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SYNTHESIS OF 2H-PYRROLE 1-OXIDES VIA 3-BROMO-1-PYRROLINE 1-OXIDES

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We describe a synthesis of 2H-pyrrole 1-oxides (3) from the 3-bromopyrroline 1-oxides (2). Bromination in the 3-position of 1-pyrroline 1-oxides appears to be a general reaction and the 2-cyano-1-pyrroline 1-oxides (1) undergo reaction with N-bromosuccinimide (NBS) to form the monobromo nitrones (2) in approximately 70% yield. These can be dehydrobrominated using pyridine N-oxide or triethylamine to afford the 2H-pyrrole 1-oxides (3) in 70-90% yield. The bromo-substituted 2H-pyrrole 1-oxides (8 and 9) are also formed directly from the nitrones (6 and 7), by bromination with NBS and sodium hydride-dioxan dibromide respectively. In these cases, intermediate 3-bromopyrroline 1-oxides cannot be detected. The 2H-pyrrole 1-oxides⁺ all absorb in the ultraviolet region at 320-360 nm and detailed spectral data are given below for the simplest member (3a).

Several 2H-pyrrole 1-oxides have been described previously[1] but their syntheses do not appear to be general. The bromo nitrones (2) are useful for the preparation of other 3-substituted compounds. Thus the 3-bromo compounds (2) with silver nitrate in acetonitrile gave the nitrate esters (4). Treatment of these esters (4) with triethylamine gave in good yield the 3-oxo-1-pyrroline 1-oxides (5); they are of interest in relation to the known photochemical rearrangement of 3-oxo-1-pyrroline 1-oxides to N-acylazetidinones.[2] Detailed spectral data are given below for the simplest cyano-oxonitrone (5a) for comparison with the related 2H-pyrrole 1-oxides (3a).

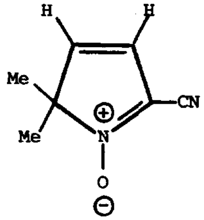
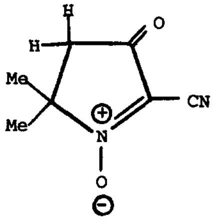
Several aspects of this work deserve special comment.

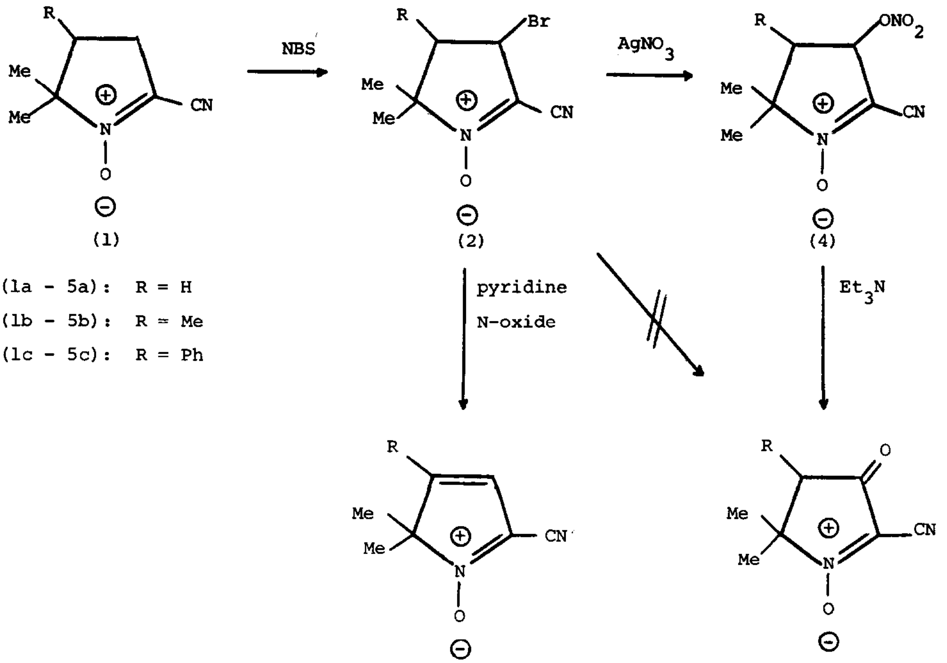
(i) Treatment of the bromo compounds (2) with pyridine N-oxide fails to afford the oxonitrones (5) by initial attack of oxygen at C-3 followed by abstraction of the α-proton[3,4]: removal of the β-proton is clearly preferred. There appears to be only one reported example of the reaction of pyridine N-oxide with a bromo compound bearing β-protons and the product is still the ketone and not the alkene.[4]

(ii) The α-bromo nitrones (2) can be compared with the known acyclic α-chloro nitrones[5], which however, cannot so far be obtained satisfactorily by reaction of nitrones with N-chlorosuccinimide.

(iii) Identical chemical shifts are observed for the C-3 and C-4 protons in the proton magnetic resonance (p.m.r.) spectrum of the 2H-pyrrole 1-oxide (3a). In view of the similarity between nitrones and carbonyl compounds, this behaviour is in striking contrast to the widely differing chemical shifts[6] of α- and β-protons in similar α,β-unsaturated carbonyl compounds.

SPECTRAL DATA

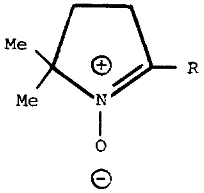
		
P.m.r.	δ 1.44, s (6H)	δ 1.63, s (6H)
(CDCl$_3$)	6.47, s (2H)	2.99, s (2H)
Infrared (nujol)	2225, 1565 cm^{-1}	2225, 1718, 1525 cm^{-1}
Ultraviolet (EtOH)	322 nm (ε = 5350)	280 nm (ε = 14300)



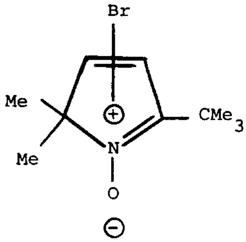
(1) (2) (4)

(1a - 5a): R = H
(1b - 5b): R = Me
(1c - 5c): R = Ph

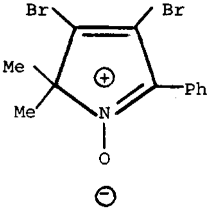
(3) (5)



(6) R = CMe$_3$
(7) R = Ph



(8)



(9)

REFERENCES

+ All new compounds (2-5, 8 and 9) have been fully characterised by spectral and analytical data, except for the position of bromine in (8) and the analytical purity of (2a, 4b and 5c).

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