The Reaction of Pyridazine 1-Oxide with a Grignard Reagent

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MANY reports on Grignard reactions with aromatic amine oxides have been published.[1] The main reaction is nucleophilic substitution by alkyl or aryl groups of the α-position of the *N*-oxide with accompanying deoxygenation of the *N*-oxide group. The reaction can also occur without deoxygenation, giving substituted 1-hydroxy-1,2-dihydro-derivatives.[2]

Though the reaction of pyridazines was examined widely by Crossland *et al.*,[3] no report has appeared on the reaction of pyridazine or cinnoline *N*-oxides. We have examined the reaction of the former and observed ring opening to aryl substituted butene-ynes.

When pyridazine 1-oxide (I) was dissolved in tetrahydrofuran (THF) and treated at 15—20° with phenylmagnesium bromide (II) (prepared in ether) 1,4-diphenylbuta-1,3-diene (IVa) was obtained as the main product in about 28% yield, and 1-phenylbut-1-ene-3-yne (IIIa) and 3,6-diphenylpyridazine (Va) as by-products in very small yields. When THF alone was used as solvent, compounds (III) were the sole products (*ca.* 80%, crude). The products are shown in the Table with their physical data and yields.

The structures of the products (III) were in agreement with their elemental analyses and i.r. and n.m.r. spectra. For example, the i.r. spectrum of (IIIa) showed a band at about 3300 cm.$^{-1}$, attributable to an acetylenic methine stretching vibration, and bands appearing at about 2100 cm.$^{-1}$ ($\nu_{C\equiv C}$) and at about 960 cm.$^{-1}$ corresponding to a *trans*-ethylenic bond.

The n.m.r. spectrum of (IIIa) in CCl_4 solution exhibited signals at τ 2·8 (5 H, singlet, phenyl), 3·13 (1 H, doublet,

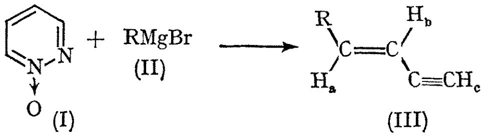
TABLE

			I.r.(Liq. Cap.) (cm.$^{-1}$)			N.m.r.(CCl_4) τ, (J in Hz.)			Yield(%)	
Compound	B.p./mm.Hg.	n_D^{20}	$\nu\equiv CH$	$\nu C\equiv C$	$\delta=CH$	H_a	H_b	H_c	Crude	Pure
(IIIa)[a]	49—50°/2	1·6105	3300	2100	957	3·13 (15·6)	4·08 (15·6,2·3)	7·14 (2·3)	81·4	35·0
(IIIb)	85—90°/6	1·5950	3300	2100	959	3·03 (15·6)	4·05 (15·6,2·3)	7·15 (2·3)	82·3	34·8
(IIIc)[c]	46—47°/1 (m.p. 40—42°)	—	3280	2080	955	2·73 (15·6)	4·03 (15·6,2·3)	7·12 (2·3)	76·3	41·1
(IIId)	73—74°/2	1·6033	3310	2100	959	3·10 (15·6)	4·03 (15·6,2·3)	7·13 (2·3)	62·3	30·7
(IIIe)[c]	66—69°/1 (m.p. 47—49°)	—	3300	2100	959	3·09 (15·6)	4·13 (15·6,2·3)	7·18 (2·3)	15·7	8·4
(IIIf)[b]	71—72°/2	1·6098	3310	2100	959	3·03 (15·6)	3·93 (15·6,2·3)	7·13 (2·3)	—	22·1

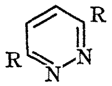
[a] Lit.[4]; b.p. 55—75° (0·01 mm. Hg), n_D^{20} 1·6153. [b] Anisole: Yield 4·2%. [c] I.r. spectrum in KBr.

J 15·6 Hz., H_a), 4·08 (1 H, quartet, J 15·6 and 2·3 Hz., H_b), and 7·14 (1 H, doublet, J 2·3 Hz., H_c). The coupling constant $J_{a,b}$ (15·6 Hz.) is consistent with the coupling of two protons across a *trans*-double bond. Furthermore, the coupling constant $J_{b,c}$ (2·3 Hz.) implies that H_c is a proton at the end of an acetylenic bond. From these results, (IIIa) is considered to be 1-phenyl-*trans*-but-1-ene-3-yne, and the other physical data are consistent with literature values.

On examining the ether extracts of the crude reaction products by t.l.c., traces of (IV) and (V) were observed. However, further examination was impossible because of shortage of material, except in the case of (IIf), from which anisole was obtained as by-product in 4·2% yield.



RCH:CH·CH:CHR
(IV)



(V)

(a) R = Ph; (b) R = *p*-Me·C_6H_4; (c) R = *o*-Me·C_6H_4; (d) R = *m*-Me·C_6H_4; (e) R = *p*-MeO·C_6H_4; (f) R = *o*-MeO·C_6H_4.

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[1] *e.g.*, E. Ochiai, "Aromatic Amine Oxides," Elsevier, Amsterdam, 1967, pp. 251—253; E. Hayashi, E. Oishi, T. Tezuka, and K. Ema, *J. Pharm. Soc. Japan*, 1968, **88**, 1333.

[2] T. Kato and H. Yamanaka, *J. Org. Chem.*, 1965, **30**, 910.

[3] I. Crossland, *Acta Chem. Scand.*, 1956, **16**, 1877; 1963, **17**, 1276; 1964, **18**, 1653; 1965, **19**, 1652; 1967, **21**, 2104; 1968, **22**, 1669; 2700.

[4] Farbenfabriken Bayer A. G., Ger. Pat. 1,186,063 (1965); (*Chem. Abs.*, 1966, **62**, 14498).