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Synthesis and Reactions of Some Pyrazine Derivatives

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SYNTHETIC COMMUNICATIONS, 24(13), 1895-1916 (1994)

SYNTHESIS AND REACTIONS OF SOME PYRAZINE DERIVATIVES

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The pharmacodynamic properties[1-3] of substituted amino pyrazines as well as their importance in the synthesis of pteridine and other polyfused heterocyclic systems is well known[4,5]. In this investigation we aim to prepare a new series of condensed heterocyclic systems containing the pyrazine nucleus.

Perchais and Fleury[6] reported on the reaction of active methylene compounds with *O*-paratoluenesulphonylisonitrosomalodinitrile (OTMD) in basic medium to give salts of 1,1,3,3-tetracyano-2-azapropenide (TCAP) as well as polysustituted pyrazines derived from cyclization of these anions. These reactions offer an easy and versatile route to obtain 3,5-dicyanopyrazine 1 which is the result of the reaction of OTMD with malononitrile in pyridine followed by cyclization of the pyridinium salt in an

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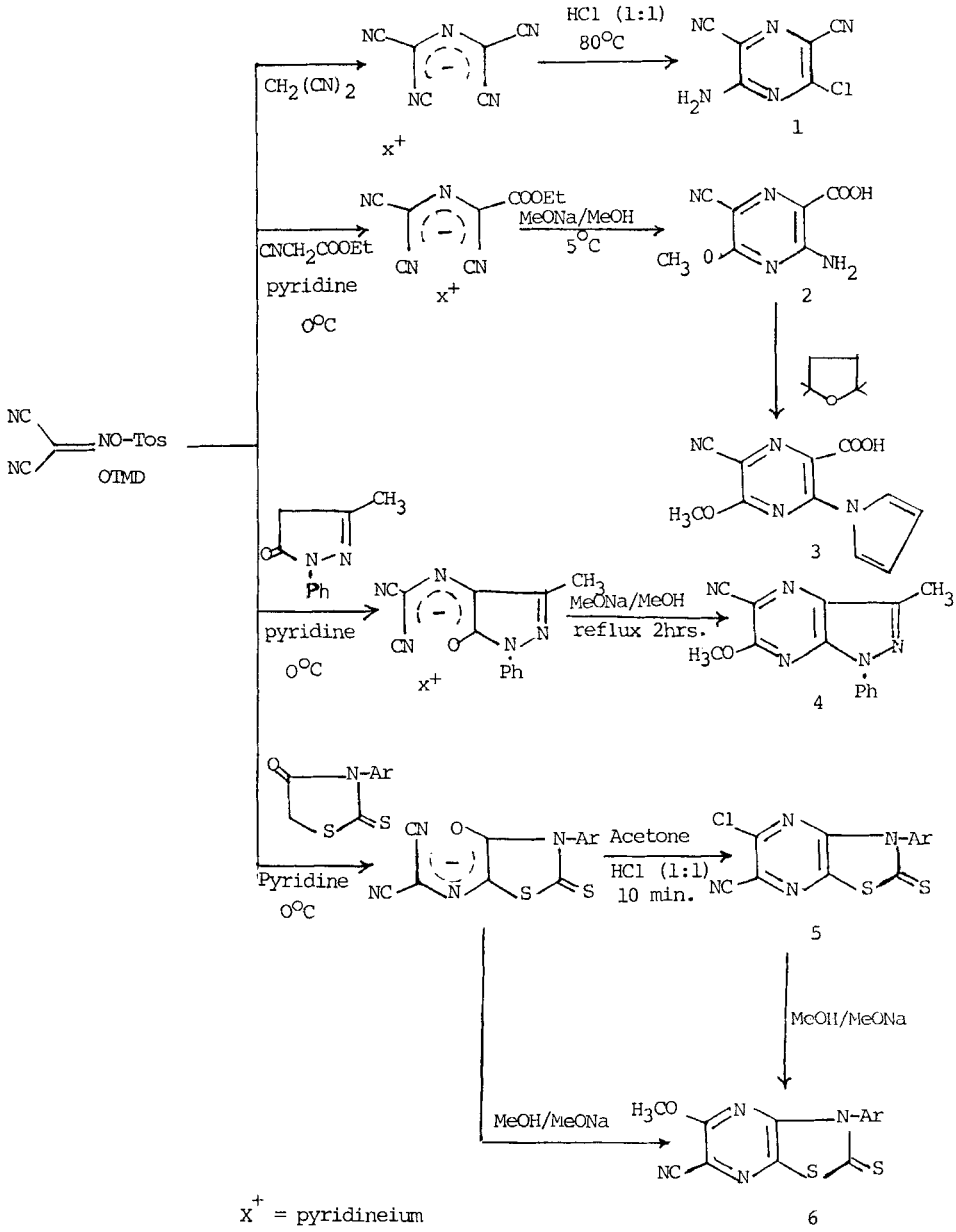
acidic medium (scheme **A**). Similarly we treated OTMD with ethyl cyanoacetate to obtain the 2-azapropenide salt. Cyclization of this salt in MeOH/MeONa at 5 °C gave after acidification 2-amino-3- carboxy-5-cyano-6-methoxypyrazine **2** (scheme **A**). The amino group in this compound was converted into the N-pyrryl ring derivative **3** on reaction with 2,5-dimethoxytetrahydrofuran in acetic acid.

The reaction of OTMD with N-phenylpyrazol-5-one in pyridine at 5 °C was reported[6] and the authors obtained the corresponding 2-azapropenide salt. We, however, were able to cyclize this salt into 5-cyano-6-methoxy-N-phenylpyrazolo[4,5-b]pyrazine **4** on reflux in a MeOH/MeONa solution. Similarly we treated OTMD with 2-thiono-3-N(*p*-tolyl)-4-thiazolidinone in pyridine at 0 °C to obtain the corresponding 2-azapropenide salt which was cyclized either in acidic [acetone/HCl 1:1] or basic [MeOH/MeONa] media into 5-chloro-6-cyano-2-thiono-3-N(*p*-tolyl)thiazolo[4,5-b]-pyrazine **5** or 6-cyano-5-methoxy-2-thiono-3-N(*p*-tolyl)thiazolo-[4,5-b]pyrazine **6**, respectively. The cyclization step is assumed to involve a nucleophilic addition at the cyano group either by HCl to give $\underset{\text{Cl}}{\text{C=NH}}$ or by MeOH to give $\underset{\text{OCH}_3}{\text{C=NH}}$ followed by a nucleophilic attack in each case at the C-OH moiety with loss of water. The chloro atom in compound **5** was easily substituted with a methoxy group to give compound **6** (cf. scheme **A**).

From the different reactive polysustituted pyrazines prepared here we investigated in detail 2-amino-6-chloro-3,5-di-



Scheme A

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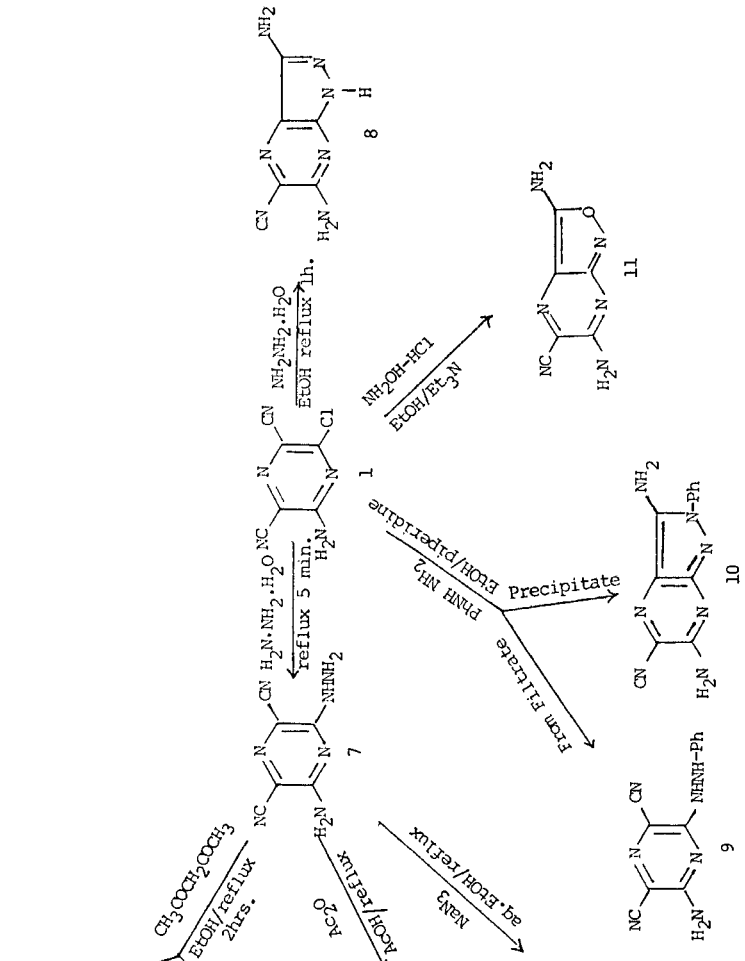
cyanopyrazine **1** with the goal to build new condensed heterocyclic systems. Substitution of the chlorine atom could readily be affected with hydrazine hydrate, phenylhydrazine or hydroxylamine hydrochloride and a 3,6-diamino-5-cyanopyrazolo[4,5-b]pyrazine **8**, 3,6-diamino-5-cyano-2-phenylpyrazolo[4,5-b]pyrazine **10** or 3,6-diamino-5-cyanoisoxazolo[3,4-b]pyrazine **11**, respectively, via subsequent nucleophilic attack of the amino or imino group at the cyano function (scheme **B**), In the former two cases, however, the simple substituted products, namely, 2-amino-3,5-dicyano-6-phenylhydrazinopyrazine **7** and **9** were also obtained. Compound **7** was reacted with acetylacetone in boiling ethanol to give both the simple condensation product **12** as well as the cyclized compound 2-amino-3,5-dicyano-6-(2',4'-dimethylpyrazol-1-yl)-pyrazine **13**. Compound **7** was acylated using a mixture of acetic anhydride/glacial acetic acid to give 4-acetylamino-5,7-dicyano-3-methyltriazolo[1,2-a]pyrazine **14** as a result of intramolecular cyclization with loss of water. The diazotization of compound **7** at 5°C produced the 4-amino-5,7-dicyanotetrazolo[1,5-a]pyrazine **15** through an electrophilic attack of the formed diazo group at the nitrogen atom in pyrazine ring. This compound was also obtained from compound **1** on reaction with sodium azide in aqueous alcoholic solution (cf. scheme **B**).

The reaction of compound **1** with thiourea (cf. scheme **C**) gives different compounds depending on the reaction conditions. Thus in boiling ethanol the reaction gave a solid product which was



Scheme B

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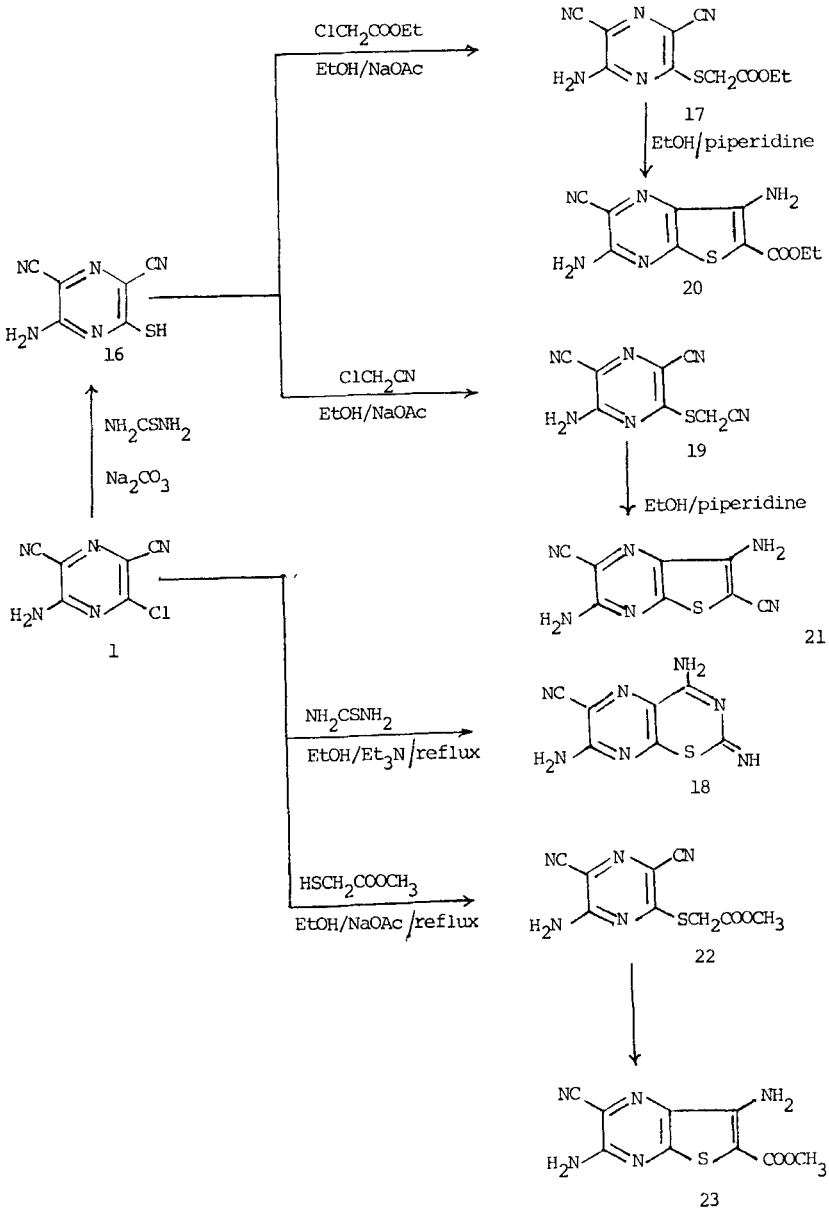
heated in a boiling aqueous sodium carbonate solution. After acidification, 2-amino-3,5-dicyano-6-mercaptopyrazine **16** was obtained. On the other hand, when the reaction was carried out in boiling ethanol containing a catalytic ammount of triethylamnie it gave 3,6-diamino-4-cyano-8- iminopyrazino[3,2-a]1,3-thiazine **17**. Compound **16** was treated with ethyl chloroacetate or chloroacetonitrile in boiling ethanol containing sodium acetate to afford the S-alkylated products 2-amino-6-carbethoxymethyl-mercapto-3,5-dicyanopyrazine **18** or 2-amino-3,5-dicyano-6-cyano-methylmercaptopyrazine **19**, respectively. Cyclization in boiling ethanol containing sodium ethoxide catalyst gave 3,6-diamino-2-carbethoxy-5-cyanothieno[2,3-b]pyrazine **20** or 3,6-diamino-2,5-dicyanothieno[2,3-b]pyrazine **21**, respectively,

The reaction of compound **1** with methyl mercaptoacetate in refluxing ethanol in the presence of sodium acetate gave 2-amino-6-carbomethoxymethylmercapto-3,5-dicyanopyrazine **22** which, again, gave in refluxing ethanol containing piperidine catalyst, the corresponding cyclized product 3,6-diamino-2-carbo-methoxy-5-cyanothieno[2,3-b]- pyrazine **23** (cf. scheme **C**).

In contrast to the amine **2**, the reaction of compound **1** with 2,5-dimethoxytetrahydrofuran failed to afford the corresponding N-pyrryl derivative. However, its N-oxide derivative **24** gave under the same experimental conditions 2-chloro-3-cyano-5-imino-pyrrolo[1,2-a]pyrrolo[2,3-e]pyrazine N-oxide **25** as a result of



Scheme C

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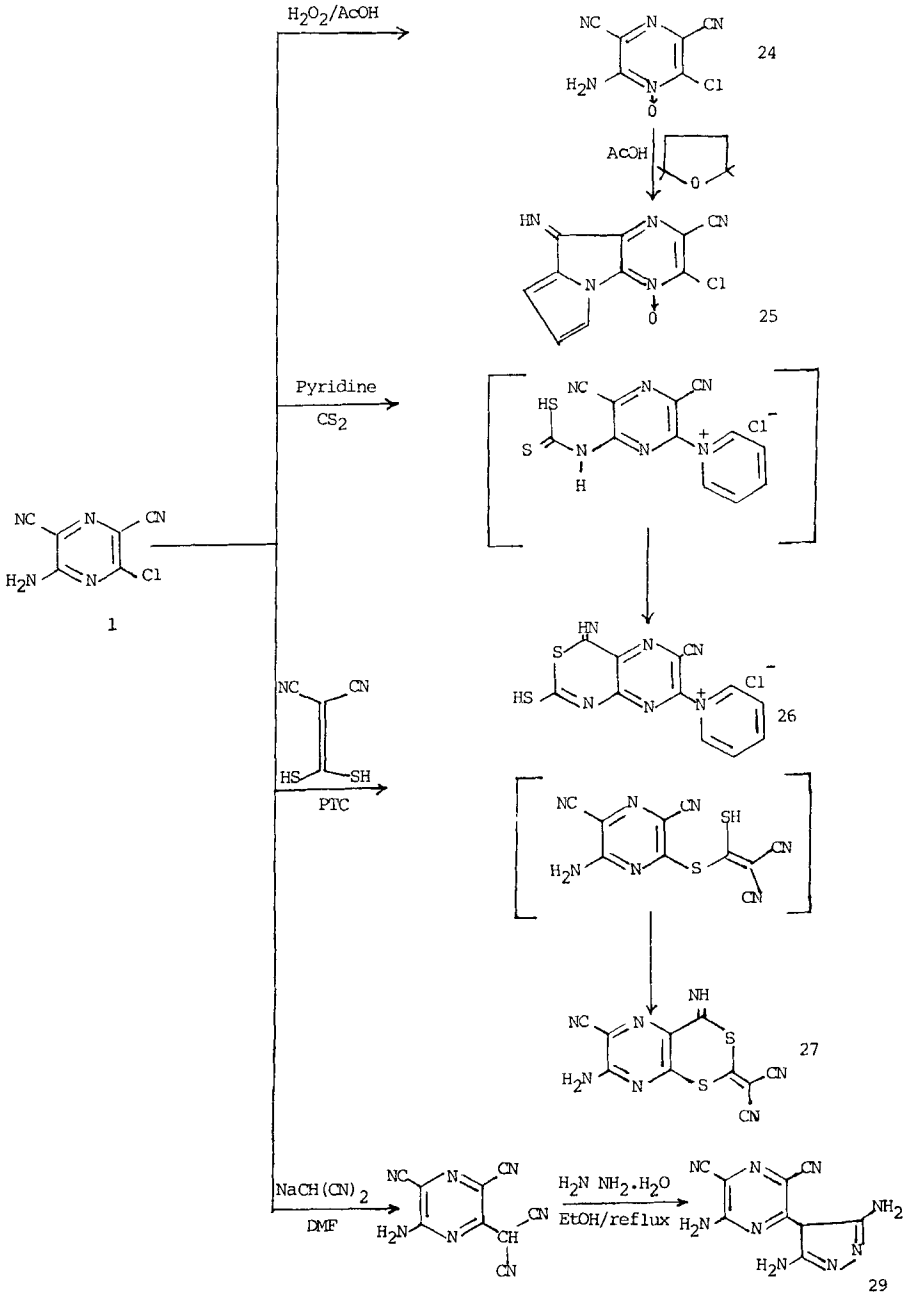
cyclization of N-pyrryl ring to the cyano group (cf. scheme **D**). Compound **1** was also treated with carbon disulphide in pyridine for about 6h and 6-cyano-8-imino-2-mercapto-5-pyridopyrazino-[2,3-e]thiazine chloride **26** was obtained. This can be reasoned by nucleophilic addition of the amino group to CS_2 followed by second nucleophilic addition of the mercapto group at the cyano function.

The reaction of dicyanodimercaptoethylene with compound **1** was carried out under phase-transfer catalysis (PTC) conditions. A nucleophilic attack of the mercapto group at the C-Cl linkage with loss of HCl molecule followed by another nucleophilic attack of the second mercapto group at the cyano function formerly explains the formation of 2-amino-6-cyano-2-dicyanomethylene-4-imino[1,3]dithiono[5,6-b]pyrazine **27**. Compound **1** was also reacted with sodiomalononit- rile in DMF at reflux temperature to give 2-amino-3,5-dicyano-6-dicyanomethylenepyrazine **28**. This compound was allowed to react with hydrazine hydrate in ethanol at reflux temperature to give 2-amino- 3,5-dicyano-6-(3',5'-diaminopyrazol-4-yl)pyrazine **29** (cf. scheme **D**).

EXPERIMENTAL:

2-Amino-3-carboxy-5-cyano-6-methoxyprazine 2 :

A solution of (0.01 mol) of O-paratoluensulphonylisonitroso-somalodinitrile (OTMD) in 80 ml diethyl ether was gradually added



Scheme D

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to (0.01 mol) of ethyl cyanoacetate in 4 ml pyridine at 0°C. The reaction mixture was stirred for 1 hour and the formed solid was filtered off. 0.01 mole of this salt was dissolved in 10 ml methanol and was treated gradually with 0.02 mol of sodium methoxide in methanol at 5°C. The reaction mixture was stirred for 15 minutes and was left for 1 hour at room temperature. The obtained solid was filtered off, dissolved in water and was neutralized with HCL (1:1) and recrystallized from acetonitrile.

3-Carboxy-5-cyano-6-methoxy-2-N-pyrrylopyrazine 3 :

A mixture of compound 2 (0.01 mol) and 2,5 dimethoxytetrahydrofuran (0.01 mol) in 30 ml acetic acid was heated under reflux for 1 hour. The precipitated solid was filtered off, recrystallized from ethanol.

5-Cyano-6-methoxy-3-methyl-1-phenylpyrazolo(4,5-b)pyrazine 4.

To a solution of 3-methyl-1-phenylpyrazolo-5-one (0.01 mol) in a mixture of pyridine (5ml) and diethyl ether (10 ml) at 0°C, OTMD (0.01 mol) in 150 ml of diethy lether was added dropwise. The reaction mixture was refluxed for 2 hours. On concentration, dilution with water, and neutralisation with dilute HCl, the titled product was obtained and was recrystallized from ethanol.

5-Chloro-6-cyano-2-thiono-3-N-P-tolylthiazolo(4,5-b)pyrazine 5:

To a solution of 3-p-tolyl-2-thionothiazolidin-4-one (0.01 mol) in a mixture of pyridine (5 ml) and methylene chloride (10

ml), OTMD (0.01 mol) in 100 ml of methylene chloride was gradually added at 0°C. The reaction mixture was stirred for 1 hour and was then evaporated in vacuo. The residue was throughly washed with water, filtered off and dried. 0.01 mol of this product was heated at reflux temperature for about 10 minutes in 15 ml acetone HCl mixture (1:1). The precipitated compound was filtered off and was recrystallised from ethanol.

6-Cyano-5-methoxy-2-thiono-3-N-p-tolylthiazolo(4,5-b)pyrazine 6:

Method A:

To a solution of 3-p-tolyl-2-thionothiazolidin-4-one(0.01 mol) in mixture of pyridine (5 ml) and methylene chloride (10 ml), OTMD, (0.01 mol) in 100 ml of methylene chloride was added dropwise at 0°C. The reaction mixture was stirred for 1 hour and was then evaporated in vacuo. The residue was throughly washed with water, filtered off and dried to give 1.99g (0.01 mol) of solid product which was added to a solution of (0.02 mol) of sodium metal in 30 ml of methanol. The reaction mixture was refluxed for 2 hours. On concentration, dilution with water and neutralisation with dilute HCl. The titled product was precipitated and was collected by filteration, then recrystallised from ethanol.

Method B:

compound 5 (0.01 mol) was added to a solution of sodium metal (0.02 mol) in 5 ml methanol and the reaction mixture was refluxed

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for 2 hours. On concentration and dilution with water, followed by neutralisation with dilute HCl, the titled product was obtained and was recrystallised from ethanol.

2-Amino-3,5-dicyano-6-hydrazinopyrazine (7):

A mixture of (0.01 mol) of compound 1 and (0.02 mol) of hydrazine hydrate was dissolved in 50 ml ethanol. The mixture was refluxed with stirring for 5 minutes. The solid product was filtered off and recrystallized from ethanol.

3,6-diamino-5-cyanopyrazolo(4,5-b)pyrazine (8):

A mixture of (0.01 mol) of compound 1 and (0.02 mol) of hydrazine hydrate in 50 ml ethanol was refluxed for one hour and the solid product was filtered off and recrystallised from methanol.

2-Amino-3,5-dicyano-6-phenylhydrazinopyrazine (9) and 3,6-diamino-5-cyano-2-phenylpyrazolo(4,5-b)pyrazine (10):

A mixture of compound 1 (0.01 mol) and phenylhydrazine (0.12 mol) was dissolved in 50 ml ethanol. The mixture was heated at reflux temperature for 30 minutes and was then cooled to room temperature. The precipitate was filtered off and recrystallised from dioxane to give compound 10. The filterate was concentrated and was left to cool. The precipitate was filtered off and recrystallized from ethanol to give compound 9.

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4,7-Diamino-5-cyanooxazolo(3,4-b)pyrazine 11 :

An equimolar mixture of compound 1 and hydroxylamine hydrochloride (0.01 mol) was dissolved in 50 ml ethanol, then treated with (0.01 mol) of TEA and heated at reflux temperature for 2 hours. Evaporation affords a residue which was washed thoroughly with water, filtered off, dried and recrystallized from ethanol.

2-Amino-3,5-dicyano-6-(2',4'dimethylpyrazolo-1-yl)pyrazine 13:

A mixture of (0.01 mol) of compound 7 and (0.02 mol) of acetylacetone was dissolved in 30 ml ethanol and refluxed for 2 hours. On cooling, the precipitated solid was collected and recrystallised from ethanol to give 13. The filterate was concentrated to give comp.12 which was recrystallised from ethanol.

4-Acetylamino-5,7-dicyano-3-methyl triazolo(1,2-a)pyrazine 14:

A mixture of 2-amino-3,5-dicyano-6-hydrazinopyrazine 7. Along with 20 ml of acetic anhydride and 20 ml of acetic acid 20 ml was refluuxed for 6 hours. The cooled reaction mixture was poured in ice-cold water and the precipitated solid was recrystallized from ethanol.

4-Amino-5,7-dicyanotetrazolo(1,5-a)pyrazine 15:

Method A:

7 ml 10% solution of sodium nitrite was slowly added to a

solution of 2-amino-3,5-dicyano-6-hydrazinopyrazine 7 (0.002 mol) in 5 ml concentrated hydrochloric acid at 0°C under efficient stirring. The obtained solid was recrystallized from ethanol.

Method B:

A mixture of compound 1 (0.01 mol) and sodium azide (0.02 mol) was dissolved in aqueous ethanol (50 ml, 90%) and was refluxed for 4 hours, left to cool and the obtained product was recrystallised from ethanol.

2-Amino-3,5-dicyano-6-mercaptopyrazine 16:

An equimolar mixture of 1 and thiourea (0.01 mol) in 50 ml ethanol was refluxed for one hour. The precipitated solid was filtered off, dried and was then dissolved in 10% sodium carbonate solution. The mixture was heated for 1 hour, left to cool and filtered off. On acidification of the filterate with acetic acid, a yellow precipitate was formed which recrystallized from ethanol.

3,6-Diamino-4-cyano-8-iminopyrazino(3,2-e)thiazine 17:

A mixture of 1, thiourea and triethylamine (0.01 mol) was refluxed in 50 ml ethanol for 3 hours and was then evaporated in vacuo.The residuue was washed throughly with water, filtered off, dried and recrystallized from ethanol.

2-amino-6-carbethoxymethylmercapto-3,5-dicyanopyrazine 18 and 2-Amino-3,5-dicyano-6-cyanomethylmercaptopyrazine 19.

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General Procedure:

A mixture of compound 16 (0.01 mol), ethyl chloroacetate or chloroacetonitrile (0.011 mol) and sodium acetate (0.015 mol) in ethanol 30 ml was refluxed for 30 minutes. The reaction mixture was left to cool and diluted with water where by compounds 18 or 19 was precipitated, filtered off, washed with water, dried and recrystallized from ethanol.

3,6-Diamino-2,5-dicyanothieno(2,3-b)pyrazine 21 and 3,6-diamino-2-carbethoxy-5-cyanothieno(2,3-b)pyrazine 20:

General Procedure:

To a solution of compounds 18 or 19 (0.01 mol) in 30 ml ethanol a few drops of sodium ethoxide solution was added. The solid obtained was filtered off, dried and recrystallized from ethanol.

2-Amino-6-carbmethoxymethylmercapto-3,5-dicyanopyrazine 22:

A mixture of 1 (0.01 mol), methyl mercaptoacetate (0.01 mol) and sodium acetate (0.015 mol) in 30 ml ethanol was refluxed for 30 minutes. The solid precipitated on cooling was filtered off, washed with water and recrystallized from ethanol.

3,6-Diamino-2-carbmethoxy-5-cyanothieno(2,3-b)pyrazine 23:

To a solution of 22 (0.01 mol) in 50 ml ethanol, a few drops of sodium ethoxide solution (0.5 g sodium/20 ml ethanol) was added. The solution was refluxed for 15 minutes and was left to

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Table 1: Analytical and Spectral Data of The New Compounds Reported .

Product	m.p.[a]	Yield %	Molecular Formula	Analysis Calc./Found. C%	H%	N%	I.R. (Cm^{-1})[b]	^1H-NMR(DMSOd_6)[c] (δppm)
2	255	81	$C_7H_6N_4O_3$ (194.15)	43.30 / 42.90	3.11 / 3.00	28.86 / 28.70	3600-2900 (COOH, NH_2), 2220(CN); 1630(C=N).	8.20(s,^{1}H,COOH);7.80-7-60 (br,2H,NH_2);4.10(s,3H,OCH_3)
3	127	86	$C_{11}H_{12}N_4O_3$ (244.20)	54.10 / 54.40	3.30 / 3.18	22.94 / 22.77	3600-2900(COOH,OH); 2220(CN);1630(C=N)	8.90(s,H,COOH);8.00-7.80(m, 2H,α,α'-pyrryl);6.60-6.40 (m,2H,β,β'-pyrryl);4.20(s, 3H,OCH_3).
4	219	71	$C_{14}H_{11}N_5O$ (265.27)	63.38 / 63.20	4.18 / 4.29	26.40 / 26.26	2980(C-H ali.)2190(CN), 1620(C=N).	8.20-8.00(m,2H,phenyl),7.40-7.20(m,3H,phenyl),4.10(s,3H, OCH_3).
5	183	78	$C_{13}H_7N_4S_2Cl$; (306.66)	46.95 / 46.65	2.02 / 2.07	18.27 / 18.17	3050(C-H);2980(C-H ali.); 2210(CN); 1670(C=S); 1650(C=N).	7.50-7.10(m,4H,phenyl),3.10 (s,3H,P-CH_3)
6	89	a)63; b)79	$C_{14}H_{10}N_4S_2O$ (314.37)	53.48 / 53.90	3.20 / 3.09	17.82 / 17.77	3030(C-H);2980(C-H), 2220(CN),1670(C=S), 1630(C=N).	7.50-7.20(br,4H,phenyl),4:10 (s,3H,OCH_3).
7	266[b]	62	$C_6H_5N_7$ (175.15)	41.41 / 40.85	2.87 / 2.91	55.98 / 55.54	3370,3250,3210(NH,NH_2); 2220-2210(CN);1650(C=N)	8.20-8.00(br,1H,NH);6.70(s, 2H,NH_2,pyrazine),5.60(s,2H, NH_2).
8	285[d]	74	$C_6H_5N_7$ (175.15)	41.41 / 40.85	2.87 / 2.91	55.98 / 55.54	3450,3370,3280(NH,NH_2); 2220(CN), 1670(C=N).	10.50-10.20(br,1H,NH);7.00 (s,2H,NH_2,pyrazine);5.90(s, 2H,NH_2pyrazole).

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9	> 300	20	$C_{12}H_9N_7$	57.36	3.61	39.03	3420,3320,3210(NH,NH_2);	9.20-9.00(br,1H,NH);8.70-
			(251.25)	57.33	3.57	38.99	2220,2210(CN);1650(C=N); 1620(C=C).	8.50(br,2H,HNph);7.60-7.45 (br,2H,NH_2),7.40-7.25(m,5H, ph).
10	215[d]	55	$C_{12}H_9N_7$	57.36	3.61	39.03	3400,3310,3210($2NH_2$),	7.90-7.70(br,4H,NH_2);7.60-
			(251.15)	57.30	3.55	39.00	2220(CN);1670(C=N);1660 (C=C).	7.40(m,5H,phenyl).
11	270	75	$C_6H_4N_6O$	40.91	2.28	47.71	3490,3380,3300(NH),2220	9.00-8.80(br,2H,NH_2pyrazine);
			(176.14)	40.59	2.32	47.92	(CN); 1650(C=N).	5.20-4.90(br,2H,NH_2isooxazole)
12	230	30	$C_{11}H_{11}N_7O$	51.35	4.31	38.11	3370,3260,3210(NH,NH_2),	8.20(s,1H,NH),7.20(br,2H,NH_2)
			(257.25)	51.23	4.40	38.00	2950,2890(C-H ali.);2230, 2220(CN),1710(C=O),1650 (C=N).	4.20(br,2H,CH_2),2.70(s,3H, $COCH_3$);2.20(s,3H,CH_3)
13	> 300	41	$C_{11}H_9N_7$	55.22	3.79	40.98	3400,3310(NH_2);3030(C-H),	7.20(br,2H,NH_2),6.10(s,1H,
			(239.24)	55.42	3.53	40.57	2970(C-H ali.),2220,2210 (CN).	CH),2.30(α,6H,$2CH_3$).
14	275	54	$C_{10}H_7N_7O$	49.79	2.92	40.65	3600-3200(NH),2980(C-H),	10.60(s,1H,NH),2.70(s,3H,
			(241.20)	49.67	2.93	40.31	2220,2200(CN),1680(C=O)	$COCH_3$);2.10(s,3H,CH_3).
15	170	a)53;	$C_6H_2N_8$	38.17	1.08	60.20	3350,3230(NH_2)2220,2210	4.90-4.70(br,2H,NH_2).
		b)64	(186.14)	38.57	0.98	60.00	(CN);1650(C=N).	
16	298	50	$C_6H_3N_5S$	40.67	1.70	39.53	3340,3330(NH_2),2220,2210	8.20-8.00(br,2H,NH_2);7.20
			(177.18)	40.42	1.63	39.33	(CN).	(s,1H,SH).
17	195	63	$C_7H_5N_7S$	38.34	2.30	44.72	3600-3150(NH,NH_2),2215	10.00-9.80(br,1H,NH),9.00-
			(219.23)	38.51	2.27	44.60	(CN), 1640(C=N).	8.80(br,2H,NH_2pyrazine).

(continued)

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Table 1 Continued

18	159	76	$C_{10}H_9N_5SO_2$ (263.27)	45.62 45.58	3.45 3.36	26.60 26.49	3300,3200(NH_2);2950,2900 (C-H);2200,2190(CN),1720 (C=O ester).	7.00-6.80(br,2H,NH_2);4.40 (s,2H,CH_2),4.30-4.10(q,2H, CH_2),1.30-1.10(t,3H,CH_3).
19	182	78	$C_8H_4N_6S$ (216.22)	44.44 44.23	1.86 1.75	38.87 38.53	3350,3250(NH_2);2980 (C-H ali.),2210,2200(CN); 1630(C=N).	8.20-8.00(br,2H,NH_2);4.10 (s,2H,CH_2).
20	225	79	$C_{10}H_9N_5SO_2$ (263.27)	45.62 45.57	3.45 3.32	26.60 26.50	3400,3320,3170(NH_2); 2920(C-H ali.);2220(CN); 1710(C=O).	7.80-7.60(br,2H,NH_2);7.00-6.80(br,2H,NH_2)4.20-4.00 (q.2H,CH_2);1.30-1.10(t,3H, CH_3).
21	217	74	$C_8H_4N_6S$ (216.22)	44.44 44.26	1.86 1.80	38.87 38.70	3500,3350,3270(NH_2), 2215,2210(CN),1640(C=N)	8.30-8.10(br,2H,NH_2 pyrazine) 7.50-7.20(br,2H,NH_2 thiophene)
22	157	80	$C_9H_7N_5SO_2$ (249.25)	43.37 43.42	2.83 2.73	28.10 28.27	3320,3210(NH_2),2350, 2920(C-H ali.),2210(CN), 1710(C=O ester).	8.50-8.30(br,2H,NH_2),4.20(s, 2H,CH_2);3.70(s,3H,CH_3).
23	317	38	$C_9H_7N_5SO_2$ (249.25)	43.37 43.40	2.83 2.78	28.10 28.19	3450,3320,3200(NH_2), 2910(C-H ali.),2200(CN); 1690(C=O ester)	8.00-7.80(br,2H,NH_2);7.20-7.00(br,2H,NH_2),3.90(s,3H, CH_3).
24	199	61	$C_6H_2N_5OCl$ (195.62)	36.80 36.72	2.02 2.00	70.03 69.92	3500,3400(NH_2),2215, 2210(CN),1650(C=N).	8.30-8.10(br,2H,NH_2).
25	110	61	$C_{10}H_4N_5OCl$ (245.67)	48.89 48.82	1.64 1.56	28.51 28.31	3600-3200(NH),3050(C-H arom.)2220(CN),1650(C=N).	9.00-8.80(br,1H,NH),7.10 (d,1H,α-pyrryl);6.60-6.40 (m, 2H,β ,β' -pyrryl).

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26	>300	59	$C_{12}H_7N_6S_2Cl$ (334.84)	43.04 42.75	2.11 2.07	25.10 24.79	3600-3200(NH_2),3050(O-H arom.);2220(CN),1630 (C=N).	9.80-9.70(br,1H,NH),8.80-8.60(br,5H,pyridine),4.20(s, 1H,SH).
27	>300	70	$C_{10}H_3N_7S_2$ (285.30)	42.10 41.75	1.06 1.00	34.37 34.21	3480,3370,3210(NH,NH_2); 2200,2190(CN);1690(C=N).	8.75-8.65(br,1H,NH);7.60-7.30(br,2H,NH_2).
28	167	52	$C_9H_3N_7$ (209.17)	51.68 50.49	1.45 1.37	46.88 46.65	3370,3260(NH_2),2970 (C-H ali.);2220,2215 (CN).	8.40-8.20(br,2H,NH_2),4.00 (s,1H,CH).
29	185	71	$C_9H_7N_9$ (240.21)	44.99 44.80	2.52 2.47	52.48 52.31	3500-3200(NH_2),2980 (C-H ali.),2220,2200(CN); 1650(C=N).	7.90-7.70(br,2H,NH_2),6.30 (s,1H,CH);5.70-5.40(br,4H. $2NH_2$ pyrazole).

(a) Not corrected.

(b) Measured with a Pye Unicam SP 1200 Spectrophotometer.

(c) Measured with a Varian EM360L Spectrometer Using TMS as internal Standard.

cool. The obtained solid was filtered off, dried and recrystallized from ethanol.

2-Amino-6-chloro-3,5-dicyanopyrazine 1-oxide 24:

Compound 1 (0.01 mol) in acetic acid 30 ml was mixed with 10 ml of H_2O_2, then heated with stirring at 60°C for 16 hours and left to cool. The obtained solid was filtered off, and recrystallized from acetic acid.

2-Chloro-3-cyano-5-iminopyrrolo(1,2-a)pyrrolo(2,3-e)pyrazine 1-oxide 25:

An equimolar mixture of compound 24 and 2,5 dimethoxytetrahydrofuran (0.01 mol) was dissolved in 30 ml of acetic acid and was refluxed for one hour. The obtained solid was filtered off, dried and crystallized from ethanol.

6-Cyano-8-imino-2-mercapto-5-pyridopyrazino(2,3-e)thiazine chloride 26:

A mixture of 10.01 mol of compound 1 and carbon disulphide (2 ml) was stirred at room temperature in 30 ml of dry pyridine where a precipitate was formed. The reaction mixture was heated on a water bath for 6 hours. The final precipitate was filtered off, dried and recrystallized from benzene.

2-Amino-6-cyano-2-dicyanomethylene-4-imine[1,3]dithiono(5,6-b) pyrazine 27:

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An equimolar mixture of 1 and dicyanodimercaptoethylene (0.01 mol) in 50 ml benzene and 10 gm. of anhydrous potassium carbonate was stirred at room temperature for 3 hours in presence of (TBAB) as catalyst. The reaction mixture was filtered off and K_2CO_3 layer was dissolved in water. The undissolved compound was filtered off, dried and recrystallized from ethanol.

2-Amino-3,5-dicyano-6-dicyanomethylpyrazine 28:

An equimolar mixture of 1 and sodiomalononitrile (0.01 mol) was refluxed in dimethyl formamide (30 ml) for 2 hours. The precipitated solid was filtered off dried and recrystallised from ethanol.

2-Amino-3,5-dicyano-6-(3',5'diaminopyrazol-4-yl)pyrazine 29:

A mixture of compound 28 (0.01 mol) and hydrazine hydrate(0.02 mol) was refluxed in 50 ml ethanol for 2 hours. The obtained solid was recrystallized from ethanol to give the titled product.

References:

1- "British Pharmaceutical Codex" P.692, Pharmaceuutical Press, Londres(1968).

2- Yoshida S., Japan, Patent 6843(1962), Chem. Abs., 58, 13969(1963).

3- Wilson C.O., Jones T.E., "American Drug Index" Pitman Medical Publ., Londres(1969).

4- Albert A., Brown D. J. and Cheesman G., J. Chem. Soc. 474(1951).

5- Taylor E.C., Perlman K.L., Sword I.P., Sequin-Frey M. and Jacubi P.A., J. Amer. Chem. Soc., 95, 6407(1973).

6- Perchais J. and Fleury J.P. Tetrahedron, 30, 999(1974).

7- Fiaud J.C. and Kagant B., Tetrahedron Letters, 1019(1971).

8- Little E.L., Middleton W. J., Coffman D.D., Engelhardt V.A. and Sausen G.N., J. Amer. Soc. 80, 2832(1958).

9- Krapcho A.P. and Huyffler P.S., J. Org. Chem., 28, 2461(1963).

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