Formation of 1,2,3-Benzotriazines by Oxidation of 1- and 2-Aminoindazoles

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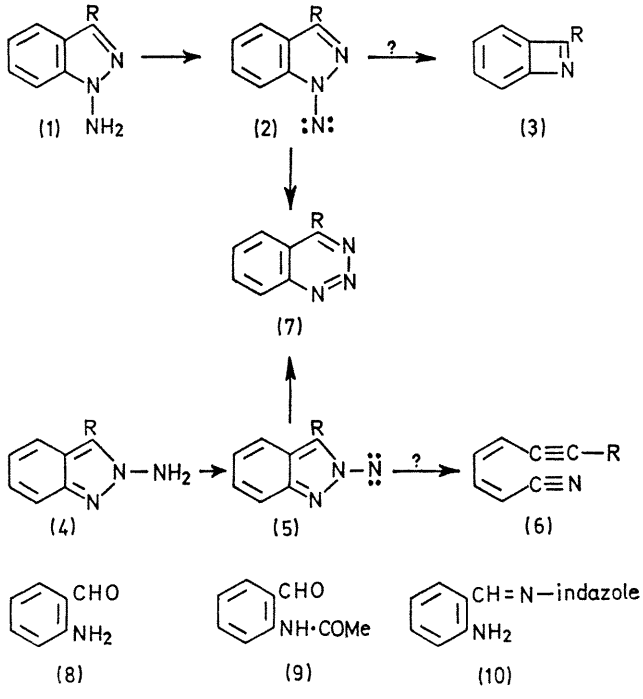
Summary 4-Substituted 1,2,3-benzotriazines are formed in high yield by oxidation of 1- and 2-amino-3-substituted indazoles; 1,2,3-benzotriazine itself is formed in the same way if nucleophiles are carefully excluded.

OXIDATION of 1- (**1**) and 2-aminoindazole (**4**) was investigated since it seemed likely that, by analogy with the oxidation of 1- and 2-aminobenzotriazole and related compounds,[1] nitrogen would be extruded from the resulting nitrenes (**2**) and (**5**). The former should lose nitrogen and either collapse to the azabenzocyclobutadiene (**3**) or fragment further to RCN and benzyne. The latter, (**5**), should lose nitrogen and ring-open to the cyanoacetylene (**6**), or possibly collapse to the azabenzocyclobutadiene (**3**). It was thought that common products from the oxidation of 1- and 2-aminoindazoles would indicate the intermediacy of (**3**).

The *N*-aminoindazoles [(**1**) and (**4**); R = H, Me, and Ph] were readily obtained by amination of the indazoles with hydroxylamine-*O*-sulphonic acid in aqueous alkali. The isomers were separated chromatographically and their structures established spectroscopically and by independent synthesis of the 2-amino-compounds.

Somewhat surprisingly, oxidation of the *N*-amino-3-substituted indazoles [(**1**) and (**4**); R = Me and Ph] with lead tetra-acetate in dichloromethane did not lead to the loss of nitrogen, but the 1,2,3-benzotriazines (**7**; R = Me and Ph) were formed rapidly and almost quantitatively. Similarly, oxidation of 1- and 2-aminoindazole [(**1**) and (**4**); R = H] gave the parent benzotriazine (**7**; R = H). However the latter is highly susceptible to attack by nucleophiles

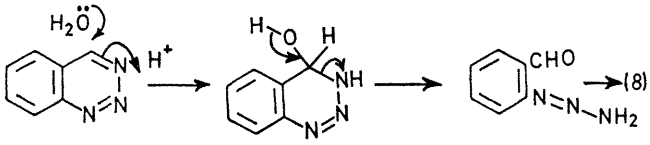


and it could only be isolated when the *N*-aminoindazole was added slowly to lead tetra-acetate in rigorously dried solvents in the presence of excess of powdered calcium oxide to remove acetic acid. In the absence of such precautions the products (**8**), (**9**), and (**10**) were obtained in variable yields, by attack of water, acetic acid, or the starting aminoindazole, respectively, on the triazine. Formation of *o*-aminobenzaldehyde (**8**), for example, is rationalised as shown; the initial "covalent hydration" is well known for related heterocyclic systems.[2]

Once isolated, as a colourless, crystalline solid, m.p. 119—120°, 1,2,3-benzotriazine (**7**; R = H) is quite stable. Its structure is supported by analytical, spectral, and mass spectral data, by its rapid reaction in solution with nucleophiles to give derivatives of *o*-aminobenzaldehyde, and by its thermal fragmentation in the vapour phase (450° at 0·02 Torr) to give benzyne, isolated as biphenylene (40%).

[1] C. D. Campbell and C. W. Rees, *J. Chem. Soc.* (*C*), 1969, 742.
[2] A. Albert, *Angew. Chem. Internat. Edn.*, 1967, **6**, 919.

The lower reactivity of the 4-substituted benzotriazines towards nucleophiles is attributed to a combination of steric and electronic effects.



Oxidation of 1- and 2-aminoindazoles thus provides a further, and as yet the cleanest, route to 1,2,3-benzotriazines. The reaction promises wide scope; for example 3-methoxyindazole can be converted into 4-methoxy-1,2,3-benzotriazine in high yield by amination and oxidation.

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