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ADSORPTION OF POLYAMPHOLYTES ON POLYSTYRENE LATEX. EFFECT ON THE COLLOID STABILITY

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The interfacial characteristics of low charge density polyelectrolytes and polyampholytes synthesized by a microemulsion polymerization technique have been investigated. Terpolymers of acrylamide (AM, neutral segment), [2-(methacryloyloxy)ethyl] trimethylammonium chloride (MADQUAT, positively charged segment) and sodium 2-(acrylamido)-2-methyl propanesulfonate (NaAMPS, negatively charged segment), copolymers of AM and MADQUAT as well as of MADQUAT and NaAMPS were adsorbed on a negatively charged polystyrene latex. All polymers may be classified in two classes on the basis of the zeta potential of the colloid-polymer complexes. Copolymers and terpolymers having an excess of positively charged chain segments adsorb on the latex as usually observed for polycations. Terpolymers characterized by a small excess of negatively charged chain segments adsorb on negatively charged colloids as theoretically predicted. Adsorption induces a redistribution of the chain segments so that, on the average, positively charged chain segments are concentrated in the inner interfacial zone while negatively charged ones are concentrated in the outer zone. The importance of the charge distribution anisotropy is revealed by the fact that adsorption of a neutral copolymer bearing positively and negatively charged chain segments in equal concentration and almost alternatively distributed along the chain backbone conferred a zeta potential of –20 mV to the latex-polymer complex. This value has to be compared to the zero potential determined in the presence of polyacrylamide.

The sedimentation behavior of the latex-polymer complexes has also been studied. The latex-polyelectrolyte systems induce a fast destabilization of the latex and it was found that the optimum flocculation requires roughly the same number of free and polymer-coated surface portions ($\theta = 0.5$). As for the latex-polyampholyte systems, different situations can be observed depending on the net charge of the polyampholytes. Those characterized by an excess of negatively charged chain segments do not induce flocculation. When positively charged chain segments are in excess, flocculation immediately starts after mixing and develops in a way similar to that induced by adsorption of polyelectrolytes.

At the optimum flocculation concentration, terpolymers and copolymers exert the role of destabilizing agents although with very different efficiency. The excess of surface charge constitutes the most indicative parameter. The existence of internal repulsive interactions at large distances usually contributes to slow down the aggregation rates by inducing a partial reversibility in the process. The electrostatic origin of the internal fragmentation was asserted by the correlation existing between the magnitude of the zeta potential of the colloid-polymer complex and the relative extent of the fragmentation process. Likewise, the evolution with time of the zeta potential could be correlated to the evolution of the colloid stability.

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