

Use of ultrafiltration membranes in the treatment of refinery wastewaters

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ABSTRACT

Conventional treatments of refinery wastewaters no longer meet today's international standards because of the high concentrations, low efficiency or high costs. Membrane processes such as ultrafiltration have been accepted as a versatile separation process for refinery wastewater treatment in recent years. This study focuses on optimizing the operating parameters of ultrafiltration for treating these effluents. It was the aim of this investigation to determine the suitability of four different membranes with different pore sizes for the ultrafiltration of Arabic Aramco crude oil diluted in tap water. The Carbon-Zircon 500 Å tubular membrane was selected among the tested membranes after it proved to be a total barrier for the oil at any feed concentration and gave the highest permeation flux, which is optimized at about 200 l/h.m² with optimal operating parameters. The influence of operating parameters on the flux decline and the deposit specific cake resistance were studied. Results showed that increased feed concentration severely decreased the permeate flux, but transmembrane pressure and shear stress had relatively little effect on the flux decline. The specific cake resistance depends strongly on the pressure and the concentration and is independent of the temperature and cross-flow velocity due to shearing forces. The oil rejection depends on the membrane characteristics and the type of emulsion. The main parameter affecting the process is temperature, as this determines the droplet size distribution which strongly influences the permeation flux. Filtration models were used to characterize the type of fouling that occurs. Results showed that there is an absence of irreversible fouling and the main limiting process is the mass accumulation on the membrane surface.

Keywords: Ultrafiltration; Refinery wastewaters; Barrier membranes; Fouling

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