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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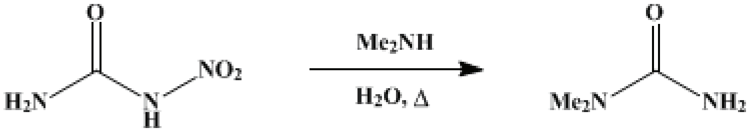
Organic Syntheses, Coll. Vol. 4, p.361 (1963); Vol. 32, p.61 (1952).

asym-DIMETHYLUREA

[Urea, 1,1-dimethyl-]



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1. Procedure

In a 1.5-l. beaker (Note 1), 191 ml. (180 g.) of aqueous 25% dimethylamine solution (1.0 mole) is diluted with 64 ml. of water and treated with 116 g. (1.1 moles) of nitrourea.[2] The temperature of the resulting brownish liquid rises spontaneously to 35–42°. The solution is warmed to 56–60°, and a reaction sets in vigorously with evolution of nitrous oxide. External cooling with water is applied when required; the reaction temperature is maintained below 70° during the first 5–7 minutes and below 85° during the second period of 5–7 minutes. After a total of 10–15 minutes, the effervescence slackens and the reaction mixture is kept at 90–100° until the evolution of gas has completely ceased. This usually requires an additional 15–20 minutes.

The resulting liquid is heated with about 1 g. of activated carbon and is filtered with suction while hot; the clear, faintly colored filtrate is transferred to an evaporating dish and heated on a steam bath to remove most of the water. The residual, somewhat viscous, liquid (about 120 ml.) is then transferred to a beaker; the evaporating dish is rinsed with 10 ml. of water, and this solution is added to the contents of the beaker. To this is added 95% ethanol (50 ml.), and the mixture is warmed to effect solution. On cooling, large crystals separate which, at 0°, almost fill the bulk of the solution. The crystalline mass is broken up with a glass rod, collected on a suction filter, and washed quickly, while on the filter, with two successive portions of ice water (Note 2), drained, and air-dried (Note 3). The yield of large, colorless prismatic crystals of *asym*-dimethylurea is 35–40 g. (40–45%); m.p. 182–184° (Note 4).

The combined filtrates, on further evaporation and dilution with 95% ethanol as above, yield an additional 15–20 g. of material of approximately the same quality, bringing the total yield up to 57–68%. In a series of preparations, yields can be further increased a few per cent by carrying over mother liquors to subsequent batches.

2. Notes

1. The reaction mixture froths considerably in the initial stages, and the use of a sufficiently large reaction vessel is important.
2. Since *asym*-dimethylurea is appreciably soluble in water, enough ice water is added to just cover the crystals on the filter, and suction is applied immediately.
3. A slight odor of dimethylamine, which persists, disappears when the product is dried at 80° for 1–2 hours.
4. The use of nitrourea is generally applicable to the preparation of urea derivatives and usually affords the required carbamide in excellent yield.[3,4]

3. Discussion

asym-Dimethylurea has been prepared by the interaction of dimethylamine sulfate and potassium cyanate[5] or dimethylamine and nitrourea.[3] It is also obtained by the hydrolysis of dimethylcyanamide in acid[6] and alkaline[7] media. Other reactions yielding the product include the action of dimethylamine on methyl γ-methylallophanate[8] or diethoxymethyleneimine,[9] and the hydrolysis of 1,1,2-trimethylisourea[10] or methyl dimethylthiocarbamate.[11]

References and Notes

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

asym-DIMETHYLUREA

ethanol (64-17-5)

carbon (7782-42-5)

urea,
carbamide (57-13-6)

dimethylamine (124-40-3)

Nitrourea (556-89-8)

potassium cyanate (590-28-3)

dimethylcyanamide (1467-79-4)

Urea, 1,1-dimethyl- (598-94-7)

nitrous oxide (10024-97-2)

dimethylamine sulfate

methyl γ-methylallophanate

diethoxymethyleneimine

1,1,2-trimethylisourea

methyl dimethylthiocarbamate (16703-45-0)