Optically Active Organic Sulphites: Sulphur as an Asymmetric Centre

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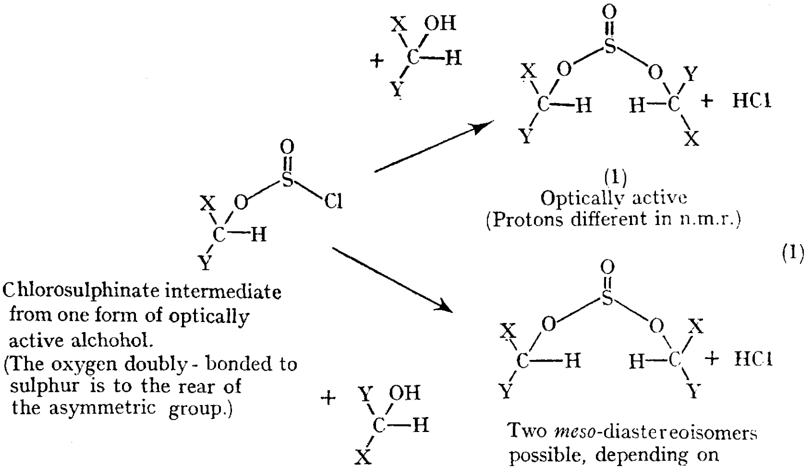
IT is well known that the configuration of groups attached to sulphur in organic sulphites is pyramidal and stable at room temperature. As a consequence, examples of geometrically isomeric pairs of cyclic sulphites, in which the S=O double bond has each of two possible directions, have become common.[1] Thus, condensation of an optically active alcohol with thionyl chloride should lead to an optically active sulphite and diastereoisomers should exist in such a system [equation (1)]; this has been shown by the recent isolation of two diastereoisomeric s-butyl alcohol sulphites,[2] which exhibit the symmetry characteristics in the n.m.r. noted in equation (1). With the diphenacyl malate–thionyl chloride system, we have isolated the pure (*S*)-(−)-form of the diphenacyl malate sulphite ester. The absolute configuration here corresponds to (I) in which X = $PhCO{\cdot}CH_2{\cdot}O{\cdot}CO{\cdot}CH_2$–, and Y = $PhCO{\cdot}CH_2{\cdot}O{\cdot}CO$–. (*S*)-(+)-Diphenacyl malate,[3] m.p. 106°, $[\alpha]_D = +10{\cdot}0°$ (acetone), was condensed with thionyl chloride at 30° in the presence of pyridine to yield a product which, after repeated fractional crystallization from acetone–water to constant rotation, gave a 2% yield of pure (*S*)-(−)-bis(diphenacyl malate) sulphite, m.p. 110—112°, $[\alpha]_D = -61{\cdot}3°$ (acetone).



Chlorosulphinate intermediate from one form of optically active alchohol.
(The oxygen doubly-bonded to sulphur is to the rear of the asymmetric group.)

(I)
Optically active
(Protons different in n.m.r.)

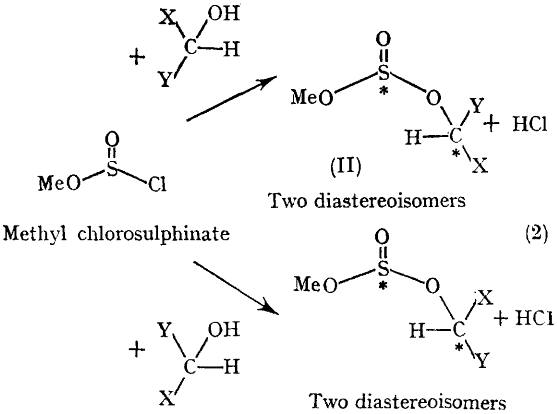
(1)

Two *meso*-diastereoisomers possible, depending on configuration at S.
(Protons same in n.m.r. within each molecule.)

Of greater interest are the mixed sulphite esters formed by condensation of one molecule of a non-asymmetric alcohol and one molecule of an asymmetric alcohol with one molecule of thionyl chloride [equation (2)]. Here, the products contain asymmetric sulphur atoms as well as asymmetric carbons, and diastereoisomeric pairs of enantiomers should occur in the system.[4] This we have shown by the isolation of two diastereosiomers of (*S*)-(−)-methyl(diphenacyl malate) sulphite. (*S*)-(+)-Diphenacyl malate was condensed with methyl chlorosulphinate,[5] and fractional crystallization of the product from acetone–water yielded two substances with constant rotation and with the properties listed in the Table. Their n.m.r. spectra were characterized by a small, clear difference in the single resonance peaks for the methyl protons. A small amount of the bis(diphenacyl malate) ester was also isolated, probably formed from a few per cent of thionyl chloride impurity in the methyl chlorosulphinate. Disproportionation of the mixed sulphite[6] did not occur during its preparation and work-up, because dimethyl sulphite was entirely absent (n.m.r.).

Properties of diastereoisomers of (S)-(−)-*methyl(diphenacyl malate) sulphite*

	M.p.	$[\alpha]_D$(Acetone)	(τ Me)
(IIA):	101—102°	−50·2°	6·25
(IIB):	74—75°	−4·4°	6·27



(II)

(2)

What appears to be the first report of isomerism due to the pyramidal configuration of the sulphite group in organic sulphites actually involved diastereoisomerism in the optically active system (+)-ethyl 3α-chloro-5,19-dihydroxyetiocholanate cyclic sulphite.[4,7]

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