Supplementary Information

Recovery and Redispersion of Gold Nanoparticles Using a Self-assembly of pH Sensitive Zwitterionic Amphiphile

Clara Morita-Imura*, Yoshiro Imura, Takeshi Kawai and Hitoshi Shindo* Department of Applied Chemistry, Chuo University Kasuga, Bunkyo-ku, Tokyo 112-8551 (Japan) *cimura@kc.chuo-u.ac.jp, shindo@kc.chuo-u.ac.jp

Synthesis of C16CA

Methyl acrylate (14.30 g, 0.17 mol) was added to hexadecylamine (2.0 g, 8.30 mmol) in 15 mL methanol. The solution was stirred at 40°C for 3 days followed by removal of the solvents and excess methyl acrylate by rotary evaporation to yield 3-[(2-methoxycarbonyl-ethyl)-hexadecyl-amino]-propionic acid methyl ester (C16ME) as a viscous liquid. C16ME (3.0 g, 7.23 mmol) and 18 mL 1N NaOH (18 mmol) were added to 18 mL methanol and the mixture stirred for 1 day at room temperature. Removal of the solvent by evaporation yielded 3-[(2-carboxy-ethyl)-hexadecyl-amino]-propionic acid as a white solid, which was washed with hexane and methanol (yield: 90%).

¹H NMR (D₂O): δ 0.88 (t, 3H, CH₃), 1.25 (br, 28H, CH₂), 1.45 (br, 4H, **CH**₂CH₃, CH₂**CH**₂CH₂N), 2.36 (t, 4H, CH₂**CH**₂CO), 2.42 (t, 2H, **CH**₂N), 2.73 (t, 4H, N**CH**₂CH₂CO)

The Krafft point of C18AA was 7°C, which was obtained using a DSC 8000 instrument (Perkin Elmer). The pKa value was determined by acid-base titration using a pH meter (Horiba) with 0.1 N HCl and 0.1 N NaOH aqueous solutions. The pKa was 6.2, 1.6, 2.0 at 27°C.



Scheme S1. Synthesis of 3-[(2-carboxy-ethyl)-hexadecyl-amino]-propionic acid (C16CA).

Rheological measurements



Figure S1 (a) Steady shear viscosity measurement, (b) dynamic viscoelastic measurement of 6 wt% C16CA solution at pH 1.

Preparation of Au NPs capped with citric acid

0.09 g of citric acid was dissolved in 20 mL of purified water. 80 mL of 0.625 mM aqueous HAuCl₄ solution and 20 mL of 15 mM aqueous citric acid solution were mixed at 90°C and stirred for 10 min to obtain a reddish colored solution. The solution was stirred for 1 day at room temperature.



Figure S2. (a) UV-Vis spectra of Au NPs dispersion as prepared. (b) TEM image of Au NPs as prepared.

Redispersion of Au NPs



Figure S3 TEM images of redispersion of Au NPs at [C16CA]/[Au] = (a) 100, (b) 80, (c) 50, (d) 20 and (e) 10.



Figure S4 Distributions of Au NPs for (a) initial dispersion and (b-f) redispersions at various [C16CA]/[Au] ratios.



Figure S5. TEM images of multicycled redispersion of Au NPs at (a) redispersion-1 (cycle 1), (b) redispersion-2 (cycle 2) and (c) redispersion-3 (cycle 3).