

ASYMMETRIC DIELS - ALDER REACTIONS WITH α -CHLORONITROSO COMPOUNDS - II.¹⁾
THE USE OF A CARBOHYDRATE DERIVED α -CHLORO- α -NITROSO ETHER

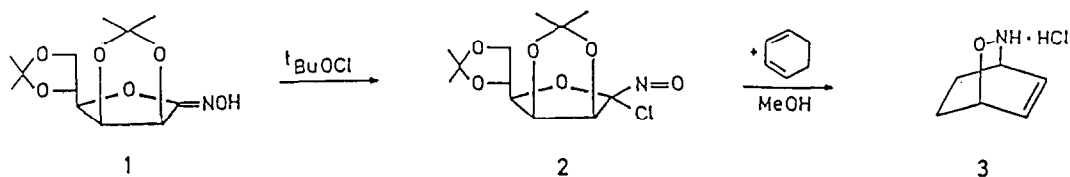
H. Felber^{a)}, G. Kresze^{a)}, H. Braun^{a)}, and A. Vasella^{b)}

a) Organisch-chemisches Institut der Technischen Universität München
Lichtenbergstraße 4, D-8046 Garching

b) Organisch-chemisches Institut der Universität Zürich
Winterthurer Straße 190, CH-8057 Zürich

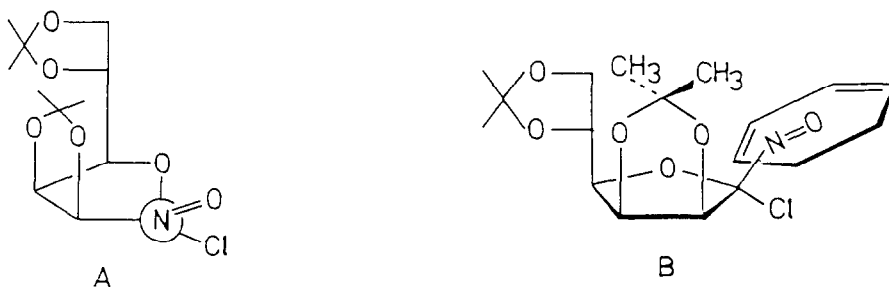
Abstract: The Diels-Alder reaction of 1,3-cyclohexadiene with the α -chloro- α -nitroso ether 2, prepared from mannose via the lactone oxime 1, gives the adduct 3 with 1-(S),4-(R) configuration in 69 % chemical yield and \geq 95 % enantiomeric excess.

The advantages of using α -chloronitroso compounds in stereoselective Diels-Alder reactions have been described in the previous publication¹⁾. There, we reported asymmetric induction with an α -chloronitroso compound derived from epiandrosterone. The use of optically active educts in the preparation of enantiomerically pure α -chloronitroso compounds is, of course, possible for many different classes of natural products. One of the least expensive classes in this respect are the carbohydrates. Moreover, they offer a wide range of structure variations and allow the evaluation of steric and (stereo)electronic effects.



Accordingly, we have synthesized a suitable reagent for performing asymmetric Diels-Alder reactions starting with 2,3:5,6-di-O-isopropylidene-D-mannofuranose²⁾, which was transformed into the known³⁾ mannonolactone oxime 1. By reaction with ^tBuOCl (CH₂Cl₂, -10°C, 1 h), 1 forms in a nearly quantitative yield diastereoselectively the α -chloro- α -nitroso ether 2, the first one to be described in this series as far as we know. The compound 2 was obtained in the form of blue crystals; it is stable at room temperature for several days⁴⁾. Its ¹³C NMR spectrum shows a signal for the C-1 atom at $\delta = 126.2$ ppm, a shift which indicates a hindered position of the nitroso group.

An X-ray investigation of the compound 2 is on the way, at the moment we assume the configuration to be as shown, which seems to be plausible because the corresponding α -bromonitro derivative (- prepared in an analogous way from 1 and sodium hypobromite via the corresponding α -bromonitroso compound -) was shown by X-ray structural analysis to possess the same stereochemistry⁵⁾. In this configuration of 2 the freedom of rotation of the nitroso group is severely limited. The rotamer A shown should have the lowest energy.



1,3-Cyclohexadiene reacts with the nitroso compound 2 even at -78°C within one hour to give the bicyclic oxazine derivative 3¹⁾ in 69 % yield. This compound is optically active ($[\alpha]_{\text{D}}^{20} +24.0^{\circ}$ ($c = 5, \text{CH}_3\text{OH}$)), its specific rotation as well as the NMR spectrum of its 10-camphor-sulfonyl derivative show that it is optically pure within the experimental accuracy. The sign of rotation is consistent with the 1-(S),4-(R) configuration - opposite to the one obtained by Diels-Alder reaction of cyclohexadiene with 17 α -chloro-17 β -nitroso-3 β -hydroxy-5 α -androstane¹⁾. This is compatible with the steric model for the educt 2, provided that the least hindered approach of the diene in the cycloaddition takes place as shown in picture B.

Acknowledgement: Financial support of this work by the Deutsche Forschungsgemeinschaft and the Fonds der Chemischen Industrie is gratefully acknowledged.

References and Notes

- 1) Asymmetric Diels-Alder Reactions with α -Chloronitroso Compounds. I.: M. Sabuni, G. Kresze, and H. Braun, *Tetrahedron Lett.* **1984**, previous communication.
- 2) H. Ohle, and G. Berend, *Ber. Deut. Chem. Ges.* **58**, 2591 (1925).
- 3) a) A. Vasella, *Helv. Chim. Acta* **60**, 1273 (1977).
b) B. M. Aebischer, H. W. Hanssen, and A. T. Vasella, *J. C. S. Perkin Trans. I* **1982**, 2139.
- 4) All new compounds described in this paper gave satisfactory elementary analysis and spectra.
- 5) a) B. Aebischer, A. Vasella, and H.-P. Weber, *Helv. Chim. Acta* **65**, 621 (1982).
b) B. Aebischer, Thesis, Université de Fribourg (Suisse) 1983.

(Received in Germany 23 August 1984)