REACTIONS OF 2-MERCAPTOPYRIMIDINES WITH α, ω-BROMOCHLORO- AND α, ω-BROMOFLUOROALKANES

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The reactions of 2-mercaptopyridines with α, ω-bromohaloalkanes have given the corresponding haloalkylthiopyrimidines and α, ω-bis(2-pyrimidylthio)alkanes. The IR spectra of the compounds obtained have been recorded and some of their constants have been determined.

We have previously reported [1] the reaction of 2-mercaptopyrimidines with α, ω-dibromo- and α, ω-dichloroalkanes. Continuing this work, we have studied the reaction of 2-mercaptopyrimidine (I), 2-mercapto-6-methylpyrimidine (II), and 2-mercapto-4,6-dimethylpyrimidine (III) with bromochloromethane (IV), 1-bromo-4-chlorobutane (V), and 1-bromo-2-fluoroethane (VI).

As was to be expected, the reaction of I and III with IV and V gave, in addition to the previously reported α, ω-bis(2-pyrimidinylthio)alkanes, the corresponding ω-chloroalkylthiopyrimidines. But in the reaction of II with IV it was possible to isolate only bis(6-methyl-2-pyrimidinylthio)methane (VII), in spite of changes in the reaction conditions, the medium, and the ratio of the reactants.

The reactions of I and III with VI led to only the corresponding β-fluoroethylthiopyrimidines.

The structure of the bis(2-pyrimidinylthio)alkanes, apart from VII, was confirmed by the agreement of the melting points of the samples obtained with those of compounds described previously, and the complete identity of the corresponding IR spectra. The structures of the other compounds were confirmed by the results of elementary analysis.

The IR spectra of all the chloroalkylthiopyrimidines obtained had a strong band in the 650 cm^{-1} region which can be ascribed to the vibrations of the C—Cl bond. The vibrations of the C—F bond in the IR spectra of the fluoroethylthio derivatives appear in the 990–1070 cm^{-1} region. These bands do not appear in the spectra of any of the bis(2-pyrimidinylthio)alkanes or in those of the initial mercaptopyrimidines.

Some properties of the compounds obtained are given in the table.

EXPERIMENTAL

Starting materials. Compounds I and II were obtained by known methods [2, 3] and were used in the form of the hydrochlorides. Compound III was obtained by a method analogous to that given by Kosolapoff and Roy [4] and was used in the subsequent reactions in the form of the sodium salt. Commercial bromochloromethane was purified by redistillation, 1-Bromo-2-fluoroethane was obtained from 1,2-dibromoethane and KF [5], and 1-bromo-4-chlorobutane from tetrahydrofuran and a mixture of NaCl and NaBr in the presence of sulfuric acid [6]. Both substances were purified by distillation.

The IR spectra were recorded on a UR-10 spectrophotometer. Drops of the liquid substances were pressed between KBr plates, and the solid substances were suspended in paraffin oil.

2-(Chloromethylthio)-4,6-dimethylpyrimidine (VIII). At −4° to to 0° C, 8 g (0.0370 mole) of the trihydrate of the sodium salt of III was added to a stirred solution of 5 g (0.0386 mole) of IV in 25 ml of dry dimethylformamide. Then the reaction mixture was kept at 0° to +5° C for 10 min and at room temperature for 1 hr and was then filtered. The precipitate was washed with water and ether. This gave 1.2 g of bis(4,6-dimethyl-2-pyrimidinylthio)methane (IX), mp 178.5°–179.5° C (from isobutanol). The filtrate was poured into water. The water-insoluble oil immediately crystallized. This gave 4.5 g (64.47%) of VIII, mp 53.7°–53.2° C (from petroleum ether, 40°–70° C). After two days, the aqueous filtrate deposited another 0.2 g of IX. The total yield of IX was 1.4 g (25.88%).

2-(Chloromethylthio)pyrimidine (X) and 2-(δ-chlorobutylthio)-4,6-dimethyl pyrimidine (XI) were obtained similarly. In the case of X, the reaction was carried out with the hydrochloride of I in the presence of anhydrous potassium carbonate.

Compounds VIII and X formed colorless needle-like crystals insoluble in water and readily soluble in ether, chloroform, petroleum ether, and acetone. Compound XI formed a water-immiscible colorless liquid.

Bis(6-methyl-2-pyrimidinylthio)methane (VII). A mixture of 7.5 g (0.0461 mole) of the hydrochloride of II and 6.37 g of finely ground anhydrous potassium carbonate in 30 ml of dimethylformamide was added over 30 min at room temperature to a stirred solution of 6 g (0.0463 mole) of IV in 5 ml of dry dimethylformamide. The temperature of the mixture rose to +30° C. After 1 hr, the mixture was poured

Properties of the Compounds Obtained

Compound	Mp, °C or bp, °C, (mm)	d_4^{20}	n_D^{20}	Empirical formula	Found, %			Calculated, %			Yield, %
					C	H	N	C	H	N	
VII	86.7—87.5	—	—	$C_{11}H_{12}N_4S_2$	50.45	4.64	21.46	50.00	4.55	21.21	60.92
VIII	53.7—54.2	—	—	$C_7H_9ClN_2S$	44.15	4.75	15.07	44.56	4.77	14.85	64.47
X	47.7—48.1	—	—	$C_5H_5ClN_2S$	37.31	3.53	17.64	37.38	3.12	17.45	34.55
XI	107.0—107.5 (0.02)*	1.1452	1.5540	$C_{10}H_{15}ClN_2S$	52.12	6.75	12.22	52.06	6.51	12.15	37.48
XII	66.0—67.0 (0.025)	1.1611	1.5388	$C_8H_{11}FN_2S$	51.58	6.08	15.28	51.61	5.91	15.05	77.40
XIII	62.0—63.0 (0.025)	1.2657	1.5575	$C_6H_7FN_2S$	45.61	4.75	17.50	45.57	4.43	17.72	51.47

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*The product obtained from 1,4-dichlorobutane [1] had the following constants: bp 107°–108° C (0.02 mm); d_4^{20} 1.1437; n_D^{20} 1.535.

into water. The crystals that separated were filtered off after a day (3.5 g), and the aqueous filtrate was extracted with chloroform and petroleum ether. A further 0.5 g of product was obtained from the extracts. It was established by analysis that this was compound VII, yield 4 g (60.92%), mp 86.7°–87.5° C (from isubutanol). The product was insoluble in water, sparingly soluble in petroleum ether, and readily soluble in chloroform, lower alcohols, acetone, and hot ethyl cellosolve. IR spectrum: 548, 580, 755, 772, 785, 800, 825, 885, 1180, 1205, 1235, 1270, 1330, 1440, 1540, 1580, cm^{-1}.

2-(β-Fluoroethylthio)84, 6-dimethylpyrimidine (XII). Fifteen grams (0.0694 mole) of the trihydrate of the sodium salt of III was added at 22°–26° C to a stirred solution of 9 g (0.0709 mole) of VI in 25 ml of dimethylformamide. Then the mass was heated at 40°–45° C for 5 min, cooled to room temperature, poured into water (1 *l*), and extracted with petroleum ether (0.5 *l*). The extract was separated off and dried over sodium sulfate. The liquid remaining after the solvent had been driven off was fractionated. After three distillations, 10 g (77.40%) of XII was obtained with bp 66°–67° C (0.025 mm); d_4^{20} 1.1611; n_D^{20} 1.5388.

2-(β-Fluoroethylthio)pyrimidine (XIII) was obtained similarly from the hydrochloride of I in the presence of anhydrous potassium carbonate.

REFERENCES

1. N. G. Pashkurov and V. S. Reznik, DAN, **171**, 874, 1966.
2. Organic Syntheses, N. Y., London, Sydney, **43**, 68, 1963.
3. D. M. Burness, J. Org. Chem., **21**, 97, 1956.
4. G. M. Kosolapoff and C. H. Roy, J. Org. Chem., **26**, 1896, 1961.
5. F. W. Hoffmann, J. Org. Chem., **15**, 425, 1950.
6. A. Kaluszyner, J. Org. Chem., **22**, 834, 1957.

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