

Alternative Greener Method for Preparation of Alkenes from Alcohol

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Salem State University, Fall 2010

Background:

Most undergraduate organic chemistry labs study the preparation of alkenes via the dehydration reaction of alcohols. Traditionally, concentrated sulfuric or phosphoric acid is used as a catalyst for this reaction.¹ These concentrated acids are corrosive and cause unnecessary waste that can be harmful to humans and the environment. An alternative greener method is proposed, using Montmorillonite KSF clay, a non-toxic and reusable catalyst.²

The clay catalyzes the dehydration reaction of 2-methylcyclohexanol to give an isomeric mixture of alkenes. The major product of this reaction is 1-methylcyclohexene, which comprises approximately 67% of the product when formed via the traditional acid-catalyzed method.³ The minor products of this reaction are 3-methylcyclohexene and a small amount of methylenecyclohexane, as shown in Figure 1.

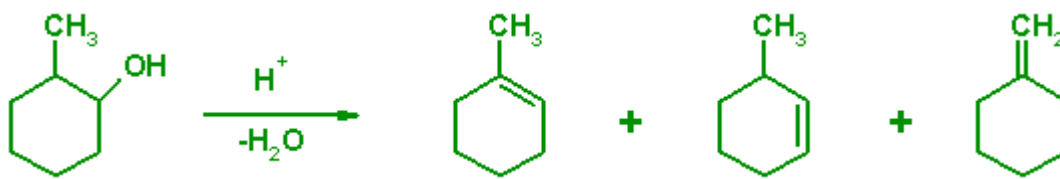


Figure 1.

Experimental Procedure:

Into a 25 mL round bottom flask, add 5 mL of 2-methylcyclohexanol and 0.25 g of Montmorillonite KSF clay, along with a magnetic stirring bar. Attach a condenser and reflux the solution with stirring for 90 min. After this time, allow the flask to cool briefly and reassemble the apparatus for a simple distillation to allow separation of the product from the unreacted alcohol and the catalyst. Collect about 2 mL of product and then analyze via gas chromatography to determine the percentages of different isomers in the product mixture.

References:

1. Dehydration of 2-methylcyclohexanol. *J. Chem. Educ.* **1967** 44 (10), 620.
2. Alkene preparation via the principles of green chemistry. *Educación Química* **2010**, 21(2), 183-189.
3. Levy, Irvin J. Informal Communication. Salem State University. Dec 2010.