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Easy access for the synthesis of 2-aryl 2,3-dihydroquinazolin-4(1*H*)-ones using *gem*-dibromomethylarenes as synthetic aldehyde equivalent†

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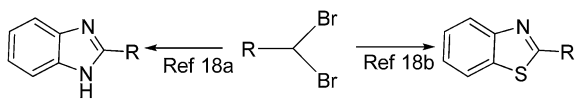
One step synthesis of 2,3-dihydroquinazolin-4(1*H*)-ones from *gem*-dibromomethylarenes using 2-aminobenzamide is described. *Gem*-dibromomethylarenes are used as aldehyde equivalent for the efficient synthesis of 2,3-dihydroquinazolin-4(1*H*)-ones, this synthesis takes shorter reaction time with quick isolation and excellent product yield.

Introduction

Quinazolinone derivatives have drawn considerable attention due to their antidepressant,[1a] analgesic,[1b] diuretic,[1c] antihistamine,[2a] vasodilating,[2b] antihypertensive,[2c] and anti-inflammatory activities.[3] They also possess anticancer[4] activities like inhibition of tubulin formation,[5,6] inhibition against VEGFR2 tyrosine kinase and cell proliferation.[7] These *N*-containing heterocyclic compounds are integral part of many drug molecules and several classical methods for the synthesis of 2,3-dihydroquinazoline-4(1*H*)-ones are available.[8–15]

Many transition metals like Sc, Ti, Co, Cu, Zn, Zr, and Ru are used in the synthesis of 2,3-dihydroquinazoline-4(1*H*)-ones.[16a–g] In addition, *gem*-dibromomethylarenes are used as aldehyde equivalent in the synthesis of cinnamic acids,[17a] cinnamic esters,[17b] benzimidazoles,[18a] benzothiazoles[18b] and aryl oximes.[18c] In continuation of our studies[18a,b,c] (Scheme 1), we tried using *gem*-dibromomethylarenes for the synthesis of 2,3-dihydroquinazoline-4(1*H*)-ones.



Scheme 1 Examples of *gem*-dibromomethylarenes as aldehyde equivalent in synthesis.

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We investigated model reaction between 2-aminobenzamide and *gem*-dibromomethylarenes under different conditions, and the results are presented in Table 1.

Results and discussion

The synthesis of *gem*-dibromomethylarenes was initiated from the corresponding commercially available methyl analogues using *N*-bromo succinamide (2.0 equiv.) in carbon tetrachloride with a catalytic amount of benzoyl peroxide (0.2 equiv.) under reflux conditions. A mixture of 1-chloro-3-(dibromomethyl) benzene **1a** (1.0 equiv), 2-aminobenzamide **2a** (1.1 equiv.), potassium *tert*-butoxide (*t*-BuOK) (0.5 equiv.) in anhydrous pyridine and dimethylformamide (3 : 1 ratio) solvent was stirred at room temperature, but only trace amount of product was obtained even after 6 h of stirring (entry 1, Table 1). Improvement in product yield (entry 2, Table 1) was achieved when the reaction mixture was heated at 80 °C for 6 h. The reaction was monitored by increasing the equivalence of *t*-BuOK, and the maximum yield was obtained with 1.0 mmol of *t*-BuOK, and the starting material was consumed in 4 h as indicated by TLC. After workup and purification by column chromatography, 2-(3-chlorophenyl)-2,3-dihydroquinazolin-4(1*H*)-one **3a** was isolated with 90% yield (entries 3 and 4, Table 1), and any increase in the equivalent of base did not influence the yield. Bases, like *N*-ethyldiisopropylamine, triethylamine, DABCO and DBU, did not promote the reaction (entries 5–8, Table 1), whereas pyrrolidine, morpholine and piperidine gave less yields in 6 h (entries 9–11, Table 1). Both aromatic and heteroaromatic *gem*-dibromomethylarenes bearing various functionalities, such as chloro, bromo, fluoro, methoxy, ester, *tert*-butyl and trifluoro methyl, –OTHP, –OTBDMS groups, survived the reaction and provided high yields of corresponding products (Table 2).

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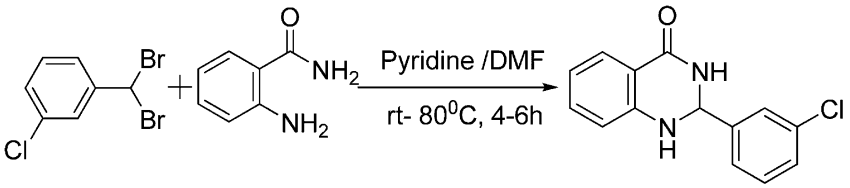
Table 1 Optimization experiments for the synthesis of **3a**[a]



Entry	Base	Equivalent	Temp. (°C)	Time (h)	Yield[b] (%) of **3a**
1	*t*-BuOK	0.5	0–25	6	Trace
2	*t*-BuOK	0.5	80	6	45
3	***t*-BuOK**	**1.0**	**80**	**4**	**90**
4	*t*-BuOK	1.5	80	4	89
5	DIPEA	1.0	80	6	—
6	TEA	1.0	80	6	—
7	DABCO	1.0	80	6	—
8	DBU	1.0	80	6	—
9	Pyrrolidine	1.0	80	6	18
10	Morpholine	1.0	80	6	22
11	Piperidine	1.0	80	6	30

[a] Reaction condition: *gem*-dibromomethylarenes **1** (1.0 equiv.) and 2-aminobenzamide **2** (1.1 equiv.), (*t*-BuOK) 1.0 mmol. [b] Isolated yields after column chromatography.

The reaction of *gem*-dibromomethylarenes with 2-aminobenzamide yielded corresponding 2,3-dihydroquinazolin-4(1*H*)-ones, and the proposed reaction mechanism is shown in Scheme 2.

Conclusion

In summary, this is an effective and efficient method of conversion of substituted 2-aminobenzamide into corresponding 2,3-dihydroquinazolin-4(1*H*)-ones using *gem*-dibromomethylarenes under mild reaction conditions. The use of *gem*-dibromomethylarenes for the direct synthesis of biologically important 2,3-dihydroquinazolin-4(1*H*)-ones has been indicated. As this reaction provides 2,3-dihydroquinazolin-4(1*H*)-ones in a single step from *gem*-dibromomethylarenes, it is one of the easiest pathways for accessing these compounds and the starting material is easily available. This transformation would have many applications in synthetic chemistry.

Experimental section

General information

Melting points were recorded (uncorrected) on a Buchi Melting Point B-545 instrument. Infrared (IR) spectra were recorded using a Jasco FTIR-4100 series. All reagents and solvents used were commercially procured and used as received. The ^{1}H NMR spectra were measured on a Bruker DPX-400 at 400 MHz with TMS as internal standard. The ^{13}C NMR spectra were measured on a Bruker DPX-400 at 100 MHz. The mass spectra were recorded on a JEOL JMS-AX505HA mass spectrometer.

Typical procedure for the synthesis of 2-(4-*tert*-butylphenyl)-6-chloro-2,3-dihydroquinazolin-4(1*H*)-one (3f). Potassium *tert*-butoxide (0.366 g, 0.00327 mol) was added to a suspension of 4-tertiary butylbenzalbromide (**1f**) (1 g, 0.00327 mol) and 2-amino-5-chlorobenzamide (**2b**) (0.614 g, 0.0036 mol) in pyridine–dimethyl formamide (6.0 : 2.0 mL) solvent mixture. The resultant mixture was heated at 80 °C for 4 h. Progress of the reaction was monitored by TLC. The reaction mass was mixed with water then extracted with ethyl acetate (2 × 20 mL), and the organic phase was washed with brine solution and dried over anhydrous sodium sulphate. The organic phase was evaporated and the crude product was purified by column chromatography using silica gel mesh 100–200 (30% EtOAc in hexane).

2-(3-Chlorophenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3a). White solid; m.p. 188.9–189.9 °C. (Lit.[11] 189.8–189.9 °C) IR (KBr) ν_{max} 3290, 3199, 1652, 1613 cm^{-1}. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.42 (s, 1H), 7.63–7.60 (m, 1H), 7.53 (s, 1H), 7.47–7.31 (m, 3H), 7.23–7.27 (m, 2H), 6.77 (d, J = 7.6 Hz, 1H), 6.69 (t, J = 7.6 Hz, 1H), 5.77 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 163.9, 147.9, 144.8, 133.9, 133.4, 130.7, 128.7, 127.8, 127.2, 125.8, 117.8, 115.3, 114.9, 66.0 ppm; MS(ESI): m/z = 258.8, HRMS (ESI): calcd for [$C_{14}H_{13}ClN_2O$ + H^+]: 259.7109, found 259.7105.

2,4-Dichloro, 3-dihydroquinazolin-4(1*H*)-one (3b). White solid, m.p. 182–184 °C (Lit.[15] 181–185 °C); IR (KBr): 3337, 3179, 3025, 1661 cm^{-1}. ^{1}H NMR (DMSO-d_6, 400 MHz): 8.25 (s, 1H), 7.68–7.65 (m, 3H), 7.50–7.47 (m, 1H), 7.29–7.24 (t, J = 7.5 Hz, 1H), 7.04 (s, 1H), 6.93 (d, J = 6.4 Hz, 1H), 6.71 (t, J = 8.1 Hz, 1H), 6.1 (s, 1H) ppm; ^{13}C NMR (100 MHz DMSO-d_6): δ 163.6, 147.5, 136.9, 133.9, 133.5, 132.9, 130.9, 128.9, 128.6, 127.4, 117.6, 114.7, 114.6, 63.3 ppm; MS(ESI): m/z = 293.148, HRMS (ESI): calcd for [$C_{14}H_{11}Cl_2N_2O$ + H^+]: 294.1559, found 294.1556.

2-(Pyridin-4-yl)-2,3-dihydroquinazolin-4(1*H*)-one (3c). Light yellow solid; m.p.: 187–188 °C (lit.[8] not reported) IR (KBr): 2922,

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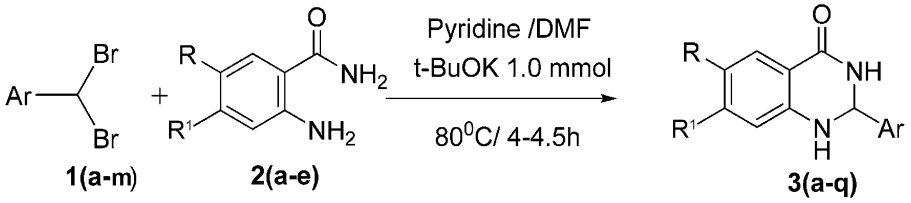
Table 2 2-Aryl-2,3-dihydro quinazolin-4(1*H*)-ones results



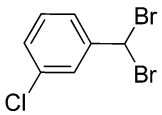
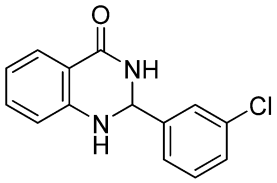
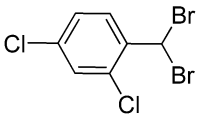
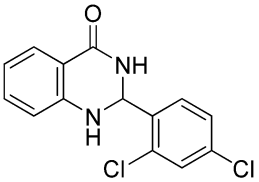
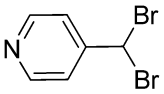
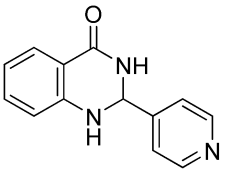
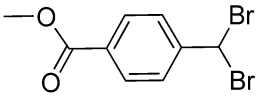
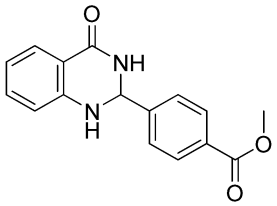
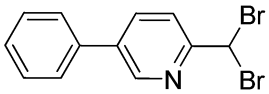
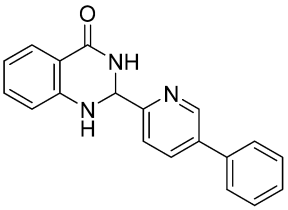
Entry	(Ar) substrate[a] (1)	Yield (1) (%)	(2)	Product (3)	Time (h)	Yield (3)[b,c] (%)
1	 1a	87	R = –H, R^1 = –H, 2a	 3a	4	90[11]
2	 1b	84	R = –H, R^1 = –H, 2a	 3b	4	88[15]
3	 1c	78	R = –H, R^1 = –H, 2a	 3e	4.5	84[8]
4	 1d	80	R = –H, R^1 = –H, 2a	 3d	4	86[9]
5	 1e	81	R = –H, R^1 = –H, 2a	 3e	4	78

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Table 2 (*Contd.*)

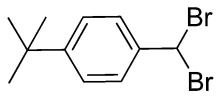
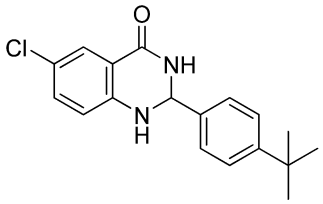
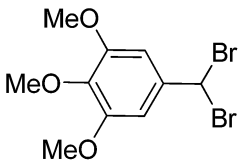
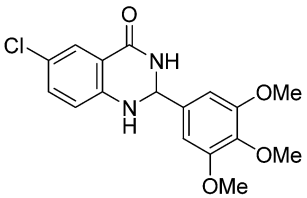
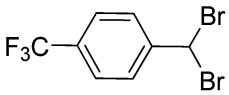
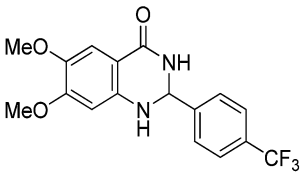
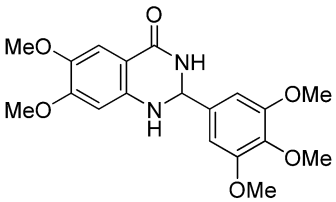
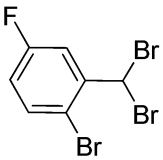
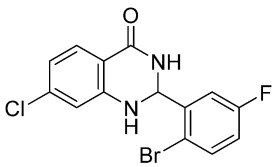
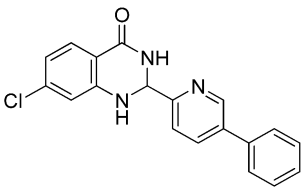
Entry	(Ar) substrate[a] (**1**)	Yield (**1**) (%)	(**2**)	Product (**3**)	Time (h)	Yield (**3**)[b,c] (%)
6	 **1f**	86	R = Cl, R^1 = –H, **2b**	 **3f**	4	85
7	 **1g**	84	R = Cl, R^1 = –H, **2b**	 **3g**	4	86
8	 **1h**	87	R = OMe, R^1 = OMe, **2c**	 **3h**	4	90
9	**1g**	—	R = OMe, R^1 = OMe, **2c**	 **3i**	4	81
10	 **1i**	77	R = –H, R^1 = Cl, **2d**	 **3j**	4	78
11	**1e**	—	R = –H, R^1 = Cl **2d**	 **3k**	4	83

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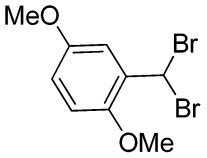
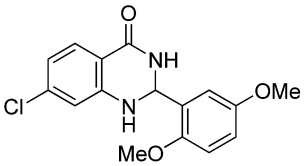
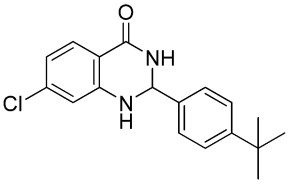
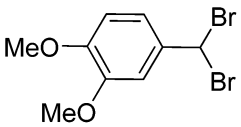
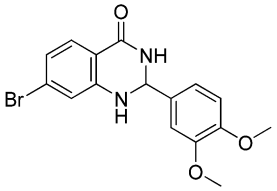
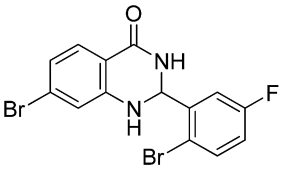
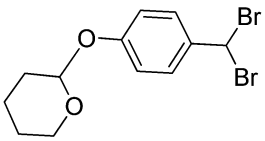
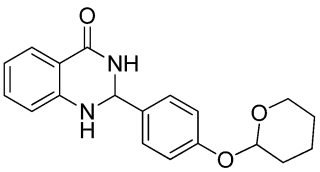
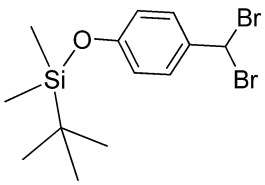
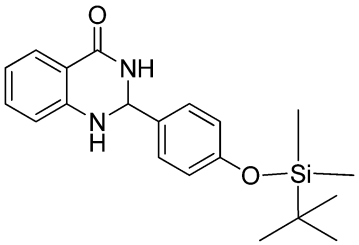
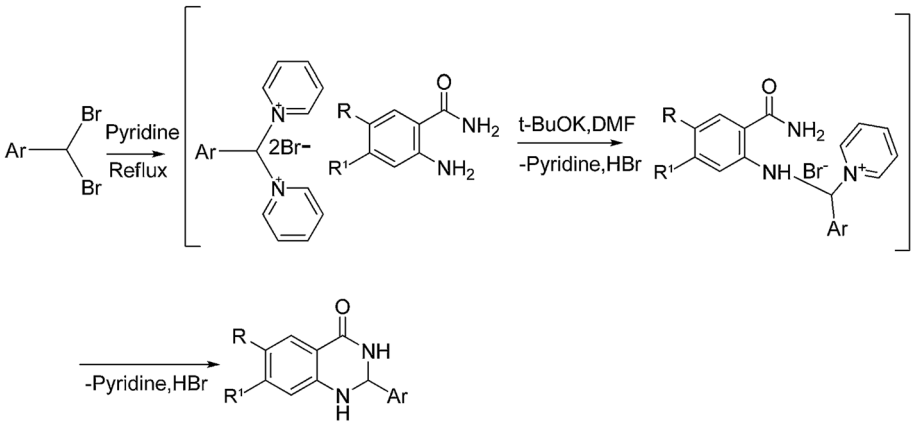
Table 2 (*Contd.*)

Entry	(Ar) substrate[a] (1)	Yield (1) (%)	(2)	Product (3)	Time (h)	Yield (3)[b,c] (%)
12	 **1j**	80	R = –H, R^1 = Cl, **2d**	 **3l**	4	79
13	**1f**	—	R = –H, R^1 = Cl, **2d**	 **3m**	4	85
14	 **1k**	85	R = –H, R^1 = Br, **2e**	 **3n**	4	88
15	**1i**	—	R = –H, R^1 = Br, **2e**	 **3o**	4	89
16	 **1l**	45	R = –H, R^1 = –H, **2a**	 **3p**	4	60
17	 **1m**	84	R = –H, R^1 = –H, **2a**	 **3q**	4	75

[a] Substrates are prepared from the commercial methyl analogues by radical bromination. [b] Isolated yields of product (3). [c] Literature reported compounds.



Scheme 2 Proposed mechanism of reaction between *gem*-dibromomethylarene and 2-aminobenzamide in pyridine/dimethyl formamide.

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2853, 1674, 1605, cm^{-1}. ^{1}H NMR (400 MHz, DMSO-d_6): δ = 8.88 (d, 2H, J = 6.0 Hz), 8.36 (d, 2H, J = 7.5 Hz), 8.17 (d, 2H, J = 4.5 Hz), 7.88 (d, 2H, J = 3.0 Hz), 7.63–7.58 (m, 1H), 5.85 (s, 1H), 5.04 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ = 160.93, 147.98, 146.88, 132.95, 126.34, 125.84, 124.46, 120.22, 69.15 ppm; MS(ESI): m/z = 225.245. HRMS (ESI): calcd for [$C_{13}H_{12}N_3O$ + H^+]: 226.2539. Found 226.2535.

Methyl 4-(4-oxo-1,2,3,4-tetrahydroquinazolin-2-yl)benzoate (3d). White solid; m.p.: 200.2–202.4; (lit.[9] 199.2–202.3 °C). IR (KBr): 3328, 3025, 2930, 1760, 1610 cm^{-1}. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 7.97 (d, J = 8.3 Hz, 2H), 7.64–7.57 (m, 3H), 7.28–7.22 (m, 2H), 6.75 (d, J = 7.5 Hz 1H), 6.68 (td, J = 7.5, 1.0 Hz, 1H), 5.84 (t, J = 2.1 Hz, 1H), 3.85 (s, 3H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 165.91, 163.36, 147.50, 146.94, 133.40, 129.56, 129.22, 129.22, 127.33, 127.14, 127.14, 117.26, 114.86, 114.43, 65.88, 52.16 ppm; MS(ESI): m/z = 282.294, HRMS (ESI) calcd for [$C_{16}H_{15}N_2O_3$ + H^+]: 283.3019, found 283.3015.

2-(5-Phenylpyridin-2-yl)-2,3-dihydroquinazolin-4(1*H*)-one (3e). Light yellow solid; m.p.: 185–186 °C; IR (KBr) ν_{max} 3184.26, 3066.61, 2929.67, 1666.38, 1610.45 cm^{-1}. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.66–8.64 (d, J = 4.8 Hz, 1H), 8.32 (s 1H), 8.09–8.07 (d, J = 8.4 Hz, 2H), 7.95–7.93 (d, J = 8 Hz, 1H), 7.88–7.84 (tt, J = 1.6 Hz, 1H), 7.62–7.58 (m 3H), 7.35–7.32 (m, 1H), 7.26–7.22 (tt, J = 8.4 Hz, 1H), 7.15 (s, 1H), 6.76–6.74 (d, J = 8 Hz, 1H), 6.69–6.52 (tt, J = 8 Hz, 1H), 5.8 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 163.52, 155.57, 149.54, 147.76, 142.41, 138.8, 137.2, 133.3, 127.34, 127.22, 126.45, 122.68, 120.29, 117.13, 114.97, 114.42, 66.18 ppm; MS(ESI): m/z = 301.122, HRMS (ESI) calcd for [$C_{19}H_{15}N_3O$ + H^+] 302.3498, found 302.3495.

2-(4-*tert*-Butylphenyl)-6-chloro-2,3-dihydroquinazolin-4(1*H*)-one (3f). Light yellow solid; m.p.: 180–182 °C; IR (KBr) ν_{max} 3328.91, 3257.55, 2929.67, 1741.60, 1612.38 cm^{-1}.^{1}H NMR (400 MHz, DMSO-d_6): δ 8.38 (s, 1H), 7.53–7.52 (d, J = 2.4 Hz, 1H), 7.42–7.38 (m, 4H), 7.27–7.24 (m, 2H), 6.75–6.73 (d, J = 8.4 Hz, 1H), 5.73 (s, 1H), 1.26 (S, 9H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.40, 151.13, 146.62, 138.18, 132.96, 126.59, 126.35, 126.20, 125.11, 120.61, 116.31, 116, 66.27, 34.28, 31.04 ppm; MS(ESI): m/z = 314.119. HRMS (ESI) calcd for [$C_{18}H_{20}ClN_2O$ + H^+] 315.8172 found 315.8170.

6-Chloro-2-(3,4,5-trimethoxyphenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3g). White solid; m.p.: 158–160 °C. IR (KBr) ν_{max} 3274.90, 3197.76, 2964.39, 2929.67, 1654, 1612.33 cm^{-1}. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.36 (s, 1H), 7.54–7.53 (d, J = 2.4 Hz, 1H), 7.29–7.24 (m, 2H), 6.82–6.77 (m, 4H), 5.72 (S, 1H), 3.76 (s, 6H), 3.64 (s, 3H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.49, 152.76, 146.73, 137.69, 136.17, 133.02, 126.40, 120.86, 116.42, 116.12, 104.45, 66.73, 59.95, 59.71, 55.92 ppm; MS(ESI): m/z = 348.088, HRMS (ESI) calcd for [$C_{17}H_{18}ClN_2O_4$ + H^+] 349.7888, found 349.7885.

6,7-Dimethoxy-2-(4-(trifluoromethyl)phenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3h). Light yellow solid; m.p.: 188–189 °C; IR (KBr) ν_{max} 3301.91, 3197.76, 2925.81, 2852.52, 1649.02, 1618.17 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.18 (s, 1H), 7.75–7.67 (m, 4H), 7.08 (s, 1H), 6.91 (s, 1H), 6.35 (s, 1H), 5.77 (s, 1H), 3.72 (s, 3H), 3.65 (S, 3H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 163.44, 153.93, 146.60, 143.07, 141.58, 127.74, 127.54, 125.18, 125.15, 125.04, 109.74, 106.62, 97.99, 65.92, 55.74, 55.34 ppm; MS(ESI): m/z = 352.307, HRMS (ESI) calcd for [$C_{17}H_{16}F_3N_2O_3$ + H^+] 353.3157, found 353.3155.

6,7-Dimethoxy-2-(3,4,5-trimethoxyphenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3i). Light red solid; m.p.: 242–244 °C. IR (KBr) ν_{max} 3353.98, 3197.76, 2937.38, 2837.09, 1654.81, 1620.09, cm^{-1}. ^{1}H NMR (400 MHz, DMSO-d_6): δ 7.49 (s, 1H), 7.13 (s, 1H), 6.85 (s, 2H), 6.7 (s, 1H), 6.4 (s, 1H), 5.64 (s, 1H), 3.78 (s, 3H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 163.82, 153.78, 152.83, 152.64, 143.75, 141.55, 137.48, 136.52, 109.79, 108.24, 104.96, 104.80, 97.99, 67.30, 59.91, 55.87, 55.77, 55.69, 55.35 ppm; MS(ESI): m/z = 374.387, HRMS (ESI) calcd for [$C_{19}H_{23}N_2O_6$ + H^+] 375.3957, found 375.3954.

2-(2-Bromo-5-chlorophenyl)-7-chloro-2,3-dihydroquinazolin-4(1*H*)-one (3j). White solid; m.p.: 197–198 °C; IR (KBr) ν_{max} 3353.98, 3288.4, 3182.33, 3051.18, 2921.96, 2854.45, 1694.02, 1610.45 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.33 (s, 1H), 7.74–7.7 (m, 1H), 7.63 (s, 1H), 7.41–7.38 (dd, J = 2.6 Hz, 1H), 7.29–7.22 (m, 2H), 6.81–6.8 (d, J = 1.2 Hz, 1H), 6.75–6.72 (dd, J = 1.8 Hz, 1H), 6.1 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.57, 160.13, 148.35, 141.02, 138.01, 134.65, 129.35, 117.92, 117.6, 116.58, 115.99, 115.75, 113.27, 66.24 ppm; MS(ESI): m/z = 355.589,

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HRMS(ESI) calcd for [$C_{14}H_{10}BrClFN_2O$ + H^+] 356.5974, found 356.5971.

7-Chloro-2-(5-phenylpyridin-2-yl)-2,3-dihydroquinazolin-4(1*H*)-one (3k). Brown solid; m.p.: 208–210 °C; IR (KBr) ν_{max} 3193.9, 3068.53, 2923.88, 2854.45, 2813.95, 1666.38, 1610.45 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.66–8.65 (d, J = 4.4 Hz, 1H), 8.45 (s, 1H), 8.11–8.09 (d, J = 8.4 Hz, 1H), 7.95–7.93 (d, J = 8 Hz, 1H), 7.89–7.84 (tt, J = 1.46 Hz, 1H), 7.62–7.56 (m, 4H), 7.43 (s, 1H), 7.36–7.33 (m, 1H), 6.8–6.79 (d, J = 2 Hz, 1H), 6.69–6.67 (dd, J = 2 Hz, 1H), 5.86 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.63, 155.48, 149.53, 148.66, 142.04, 138.94, 137.81, 137.37, 137.21, 129.32, 128.35, 127.1, 126.54, 122.69, 120.29, 117.04, 113.62, 113.42, 66.07 ppm; MS(ESI): m/z = 335.787, HRMS (ESI) calcd for [$C_{19}H_{15}ClN_3O$ + H^+] 336.7949, found 336.7945.

7-Chloro-2-(2,5-dimethoxyphenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3l). Light yellow solid; m.p.: 208–210 °C; IR (KBr) ν_{max} 3330.84, 3298.05, 3234.4, 3060.82, 2962.46, 2867.95, 1643.24, 1610.45 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.11 (s, 1H), 7.61–7.59 (d, J = 8.4 Hz, 1H), 7.04 (s, 1H), 6.99–6.96 (m, 1H), 6.9–6.87 (m, 2H), 6.817–6.813 (d, J = 1.6 Hz, 1H), 6.67–6.65 (dd, J = 2 Hz, 1H), 5.99 (s, 1H), 3.77 (s, 3H), 3.66 (s, 3H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.91, 152.85, 150.36, 148.71, 137.74, 129.58, 129.21, 124.74, 116.92, 113.61, 113.5, 113.34, 112.24, 61.07, 55.99, 55.36 ppm; MS(ESI): m/z = 318.754. HRMS (ESI) calcd for [$C_{16}H_{16}ClN_2O_3$+H^+] 319.7628, found 319.7628.

2-(4-*tert*-Butylphenyl)-7-chloro-2,3-dihydroquinazolin-4(1*H*)-one (3m). Light yellow solid; m.p.: 110–112 °C; IR (KBr) ν_{max} 3332.76, 3170.76, 3031.89, 2925.81, 2831.31, 1656.74, 1608.52 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.31 (s, 1H), 8.14–8.1 (dd, J = 2.6 Hz, 1H), 7.6–7.38 (m, 4H), 7.3 (s, 1H), 6.757–6.752 (d, J = 2 Hz, 1H), 6.67–6.65 (dd, J = 2 Hz, 1H), 5.75 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.71, 151.17, 148.8, 138.24, 137.72, 129.13, 127.68, 126.55, 125.43, 125.3, 116.9, 113.6, 113.31, 66.33, 34.29, 31.04, 30.84 ppm; MS(ESI): m/z = 314.809, HRMS (ESI) calcd for [$C_{18}H_{20}ClN_2O$ + H^+] 315.8172, found 315.8170.

7-Bromo-2-(3,4-dimethoxyphenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3n). White solid; m.p.: 137–138 °C; IR (KBr) ν_{max} 3298.26, 3182.33, 3070.46, 2956.67, 2923.67, 2923.88, 2852.52, 1700, 1610 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.38 (s, 1H), 7.52–7.49 (m, 3H), 7.33 (s, 1H), 7.24–7.2 (m, 1H), 6.94–6.93 (d, J = 2 Hz, 1H), 6.83–6.80 (dd, J = 1.8 Hz, 1H), 5.81 (s, 1H), 3.68 (s, 6H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.65, 148.42, 141.06, 134.75, 129.42, 127, 120.44, 118.16, 117.94, 116.63, 115.98, 115.74, 113.57, 66.20, 55.42, 55.36 ppm; MS(ESI): m/z = 363.205, HRMS (ESI) calcd for [$C_{16}H_{16}BrN_2O_3$+H^+] 364.2138, found 364.2135.

7-Bromo-2-(2-bromo-5-fluorophenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3o). White solid; m.p.: 206–207 °C; IR (KBr) ν_{max} 3294.36, 3194.33, 3074.5, 2958.67, 2926.86, 2854.53, 1705.1, 1605 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.34 (s, 1H), 7.74–7.7 (m, 1H), 7.57–7.55 (d, J = 8.4 Hz, 1H), 7.40–7.37 (dd, J = 3.2 Hz, 1H),7.28–7.23 (m, 2H), 6.963–6.960 (d, J = 1.2 Hz, 1H), 6.89–6.86 (dd, J = 1.8 Hz, 1H), 6.09 (s, 1H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): δ 162.69, 160.91, 148.74, 137.49, 129.39, 128.95, 126.82, 125.16, 119.96, 116.40, 115.28, 115.07, 113.88, 65.75 ppm; MS (ESI): m/z = 400.04, HRMS (ESI) calcd for [$C_{14}H_{10}Br_2FN_2O$ + H^+] 401.0484, found 401.0481.

2-(4-(Tetrahydro-2*H*-pyran-2-yloxy)phenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3p). White solid; m.p.: 136–138 °C; IR (KBr) ν_{max} 3327, 3028, 2932, 1738, 1615 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.16 (s, 1H), 7.59–7.57 (d, J = 8 Hz, 1H), 7.39–7.37 (d, J = 8 Hz, 2H), 7.23–7.19 (t, J = 7.6 Hz, 1H), 7.02–6.98 (m, 3H), 6.72–6.63 (m, 2H) 5.67 (s, 1H), 5.45 (s, 1H), 3.72–3.67 (m, 1H), 3.52–3.48 (m, 1H), 1.88–1.69 (m, 3H), 1.60–1.48 (m, 4H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): 164.13, 157.07, 148.43, 134.88, 134.86, 133.69, 128.54, 127.78, 117.52, 116.63, 115.39, 114.83, 96.04, 66.79, 61.91, 30.21, 25.11, 18.98 ppm; MS (ESI): 324.14, HRMS (ESI) calcd for [$C_{19}H_{20}N_2O_3$+H^+] 325.1552, found 325.1550.

2-(4-(*tert*-Butyldimethylsilyloxy)phenyl)-2,3-dihydroquinazolin-4(1*H*)-one (3q). White solid; m.p.: 139–141 °C; IR (KBr) ν_{max} 3329.86, 3032.60, 2928.72, 1740.30, 1612.30 cm^{-1}; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.17 (s, 1H), 7.64–7.62 (dd, J = 1.6 Hz, 1H), 7.41–7.39 (dd, J = 2 Hz, 2H), 7.28–7.24 (m, IH), 7.02 (s, 1H), 6.89–6.87 (dd, J = 2 Hz, 2H), 6.77–6.75 (d, J = 8.4 Hz, 1H) 6.71–6.67 (m, 1H), 5.72 (s, 1H), 1.02–0.92 (m, 9H), 0.25–0.15 (m, 6H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6): 164.07, 155.77, 148.45, 134.8, 133.69, 128.78, 127.77, 119.97, 117.50, 115.32, 114.81, 66.85, 26.0, 18.38, −4.08 ppm; MS (ESI): 354.17, HRMS (ESI) calcd for [$C_{20}H_{26}N_2O_2Si$ + H^+] 355.1852, found 358.1948.

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