An Efficient Synthesis of Pyrimido[4,5-*b*]quinoline and Indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine Derivatives via Multicomponent Reactions in Ionic Liquid

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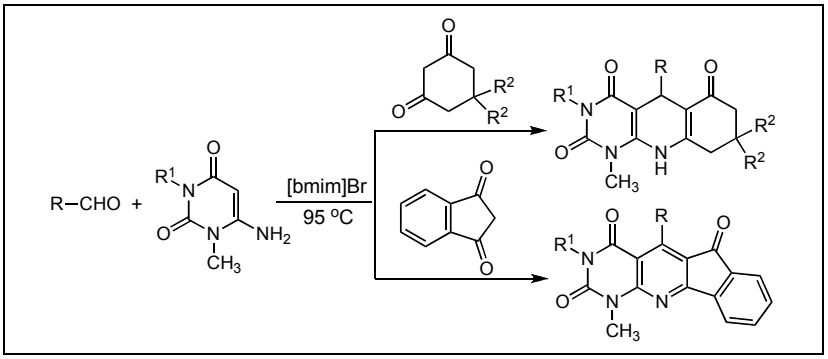

A series of pyrimido[4,5-*b*]quinoline and indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine derivatives were synthesized *via* the three-component reaction of an aldehyde, 6-aminopyrimidine-2,4-dione and 5,5-dimethyl-1,3-cyclohexanedione or 1,3-indanedione in ionic liquid 1-*n*-butyl-3-methylimidazolium bromide ([bmim]Br). This protocol has the advantages of easier work-up, milder reaction conditions, high yields and an environmentally benign procedure compared with other methods.

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INTRODUCTION

The importance of uracil and its annelated derivatives is well recognized by synthetic [1] as well as biological [2] chemists. With the development of clinically useful anticancer and antiviral drugs [3], there has recently been remarkable interest in the synthetic manipulations of uracils [4]. Pyrido[2,3-*d*]pyrimidines represent a heterocyclic ring system of considerable interest because of several biological activities associated with this scaffold. Some analogues have been found to act as anticancer agents inhibiting dihydrofolate reductases or tyrosine kinases [5], while others are known antiviral agents [6]. Therefore, for the preparation of these complex molecules large efforts have been directed towards the synthetic manipulation of uracils. As a result, a number of reports have appeared in the literature that usually describe forcing conditions, long reaction times using organic solvent and complex synthetic pathways [7]. Thus new routes for the synthesis of these molecules have attracted considerable attention in search for a rapid entry to these heterocycles.

Multi-component reactions (MCRs) are economically and environmentally very advantageous because multi-step syntheses produce considerable amounts of waste mainly due to complex isolation procedures often involving expensive, toxic and hazardous solvents after each step. MCRs are perfectly suited for combinatorial library synthesis, and thus are finding increasing use in the discovery process for new drugs and agrochemicals [8].

The ionic liquids have been the subject of considerable current interest as environmentally benign reaction media in organic synthesis because of their unique properties of nonvolatility, nonflammability, and recyclability, among others [9]. There has been growing recognition that ionic liquids are an attractive medium for many organic reactions and many MCRs in ionic liquids have been reported [10]. As part of our current studies on the development of new routes to heterocyclic systems [11], we now report an efficient and clean synthetic route to indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine derivatives and pyrimido[4,5-*b*]quinoline derivatives in ionic liquid without any catalyst.

RESULTS AND DISCUSSION

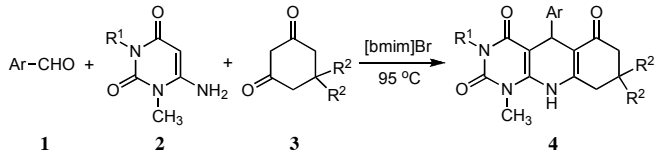
When the three-components of aromatic aldehyde **1**, 6-aminopyrimidine-2,4-dione **2** and 5,5-dimethyl-1,3-cyclohexanedione or 1,3-cyclohexanedione **3** were treated in 1-*n*-butyl-3-methylimidazolium bromide ([bmim]Br) at 95 °C for a few hours (Scheme 1), the desired 5-aryl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6-trione **4** were obtained in high yields (Table 1).

Table 1

Synthesis of **4** in ionic liquid [bmim]Br.

Entry	Ar	R^1	R^2	Time (h)	Yield (%)
4a	4-$CH_3OC_6H_4$	CH_3	CH_3	3	95
4b	4-$CH_3C_6H_4$	CH_3	CH_3	3	93
4c	4-BrC_6H_4	CH_3	CH_3	4	89
4d	4-ClC_6H_4	CH_3	CH_3	3.5	90
4e	2-$CH_3OC_6H_4$	CH_3	CH_3	5	78
4f	3,4-$Cl_2C_6H_3$	CH_3	CH_3	4	97
4g	2,4-$Cl_2C_6H_3$	CH_3	CH_3	4	98
4h	3,4-$(CH_3)_2C_6H_3$	CH_3	CH_3	3.5	90
4i	2-ClC_6H_4	CH_3	CH_3	4.5	85
4j	Thiophen-2-yl	CH_3	CH_3	3	78
4k	4-$CH_3OC_6H_4$	H	CH_3	4	85
4l	4-$CH_3C_6H_4$	H	CH_3	4	81
4m	4-BrC_6H_4	H	CH_3	5	82
4n	4-ClC_6H_4	H	CH_3	4	80
4o	2,4-$Cl_2C_6H_3$	H	CH_3	3	99
4p	4-FC_6H_4	H	CH_3	3	92
4q	2-$CH_3OC_6H_4$	H	CH_3	3.5	93
4r	3,4-$OCH_2OC_6H_3$	H	CH_3	4	89
4s	2-ClC_6H_4	H	CH_3	4	97
4t	Thiophen-2-yl	H	CH_3	5	85
4u	4-$CH_3C_6H_4$	CH_3	H	3	87
4v	4-FC_6H_4	CH_3	H	2	91
4w	4-ClC_6H_4	CH_3	H	2	86
4x	Thiophen-2-yl	CH_3	H	3.5	80
4y	4-$CH_3OC_6H_4$	H	H	2	91
4z	3,4-$(CH_3)_2C_6H_3$	H	H	2.5	93

Scheme 1

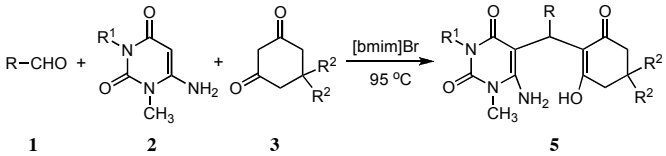


1 **2** **3** **4**

As shown in Table 1, this protocol could be applied not only to the aromatic aldehydes with either electron-withdrawing groups (such as halide groups) or electron-donating groups (such as alkyl, hydroxy groups), but also to heterocyclic aldehydes. Therefore, we concluded that the electronic nature of the substituents of aldehydes has no significant effect on this reaction.

However, when an alphatic aldehyde was treated with **2** and **3** in [bmim]Br, the desired product **4** was not obtained, but the uncyclized product **5** was obtained (Scheme 2 and Table 2).

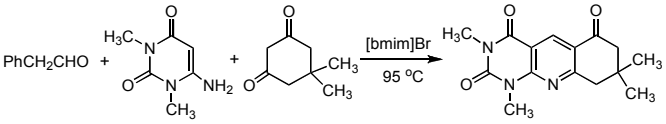
Scheme 2



1 **2** **3** **5**

It is interesting, when phenylacetaldehyde was treated with 6-amino-1,3-dimethylpyrimidine-2,4-dione and 5,5-dimethyl-1,3-cyclohexanedione, only 1,3,8,8-tetramethyl-6,7,8,9-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6-trione **6** was obtained in 67 % yield (Scheme 3). In this reaction the phenylacetaldehyde serves as a one carbon source in the forming the central ring of the product by losing the toluene or its equivalent under mild conditions. This method has not been reported in the literature.

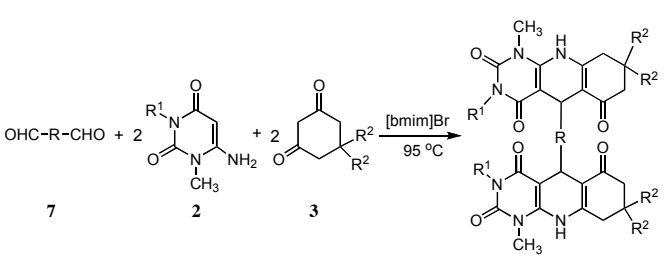
Scheme 3



6

As expected, when the aromatic aldehydes **1** was replaced by dicarboxaldehydes **7**, another series of bis(pyrimido[4,5-*b*]quinolin-2,4,6-trione) **8** were obtained under the same reaction conditions (Scheme 4). The results are summarized in Table 2.

Scheme 4



7 **2** **3** **8**

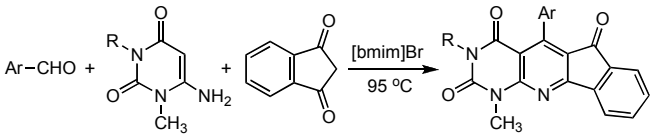
Table 2

Synthesis of **5** and **8** in ionic liquid [bmim]Br.

Entry	R	R^1	R^2	Time (h)	Yield (%)
5a	iso-propyl	CH_3	CH_3	4	72
5b	iso-propyl	CH_3	H	4	64
8a	1,4-C_6H_4	CH_3	CH_3	4	71
8b	1,3-C_6H_4	H	CH_3	4	82
8c	1,4-C_6H_4	CH_3	H	3.5	70

In order to expand the scope of the present method, the replacement of 1,3-cyclohexanedione **3** with 1,3-indanedione **9** was examined. This is particularly attractive because compounds with indenopyridine motif show a wide range of biological activities such as calcium antagonistic [12], antioxidant [13], antihistamine and antidepressant [14] activities, and also act as phosphodiesterase (PDE) inhibitors [15], NK-1 and dopamine receptor ligands [16]. To our delight, under the above optimized conditions, the reactions proceeded smoothly. A series of indeno[2',1':5,6]-pyrido[2,3-*d*]py-rimidines **10** were obtained (Scheme 5) in excellent yields. The results are summarized in Table 3.

Scheme 5



1 **2** **9** **10**

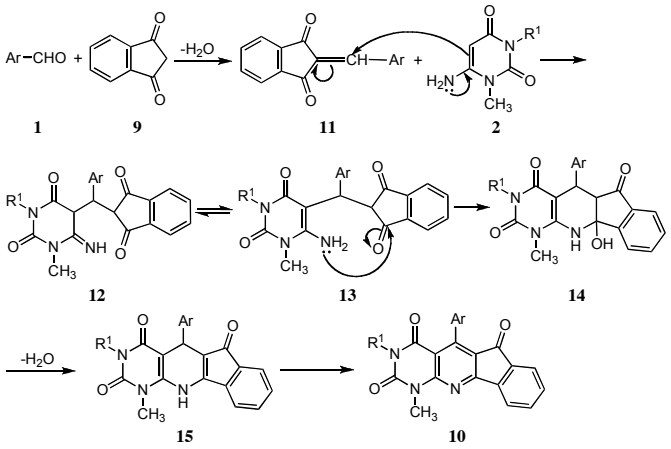
Table 3

Synthesis of **10** in ionic liquid [bmim]Br.

Entry	Ar	R	Time (h)	Yield (%)
10a	4-$CH_3C_6H_4$	CH_3	4	86
10b	4-FC_6H_4	CH_3	3	90
10c	4-ClC_6H_4	CH_3	3	92
10d	4-BrC_6H_4	CH_3	3	92
10e	4-$NO_2C_6H_4$	CH_3	3.5	91
10f	3-$NO_2C_6H_4$	CH_3	4	90
10g	2-NO_2-5-ClC_6H_3	CH_3	3.5	90
10h	3,4-$Cl_2C_6H_3$	CH_3	3.5	93
10i	3-ClC_6H_4	CH_3	3	90
10j	2,4-$Cl_2C_6H_3$	CH_3	3	92
10k	3,4-$OCH_2OC_6H_3$	CH_3	3	90
10l	Thiophen-2-yl	CH_3	4.5	75
10m	Pyridin-4-yl	CH_3	5	77
10n	4-$CH_3OC_6H_4$	H	2	91
10o	4-ClC_6H_4	H	2	93
10p	4-BrC_6H_4	H	2.5	91
10q	4-$NO_2C_6H_4$	H	2	89

Although the detailed mechanism of the above reaction remains to be fully clarified, the formation of indeno-[2',1':5,6]pyrido[2,3-*d*]pyrimidine derivatives **10** could be explained by a reaction sequence presented in Scheme 6. We proposed that the reaction proceeded *via* a reaction sequence of condensation, addition, cyclization, dehydration and aromatization. First, the condensation of aldehyde **1** and 1,3-indanedione **9** gave the intermediate product **11**. The addition of **11** to 6-aminopyrimidine-2,4-dione **2** then furnished the intermediate product **13**, which upon intramolecular cyclization, dehydration and aromatization gave rise to **10**.

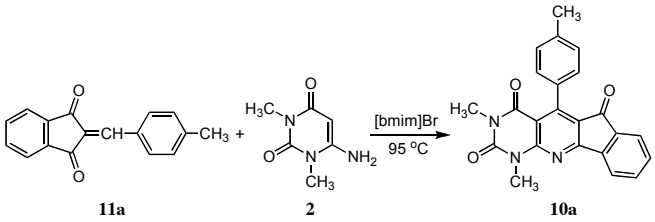
Scheme 6



1 **9** **11** **2** **12** **13** **14** **15** **10**

Evidence supporting this proposed mechanism came from the observation that when **11a** and **2** were reacted under same conditions, the expected product **10a** was obtained in a yield similar to that obtained in the one-pot reaction (Scheme 7).

Scheme 7



11a **2** **10a**

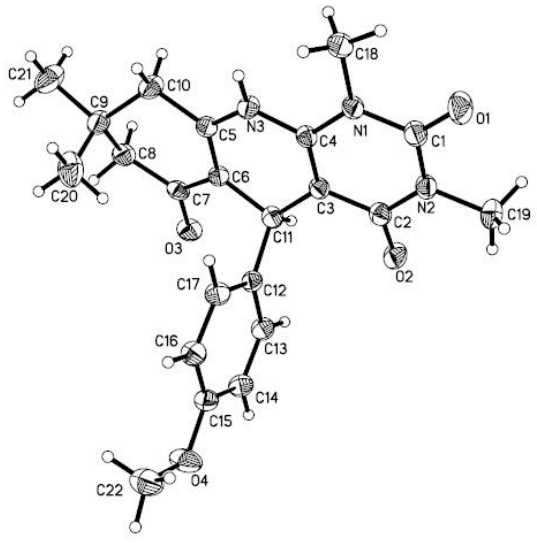


Figure 1. X-ray structure of **4a**

All the products **4**, **5**, **6**, **8** and **10** were characterized by IR, ^{1}H NMR and elemental analysis. The structures of **4a**, **5a** and **10b** were further confirmed by single crystal X-ray diffraction analysis. Figure 1, Figure 2 and Figure 3 show the molecular structures of **4a**, **5a** and **10b**, respectively. The crystallographic data of these compounds are summarized in Table 4

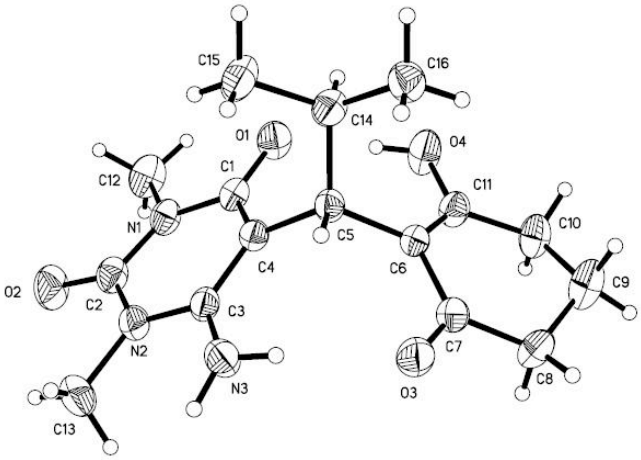


Figure 2. X-ray structure of **5a**

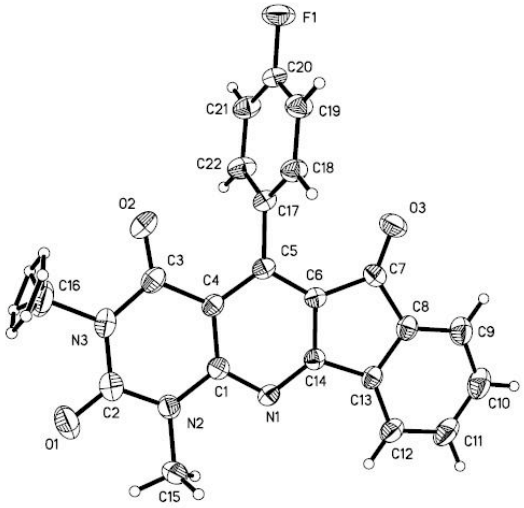


Figure 3. X-ray structure of **10b**

In conclusion, a series of 5-aryl-5,6,7,8,9,10-hexhydropyrimido[4,5-*b*]quinoline-2,4,6-triones and 5-arylindeno-[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6-triones were synthesized *via* three-component reaction of aldehyde, 6-aminopyrimidine-2,4-dione and 5,5-dimethyl-1,3-cyclohexanedione or 1,3-cyclohexanedione or 1,3-indanedione in ionic liquid [bmim]Br. The advantages of this method are easier work-up, milder reaction conditions, high yields and environmentally benign procedure.

Table 4

Crystallographic data for **4a**, **5a** and **10b.**

	4a	**5a**	**10b**
Empirical formula	$C_{22}H_{25}N_3O_4$	$C_{16}H_{23}N_3O_4$	$C_{22}H_{14}FN_3O_3$
Formula weight	395.45	321.37	387.36
Temperature (K)	298(2)	298(2)	298(2)
Wavelength (Å)	0.71073	0.71073	0.71073
Crystal system	monoclinic	monoclinic	monoclinic
Space group	$P2_1/n$	$P2_1/n$	$P2_1/c$
a (Å)	10.827(13)	9.119(2)	11.765(2)
b (Å)	16.65(2)	19.354(5)	15.455(3)
c (Å)	11.160(3)	9.200(2)	10.041(2)
□(º)	90	90	90
□(º)	100.022(17)	96.867(4)	103.423(2)
□(º)	90	90	90
V(Å^3)	1981(4)	1611.9(7)	1775.9(6)
Z	4	4	4
$D_{calc.}$ (Mg/m^3)	1.326	1.324	1.449
Absorption coefficient (mm^{-1})	0.092	0.096	0.106
F (000)	840	688	800
Crystal size (mm)	0.48 × 0.39 × 0.32	0.42 × 0.23 × 0.19	0.62 × 0.50 × 0.43
□Range (º)	2.22 to 25.01	2.10 to 25.01	1.78 to 25.01
Limiting indices	-10 ≤ h ≤ 12	-10 ≤ h ≤ 10	-13 ≤ h ≤ 13
	-19 ≤ k ≤ 14	-22 ≤ k ≤ 23	-12 ≤ k ≤ 18
	-12 ≤ l ≤ 13	-8 ≤ l ≤ 10	-11 ≤ l ≤ 10
Reflections collected	9910	8368	9003
Independent reflections	3489	2838	3124
Data/restraints/parameters	3489/0/262	2838/0/208	3124/0/262
Goodness-of-fit on F^2	1.019	1.032	1.046
Final R indices [$I > 2$□(I)]	0.0477	0.0531	0.0450
R indices (all data)	0.1118	0.1333	0.1085
Largest diff. Peak and hole (e·Å^{-3})	0.220 and -0.181	0.352 and -0.174	0.197 and -0.189

EXPERIMENTAL

Melting points were determined in open capillaries and are uncorrected. IR spectra were recorded on a Tensor 27 spectrometer. ^{1}H NMR spectra were measured on a Bruker DPX-400 M Hz spectrometer using TMS as internal standard, DMSO-d_6 as solvent. Microanalyses were carried out on Perkin-Elmer 2400 II instruments. X-ray diffraction was recorded on a Siemens Smart-1000 CCD diffractometer.

General Procedure for the Synthesis of 4, 5 and 6. A dry 50 mL flask was charged with aldehydes **1** (1 mmol), 6-aminopyrimidine-2,4-dione (1 mmol), 5,5-dimethyl-1,3-cyclohexanedione or 1,3-cyclohexanedione (1 mmol) and ionic liquid [bmim]Br (2 mL). The mixture was stirred at 95 ℃ for 2-5 h to complete the reaction (monitored by TLC), then 5 mL H_2O was added. The yellow solid was filtered off and washed with water. The filtrate was the recovered for reuse by drying at 80 ℃ several hours in a vacuum. The crude product was purified by recrystallization from DMF and H_2O to give **4** or **5** or **6**.

5-(4-Methoxyphenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4a). This compound was obtained as solid with mp > 300 ℃; ir (potassium bromide): 3283, 3095, 2953, 2884, 1705, 1636, 1489, 1426, 1379, 1338, 1291, 1243, 1207, 1147, 1080, 1036, 962, 884, 847, 787, 757, 728 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.89 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.04 (d, J = 16.4 Hz, 1H, CH), 2.21 (d, J = 16.4 Hz, 1H, CH), 2.53 (d, J = 17.2 Hz, 1H, CH), 2.60 (d, J = 17.2 Hz, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 3.67 (s, 3H, CH_3O), 4.82 (s, 1H, CH), 6.74 (d, J = 8.4 Hz, 2H, ArH), 7.12 (d, J = 8.4 Hz, 2H, ArH), 8.98 (br., s, 1H, NH). *Anal.* Calcd. for $C_{22}H_{25}N_3O_4$: C, 66.82; H, 6.37; N, 10.63. Found: C, 66.95; H, 6.31; N, 10.72.

1,3,8,8-Tetramethyl-5-*p*-tolyl-7,8,9,10-tetrahydropyrimido-[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4b). This compound was obtained as solid with mp > 300 ℃; ir (potassium bromide): 3221, 3091, 2959, 1702, 1661, 1642, 1595, 1493, 1379, 1338, 1289, 1244, 1208, 1149, 1124, 1080, 1042, 961, 845, 825, 786, 756 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.89 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.03 (d, J = 16.0 Hz, 1H, CH), 2.19 (s, 3H, CH_3), 2.21 (d, J = 16.0 Hz, 1H, CH), 2.53 (d, J = 16.8 Hz, 1H, CH), 2.60 (d, J = 16.8 Hz, 1H, CH), 3.08 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.83 (s, 1H, CH), 6.97 (d, J = 8.0 Hz, 2H, ArH), 7.10 (d, J = 8.0 Hz, 2H, ArH), 8.98 (br., s, 1H, NH).*Anal.* Calcd. for $C_{22}H_{25}N_3O_3$: C, 69.64; H, 6.64; N, 11.07. Found: C, 69.70; H, 6.58; N, 11.15.

5-(4-Bromophenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4c). This compound was obtained as solid with mp 281-283 ℃; ir (potassium bromide): 3381, 3063, 2963, 1696, 1654, 1637, 1503, 1377, 1360, 1289, 1244, 1210, 1150, 1076, 1012, 959, 848, 826, 751, 723, 690 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.88 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.04 (d, J = 16.0 Hz, 1H, CH), 2.22 (d, J = 16.0 Hz, 1H, CH), 2.53 (d, J = 16.4 Hz, 1H, CH), 2.60 (d, J = 16.4 Hz, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.84 (s, 1H, CH), 7.18 (d, J = 8.4 Hz, 2H, ArH), 7.38 (d, J = 8.4 Hz, 2H, ArH), 9.05 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{22}BrN_3O_3$: C, 56.77; H, 4.99; N, 9.46. Found: C, 56.84; H, 4.94; N, 9.37.

5-(4-Chlorophenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4d). This compound was obtained as solid with mp 292-294 ℃; ir (potassium bromide): 3387, 3048, 2964, 1691, 1654, 1627, 1505, 1377, 1326, 1288, 1243, 1209, 1149, 1092, 1049, 1016, 958, 848, 825, 776, 749, 691 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.88 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.04 (d, J = 16.4 Hz, 1H, CH), 2.22 (d, J = 16.4 Hz, 1H, CH), 2.53 (d, J = 17.6 Hz, 1H, CH), 2.61 (d, J = 17.6 Hz, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.86 (s, 1H, CH), 7.24 (s, 4H, ArH), 9.05 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{22}ClN_3O_3$: C, 63.08; H, 5.55; N, 10.51. Found: C, 63.27; H, 5.59; N, 10.43.

5-(2-Methoxyphenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4e). This compound was obtained as solid with mp > 300 ℃; ir (potassium bromide): 3209, 3071, 2943, 2835, 1704, 1647, 1602, 1514, 1382, 1353, 1289, 1243, 1176, 1147, 1110, 1082, 1050, 1026, 961, 860, 784, 767, 748 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.83 (s, 3H, CH_3), 1.03 (s, 3H, CH_3), 1.93 (d, J = 16.0 Hz, 1H, CH), 2.17 (d, J = 16.0 Hz, 1H, CH), 2.48 (d, J = 16.4 Hz, 1H, CH), 2.54 (d, J = 16.4 Hz, 1H, CH), 3.04 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 3.67 (s, 3H, CH_3O), 4.94 (s, 1H, CH), 6.74-6.78 (m, 1H, ArH), 6.83 (d, J = 8.4 Hz, 1H, ArH), 7.04-7.07 (m, 1H, ArH), 7.23 (d, J = 7.6 Hz, 1H, ArH), 8.96 (br., s, 1H, NH). *Anal.* Calcd. for $C_{22}H_{25}N_3O_4$: C, 66.82; H, 6.37; N, 10.63. Found: C, 66.94; H, 6.31; N, 10.73.

5-(3,4-Dichlorophenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4f). This compound was obtained as solid with mp > 300 ℃; ir (potassium bromide): 3212, 3092, 2954, 2891, 1699, 1661, 1635, 1595, 1490, 1376, 1345, 1288, 1245, 1198, 1153, 1127, 1081, 1052, 1028, 960, 833, 783, 750 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.89 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.06 (d, J = 16.0 Hz, 1H, CH), 2.22 (d, J = 16.0 Hz, 1H, CH), 2.54 (d, J = 17.2 Hz, 1H, CH), 2.63 (d, J = 17.2 Hz, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.84 (s, 1H, CH), 7.21 (dd, J_1 = 2.0 Hz, J_2 = 8.0 Hz, 1H, ArH), 7.40 (d, J = 2.0 Hz, 1H, ArH), 7.45 (d, J = 8.0 Hz, 1H, ArH), 9.09 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{21}Cl_2N_3O_3$: C, 58.07; H, 4.87; N, 9.68. Found: C, 58.21; H, 4.83; N, 9.59.

5-(2,4-Dichlorophenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4g). This compound was obtained as solid with mp > 300 ℃; ir (potassium bromide): 3219, 3092, 2953, 2871, 1704, 1654, 1644, 1602, 1495, 1459, 1379, 1358, 1288, 1243, 1211, 1149, 1125, 1099, 1082, 1045, 962, 863, 841, 754 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.89 (s, 3H, CH_3), 1.03 (s, 3H, CH_3), 1.98 (d, J = 16.0 Hz, 1H, CH), 2.20 (d, J = 16.0 Hz, 1H, CH), 2.53 (d, J = 17.2 Hz, 2H, CH_2), 3.05 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 5.13 (s, 1H, CH), 7.25 (dd, J_1 = 2.0 Hz, J_2 = 8.4 Hz, 1H, ArH), 7.33 (d, J = 8.4 Hz, 1H, ArH), 7.35 (d, J = 2.0 Hz, 1H, ArH), 9.04 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{21}Cl_2N_3O_3$: C, 58.07; H, 4.87; N, 9.68. Found: C, 58.24; H, 4.92; N, 9.57.

5-(3,4-Dimethylphenyl)-1,3,8,8-tetramethyl-7,8,910-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4h). This compound was obtained as solid with mp 294-296 ℃; ir (potassium bromide): 3204, 3089, 2963, 1699, 1661, 1632, 1595, 1492, 1371, 1287, 1245, 1209, 1148, 1129, 1082, 1052, 960, 883, 838, 797, 758, 685 cm^{-1}; ^{1}H nmr (DMSO-d_6): δ 0.90 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.03 (d, J = 16.4 Hz, 1H, CH), 2.10 (s, 3H, CH_3), 2.12 (s, 3H, CH_3), 2.21 (d, J = 16.4 Hz, 1H, CH), 2.53 (d, J = 17.2 Hz, 1H, CH), 2.60 (d, J = 17.2 Hz, 1H, CH), 3.08 (s, 3H, CH_3N), 3.44 (s, 3H, CH_3N), 4.78 (s, 1H, CH), 6.89-6.93 (m, 2H, ArH), 6.98 (s, 1H, ArH), 8.98 (br., s, 1H, NH). *Anal.* Calcd. for $C_{23}H_{27}N_3O_3$: C, 70.21; H, 6.92; N, 10.68. Found: C, 70.35; H, 6.99; N, 10.62.

5-(2-Chlorophenyl)-1,3,8,8-tetramethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4i). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3222, 3093, 2959, 1702, 1661, 1632, 1606, 1493, 1438, 1379, 1359, 1288, 1244, 1210, 1150, 1128, 1080, 1050, 962, 836, 769, 752 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.88 (s, 3H, CH_3), 1.03 (s, 3H, CH_3), 1.97 (d, *J* = 16.0 Hz, 1H, CH), 2.19 (d, *J* = 16.0 Hz, 1H, CH), 2.58 (d, *J* = 17.2 Hz, 2H, CH_2), 3.04 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 5.16 (s, 1H, CH), 7.05-7.10 (m, 1H, ArH), 7.14-7.22 (m, 2H, ArH), 7.33 (d, *J* = 7.6 Hz, 1H, ArH), 9.02 (br., s, 1H, NH). *Anal.* Calcd. for C_{21} $H_{21}ClN_3O_3$: C, 63.08; H, 5.55; N, 10.51. Found: C, 63.17; H, 5.42; N, 10.64.

1,3,8,8-Tetramethyl-5-(thiophen-2-yl)-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4j). This compound was obtained as solid with mp 295-296 ºC; ir (potassium bromide): 3299, 3239, 2961, 2944, 2869, 1702, 1661, 1640, 1614, 1494, 1437, 1380, 1359, 1342, 1280, 1247, 1210, 1202, 1148, 1071, 1051, 1035, 959, 873, 841, 811, 784, 753, 715 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.97 (s, 3H, CH_3), 1.06 (s, 3H, CH_3), 2.14 (d, *J* = 16.4 Hz, 1H, CH), 2.27 (d, *J* = 16.4 Hz, 1H, CH), 2.57 (d, *J* = 16.4 Hz, 1H, CH), 2.61 (d, *J* = 16.4 Hz, 1H, CH), 3.15 (s, 3H, CH_3N), 3.41 (s, 3H, CH_3N), 5.20 (s, 1H, CH), 6.75-6.83 (m, 2H, ArH), 7.17-7.21 (m, 1H, ArH), 9.19 (br., s, 1H, NH). *Anal.* Calcd. for $C_{19}H_{21}N_3O_3S$: C, 61.44; H, 5.70; N, 11.31. Found: C, 61.63; H, 5.60; N, 11.47.

5-(4-Methoxyphenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4k). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3278, 3218, 3092, 2968, 2832, 1721, 1654, 1644, 1492, 1420, 1383, 1356, 1284, 1237, 1213, 1171, 1154, 1104, 1039, 879, 838, 747 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.89 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.04 (d, *J* = 16.0 Hz, 1H, CH), 2.21 (d, *J* = 16.0 Hz, 1H, CH), 2.52 (d, *J* = 17.2 Hz, 1H, CH), 2.59 (d, *J* = 17.2 Hz, 1H, CH), 3.36 (s, 3H, CH_3N), 3.67 (s, 3H, CH_3O), 4.77 (s, 1H, CH), 6.74 (d, *J* = 8.4 Hz, 2H, ArH), 7.11 (d, *J* = 8.4 Hz, 2H, ArH), 8.92 (br., s, 1H, NH), 10.98 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{23}N_3O_4$: C, 66.13; H, 6.08; N, 11.02. Found: C, 66.27; H, 6.02; N, 11.19.

1,8,8-Trimethyl-5-*p*-tolyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4l). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3276, 3218, 3092, 2970, 2888, 1724, 1663, 1647, 1620, 1491, 1383, 1345, 1281, 1237, 1211, 1169, 1154, 1105, 1064, 880, 848, 830 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.88 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.03 (d, *J* = 16.0 Hz, 1H, CH), 2.19 (s, 3H, CH_3), 2.21 (d, *J* = 16.0 Hz, 1H, CH), 2.52 (d, *J* = 17.6 Hz, 1H, CH), 2.59 (d, *J* = 17.6 Hz, 1H, CH), 3.37 (s, 3H, CH_3N), 4.79 (s, 1H, CH), 6.98 (d, *J* = 8.0 Hz, 2H, ArH), 7.08 (d, *J* = 8.0 Hz, 2H, ArH), 8.93 (br., s, 1H, NH), 10.98 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{23}N_3O_3$: C, 69.02; H, 6.34; N, 11.50. Found: C, 69.18; H, 6.29; N, 11.63.

5-(4-Bromophenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4m). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3279, 3220, 3092, 2966, 2889, 1724, 1661, 1645, 1614, 1490, 1382, 1355, 1277, 1238, 1212, 1169, 1153, 1067, 1008, 879, 849, 833, 750 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.87 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.04 (d, *J* = 16.0 Hz, 1H, CH), 2.22 (d, *J* = 16.0 Hz, 1H, CH), 2.52 (d, *J* = 17.2 Hz, 1H, CH), 2.60 (d, *J* = 17.2 Hz, 1H, CH), 3.37 (s, 3H, CH_3N), 4.80 (s, 1H, CH), 7.17 (d, *J* = 8.4 Hz, 2H, ArH), 7.38 (d, *J* = 8.4 Hz, 2H, ArH), 8.98 (br., s, 1H, NH), 11.03 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{20}BrN_3O_3$: C, 55.83; H, 4.68; N, 9.77. Found: C, 55.95; H, 4.64; N, 9.82.

5-(4-Chlorophenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4n). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3276, 3219, 3092, 2968, 2890, 1742, 1663, 1639, 1617, 1490, 1383, 1355, 1278, 1237, 1213, 1169, 1153, 1086, 1012, 879, 850, 834, 751 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.87 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.04 (d, *J* = 16.0 Hz, 1H, CH), 2.22 (d, *J* = 16.0 Hz, 1H, CH), 2.53 (d, *J* = 17.6 Hz, 1H, CH), 2.60 (d, *J* = 17.6 Hz, 1H, CH), 3.38 (s, 3H, CH_3N), 4.82 (s, 1H, CH), 7.22 (d, *J* = 8.8 Hz, 2H, ArH), 7.25 (d, *J* = 8.8 Hz, 2H, ArH), 8.99 (br., s, 1H, NH), 11.03 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{20}ClN_3O_3$: C, 62.26; H, 5.22; N, 10.89. Found: C, 62.27; H, 5.16; N, 10.94.

5-(2,4-Dichlorophenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4o). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3279, 3201, 3087, 2960, 1718, 1676, 1649, 1632, 1585, 1496, 1381, 1357, 1281, 1236, 1214, 1151, 1103, 1064, 1046, 846, 757 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.89 (s, 3H, CH_3), 1.03 (s, 3H, CH_3), 1.98 (d, *J* = 16.0 Hz, 1H, CH), 2.20 (d, *J* = 16.0 Hz, 1H, CH), 2.53 (d, *J* = 17.6 Hz, 2H, CH_2), 3.38 (s, 3H, CH_3N), 5.09 (s, 1H, CH), 7.26 (dd, J_1 = 2.0 Hz, J_2 = 8.4 Hz, 1H, ArH), 7.33 (d, *J* = 8.4 Hz, 1H, ArH), 7.35 (d, *J* = 2.0 Hz, 1H, ArH), 8.98 (br., s, 1H, NH), 10.96 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{19}Cl_2N_3O_3$: C, 57.15; H, 4.56; N, 10.00. Found: C, 57.32; H, 4.51; N, 10.12.

5-(4-Fluorophenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4p). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3282, 3224, 3095, 3017, 2962, 2889, 1724, 1661, 1646, 1617, 1491, 1420, 1384, 1344, 1282, 1218, 1154, 1112, 1066, 846, 753, 713 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.87 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.05 (d, *J* = 16.0 Hz, 1H, CH), 2.22 (d, *J* = 16.0 Hz, 1H, CH), 2.53 (d, *J* = 17.2 Hz, 1H, CH), 2.60 (d, *J* = 17.2 Hz, 1H, CH), 3.38 (s, 3H, CH_3N), 4.83 (s, 1H, CH), 6.98-7.03 (m, 2H, ArH), 7.21-7.24 (m, 2H, ArH), 8.98 (br., s, 1H, NH), 11.02 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{20}FN_3O_3$: C, 65.03; H, 5.46; N, 11.38. Found: C, 65.16; H, 5.51; N, 11.32.

5-(2-Methoxyphenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4q). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3238, 3209, 3088, 2952, 2834, 1714, 1648, 1617, 1499, 1383, 1358, 1286, 1250, 1235, 1198, 1158, 1119, 1029, 856, 789, 757 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.83 (s, 3H, CH_3), 1.03 (s, 3H, CH_3), 1.93 (d, *J* = 16.4 Hz, 1H, CH), 2.17 (d, *J* = 16.4 Hz, 1H, CH), 2.48 (d, *J* = 17.2 Hz, 1H, CH), 2.53 (d, *J* = 17.2 Hz, 1H, CH), 3.38 (s, 3H, CH_3N), 3.68 (s, 3H, CH_3O), 4.89 (s, 1H, CH), 6.75-6.78 (m, 1H, ArH), 6.84 (d, *J* = 8.0 Hz, 1H, ArH), 7.04-7.08 (m, 1H, ArH), 7.20 (dd, J_1 = 1.6 Hz, J_2 = 7.2 Hz, 1H, ArH), 8.89 (br., s, 1H, NH), 10.84 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{23}N_3O_4$: C, 66.13; H, 6.08; N, 11.02. Found: C, 66.25; H, 6.21; N, 11.09.

5-(3,4-Methylidenedioxyphenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*, 5*H*)-trione (4r). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3296, 3164, 3058, 2953, 2804, 1720, 1691, 1671, 1641, 1625, 1495, 1439, 1415, 1367, 1357, 1246, 1212, 1169, 1151, 1104, 1036, 927, 857, 794, 778, 759 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.90 (s, 3H, CH_3), 1.04 (s, 3H, CH_3), 2.06 (d, *J* = 16.0 Hz, 1H, CH), 2.21 (d, *J* = 16.0 Hz, 1H, CH), 2.52 (d, *J*

= 17.6 Hz, 1H, CH), 2.60 (d, *J* = 17.6 Hz, 1H, CH), 3.37 (s, 3H, CH_3N), 4.76 (s, 1H, CH), 5.91 (s, 2H, OCH_2O), 6.51-6.67 (m, 1H, ArH), 6.71-6.73 (m, 2H, ArH), 8.94 (br., s, 1H, NH), 11.00 (br., s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{21}N_3O_5$: C, 63.79; H, 5.35; N, 10.63. Found: C, 63.71; H, 5.42; N, 10.74.

5-(2-Chlorophenyl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4s). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3282, 3223, 3087, 2954, 2869, 1684, 1625, 1609, 1497, 1438, 1378, 1356, 1342, 1283, 1239, 1214, 1169, 1148, 1100, 1037, 790, 755 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.88 (s, 3H, CH_3), 1.03 (s, 3H, CH_3), 1.97 (d, *J* = 16.0 Hz, 1H, CH), 2.19 (d, *J* = 16.0 Hz, 1H, CH), 2.53 (d, *J* = 17.2 Hz, 2H, CH_2), 3.38 (s, 3H, CH_3N), 5.12 (s, 1H, CH), 7.06-7.11 (m, 1H, ArH), 7.15-7.23 (m, 2H, ArH), 7.32-7.35 (m, 1H, ArH), 8.96 (br., s, 1H, NH), 10.93 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{20}ClN_3O_3$: C, 62.26; H, 5.22; N, 10.89. Found: C, 62.39; H, 5.14; N, 10.94.

5-(Thiophen-2-yl)-1,8,8-trimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4t). This compound was obtained as solid with mp 294-296 ºC; ir (potassium bromide): 3332, 3187, 3064, 2959, 1706, 1664, 1625, 1498, 1384, 1352, 1278, 1256, 1214, 1148, 1090, 1061, 1035, 887, 834, 786, 764, 696 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.97 (s, 3H, CH_3), 1.06 (s, 3H, CH_3), 2.14 (d, *J* = 16.0 Hz, 1H, CH), 2.27 (d, *J* = 16.0 Hz, 1H, CH), 2.53 (d, *J* = 17.6 Hz, 1H, CH), 2.60 (d, *J* = 17.6 Hz, 1H, CH), 3.36 (s, 3H, CH_3N), 5.15 (s, 1H, CH), 6.74 (d, *J* = 3.2 Hz, 1H, ArH), 6.82 (dd, J_1 = 3.2 Hz, J_2 = 4.8 Hz, 1H, ArH), 7.19 (dd, J_1 = 1.2 Hz, J_2 = 5.2 Hz, 1H, ArH), 9.12 (br., s, 1H, NH), 11.11 (br., s, 1H, NH). *Anal.* Calcd. for $C_{18}H_{19}N_3O_3S$: C, 60.49; H, 5.36; N, 11.76. Found: C, 60.33; H, 5.29; N, 11.91.

1,3-Dimethyl-5-*p*-tolyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]-quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4u). This compound was obtained as solid with mp 284-285 ºC; ir (potassium bromide): 3285, 3096, 2937, 1702, 1687, 1661, 1637, 1605, 1506, 1396, 1380, 1354, 1288, 1245, 1201, 1171, 1150, 1124, 1082, 1043, 949, 758 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.75-1.83 (m, 1H, CH), 1.91-1.96 (m, 1H, CH), 2.19 (s, 3H, CH_3), 2.21-2.27 (m, 2H, CH_2), 2.55-2.61 (m, 1H, CH), 2.74-2.79 (m, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.87 (s, 1H, CH), 6.97 (d, *J* = 8.0 Hz, 2H, ArH), 7.10 (d, *J* = 8.0 Hz, 2H, ArH), 9.07 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{21}N_3O_3$: C, 68.36; H, 6.02; N, 11.96. Found: C, 68.43; H, 5.94; N, 12.06.

1,3-Dimethyl-5-(4-fluorophenyl)-7,8,9,10-tetrahydropyrimido[4,5-b]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4v). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3302, 2947, 1700, 1653, 1610, 1503, 1443, 1379, 1355, 1289, 1254, 1238, 1214, 1198, 1170, 1153, 1142, 1094, 1048, 950, 834, 764, 753 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.77-1.84 (m, 1H, CH), 1.92-1.98 (m, 1H, CH), 2.23-2.27 (m, 2H, CH_2), 2.54-2.62 (m, 1H, CH), 2.74-2.81 (m, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.91 (s, 1H, CH), 6.97-7.01 (m, 2H, ArH), 7.22-7.26 (m, 2H, ArH), 9.11 (br., s, 1H, NH). *Anal.* Calcd. for $C_{19}H_{18}FN_3O_3$: C, 64.22; H, 5.11; N, 11.82. Found: C, 64.37; H, 5.04; N, 11.93.

5-(4-Chlorophenyl)-1,3-dimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4w). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3298, 3234, 3094, 2957, 2890, 1700, 1639, 1612, 1499, 1443, 1378, 1355, 1289, 1256, 1238, 1198, 1170, 1142, 1047, 1012, 949, 840, 752 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.77-1.84 (m, 1H, CH), 1.92-1.98 (m, 1H, CH), 2.23-2.27 (m, 2H, CH_2), 2.55-2.62 (m, 1H, CH), 2.74-2.81 (m, 1H, CH), 3.09 (s, 3H, CH_3N), 3.45 (s, 3H, CH_3N), 4.90 (s, 1H, CH), 7.24 (s, 4H, ArH), 9.12 (br., s, 1H, NH). *Anal.* Calcd. for $C_{19}H_{18}ClN_3O_3$: C, 61.38; H, 4.88; N, 11.30. Found: C, 61.51; H, 4.84; N, 11.37.

5-(Thiophen-2-yl)-1,3-dimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4x). This compound was obtained as solid with mp 288-290 ºC; ir (potassium bromide): 3271, 3228, 3086, 3069, 2952, 2883, 1699, 1650, 1604, 1503, 1378, 1348, 1335, 1294, 1236, 1201, 1168, 1141, 1083, 1040, 949, 911, 882, 856, 787, 754, 712 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.78-2.05 (m, 2H, CH_2), 2.28-2.34 (m, 2H, CH_2), 2.53-2.63 (m, 1H, CH), 2.72-2.83 (m, 1H, CH), 3.16 (s, 3H, CH_3N), 3.44 (s, 3H, CH_3N), 5.22 (s, 1H, CH), 6.74 (d, *J* = 3.2 Hz, 1H, ArH), 6.81 (dd, J_1 = 3.6 Hz, J_2 = 4.8 Hz, 1H, ArH), 7.18 (d, *J* = 4.8 Hz, 1H, ArH), 9.24 (br., s, 1H, NH). *Anal.* Calcd. for $C_{17}H_{17}N_3O_3S$: C, 59.46; H, 4.99; N, 12.24. Found: C, 59.62; H, 4.86; N, 12.35.

5-(4-Methoxyphenyl)-1-methyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4y). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3184, 3058, 2941, 2809, 1727, 1654, 1602, 1506, 1426, 1379, 1330, 1238, 1205, 1195, 1161, 1127, 1106, 1052, 1036, 908, 892, 842, 761, 714 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.75-1.85 (m, 1H, CH), 1.90-1.98 (m, 1H, CH), 2.21-2.26 (m, 2H, CH_2), 2.55-2.60 (m, 1H, CH), 2.75-2.80 (m, 1H, CH), 3.38 (s, 3H, CH_3N), 3.67 (s, 3H, CH_3O), 4.82 (s, 1H, CH), 6.74 (d, *J* = 8.4 Hz, 2H, ArH), 7.11 (d, *J* = 8.4 Hz, 2H, ArH), 9.00 (br., s, 1H, NH), 10.98 (br., s, 1H, NH). Anal. Calcd. for $C_{19}H_{19}N_3O_4$: C, 64.58; H, 5.42; N, 11.89. Found: C, 64.72; H, 5.38; N, 11.97.

5-(3,4-Dimethylphenyl)-1-methyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (4z). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3209, 3090, 3033, 2961, 1711, 1644, 1507, 1413, 1382, 1355, 1341, 1269, 1216, 1186, 1146, 1134, 1104, 896, 831, 799, 761, 712 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.73-1.80 (m, 1H, CH), 1.81-1.97 (m, 1H, CH), 2.10 (s, 3H, CH_3), 2.13 (s, 3H, CH_3), 2.22-2.27 (m, 2H, CH_2), 2.53-2.60 (m, 1H, CH), 2.74-2.78 (m, 1H, CH), 3.38 (s, 3H, CH_3N), 4.81 (s, 1H, CH), 6.88-6.96 (m, 3H, ArH), 9.00 (br., s, 1H, NH), 10.97 (br., s, 1H, NH). *Anal.* Calcd. for $C_{20}H_{21}N_3O_3$: C, 68.36; H, 6.02; N, 11.96. Found: C, 68.42; H, 5.94; N, 12.07.

6-Amino-5-(1-(2-hydroxy-4,4-dimethyl-6-oxocyclohex-1-enyl)-2-methylpropyl)-1,3-dimethylpyrimidine-2,4(1*H*,3*H*)-dione (5a). This compound was obtained as solid with mp 230-231 ºC; ir (potassium bromide): 3383, 3208, 2954, 2867, 1691, 1656, 1611, 1589, 1506, 1472, 1453, 1382, 1353, 1322, 1305, 1249, 1214, 1151, 1128, 1108, 1050, 968, 942, 927, 895, 795, 761, 674 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.74 (d, *J* = 6.4 Hz, 3H, CH_3), 0.79 (d, *J* = 6.4 Hz, 3H, CH_3), 0.99 (s, 6H, 2 × CH_3), 2.13 (d, *J* = 17.6 Hz, 1H, CH), 2.22 (d, *J* = 16.4 Hz, 2H, CH_2), 2.35 (d, *J* = 17.6 Hz, 1H, CH), 2.85-2.97 (m, 1H, CH), 3.17 (s, 3H, CH_3), 3.30 (s, 3H, CH_3), 3.46 (d, *J* = 11.2 Hz, 1H, CH), 7.20 (s, 2H, NH_2), 13.18 (s, 1H, OH). *Anal.* Calcd. for $C_{18}H_{27}N_3O_4$: C, 61.87; H, 7.79; N, 12.03. Found: C, 62.04; H, 7.58; N, 12.28.

6-Amino-5-(1-(2-hydroxy-6-oxocyclohex-1-enyl)-2-methylpropyl)-1,3-dimethylpyrimidine-2,4(1*H*,3*H*)-dione (5b). This compound was obtained as solid with mp 234-235 ºC; ir (potassium bromide): 3357, 3177, 2948, 2873, 1698, 1654, 1614, 1583, 1501, 1452, 1370, 1352, 1269, 1195, 1148, 1111,

1046, 980, 963, 935, 784, 753, 704, 678 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.73 (d, J = 6.4 Hz, 3H, CH_3), 0.77 (d, J = 6.4 Hz, 3H, CH_3), 1.75-1.86 (m, 2H, CH_2), 2.18-2.40 (m, 4H, 2 × CH_2), 2.82-2.90 (m, 1H, CH), 3.17 (s, 3H, CH_3), 3.31 (s, 3H, CH_3), 3.45 (d, J = 10.8 Hz, 1H, CH), 7.29 (s, 2H, NH_2), 13.24 (s, 1H, OH). *Anal.* Calcd. for $C_{16}H_{23}N_3O_4$: C, 59.80; H, 7.21; N, 13.08. Found: C, 60.13; H, 7.06; N, 12.87.

1,3,8,8-Tetramethyl-8,9-dihydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,7*H*)-trione (6). This compound was obtained as solid with mp 193-195 ºC; ir (potassium bromide): 2959, 2873, 1717, 1691, 1664, 1597, 1498, 1476, 1414, 1370, 1357, 1326, 1303, 1271, 1224, 1140, 1115, 1067, 1039, 985, 965, 822, 793, 753, 696 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.06 (s, 6H, 2 × CH_3), 2.54 (s, 2H, CH_2), 3.07 (s, 2H, CH_2), 3.31 (s, 3H, CH_3), 3.60 (s, 3H, CH_3), 8.62 (s, 1H, CH). HRMS [Found: m/z, 287.1267 (M^+); Calcd. for $C_{15}H_{17}N_3O_3$: M, 287.1270].

1,3,8,8-Tetramethyl-5-(4-(1,3,8,8-tetramethyl-2,4,6-tri-oxo-1,2,3,4,5,5a,6,7,8,9,9a,10-dodecahydropyrimido[4,5-*b*]quinolin-5-yl)phenyl)-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (8a). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3280, 3229, 3092, 2956, 2868, 1698, 1654, 1636, 1508, 1375, 1286, 1241, 1208, 1149, 1125, 1098, 1049, 978, 960, 891, 858, 811, 762, 752, 685 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.91 (s, 6H, 2 × CH_3), 1.02 (s, 6H, 2 × CH_3), 2.08 (d, J = 16.4 Hz, 2H, 2 × CH), 2.17 (d, J = 16.4 Hz, 2H, 2 × CH), 2.50 (d, J = 16.4 Hz, 2H, 2 × CH), 2.63 (d, J = 16.4 Hz, 2H, 2 × CH), 3.08 (s, 6H, 2 × CH_3), 3.42 (s, 6H, 2 × CH_3), 4.82 (s, 2H, 2 × CH), 7.02 (s, 4H, ArH), 9.00 (s, 2H, 2 × NH). *Anal.* Calcd. for $C_{36}H_{40}N_6O_6$: C, 66.24; H, 6.18; N, 12.88. Found: C, 66.49; H, 6.05; N, 13.06.

1,8,8-Trimethyl-5-(3-(1,8,8-trimethyl-2,4,6-trioxo-1,2,3,4,5,5a,6,7,8,9,9a,10-dodecahydropyrimido[4,5-*b*]quinolin-5-yl)-phenyl)-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (8b). This compound was obtained as solid with mp 298-299 ºC; ir (potassium bromide): 3527, 3177, 3024, 2958, 2808, 1717, 1655, 1503, 1437, 1415, 1372, 1357, 1282, 1257, 1233, 1205, 1170, 1151, 1101, 1062, 885, 861, 819, 774, 753, 704, 662 cm^{-1}; ^1H nmr (DMSO-d_6): δ 0.70 (s, 6H, 2 × CH_3), 1.02 (s, 6H, 2 × CH_3), 1.95 (d, J = 16.4 Hz, 2H, 2 × CH), 2.19 (d, J = 16.4 Hz, 2H, 2 × CH), 2.44-2.56 (m, 4H, 4 × CH), 3.39 (s, 6H, 2 × CH_3), 4.70 (s, 2H, 2 × CH), 6.94-6.98 (m, 4H, ArH), 8.83 (s, 2H, 2 × NH), 10.95 (s, 2H, 2 × NH). *Anal.* Calcd. for $C_{34}H_{36}N_6O_6$: C, 65.37; H, 5.81; N, 13.45. Found: C, 65.56; H, 5.53; N, 13.28.

5-(4-(1,3-Dimethyl-2,4,6-trioxo-1,2,3,4,5,5a,6,7,8,9,9a,10-dodecahydropyrimido[4,5-*b*]quinoline-5-yl)phenyl)-1,3-dimethyl-7,8,9,10-tetrahydropyrimido[4,5-*b*]quinoline-2,4,6(1*H*,3*H*,5*H*)-trione (8c). This compound was obtained as solid with mp 288-290 ºC; ir (potassium bromide): 3411, 3308, 3213, 3086, 2952, 1697, 1660, 1631, 1500, 1380, 1359, 1290, 1260, 1238, 1201, 1170, 1141, 1045, 948, 815, 748 cm^{-1}; ^1H nmr (DMSO-d_6): δ 1.77-2.00 (m, 4H, 2 × CH_2), 2.18-2.31 (m, 4H, 2 × CH_2), 2.54-2.63 (m, 2H, CH_2), 2.75-2.83 (m, 2H, CH_2), 3.08 (s, 6H, 2 × CH_3), 3.43 (s, 6H, 2 × CH_3), 4.85 (s, 2H, 2 × CH), 7.03 (s, 4H, ArH), 9.08 (s, 2H, 2 × NH). *Anal.* Calcd. for $C_{32}H_{32}N_6O_6$: C, 64.42; H, 5.41; N, 14.09. Found: C, 64.67; H, 5.26; N, 14.31.

1,3-Dimethyl-5-*p*-tolylindeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10a). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3034, 2949, 2843, 1715, 1681, 1669, 1609, 1596, 1558, 1513, 1469, 1445, 1433, 1381, 1357, 1317, 1286, 1270, 1249, 1176, 1156, 1079, 1022, 887, 834, 796, 735, 678 cm^{-1}; ^1H nmr (DMSO-d_6): δ 2.41 (s, 3H, CH_3), 3.14 (s, 3H, CH_3), 3.74 (s, 3H, CH_3), 7.12 (d, J = 7.6 Hz, 2H, ArH), 7.20 (d, J = 7.6 Hz, 2H, ArH), 7.59 (d, J = 7.2 Hz, 1H, ArH), 7.63 (t, J = 7.2 Hz, 1H, ArH), 7.77 (t, J = 7.2 Hz, 1H, ArH), 7.97 (d, J = 7.6 Hz, 1H, ArH). *Anal.* Calcd. for $C_{23}H_{17}N_3O_3$: C, 72.05; H, 4.47; N, 10.96. Found: C, 72.24; H, 4.38; N, 11.04.

1,3-Dimethyl-5-(4-fluorophenyl)indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10b). This compound was obtained as solid with mp 294-297 ºC; ir (potassium bromide): 3074, 2955, 1714, 1678, 1604, 1563, 1498, 1409, 1383, 1360, 1318, 1289, 1214, 1178, 1160, 1138, 1094, 1081, 1032, 1010, 981, 938, 890, 838, 798, 776, 747, 702, 677 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.16 (s, 3H, CH_3), 3.77 (s, 3H, CH_3), 7.20-7.31 (m, 4H, ArH), 7.62-7.68 (m, 2H, ArH), 7.77-7.82 (m, 1H, ArH), 8.01 (d, J = 8.0 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{14}FN_3O_3$: C, 68.21; H, 3.64; N, 10.85. Found: C, 68.43; H, 3.78; N, 10.62.

5-(4-Chlorophenyl)-1,3-dimethyl-indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10c). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3054, 2955, 1714, 1661, 1598, 1563, 1494, 1469, 1408, 1380, 1361, 1315, 1287, 1224, 1172, 1156, 1140, 1084, 1033, 1014, 981, 940, 887, 824, 796, 779, 750, 701 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.15 (s, 3H, CH_3), 3.76 (s, 3H, CH_3), 7.27 (d, J = 8.0 Hz, 2H, ArH), 7.47 (d, J = 8.0 Hz, 2H, ArH), 7.61-7.67 (m, 2H, ArH), 7.79 (t, J = 7.2 Hz, 1H, ArH), 8.00 (d, J = 7.2 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{14}ClN_3O_3$: C, 65.43; H, 3.49; N, 10.41. Found: C, 65.18; H, 3.63; N, 10.61.

5-(4-Bromophenyl)-1,3-dimethyl-indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10d). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3042, 2958, 1720, 1669, 1592, 1571, 1503, 1491, 1466, 1449, 1414, 1381, 1361, 1319, 1289, 1223, 1172, 1140, 1094, 1082, 1068, 982, 941, 824, 796, 778, 701, 672 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.15 (s, 3H, CH_3), 3.75 (s, 3H, CH_3), 7.21 (d, J = 8.0 Hz, 2H, ArH), 7.59-7.67 (m, 4H, ArH), 7.79 (t, J = 7.2 Hz, 1H, ArH), 8.00 (d, J = 7.2 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{14}BrN_3O_3$: C, 58.95; H, 3.15; N, 9.37. Found: C, 59.23; H, 3.02; N, 9.65.

1,3-Dimethyl-5-(4-nitrophenyl)indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10e). This compound was obtained as solid with mp 254-256 ºC; ir (potassium bromide): 3078, 2942, 1717, 1670, 1601, 1568, 1517, 1505, 1464, 1411, 1381, 1344, 1316, 1291, 1222, 1196, 1173, 1140, 1093, 1081, 1031, 1007, 889, 855, 820, 797, 779, 750, 727, 703 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.14 (s, 3H, CH_3), 3.76 (s, 3H, CH_3), 7.56 (d, J = 8.4 Hz, 2H, ArH), 7.60-7.67 (m, 2H, ArH), 7.80 (t, J = 7.2 Hz, 1H, ArH), 8.02 (d, J = 7.2 Hz, 1H, ArH), 8.30 (d, J = 8.4 Hz, 2H, ArH). *Anal.* Calcd. for $C_{22}H_{14}N_4O_5$: C, 63.77; H, 3.41; N, 13.52. Found: C, 63.89; H, 3.24; N, 13.73.

1,3-Dimethyl-5-(3-nitrophenyl)indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10f). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3080, 2952, 1716, 1669, 1607, 1567, 1527, 1501, 1463, 1409, 1380, 1344, 1318, 1289, 1221, 1171, 1143, 1106, 1081, 1036, 983, 943, 879, 796, 777, 748, 728, 718, 702, 692 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.16 (s, 3H, CH_3), 3.79 (s, 3H, CH_3), 7.62-7.68 (m, 2H, ArH), 7.73-7.76 (m, 2H, ArH), 7.81 (d, J = 7.2 Hz, 1H, ArH), 8.03 (d, J = 7.6 Hz, 1H, ArH), 8.20 (s, 1H, ArH), 8.32 (d, J = 7.2 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{14}N_4O_5$: C, 63.77; H, 3.41; N, 13.52. Found: C, 64.01; H, 3.54; N, 13.26.

1,3-Dimethyl-5-(2-nitrophenyl)indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10g). This compound was

obtained as solid with mp > 300 ºC; ir (potassium bromide): 3060, 2955, 2858, 1716, 1667, 1603, 1567, 1525, 1504, 1462, 1415, 1384, 1344, 1319, 1287, 1268, 1222, 1193, 1174, 1144, 1103, 1035, 942, 895, 876, 843, 796, 778, 749, 702, 690 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.17 (s, 3H, CH_3), 3.79 (s, 3H, CH_3), 7.58 (s, 1H, ArH), 7.65-7.70 (m, 2H, ArH), 7.81-7.85 (m, 2H, ArH), 8.04 (d, *J* = 7.6 Hz, 1H, ArH), 8.38 (d, *J* = 8.8 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{13}ClN_4O_5$: C, 58.87; H, 2.92; N, 12.48. Found: C, 59.13; H, 3.08; N, 12.25.

5-(3,4-Dichlorophenyl)-1,3-dimethylindeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10h). This compound was obtained as solid with mp 253-256 ºC; ir (potassium bromide): 3094, 3072, 2957, 1712, 1667, 1609, 1570, 1548, 1497, 1451, 1412, 1386, 1357, 1317, 1285, 1211, 1203, 1170, 1159, 1135, 1094, 1077, 1029, 1006, 861, 823, 797, 778, 751, 700 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.17 (s, 3H, CH_3), 3.77 (s, 3H, CH_3), 7.26 (d, *J* = 8.4 Hz, 1H, ArH), 7.57 (s, 1H, ArH), 7.65-7.70 (m, 3H, ArH), 7.81 (t, *J* = 7.2 Hz, 1H, ArH), 8.01 (d, *J* = 7.2 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{13}Cl_2N_3O_3$: C, 60.29; H, 2.99; N, 9.59. Found: C, 60.04; H, 3.09; N, 9.36.

5-(3-Chlorophenyl)-1,3-dimethyl-indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10i). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3072, 2953, 1716, 1669, 1603, 1565, 1520, 1461, 1411, 1380, 1359, 1318, 1288, 1224, 1203, 1192, 1174, 1141, 1103, 1081, 1035, 1007, 983, 941, 891, 858, 795, 776, 749, 728, 698 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.16 (s, 3H, CH_3), 3.76 (s, 3H, CH_3), 7.20 (d, *J* = 7.6 Hz, 1H, ArH), 7.33 (s, 1H, ArH), 7.42-7.50 (m, 2H, ArH), 7.61-7.67 (m, 2H, ArH), 7.79 (t, *J* = 7.2 Hz, 1H, ArH), 8.00 (d, *J* = 7.6 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{14}ClN_3O_3$: C, 65.43; H, 3.49; N, 10.41. Found: C, 65.62; H, 3.27; N, 10.55.

5-(2,4-Dichlorophenyl)-1,3-dimethyl-indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10j). This compound was obtained as solid with mp 297-298 ºC; ir (potassium bromide): 3062, 2956, 1718, 1676, 1593, 1571, 1505, 1482, 1413, 1382, 1360, 1317, 1288, 1251, 1221, 1171, 1157, 1145, 1100, 1083, 1057, 1027, 982, 888, 844, 820, 795, 778, 766, 747, 700 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.18 (s, 3H, CH_3), 3.77 (s, 3H, CH_3), 7.28 (d, *J* = 8.4 Hz, 1H, ArH), 7.65-7.70 (m, 2H, ArH), 7.72 (s, 1H, ArH), 7.82 (t, *J* = 7.2 Hz, 1H, ArH), 8.03 (d, *J* = 7.2 Hz, 1H, ArH). *Anal.* Calcd. for $C_{22}H_{13}Cl_2N_3O_3$: C, 60.29; H, 2.99; N, 9.59. Found: C, 60.52; H, 3.07; N, 9.42.

1,3-Dimethyl-5-(3,4-methylenedioxylphenyl)indeno-[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10k). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3071, 2958, 2915, 1717, 1673, 1605, 1566, 1493, 1438, 1411, 1381, 1361, 1337, 1291, 1238, 1174, 1153, 1125, 1104, 1081, 1031, 1007, 982, 926, 911, 883, 812, 796, 778, 749, 702 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.17 (s, 3H, CH_3), 3.75 (s, 3H, CH_3), 6.10 (s, 2H, OCH_2O), 6.71 (d, *J* = 8.0 Hz, 1H, ArH), 6.83 (s, 1H, ArH), 6.94 (d, *J* = 8.0 Hz, 1H, ArH), 7.63-7.67 (m, 2H, ArH), 7.77-7.80 (m, 1H, ArH), 7.99 (d, *J* = 7.6 Hz, 1H, ArH). *Anal.* Calcd. for $C_{23}H_{15}N_3O_5$: C, 66.83; H, 3.66; N, 10.16. Found: C, 66.54; H, 3.77; N, 10.34.

1,3-Dimethyl-5-(thiophen-2-yl)indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10l). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3099, 1714, 1666, 1568, 1533, 1499, 1408, 1382, 1362, 1343, 1286, 1231, 1204, 1172, 1133, 1080, 1044, 1020, 978, 884, 857, 797, 780, 748, 702 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.19 (s, 3H, CH_3), 3.75 (s, 3H, CH_3), 7.00-7.03 (m, 1H, ArH), 7.12-7.14 (m, 1H, ArH), 7.64-7.68 (m, 2H, ArH), 7.72 (d, *J* = 5.2 Hz, 1H, ArH), 7.78-7.82 (m, 1H, ArH), 8.01 (d, *J* = 7.6 Hz, 1H, ArH).Anal. Calcd. for $C_{20}H_{13}N_3O_3S$: C, 63.99; H, 3.49; N, 11.19. Found: C, 64.23; H, 3.32; N, 11.38.

1,3-Dimethyl-5-(pyridine-4-yl)indeno[2',1':5,6]pyrido[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10m). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3068, 1715, 1667, 1601, 1569, 1548, 1498, 1464, 1410, 1378, 1360, 1319, 1305, 1291, 1222, 1171, 1140, 1093, 1084, 1034, 991, 889, 824, 797, 778, 749, 702 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.17 (s, 3H, CH_3), 3.78 (s, 3H, CH_3), 7.28 (d, *J* = 5.2 Hz, 2H, ArH), 7.63-7.68 (m, 2H, ArH), 7.81 (t, *J* = 6.8 Hz, 1H, ArH), 8.03 (d, *J* = 7.2 Hz, 1H, ArH), 8.62 (d, *J* = 5.2 Hz, 2H, ArH). *Anal.* Calcd. for $C_{21}H_{14}N_4O_3$: C, 68.10; H, 3.81; N, 15.13. Found: C, 68.35; H, 3.67; N, 15.32.

1,3-Dimethyl-5-(4-methoxyphenyl)indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10n). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3169, 3118, 3034, 2963, 2852, 1721, 1694, 1609, 1561, 1491, 1414, 1362, 1317, 1288, 1251, 1174, 1155, 1129, 1110, 1025, 990, 879, 836, 826, 797, 777, 751, 743 cm^{-1}; ^1H nmr (DMSO-d_6): δ 3.68 (s, 3H, CH_3), 3.84 (s, 3H, CH_3O), 6.94 (d, *J* = 8.4 Hz, 2H, ArH), 7.21 (d, *J* = 8.8 Hz, 2H, ArH), 7.63-7.66 (m, 2H, ArH), 7.77-7.80 (m, 1H, ArH), 7.98 (d, *J* = 6.8 Hz, 1H, ArH), 11.57 (s, 1H, NH). *Anal.* Calcd. for $C_{22}H_{15}N_3O_4$: C, 68.57; H, 3.92; N, 10.90. Found: C, 68.72; H, 3.75; N, 11.07.

5-(4-Chlorophenyl)-1,3-dimethyl-indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10o). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3171, 3125, 3045, 2844, 1720, 1689, 1597, 1562, 1490, 1449, 1396, 1361, 1316, 1301, 1287, 1227, 1189, 1174, 1156, 1131, 1090, 1070, 1016, 992, 879, 838, 828, 796, 777, 752, 744, 720, 696 cm^{-1}, ^1H nmr (DMSO-d_6): δ 3.68 (s, 3H, CH_3), 7.29 (d, *J* = 8.4 Hz, 2H, ArH), 7.45 (d, *J* = 8.4 Hz, 2H, ArH), 7.63-7.66 (m, 2H, ArH), 7.78-7.81 (m, 1H, ArH), 8.00 (d, *J* = 7.6 Hz, 1H, ArH), 11.65 (s, 1H, NH). Anal. Calcd. for $C_{21}H_{12}Cl\ N_3O_3$: C, 64.71; H, 3.10; N, 10.78. Found: C, 64.93; H, 2.91; N, 10.89.

5-(4-Bromophenyl)-1-methyl-indeno[2',1':5,6]pyrido[2,3-*d*]-pyrimidine-2,4,6(1*H*,3*H*)-trione (10p). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3168, 3050, 2845, 1719, 1647, 1607, 1594, 1565, 1490, 1447, 1380, 1359, 1317, 1287, 1229, 1173, 1156, 1131, 1101, 1077, 1012, 992, 879, 834, 797, 778, 745, 713 cm^{-1}, ^1H nmr (DMSO-d_6): δ 3.68 (s, 3H, CH_3), 7.23 (d, *J* = 8.0 Hz, 2H, ArH), 7.59 (d, *J* = 8.4 Hz, 2H, ArH), 7.63-7.66 (m, 2H, ArH), 7.80 (t, *J* = 7.6 Hz, 1H, ArH), 8.00 (d, *J* = 7.6 Hz, 1H, ArH), 11.66 (s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{12}BrN_3O_3$: C, 58.08; H, 2.79; N, 9.68. Found: C, 58.32; H, 2.55; N, 9.84.

5-(4-Hydroxyphenyl)-1-methyl-indeno[2',1':5,6]pyrido-[2,3-*d*]pyrimidine-2,4,6(1*H*,3*H*)-trione (10q). This compound was obtained as solid with mp > 300 ºC; ir (potassium bromide): 3228, 3098, 2924, 1715, 1649, 1607, 1588, 1516, 1489, 1418, 1389, 1371, 1350, 1280, 1258, 1223, 1170, 1109, 1067, 1016, 989, 879, 852, 827, 797, 782, 768, 751, 739 cm^{-1}, ^1H nmr (DMSO-d_6): δ 3.67 (s, 3H, CH_3), 6.75 (d, *J* = 8.4 Hz, 2H, ArH), 7.09 (d, *J* = 8.4 Hz, 2H, ArH), 7.61-7.65 (m, 2H, ArH), 7.78 (t, *J* = 7.6 Hz, 1H, ArH), 7.96 (d, *J* = 7.2 Hz, 1H, ArH), 9.58 (s, 1H, OH), 11.54 (s, 1H, NH). *Anal.* Calcd. for $C_{21}H_{13}N_3O_4$: C, 67.92; H, 3.53; N, 11.32. Found: C, 68.11; H, 3.70; N, 11.14.

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