Acid-catalyzed dehydration of small 1º-alcohols constitutes a specialized method of preparing symmetrical ethers.

**Introduction**

As shown in the following two equations, the success of this procedure depends on the temperature. At 110° to 130 °C an $S_N2$ reaction of the alcohol conjugate acid leads to an ether product. At higher temperatures (over 150 °C) an E2 elimination takes place.

\[
2 \text{CH}_3\text{CH}_2\text{OH} + \text{H}_2\text{SO}_4 \rightarrow [130 °C] \text{CH}_3\text{CH}_2\text{O}-\text{CH}_2\text{CH}_3 + \text{H}_2\text{O}\\
\]

\[
\text{CH}_3\text{CH}_2\text{OH} + \text{H}_2\text{SO}_4 \rightarrow [150 °C] \text{CH}_2=\text{CH}_2 + \text{H}_2\text{O}\\
\]

In this reaction alcohol has to be used in excess and the temperature has to be maintained around 413 K. If alcohol is not used in excess or the temperature is higher, the alcohol will preferably undergo dehydration to yield alkene.

\[
\text{CH}_2\text{CH}_3\text{OH} \xrightarrow{\text{H}_2\text{SO}_4, 443 K} \text{CH}_2=\text{CH}_2 \\
\text{CH}_2\text{CH}_3\text{OH} \xrightarrow{\text{H}_2\text{SO}_4, 410 K} \text{C}_2\text{H}_5\text{O}\text{C}_2\text{H}_5
\]

If ethanol is dehydrated to ethene in presence of sulfuric acid at 433 K, but as 410 K, ethoxyethane is the main product. The dehydration of secondary and tertiary alcohols to get corresponding ethers is unsuccessful as alkenes are formed easily in these reactions.

\[
\text{CH}_3\text{CH}(\text{OH})\text{CH}_3 \xrightarrow{\text{Conc} \text{H}_2\text{SO}_4} \text{CH}_3\text{C}=\text{CH}_2 + \text{H}_2\text{O} \\
\text{Tert - Butyl alcohol}
\]

This reaction **cannot** be employed to prepare unsymmetrical ethers. It is because a mixture of products is likely to be obtained. The **Williamson Ether synthesis** or alkoxymercuriation/demercuration apporach can be used to prepare unsymmetrical ethers.

**Contributors**

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