3*H*-1,2,4-Dioxazoles from 1,3-Oxazoles

M. L. GRAZIANO, M. R. IESCE, A. CAROTENUTO, R. SCARPATI*

Istituto di Chimica Organica dell'Università, Via Mezzocannone 16, I-80134 Napoli, Italy

Recently we reported that 5-alkoxy-4-methyl-2-phenyloxazoles (**1a** and **1b**) are partly converted, by dye-sensitized photooxidation, into 3-alkoxycarbonyl-3-methyl-5-phenyl-1,2,4-dioxazoles (**3a** and **3b**) (yields 47%) which are the first examples of this ring system, and also the first peroxyimidates[1]. A mechanism consistent with the results obtained is shown in the following scheme.

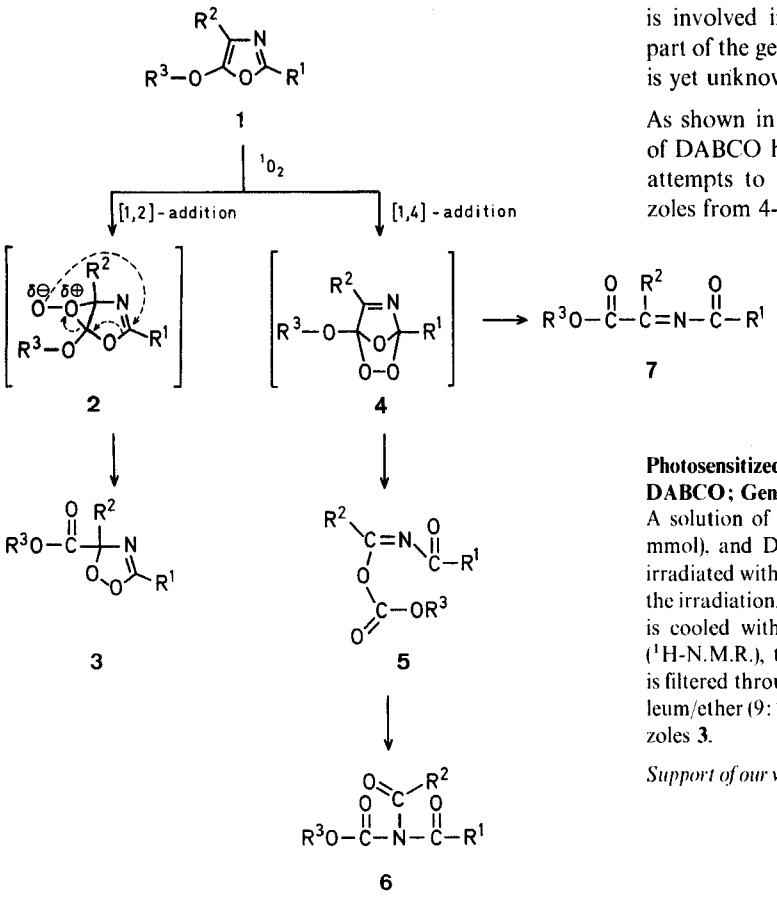
As the dioxazoles **3** are key intermediates in the synthesis of many interesting compound types[2] we report now an improved preparative method which can be applied starting from all fully substituted 5-alkoxyoxazoles.

The reaction of **1a** with the singlet oxygen in the presence of concentrations of the same order of substrate and 1,4-diazabicyclo[2.2.2]octane (DABCO) is completely inhibited

Table 1. Effect of the DABCO Concentration on the Dye-sensitized Photooxidation of **1a**

Initial Conc.[a] $\times 10^3$ (molar) of **1a**	of DABCO	Oxidation [%]	Reaction Time[b] [h]	Yield[c] [%] **3a**	**6a**	**7a**
100	0	100	1	47	10	40
100	1	100	1.5	61	8	28
100	5	100	2.5	66	5	26
100	7	100	3.5	82	4	11
100	9	100	4	97	–	–
100	11	95	4	90	–	–
100	20	0	4	–	–	–
100	100	0	4	–	–	–

[a] In chloroform.
[b] At room temperature.
[c] Isolated products by chromatography on silica gel (see Ref.[1])



according to the general pathway of the reactions involving the singlet oxygen[3]. However the yields of **3a** are remarkably improved (97%) when the reaction is carried out in the presence of small amounts of DABCO (Table 1).

is involved in this process remains to be resolved. It is part of the general inhibition mechanism by DABCO which is yet unknown[4].

As shown in Table 2, the photooxidation in the presence of DABCO has a wide range of applicability even though attempts to synthesize 3-monosubstituted 3*H*-1,2,4-dioxazoles from 4-unsubstituted oxazoles failed.

Photosensitized Oxidation of Oxazoles 1 in the Presence of DABCO; General Procedure:

A solution of the oxazole (2 mmol), methylene blue (1.6×10^{-2} mmol), and DABCO (0.18 mmol) in dry chloroform (20 ml) is irradiated with a halogen-superphot lamp (Osram 650 W). During the irradiation, dry oxygen is bubbled through the solution which is cooled with a water sleeve. When the reaction is complete (^{1}H-N.M.R.), the solvent is removed in vacuo and the residue is filtered through a short column of silica gel [eluent: light petroleum/ether (9:1)]. Evaporation of the solvent gives the pure dioxazoles **3**.

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Table 2. Dioxazoles **3** by Dye-sensitized Photooxidation of Oxazoles **1** in the Presence of DABCO[a]

Product[b]	R^1	R^2	R^3	Yield [%]	Reaction time[c]	Molecular formula[d]	^{1}H-N.M.R. ($CDCl_3$/TMS)[e] δ [ppm]
3a	C_6H_5	CH_3	CH_3	97	4 h	–	see Ref.[1]
3b	C_6H_5	CH_3	C_2H_5	98	4 h	–	see Ref.[1]
3c	C_6H_5	*i*-C_3H_7	CH_3	92	3 h	$C_{13}H_{15}NO_4$ (249.3)	8.00–7.32 (m, 5 H_{arom}); 3.81 (s, 3 H, OCH_3); 2.59 (m, 1 H, CH); 1.08 and 0.99 (2d, 6 H, $2CH_3$)
3d	C_6H_5	C_6H_5—CH_2	CH_3	85	3 h	$C_{17}H_{15}NO_4$ (297.3)	7.85–7.09 (m, 10 H_{arom}); 3.76 (s, 3 H, OCH_3); 3.44 (s, 2 H, CH_2)
3e	C_6H_5	C_6H_5	CH_3	90	4 h	$C_{16}H_{13}NO_4$ (283.3)	8.05–7.25 (m, 10 H_{arom}); 3.77 (s, 3 H, OCH_3)
3f	C_6H_5—CH_2	CH_3	CH_3	90	4 h	$C_{12}H_{13}NO_4$ (235.2)	7.32 (s, 5 H_{arom}); 3.76 (s, 3 H, OCH_3); 3.69 (s, 2 H, CH_2); 1.72 (s, 3 H, CH_3)
3g	*n*-C_5H_{11}	CH_3	CH_3	73	5 h	$C_{10}H_{17}NO_4$ (215.2)	3.79 (s, 3 H, OCH_3); 2.32 (m, 2 H, =C—CH_2); 1.73 (s, CH_3) + 1.09–0.75 (m, C_4H_9) together 12 H
3h	CH_3	$COOCH_3$	CH_3	92	3 h	$C_7H_9NO_6$ (203.1)	3.85 (s, 6 H, $2 \times OCH_3$); 2.15 (s, 3 H, CH_3)

[a] Molar ratio of oxazole **1**: DABCO = 11:1.

[b] Products are oils except for **3d** (m.p. 57–59°) and **3e** (m.p. 47–49°).

[c] Time required for reaction at room temperature.

[d] All new compounds gave satisfactory microanalyses (C ±0.48%, H ±0.24%, N ±0.21%, O_{act} ±0.53); analyses were performed by Mikroanalytisches Laboratorium E. Thommen, CH-4126 Bettingen, Switzerland.

[e] Recorded on a Perkin Elmer R 12A spectrometer.

The above results can be rationalized assuming that the appropriate DABCO concentration suppresses the 1,4-addition of the singlet oxygen to the oxazole **1a**, but only retards the 1,2-addition. However, the manner in which the DABCO

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