

Aggregation/deaggregation of chiral nanoparticles induced by aromatic solvents

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Reversible aggregation/deaggregation of nanoparticles attracts much attention because of their potential application in biology, chemistry, and material sciences. Surface grafting with functional molecules have been developed, and the specific affinity of biomolecules like DNA were usually used in this process. The application of the noncovalent bonding interactions of the grafted organic molecules is less common, but the development of such a method would broaden the scope of the reversible assembly of nanoparticles on nanometer and micrometer scales. During our studies, novel helicene-grafted chiral silica¹ or gold nanoparticles were synthesized, and the interactions of helicenes were employed to control the reversible aggregation/deaggregation of nanoparticles by aromatic solvents. Such a large aromatic solvent dependence for the dispersion of the nanoparticle was realized by nonplanar π - π interactions of helicenes.

Silica nanoparticles with sizes of 210 and 440nm were grafted with helicene derivatives containing silane moiety via reaction of 3-aminopropylsilane with helicencarboxylic acid chlorides.¹ Gold nanoparticles at 15 nm were reacted with helicene compound possessing mercapto-groups via 4-aminothiophenol based on amidation. Characterizations of IR, UV-vis, CD, ¹H NMR and TG proved the presence of (*M*)- and (*P*)-helicenes on nanoparticles. The chiral nanoparticles deaggregated and aggregated in soft and hard aromatic solvents (Figure 1). These behaviors were caused by the noncovalent bond interactions between helicenes, especially the nonplanar π - π interactions, and it was also confirmed by TEM, in-situ CD and DLS detection.

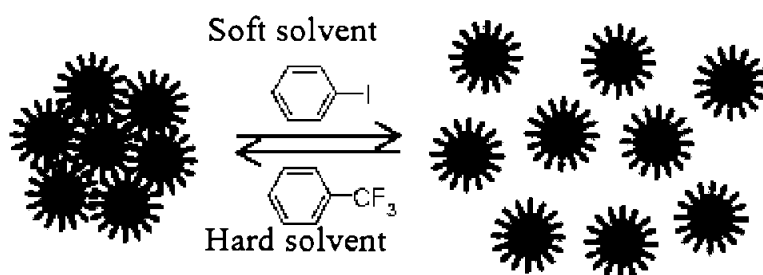


Figure 1. Aggregation/deaggregation of chiral nanoparticles induced by aromatic solvents

References :

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