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ÁREA: Síntese e caracterização de catalisadores e adsorventes

Evaluation of different synthetic routes on the physicochemical properties of MIL-100(Fe) for application in photocatalysis

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Resumo-Abstract

Metal-organic frameworks (MOFs) are materials composed of a three-dimensional network of metal ions and organic ligands. The MIL-100(Fe) MOF is formed by iron ions and trimesic acid as the ligand. Its porous structure and high surface area have attracted interest in various catalytic applications, such as heterogeneous photo-Fenton processes aimed at degrading toxic and recalcitrant compounds present in effluents. Different synthetic routes result in distinct physicochemical properties, affecting the material's structural, textural, and morphological characteristics, which directly impact its applications. The study of these routes also aims to optimize large-scale synthesis using accessible solvents, methodologies, and equipment, promoting economic and clean production. The objective of this study was to evaluate and compare the effects of synthesis by hydrothermal and direct precipitation methods on the physicochemical properties of MIL-100(Fe) MOF, following the synthesis procedures described in the literature [1-2]. Characterizations were performed by X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), nitrogen adsorption/desorption, and thermogravimetric analysis (TG/DTG). The MOF obtained by hydrothermal synthesis exhibited a more defined crystalline structure, as well as a higher surface area and pore volume (582 m^2/g and 0.42 cm^3/g) compared to direct precipitation (93 m^2/g and 0.05 cm^3/g). FT-IR analysis showed characteristic bands of the chemical bonds reported in the literature for the MIL-100(Fe) structure [3]. Regarding SEM analysis, differences in morphology were observed. In TG/DTG profiles, stages identified as dehydration, structural collapse, and complete degradation to oxides revealed slightly higher thermal stability in the direct precipitation method. From this study, it was concluded that although the precipitation route is simpler, the hydrothermal method offers better characteristics for photocatalytic applications, such as higher surface area.

Keywords: MOF, Room temperature green synthesis, hydrothermal synthesis, photocatalysis.

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