



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.

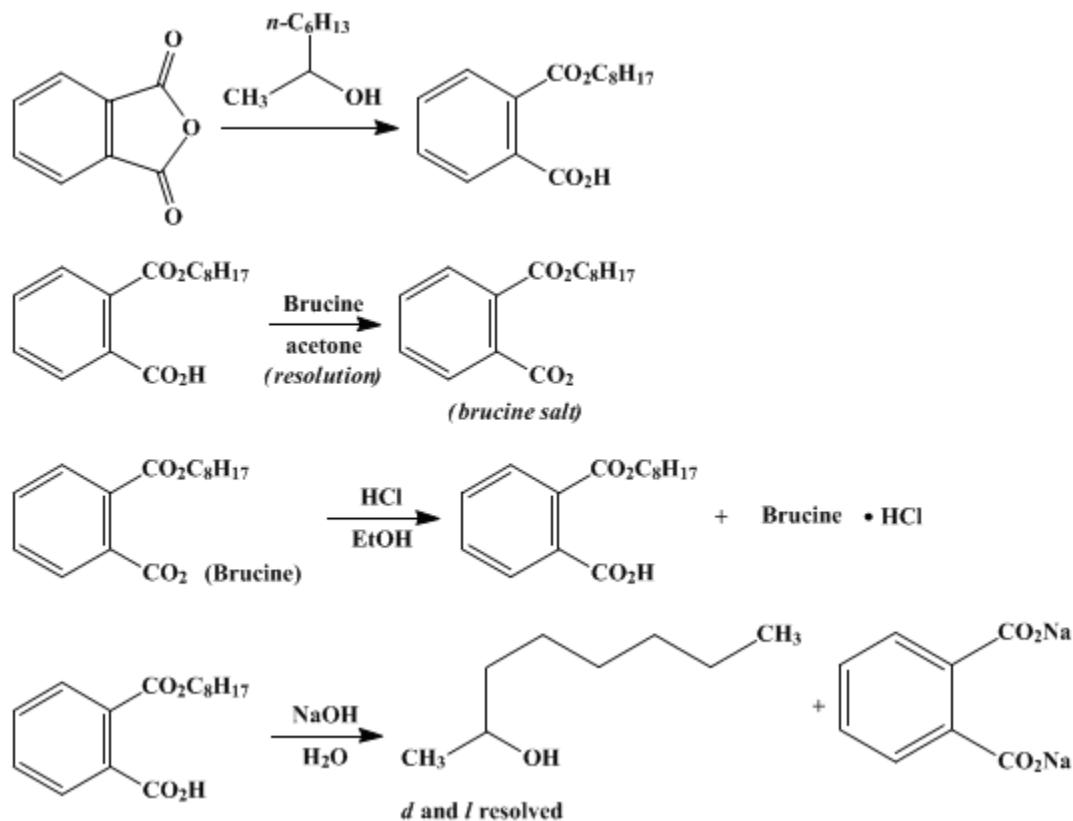
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These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

Organic Syntheses, Coll. Vol. 1, p.418 (1941); Vol. 6, p.68 (1926).

d- and *l*-OCTANOL-2

[2-Octanol, *d*- and *l*-]



Submitted by Joseph Kenyon

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1. Procedure

(A) *Preparation of sec.-Octyl Hydrogen Phthalate*.—A mixture of 130 g. (1 mole) of *sec*-octyl alcohol (p. 366) and 148 g. (1 mole) of phthalic anhydride is heated for twelve to fifteen hours in a flask surrounded by an oil bath at 110–115° (Note 1). During the heating the mixture should be mechanically stirred or shaken occasionally to give a homogeneous liquid. The cooled reaction mixture is added to about 8 l. of water which contains 150 g. (1.4 moles) of anhydrous sodium carbonate. The solid material gradually goes into solution, and if the resulting solution is perfectly clear, dilute hydrochloric acid is added in slight excess, thus precipitating the *sec*-octyl hydrogen phthalate as an oil which rapidly turns to a solid; if the alkaline solution is not clear, owing to the presence of methyl hexyl ketone in the original alcohol, it should be extracted with ether to remove the ketone before acidifying with hydrochloric acid.

The octyl hydrogen phthalate is filtered, washed with water, ground thoroughly with water in a mortar, and finally filtered and dried. For complete purification it may be crystallized either from petroleum ether (b.p. 60–70°) or glacial acetic acid, from which it separates as needles melting at 55°. The crude material, however, is perfectly satisfactory for the following experiments. The yield is nearly quantitative if the *sec*-octyl alcohol is pure (Note 2) and (Note 3).

(B) *Resolution*.—A warm solution of 278 g. (1 mole) of *sec*-octyl hydrogen phthalate and 600 cc. of acetone is treated with 394 g. (1 mole) of brucine and the mixture warmed until the solution is clear. Upon cooling, the crystals of brucine salt (A) form. These are filtered, pressed, and washed in the funnel

with 250 cc. of **acetone**. The combined filtrate and washings are concentrated to about 50 per cent of their original volume and then poured into dilute **hydrochloric acid** (slightly more than the calculated amount), which causes the precipitation of the **sec.-octyl hydrogen phthalate**. After the precipitate sets to a crystalline mass, it is filtered, washed with cold water, and dried. This weighs approximately one-half of the original ester used and has a rotation $[\alpha]_{5461} - 47^\circ$ in absolute **alcohol** solution (**Note 4**).

The crystals (A) are dissolved in the minimum amount of hot **ethyl alcohol** and decomposed by pouring the solution into dilute **hydrochloric acid**. The weight of the ester thus obtained is about one-half of that originally taken, and its rotation in absolute alcohol is about $[\alpha]_{5461} + 47^\circ$, $[\alpha]_D + 44^\circ$.

The two lots of crude active **sec.-octyl hydrogen phthalate** are now separately crystallized twice from **acetic acid** (about 2 g. of 90 per cent **acetic acid** should be used for each gram of solid). They are thus obtained in an optically pure condition and possess the rotations $[\alpha]_{5461} - 58.5^\circ$, $[\alpha]_D - 48.4^\circ$ and $[\alpha]_{5461} + 58.3^\circ$, $[\alpha]_D + 48.4^\circ$, respectively. The amount of pure product, m.p. 75° , obtained in each case is respectively about 99 g. and 96 g. (about 70 per cent of the theoretical amount). The **sec.-octyl hydrogen phthalate** of low optical activity obtained by adding water to the **acetic acid** filtrates can be collected and used in a subsequent preparation.

(C) *Hydrolysis*.—Optically pure *l*- and *d*-**sec.-octyl alcohols** are obtained by distillation in a current of steam of the **sec.-octyl hydrogen phthalate** and 2 moles of **sodium hydroxide** in 30 per cent solution. The alcohols are practically insoluble in water and are separated, dried with **potassium carbonate**, and distilled. Each boils at $86^\circ/20$ mm. and has a rotation $[\alpha]_{5461}^{17^\circ} + 11.8^\circ$, $[\alpha]_D^{17^\circ} + 9.9^\circ$ or $[\alpha]_{5461}^{17^\circ} - 11.8^\circ$, $[\alpha]_D^{17^\circ} - 9.9^\circ$. The yields of alcohol from the **sec.-octyl hydrogen phthalates** are about 95 per cent of the calculated amounts.

2. Notes

1. If this temperature is exceeded the yield of **octyl phthalate** is reduced and the color of the product is very dark. The color is carried through with the *l*-fraction, making it difficult to read rotations.
2. The yield of **sec.-octyl hydrogen phthalate** from the crude **sec.-octyl alcohol** used in this preparation was 61–64 per cent.
3. It is reported that **sec.-octyl hydrogen phthalate** may be prepared in a purer state and with better yields if the reaction is carried out in the presence of **pyridine** according to the procedure of Levene and Mikeska for preparing the acid phthalate of **cyclohexyl phenyl carbinol**¹ (H. L. Haller, private communication).
4. Frequently this product is so dark that a determination of rotation is impossible.

3. Discussion

The resolution of **sec.-octyl alcohol** was first described by Pickard and Kenyon.² The method employed by these authors differs from the procedure described in the following respects. The brucine salt of **sec.-octyl hydrogen phthalate** was crystallized several times from **acetone** until it reached optical purity and was then decomposed to give pure *d*-**sec.-octyl hydrogen phthalate**. The partly levorotatory hydrogen phthalic ester obtained by the decomposition of the more soluble fractions of the brucine salt was then combined with **cinchonidine** and the cinchonidine salt crystallized some half-dozen times from **acetone** until optical purity was reached. Decomposition of this salt yielded the optically pure *l*-**sec.-octyl hydrogen phthalate**.

The procedure described³ is much more convenient.

References and Notes

1. Levene and Mikeska, *J. Biol. Chem.* **75**, 594 (1927).
2. Pickard and Kenyon, *J. Chem. Soc.* **91**, 2058 (1907).
3. Kenyon, *ibid.* **121**, 2540 (1922).

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

petroleum ether

ester

brucine salt

acid phthalate

hydrogen phthalic ester

cinchonidine salt

D- and L-Octanol-2

2-Octanol, d- and l-

d-sec.-octyl alcohols

sec.-octyl hydrogen phthalates

brucine salt of sec.-octyl hydrogen phthalate

ethyl alcohol,
alcohol (64-17-5)

potassium carbonate (584-08-7)

hydrochloric acid (7647-01-0)

acetic acid (64-19-7)

ether (60-29-7)

sodium hydroxide (1310-73-2)

sodium carbonate (497-19-8)

phthalic anhydride (85-44-9)

acetone (67-64-1)

pyridine (110-86-1)

sec.-octyl alcohol (123-96-6)

sec.-Octyl Hydrogen Phthalate,
d-sec.-octyl hydrogen phthalate,
l-sec.-octyl hydrogen phthalate (5393-19-1)

methyl hexyl ketone (111-13-7)

octyl hydrogen phthalate,
octyl phthalate

brucine

cyclohexyl phenyl carbinol

cinchonidine (485-71-2)