



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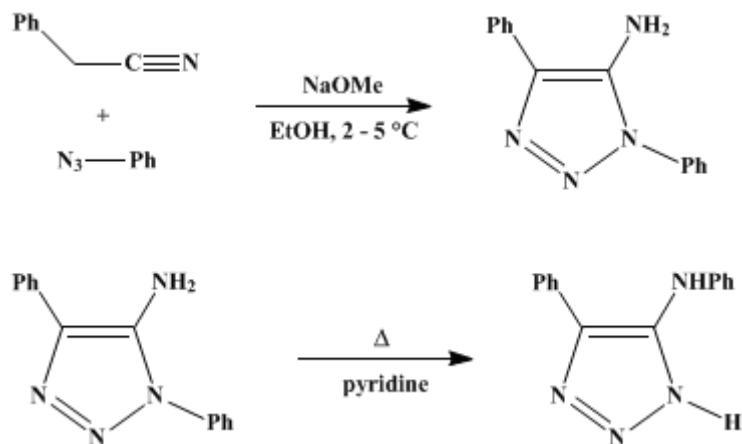
These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

Organic Syntheses, Coll. Vol. 4, p.380 (1963); Vol. 37, p.26 (1957).

1,4-DIPHENYL-5-AMINO-1,2,3-TRIAZOLE AND 4-PHENYL-5-ANILINO-1,2,3-TRIAZOLE

[1H-1,2,3-Triazole, 5-amino-1,4-diphenyl-]

[1H-1,2,3-Triazole, 4-phenyl-5-(phenylamino)-]



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1. Procedure

A. *1,4-Diphenyl-5-amino-1,2,3-triazole*. A 500-ml. three-necked flask is equipped with a sealed stirrer, a thermometer well, and a dropping funnel which is protected by a drying tube and has a pressure-equalizing side arm. A mixture of 35.7 g. (0.3 mole) of phenyl azide (Note 1) and 38.6 g. (0.33 mole) of phenylacetonitrile (Note 2) is placed in the flask. The flask is immersed in an ice-water mixture contained in a 1-gal. Thermos flask. After the reaction mixture has cooled to about 2°, a solution of 24.3 g. (0.45 mole) of sodium methoxide (Note 3) in 150 ml. of absolute ethanol is added dropwise during the course of 2 hours. The reaction mixture is then stirred at 2-5° in the ice-water bath for a period of 48 hours (Note 4). After the cooling bath has been removed and the flask allowed to warm spontaneously to room temperature, the mixture is filtered by suction on a sintered glass funnel, and the collected product is washed with three 50-ml. portions of absolute ethanol. The dried product weighs 62-65 g. (88-92%) and consists of white, fine platelike crystals, m.p. 169-171°. Recrystallization from benzene does not alter the melting point (Note 5).

B. *4-Phenyl-5-anilino-1,2,3-triazole*. Six grams (0.025 mole) of 1,4-diphenyl-5-amino-1,2,3-triazole is dissolved in 20 g. of dry pyridine (distilled from solid sodium hydroxide) and heated under reflux for 24 hours (Note 6). The reaction mixture (Note 7) is poured into 1 l. of ice water. The product separates as a slightly yellowish milky oil which is converted to white needle-like crystals by stirring the mixture and scratching the beaker with a glass rod. The product is collected by suction filtration, washed with water, suction-dried, and recrystallized from aqueous ethanol (Note 8). The yield is 5.5-5.6 g. (92-93%) of fine white needle-like crystals, m.p. 167-169° (Note 9), soluble in hot water and ether, but difficultly soluble in benzene.

2. Notes

1. Prepared by the method of Lindsay and Allen, *Org. Syntheses, Coll. Vol. 3, 710 (1955)*. The phenyl azide used had b.p. 41-43°/5 mm., $n_D^{25.5}$ 1.5567. The boiling point deviates slightly from that given by Lindsay and Allen, namely 49-50°/5 mm.; however, it agrees fairly well with the other value given by these authors, namely 66-68°/21 mm., and with the values of Darapsky,² and the vapor pressure

determinations by Carothers,³ as shown by a plot of $\log p$ vs. $1/T$.

2. The Eastman product was used without purification.
3. Anhydrous sodium methoxide from Matheson Chemical Corporation was used.
4. The yield and purity of the product, i.e., with respect to decreased content of acidic isomer (**4-phenyl-5-anilino-1,2,3-triazole**), depends upon maintaining a low temperature throughout the entire reaction.
5. The product is essentially pure. 1,4-Disubstituted-5-amino-1,2,3-triazoles are readily isomerized;⁴ accordingly, care must be exercised in the recrystallization of such products from solvents. It has been found by experiment that the best practice, in order to avoid isomerization, is to heat the **benzene** to boiling before addition of the product for recrystallization. Repeated tests have shown that a single careless recrystallization of the product from **benzene** can increase the content of acidic isomer by as much as 4%. Polar solvents must be avoided.

The purity of the product can be determined⁵ by titration in glacial **acetic acid**, using **perchloric acid** (in glacial **acetic acid**) as titrant and methyl violet (0.2 g. of methyl violet in 100 ml. of **chlorobenzene**) as visual indicator (the first appearance of blue color is taken as the end point).

6. This is more than enough time to allow for the complete irreversible isomerization. The extent of isomerization is checked by removing a small quantity of the reaction mixture, isolating the product by dilution with water, and testing its solubility in dilute **potassium hydroxide** solution. It should be completely soluble.
7. If any solid material is present, it should be removed by filtration.
8. The acidic isomer can be recrystallized from **ethanol** without the formation of any of the basic isomer. The checkers used for each gram of product 5 ml. of **ethanol** and 2.5 ml. of water. After solution of the product, treatment with Darco and filtration, 2.5 ml. of water was added to the hot solution.
9. The purity of the acidic isomer is best determined⁵ by titration against **sodium methoxide** in **dimethylformamide**, using potentiometric indicator. This test showed the present product to be free of basic isomer.

3. Discussion

The present method is a modification of that first reported by Dimroth.⁶ The method of irreversible isomerization in boiling **pyridine** was first reported by Dimroth⁷ for the conversion of **1-phenyl-5-amino-1,2,3-triazole** to **5-anilino-1,2,3-triazole**.

References and Notes

1. De Paul University, Chicago, Illinois.
2. Darapsky, *Ber.*, **40**, 3038 (1907).
3. Carothers, *J. Am. Chem. Soc.*, **45**, 1734 (1923).
4. Lieber, Chao, and Rao, *J. Org. Chem.*, **22**, 654 (1957).
5. Lieber, Rao, and Chao, *Anal. Chem.*, **29**, 932 (1957).
6. Dimroth and Werner, *Ber.*, **35**, 4058 (1902).
7. Dimroth, *Ann.*, **364**, 183 (1909).

Appendix

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

methyl violet

ethanol (64-17-5)

acetic acid (64-19-7)

Benzene (71-43-2)

ether (60-29-7)

sodium hydroxide (1310-73-2)

sodium methoxide (124-41-4)

chlorobenzene (108-90-7)

pyridine (110-86-1)

potassium hydroxide (1310-58-3)

phenylacetonitrile (140-29-4)

dimethylformamide (68-12-2)

PHENYL AZIDE (622-37-7)

1,4-Diphenyl-5-amino-1,2,3-triazole,
1H-1,2,3-Triazole, 5-amino-1,4-diphenyl- (29704-63-0)

1H-1,2,3-Triazole, 4-phenyl-5-(phenylamino)-,
4-Phenyl-5-anilino-1,2,3-triazole (53684-55-2)

perchloric acid (7601-90-3)

1-phenyl-5-amino-1,2,3-triazole

5-anilino-1,2,3-triazole