Synthesis of Optically Active *N*-Alkylidenesulphinamides

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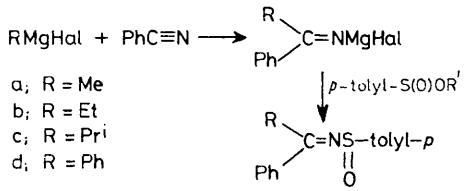
Summary Optically active *N*-alkylidenesulphinamides can be obtained from imino-Grignard reagents and sulphinate esters; the reaction is highly stereospecific and proceeds with inversion of chirality at sulphur.

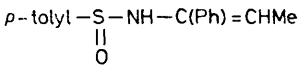
THE synthesis[1] and reactivity[1,2] of *N*-alkylidenesulphinamides (*N*-sulphinylimines) has recently been reported, and their barrier to planar inversion at nitrogen examined.[3]

We have prepared the *N*-alkylidenesulphinamides (**1**) *via* a new route, involving interaction of an alkyl or aryl

Grignard reagent with a nitrile, and subsequent reaction with a sulphinate ester.†



(1)



(2)

Starting from (−)-menthyl (*S*)-toluene-*p*-sulphinate (**3**), $[\alpha]_D^{25}$ −202° (acetone),[4] the optically active *N*-alkylidenesulphinamides (**1a**)—(**1d**) were obtained in fair to excellent yields (see Table). Compound (**1b**) was accompanied by minor amounts of the tautomeric enamine (**2**), m.p. 92—93 °C, $[\alpha]_D^{25}$ −17·0° ($CHCl_3$).‡

TABLE

Stereospecific synthesis of *N*-Alkylidenesulphinamides

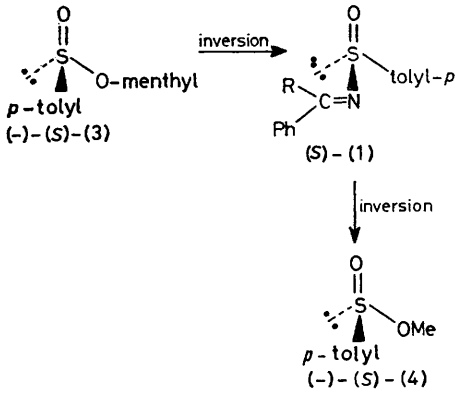
Compound[a]	M.p. (n^{25})	$[\alpha]^{25}$[b]	$[\alpha]_{436}^{25}$
(**1a**)	99—100 °C	+98·0°	+204·0°
(**1b**)	(1·6170)	+26·2°	+35·0°
(**1c**)	74—75 °C	−288·0°	−696·0°
(**1d**)	143—144 °C[d]	−56·2°	+61·0°

[a] All compounds gave satisfactory elemental (C, H, N) analysis and spectra (i.r., ^{1}H n.m.r.) in agreement with the structure assigned. The absolute configuration of (**1a**)—(**1d**) was (*S*). [b] *c* 1, in $CHCl_3$. [c] From Pr^i_2O. [d] From EtOH.

The reaction proceeds with a very high stereospecificity. Indeed the optical purity of (**1a**), determined with the aid of the chiral shift reagent Eu(tfc)$_3$,[5] was found to be ≥95%. The ^{1}H n.m.r. spectrum of racemic (**1a**) in the presence of Eu(tfc)$_3$ showed two different sets of peaks corresponding to two enantiomers. Attempts to determine the optical purity of (**1b**)—(**1d**) with Eu(tfc)$_3$ were unsuccessful. However crystallization of mixtures of optically active (**1c**), $[\alpha]_D^{25}$ −288°, and racemic (**1c**) as well as of optically active (**1d**), $[\alpha]_T^{25}$ −56°, and racemic (**1d**), increased the optical rotation and m.p. of the mixtures to constant values, identical to those of the starting (−)-(**1c**) and (−)-(**1d**). Thus these compounds are very likely to be optically pure.

The absolute configurations of compounds (**1a**)—(**1d**) were assigned (see Table) on the basis of the reasonable assumption that reaction of (**3**) with the imino-Grignard reagent proceeds with inversion of chirality at sulphur, as had been established for the conversion, *via* reaction with Grignard reagents, of sulphinate esters into sulphoxides[6] and sulphinamides,[7] of sulphonate esters into sulphones,[8] and of alkoxysulphonium salts into sulphonium salts.[9]

The *N*-alkylidenesulphinamides (**1a**)—(**1d**) were converted into (−)-(*S*)-methyl toluene-*p*-sulphinate (**4**) by treatment with methanol in the presence of trifluoroacetic acid.



Even if conversion of (**1**) into (**4**) proceeded with a low degree of stereospecificity, it should occur with predominant inversion of chirality at sulphur, as shown[10] for the acid-catalysed alcoholysis of sulphinamides. The assignment of the absolute configuration of (**1**) is thus confirmed, since in any case conversion (**3**) → (**1**) and (**1**) → (**4**) must proceed with the same stereochemical path at sulphur.

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† The reactions were carried out in diethyl ether with a molar ratio RMgHal : RCN : *p*-tolyl–S(O)OR′ of 2 : 2 : 1; the sulphinate was added at −40 °C, and the temperature was then gradually increased to +25 °C.

‡ More puzzling is the formation from benzonitrile, MeMgI, and (**4**), of a compound, m.p. 132—133 °C, $[\alpha]_D^{25}$ +360·7° ($CHCl_3$), to which, on the basis of the spectroscopic properties (i.r., ^{1}H n.m.r.) and elemental analysis, can be attributed the following structure: *p*-tolyl–S(O)N=C(Ph)–CH_2S(O)–tolyl-*p*. No substantial variation in the composition of the products was observed by changing the molar ratio or the mode of addition of the reagents.

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