



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.

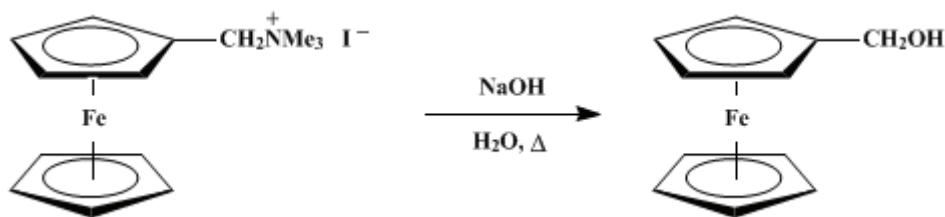
The procedures described in *Organic Syntheses* are provided as published and are conducted at one's own risk. *Organic Syntheses, Inc.*, its Editors, and its Board of Directors do not warrant or guarantee the safety of individuals using these procedures and hereby disclaim any liability for any injuries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

Organic Syntheses, Coll. Vol. 5, p.621 (1973); Vol. 40, p.52 (1960).

HYDROXYMETHYLFERROCENE

[Iron, cyclopentadienyl]-(hydroxymethyl)cyclopentadienyl-]



Submitted by Daniel Lednicer, T. Arthur Mashburn, Jr., and Charles R. Hauser¹.

Checked by B. C. McKusick, H. F. Mower, and G. N. Sausen.

1. Procedure

Caution! This preparation should be conducted in a hood because trimethylamine is evolved.

A solution of 10.0 g. (0.25 mole) of sodium hydroxide in 250 ml. of water is prepared in a 1-l. round-bottomed flask equipped with a reflux condenser and a mechanical stirrer. Twenty-five grams (0.065 mole) of N,N-dimethylaminomethylferrocene methiodide² is added to the solution. The resulting suspension is heated to reflux temperature with stirring. At this point the solid is in solution. Within 5 minutes oil starts to separate from the solution and trimethylamine starts to come off. At the end of 3.5 hours, at which time the evolution of the amine has virtually ceased, the reaction mixture is allowed to cool to room temperature. The oil generally crystallizes during the cooling. The mixture is stirred with 150 ml. of ether until the oil or solid is all dissolved in the ether. The ether layer is separated in a separatory funnel and the aqueous layer is extracted with two additional 150-ml. portions of ether. The combined ether extracts are washed once with water and dried over sodium sulfate.

The oil that remains when the solvent is removed from the extract crystallizes when cooled to room temperature. This orange solid is recrystallized from 150 ml. of hexane (Note 1) to yield 9.5–12.5 g. (68–89%) of hydroxymethylferrocene, m.p. 74–76°. One more recrystallization from the same solvent affords 8.2–11.0 g. (59–79%) (Note 2) of good-quality alcohol as golden needles, m.p. 76–78° (Note 3).

2. Notes

1. Eastman Kodak Company practical grade hexane is suitable.
2. The yield of this reaction is directly dependent on the purity of the quaternary salt employed. If the salt is prepared from redistilled N,N-dimethylaminomethylferrocene, the yield of alcohol may be as high as 90%.³
3. The pure alcohol melts at 81–82°.

3. Discussion

Hydroxymethylferrocene has been made by condensing ferrocene with N-methylformanilide to give ferrocenecarboxaldehyde, and reducing the latter with lithium aluminum hydride,⁴ sodium borohydride,⁵ or formaldehyde and alkali.⁵ The present procedure is based on the method of Lindsay and Hauser.³ A similar procedure has been used to convert gramine methiodide to 3-hydroxymethylindole,⁶ and the method could probably be used to prepare other hydroxymethyl aromatic compounds.

References and Notes

1. Department of Chemistry, Duke University, Durham, North Carolina. The work was supported by the Office of Ordnance Research, U. S. Army.
 2. See [p. 434](#), this volume.
 3. J. K. Lindsay and C. R. Hauser, *J. Org. Chem.*, **22**, 355 (1957).
 4. P. J. Graham, R. V. Lindsey, G. W. Parshall, M. L. Peterson, and G. M. Whitman, *J. Am. Chem. Soc.*, **79**, 3416 (1957).
 5. G. D. Broadhead, J. M. Osgerby, and P. L. Pauson, *J. Chem. Soc.*, 650 (1958).
 6. E. Leete and L. Marion, *Can. J. Chem.*, **31**, 775 (1953).
-

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

Ferrocene

N,N-Dimethylaminomethylferrocene methiodide

Hydroxymethylferrocene

N,N-dimethylaminomethylferrocene

ferrocenecarboxaldehyde

[ether \(60-29-7\)](#)

[sodium hydroxide \(1310-73-2\)](#)

[formaldehyde \(50-00-0\)](#)

[sodium sulfate \(7757-82-6\)](#)

[Trimethylamine \(75-50-3\)](#)

[lithium aluminum hydride \(16853-85-3\)](#)

[N-methylformanilide \(93-61-8\)](#)

[hexane \(110-54-3\)](#)

[sodium borohydride \(16940-66-2\)](#)

[gramine methiodide 3-hydroxymethylindole \(700-06-1\)](#)

[Iron, cyclopentadienyl\[\(hydroxymethyl\)cyclopentadienyl\]](#)