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Photophysics and Photochemistry of Cross-Conjugated Y-Shaped Enediyne Fluorophores

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Abstract : Organic fluorophores with π-conjugated scaffolds are important because of their interesting optoelectronic properties. In recent years, our lab has been engaged in understanding the photophysics of small diacetylene bridged fluorophores and found the diynes as a promising class of π-conjugated fluorophores. Building on this understanding, recently we have focused on the photophysics of a less explored class of cross-conjugated Y-shaped enediynes (one double and two triple bonds). Here we present the photophysical properties of such enediynes which show interesting photophysical properties that include dual emissions from locally excited (LE) and intramolecular charge transfer (ICT) states and ring size dependent aggregate fluorescence in non-aqueous media. The dyes also show prominent aggregate fluorescence in mixed-aqueous solvents and solid powder form. We further show that the solid state fluorescence can be reversibly switched multiple of cycles by external stimuli, highlighting their potential applications in solid states. The enediynes with push-pull electronic substituents/moieties exhibit high contrast fluorescence color switching upon continuous photon illumination. The intriguing photophysical outcomes of the enediynyl fluorophores are judiciously exploited to generate single-component white light emission in binary solvent mixtures and sense polar aprotic vapor in polymer film matrices. The photophysical behavior of the dyes is further successfully utilized to monitor the microenvironment changes of biologically relevant anisotropic media such as bile salts. In summary, the newly introduced cross-conjugated enediynes enrich the toolbox of organic fluorophores and vouch to display versatile applications.

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