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.

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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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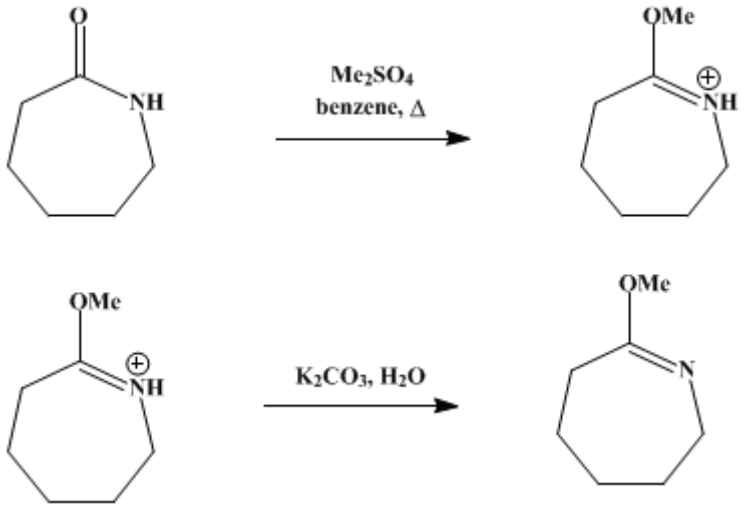
Organic Syntheses, Coll. Vol. 4, p.588 (1963); Vol. 31, p.72 (1951).

O-METHYLCAPROLACTIM

[2H-Azepine, 7-methoxy-3,4,5,6-tetrahydro-]



Submitted by Richard E. Benson and Theodore L. Cairns[1].
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1. Procedure

In a 5-l. three-necked flask equipped with a reflux condenser, a sealed mechanical stirrer, and a 1-l. dropping funnel are placed 678 g. (6.0 moles) of ε-caprolactam[2] and 2 l. of benzene (Note 1). The mixture is heated on a steam bath to reflux temperature, during which time all the solid dissolves. At this point 569 ml. (757 g., 6.0 moles) of dimethyl sulfate (Note 1) is added with stirring in a thin stream through the dropping funnel. The rate is about 4 ml. per minute, and the addition requires 2.5 hours. The stirring and heating are continued for an additional 2 hours, during which time two separate phases appear in the reaction mixture. The stirring is then discontinued and the mixture is heated under reflux for an additional 14 hours.

The mixture is cooled to room temperature, and 600 ml. of 50% potassium carbonate is added slowly through the dropping funnel with stirring (Note 2) to the reaction mixture over a period of 30 minutes. After the vigorous evolution of carbon dioxide has subsided, the mixture is stirred (Note 2) slowly for 30 minutes. The potassium methyl sulfate (Note 3) present is removed by filtration, the solid filter cake is washed with two 100-ml. portions of ether,and the washings are combined with the original filtrate. The filtrate is transferred to a 4-l. separatory funnel, the aqueous layer withdrawn, and the organic layer transferred to a 3-l. round-bottomed flask. The ether and benzene are removed by distillation at slightly reduced pressure (200–600 mm.) and the product distilled through an 8-in. Vigreux column. After a fore-run of benzene and O-methylcaprolactim, the fraction boiling at 65–67°/24 mm., n_D^{25} 1.4610, d_4^{25} 0.9598, is collected. The yield is 450–473 g. (59–62%). An additional quantity of the imino ether can be recovered from the fore-run by distillation through an efficient column, making the total yield 463–517 g. (61–68%) (Note 4).

2. Notes

1. Commercial grade reagents were used throughout. The ε-caprolactam was obtained from the Explosives Department, E. I. du Pont de Nemours and Company, Inc., Wilmington, Delaware.
2. Vigorous stirring at this point should be avoided or otherwise an emulsion will be formed that is difficult to break.
3. The solid that separated was not identified, but it was presumed to be potassium methyl sulfate.

4. The corresponding O-ethyl derivative (b.p. 81–82°/26 mm.) can be prepared in 52% yield by a similar procedure.

3. Discussion

O-Methylcaprolactim has been prepared by the reaction of cyclohexanone oxime, *p*-toluenesulfonyl chloride, and methanol;[3] and by the procedure[4] described above, which is a modification of the method given in the patent literature.[5]

This preparation is referenced from:

- Org. Syn. Coll. Vol. 8, 263

References and Notes

1. E. I. du Pont de Nemours and Company, Wilmington, Delaware.
2. *Org. Syntheses Coll. Vol.* **2**, 371 (1943).
3. Schmidt and Zutavern, Ger. pat. 532,969 [*Frdl.*, **18**, 3050 (1931)].
4. Benson and Cairns, *J. Am. Chem. Soc.*, **70**, 2115 (1948).
5. Schlack, U.S. pat. 2,356,622 [*C.A.*, **39**, 1420 (1945)].

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

potassium carbonate (584-08-7)

Benzene (71-43-2)

methanol (67-56-1)

ether (60-29-7)

carbon dioxide (124-38-9)

dimethyl sulfate (77-78-1)

ε-caprolactam (105-60-2)

Cyclohexanone oxime (100-64-1)

O-Methylcaprolactim,
2H-Azepine, 7-methoxy-3,4,5,6-tetrahydro- (2525-16-8)

potassium methyl sulfate (562-54-9)

p-Toluenesulfonyl chloride (98-59-9)