

Selective colorimetric sensing of mercury (II) using turn off - turn on mechanism from riboflavin stabilized silver nanoparticles in aqueous medium

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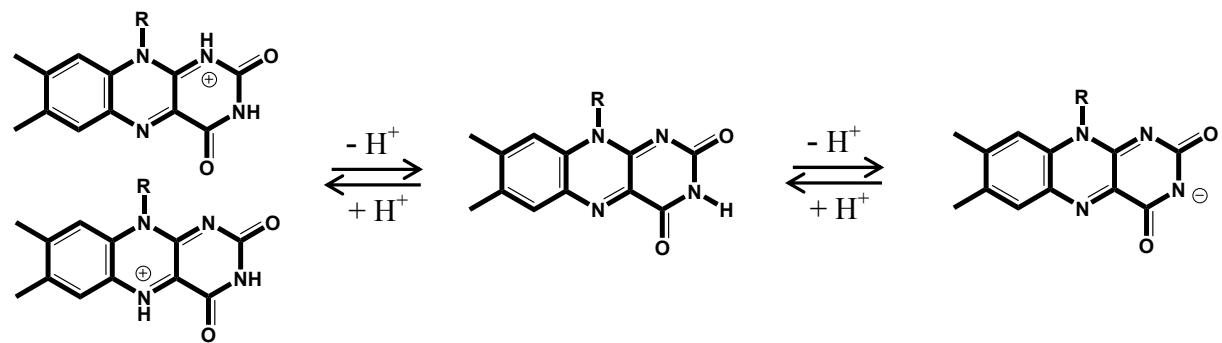
Material and methods:

(-)- Riboflavin (R) and Silver nitrate were purchased from Aldrich Chemical Co., USA. A homogeneous 10ml, 1×10^{-3} M solution of riboflavin in HPLC grade water was made by heating in a 30ml vial and was kept to cool down at room temperature. In this solution, 1 ml, 1×10^{-3} M silver nitrate solution was added dropwise under stirring condition and continued the stirring for next 2 hr. The formation of silver nanoparticles was visually detected by the color change from bright yellow to reddish orange and confirmed by the UV-spectroscopy and TEM microscopy.

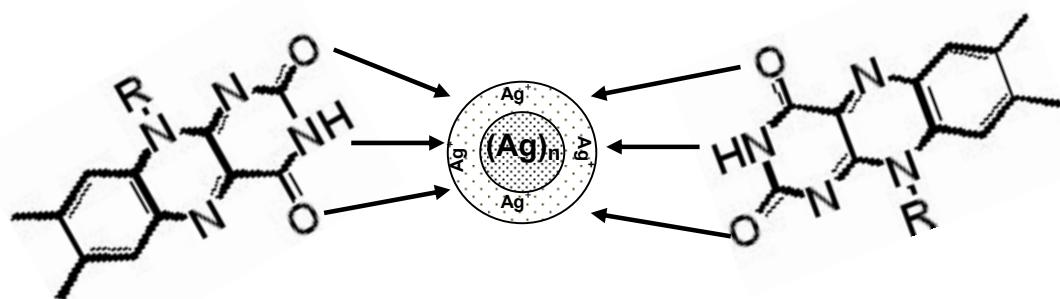
The UV-vis spectra of the samples ($R = 1 \times 10^{-3}$ M and metal ion concentrations were 1 μM) were recorded on a Hewlett-Packard UV-vis spectrophotometer (model 8453) using solutions in a cuvette of 1 mm path length. The photoluminescence studies of samples prepared in a sealed cuvette, have been carried out in a Horiba Jobin Yvon Fluoromax 3 instrument. 0.9ml R-Ag NP solution is taken in a cuvette and 0.1 ml metal ion solution (1 μM) is added to it. The mixture is homogenized by shaking and the spectra of the samples are taken from the respective instruments.

In case of testing of Hg^{2+} ions in a tannery waste water, to the 0.9 ml R-Ag NP solution 0.05ml reference Hg^{2+} solution of different strengths (20, 50 and 75nm) is added, followed by the addition of 0.05 ml sample solution. After homogenization by shaking, the PL- intensity is measured for four sets of experiments following the similar procedure mentioned above. The average of these values are taken as the sample intensity (I) and the percent increment $(I - I_0)/I_0$ of PL intensity (I) from that of Ag NP solution (I_0) is calculated. Similar procedure is adopted for testing of Hg^{2+} solution in the tap water of our institute.

The TEM micrographs are taken from a high resolution transmission electron microscope (JEOL, 2010EX) operated at an accelerated voltage of 200KV fitted with a CCD Camera.



Scheme S1: Structure of anionic, neutral and cationic form of Riboflavin (R= - CH₂(CHOH)₃CH₂OH).



Scheme 2: Schematic presentation of the stabilization of Ag nanoparticles (sphere) by complexation of adsorbed Ag²⁺ with riboflavin (R)

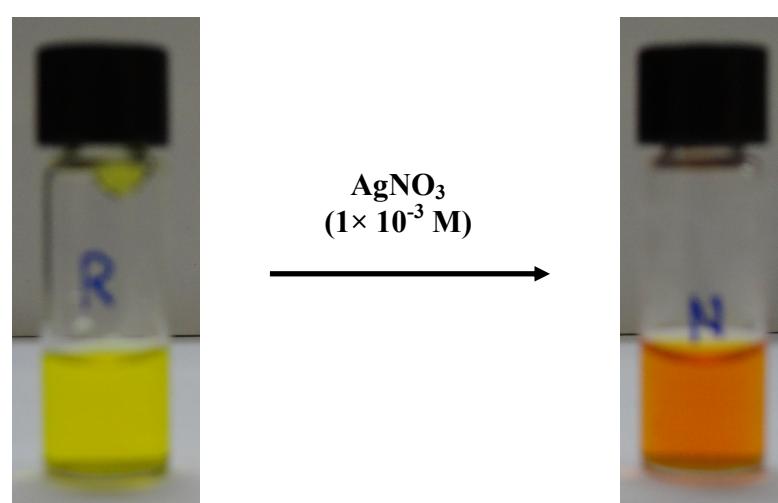


Figure S1: Formation and stabilization of riboflavin stabilized silver nanoparticles as evident from color change from yellow to deep orange.

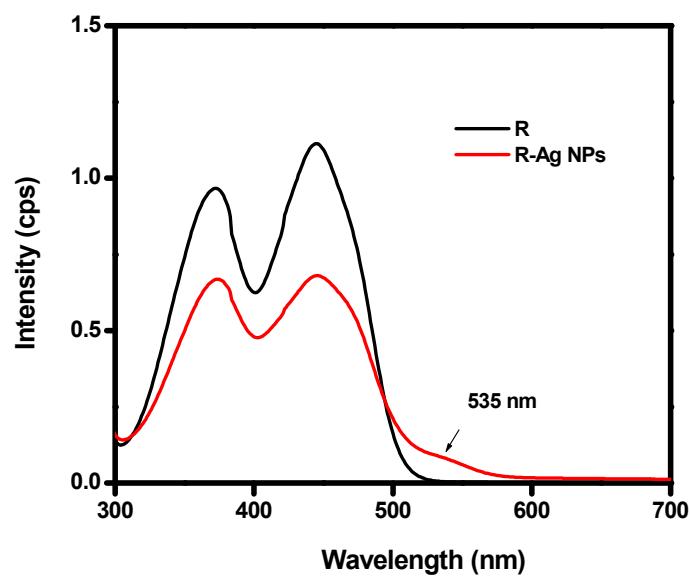


Figure S2: Normalized UV-vis spectra of the pure riboflavin solution ($1 \times 10^{-3} \text{ M}$) and the riboflavin stabilized silver nanoparticle solution.

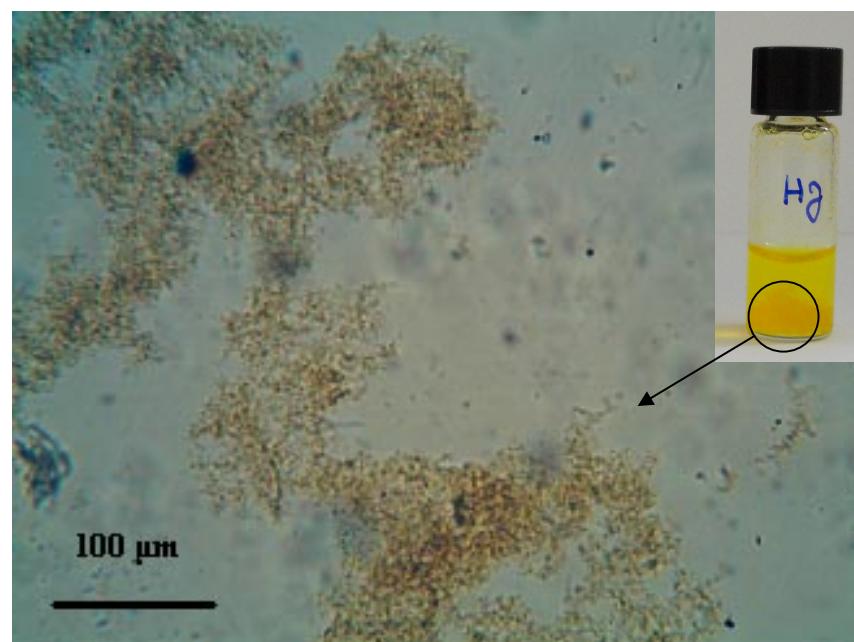


Figure S3: Optical microscopy image of the aggregate collected after 1 hr of addition of the Hg^{2+} solution to the R-Ag NPs.

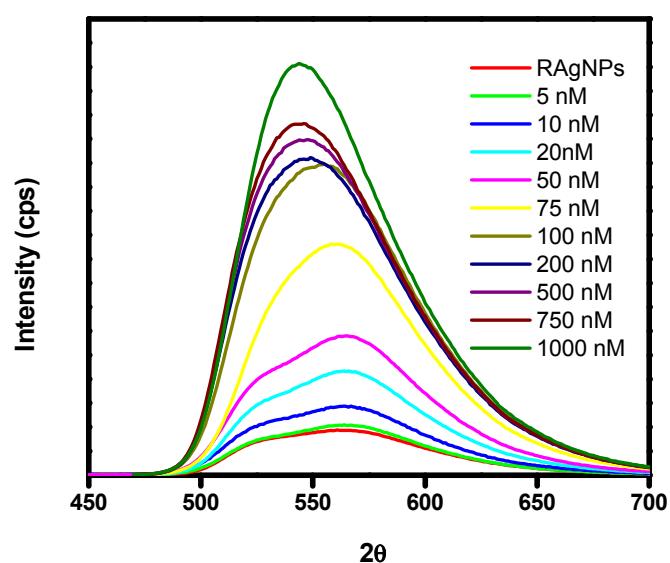


Figure S4: Fluorescence spectra of the R-Ag NPs to the indicated concentrations of Hg^{2+} ion solution.

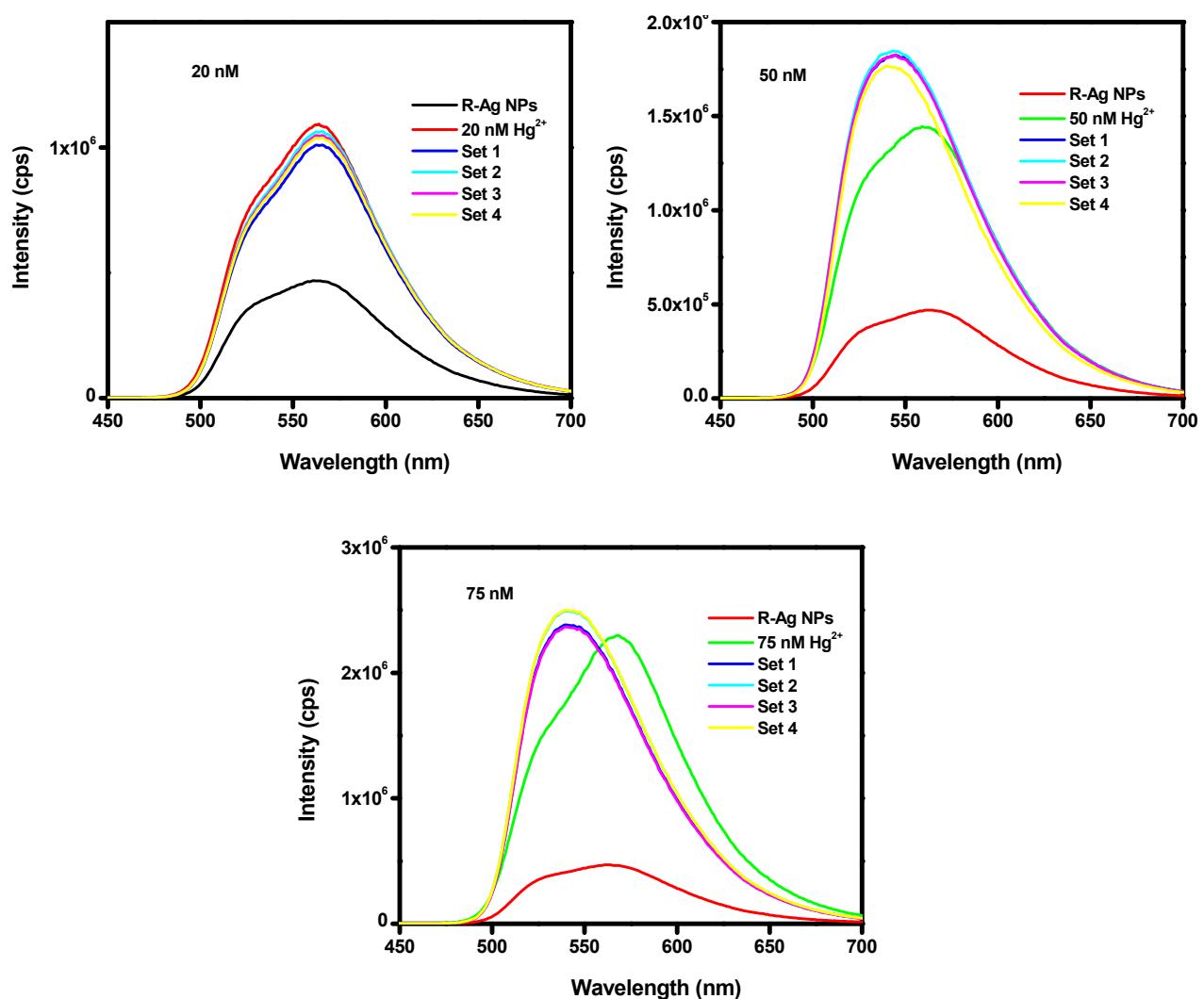


Figure S5: PL-spectra of the R-Ag NPs solution mixed with different reference Hg^{2+} (20, 50 and 75 nM) solution and the tap water sample collected from our institute.

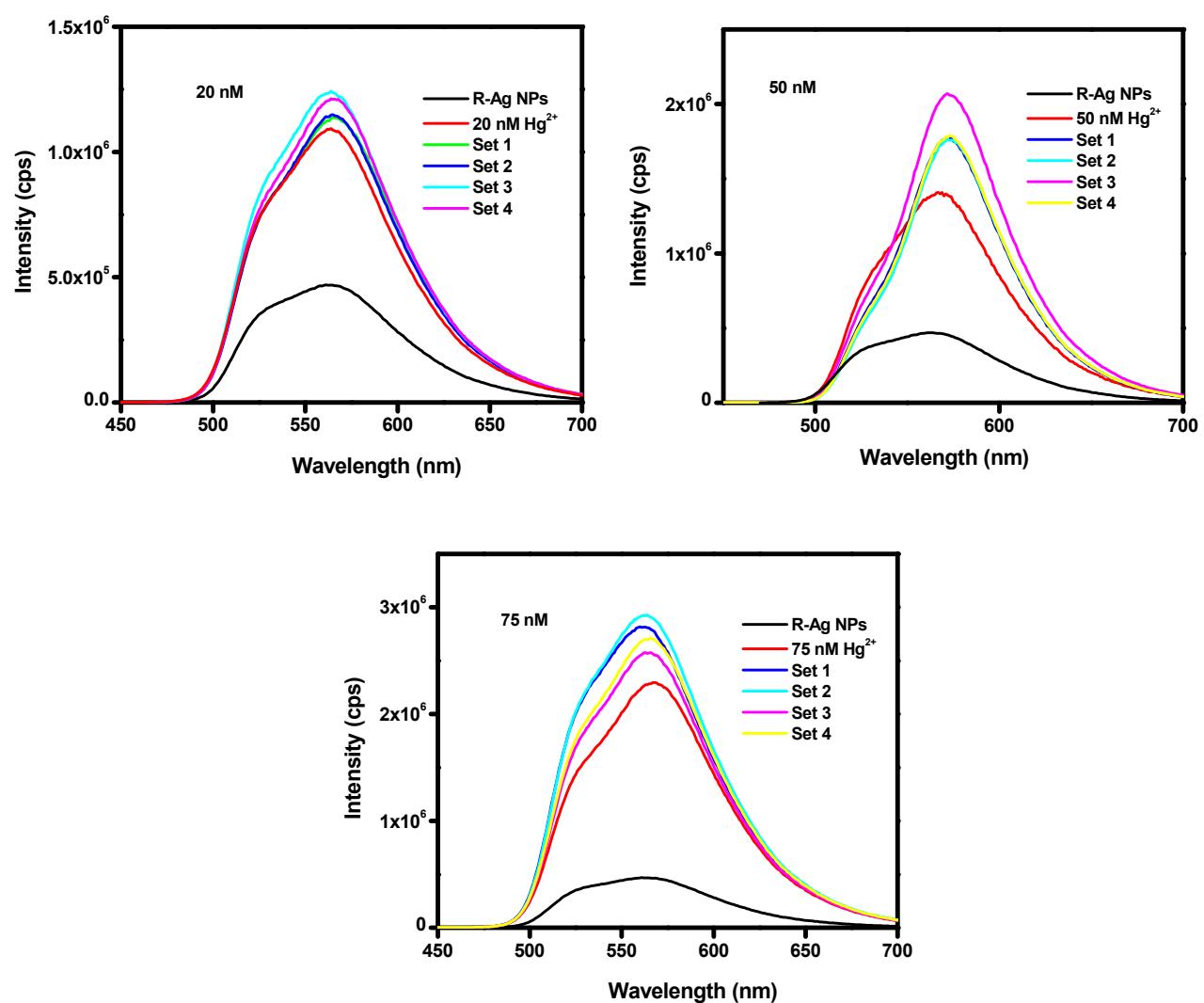


Figure S6: PL-spectra of the R-Ag NPs solution mixed with different reference Hg^{2+} (20, 50 and 75 nM) solution and the waste water from a tannery at Bantala, Kolkata.