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How to enhance fluorescence and two-photon properties of typical dipolar dyes in aqueous media?

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The donor-acceptor (D-A) type dipolar dyes have been widely used as fluorophores in molecular probes and biological tags.¹ In general, this type fluorophores emit strongly in organic solvents but poorly in aqueous media. To enhance the poor emission behaviour of dipolar dyes in aqueous media, we carried out a systematic structure variation of the donor, amino substituent of acedan which is an important two-photon dye.² We have identified several factors that influence the emission behaviour of the dipolar dyes in aqueous media by inhibiting the liable factors for poor emission: 1,3-allylic strain, rotational freedom, and hydrogen bonding with water. This rational approach can be applied to other dipolar fluorophores, as demonstrated for naphthalimide, coumarin, and (4-nitro-2,1,3-benzoxadiazol-7-yl)amine (NBD) dyes. The new acedan and naphthalimide dyes thus allow us to obtain much brighter two-photon fluorescent images in cells and tissues than in their conventional forms. As an application of these findings, a thiol probe was synthesized based on naphthalimide dye, which showed greatly enhanced fluorescence from the widely used N,N-dimethylamino forms. The results indicated that our approach has great potential for the development of efficient dipolar dyes and fluorescence probes for studying biological systems, particularly by two-photon microscopy.

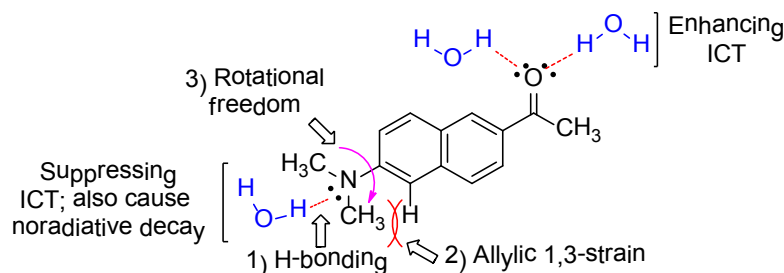


Figure 1. Three factors that affect the emission behavior of acedan, a representative dipolar dye (Taken from ref 2).

Biography

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