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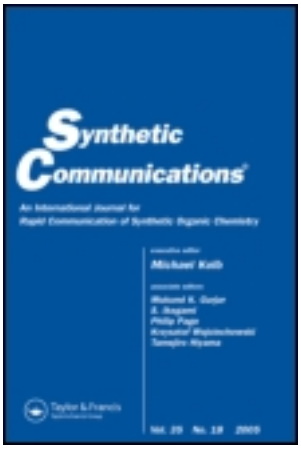

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First Synthesis of *N*-Substituted Amino and *N*-Sulfonylaminated Methylthiopyrimidines: Reaction of Dimethyl *N*-Cyanodithioiminocarbonate With Substituted Hydrazides

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Abstract: A novel and efficient method for the synthesis of a new variety of methylsulfanylpyrimidines by the reaction of dimethyl *N*-cyanodithioiminocarbonate with substituted hydrazides. The synthetic potential of the method is demonstrated.

Keywords: Antimetabolites, cyanoacetohydrazide, dimethyl *N*-cyanodithioiminocarbonate, heterocycles, methylsulfanylpyrimidines, substituted hydrazides

Pyrimidine derivatives, which are structurally related to purine bases and many other biologically active compounds, have attracted much attention from the viewpoint of medicinal chemistry. Because the direct introduction of specific substituents into the pyrimidine nucleus is not easy, syntheses directed to the construction of the ring bearing useful functional groups have been developed.[1] As part of our program directed toward the preparation of potential antimetabolites,[2,3] we have recently reported different successful approaches for the syntheses of purine, folic acid, and pyrimidine analogues.[4–6] Derivatives of these ring systems are interesting as

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antimetabolites in biochemical reactions.[7] The present research deals with a novel synthesis of (3)*N*-substituted amino-6-methylsulfanyl-4-oxo-pyrimidine-5-carbonitriles **6**, **7**, **12**, and **14** and deaza analogues of purine **10** by the reaction of dimethyl *N*-cyanodithioiminocarbonate with substituted hydrazides. As far as we know this is the first example of this approach to be reported for pyrimidine derivatives. Thus, it has been found that *S*,*S*-dimethyl *N*-cyanodithioimidocarbonate **2**, prepared by the reaction of cyanamide **1**, carbon disulfide, and methyl iodide in the presence of alkali, reacted with 1-cyanoacetyl-4-arylmethylidene-semicarbazide **3a–f** at room temperature in the presence of pulverized potassium hydroxide in 1,4-dioxane to give the corresponding 4-oxopyrimidine-(3)*N*-Schiff bases **6**. The structures of **6** were established on the basis of elemental analysis and spectral data (IR, ^{1}H NMR, ^{13}C NMR, and MS). The formation of **6** from the reaction of **2** and **3** is assumed to proceed via Michael addition of the methylene function in **3** onto the double bond in **2**. The formed Michael adducts then cyclized smoothly via CH_3SH elimination and addition to the cyano group. Compounds **6** can also be prepared by the reaction of the corresponding (3)*N*-amino-4-oxopyrimidine **9** with substituted aldehydes in refluxing ethanol containing catalytic amounts of piperidine. When dimethyl *N*-cyanodithioiminocarbonate **2** is treated with cyanoacetohydrazide **8** at room temperature for 24 h in the presence of KOH/dioxane, **9** was obtained in good yield. Compounds **6** reacted with hydrazine in refluxing ethanol contaning catalytic amounts of piperidine to give the corresponding pyrazolo[3,4-d]pyrimidin-4(3*H*)-ones **10**. The structure of compounds **10** was established on the basis of elemental analysis and spectral data. To explore the possibility that this reaction applied to other classes of substituted cyanoacetohydrazide, we investigated the reaction of **2** with cyanoacetobenzoylhydrazide **11**. The latter was prepared from cyanoacetohydrazide **8** with benzoyl chloride.[8] Thus, we treated **11** with one equivalent of compound **2** in dioxane containing a catalytic amount of potassium hydroxide for 24 h at room temperature and obtained the corresponding substituted 6-alkylthio-(3)*N*-benzoylamino-4-oxopyrimidine derivative **12** in moderate yield. The structure of **12** was established on the basis of its elemental analysis and IR, ^{1}H NMR, and MS spectroscopies. Reaction of dimethyl *N*-cyanodithioiminocarbonate with 1-cyanoacetylthiosemicarbazide was also examined. Thus, when **2** was treated with 4-phenyl-1-cyanoacetylthiosemicarbazide **13** in the presence of KOH/dioxane, the *N*-(2-amino-5-cyano-3,4-dihydro-6-methylsulfanyl-4-oxo-3-pyrimidinyl)phenyl thiourea derivative **14** was obtained. Structure **14** was established on the basis of elemental analysis and spectral data (IR, ^{1}H NMR, ^{13}C NMR, and MS). Compounds **12** and **14** can also be prepared by the reaction of the corresponding (3)*N*-amino-4-oxopyrimidine **9** with benzoyl chloride and phenylisothiocyanate, respectively.

To investigate the scope of this reaction further and to establish whether the reaction of dimethyl *N*-cyanodithioiminocarbonate with substituted

cyanohydrazides could be extended to provide a general approach to (3)*N*-substituted-6-methylthio-4-oxopyrimidine-5-carbonitriles, we studied the reaction of cyanodithioiminocarbonate **2** with other functionalized cyanohydrazides. Thus, it has been found that cyanoacetohydrazide **8** reacts with arylsulfonyl chloride in ethanol containing catalytic amounts of piperidine to afford the corresponding *N*-cyanoacetoarylsulfonylhydrazides **15** in good yield. Compounds **15** reacted with **2** in dioxane containing a catalytic amount of potssium hydroxide to yield a product assigned as (3)*N*-arylsulphonylamino-6-alkylthio-4-oxopyrimidine **18**. The structures of **18** were established on the basis of their elemental analysis and spectral data (IR, ^{1}H NMR, and MS). The formation of **18** from **2** and **15** is assumed to proceed via addition of the active methylene group of **15** to the double bond of **2** to give intermediate Michael adducts. The latter loses elements of CH_3SH to yield the intermediate **16**, which cyclized to yield the novel (3)*N*-arylsulphonylamino-6-alkylthio-4-oxopyrimidine derivatives **18**. Compounds **18** reacted with hydrazine in refluxing ethanol containing catalytic amounts of piperidine to give the corresponding purine analogues **19**. The structure of compounds **19** was established on the basis of elemental analysis and spectral data.

In summary, we have achieved a regiospecific synthesis of interesting *N*-substituted amino, *N*-sulfonylaminated-6-alkythio-4-oxopyrimidines, and their corresponding purine analogues by the reaction of dimethyl *N*-cyanodithioiminocarbonate **2** with cyanohydrazides **8**, **11**, **13**, and **15**.

EXPERIMENTAL

All melting points were determined in open glass capillaries on a Gallenkamp melting-point apparatus and are uncorrected. Their spectra were obtained (KBr disc) on a Perkin Elmer/1650 FT-IR instrument. The ^{1}H NMR and ^{13}C NMR spectra were measured in a Varian 400- or Wilmad 270-MHz spectrometer for $(CD_3)_2SO$ solutions using $SiMe_4$ as internal standard. Mass spectra were recorded in a Varian MAT 112 spectrometer. Analytical data were obtained from the Microanalytical Data Center at Cairo University.

2-Amino-4-(methylthio)-6-oxo-1-{[(1*Z*)-arylmethylene]amino}-1,6-dihydropyrimidine-5-carbonitrile (6a–f) and 2-Amino-(3)*N*-arylmethylideneamino-3,4-dihydro-6-methylthio-4-oxopyrimidine-5-carbonitriles (6a-f), General Procedure

Dimethyl N-cyanodithioiminocarbonate **2** (1.46 gm, 0.01 mol) was added to a stirred solution of the 1-cyanoacetyl-4-arylmethylidenesemicarbazid **3** (0.01 mol) in dry dioxane (50 mL) containing potassium hydroxide (0.56 g, 0.01 mol) at room temperature (25°C). The solution was left stirring

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overnight at room temperature; the precipitate solid was collected by filtration and crystallized from the appropriate solvent.

6a: Buff, mp 228°C (from EtOH), yield (84%). IR (KBr) ν_{max}/cm^{-1} 3436, 3331(NH_2), 2207 (CN), and 1629 (C═O). ^{1}H NMR (DMSO) δ 2.55 (s, 3H, SCH_3), 7.44–8.12 (m, 5H, C_6H_5), 8.97 (s, br, 2H, NH_2), 9.00 (s, 1H, ═CH). ^{13}C NMR (DMSO) δ 12.50 (SCH_3), 117.00 (CN), 126.35–132.80 (phenyl carbons), 152.87 (═CH), 155.87 (C-5), 161.01 (C-6), 167.15 (C-2), 169.86 (C-4). $C_{13}H_{11}N_5OS$, calcd. C, 54.73; H, 3.85; N, 24.56; S, 11.22. Found: C, 54.9; H, 4.0; N, 24.7; S, 11.3%.

6b: Buff, mp 300°C (from EtOH), yield (87%). IR(KBr) ν_{max}/cm^{-1} 3427 (NH_2) and 2210 (CN). ^{1}H NMR (DMSO) δ 2.05 (s, 3H, CH_3), 2.55 (s, 3H, SCH_3), 7.39–7.96 (m, 4H, C_6H_5), 8.13 (s, br, 2H, NH_2), 8.86 (s, 1H, ═CH). ^{13}C NMR (DMSO) δ 12.41 (CH_3), 20.53 (SCH_3), 117.4 (CN) 128.09–134.22 (phenyl carbons), 152.61 (═CH), 157.7 (C-5), 160.31 (C-6), 167.38 (C-2), 172.68 (C-4). $C_{14}H_{13}N_5OS$, calcd.: C, 56.19; H, 4.35; N, 23.41; S, 10.70. Found: C, 56.1; H, 4.3; N, 23.5; S, 10.7%.

6c: Brown, mp 300°C (from EtOH), yield (88%). IR (KBr) ν_{max}/cm^{-1} 3316 (NH_2), 2927 (═CH), and 2210 (CN). $C_{13}H_{11}N_5O_2S$, calcd.: C, 51.82; H, 3.65; N, 23.25; S, 10.63. Found: C, 52.0; H, 3.9; N, 23.4; S, 10.7%.

6d: Buff, mp 244°C (from EtOH), yield (85%). IR (KBr) ν_{max}/cm^{-1} 3427 and 3276 (NH_2), 3049 (═CH), 2206 (CN), and 1658 (C═O). ^{1}H NMR (DMSO) δ 2.53 (s, 3H, SCH_3), 3.82 (s, 3H, OCH_3), 7.00–7.95 (m, 4H, C_6H_4), 8.04 (s, br, 2H, NH_2), 8.82 (s,1H, ═CH). ^{13}C NMR (DMSO) δ 12.44 (SCH_3), 55.42 (OCH_3), 114.18(CN), 127.81 (phenyl carbons), 152.88 (═CH), 160.31(C-5), 162.91 (C-6), 169.03 (C-2), 172.31 (C-4). $C_{14}H_{13}N_5O_2S$, (M^+ =315), calcd.: C, 53.33; H, 4.12; N, 22.22; S, 10.15. Found: C, 53.6; H, 4.0; N, 22.3; S, 10.2%.

6e: Brown, mp 260°C (from EtOH), yield (87%). IR (KBr) ν_{max}/cm^{-1} 3651 and 3434 (NH_2), 2927 (═CH), 2212 (CN), and 1671 (C═O). $C_{13}H_{10}ClN_5OS$, calcd.: C, 48.92; H, 3.13; N, 21.90; S, 10.01. Found: C, 49.0; H, 3.3; N, 21.7; S, 10.0%.

6f: Buff, mp 300°C (from EtOH), yield (80%). IR (KBr) ν_{max}/cm^{-1} 3316 (NH_2), 2209 (CN), and 1650 (C = O). ^{1}H NMR (DMSO) δ 2.50 (s, 3H, SCH_3), 7.39–7.96 (m, 4H, C_6H_4), 8.13 (s, br, 2H, NH_2), 8.16 (s, 1H, ═CH). ^{13}C NMR (DMSO) δ 12.53 (SCH_3), 117.41 (CN), 128.09–134.20 (phenyl carbons), 152.41 (═CH), 156.10 (C-5), 157.12 (C-6), 160.10 (C-2), 167.38 (C-4). $C_{13}H_{10}ClN_5OS$, calcd.: C, 48.82; H, 3.12; N, 21.90; S, 10.01. Found: C, 49.0; H, 3.4; N, 22.0; S, 10.1%.

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2-Amino-(3) *N*-arylmethylideneamino-3,4-dihydro-6-anilino-4-oxopyrimidine-5-carbonitriles (7a-f), General Procedure

A mixture of **6a–f** (0.01 mol) and aniline (0.093 g, 0.01 mol) was heated at 150°C (bath temperature) for 30 min; after cooling, the resulting solid product was triturated with water, filtered off, and crystallized from the appropriate solvent.

7a: Yellow, mp > 300°C (from EtOH), yield (80%). IR (KBr) ν_{max}/cm^{-1} 3506, 3428 (NH_2), 2928 (=CH), and 2209 (CN). $C_{18}H_{14}N_6O$, calcd.: C, 65.45; H, 4.24; N, 25.45. Found: C, 65.7; H, 4.3; N, 25.7%.

7b: yellow, mp 200°C (from EtOH), yield (87%). IR (KBr) ν_{max}/cm^{-1} 3418 (NH_2), 2926 (=CH), 2208 (CN), and 1645 (C=O). ^{1}H NMR (DMSO) δ 2.05 (s, 3H, CH_3), 6.63 (s, br, 2H, NH_2), 7.29–7.39 (m, 9H, C_6H_5 and C_6H_4), 8.04 (s, br, 1H, NH), 9.00 (s, 1H, =CH). $C_{19}H_{16}N_6O$, calcd.: C, 66.28; H, 4.65; N, 24.42. Found: C, 66.3; H, 4.7; N, 24.6%.

7c: Colorless, mp 140°C (from EtOH), yield (82%). IR (KBr) ν_{max}/cm^{-1} 3528 and 3417 (NH_2), 2212 (CN), and 1620 (C=O). $C_{18}H_{14}N_6O_2$, calcd.: C, 62.42; H, 4.04; N, 24.27. Found: C, 62.7; H, 4.0; N, 24.5%.

7d: Buff, mp 215°C (from EtOH), yield (87%). IR (KBr) ν_{max}/cm^{-1} 3629 and 3569 (NH_2), 3000 (=CH), 2205 (CN), and 1630 (C=O). ^{1}H NMR (DMSO) δ 3.81 (s, 3H, OCH_3), 6.53 (s, br, 2H, NH_2), 6.91–7.07 (m, 9H, C_6H_5 and C_6H_4), 8.04 (s, br, 1H, NH), 8.36 (s, 1H, =CH). ^{13}C NMR (DMSO) δ 51.16 (OCH_3), 115.61 (CN), 123.83–131.71 (2 phenyl carbons), 152.27 (=CH), 155.17 (C-5), 155.77 (C-6), 158.91 (C-2), 172.00 (C-4). $C_{19}H_{16}N_6O_2$, calcd.: C, 63.33; H, 4.44; N, 23.33. Found: C, 63.7; H, 4.5; N, 23.8 %.

7e: Colorless, mp > 300°C (from EtOH), yield (71%). IR (KBr) ν_{max}/cm^{-1} 3418 and 3317 (NH_2), 2933 (=CH), 2201 (CN), and 1633 (C=O). $C_{18}H_{13}ClN_6O$, calcd.: C, 59.34; H, 3.57; N, 23.04. Found: C, 59.4; H, 3.3; N, 23.1%.

7f: Buff, mp >300°C (from EtOH), yield (75%). IR (KBr) ν_{max}/cm^{-1} 3838, 3752 and 3440 (NH_2, NH), 2207 (CN), and 1647 (C=O). $C_{18}H_{13}ClN_6O$, calcd.: C, 59.27; H, 3.59; N, 23.04. Found: C, 59.6; H, 3.7; N, 23.3%.

2,(3) *N*-Diamino-3,4-dihydro-6-methylsulfanyl-4-oxopyrimidine-5-carbonitrile (9), General Procedure

Dimethyl N-cyanodithioiminocarbonate **2** (1.46 g, 0.01 mol) was added to a stirred solution of the cyanoacetohydrazide **8** (0.99 g, 0.01 mol) in dry

dioxane (50 mL) containing potassium hydroxide (0.56 g, 0.01 mol) at room temperature (25°C). The solution was left stirring overnight at room temperature; the precipitate solid was collected by filtration and crystallized from the appropriate solvent.

9: Brown, mp 280°C (from EtOH), yield (87%). IR (KBr) ν_{max}/cm^{-1} 3493, 3317 (NH_2), 2210 (CN). ^1H NMR (DMSO) δ 2.68 (s, 3H, SCH_3), 5.52 (s, br, 2H, NH_2), 8.42 (s, br, 2H, NH_2). $C_6H_7N_5OS$ (M^+= 197) calcd.: C, 36.55; H, 3.55; N, 35.53; S, 16.24. Found: C, 36.5; H, 3.7; N, 35.8; S, 16.6%.

2,5-Diamino-(3) *N*-arylmethylideneamino-7*H*-pyrazolo[3,4-d]pyrimidine–4(3*H*)-ones (10a–f), General Procedure

A mixture of equivalent amounts of **6a–f** (0.01 mol) and hydrazine hydrate (0.05 g, 0.01 mol) was heated in ethanol (30 mL) containing a catalytic amount of piperidine for 3 h. After cooling of the reaction mixture, the final product was filtered off and recrystallized from the appropriate solvent (Scheme 1).

10a: Buff, mp 240°C (from EtOH), yield (82%). IR (KBr) ν_{max}/cm^{-1} 3450 (NH_2). $C_{12}H_{11}N_7O$, calcd.: C, 53.53; H, 4.089; N, 36.43. Found: C, 53.8; H, 4.0; N, 36.6%.

10b: Buff, mp 140°C (from EtOH), yield (79%). IR (KBr) ν_{max}/cm^{-1} 3202 (NH_2), and 1659 (C=O). $C_{13}H_{13}N_7O$, calcd.: C, 55.12; H, 4.59; N, 34.62. Found: C, 55.0; H, 4.4; N, 34.3%.

10c: Yellow, mp 200°C (from EtOH), yield (76%). IR (KBr) ν_{max}/cm^{-1} 3454 and 3326 (NH_2, NH), 1610 (C=O). $C_{12}H_{11}N_7O_2$, calcd.: C, 50.53; H, 3.87; N, 34.39. Found: C, 50.7; H, 3.8; N, 34.9%.

10d: Buff, mp 300°C (from EtOH), yield (80%). IR (KBr) ν_{max}/cm^{-1} 3650, 3639, and 3447 (NH_2, NH), 2933 (=CH), and 1668 (C=O). ^1H NMR (DMSO) δ 3.36 (s, 3H, OCH_3), 4.43 (s, br, 1H, NH_2), 5.19 (s, br, 2H, NH_2), 7.03–7.95 (m, 4H, C_6H_4), 8.05 (s, br, 1H, NH), 8.78 (s, 1H, =CH). $C_{13}H_{13}N_7O_2$, calcd.: C, 52.17; H, 4.35; N, 32.78. Found: C, 52.3; H, 4.3; N, 32.9%.

10e: Colorless, mp 300°C (from EtOH), yield (77%). IR (KBr) ν_{max}/cm^{-1} 3434 and 3360 (NH_2 and NH). $C_{12}H_{10}ClN_7O$, calcd.: C, 47.46; H, 3.32; N, 32.28. Found: C, 47.7; H, 3.67; N, 32.7%.

10f: Colorless, mp 300°C (from EtOH), yield (75%). IR (KBr) ν_{max}/cm^{-1} 3391 (NH_2) and 1646 (C=O). $C_{12}H_{10}ClN_7O$, calcd.: C, 47.46; H, 3.32; N, 32.28. Found: C, 47.5; H, 3.5; N, 32.1%.

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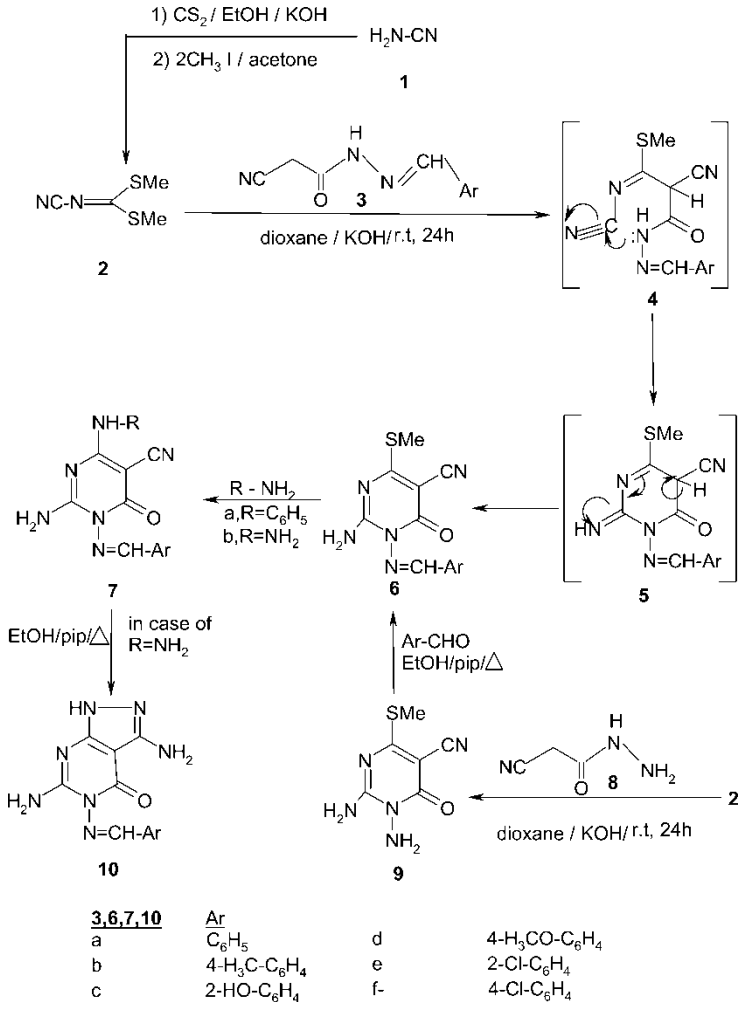

3,6,7,10	Ar		
a	C_6H_5	d	4-H_3CO-C_6H_4
b	4-H_3C-C_6H_4	e	2-Cl-C_6H_4
c	2-HO-C_6H_4	f-	4-Cl-C_6H_4

Scheme 1.

2-Amino-(3) *N*-benzoylamino-3,4-dihydro-6-methylthio-4-oxo-pyrimidine-5-carbonitriles (12), General Procedure

Dimethyl *N*-cyanodithioimino-carbonate **2** (1.46 g, 0.01 mol) was added to a stirred solution of cyanoacetobenzoylhydrazide **11** (2.03 g, 0.01 mol) in dry dioxane (50 mL) containing potassium hydroxide (0.056 g, 0.01 mol) at (25°C). The reaction mixture was stirred for 30 min at room temperature; the precipitate solid was collected by filtration and crystallized from the appropriate solvent.

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12: Buff, mp > 300°C (from EtOH), yield (70%). IR (KBr) ν_{max}/cm^{-1} 3208 (NH_2), 2222 (CN), and 1628 (C═O). ^1H NMR (DMSO) δ 2.52 (s, 3H, SCH_3), 7.53–8.02 (m, 5H, C_6H_4), 7.98 (s, br, 2H, NH_2), 8.58 (s, br, 1H, NH). $C_{13}H_{11}N_5O_2S$, calcd.: C, 51.82; H, 3.63; N, 23.25; S, 10.63. Found: C, 52.1; H, 3. 6; N, 23.2; S, 10.6%.

N-(2-Amino-5-cyano-3,4-dihydro-6-methylsulfanyl-4-oxo-3-pyrimidinyl)phenyl Thiourea (14), General Procedure

Dimethyl *N*-cyanodithioiminocarbonate (1.46 gm, 0.01 mol) was added to a stirred solution of 4-phenyl-1-cyanoacetylthiosemicarbazide **13** (2.34 g, 0.01 mol) in dry dioxane (50 mL) containing potassium hydroxide (0.56 g, 0.01 mol) at room temperature (≈25). The solution was left stirring overnight at room temperature; the precipitate solid was collected by filtration and crystallized from the appropriate solvent (Scheme 2.)

14: Buff, mp 300°C (from EtOH), yield (77%). IR (KBr) γ_{max}/cm^{-1} 3433 (NH_2), 2250 (CN). ^1H NMR (DMSO) δ 2.51 (s, 3H, SCH_3), 6.53 (s, br, 2H, NH_2), 6.98–7.07 (m, C_6H_5, 5H), 8.04 (s, br, 1H, NH), 8.08 (s, br, 1H, NH). ^{13}C NMR (DMSO) δ 12.42 (SCH_3), 115.73 (CN), 128.04–133.46 (phenyl carbons), 148.76 (C-5), 152.70 (C-6), 168.30 (C-2), 169.65 (C-4), 184.00 (C═S). $C_{13}H_{12}N_6OS_2$ ($M^+ = 332$), calcd.: C, 46.98; H, 3.61; N, 25.30; S, 19.27. Found: C, 47.1; H, 3.9; N, 25.6; S, 19.3%.

2-Amino-(3) *N*-arylsulphonylamino-3,4-dihydro-6-methylthio-4-oxopyrimidine-5-carbonitriles (18), General Procedure

Dimethyl *N*-cyanodithioimino carbonate **2** (1.46 g, 0.01 mol) was added to a stirred solution of *N*-cyanoacetoarylsulfonylhydrazides **15** (0.01 mol) in dry dioxane (50 mL) containing potassium hydroxide (0.56 g, 0.01 mol) at (≈25°C). The reaction mixture was stirred for 30 min at room temperature; the precipitate solid was collected by filtration and crystallized from the appropriate solvent (Scheme 3).

18a: Brown, mp >300°C (from EtOH), yield (82%). IR (KBr) ν_{max}/cm^{-1} 3460 and 3425 (NH_2), 2905 (CH), 2210 (CN), and 1660 (C═O). ^1H NMR (DMSO) δ 2.41 (s, 3H, SCH_3), 7.36–7.78 (m, 5H, C_6H_5), 8.93 (s, br, 2H, NH_2), 11.60 (s, br, 1H, NH). $C_{12}H_{11}N_5O_3S_2$, (M^+═337) calcd.: C, 42.72; H, 3.26; N, 20.77; S, 18.99. Found: C, 42.9; H, 3.9; N, 20.3; S, 18.7%.

18b: Buff, mp 300°C (from EtOH), yield (89%). IR (KBr) ν_{max}/cm^{-1} 3480 and 3439 (NH_2), 2860 (CH), 2209 (CN), and 1656 (C═O). ^1H NMR (DMSO) δ 2.30 (s, 3H, CH_3), 2.49 (s, 3H, SCH_3), 6.89 (s, br, 2H, NH_2), 7.11–7.62 (m, 4H, C_6H_4), 8.21 (s, br, 1H, NH). ^{13}C NMR (DMSO) δ 12.09

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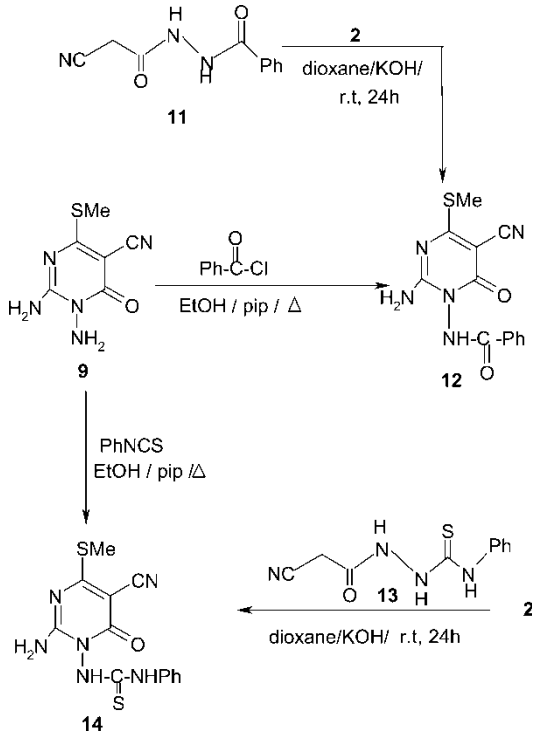

Scheme 2.

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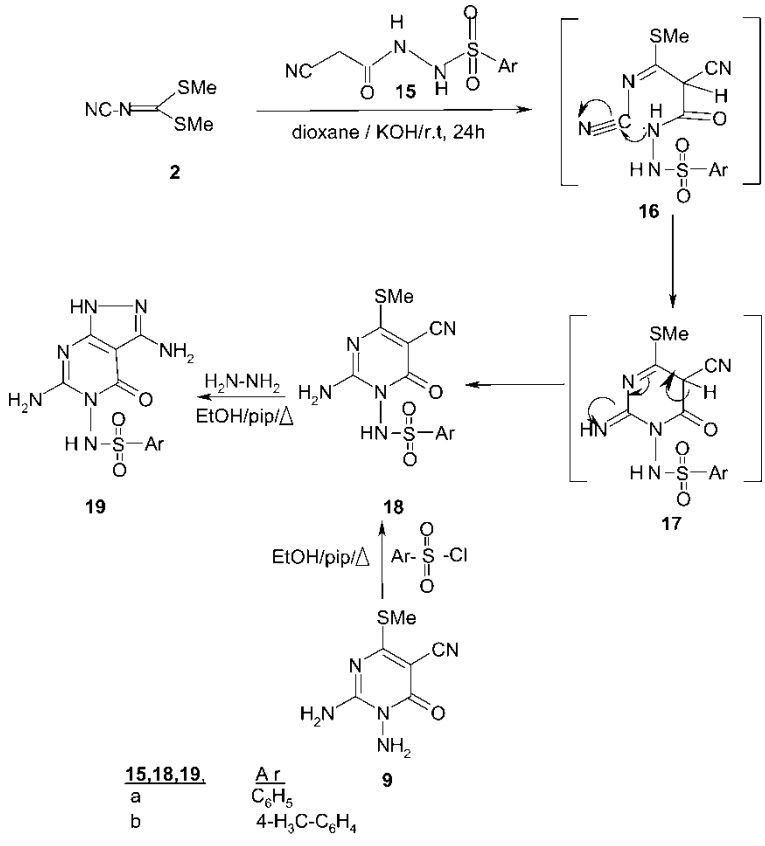
(CH_3), 20.78 (SCH_3), (C-5), 116.54 (CN), 125.99–129.61 (phenyl carbons), 138.40 (C-5), 138.73 (C-6), 144.82 (C-2), 157.99 (C-4). $C_{13}H_{13}N_5O_3S_2$, calcd.: C, 44.44; H, 3.70; N, 19.94; S,18.23. Found: C,44.6; H, 3.9; N, 20.0; S, 18.5%.

2,5-Diamino–(3) *N*-4-(methylbenzenesulfonamido)-7*H*-pyrazolo[3,4-d] pyrimidine-4(3*H*)-one (19a, b), General Procedure

A mixture of equivalent amounts of **18** (0.01 mol) and hydrazine hydrate (0.5 g, 0.01 mol) was heated in ethanol (30 mL) containing a catalytic amount of piperidine for 3 h. After cooling of the reaction mixture, the final product was filtered off and recrystallized from the appropriate solvent.

19a: Colorless, mp >300°C (from EtOH), yield (78%). IR (KBr) ν_{max}/cm^{-1} 3482 and 3311 (NH_2, NH). $C_{11}H_{11}N_7O_3S$, calcd.: C, 41.12; H, 3.42; N, 30.52; S, 9.96. Found: C, 41.0; H, 3.5; N, 30.5; S, 10.0%.



Scheme 3.

19b: Buff, mp 185°C (from EtOH), yield (82%). IR (KBr) ν_{max}/cm^{-1} 3543, 3474, and 3328 (NH_2, NH). ^1H NMR (DMSO) δ 2.20 (s, 3H, CH_3), 5.82 (s, br, 2H, NH_2), 7.42–7.65 (m, 4H, C_6H_4), 8.23 (s, br, 2H, NH_2), 11.89 (s, br, 1H, NH). $C_{12}H_{13}N_7O_3S$, calcd.: C, 42.98; H, 3.88; N, 29.25; S, 9.55. Found: C, 42.6; H, 3.5; N, 29.3; S, 9.6%.

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