Electronic Supplementary Material (ESI) for Nanoscale Advances.

Supporting Information

Development of a near infrared Au-Ag bimetallic nanocluster for ultrasensitive detection of toxic Pb^{2+} ions *in vitro* and inside cells

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Table S1. Volume and molar ratio of Au^{3+} and Ag^{+} used for the synthesis of Au-Ag@BSA NCs.

	Volume ratio (ml)	Molar ratio (M)
Au:Ag	2.0:0.5	3.6:0.8
	1.5:1.0	2.7:1.6
	1.25:1.25	2.3:2.0
	1.0:1.5	1.8:2.4
	0.5:2.0	0.9:3.1

Table S2. Time resolved study of Au-Ag@BSA NCs with simultaneous variation of Au and Ag molar ratios.

$[AuCl_4^-]$ (mM)	$[Ag^+]$(mM)	λ_{ems}	τ_1 (ns)	τ_2 (ns)	τ_{av} (ns)	χ^2
4.5	0	680	1.74	260	211	1.08
3.6	0.8	665	1.48	157	133	1.13
2.7	1.6	703	5.64	112	100	1.16
2.3	2.0	718	1.04	98.6	14.2	1.25
1.8	2.3	766	1.37	116	11	1.16
0.9	3.1	815	0.9	64	2.5	1.04

Table S3. Different sensors for the detection of contaminants (toxic ions).

Sensing Probes	Contaminant	LOD	Ref.
Au NP	Pb^{2+}	100 nM	1
Au NP	Pb^{2+}	3 nM	2
Au NC	Hg^{2+}	0.1 nM	3
Au NC	Fe^{3+}	5.4 μM	4
Au NC-QD conjugate	Hg^{2+}	9 nM	5
Au NP-Graphene Oxide conjugate	Pb^{2+}	0.1 nM	6
Au NC	CN^{-}	2 nM	7
Au nanofilm	Pb^{2+}	0.1 $\mu molL^{-1}$	8
DNAzyme-Au NP hybrid	Pb^{2+}	0.028 nM	9
Au NC	Pb^{2+}	10 nM	10
Au-Ag NC	Pb^{2+}	96.02 nM	Present work

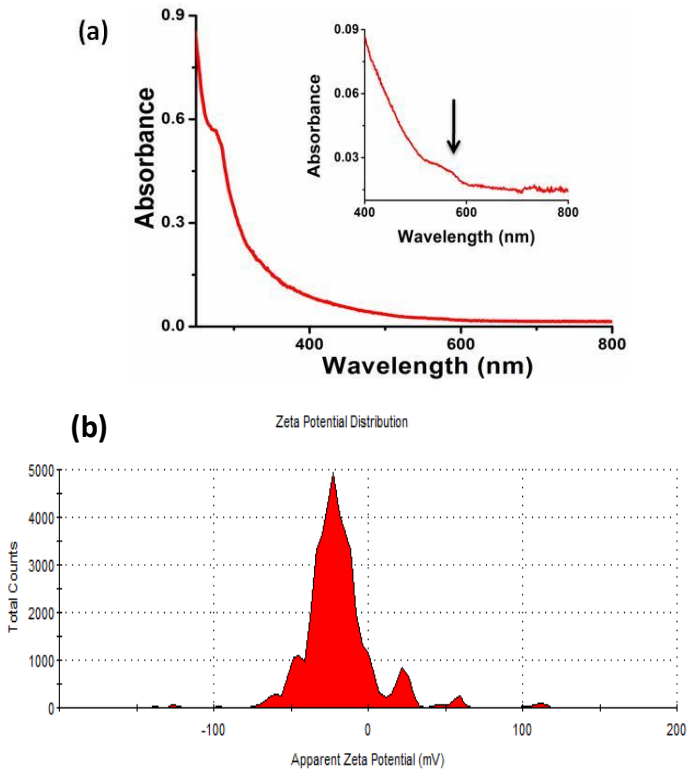

Figure S1. (a) Absorption spectra of Au-Ag@BSA NCs where Au-Ag molar ratio was 2.3:2, inset shows broad shoulder due to the incorporation of Ag (zoomed in from Figure S1a); (b) Zeta potential of Au-Ag@BSA NCs.

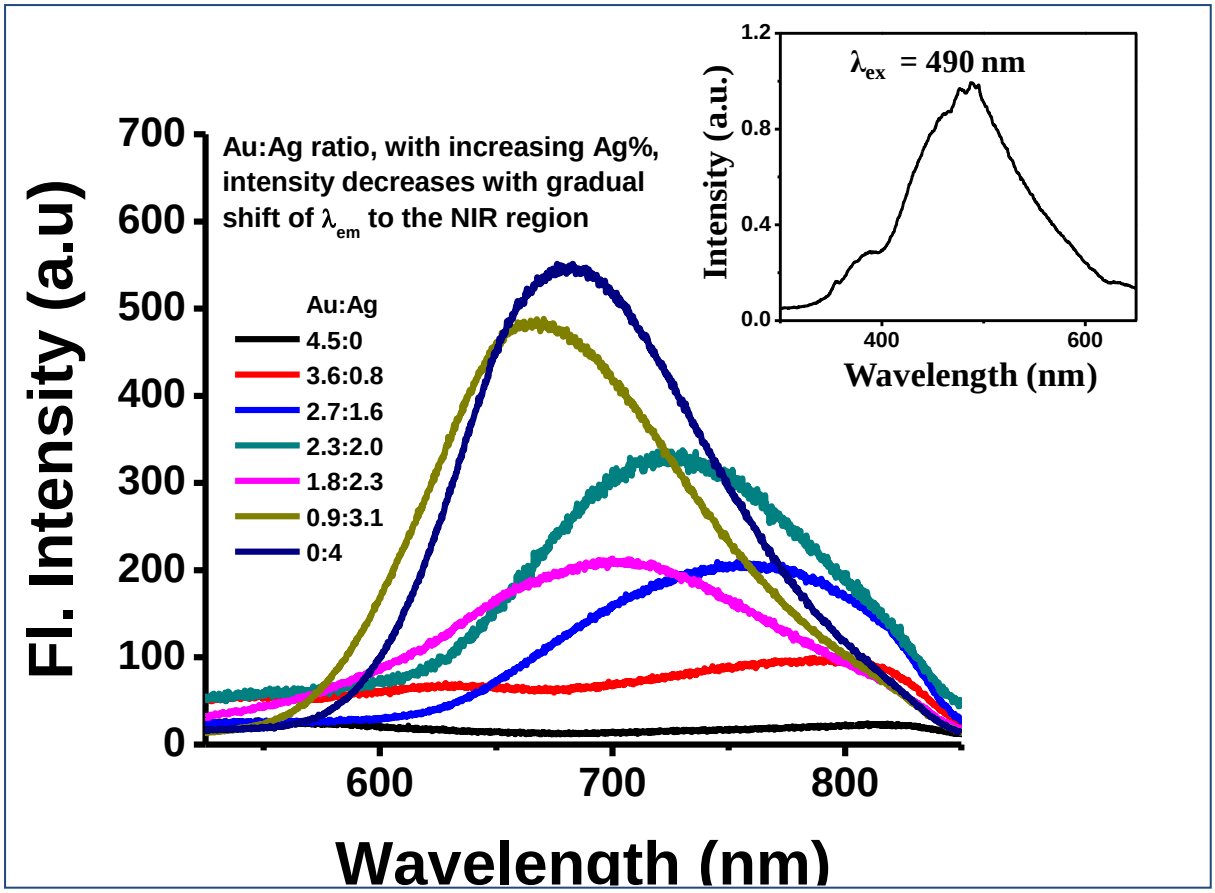

Figure S2. Decrease of fluorescence Intensity of Au-Ag@BSA NCs with increasing concentration of Ag, inset: excitation spectrum of Au-Ag@BSA NCs.

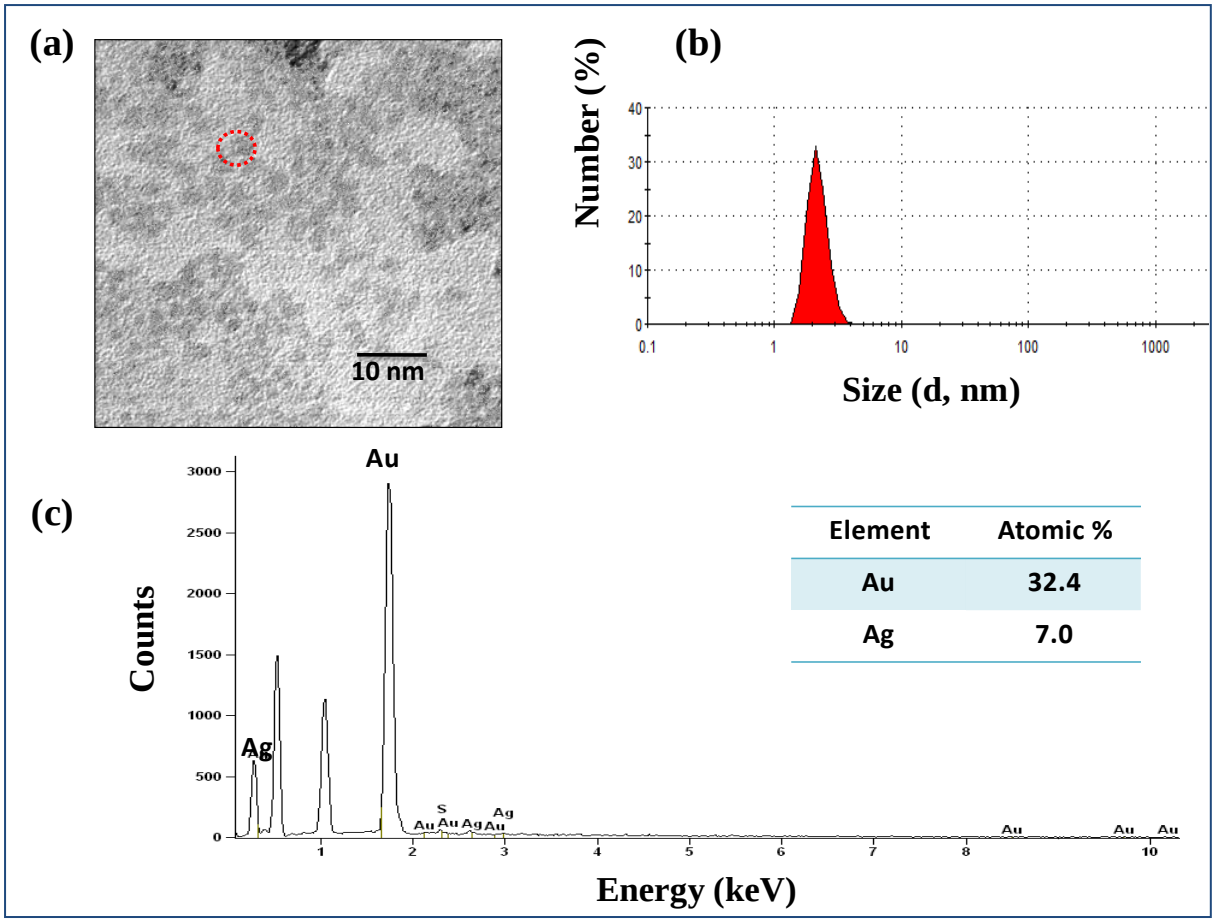

Figure S3. (a) TEM image of as prepared Au-Ag@BSA NCs, Scale bar was 10 nm; (b) DLS size distribution of Au-Ag@BSA NCs showed the existence of higher population of particles ~2 nm in diameter; (c) EDAX spectrum showed the composition and apparent atomic ratio of Au and Ag in Au-Ag@BSA NCs. Inset table showed the elemental composition (Au/Ag) of Au-Ag@BSA NCs.

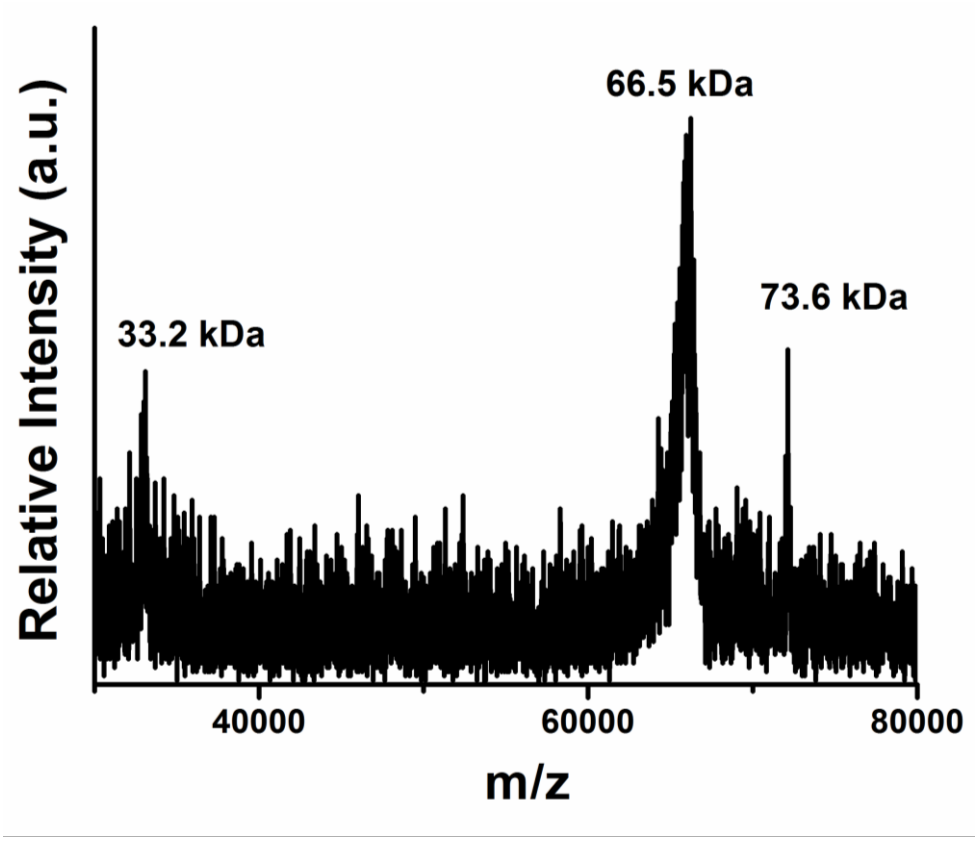

Figure S4. MALDI mass spectrum of as-prepared Au-Ag@BSA NC.

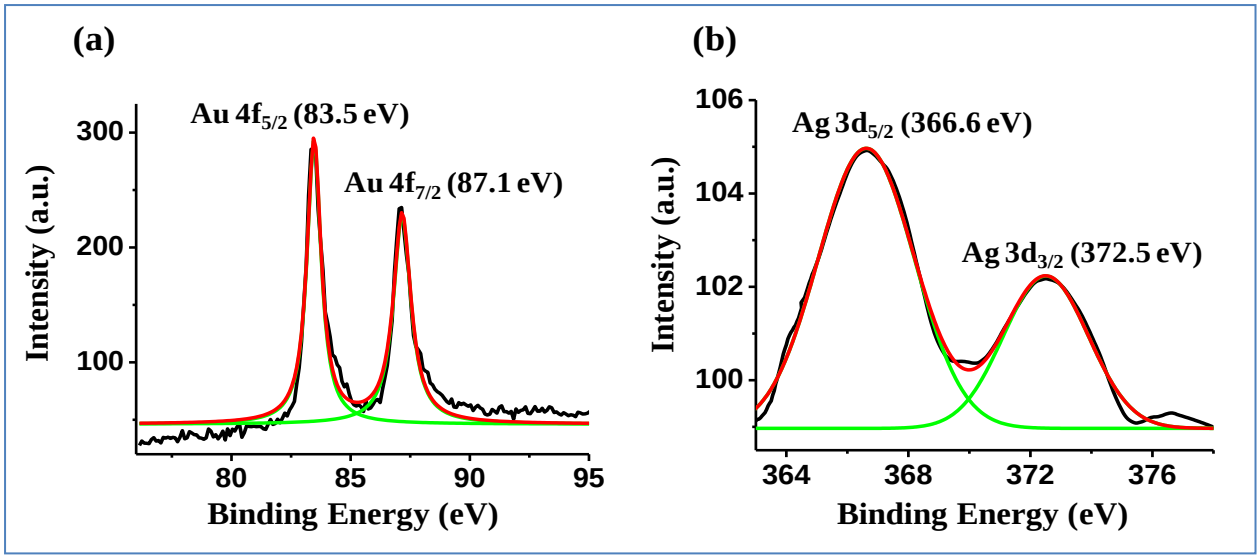

Figure S5. X-ray photoelectron spectra (XPS) of (a) Au 4f and (b) Ag 3d of Au-Ag@BSA NCs.

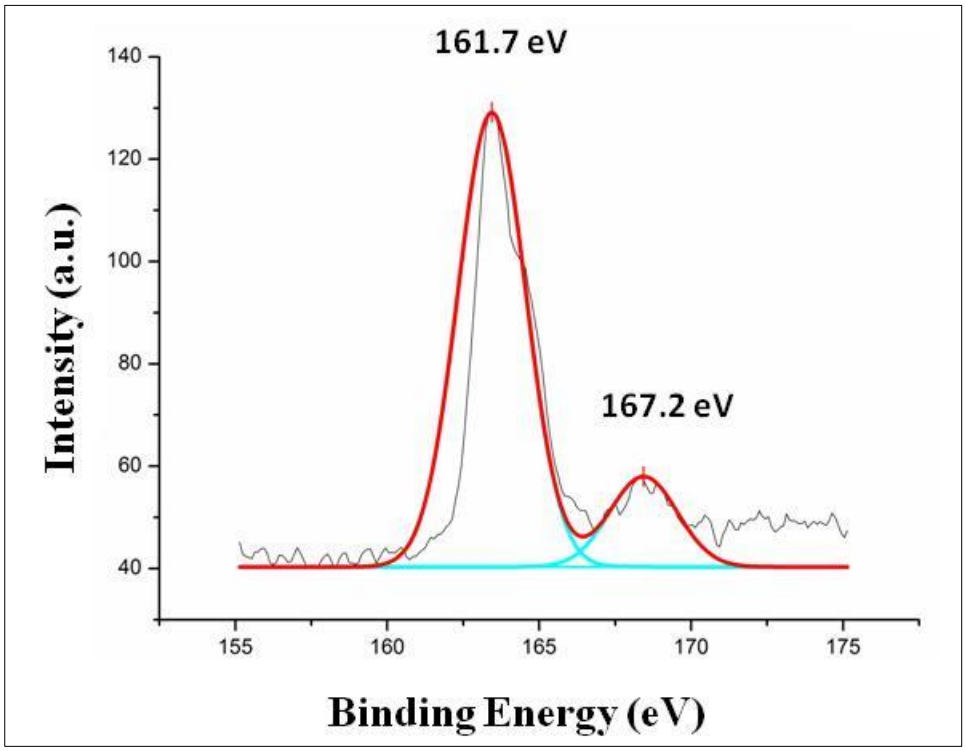

Figure S6. X-ray photoelectron spectra of S 2p states.

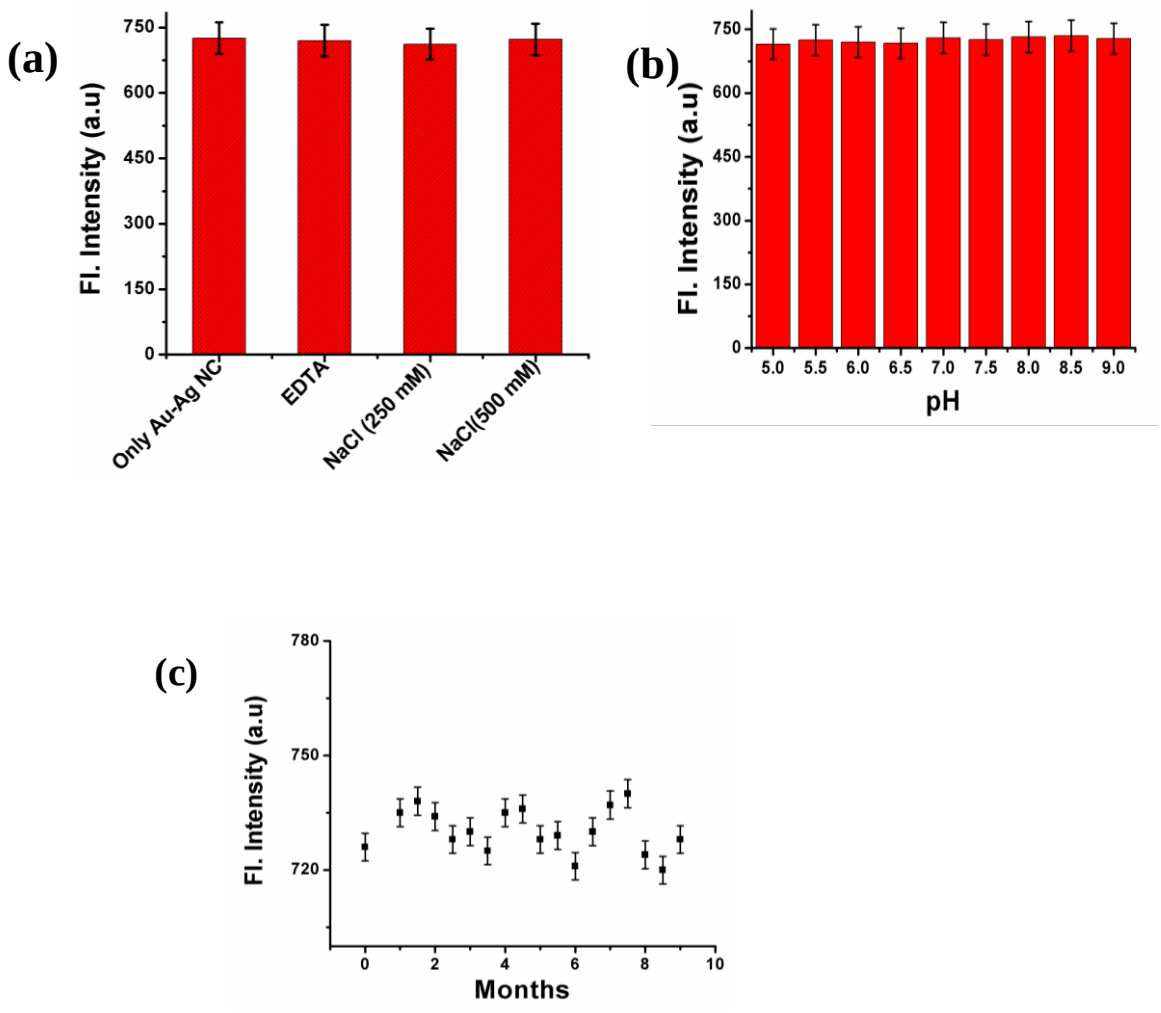

Figure S7. Fluorescence Stability of the as prepared Au-Ag@BSA nanocluster in presence of (a) EDTA and NaCl; (b) at different pH; (c) Au-Ag@BSA NCs fluorescence stability with time.

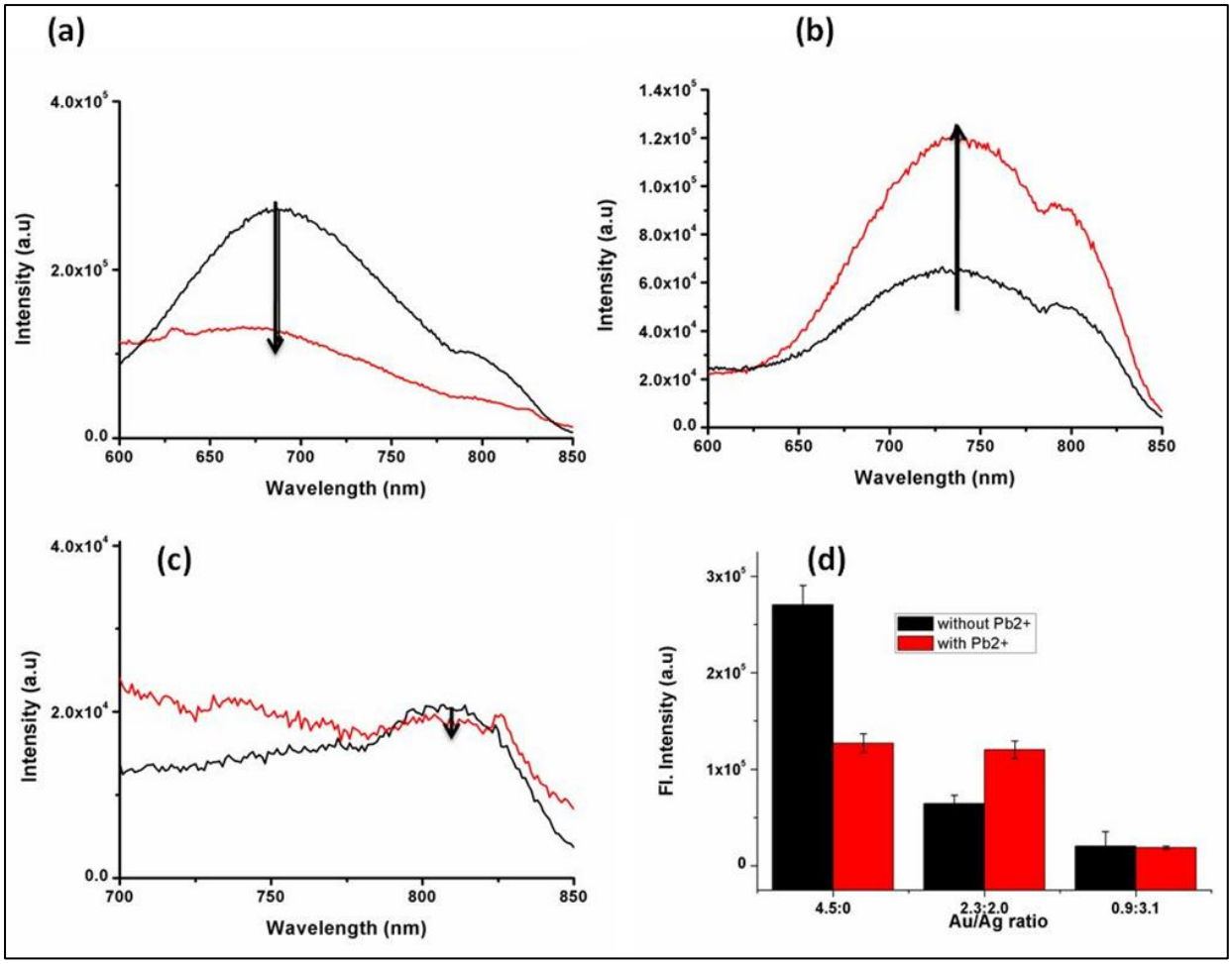

Figure S8. Fluorescence intensity of Au-Ag @BSA NCs containing three different molar ratios of Au/Ag (a) 4.5:0; (b) 2.3:2.0 and (c) 0.9:3.1 in presence(red) and absence of Pb^{2+}(black).(d) plot of fluorescence intensity against three ratio of Au/Ag suggesting the significant enhancement of intensity only for the ratio 2.3:2.0.

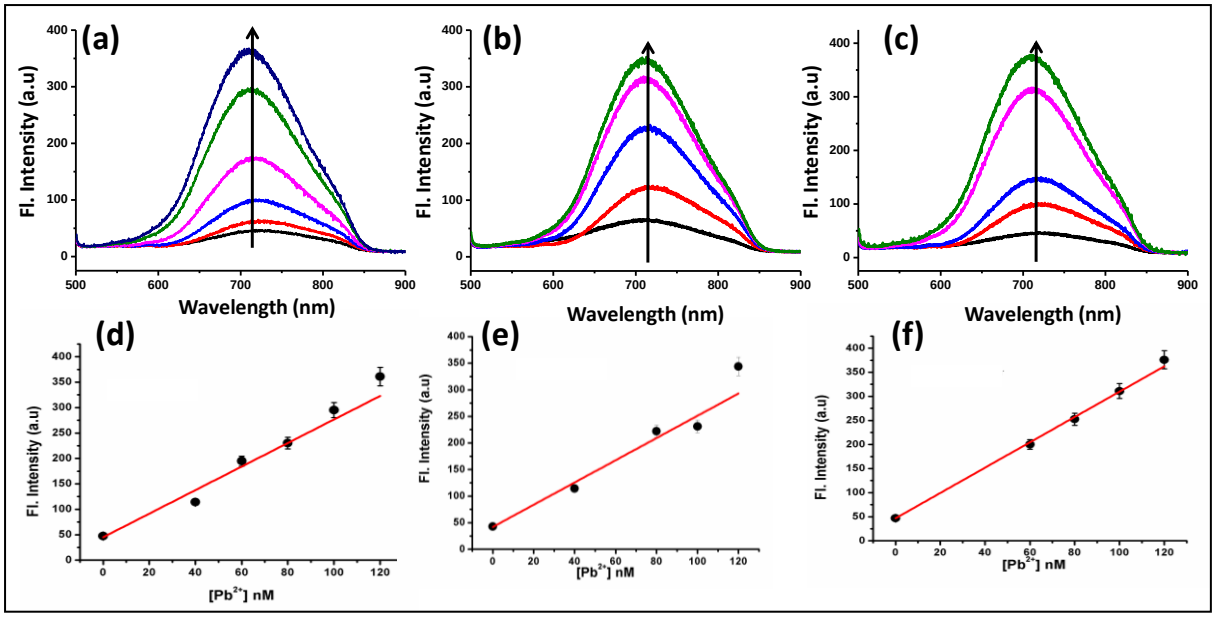

Figure S9. Fluorescence intensity increment of Au-Ag @BSA NCs (Au/Ag = 2.3:2.0) with gradual addition of Pb^{2+} in (a) tap water, (b) pond water and (c) drinking water (obtained by reverse osmosis of the tap water). Concentration dependence plot for the determination of recovery of Au-Ag@BSA NCs in the presence of (d) tap water, (e) pond water and (f) drinking water (obtained by reverse osmosis of the tap water).

References

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