

Electric field-driven extraction of lipophilic anions across a carrier-mediated polymer inclusion membrane

Abstract

The use of a cationic carrier-mediated polymer inclusion membrane (PIM) for extraction and preconcentration of anionic model analytes driven by an electric field directly into an aqueous acceptor solution is demonstrated. The optimized membrane was 20 μm thick and consisted of 60% cellulose triacetate as base polymer, 20% *o*-nitrophenyl octyl ether as plasticizer, and 20% Aliquat 336 as cationic carrier in the perchlorate form. By applying voltages of up to 700 V across the membrane, the lipophilic model analytes propanesulfonate, octanesulfonate, and decanesulfonate could be transported from the aqueous donor solution to the aqueous acceptor solution with efficiencies $>90\%$ within 5 to 20 min. A preconcentration factor of 26, defined by the volume ratio between donor and acceptor compartments of the current cell design, could be achieved. The utility of the method for analytical applications is demonstrated by extraction of the herbicide glyphosate and its breakdown product aminomethylphosphonic acid from spiked river water, followed by quantification with capillary electrophoresis using contactless conductivity detection. Limits of detection of 0.8 and 1.5 ng/mL were obtained for glyphosate and aminomethylphosphonic acid, respectively.