Synthesis and Characterization of MCM-41 impregnated with Magnesium and Chromium and its Catalytic Properties for Reaction of Ethanol Conversion

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Motivation

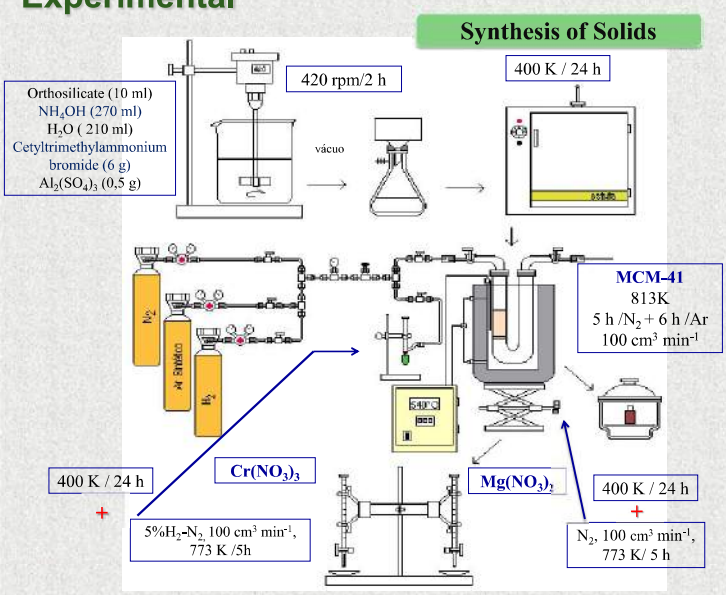
The high production of ethyl alcohol, initially motivated by its application as an energy alternative to fossil fuels, also allowed the return of alcohol chemistry, that ethanol has been harnessed as a renewable feedstock for the manufacture of chemicals with high value, which were formerly produced by significantly more aggressive to the environment reaction routes and chemical processes [1;2]. However, despite recent advances achieved by alcohol chemistry, the new challenges and requirements of the industry make the preparation and study of new formulations of catalysts for exploitation of alcohol applications as raw material is an area of research with constant demand, especially in countries with high ethanol like Brazil [3].

Among the advances in the synthesis of catalytic, are the mesoporous materials, which have uniform pore distribution in a range of 2 to 10 nm, and have high potential for application, mainly as precursors in the synthesis of catalysts formed from the introduction metals in their structural network, being by isomorphic substitution or by post-synthesis impregnation [4]. Among these materials stand out from the molecular sieve MCM-41, which was synthesized in the laboratories of Mobil Oil Company [5]. Although catalysts based on MCM-41 have already shown active for this type of reactions, studies are needed for a better understanding of their catalytic behavior in general, making emphasis on the effect of impregnation of various metals in the selectivity to products still are.

Goals

The present work aims to synthesize and characterize bifunctional compounds of the type MCM-41 with and without Al in the structure and impregnate them with Mg and Cr and verify the effect of the percentages of these metals on the support on the catalytic activity of ethanol vapor and selectivity to the products.

Experimental



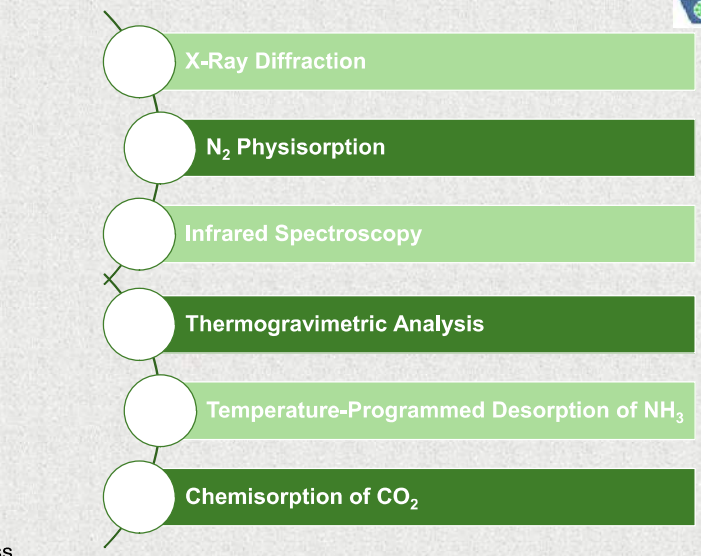


Figure 1. Design of the synthesis of MCM-41 support and metal catalysts process.

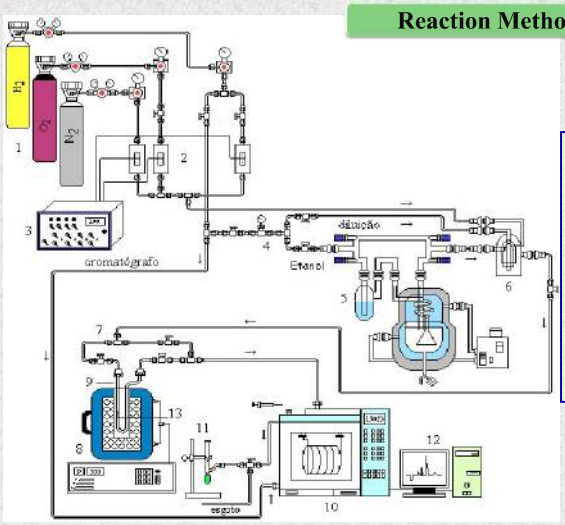


Figure 2. Design of reaction system.

Processing Results

The conversion is expressed as a percentage (%) considering the number of initial moles of reactant (n_0) relative to the number of moles of reactant in a given time (n_t).

$$X = \frac{n_0 - n_t}{n_0} \times 100$$

The selectivity is determined by the number of moles of a product (n_i) in relation to the number of moles of the sum of all products ($\Sigma\, n_n$).

$$S = \frac{n_i}{\sum_n^0 n_n} \times 100$$

References

1. Haishi T., Kasai K., Iwamoto M., Chemistry Letters, v. 40, (2011).
2. Sugiyama S., Kato Y., Wada T., Ogawa S., Nakagawa K., Sotowa K. Topics in Catalysis, v.53 (2010).
3. Angelici, C., Weckhuysen B. M., Bruijnincx P. C. A. Chemsuschem, v. 6, (2013).
4. Corma, A., Kan, Q., Navarro, M. T., Pariente, J. P., Rey, F. *Chem. Mater*, 9(10), p. 2123-2126, (1997).
5. Beck, J. S. Vartuli, J. C., Roth, J. W., Leonowicz, M.E., Kresge, C. T., Schmitt, K. D., Chu, C. T. W., Olson, O. H., Sheppard, E. W., Mccullen, S. B., Higgins, J. B., Schlenkert, J. L. *Journal American Chemistry Society*, 114 (27), p. 10834-10843, (1992).