Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

White light emission from a mixture of silicon quantum dots and gold nanoclusters and its utilities in sensing of mercury (II) ions and thiol containing amino acid

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Time resolved fluorescence measurements. Time resolved fluorescence measurements were performed using a picosecond time correlated single photon counting (TCSPC) system from Horiba scientific (Model: Deltaflex[tm]). A picosecond diode laser (Model: NanoLED-405L) with an excitation wavelength of 402 nm was used to excite the sample. The system has a pulse width of < 200 ps. The fluorescence decay was described as a sum of exponential functions:

$$D(t) = \sum_{i=1}^{n} a_i \exp\left(\frac{-t}{\tau_i}\right)$$

Where $D(t)$ is the normalized fluorescence decay, τ_i are the fluorescence lifetimes of various fluorescent components and a_i are the normalized pre-exponential factors. The amplitude weighted lifetime is given by:

$$\langle \tau \rangle = \sum_{i=1}^{n} a_i \tau_i \qquad \text{……Equation 1}$$

To get the best fitting while doing analysis Chi square (χ^2) values were kept near to unity.

Quantum yield calculation

Quantum yield of the white light emitting mixture was calculated using Quinine sulphate as reference. Quinine sulphate in 0.1M H_2SO_4 was chosen as the reference standard and the samples were excited at 365nm. The absorption and fluorescence spectra of reference solution and WLEM were recorded by adjusting the concentration of solutions such that the absorbance value at excitation wavelength (365nm) was between 0.01 and 0.1. The absorbance values of all the samples was kept below 0.1 to minimize the self-absorption effects in the fluorescence spectra. Fluorescence quantum yield was estimated by integrating the area under the fluorescence curve. The integrated fluorescence intensity versus absorbance values of WLEM and the reference was plotted and fitted linearly to calculate the slope. The following equation was then employed to calculate the quantum yield of WLEM (QY_{WLEM}).

$$QY_{WLEM} = QY_{Ref} \text{ x } (m_{WLEM}/m_{Ref}) \text{ x } (\eta_{WLEM}/\eta_{Ref})$$

where,

QY_{Ref} = Quantum yield of Quinine sulphate which is 0.54;

m_{WLEM} = slope of white light mixture;

m_{Ref} = slope of quinine sulphate;

η_{WLEM} = Refractive index of white light mixture and

η_{Ref} = Refractive index of quinine sulphate.

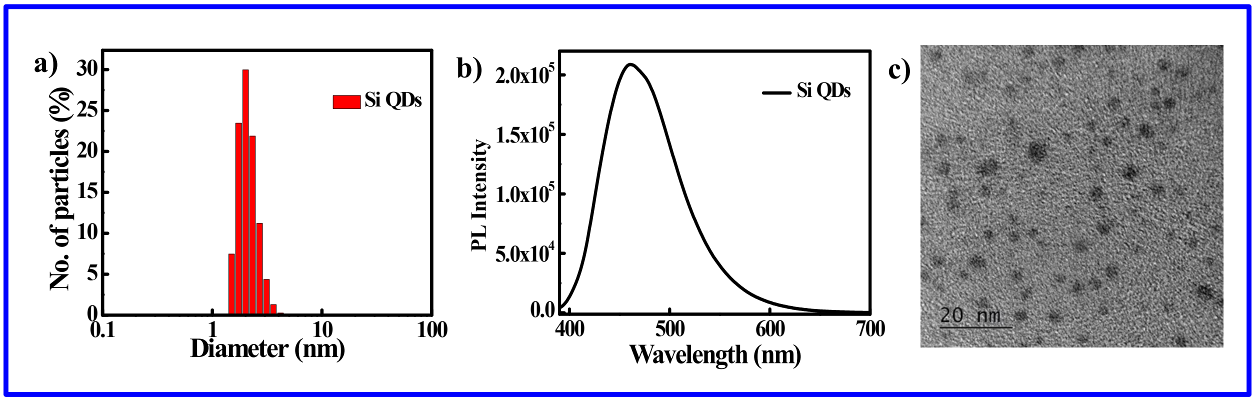

Figure S1. (a) DLS size distribution of the as synthesized Si QDs ; (b) PL spectrum of Si QDs; and (c) TEM images of as synthesized Si QDs.

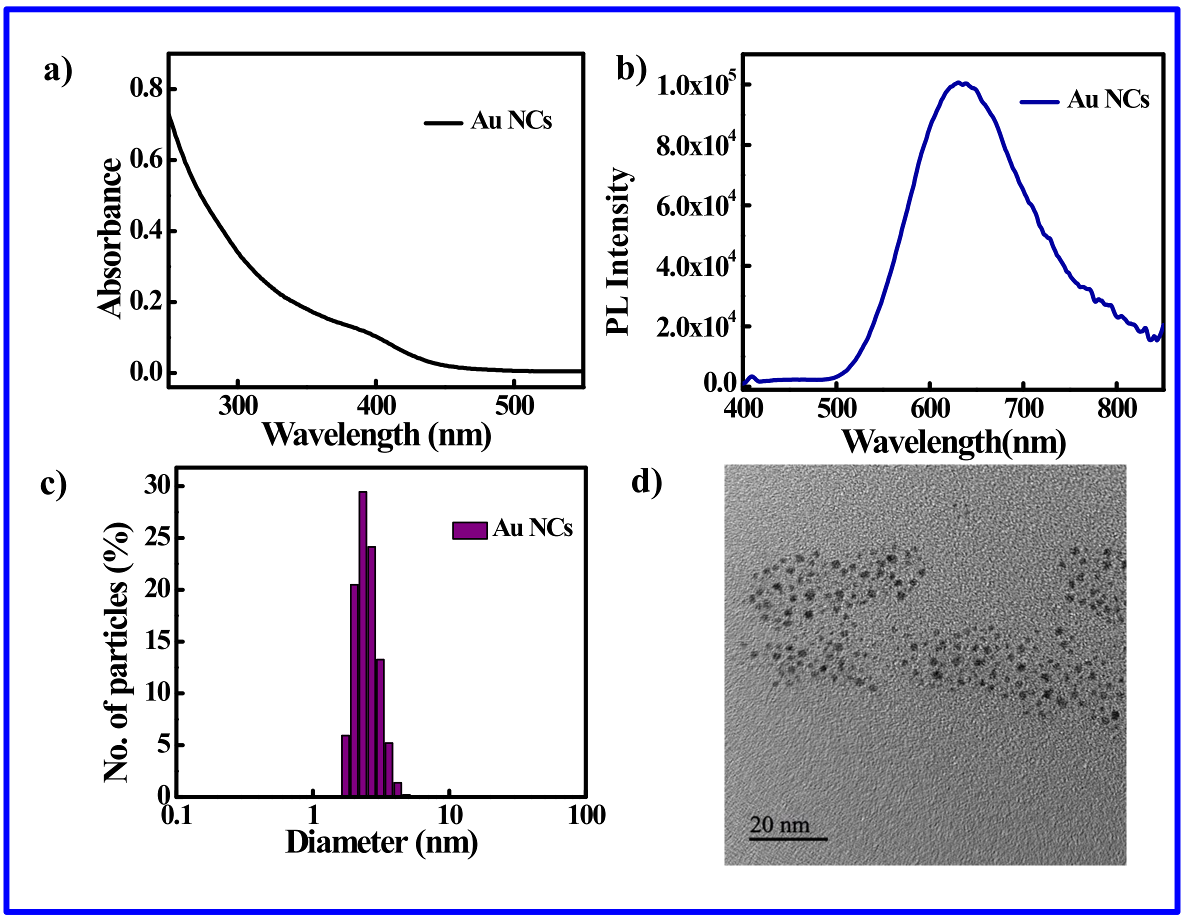

Figure S2. (a) UV- visible absorption spectrum of Au NCs; (b) PL spectrum of Au NCs (λ_{ex} = 365 nm); (c) DLS size distribution of the Au NCs and (d) TEM images of Au NCs.

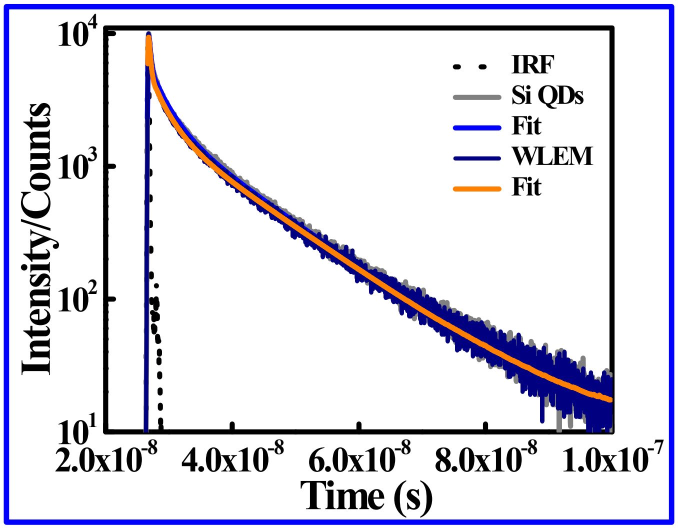

Figure S3. Lifetime decay curves of only Si QDs (Grey) and Si QDs in WLEM (Navy) excited at 402 nm. Black plot denotes the instrument response function.

Table S1. Decay time components of only Si QDs and Si QDs in WLEM

System	b_1	τ_1	b_2	τ_2	b_3	τ_3	$\langle\tau\rangle = b_1\tau_1 + b_2\tau_2 + b_3\tau_3$	χ^2
Si QDs	0.23	2.7	0.71	12.7	0.07	0.26	9.5	1.3
WLEM	0.22	2.65	0.71	13	0.08	0.25	9.82	1.3

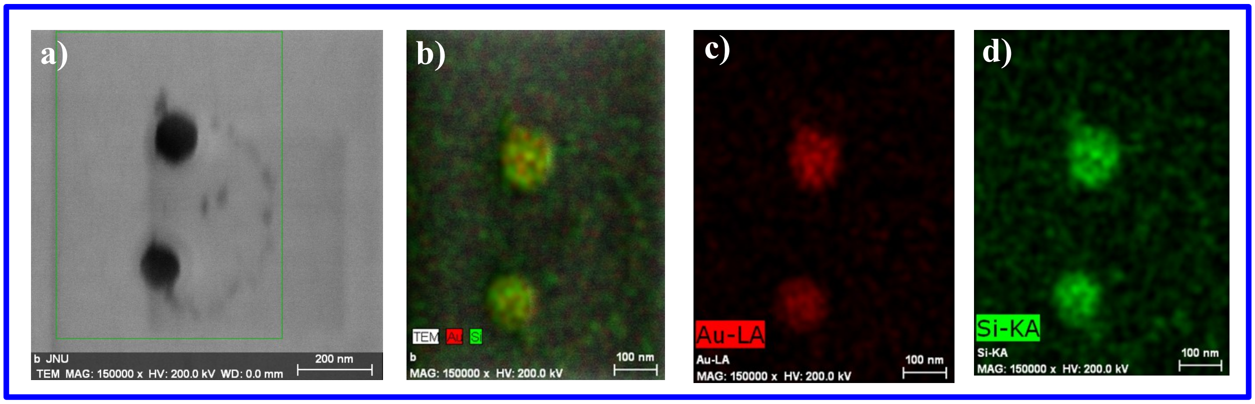

Figure S4. (a) Bright field STEM images of WLEM; and (b,c,d) the corresponding elemental mapping.

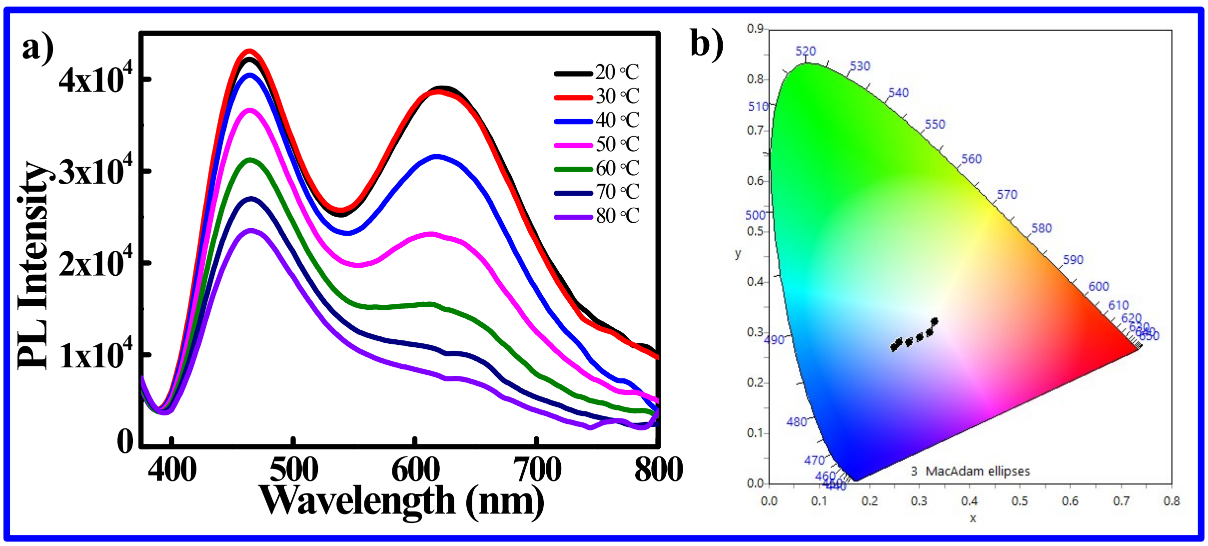

Figure S5. (a) PL spectra of WLEM in the temperature range of 20 ºC to 80 ºC; and (b) corresponding CIE plot.

a)

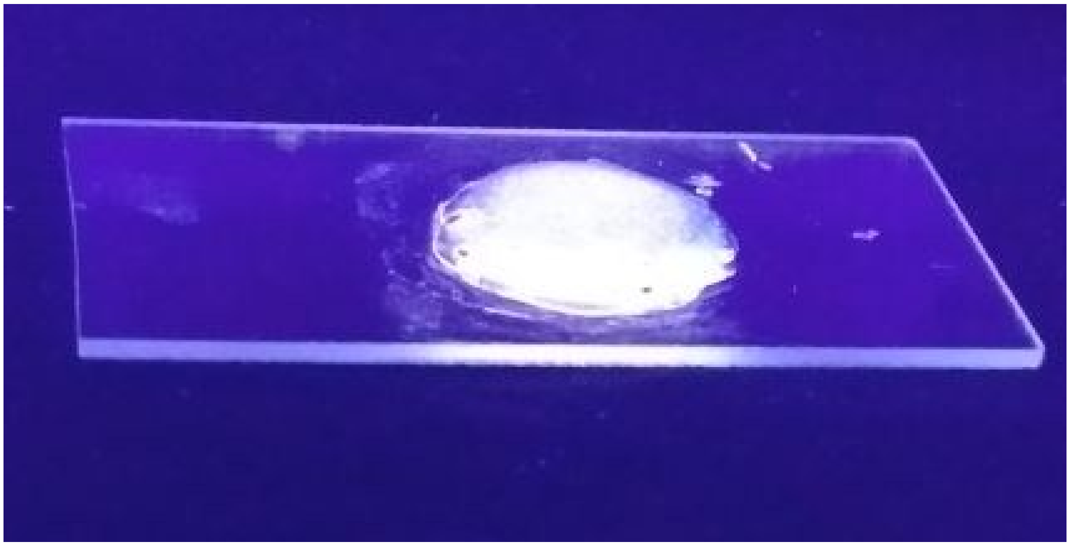

Figure S6. (a) Digital image of WLEM incorporated in PVP film under UV light (λ_{ex} = 365 nm).

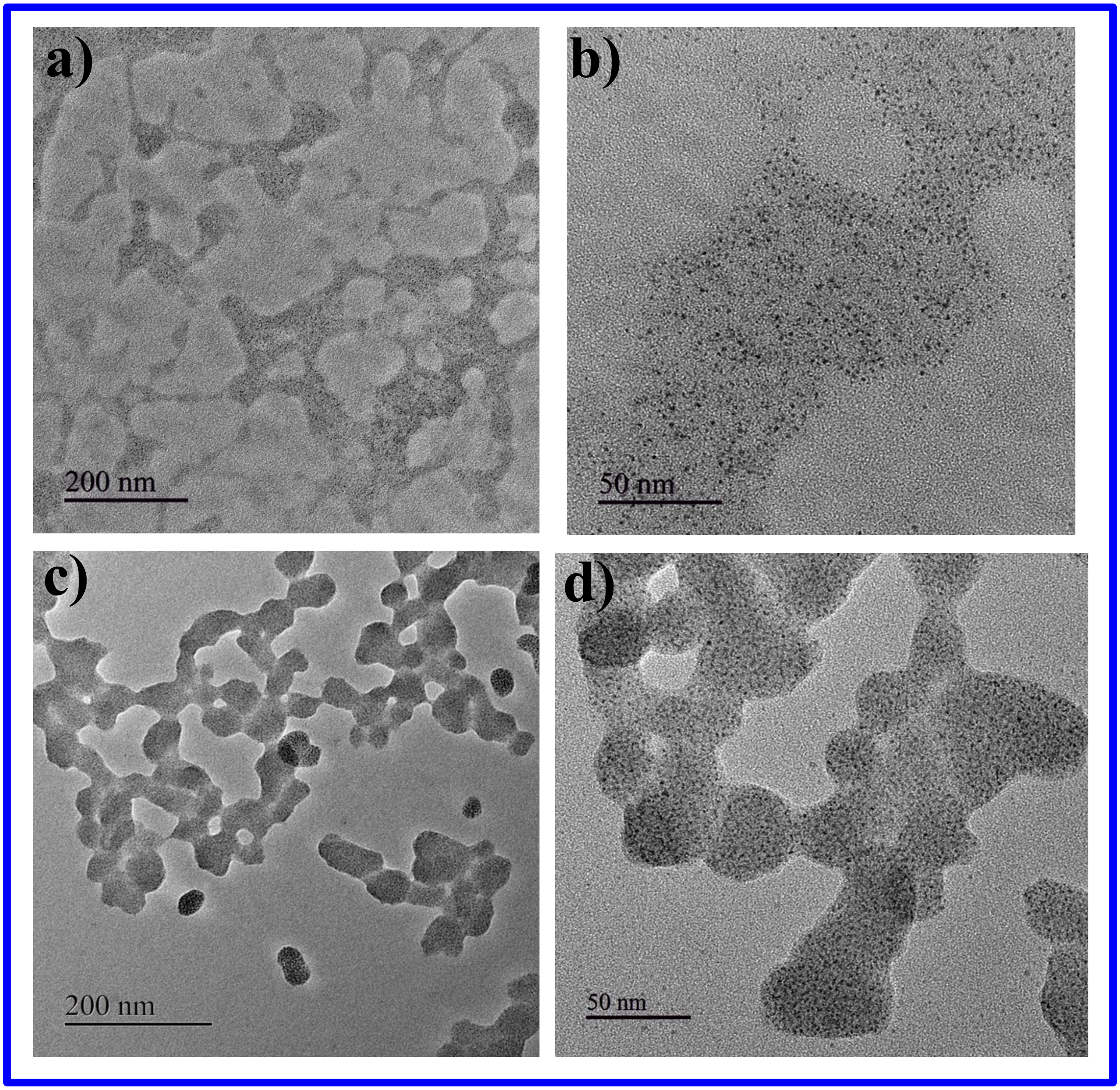

Figure S7. TEM images of WLEM (a and b) with Hg^{+2} ions; and (c and d) with Hg^{+2} ions and Cys.