

SPECTRAL PROPERTIES OF BENZANTHRONE DYES IN SOLVENTS WITH DIFFERENT VISCOSITY

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A number of human disorders induced by e.g. ionizing radiation or pathogenic protein aggregates are linked to the viscosity alterations in cell environment. One of the effective tools for viscosity measurements is represented by fluorescent molecular rotors, in which electron donor and acceptor can rotate relative to each other, forming twisted intramolecular charge transfer (TICT) complexes. A well-explored example for a TICT molecule is an amyloid marker Thioflavin T (ThT), which is known to move from its local excited (LE) state into a nonfluorescent TICT state in nonviscous environment by twisting benzothiasole fragment around dimethylaminobenzene moiety. It is important to ascertain whether amyloid sensitivity of the recently synthesized benzanthrone dyes (BD) also originates from their TICT–LE transitions. In the present work spectral properties of the novel fluorophores in Ethanol (E) and Glycerol (75.2%)/EtOH (GE) solutions have been studied using fluorescence and absorption spectroscopy techniques. Analysis of the absorbance spectra indicates a dramatic shift (~68 nm) of AM1 and AM3 absorbance maxima to the shorter wavelengths which was accompanied by slight changes of optical density (OD). On the other hand, AM2 in E displayed two absorbance peaks, 396 and 463 nm, with OD ratio about 1:3. The dye transition to very viscous (and more polar) GE solution leads to the disappearance of the 463 nm absorbance peak and to the ~3-fold increase of 396 nm peak. Moreover, AM2 OD in EG at 396 nm was ~7 times higher than that in E. It should be pointed out, that the absorbance spectra of AM1 and AM3 in E were broader than in EG indicating the possible existence of different absorbance peaks. The last statement is confirmed by the appearance of the second fluorescence emission peak (532 nm) after transition of the dyes from GE to E in addition to the initial peak (~632 nm) observed in E. The average ~8 times fluorescence increase of the dyes at 532 nm on going from E to GE makes them sensitive to viscosity changes. The shorter wavelength peak can be attributed to LE state, which is more fluorescent in viscous solvents, and the longer wavelength one – to TICT state, which is fluorescent in the case of BD, but with quantum yield being lowered in viscous environment due to TICT-LE transitions. The average anisotropy increase appeared to be ~12, when going from E to GE, which also confirmed BD sensitivity to solvent viscosity. To conclude, BD proved to be sensitive to solvent viscosity, exhibiting increase of quantum yield and anisotropy in rigid solvent, the property characteristic of molecular rotors. However, BD display also sensitivity to environmental polarity, since the fluorescence intensities of TICT-peaks in E were higher than those of LE-peaks in GE.