

Fluorescent chromic properties of polycyclic aromatic polymer colloidal particles

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Nanosized fluorescent particles are widely used in various fields, such as fluorescence imaging, analytical probes, and biological cell labeling. Many of these materials are classified as quantum dots containing rare metals or as nanoparticles (e.g., polymers and silica) doped with fluorescent dyes. We have been developing fully organic fluorescent polymer nanoparticles composed of a polycyclic aromatic backbone. In this presentation, we describe the facile preparation of polycyclic aromatic polymer colloidal particles with fluorescent chromic properties, as well as their solvatochromism and stimuli responsiveness.

Fluorescent polycyclic aromatic polymer colloidal particles were prepared by precipitation polymerization using 1,3-dihydroxynaphthalene as a monomer and 1,3,5-trimethyl-1,3,5-triazinane as a crosslinking agent. TEM observations revealed spherical particles with diameters of 100–150 nm, and their luminescence color under UV light changed from blue to red and then to white, depending on the reaction time. The obtained particles were thoroughly washed to remove unreacted monomer and crosslinking agent, and then dispersed in various solvents.

Interestingly, the luminescence color was strongly affected by the solvent; for instance, it was yellow-green in chloroform and red in DMSO. Fluorescence spectra ($\lambda_{\text{ex}} = 365 \text{ nm}$) showed emission peaks at 490 nm and 640 nm in chloroform, and at 441 nm and 650 nm in DMSO (Figure 1). The emission intensity at shorter wavelengths was relatively higher than that at longer wavelengths in chloroform, whereas the intensity at longer wavelengths was higher in DMSO. This luminescence color was maintained over a long period when the particles were stored in a dry state.

Presumably, interactions between polymer chains within the particles are altered by the penetration of solvent or metal ions into the network structure, resulting in changes in the luminescence color.

Keywords:

Polynaphthoxazine, Precipitation polymerization, Mono-dispersed spherical particles, Stimuli-responsive

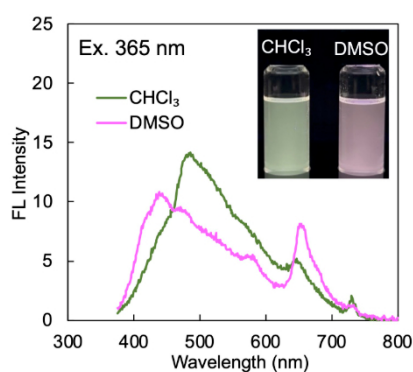


Figure 1 Fluorescence spectra of polycyclic aromatic polymer colloidal particles in CHCl_3 and DMSO ($\lambda_{\text{ex}} = 365 \text{ nm}$), with corresponding photos under UV irradiation.