Supporting Information

EXPERIMENTAL METHODS

Chemicals obtained from the following sources were of highest purity grade commercially available and used as received. Cadmium bromide tetrahydrate ($CdBr_2$. $4H_2O$) and Sodium sulfide nonahydrate ($Na_2S.9H_2O$) were purchased from Aldrich Chemicals. Tetraoctyl ammonium bromide (TOAB) was purchased from Lancaster Chemicals. Toluene of HPLC grade and Sodium sulphate of analytical grade were purchased from SRL Chemicals.

The absorption spectral studies were carried out in Agilent 8453 diode-array spectrophotometer. The fluorescence emission studies were carried out in Perkin-Elmer MPF-44B fluorescence spectrophotometer. The lifetime studies were carried out by time resolved single photon counting technique. For HRTEM studies, a drop of nanoparticle solution was placed on a carbon coated Cu grid and the solvent was allowed to evaporate. Specimens were imaged on a JEOL 300 kV high resolution transmission electron microscope. Powder X-ray diffraction studies were carried out using Philips Pan Analytical Xperts instrument and analysed using JCPDS Card references.

Synthesis of tetraoctyl ammonium bromide stabilized CdS quantum dots; phase transfer method

A novel procedure is proposed for the synthesis of tetraoctyl ammonium bromide stabilized CdS nanocrystals at room temperature. The tetraoctyl ammonium bromide acts as phase transfer catalyst and also as stabilizing agent. The synthesis method is explained below.

Step1: *Preparation of tetraoctyl ammonium bromide stabilized Cadmium precursor*

85 mg (2.5 mM) of $CdBr_2.4H_2O$ was dissolved in 100 ml of Argon saturated distilled water. 548 mg (10 mM) of TOAB was dissolved in Argon saturated toluene. Both the solutions were deaereated for 10 minutes, mixed together and stirred for 1 hour in a three necked round bottom flask with

simultaneous Argon purging. The organic layer was separated and treated as the precursor for Cadmium ions.

The precursor solution was divided into four equal portions of 25 ml (2.5 mM) to prepare CdS quantum dots of varying precursor ratio.

Step2: *Preparation of Sulfide ion precursor solutions*

60 mg (25 mM) of $Na_2S.9H_2O$ accurately weighed and made up to 10 ml with triply distilled water pretreated with Argon. This solution was treated as bulk. From the bulk solution, two precursor solutions of 10 ml of same concentration 6.3 (mM) were prepared such that the cadmium to sulfide mole ratio becomes 1:1 and they were labeled as S1, S2.

Step3: *Preparation of CdS nanocrystals*

25 ml (2.5 mM) of argon saturated Cd^{2+} precursor solution was taken in a round bottom flask and 10 ml of argon saturated S1 solution was taken in a pressure-equalizing funnel and added to the Cd^{2+}@TOAB solution with a uniform rate of 10ml/min with simultaneous stirring. The addition rate was maintained uniform through out the addition process. After 1 hour of stirring under inert atmosphere, a yellow organic layer obtained was separated from the aqueous phase and treated with a pinch of sodium sulfate to dehydrate the solution. The solvent was removed using rotary evaporator at 60°C. The yellow solid of TOAB stabilised CdS nanocrystals obtained was stored under vacuum. Similar procedure was followed to prepare CdS nanocrystals with a lower addition rate of 1ml/min sulphide precursor (S2). The nanocrystals obtained were stored in vaccum. The particles were redispersed in nonpolar solvents for further investigations. Some of the studies were carried out with the freshly prepared nanocrystals. In this method of synthesis, TOAB acts as phase transfer catalyst for cadmium ions initially and subsequently it acts as a stabilizer for the CdS particles formed.

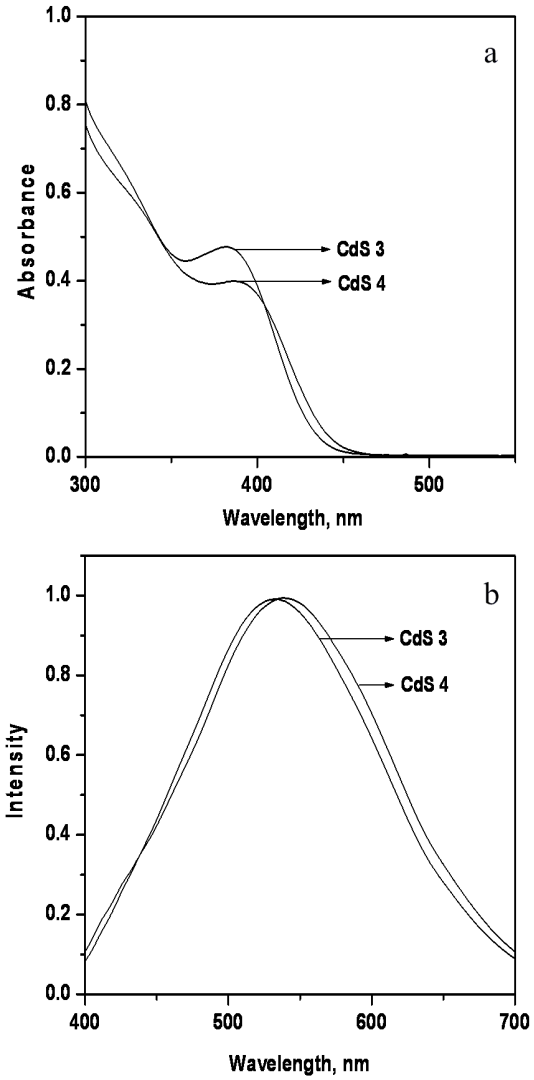


Figure S1: **a**) Absorption spectrum of 1:1 CdS nanocrystals CdS **3** at 7 ml/min, CdS **4** at 3 ml/min sulphide precursor addition rate. **b**) The corresponding emission spectrum of CdS **3** and CdS **4** (λ_{exc} = 370 nm)

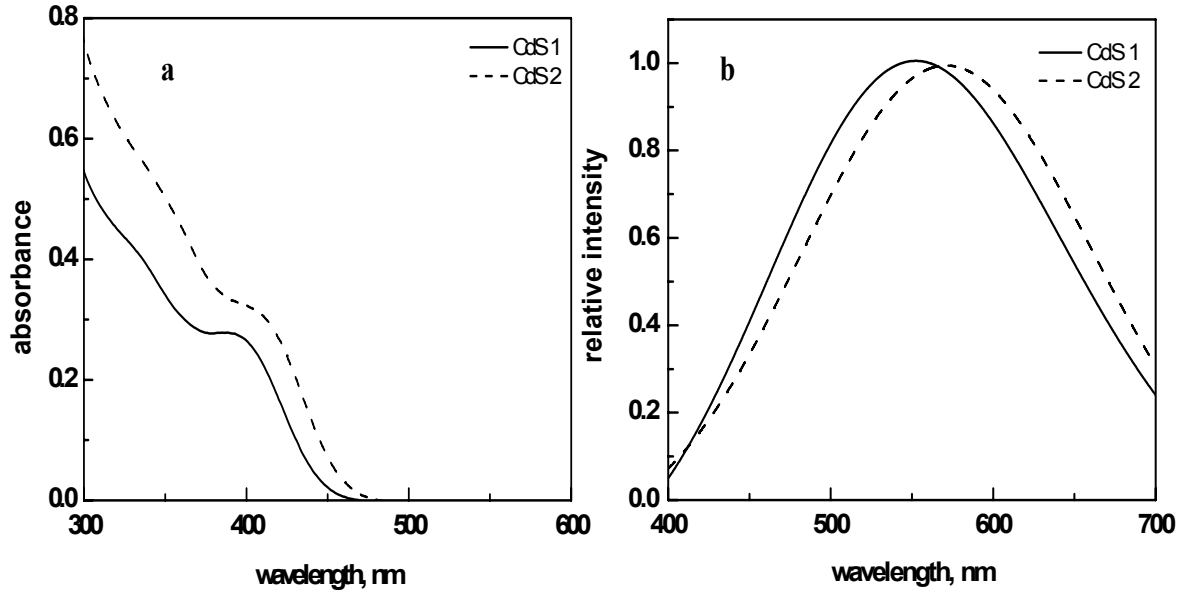


Figure S2: **a**) Absorption spectrum of 1:1 CdS quantum dots with higher concentration (20 mM) of TOAB CdS **1** at 10 ml/min, CdS **2** at 1 ml/min sulphide addition rate. **b**) The corresponding emission spectrum of CdS **1** and CdS **2** (λ_{exc} = 370 nm)

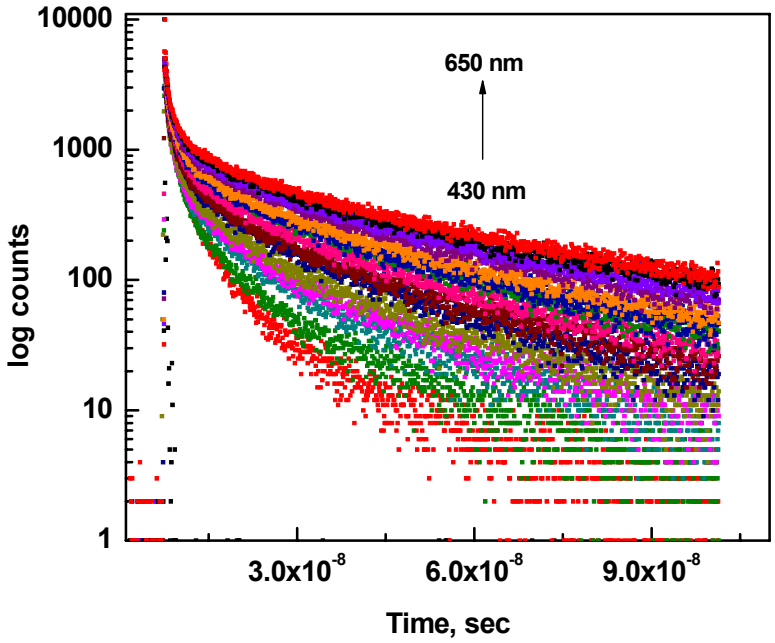


Figure S3: Lifetime decay of 1:1CdS nanorods monitored at different emission wavelengths (λ_{exc} = 373 nm)

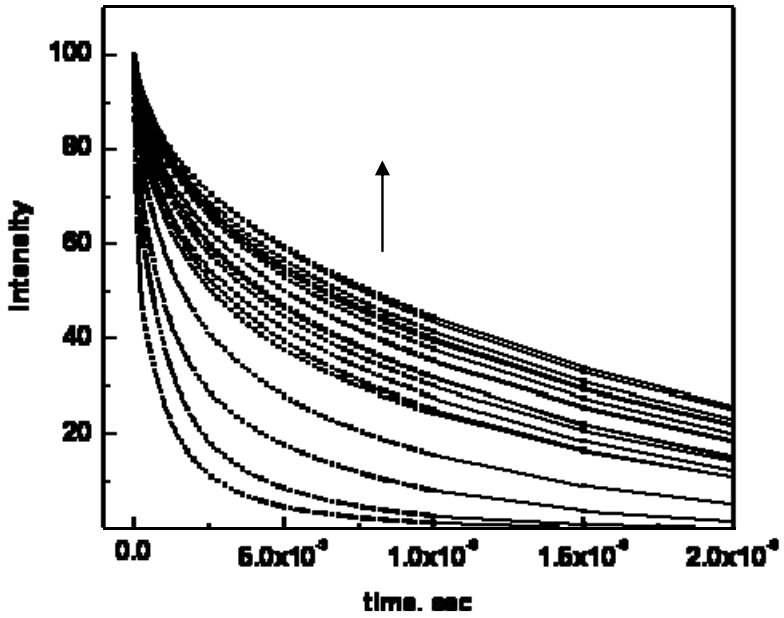


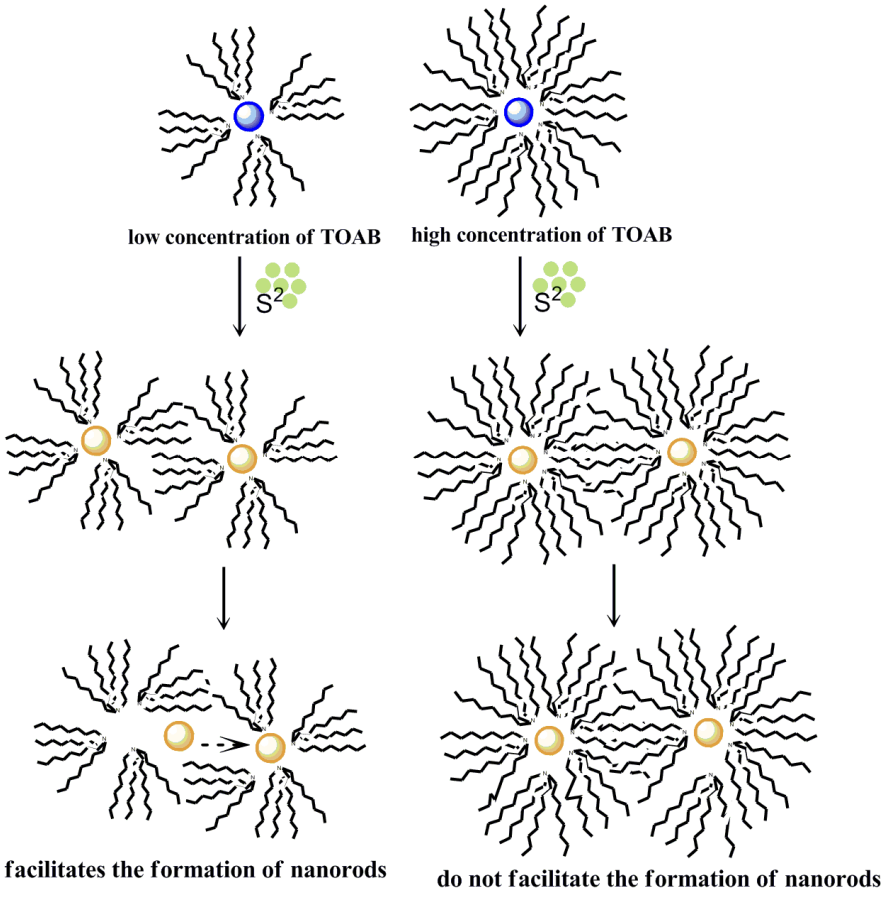
Figure S4: Lifetime decay constructed from the decay monitored at different wavelengths[23] and the steady state fluorescence of CdS nanorods.

Table S1: Emission decay lifetime of CdS nanorods in toluene monitored at different emission wavelengths

Wavelength, nm	τ_1, ns	B_1	τ_2, ns	B_2	τ_3, ns	B_3	χ^2
430	1.00	42.43	0.12	19.85	6.44	37.72	1.08
450	1.43	35.43	0.17	18.40	9.18	46.17	1.14
470	1.64	30.70	0.19	15.67	12.57	53.63	1.15
480	1.67	28.14	0.20	14.67	12.11	57.21	1.16
490	1.45	25.50	0.20	13.16	12.52	61.33	1.12
500	1.84	26.05	0.22	12.51	13.83	61.44	1.24
510	1.69	24.68	0.21	10.87	14.00	64.45	1.07
520	1.65	23.06	0.29	10.39	13.45	66.56	1.18
530	1.96	22.77	0.25	10.76	15.55	66.48	1.28
540	1.97	21.13	0.27	10.22	15.67	66.65	1.07
550	2.10	20.64	0.29	9.81	16.17	69.55	1.03
560	1.95	20.60	0.28	8.65	16.96	70.75	1.08
570	2.02	19.43	0.29	8.54	16.84	72.03	1.17
590	2.04	18.55	0.31	8.05	17.32	73.40	1.14
610	2.34	16.83	0.36	8.43	18.30	74.74	1.09
630	2.11	15.43	0.32	8.68	18.55	75.89	1.15

Table S2: Shows the d-spacing values of the X-ray diffraction spectrum of TOAB (blank)

S.No.	Pos. [°2Th.]	FWHM [°2Th.]	d-spacing [Å]
1	14.366	0.1171	6.1656
2	18.7953	0.2007	4.72141
3	20.5379	0.1506	4.32457
4	22.4553	0.1171	3.95946
5	23.1295	0.1004	3.84555
6	23.943	0.1338	3.71669
7	24.953	0.2007	3.56851
8	26.1982	0.1673	3.40165
9	27.2501	0.2007	3.27268
10	28.807	0.2007	3.09925
11	29.2333	0.2007	3.05503
12	30.4432	0.4684	2.93631
13	31.6223	0.1673	2.82946
14	32.2475	0.2007	2.77602
15	34.2468	0.2007	2.6184
16	35.473	0.2676	2.53065
17	36.1761	0.2007	2.48306
18	38.9159	0.8029	2.31433
19	41.1966	0.5353	2.19132
20	42.8601	0.4015	2.11005
21	43.7248	0.4015	2.0703
22	45.8169	0.4015	1.98052
23	47.0372	0.4896	1.93035



Scheme S1: Mechanism showing the effect of lower (10 mM) and higher (20 mM) concentration of TOAB in the formation of CdS nanorods