Design of Ion-Exchange Membrane by Radiation-Induced Graft Polymerization

Kyoichi Saito, Satoshi Tsuneda, William Lee
Department of Chemical Engineering, University of Tokyo

SUMMARY

Strongly basic anion-exchange membranes were prepared by radiation-induced graft polymerization. Porous and nonporous polyethylene films were used as a trunk polymer for grafting. Quaternary ammonium salts were introduced into polyethylene films by grafting of the following three vinyl monomers, and subsequent chemical modifications: glycidyl methacrylate (GMA), diethylaminoethyl methacrylate (DEMA), and vinyl benzyl trimethylammonium chloride (VBTAC). Hydroxyethylmethacrylate (HEMA) was co-grafted to initiate the VBTAC grafting. The VBTAC/HEMA-grafted membrane was selected because of its practical physical strength. Urea permeability across the resulting anion-exchange membranes was evaluated using a diffusion dialysis cell. The anion-exchange membrane based on the porous PE film did not reject cations, whereas the anion-exchange membrane based on the nonporous PE film with the degree of VBTAC/HEMA grafting higher than 75 % exhibited urea and phosphate ion permeation. Higher hydrophilicity was added to the anion-exchange membrane by co-grafting of HEMA with VBTAC, compared with conventional anion-exchange membranes based on styrene-divinylbenzene matrix.