Graphene Oxide as Separation Layer for Nanofiltration of Salty and/or Protein Solutions

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Abstract
Graphene oxide (GO) is used as the ultrathin separation layer on composites in this work to prepare water selective membranes for purification processes. The synthesized ultrathin GO separation layer is distributed on the top surface of a micro-porous polyvinylidene fluoride-polyacrylic acid (PVDF-PAA) intermediate layer, formed on a non-woven support to improve the mechanical properties of the three-layer composite membranes. The resulting membranes are tested on a nanofiltration (NF) system to examine the water permeability and solute rejection efficiency for salty and protein solutions. The rejection was 79 % for Na_2SO_4, 27 % for NaCl, and 98 % for bovine serum albumin (BSA) solutions (Fig. 1). The water permeation data through the GO composite membrane followed modified Hagen-Poiseuille's law, and suggests that the GO interlayer spacing is modified in response to various ions. The separation efficiencies are mainly due to the Donnan exclusion mechanism contribution for salt solutions and sieving mechanism for proteins. The NF operation shows an anti-fouling property in the GO composite membrane for protein filtration (Fig. 2). The high GO composite membrane performance exhibits potential for the separation and purification of aqueous salts and/or protein solutions.

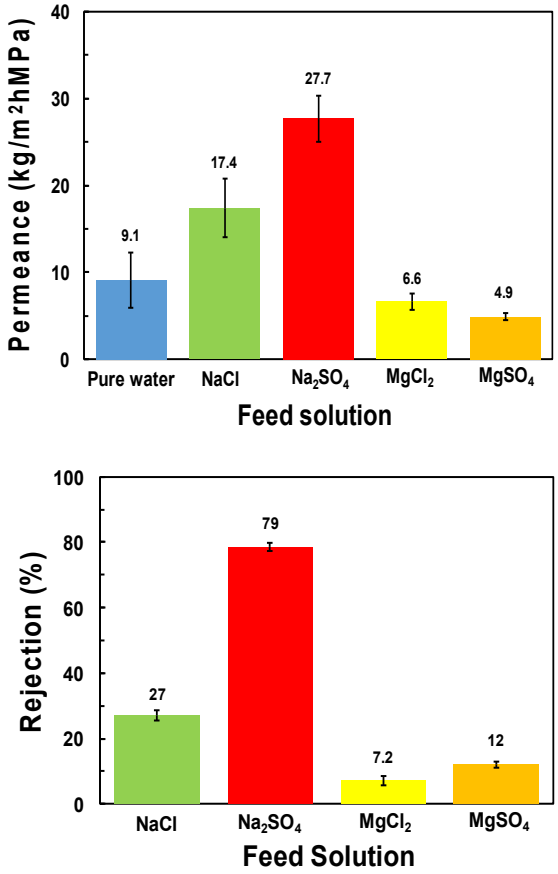

Figure 1: Water permeance (top) and salt rejection (bottom) of salty solutions through GO/PVDF-PAA/non-woven thin film composite.

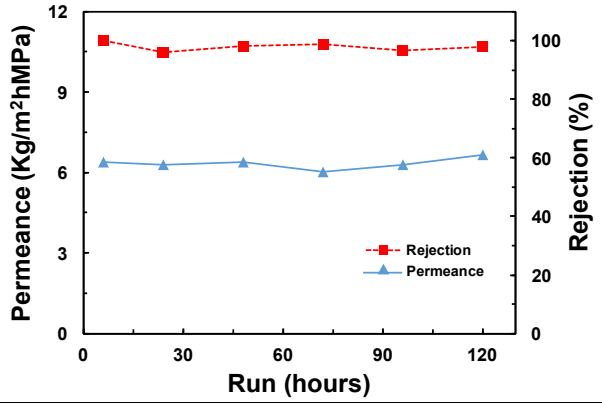

Figure 2: Water permeance (triangle symbol, left axis) and protein rejection (square symbol, right axis) of BSA solution through GO/PVDF-PAA/non-woven thin film composite.