

experiment date(s):

Minilab 25 – Oxidation of Alcohols by Potassium Permanganate

Goal

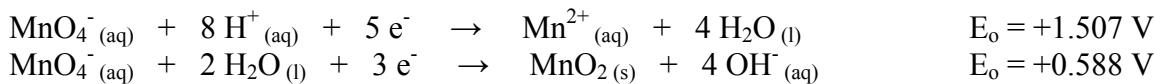
To predict and test the relative order of reactivity of alcohols toward permanganate oxidation.

Reading and Working Ahead

You should determine the order of reactivity you anticipate for the alcohols assigned. Generally speaking, as alkyl groups are added to an alcohol, that alcohol becomes more electron rich. Oxidation involves removal of electrons from the alcohol. Which alcohol do you expect to give up electrons more easily, the electron-rich or electron-poor alcohol?

Also, predict the products expected from reaction of each alcohol.

Something else to contemplate: what is the function of the acid (HCl) added after 10 minutes of reaction? Well, permanganate undergoes two different reduction processes depending on whether the solution is neutral/basic or acidic.



A more positive reduction potential means the reaction is more spontaneous; thus, it has a greater driving force in the forward direction. Hence, permanganate undergoes reduction more readily under acidic conditions. This makes the acidic permanganate solution the stronger oxidizing agent.

Procedure

Be careful to use the same volume of permanganate for each experiment, and the same number of drops for the alcohol.

You will not need to stopper the test tubes. You can shake them by holding the top and swirling the bottom rapidly.

Pre-lab Questions

Refer to the MSDSs located in the lab to answer the following questions:

1. What are the potential health effects from inhalation of KMnO₄?
2. List two “DO NOTs” if someone ingests KMnO₄.
3. What is the LD₅₀ (oral for rats) for 2-methyl-2-propanol?

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Follow-up Questions

1. The reaction of 2-methyl-2-propanol was no doubt, unexpected, as 3° alcohols are not oxidized by the standard mechanism. You should have observed this reaction occur only upon addition of concentrated H₂SO₄. The products formed from reaction of 2-methyl-2-propanol were carbon dioxide (CO₂) and acetone (CH₃COCH₃). These are the products formed from permanganate oxidation of 2-methylpropene. Describe how it is possible that 2-methylpropene could be formed from 2-methyl-2-propanol at this particular step in the reaction.
2. What is the purpose of the test tube containing only KMnO₄? Specifically, describe the function of a “control” experiment.