Permanganate Test

Functional Group(s): alkenes, alkynes, 1 °, 2 ° benzylic carbons
Known(s): 1-butanol, 2-butanol, tert-butanol, phenol, decene

Procedure

Set up a test tube rack containing six, small (75mm X 12mm) test tubes. Be sure that the test tubes are clean and dry. Label the test tubes 1-6. In test tube 1, place 2 drops ofof the unknown or ~5mg of a solid. Place approximately two drops of each known compound in test tubes #2-6. Add 2ml of ethanol to each tube and vortex for 30 seconds. Add 1-2 drops of the permanganate reagent each test tube. *Do not add an excess of the reagent.* The permanganate reagent is deep purple in color. Observe each tube for the dissipation of the purple color and compare the results of the knowns with the unknown. If color change is not perceptible, add another 2ml of ethanol to dilute the reaction mixture and observe.

Results

The dissipation of the purple color of the permanganate reagent to a yellow color indicates that the tested compound contains an unsaturated hydrocarbon, that is not aromatic. Benzylic carbon or nitrogen atoms that are either primary or secondary will also react with permanganate and cause a dissipation of the purple color. Some alcohols are also susceptible to oxidation with this reagent.

Theory

Reaction of potassium permanganate with alkenes or alkynes occurs through an oxidation process. The permanganate oxygen atoms add to the pi system of the alkene or alkyne to generate a cyclic intermedicate that decomposes to a diol product. The diol product generated from alkynes reacts further to provide a a-hydroxcarbonyl compound as the final product. The purple permanganate reagent is reduced during the course of the reaction to give a colorless or yellow solution. Permanganate may also react with benzylic atoms through a somewhat different reaction mechanism. The pi bonds of the benzene ring do not react, however, the benzylic atom of toluene (for example) will be oxidized to a carboxylic acid.