Nuclear Synthesis of 1,4-Dihydropyridines by Rearrangement of Aziridinobicyclo[2,2,1]pyridazine Carboxylates

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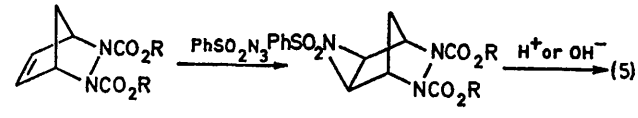
Summary The adducts of cyclopentadiene and azodicarboxylate esters were treated with benzenesulphonyl azide producing the fused aziridine derivatives, (**4**) and (**5**); hydrolysis of the ethyl ester (**4**) gave the diazatricyclene (**7**) whereas hydrolysis of the t-butyl ester led to the dihydropyridine (**9**).

THE recent report[1] describing the synthesis of divinyl amine derivatives from aziridinosulpholens suggested that this process should be amenable toward the synthesis of dihydropyridines. Attempts to apply this sequence to the



(1) R = Et
(2) R = Bu^t
(3) R = Et
(4) R = Bu^t

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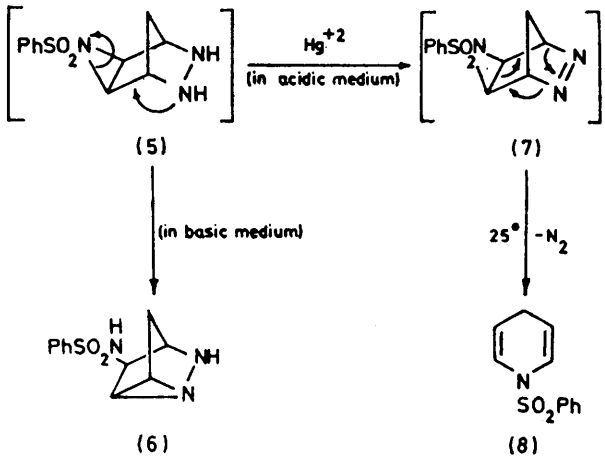
latter were fruitless owing mainly to the failure of cyclopentadiene to form a cyclic adduct with sulphur dioxide. The readily available[2] cycloaddition product (**1**) from cyclopentadiene and diethyl azodicarboxylate was therefore chosen as a suitable precursor. When a benzene solution



of (**1**) and benzenesulphonyl azide was heated (80°, 6 h) and the concentrate chromatographed on silica gel (ether–pentane 1·5 : 1), the aziridine derivative (**3**) was obtained in excellent yield (97%, m.p. 123—124°; i.r. 1325, 1170, 760 cm^{-1}; *m/e* 395).‡

Treatment of (**3**) with methanolic KOH (2 h, 65°) produced only the diazatricyclene (**6**) (93%) [m.p. 180—181°; i.r. 3235, 2850—2600 cm^{-1}; *m/e* 250 ($M^+ - 1$)]. The 1,3-elimination process is kinetically too favourable to be intercepted under these conditions. The rapid transformation of (**3**) into (**6**) is in marked contrast to the host of products resulting from the alkaline hydrolysis of (**1**)[3] and represents a striking example of the 1,3-*trans*-orientation required for 1,3-elimination reactions.[4]

The t-butyl ester (**2**) (m.p. 99—100°; i.r. 2980, 1740, 1692 cm^{-1}) was synthesised (92%) from cyclopentadiene and di-t-butyl azodicarboxylate. Addition of benzenesulphonyl azide to (**2**) in benzene (20 h, 80°) gave (**4**) (m.p. 145—147°; i.r. 3048, 1700, 1582) (90%). Removal of the ester function in (**4**) under acidic conditions, minimised 1,3-elimination owing to protonation of the hydrazine (**5**). Thus, addition of dry hydrogen chloride to an ethanolic solution of the t-butyl derivative (**4**) containing excess of mercuric oxide afforded the dihydropyridine (**8**) (m.p. 86—89°; i.r. 3060, 1680, 1630, 1610, 1350, 1185 cm^{-1}) (63%).

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‡ All new compounds gave satisfactory combustion and n.m.r. spectral analyses.

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[3] S. G. Cohen, R. Zand, and C. Steel, *J. Amer. Chem. Soc.*, 1961, **83**, 2895; In the absence of the bridged methylene group in (**2**), hydrolysis proceeds normally to the cyclic azo-compounds, J. A. Berson and S. S. Olin, *J. Amer. Chem. Soc.*, 1969, **91**, 778.
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