Strong UV Emission from Water Dispersible Eu^{2+}-doped $BaSO_4$ Nanoparticles: A Material for Enhancing the Photocatalytic Activity of Carbon Dots

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Here, we report a facile microwave-assisted green synthetic route for the preparation of highly luminescent water dispersible polyacrylic acid-coated europium (Eu^{2+})-doped $BaSO_4$ nanoparticles at low temperature for the first time. Polyacrylic acid coating over nanoparticles renders them water dispersible. Upon UV (250 nm) excitation, europium-doped $BaSO_4$ nanoparticles exhibit a strong and broad UV luminescence near at 368 nm. This emission peak is quite strong and has a relative luminescence quantum yield (QY) of 53%. The high QY of the UV emission from the nanoparticles is explored for the enhancement of the visible photocatalytic properties of the carbon dots (Cdots). In fact, faster degradation of the Rhodamine B is noted for the mixture containing both Eu^{2+}-doped $BaSO_4$ nanoparticles and cetyl trimethylamonium bromide capped Cdots. This is attributed to the strong overlap of the UV emission of Eu^{2+} with the absorption spectrum of Cdots leading to high energy transfer efficiency (~64%). The energy transfer process is supported by the observation of lower dye degradation for the colloidal mixtures having different (high to low) Cdots concentration where the distance between Eu^{2+} in $BaSO_4$ to Cdots is increased.