Electronic Supplementary Material (ESI) for RSC Advances

Electronic Supplementary Information

A Facile Synthesis of 1D Nano structured Selenium and Au Decorated Nano Selenium: Catalysts for Clock Reaction

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INSTRUMENTATION.

Phase purity of the synthesized samples were determined by recording XRD on a Philips PW-1710 X-ray diffractrometer (40 kV, 20 mA) with Cu Kα radiation (λ = 1.5418 Å) in the 2θ range of 20°-70° at a scanning rate of 0.5° min^{-1}.

The morphology of the product were analyzed by Field Emission Scanning Electron Microscopy (FESEM) using a (Supra 40, Carl Zeiss Pvt. Ltd.) microscope at an accelerating voltage of 20 kV. Compositional analysis of the sample was completed with an energy dispersive X-ray micro analyzer (OXFORD ISI 300 EDAX) attached to the scanning electron microscope.

Transmission electron microscopic (TEM) analyses of the samples were carried out on a Hitachi H-9000 NAR transmission electron microscope, operating at 100 kV. Samples were prepared by sonicating the powders with alcohol and then placing a drop of solution on a carbon-coated copper grid followed by solvent evaporation in a vacuum.

X-ray photoelectron spectroscopy (XPS) analysis was carried out with a VG Scientific ESCALAB MK II spectrometer (UK) equipped with a Mg Kα excitation source (1253.6 eV) and a five-channeltron detection system.

Raman spectra are obtained with a Renishaw Raman Microscope, equipped with a He−Ne laser excitation source emitting at a wavelength of 632.8 nm, and a Peltier cooled (−70°C) charge coupled device (CCD) camera. A Leica microscope with 50X objective lens is used. The holographic grating with 1800 grooves/mm and the 1 cm^{-1} slit enabled the spectral resolution. Laser power at the sample is 4.5 mW and the data acquisition time is 30 s.

All UV-vis absorption spectra for the clock reaction were recorded on SPECTRASCAN UV 2600 digital spectrophotometer (Chemito, India).

TGA analysis is performed using Toledo TGA/SDTA 851Thermal Analyzer instrument (Switzerland) in N_2 atmosphere.

EXPERIMENTAL PROCEDURE:

Synthesis of Noble metal deposited Se NWs.

Ag_2Se was deposited on selenium by starring 20 mL 10^{-3} M $AgNO_3$ solution with 5 mg as synthesized Se NWs in a 100 mL beaker at room temperature for 2 days. After completion of stirring the product was washed with distilled water and ethanol several times to remove excess $AgNO_3$ solution.

In case of Au(0) deposition on selenium was synthesized by taking $HAuCl_4$ solution instead of $AgNO_3$ solution keeping all other reaction parameter constant.

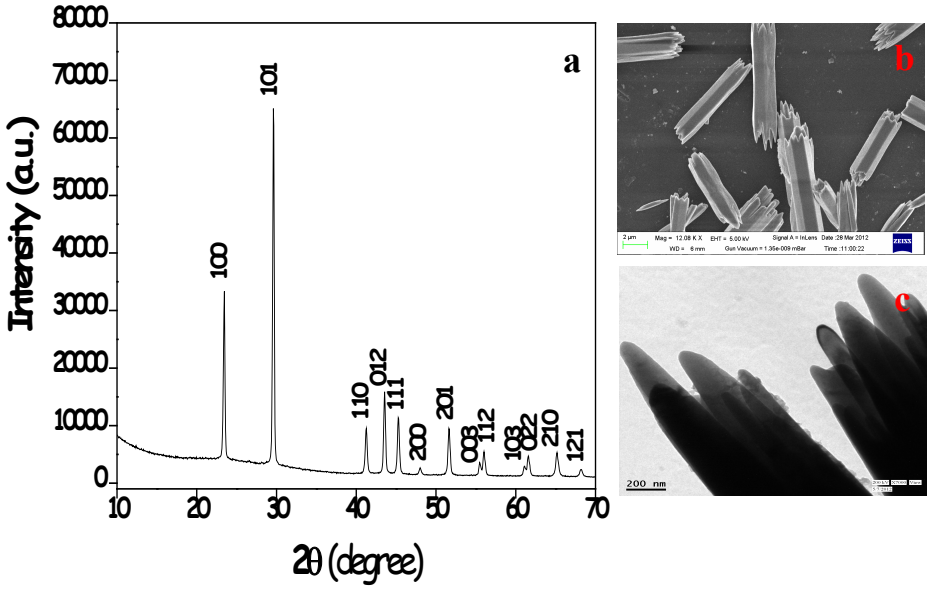

Fig. S1: (a) XRD pattern (b) FESEM and (c) TEM images of Se NRs; synthesized in presence of PVP.

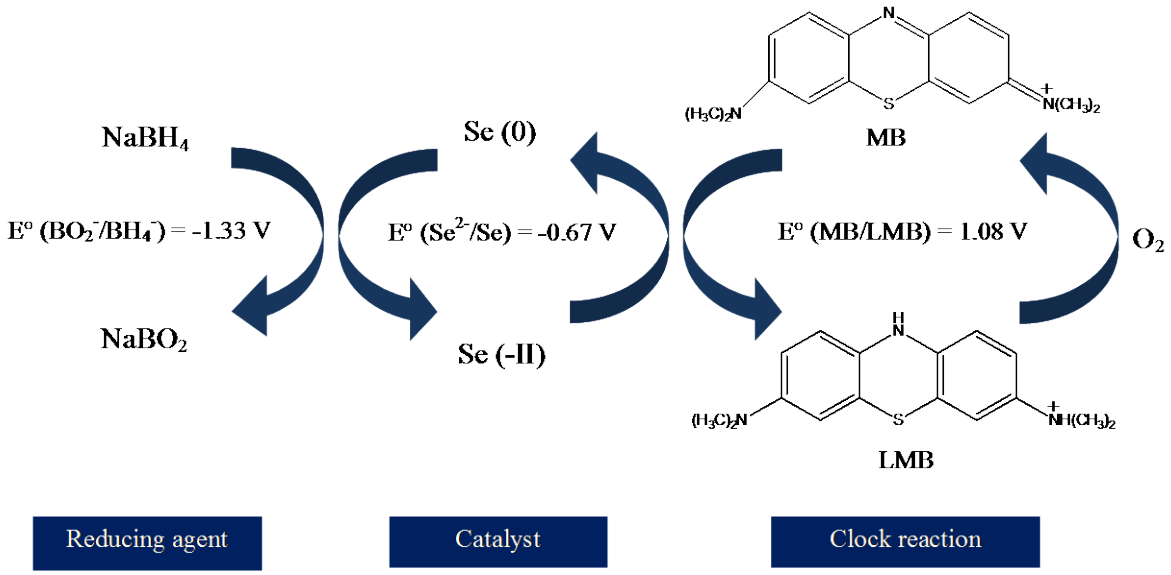

Fig. S2: Proposed mechanism for clock reaction of methylene blue.

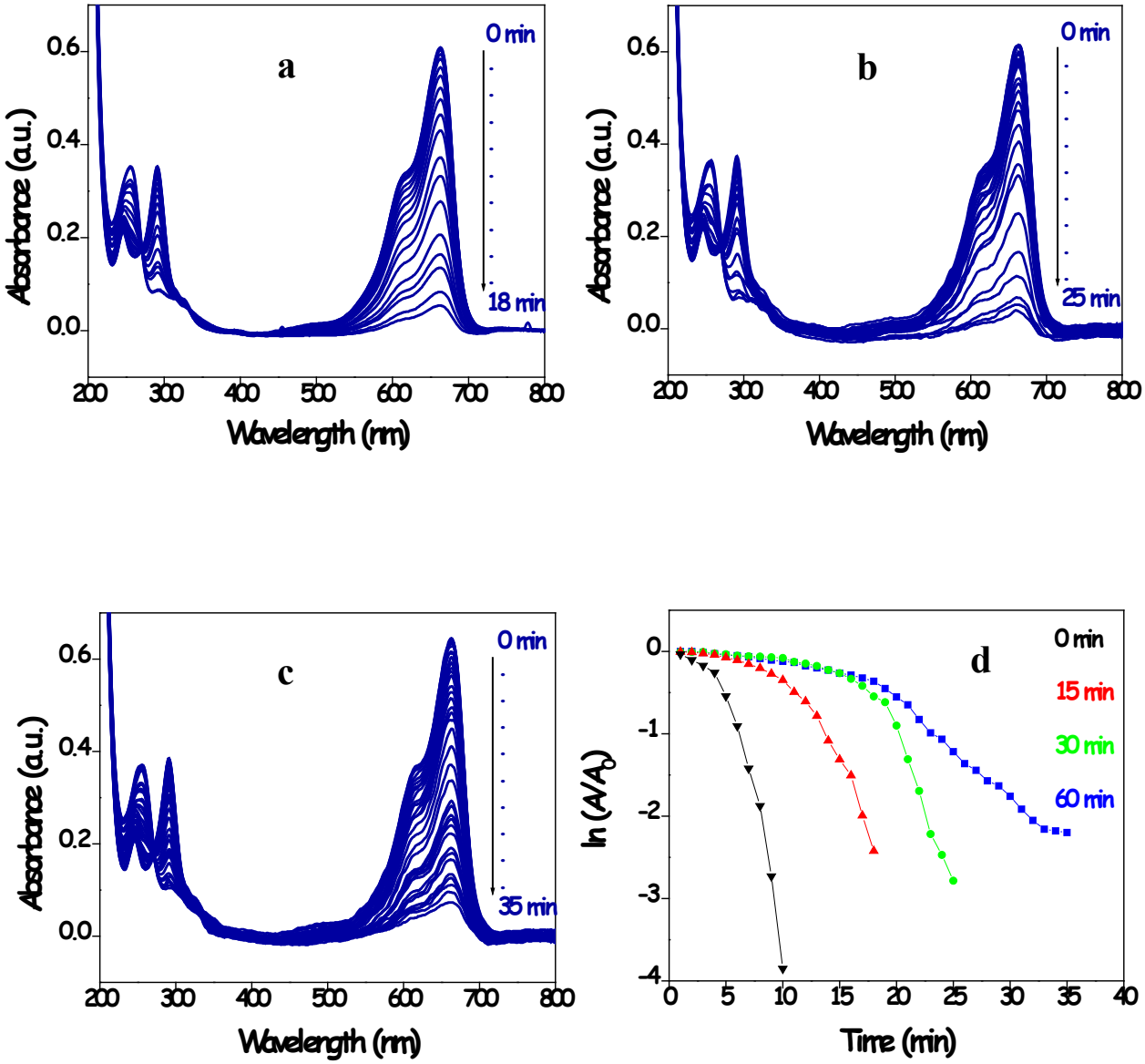

Fig. S3: Comparative study of Clock reaction of MB by using $NaBH_4$ solution after

(a) 15 min, (b) 30 min (c) 60 min solution preparation and

(d) Plot of ln (A/A0) vs. Time of MB reduction using these $NaBH_4$ solutions.

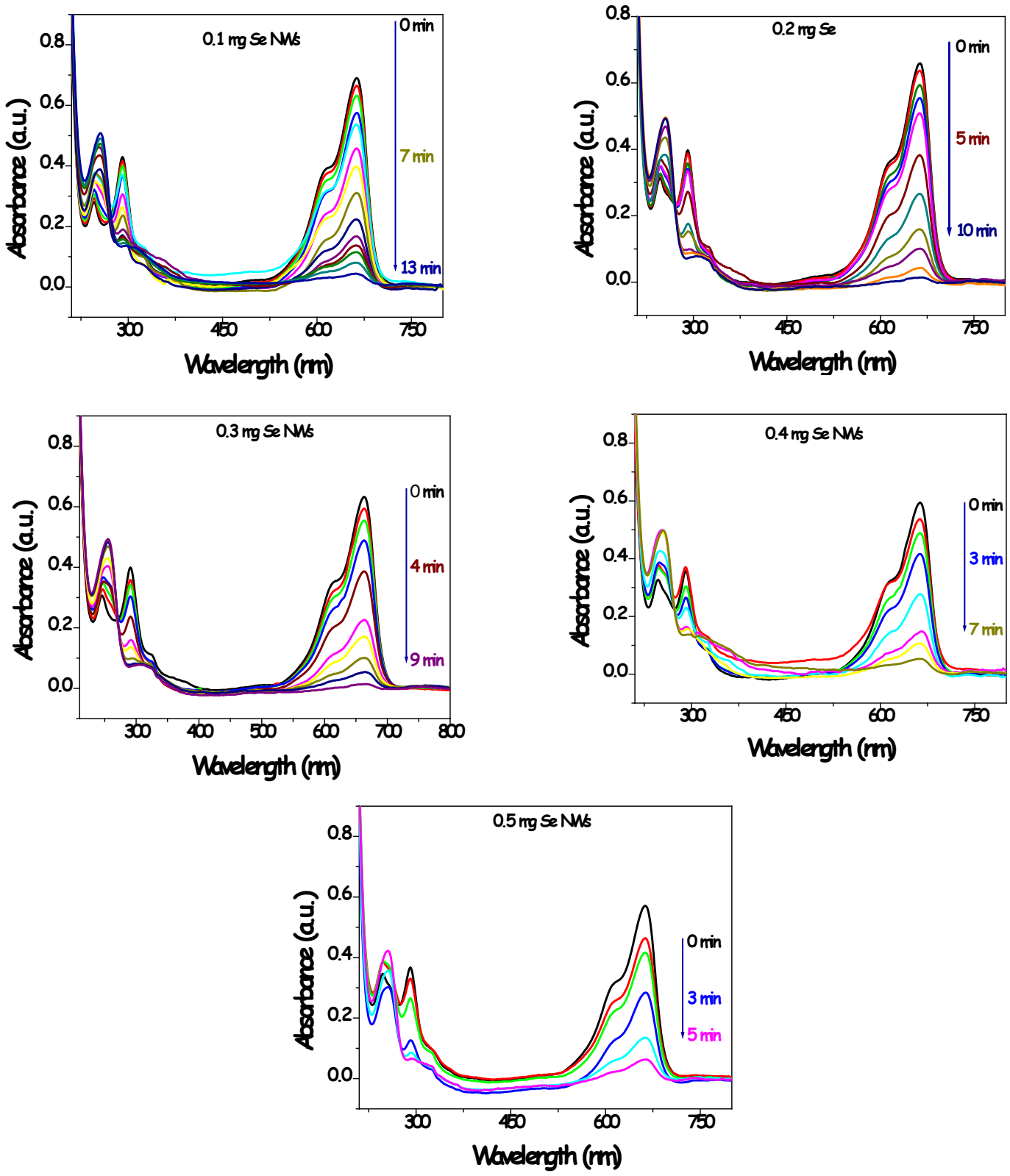

Fig. S4: Absorption spectra for MB reduction by $NaBH_4$ with different Catalyst dose maintaining all other reaction parameter constant.

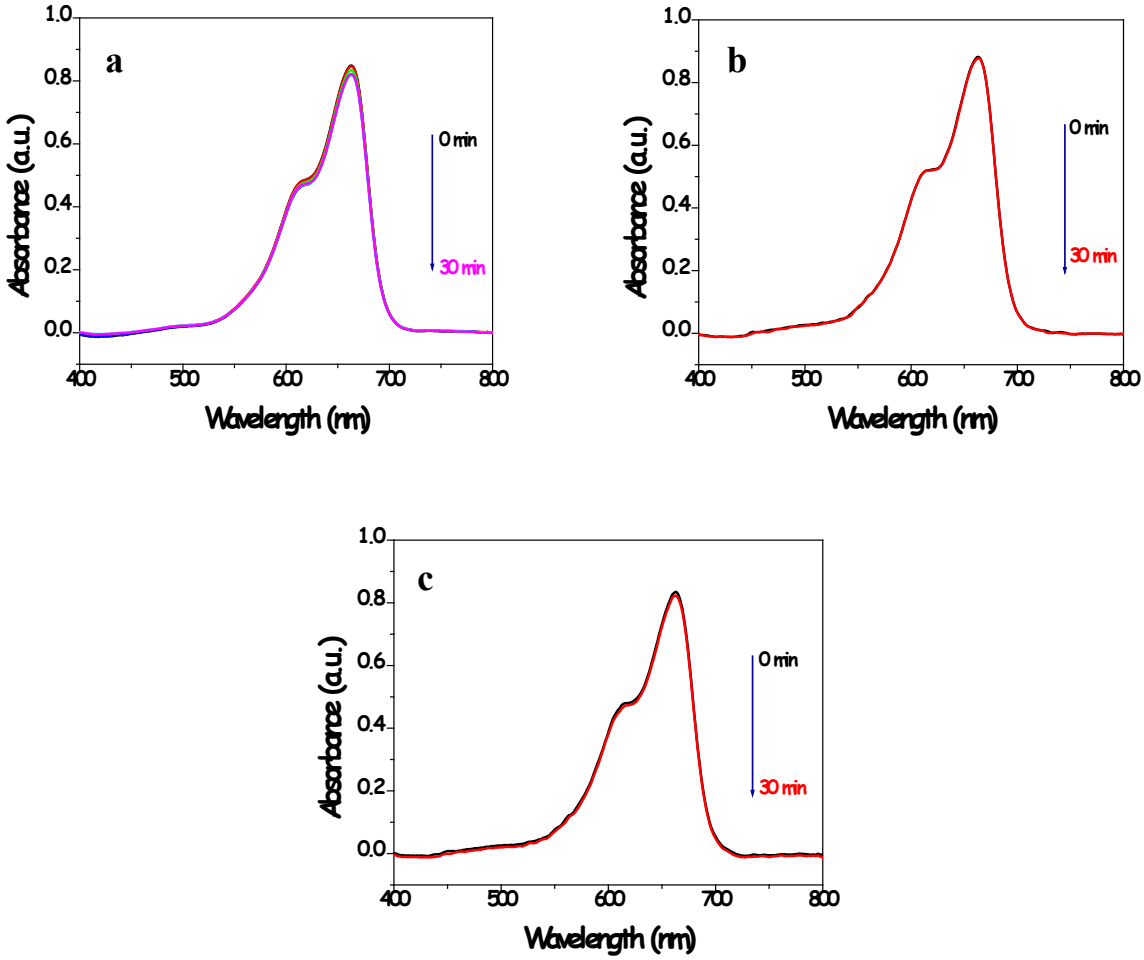

Fig. S5: Comparative study of Clock reaction of MB by using various reducing agent e.g.

(a) Hydrazine hydrate, (b) Ammonium thiocyanate and (c) Glucose.

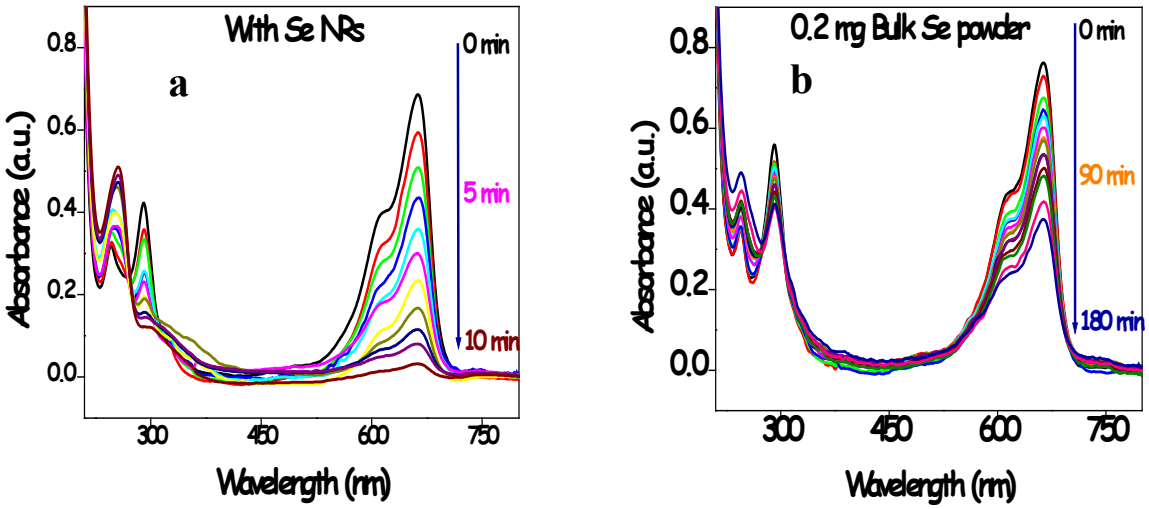

Fig. S6: (a) UV- vis spectra of MB reduced by $NaBH_4$ in presence of 0.2 mg of Se NRs and (b) UV-vis spectra of MB reduced by $NaBH_4$ in presence of 0.2 mg Bulk Se powder.

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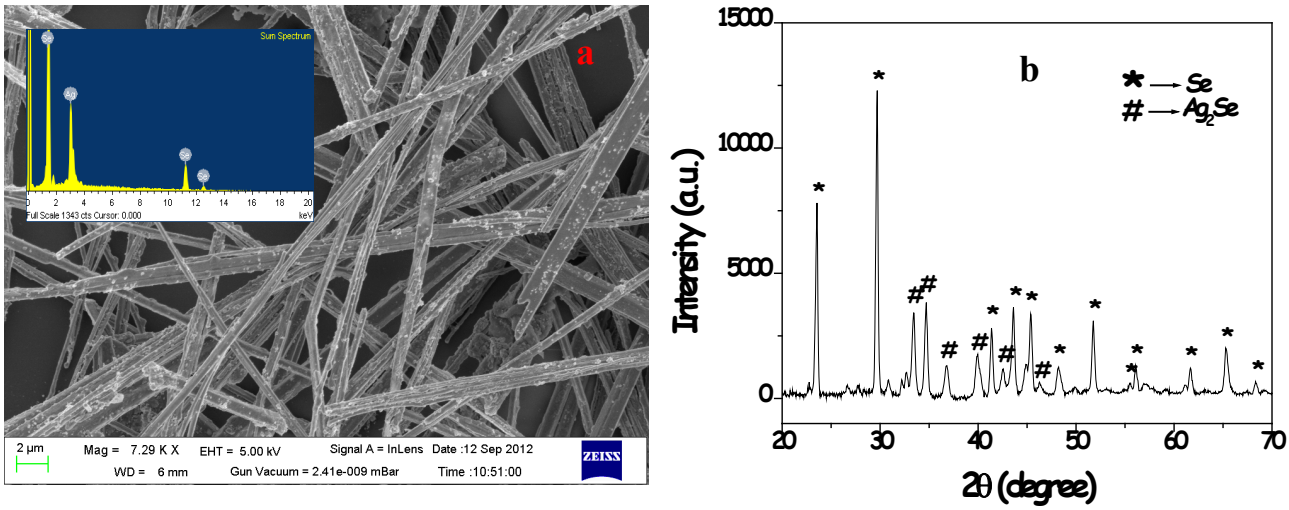

Fig. S7. (a) FESEM image of Ag_2Se deposited selenium; inset presents EDAX analysis. (b) Shows the XRD pattern of Ag_2Se deposited selenium respectively.

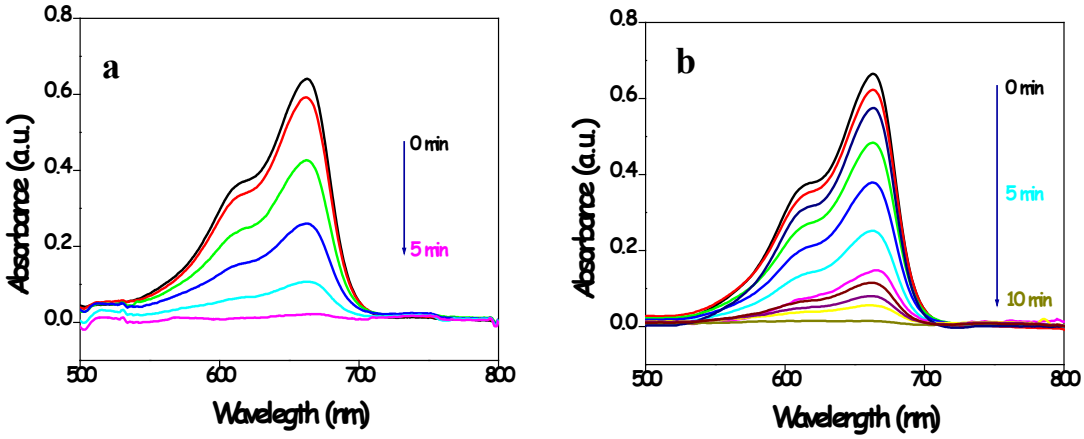

Fig. S8: (a) UV- vis spectra of MB reduced by $NaBH_4$ in presence of 0.2 mg of Au(0) deposited Se NWs and (b) UV-vis spectra of MB reduced by $NaBH_4$ in presence of 0.2 mg Ag_2Se deposited Se NWs.