Synthesis of 2-Phenyl-3-aroylisoxazolidine-4,5-dione from the Silyl Enol Ether-Nitrosobenzene Adduct and Oxalyl Chloride

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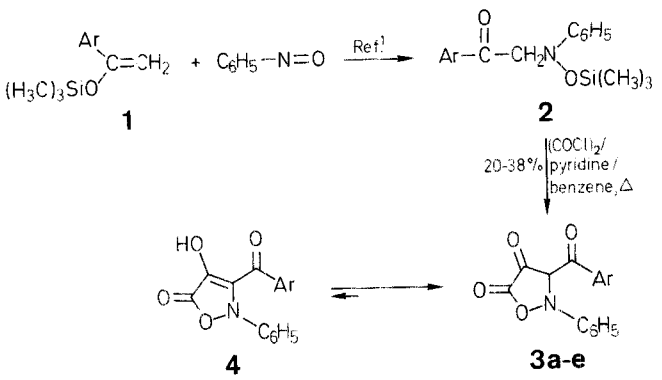
Isoxazolidine-4,5-diones **3** were prepared by refluxing α-hydroxyamino ketones **2** with oxalyl chloride in a mixture of benzene and pyridine.

In the previous paper[1], it was reported that aryl silyl enol ethers **1** react readily with nitrosobenzene to give α-hydroxyamino ketones **2**. This silyl enol ether-nitrosobenzene adduct has been demonstrated to be useful for the syntheses of phenylglyoxal anil by elimination[2], of α-aroylnitrone by oxidation[3], and of β-(*N*-phenyl) amino alcohol by reduction[4]. The bi-functionality in **2** is now utilized in the reaction with bi-electrophilic oxalyl chloride to cyclize directly to a new ring system, isoxazolidine-4,5-dione **3**.

The reation of **2** with oxalyl chloride was carried out in a mixture of benzene and pyridine at reflux temperature. The product[3] was separated by chromatography on a silica gel column, and its structure was determined by elemental and spectral analyses. The mass spectrum exhibited the expected molecular ion peak from a 1 : 1 cyclized product together with a parent peak from the fragmented aroyl ion. The IR spectrum showed the presence of three different carbonyl groups at $\nu = 1770$, 1710 and 1690 cm^{-1}. The ^1H-NMR spectra had a characteristic signal around at $\delta = 5.5$ as a singlet due to 3-H. These data confirmed the product to be isoxazolidine-4,5-dione, which exists in its keto form **3** rather than the enol form **4**.

In the isoxazolidinedione ring system, only 3,5-dione derivatives are so far reported[5]. Thus, the present method affords the hitherto unknown 4,5-dione derivatives starting from a silyl enol ether, although in moderate yield.



1–4	Ar
a	C_6H_5
b	4-H_3CO—C_6H_4
c	4-Cl—C_6H_4
d	2-Thienyl
e	2-Furyl

2-Phenyl-3-aroylisoxazolidine-4,5-dione (3); General Procedure:
To a solution of **2** (1 mmol) prepared from a silyl enol ether **1** and nitrosobenzene[1] and pyridine (120 mg, 1.5 mmol) in dry benzene (3 ml) is added oxalyl chloride (127 mg, 1 mmol) at room temperature, and the mixture is refluxed for 3 h. After removal of the resulting precipitate by filtration, the solvent is evaporated in vacuo to leave a brown oil, which is chromatographed on a silica gel column (Fuji-Davison BW-300) using chloroform as eluent to give the isoxazolidine-4,5-dione **3**. Analytical samples are obtained by recrystallization from chloroform/ether.

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[4] Sasaki, T., Mori, K., Ohno, M. *Synthesis* **1985**, 280.
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Table. 2-Phenyl-3-aroylisoxazolidine-4,5-diones **3** Prepared

Product No.	Yield[a] [%]	m.p. [°C]	Molecular Formula[b]	IR ($CHCl_3$) ν [cm^{-1}]	^1H-NMR ($CDCl_3$) δ [ppm]	MS (70 eV) *m/e* (relative intensity; %)
3a	38	183–185°	$C_{16}H_{11}NO_4$ (281.3)	1770, 1710, 1690	5.58 (s, 1H); 6.7–8.2 (m, 10H)	281 (16), 253 (1), 148 (6), 120 (11), 105 (100), 91 (69), 77 (90)
3b	30	220–222°	$C_{17}H_{13}NO_5$ (311.3)	1780, 1710, 1690	3.97 (s, 3H); 5.54 (s, 1H); 7.01 (d, 2H, J = 9 Hz); 6.7–8.2 (m, 5H); 8.02 (d, 2H, J = 9 Hz)	311 (3), 207 (6), 135 (100), 92 (29), 77 (68)
3c	29	222–224°	$C_{16}H_{10}ClNO_4$ (315.7)	1770, 1700, 1690	5.55 (s, 1H); 6.7–8.2 (m, 5H); 7.52 (d, 2H, J = 9 Hz); 8.01 (d, 2H, J = 9 Hz)	315 (4), 287 (1), 148 (3), 139 (100), 111 (90), 77 (90)
3d	24	188–190°	$C_{14}H_9NO_4S$ (287.3)	1780, 1700, 1680	5.50 (s, 1H); 7.00 (dd, 1H, J = 5 Hz, 4 Hz); 7.79 (dd, 1H, J = 5 Hz, 1 Hz); 7.97 (dd, 1H, J = 4 Hz, 1 Hz); 6.7–8.2 (m, 5H)	287 (67), 259 (2), 148 (10), 111 (100), 83 (51), 77 (56)
3e	20	212–214°	$C_{14}H_9NO_5$ (271.2)	1780, 1710, 1690	5.47 (s, 1H); 6.67 (dd, 1H, J = 4 Hz, 2 Hz); 7.42 (dd, 1H, J = 4 Hz, 1 Hz); 7.71 (dd, 1H, J = 2 Hz, 1 Hz); 6.7–8.2 (m, 5H)	271 (50), 243 (18), 148 (33), 95 (100), 77 (82)

[a] Yield of isolated product based on the purified hydroxyamino ketone **2**.
[b] Satisfactory microanalyses obtained: C ±0.15, H ±0.06, N ±0.05.