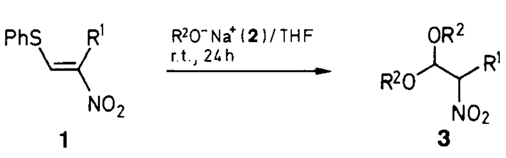
Facile Preparation of α-Nitroaldehyde Acetals from (*E*/*Z*)-2-Nitro-1-phenylthio-1-alkenes

Akio Kamimura,* Tomoaki Nagashima

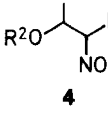
Department of Chemistry, Faculty of Liberal Arts, Yamaguchi University, Yamaguchi 753, Japan

The reaction of (*E*/*Z*)-2-nitro-1-phenylthio-1-alkenes with alkoxides provided a new method for the preparation of 1,1-dibenzyloxy- and 1,1-dialkoxy-2-nitroalkanes.

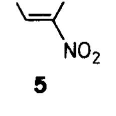
α-Nitroaldehyde acetals are potentially useful synthetic intermediates. For example, Jäger and co-workers have succeeded in the total syntheses of amino sugars using nitroacetaldehyde acetals.[1] There are several synthetic methods for the preparation nitroaldehyde acetals.[2-6] Although nitroacetaldehyde acetals may be readily prepared by these methods, general synthesis of α-nitroaldehyde acetals is not so easy. For example, reaction of trialkyl orthoformate and nitromethane in the presence of zinc chloride gave nitroacetaldehyde dialkyl acetals in low yield whilst the corresponding reaction of triethyl orthoformate and nitroethane gave nitropropionaldehyde diethyl acetal in only 13% yield.[2] In this paper we report an efficient preparation of α-nitroaldehyde acetals from (*E*/*Z*)-2-nitro-1-phenylthio-alkenes, which are prepared from 1-acetoxy-2-nitroalkanes, and alkoxides.



1 **3**



4



5

1–3	R^1	R^2
a	H	Me
b	H	$PhCH_2$
c	Me	$PhCH_2$
d	Et	$PhCH_2$
e	$CH_3(CH_2)_6$	$PhCH_2$

Reaction of sodium alkoxide **2** and (*E*/*Z*)-2-nitro-1-phenylthio-1-alkenes **1** in tetrahydrofuran at room temperature proceeded smoothly to give α-nitroaldehyde acetal **3** in 77–88% yield. The results are summarized in the Table. The three-step reaction, i.e. conjugate addition of 2 equivalents of alkoxide and elimination of the thiolate anion was concomitant and no products from intermediates, for example, monothioacetals **4** or 1-alkoxy-2-nitro-1-alkenes **5** were obtained as byproducts under these conditions. The eliminated thiolate was mostly recovered as diphenyl disulfide. A large excess of alkoxide was necessary to obtain **3** in good yield because of low nucleophilicity of alkoxide anion.

Preparation of 1,1-Dibenzyloxy- and 1,1-Dialkoxy-2-nitroalkanes 3; General Procedure:

To an alkoxide solution (50 mmol) in THF (50 mL) [generated from NaH (60%, 2.00 g, 50 mmol) and an alcohol **2** (50 mmol)] is added **1** (10 mmol) in THF (10 mL) and the solution is stirred at r.t. for 24 h. The mixture is poured into 1 M aq AcOH (100 mL) and the aqueous phase is extracted with EtOAc (2 x 50 mL). Combined organic phases are washed with brine (25 mL) and dried (Na_2SO_4). The solvent is evaporated and the crude product **3** is chromatographed on a silica gel column (230–400 mesh) using hexane/EtOAc (20:1) as an eluent to give **3** (Table).

Received: 8 January 1990; revised: 23 March 1990

(1) Jäger, V.; Schone, R. *Tetrahedron* **1984**, *40*, 2199.
(2) Rene, L.; Royer, R. *Synthesis* **1981**, 878.
(3) Francotte, E.; Verbruggen, R.; Viehe, H.G.; Van Meerssche, M.; Germain, G.; Declerq, J.-P. *Bull. Soc. Chim. Belg.* **1978**, *87*, 693.
(4) Kabusz, S.; Tritschler, W. *Synthesis* **1971**, 312.
(5) Shiga, M.; Tsunashima, M.; Kono, H.; Motoyama, I.; Hata, K. *Bull. Chem. Soc. Jpn.* **1970**, *43*, 841.
(6) Losanitsch, M.S. *Ber. Dtsch. Chem. Ges.* **1909**, *42*, 4044.
(7) Ono, N.; Kamimura, A.; Kaji, A. *J. Org. Chem.* **1986**, *51*, 2139.

Table. 1,1-Dibenzyloxy- and 1,1-Dialkoxy-2-nitroalkanes **3** Prepared

Product	Yield[a] (%)	Molecular Formula or Lit. bp (°C)/Torr	IR (neat)[b] ν(cm^{-1})	^{1}H-NMR ($CDCl_3$/TMS)[c] δ, J(Hz)
3a	78	63–65/10	1560, 1095	3.39 (s, 6H), 4.38 (d, 2H, J = 6.0), 4.97 (t, 1H, J = 6.0)
3b	88	$C_{16}H_{17}NO_4$ (287.3)	1555, 1060	4.54 (d, 2H, J = 6.0), 4.60–4.70 (m, 4H), 5.37 (t, 1H, J = 6.0), 7.20 (m, 10H)
3c	84	$C_{17}H_{19}NO_4$ (301.3)	1550, 1070	1.58 (d, 3H, J = 6.0), 4.60–4.70 (m, 4H), 4.70–4.90 (m, 1H, J = 6.0), 5.07 (d, 1H, J = 4.8), 7.20 (m, 10H)
3d	77	$C_{18}H_{21}NO_4$ (315.4)	1550, 1060	0.95 (t, 3H, J = 7.2), 1.93 (q, 2H, J = 7.2), 4.60–4.70 (m, 4H), 4.90–5.10 (m, 1H), 5.05 (d, 1H, J = 7.2), 7.20 (m, 10H)
3e	88	$C_{23}H_{31}NO_4$ (385.5)	1555, 1060	0.85 (t, 3H, J = 6), 1.10–2.00 (m, 12H), 4.60–4.70 (m, 4H), 4.90–5.20 (m, 1H), 5.04 (d, 1H, J = 7.2), 7.20 (m, 10H)

[a] Isolated yield, **3a**–**e** were obtained as oils.
[b] Measured using a Hitachi 285 Infrared spectrophotometer.
[c] Obtained on a Hitachi R-600 spectrometer.
[d] Satisfactory microanalyses obtained: C ±0.39, H ±0.29, N ±0.28