

The main objective of this study is to optimize the synthesis routes for producing high-performance nanoceramics and to systematically evaluate their efficiency in removing hazardous pollutants, including petroleum hydrocarbons, heavy metals, and recalcitrant organic compounds. In this work, a nanostructured Dy<sub>2</sub>Sn<sub>2</sub>O<sub>7</sub>@Ar-C<sub>3</sub>N<sub>4</sub>/NFT composite was successfully synthesized and characterized as an efficient photocatalyst for the purification of refinery wastewater. The synthesized nanoceramics were subjected to detailed structural, morphological, and functional characterization using X-ray diffraction (XRD), scanning electron microscopy (SEM), and Fourier transform infrared spectroscopy (FTIR). Moreover, the effects of key operating parameters such as pH, temperature, pollutant concentration, and catalyst dosage on photocatalytic efficiency were systematically investigated. The results demonstrated that the fibrous nanoceramic composite exhibits excellent photocatalytic activity and stability, leading to a remarkable reduction in various organic and inorganic contaminants. The optimized conditions significantly enhanced pollutant degradation rates, indicating promising potential for large-scale wastewater treatment applications. Overall, the study highlights the strong capability of Dy<sub>2</sub>Sn<sub>2</sub>O<sub>7</sub>@Ar-C<sub>3</sub>N<sub>4</sub>/NFT nanoceramics as a sustainable and efficient material for environmental remediation technologies.

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