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.

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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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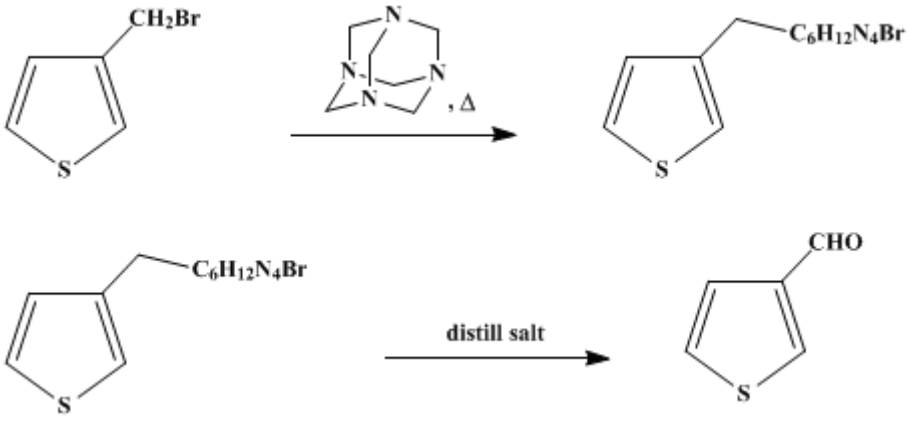
Organic Syntheses, Coll. Vol. 4, p.918 (1963); Vol. 33, p.93 (1953).

3-THENALDEHYDE

[3-Thiophenecarboxaldehyde]



Submitted by E. Campaigne, R. C. Bourgeois, and W. C. McCarthy[1].
Checked by Charles C. Price and E. A. Dudley.

1. Procedure

Hexamethylenetetramine (77 g., 0.55 mole) is dissolved in 200 ml. of chloroform, and 88 g. (0.5 mole) of 3-thenyl bromide (p.921) is added as rapidly as possible with shaking (Note 1). A reflux condenser is attached, and the mixture is refluxed over a steam bath for 30 minutes. After being cooled, the mixture of chloroform and crystalline product (Note 2) is poured into 250 ml. of water and stirred until all the salt dissolves. The chloroform layer is separated and washed twice with 125-ml. portions of water, and the combined water extracts are steam-distilled. When the distillate comes over clear (about 1 l. of distillate is usually collected), it is acidified with a little hydrochloric acid (Note 3) and extracted with three 100-ml. portions of ether. After drying over Drierite, the ether is evaporated, and the residue is distilled. 3-Thenaldehyde is collected at 72–78°/12 mm. or 195–199°/744 mm., n_D^{20} = 1.5860 (Note 4). The yield is 30–40 g. (54–72%).

2. Notes

1. The reaction mixture refluxes spontaneously, and it is necessary to be cautious in adding the reagents to prevent the chloroform from boiling over.
2. The crystalline hexamine salt may be isolated and recrystallized at this step. It softens at 120° and melts with decomposition at 150°.
3. The Sommelet procedure[2] yields a mixture of aldehyde and amines. Acidification removes the amines from the ether extract.
4. The checkers obtained the product, b.p. 80–81°/14 mm.

3. Discussion

3-Thenaldehyde has previously been prepared by Steinkopf and Schmitt[3] from 3-thienylmagnesium iodide and ethyl orthoformate in low yield. The first application of the method described here was reported by Campaigne and LeSuer.[4] 3-Thenaldehyde also has been obtained from 3-thenoic acid by the Sonn-Müller procedure[5] and from 3-bromothiophene by treatment with butyllithium and dimethylformamide.[6]

This preparation is referenced from:

- Org. Syn. Coll. Vol. 4, 919

- Org. Syn. Coll. Vol. 5, 121

References and Notes

1. Indiana University, Bloomington, Indiana.
2. Sommelet, *Compt. rend.*, **157**, 852 (1913).
3. Steinkopf and Schmitt, *Ann.*, **533**, 264 (1938).
4. Campaigne and LeSuer, *J. Am. Chem. Soc.*, **70**, 1555 (1948).
5. Nishimura, Motoyama, and Imoto, *Bull. Univ. Osaka Prefect., Ser. A*, **6**, 127 (1958) [*C. A.*, **53**, 4248 (1959)].
6. Gronowitz, *Arkiv Kemi*, **8**, 441 (1955).

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

Drierite

hydrochloric acid (7647-01-0)

ether (60-29-7)

chloroform (67-66-3)

Ethyl orthoformate

hexamethylenetetramine (100-97-0)

butyllithium (109-72-8)

dimethylformamide (68-12-2)

3-Thenaldehyde

3-Thiophenecarboxaldehyde (498-62-4)

3-Thenyl bromide

3-thienylmagnesium iodide

3-Thenoic acid

3-Bromothiophene (872-31-1)