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Oxidative synthesis of quinazolinones and benzothiadiazine 1,1-dioxides from 2-amino-benzamide and 2-aminobenzenesulfonamide with benzyl alcohols and aldehydes†

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An interesting procedure for the zinc-catalyzed oxidative transformation of ready available 2-aminobenzamide, 2-aminobenzenesulfonamide with benzyl alcohols has been developed. Various quinazolinones and benzothiadiazine 1,1-dioxides were prepared in moderate to good yields under identical conditions. The reactions of both aromatic aldehydes and aliphatic aldehydes with 2-aminobenzamide under catalyst free conditions were described as well. In water media, the products were formed in good yields.

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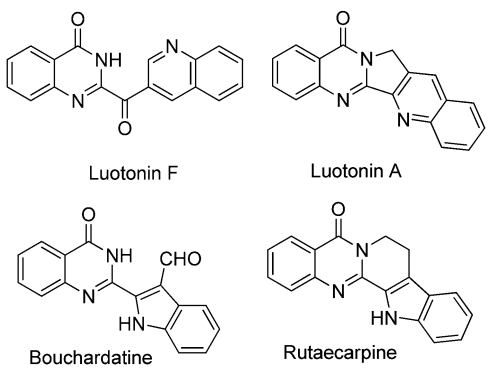
Heterocyclic compounds synthesis is one of the main branches of organic synthesis, due to the recognized importance of heterocycles in natural products, advanced materials, crop protecting agents, and pharmaceuticals.[1] Among the numerous known heterocyclic compounds, quinazolinones (Scheme 1) and benzothiadiazine 1,1-dioxides are attractive frameworks because of their reported anticancer, antiviral, anti-inflammatory, as well as anti-microbial activity properties.[2] Moreover, quinazolinones are used as ligands for benzodiazepine and AMPA receptors in the CNS system or as DNA binders as well.[3] Regarding their prevalence, plentiful methodologies have been developed for heterocycles preparation, cascade reaction, domino reaction, multicomponent reaction are representative examples. For the synthesis of quinazolinones and benzothiadiazine 1,1-dioxides,[4] the reaction of carboxylic acid derivatives (such as benzoic acids, benzoyl chlorides and *etc.*) with 2-aminobenzamide and 2-aminobenzenesulfonamide are the typical procedures.[5] The oxidation of 2-amido benzonitriles are also known and some other methodologies were developed as well.[6] More recently, the reaction of 2-aminobenzamide or 2-aminobenzenesulfonamide with benzyl alcohols come into the view of synthetic chemists and Pd, Ru or Ir are the usual applied catalysts.[7] Remarkably, in 2013, an iodine-catalyzed one-pot two-step oxidative synthesis of quinazolinones from alcohols and 2-aminobenzamide was reported.[7d] The reaction using DMSO as oxidant, using DMC as solvent at 100 °C, the reaction *via* the oxidation of alcohols to aldehydes as the key step and then followed by cyclization to give quinazolinones.



Scheme 1 Selected examples of biological active quinazolines.

We recently reported a zinc-catalyzed oxidative amidation of benzyl alcohols, numbers of amides were prepared by using TBHP as oxidant.[8] In view of copious advantages of zinc catalysis[9] and our incessant research interests in developing zinc-catalyzed oxidation reactions,[10] we became interested in applying our procedure in the direct oxidative synthesis of quinazolinones and benzothiadiazine 1,1-dioxides from 2-aminobenzamide and 2-aminobenzenesulfonamide with benzyl alcohols. As we expected, various desired products were

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† Electronic supplementary information (ESI) available. See DOI: 10.1039/c3ra45765f

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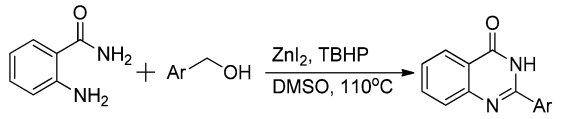
Table 1 Zinc-catalyzed oxidative synthesis of quinazolinones[a]



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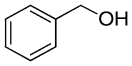
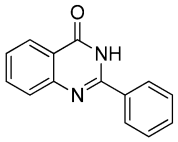
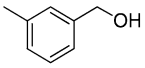
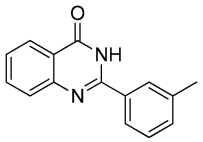
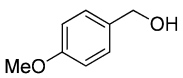
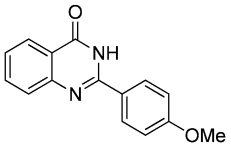
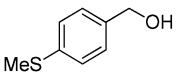
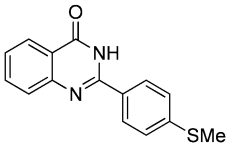
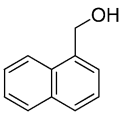
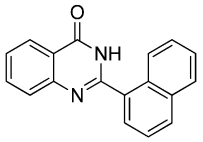
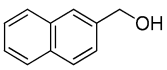
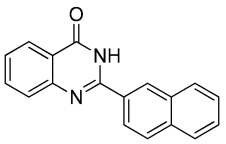
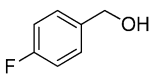
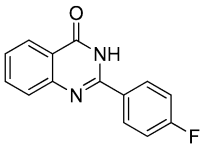
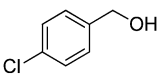
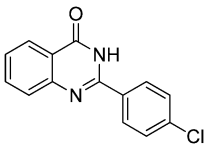
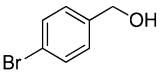
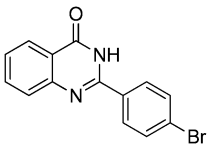
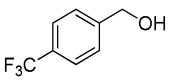
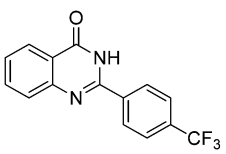
1			90
2			85
3			80
4			73
5			69
6			71
7			76
8			63
9			75
10			70

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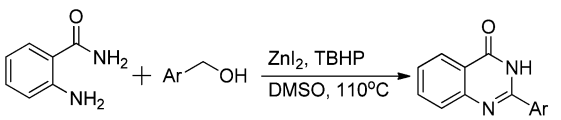

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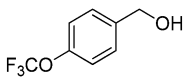
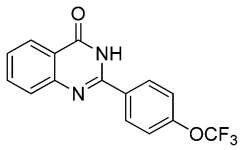
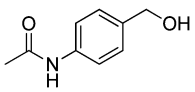
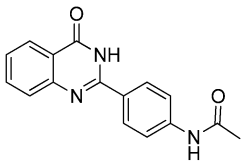
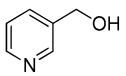
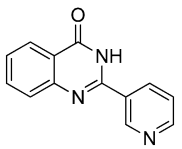
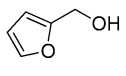
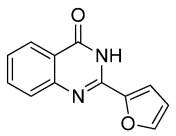
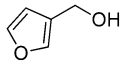
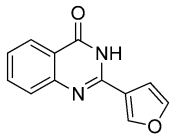
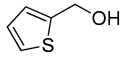
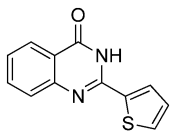
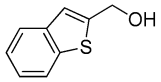
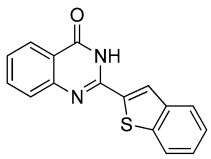
11			76
12			75
13			68
14			60
15			67
16			72
17			85

[a] ZnI_2 (10 mol%), 2-aminobenzamide (1 mmol), benzyl alcohols (1 mmol), DMSO (2 mL), TBHP (70% in H_2O; 4 eq.), 110 °C, 16 h. [b] Isolated yields.

prepared in good to excellent yields under our conditions in one-pot one-step manner.

Based on our previous report,[8] the initial experiment was carried out in H_2O (2 mL) at 110 °C. But no product was produced with 23% conversion of benzyl alcohol in the presence of ZnI_2 (10 mol%) and TBHP (70% in H_2O; 4 eq.). 10% of quinazolinone was formed in toluene with 41% of benzyl alcohol converted under the same conditions, while only 5%

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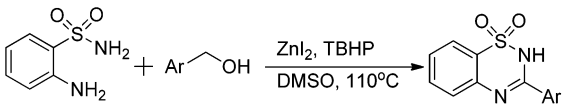
Table 2 Zinc-catalyzed oxidative synthesis of benzothiadiazine 1,1-dioxides[a]



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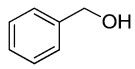
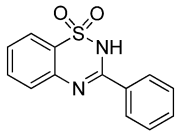
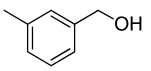
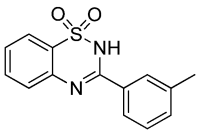
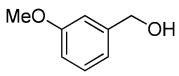
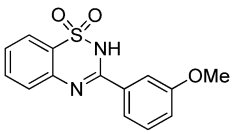
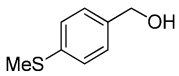
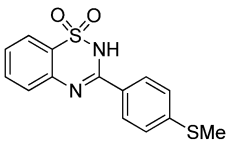
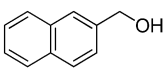
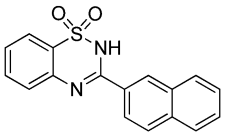
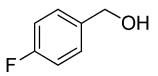
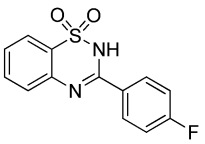
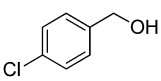
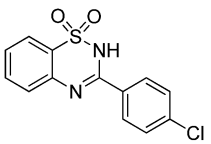
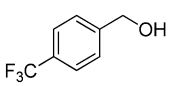
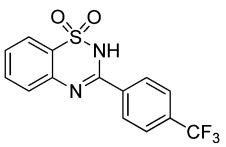
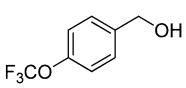
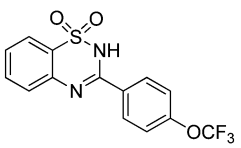
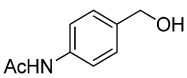
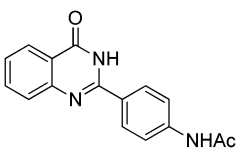
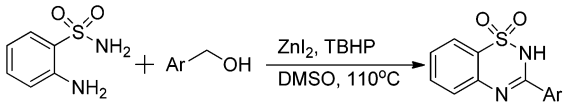
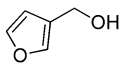
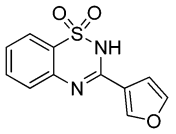
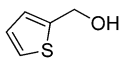
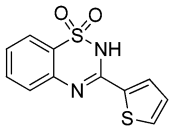
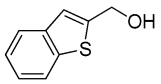
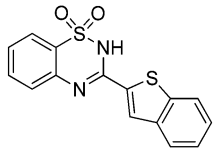
1			86
2			88
3			89
4			60
5			60
6			75
7			69
8			83
9			79
10			67

Table 2 (*Contd.*)



Entry	Substrate	Product	Yield[b]
11			76
12			64
13			58

[a] ZnI_2 (10 mol%), 2-aminobenzenesulfonamide (1 mmol), benzyl alcohols (1 mmol), DMSO (2 mL), TBHP (70% in H_2O; 4 eq.), 110 °C, 16 h. [b] Isolated yields.

yield was resulted in DMF. To our delight, 95% of our desired product was formed by using DMSO as solvent. With decreased temperature (80 °C) in DMSO, the yield of quinazolinone drops dramatically and lot of *N*-(2-carbamoylphenyl)benzamide was isolated.

With the best reaction conditions in hand, we carried out the generality of this methodology with different benzyl alcohols (Table 1 and 2). Methyl-, methoxy-, methylthio-substituted benzyl alcohols were successfully converted and gave the corresponding products in 73–85% yields (Table 1, entries 2–4). Naphthyl substituted quinazolinones were produced in 69–71% yield under the same conditions (Table 1, entries 5 and 6). Additionally, halogen-substituted and electron-withdrawing group-substituted benzyl alcohols can be reacted as well and the desired products were isolated in 63–76% yields (Table 1, entries 7–12). Notably, moderate to good yields of heterocycle decorated quinazolinones were prepared under identical conditions as well (Table 1, entries 13–17). 2-Aminobenzylamine was tested as substrate as well, but only traces of desired quinazolinone was detected and together with diverse by-products.

Besides quinazolinones, benzothiadiazine 1,1-dioxides can be produced by simply replacing 2-aminobenzamide with 2-aminobenzenesulfonamide. 13 examples of benzothiadiazine 1,1-dioxides with different substituents were isolated in good yields (Table 2). Both electron-donating and electron-withdrawing functional groups were tolerable, as well as heterocyclic compounds.

Regarding the reaction pathway, we believe *N*-(2-carbamoylphenyl)benzamide or *N*-(2-sulfamoylphenyl)benzamide should

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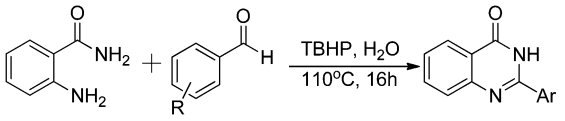
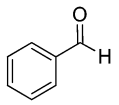
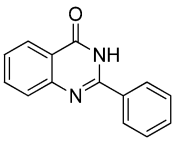
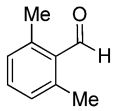
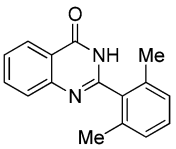
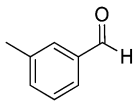
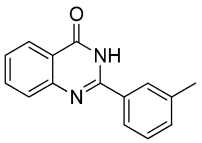
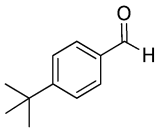
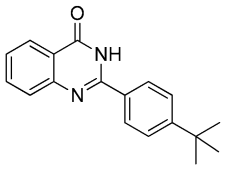
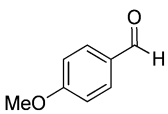
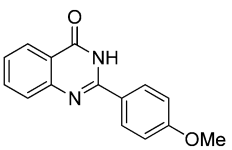
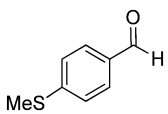
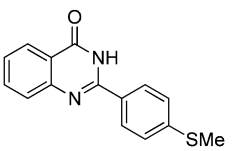
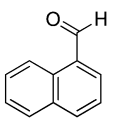
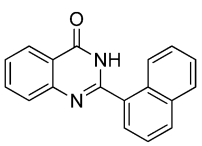
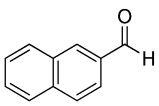
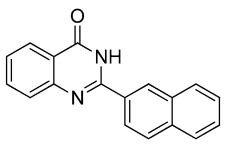
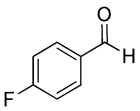
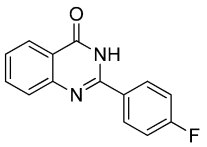
Table 3 Oxidative synthesis of quinazolinones[a]



Entry	Aldehyde	Product	Yield[b][%]
1			90%
2			60%
3			75%
4			78%
5			83%
6			70%
7			74%
8			76%
9			88%

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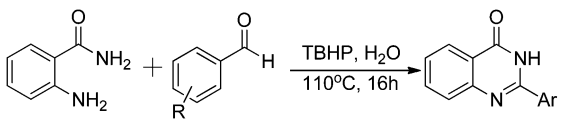


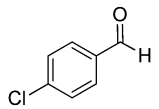
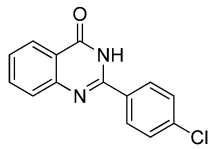
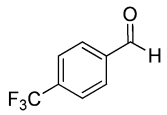
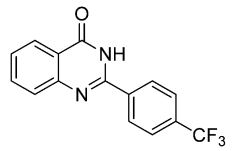
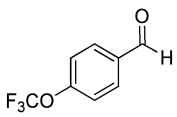
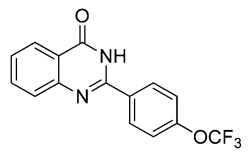
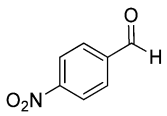
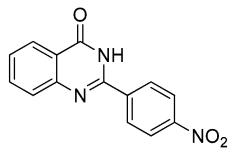
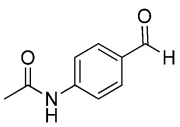
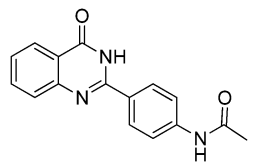
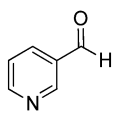
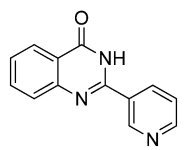
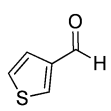
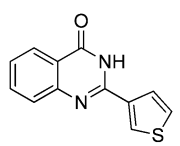
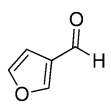
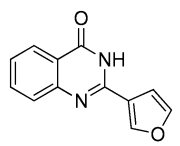
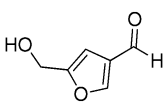
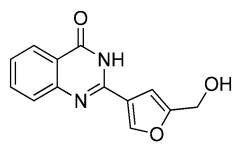
Entry	Aldehyde	Product	Yield[b][%]
10			73%
11			77%
12			71%
13			55%
14			68%
15			68%
16			80%
17			70%
18			69%

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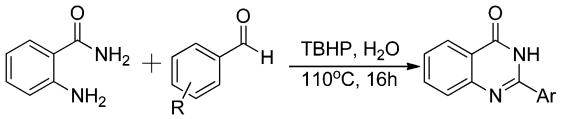
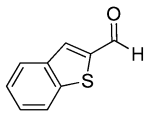
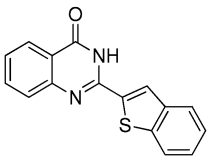
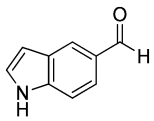
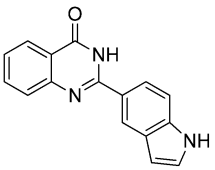
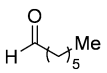
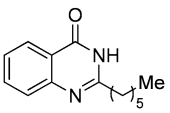
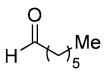
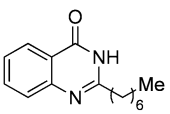
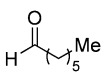
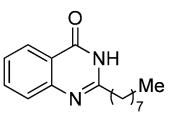
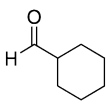
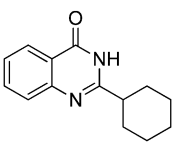
Table 3 (*Contd.*)

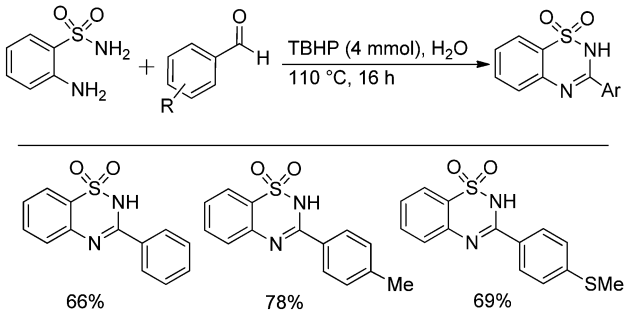


Entry	Aldehyde	Product	Yield[b][%]
19			69%
20			65%
21			88%
22			83%
23			80%
24			62%

[a] 2-Aminobenzamide (1 mmol), aldehydes (1 mmol), H_2O (2 mL), TBHP (70% in water, 4 mmol), 110 °C, 16 h. [b] Isolated yields.

be the key intermediate which could also be prepared by the reaction of 2-aminobenzamide with aldehydes under even catalyst free conditions. Here, notably, a $InCl_3$-catalyzed condensation of aromatic aldehydes with 2-aminobenzamides to quinazolinones was reported in 2012.[11] The reaction works at room temperature, but need MeCN as the organic solvent. As the demands of sustainable development, we think it's interesting and necessary to develop a more general catalyst free system for the quinazolinones synthesis.[12,13]

By simply changing the solvent from DMSO to water, excellent yield of quinazolinone was isolated under a catalyst free condition. As shown in Table 3, *ortho*-, *para*-, and *meta*-alkyl substituted benzaldehydes were successfully reacted with 2-aminobenzamide and gave the corresponding products in good yields (Table 3, entries 2–4). Methoxyl and methylthio can be tolerated as well (Table 3, entries 5 and 6). 2-Naphthyl substituted quinazolinones were prepared in good yields (Table 3, entries 7 and 8).



Scheme 2 Oxidative synthesis of benzothiadiazine 1,1-dioxides.

Several halogen and electron-withdrawing functional groups are tolerable as well and gave the desired products in good to excellent yields (Table 3, entries 9–14).

Several heterocyclic aldehydes were applied as substrates because of the interesting biological activities of heterocycles, the corresponding 2-heterocyclic substituted quinazolinones were synthesized straightforward in good yields (Table 3, entries 15–20). Remarkably, even 5-(hydroxymethyl)furan-3-carbaldehyde can be applied as starting material as the hydroxymethyl group is potentially reactive under oxidative conditions (Table 3, entry 18). Additionally, aliphatic aldehydes were reacted with 2-aminobenzamide as well and gave the corresponding alkyl-substituted products in good yields (62–88%; Table 3, entries 21–24) which are difficult in previous methodology.

Besides the preparation of quinazolinone derivatives, this green methodology can also be applied in the synthesis of benzothiadiazine 1,1-dioxides (Scheme 2). Three examples of benzothiadiazine 1,1-dioxides were produced in good yields under the same conditions. Here, the cyclization step may responsible for the need of relative high temperature, which could be decreased by the assistant of Lewis acid.

In conclusion, an interesting methodology for quinazolinones and benzothiadiazine 1,1-dioxides preparation has been developed. Under the assistant of ZnI_2/TBHP, various of the desired heterocycles were isolated in good to excellent yields. By using aldehydes instead of benzyl alcohols as substrates, the reactions can be carried out under catalyst free conditions in water. All the products were prepared in good yields.

Experimental section

General comments

All reactions were carried out under air. Reactions were monitored by TLC analysis (pre-coated silica gel plates with fluorescent indicator UV254, 0.2 mm) and visualized with 254 nm UV light or iodine. Chemicals were purchased from Aldrich, Alfa Asar and unless otherwise noted were used without further purification. All compounds were characterized by ^{1}H NMR, ^{13}C NMR, GC-MS and HRMS spectroscopy. ^{1}H spectra were recorded on Bruker AV 300 and AV 400 spectrometers. ^{13}C NMR spectra were recorded at 282 MHz. EI (70 eV) mass spectra were recorded on MAT 95XP (Thermo ELECTRON CORPORATION). GC was performed on Agilent 6890 chromatograph with a 30 m

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HP5 column. HRMS was performed on MAT 95XP (EI) and Agilent 6210 Time-of-Flight LC/MS (ESI). GC-MS was performed on Agilent 5973 chromatograph Mass Selective Detector. All yields reported refer to isolated yields.

General procedure for the oxidative synthesis of quinazolinone

ZnI_2 (10 mol%) and a stirring bar were added to a 50 mL pressure tube. Then, DMSO (2 mL), benzyl alcohol (1 mmol), and 2-aminobenzamide (1 mmol) were added. At the end, TBHP (70% in H_2O; 4 eq.) was added and the final solution was kept at 110 °C temperature for 16 h. The mixture was cooled to room and solvent was removed under vacuum. The pure product can be isolated by either washed with water, ethyl acetate and finally hexane or recrystallized from MeOH.

General procedure for the catalyst free synthesis of quinazolinone

In a 25 mL pressure tube equipped with a stirring bar, aldehyde (1 mmol), 2-aminobenzamide (1 mmol), H_2O (2 mL), and *tert*-butyl peroxide (70% in H_2O; 4 mmol) were injected by syringe. Then tube was closed and heated up to 110 °C for 16 hours. When the reaction completed, cool the reaction mixture to room temperature. The pure product can be isolated by either simply filtration or recrystallized from MeOH.

2-Phenylquinazolin-4(3*H*)-one

Yield: (200 mg, 91%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 7.53–7.64 (m, 4H), 7.76–7.90 (m, 2H), 8.17–8.23 (m, 3H), 12.6 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 121.9 (C), 126.8 (CH), 127.5 (CH), 128.4 (C), 128.7 (2CH), 129.5 (2CH), 132.3 (CH), 133.6 (C), 135.5 (CH), 149.6 (C), 153.3 (C), 163.2 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 222 (85), 119 (100), 104 (10), 92 (13), 90 (13), 77 (20). HRMS (ESI): calc. for $C_{14}H_{10}N_2O_1$: 222.07876; found: 222.07887.

2-(4-Methoxyphenyl)quinazolin-4(3*H*)-one

Yield: (201 mg, 80%); ^{1}H NMR (300 MHz, $CDCl_3$): δ = 3.76 (s, 3H), 8.26–8.30 (m, 1H), 8.60–8.72 (m, 2H), 8.91–9.02 (m, 1H), 9.07–9.10 (m, 1H), 9.44–9.49 (1H), 12.5 (s, 1H, NH_2). ^{13}C NMR ($CDCl_3$): δ = 56.3 (OCH_3), 113.4 (CH), 118.5 (CH), 121.6 (CH), 126.7 (CH), 127.5 (CH), 129.1 (CH), 130.6 (C), 130.8 (C), 134.9 (CH), 135.5 (C), 138.1 (C), 149.1 (CH), 160.2 (C), 163.1 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 252 (100), 251 (93), 223 (19), 222 (40), 221 (18), 119 (31), 91 (18), 90 (16). HRMS (EI): calc. for $C_{15}H_{12}N_2O_2$: 252.08933; found: 252.08895.

2-(4-(Methylthio)phenyl)quinazolin-4(3*H*)-one

Yield: (195 mg, 73%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.56 (s, 3H), 7.35–7.40 (m, 2H), 7.81–7.92 (m, 5H), 8.31–8.42 (m, 1H), 12.8 (s, 1H, NH).^{13}C NMR ($CDCl_3$): δ = 15.4 (SCH_3), 124.8 (2CH), 126.0 (CH), 126.8 (CH), 127.9 (CH), 128.6 (CH), 129.0 (2CH), 129.5 (C), 135.7 (C), 149.5 (CH), 150.6 (C), 152.5 (C), 163.1 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 268 (100), 119 (78), 92 (10), 90 (11). HRMS (ESI): calc. for $C_{15}H_{12}N_2O_1S$: 268.06649; found: 268.06631.

2-(*m*-Tolyl)quinazolin-4(3*H*)-one

Yield: (200 mg, 85%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 2.45 (s, 3H, CH_3), 7.44–7.59 (m, 3H), 7.76–7.79 (m, 1H), 7.81–7.90 (m, 1H), 7.99–8.03 (m, 1H), 8.06 (s, 1H), 8.17–8.21 (m, 1H), 12.6 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 20.9 (CH_3), 120.9 (C), 124.8 (CH), 125.8 (CH), 126.5 (CH), 127.4 (CH), 128.2 (CH), 128.5 (CH), 131.9 (CH), 132.6 (C), 134.6 (CH), 137.9 (C), 148.7 (C), 152.3 (C), 162.2 (CO).GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 236 (80), 119 (100), 92 (13), 90 (15). HRMS (ESI): calc. for $C_{15}H_{12}N_2O_1$: 236.09441; found: 236.09433.

2-(4-Fluorophenyl)quinazolin-4(3*H*)-one

Yield: (190 mg, 79%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 7.38–7.76 (m, 2H), 7.52–7.58 (m, 1H), 7.74–7.78 (m, 1H), 7.84–7.89 (m, 1H), 8.16–8.19 (m, 1H), 8.25–8.32 (m, 1H), 12.6 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 120.3 (2CH), 120.8 (2CH), 125.8 (CH), 130.8 (C), 131.5 (C), 132.2 (CH), 134.2 (CH), 135.4 (C), 139.5 (CH), 156.3 (C), 167.3 (CO), 168 (d, J = 249.8 Hz, CF_3). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 240 (100), 122 (13), 120 (12), 119 (93), 95 (18), 92 (15), 90 (14). HRMS (ESI): calc. for $C_{14}H_9N_2O_1F_1$: 240.06934; found: 240.06911.

2-(4-Chlorophenyl)quinazolin-4(3*H*)-one

Yield: (161 mg, 63%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 7.35–7.43 (m, 1H), 7.54–7.60 (m, 1H), 7.64–7.69 (m, 2H), 8.18–8.27 (m, 2H), 12.6 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 115.1 (C), 116.1 (CH), 123.4 (CH), 128.4 (CH), 129.7 (2CH), 131.9 (2CH), 133.6 (C), 135.6 (C), 136.1 (CH), 140.7 (C), 150.9 (C), 163.0 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 256 (73), 119 (100), 111 (11), 92 (14), 90 (14), 75 (12). HRMS (ESI): calc. for $C_{15}H_9N_2O_1Cl$: 256.03979; found: 256.03921.

2-(4-(Trifluoromethyl)phenyl)quinazolin-4(3*H*)-one

Yield: (203 mg, 70%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 7.57–7.63 (m, 1H), 7.80–7.98 (m, 4H), 8.19–8.23 (m, 1H), 8.39–8.42 (m, 2H), 12.8 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 122.2 (C), 123.0 (C), 126.4 (2CH), 126.9 (CH), 128.1 (CH), 128.6 (CH), 129.7 (2CH), 131.8 (C), 135.7 (CH), 137.5 (C), 149.3 (C), 152.2 (C), 163.1 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 290 (100), 145 (23), 119 (99), 92 (17), 90 (16). HRMS (ESI): calc. for $C_{15}H_9N_2O_1F_3$: 290.06615; found: 290.06587.

2-(4-(Trifluoromethoxy)phenyl)quinazolin-4(3*H*)-one

Yield: (232 mg, 70%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 7.55–7.60 (m, 3H), 7.76–7.79 (m, 1H), 7.86–7.91 (m, 1H), 8.18–8.22 (m, 1H), 8.32–8.36 (m, 2H), 12.7 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 121.7 (2CH), 121.9 (C), 122.6 (C), 126.8 (CH), 126.5 (d, J = 259.7 Hz, OCF_3), 128.4 (CH), 131.0 (2CH), 132.9 (C), 135.6 (CH), 149.5 (C), 151.3 (C), 152.3 (C), 163.2 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 306 (100), 119 (92), 92 (17), 90 (14). HRMS (ESI): calc. for $C_{15}H_9N_2O_2F_3$: 306.06106; found: 306.06090.

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2-(Pyridin-3-yl)quinazolin-4(3*H*)-one

Yield: (150 mg, 68%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.56–7.66 (m, 2H), 7.79–7.83 (m, 1H), 7.87–7.93 (m, 1H), 8.19–8.23 (m, 1H), 8.51–8.56 (m, 1H), 8.78 (d, J = 4.95 Hz, 1H), 9.34 (s, 1H), 12.8 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 121.9 (C), 124.2 (CH), 126.6 (CH), 127.6 (CH), 128.3 (C), 129.5 (C), 135.4 (CH), 136.1 (CH), 149.2 (CH), 151.4 (CH), 152.5 (C), 162.9 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 223 (90), 119 (100), 92 (18), 90 (13), 78 (11). HRMS (ESI): calc. for $C_{13}H_9N_3O_1$: 223.07401; found: 223.07411.

2-(Thiophen-2-yl)quinazolin-4(3*H*)-one

Yield: (164 mg, 72%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.49–7.56 (m, 1H), 7.71–7.76 (m, 2H), 7.82–7.93 (m, 2H), 8.15–8.19 (m, 1H), 8.64–8.65 (m, 1H), 12.5 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 120.9 (C), 125.8 (CH), 126.3 (CH), 127.0 (CH), 127.2 (CH), 127.3 (CH), 128.6 (CH), 134.5 (CH), 135.3 (C), 148.2 (C), 148.8 (C), 162.0 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 228 (100), 119 (59), 92 (11), 90 (12). HRMS (ESI): calc. for $C_{12}H_8N_2OS_1$: 228.03519; found: 228.03515.

2-(Furan-2-yl)quinazolin-4(3*H*)-one

Yield: (127 mg, 60%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 6.67–6.80 (m, 1H), 7.49–7.56 (m, 1H), 7.65–7.68 (m, 1H), 7.70–7.74 (m, 1H), 7.81–7.87 (m, 1H), 8.02–8.04 (m, 1H), 8.14–8.18 (m, 1H), 12.4 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 112.5 (CH), 114.4 (CH), 121.0 (C), 125.9 (CH), 126.4 (CH), 127.1 (CH), 134.6 (CH), 144.0 (C), 146.0 (CH), 146.5 (C), 154.5 (C), 161.6 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 212 (100), 211 (17), 90 (10). HRMS (ESI): calc. for $C_{12}H_8N_2O_2$: 212.05803; found: 212.05760.

2-(Furan-3-yl)quinazolin-4(3*H*)-one

Yield: (142 mg, 67%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.54–7.59 (m, 2H), 7.69–7.73 (m, 1H), 7.83–7.89 (m, 1H), 8.09–8.19 (m, 3H), 12.3 (s, 1H, NH). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 212 (100), 211 (17), 90 (10). HRMS (ESI): calc. for $C_{12}H_8N_2O_2$: 212.05803; found: 212.05760.

2-(Benzo[*b*]thiophen-2-yl)quinazolin-4(3*H*)-one

Yield: (195 mg, 70%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.17–7.25 (m, 1H), 7.44–7.61 (m, 4H), 7.74–7.78 (1H), 7.86–7.97 (2H), 8.08–8.10 (1H), 8.18–8.23 (1H), 12.9 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$) δ = 114.9, 115.5, 117.7, 123.9, 124.9, 125.0, 125.6, 127.1, 127.9, 133.7, 135.1, 135.8, 140.8, 148.5, 164.3 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 278 (100), 159 (12), 119 (38), 89 (14). HRMS (ESI): calc. for $C_{16}H_{10}N_2O_1S_1$: 278.05084; found: 278.05082.

2-(Naphthalen-1-yl)quinazolin-4(3*H*)-one

Yield: (188 mg, 69%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.60–7.72 (m, 4H), 7.77–7.95 (m, 3H), 8.07–8.11 (m, 1H), 8.19–8.29 (m, 3H), 12.7 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 121.2 (C), 125.0 (CH), 125.2 (CH), 125.8 (CH), 126.3 (CH), 126.7 (CH), 127.0 (CH), 127.4 (CH), 127.6 (CH), 128.3 (CH), 130.0 (CH), 130.4 (C), 133.1 (C), 134.5 (CH), 135.3 (C), 148.7 (C), 161.8 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 272 (92), 153 (14), 127 (27), 119 (100), 92 (15), 90 (10). HRMS (ESI): calc. for $C_{18}H_{12}N_2O_1$: 272.09441; found: 272.09424.

2-(Naphthalen-2-yl)quinazolin-4(3*H*)-one

Yield: (194 mg, 75%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.42–7.92 (m, 7H), 7.96–8.51 (m, 4H), 12.7 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 121.2 (C), 125.0 (CH), 125.2 (CH), 125.8 (CH), 125.9 (CH), 126.3 (CH), 126.8 (CH), 127.0 (CH), 127.4 (CH), 127.6 (CH), 128.3 (CH), 130.2 (C), 130.3 (C), 133.7 (C), 133.1 (C), 134.5 (CH), 148.7 (C), 153.6 (C), 161.9 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 272 (53), 272 (100).

***N*-(4-(4-Oxo-3,4-dihydroquinazolin-2-yl)phenyl)acetamide**

Yield: (209 mg, 75%); 1H NMR (300 MHz, DMSO-d$_6$): δ = 2.13 (s, 3H, CH$_3$), 7.49–7.56 (m, 1H), 7.76–7.89 (m, 4H), 8.14–8.22 (m, 3H), 10.3 (s, 1H, NH), 12.4 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 24.1, 118.3, 120.7, 125.8, 126.2, 126.7, 127.2, 128.5, 134.5, 142.1, 143.9, 151.8, 162.5 (CO), 168.7 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 279 (92), 237 (100), 119 (81), 92 (15), 90 (10), 43 (28). HRMS (ESI): calc. for $C_{16}H_{13}N_3O_2$: 279.10023; found: 279.10026.

3-Phenyl-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (222 mg, 86%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.35–7.93 (m, 7H), 8.02–8.15 (m, 2H), 12.2 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 119.0 (CH), 122.0 (C), 123.7 (CH), 127.1 (CH), 128.7 (2CH), 129.3 (2CH), 132.3 (C), 133.3 (CH), 135.9 (C), 155.2 (C). GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 258 (58), 194 (12), 155 (100), 91 (62), 64 (22). HRMS (ESI): calc. for $C_{13}H_{10}N_2OS_1$: 258.04575; found: 258.04581.

3-(3-Methoxyphenyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (256 mg, 89%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 3.91 (s, 3H, OCH$_3$), 7.29–7.38 (m, 1H), 7.45–7.54 (m, 1H), 7.56–7.61 (m, 2H), 7.74–7.92 (m, 2H), 12.2 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 56.6 (OCH$_3$), 114.3, 118.4, 119.4, 119.5, 121.4, 122.4, 124.3, 124.6, 127.7, 131.0, 134.1, 136.4, 155.5, 160.3. GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$] 288 (74), 287 (17), 155 (100), 91 (58), 63 (17). HRMS (ESI): calc. for $C_{14}H_{12}N_2O_3S_1$: 288.05631; found: 288.05583.

3-(4-(Methylthio)phenyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (160 mg, 60%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 2.55 (s, 3H, CH$_3$), 7.34–7.38 (m, 1H), 7.47–7.55 (m, 2H), 7.67–7.77 (m, 1H), 7.83–7.91 (m, 2H), 8.02–8.03 (m, 2H), 12.3 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 117.4, 122.4, 123.6, 124.8, 125.0, 126.6, 128.5, 129.6, 133.1, 134.6, 147.6, 154.2.

3-(*m*-Tolyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (240 mg, 88%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 2.44 (s, 3H, CH$_3$), 7.48–7.54 (m, 3H), 7.62–7.66 (m, 1H), 7.71–7.77 (m, 1H), 7.82–7.88 (m, 3H), 12.2 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 21.8 (CH$_3$), 119.3, 122.4, 124.2, 126.3, 127.6, 129.4, 132.7, 134.0, 134.4, 136.4, 139.4, 155.8. GC-MS (EI, 70 eV): *m*/*z* (%) [M$^+$]

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262 (62), 208 (11), 155 (100), 91 (57), 64 (17). HRMS (ESI): calc. for $C_{14}H_{12}N_2O_2S_1$: 272.06140; found: 272.06137.

3-(4-Fluorophenyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (207 mg, 75%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.39–7.58 (m, 3H), 7.64–7.68 (m, 1H), 7.74–7.81 (m, 1H), 7.88–7.92 (m, 1H), 12.2 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 116.5 (d, J = 24.5 Hz), 116.8, 122.5, 124.9 (d, J = 33.9 Hz), 128.3, 129.8, 132.9, (d, J = 24.5 Hz), 133.4, 134.4, 165.7, (d, J = 250.3 Hz), 167.3. GC-MS (EI, 70 eV): m/z (%) [M$^+$] 276 (57), 212 (15), 155 (100), 91 (69), 64 (26). HRMS (ESI): calc. for $C_{13}H_9N_2O_3S_1F_1$: 276.03633; found: 276.03625.

3-(Furan-3-yl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (188 mg, 76%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.13–7.15 (m, 1H), 7.48–7.59 (m, 2H), 7.73–7.79 (m, 1H), 7.84–7.88 (m, 1H), 7.95–7.96 (m, 1H), 11.9 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 109.1, 118.1, 120.6, 121.8, 123.5, 126.7, 133.3, 135.4, 145.4, 147.2, 149.6, 153.1. GC-MS (EI, 70 eV): m/z (%) [M$^+$] 248 (71), 155 (100), 91 (61), 64 (31).

***N*-(4-(1,1-dioxido-2*H*-benzo[*e*][1,2,4]thiadiazin-3-yl)phenyl)-acetamide**

Yield: (211 mg, 67%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 2.06 (s, 3H, CH$_3$), 7.23–7.27 (m, 1H), 7.34–7.38 (m, 1H), 7.47–7.57 (m, 3H), 7.68–7.75 (m, 1H), 7.83–7.88 (m, 1H), 8.01–8.03 (m, 1H), 9.91 (s, 1H, NH), 12.3 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 24.7, 118.3, 119.4, 123.3, 124.4, 127.4, 127.6, 133.9, 135.4, 137.8, 138.7, 148.4, 156.8 (CO), 168.9 (CO).

3-(4-Chlorophenyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (201 mg, 69%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.16-7.59 (m, 3H), 7.70–7.92 (m, 3H), 8.03–8.15 (m, 2H), 12.3 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 118.4, 121.4, 123.3, 123.6, 126.8, 128.9, 130.1, 133.1, 135.4, 137.7, 147.6, 153.6. GC-MS (EI, 70 eV): m/z (%) [M$^+$] 292 (44), 228 (11), 155 (100), 91 (57), 64 (22), 63 (16). HRMS (ESI): calc. for $C_{13}H_9N_2O_2S_1Cl$: 292.00733; found: 292.00741.

3-(4-(Trifluoromethyl)phenyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (270 mg, 79%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.13–7.34 (m, 1H), 7.53–7.67 (m, 2H), 7.76–7.82 (m, 1H), 8.05 (d, J = 7.98 Hz, 2H), 8.29 (d, J = 7.98 Hz, 2H), 12.4 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 115.8, (d, J = 12.3 Hz), 118.5, 121.4, 123.4, 123.7, 125.1 (d, J = 270.1 Hz), 127.0, 129.2, 132.7, 133.2, 135.3, 153.4. GC-MS (EI, 70 eV): m/z (%) [M$^+$] 326 (55), 307 (10), 262 (10), 155 (100), 91 (79), 64 (22). HRMS (ESI): calc. for $C_{14}H_9N_2O_2S_1F_3$: 326.03313; found: 326.03281.

3-(4-(Trifluoromethoxy)phenyl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (284 mg, 83%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.43–7.7.69 (m, 4H), 8.08–8.22 (m, 4H), 13.2 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 119.4, 121.9, 122.4, 124.3, 126.2 (d, J = 263.3 Hz), 127.8 (dd, J = 90.3 Hz), 130.2, 131.7, 132.6, 134.1, 136.3, 153.3 (d, J = 170.4 Hz), 154.5. GC-MS (EI, 70 eV): m/z (%) [M$^+$] 342 (39), 326 (24), 155 (100), 138 (10), 91 (77), 64 (26). HRMS (ESI): calc. for $C_{14}H_9N_2O_3S_1F_3$: 342.02805; found: 342.02803.

3-(Thiophen-2-yl)-2*H*-benzo[*e*][1,2,4]thiadiazine 1,1-dioxide

Yield: (169 mg, 64%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 7.24–7.27 (m, 1H), 7.49–7.55 (m, 1H), 7.60–7.65 (m, 1H), 7.73–7.78 (m, 1H), 7.81–7.82 (m, 1H), 7.86–7.89 (m, 1H), 8.60–8.62 (m, 1H), 12.0 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 119.1, 122.5, 124.3, 127.1, 127.7, 128.5, 129.1, 132.8, 134.1, 136.3, 151.0. GC-MS (EI, 70 eV): m/z (%) [M$^+$] 264 (79), 207 (20), 155 (100), 138 (11), 91 (64), 64 (30). HRMS (ESI): calc. for $C_{11}H_8N_2O_2S_2$: 264.00217; found: 264.00211.

2-(4-(*tert*-Butyl)phenyl)quinazolin-4(3*H*)-one

Yield: (216 mg, 78%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 1.35 (s, 9H), 7.50–7.61 (m, 3H), 7.73–7.88 (m, 2H), 8.14–8.21 (m, 2H), 8.46 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 31.7 (3CH$_3$), 35.35 (C), 121.8 (C), 126.3 (2CH), 126.7 (CH), 127.2 (CH), 128.2 (CH), 128.4 (2CH), 130.8 (C), 135.4 (CH), 149.6 (C), 153.1 (C), 155.2 (C), 163.2 (CO). GC-MS (EI, 70 eV): m/z (%) [M$^+$] 278 (85), 263 (100).

2-(2,6-Dimethylphenyl)quinazolin-4(3*H*)-one

Yield: (125 mg, 60%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 2.19 (s, 6H, 2CH$_3$), 7.63 (d, J = 7.63 Hz, 1H); 7.18–7.24 (m, 1H), 7.34 (t, J = 7.35 Hz, 1H); 7.59 (d, J = 7.63 Hz, 1H); , 7.72 (d, J = 7.91 Hz, 1H); 7.88 (d, J = 7.35 Hz, 1H), 8.21 (d, J = 7.63 Hz, 2H); 12.5 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 19.8 (2CH$_3$), 121.9 (C), 126.6 (CH), 127.5 (CH), 128.2 (2CH), 129.4 (CH), 129.9 (CH), 135.3 (CH), 135.4 (C), 136.2 (C), 141.9 (C), 149.6 (C), 151.8 (C), 162.5 (CO).

2-(4-Nitrophenyl)quinazolin-4(3*H*)-one

Yield: (173 mg, 65%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 6.72 (t, J = 7.63 Hz, 1H), 6.80 (d, J = 8.52 Hz, 1H), 7.27–7.33 (m, 1H), 7.37 (s, 1H), 7.63–7.66 (m, 1H), 7.78 (dt, J = 8.62 Hz, 1H), 8.29 (dt, J = 8.62 Hz, 2H), 8.56 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 115.5, 115.8, 118.4, 124.5, 128.3, 128.9, 134.5, 148.2, 148.3, 150.3, 164.3(CO). GC-MS (EI, 70 eV): m/z (%) [M$^+$] 267 (100), 221 (32), 192 (13), 119 (36), 92 (8), 90 (11).

2-(5-(Hydroxymethyl)furan-3-yl)quinazolin-4(3*H*)-one

Yield: (166 mg, 69%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 4.55 (s, 2H, OCH$_2$), 5.52 (s, 1H, OH), 6.61 (d, J = 3.43 Hz, 1H), 7.49–7.55 (m, 1H), 7.63 (d, J = 3–52 Hz, 1H), 7.71–7.76 (m, 1H), 7.81–7.87 (m, 1H), 8.13.8.17 (m, 1H), 12.5 (s, 1H, NH). ^{13}C NMR (DMSO-d$_6$): δ = 56.7 (OCH$_2$), 110.3 (CH), 115.3 (CH), 122.2 (C), 126.8 (CH), 127.3 (CH), 128.1 (CH), 135.6 (CH), 144.9 (C), 145.9 (C), 149.7 (C), 160.3 (C), 162.5 (CO).

2-Hexylquinazolin-4(3*H*)-one

Yield: (202 mg, 88%); ^{1}H NMR (300 MHz, DMSO-d$_6$): δ = 0.87 (t, J = 7.30 Hz, 3H), 1.23–1.39 (m, 6H), 1.74 (Pent. 2H), 2.61 (t, J = 7.63 Hz, 2H), 7.44–7.49 (m, 1H), 7.60–7.63 (m, 1H), 7.78–7.81

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(m, 1H), 8.09–8.13 (m, 1H), 12.2 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 14.8 (CH_3), 22.9 (CH_2), 27.7 (CH_2), 29.1 (CH_2), 31.8 (CH_2), 35.4 (CH_2), 121.7 (C), 126.6 (CH), 126.8 (CH), 127.7 (CH), 135.1 (CH), 149.9 (C), 158.4 (C), 162.8 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 230 (5), 187 (11), 160 (100). HRMS (ESI): calc. for $C_{14}H_{18}N_2O_1$: 230.14136; found: 230.14113.

2-Heptylquinazolin-4(3*H*)-one

Yield: (202 mg, 83%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 0.87 (t, J = 7.30 Hz, 3H), 1.23–1.39 (m, 8H), 1.74 (Pent. 2H), 2.61 (t, J = ,7.63 Hz, 2H), 7.44–7.49 (m, 1H), 7.60–7.63 (m, 1H), 7.78–7.81 (m, 1H), 8.09–8.13 (m, 1H), 12.2 (s, 1H, NH). ^{13}C NMR (DMSO-d_6): δ = 14.8 (CH_3), 23.0 (CH_2), 27.8 (CH_2), 29.3 (CH_2), 29.5 (CH_2), 32.1 (CH_2), 35.5 (CH_2), 121.7 (C), 126.6 (CH), 126.8 (CH), 127.7 (CH), 135.1 (CH), 149.9 (C), 158.8 (C), 163.1 (CO). GC-MS (EI, 70 eV): *m*/*z* (%) [M^+] 244 (5), 187 (10), 160 (100). HRMS (ESI): calc. for $C_{15}H_{20}N_2O_1$: 244.15701; found: 244.15698.

2-Cyclohexylquinazolin-4(3*H*)-one

Yield: (141 mg, 62%); ^{1}H NMR (300 MHz, DMSO-d_6): δ = 1.21–1.40 (m, 3H), 1.54–1.73 (3H), 1.79–1.96 (4H), 7.47 (t, J = 7.45 Hz, 1H), 7.63 (d, J = 8.40 Hz, 1H), 7.79 (d, J = 7.45 Hz, 1H), 8.11 (d, J = 8.40 Hz, 1H), 12.1 (s, 1H, NH). ^{3}C NMR (DMSO-d_6): δ = 26.3 (CH_2), 26.5 ($2CH_2$), 31.2 ($2CH_2$), 43.8 (CH), 121.9 (C), 126.6 (CH), 126.8 (CH), 127.9 (CH), 135.1 (CH), 149.9 (C), 161.7 (C), 162.9 (CO).

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