ABSTRACT

The flocculation is a process that involves the formation of aggregates and settling of colloidal particles from the stable suspensions caused by the addition of certain chemicals known as flocculants. Polymeric flocculants are extensively used for the treatment of industrial effluents and for mineral processing. Synthetic as well as natural polymers are widely used as flocculants.

Many polysaccharides play an important role in the field of science and technology because of their unique properties. The polysaccharides are available from natural and microbial resources and they are biodegradable and nontoxic. Water-soluble polymers based on cationic polysaccharides have drawn much attention in the recent decades because of their controlled biodegradability, shear stability and high efficiency as viscosifiers and flocculants. The cationised polysaccharides act as better flocculants compared to the uncationised polysaccharides, which is because of the better approachability of the loaded cationic chains to the colloidal particles. The viscosity of the cationic polysaccharide also increases than that of the base polysaccharide, because of the presence of the longer cationic chains.

The aim of the present investigation was to synthesize some water-soluble cationic polysaccharides where a cationic monomer *N* – (3-chloro-2-hydroxypropyl) trimethyl ammonium chloride (CHPTAC) had been incorporated onto the backbone of polysaccharides in presence of NaOH. Further, it was investigated to synthesize a series of cationic polysaccharides by varying the reaction parameters.

Various polysaccharides namely amylopectin, amylose, glycogen, guar gum, starch had been cationised by insertion of a cationic moiety *N* – (3-chloro-2-hydroxypropyl) trimethyl ammonium chloride (CHPTAC) onto the backbone of these polysaccharides. For each polysaccharide, various grades were developed to optimize their flocculation characteristics. It has been observed that with increase in CHPTAC concentration, flocculation performance increases, but after optimum CHPTAC concentration, with further increase in monomer concentration, the flocculation performance decreases.

The polysaccharides, CHPTAC and synthesized cationic polysaccharides were characterized by various materials characterization techniques like FTIR spectroscopy, elemental analysis, thermal analysis (TG/DTG) viscometry and X-ray diffraction analysis.

All techniques provided unambiguous proof of chemical loading of cationic moiety t polysaccharides. The flocculation characteristics of these cationised polysaccharides we evaluated in four synthetic effluents, namely coal, iron ore, Mn ore and silica suspensio The characteristics of best performing cationic polysaccharide were compared with some the commercial flocculants available in national and international market.

The weight average molecular weight (M_w) and the radius of gyration of the cationised and uncationised polysaccharides were determined by SLS analysis with the he of DLS-7000 Super Dynamic Light Scattering Spectrophotometer. It has been observed th molecular weight and the radius of gyration of cationic glycogen is highest.

Cationic polymers are more efficient as a flocculating agent for highly negative charged colloidal particles. Hence, we use coal, iron ore, Mn ore and silica suspensio which are having high negative zeta potential value. It has been observed that among t five cationic polysaccharides (cationic amylopectin, cationic amylose, cationic glycog cationic guar gum, cationic starch), cationic glycogen is showing best flocculati characteristics which is because of the highly branched structure and high molecular weig of glycogen in confirmation with Singh's Easy Approachability Model on grafted / catio polysaccharides, which states that the dangling branches of polyacrylamide / catio moieties have easy approachability when they are grafted / inserted onto the rig polysaccharide backbone. According to this model, higher is the branching in ba polysaccharide, the acrylamide / cationic moiety chain grafted / inserted on polysaccharide has easier approachability to contaminants or flocs. Since glycogen is t hyper branched polysaccharide, when it is loaded with cationic moiety, the cationic moi gets easier accessibility to form aggregates of the contaminants, providing the be flocculation characteristics. When the flocculation efficiency of best performing catio polysaccharide (cationic glycogen) was compared with some of the commercially availab flocculants, it was found that cationic glycogen surpassed all the commercial floccula except only one in the three suspensions namely coal, Mn ore and silica, but in iron o suspension, cationic glycogen performs the best amongst all commercial flocculants.

The rheological characteristics of these synthesized cationic polymers we conducted in the laboratory using Controlled –Stress TA Instruments AR-1000 Advanc Rheometer. It has been observed that aqueous solution of all the polysaccharides a cationic polysaccharides are showing non-Newtonian pseudoplastic behaviour. They f

also highly shear stable. Amongst all cationic polysaccharides, it has been found that cationic guar gum is showing the highest viscosifying attributes.