LETTERS TO THE EDITOR

OXIDATION OF SOME EPIMERIC 4-HYDROXYPIPERIDINES WITH THALLIUM (III)

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IN the present study, the rate of oxidation of three epimeric pairs of 4-hydroxypiperidines with Tl(III) was measured to determine the sensitivity of this oxidation to conformational changes.[1]

Epimeric pairs of 2,6-diphenyl-,3-methyl-2,6-diphenyl- and 3,5-dimethyl-2,6-diphenyl-4-hydroxypiperidines were prepared.[2]

Accoding to the mechanism proposed,[3] thallium (III) attacks the α-hydrogen and abstracts it as hydride ion. Table 1 which records the kinetic data shows that the β-forms Ib, IIb and IIIb)axial - OH) react at a faster rate than the α-forms (equatorial — OH, Ia, IIa and IIIa).

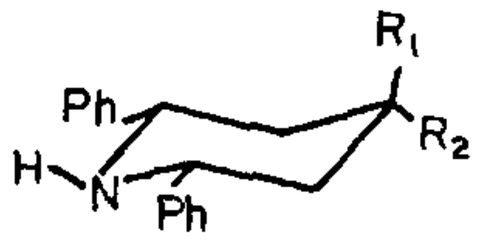
TABLE 1

Second-order rate constants for oxidation of epimeric 4-hydroxypiperidines by thallium(III)

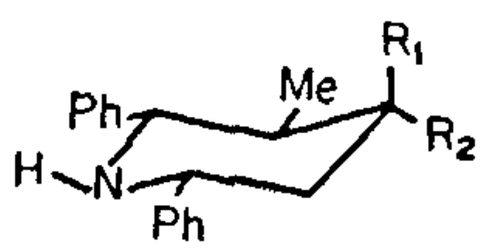
4-Hydroxypiperidine derivative	$k_2 \times 10^4$ litre mol^{-1} sec^{-1}
2,6-Diphenyl-(equatorial-OH)	2·44
2,6-Diphenyl-(axial-OH)	13·60
3-Methyl-2,6-diphenyl-(equatorial-OH)	14·86
3-Methyl-2,6-diphenyl-(axial-OH)	49·28
3,5-Dimethyl-2,6-diphenyl-(equatorial-OH)	4.59
3,5-Dimethyl-2,6-diphenyl-(axial-OH)	16.02

This is as expected since the β-forms have axial hydroxyl and equatorial hydrogen. Attack from the less hindered equatorial side is always preferred. Further, an axial hydroxyl group is subjected to greater steric strain than an equatorial hydroxyl due to non-bonded interactions with syn-axial hydrogens in the former. Since this strain will be relieved during oxidation, the strained axial alcohol is oxidised at a faster rate than the equatorial alcohol.

An alkyl group vicinal to the hydroxyl can cause non-bonded interaction with the latter. The resulting increase in strain is relieved during oxidation. Hence 3-methyl-2,6-dipenyl-4-hydroxyphiperidines (IIa and IIb) react at a faster rate than the corresponding 2, 6-diphenyl-4-hydroxypiperidines (Ia and Ib). Since in the chair conformation of 3,5-dimethyl-2,6-diphenyl-4-hydroxypiperidines (IIIa and IIIb) the hydroxyl groups have gauche interactions with both the adjacent equatorial methyl groups, one would expect the oxidation rates of epimeric 3, 5-dimethyl-2, 6-diphenyl-4-hydroxypiperidines to be higher than those of the corresponding 2,6-diphenyl-and 3-methyl 2,6-diphenyl-4-hydroxypiperidines. In the chair conformation of 3,5-dimethyl-2,6-diphenyl-4-hydroxypiperidines there exist gauche interactions which seem to be relieved if these molecules exist in twist conformation. The markedly lower rates of oxidation indicate decreased non-bonded interaction of the hydroxyl groups with adjacent methyl groups which is possible only in a highly distorted chair or a twist conformation.



I



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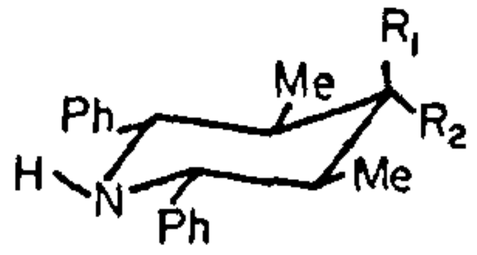

III

Ia, IIa and IIIa; R_1 = H, R_2 = OH
Ib, IIb and IIIb; R_1 = OH, R_2 = H

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SYNTHESIS OF A TETRAHYDRONAPTHALENE-2, 2-SPIROCYCLOPENTANE DERIVATIVE AND ITS REARRANGEMENT ON CATALYTIC DEHYDROGENATION

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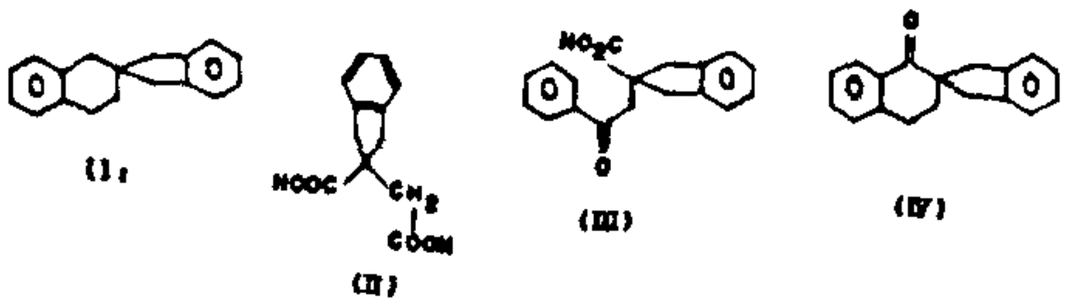
THE spiranes are known to undergo ring transformation under conditions of catalytic

dehydrogenation[1]. With a view to studying the effect of an aromatic ring on the mode and manner of ring fission of a spirocyclopentane ring, we have synthesised the spirane, 1', 2', 3', 4',—tetrahydro-spiro—[3,4—benzo-cyclopentane-1,2'- napthalene] (I) and studied its rearrangement on catalytic dehydrogenation.

The hydrocarbon (I) was prepared starting from indane which on reaction with formic acid and hydrogen peroxide followed by cyclisation of the resulting monoformate of indane-1, 2-diol yielded 2-indanone[2], m.p. 58°. Condensation of this ketone with ethyl cyanoacetate in the presence of piperidine at low temperature[3] furnished ethyl indenyl-2-cyanoacetate in 55% yield, m.p. 116° along with anhydro bis-β-hydrindone, m.p. 176°. The former on addition of potassium cyanide in aqueous alcoholic solution followed by hydrolysis by hydrochloric acid gave 3, 4-benzocyclopentane-1-carboxy-1-acetic acid (II), m.p. 168°, anhydride, m.p. 165°, anilic acid, m.p. 187°.



The anhydride of the acid (II) on catalysed condensation with benzene in the presence of aluminium chloride gave αα (3, 4-benzocyclopentane)-β-benzoyl propionic acid (III), m.p. 220°, 2·4-DNP derivative, m.p. 211°, which on Clemmensen reduction furnished αα-(3, 4-benzocyclopentane)-γ-phenyl butyric acid, m.p. 155°, along with a neutral compound, m.p. 255°, which is believed to be a lactone derived from bimolecular reduction of the keto acid. Cyclisation of the butyric acid derivative with PPA yielded 3', 4' – dihydrospiro – [3, 4-benzocyclopentane-1, 2' (1', 'H)-napthalene]–1'–one (IV), m.p. 93°, which gave the desired spirane on Clemmensen reduction.

The hydrocarbon underwent smooth rearrangement on dehydrogenation with 10% Pd-C catalyst at 320°, by fission of the spiro-cyclopentane ring adjacent to the aromatic ring, followed by angular cyclisation and dehydrogenation, yielding 1, 2-benzanthracene, m.p. 160°, picrate, m.p. 141°, TNB complex, m.p. 156°. No other hydrocarbon could be isolated from the reaction mixture.

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HYDROGEN BONDING INTERACTION OF α-TOCOPHEROL

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TOCOPHEROL has important biological functions[1,2] and its antioxidant properties have received considerable attention. Efforts have been made recently to determine the polarity of the environment around α-tocopherol and its binding with lipids[3]. Hydrogen donating capability of α-tocopherol to free radicals has also been examined[4]. We considered it important to obtain quantitative information on the hydrogen bonding interaction of α-tocopherol with electron donors and also on its self-association. We report results of such a study in this communication

Self-association of α-tocopherol was studied in CCl_4 solution by employing the O-H overtone band in the near IR region following the procedure of Singh and Rao[5]. Hydrogen bonding interaction of α-tocopherol with electron donor molecules was studied in CCl_4 solution[6]. Equilibrium constants (1:1) were determined at several temperatures, but only the value at 298 K is given here for the sake of brevity. The ΔH value reported here agrees to within ± 2 kJ mol^{-1}.

The 1:1 equilibrium constant for the dimerization of α-tocopherol at 298 K (0·32 lit mol^{-1}) is much lower than that of phenol, but is comparable to that in sterically hindered phenols[7]. The $\Delta\nu$(OH) due to dimerization of α-tocopherol is 140 cm^{-1}. The enthalpy change which is directly related to the hydrogen bond energy is also low (13·8 kJ mol^{-1}) in α-tocopherol compared to ~20 kJ mol^{-1} in the case of phenol.

Data on the hydrogen bonding interaction of α-tocopherol with electron donors are shown in table 1. The 1:1 equilibrium constants are generally lower than those with phenol[8], but are comparable to those with sterically hindered phenols[7,8]. Thus, with ethylacetate and DMF, 2, 6-dimethyl phenol shows K values of 0·8 and 7·2 lit mol^{-1} respectively. Enthalpy changes for the hydrogen bonding of electron donors with α-tocopherol are also lower than those with phenol. Thus, with ethyl acetate, DMF and DMSO, phenol shows ΔH values of 19·3, 26·4 and 29·3 kJ mol^{-1} respectively. Even 2,6-dimethyl phenol shows higher ΔH values than α-tocopherol (15 and 31 kJ mol^{-1} with ethyl acetate and DMF respectively). It,