

Supporting information

A facile route to synthesize casein capped copper nanoparticles: An effective antibacterial agent and selective colorimetric sensor for mercury and tryptophan

Vasudevavendan Chakrapani^a, Khan Behlol Ayaz Ahmed^a, V. Vinod Kumar^a, Veerappan Ganapathy^b,
Savarimuthu Philip Anthony^a and Veerappan Anbazhagan^{a*}

^a Department of Chemistry, School of Chemical and Biotechnology, SASTRA University, Thanjavur – 605043, Tamil Nadu, India.

Fax: +91-4364-22013149, Tel: +91-9159788375;

E-mail: anbazhagan@scbt.sastra.edu.

^b Department of Chemical Engineering, Sungkyunkwan University, Suwon 440-746, South Korea

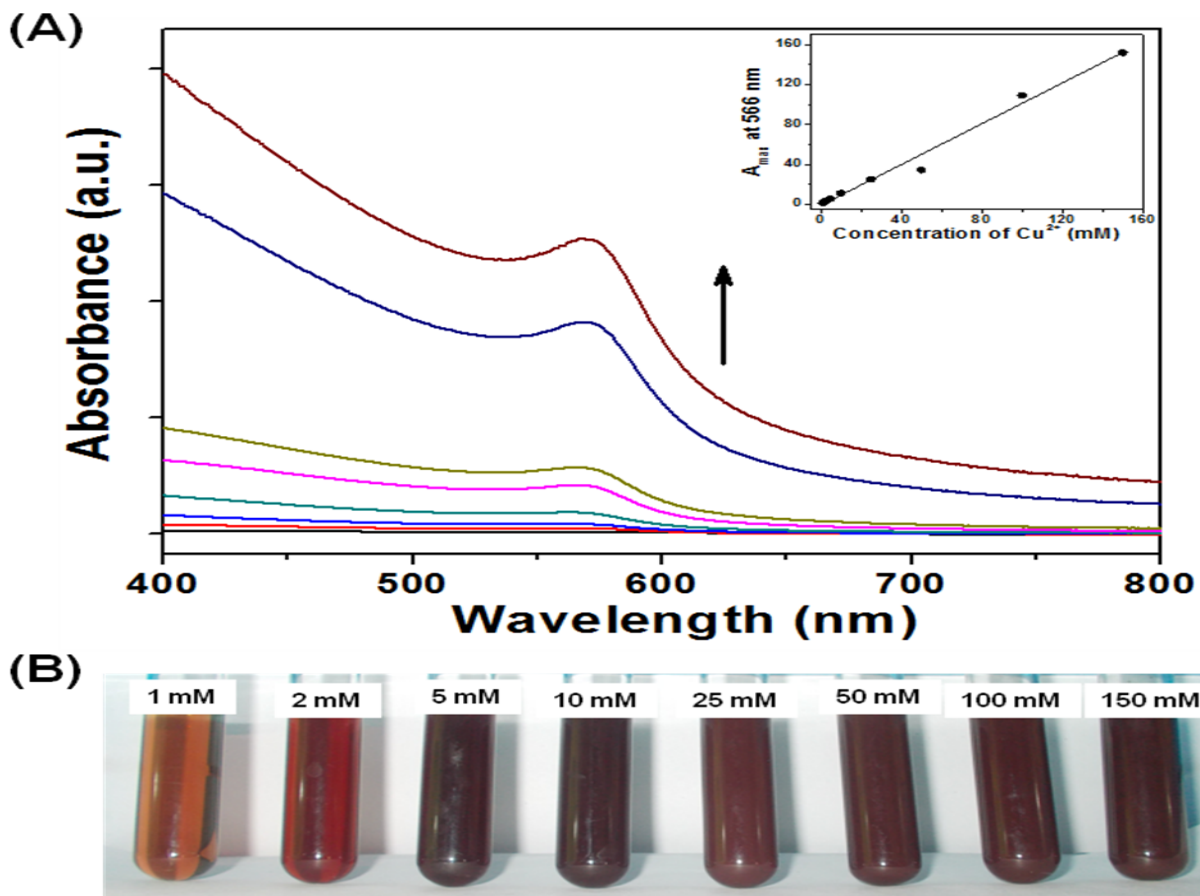


Figure S1: (A) Casein-CuNPs concentration dependent UV-Vis spectra, arrow indicates the increasing in concentration. *Inset* shows the concentration versus absorbance maxima at 566 nm. High concentrated samples were diluted prior to UV-Vis measurement and presented in (A) after multiplied by the dilution factor. The linear dependence of absorbance maxima indicates the increased content of metallic Cu in the solution. (B) Digital images of various concentrated casein-CuNPs.

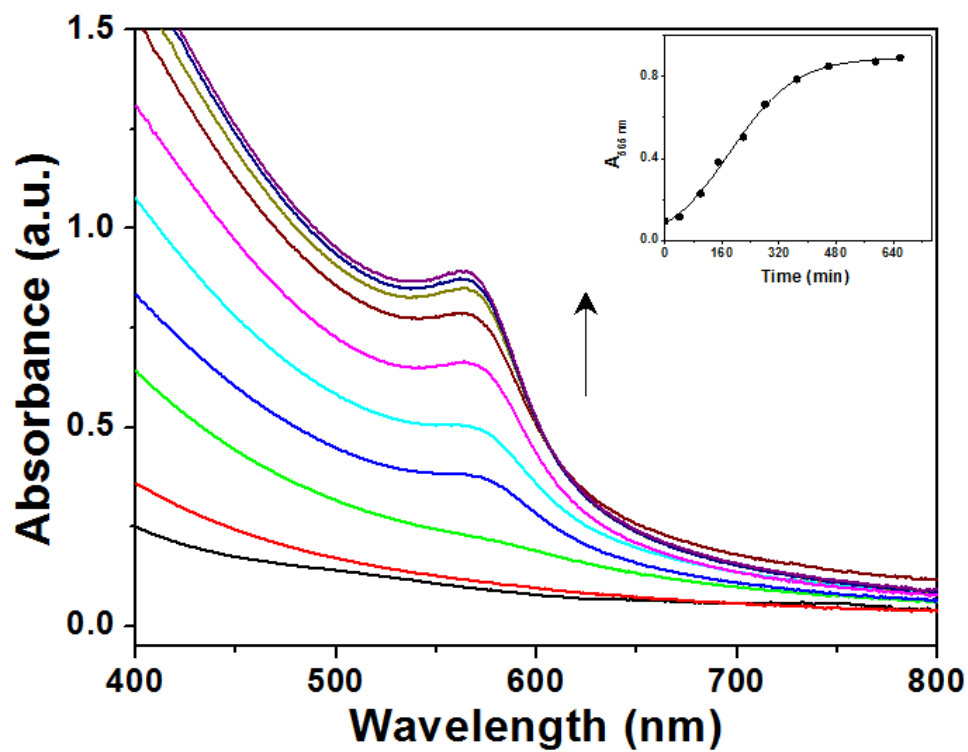


Figure S2: Time dependent UV-Vis spectra for the formation of Casein-CuNPs. *Inset* shows time versus absorbance at 565 nm. The time required to convert half of the copper complex to CuNPs was determined to be 180.10 min.

System

Temperature (°C): 25.0
Count Rate (kcps): 461.4
Cell Description: Disposable sizing cuvette

Duration Used (s): 60
Measurement Position (mm): 0.85
Attenuator: 4

Results

	Size (d.nm):	% Intensity	Width (d.nm):
Z-Average (d.nm): 109.5	Peak 1: 159.6	94.7	97.75
Pdl: 0.360	Peak 2: 17.89	2.9	4.442
Intercept: 0.685	Peak 3: 4453	2.4	926.1

Result quality : **Good**

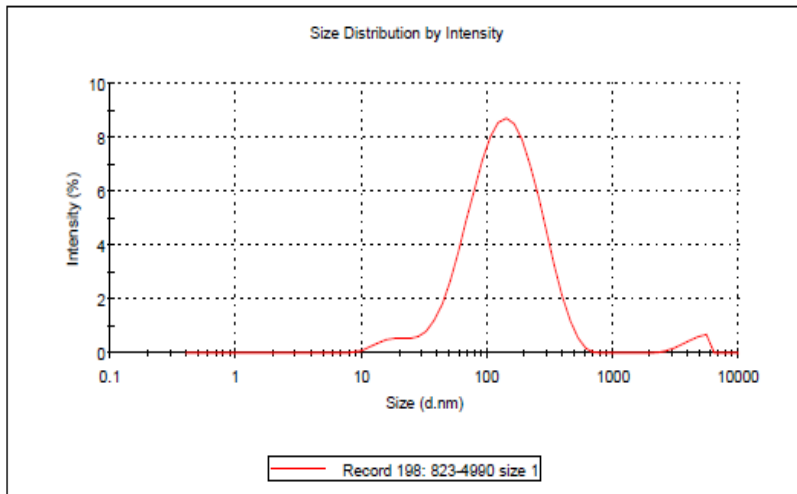


Figure S3: Particle size analysis. The average size of the casein capped CuNPs is 109.5 nm.

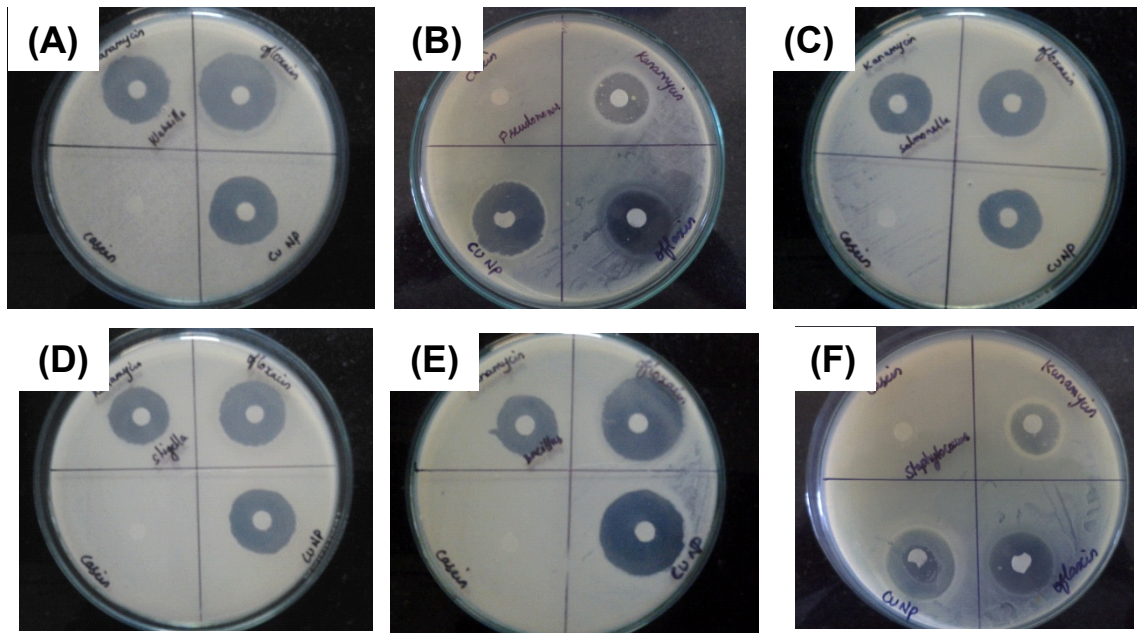


Figure S4: Zone of inhibition against (A) *K. pneumoniae*, (B) *P. aeruginosa*, (C) *S. typhimurium*, (D) *S. flexneri*, (E) *B. thuringiensis* and (F) *S. aureus*. Negative control – casein and positive control –kanamycin and ofloxacin were used. CuNPs showed good antibacterial activity as good as control antibiotic.

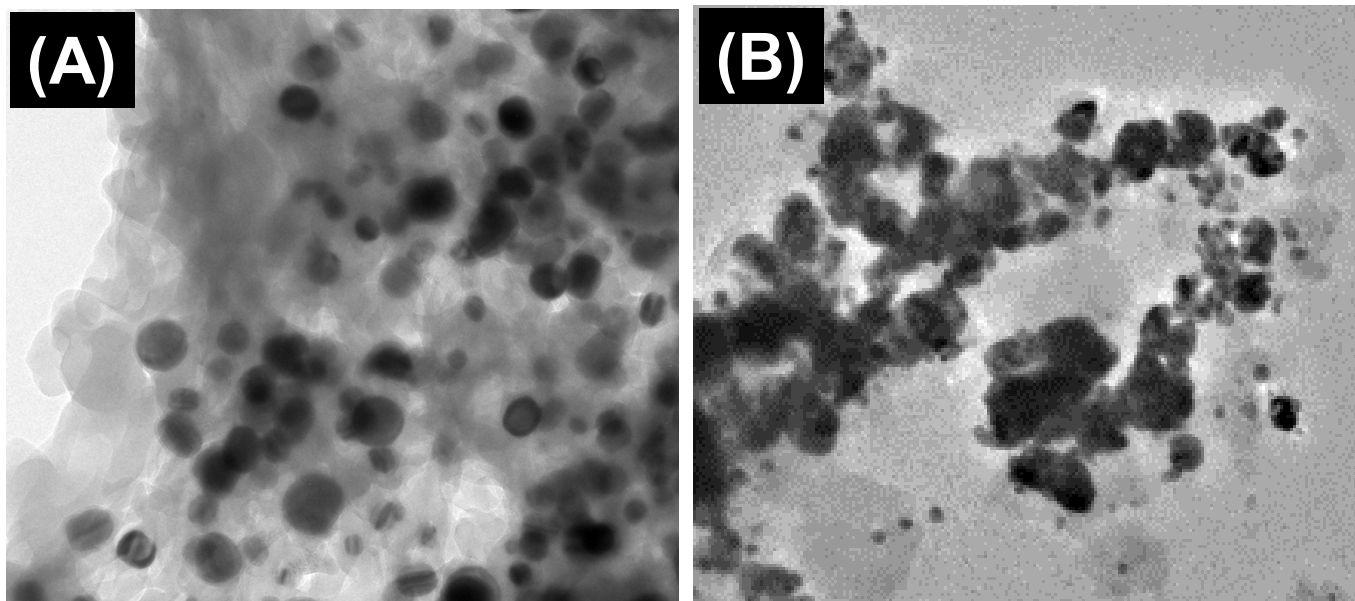
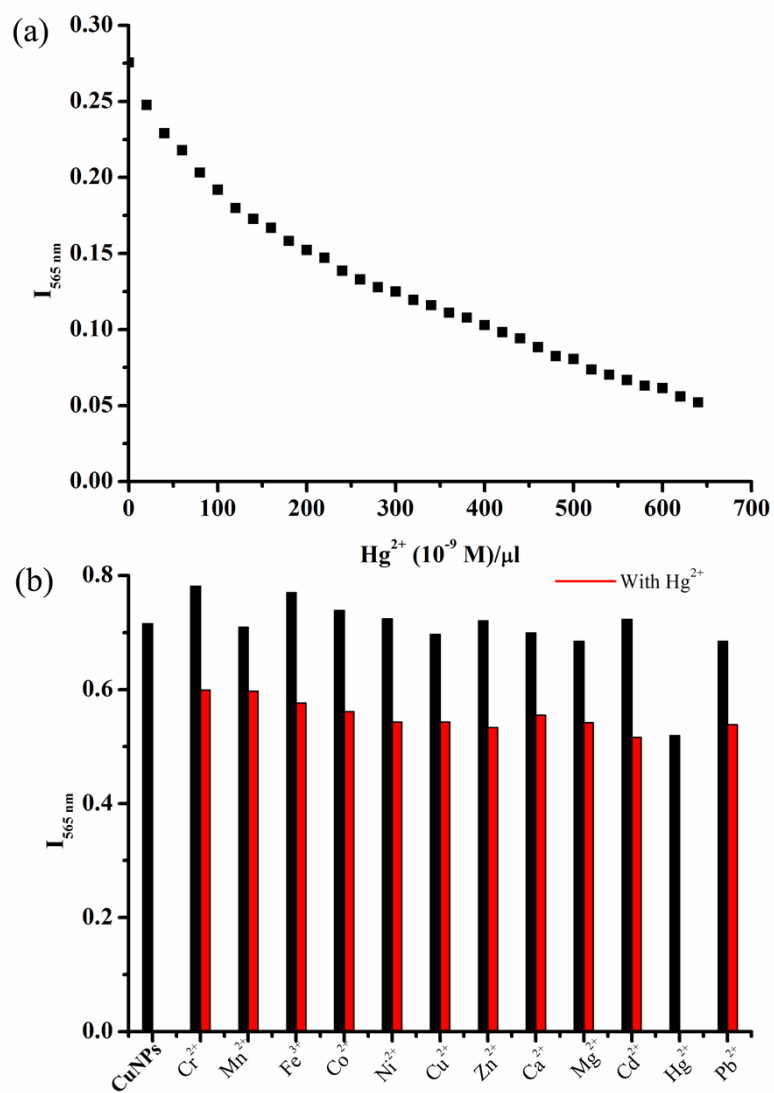


Figure S5: TEM images of the solution containing casein-CuNPs in the absence (A) and presence of Hg²⁺ (B). The observed aggregate in (B) confirms the formation of Cu-Hg precipitates.



Figures S6: (a) Change of CuNPs absorption vs concentration of Hg^{2+} and (b) selectivity studies of CuNPs for Hg^{2+} in presence of different metal ions.

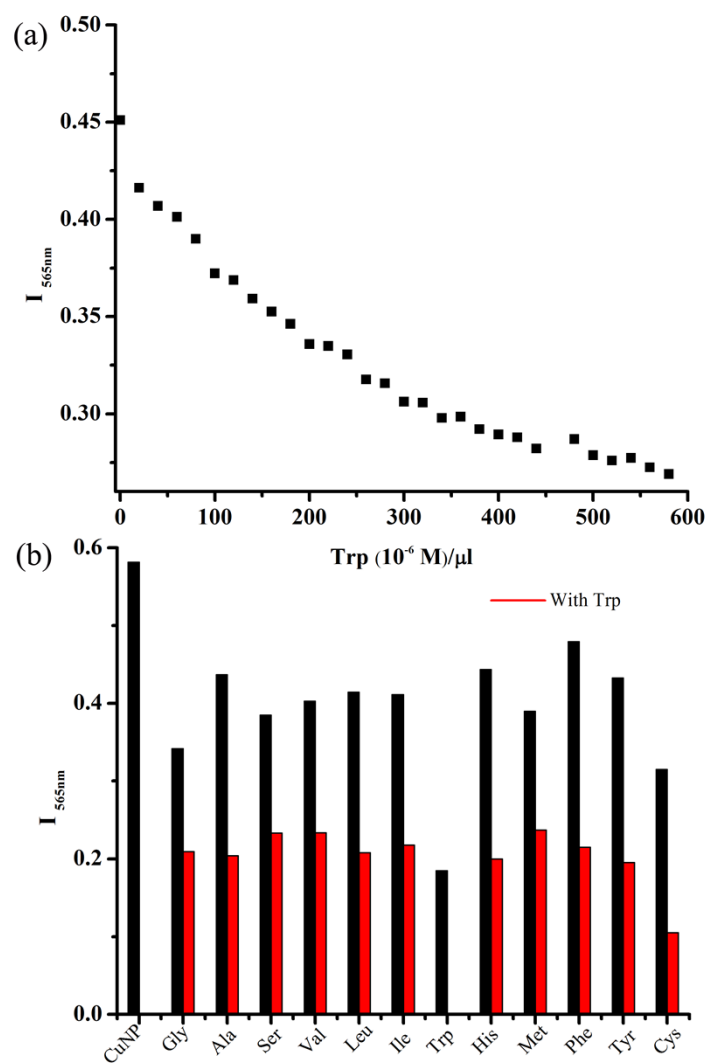


Figure S7: (a) Change of CuNPs absorption vs concentration of Trp and (b) selectivity studies of CuNPs for Trp in presence of different amino acids.

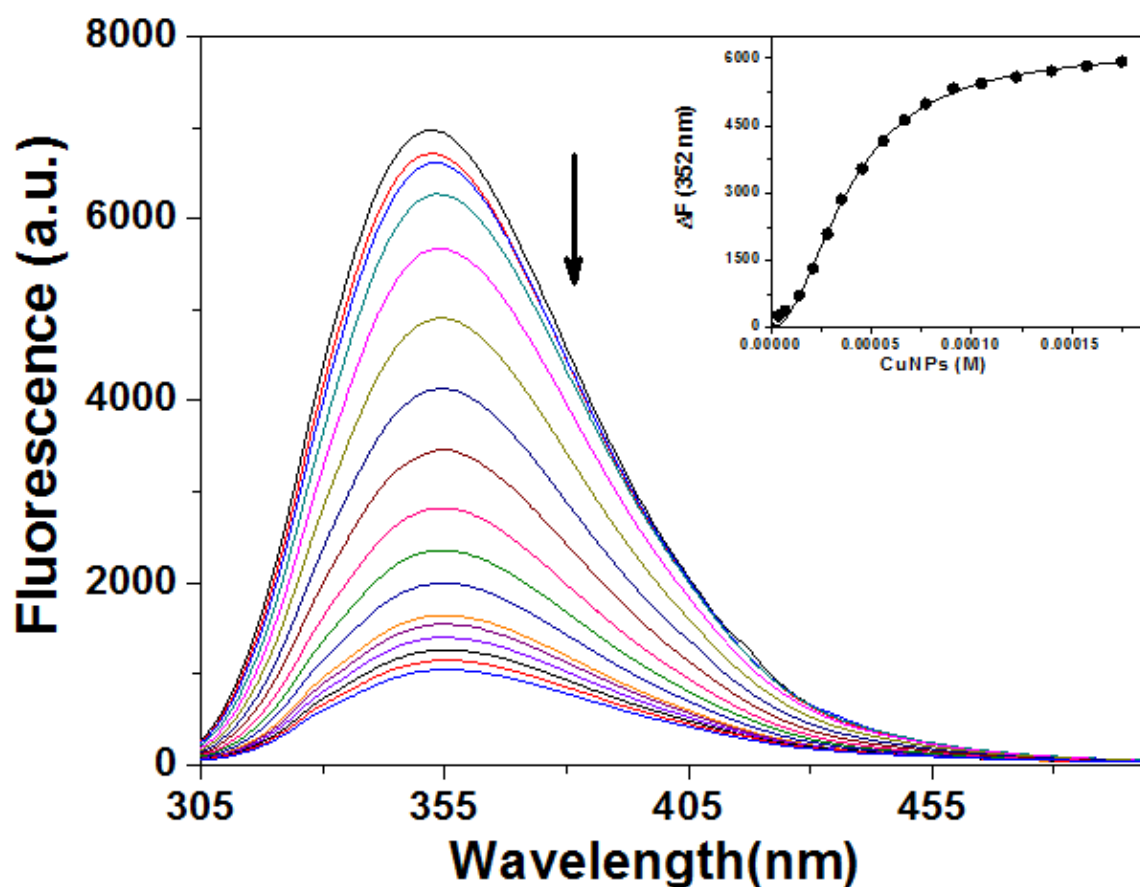


Figure S8: Trp fluorescence emission spectra monitored after addition of increasing concentration of CuNPs. The upper spectrum corresponds to free Trp and the remaining spectra with decreasing fluorescence emission were obtained in the presence of increasing CuNPs concentrations. Trp excitation wavelength: 295 nm; emission monitored between 305 – 500 nm. The inset shows the binding curves of change in fluorescence versus the concentration of CuNPs.