Experimental investigation of neutralization dialysis in three-compartment membrane stack

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ABSTRACT

This work is concerned with the feasibility of surface water desalination by the neutralization dialysis (ND) process and the difficulties related to it. The pH and the conductivity of model saline solution have been measured during different ND operations, using a three-compartment membrane stack of 64 cm^2 active area for each ion-exchange membrane (IEM). The saline solution concentration is maintained at 0.02 mol L^{-1}. The influence of three parameters has been investigated, i.e. the flow rate (from 35 to 100 mL min^{-1}), the alkaline solution concentration, and the acidic solution concentration (from 0.02 to 0.1 mol L^{-1}). We have shown that diffusion boundary layers have a great influence on the ion-exchange kinetics through the IEMs. A leakage of HCl solution through the cation-exchange membrane has been proved. Its influence is more pronounced when the acidic and alkaline solution concentrations are low. These leakages modify the shapes of the pH vs. time and conductivity vs. time curves, and decelerate the desalination efficiency. After 2–3 h of desalination process, the conductivity reached the value of 0.25 mS cm^{-1}, as recommended by the Organisation Mondiale de la Santé (OMS) for a drinking water. The desalination process was achieved within a reasonable duration in all the experiments.

Keywords: Ion-exchange membrane; Neutralization dialysis; Desalination; Surface water

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