Capacitive deionization of salt water using thin stainless steel and graphite collectors in the FdCDI process

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Abstract

While the global water resource is very limited, the rapid population growth and urbanization have caused an added demand for fresh water. The developing capacitive deionization (CDI) method has gained extensive attention mainly due to its high energy-efficiency, environmental friendly, and low cost for desalination. To improve the benefits of flow-electrode CDI (FCDI) and the simplicity of the traditional flow-by CDI methods, a novel fluidized CDI (FdCDI) has been developed**.** In this work, a feasible study for FdCDI of saltwater using the thin stainless steel (SS) as the current collectors was investigated. The less resistance graphite current collectors for the FdCDI electrodes without activated carbon (AC) coating have a greater salt adsorption capacity than that of the SS ones. Moreover, the graphite current collectors possess a nearly ideal capacitor behavior and allow the ions in the solution to be more efficiently electrosorbed by the electric double layer of flow electrodes. Nevertheless, the cyclic voltammetry (CV) curves of the AC-coated SS and graphite electrodes have a near rectangle shape for the charge/discharge process, which can be regarded as supercapacitors at a scan rate of 5-25 mV/s. The shape of the curve is similar, indicating that less resistance causes the ions to transport fast in the microporous electrodes. The thin SS become a better current collector simply due to the fact of the more feed rates (by +85%) can be achieved for FdCDI.

Keywords: *Capacitive deionization, stainless steel, graphite, fluidized capacitive deionization.*

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