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Abstract

Facile Synthesis and Photocatalytic Performance Evaluation of Nickel Oxide and Ni-Cu-Fe Oxides as Solar-Light-Driven Nanophotocatalysts

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Abstract:

In the recent decades, large quantity of synthetic dyes has been released in the water resource through their usage in paper, textile, cosmetic, leather and other industries [1, 2]. They regarded as chemical pollutants which are profoundly poisonous and threats human and aquatic health [3, 4]. Hence, eliminating them from ground and surface water is significant problem. Advanced oxidation processes (AOPs) such as semiconductor-based photocatalytic degradation as "green" method due to free usage of solar irradiation, has attracted much attention since it is an eco-friendly, cost-effective and repeatable technology [5-7]. Therefore, development of novel nanophotocatalysts with unique properties and high photocatalytic performance under visible light irradiation are of great interest to the researchers. In this research, we successfully synthesized nickel oxide and Ni-Cu-Fe oxides nanocomposite by the sono-hydrothermal method, respectively. The physical, chemical and optical properties of the synthesized photocatalysts were characterized by analyses like XRD, FESEM, BET-BJH, and DRS. Furthermore, the synthesized samples were evaluated for the removal of various organic dyes (malachite green, acid orange 7, and methyl orange) from aqueous solution under simulated solar light irradiation. BET-BJH analysis results showed that the synthesized samples due to the well-formed morphology had high specific surface area, and large pore volume. Also, DRS analysis represented that Ni-Cu-Fe oxide nanocomposite had narrower band gap energy compared to bare Nickel oxide. The photocatalytic results confirmed that the removal rate of MG over bare Nickel oxide and Ni-Cu-Fe oxide nanocomposite was 10% and 89%, respectively, in 120 min of simulated solar light luminance. This nanocomposite also degraded 64 and 58.5% of AO7 and MO, respectively, indicating its ability to the removal of a wide range of organic dyes. This outstanding performance of Ni-Cu-Fe oxide nanocomposite compared to bare Nickel oxide is attributed to the suitable adsorption ability of dye molecules and enhanced absorption capability of irradiated light resulting from the well-formed morphology, appropriate pore size distribution and geometry, proper specific surface area, and low band gap energy.

Biography:

Iman Ghasemi was born in 1997. Iman earned B.Sc. degree in chemical engineering from Sahand University of Technology where he gained experience in water treatment by photocatalysis process under the supervision of Prof. Mohammad Haghighi. Since 2018 he has been joined Reactor and Catalysis Research Center and working on the nanophotocatalyst synthesis and their

applications in different organic dye degradation. Last summer, he worked more than 4 month for "Azar Sahand Plastic Production Plant" as an intern in its quality control laboratory. His research interests include the "Green" synthesis of nanocatalysts and its application in air and water pollution control and treatment, and the study of their reaction mechanisms and kinetics.

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