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Convenient Synthesis of Sulfur Ylides by Reaction of Active Methylene Compounds with Corey-Kim Reagent

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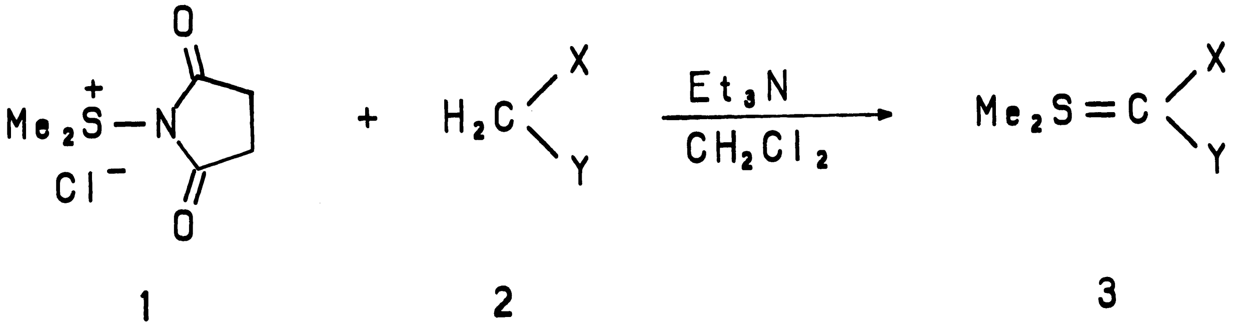
Reactions of active methylene compounds with Corey-Kim reagent in the presence of triethylamine afford stable sulfur ylides in satisfactory yields.

The so-called stable sulfur ylides such as dicarbonylmethylides are gaining a new position as a synthetic intermediate because their conversion into the siloxydienes have been established by Furukawa and his co-workers.$^{1)}$ Although several synthetic methods$^{2-4)}$ of the sulfur ylides from active methylene compounds have been reported, these methods are not necessarily satisfactory on the yield,$^{5)}$ generality,$^{6)}$ and reaction conditions.$^{7)}$ The alternative methods by photolysis$^{8,9)}$ or thermal decomposition$^{8,10)}$ of diazo compounds in the presence of dialkyl sulfides give the sulfur ylides in good yields compared with the methods described above, but require diazotization of the active methylene compounds.

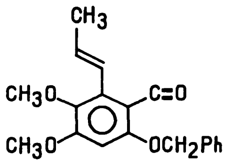
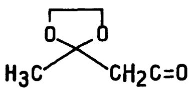
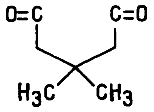
Recently, we have found that the treatment of 3-hydroxycarbonyl compounds with a large excess of Corey-Kim reagent (N-chlorosuccinimide-dimethyl sulfide)$^{11)}$ did not give the expected 1,3-diones, but afforded the dimethyl sulfonium dicarbonylmethylides as the sole product in excellent yields.$^{12)}$ This implies that the diones, initially generated by treatment of the hydroxycarbonyl compounds with the Corey-Kim reagent, are more reactive toward the reagent than the substrates, and hence immediately react with the reagent to give the ylides. On the basis of the background described above, we tried the reaction of the various active methylene compounds having two electron withdrawing groups with Corey-Kim reagent. Herein we wish to report the convenient method for preparation of the stable ylides **3** from various active methylene compounds **2** by use of the Corey-Kim reagent **1** in the presence of triethylamine.



A typical procedure is as follows. To a suspension of N-chlorosuccinimide (3.472 g, 26.0 mmol) in anhydrous dichloromethane (110 mL), dimethyl sulfide (2.7 ml, 36.9 mmol) is added dropwise at -78 °C under argon, and the stirring is continued for 1 h at the same temperature. Then, a solution of the active methylene compounds **2a** (20.0 mmol) is added at the same temperature. After 1 h, triethylamine (4.2 mL, 30.3 mmol) is added to the mixture, and stirring is continued for additional 1 h at the same temperature. The mixture is treated with cold brine (60 mL), and extracted with ether (180 mL). The organic layer is washed three times with brine (60 mL), and dried over anhydrous magnesium sulfate. After the solvent is evaporated, the residue obtained is purified by column chromatography on silicagel (100-200 mesh, Micro Bead 4B, Fuji-Davison Chemical Ltd., eluent; 5% acetone in chloroform) to afford the desired ylides **3a**. These results are summarized in Table 1.

In these reactions, the ylides **3** were obtained in satisfactory yields even by use of a small excess (1.3 equiv.) of reagent **1** , except for the case of run 12, 13 where the reaction is sluggish or does not cocur presumably due to weaker acidity of the active methylene positions. Furthermore, the reaction proceeded smoothly even in the presence of acid-labile functional groups (ethylene ketal, benzyl ether) (run 4), and mono-ylidation was observed in the case of the substrate having two reaction sites (run 8). The structure of the ylides **3** was confirmed by comparing the spectral and physical data with those of authentic samples. The signals of ylide-carbon appear at δ 70-95 ppm in the ^{13}C-NMR spectra of the ylides (**3a-i**) having two carbonyl groups containing at least one acyl group, at δ 58.6 in that of the ylide (**3j**) having two alkoxycarbonyl groups, and at significantly higher field (δ 36.4, and 15.8) in those of the ylides (**3k**,

Table 1. Reaction of active methylene compounds **2** with Corey-Kim reagent **1**

Run		Active methylene compounds **2** X-CH2-Y X	 Y	Stable ylide **3** Yield/%	Mp/ °C (Lit. Mp/ °C)
1	**a**	PhC=O	PhC=O	99	210-211(209)9)
2	**b**	PhC=O	MeC=O	96	105-107(109-110)3)
3	**c**	MeC=O	MeC=O	78	166-169(168-169)3)
4	**d**			80	oil13)
5	**e**			95	172-175(172-173)3)
6	**f**	PhC=O	CO_2Et	98	91-93.5(84-85)14)
7	**g**	MeC=O	CO_2Me	94	112-114(115-117)14)
8	**h**	$EtOCOCH_2C=O$	CO_2Et	88	oil
9	**i**	MeC=O	CONHPh	97	153-156(156.5-158)4)
10	**j**	CO_2Me	CO_2Me	78	168-170(169-170)8)
11	**k**	CO_2Me	CN	82	157-160(158-160)4)
12	**l**	CN	CN	46	96-98(99-100)3)
13	**m**	PhC=O	Ph	0	

and **31**) having cyano group.

It is noteworthy that this ylide formation reaction proceeds under mild conditions, in excellent yields in comparison with the conventional methods.

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5) The yields obtained using these methods are generally from 10 to 50% and exceed 60% only in a few cases.

6) In these methods, experimental examples are mostly 3-5 examples.

7) Some methods require rather drastic reaction conditions (>100 °C).

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