

NUCLEOPHILIC SUBSTITUTION OF ACTIVE METHYLENE GROUP ON THIONYL CHLORIDE  
AND ITS APPLICATION FOR THE SYNTHESIS OF A FEW HETEROCYCLIC COMPOUNDSKitaro Oka and Shoji HaraTokyo College of Pharmacy, Taito-ku, Tokyo 110

Over the years, a great deal of interest has been shown in the reactions of thionyl chloride with a broad spectrum of organic functional groups. These investigations have clearly showed the value of thionyl chloride as a reagent for preparation of alkyl chlorides, acyl chlorides and so on.

Now we will concentrate on some lesser known but nevertheless rather general reactions of thionyl chloride with active methylene groups which seem to be of considerable synthetic significance. Though at first these reactions appear to be extremely varied and complex, they may be arbitrarily classified as multifunctional utilization of thionyl chloride in organic synthesis. In these reactions, thionyl chloride is involved fundamentally in these consecutive reactions: nucleophilic substitution of the active methylene-carbon on thionyl chloride, elimination of hydrogen chloride to form the sulfine, Pummerer type rearrangement to give the  $\alpha$ -chlorosulfonyl chloride, and elimination of hydrogen chloride in the case of active methyl groups to afford the thioacyl chloride.

Firstly the synthesis of thioacyl chlorides, which are not such well-known chemical species, from the active methyl-compounds, and secondly their chemical behavior and reactivity as further applied to the synthesis of sulfur-containing heterocycles will be discussed.

Thus acetophenone was treated with ten molar equivalents of thionyl chloride in the presence of catalytic amount of pyridine at room temperature to give almost quantitatively the 1 : 1 mixture of  $\alpha$ -chloro- $\alpha$ -chlorosulfonyl acetophenone (1) and 2-oxophenylthioacetyl chloride (2). Methyl pyruvate and 2-methylthiazole were also treated at elevated temperatures to give 3-methoxy-2,3-dioxothioproponyl chloride (3) and 2-chlorothiocarbonylbenzothiazole (4), respectively. The mixture of 1 and 2, and the compound 3 were treated with 1,2-phenylenediamine to afford 2-thio-3-phenylquinoxaline (5) and bis(3-methoxycarbonylquinoxalin-2-yl) disulfide (6) in good yields, respectively. The mixture of 1 and 2, and the compound 4 were treated with bromoethanolamine hydrobromide to give 2-benzoyl-2-thiazoline (7) and 2-(2-thiazolin-2-yl)-benzothiazole (8), respectively. The mixture of 1 and 2 was treated with L-cysteine methyl ester hydrochloride to give 2-benzoyl-4-methoxycarbonylthiazole (9).