Kinetics of membrane flux decline: The role of natural colloids and mitigation via membrane surface modification

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Abstract: Applications of membrane technologies for potable water production have been expanding significantly, leading to increased efforts to control membrane fouling, which can significantly reduce membrane performance, increase operating costs, and shorten membrane life. Natural organic matter is ubiquitous in all water supplies and has been implicated as a major contributor to fouling during filtration of natural water. In this review, we discuss factors that influence NOM fouling, including hydrodynamics; properties of the feed constituents such as size, hydrophobicity, charge density and isoelectric point; properties of the membrane including hydrophobicity, charge density, surface roughness, and porosity; and properties of the solution phase such as pH, ionic strength and concentration of metals. We review approaches to identify and mathematically describe fouling kinetics, including effects of pore blockage, cake formation, and osmotic pressure. Finally, we discuss strategies to mitigate fouling, with a focus on strategies that involve a modification of the nanostructure of membrane surfaces, via UV-assisted graft polymerization of hydrophilic monomers to increase surface wettability and reduce interactions between NOM and the membrane surface.

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