An Intermediate in the Reduction of Quinoline Analogues of Model Compounds for a Coenzyme

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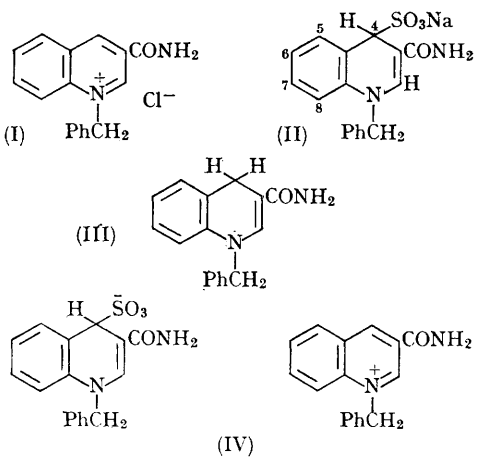
THE reduction of pyridine model compounds for NAD by sodium dithionite is well known.[1] The analogous quinoline derivatives have been studied to a much lesser extent.[2,3] The mechanism of reduction by sodium dithionite has received considerable attention since the postulation of an intermediate possessing a sulphinate group in the 4-position of a dihydropyridine derivative.[4] Subsequently a product with an elemental composition corresponding to that of an intermediate possessing a sulphinate group in the 2-position of a 1,2-dihydropyridine was isolated from the reaction of 1-(2,6-dichlorobenzyl)-3,5-dicarbamoylpyridinium bromide and sodium dithionite.[5] Recently Caughey and Schellenberg[6] have indicated the isolation and characterization of an intermediate possessing the sulphinate group in the 4-position of 1-benzyl-1,4-dihydronicotinamide derivative.

We now report the isolation of a stable compound containing sulphur and sodium (42%) in the reduction of 1-benzyl-3-carbamoylquinolinium chloride (I) by sodium dithionite. Analytical and physical data indicated that the compound isolated (II) possessed a sulphonate group (ν_{SO_3Na} 1180,



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[3] K. Sutter-Kostic and P. Karrer, *Helv. Chim. Acta*, 1956, **39**, 677.
[4] M.B. Yarmolinsky and S. P. Colowick, *Biochim Biophys. Acta*, 1956, **20**, 177.
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[6] W. S. Caughey and K. A. Schellenberg, *Fed. Proc.*, 1964, **23**, 479.

1210 cm.$^{-1}$, KBr) [λ_{max} (95% ethanol) 240 mμ, $\epsilon = 8{\cdot}6 \times 10^{-3}$; 332 m$\mu$, $\epsilon = 8{\cdot}0 \times 10^{3}$]. A nuclear magnetic resonance spectrum in deuterated dimethyl sulphoxide was compatible with the structure assigned (H-4 as singlet at τ 5·25; N–CH_2– as a singlet at τ 5·02 and a complex multiplet centred at τ 2·92 with an area equivalent to twelve protons). The expected dihydro-derivative (II) was isolated in 29% yield.

Three possibilities may be put forward to explain the formation of (II). (1) It may be a true intermediate in the reduction of quinolinium salts by dithionite. Compound (I) and alkaline sodium hydrogen sulphite yielded compound (II). Compound (II) was stable in air and in alkaline solutions. (2) Bisulphite may be present as an impurity in commercial dithionite which would react with (I) under alkaline conditions to give (II). However, in the absence of carbonate the reaction of (I) with dithionite yielded (III) in 80% yield. Compound (I) and bisulphite at pH 7 yielded a new compound (IV), containing sulphur. If bisulphite was responsible for the formation of (II), then compound (IV) should have been obtained in the reduction of (I) in neutral dithionite. (3) Compound (II) may have resulted from the oxidation of a sulphinate derivative to the more stable sulphonate derivative. Compound (II) and dithionite yielded (III) (85%). Compound (IV) was also obtained by the action of acids on (II) and by the action of aqueous sulphur dioxide on (I).

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