α-Methylene-oximes from α-Chloro-oximes and α-Chloro-nitroso-compounds by Dimethylsulphoxonium Methylid

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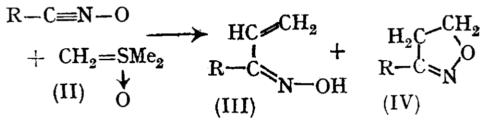
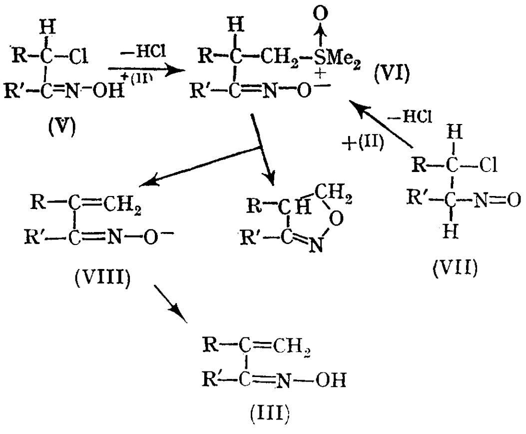
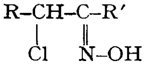
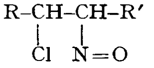
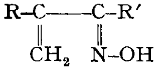
PREVIOUSLY we have reported the reaction of nitrile oxides (I) with dimethylsulphoxonium methylid (II); we now report the latter's reaction with α-chloro-oximes (V) and α-chloronitroso-compounds (VII). A double-insertion of methylene by (II) into (I) gives vinyl-oximes (III) and/or Δ^2-isoxazolines (IV).[1,2] Since α-chloro oximes and α-chloronitroso-compounds are known to react with nucleophiles, usually to give the same substituted oximes, these two classes of compound could also give rise to α-methylene oximes (III) and/or substituted Δ^2-isoxazolines according to the Scheme:





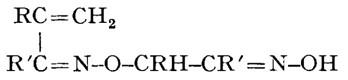
α-Methylene-oximes from α-chloro-oximes and α-chloro-nitroso-compounds with dimethylsulphoxonium methylid[a]

	α-Chloro-oximes (V)  $\mathrm{R{-}\underset{Cl}{\underset{\vert}{CH}}{-}\underset{N{-}OH}{\underset{\Vert}{C}}{-}R'}$		α-Chloro-nitroso-compounds (VII)  $\mathrm{R{-}\underset{Cl}{\underset{\vert}{CH}}{-}\underset{N=O}{\underset{\vert}{CH}}{-}R'}$		α-Methylene-oximes (III)  $\mathrm{R{-}\underset{CH_2}{\underset{\Vert}{C}}{-}\underset{N{-}OH}{\underset{\Vert}{C}}{-}R'}$	
					Yields (%)[b]	
	R	R′	R	R′	from (V)	from (VII)
a;	H	Me			56	
b;	H	Bu^t			35[c]	
c;	$-[\mathrm{CH_2}]_4-$		$-(\mathrm{CH_2})_4-$[a]		7 (27)	38 (28)
d;	$-[\mathrm{CH_2}]_5-$		$-(\mathrm{CH_2})_5-$		42	58
e;	$-[\mathrm{CH_2}]_6-$		$-(\mathrm{CH_2})_6-$		36 (12)	69 (5)
f;			Ph	Me[e]		25
g;			4–MeO–$\mathrm{C_6H_4}$	Me		42 (25)
h;			Me	Me		30 (25)

[a] The structures of new compounds were determined by analysis, n.m.r., and mass spectrometry.
[b] The yields reported in brackets are referred to compounds (X).
[c] Isoxazoline yield 30%.
[d] This compound did not react with (II) in the cold. The reaction was then performed at 60°.
[e] From the structure of (IIIg) it follows that (VIIg) is 1-chloro-1-(4′-methoxyphenyl)-2-nitrosopropane and not 2-chloro-1-(4′-methoxyphenyl)-1-nitroso-propane, as reported previously: O. Wallach, *Annalen*, 1904, **332**, 305; J. B. Shoesmith and R. H. Slater, *J. Chem. Soc.*, 1925, **127**, 1940.

The results (Table) agreed with this prediction. The ylid (II), by nucleophilic displacement on (V) and (VII), gives the intermediate (VI),† which can undergo a β-elimination to give the anion (VIII). This, on treatment with water, gives the oxime (III). Intramolecular nucleophilic displacement of dimethyl sulphoxide can also occur in (VI) giving the Δ^2-isoxazoline (IV). Most of the α-chloro-oximes and α-chloro-nitroso-compounds tested followed the first route. An isoxazoline was obtained, together with the corresponding unsaturated oxime (IIIb), from the oxime of chloromethyl t-butyl ketone (Vb) only. In the two cases [(Va) and (Vb)] in which direct comparison with the corresponding nitrile oxides was possible, the products of the reaction with (II) were the same.[2]

The reactions were run in dimethyl sulphoxide–tetrahydrofuran solution (room temp.). After work-up of the reaction mixture, the products were isolated by chromatography on silica gel. The α-methylene-oximes obtained are reported in the Table. Generally the yields were moderate, but the reaction can be of some synthetic interest because of the ready availability of α-chloro-nitroso-compounds from olefins and NOCl. Among the by-products substantial amounts of compounds of structure (X) were obtained, arising from a displacement of $\mathrm{Cl^-}$ in (V) or (VII) by the intermediate (VIII), which competes with (II). This



$$\mathrm{\overset{RC=CH_2}{\overset{\vert}{R'C}}=N{-}O{-}CRH{-}CR'=N{-}OH} \qquad \text{(X)}$$

was not unexpected since similar nucleophilic displacements were already observed with some α-chloro-nitroso-compounds in alkaline medium.[3] Sometimes the methyl ethers of the oximes (III) were also isolated, in small amounts, but no cyclopropanes were isolated, even with a large excess of (II). The α-chloro-ketones corresponding to the oximes (V) do give cyclopropanes,[4] probably through intermediate α-methylene-ketones. The insertion of methylene by (II) into the double bond of (VIII) to give a cyclopropane[5] is prevented by the negative charge on the oxygen.

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† The intermediate (VI) can also arise from both α-chloro-oximes and α-chloro-nitroso-compounds through an elimination–addition mechanism, as postulated for similar reactions: W. Pritzkow, H. Schaefer, P. Pabst, A. Ebenroth, and J. Bege, *J. prakt. Chem.*, 1965, **29**, 123; A. Dornow and H. D. Jordon, *Chem. Ber.*, 1961, **94**, 76.

[1] A. Umani-Ronchi, P. Bravo, and G. Gaudiano, *Tetrahedron Letters*, 1966, 3477.
[2] G. Gaudiano, P. P. Ponti, and A. Umani-Ronchi, *Gazzetta*, 1968, **98**, 48.
[3] N. Thorne, *J. Chem. Soc.*, 1956, 2587.
[4] P. Bravo, G. Gaudiano, C. Ticozzi, and A. Umani-Ronchi, *Tetrahedron Letters*, in the press.
[5] A. W. Johnson, "Ylid Chemistry", Academic Press, New York and London, 1966. p. 304.