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Influence of physico-chemical interactions on formation and properties of polymer nanoparticles

Nanoprecipitation is a very useful technique for encapsulation of hydrophobic species in nanoparticles dispersed in aqueous systems. In particular it enables encapsulation of a hydrophobic drug in submicron particles and thereby effectively increases its water solubility but the technique is more generally applicable in various areas of physics, medicine and chemistry. A key factor that determines the functionality of NPs is their size and the distribution of sizes that limits or enhances various applications. Various approaches to control the size of nanoparticles will be discussed. This includes macroscopic nanoprecipitation as well as nanoprecipitation in microfluidic channels, effects of temperature, concentration, ionic strength and quality of the solvents. Nanoparticles can be prepared with or without surfactants; in the latter case influence of the nature of the surfactant will be demonstrated by comparing neutral and charged surfactants, and low-molecular-weight and polymeric surfactants. Kinetics of nanoprecipitation will be discussed on the basis of time-resolved SAXS measurements. Interaction of the polymer with the solvents as well as the miscibility of the solvents used has an important effect on the final size and properties of nanoparticles. Generally the nanoparticles are not compact but have an inner porosity (that will be quantified), which is a convenient structural feature for loading of the molecules to be encapsulated.

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Preferred topic

Gels and nanoparticles

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