such as a temperature sensor, light sensor, voltage sensor, etc.

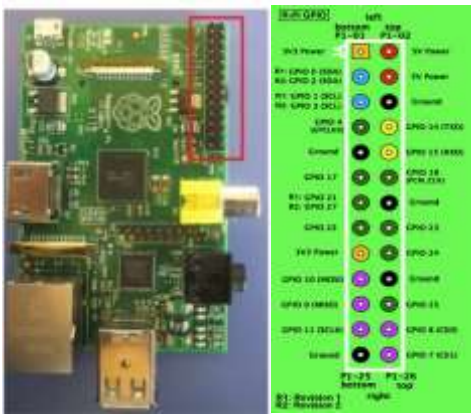


Fig 1. Raspberry Pi GPIO

2.6. Related Works

The earlier study used as reference is on [6]. This study has made a prototype device that can monitor the amount of electrical. Uunfortunately, the current measurement captured process must cut off the power of the panel and if there is any abnormal event, the risk of damage can be occur on prototype. Therefore this research is developed further by using a sensor that can perform measurements without having to cut off the power from the distribution panel so that in case of an abnormal situation, it will not damage the equipment. Furthermore, previous research on temperature monitoring and termination of the electrical connection has also been done in [7]. This study makes a prototype system that can be monitor the temperature scale in the data center and monitor power conditions. The study on [4][5][18], explains how the online monitoring of the power system by using sample data that is recorded on the PMU are placed at various locations with the same frequency. The studies contributed to monitoring the stability of the voltage and frequency of the power system. Preliminary research on the design of a monitoring system using a Single Board Computer BCM2835 is on [8]. While [1] discuss about a prototype of power flow breaker household scale. This tool is able to cut, connect, and send status is active or not active flow of electric power to the connected load of up to 2.2 Kw. Study on [3] and [13] discuss the monitoring of voltage, current and power by using a microcontroller Atmega 16 as a control system.

Still regarding the control and monitoring of room temperature, the study on [15] describes the server room temperature that must be monitored so not to exceed the limits of tolerance. By monitoring the server room temperature, managers can identify and minimize damage to the server. Research on [16] and [12] related to monitoring network that can be displayed in real time by using web services, while [10] monitoring server by

using SMS (Short Message Services). Another of important previous study is related to the presentation of information and the manufacturing quality and interactive web services as an interface to the results of monitoring can be displayed properly, complete and accurate. The studies related on this were on [11] and [12]. Based on the studies that have been done previously on-line monitoring system for a variety of purposes, using a variety of methods and tools, it is expected to be a valuable experience both in the analysis, design and implementation in the field.

III. Research Methodology

Fig. 2. show the hardware design architecture of system monitoring, from the diagram show the system used 4 type of sensor that is temperature sensor, voltage sensor, current sensor, and KwH meter that those will connected to main control device BCM 2835 (Raspberry Pi) through the GPIO pin. The current, voltage, power, and temperature data will be saved on to database server in real time, MySQL used as data base server engine.

The gathered data will be proceed by the system and shown as a web page and displayed as a historical chart statistic that can be access by users using web browser.

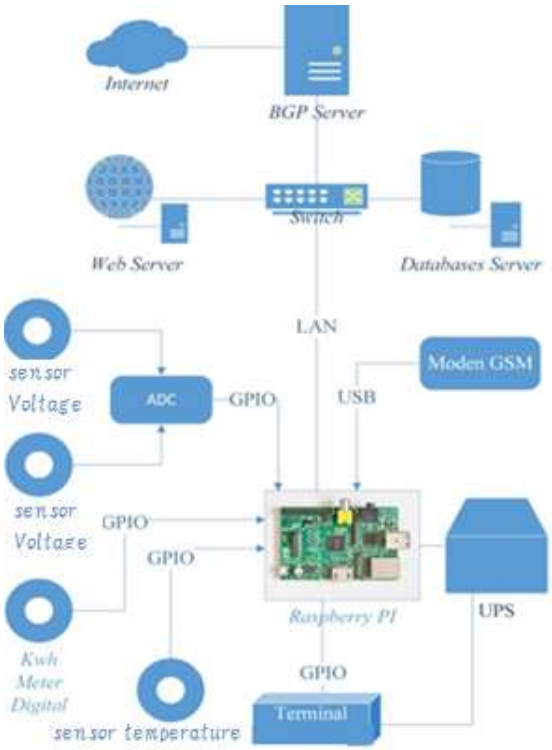
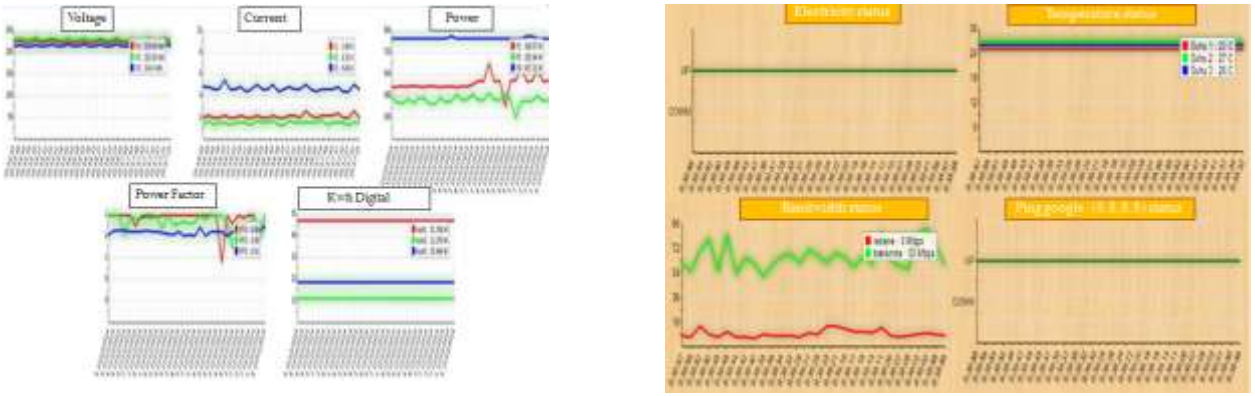


Fig 2. Hardware Design Architecture

IV. Results and Dsicussions

4.1. Development and Implementation

Based on observations and interviews to UPT TIK Manager, the system monitoring should be able to show a real time report and can be accessed through website, system also automatically generates report. Web-based live monitoring created using Python Programming Language, javascript, and html. Data charts graphic should be in realtime and updated every 3 seconds.



(a) Life Web Base Report for Electric Quantities

(b) Life Web Base Report for electricity, temperature, network utilization

Fig 3. (a)(b) Application Report

Fig. 3. shows the application report on real time condition, data capture is every 3 second and the system generates the graphics on web application.

4.2. Monitoring of Electrical Quantities

The monitoring of Electrical Quantities implementations are displayed in graphical form below. Monitoring charts for each quantities is shown in Fig. 4, Fig. 5, and Fig. 6.

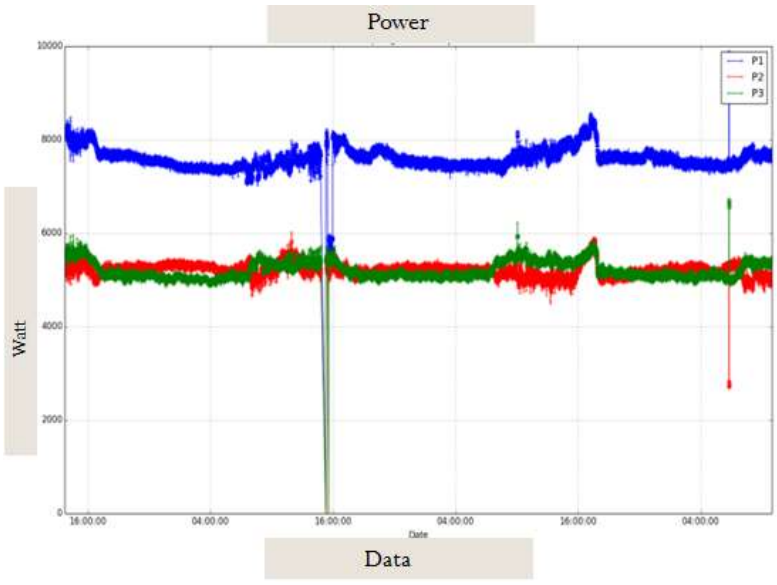


Fig 4. Power Monitoring Implementation

The graph of power monitoring shows that on Phase 1 that is highly loaded with average 8.000 Watt, phase 2 and phase 3 energy consumption was lower than Phase 1.

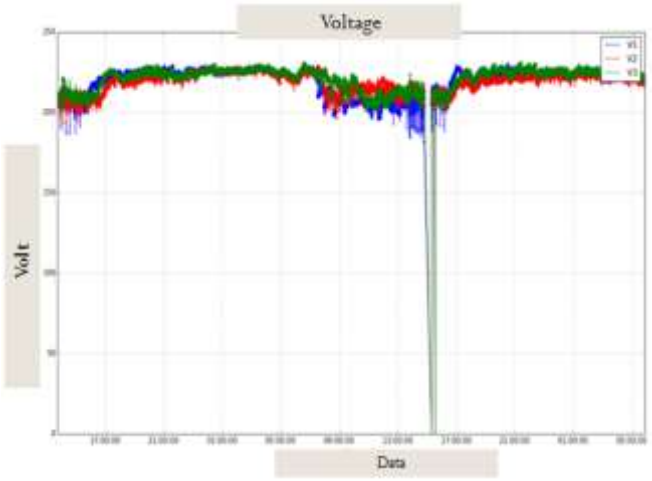


Fig 5. Voltage Monitoring Implementation

On Fig. 5. shows that phase voltage tends to be stable in range between 200 V to 230 V.

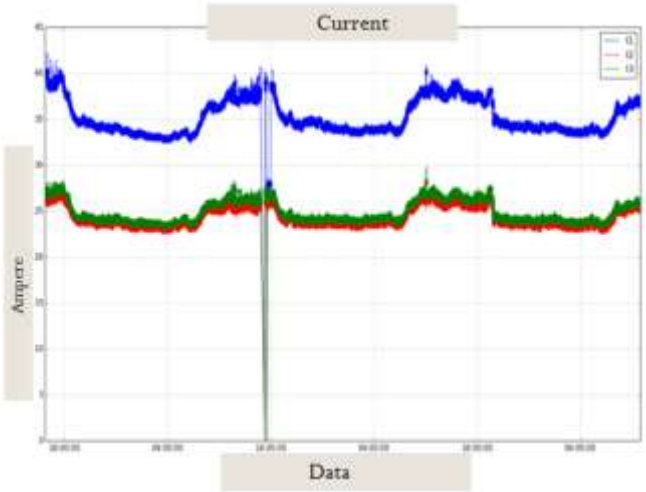


Fig 6. Current Monitoring Report

Fig. 6. shows report of current value, it shows that current on Phase 1 was the highest current as compared with other current on Phase 2 or Phase 3. This data is in line with power consumption report on Fig. 4.

4.3. Bandwidth Monitoring

BGP server bandwidth utilization, graphs was taken on September 3, 2015. It presents bandwidth usage started to increase at 8 am to 4 pm during Unila working hours. After 4pm bandwidth usage began to decline and reach its lowest condition on 4 am until 8 am.

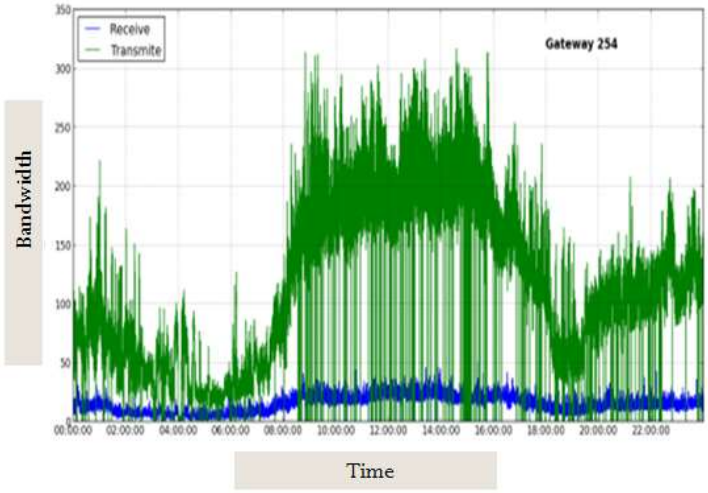


Fig 7. Daily Bandwidth Usage Statistic

4.4. Temperature Monitoring Implementation

Dallas sensor DS18B20 is used to get temperature data, consist of 3 units placed on different place on Data Centre room , maximum temperature above 28.13oC , the lowest temperature of 16.8oC. High temperature happened because all of Air Conditioner (AC) on Data Centre room didn't work. as well.

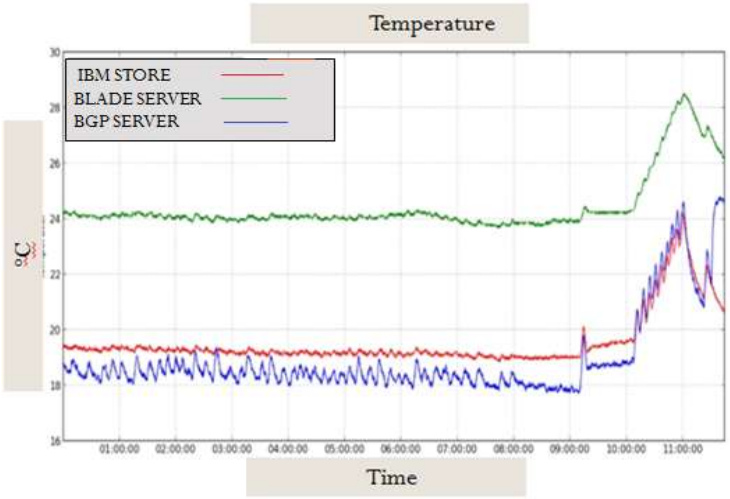


Fig 8. Temperature Report

V. Conclusions

System monitoring provided interactive live report to help IT management analyzing and evaluating the electricity and internet connection SLA. Results monitoring of 3-phase electrical system at a data center "Unit Pelayanan Teknis Teknologi Informasi dan Komunikasi-Universitas Lampung (UPT.TIK UNILA)" shows that phase voltage tends to be stable in 200 V to 230 V. The lowest voltage occur when peak load at 11 am to 2 pm, because of the tendency of the use of equipment electricity at that time. For bandwidth usage increase during working hours at 8 am to 4 pm, which indicates the number of users is still focus in daylight. While temperatures, the result shows higher temperature in the day at 10 am until 1 pm, because of the influence of the outdoor temperature.

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Chapter 18

Vocational High School E-Learning Readiness: A Survey for Industrial Knowledge Transfer

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Abstract. Indonesia requires highly skilled workers to support and sustain high economic growth. However, in recent years youth unemployment remains high. The high unemployment rate is attributed to the lack of skills of vocational school graduates. The skills of these graduates do not match the technologies used in the industry. Astra Manufacturing Polytechnic (Polman Astra) aims to remedy the issue by initiating a blended learning program to transfer industrial knowledge for vocational school (SMK) teachers in Greater Jakarta. A descriptive study was conducted to SMKs in North Jakarta to understand school readiness level to implement the program. Furthermore, the research also analyzes the teacher perception of industrial knowledge. Following the questionnaire results, the study reveals that the schools surveyed are generally ready to implement e-learning but require further training. Further results indicate that exposing teachers to industrial knowledge is crucial in order to keep up with the technologies of the industry.

Keywords: highly skilled workers, vocational education, industrial knowledge, blended learning, e-learning readiness.

I. Introduction

Recent years, Indonesia has performed high economic growth with yearly growth of more than 5% from 2008 to 2013 [1]. Despite such high growth, the youth employment rate has steadily decreased since 2007, the Fig. remains above regional average. Youth unemployment in 2014 was 17.1%, 3.4% higher than OECD average [2]. Furthermore, young people (15-24 years old) constitutes 71.4% of total unemployment rate in Indonesia [3]. Indonesian government puts it as their main priority to remedy this problem; Indonesia in the coming decade requires employed young skilled workers to sustain the high economic growth. The government encourages young people to study in vocational technical school (SMK) instead of general high schools (SMA). The government aims to achieve a 70:30 ratio between SMK and SMA in 2015 [4]. Therefore, young people could have specific and practical skills required by the industry. However, recent studies has shown that the education and skills of such SMK graduates are not sufficient to work in the Industry [3]. One cause is attributed to the lack of appropriate industrial knowledge of SMK students. SMK students are mandated to do internship in the industry for two months in various companies. Such internship experience does not work well occasionally as companies see the internship as a burden, particularly for small and medium companies (SME). Therefore, the internship does not provide the right benefits as expected for both students and the companies. The condition worsened as many teachers do not have the exposure and industrial experience. With the fast-moving changes in technologies of the industry, their skills are rapidly becoming obsolete.

Astra Manufacturing Polytechnic (Polman Astra) as an educational institution has close links to the industry aims to narrow the gap by providing the best industrial practice and the knowledge to SMK teachers. The objective is to provide suitable industrial skills for the SMK teachers in great Jakarta. With greater understanding, the teachers are expected to be able to transfer the industrial knowledge effectively to their student. Therefore, the students could obtain the essential skills to match the latest technologies by the industry.
In 2015, Polman Astra implements the program industrial knowledge sharing to 20 SMKs around Greater Jakarta (Jabotabek). However, due to geographical and limited time schedules, implementing the program in each SMK has been a problem. With lowering costs of internet connectivity, the infrastructure has become more affordable for students to be online. Therefore, Polman Astra aims to deliver such materials through the internet. However, infrastructure inequality among SMK pose another challenge to deliver electronic learning (e- learning).
Blended learning is a concept that combines conventional learning and e-learning. According to Mazlouminaya et.al., blended learning have the advantages in pedagogy, accessibility and flexibility, and cost effectiveness compare to full e-learning [5]. Furthermore, blended learning can retain engagement between student and teacher. As a result, Polman Astra decided to deliver the courses through blended learning. While conventional teaching is normally not a problem, the e- learning must be carefully examine to ensure successful implementation of the program. Therefore, in light of inequality among SMKs, a pilot project to assess SMK readiness level has been conducted in 5 SMKs around Greater Jakarta. However, due to scheduling issues, current research data could only be obtained from 2 SMKs involving 29 teachers where both surveyed SMKs located in North Jakarta.

The objective of the research were two-fold:

[1]. To understand the readiness level of SMKs teachers to $_1$blended learning concept in terms of infrastructure, material content, financial and study mentality.
[2]. To recognize teachers' perception about industrial knowledge transferred to their school.
[3]. To our knowledge, the research was the first to utilize blended learning concept to share the best industrial practices to SMK teachers in Indonesia. The research has contributed to enriching industrial knowledge dissemination methods for SMK teachers. The rest of the paper are organized as follow: Section 2 describes study literature, Section 3 explains research design, Section 4 is dedicated to surveyed results, Section 5 presents data analysis and discussion, and finally Section 6 concludes the implications and limitation of the research.

II. Literature Review

E-Learning readiness is defined as an organization of physical and mental readiness to conduct and experience e- learning [6]. E-Learning readiness explains organization readiness level in various dimensions to implement e-learning. Researchers have discussed some of the dimensions to measure the readiness level to become the basis construction of e- learning readiness model.
Aydin and Tasci [7] proposed technology, innovation, people and self-development. Tarvid [8] introduced human resources, infrastructure and information. Chapnick [9] categorized 8 e-learning readiness dimensions as follows: psychological, sociological, environmental, human resource, financial, technological, equipment, and content. Swatman and So [6] used 6 dimensions to measured e-learning readiness that were student preparedness, teacher preparedness, IT infrastructure, management support, school culture, and conventional teaching preference. Akaslan and Law [10] specifically measured the readiness level through technology, people, content, and institution. Saekow and Samson [11] applied policy, technology, financial, human resources, and infrastructure. Similarly, Kaur and Abas [12] utilized learner, management, personnel, content, technical, cultural, and financial.

Above previous works shared measurement dimensions that can be categorized based on the context and substance [13]. In this research the e-learning readiness dimensions were constructed as follow:

a. Human resources: organization culture, budget, people, self-development, skill/competency, e-learning training, user attitude, and industrial knowledge user perception.
b. Financial aspect: budget.
c. Technology.
d. Infrastructure: networking and hardware.

The dimension were used to calculate e learning readiness index. The index score represents an organization readiness level to accept and implement e-learning. To measure 11 e- learning dimensions, 42 Likert scale questions and 1 open question about current gadget used were constructed. Each dimension scores and final scores were thoroughly examine to interpret readiness index based on Aydin & Tasci scoring model [7] as depicted in Fig. 1. The model describes that in 1-5 Likert scale, the mean value of 3.4 is defined as the

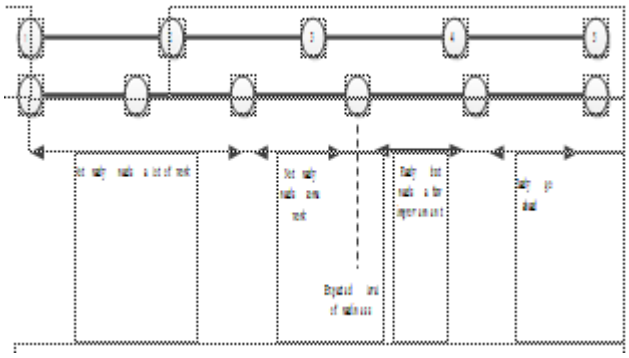

Fig. 1. E-Learning Readiness index adapted from Aydin & Tasci [7].

expected readiness level. The mean value is defined based on critical level of 4 intervals/5 categories = 0.8. Therefore, the score below 3.4 implies that the organization is not ready to implement e-learning. Scores between 3.4 and 4.2 means that an organization is ready but still require a few improvements. Likewise, score above 4.2 indicates that an organization is ready to implement e-learning.

III. Research Design

The research was an explorative research with case study to obtain a whole picture of particular context. Within the research, the context was knowledge sharing for vocational technical school in Greater Jakarta. Therefore, the research steps were described as follow: studying related literatures, determining research variables, designing questionnaire, collecting data, analyzing results, and conclusion.

The data used in this research are quantitative data for both primary and secondary data. Primary data were obtained from questionnaire results. Whereas, secondary data were obtained from literatures review of related works. The research was conducted in Greater Jakarta involving 5 SMKs. Those schools are the schools under Astra group supervision. However during first phase because of scheduling issues, the research was only able to obtain data from 2 SMKs in North Jakarta. However, the initial data from these location still provide an indication and important insight of SMK's readiness level.

Proportional purposive non random sampling was used to obtain data from SMK teachers. In this research respondent sample were selected from two categories:

1. SMK teachers who are able to judge e-learning/blended learning aspects of the school. The teachers under this category are school heads and computer laboratory coordinators.
2. Teachers who have at least 3 years teaching experience in surveyed school.

The research used both interviews and questionnaires to recognize school readiness in accepting and implementing blended learning concept. Moreover, the questionnaire was adapted from previous questionnaire and adjusted with SMK characteristic. Questionnaire used Likert scale (1-5) and all questions use Indonesian language to avoid misunderstanding of participants. The translation of some questionnaire

TABLE I
Sample Of Questionnaire Questions

	Organization culture	1	2	3	4	5
K1	I understand e-learning.					
K2	I understand value and benefit of e-learning.					
K3	I already have independent learning habit.					
K4	Teacher has good knowledge sharing culture and cooperative.					
	Budget	1	2	3	4	5
B1	The school has allocated budget for buying hardware to implement e-learning.					
B2	The school has allocated budget for internet connection.					
	People	1	2	3	4	5
PE1	The school has manpower to facilitate e-learning implementation.					
PE2	I have enough experience in technology-based learning (i.e. *Computer Based Learning, multimedia based learning*).					
PE3	I use internet as learning sources (Youtube, Blog, Tutorial, etc)					

questions are showed in table 1. After all data were collected, the data were processed as follows:

a. Calculate average values of all questionnaires in each research variables.
b. Determine readiness index for research variables according to index criteria by Aydin Tascii.
c. Determine readiness index for each SMKs
d. Analyze e-learning readiness resulted from point (b) and (c).

IV. Results and Discussions

The result showed that all the SMKs had readiness index 3.90. Detail dimension results are as follow: readiness level for organization culture was 4.10, budget readiness was 3.84, people dimension was 3.69, self-development readiness was 4.31, skill readiness level was 4.19, e-learning training was 1.83, user attitude was 4.10, user perception was 3.80, technology was 3.95, infrastructure: network was 3.61, and hardware was 3.39.

Those results implied that all SMKs in North Jakarta was ready to implement e-learning but required few improvement. The overall readiness index 3.90 was greater than expected readiness level 3.40. Fig. 2 shows the readiness level of each dimension. With the exception in training, other dimensions had readiness index above 3.40. Among eleven dimensions of the research, only training dimension with index score 1.83 that did not meet index score requirement. The results showed that all SMKs are ready to implement e-learning but require e-learning training to be

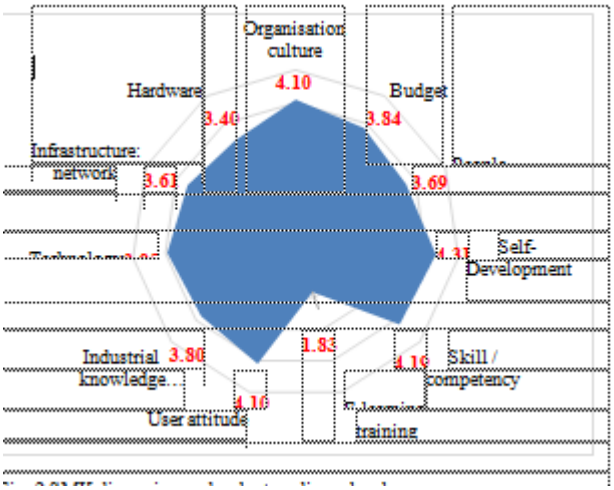

Fig. 2 SMK dimensions radar chart readiness level.

successfully implement the e-learning. The highest readiness level was self-development dimension that is 4.31 followed by skill dimension with score 4.19. Those scores represented that all SMKs teacher had high maturity to develop their skill in supporting successful e-learning implementation. Furthermore, they also had high computer literacy and already had adequate skill to implement e-learning.

Further results showing dimension analysis based on respondents educational background are depicted in Fig. 3. The results showed that teachers with master degree background were the most optimistic and ready to implement e-learning without needed any improvements with score 4.32. While, teachers with other education background were ready but required few improvements. However, despite of optimistic perception, the high-educated teachers also perceived that e-learning training was mandatory for a successful e-learning implementation. In industrial knowledge user perception, the teachers with "undefined" educational background perceived that the industrial knowledge was important for the student.

The data revealed that the surveyed SMKs in North Jakarta were ready to implement e-learning with few improvements. All the SMK teachers shared the same perception of further training requirement before implementing the e-learning program. Further data in each dimension indicated that self- development had the highest dimension that means all teachers were ready to develop the skill themselves. Whereas, the rest of dimensions unveiled that all teachers required improvement before implementing the program.

Moreover, skills, organization culture, attitude, technology and budget were dimensions that required less improvement. Furthermore, the teachers shared positive value towards dimension that associated with their personal ability such as skills, organization culture, attitude, and technology. While, e- learning supporting dimensions such as hardware, network, and people were perceived as dimensions that needs much improvement. The result implied that school should focus on improving e-learning supporting dimension.

In industrial knowledge user perception, the teachers perceived that industrial knowledge is important, but need

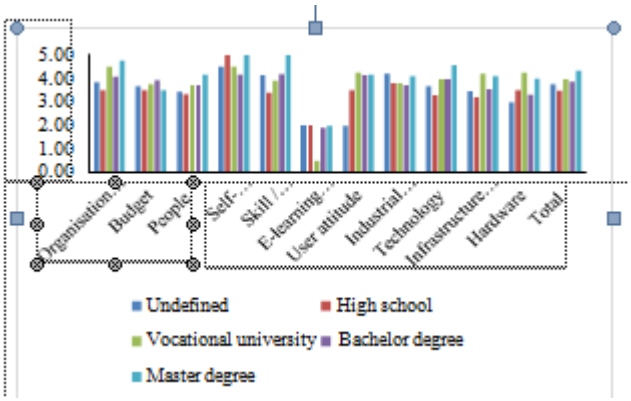

Fig. 3 Dimension results of respondents' educational background.

improvement to be able to deliver the suitable content to the students. This fact was supported with the question no 3 in teacher perception about their industrial knowledge dimension that had score 3.07 as depicted in table 2. The score was below the expected level of readiness. Therefore, transfer knowledge from industry is beneficial to SMK teacher in order to upgrade their skills to comply with industrial requirements.

TABLE II
Industrial Knowledge User Perception Result

No	Questions	Scor
1	I am interested to give industrial	4.28
2	I think that industrial knowledge could	4.59
3	I think that I have adequate industrial	3.07
4	My superior is fully supportive of	3.59
5	I can easily search and obtain industrial knowledge material for my students.	3.48

V. Conclusion

The descriptive research using survey data reveals that the surveyed schools are generally ready to implement e-learning but require further training to be successfully implement the program. Furthermore, the school should focus the improvement on hardware, network, and people to support the e-learning implementation. The study also shows that teachers with master degree background are the most ready teachers to implement e-learning. Furthermore, the teachers agree that they do not have adequate skills required to teach industrial knowledge. Therefore, transfer knowledge is needed to improve the teacher industrial knowledge.

The data collection for Greater Jakarta are currently on- going. Therefore, because of the current data are received from SMKs in North Jakarta, the conclusion are limited to area where the school located that is in North Jakarta, However, when the data from other locations are obtained, different results might be expected and conclusion for Greater Jakarta could be drawn.

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Chapter 19

Modeling and Simulation of Solar PV Array Emulator Utilizing Buck Converter with Adaptive Control Base on Neural Network

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Abstract. This paper presents the modeling and simulation of Solar Array Emulator utilizing Buck Converter with Neural Network Adaptive control. The simulation activity carried out using MATLAB/Simulink software. The Solar Array emulator is realized by controlling buck converter using Adaptive control base on Neural Network Controller with reference from Solar Array model. The Solar Array model was derived from the characteristic equation Solar Cell. The characteristics of Solar Array Emulator model was tested by varying the value of load and considering the effect of irradiance variation. The output characteristics of Solar Array Emulator model is verified by comparing to the characteristics of the actual PV module. The Sunmodule SW50 poly RMA from SolarWord is chosen as a reference for this simulation. The proposed Solar Array Emulator was found to be valid and accurate for any irradiance variations.

Keywords: Solar Array Emulator; Buck Converter; Photovoltaic; Matlab; Simulink.

I. Introduction

The increasing of world demand for energy resources is a crucial challenge that makes renewable energy sources has gained importance. One of the most promising renewable energy sources is solar photovoltaic [1]. It can produce direct current electricity when exposed to direct sunlight. Solar photovoltaic are solid state devices that convert the energy of sunlight directly into electrical energy. Solar photovoltaic have several advantages such as pollution-free, low maintenance costs and low operating costs. Their sources of energy, which is derived from solar energy, are also widely available and it is free.

Photovoltaic technology is a technology for generating electrical power by converting solar radiation into direct current electricity using semiconductors who have photovoltaic effect. The main component of a PV system is the solar cell, which functions to convert solar energy into direct current electrical energy.

In application, several solar cells connected in series and parallel to form a solar module, and several solar modules can be connected in series or parallel to form a Solar Array in order to increase the output power of a solar panel system. When exposed to sunlight, the solar panels will generate the direct current electricity, which is ready to supply power to the load. Because of its energy conversion systems using Photovoltaic technology, the power plant of this type is also called Solar Photovoltaic Power Plant.

Actually, Solar PV Power Plant is an appropriate solution to overcome the energy crisis. The photovoltaic system is recognized to be at the forefront in renewable energy generation. However, PV systems do have some limitations. These include low efficiency and higher initial cost [1-4]. Therefore, further research towards the efforts to improve the efficiency of photovoltaic system is needed.

Many factors that affect the performance of the Solar PV Array system should be investigated. Therefore, Solar Array Emulator is needed to find out how much these factors affect the performance of the solar photovoltaic system.

In this paper, a modeling and simulation of Solar Array Emulator utilizing Buck Converter under MATLAB-Simulink software is carry out. The Solar Array emulator is realized by controlling buck converter using Adaptive control base on Neural Network Controller. The characteristics of Photovoltaic Emulator model was tested by varying the value of load and considering the effect of irradiance variation. The output characteristics of Solar Array Emulator model is verified by comparing to the characteristics of the actual PV module SolarWord SW50.

II. Solar PV Array Model

In application Solar cell transform solar radiation into DC current to generate electric power based on the principle of photovoltaic effect in semiconductor materials.

The most common model used to predict energy production in photovoltaic cell modeling is the single diode circuit model that represents the electrical behavior of the pn-junction is given in [5-6]. Fig. 1 shows the single diode circuit model of Solar cell.

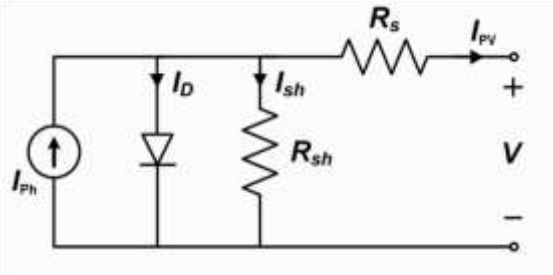

Fig. 5. Solar Cell Equivalent Circuit

From the single diode equivalent circuit in Fig. 1, the equation for the output current is given by:

$$I_{pv} = I_{ph} - I_D - I_{sh} \qquad (1)$$

where

I_{pv}= output current (ampere)
I_{ph}= photocurrent (ampere)
I_D = diode current (ampere)
I_{sh} = shunt current (ampere)

The current through the diode follow the Shockley diode equation:

$$I_D = I_O\left[e^{\left(\frac{qV_D}{nkT}\right)} - 1\right] \qquad (2)$$

where
I_O= reverse saturation current (ampere)
n = diode ideality factor
q = elementary charge
k = Boltzmann's constant
T = absolute temperature

By Ohm's law, the shunt resistor current is:

$$I_{sh} = \frac{V_{sh}}{R_{sh}} \quad (3)$$

where R_{sh}= shunt resistance (Ω), and the voltage across R_{sh} is V_{sh} equal to V_D, and:

$$V_D = V_{pv} + I_{pv} R_s \quad (4)$$

where
V_D= voltage across diode and resistor Rsh (volt)
V_{pv}= voltage across the output terminals (volt)
I_{pv}= output current (ampere)
R_S= series resistance (Ω)

Substituting equation (2) and (3) into the first equation and using equation (4) produces the characteristic equation of a solar cell, which relates solar cell parameters to the output current and voltage [1-2]:

$$I_{pv} = I_{ph} - I_O \left[e^{\left(\frac{q(V_{pv} + I_{pv} R_s)}{nkT} \right)} - 1 \right] - \frac{V_{pv} + I_{pv} R_s}{R_{sh}} \quad (5)$$

Table 1. Specification Of Solarworld SW50 Module [7]

Parameters	*Symbol*	*Value*
Maximum power	P_m	50 W
Voltage at max power	V_m	18.2 V
Current at max power	I_m	2.75 A
Open circuit voltage	V_{oc}	22.1 V
Short circuit current	I_{sc}	2.98 A
Number of Series Cells	N_s	36
Number of Parallel Cells	N_p	1

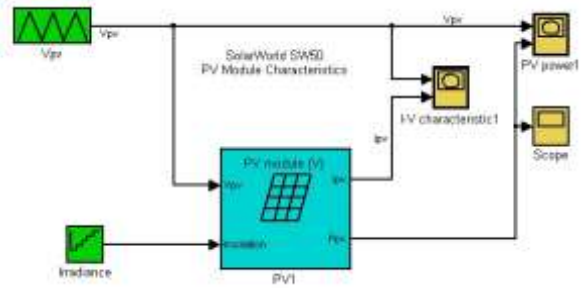

Fig. 2. Simulink Model of the solar cell

The nonlinear and explicit equation given by Eq. (5) depends on solar irradiance, the cell temperature, and their reference values which are generally provided by manufacturers of PV modules for specified operating condition. As Standard Test Conditions the irradiance is 1000W/m^2 and the cell temperature is 25^{O}C [1-7].

Based on the equations (1) to (5), and using the electrical parameter specifications of SolarWorld SW50 module presented in Table 1, the model of Solar PV Cell has been developed. The model of the Solar PV Cell was implemented using a MATLAB-Simulink software. The table says that The SolarWorld SW50 module provides 50W nominal maximum power at Standard Test

Conditions and has 36 series connected cells [7]. Fig. 2 shows the model of the Solar PV cell with input parameters irradiance and voltage. The contents of the block PV1-Module in Fig. 2 are shown in Fig. 3.

The Solar PV Array model was developed using MATLAB-Simulink software. The developed model of the Solar PV Array is shown as Fig. 4. Model of Solar PV Array consist of 6-module SolarWorld SW50 in series connection.

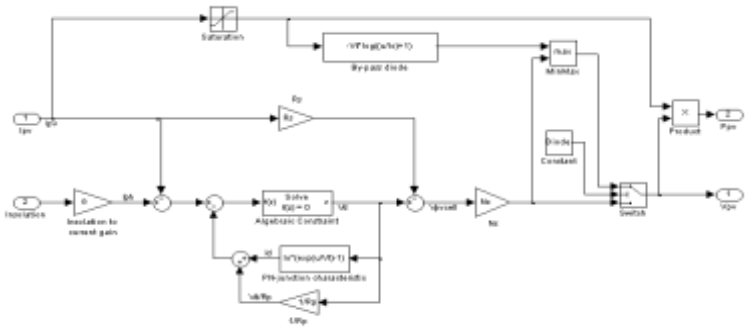

Fig. 3. Simulink Model of block PV1-Module in Fig. 2.

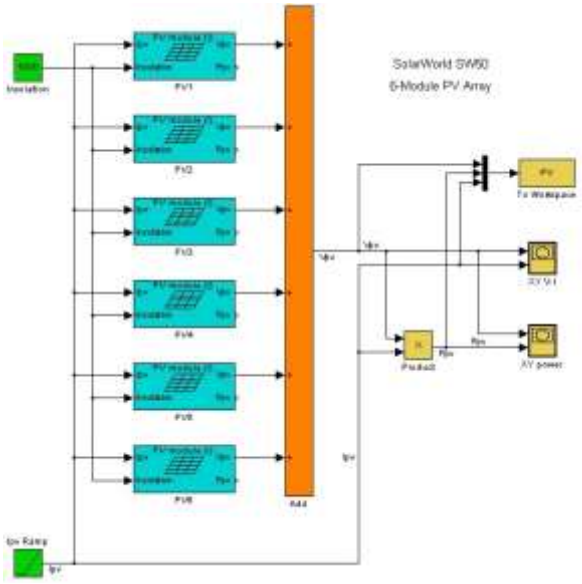

Fig. 4. Model of Solar PV Array consist of 6-module SolarWorld SW50 in series connection

III. Buck Converter For Solar PV Array Emulator

Buck Converter Power Circuit

The Buck converter is a type of step-down DC-DC converter. Output of the Buck converter is regulated according to the duty cycle of the PWM input at fixed frequency. The power circuit of a Buck converter is illustrated in Fig. 5, consists of DC source Vs, Power Switch Q, Diode, Inductor, Capacitor, and load Resistor [8-10].

In steady state operation, the average output voltage of the Buck Converter is

$$V_o = D.V_s$$

where D is duty cycle.

Neural Network Controller

In order to design the neural network controller, some information about the plant is needed. Usually the numbers of input and output neuron at each layer are equal to the number of input and output signals of the system respectively. The architecture of the proposed neural network control of a Buck converter adopted from [10] as shown in Fig. 6.

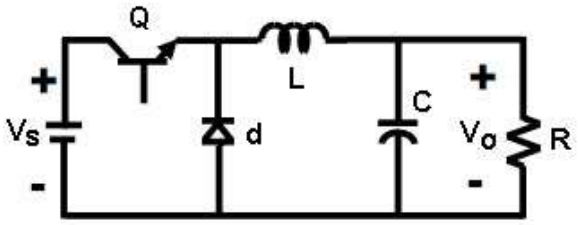

Fig. 5. Power circuit of a Buck Converter

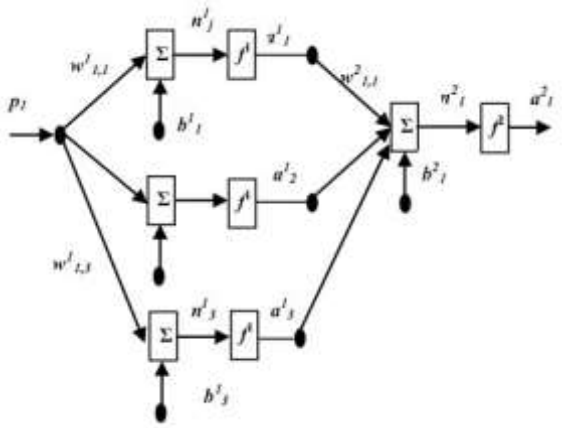

Fig. 6. Architecture of the neural network controller [10].

The connections weight parameter between jth and ith neuron at mth layer is given by wth, while bias parameter of this layer at ith neuron is given by bim. Transfer function of the network at tth neuron in mth layer is defined as

$$n_i^m = \sum_{j=1}^{S^{m-1}} w_{ij}^m a_j^{m-1} + b_i^m$$

The output function of neuron at m_{th} layer is given by $aim = f\,m\,(nim)$

$$a_i^m = f^m\left(n_i^m\right)$$

where ***f is*** activation function of the neuron. In this design, the activation function for the output layer and the hidden layer are unity and a tangent hyperbolic function respectively.

The activation function of the hidden layer is given as

$$f^m\left(n_i^m\right) = \frac{2}{1+e^{-2n_i^m}} - 1$$

Updating of the connection weight and bias parameters are given by

$$w_{ij}^m(k+1) = w_{ij}^m(k) - \alpha\frac{\partial F(k)}{\partial b_i^m}$$

$$b_i^m(k+1) = b_i^m(k) - \alpha\frac{\partial F(k)}{\partial b_i^m}$$

where ***k*** is sampling time, ***a*** is learning rate, and ***F*** performance index function of the network.

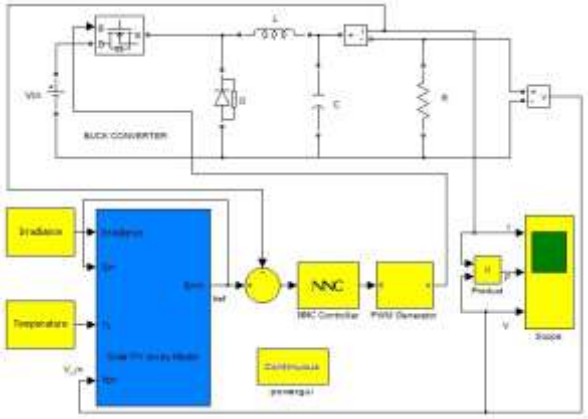

Fig. 7. Model of Solar PV Array Emulator utilizing Buck Converter

MODELLING OF SOLAR PV ARRAY EMULATOR UTILIZING BUCK CONVERTER

The model of the Solar PV Array Emulator using Buck Converter was developed using a MATLAB-Simulink model. The developed Solar PV Array consists of 6module SolarWorld SW50 in series connection.

A Simulink model of Buck Converter is carried out by using Power Electronic model of SimPower toolbox. The developed Buck converter model consists of DC source, power Mosfet, Diode, Inductor, Capacitor, and load Resistor. The buck converter is controlled by a Neural Network controller and PWM generator.

Finally, both of Buck Converter model and Solar PV Array model are combined to produce a solar PV Array Emulator. The developed solar PV Array Emulator model is shown in Fig. 7.

III. Result and Discussions

3.1 Solar PV Array Model output under number of modul variation

The performance of the Solar PV Array model is tested through simulation. In this simulation, Model of Solar PV Array from Fig. 4 is used. The output of the PV Array model is investigated when the number of modules that are connected in series changed from 1 to 6 modules. Fig. 8 to 10 depicts the performances curve of Solar PV Array model.

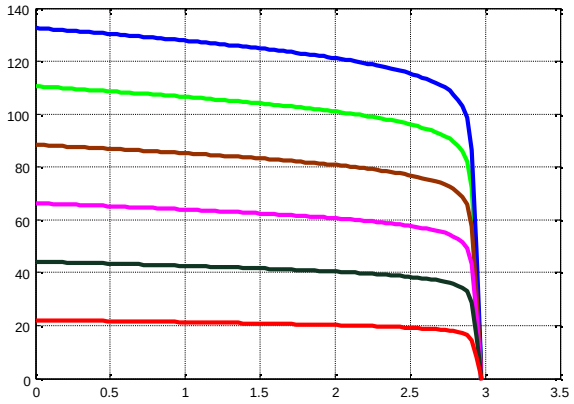

Fig. 8. Voltage-Current Curve of Solar PV Array Model

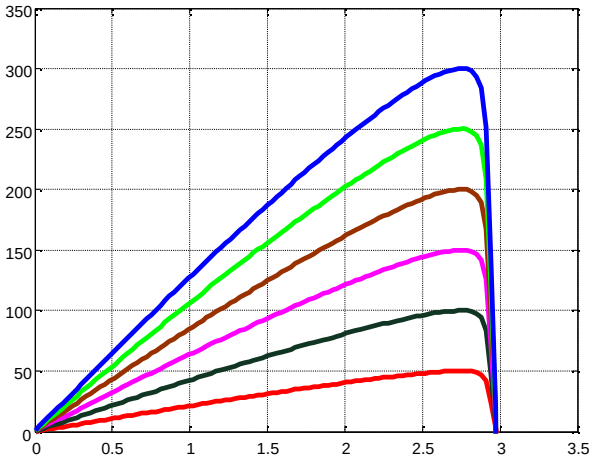

Fig. 9. Power-Current Curve of Solar PV Array Model

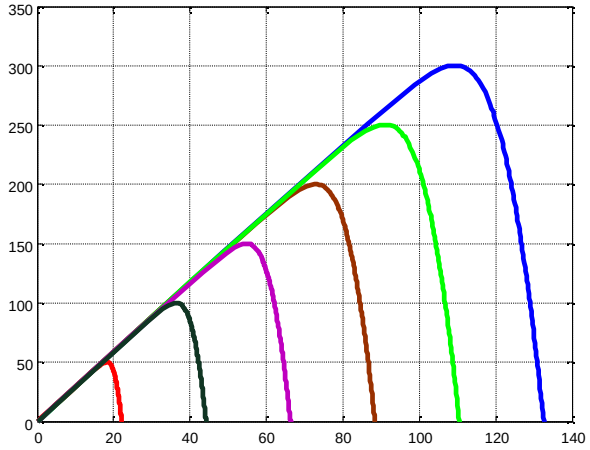

Fig. 10. Power-Voltage Curve of Solar PV Array Model

Fig. 8 shows the Voltage-Current curve of the Solar PV Array when the number of modules that are connected in series changed from 1 module to 6 modules. This Fig. shows that the output voltage of Solar PV Array is increase with the increase of module-number in series connection.

Fig. 9 shows the Power-Current curve of the Solar PV Array when the number of modules that are connected in series changed from 1 module to 6 modules. From this Fig. we know that the output Power of Solar PV Array and the maximum power point of the Solar PV Array are also increase with the increase of module-number in series connection.

The curve in Fig. 10 shows the relation of Power and Voltage of the Solar PV Array when the number of modules that are connected in series changed from 1 module to 6 modules.

3.2 Solar PV Array Emulator Performance

For the simulation study, the PV Array consist of 6module of SolarWorld SW50 50W PV Module is considered. The specification of 1-module of SolarWorld PV module corresponding to 25^{O}C temperature and $1000W/m^2$ solar irradiation is shown in table I. The specification of 6-module of SolarWorld SW50 PV module in series Connection obtained from the calculation. Based on calculation, the specification of the PV Array that consist of 6-module in series connection of SolarWorld SW50 PV module corresponding to 25^{O}C temperature and $1000W/m^2$ solar irradiation can be written as shown in table II.

Table 2. Parameter Of Pv Array With 6-Module Of Solarworld Sw50 In Series Connection

Parameters	*Value*
Maximum power	300.3 W
Voltage at max power	109.4 V
Current at max power	2.75 A
Open circuit voltage	132.6 V
Short circuit current	2.98 A
Number of Module in Series	6
Number of Module in Parallel	1

In the simulation, Model of Solar PV Array Emulator utilizing Buck Converter from Fig. 7 is used. The output of the Solar PV Array Emulator is investigated. The performance of Solar PV Array Emulator model tested with variable load. The data simulation results are given in Table III.

Table 3. Data simulation results

No	*V (Volt)*	*I (Amp)*	*P (Watt)*
1	132.14	0.11	13.87
2	129.84	0.60	77.90
3	127.19	1.11	141.18
4	125.42	1.41	176.85
5	123.43	1.71	211.06
6	121.06	2.01	243.32
7	119.18	2.21	262.80
8	116.85	2.40	280.43
9	114.46	2.55	291.88
10	110.94	2.70	299.53
11	109.40	2.75	300.29
12	106.54	2.81	298.83
13	103.01	2.85	293.59
14	94.69	2.90	274.12
15	86.41	2.91	251.44
16	69.13	2.93	202.20
17	48.43	2.94	142.38
18	27.56	2.96	81.44
19	6.69	2.97	19.87

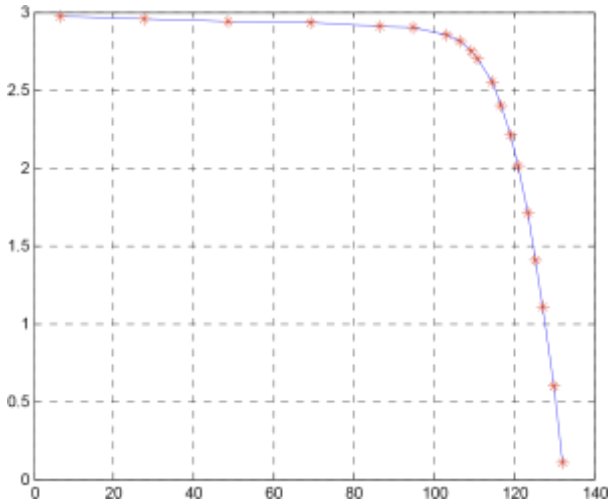

Fig. 11. I-V characteristics of Solar PV Array

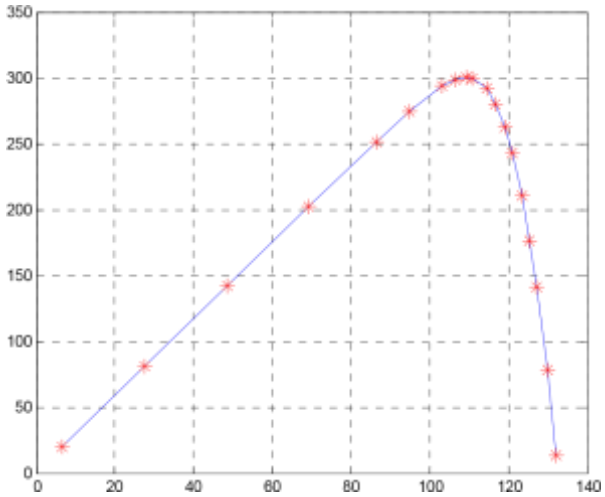

Fig. 12. P-V characteristics of Solar PV Array

From data simulation, the obtained characteristic for the Solar PV Array Emulator utilizing Buck Converter is shown in Fig. 11 and 12. Fig. 11 shows the CurrentVoltage (I-V) characteristics and Fig. 12 shows the Power-Voltage (P-V) characteristics of the created PV Array Emulator models. With Irradiance 1000W/m^2 and Temperature 25^{O}C, the Solar PV Array emulator produce the maximum power is 300.29 Watt with voltage at the maximum power of 109.40 V and current at the maximum power of 2,75 A at the value of 40 Ohm load.

For comparison, according the table II, at standard test conditions, PV array with 6-Module of SolarWord SW50 in series connection produces maximum power 300.3 Watt with voltage at maximum power of 109.4 V and current at the maximum power of 2.75 A. The data shows that the developed model of Solar PV Array Emulator is valid.

IV. Conclusions

A modeling and simulation of Solar PV Array Emulator Utilizing Buck Converter is presented. The performance of the Solar PV Array Emulator system has been investigated. The simulation results show the proposed Solar PV Array Emulator model has similar characteristics to the actual characteristics of 6-module SolarWorld SW50 in series connection. In the standard test conditions it was found that the proposed Solar PV Array Emulator produces the maximum power 300.29 Watt with voltage and current of 109.40V and 2.75A. For comparison, according the datasheet, at standard test conditions the Shell SP75 solar module produces the maximum power 300.3 Watt with voltage at the maximum power of 109.4 V and current of 2.75 A..

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Chapter 20

Line Balancing by combining given Work Cell and single tasks, a Small Scale Industry case

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Abstract. A clothing small scale industry produced a kind of trousers that needs operation order of 25 tasks, is lamented that the productivity is not as expected. Through a tracing of production data, the series of operations and the processing time of each operation are determined. Since certain tasks in production floor are using the same machines that could be declared as defined work cells, there are unnecessary waiting time on several point of operations. The company is suggested to combine previous defined work cells with new others by common work cell line balancing. This conditional work cell balancing could increase the efficiency as the man cost and waiting time are reduced. It shows that line balancing idea is still the relevant way to improve such case although other recommendation related with machine layout should still be initiated for better time and distance of material or product transportation in the shop.

Keywords: line balancing, productivity, work cell.

I. Introduction

This manuscript explains a case of a clothing small scale industry in the West of Bandung, Indonesia, that produced a kind of trousers. Although the procedure of its production was not that proper since the goal is just simply answer the market, but their quality is quite good. Anyhow, there is a willingness and spirit to develop the company in order to grow the market share up. Therefore few evaluations were made and there are several points could be improved.

It is found in the production flow with operation order of 25 tasks, operated by 18 workers, that the productivity is not as expected since there are unnecessary waiting time on several point of operations. There are no any information of standard operation time of each task, its flow succession of operation, etc, but the employees are capable to do their activities well due to their skill, experience and product knowledge.

The idea is just trace the production data as it is needed to be immediately seen for the work cell system and kind of operation included time of each task in order to obtain its series of operations and define the precedence diagram, as a basic way for line balancing and initiate possible improvement. The investigation of operation time that already done by time motion study and statistical approach won't be discussed in this manuscript. There will be the explanation of work cell line balancing and its assignment that is combining between heuristic and trial-error way.

II. Literature Review and Methodology

In work cell line balancing, defining task list of the case with each tasks' operation time is a mandatory[1] in order to get total operation time and create its precedence diagram because there are the predecessor tasks as well in such list content. Referred to this task list and precedence diagram, maximum capacity (K) could be calculated with company's operation time (OT), whereas the cycle time (CT) is taken from the longest task time[1], using following general equation:

$$K = OT / CT \quad (1)$$

Further, the CT which will be used for each work cell could be calculated by equation that is taken from (1) where K might be assumed considering te demand level conditionally:

$$CT = OT / K \quad (2)$$

Moreover, the minimum number of Work Cell then could be defined as one of necessary factors in the line balancing principle by below mentioned equation :

$$N = Total\ 't' / CT \quad (3)$$

where Total 't' is the sum of the whole tasks in the system. The efficiency of reached condition can be then calculated by:

$$Balance\ Efficiency = Total\ 't' / (CT.N) \quad (4)$$

where CT is the maximum cycle time of each work cells in the system[3] that calculated by previous equation (2). Commonly, the task assignment into work cells successively in heuristic method is using the combination by prioritizing few criteria; choose the task that does not have any predecessor or the predecessor is already assigned, the task with most followers, or which had the longest operation time 't'[2].

The first thing that have to be traced are the production data related with series of operations, operation time of each task and other necessary information, as stated in following Fig.1. The number of operation and machines will be named in simple identities as A, B, C and so forth, in order to make the task list won't be more complicated and the usual work cell assignment could be defined easier for the precedence diagram.

This assignment then should be checked with actual situation where certain machine is used for several tasks, for those such machine is operated. The new next possible assignments then could be defined where given work cells or machine that used for certain tasks are combined with stand alone tasks. This could be an alternative of choice that theoretically could be better or more efficient than the previous or actual situation.

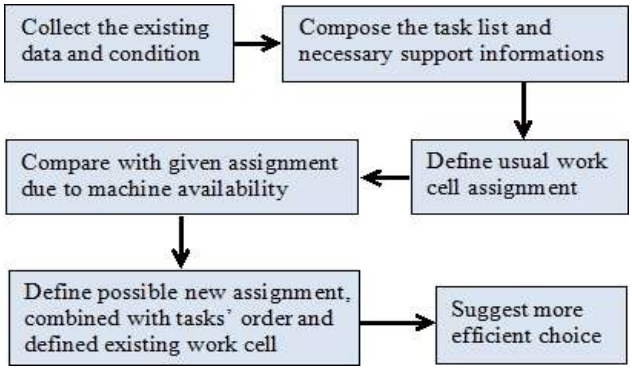

Fig. 1. The steps to create Work Cell Line Balancing.

III. Results and Discussions

Below mentioned "Table-1" shows the list of tasks that is used to produce a kind of Trouser discussed in the topic, where the unit of time (t) are in second. As stated, the tasks' operation time are obtained by a time motion study and statistical approach that won't be discussed, whereas its series of operations are defined from production floor investigation.

TABLE I TASK LIST OF TROUSERS PRODUCTION LINE

task	time	predecessor
A	20	-
B	33	A
C	25	B
D	30	C
E	110	D
F	40	E
G	17	F
H	20	-
I	30	H
J	42	I
K	30	J
L	20	-
M	102	L,K
N	12	-
O	51	N
P	102	O
Q	38	P,M
R	70	Q
S	72	R
T	32	S
U	85	T
V	54	U
W	54	V
X	30	-
Y	79	X
total 't'	1.198	

Though the number of production target is not clearly stated, the actual performance with normal working time of 7 hours per day is approximately 195 units per day in average, that may called as their contribution part of market share with other companies. The fluctuation or increase of demand just simply provided by overtime conditionally. Regarding the willingness for capacity up, maximum capacity (K) could be calculated by assuming operation time (OT) to 12 hours per day or 43'200 seconds per day and cycle time (CT) is taken from the longest task time[1], using equation (1). Since the longest task time is task 'E' (110 seconds) the possible maximum K is 43'200 / 110 = 393 units per day, and the realistic K possibly assumed to 300 units per day.

Using this assumed K, the CT which will be used for each work cell could be calculated by equation (2) thus the cycle time result is 43'200 / 300 = 144 seconds per unit. Using (3) the minimum N then 1'198 / 144 = 8.3 Work Cells, rounded up to 9. By prioritizing the criteria of choosing the task that does not have any predecessor or the predecessor is already assigned, the task with most followers, or which had the longest operation time 't'[2], the assignment could be initiated successively. "Table-2" explains the theoretical assignment process of task A till Y that is using 9 Work Cells and had the 1'198 / (144 x 9) = 92.4% balance efficiency.

But actually there are three machines that operate several tasks and these could be called as 'given Work Cells'. They are: Work Cell-1 that had task A, C, G, H and L; Work cell-2 for Q and S; and Work Cell-3 which operates N, O and R. The other task such as B, D, E etc are executed by each single machine and man.

TABLE II THE COMMON ASSIGNMENT PROCESS

work cell	T (task)	t (time)	remain t	feasible T	most followers	longest t
1	A	20	124	B	-	-
	B	33	91	C	-	-
	C	25	66	D	-	-
	D	30	36	G, H, I	G, H	I
	I	30	6	-	-	-
2	E	110	34	G, H	H	H
	H	20	14	-	-	-
3	F	40	104	G, J	G	J
	G	17	87	J, K	J	J
	J	42	45	K, N, L	N	K
	K	30	15	N	-	-
	N	12	3	-	-	-
4	L	20	124	M, O	O	M
	M	102	22	-	-	-
5	O	51	93	Q, R	R	R
	Q	38	55	T, V	T	V
	T	32	23	-	-	-
6	P	102	42	X	-	-
	X	30	12	-	-	-
7	R	70	74	S	-	-
	S	72	2	-	-	-
8	U	85	59	V	-	-
	V	54	5	-	-	-
9	W	54	90	Y	-	-
	Y	79	11	-	-	-

Therefore, in fact the company worked with 18 work cells in total, means the assignment on "Table-2' is not valid any longer. Following "Fig.2" shows the actual assignments in non scaled and not real machine layout or position, in order to explain the work flow clearly. As CT is the cycle time of the system[3] that calculated by equation (1), in this condition the result of its efficiency is 1'198 / (144 x 18) = 46.2%. In such condition, it is easy to imagine that there are unnecessary waiting time on several point of operations. It shows easily the duration differences of tasks in succession.

At task M for instance, the product output from K should wait 72 seconds for each cycle before it could be processed, or machine F has to wait up to 70 seconds each cycle until machine E is finished. It is found by investigation that the operators of several machines even decided to do other activity while waiting until the products from previous process became a pile and they would execute the process with no interrupted for certain quantity of products.

Therefore, a conditional work cell line balancing should be initiated. A new possible assignment then could be defined where given work cells or machine that used for certain tasks are combined with stand alone tasks. The assignment process seems not possible to use the heuristic method but the trial-error way. The reason is that in heuristic way the given Work Cell (W/C) that are W/C-1, W/C-2 and W/C-3 have to be stated as a task for each W/C, whereas actually they had several real tasks per W/C that caused by multiple in and out work flow between such W/C and its predecessors or operations after.

Thus the assignment process have to be done by considering the nearest or successive task with such W/C. Task I, J and K for instance; they might be done by one W/C referred to above mentioned three criteria where, in this case, W/C-1 as the predecessor of task I is judged as one task. This might be not a usual way comparing with common work cell line balancing, that only assign the single tasks.

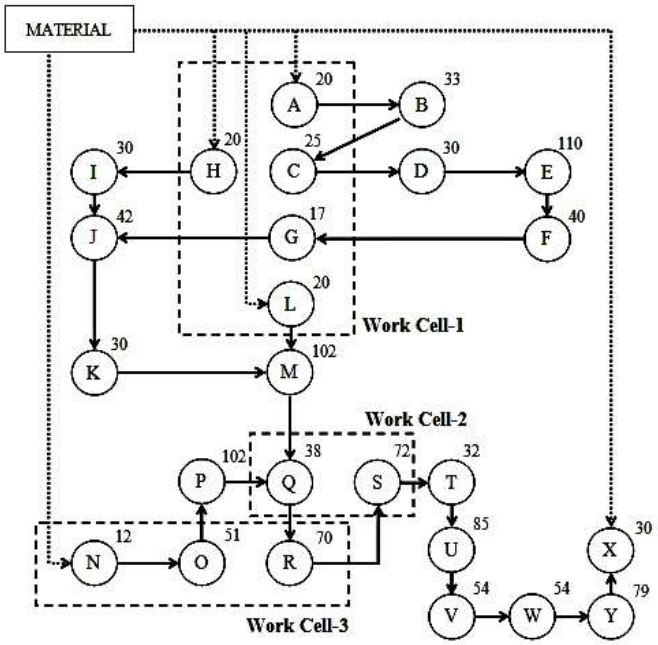

Fig. 2. The Original Trousers Precedence Diagram

The whole assignments in the system is explained in "Fig.3", as stated, by combining the heuristic method and trial-error way. With such new assignment, using equation (4) where total 't' is 1'198 seconds and CT is 144 seconds per unit with execution by 11 W/S, the efficiency then will be 1'198 / (144 x 11) = 75.6%. Compared to 46.2% previously, such increasing is contributed especially from the number of W/S and man. Though do not use standard way nor usual method, this conditional work cell balancing could reduce man cost and waiting time, thus line balancing idea is still the relevant way to improve such case. In this new assignment of production line, every remain worker will do the tasks without any unnecessary waiting time or much less. The company may or should consider or decide to minimize the number of worker from this kind of product by assigning them for other job, project, task etc.

Since such assignments are made theoretically without considering the machines position in the actual situation, the next stage of improvement could be machine re-layout due to time or distance of material or product transportation in the shop. "Fig.4" shows the existing or real workplace layout where the different kind of machines are identified with different color; those are machine-1 (task A, C, G, H, L), machine-2 (Q, S), machine-3 (N, O, R), machine-4 (V), machine-5 (F, K), machine-6 (Y), machine-7 (B, D, T, M, I, J, E, P, U, or W) and machine-8 (X).

Since the store of material is on the 'garage' area, it could be imagined that the material flow with such layout is similar with 'jumble flow' in the 'job shop', though the tasks for machine-7 (B, D, T etc) for instance, that in the previous original layout are located separately, might be re-assigned or changed each other to get the shortest distance of transportation in the shop. Therefore, machine re-layout is recommended which this could be not that easy, with number of consequences, since there are few walls should be replaced or moved in order to get an ideal condition.

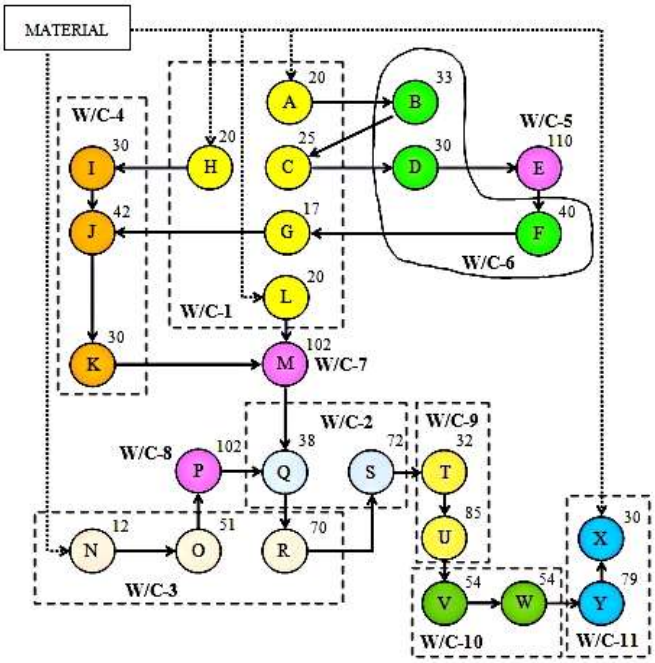

Fig. 3. The New Trousers Precedence Diagram

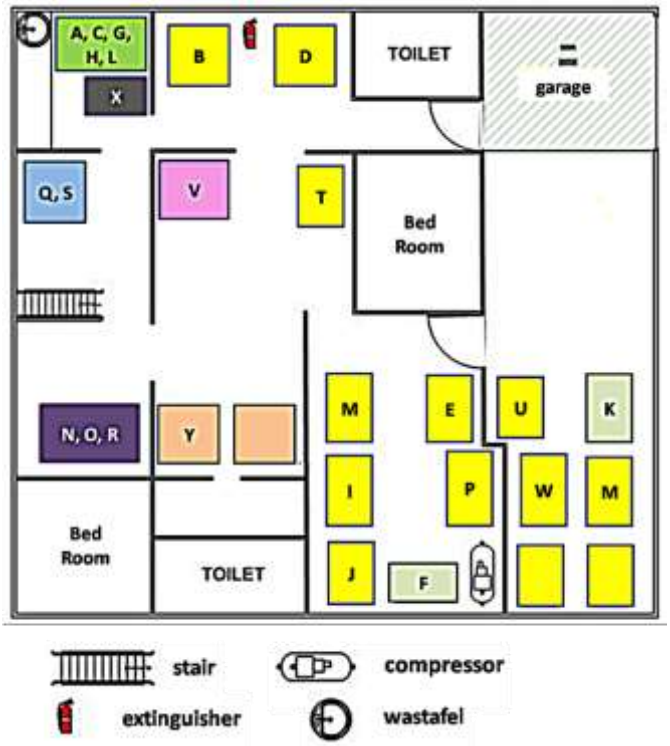

Fig. 4. The Existing Workplace Layout

In addition, it is shown as well that there are another unused machine-6 near the operation Y and other two units of unused machine-7 on the W operation area, that can be planned for other product or production line further. This should be checked with the general business plan appropriateness of the company, related with middle and long term of enterprise planning. As noted that some workers are reduced after improvement, they could be developed according the bigger company planning to handle new production line gradually.

IV. Conclusions

In a clothing small scale industry in the West of Bandung, Indonesia, a kind of trousers is produced where operation order of 25 tasks is needed. As the productivity is not as expected, through a tracing of production data the series of operations and the processing time of each operation are determined, in order to analyze related things for improvement. Since certain tasks in such production floor are using the same machines that could be declared as defined work cells, whereas many other tasks operate by each specific machine, there are unnecessary waiting time on several point of operations. The company is suggested to combine previous defined work cells with new others by common work cell line balancing.

Though do not use standard way nor usual method, this conditional work cell balancing could increase the efficiency from 46.2% up to 75.6% as the man cost and waiting time are reduced. The company may consider to minimize the number of worker from this kind of product by assigning them for other job, project, task etc. It shows that line balancing idea is still the relevant way to improve such case. It is no doubt that other recommendation related with machine layout should be initiated on the next stage due to improve the material flow, avoiding 'jumble flow' like in the 'job shop' in order to get the shortest distance of transportation in the shop. Nevertheless; this could be possibly not that easy since there are consequences such as few walls in the actual condition that should be replaced or moved in order to get an ideal layout. This recommendation then should be in line with the general business plan appropriateness related with certain term of enterprise planning.

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Chapter 21

Simulation of Type PWR (Pressurised Water Reactor) Reactor Water Temperature using Optimal Discrete Control and D-Pole Assignment Method

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Abstract In design of optimal control system,one of most important problems that designers dealing with is selection of Q and r weight matrix.That is how to select such the matrix so not only optimal qualification is fulfilled,but also qualification of dynamic characteristic which is consistent with specification. In solving the problem, K.Furuta and S.B.Kim from Tokyo Institute of Tecgnology,by 1987,have succeded to develop a method of selecting the weight matrix called as "D-Pole Assignment" method.It is in principle designed to put the poles of closed circle system into a circle-shaped zone with certain center and radius,which as then called as the "D-Zone". In order to facilitate the design process, "D-Pole Assignment" method was applied in this research for design of discrete optimal control at z-plane. This research also examines computation procedur of respond matrix to Riccati P.equation,F^1 feedback vector,and Q weight matrix through the form of canonical fasevariable.Because the computation procedures of P,Q, and F^1 by "D-Pole Assignment" will difficult to be done as a result of A and b matrix which are in common form. Then the produced design procedure is applied into dynamic simulation of PLTN type PWR (Pressurised Water Reactor).The simulation performed to the control system of boiling water temperature within secondary circle of reactor,since the main effect of reactivity in reactor is caused by the temperature change.Furthermore simulation is conducted by means of investigating effect of citating period selecting on location of poles in the closed circle,and effect of change in "D-Zone" center on dynamic respond and the use control energy in closed circle system. Generally,from the simulation can be concluded that stability system became stronger when location of "D-Zone" center more and more close to unit circle center in z-plane.In order to include all poles the of the closed circle system into "D-Zone" then limits of center (α) and radius (r_2) of the the "D-Zone" would be $0{,}025 < \alpha < 0{,}40$ and $r_2 = 0{,}40$ respectively.

Keywords: Feedback,Weight Matrix,PWR,Phase Variable,Riccati Equation.

I. Introductions

In general, an optimal control theory is defined as a control theory that its solution seeking is based on efforts to optimize quadratic measuring rod (performance) function, and a resultant control system will be fulfilling optimal requirements as optimal input is given.

The problem is a system under design, in general, can't to meet directly desirable specification in terms of dynamic characteristics (transient conception) of a system, since dynamic characteristics of a system is heavily depending on selected quality matrices value. K. Furuta and S.B. Kim of Tokyo Institute of Technology were successful developing a method of selecting weight matrix Q and r they called "D-Pole Assignment." The method is designed to put closed circular system poles in a circular region having both central point and specified radius.

The method has excellences as compared with other methods, for example, Nyquist and Root-Locus and trial and error in determining weight matrix and, thus, can be applied to either continue system or discrete system. In addition, the process may be made simpler, easier, and faster as compared with other methods in high-order systems. In this method, we are able to get directly weight matrix Q and r and feedback F^1 that guarantee the compliance of optimal criteria and desirable specification of a system.

II. Objective

The aim of this study is to prepare optimal feedback F^1 accounting procedure and weight matrix Q and r in discrete time area. Furthermore, the planning procedural output is tried out in the simulation of PLTN Type PWR dynamics, particularly the systematization of boiled water temperature in a secondary reactor circle.

III. Problem Solving Method

Because of difficulties in weight matrix Q and optimal feedback F^1 vector counting processes by "D-Pole Assignment" as matrices A and b have even common shapes, the following steps to solve the problems are taken:

a. Numerous input systems are transformed into single input system of common type.
b. Single input system of common type is transformed into single input system of variable phase canonic type.
c. For the accounting output in step (b), optimal feedback $F_1^{\sim}$ vector accounting procedure, Riccati equation matrix $P_1^{\sim}$, and weight matrix $Q^{\sim}$ are reduced to quadratic display measuring rod.
d. Accounting output in step (c) is transformed again into single input system of common type.
e. Accounting output in step (d) is transformed again into input system of multiple common types.

IV. Basic Theory

a. D-Pole Assignment Method

"D-Pole Assignment" method in discrete system is, essentially, designed to put whole closed circular system pole in a specified circular region having central point and radius on α area, placed in a circular region with single radius on z area as shown in Fig. 1, location of D region on z area, as follows.

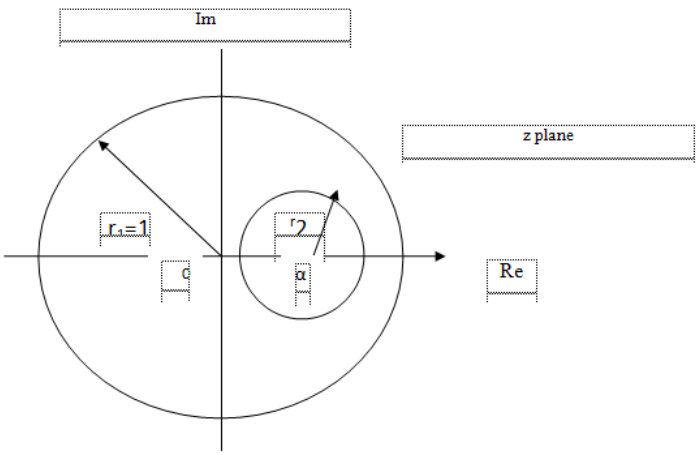

Fig. 1:Location of D-Region z plane

For the quality matrices fulfilling optimal requirements and "D-Pole Assignment", the reductions of equation are as follows.

$$Q=P_1+r_2^2\ Q_1-\alpha\ P_1\ A-\alpha\ A^T\ P_1+(\alpha^2-r^2)\ P_1 \quad (1)$$

$$r=r_2^2\ r_1 \quad (2)$$

b. Nuclear Power Electric Plant of PWR Type

Fig. 2, primary and secondary circle of PLTN type PWR all represent PWR reactor system. Reactor here is source of heat energy. The heat is extracted by passing through coolant to the reactor. The heat energy, subsequently, is transferred to turbine through "steam generator".

For PWR generator, the equations to be reduced are kinetics, transfer of heat from fuel to water, equilibrium of heat for the cooling water in then kernel of reactor, transportation deceleration, and temperature escaping from the steam generator,

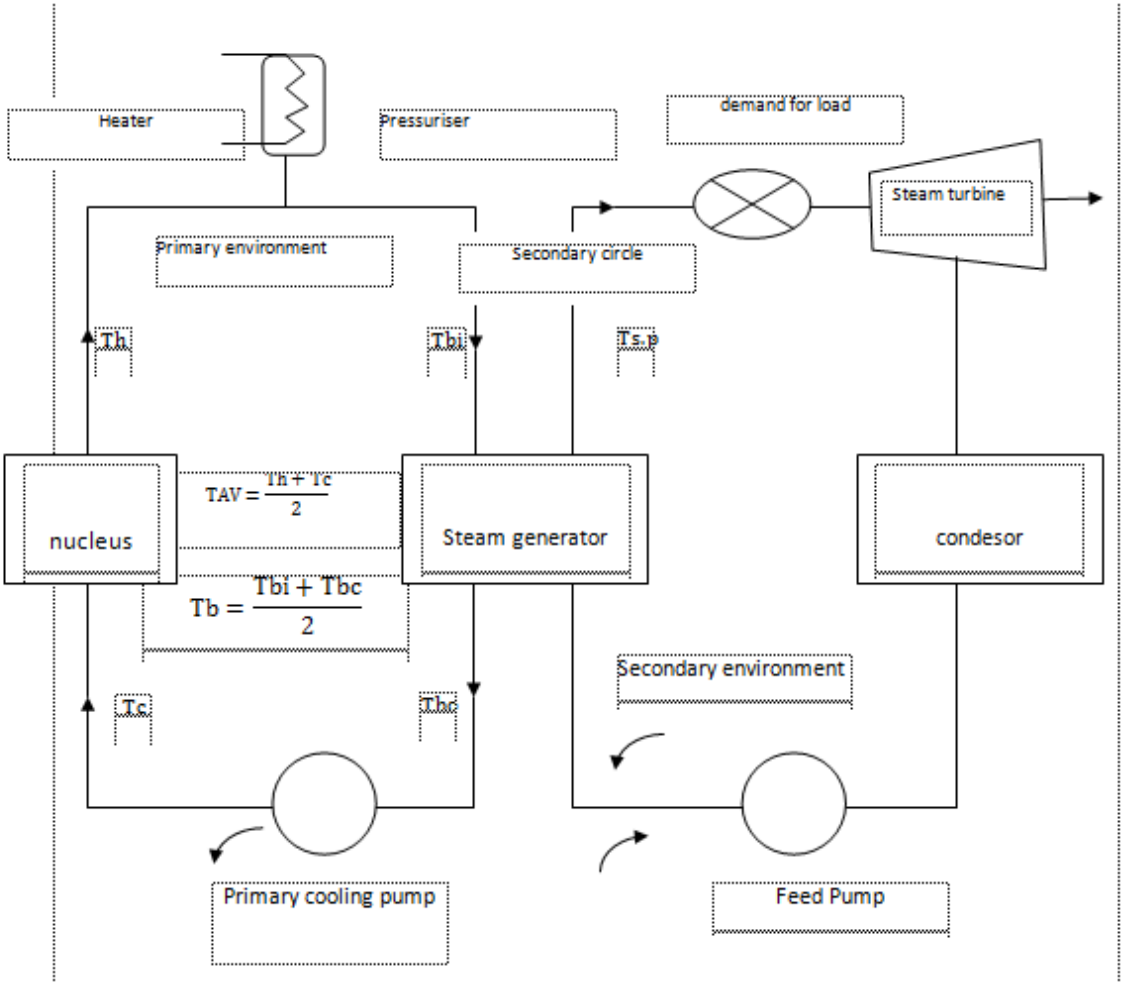

Fig. 2:Primary and Secondary Circle of PLTN Type PWR

V. Results and Discussion

a. Fig. 3 is simulation of boiled water temperature deviation in secondary circle of reactor over the selection of "D Region" (variation of α) on unit ladder input.

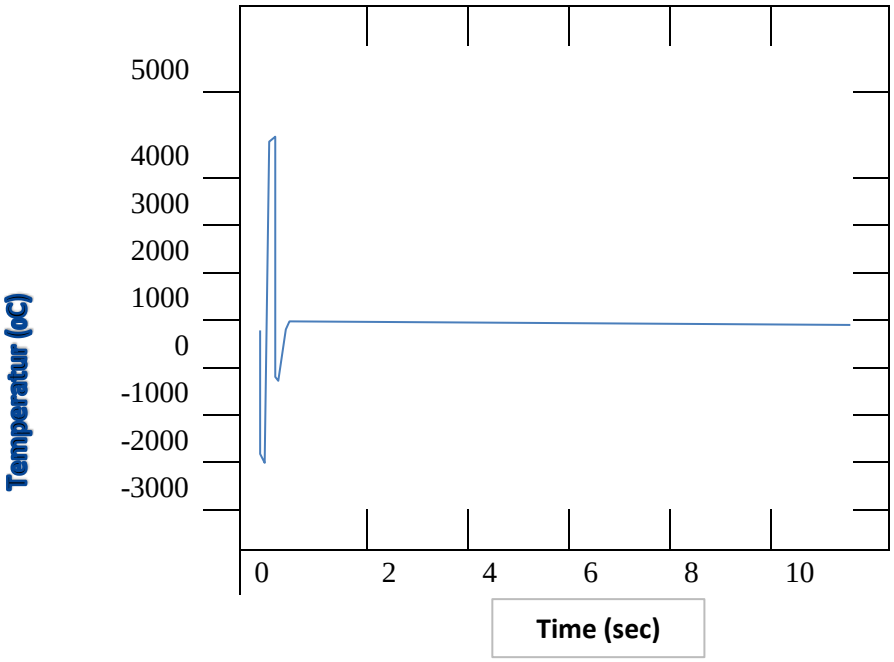

Fig. 3: Simulation of Boiled Water Temperature

The results of the simulation shown that: 1) the more near the central point of "D Regional" (α) to the center of unit circle, better the stability of system will be, 2) maximum overshoot is bigger when α is smaller, 3) when α is smaller, the controlling signal will be bigger.

b. Fig. 4 is simulation of boiled water temperature deviation in secondary circle of reactor over the variation of time sampling value.

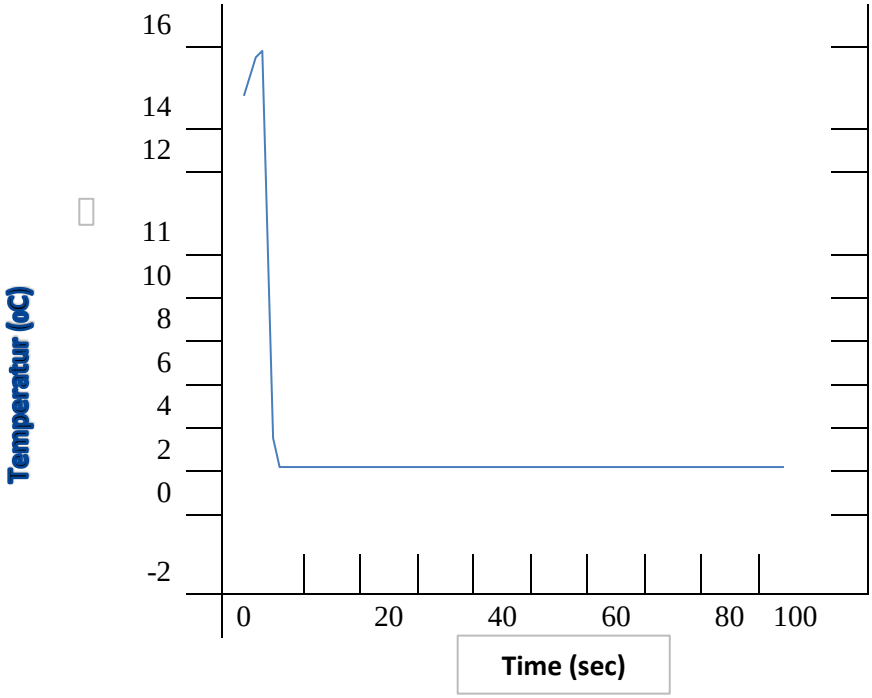

Fig. 4: Simulation of Boiled Water Temperature

The results of the simulation shown that T_s is enlarged by constant α and r_2, it is seemed the reaction of system is lower (the stability of system is longer).

VI. Conclusions

Based on the results of the simulation, the conclusions might be drawn as follows:

1. Weight matrix Q and r and feedback F^1 vector might be found by "D-Pole Assignment" method.
2. When α is smaller: the system is more quickly stable, maximum overshoot is bigger, and controlling signal is larger.
3. When T_s is larger, the system is slower to reach the stable point.
4. The selection of best "D Region" is $0.025 \leq \alpha \leq 0.40$ and $r_2 = 0.40$; it is due to the desirable specification of system is met in the region.

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Chapter 22

A Game of Arranging Scrambled Letters into Meaningful Words for Young Children using FSA Method

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Abstract. The most gaming enthusiasts are children, because children have a natural tendency to play. Game-based learning helps children to exercising concentration. This study applies Finite State Automata (FSA) method to recognize letters a player selects according to vowel and consonant. The results was a game of recognizing A-Z letter, sorting scrambled letters and arranging scrambled letters into meaningful words. Implementation of the grouping meaningful words are still limited in the use of array data structure and, hence, game development will be required using meaningful word database.

Keywords: Game, Learning Method, Young Children, Array, FSA

I. Introduction

Early Childhood Education (ECD) is an education for children before entering formal education. ECD according to the Republic of Indonesia Act No. 21/ 2003 on National Education System (NES) stated that early childhood development is an effort aimed at children aged 0-6 year old, which is accomplished through the provision of educational stimulation to assist their physical and psychological growth and development to prepare them entering the next educational level. A game-based learning method, i.e., a method of learning whilst playing, is applied in early childhood education. It is intended that the children are learning whilst having fun and playing. When learning doesn't exciting, it can be concluded that the learning process is boring and failed to make the children to have fun. There are many ways to encourage children learning whilst having fun, among other, use of a computer game. Children, especially young children, prefer game as a learning tool. A Game-based learning method provides opportunities for children to explore, discover, express feelings, creativity, and learn new things, whilst having fun. [1] In the learning process, children learn to recognize A-Z letters, a sequence of letters, sorting A-Z letters from scrambled letters and arranging scrambled letters into meaningful words. Game-for-Learning method - especially an exciting game providing challenges and prizes encouraging children to play - will generate a habit of learning whilst playing in children. Game-based learning method is effective methods for children learning, because children more focus on gaming than on conventional learning presentation. Term "conventional" here means that a teacher presents a lesson to the children, while the children pay attention and obey their teacher. This conventional learning will immediately lead to boring for children in learning. When a game presenting a positive values, then the children should have able to accept them more easily than with a conventional learning model [1].

II. Purpose

The purpose of this study is to assist the early childhood teacher in teaching letters and meaningful words from scrambled letters. This study pursues the following objectives:

1. To improve concentration of children in learning.
2. To increase power of their reasoning / analysis.
3. To optimize their right brain function
4. To increase ability of the children to recognize letters and create words more quickly.
5. To improve their ability to quickly mention the name of the goods or object they look at.

III. Method

The study was conducted at Islamic kindergarten AN-NUR in Citangkil village, Citangkil subdistrict, Cilegon city, Banten. Interviews and observation were applied to obtain on-site data. Pre- and post-gaming data sources was obtained from the questioner submitted to the teachers characterizing their students in the process of learning to recognize and arrange letters in the class. The analysis included a learning model in the kindergarten, an analysis of game users, analytical techniques such as pretest (the children's ability before using the game) and post-test (the children's ability after using the game), Array Algorithms and FSA (Finite State Automata). Designing of the game made use of the gaming system and a storyboard. The results obtained were a game for young children to help provide knowledge on how to recognize and arrange scrambled letters into meaningful words, such as balls, cock, eye, and so on.

IV. Result and Discussion

Game-based learning method will generate a habit of playing whilst learning in children, especially when the game is fun and there are challenges with prizes that make children more motivated and eager to play. Game-based learning is one of the effective methods of children learning, because children more focus on gaming than on conventional learning. Conventional means that the teacher teaches to the children, while the children pay attention to and obey their teacher instruction. This method results in boredom of learning in the children. The observation indicated that the children inthe classroom are generally difficult to concentrate because of their peers' behavior of disturbing and making noise. In contrast, the children fully focus on gaming to lose track of time. It can be drawn a conclusion that games really teach certain things because children get the full concentration on it.

1.Analysis of Game

User was human beings playing this game for the period of time of this study. The users of this game were kindergarten students with age of 4-6 years old. High attention was paid on user interface and features implemented in the game, so that this game provided a satisfaction, pleasure, and knowledge for the users.

2.Analysis Technique of Software Development

Analysis techniques are applied to provide work flow of the system for developing letter recognition game. They include:

a. Array algorithm

Array algorithm is used to store data in the form of words stored in the internal memory of a computer so that the system does not need to use database, because the data of words that will be used in this game are small. They are A-Z alphabet and meaningful words described in the storyboard, i.e., diagram of arranging letters.

Font Recognition Algorithm

Declaration

Abjad:array[1..26] of

string = (‘Aa’, ‘Bb’, ‘Cc’, ‘Dd’, ‘Ee’, ‘Ff’, ‘Gg’, ‘Hh’, ‘Ii’, ‘Jj’, ‘Kk’, ‘Ll’, ‘Mm’, ‘Nn’, ‘Oo’, ‘Pp’, ‘Qq’, ‘Rr’, ‘Ss’, ‘Tt’, ‘Uu’, ‘Vv’, ‘Ww’, ‘Xx’, ‘Yy’, ‘Zz’)

Word:array[1..17] of

string = (‘BOLA’, ‘AYAM’, ‘RODA’, ‘MATA’, ‘IKAN’,’MOBIL’,’ZEBRA’,’RUMAH’, ‘GELAS’,’BALON’,’DURIAN’,’SEPATU’, ‘KERETAVICELINCI’,’MUTIARA’,’ ‘MATAHARI’,’RAMBUTAN’)

Description

{proses}

Enddescription

b. Finite State Automata (FSA)

Finite State Diagram (FSD) describes Finite State Automata. FSD is a type of diagram used in computer science and related fields to describe the behavior of the system. Diagram refers to a two-dimensional geometric symbolic representation of information according to some visualization technique.

FSA is used to recognize token of the scrambled letters and a player arranges the letters into a meaningful word. Given the input string is finite (A-Z), the FSA broke into two parts, namely the Deterministic Finite Automata (DFA) and nondeterministic Finite Automata (NFA). Analysis approach applies DFA. The nature of the DFA is that two outputs are resulted from one state. For ease of analysis, the researchers use the string input of IDV (identifier Vocals) and IDK (identifier consonants), IDV and idK have a different state, starting from the initial state (q0), state (ql) and state (q2). Each state has a transition based on the input string, ie the transition (q0, ...), transition (ql, ...) and the transition (q2, ...). The symbols are to indicate the input string.

Finite State Automata is to recognize scrambled letter token:

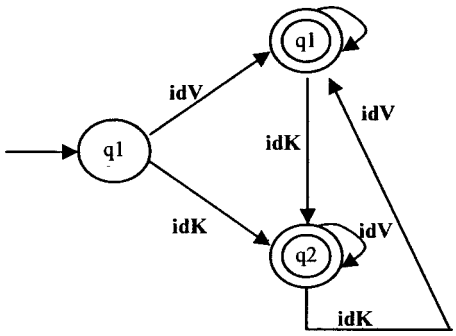

Fig. 1:Analysis of scrambled letters using the FSA

By analyzing results of the image above, for example, input string "BOLA", then the transition is:

Transition (q0,B)= q2

Transition (q2,O)= q2

Transition (q2,L)= q1

Transition (q1,A)= q1

Because the final string indicates final state (double circle), the inputed string BOLA is accepted. Then the string is examined whether there is a word BOLA in word array. If exist, the result is true, while if not exist, the result is false, indicating it is not the word in question.

V. Research Design

Characteristics and elements contained in the game [9] should guide in designing the system of the game. They include:

a) Format: The game consists of five level with different difficulties, from the lowest level of introducing letters A-Z to the highest level of arranging words from scrambled letters.

b) Rules: A player must go through the stages of instructions to complete the task in accordance with any questions.If the goal is completed, the game will continue to the next level.

c) Policy: when a player makes a mistake in arranging the letter, he or she obtains an opportunity to rescramble and rearrange with consequence of different prizes.

d) Scenario: Firstly a player is introduced to letters. It is in accordance with the teaching method of reading for children [8], in which they should pass the early stage. After that, they are asked to find objects that are prefixed by the letter requested by matching them. Still in the same stage, a player is asked to arrange scrambled letters into meaningful word. In this level, he or she is trained to understand letters, instead of memorization. The difficulty level of arranging scrambled letters into meaningful words should be in accordance with questions. A player receives a set of 4 to 8 scrambled letters and should arrange them into meaningful words.

e) Event/ Challenge: prize of the challenges is gold and silver. Timer is used to provide a challenge to players in order to compete for the star. The next challenge is scrambled letters provided for player to arrange a meaningful word related to object in question.

f) f Roles: A player plays a role as a child holding a scrambled letter to arrange them into meaningful word in accordance with the question.

g) Decisions: A player makes decisions in determining which letters he or she should selects or which strategies he or she adopts so as to finish the game more quickly.

h) Levels: The game consist of multiple levels of difficulty, each of which consists of questions to be answered to achieve the next level. The difficulty level is adjusted by the method of reading to children with learning how to spell [8]

i) Score models: the player receive a prize of gold or silver star once he or she complete the task within predetermined time setting. This can be seen at certain levels that require a challenge.

j) Indicators: The indicator panel contains the letters that have been collected as a reference and how many more letters that should be taken. It is useful to motivate children to find the entire letter to arrange.

k) Symbols: Arrow symbols indicate the direction to reach the next level. There are also buttons on the menu that is used to get to the level of the game.

Storyboard design

In describing the design of this storyboard, the authors present the use of UML, which is a technique for documentation of programming system, in this, game programming case.

The design of this storyboard contains a discussion of the storyline of this game that will be delivered using text and images. In this game, the story is broken into three parts, namely:

Menu Section

It is an opening page that contains menu. A player selects his or her preference to achieve a certain level of material. This section will appear choices that will lead to a level corresponding to the chosen difficulty level.

Rule Section

This section will display a box of attainment targets which must be done by the players to continue the game. Parts of this rule are on every menu that will lead to the game chart.

Level Section

This section is the liaison between the menu and the sub-levels. This section displays instructions on what to do to solve the run. This level consists of letter recognition, arranging scrambled letters, and stringing letters.

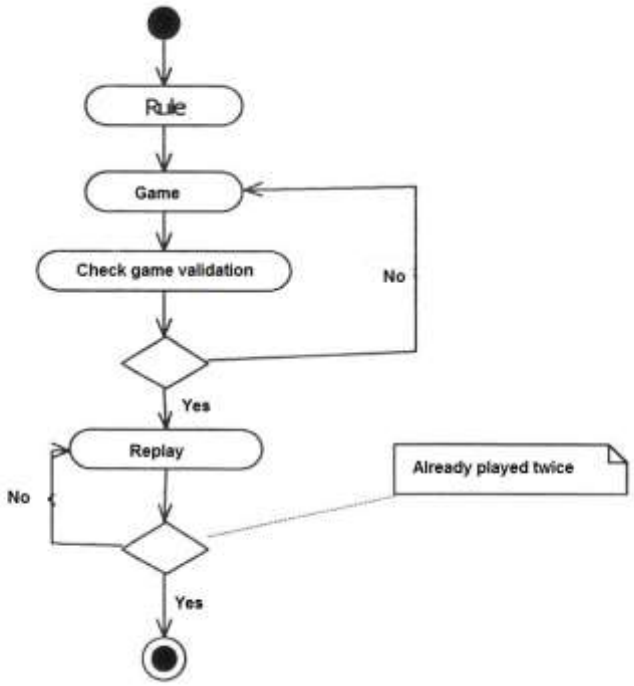

Fig. 2:Activity Diagram of sorting scrambled letters

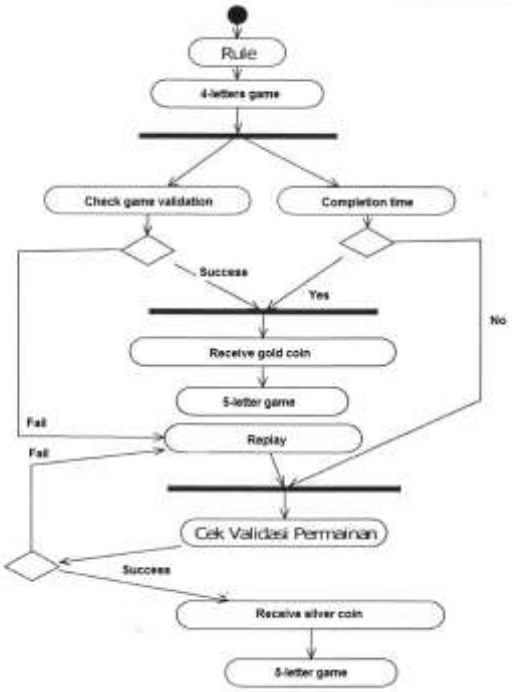

Fig. 3:Activity Diagram of arranging 4,5,6,7 and 8 letters

VI. Conclusions

From the results of this research were carried out starting from the beginning to test the application for letter recognition game for young children to this, it was concluded that:

a.Finite State Automata (FSA) is an automata machine from regular languages.Finite State Automata have a finite number of state, and can be moved from one state to another.Changes in the state expressed by the FSA transition function. Control mechanisms compiled word search string is split in two by way of following the path of vowels and consonants, it is valid to control the game compiled alphabetic string into a word (level 3). As for the AZ alphabet string control using a FSD method (Finite State Diagram) by reason of the search is only performed on one path through letter token is found.

b.The learning process will achieve optimal results when supported by the approaches and methods appropriate, interesting and interactive. Based on the observations in this study, learning of letters recognition using conventional methods is unpleasant for young children students and most students are difficult to focus on learning. Instead, with the the game-based learning method, learning of letter recognition is pleasure for them and they can focus on the subject. Besides, they may learn at home under the guidance of their parents.

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Chapter 23

Design Method of Position and Attitude Controller Using for Quad-rotor System

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Abstract. Design method such as PID control and optimization of the control period is proposed in a reliable and simple quad-rotor system quad-rotor system. From the verification test, proposed method is applicable to quad-rotor system.

Keywords: Controller, filter, PID, quad-rotor, sensor.

I. Introduction

UAD-ROTOR is a multi-rotor helicopter that is a vertical take-off and landing and propelled by four rotors, and quad-rotor has better high mobility than other unmanned aerial vehicle (UAV). Basically, quad-rotor used various sensors for measuring of the position and the height. Also, these quad-rotor is required to complicated control theory to overcome the irregular environment and variety of disturbances, such as wind or air flow.

In this paper, design method such as PID control and optimization of the control period is proposed in a reliable and simple quad-rotor system. From the verification test, proposed method is applicable to quad-rotor system.

II. Configuration Of Quad-Rotor System

2.1. Hardware

The quad-rotor system is consisted of two ATMEGA processors as the controller, RF transmitter-receiver having the long transmission distance, and the sensor for position control of the quad-rotor system as shown in Fig. 1.

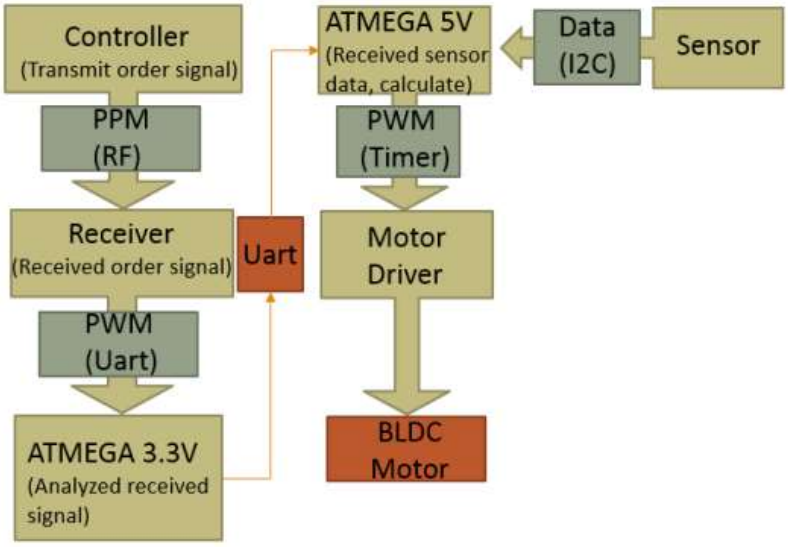

Fig. 1. Control block diagram of quad-rotor system

Fig. 2. Control part configuration having multi-layered circuit

The two ATMEGA processors in the control unit are used to reduction of the amount of calculation of each MCU. The MCU is required a lot of operations such as sensing, filtering, PID calculating, and RF communicating. Therefore, the MCU of quad-rotor system is separated as the main and sub MCU. As a result, control period is shortened and reliability is increased. For balance control, many elements of quad-rotor system need to be harmoniously arranged in a limited space. So control part configuration having multi-layered circuit is used as shown in Fig. 2 [1].

2.2. Software

The data of the gyro sensor is accurate during a short period of time, but as increasing of time data becomes inaccurate by accumulation of errors. On the other hand acceleration sensor does not accumulate error data. By using this complementary aspect, roll and pitch position of quad-rotor system are measured and used on filtering as shown in Fig. 3 [2].

By using this method, the burden on the software is reduced and control cycle is fasted [3].

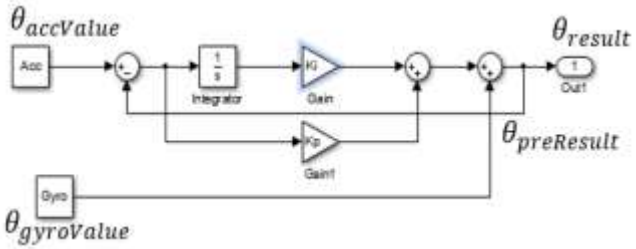

Fig. 3. Control block diagram of complementary filter

When transferring data from sensor to MCU, the MCU analyzes the data and calculates a tilt angle. Thereafter the MCU sends a signal to each motor driver to adjust the thrust of the motor, and repeats the process from the PID control routines as shown in Fig. 4 [4].

III. State Equations

Since quad-rotor system has 6 degree of freedom (DOF) as shown in Fig. 2, six state variables are required to express the state equations. Using the Euler transform matrix, calculation of a linear velocity coordinate transform matrix and angular speed coordinate transform matrix is as in following:

$$R_I^B = R_x(\phi)R_y(\theta)R_z(\psi)$$

$$= \begin{bmatrix} cos\theta cos\psi & cos\theta sin\phi & -sin\theta \\ (sin\psi sin\theta cos\psi - cos\phi sin\psi) & (cos\phi cos\psi + sin\phi sin\theta sin\psi) & sin\phi cos\theta \\ (cos\phi sin\theta cos\psi + sin\phi sin\psi) & (sin\theta cos\phi sin\psi - sin\phi cos\psi) & cos\theta cos\phi \end{bmatrix}.$$

$$\begin{bmatrix} p \\ q \\ r \end{bmatrix} = \begin{bmatrix} 1 & 0 & -sin\theta \\ 0 & cos\phi & sin\phi cos\theta \\ 0 & -sin\phi & cos\phi sin\theta \end{bmatrix} \begin{bmatrix} \dot{\phi} \\ \dot{\theta} \\ \dot{\psi} \end{bmatrix} \quad (1)$$

Use Newton's second law and transport theory to solve as in following:

$$\dot{u} = (Vr - Wq) - g \cdot sin\theta + \frac{F_x}{m}$$
$$\dot{v} = (pW - rU) + g \cdot sin\phi cos\theta + \frac{F_y}{m}$$
$$\dot{w} = (qU - pV) + g \cdot cos\theta cos\phi + \frac{F_z}{m} \quad (2)$$

These six state variables from Eq. (2) and Eq. (3) are used in modeling and design of controller of quad-rotor system [5].

$$\dot{p} = \frac{(-I_{zz} + I_{yy})qr}{I_{xx}} + \frac{L}{I_{xx}}$$
$$\dot{q} = \frac{(-I_{xx} + I_{zz})pr}{I_{yy}} + \frac{M}{I_{yy}}$$
$$\dot{r} = \frac{(-I_{yy} + I_{xx})pq}{I_{zz}} + \frac{N}{I_{zz}} \quad (3)$$

These six state variables from Eq. (2) and Eq. (3) are used in modeling and design of controller of quad-rotor system [5].

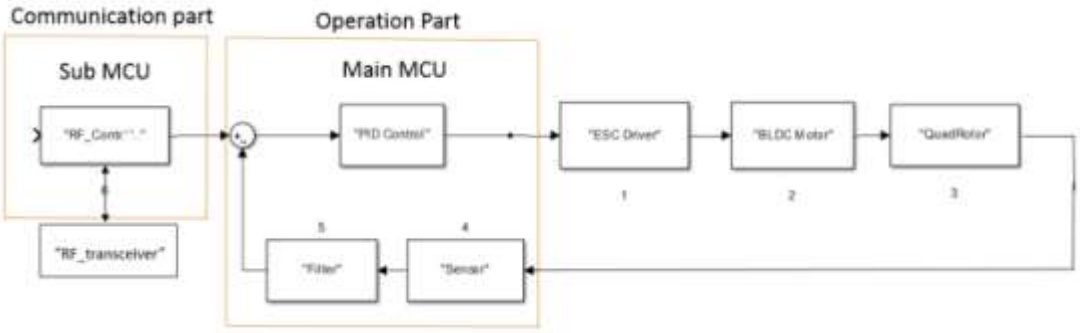

Fig. 4. Control algorithm of quad-rotor system

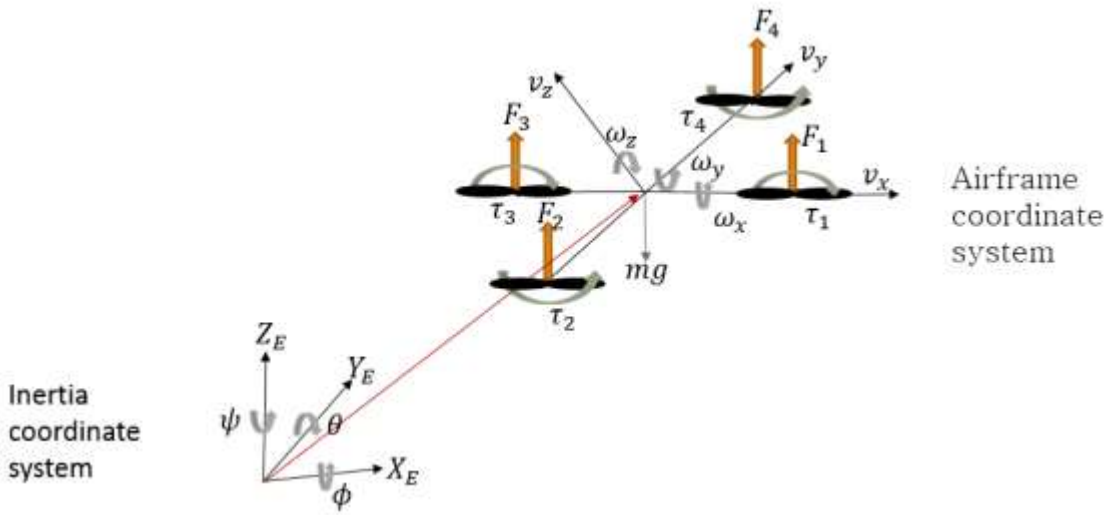

Fig. 5. Coordinate system for quad-rotor modeling.

Fig. 6. Developed quad-rotor system

IV. Conclusions

In this paper, design method such as PID control and optimization of the control period is proposed in a reliable and simple quad-rotor system. The mathematical modeling, complementary filter, PID control routines, and Matlab & Simulink for more precise attitude control of the quad-rotor system are used. The proposed attitude control method is applied to the developed quad-rotor system as shown in Fig. 6. From the verification test, proposed method is applicable to quad-rotor system.

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Chapter 24

Design of Boiler Controller with LAN Based Data Logger

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Abstract. Steam generation systems are a crucial part of most any industrial systems. Therefore, boiler control is an important problem. It is required to keep the boiler operating well for large changes in the operating conditions. The focus of this research is to design a system for monitoring, controlling and data storage operation of an industrial boiler, especially at the critical parameters that could potentially cause an accident. Based on several results it can be said that the boiler works in accordance with the stages of its operations. The system is able to monitor and control from a remote computer via a LAN as a medium of communication. Data of operational activity stored in the data base of the computer or external memory data logger with web CSV format.

***Keywords*:** Burner System, Boiler Controller, Data Logger.

I. Introduction

Acquiring multiple data, the data may be analog or discrete in nature from the field or process at high speed using multi-channel data acquisition system, processing the data with the help of a data processing algorithm and a computing device and displaying the data for the user is the elementary need of any industrial system [1]. After acquiring data from the field, the signal conditioning and processing operations are performed. After the signal conditioning operation, signal is given to a signal processing algorithm which processes the signal and stores the data in a memory unit.

Steam generation systems are a crucial part of most any industrial systems. Therefore, boiler control is an important problem that are frequently changing load or subject to sudden load disturbances, which are common in industrial process. In such circumstances it is required to keep the boiler operating well for large changes in the operating conditions. One way to achieve this is to incorporate more process knowledge into the control system that able to be monitored, controlled and analyzed the process in every particularly time [2]-[3].

Therefore, various researches have been done to improve boiler control system by introducing data acquisition and logger system [3]-[4]. With the advantage of technology personal computers are used for data acquisition, test and measurement and automation, such as PLCs and SCADA [5]-[9]. Many of the networking technologies have also been progressively integrated by newly introduced connectivity solutions (Ethernet or Wireless LAN) [10]-[12]. Obviously, as an example, today it is possible to use a common personal computer in order to implement even complex remote supervisory tasks of simple as well as highly sophisticated industrial plants [12].

This paper attend to design a system for monitoring, controlling and data storage operation of an industrial boiler, especially at the critical parameters that could potentially cause an accident takes a case study of a boiler.

The research will use a boiler that produce 20 tons/hour of steam and working with 24.5 bars. The boiler used two-burner unit with either fueled by gas or diesel. There are several parameter of boiler operations that be incorporated into design of data logger.

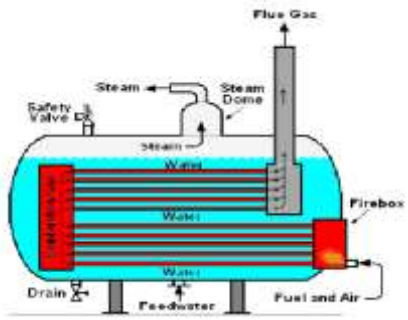
II. Boiler System and Data Logger

A. Boiler System

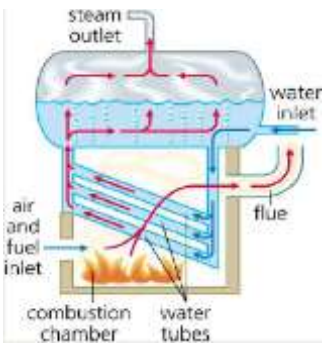
Steam boiler is a device used to convert water to steam at a required pressure and temperature by applying heat. Fuel is burnt in the boiler furnace to generate the heat. The boiler fuel can be coal or furnace oil. Boilers are available in two basic designs: fire tube and water tube as depicted in Fig. 1. Boilers should produce steam at high pressure and temperature to meet maximum work efficiency. These conditions are achievable only with water tube boilers.

A water tube boiler is a type of boiler in which water circulates in tubes heated externally by the fire. Fuel is burned inside the furnace, creating hot gas which heats water in the steam-generating tubes. The heated water then rises into the steam drum. Here, saturated steam is drawn off the top of the drum. Superheated steam is used to drive turbines. Since water droplets can severely damage turbine blades, steam is superheated to 730°F (388°C) or higher to ensure that there is no water content in the steam. A significant advantage of the water tube boiler is that there is less chance of a catastrophic failure: there is not a large volume of water in the boiler nor are there large mechanical elements subject to failure.

There are different kinds of losses in boilers. Loss in efficiency is reported mainly because of incomplete combustion of carbon, unburned fuels, moisture content in fuel and external radiation. Boiler is a high pressure device which is required to be operated with safe permissible limits. Safe handling of boiler is foremost important otherwise the boiler gets damaged and can get burst. Bursting of boiler can extensively damage property and man power.



(a)



(b)

Fig. 1. Type of Boiler System: (a) Fire Tube and (b) Water Tube.

Burner is part of the main supporters of the boiler that serves to boil water. The operation of the burner determines combustion products, system security and efficiency of the overall system. A burner system control unit comprises: burner control unit, flame sensor, servo motor, solenoid valve, magnetic coil coupling oil pump, power, electro motor blower, gas pressure switch, air pressure switch, oil return pressure switch. A cut-away view of burner unit is depicted in Fig. 2.

Fig. 2. Burner Unit.

B. Data Logger

Most measurements begin with a transducer, a device that converts a measurable physical quantity, such as temperature, strain, or acceleration, to an equivalent electrical signal. Transducers are available for a wide range of measurements, and come in a variety of shapes, sizes, and specifications.

Sensor is used to sense the physical parameters from the physical world. The output of the sensor is provided to the signal conditioning element. The main purpose of signal conditioning element is to remove the noise of the signal, amplify the signal. The output of the signal conditioning system is provided to ADC that converts the analog signal to the equivalent digital data. The equivalent digital data is then fed to the computer, which acts both as a controller and display element.

Once data has been acquired, there is a need to store it for current and future reference. Today, alternative methods of data storage embrace both digital computer memory and that old traditional standby-paper. There are two principal areas where recorders or data loggers are used. Recorders and data loggers are used in measurements of process variables such as temperature, pressure, flow, pH, humidity; and also used for scientific and engineering applications such as high-speed testing (e.g., stress/strain), statistical analyses, and other laboratory or off-line uses where a graphic or digital record of selected variables is desired. Digital computer systems have the ability to provide useful trend curves on CRT displays that could be analyzed.

After data acquisition and data logging function are completed supervisory control comes in to action. In supervisory control the computer which acts as a controller compares the signal coming from the process with the reference value or set point to calculate the error. According to the value of error the controller gives a decision which is also said to be as control action. The decision or control action is implemented in the process using actuator and final control element. The output of the controller is given to the digital to analog converter, which is then conditioned according to the process needs. The final signal is passed to the process and control action is implemented in the process through actuator and final control element. Fig 3 illustrated data logger process.

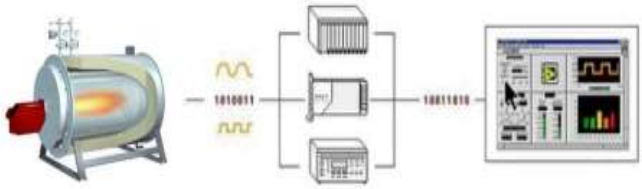


Fig. 3. Data Logger Process.

III. System Design

A. Burner Operation Design

The research used boiler that produce 20 tons/hour of steam and working with 24.5 bars. The boiler used two-burner unit with either fueled by gas or diesel. There are ten parts of boiler operations that be incorporated into design of data logger. These parts are designed to be accessed remotely using digital input. The parts are listed in Table I.

TABLE I
REMOTE ACCESS ENABLE BURNER PARTS

Remote Enable Access	Status	Note
Feed Pump Hand	ON/OFF	Feed Pump Manual
Feed Pump Auto	ON/OFF	Feed Pump Auto
Feed Pump 1	ON/OFF	Feed Pump Optional 1
Feed Pump 2	ON/OFF	Feed Pump Optional 2
Burner O	ON/OFF	Boiler Start
Mode of Operation Gas	ON/OFF	Use Gas Operation
Mode of Operation Oil	ON/OFF	Use Oil Operation
Reset	ON/OFF	Reset Fault and Alarm
Output Control Partial Load	ON/OFF	Min Burn Manual
Output Control Partial Load	ON/OFF	Max Burn Manual

On the other side, the system also are designed some operation status that able to monitor directly. Some parts are using digital inputs while the other is using analog inputs. Table II listed operational status that using digital input while Table III listed the analog input ones.

TABLE II
STATUS ACTIVITY MONITORING OF BOILER (DIGITAL INPUT)

Boiler Monitor Status	Activity	Note
Feed Pump Operation	ON/OFF	Feed Pump Operating
Full Load	ON/OFF	Burning Max
Over Pressure	ON/OFF	1st Over Pressure
Trouble Burner 1	ON/OFF	Trouble in Burner 1
Trouble Burner 2	ON/OFF	Trouble in Burner 2
Final Pressure	ON/OFF	2nd Over Pressure
Gas Pressure 1	ON/OFF	Low Pressure in 1
Gas Pressure 2	ON/OFF	Low Pressure in 2
Pre Warning	ON/OFF	Level Pre Warning
High/Low Water	ON/OFF	Water Level
Oil Operation Burner 1	ON/OFF	Burner 1 with Oil
Gas Operation Burner 1	ON/OFF	Burner 1 with Gas
Burner Operation	ON/OFF	Burner Operating
Oil Operation Burner 2	ON/OFF	Burner 2 with Oil
Gas Operation Burner 2	ON/OFF	Burner 2 with Gas
Remote Enable	ON/OFF	Operating in Remote

TABLE III
STATUS ACTIVITY MONITORING OF BOILER (DIGITAL INPUT)

Boiler Monitor Status	Parameter Input	Note
Current	0-200 Ampere	Current for panel
Gas Pressure Burner 1	0-100 mbar	Gas Pressure Burner 1
Oil Pressure Burner 1	0-25 bar	Oil Pressure Burner 1
Gas Pressure Burner 2	0-1000 mbar	Gas Pressure Burner 2
Oil Pressure Burner 2	0-25 bar	Oil Pressure Burner 2
Water Level	0-100%	Level in Boiler Tube
Pressure Steam	0-40 bar	Pressure Steam
Flue Temperature	0-300 ^{o}C	Temperature in flue
Burner Operation 1	0-100%	Value of burning
Burner Operation 2	0-100%	Value of burning

Boiler system will operate after power system is available and protection systems are in safe limits. There are two options for operating boiler system, oil or gas fueled. Normal process of boiler system is depicted in Fig. 4.

Throughout the boiler process, there are several responses that occur as a result of passing parameters to specific values. This response is designed in order to keep the system from not desirable things. The parameters and their specific value are listed in Table IV.

TABLE IV
BOILER RESPONS

Monitor Status	Parameter	Note	Respons
Water Level	40%	Low water	Alarm down
	45%	Pre Warning	Alarm operate
	60%	Start Feed Pump	Normal boiler
	80%	Stop Feed Pump	Normal boiler
	85%	High Water	Boiler operate
Pressure Steam	17.5 bar	Normal Pressure	Boiler operate
	>17.5 bar	High Pressure	Burning down
	<17.5 b	Low Pressure	Burning up
	18 bar	Over Pressure	Shut down
Flue Temperature	> 290 oC	High Temperature	Boiler operate
	< 290 oC	Low Temperature	Normal boiler

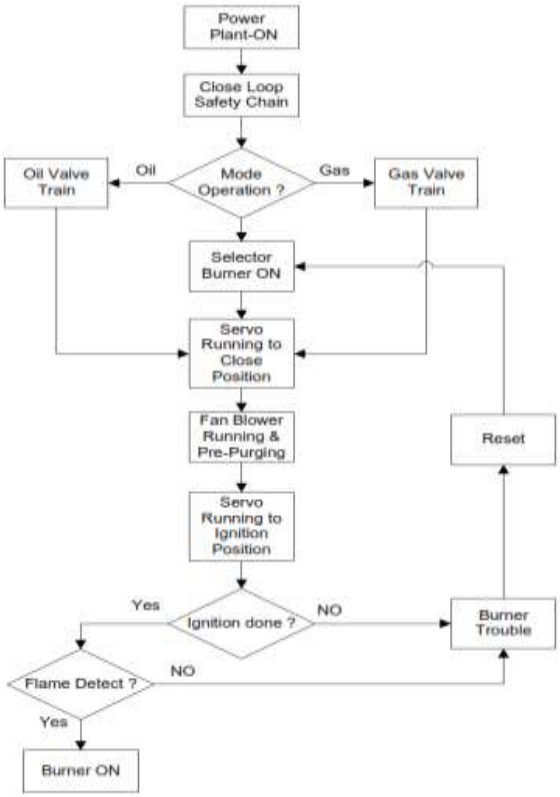


Fig. 4. Flow Chart of Normal Boiler System Process.

B. Configuration System Design

Based on burner operation design described before, there are several configuration must be planned according to its function. The configurations are: hardware configuration, software configuration and network configuration.

Hardware configuration design is based on some PCs that interconnected with a LAN corporate via Ethernet cable UTP CAT5 to make special network. Some sensors and a PLC connected to the network to acquire data and control the process. Fig. 5 displayed hardware configuration.

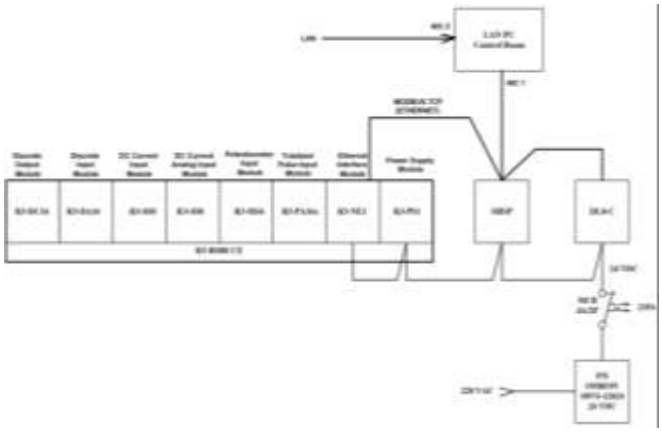


Fig. 5. Hardware Configuration.

Some PCs with Windows XP operating system used in software configuration. Several software applications, such as: PC configurator cable, configuration software web data logger, remote I/O configurator, PLC software programmer and VNC viewer. The software applications used to make sure the process able to be monitored and controller suitably. Software configuration is depicted in Fig. 6.

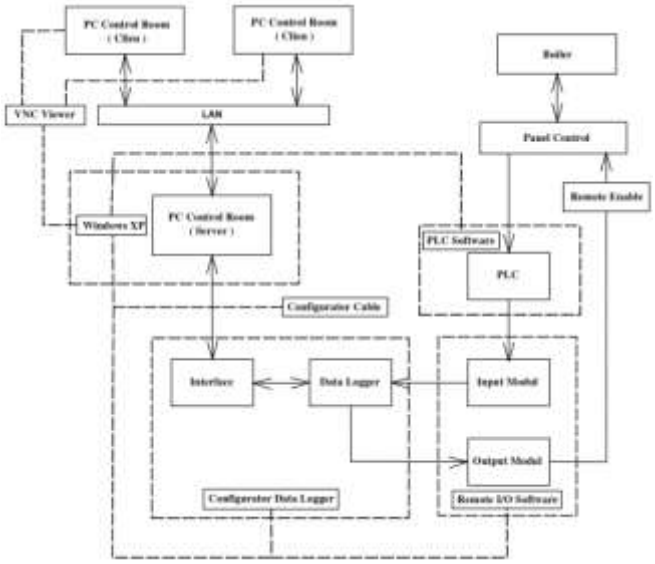


Fig. 6. Software Configuration.

Network configuration design used LAN Corporate and Wi-Fi router that interconnected with some PCs and web data logger device. Network configuration is depicted in Fig. 7.

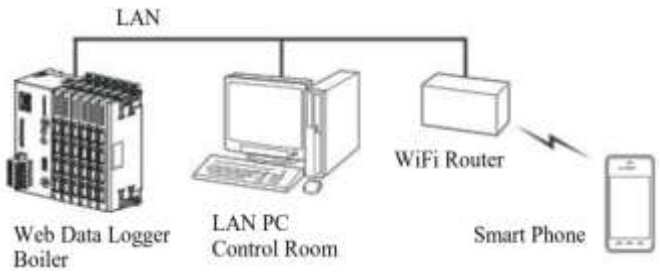


Fig. 7. Network Configuration.

IV. Results and Discussions

A. Operational Status Monitoring

All of configuration design has been done. Some display of front panel boiler controller will be described. Fig. 8 shows overview of monitor display that describes overall process that can be controlled remotely as digital output. In Data Menu, there are Analog Input Data (AI Data), Digital Input Data (DI Data), Pulse Input Data (PI Data) and Digital Output Data (DO Data). It shows that status ON or OFF differentiates by color in column. Remote access control is done by clicking selector switch in monitor display. The remote access control is indicated by ON or OFF status and different color column.

However, Fig. 9 shows overview of monitor display that can be monitored remotely as digital input. It shows some parameter values and several statuses as ON or OFF and differentiates by color in column.

Fig. 8. Overview of PC Display for Remote Access Control (Digital Input).

Fig. 9. Overview of PC Display for Remote Access Control (Digital Input).

Overview of operational status of boiler activity is shown in Fig. 10 as table that display several input data parameters. The table presented actual value and unit of every parameter.

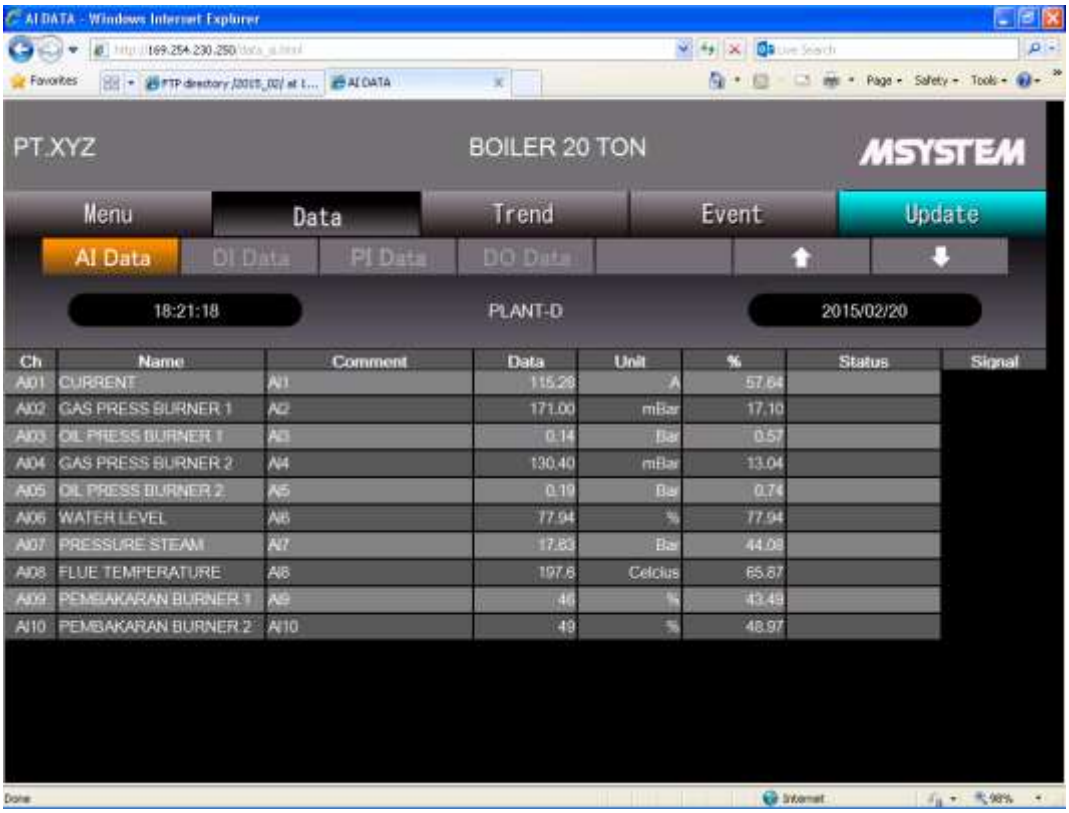


Fig. 10. Overview of PC Display for Remote Access Control (Analog Input).

B. Trend Display

Trend is a display in the form of graphs based on time intervals or sampling rate that has been established to monitor all parameters, digital and analog inputs and operational status, as well. The parameters are recorded on the PC monitor so able to view operational status for earlier time. Fig. 11 and Fig. 12 showed four parameters of analog input and four operational statuses, respectively.

Fig. 11. Overview of Trend Display for Four Parameters (Analog Input).

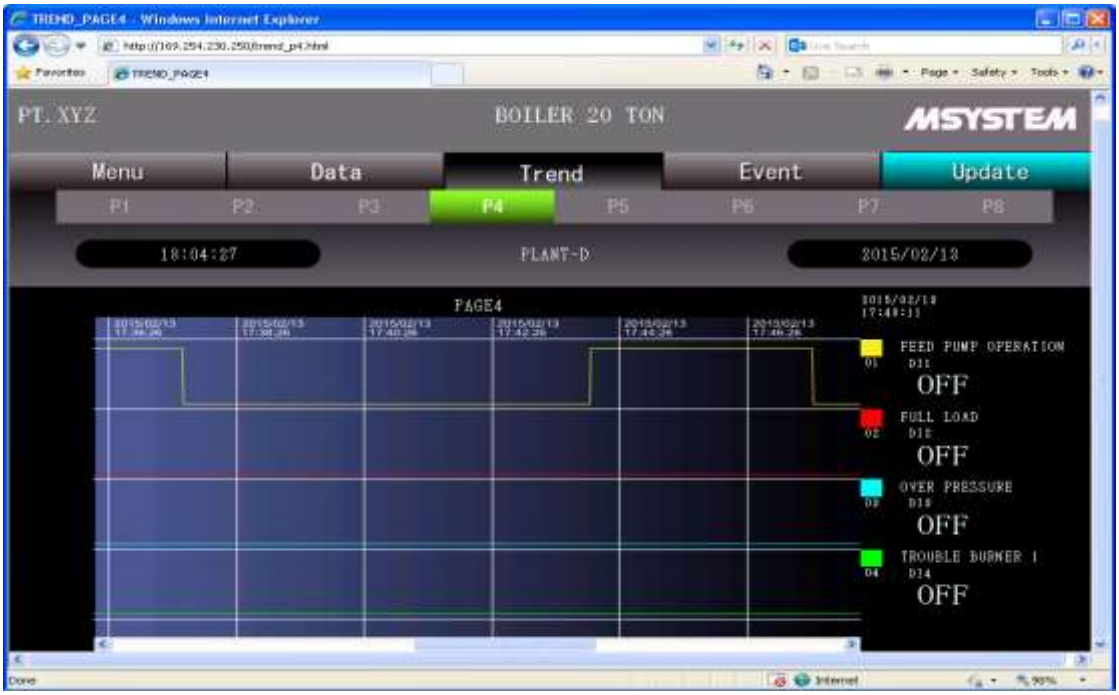


Fig. 12. Overview of Trend Display for Four Operational Statuses (Analog Input).

C. Network Analysis

In order to test performance of network it is used Wireshark software application. Wireshark used as network protocol analyzer. Fig. 13 displayed capture protocol results via LAN communication.

Fig. 13 shows two-way active communication on LAN network between two module using TCP protocol. The Fig. shows data logger IP at 169.254.230.250 and Ethernet interface module IP at 169.254.230.251.

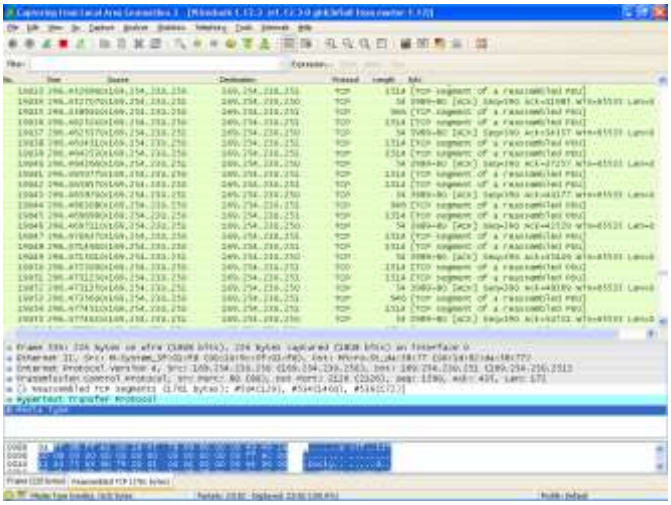


Fig. 13. Overview Captures Result of Network Protocol.

D. Data Storage

As described in designing process that operational activity and data will be stored via web data logger in data base or external memory. The data will be store if CSV format. Data storage is done in order to analyze if there are any errors, faults or disturbances in process. Fig. 14 shows several data that have been stored in CSV format by certain setup time interval.

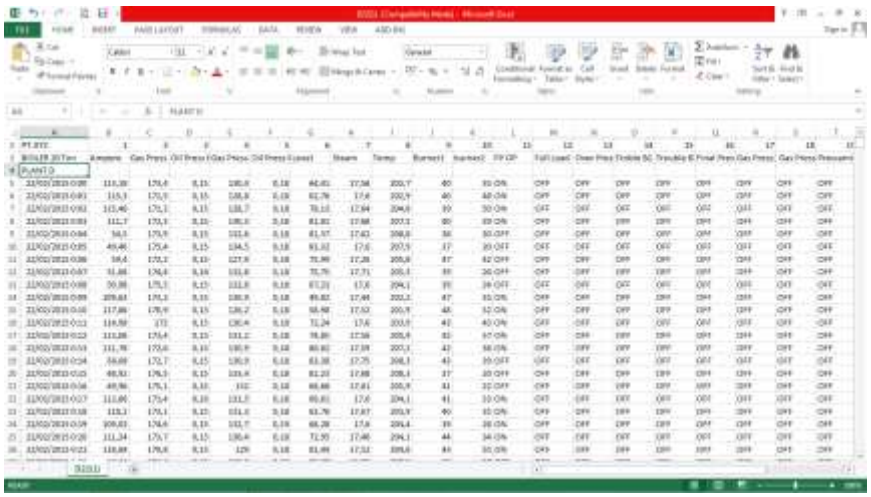


Fig. 14. Overview Data Storage of Several Parameters in CSV Format.

V. Conclusion

The focus of this research is to design a system for monitoring, controlling and data storage operation of an industrial boiler, especially at the critical parameters that could potentially cause an accident. Based on several results it can be said that the boiler works in accordance with the stages of its operations. The system is able to monitor and control from a remote computer via a LAN as a medium of communication. It is evidenced by the interaction of IP addresses between web data logger and Ethernet interface module with TCP as the protocol is using software Wireshark. Operational activity data stored in the data base of the computer or external memory data logger with web CSV format that can be read multiple formats text-editor.

PLC technology as the main control system control is now commonly used because of its flexibility that can adapt to other devices including web data logger which is one of the methods for monitoring and control of a machine or system that utilizes corporate Ethernet network. Limitations when using these networks were related to corporate policy that restricts access to the network exit, so the system does not work optimally. Another limitation of this system is visually less attractive compared with the SCADA system, because it only displays the data tables and graphs are only understood by those involved.

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Chapter 25

Tensile Strength Analysis of Concrete-Cellulose Composite from Coconut Coir

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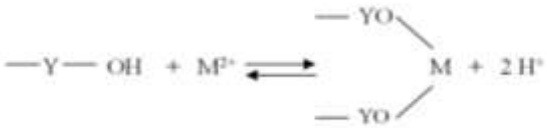
Abstract. Composites of the planned concrete grade K-275 mixed with cellulose powder were made to look the effect of density, tensile strength, and compressive strength of the composite material by adding the cellulose powder. Powdered cellulose obtained from the coconut coir insulation by solvent replacement method and affixed to the concrete with variation 0%; 0.25%; 0.5%; 0.75% and 1% of the concrete total weight. This research aims to produce a lighter material that has resembles or even exceed power than previous materials. The best conditions from this research analysis occur in 0,5% cellulose powder addition that is formed lower density material with 2.8208 Mpa of tensile strength and 17.8344 MPa compressive strength, rise respectively 33, 33% and 16.66% compared to the tensile strength and compressive strength of concrete without cellulose powder addition.

Keywords: composites, concrete, cellulose, density, tensile strength, compressive strength.

I. Introduction

Concrete is needed as one of the main ingredients in infrastructure development. We need at least four main building blocks, namely coarse aggregate, fine aggregate, water and cement and other materials can also be added as an additive (Claudio at al, 2007). Concrete has resistance to press very well, but not so with strength against the pull. Tensile strength of concrete only reach 10% to 15% of the value of compressive strength (Prayuda, 2012). These properties cause easily appear small cracks in the concrete that could lead to collapse when given additional concrete loads (Sudarmoko, 1990). Repair concrete properties can be done with the addition of natural fibers (coconut coir) Eniarti M., (2010) but not all of the content in natural fiber has good effect. Lignin has a bad influence on the strength of the fiber(Siswadi et al,2007, Klemmat al. 1998), this research will minimaze lignin content and enlarge cellulose content in fiber by cellulose insulation with solvent replacement method. The presence of OH groups in cellulose and hemicellulose cause polar nature. Ion exchange mechanism occurs between -OH group bonded in surface with the kation in logam. In this case the -OH group will bind to positive metal ions in the cement content, Si2+ , with this following mechanism.



M^{2+} is a metal ion, OH is a hydroxyl group and Y is a -OH group attached matrix. The interaction between -OH with metal ions is also possible through the formation mechanism of complex coordination because oxygen atom (O) in the -OH group has a free electron pair, while the metal ions have empty d orbitals. The lone pair will occupy a vacant orbital which is owned by a metal ion, thus forming a compound or complex ion (Sukarta, 2008).

Accordingly, research used cellulose and hemicellulose isolated from coconut coir as an additive in the manufacture of concrete, with the hope that the tensile strength of the material that is high in natural fiber

significant effect on tensile strength of concrete by varying the ratio cellulose-hemicellulose of the total concrete weight to obtain concrete with the most excellent tensile strength.

II. Experiments

2.1. Materials

Coconut husk which will be used as raw materials derived from Desa negeri Agung, Kecamatan Marga Tiga, Lampung Timur. The materials used for coconut coir isolation are Ethanol, Toluene, Aqua DM, NaOH,, NaOCl solution (commercial bleach) 0.5%, sulfuric acid (H2SO4). Materials used in the concrete manufacturing is accordance with SK SNI DT 91-000802007 for the quality of concrete K-275 (24 MPa), those are cement, coarse aggregate, fine aggregate, and water.

Table 1. Procedures of Measuring Concrete Unit Price

Concrete Quality	Cement (kg)	Fine Agregat (kg)	Coarse Agregat (kg)	Water (liter)	w/c ratio
7.4 MPa (K 100)	247	869	999	215	0.87
9.8 MPa (K 125)	276	828	1012	215	0.78
12.2 MPa (K 150)	299	799	1017	215	0.72
14.5 MPa (K 175)	326	760	1029	215	0.66
16.9 MPa (K 200)	352	731	1031	215	0.61
19.3 MPa (K 225)	371	698	1047	215	0.58
21.7 MPa (K 250)	384	692	1039	215	0.56
24.0 MPa (K 275)	406	684	1026	215	0.53
26.4 MPa (K 300)	413	681	1021	215	0.52
28.8 MPa (K 325)	439	670	1006	215	0.49
31.2 MPa (K 350)	448	667	1000	215	0.48

2.2. Cellulose Insulation

This isolation using a solvent replacement. 1200 grams Coconut coir chopped in order to facilitate the isolation process, and then collected in a container containing the solvent ethanol-toluene volume ratio of 1: 2 for 4 hours. The mixture is heated to a temperature of 600C to evaporate the solvent. The extract rinsed with hot aqua DM (800C) until free from ethanol and toluene and other minerals. Then the sample is immersed in hot NaOH 2M (90 ° C) for 1 hour to remove the lignin content. Heat soaking process with NaOH is repeated for 1 hour until the filtrate does not precipitate when sulfuric acid is added (H2SO4) and the product produced in the form of a yellowish brown powder. Furthermore, the product is immersed in a solution of 0.5% NaOCl containing 1 gram of NaOH for 15 minutes to form a white product. The products produced at this stage is washed with 70% ethanol and aqua DM to get this neutral pH and remove any remaining NaOCl. The product is dried with a vacuum oven at 600 C for 3 hours. Cellulose-hemicellulose isolated from waste coconut coir ready weighed and mixed into the concrete.

2.3. Manufacture of composites

Concrete mixed with cellulose-hemicellulose then called specimen was planned to have compressive strength f'c = 24 MPa, created with the following steps: Mortar materials was prepared for manufacturing 10 specimens, with composition 21 924 grams of cement; 36 936 grams of sand; 55 404 grams of gravel; and 11,610 grams of water. The materials were inserted into Molen machine until well mixed. The mixture was poured into a container for a while before the slump test (the mixture viscosity test). Slump test was done by pouring amount of the concrete into the Abrams Cone where placed on an another container which have been smeared oil in side inner previously, compacted, then Abrams cone was lifted slowly so the dough left in the container.

The concrete was feasible if maximum of descent printout Abrams cone was 2 cm. To make 1 specimen, the mixture is loaded into a cylindrical mold and then weighed to determine the weight. For the first variant specimen, as much as 0.25% of the net weight of the initial mixture is reduced, then replaced by cellulose-hemicellulose extracted. Mortar is poured back into the container, affixed cellulose-hemicellulose, cellulose-hemicellulose stirred untill dispersed evenly, then put back into the mold cylinder. Specimens with this composition was made 2 pieces for tensile strength and compressive strength test purposes. Then the same thing is repeated for manufacture variants specimens with 0.5%, 0.75% and 1% cellulose-hemicellulose of the concrete weight. Also made two specimens without cellulose-hemicellulose added (normal concrete) for comparison. Specimens are compacted with tamper and vibrators. Digesters allowed to harden for 24 hours. The mold is removed, the specimen soaked in either water or in a wet sacks for 28 days until they are ready to be tested.

III. Results and Discussions

3.1. Cellulose Insulation

Cellulose obtained from experiment are physically creamy yet completely white, as shown in Figure 4.1 because the whitening agent/bleaching (NaOCl) that used are in low concentration. If using high concentration NaOCl, the main chains of cellulose would lead to degradation, so that the properties of the material decreases. The powders data analysis result presented in Table 2.

Fig 2. Coconut coir after treatment (left); Coconut coir before treatment (right)

Table 2. Coconut Coir Content Before and After Treatment

No.	Sample Code	Hemicellulose	Cellulose	Lignin
		(%)		
1	Coconut Coir without Treatment	14,6232	36,7337	30,9059
2	Coconut Coir After Treatment	12,3441	47,8346	18,1086

From this insulation, cellulose content rise became 47,8346% from 36,7337%, hemicelluloses content decline from 14,6232% to 12,3441%, and lignin content also decline from almost 31% to 18,1086% in coconut coir. That all values are analysys data result from Politeknik Negeri Lampung Analysys Laboratory. Hemicellulose content decline because Hemicellulose content value declines could be due to the degradation of hemicellulose when repeatedly soaking with NaOH.

3.1. Manufacture of composites

Specimens are 10 pieces solid cylinder with 30cm height and 15cm diameter, which each of the ten-cylinder density will be measured. Then 5 cylinders are to be tested its compressive strength, and 5 other cylinders will be tested its tensile strength. That cylinders are concrete-cellulose composites added with treatmented 0%, 0,25%, 0,5%, 0,5%, and 1% coconut coir of cylinder weight, they are 0gram; 30,88gram; 61,77gram; 92,65gram; and 123,54gram. Cylinders as specimens shown in figure 4.

Fig 4. Specimen cylinders

Figure 4. shows that specimen cylinders looks like normal concrete cylinder.

3.2. Density Analysis

Density is defined as mass per unit volume of material. Density test done to determine the density of each cylinder. In accordance with the long-term goals to be achieved, would like to obtain material that is lighter but has the same strength and quality even exceed the pre-existing material. The density of a material can be determined by the formula $\rho = m / v$, where m is the mass of the cylinder and v is the volume of a cylinder. Here is the measurement data:

Table 3. Cylinder measurement data

No.	Cylinder Code	Weight (kg)	Volume (m3)	Density ($\rho = m/V$) (kg/m3)	ρ average
1	SA 0 (a)	12.470	0.005301438	2352.19199	2353.135131
2	SA 0 (b)	12.480	0.005301438	2354.078271	
3	SA 0,25 (a)	12.390	0.005301438	2337.101745	2326.255631
4	SA 0,25 (b)	12.275	0.005301438	2315.409517	
5	SA 0,5 (a)	12.150	0.005301438	2291.831009	2285.229027
6	SA 0,5 (b)	12.080	0.005301438	2278.627044	
7	SA 0,75 (a)	11.850	0.005301438	2235.242589	2229.583747
8	SA 0,75 (b)	11.790	0.005301438	2223.924905	
9	SA 1 (a)	11.725	0.005301438	2211.664081	2212.135651
10	SA 1 ((b)	11.730	0.005301438	2212.607221	

SA 0 (a) shows the cylinder with 0% coconut coir addition into specimen that to be used as a test object in the compressive strength test or also called normal concrete. SA 0 (b) shows the cylinder with t 0% coconut coir addition that to be used as a test object in the compressive strength test. SA Code 0.25 (a) and (b) shows the cylinder with 0,25% addition and so on. The mass of the cylinder is obtained from the measurement results using10 gram precision scales with like shown in Figure 6. Volume calculated using the formula $\pi r2t$ because in this case the test object dimension can be seen easily.

But if the test object is an irregular in shape object , the volume calculation can be done by using increasing fluid in a measuring cup (Sudarmoko, 1990).

Fig 5. Measuring the specimen weight

Densities of specimen with 1%, 0,75%, 0,5% and 0,25% addition are 2212,135 kg/m3, 2229,5837 kg/m3, 2285,229 kg/m3, and 2326,349 kg/m3. And specimen density without addition is s 2354,3612 kg/m3.

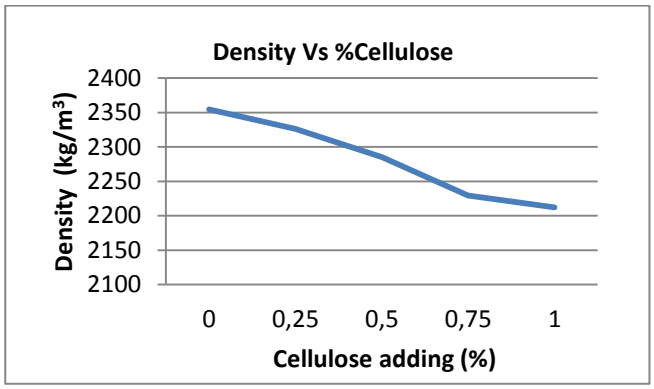


Fig 6. Corelation between cylincer density and percentage of the cellulose filler

Shown in fig 6. the more addition of coconut coir into the concrete, the lighter concrete mass we get, indicated with it density that is getting smaller. It is caused, some of concrete mixture replaced by coconut coir that has lower density than it mixture.

3.3. Tensile Strength

Tensile strenght test of cylinders done with a machine shown in Table 4. The needles on the instrument indicates the value of the load required to reach first cracks in the sides of cylinder (kN). Then do the calculations to obtain tensile strength values with data obtained as shown in Table 4.

Table 4. Tensile Strength Analysis Data Result

% adding	Weight (kg)	Force (Newton)	Diameter (mm)	Height (mm)	Fu (age factor) 28 hari	Tensile Strength (Mpa)
0	12.480	150000	150	300	1	2.12314225
0.25	12.275	160000	150	300	1	2.26468507
0.5	12.080	200000	150	300	1	2.83085633
0.75	11.790	190000	150	300	1	2.68931352
1	11.730	180000	150	300	1	2.5477707

Figure 7. Tensile Strenght Analysis

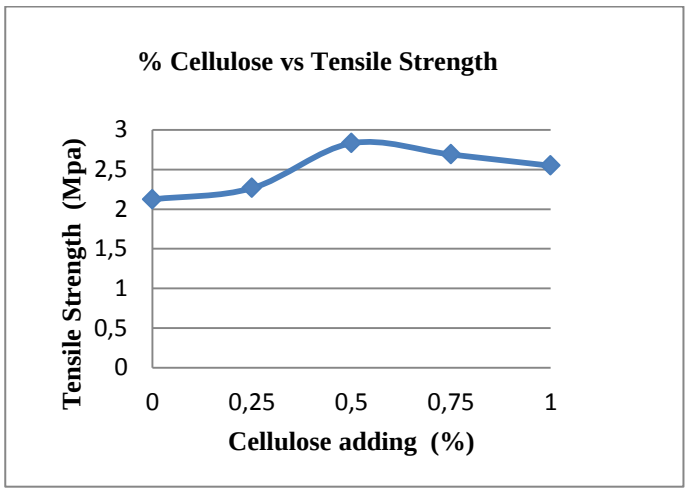


Fig. 8. The effect of Coconut coir powder substitution for Concrete Tensile Strength

Fig 8. explains that the use of isolated cellulose powder from coconut coir made an increase in tensile strength value when compared to normal concrete. Variations addition of the cellulose powder 0.25%; 0.5%; 0.75% and 1% respectively produce concrete tensile strength values of 2,264 MPa; 2.8208 MPa; 2.6893 MPa; and 2.5477 MPa. The maximum tensile strength value obtained in 0.5% coconut coir powder substitution, that is 2.8308 MPa with increased tensile strength as much as 33,33%. The use of cellulose powder of coconut coir to the concrete more than 0.5% would reduce the value of the maximum tensile strength of concrete, but the value is still above normal concrete tensile strength. The density of that maximum tensile strength value with optimal percentage is 2278.62 kg / m3, which is smaller than normal concrete density that is used as reference in this study.

3.4. Compressive Strength Analysis

Concrete-cellulose composites compressive strength test conducted to determine the effect of cellulose powder addition to concrete compressive strength. Has been tested and observated a pieces normal concrete without cellulose powder addition and 4 pieces concrete with cellulose powder addition with variation of 0.25%; 0.5%; 0.75%; and 1% of the total weight of the concrete, the results are shown in the Figure below.

Table 5. Compressive Strength Analysis Data Result

% Adding	Weight (kg)	Force (Newton)	Diameter (mm)	Height (mm)	Appearance (mm2)	Compressive Strength (MPa)
0	12.470	270000	150	300	17662.5	15.2866242
0.25	12.390	300000	150	300	17662.5	16.985138
0.5	12.150	315000	150	300	17662.5	17.8343949
0.75	11.850	220000	150	300	17662.5	12.45576787
1	11.725	200000	150	300	17662.5	11.32342534

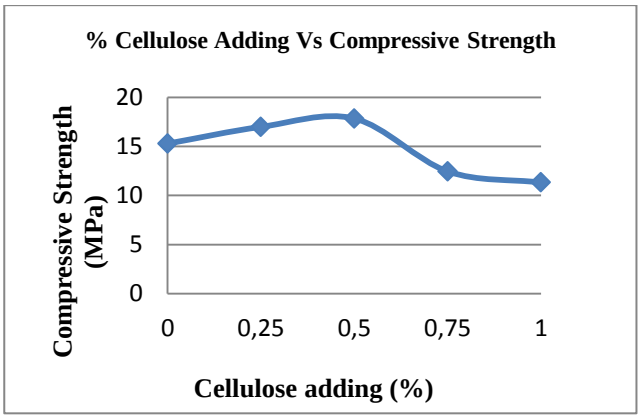


Fig 9. The effect of Coconut coir powder substitution for Concrete Tensile Strength

In the figure above shown that the maximum compressive strength value obtained in 0,5% coconut coir powder substitution, 17.8344 MPa with density value of 2291.83 kg / m3 , still lighter than normal concrete, while the addition of coconut fiber cellulose powder into the concrete more than 0.5% , it will decrease the compressive strength of concrete to below the compressive strength of normal concrete (Siswad, Alfeara 2007).

IV. Conclusions

After a series of studies, obtained some conclusions, cellulose content produced in this study amounted to 47.8346%, increase 11.1% compared to the previous. The content of hemicellulose down which initially amounted to 14.6232% to 12.3441%, and the amount of lignin which initially 30.9059% fell to 18.1086%. The study produced concrete-celluose composite which has a lower density than the normal concrete but resistant to pressure and traction better than concrete without powder addition. The maximum tensile strength values obtained on a variety of 0,5% pwder addition composite which is equal to 2.8208 MPa, rise up 33.33% compared to normal concrete. The maximum compressive strength value of the composite obtained in 0,5% addition variation, 17.8344 MPa, rise up16.66% compared to normal concrete.

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SECTION 2 : AGRICULTURE AND FOOD SCIENCE

Special Contribution

Bacterial Enzymes with Special Characteristics for Biotechnological Applications

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Abstract. Bacterial enzymes have been extensively studied for their isolation and characterization of their specific properties. The enzymes can be utilized as biocatalysts to function eco-friendly and economically reactions in bio-processes, compared with the use of chemical catalysts. The special characteristics of enzymes having thermotolerance, tolerance to a varied range of pH, and stability under high salt condition and in organic solvents are isolated and exploited for their industrial applications. Such enzymes have been characterized and have proven their utility in bio-industries such as food, leather, textiles, animal feed, and laundry detergent and in bio-conversion and bio-remediation. Here regio- and enantio- selective bioconversion of aromatic and aliphatic amines by bacterial enzymes and molecular structural analysis of halotolerant mechanism of bacterial hydrolytic enzymes will be introduced.

Chapter 26

A Preliminary Assessment for The Presence of a Crushing Plant in Lampung Timur Regency

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Abstract. This paper aims to preliminary assessment for the presence of a crushing plant in Lampung Timur regency. Evaluation of this project included technical aspect and financial aspect. Tehnically, Marga Tiga district selected as the project location, caused of a lot of raw material and lack of competitor in this district. Hypotec reserves of basalt rocks in Marga Tiga district reach 8 milion tons. Single togle jaw crusher chosen as due; simple in construction, low maintenance, high productivity and can be produced locally. The installed capacity of the crushing plant unit is 20 m3/hour, with production size of 2-3 cm,1-2 cm, and finess than 0.5 mm. Calculation of financial aspect obtained 4 years for payback period; positive Net Present Value (NPV) 1,109,106,085; 1.46 of profitability index; and 24.08% of Internal rate of return (IRR). The presence of a crushing plant in Lampung Timur regency is feasible and competent to be run. The presence of this unit will create very beneficial multiplier effect for development in the region.

Keywords: basalt ,crusher, IRR,NPV, Lampung Timur,

I. Introduction

Indonesian governments have decided infrastructure development as priorities for the next five years. This condition needs to be followed by the availability of adequate materials. Split stone is one of the basic materials needed in the construction of infrastructures (bridges, roads, buildings, dams, etc.). Split stone can also be used as aggregate in concrete manufactured. Split stone obtained by crushing andesite or basalt rocks. *Lampung Timur* regency has potential of basalt rocks that can be used as raw material split stone. Total reserves of basalt rocks in *Lampung Timur* reached 27,088,789m^3[1], scattered in the area of district Sukadana, Mataram Baru, Bumi Agung, Jabung, Marga Tiga, and Way Jepara. The potential has not been used optimally. As an illustration, in the range of 2009-2013 split stone produced only 172,225 m^3[1]. The low production capacity, caused the processing are still using manpower to break the rocks into the desired size range.The experience of the contractors in *Lampung Timur* regency, to meet the needs of split stone in large quantities required long periods of time, or obtained by supplied from other areas. This condition leads to high costs for contractors.
Split stone consists of various sizes such as sizes of 5-7 cm, 2-3 cm, 1-2 cm, 0-0.5 cm and size like sand. To process into various sizes is needed a circuit size reduction processes or better known unit of crushing plant. In industries supporting mining and milling operations, crushing plays a massive role in reducing particle sizes of rocks and ores. To reach desirable end product size, the feed material endures a few crushing stages that form a circuit. A crushing plant system consists of a combination of unit operations for storing, feeding, crushing, screening, and conveying [2]. The crushing plants are often designed to be able to produce certain throughput onpredefined specification and a size distribution while keeping the plant capacity and quality, resulting a reasonable cost and energy consumption [3],[4],[5].

The main challenging of running a crushing plant as competently as possible is to know how each production unit affects efficiency of the whole plant [6]. Therefore, a preliminary study on the technological and economic assessment for the presence of a crushing plant in Lampung Timur regency needs to be done.

Crushing Technologies

Various types of crushers are used in the stone crushing industry such as Jaw Crushers, Roller Crushers, Cone Crushers, Impactor, Rotopoctor etc. Generally, only Jaw crushers are used as Primary crushers. For secondary and tertiary crushing application either of Jaw, cone, roller, impactor or rotopoctor type crushers are used. Various types of crushers are briefly described below [7].

Jaw Crushers:

These are the oldest type of and most commonly used crushers in use and have changed little from the original design. In Jaw Crusher the feed is compressed between a stationary and a movable surface. A few of common types of Jaw crushers, in use, are described below.

1) Double Toggle Crusher: The Blake jaw crusher has a fixed jaw and a moving jaw pivoted at the top. The crushing faces themselves are formed either of manganese steel or of chilled cast iron. The maximum pressure is exerted on the large material, which is introduced at the top. These crushers are made with jaw widths varying from about 2" to 48" and the running speed varies from about 100 to 400 RPM.
2) Single toggle Jaw crusher: The single-toggle crusher is the simplest and the lightest of the jaw crushers but is suitable only for producing low crushing forces and therefore used for soft rocks.
3) Impact Jaw Crushers: In this type of crusher the crusher cavity is inclined. As there is larger stroke and higher rotation speed (about 400 rpm) a stronger impact is achieved. As a result, hard, tough materials can be processed [7].

Gyratory (Cone) Crushers

In Gyratory Crushers the stress to the feed is applied between a stationary and a movable surface. The crushing head is employed in the form of a truncated cone, mounted on a shaft, the upper end of which is held in a flexible bearing, whilst the lower end is driven eccentrically so as to describe a circle. The crushing action takes place around the cone[7].

1) Primary Gyratory Crusher: In the primary gyratory crusher the stress is applied to the feed by pressure as the conical head periodically approaches the bowl. The primary Gyratory Crusher is a large, heavy and expensive machine. It is used only for special materials and high through put. As the crusher is continuously in action, the fluctuation in the stresses are smaller compared to the jaw crusher but the power consumption is lower. It gives a finer and more uniform product compared to the jaw crusher.
2) Cone Crusher: Cone crusher have shallower cavity than that of the primary gyratory crusher. This crusher produces higher reduction ratios of up to 18. A uniform product size and good shape is ensured because of the long parallel gap before aperture. The stroke is large and the speed of rotation is 200 - 300 rpm, which ensures a cubical shape to the product. The shallow cone crushers are mainly used for the fine crushing of hard and moderately hard materials [7].

Hammer Crusher

In hammer crushers the hammers are attached to the rotor via pivots so that they are deflected when they hit strong and particularly large stones. In most cases the crushing zone is surrounded by grate bars so that fragments which are larger than the openings of the grating are retained in the crushing zone.

Huge hammer crushers with rotor diameters up to 3 m are available which have throughput of even 1500T/hr. Although hammer crushers wear more quickly than impact crushers, they can process moist materials more efficiently. Only soft to moderately hard materials can be processed because of wear considerations. These crushers are simpler than jaw and cone crushers and units with equivalent throughput are much smaller in size [7].

Financial Analysis

Financial feasibility analysis carried out with the following parameters :

Payback Period is the measure of capital investment desirability which was developed before discounted cash flow techniques were widely understood. This measure is still used as primary decision criteria for some firms. The payback period is the number of years until the cumulative cash benefit equals the money invested. Payback was the principle capital budgeting criterion for a number of years. The reason for its popularity is the ease to explain the rule to employees with no background in finance. The payback period is also used as a risk measure. The longer time it takes to cover the original investment, the more risk and the chance there is something to go wrong. Payback period is used primarily as supplementary information. Managers relied on payback in earlier years [8].

Net Present Value is the method which improves the effectiveness of project evaluations. This method which relies on discounted cash flow (DCF) techniques that proceed as follows: 1) Find the present value of each cash flow, including both inflows and outflows, discounted at the project's cost of capital 2) Sum these discounted cash flows: this sum is defined as the project's NPV 3) If the NPV is positive, the project should be accepted, while if the NPV is negative, it should be rejected. If the projects with positive NPVs are mutually exclusive, the one with the higher NPV should be chosen [8].

Internal Rate of Return is a yield, on average, per year. The IRR is defined as the discounted cash rate that equates the present value of a project's expected cash inflows to the present value of the project's costs: PV (inflows) =PV (investment costs) or the rate that forces the NPV to equal zero. The decision rule for the Internal Rate of Return is to invest in a project if it provides a return greater than the cost of capital. The cost of capital, in the context of the IRR, is a hurdle rate, the minimum acceptable rate of return [8].

Profitability Index is the ratio of the present value of change in operating cash inflows to the present value of investment cash outflows. PI is the ratio of the tow present values. The PI is often referred to as the benefit-cost ratio, since it is the ratio of the benefit from an investment to its cost. PI tells how much value we get for investment. The rule is PI is greater than one, we accept it. Capital investment projects are classified by project life within short- term or long- term. The long-term projects, in case of long term, the time value of money plays an important role. Long-term asset are based on projections of cash flows far into the future and consider the time value of money. Investment provides benefits over a limited period of time, referred to as its economic life asset by physical deterioration, obsolescence or the degree of competition in the market for a product [8].

II. Results and Discussion

A. Analysis of Technical Aspects

Location determination is based on the following considerations; marketing factors; regulations and policies of local governments and land use rights; labor factor, regarding the availability, level of wages, the cost of living; factor driving force regarding electrical energy, fuel problem; the availability of raw materials; environmental factors such as transportation, roads and telecommunications[9]. Marga Tiga district was chosen as the location for the establishment of the unit crushing plant. Factors of raw materials and relatively small level of competition are main reason why Marga Tiga districts selected for the project location. Marga Tiga have a hipotic resource of 6 million tons bassalt rock.The availability of labor and electricity resources, as well as other supporting facilities adequate. Marga Tiga bordered with Sukadana district, which has reserves of 18 milion m^3 of basalt rocks [1].

In the crushing plant, preparation of layouts based on the type of product-oriented layout, because the production process is carried out in sequence so that the preparation of heavy equipment machines are arranged in sequence, starting with taking the material to production processes and loading to consumers [10]. Layout for this project can be seen in Fig. 1.

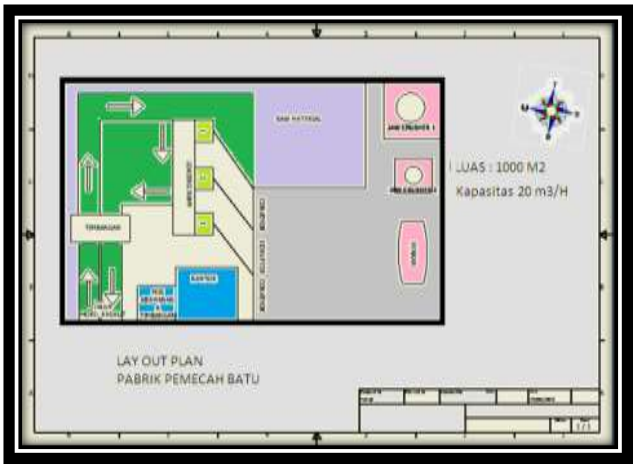

Fig 1. Layout of crushing plant unit

To get the basalt rocks as a raw material for stone split, it's carried out by open-pit mining system using heavy equipment such as excavators. Obtained the raw material no significant problems, because the thickness of the overburden is only about 0-1 meters and vegetation at the site only in the form of grass, or short-term seasonal crops, as shown in Fig. 2.

Fig. 2. Raw Material

Raw material is basalt rock with colored dark black-gray, have the form of massive boulders. test analysis of the raw material are presented in the table 1.

TABLE 1. Report of Analysis

No.	*Parameters*	*Value*		*Method*
1.	Hardness	8.3	HBN	Rockwell
2.	Density	2.69	Gram/cm^3	Archimedes

Machinery and equipment needed to during this process can be seen in the table 2.

TABLE 2. Equipment

No	*Type of Equipment*	*Quantity*
1.	Excavator	1 Unit
2.	Dump truck	1 Unit
3.	Jaw Crusher	2 Unit
4.	Grizlly	1 Unit
5.	Vibrating Screens	1 Unit
6.	Conveyor	5 Unit
7.	Wheel loader	1 Unit
8.	Generator set	1 Unit

Primary and secondary jaw crusher used toogle single type, each with a capacity of 10-20 m^3 / hour, and 4-10 m^3 / hour, as illustrated jaw crusher used can be seen in Fig. 3.

Fig 3. (a) Primary Jaw Crusher ; (b) Secondary Jaw Crusher

Grizzly is used as a raw material transporter to the primary jaw crusher. Vibrating screen has three levels for classifying the various sizes of products. Powered generator set used 150 KVA. The generator is used when the electricity supply is disrupted.

B. Financial Feasibility Analysis

1. *Initial Investment*

Total value of the initial investment is IDR 2,395,000,000.00 with the details as shown in Table 3. Lifetime economical pad equipment is expected for 10 years. All initial investments acquired through a loan with an interest rate of 13% per year.

TABLE 3. Initial Investment

Allocation	***Total (IDR)***
Land	150.000.000
Wheel loader	750.000.000
Stone Crusher Machine	1.120.000.000
Electricity	250.000.000
Building	125.000.000
	2.395.000.000

2. *Proceeds*

Proceeds are net cash inflows obtained sums earningsobtained from stone-breaking effort, the number of depreciation by taking into account the tax and cost of capital that must be borne by Investment / Initial investment, so that the information can be obtained from Income statement below [11].

TABLE 4. Profit of The Project

Parameters	*Total (IDR)*
Total Sales	520.000.000
Total Production Cost	455.000.000
Gross Profit	65.000.000
Comercial Expenditure	10.000.000
Earning before interest and taxes (EBIT)	62.000.000
Interest expense	25.945.833
Net profit before taxes	36.814.167
Taxes (25%)	766.962
Earning after taxes	36.047.205

From the table 4, obtained earning after taxes is IDR 432,566,458 /year. Estimated economic lifetime equipments is 10 years, depreciation of all equipment is IDR 11,113,000/month or IDR 133,356,000/year. Net Cash Flow is defined the value of proceeds or the amount of net revenue that covers EBIT (Earnings before interest and taxes) multiplied by (1-tax rate of 25% per year) plus the amount of depreciation in one year [11]. . For this project value of proceeds is IDR 698,196,000/year .

3. Payback Period (PBP)

Payback Period indicates how long a period of time hinted to restore the value of investments by dividing total initial investment with total proceeds per year. Furthermore, the calculation proceeds assuming constant PBP (annuity) per year, it can be calculated PBP her as follows [11] :

$$\text{Payback period} = \frac{initial\ investment}{total\ proceeds} \qquad (1)$$

PBP for this project = 3,43 ≈ 4 years.

4. Net Present Value (NPV)

Net present value is the value on the basis of net present value time money that would come to be assessed at the present time. It will obtained from the difference of the present value of proceeds by the present value of the initial investment by taking into account the economic life and certain of discount rate[11]. From the calculations, the NPV positif for this project is 1,109,106,085. It means, crushing plant unit is feasible for set up in *Lampung Timur* regency.

5. Profitability Index (PI)

Profitability index (PI), can be calculated by comparing PV of Cash Inflow to the PV of initial Investment[11].

$$\text{PI} = \frac{PV\ of\ cash\ inflow}{PV\ of\ investment} \qquad (2)$$

The results of calculations of profitability index (PI) obtained a value is 1.46, it's greater than the number 1, so that crushing plant unit is feasible for set up in *Lampung Timur* regency.

6. Internal rate of return (IRR)

Internal rate of return used to calculate the interest rate that equates the present value of the value of proceeds. IRR is used as a benchmark level in the project's ability to generate proceeds equal to the initial investment and then compared to the level of its cost of capital. To obtain these values do interpolation approach by calculating the NPV is positive with a negative NPV, so will be obtained a certain discount factor that results in NPV value equal to 0, with the formula [11]:

$$\text{IRR} = \sum_{t=0}^{n} + \frac{net\ cash\ inflow}{(1+r)^n} = 0 \qquad (3)$$

Where; n is last period that expected; $\sum_{t=0}^{n} +$ is he amount of cash flow that discounted-right at the end of the year. From the calculation, obtained value IRR for this project is 24.08%, greater than the rate of interest used in the calculation (13%). It means, crushing plant unit is feasible for set up in *Lampung Timur* regency.

III. Conclusions

The presence of crushing plant is needed in *Lampung Timur* regency. Due to rich in raw material, the lack of competitor is still rare in that region. More over with crushing plant can improve the production of split stone which is curently done by man power. Based on financial feasibility analysis, this project is feasible to be done with pa back period almost less than 4 years.

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Chapter 27

Food Technopreneur A Design of New Curriculum in Indonesia's Higher Education

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Abstract. This article describes the curriculum design of a new undergraduate degree program in Food Technology at the Prasetiya Mulya Business School, BSD-Tangerang. The main objective of this undergraduate program is to address the country's need for producing qualified and skilful food technologytrained engineers with entrepreneurial skills. Therefore, one of the program's educational objectives is to build tomorrow's technopreneur leaders. The needs of the students, industries and other stakeholders of this program will also be highlighted in the development of the program educational objectives and program outcomes. Data and analysis of the market survey conducted from both the industry and student perspective will be presented. The curriculum structure of the program to accomplish the program outcomes will also be discussed in this article.

Keywords: Food technology, Food technopreneur, Higher education curriculum, Food industry

I. Introduction

Indonesia, as the fourth most populous country in the world with a population of 235 million people, is a very large market for food and beverage products. The sector has proven to be very resilient during economic downturns, and for many multinational food companies, Indonesia is among their most important markets. Until the last trimester of 2015, the food industry in Indonesia predicted to reach 700 trillion IDR, around 10% of Indonesia's GDP [1].

Central Bureau of Statistics reported that Food products is 7.3 % of GDP , which grew significantly to 35% from 2004 until 2010 and involved more than 5,000 business units [1]. Until now, the food industry is still a mainstay of the non-oil manufacturing sector in Indonesia.

However, to mobilize the national food industry, Indonesia still imports raw materials & food additives in a big amount. In 2014 we imported 5.6 million tons of wheat , 2.7 million tons of sugar , 2 million tons of soybeans and more than 70 % of raw materials for dairy processing industry [1]. Moreover, More than 30 % of the food additives, ranging from coloring, artificial sweeteners, preservatives, flavorings, flavor enhancers, antioxidants, acidity regulator, bleach, bund flour, emulsifiers and the thickener, still imported from Europe and the United States [1].

The above fact is ironic considering Indonesia has a big potential for natural resources. Another ironic reality is that the food technology graduates in Indonesia had only become ' spectator ' than being ' main actors ' in the food industry in Indonesia. They used to be a worker, not yet having the sense to produce new products from Indonesia's natural resources.

Central Bureu of Statistics data in 2013 describes the percentage of entrepreneurs in Indonesia amounted to only 0.24 % of the total population, in which the neighboring countries, Malaysia has reached 3 % . To reach 2% , Indonesia needs at least 3.6 million new entrepreneurs [2].

Regardless of political issues in food imports regulation, food technology curriculum in the faculty needs to be renew so that graduates of the faculty of food technology in Indonesia were having the technical ability and also has a high business spirit for the establishment of an independent nation. With the above issue, this paper tried

to explain the importance of mindset change in the pattern of education in the faculty of food technologyy, to produce not only food technology workers but also a reliable food technopreneur.

II. The Need For Technopreneurship In The Food Industry

The term technopreneurs arose from within Singapore culture to describe entrepreneurs who combine entrepreneurial skills with technology [3]. The best candidates for technopreneurship, especially in the area of food technologist are researchers as well as students with science and technology background. Therefore, the education of engineers must be a multi-frontal effort. The fundamentals of engineering must be instilled into the student. The knowledge of how to manage an enterprise must be taught and the practical method of problem solving must be applied. The engineer who barely knows how to take his or her theory out of academic idealism progresses to being someone who is a master craftsman. They become a manager of an enterprise with several roles. They must train new engineers, must operate the engine correctly, and they must review the economics of the enterprise. They must have technical, economic and people skills - not a commonly found combination. It is easy to find two of the three skills in one person; but it is difficult to fine all three skills in one person [4]. Therefore, Prasetiya Mulya Business School feels the urgent need to address this issue in the design of a new curriculum in their Food Technology

The new programme will be developed by designing the curriculum backwards by first identifying the major outcomes as the focus and linking planning, teaching and assessment decisions directly supporting these intended outcomes. The new developed programme will have a more directed and coherent curriculum so as to produce strategic thinking technoprenours, who will have the skills to succeed in a rapidly changing global business environment. This will provide an avenue for students to compete in the global business area and emerge as successful future entrepreneurs [5]. The main design objectives of this new programme can be summarised as follows:

To carry out unprecedented investigation on the level of implementation, and development of food technology in Indonesia industries and universities. • To address the industry and country's need for qualified and skillful food technology-trained engineers with entrepreneurship skills. • To propose a novel outcome-based educational model for the food technology ungraduate programme and its impact on student learning, curriculum development and assessment.

III. Business Competence in The New Curiculum of Food Technology

Prasetiya Mulya Business School applying the outcome based curriculum in designing their new department. The key underlying principles in the design of the outcome based curriculum reflects the requirements and the needs of the main stakeholders of the undergraduate programme, namely the university, industry, students and parents, and the government. In addition to the above underlying principles in the design of the outcome-based curriculum, the programme must also abide by the statutory regulations set by the university. The set of guidelines adopted for the content of the new postgraduate programme can be summarised as follows:

1) The curriculum is packaged as a eight semester (four year) programme.
2) The programme must have a minimum of 14 credit hours (1 credit is equivalent to 50 minutes of lectures or 1 hour tutorial/laboratory work).
3) The curriculum is to be built upon the foundation of a balance between food technology, business and information technology (IT).
4) The programme must instil technopreneurship knowledge in the students.
5) The curriculum must include courses from the business and marketing faculty.

The breakdown of the curriculum can be seen in the Fig. 1 below.

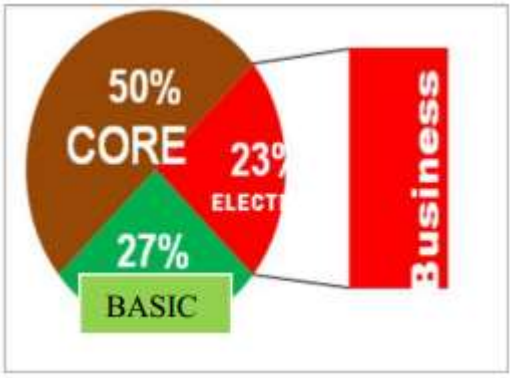

Fig 1. The breakdown of Prasetiya Mulya Business School Food Technology curriculum

For the course offered, Prasetiya Mulya Business School using the standard from the Institute of Foos Technology, USA. Below is the detail course offered in Prasetiya Mulya Business School, Food Technology Faculty.

Table 1. course offered in PMBS

Compulsory	Core	Elective
Religious studies	Food safety	Technology of fruits and vegetables
Civics	Food microbiology	Technology of muscle-based foods
Community development	Food metabolism	Cereal technology
Basic chemistry	Food biology	Milk and dairy technology
Organic and anorganic chemistry	Sensory evaluation	Confectionary Technology
Basic biology	Food processing	Beverage Technology
General Microbiology		Flavor Chemistry and Technology
Applied math	Sanitation and hygiene	Marketing research
Applied physics	Food packaging	Customer insight
Business communication	Food regulation	Business ethic
Internship	Food Biochemistry	Business development
Research method	Food additives	Business creation
	Food analysis	Managerial accounting
	Process control and automation	Analytical and craetive thinking
	Product development	Consumer behaviour

The curriculum was designed to strengthen students' knowledge in the core courses with a total of 72 credit hours. The students also have to take specialised elective courses, which are offered as specialisation in food technology and business. The electives in the specialisation area total nine 25 hours.

The proposed curriculum includes the internship program in the partner company of PMBS. After students finishing their compulsory internship program, in which they have to worked fulltime for 4-6 weeks during the holiday in semester 2 in the company, students will undertake a program of Community Development which is divided into 2 parts.

Community development course to build the capacity of student social awareness ,social adaptability and social responsibility and to build networking capabilities of students during the learning program at the Prasetiya Mulya Business School. In the Community Development course I student must do social work at least 20 hours during the semester 2 in social homes or community residences and do social projects in the group. The activity was conducted to train sensitivity, awareness and empathy in the community about a particular student need. In the Community Development II courses , students in the group will run a program of capacity building and the welfare of society through entrepreneurial activities when the semester break for a month before the 6th semester and perform project monitoring and guidance during the semester 6. Project work must have positive impact on families' partners in village.

The Food Technology Technopreneurship course is offered in the seventh semester. In this course, students will be taught about the knowledge of business organisation and management, accounting and marketing, business proposals and business financial issues. Case studies will be used to strengthen their soft skills and enhance their business strategy. This course is a co -requisite to their final year project and the assessment is based purely on reports and presentations. In the technepreneurship course, students are required to write up a proper business plan pertaining to the commercialisation aspect of their research work in the final year project.

In addition to the core and elective courses, all students are required to take courses that are basic to all undergraduate students from all disciplines. These courses are research methodology and thesis writing, and a presentation course, religious studies and civics. The detail for basic course offered in PMBS can be seen in table 2.

Table 2. Basic course offered in PMBS

Semester	Course	Credit Hour Class	Credit Hour Lab	Total
1	Religious studies	2	0	2
	Civics	2	0	2
	Business communication	3	0	3
	Principles of Food Science and Technology	2	0	2
	Academic Writing	2	0	2
	Basic chemistry	2	1	3
	Applied physics	2	1	3
2	General Microbiology	2	1	3
	Basics of Biology	2	1	3
	Applied math	3	0	3
	Scientific Writing & Presentation Skills	2	0	2
	Food Biochemistry	3	1	4
	Analytical chemistry	2	1	3
	Basic material	2	0	2
6	Product development	3	1	4
	Food enterpreneurship	3	2	5
	Food Industry Management	3	0	3
	Elective Courses	6		6
	Internship*	2	0	2
7	Business ethics	2	0	2
	Elective Courses	4		4
8	Final Project	6	0	6

IV. Conclusions

Many factors have the potential to reshape or redirect the Food engineering world. Significant changes in the responsibilities and expectations of engineers have occurred over the last ten years and will continue for the next ten. To meet the challenge of employability or marketability, engineers will still be judged by what knowledge and skills they have acquired from their education. They must equip themselves with technical expertise or risk being phased out.

Moreover, engineers graduating in food technology, outside the technical knowledge, their skills must include components such as business, soft skills and interdisciplinary food technology knowledge. Given the rapid advancement of food technology, specific job training will not prepare engineers for an entire career, but they will need additional skills such as tenhnopreneurship skills along with the ability and desire for lifelong learning. Therefore, engineers will need to have technopreneurship skills to stay employable. It is hoped that this new undergraduatgraduate course will consolidate the following aspects:

1) Creating a technopreneurship culture and increasing the supply of new entrepreneurs through a food technology project-based programme.
2) Driving a culture change towards OBE for learning in engineering programmes that can anticipate real benefits and improvement.
3) Enhancing relationships between university and industries, leading to useful linkages and seamless collaboration.

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Chapter 28

Establishing Working Relationship of Food Supplier as Part of effectiveness Food Safety Assessment: Case Study in Indonesia Global Chain Restaurants

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Abstract. Purchasing raw foods materials that are used to make our product must be carefully controlled. Selecting and evaluating the right foods supplier today has become much more critical and complex. Involving process of selecting the right supplier can help many food industries and restaurants meet or exceed regulatory standards, drive customer demand and build a strong brand reputation of quality products. Quality and safety for ingredients, products and packaging are mandatory requirement for every food business, so choosing a good supplier is a critical business decision. Consequently, supply chain team has needed to identify choosing the right supplier, as well as several best practices in the food industry or restaurant. Establishing close working relationships with our foods supplier and provide them high standards also providing feedback as to their performance would be part of effective supplier programs in food safety assessment. Some criteria that should be provide by our food supplier were considered as approved supplier such as purchasing specification, quality system compliance, Regulatory compliance and certificate of analysis. The study found that trust and communication area key element in establishing strong working relationships with foods supplier. Working relationships with foods suppliers have come to be viewed as a competitive advantage for Food Industries and Restaurant who looking for long-term economic success. Trusted food suppliers were described as communicating effectively and demonstrating a willingness to work collaboratively. Foods suppliers who communicate directly and clearly are become more effective in implementation of Food Safety assessment.

Keywords: Foods supplier, Food Safety, Purchasing specification, Quality system compliance and certificate of analysis.

I. Introduction

Food safety assessment was required to maintained and ensure the implementation of food safety management system is effective compliance, it also related with food supplier selection and agreements. Selecting the good food supplier means we make a relationship starts by defining what we are required of that supplier to be considered " Approved Supplier" the first step is telling a potential supplier exactly what you want in the form of a purchasing specification. Having many supplier can reduce control over food safety. The reduced control of sourcing raw material from many supplier can outweigh its economic benefit. An important part of a good food safety implementation depend on knowing that suppliers understand and assist in controlling hazards in a facility' products.

By having an agreement with supplier, the supplier shares responsibility for safe final product. Share as much information as possible with suppliers when developing and running the facility's food safety system. Good communication helps ensure that the facility's food safety information is up-to-date and correct.

II. Prosedure

A common method that use for Supplier Food Safety assessment includes :

1. Supplier Selection
2. Approved supplier list
3. Product Specification and controls
4. Supplier Evaluation
5. Corrective action

2.1. Supplier Selection

This step was aimed to ensure that raw material, service and other material received from supplier are safe. Commonly at food industry and restaurant in Indonesia was classified into medium risk material, high risk material and packaging. Some basic requirement for food supplier selection are listed :

a. What type of food safety system they have in place.
b. Are the product were manufacturers or wholesale warehouse.
c. GMP inspection (cleaning of equipment, storage condition for dry food, chilled food and frozen food, facility, loading delivery, personal hygiene, waste management, pest control, (Fig 1.).

2.2. Supplier Approval

This process were concerned into decision. Once they approved they were listed in the approved supplier list. Some approved supplier list should include:

a. What product the supplier is approved for
b. Detail of contract information including individual contact, name of manufacturer or wholesaler and emergency contact in case of recall.
c. Date approval and date supplier started working into our facility.

2.3. Product Specification and Controls

This program should ensure that all incoming material are meet all specifications, such as important food safety characteristic below:

a. Chemical
b. Physical
c. Microbiological
d. Sensory
e. Allergenic
f. Visual

They may also include required or allowed (numerical) limits or ranges for the test results.

2.4. Supplier Evaluation

This program was concerned into checking how well supplier controls are working, that can be observed through;

a. Inspection of incoming materials
b. On-site audits supplier
c. Input material testing

2.5. Corrective Action

This program is used when evaluation has been done, sometime this corrective action was issued in the case of nonconformance material was come into our site.

III. Results and Discussions

3.1. Supplier Selection

In Indonesia food suppliers could be categorized as a manufacturer and wholesaler. Some were established with Food Safety Management System within either manufacturer or wholesaler as we call big chain supplier, others we called it middle supplier and small supplier. In term of supplier selection as part of food safety assessment they were rarely meet any nonconforming or finding. Since they were fully concerned on food safety requirement. What we need to concern is when we deal with supplier that we need their product but in term of food safety assessment were needed to be develop as commonly we called middle supplier which is their supply a local or traditional foods, such as seasoning, cookies, traditional set menu (Table 1).

Table 1. List Priorities Food Supplier Assessment.

Requirements	Minimum Score achievement			
	1	2	3	4
Storaging method				
Facility condition				
Personal Hygiene,training and health				
Delivery Management				
Waste and pest control				

Through this matter some food industry or restaurant were classified all various food supplier into some categorized, such as ranked or scored. These method were helpful in term that they can purchase some needed specific food but still hold down any overcome issue regarding food safety implementation. In regard to big supplier we would not be needed many effort to explain further dealing with the food safety requirement, since they were aware and implemented all the food safety requirement, but in term of middle and small supplier some point due to food safety requirement would be need further communication and would sometime develop their performance with food safety implementation to minimize safety risk come into our production area and more so over eliminate food outbreak. Some food industry or were classified food supplier into certain scoring, through this scoring they would be focused on how their monitory food supplier in other way they also would be needed to develop food supplier performance (Table 2).

Table.2. Scoring table on Food Supplier performance

Category	Total Score	Note
Big Supplier	Min >75%	Verification will be held per 1 year
Middle Supplier	Min 74-60	Verification will be 6 month after listed in supplier approval list or any nonconforming high risk issue.
Small Supplier	Min 59-50	New prospect supplier were get food safety introduction as shortly they listed in the supplier approval list

3.2. Supplier Approval

Suppliers approval list are needed to be documented as this process was came after initial assessment as part of supplier selection. Mostly in food industry the list of food supplier was categorized into high risk food supplier, medium risk food supplier or low risk food supplier. High risk supplier were mostly for frozen products, meat, fish, poultry and ready to eat foods (RTE), example of medium risk food is dry food, grain, flour,etc. In fact high risk food supplier were listed to be the most supplier that need to be controlled wither in the initial assessment or during delivery processed/incoming process. Through this list also we have to know whether they have food safety program or any appropriate quality control system

Table 3. Categorized Food Supplier

Food Supplier	*Product Example*
High Risk Food Supplier	Cooked meat and poultry, dairy products, egg product, shellfish and seafoods
Medium Risk Food Supplier	Fruits, vegetable, juices, canned food, butter and confectionary
Low Risk Food Supplier	Acidic food, dry food, preserved foods, food with high sugar

Through this supplier approval list we would be needed a date of approval and signature of person in charge since this date was indicate the food supplier were started working with the contracting facility and know the person in the contracting facility responsible for this list.

3.3. Product Specification and Controls

Product specifications mean that a product must meet acceptance criteria or expectations. Which is meant refer to the specified limits for the amount or presence of contaminants, impurities or foreign material. This document will become an important control tool for the facilities which is describe the name ingredients, kind of packaging material, or chemical also the most important this is specification of acceptance criteria or reject levels. Most of incoming products were expected to be conformance with the standard but in fact some specification factor were not meet expectation in the other hand we need this product immediately to use. Here is some critical control would be needed in term we make critical control that should be conformance with the specification without any tolerance. These point should be checked and documented in every incoming product.

Table 4. List of Mandatory point during

Category	*High risk*	*Medium risk*	*Low risk*
Physical	V	V	V
Chemical	V	V	V
Product Temperature	V	V	V
Personal hygiene & Equipment Sanitation	V	V	V

Note V : comply with product specification

Incoming material inspection will be required Certificate of analysis (CoA) for each product, visual inspection and analytical laboratory testing. In real case CoA or laboratory testing were stated that the result was applied for certain period of time, so we have to accommodate that these document would not be need in every incoming process.

Table 5. Checked Parameter per Period

Inspection checked	*Period*	
	Per Incoming	Certain Time
Visual Checked	V	_
CoA	-	V
Halal	V	-
Daily laboratory checked (microbiological)	V	-

3.4. Supplier Evaluation

Verification was part Food Safety requirement, in this case we need to evaluate supplier which is mean to evaluate their performance during contract working. This evaluation could be checked during inspection of incoming materials (Fig 4.) and on-site audits of supplier with the obtained duration and score right after the selection is done (Fig 2.), input material testing combination all of them which all parameter should be checked by qualified personnel. In supplier audit, person in charge or person in contracting facilities visit the supplier's facility. For products with higher food safety risk, supplier audit help maintain safety controls over incoming material, it should be confirm for management commitment that, supplier facility and equipment are well maintained, food safety system, manufacturing quality program, regulatory requirements.

Table 6. Food Safety System applied at Restaurant and Food Industry in Indonesia

Food Safety System	*Description*	*Note*
ISO 2200	Food Safety Management System	Accredited by certification body
HACCP	Hazard Analysis Critical Control Point	Accredited by certification body
GMP	Good Manufacturing Practice	
Piagam Bintang 1	Good Manufacturing Practice	Certtified by BPOM
Piagam Bintang 2	Good Quality Practice	Certtified by BPOM
Piagam Bintang 3	GMP and HACCP	Certtified by BPOM
Sertifikasi Laik Sehat	Good Caterer practice	Certified by Health Department

3.5. Corrective Action

Corrective action would be needed when non-conformance was found during incoming delivery or evaluation audit. This non-conformance information is sent back to the supplier and they are then required to investigate and find the cause of the deviation or problem. Food supplier need to provide documents showing that the problem was found and corrected. These documents should prove that steps were taken to prevent the problem from reoccurring. Usually document may include inspection checklist, operator training records or a change to the process. A corrective action log confirms that the facility follow up on issues about supplied products. It also allows the facility to track any continuing problems in follow up with the supplier in question. We need also to define any corrective action when non conforming were happen during delivery product from supplier. In this case we need to control what action would be need to be taken effectively reduce or get rid of the hazard and define what is critical limits and corrective action was addressed what should be done if the control measure fails and or the critical limits are not met.

Table 7. Corrective Action table for many issues during receiving material

Hazard	*Control Measure and Critical Limits*	*Corrective Action*
Presence and growth of harmful bacteria	Accept deliveries from reputable supplier at a temperature that will discourage the growth of harmful bacteria Food collected must be transported in a way that will ensure that the temperature on arrival will comply with food specification	Decide if food should be rejected Review supplier Dispose of unsafe food Review collection practice or methods of transportation Reject food beyond "use by" date and review supplier
Cross Contamination	Keep raw and cooked/ready to eat foods separate use safe handling practice	Reject food which may be contaminated Review delivery methods Review staff training
Contamination from vehicle and equipment	Make sure that delivery/collection vehicle is clean Make sure that food is protected/covered	Reject food which may be contaminated Review supplier Review staff training

IV. Conclusions

Good working relationship between buyer and food supplier can increasing long term partnerships, improve the operation and food safety implementation as a whole for mutual benefit of all parties involved. However suggested that the degree of good working relationship that develops between buyer and food suppliers are likely to be more improved by continuous improvement and commitment among them in implementing Food Safety Management System all pre-requisite and procedure were need to be applied in all process and every non conformance issue would be need to get corrective action to avoid re-occurrence.

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Chapter 29

Effect of Manure and Urea on Chemical Properties of Sandy Soil and Physiological Properties of Aloe Vera L. Plant Cultivated in Coastal Sandy Area

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Abstract. Study dealing with the application of cow-manure and urea in different doses in coastal sandy land has aimed to determine the chemical properties dynamic of sandy soil and physiological properties of the aloe plant under nutrient stress condition. The research was conducted in coastal sandy area of Depok, Kretek District, Bantul Regency, Special Region of Yogyakarta, Indonesia. The Research was carried out from January until August 2015 using a factorial experiment arranged in Randomized Completely Block Design. The first factor was the doses of manure consisting of three levels, i.e 10; 20 and 30 ton ha-1. The second factor was doses of urea consisting of five levels i.e : 0; 150; 300; 450 and 600 kg.ha-1. The soil chemical properties parameters included organic C content, organic matters level, pH value, total N content, and Cation Exchange Capacity (CEC) were observed. The observation was also objected to physiological parameters of aloe plant such as leaf area, stomatal density, total chlorophyll content, plant photosynthetic rate, plant respiration rate, proline content, and aloetic acid (aloin) content. The results of the experiment indicated that there was an influence of the manure as well as urea on both the chemical properties of sandy soil and the physiological properties of aloe plant.

Keywords: Aloe vera, physiological properties, sandy soil.

I. Introduction

The Aloe vera plant has been used not only as an ornamental plant but also as a health food ingredient materials for the cosmetic industry, and as a medicinal plant [36, 11]. This plant has multifunctional therefore it has known as a Miracle Plant [7].The leaves of this plant contain fat compounds, carbohydrates, proteins, and 18 essential amino acids, four kinds of vitamins, minerals and six kinds of enzymes. It also contains secondary metabolites: alkaloids, aloins, lectins, lignin, saponins, tannins, phenolic and glucomannan. It is the synergistic activity of all these active substances that contributes to the efficacy of aloe leaves. Aloe vera leaves can be used to improve hair growth, cell regeneration, immunity, and to heal wound, skin irritations, and as anti-inflammatory, antiseptic, antibiotic, antioxidant, anticancer, and anti-cholesterol, antidiabetic, so that Aloe vera leaf is currently used as an ingredient in phytotherapeutics [9, 25, 39, 27].

Aloe plant is one of the horticultural commodities that appropriate to be developed in tropical areas such as Indonesia [12]. For the development of this plant arable land is needed, while the available arable land in Indonesia has decreased and undergone conversion. Available land is marginal land in the form of sandy soil such as coastal sandy land. Up till now the handling of coastal sandy soil is still relatively inadequate. Java Island, the most populous island in Indonesia, has an 81.000 km2 area of seaside potential to be developed as agricultural land. The Special Region of Yogyakarta, located in the southern of Java Island, has an expanse of coastland covering approximately 3.300 hectares or 4% of the total area, extending 110 km on the south coast of the country of Indonesian. The ocean stretch of sandy area is around 1-3 km from the coastline. The coastland is marginal land with the following characteristics: sandy textures, loose structure, low nutrient content, low cation exchange capability (CEC) , low water storage capacity, extremely high soil temperature during the day, highly wind speed and evaporation rate [40].

To improve the properties of sandy soil an innovative technique is required in the form of ameliorative materials such as manures. The application of manures can create better soil structure of sandy beach land [29]. Manures as the organic fertilizer not only can increase soil fertility, but also can create healthier ecosystem an environment [34]. To increase essential elements content and decrease the soil temperature of coastal sandy land can be used natural organic fertilizers [35]. Aggregation and productivity of sandy land can be increased by using properly fermented organic materials [37].

Plants growing in coastal sandy land can not only suffer due to lack of nutrients but also suffer because of high temperature condition. In high temperature plants will have more thickness leaves, wide stomatal opening, increasing gas exchange, high biomass accumulation [28]. Under stress condition plants can have physiological properties change such as net assimilation rate, respiration rate, stomatal conducting, chlorophyll content, leaf thickness, leaf area, and yield [4]. Assimilate production of the plant depends on light condition, leaf position, air temperature, CO2 concentration, water, and nutrient elements [38]. Therefore, it is exciting to study the chemical properties of sandy soil and the physiological properties of the aloe plant cultivated in coastal sandy land treated with different doses of manure and urea.

II. Materials and Methods

2.1. Description of the study

The field experiment had been conducted in the coastal sandy area of Depok, Kretek, Bantul Regency, Special Region of Yogyakarta. It has daily temperature of 31-40°C, 100% light intensity, 64-75% humidity, rainfall of 1672.5 mm.year-1. The laboratory observation had been carried out in the Crop Production Laboratory of the Faculty of Agriculture, University of Sarjanawiyata Tamansiswa, and in the Soil Science Laboratory, Plant Science Laboratory and Integrated Research and Testing Laboratory of Gadjah Mada University.

2.2. Experimental design

The research used factorial experiment arranged in a complete randomized block design with 3 replications. The first factor was the dosage of manure consisting of three levels, i.e 10 tons ha-1; 20 tons ha-1; and 30 tons ha-1. The second factor was the dosage of urea fertilizer consisting of five levels i.e: 0 kg. ha-1; 150 kg. ha-1; 300 kg. ha-1, 450 kg. ha-1; and 600 kg. ha-1. It resulted 15 combined treatments.

2.3. Experimental procedures

Experimental procedures consist of: Seedling preparations of aloe plants growth in polybag. Initial soil observation to chemical properties. Soil tillage using hoe, land plotting, and planting hole making. Application of manure as a basic fertilizer base on the treatment doses. Planting of the plant, meanwhile giving urea in one-third doses. Urea application **for** the second and third fertilization, each using one-third doses. Water irrigation was done every day in the afternoon using sprayer. Weeding was done manually. Final soil observation to chemical properties was done 6 months after planting.

2.4. Data collection and analysis

The variable for observation of the chemical properties of sandy soil included: pH, concentration of organic C, organic matter, total N and the CEC, while the physiological properties included: leaf area, chlorophyll concentration, density of stomata, photosynthetic rate, respiration rate, transpiration rate, proline concentration, and aloin concentration. The observation of pH using digital pH meter, organic C as well as organic matter using Walkley & Black method, total N using spectrophotometric method, CEC using Flamefotometer & AAS method, Transpiration rate using chlorine cobalt pepper method, stomatal density using stomatal printing and optical lab method, chlorophyll content using Winterman & Demonts, 1965 method, proline concentration using Bates, 1973 method, and aloin concentration using Thin Layer Chromatography Wagner, 1996 method. Analysis of results used analysis of variance at the significance level of 5%, followed by Duncan's Multiple Range Test at the significant level of 5 %.

III. Results and Discussions

3.1. Chemical Properties of Sandy Soil

Results of the experiment indicate that it occur an interaction between manure and urea on both organic C content and organic matter level of the sandy soil (Table 1). The results indicate that application of manure 10 t.ha-1 can increase the organic C level when 150 to 450 kg.ha-1 urea are added. Based on the results of this research, to obtain the highest levels of organic C, 20 ton ha-1manure combined with 600 kg.ha-1urea must be added to the sandy soil. A low level of organic C was obtained on the provision of 10 ton ha-1manure and without the addition of urea. This is consistent with the opinion of Islam et al. [22] that manure can improve soil organic C. Rezig et al. [30] reported that organic fertilizer can increase organic carbon waste. Similarly, Singh et al. [32] stated that organic fertilizer and chemical fertilizer can increase the organic C of the soil.

Based on the results of this study (Table 1.), in order to obtain a high organic matter content of sandy soil 20 tons ha-1of manure and an addition of 600 kg.ha-1 urea is needed. The lowest organic matter content is obtained when 10 ton ha-1 manure is added without the addition of urea. This is consistent with the report of Celik et al. [10] that the given of additional manure and compost can improve the organic matter content of the soil, and it is also in line with the report of Adeoye et al. [1] and Ibrahim et al. [21] reported that the provision of cow and chicken manures and compost can improve the organic matter content of the soil.

Table 1. The interaction between manure and urea on organic C and organic matter level

Variable Treatment: manure + urea dosages / ha	Organic C level (%)	Organic Matter level (%)
10 t + 0.0 kg.ha^{-1}	0.68 c	1.09 d
10 t + 150 kg.ha-^{1}	0.82 b	1.32 bc
10 t + 300 kg.ha-^{1}	0.78 b	1.15 d
10 t + 450 kg.ha^{-1}	1.53 b	1.53 b
10 t + 600 kg.ha^{-1}	0.82 b	1.42 b
20 t + 0.0 kg.ha^{-1}	0.86 b	1.20 d
20 t + 150 kg.ha^{-1}	0.78 b	1.13 bc
20 t + 300 kg.ha^{-1}	0.76 b	1.26 c
20 t + 450 kg.ha^{-1}	0.78 b	1.53 b
20 t + 600 kg.ha^{-1}	1.13 a	2.46 a
30 t + 0.0 kg.ha^{-1}	0.85 b	1.26 c
30 t + 150 kg.ha^{-1}	0.82 b	1./42 b
30 t + 300 kg.ha^{-1}	0.73 bc	1.26 c
30 t + 450 kg.ha^{-1}	0.79 b	1.37 b
30 t + 600 kg.ha^{-1}	1.21 a	2.10 a
Interaction	**(+)**	(+)

Note: Mean within a column followed by the same letter are not significantly different using Duncan's Multiple Range Test at the 0.05 probability level.

In this research no interactions between the application of manure and urea occur on pH, total N content, and CEC (Table 2). Based on the results of the study, provision of 20 ton ha-1 of cow manure can slightly increase the pH of sandy soil, while the addition of urea up to a dosage of 600 kg.ha-1 do not affect the pH of sandy soil. This is in accordance with the reports of Gasparalos et al. [16] and Hasan and Mahmoud [18] that organic fertilizer, can increase the pH of the soil. In another hand, Singh et al. [32] reported also that vermicomposting is able to raise the pH of the soil. Results of this study are not consistent with Sridhar et al. [33] reported that the provision of urea fertilizer can increase the pH of the soil.

The results of this study indicate that the optimum dosage to produce the highest total N content is with provision of 30 ton ha-1manure (Table 2). The total N content of 0.05% is the highest, although this still belonged to the low category. Similarly, the provision of urea fertilizer, with the optimum dosage of 450 kg.ha-1, can produce the highest total N content of 0.05%.

This is supported by Sridhar et al. [33] that high urea fertilizer can increase the levels of N total. Result of this study is not in accordance with Singh et al. [32] reported that the total N increases when an organic fertilizer is provided in combination with a chemical fertilizer..

Table.2. pH value, N Total level and C E C of the sandy soil after application of manure and urea.

Application	Dosage	pH value (H_2O)	Total N (%)	C E C (c $mol^+.kg^{-1}$)
Cow Manure	10	7.01 b	0.03 b	2.95 b
(ton.ha^{-1})	20	7.21 a	0.03 b	3.11 a
	30	7.01 b	0.05 a	3.29 a
Urea	0	7.08 p	0.03 q	3.30 p
(kg.ha-1)	150	7.04 p	0.03 q	3.50 p
	300	7.01 p	0.03 q	2.95 q
	450	7.04 p	0.05 p	3.21 p
	600	7.01 p	0.03 q	2.61 q
Interaction		**(-)**	**(-)**	**(-)**

Note: Mean within a column followed by the same letter are not significantly different using Duncan's Multiple Range Test at the 5% probability level.

Results of the research indicate that the optimum dosage to produce high CEC 3.11 was manure application of 20 tons ha-1 even this result still belonged to a very low category. Results of this study is in a line with the research of Gasparalos et al. [16]; Hornick [19]; Rezig et al. [30]; that applications of organic fertilizers can increase the CEC of the soil.

3.2. Physiological Properties

Results of the research (Table 3) indicate that provision of 30 tons manure ha-1 and the addition of 450 kg urea ha-1 produced a broader leaf blade than provision without urea, as well as with urea with of 150, 300 and 600 kg.ha-1. The addition of 600 kg urea ha-1 led to a decrease in leaf area, even lower than without urea. The results are consistent with reports by Adekiya and Agbede [2] that a combination of organic fertilizer and chemical fertilizer can improve tomato leaf area. Ayeni et al. [5] reported that the application of organic and inorganic fertilizers can increase corn leaf area. Likewise Derkota and Dha [13] reported that a combination of organic fertilizer and chemical fertilizer increases Centella asiatica L. leaf area. Amara and Mourad [3] reported that a combination of organic and inorganic fertilizers can increase the leaf area of potato plants.

Based on the research results (Table 3), the highest stomatal density is obtained on a treatment combination of 30 tons ha-1 manure and 300 kg ha-1 urea. Huishi et al. [2] reported that the stress conditions of soil can increase the density of stomata in darken colored mustard greens, and Selebasto et al. [31] reported that a stressful environment can increase the stomatal density of Arabidopsis thaliana leaves.

Results of this study indicate that treatment combinations of manure in a dosage of 20 tons and urea 450 kg ha-1 as well as manure 30 tons ha-1 and urea 600 kg.ha-1 can produce the highest total chlorophyll content (Table 3). The lowest total chlorophyll content was obtained on manure provision of 20 tons ha-1 without urea. This study indicate that like other plants, aloe plant need much amount of nitrogen to produce chlorophyll. This result is in accordance with the report of El-Sherif and Sarwat [14] that the provision of chicken manure increased the chlorophyll content of rosella leaves, and Karanatsitis and Bouva [26] that an organic fertilizer increased the pigment of chlorophyll concentration in pepper. The result is also consistent with the report of Hamid and Jawaid [17 that a combination of chicken manure and NPK fertilizer could increase pea chlorophyll, and Ibrahim et al. [21] reported that a combination of chicken manure and a chemical fertilizer could increase the chlorophyll content of Labisia pumila plant.

The results of the study (Table 3) indicate that the highest photosynthetic rate is obtained by provision of manure 30 tons ha-1 and urea in a dosage of 450 kg.ha-1. This result indicate that the higher minerals application can led higher photosynthetic rate of the plant. This is congruent with Jouyban's report [23] that a plant in a stress condition can result lower plant photosynthetic rate, due to a decrease in the production of photosynthetic enzyme.

Table 3. Leaf Area, Stomatal Density, Chlorophyll Content and Photosynthetic Rate of Aloe Leaves

Variable Treatment: manure + urea dosages	Leaf Area (cm^2)	Stomatal Density (Stomatal/mm^2)	Total of Chlorophyll Content (mg/g)	Photosynthetic Rate (µmol/mm^2/s)
10 t + 0.0 kg.ha^{-1}	100.80 f	36.55 bc	0.16 c	23.03 b
10 t + 150 kg.ha-^{1}	158.36 d	38.24 b	0.14 cd	21.26 c
10 t + 300 kg.ha-^{1}	192.31 b	30.89 c	0.20 b	15.06 d
10 t + 450 kg.ha^{-1}	185.58 c	39.64 b	0.17 b	20.51 c
10 t + 600 kg.ha^{-1}	202.48 b	39.11 b	0.17 b	23.50 c
20 t + 0.0 kg.ha^{-1}	112.25 f	31.48 c	0.14 d	28.84 b
20 t + 150 kg.ha^{-1}	182.78 c	40.19 b	0.20 b	25.17 b
20 t + 300 kg.ha^{-1}	194.01 c	35.60 b	0.17 b	18.94 cd
20 t + 450 kg.ha^{-1}	184.55 c	38.48 b	0.20 a	21.01 c
20 t + 600 kg.ha^{-1}	188.55 b	38.65 b	0.18 b	17.49 cd
30 t + 0.0 kg.ha^{-1}	195.09 b	39.35 b	0.13 d	26.08 b
30 t + 150 kg.ha^{-1}	192.36 b	35.82 bc	0.14 d	26.57 b
30 t + 300 kg.ha^{-1}	197.78 b	46.09 a	0.20 b	23.03 c
30 t + 450 kg.ha^{-1}	263.84 a	38.59 b	0.16 c	33.97 a
30 t + 600 kg.ha^{-1}	171.18 d	39.36 b	0.26 a	25.77 b
Interaction	**(+)**	(+)	(+)	(+)

Note: Mean within a column followed by the same letter are not significantly different using Duncan's Multiple Range Test at the 0.05 probability level.

Based on this research (Table 4), the highest plant respiration rate can be obtained on a application combination of manure 30 tons ha-1 and urea 150 kg ha-1. Results of this study is in line with report of Boudh et al. [8] that a compost organic fertilizer can increase the rate of respiration in ashwaganda plants (Withania sonintera L.). In one hand, Jouyban [23] reported that when the plant grow in the soil in a strees condition will have lower the respiration rate. In another hand, Likewise Fahramand et al. ([15] reported that strees condition can increase the rate of respiration of the plant.

Table 4. The Respiration Rate, The Transpiration Rate and Proline Content of Aloe Leaves.

Variable Treatment: manure+urea dosages	Respiration Rate (mg/kg/hour)	Transpirion Rate (minute/cm^2)	Proline Content (ppm)	Aloin content (ppm)
10 t + 0.0 kg.ha^{-1}	126.42 d	30.66 b	6.75 a	645.67 d
10 t + 150 kg.ha^{-1}	68.52 f	30.00 b	6.13 a	822.89 a
10 t + 300 kg.ha^{-1}	76.92 ef	28.33 b	5.38 a	524.37 g
10 t + 450 kg.ha^{-1}	124.65 d	38.00 b	5.12 a	811.29 a
10 t + 600 kg.ha^{-1}	96.25 c	48.66 a	5.12 a	676.42 c
20 t + 0.0 kg.ha^{-1}	180.23 b	18.66 d	4.49 b	492.42 g
20 t + 150 kg.ha^{-1}	144.04 c	24.00 c	4.36 b	605.72 f
20 t + 300 kg.ha^{-1}	141.33 c	31.33 b	4.12 b	637.99 d
20 t + 450 kg.ha^{-1}	142.02 c	23.66 c	3.96 c	566.97 f
20 t + 600 kg.ha^{-1}	84.82 ef	26.00 c	3.85 c	760.84 b
30 t + 0.0 kg.ha^{-1}	73.04 ef	24.33 c	3.67 c	723.41 b
30 t + 150 kg.ha^{-1}	225.98 a	26.00 c	2.66 d	627.53 d
30 t + 300 kg.ha^{-1}	144.64 c	31.66 b	2.40 d	791.50 b
30 t + 450 kg.ha^{-1}	54.69 g	33.33 b	2.28 d	567.47 f
30 t + 600 kg.ha^{-1}	158.79 bc	32.66 b	2.00 d	648.82.d
Interaction	**(+)**	**(+)**	**(+)**	

Note: Mean within a column followed by the same letter are not significantly different using Duncan's Multiple Range Test at the 0.05 probability level.

The results (Table 4) indicate that the highest transpiration rate was obtained on treatment combination of manure 10 tons ha-1 in combination with all urea 600 kg.ha-1. This result is not so consistent with the report of Kalpana [24] that the manure or organic fertilizer can increase the rate of transpiration in pepper, and quite consistent with Bahadur et al. [6] reported that a strees condition may increase the rate of transpiration in vegetables.

Based on the results (Table 4), the highest concentration of proline is obtained on a combination of manure 10 tons ha-1in combination with urea application in all doses . These results indicate that application of urea had no significantly effect on the levels of proline content of aloe leaves. Low levels of proline are obtained on treatment combination of manure 30 tons ha-1 in combination with urea of 150 – 600 kg.ha-1. These conditions indicate that higher dosage of manure can result better environment that appropriate for plant growth so it resulted lower proline content of aloe leaves. Results of the study is in accordance with Jouyban [23] reported that a strees condition increase the proline content, and Fahramand et al. [15] and Zamani et al. [41] reported that a plant in a strees condition increases in the proline content.

The results of this study (Table 4) indicate that treatment combination of manure 10 tons ha-1 and urea all doses can result higher aloin average concentration than that of other combinations. These results indicate that the application of lower dosage of manure in coastal sandy soil can create inappropriate condition for plant growth of Aloe plant so it results in higher aloin concentration of the plant.

IV. Conclusions

Good working relationship between buyer and food supplier can increasing long term partnerships, improve the operation and food safety implementation as a whole for mutual benefit of all parties involved. However suggested that the degree of good working relationship that develops between buyer and food suppliers are likely to be more improved by continuous improvement and commitment among them in implementing Food Safety Management System all pre-requisite and procedure were need to be applied in all process and every non conformance issue would be need to get corrective action to avoid re-occurrence.

Results of this research indicate that:

1. Manure application in doses of 20 – 30 tons ha-1 can create better chemical properties of coastal sandy sail, nevertheless urea applications in doses up to 600 kg ha-1 have no result better chemical properties of coastal sandy soil.
2. Manure application in doses of 20 – 30 tons ha-1 in combination with urea 300 – 400 kg ha-1 can result better physiological properties of aloe plant cultivated in coastal sandy land.
3. Manure application in doses of 10 tons ha-1 results proline and aloin concentration higher than that of manure application in higher doses.

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SECTION 3 : MEDICAL SCIENCES AND BIOMEDICAL ENGINEERING

Special Contribution

A Begin of Robot Supported Human Programming

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Abstract. Robot was created to help human in rapid manufacturing, precision work, dangerous activities, rehabilitation and medical assistance. In the last few years, humanoid robots show very advanced ability. They are able to mimic human emotion and even become sleeping partner. The advantages of robot compare to human are abilities to store and search data, use sensors for specific application, and use high level mathematical thinking to solve problem. Combination of robot and human abilities is a part of human programming and will bring human to have better life. Human is a time dependent DNA coded bioenergy symphony. They develop according to time, rule based coded in the DNA and environment influenced bioenergy symphony. As a body system, human has sensing system, processing system and actuating system. The sensing system consists of 4 sense organs and integumentary organs. The data received by sensing system is sent to processing system which is brain via nerve system. Brain will store and process the data and send result to other organs in the body as a response of stimulation given. The output can be a voice, movement or emotion signal, which is executed by human skeletal and muscular system. The stimulation given is influenced by rule based stored in DNA as well as bioenergy from environment. In order to work properly these systems are supported by circulatory system, respiration system, digestive system, urinary system, lymphatic system and endocrine system. Human development is grouped into 8 stages which is infant (0-1 years old), toddler (1-3), small child(3-6), child (6- 12), adolescence (12-20), young adulthood(20-40), middle adulthood(40-60) and late adulthood (above 60 years old). There are 3 development domains for each stages which are physical domain, cognitive domain and social-emotional domain. The development domains are interrelated and can be stimulated through physical, education and environmental interventions. These interventions are part of human programming. Human programming consists of three parts which are development domain assessment, intervention formulation and intervention management. In order to formulate intervention for specific target, the human data such as human DNA, brain data, body health information and bioenergy symphony characteristics as well as data base of intervention programs are required. This can be done with support of automation system or robot which has capability to gather human data, formulate intervention, communicate with human, as well as conduct intervention if required. In this talk, a programming method and result for toddler is presented. A smart doll is used as a smart assistant to assess toddler development abilities and conduct some interventions. The intervention data and processing program are managed by online data centre called OSCA Tool. The system has been tested in 34 children under 5 years old including six sub developmental domains: gross motor, fine motor, cognitive, language, self-help and social interaction. Test result shows that the effectiveness of the system to achieve the developmental target is more than 83% with 95 % system reliability. This result shows that the system is very promising to help human to achieve life target. This is however only “a begin of human programming” for better future mankind and universe sustainability.

Keywords: Robot, rapid manufacturing, human programming, brain data.

Chapter 30

Application Brain Wave for Wheel Robotic Movement using Mindflex

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Abstract. Brain is made up of billions of brain cells called neurons, which use electricity to communicate with each other. The combination of millions of neurons sending signals at once produces an enormous amount of electrical activity in the brain, which can be detected using sensitive medical equipment (such as an EEG), measuring electricity levels over areas of the scalp. The combination of electrical activity of the brain is commonly called a *brainwave* pattern. The experiments conducted at the beginning of this study use a wheel robotic, which is by only moving the wheel robotic to turn left, right and forward. Mindflex is a kind of device which can transmit the brain wave. The process of learning starts by setting mindflex on the head to read the brain wave. The data from the brain wave are processed in the computer so that the required value of the wave is transferred to the wheel robotic to move it forward, turn left and right according to the mind's instruction. The result of training or learning of brain wave was determined by its threshold, which was then repeated 50 times until it obtained 62% accuracy. The software used on microcontroller Arduino was C program language.

Keywords : Wheel Robot, Brainwave, wheel robotic, mindflex.

I. Background

In the human body there is a very important organ that regulates and coordinated most of the behavior, movement up the body functions homeostasis such as blood pressure, heart rate, until the fluid balance and body temperature, the organ in question is brain a central structure setting which has a volume of approximately 1.350cc and consists of 100 million cells nerves or neurons. The brain has an important role, namely, responsible for setting the entire body and the human mind so that there the link between the brain and thinking. In addition, the brain also affect which means the development of cognitive psychology, the brain is also responsible for the the function of memory, emotion, recognition, motor learning and all forms learning.

Many activities that occur in the brain is something that is very interesting to study, many researchers have previously conducted research to be able to develop tools that can deliver activity in the brain through waves recorded from the brain.

Brainwave is combination of electrical activity of the brain. The Brain is made up of billions of brain cells called neurons, which use electricity to communicate with each other. The combination of millions of neurons sending signals at once produces an enormous amount of electrical activity in the brain, which can be detected using sensitive medical equipment (such as an EEG, Mindflex).

There is now a tool that can communicate a human with computer directly through the brain's electrical signals are used, The tool is called Brain Computer Interface (BCI). By using the system BCI is a collection of sensor and processing component can wave covering the display and sensor stimulator that translates brain activity someone directly into useful control or communication waves, can be used as an assistive technology to connect different abilities Among people with the environment (Wolpaw, 2002) .Aktifitas is the case The brain is very interesting to be a research theme.

The proof of brain wave activity on EEG scalp namely (Electroencephalograpy) often used as a research object in two decades (Duvinage et al,2012). Through the EEG waves, users can deliver what thinking without saying, or in other words, the user can controlling things with his mind. But requires a lot of money to conduct such research. Now there are tools that can catch the wave EEG for control something through the mind is a tool Mindflex with price which are relatively cheaper than the tool BCI (Brain Computer Interface) more.

Mindflex is a kind of device which can transmit the brain wave. The process of learning starts by setting mindflex on the head to read the brain wave. The data from the brain wave are processed in the computer.

II. Literature Review

Brain wave is a complex wave caused by electrical impulses activities inside the brain. The higher the mental activities (conscious, focused, energetic activities) are, the higher the frequency of the waves in the brain (Gunawan, 2011).

2.1 Mindflex and Brain waves

The Mind Flex provide eight values representing the amount of electrical activity at different frequencies (Mika, 2012). This data is heavily filtered/amplified, so where a conventional medical-grade EEG would give you absolute voltage values for each band, NeuroSky instead gives you relative measurements which aren't easily mapped to real-world units. A run down of the frequencies involved follows, along with a grossly oversimplified summary of the associated mental states.

- Delta (1-3Hz): sleep
- Theta (4-7Hz): relaxed, meditative
- Low Alpha (8-9Hz): eyes closed, relaxed
- High Alpha (10-12Hz)
- Low Beta (13-17Hz): alert, focused
- High Beta (18-30Hz)
- Low Gamma (31-40Hz): multi-sensory processing
- High Gamma (41-50Hz)

2.2. Wheel robotic

A wheel robotic which has two wheel can move to turn left, right and forward. The device is controlled by using microcontroller Arduino. Arduino Uno is a microcontroller or a small computer which can be programmed to process input and output between the equipment and connected external component (Sandin, 2003). The specification of the device is as shown in Table 1.

Table 1 Device Specification

NO	*DEVICE*	*TYPE*
1.	Microcntroller	Arduino Uno
2.	Motor DC	5 -12 Volt DC
3.	Motor Driver	2A for DFROBOT
4.	Wifi transmiter & Receiver	CS 3000

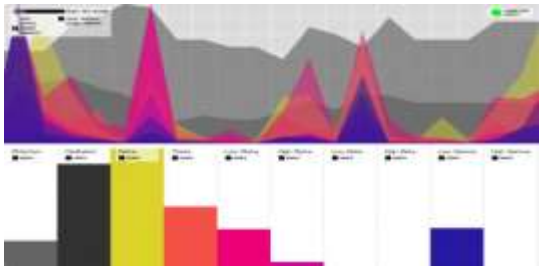
Whereas the data input sent is as shown in Table 2

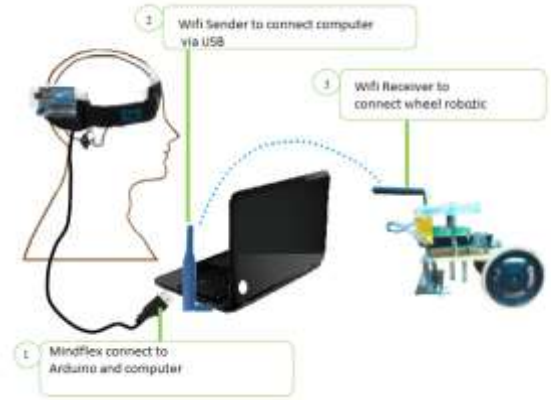
Table 2 Series of Data Input on Robotic Arm

NO	*DATA OF INPUT*	*ACTIVITY OF WHEEL ROBOT*
1.	A	Forward
2.	B	Turn left
3.	C	Turn Right

III. Results and Discussion

The experiments in this study were conducted by setting Mindflex to a person who then exercised to be able to produce three kinds of data so that he could move the wheel robotic according to Table 2.2. The procedure of the experiment is shown on the scheme on Fig. 1.



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200,0,0,670016,27766,8515,36018,39236,33040,33201,35580
200,0,0,403789,173418,73424,114277,60615,87908,72202,59514
200,0,0,103907,9061,6300,4445,2553,3780,7491,6766
200,0,0,46185,38494,32585,7639,10915,18850,28676,8507
200,0,0,905147,32790,26684,8992,12675,29960,9482,39410
200,0,0,956075,42960,17862,41838,45825,32038,127149,60657
200,0,0,546509,392029,123992,48736,30735,285507,71626,104190
200,0,0,972250,44677,24686,45534,25744,32916,39124,9025
200,0,0,38122,51933,49167,9984,10991,12249,32522,22006
200,0,0,664311,40775,35738,18316,32674,46771,23267,12373
200,0,0,901724,80865,4168,81148,16836,36502,50915,24260
200,0,0,645045,105216,22568,25301,59625,15651,9641,27785
```

Fig.1 Schema of Brain Wave and Wheel Robot

Fig. 1 shows a person who uses a Mindflex on his head so that his brain wave is read to produce eight values of brain wave sent to a computer. For the time being, there are two kinds of waves used: Alpha and Beta. The experiments were carried out by focusing and relaxing to produce data as Table 3.
The result of the experiment for generated threshold value in Table 3.

Table 3 The Result of Threshold Experiment

Conditional	*Alpha*	*Beta*
Focus	$40.290 \leq Alpha < 148.707$	$150.493 \leq Beta < 292.865$
Relax	$151.029 \leq Alpha < 254.638$	$150.493 \leq Beta < 241.987$
Normal	$10.980 \leq Alpha < 150.000$	$12.304 \leq Beta < 150.000$

and activity of wheel robotic in Table 4.

Table 4 Threshold and Activity of Wheel Robotic

Conditional	*Activity Wheel Robot*	*Text to Sent via Serial Port*
Normal	Forward	A
Focus	Turn left	B
Relax	Turn Right	C

The result of experiments to move the wheel robotic for 50 times can be seen in Table 5.

Table 5 The Result of Experiments to Move The wheel Robotic

No	*Target*	*Value of*		*Result*	*Status*
		Alpha	Beta		
1	Normal	99700	125080	Normal	True
2	Normal	102374	134490	Normal	True
3	Focus	137944	124800	Normal	False
4	Rilex	128775	120096	Normal	False
5	Focus	167004	187540	Rilex	False
6	Normal	100280	167599	Normal	True
7	Rilex	175840	184653	Rilex	True
8	Rilex	126749	97748	Normal	False
9	Focus	139863	99583	Normal	False
10	Normal	138769	149859	Normal	True
11	Normal	109785	139097	Normal	True
12	Focus	168579	186950	Rilex	False
13	Rilex	183746	189822	Rilex	True
14	Normal	147239	123498	Normal	True
15	Focus	164387	204957	Rilex	False
16	Focus	134984	175034	Focus	True
17	Rilex	214940	183470	Rilex	True
18	Normal	140459	149845	Normal	True
19	Normal	140002	165709	Focus	False
20	Focus	134923	175039	Focus	True

No	*Target*	*Value of*		*Result*	*Status*
		Alpha	Beta		
21	Focus	123495	130458	Normal	False
22	Rilex	132040	167402	Focus	False
23	Rilex	173901	183940	Rilex	True
24	Focus	143095	173928	Focus	True
25	Normal	130249	149240	Normal	True
26	Normal	130983	100394	Normal	True
27	Rilex	163910	164028	Rilex	True
28	Normal	183470	209384	Rilex	False
29	Focus	198347	187340	Rilex	False
30	Normal	173409	163984	Rilex	False
31	Rilex	201989	198437	Rilex	True
32	Normal	130324	128479	Normal	True
33	Focus	109238	98421	Normal	False
34	Normal	102349	129048	Normal	True
35	Rilex	174901	192038	Rilex	True
36	Rilex	201924	231984	Rilex	True
37	Rilex	123846	124987	Normal	False
38	Focus	139018	109484	Normal	False
39	Normal	128469	142252	Normal	True
40	Focus	120420	167492	Focus	True
41	Normal	130983	143254	Normal	True
42	Normal	124325	98685	Normal	True
43	Focus	196463	176889	Rilex	False
44	Focus	145478	186575	Focus	True
45	Rilex	187575	197646	Rilex	True
46	Rilex	208976	278964	Rilex	True
47	Normal	132445	107957	Normal	True
48	Normal	145378	124266	Normal	True
49	Normal	109769	176443	Focus	False
50	Rilex	124366	198656	Focus	False
Total					T=31 F=19
	Prosentation= (31/50)*100%				62%

IV. Conclusions

The learning or training of moving the wheel robotic through brain wave using mindflex should be carried out repeatedly to obtain the required, slightly stable threshold value.The result of experiment to control the robotic arm for 50 times yielded 62% accuracy.

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SECTION 4 : LIFE AND APPLIED SCIENCES

Special Contribution

Some Examples of Designing Integrated Heterogeneous Catalyst System

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Abstract. The design and synthesis of particulate materials for new catalyst systems with novel properties remain a big challenge today. Here an attempt has been made to synthesize particulate materials for several heterogeneous catalytic systems, which contain examples from our recent research projects in this area. The particulate catalysts have been designed for single centre catalyst, phase-boundary catalyst, bifunctional catalyst, photocatalyst and chiral catalyst. In our current research, the synthesis of wellaligned titanium dioxide catalyst with very high length to the diameter ratio was also demonstrated for the first time by sol-gel method under magnetic field with surfactant as structure aligning agent.

Keywords : Particulate materials; Heterogeneous catalytic system; Synthesis of titanium dioxide under magnetic field; Liquid-gas boundary catalyst; Bifunctional catalyst;

Chapter 31

Mitigation of N_2O and CH_4 emissions from Corn Field using Urea Granulated with Nitrification Inhibitors and Zeolite

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Abstract. Agriculture accounted considerably to the greenhouse gases emission such as N_2O and CH_4. The aim of study is assessing reduction of N_2O and CH_4 emissions from corn field fertilized with urea granulated nitrification inhibitor namely dicyandiamide (DCD) and neem (N) and zeolite as slow release media. The results show that nitrification inhibitors and zeolite is reducing both N_2O and CH_4 emissions from corn field fertilized. We observed that the application of urea (U) with dicyandiamide (UD), U with zeolite (UZ), U with neem (UN), U with zeolite+neem (UZN), and U with zeolite+ DCD decreased the N_2O emissions by 86.73%, 59.65%, 16.38%, 66.85%, and 81.94%, respectively. Therefore, larger reduction of N_2O emission in corn field was applied by UD. However, applying UD in field seems enhance CH_4 emission 0.95 kg CH_4-C ha^{-1} $season^{-1}$ compared to other treatments. The observations should be further being tested to an integrated abatement of agricultural nitrogen as well as carbon losses.

Keywords: Cornfield, Emission of N_2O and CH_4, Mitigation, Nitrification inhibitor

I. Introduction

Urea ($CO(NH_2)_2$ has been widely used by farmers as a major source of nitrogen to support corn production. The use of urea fertilizer in agriculture in order to increase the quantity and quality of agricultural food production turned out to have an impact on ozone layer depletion due to enhance the Greenhouse Gas emissions particularly N_2O gas (IPCC. 2007).

Plants require nitrogen as a constituent element of proteins, nucleic acids and other important organic molecules. Plants absorb nitrogen in the form of ammonium (NH_4^+) and nitrate (NO_3^-). Ammonium cation form are bounded by the negatively charged of soil particles, therefore that are relatively stable in the soil. Conversely, in the form of NO_3^- anion is more mobile and is not retained by soil particles so easily swept away by runoff or missing gas vaporized in the form of N_2O, NO and N_2 through nitrification and denitrification processes and thus potentially become as greenhouse gases, (Firestone and Davidson, 1989)

One of biggest contributors to global warming today is methane (CH_4) resulting from agricultural land and livestock (especially of the digestive system of animals), and nitrous oxide (N_2O) from the use of nitrogen fertilizer (IPCC, 2007).

Greenhouse gases capable of absorbing solar radiation in the atmosphere, causing the temperature at the surface of the earth becomes warmer. However, various human activities, particularly agriculture sector as well as industrial processes and transport, causing GHG emitted into the atmosphere continue to rise. As a result, there was a change in the composition of greenhouse gases in the atmosphere. Then this causes the radiation reflected back by the earth's surface into space constrained, causing the accumulation of heat in the atmosphere (Mosier and Kroeze, 2000).

Emissions in agricultural land is determined by the denitrification process in anaerobic soil conditions and nitrification in aerobic soil conditions. The process of release of nitrous oxide from the soil into the air which is influenced by diffusion processes in the soil and the soil's capacity to consume N_2O, which is determined by several factors, among others, production footprint in the soil, soil texture and soil water content (Jumadi et al, 2005; 2008). Denitrification is the final step in nutrient cycling of nitrogen in anaerobic atmosphere wherein the fixed nitrogen is returned to the atmosphere in the form of N_2O (Di and Cameron, 2006).

Reduction of greenhouse gas emissions resulting from the provision of urea fertilizer on crops can be done by adding a slow-release materials such as zeolites and nitrification inhibitors (neem and DCD) on urea fertilizer used (Majumdar et al, 2001;2004). Neem as a natural nitrification inhibitor and DCD as synthesis nitrification inhibitors. Neem seeds contain secondary metabolites such as polyphenols or certain unsaturated fats that can act as inhibitors of nitrification and can improve the efficiency of urea fertilizer (Malla et al, 2010). However, the urea granulated with nitrification inhibitor and control slow release has not been use in Indonesia to reduce emissions of greenhouse gases and rate nitrification.

II. Materials and Methods

This study was conducted over 6 months beginning in July 2014 until February 2015 in Balitsereal Indonesian Cereals Research Institute (ICERI), Maros (4°59'11.3"S 119°34'34"E). This study consisted of seven treatments namely control (K), urea (U), urea zeolite (UZ), neem urea (UN), urea dicyandiamide (UD), neem zeolite urea (UZN), and urea zeolite dicyandiamide (UZD) with three replicates. Granulating of fertilizer were made using inclined pan granulator.

Fertilization was done in split time, 100 kg N/ ha for the first fertilization and 100 kg N/ha for the second fertilization. The first fertilization is done on the 7th day after planting the seed and fertilizer second is 29 days after planting the seed.

N_2O and CH_4 emission rate was measured using chamber closed method (Jumadi et al, 2008) Basic chamber put into the ground as deep as 2-5 cm around the corn crop. The temperature inside the chamber is measured using a thermometer. Gas sampling is done at minute 0 and 20 every 4 days during corn planting season. Gas retrieval performed at 8:00 to 11:00 a.m. Gas samples were taken around 30 ml and then immediately transferred into the vacuum vial. The concentration of N_2O was determined by gas chromatography (Shimadzu, GC 14B) equipped with eletctron capture detector (ECD), while the concentration of CH_4 with flame ionization detector (FID). The rate of N_2O and CH_4 were calculated from the change in concentration of N_2O and CH_4 over time. The cumulative rate of N_2O and CH_4 per season from the field were obtained by integration of N_2O or CH_4 fluxes during the cropping season. The EF = Emission Factor was calculated using the following equation.

$EF\ (\%) = (T_F - T_{UF})/\ N\ x100$

Where: T_F danT_{UF} = Cumulative rate of N_2O emitted from the nitrogen applied to the plot and the plot of non-nitrogen (control), respectively (kg N_2O-N ha-1 season-1) and N = the amount of nitrogen that is used in the field (kg N ha-1 season-1)

Percentage loss of N_2O produced from fields with nitrification inhibitors or nitrification inhibitor and zeolite combination was calculated using the following equation.
N_2O Reduction (%)=(A-C)/ (A-B) x100

Where A is the cumulative emissions of N_2O in the urea plot, B is the cumulative emissions of N_2O in the control plot, and C is the cumulative emissions of N_2O in the plot nitrification inhibitor (UZ, UN, UD, UZN, UZD).
NH_4^+ and NO_3^- concentrations were determined by weighing 10 grams of soil then put in clean plastic sample bottle and extracted with 50 ml of 2M KCl solution. Amounts of NH_4^+ and NO_3^-were determined by the nitroprusside (Anderson et al. 1989) and Hydrazine reduction (Hayashi et al. 1997) methods, respectively. Standard deviations and means of the data were calculated. Each mean was compared with others using the least significant differences (LSD=0.05) value by SPSS software (Ver.20.0 for windows, SPSS Inc., Chicago, USA).

III. Results and Discussions

The emissions of N_2O emissions were observed peaked on 44 days after transplanting (DAT) for all treatments where counted as K (0.03), U (0.98), UZ (0.37), UZD (0.15), UZN (0.34), UD (0.08), UN (1.3), then gradually decrease until 84 DAT (Fig.1). While, CH4 gas were emitted on 52 DAT, as K (0.3), UZN (0.01), UZD (0.12), UD (0.37), UN (0.035). Therefore, flux of N_2O was highly emitted at urea treatment compare to UZ, UZN, and UN than UD and UZD treatments which might be zeolite acts as a slow-release fertilizer and inhibition of nitrification process.

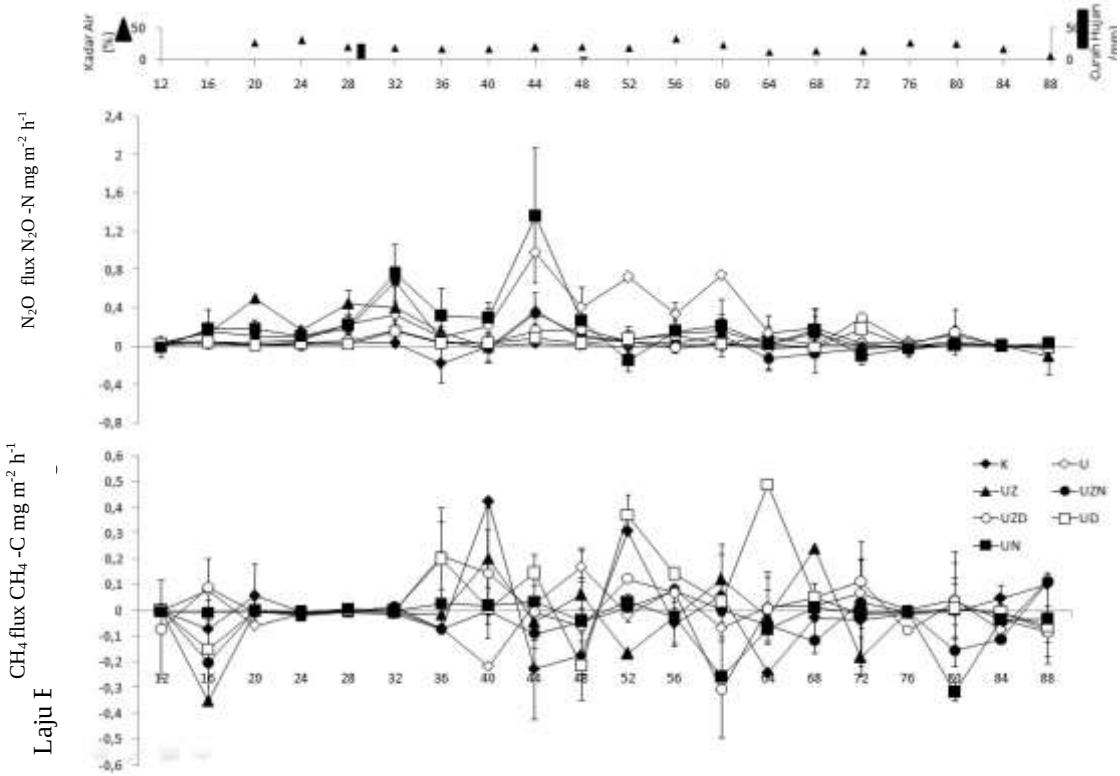

Fig. 1. Emission gas of N_2O, CH_4 , soil moisture, dan precipitation in a season corn plantation.

Addition of of neem less effective in inhibiting nitrification process due to the nitrogen organic on neem can be utilized by microbes as amonification process in which ammonium is produced. Hence, production of N_2O gas at low rate emissions generated by UZD and UD, which also indicates that UZD and UD effective in inhibiting nitrification and denitrification in the corn field. According Jumadi, et al (2006), reduction of N_2O emissions by

DCD effective under aerobic conditions, and larger accounts for the results of N_2O in the process of denitrification under waterlogged conditions. In addition to aerobic conditions, the concentration of N_2O emissions are also influenced by several factors such as soil temperature, soil moisture, soil aeration status, structure, texture, precipitation/ irrigation, pH, organic matter content, soil type, rainfall and soil water content.
The highest emission factors generated by the urea due to the absence of nitrification inhibitors in combination with urea to lead nitrification and denitrification to release of N_2O into the atmosphere. Emission factor of UN was generated higher than UD, while UZN was higher compared with UZD. Emission factor is a representative value that connects a quantity of pollutants released into the atmosphere from an activity related to the sources of pollutants (Jumadi et al, 2008). These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of activity which emit pollutants
The number of nitrogen escaping into the atmosphere per growing season (July to September 2014) the highest in the plot urea with 4.36 kg N ha^{-1} $season^{-1}$ followed by the UN with 3.64 kg N ha^{-1} $season^{-1}$, then plot UZ and UZN each 1.76 kg N ha^{-1} $season^{-1}$ and 1.44 kg N ha^{-1} $season^{-1}$. UZD and UD for each 0.78 kg N ha^{-1} $season^{-1}$ and 0.57 kg N ha^{-1} $season^{-1}$. Therefore, Reduction of N_2O emissions by addition of UD was highest around 86.7% then UZD, UZN, UZ, and UN as 81.9%, 66.8%, 59.6%, and 16.3 respectively (Table 1). Nitrification inhibition is an effort to minimize N losses through leaching. Malla et al (2005) suggested that in order to reduce N losses and increase efficiency, one of the mechanisms is the use of nitrification inhibitors.

Table 1. The Emission Factor (EF%) and N_2O Reduction in a season corn plantation

Treatment	*Total gas (Kg N_2O-N/ha/season)*	*EF %*	*Reduction %*
K	$0,31^{a}$		
U	$4,6^{d}$	2,1	
UZ	$2,0^{bc}$	0,8	59,6
UN	$3,9^{cd}$	1,8	16,3
UD	$0,8^{a}$	0,2	86,7
UZN	$1,7^{a}$	0,7	66,8
UZD	$1,1^{a}$	0,3	81,9

Description : The numbers followes by the same means it isn't real in the standard of α = 0,05

The concentration of N_2O emissions were influenced by several factors such as soil moisture and soil aeration status, structure, texture, porosity and precipitation, pH, organic matter content, soil type, rainfall and soil moisture content, Increasing concentrations of N_2O emissions were affected by soil moisture at 44^{th} day (Fig. 1). N_2O gas is produced naturally in soils by microbiological processes, nitrification and denitrification. Nitrification bacteria which is Chemoautotrofik bacteria play a role in the process of nitrification and denitrification that is responsible for the loss of N from crop land (Di and Cameron, 2006)
Nitrification is the oxidation of ammonium to nitrate via intermediate products nitrites, while denitrification is the reduction of nitrate to nitrogen gas and by products such as nitrite also. Nitrification is the ammonium oxidation process to produce nitrate involving two groups of microorganisms, namely ammonium group and nitric oxide oxidation bacteria. Nitrification inhibitors used are neem and dicyandiamide (DCD).

Polyphenol compounds, such as tannins contained in the neem seeds, is one of the components of the organic material that is only able to be utilized by fungi , especially Aspergillus and Penicillium genus, so it can not utilize or severely hampered. Heterotropik microbes such as *Aspergillus flavus* can also perform nitrification, but its effectiveness is considered less important than nitrification bacteria chemoautotrop (Jumadi et al, 2005). Although in around the roots of plants rhizosphere available amino acids in large amounts, the polyphenol compounds would inhibit the activity of several genera of bacteria in produce N_2O (Conrad and Klose, 2006). Nitrification inhibition process possibly by inhibiting the enzyme hydroxylamine oxidoreductase and ammonia monooxygenase in

bacteria, so it can suppress the conversion of ammonium to nitrite or suppress the conversion of nitrite to nitrate, thus resulting N_2O emissions are low.

Inhibition of the nitrification process can be determined by doing analysis of ammonium and nitrate. Ammonium and nitrate is an indicator of the occurrence of nitrification in the soil, if nitrate in the soil high and ammonium low that is indicating that nitrification occurs while the ammonium in the soil when the high and low nitrate indicates that the nitrification process is inhibited (Table 2 and 3).

Table 2. Change of Ammonium (NH_4^+) concentration during corn plantation

Treatment	*Days After Planting*					
	68	72	76	80	84	88
K	13,2	9,65	42,1^{ab}	38,1	10,5	64,3^{ab}
U	14,4	11,28	34,5^{ab}	34,5	25,2	132,5^{a}
UZ	14,7	12,41	56,6^{b}	55,6	13,9	108,8^{ab}
UN	11,4	9,30	22,4^{a}	32,2	14,6	31,8^{ab}
UD	11,2	7,79	37,5^{ab}	50,2	29,2	64^{ab}
UZN	16	13,81	35,2^{ab}	56,9	15,6	27,9^{b}
UZD	15,5	9,61	46,6^{ab}	32,2	55,7	41,9^{ab}

Table 3. Change of Nitrat (NO_3^-) concentration during corn plantation

Treatment	Days After Planting					
	68	72	76	80	84	88
K	13,8	6,3^{b}	31,9	7,1^{a}	3,4^{b}	17,3^{c}
U	20,7	13,6^{a}	47,5	12,1^{a}	4,7^{c}	33,5^{c}
UZ	16,9	29,9^{a}	56,4	40,2^{b}	5,5^{c}	21,6^{ab}
UN	16,8	5,1^{b}	64,4	46,5^{b}	1,9^{a}	24,2^{c}
UD	28,3	11,9^{ab}	46,4	6,3^{a}	5,2^{c}	7,00^{a}
UZN	24,4	23,7^{a}	44,8	13,3^{a}	4,6^{c}	12,7^{ab}
UZD	19,4	26,9^{a}	77,8	10,9^{a}	11,6^{d}	12,9^{ab}

Description: K (Kontrol), U (urea), UZ (Urea Zeolit), UN (Urea Neem), UD (Urea Dicyandiamide), UZN (Urea Zeolit Neem), Urea Zeolit Dicyandiamide). The numbers followes by the same means it isn't real in the standard of α = 0,05

Availability of nitrate in the soil is one of the factors that determine the rate of denitrification. NO_3^- very unstable on waterlogged soil conditions, which in a few days after the flooding nitrate will be lost as N_2O and N_2 through denitrification. Denitrification processes generate N_2O in anaerobic atmosphere, but it is reported that the process can take place in the presence of O_2 (Di and Cameron, 2006).

Contrast to N_2O, CH_4 not only produced through microbial activity but can also be produced from the transport of coal, natural gas, and petroleum. The low concentration of CH_4 gas emissions produced because of low rainfall on agricultural land. According Conrad and Klose (2006) Methane is produced as the end result of microbial processes through the process of anaerobic decomposition of organic matter by methanogenic archeae. These archeae only active when soil conditions in the stagnant state.

Increasing emissions of CH_4 gas on 52th day were K (0.3), UZN (0.01), UZD (0.12), UD (0.37), UN (0.035) and decreased on 88th day each UZ (-0.07), UZD (-0.08), UD (-0.06), and UN (-0.03). While the increase in N_2O emissions on 44th day for all treatments that K (0.03), U (0.98), UZ (0.37), UZD (0.15), UZN (0.34), UD (0.08), the UN (1.3) and decreased on 84th day, respectively K (0,012), U (0.003), UZ (0.008), UZN (0,005), UZD (0.0007), UD (0.01), and UN (-0.0003).

Comparing urea to control, the emissions of CH_4 and N_2O highest generated by U fertilizer whereas the control treatment generates the lowest CH_4 and N_2O (Fig. 1). Then, if the comparison of granulated urea fertilizers with nitrification inhibitor experienced (Neem) and synthesis (Dicyandiamide) The highest gas emissions produced in the emissions of CH_4 gas is UD and UZD, while the lowest CH_4 emissions generated are UN and UZN. It is inversely proportional to N_2O emissions that was generated the highest N_2O emissions generated by the UN and UZN, whereas the lowest was UD and UZD Methane (CH_4) will only be formed on the surface of the soil is very reductive conditions, stagnant in the long term as well as swamps, ponds, dams, or water basin. Being in areas experiencing flooding and drying alternately (alternate) such as rice cultivation systems, reductive conditions to produce gas (CH_4) is relatively difficult to achieve. In addition to anaerobic conditions , other factors that affect the formation of CH_4 gas is pH. Soil pH is measured with a range of 5,4 to 6,8. Methanogenic require an environment with optimum acidity slightly different to breed. Low pH can inhibit archeae growth asidogenesis, while a pH below 6.4 can be toxic to methanogenesis. pH range suitable for archeael proliferation while the pH range of 6,6 to 7 methanogenesis in general is from at pH 6,4 to 7,2.

Methanogenic archeae use carbon compounds and energy to make the process of methanogenesis, carbon compounds are used eg compound mixture of H_2 and CO_2, formic, methanol, methylamine, acetate. Methanogens also play an important role against rotation H_2 in anaerobic environments (Conrad and Klose, 2006).

IV. Conclusions

The urea granulation without nitrification inhibitors (U) significantly increased the emission of N_2O. Urea dicyandiamide (UD) has highest reduction among treatments, but that is not significantly different from the urea zeolite dicyandiamide (UZD), urea zeolite neem (UZN), and control (K). This indicates that the UD, UZD, and UZN effective in inhibiting nitrification process, while CH_4 emission .

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Chapter 32

Influence of the Concentration of Ga-doped on the Structural and Optical Properties of ZnO Thin Films

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Abstract. Gallium (Ga) doped zinc oxide transparent conductive films were deposited on corning glass by homemade DC magnetron sputtering. Influence of Ga-doped concentration on the structural and optical properties of ZnO:Ga thin films were studied by XRD and UV-Vis spectrometer. The XRD pattern demonstrated that crystallinity of the film was improved with increasing Ga-doped concentration from 1 to 2%, but the peak (002) intensity of the samples deposited at Ga doped 3% significantly decreased with increasing Ga-doped concentration. The optical transmittance of ZnO films with 1 and 2% Ga-doped concentration are about 85% in the visible range and the films deposited at 3% Ga-doped concentration is about 70%. Band gap of the ZnO thin films are 3.28, 3.25 and 3.22 eV for 1, 2 and 3% Ga-doped concentration respectively.

Keywords: ZnO, Ga-doped, DC magnetron sputtering

I. Introduction

Transparent conductive oxide (TCO) thin film materials such as zinc oxide (ZnO) and indium tin oxide (ITO) have been widely to used as transparent electrodes, window materials for display and solar cells. These materials have received much attention because their interesting optical and electrical properties [1]. ZnO is a promising alternative to ITO in TCO applications, due to inexpensive, non toxic, relatively low deposition temperature and chemical stability [2], and wide band-gap (3.4 eV) [3]. However, the properties of the pure ZnO are unstable [4]. Therefore, to enhance these properties, ZnO can be doped with some dopants. The group III such as B, Al, Ga, and In have been doped to ZnO crystals [5]. The atom dopants replace the Zn site in the ZnO crystal. In this case, more one free electron has been generated.

From all dopant elements, Ga is the most effective for ZnO [4] because the covalent bond length of Ga-O (1.92 Å) and Zn-O (1.97 Å) is similar. Therefore, the doping of Ga to the ZnO crystal can be reduced the deformation of the ZnO crystal structure.

ZnO films have been grown by many methods. Among the preparation techniques, sputtering method is promising with several advantages. The films can deposit in large area and the growth rate is high enough [6]. Also, sputtering method is low cost of the source materials [2]. In this study, ZnO:Ga thin films with different Ga concentration were fabricated by using homemade dc magnetron sputtering. The structural and optical properties of ZnO:Ga films were investigated

II. Experimental Procedure

A homemade dc magnetron sputtering system was employed for the deposition of ZnO:Ga thin films on corning glas substrates at substrate temperature at 400°C. A sintered targed with a mixture of ZnO (99.999 % purity) and Ga_2O_3 (99.999 % purity) was employed as the source materials. The target diameter was 2.5 cm with total mass of 10 gram. The amount of Ga_2O_3 added to the target was varied at concentration 1 and 3 (wt. %) respectively. The dc sputtering power was kept constant at 30 watt. The ultrasonic bath was used to clean corning glass substrates with aceton and methanol solution for 15 minutes. All the films were deposited at 60 minutes deposition time.

The structural properties were analyzed with X-ray diffractometer (XRD) with $Cu-K_\alpha$ radiation (1.5406 Å). The optical transmittance measurement was done by UV-Vis spectroscopy. The samples were characterized at room temperature. The characterization results have been compared with the properties of ZnO:Ga (2%) in the previous work [7].

III. Results and Discussions

Fi. 1 shows the XRD spectrum for ZnO:Ga thin films at 1 and 3% Ga-doped concentration. The spectrum has been compared by ZnO:Ga (2%) XRD spectrum in the previous work [7]. As shown in Fig. 1, a strong (002) peak is observed at 2θ = 34.4 and a weak (004) peak for all samples. These crystalline dimension along *c*-axis is 34.57, 34.44 and 34.05 for 1, 2 and 3 % Ga concentration respectively, as estimated by Scherer formula. These peaks indicate that the crystal structure almost independent of the Ga-doped concentration. Only the films deposited with 3% Ga-doped concentration showed a weak (101) peak. It reveal that all of the obtained ZnO thin films were polycrystalline with the hexagonal wurzite structure and had a preferred orientation with *c*-axis perpendicular to the substrates [8]. These films showed that no Ga_2O_3 phase was found from the XRD patterns, which implies that Ga atoms substitute Zn atom in the hexagonal lattice or probably segregate to the non crystalline region and form Ga-O bond. Ma *et al.* [2] believed that much of Ga is able to ionize into Ga^{3+} and substitute Zn^{2+}, so that it can contribute a free electron from each Ga atom.

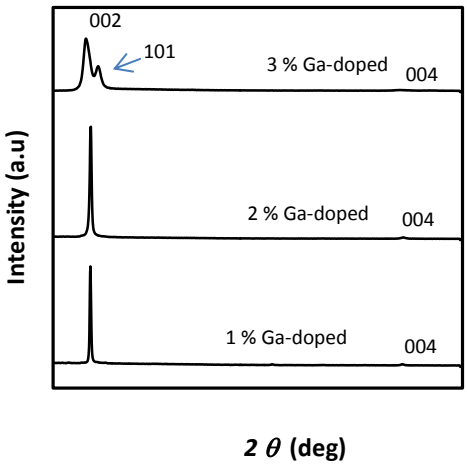


Fig. 1. X-ray diffraction patterns for ZnO:Ga thin films deposited at different Ga concentrations.

As the deposition Ga concentration doped increases, the diffraction angle does not change significantly and the intensity of of the (002) peak becomes more intense and sharper at 2% Ga concentration. However, when the Ga concentration at 3 %, the intensity of the (002) peak becomes very weak, which can be indicated to degraded the crystallinity of the samples. This is could occur because the number of Ga nuclei increase during the deposition process so that the distribution of crystallities became more random [9]. Thus, the XRD pattern demonstrated that crystallinity of the film was improved with increasing Ga-doped concentration from 1 to 2%, but the peak (002) intensity of the samples deposited at 3% Ga-doped concentration significantly decreased with increasing Ga concentration.

TABLE I
STRUCTURAL PARAMETERS OF GALLIUM DOPED ZINC OXIDE THIN FILMS DEPOSITED AT DIFFERENT ARGON CONCENTRATION

Sample	2θ (^{o})	Lattice constant c (Å)	Crystal size (nm)	d-spacing (Å)
1% Ga-doped ZnO	34.57	0.519	42	2.59
2% Ga-doped ZnO [7]	34.44	0.520	24	2.60
3% Ga-doped ZnO	34.05	0.526	12	2.63

Table I shows structural parameters of the ZnO:Ga thin films deposited. It clearly shown that the Ga concentration has a great influence on ZnO:Ga crystal size. These parameters reveal that increasing of the Ga-doped concentration reduces crystal size. However, the *c*-axis lattice constant, increased from 0.519 to 0.526 Å with increase in the Ga concentration. The increase in the *c*-axis lattice occurs probably due to the increase in substitution of Ga^{3+} ions, so that increase the repulsive force total. Crystal size decrease from 42 to 12 nm with increasing Ga concentration showed that ion Ga^{3+} more random distribution.

TABLE II
LATTICE STRAIN AND STRESS VALUE OF GALLIUM DOPED ZINC OXIDE THIN FILMS DEPOSITED AT DIFFERENT ARGON CONCENTRATION

Sample	Lattice strain	Stress (GPa)
1% Ga-doped ZnO	0.1555	- 36.2234
2% Ga-doped ZnO	0.2068	- 48.2022
3% Ga-doped ZnO	0.5791	- 134.9198

Table II shows lattice strain and stress value of ZnO thin films with different Ga concentration doped. Lattice strain and stress values can be analyzed from XRD spectra. Lattice strain value of the ZnO:Ga films can be found with tangent formula [10]

$$\varepsilon = \frac{\beta}{4\tan\theta} \quad (1)$$

Where ε is lattice strain, β is full width half maximum (FWHM) and θ is diffraction angle. Stress of the films is given by Eq.2.

$$\sigma_{film}^{XRD} = -233\varepsilon \quad (2)$$

Where σ_{film}^{XRD} denotes thin film stress.

Fig. 2 shows the optical transmittance spectra for the ZnO:Ga thin films fabricated with 1 and 3% Ga-doped concentration. The spectrum of optical transmittance of the samples were compared with optical transmittance of ZnO:Ga (2%) spectrum also. The transmittance of the ZnO thin films with 1 and 2% Ga concentration were 85% in the visible region. This value is similar with the transmittance spectrum of the ITO thin films [5]. However, transmittance of 3% Ga-doped ZnO only reached about 70%. It occurs probably due to related with the degraded the crystallite structure of ZnO thin films.

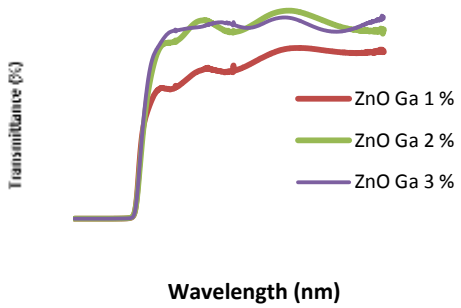
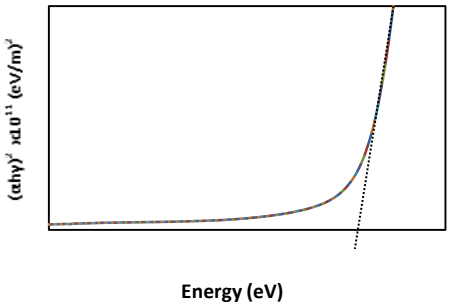
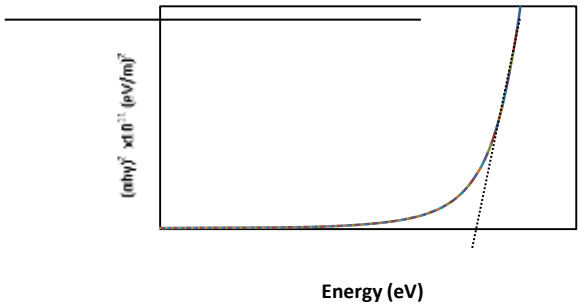


Fig. 2. Transmittance spectrum of ZnO:Ga thin films prepared at different Ga-doped concentrations.



(a)



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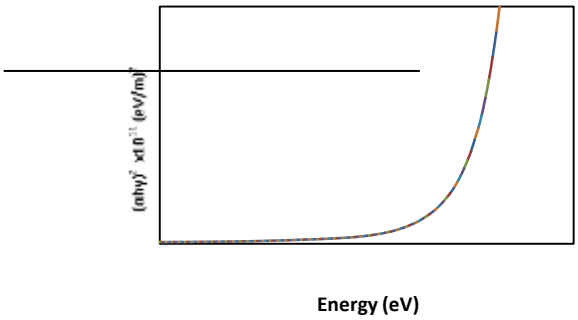

(c)

Fig. 3. Optical band gap (E_g) of ZnO thin films at different Ga-doped concentration: (a) 1%; (b) 2%; and (c) 3%.

ZnO:Ga thin films have a direct band gap, so that the absorption edge for interband transition is given by Eq. 3.

$$(\alpha h\nu)^2 = A(h\nu - E_g) \tag{3}$$

where α denotes the absorption coefficient and A denotes the constant for a direct transition. The E_g of the films is obtained by plotting α^2 vs. $h\nu$ and extrapolating the straight line portion of this plot to the energy axis as shown in Fig. 4. As the Ga concentration increases from 1 to 3%, the band gap E_g of the ZnO:Ga thin films decrease from 3.28 to 3.22 eV, which is sorter than that of undoped ZnO (~3.3 eV) [5]. This deviation may be due to the structural defects takes place at deposition process [11]. The decrease of band gap occurs probably due to correlate with the crystal size and lattice strain of the films. Furthermore, the decreasing band gap can be due to the carrier concentration effect [12]. In previous work, Shin *et al.*[5] reported that the optical band gap would decrease with decreasing carrier concentration. On the other hand, Lin *et al.* [9] also reported that the carrier mobility dropped when Ga was between 3.0 and 10.0 at%

IV. Conclusions

Gallium doped ZnO thin films were fabricated on corning gas substrates at different Ga concentration 1, 2 and 3% (wt) by homemade DC magnetron sputtering. All films deposited are polycrystalline with the hexagonal wurzite structure and had a preferred orientation with *c*-axis perpendicular to the substrates. The Ga-doped concentration has a great influence on film structural. As the deposition Ga-doped concentration increases, the diffraction angle does not change significantly and the intensity of of the (002) peak becomes more intense and sharper at 2% Ga concentration. However, when the Ga-doped concentration at 3 %, the intensity of the (002) peak becomes very weak, which can be indicated to degraded the crystallinity of the Ga-doped ZnO thin films. The optical transmittance of ZnO films with 1 and 2% Ga-doped concentration are about 85% in the visible range. However, transmittance of the films deposited at 3% Ga-doped concentration is about 70%. Band gap of the ZnO thin films are 3.28, 3.25 and 3.22 eV for 1, 2 and 3% Ga-doped concentration respectively. The optical band gap of the ZnO:Ga deposited are shorter than of pure ZnO (~3.3 eV).

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Chapter 33

Histopathology of gill of Pangasius sutchi infected with Aeromonas hydrophila and are cured using Curcumin

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Abstract—This study aims to understand the histological structure of gill of *Pangasius sutchi* that is infected with *Aeromonas hydrophila* and treated with curcumin has been conducted on February to April 2015. There were 3 treatments applied. The treated fishes were infected with *A. hydrophila* (0.1 ml of 10^9 of *A. hydrophila* culture) and then were immerse in 3 different concentrations of curcumin, they were T1 (0.5 g/l); T2 (0.7 g/l) and T3 (0.9 g/l) for 5 minutes/ day for a 2 weeks period. The negative control were fishes that were not receive any treatment, while the positive control were fishes that were infected with *A. hydrophila*, and were not treated with curcumin. Fish organ (gill) were processed for histological studied (formalin fixed, alcohol series, HE stained and 6 sliced. The result showed various types of damage such as necrosis, hemorrhage, fused lamella, loss of epithelium on the secondary lamella and oedema. Based on data obtained, it can be concluded that immersion of fish in curcumin is able to cure *A. hydrophila* infection on fish.

Keywords: Gill, *Aeromonas hydrophila, Pangasius sutchi*, Curcumin

I. Introduction

Aeromonas hydrophila is an apportunistic pathogen of a wide variety of hosts ((Harikrishnan, 2009). *Pangasius sutchi* or "jambal fish" is freshwater fish that commonly inhabit in river in Riau Province. This fish is belonged to the members of Pangasidae family. In Riau, *Pangasius sutchi* has relatively high economical values. This fish commonly sold as fresh (Rp 20.000 – Rp 30.000/ kg) or as smoked-fish (Rp 100.000 - Rp 120.000/ kg).

The most serious problem in the fish culture is the mass death of the fish that is caused by fish disease such as motile aeromonads septicaemia. Motile Aeromonads Septicaemia (MAS) is acute or sub acute or chronic infectious disease in all freshwater fishes caused by motile aeromonads bacteria. The disease caused about 80% mortality in fish farming especially when the fish held under stress (Austin and Austin, 1987). MAS diseases can be transmitted by discharge from the intestinal tract and external lesions on the skin. On the other hand, the parasitic damage and fungal infection of the epidemic may allow the entry and spread of infection among fish. Carrier fish also play an important role in transmission of the MAS infection. This disease is characterized by rapidly fatal septicemia with few gross signs, exophthalmia, ascitis and ulcer formation (Yardimci and Aydin, 2011).

Most cultured and wild fish, such as carp, channel catfish, eel, goldfish, snakehead fish, tilapia and pangasius are susceptible to *A. hydrophila* infection. There are many factor for the predisposing the diseases such as malnutrition, low temperature, overcrowding and high organic pollution (Santos *et al.*, 2014). These factors can play a important role in lowering the resistance of fish body, so that the fish become more susceptible to motile aeromonads septicaemia infection.

Laith and Najiah (2013) reported that the clinical sign of the MAS diseases in Catfish showed symptoms of increased respiration and lethargy, skin lessions such as white discoloration, shallow hemorrhagic ulcers or deep ulcers with exposed underlying muscle. Some fish showed marked hemorrhages on the base of the fins and went. Others were dropsy, kidney congestion and enlargement, pale liver and gills, or gall-bladder, enlargement with the accumulation of yellowish fluid in the body cavity.

Motile aeromonads septicaemia can be treated by using antibiotic containing 2 to 4 g of oxytetracycline/Kg of feed per day for 10 days. Sulfamerazine at 264 mg/Kg given in food for 3 days, by 154 mg/Kg/fish/day for 11 additional days is effective treatment for Motile Aeromonas Septicemia. Prolonged bath treatments with potassium permanganate at 2 to 4 mg/L will be effective (Afrianto and Liviawaty, 2001). However, the use of chemicals and antibiotics causes negative effects such as bacterial resistance and environmental pollution.

To avoid the negative effect of antibiotics, alternative treatment such as the use of traditional medicine such as turmeric can be applied. The most important chemical components of turmeric are a group of compounds called curcuminoids, which include curcumin (diferuloylmethane), demethoxycurcumin, and bisdemethoxycurcumin (Nagpal and Sood, 2013). The best studied compound is curcumin, which constitutes 3.14% of powdered turmeric (Tayyem *et al.*, 2006). In addition, other important volatile oils include turmerone, atlantone, and zingiberene. Some general constituents are sugars, proteins, and resins.The active compound curcumin is believed to have a wide range of biological effects including anti inflammatory, antioxidant, antitumour, antibacterial, and antiviral activities, which indicate potential in clinical medicine (Aggarwald *et al.*, 2007).

Morphological changes in the gills are widely used as parameters in biomonitoring programs, for they are defense mechanisms to potential stressors of the aquatic environment. Histopathological features of the fish organ have been used as biomarkers. Research on histological structure of gill of *Pangasius sutchi* especially is limited. To obtain information on histological alterations of gill of *Pangasius sutchi* that were infected with *A. hydrophila* and are cured using curcumin, this research is needed.

II. Materials and Methods

In this study, fish samples (*Pangasius sutchi*) were obtained from hatchery in Bangkinang, Riau Province. Fish samples were varied from 80 - 120 mm TL and 10 to 15 g BW. The experiment were performed in the Parasite and Fish Diseases Laboratory of Fishery and Marine Science Faculty of Riau University. In this experiment, 15 aquaria (25 l) were used and fishes were adapted. *Aeromonas hydrophila* strain (ATCC 35654) used in this study was obtained from Fish Quarantine in Pekanbaru. The fishes were infected with *A. hydrophila* (0.1 ml of 10^9 of *A. hydrophila* culture). Curcumin was extracted from *Curcuma longa* based on Harjanti (2008). There are five treatments applied e.g as negative control, the infected fishes that were not treated, while the positive control were the infected fishes that were treated with *A. hydrophila*. The fishes were immersed in 3 different concentrations ofcurcumin, they were T1 (0.5 g/l); T2 (0.7 g/l) and T3 (0.9 g/l) for 5 minutes/ day for a 2 weeks period. Fishes were then reared for 14 days. Gills were processed for histological study, following Darjono *et al.*, (2001). The tissues were alcohol series processed, paraffin embedded, 6 µ sectioned and Hematoxylin-Eosin stained. Then the tissue were studied using a binocular microscope (Olympus CX 21), abnormalities occur in gill were observed and noted. The level of gill alteration is calculated by using Histopathologic Alteration Index (HAI) following Lopez and Thomaz (2011).

III. Results and Discussions

The gill structure of normal fish shown a normal pattern of gill fillament (Fig. 1, A1), however the histological changes in the gills of *Pangasius sutchi* in 3 different concentrations of curcumin shown abnormalities (Table 1).

Table 1. List of histopathologic alteration observed in the gill of *Pangasius sutchi* in 3 different concentrations of curcumin

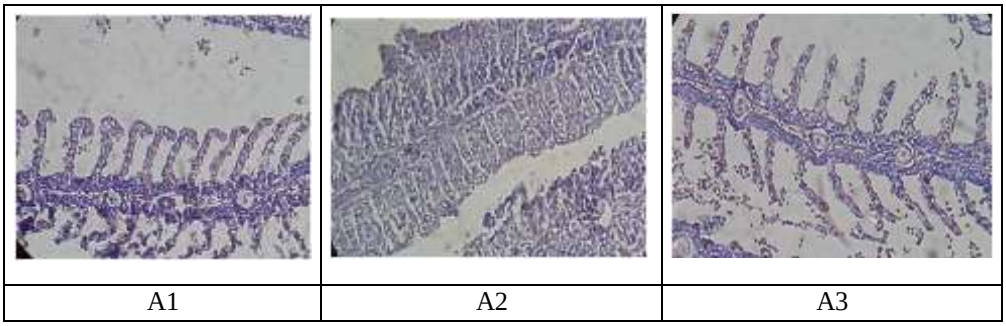
Organs	Histopathologic alterations	Curcumin concentration				
		To (Negative control)	Tp (Positive control)	T1 (0.5g/l)	T2 (0.7 g/l)	T3 (0.9 g/l)
Gill	Necrosis	-	6/10 (60%)	5/10 (50%)	3/10 (30%)	1/10 (10%)
	Hemorrhage	-	8/10 (80%)	6/10 (60%)	3/10 (30%)	2/10 (20%)
	Fused lamellae	-	10/10 (100%)	5/10 (50%)	4/10 (40%)	1/10 (10%)
	Lifting of respiratory epithelium	-	4/10 (40%)	2/10 (20%)	2/10 (20%)	-
	Oedema	-	1/10 (10%)	1/10 (10%)	-	-
	HAI Value		32,8	18,9	14,8	12,3

Histological study shown that in control fish, there were no gill abnormalities were observed. It is characterized by the primary gill lamellae are flat leaf structures with a central rod like supporting axis and a row of secondary gill lamellae side of it. Butchiram *et al.*,(2009) stated that histological structure of gills in control fish (*Tilapia mossambica*) bearing four pairs of gill lamellae and both the sides were supported by bony structure and primary lamellae. The secondary lamellae shown numerous channels of blood capillaries, each separated by single layered pillar cells when observed in vertical section (Lopes and Thomaz, 2011). The laminar epithelium was thick followed by basement membrane below which the pillar cells enclosed blood spaces, large number of mucous cells were present on the epithelial gill rackers, where as primary lamellae had comparatively small and less number of mucous cells (Saenphet *et al.*, 2009). The value of the Histological Alteration Index (HAI) prove that the gill condition of the fish that were infected with *Aeromonas hydropila* was worse than that of in control fish. According to Poleksik and Mitrovic-Tutundzik in Lopez and Thomaz (2011) the HAI value of the infected fish (32,8) can be catagorized as "*moderate changes in the organs*", however the HAI value of the treated fish of 0.9 g/L curcumin concentration (12,3) can be categorized as "*normal*".

Yardimci and Aydin (2011) reported that focal hemorrhage and dermal lessions accompanied by ulcerative form of the desease were observed in chronic motile aeromonad infection significantly and target organs in acute septicaemeia were gill, liver and kidney. The lessions in the gill of treated fish with *Aeromonas hydrophila* included necrosis (60%), hemorrhage (80%), fusion of several lamellae (100%), lifting of respiratory epithelium (40%) and oedema (10%) (Fig. 1, A2). Rao *et a*l.,(2004) found *Astronotus ocellatus* infected with motile aeromonad septicaemia contained a large amount of red-ascitic fluid accumulated in the abdominal cavity along with hemorrhages in gills. Windarti *et al.*, (2013) stated that gill structure of *Ompok hypothalmus* of the Siak River, Riau shown necrosis, hemmorhage, hyperplasia, lifting of respiratory epithelium, fusion an disorganization of secondary gill lamellae and shortening of secondary lamellae. Harikrishnan *et al., (*2009) found that alteration signs such as as hyperplasia, hypertrophy and lifting of epithelial cells are present in the gill lamellae of fish that are infected with *Aeromonas hydrophila*. The lessions in gill of *P. sutchi* that were infected with *A. hydrophila* in this study shown the same pattern as previous studies. A similar type of tissue destruction and the affinity of this bacterium to the gill were reported by Angka (1990).

The histopathology of gills of experimental fish is given in Fig. 1, A3. The gill structure of the treated fishes of 0.5 g/l curcumin concentration shown several alterations types. The most histopathological alterations observed are hemorrhages (60%), necrotic (50%), fused lamellae/lifting of respiratory epithelium (20%), while oedema (10%) was rare observed. The secondary lamellae of the treated fishes of 0.5 g/l curcumin concentration showed several damage and marked proliferation. The lifting of respiratory epithelium is the most frequent lession observed in all gills sampled followed by fused lamellae of the lamellar epithelium. Lopes and Thomaz (2011) stated that the lifting of respiratory epithelium is one of the erliest injuries found in fish. It is characterized by displacement of the klining epithelium of the secondary lamellae, in which the formation of a space called oedema occurs. Santos *et al.*, (2014) stated that hyperplasia leads to the proliferation of adjacent lamellae cells, reducing the inter-lamellar space, which may cause a fusion of lamellae.

Gill structure of the treated fishes that were cured with curcumin (0.9 g/l) showing less abnormalities (Fig. 1, A3). The abnormalities indicated hemorrhage (20%), necrosis and fused lamellae (10%). In this study, treated fish had faster regenerative responses such formation of normal gill by immersing in 0,9 g/l curcumin. Wu *et al.*, (2001) found that weight gain of eels (*A. anguilla*) treated with traditional Chinese medicines (TCMs) increased significantly their resistance to common infectious diseases. Jian and Wu (1994) observed that traditional Chinese medicines had a beneficial effect on the growth and on the prevention and treatment of common diseases in *C. carpio.* Dey and Chandra (1995) observed that neem leaves, garlic and turmeric powder induced diseases resistance of fry of carp. In this study, we found that herbal medicine (curcumin) can be use as alternative medicine for practical use in diseases management strategy in fish. However, the MAS symptoms in the fish in this study was not completely cured. The gill of the fish was taken by the 14th day after being treated with curcumin. This time period may not be enough for the fish organ for recover from the damage cause by the MAS. If the fish was reared for longer time, the condition of gill structure might be better. Sukarni *et al.*,2012 stated that organ recovery will be completed by around 30 days. As curcumin showing great potensial for curing the symptoms, the use of curcumin for curing the MAS diseases is recommended. Therefore,complementary studies are needed for futher evaluation of this problem.



A1	A2	A3

Fig 2. Photomicrograph of the gill of *P. sutchi* (H&E, 400x). A1. Control fish, A2. Infected fish with *A. hydrophila*, A3. Treated fish with 0.9 g/l of curcumin concentration

IV. Conclusions

Histological alterations of gill shown different types of alterations. Abnormalities in gill structure are necrosis, hemorrhage, fused lamella, loss of epithelium on the secondary lamella and oedema. The use of curcumin with 0.9 g/l concentration is able in curing motile aeromonads septicaemia diseases in *P. sutchi*.

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Chapter 34

Homeschooling in Lampung Province

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Abstract. The study aims to examine the effect of alternative education homeschooling towards students' learning achievement on math, English, science, and interest. The population of the research was 197 homeschooling students, sampling technique was taken randomly for 93 students. Dependent variable was learning achievement and independent variable was homeshooing learning. The data was analized by anova. The result of the research was shown that there was significant influence between homeschooling learning and academic achievement with a value of R Square of 0208, influence significant level of F count=23.903 with significance level/probability 0.000>0.05
Keywords: alternative education, homeschooling, learning achievement

I. Introduction

Homeschooling is caused by school management that is not well ordered, demographics, religious, social, economic, and negative experiences of parents to the school. It is one of alternative education of family interest in many big countries (Mintz 1994, Lines 1996, Ray 1990, Yang & Kayaardi 2004, Essenberg 2004, Knowles, 1991b; Wyatt, 2008). In 2007, NHES survey found three general reasons for homeschooling, they were (a) concern about the school environment (88%), (b) desire to provide moral or religious teaching (83%), and (c) dissatisfaction with academic teaching at school "(73%), (Planty et al., 2009).

As an alternative education, homescholing gives a meaningful contribution to the formation of civil society, the democratic society has a spirit of universal brotherhood, mutual respect, attention and cooperation, (Norlidah Alias, 2012). Alternative education is an imperative element in society, and therefore needs to be developed and constructed in reform efforts towards the development of education for lifelong education, (Kathi Moreau, 2012). Alternative education gives more value to the learning system and a learning experience, (Sandra Martin-Chang, 2011).

Homeschooling is an education held by the their own family to family members who are still in school age (Mayberry, Knowles, Ray, dan Marlow, 1995, Osborn, 2000, Ray, 2000, DiStefano, Rudestam, Silverman 2004).

Home schooling learning process can utilize the existing facilities in the environment, private tutor, tutor, internet and audio-visual technology, (Sumardiono 2007, Simbolon 2007, Ramson 2001), so it remains systemic, (Yusufhadi, 2007). Homeschooling will give the children learning with various situations, conditions, and social environment that continues to evolve, and it will strengthen democratic values and sustainable to broader community, (Robert Kunzman, 2010).

In order to answer the truth of the above, the study of alternative education is needed to examine to get a comprehensive overview of the program in Lampung Province, (Robert Kunzman, 2013).

II. Methedology of Research

The research population was 197 children of homeschool students, the sampling technique used a random sampling of 93 children. The dependent variable was the learning achievement in mathematics, English, science, and interests. The independen variable was homeschooling learning. Data was collected by documentation and learning achievement test. The study aimed to examine the effect of homeschooling toward learning achievement which was measured from the average score of learning achievement test at the end of the academic year.

III. Results and Discussions

The research proved to accept the hypothesis that there was influence between learning homeschooling with student achievement on mathematics, English, science, and interests, with the value of R Square of 0208, the significance level of the influence of Fcount = 23 903 with a significance level/probability 0.000 <0.05, then regression model could be used to predict the regression equation Y with Y ^ = 76.001 + 3.274 X. Each additional 1 value X then Y value increased 3,274. Positive constant value showed the positive effect of independent variables on the dependent variable. If homeschooling learning variables rose or influence in one unit, then the variable learning achievement would rise.

Table I. Coefficients

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*
		B	Std. Error	Beta		
1	(Constant)	76,001	1,299		58,506	,000
	homeschooling	3,274	,670	,456	4,889	,000

a. Dependent Variable: prestasi

Table II. Model Summary

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
1	,456a	,208	,199	5,221

a. Predictors: (Constant), homeschooling

Table III. ANOVAb

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	651,590	1	651,590	23,903	,000a
	Residual	2480,669	91	27,260		
	Total	3132,258	92			

a. Predictors: (Constant), homeschooling

b. Dependent Variable: prestasi

Homeschooling has been proven to help students develop their academic potential, according to research which has been conducted since 1990-2010 (Ray 1990, 1994, 1997a, 1997b, 2010), each case of the students has consistently scored of learning achievement at the 80th percentile or on almost every measurement. Homeschooling outperforms regular schools on standardized tests (Gaither, 2008b; Kunzman, 2009a). The research of Frost and Morris (1988) in 74 cities with a control variable family background, had resulted scores above average in all subjects, other than mathematics. It is based on the research (Wartes, 1991; Ray, 1997a; Rudner, 1999 ; Belfield 2005; Quaqish, 2007; Frost & Morris, 1988; Kunzman, 2009a; Thomas & Pattison, 2008). Ray & Wartes (1991), Ray (2010) and Oliveira, Watson, & Sutton, (1994) found the diffence significant that learning achivement of homeschooling student was higher than regular school's. However the parent's role is important. On the other side, Belfield (2005), Boulter, (1999), and Medlin (2000) conclude that homeschooling students who had high score on reading, writing, and mathematic were depended on their parents' background.

Homeschooling is chosen by the family because they can meet their children to learn in the same room and invite the expert (Gaither, 2008a; Safran, 2009). The children will learn base on their own pace and have the freedom to develop their interest, (Keys & Crain, 2009, p. 6). They are free to study with the environment, (Coleman, 2010; Gaither, 2009; Taylor-Hough, 2010; Thomas & Pattison, 2008) and by an eclectic approach so that the interaction will run informally and spontaneously (Charvoz, 1988; Holinga, 1999; Knowles, 1988; Lois, 2006; Stevens, 2001; Van Galen, 1988; Thomas, 1994).

IV. Conclusion and Suggestion

Homeschooling is an alternative education that has a value equal to a regular school, because it can increase learning achievement of children. In order to be effective in homeschooling, parents do a character analysis of the child so that they can select the right methods, media, and teachers in the learning process

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Chapter 35

Education as an Earthquake Disaster Mitigation Efforts to Improve Safety in Children Through State Primary Media Comics in The Village New District Labuhan Ratu Bandarlampung Lampung

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Abstract In order to build a culture of safety and resilience, especially for the younger generation, disaster risk reduction needs to be given to children from an early age. A total of 113 countries in the world have included disaster preparedness education into primary schools. Among them are India, Iran, Turkey and Bangladesh. Learning from the experience of the natural disaster that occurred in the province of Lampung, hence the need for disaster preparedness especially pedidikan about earthquakes for children since childhood using comics media, considering the kids really like the comic. Targets to be achieved from this research is to increase knowledge, skills and awareness of primary school students in urban areas Bandarlampung against earthquake disaster through the medium of comics. The purpose of this study was to determine the elementary school students' knowledge about disaster preparedness education before and after reading the comics. The method used in this research is descriptive survey method that uses structured questions given to students from elementary age of 12 years. Taking samples of random sampling techniques where students sampled were children of primary school.

***Keywords**: education, mitigation, disaster*

I. Introductions

Indonesia merupaka country with a high vulnerability to earthquakes. Earthquakes are caused by the interaction of tectonic plates can cause tidal waves in the ocean in case. Earthquakes often led to casualties, both adults and children and toddlers. The main cause of fatalities are due to a lack of public knowledge about the disaster and the lack of community preparedness in anticipation of the disaster. Especially for the earthquake victims who died as a result because of falling rubble from collapsed buildings. Among the casualties, most are women and children. Why? Because they are less aware of the knowledge about how to deal with when the earthquake came. Generally they do not immediately respond to the earthquake disaster. Salu Lampung Province is one province that includes the path of the fire ring is certainly also experienced natural disasters bumi.Berdasarkan earthquake Earthquake Threat Map created by the Regional Disaster Management Agency of Lampung Province in 2010, it is known that the entire section in the Lampung province have the threat of earthquakes Earth, such as in Bandarlampung have the threat of floods, earthquakes, landslides, fires, tornados, etc.

Great earthquake that occurred in Lampung have occurred in Liwa on February 15, 1994 which caused severe damage in Liwa, Lampung Barat with earthquake centered in Fault Semangko, Indian Ocean. According to the report almost all permanent buildings in Liwa to the ground. No fewer than 196 inhabitants of several villages and districts in West Lampung were killed, while the number of wounded nearly 2,000. On average they killed and injured by falling debris. Based on the information, the number of people who lost their homes nearly 75 thousand.

The impact of the earthquake is still felt up to 40 kilometers from the capital of the West Lampung regency. (https://id.wikipedia.org/wiki/Gempa_bumi_Liwa_1994, February 28, 2011). The latest earthquake occurred in Lampung ie on 18.10.2014 according to the Meteorology, Climatology, and Geophysics has happened twice earthquakes in the province of Lampung, but according to local authorities until Sunday

morning there has been no reports of damage and casualties as a result of the quake. BMKG through the Head of Geophysics Station Kotabumi Lampung, Yuharman, mentioned twice an earthquake that occurred in Lampung on Saturday, the quake measuring 5.2 on the Richter scale (SR) occurred at 15:02 pm on the coordinates of 5.81 degrees. South latitude (LS) and 104.10 degrees east longitude (BT), with a depth of 28 km.Lokasi this earthquake in the southSumatra; 73 km southwest of West Lampung regency; 85 km southwest Tanggamus; 110 km southwest Pringsewu; 135 km southwest Bandarlampung in Lampung; and 305 km northwest of Jakarta. Nevertheless, a number of residents in Lampung, as in Bandarlampung claimed to feel a tremor of 4.6 magnitude and was surprised at the center of their activity (http://www.antaranews.com/berita/459454/gempa-di-lampung-tak-no-damage-report, 19 October 2014). Based on the index map earthquake hazard BNPB tahun2010, Bandarlampung included into the high earthquake hazard.

Therefore, education disaster preparedness should further be given to students in schools especially at the primary level where it is necessary to teach children of primary school age on standby earthquake, which also includes, how to save themselves when disaster threatens and avoid unnecessary accidents happen in everyday life. Knowledge of the earthquake itself, has actually been awarded to students in the 5th grade elementary 2nd half on the material science of Nature and impact events. There is described one of them about earthquakes, just not detailed. Likewise the students grade 6 semesters 2, the material is also given earthquake in social studies of natural phenomena Indonesia and neighboring countries.
The approach can be done to provide knowledge about earthquake disaster mitigation to children of primary school is one with the comic medium. We all know that children are very fond of reading comics. The comic itself is actually one of the alternative readings are entertaining children, it's just that sometimes the content in the comics there are some that are not appropriate for children of primary school age. Therefore, it would be interesting if the knowledge about earthquake disaster mitigation can be introduced through the medium of comics.

II. Problem Formulation

1. Indonesia is a country prone to earthquakes
2. The death toll caused by the earthquake at most are children and women
3. Earthquakes can occur anywhere without warning.
4. Children of primary school age need to acquire knowledge about disaster mitigation5. Media comics is one alternative giving interesting learning media to convey knowledge about earthquake disaster mitigation.

III. Research Objectives

Targets to be achieved through this research is to provide and improve knowledge among children of primary school age to the earthquake that emerge through the medium of comics on mitigation of disaster preparedness.

Fig 1. Map Hazards Lampung Province, 2010

IV. Study of Theoretical

a.Understanding Earthquake Disaster Mitigation

Disaster mitigation is a series of efforts to reduce disaster risk, either through physical development as well as awareness and capacity building is facing the threat of disaster (Article 1, paragraph 6 of Regulation No. 21 Year 2008 on the Implementation of Disaster Management).

Disaster itself is an event or series of events that threaten and disrupt the lives and livelihoods caused by both natural factors and / or non-natural factors and human factors that resulted in the emergence of human fatalities, environmental damage, loss of property, and psychological impact. Disasters can be a fire, tsunamis, earthquakes, volcanic eruptions, floods, landslides, tropical storms, and others.(http://www.rcweb.0fees.net/index.php?p=1_27_Pengertian-Mitigasi&ckattempt=1, 2013)

Mitigation can be done in three stages: before it happens, when it took place and after an earthquake.
1. Before an earthquake
Some things we can do that is always alert is:
a. Construct buildings (office, home, etc.) in accordance with standard kaidah2. Discuss the one with experts so that your building earthquake resistant. Do not build with carelessly let alone without calculation.
b. Dentify the location of the building where you live or work, if not at fault earthquake or other such places prone to landslides and so on.
c. Place the furniture in place proportionate. If you have a closet, it's good to be nailed to the wall, so as not to collapse and come to rest on when an earthquake happens. If there are furnishings which are suspended, check regularly savety.
d. standby equipment such as flashlights, P3K boxes, instant food and so on. Provide also a radio, because at the time of the earthquake means of communication and other. information such as Phone, HP, Television, the Internet will be disrupted. Radios that use only batteries will be very useful in times of disaster.
e. Always check the use of electricity and gas, turn off when not in use.
f. Record important calls such as firefighters, hospital etc.
g. Know the evacuation route. Some areas in Indonesia, especially in areas prone to tsunami, now has to build the evacuation route to higher ground.

h. Follow simulated seismic disaster mitigation activities that have been started by some of the areas such as the city of Padang, West Sumatra. This is usually done by the Japanese people. So they are not awkward anymore when disaster strikes. By attending this event, we will be familiar with bentuk2 early warning provided by the local government, such as sirens sign Tsunami, Flood sirens etc.

2. When the earthquake took place
a.The first one is DO NOT BE PANIC, mastered yourself that you can escape from the disaster.
b.Avoidance of buildings, trees, power poles, etc. are likely to collapse upon us. If you are inside a building, try to run out. If not possible take shelter under a strong table, bed. Or take shelter in a corner of the building.
c.Pay attention to where you are standing, because of large earthquakes will allow rengkahan ground.
d.If you are driving, turn off your vehicle and fell. If you are on the beach, then ran away from the beach. if you were in a mountainous area, then look around you whether there is a possibility of landslides.

3. After an earthquake
a.If you are still in the building, then exit in an orderly manner, do not use the elevator, use the stairs.
b.Check your surroundings, whether there is any damage, be it power outages, gas leaks, cracked walls etc. Check also if anyone is injured. If yes, do first aid.
c.Avoid building that seems almost collapsed or the potential for collapse
d.Look for information about the earthquake, use radio earlier.

b. Earthquake Disaster Mitigation Education

Disaster mitigation include activities and protection measures that can be initiated from preparation before the disaster took place, assess hazards. Furthermore, disaster prevention may be the rescue, rehabilitation and relocation. Behave like understanding and skills in preventing, detecting, anticipating disasters effectively. Pattern recognition seems indispensable disaster management through education.

This is in line that mandated by Law No. 24 Year 2007 on Disaster Management should be integrated into development programs, including in the education sector. It is also stressed in the law is that education is a determining factor in disaster risk reduction activities. Socialization on aspects of an earlier age and the type of lesson that touched directly natural phenomena such as IPA, is very strategic to be implemented, since the two aspects were not widely used by teachers and school authorities. In fact, primary school children's understanding of natural phenomena such as floods, landslides, volcanic eruptions and earthquakes have been revealed in science lessons.

Therefore, skills and understanding of the application of disaster mitigation dintegrasikan with science lessons be interesting, these conditions are expected to develop sensitivity and reduce anxiety in children's self. Knowledge and life skills needed by students in particular classes early so that when disaster strikes can perform self-rescue efforts and can also help others. This strategy is considered accurate because, elementary school children is a condition that is easily formed, in accordance with the development of children, students at the age of 7-12 years, according to Piaget's theory of development, the concrete operational phase. In the dimensions of the children get to know the reality and easily mimicked what is given.

c. Characteristics Of Primary School Students (7-12 Years)

The period of primary school age as childhood final which takes place from the age of six years until approximately the age of eleven or twelve years old. The main characteristics of elementary school students is that they show individual differences in many aspects and fields of, among others, differences in intelligence, ability in cognitive and language, personality development and physical development of children. Medium according to Thornburg (1984) primary school children is an individual that is growing, perhaps no longer in doubt his courage.

Each elementary school child is in physical and mental changes lead to better. Their behavior in the face of social and non-social environment increases. A fourth grader, have the ability of tolerance and cooperation are higher, there is even among those who reveal the behavior of adolescent behavior approaching the beginning. According to Piaget, there are five factors that support the intellectual development are: maturity (maturation), experience (physical experience), penyalaman mathematical logic (logical mathematical experience), social transmission (social transmission), and the balance (equilibriun) or the regulatory process itself (self-regulation).

Primary school age children interested in learning achievement. They develop self-confidence in the ability and the achievement of good and relevant. Although children need a balance between feeling and ability with the fact that they won, but the feeling of failure or incompetence can force them feeling negative towards itself, thereby inhibiting their learning. Piaget identified the stages of intellectual development through which children are: (a) the motor sensory phase of 0-2 years of age, (b) the operational phase of 2-6 years of age, (c) concrete operational stage aged 7-11 or 12 years, (d) formal operational stage 11 or 12 years of age and over.

Based on the above, elementary school students are at the operational stage concrete, at this stage, children develop logical thinking, is still very tied to the facts of perceptual, means that children are able to think logically, but is still limited to the objects of concrete, and is able to perform conservation , Focused on the development of intellectual and psychosocial primary school students, this shows that they have their own characteristics, which in the process of thinking, they can not be separated from the world of concrete or things that are factual, while the psychosocial development of children of primary school age are still rests on the same principles where they can not be separated from the things that can be observed, because they are already expected in the world of knowledge.At this age they enter public school, their learning process is not just happening in the school environment, because they are already introduced in real life within the community.

Nasution (1992) says that the period of high grade primary school has several characteristics as follows: (1) lack of interest on the lives of everyday practical concrete, (2) very realistic, curious and eager to learn, (3) the end of the period it has no interest in things and specific subjects, by experts who follow the theory of factors

forecasted as start prominence of factors, (4) generally children facing their duties freely and seek to resolve itself, (5) in this period child looking at the value of (bad performance) as the right size on school performance, (6) the child at this age like to form a peer group, usually to play together.
As said Darmodjo (1992) primary school age children are children who are experiencing perrtumbuhan both intellectual growth, emotional and growth badaniyah, where the speed of growth of the child in each of these aspects are not the same, resulting in a wide variety of growth rates of these three aspects. This is a factor that gave rise to individual differences in children of primary school age even though they are in sama.Dengan characteristics of students who have been described as above, teachers are required to be able to pack the planning and learning experience that will be given to students with good, deliver -it is in the neighborhood of everyday student life, so that lessons learned are not abstract and more meaningful for children. In addition, students should be given the opportunity to be pro-active and gain direct experience both individually and in groups.Its characteristics include:

1.like play

That is in an early age children tend to want to play and spend time just to play because children are innocent that he knows just play it on the order not less happy childhood megalami children should not be restricted in playing. As an elementary teacher candidates we need to know the character of the child so that the application of the method or the learning model can be fit and achieve the target, for example a model pembelajran relaxed but serious, play while learning and preparing schedules for subjects (science, math, etc.) with mild interspersed lessons (skills, sports etc.)

2.Like move

Children love to move his point in the future growth and mental child becomes hyperactive even here there bobbing like feel not tired of them do want to be quiet and sit down according to the observations of experts child sitting quietly a maximum of about 30 minutes. Therefore, we as a prospective teacher should designing a model of learning that allows the child to move or moves.
Perhaps with games or sports, etc.

3.Like work in groups

Children love working in groups meant as a human being,children also have an instinct as social beings who socialize with others, especially peers, sometimes they form a group certain to play. In the group of children can learn to meet the rules group rules, learning of solidarity, learning does not depend on receipt environment, learn to accept responsibility, learn to compete with people Another healthy manner (sportsmanship), learn the sport, learn fairness and democracy. This may have implications for us as prospective teachers to specify the method or model of group learning so that children get a lesson as mentioned above, the teacher can make a small group eg 3-4 children to be more easily coordinated because there are many differences opinions and characteristics of these children and reduce contention among children in one group. Then the children were given a task to do together, here the child should brainstorm children become more appreciative the opinions of others also.

4.Like feel / do something directly

Judging from the theory of cognitive development, elementary school children entered the operational phase concrete. From what is learned at school, he learned to associate the concept of The new concept with old concepts. So in the understanding of elementary school children all material or knowledge acquired must be proven and implemented their own order they can understand the original concept given. Based on this experience, students form concepts about numbers, space, time, the functions of the body, the role of gender, moral, and so on.

Thus we as a prospective teacher should design a learning model that enables a child to engage directly in the learning process. For example, children will be more understanding about the direction winds, by bringing direct child out of the classroom, then pointed. Direct each direction angina, even with a bit sticking out her tongue would known exactly from which direction the wind when it blows.

5. crybaby Kids

At the age of elementary school children, the child is still whiny and spoiled. They always wanted observed and obeyed all their desires are still not independent and should always guided.Therefore, we must make methods instructional tutorial or method of guidance so that we can always guide and directing the child, the child mental shape so as not whiny.

6. Difficult kids to understand the contents of the speech of others.

On the basis of that elementary education, child difficulty in understanding what is given teacher, teachers here have to be able to make or use the appropriate method for example by means of experimental methods so that children can understand the given lesson to find their own core of the lesson, while the lectures make children even do not understand the contents of what was said by the teacher.

7. Like note

In a child's social interaction are usually looking for the attention of a friend or teacher, they are happy when others notice, in various ways done so that people notice. Here the role of the teacher to direct The child's feelings by using a question and answer method, for example, children wants to be noticed will try to answer or ask the teachers to other children and teachers watched

8.Like mimic

In daily life children who are often looking for a Fig. he saw and he encountered. They then mimicked what was done and charged people he wanted to emulate them. In real life many children are affected. Television shows and mimicked the scene performed there, say event smack down that first aired now been eliminated because there is news of a child movements in the smack down on her friend, who finally makes his injured. But now television has been sorted out to whom the show watchable. Another example are typically emulated is a teacher who becomes the center of attention of the students. We as a prospective teacher must keep the actions, attitudes, words, looks nice and neat in order to provide a good example for our students. television shows and mimicked the scene performed there, say event smack down that first aired now been eliminated because there is news of a child movements in the smack down on her friend, who finally makes his injured. But now television has been sorted out to whom the show watchable. Another example are typically emulated is a teacher who becomes the center of attention of the students. We as a prospective teacher must keep the actions, attitudes, words, looks nice and neat in order to provide a good example for our students.

d. Media Comics For Learning

Comics can be defined as a form of cartoon that reveals the characters and stories in order to implement a close relationship with the image and is designed to provide entertainment to the reader (astimuara.blogspot.com, 2014). Comic is one of the graphic media which can also be used in education, serves as a tool to clarify the material, creating value more sense, to understand the material, interest and attention of students, students feel

happy, arousing the curiosity of students, motivating students to learn, etc.As one of the visual media, comics media certainly has its own advantages when used in teaching and learning activities. Excess comic medium by Trimo (1997.22) is:

1.Comic add vocabulary readers
2. Simplify the students catch things or abstract formula
3. Can develop children's interest and develop a field of study other
4. All the comics to the one thing that is good.

While the weakness of comics by Trimo (1997.21) is:
1. Many love scene that stands out
2. Ease of people reading comics makes lazy to read, causing denial-denial of the books that are not illustrated.
The fundamental role of comics as a medium of learning, according Sudjana and Rival (2002.68) is the ability to create student interest. As `Audio-Visual media, in order to function properly that optimize learning, then in the development of the comic had to hold on a few things, as follows (Arsyad, 2006):

1. Shape
Selection of important form in order to generate interest and attention of students.
2. Outline
Lines used to connect the elements that are sequential. So it can be said that the elements of this line can help the clarity of the story.
3. Texture
Serves to create the impression of a smooth or rough that may indicate an element of suppression.
4.Warna
Function gives the impression of separation or emphasis and to build cohesion and enhance the reality of the object and create an emotional response.

Comic educative value in the learning process is not in doubt. Media comics in the learning process creates high student interest.

E. Comic Earthquake

Comic earthquakes used in this study is a comic book titled "earthquakes! The Story of the Village Community Role As Earthquake Disaster ". Created and published by IDEP foundation for community-based disaster management in 2007. This comic tells the story of children who live in Bali and experience an earthquake with his family. In the comic was also told about the incident before the earthquake, during earthquake and after the incident gempa.Pada the back of the comic book are descriptions of earthquakes explanation either cause or effect, measures of preparedness, action during the earthquake, acts after the earthquake took place.

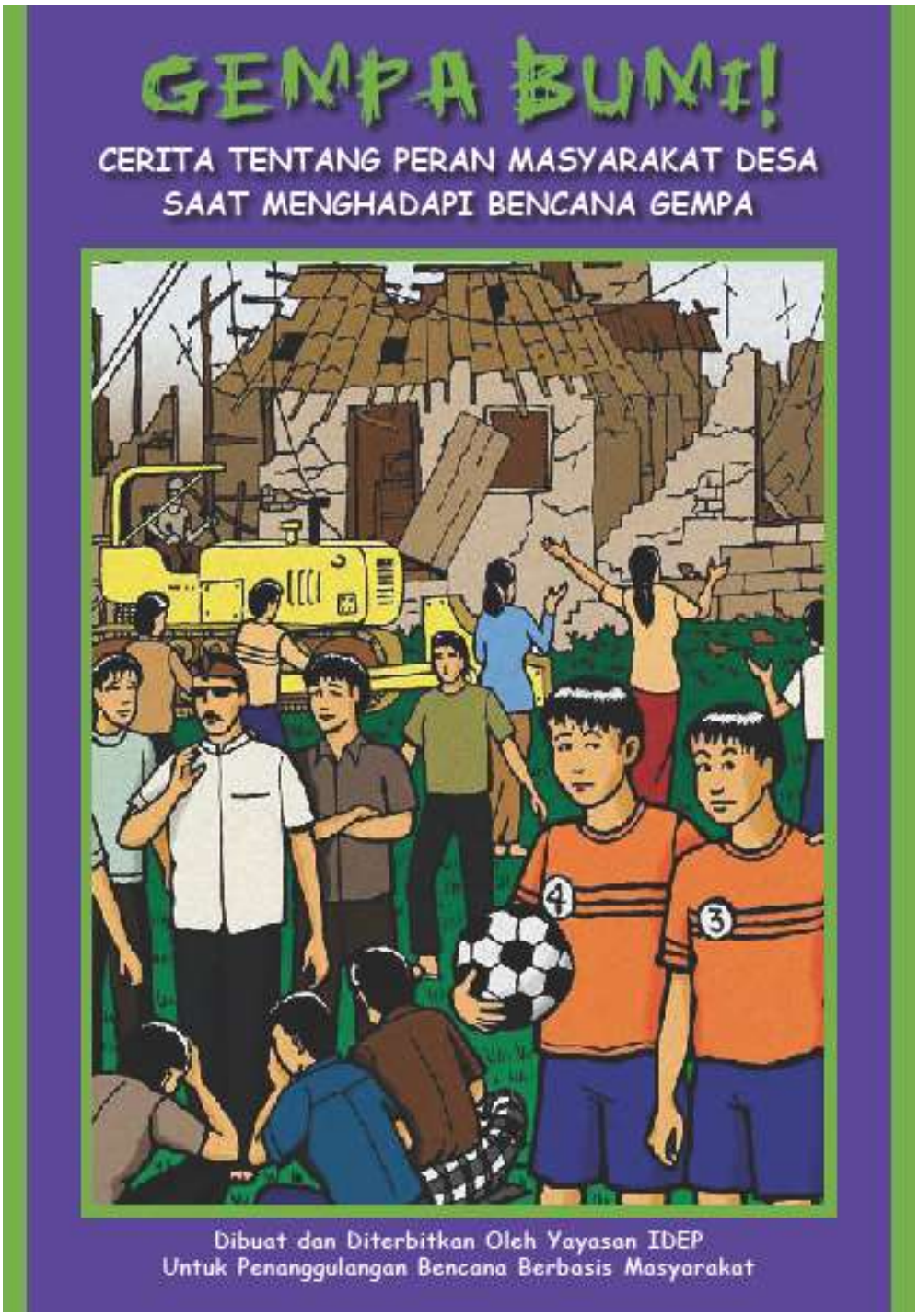

Fig. 2. Comic Earthquake

V. Research Methods

The method used in this research use descriptive qualitative research method with survey approach, which is to get an overview of the research variables either one variable or more without making comparisons or connect with other variables. The study was conducted in June 2015.Lokasi research in the village of Kampung Baru Kedaton Bandarlampung. Instruments used in the collection of field data using test questions pretest posttest in the form of multiple choice, a, b, c, d, e totaling 20 questions.

The unit of analysis in this study were elementary school students aged 12 years who attend school at SDN 1 and 2 Kampung Baru Kedaton Bandarlampung 6th grade who is on vacation data collection technique using about pretest postets. Analysis of data using the scoring. Furthermore, to find out how much the students' understanding of the three aspects of disaster mitigation, ie before the earthquake there were six questions, in the event of an earthquake there are 6 questions, after the earthquake there are eight questions, then it is done by calculating a score by percentage (%) in each category is to calculate the total score divided by the acquisition of a maximum score multiplied by 100 to obtain the percentage results. The result, then matched with the data interpretation criteria scores as in Table 1 below.

Table 1. List Criteria Score Interpretation

no	*understanding Category*	*Persentase (%)*
1	Less than once	0-20
2	Less	21-40
3	Self	41-60
4	Good	61-80
5	Well once	81-100

Source: Arikunto 2006

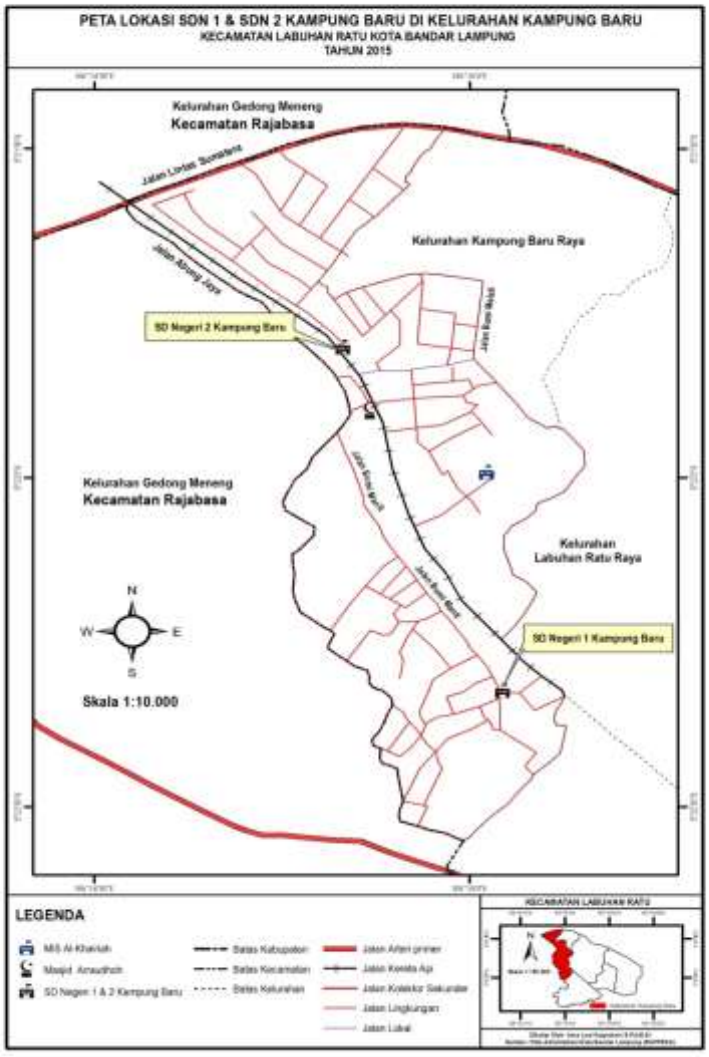

Fig 3. Map Location SDN 1 and SDN 2 Kampung Baru

VI. Research

Researchers conducted a pretest and posttest be spread about the question for elementary school students grade 6 in the new village in children yanag being school holidays which is derived from SDN 1 and 2 KampungBaru. Pretest given before students acquire disaster preparedness educational materials and a posttest is given after primary school students read a comic about disaster preparedness. The material in question is the third aspect of categories, before the earthquake, in the event of an earthquake and after the earthquake. Scoring, this study is the sum total of items each student who answered each item correctly on the test item. Problem pretest posttest totaling 20 items, where each item was answered correctly was given a score of 1 and one given a score of 0 to a maximum score is 20. For the assessment, is to divide the score in the can each student with a 0.2, so that the range of values obtained between 0-100. Overall, there is increased knowledge of elementary school students about disaster mitigation in view of the results of pretest scores and postesnya. Before the elementary school students reading comics about disaster mitigation, they have not understood correctly what the concept of disaster mitigation. But once given a comic about disaster mitigation, and they read it, they get additional knowledge thus increasing the value of their postest. This can be seen in Table 1, the list of scores and the pretest and posttest them.

Table 2. List of pretest posttest scores and Value Elementary Students STATE 1 and 2 Kampung Baru

No child	Score pretest	pretest value	score postest	posttest value	Difference in value pretest posttest
1	8	40	12	60	+20
2	6	30	12	60	+30
3	3	15	15	75	+60
4	3	15	16	80	+65
5	8	40	15	75	+35
6	5	25	15	75	+50
7	4	20	10	50	+30
8	6	30	12	60	+30
9	4	20	16	80	+60
10	4	20	16	80	+60
11	6	30	14	70	+40
12	4	20	16	80	+60
13	2	10	10	50	+40
14	8	40	14	70	+30
15	6	30	14	70	+40
16	4	20	12	60	+40
17	5	25	10	50	+25
18	8	40	14	70	+30
19	6	30	12	60	+30
20	3	15	16	80	+65

Sumber: data primer 2015

From Table 2 above in mind that, of the 20 children good SDN SDN 1 and 2 Kampungbaru, when given a pretest question, was only able to answer a few questions only. Such as student numbers 1, 20 given problem, only able to obtain a pretest score of 8. This is because some items contain material from the comics, while they have not read the comics before. Although students who are currently sixth grade and has been getting material natural disasters in 5th grade, but it turns out that they get a score also not optimal. Scores are small, certainly smaller impact on the value pula.Pada pretest there were only scores 10 as acquisition balanced 2. But after they

read comics on earthquake disaster mitigation, the acquisition of their posttest scores improved considerably from the previous pretest. For example, previously postestnya only got a score of 2, after reading the comic acquisition postestnya score to 10 with a value of 50. This means that their knowledge of earthquake disaster mitigation increases, after reading the comics on earthquake disaster mitigation. Problem pretest posttest on earthquake disaster mitigation is divided into three categories, namely category before the earthquake (about 1-6), a category in the event of earthquakes (about 7-12) and the category after the earthquake (about 13-20). Each category because each numbered 6,6,8, making a total of about pretest posttest No 20. To determine the ability of students in each category, the analysis item in order to get the score of each acquisition -masing items. Furthermore, for the category before the earthquake, then the acquisition postestnya pretest scores in Table 3.

Table 3. Score pretest posttest Category Before the Earthquake

no	*items*	*Scores acquisition pretest*	*Scores acquisition postest*
1	1	8	18
2	2	6	10
3	3	7	20
4	4	12	16
5	5	5	10
6	6	8	20
	Score acquisition	46	94
	Maksimal score	200	200
	score (%)	23%	47%

Source: primary data 2015

Seen in Table 3, it is known that for items No. 1,2,3,5, and 6, from 20 students who answered the category before the earthquake turned out to be the correct answer less than 10 students. This happens because of the questions it contains material on earthquake disaster mitigation knowledge before the earthquake in general and those in the comics, so a lot of elementary school students who answered questions, wrong. As for question number 4, why the answer is right there 12 students, as a matter included in the category of easy matter which one of the alternative answer is, all right, making it easier for students to choose jawaban.Namun increase in scores occurred during the post-test, after students read comics earthquake disaster mitigation. For all items, can be answered by students from elementary right where the answer is right there 10-20 elementary students in each item you see. So from here it can be seen that the elementary students the knowledge of earthquake disaster mitigation after reading the comics form the increase in the category before an earthquake.For the second category, ie at the time of the earthquake which amounted to 6 about the beginning of the question number 7 to number 12, the acquisition of pretest scores postesnya per item can be viewed in Table 4.

Table 4. Scores pretest posttest Category On When Earthquake

no	*items*	*Scores acquisition pretest*	*Scores acquisition postest*
1	7	7	14
2	8	10	16
3	9	8	20
4	10	7	20
5	11	8	13
6	12	20	20
	Scores acquisition	60	103
	Maksimal score	200	200
	score(%)	30%	51,5%

Source: primary data 2015

As in Table 3, in Table 4 was obtained a score lower than the score pretestnya postestnya per item. Why? Due to the material about the category in the event of an earthquake, many took the material from the comic, so it is known why the score postestnya be increased because they've read the comics and their answers correct errors during the posttest.The next category is material to the three questions about the aftermath of an earthquake. Problem starts from number 13 to number 20. Acquisition postestnya pretest scores of each item can be seen in Table 5.

Table 5. Scores pretest posttest category after the earthquake

no	*items*	*Scores acquisition pretest*	*Scores acquisition postest*
1	13	4	20
2	14	6	17
3	15	5	20
4	16	10	20
5	17	9	14
6	18	13	19
7	19	8	20
8	20	1	18
	Scores acquisition	56	148
	Maksimal score	200	200
	score(%)	28%	74,5%

Source: primary data 2015

Table 5 shows the results of a score that is not much different from the previous tables 3 and 4, where the acquisition pretestnya scores lower than the acquisition posttest scores. Pretest posttest score obtained by item with the division of the three categories above, then the percentage in order to determine how large a percentage of the ability of elementary school students in the 6th grade understanding the material per category seen from pretest scores postestya per item. Score the percentage obtained by dividing the total score of the acquisition of the category with the maximum score multiplied by 100. Example matter for category one, about the categories before the earthquake, Table 3, for pretest scores obtained percentage of 60 divided by 200 multiplied by 100 equals 30 percent. Thirty percent of this which will be matched with a list of criteria for the interpretation of the score Arikunto, 2006, to be adjusted by category understanding, whether the percentage of 30% is included in the category of less understanding, less, sufficient, good or excellent. The percentage list pretest scores for the three categories can be seen in Table 6.

Table 6. Percentage Score List pretest By Category Third Earthquake Disaster Mitigation

Earthquake Disaster Mitigation category	*Prosentase pretest*	*Criteria Understanding*
Prior to the earthquake	23%	less
In the event of an earthquake	30%	less
After the earthquake occurred	28%	less

Source: primary data 2015

Seen in Table 6, it can be seen each percentage score of pretestnya ie 23% for the category before the earthquake with the criteria of understanding including less, 30% pretest scores for the category in the event of an earthquake with the criteria of understanding less, and 28% pretest scores for category after the earthquake with the criteria of understanding also includes less. It can be concluded that in fact the ability of elementary school students in answering the question pretest for the three categories of entry criteria kurang.Kurangnya

understanding about the understanding of the pretest, mainly due to lack of primary school students have read about previous earthquakes materials. Although the material was never delivered in class 5 but since the study was conducted during the school holidays, then how frequently they read the book not as often during the school day. So do not be surprised if their pretest scores per item based on the criteria categories include less understanding.Not so with the percentage of their post-test scores. After reading comics earthquake disaster mitigation, they increased the posttest scores showed that their knowledge of earthquake disaster mitigation also increased. Can be seen in Table 7.

Table 7. Percentage Score List posttest By Category Third Earthquake Disaster Mitigation

Earthquake Disaster Mitigation category	*Prosentase postest*	*criteria*
Prior to the earthquake	47%	Enough
In the event of an earthquake	54,5%	Enough
After the earthquake occurred	74,5%	Good

Source: primary data 2015

Table 7 above shows that for the category before the earthquake, the percentage postestnya to 47% from pretest percentage of 23%. Increased by 24%. But despite the increase, it is still understanding criteria including criteria cukup.Kategori at the time of the earthquake, the percentage postestnya pretestnya 54.5% compared to 30%, an increase of 24.5% with a sufficient understanding of the criteria. Category after the earthquake, the percentage was 74.5% postestnya of postestnya which is only 28%, an increase of 46.5% and enter in either category. It can be concluded that the percentage of post-test to obtain the understanding that the two criteria for the categories before and at the time of the earthquake, -siswa elementary school students have sufficient understanding, while for the category after the earthquake, their understanding has been included either.

VII. Conclusion

1. Knowledge Students grade 6 before being given a comic media still do not understand about the earthquake disaster mitigation.
2. Having given medium of comics, their knowledge of earthquake disaster mitigation become quite familiar in the category of the material before the earthquake and in the event of an earthquake. For the category after the earthquake their knowledge after reading the comics to be good.

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Chapter 36

Hipotetic Model of Continuous Professional Development of Vocational Lecturer in The Higher Vocational Education In Lampung

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Abstract. One key to the effectiveness and efficiency of higher vocational education lies in human resources namely lectures. Lectures are professional educators and scientist with main task of transforming, developing, and spreading the knowledge, technology, and art through education, research, service to the community. To do that, need development model of continuous professional competence which will affect the increase of 4 competence of lecturers, especially professional competence. The problem is the development of lecture professional competence in higher vocational education in Lampung has not optimally yet, and uncoordinated well, so that the level of professionalism of lecturers depend on himself. The objective of this research is to develop hypothetical model of continuous professional competence development of vocational lecturer in the higher vocational education in Lampung. The research begins with describing the condition of existing management professional competence of vocational lecturer, then do the theoretical studies and concludes with the development of hypothetical model.
Keywords: continuous professional development, higher vocational education, lecturer professionalism

I. Introduction

Lecturer in vocational education, must have special professional competence. Because vocational education is the total process of education aimed at developing the competencies needed Effectively function in an occupation or group of occupations, Wenrich and Wenrich (1974). Vocational education as a forum for competence development in accordance with one's needs, developed on the basis of a person's need for a particular jo. Vocational education has another purpose beside to develop the hard skills, also oriented on soft skills, educational values and attitudes (Wenrich&Wenrich,1974, Thompson 1973), applied, occupational/ jobspecific consisting of lines diploma (D-I, D-II, D-III and D-IV) and specialists (Sp1 and Sp2), (Hadiwiratama in Dedi Supriadi, 2002). Education Diploma and politeknik will produce alumni who are entrepreneurial, (Bambang Budiyono 2001, Clarke 2008).

The importance of continuous improvement of the professional competence of vocational lecturers have not been fully recognized by professors and leaders in higher education vocational institutions.Lecturer professional competence covers three areas/ Tri Dharma College: education and teaching, research and community service. Continuous improvement of professional competence for lecturers, supported by Government Regulation 37/2009 and Law No. 14 Year 2005 on Teachers and Lecturers Article 60, Law Number 20 Year 2003 on National Education System Article 39 paragraph 2 of Law No. 20 in 2003. The development of continuous professional competence for vocational lecturers means that the lecturer competence development carried out in accordance with the needs, gradually, continuing to increase professionalism.

Competence is something that someone pointed out in the work every day, the focus is on the behavior in the workplace, (Kravets, 2004), and the competence of either category threshold and differentiating with regard to the effectiveness of individual performance on the job, (Spencer1993, Green 1999, Liu 2009, Masten 1995, Looy 1998). Thus competencies into aspects that determine the success of the organization, with high

competence that lecturer have will determine the quality of faculty that are owned by the college, which will ultimately determine the competitive quality of higher education itself . George Klemp (1980) in Boyatzis (1982) and Dubois (2004) describe the "job competency as an underlying characteristic of a person the which results in effective and/or superior performance in a job". He also expressed "competencies are characteristics that are causally related to effective or superior performance in a job".

To answer the truth of the above needs to be generated hypothetical model of Continuous Competence Professional Development of Vocational Lecturers (CCPD-VL) on vocational education in Lampung.

II. Research Methods

The study was conducted in three phases, namely: (1) preliminary studies, assessment of the condition of professional competence development lecturer (existing pre-assessment), (2) the development of prototypes and (3) the outcome of research, which produces the final hypothetical model. Data obtained by the analysis of theory, observation and interviews, with observation measurement tools guide and the interview guide. The study population is a lecturers in vocational education in Lampung by purposively sampled.

III. Results and Discussions

The research of development hypothetical model CCPD-VL outline contained in Fig. 1 below

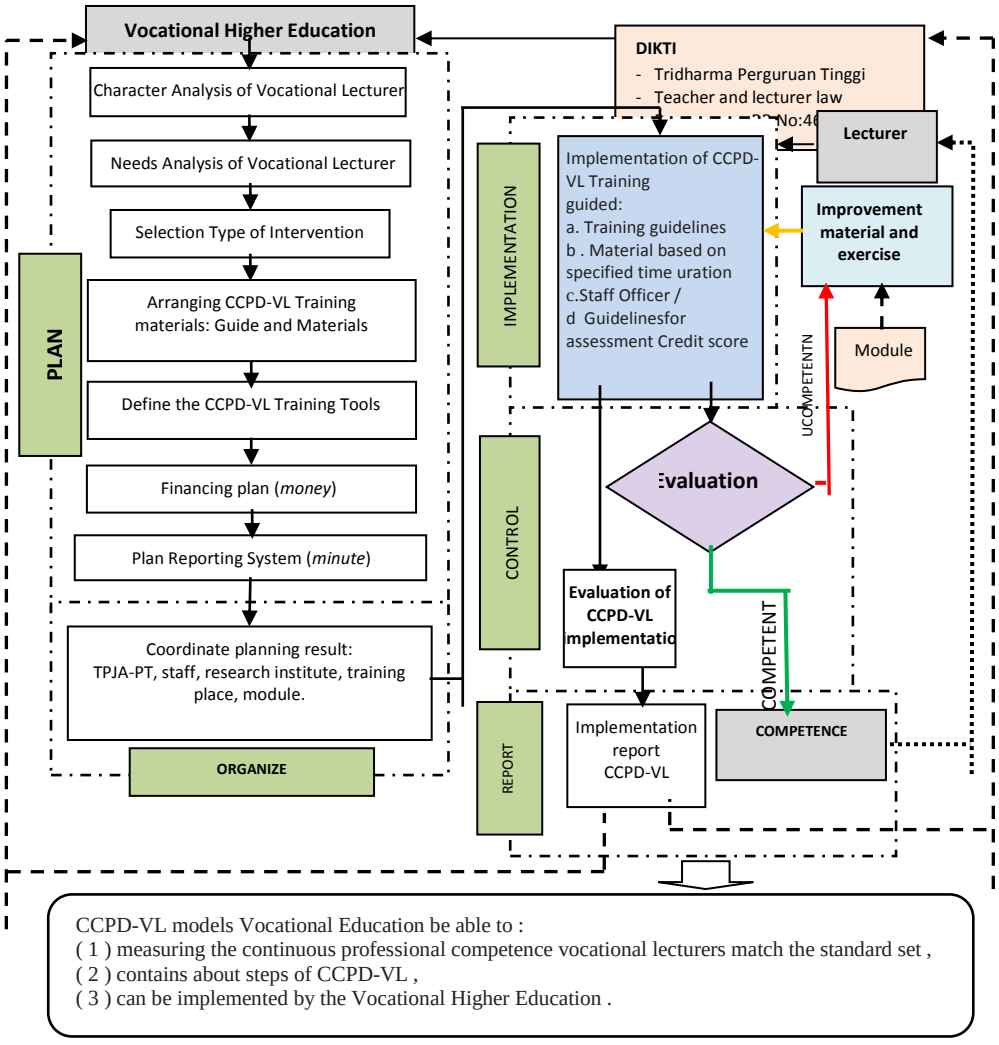

Fig 1. Hypohetic Model of CCPD-VL Vocational Education

The first phase of the hypothetical model CCPD-VL is planning covers several aspects: personal (man), financing (money), material (materials), method (method), equipment (machine) and reporting (minute). In planning CCPD-VL involves three units namely PATA-C (Position Assessment Team Academic College), Institute for Research and Community Service (IRCS), and Section Officer (SO). Briefly linkages agencies/ institutions that play a role in planning and components as well as aspects of planning can be observed in Fig. 2.

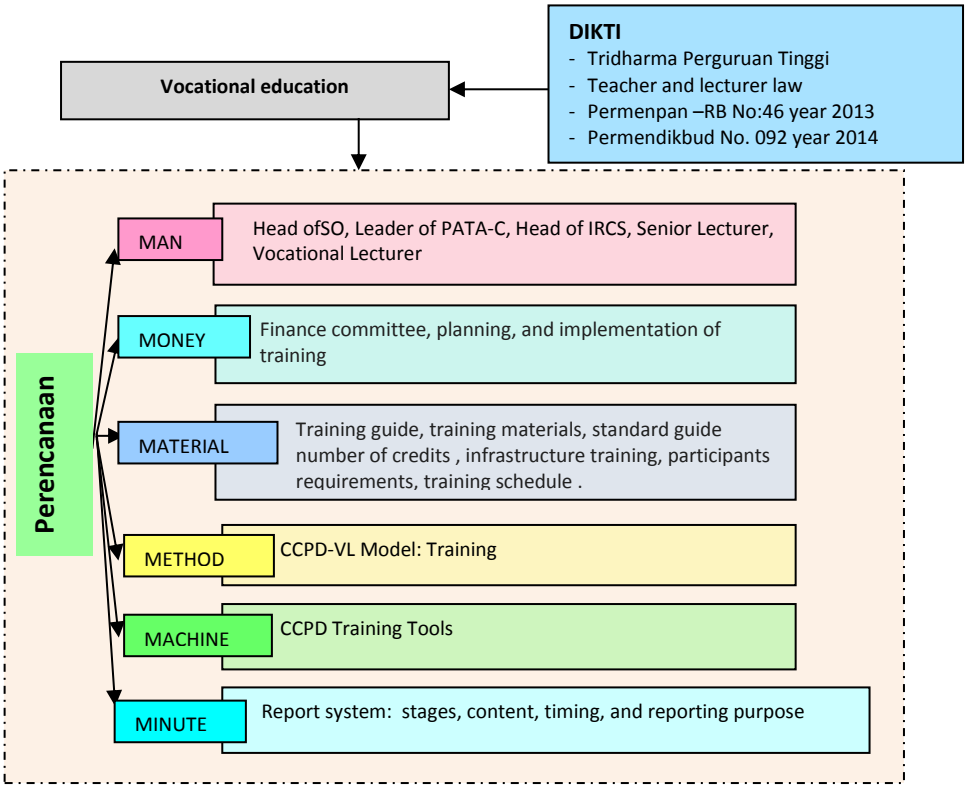

Fig2. Chart of CCPD-VL Planning Component

The second step is organizing a working mechanism between organizers CCPD-VL, which PATA-C with the personnel department concerning the results of the planning and preparation of the training PKPB - DV involving various parties , as it has been formulated in the committee . Organizing includes components : (1) the committee training CCPD-VL and description of work , (2) resource training, (3) the draft budget implementation of training CCPD-VL, (4) a method of training CCPD-VL, (5) training material and guidance assessment of credit points, (6) the infrastructure of education and training, (7) the requirements of participants and (8) the training schedule. Coordination is also done to prepare the place , materials and training equipment that will be used. Chart of CCPD-VL organizing components as shown in Fig. 3 . The implementation phase of the entire plan has been drawn up . Existing activities at this stage is the implementation of training CCPD-VL with the availability of a place of education and training, training materials, training equipment, speaker training, a training and assessment guidelines vocational lecturers credit points; as shown in Fig. 4.

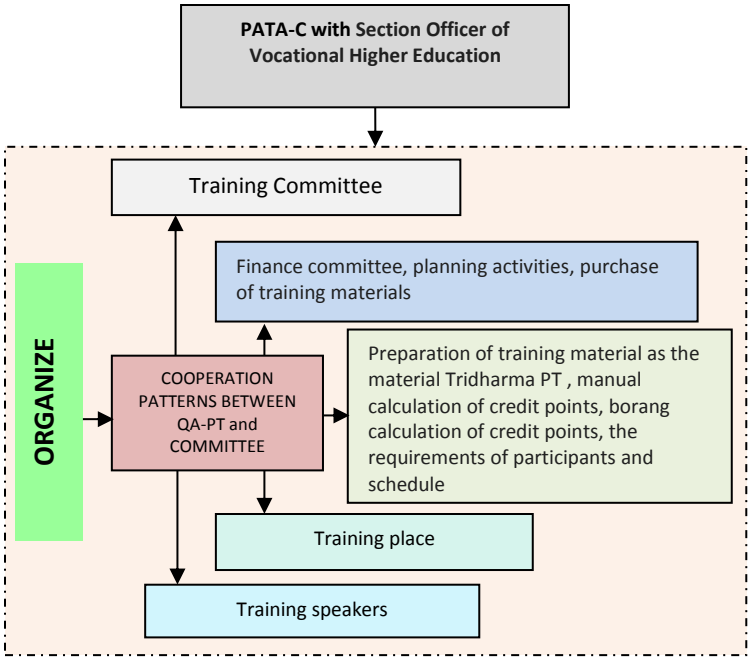

Figure 3. Chart of CCPD-VL Organizing Component

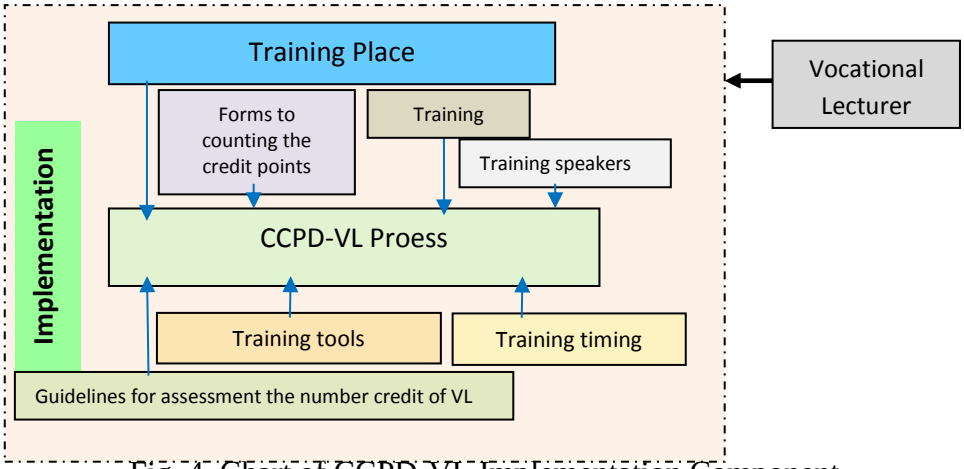

Fig. 4. Chart of CCPD-VL Implementation Component

The fourth stage is the control, executed by : (1) an evaluation of the development of professional competence of vocational lecturers using predefined assessment standards , this evaluation is to determine the vocational lecturers that has developed and underdeveloped professional competence. (2) Evaluation of education and training CCPD-VL ranging from planning, organizing and implementation. Evaluation is expected as feedback for the organization of training CCPD-VL next year. The implementation of evaluation made by the organizing committee.as shown in Fig. 5.

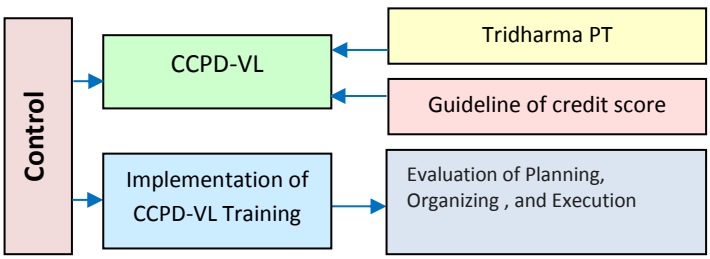

Fig 5. Chart of CCPD-VL Controlling Patterns

IV. Conclusions and Suggestions

CCPD-VL hypothetical model of vocational higher education which is developed is expected to be an alternative in the development of professional competence on an ongoing basis for vocational lecturers to overcome the problem of not smooth faculty in developing professional competence and in order to get CCPD-VL models that are effective, efficient and practical . Thus the model that developed is able to : (1) measure the professional competence of lecturers on an ongoing basis according to the guidelines calculation of credit points, (2) contains about steps models CCPD-VL and guidebooks training CCPD-VL, and (3) can be implemented by vocational higher education.

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Chapter 37

Fish Condition Factor as Bioindicator of Water Quality on Mangrove Ecosystems at Labuhan Maringgai, Indonesia.

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Abstract. This paper discuss on the use of fish Condition Factor (CF) as a bioindicator of water quality level in mangrove ecosystems at Labuhan Maringgai, Indonesia. The results shows that fish CF, in the research site, are mostly higher than one. The following are the value for each fish species: Mystus nigriceps (1,23), Eleutheronema tetradactylus (0,93), Valamugil seheli (1,09), Mallotus villosus (1,61), Paraplagusia blochi (0,56), Lutjanus Griseus (2,22), Epinephelus fuscoguttatus (1,74), Lutjanus campechanus (1,74), Argyrops Bleekeri (3,07), Macrones microchus (1,19), Arius sagor (1,03), Lates calcarife (1,23), Plotusus canius (0,52). Regarding to the measured CF, it is known that the water quality at the concerned mangrove ecosystem is suitable for fish survival (fish CF > 1). Measured water quality at the concerned site was considered as mild to moderately polluted, proved by Pollution Index values of 1.84 to 8.34. Nitrate and turbidity, in particular, were failed to meet the water quality standard.

Keywords: Condition factor, Labuhan Maringgai, Mangrove ecosystems, Pollution index

I. Introduction

Lampung Mangrove Center consist of 700 Ha of mangrove forest located in the village of Margasari, Labuhan Maringgai which is part of East Lampung Regency. The Mangrove Center was established based on the regent letter No. 660/305/04/SK/2005/1546/J.26 /KL/2005 on May 10, 2005.Mangrove forest is a type of forest located in areas influenced by the tidal fluctuation (coastal and estuaries). Plant species that grow in the forest are mostly tolerant to high salinity level. In addition, mangrove ecosystem is a system consisting of organisms (plants and animals) that interact each other as well as with their habitat environmental factors [1,2].

It has been well known that there are two principal functions of mangrove ecosystems, namely the ecological function and economical function.Based on ecologically perspective, mangrove ecosystem play their role as the following a) a source of organic material for aquatic ecosystem, b) food source for marine organisms, c) habitat of marine organisms, d) spawning and nursing ground for marine organisms and e) protect land from abrasion. Mean while in term of economical point of view, mangrove forests provide a) source of building materials, b) firewood, c) raw materials of paper, d) food, medicine and textile, b) tourism spot [2,3].

It was presented by [4] that mangrove is considered as a very unique ecosystem since in the area it can be found two groups of organisms living and adapt in two difference side of the mangrove ecosystem as their habitat, namely a) terrestrial organisms living in the forest canopy or its land such as birds, snakes and monkey, their activity mostly during low tide so that they do not need special adaptation to see water. b) marine organisms live in the bottom of the tree or in saline water. The dominant animal group, in the area, is a kind of mollusks, shrimp, worms and some other kinds of fish.

Mollusks which are often found on the stem or roots of the mangroves is snails (Littorinidae) and oysters (Bivalvia) which are mostly lived in the rooting side of mangroves. It is well known that shrimp and particularly crab are very abundant on the mangrove ecosystem, they live with how to make a hole in the soft substrates, such as mangrove crabs (*Scylla*, sp), crab (*Uca* sp), small crab attaching (*Portunus* sp), soldier crabs (*Muctiris* sp), stone crabs (*Grapsus* sp) and various ghost crabs (*Dotia, Cleistostoma*). They life by eating any kinds of detritus from both the sea and land. They are also supports their life in the ecosystem by filtering both plankton and zooplankton. The mangrove area is suitable location for nursery grounds, feeding grounds, and spawning

grounds of most shrimp and also for saltwater fish particularly mullet, before their lives and migrate to the deep sea [3,4,5].

Condition Factor (CF)

Condition Factor is the Fulton's formula [weight/length^3] x100, which is widely used to determine the nutritional state of fish and it is also used to evaluate the fattiness of fish [6]. The CF can also be used as an indicator of health status or fitness level of particular fish [7]. The CF can also be used as an indicator for monitoring the nutrition and health status of concerned fish populations during a long period of exposure time [8].

The value of CF is influenced by age, gender, season, maturity level of the gonads, the fulfillment of the gastric contents, type of consumed food, and development level of the fish muscles. On particular type of fish, the weight of its gonad is more than 15% of its total weight. In case of female fish, CF value will dramatically decrease after their eggs has been released from their ovaries [9].

Pollution Index (PI)

Quality of water is commonly determined by using the pollution index (IP). Pollution index used to determine contaminants compare to the standard of water quality parameters.The pollution index is however only can be measured for specified sites, which then be used to interpret for wider area of water. The method will be able to be directly connected to the water quality standard both based on concerned parameter and particular water usage [10].

II. Research Methods

Time and place

This research was conducted during period of June-July 2015. The research was performed in the Mangrove Centrelocated atMargasari, East Lampung Regency, Lampung, Indonesia.

Research Approach

1) *Diversity And Status Of Fish Condition*

Number of fish at different locations were collected during data collection, carried out supported by fishermen of Margasari. The fish were obtained by direct capture on research site or caught by fishermen within the area of mangrove ecosystems. Each type of fish was taken at least five samples. Number of cultivated fish (tilapia/*Oreochromis niloticus* and milkfish/*Chanos chanos*), were also taken as a comparison. All samples were measured their total length, and weight. Mean while species identification of fish was conducted in biology laboratory, the University of Lampung.

The water quality parameters which were analyzed include: turbidity, total suspended solid (TSS), total dissolved solid (TDS), temperature, salinity, nitrates, nitrites, sulfides, ammonia, phosphate, sulfate, chemical oxygen demands (COD), biological oxygen demands (BOD), and dissolved oxygen (DO).

2) Determination Of Condition Factor

Analysis was conducted to define the status of the fish condition. The method was determined based on the value of the Condition Factor (CF), derived from the Fulton's formula, [gram/(centimeters)^3] x 100 [6].

3) Determination of the level of quality of waters with pollution index (PI).

$$PI = \sqrt{\frac{(C/L)_M^2 + (C/L)_R^2}{2}} \qquad (1)$$

L = the concentration of raw water quality
C= the concentrations of measured parameters in situ
M = maximum
R = average

Evaluation of the value of the PI is :
$0 \leq PI \leq 1.0$: meet the raw quality (good condition)
$1.0 \leq PI \leq 5.0$: light polluted,
$5.0 \leq PI \leq 10$: moderately polluted
PI >10:heavily polluted [10].

III. Results and Discussions

A. Diversity Index

Based on the sampling results, it was obtained 15 fish species with diversity index of 2.35. The diversity index 2.35 can be considered that the fish diversity in the concerned mangrove forest ecosystems is in a good category [11]. The fish species which was encountered most frequently (dominant) is Mystus nigriceps. The reason could be due to the fact that the main food of the species is a small shrimp which can be easily found in the area of study.

B. Fish Condition Status

Analysis of the status of fish condition was performed based on a value of condition factor. The calculationresults of the CF values both at the mangrove ecosystems and at fish cultivationpond, can be seen in Table 2.

Table 2. Value of Fish Condition Factor

Fish Species	CF	SD
Mystus nigriceps	1,229	0,251
Eleutheronema tetradactylus	0,933	0,160
Valamugil seheli	1,099	0,092
Mallotus villosus	1,608	0,289
Paraplagusia blochi	0,561	0,055
Lutjanus Griseus.	2,219	0,433
Epinephelus fuscoguttatus	1,420	0,117
Lutjanus campechanus	1,737	0,281
Argyrops Bleekeri	3,070	0,143
Macrones microchus	1,191	0,042
Arius sagor	1,033	0,055
Lates calcarifer	1,238	0,057
Plotusus canius	0,526	0,191
Chanos chanos	0,855	0,039
Oreochromis niloticus	1,980	0,544

Results of the study shows thatmost fish (10 species) has a value of CF more than one. While the rest three fish species has value of CF less than one, this is most probably due to the fish shape, which is more cylindrical compare to the other species. In particular, [6] mentioned that CF based on Fulton's formula was not suitable for the cylindrical–shaped fish. As a comparison, it was also carried out the CF calculations for cultivated, in ponds, fish (*Chanos chanos* and *Oreochromis niloticus*) with the value of CF are 1.98 and 0.85 respectively. The value was then used as an evaluation indicator of health and fitness conditions of fish [7]. Fish could be considered in a healthy condition if there are enough food and fish seem fatter/fleshy, so fish tends to be heavier compare to its visual length. Fish in those conditions will have a value of CF higher than one. On the other hands, fish that consume less food, skinny, and slender fish has a value of condition factor of less than one [12]. The CF value affected by many factors such as the condition of the organism itself, environmental conditions, the number of organisms, as well as the availability of food. The better condition of the environment, the higher factor conditions will be [13]. As stated by [14] waters within mangrove ecosystems can provide a natural system in maintaining fishery productivity.

Based on the collected CF values, it is proved that mangrove forest ecosystem is very essential in supporting the growth of fish populations. Similar research also indicated that the value of CF on two species of Tilapia namely *Tilapia zillii* and *Oreochromis urolepis* in full strength sea water was less than one (0.86; 0.53). On the other hands,it was more than one (2,81; 3.46) in fresh water. Both of these species grow well in fresh water [15]. Similar research conducted by [16] at PT. Gunung Madu Sugar Factory was concluded that value of CF of Tilapia (*Oerochromisni laticus*) were decreased at wastewater treatment pond compared to the fresh water ponds.

C. Pollution Index (PI)

The calculation results of the pollution index can be found in Fig. 1.

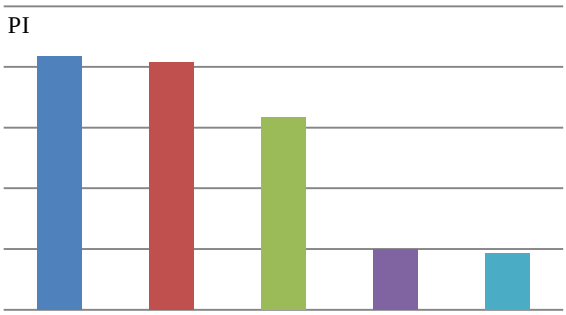

Fig. 1. Value of Pollution Index (PI)

The water quality within mangrove ecosystems at the research site was considered to be, based on the PI values, a light polluted to moderately polluted. The criteria is based on the marine life quality standard according to [17]. The water quality parameters that exceed the standard are nitrates and turbidity. Nitrate, as an indicator of fertility levels, could be sourced from the decomposition of organic materials such as domestic waste, detritus of mangrove plants and other water plants [18].

IV. Conclusions

Mangrove forest ecosystem at the village of Margasari Village is strongly support the life of the fish populations in the area. Fish populations, based on the value of diversity index, is considered in a good condition (H=2.35).The condition status of the fish at the concerned site was mostly in a healthy condition and fleshy (CF > 1). In addition to that, Water quality conditions at the concerned site was considered in the high fertility rate and plenty of natural food available for the fish population.

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