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ÁREA: Síntese e caracterização de catalisadores e adsorventes

Rota alternativa para síntese de ZIF-7-III via conversão por solvente evaporado

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Resumo-Abstract

Zeolitic Imidazolate frameworks (ZIFs) has established itself as versatile materials for various applications. Most of the known synthesis routes for ZIFs, and others metalorganic frameworks, use organic solvents, however, synthesises in aqueous media stand out for reducing the amount of harmful residues produced being more sustainable, although, these routes tend to use a higher ligand/metal molar ratio or use of a deprotonator base for the synthesis of ZIFs, with its stoichiometric molar ratio. This work proposes the use of the evaporated solvent conversion method (SEC) as an alternative route for the synthesis of ZIF-7-III, aiming at a reduction in the number of steps in the synthesis process as well as the reduction of the number of reagents and production of residue since this method does not require the use of an ammonia atmosphere [2].

For the synthesis with the SEC route, benzimidazole (bIm) was used as the ligand and zinc acetate as the metal source, both were deposed in a 8 mL Teflon beaker supported on 40 g of 4A zeolite containing water, this system was sealed in a 250 mL Teflon beaker in a stainless autoclave, which is maintained under thermal treatment at 100°C for 24h. Different Zn^{2+}:bIm:H_2O ratios were tested to evaluate the effects of these ratios on the crystallinity and purity of the obtained material. For comparison, an hydrothermal synthesis (HT) was made with zinc nitrate as the metal source and ammonium hydroxide as the deprotonator agent with the molar ratio Zn^{2+}:bIm:NH_4OH:H_2O of 1:2:17,5:200 maintaining the condition of the thermal treatment. For the characterization of the materials obtained, their topologies were identified by XRD, their composition was analysed by FTIR, and their morphology was analysed by SEM without metallization of the samples.

Comparing the material obtained via SEC with the materials obtained by the hydrothermal method it was observed that the SEC method is quite promising, which is evidenced by the significant increase in the crystallinity of the material obtained and by the nanosheet morphology which is normally obtained by microemulsion route of synthesis, as well as the fact that the material obtained is dry, eliminating the need for separation by centrifugation or filtration, however, the strict control of the amount of water and the bIm/Zn^{2+} ratio is the key to obtaining a pure and more crystalline phase.

Palavras-chave: Steam Evaporated Conversion, Sustainable synthesis, ZIF-7

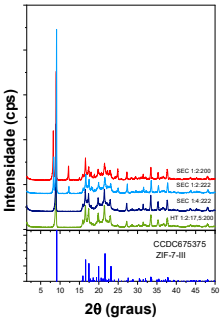

Figure 1: comparison of the diffractograms of the samples obtained by SEC and HT route and the literature standard for ZIF-7-III

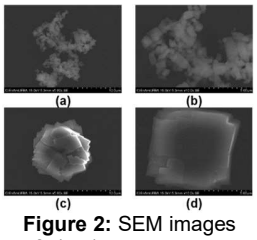

Figure 2: SEM images of (a-b) HT obtained samples and (c-d) SEC obtained samples

Referências

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