

Asymmetric Induction in Nucleophilic Addition to an $\alpha\beta$ -Unsaturated Sulphoxide

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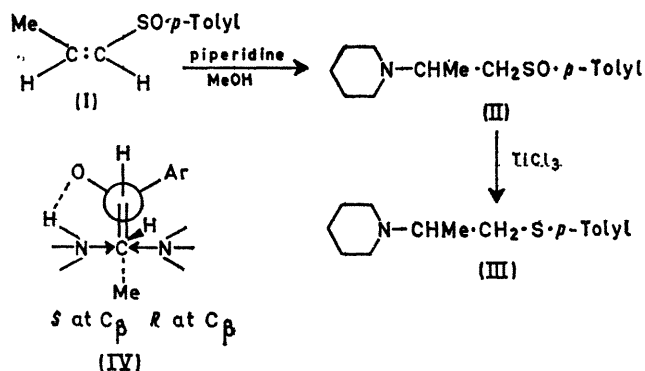
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Summary The absolute configuration of the major diastereoisomer obtained by addition of piperidine to *S*(-)-*cis*-propenyl *p*-tolyl sulphoxide has been confirmed by synthesis and is in agreement with transition state predictions.

The mechanism of nucleophilic addition of amines to $\alpha\beta$ -unsaturated sulphones has been studied in detail^{1,2} but little work has been carried out on corresponding reactions of $\alpha\beta$ -unsaturated sulphoxides. We have now examined this type of reaction with respect to asymmetric induction of addition under the influence of a chiral sulphur atom. Stereoselectivity in nucleophilic additions to chiral allylic alcohols has recently been examined.³

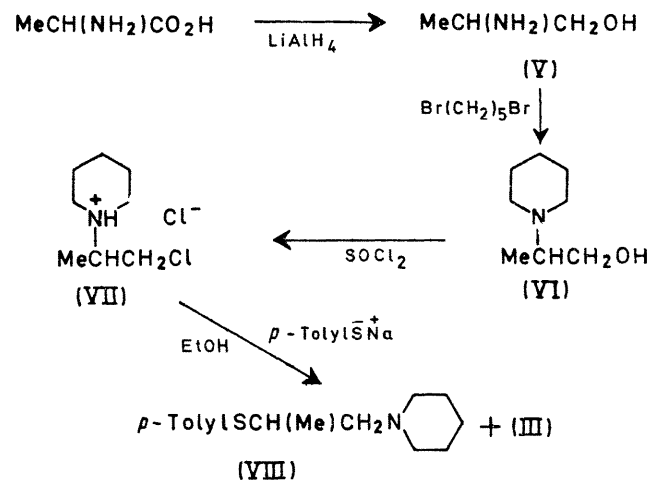


R(-)-*cis*-propenyl *p*-tolyl sulphoxide (I) was obtained by treatment of (-)-menthyl *S*-toluene-*p*-sulphinate⁴ with *cis*-propenyl magnesium bromide. It had m.p. 54–55°; $[\alpha]_{546}^{25} - 373^\circ$ ($c = 1$; EtOH) and on treatment with piperidine in methanol gave a mixture of diastereoisomeric adducts (II) (100%) m.p. 87–89°, $[\alpha]_{546}^{25} + 200^\circ$. Recrystallisation to constant rotation from light petroleum gave the major diastereoisomer, m.p. 98–99° $[\alpha]_{546}^{25} + 226^\circ$. Reduction of the adduct mixture and of the pure diastereoisomer with titanous chloride⁵ gave samples of 2-piperidinopropyl *p*-tolyl sulphide (III) with $[\alpha]_{546}^{25} - 17.7^\circ$ and -24.0° respectively, indicating an optical yield of 74%.

Absolute configuration at sulphur in the unsaturated sulphoxide is known⁶ and a reasonable model for the transition state¹ for addition (IV) suggests that the *S* configuration at the β -carbon atom should result from

preferential attack of the amine on the side of the double bond remote from the bulky aryl group leading to the complete specification of the major diastereoisomer as *R_sS_c*.

This assignment has been confirmed by synthesis of the piperidino-sulphide starting from *S*(+)-alanine. Reduction of alanine with lithium aluminium hydride gave the alcohol (V) which, with 1,5-dibromopentane, gave piperidino-alcohol (VI). This alcohol, with thionyl chloride, gave the chloride-hydrochloride (VII) which, with sodium toluene-*p*-thiolate in ethanol, gave a mixture of products, $[\alpha]_{546}^{25} - 25.8^\circ$, which n.m.r. spectroscopy indicated to be an 80:20 mixture of 2-piperidinopropyl *p*-tolyl sulphide (III) and 3-piperidinopropyl *p*-tolyl sulphide (VIII). Separation



of the mixture by preparative g.l.c. caused partial decomposition but gave (III) $[\alpha]_{546}^{25} - 16.1^\circ$, picrate m.p. 122–123° alone or mixed with the picrate (m.p. 122–124°) of the sulphide derived from the major diastereoisomeric adduct above. These picrates had $[\alpha]_{546}^{25} - 81^\circ$ and -127° respectively and had identical n.m.r. spectra. This synthesis confirms the prediction made from consideration of the likely transition state.

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¹ S. T. McDowell and C. J. M. Stirling, *J. Chem. Soc. (B)*, 1967, 343, 348, 351.

² W. G. Davies, E. W. Hardisty, T. P. Nevell, and R. H. Peters, *J. Chem. Soc. (B)*, 1970, 1004.

³ H. Felkin, G. Swierczewski, and A. Tambuté, *Tetrahedron Letters*, 1969, 707.

⁴ H. Phillips, *J. Chem. Soc.*, 1925, 2552.

⁵ D. Barnard and K. R. Hargrave, *Analyt. Chim. Acta*, 1951, 5, 536.

⁶ K. K. Andersen, *Tetrahedron Letters*, 1962, 93; M. Axelrod, P. Bickhart, J. Jacobus, M. M. Green, and K. Mislow, *J. Amer. Chem. Soc.*, 1968, 90, 4835.