

ELECTRONIC SUPPLEMENTARY INFORMATION

**Burmese grape fruit juice can trigger the “logic gate” like colorimetric sensing behavior
of Ag nanoparticles towards toxic metal ion†**

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Chemicals. Silver nitrate (AgNO_3) (Sigma-Aldrich) was used as the source of Ag^+ ions necessary for the synthesis of Ag NPs. Folin-Ciocalteu reagent, gallic acid, quercetin $\geq 95\%$ (HPLC), ascorbic acid, 2,6-dichlorophenolindo phenols and sodiumborohydride (NaBH_4) were purchased from Sigma-Aldrich Co. Tri-sodium citrate, cetyltrimethylammoniumbromide (CTAB), sodiumdodecylsulphate (SDS) and plovinylypyrrolidone (PVP) were purchased from Merck and SRL, India. All other chemicals used for the present study were of analytical grade and Milli-Q (Milli-Q Academic with 0.22 mm Millipak R-40) water was used for all the analyses.

Instrumentation. FT-IR studies were done by Shimadzu FTIR-8400S PC instrument using KBr pellets in the diffuse reflectance mode. Prior to FT-IR measurements, Ag NPs were centrifuged (Biofuge PrimoR-Thermo Scientific) at 12,000 rpm for 20 minutes followed by drying the samples under vacuum. Absorption spectra were recorded on dual-beam UV-Vis spectrophotometer (PerkinElmer, Lambda 35). For Transmission Electron Microscopy (TEM) study, samples were prepared by drop-coating the synthesized Ag NPs solution onto carbon-coated copper grids (400 mesh size). The films on the grids were allowed to dry prior to the TEM measurement in a JEOL JEM-2100 instrument.

For powder X-Ray diffraction (XRD) analyses, samples were prepared in the following way: Ag NPs solutions were centrifuged at 14000 rpm for 30 minutes and the supernatant was discarded. Then water was added to the Ag NPs and vortexed after which the sample solution was centrifuged in the previous way. All these steps were repeated for three times and finally the residue part was dried in vacuum whereby a dry powder was obtained. This was dispersed evenly over a quartz slide to carry out XRD studies. The XRD pattern was recorded using the Rigaku-Smart Lab diffractometer attached with D/tex ultra detector and $\text{CuK}\alpha$ source operating at 50 mA and 40kV. The scan range was fixed at $2\theta = 20^\circ$ to 90° with a stepwise size of 0.02° .

To get an idea of the electrochemical behavior of the green multifunctional agent i.e. the juice of the *Baccaurea ramiflora* fruit pulp and reasons behind Hg^{2+} sensing activities of the synthesized Ag NPs, we have done cyclic voltammetry (CV) assays of the corresponding sample solutions using a Potentiostat-galvanostat (PAR Vera Stat TM-II). A three electrode system was employed viz., SCE as the reference electrode, a platinum wire as a working electrode and a platinum plate as a counter electrode. The cyclic voltammograms were recorded in the range of -1.0 to +1.0 V with a scan rate of 50 mV s^{-1} .

Thermal response of the synthesized Ag NPs was monitored by Thermo Gravimetric Analysis (TGA). TGA of Ag NPs sample was done using a Pyris Diamond TG/DTA (Perkin Elmer, STA-6000) thermal analyzer. The experiment was set in the temperature range of 40-713°C and at heating rate of $10^\circ\text{C min}^{-1}$ under nitrogen atmosphere.

GC-MS analysis

INSTRUMENTATION:

The *Baccaurea ramiflora* fruit juice was analyzed with a Varian (Walnut Creek, CA) Saturn 2200 mass spectrometer coupled to a model 3800 gas chromatograph. The mass spectrometer was used in the full scan mode with electron impact ionization. The system was equipped with a Model 1079 programmed temperature vaporizer injector, electronic flow control and autosampler (CTC COMBIPAL). The injection liner (single gooseneck 3.4 mm id) contained a plug of carbofrit (Restec Bollefonte, PA) to allow 9 μL injections of the ethyl acetate extract of fruit juice. Varian MS Workstation Software (Version 5.1.2600.2180) was used for instrument control and data analysis.

GC Parameters:

Column : VF-5 MS, 30 m length (0.25 mm id, 0.25 μ m film thickness)
Flow rate : 1.0 mL/ min
Injection volume : 9 μ l

Column oven temperature programmed:

Temp ($^{\circ}$ C)	Rate ($^{\circ}$ C/min)	Hold (min)	Total time (min.)
70	-	2	2
180	20	0	7.50
200	10	1	10.50
280	20	2	16.50

METHOD OF ANALYSIS:

1mL extract + 10 mL EA+1g NaCl+1.5 g NaSO₄. The mixture was vortexed well and centrifuged at 5000 rpm for 10 minutes. Then the supernatant organic part was collected. The extract was then filtered through 0.2 μ m nylon membrane filter and finally ethyl acetate extract was analyzed by GC-MS. The analysis was done by matching the spectrum with the help of NIST LIBRARY.

Synthesis of Ag NPs by NaBH₄ reduction of Ag⁺ ions in the presence of various stabilizing agents [trisodium citrate, CTAB, SDS and PVP].

We have followed the method of S. Agnihotri et al.¹⁷ with slight modification. In a typical procedure, 1.46 mg of trisodium citrate and 1.89 mg NaBH₄ were dissolved in 25 mL of nano pure water whereby final concentration of each of the components became 2 mM. The reaction mixture was stirred at 60 $^{\circ}$ C for 30 minutes. After this 1 mL of aqueous AgNO₃ solution (0.05 M) was slowly added to it in dropwise manner whereby the final concentration of Ag⁺ ions in the reaction mixture became 2 mM. pH of the reaction medium was adjusted to 10 by adding dilute

NaOH solution. Temperature was slowly raised to 90°C and the reaction mixture was stirred continuously at this temperature for 20 minutes. Then the reaction mixture was cooled at room temperature and appearance of golden yellow color confirmed the formation of AgNPs. This was further confirmed by monitoring its SPR absorption band at 394 nm [Fig. S1(a)] and corresponding TEM image [Fig. S2(a)].

Same procedure was repeated for syntheses of AgNPs by the NaBH₄ reduction of Ag⁺ ions in the presence of other stabilizing agents such as CTAB (1 mM), SDS (10 mM) and PVP (0.1%). Formation and growth of the synthesized Ag NPs were confirmed on the basis of their absorption spectra [Fig. S1(b-d)] whereas the shape and size of the NPs were established on the basis of their TEM images as shown in Fig. S2(b-d).

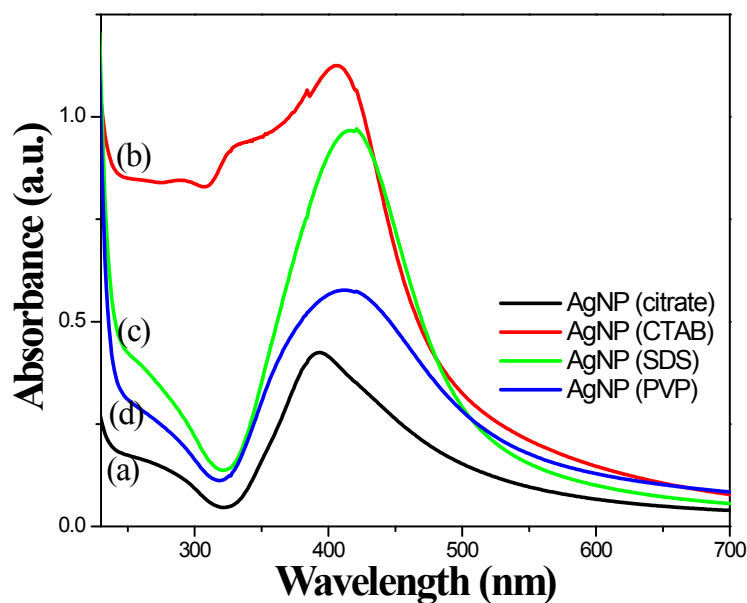


Fig. S1 UV-visible spectra are of synthesized Ag NPs by NaBH₄ reduction of Ag⁺ ions in the presence of various stabilizing agents: tri-sodium citrate **(a)**, CTAB **(b)**, SDS **(c)** and PVP **(d)**.

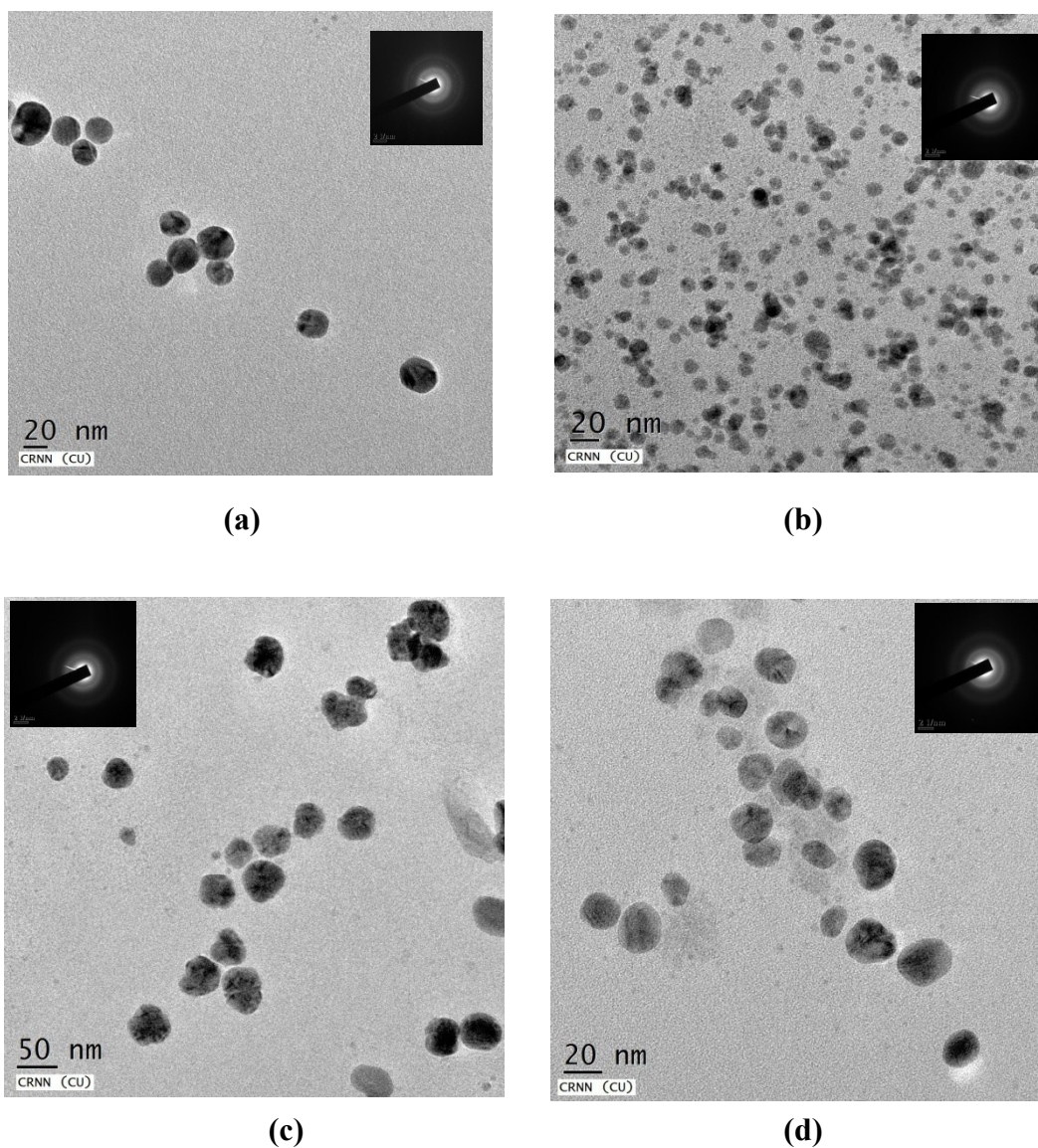


Fig. S2 TEM images of Ag NPs prepared using tri-sodium citrate **(a)**, CTAB **(b)**, SDS **(c)** and PVP **(d)** and in inset SAED pattern of Ag NPs.