



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.

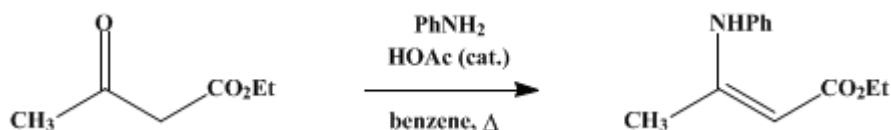
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These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

Organic Syntheses, Coll. Vol. 3, p.374 (1955); Vol. 29, p.42 (1949).

ETHYL β -ANILINOCROTONATE

[Crotonic acid, β -anilino-, ethyl ester]



Submitted by George A. Reynolds and Charles R. Hauser.

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1. Procedure

In a 1-l. round-bottomed flask attached to a Dean and Stark constant water separator ([Note 1](#)) which is connected to a reflux condenser are placed 46.5 g. (45.5 ml., 0.5 mole) of redistilled [aniline](#), 65 g. (63.5 ml., 0.5 mole) of commercial [ethyl acetoacetate](#), 100 ml. of [benzene](#), and 1 ml. of glacial [acetic acid](#). The flask is heated in an oil bath at about 125°, and the water which distills out of the mixture with the refluxing [benzene](#) is removed at intervals. Refluxing is continued until no more water separates (9 ml. collects in about 3 hours) and then for an additional 30 minutes. The [benzene](#) is then distilled under reduced pressure, and the residue is transferred to a 125-ml. modified Claisen flask with an insulated column. The flask is heated in an oil or metal bath maintained at a temperature not higher than 120° while the fore-run of [aniline](#) and [ethyl acetoacetate](#) is removed by distillation under reduced pressure, and at 140–160° during distillation of the product ([Note 2](#)). The yield of [ethyl \$\beta\$ -anilincrotonate](#) boiling at 128–130° /2 mm., n_D^{25} 1.5770, is 78–82 g. (76–80%).

2. Notes

1. A Dean and Stark separator made with a stopcock for removal of water¹ or any continuous water separator which will return the [benzene](#) to the reaction mixture may be used.
2. The submitters state that if the temperature of the bath rises much above 120° during distillation of the fore-run, or much above 160° during distillation of the product, the [ethyl \$\beta\$ -anilincrotonate](#) may be contaminated with [diphenylurea](#), part of which may precipitate from the distillate on standing. Such a precipitate can be removed by adding an equal volume of 30–60° petroleum ether to the distillate and filtering. The petroleum ether is distilled from the filtrate, and the residue is placed in a vacuum desiccator over mineral oil or is redistilled.

3. Discussion

The procedure described is a modification of procedures employed previously. [Ethyl \$\beta\$ -anilincrotonate](#) is obtained when the reactants are allowed to stand at room temperature for several days without a catalyst,^{2,3,4} or are heated on a steam bath,⁴ or are allowed to stand for 12 hours in the presence of a catalytic amount of [aniline hydrochloride](#).⁵ [Iodine](#) also is a catalyst.⁵ Properties of the ester are reported by Coffey, Thomson, and Wilson.⁵

This preparation is referenced from:

- [Org. Syn. Coll. Vol. 3, 593](#)

References and Notes

1. Cope, Hofmann, Wyckoff, and Hardenbergh, *J. Am. Chem. Soc.*, **63**, 3452 (1941).
2. Knorr, *Ber.*, **16**, 2593 (1883).

3. Limpach, *Ber.*, **64**, 969 (1931).
 4. Conrad and Limpach, *Ber.*, **20**, 944 (1887).
 5. Coffey, Thomson, and Wilson, *J. Chem. Soc.*, **1936**, 856.
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Appendix
Chemical Abstracts Nomenclature (Collective Index Number);
(Registry Number)

petroleum ether

acetic acid (64-19-7)

Benzene (71-43-2)

aniline (62-53-3)

aniline hydrochloride (142-04-1)

iodine (7553-56-2)

Ethyl acetoacetate (141-97-9)

diphenylurea (603-54-3)

ETHYL β -ANILINOCROTONATE,
Crotonic acid, β -anilino-, ethyl ester (6287-35-0)