



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.

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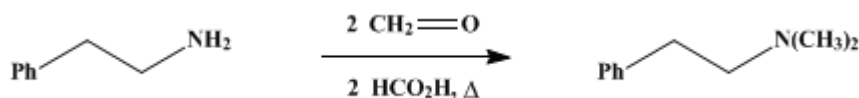
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These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

Organic Syntheses, Coll. Vol. 3, p.723 (1955); Vol. 25, p.89 (1945).

β-PHENYLETHYLDIMETHYLAMINE

[Phenethylamine, N,N-dimethyl-]



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1. Procedure

To 51.2 g. (1 mole) of 90% **formic acid** in a 500-ml. round-bottomed flask (**Note 1**), cooled in running tap water, is added slowly 24.2 g. (0.2 mole) of **β-phenylethylamine**. To the resulting clear solution are added 45 ml. (0.6 mole) of **formaldehyde** solution (concentration, 37%) (**Note 2**) and a small boiling stone. The flask is connected to a reflux condenser and is placed in an oil bath which has been heated to 90–100°. A vigorous evolution of **carbon dioxide** begins after 2–3 minutes, at which time the flask is removed from the bath until the gas evolution notably subsides (15–20 minutes); then it is returned to the bath and heated at 95–100° for 8 hours.

After the solution has been cooled, 100 ml. of 4 *N* **hydrochloric acid** is added and the solution is evaporated to dryness under reduced pressure (water pump) from a water bath; the receiver is cooled in an ice bath. The pale yellow syrupy residue (or crystalline solid) is dissolved in 60–75 ml. of water, and the organic base is liberated by the addition of 50 ml. of 18 *N* **sodium hydroxide** solution. The upper (organic) phase is separated, and the lower (aqueous) phase is extracted with two 30-ml. portions of **benzene**. The combined organic base and **benzene** extracts are dried over 10 g. of anhydrous granular **potassium carbonate** (**Note 3**). After the **benzene** has been distilled slowly under slightly reduced pressure from a 125-ml. Claisen flask, the pressure is lowered further, and the product is distilled. The yield of colorless **β-phenylethyldimethylamine** boiling at 97–98°/22 mm. (**Note 4**) is 22–24.7 g. (74–83%) (**Note 5**).

2. Notes

1. A flask of this size is used because of the tendency of the solution to froth during the gas evolution. Frothing usually is not bad with this amine but is quite bothersome when the higher aliphatic amines (**decylamine** to **octadecylamine**) are methylated.
2. U.S.P. **formaldehyde** was used. The commercial aqueous-methanolic solution contains 37% **formaldehyde** by weight. It is sometimes called "40% formalin" because 100 ml. of the solution contains 40 g. of **formaldehyde**.
3. If complete separation of the **benzene** extracts from the aqueous solution is difficult, it is advantageous to dry the **benzene** solution roughly over 10 g. of the anhydrous **potassium carbonate** and to decant the resulting clear solution into another flask where it may be dried over 5 g. of fresh drying agent. The spent drying agent is rinsed with 15–20 ml. of **benzene**, and the rinsings are added to the main solution.
4. Another boiling point is 66–68°/6 mm. If the product is distilled through a short column (12–15 cm.) packed with glass helices, it boils constantly at 98°/22 mm. The recovery is somewhat lower when a column is used.
The product gives a negative carbylamine test and hence contains no significant amount of unchanged primary amine.
5. This methylation procedure is quite generally satisfactory for simple primary and secondary amines. For methylation of a secondary amine only half as much **formaldehyde** is required, although a larger amount does no harm. The submitters also have prepared, in uniformly good yields, **benzyl dodecylmethylamine** (b.p. 180–182°/4 mm.) from **benzyl dodecylamine**, and **α-amylhexyldimethylamine** (b.p. 115°/16 mm.) from **α-amylhexylamine**. It is reported¹ that the reaction

can be successfully applied to the methylation of butylamine, benzylamine, tetramethylenediamine, piperidine, and α -phenyl- α -aminobutyric acid.

3. Discussion

The procedure given above is an adaptation of the methylation method first used by Sommelet and Ferrand² and developed more fully by Clarke, Gillespie, and Weisshaus.¹ β -Phenylethyldimethylamine has been prepared from β -phenylethylamine by alkylation with dimethyl sulfate;³ by the reaction of β -phenylethylamine and of N-methyl- β -phenylethylamine with formaldehyde;⁴ by catalytic reduction of phenylacetonitrile in the presence of dimethylamine;⁵ by the reaction of dimethylamine with β -phenylethyl chloride^{6,7,8} and with β -phenylethyl bromide;⁸ and by the reaction of phenylacetaldehyde with dimethylamine.⁹

This preparation is referenced from:

- Org. Syn. Coll. Vol. 5, 315

References and Notes

1. Clarke, Gillespie, and Weisshaus, *J. Am. Chem. Soc.*, **55**, 4571 (1933).
2. Sommelet and Ferrand, *Bull. soc. chim. France*, (4) **35**, 446 (1924).
3. Johnson and Guest, *J. Am. Chem. Soc.*, **32**, 761 (1910).
4. Decker and Becker, *Ber.*, **45**, 2404 (1912); *Ann.*, **395**, 344 (1913).
5. Buck, Baltzly, and Ide, *J. Am. Chem. Soc.*, **60**, 1789 (1938).
6. Barger, *J. Chem. Soc.*, **95**, 2193 (1909).
7. Tiffeneau and Fuhrer, *Bull. soc. chim. France*, (4) **15**, 173 (1914).
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9. Ger. pat. 291,222 [*Frdd.*, **12**, 802 (1914–1916)].

Appendix

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

potassium carbonate (584-08-7)

hydrochloric acid (7647-01-0)

Benzene (71-43-2)

sodium hydroxide (1310-73-2)

formaldehyde (50-00-0)

formic acid (64-18-6)

carbon dioxide (124-38-9)

dimethyl sulfate (77-78-1)

piperidine (110-89-4)

phenylacetonitrile (140-29-4)
dimethylamine (124-40-3)
Butylamine (109-73-9)
 β -phenylethyl chloride (622-24-2)
 β -phenylethyl bromide (103-63-9)
benzylamine (100-46-9)
phenylacetaldehyde (122-78-1)
 β -Phenylethylamine (64-04-0)
 β -PHENYLETHYLDIMETHYLAMINE,
Phenethylamine, N,N-dimethyl- (1126-71-2)
decylamine (2016-57-1)
octadecylamine (124-30-1)
benzylododecylmethylamine
benzylododecylamine
 α -amylhexyldimethylamine
 α -amylhexylamine (33788-00-0)
 α -phenyl- α -aminobutyric acid (33875-38-6)
N-methyl- β -phenylethylamine (589-08-2)
tetramethylenediamine (110-60-1)