

1_GEOMEMBRANE

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1 APPLICATION OF GEOMEMBRANE AS CARBON CAPTURE AT PALM OIL MILL

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ABSTRACT: Global warming is the most important issue in last decade that causes a climate change. Global warming is triggered by greenhouse effect, whereas the process by absorption and emission of infrared radiation by atmospheric gases increases the temperature. Methane is one of the gases, which contribute to increase the greenhouse effect and predicted 20 times larger than Carbon Dioxide potential impact. However, methane can be used as alternative resources energy such as biogas. Methane is produced from organic waste like biomass, animal and human waste, also the palm oil mill's waste. In West Indonesia where the expansions of palm oil fields grow faster, the increasing methane gases become a serious matter. One of the alternative solutions to minimize that methane's impact is by using an aerobic bio-digestion process. HDPE geomembrane, one of the geosynthetic products can be used to captures the methane gases and led in them by using a pipeline to the biogas converter. The installation processes of geomembrane are including patterning, deploying, anchoring and seaming of HDPE geomembrane. As a carbon capture in Palm Oil mill, HDPE geomembrane contribute to reduce the greenhouse effect, provide an alternative energy and for the future hopefully will save our environment.

KEYWORDS: global warming, methane, carbon capture, HDPE geomembrane, biogas, anaerobic bio-digestion process

INTRODUCTION

The spectacular expansion of palm oil mill in Indonesia; especially in West Indonesia, not only generate income for inhabitant in that the region, but in the other hand it's also left a serious problem behind with the palm oil mill's waste. That waste potent to produce the methane gases (CH_4), which predict will be increasing the greenhouse gases effect 20 times larger than Carbon Dioxide. Contribution of several gases to increase the greenhouse effect is shown on the figure below.

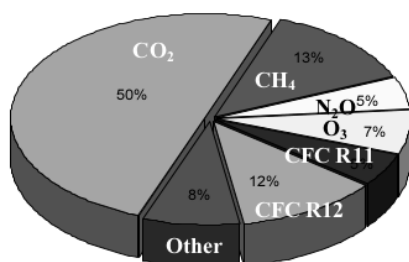


Fig. 1 Percentage contribution of several gases that increasing the greenhouse effect

Palm Oil Mill effluent as known as POME is a liquid waste of palm oil mill, which has 100 times potential as a pollutant waste than another municipal waste. That potential effect will increase the greenhouse effect, if there is no action to treat that entire palm oil mill's waste. The Biological Oxygen Demand of untreated POME average 25,000 mg/liter (Ojonoma & Nnennaya, 2007). Anaerobic biodigestion system can solve the problem of greenhouse gases effect of palm oil mill effluent and also give several benefits:

- Re-use the POME as an alternative source energy
- Create an electricity power
- Reduce the unpleasant odor
- Re-use the POME as a fertilizer
- Reduce the impact of greenhouse gases

Based on the research, 50 million tons of biomass has 1.4 trillion cubic meters potential of biogas or equivalent to 337 MW electrical power generations.

POME TREATMENT SYSTEM

The conventional treatment system of POME is use biological system, by utilizing the microbe to reduce BOD and neutralizing the acidity of POME.

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This conventional system need open lagoon with size depend on the volume of POME will be treated. These are 3 phases of POME Treatment, such as:

Preliminary Treatment

This phase consist of de-oiling and acidifying pond.

At first phase, POME from fat-pit delivers to de-oiling pond, and then transferred to acidifying pond. The temperature and acid density at acidifying pond is kept constant in high condition to ensure the oil content at the POME surface still liquid.

The POME will be remained at acidifying pond during 4 to 5 days to increase the acid density for making easier the next process.

Anaerobic Biodigestion Treatment

The purpose of this treatment is to change the complex organic mass into the simple one.

There are 2 phases on an-aerobic biodigestion treatment i.e. primary and subsequent anaerobic alternation lagoon.

Primary alternation lagoon

In this pond, the complex organic mass will be changed to volatile acid by using an acid bacterial. BOD and COD will be decreased in neutral condition at lagoon during 40 days.



Fig. 2 Primary Lagoon

Subsequent anaerobic alternation lagoon

In this lagoon, the volatile acid changes into an acetate acid and then it will become the gases of CO, CH₄, H₂S, and H₂O.

Further Treatment

The further treatment of POME consists of 2 lagoons: facultative and aerobic lagoon.

Facultative lagoon

The aerobic oxidation occurs at the surface and in that time the an-aerobic fermentation of sedimentation is also occurred, as a consequence the value of BOD and COD will be decreased.

Aerobic lagoon

Bacterial need oxygen for proliferating, so in this place they will get it and all the process will decrease BOD and COD value.



Fig. 3 Subsequent Lagoon

BIOGAS

The biggest component of biogas, which produced from POME treatment, is methane gas; for 600 kg – 700 kg of POME can produce biogas approximately 20 m³ (Goenadi, 2006).

The process of methane can be divided into 3 stages: hydrolysis, asetogenesis (dehydrogenesis) and metanogenesis (Sorensen, 2004).

At first phase (hydrolysis phase), the complex biomass is decomposited to a simple glucose by using microorganism enzyme as catalyst. The important thing in this process is the result of a simpler chemistry for the next phase.

The second phase will change glucose into an acetate acid and broken off the long acid chain become the short one finally it will produce an acetate acid as a final product.

The third phase is the changing process of biogas from acetate acid by using fermentation of metanogenic bacterial.

As an illustration, in case of palm oil mill process 100 ton of fresh fruit bunches (FFB) per hour, will produce 50 m³/hour of POME (assumed 55% of FFB with unit weight 1.1g/cm³, Kartiman, 2008). If the mill operates 10 hours/day, the volume of POME will be

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