UNIVERSITI TEKNOLOGI MARA

TREATMENT OF PALM OIL MILL SECONDARY EFFLUENT (POMSE) USING SOLAR FENTON OXIDATION WITH IRON-CONTAINING SLUDGE

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Abstract

Treatment of Palm Oil Mill Secondary Effluent (POMSE) Using Solar Fenton Process with Iron- Containing Sludge

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Purpose: A study was conducted to determine the effect of solar radiation in Fenton process on Palm Oil Mill Secondary Effluent (POMSE) and the efficiency of the process was assessed based on COD and color removal. The usability of recovery and reuse iron containing sludge as a source of iron was also determined. **Methodology:** POMSE sample was collected from a palm oil mill located in Kuala Kubu Baru, Selangor. The solar Fenton process was conducted in batch mode at laboratory scale. The solar energy was employed in the Fenton process. The POMSE was characterized in terms of pH, COD, color, suspended solid and total iron. The experimental work consists of two stages where the first stage was oxidation reaction at different reaction times which are 30 and 60 minutes. The experiment was followed by second stage which is oxidation process using iron recovered from Fenton sludge as a source of iron instead of fresh iron. This stage was repeated for five times. The supernatant and sludge were characterized after treatment process. **Result:** The result for pH, color, COD, total iron and suspended solid of POMSE were 8.10, 315 ADMI, 206 mg/L, 0.7 mg/L and 149 mg/L respectively. The COD and color removal for 30 minutes reaction time were 43% and 93% respectively. For 60 minutes reaction time, the COD and color removal were 66% and 84% respectively. There is no significant difference on reaction times for the treatment process with p-value= 0.378 and 0.423 (p-value> 0.05). The Fenton sludge was characterized in terms of specific gravity, moisture content, VSS, TSS and metal content which is iron (Fe). The ability of iron sludge as iron source also was observed through performance of color and COD removal. The color removal percentage ranged from 30% to 67% for 30 minutes reaction time and 3% to 84% for 60 minutes reaction time. The COD removal was 7% for 30 minutes and 21% for 60 minutes. There was no COD removal occurred from recycle 2 to recycle 5 using recovered iron. **Conclusion:** Solar Fenton process was found to be efficient in treating the wastewater based on removal of COD and color. The iron recovery from sludge generated in Fenton oxidation was feasible according to the removal of color but further study is needed on iron recovery sludge.

Keywords*: Fenton, palm oil mill secondary effluent, solar Fenton, iron recovery Fenton sludge, Chemical Oxygen Demand, color*

CHAPTER 1

INTRODUCTION

1.1 Background information

Oil palm plantation is presently covering millions of hectares across Malaysia, Indonesia and Thailand and is becoming the world's number one industrial crop. In 2003, Malaysia remained the world's largest producer and exporter of palm oil with 13.4 million tons or 49% of world production and 12.2 million tons or 58% of total world exports (Ahmad, Ismail, & Bhatia, 2005). In 2006, Malaysian agricultural exports rose to about US$12.9 billion with palm oil contributing to 51.4% of total agricultural exports (Aris, Ooi, Kon, & Ujang, 2008).

Palm Oil Mill Effluent (POME) is liquid effluent generated from the palm oil mill that can introduced a significant amount of pollutants to the environment. It is estimated that for every tonne of crude palm oil produced, about 2.5 to 3.5 tonnes of palm oil mill effluent (POME) is generated (Ahmad et al., 2005). Biological treatment processes are widely applied to treat POME, which then produced Palm Oil Mill Secondary Effluent (POMSE). Generally, traditional biological oxidation processes failed in eliminating toxic and recalcitrant organic micro pollutants whereas physicochemical technologies such as flocculation, membrane filtration or adsorption on activated carbon just transferred them from one phase to another without destroying them. Therefore, it is very important to establish alternative solution capable to reduce a significant part of this pollution by destroying the toxic and hazardous organic pollutants. For these reasons, the demand for very efficient oxidation methods has significantly increased over the last twenty years (Stasinakis, 2008).

During the last few years a series of new methods for water and wastewater purification, called Advanced Oxidation Processes (AOP), have received increasing