Supporting Information

Surface Plasmon Resonance, Formation Mechanism, and Surface enhanced Raman Spectroscopy of Ag+-Stained Gold Nanoparticles

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**S1. UV-vis spectra for the Ag+ treated AuNPs with and without dialysis purification.**



**Figure S1.** UV-vis spectra for the Ag+ treated (A) dialyzed and (B) as-synthesized AuNPs. (black) AuNP control spectrum (red) AuNP/KNO3 control spectrum (blue) AuNP/AgNO3 spectrum. The nominal concentration of KNO3 and AgNO3 is 2.5 mM.

**S2. Example PRS2 data analysis of AuNPs treated with 150 µM AgNO3**



**Figure S2**. (A) UV-vis extinction spectrum of AuNPs treated with 150 µM AgNO3. (B) As-acquired PRS2 solution spectra with excitation and emission polarization combination of (red) VV and (black) VH. (C) Solvent PRS2 VV and VH spectra. (D) Inner-filter-effect corrected PRS2 spectra of the (B) as-acquired spectra using its (A) UV-vis spectra. (D) AuNP specific PRS2 spectra obtained by subtracting (C) solvent background spectra from (C) IFE corrected spectra. (E) G factor spectrum of the spectrofluorometer used for spectral acquisitions. (F) Scattering depolarization spectrum of AuNP (G) Scattering cross-section spectrum of PSNP used as the external reference for the analyte cross-section quantification. The inset is the UV-vis extinction spectrum of PSNP that used to calculate its scattering cross-sections. (H) PRS2 spectra of PSNP that shows PSNP has a depolarization of 0. (I) (red) Extinction cross-section spectrum and (black) absorption cross-section spectrum of AuNP quantified by subtracting the scattering cross-section spectrum from its extinction cross-section spectrum. (J) Scattering cross-section spectra of AuNP calculated with equation . (K) Scattering-to-extinction spectrum (S/E) of AuNP calculated by dividing scattering cross-section spectrum by its extinction cross-section spectrum.

**S3. The empirical fitting of the kinetic data for the adsorption of Ag+ onto 13-nm AuNPs.**



**Figure S3.** Empirical fitting of the time-course of the time-resolved UV-vis spectra with (A) one-pseudo-first-order kinetics () (B) two-pseudo-first-order equation (). The nominal concentration of Ag+ is 100 µM.

**S4. Photograph and UV-vis spectra showing the formation of Ag-citrate salt.**



**Figure S4.** (A) Photograph of (i) citrate solution, (ii) KNO3/citrate, (iii) AgNO3/citrate. Nominal concentration of citrate, KNO3, and AgNO3 are 4 mM, 12 mM and 12 mM respectively. (B) UV-vis spectra obtained for (a) dialyzed AuNPs/AgNO3, (b) as-synthesized AuNP supernatant/AgNO3. (c) (as-synthesized AuNP supernatant/AgNO3)/dialyzed AuNPs. Nominal concentration of AgNO3 is 2.5 mM. The shape of the spectrum indicates that there are insoluble particles formed by Ag+ reacting with excess citrate and chloride in the AuNP centrifugation supernatant.