# Supporting Information

# Surface Modification of Citrate-Capped Gold Nanoparticles Using CTAB Micelles

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## 1. Response of 12 nm AuNPs to Addition of CTAB

The response of gold nanoparticles (AuNPs) to CTAB is similar regardless of the size of AuNPs. When we used 12 nm AuNPs, we observed similar spectral changes with increasing concentrations of CTAB. Addition of a small amount of CTAB to a solution of 12 nm AuNPs causes the aggregation of the AuNPs (Figure S1). The localized surface plasmon resonance (LSPR) band at 522 nm drops and the extinction band in the longer wavelength region (~800 nm) rises. However, the UV-vis spectrum is restored with the addition of high concentration CTAB and remains unchanged. The critical concentration for the change (~0.7 mM) is near the critical micelle concentration (CMC) of CTAB, suggesting that CTAB micelles stabilize the citrate-capped AuNPs.

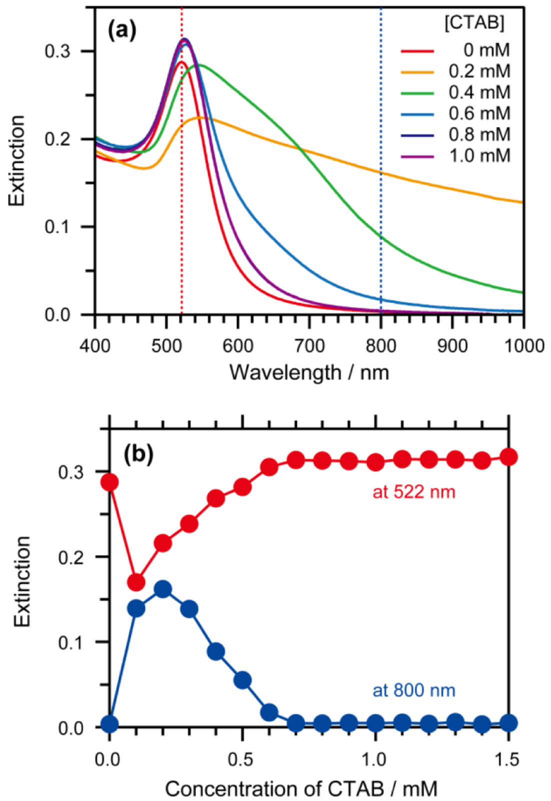
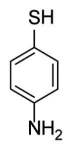


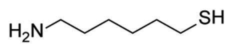

**Figure S1.** (a) Changes in the UV-vis spectrum of 12 nm AuNP solutions with the addition of increasingly concentrated CTAB. (b) Spectral intensity changes at the characteristic wavelengths for dispersed (522 nm) and aggregated (800 nm) 12 nm AuNPs as a function of the concentration of added CTAB.

## 2. Response of AuNPs to Addition of Other Cationic Ligands

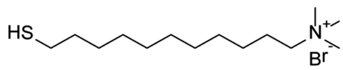
The response of AuNPs to CTAB is markedly distinguished from other cationic surface ligands. Addition of CTAB to AuNPs results in aggregation to stabilization of AuNPs as the concentration of CTAB increases. In contrast, other cationic ligands cause aggregation of AuNPs regardless of their concentration. We tested three different cationic ligands:




*p*-aminothiophenol (p-ATP)




6-amino-1-hexanethiol




(11-mercaptoundecyl)-N,N,N-trimethylammonium bromide

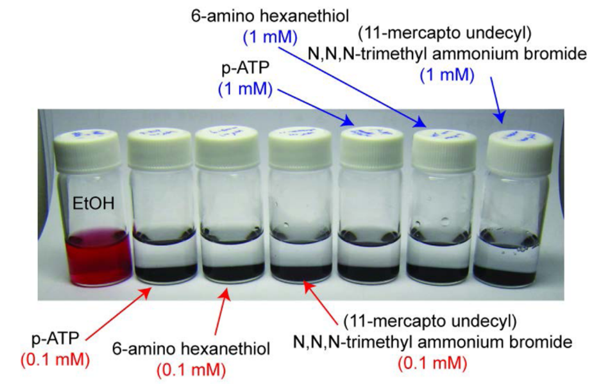



**Figure S2.** Photographs of mixtures of 32 nm AuNP solutions with solutions of cationic ligands listed above prepared in 0.1 mM and 1 mM. Addition of those cationic ligands causes aggregation of AuNPs at both concentrations. A control sample (AuNPs + ethanol) was included in the far left for color comparison.

We prepared 2 mL solutions of above ligands in 0.1 mM and 1 mM (in ethanol for p-ATP and in water for the other two) and added them to 2 mL aqueous solution of AuNPs (32 nm). Figure S2 below shows that those cationic ligands cause the aggregation of AuNPs. The aggregation is so severe that the AuNPs precipitate.

### 3. Stability of CTAB Micelle-Stabilized AuNPs

The CTAB micelle-capped AuNPs are stable and robust. It appears that the CTAB micelles adsorbed on the AuNP surfaces via electrostatic interaction with citrate anions protect the surface very well. We added 1,10-decanedithiol (DDT) ligands that strongly bind to AuNP surfaces and consequently induce the aggregation. Figure S3 shows that the micelle-stabilized AuNPs (AuNP + CTAB) remain stable upon addition of DDT whereas the usual citrate-capped AuNPs (AuNP + $H_2O$) are aggregated.

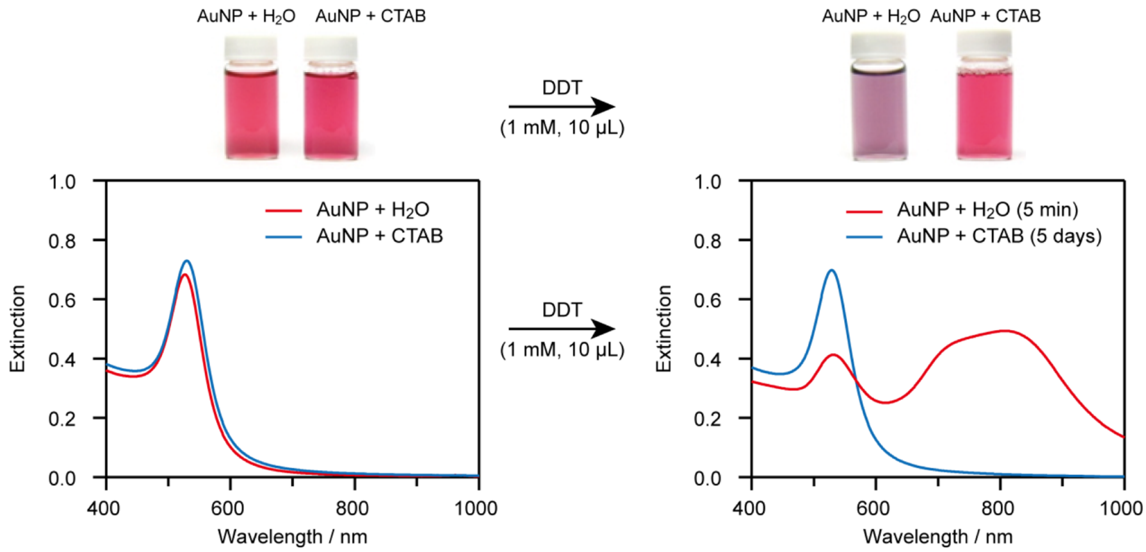



**Figure S3.** Changes in color and UV-vis spectrum of citrate-capped AuNPs (AuNP + $H_2O$) and CTAB micelle-capped AuNPs (AuNP + CTAB) with the addition of strongly Au-binding ligand, DDT.