# Supporting Information

for

# Development of a gold nanoparticle-based colorimetric sensor utilizing cysteine-loaded liposomes in acidic buffer solutions

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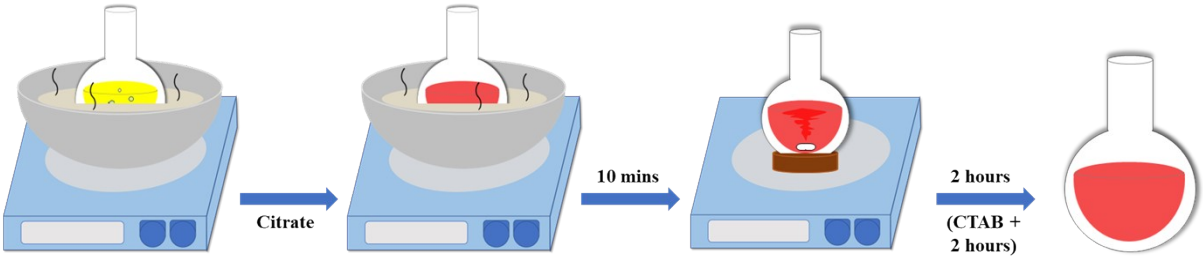
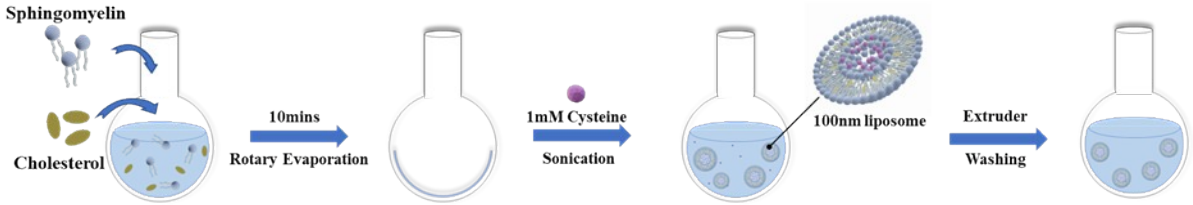



**Scheme S1.** Schematic illustration of the preparation of cit-AuNPs and cit-AuNPs-CTAB using the citrate reduction method.




**Scheme S2.** Schematic illustration for liposome synthesis. A mixture of sphingomyelin and cholesterol is used to make a thin lipid film, and then Cys is added. Thereafter, an extruder process is performed using a 100 nm filter to equalize the size of the liposome, and a washing step is conducted to remove free Cys in the solution.

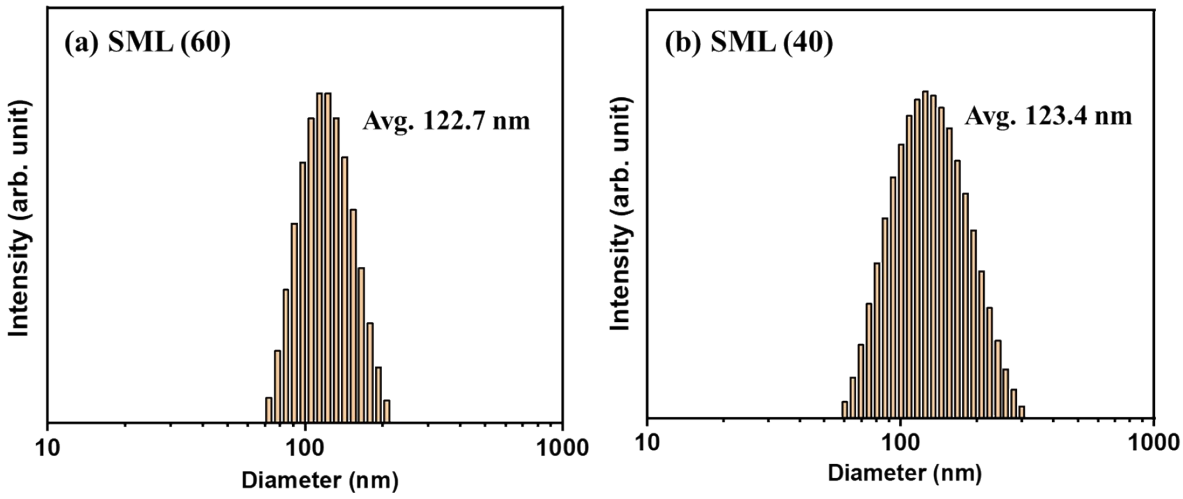



**Figure S1.** Size distribution of a) SML 60 and b) SML 40 measured by ELS.

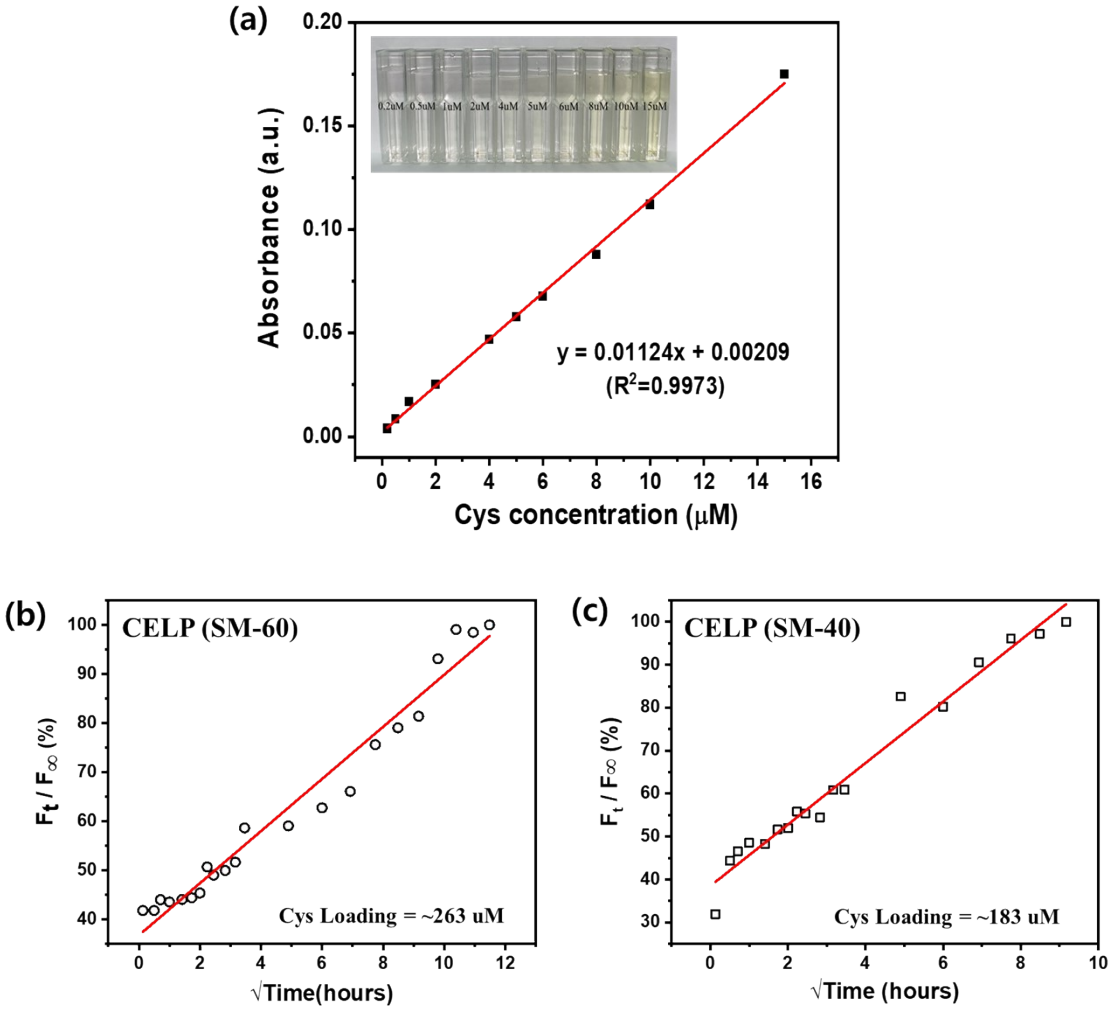



**Figure S2** (a) Standard calibration curve for 0.2 μM, 0.5 μM, 1 μM, 2 μM, 4 μM, 5 μM, 6 μM, 8 μM, 10 μM, 15 μM of cysteine prepared by using Ellman's method. Fractional absorbance changes of Cys released from (b) CELP (SML 60) and c) CELP (SML 40) during in-vitro release tests. The Higuchi model equation was applied to the release kinetics of CELP with different fractions of SML.

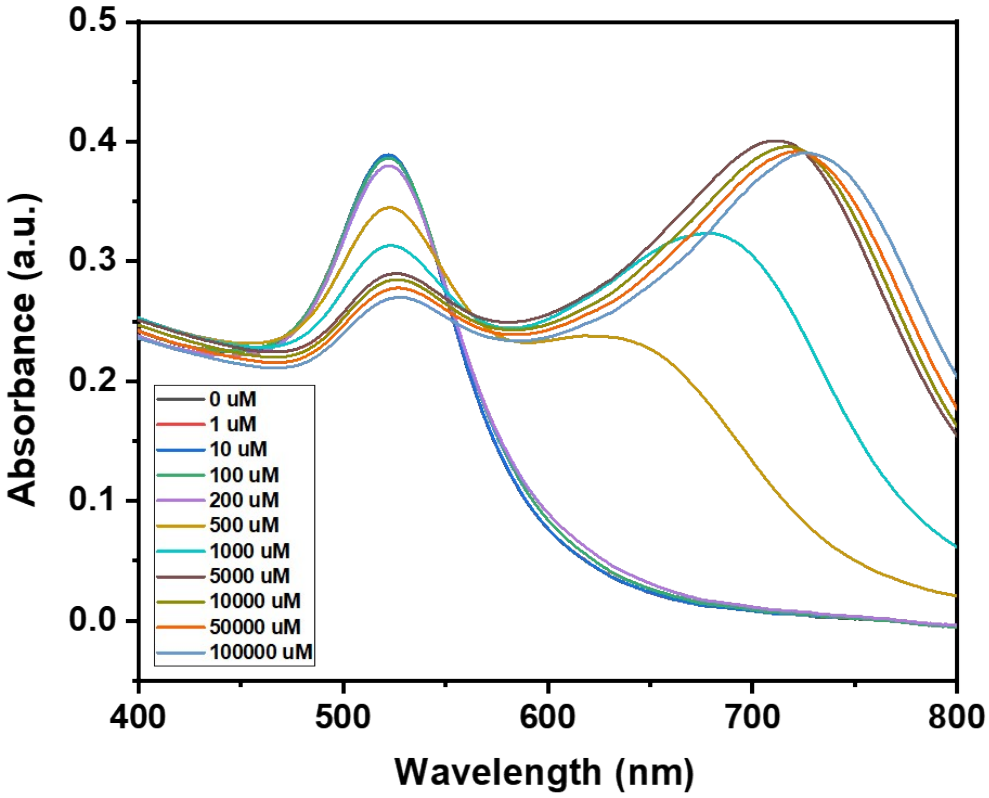
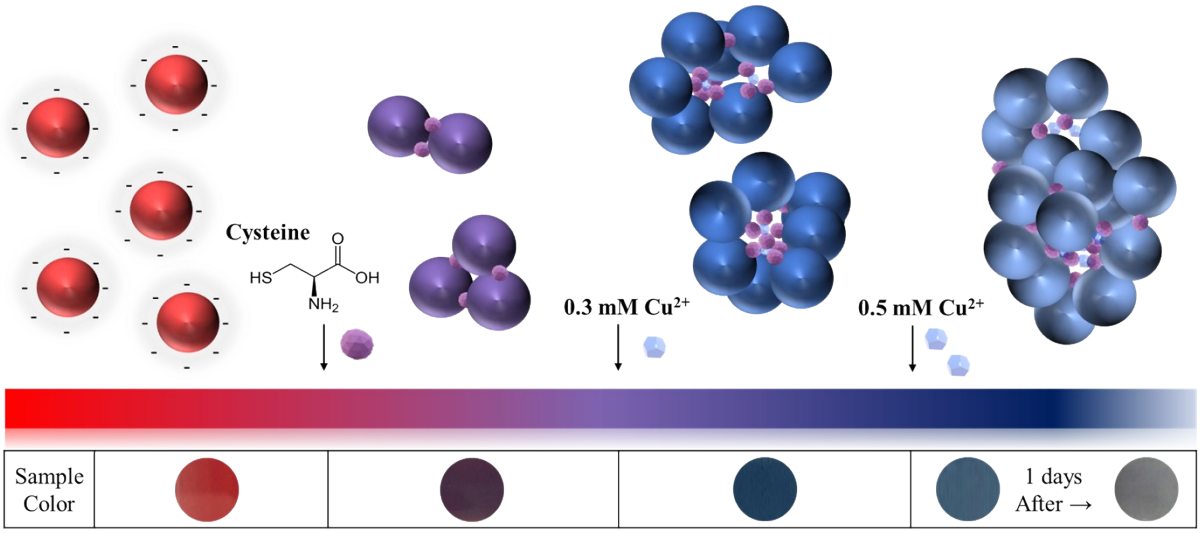



**Figure S3.** UV-vis spectra of AuNPs in the presence of different concentrations of cysteine (0 μM, 1 μM, 10 μM, 100 μM, 200 μM, 500 μM, 1000 μM, 5000 μM, 10000 μM, 50000 μM, 100000 μM).




**Scheme S3.** Schematic representation of aggregation and sample colors of gold nanoparticles at varying concentrations of $Cu^{2+}$ in the presence of 20 µM cysteine after 15 min.

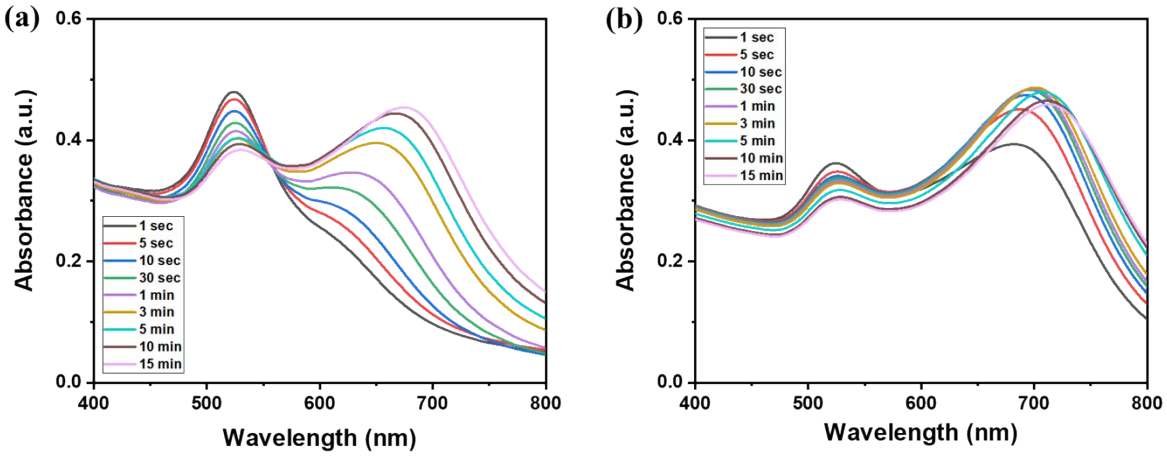
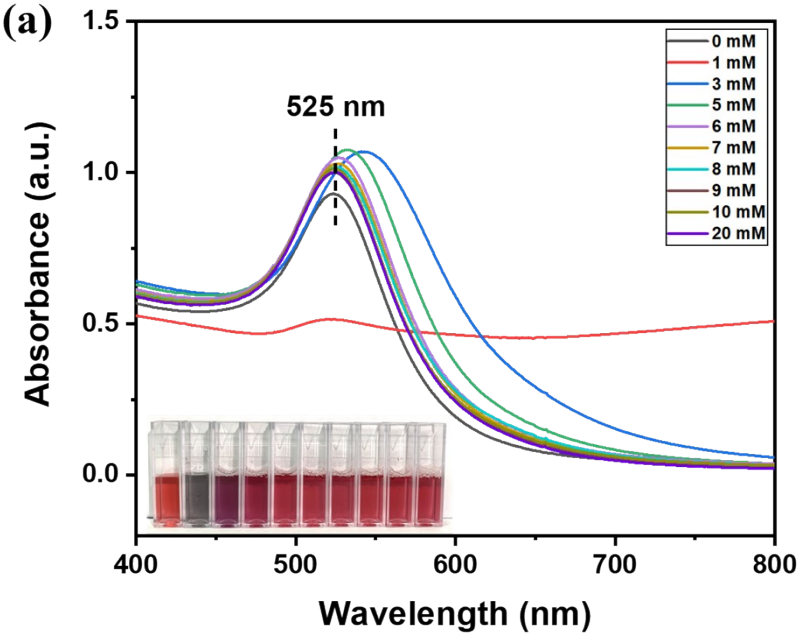



**Figure S4.** UV-vis spectra of cit-AuNPs over time when AuNPs, CELPs, TX-100, and 0.3 mM $Cu^{2+}$ ions are in at (a) pH 7 and (b) pH 5.

(a)




(b)

| Sample | Zeta potential |
|---|---|
| AuNPs (2mL) | -27.09 |
| AuNPs (1.8mL) + CTAB 1mM (0.2mL) | +11.37 |
| AuNPs (1.8mL) + CTAB 3mM (0.2mL) | +12.53 |
| AuNPs (1.8mL) + CTAB 5mM (0.2mL) | +12.91 |
| AuNPs (1.8mL) + CTAB 6mM (0.2mL) | +21.35 |
| AuNPs (1.8mL) + CTAB 7mM (0.2mL) | +23.59 |
| AuNPs (1.8mL) + CTAB 8mM (0.2mL) | +24.30 |
| AuNPs (1.8mL) + CTAB 9mM (0.2mL) | +27.25 |
| AuNPs (1.8mL) + CTAB 10mM (0.2mL) | +27.67 |
| AuNPs (1.8mL) + CTAB 20mM (0.2mL) | +43.64 |

**Figure S5.** (a) UV-vis spectra and (b) zeta potentials of cit-AuNPs with varying concentrations of CTAB ranging from 0 to 20 mM.

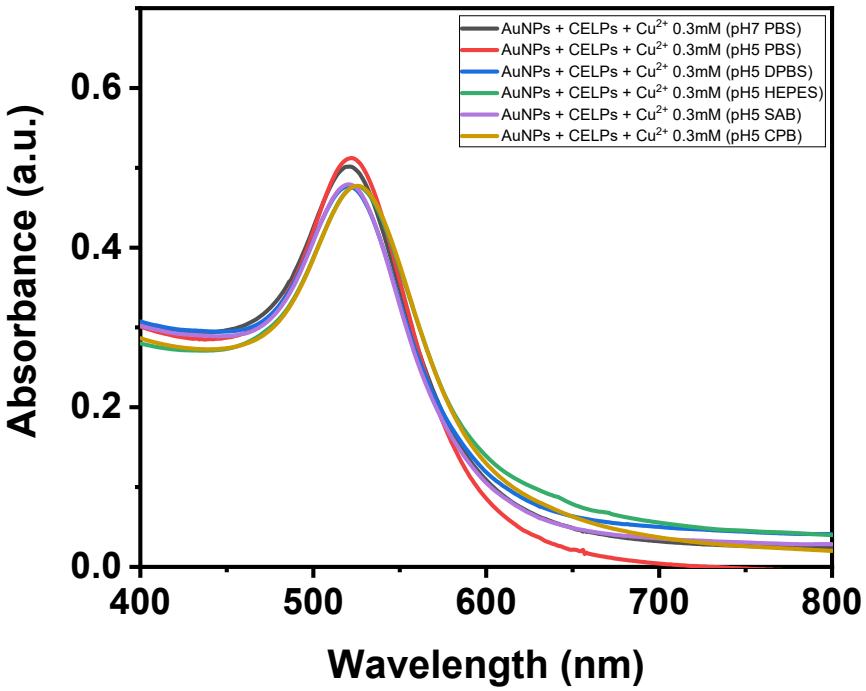



**Figure S6.** UV-vis spectra of AuNPs in the presence of CELPs and 0.3 mM $Cu^{2+}$ in various buffer solutions. The samples in PBS were prepared with cit-AuNPs, but all other samples were prepared with cit-AuNPs-CTAB.