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THE REACTION OF CARBONYL-STABILIZED SULFUR YLIDES WITH 1,4-DIPOLE ; A NEW SYNTHETIC METHOD OF PYRIMIDINES

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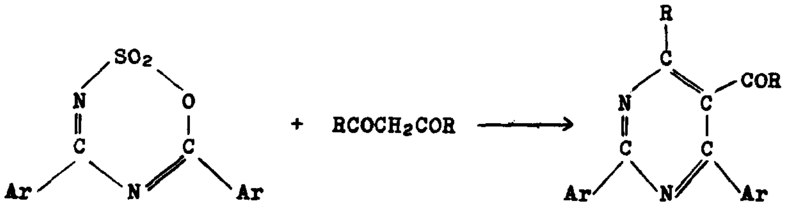
One of the most useful synthetic methods is 1,3-dipolar cycloaddition in which five-membered heterocyclic compounds are prepared by addition of 1,3-dipolar compounds to double bonds[1]. Sulfur or phosphorus ylides as 1,3-dipolephile are also useful starting materials for the synthesis of heterocycles[2-4], although the mechanism of the reactions may be different from 1,3-dipolar cycloaddition.

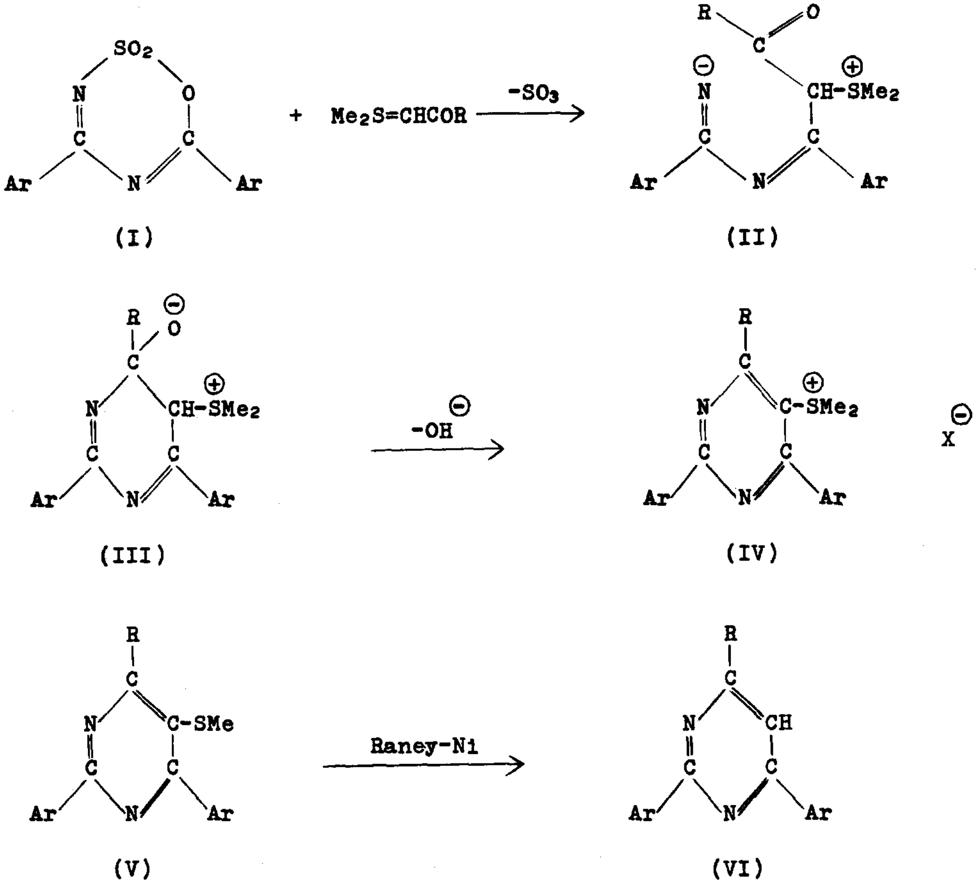
The reaction of 1,4-dipoles with sulfur ylides would be expected to parallel the reaction of the 1,4-dipole (I) with 1,3-dicarbonyl compounds in the presence of base[5], while the mechanism of the reaction of carbonyl-stabilized sulfur ylides with 1,3-dipoles is still not fully settled.



The authors have found that the reaction of carbonyl stabilized sulfur ylides with (I), a precursor of 1,4-dipole, at ambient temperature furnished 5-dimethylsulfonium pyrimidines in 74-96 % yields.

Some tentative conclusions about the mechanism of the reaction can be drawn (Chart 1). Nucleophilic attack of the ylide on (I) and subsequent elimination of sulfur trioxide gives (II). The ring closure of (II) to the betaine (III) is analogous one to the reaction of nitrile imine with the sulfur ylide$^{2)}$. The elimination of hydroxy anion from (III) to the sulfonium salt (IV) is feasible because of the formation of resonance stabilized pyrimidine and derives the reaction to completion.

Chart 1



The structural assignment of IVa (Table I) was substantiated by elemental analysis, $C_{34}H_{34}N_2S_3O_5$; IR (in nujor), νc=o 1675cm^{-1}; N.M.R (in DMSO-d_6), at τ1.9-3.3 (m, 20H, aromatic H), at 5.8-6.6 (broad, 2H, methylene H), at τ6.75 and 6.94 (two singlets. 12H, methyl H), and the decomposition in aqueous potassium chloride solution under heating to Va ; elemental analysis, $C_{23}H_{18}N_2S$; N.M.R(DMSO-d_6) at τ1.5-2.6 (m. 15H, aromatic H), at τ8.23 (s. 3H, methyl H).

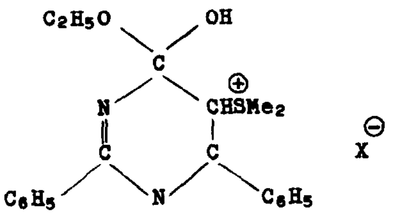
Desulfurization of Va by Raney nickel gave 2,4,6-triphenylpyrimidine which structure was characterized by comparison with the authentic specimen.

In general the reaction was carried out by adding I to a solution of ylide in benzene. The reaction mixture was kept at room temperature overnight. The precipitate from the reaction mixture was collected by filtration and washed with water to leave IV. IV was purified by recrystallization. The decomposition of IV in aqueous potassium chloride was carried out by heating for 4 hours. The precipitate from the reaction mixture was collected by filtration and purified by recrystallization.

Table 1. Dimethylsulfonium pyrimidines (IV) and methylthio pyrimidines (V)

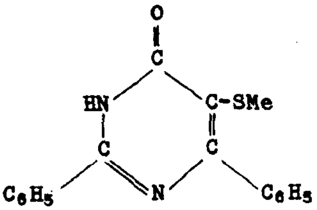
	IV		V	
	Yield(%)	Mp.(°c)	Yield(%)	Mp.(°c)
a, Ar=R=C_6H_5 X=$C_6H_5COCH_2SMe_2.SO_4$	77	145-151	32	111-113
b, Ar=C_6H_5, R=p-$CH_3C_6H_4$ X=p-$CH_3C_6H_4COCH_2SMe_2.SO_4$	96	146-148	21	116-118
c, Ar=C_6H_5, R=p-ClC_6H_4 X=p-$ClC_6H_4COCH_2SMe_2.SO_4$	83	155-158	53	126-128
d, Ar=C_6H_5, R=p-BrC_6H_4 X=p-$BrC_6H_4COCH_2SMe_2.SO_4$	86	144-146	68	120-122
e, Ar=C_6H_5, R=m-$NO_2C_6H_4$ X=m-$NO_2C_6H_4COCH_2SMe_2.SO_4$	90	125-131	96	121-122
f, Ar=C_6H_5, R=β-Naphthyl X=β-Naphthyl-$COCH_2SMe_2.SO_4$	89	137-140	67	131-133
g, Ar=p-$CH_3C_6H_4$, R=C_6H_5 X=$C_6H_5COCH_2SMe_2.SO_4$	74	129-131	90	99-101
h, Ar=p-$CH_3C_6H_4$, R=p-ClC_6H_4 X=p-$ClC_6H_4COCH_2SMe_2.SO_4$	84	167-169	30	124-126
i,	89	135-138	34	287-290

The reaction of I with ethyl (dimethylsulfuranylidene)-acetate gave IVi which was also decomposed to Vi.



$\overset{\ominus}{X} = C_2H_5OCOCH_2SMe_2.\overset{\ominus}{SO_4}$

IVi



Vi

The yields and melting point of IV and V are shown in table I.

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