



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](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.

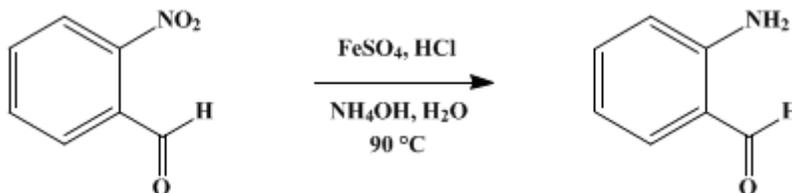
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*These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.*

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## ***o*-AMINOBENZALDEHYDE**

### **[Anthranilaldehyde]**



Submitted by Lee Irvin Smith and J. W. Opie<sup>1</sup>.

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### **1. Procedure**

A 1-l. three-necked flask is employed as a reaction vessel from which the product can be steam-distilled *immediately* after completion of the reaction (**Note 1**). It is convenient to arrange the apparatus for the reaction and that for the steam distillation on the same steam bath, with provision for the rapid connection of the flask to the distillation assembly at the desired time. For use as a reaction vessel the flask is mounted on a steam bath and fitted with a mechanical stirrer and a reflux condenser; the third neck is closed by a cork.

In the steam-distillation assembly (**Note 1**) one of the small necks of the flask is fitted with a steam-inlet tube, connected through a water trap to a steam line; the other small neck is closed by a cork. The central neck is fitted to a Kjeldahl trap leading to a 50-cm. Allihn condenser set downward and connected in series to a 50-cm. Liebig condenser. The second condenser leads to a 500-ml. three-necked flask used as the receiver. The receiving flask is immersed in an ice bath and fitted with an Allihn reflux condenser.

When all the apparatus has been set up and tested the flask is connected to the reaction assembly, and 175 ml. of water, 105 g. (0.38 mole) of **ferrous sulfate heptahydrate**, 0.5 ml. of concentrated **hydrochloric acid**, and 6 g. (0.04 mole) of *o*-nitrobenzaldehyde (see p. 641) are introduced in the order given. The stirrer is then started, and the flask is heated by means of the steam bath. When the temperature of the mixture reaches 90°, 25 ml. of concentrated **ammonium hydroxide** is added in one portion, and at 2-minute intervals three 10-ml. portions of **ammonium hydroxide** are added. Stirring and heating are continued throughout. The total reaction time is 8–10 minutes.

Immediately after the addition of the last portion of **ammonium hydroxide**, the reflux condenser and stirrer are removed and the flask is connected to the steam-distillation assembly. The mixture is steam-distilled as rapidly as possible, and two 250-ml. fractions of distillate are collected during a period of 10–13 minutes (**Note 2**). The first fraction is saturated with **sodium chloride**, and the solution is stirred at 5° until precipitation appears to be complete. The solid is collected on a Büchner funnel and dried in the air. The product weighs 2.72–3.11 g. (57–65%) and melts at 38–39°. The second fraction of the distillate is saturated with **sodium chloride** and combined with the filtrate remaining from the first fraction. The combined solution is extracted with two 45-ml. portions of **ether**. The combined **ether** extract is filtered, dried over anhydrous **sodium sulfate**, and concentrated by distillation, finally under reduced pressure. The residue solidifies on cooling and weighs 0.6–1.0 g.; it can be purified by steam distillation from 40–50 ml. of saturated **sodium chloride** solution until 100 ml. of distillate is collected, saturation of the distillate with **sodium chloride**, cooling, and filtration. The pure product so obtained weighs 0.42–0.87 g. The total yield (**Note 3**) is 3.3–3.6 g. (69–75%).

### **2. Notes**

1. Rapid removal of the product from the reaction mixture is essential to the success of this preparation.

The steam-distillation assembly should be sturdily constructed, with all parts except the distilling flask in place at the time the reaction is started. To ensure the proper fitting of the distilling flask it is convenient to construct the distillation apparatus with the flask in place and, after testing of the apparatus, to remove the flask and incorporate it into the reaction assembly.

2. The first fraction is drawn into a round-bottomed flask through a tube inserted into the third neck of the receiver (by the use of a water pump or a suction line) without interruption of the distillation.

3. The submitters have obtained yields of about 70% in runs eight times as large as that described. This amino aldehyde undergoes self-condensation on standing, especially in a desiccator, and so the product should be used immediately.

### 3. Discussion

*o*-Aminobenzaldehyde has been obtained from its oxime by the action of ferric chloride;<sup>2</sup> the oxime was obtained by reduction of *o*-nitrobenzaldoxime.<sup>3</sup> *o*-Aminobenzaldehyde has also been obtained from *o*-aminobenzyl alcohol by the action of sodium sulfide<sup>4</sup> or by the action of zinc dust and alkali;<sup>5</sup> and from *o*-nitrobenzylaniline or N-(2-nitrobenzyl) sulfanilic acid by the action of alkali sulfides and sulfur.<sup>6</sup> The aldehyde results in small amounts from the action of alkali alone upon *o*-nitrobenzyl alcohol<sup>7</sup> and from the action of ferrous sulfate and ammonia upon anthranil.<sup>8</sup> The only preparative methods involve the reduction of *o*-nitrobenzaldehyde with ferrous sulfate and ammonia.<sup>8, 9</sup> Catalytic reduction of *o*-nitrobenzaldehyde has been reported to yield *o*-aminobenzaldehyde,<sup>10,11</sup> but the method was not successful in the hands of the submitters.

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### References and Notes

1. Work done under contract with the Office of Scientific Research and Development.
2. Gabriel, *Ber.*, **15**, 2004 (1882).
3. Gabriel and Meyer, *Ber.*, **14**, 2339 (1881); **36**, 803 (1903).
4. Ger. pat. 106,509 (*Chem. Zentr.*, **1900**, I, 1084).
5. Freundler, *Compt. rend.*, **136**, 371 (1903); **138**, 1425 (1904); *Bull. soc. chim. France*, [3] **31**, 876 (1904).
6. Ger. pats. 99,542, 100,968 (*Chem. Zentr.*, **1899**, I, 238, 958); Cohn and Springer, *Monatsh.*, **24**, 95 (1903); Friedländer and Lenk, *Ber.*, **45**, 2084 (1912).
7. Freundler, *Bull. soc. chim. France*, [3] **31**, 879 (1904); Carré, *Compt. rend.*, **140**, 664 (1905); *Bull. soc. chim. France*, [3] **33**, 1162, 1165 (1905); *Ann. chim.*, [8] **6**, 409, 413 (1905).
8. Friedländer, *Ber.*, **15**, 2573 (1882).
9. Friedländer and Göhring, *Ber.*, **17**, 456 (1884); Bamberger, *Ber.*, **60**, 319 (1927).
10. Ruggli and Schmidt, *Helv. Chim. Acta*, **18**, 1235 (1935); Nord, *Ber.*, **52**, 1711 (1919).
11. Borsche and Ried, *Ber.*, **76B**, 1015 (1943).

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### Appendix

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

hydrochloric acid (7647-01-0)

ammonia (7664-41-7)

ether (60-29-7)

sodium chloride (7647-14-5)

sodium sulfate (7757-82-6)

sulfur (7704-34-9)

ferrous sulfate (13463-43-9)

zinc (7440-66-6)

ferric chloride (7705-08-0)

ammonium hydroxide (1336-21-6)

sodium sulfide (1313-82-2)

o-Nitrobenzaldehyde (552-89-6)

Anthranilaldehyde,  
o-Aminobenzaldehyde (529-23-7)

ferrous sulfate heptahydrate (7782-63-0)

N-(2-nitrobenzyl) sulfanilic acid

anthranil (271-58-9)

o-nitrobenzaldoxime

o-Aminobenzyl alcohol (5344-90-1)

o-nitrobenzylaniline

o-nitrobenzyl alcohol (612-25-9)