Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Cannabis Sativa derived carbon dots with N-S co-doped: highly efficient nanosensors for temperature and vitamin B_{12}

Pranav Tiwari[a], Navpreet Kaur[b], Vinay Sharma[b], Hyeonggon Kang[d], Jamal Uddin[d] and Shaikh M. Mobin [abc] *

[a]Discipline of Metallurgical Engineering and Material Science, [b]Discipline of Biosciences and Biomedical Engineering, [c]Discipline of chemistry, Indian Institute of Technology Indore, Simrol, Khandwa Road, Indore 453552, India

[d]Center for Nanotechnology, Department of Natural Sciences, Coppin State University, 2500 W. North Ave., Baltimore, MD21216, USA

* Corresponding author- xray@iiti.ac.in

SUPPORTING INFORMATION

Fig. S17.(a) Plot of integrated Fluorescence intensity (excited at 360 nm) against absorbance values at 360 nm of N@VRCD. (b) Plot of integrated Fluorescence intensity (excited at 345 nm) against absorbance values at 345 nm of quinine sulfate(QS).

Table S1. Deconvoluated fluorescence spectra with temperature increment.

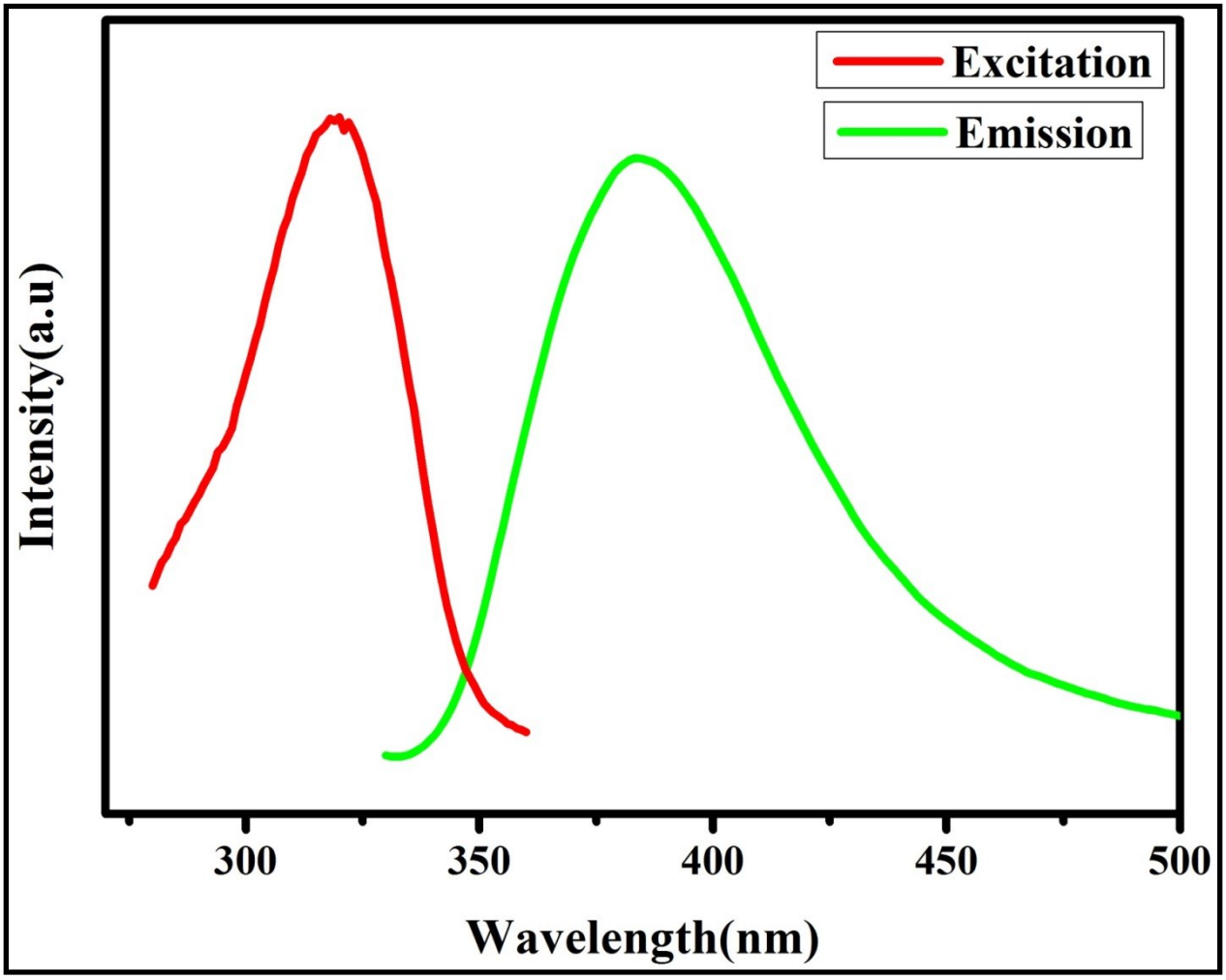

Fig. S1 Excitation and emission spectrum of N-S@CsCD.

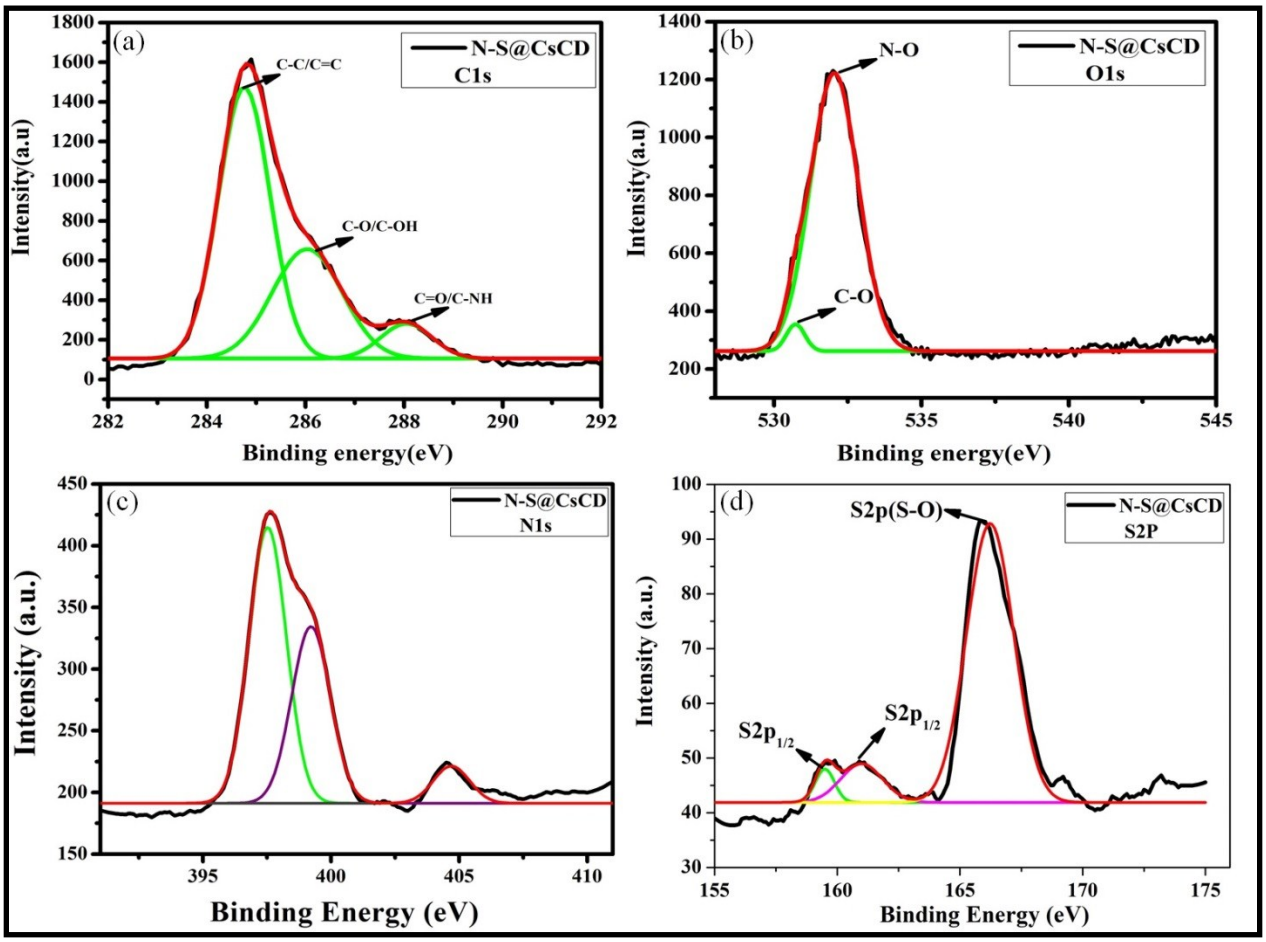

Fig. S2 Deconvoluated XPS peak of N-S@CsCD (a) C1s (b) O1s (c) N1s (d) S2p.

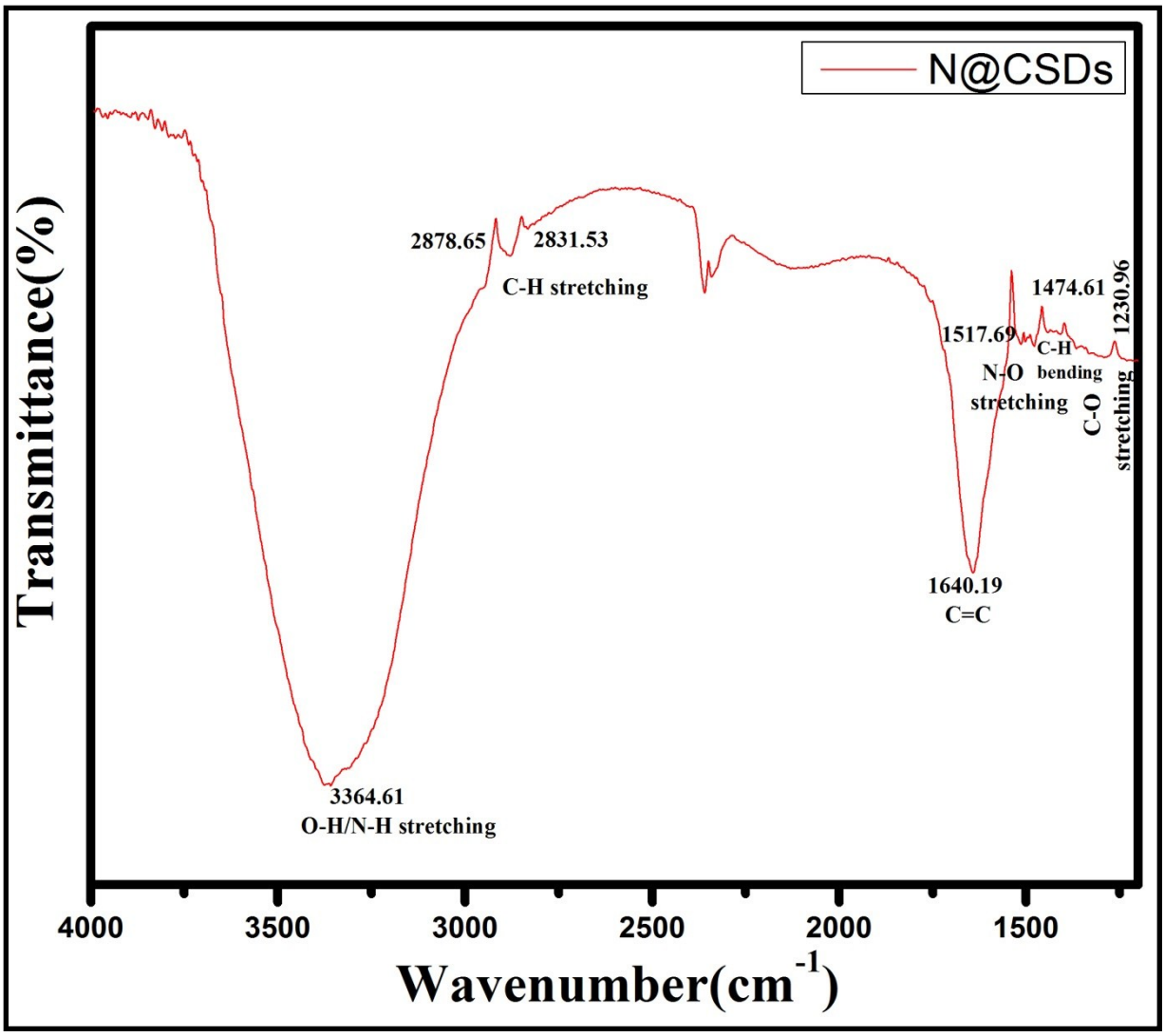

Fig. S3 FTIR spectra of N-S@CsCD.

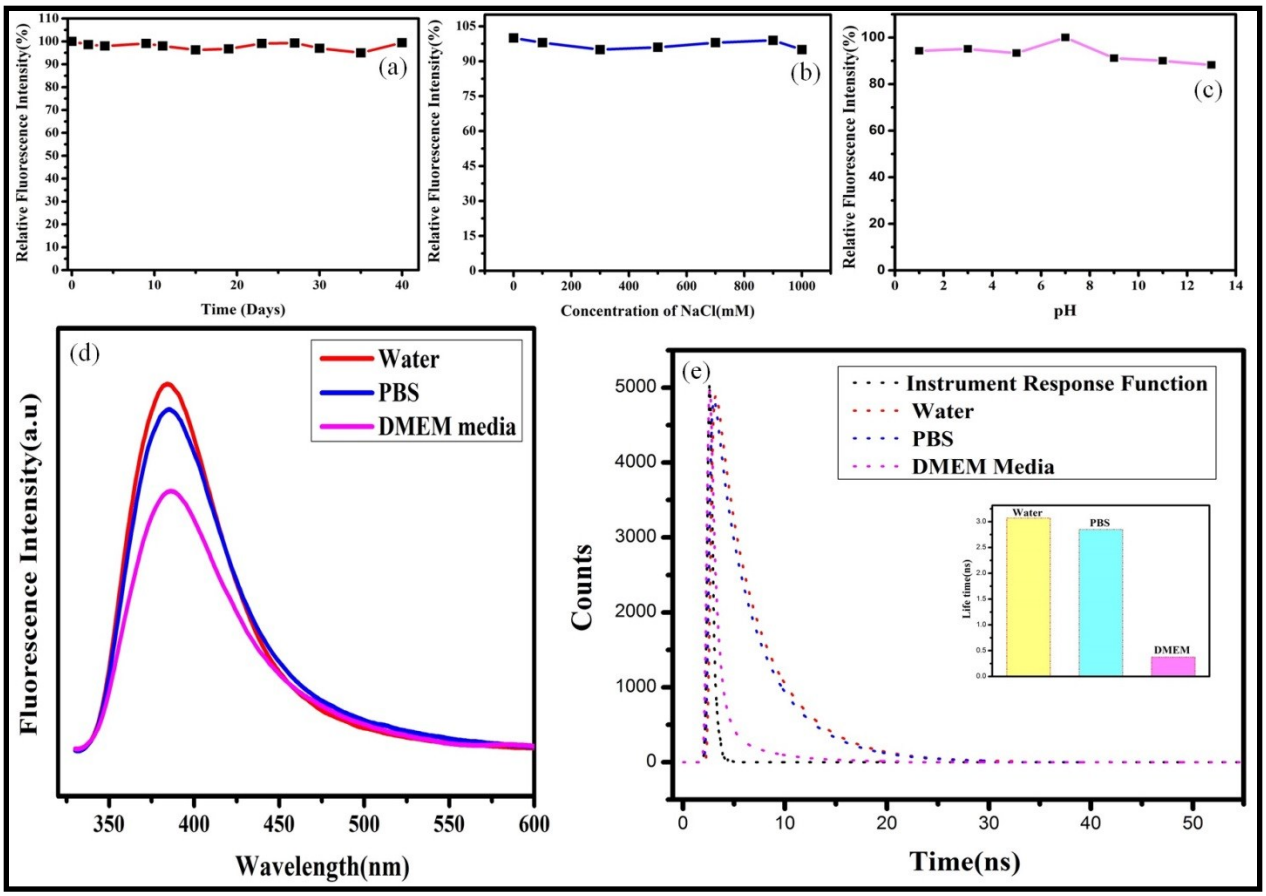

Fig. S4 Fluorescence stability of N-S@CsCD with (a) number of days (b) Salt concentration (c) pH (d) fluorescence intensity of N-S@CsCD in varying fluids (e) fluorescence life time decay of N-S@CsCD in varying fluid.

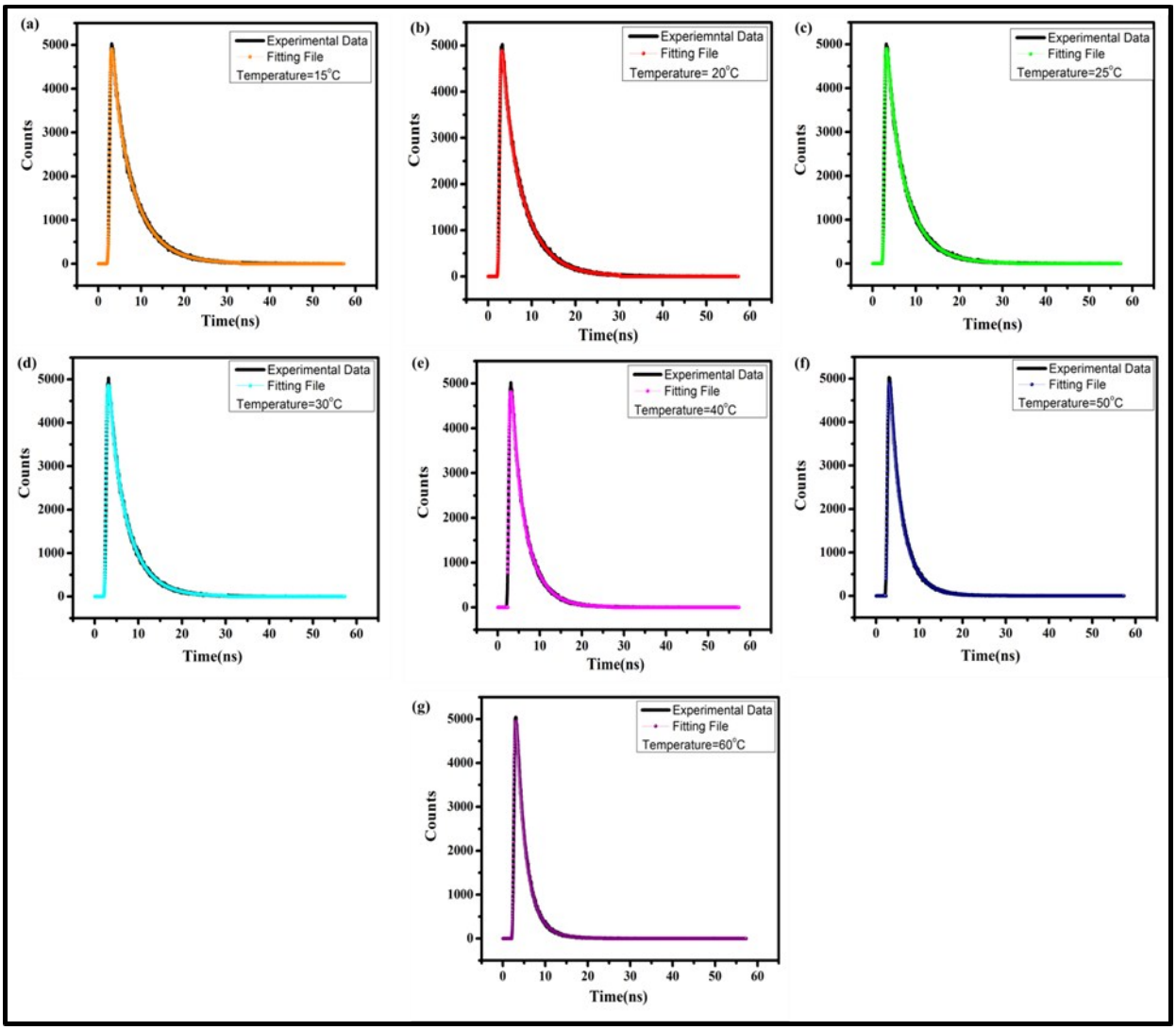

Fig. S5 Temperature dependent life time value of N-S@CsCD experimental data are shown in black solid lines and circles exhibit fitting data (a) Temperature=15^{o}C (b) Temperature=20^{o}C (c) Temperature= 25^{o}C (d) Temperature= 30^{o}C (e) Temperature= 40^{o}C (f) Temperature= 50^{o}C (g) Temperature= 60^{o}C.

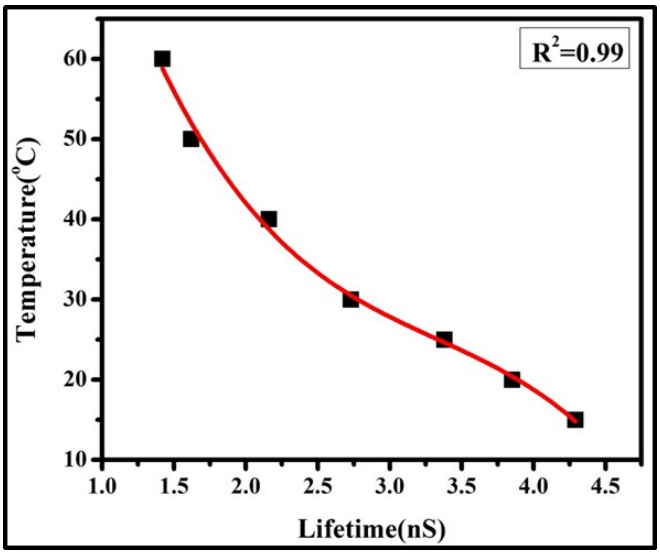

Fig. S6 Polynomial calibration curve for N-S@CsCD life time value with temperature.

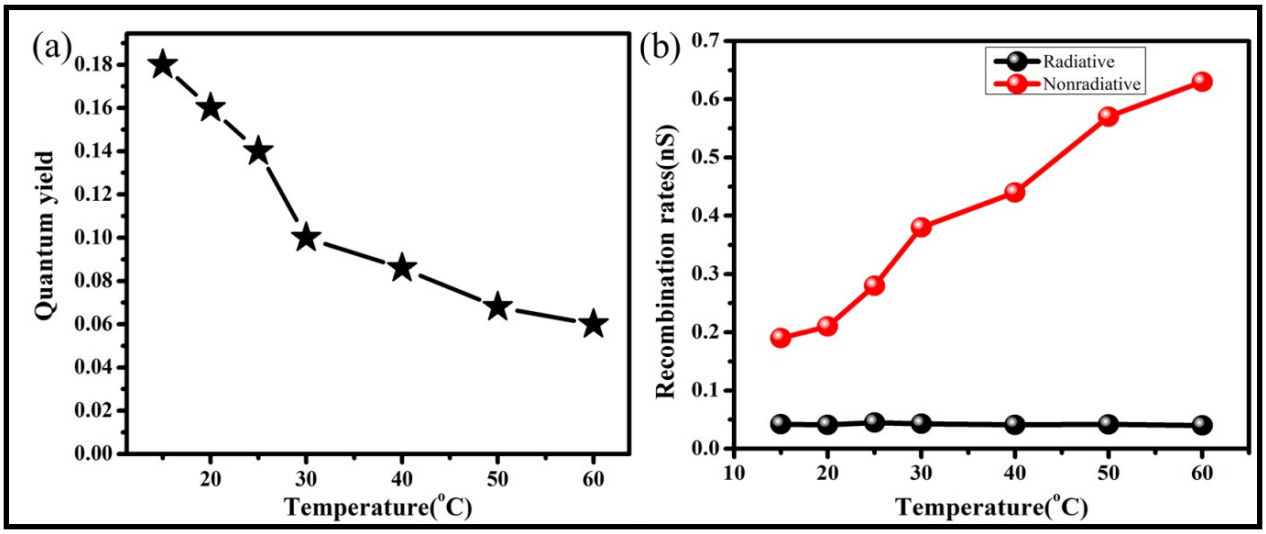

Fig. S7 Effect of temperature (a) Quantum yield (b) Radiative and non radiative recombination rates .

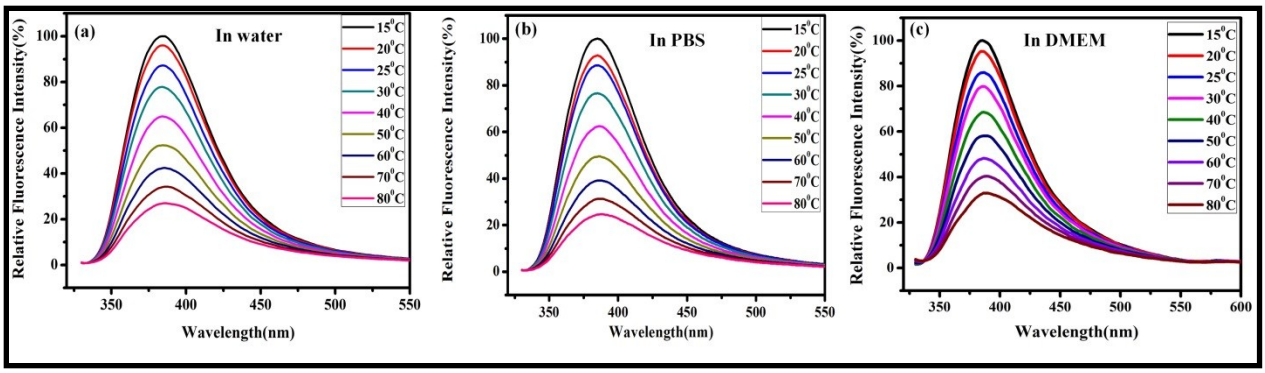

Fig. S8 Temperature dependent fluorescence changes in N-S@CsCD with varying fluid (a) water (b) PBS (c) DMEM.

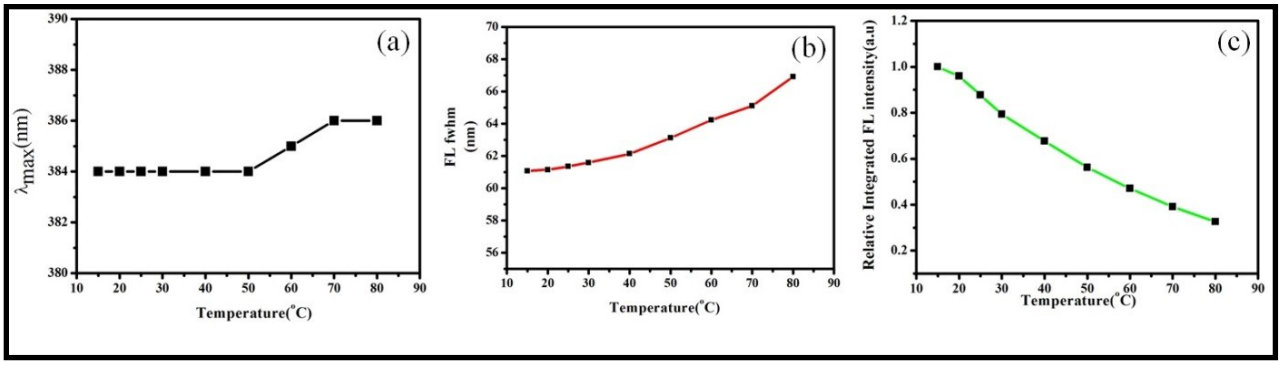

Fig. S9 Temperature dependent fluorescence changes in N-S@CsCD (a) emission wavelength (b) fwhm (c) relative integrated fluorescence intensity.

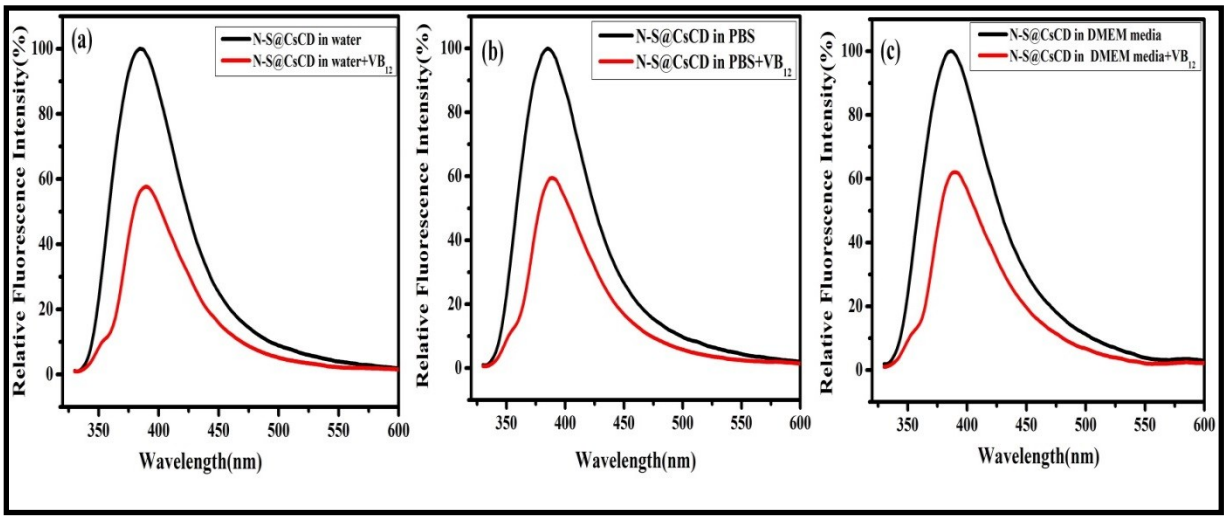

Fig. S10 Vitamin sensing with N-S@CsCD with varying fluid (a) water (b) PBS (c) DMEM.

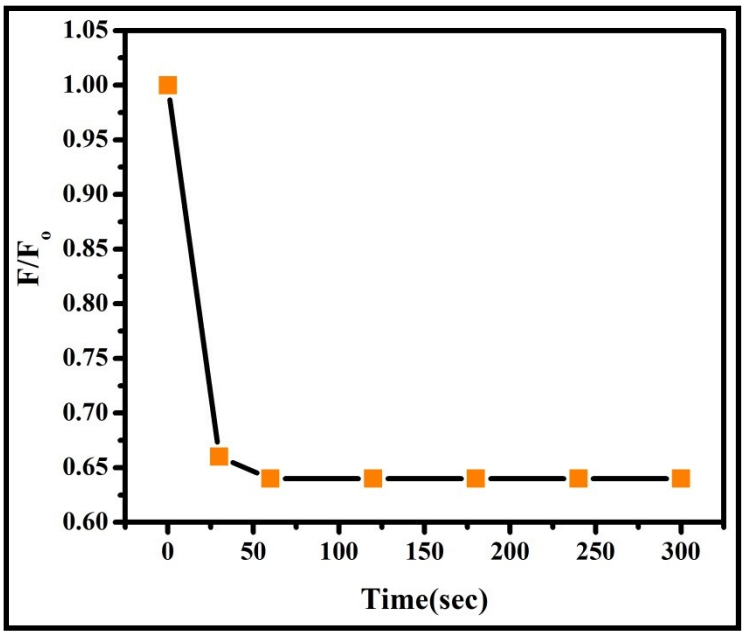

Fig. S11 Sensing response time of N-S@CsCD with VB_{12}.

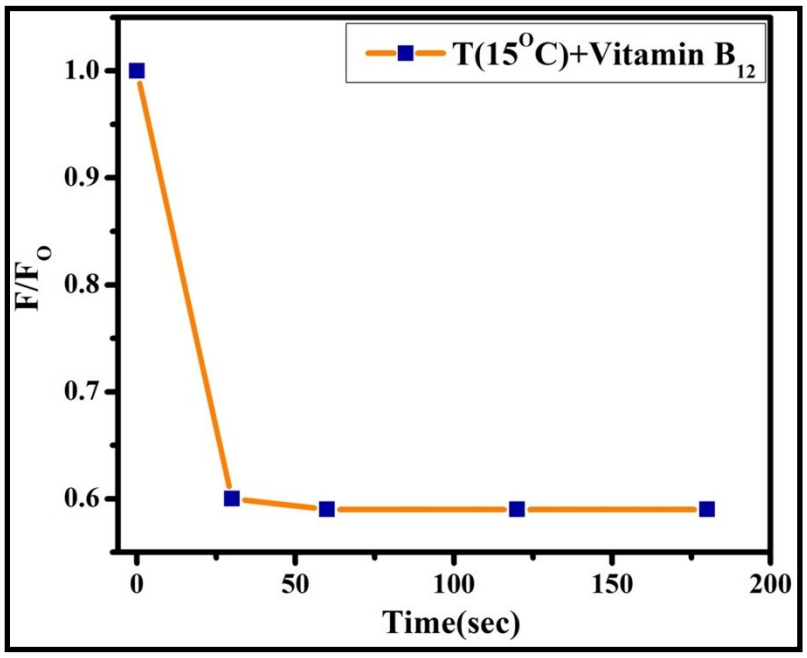

Fig. S12 Sensing response time of N-S@CsCD with T=15^{o}C+ VB_{12}.

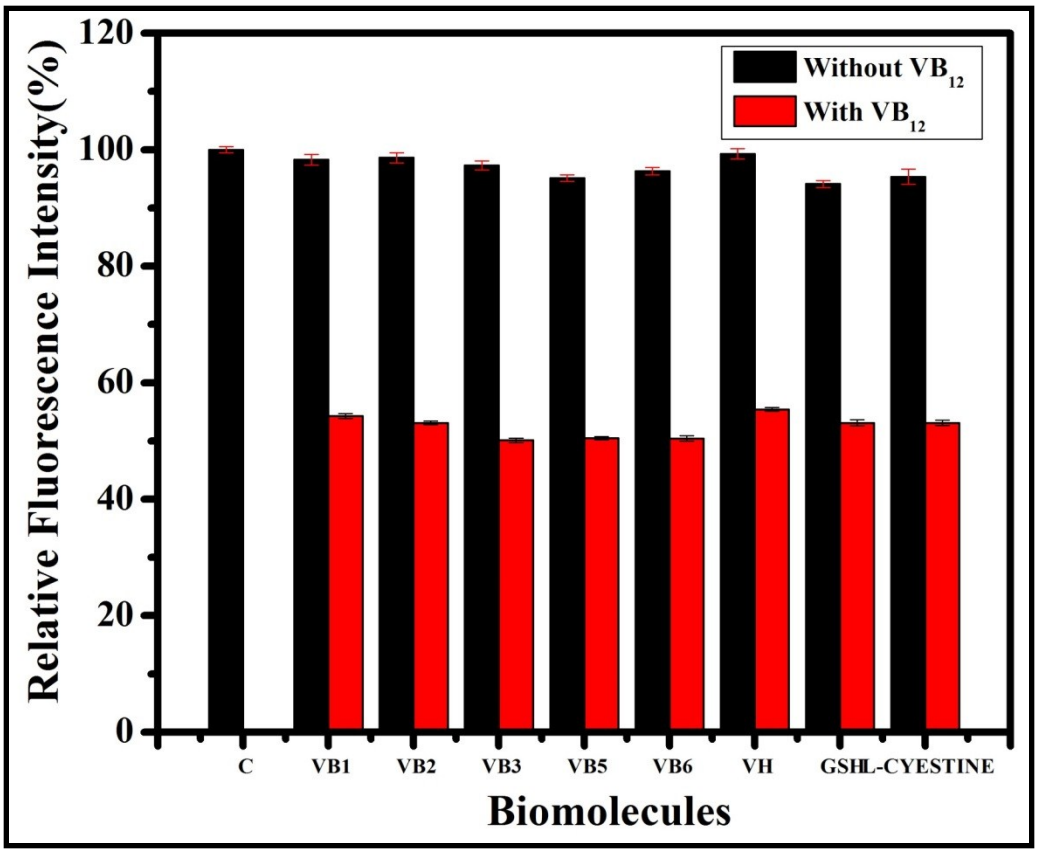

Fig. S13 Effect of interfering species.

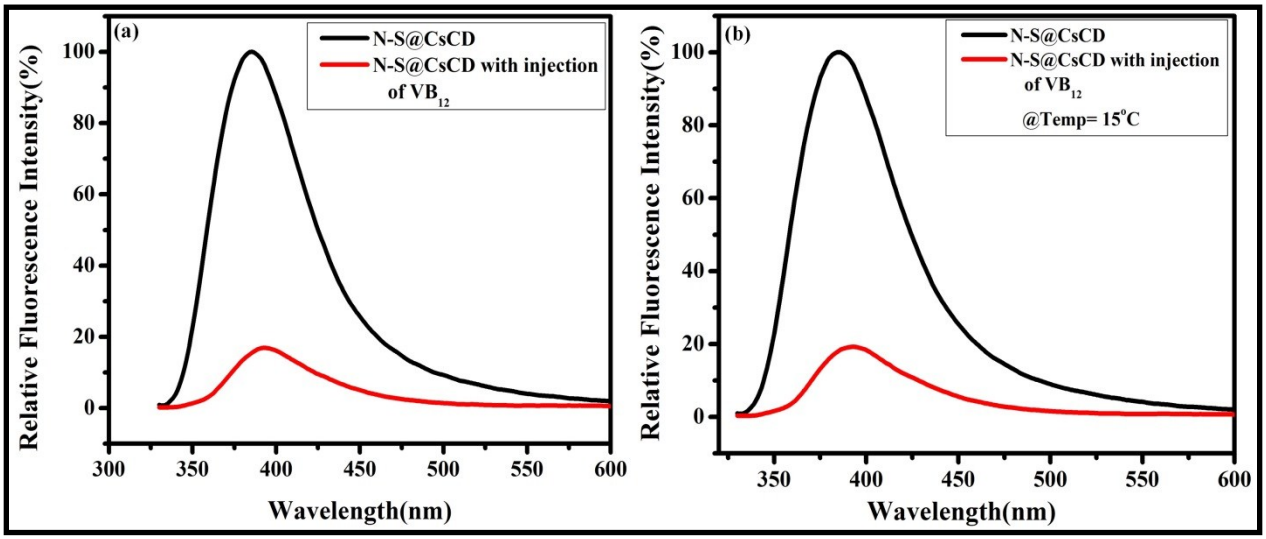

Fig. S14 Real sample analysis (a) Fluorescence intensity of N-S@CsCD and with VB_{12} injection (b) Fluorescence intensity of N-S@CsCD and with VB_{12} injection at temperature=15^{o}C.

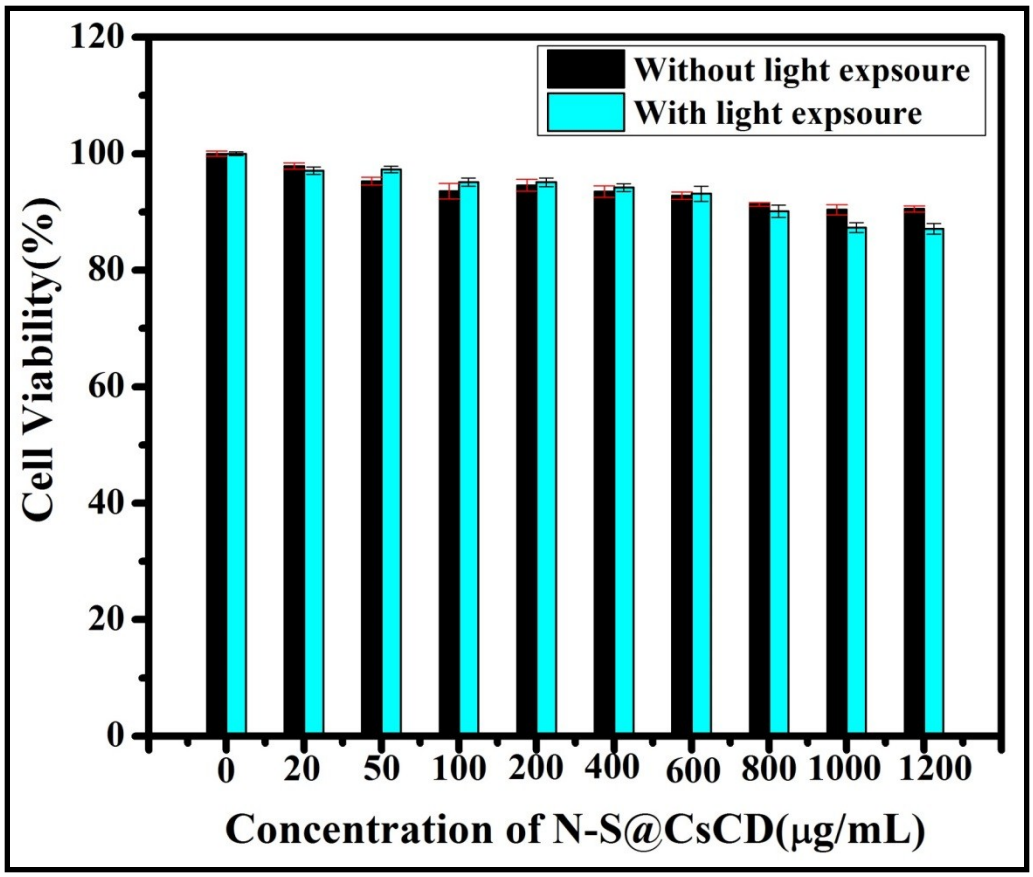

Fig. S15 Phototoxicity of N-S@CsCD.

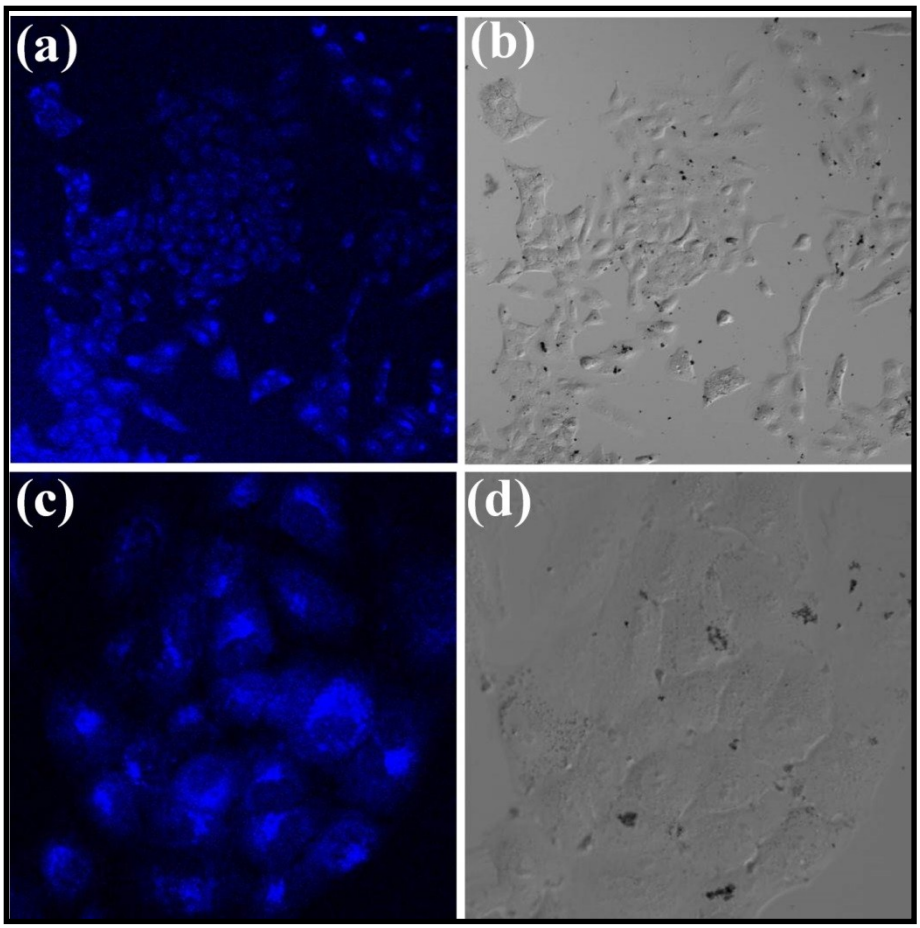

Fig. S16 Intracellular imaging of N-S@CsCD.

TableS1. Deconvoluated fluorescence spectra with temperature increment.

Sl no	Temp(ºC)	FWHM	Peak1(nm)	Peak2(nm)
1	15	43.94	380.80	414.37
2	20	44.05	380.86	414.33
3	25	44.23	381.13	415.20
4	30	44.61	381.33	415.80
5	40	45.37	381.97	417.58
6	50	45.96	382.53	419.17
7	60	47.15	383.46	421.98
8	70	48.09	384.51	424.94
9	80	49.23	385.33	427.88

Method: Quantum yield measurement

Quantum yield of N-S@CsCD was calculated using five-point method. The absorbance of N-S@CsCD and standard (Quinine sulphate) was fixed 0.02, 0.04, 0.06, 0.08 and 0.1. Results were summarized in table S2. The average quantum yield was found to be ~14.38%.

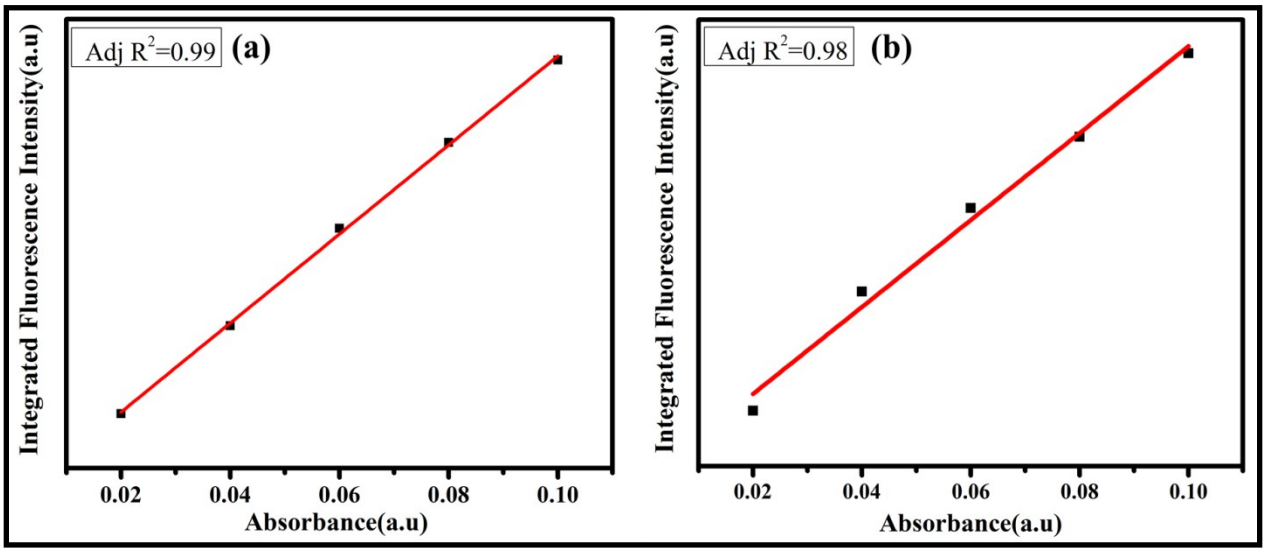

Fig. S17.(a) Plot of integrated Fluorescence intensity (excited at 360 nm) against absorbance values at 360 nm of N@VRCD. (b) Plot of integrated Fluorescence intensity (excited at 345 nm) against absorbance values at 345 nm of quinine sulfate(QS).

TableS2. Quantum yield calculated using steady-state comparative method.

S.No.	**Absorbance**	**Quantum yield**
1.	0.02	15.05%
2.	0.04	14.43%
3.	0.06	13.95%
4.	0.08	14.31%
5.	0.1	14.16%