Organic Syntheses

A Publication
of Reliable Methods
for the Preparation
of Organic Compounds

Working with Hazardous Chemicals

The procedures in *Organic Syntheses* are intended for use only by persons with proper training in experimental organic chemistry. All hazardous materials should be handled using the standard procedures for work with chemicals described in references such as "Prudent Practices in the Laboratory" (The National Academies Press, Washington, D.C., 2011; the full text can be accessed free of charge at http://www.nap.edu/catalog.php?record_id=12654). All chemical waste should be disposed of in accordance with local regulations. For general guidelines for the management of chemical waste, see Chapter 8 of Prudent Practices.

In some articles in *Organic Syntheses*, chemical-specific hazards are highlighted in red "Caution Notes" within a procedure. It is important to recognize that the absence of a caution note does not imply that no significant hazards are associated with the chemicals involved in that procedure. Prior to performing a reaction, a thorough risk assessment should be carried out that includes a review of the potential hazards associated with each chemical and experimental operation on the scale that is planned for the procedure. Guidelines for carrying out a risk assessment and for analyzing the hazards associated with chemicals can be found in Chapter 4 of Prudent Practices.

The procedures described in *Organic Syntheses* are provided as published and are conducted at one's own risk. *Organic Syntheses, Inc.*, its Editors, and its Board of Directors do not warrant or guarantee the safety of individuals using these procedures and hereby disclaim any liability for any injuries or damages claimed to have resulted from or related in any way to the procedures herein.

These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

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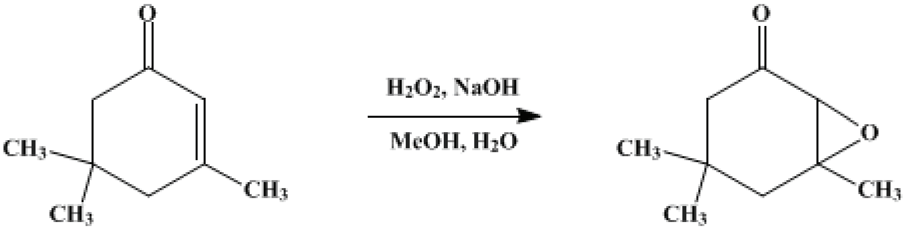
Organic Syntheses, Coll. Vol. 4, p.552 (1963); Vol. 37, p.58 (1957).

ISOPHORONE OXIDE

[Cyclohexanone, 2,3-epoxy-3,5,5-trimethyl-]



Submitted by Richard L. Wasson and Herbert O. House[1].
Checked by James Cason and Ralph J. Fessenden.

1. Procedure

In a 1-l. three-necked flask, equipped with a dropping funnel, a mechanical stirrer, and a thermometer, is placed a solution of 55.2 g. (0.4 mole) of isophorone (Note 1) and 115 ml. (1.2 moles) of 30% aqueous hydrogen peroxide (*Caution! avoid contact with skin*) in 400 ml. of methanol. After the contents of the flask have been cooled to 15° by means of an ice bath, 33 ml. (0.2 mole) of 6*N* aqueous sodium hydroxide is added, dropwise and with stirring, over a period of 1 hour. During the addition the temperature of the reaction mixture is maintained at 15–20° with a bath of cold water (Note 2). After the addition is complete, the resulting mixture is stirred for 3 hours as the temperature of the reaction mixture is maintained at 20–25° (Note 3) and (Note 4). The reaction mixture is then poured into 500 ml. of water, and the resulting mixture is extracted with two 400-ml. portions of ether. The combined extracts are washed with water and dried over anhydrous magnesium sulfate. After the bulk of the ether has been removed by distillation (or flash distillation) through a 30-cm. Vigreux column (Note 5) at atmospheric pressure, the residual liquid is distilled through the Vigreux column under reduced pressure. The yield of isophorone oxide (Note 4) is 43–44.5 g. (70–72%), b.p. 70–73°/5 mm., n_D^{25} 1.4500–1.4510.

2. Notes

1. A technical grade of isophorone, b.p. 80–84°/9 mm., n_D^{25} 1.4755, purchased from Eastman Kodak Company, was employed for this preparation.
2. If the temperature of the reaction mixture is less than 15°, the reaction does not begin. When the resulting mixture is subsequently warmed to room temperature the exothermic reaction which results is difficult to control (Note 3).
3. If the temperature of the reaction mixture is allowed to rise above 30°, the yield of isophorone oxide is diminished.
4. If desired, the course of the reaction may be followed by means of the optical density of the reaction mixture at 235 mμ. The ultraviolet spectrum of isophorone has a maximum at 235 mμ (ε 13,300); the ultraviolet spectrum of isophorone oxide has a maximum at 292 mμ (ε 43). A total reaction time of 4 hours under the conditions specified was found to be ample for the complete conversion of isophorone to its oxide. If the conversion is not complete, the product cannot be separated from the unchanged isophorone without recourse to precise fractional distillation. The absence of isophorone from the final product may be verified by examination of the spectrum at 235 mμ.
5. When the checkers distilled the product through a simple type of Podbielniak column of 65-cm. length, with heated jacket and partial reflux head, the boiling range was 1°, 74–75°/6 mm., but the yields and index of refraction were the same as those reported by the submitters.

3. Discussion

Isophorone oxide has been prepared by the epoxidation of isophorone with alkaline hydrogen peroxide.[2,3]

This preparation is referenced from:

- Org. Syn. Coll. Vol. 4, 957
- Org. Syn. Coll. Vol. 6, 679

References and Notes

1. Massachusetts Institute of Technology, Cambridge 39, Massachusetts.
2. Treibs, *Ber.*, **66**, 1483 (1933).
3. House and Wasson, *J. Am. Chem. Soc.*, **79**, 1488 (1957).

Appendix
Chemical Abstracts Nomenclature (Collective Index Number); (Registry Number)

methanol (67-56-1)

ether (60-29-7)

sodium hydroxide (1310-73-2)

hydrogen peroxide (7722-84-1)

magnesium sulfate (7487-88-9)

Isophorone oxide,
Cyclohexanone, 2,3-epoxy-3,5,5-trimethyl- (10276-21-8)

isophorone