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Membrane Filtration and Membrane Bioreactors for Wastewater Treatment

 Springer

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Chapter 9

Comprehending Membrane Fouling: Causes, Effects, and Mitigation Strategies



Saimah Khan, Zeba Ali Mumtaj, Abdul Rahman Khan,
Amadur Rahman Khan, and Roohul Abad Khan

Abstract Membrane technology has emerged as a critical component in water treatment, wastewater reclamation, and food processing due to its efficiency and cost-effectiveness. Membrane fouling is one of the ongoing issues preventing its widespread use, though. Membrane fouling is the term used to describe the buildup of undesirable materials on the membrane's surface or inside its pores, which results in lower performance and higher operating expenses. The objective of this study is to present a thorough analysis of membrane fouling, emphasizing its causes, effects, and preventative measures. First, it discusses the various mechanisms that contribute to membrane fouling, such as physical deposition, adsorption, and biological growth. Comprehending these mechanisms is essential to formulating efficacious fouling control tactics. Second, the effects of membrane fouling on system efficiency and viability from an economic standpoint are explained. Fouling can have a number of negative effects, including decreased flux rates, higher energy consumption, and frequent membrane replacement or cleaning cycles. These effects highlight the necessity of taking preventative action to minimize fouling. Finally, a variety of mitigation techniques to stop membrane fouling are examined. These tactics cover surface modifications, chemical cleaning, backwashing, and sophisticated monitoring and control methods, among other preventive and corrective measures. Furthermore, new developments are examined, including the application of nanomaterials and bio-inspired coatings for fouling mitigation.

Keywords Membrane foulants · Mitigation strategies · Gas bubbling · Backwashing

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