General Synthesis of Oxirans

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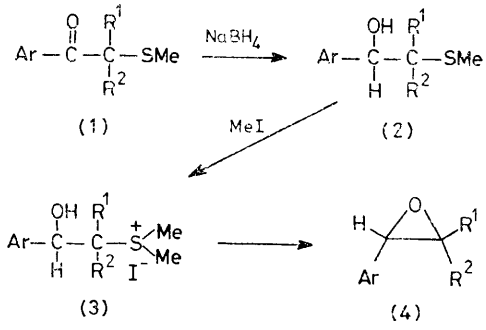
Summary A general synthesis of oxirans is reported, involving cyclisation of β-hydroxy-dimethylsulphonium salts, derived from α-sulphenylated ketones, with Bu^{t}OK or NaH in dimethyl sulphoxide.

β-HYDROXY-SULPHIDES and related compounds, prepared by condensation of ketones with nucleophilic alkylidene sulphur reagents[1] or by the reduction of phenylthioacetic acid derivatives with $LiAlH_4$,[2] have been proposed as efficient intermediates for the synthesis of oxirans. We report an alternative general synthesis of oxirans by the use of α-sulphenylated ketones[3] as the starting material.

Reduction of α-methyl-α-(methylthio)propiophenone (**1a**) with $NaBH_4$ to (**2a**), followed by *S*-methylation of (**2a**) with methyl iodide in MeOH under reflux for 3 h afforded the β-hydroxydimethylsulphonium iodide (**3a**), which was treated with Bu^{t}OK (1·0 mol. equiv.) in dimethyl sulphoxide (DMSO) at room temperature for 2 h to give the epoxide (**4a**)† [68% from (**1a**); δ (CCl_4) 1·01 (3H, Me *cis* to Ar), 1·41 (3H, Me *trans* to Ar), and 3·69 (1H, C*H*Ar)]. *S*-Methylation of (**2b**), obtained from (**1b**), with methyl iodide afforded (**3b**), which was treated with Bu^{t}OK to give the *cis*-epoxide (**4b**)[4] [70% from (**1b**); δ (CCl_4) 1·03 (3H, CH*Me*, d *J* 5 Hz) and 3·89 (1H, C*H*Ar, d, *J* 4 Hz)].

† All new compounds gave satisfactory spectroscopic data, microanalyses, and/or high resolution mass spectra.

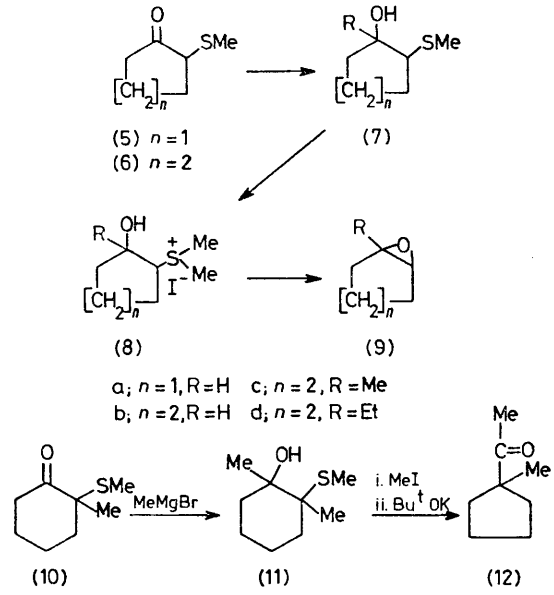
The *cis*-epoxides (**4c**) [64% from (**1c**); δ (CCl_4) 3·93 (1H, C*H*Ar, d, *J* 4 Hz)], (**4d**) [68% from (**1d**); δ (CCl_4) 1·03 (3H, CH*Me*, d, *J* 5 Hz) and 3·85 (1H, C*H*Ar, d, *J* 4 Hz)], and (**4e**) [70% from (**1e**); δ (CCl_4) 1·01 (3H, CH*Me*, d, *J* 5 Hz) and 3·85 (1H, C*H*Ar, d, *J* 4 Hz)] were prepared similarly. Although in the reaction of sulphonium ylides with carbonyl compounds, *trans*-oxirans[6] or a mixture of *trans*- and *cis*-isomers have been obtained, in the present case, the *trans*-oxirans were not formed.‡



a; Ar = Ph, $R^1 = R^2 = Me$
b; Ar = Ph, $R^1 = H$, $R^2 = Me$
c; Ar = Ph, $R^1 = H$, $R^2 = Et$
d; Ar = *p*-$MeOC_6H_4$, $R^1 = H$, $R^2 = Me$
e; Ar = *p*-MeC_6H_4, $R^1 = H$, $R^2 = Me$

SCHEME 1

Furthermore, 2-methylthiocyclopentanol (**7a**) and 2-methylthiocyclohexanol (**7b**), obtained by the reduction of (**5**) and (**6**) with $NaBH_4$, were converted into the epoxides (**9a**) and (**9b**), respectively, by treatment of the corresponding *S*-methylated intermediates (**8a**) and (**8b**) with NaH in DMSO, in good yield. Grignard reaction of (**6**) with MeMgBr and EtMgBr in ether gave the corresponding alcohols (**7c**) and (**7d**), respectively. The alcohols (**7c**) and (**7d**) also led to the epoxides (**9c**) and (**9d**), *via* the corresponding *S*-methylated intermediates (**8c**) and (**8d**), respectively, in good yield (Scheme 2).



SCHEME 2

In contrast, the cyclohexanol (II), obtained by methylation of (**10**) with MeMgBr, afforded 1-acetyl-1-methylcyclopentane (**12**) [δ (CCl_4) 1·20 (3H, 1-Me) and 2·08 (3H, MeCO); ν(C=O) 1698 cm^{-1}].

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‡ Since the configuration of the alcoholic intermediates was not determined, the reason why *cis*-epoxides were exclusively obtained is not clear. Assuming that the alcohols were in the *erythro*-form, inversion of the configuration of the carbanion centre adjacent to the dimethylsulphonium group might have taken place before cyclisation, caused by the solvent effect of DMSO; B. M. Trost and M. J. Bogdanowicz, *J. Amer. Chem. Soc.*, 1973, **95**, 5298.

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