Optimization of conditions in ultrafiltration treatment of produced water by polymeric membrane using Taguchi approach

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ABSTRACT

In this study, the ultrafiltration of produced water was studied using a two-stage ultrafiltration process. In the first stage, the influences of operating parameters, including transmembrane pressure, temperature, and cross-flow velocity on the amount of flux decline caused by membrane fouling, were investigated using a polymeric membrane. In order to design the experiments and optimize the experimental results, the Taguchi method was applied. \(L_9\) \((3^3)\) orthogonal array for experimental planning and the smaller-the-better response category was selected to obtain optimum conditions because the lowest flux decline was our aim. Analysis of variance was used to determine the most important parameters affecting the flux decline caused by membrane fouling. The optimum conditions were found at the first level of transmembrane pressure (1.5 bar), second level of temperature (40°C), and third level of cross-flow velocity (1 m/s). In the second stage, performance of ultrafiltration system by the polymeric membrane was investigated under the optimum conditions and 99% oil and grease, 100% TSS, 99% Turbidity, and 68% TOC removal was obtained. Also, the size of particles in feed decreased from the range of 200–800 nm to 1.5–3 nm.

Keywords: Polymeric membrane; Produced water; Taguchi; Ultrafiltration

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