A Mild, High-Yield Procedure for the Conversion of Benzyl Halides to Benzaldehydes[1]

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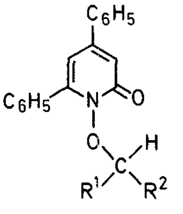
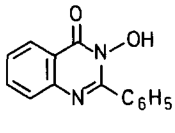
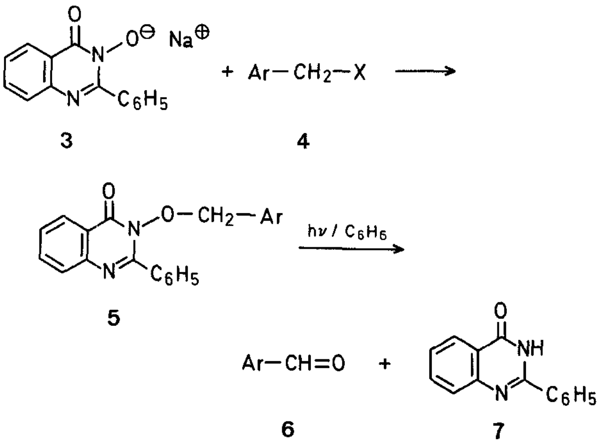
Recently[2] *we demonstrated the utility of the sodium salt* of 1-hydroxy-4,6-diphenyl-2-pyridone for the preparation of carbonyl compounds from halides by pyrolysis of intermediates of type **1**. We now report a convenient alternative for benzyl halides based on the photolysis of the hydroxamate esters **5** derived from 2-phenyl-3-hydroxy-4(3*H*)-quinazolinone (**2**).



1



2



The esters **5** are readily synthesized by alkylation of the sodium salt **3** with benzyl halide in dimethylformamide. In the case of benzyl halides bearing electron-withdrawing substituents this alkylation reaction is complete in only minutes after the reactants are mixed at room temperature. For other benzyl halides the alkylation reaction was effected by gently heating at 70–80°.

On photolysis in benzene the esters **5** are smoothly converted into the desired aldehyde and 2-phenyl-4(3*H*)-quinazolinone **7**. Separation of the aldehyde from side-product **7** is effected either by steam distillation or by treatment with 5 molar sulfuric acid followed by extraction.

The conversion **5**→**6**+**7** probably involves a Norrish type II process rendered particularly facile by ready cleavage of the weak N—O bond[3]. Similar reactions involving cyclic hydroxamic acids formally derived from pyridine are known[4] and a related photoelimination reaction of a cyclic amide has been reported[5].

2-Carboxymethylbenzanilide:

To a well-stirred solution of methyl anthranilate (0.24 mol) and triethylamine (0.24 mol) in tetrahydrofuran (125 ml) is added benzoyl chloride (0.24 mol) dropwise with cooling. The resulting reaction mixture is stirred at room temperature for 2 h and then filtered. The filtrate is evaporated in vacuo and the residue dried

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Table. Aldehydes from Hydroxamate Esters **5** by Photolysis in Benzene

Substrate **4** Ar	X	Product **5**	Yield[a] [%]	m.p.[b] (solvent)	^{1}H-N.M.R. ($CDCl_3$) δ [ppm] (s, Ar—C$\underline{H}_2$)	Product **6**	Yield [%]	n_D (temp.) or m.p.	Lit.[7] n_D (temp.) or m.p.
C_6H_5	Br	**5a**	86	123–125° (CH_3OH)	4.91	**6a**	54	1.5464 (16°)	1.5463 (20°)
2-Cl—C_6H_4	Cl	**5b**	84	144–145° (CH_3OH)	5.15	**6b**	64	1.5678 (16°)	1.5662 (20°)
4-Cl—C_6H_4	Cl	**5c**	77	130–131° (CH_3OH)	4.89	**6c**	59	42–45°[c]	47.5°
4-H_3C—C_6H_4	Cl	**5d**	78	126–127° (CH_3OH)	4.88	**6d**	63	1.5479 (15°)	1.5454 (20°)
3-NC—C_6H_4	Br	**5e**	75	147–149° (CH_3OH)	4.93	**6e**	46	77–79° (ethanol/H_2O)	79–81°
4-NC—C_6H_4	Br	**5f**	83	153–155° (CH_3OH)	4.98	**6f**	53	98–101° (ether)	101–102°

[a] Yield of recrystallized product.

[b] Uncorrected.

[c] Purified by distillation.

to yield the amide in quantitative crude yield. The product is used without further purification in the preparation of 2-phenyl-3-hydroxy-4(3*H*)-quinazolinone by the method of Harrison and Smith[6].

2-Phenyl-3-hydroxy-4(3*H*)-quinazolinone, Sodium Salt:

Recrystallized 2-phenyl-3-hydroxy-4(3*H*)-quinazolinone (16.4 g) is added to a solution resulting from reaction of sodium (1.60 g) with methanol (150 ml). The resulting solution is stirred 1 h. The reaction mixture is evaporated to dryness and the residue dried over phosphorus pentoxide to yield the crude sodium salt which is used without further purification.

General Procedure for Preparation of Hydroxamate Esters 5:

2-Phenyl-3-hydroxy-4(3*H*)-quinazolinone, sodium salt (2.6 g; 10 mmol) is dissolved in dimethylformamide (10 ml). The appropriate benzyl halide (10 mmol) is added and the solution stirred at room temperature for 10 min (**5e, f**) or warmed at 70–80° for 15–20 min. The reaction mixture is poured into 50 ml water and extracted with chloroform (3 x 20 ml). The extracts are dried with magnesium sulfate, evaporated in vacuo, and the residue recrystallized from the appropriate solvent. ^{1}H-N.M.R. spectra of all esters show a doublet at $\delta = 8.38$ and a complex multiplet in the region $\delta = 6.8–8.0$ ppm.

General Procedure for Photolysis of Hydroxamate Esters (5):

The appropriate ester (1.0–1.5 g) in benzene (90 ml) is degassed and then irradiated in a pyrex vessel with a 100-watt medium pressure mercury arc lamp for 4–5 h. The reaction mixture is evaporated in vacuo and the residue either steam distilled (**5e, f**) or treated with 5 molar sulfuric acid. In either case the liquid is extracted with chloroform and the extracts dried with magnesium sulfate. Following evaporation in vacuo the residue is recrystallized or distilled in vacuo. ^{1}H-N.M.R. spectra of aldehyde products showed uniformly no impurities. G.L.C. (Carbowax 20M/185°) of products showed traces of the corresponding benzyl alcohol in certain cases.

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[1] Part XX in the series Heterocycles in Organic Synthesis. Part XIX, A. R. Katritzky, J. Lewis, P.-L. Nie, *J. Chem. Soc., Perkin Trans 1*, in press.

[2] M. J. Cook, A. R. Katritzky, G. H. Millet, *Heterocycles* **7**, 227 (1977).

[3] See for example P. J. Wagner, *Acc. Chem. Res.* **4**, 168 (1971).

[4] (a) H. Furrer, *Tetrahedron Lett.* **1974**, 2953.
(b) J. Al-Hassam, M. J. Cook, A. R. Katritzky, G. H. Millet, unpublished results.

[5] M. D. Shetlar, P. J. S. Koo, *Tetrahedron Lett.* **1975**, 2015.

[6] D. Harrison, A. C. B. Smith, *J. Chem. Soc.* **1960**, 2157.

[7] *Handbook of Chemistry and Physics.* 51st Edn., Chemical Rubber Co., Cleveland, Ohio, 1970–1971.

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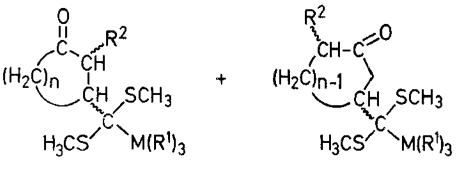
Abstract no 5213, *Synthesis* **1978** (6), 483;
The structures for products **8** and **9** should be:



8 **9**

Abstract no. 5254, *Synthesis* **1978** (7), 556;
The title should be:
Reaction of 1-Ethoxy-1-trimethylsiloxycyclopropane with Carbonyl Compounds

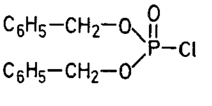
J.-P. Majoral, *Synthesis* **1978** (8), 557–576;
Sub-heading 4.2.1. (p. 565) should read:
4.2.1. 3,4-Dihydro-2*H*-1,2,3-diazaphospholes
The products **83** (p. 569) should be named:
3,4-Dihydro-2*H*-1,2,4,5,3-tetraazaphosphepin derivatives
The products **84** (p. 569) should be named:
2,3,5,6,4-benzotetraazaphosphonin derivatives

J. D. Finlay, D. J. H. Smith, T. Durst, *Synthesis* **1978** (8), 579–580;
The compounds **1** should be named:
5-phenyl-1,2-oxathiolane 2-oxides.

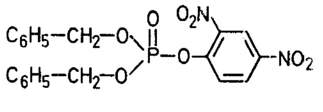
G. Sosnovsky, M. Konieczny, *Synthesis* **1978** (8), 583–585;
The heading for the first experimental procedure (p. 584) should read:
1-Oxyl-2,2,6,6-tetramethyl-4-piperidyl *N*,*N*-(1,2-Ethanediyl)-benzenephosphonoamidite (7a):

F. Hordziejewicz, Z. Skrowaczewska, *Synthesis* **1978** (8), 585–586;
The heading for the first experimental procedure (p. 586) should read:
Purification of Commercial 2,6-Lutidine:

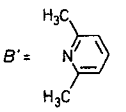
F. Ramirez, J. F. Marecek, *Synthesis* **1978** (8), p. 601–603;
In Scheme **A** (p. 602) the structures of compounds **5**, **6**, and *B′* should be:



5

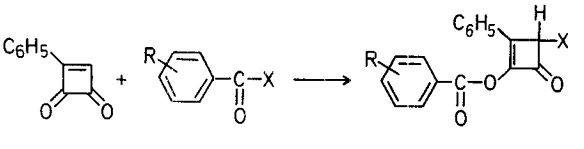


6



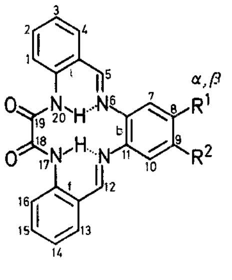
A. R. Katritzky, S. B. Brown, *Synthesis* **1978** (8), 619–620;
The heading for the first experimental procedure (p. 619) should read:
2′-Methoxycarbonylbenzanilide:

H. Knorr, W. Ried, *Synthesis* **1978** (9), 649–666;
The formula for the formation of product **86** (p. 661) should be:



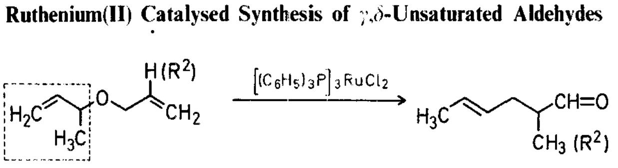
86

C. Skötsch, E. Breitmaier, *Synthesis* **1978** (8), 680–681.
The numbering for compounds **3a–c** (see Scheme p. 680) should be as shown below:



3a $R^1 = R^2 = H$
b $R^1 = H$, $R^2 = t\text{-}C_4H_9$
c $R^1 = R^2 = CH_3$

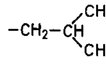
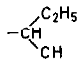
Abstract no. 5309, *Synthesis* **1978** (10), 789;
The title and formula **1**→**2** should be as follows:
Ruthenium(II) Catalysed Synthesis of γ,δ-Unsaturated Aldehydes



1 **2**

S. Sharma, *Synthesis* **1978** (11), 803–820;
Product **24** (p. 807) should be named:
12-Oxo-12*H*-benzimidazo[2,1-*b*][1,3]-benzoxazine
and product **28** (p. 807) should be named:
2-thioxo-2,5-dihydroimidazole 3-oxide

F. M. F. Chen, K. Kuroda, N. L. Benoiton, *Synthesis* **1978** (12), 928–929;
The 4th, 5th, and 6th entries in the Table (p. 928) should be:

		N-Benzyloxycarbonyl derivatives **4a**				*N*-*t*-Butoxycarbonyl derivatives **4b**			
Amino Acid	R^2	Yield [%]	m.p. (dec)	Lit. m.p. or Molecular formula^a	$[\alpha]_D^{23}$ (2, $CHCl_3$)	Yield [%]	m.p. (dec)	Lit. m.p. and/or Molecular formula^a	$[\alpha]_D^{23}$ (2, CH_3Cl)
L-Leu	 $-CH_2-CH(CH_3)_2$	90	oil^c	oil^2	− 3.0°	83	76–77°	70–72°^{8}	−16.6°
L-MeLeu		86	oil	$C_{30}H_{40}N_2O_7$ (540.6)	−39.0				
L-Ile	 $-CH(C_2H_5)(CH)$					55^d	68–69°	77–79°^{8}	−32.8°