Electronic Supplementary Material (ESI) for RSC Advances.


**Supporting Information**

# Luminescent, Ferromagnetic Silver Glyco-nanoparticles: Synthesis to Annealing-induced Substrate Specific transformation

*Jaba Mitra*[a, b] *and Ashutosh Sharma**[a]

[a] *Department of Chemical Engineering, Indian Institute of Technology, Kanpur, Kanpur-208016*

[b] *Present Address: Material Science and Engineering, University of Illinois, Urbana Champaign*

Email: ashutos@iitk.ac.in, Tel: +91-512-2597026

# Table of Contents:

## 1. Scheme elaborating reduction mechanism of silver salt

Scheme 1: A rough scheme elaborating the reduction mechanism of silver salt is given below:

$$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$$

$$CH_2OH\text{-}(CHOH)_4\text{-}CHO + 2Ag^+ + 2OH^- \rightarrow CH_2OH\text{-}(CHOH)_4\text{-}COOH + Ag + H_2O$$

$$2Ag^+ + 2OH^- \rightarrow Ag_2O + H_2O$$

$$Ag_2O + CH_2OH\text{-}(CHOH)_4\text{-}CHO \rightarrow CH_2OH\text{-}(CHOH)_4\text{-}COOH + Ag$$

## 2. UV-Vis spectra of silver nanoparticles obtained on reduction with sugar cane juice and sugar solution (13% sucrose and 2% glucose) under identical reaction conditions

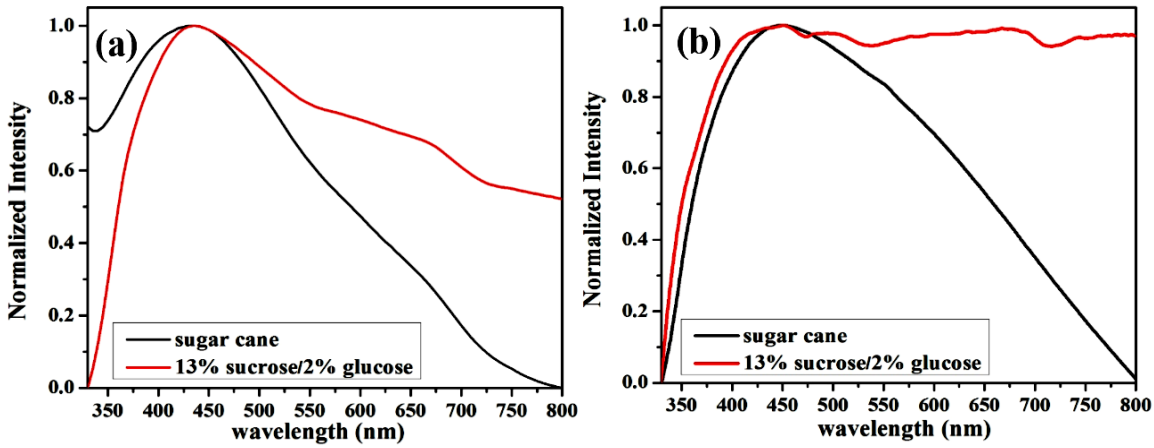


**Figure S1.** UV-Vis spectra of Ag glyconanoparticles as a function of reducing agent composition at (a) 100 $^oC$ and (b) pH ~ 8 at 0.4 M silver salt concentration after 2 h reaction.

## 3. FTIR spectra of silver nanoparticles

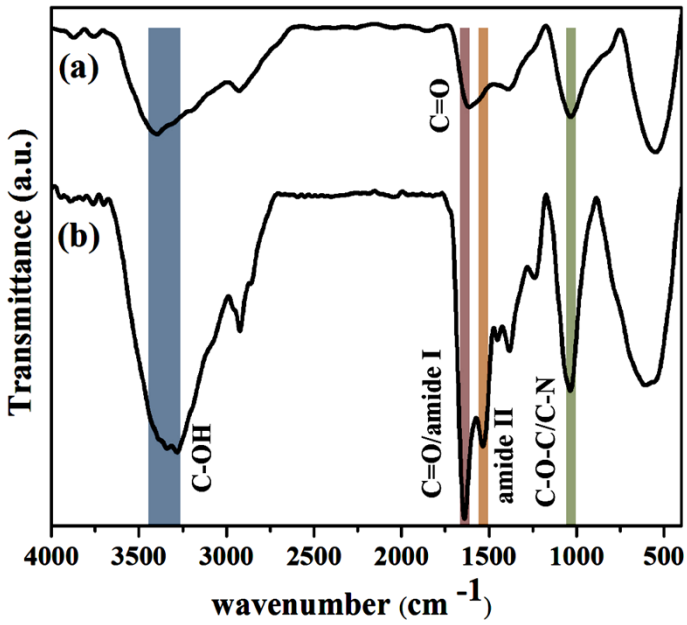


**Figure. S2.** FTIR of Ag nanoparticles synthesized with (a) sugar solution (13% sucrose + 2% glucose) and (b) sugar-cane juice.

## 4. Raman image of silver glyconanoparticles.

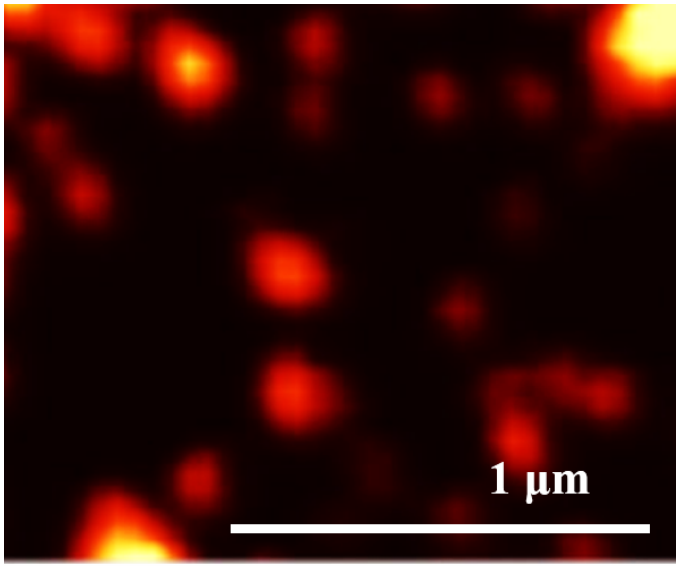


**Figure. S3.** Raman image of the glyconanoparticles

**5 & 6. FESEM, AFM and TEM images of silver nanoparticles obtained under different reaction conditions.**

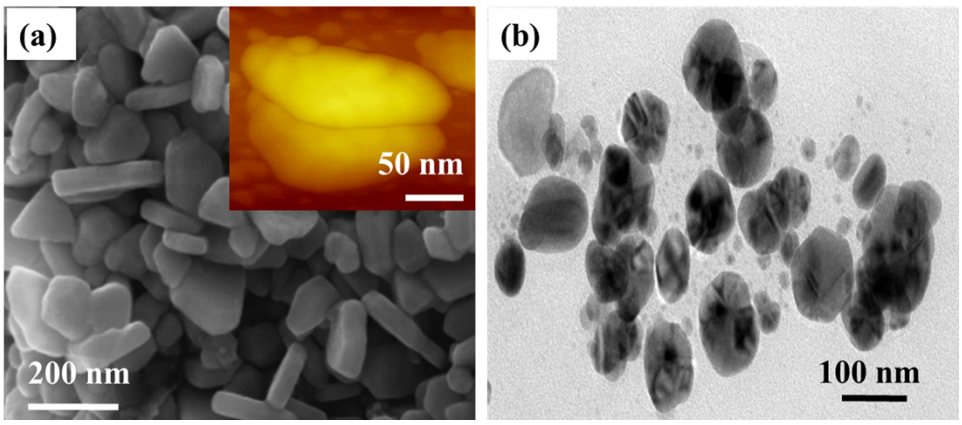


**Figure. S4**. (a) FESEM micrograph of silver nanoparticles synthesized at 100 $^{o}$C at 0.1 M salt concentration after 3 h reaction with sugarcane juice. Inset shows AFM image of nanotriangles. (b) TEM image of silver nanoparticles obtained after 2 h synthesis with sugar solution at 100 $^{o}$C at 0.1 M salt concnetration.

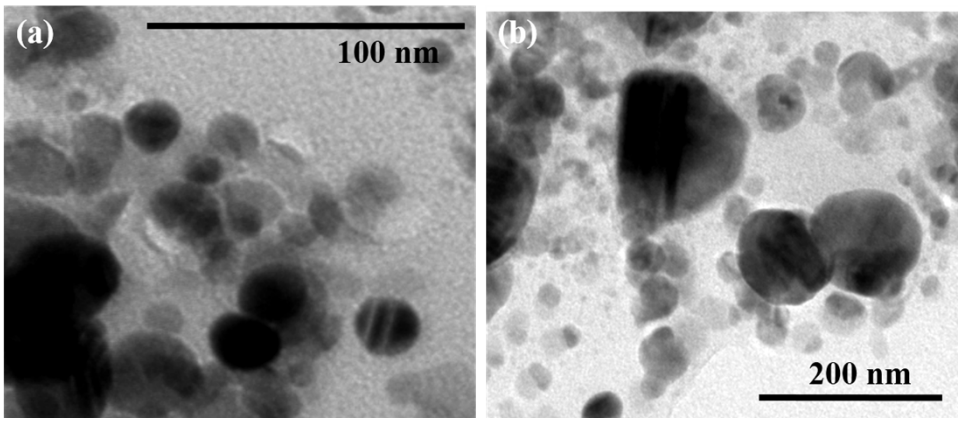


**Figure. S5**. TEM micrographs of silver nanoparticles synthesized at (a) 60 $^{o}$C and (b) 150 $^{o}$C using sugar cane juice, at 0.4 M salt concentration after 2 h reaction.

## 7. EDX mapping of silver nanoparticles

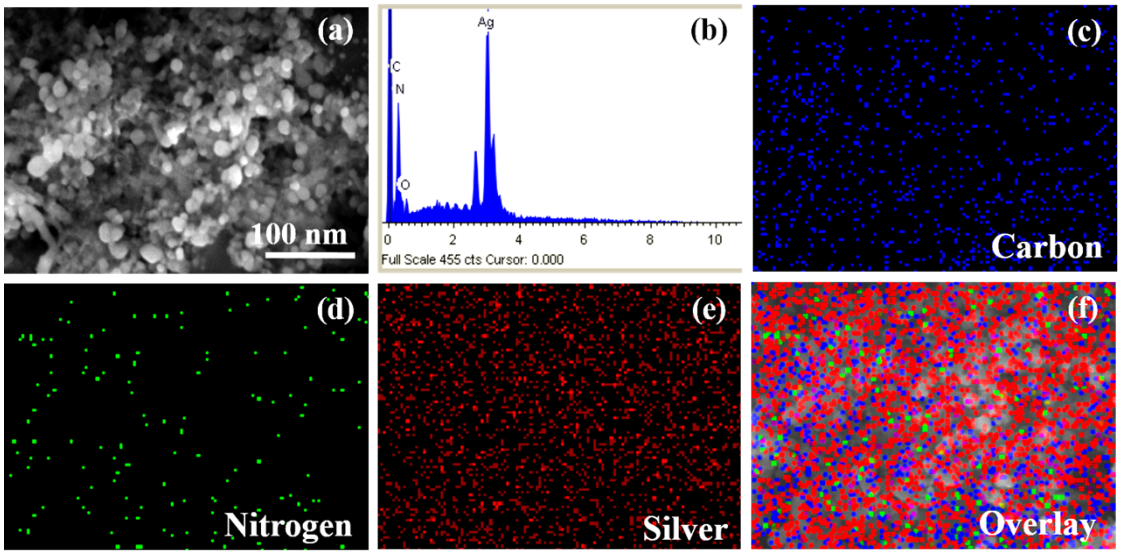


**Figure. S6**. (a) Representative FESEM image of silver nanoparticles and its (b) EDX spectra showing elemental composition and (c-f) elemental mapping images (c: Carbon, d: Nitrogen, e: Silver, f: Overlay).

## 8. XRD spectra of silver nanoparticles obtained on reduction with sugar cane juice and sugar solution (13% sucrose and 2% glucose) under identical reaction conditions.

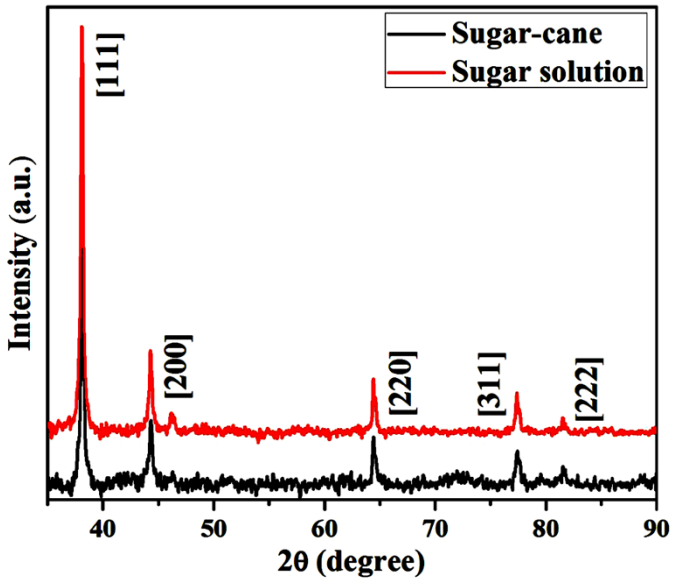

**Figure S7.** XRD patterns of Ag nanoparticles synthesized using sugar-cane juice and sugar solution (13% sucrose + 2% glucose).

## 9. Magnetic hysteresis of silver nanoparticles obtained on reduction with sugar cane juice and sugar solution (13% sucrose and 2% glucose) under identical reaction conditions and dependence of coercive field on particle size.

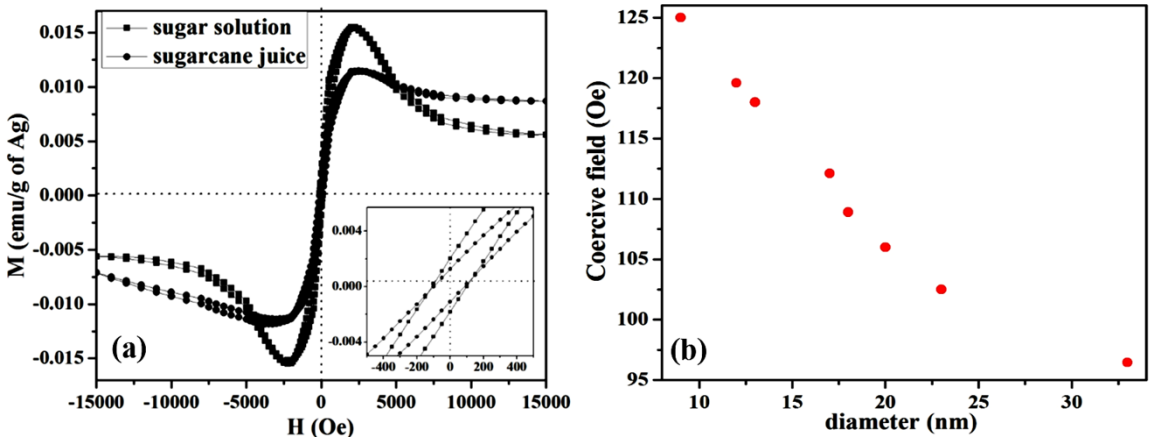


**Figure S8.** (a) Magnetic hysteresis of Ag nanoparticles synthesized using sugar-cane juice and sugar solution (13% sucrose + 2% glucose). (b) Dependence of coercive field on size of nanoparticles.

## 10. Annealed particle size distribution on different substrates at 250 °C

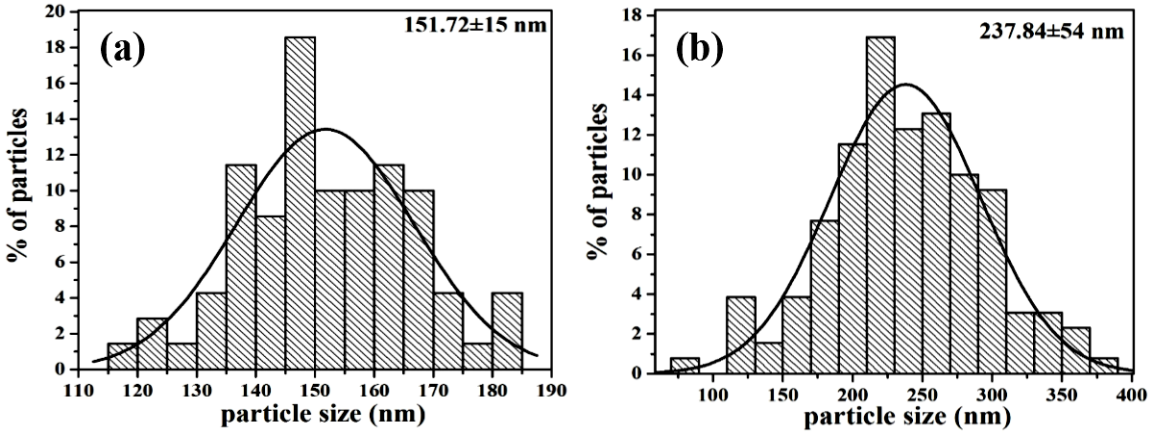


**Figure S9.** Size distribution of annealed silver nanoparticles at 250 °C on (a) PAN fiber substrate and (b) silicon substrate.

## 11. Dendrimeric strucutures formed after annealing at 800 °C.

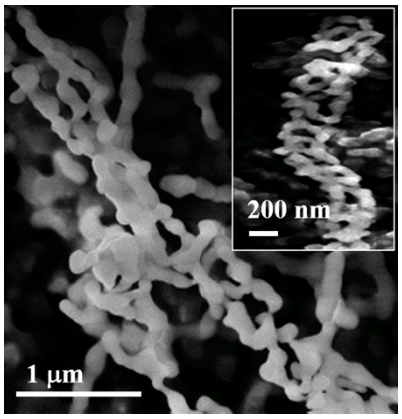


**Figure S10.** Rudimentary dendrimeric structures formed post-annealing. Inset shows magnified view.

## 12. EDX spectrum of as-annealed silver helices

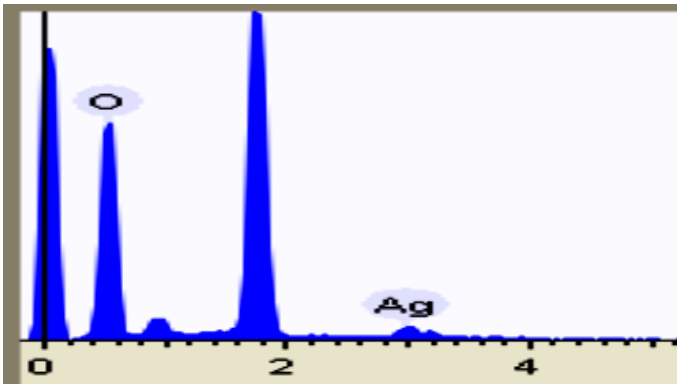


**Figure S11.** EDX spectra showing elemental composition of silver helices.

## 13. Fluorescence micrographs of as-annealed helical structures

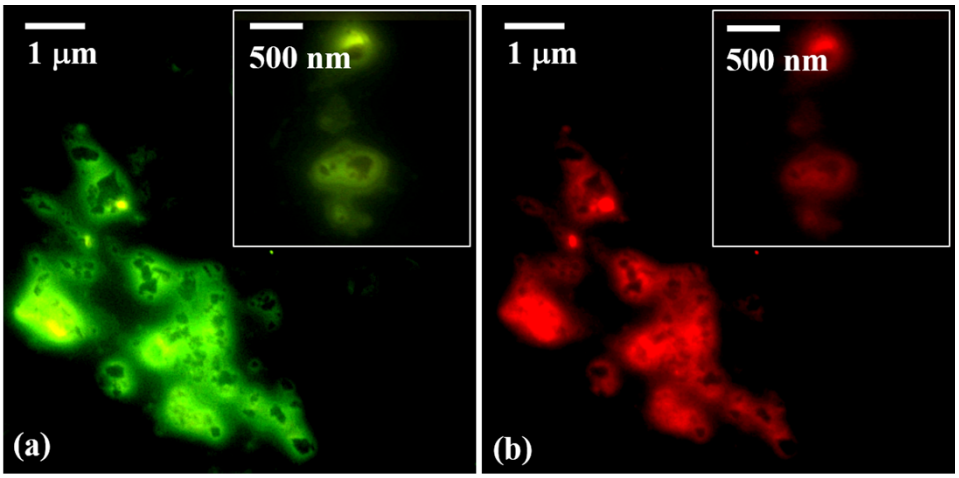


**Figure S12.** Fluorescence micrographs of helical structures obtained after annealing at cut-off filters (a) 488 nm and (b) 561 nm. Inset shows magnified views of individual helices.

## 14. Raman spectra of annealed helical silver structures

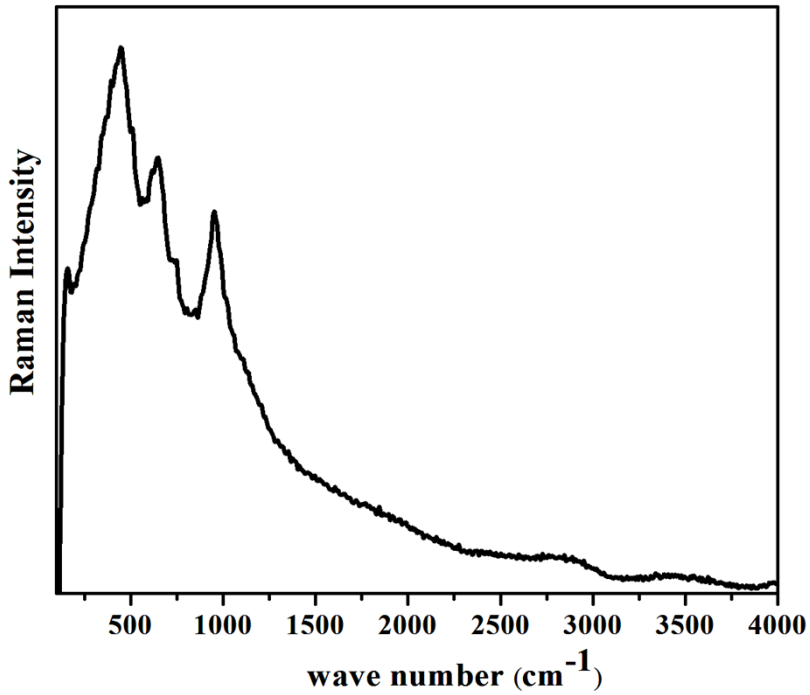


**Figure S13.** Raman spectrum of as annealed silver nanoparticles (800 $^{o}$C).