

Abstract

The interaction between cationic polymers and colloidal silica play a decisive role in papermaking. The aim of this thesis is to improve the understanding of flocculation between cationic polymers and colloidal silica. Apart from studying flocculation where the polymers are similar or smaller in size compared to the particles, also flocculation where the polymers are much larger in size have been studied, which is a less investigated area.

The electroacoustic technique (ESA), normally used for characterising the electrical properties of colloidal particles, has been demonstrated to be a valuable method for studying the electrokinetic properties of flocculation.

The charge compensation of the silica charges was compared for a linear cationic polyacrylamide (CPAM) and a branched cationic polyamine (POL). It was found that CPAM obtained charge neutralisation at a smaller amount of added charges than the POL. Flocculation experiments were also performed where the two polymers were added either simultaneously or sequentially to the dispersion. The charge compensation given by CPAM alone was at most charge ratios (polymer charges/silica charge) more effective in compensating the silica charges.

The flocculation between cationic polyacrylamide (CPAM) and nano-sized colloidal silica of different size was studied with a Stopped Flow technique. The extent and the kinetics of flocculation were measured.

The effect of changing ionic strength was investigated for the flocculation between CPAM and both nano-sized silica particles and silica with a diameter of 100 nm. In both cases less polymer charges were needed at high ionic strength for reversal of the silica charges.

The ESA technique was also used to determine the dynamic mobility as a function of ionic strength for the polyelectrolytes involved in the flocculation experiments.

A method was developed to determine the size and shape of the nano-sized silica particles used in the flocculation studies.

The coil-to-globule transition of poly(N-isopropylacrylamide) adsorbed onto colloidal silica has been studied. The stability at the θ -temperature was improved by adding an anionic surfactant.

Keywords: Colloidal silica, polyelectrolytes, flocculation, polyNIPAM, electroacoustic sonic amplitude

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