

Effective anti-scaling using low molecular weight polyacrylamide

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Abstract

Low molecular weight Polyacrylamide (PAM) is known to be an effective anti-scaling agent for preventing scale formation in industrial processes. We aim to improve its performance by converting the amide groups to carboxylate using base hydrolysis. Low molecular weight PAM was synthesized by free radical polymerization technique. The reaction was initiated by using ammonium persulphate as an initiator. Hydrolysis of PAM with sodium hydroxide yielded partially hydrolyzed PAM or poly (acrylamide-co-sodium acrylate), which was tested for its performance as anti-scalant in solution of calcium chloride and sodium sulphate. To control molecular weight of PAM, the ratio of acrylamide monomer to initiator and also ratio of monomer to chain transfer agent were studied. The synthesized polymer was characterized its chemical structure by Fourier transform infrared spectroscopy (FTIR). The results confirm the structure of PAM due to the presence of infrared bands corresponding to amide group (1615 cm^{-1}) and acid group (1660 cm^{-1}). Gel Permeation Chromatography (GPC) was used for determining the molecular weight of synthesized polymer. In addition, percentage of hydrolysis was obtained by a titration with hydrochloric acid, and the effect of molecular weight on degree of hydrolysis and anti-scaling behavior were also investigated.