



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.

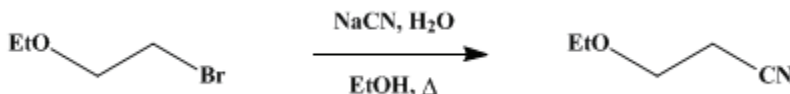
The procedures described in *Organic Syntheses* are provided as published and are conducted at one's own risk. *Organic Syntheses, Inc.*, its Editors, and its Board of Directors do not warrant or guarantee the safety of individuals using these procedures and hereby disclaim any liability for any injuries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

Organic Syntheses, Coll. Vol. 3, p.372 (1955); Vol. 23, p.33 (1943).

β-ETHOXYPROPIONITRILE

[Propionitrile, β-ethoxy-]



Submitted by George C. Harrison and Harvey Diehl.
Checked by R. L. Shriner and C. H. Tilford.

1. Procedure

In a 3-l. three-necked flask, equipped with a Hershberg stirrer, a reflux condenser, and a dropping funnel, are placed 175 g. (3.6 moles) of [sodium cyanide](#) and 125 ml. of distilled water ([Note 1](#)). The mixture is stirred until the [sodium cyanide](#) is dissolved, and then, while vigorous stirring is continued, 535 g. (360 ml., 3.5 moles) of [β-ethoxyethyl bromide](#) ([p. 370](#)) in 260 ml. of 95% [ethanol](#) is added over a period of 15 minutes. The separatory funnel is replaced by a 360° thermometer, and the mixture is stirred and gently refluxed for 10 hours.

The mixture is then fractionally distilled until the temperature reaches 140°. The first fraction boiling at 75–95° consists mostly of [ethanol](#) and water, and is discarded. The fraction boiling between 95° and 140° contains water and 25–30 g. of [β-ethoxypropionitrile](#). This is extracted twice with 50-ml. portions of [benzene](#), and the [benzene](#) extracts are added to the cooled residue in the distilling flask. The mixture is filtered ([Note 2](#)), the solid material is washed with 75 ml. of [benzene](#), which is added to the filtrate, and the whole is distilled. The fraction boiling at 169–174° is collected; it weighs 178–200 g. (52–58%).

2. Notes

1. The reaction should be carried out under the hood.
2. Direct distillation without filtration may result in clogging the condenser by [ammonium bromide](#).

3. Discussion

[β-Ethoxypropionitrile](#) has been prepared by the action of [potassium cyanide](#) on [β-ethoxyethyl bromide](#).¹ The addition of [ethanol](#) to [acrylonitrile](#) with [sodium ethoxide](#),^{2,3} [sodium hydroxide](#),³ or [benzyltrimethylammonium hydroxide](#)⁴ is reported to be a superior procedure. The action of [sodium ethoxide](#) on a mixture of [β-hydroxypropionitrile](#) and [ethyl formate](#), [ethyl benzoate](#), [ethyl bromide](#), or [ethyl sulfate](#) also results in the formation of [β-ethoxypropionitrile](#).⁵

References and Notes

1. Henry, *Bull. soc. chim. France*, (2) **44**, 458 (1885).
 2. Koelsch, *J. Am. Chem. Soc.*, **65**, 437 (1943).
 3. MacGregor and Pugh, *J. Chem. Soc.*, **1945**, 535.
 4. Utermohlen, *J. Am. Chem. Soc.*, **67**, 1505 (1945).
 5. Chelintsev, Benevolenskaya, and Dubinin, *J. Gen. Chem. U.S.S.R.*, **17**, 269 (1947).
-

(Registry Number)

ethanol (64-17-5)

Benzene (71-43-2)

sodium hydroxide (1310-73-2)

sodium cyanide (143-33-9)

ammonium bromide (12124-97-9)

Ethyl bromide (74-96-4)

potassium cyanide (151-50-8)

sodium ethoxide (141-52-6)

β -hydroxypropionitrile (109-78-4)

ethyl benzoate (93-89-0)

ethyl formate (109-94-4)

ethyl sulfate

acrylonitrile (107-13-1)

β -Ethoxyethyl bromide (592-55-2)

β -Ethoxypropionitrile,
Propionitrile, β -ethoxy- (2141-62-0)

benzyltrimethylammonium hydroxide (100-85-6)