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Fabrication of Novel WO_3 /$NiCo_2O_4$ magnetic photocatalysts with UV-light driven photocatalytic activity in MB degradation in an aqueous solution

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This work presents the preparation and characterization of a novel synthesized Tungsten trioxide and Nickel Cobaltite hybrid (WO_3/$NiCo_2O_4$) and investigates its photocatalytic activity for Methylene Blue (MB) decomposition under UV radiation. The nanopowder of WO_3/$NiCo_2O_4$ was synthesized by hydrothermal method. The samples using various mass ratios (1:1, 1:2, and 2:1) of WO_3 and $NiCo_2O_4$ were prepared under the same conditions. Several techniques, such as XRD, SEM, TEM, BET, DRS, and VSM were used to characterize the structure and morphology of the products. The WO_3/$NiCo_2O_4$ photocatalysts exhibit enhanced photocatalytic removal efficiency towards the target pollutant in comparison to pristine $NiCo_2O_4$ and WO_3.

Although The valence band potential (EVB) of WO_3 reaches approximately 2.7–3.4 eV which is a suitable potential for oxidation but single component WO_3 has displayed low photocatalytic performance despite UV light or visible light range because of its low conduction band edge position (+0.5 V vs. NHE at pH = 0) [1]. $NiCo_2O_4$ is used as a valuable candidate for photocatalysis as it provides a redox couple of Co^{3+}/Co^{2+} and Ni^{3+}/Ni^{2+} which provide considerably more catalytic active sites when compared with NiO and Co_3O_4. However, the practical use of $NiCo_2O_4$ as photocatalytic material is minimal due to its low efficiency and long-term stability [2].

The aim of the synthesis of WO_3/$NiCo_2O_4$ hybrid samples is to improve the photocatalytic properties of semiconductors and to solve the challenges that were discussed. The advantage of the above research is the use of this photocatalyst to increase the efficiency of wastewater treatment and lower the costs to remove colored pollutants. The synthesized material must have magnetic properties to reuse the synthesized sample for multiple cycles in the photocatalytic process.The magnetic separation of WO_3/$NiCo_2O_4$ nanocomposite dispersed in an aqueous solution by employing a permanent magnet to provide a magnetic field is possible [3].

Keywords: Dye, Nanocomposite, $NiCo_2O_4$, Photocatalyst, WO_3

References

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