

The effect of active layer non-uniformity on the flux and compaction of TFC membranes

Authors: Yazan A. Hussain, Mohammed H. As-Saleh, and Suekainah S. Ar-Ratrout

Abstract: The flux through thin film composite (TFC) membranes is controlled by its active layer. The submicron thickness and the inherent heterogeneity in the properties of this layer make it susceptible to spatial non-uniformity during the synthesis process. The non-uniformity of the active layer has been reflected in large discrepancies between published data for commercial membranes. This study analyzes the behavior of a commonly studied commercial nanofiltration membrane under different operating conditions and attempt to explain the variation in flux between samples based on the active layer properties. Based on pure water permeation results, the active layer was found to exhibit two different behaviors depending on the transmembrane pressure. At low pressures (< 20 bar), strong variations between samples, attributed to non-uniformity, were observed and the steady membrane flux was directly proportional to its initial characteristics. At high pressures (> 40 bar), the variations between samples were suppressed to a large extent. Based on these observations, it was concluded that the active layer undergo an instantaneous compaction which results in more consistency between samples. In addition, it is hypothesized that the depth heterogeneity of the active layer reported in literature produces two different compaction behaviors within this layer. The effect of flow conditions is also discussed in terms of active layer effects.