International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(2): 33-34

Received: 07-01-2017
Accepted: 08-02-2017

Sachin B Kakodkar
Department of Chemistry, Parvatibai Chowgule College of Arts and Science (Autonomous), Margao, Goa, India

Correspondence
Sachin B Kakodkar
Department of Chemistry, Parvatibai Chowgule College of Arts and Science (Autonomous), Margao, Goa, India

Catalytic activity of MCM-41 catalyst for dehydration reaction of isopropyl alcohol: Correlation of catalytic activity with acidity of catalyst

Sachin B Kakodkar

Abstract
The catalytic activity of MCM-41 catalysts has been evaluated for the dehydration reaction of isopropyl alcohol. The catalytic activity is correlated to the acidity of the catalysts.

Keywords: MCM-41, dehydration, isopropyl alcohol

1. Introduction
Ever since their discovery M41S family of crystalline mesoporous materials attracted increasing attention of researchers working in areas of catalysis and materials science [1, 2]. MCM-41 is a high surface area material which can be easily modified by incorporation of different cations, thus leading to materials with acidic or redox properties. Because of their high flexibility in terms of synthesis conditions, pore size tuning and framework composition, they find applications in a number of catalytic applications.
MCM-41 has been used as catalyst for various reactions such as acylation and alkylation [3], oxidation [4], etc. The present paper deals with catalytic activity of MCM-41 (previously reported) [5] for the dehydration reaction of isopropyl alcohol. The catalytic activity is correlated to the acidity of the catalysts.

2. Experimental
The syntheses of MCM-41 catalysts used in the following studies and their acidity studies by temperature programmed desorption of ammonia have been reported earlier [5].

2.1 Dehydration reaction of isopropyl alcohol
The dehydration of isopropyl alcohol was carried out in a vertical flow type of a reactor system at atmospheric pressure. In a typical experiment, 1.0 g of the finely powdered catalyst is packed in a quartz reactor. The catalyst is activated in flowing air for about 6 hours at 500 ^{o}C. The temperature is then brought to the reaction temperature in dry nitrogen. The reactant isopropyl alcohol is passed through the reactor using syringe peristaltic feed pump at preset flow rate to get the desired weight hourly space velocity (WHSV). The products were analysed by gas chromatography using a Chemito 8610 HT gas chromatograph using Porapak Q column. The products of the reaction were found to be the propene and diisopropyl ether (DPE). The dehydration reaction of isopropyl alcohol was carried out at a temperature of 250 ^{o}C, WHSV of 4.00 h^{-1} over various MCM-41 catalysts.

3. Results and Discussion
3.1 Reaction Conditions
Temperature = 250 ^{o}C
Weight of catalyst = 1 g
WHSV = 4.00 h^{-1}
TOS = 2 h
HMCM-41(1) was the most active catalyst for the dehydration reaction of isopropyl alcohol as seen from Figure 1. It also exhibited a high selectivity towards diisopropyl ether. Since the reaction is an acid catalysed reaction the high activity of the catalyst is justified.

The sulphated catalysts also exhibited a high catalytic activity as compared to the original catalyst i.e. SiMCM-41. Also the highly sulphated sample S/SiMCM-41(2) exhibited a higher selectivity towards diisopropyl ether. Thus it is indicative that the dehydration of alcohol to ether requires more strong acidity as possessed by these two catalysts. The catalysts with lower acidities like SiMCM-41 and NaMCM-41 were found to exhibit poor catalytic activity.

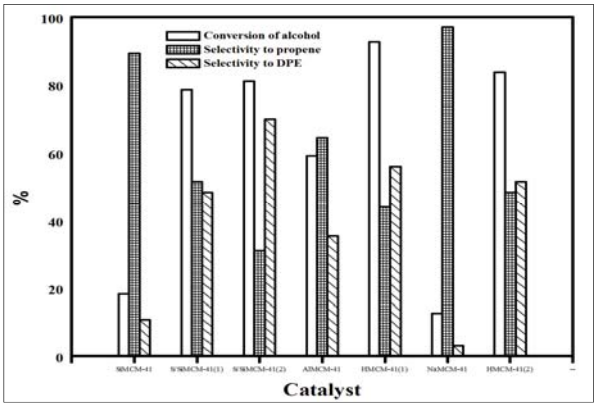

Fig 1: Catalytic Activity of various MCM-41 catalysts for the dehydration reaction of isopropyl alcohol

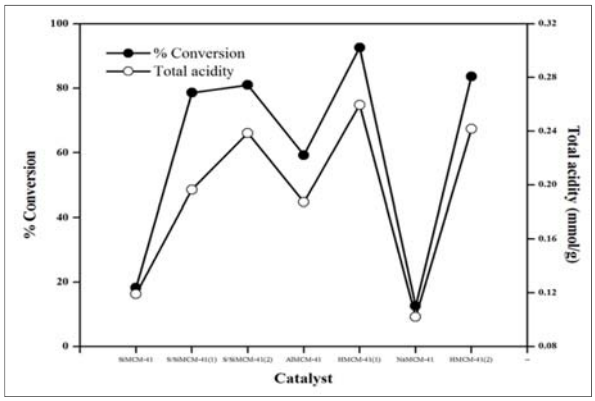

Fig 2: Catalytic Activity of various MCM-41 catalysts for dehydration reaction of isopropyl alcohol and corresponding total acidity

From Figure 2, it is evident that conversion of alcohol nearly followed the same trend as total acidity which indicates that the acid sites in the catalyst are the active sites for the conversion of alcohol.

4. References

1. Kresge CT, Leonowicz ME, Roth WJ, Vartuli JC, Beck JS. Nature. 1992; 359:710.
2. Beck JS, Vartuli C, Roth WJ, Leonowicz ME, Kresge CT, Schmitt KD *et al.* J Am Chem Soc. 1992; 114:10834.
3. Kadgaonkar MD, Laha SC, Pandey RK, Kumar P, Mirajkar SP, Kumar R. Catalysis Today. 2004; 97:225.
4. Srinivas N, Radha Rani V, Kulkarni SJ, Raghavan KV. J. Mol. Catal. A: Chemical. 2002; 179(1-2):221.
5. Kakodkar SB, Chem. Sci. Trans. 2015; 4(2):438.