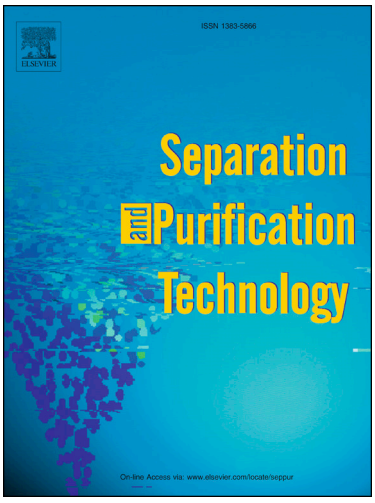

Effect of surface profiling of a cation-exchange membrane on the phenylalanine and NaCl separation performances in diffusion dialysis

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Effect of surface profiling of a cation-exchange membrane on the phenylalanine and NaCl separation performances in diffusion dialysis

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Abstract

Diffusion dialysis (DD) is an environmentally appropriate method for separating components, which are unstable under the external influences (high temperature, high pressure, presence of electric field). The roadblock to the wider application of the DD method for separation and purification of amino acids is relatively low rate and selectivity of diffusion transport of these substances through ion-exchange membranes. In this paper, mechanisms of amino acid selective transport and possibilities to increase its flux across a cation-exchange membrane are considered. In particular, the effect of replacement of a flat membrane with a profiled one, prepared by the method of hot pressing, when using the same material is examined. Experimental and theoretical study is carried out using solutions of phenylalanine amino acid and NaCl when applying a commercial flat MK-40 cation-exchange membrane and its modification MK-40_{pr} with profiled surface. It is found that the relatively high selective transport of phenylalanine is due to its facilitated diffusion, while the NaCl diffusion is reduced by the Donnan effect. The MK-40_{pr} membrane allows a 8-fold increase in phenylalanine flux in comparison with the MK-40 membrane. This increase in partly due to the increased surface available for mass transfer (in 2.3 times), but also to better hydrodynamics reducing the diffusion layer thickness and to a higher fraction of conductive