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Synthesis and characterization of Iron tungstate Nanoparticles as a Photocatalyst and Nano-adsorbent
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Abstract
Iron tungstate ($FeWO_4$) nanoparticles were synthesized using a simple sol-gel method, employing sodium tungstate dihydrate and iron(II) sulfate as precursors, with distilled water serving as the solvent. The synthesized nanoparticles underwent a thorough characterization process utilizing various techniques, including Fourier-transform infrared (FTIR) spectroscopy, high-resolution scanning electron microscopy (HRSEM), high-resolution transmission electron microscopy (HRTEM), energy-dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), and Brunauer-Emmett-Teller (BET) nitrogen adsorption-desorption analysis.
FTIR spectroscopy revealed key vibrational modes: peaks at 771 cm^{-1} and 948 cm^{-1} were attributed to O–W–O vibrations and W–O bond stretching, respectively. Additionally, a peak at 567 cm^{-1} corresponded to Fe–O bending vibrations, while peaks at 3423 cm^{-1} and 1620 cm^{-1} were assigned to H–O–H stretching modes and bending vibrations, indicating the presence of free or adsorbed water. HRSEM and HRTEM analyses confirmed that the nanoparticles had an aggregated, spherical morphology. Furthermore, XRD analysis demonstrated the formation of a highly crystalline monoclinic phase of $FeWO_4$ under optimal synthesis conditions: a solution pH of 7, a reaction temperature of 30℃, and a stirring speed of 500 rpm. This comprehensive characterization underscores the successful synthesis of $FeWO_4$ nanoparticles and highlights their potential for various applications across multiple fields.

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