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EXPLORING ZIF 8, MOF 5 AND ZIF 67: ADVANCES IN METAL ORGANIC FRAMEWORK SYNTHESIS

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Introduction. Lithium is a crucial component in lithium-ion batteries, essential for electronic devices and electric vehicles. The growing demand for sustainable technologies has driven research into advanced materials for efficient lithium extraction. This study explores three metal-organic frameworks (MOFs): ZIF-8 [1,2], MOF-5 [3], and ZIF-67 [4]. While ZIF-8 and MOF-5 are zinc-based, ZIF-67 contains cobalt but shares a similar structure with ZIF-8. These MOFs were chosen for their structure and properties, making them suitable for studying their efficacy in lithium extraction. By comparing these MOFs, we aim to better understand their synthesis conditions and performance [4].

Study Approach.

Utilizing the hydrothermal method for the synthesis of the MOFs, the main intention was to compare the synthesis conditions and characteristics of ZIF-8, MOF-5, and ZIF-67. Scanning Electron Microscopy (SEM) was employed to evaluate the morphology and size of the crystals, while X-ray Diffraction (XRD) was used to identify the crystalline phases and verify the purity of the synthesized MOFs. This data is crucial for better understanding their structural properties and optimizing their performance in lithium extraction

The general objective of this study was to evaluate and compare the synthesis conditions, structural characteristics, and lithium extraction performance of ZIF-8, MOF-5, and ZIF-67 MOFs, contributing to the advancement of lithium extraction.

The specific objectives are as follows:

1. "Optimization of MOF Synthesis" – This objective was achieved by adjusting the synthesis parameters and evaluating the quality and purity of the synthesized MOFs.
2. "Exploration of Composition and Structural Characterization" – To achieve this, Scanning Electron Microscopy (SEM) and X-ray Diffraction (XRD) were used to analyze the morphology, crystal size, and crystalline phases of the synthesized MOFs.
3. "Comparative Analysis of MOF Performance" – The advantages and limitations of each MOF were identified, along with an analysis of the factors influencing their performance in lithium extraction applications.

Conclusion. This study provides an initial understanding of the properties and performance of the MOFs ZIF-8, MOF-5, and ZIF-67 in lithium extraction. Through structural characterization and extraction tests, knowledge of these materials has been advanced. The obtained results lay the foundation for future research and applications in lithium separation techniques.

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