



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.

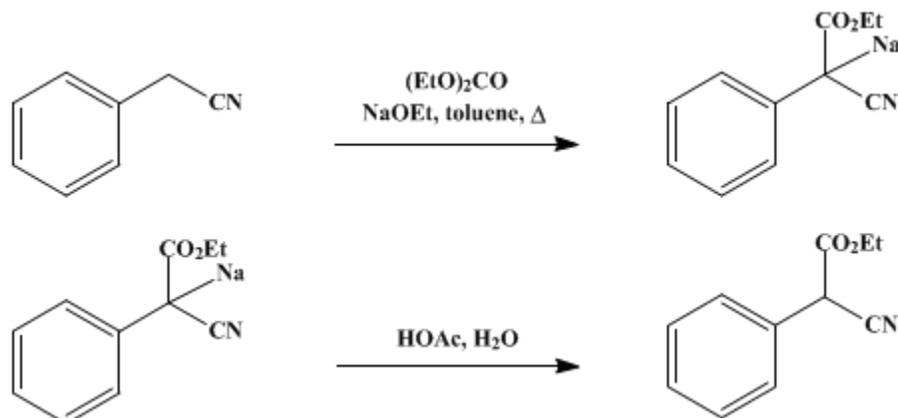
The procedures described in *Organic Syntheses* are provided as published and are conducted at one's own risk. *Organic Syntheses, Inc.*, its Editors, and its Board of Directors do not warrant or guarantee the safety of individuals using these procedures and hereby disclaim any liability for any injuries 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. 4, p.461 (1963); Vol. 30, p.43 (1950).

ETHYL PHENYLCYANOACETATE

[Acetic acid, cyanophenyl-, ethyl ester]



Submitted by E. C. Horning and A. F. Finelli¹.

Checked by William S. Johnson and H. Wynberg.

1. Procedure

Sodium ethoxide is prepared from 12.0 g. (0.52 g. atom) of sodium and 300 ml. of anhydrous ethanol in a 1-l. three-necked round-bottomed flask fitted with a reflux condenser carrying a calcium chloride tube. After the sodium has dissolved completely, the condenser is arranged for distillation under reduced pressure and the excess ethanol is removed by heating the flask on a steam bath while the system is maintained at the pressure obtained with an ordinary aspirator (Note 1).

As rapidly as possible, after removal of the ethanol, the flask is fitted with a rubber-sealed stirrer, a dropping funnel, a distilling head containing a thermometer, and a condenser arranged for distillation into a flask protected by a calcium chloride tube. There are then added 300 ml. (292 g., 2.5 moles) of dry diethyl carbonate, 80 ml. of dry toluene, and 58.5 g. (0.50 mole) of phenylacetonitrile (Note 2). The flask is heated, with good stirring, and the cake of sodium ethoxide soon dissolves. When distillation has started, dry toluene is added dropwise at about the same rate that the distillate is collected. Approximately 200–250 ml. of toluene should be added in a period of 2 hours (Note 3) while stirring and distillation are continued.

The mixture is cooled and transferred to a 1-l. beaker. After addition of 300 ml. of cold water, the aqueous phase is acidified with 35–40 ml. of acetic acid. The layers are separated and the water solution is extracted with three 75-ml. portions of ether. The organic solutions are combined, washed with 100 ml. of water, and dried over anhydrous magnesium sulfate. The low-boiling solvents are removed by distillation at atmospheric pressure, and the residue is distilled under reduced pressure through a short (15-cm.) Vigreux column. After a 1–5 g. forerun, the product is collected at 125–135°/3–5 mm. (Note 4). The yield is 66–74 g. (70–78%).

2. Notes

1. The success of this procedure is dependent upon the quality of the sodium ethoxide. The ethanol should be dried before use,² and the sodium ethoxide should not be heated to a temperature higher than 90–100°. The dry material can be transferred, but in this case it is advisable to prepare it in the flask in which it is to be used.
2. Commercial phenylacetonitrile should be distilled before use. The diethyl carbonate and toluene are dried by distillation.
3. Any ethanol remaining in the sodium ethoxide, together with the ethanol produced during the

reaction, is removed during this period. The progress of the carbethoxylation reaction can be followed by temperature readings. During the first half of the heating period distillation usually occurs at a vapor temperature of 80–85°, but as the reaction nears completion and the ethanol is removed, the temperature rises to 110–115°. Near the end of the period, the sodium salt of ethyl phenylcyanoacetate appears as a precipitate.

4. Other observed boiling points are 129–131°/3 mm., 145–150°/7–8 mm. The product is a colorless liquid, n_D^{25} 1.5012–1.5019.

3. Discussion

This procedure is a modification of the method of Wallingford, Jones, and Homeyer.³ The carbethoxylation of phenylacetonitrile is the only method of preparative value for this compound.

This preparation is referenced from:

- *Org. Syn. Coll. Vol. 4*, 776

References and Notes

1. University of Pennsylvania, Philadelphia, Pennsylvania.
2. *Org. Syn. Coll. Vol. 2*, 155 (1943).
3. Wallingford, Jones, and Homeyer, *J. Am. Chem. Soc.*, **64**, 576 (1942); Testa, Fontanella, Christiani, and Fava, *Ann.*, **614**, 158 (1958).

Appendix

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

sodium salt of ethyl phenylcyanoacetate

ethanol (64-17-5)

acetic acid (64-19-7)

ether (60-29-7)

toluene (108-88-3)

sodium (13966-32-0)

sodium ethoxide (141-52-6)

phenylacetonitrile (140-29-4)

magnesium sulfate (7487-88-9)

diethyl carbonate (105-58-8)

Ethyl phenylcyanoacetate,
Acetic acid, cyanophenyl-, ethyl ester (4553-07-5)

