Pyrimidines. 8. Chlorination of 6-Methyluracil with Phosphorus Oxychloride in the Presence of Trialkyamines

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The effect of the tertiary amines triethyl, tri-*n*-propyl, and tri-*n*-butylamines on the chlorination of 6-methyluracil by phosphorus oxychloride was studied. A comparison with the reaction of preformed 2,4-dichloro-6-methylpyrimidine and triethylamine in toluene was made. The reaction in phosphorus oxychloride in the presence of triethylamine afforded low yields of 2-diethylamino derivative after short heating periods and high yields of the 2,4-bis(diethylamino) derivative after 188 hours of boiling. Heating the preformed 2,4-dichloro-6-methylpyrimidine in toluene in the presence of triethylamine yielded primarily the 2-diethylaminopyrimidine along with a small amount of the 4-diethylamino isomer. After 188 hours, the product mixture was composed of 87% 2-diethylamino and 13% of 4-diethylamino isomers. Although substituent orientation was essentially the same, the yields of products seem to have been influenced by the dielectric constants of the solvents.

Tri-*n*-propylamine in phosphorus oxychloride yielded solely the dichloropyrimidine, even after 188 hours of boiling, and is recommended as the amine of choice in such chlorination reactions. Tri-*n*-butylamine was the same after 48 hours, but 4% of 4-di-*n*-butylaminopyrimidine was found after 188 hours of heating.

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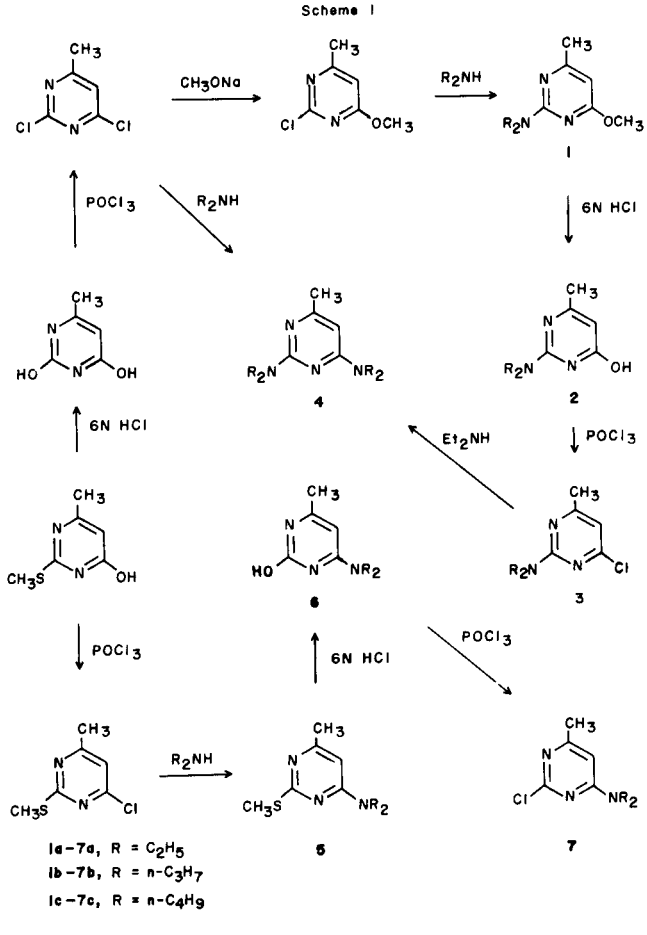
Because of our interest in the antifungal properties of ring-chlorinated pyrimidines [1-4], we undertook systematic studies of the chlorination process [5,6]. It was observed that on prolonged heating (188 hours) of 6-methyluracil with phosphorus oxychloride in the presence of *N,N*-dimethylaniline the following products were formed: 2,4-dichloro-6-methylpyrimidine (66%), 4-chloro-2-*N*-methylanilino-6-methylpyrimidine (23%), 2-chloro-4-*N*-methylanilino-6-methylpyrimidine (6%), and 2,4-bis(*N*-methylanilino)-6-methylpyrimidine (5%). In an earlier study on the effect of tertiary amines on polychloropyrimidines in boiling toluene, high yields of 2-*N,N*-disubstituted amines were reported. The structures of these amines were postulated and not established [7].

It was desired to examine the efficacy of tertiary aliphatic amines on the chlorination of pyrimidines in phosphorus oxychloride and to reinvestigate the amination of the chloropyrimidines with tertiary amines in toluene. A further point of interest was to determine if these results would lead to a facile approach to 2-*N,N*-diethylamino-6-methylpyrimidin-4-ol from the easily accessible 6-methyluracil. The diethylaminopyrimidine is an intermediate for the insecticide, *O,O*-diethyl-*O*-[2-(diethylamino)-6-methyl-4-pyrimidinyl]phosphorothioate [8].

The chlorination of 6-methyluracil in phosphorus oxychloride in the presence of triethylamine (TEA), tri-*n*-propylamine (TPA), and tri-*n*-butylamine (TBA) over 188 hours of reflux time was studied. The reaction of 2,4-dichloro-6-methylpyrimidine with TEA in boiling toluene

Scheme I



was carried out similarly. Products of the reactions were identified by gas chromatography by matching peaks obtained with those from authentic samples of compounds. The preparations of the expected compounds are summarized in Scheme 1 [9].

When 2-chloro-4-methoxy-6-methylpyrimidine [10] was treated with di-*n*-propyl or di-*n*-butylamine in ethanol in a sealed stainless steel pressure vessel at 88° overnight, the respective dialkylamines were obtained, **1b** (74%) and **1c** (89%). The ethyl analogue, **1a**, was prepared by heating diethylamine with the chloropyrimidine in ethanol under reflux for 38 hours (64%). On hydrolysis of the methoxy compounds with 6*N* hydrochloric acid, the pyrimidinols were formed, **2a** (63%), **2b** (52%), and **2c** (78%). Compounds **2** were chlorinated with phosphorus oxychloride to yield the chloro derivatives, **3a** (81%), **3b** (86%), and **3c** (89%). The 2,4-bis(*N,N*-dialkylamino)-6-methylpyrimidines were obtained from 2,4-dichloro-6-methylpyrimidine [6], by the method used for the preparation of compounds **1**, and the yields of **4b** and **4c** were 93% and 77%, respectively. Compound **4a** was prepared from **3a** in 65% yield by heating with diethylamine at 115° overnight.

The 4-*N,N*-dialkylamines **5** were obtained from 4-chloro-6-methyl-2-methylthiopyrimidine [11] by reaction with the corresponding dialkylamine in the stainless steel pressure vessel at 88°. The yields of products were: **5a**, 88%; **5b**, 84%; and **5c**, 76%. Hydrolysis with 6*N* hydrochloric acid yielded **6a** (95%), **6b** (50%), and **6c** (61%). Chlorination with phosphorus oxychloride afforded **7a** (92%), **7b** (81%), and **7c** (64%).

Compounds were characterized by elemental analysis and uv spectra. The 60 MHz nmr spectra were consistent with the assigned structures.

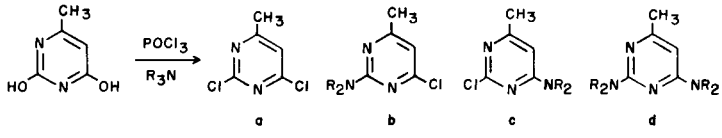
The effect of time on product formation in the reaction of 6-methyluracil with the tertiary amines in boiling phosphorus oxychloride was determined by gas chromatographic assay of samples taken at 3, 24, 48, and 188 hours. The products were identified by matching the chromatograms with those obtained from mixtures of authentic samples of the expected products (6-methyl-2,4-dichloropyrimidine, **3a-c**, **4a-c**, and **7a-c**). The results are summarized in Table 1. With the exception of the amine TEA which yielded 4-5% of the 2-diethylamino compound after 24 hours, none of the other amines afforded any 2-dialkylamino products. No 4-dialkylamino derivatives were observed during the entire course of the reaction. After 48 hours, in addition to the dichloropyrimidine (93%), 4% of **3a** and 3% of **4a** were observed. At the end of the 188 hour period, 11% of 6-methyl-2,4-dichloropyrimidine and 89% of **4a** were found in the mixture. The products obtained from the parallel studies with TPA and TBA showed only the dichloropyrimidine after 48 hours and 188 hours for TPA and 4% of **4c** along with 96% of 6-methyl-2,4-dichloropyrimidine when TBA was the amine.

The results of the time study on the reaction of preformed 6-methyl-2,4-dichloropyrimidine and TEA in boiling toluene are shown in Table 2. The major reaction product of each time interval was **3a**. Seven percent of **7a** was formed along with 54% of **3a** after 16 hours. The final composition of the mixture after 188 hours was **3a** (87%) and **7a** (13%).

The amination of chloropyrimidines by tertiary amines takes place by a Hofmann type reaction, primarily in the 2 position, when the reaction occurs in phosphorus oxychloride in the presence of *N,N*-dimethylaniline [6]. In a similar reaction when the tertiary amine is TEA, substitu-

Table 1

Reaction of 6-Methyluracil with Phosphorus Oxychloride in the Presence of Triethylamine (TEA), Tri-*n*-propylamine (TPA) and Tri-*n*-butylamine (TBA)

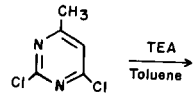


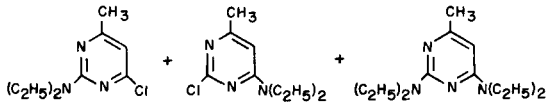
Amine	Reflux Time (hours)															
	3				24				48				188			
	Composition of Mixture, % [a]															
	a	**b**	**c**	**d**	**a**	**b**	**c**	**d**	**a**	**b**	**c**	**d**	**a**	**b**	**c**	**d**
TEA	95	5	0	0	96	4	0	0	93	4	0	3	11	0	0	89
TPA	100	0	0	0	100	0	0	0	100	0	0	0	100	0	0	0
TBA	100	0	0	0	100	0	0	0	100	0	0	0	96	0	0	4

[a] Quantitation by gas chromatography.

Table 2

Reaction of 2,4-Dichloro-6-Methylpyrimidine with Triethylamine (TEA) in Toluene





Reflux Time (hr)	Composition of Mixture, % [a]			
	a	**b**	**c**	**d**
8	72	28	0	0
16	39	54	7	0
24	27	63	10	0
48	12	78	10	0
72	7	81	12	0
188	0	87	13	0

[a] Quantitation by gas chromatography.

tion takes place in low yield only in the 2 position during the first 24 hours; however, a high yield of the bis(2,4-diethylamine) resulted after 188 hours (Table 1). Comparing these results with those obtained when the reaction is carried out in toluene in the presence of TEA (Table 2), the orientation of the amine is essentially the same but in high yield. A by-product of 4-diethylaminopyrimidine is also observed in low yield and no bis dialkylamine is found after 188 hours. It is suggested that the difference in these reactions may be due to the large difference in dielectric constants of the two solvents [12].

When the tertiary amine employed was TPA, no amination took place after 188 hours of heating, and with TBA a small amount of the bis(dibutylamino) compound was detected between 48 and 188 hours. It appears that tri-*n*-propylamine is the base of choice for use in the chlorination of pyrimidines by phosphorus oxychloride.

Although **2a** was prepared without difficulty, it does not seem that the reactions studied would lead to the facile approch sought.

EXPERIMENTAL

Melting points were taken on a Thomas-Hoover melting point apparatus and are uncorrected. Ultraviolet spectra were gotten with a Perkin-Elmer Lambda 5 uv/vis spectrophotometer, and refractive indices were taken with an Abbe-3L, B & L refractometer. 60 MHz nmr spectra were obtained with a Varian A-60A spectrometer. The purity of samples and the course of reactions were established by gas chromatography which was performed on a Varian Aerograph Model 1200 gas chromatograph with a flame ionization detector to which was attached a Varian Model 20 recorder. The column employed was 5 feet × 1/8 inch o.d. packed with 5% OV-101 on 80-100 mesh Gas Chrom Q.

2-*N,N*-Diethylamino-4-methoxy-6-methylpyrimidine (**1a**).

2-Chloro-4-methoxy-6-methylpyrimidine [10] (15.9 g, 0.1 mole), diethylamine (14.6 g, 0.2 mole), and 100 ml of ethanol were heated under reflux for 38 hours. The ethanol was removed in a rotary evaporator under vacuum, and the residue was partitioned between ether and water. The ether layer was washed with water and dried over sodium sulfate. After vacuum evaporation of the ether, the residue was distilled under vacuum. The product boiled at 66° (0.05 mm) and yielded 11.5 g (59%) of compound, n_D^{25} 1.5055; uv (methanol): λ max 245 (ε 1869), 287 (ε 420).

The same reaction mixture heated in a stainless steel pressure vessel at 88° for 6 hours yielded 64% of product.

Anal. Calcd. for $C_{10}H_{17}N_3O$: C, 61.51; H, 8.78; N, 21.52. Found: C, 61.73; H, 8.87; N, 21.23.

2-*N,N*-Di-*n*-propylamino-4-methoxy-6-methylpyrimidine (**1b**).

The title compound was prepared in the stainless steel pressure vessel by heating at 88° overnight and purified in the same manner as **1a**. The yield of product was 74%, bp 82° (0.01 mm), n_D^{25} 1.4987; uv (methanol): λ max 246 (ε 1944), 287 (428); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.20 (6-CH_3), 5.73 (5-H).

Anal. Calcd. for $C_{12}H_{21}N_3O$: C, 64.54; H, 9.48; N, 18.82. Found: C, 64.44; H, 9.63; N, 19.02.

2-*N,N*-Di-*n*-butylamino-4-methoxy-6-methylpyrimidine (**1c**).

Compound **1c** was prepared in the same manner as **1b** in 89% yield, bp 123-124° (0.4 mm), n_D^{25} 1.4946; uv (methanol): λ max 246 (ε 2031), 288 (437); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.15 (6-CH_3), 5.68 (5-H).

Anal. Calcd. for $C_{14}H_{25}N_3O$: C, 66.89; H, 10.03; N, 16.72. Found: C, 66.99; H, 10.15; N, 17.00

2-*N,N*-Diethylamino-6-methylpyrimidin-4-ol (**2a**).

A suspension of **1a** (12.5 g, 0.075 mole) in 125 ml of 6*N* hydrochloric acid was heated with stirring under reflux overnight. The aqueous acid was removed by vacuum evaporation, and the residue was dissolved in 100 ml of water. Pyridine was added to *p*H 7, and the solution was refrigerated overnight. The product was removed by filtration, washed with water, and dried at 70° overnight. The compound was obtained in 80% yield, and the analytical sample was crystallized from 10% aqueous ethanol mp 133-134°; uv (methanol): λ max 227 (ε 1513), 298 (808); nmr [60 MHz (DMSO-d_6, TMS)]: δ 2.05 (6-CH_3), 5.43 (5-H).

Anal. Calcd. for $C_9H_{15}N_3O$: C, 59.64; H, 8.34; N, 23.19. Found: C, 59.75; H, 8.15; N, 23.08.

2-*N,N*-Di-*n*-propylamino-6-methylpyrimidin-4-ol (**2b**).

Compound **2b** was prepared from **1b** by the same procedure as for **2a**. The product was obtained in 52% yield, and the analytical sample was crystallized from 50% aqueous ethanol, mp 110-111°; uv (methanol): λ max 227 (ε 1583), 298 (864); nmr [60 MHz (DMSO-d_6)]: δ 2.03 (6-CH_3), 5.42 (5-H).

Anal. Calcd. for $C_{11}H_{19}N_3O$: C, 63.13; H, 9.15; N, 20.08. Found: C, 63.14; H, 9.03; N, 20.37.

2-*N,N*-Di-*n*-butylamino-6-methylpyrimidin-4-ol (**2c**).

The title compound was prepared from **1c** in the same manner as **2a** and **2b**. The product was obtained in 78% yield, and the analytical sample was crystallized from 75% aqueous ethanol, mp 99°; uv (methanol): λ max 228 (ε 1564), 299 (891); nmr [60 MHz (DMSO-d_6, TMS)]: δ 2.03 (6-CH_3), 5.40 (5-H).

Anal. Calcd. for $C_{13}H_{23}N_3O$: C, 65.79; H, 9.77; N, 17.71. Found: C, 65.54; H, 9.79; N, 17.95.

4-Chloro-2-*N,N*-diethylamino-6-methylpyrimidine (**3a**).

A suspension of **2a** (13.5 g, 0.074 mole) in 135 ml of phosphorus oxy-

chloride was heated under reflux for 3 hours. The phosphorus oxychloride was removed under vacuum, and the residue was poured into an ice-water slurry. The aqueous material was extracted with ether, and the ether solution was washed with water and dried over sodium sulfate. After evaporation of the ether, the residue was distilled, bp 66° (0.01 mm). The yield of product was 81%, n_D^{25} 1.5284; uv (methanol): λ max 249 (ε 2250), 309 (314); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.25 (6-CH_3), 6.27 (5-H).

Anal. Calcd. for $C_9H_{14}ClN_3$: C, 54.13; H, 7.07; Cl, 17.75; N, 21.04. Found: C, 54.01; H, 7.00; Cl, 18.03; N, 21.21.

4-Chloro-2-*N,N*-di-*n*-propylamino-6-methylpyrimidine (**3b**).

Compound **3b** was prepared from **2b** in 86% yield in the same manner as **3a** was prepared from **2a**. The product boiled at 84° (0.01 mm), n_D^{25} 1.5183; uv (methanol): λ max 250 (ε 2246); 311 (296); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.23 (6-CH_3), 6.27 (5-H).

Anal. Calcd. for $C_{11}H_{18}ClN_3$: C, 58.01; H, 7.97; Cl, 15.57; N, 18.45. Found: C, 58.16; H, 8.03; Cl, 15.47; N, 18.34.

4-Chloro-2-*N,N*-di-*n*-butylamino-6-methylpyrimidine (**3c**).

The title compound was obtained from **2c** in 89% yield in the same manner as **3a** was prepared from **2a**. The compound boiled at 92-93° (0.01 mm), n_D^{25} 1.5096; uv (methanol): λ max 250 (ε 2240), 311 (291); nmr [60 MHz (deuteriochloroform, TMS)]: 2.25 (6-CH_3), 6.27 (5-H).

Anal. Calcd. for $C_{13}H_{22}ClN_3$: C, 61.04; H, 8.67; Cl, 13.86; N, 16.43. Found: C, 60.94; H, 8.50; Cl, 13.92; N, 16.71.

2,4-bis(*N,N*-Diethylamino)-6-methylpyrimidine (**4a**).

A mixture of **3a** (10.2 g, 0.05 mole) in 30 ml of ethanol and diethylamine (8.7 g, 0.1 mole) in 40 ml of ethanol was sealed in a stainless steel pressure vessel and kept at 115° overnight. The alcohol was vacuum evaporated, and the residue was dissolved in ether. The ether layer was washed with water, dried over sodium sulfate, and evaporated under vacuum. The residue was distilled, bp 97° (0.01 mm), and the product was obtained in 65% yield, n_D^{25} 1.5252; uv (methanol): λ max 230 (ε 2778), 293 (814); nmr [60 MHz (deuteriochloform, TMS)]: δ 2.18 (6-CH_3), 5.55 (5-H).

Anal. Calcd. for $C_{13}H_{24}N_4$: C, 66.06; H, 10.23; N, 23.71. Found: C, 66.04; H, 10.06; N, 23.98.

2,4-bis(*N,N*-Di-*n*-propylamino)-6-methylpyrimidine (**4b**).

A mixture of 2,4-dichloro-6-methylpyrimidine (10 g, 0.06 mole) in 30 ml of ethanol and di-*n*-propylamine (24.3 g, 0.24 mole) in 40 ml of ethanol was heated in a stainless steel pressure vessel at 88° overnight. The solvent was removed under vacuum, and the residue was partitioned between ether and water. The ether layer was washed with water, dried over sodium sulfate, and vacuum evaporated. The residue was distilled, bp 161° (1.0 mm), and the product was obtained in 93% yield, n_D^{25} 1.5127; uv (methanol): λ max 230 (ε 2653), 294 (797); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.17 (6-CH_3), 5.53 (5-H).

Anal. Calcd. for $C_{17}H_{32}N_4$: C, 69.81; H, 11.03; N, 19.16. Found: C, 69.78; H, 11.14; N, 19.39.

2,4-bis(*N,N*-Di-*n*-butylamino)-6-methylpyrimidine (**4c**).

The title compound was prepared from 2,4-dichloro-6-methylpyrimidine by the same procedure as **4b**. Compound **4c** was obtained in 77% yield, bp 154° (0.01 mm), n_D^{25} 1.5425; uv (methanol): λ max 230 (ε 2812), 295 (845); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.17 (6-CH_3), 5.52 (5-H).

Anal. Calcd. for $C_{21}H_{40}N_4$: C, 72.36; H, 11.57; N, 16.07. Found: C, 72.62; H, 11.52; N, 16.33.

4-*N,N*-Diethylamino-6-methyl-2-methylthiopyrimidine (**5a**).

A mixture of 4-chloro-6-methyl-2-methylthiopyrimidine [11] (26.2 g, 0.15 mole in 30 ml of ethanol) and diethylamine (21.9 g, 0.3 mole in 40 ml of ethanol) was heated in a stainless steel pressure vessel at 88° for 6 hours. The product was recovered in the same manner as **4c**. Compound **5a** was obtained in 88% yield, bp 124° (0.1 mm), n_D^{25} 1.5678; uv (methanol): λ max 239 (ε 2501), 291 (712); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.25 (6-CH_3), 5.90 (5-H).

Anal. Calcd. for $C_{10}H_{17}N_3S$: C, 56.83; H, 8.11; N, 19.88; S, 15.18. Found: C, 57.08; H, 8.14; N, 19.78; S, 15.45.

4-*N,N*-Di-*n*-propylamino-6-methyl-2-methylthiopyrimidine (**5b**).

The title compound was prepared in the same manner as **5a**. The yield of product was 80%, bp 128° (0.03 mm), n_D^{25} 1.5519; uv (methanol): λ max 240 (ε 2464), 291 (722); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.25 (6-CH_3), 5.88 (5-H).

Anal. Calcd. for $C_{12}H_{21}N_3S$: C, 60.21; H, 8.84; N, 17.55; S, 13.40. Found: C, 60.13; H, 8.88; N, 17.52; S, 13.28.

4-*N,N*-Di-*n*-butylamino-6-methyl-2-methylthiopyrimidine (**5c**).

Compound **5c** was prepared by the same method as **5a** in 76% yield, bp 132° (0.05 mm), n_D^{25} 1.5400; uv (methanol): λ max 240 (ε 2517), 291 (736); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.25 (6-CH_3), 5.90 (5-H).

Anal. Calcd. for $C_{14}H_{25}N_3S$: C, 62.87; H, 9.42; N, 15.71; S, 11.99. Found: C, 62.93; H, 9.33; N, 15.79; S, 12.17.

4-*N,N*-Diethylamino-6-methylpyrimidin-2-ol (**6a**).

A suspension of **5a** (25.4 g, 0.12 mole) in 130 ml of 6*N* hydrochloric acid was heated under reflux with stirring overnight. After removal of the aqueous acid in the rotary evaporator under vacuum, the residue was dissolved in 150 ml of water, adjusted to *p*H 7.0 with pyridine, and refrigerated overnight. The product was recovered in 61% yield by filtration, washing with water, and drying at 70° overnight. The analytical sample was crystallized from water, mp 228-229°; uv (methanol): λ max 206 (ε 2205), 275 (1242); nmr [60 MHz (DMSO-d_6, TMS)]: δ 2.07 (6-CH_3), 5.75 (5-H).

Anal. Calcd. for $C_9H_{15}N_3O$: C, 59.64; H, 8.34; N, 23.19. Found: C, 59.51; H, 8.41; N, 22.97.

4-*N,N*-D-*n*-propylamino-6-methylpyrimidin-2-ol (**6b**).

Compound **6b** was prepared from **5b** in the same manner as **6a** was obtained from **5a**. The yield of product was 50%, and the analytical sample was crystallized from water, mp 176-177°; uv (methanol): λ max 207 (ε 2169), 275 (1271); nmr [60 MHz (DMSO-d_6, TMS)]: δ 2.07 (6-CH_3), 5.68 (5-H).

Anal. Calcd. for $C_{11}H_{19}N_3O$: C, 63.13; H, 9.15; N, 20.08. Found: C, 63.13; H, 8.88; N, 19.77.

4-*N,N*-Di-*n*-butylamino-6-methylpyrimidin-2-ol (**6c**).

The title compound was prepared from **5c** in the same manner as **6a** was obtained from **5a**. The yield of product was 61%, and the analytical sample was crystallized from 70% aqueous ethanol, mp 155-156°; uv (methanol): λ max 207 (ε 2200), 276 (1287); nmr [60 MHz (DMSO-d_6, TMS)]: δ 2.08 (6-CH_3), 5.67 (5-H).

Anal. Calcd. for $C_{13}H_{23}N_3O$: C, 65.79; H, 9.77; N, 17.71. Found: C, 65.64; H. 9.63; N, 17.63.

2-Chloro-4-*N,N*-diethylamino-6-methylpyrimidine (**7a**).

Compound **7a** was prepared from **6a** by the same method as **3a** was prepared from **2a**. The yield of product was 92%, bp 109° (0.03 mm) n_D^{25} 1.5438; uv (methanol): λ max 253 (ε 1273), 280 (548); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.32 (6-CH_3), 6.12 (5-H).

Anal. Calcd. for $C_9H_{14}ClN_3$: C, 54.13; H, 7.07; Cl, 17.75; N, 21.04. Found: C, 54.41; H, 7.28; Cl, 18.05; N, 20.95.

2-Chloro-4-*N,N*-di-*n*-propylamino-6-methylpyrimidine (**7b**).

The title compound was prepared from **6b** as above. The product was obtained in 81% yield, bp 118° (0.02 mm), n_D^{25} 1.5312; uv (methanol): λ max 254 (ε 1732), 281 (558); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.30 (6-CH_3), 6.10 (5H).

Anal. Calcd. for $C_{11}H_{18}ClN_3$: C, 58.01; H, 7.97; Cl, 15.57; N, 18.45. Found: C, 58.21; H, 7.98; Cl, 15.85; N, 18.77.

2-Chloro-4-*N*,*N*-di-*n*-butylamino-6-methylpyrimidine (**7c**).

Compound **7c** was prepared from **6c** in a manner similar to the preparation of **3a** from **2a**. The product was obtained in 64% yield, bp 134-135° (0.03 mm), n_D^{25} 1.5217; uv (methanol): λ max 254 (ε 1762), 282 (505); nmr [60 MHz (deuteriochloroform, TMS)]: δ 2.30 (6-CH_3), 6.10 (5-H).

Anal. Calcd. for $C_{13}H_{22}ClN_3$: C, 61.04; H, 8.67; Cl, 13.86; N, 16.43. Found: C, 61.13; H, 8.65; Cl, 13.91; N, 16.31.

Products Identified by Heating 6-Methyluracil under Reflux with Phosphorus Oxychloride in the Presence of TEA, TPA, and TBA. Respectively, for 3, 24, 48, and 188 Hours.

To 25 ml portions of phosphorus oxychloride were added 6-methyluracil (2.5 g, 0.02 mole) together with 2 molar equivalents of the respective tertiary amine. The mixtures were heated under reflux, and 1 ml aliquots were removed after each time period. The aliquots were poured onto ice and extracted with ether (3 × 10 ml). The extract was dried over calcium chloride and gas chromatographed. Quantitation was accomplished by integrating the areas under the curves. The data are summarized in Table 1.

Products Identified by Heating 2,4-Dichloro-6-methylpyrimidine in Toluene under Reflux with Triethylamine for 8, 16, 24, 48, 72, and 188 Hours.

To a solution of 2,4-dichloro-6-methylpyrimidine (8.1 g, 0.05 mole) in 90 ml of dry toluene was added a solution of triethylamine (10.1 g, 0.1 mole) in 30 ml of toluene. The mixture was heated under reflux, and 1 ml samples were withdrawn after each time period and assayed by gas chromatography without further workup. Quantitation was achieved as above. The results are summarized in Table 2.

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[9] The "hydroxy" pyrimidines will be shown as hydroxy derivatives and not as oxo forms, irrespective of the evidence for the existence of a particular predominant tautomeric form.

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