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# 2-($\beta$-HYDROXY-$\beta$-METHYLSULFINYLMETHYL)ALKYL-2,3-DIHYDRO-1-BENZOFURANS BY ADDITION OF THE WHOLE MOLECULE OF DIMETHYLOXOSULFONIUM METHYLIDE TO o-HYDROXYBENZALKETONES

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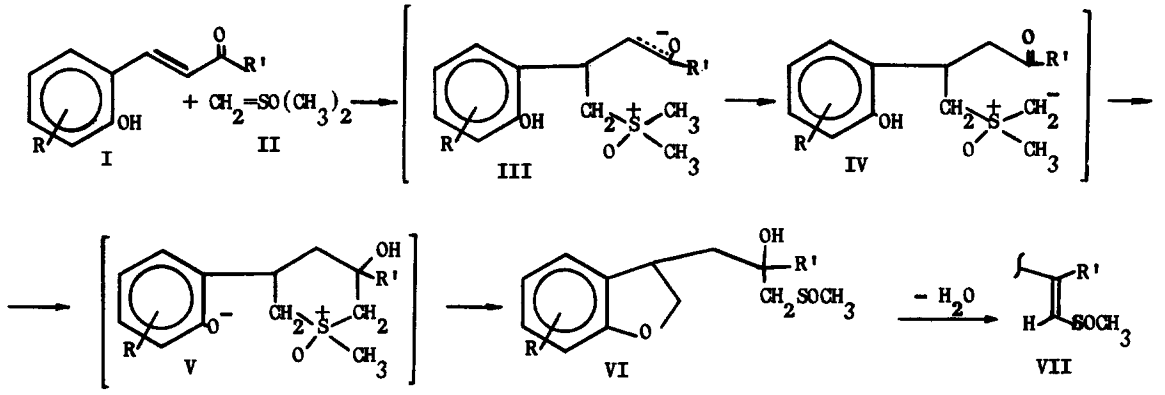
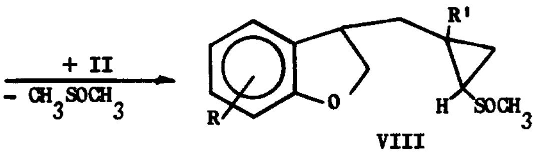
Dimethyloxosulfonium methylide (II) is a widely used reagent for methylene transfer to electron deficient groups. With carbonyls it forms epoxides; with Michael acceptors, generally cyclopropanes; and with substrates with a nucleophile appropriately placed near the reaction centre, it forms larger rings from the participation of this nucleophile. However, one seldom observes the transfer of the whole molecule to substrate, as in the formation of S-methylthiabenzene-S-oxides from 1,3-diketones.[1]

During some work on the syntheses of oxygen heterocycles using this ylide,[2] we discovered a new case in which the dimethyloxosulfonium methylide is transfered in entirety to the reaction substrate in a truly novel way. We observed that addition to a solution of II in DMSO of an equimolar amount of o-hydroxybenzalketone (I) causes a rapid reaction, with the appearance of an intense red color which dissipates in 10-15 minutes. The crude reaction product, after the usual work-up, consist of a group of minor, non polar products (5-10 %)[3] and a major, polar one (VI) (≈50-60 % from I) which is isolated by crystallization from ethanol or chromatography on silica gel with ether/methanol (85/15) as eluent. Both mass spectral and elemental analysis show that this product derives from a one to one addition of ylide to substrate, and the nmr spectrum confirms structure VI unequivocally. In the spectrum of VIa ($CDCl_3$) two singlets at 1.54 (3H) and 2.62 $\delta$(3H) are indicative of two methyls bounded respectively to the quaternary carbon and to the SO function. Two AB systems respectively at: 4.75 (Ha), 4.30 $\delta$ (Hb), $J_{Ha,Hb}$ = 9 Hz and 2.10 (Hd), 1.88 $\delta$(He), $J_{Hd,He}$ = 14 Hz, both with a further coupling with the proton at 3.70 $\delta$(Hc, broad multiplet[4]) take account for the fragment $O-CH_aH_b-CH_c-CH_dH_e-C$. A third isolated AB system at 2.96 (Hf), 2.71 $\delta$(Hg), $J_{Hf,Hg}$ = 13 Hz can be attributed to the $CH_2SO$ group.

The reaction sequence we propose for the formation of VI is outlined in the scheme. The first attack of ylide on the conjugate double bond to form zwitterion III is followed by the rapid protonation of the enolate anion and the formation of new ylide IV. The intramolecular attack of this ylide on the carbonyl leads to intermediate V. As this cannot form the stable S-methylthiabenzene-S-oxide, the phenolate anion reacts as shown to give a dihydrofuran and a $\beta$-hydroxysulfoxide. And so one obtains the final product. An ylide to substrate ratio of three to one and longer reaction times lead, in addition to the same mixture of non polar products[3], to a new polar compound (50-60 % from I) of structure VIII, as shown by mass spectra and nmr[5]. Clearly, VIII is formed from VI by the elimination of water and the successive transfer of a methylene from ylide to the double bond activated by the sulfoxide group.





In the table are reported the substrates used with ylide II and reaction products VI and VIII obtained depending on the reaction conditions used.-

TABLE[6]

| | I | | VI | | VIII | |
|---|---|---|---|---|---|---|
| | R | R' | Yields | M.p. | Yields | M.p. |
| a | H | Me | 72 | 90–92 | 51 | 102–104 |
| b | H | Et | — | — | 60 | 120–122 |
| c | H | Ph | 54 | 156–157 | — | — |
| d | 7–OMe | Me | — | — | 52 | 137–138 |
| e | H | t–Bu | 51 | liquid | — | — |

## References and Footnotes

1) B. Holt, J. Howard, and P. A. Lowe, Tetrahedron Lett., 4937, 1969 ; B. M. Trost and L. S. Melvin, "Sulfur Ylides", Academic Press, New York, 1975, pag. 58
2) P. Bravo, C. Ticozzi and D. Maggi, J. Chem. Soc., Chem. Comm., 1976, 789; P. Bravo, C. Ticozzi and D. Maggi, Heterocycles, 4, 1755, 1976
3) In addition to unreacted starting materials, the mixture also contains compounds of molecular weights corresponding to starting materials plus 14, plus 28, and plus 42, whose structures and mechanisms of formation have not completely clarified.
4) By irradiating aromatic protons the broad Hc signal becomes sharper and shows the expected fine structure; quartet of doublets due to three equal coupling constants of 9.0 Hz and $J_{Hc,Hd}$= 3.5 Hz
5) The nmr spectrum ($CDCl_3$) of VIIIa shows two singlets at 1.22 and 2.63 $\delta$ ($CH_3C$ and $CH_3SO$) and two AB systems respectively at; 4.69 (Ha), 4.29$\delta$(Hb), $J_{Ha,Hb}$ = 8.5 Hz and 2.17 (He), 1.70 $\delta$ (Hd), $J_{He,Hd}$ = 14 Hz; both with a further coupling with the proton at 3.14 $\delta$ (Hc) ($O{-}CH_aH_b{-}CH_c{-}CH_dH_e{-}C$).
6) Satisfactory analyses were obtained for all new compounds. IR, NMR and Mass Spectral data are in accord with structures proposed. Compound VIc consists of a mixture of two diastereoisomers.