Supplementary Material (ESI) for Nanoscale

Electronic Supplementary Information (ESI)

Shape-tailoring of gold nanostructures: Can a detergent act as the reducing or protecting agent?

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Experimental Section

Materials: $KAuCl_4$ as the precursor for the formation of AuNPs was obtained from Aldrich. Commercial detergent (Jayeonpong, brand name) from LG Household and Health Care, South Korea, and was used as both the reducing and protecting agent. It consists of ~23 % surfactants such as alcoholic (anionic), olefinic (anionic), and aminic (nonionic) and ~77 % pine needle extract, etc. 4-Nitrophenol (Junsei, Japan), and $NaBH_4$ (Aldrich) were purchased and used without further purification.

Characterization: The UV-visible absorption spectra were recorded on a Varian Cary 500 spectro-photometer. Transmission electron microscopy (TEM) was performed with a Philips T20ST instrument. The TEM specimens were prepared by placing a few drops of sample solution on a copper mesh covered with a carbon film and allowing the solvent to evaporate at room temperature for overnight. The particle shape distributions were calculated by image analysis, always over more than 100 counts.

Synthesis of gold nanoparticles: The AuNPs were prepared by the reduction of Au^{3+} ions in an aqueous solution containing the detergent at room temperature. The procedure was quite easy and straightforward. In a typical experiment, 0.4 mM $KAuCl_4$ was added to 10 mL of 1 wt% aqueous solution of the detergent at room temperature, leading to the slow formation of AuNPs, as manifested by a pinkish coloration of the solution. No stirring was necessary after the solution was shaken for

homogenization. Therefore, the samples were left standing for the reaction to proceed at room temperature. The extent of the reaction depended on the concentration of detergent, while the time needed for its completion mainly depended on the concentration of the reactants and on the reaction temperature.

Catalytic reduction of 4-nitrophenol: An aqueous solution of $NaBH_4$ (1 mL, 15 mM) was mixed with 4-nitrophenol (1.7 mL, 0.2 mM) in a standard quartz cuvette. The light yellow color of the 4-nitrophenol was turned to yellowish green due to the formation of 4-nitrophenolate ion. An aliquot of AuNPs prepared at 4 ºC (0.3 mL) was added to the resulting solution and the time dependent absorbance spectra were recorded with a time interval of 1 min in the scanning range of 200-800 nm at room temperature.

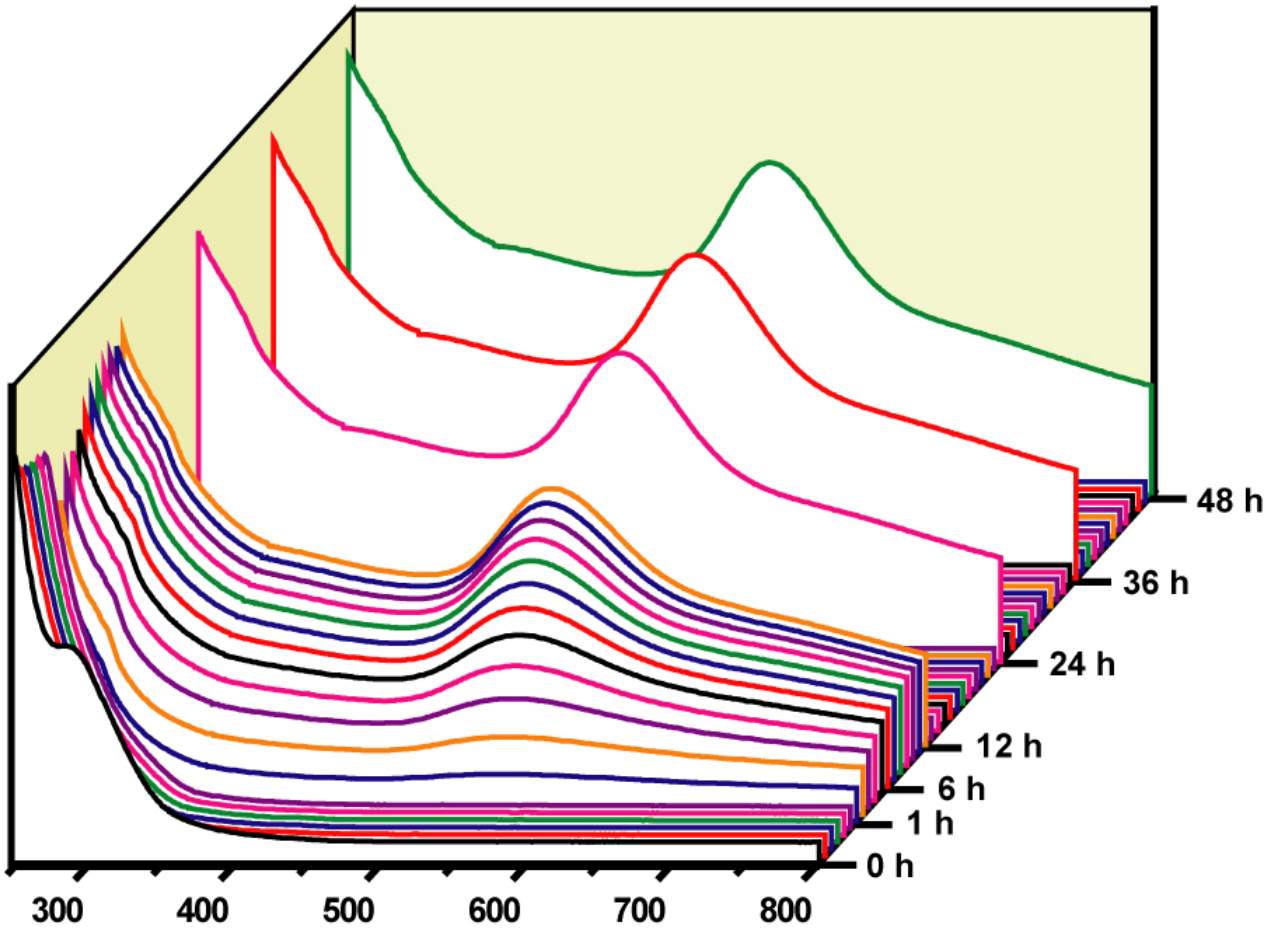

Fig. S1 Time-dependent UV-vis spectra showing the conversion of gold salt (0.4 mM) to AuNPs after adding detergent (1 wt%) in aqueous solution at room temperature.

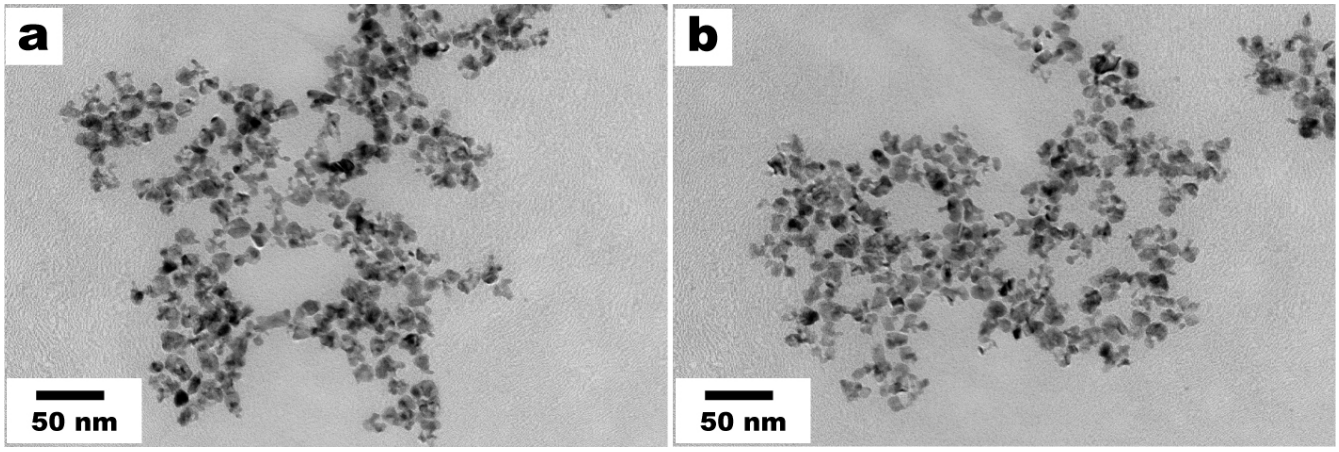

Fig. S2. TEM images of palladium nanoparticles obtained at (a) 45 ºC and (b) 65 ºC.