Preparation and Electrochemical Characterization of Poly(N-isopropylacrylamide-*co*-acrylic acid) Gels Swollen by Nonaqueous Solvents: Alcohols

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Preparation and electrochemical characterization of poly(N-isopropylacrylamide-*co*-acrylic acid), NIPA-AA, gels swollen by organic solvents are described. Five simple alcohols, methanol, ethanol, 1-propanol, 1-butanol, 1-pentanol, were chosen for these studies. Transport properties of gels swollen by alcohols for several NIPA-AA concentrations were investigated using steady-state voltammetry at microelectrodes with 1,1'-ferrocenedimethanol as an electroactive probe. Diffusion coefficients of 1,1'-ferrocenedimethanol determined over the temperature range 5 – 55 °C were used to evaluate the activation energy of the probe diffusion and to estimate the local microscopic viscosity of the gels using the Arrhenius equation and the Stokes-Einstein relation, respectively.

It was found that an increase in the solvent viscosity is accompanied by an increase in the macroscopic viscosity of the gel, however, enormously large value of macroscopic viscosity has an insignificant effect on the transport parameters for uncharged species. Diffusion of an uncharged probe in gels was almost as fast as in corresponding liquid media (alcohols). Change in the composition of NIPA-AA/alcohol gels from 2.5 to 4.0% polymer concentration influenced the diffusion coefficient value at 25 °C and activation energy of diffusion by less than 18% and 13%, respectively.

No volume phase transition of NIPA-AA gels was observed while swollen by alcohols, a phonomenon well known for NIPA-AA gels swollen by water, indicating a key role of hydrogen bonds in that process. The strength of hydrogen bonds at amide groups of the NIPA-AA polymer swollen by alcohols and water was examined by Fourier transform infrared spectroscopy, FT-IR.