



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.

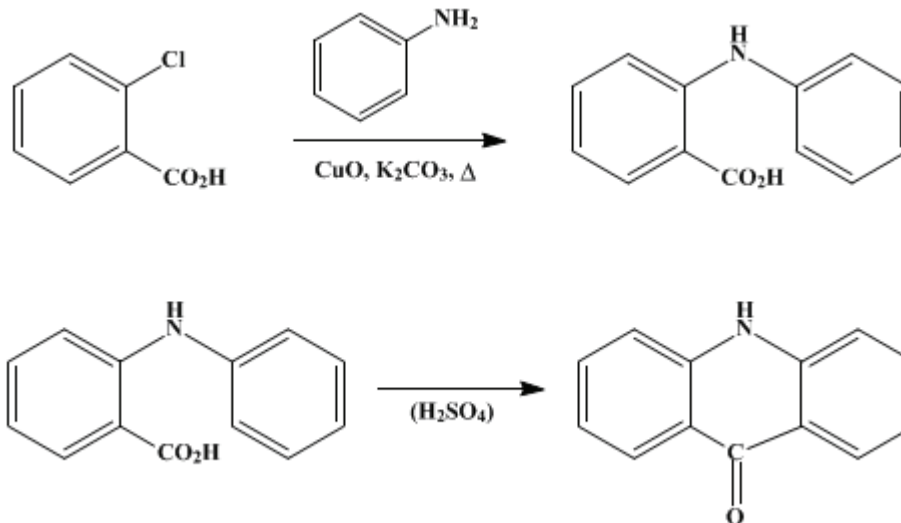
In some articles in *Organic Syntheses*, chemical-specific hazards are highlighted in red "Caution Notes" within a procedure. It is important to recognize that the absence of a caution note does not imply that no significant hazards are associated with the chemicals involved in that procedure. Prior 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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## ACRIDONE



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### 1. Procedure

(A) *N*-Phenylanthranilic Acid.—In a 1-l. round-bottomed flask fitted with an air-cooled condenser, a mixture of 155 g. (1.66 moles) of aniline, 41 g. (0.26 mole) of *o*-chlorobenzoic acid (Note 1), 41 g. (0.3 mole) of technical anhydrous potassium carbonate, and 1 g. of copper oxide is refluxed for two hours, using an oil bath. The excess aniline is removed by distillation with steam (about three hours is required), and 20 g. of decolorizing carbon (Note 2) is added to the brown residual solution. The mixture is boiled for fifteen minutes and filtered by suction. The filtrate is added, with stirring, to a mixture of 30 cc. of concentrated hydrochloric acid and 60 cc. of water. The precipitated acid is filtered with suction when cold. After drying to constant weight in the air, the yield is 46–52 g. (82–93 per cent of the theoretical amount) of a nearly white product; m.p. 179–181° with preliminary shrinking (Note 3), (Note 4), and (Note 5).

(B) Acridone.—In a 500-cc. flask a solution of 42.7 g. (0.2 mole) of *N*-phenylanthranilic acid (Note 6) in 100 cc. of concentrated sulfuric acid (sp. gr. 1.84) is heated on a boiling water bath for four hours and then poured into 1 l. of boiling water. Spattering is minimized by allowing the solution to run down the wall of the container. The yellow precipitate is filtered after boiling for five minutes, and the filtrate is saved (Note 7). The moist solid is boiled for five minutes with a solution of 30 g. (0.28 mole) of sodium carbonate in 400 cc. of water, collected with suction (Note 8), and washed well with water. After drying in the air the crude acridone weighs 35.5–37.5 g. (91–96 per cent of the theoretical amount) and melts at 344–346° (Note 9). This material is pure enough for many purposes; it may be recrystallized from a mixture of aniline and acetic acid, using 10 cc. of aniline and 25 cc. of acetic acid for every 2 g. of solid. The recovery is about 90 per cent, and the recrystallized product melts at 348–352° (Note 10).

### 2. Notes

1. Sixty grams of technical *o*-chlorobenzoic acid is dissolved in 200 cc. of hot water containing 20 g. of sodium carbonate, 10 g. of decolorizing carbon is added, and, after boiling for ten minutes, the mixture is filtered by suction. The filtrate is added to hydrochloric acid prepared by diluting 31 cc. of the concentrated acid with an equal volume of water. The air-dried product weighs 41 g. and is used directly. This purification is essential to obtain a good yield and a product of good quality. If it is omitted, a blue to black acid results, from which the color is removed only with difficulty.

- Directions for preparing *o*-chlorobenzoic acid by the oxidation of *o*-chlorotoluene are given on p. 135.
2. Ordinary animal charcoal and Darco gave equally good results.
  3. *N*-Phenylanthranilic acid decomposes slowly at elevated temperatures. Before the melting point is reached, there is considerable preliminary shrinkage. If the "dip method" is used, the melting point is 182–183°. The literature values vary from 181° to 184° for the pure acid.
  4. This acid is pure enough for all ordinary purposes. The melting point is only slightly raised by dissolving 5 g. in 100 cc. of water containing 2.5 g. of sodium carbonate, adding 2.5 g. of decolorizing carbon, boiling for five minutes, filtering, and acidifying. The recovery is 4.6 g. If the product is colored this procedure must be followed to get acridone of light color.
  5. For recrystallization, 5 g. of the acid is dissolved in 25 cc. of boiling alcohol and 5 cc. of water added. The recovery is 4.8 g., and the melting point is 182–183°. Acetic acid (2 cc. per gram) may be substituted for alcohol; it is more convenient for recrystallizing large quantities.
  6. The *N*-phenylanthranilic acid may be used without recrystallization if it has been prepared from purified *o*-chlorobenzoic acid. If not, the crude *N*-phenylanthranilic acid must be decolorized as described in (Note 4); otherwise a greenish acridone is obtained which, however, has the proper melting point.
  7. On standing overnight, the filtrate deposits 1.6 to 2 g. of a very impure product which melts at about 315°.
  8. On acidification of the filtrate, a little (1.5–2 g.) *N*-phenylanthranilic acid is always precipitated.
  9. The crude acridone shrinks in a capillary tube at 330–335° and melts to a dark-colored liquid at 344–346°.
  10. Isoamyl alcohol may also be used for recrystallization; 1 g. of acridone requires 120 cc. of solvent and yields 0.75 g. of material melting at 354°, using a Berl-Kullman copper block.<sup>1</sup>

### 3. Discussion

The practical methods of preparation of *N*-phenylanthranilic acid are the action of aniline on *o*-chloro- or *o*-bromobenzoic acid,<sup>2, 3</sup> or the action of bromobenzene on anthranilic acid,<sup>4, 5, 6</sup> copper or its salts being used in both instances.

The only method of preparative value for acridone is by ring closure of *N*-phenylanthranilic acid.<sup>7</sup>

This preparation is referenced from:

- [Org. Syn. Coll. Vol. 2, 135](#)

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### References and Notes

1. Berl and Kullman, Ber. **60**, 811 (1927); for an elaborate modification, see Walsh, Ind. Eng. Chem., Anal. Ed. **6**, 468 (1934).
  2. Ullmann, Ber. **36**, 2383 (1903); Ann. **355**, 322 (1907).
  3. Meister, Lucius, and Brüning, Ger. pat. 145,189 (Chem. Zentr. **1903**, II, 1097).
  4. Goldberg, Ber. **39**, 1691 (1906).
  5. Houben and Brassert, *ibid.* **39**, 3238 (1906).
  6. Goldberg and Ullmann, Ger. pat. 173,523 (Chem. Zentr. **1906**, II, 931); Goldberg, Ger. pat. 187,870 (Chem. Zentr. **1907**, II, 1465).
  7. Graebe and Lagodzinski, Ber. **25**, 1734 (1892); Ann. **276**, 35 (1893); Matsumura, J. Am. Chem. Soc. **57**, 1533 (1935).
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### Appendix

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

copper or its salts  
o-chloro- or o-bromobenzoic acid  
alcohol (64-17-5)  
potassium carbonate (584-08-7)  
sulfuric acid (7664-93-9)  
hydrochloric acid (7647-01-0)  
acetic acid (64-19-7)  
aniline (62-53-3)  
sodium carbonate (497-19-8)  
decolorizing carbon (7782-42-5)  
bromobenzene (108-86-1)  
o-Chlorotoluene (95-49-8)  
Anthranilic Acid (118-92-3)  
copper oxide (1317-38-0)  
isoamyl alcohol (123-51-3)  
Acridone (578-95-0)  
N-Phenylanthranilic acid (91-40-7)  
o-Chlorobenzoic acid (118-91-2)