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KETENE THIOACETAL MONOSULFONIUM SALTS: A TWO-CARBON MICHAEL ACCEPTOR[1)]

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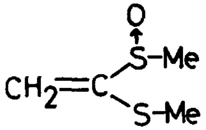
It has recently been reported that the ketene thioacetal monooxide(1) can be successfully used as a two carbon Michael acceptor[2)]. In connection with the synthetic studies of natural products, introduction of carbon two units bearing a functional group into the angular position was required. In an effort to achieve this[3)], we independently found that the ketene thioacetal mono-sulfonium-salt(2) underwent the same type of reaction. In the model experiments using this reagent, however, the vinyl thioethers(3) were also produced along with the expected acetaldehyde derivatives(4). The former involving the vinyl thioether moiety, a useful latant functional group in organic synthesis, became the major product when the work-up condition was appropriately selected, which constitutes the particular feature of the present method.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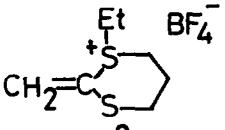
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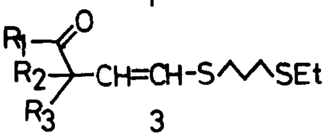
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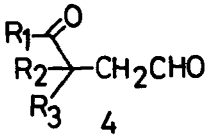
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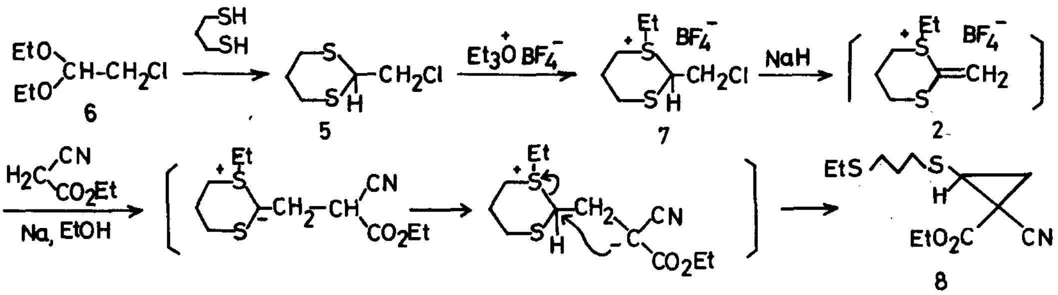
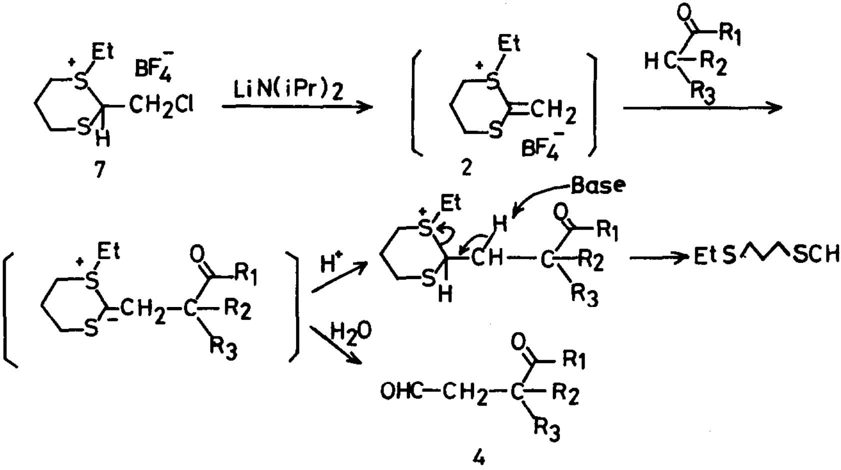
The ketene thioacetal monosulfonium salt(2) is expected to be prepared conveniently by S-monoalkylation of 2-chloromethyl-1,3-dithiane(5)[4)] with $Et_3O^+ BF_4^-$ followed by base treatment. Thus, 7 prepared from chloroacetal(6) was treated with NaH in CH_2Cl_2 and the mixture was reacted with ethyl cyanoacetate in EtOH in the presence of EtONa to afford the alkylthiocyclopropane derivative(8) in 73% yield(crude). Formation of **8** obviously shows that **2** is generated during the reaction since the simple vinylsulfonium salt is known to affords the cyclopropane derivatives by the analogous reaction[5].

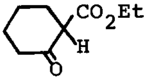
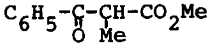


Now that **2** was proved to be generated, the same procedure[6] was applied to the reaction with the active methine compounds. In these cases, the desired aldehydes were expected to be produced[7] since the initial addition products were incapable of forming cyclopropane derivatives. Actually, the aldehydes(4) were obtained mainly but the vinyl thioethers(3) were also involved in the products(Table 1). The pathway leading to these compounds may be shown as follows:



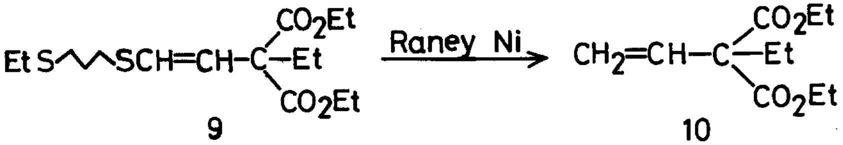
The ratio of **3** and **4** was subtly influenced by the work-up condition. For example, when the reaction mixture of **2** with EtCH(CO$_2$Et)$_2$ was warmed in the presence of Et$_3\overset{+}{N}$H Cl$^-$, **9** became a major product. Treatment of **9** with Raney Ni[8]

Table 1. The Reaction of 7 with Active Methine Compounds in the Presence of Lithium Diisopropylamide

Starting Material	LiN(iPr)$_2$	Solvent	Quenching Reagent	Product(%) 3	4
Me-CH(CO$_2$Et)$_2$(1 equiv)	1 equiv	DME	3% CuSO$_4$	9	67
〃 〃	〃	〃	Excess FSO$_3$Me then, 3% CuSO$_4$	-	70
〃 〃	2 equiv	〃	3% CuSO$_4$	31	33
Et-CH(CO$_2$Et)$_2$ 〃	1 equiv	〃	〃	18	46
〃 〃	〃	〃	Et$_3\overset{+}{N}$H Cl$^-$	63	18
 〃	〃	〃	3% CuSO$_4$	*	82
 $C_6H_5-\underset{O}{\overset{}{C}}-\underset{Me}{C}H-CO_2Me$ 〃	〃	〃	〃	*	50
〃 〃	〃	DME + HMPA	〃	*	62

* Formation of 3 was observed but isolation was not attempted.

afforded the desulfurization product(10) in 80% yield, which demonstrated that the vinyl group was successfully introduced into the tertiary carbon atom α to a carbonyl group.



9 10

Recently, the chemistry of vinyl sulfides and sulfoxides has attracted much attention and several interesting reactions have been reported[9)]. The present method of introducing the thiovinyl group on the tertiary carbon together with these newly developed reactions would be useful in the synthesis of a variety of natural products having various angular substituents. Efforts aimed in this direction are being continued.

REFERENCES

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2) J.L. Herrmann, G.R. Kieczylowski, R.F. Romanet, P.J. Wepplo, R.H. Schlessinger, *Tetrahedron Letters*, 4711(1973); J.L. Herrmann, G.R. Kieczykowski, R.F. Romanet, R.H. Schlessinger, *ibid*., 4715(1973).
3) Every attempt to introduce suitable substituents by alkylation was unsuccessful in our system. Y. Ban, T. Ohnuma, T. Oishi, unpublished work. See also, R.B. Turner, K.H. Ganshirt, P.E. Shaw, J.D. Tauber, *J. Am. Chem. Soc.*, **88**, 1776(1966); J.P. Kutney, W.J. Cretney, P.L. Quesne, B. McKague, E. Piers, *ibid*., **92**, 1712(1970).
4) Chloroacetal(6) is commercially available. **5** was obtained as a colorless prisms(mp. 33-4°,after recrystallization from petroleum ether) in the yield of 70%(crude) when dry HCl gas was introduced into a mixture of **6** and 1,3-propanedithiol in CHCl$_3$.
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6) Since the model experiment showed that abstraction of HCl from **7** by NaH apprared to proceed rather slowly and incompletely at low temperature, Lithium diisopropylamide was used thereafter.
7) Hydrolysis of 1,3-dithiolane monosulfonium salts by 3% CuSO$_4$ is reported to give the corresponding aldehydes in high yield. T. Oishi, K. Kamemoto, Y. Ban, *Tetrahedron Letters*, 1085(1972). See also, ref. 1).
8) R.L. Autrey, P.W. Scullard, J. Am. Chem. Soc., 90, 4917(1968).
9) N. Miyamoto, H. Nozaki, *Tetrahedron*, **29**, 3819(1973); G.A. Russell, E. Sabourin, G.J. Mikol, *J. Org. Chem.*, **31**, 2854(1966); N. Miyamoto, D. Fukuoka, K. Uchimoto, H. Nozaki, *Bull. Chem. Soc. Japan*, **47**, 1817(1974); G. Tsuchhashi, S. Mitamura, K. Ogura, *Tetrahedron Letters*, 323 (1973); *ibid*., 2469(1973); *ibid*., 455(1974).