Structure dependence of intramolecular photoinduced electron transfer in 9-aminoacridine benzoyl esters dyads linked by a polyether chain

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Electron transfer plays a crucial role in energy transformation of natural biological systems such as the photosynthetic process by which plants convert solar energy into chemical energy. This is achieved in photosynthesis by a series of electron transfers which occur after light is absorbed¹. Among the various factors which influence the efficiency of electron transfer structural effect is one of the important features to be considered. In recent years, numerous synthetic model dyads in which electron donor and electron acceptor are covalently linked by different spacers have been designed and synthesized in an effort to understand how the structural factors might influence the photophysical processes²-⁴. In this note, donor-acceptor dyads consisting of 9-aminoacridine and benzoyl ester units connected by a hydrophilic tetraethylene glycol chain have been synthesized. The photoinduced electron transfer behavior of the flexible dyads was studied by steady-state fluorescence spectroscopy.

The structure of the donor-acceptor dyads is as follows:

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1 Experimental

The absorption spectra were measured on a Hitachi 557 spectrophotometer. Fluorescence spectra were recorded using a Perkin-Elmer LS-5 spectrofluorometer equipped with a 3600 data station. Fluorescence lifetime measurements were determined using a Horiba NAES-1100 time-correlated single-photon counting instrument. The solvents were of analytical grade and were checked before use. They showed no emission upon excitation at the wavelength used in the experiments. The concentration of the solution used for spectral measurements was about $1 \times 10^{-5}$ mol/L.

2 Results and discussion

2.1 Spectroscopic properties of the dyads and intramolecular fluorescence quenching

Figure 1 gives the absorption spectra of the dyads normalized at 410 nm. It is shown that the absorption spectra of the aminoacridine moiety in the dyads with acceptor bearing electron withdrawing groups are similar to that of the model compound (A-B-Bn). This indicates that there is no interaction between the two chromophores in the ground state.

Figure 2 gives the fluorescence spectra of the dyads excited at 410 nm. It is shown that the dyad with dichlorobenzoyl unit (A-B-Cl$_2$) exhibits stronger emission. This indicates that quenching of aminoacridine fluorescence by dichlorobenzoyl group is weak but quenching by cyano, nitro and 4-chloro-3,5-dinitrobenzoyl groups is strong. However, the emission of the dyad with 3,5-dinitrobenzoyl unit is very weak, indicating very strong quenching of the aminoacridine fluo-