Influence of the ratio of resin to polymeric binder on the heterogeneity of cation-exchange membranes

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ABSTRACT

In this study, heterogeneous cation-exchange membranes were prepared by a casting method using mixtures of cation exchange resin and polymeric binder for the application of desalination and water treatment. The influence of the ratio of cation-exchange resin to polymeric binder on the electrochemical properties, such as the characteristic values in the current–voltage relationship, electrical conductivity, and chronopotentiometric values, was investigated and the preparation method was optimized based on the characterized properties of the heterogeneous cation-exchange membranes. The heterogeneity, determined by their ion-exchange resin content, was estimated based on the characterized electrochemical properties, which is related to the inter-gel phase fraction and the conducting phase. It was observed that the heterogeneity of the prepared cation-exchange membranes increased with transition time and limiting current density. In electrodialytic experiments, the heterogeneous cation-exchange membranes showed reasonably good desalination performance compared to commercial heterogeneous membranes, which is related to the heterogeneity as well as the membrane properties.

Keywords: Cation-exchange membrane; Desalination; Electrochemical properties; Electrodialysis; Heterogeneity