A Novel Approach to the Isoindole System

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THE isoindole–1*H*-isoindole system (*e.g.*, I, II) is a potentially tautomeric one which, although long sought,[1] has been obtained only recently and then in the conjugatively stabilised form of 1-aryl and 1,3-diaryl derivatives.[2] In considering the mechanism of the reductive self-condensation of 2,5-dimethylpyrrole to the 1,3,4,7-tetramethylisoindolines (III) we proposed[3] that the corresponding isoindole or 1*H*-isoindole was an intermediate. Further work to test this proposal has now led to the isolation* of the first *C*-alkylisoindole system.

The acid-catalysed self-condensation of 2,5-dimethylpyrrole under nitrogen gives a product, $C_{12}H_{15}N$ (elemental analysis, mass spectrum) m.p. 142—144° (*in vacuo*) in 55% yield. It can be kept for several weeks under nitrogen at $-20°$. Reduction (metal–acid or catalytic) gives a mixture of the *cis*- and *trans*-1,3,4,7-tetramethylisoindolines (III), while oxidation ($KMnO_4$) gives benzene-1,2,3,4-tetracarboxylic acid (isolated as the ester IV). Hence the substance has the isoindole skeleton and oxidation level. In accord with this it is also obtained in good yield by treating the benzenesulphonyl derivative (V) of 1,3,4,7-tetramethylisoindoline with strong base.

The spectroscopic evidence indicates that the 1*H*-isoindole (II) predominates; the isoindole is probably detected under certain conditions, although the situation is somewhat complicated (especially for observations in dilute solution) by the easy autoxidation of the system (see below). Thus infrared bands are observed at 1610, 1570, and 1500 cm.$^{-1}$ (aromatic ring, conjugated azomethine) and 810 cm.$^{-1}$ (1,4-disubstituted benzene). The solid shows no strong band attributable to N–H stretching [*cf.* 2,3,4,5-tetramethylpyrrole, ν = 3330 cm.$^{-1}$ (s)] although a weak band is observed at 3120 cm.$^{-1}$: in carbon tetrachloride, however, a band appears at 3350 cm.$^{-1}$ The ultraviolet spectrum (KBr disc) has maxima at 292·5, 302·5, and 349 mμ: the last band possibly

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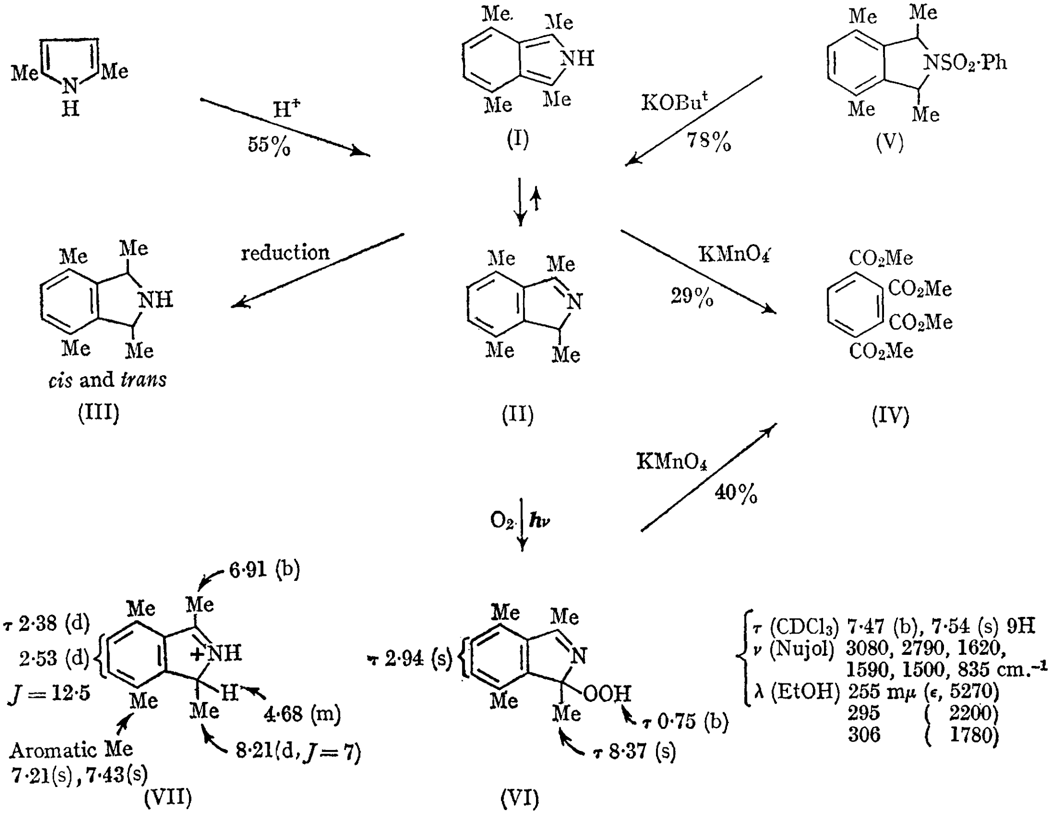
* Isoindole itself has been trapped as a Diels–Alder adduct[4] but has not apparently been isolated.

represents the isoindole tautomer since this absorption is not present in compound (VI). The n.m.r. spectrum in $CDCl_3$ is complex, but shows a doublet (~2·5H) at τ 8·56 and, coupled with it, a quartet at τ 5·27, which features are attributable to the Me–CH system of the 1*H*-isoindole (II): in acidic solvents, however, the spectrum corresponds cleanly to the 1*H*-isoindolium ion (VII).



The tetra-alkylisoindole system is readily autoxidised. For example, photochemical autoxidation in ether–benzene gives an adduct $C_{12}H_{15}NO_2$, m.p. 138° (decomp.) which, on the basis of the spectroscopic data, is formulated as the hydroperoxide (VI). This and other adducts are being investigated further.

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