Spin Traps

Give your radicals some life!

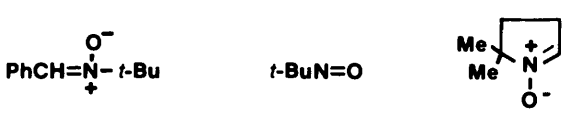
The problem of the detection and identification of short-lived free radicals has been a subject of extreme interest. This important area of research was facilitated by the recent development of the technique of *spin trapping*.[1] This technique involves the trapping of a free radical by an addition reaction to produce a more stable radical, detectable by esr, whose hyperfine coupling parameters enable identification of the initially trapped radical. An example is the reaction of a radical with a nitrone to form a stable nitroxide radical.

The addition product is called a "spin adduct."

The following applications of spin trapping agents have been developed:

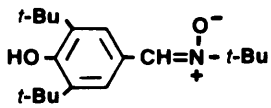
1) atom trapping[1]
2) gas-phase free radical trapping[2]
3) spin trapping of radicals in solids[3]
4) mechanistic investigations[1,4-10]
5) detection of intermediates in electrochemical transformations[11]
6) study of radical polymerizations[12,13]
7) study of free radicals in cigarette smoke[14,15]
8) detection of important intermediates in biological oxidation-reduction reactions[16]
9) synthesis of a variety of nitroxides which might be difficult to obtain by conventional synthetic methods

Since each spin trap has advantages and disadvantages[1] depending on its intended application, it is desirable to have a variety of traps from which to choose. Aldrich now offers three very useful spin traps: *N-tert*-butyl-α-phenylnitrone **(PBN)**, 2-methyl-2-nitrosopropane **(N-t-B)**, and 5,5-dimethyl-1-pyrroline-1-oxide **(DMPO)**.



PBN **N-t-B** **DMPO**

An interesting bifunctional spin trap, α-(3,5-di-*tert*-butyl-4-hydroxyphenyl)-*N-tert*-butylnitrone, was used by Pacifici and Browning to distinguish between carbon- and oxygen-centered radicals.[17] The radicals produced nitroxides and phenoxides, respectively. Later it was shown that an equimolar mixture of **PBN** and **2,4,6-tri-*tert*-butylphenol** gave similar results more conveniently.[18]



A large research effort continues in order to find new applications for spin traps. Much emphasis is being placed on quantitative work and elucidation of mechanisms, especially in biological systems.

References:

1) E.G. Janzen, *Acc. Chem. Res.*, **4**, 31 (1971), and references cited therein.
2) E.G. Janzen and I.G. Lopp, *J. Phys. Chem.*, **76**, 2056 (1972).
3) C. Lagercrantz and S. Forshult, *Nature*, **218**, 1247 (1968).
4) K.N. Joblin, A.W. Johnson, M.F. Lappert, and B.K. Nicholson, *Chem. Commun.*, 441 (1975).
5) A. Ledwith, P.J. Russell, and L.H. Sutcliffe, *J. Chem. Soc., Perkin Trans. 2*, 1925 (1972).
6) F.P. Sargent and E.M. Gardy, *Can. J. Chem.*, **54**, 275 (1976).
7) F.P. Sargent and E.M. Gardy, *ibid.*, **52**, 3645 (1974).
8) K. Okamoto and K. Komatsu, *Bull. Chem. Soc. Jpn.*, **47**, 1709 (1974).
9) A. Ledwith, P.J. Russell, and L.H. Sutcliffe, *J. Chem. Soc., Perkin Trans. 2*, 630 (1973).
10) S. Terabe and R. Konaka, *ibid.*, 2163 (1972).
11) A.J. Bard, J.C. Gilbert, and R.D. Goodin, *J. Amer. Chem. Soc.*, **96**, 620 (1974).
12) T. Kunitake and S. Murakami, *Polym. J.*, **3**, 249 (1972); *Chem. Abstr.*, 77, 20122*j* (1972).
13) T. Otsu and J. Ohta, *Mem. Fac. Eng., Osaka City Univ.*, **15**, 69 (1974); *Chem. Abstr.*, **84**, 17819*f* (1976).
14) G.P. Morie, *Tob. Sci.*, **18**, 83 (1974); *Chem. Abstr.*, **81**, 133024*e* (1974).
15) E.R. Menzel, W.R. Vincent, and J.R. Wasson, *J. Magn. Reson.*, **21**, 321 (1976).
16) J.R. Harbour and J.R. Bolton, *Biochem. Biophys. Res. Commun.*, **64**, 803 (1975).
17) J.G. Pacifici and H.L. Browning, *J. Amer. Chem. Soc.*, **92**, 5231 (1970).
18) C.M. Camaggi and M.J. Perkins, *J. Chem. Soc., Perkin Trans. 2*, 507 (1972).

For an excellent review on the related area of spin labels, see C.F. Chignell, Aldrichimica Acta, 7, 1 (1974).

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