Tetrahedron Letters No. 17, pp 1397 - 1400, 1975. Pergamon Press. Printed in Great Britain.

SULFONYL CARBANIONS IN SYNTHESIS. II.
A NOVEL SYNTHESIS OF 1,4-DICARBONYL SYSTEMS.[1]

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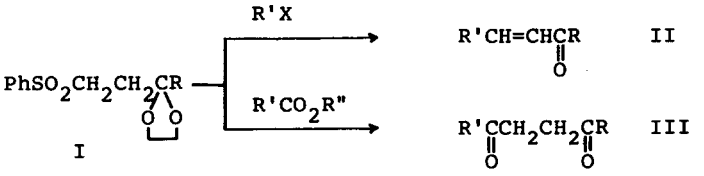
(Received in Japan 4 March 1975; received in UK for publication 18 March 1975)

Recent report from this laboratory has shown that γ-oxosulfone acetals and ketals (I) can be used as a synthon of β-acylvinyl anions which, on alkylation, lead to the stereoselective formation of the E-isomer of α,β-unsaturated carbonyl compounds (II).[2] We now wish to describe herein the second synthetic application of the same units as masked β-acylethyl anions. Namely, acylation of the anion derived from I with esters, followed by reductive desulfonylation and hydrolysis, provided a convenient rout to γ-ketoaldehydes (III, R=H) and 1,4-diketones (III, R=Me).[3]



n-Butyllithium (2 molar equivalents) was added to a stirred solution of 3-benzenesulfonylpropanal ethylene acetal 1 in anhydrous THF containing 2 molar equivalents of tetramethylethylenediamine (TMEDA) at -75°. Quenching of the solution with deuterium oxide at room temperature followed by usual work-up afforded 3-benzenesulfonyl-3,3-dideuteropropanal ethylene acetal in quantitative yield. This may mean that the solution contains a sulfonyl dicarbanion.[4] The dianion solution was now transfered to hypodermic syringe under an inert atmosphere and was added slowly to a cooled (-75°) solution of 1 molar equiva-

lent of an ester dissolved in THF and hexamethylphosphoric triamide (5:1). After stirring for 1 hr at -75° and for an additional 5 hr at room temperature, the reaction mixture was treated with aq. NH_4Cl. Purification of the crude products by column chromatography (silica gel/EtOAc:n-hexane=3:7) gave the acylated products 2 in good yields (Table I).[5] Comments are required on the choice of reaction conditions for the above described acylation; (a) 2 moles of n-butyllithium was necessary, as half of the base was consumed by the resulting β-ketosulfones 2, (b) inverse addition of the dianion to the ester seemed to suppress side reactions, and (c) use of TMEDA enabled the formation of homogeneous carbanion solution.

Treatment of the β-ketosulfones 2 with aluminum amalgam[6] in 10% aq. n-PrOH for 3 hr at room temperature produced γ-ketoaldehyde ethylene acetals 3 in exellent yields. Some of the results are collected in Table I.

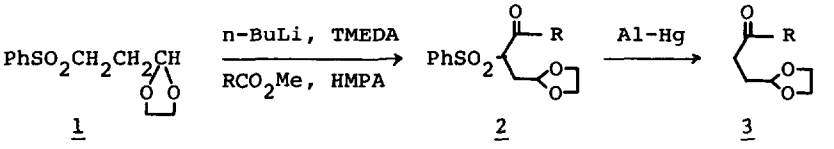
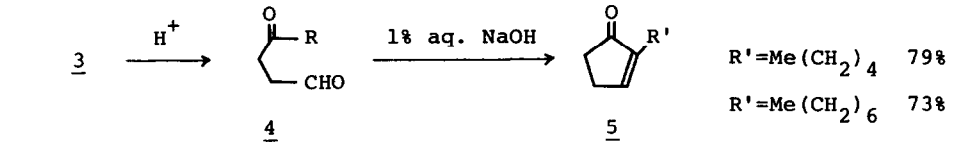


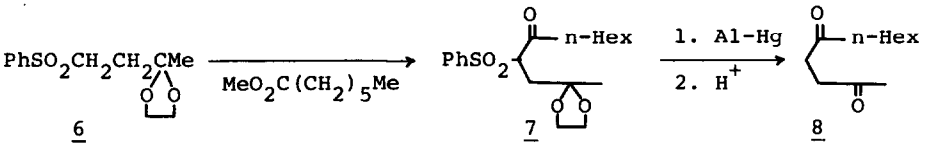
Table I. Yields of Addition Products 2 and γ-Ketoaldehyde Acetals 3

R	2(%)	3(%)
$Me(CH_2)_2$	71	89
$H_2C{=}CHCH_2CH_2$	83	85
$Me(CH_2)_5$	85	92
$Me(CH_2)_7$	94	98

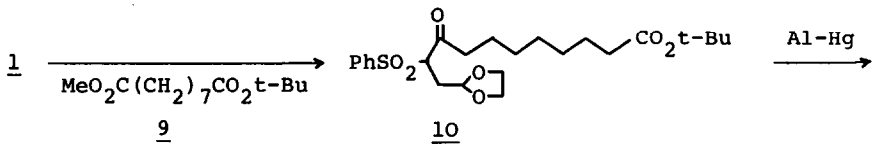
Hydrolysis of the acetal function was performed by refluxing 3 in acetone: water (3:1) containing a catalytic amount of concentrated hydrochloric acid to afford γ-ketoaldehydes 4 in quantitative yields. The base catalyzed cyclization (1% aq. NaOH)[7] of the crude γ-ketoaldehydes 4 gave the corresponding cyclopentenone derivatives 5,[8] which exhibited spectral properties in agreement with the published data.[3d] Similarly, starting from the sulfone ketal 6[2] and methyl n-heptanoate, the β-ketosulfone 7 was obtained in 53% yield, though the yield

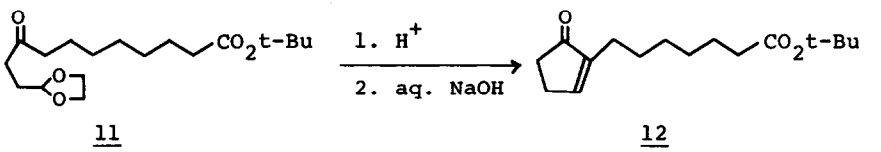
was not optimized. Reductive desulfonylation and hydrolysis as above gave the 1,4-diketone 8 (72% yield, mp 33°, lit.[9] mp 33°), which is the well-known precursor of dihydrojasmone.





The synthetic scheme disclosed here may find considerable utility when one considers that functionalized esters can also be used as acylating agents. In order to demonstrate the efficiency of this method, we have now carried out the synthesis of functionalized cyclopentenone 12,[10] which has already been used as a prostaglandin precursor.[11] The condensation of the dianion of 1 with





t-butyl methyl azelaate 9[12] under the silimar condition as before provided the acylation product 10 in moderate yield. The crude 10 was directly submitted to hydrogenolysis with aluminum amalgam to afford 11 (78% overall yield based on 1). Subsequent hydrolysis and cyclization by treatment with 1% aq. NaOH produced the desired product, t-butyl 3-oxocyclopentene-2-heptanoate 12 (64% overall yield based on 11; ν_{max} 1730, 1705, 1160 cm^{-1}; nmr (CCl_4) δ 0.98-1.73 (m, 8H, CH_2), 1.42 (s, 9H, Me), 1.90-2.70 (m, 8H, CH_2), 7.13 (m, 1H, CH=C).

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