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Phenol removal from oil refinery wastewater using anaerobic stabilization pond modeling and process optimization using response surface methodology (RSM)

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ABSTRACT

Oil refinery process releases toxic pollutants into aqueous environment. Phenol and its derivations as the most important pollutants pose severe environmental concern. In this study, the rectangle anaerobic stabilization pond (ASP) consisting of feed tank with workload of 60 Lit (1 × 0.2 × 1) meter of phenol was used. This study evaluated the interactive effect of phenol concentration (200–400 mg/l), temperature (8–24°C) and Hydraulic retention time of (HRT) (2–5 d) on the efficiency of anaerobic stabilization pond for oil refinery wastewater treatment. In this study, experiments were carried out based on central composite design (CCD) and analyzed and modeled by response surface methodology (RSM) aimed at demonstrating the operating variables and also the interactive effect of three independent variables on 7 responses. The maximum removal efficiency of SCOD, TCOD, SBOD and TBOD were 66.26, 68.95, 65.3 and 67.02%, respectively, at phenol concentration of 200 mg/L, HRT of 2 d, and temperature of 24°C. Generally, the ratio of N/P varied between 6.69–9.12 and 7.04–12.93, respectively, in influent and effluent of anaerobic stabilization pond. The maximum phenol removal efficiency reached 70.53% and 81.63% at phenol concentration of 200 mg/L, temperature of 24°C with HRT (2 and 5 d), respectively. The phenol removal efficiency was significantly influenced by increasing the temperature compared to decreasing the phenol concentration. The result indicated that the anaerobic stabilization pond was a capable biological treatment process that could achieve the moderate removal of oil refinery wastewater.

Keywords: Phenol; Oil refinery; Wastewater; Anaerobic stabilization pond; RSM

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