

2-ARYL-6,8-DIBROMO-2,3-DIHYDROQUINAZOLIN-4(1*H*)-ONES AS SUBSTRATES FOR THE SYNTHESIS OF 2,6,8-TRIARYLQUINAZOLIN-4-ONES

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ABSTRACT. Direct bromination of 2-aminobenzamide was achieved using *N*-bromosuccinimide in chloroform-carbon tetrachloride mixture at room temperature for 3 h to afford 2-amino-3,5-dibromobenzamide in high yield and purity. 2-Amino-3,5-dibromobenzamide was, in turn, condensed with benzaldehyde derivatives in the presence of boric acid to afford novel 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones. Suzuki-Miyaura cross-coupling of the latter with arylboronic acids yielded the corresponding 2,6,8-triaryl-2,3-dihydroquinazolin-4(1*H*)-ones. These triarylquinazolin-4(1*H*)-ones were dehydrogenated using iodine (2 equiv.) in ethanol under reflux to yield the potentially tautomeric 2,6,8-triarylquinazolin-4(3*H*)-ones.

KEY WORDS: 2-Amino-3,5-dibromobenzamide, 2-Aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones, Suzuki-Miyaura cross-coupling, 2,6,8-Triaryl-2,3-dihydroquinazolin-4(1*H*)-ones, 2,6,8-Triarylquinazolin-4(3*H*)-ones

INTRODUCTION

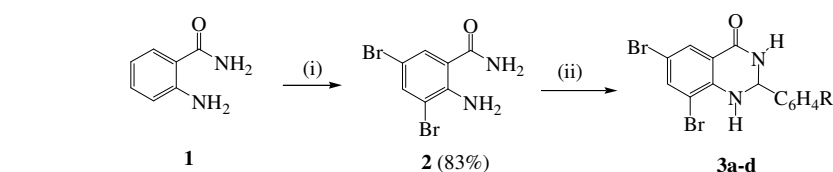
The 2,3-dihydroquinazolin-4(1*H*)-one-based compounds continue to attract considerable attention in synthesis because of their rich biological activities and excellent pharmacological properties [1-5]. These compounds are generally accessible via the condensation of isatoic anhydride or anthranilamide derivatives with aldehydes or ketones using *p*-toluenesulfonic acid [5], HCl [6], samarium iodide [7], TiCl₄-Zn [8], NH₄Cl [9], boric acid [10], cerium(IV) ammonium nitrate [11], iodine [12], gallium(III) triflate [13] or β -cyclodextrin [14] as catalysts. Molecular iodine catalyzed condensation of isatoic anhydride with benzaldehyde derivatives in the presence of NH₄OAc in ethanol under reflux, on the other hand, previously afforded the 2-arylquinazolin-4(3*H*)-ones exclusively or along with the 2,3-dihydroquinazolin-4(1*H*)-ones depending on the ratio of iodine used [15]. A thorough literature search revealed that the 2-substituted 2,3-dihydroquinazolin-4(1*H*)-one derivatives bearing carbon-containing groups (aryl, alkenyl, alkynyl) on the fused benzo ring remain surprisingly unexplored so far. In our view, such polysubstituted derivatives can be readily accessible via transition metal catalyzed cross-coupling of the corresponding pre-synthesized halogenated 2,3-dihydroquinazolin-4(1*H*)-ones. We envisioned that the 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones represent potential candidates for such transformation to afford novel polysubstituted quinazolin-4(1*H*)-ones bearing carbon- or heteroatom-containing substituents. We herein describe the synthesis of the 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones and sequential transformation via the Suzuki-Miyaura cross-coupling with arylboronic acids followed by dehydrogenation to afford novel polysubstituted quinazolin-4(3*H*)-one derivatives.

RESULTS AND DISCUSSION

The first task in this investigation was to synthesize the requisite 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones from 2-amino-3,5-dibromobenzamide and benzaldehyde derivatives. 2-Amino-3,5-dibromobenzamide required as a precursor for this purpose was prepared

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before in 85% yield by treatment of (2-amino-3,5-dibromophenyl)(benzotriazole-1-yl)methanone with excess aqueous ammonium hydroxide in THF at 0 °C [16]. The labeled 3,5-dibromo- $^{13}\text{C}_7$ anthranilamide, on the other hand, has been prepared in 47% yield by acid hydrolysis of 2-amino-3,5-dibromo- $^{13}\text{C}_7$ -benzonitrile [17]. Although 2-aminobenzamide is commercially available and has been used in several transformations before, to our knowledge, direct bromination of this compound has not been explored so far. On the other hand, the analogous 2'-aminoacetophenone has been found to undergo bromination with NaBr-oxone in acetonitrile [18], Br_2 in acetic acid [19], or *N*-bromosuccinimide (NBS) in CHCl_3 - CCl_4 mixture [20] to afford 2-amino-3,5-dibromoacetophenone in high yield. Based on these literature precedents, we subjected anthranilamide **1** to NBS (2.5 equiv.) in chloroform-carbon tetrachloride mixture (3/2, v/v) at room temperature. To our delight, we isolated directly after 3 h by filtration and recrystallization, a product characterized using a combination of NMR and IR spectroscopic techniques as well as mass spectrometry as the 3,5-dibromoanthranilamide **2** (Scheme 1). Whereas benzamide was found to react with NaBr-oxone mixture to afford *N*-bromobenzamide [18] in our case, no product resulting from possible *N*-bromination was detected or isolated from the reaction mixture. Compound **2** was, in turn, condensed with benzaldehyde derivatives (1 equiv.) under solvent-free conditions using boric acid as a catalyst following a literature method [10] to afford the corresponding novel 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones **3a-d** (Scheme 1). A series of the analogous 2,3-disubstituted 6,8-dibromoquinazolin-4(3*H*)-one derivatives has nevertheless been synthesized before from the reaction of 6,8-dibromo-2-methyl-1-benzoxazin-3(4*H*)-one with nitrogen nucleophiles such as hydrazine hydrate, sulpham drugs and 4'-aminoacetophenone [21]. The 6-fluoro-8-(iodo/bromo)-2-methylquinazolin-4(3*H*)-ones, on the other hand, have been prepared via the reaction of 6-fluoro-8-iodo/bromo-2-methyl-1-benzoxazin-3(4*H*)-ones with aqueous ammonia under reflux [22].



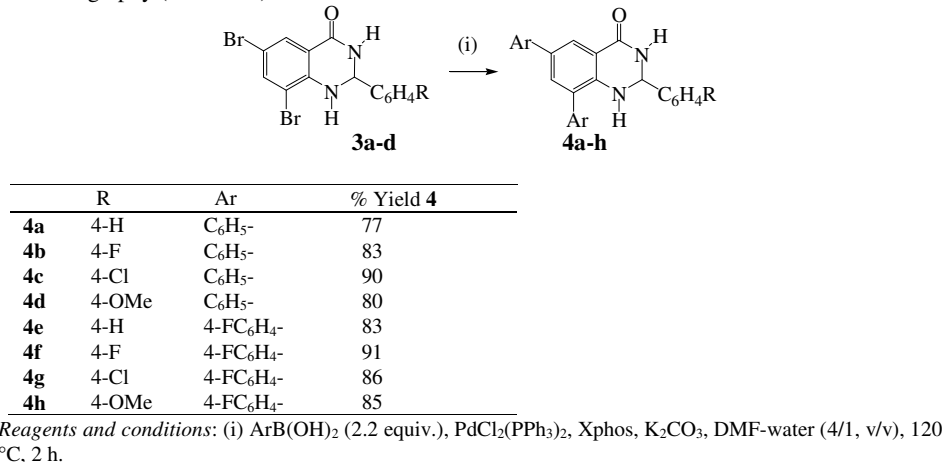
	R	% Yield 3
3a	4-H	87
3b	4-F	82
3c	4-Cl	90
3d	4-OMe	86

Reagents and conditions: (i) NBS, CHCl_3 - CCl_4 (3/2, v/v), rt, 3 h; (ii) ArCHO, boric acid (20 mol %), 120 °C, 5 min.

Scheme 1. Synthesis of the 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones **3a-d**.

The need to access a diverse range of the 2,3-dihydroquinazolin-4(1*H*)-ones bearing carbon-containing substituents on the fused benzo ring, in conjunction with limited contemporary synthetic approach to such systems prompted us to elaborate compounds **3a-d** via palladium-catalyzed Suzuki-Miyaura cross-coupling with arylboronic acids as coupling partners. As a reference starting point for exploration, we subjected compound **3a** to phenylboronic acid (1.2 equiv.) in the presence of dichlorobis(triphenylphosphine)palladium(II) ($\text{PdCl}_2(\text{PPh}_3)_2$) as Pd(0) source and potassium carbonate as a base in *N,N*-dimethylformamide-water (4/1, v/v). The reaction was however unsuccessful due to formation of complex mixtures. We opted for the use of 2-dicyclohexylphosphino-2',4',6'-triisopropylbiphenyl (Xphos) as a ligand to coordinate with

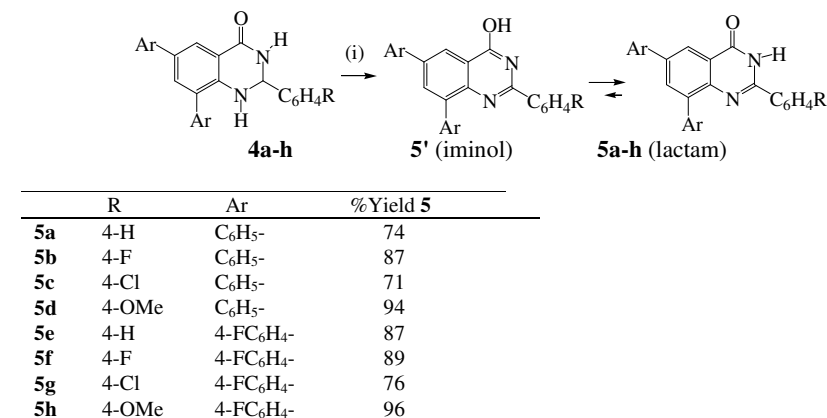
palladium and increase its electron density and, in turn, accelerate the oxidative addition and reductive elimination steps in the catalytic cycle [23]. Compound **3a** was subjected to phenylboronic acid (1.2 equiv.) in the presence of $\text{PdCl}_2(\text{PPh}_3)_2$ -Xphos catalyst complex and potassium carbonate as a base in DMF under reflux and the starting material was consumed within 3 h (tlc monitoring). ^1H NMR spectroscopic analysis of the crude product revealed the presence of a mixture of the diarylated quinazolin-4(1*H*)-one and the dehydrogenated starting material. However, these compounds could not be separated by column chromatography due to similar R_f values. Non-selectivity to afford double coupled derivatives has been previously observed with Suzuki-Miyaura cross-coupling of the analogous 2-aryl-6,8-dibromoquinolin-4(1*H*)-ones with arylboronic acids [24]. Likewise, the Heck reaction of the analogous 6,8-dibromoflavone with methyl acrylate afforded mixture of both 6- and 8-monosubstituted and 6,8-disubstituted flavones [25]. To ensure exhaustive multiple coupling in cases where it is difficult or not possible to control the selectivity of cross coupling of halogenated heterocycles bearing similar halogen atoms on the fused benzo ring, an excess of the arylboronic acid is often employed to drive the reaction to completion [26]. A similar strategy was also employed before by Zhang *et al.* on 8-bromo-6-chloroquinoline with excess of bis(pinacolato)diboron (2.2 equiv.) and phenylbromide to afford 6,8-diphenylquinoline in 94% yield [27]. In analogy with these literature precedents, we subjected **3a** to phenylboronic acid (2.2 equiv.) using $\text{PdCl}_2(\text{PPh}_3)_2$ -Xphos catalyst complex and potassium carbonate as a base in aqueous DMF at 120 °C. We isolated after 2 h by column chromatography over silica gel the cross-coupled products **4a** (70%) and traces of its dehydrogenated derivative. The use of aqueous dioxane as solvent, on the other hand, afforded **4a** (77%) without traces of the dehydrogenated cross-coupled product. These reaction conditions were extended to substrates **3b-d** with phenylboronic and 4-fluorophenylboronic acids (2.2 equiv.) as coupling partners to afford the cross-coupled products **4a-h** in appreciable yields and high purity without the need for column chromatography (Scheme 3).



Scheme 2. Suzuki-Miyaura cross-coupling of **3a-d** with arylboronic acids.

The heterocyclic ring of the 2,3-dihydroquinazolin-4(1*H*)-ones has been found to undergo a different degree of unsaturation through dehydrogenation or aromatization to afford the potentially tautomeric quinazolin-4(3*H*)-ones or their quinazoline derivatives [28-32]. Quinazolin-4(3*H*)-ones are versatile building blocks in the synthesis of novel 2,3-disubstituted quinazolinones [28-31] and their 2,4-disubstituted quinazoline derivatives using the principles of lactam-lactim dynamic

equilibrium phenomena [32]. Oxidants such as KMnO_4 [28], CuCl_2 [29], DDQ [30] and MnO_2 [31] have been employed before in stoichiometric or large excess to convert the 2,3-dihydroquinazolin-4(1*H*)-ones into their quinazolin-4(3*H*)-one derivatives. In this investigation, we opted for the use of molecular iodine which has been used before as an oxidant to effect the oxidative aromatization of α,β -unsaturated cyclic compounds and the analogous 2,3-dihydroquinolin-4(1*H*)-ones [24]. Compounds **4a-h** were subjected to molecular iodine (2 equiv.) in ethanol under reflux for 2 h and we isolated the potentially tautomeric quinazolin-4(3*H*)-ones **5a-h** in high yield and purity without the need for column chromatography (Scheme 2). Their N-4(3*H*)-oxo nature was confirmed by the absence of the N-1 and C-2 proton signals in their ^1H NMR spectra and the significant downfield shift of the N-3 proton signal to δ *ca.* 12.35 ppm. The analogous 2-arylquinazolin-4(3*H*)-one derivatives bearing an aryl group at the 6-position of the fused benzo ring have been found to serve as orally available ghrelin receptor antagonists for the treatment of diabetes and obesity [33].



Reagents and conditions: (i) I_2 (2 equiv.), ethanol, reflux, 2 h.

Scheme 3. Iodine/ethanol-promoted dehydrogenation of **4a-h**.

In summary, the results of this investigation demonstrate that anthranilamide readily undergoes bromination to afford 2-amino-3,5-dibromobenzamide in high yield and purity without affecting the amide nitrogen. Palladium-mediated Suzuki-Miyaura cross-coupling of the 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1*H*)-ones derived from 2-amino-3,5-dibromobenzamide and arylaldehydes occurs without selectivity to afford novel 2,6,8-triaryl-2,3-dihydroquinazolin-4(1*H*)-ones. Iodine-mediated dehydrogenation of the latter afforded the corresponding potentially tautomeric 2-arylquinazolin-4(3*H*)-ones, which are potential building blocks for the synthesis of novel 2,3-disubstituted quinazolinones and their 2,4-disubstituted quinazoline derivatives using the principles of lactam-lactim dynamic equilibrium phenomena. Moreover, aromatization of the quinazolin-4(3*H*)-ones with POCl_3 followed by substitution with heteroatom-containing (N, O, S) nucleophiles or cross-coupling would afford novel polysubstituted quinazolines with potential biological or photophysical properties.

EXPERIMENTAL

Melting points were recorded on a Thermocouple digital melting point apparatus and are uncorrected. IR spectra were recorded as powders using a Bruker VERTEX 70 FT-IR Spectrometer with a diamond ATR (attenuated total reflectance) accessory by using the thin-film

method. For column chromatography, Merck kieselgel 60 (0.063–0.200 mm) was used as stationary phase. NMR spectra were obtained as DMSO-*d*₆ solutions using Varian Mercury 300 MHz NMR spectrometer and the chemical shifts are quoted relative to the solvent peaks. High-resolution mass spectra were recorded at the University of Stellenbosch Mass Spectrometry Unit using Synapt G2 Quadrupole Time-of-flight mass spectrometer.

Synthesis of 2-amino-3,5-dibromobenzamide (2)

A mixture of 2-aminobenzamide/anthranilamide (**1**) (10.00 g, 73.4 mmol) and *N*-bromosuccinimide (26.37 g, 148.2 mmol) in chloroform-carbon tetrachloride mixture (3/2, v/v; 400 mL) was stirred at room temperature for 3 h. The resulting precipitate was filtered dry on a sintered funnel to afford (**2**) (17.93 g, 83%), m.p. 216–217 °C (Lit. [18] 214–215 °C); IR (ATR): ν_{\max} = 757, 803, 1129, 1239, 1386, 1450, 1567, 1640, 3180, 3326, 3367, 3423 cm⁻¹; ¹H NMR: δ = 6.80 (brs, 2H), 7.46 (br s, 1H), 7.73 (d, *J* 2.4 Hz, 1H), 7.78 (d, *J* 2.4 Hz, 1H), 8.05 (brs, 1H); ¹³C NMR: δ = 105.4, 110.9, 117.3, 131.2, 137.2, 146.5, 169.7; HRMS (ESI): *m/z* [M+H]⁺ calculated for C₇H₇N₂O⁷⁹Br₂⁺: 292.8925; found: 292.8928.

Typical procedure for the synthesis of 2-aryl-6,8-dibromo-2,3-dihydroquinazolin-4(1H)-ones 3a–d.

A mixture of **2** (1 equiv.), benzaldehyde derivative (1.0 equiv.) and boric acid (0.2 equiv.) in a crucible was homogenized with a mortar and then transferred to a round-bottomed flask. The mixture was heated at 120 °C with a heat gun for 5 min. The resultant solid was quenched with an ice-cold water and then filtered on a sintered funnel. The crude product was recrystallized from ethanol to afford **3** as a solid. The following products were prepared in this fashion.

6,8-Dibromo-2-phenyl-2,3-dihydroquinazolin-4(1H)-one (3a). A mixture of **2** (2.00 g, 6.82 mmol), benzaldehyde (0.72 g, 6.82 mmol) and boric acid (0.08 g, 1.36 mmol) afforded **3a** (2.26 g, 87%), m.p. 198–200 °C; IR (ATR): ν_{\max} = 743, 778, 1104, 1367, 1486, 1598, 1679, 3173, 3380 cm⁻¹; ¹H NMR: δ = 5.78 (t, *J* 3.6 Hz, 1H), 7.24 (d, *J* 3.3 Hz, 1H), 7.429–7.41 (m, 5H), 7.68 (d, *J* 2.1 Hz, 1H), 7.80 (d, *J* 2.1 Hz, 1H), 8.89 (d, *J* 3.3 Hz, 1H); ¹³C NMR: δ = 65.2, 108.3, 109.3, 118.4, 126.4, 128.7, 128.9, 129.7, 138.3, 142.7, 143.9, 161.6; HRMS (ESI): *m/z* [M+H]⁺ calculated for C₁₄H₁₁N₂O⁷⁹Br₂⁺: 380.9238; found: 380.9242.

6,8-Dibromo-2-(4-fluorophenyl)-2,3-dihydroquinazolin-4(1H)-one (3b). A mixture of **2** (2.00 g, 6.82 mmol), 4-fluorobenzaldehyde (0.84 g, 6.82 mmol) and boric acid (0.08 g, 1.36 mmol) afforded **3b** (2.21 g, 82%), m.p. 208–210 °C; IR (ATR): ν_{\max} = 718, 850, 876, 1155, 1231, 1487, 1599, 1686, 3181, 3374 cm⁻¹; ¹H NMR: δ = 5.79 (t, *J* 3.6 Hz, 1H), 7.24 (d, *J* 3.3 Hz, 1H), 7.20 (t, *J* 8.7 Hz, 2H), 7.42 (t, *J* 8.7 Hz, 2H), 7.69 (d, *J* 2.1 Hz, 1H), 7.81 (d, *J* 2.1 Hz, 1H), 8.88 (d, *J* 3.3 Hz, 1H); ¹³C NMR: δ = 64.8, 108.5, 109.3, 115.7 (d, ²*J*_{CF} Hz), 118.3, 128.6 (d, ³*J*_{CF} 21.7 Hz), 129.8, 138.4, 138.8 (d, ⁴*J*_{CF} 3.0 Hz), 143.8, 161.5, 162.4 (d, ¹*J*_{CF} 242.4 Hz); HRMS (ESI): *m/z* [M+H]⁺ calculated for C₁₄H₁₀N₂O⁷⁹Br₂⁺: 396.8987; found: 396.8969.

6,8-Dibromo-2-(4-chlorophenyl)-2,3-dihydroquinazolin-4(1H)-one (3c). A mixture of **2** (2.00 g, 6.82 mmol), 4-chlorobenzaldehyde (0.96 g, 6.82 mmol) and boric acid (0.08 g, 1.36 mmol) afforded **3c** (2.54 g, 90%), m.p. 237–238 °C; IR (ATR): ν_{\max} = 788, 823, 896, 946, 1085, 1142, 1360, 1420, 1481, 1596, 1671, 3182, 3362 cm⁻¹; ¹H NMR: δ = 5.78 (t, *J* 3.6 Hz, 1H), 7.24 (d, *J* 3.3 Hz, 1H), 7.40 (d, *J* 9.0 Hz, 2H), 7.44 (d, *J* 9.0 Hz, 2H), 7.67 (d, *J* 2.1 Hz, 1H), 7.80 (d, *J* 2.1 Hz, 1H), 8.90 (d, *J* 3.3 Hz, 1H); ¹³C NMR: δ = 64.7, 108.5, 109.4, 118.3, 128.4, 128.9, 129.8, 133.4, 138.4, 141.6, 143.8, 161.5. HRMS (ESI): *m/z* [M+H]⁺ calculated for C₁₄H₁₀N₂O³⁵Cl⁷⁹Br₂⁺: 412.8692; found: 412.8676.

6,8-Dibromo-2-(4-methoxyphenyl)-2,3-dihydroquinazolin-4(1H)-one (**3d**). A mixture of **2** (2.00 g, 6.82 mmol), 4-methoxybenzaldehyde (0.93 g, 6.82 mmol) and boric acid (0.08 g, 1.36 mmol) afforded **3d** (2.40 g, 86 %), m.p. 195–197 °C; IR (ATR): ν_{\max} = 759, 779, 1033, 1119, 1206, 1512, 1676, 3181, 3381 cm^{-1} ; ^1H NMR: δ = 3.71 (s, 3H), 5.73 (t, J 3.3 Hz, 1H), 6.91 (d, J 8.7 Hz, 2H), 7.09 (d, J 2.7 Hz, 1H), 7.30 (d, J 8.7 Hz, 2H), 7.68 (d, J 2.1 Hz, 1H), 7.79 (d, J 2.1 Hz, 1H), 8.22 (d, J 3.3 Hz, 1H); ^{13}C NMR: δ = 55.6, 64.9, 108.2, 109.3, 114.2, 118.4, 127.7, 129.7, 134.6, 138.4, 143.9, 159.6, 161.7; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{15}\text{H}_{13}\text{N}_2\text{O}_2^{79}\text{Br}_2^+$: 408.9187; found: 408.9192.

Typical procedure for the Suzuki-Miyaura cross-coupling of 3a-d with arylboronic acids

2-Aryl-6,8-dibromoquinazolin-4(1H)-one **3** (1 equiv.), arylboronic acid (2.5 equiv.), $\text{PdCl}_2(\text{PPh}_3)_2$ (5% of **3**), Xphos (10% of **3**), K_2CO_3 (2 equiv.) and DMF-water (4/1, v/v; ca. 5 mL/mmol of **3**) were added to a two-necked flask equipped with a stirrer bar, rubber septum and a condenser. The mixture was flushed for 20 min with argon gas and a balloon filled with an argon gas was connected to the top of the condenser. The mixture was heated with stirring at 120 °C under an argon atmosphere for 3 hours and then cooled to room temperature. The cooled mixture was poured into an ice-cold water and the precipitate was filtered on a sintered funnel. The solid product was taken-up into chloroform and the solution was washed twice with brine. The organic phase was dried over MgSO_4 , filtered and then evaporated under reduced pressure. The product was recrystallized from ethanol to afford the 2,6,8-triarylquinazolin-4(1H)-one **4**. The following products were prepared in this fashion.

2,6,8-Triphenylquinazolin-4(1H)-one (**4a**). A mixture of **3a** (1.00 g, 2.61 mmol), phenylboronic acid (0.699 g, 5.74 mmol), $\text{PdCl}_2(\text{PPh}_3)_2$ (0.092 g, 0.313 mmol), Xphos (0.125 g, 0.263 mmol) and K_2CO_3 (0.725 g, 5.26 mmol) in DMF-water (20 mL) afforded **4a** (0.750 g, 77%), m.p. 215–217 °C; IR (ATR): ν_{\max} = 697, 760, 1274, 1381, 1573, 1680, 3050, 3173, 3384 cm^{-1} ; ^1H NMR: δ = 5.70 (t, J 3.0 Hz, 1H), 6.50 (d, J 3.0 Hz, 1H), 7.26–7.53 (m, 14H), 7.62 (d, J 7.5 Hz, 2H), 7.95 (d, J 3.0 Hz, 1H), 8.65 (d, J 3.0 Hz, 1H); ^{13}C NMR: δ = 65.5, 116.9, 125.3, 126.3, 126.6, 127.1, 128.2, 128.4, 128.5, 128.8, 129.3, 129.4, 129.5, 129.7, 133.0, 138.0, 140.0, 143.2, 143.6, 163.7; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{26}\text{H}_{21}\text{N}_2\text{O}^+$: 377.1654; found: 377.1651.

2-(4-Fluorophenyl)-6,8-diphenylquinazolin-4(1H)-one (**4b**). A mixture of **3b** (1.00 g, 2.49 mmol), phenylboronic acid (0.67 g, 5.47 mmol), $\text{PdCl}_2(\text{PPh}_3)_2$ (0.090 g, 0.125 mmol), Xphos (0.120 g, 0.250 mmol) and K_2CO_3 (0.690 g, 5.02 mmol) in DMF-water (20 mL) afforded **4b** (0.810 g, 83%), m.p. 198–200 °C; IR (ATR): ν_{\max} = 684, 699, 760, 890, 1155, 1235, 1465, 1519, 1613, 1652, 3156, 3392 cm^{-1} ; ^1H NMR: δ = 5.71 (t, J 3.0 Hz, 1H), 6.51 (d, J 2.4 Hz, 1H), 7.19 (t, J 8.7 Hz, 2H), 7.25 (t, J 7.5 Hz, 1H), 7.38–7.53 (m, 10H), 7.62 (d, J 7.5 Hz, 2H), 7.97 (d, J 2.4 Hz, 1H), 8.66 (d, J 3.0 Hz, 1H). ^{13}C NMR: δ = 65.0, 115.6 (d, $^2J_{\text{CF}}$ 21.4 Hz), 116.8, 125.3, 126.3, 127.2, 128.2, 128.6, 128.7, 128.8, 129.4 (d, $^3J_{\text{CF}}$ 8.3 Hz), 129.5, 129.8, 133.1, 138.0, 139.3 (d, $^4J_{\text{CF}}$ 2.8 Hz), 139.9, 143.5, 162.3 (d, $^1J_{\text{CF}}$ 242.3 Hz), 163.7; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{26}\text{H}_{20}\text{N}_2\text{FO}^+$: 395.1555; found: 395.1555.

2-(4-Chlorophenyl)-6,8-diphenylquinazolin-4(1H)-one (**4c**). A mixture of **3c** (1.00 g, 2.41 mmol), phenylboronic acid (0.650 g, 5.32 mmol), $\text{PdCl}_2(\text{PPh}_3)_2$ (0.084 g, 0.122 mmol), Xphos (0.114 g, 0.241 mmol) and K_2CO_3 (0.672 g, 4.87 mmol) in DMF-water (20 mL) afforded **4c** (0.900 g, 90%), m.p. 199–201 °C; IR (ATR): ν_{\max} = 697, 756, 1060, 1287, 1318, 1506, 1656, 3097, 3421 cm^{-1} ; ^1H NMR: δ = 5.69 (t, J 3.0 Hz, 1H), 6.56 (s, 1H), 7.26 (t, J 7.5 Hz, 1H), 7.38–7.60 (m, 12H), 7.62 (d, J 8.4 Hz, 2H), 7.95 (s, 1H), 8.67 (d, J 3.0 Hz, 1H); ^{13}C NMR: δ = 64.9, 116.8, 125.3, 126.3, 127.2,

128.2, 128.6 (2xC), 128.8, 129.2, 129.3, 129.4, 129.5, 129.8, 133.1, 138.0, 139.9, 142.2, 143.4, 163.7; HRMS (ESI): m/z $[M+H]^+$ calculated for $C_{26}H_{20}N_2^{35}ClO^+$: 411.1264; found: 411.1260.

6,8-Diphenyl-2-(4-methoxyphenyl)quinazolin-4(1H)-one (4d). A mixture of **3d** (1.00 g, 2.66 mmol), phenylboronic acid (0.710 g, 5.85 mmol), $PdCl_2(PPh_3)_2$ (0.086 g, 0.122 mmol), Xphos (0.126 g, 0.266 mmol) and K_2CO_3 (0.672 g, 4.87 mmol) in DMF-water (20 mL) afforded **4d** (0.860 g, 80%), m.p. 218–219 °C; IR (ATR): ν_{max} = 692, 1058, 1188, 1444, 1606, 1654, 3241, 3390 cm^{-1} ; 1H NMR: δ = 3.71 (s, 3H), 5.66 (t, J 3.0 Hz, 1H), 6.34 (d, J 3.0 Hz, 1H), 6.90 (d, J 8.7 Hz, 2H), 7.28 (t, J 7.5 Hz, 1H), 7.33 (d, J 8.7 Hz, 2H), 7.38–7.53 (m, 8H), 7.62 (d, J 7.5 Hz, 2H), 7.96 (d, J 3.0 Hz, 1H), 8.58 (d, J 3.0 Hz, 1H); ^{13}C NMR: δ = 55.6, 65.2, 114.1, 116.9, 125.3, 126.3, 127.1, 127.9, 128.1, 128.4, 129.3, 129.4, 129.5, 129.7, 132.9, 125.0, 138.0, 140.0, 143.6, 159.5, 163.8; HRMS (ESI): m/z $[M+H]^+$ calculated for $C_{27}H_{23}N_2O_2^+$: 407.1760; found: 407.1758.

6,8-Bis(4-fluorophenyl)-2-phenylquinazolin-4(1H)-one (4e). A mixture of **3a** (1.00 g, 2.63 mmol), 4-fluorophenylboronic acid (0.81 g, 5.76 mmol), $PdCl_2(PPh_3)_2$ (0.092 g, 0.130 mmol), Xphos (0.125 g, 0.263 mmol) and K_2CO_3 (0.726 g, 5.26 mmol) in DMF-water (20 mL) afforded **4e** (0.90 g, 83%), m.p. 312–315 °C; IR (ATR): ν_{max} = 696, 797, 834, 1211, 1601, 1666, 3068, 3165, 3369 cm^{-1} ; 1H NMR: δ = 5.68 (t, J 3.3 Hz, 1H), 6.55 (d, J 2.4 Hz, 1H), 7.22 (t, J 8.7 Hz, 2H), 7.28–7.41 (m, 7H), 7.46 (d, J 2.1 Hz, 1H), 7.49 (t, J 8.7 Hz, 2H), 7.65 (t, J 8.7 Hz, 2H), 7.93 (d, J 2.1 Hz, 1H), 8.63 (s, 1H); ^{13}C NMR (75 MHz, DMSO- d_6): δ = 65.5, 116.1 (d, $^2J_{CF}$ 21.1 Hz), 116.3 (d, $^2J_{CF}$ 21.3 Hz), 116.9, 125.3, 126.6, 127.5, 128.3 (d, $^3J_{CF}$ 8.0 Hz), 128.5, 128.7, 128.8, 131.5 (d, $^3J_{CF}$ 8.3 Hz), 133.0, 134.3 (d, $^4J_{CF}$ 3.2 Hz), 136.4 (d, $^4J_{CF}$ 3.0 Hz), 143.1, 143.7, 161.8 (d, $^1J_{CF}$ 242.0 Hz), 162.2 (d, $^1J_{CF}$ 242.5 Hz), 163.6; HRMS (ESI): m/z $[M+H]^+$ calculated for $C_{26}H_{19}N_2OF_2^+$: 413.1465; found: 413.1463.

2,6,8-Tris(4-fluorophenyl)quinazolin-4(1H)-one (4f). A mixture of **3b** (1.00 g, 2.51 mmol), 4-fluorophenylboronic acid (0.77 g, 5.52 mmol), $PdCl_2(PPh_3)_2$ (0.088 g, 0.125 mmol), Xphos (0.119 g, 0.251 mmol) and K_2CO_3 (0.693 g, 5.02 mmol) in DMF-water (20 mL) afforded **4f** (0.990 g, 91%), m.p. 265–267 °C; IR (ATR): ν_{max} = 794, 874, 1213, 1377, 1485, 1604, 1667, 3055, 3171, 3370 cm^{-1} ; 1H NMR: δ = 5.69 (t, J 3.3 Hz, 1H), 6.56 (d, J 2.4 Hz, 1H), 7.18 (t, J 8.7 Hz, 2H), 7.21 (t, J 8.7 Hz, 2H), 7.32 (t, J 8.7 Hz, 2H), 7.43 (t, J 8.7 Hz, 2H), 7.46 (d, J 2.1 Hz, 1H), 7.49 (t, J 8.7 Hz, 2H), 7.66 (t, J 8.7 Hz, 2H), 7.92 (d, J 2.1 Hz, 1H), 8.64 (d, J 2.7 Hz, 1H); ^{13}C NMR: δ = 65.1, 115.6 (d, $^2J_{CF}$ 21.4 Hz), 116.1 (d, $^2J_{CF}$ 21.4 Hz), 116.3 (d, $^2J_{CF}$ 21.4 Hz), 116.8, 125.3, 127.7, 128.3 (d, $^3J_{CF}$ 8.0 Hz), 128.8, 128.9 (d, $^3J_{CF}$ 8.3 Hz), 131.6 (d, $^3J_{CF}$ 8.3 Hz), 133.1, 134.2 (d, $^4J_{CF}$ 3.2 Hz), 136.4 (d, $^4J_{CF}$ 3.2 Hz), 139.2 (d, $^4J_{CF}$ 3.0 Hz), 143.6, 161.9 (d, $^1J_{CF}$ 242.2 Hz), 162.3 (d, $^1J_{CF}$ 242.8 Hz), 162.3 (d, $^1J_{CF}$ 242.5 Hz), 163.6; HRMS (ESI): m/z $[M+H]^+$ calculated for $C_{26}H_{18}N_2OF_3^+$: 431.1371; found: 431.1372.

2-(4-Chlorophenyl)-6,8-bis(4-fluorophenyl)quinazolin-4(1H)-one (4g). A mixture of **3c** (1.00 g, 2.41 mmol), 4-fluorophenylboronic acid (0.745 g, 5.32 mmol), $PdCl_2(PPh_3)_2$ (0.084 g, 0.121 mmol), Xphos (0.114 g, 0.241 mmol) and K_2CO_3 (0.672 g, 4.87 mmol) in DMF-water (20 mL) afforded **4g** (0.93 g, 86%), m.p. 326–328 °C; IR (ATR): ν_{max} = 790, 825, 1089, 1222, 1482, 1609, 1673, 3065, 3166, 3372 cm^{-1} ; 1H NMR (300 MHz, DMSO- d_6): δ = 5.68 (t, J 3.3 Hz, 1H), 6.62 (d, J 3.3 Hz, 1H), 7.22 (t, J 8.7 Hz, 2H), 7.33 (t, J 8.7 Hz, 2H), 7.41 (s, 4H), 7.46 (d, J 2.1 Hz, 1H), 7.48 (t, J 8.7 Hz, 2H), 7.65 (t, J 8.7 Hz, 2H), 7.93 (d, J 2.1 Hz, 1H), 8.67 (s, 1H); ^{13}C NMR (75 MHz, DMSO- d_6): δ = 65.0, 116.1 (d, $^2J_{CF}$ 21.3 Hz), 116.3 (d, $^2J_{CF}$ 21.1 Hz), 116.8, 125.3, 128.3 (d, $^3J_{CF}$ 8.0 Hz), 128.7, 128.8, 128.9, 131.6 (d, $^3J_{CF}$ 8.0 Hz), 133.2, 134.2 (d, $^4J_{CF}$ 3.0 Hz), 136.4 (d, $^4J_{CF}$ 3.1 Hz), 136.1, 136.4 (d, $^4J_{CF}$ 21.3 Hz), 142.1, 143.6, 161.9 (d, $^1J_{CF}$ 241.9 Hz), 162.3 (d, $^1J_{CF}$ 242.7 Hz), 163.6; HRMS (ESI): m/z $[M+H]^+$ calculated for $C_{26}H_{18}N_2OF_2^{35}Cl^+$: 447.1076; found: 447.1077.

6,8-Bis(4-fluorophenyl)-2-(4-methoxyphenyl)quinazolin-4(1H)-one (**4h**). A mixture of **3d** (1.00 g, 2.44 mmol), 4-fluorophenylboronic acid (0.75 g, 5.36 mmol), PdCl₂(PPh₃)₂ (0.085 g, 0.122 mmol), Xphos (0.116 g, 0.244 mmol) and K₂CO₃ (0.674 g, 4.88 mmol) in DMF-water (20 mL) afforded **4h** (0.92 g, 85%), m.p. 230–232 °C; IR (ATR): ν_{max} = 797, 831, 1024, 1217, 1445, 1606, 1654, 3249, 3375 cm⁻¹; ¹H NMR: δ = 3.71 (s, 3H), 5.63 (t, *J* 3.3 Hz, 1H), 6.44 (d, *J* 3.3 Hz, 1H), 6.90 (d, *J* 8.7 Hz, 2H), 7.22 (t, *J* 8.7 Hz, 2H), 7.31 (d, *J* 8.7 Hz, 2H), 7.32 (t, *J* 8.7 Hz, 2H), (d, *J* 3.0 Hz, 1H), 7.45 7.31 (t, *J* 8.7 Hz, 2H), 7.66 (t, *J* 8.7 Hz, 2H), 7.92 (d, *J* 3.0 Hz, 1H), 8.57 (d, *J* 3.0 Hz, 1H); ¹³C NMR: δ = 56.0, 65.3, 114.1, 116.1 (d, ²*J*_{CF} 21.3 Hz), 116.3 (d, ²*J*_{CF} 21.1 Hz), 116.9, 125.3, 127.6, 128.0, 128.3 (d, ³*J*_{CF} 8.0 Hz), 128.7, 131.5 (d, ³*J*_{CF} 8.0 Hz), 133.0, 134.3 (d, ⁴*J*_{CF} 3.1 Hz), 135.0, 136.4 (d, ⁴*J*_{CF} 3.2 Hz), 143.8, 159.5, 161.9 (d, ¹*J*_{CF} 241.9 Hz), 162.2 (d, ¹*J*_{CF} 242.8 Hz), 163.7; HRMS (ESI): *m/z* [M+H]⁺ calculated for C₂₇H₂₁N₂O₂F₂⁺: 443.1574; found: 443.1578.

Typical procedure for the iodine-ethanol-promoted dehydrogenation of 4a-h

A stirred mixture of the 2,6,8-triaryl-2,3-dihydroquinazolin-4(1H)-one **4** (1 equiv.) and iodine (2 equiv.) in ethanol (15 mL per mmol of **4**) was refluxed for 60 min. The mixture was allowed to cool to room temperature and then quenched with saturated sodium thiosulfate solution. The resulting precipitate was filtered on a sintered funnel, washed with cold ethanol and dried under reduced pressure to afford the corresponding quinazolin-4(3H)-one **5**. The following products were prepared in this fashion.

2,6,8-Triphenylquinazolin-4(3H)-one (**5a**). A mixture of **4a** (0.76 g, 2.01 mmol) and iodine (1.02 g, 4.02 mmol) in ethanol (30 mL) afforded **5e** (0.56 g, 74%), m.p. 318–320 °C; IR (ATR): ν_{max} = 658, 759, 1291, 1598, 1652, 3152, 3302 cm⁻¹; ¹H NMR: δ = 7.42–7.56 (m, 9H), 7.84 (d, *J* 7.8 Hz, 2H), 7.88 (d, *J* 7.8 Hz, 2H), 8.14 (s, 2H), 8.16 (d, *J* 3.0 Hz, 1H), 8.41 (s, 1H), 12.71 (s, 1H); ¹³C NMR: δ = 127.6, 128.2, 132.4, 132.9, 133.2, 133.3, 133.5, 134.1, 134.7, 136.2, 136.9, 138.3, 138.9, 143.4, 143.7, 144.3, 144.9, 150.5, 156.7, 168.1; HRMS (ESI): *m/z* [M+H]⁺ calculated for C₂₆H₁₉N₂O⁺: 375.1497; found: 375.1502.

2-(4-Fluorophenyl)-2,8-diphenylquinazolin-4(3H)-one (**5b**). A mixture of **4b** (1.36 g, 3.59 mmol) and iodine (1.82 g, 7.18 mmol) in ethanol (30 mL) afforded **5c** (1.18 g, 87%), m.p. 308–309 °C; IR (ATR): ν_{max} = 686, 759, 893, 1233, 1601, 1667, 3055, 3162 cm⁻¹; ¹H NMR: δ = 7.36 (t, *J* 7.8 Hz, 2H), 7.44 (t, *J* 7.5 Hz, 2H), 7.52 (t, *J* 7.5 Hz, 4H), 7.81 (d, *J* 7.8 Hz, 2H), 7.85 (d, *J* 7.8 Hz, 2H), 8.11 (d, *J* 3.0 Hz, 1H), 8.19 (d, *J* 7.8 Hz, 2H), 8.39 (d, *J* 3.0 Hz, 1H), 12.70 (s, 1H); ¹³C NMR: δ = 116.2 (d, ²*J*_{CF} 21.7 Hz), 122.5, 123.1, 127.4, 127.9, 128.3, 128.5, 129.6, 129.8 (d, ⁴*J*_{CF} 2.9 Hz), 130.7 (d, ³*J*_{CF} 9.0 Hz), 131.1, 133.9, 138.4, 138.7, 139.3, 139.8, 145.4, 150.8, 163.0 (d, ¹*J*_{CF} 248.1 Hz), 163.1; HRMS (ESI): *m/z* [M+H]⁺ calculated for C₂₆H₁₈N₂O⁺: 392.1407; found: 392.1411.

2-(4-Chlorophenyl)-6,8-diphenylquinazolin-4(3H)-one (**5c**). A mixture of **4c** (0.74 g, 1.79 mmol) and iodine (0.91 g, 3.58 mmol) in ethanol (30 mL) afforded **5c** (0.52 g, 71%), m.p. 313–315 °C; IR (ATR): ν_{max} = 677, 754, 804, 839, 1597, 1669, 3081, 3156 cm⁻¹; ¹H NMR: δ = 7.42–7.56 (m, 8H), 7.81 (d, *J* 7.8 Hz, 2H), 7.88 (d, *J* 7.8 Hz, 2H), 8.14 (d, *J* 7.8 Hz, 2H), 8.15 (s, 1H), 8.41 (d, *J* 3.0 Hz, 1H), 12.77 (s, 1H); ¹³C NMR: δ = 122.7, 123.2, 127.4, 127.9, 128.3, 128.5, 129.2, 129.7, 130.0, 131.2, 132.6, 133.8, 136.6, 138.4, 138.8, 139.4, 139.8, 145.6, 151.4, 163.5; HRMS (ESI): *m/z* [M+H]⁺ calculated for C₂₆H₁₈N₂O³⁵Cl⁺: 409.1108; found: 409.1092.

6,8-Diphenyl-2-(4-methoxyphenyl)quinazolin-4(3H)-one (**5d**). A mixture of **4d** (0.90 g, 1.81 mmol) and iodine (0.91 g, 3.62 mmol) in ethanol (30 mL) afforded **5d** (0.85 g, 94%), m.p. 307–

309 °C; IR (ATR): ν_{\max} = 698, 763, 1248, 1594, 1665, 3036, 3160 cm^{-1} ; ^1H NMR: δ = 3.83 (s, 3H), 7.07 (d, J 7.8 Hz, 2H), 7.44 (t, J 7.8 Hz, 2H), 7.51 (d, J 7.8 Hz, 2H), 7.54 (d, J 7.8 Hz, 2H), 7.82 (d, J 7.8 Hz, 2H), 7.86 (d, J 7.8 Hz, 2H), 8.13 (d, J 3.0 Hz, 1H), 8.15 (d, J 7.8 Hz, 2H), 8.39 (d, J 3.0 Hz, 1H), 12.97 (s, 1H); ^{13}C NMR: δ = 56.0, 114.6, 122.3, 123.1, 125.4, 127.4, 127.9, 128.3, 128.4, 129.7, 129.9, 131.2, 133.9, 138.0, 138.8, 139.4, 139.6, 145.7, 151.3, 162.4, 163.1; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{27}\text{H}_{21}\text{N}_2\text{O}_2$: 405.1603; found: 405.1606.

6,8-Bis(4-fluorophenyl)-2-phenylquinazolin-4(3H)-one (5e). A mixture of **4e** (0.70 g, 1.70 mmol) and iodine (0.87 g, 3.40 mmol) in ethanol (30 mL) afforded **5e** (0.61 g, 87%), m.p. 318–320 °C; IR (ATR): ν_{\max} = 692, 827, 1158, 1231, 1466, 1507, 1599, 1650, 3147, 3175 cm^{-1} ; ^1H NMR: δ = 5.84 (s, 1H), 7.09 (t, J 8.7 Hz, 2H), 7.13 (t, J 8.7 Hz, 2H), 7.36 (d, J 7.5 Hz, 2H), 7.37 (t, J 8.7 Hz, 2H), 7.46 (d, J 7.5 Hz, 2H), 7.47 (d, J 3.0 Hz, 1H), 7.53 (t, J 8.7 Hz, 2H), 8.35 (d, J 3.0 Hz, 1H), 12.72 (br s, 1H); ^{13}C NMR: δ = 115.1 (d, $^2J_{\text{CF}}$ 21.0 Hz), 116.4 (d, $^2J_{\text{CF}}$ 21.6 Hz), 122.6, 123.2, 128.2, 129.2, 129.6 (d, $^3J_{\text{CF}}$ 8.3 Hz), 131.9, 133.1, 133.2 (d, $^3J_{\text{CF}}$ 8.0 Hz), 133.9, 134.9 (d, $^4J_{\text{CF}}$ 2.3 Hz), 135.7 (d, $^4J_{\text{CF}}$ 3.0 Hz), 137.4, 138.8, 145.3, 151.8, 162.3 (d, $^1J_{\text{CF}}$ 243.3 Hz), 162.7 (d, $^1J_{\text{CF}}$ 244.2 Hz), 162.9; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{26}\text{H}_{17}\text{N}_2\text{OF}_2$: 411.1309; found: 411.1313.

2,6,8-Tris(4-fluorophenyl)quinazolin-4(3H)-one (5f). A mixture of **4f** (0.81 g, 1.87 mmol) and iodine (0.95 g, 3.74 mmol) in ethanol (30 mL) afforded **5f** (0.72 g, 89%), m.p. > 350 °C; IR (ATR): ν_{\max} = 801, 821, 1157, 1231, 1511, 1607, 1676, 3085, 3168, 3467 cm^{-1} ; ^1H NMR: δ = 7.31 (t, J 8.7 Hz, 2H), 7.32 (t, J 8.7 Hz, 2H), 7.36 (t, J 8.7 Hz, 2H), 7.85 (t, J 8.7 Hz, 2H), 7.90 (t, J 8.7 Hz, 2H), 8.08 (d, J 3.0 Hz, 1H), 8.17 (t, J 8.7 Hz, 2H), 8.35 (d, J 3.0 Hz, 1H), 12.68 (br s, 1H); ^{13}C NMR: δ = 115.1 (d, $^2J_{\text{CF}}$ 21.1 Hz), 116.1 (d, $^2J_{\text{CF}}$ 21.6 Hz), 116.4 (d, $^2J_{\text{CF}}$ 21.4 Hz), 122.6, 123.2, 129.5 (d, $^3J_{\text{CF}}$ 8.3 Hz), 129.7 (d, $^4J_{\text{CF}}$ 2.3 Hz), 130.8 (d, $^3J_{\text{CF}}$ 8.8 Hz), 133.2 (d, $^3J_{\text{CF}}$ 8.3 Hz), 133.8, 134.8 (d, $^4J_{\text{CF}}$ 3.2 Hz), 135.7 (d, $^4J_{\text{CF}}$ 3.1 Hz), 137.4, 138.7, 145.3, 150.8, 162.2 (d, $^1J_{\text{CF}}$ 242.8 Hz), 162.6 (d, $^1J_{\text{CF}}$ 243.3 Hz), 164.3 (d, $^1J_{\text{CF}}$ 243.3 Hz), 164.6; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{26}\text{H}_{16}\text{N}_2\text{OF}_3$: 429.1215; found: 429.1215.

2-(4-Chlorophenyl)-6,8-bis(4-fluorophenyl)quinazolin-4(3H)-one (5g). A mixture of **4g** (1.15 g, 2.58 mmol) and iodine (1.31 g, 5.16 mmol) in ethanol (30 mL) afforded **4g** (0.87 g, 76%), m.p. 342–344 °C; IR (ATR): ν_{\max} = 670, 823, 999, 1096, 1229, 1463, 1506, 1598, 1675, 3387 cm^{-1} ; ^1H NMR: δ = 7.33 (t, J 7.8 Hz, 2H), 7.34 (t, J 7.8 Hz, 2H), 7.58 (d, J 7.8 Hz, 2H), 7.87 (t, J 7.8 Hz, 2H), 7.90 (t, J 7.8 Hz, 2H), 8.07 (s, 1H), 8.16 (d, J 7.8 Hz, 2H), 8.35 (s, 1H), 12.54 (br s, 1H); ^{13}C NMR: δ = 115.0 (d, $^2J_{\text{CF}}$ 21.0 Hz), 116.4 (d, $^2J_{\text{CF}}$ 21.3 Hz), 122.7, 123.3, 129.1, 129.5 (d, $^3J_{\text{CF}}$ 8.2 Hz), 130.1, 133.1 (d, $^3J_{\text{CF}}$ 8.3 Hz), 133.2, 133.7, 135.2 (d, $^4J_{\text{CF}}$ 3.2 Hz), 136.0 (d, $^4J_{\text{CF}}$ 3.1 Hz), 136.3, 136.7, 138.4, 145.9, 152.8, 162.2 (d, $^1J_{\text{CF}}$ 242.8 Hz), 162.6 (d, $^1J_{\text{CF}}$ 243.3 Hz), 164.8; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{26}\text{H}_{16}\text{N}_2\text{OF}_2^{35}\text{Cl}^+$: 445.0919; found: 445.0912.

6,8-Bis(4-fluorophenyl)-2-(4-methoxyphenyl)quinazolin-4(3H)-one (5h). A mixture of **4h** (0.73 g, 1.65 mmol) and iodine (0.84 g, 3.30 mmol) in ethanol (30 mL) afforded **5h** (0.70 g, 96%), m.p. > 350 °C; IR (ATR): ν_{\max} = 801, 818, 830, 1186, 1227, 1227, 1510, 1570, 1595, 1676, 3168 cm^{-1} ; ^1H NMR: δ = 3.88 (s, 3H), 7.04 (d, J 7.8 Hz, 2H), 7.30 (t, J 8.7 Hz, 2H), 7.12 (t, J 8.7 Hz, 2H), 7.85 (t, J 8.7 Hz, 2H), 7.87 (t, J 8.7 Hz, 2H), 8.10 (d, J 7.8 Hz, 2H), 8.13 (d, J 3.0 Hz, 1H), 8.35 (d, J 3.0 Hz, 1H), 12.56 (s, 1H); ^{13}C NMR: δ = 55.8, 114.5, 114.9 (d, $^2J_{\text{CF}}$ 21.1 Hz), 116.3 (d, $^2J_{\text{CF}}$ 21.3 Hz), 122.2, 123.1, 125.3, 129.4 (d, $^3J_{\text{CF}}$ 8.3 Hz), 129.9, 132.0 (d, $^3J_{\text{CF}}$ 8.0 Hz), 133.7, 134.9 (d, $^4J_{\text{CF}}$ 3.2 Hz), 135.8 (d, $^4J_{\text{CF}}$ 3.0 Hz), 136.9, 138.4, 145.5, 151.3, 162.2 (d, $^1J_{\text{CF}}$ 243.0 Hz), 162.3, 162.6 (d, $^1J_{\text{CF}}$ 244.1 Hz), 163.0; HRMS (ESI): m/z $[\text{M}+\text{H}]^+$ calculated for $\text{C}_{27}\text{H}_{19}\text{N}_2\text{O}_2\text{F}_2$: 441.1415; found: 441.1416.

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