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Oily wastewater treatment using ultrafiltration

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ABSTRACT

Treatment of the oily and greasy wastewater of Tehran refinery using an ultrafiltration (UF) system was experimentally studied. In the experiments, a polysulfone (PS) (30 kDa) and a polyacrylonitrile (PAN) (20 kDa) and the API wastewater of Tehran refinery as membranes and feed were used, respectively. Effects of different operating parameters such as transmembrane pressure (TMP), cross flow velocity (CFV), temperature and pH on permeate flux, fouling resistance (R_f) and rejection were studied. According to the results, the optimum operating conditions of the UF process were found as following: TMP (3 bar), CFV (1 m/s), operating temperature (40°C) and pH (9). Performance of the both membranes for the wastewater treatment was compared. The PAN membrane showed higher rejection, permeate flux and less R_f than the PS membrane. Also, when using the PAN membrane, concentration polarization phenomenon and consequently gel layer formation took place quicker. A cleaning procedure was proposed using a metal chelating agent (EDTA) and an anionic surfactant (SDS) which was able to regenerate the fouled UF membranes effectively by optimizing chemical (pH) and physical (cleaning time, CFV and temperature) conditions. Analysis of the UF process showed 99.7%, 77.2%, 63.3%, 65.4%, 29.8%, 100% and 99.5% reductions of oil and grease content, TOC, COD, BOD5, TDS, TSS and turbidity, respectively. Long term experiments confirmed that UF using the PAN membrane is effective for treatment of oily wastewater produced from refinery processes. A comparative study also showed that UF is more effective than the conventional biological method.

Keywords: Wastewater treatment; Ultrafiltration; Fouling; Chemical cleaning

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