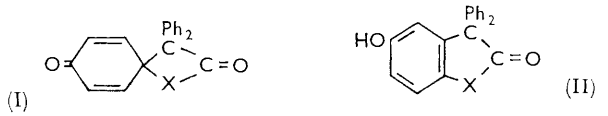
552. *The Addition of Diphenylketen to Benzoquinone N-Phenylimine*

By C. W. Bird

Addition of diphenylketen to benzoquinone had been shown [1] to form the β-lactone adduct (Ia), which is converted into the benzofuranone (IIa) on exposure to sunlight. Interest [2] in the molecular rearrangement of small-ring compounds suggested an investigation of the corresponding β-lactam (Ib).



(a) X = O ; (b) X = NPh

An ethereal solution of benzoquinone *N*-phenylimine was rapidly decolourised by the addition of an equimolar amount of diphenylketen. Evaporation of the solution in the cold gave an oil having the expected infrared spectrum (strong C=O bands at 1760 and 1670 cm.$^{-1}$) for (Ib). On standing, the oil slowly crystallised and the carbonyl bands were replaced by bands at 3400 (O–H) and 1690 cm.$^{-1}$ (C=O), suggesting that the original product was the β-lactam (Ib) which had rearranged to give the oxindole (IIb). The product was readily converted into the methyl ether ($\nu_{max.}$ 1725 cm.$^{-1}$) by dimethyl sulphate and alkali. The n.m.r. spectrum of this ether, in carbon tetrachloride at 60 Mc./sec., confirmed the structure. The three protons of the methyl group appeared at τ 6·28; the aromatic protons of the 3,3-diphenyl group were centred at τ 2·69 and those of the *N*-phenyl group at τ 2·53; the three remaining aromatic protons gave rise to a complex multiplet between τ 3 and 3·5.

Experimental.—Diphenylketen [3] (1·9 g.) was added to a solution of benzoquinone *N*-phenylimine [4] (1·8 g.) in ether (100 ml.) at room temperature. The almost colourless solution was set aside overnight and evaporated in the cold; the resulting oil slowly crystallised to give *5-hydroxy-1,3,3-triphenyloxindole* (IIb) (2·3 g.), m. p. 234—235° (from ethanol) (Found: C, 82·85; H, 5·2; N, 3·4; O, 8·5. $C_{26}H_{19}NO_2$ requires C, 82·7; H, 5·1; N, 3·7; O, 8·5%). The *methyl ether*, prepared by dissolving compound (IIb) in aqueous methanolic sodium hydroxide and adding dimethyl sulphate, had m. p. 171—172° (from ethanol) (Found: C, 82·5; H, 5·4; N, 3·7. $C_{27}H_{21}N_2O$ requires C, 82·8; H, 5·4; N, 3·6%).

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[1] H. Staudinger and St. Bereza, *Annalen*, 1911, **380**, 243.
[2] C. W. Bird, *J.*, 1963, 674; *Tetrahedron Letters*, 1964, 609; *J.*, 1964, 5284.
[3] L. I. Smith and H. H. Hoehn, *Org. Synth.*, Coll. Vol. III, p. 356.
[4] H. J. Teuber and G. Staiger, *Chem. Ber.*, 1954, **87**, 1251.