Supplementary Material (ESI) for Chemical Communications

Parameters for selective colorimetric sensing of mercury(II) in aqueous solution using mercaptopropionic acid-modified gold nanoparticles

Chih-Ching Huang[a] and Huan-Tsung Chang* [a, b]

[a]*Department of Chemistry, National Taiwan University, Taipei, Taiwan*

[b]*Department of Natural Science Education, National Taitung University, Taitung, Taiwan*

Correspondence: Professor Huan-Tsung Chang, Department of Chemistry, National Taiwan University, 1, Section 4, Roosevelt Road, Taipei 106, Taiwan

Tel and fax: 011-886-2-33661171

E-mail: changht@ntu.edu.tw

Supplementary Material (ESI) for Chemical Communications

EXPERIMENTAL SECTION

Chemicals. Mercaptopropionic acid (MPA) and 2,6-pyridinedicarboxylic acid (PDCA) were obtained from Sigma (St. Louis, MO). Trisodium citrate, boric acid, tris(hydroxymethyl)aminomethane (Tris), and all of the metal salts used in this study were purchased from Aldrich (Milwaukee, WI). Hydrogen tetrachloroaurate(III) trihydrate was obtained from Acros (Geel, Belgium).

Synthesis of AuNPs. AuNPs were prepared through the citrate-mediated reduction of $HAuCl_4$.[1–3] A 250-mL aqueous solution of 1 mM $HAuCl_4$ was brought to a vigorous boil with stirring in a round-bottom flask fitted with a reflux condenser; 38.8 mM trisodium citrate (25 mL) was then added rapidly to the solution. The solution was heated under reflux for another 15 min, during which time its color changed from pale yellow to deep red. The solution was cooled to room temperature while stirring continuously. The sizes of the nanoparticles were verified through TEM analysis (H7100, Hitachi High-Technologies Corporation, Tokyo, Japan); the AuNPs appeared to be nearly monodispersed, with an average size of 13.3 ± 0.5 nm. The particle concentration of the AuNPs (ca. 15 nM) was determined according to Beer's law using an extinction coefficient of ca. 10^8 M^{-1} cm^{-1} at 520 nm (double-beam UV–Vis spectrophotometer, Cintra 10e, GBC, Victoria, Australia) for AuNPs of 13.3-nm diameter.[3]

Modification of AuNPs. MPA-AuNPs were prepared by adding 10 mM MPA (10 μL) to the as-prepared 13-nm-diameter AuNP solution (15 nM; 10 mL) under stirring. After reaction for 2 h at room temperature, the mixtures were prepared in different buffers; one representative buffer is 50 mM Tris-borate at pH 9.0. The final concentration of MPA-AuNPs in each of the different buffers was 6.0 nM.

Scattering Imaging. An Olympus IX70 inverted microscope (Tokyo, Japan) was used to construct the scattering device, as described in our previous report.[4] A 100-W halogen lamp, in conjunction with a high-numerical-aperture dark-field condenser (NA = 1.2-1.4; U-DCW, Olympus), was used to illuminate the nanoparticles. The scattering signals were collected using a 40× (NA = 0.55) objective into a digital color camera (Coolpix 5400, Nikon, Tokyo, Japan) attached to the side port of the microscope. The low-cost camera provided images at a resolution of up to 680 × 512 pixels, which represents a 200 × 150 μm detection area when using a 40× objective.

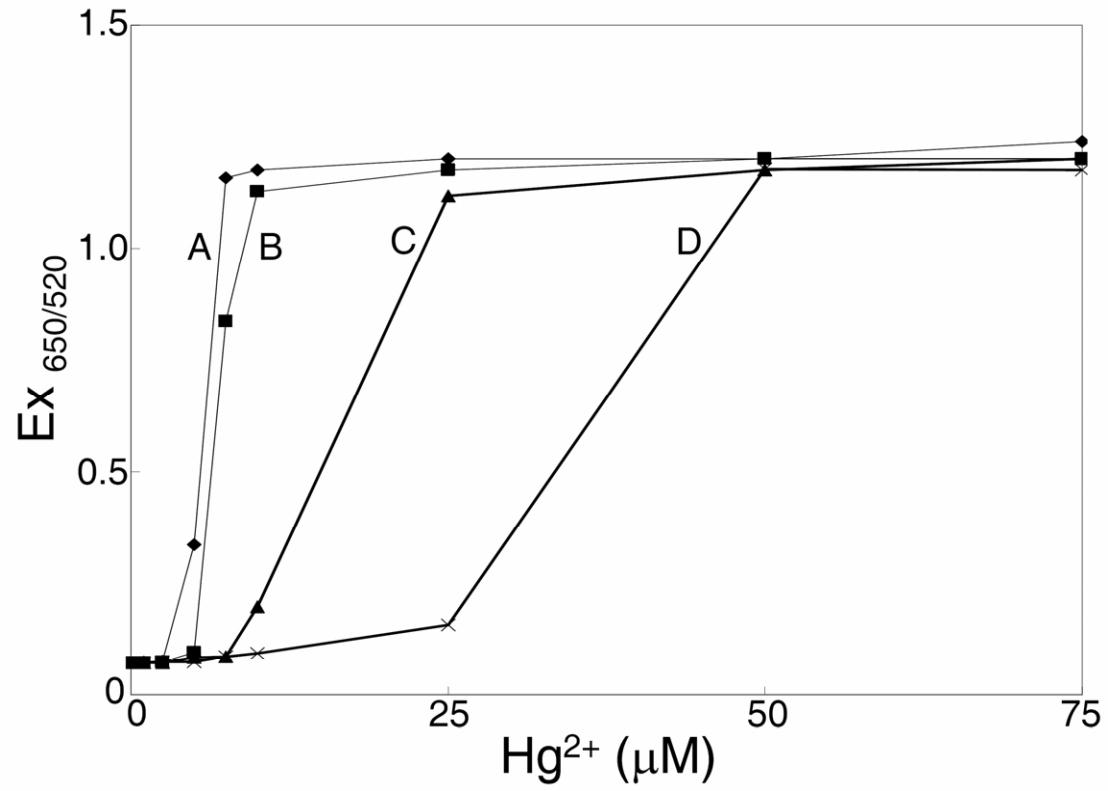

Fig. S1 Effect of the MPA density of the MPA-AuNPs on the detection of Hg^{2+} in 50 mM Tris-borate solutions (pH 9.0). The MPA densities were (A) 6.70×10^2, (B) 1.76×10^3, (C) 3.35×10^3, and (D) 6.70×10^3 molecules per AuNP. Other conditions were the same as described in Fig. 1.

Supplementary Material (ESI) for Chemical Communications

References:

1 G. Frens, *Nat. Phys. Sci.*, 1973, **241**, 20.

2 K. C. Grabar, R. G. Freeman, M. B. Hommer and M. J. Natan, *Anal. Chem.*, 1995, **67**, 735.

3 R. C. Mucic, J. J. Storhoff, C. A. Mirkin and R. L. Letsinger, *J. Am. Chem. Soc.*, 1998, **120**, 12674.

4 W.-L. Tseng, K.-H. Lee and H.-T. Chang, *Langmuir*, 2005, **21**, 10676.