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SULPHOXIDES III[1]

Preparation and Properties of α-Sulphinylesters

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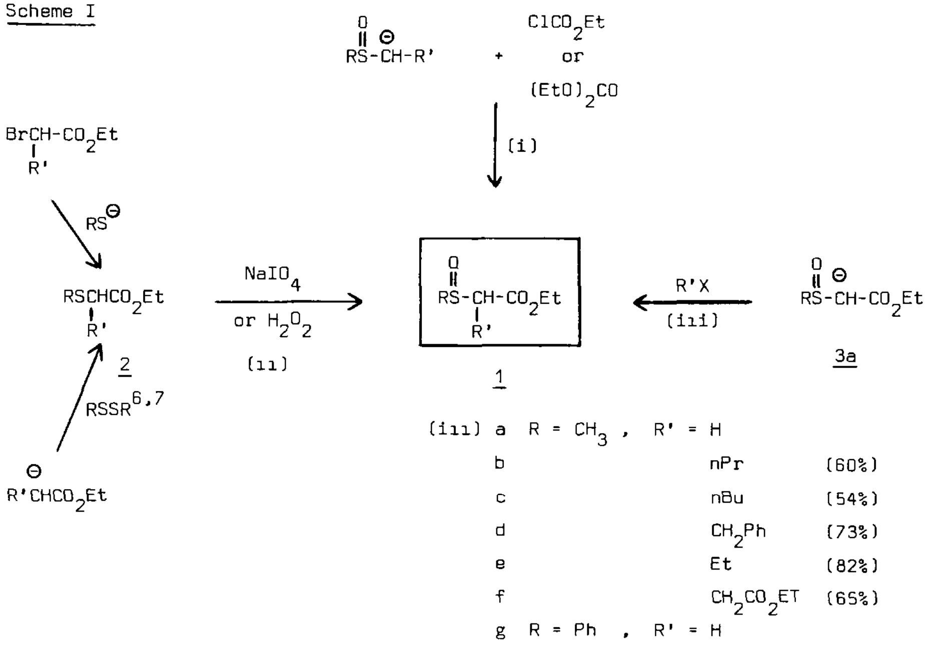
Our interest in the chemistry and stereochemistry of functionalised sulphoxides[2] led us to consider the class of α-sulphinylesters 1 (Scheme I) Though Pummerer studying the acid-catalysed decomposition of sulphoxides[3], included 1g, type 1 compounds -unlike β-ketosulphoxides- have not been investigated in a more or less systematic fashion since This is surprising in view of the high synthetic utility of esters in general, as demonstrated by the vast number of condensation reactions in alkaline solutions Functionalisation with the equally interesting sulphinyl moiety to give 1 may well lead to a very versatile class of compounds In the present letter we wish to communicate some of our results on the chemistry of 1

Scheme I



(iii)	a	R = CH_3 ,	R' = H	
	b		nPr	(60%)
	c		nBu	(54%)
	d		CH_2Ph	(73%)
	e		Et	(82%)
	f		CH_2CO_2ET	(65%)
	g	R = Ph ,	R' = H	

The "parent" compound 1a can be prepared in about 80% isolated yield from dimsyllithium in THF in a manner analogous to that for β-ketosulphoxides[4], using ethylchloroformate or diethylcarbonate instead of esters RCO_2Et (Scheme I, i)[5] Alternatively, 1a is prepared via the corresponding sulphide 2, which can be obtained in various ways (Scheme I, ii[6,7]) Most conveniently, the oxidation is carried out using sodium periodate or hydrogen peroxide[8], resulting in ca 90% isolated yield Method (ii) can also be used to obtain derivatives of 1 with R ≠ H, while reaction (i) may be chosen in cases where R ≠ CH_3, e g R = C_6H_5, or in the case of symmetrical sulphoxides with R = CH_2R'

Carbanion 3a is easily prepared from 1a using sodium hydride in DMSO at room temperature[9] It reacts with primary alkylbromides or -iodides to give the α-alkylated esters 1b-f with good isolated yields (Scheme I, iii)[10] When a second equivalent of NaH and an alkylhalide is added, either in a one-step or in a two-step procedure[11], the α,α-dialkylated esters can be prepared (Scheme II, E) Acid chlorides (including ethylchloroformate) react with 3a to give Pummerer type products.

The further synthetic capabilities of 1 are illustrated by the following examples A - D (cf Scheme II)

(A) Whereas 1a is very stable, the α-substituted derivatives 1b-f eliminate RSOH upon heating[7], leading to the corresponding (trans)-α,β-unsaturated esters[12] When for example 1c (neat, or in DMSO solution) is heated at 140° for one hour, the ethylester of pent-2-enoic acid is formed in 80% yield Analogously, 2f leads to diethylfumarate in 70% yield This shows that, using 1a as a synthone, alkylhalides RCH_2X may be converted into $RCH = CH - CO_2Et$ in an essentially one-step procedure

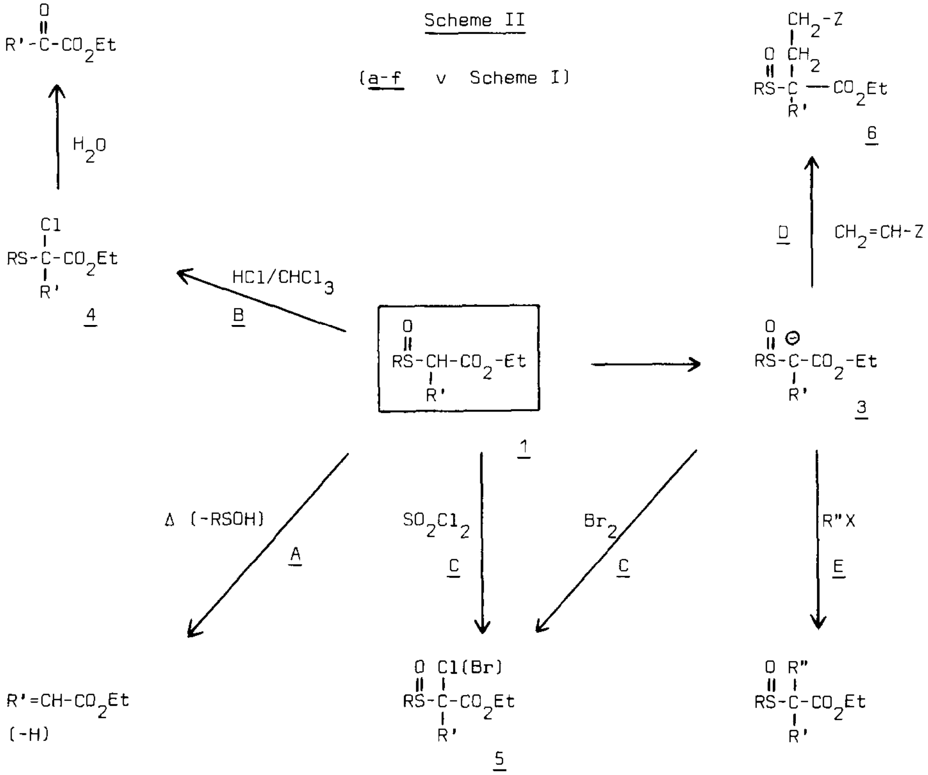
(B) 1a is rapidly converted at room temperature by dry HCl in $CHCl_3$ into 4a (80% yield)[3,13] Hydrolysis of 4a and analogous chlorides leads to α-keto-esters, thus effecting the transformation of RX into $R - CO - CO_2Et$

(C) When a solution of bromine in CCl_4 is added to 3a in THF, $CH_3S(O)CHBrCO_2Et$ (5a) is formed in 60% yield[14] The corresponding chloride can be obtained by reaction of 1a with sulphurylchloride in CH_2Cl_2[15]. These halogenated esters appear to eliminate HX upon standing.

(D) The important family of Michael-type additions[16] is exemplified by the reaction involving 3a and methylacrylate. One mole of 1a reacting with five moles of methylacrylate upon addition of 0 2 moles of NaH and refluxing the mixture in THF for two hours, leads to the adduct 6a, Z = CO_2Me, in ca 80% isolated yield.

Scheme II

(a-f v Scheme I)



These products can evidently be used for the preparation of sulphur-free products, employing one of the methods mentioned above. Thus, mere pyrolysis of the methylacrylate adduct leads to $EtO_2C - CH = CH - CH_2CO_2Me$.

The examples given above demonstrate that the α-sulphinylester family indeed constitutes a versatile class of compounds, undergoing a number of synthetically useful reactions Alternative modes of conversion (such as reductive desulphurisation[17]), as well as reactions involving the ester moiety (e.g. condensation reactions leading to heterocyclic compounds) are of potential interest.

Our investigations, including the possibility of carbene formation from the halogenated sulphinylesters 5 (R' = H) as well as the conversion of 5 into functionalised vinylsulphoxides (e.g through base-catalysed elimination of HX[18]) are being continued

Notes and references

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4. In our hands, the reaction of dimsylsalt with acid chlorides RCOCl leads to Pummerer-type products (e.g CH_3SCH_2OCOR) rather than to β-ketosulphoxides $CH_3S(O)CH_2COR$
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9. *3a* is of moderate stability as such upon standing a white precipitate is formed, the structure of which is now under investigation
10. Reactions with n-butyllithium in THF were unsatisfactory[11]
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