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Copper-Catalyzed Synthesis of Substituted Quinazolines from Benzonitriles and 2-Ethynylanilines via Carbon-Carbon Bond Cleavage Using Molecular Oxygen

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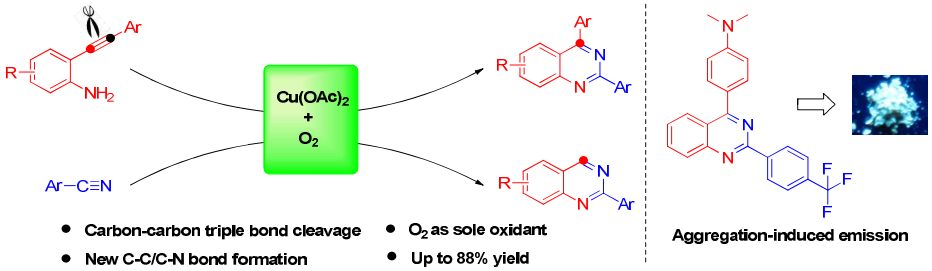
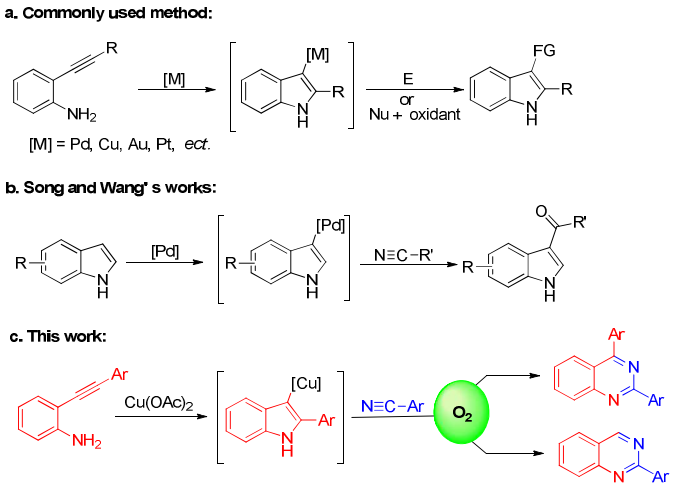


Abstract: A copper-catalyzed process for the synthesis of substituted quinazolines from benzonitriles and 2-ethynylanilines using molecular oxygen (O_2) as sole oxidant is described. The mild catalytic system enabled the effective cleavage of the C-C triple bond and construction of new C−N, C−C bonds in one operation. Furthermore, the compound *N*,*N*-dimethyl-4-(2-(4-(trifluoromethyl)phenyl)quinazolin-4-yl)aniline (**3dj**) exhibited obvious aggregation-induced emission (AIE) phenomenon, and the fluorescence quantum yield ($\Phi_{F,film}$) and lifetime (τ_{film}) were measured to be 45.5% and 5.8 *ns* in thin films state, respectively.

INTRODUCTION

Transition metal-catalyzed carbon-carbon bond cleavage has been recognized as a challenging and attractive area, which provides a new chemical reaction model for organic synthesis.[1] Over the past several decades, much progress has been achieved in the cleavage of carbon-carbon single bonds and carbon-carbon double bonds.[2,3] However, only a few examples on carbon-carbon triple bond cleavage reactions have been reported, which is due to its extraordinarily large bond dissociation energy (>200 kcal/mol) required.[2a] In order to achieve this goal,[2a,3a,3d] many noble metal catalysts and stoichiometric amount of nonrenewable oxidants are often employed to activate carbon-carbon triple bond, thereby making their application less desirable. Thus, there is still room for broadening the scope of more environmentally friendly and more economic "green" methods to activate carbon-carbon triple bond.

Scheme 1. Transformations of 2-Alkynylanilines and Indoles



N-Heterocyclic compounds play an important role in organic synthesis because of their abundance in numerous natural products, biologically active compounds and materials.[4] 2-Alkynylanilines as highly versatile building blocks has proven wide

application in the construction of *N*-heterocyclic compounds.[5] In the past decades, transition-metal-catalyzed intramolecular cyclization of 2-ethynylanilines have attracted great attention as one of the efficient strategies to assemble substituted indoles.[6-14] Most of these strategies involved the intramolecular aminometalation to afford 3-indoly-metal species, which is trapped with suitable electrophiles or oxidative coupling with nucleophiles (Scheme 1a). Although much progress has been achieved in this area, the exploration of novel catalytic system to enrich the diversity of the transformation remains an active research field.

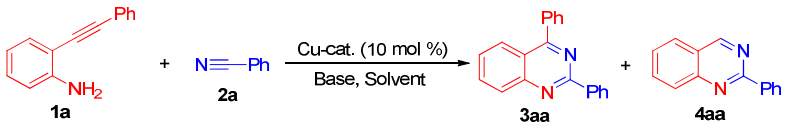
Recently, Song and Wang's group developed the palladium-catalyzed addition of indoles with nitriles through 3-indoly-palladium intermediates. which provides a valid path to 3-acylindoles (Scheme 1b).[15] Nevertheless, the nitrogen atoms of nitriles have not been effectively utilized owing to the hydrolysis of ketimine intermediates. Based on our continuous interest in the effective transformation of nitriles,[16] we describe a copper-catalyzed synthesis of substituted quinazolines[17] from benzonitriles and 2-ethynylanilines via carbon-carbon triple bond cleavage using molecular oxygen (O_2) as sole oxidant. This strategy enables effective assembly of quinazolines by C-N, C-C bond formations and aerobic C-C triple bond cleavage (Scheme 1c).

RESULTS AND DISCUSSION

In preliminary experiments, 2-(phenylethynyl)aniline (**1a**, 0.2 mmol) was treated with $Cu(OAc)_2$ (10 mol %), *t*-BuOK (3 equiv), and benzonitrile (**2a**, 0.3 mmol) in DMSO (2 mL) under 1 atm O_2 atmosphere at 120 ^oC for 24 h, and the desired product 2,4-diphenylquinazoline (**3aa**) was observed in 62% yield (Table 1, entry 1). Then, a

series of copper catalysts were screened and did not display better catalytic activity than $Cu(OAc)_2$ (Table 1, entries 2-5). The examination of bases revealed that *t*-BuOK was the most suitable base for this reaction system (Table 1, entries 6-12). Other bases presumably are not conducive to the formation of intermediate **A** (see Scheme 4), and the intramolecular cyclization product 2-phenyl-1*H*-indole was obtained in these cases. However, the use of DMA, DMF, dioxane, toluene or acetonitrile as solvent was proven to be disadvantageous to the reaction, as the yields were significantly decreased (Table 1, entries 13-17). Surprisingly, the reaction of 2-(phenylethynyl)aniline (**1a**) with benzonitrile (**2a**) gave the 2-phenylquinazoline product (**4aa**) in 67% yield when toluene was used as the solvent. Reducing the amount of solvent to 0.5 mL resulted in a higher yield (Table 1, entries 1 *vs*. 18). Notably, when the initial substrate ratio was changed, the yield of **3aa** enhanced from 81% to 87% (Table 1, entries 18 vs. 19). It is remarkable that the yield decreased significantly by using anhydrous DMSO as the solvent (Table 1, entry 20). The importance of H_2O was further proven by adding H_2O (5.0 equiv) to anhydrous DMSO, which gave an improved yield of **3aa** (Table 1, entries 20 *vs*. 21). Hence, **1a** (0.2 mmol), **2a** (0.4 mmol), $Cu(OAc)_2$ (10 mol %), *t*-BuOK (3 equiv) in DMSO (0.5 mL) under 1 atm O_2 atmosphere at 120 ^oC for 24 h were chosen as the optimized conditions.

Table 1. Optimization of Reaction Conditions[a]



Entry	Catalyst	Base	Solvent	Yield **3aa**/**4aa** (%)[b]
1	$Cu(OAc)_2$	*t*-BuOK	DMSO	62/0
2	$Cu(OTf)_2$	*t*-BuOK	DMSO	trace/0
3	CuSCN	*t*-BuOK	DMSO	trace/0
4	$CuCl_2$	*t*-BuOK	DMSO	trace/0
5	$CuBr_2$	*t*-BuOK	DMSO	trace/0
6	$Cu(OAc)_2$	K_2CO_3	DMSO	0/0
7	$Cu(OAc)_2$	Cs_2CO_3	DMSO	0/0
8	$Cu(OAc)_2$	$NaCO_3$	DMSO	0/0
9	$Cu(OAc)_2$	Ag_2CO_3	DMSO	0/0
10	$Cu(OAc)_2$	NEt_3	DMSO	0/0
11	$Cu(OAc)_2$	*t*-BuONa	DMSO	trace/0
12	$Cu(OAc)_2$	*t*-BuOLi	DMSO	trace/0
13	$Cu(OAc)_2$	*t*-BuOK	DMA	24/0
14	$Cu(OAc)_2$	*t*-BuOK	DMF	27/0
15[c]	$Cu(OAc)_2$	*t*-BuOK	dioxane	0/0
16[c]	$Cu(OAc)_2$	*t*-BuOK	toluene	19/67
17[c]	$Cu(OAc)_2$	*t*-BuOK	acetonitrile	0/0
18[d]	$Cu(OAc)_2$	*t*-BuOK	DMSO	81/0
19[e]	$Cu(OAc)_2$	*t*-BuOK	DMSO	87/0
20[e,f]	$Cu(OAc)_2$	*t*-BuOK	DMSO	51/0
21[e,g]	$Cu(OAc)_2$	*t*-BuOK	DMSO	84/0

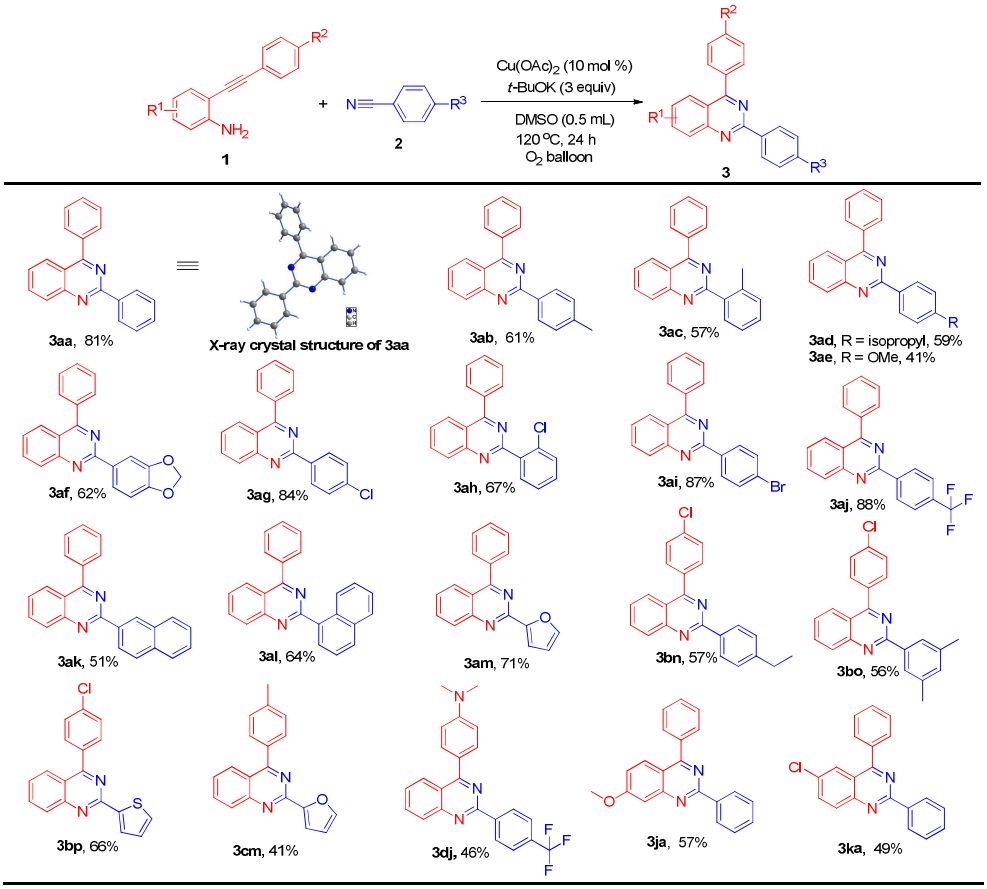
[a]All reactions were carried out under the following conditions: **1a** (0.2 mmol), **2a** (0.3 mmol), catalyst (10 mol %), base (3 equiv), solvents (2 mL), 120 ^{o}C, 24 h, with an O_2 balloon. [b]GC yield using dodecane as internal standard. Yields determined by GC based on **1a** with *n*-dodecane as internal standard. [c]100 ^{o}C. [d]Solvents (0.5 mL). [e]**1a** (0.2 mmol), **2a** (0.4 mmol), solvents (0.5 mL). [f]Anhydrous DMSO with 100 mg of 4 Å MS. [g]Anhydrous DMSO with addition of H_2O (5.0 equiv).

To explore the scope and limitations of this approach, various aryl substituted nitriles **2b**-**2o** were applied to the reaction with 2-(phenylethynyl)aniline (**1a**) under the optimized conditions. Typical results are shown in Table 2. To our delight, most of the reactions proceeded smoothly to afford the corresponding quinazoline products in moderate to good yields (**3aa**-**3am**). The crystallization of compound **3aa** from

anhydrous ethanol gave single crystals suitable for X-ray analysis. The benzonitriles **2b**-**2f** possessing electron-donating group, such as 4-methyl, 2-methyl, 4-isopropyl, 4-methoxy and 1,3-methylenedioxy at the aryl ring could transfer to the desired products **3ab**-**3af** in 41%-62% yields, and some substrates bearing an electron-withdrawing group, including 4-chloro, 2-chloro, 4-bromo and 4-trifluoromethyl at the benzene ring also reacted smoothly and afforded the desired products **3ag**-**3aj** in 67-88% yields. Obviously, the electron-deficient aryl substituted nitriles performed better than the electron-rich aryl substituted ones. This might be due to the electron-rich benzonitriles are unfavorable for the nucleophilic addition of the amino group (see the proposed mechanism in Scheme 4). Sterically hindered substrates such as 1- and 2-naphthonitrile also transformed to the expected products **3al** and **3ak** in 64% and 51% yields. Furthermore, nitriles bearing a heterocyclic substituent such as 2-furonitrile and 2-thiophene could also convert to the desired products **3am** and **3bp** in moderate yields. In addition, the transformation of 2-(phenylethynyl)aniline (**1b**) possessing an electron-withdrawing group at the aryl ring (R^2 = 4-ClC_6H_4) afforded the desired products **3bn** and **3bo** in 57% and 56% yields. The transformations of substrates **1c** and **1d** possessing an electron-donating group (R^2 = 4-MeC_6H_4 and R^2 = 4-(dimethylamino)-C_6H_4) at the benzene ring also gave the corresponding products **3cm** and **3dj** in 41% and 46% yields. The intramolecular cyclization side product 2-phenyl-1*H*-indoles **5c** and **5d** were detected in 45% and 39% GC yields in these cases. The electron-donating 5-methoxy-substituted (**1j**) and the electron-withdrawing 4-chloro-substituted (**1k**)

2-ethynylanilines were both reacted with **2a** under the optimal conditions to provide **3ja** and **3ka** in 57% and 49% yields.

Table 2. Synthesis of Substituted Quinazolines 3[a,b]

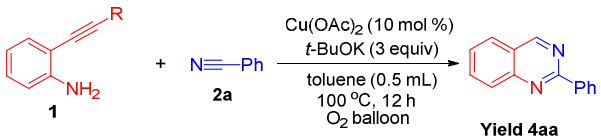


[a]All reactions were carried out under the following conditions: **1** (0.2 mmol), **2** (0.4 mmol), $Cu(OAc)_2$ (10 mol %), *t*-BuOK (3 equiv) and DMSO (0.5 mL), 120 °C, 24 h with an O_2 balloon. [b]Isolated yields.

Next, we investigated the effects of different 2-(phenylethynyl)anilines on the synthesis of 2-phenylquinazoline (**4aa**) (Scheme 2). Further research showed that the 2-(phenylethynyl)anilines bearing an electron-donating substituent (**1e** and **1f**) produced a higher yield of product **4aa** than those analogues bearing an electron-withdrawing substituent (**1b** and **1f**). No desired product was detected when

heterocyclic-substituted alkyne was used (**1g**).

Scheme 2. Screening for the Alkynes[a,b]

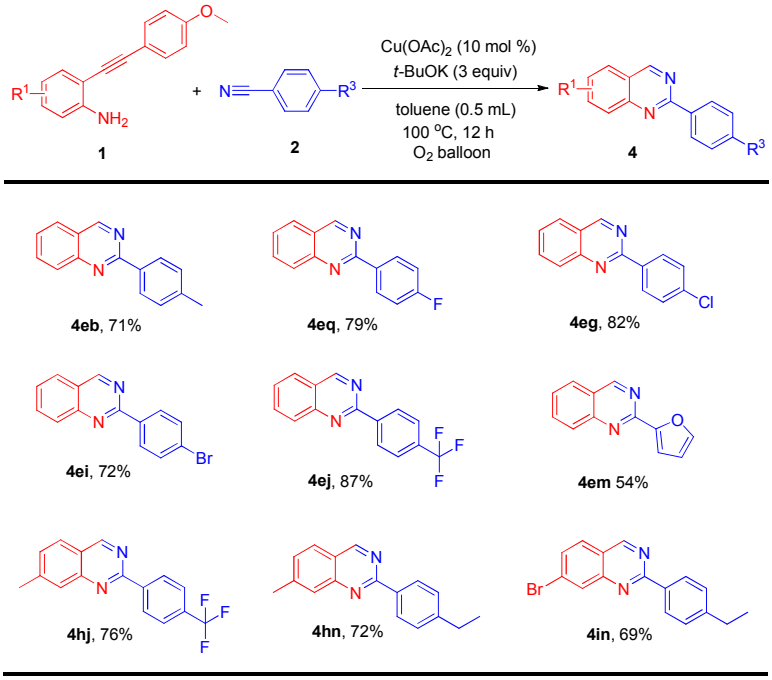


	Yield 4aa
1a: R = Ph	67%
1b: R = 4-ClC_6H_4	63%
1c: R = 4-MeC_6H_4	74%
1e: R = 4-$MeOC_6H_4$	82 (79)%
1f: R = 4-$CF_3C_6H_4$	41%
1g:R = 3-thiophene-yl	0%

[a]Reaction conditions: **1** (0.2 mmol), **2a** (0.3 mmol), $Cu(OAc)_2$ (10 mol %), *t*-BuOK (3.0 equiv), toluene (0.5 mL), 100 °C, 12 h, with an O_2 balloon. [b]GC yield using *n*-dodecane as internal standard. Yields determined by GC based on **1** with *n*-dodecane as internal standard. Isolated yield is in the parentheses.

Later, we turned our attention to the scope of this transformation. The scope of aromatic nitriles and substituted 2-alkynylanilines were investigated under the optimal conditions (Table 3). It was found that benzonitriles with various functional groups were successfully transformed to the desired 2-(phenylethynyl)anilines in moderate to good yields (**4eb-4in**). In general, the reaction yield was comparatively higher when electron-withdrawing group (i.e.−F, −Cl, −Br and $-CF_3$) was present on the benzene ring. This result could be explained by electron-deficient benzonitriles benefit from the nucleophilic addition of the amino group. Furthermore, nitriles bearing a heterocyclic substituent such as 2-furonitrile also gave the desired product in 54% yield (**4em**), and amides were found as side products in these reactions.

Table 3. Synthesis of Substituted Quinazolines 4[a,b]

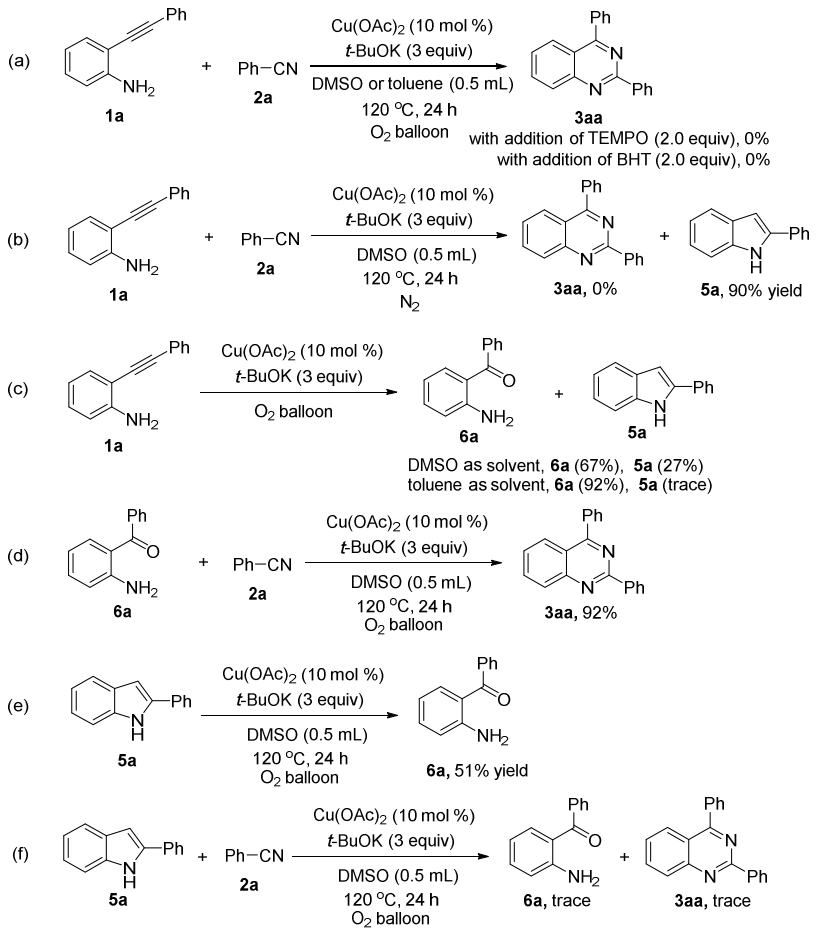


[a]All reactions were carried out under the following conditions: **1** (0.2 mmol), **2** (0.3 mmol), $Cu(OAc)_2$ (10 mol %), *t*-BuOK (3 equiv) and toluene (0.5 mL), 100 °C, 12 h, with an O_2 balloon. [b]Isolated yields.

A series of control experiments were subsequently carried out to develop a deeper understanding of the reaction mechanism (Scheme 3). We conducted the radical scavengers such as TEMPO (2,2,6,6-tetramethyl-1-piperidinyloxy) or BHT (3,5-di-*tert*-butyl-4-hydroxytoluene) to the reaction system (Scheme 3a). In both cases, the formation of **3aa** was affected dramatically on the whole. The reaction of 2-(phenylethynyl)aniline (**1a**) with benzonitrile (**2a**) was carried out under a nitrogen atmosphere, and the corresponding 2,4-diphenylquinazoline (**3aa**) was not obtained, with 2-phenyl-1*H*-indole (**5a**) as the major product (Scheme 3b), which indicated that the reaction required the presence of oxygen. The compound **1a** was subjected to the optimized reaction conditions in DMSO and gave **6a** and **5a** in 67% and 27% yields, respectively. When toluene was used as the solvent in the reaction, the product **6a** was

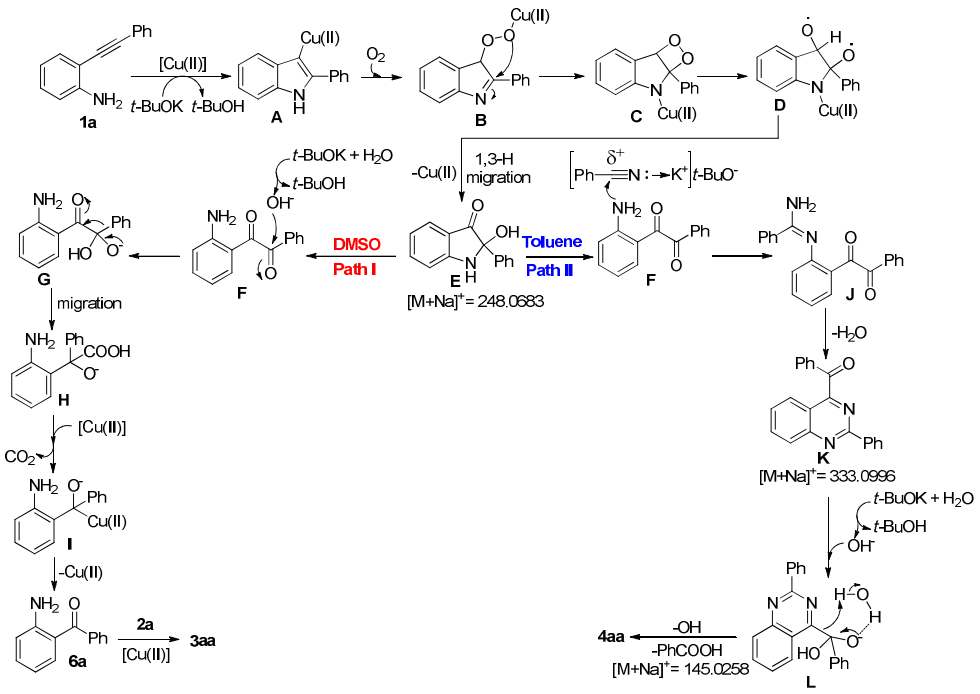
formed in 92% yield (Scheme 3c). When **6a** was treated with **2a**, the desired product **3aa** was obtained in 92% yield (Scheme 3d), which suggested that **6a** should be the possible intermediate under the standard reaction conditions. Additionally, when **5a** was subjected to the optimized reaction conditions, **6a** could be isolated in 51% yield (Scheme 3e). However, the reaction of **5a** and **2a** was conducted under the standard conditions, only trace amount of products **6a** and **3aa** could be detected (Scheme 3f), and **5a** presumably is not conducive to the formation of intermediate **A** due to the coordination of copper and nitrile (see Scheme 4). These results demonstrated that **5a** might not be the intermediate in the current reaction system.

Scheme 3. Control Experiments



On the basis of the above results and previous reports,[18] we proposed a plausible reaction mechanism for this transformation detailed in Scheme 4. This transformation pathway is initiated by aminocupration of 2-alkynyl aniline to afford the organocopper(II) intermediate **A**, which would be further oxidized to intermediate **B** in the presence of oxygen. Then, the intramolecular nucleophilic addition of peroxy anion to the C-N double bond forms a four-membered ring **C**. Cracking of the peroxy bond gives the intermediate **D**, which undergoes the [1,3]-H shift and protonated to form the intermediate **E** ($[M+Na]^+$= 348.0683). Subsequently, intermediate **F** is formed by C-N bond cleavage. In path I, intermediate **F** with OH^- adduct affords intermediate **G**, which undergoes rearrangement/decarboxylation to yield intermediate **I**, followed by collapse to release **6a**. Finally, the condensation of **6a** with benzonitrile **2a** gives **3aa**. When toluene is used as solvent (path II), the nitrile group can be readily activated through the coordination with the potassium cation in the presence of *t*-BuOK.[18d] The addition of the amino group of **F** to nitrile group generates the intermediate **J**. Then the intramolecular cyclization of **J** affords **K** ($[M+Na]^+$= 333.0996), which quickly converts into intermediate **L** by OH^- addition. Eventually, **L** undergoes cleavage to yield hydroxide ion, benzoic acid ($[M+Na]^+$= 145.0258), and **4aa**.[18e,18f]

Scheme 4. Possible Reaction Mechanism



Interestingly, only **3dj** of all the products shows bright emission in the solid state, when excited under an ultraviolet lamp (365 nm), and the fluorescence quantum yield ($\Phi_{F,film}$) and lifetime (τ_{film}) were measured to be 45.5% and 5.8 ns in thin films state, respectively. Furthermore, the fluorescence spectra of **3dj** exhibited obvious wavelength changes in different solvents, which showed that the Stokes shift increased quickly on increasing the solvent polarity (Figures 1a and 1b). In order to evaluate the optical properties of product **3dj**, the PL spectra of **3dj** in the THF/water mixtures with various water content was then investigated (Figure 1c). In pure THF solution, **3dj** exhibits bright green luminescence, however, the photoluminescence intensity showed nearly sustained decrease until the water fraction (f_w) reached 70%, and the 41nm red shift could also be detected. This phenomenon could be attributed to an increase in the solvent polarity and intramolecular charge-transfer (ICT) mechanism. From 73% f_w to 90% f_w, the PL intensity of **3dj** gradually increased,

demonstrating the aggregation induced emission (AIE) effect. In this stage, because increasing the water content would reduce the solubility, **3dj** began to aggregate. Meanwhile, the ICT effect was efficiently weakened. The fluorescence intensity of **3dj** in water/THF mixture (f_w = 90%) buffered by BR under different pH conditions was also determined (Figure 1d). A weak fluorescence intensity was seen at pH 1. With the gradually increase of the pH from 2 to 5, enhanced fluorescence intensity was observed. When adjusted the pH of the solution from 6 to 12, the emission behavior was similar, indicating that no state change at the range pH values, and the fluorescence intensity at 482 nm was plotted at different pH values (on the Figure 1d).

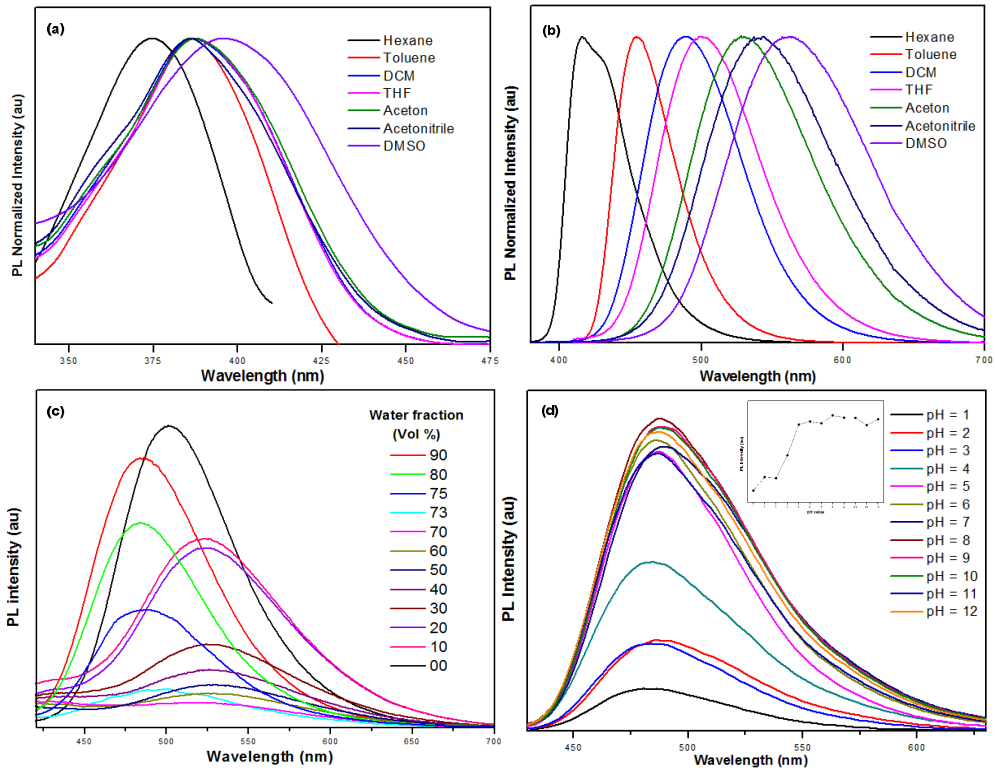


Figure 1. (a) Excitation spectra of **3dj** in different solvents. (b) Emission spectra of **3dj** in different solvents. (c) Fluorescence spectra of **3dj** in THF/water mixtures (10^{-5} mol/L). (d) Fluorescence spectra of **3dj** in solutions (10^{-5} mol /L) of different pH.

CONCLUSION

In conclusion, we have developed a concise construction of substituted quinazoline derivatives via $Cu(OAc)_2$-catalyzed cyclization of 2-ethynylanilines with benzonitriles. The process produced substituted quinazolines in moderate to good yields with readily available staring materials and catalyst. With this powerful synthetic strategy, we discovered a new solid-state blue-emitting organic molecule. This method provided a clue about the further development of new types of aggregation induced emission (AIE) luminescent materials.

EXPERIMENTAL SECTION

General Information: NMR spectra were obtained using a Bruker Avance 400 spectrometer (^{1}H at 400 MHz, and ^{13}C at 101 MHz). Chemical shifts for ^{1}H NMR spectra are reported in parts per million (ppm) from tetramethylsilane with the solvent resonance as the internal standard ($CDCl_3$: δ 7.26 ppm). Chemical shifts for ^{13}C NMR spectra are reported in parts per million (ppm) from tetramethylsilane with the solvent as the internal standard ($CDCl_3$: δ 77.0 ppm). IR spectra were obtained either as potassium bromide pellets or as liquid films between two potassium bromide pellets with a spectrometer. GC−MS was obtained using electron ionization. HRMS was obtained with a LCMS-IT-TOF mass spectrometer. UV-vis absorption spectra were obtained using Shimadzu UV-2600 spectrophotometer. Photoluminescence spectra were recorded on a Horiba Fluoromax-4 spectrofluorometer. Thin film fluorescence quantum yields were measured using a Hamamatsu absolute PL quantum yield

spectrometer C11347 Quantaurus-QY. Fluorescence lifetimes were determined with a Hamamatsu C11367-11 Quantaurus-Tau time-resolved spectrometer.

General Procedure for the Preparation of Compound 3: The reaction mixture of 2-ethynylanilines **1** (0.2 mmol), nitriles **2** (0.4 mmol), $Cu(OAc)_2$ (10 mol %) and *t*-BuOK (3 equiv) were added to DMSO (0.5 mL). The mixture was stirred at 120 ^oC for 24 h under O_2 balloon and monitored periodically by TLC. Upon completion, the reaction mixture was diluted with water (30 mL) and extracted with ethyl acetate (3 × 30 mL). The combined organic layers were washed with water and brine, dried over Na_2SO_4 and filtered. The solvent was removed under vacuum. The residue was purified by flash column chromatography to afford substituted quinazolines **3**.

General Procedure for the Preparation of Compound 4: The reaction mixture of *o*-alkynylanilines **1** (0.2 mmol), nitriles **2** (0.4 mmol), $Cu(OAc)_2$ (10 mol %) and *t*-BuOK (3 equiv) were added to toluene (0.5 mL). The mixture was stirred at 100 ^oC for 12 h under O_2 balloon, and monitored periodically by TLC. Upon completion, the reaction mixture was diluted with water (30 mL) and extracted with ethyl acetate (3 × 30 mL). The combined organic layers were washed with water and brine, dried over Na_2SO_4 and filtered. The solvent was removed under vacuum. The residue was purified by flash column chromatography to afford substituted quinazolines **4**.

2,4-Diphenylquinazoline (3aa)[19]: Purified via flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 81% (45.7 mg) as a white solid: 117-119 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.73 (d, *J* = 7.3 Hz, 2H), 8.15 (dd, *J* = 17.4, 8.4 Hz, 2H), 7.89-7.86 (m, 3H), 7.61-7.53 (m, 7H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ

ppm) 168.3, 160.2, 151.9, 138.2, 137.6, 133.5, 130.5, 130.1, 129.9, 129.1, 128.6, 128.5, 126.9, 121.6. **IR** (KBr, cm^{-1}): 2921, 1538, 1477, 1326, 754. **HRMS** (ESI) m/z: calcd for $C_{20}H_{15}N_2$ $[M + H]^+$ 283.1230; found 283.1238.

4-Phenyl-2-(p-tolyl)quinazoline (3ab)[22]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 61% (36 mg) as a white solid: 166-168 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) δ 8.60 (d, *J* = 8.1 Hz, 2H), 8.15-8.10 (m, 2H), 7.95-7.84 (m, 3H), 7.66-7.57 (m, 3H), 7.55-7.40 (m, 1H), 7.34 (d, *J* = 8.0 Hz, 2H), 2.45 (s, 3H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) δ 168.3, 160.3, 151.9, 140.8, 137.8, 135.5, 133.5, 130.2, 129.9, 129.3, 129.0, 128.7,128.5, 127.0, 126.8, 121.6, 21.5. **IR** (KBr, cm^{-1}): 2919, 1533, 1456, 1334, 764. **HRMS** (ESI) m/z: calcd for $C_{21}H_{17}N_2$ $[M + H]^+$ 297.1386; found 297.1387.

4-Phenyl-2-(o-tolyl)quinazoline (3ac)[22]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 57% (33.7 mg) as a white solid: 72-74 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.18 (dd, *J* = 8.2, 5.0 Hz, 2H), 8.03-7.97 (m, 1H), 7.95-7.83 (m, 3H), 7.6-7.55 (m, 4H), 7.38-7.31 (m, 3H), 2.69 (s, 3H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.1, 163.4, 151,7, 138.8, 137.5, 137.4, 133.6, 131.3, 130.8, 130.2, 130.0, 129.2, 129.0, 128.6, 127.3, 127.0, 126.0, 121.0, 21.3. **IR** (KBr, cm^{-1}): 2919, 1537, 1462, 1259, 1087, 799. **HRMS** (ESI) m/z: calcd for $C_{21}H_{17}N_2$ $[M + H]^+$ 297.1386; found 297.1382.

2-(4-Isopropylphenyl)-4-phenylquinazoline (3ad): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 59% (38.2 mg) as a white solid: 92-94 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.65 (d, *J* = 8.3 Hz, 2H),

8.17-8.10 (m, 2H), 7.92-7.84 (m, 3H), 7.62-7.58 (m, 3H), 7.54-7.49 (m, 1H), 7.42 (d, *J* = 8.3 Hz, 2H), 3.02 (septet, *J* = 7.5, 6.9 Hz, 1H), 1.34 (s, 3H), 1.32 (s, 3H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.1, 160.3, 151.9, 151.5, 137.7, 135.9, 133.4, 130.1, 129.8, 129.0, 128.7, 128.4, 126.9, 126.7, 126.6, 121.5, 34.1, 23.8. **IR** (KBr, cm^{-1}): 2960, 1536, 1453, 1339, 1261, 770. **HRMS** (ESI) m/z: calcd for $C_{23}H_{21}N_2$ $[M + H]^+$ 325.1699; found 325.1697.

2-(4-Methoxyphenyl)-4-phenylquinazoline (3ae)[19]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 41% (25.6 mg) as a white solid: 158-160 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.66 (d, *J* = 8.8 Hz, 2H), 8.11 (t, *J* = 8.6 Hz, 2H), 7.93- 7.82 (m, 3H), 7.66-7.55 (m, 3H), 7.51 (t, *J* = 7.6 Hz, 1H), 7.04 (d, *J* = 8.8 Hz, 2H), 3.90 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) δ168.2, 161.8, 160.1, 152.1, 137.8, 133.5, 131.0, 130.0, 129.9, 128.9, 128.5, 127.0, 126.5, 121.4, 113.9, 55.4. **IR** (KBr, cm^{-1}): 2920, 1533, 1461, 1337, 1251, 765. **HRMS** (ESI) m/z: calcd for $C_{21}H_{17}N_2O$ $[M + H]^+$ 313.1335; found 313.1342.

2-(Benzo[d][1,3]dioxol-5-yl)-4-phenylquinazoline (3af)[21]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 62% (40.4 mg) as a white solid: 169-170 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.32 (dd, *J* = 8.2, 1.6 Hz, 1H), 8.20 (d, *J* = 1.6 Hz, 1H), 8.09 (dd, *J* = 8.6, 2.8 Hz, 2H), 7.88-7.85 (m, 3H), 7.63-7.56 (m, 3H), 7.50 (ddd, *J* = 8.2, 7.0, 1.0 Hz, 1H), 6.95 (d, *J* = 8.2 Hz, 1H), 6.04 (s, 2H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.1, 159.7, 152.0, 149.8, 148.1, 137.7, 133.5, 132.7, 130.2, 129.9, 129.0, 128.5, 127.0, 126.7, 123.6, 121.5, 108.9, 108.3, 101.4. **IR** (KBr, cm^{-1}): 2921, 1536, 1495, 1333, 774. **HRMS** (ESI) m/z: calcd

for $C_{21}H_{15}N_2O_2$ $[M + H]^+$ 327.1128; found 327.1127.

2-(4-Chlorophenyl)-4-phenylquinazoline (3ag)[22]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 84% (53 mg) as a white solid: 190-192 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.65 (d, J = 7.9 Hz, 2H), 8.14 (t, J = 7.5 Hz, 2H), 7.94-7.84 (m, 3H), 7.60-7.56 (m, 4H), 7.49 (d, J = 7.9 Hz, 2H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.5, 159.3, 151.9, 137.5, 136.8, 136.7, 133.7, 130.1, 130.0, 129.1, 128.7, 128.5, 127.2, 127.0, 121.7. **IR** (KBr, cm^{-1}): 2918, 1533, 1471, 1332, 1159, 1084. **HRMS** (ESI) m/z: calcd for $C_{20}H_{14}ClN_2$ $[M + H]^+$ 317.0840; found 317.0843.

2-(2-Chlorophenyl)-4-phenylquinazoline (3ah)[22]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 67% (42.3 mg) as a white solid: 93-95 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.19 (t, J = 7.5 Hz, 2H), 7.97-7.84 (m, 4H), 7.63-7.52 (m, 5H), 7.42-7.38 (m, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.1, 161.2, 151.4, 138.4, 137.1, 133.7, 132.9, 131.7, 130.4, 130.1, 130.0, 129.0, 128.9, 128.5, 127.9, 127.7, 126.9, 121.2. **IR** (KBr, cm^{-1}): 2920, 1535, 1481, 1335, 757. **HRMS** (ESI) m/z: calcd for $C_{20}H_{13}ClN_2Na$ $[M + Na]^+$ 339.0659; found 339.0653.

2-(4-Bromophenyl)-4-phenylquinazoline (3ai)[20]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 87% (62.6 mg) as a white solid: 192-194 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.62-8.55 (m, 2H), 8.13 (dd, J = 12.2, 4.6 Hz, 2H), 7.93-7.84 (m, 3H), 7.67-7.54 (m, 6H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.5, 159.3, 151.9, 137.5, 137.1, 133.7, 131.7, 130.2, 130.1,

130.0, 129.1, 128.6, 127.2, 127.0, 125.3, 121.7. **IR** (KBr, cm^{-1}): 2920, 1534, 1459, 1386, 694. **HRMS** (ESI) m/z: calcd for $C_{20}H_{14}BrN_2$ $[M + H]^+$ 361.0335; found 361.0331.

4-Phenyl-2-(4-(trifluoromethyl)phenyl)quinazoline (3aj)[20]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 88% (63 mg) as a white solid: 124-126 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.82 (d, *J* = 8.1 Hz, 2H), 8.15 (t, *J* = 8.7 Hz, 2H), 7.89 (dd, *J* = 8.9, 5.1 Hz, 3H), 7.78 (d, *J* = 8.2 Hz, 2H), 7.65 -7.54 (m, 4H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.5, 158.8, 151.9, 141.6, 137.5, 133.8, 132.1(q, *J* = 270.8 Hz), 130.2, 130.1, 129.3, 128.9, 128.6, 127.6, 127.1, 125.4 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 270.8 Hz), 122.0, **^{19}F NMR** (376 MHz, $CDCl_3$, δ ppm) -62.57. **IR** (KBr, cm^{-1}): 2924, 1539, 1485, 1319, 1107, 769. **HRMS** (ESI) m/z: calcd for $C_{21}H_{14}F_3N_2$ $[M + H]^+$ 351.1104; found 351.1110.

2-(Naphthalen-2-yl)-4-phenylquinazoline (3ak)[19]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 51% (33.9 mg) as a white solid: 182-184 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.26 (s, 1H), 8.83 (dd, *J* = 8.6, 1.3 Hz, 1H), 8.23 (d, *J* = 8.4 Hz, 1H), 8.15 (d, *J* = 8.3 Hz, 1H), 8.08- 8.03 (m, 1H), 8.00 (d, *J* = 8.7 Hz, 1H), 7.98-7.86 (m, 4H), 7.67-7.49 (m, 6H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.5, 160.2, 152.0, 137.7, 135.5, 134.7, 133.7, 133.5, 130.3, 130.0, 129.4, 129.1, 129.0, 128.6, 128.2, 127.7, 127.1, 127.0, 126.1, 125.6, 121.8. **IR** (KBr, cm^{-1}): 2921, 1540, 1465, 1332, 698. **HRMS** (ESI) m/z: calcd for $C_{24}H_{17}N_2$ $[M + H]^+$ 333.1386; found 333.1382.

2-(Naphthalen-1-yl)-4-phenylquinazoline (3al)[19]: Purified *via* flash column

chromatography with 40% ethyl acetate/petroleum ether, yielding 64% (42.5 mg) as a white solid: 171-173 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.85 (d, *J* = 8.4 Hz, 1H), 8.27 (ddd, *J* = 27.1, 12.9, 4.5 Hz, 3H), 8.03-7.90 (m, 5H), 7.67-7.52 (m, 7H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.4, 162.7, 151.7, 137.4, 136.5, 134.2, 133.7, 131.3, 130.1, 130.0, 129.9, 129.6, 129.1, 128.5, 128.4, 127.4, 126.9, 126.7, 126.1, 125.7, 125.3, 121.2. **IR** (KBr, cm^{-1}): 2920, 1535, 1464, 1325, 768. **HRMS** (ESI) m/z: calcd for $C_{24}H_{16}N_2Na$ $[M + Na]^+$ 355.1206; found 355.1209.

2-(Furan-2-yl)-4-phenylquinazoline (3am)[19]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 71% (38.6 mg) as a white solid: 166-168 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.16 (d, *J* = 8.5 Hz, 1H), 8.05 (d, *J* = 8.3 Hz, 1H), 7.89-7.78 (m, 3H), 7.69 (s, 1H), 7.60-7.55 (m, 3H), 7.53-7.47 (m, 2H), 6.59 (dd, *J* = 3.4, 1.7 Hz, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.8, 153.5, 152.8, 151.6, 145.3, 137.2, 133.9, 130.1, 130.0, 128.9, 128.6, 127.1, 127.0, 121.6, 114.3, 112.2. **IR** (KBr, cm^{-1}): 2922, 1536, 1481, 1336, 758. **HRMS** (ESI) m/z: calcd for $C_{18}H_{12}N_2NaO$ $[M + Na]^+$ 295.0842; found 295.0841.

4-(4-Chlorophenyl)-2-(4-ethylphenyl)quinazoline (3bn): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 57% (39.3 mg) as a white solid: 178-180 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.59 (d, *J* = 8.2 Hz, 2H), 8.15 (d, *J* = 8.4 Hz, 1H), 8.06 (d, *J* = 8.2 Hz, 1H), 7.91- 7.81 (m, 3H), 7.62-7.49 (m, 3H), 7.36 (d, *J* = 8.1 Hz, 2H), 2.75 (q, *J* = 7.6 Hz, 2H), 1.30 (t, *J* = 7.6 Hz, 3H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 167.0, 160.4, 152.1, 147.2, 136.2, 136.1, 135.6, 133.6, 131.5, 129.2, 128.8, 128.7, 128.2, 127.0, 126.6, 121.4, 28.9, 15.5.

IR (KBr, cm^{-1}): 2922, 1536, 1459, 1333, 759. **HRMS** (ESI) m/z: calcd for $C_{22}H_{18}ClN_2$ $[M + H]^+$ 345.1153; found 345.1155.

4-(4-Chlorophenyl)-2-(3,5-dimethylphenyl)quinazoline (3bo): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 56% (39.1 mg) as a white solid: 185-187°C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.31 (s, 2H), 8.19 (d, *J* = 8.4 Hz, 1H), 8.08 (d, *J* = 8.3 Hz, 1H), 7.95-7.84 (m, 3H), 7.66-7.52 (m, 3H), 7.18 (s, 1H), 2.48 (s, 6H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 167.1, 160.6, 152.0, 138.1, 137.9, 136.2, 136.1, 133.7, 132.5, 131.6, 129.3, 128.9, 127.1, 126.5, 126.4, 121.5, 21.5. **IR** (KBr, cm^{-1}): 2921, 1540, 1479, 1340, 757. **HRMS** (ESI) m/z: calcd for $C_{22}H_{18}ClN_2$ $[M + H]^+$ 345.1153; found 345.1152.

4-(4-Chlorophenyl)-2-(thiophen-2-yl)quinazoline (3bp): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 66% (42.5 mg) as a white solid: 157-159 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.19 (d, *J* = 3.5 Hz, 1H), 8.08 (d, *J* = 8.5 Hz, 1H), 8.03 (d, *J* = 8.3 Hz, 1H), 7.87 (t, *J* = 7.7 Hz, 1H), 7.82 (d, *J* = 8.4 Hz, 2H), 7.60- 7.46 (m, 4H), 7.21-7.15 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 167.1, 157.2, 151.9, 144.0, 136.4, 135.7, 133.9, 131.5, 130.0, 129.4, 128.9, 128.3, 126.9, 126.7, 121.3. **IR** (KBr, cm^{-1}): 2921, 1531, 1483, 1338, 711. **HRMS** (ESI) m/z: calcd for $C_{18}H_{12}N_2SCl$ $[M + H]^+$ 323.0404; found 323.0398.

2-(Furan-2-yl)-4-(p-tolyl)quinazoline (3cm): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 41% (23.5 mg) as a white solid: 138-140 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.16 (d, *J* = 8.5 Hz, 1H), 8.09 (d, *J* = 8.4 Hz, 1H), 7.88-7.86 (m, 1H), 7.74 (d, *J* = 8.0 Hz, 2H), 7.69 (s, 1H),

7.53-7.49 (m, 2H), 7.39 (d, *J* = 7.9 Hz, 2H), 6.60-6.59 (m, 1H), 2.46 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.9, 153.5, 152.9, 151.6, 145.2, 140.3, 134.4, 133.8, 130.1, 129.3, 128.9, 127.3, 126.9, 121.7, 114.2, 112.2, 21.5. **IR** (KBr, cm^{-1}): 2921, 1534, 1478, 1263, 755. **HRMS** (ESI) m/z: calcd for $C_{19}H_{14}N_2NaO$ $[M + Na]^+$ 309.0998; found 309.1003.

N,N-Dimethyl-4-(2-(4-(trifluoromethyl)phenyl)quinazolin-4-yl)aniline (3dj): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 46% (36.2 mg) as a white solid: 136-138 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.82 (d, *J* = 8.2 Hz, 2H), 8.29 (d, *J* = 8.1 Hz, 1H), 8.12 (d, *J* = 8.4 Hz, 1H), 7.92-7.83 (m, 3H), 7.77 (d, *J* = 8.3 Hz, 2H), 7.56 (t, *J* = 7.6 Hz, 1H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.10 (s, 6H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 168.1, 158.7, 152.0, 151.9, 142.0, 138.8 (q, *J* = 36.9 Hz), 133.3, 131.9, 129.1, 128.8, 127.5, 127.0, 125.3 (q, *J* = 3.6 Hz), 124.9, 124.3 (q, *J* = 270.4 Hz), 121.9, 111.8, 40.3, **^{19}F NMR** (376 MHz, $CDCl_3$, δ ppm) -62.73. **IR** (KBr, cm^{-1}): 2919, 1643, 1462, 1262, 754. **HRMS** (ESI) m/z: calcd for $C_{23}H_{19}F_3N_3$ $[M + H]^+$ 394.1526; found 394.1533.

7-Methoxy-2,4-diphenylquinazoline (3ja): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 57% (35.6 mg) as a white solid: 235-237 ^oC. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.67 (d, J = 7.3 Hz, 2H), 8.01 (d, J = 9.2 Hz, 1H), 7.87-7.85 (m, 2H), 7.58-7.57 (m, 3H), 7.54-7.47 (m, 4H), 7.16 (d, J = 9.1 Hz, 1H), 4.03 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 167.3, 163.8, 160.9, 154.4, 138.3, 137.9, 130.5, 130.1, 129.8, 128.7, 128.5, 128.4, 120.3, 117.1, 106.6, 55.8. **IR** (KBr, cm^{-1}): 2922, 1763, 1693, 1242, 1026, 697. **HRMS** (ESI)

m/z: calcd for $C_{21}H_{17}ON_2$ $[M + H]^+$ 313.1335; found 313.1336.

6-Chloro-2,4-diphenylquinazoline (3ka)[19]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 49% (30.9 mg) as a white solid: 195-197 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 8.71-8.66 (m, 2H), 8.14 (d, J = 9.0 Hz, 1H), 8.10 (d, J = 2.1 Hz, 1H), 7.88-7.81 (m, 3H), 7.65-7.60 (m, 3H), 7.55-7.50 (m, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 167.7, 160.5, 150.4, 137.7, 137.1, 134.6, 132.7, 130.8, 130.7, 130.3, 130.1, 128.7, 128.7, 128.6, 125.8, 122.2. **IR** (KBr, cm^{-1}): 2988, 1748, 1244, 1049, 798. **HRMS** (ESI) m/z: calcd for $C_{20}H_{14}ClN_2$ $[M + H]^+$ 317.0840; found 317.0844.

2-Phenylquinazoline (4aa)[23]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 79% (32.5 mg) as a white solid: 98-100 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.46 (s, 1H), 8.67-8.59 (m, 2H), 8.12-8.06 (m, 1H), 7.93-7.86 (m, 2H), 7.64-7.51 (m, 4H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) δ 161.1, 160.5, 150.8, 138.0, 134.1, 130.6, 128.7, 128.6, 127.3, 127.1, 123.6. **IR** (KBr, cm^{-1}): 2923, 1556, 1455, 1266, 757. **HRMS** (ESI) m/z: calcd for $C_{14}H_{11}N_2$ $[M + H]^+$ 207.0917; found 207.0919.

2-(*p*-Tolyl)quinazoline (4eb)[23]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 71% (31.2 mg) as a white solid: 97-99 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.44 (s, 1H), 8.52 (d, *J* = 8.2 Hz, 2H), 8.13-8.01 (m, 1H), 7.95-7.80 (m, 2H), 7.64-7.50 (m, 1H), 7.34 (d, *J* = 8.0 Hz, 2H), 2.45 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 161.2, 160.4, 150.8, 140.9, 135.3, 134.1, 129.4, 128.6, 127.1, 127.0, 123.5, 21.52. **IR** (KBr, cm^{-1}): 2926, 1559, 1459, 1266, 755.

HRMS (ESI) m/z: calcd for $C_{15}H_{13}N_2$ $[M + H]^+$ 221.1073; found 221.1079.

2-(4-Fluorophenyl)quinazoline (4eq)[23]**:** Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 79% (35.4 mg) as a yellow solid: 136-137 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.45 (s, 1H), 8.68- 8.58 (m, 2H), 8.07 (d, *J* = 8.4 Hz, 1H), 7.95-7.87 (m, 2H), 7.62 (dd, *J* = 11.0, 4.0 Hz, 1H), 7.24-7.13 (m, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm)165.9, 163.5, 160.5, 160.1, 150.7, 134.3, 134.2, 130.70 (d, *J* = 8.7 Hz), 128.6, 127.22 (d, *J* = 14.2 Hz), 123.5, 115.5 (d, *J* = 21.5 Hz), **^{19}F NMR** (376 MHz, $CDCl_3$, δ ppm) -110.52. **IR** (KBr, cm^{-1}): 2921, 1585, 1402, 1219, 800. **HRMS** (ESI) m/z: calcd for $C_{14}H_{10}N_2F$ $[M + H]^+$ 225.0823; found 225.0825.

2-(4-Chlorophenyl)quinazoline (4eg)[23]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 82% (39.4 mg) as a yellow solid: 137-139 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.43 (s, 1H), 8.60-8.51 (m, 2H), 8.09-8.01 (m, 1H), 7.95-7.86 (m, 2H), 7.66-7.57 (m, 1H), 7.53-7.43 (m, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 160.5, 160.0, 150.7, 136.9, 136.5, 134.3, 129.9, 128.8, 128.6, 127.5, 127.2, 123.6. **IR** (KBr, cm^{-1}): 2920, 1575, 1405, 1265, 751. **HRMS** (ESI) m/z: calcd for $C_{14}H_{10}ClN_2$ $[M + H]^+$ 241.0527; found 241.0528.

2-(4-Bromophenyl)quinazoline (4ei)[23]**:** Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 72% (40.7 mg) as a yellow solid: 122-123 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.43 (s, 1H), 8.49 (d, *J* = 8.5 Hz, 2H), 8.06 (d, *J* = 8.8 Hz, 1H), 7.89 (dd, *J* = 7.9, 6.3 Hz, 2H), 7.69-7.56 (m, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 160.4, 160.2, 150.7, 137.0, 134.3, 131.8, 130.2,

128.6, 127.5, 127.2, 125.4, 123.7. **IR** (KBr, cm^{-1}): 2991, 1578, 1404, 1265, 752. **HRMS** (ESI) m/z: calcd for $C_{14}H_{10}N_2Br$ $[M + H]^+$ 285.0022; found 285.0019.

2-(4-(Trifluoromethyl)phenyl)quinazoline (4ej)[23]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 87% (47.7 mg) as a white solid: 144-146 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.47 (s, 1H), 8.74 (d, *J* = 8.2 Hz, 2H), 8.10 (d, *J* = 8.8 Hz, 1H), 7.94 (d, *J* = 7.6 Hz, 2H), 7.78 (d, *J* = 8.3 Hz, 2H), 7.68-7.61 (m, 1H), **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 160.6, 159.6, 150.7, 141.3, 134.4, 132.3 (q, *J* = 32.2 Hz), 128.9, 128.8, 127.9, 127.2, 125.5 (q, *J* = 3.8 Hz), 123.8, 123.6 (q, *J* = 292.6 Hz), **^{19}F NMR** (376 MHz, $CDCl_3$, δ ppm) -62.67. **IR** (KBr, cm^{-1}): 2923, 1540, 1457, 1262, 756. **HRMS** (ESI) m/z: calcd for $C_{15}H_{10}F_3N_2$ $[M + H]^+$ 275.0791; found 275.0777.

2-(Furan-2-yl)quinazoline (4em)[23]: Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 54% (21.2 mg) as a white solid: 116-118 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.36 (s, 1H), 8.08 (d, *J* = 8.8 Hz, 1H), 7.89-7.85 (m, 2H), 7.68 (d, *J* = 0.8 Hz, 1H), 7.57 (t, *J* = 7.5 Hz, 1H), 7.45 (d, *J* = 3.4 Hz, 1H), 6.60-6.59 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) δ 160.7, 154.1, 152.5, 150.4, 145.4, 134.5, 128.4, 127.3, 123.4, 114.1, 112.3. **IR** (KBr, cm^{-1}): 2923, 1587, 1483, 1262, 755. **HRMS** (ESI) m/z: calcd for $C_{12}H_8N_2NaO$ $[M + Na]^+$ 219.0529; found 219.0526.

7-Methyl-2-(4-(trifluoromethyl)phenyl)quinazoline (4hj): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 76% (43.8 mg) as a white solid: 157-159 °C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.37 (s, 1H),

8.71 (d, *J* = 8.0 Hz, 2H), 7.99 (d, *J* = 8.6 Hz, 1H), 7.80-7.72 (m, 3H), 7.68 (s, 1H), 2.57 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 159.9, 158.9, 149.2, 147.0, 141.4, 138.1, 136.7, 131.9 (q, *J* = 32.0 Hz), 128.6, 128.4, 125.4 (q, *J* = 3.8 Hz), 124.2 (q, *J* = 270.5 Hz), 122.9, 21.7, **^{19}F NMR** (376 MHz, $CDCl_3$, δ ppm) -62.66. **IR** (KBr, cm^{-1}): 2921, 1635, 1415, 1266, 754. **HRMS** (ESI) m/z: calcd for $C_{16}H_{12}F_3N_2$ $[M + H]^+$ 289.0947; found 289.0949.

2-(4-Ethylphenyl)-7-methylquinazoline (4hn): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 72% (35.7 mg) as a white solid: 67-69°C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.35 (s, 1H), 8.51 (d, *J* = 8.3 Hz, 2H), 7.97 (d, *J* = 8.6 Hz, 1H), 7.71-7.69 (m, 1H), 7.65 (s, 1H), 7.36 (d, *J* = 8.3 Hz, 2H), 2.74 (q, *J* = 7.6 Hz, 2H), 2.55 (s, 3H), 1.30 (t, *J* = 7.6 Hz, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 160.6, 159.7, 149.4, 146.9, 137.2, 136.3, 135.7, 128.5, 128.3, 128.1, 125.8, 123.5, 28.9, 21.6, 15.4. **IR** (KBr, cm^{-1}): 2921, 1562, 1423, 1263, 754. **HRMS** (ESI) m/z: calcd for $C_{17}H_{17}N_2$ $[M + H]^+$ 249.1386; found 249.1385.

7-Bromo-2-(4-ethylphenyl)quinazoline (4in): Purified *via* flash column chromatography with 40% ethyl acetate/petroleum ether, yielding 69% (43 mg) as a white solid: 143-145°C. **^{1}H NMR** (400 MHz, $CDCl_3$, δ ppm) 9.36 (s, 1H), 8.51 (d, *J* = 8.0 Hz, 2H), 8.05 (s, 1H), 7.94 (s, 2H), 7.36 (d, *J* = 7.9 Hz, 2H), 2.77-2.70 (m, 2H), 1.29 (d, *J* = 7.6 Hz, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$, δ ppm) 161.5, 159.3, 149.5, 147.6, 137.5, 135.1, 130.4, 129.2, 128.7, 128.3, 124.4, 120.5, 28.9, 15.4. **IR** (KBr, cm^{-1}): 2921, 1543, 1418, 1263, 753. **HRMS** (ESI) m/z: calcd for $C_{16}H_{14}BrN_2$ $[M + H]^+$ 313.0335; found 313.0335.

ASSOCIATED CONTENT

Supporting Information

Copies of NMR spectra for all compounds and X-ray crystallographic data for **3aa**. This material is available free of charge via the Internet at http://pubs.acs.org.

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Notes

The authors declare no competing financial interest.

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