Photoreaction of Quinones with an Amphiphilic Porphyrin Sensitizer

(*Graduate School of Science and Technology, Meijo University*) ○Yui Tanaka, Toshi Nagata
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Introduction. Artificial photosynthesis has three components: water oxidation, electron transfer and storage, and carbon dioxide reduction. Yusa et al. reported the photoreduction of quinones in a homogeneous system using a phthalocyanine and a thiol.[1] The reduced product, hydroquinones, can be potentially used as a reusable reductant. For this reaction to be more useful, it is desirable that the reduced product can be isolated in a separate phase. In this context, we attempted to realize this reaction in a two-phase system, by use of amphiphilic photosensitizers (Figure 1). We chose an amphiphilic porphyrin, $[ZnP(C_{12})_1]^{3-}\cdot 3Na^+$, as a photosensitizer in a two-phase system. Dodecyloxy group was used as the hydrophobic group and sulfo group was used as the hydrophilic group.

Synthesis. Porphyrins with trimethylsilyl groups were synthesized from 4-trimethylsilylbenzaldehyde, 4-dodecyloxybenzaldehyde, and pyrrole by the Lindsay method.[2] Me_3SiOSO_2Cl was used to convert the trimethylsilyl groups to sulfo groups.[2] The obtained porphyrin trisulfonic acid was converted to the tris(tetrabutylammonium) salt and extracted with organic solvents to remove water-soluble by-products. Subsequently, zinc was introduced, and the resulting zinc porphyrin was converted to the trisodium salt using Dowex.

Photochemical Properties. The UV and fluorescence spectra of the obtained porphyrin in methanol are shown in Figures 2 and 3, respectively. The results of quenching and photoreaction by quinone will be also reported.

Fig. 1 Photoreduction of quinones with an amphiphilic Porphyrin

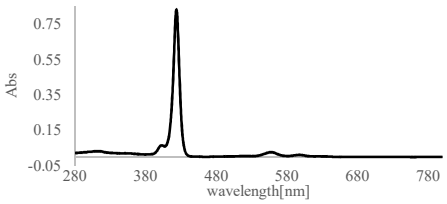

Fig. 2 UV spectrum of $[ZnP(C_{12})_1]^{3-}\cdot 3Na^+$ in CH_3OH

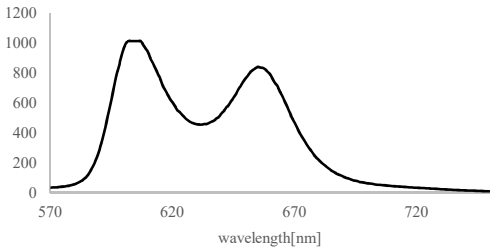

Fig. 3 Fluorescence spectrum of $[ZnP(C_{12})_1]^{3-}\cdot 3Na^+$ in CH_3OH

1) M. Yusa and T. Nagata, *Photochem. Photobiol. Sci.*, **2017**, *16*, 1043-1048.
2) K. Hosomizu, et al., *J. Phys. Chem. B.*, **2008**, *112*, 16517-16524.