

Synthesis of Highly Monodisperse Silica Nanoparticles and Its Surface Modification with Fluorescent Dyes

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Monodisperse colloidal particles have been widely studied because of their various applications in chemistry, biology and material science. Notably, silica particles have been conventionally prepared by Stöber method which utilizes ammonia-catalyzed hydrolysis and condensation of tetraethylorthosilicate (TEOS) in ethanol. However it has been challenge to synthesize monodisperse silica particles, size of less than 100 nm. In this study, we report effective synthetic method which uses oil-water interface for slow releasing of TEOS, which leads to small size silica particles. TEOS, which is dispersed in cyclohexane, was slowly delivered into aqueous phase. Subsequently, hydrolysis and condensation reaction occurred due to base catalyst, L-arginine, in aqueous phase which causes polymerization of silica nanoparticles. As a result, silica nanoparticles size of less than 50 nm were synthesized and further regrowth was conducted using Stöber method for precise size control range from 130 ~ 1000 nm. In addition, silica surface could be modified with fluorescent dyes, which allows us to extend optical studies with fluorescence microscope.