

PHOTOINDUCED ELECTRON TRANSFER FROM 3-(9-ANTHRACENE)PROPYLTRIMETHYLAMMONIUM BROMIDE TO METHYLVIologen ON THE SURFACE OF POLYSTYRENE LATEX PARTICLES

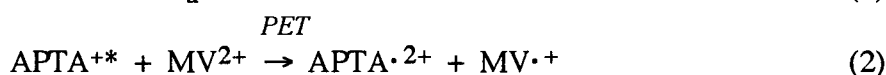
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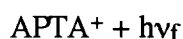
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Latex particles represent a type of organic solid material which can be employed as a micro-substrate for photoreactions. The surface consists of organic polymers embedded sparsely with functional groups such as sulfate, carboxyl, or amino groups. This structure leads latex particles to have two kinds of adsorption sites on the surface: (a) the polymer matrix which affords continuous adsorption domains to nonpolar and less polar adsorbates, and (b) the functional group which gives discrete adsorption points to ionic and highly polar species. Such a feature has never been seen in any of other solid materials. Furthermore, latex particles have many other features, as summarized in a previous paper [1]. In this study, we have investigated photoinduced electron transfer from 3-(9-anthracene)propyltrimethylammonium bromide (APTAB) to methylviologen (MV²⁺) in polystyrene (PS) latex dispersions.

The fluorescence of 3-(9-anthracene)propyltrimethylammonium ion (APT⁺) is quenched by methylviologen (MV²⁺) through PET as follows:



↓ fluorescence



According to Eq. 2, we can observe the PET reaction by monitoring the quenching of fluorescence of APT⁺. It was found that the PET reaction from APT⁺ to MV²⁺ was several hundreds times enhanced on going from an aqueous homogeneous solution to the PS latex dispersion. This enhancement is ascribed to the effective adsorption of the donor and acceptor onto the latex surface, as evidenced by adsorption isotherm measurements.

The mechanism of PET quenching of APTAB in the latex dispersion was examined by time-resolved fluorescence measurements. The fluorescence decay curve of APTAB shows two-exponential nature in the latex dispersion, reflecting the distribution of this fluorophore between bulk aqueous phase and the latex particles. From the dependence of the preexponential factor and lifetime on the quencher concentration, it was elucidated that the quenching on the latex surface is operated by both *static* and *dynamic* mechanisms.

As seen from Eq. 2, the products of the present PET are APT⁺·²⁺ and MV⁺· radicals. The former has two positive charges, one on the anthracene chromophore and the other on the trimethylammonium group. As the PS latex particles employed have negative charges due to sulfate groups on the surface, both MV⁺· and the positively-charged anthracene chromophore of APT⁺·²⁺ seem to be effectively anchored to the latex surface. Therefore, we expect that the back electron transfer will be suppressed, resulting in an efficient charge separation. Such an effect of the latex is now under investigation by laser flash photolysis techniques [2].

[1] K. Nakashima, S. Tanida, T. Miyamoto, and S. Hashimoto, *J. Photochem. Photobiol. A: Chem.* **117** (1998) 111.

[2] K. Nakashima, T. Miyamoto, and S. Hashimoto, *Chem. Commun.*, **1999**, 213.