UNIVERSITI TEKNOLOGI MARA

BIOGAS PRODUCTION FROM POME BY USING LOW INTENSITY SONIC WAVE

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ABSTRACT

Oil palm industry is the main agricultural industry in Malaysia. In 2006, Malaysia's palm oil mills created more than 58 million tonnes of Palm Oil Mill Effluent (POME). POME categorize as complex waste because of high concentration insoluble organic solids and chemical oxygen demand (COD). Open lagoons treatment at high ambient temperatures has widely ben used nowadays that cause to the uncontrolled generation of methane and carbon dioxide that both gas contribute to green-house environmental problem. It is crucial to create an alternative process to treat the POME as the increase of the environmental concern principally to the green-house gasses emission. Now days, anaerobic digestion has extensively been used to treat the POME because it is a low cost process and capabilities to create biogas. However, anaerobic process is a slow process because of the biological degradation rate is very slow. This result in long fermentation time and can cause to a lower biogas yield. This rate-limiting process mainly happen at the hydrolysis step where the degradation of POME happen in anaerobic digestion. Broad studies had been conducted to improve the anaerobic digestion of POME and it has been discover that by using the low intensity ultrasonic wave pre-treatment can improve and speed up the hydrolysis first stage process in POME anaerobic digestion.

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INTRODUCTION

1.1 Research Background

Palm oil industry has become one of the important agriculture-based industries in Malaysia. The palm oil mill industry in Malaysia has practised continuous and progressive development in that made the country being the second largest palm oil supplier in the world after Indonesia (Shafie, 2017). The production of palm oil from fresh fruit bunch (FFB) will contribute to the generation of POME. The Malaysian Palm Oil Board (MPOB) stated that the crude palm oil total production in 2016 was 17,319,177 ton (MPOB, 2016). For every ton processed of fresh fruit bunches (FFB) it produce approximately 0.65 ton of raw POME (Choo, 2007) , (Wu, 2007). The encouraging growth of palm oil mill leads to negative effect towards the environment because of the identification as the largest contribution for discharging the major waste pollution in the form of POME (Shafie, 2017). POME is a traceable point source of water pollutant that consists of high COD and suspended solids (Abdurahman R. A., 2011). POME also has high content of organic matter and pathogenic organisms (Mansor, 2017).

Raw POME has physical characteristics as brownish, oily, colloidal suspension at acidic condition with high content of total suspended solids (TSS) concentration, chemical oxygen demand (COD) biological oxygen demand (BOD).The composition of water is 95-96 %, total solids is around 4-5%, 2-4% suspended solid and the oil and grease content is about 0.6-0.7% that will be discharge as POME at temperature 80-90 °C (Yunus, 2015). Apart from that, complex organic matter that are hard to decompose biologically (Lin, 2017) such as phenols at 5800 mg/L, lignin at 4700 mg/L, carotene at 8 mg/L and pectin at 3400 mg/L are present in the raw POME (Sambanthamurthi, 2000). Straight release of POME into water sources can lead to a severe environmental issues. The treatment of POME is an alternatives action to minimise the discharges of wastewater, recycle the POME, and can improve the methane so as to reduce the greenhouse gas releases problem.

In this day and age, the POME treatment still depends significantly towards the conventional ponding structure that comprises of facultative ponds and anaerobic followed by polishing ponds (Shin, 2014). The issues arise with treatment of POME by aerobic process by using a pond system are big area necessity, long retention time which is 90-120 days, the