Fabrication and modeling of Nafion®–graphene oxide nanocomposite membranes for concentrating hydrogen peroxide by pervaporation

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Concentrating hydrogen peroxide by pervaporation was investigated using Nafion®–graphene oxide nanocomposite membranes. The graphene oxide was synthesized by a modified Hummers method. The nanocomposite membranes were prepared by a solution casting method. AFM, XRD, FTIR, DMA, and TEM were used to characterize the graphene oxide and the nanocomposite membranes. The results reveal that graphene oxide was exfoliated and well dispersed in Nafion® matrix with loading level of 1–5 wt% graphene oxide. A high performance was obtained on a nanocomposite membrane containing 3 wt% graphene oxide with 25% lower hydrogen peroxide permeate flux (3.751 mol/(h·m^2)) and 30% higher selectivity (1.896) as compared with the pristine Nafion® membrane. Furthermore, in order to predict the time dependency of the membrane performance and retentate mole fraction of hydrogen peroxide, the mass transfer in pervaporation process was modeled based on a solution–diffusion mechanism. The model results were fitted to the experimental data.