Assessment of capacitive deionization microfluidic desalination via electrode microstructure analysis

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ABSTRACT
Microfluidics desalination technology is an immerging path of technology to utilize the domination of many apparent fluids physical properties (viscosity and surface tension) in the micro-flow systems. The traditional and commercially applied desalination methods suffer from several drawbacks such as high power consumption and low separation performance. It is believed that the flow of liquids in the micro-scaled structures will optimize the mixing efficiency and that will definitely lead to higher desalination performance. The present work introduces a microfluidics chip for water desalination. The chip was fabricated using polydimethylsiloxane soft lithography method. The aluminium electrodes were coated with carbon powder in order to avoid dissolution. The desalination efficiency was analyzed and evaluated with different feed flow rate (70, 90, 110, 130 and 150 mL/h) using capacitive deionization method. The dissolution of electrodes were observed for 35 min with the feed flow rate ranging 70 to 150 mL/h. The desalination efficiency with aluminium electrodes and carbon-coated electrodes was 65% and 58% respectively. The microstructure of electrode was analyzed by using scanning electron microscopy coupled with energy dispersive X-ray (SEM/EDX). The result revealed that the aluminium electrode experienced dissolution at 70 mL/h while the carbon-coated electrodes start to dissolve at t = 30 min. The findings in this work shows that the dissolution time for electrodes were relies on its surface properties.

KEYWORDS
Capacitive deionization; Carbon coated electrode; Desalination; Dissolution; Microstructure analysis

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