Furano Compounds. XXII

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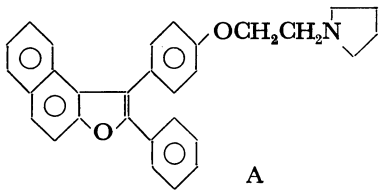
(Received November 21, 1973)

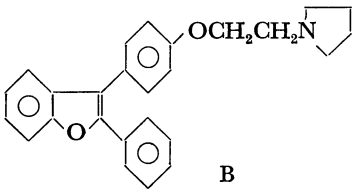
The synthesis of 2′,3′-diphenylfuranobenzoxanthones with the condensed benzene ring at the 5,6; 6,7; and 7,8 positions and with possible antifertility activity is recorded.

The first report on the use of polyphosphoric acid as an effective reagent for the condensation of phenols with benzoin to give 2′,3′-diphenylbenzofurans was made by us earlier.[1] Subsequently employing this method and various 1,3-dihydroxyxanthones in the place of phenols a number of 1-hydroxy-2′,3′-diphenylfurano[4′,5′:3,4]xanthones carrying alkyl (methyl) substituents in various positions of the free benzenoid ring were synthesised and the results recorded.[2] The synthesis of these compounds was warranted on the basis that they may serve as potential antifertility agents due to the presence of 2,3-diphenylfuran moiety.

The beneficial influence of a naphthaleno nucleus on the antifertility activity is established by the observations of Carney *et al.*[4] on the enhanced activity of 2,3-diphenylnaphthofurans over 2,3-diphenylbenzofurans. This is further corroborated by Chawla *et al.*[3] who have shown that the antifertility activity of 3-(1-pyrrolidinoethoxyphenyl-2-phenyl) naptho [2,1-*b*] furan (A) (as hydrochloride) is ten times that of 2-phenyl-3-pyrrolidinoethoxyphenylbenzofuran (B).



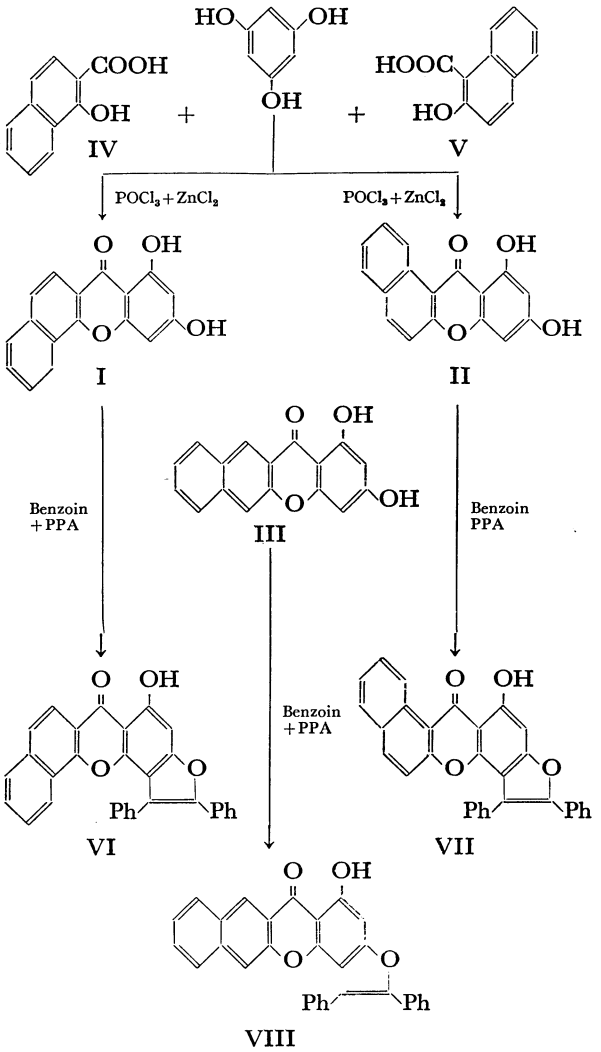
A



B

Hence the synthesis of various 2′,3′-diphenylfurano-[4′,5′:3,4]benzoxanthones has been undertaken and the results recorded. Two angular and one linear benzoxanthones *viz.* 1,3-dihydroxy-5,6-benzoxanthone (I), 1,3-dihydroxy-7,8-benzoxanthone (II) as also 2,3-dihydroxy-6,7-benzoxanthone (III) have been used as the starting material. The xanthones (I) and (II) whose syntheses are recorded for the first time have been obtained by condensing phloroglucinol with 1-hydroxy-2-naphthoic acid (IV) in the case of I and 2-hydroxy-1-naphthoic acid (V) in the case of II in the presence of phosphorus oxychloride and zinc chloride (Grover, Shah, and Shah[5]). It may be added that in view of the easy decarboxylation of 2-hydroxy-1-naphthoic acid under the conditions employed for the preparation of xanthone, the reaction had to be carried out at room temperature for a longer period.

The hydroxyxanthones (I, II, and III) are then condensed with benzoin in the presence of polyphosphoric acid at 100—110 °C to yield the desired 2′,3′-diphenylfuranobenzoxanthones (VI—VIII). These compounds will be screened for their antifertility activity in due course.



Experimental

IR Spectra were determined on a perkin-Elmer Model 221 spectrophotometer with sodium chloride prisim—in KBr disc.

1,3-Dihydroxy-5,6-Benzoxanthone (I). 1-Hydroxy-2-naphthoic acid (10 g), phloroglucinol (10 g), freshly fused zinc chloride (30 g) and phosphorus oxychloride (70 ml) were heated at 60—70 °C for 2 hr. The separated product was filtered, washed with dilute sodium bicarbonate solution

and with water. The xanthone crystallised from aqueous alcohol as yellow needles, mp 299—300 °C. Yield: 2.8 g. Found: C, 73.8; H, 4.2%. Calcd for $C_{17}H_{10}O_4$: C, 73.3; H, 3.6%. νCO: 1650 cm^{-1}, νOH: 3200 (broad) cm^{-1}.

1-Hydroxy-2',3'-diphenyl-5,6-benzo[4',5':3,4]furanoxanthone (VI). 1,3-Dihydroxy-5,6-benzoxanthone (2 g), benozin (2 g) were mixed and added in small portions to polyphosphoric acid (25 g of P_2O_5 and 12 ml of orthophosphoric acid) at 110 °C for 1 hr. The mixture was heated at 100—110 °C, with constant stirring for 4 hr. It was then cooled and poured into ice-water. The solid that separated was filtered, macerated with 5% aqueous sodium bicarbonate and again filtered. Purification of the crude product by chromatography over silica gel employing petroleum ether as the eluent gave compound (VI) which crystallised from benzene as shining needles, mp 212—213 °C. Yield: 0.06 g. Found: C, 81.5; H, 4.5%. Calcd for $C_{31}H_{18}O_4$: C, 81.9; H, 4.0%. νCO: 1645 cm^{-1}, No free OH absorption.

1,3-Dihydroxy-7,8-benzoxanthone (II). 2-Hydroxy-1-naphthoic acid (8 g), phloroglucinol (8 g) freshly fused zinc chloride (24 g) and phosphorus oxychloride (56 ml) were mixed together and kept at room temperature for 48 hr. The reaction mixture was poured into crushed ice and worked up as usual. The xanthone crystallised from aqueous alcohol as yellow needles, mp 271—272 °C. Yield: 2.5 g. Found: C, 69.6; H, 4.6%. Calcd for $C_{17}H_{10}O_4 \cdot H_2O$: C, 69.2; H, 4.7%. $\nu_{C=O}$: 1650 cm^{-1}. ν_{OH}: 3000, 3100 cm^{-1} (broad).

1-Hydroxy-7,8-benzo-2',3'-diphenyl[4',5':3,4]furanoxanthone (VII). A mixture of 1,3-dihydroxy-7,8-benzoxanthone (3 g), benzoin (3 g) were added to PPA (25 g of P_2O_5 and 14 ml of orthophosphoric acid) at 120 °C during 1 hr with stirring. The reaction mixture was heated for a further period of 5 hr at 100 °C and then poured into crushed ice. The crude substance was purified by chromatography over silicagel. Petroleum ether elution gave (VII) which crystallised from benzene as yellow shining needles, mp 245 °C. Yield: 0.1 g. Found: C, 81.7; H, 4.3%. Calcd for $C_{31}H_{18}O_4$: C, 81.9; H, 4.0%. $\nu_{C=O}$: 1645 cm^{-1}. No free OH absorption.

References

1) M. Kanakalingeswara Rao and S. Rajagopal, *Curr. Sci.*, **41**, 677 (1972).

2) M. Kanakalingeswara Rao and S. Rajagopal, *Ind. J. Chem.*, **11**, 708 (1973).

3) H. P. S. Chawla, P. K. Grover, Nitya Anand, V. P. Kamboj, and A. B. Kar, *J. Med. Chem.*, **13**, 54 (1970).

4) R. W. J. Carney, M. Hill, and W. L. Bencze, U.S. 3340276, 5 Sept. (1967).

5) P. K. Grover, G. D. Shah, and R. C. Shah, *J. Chem. Soc.*, **1955**, 3982.