Supporting Information

Highly monodispersed Ag embedded SiO_2 nanostructured thin film for Sensitive SERS substrate: Growth, characterization and Detection of dye molecules

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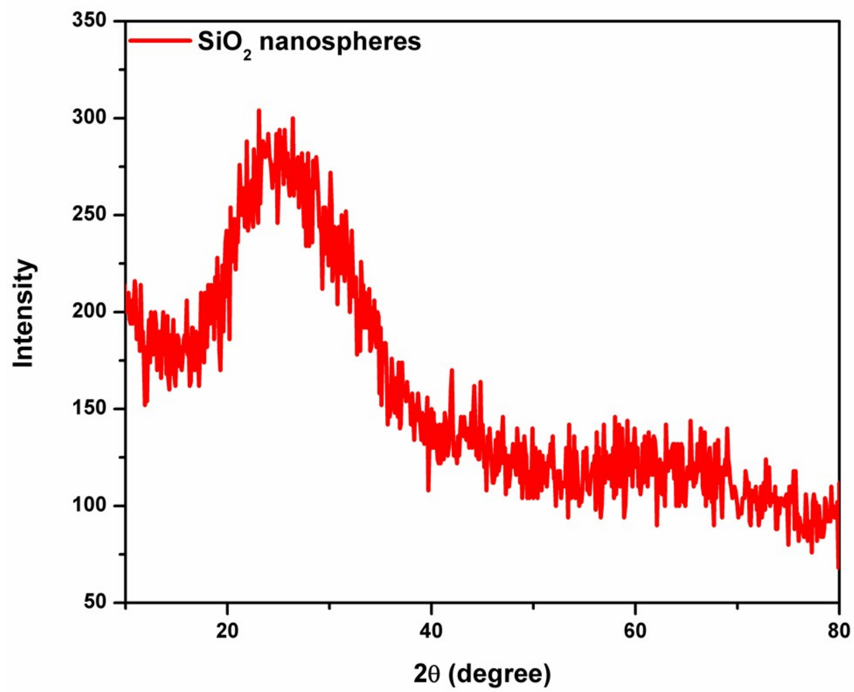

Fig.S1. XRD pattern of SiO_2 nanospheres

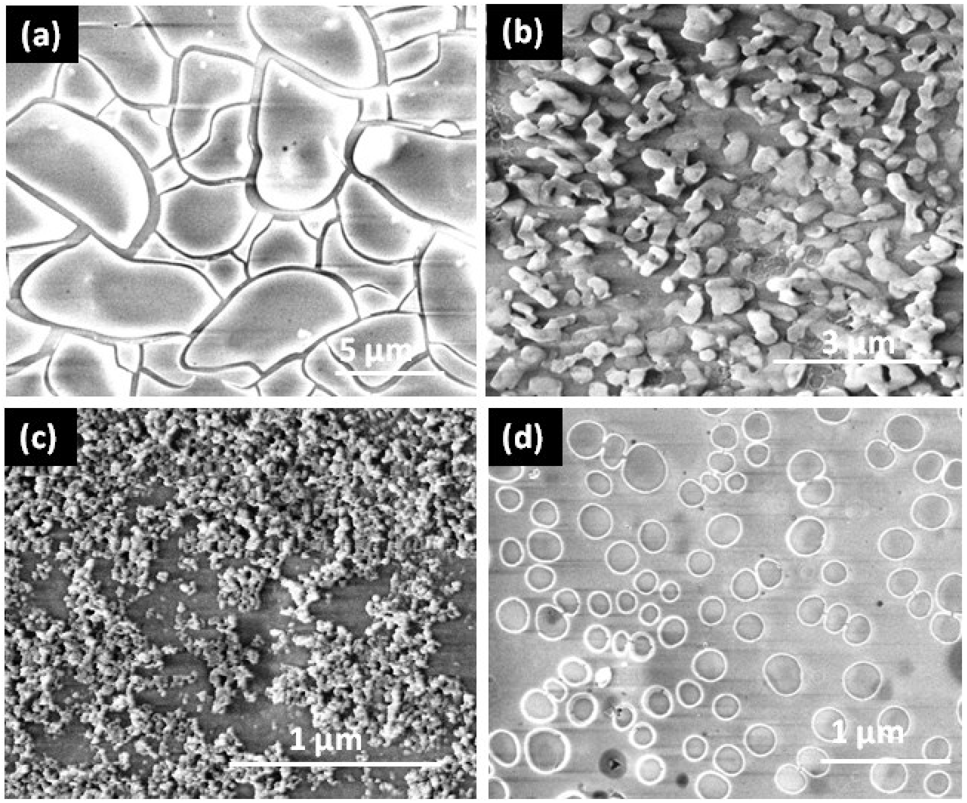

Fig. S2 Growth process of SiO_2 nanospheres a) absence of water b) 5 ml H_2O+pH 6 c) 5 ml H_2O +pH 7 d) 10 ml H_2O +pH8

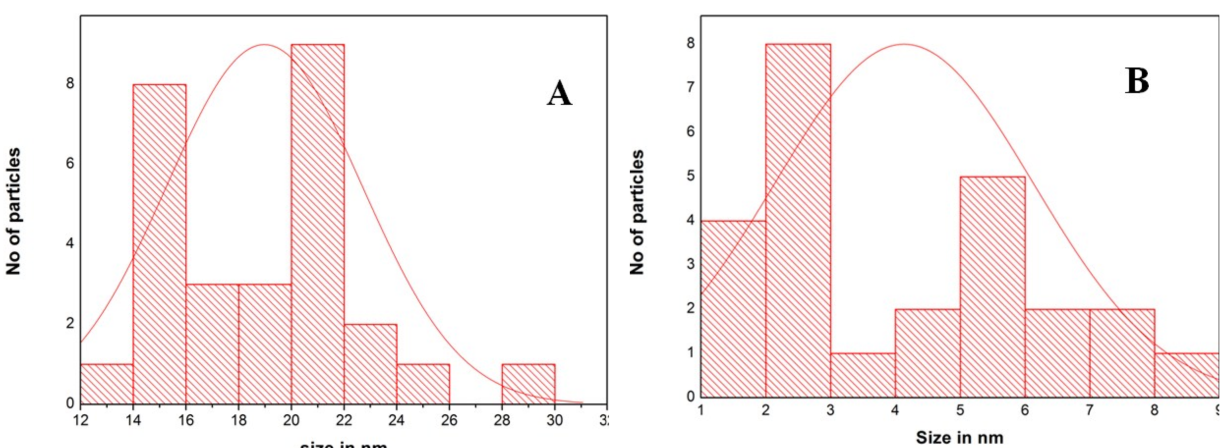

Fig. S3. Particle size distribution for A) Silver hydrosol A (19nm) B) Silver hydrosol B (5nm)

The quantitative size distribution for normal curve fit shows sizes of silver hydrosol A and B.

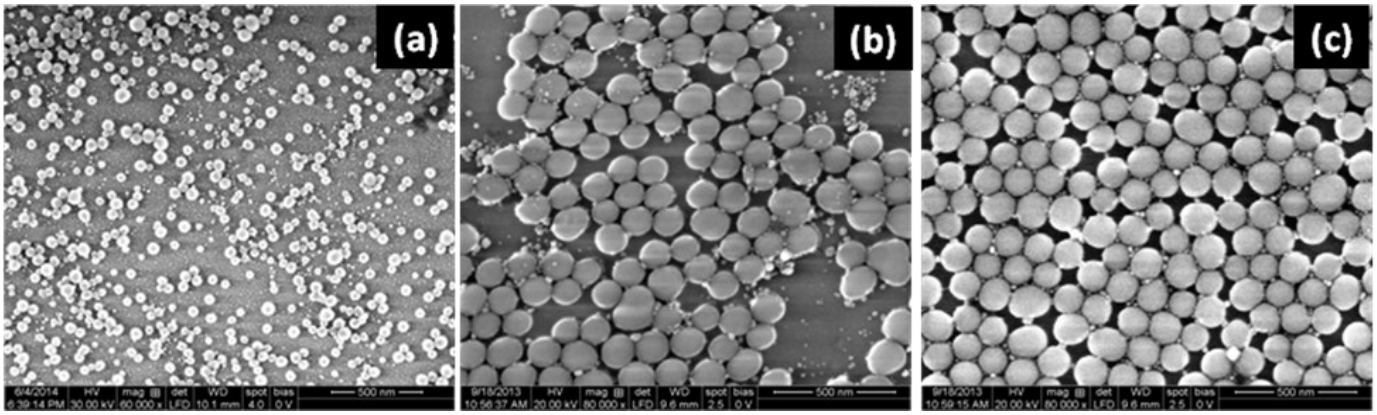

Fig. S4. Silver (HydrosolA) coated silica nanospheres by varying silica size a) 50 nm b) 100 nm and c) 130 nm

As the size of Silica nanospheres increases the gap and hot spot increases for SERS.

Case 1: Distance between Silica and Silver is more than 70 nm

Case2: Distance between Silica and silver is between 25-30nm somewhere near to 15nm but monodispersity is less

Case3: Ag nanoparticles around 15 nm and nano gap between silica and silver about 20 nm

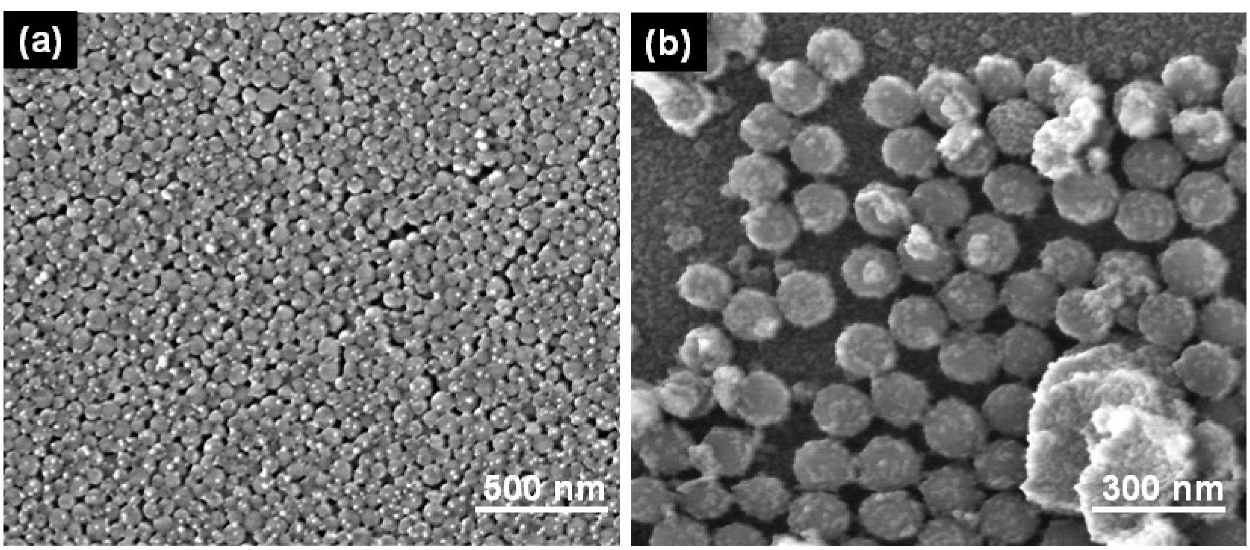

Fig. S5. Silver (hydrosol B) coated silica nanospheres

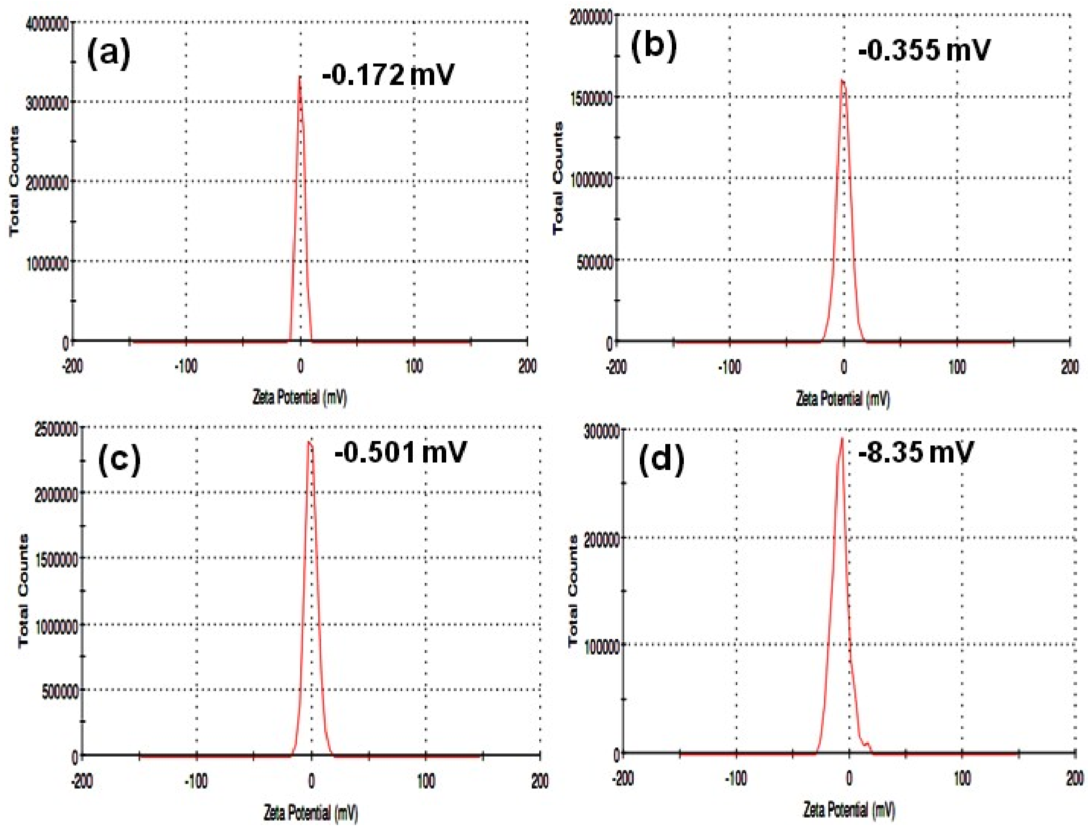

Fig. S6. Zeta potential of SiO_2 nanospheres prepared at a) pH 7 b) pH 8 c) pH 9 and d) pH 10.

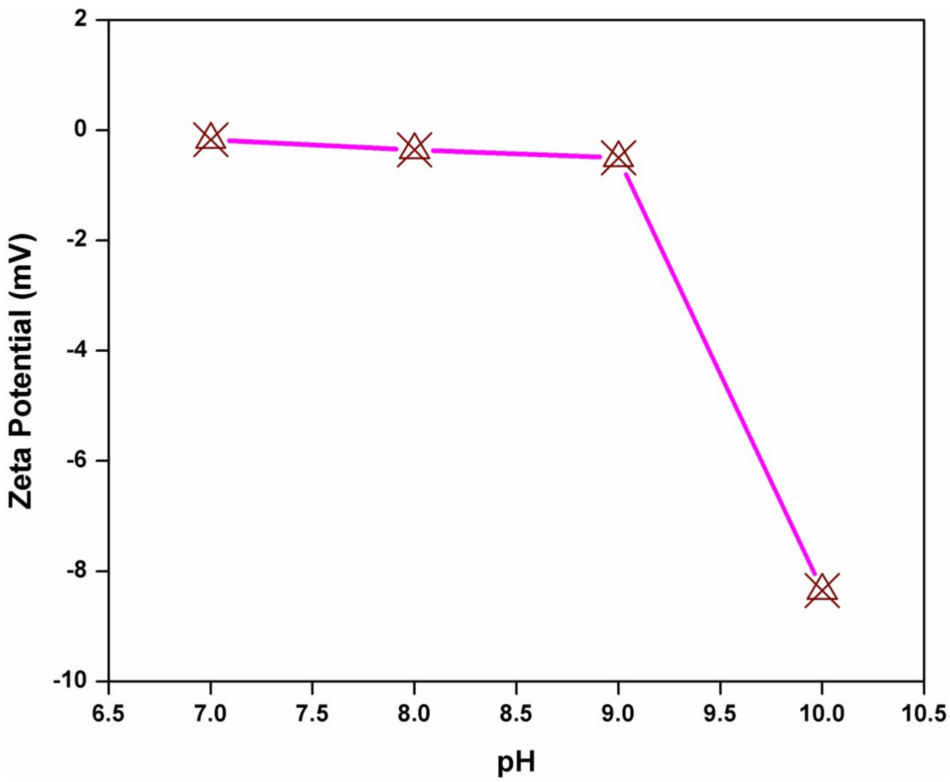

Fig. S7. Zeta potential variation of SiO_2 nanospheres

When the pH of SiO_2 increases zeta potential decreases and high negativity of silica spheres results in larger nanoparticles through faster nucleation.

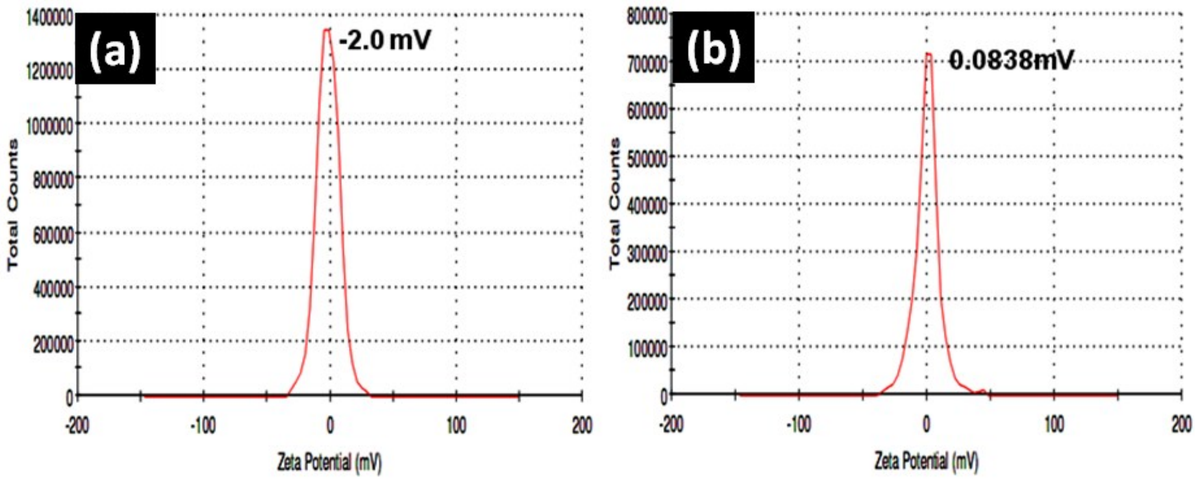

Fig. S8. Zeta potential of a) Ag hydrosol A b) Ag hydrosol B

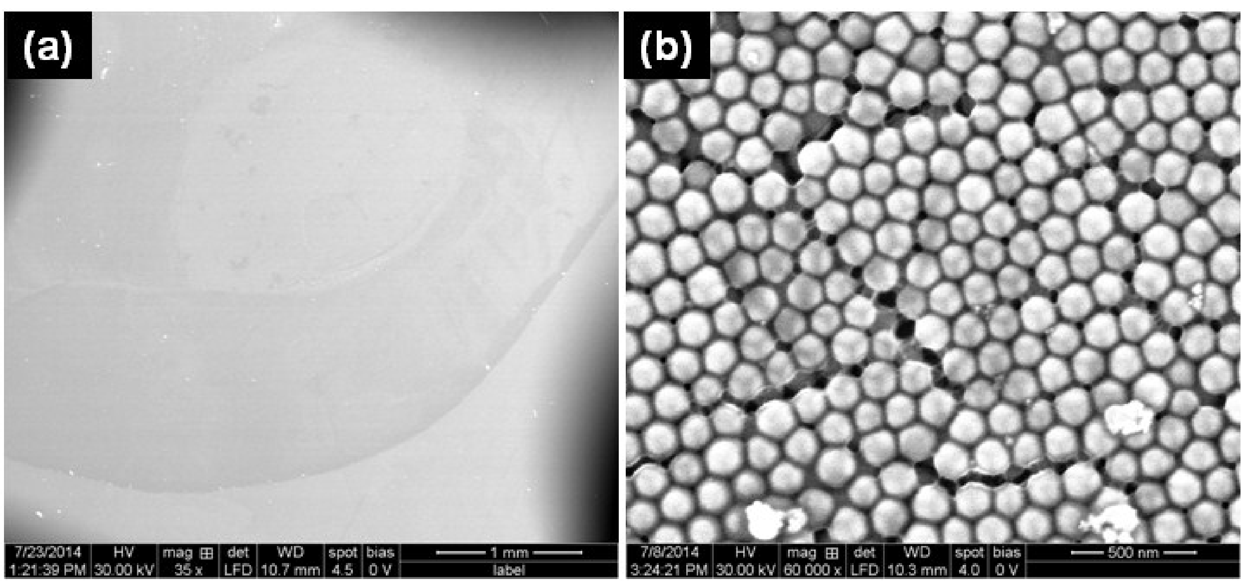

Fig. S9. FESEM images of silica nanospheres a) After putting Dye b) Magnified Image

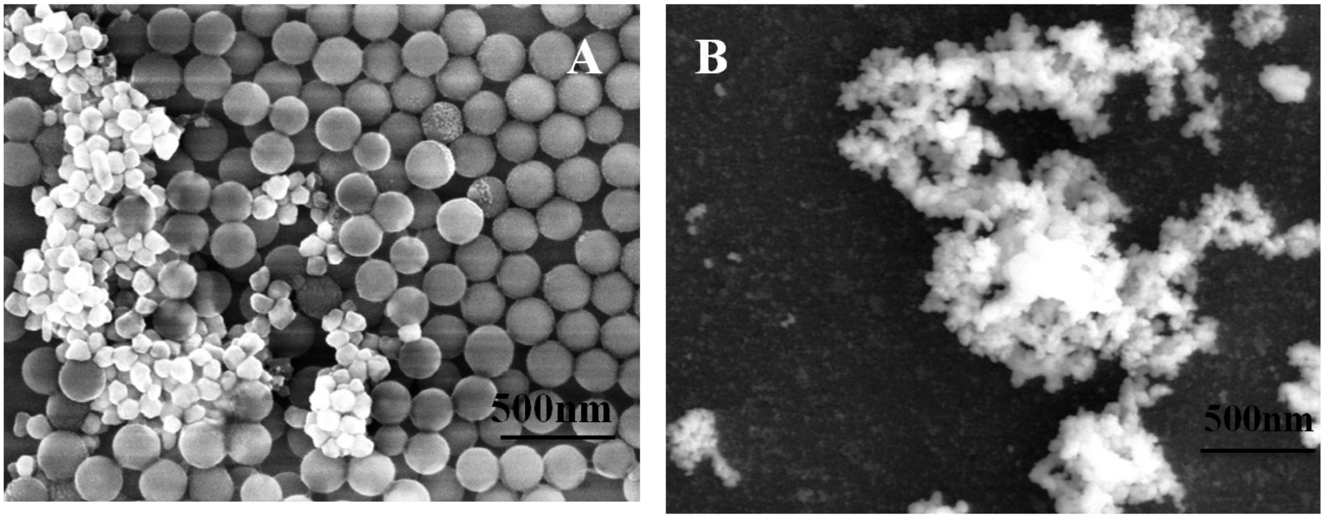

Fig. S10. A) Ag nanoparticle of size 80 nm on Ag@Sio2 nanospheres B) Silver (Hydrosol A) with PVP 1 molar.

Fig 10represents the bigger silver nanoparticles which can't adhere exactly in between the silica spheres and the agglomeration of silver spheres takes place. Moreover the probe molecule can't be fit tightly in between this nanogaps tends to less SERS.

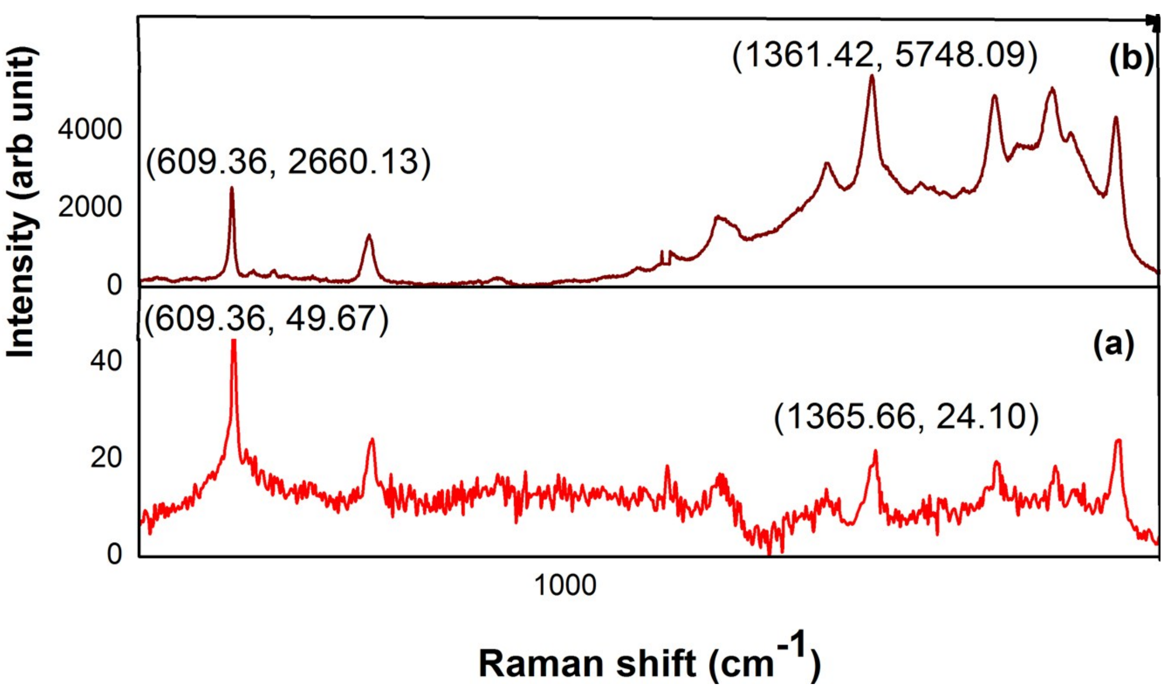

Fig.11. a) Normal Raman spectra R6G 10^{-3} and b) SERS spectra of R6G using 10^{-11} molar for prepared thin films

Enhancement factor calculation

Where C_{surf} is the concentration of R6G solution for SERS, *Csurf*=10^{-11} M, *v* is the volume of R6G solution used for SERS detection, *v*=20 µL, *r* is the radius of 20 µL of R6G solution formed on the SERS substrate, *r*=4mm.

From fig. 10 *Ibulk* (1365cm-1) and *Isurf* (1361 cm-1) are 24.10 and 5748.09 cps, respectively. Here Considering the incident laser power for normal Raman spectrum and SERS spectrum acquisition, are same. Hence *Isurf / Ibulk*= 5748.09 / 24.10

Finally, the EF of this Ag@SiO_2 SERS substrate can be
Calculated as 7.79×10^8