Electrochemical and transport properties of polystyrene - and polyvinyl chloride-based pyridine Th(IV) phosphate composite ion-exchange membranes: a comparative study

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Abstract

The polystyrene (PS)- and polyvinyl chloride (PVC)-based pyridine Th(IV) phosphate (PTP) composite membranes were fabricated successfully and characterized by scanning electron microscopy, X-ray diffraction, Fourier transform infrared spectroscopy and thermogravimetric analysis. The ion-exchange membranes prepared by using 25% of organic polymers i.e. polystyrene and polyvinyl chloride and 75% of pyridine Th(IV) phosphate were possessed good water uptake, good mechanical, chemical and thermal stabilities, ion-exchange capacity and better permselectivity. The electrochemical properties such as transport number, mobility ratio, charge effectiveness and surface charge density of the composite membranes were also determined. The results of transport properties revealed that the developed composite ion-exchange membranes can be employed for the efficient desalination of saline water and electrodialysis process.

Keywords: Composite membranes; Pyridine Th(IV) phosphate; Electrochemical studies; Transport properties; Charge density

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Now-a-days, organic–inorganic composite membranes have attracted great attention for membrane preparation because of their unique opportunity to combine the remarkable features of organic materials with those of inorganic materials. For the preparation of this kind of materials, incorporation of inorganic network through co-precipitation method into a polymer matrix is commonly employed. The present composite membranes show a large number of applications in medicine, pharmacy, chemical industry, wastewater treatment including separation tasks in the beverage and textile industry and others. These applications are attributed to their high thermal resistance, chemical resistance, mechanical strength and high transport number.