Electronic Supplementary Information

DNA-Mediated Phase Transfer of CdTe Quantum Dots Using Reverse Micelles

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Experimental

Materials

Dilauroyl phosphatidylcholine (DLPC, 99% purity) was purchased from NOF Corporation (Tokyo, Japan). Synthesized DNA oligonucleotides were purchased from Tsukuba Oligo Service Co., Ltd. (Tsukuba, Japan). Tris(2-carboxyethyl)phosphine hydrochloride was purchased from Tokyo Chemical Industry Co., Ltd. (Tokyo, Japan). Other chemicals were purchased from Wako Pure Chemicals (Osaka, Japan). Error bars in figures represent standard deviations.

Preparation of DNA surfactant

A DNA surfactant was synthesized according to a method reported previously.[1, 2] Briefly, 5′-aminated DNA oligonucleotide (0.5 mM) in a phosphate buffer (50 mM, 10 μL) was mixed with a

dimethylsulfoxide solution (54 μL) containing oleic acid *N*-hydroxysuccinimide ester (1 mM). Following incubation of the mixture at 40 °C for 24 h, the synthesized 5′-oleoyl DNA oligonucleotide (DNA surfactant) was purified by high-performance liquid chromatography using an ODS column. [1, 2]

Table S1. Nucleotide sequences of DNA surfactants and DNA-QDs

Name	**Sequence**
DNA–surfactant **1**	Oleoyl-5′-CTCGTCGTGTTA-3′
DNA–surfactant **2**	Oleoyl-5′-GCTCTGGCTAAA-3′
DNA-CdTe QDs	HS-5′-TAACACGACGAG-3′

Preparation of CdTe QDs in aqueous solution

Mercaptopropionic acid (MPA)-capped CdTe QDs were synthesized according to the literature.[3] Te powder (0.2 mmol), $NaBH_4$ (1 mmol), and H_2O (5 mL) were mixed and bubbled with N_2 for 60 min to obtain a NaHTe solution. $CdCl_2$ (4 mmol) and MPA (0.6 mmol) were added to water (50 mL), and the pH value of the solution was adjusted to 10.3 using NaOH (1 M). The solution was bubbled with N_2 for 30 min. Then, 800 μL of NaHTe solution was added. The resulting mixture was refluxed at 90 °C for 3–90 h under open air conditions and dialyzed against Milli-Q water for 2 h. The diameter of the CdTe QDs was determined according to the literature.[4]

The Cd and Te concentrations in the CdTe QDs aqueous solution were measured using flame

atomic absorption spectrometry (FAAS; Z-2310; Hitachi High-Technologies Co., Tokyo, Japan). The concentration of CdTe QDs was calculated based on the atomic Cd and Te concentrations in the QDs solution and the QD diameter.

Functionalization of CdTe QDs with SH-DNA

CdTe QDs were functionalized with SH-5'-DNA (5'-thiolated-DNA) according to the literature.[5] Thiolated-DNA oligonucleotides (5′-HS-TAACACGACGAG-3′) (100 μM) were treated with 100 μM tris(2-carboxyethyl)phosphine hydrochloride for 1 h at room temperature. This solution was then added to the synthesized CdTe QDs solution (SH-DNA:CdTe QDs (molar ratio) of 1:1, 1:2, 1:4, or 1:8). The mixture was incubated overnight. A NaCl solution (1 M) was slowly added to the mixture to achieve a concentration of 100 mM.

Extraction of DNA-QDs from an aqueous phase to an organic phase

The extraction of DNA-QDs using reverse micelles was performed as follows. Typically, the aqueous phase comprised tris-HCl buffer (pH 8, 25 mM), KCl (300 mM), DNA-QDs (75 nM), and DNA surfactant **1** (300 nM). The organic phase comprised 2,2,4-trimethyl pentane, DLPC (15 mM), and 1-hexanol (390 mM). First, the organic phase (1 mL) was added to the aqueous phase (1 mL). After the two phases were gently stirred at 25 °C for 3 h, the fluorescence of the DNA-QDs in the organic and aqueous phases was measured at 25 °C using a fluorescence spectrophotometer (FP-

8200 fluorescence spectrometer; Jasco, Tokyo, Japan). The excitation wavelength was 365 nm.

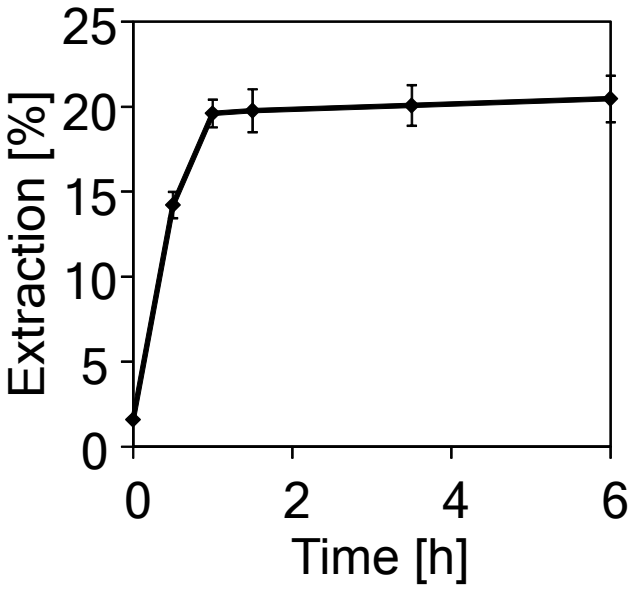

Fig. S1. Effect of extraction time on the extraction of DNA-QDs (QDs, 3 nm in diameter). The aqueous phase (tris-HCl buffer (pH 8, 25 mM), KCl (300 mM)) contained DNA surfactant 1 (400 nM) and DNA-QDs (100 nM), and the organic phase (2,2,4-trimethylpentane) contained DLPC (10 mM) and 1-hexanol (3 vol.%). The DNA/QD ratio was set at 4. The extraction and fluorescence measurements were carried out at 25 °C. Experiments were conducted in triplicate. Error bars represent standard deviations.

References

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