ABSTRACT

Polymeric flocculants have found wide applications wherever some form of solid-liquid separation is involved. Recently water soluble polymers based on grafted polysaccharides have attracted keen attention because of their reduced biodegradability, reasonable shear stability and efficient functioning as flocculants. The graft copolymers act as better flocculants compared to their linear counterparts which is probably because of the better approachability of the grafted acrylic chains to the colloid particles.

The aim of the present investigation was to synthesize the graft copolymers of polyacrylamide with starch and its two constituents, amylose and amylopectin. Further in case of amylopectin, it was planned to synthesize a series of graft copolymers with variation in the number and length of polyacrylamide chains. The plan was to study the efficacy of the three copolymers among themselves as well as the impact of variation in the number and length of polyacrylamide chains in the graft copolymers on flocculation.

The graft copolymers were synthesized using the ceric ion induced redox method of initiation. A variation in the number of moles of acrylamide and ceric ammonium nitrate was done to effect a variation in the number and length of polyacrylamide chains in the amylopectin based graft copolymers. The products were characterized using viscometry, elemental analysis, IR, NMR, XRD, SEM and enzyme hydrolysis. Flocculation of graft copolymers was carried out with three synthetic effluents, namely, a lead slurry (2000 ppm in lead ions), a kaolin suspension (0.25%) and a bentonite suspension (1%). In addition, a case study was made with a paper mill white effluent. The results were compared with some of the commercial flocculants.

A series of eight graft copolymers based on amylopectin (Ap-g-PAM 1 to Ap-g-PAM 8) and one each based on starch (St-g-PAM) and amylose (Am-g-PAM) were synthesized . The variation of synthetic parameters are reflected in the intrinsic viscosity of graft copolymers. Results of elemental analysis, IR, NMR, SEM, XRD etc. establish the proof of grafting. Plots of relative viscosity vs time in case of amylopectin and one of its graft copolymers indicate that amylopectin degrades appreciably over a period of 100 days whereas the graft copolymer does not over the same period. Enzyme hydrolysis of graft

copolymers results in a considerable decrease in the original intrinsic viscosity which is a conclusive proof of grafting.

The study of flocculation efficacy in kaolin suspension established Ap-g-PAM to be more effective than Am-g-PAM and St-g-PAM. When compared with some of the commercial flocculants, Ap-g-PAM was found to be best in performance in case of kaolin suspension. In the series of graft copolymers based on amylopectin, the one with fewer and longer polyacrylamide chains was found to be most effective in kaolin suspension. The bentonite suspension did not flocculate appreciably with any of the polymers, the supernatant turbidity remaining well above 250 NTU in all cases. In case of the white paper effluent, the performance of Aquaset AS 510 was the best although the performance of Ap-g-PAM was on a par with Sufloc, another commercial flocculant.