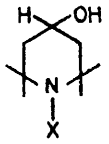
Unexpected Oxidation of a Nitroxide Alcohol with *m*-Chloroperbenzoic Acid

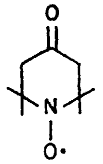
By JAMES A. CELLA,* JAMES A. KELLEY, and EDWARD F. KENEHAN
(*Division of Biochemistry, Walter Reed Army Institute of Research, Washington, D.C.* 20012)

Summary Oxidation of 2,2,6,6-tetramethylpiperidin-4-ol (**1a**) with *m*-chloroperbenzoic acid in methylene chloride produces, in addition to the expected nitroxide (**1b**), varying amounts of 4-oxo-2,2,6,6-tetramethylpiperidin-1-oxyl (**2**).

THE peracid oxidation of secondary amines to nitroxides has been applied with some success to the preparation of stable nitroxides in the oxazolidine series.[1] The advantages of short reaction times and overall simplicity compared with the tungstate-catalysed hydrogen peroxide method for generating nitroxides[2] prompted our use of *m*-chloroperbenzoic acid for the preparation of the nitroxide (**1b**), an important intermediate for the preparation of spin-labelled biomolecules.[3]



(1) a; X = H
b; X = O•



(2)

Reaction of the amine (**1a**) with *m*-chloroperbenzoic acid in methylene chloride resulted in the concomitant formation of the ketonitroxide (**2**),† in addition to the expected nitroxide (**1b**). Small amounts of (**2**) were produced even under carefully controlled conditions. Indeed, under more forcing conditions, (**2**) becomes the principal product of the reaction (see Table).

TABLE. Peracid oxidations[a,b]

Substrate	(concentration/M)	Peracid (mol.equiv)	(**1b**) (%)	(**2**) (%)	(%) Reaction[c]
(**1a**)	(0·125)	1·0	90	10	77
(**1a**)	(0·125)	1·5	63	37	91
(**1a**)	(0·125)	2·0	42	58	100
(**1a**)	(0·013)	2·0	58	42	100
(**1a**)	(0·001)	2·0	99	1	100
(**1a**)[d]	(0·125)	3·0	15	85	100
(**1b**)	(0·125)	1·0	12	88	—

[a] Product ratios were determined by g.l.c. [b] Peracid in CH_2Cl_2 was added dropwise to a solution of the the substrate at ambient temperature unless otherwise indicated. [c] As measured by amount of unchanged amine. [d] Amine added rapidly to peracid.

Peracid-mediated conversion of an alcohol into a ketone has not been reported. Indeed, epoxidations with these reagents are often conducted on olefinic alcohols with no apparent complications.[4] Intramolecular hydrogen abstraction by the 'free' electron of the nitroxide does not appear to be responsible for this unusual oxidation since dilution of the reaction mixture suppresses the formation of (**2**). However, the radical (**2**) is produced in good yield upon treatment of the radical (**1b**) with 1 equiv. of *m*-chloroperbenzoic acid.

(*Received*, 8*th August* 1974; *Com.* 1020.)

---

† Reaction mixtures were analysed by g.l.c. and g.l.c.–mass spectrometry. Products were identified by comparison of their mass spectra with those of authentic samples. Isolated yields were consistent with calculated g.l.c. yields.

[1] K. Tokumaru, H. Sakuragi, and O. Simamura, *Tetrahedron Letters*, 1964, 3945; G. C. Letourneux, H. Lemaire, and A. Rassat, *Bull. Soc. chim. France*, 1965, 3283; J. F. W. Keana, S. B. Keana, and D. Beetham, *J. Amer. Chem. Soc.*, 1967, **89**, 3055; A. S. Waggoner, T. J. Kingzett, S. Rottschaefer, O. H. Griffith, and A. D. Keith, *Chem. Phys. Lipids*, 1969, **3**, 245.

[2] E. G. Rozantzev and M. B. Neiman, *Tetrahedron*, 1964, **20**, 131; E. G. Rozantzev and L. A. Krinitzkaya, *ibid.*, 1965, **21**, 491.

[3] O. H. Griffith and A. S. Waggoner, *Accounts Chem. Res.*, 1969, **2**, 17.

[4] For a number of examples see D. Swern, *Org. Reactions*, 1953, **7**, 378, and for a recent example, see M. Miyashita and A. Yoshikoshi, 1974, *J. Amer. Chem. Soc.*, **96**, 1917.