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Green Synthesis of Spinach Derived Carbon Dots for Photocatalytic Generation of Hydrogen from Sulfide Wastewater

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Abstract : Sulfide is one of the major pollutants of tannery effluent which is mainly generated during the process of unhairing. Recovery of Hydrogen green fuel from sulfide wastewater using photocatalysis is a 'Cleaner Production Method', since renewable solar energy is utilized. It has triple advantages of the generation of H2, waste minimization and odor or pollution control. Designing of safe and green photocatalysts and developing suitable solar photoreactor is important for promoting this technology to large-scale application. In this study, green photocatalyst i.e., spinach derived carbon dots (SCDs 5 wt % and 10 wt %)/TiO2 nanocomposite was synthesized for generation of H2 from sulfide wastewater using lab-scale solar photocatalytic reactor. The physical characterization of the synthesized solar light responsive nanocomposites were studied by using DRS UV-Vis, XRD, FTIR and FESEM analysis. The absorption edge of TiO2 nanoparticles is extended to visible region by the incorporation of SCDs, which was used for converting noxious pollutant sulfide into eco-friendly solar fuel H2. The SCDs (10 wt%)-TiO2 nanocomposite exhibits enhanced photocatalytic hydrogen production i.e. ~27 mL of H2 (180 min) from simulated sulfide wastewater under LED visible light irradiation which is higher as compared to SCDs. The enhancement in the photocatalytic generation of H2 is attributed to combining of SCDs which increased the charge mobility. This work may provide new insights to usage of naturally available and cheap materials to design novel nanocomposite as a visible light active photocatalyst for the generation of H2 from sulfide containing wastewater.

Keywords : carbon dots, hydrogen fuel, hydrogen sulfide, photocatalysis, sulfide wastewater
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