

Petroleum Refinery Effluent Biodegradation in Sequencing Batch Reactor

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Abstract

Petroleum refineries are looking for an alternative wastewater treatment method to ensure that they will meet the regulatory limit of effluent discharge standard set in environmental quality regulations. In this study, the overall goal was to monitor the treatment efficiency by a lab scale process in order to determine the degradation process in a batch biological treatment system. Three different configuration of sequencing batch reactor were used to treat petroleum refinery wastewater (PRWW). Aerobic SBR for raw PRWW, two-stage anaerobic-aerobic SBR for raw PRWW, and aerobic for mixed raw PRWW and domestic wastewater. The process was operated continuously in batch mode with continuous operation and monitoring with regards to COD, Ammonia-nitrogen, Nitrate-nitrogen, Phosphorous, Sulfate, MLSS, MLVSS. The effluent sCOD, Ammonia-nitrogen, Nitrate-nitrogen, TSS, and VSS for aerobic SBR were 54 mg/L, 5.9 mg/L, 1.47 mg/L, 66 mg/L, and 19 mg/L respectively. And for two-stage anaerobic-aerobic SBR were 49 mg/L, 0.8 mg/L, 3.1 mg/L, 60 mg/L, and 17 mg/L respectively. And for the aerobic SBR treating mixed PRWW with domestic were 53 mg/L, 0.8 mg/L, 1.9 mg/L, 76 mg/L, and 52 mg/L respectively. As a result, combined anaerobic-aerobic SBR treating PRWW gave pathway for maximum biodegradation and showed relatively better performance.

Keywords: Petroleum refinery wastewater, biodegradation, anaerobic-aerobic, SBR.

1 Introduction

Large volumes of water are used during the refining process in petroleum refineries which subsequently generate large volume of wastewater. The refinery wastewaters mostly contain high level of pollutants which are similar to those identified in crude oils [1]. Each refinery is made up of different plants, which produce different wastewater characteristics that is generally unique and can vary periodically [2]. Effluents discharged from petroleum refineries without proper treatment is hazardous to the environment. Studies have been shown that refinery effluent discharged into the water bodies resulted in the presence of high concentrations of pollutant in the water as well as in the sediments. The toxicants have been shown to be present in concentrations which may be toxic to aquatic organisms [3]. Biological treatment processes are known to be economical and an efficient method that can be used for treating wastewater from the refineries [4]. Petroleum refinery effluent treatment attracted researchers to provide reliable biological treatment process. Petroleum refinery wastewater and its major components such as phenols and BTEX has been studied to investigate the treatment efficiency by using aerobic, anaerobic and anoxic or a combinations of two or more biological conditions [5, 6, 7, 8].