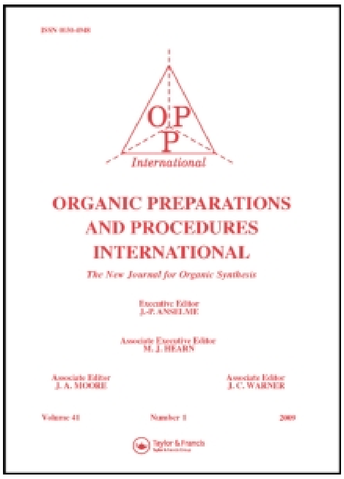


Organic Preparations and Procedures International
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t902189982

A STEREOSELECTIVE SYNTHESIS OF endo-7-PHENYL-2-OXABICYCLO[4.1.0]HEPTANE

Gregory D. Hobbs[a]; James D. Woodyard[a]; John R. Curtis[a]
[a] Department of Chemistry and Kilgore Research Center, West Texas State University, Canyon, TX

To cite this Article Hobbs, Gregory D. , Woodyard, James D. and Curtis, John R.(1981) 'A STEREOSELECTIVE SYNTHESIS OF endo-7-PHENYL-2-OXABICYCLO[4.1.0]HEPTANE', Organic Preparations and Procedures International, 13: 5, 356 — 360

To link to this Article: DOI: 10.1080/00304948109356139

URL: http://dx.doi.org/10.1080/00304948109356139

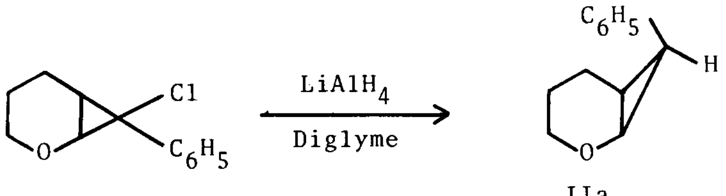
REFERENCES

1. E. Profft and W. George, Ann., 643, 136 (1961).
2. T. Hisano and M. Ichikawa, Yakugaku Zasshi, 91, 1136 (1971); C. A., 76, 14432y (1972).
3. D. W. Hein, R. J. Alheim and J. J. Leavitt, J. Am. Chem. Soc., 79, 427 (1957).
4. J. L. Walter and H. Freisen, Anal. Chem., 26, 217 (1954).
5. T. Hisano and M. Ichikawa, Chem. Pharm. Bull.(Tokyo), 22, 1923 (1974); C. A., 82, 57252f (1975).

A STEREOSELECTIVE SYNTHESIS OF endo-7-PHENYL-2-OXABICYCLO[4.1.0]HEPTANE

Submitted by (7/8/80)
Gregory D. Hobbs, James D. Woodyard* and John R. Curtis
Department of Chemistry and Kilgore Research Center, West Texas State University
Canyon, TX 79016

The epimeric 7-chloro-7-phenyl-2-oxabicyclo[4.1.0]heptanes (I) have been reduced with zinc in sodium ethoxide to give a mixture of the endo and exo-7-phenyl-2-oxabicyclo[4.1.0]-heptanes (IIa and IIb respectively),[1] which are difficult to separate due to the small difference in their boiling points. Jensen and Patterson[2] reported the use of triphenyltin hydride prepared in situ from lithium aluminum hydride and triphenyltin chloride for the stereoselective reduction of structurally related compounds, the 7-chloro-7-phenylnorcaranes. We observed that lithium aluminum hydride is the only reducing agent required for the stereoselective reduction of these compounds[3] and now describe the application of this reaction to the reduction of I to yield pure endo-7-phenyl-2-oxabicyclo-[4.1.0]heptane.



I

IIa

The 7-chloro-7-phenyl-2-oxabicyclo[4.1.0]heptanes (I)[4] were reduced with five equivalents of lithium aluminum hydride in diglyme at 60° for 15 hours, furnishing only one compound, endo-7-phenyl-2-oxabicyclo[4.1.0]heptane (IIa), (98% pure) in 75% yield, mp. 43-44°. The nmr spectrum of IIa displayed absorptions at δ 7.0-7.5 (5H, m), 2.9-3.9 (3H, m), 1.6-2.05 (3H, m) and 0.5-1.4 (3H, m). The infrared spectrum displayed a band in the 1000-1050 cm^{-1} region which is characteristic for most cyclopropyl rings,[5] although this is not always reliable in cases where the compound contains an oxygen atom.[6] The ultraviolet spectrum furnished absorption bands at 207.5 (ε 6390) and 217 nm (ε 5630) which is characteristic of phenyl-substituted cyclopropanes.[4,7,8] The mass spectrum exhibited its molecular ion at m/e 174. The stereochemical assignment of IIa was made on both spectroscopic and chemical data. No change was observed in the phenyl absorptions in the nmr spectrum of IIa as a function of temperature, whereas a coalescence of the phenyl absorptions of the exo isomer was observed as the temperature was increased and the energy barrier for rotation of the phenyl ring overcome. This rotation is not possible with the <u>endo</u> configuration.[1] Chemical evidence supporting the stereochemical structure of IIa was obtained from its base equilibration which produced the thermodynamically more stable <u>exo</u> isomer. This equilibration is possible only if IIa has the <u>endo</u> configuration.[1,9] These data are in agreement with the assigned structure. Using smaller amounts of lithium aluminum hydride gave less IIa. Reduction with triphenyltin hydride and lithium aluminum hydride at high temperatures produced a 52% yield of an alcohol, tentatively identified as 1-phenyl-2-(3-hydroxy-1-propyl)cyclopropane (III). III furnished a correct elemental analysis for $C_{12}H_{16}O$, ultraviolet absorption band at 222 nm (ε 9000) and an nmr spectrum with absorptions at δ 6.6-7.3 (5H, m), 4.0 (1H, s), 3.5 (2H, t, J = 6) and 0.3-1.8 (8H, m). This data is consistent with the assigned structure.

TABLE. <u>REDUCTION OF THE 7-CHLORO-7-PHENYL-2-OXA-BICYCLO[4.1.0]HEPTANES (I)</u>

Run	Reaction Conditions					VPC Analysis of Reaction Mixture			
	Temp	Time[a]	Solvent[b]	$LiAlH_4$	$(Ph)_3SnCl$	I	IIa	IIb	III
1	25°	54	diglyme	4.62g	-	3	97	-	-
2	60°	15	diglyme	4.62g	-	2	98	-	-
3	60°	15	diglyme	3.70g	-	6	94	-	-
4	150°	6	diglyme	4.62g	.95g	-	-	-	100

a) Time recorded in hours.
b) 100 ml of solvent and 5 g of I were employed.

EXPERIMENTAL

An F&M gas chromatograph, Model 810, equipped with a flame ionization detector, was employed for all gas chromatographic analyses. Infrared spectra were obtained using a Beckman Model 10 grating infrared spectrophotometer with potassium bromide cells. NMR spectra were recorded in carbon tetrachloride with a Varian A-60 spectrometer employing tetramethylsilane as an internal reference. Ultraviolet spectra were recorded in cyclohexane with a Bausch and Lomb Model 505 spectrophotometer. Elemental analyses were performed by M-H-W Laboratories, Garden City, Mich. Melting points were determined with a Thomas-Hoover capillary melting point apparatus and are corrected. Boiling points are uncorrected.

endo-7-Phenyl-2-oxabicyclo[4.1.0]heptane (IIa).- Lithium aluminum hydride (4.62 g, 0.1217 mole) was added to 100 ml of dry diglyme in a 4-necked 250 ml flask equipped with a mechanical stirrer, a dropping funnel, and a calcium chloride drying tube. An oil bath was used to maintain the temp. at 60°; 5 g of I,[4] was slowly added and the reaction was allowed to proceed for 15 hrs. The reaction mixture was then cooled, and the excess lithium aluminum hydride destroyed by the sequential dropwise addition of 4.7 ml of water, 4.7 ml of 15% sodium hydroxide solution, and 13.9 ml of water.[10] The reaction mixture was then filtered, taken up in ether, washed with water, and dried over anhydrous magnesium sulfate. The ether was then evaporated, and the residue distilled *in vacuo* affording 3.13 g (75% yield) of IIa, which analyzed by vpc[11] as 98% IIa and 2% I, bp. 132-140°/15 mm; mp. 43-44°, lit.[1] bp. 113-114°/11 mm, mp. 43-44°.

Anal. Calcd. for $C_{12}H_{14}O$: C, 82.72; H, 8.10. Found: C, 82.62; H, 8.15.

Acknowledgement. - The mass spectral data was kindly supplied by Clifford G. Venier. The authors wish to acknowledge the financial support (Grant AE-361) of The Robert A. Welch Foundation.

REFERENCES

1. J. D. Woodyard, P. R. Morris and G. D. Hobbs, J. Heterocyclic Chem., 17, 1097 (1980).
2. F. R. Jensen and D. B. Patterson, Tetrahedron Lett., 3837 (1966).
3. J. D. Woodyard and P. R. Morris, Org. Prep. Proced. Int., 5, 275 (1973).
4. J. E. Hodgkins, J. D. Woodyard, and D. L. Stephenson, J. Am. Chem. Soc., 86, 4080 (1964).
5. N. B. Colthup, L. H. Daly, and S. E. Wiberley, "Introduction to Infrared and Raman Spectroscopy," Academic Press, New York, 1969, p. 198.
6. A. R. H. Cole, J. Chem. Soc., 3807 and 3810 (1954).
7. M. T. Rogers, J. Am. Chem. Soc., 69, 2544 (1947).
8. J. D. Oliver, J. D. Woodyard, P. E. Rush and J. R. Curtis, J. Heterocyclic Chem., 11, 1125 (1974).
9. G. L. Closs and J. J. Coyle, J. Org. Chem., 31, 2759 (1966).
10. V. M. Mićović and M. Lj. Mihailović, ibid., 18, 1190 (1953).
11. Analysis by vpc was accomplished on a 6 ft. by 0.25 in. 10% Ucon 50 HB 2000 (polar) column operated at 175°.

A CONVENIENT SYNTHESIS OF 2-PHENYL-2-THIAZOLIN-5-ONES

Submitted by (10/27/80)
Nobutaka Suzuki* and Yasuji Izawa

Department of Chemistry
Faculty of Engineering
MIE University
Tsu 514, JAPAN

2-Aryl-2-thiazolin-5-ones,[1] a sulfur analogue of azlactones, form