



Optimization of operating conditions in ultrafiltration process for produced water treatment via Taguchi methodology

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ABSTRACT

This paper describes how to find optimal operating conditions of three controlling parameters, i.e. temperature, transmembrane pressure (TMP), and cross-flow velocity (CFV) for maximizing the permeate flux and total organic carbons (TOC) rejection, and minimizing the fouling resistance using Taguchi method in ultrafiltration (UF) treatment of the real produced water. At first, the optimal operating conditions were found at a temperature of 45°C, TMP=4 bar, and CFV of 2.25 m/s. To determine the most significant parameters affecting the response parameters, an analysis of variance was employed. In the second stage, performance of applied polymeric membrane in the UF system was studied under an optimum operating condition thus, 100% oil and grease, 100% total suspended solids, 99.78% Turbidity, and 79% TOC removal was obtained. The experimental calculations indicated that both pore blocking and cake layer formation mechanisms of fouling contributed quite effectively to the flux decline during the UF process. It is then concluded that purified produced water has the appropriate qualifications to be used for other necessary applications including irrigation, injection into oil wells, cooling towers, and boilers.

Keywords: Experimental design; Optimization; Polymeric membrane; Produced water; Ultrafiltration

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