Silver nanoparticle based highly selective and sensitive solvatochromatic sensors for colorimetric detection of 1,4-dioxane in aqueous media

Anshu Kumar,[a,b] Gaurav Vyas,[a,b] Madhuri bhatt,[a,b] shreya bhatt,[a,b] and Parimal Paul*[a,b]

[a]*Analytical Discipline and Centralized Instrument Facility,*

CSIR-Central Salt & Marine Chemicals Research Institute,

Bhavnagar 364 002, India.

[b]*Academy of Scientific and Innovative Research (AcSIR),*

CSIR-CSMCRI, Bhavnagar, 364002, India.

Electronic Supplimentary Information (ESI)

EXPERIMENTAL SECTION

Chemicals and solutions: Sodium citrate tribasic dihydrate, sodium borohydride, silver nitrate (s. d. fine-CHEM LiMiTEd, Mumbai) were purchased from Sigma-Aldrich. Methanol, acetone, acetonitrile, isopropanol with HPLC grade were purchased from Fisher Scientific. Ethanol (spectrochem Pvt. Ltd.), dichloromethane, THF, hexane, chloroform, diethyl ether, dimethylformamide, DMSO and 1,4 dioxane were supplied by SRL. All chemicals were of analytical grade and were used without further purification.

Instrumentation: UV−vis absorption spectra were recorded on a Varian model CARY 500 spectrophotometer. Transmission electron microscopy (TEM) measurements were conducted on a JEOL, model JEM 2100 transmission electron microscope, elemental analysis by EDX (INCA, Japan) and FESEM measurements were conducted on a JEOL, model JSM-7100F.

Synthesis of citrate-Ag NPs: Citrate stabilized Ag NPs (6±4-nm diameter) were synthesized with little modification of the published procedure.[1] Ag^+ ions (10 mM) were equilibrated under continuously gentle stirred at RT with added trisodium citrate (10 mM) and then 8.8 mg $NaBH_4$ was added into the solution and stirred for 10 min at RT. The colour of the solution was changed from colourless to yellow, indicating the formation of citrate stabilized silver nanoparticles (ci-Ag NPs).

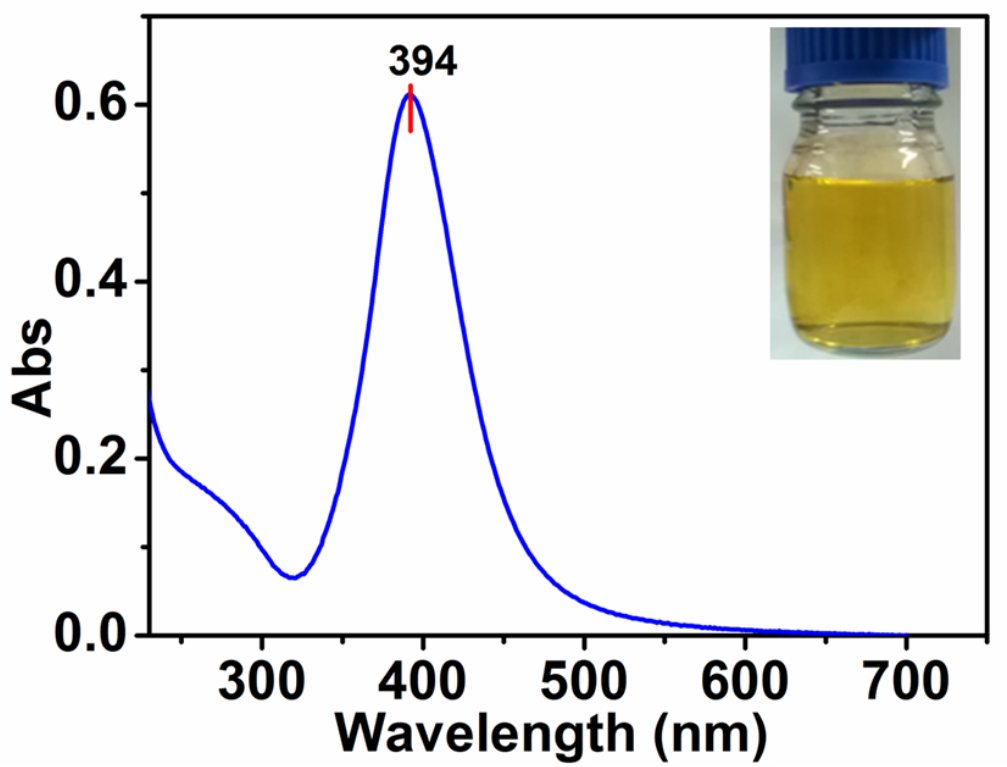

Fig. S1. UV-vis spectrum of ci-AgNPs and photographic image (inserted) showing colour of the solution.

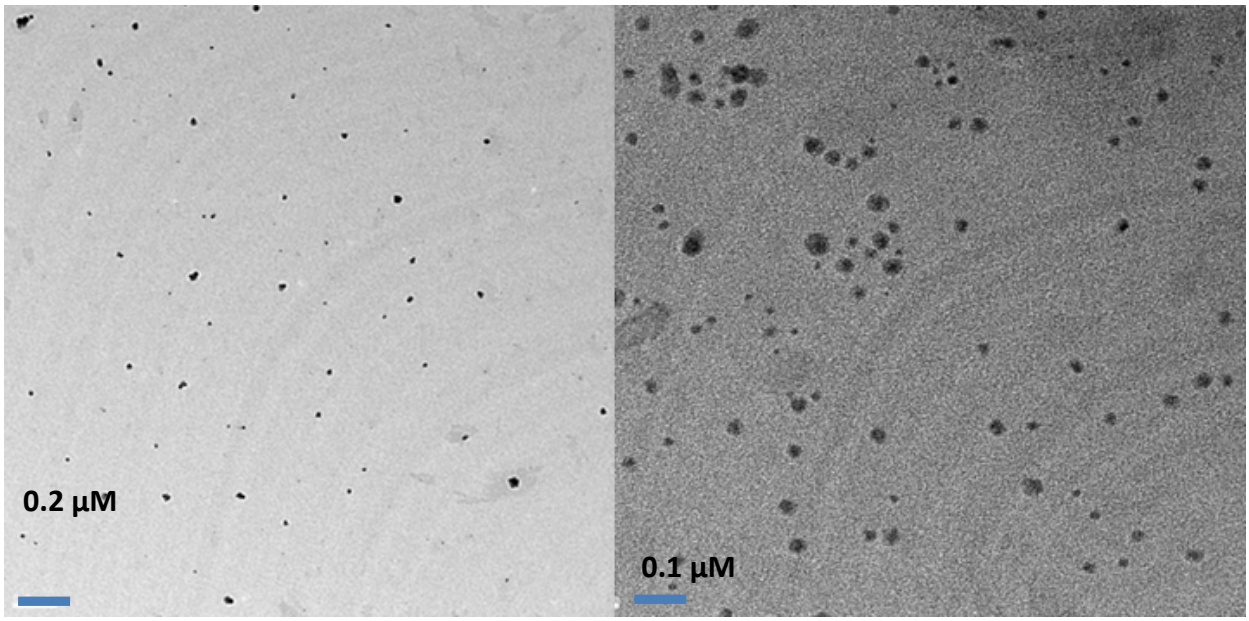

Fig. S2 TEM image of the ci-AgNPs prepared

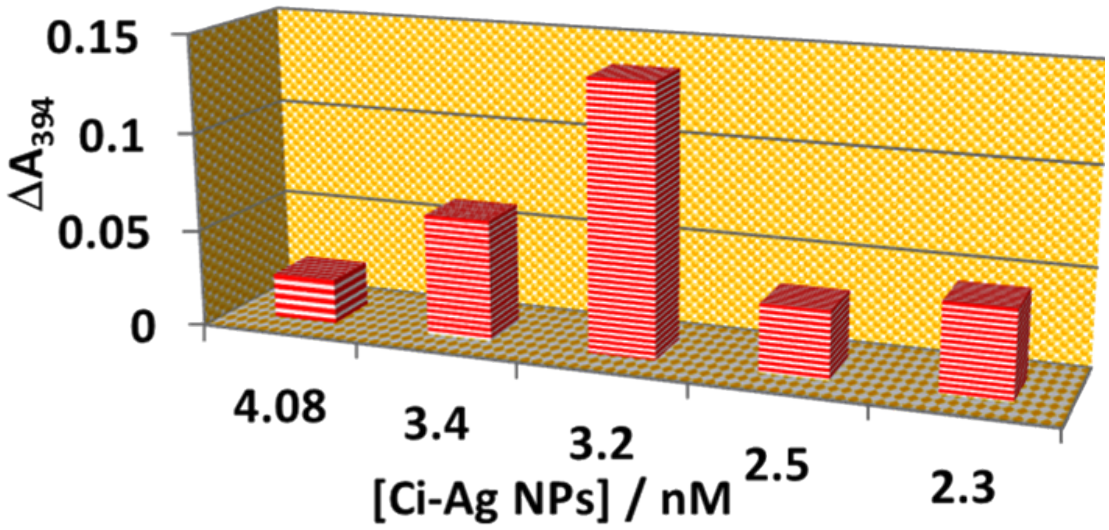

Fig. S3. Plot of the change in absorption intensity at 394 nm (ΔA_{394}) as a function of the concentration of ci-Ag NPs upon addition of 1,4 dioxane.

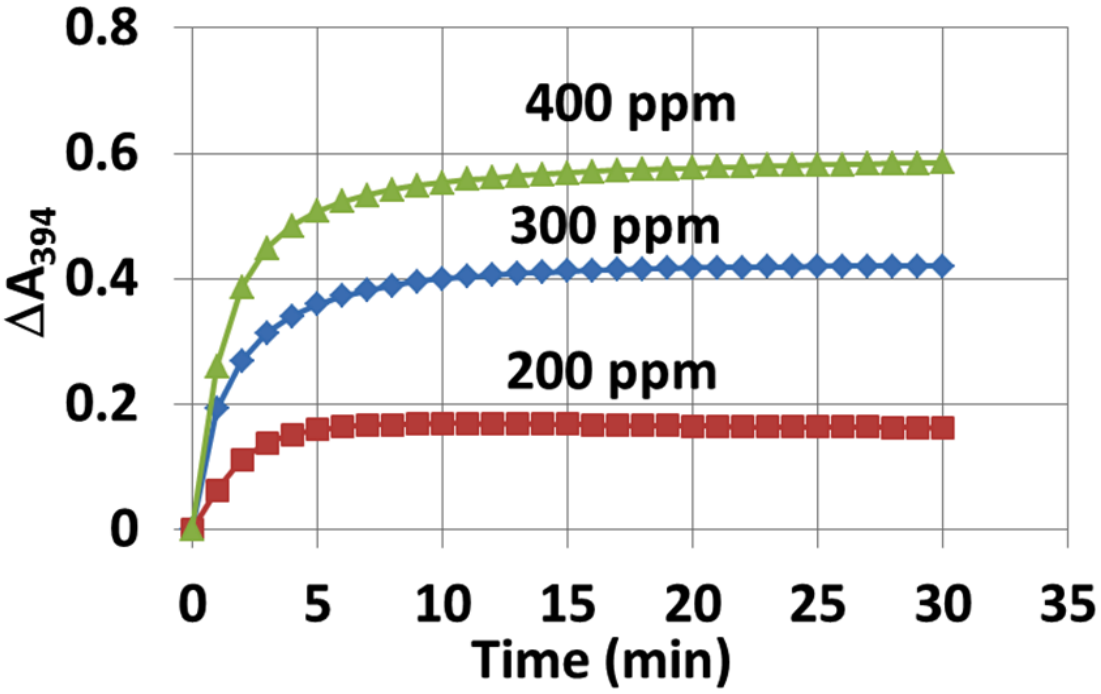

Fig. S4. Time-dependent change in absorption intensity at 394 nm (ΔA_{394}) for ci-Ag NPs upon addition of 1,4 dioxane with different concentrations (200, 300, 400 ppm).

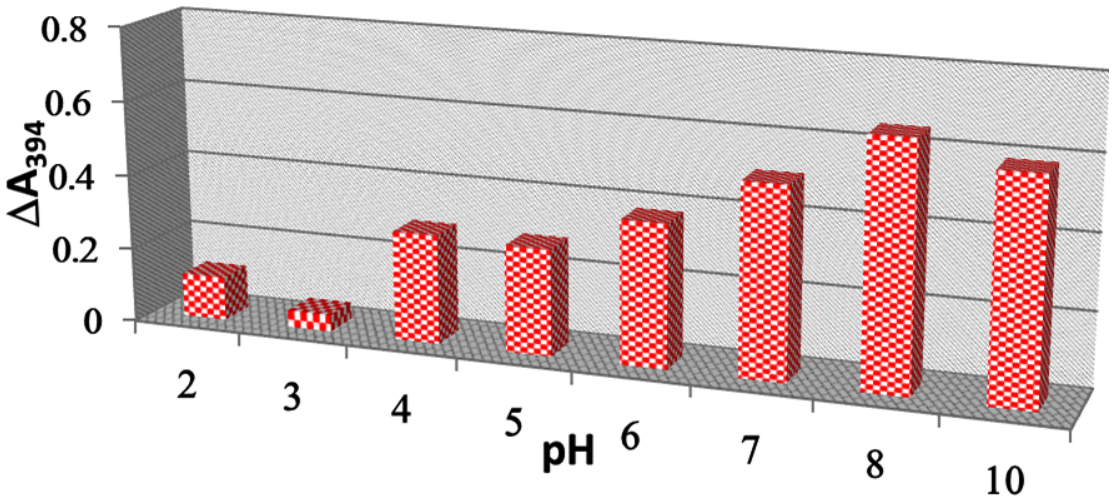

Fig. S5. Plot of the change in absorption intensity at 394 nm (ΔA_{394}) of the ci-AgNPs upon addition of 1,4-dioxane as a function of pH.

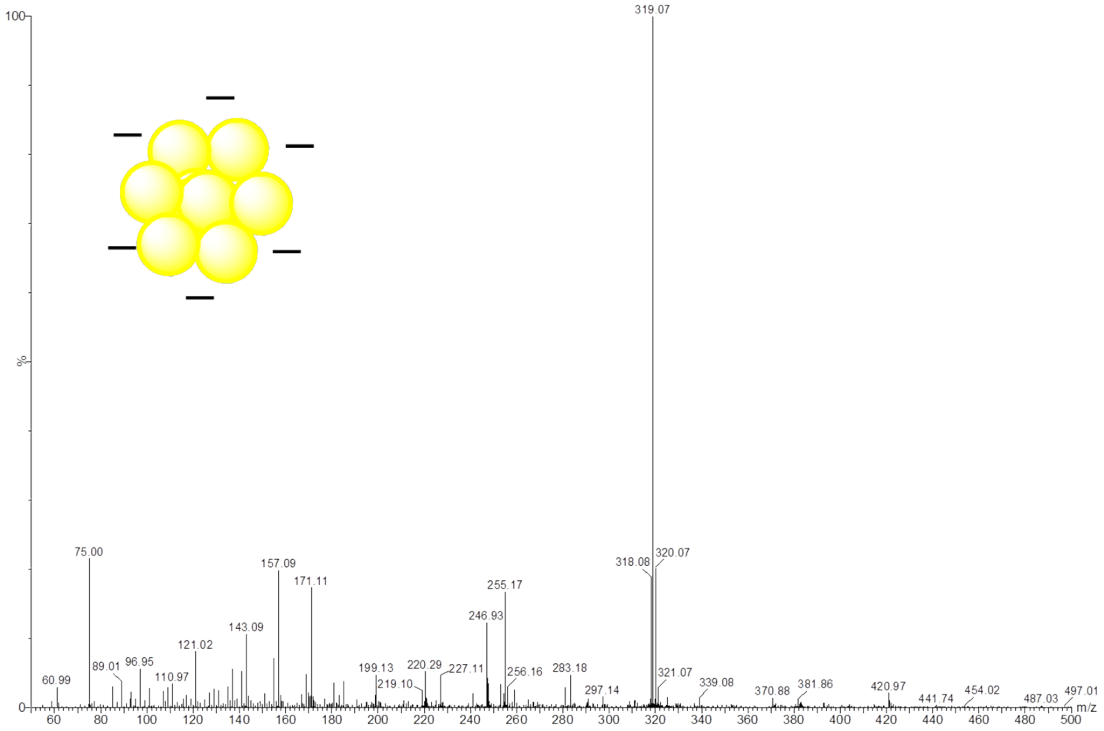

Fig. S6. ES-Mass spectrum of ci-AgNPs in aqueous media

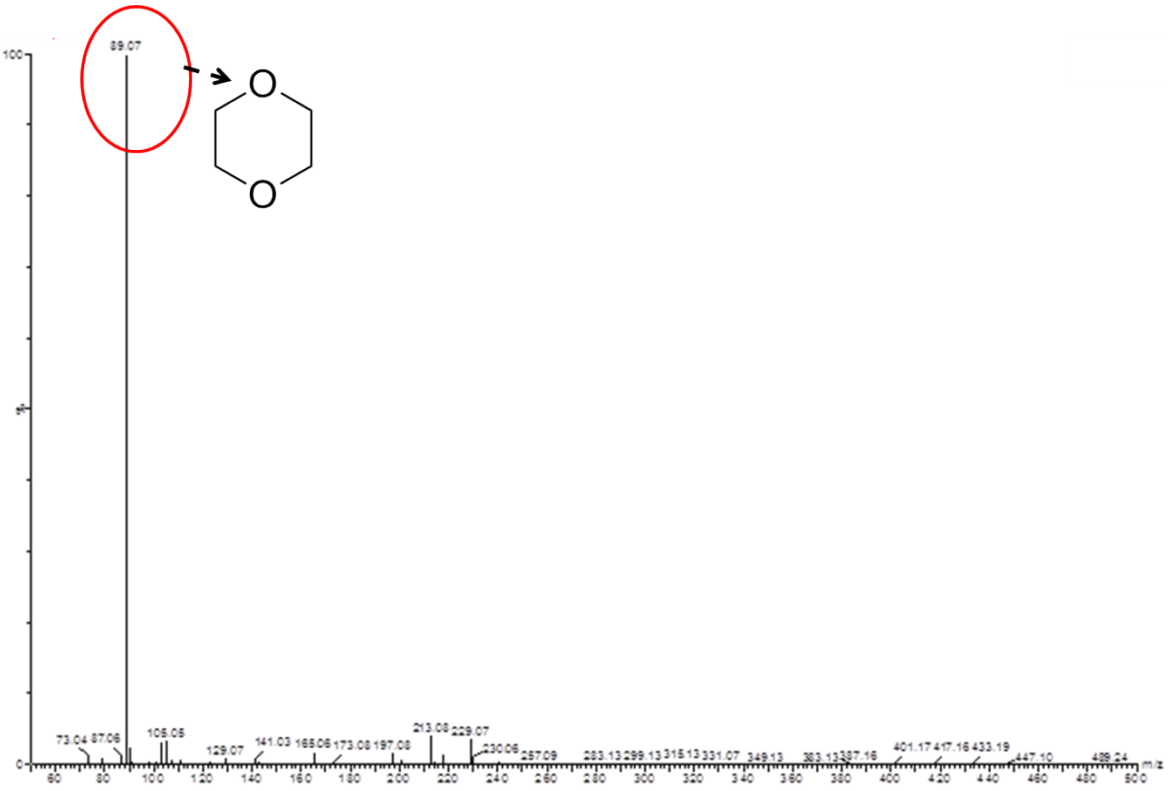

Fig. S7. ES-Mass spectrum of 1,4 dioxane

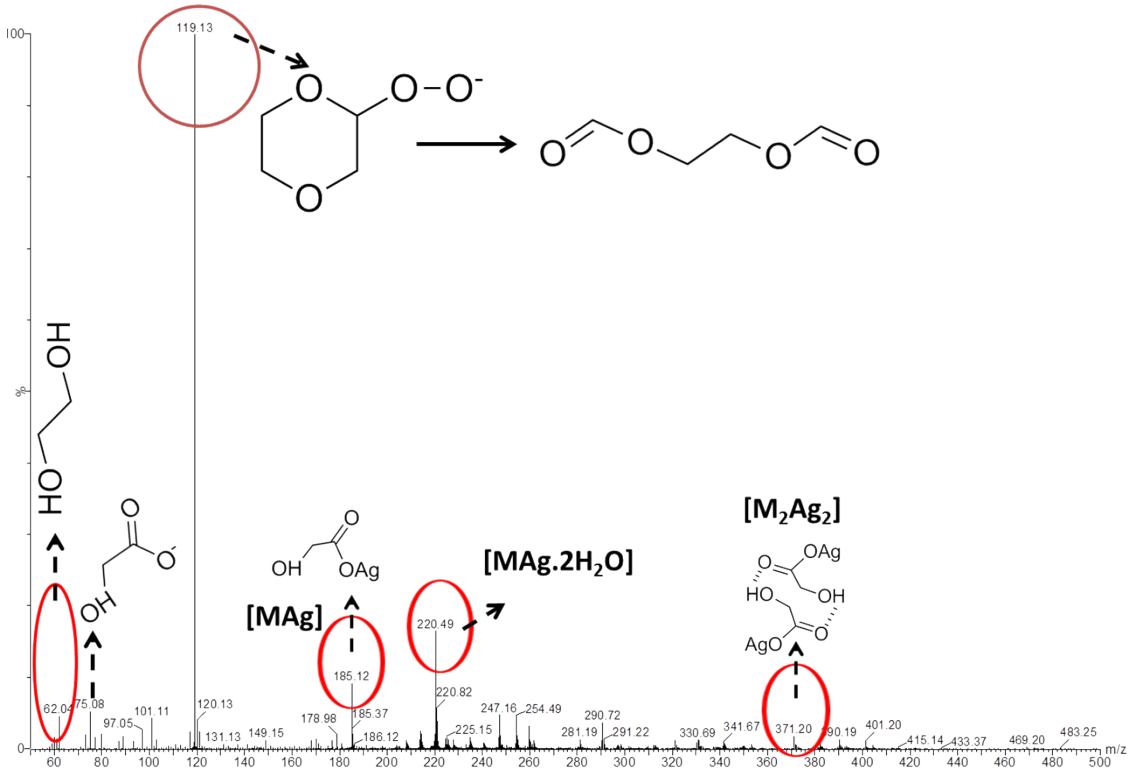

Fig. S8. ES-Mass spectrum of ci-AgNPs upon addition of 1,4-dioxane with concentration ($V_{diox.}/V_{total}$) 6.6 x 10^{-4}.

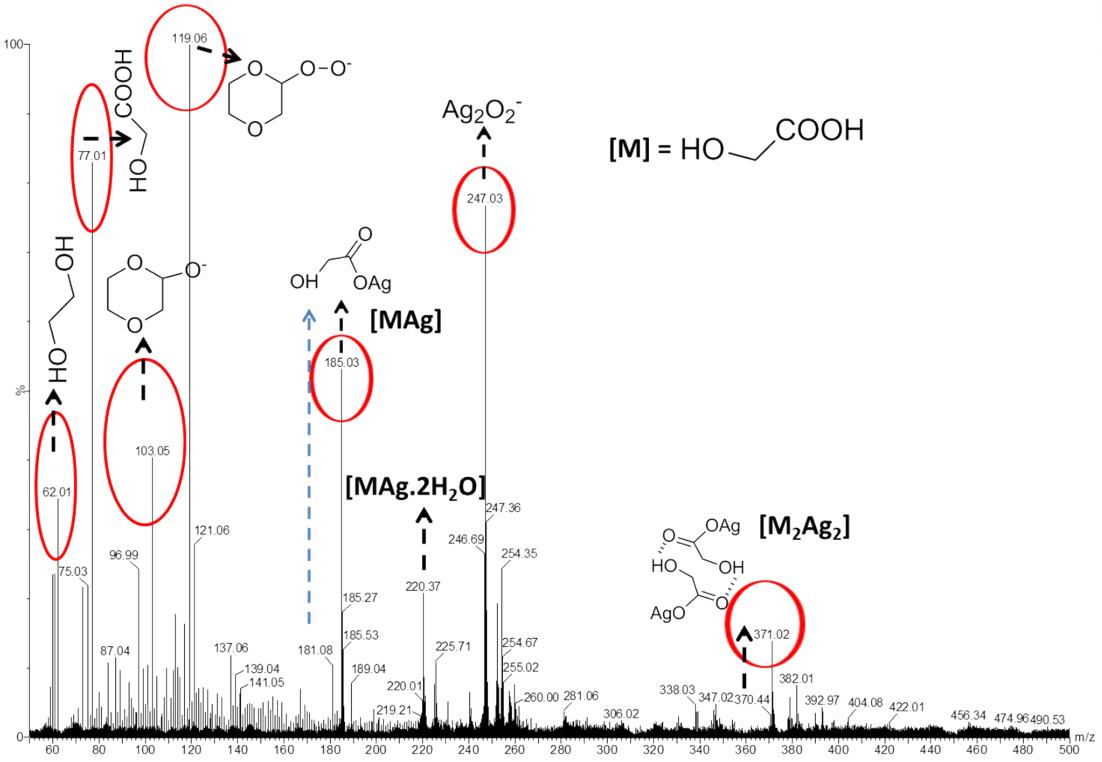

Fig. S9. ES-Mass spectrum of ci-AgNPs upon addition of 1,4-dioxane with concentration ($V_{diox.}/V_{total}$) 6.6 x 10^{-3}.

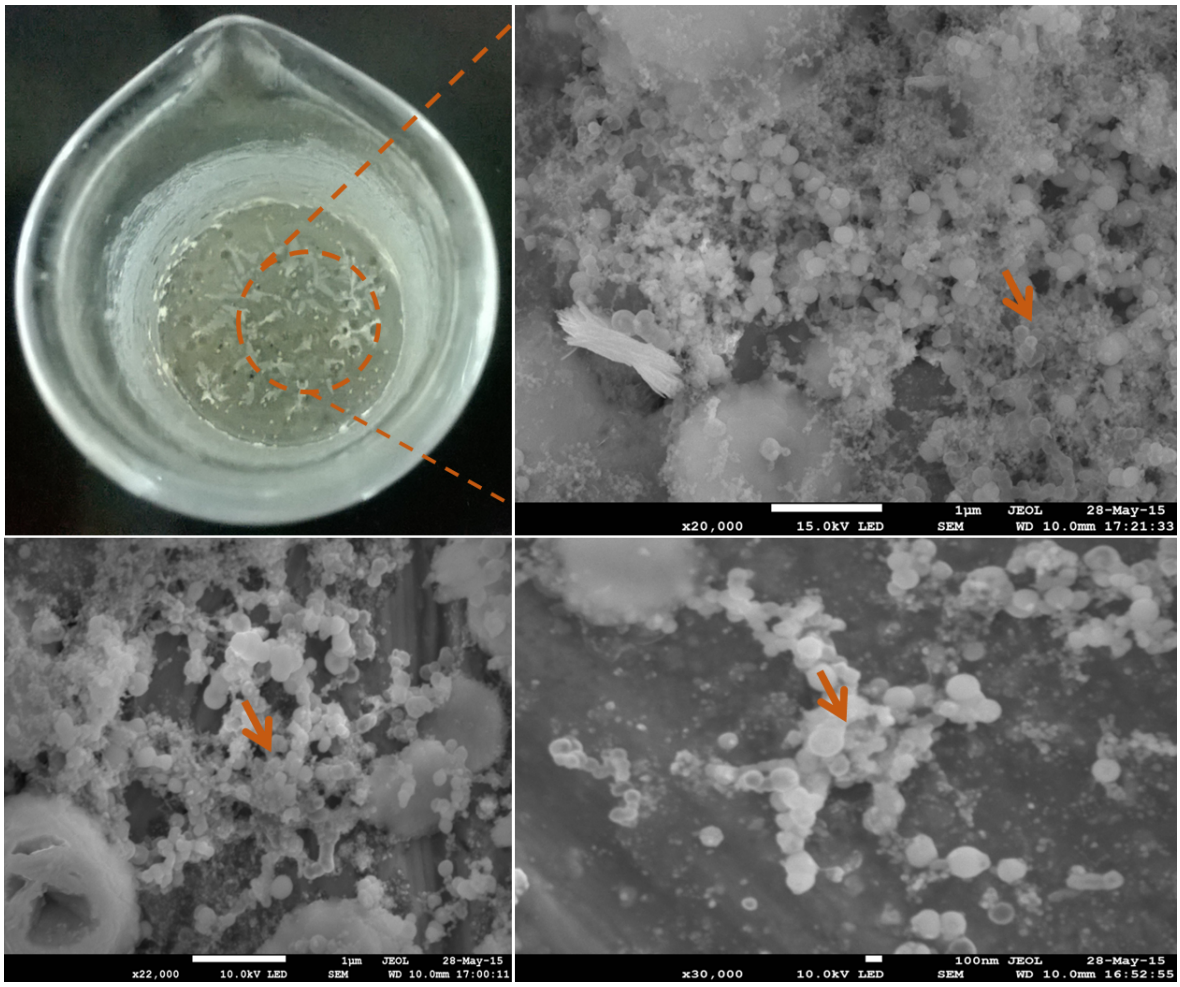

Fig. S10. FESEM and photographic images of the ci-AgNPs in presence of 1,4-dioxane.

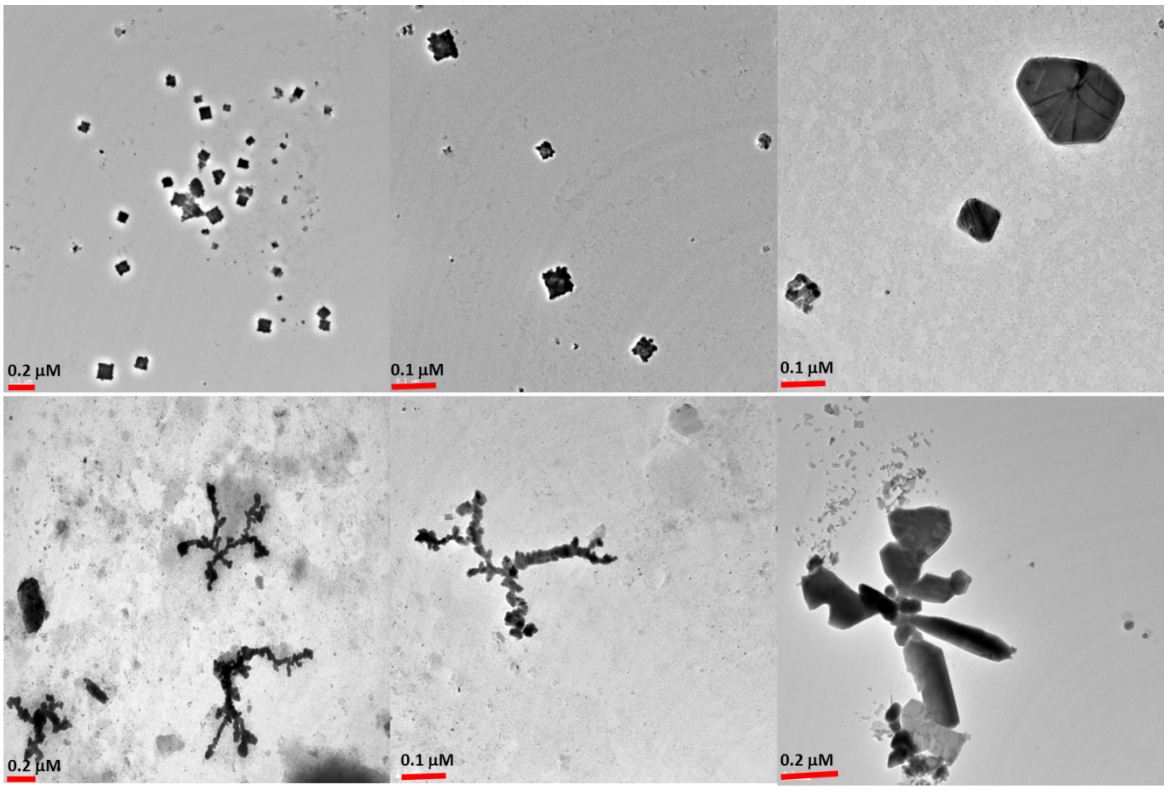

Fig. S11. TEM images of ci-AgNPs in presence of different concentration of 1,4-dioxane.

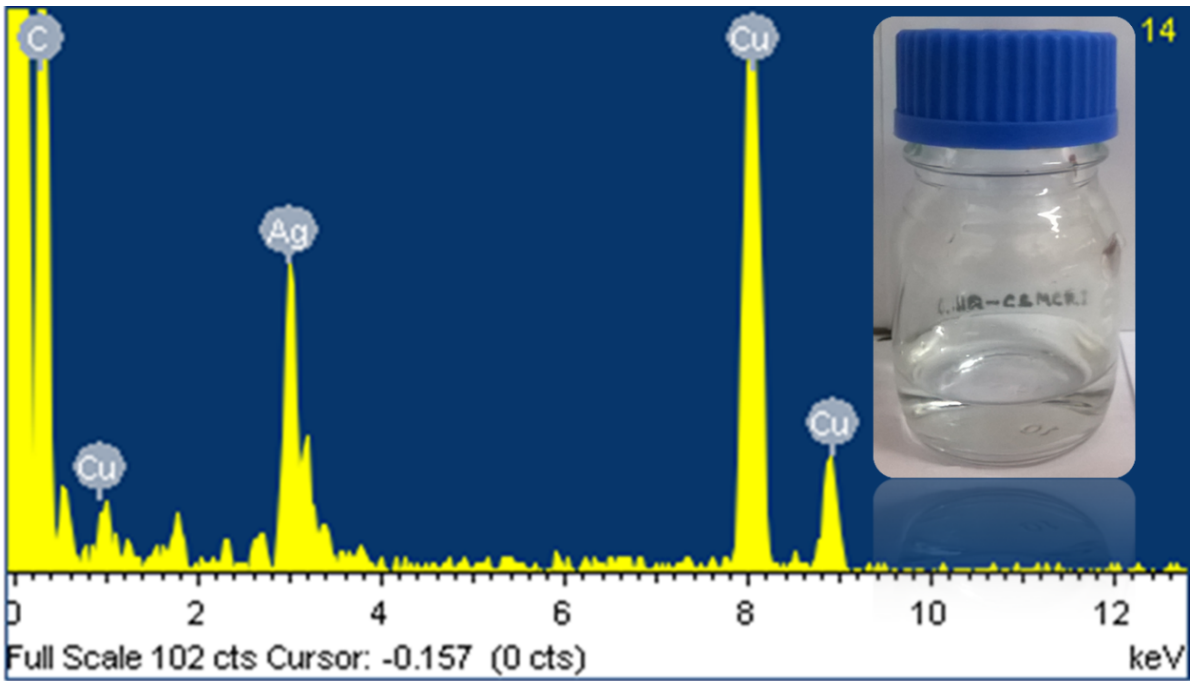

Fig. S12. EDX analysi of ci-AgNPs in presence of 1,4-dioxane.

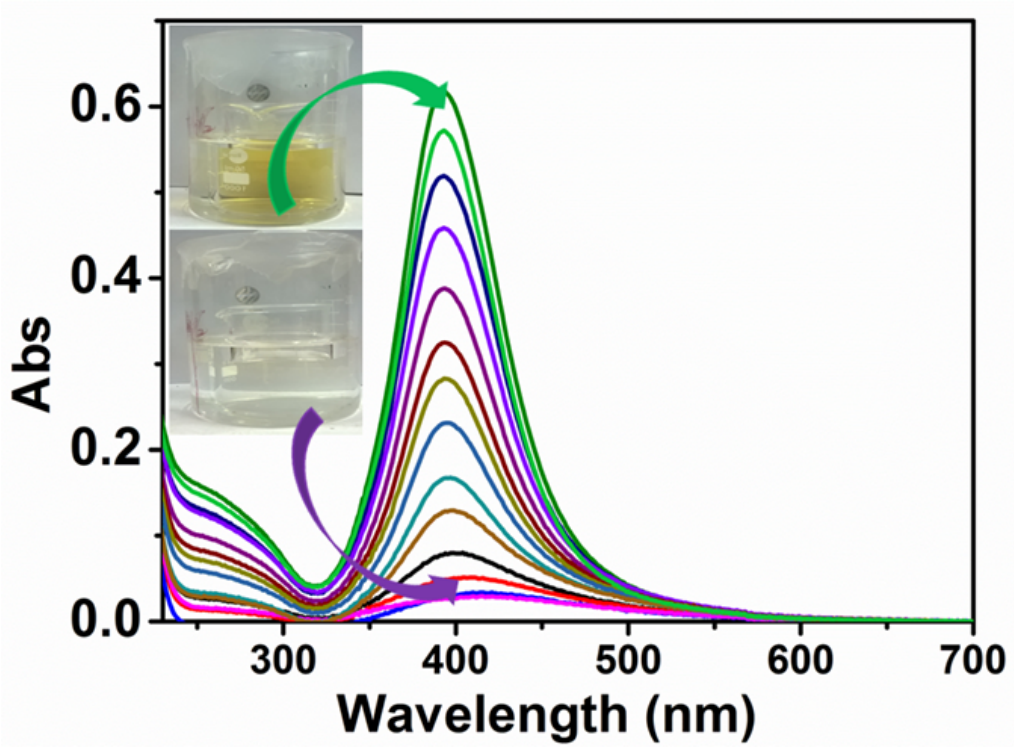

Fig. S13. Absorption spectral change of ci-AgNPs (pH 8) in presence of 1,4-dioxane vapour with time and photograph showing colour change of ci-AgNPs upon exposure of 1,4-dioxane vapour (inserted).

Reference

1 D. Xiong, M. Chen and H. Li, Chem. Commun., 2008, 880–882