Organic Syntheses

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.

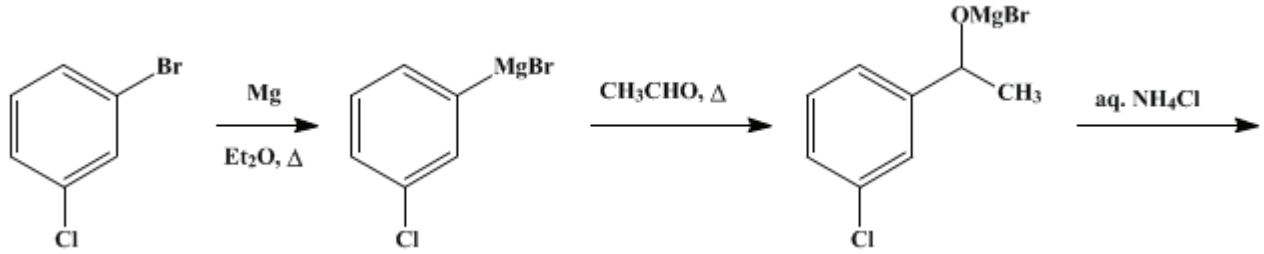
These paragraphs were added in September 2014. The statements above do not supersede any specific hazard caution notes and safety instructions included in the procedure.

DOI:10.15227/orgsyn.028.0028

Organic Syntheses, Coll. Vol. 3, p.200 (1955); Vol. 28, p.28 (1948).

m-CHLOROPHENYLMETHYLCARBINOL

[Benzyl alcohol, *m*-chloro-α-methyl-]



Submitted by C. G. Overberger, J. H. Saunders, R. E. Allen, and Robert Gander.
Checked by Arthur C. Cope and Theodore T. Foster.

1. Procedure

A dry 2-l. three-necked round-bottomed flask is equipped with a sealed stirrer, a 500-ml. dropping funnel (Note 1), and an efficient reflux condenser attached to a calcium chloride tube. In the flask are placed 29.1 g. (1.2 gram atoms) of magnesium turnings, a crystal of iodine, and about 50 ml. of dry ether. A solution of 229 g. (1.2 moles) of *m*-bromochlorobenzene (Note 2) in 850 ml. of dry ether is added with stirring at a rate which maintains rapid refluxing. The reaction begins after 20–50 ml. of the ether solution is added (Note 3), and the addition requires 1–3 hours. The mixture is stirred and heated on the steam bath under reflux for 1 hour after all the *m*-bromochlorobenzene has been added.

A cooled solution of 60 g. (1.365 moles) of freshly distilled acetaldehyde in 200 ml. of dry ether (Note 4) is added through the dropping funnel during 2–3.5 hours, as rapidly as the condenser capacity permits. The mixture is stirred and heated under reflux for 1 hour after the addition is completed.

The reaction mixture is cooled in ice, and the addition compound is decomposed by adding dropwise with stirring 185 ml. of a 25% solution of ammonium chloride in water (Note 5). The ether solution becomes clear, and the salts separate as a cake. The ether solution is decanted, combined with 150 ml. of ether that has been used to rinse the salt cake, and dried over anhydrous magnesium sulfate. After removal of the ether the product is distilled under reduced pressure to give 154.5–164.5 g. (82.5–88%) of *m*-chlorophenylmethylcarbinol boiling at 99–104°/4 mm.; n_D^{25} 1.5405 (Note 6).

2. Notes

1. It is convenient to use a Hershberg stirrer with a rubber slip seal protected from ether vapor with a short water-cooled condenser. The dropping funnel may be connected to the flask through an extension tube to prevent clogging, which occurs if the Grignard reagent comes in contact with the acetaldehyde in the tip of the funnel.
2. *m*-Bromochlorobenzene was prepared according to p. 185. It may be purchased from the Eastman Kodak Company.
3. If the reaction does not begin spontaneously, the mixture should be heated under reflux until the reaction starts before more than 50 ml. of the *m*-bromochlorobenzene solution is added.
4. The solution is cooled to prevent loss of acetaldehyde by vaporization. Commercial acetaldehyde may be redistilled just before it is used, or acetaldehyde may be prepared by depolymerization of paraldehyde.[1]
5. The submitters state that the complex may be decomposed by pouring the reaction mixture onto 1 kg. of crushed ice to which 50 ml. of concentrated sulfuric acid has been added. The ether layer is separated, combined with two 100-ml. ether extracts of the aqueous layer, and washed with three 250-ml. portions of water, one 250-ml. portion of 10% sodium carbonate solution, and finally with 250 ml. of water.

6. The same general method (including the procedure of (Note 5)) has been used by the submitters to prepare the following substituted phenylmethylcarbinols:

Carbinol	*Boiling Point*	% *Yield*
m-Trifluoromethylphenylmethylcarbinol	100–102°/17 mm.	83
m-Methylphenylmethylcarbinol	103–105°/6 mm.	71
m-*tert*-Butylphenylmethylcarbinol	130–134°/17 mm.	56

An alternative preparation of similar carbinols, consisting in the reaction of methylmagnesium iodide with a substituted benzaldehyde, is advantageous when the aromatic aldehyde is available. The following carbinols have been prepared by the submitters in that way:

Aldehyde	*Carbinol*	*Boiling Point*	% *Yield*
p-Chlorobenzaldehyde [Heyden Chemical Corporation; *Org. Syntheses* Coll. Vol. **2**, 133 (1943)]	*p*-Chlorophenylmethylcarbinol	98–100°/4.5 mm.	59
o-Chlorobenzaldehyde (Heyden Chemical Corporation)	*o*-Chlorophenylmethylcarbinol	94°/4 mm.	69
o-Bromobenzaldehyde	*o*-Bromophenylmethylcarbinol	102–105°/2–3 mm.	73
m-Bromobenzaldehyde	*m*-Bromophenylmethylcarbinol	105–110°/2–3 mm.	74
p-Bromobenzaldehyde [*Org. Syntheses* Coll. Vol. **2**, 89, 442 (1943)]	*p*-Bromophenylmethylcarbinol	90°/1 mm.	64
2,3-Dichlorobenzaldehyde	2,3-Dichlorophenylmethylcarbinol	112–113°/2 mm. m.p. 55–57°	76
2,4-Dichlorobenzaldehyde (Heyden Chemical Corporation)	2,4-Dichlorophenylmethylcarbinol	125–126°/7 mm.	62
2,6-Dichlorobenzaldehyde (Eastman Kodak Company)	2,6-Dichlorophenylmethylcarbinol	104–107°/2.5 mm.	89
3,5-Dichlorobenzaldehyde	3,5-Dichlorophenylmethylcarbinol	126°/4 mm.	69
3,4-Dichlorobenzaldehyde (Heyden Chemical Corporation)	3,4-Dichlorophenylmethylcarbinol	125–130°/3–4 mm.	73

3. Discussion

This procedure is adapted from the preparation described by Marvel and Schertz.[2] *m*-Chlorophenylmethylcarbinol also has been prepared from *m*-chlorobenzaldehyde and methylmagnesium iodide,[3,4,5] and by the reduction of *m*-chloroacetophenone in the presence of copper chromite.[6]

This preparation is referenced from:

- Org. Syn. Coll. Vol. 3, 204

References and Notes

1. *Org. Syntheses* Coll. Vol. **2**, 407 (1943).
2. Marvel and Schertz, *J. Am. Chem. Soc.*, **65**, 2054 (1943).

3. Lock and Bock, *Ber.*, **70**, 916 (1937).
4. Brooks, *J. Am. Chem. Soc.*, **66**, 1295 (1944).
5. Ushakov and Matuzov, *J. Gen. Chem. U.S.S.R.*, **14**, 120 (1944) [*C. A.*, **39**, 916 (1945)].
6. Emerson and Lucas, *J. Am. Chem. Soc.*, **70**, 1180 (1948).

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

acetaldehyde (75-07-0)

sulfuric acid (7664-93-9)

ether (60-29-7)

ammonium chloride (12125-02-9)

magnesium turnings (7439-95-4)

sodium carbonate (497-19-8)

benzaldehyde (100-52-7)

iodine (7553-56-2)

methylmagnesium iodide (917-64-6)

magnesium sulfate (7487-88-9)

COPPER CHROMITE

2,3-Dichlorobenzaldehyde (6334-18-5)

2,3-Dichlorophenylmethylcarbinol

2,4-Dichlorobenzaldehyde (874-42-0)

2,4-Dichlorophenylmethylcarbinol (81156-68-5)

2,6-Dichlorobenzaldehyde (83-38-5)

2,6-Dichlorophenylmethylcarbinol

3,5-Dichlorobenzaldehyde (10203-08-4)

3,5-Dichlorophenylmethylcarbinol

3,4-Dichlorobenzaldehyde (6287-38-3)

3,4-Dichlorophenylmethylcarbinol

m-Bromobenzaldehyde (3132-99-8)

m-Chlorobenzaldehyde (587-04-2)

p-Chlorobenzaldehyde (104-88-1)

o-chlorobenzaldehyde (89-98-5)

p-Bromobenzaldehyde (1122-91-4)

m-bromochlorobenzene (108-37-2)

m-Chlorophenylmethylcarbinol (5182-44-5)

Benzyl alcohol, m-chloro-α-methyl- (6939-95-3)

m-Trifluoromethylphenylmethylcarbinol (455-01-6)

m-Methylphenylmethylcarbinol (1875-89-4)

m-tert-Butylphenylmethylcarbinol

p-Chlorophenylmethylcarbinol (1875-88-3)

o-Chlorophenylmethylcarbinol (19819-95-5)

o-Bromobenzaldehyde (6630-33-7)

o-Bromophenylmethylcarbinol (1074-16-4)

m-Bromophenylmethylcarbinol (28229-69-8)

p-Bromophenylmethylcarbinol (4654-39-1)

m-chloroacetophenone (99-02-5)

paraldehyde (123-53-7)