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Hybrid CV-CC operation of capacitive deionization in comparison with constant current and constant voltage

Saleem, Muhammad Wajid

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Hybrid CV-CC operation of capacitive deionization in comparison with constant current and constant voltage

Muhammad Wajid Saleem, Y. A. C. Jande, Muhammad Asif & Woo-Seung Kim

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Abstract

Capacitive deionization (CDI) is a technique used to desalinate saline water by means of electrical potential applied to the electrode along both sides of a spacer channel through which water flows. CDI operates either at constant voltage (CV) or at constant current (CC) operation to desalinate saline water. The purity of the water is the main requirement at the outlet of the cell. The lowest effluent concentration is achieved within a very short time by operating the CDI cell at CV, but after that the effluent concentration continues to increase. On the other hand, in CC, the lowest concentration is achieved later as compared with CV, but once it is achieved it continues to remain constant until the target voltage is reached. In this paper, we combine both CV and CC operation to get the lowest concentration for maximum time during the adsorption process so that more desalinated water is produced. We compare hybrid CV-CC and constant voltage and constant current in terms of effluent concentration, energy consumption per ion removal, water recovery, and water quality by varying operational parameters like cell potential. It was observed that ultrapure water can be produced with hybrid CV-CC operation by systematically varying different process parameters like flow rate and cell potential to get better results.

KEYWORDS: Capacitive deionization, hybrid CV-CC, water purity