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## The TCICA test for distinguishing primary and secondary alcohols

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### Abstract (Document Summary)

Simple primary and secondary alcohols can easily be distinguished by their rate of oxidation with trichloroisocyanuric acid (TCICA). The TCICA test is conducted by adding the unknown to a solution of TCICA in acetonitrile containing hydrochloric acid and measuring the time for a precipitate to form.

### Full Text (518 words)

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Simple primary and secondary alcohols can easily be distinguished by their rate of oxidation with trichloroisocyanuric acid (TCICA).<sup>1,2</sup> The TCICA test is conducted by adding the unknown to a solution of TCICA in acetonitrile<sup>3</sup> containing hydrochloric acid<sup>4</sup> and measuring the time for a precipitate<sup>5</sup> to form. Primary alcohols react slowly and secondary alcohols react rapidly. To generate comparison data for primary and secondary alcohols, tests should be first carried out using ethanol and 2-propanol.<sup>6</sup>

### TCICA Test Procedure

To a small test tube add 0.5 mL of the TCICA solution in acetonitrile (30 mg/mL), one drop of 1 N HCl, and one drop of the sample. After noting the time, flick the test tube with your finger several times to mix the contents. Watch the test tube until a precipitate forms and record the elapsed time. The elapsed time could range from a few seconds to a few minutes.

In order to destroy any unreacted TCICA before disposal in the appropriate waste container, a few crystals of sodium hydrogen sulfite (NaHSO<sub>3</sub>) and a few drops of water should be added to the test tube, and the mixture should be allowed to react for a few minutes.<sup>7</sup>

CAUTION: TCICA solution is a bleach and a strong oxidizing agent and will discolor clothes. Do not get the solution on your clothes, your skin, or any lab surfaces. Spills can be cleaned up with sodium hydrogen sulfite solution.

### [Footnote]

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### [Footnote]

Notes

1. Trichloroisocyanuric acid can be used to prepare ketones from secondary alcohols; see Hiegel, G. A.; Nalbandy, M. *Synth. Commun.* 1992, 22, 1589.

2. Other methods for distinguishing alcohols include the Lucas test-see Roberts, R. M.; Gilbert, J. C.; Martin, S. F. Experimental Organic Chemistry; Saunders: New York, 1994; p 693; and <sup>1</sup>H NMR-see McGreer, D. E.; Mocek, M. M. J. Chem. Educ. 1963, 40, 358.
3. As other strong oxidizing agents, TCICA should be added to the solvent, not the solvent to the TCICA. Solutions of TCICA in acetonitrile are stable for years when stored in a brown bottle. TCICA is used as a swimming pool disinfectant and is widely available.

**[Footnote]**

4. The reaction will proceed without the HCl, but the reaction times are more reliable when it is used.
5. The precipitate is cyanuric acid, a solid used to inhibit light-induced destruction of chlorine in swimming pools.
6. We have used this test in organic lab classes for several years, and it gives reliable results in the hands of students. Students are not provided with comparison reaction times; therefore, each student runs the ethanol and 2-propanol tests to get this information. Primary alcohols take about 7-30 min to give a precipitate and secondary alcohols take about 0.1-1.2 min. Tertiary alcohols, which cannot be oxidized directly, take 3 or more hours before a precipitate begins to form; presumably this occurs after dehydration to an alkene.
7. Iodide-starch test paper wetted with water can be used to test for the presence of oxidizing power before the solution is placed in the waste container.

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