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[DBU][OAC] MEDIATED: ONE POT, FOUR-COMPONENT SYNTHESIS DIHYDROPHTHALAZIN-4-HETEROYL - 4H-PYRANS

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ABSTRACT
One pot, four-component environmentally synthesis of 2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl-4-heteroyl-4H-pyran-3,5-dicarbonitriles **5a-5f** have been synthesized by condensing diethyl phthalate **1**, ethyl cyanohydrazide **2**, heteroaromatic aldehydes **3a-3f** and active methylene compounds **4** in [DBU][OAc] medium1,8-diazabicyclo[5.4.0]-undec-7-en-8-ium acetate, at 60-65 ^{o}C for 2 h. Particularly valuable features of this method include high yield, broad substrate scope, shorter reaction times and straight forward procedure.

KEYWORDS: Diethyl phthalate, Heteroaromatic aldehydes, Ethyl cyanohydrazide Active methylene compounds

INTRODUCTION:
Non-volatile, room-temperature ionic liquids (RTILs) have been extensively used as solvents and catalysts in ‘‘green chemistry’’[I], a major driving force motivating organic chemists to develop environmentally benign methods of preparation of organic compounds[II]. Ionic liquids are widely used in many fields of chemistry and industry[III]. Their use as catalysts has attracted much attention in organic synthesis, because product isolation and catalyst recycling are very easy; occasionally, improvements of reaction rate and/or selectivity are also observed[IV].

Multi-component reactions (MCRs) are one-pot processes in which three or more compounds react in a single reaction vessel to form a product containing substantial components of all the reactants[V]. Thus, design of highly efficient chemical reaction sequences that provide maximum structural complexity and diversity with a minimum number of steps in the synthesis of compounds with interesting properties is important for drug discovery and synthesis of natural products[VI]. MCRs have attracted much attention in combinatorial and medicinal chemistry and have been designed to produce biologically active compounds[VII]. One of the main challenges
in medicinal chemistry is the design and synthesis of biologically active molecules[VIII].

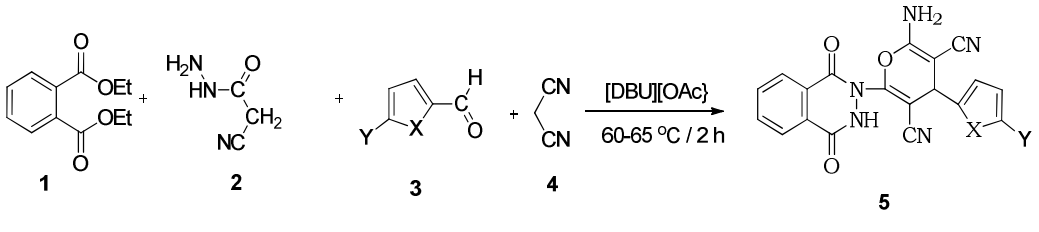
Phthalazines are important heterocycles that are known to possess multiple biological activities such as antimicrobial, anticonvulsant, antifungal, anticancer and anti-inflammatory.[IX] Carling *et. al* reported[X] the synthesis of 3-phenyl-6-(2-pyridyl)methyloxy-1, 2, 4-triazolo[3, 4 - *a*]phthalazines and analogues which were found to be a key structural element of certain CNS - active drugs. Jain *et. al* reported[XI] the synthesis of keto-glutamine tetra peptide analogues containing a 2-oxo-pyrrolidine ring as a glutamine side chain mimic which showed improved inhibition against hepatitis A virus 3C proteinase. Grasso *et. al* reported[XII] the synthesis of 6,7-methylenedioxyphthalazin - 1(2*H*) - ones which were found to be potent anticonvulsant agents. Nomoto *et. al* reported[XIII] the synthesis of 6,7-dimethoxyphthalazine derivatives which showed relatively potent cardiotonic activity comparable to that of amrinone. Watanabe *et. al* reported[XIV] the synthesis of 4-benzylamino-1-chloro-6-substitutedphthalazines which were found to be vasorelaxant activatives and a number of methods have been reported for the synthesis of phthalazine derivatives.[XV] Therefore, it was considered worthwhile to synthesize phthalazine moiety containing 4*H*-pyrans.

Keeping these results in our mind, we now wish to report one-pot, three component synthesis of tiltle compounds in weakly basic [DBU][OAc] medium.

RESULTS AND DISCUSSION:

First, we have developed one pot, four-component reaction of diethyl phthalate **1** (1 mmol), ethyl cyanohydrazide[XVI] **2** (1 mmol), furfuraldehyde **3a** (1 mmol), and malononitrile **4** (1 mmol) in different ionic liquid medium (([DBUH][OAc], [bmim][Br] & [bmim][OH]) at 60-65 ^{o}C to form 2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4-(furan-2-yl)-4H-pyran-3,5-dicarbonitrile **5a** as a model reation. However, it was found that the one-pot reaction of in the presence of [DBUH][OAc] as medium for 2 h at 60-65 ^{o}C gave the highest yield (90%) and the clean product **5a** (**Table 1, entry 1)**. Here, intially compound **1** was reacted with **2** in [DBU][OAc] at 60-65 ^{o}C for 20 min to form 3-(1, 4-dioxo-3, 4-dihydrophthalazin-(1H)-yl)-3-oxopropanenitrile as intermediate **6** (confirmed by TLC that means absence of starting materials). Then to this reaction mixture added **3a** and **4** and again heated at 60-65 ^{o}C for 1.5 h to form 2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4-(furan-2-yl)-4H-pyran-3,5-dicarbonitrile **5a.** The product i.e 2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4-(furan-2-yl)-4H-pyran-3,5-dicarbonitrile **5a** were obtained in excellent yield (90%) on simple work-up of reaction mixture. The structure of the compound **5a** has been confirmed by ^{1}H-NMR, IR and Mass spectroscopy.

By hopeful of above optimisation conditions, the one-pot reaction has been carried out at different temparature (RT, 40, 60 and 80 ^{o}C) in the presence of [DBUH][OAc] mediated to get desired compound **5a**. However, it was found that the one-pot reaction of [1 (1 mmol), 2 (1 mmol), 3a (1 mmol) & 4a (1 mmol)] in the presence of [DBUH][OAc] as medium (1 mmol) for 120 min at 60-65 ^{o}C gave the highest yield (90%) and the clean product **5a (Table 1, entry 1).** In order to examine the quantity of [DBUH][OAc] , the one-pot rection has been carried out at different quantity (0.5 , 1 and 2 mmol) of [DBUH][OAc] with respect of diethyl phthalate **1**. However, it was found that the one-pot reaction of [1 (1 mmol), 2 (1 mmol), 3a (1 mmol) & 4a (1 mmol)] in the presence of [DBUH][OAc] as medium (1 mmol) for 2 h at 60-65 ^{o}C gave the highest yield (90%) (**Table 2, entry 2)**.

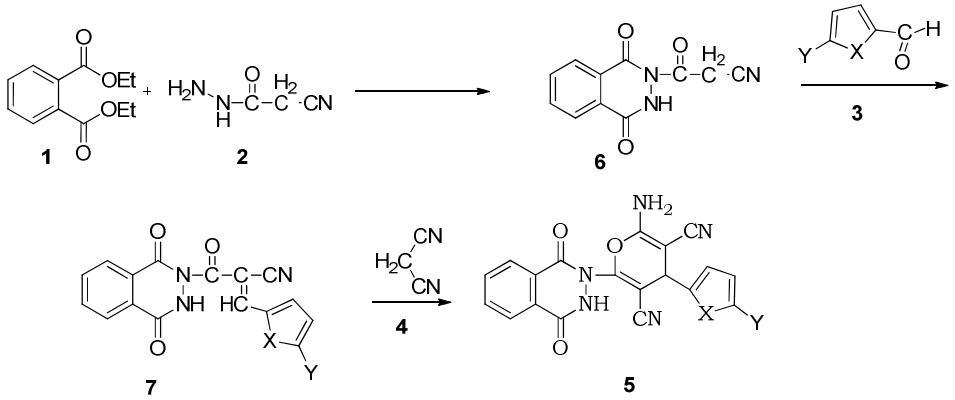


SCHEME1: Synthesis of **5** by one-pot synthesis

After having optimized the reaction conditions, the generality of the reaction was confirmed by carrying out the condensation of several others **3b-3f** respectively in [DBU][OAc] medium at 60-65 ^{o}C for 2 h giving **5b-5f** very good yields and no side product formation was detected. It was found that this method works with a wide variety of substrates. It is worthy to mention that the reaction of **1, 2, 3a-3f** & **4** could get higher yield and require shorter reaction time for formation of **5a-5f**.

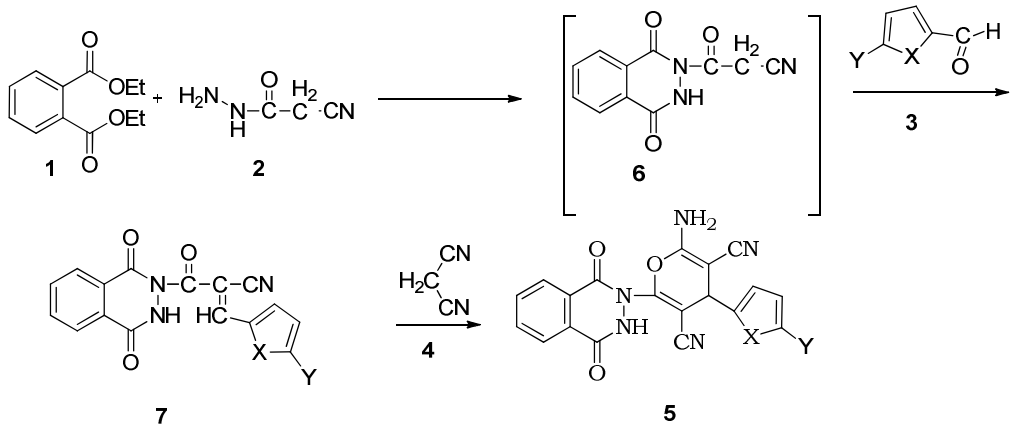
The synthesis of **5** could also be achieved in step-wise syntheses. Thus, a mixture of **1** and **2** was heated at 60-65 ^{o}C for 0.5 h in [DBU][OAc] medium to form intermediate **6**[XVII]. Then, **6** was reacted with **3** at 60-65 ^{o}C for 0.5 h in [DBU][OAc] medium to form intermediate **7**[XVIII] followed by **7** was reacted with **4** at 60-65 ^{o}C for 0.5 h in [DBU][OAc] medium to form **5**. The reaction was monitored by TLC. The structures of these products have been established earlier on the basis of their spectral data (**SCHEME 2**).

Furthermore, the compound **5** was assigned E-configuration on the presumption that bulky groups in a trans position would confer thermal stability on the molecule. This has been found to be case by a careful examination of the Frame-work molecular models of both E and Z-configurations of **5** wherein it was observed that there were minimum number of steric interactions in the E-configuration.



SCHEME 2: Step-Wise Synthesis of **5.**

Encouraged by the above results, synthesis of **5** has been achieved successfully through tandem method by using step-wise sequences. **(SCHEME 3).**



SCHEME 3: Tandem Synthesis of **5.**

TABLE 1.
Effect of **ionic liquid, & temperature** on reaction of **1, 2, 3a & 4** to yielding **5a.**

Entry	**Ionic liquid**	**Temp**	Time /h	5a (%)
1	[DBUH][OAc]	**60-65 ^{o}C**	**2**	**90**
2	[bmim][Br]	60-65 ^{o}C	5	70
3	[bmim][OH]	60-65 ^{o}C	3	75
4	[DBUH][OAc]	RT	12	85
5	[DBUH][OAc]	40-45 ^{o}C	3.5	70
6	[DBUH][OAc]	80-85 ^{o}C	1.5	60

TABLE 2.
The effect of amount of [DBUH][OAc] in the preparation of **5a** by **1, 2, 3a & 4**.

Entry	mmol of [DBUH][OAc]	Time /h	5a (%)
1	0.5	4	85
2	**1**	**2**	**90**
3	2	2	80

EXPERIMENTAL SECTION

Melting points are uncorrected and were determined in open capillary tubes in sulphuric acid bath. TLC was run on silica gel – G and visualization was done using iodine vapour or UV light. IR spectra were recorded using Perkin – Elmer 1000 instrument in KBr pellets. ^{1}H NMR spectra were recorded in DMSO – d_6 using TMS as internal standard at 400 MHz operating frequency. Mass spectra were recorded on Agilent-LCMS instrument. All reagents were purchased from Merck or Aldrich and used without further purification. [DBU][Ac] was prepared as reported elsewhere[XVII].

Preparation of 5a-5f from 1, 2, 3a-3f & 4 by one-pot synthesis:

A mixture of **1** (1 mmol) and **2** (1 mmol) were heated at 60-65 ^{o}C for 0.5 h in [DBU] [OAc] (1 mmol) for 0.5 h. Until no starting materials could be detected on thin-layer chromatography (TLC). To this reaction mass added **3** and **4** compounds and again heated at at 60-65 ^{o}C for 1.5 h. Until no starting materials could be detected on thin-layer chromatography (TLC). After the reaction was complete, cold water was added to the

reaction mixture and solid part was separated by filtration. The product was recrystallised from ethanol solvent to obtain **5**.

2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4-(furan-2-yl)-4H-pyran-3,5-dicarbonitrile 4a: Mp: 207–209 ^{o}C; Yield: 90%; IR (KBr) : 3302-3406 cm^{-1} (br, medium, -NH-), 2211 cm^{-1} (s, strong, -CN-), 1715 cm^{-1} (s, strong, -CO- of amide group), 1655 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.2 (s, 1H, -CH), 7.0-8.2 (m, 7H, Ar-H), 9.6 (s, 2H, –NH_2), 11.4 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 44.7, 74.6, 85.4, 113.7, 114.3, 123.6, 126.7, 127.8, 129.6, 131.8, 133.2, 137.1, 155.4, 157.5, 163.1, 163.8; $M^{+\cdot}$+1 =374

2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4-(thiophen-2-yl)-4H-pyran-3,5-dicarbonitrile 4b: Mp: 189–191 ^{o}C; Yield: 89% ; IR (KBr) : 3306-3401 cm^{-1} (br, medium, -NH-), 2218 cm^{-1} (s, strong, -CN-), 1706 cm^{-1} (s, strong, -CO- of amide group), 1659 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.5 (s, 1H, -CH), 7.4-8.1 (m, 7H, Ar-H), 9.8 (s, 2H, –NH_2), 12.1 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 49.5, 74.5, 87.3, 113.9, 115.1, 124.2, 127.8, 128.6, 129.1, 130.7, 134.3, 137.0, 155.8, 157.3, 163.0, 163.5; $M^{+\cdot}$+1 =390.

2-amino-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4-(1H-pyrrol-2-yl)-4H-pyran-3,5-dicarbonitrile 4c: Mp: 191–192 ^{o}C; Yield: 86%; IR (KBr) : 3303-3405 cm^{-1} (br, medium, -NH-), 2217 cm^{-1} (s, strong, -CN-), 1704 cm^{-1} (s, strong, -CO- of amide group), 1658 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.0 (s, 1H, -CH), 7.2-8.4 (m, 7H, Ar-H), 9.3 (s, 2H, –NH_2), 11.4 (s, 1H, -NH, D_2O exchangeable); 11.9 (s, 1H, -NH, D_2O exchangeable);^{13}C-NMR (DMSO-d_6, 100 MHz): δ 47.5, 74.6, 86.3, 115.7, 116.2, 123.4, 126.7, 127.4, 128.8, 132.4, 133.2, 134.1, 154.5, 156.3, 163.1, 163.4; $M^{+\cdot}$+1 =373.

2-amino-4-(5-bromofuran-2-yl)-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4H-pyran-3,5-dicarbonitrile 4d: Mp: 210–212 ^{o}C; Yield: 88%; IR (KBr) : 3305-3405 cm^{-1} (br, medium, -NH-), 2215 cm^{-1} (s, strong, -CN-), 1716 cm^{-1} (s, strong, -CO- of amide group), 1658 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.1 (s, 1H, -CH), 7.0-8.2 (m, 6H, Ar-H), 9.5 (s, 2H, –NH_2), 11.2 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 44.9, 74.9, 85.8, 113.9, 114.9, 123.1, 126.2, 127.1, 129.2, 131.4, 133.5, 137.2, 155.2, 157.6, 163.2, 163.1; $M^{+\cdot}$+1 =451

2-amino-4-(5-bromothiophen-2-yl)-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4H-pyran-3,5-dicarbonitrile 4e: Mp: 193–195 ^{o}C; Yield: 87% ; IR (KBr) : 3302-3401 cm^{-1} (br, medium, -NH-), 2213 cm^{-1} (s, strong, -CN-), 1702 cm^{-1} (s, strong, -CO- of amide group), 1655 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.1 (s, 1H, -CH), 7.4-8.1 (m, 6H, Ar-H), 9.5 (s, 2H, –NH_2), 12.2 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 49.1, 74.3, 87.2, 113.6, 115.2, 124.1, 127.4, 128.8, 129.2, 130.5, 134.8, 137.2, 155.6, 157.4, 163.1, 163.3; $M^{+\cdot}$+1 =469.

2-amino-4-(5-bromo-1H-pyrrol-2-yl)-6-(1,4-dioxo-3,4-dihydrophthalazin-2(1H)-yl)-4H-pyran-3,5-dicarbonitrile 4f: Mp: 189–191 ^{o}C; Yield: 88%; IR (KBr) : 3301-3402 cm^{-1} (br, medium, -NH-), 2214 cm^{-1} (s, strong, -CN-), 1701 cm^{-1} (s, strong, -CO- of amide group), 1659 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.3 (s, 1H, -CH), 7.2-8.4 (m, 6H, Ar-H), 9.5 (s, 2H, –NH_2), 11.3 (s, 1H, -NH, D_2O exchangeable); 11.8 (s, 1H, -NH, D_2O exchangeable);^{13}C-NMR (DMSO-d_6, 100 MHz): δ 47.3, 74.8, 86.2, 115.1, 116.1, 123.8, 126.8, 127.8, 128.9, 132.1, 133.3, 134.2, 154.3, 156.1, 163.2, 163.1; $M^{+\cdot}$+1 =452.

Preparation of 6 from 1 & 2 via step-wise reaction:

A mixture of diethyl phthalate **1** and ethylcyanohydrazide **2** were heated at 60-65 ^{o}C in [DBU] [OAc] (1 mmol) for 0.5 h. After the completion of the reaction as monitored by TLC, the reaction mixture was poured into ice-cold water. The product was precipitated out, filtered, washed with water, dried and recrystallised from ethanol. Yield=72%. M.P. 152-154˚C [Lit M.P. 150-152 ^{o}C][17].

Preparation of 7 from 6 & 3:

A mixture of **6** (1 mmol), **3a-3f** (1 mmol) and [DBU] [OAc] (1 mmol) were heated at 60-65 ^{o}C for 0.5 h. After the completion of the reaction as monitored by TLC, the reaction mixture was poured into ice-cold water. The product was precipitated out, filtered, washed with water, dried and recrystallised from ethanol. Yield =85%.

(E)-2-(1,4-dioxo-1,2,3,4-tetrahydrophthalazine-2-carbonyl)-3-(furan-2-yl)acrylonitrile 7a: Mp: 168–170 ^{o}C; IR (KBr) : 3140-3438 cm^{-1} (broad, medium, -NH-), 2258 cm^{-1} (sharp, strong, -CN-), 1743 Cm^{-1} (sharp, strong, -CO- group), 1730 Cm^{-1} (sharp, strong, -CO- group), 1683 cm^{-1} (sharp, strong, -CO- of amide group), ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.8 (s, 1H, -CH), 7.5-8.2 (m, 7H, –ArH), 11.3 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 81.2, 81.2, 117.2, 122.4, 124.2, 127.4, 128.2, 128.6, 129.1, 129.1, 129.3, 133.1, 136.2, 164.3, 164.4, 164.8; $M^{+\cdot}$+1= 308.

(E)-2-(1,4-dioxo-1,2,3,4-tetrahydrophthalazine-2-carbonyl)-3-(thiophen-2-yl)acrylonitrile 7b: Mp: 160–162 ^{o}C; IR (KBr) : 3294-3519 cm^{-1} (broad, medium, -NH-), 2258 cm^{-1} (sharp, strong, -CN-), 1794 cm^{-1} (sharp, strong, -CO- group), 1748 cm^{-1} (sharp, strong, -CO- of amide group),1682 cm^{-1} (sharp, strong, -CO- of amide group); ^{1}H-NMR (DMSO-d_6, 400 MHz): δ 7.3 (s, 1H, -CH), 7.9-8.6 (m, 7H, –ArH), 11.3 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 81.3, 81.3, 117.2, 122.8, 124.0, 127.2, 128.2, 128.5, 129.0, 129.1, 129.5, 133.1, 136.0,164.4, 164.4, 164.7; $M^{+\cdot}$+1= 324.

(E)-2-(1,4-dioxo-1,2,3,4-tetrahydrophthalazine-2-carbonyl)-3-(1H-pyrrol-2-yl)acrylonitrile 7c: Mp: 169–171 ^{o}C; IR (KBr) : 3046-3444 cm^{-1} (broad, medium, -NH-), 2258 cm^{-1} (sharp, strong, -CN-), 1773 Cm^{-1} (sharp, strong, -CO- group), 1730 Cm^{-1} (sharp, strong, -CO- group), 1673 cm^{-1} (sharp, strong, -CO- of amide group), ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.5 (s, 1H, -CH), 7.4-8.1 (m, 7H, –ArH), 11.1 (s, 1H, -NH, D_2O exchangeable), 12.1 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 81.0, 81.2, 117.1, 122.6, 124.5, 127.2, 128.2, 128.7, 129.1, 129.2, 129.3, 133.1, 136.2, 164.3, 164.6, 164.8; $M^{+\cdot}$+1= 307.

(E)-3-(5-bromofuran-2-yl)-2-(1,4-dioxo-1,2,3,4-tetrahydrophthalazine-2-carbonyl) Acrylonitrile 7d: Mp: 156–159 ^{o}C; IR (KBr) : 3145-3432 cm^{-1} (br, medium, -NH-), 2259 cm^{-1} (s, strong, -CN-), 1748 Cm^{-1} (s, strong, -CO- group), 1735 Cm^{-1} (s, strong, -CO- group), 1685 cm^{-1} (s, strong, -CO- of amide group), ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.9 (s, 1H, -CH), 7.5-8.2 (m, 6H, –ArH), 11.8 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 81.1, 81.6, 117.1, 122.3, 124.8, 127.6, 128.3, 128.9, 129.3, 129.6, 129.9, 133.2, 136.4, 164.5, 164.8, 164.9; $M^{+\cdot}$+1= 387.

(E)-3-(5-bromothiophen-2-yl)-2-(1,4-dioxo-1,2,3,4-tetrahydrophthalazine-2-carbonyl) acrylonitrile 7e: Mp: 165–167 ^{o}C; IR (KBr) : 3295-3512 cm^{-1} (br, medium, -NH-), 2245 cm^{-1} (s, strong, -CN-), 1793 cm^{-1} (s, strong, -CO- group), 1749 cm^{-1} (s, strong, -CO- of amide group), 1680 cm^{-1} (s, strong, -CO- of amide group); ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 7.1 (s, 1H, -CH), 7.9-8.6 (m, 6H, –ArH), 11.2 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 81.1, 81.5, 117.1, 122.4, 124.2, 127.3, 128.1, 128.3, 129.1, 129.5, 129.6, 133.2, 136.1,164.2, 164.6, 164.8; $M^{+\cdot}$+1= 403.

(E)-3-(5-bromo-1H-pyrrol-2-yl)-2-(1,4-dioxo-1,2,3,4-tetrahydrophthalazine-2-carbonyl) acrylonitrile 7f: Mp: 171–173 ^{o}C; IR (KBr) : 3048-3440 cm^{-1} (br, medium, -NH-), 2252 cm^{-1} (s, strong, -CN-), 1775 Cm^{-1} (s, strong, -CO- group), 1731 Cm^{-1} (s, strong, -CO- group), 1675 cm^{-1} (s, strong, -CO- of amide group), ^{1}H- NMR (DMSO-d_6, 400 MHz): δ 6.3 (s, 1H, -CH), 7.4-8.1 (m, 6H, –ArH), 11.4 (s, 1H, -NH, D_2O exchangeable), 12.2 (s, 1H, -NH, D_2O exchangeable); ^{13}C-NMR (DMSO-d_6, 100 MHz): δ 81.3, 81.5, 117.4, 122.8, 124.8, 127.1, 128.5, 128.8, 129.2, 129.4, 129.8, 133.2, 136.3, 164.5, 164.6, 164.8; $M^{+\cdot}$+1= 386.

Preparation of 5 from 7 & 4:

A mixture of **7** (1 mmol), **4** (1 mmol) and [DBU] [OAc] (1 mmol) were heated at 60-65 ^{o}C for 1.0 h . After the completion of the reaction as monitored by TLC, the reaction mixture was poured into ice-cold water. The product was precipitated out, filtered, washed with water, dried and recrystallised from ethanol to form **5**. Yield =80%.

Preparation of 5a-5f from 1, 2, 3a-3f & 4 by tadam synthesis:

A mixture of **1** (1 mmol) and **2** (1 mmol) were heated at 60-65 ^{o}C for 0.5 h in [DBU] [OAc] (1 mmol). Until no starting materials could be detected on thin-layer chromatography (TLC). To this reaction mass, added **3** heated at 60-65 ^{o}C for 0.5 h in [DBU] [OAc] (1 mmol). Until no starting materials could be detected on thin-layer chromatography. Than, added **4** compounds and again heated at at 60-65 ^{o}C for 1.5 h. Until no starting materials could be detected on thin-layer chromatography (TLC). After the reaction was complete, cold water was added to the reaction mixture and solid part was separated by filtration. The product was recrystallised from ethanol solvent to obtain **5**.

CONCLUSION

In summary, we have successfully adapted a simple one pot as well as step-wise and tandem process for synthesis of novel 2 -amino–6 (1, 4–dioxo - 3, 4–dihydrophthalazin-2(1H) - yl - 4- heteroyl - 4H –pyran - 3, 5-dicarbonitriles with simple work up procedures in green methods.

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