ABSTRACT

The phenomenon of turbulent drag reduction by polymeric additives has numerous potential applications. The commercial applications are limited due to the fact that polymers undergo rapid shear degradation under turbulent flow conditions and loose their drag reduction effectiveness very soon. Natural polymers like guargum, xanthangum, etc., offer more shear resistance but are relatively less effective drag reducers. Their solutions are also prone to biodegradation.

Present work has been undertaken to improve the drag reduction effectiveness and to decrease the biodegradability of these polysaccharides by incorporation of polyacrylamide into the system. This was carried out by graft copolymerization of acrylamide onto these polysaccharides by aqueous solution polymerization method, using ceric ion redox initiator system. It was also envisaged that incorporation of branches will also improve the shear stability.

Several graft copolymers of guargum, xanthangum, CMC and starch were prepared by changing initiator concentration and monomer concentration in the reaction media. These polymers were then studied for their drag reduction effectiveness, shear stability and biodegradability. The drag reduction measurements were carried out by turbulent flow rheometer operating at nominal Reynolds number of 14000. For shear stability studies the same solution is passed repeatedly through the test pipe and drag reduction was measured up to 1000 passes. The relative viscosity as a function of time was taken as criterion for biodegradation. Relative viscosity measurements were carried out at certain intervals of time up to ten days.

It was observed that in all the graft copolymers studied, the drag reduction effectiveness and resistance to biodegradation were improved over their respective polysaccharides. The variation of number of grafts per molecule and length of graft affects the drag reduction effectiveness. Increase in length of graft improves drag reduction effectiveness of the graft copolymers.