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POLYMER NANOPARTICLES STABILISED BY SURFACTANTS AND REPRODUCIBILITY OF THEIR PREPARATION

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The polymer nanoparticles with various properties are prospective candidates for applications in biotechnology and nanomedicine. We are studying polymer nanoparticles stabilised by surfactants with a more general aim of modifying their surface with biocompatible nanocoating.

We have studied polymer nanoparticles made of poly(methyl methacrylate) and of polystyrene dispersed in water. The dispersion was created by mixing a solution of a polymer with a solution of a surfactant in pure water. We have investigated dispersions of the above mentioned polymers with several ionic and non-ionic surfactants. Our study has shown how nanoparticles properties were changed by a chemical composition of surfactants, molecular weight of polymers, concentrations of both components and finally, by method of nanoparticles preparation. The study has provided the weight-average molecular weights, hydrodynamic radii, radii of gyration and non-uniformity for selected types of nanoparticles. We have focused on reproducibility of the preparation of these nanoparticles.

We have observed the formation of well-defined nanoparticles with hydrodynamic radii from 50 to 200 nm by light scattering methods. This formation was qualitatively explained by stabilisation of monodisperse nuclei of polymer with chosen surfactant at the early stage of the phase separation of the polymer. The adsorbed surfactant hydrophilises the nanoparticle surface. If amount of the adsorbed surfactant reaches critical surface concentration, growth of the nanoparticle is stopped. Therefore, a structure of the particles is supposed to be similar to block copolymer micelles. The hydrophobic polymer molecules form an insoluble core of the nanoparticle and their hydrophilic shell consists of the hydrophilic parts of surfactant molecules. An intermediate shell at the core-shell interface contains both the hydrophobic parts of surfactant and the polymer chains.

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