

**RICE HUSK MODIFICATION VIA ESTERIFICATION
FOR PALM OIL MILL EFFLUENT (POME)**

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ABSTRACT

Palm Oil Mill Effluent (POME) is a colloidal suspension originating from a mixture of sterilizer condensate, separator sludge and hydro-cyclone wastewater which is thick brownish colloidal mixture of water, oil and fine suspended solids when it is fresh. POME produced from industry contains higher amount of Chemical Oxygen demand (COD), Biological Oxygen Demand (BOD), Suspended Solid (SS) and oil and grease which over limit the standard set by the Government Agency which is Department of Environment (DOE). POME is categorized as a serious problem towards the environment as it can cause the reduction of oxygen in water thus affected the river and aquatic life when there are excessive amount of untreated POME. Due to this case, many methods have been conducted in treating the POME such as membrane technology, adsorption, and single stage ponding system. Adsorption is considered as an effective method because it is simple, applicable and low cost technique in treating the POME. Thus, the adsorption was selected by using the natural adsorbent which is rice husk for POME treatment. The rice husk was chosen because of its simple accessibility and most abundant biodegradable. The rice husk was modified via esterification process by an effective mass of stearic acid, $\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$ in order to improved its hydrophobicity character. The effects of percentage of calcium oxide, CaO added and ratio of rice husk to stearic acid on the capacity of oil adsorption were investigated. The parameters that have been varied during the experiment were the percentage of calcium oxide added (5 % and 10 %) and ratio of rice husk to stearic acid (1:1, 1:4 and 1:7). Oil adsorption test was carried out in order to characterize the esterified rice husk in removal of oil from POME thus increased in oil adsorption capacity. The optimum operating condition of esterified rice husk was obtained at ratio of 1:7 rice husk to stearic acid and 5 % of calcium oxide added into the reaction as it successfully increased the oil adsorption for the removal of oil from POME at 0.1992 g/g. In addition, the high adsorption capacity of modified rice husk was better than unmodified rice husk as a result of increasing from 0.0824 g/g (40 %) to 0.1992 g/g (96.7%).

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CHAPTER 1

INTRODUCTION

1.1 Background study

Palm Oil Mill Effluent (POME) was a colloidal suspension originating from a mixture of sterilizer condensate, separator sludge, and hydro cyclone wastewater. POME was a thick brownish colloidal mixture of water, oil and fine suspended solids when it is fresh (Madaki et. al., 2013).

POME can be stated as the most expensive and it is one of the wastes that were difficult to manage by mill operators. This is because there are large amounts of generated at a time. Based on the findings, there was about 26.7 million tons of solid biomass and almost 30 million tons of POME was generated from 381 palm oil mills in Malaysia. The amount of POME produced was increased in 2005 whereby it turns to 53 million tons. The increasing amount of POME was due to the production and processing of palm oil continuous to rise to meet both domestic and global demand (Madaki et. al., 2013).

Nowadays, POME is categorized as one of the environmental concerns. This is because POME could cause health hazards if it is improperly treat (Wahi et. al., 2013). The excessive amount of untreated POME may cause the reduction of oxygen in the water. Hence, it will be affected the aquatic life. In addition, the rivers also degraded because of untreated POME. According to Madaki (2013), the rivers degraded was proven when people from Keningau and Murat who keeply reported the case of pollution due to the palm oil mills are polluting the Ongom, Ambual and Puntir rivers. The people from Murat complained that oil and the dirt pollution is coming from a mill had crippled the water source for the residents in Pegalan River (Madaki