1*H*-2,3-Benzoxazin-1-ones. II. Action of Amines, Phenylhydrazine, Aluminium Chloride, and Grignard Reagents on 4-Aryl-1*H*-2,3-benzoxazin-1-ones

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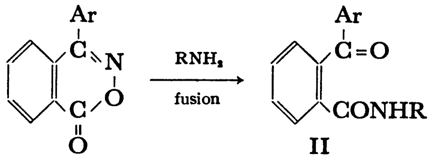
4-Aryl-1*H*-2,3-benzoxazin-1-one on reaction with amines by fusion gave *o*-aroyl benzamides. With benzylamine in benzene they gave (2-benzylcarbamoyl)-benzophenone oximes, and with phenylhydrazine they gave 1,3-diaryl-1,2-dihydrophthalazin-4-ones. However, with anhydrous $AlCl_3$ (12 mol) in reactive hydrocarbon substrates, they gave the corresponding *o*-aroylbenzophenone anils. With Grignard reagents they gave the corresponding *o*-aroyl-triaryl-methanols, which upon cyclization gave 1,1,4-triaryl-1(*H*)-2,3-benzoxazines.

Reaction of 1H-*2,3-Benzoxazin-1-ones with Amines.* We have found a new reaction of 1*H*-2,3-benzoxazin-1-one with amines.

4-Aryl-1*H*-2,3-benzoxazin-1-ones (Ia and b) react with benzylamine, and aniline by fusion to give *N*-substituted *o*-aroyl benzamides (IIa—d).

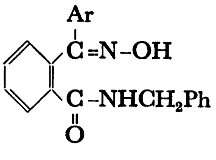


I II

	Ar
a:	C_6H_5
b:	$C_6H_4CH_3(\text{-}p)$
c:	$C_6H_4Cl(\text{-}p)$

	Ar	R
a:	C_6H_5	$C_6H_5\text{-}CH_2$
b:	$C_6H_4CH_3(\text{-}p)$	$C_6H_5\cdot CH_2$
c:	C_6H_5	C_6H_5
d:	$C_6H_4CH_3(\text{-}p)$	C_6H_5

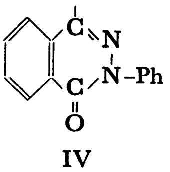
It was found that IIIa—c were formed from the reaction of Ia—c with benzylamine in benzene.



III

a: $Ar=C_6H_5$, b: $Ar=C_6H_4CH_3(\text{-}p)$, c: $C_6H_4Cl(\text{-}p)$.

Reaction of 1H-*2,3-benzoxazin-1-ones with Phenylhydrazine.* 4-Aryl-1*H*-2,3-benzoxazin-1-ones (Ia—c) react with phenylhydrazine to give the corresponding 1,3-diaryl-1,2-dihydrophthalazin-4-ones (IVa—c).



IV

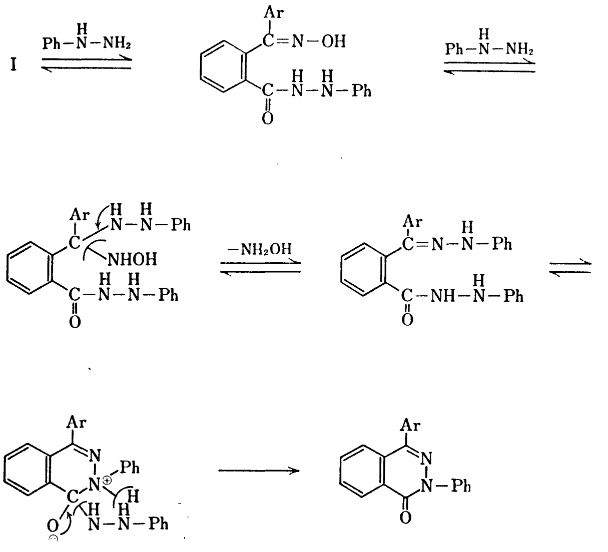
a: $Ar=C_6H_5$, b: $Ar=C_6H_4CH_3(\text{-}p)$,
c: $Ar=C_6H_4Cl(\text{-}p)$

The structure of IVa—c was confirmed:

(i) *Via* the reaction of the corresponding *o*-aroylbenzoic acids (Va—c) with phenylhydrazine.[2,3]

(ii) *From IR spectra*: IVa—c showed $\nu_{C=O}$ in the region 1700—1690 cm^{-1}.

The reaction possibly takes place according to the following mechanism (Scheme 1).



Scheme 1. The above mechanism was proved from the fact that benzophenone oxime reacts with hydrazines to give benzophenone hydrazones.[4]

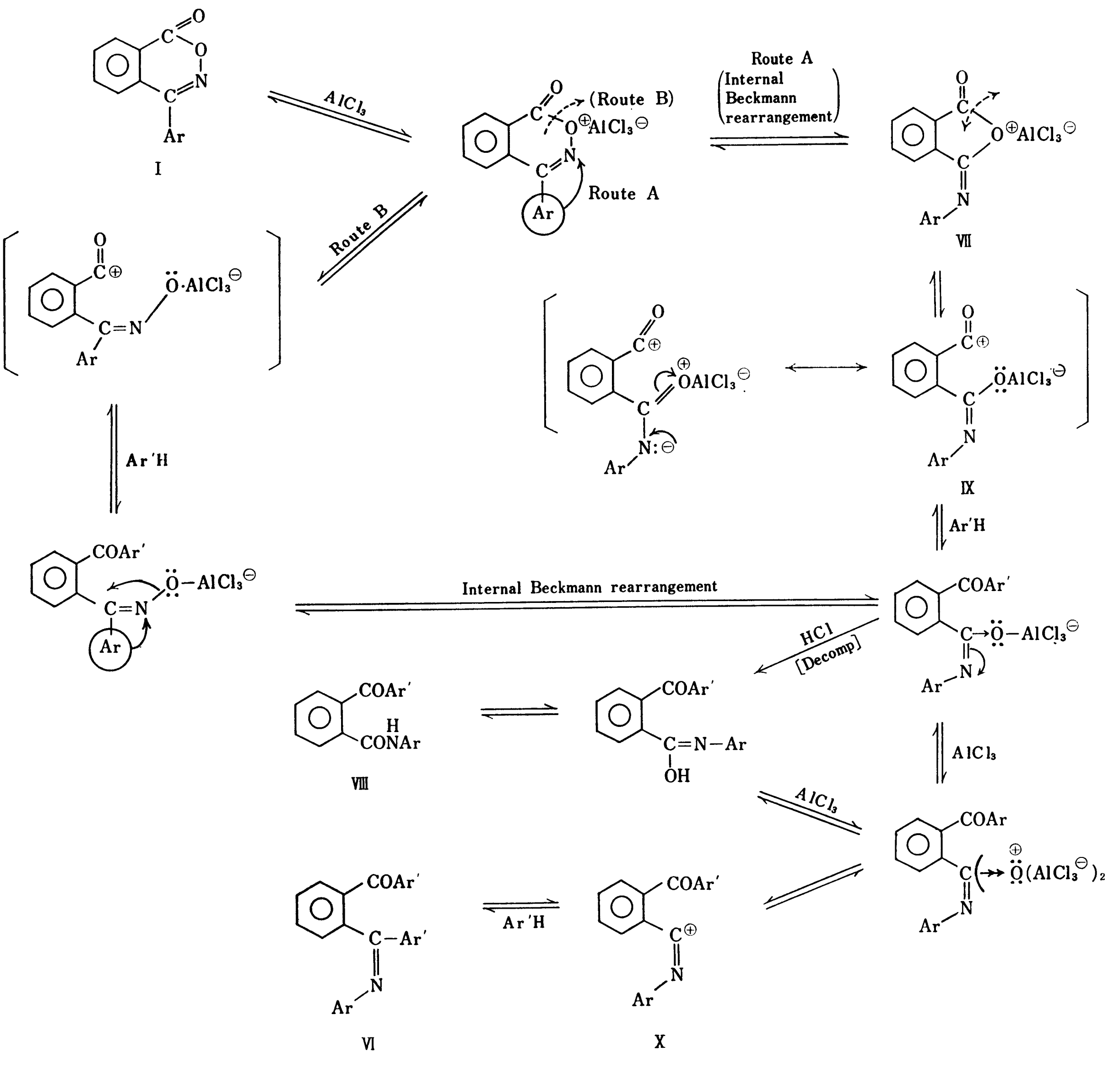
Action of Anhydrous $AlCl_3$ in Reactive Aromatic Hydrocarbon Substrates. 4-Phenyl-1(*H*)-2,3-benzoxazin-1-one (Ia) reacts with hot benzene, toluene, and anisole in the presence of 12 mol anhydrous $AlCl_3$ to give 2-benzoyl-; 2-(*p*-toluoyl)-4′-methyl; and 2-(*p*-anisoyl)-4′-methoxybenzophenone anils (VIa—c), respectively. Under the same conditions 4-(*p*-tolyl)-, and 4-(*p*-chlorophenyl)-1*H*-2,3-benzoxazin-1-ones (Ib, and c) gave the corresponding 2-aroylbenzophenone *p*-methyl anils (VId—f) and 2-aroylbenzophenone *p*-chloro anils (VIg—i) respectively.

The structure of VIa—i was confirmed from IR spectra which revealed the presence of $\nu_{C=O}$ in the region 1720—1700 cm^{-1}. The reaction possibly takes place according to the following mechanism (Scheme 2).

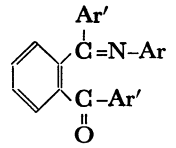
Route A in the above scheme is the most probable one for the following reasons: (i) 3-Phenyliminophthalide (VII) is found to undergo Friedel-Crafts reaction with benzene to give *o*-benzoylbenzanilide (VIII)[5] (ii) formation of *N*-arylphthalimides, when chlorobenzene was used as a substrate,[1] indicates that the carbonium ion (IX) is formed as an intermediate.

o-Aroylbenzanilide (VIII) was found to be an intermediate in the above mechanism from the following:

(i) It was formed from reaction of I with benzene,



Scheme 2.



VI

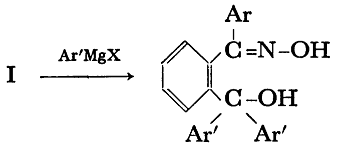
	Ar	Ar'
a:	C_6H_5	C_6H_5
b:	C_6H_5	$C_6H_4CH_3$(-*p*)
c:	C_6H_5	$C_6H_4OCH_3$(-*p*)
d:	$C_6H_4CH_3$(-*p*)	C_6H_5
e:	$C_6H_4CH_3$(-*p*)	$C_6H_4CH_3$(-*p*)
f:	$C_6H_4CH_3$(-*p*)	$C_6H_4OCH_3$(-*p*)
g:	C_6H_4Cl(-*p*)	C_6H_5
h:	C_6H_4Cl(-*p*)	$C_6H_4CH_3$(-*p*)
i:	C_6H_4Cl(-*p*)	$C_6H_4OCH_3$(-*p*)

and toluene in presence of 6 mol $AlCl_3$.[1)]

(ii) When VIIIa, and b were treated with benzene and toluene in 12 mol $AlCl_3$, they gave the corresponding *o*-aroylbenzophenone anils (VIa, and b) *via* carbonium ion X.

Action of Grignard Reagents. We have reinvestigated[6a,b)] the problem of reaction of Grignard reagents with 4-aryl-1*H*-2,3-benzoxazin-1-ones (I).

Phenylmagnesium bromide reacts with 4-(*p*-tolyl)-, and 4(*p*-chlorophenyl)-1*H*-2,3-benzoxazin-1-ones (Ib and c) to give oximes of 2'-(*p*-toluoyl)-, and 2-(*p*-chlorobenzoyl)-triphenyl methanols (XIa and b), respectively. Similarly, *o*-anisylmagnesium bromide reacts with

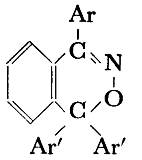


XI

	Ar	Ar'
a:	$C_6H_4CH_3$(-*p*)	C_6H_5
b:	C_6H_4Cl(-*p*)	C_6H_5
c:	C_6H_5	$C_6H_4CH_3O$(-*o*)
d:	$C_6H_4CH_3$(-*p*)	$C_5H_4CH_3O$(-*o*)
e:	C_6H_4Cl(-*p*)	$C_6H_4CH_3O$(-*o*)

Ia—c to give the corresponding oximes of *o*-aroyl-triarylmethanols (XIc—e).

The structure of XI was confirmed as follows: (i) *IR spectra* showed two ν_{OH} (bonded) in the regions 3520—3180 cm^{-1} and 3280—3050 cm^{-1} for oximes and *tert*-alcoholic groups. (ii) cyclization with (HCl/acetic) and/or (HCl/ethanol) to give 1,1,4-triaryl-1*H*-2,3-benzoxazines (XIIa—e).[6b)]



XII

	Ar	Ar′
a:	$C_6H_4CH_3$(-*p*)	C_6H_5
b:	C_6H_4Cl(-*p*)	C_6H_5
c:	C_6H_5	$C_6H_4CH_3O$(-*o*)
d:	$C_6H_4CH_3$(-*p*)	$C_6H_4CH_3O$(-*o*)
e:	C_6H_4Cl(-*p*)	$C_6H_4CH_3O$(-*o*)

Experimental

All mp's are not corrected, IR spectra were measured on a Unicam SP 1200 spectrophotometer by means of KBr wafer technique.

*Action of Amines on 4-Aryl-1*H*-2,3-benzoxazin-1-ones (I a, b). Formation of IIa—d*: A mixture of Ia, b (0.1 mol), and amine (0.6 mol) was heated at 150 °C on a sand bath for 12 hr. The excess amine was removed with concd-hydrochloric acid, and the solid product obtained was crystallized from methanol (Table 1).

Action of Benzylamine on Ia—c in Benzene. Formation of IIIa—c: To a solution of Ia—c (0.1 mol) in benzene (20 ml) was added benzylamine (0.3 mol). The reaction mixture was heated under reflux for about 12 hr, and then cooled. The solid product was filtered off, and crystallized from benzene (Table 2).

Table 1. Action of amines on Ia—c

Compd.	Mp °C	Yield %	Formula (M. Wt.)	Analysis % Found	Required
IIa	178	68	$C_{21}H_{17}NO$ (315)	C 79.60 H 5.50 N 4.2	80.0 5.4 4.4
IIb	150	78	$C_{22}H_{19}NO_2$ (329)	C 80.70 H 5.75 N 4.30	80.24 5.78 4.25
IIc	191	80	$C_{20}H_{15}NO_2$ (301)	C 79.50 H 4.90 N 5.10	79.73 4.98 4.65
IId	213—215	78	$C_{21}H_{17}NO_2$ (315)	C 80.00 H 5.4 N 4.4	79.4 5.2 4.6

Table 2. Action of benzylamine on Ia—c in benzene

Compd.	Mp °C	Yield %	Formula (M. Wt.)	Analysis % Found	Required
IIIa	172—173	80	$C_{21}H_{18}N_2O_2$ (330)	C 76.50 H 5.70	76.36 5.45
IIIb	148	75	$C_{22}H_{20}N_2O_2$ (344)	C 76.6 H 6.0	76.7 5.8
IIIc	178 (decomp)	70	$C_{21}H_{17}N_2O_2Cl$ (364.5)	C 69.5 H 4.8 Cl 9.9	69.1 4.6 9.7

Action of Phenylhydrazine on Ia—c. Formation of IVa—c: A solution of Ia—c (0.1 mol) in glacial acetic acid (20 ml) was treated with phenylhydrazine (0.3 mol). The reaction mixture was heated under reflux for 2 hr and then cooled. The solid product was filtered off and crystallized from acetic acid (Table 3).

Table 3. Action of phenylhydrazine on Ia—c

Compound	Mp °C	Yield %	Reference
IVa	168	80	2
IVb	140	79	3
IVc	169	82	3

Action of Anhydrous $AlCl_3$ in Reactive Aromatic Hydrocarbon Substrates on Ia—c. Formation of VIa—i: Anhydrous aluminium chloride (12 mol) was added under stirring to a solution of Ia—c (0.1 mol) in dry aromatic substrates (20 ml). The reaction mixture was heated under reflux for 6 hr, and the complex formed was decomposed with ice-cold dilute hydrochloric acid. The solvent was steam distilled, and the residual solid was filtered off and crystallized from ethanol (Table 4).

Table 4. Action of anhydrous $AlCl_3$ on Ia—c

Compd.	Mp °C	Yield %	Formula (M. Wt.)	Analysis % Found	Required
VIa	188	63	$C_{26}H_{19}NO$ (361)	C 86.7 H 4.8 N 3.8	86.4 5.3 3.9
VIb	194	68	$C_{28}H_{23}NO$ (389)	C 87.0 H 6.1 N 3.7	86.4 5.8 3.6
VIc	191	70	$C_{28}H_{23}NO_3$ (421)	C 79.8 H 5.7 N 3.5	79.8 5.4 3.3
VId	205—206	60	$C_{27}H_{21}NO$ (375)	C 86.1 H 5.5 N 3.8	86.4 5.6 3.7
VIe	282—284	63	$C_{29}H_{25}NO$ (403)	C 85.9 H 5.9 N 3.1	86.3 6.2 3.4
VIf	184	58	$C_{29}H_{25}NO_3$ (435)	C 79.7 H 5.2 N 3.0	80.0 5.7 3.2
VIg	220	60	$C_{26}H_{18}ClNO$ (395.5)	C 78.2 H 4.6 N 3.3 Cl 9.4	78.8 4.6 3.5 8.97
VIh	230	65	$C_{28}H_{22}ClNO$ (423.5)	C 79.2 H 5.2 N 3.2 Cl 8.2	79.3 5.2 3.3 8.4
VIi	160	58	$C_{28}H_{22}ClNO_3$ (455.5)	C 73.9 H 4.8 N 3.1 Cl 7.8	73.7 4.9 3.0 7.5

Action of Anhydrous $AlCl_3$ (VIIIa, and b). Formation of VIa, and b: Anhydrous aluminium chloride (12 mol) was added under stirring to a solution of VIIIa and b (0.1 mol) in dry aromatic substrates (20 ml). The reaction mixture was heated under reflux for 6 hr, and the complex formed was decomposed with ice-cold dilute hydrochloric acid. The solvent was steam distilled, and the residual solid was filtered off and crystallized from ethanol, yield 70%. It was proved to be VIa and VIb prepared *via* the reaction of Ia and Ib with anhydrous $AlCl_3$ by mp and mixed mp.

Action of Grignard Reagents on Ia—c. Formation of XIa—c: A solution of the Grignard reagents (0.6 mol) in dry ether was added to a solution of Ia—c (0.1 mol) in dry ether (30 ml). The reaction mixture was heated under reflux for 6 hr, then left to stand overnight. The reaction mixture was decomposed with ice-cold concentrated solution of ammonium chloride. The ethereal layer was separated, dried over anhydrous sodium sulfate, and the solvent was distilled off. The solid product was filtered off and crystallized from benzene (Table 5).

TABLE 5. ACTION OF GRIGNARD REAGENT ON Ia—c

Compd.	Mp °C	Yield %	Formula (M. Wt.)	Analysis % Found	Analysis % Required
XIa	170	58	$C_{27}H_{23}NO_2$	C 81.7	82.4
			(393)	H 6.2	5.8
XIb	172—174	68	$C_{26}H_{20}NO_2Cl$	C 75.2	75.5
			(413.5)	H 5.5	4.8
				Cl 8.6	8.56
XIc	218	64	$C_{28}H_{25}NO_4$	C 77.3	76.5
			(439)	H 5.9	5.7
XId	206—207	60	$C_{29}H_{27}NO_4$	C 77.0	76.8
			(453)	H 5.7	5.9
XIe	198—200	64	$C_{28}H_{24}NO_4Cl$	C 70.6	70.94
			(473.5)	H 4.8	5.07
				Cl 7.4	7.4

Cyclization of XIa—e with HCl/acetic. Formation of XIIa—c: A solution of XIa—e (0.1 mol) in a mixture of 10 ml acetic, 2 ml HCl was heated on a boiling water-bath for about 12 hr, cooled and then poured on ice-cold water. The solid obtained was filtered off, and crystallized from ethanol (Table 6).

TABLE 6. CYCLIZATION OF Ia—e

Compd.	Mp °C	Yield %	Formula (M. Wt.)	Analysis % Found	Analysis % Required
XIIa	209—211	40	$C_{27}H_{21}NO$	C 86.1	86.4
			(375)	H 5.3	5.3
XIIb	215—218	40	$C_{26}H_{18}NOCl$	C 78.6	78.8
			(395.5)	H 4.2	4.5
				Cl 8.5	8.9
XIIc	168—170	42	$C_{28}H_{23}NO_3$	C 79.9	79.8
			(421)	H 5.6	5.5
XIId	185—186	52	$C_{29}H_{25}NO_3$	C 79.9	80.0
			(435)	H 5.6	5.7
XIIe	208—209	60	$C_{28}H_{22}NO_3Cl$	C 73.9	73.76
			(455.5)	H 4.8	4.8
				Cl 8.0	7.8

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