Supporting Information

Selective Colorimetric Detection of Glutathione Based on Quasi-Stable Gold Nanoparticles Assembly

Bo Hu, Xian Cao, Peng Zhang*

Department of Chemistry, University of Cincinnati, Cincinnati, Ohio, 45221

Correspondence should be addressed to P. Zhang, E-mail: peng.zhang@uc.edu.

Experimental Section

Chemicals. Hydrogen tetrachloroaurate(III) trihydrate ($HAuCl_4 \cdot 3H_2O$), L-glutathione, L-cysteine, L-Histidine, L-arginine, L-alanine, L-glycine, D-glucose, and L-glutamic acid were purchased from Sigma-Aldrich. Sodium citrate and sodium nitrate were from Fisher Scientific. Homocysteine was from TCI America. All chemicals were used without further purification. All solutions were prepared using deionized (DI) water (18 MΩ-cm).

Synthesis of AuNPs: Citrate-stabilized AuNPs of ~20 nm in diameter were prepared similar to the previous literature.[1, 2] Typically, $HAuCl_4$ solution (10 mM, 1.47 mL) was added into 48.5 mL of DI water. The solution was heated to reflux under vigorous stirring. After 10 min, sodium citrate solution (1%, 1 mL) was rapidly injected under vigorous stirring. The reaction mixture was kept refluxing and stirring for 5 min until its color turning red. Then it was cooled down slowly to room temperature under stirring. The products were centrifuged at 13000 rpm for 10 min and the colorless supernatant removed. The precipitates were finally dispersed into 1.5 mL of DI water resulting in an approximate concentration of 10 mM for AuNPs. The AuNPs solution was kept at 4 °C until later use.

Characterization: The morphology of the aggregated AuNPs was characterized by using a Phillips Biotwin 12 transmission electron microscope (FEI). TEM samples were prepared by directly applying 10 μL of the aggregated AuNPs solution onto a carbon-coated copper grid (300 mesh, Electron Microscopy Sciences), and let dried at room temperature. An Ocean Optics USB4000-ISS-UV-Vis spectrometer was used to measure the UV-vis spectra.

Colorimetric Detection of GSH: The sensitivity of the colorimetric detection was determined as follows. For glutathione, 50 μL GSH solutions of different concentrations (from 4 to 32 μM) were added into 50 μL of 10 mM AuNPs solution. After 1 min, 900 μL of 44.4 mM $NaNO_3$ solution was added under stirring. The mixed solution was let stand for 15 min. Extinction spectra of the mixed solution were recorded. With a titration curve, the concentration of an unknown GSH solution can be quantified by its extinction ratio ($I_{770\ nm}/I_{525\ nm}$).

Detection Selectivity: The selectivity of the colorimetric detection was assessed with GSH as the intended target molecule. In a typical run, 50 μL GSH solution, or other amino acids and monosaccharide, including L-cysteine, homocysteine, L-histidine, L-arginine, L-glycine, D-glucose, L-lysine, and L-glutamic acid, of the same concentration (20 μM), was mixed with 50 μL of 10 mM AuNPs solution. After 1 min, 900 μL of 44.4 mM $NaNO_3$ solution was added, and finally the mixed solution was let stand for 15 min. Extinction spectra of the mixture solution were then recorded.

1. G. Frens, *Nature Physical Science* 1973, **241**, 20.
2. B. Hu, X. Cao and P. Zhang, *ChemPlusChem*, 2013, **78**, 506.