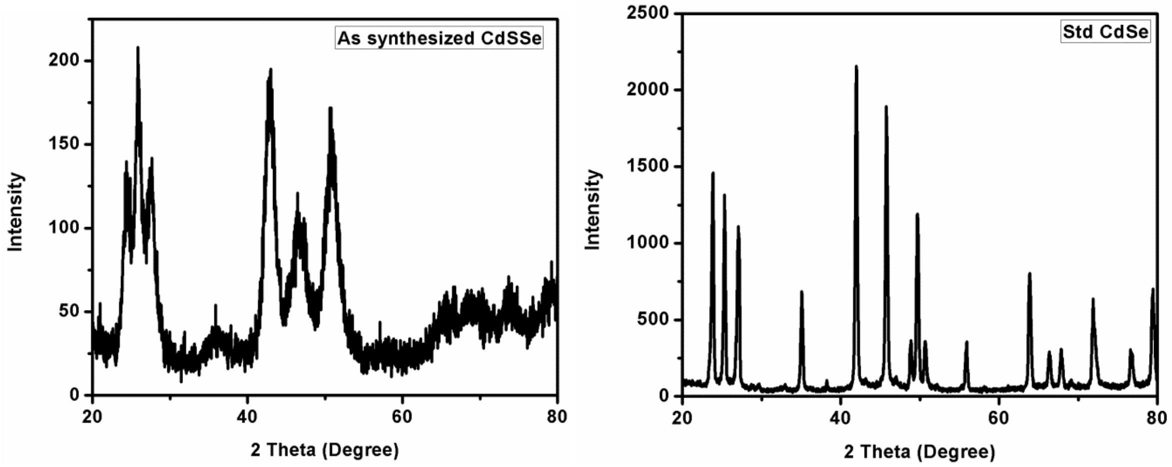
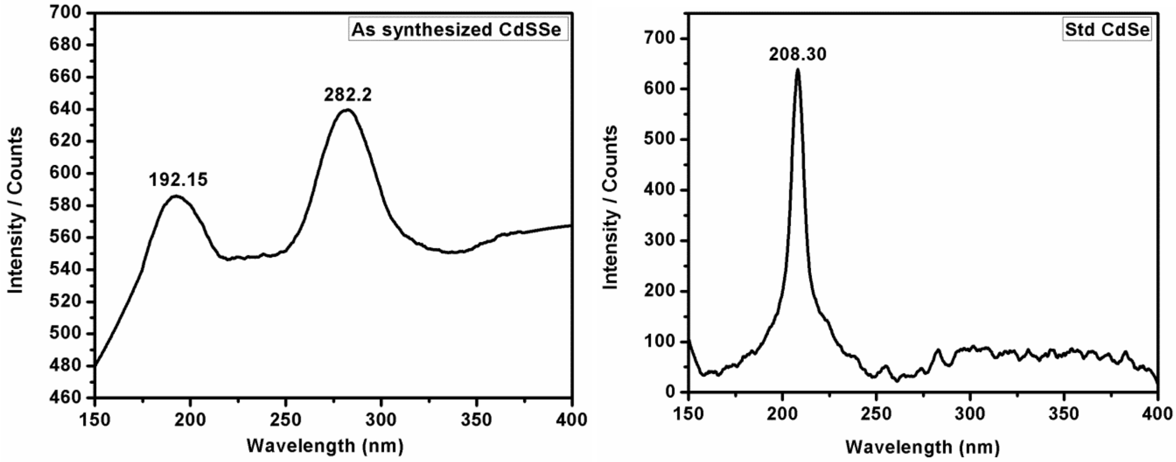
Supporting Information

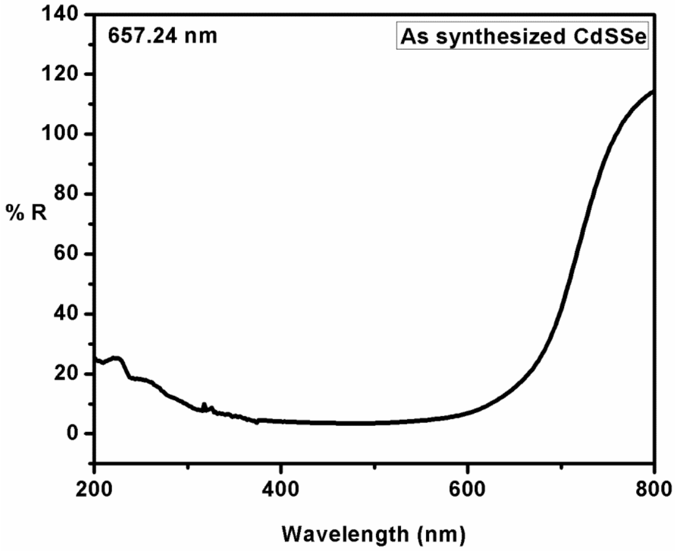
S-1: XRD of as synthesized $CdS_{0.5}Se_{0.5}$ and standard CdSe powder



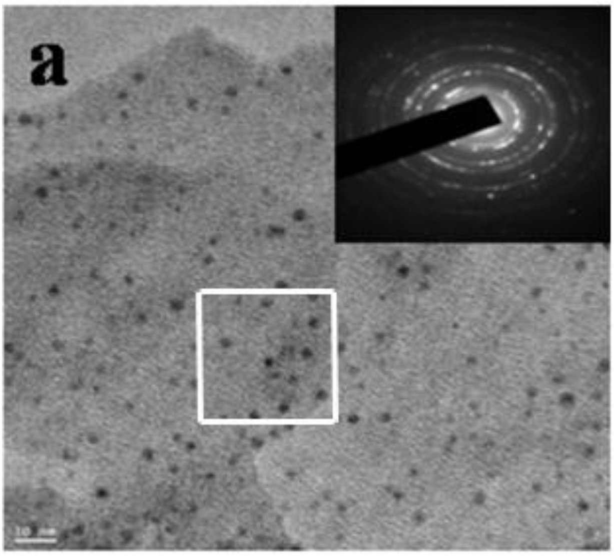
S-2: Raman spectra of as synthesized $CdS_{0.5}Se_{0.5}$ and standard CdSe Powder



S-3: UV-Vis spectra of as synthesized $CdS_{0.5}Se_{0.5}$ powder



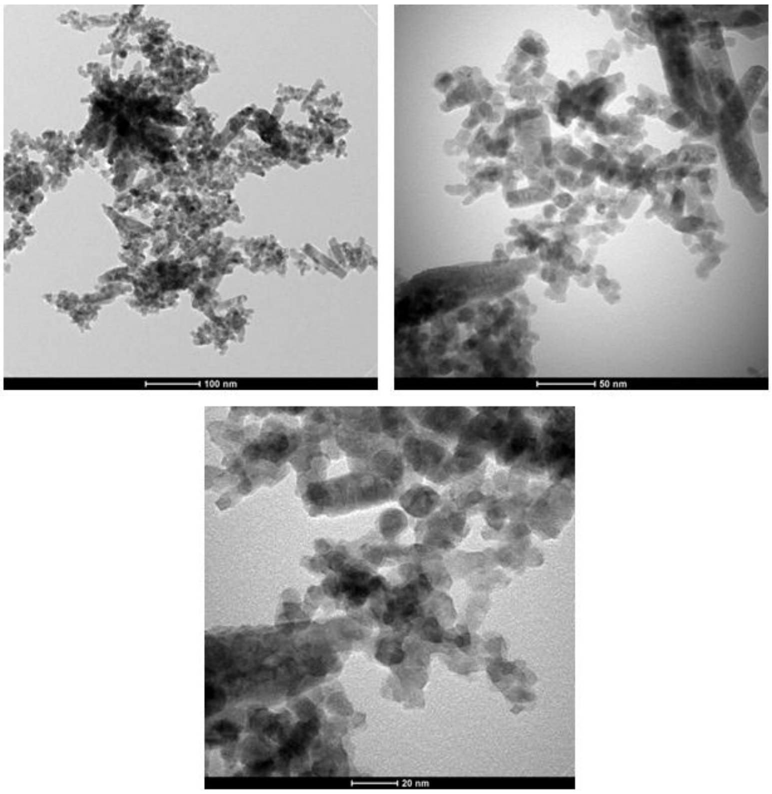
S4 : Narrow distribution of Quantum dots



HRTEM image of CdSe-glass nanosystem (CS03)

If, we consider 1 x 1 micron area of surface of the glass particle which contain around 400-500 QDs of CdSe of size 2-3 nm as shown in the HRTEM image. We have considered only one surface of the glass particle, if we consider other faces, ultimately there will be more number of QDs in the glass particle. It is quite understood that HRTEM gives clear presence of QDs on the surface of the glass. Hence, there is more number of active QDs of size 2-3 nm on the surface of the one glass particle of micron size. We used 0.5 gm of glass powder, which may contain huge number of glass particles of micron size. In nutshell, ultimately the exposed QDs are huge in numbers (difficult to measure) as the quantum dot size goes down. In other words, if the size is less than one nm then the exposed quantum dots will be more on surface of the glass particles. Hence, we achieved more hydrogen evolution for glass nanosystem having lower quantum dot size. Hence, we made logical statement that the exposed QDs on the glass surface are responsible for photocatalytic activity. The growth of quantum dots up to 1nm in glass matrix is challenging and same work is in progress. As glass is highly insulating does not have any significance because it gives zero photocatalytic activity. This is the novelty of our work.

S-5: TEM images of as synthesized $CdS_{0.5}Se_{0.5}$ powder.



S-6: Repeatability and reusability of photocatalyst, $CdS_{0.5}Se_{0.5}$/CdSe quantum dot–glass nanosystem

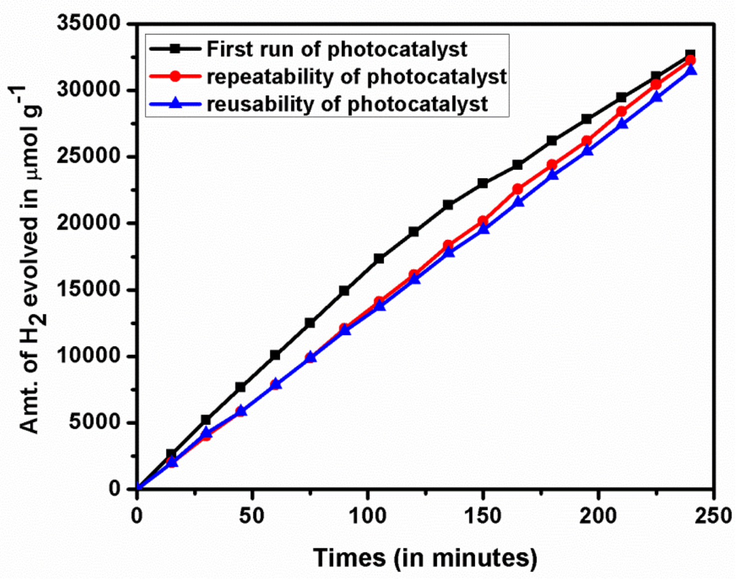


Figure S-6 (a). Photocatalytic activity for hydrogen evolution of $CdS_{0.5}Se_{0.5}$ dot–glass nanosystem (CSS03).

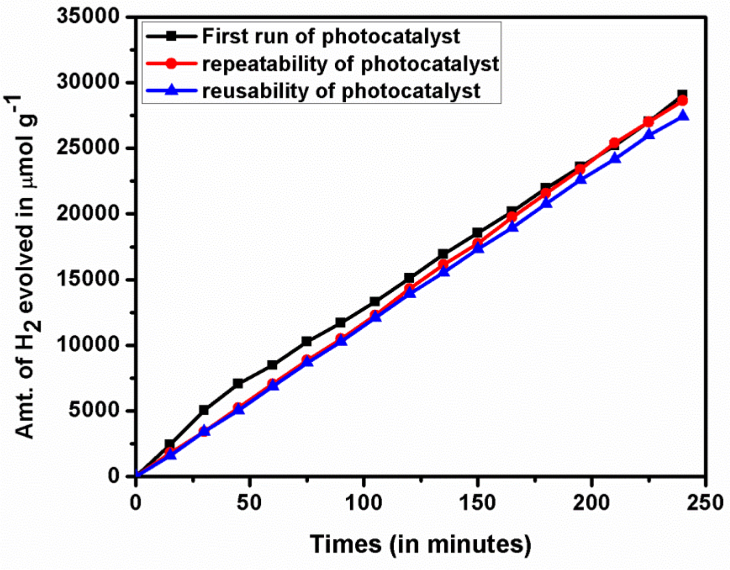
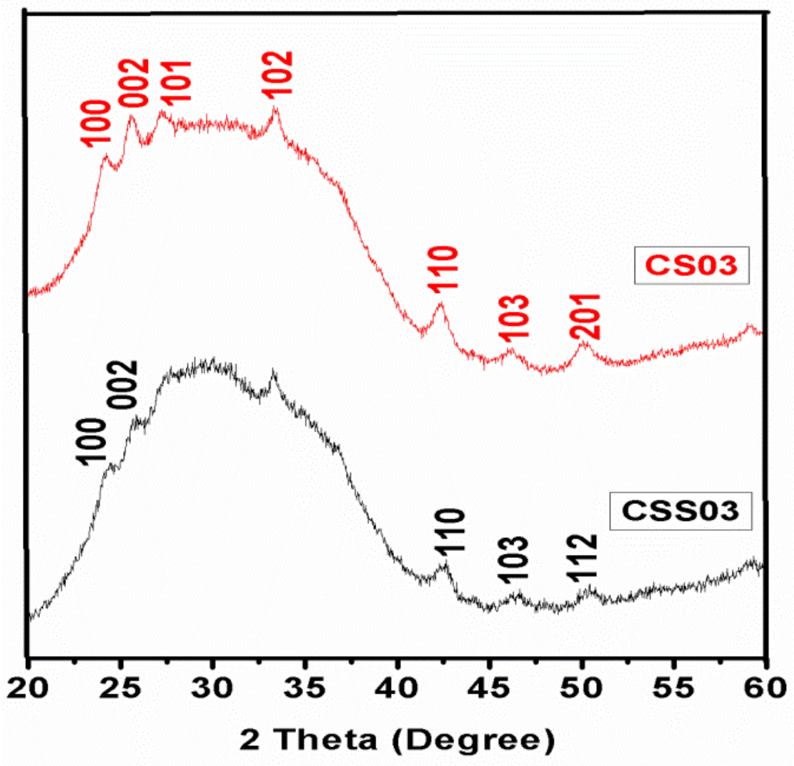


Figure S-6 (b). Photocatalytic activity for hydrogen evolution of CdSe quantum dot–glass nanosystem (CS03).

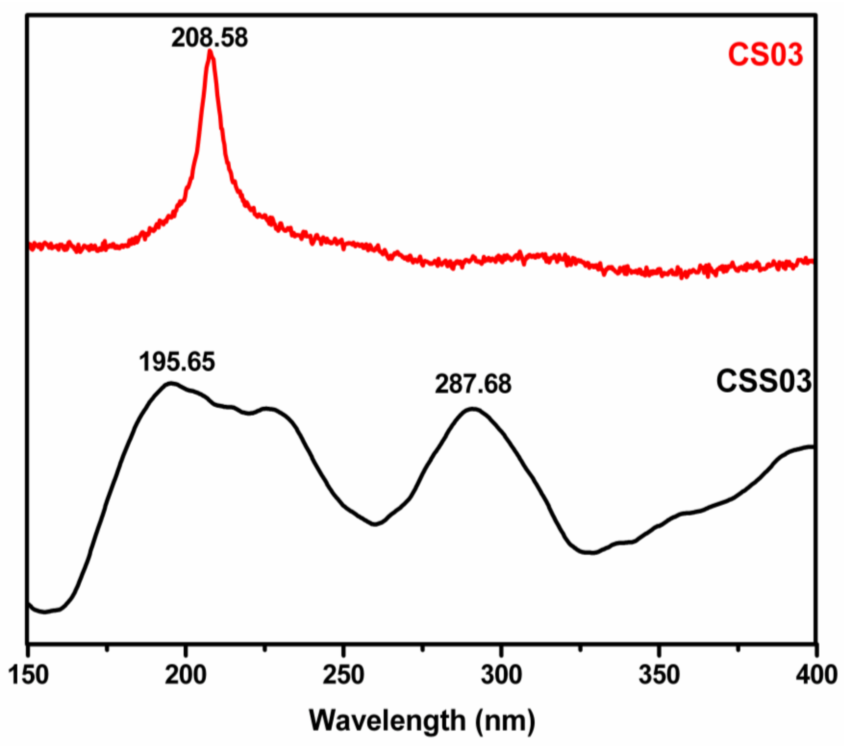
Table S1 : Summary of repeatability and reusability study of photocatalysts for hydrogen evolution.

Photocatalyst	Amount of hydrogen evolved in µmol h^{-1} g^{-1} for **first run**	Amount of hydrogen evolved in µmol h^{-1} g^{-1} for **second run (for repeatability study)**	Amount of hydrogen evolved in µmol h^{-1} g^{-1} for **reused run (For reusability study)**
CSS03	8164.53	8063.72	7862.14
CS03	7257.36	7156.56	6854.17

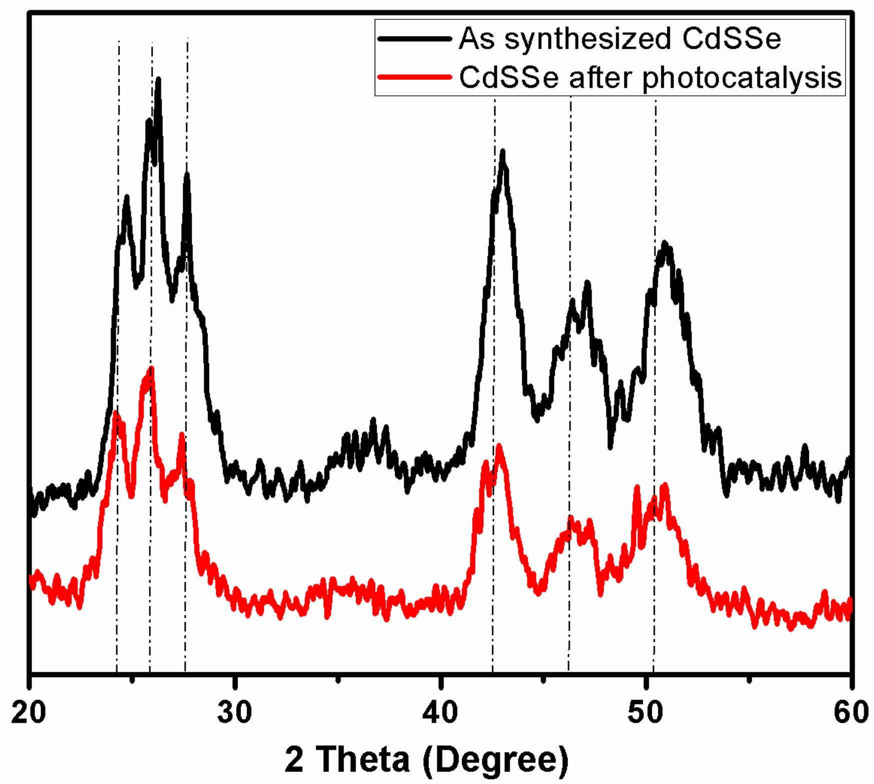
S-7: XRD pattern of reused glass photocatalysts



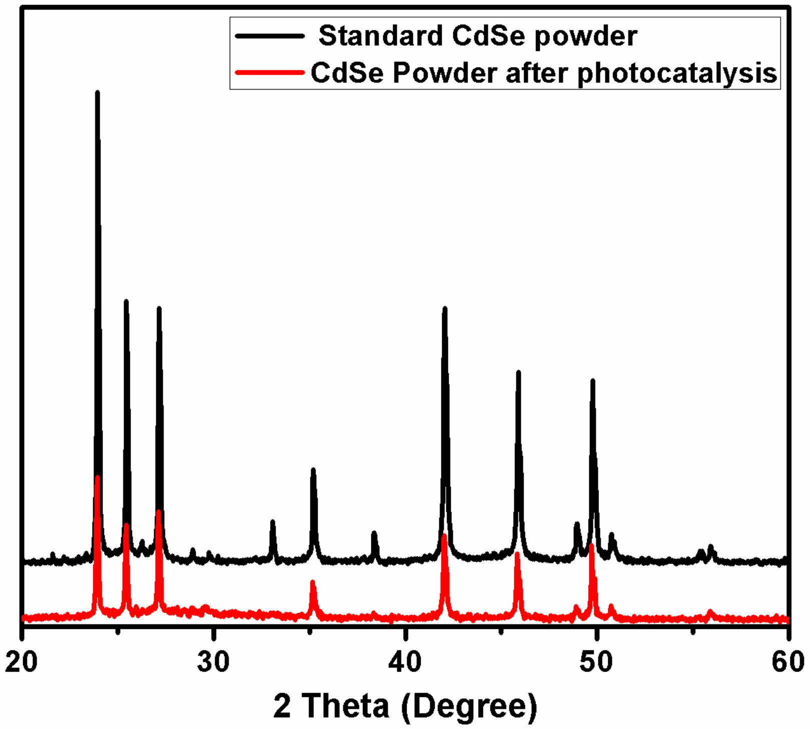
S-8: Raman spectra of reused glass photocatalysts



S-9: XRD pattern of as synthesized $CdS_{0.5}Se_{0.5}$ powder and $CdS_{0.5}Se_{0.5}$ powder after photocatalysis reaction.



S-10: XRD pattern of as synthesized CdSe powder and CdSe powder after photocatalysis reaction.



S-11: Synthesis procedure of $CdS_{0.5}Se_{0.5}$ powder

The synthesis of $CdS_{0.5}Se_{0.5}$ is carried out by procedure given in literature (Y. Liu, Y. Xu, J. P. Li and B. Zhang, *Materials Research Bulletin*, 2006, **41**, 99.

Procedure: The stoichiometric amount of Cd $(NO_3)_2$ $4H_2O$ was dissolved in 60 ml of DI water in a 250-ml glass beaker equipped with a magnetic stirrer, then $CS(NH_2)_2$, Se powder and 10 ml of $N_2H_4.H_2O$ were added into the beaker. The reactant solution was stirred for 10 min at room temperature and then removed to a stainless steel autoclave with a Teflon liner. The autoclave was kept at 140^0C for 10 h and then cooled to room temperature naturally. The precipitate was filtered, washed with distilled water and methanol. The product was dried at 70^0C in laboratory oven.