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An enhanced treatment efficiency for diluted palm oil mill effluent using a photo-electro-Fenton hybrid system

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Abstract: Photocatalysis, electrolysis and Fenton process are three important advanced oxidation processes (AOPs) which produces hydroxyl radical to degrade organic matter in wastewater within 4-6 hours under ambient conditions. A photocatalysis, electrolysis and Fenton (photo-electro-Fenton) process hybrid system has been carried out to treat diluted palm oil mill effluent (POME) in this study. An electrolytic cell was set up with a stainless steel anode and a platinum wire cathode with applied cell potential of 3V. Diluted POME was then treated in the cell with the mixture of titanium oxide (TiO_2) as the photocatalyst, sodium sulfate (Na_2SO_4) solution as the electrolyte, hydrogen peroxide (H_2O_2) and iron sulfate ($FeSO_4$) as the Fenton reagents. The effects on the duration, pH, concentration of TiO_2 and different light conditions on the removal efficiency of chemical oxygen demand (COD) of the diluted POME were studied. The optimal conditions for the photo-electro-Fenton hybrid system were found to be 4 hr contact time at pH 4 with 60 mg/L TiO_2 under sunlight. With such conditions, the COD removal efficiency was able to achieve 97 %. On the other hand, the photo-electro-Fenton hybrid system gave the highest COD removal efficiency compared to the electro-Fenton hybrid system, Fenton and photocatalyst, respectively.

Keywords: photo-electro-Fenton hybrid system; advanced oxidation process (AOP); Fenton; palm oil mill effluent (POME)

INTRODUCTION

Advanced oxidation processes (AOPs) are defined as the processes that generate hydroxyl radicals (OH•) in sufficient quantities to degrade organic matter and nutrients present in the wastewater effluents. Among the AOPs, photocatalysis, electrolysis and Fenton process in particularly were widely studied and used in various industries due to their low costs, ease of operation,

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