

Dye-Concentrated Organically Modified Silica Nanoparticles as Fluorescent Magnesium Probe and Its Application of Fluorescent Imaging for Bittern

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Summary

While metal ions in nigari (bittern) have caught our attention as health has become an important issue to many peoples' lives, there are little analytical methods to grasp time-dependently the metabolism of metal ions *in vivo*. Organic fluorescent dyes have recently employed as fluorescent probes for molecular imaging. However, organic dyes-based fluorescent probes exhibit a strong tendency to form aggregates when accumulated on a target molecule, which cause emission quenching. The phenomenon causes serious disadvantages such as narrowing the measurement range and lowering the light permeability to body for their fluorescent imaging. In particular, it is very difficult to detect accurately metal ions derived from nigari *in vivo* because great amounts of metal ions are contained in nigari. Therefore, the development of new fluorescent dyes is required to improve the drawback of these problems. While the recent study entirely devotes to prevent aggregation-caused quenching (ACQ), we focus on the development of a fluorescent dye with aggregation-induced emission enhancement (AIEE) which enables to solve these problems. Here, we report for the first time the design, syntheses, and characteristics of new class of AIEE-active rhodamine dyes. As for the design of AIEE-active rhodamine dyes, the π -conjugation of luminophore moiety is further extended compared with that of conventional rhodamine dyes. The elongated luminophore moiety in the monomeric state is greatly distorted resulting in no emission. In the aggregated states, the luminophore moiety is partial-planarized and intra-rigidified resulting in emission enhancement. To challenge this concept, we have found a synthetic route for new class of rhodamine dyes: aminobenzopyro-xanthene derivatives (ABPX). ABPX was synthesized from the condensation of benzophenone derivative with resorcinol. Then the emission spectra of ABPX dissolved in various solvents were measured. The emission intensity increased as ABPX concentration increased, and the behavior was directly opposite to the ACQ of common rhodamine dyes. These results showed that ABPX exhibited AIEE behavior, and the aggregation functional photoswitching character was useful to control an on/off emission system. ABPX have wide range linearity of emission intensity against the concentration. ABPX showed the long-fluorescent wavelength region from far-red to near-infrared. These photocharacterics benefit for the *in vivo* monitoring of target molecules. In addition, three ABPX derivatives possessing the metal coordination ability were newly prepared. The photocharacteristics of coordination between ABPX derivatives and metal ions are examined. We expect that ABPX series might be serve as a fluorescent imaging probe for elucidation of biological metabolism of metals ion in nigari.