STUDIES ON 1,3-BENZOXAZINES IV. REACTION OF IMIDOYL CHLORIDES OF 1,3-BENZOXAZINES WITH SULFOXIDES

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Abstract --- The reaction of imidoyl chloride (1) with DMSO at room temperature gave rise to dimeric compound (3) as the main product besides hydroxymethyl compound (2), oxidized compound (4) and paraformaldehyde (5). On the other hand, the reaction was carried out at 85°C to give a different type product (9) involving ketal exchange reaction. When dibenzyl sulfoxide was used instead of DMSO, dimethyl ketal exchange product (10) was obtained together with benzaldehyde (11).

In the previous paper of this series, we have investigated the reaction of imidoyl chlorides of 1,3-benzoxazines with various pyridine N-oxides.[1)2)]
In the continuation and extension of our studies on 1,3-benzoxazines, the reaction of 4-chloro-2,2-dimethyl-2H-1,3-benzoxazine (1) with dimethyl sulfoxide or dibenzyl sulfoxide was investigated.
Treatment of imidoyl chloride (1) with excess amounts of DMSO at room temperature for 2 days, follwed by silica gel chromatography, gave three products (2, 3 and 4) in 10, 38 and 30 % yields, respectively, in addition to paraformaldehyde (5). The structural assignment of the reaction products was determined on the basis of the follwing results.
2,2-dimethyl-3-hydroxymethyl-4-oxo-4H-1,3-benzoxazine (2): white needles from CH_2Cl_2-hexane, mp. 93-94° C, Anal. Calcd. for $C_{11}H_{13}NO_3$: C, 63.75; H, 6.32; N, 6.76. Found: C, 63.57; H, 6.36; N, 6.72, ir (Nujol) 1640 (C=O) and 3320 (OH) cm^{-1}, nmr ($CDCl_3$) δ (ppm) 1.73 (6H, s, $<^{CH_3}_{CH_3}$), 4.22 (1H, t, J=18 Hz, -OH), 5.17 (2H, d, J=18 Hz, $-N\underline{CH_2}OH$), 6.80-8.10 (4H, m, aromatic H), mass (M^+:m/e 207).
1,1-bis [3-(2,2-dimethyl-4-oxo-4H-1,3-benzoxazinyl)] dimethyl ether (3): white needles from ether-hexane, mp. 123-124° C, Anal. Calcd. for $C_{22}H_{24}N_2O_5$: C, 66.65;

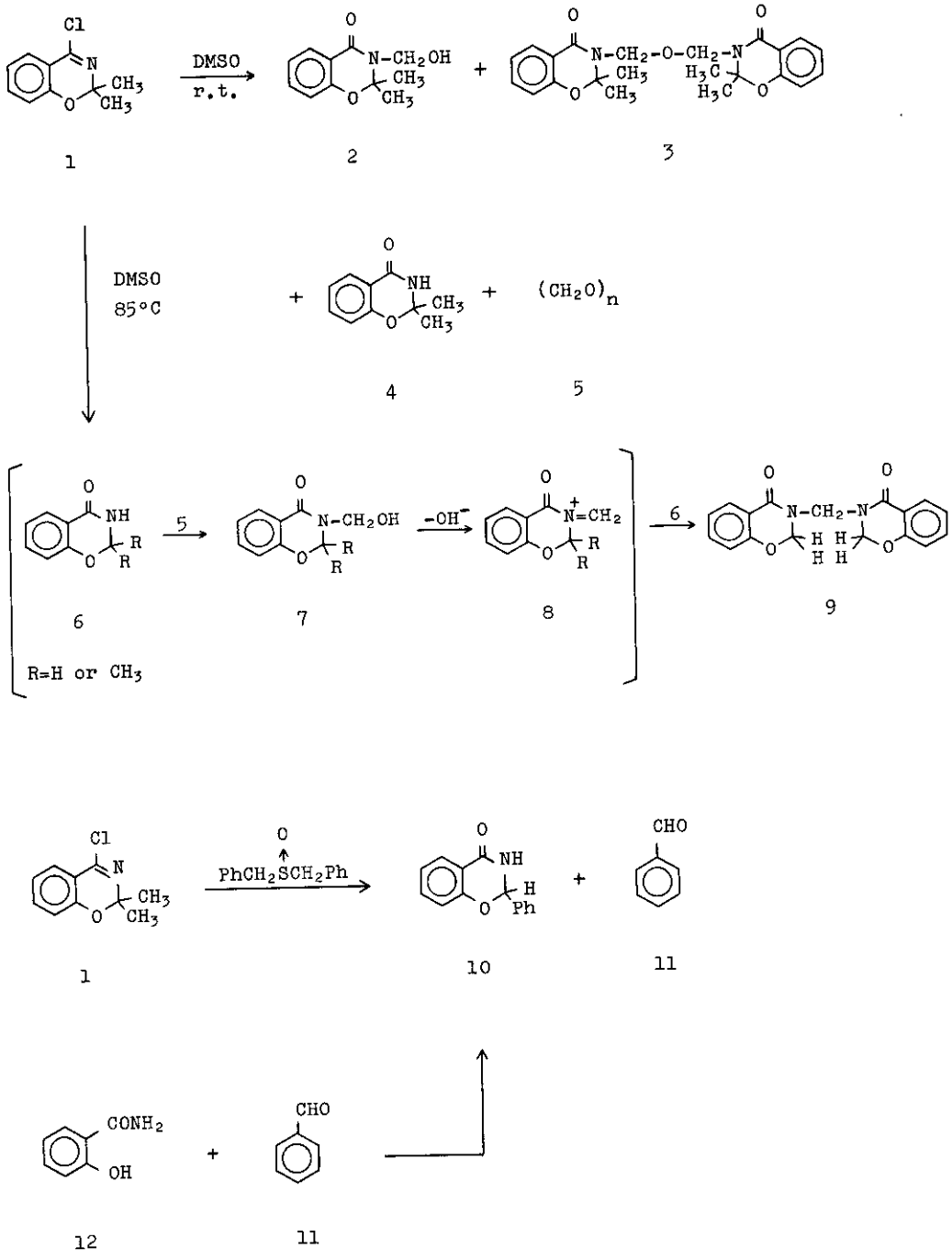

Chart 1

H, 6.10; N, 7.07. Found: C, 66.73; H, 6.16; N, 7.04, ir (Nujol) 1680 (C=O) cm^{-1}, nmr ($CDCl_3$) δ (ppm) 1.75 (12H, s, 2 $<^{CH_3}_{CH_3}$), 5.23 (4H, s, $-\underline{CH_2}O\underline{CH_2}-$), 6.80-8.10 (8H, m, aromatic H), mass (M^+: m/e 396).

2,2-dimethyl-4-oxo-4H-1,3-benzoxazine (4): white needles from ethyl acetate-hexane, mp. 138-140° C (lit.,[3] mp. 138°C).

Michelot and Tehoubar[4] reported that the reaction of acyl halides with DMSO gives chloromethyl methyl sulfide (14) and the corresponding acid derivatives. Martin and Weise[5] obtained paraformaldehyde together with the corresponding amide and 14 by the reaction of N-phenylbenzimidoyl chloride with DMSO.

Considering these reports, paraformaldehyde may be produced by further reaction of initially formed 14 with DMSO and the first reaction product, 2, may be formed by hydroxymethylation of 4 with paraformaldehyde as depicted in Chart 2. The second reaction product, 3, may be arised by dimerization of 2.

When the reaction was carried out at 85°C for 2 h, a new reaction product, bis [3-(4-oxo-4H-1,3-benzoxazinyl)] methane (9), was obtained in 55 % yield, mp. 151-153° C (ether-hexane), Anal. Calcd. for $C_{17}H_{14}N_2O_4$: C, 65.84; H, 4.55; N, 9.03, Found: C, 65.63; H, 4.48; N, 8.85, ir (Nujol) 1670 (C=O) cm^{-1}, nmr ($CDCl_3$) δ (ppm) 5.20 (2H, s, $-N\underline{CH_2}N-$), 5.50 (4H, s, 2 $<^{H}_{H}$), 6.90-8.10 (8H, m, aromatic H), mass (M^+: m/e 310).

A plausible mechanism for the formation of 9 would be expressed as shown in Chart 1. An immonium intermediate (8), which produced from an initially formed hydroxymethyl compound by loss of OH^-, was reacted with 6 to give the product (9). Ketal exchange reaction occured with paraformaldehyde which was a by-product of the reaction of 1 with DMSO in the course of this reaction.

Then we carried out the reaction of dibenzyl sulfoxide with 1 in dioxane at room temperature for 5 days to give only ketal exchange product, 2-phenyl-4-oxo-4H-1,3-benzoxazine (10) $C_{14}H_{11}NO_2$, mp. 166-167° C (lit.,[6] 168° C), ir (Nujol) 1690 (C=O) cm^{-1}, nmr ($CDCl_3$) δ (ppm) 6.27 (1H, s, $<^{H}_{Ph}$), 6.60-8.10 (9H, m, aromatic H), mass (M^+: m/e 225), in 87 % yield accompanied with benzaldehyde (11). Compound 12 was prepared independently by the reaction of salicyl amide (12) with benzaldehyde (11). An attempt to obtain the dimeric compound by the refluxing reaction conditions was unsuccesaful.

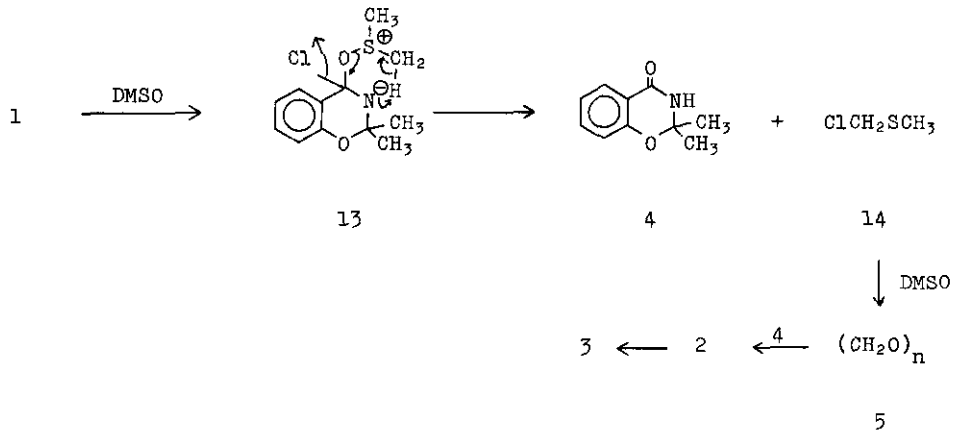

Chart 2

References

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