

GENERATION OF THE ENOLATE OF SUCCINIC ANHYDRIDE IN THE PRESENCE OF CARBONYL
COMPOUNDS. A FACILE PREPARATIVE METHOD OF β -METHOXYCARBONYL γ -SUBSTITUTED
 γ -BUTYROLACTONES

Naoki Minami and Isao Kuwajima*

Department of Chemistry, Tokyo Institute of Technology,

Ookayama, Meguro-ku, Tokyo 152

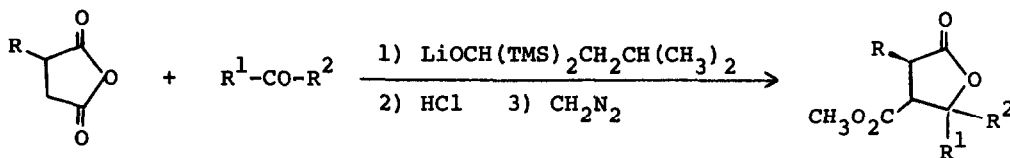
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Although, for synthetic purpose of alkylated ketone, aldol, or β -hydroxy ester, various efforts have been made for specific preparation of ketone¹ or ester enolate,² generation of enolates of acid anhydrides has little been reported.³ For its effective generation, to be controlled are the following two factors: (i) preferential attack of the base employed on hydrogen to that on carbonyl carbon and (ii) prevention of the self-condensation reaction of the anhydride, because of high reactivity of the carbonyl function of the anhydride. For circumvention of these problems, it appears to be crucial to employ a sterically hindered base to favor its interaction to hydrogen specifically, and to be desirable to generate the enolate in the presence of its acceptor.

We have recently reported that reductive silylation reaction of carboxylic esters followed by acidic hydrolysis affords the corresponding 1,1-bis(trimethylsilyl)alkan-1-ol⁴ and its lithium alkoxide can be used as an efficient base for specific generation of methyl ketone⁵ or ester enolates⁶ even in the existence of aldehydes. These results suggested that this type of sterically hindered alkoxide might be employable for purpose described above. Such assumption has been realized with succinic anhydride as described in the following example; to a THF (4 ml) solution of lithium 1,1-bis(trimethylsilyl)-3-methyl-1-butoxide (1.1 mmol) was added a THF (4 ml) solution of 3-phenylpropanal (134 mg, 1.0 mmol) and succinic anhydride (110 mg, 1.1 mmol) at -78° under argon atmosphere. After it was stirred for 30 min at that temperature, the reaction mixture was quenched with aq sodium bicarbonate and was extracted with ether. The aqueous layer was acidified with dil. HCl and was extracted with ethyl acetate. From the extracts, β -methoxycarbonyl- γ -phenethyl- γ -butyrolactone (198 mg, 80%) was isolated after treating with diazomethane, followed

by tlc purification.

Similarly, the corresponding substituted γ -butyrolactones are obtained in good yield when aldehydes are present in the reaction system, while ketones afford the adducts in only moderate yield, as shown in the following equation. It is also found that, from methylsuccinic anhydride, the enolate can be successfully generated on the methylene site exclusively to give the corresponding adduct, while the enolate generation from glutaric anhydride is not so effective as the case with succinic ones.



R = H			R = CH ₃		
R ¹	R ²	Yield (%)	R ¹	R ²	Yield (%)
C ₆ H ₅	H	84	C ₆ H ₅	H	84
C ₆ H ₅ CH ₂ CH ₂	H	80	C ₆ H ₅ CH ₂ CH ₂	H	75
C ₃ H ₇ CH=CH	H	82	C ₃ H ₇ CH=CH	H	85
C ₅ H ₁₁	H	78	C ₅ H ₁₁	H	72
(CH ₃) ₂ CH	H	76	(CH ₃) ₂ CH	H	70
-(CH ₂) ₅ -		51	-(CH ₂) ₅ -		57

References

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