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Mini Review

Improvement of Photocatalytic Methods to Treat the Wastewater at Sohar Oil Refinery, Oman

Dheeaa al deen Atallah Aljuboury*

School of Civil Engineering, Universiti Sains Malaysia,

***Corresponding author:** Dheeaa al deen Atallah Aljuboury, School of Civil Engineering, Universiti Sains Malaysia, Nibong Tebal, Seberang Perai Selatan, Pulau Pinang, 14300, Malaysia.

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A large amount of water is used in the petroleum refinery activity. Consequently, significant volume of wastewater is generated. Recently, a wide range of pollutant compounds is detected in petroleum wastewater in Sohar Oil Refinery (SOR). Thus, the elimination of these chemicals from petroleum wastewater is presently one of the most important aspects of pollution control in Oman. The concentrations range for chemical oxygen demand (COD) in petroleum wastewater from SOR is between 550-1600 ppm and the concentrations range for total organic compounds (TOC) is between 220-265 ppm. The standard discharge limits for COD and TOC, which are < 200 ppm and < 75 ppm, respectively. In order to meet the standards, new treatment alternatives should be established. Advanced oxidation processes (AOPs) have the capability of rapid degradation of recalcitrant pollutants in the aquatic environment. In this process, remediation of hazardous substances is attributed to hydroxyl radical, which exhibit reactivity toward organic. In this study, two novel techniques were investigated to enhance the treatment efficiency utilizing solar photocatalyst TiO_2/ZnO/Fenton process and solar photocatalyst TiO_2/ZnO/Air process to remove COD and TOC from the petroleum wastewater in SOR. In addition, a novel route to treat the petroleum wastewater was investigated by using solar energy with the photocatalyst of TiO_2/Fenton process. Several set of experiments were carried out to investigate the influence of important operating parameters, including catalysts dosage, Fenton ratio, Fenton reagents dosages, pH and reaction time on the removal efficiencies of TOC and COD. Several set of experiments were carried out according to Central composite design (CCD) with Responses surface methodology (RSM) to determine the COD and TOC removal efficiency and residual iron under the optimum operational conditions. By using the solar photocatalyst TiO_2/ZnO/Fenton process, the treatment efficiency improved from 18% to 88% for TOC removal and from 24% to 61% for COD removal at the neutral value of pH 7. The solar photocatalyst TiO_2/ZnO/air process enhanced treatment efficiency from 18% to 79% for TOC and from 24% to 51% for COD removal at the neutral value of pH 7. Thus, these two new methods should be the best choice in applications to remove the COD and TOC from the petroleum wastewater in SOR.

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Conflict of Interest

No conflict of interest.