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.

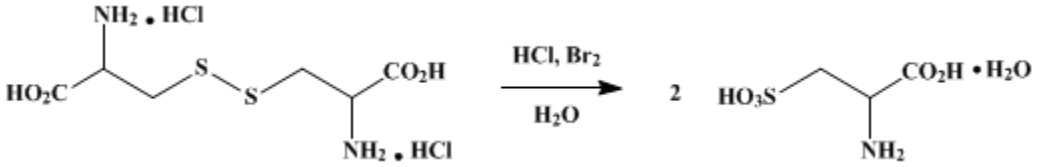
The procedures described in *Organic Syntheses* are provided as published and are conducted at one's own risk. *Organic Syntheses, Inc.*, its Editors, and its Board of Directors do not warrant or guarantee the safety of individuals using these procedures and hereby disclaim any liability for any injuries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

DOI:10.15227/orgsyn.020.0023

Organic Syntheses, Coll. Vol. 3, p.226 (1955); Vol. 20, p.23 (1940).

CYSTEIC ACID MONOHYDRATE



Submitted by H. T. Clarke
Checked by Henry Gilman and H. J. Harwood.

1. Procedure

To a solution of 24 g. (0.1 mole) of cystine in a cold mixture of 150 ml. of water and 50 ml. of concentrated hydrochloric acid is added, dropwise, 80 g. (25 ml., 0.5 mole) of commercial bromine, with occasional stirring, during 40 minutes. The temperature of the mixture rises to about 60°. The resulting solution, which contains a little unreduced bromine, is then evaporated under reduced pressure on a steam bath. The dark-colored crystalline residue is dissolved in 100 ml. of distilled water and filtered from a small quantity of amorphous insoluble matter. The filtrate is concentrated by evaporation on a water bath to 65 ml. and allowed to crystallize by standing overnight in a refrigerator. The crystals are filtered with suction and washed well with about 100 ml. of 95% ethanol in several portions, the washings being collected separately. The crystals are dried under reduced pressure over phosphorus pentoxide. A second crop is obtained by diluting the washings with an equal volume of water, evaporating until free of ethanol (Note 1), adding the residue to the mother liquor, and evaporating the combined solution to dryness on the water bath. The residue is dissolved in 30–40 ml. of water, decolorized with 0.5–1.0 g. of charcoal, concentrated to 15 ml., and, when cold, treated with 30 ml. of 95% ethanol. The crystals so formed are collected, washed with ethanol, and dried as before (Note 2). The total yield is 30.5–33.5 g. of pure cysteic acid monohydrate (81–90%). It melts, with vigorous evolution of gas, at 278° (289° cor.) (Note 3), and shows the rotation $[\alpha]_{54}^{246}$ + 9.36° (6% in water).

2. Notes

1. Cysteic acid appears to esterify readily on warming with ethanol, but the resulting ester is rapidly hydrolyzed by warming with dilute mineral acid.
2. The final mother liquors, on evaporation to dryness, yield 2–3 g. of a light-brown amorphous product which is readily soluble in water but insoluble in 95% ethanol. In concentrated hydrobromic acid this by-product forms a dark solution, the color of which is discharged on dilution with water.
3. The decomposition point of 278° is obtained by placing the capillary in a bath already heated to 260–270°. If the sample is slowly heated, starting at room temperature, a decomposition point of 257–258° is observed.

3. Discussion

The most convenient oxidant for the preparation of cysteic acid from cystine is aqueous bromine.[1] Iodine[2] and hydrogen peroxide[3] also bring about the reaction, but with both substances some of the sulfur is split off as sulfuric acid.

References and Notes

1. Friedmann, *Beitr. Chem. Physiol. u. Pathol.*, **3**, 1 (1903).
2. Yamazaki, *J. Biochem. Japan*, **12**, 207 (1930); Shinohara, *J. Biol. Chem.*, **96**, 285 (1932).
3. Schöberl, *Z. physiol. Chem.*, **216**, 193 (1933).

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

ethanol (64-17-5)

sulfuric acid (7664-93-9)

hydrochloric acid (7647-01-0)

HYDROBROMIC ACID (10035-10-6)

bromine (7726-95-6)

sulfur (7704-34-9)

iodine (7553-56-2)

hydrogen peroxide (7722-84-1)

cystine (56-89-3)

cysteic acid

Cysteic acid monohydrate (23537-25-9)

phosphorus pentoxide (1314-56-3)