Supplementary Information

Label-free gold nanorod-based plasmonic sensing of arsenic(III) in contaminated water

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Synthesis of polyethyleneimine functionalized cobalt ferrite nanoparticles

Polyethyleneimine (PEI)-functionalized cobalt ferrite nanoparticles were synthesized according to the method described by Chen, and co-workers with slight modification.[1] In brief, 20 mL of 1.8 M aqueous solution of NaOH was taken in a round-bottom flask and heated to 80 ^{o}C in an oil bath. Then an aqueous mixture of 5 mL 0.5 M $CoCl_2.4H_2O$, 5 mL 1 M $FeCl_3.6H_2O$ and 1.5 mL PEI (30% w/v in water) was added dropwise into the NaOH solution during which black precipitate of PEI-$CoFe_2O_4$ nanoparticles formed. After the addition, the temperature of the reaction mixture was raised to 90 ^{o}C and the heating was continued for 1 hr. Finally the reaction mixture was cooled to room temperature and the black precipitate was washed several times with DI water to remove unreacted PEI from nanoparticles, if any. The purified PEI-$CoFe_2O_4$ nanoparticles were dried in an oven at 60^{o}C overnight for further use.

Characterization of PEI-CoFe2O4 NPs

The formation of pure phase PEI-$CoFe_2O_4$ NPs was characterized by recording the XRD spectra of powder PEI-$CoFe_2O_4$ NPs in a Rigaku Miniflex X-ray diffractometer in the angle range of 20^{o} -80^{o} with 5^{0}/min scan rate The presence of (311), (220), (400), (422), (511) and (440) peaks in the XRD pattern denote the formation of $CoFe_2O_4$ nanoparticles (Fig. S2A).[2] To characterize the coating of PEI on $CoFe_2O_4$ NPs, Raman spectra of PEI and PEI-$CoFe_2O_4$ NPs were recorded in the region where signatures for PEI appear. For recording Raman spectra of PEI, a few drops of liquid PEI were placed on a glass slide and dried in air. For recording Raman spectra of PEI-$CoFe_2O_4$ NPs, a few drops of nanoparticles dispersion in DI water were placed in a glass slide followed by drying under air prior to the acquisition of spectra. Spectra were recorded in EnSpectr R532 Raman Analyzer using 532 nm Laser. The presence of PEI on the surface of $CoFe_2O_4$ NPs was ascertained by comparing the signatures of PEI in the Raman spectra[3, 4] with that of PEI-$CoFe_2O_4$ NPs (Fig. S2B).

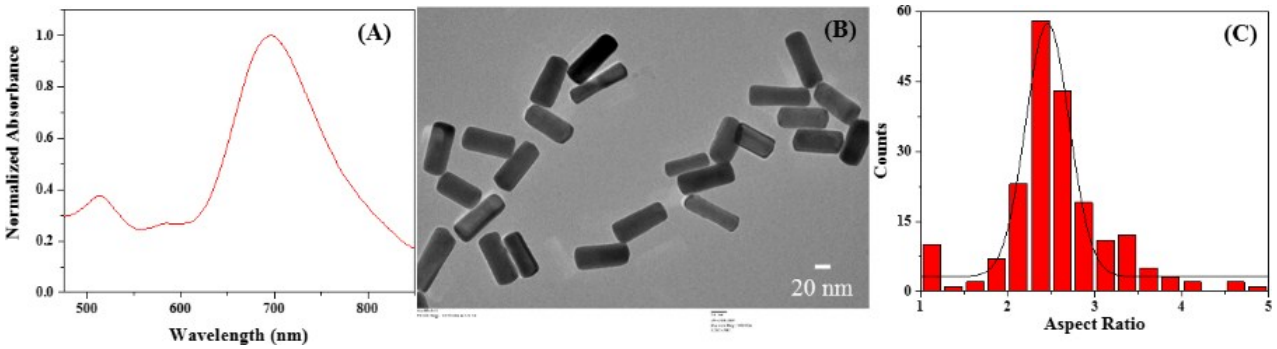

Fig. S1 (A) Normalized Vis absorption spectra, (B) transmission electron microscope image, and (C) statistical distribution of aspect ratio of as-synthesized Au-NRs.

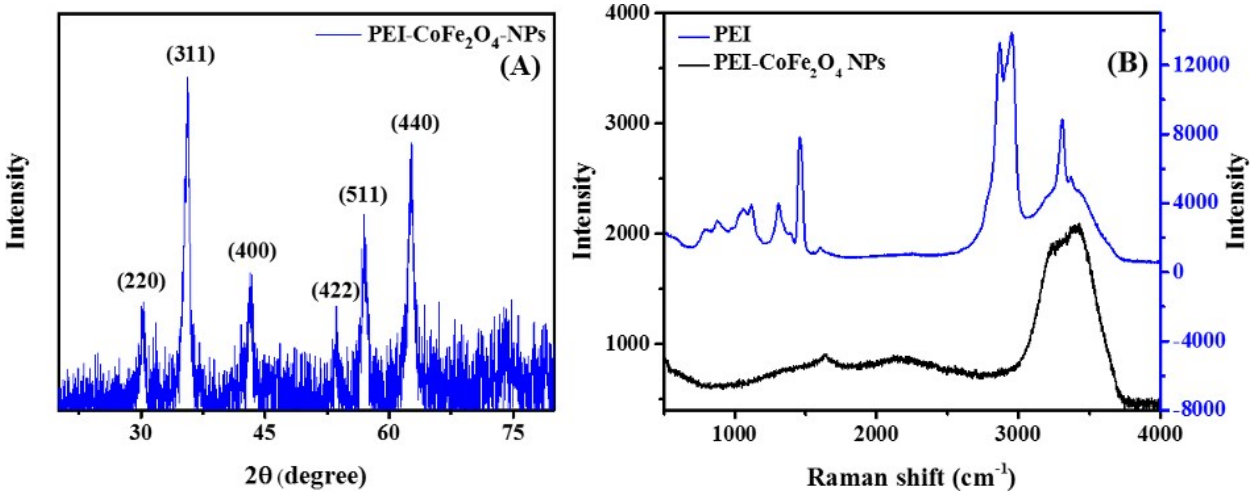

Fig. S2 (A) XRD of PEI-CoFe2O4 NPs, (B) Raman spectra of PEI and PEI-CoFe2O4 NPs after drop coating on a glass slide.

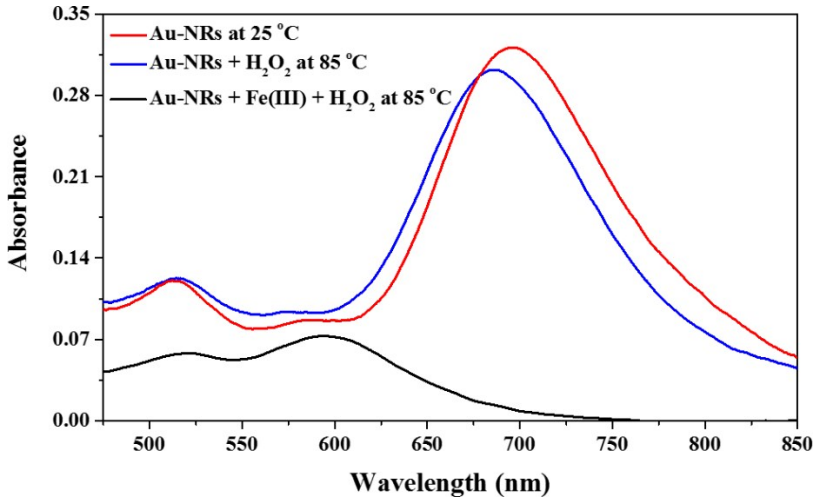

Fig. S3 Vis absorption spectra of Au-NRs after incubating for 7 min at 85 °C in the absence and presence of H_2O_2 and $FeCl_3$. System contains 20 µL 2.5 mM $FeCl_3$, 20 µL 0.09 % w/v H_2O_2 and 0.2 mL as-synthesized Au-NRs. Final volume and pH of the solution were maintained to 2.0 mL and 1.3, respectively, by HCl.

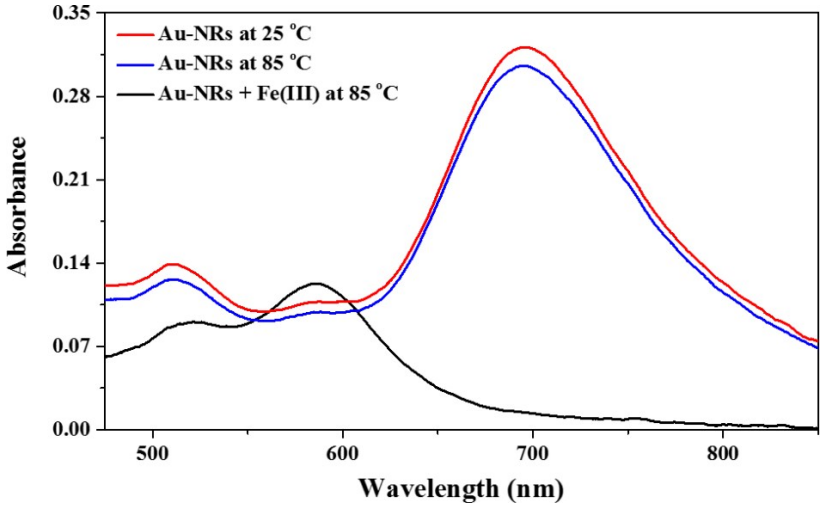

Fig. S4 Vis absorption spectra of Au-NRs after incubating for 10 min at 85 °C in the absence and presence of $FeCl_3$. System contains 25 µL 4 mM $FeCl_3$ and 0.2 mL as-synthesized Au-NRs. Final volume and pH of the solution were maintained to 2.0 mL and 1.3, respectively, by HCl.

References:

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