

Supporting Information

Size Effect on UV-Vis absorption Properties of Colloidal C₆₀ Particles in Water

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Experimental Section

1. Materials in this study

C₆₀ (>99.5% pure) was purchased from Tokyo Kasei Kogyo Co., Ltd. (Tokyo, Japan). THF (Infinity Pure, no stabilizer) was purchased from Wako Pure Chemical Industries, Ltd. (Osaka, Japan). Ultra-pure water was produced by a Milli-Q system (Nihon Millipore KK, Tokyo, Japan) using 0.1 µm filters. The electric resistance of the ultra-pure water was 18.2 MΩ cm and the total organic carbon contained in the water was less than 6 ppb.

2. Preparation of colloidal C₆₀ particles suspension

Small amounts of solid C₆₀ (from 3 to 30 mg) were placed in 30 mL of high-purity THF and dissolved ultrasonically for 150 min under N₂ atmosphere at 25 °C. Excess solid was filtered off with a PTFE membrane filter (nominal pore size 0.45 µm, Tokyo Roshi Kaisha, Ltd., Japan) to give a saturated yellow solution of C₆₀ particles. This solution of C₆₀ was injected into water (the ratios of the solvents were varied from 4:1 to 1:4), and gaseous nitrogen was purged through the solution using 0.1 µm filters (Whatman International Ltd., UK) for around 1.0 – 3.0 hours to remove THF. During the nitrogen purge, the sample vial was placed in a water bath to maintain the temperature at 25 °C. A clear yellow solution resulted after THF removal. Using ¹H- and ¹³C-NMR spectroscopy, the residual THF and the production of oxidized C₆₀ were examined.

3. DLS measurement

A DLS7000 (Otsuka Electronics Co., Ltd.) was equipped with a goniometer system with a 35 mW He-Ne laser at a wavelength of 632.8 nm. Multiple tau digital correlations were measured at a minimum sampling time of 0.1 μ s. The measurements were performed at scattering angles of 90 degrees. A sample quartz cell was set in a silicon oil bath where the refractive index of the oil was almost the same as the cell. The measurement temperature was regulated at $25.0 \text{ }^{\circ}\text{C} \pm 0.1 \text{ }^{\circ}\text{C}$. The instrument was used in a clean room kept at a constant temperature of $23.0 \pm 0.3 \text{ }^{\circ}\text{C}$ and humidity of $40 \pm 3\%$.

4. AFFFF measurement

The size distribution of the C_{60} colloidal particles was carried out using an AF2000 FFF system (Postnova, Germany) equipped with a cellulose membrane (Z-MEM-AQU-427N) with a molecular weight cutoff of 10,000 molecular mass and a channel thickness of 350 μ m. The cross flow was changed from 0.5 to 0.25 mL/min and the channel flow was constant at 0.5 mL/min. The eluted sample particles at the outlet of the channel were monitored by a DAD UV detector (1200 Series, Agilent Technologies Inc., USA) and an RI detector (Optilab Rex, Wyatt Co., USA). In order to determine the size of the nanoparticles in each fraction separated by AFFFF, a multi-angle light scattering detector (Dawn Heleos, Wyatt Co., USA) with a semiconductor laser at a wavelength of

690 nm was used. The elution system used in this study was ultra-pure water produced by a Milli-Q system (Nihon Millipore KK, Tokyo, Japan) using 0.1 μm filters.