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ASYMMETRIC DIELS-ALDER REACTIONS WITH CHIRAL ALKOXYCYCLOHEXADIENES

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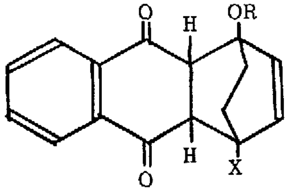
Abstract: Excellent diastereofacial discriminations have been observed for the addition of 1,4-naphthoquinone to alkoxycyclohexa-1,3-dienes subject to appropriate selection of a chiral alkoxy group.

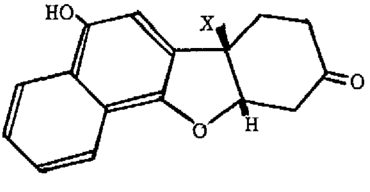
In appropriate cases Diels-Alder additions to acyclic dienes bonded to a chiral fragment may proceed with very high diastereofacial selectivities[1,2,3], however no comparable studies have been reported for cyclic dienes. The observation[4] that cycloadditions to tetrahydropyranyloxycyclohexa-1,3-diene result in adducts having only one of the possible configurations at *the chiral centre of the tetrahydropyranyl ring has led to the prediction* that its replacement by a sugar would result in chiral induction. We report here some pertinent experimental observations made in connection with a projected chiral synthesis of some Amaryllidaceae alkaloids.

The alkoxycyclohexadienes used in our study were prepared by Birch reduction of the corresponding aryl ether and subsequent acid catalysed equilibration, which provided an approximately 2:1 mixture of the 1,3- and 1,4-dienes. Addition of 1,4-naphthaquinone to the diene mixture provided the anticipated adduct(s) (1a,b) which was readily converted[5] by aqueous acid to the corresponding benzonaphthofuranone (2a,b) with release of the *original chiral moiety. The enantiomeric ratios were established by the* method of Mosher[6] and, in conjunction with the observed optical rotations, lead to the results listed in the Table. The results obtained with the glucopyranosyl ether are on a par with those obtained with several ethers



(1a) $X = H$

(1b) $X = CH_3$



(2a) $X = H$

(2b) $X = CH_3$

TABLE

Source of Chiral Diene	Product	% of [+]-isomer
O-Phenyl-(-)-borneol	(2a)	37
O-Phenyl-(-)-menthol	(2a)	46.7
O-Phenyl-(+)-isopinocampheol	(2a)	64.5
2,3,4,6-Tetra-O-methyl-O-phenyl-β-D-glucopyranoside	(2a)	58.5
O-Phenyl-1,2,5,6-diisopropylidene-D-glucose	(2a)	97.5
O-p-Tolyl-1,2,5,6-diisopropylidene-D-glucose	(2b)	97.5

of terpenoid origin and does not mirror the effectiveness of this chiral group in acyclic systems[2].

However, most satisfactory results were obtained using ethers derived from diisopropylideneglucose as the chiral moiety in keeping with its successful utilisation in inducing chiral induction of cycloadditions to butadienes[7]. If we assume that similar conformations are adopted in the present Diels-Alder additions to those that can be deduced for the acyclic situation then we can tentatively assign the absolute stereochemistry indicated in formula (2a,b) to the predominant (+)-isomer, which corresponds to the natural stereochemistry of the target alkaloids.

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