The Lithium Diisopropylamide-Induced Hydrolysis of Ethanediyl *S,S*-Acetals of Aryl Methyl Ketones

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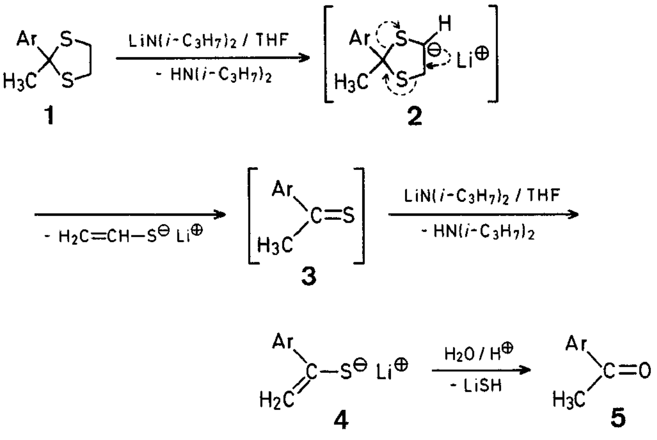
The conversion of *S,S*-acetals into the corresponding carbonyl compounds may be achieved by the following two methods[1]:

- acidic or transition-metal hydrolysis;
- oxidative or alkylative hydrolysis.

Several procedures using reagents such as mercury(II) chloride, ceric ammonium nitrate, *N*-bromosuccinimide, trichloroisocyanuric acid, chloramine-T, and methyl fluorosulfate under either acidic or neutral conditions are currently known[2]. It can be assumed that in the presence of these reagents the *S,S*-acetals undergo electrophilic attack on the S-atom followed by cleavage of the C—S bond in the first step of the reaction. We have now found that lithium diisopropylamide in tetrahydrofuran converts ethanediyl *S,S*-acetals of aryl methyl ketones (**1**) into the carbonyl compounds (**5**) in satisfactory yields via a different mechanism.



In contrast to the hitherto described methods[1,2], our reaction may be assumed to proceed via deprotonation of the *S,S*-acetal **1** by lithium diisopropylamide to give a species such as **2** which then undergoes electron transfer leading to the intermediate thioketone **3** and ethylenethiolate anion. The thioketone **3** thus formed is deprotonated by another molecule of lithium diisopropylamide to produce a species **4** which is finally converted into the ketone **5** by added aqueous acetic acid. Such a mechanism is in accordance with the following facts:

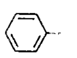
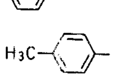
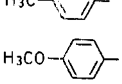
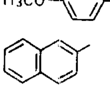
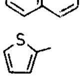
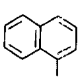
- 2 equiv of lithium diisopropylamide are required for accomplishment of the reaction; when 1 equiv of the base was used, about half of the starting *S,S*-acetal was recovered;
- C—S bond cleavage of this type is only observed with the ethanediyl *S,S*-acetals derived from ketones having α-hydrogen;
- when an appropriate alkyl halide was added to the reaction mixture after the treatment with lithium diisopropylamide, the corresponding alkyl vinyl sulfide and alkyl α-arylvinyl sulfide were produced[8].

The procedure works satisfactorily only with aryl methyl ketones (**5**). There is a significant decrease in yield when the methyl group or both the methyl and the aryl groups are replaced by higher alkyl or alkenyl groups, presumably due to a competing reaction of the intermediate thioketones with lithium diisopropylamide to form a radical anion[8]. For example, when the ethanediyl *S,S*-acetal of cyclohexanone was submitted to the procedure only a 30% yield of cyclohexanone was obtained. In spite of these limitations, the procedure has some distinct advantages such as relatively mild reaction conditions, use of readily available reagents, and simple work-up.

Lithium Diisopropylamide-Induced Hydrolysis of Ethanediyl *S,S*-Acetals of Aryl Methyl Ketones (1); General Procedure:

To a stirred, cooled (–78 °C) solution of diisopropylamine (0.76 g, 7.5 mmol) in tetrahydrofuran (21 ml) is added, during ~2-3 min, a 1.56 molar solution (4.81 ml, 7.5 mmol) of butyllithium in hexane under nitrogen, and stirring is continued at the same temperature for 30 min and at –15 °C for 10 min. The solution of lithium diisopropylamide thus prepared is cooled again to –78 °C, a solution of the ethanediyl *S,S*-acetal (**1**; 3 mmol) in tetrahydrofuran (12 ml) is added, and stirring is continued for 1 h at –15 °C. The mixture is then again cooled to –78 °C and tetrahydrofuran (12 ml), methanol (12 ml), water (3 ml), and acetic acid (3 ml) are successively added with stirring. The resultant mixture is refluxed for 2-3 h, cooled, and extracted with ether (3 × 60 ml). The ether extract is dried with magnesium sulfate, the ether is distilled off, and the residual ketone **5** is distilled under reduced pressure. The distillate may be (re)crystallized from ligroin if necessary.

Table. Lithium Diisopropylamide-Induced Hydrolysis of Ethanediyl *S,S*-Acetals of Aryl Methyl Ketones (**1**)[a]

5[b]	Ar	Yield[c] [%]	b.p./torr or m.p. [°C]	
			found	reported
a		80	b.p. 89-91°/18	b.p. 202°/760[1]
b		63	b.p. 95-98°/12	b.p. 225°/736[3]
c		62	m.p. 37-39°	m.p. 38-39°[1]
d		59	m.p. 50-52°	m.p. 53°[4]
e		54	b.p. 61-63°/2	b.p. 77-78°/4[5]
f		53	b.p. 148-152°/5	b.p. 154-156°/5[6]

[a] All *S,S*-acetals were prepared by the $AlCl_3$-catalyzed reaction of carbonyl compounds with ethanedithiol[7].

[b] All products are known compounds which gave satisfactory microanalysis (C, ±0.29; H, ±0.23). The spectral data were consistent with the assigned structures.

[c] Yield of distilled product.

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