Investigation of organic compounds on the performance of membrane capacitive deionization: desalination rate, energy consumption and its mechanisms

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\textbf{A B S T R A C T}

Attention in desalination using membrane capacitive deionization (MCDI) has led to the realization that organic substances may cause undesirable attachment onto membrane and could affect the MCDI desalination performance. Bovine serum albumin (BSA) was used as a model foulant and its effects on the desalination rate and membrane properties were studied during long-term operation. The desalination rate was found to be relatively stable (48.05\%) when the feed solution contained NaCl only, while the rate significantly decreased to 4.3\% when 100 mg/L BSA was present in the feed water. Energy consumption increased obviously due to the additional energy consumed by BSA and the increment became more significant with BSA concentration increasing. The phenomenon was further analyzed using different characterization methods and it was found that the changes in membrane properties and surface structure caused by the initial aggregate deposition onto membrane surfaces followed by the chemical attachment of native protein molecules onto these aggregates were the main reasons for the decline in the desalination rate. Eventually, a series of cleaning steps were adopted to select the most effective method for ion exchange membrane in MCDI process. These findings would offer deeper insights into the effect of organic substance on MCDI performance, which was expected to provide a theoretical basis for further application.

\textit{Keywords}: Membrane capacitive deionization; Membrane properties; Desalination rate; Energy consumption; Organic substance

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