The effect of metal ions additives on the rheological behavior of polyacrylamide solution

Hsing-Yuan Yen and Mu-Hoe Yang*
Department of Chemical Engineering, Kao Yuan Institute of Technology
Kaohsiung County, 82101 Taiwan, Republic of China

Abstract

The rheological behavior of polyacrylamide solution has been studied here in the presence of various metal ions using a concentric cylinder viscometer. Determining in shear rate of 0-555 s⁻¹, and the shear stress has provided empirical measures of the stabilization effect of the metal ions. It was found that more shear stress of the polymer solution occurs in the presence of metal ion than with pure polyacrylamide solution. The effect of temperature and of the kind of metal ions on the rheological behavior of polyacrylamide-metal solution was systematically studied by using the power equation in the temperature range of 20-50 °C and at polyacrylamide concentration of 0.5 wt%. The consistency coefficient of polyacrylamide-metal solution decreased and the flow behavior index of polyacrylamide-metal solution increased with increasing temperature. It was found that the effect of temperature on the consistency coefficient and flow behavior index of polyacrylamide-metal solution followed on Arrhenius type relationship. For metal ions, the stabilizing effect as measured by the difference in consistency and flow behavior index between polymer and metal ion, was proportional to the radius of the metal ion, suggesting that the strength of the complex between the ion and polymer is important in determining stability. Transition metal ions showed dependence of stabilizing effect on ionic radius. The general rheological equation, optimal in terms of multiple correlation coefficients, was established and confirmed by experimental data.