

Membrane capacitive deionization system combined with redox flow battery for desalination

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Capacitive deionization (CDI) process is an electrochemical system that adsorbs ions in a solution by applying a voltage. Nevertheless, there is still a need for more development in terms of capacity and speed. Among them, the membrane CDI system is composed of a system in which a solution flows through a cation exchange membrane and an anion exchange membrane. As a result, studies have been carried out mainly on adsorption of sodium and chloride ions on carbon substances.

In this study, we propose a new CDI system to desalinate water during the charging redox flow battery (RFB) system. In RFB, when redox active materials oxidize / reduce, supporting electrolytes move through the membrane to maintain charge balance. With this principle, we designed a system in which sodium and chloride ions move to keep the charge balance of each electrolyte. In this process, the redox active material and the supporting electrolyte should not pass through the membrane. Therefore, the cell is constructed by using 2-phenyl-4,4,5,5-tetramethylimidazoline-1-oxyl-3-oxide (PTIO) for redox material, and tetrabutylammonium hexafluorophosphate for supporting electrolyte.