Curved electrodialysis membranes: an innovative approach to enhance ion separation in EDMEM stacks

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ABSTRACT

The predominant driving force for ion separation in electrodialysis membrane (EDMEM) stacks is the electrical potential gradient. Nevertheless, excessive electrical potential gradient, besides higher energy consumption, could lead to other detrimental impacts such as concentration polarization and fouling. The orientation of electric field lines with respect to the main flow stream would instead be changed to offset the effect of such drawbacks. The present study introduces a potentially innovative technique utilizing curved EDMEM stacks by changing the orientation of electric field lines such that it would result in better stack performance. Mathematical simulations based on the analogy between heat and electrical conduction have been employed which confirmed the effectiveness of curved membrane. A mathematical model has also been developed which characterizes the performance of curved membranes.

Keywords: Electrodialysis; Membrane; Electric field; Ion separation; Ion mobility; Separation performance