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Electrolyte dialysis using charge-mosaic membranes

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ABSTRACT

Charge-mosaic membranes represent a subset of bipolar membranes. They contain anion- and cation-permeable domains. Anions and cations can pass through the membrane without violation of microscopic electrical neutrality. Consequently, much higher rates of transport of electrolytes compared to non-electrolytes of the same size are obtained. The ability of charge-mosaic membranes to separate low molecular weight electrolytes from non-electolytes of similar size could lead to applications such as desalination of amino acids and other organic species. Here we have determined rates of $CoCl_2$ (2:1 electrolyte), $CuSO_4$ (2:2 electrolyte), $NiSO_4$ (2:2 electrolyte), and $NiCl_2$ (2:1 electrolyte) transport through a charge-mosaic membrane made of microspheres under dialysis conditions. The results are compared to literature values for transport of KCl, a monovalent 1:1 electrolyte. Our results indicate that the mass flux of salt is the same for all four salts and for KCl. In all cases negative osmosis is observed where the volume of the dialysate increases. At the same initial dialysand salt concentration, the volume of the dialysate compartment increased more rapidly for divalent 2:1 electrolytes compared to monovalent 1:1 and divalent 2:2 electrolytes tested here. The results highlight the effect of electrolyte charge on permeability for charge-mosaic membranes.

Keywords: Charge-mosaic membranes; De-salting; Dialysis; Electrolytes; Transport rates

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