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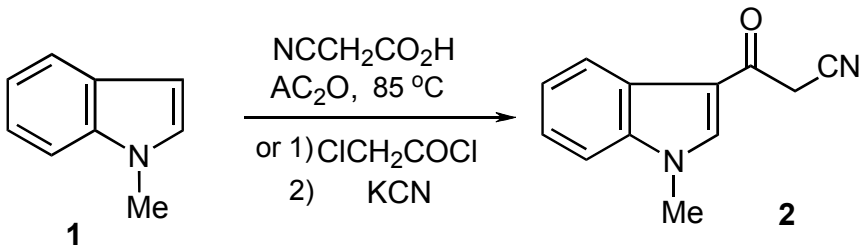
STUDIES WITH 3-OXOALKANONITRILES: SYNTHESIS AND REACTIVITY OF 3-OXO-3-(1-METHYLINDOLOYL)PROPANENITRILE

Haider Behbehani,* Hamada Mohamed Ibrahim, and Saad Makhseed

Chemistry Department; Faculty of Science; Kuwait University; P.O. Box 5969, safat, 13060-Kuwait. E-mail: hbehbehani@hotmail.com

Abstract – *N*-Methylindole was acylated at C-3 with cyanoacetic acid and acetic anhydride to yield 3-cyanoacetyl-1-methylindole which could be utilized for synthesis of a diversity of indole derivatives with heterocyclic substituent.

3-Oxoalkanonitriles are versatile reagents and their chemistry is attracting considerable recent interest.[1-3] In the previous work[4,5] it is reported an easy rout to 3-cyanoacetylindole via reacting cyanoacetic acid in presence of acetic anhydride with indole. The obtained product could be utilized to enable synthesis of variety of indole derivatives.[6-8] In conjunction of this work we report on synthesis of 1-methyl-3-cyano-acetylindole[5] **2** under similar conditions reported for synthesis of cyanoacetylindole, in addition the utility of the obtained cyanoacetylindole for synthesis of a variety of aminopyrazoles, aminotriazoles, pyridines and pyranes is reported utilizing synthetic approaches similar to those reported earlier, thus indicating their general nature (**Scheme 1**).



Scheme 1

Compound **2** readily coupled with benzenediazonium chloride to yield the arylhydrazons **3** whose structure was established based on X-ray crystal structure determination (**Figure 1**). In accordance with the previous finding that 2-arylhydrazons-3-oxoalkanenitiles prefer anti conformations like **3** over the *syn* hydrogen bonded forms further supports conclusion that the streoelectronic factors significantly overweigh the possible hydrogen bonding fixation.[9,10]

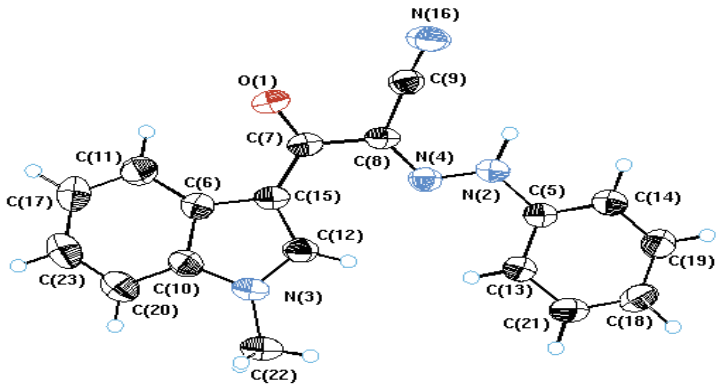
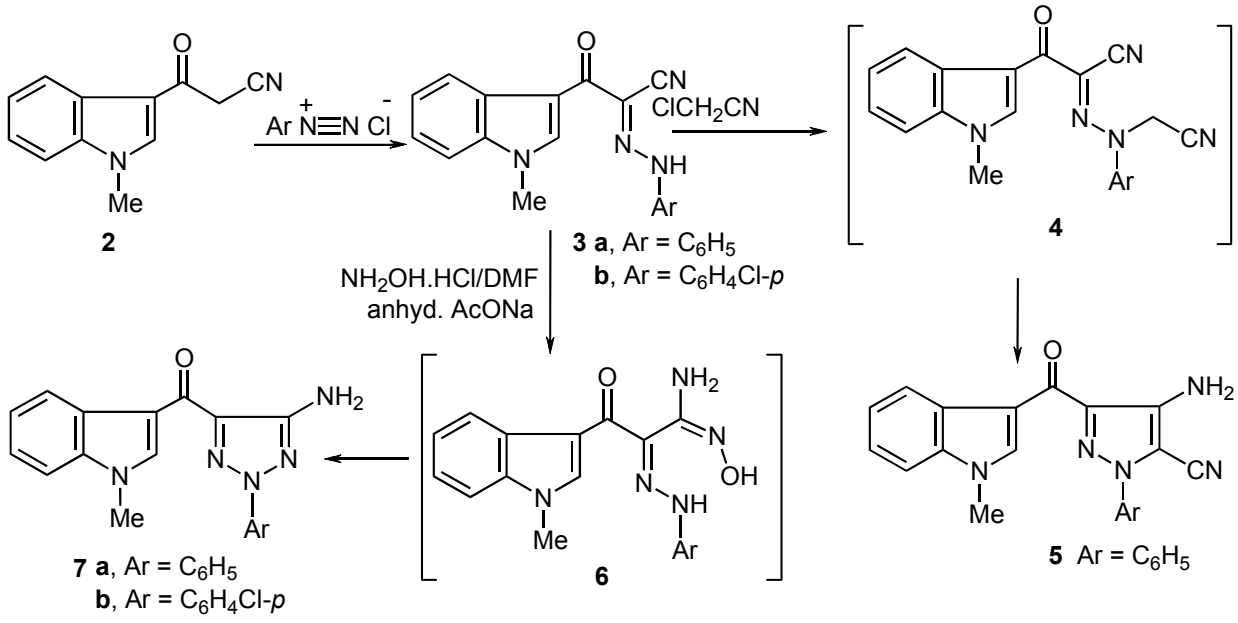


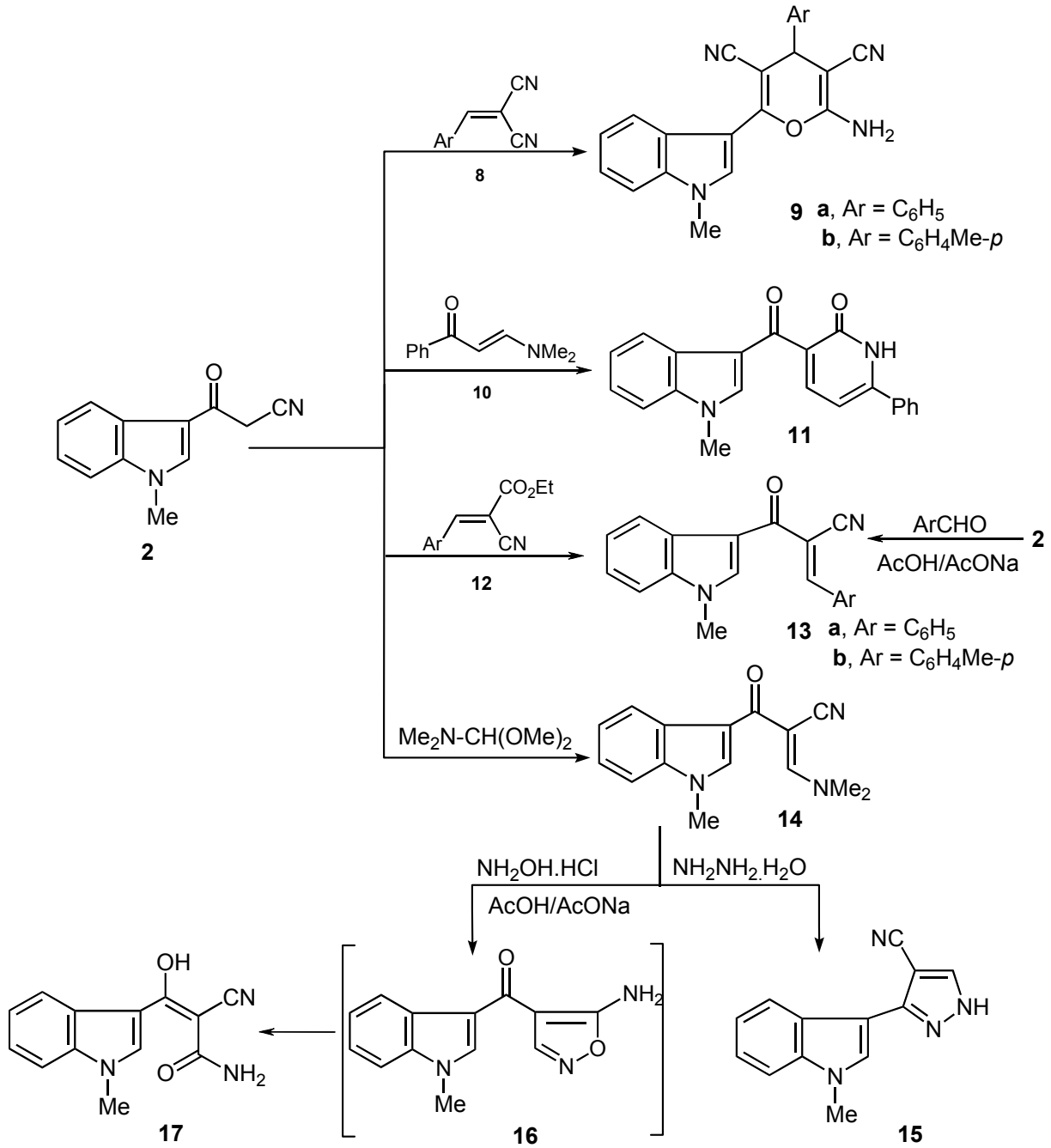
Figure 1. X-Ray crystal structure of compound **3a**

In accordance with literature reports[4,11] compound **3** react with chloroacetonitriles in triethylamine to yield the aminopyrazole **5**. It is believed that **5** is formed via initial formation of the intermediate **4** that could not, however, be isolated as it cyclizes readily under the reaction condition. Compound **3** reacted with hydroxylamine hydrochloride in refluxing DMF in presence of sodium acetate to yield **7** via the amidoxime **6.** Structure **7** is established for the reaction product based on NOE difference experiments as irradiation of the amino signal at δ 6.43 ppm did not enhance the aryl signals at δ 7.41-8.61 ppm. If the reaction product is 1,3-diaryl-1*H*-[1,2,4]triazol-5-amines, which formed via the initial Tiemann rearrangement of **6** as reported earlier[12] the amino irradiation should enhance the aromatic multiplet (**Scheme 2**).



Scheme 2

The methylene group in **2** proved sufficiently active to react with benzylidenmalononitrile **8** to yield the pyran[13] **9** and react with the enaminone **10** to yield the pyridone **11**. Trials to react **2** with ethyl benylidenecyanoacetate **12** has resulted in formation of the arylidene derivative **13** that was also obtained via condensation of **2** with benzaldehyde.



Scheme 3

Condensation of **2** with *N*,*N*-dimethylformamide dimethyl acetal (DMF DMA) afforded the corresponding enamine **14** which react, with hydrazine hydrate to yield cyanopyrazole **15**. This result consistent with the result obtained by Abdallah,[8] and Al-Qalaf *et al.*,[14] which reported the formation of

cyanopyrazoles from the reaction of 2-aroyl-3-(dimethylamino)-2-propenenitrile with hydrazine hydrate but contradicats to the reported formation of aminopyrazoles from the reaction of the enaminonitriles with hydrazine hydrate.[15]

In contrast to the behavior of **14** toward hydrazine reacting **14** with hydroxylamine hydrochloride in presence of sodium acetate afforded **17**. It is believed that initially **16** is formed then reformulated to yield **17**. However to our knowledge this is the first formation cyanoamide from aminoisooxazoles (**Scheme 3**).

The result reported here establish the general nature of the reactions reported recently with indole and other electron rich aromatics. Moreover, a varity of new indole derivatives of potential biological activity are could be prepared and indentified.

EXPERIMENTAL

All melting points are uncorrected. IR spectra were recorded in KBr disks using a Perkin-Elmer System 2000 FT-IR spectrophotometer. ^{1}H NMR (400 MHz) and ^{13}C NMR (100 MHz) spectra were recorded on a Bruker DPX 400, 400 MHz super-conducting NMR spectrometer in $CDCl_3$ or DMSO-d_6 as solvent and TMS as internal standard; chemical shifts are reported in δ units (ppm). Mass spectra were measured on a VG Autospec-Q spectrometer and shimadzu GCMS-QP 1000 EX spectrometer at 70 eV. Microanalyses were performed on a LECO CHNS-932 Elemental Analyzer. The crystal structure was determined by the X-ray unit at the National Research Center, Dokki, Cairo.

General method for the preparation of compounds 3a, b.

To a stirred solution of **2** (10 mmol) in EtOH/dioxane mixture (20 mL each) containing sodium acetate (10 g) was added the appropriate diazonium salt (prepared from 10 mmol of an appropriate aromatic amine and an appropriate quantities of sodium nitrite and hydrochloric acid). The solid product separated on standing was filtered off and recrystallized from an appropriate solvent.

3-(1-Methyl-1*H*-indol-3-yl)-3-oxo-2-(phenylhydrazono)propanenitrile 3a.

Recrystallized from dioxane/DMF as yellow crystals, yield: 2.4 g (80%), mp 199 ^{o}C; IR (KBr): 3225 (NH), 2207 (CN), 1684 cm^{-1} (CO); ^{1}H NMR (DMSO-d_6): δ 3.92 (s, 3H, CH_3), 7.14-7.57 (m, 8H, Ar-H), 8.29 (d, J = 7.5 Hz, 1H, Ar-H), 8.40 (s, 1H, indole H-2) and 11.97 ppm (br, 1H, hydrazone NH); ^{13}C NMR (DMSO-d_6): δ 34.45 (CH_3), 111.72, 112.13, 112.79, 115.84 (CN), 117.32, 122.57, 123.37, 124.12, 125.31, 128.06, 130.55, 137.62, 139.71, 143.33 (Ar-C) and 180.46 (CO); MS (EI): m/z (%) 302 (M^+, 45.7), 303 (M^++1, 14.6).

Anal. Calcd for $C_{18}H_{14}N_4O$ (302.34): C, 71.51; H, 4.67; N, 18.53. Found: C, 71.38; H, 4.58; N, 18.50.

Crystallographic analysis for compound 3a.

The crystals were mounted on a glass fiber. All measurements were performed on an ENRAF NONIUS FR 590. The data were collected at a temperature of 25 ^{o}C using the ω scanning technique to a maximum of a 2θ of 24.108 ^{o}. The structure was solved by direct method using SIR 92 and refined by full-matrix least squares. Non-hydrogen atoms were refined anisotropically. Hydrogen atoms were located geometrically and were refined isotropically.

Crystal data

$C_{18}H_{14}N_4O$, M_r = 302.337, monoclinic, a = 11.3109 (4), b = 8.6951 (3), c = 16.7545 (8) Å, V = 1489.08 (10) Å^3, α = γ = 90.00 ^{o}, β = 12. (18) x 10^{1}°, space group: $P2_1/c$, D_x = 1.349 Mg m^{-3} reflection 4676 measured, θ_{max} = 25.02 °, ωR factor = 0.080. Figure 1 illustrates the structure as determined. Full data can be obtained on request from the CCDC.[16]

2-[(4-Chlorophenyl)hydrazono]-3-(1-methyl-1*H*-indol-3-yl)-3-oxopropanenitrile 3b.

Recrystallized from dioxane/DMF as yellow crystals, yield: 2.6 g (77%), mp 220 ^{o}C; IR (KBr): 3230 (NH), 2205 (CN), 1678 cm^{-1} (CO); ^{1}H NMR (DMSO-*d*$_6$): δ 3.92 (s, 3H, CH_3), 7.26-7.60 (m, 7H, Ar-H), 8.26 (d, *J* = 7.8 Hz, 1H, Ar-H), 8.40 (s, 1H, indole H-2) and 12.10 ppm (br, 1H, hydrazone NH); ^{13}C NMR (DMSO-*d*$_6$): δ 33.88 (CH_3), 111.16 (CH), 111.54 (C), 112.05 (C), 115.85 (CN), 118.33 (CH), 121.97 (CH), 122.84 (CH), 123.58 (CH), 127.46 (C), 128.52 (C), 129.82 (CH), 137.09 (C), 139.25 (CH), 141.73 (C) and 179.69 (CO); MS (EI): m/z (%) 336 (M^+, 30.2), 337 (M^++1, 9.8).

Anal. Calcd for $C_{18}H_{13}ClN_4O$ (336.78): C, 64.20; H, 3.89; Cl, 10.53; N, 16.64. Found: C, 64.11; H, 3.80; Cl, 10.23; N, 16.77.

4-Amino-3-(1-methyl-1*H*-indol-3-yl-carbonyl)-1-phenyl-1*H*-pyrazole-5-carbonitrile 5.

A mixture of **3a** (10 mmol) and chloroacetonitrile (1.1 mL, 15 mmol) in a mixture of DMF (2 mL) and triethylamine (10 mL) were refluxed for 40 min with continuous stirring. Then, the reaction mixture was allowed to cool and poured into acidified ice-water. The solid product, so formed, was collected by filtration washed with water and recrystallized from ethanol as yellow crystals; yield: 2.4 g (70%), mp 142 ^{o}C; IR (KBr): 3434, 3384 (NH_2 and NH), 2227 (CN), 1601 cm^{-1} (CO); ^{1}H NMR (DMSO-*d*$_6$): δ 3.92 (s, 3H, CH_3), 5.99 (s, 2H, NH_2), 7.34-7.78 (m, 9H, indole H and Ar-H), 8.68 (s, 1H, indole H-2); ^{13}C NMR (DMSO-*d*$_6$): δ 33.47 (CH_3), 110.84, 111.24, 114.83 (CN), 116.44, 121.61, 122.47, 122.89, 123.23, 124.44, 127.09, 129.66, 129.87, 136.72, 138.78, 142.58, 145.01 (Ar-C) and 179.61 (CO); MS (EI): m/z (%) 341 (M^+, 25.2), 342 (M^++1, 7.24).

Anal. Calcd for $C_{20}H_{15}N_5O$ (341.38): C, 70.73; H, 4.43; N, 20.52. Found: C, 70.85; H, 4.39; N, 20.50.

General method for the preparation of compounds 7a, b.

A mixture of arylhydrazononitriles **3a, b** (10 mmol), and hydroxylamine hydrochloride (1 g, 15 mmol)

was refluxed in DMF (20 mL) in presence of anhydrous sodium acetate (2 g) for 2 h. Then, the reaction mixture was allowed to cool to rt and poured onto ice cold water. The formed crude product was collected by filtration washed with water and recrystallized from EtOH/DMF mixture as yellow crystals.

(5-Amino-2-phenyl-2*H*-1,2,3-triazol-4-yl)(1-methyl-1*H*-indol-3-yl)methanone 7a.

Yield: 2.5 g (79%); mp 200-202 ^{o}C; IR (KBr): 3454, 3342 (NH_2), 1608 cm^{-1} (CO); ^{1}H MNR (DMSO-d_6): δ 4.01 (s, 3H, CH_3), 6.43 (s, 2H, NH_2), 7.27-8.42 (m, 9H, Ar-H), 8.95 (s, 1H, indole H-2); ^{13}CNMR (DMSO-d_6): δ 33.38 (CH_3),110.76, 113.07, 118.28, 121.69, 122.36, 123.04, 126.89, 127.41, 129.62, 131.63, 136.93, 138.96, 139.12, 155.67 (Ar and triazole carbons) and 180.34 (CO); MS (EI): m/z (%) 317 (M^+, 46.8), 304 (M^++1, 16.3).

Anal. Calcd for $C_{18}H_{15}N_5O$ (317.35): C, 68.13; H, 4.76; N, 22.07. Found: C, 68.25; H, 4.72; N, 21.99.

[5-Amino-2-(4-chlorophenyl)-2*H*-1,2,3-triazol-4-yl](1-methyl-1*H*-indol-3-yl)methanone 7b.

Yield: 2.85 g (81%); mp 229 ^{o}C; IR (KBr): 3432, 3326 (NH_2), 1606 cm^{-1} (CO); ^{1}H MNR (DMSO-d_6): δ 4.00 (s, 3H, CH_3), 6.47 (s, 2H, NH_2), 7.26-8.41 (m, 8H, Ar-H), 8.94 (s, 1H, indole H-2); ^{13}CNMR (DMSO-d_6): δ 33.40 (CH_3), 110.77 (CH), 113.03 (C), 119.93 (CH), 121.69 (CH), 122.40 (CH), 123.07 (CH), 126.87 (C), 129.56 (CH), 131.52 (C), 131.93 (C), 136.94 (C), 137.73 (C), 139.22 (CH), 155.76 (C), (Ar and triazole carbons) and 180.20 (CO); MS (EI): m/z (%) 351 (M^+, 68.5), 352 (M^++1, 19.6).

Anal. Calcd for $C_{18}H_{14}ClN_5O$ (351.80): C, 61.46; H, 4.01; Cl, 10.08; N, 19.91. Found: C, 61.24; H, 4.02; Cl, 10.14; N, 19.77.

General method for the preparation of compounds 9a, b.

A mixture of **2** (10 mmol) and an appropriate arylidenemalononitrile **8** (10 mmol) in EtOH (20 mL) in the presence of piperidine were refluxed for 30 min with continuous stirring. Then, the reaction mixture was allowed to to cool to rt. The solid product so formed was collected by filtration washed with MeOH and recrystallized from EtOH.

2-Amino-6-(1-methyl-1*H*-indol-3-yl)-4-phenyl-4*H*-pyran-3,5-dicarbnitrile 9a.

Yield: 3.1 g (88%); mp 241 ^{o}C; IR (KBr): 3476, 3342 (NH_2), 2197 (CN), 1671cm^{-1} (C=N); ^{1}H MNR (DMSO-d_6): δ 3.86 (s, 3H, CH_3), 4.42 (s, 1H, pyran H-4), 7.20-7.99 (m, 11H, Ar-H), 8.15 (s, 1H, indole H-2); ^{13}CNMR (DMSO-d_6): δ 33.22 (CH_3), 39.72 (pyran C-4), 55.90 (pyran C-3), 84.06 (pyran C-5), 104.32 (C), 110.71 (CH), 118.85 (CN), 119.26 (CN), 121.27 (CH), 121.73 (CH), 122.74 (CH), 124.87 (C), 127.60 (CH), 127.73 (CH), 128.95 (CH), 132.87 (CH), 136.51 (C), 143.10 (C), 155.25 (C), 158.65 (C) (Ar carbons); MS (EI): m/z (%) 352 (M^+, 77.5), 304 (M^++1, 24.6).

Anal. Calcd for $C_{22}H_{16}N_4O$ (352.40): C, 74.98; H, 4.58; N, 15.90. Found: C, 75.04; H, 4.63; N, 15.97.

2-Amino-6-(1-methyl-1*H*-indol-3-yl)-4-*p*-tolyl-4*H*-pyran-3,5-dicarbnitrile 9b.

Yield: 3.0 g (82%); mp 203 ^{o}C; IR (KBr): 3398, 3318 (NH_2), 2198 (CN), 1666 cm^{-1} (C=N); ^{1}H MNR (DMSO-d_6): δ 2.32 (s, 3H, CH_3), 3.87 (s, 3H, CH_3), 4.37 (s, 1H, pyran H-4), 7.20-7.99 (m, 10H, Ar-H), 8.14 (s, 1H, indole H-2); ^{13}CNMR (DMSO-d_6): δ 20.66 (CH_3), 33.15 (CH_3), 39.34 (pyran C-4), 56.01 (pyran C-3), 84.24 (pyran C-5), 104.33 (C), 110.63 (CH), 118.80 (CN), 119.22 (CN), 121.18 (CH), 121.67 (CH), 122.67 (CH), 124.83 (C), 127.45 (CH), 129.43 (CH), 132.73 (CH), 136.45 (C), 136.90 (C), 140.11 (C), 155.00 (C), 158.52 (C) (Ar carbons); MS (EI): m/z (%) 366 (M^+, 92.25), 367 (M^++1, 27.9).

Anal. Calcd for $C_{23}H_{18}N_4O$ (366.43): C, 75.39; H, 4.95; N, 15.29. Found: C, 75.44; H, 4.85; N, 15.25.

3-(1-Methyl-1*H*-indole-3-carbonyl)-6-phenyl-1*H*-pyridine-2-one 11.

A mixtue of 3-(1-methyl-1*H*-Indol-3-yl)-3-oxopropanenitrile **2** (1.98 g, 10 mmol), and enaminone **10** (1.75 g, 10 mmol) was refluxed in AcOH (20 mL) in presence of anhydrous sodium acetate (2 g) for 4 h. Then, the reaction mixture was allowed to cool to rt and poured onto ice cold water. The formed crude product was collected by filtration, washed with water and recrystallized from toluene/petroleum ether mixture as orange crystals. Yield: 2.4 g (73%); mp 128-130 ^{o}C; IR (KBr): 3438 (NH), 1725, 1657 (2 CO), 1596 cm^{-1} (C=N); ^{1}H MNR (DMSO-d_6): δ 3.87 (s, 3H, CH_3), 7.17-8.38 (m, 13H, Ar-H, pyridine H and NH), ^{13}C NMR (DMSO-d_6): δ 32.91 (CH_3), 110.04 (CH), 113.48 (C), 115.69 (CH), 120.24 (CH), 121.50 (CH), 121.84 (CH), 126.61 (CH), 126.75 (C), 128.94 (CH), 129.25 (CH), 130.16 (C),130.58 (CH), 136.55 (CH), 136.84 (C), 138.73 (C), 150.35 (C), 155.34 (CONH) and 171.29 (CO); MS (EI): m/z (%) 328 (M^+, 45.6), 329 (M^++1, 13.2).

Anal. Calcd for $C_{21}H_{16}N_2O_2$ (328.37): C, 76.81; H, 4.91; N, 8.53. Found: C, 76.92; H, 4.86; N, 8.61.

General procedure for the preparation of compounds 13a, b.

Method A:

A mixture of cyanoacetylindole **2** (1.98 g, 10 mmol), and an appropriate aromatic aldehyde (10 mmol) was refluxed in AcOH (20 mL) in presence of ammonium acetate (2 g) for 3 h. Then, the reaction mixture was allowed to cool to rt and poured onto ice cold water the formed crude product was collected by filtration washed with water and recrystallized from a proper solvent.

Method B:

A mixture of **2** (10 mmol) and an appropriate ethylarylidenecyanoacetate (10 mmol) in EtOH (20 mL) in the presence of piperidine were refluxed for 30 min with continuous stirring. Then, the reaction mixture was allowed to to cool to rt and poured onto ice cold water the formed crude product was collected by filtration washed with water and recrystallized from a proper solvent.

(*E*)-2-(1-Methyl -1*H*-indole-3-carbonyl)-3-phenylacrylonitrile 13a.

Recrystalized from EtOH, yield: 2.25 g (79%); mp 146 °C; IR (KBr): 2206 (CN), 1638 (CO), 1582 cm^{-1} (C=C); ^{1}H MNR (DMSO-d_6): δ 3.92 (s, 3H, CH_3), 7.31-7.25 (m, 10H, Ar-H and olefinic CH), 8.48 (s, 1H, indole H-2); ^{13}C NMR (DMSO-d_6): δ 33.42 (CH_3), 110.97 (CH), 111.55 (C), 112.35 (C), 117.43 (CN), 121.50 (CH), 122.83 (CH), 123.63 (CH), 126.51 (C), 129.12 (CH), 130.23 (CH), 132.29 (CH), 132.42 (C), 137.45 (C), 139.55 (CH), 151.89 (Ar-C and olefinic C) and181.09 (CO); MS (EI): m/z (%) 286 (M^+, 53.5), 287 (M^++1, 15.3).

Anal. Calcd for $C_{19}H_{14}N_2O$ (286.34): C, 79.70; H, 4.93; N, 9.78. Found: C, 79.74; H, 4.93; N, 9.79.

(*E*)- 2-(1-Methyl-1*H*-indole-3-carbonyl)-3-(*p*-tolyl)acrylonitrile 13b.

Recrystalized from EtOH, yield: 2.1 g (82%); mp 149 °C; IR (KBr): 2201 (CN), 1635 (CO), 1608 cm^{-1} (C=C); ^{1}H MNR (DMSO-d_6): δ 2.40 (s, 3H, CH_3), 3.92 (s, 3H, CH_3), 7.30-7.97 (m, 8H, Ar-H), 8.18 (s, 1H, olefinic CH), 8.46 (s, 1H, indole H-2); ^{13}C NMR (DMSO-d_6): δ 21.30 (CH_3), 38.44 (CH_3), 110.26, 110.99, 112.39, 117.74 (CN), 121.53, 122.80, 123.62, 126.56, 129.71, 129.77, 130.43, 137.42, 139.31, 143.05, 151.99(Ar-C and olefinic C), 181.18 (CO); MS (EI): m/z (%) 300 (M^+, 82.25), 301 (M^++1, 26.5).

Anal. Calcd for $C_{20}H_{16}N_2O$ (300.36): C, 79.98; H, 5.37; N, 9.33. Found: C, 80.06; H, 5.46; N, 9.25.

(*E*)-3-(Dimethylamino-2-(1-methyl-1*H*-indol-3-ylcarbonyl)acrylonitrile 14.

A mixture of **2** (1.98 g, 10 mmol), *N*,*N*-dimethylformamide dimethyl acetal (DMF DMA) (1.2 mL, 10 mmol) and few drops of DMF in toluene was refluxed for 2 h. The solvent was evaporated under reduced pressure and the remaining residue was crystallized from EtOH as yellow crystals, yield: 2.25 g (89%), mp 206 °C; IR (KBr): 2184 (CN), 1636 cm^{-1} (CO); ^{1}H NMR ($CDCl_3$): δ 3.26 (s, 3H, CH_3), 3.45 (s, 3H, CH_3), 3.86 (s, 3H, CH_3), 7.28-7.36 (m, 3H, Ar-H), 8.07 (s, 1H, olefinic CH), 8.37 (s, 1H, indole H-2) and 8.40-8.43 ppm (m,1H, Ar-H);^{13}C NMR ($CDCl_3$): δ 33.16 (CH_3), 38.40 (CH_3), 47.62 (CH_3), 77.99 (C-2), 109.02, 114.13 (CN), 121.76, 121.94, 122.56, 122.61, 127.51, 134.69, 136.26 (Ar-C), 158.55 (olefinic C) and 181.17 (CO); MS (EI): m/z (%) 253 (M^+, 91.3 %), 2 (M^++1, 22.5 %).

Anal. Calcd for $C_{15}H_{15}N_3O$ (253.31): C, 71.13 H, 5.97; N, 16.59. Found: C, 71.22; H, 5.91; N, 16.68.

3-(1-Methyl-1*H*-indol-3-yl)-1*H*-pyrazole-4-carbonitrile 15.

A mixture of the enamine **14** (10 mmol, 2.5 g), and hydrazine hydrate (0.75 mL, 15 mmol) in dioxane (20 mL) or in AcOH (20 mL) was refluxed for 2 h. The reaction mixture was allowed to cool down to rt and then poured into ice cold water. The crude product was then collected by filtration washed with water and crystallized from EtOH as white crystals, yield: 1.9 g (86%), mp 148 °C; IR (KBr): 3281 (NH), 2223 (CN), 1617 cm^{-1} (C=N); ^{1}H NMR ($CDCl_3$): δ 3.80 (s, 3H, CH_3), 7.17-7.39 (m, 3H, Ar-H), 7.70 (s, 1H, pyrazole CH), 7.79 (s, 1H, indole H-2), 7.94 (d, J = 8.0 Hz, 1H, Ar-H) and 12.24 ppm (br, 1H, NH); ^{13}C NMR ($CDCl_3$): δ 33.28 (CH_3), 88.15, 103.00, 110.04, 115.28 (CN), 119.95, 121.21, 123.05, 124.94,

129.38, 136.95, 140.28 and 146.59 (Ar-C and pyrazole carbons); MS (EI): m/z (%) 222 (M^+, 100%), 223 (M^++1, 22.5%).

Anal. Calcd for $C_{13}H_{10}N_4$ (222.25): C, 70.26 H, 4.54; N, 25.21. Found: C, 70.32; H, 4.65; N, 25.19.

(*E*)-2-Cyano-3-hydroxy-3-(1-methyl-1*H*-indol-3-yl)acrylamide 17.

A mixture of the enamine **14** (10 mmol, 2.5 g), and hydroxylamine hydrochloride (1 g, 15 mmol) was refluxed in AcOH (20 mL) in presence of anhydrous sodium acetate (2 g) for 8 h. Then, the reaction mixture was allowed to cool to rt and poured onto ice cold water the formed crude product was collected by filtration washed with water and recrystallized from EtOH as buff crystals, yield: 1.6 g (67%); mp 217 ^oC; IR (KBr): 3402, 3349 (NH_2), 3200 (OH), 2202 (CN), 1668 cm^{-1} (CO); ^1H MNR (DMSO-d_6): δ 3.92 (s, 3H, CH_3), 7.18-7.28 (m, 2H, 2Ar-H), 7.58 (d, J = 8.0 Hz, 1H, indole H-4), 8.00 (br, 3H, NH_2 and OH) 8.12 (d, J = 8.0 Hz, 1H, indole H-7) and 8.45 ppm (s, 1H, indole H-2)); ^{13}CNMR (DMSO-d_6): δ 33.57 (CH_3), 69.49 (C2), 108.27, 111.01, 119.06, 122.18, 122.28, 123.18, 126.05, 135.61, 136.66 (CN and Ar carbons) 174.01 (CO) and 181.03 (C3); MS (EI): m/z (%) 241 (M^+, 81.0), 242 (M^++1, 28.9).

Anal. Calcd for $C_{13}H_{11}N_3O_2$ (241.25): C, 64.72; H, 4.60; N, 17.42. Found: C, 64.90; H, 4.79; N, 17.44.

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