



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.

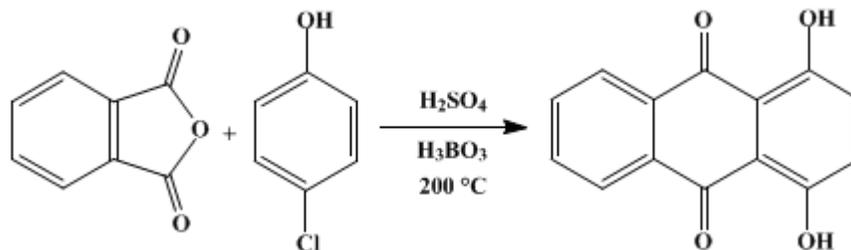
In some articles in *Organic Syntheses*, chemical-specific hazards are highlighted in red "Caution Notes" within a procedure. It is important to recognize that the absence of a caution note does not imply that no significant hazards are associated with the chemicals involved in that procedure. Prior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

The procedures described in *Organic Syntheses* are provided as published and are conducted at one's own risk. *Organic Syntheses, Inc.*, its Editors, and its Board of Directors do not warrant or guarantee the safety of individuals using these procedures and hereby disclaim any liability for any injuries or damages claimed to have resulted from or related in any way to the procedures herein.

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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QUINIZARIN



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1. Procedure

One hundred fifteen grams (0.9 mole) of *p*-chlorophenol, 300 g. (2.0 moles) of phthalic anhydride, 50 g. of crystallized boric acid, and 2 kg. (1090 cc.) of 95 per cent sulfuric acid are thoroughly mixed in a 1.5-l. round-bottomed flask. The flask is then immersed to the neck in an oil bath and the temperature gradually raised to 200° during the course of one-half to three-quarters of an hour (Note 1). It is then kept constant at 200° for three and one-half hours. Owing to the tendency of the phthalic anhydride to sublime, the mouth of the flask is covered with a piece of porous plate. When cool, the colored melt is poured slowly into 5 l. of cold water with continuous stirring, and filtered. The precipitate is boiled with 10 l. of water and filtered hot to remove the excess of phthalic anhydride which goes into solution. The residue is then suspended in 10 l. of boiling water, and to this suspension is added a sufficient quantity of 10 *N* potassium hydroxide solution to produce a purple color (about 30 cc.), followed by 300 cc. more (Note 2). The alkaline solution is filtered hot, and the residue (about 5–10 g.) is washed with 200 cc. of hot 2 per cent potassium hydroxide solution and discarded.

The purple quinizarin solution is next saturated with carbon dioxide and the precipitated quinizarin again filtered. The product is then boiled with 5 l. of a 10 per cent solution of sodium carbonate until it appears black (probably the monosodium salt) to dissolve the last traces of purpurin. The mixture is cooled to room temperature and filtered, and the precipitate is boiled with 5 l. of 5 per cent hydrochloric acid to liberate the quinizarin. The mixture is again cooled to room temperature, and the final product is filtered, washed with cold water, and dried at 100°.

The yield is 147–160 g. (68–74 per cent of the theoretical amount). It sinters at 190–191° and melts at 199–200° (corr.). A sample twice recrystallized from glacial acetic acid melted at 200–202° (corr.) (Note 3). The crystal form of this product compares very favorably with that of quinizarin of the highest purity, as observed under the microscope.

2. Notes

1. An enameled bucket placed on a Fletcher radial burner serves well for this purpose.
2. The "purple color" end-point is not sharp, but as soon as the red hue of the mixture has distinctly changed toward purple, this point is considered reached. A variation of 5–10 cc. either way has little effect, but a large excess gives a large alkali-insoluble residue.
3. Purified quinizarin is reported as melting at 194–195°.¹ A melting point of 191–193°, probably uncorrected, is also given.²

3. Discussion

Quinizarin can be prepared by heating *p*-chlorophenol, phthalic anhydride, and either sulfuric acid³ or aluminum chloride;⁴ by diazotizing *p*-chloroaniline, condensing it with phthalic anhydride, and hydrolyzing;⁵ by heating hydroquinone with phthalic anhydride;⁶ by heating hydroquinone, phthalic

anhydride, and c. p. sulfuric acid;⁷ by oxidizing anthraquinone with ammonium persulfate in sulfuric acid solution⁸ or with nitrosylsulfuric acid in the presence of mercury or a mercury compound;⁹ by treating anthraquinone and 2-hydroxyanthraquinone with sulfuric and nitric acids in the presence of boric acid;¹⁰ by heating anthraquinone with sulfuric acid in the presence of boric acid to 260–280°;¹¹ by chlorination of hydroxy-anthraquinone followed by hydrolysis with sulfuric acid in the presence of boric acid;¹² and by a method like the procedure described, in which a mixture of *o*- and *p*-chlorophenol is heated above 200°.¹³

References and Notes

1. Grimm, Ber. **6**, 508 (1873).
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4. National Aniline and Chemical Co., U. S. pat. 1,886,237 [C. A. **27**, 1366 (1933)].
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6. Grimm, Ber. **6**, 506 (1873).
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12. Thomas, U. S. pat. 1,504,165 [C. A. **19**, 77 (1925)].
13. Dodd, Sprent, and United Alkali Co. Ltd., Brit. pat. 245,584 [C. A. **21**, 249 (1927)]. Gubelmann and Weiland, U. S. pat. 1,790,915 [C. A. **25**, 1539 (1931)].

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

monosodium salt

purpurin

mercury or a mercury compound

sulfuric and nitric acids

o- and *p*-chlorophenol

sulfuric acid (7664-93-9)

hydrochloric acid (7647-01-0)

acetic acid (64-19-7)

hydroquinone (123-31-9)

sodium carbonate (497-19-8)

carbon dioxide (124-38-9)
phthalic anhydride (85-44-9)
Anthraquinone (84-65-1)
aluminum chloride (3495-54-3)
potassium hydroxide (1310-58-3)
boric acid (10043-35-3)
Quinizarin (81-64-1)
ammonium persulfate (7727-54-0)
nitrosylsulfuric acid (7782-78-7)
2-hydroxyanthraquinone (605-32-3)
hydroxy-anthraquinone (129-43-1)
p-chloroaniline (106-47-8)
p-chlorophenol (106-48-9)