Fouling characteristics of NOM during the ceramic membrane microfiltration process for water treatment

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ABSTRACT

Ceramic membrane filtration is one of the most promising membrane technologies used for advanced water treatment. Many studies of the fouling behavior of natural organic matter (NOM) have been conducted, but membrane fouling due to dissolved organic matter remains a critical problem preventing the efficient operation of ceramic microfiltration (MF) in water treatment. The aim of this study was to evaluate the fouling characteristics of NOM during ceramic MF using pilot-scale ceramic membrane equipment. In experiments to characterize this fouling behavior, humic acid (HA), bovine serum albumin (BSA), and sodium alginate (SA) were used as representatives of humic substances, proteins, and polysaccharides, respectively. In particular, we evaluated the effects of several parameters on the fouling characteristics of NOM, including concentration, foulant mixture, and rate of flux recovery. The flux decline in the presence of SA showed that ceramic membrane fouling occurred immediately. The membrane fouling by HA was well explained by a linear regression equation. More interestingly, BSA was found to cause mainly irreversible fouling, which is significant because this mechanism involves internal pore adsorption through particle superposition due to foulant accumulation on the membrane surface. The results indicate that the different fouling behaviors of the three types of macromolecules are distinct due to their apparent physical–chemical characteristics.

Keywords: Ceramic membrane; Fouling; Microfiltration; Natural organic matter (NOM)