Electronic Supplementary Material (ESI) for Analytical Methods.

Supporting Information

Separation of Nano- and Micro-Sized Materials by Hyphenated Flow and Centrifugal Field-Flow Fractionation

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1. Experimental Section

1.1 Samples used in this study

Surfactant-free aqueous suspensions (approximately 10 wt %) of PS-latex nanoparticles used in this study were supplied by JSR Co., Tsukuba, Japan. Aqueous dispersions of various PS-latex particles (STADEX SC-0070-D: 70 nm; STADEX SC-032-S: 309 nm; STADEX SC-051-S: 506 nm; STADEX SC-081-S: 814 nm; STADEX SC-103-S: 1005 nm; and STADEX SC-200-S: 2005 nm) were used in this study. An aqueous dispersion of silica particles (#24321: 280 nm) was purchased from Polysciences, Inc., Warrington, USA. The suspension was diluted with ultrapure water from a Milli-Q system (Nihon Millipore KK, Tokyo, Japan,) with 0.1 μm filters. The concentrations of the particles in this study were 2.0, 0.5, 0.5, 0.5, 1.6, and 1.6 mg/mL for STADEX SC-0070-D, STADEX SC-032-S, STADEX SC-051-S, STADEX SC-081-S, STADEX SC-103-S, and STADEX SC-200-S, respectively. The concentration of silica particles was 8.0 mg/mL.

1.2 Flow FFF and Centrifugal FFF UV measurement.

An AF2000 system (Postnova Analytics GmbH, Landsberg, Germany) equipped with a cellulose membrane (Z-MEM-AQU-427N) with a molecular weight cutoff of 10 kDa and a channel thickness of 350 μm was used as the flow FFF separation part in this study. A CF2000 channel and rotor (Postnova Analytics GmbH) with a channel thickness of 250 μm was used as the centrifugal FFF separation part in this study. The line length and internal diameter between flow-FFF and centrifugal-FFF are 30 cm and 0.762 mm, respectively. The main carrier flow and the focus flow were provided by two double pumps (PN1122, Postnova Analytics GmbH). The carrier fluid was degassed on-line using a vacuum degasser (PN7505, Postnova Analytics GmbH). An aqueous solution of NovaChem surfactant (0.1 wt %; Postnova Analytics GmbH) was passed through 0.1 μm filters and used as the elution medium in both FFF separation techniques. The hyphenated separation system was constructed by connecting the outlet

of the flow FFF system to the inlet of the centrifugal FFF channel (figure 3 in MS). The syringe pump system is used to reduce the back pressure for centrifugal FFF channel when the viscosity of solvent is high. The final FFF outlet of the hyphenated FFF system was connected to a UV detector (SPD-20A, Shimadzu Co., Japan) set at 254 nm.