Synthesis of the First Examples of 5*H*-1,2-Benzodiazepines

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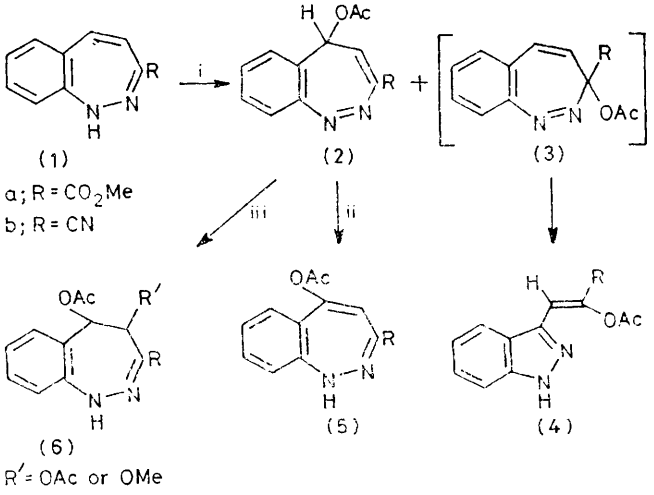
Summary Treatment of the 1*H*-1,2-benzodiazepines (**1**) with lead tetra-acetate affords the previously unknown 5*H*-1,2-benzodiazepines (**2**), which, on treatment with base, undergo tautomerization to the 1*H*-isomers (**5**), and on photolysis give the indole (**8**).

THE tautomerism of aza-cycloheptatrienes has been widely investigated.[1] In the monomeric 1,2-diazepines the 3*H*-,[2] 4*H*-, and 5*H*-tautomers[3] are known to be stable, but antiaromatic NH tautomers are unstable and can be isolated only as their iron tricarbonyl compounds[4] or *N*-substituted derivatives with electron-withdrawing substituents.[5] The 2,3-benzodiazepines have two CH tautomers and no antiaromatic NH forms.[6] However, we have previously shown that the 1*H*-1,2-benzodiazepines[7] are more stable than their 3*H*-tautomers, one of the two possible CH forms, which are readily tautomerized to the 1*H*-isomers by both bases and acids and are also susceptible to thermal and photochemical rearrangements.[8] Direct tautomerization of 1*H*- and 3*H*-tautomers into 5*H*-tautomers has not been successful. Therefore, we were interested

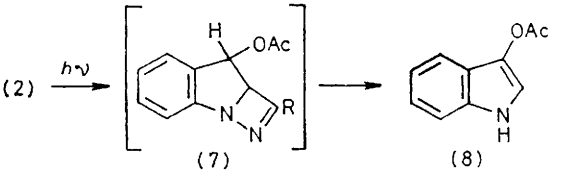


i, $Pb(OAc)_4$; ii, Et_3N; iii, AcOH or MeOH

in the preparation of the 5*H*-1,2-benzodiazepines and now report the synthesis of the first examples of the 5*H*-diazepines (**2**) and some of their reactions.

Treatment of the 1*H*-diazepines (**1**) with lead tetra-acetate in methylene chloride gave the 5*H*-diazepines (**2**)† and the 3-vinylindazoles (**4**)‡ in yields of 60—65 and 25%, respectively. The 3*H*-1,2-benzodiazepines are known to be extremely susceptible to heat- and light-induced rearrangements to give 3-vinylindazoles in high yields.[8] Thus the pyrazoles (**4**) may be formed *via* the 3*H*-diazepines (**3**). Oxidation of the 1*H*-diazepines (**1**, R = H, Cl, or OMe) gave only the corresponding 3*H*-diazepines (**3**) and/or pyrazoles (**4**), and no 5*H*-diazepines (**2**).

The 5*H*-diazepines (**2**) were readily tautomerized into the 1*H*-isomers (**5**) by treatment with bases such as triethylamine; this is analogous to the behaviour observed for 3*H*-1,2-benzodiazepines.[8] Treatment of (**2**) with acetic acid or methanol gave the corresponding adducts (**6**) in *ca.* 70% yield *via* 1,4-addition.§ When (**2**) was heated in xylene at 100—140 °C it decomposed giving no characterized products, in contrast to the 1*H*- and 3*H*-tautomers. Finally, the 5*H*-diazepines (**2**) were irradiated with a halogen lamp to give 3-acetoxyindole (**8**) in 75% yield, which may be formed *via* the tricyclic valence isomer (**7**) followed by extrusion of RCN, analogous to the behaviour observed for 3*H*-1,2-diazepines,[9] 2,3-benzodiazepines,[6] and triazepines.[10] This photochemical behaviour of (**2**) is also different from that of 1*H*- and 3*H*-1,2-benzodiazepines.



In conclusion, these results and those already reported clearly indicate that in the three 1,2-benzodiazepine tautomers the antiaromatic NH form is the most stable and the stability sequence is 1*H*- > 3*H*- > 5*H*-tautomer.

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† Compound (**2a**) was purified by silica gel chromatography: viscous orange oil; δ ($CDCl_3$) 2·08 (3H, s, COMe), 3·85 (3H, s, OMe), 5·66 (1H, d, 5-H), 6·78 (1H, d, 4-H), 7·2—8·0 (4H, m, Ar-H), and $J_{4,5}$ 6 Hz. However, compound (**2b**) gradually decomposed during isolation; thus it was used in the reactions without further purification.

‡ Satisfactory elemental analyses and spectral data were obtained for all new compounds; (**4a**) had m.p. 148—150 °C, (**4b**) m.p. 78—80 °C, (**5a**) m.p. 120—122 °C, and (**5b**) m.p. 128—130 °C.

§ Treatment of (**5**) with AcOH or MeOH did not give (**6**); thus the adducts (**6**) must be directly formed from (**2**).

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