XIV ENCAT
Encontro de Catálise do Norte, Nordeste e Centro-Oeste
Catálise: Impulsionando a transição energética para um futuro mais sustentável
17-19 novembro 2024 • Fortaleza
SBCAT SOCIEDADE BRASILEIRA DE CATÁLISE

AREA: Synthesis and characterization of catalysts and adsorbents

Chabazite zeolite via interzeolite conversion

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Abstract

In face of the increasing demand of conventional energy sources and the consequent environmental impacts, in particular those related to global warming, the development of sustainable and renewable energy technologies is highly demanded. In this context, biogas from anaerobic digestion of the organic fraction of municipal solid waste represents an important alternative as energy source. Nevertheless, its use requires cleaning and upgrading processes to remove CO_2, which can represent 30-60% of the biogas as well as other undesired trace components such as H_2S, water vapor, and N_2 [1]. Techniques for CO_2 separation include absorption, membranes, cryogenic distillation, and adsorption. Adsorption proved to be more suitable for several upgrading plants due to the adsorbent regeneration feature and also to the flexible design for different adsorbents [2].

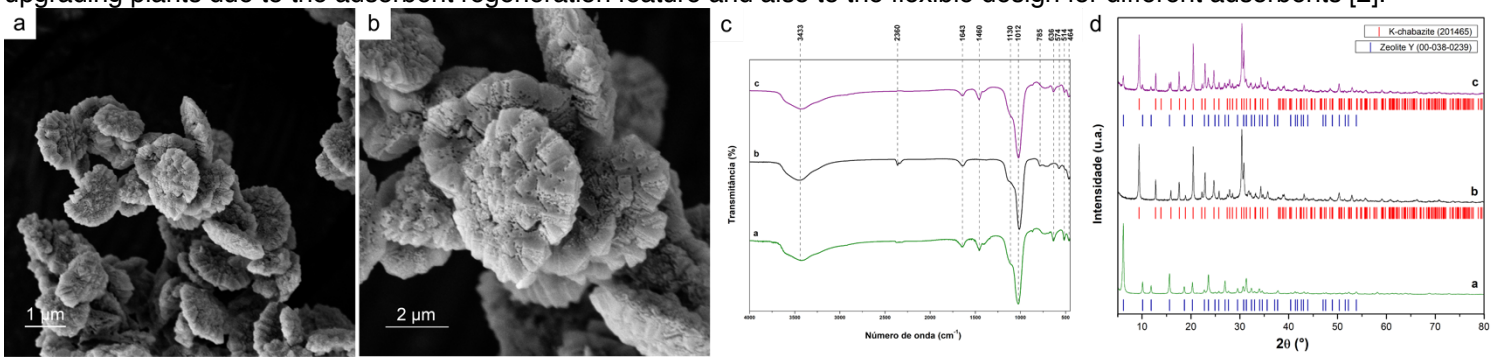

Fig. 1. *SEM images of chabazite zeolite with two magnifications: x 20 K (a) and x 50 K (b); FTIR spectra of chabazite zeolite (c.c and c.b) and zeolite Y (c.a); XRD patterns of zeolite samples chabazite (d.c and d.b) and zeolite Y (d.a).*

Zeolites, crystalline aluminossilicates with high ordered porous systems, can be used as highly efficient adsorbents for CO_2 capture. In this work, it is presented a strategy for the synthesis of Zeolite Chabazite via zeolite interconversion using Zeolite Y crystals and using fly ash as the precursor material. By means of a series of techniques such as powder X-ray diffraction, Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy, we were able to confirm the efficiency of syntheses process. The micrographs show the morphology of the zeolitic crystals, as well as their uniform shapes and sizes, containing cuboidal characteristics. Its clusters resemble swollen disks [3]. FTIR spectra shows subtle differences in relation to Y zeolite (mother zeolite) and chabazite zeolite (daughter zeolite), with specific bands for the first one (1460 cm^{-1}, 636 cm^{-1}, 514 cm^{-1}) and for the second one (2360 cm^{-1}, 785 cm^{-1}, 574 cm^{-1}). In addition, the X-ray pattern shows the crystalline phases of zeolite Y, which are different from the phases observed for chabazite zeolite, showing its complete zeolite. Furthermore, as an improvement to this work, adsorption isotherms will be produced to evaluate the kinetic behavior of the synthesized material.

Keywords: Zeolites, Zeolitic Interconversion, Adsorption, Biogas.

References

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Acknowledgement

CAPES, CNPq, Central Analítica (UFC), Laboratório de Raios-X (UFC) and Laboratório de Peneiras Moleculares (UFRN).