CHEMISTRY LETTERS, pp. 767-768, 1992.

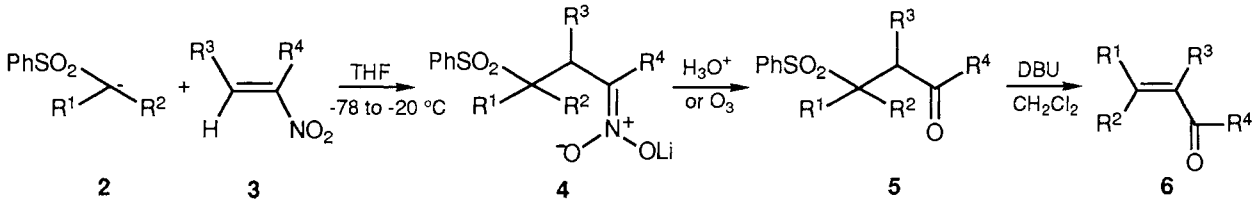
An Expedient Synthesis of α,β–Unsaturated Ketones Using Nitroalkenes and Sulfones

Bahlul Z. AWEN,† Masaaki MIYASHITA,* Tomonori SHIRATANI, Akira YOSHIKOSHI,† and Hiroshi IRIE
Faculty of Pharmaceutical Sciences, Nagasaki University, Bunkyo-machi, Nagasaki 852
†The Chemical Research Institute of Non-Aqueous Solutions, Tohoku University, Aoba-ku, Sendai 980

A facile synthesis of various substituted α,β–unsaturated ketones utilizing nitroalkenes and sulfones are described, in which conjugate addition of sulfonyl carbanions to nitroalkenes, ozonolysis or acid treatment of the resulting lithium nitronates, and subsequent elimination of sulfinic acid from keto sulfones by DBU are involved.

Carbon-carbon bond-forming processes involving nitroalkenes are of increasing importance in synthetic organic chemistry since nitroalkenes not only serve as efficient Michael acceptors but also nitro groups provide the remarkable versatility in further synthetic transformation.[1] We have developed the synthetic methodology for 1,4-diketones,[2] γ-keto esters,[2,3] 3-acylfurans,[4] and tricarbonyl compounds[4] utilizing nitroalkenes as carbonyl synthons (oxoalkylating reagents).[5] In connection with a program on the synthesis of such carbonyl compounds[5] we report here an expedient synthesis of various substituted α,β–unsaturated ketones including tetra-substituted ones starting from nitroalkenes and sulfones.

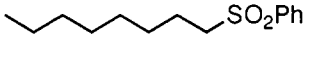
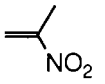
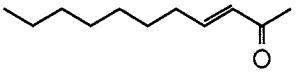
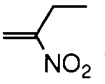
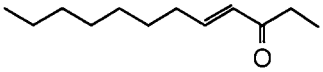
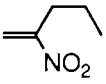
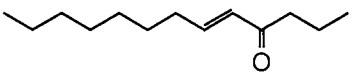
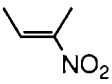
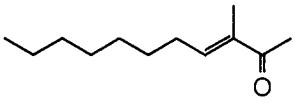
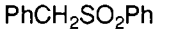
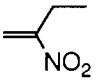
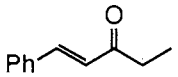
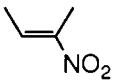
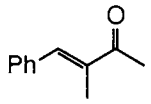
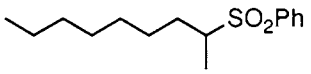
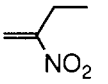
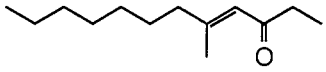
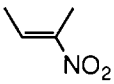
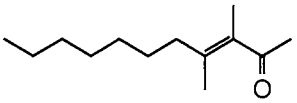
The sulfonyl carbanions **2**, generated from the corresponding alkyl sulfones **1** with lithium diisopropylamide (LDA, 1.5 equiv.) in tetrahydrofuran (THF) at -78 to -45 °C (1.5 h), reacted with a variety of conjugated nitroalkenes **3** (1.5 equiv.; -78 to -20 °C, 2 h) to yield the Michael adducts **4** (lithium nitronates) which were, without isolation, converted into keto sulfones **5** by treatment with 3% HCl at 80 °C for 6 h (Nef reaction)[6] or by ozonolysis in CH_2Cl_2[7] at -78 °C (1.5 h, then $(CH_3)_2S$, 0 °C, 1 h) (Scheme 1). The crude keto sulfones **5** thus obtained were treated with 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU, 1.5 equiv.) in CH_2Cl_2 at 0 °C (2 - 5 h) to provide α,β–unsaturated ketones **6**. The results are summarized in Table 1. As seen from Table 1, the yields (71 - 88%) of **6** from **1** via ozonolysis were found to be much superior to those (55 - 69%) obtained via the Nef reaction. Thus a variety of α,β–unsaturated ketones **6**, including di-, tri- , and tetra-substituted ones, are easily obtainable in good yields starting from readily available starting materials. Since various nitroalkenes are readily available from nitroalkanes via nitroaldol condensation with aldehydes or ketones,[1,8] the present method provides a facile entry into α,β–unsaturated ketones.



2 3 4 5 6

Scheme 1.

Table 1. Synthesis of α,β–unsaturated ketone **6** from sulfone **1** and nitroalkene **3**

Sulfone	Nitroalkene	Product	Yield / % [a,b] A	(B)
			75	(67)
			84	(68)
			88	(58)
			82 E/Z=7:1	(61)
			86	(70)
			88	(55)
			82 E/Z=2:1	(55)
			71 [c] E/Z=1:1	(57) [c]

a) Overall yield from sulfone **1**, after purification by silica gel flash chromatography. A: Yield via ozonolysis. B: Yield via the Nef reaction. b) The ratio of geometrical isomers was determined by ^{1}H NMR spectroscopy. c) The corresponding keto sulfone was treated with DBU (4 equiv.) at 70 °C for 63 h.

References

1) D. Seebach, E. W. Colvin, and T. Weller, *Chimia*, **33**, 1 (1979); R. S. Varma and G. W. Kabalka, *Heterocycles*, **24**, 2645 (1986); A. G. M. Barrett and G. G. Graboski, *Chem. Rev.*, **86**, 751 (1986).
2) M. Miyashita, T. Yanami, T. Kumazawa, and A. Yoshikoshi, *J. Am. Chem. Soc.*, **106**, 2149 (1984).
3) M. Miyashita, R. Yamaguchi, and A. Yoshikoshi, *J. Org. Chem.*, **49**, 2857 (1984).
4) T. Yanami, A. Ballatore, M. Miyashita, M. Kato, and A. Yoshikoshi, *J. Chem. Soc., Perkin Trans. 1*, **1978**, 1148.
5) A. Yoshikoshi and M. Miyashita, *Acc. Chem. Res.*, **18**, 284 (1985).
6) 3% HCl (5 mL / 1 mmol of sulfone) was added to the reaction mixture of **2** and **3** in THF and the resulting heterogeneous mixture was stirred at 80 °C for 6 h.
7) THF was evaporated in vacuo and the residue was dissolved in CH_2Cl_2 and then subjected to ozonolysis.
8) P. Knochel and D. Seebach, *Synthesis*, **1982**, 1017.

(Received February 7, 1992)