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CuO Nanoparticle Catalyzed Synthesis of 2,3-Disubstituted Quinazolinones via Sequential *N*-Arylation and Oxidative C−H Amidation

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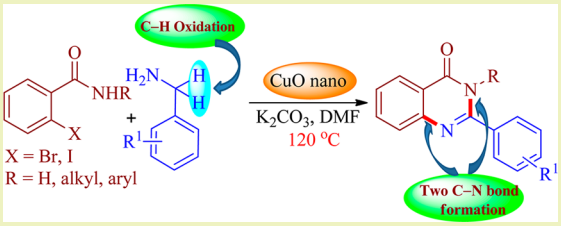
Supporting Information

ABSTRACT: CuO nanoparticle catalyzed synthesis of 2,3-disubstituted quinazolinones has been accomplished from 2-halobenzamides and (aryl)methanamines under an air atmosphere. This synthesis of the *N*-heterocycle involves a sequential Ullmann coupling [between 2-halobenzamide and (aryl)methanamine], oxidation of the *in situ* generated secondary amine to imine. This is then followed by an intramolecular nucleophilic attack of the amidic N−H on to the imine carbon (C−N bond formation) resulting in the synthesis of 2,3-disubstituted quinazolinones. The recyclability of the catalyst and tolerance of a wide range of functional groups makes this method efficient and cost-effective.



KEYWORDS: *N-Heterocycle synthesis, CuO nanoparticle, C−H functionalization, Domino reaction*

INTRODUCTION

Transition metal catalyzed C−C and C−heteroatoms bond forming reactions via cross coupling is a central theme in recent synthetic organic chemistry.[1−6] However, these traditional coupling reactions are associated with various issues such as requirement of additional functionalities in the starting materials and the use of stoichiometric metal based reagents. Direct C−H activation has recently gained great interest, as the reaction obviates the above requirements, which can significantly reduce the number of synthetic steps and improve the atom economy of the process to access specific target molecules.[7−16] In last few decades, synthesis of nitrogen containing polyheterocycles[17−22] via a domino approach and the reaction involving the direct C−H bond activation has emerged as one of the powerful tools for their synthesis.[23−28]

Significant attention has been paid to nitrogen bearing heterocycles, as they are the integral part of many natural products and biologically and pharmaceutically active molecules.[29−33] Among nitrogen containing heterocycles, quinazolinones represent a class of very important structural motifs as they form the core skeleton of many natural products like luotonine A,[34] rutaecarpine,[35] bouchardatine,[36] etc. They are also the major building blocks of many drugs having antihypertensive,[37] anti-inflamatory,[38] antibacterial,[39] anticancer,[40] and antituberculosis[41] activities. Therefore, there is substantial interest to develop a novel, efficient, and practical approach for their synthesis. Since quinazolinones are assigned as privileged structures in drug development, a number of methods have been developed for their synthesis.[42] The conventional synthesis of quinazolinones involves coupling of *o*-aminobenzamides or *o*-nitrobenzamides with aldehydes,[43] alcohols,[44,45] and other coupling reagents.[46] However, benzoic acid derivatives bearing *o*-amino or *o*-nitro groups are not readily available and are difficult to prepare. With the advancement of Cu catalyzed N-arylation strategies for the synthesis of *N*-heterocycles,[1−3,47−56] Fu's group reported the synthesis of quinazolinones using 2-halobenzamide and benzylamine using copper(I) in an air atmosphere.[18] So far, many methods have been reported using various transition metal catalysts.[45,57−60] However, due to the homogeneous nature of the reaction mixture further use of the catalyst for the next catalytic cycle is rarely studied as the separation of catalyst and product is often difficult. Heterogeneous catalytic systems have several advantages in terms of good dispersion of their active site and easy separation of reaction mixture and catalyst recyclability over homogeneous systems.

In the modern era of organic synthesis, nanoparticle catalyzed reactions have been one of the most progressive research areas.[61−63] Owing to the advantage of heterogeneous catalysts, nanocrystalline metal oxides have always tempted the synthetic chemists. They are advantageous over conventional metal catalysts in terms of large surface area, high reactivity, and high thermal resistance giving higher yields with better atom economy. Several N, O, and S-arylation reactions using CuO nanoparticles are already reported.[58−66] To the best of our knowledge, nano-CuO catalyzed domino reaction for the synthesis of quinazolinones have not been explored. Herein, we report a simple and efficient method for the synthesis of a diverse array of quinazolinones via the Ullmann coupling of

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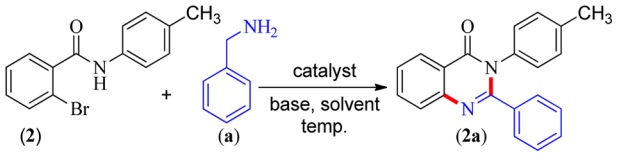
various *o*-halobenzamides and (aryl)methanamines followed by an intramolecular aerobic oxidative C−H amidation.

RESULTS AND DISCUSSION

In light of the aforestated advantages of a heterogeneous catalytic system (CuO nano), our initial investigation was intended toward the synthesis of quinazolinones. 2-Bromo-*N*-(*p*-tolyl)benzamide (**2**) (1 equiv) and benzylamine (**a**) (2 equiv), were chosen as the prototypical substrates, in the presence of the catalyst CuO nano (5 mol %) and K_2CO_3 (3 equiv) in DMSO. As expected, the reaction with the above-mentioned combinations at 120 °C resulted in the formation of 2-phenyl-3-(*p*-tolyl)quinazolin-4(3*H*)-one (**2a**) in 67% yield. With this positive outcome, further optimizations were carried out in order to improve the overall yield. Various other conventional copper salts such as CuI (43%), CuBr (55%), CuCl (32%), and $Cu(OAc)_2$ (51%) examined were all found inferior to CuO nano (67%) (Table 1, entries 1−5). A 2-fold

Table 1. Screening of the Reaction Conditions[a]



(2) (a) (2a)

entry	catalyst (mol %)	base (equiv)	solvent	temp (°C)	yield (%)[b]
1	CuO nano (5)	K_2CO_3 (3)	DMSO	120	67
2	CuI	K_2CO_3 (3)	DMSO	120	43
3	CuBr (5)	K_2CO_3 (3)	DMSO	120	55
4	CuCl (5)	K_2CO_3 (3)	DMSO	120	32
5	$Cu(OAc)_2$ (5)	K_2CO_3 (3)	DMSO	120	51
6	CuO nano (2.5)	K_2CO_3 (3)	DMSO	120	62
7	CuO nano (10)	K_2CO_3 (3)	DMSO	120	68
8	CuO nano (5)	Cs_2CO_3 (3)	DMSO	120	57
9	CuO nano (5)	Na_2CO_3 (3)	DMSO	120	32
10	CuO nano (5)	K_2CO_3 (2)	DMSO	120	54
11	CuO nano (5)	K_2CO_3 (4)	DMSO	120	69
12	**CuO nano (5)**	**K_2CO_3 (3)**	**DMF**	**120**	**78**
13	CuO nano (5)	K_2CO_3 (3)	DMA	120	53
14	CuO nano (5)	K_2CO_3 (3)	PhCl	120	30
15	CuO nano (5)	K_2CO_3 (3)	CH_3CN	120	00
16	CuO nano (5)	K_2CO_3 (3)	DMF	130	79
17	CuO nano (5)	K_2CO_3 (3)	DMF	110	71
18		K_2CO_3 (3)	DMF	120	
19	CuO nano (5)		DMF	120	

[a]Reaction conditions: 2-Bromo-*N*-(*p*-tolyl)benzamide **2** (0.25 mmol), benzylamine (**a**) (0.5 mmol), catalyst (0.0125 mmol), base (0.75 mmol), and solvent (2 mL) under air for 9 h. [b]Isolated yield.

decrease in the catalyst (CuO) loading (2.5 mol %) lowered the product yield (62%) (Table 1, entry 6). However, an increase in the catalyst loading (10 mol %) had no substantial effect on this transformation (68%) (Table 1, entry 7). The use of other inorganic bases such as Cs_2CO_3 and Na_2CO_3 resulted in lower yields (Table 1, entries 8 and 9) as compared to K_2CO_3 (Table 1, entry 1). No further improvement in the yield (69%) was observed when the K_2CO_3 quantity was increased to 4 equivs (Table 1, entry 11). The yield decreased (54%) when the quantity of the base was reduced to 2 equivs (Table 1, entry 10). A substantial improvement in the yield (78%) was observed when the reaction was performed in DMF (Table 1, entry 12) in lieu of DMSO. Other solvents such as dimethylacetamide (53%), chlorobenzene (30%), and acetonitrile (00%) did not give encouraging results (Table 1, entries 13−15). An increase in the reaction temperature by 10 °C (130 °C) had no impact on the product yield (79%) (Table 1, entry 16) while a lowering in the reaction temperature by 10 °C (110 °C) results in a slight decrease in the product formation (71%) (Table 1, entry 17). Under otherwise identical conditions, control experiments either in the absence of catalyst or base failed to provide the desired product signifying the requirements of both (Table 1, entries 18 and 19).

From the above screening experiments, it was found that the use of 5 mol % CuO nano and 3 equivs of K_2CO_3 in DMF at 120 °C to be the optimal reaction condition (Table 1, entry 12) which was used for rest of the investigations. As shown in Scheme 1, most of the substrate studied provides good to moderate yields of products regardless of their electronic environment. Initially, the effect of substituents on the aryl ring of benzylamine (**a**−**i**) was examined by reacting them with 2-bromo-*N*-phenylbenzamide (**1**). Benzylamine bearing electron-donating substituents such as *p*-CH_3 (**b**) and *p*-OCH_3 (**c**) all afforded their respective products (**1b**) and (**1c**) in good yields, 75% and 71%, respectively (Scheme 1). However, the presence of moderately electron-withdrawing groups such as *p*-Cl (**d**) and *p*-F (**e**) gave lower yields of their respective quinazolinones (**1d**) (67%) and (**1e**) (62%), while the presence of a strong electron-withdrawing group like *p*-NO_2 (**f**) in benzylamine resulted in a substantial drop (51%) in the product yield (**1f**). A comparative study in the reactivity of benzamides bearing *ortho*-iodo and *ortho*-bromo substituents and aryl iodides showed higher reactivity giving better yields than the corresponding bromides (Scheme 1, **1a**−**1f**).

Further, the effects of substituents on the *N*-aryl ring (Ar^2) of the benzamides (2−4) were examined. As can be seen from Scheme 1, the presence of electron-donating groups in Ar^2 such as *p*-CH_3 (**2**) and *p*-OCH_3 (**3**) provided higher yields of products (**2a**−**2d** and **3a**−**3d**) irrespective of the substituents present in the Ar^1 ring. However, when the Ar^2 ring is substituted with an electron-withdrawing group such as *p*-Cl (**4**) and the Ar^1 ring with electron-neutral (-H) (**a**), electron-donating (*p*-CH_3) (**b**) and electron-withdrawing (*p*-Cl) (**d**) groups, all afforded their corresponding products (**4a**, 59%), (**4b**, 64%), and (**4d**, 52%), respectively. As can be seen from Scheme 1, maximum yields of 2,3-disubstituted quinazolinones were obtained when both Ar^1 and Ar^2 possess electron-donating groups [(**2b**, 82%), (**2c**, 79%), (**3b**, 85%), and (**3c**, 81%)]. Slightly lower yields were obtained when any one of the ring is substituted with electron-donating groups and the other ring with electron-neutral [(**1b**, 75%), (**1c**, 71%), (**2a**, 78%), and (**3a**, 77%)] and electron-withdrawing [(**2d**, 67%), (**3d**, 71%), and (**4b**, 64%)] groups. Yields obtained were lowered further when both the rings are substituted with electron-withdrawing groups (**4d**, 52%). The structure of the product (**3b**) has been confirmed by single X-ray crystallography (Figure 1). Besides simple (aryl)methanamines, other heterocyclic methanamines like 2-picolylamine (**g**) and 3-picolylamine (**h**) were also investigated. Interestingly, they also serve as good coupling partners to provide products (**1g**) and (**1h**) in 64% and 67% yields, respectively. Similarly, 2-bromo-*N*-(pyridin-2-yl)benzamide (**5**) also participated in the reaction with benzylamine (**a**) to afford the corresponding product (**5a**) in modest yield (53%). Notably, a poor yield of 39% (**5g**) was obtain when 2-bromo-*N*-(pyridin-2-yl)benzamide (**5**) was

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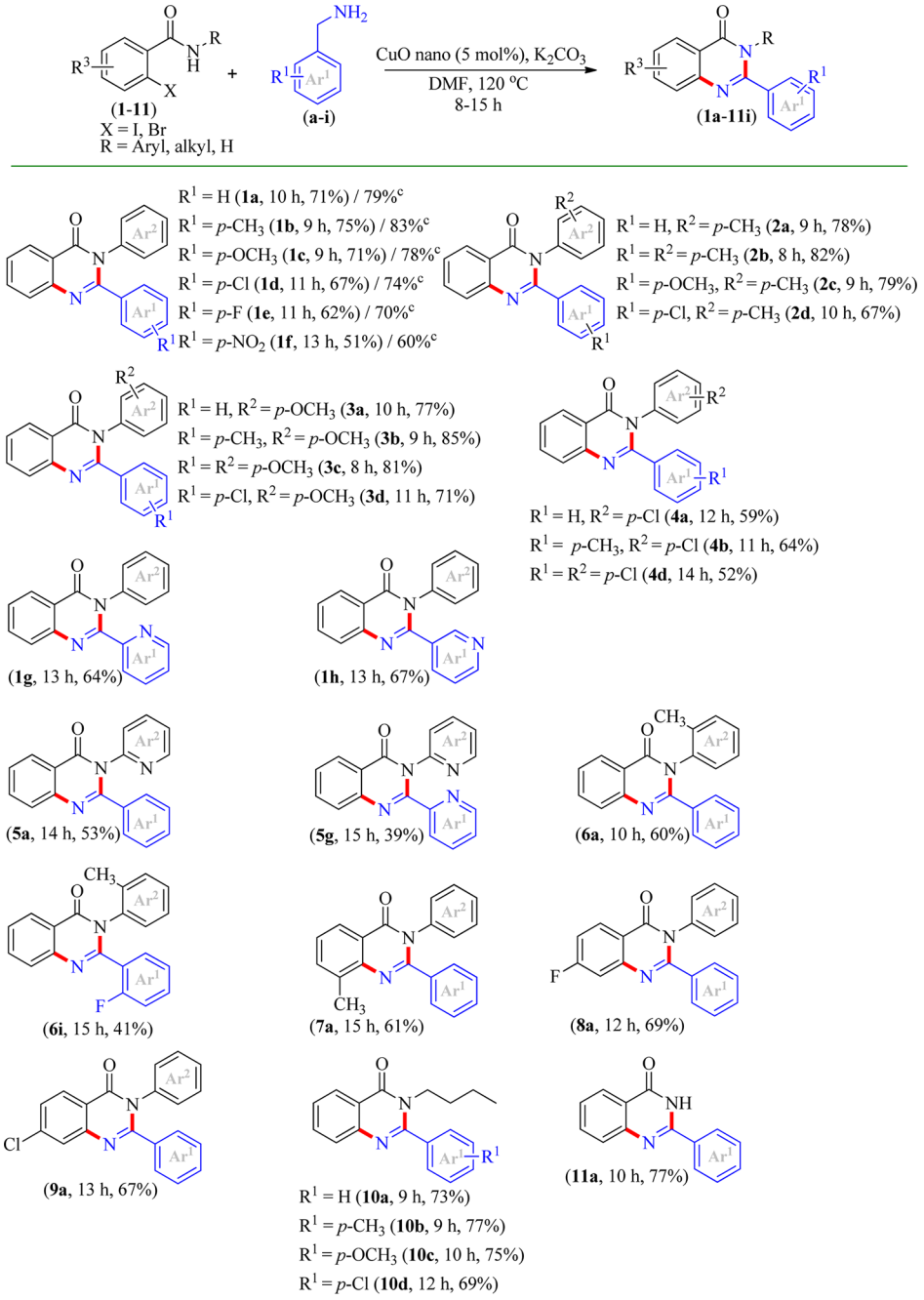
Scheme 1. Synthesis of Various Quinazolinones[a,b,c]



[a]Reaction conditions: 2-bromobenzamide (**1**−**11**) (0.25 mmol), aryl methanamine (**a**−**i**) (0.5 mmol), CuO nano (0.0125 mmol), K_2CO_3 (0.75 mmol), and DMF (2 mL) under air for 8−15 h. [b]Isolated yield. [c]Reaction performed with 2-iodo-*N*-phenylbenzamide.

coupled with 2-picolylamine (**g**). The poor yield obtained for (**5g**) is consistent with the observation for the substrate bearing electron-withdrawing groups in both Ar^1 and Ar^2 rings as was observed in (**4d**).

An *ortho* substituted *N*-aryl benzamide (**6**) gave a comparatively lower yield of 60% (**6a**) in contrast to its *para* analogue (**2a**, 78%), which may be due to the steric hindrance imparted by the *ortho* methyl group. A further decrease in the product (**6i**) yield (41%) was observed when *ortho* substituted amide (**6**) was treated with (2-fluorophenyl)methanamine (**i**). Similarly, 2-bromobenzamide substituted with -Me (**7**), -F (**8**), and -Cl (**9**) underwent efficient coupling with benzylamine (**a**) to afford their corresponding quinazolinones (**7a**), (**8a**), and (**9a**), respectively, in good yields (Scheme 1). Apart from *N*-aryl benzamide and *N*-alkyl (**10**) as well as unsubstituted amide (**11**) were also investigated. Gratifyingly, they provided their corresponding quinazolinones (**10a**−**10d** and **11a**, Scheme 1) in the range of 69% to 77% yields when reacted with various benzylamines (**a**−**d**).

Further, to understand the possible reaction mechanism, control experiments were performed which are depicted in Scheme 2. A CuO nano catalyzed reaction of 2-bromo-*N*-(*p*-tolyl)benzamide (**2**) and benzylamine (**a**) in an atmosphere of N_2 under otherwise identical conditions afforded the Ullmann coupled product 2-(benzylamino)-*N*-(*p*-tolyl)benzamide (**2′**) in 78% [Scheme 2 (i)] along with a trace (<5%) of cyclized

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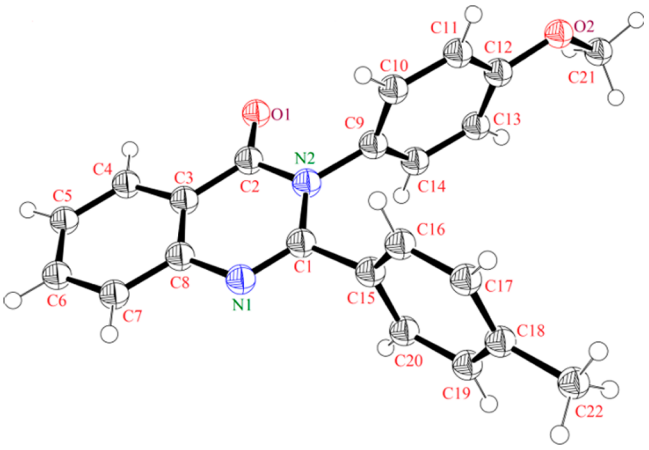
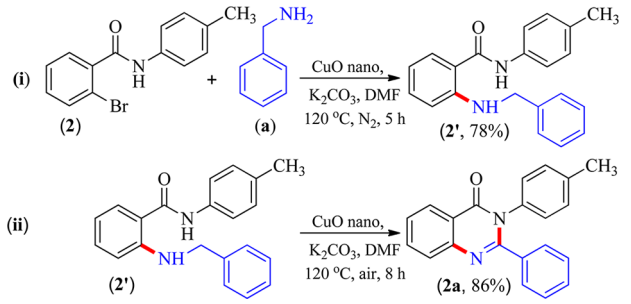


Figure 1. ORTEP view of **3b**.

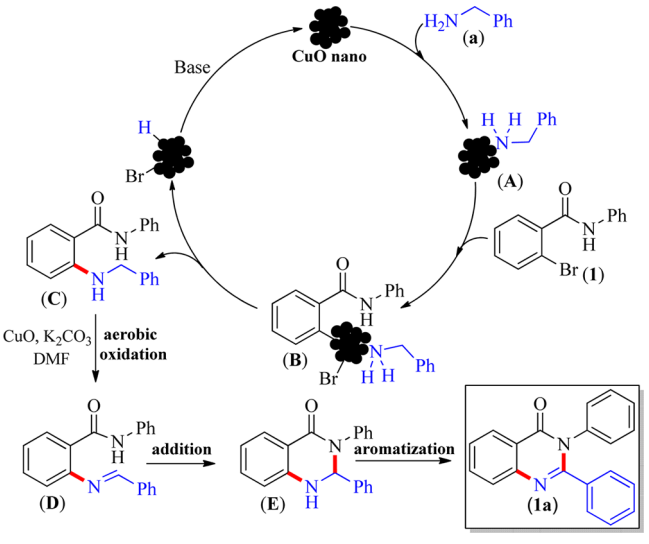
Scheme 2. Control Experiments



product (**2a**). The isolated Ullmann product (**2′**) when subjected to the standard reaction condition was transformed to 2-phenyl-3-(*p*-tolyl)quinazolin-4(3*H*)-one (**2a**) in 86% yield [Scheme 2 (ii)], suggesting its intermediacy during the course of the reaction.

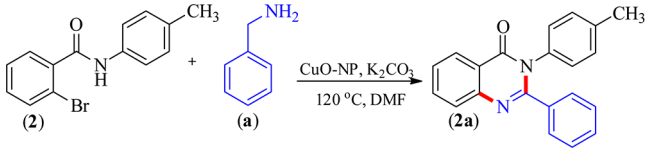
On the basis of the above results and from literature precedence, a plausible mechanism for the formation of 2,3-disubstituted quinazolinones has been proposed as depicted in Scheme 3. It is assumed that the mechanistic path goes via oxidative addition followed by reductive elimination (Scheme 3). Benzylamine (**a**) stabilized active cluster of CuO nanoparticle (**A**) undergoes oxidative addition with 2-bromo-*N*-phenylbenzamide (**1**) to form intermediate (**B**), which on subsequent reductive elimination generates Ullmann-type coupled product (**C**). Removal of hydrogen halide with base regenerates the CuO nanoparticle which maintains the catalytic cycle (Scheme 3). Copper catalyzed aerobic oxidation of (**C**) gives an imine intermediate (**D**). An intramolecular nucleophilic attack of the amidic N−H onto the imine carbon generates (**E**) which is finally oxidized to give product (**1a**) (Scheme 3).

Scheme 3. Mechanistic Pathway



To check the efficacy of the catalyst for the next catalytic cycle, the catalyst was recovered from the reaction mixture by centrifugation and was washed thoroughly with ethyl acetate and water. The catalytic efficiency of the recovered catalyst was examined up to three cycles by coupling (**2**) and (**a**) under standard reaction conditions. It was found that the catalytic activity of the recovered CuO was slightly lower in subsequent cycles (Table 2). After the third cycle, the reaction mixture

Table 2. Recyclability of CuO-Nanoparticles



run	catalyst recovery (%)	time (h)	product yield (%)
1[a]	92	9	78
2[b]	87	13	72
3[b]	81	17	67

[a]2-Bromo-*N*-(*p*-tolyl)benzamide (**2**) (0.25 mmol), benzylamine (**a**) (0.5 mmol), CuO-nanoparticle (0.0125 mmol), K_2CO_3 (0.75 mmol), and DMF (2 mL) under air at 120 °C. [b]The recovered catalyst was used under identical reaction conditions as in the first run.

containing the catalyst was centrifuged, and its surface morphology was analyzed and compared with that of a fresh catalyst using TEM (Figure 2), which shows agglomeration of the catalyst during the course of the reaction.

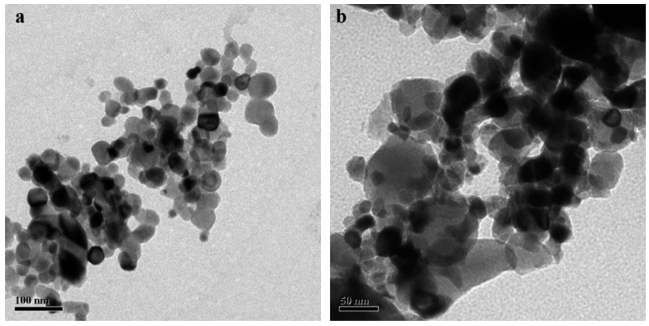


Figure 2. TEM Images of (a) Fresh CuO nanocatalyst and (b) CuO nanocatalyst after third cycle.

CONCLUSIONS

We have developed a CuO nanoparticle catalyzed simple and efficient method for the synthesis of 2,3-disubstituted quinazolinones by coupling of 2-halobenzamides and (aryl)-methanamines. This reaction operates through sequential C−N bond formation, aerobic oxidation, and intramolecular cyclization without the requirement of ligand and additives. The

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method is advantageous as it offers low catalyst loading, high yield, and recyclability of the catalyst and tolerance of a wide range of functional groups.

EXPERIMENTAL PROCEDURES

All of the compounds were commercial grade and used without further purification. Organic extracts were dried over anhydrous sodium sulfate. Solvents were removed in a rotary evaporator under reduced pressure. Silica gel (60−120 mesh size) was used for the column chromatography. Reactions were monitored by TLC on silica gel 60 F254 (0.25 mm). NMR spectra were recorded in $CDCl_3$ with tetramethylsilane as internal standard for proton NMR (400 and 600 MHz) and $CDCl_3$ solvent as the internal standard for ^{13}C NMR (100 and 150 MHz). HRMS spectra were recorded using ESI mode. IR spectra were recorded in KBr or neat.

General Procedure for the Synthesis of 2-Phenyl-3-(*p*-tolyl)quinazolin-4(3*H*)-one (2a). To an oven-dried round-bottomed flask charged with a stir bar, 2-bromo-*N*-(*p*-tolyl)benzamide (**2**) (0.25 mmol, 72.5 mg), benzylamine (**a**) (0.5 mmol, 53.5 mg), CuO nano (5 mol %, 1 mg), and K_2CO_3 (3 equiv., 0.75 mmol, 103.5 mg) in DMF (2 mL) were added and stirred on a preheated oil bath at 120 °C for 9 h. After the completion of the reaction (as indicated by the TLC), the reaction mixture was cooled to room temperature and admixed with water (10 mL), and the product was extracted with ethyl acetate (2 × 20 mL). The organic phase was dried over anhydrous Na_2SO_4, and the solvent was removed under vacuum. The crude product was then purified by column chromatography (ethyl acetate/hexane, 1.2:8.7) to afford corresponding quinazolinone **2a** (61 mg, 78%).

2,3-Diphenylquinazolin-4(3*H*)-one (1a). White solid (53 mg, 71%); mp 151−152 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.15 (d, 2H, J = 6.8 Hz), 7.22 (d, 2H, J = 7.6 Hz), 7.25−7.29 (m, 3H), 7.32−7.35 (m, 3H), 7.53−7.57 (m, 1H), 7.82−7.83 (m, 2H), 8.36 (d, 1H, J = 7.6 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.2, 127.4, 127.5, 127.6, 128.0, 128.2, 128.6, 129.2, 129.3, 129.5, 135.0, 135.6, 137.9, 147.7, 155.4, 162.5. IR (KBr): 3056, 2922, 2848, 1681, 1551, 1464,, 1336, 1265, 1022, 774, 697 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{15}N_2O$ (MH^+) 299.1179; found 299.1184.

3-Phenyl-2-(*p*-tolyl)quinazolin-4(3H)-one (1b). White solid (59 mg, 75%); mp 175−176 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.27 (s, 3H), 7.00 (d, 2H, J = 8.4 Hz), 7.15 (d, 2H, J = 6.8 Hz), 7.22 (d, 2H, J = 8.4 Hz), 7.25−7.35 (m, 3H), 7.50−7.54 (m, 1H), 7.79−7.81(m, 2H), 8.34 (d, 1H, J = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.5, 121.1, 127.3, 127.4, 127.9, 128.5, 128.8, 129.15, 129.18, 129.3, 132.8, 134.9, 138.0, 139.7, 147.8, 155.5, 162.6. IR (KBr): 2979, 2923, 2853, 1680, 1544, 1464, 1334, 1263, 1107, 822, 770, 697 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{17}N_2O$ (MH^+) 313.1335; found 313.1341.

2-(4-Methoxyphenyl)-3-phenylquinazolin-4(3*H*)-one (1c). White solid (58 mg, 71%); mp 144−145 °C. ^1H NMR (600 MHz, $CDCl_3$): δ (ppm) 3.75 (s, 3H), 6.72 (d, 2H, J = 8.4 Hz), 7.16 (d, 2H, J = 7.8 Hz), 7.29 (q, 3H, J = 9.6 Hz), 7.35 (t, 2H, J = 7.8 Hz), 7.52 (s, 1H), 7.81 (s, 2H), 8.34 (d, 1H, J = 7.8 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 55.4, 113.5, 120.9, 127.2, 127.3, 127.7, 127.9, 128.5, 129.15, 129.23, 130.9, 134.9, 138.0, 147.7, 155.1, 160.4, 162.6. IR (KBr): 3529, 3061, 2927, 1678, 1602, 1546, 1464, 1336, 1254, 1179, 1026, 778, 699 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{17}N_2O_2$ (MH^+) 329.1285; found 329.1292.

2-(4-Chlorophenyl)-3-phenylquinazolin-4(3*H*)-one (1d). White solid (56 mg, 67%); mp 169−170 °C. ^1H NMR (600 MHz, $CDCl_3$): δ (ppm) 7.14 (d, 2H, J = 5.6 Hz), 7.18 (d, 2H, J = 7.2 Hz) 7.28 (d, 2H, J = 5.6 Hz), 7.30−7.35 (m, 3H), 7.52−7.55 (m, 1H), 7.81 (t, 2H, J = 4.0 Hz), 8.34 (d, 1H, J = 5.2 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.1, 127.4, 127.7, 128.0, 128.5, 128.9, 129.2, 129.4, 130.6, 134.1, 135.0, 135.8, 137.7, 147.5, 154.2, 162.3; IR (KBr): 3251, 3047, 2924, 2843, 1681, 1544, 1464, 1333, 1262, 1085, 1013, 833, 770, 696 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{14}ClN_2O$ (MH^+) 333.0789; found 333.0792.

2-(4-Fluorophenyl)-3-phenylquinazolin-4(3*H*)-one (1e). Yellow solid (49 mg, 62%); mp 163−165 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 6.90 (t, 2H, J = 8.4 Hz), 7.13 (d, 2H, J = 6.8 Hz), 7.29−7.36 (m, 5H), 7.51−7.55 (m, 1H), 7.81 (d, 2H, J = 5.6 Hz), 8.34 (d, 1H, J = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 115.2, 115.5, 121.09, 121.13, 127.4, 127.6, 127.9, 128.7, 129.25, 129.31, 131.3, 131.4, 135.0, 137.8, 147.5, 154.4, 162.4, 164.4. IR (KBr): 3181, 3047, 2911, 1684, 1601, 1504, 1335, 1272, 1226, 1132, 1017, 842, 769, 694 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{14}FN_2O$ (MH^+) 317.1085; found 317.1093.

2-(4-Nitrophenyl)-3-phenylquinazolin-4(3*H*)-one (1f). Orange solid (44 mg, 51%); mp 163−165 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.05 (t, 1H, J = 7.6 Hz), 7.24 (t, 1H, J = 7.6 Hz), 7.49−7.42 (m, 3H), 7.64 (d, 1H, J = 8.0 Hz), 7.69 (d, 2H, J = 8.0 Hz), 8.17 (d, 2H, J = 8.8 Hz), 8.36 (d, 2H, J = 8.8 Hz), 8.65 (d, 1H, J = 8.4 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.2, 122.1, 123.4, 123.9, 124.2, 125.7, 128.8, 129.2, 129.5, 129.6, 130.4, 133.4, 137.3, 139.7, 140.4, 167.7. IR (KBr): 3300, 3228, 2922, 2852, 1654, 1600, 1523, 1438, 1338, 1251, 904, 760, 693 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{14}N_3O_3$ (MH^+) 344.1030; found 344.1025.

2-Phenyl-3-(p-tolyl)quinazolin-4(3*H*)-one (2a). Yellow solid (62 mg, 78%); mp 172−174 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.30 (s, 3H), 7.01 (d, 2H, J = 8.4 Hz), 7.10 (d, 2H, J = 8.4 Hz), 7.19−7.25 (m, 3H), 7.34 (d, 2H, J = 6.8 Hz), 7.50−7.54 (m, 1H), 7.79−7.83 (m, 2H), 8.34 (d, 1H, J = 8.8 Hz,). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.3, 121.1, 127.4, 127.9, 128.1, 128.9, 129.2, 129.4, 129.8, 134.8, 135.1, 135.7, 138.5, 147.7, 155.5, 162.6. IR (KBr): 3033, 2916, 2853, 1883, 1591, 1504, 1337, 1269, 1109, 1022, 771, 696 cm^{-1}. HRMS (ESI): calcd.for $C_{21}H_{17}N_2O$. (MH^+) 313.1335; found 313.1343.

2,3-Di-*p*-tolylquinazolin-4(3*H*)-one (2b). Yellow solid (67 mg, 82%); mp 168−169 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.28 (s, 3H), 2.32 (s, 3H), 7.02 (d, 4H, J = 8.4 Hz), 7.12 (d, 2H, J = 8.0 Hz), 7.25 (t, 2H, J = 5.2 Hz), 7.49−7.53 (m, 1H), 7.77−7.82 (m, 2H), 8.34 (d, 1H, J = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.2, 21.3, 120.9, 127.0, 127.2, 127.6, 128.6, 128.7, 129.0, 129.1, 129.6, 134.6, 135.1, 138.3, 139.4, 147.6, 155.5, 162.5. IR (KBr): 3036, 2922, 2857, 1686, 1556, 1510, 1469, 1339, 1270, 1181, 1022, 818, 774 cm^{-1}. HRMS (ESI): calcd.for $C_{22}H_{19}N_2O$ (MH^+) 327.1492; found 327.1498.

2-(4-Methoxyphenyl)-3-(*p*-tolyl)quinazolin-4(3*H*)-one (2c). Yellow solid (68 mg, 79%); mp 155−156 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.32 (s, 3H), 3.75 (s, 3H), 6.72 (d, 2H, J = 9.2 Hz), 7.02 (d, 2H, J = 8.0 Hz), 7.13 (d, 2H, J = 8.4 Hz), 7.29 (d, 2H, J = 9.2 Hz), 7.47−7.51 (m, 1H), 7.75−7.80 (m, 2H), 8.32 (d, 1H, J = 7.2 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.4, 55.4, 113.5, 121.0, 127.1, 127.4, 127.7, 128.2, 128.9, 129.9, 130.9, 134.8, 135.4, 138.4, 147.8, 155.3, 160.4, 162.8. IR (KBr): 3060, 3022, 2957, 2836, 1685, 1589, 1507, 1463, 1333, 1245, 1025, 835, 773 cm^{-1}. HRMS (ESI): calcd.for $C_{22}H_{19}N_2O_2$ (MH^+) 343.1441; found 343.1449.

2-(4-Chlorophenyl)-3-(*p*-tolyl)quinazolin-4(3*H*)-one (2d). Yellow solid (58 mg, 67%); mp 183−184 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.31 (s, 3H), 6.99 (d, 2H, J = 8.0 Hz), 7.11 (d, 2H, J = 8.0 Hz), 7.17 (d, 2H, J = 8.8 Hz), 7.32 (d, 2H, J = 8.0 Hz), 7.48−7.52 (m, 1H), 7.73−7.81 (m, 2H), 8.31 (d, 1H, J = 7.6 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.4, 121.1, 127.4, 127.6, 127.8, 128.4, 128.8, 129.1, 130.0, 130.6, 134.2, 134.9, 135.6, 138.8, 147.5, 154.4, 162.4. IR (KBr): 3055, 2922, 2843, 1680, 1546, 1333, 1263, 1123, 1012, 833, 766, 690 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{16}ClN_2O$ (MH^+) 347.0946; found 347.0951.

3-(4-Methoxyphenyl)-2-phenylquinazolin-4(3*H*)-one (3a). Yellow solid (63 mg, 77%); mp 195−197 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 3.77 (s, 3H), 6.81 (d, 2H, J = 8.4 Hz), 7.05 (d, 2H, J = 9.2 Hz), 7.21−7.26 (m, 3H), 7.34 (d, 2H, J = 6.0 Hz), 7.49−7.55 (m, 1H), 7.80−7.83 (m, 2H), 8.35 (d, 1H, J = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 55.6, 114.4, 121.2, 127.4, 127.9, 128.1, 128.2, 129.2, 129.4, 130.2, 130.5, 134.9, 135.8, 147.7, 155.7, 159.4, 162.8. IR (KBr): 3064, 2964, 2832, 1680, 1559, 1503, 1338, 1245, 1024, 830, 770, 699 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{17}N_2O_2$ (MH^+) 329.1285; found 329.1291.

3-(4-Methoxyphenyl)-2-(*p*-tolyl)quinazolin-4(3*H*)-one (3b). Yellow solid (73 mg, 85%); mp 237−239 °C. ^1H NMR (400 MHz,

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$CDCl_3$): δ (ppm) 2.28 (s, 3H), 3.77 (s, 3H), 6.82 (d, 2H, *J* = 8.8 Hz), 7.01−7.07 (m, 4H), 7.23 (d, 2H, *J* = 8.0 Hz), 7.48−7.52 (m, 1H), 7.73−7.81 (m, 2H), 8.33 (d, 1H, *J* = 7.2 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.5, 55.6, 114.4, 121.0, 127.2, 127.3, 127.8, 128.9, 129.1, 130.2, 130.6, 132.9, 134.8, 139.5, 147.8, 155.8, 159.3, 162.8. IR (KBr): 3059, 3031, 2962, 2835, 1685, 1609, 1564, 1584, 1471, 1346, 1252, 1023, 817, 777, 619, 543 cm^{-1}. HRMS (ESI): calcd. for $C_{22}H_{19}N_2O_2$ (MH^+) 343.1441; found 343.1449.

2,3-Bis(4-methoxyphenyl)quinazolin-4(3*H*)-one (3c). White solid (73 mg, 81%); mp 134−136 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 3.76 (s, 3H), 3.78 (s, 3H), 6.73 (d, 2H, *J* = 8.4 Hz), 6.84 (d, 2H, *J* = 8.8 Hz), 7.04−7.07 (m, 2H), 7.27−7.32 (m, 2H), 7.47−7.51 (m, 1H), 7.75−7.80 (m, 2H), 8.32 (d, 1H, *J* = 7.6 Hz). ^{13}C NMR (150 MHz, $CDCl_3$): δ (ppm) 55.4, 55.6, 113.6, 114.5, 121.0, 127.1, 127.4, 127.8, 128.2, 130.2, 130.8, 130.9, 134.8, 147.8, 155.4, 159.3, 160.4, 162.9. IR (KBr): 3064, 2924, 2838, 1677, 1604, 1507, 1466, 1252, 1174, 1023, 827, 776 cm^{-1}. HRMS (ESI): calcd. for $C_{22}H_{19}N_2O_3$ (MH^+) 359.1390; found 359.1396.

2-(4-Chlorophenyl)-3-(4-methoxyphenyl)quinazolin-4(3*H*)-one (3d). White solid (64 mg, 71%); mp 161−162 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 3.79 (s, 3H), 6.84 (d, 2H, *J* = 9.2 Hz), 7.04 (d, 2H, *J* = 9.2 Hz), 7.21 (d, 2H, *J* = 8.8 Hz), 7.29 (d, 2H, *J* = 8.8 Hz), 7.51−7.55 (m, 1H), 7.77−7.83 (m, 2H), 8.33 (d, 1H, *J* = 8.4 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 55.6, 114.6, 121.1, 127.5, 127.6, 127.9, 128.5, 130.16, 130.20, 130.6, 134.3, 135.0, 135.7, 147.6, 154.6, 159.5, 162.6. IR (KBr): 3328, 3052, 2928, 1676, 1505, 1330, 1244, 1176, 1022, 831, 777 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{16}ClN_2O_2$ (MH^+) 363.0895; found 363.0901.

3-(4-Chlorophenyl)-2-phenylquinazolin-4(3*H*)-one (4a). Yellow solid (49 mg, 59%); mp 190−196 °C.^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.07−7.10 (m, 2H), 7.22−7.34 (m, 7H), 7.51−7.56 (m, 1H), 7.81 (d, 2H, *J* = 4.0 Hz), 8.33 (d, 1H, *J* = 7.6 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 120.9, 127.4, 127.6, 128.0, 128.4, 129.1, 129.4, 129.8, 130.6, 134.5, 135.1, 135.3, 136.3, 147.5, 155.0, 162.3. IR (KBr): 3056, 3035, 1678, 1565, 1471, 1340, 1271, 1089, 1017, 838, 770, 699 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{14}ClN_2O$ (MH^+) 333.0789; found 333.0795.

3-(4-Chlorophenyl)-2-(*p*-tolyl)quinazolin-4(3*H*)-one (4b). Yellow solid (55 mg, 64%); mp 130−134 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.29 (s, 3H), 7.04 (d, 2H, *J* = 8.4 Hz), 7.09 (d, 2H, *J* = 8.8 Hz), 7.21 (d, 2H, *J* = 8.4 Hz), 7.29 (d, 2H, *J* = 8.8 Hz), 7.49−7.53 (m, 1H), 7.79 (d, 2H, *J* = 4.4 Hz), 8.31 (d, 1H, *J* = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 21.5, 120.8, 127.3, 127.5, 127.9, 129.05, 129.09, 129.4, 130.6, 132.4, 134.4, 135.0, 136.5, 140.0, 147.6, 155.0, 162.4. IR (KBr): 3063, 2919, 2846, 1692, 1593, 1467, 1334, 1268, 1085, 1015, 815, 771 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{16}ClN_2O$ (MH^+) 347.0946; found 347.0939.

2,3-Bis(4-chlorophenyl)quinazolin-4(3*H*)-one (4d). White solid (47.5 mg, 52%); mp 174−176 °C.^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.09 (d, 2H, *J* = 8.4 Hz),7.22−7.33 (m, 6H), 7.55 (t, 1H, *J* = 6.8 Hz), 7.76−7.84 (m, 2H), 8.32 (d, 1H, *J* = 7.6 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 120.9, 127.4, 127.9, 128.0, 128.7, 129.7, 130.5, 130.6, 133.7, 134.8, 135.2, 136.07, 136.11, 147.4, 153.8, 162.2. IR (KBr): 3062, 2922, 2848, 1682, 1596, 1486, 1336, 1268, 1086, 1012, 832, 764, 689 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{13}Cl_2N_2O$ (MH^+) 367.0399; found 367.0390.

3-Phenyl-2-(pyridin-2-yl)quinazolin-4(3*H*)-one (1g). White solid (48 mg, 64%); mp 155−156 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.16 (t, 1H, *J* = 6.4 Hz), 7.20 (d, 2H, *J* = 8.0 Hz), 7.25−7.32 (m, 3H), 7.50 (d, 1H, *J* = 8.0 Hz), 7.57 (t, 1H, *J* = 6.8 Hz), 7.63 (d, 1H, *J* = 8.0 Hz), 7.81−7.87 (m, 2H), 8.37−8.41 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.6, 122.6, 123.9, 124.5, 127.4, 127.9, 128.1, 128.4, 128.9, 129.1, 134.9, 136.5, 137.5, 147.4, 149.0, 153.5, 162.2. IR (KBr): 3182, 3059, 2923, 2853, 1686, 1582, 1467, 1353, 1277, 775, 695 cm^{-1}. HRMS (ESI): calcd. for $C_{19}H_{14}N_3O$ (MH^+) 300.1131; found 300.1126.

3-Phenyl-2-(pyridin-3-yl)quinazolin-4(3*H*)-one (1h). Brown solid (50 mg, 67%); mp 170−172 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.17 (d, 3H, *J* = 6.8 Hz), 7.30−7.38 (m, 3H), 7.55−7.62 (m, 2H), 7.81−7.86 (m, 2H), 8.36 (d, 1H, *J* = 7.2 Hz), 8.58 (bd, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.2, 127.5, 127.96, 128.01, 129.1, 129.3, 129.6, 135.1, 136.4, 137.3, 147.5, 149.9, 150.3, 152.7, 162.2. IR (KBr): 3041, 2923, 2854, 1677, 1591, 1469, 1338, 1276, 1022, 951 cm^{-1}. HRMS (ESI): calcd. for $C_{19}H_{14}N_3O$ (MH^+) 300.1131; found 300.1136.

2-Phenyl-3-(pyridin-2-yl)quinazolin-4(3*H*)-one (5a). Brown solid (40 mg, 53%); mp 180−182 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.19−7.27 (m, 4H), 7.31 (d, 1H, *J* = 8.0 Hz), 7.38 (d, 2H, *J* = 6.8 Hz), 7.52−7.56 (m, 1H), 7.71−7.75 (m, 1H), 7.79−7.85 (m. 2H), 8.36 (d, 1H, *J* = 7.6 Hz), 8.45 (d, 1H, *J* = 4.8 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.2, 123.9, 124.8, 127.3, 127.6, 128.1, 128.3, 129.0, 129.6, 135.1, 135.6, 138.2, 147.8, 149.6, 151.5, 154.7, 162.5. IR (KBr): 3063, 2923, 2848, 1682, 1556, 1463, 1336, 1080, 773, 697 cm^{-1}. HRMS (ESI): calcd. for $C_{19}H_{14}N_3O$ (MH^+) 300.1131; found 300.1127.

2,3-Di(pyridin-2-yl)quinazolin-4(3H)-one (5g). Brown semi-solid (29 mg, 39%); ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.14 (t, 1H, *J* = 4.0 Hz), 7.19 (t, 1H, *J* = 4.8 Hz), 7.54−7.58 (m, 1H), 7.71 (d, 1H, *J* = 7.6 Hz), 7.73−7.77 (m, 1H), 7.80−7.86 (m, 3H), 7.98 (d, 1H, *J* = 7.6 Hz), 8.18 (d, 2H, *J* = 13.2 Hz), 8.38 (d, 1H, *J* = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.5, 123.2, 123.8, 125.1, 125.4, 127.4, 127.9, 128.1, 135.1, 136.9, 137.4, 147.4, 148.1, 148.5, 151.5, 152.7, 153.6, 162.2. IR (KBr): 3057, 2923, 2851, 2362, 1677, 1587, 1468, 1341, 1283, 770, 689 cm^{-1}. HRMS (ESI): calcd for $C_{18}H_{13}N_4O$ (MH^+) 301.1084; found 301.1091.

2-Phenyl-3-(*o*-tolyl)quinazolin-4(3*H*)-one (6a). Yellow solid (47 mg, 60%); mp 142−143 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.14 (s, 3H), 7.06 (d, 1H, *J* = 7.6 Hz), 7.13 (t, 1H, *J* = 8.4 Hz), 7.18−7.28 (m, 5H), 7.34 (d, 2H, *J* = 6.8 Hz), 7.54 (t, 1H, *J* = 6.4 Hz), 7.80−7.86 (m, 2H), 8.37 (d, 1H, *J* = 7.6 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 18.1, 121.1, 126.8, 127.39, 127.42, 127.9, 128.0, 128.8, 129.2, 129.6, 131.2, 134.9, 135.3, 135.8, 137.0, 147.9, 155.6, 162.0. IR (KBr): 3061, 2959, 1678, 1592, 1465, 1332, 1269, 1126, 1023, 947 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{17}N_2O$ (MH^+) 313.1335; found 313.1329.

2-(2-Fluorophenyl)-3-(*o*-tolyl)quinazolin-4(3*H*)-one (6i). Yellow solid (34 mg, 41%); mp 117−119 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.16 (s, 3H), 6.88 (t, 1H, *J* = 9.6 Hz), 7.05 (t, 1H, *J* = 7.6 Hz), 7.08−7.13 (m, 2H), 7.16 (d, 2H, *J* = 4.0 Hz), 7.21−7.27 (m, 1H), 7.35 (t, 1H, *J* = 7.2 Hz), 7.55−7.59 (m, 1H), 7.80−7.85 (m, 2H), 8.39 (d, 1H, *J* = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 17.9, 115.6, 115.9, 121.4, 124.03, 124.1, 126.5, 127.4, 127.8, 127.9, 129.0, 129.3, 129.7, 130.9, 131.7, 131.8, 134.9, 136.1, 147.6, 151.6, 157.7, 160.1, 161.5. IR (KBr): 3062, 2917, 1681, 1590, 1461, 1335, 1272, 1220, 1102, 947 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{16}FN_2O$ (MH^+) 331.1241; found 331.1237.

8-Methyl-2,3-diphenylquinazolin-4(3*H*)-one (7a). Yellow solid (48 mg, 61%); mp 123−125 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 2.67 (s, 3H), 7.14 (d, 2H, *J* = 7.6 Hz), 7.19 (d, 2H, *J* = 7.2 Hz), 7.24 (t, 1H, *J* = 4.4 Hz), 7.31 (q, 3H, *J* = 7.6 Hz), 7.35 (d, 2H, *J* = 8.0 Hz), 7.41 (d, 1H, *J* = 7.6 Hz), 7.64 (d, 1H, *J* = 7.6 Hz), 8.19 (d, 1H, *J* = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 17.6, 121.0, 125.0, 127.0, 128.0, 128.5, 129.1, 129.2, 129.3, 129.4, 135.5, 135.9, 136.5, 138.1, 146.2, 153.7, 162.9. IR (KBr): 3052, 2932, 2748, 1679, 1555, 1434,, 1346, 1285, 1012 cm^{-1}. HRMS (ESI): calcd. for $C_{21}H_{16}N_2O$ (MH^+) 313.1335; found 313.1341.

7-Fluoro-2,3-diphenylquinazolin-4(3*H*)-one (8a). Yellow solid (55 mg, 69%); mp 207−209 °C. ^{1}H NMR (600 MHz, $CDCl_3$): δ (ppm) 7.13 (d, 2H, *J* = 7.2 Hz), 7.21 (t, 2H, *J* = 7.2 Hz), 7.25−7.28 (m, 3H), 7.31 (t, 4H, *J* = 7.8 Hz), 7.47 (d, 1H, *J* = 9.6 Hz), 8.35 (t, 1H, *J* = 7.2 Hz). ^{13}C NMR (150 MHz, $CDCl_3$): δ (ppm) 113.2, 113.3, 116.2, 116.3, 117.8, 121.3, 125.5, 128.2, 128.7, 129.1, 129.7, 130.1, 130.2, 135.3, 137.6, 149.9, 156.7, 161.8, 166.1, 167.8. IR (KBr): 3042, 2952, 2778, 1682, 1515, 1444,, 1346, 1285, 1012 cm^{-1}. HRMS (ESI): calcd. for $C_{20}H_{13}FN_2O$ (MH^+) 317.1085; found 317.1079.

7-Chloro-2,3-diphenylquinazolin-4(3*H*)-one (9a). White solid (56 mg, 67%); mp: 180−182 °C. ^{1}H NMR (600 MHz, $CDCl_3$): δ (ppm) 7.13 (d, 2H, *J* = 7.2 Hz), 7.21 (t, 2H, *J* = 7.8 Hz), 7.25−7.29 (m, 2H), 7.31 (bs, 4H), 7.48 (d, 1H, *J* = 8.4 Hz), 7.82 (s, 1H), 8.27 (d, 1H, *J* = 8.4 Hz); ^{13}C NMR (150 MHz, $CDCl_3$): δ (ppm) 119.6, 121.2,

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127.5, 127.6, 128.1, 128.2, 128.8, 128.9, 129.1, 129.13, 129.19, 129.2, 129.8, 137.6, 141.2, 156.6, 162.0; IR (KBr): 3032, 2912, 2758, 1672, 1565, 1134, 1006, 995 cm^{-1}; HRMS (ESI): calcd. for $C_{20}H_{13}ClN_2O$ (MH^+) 333.0789; found 333.0795.

3-Butyl-2-phenylquinazolin-4(3H)-one (10a). White solid (51 mg, 73%); mp 108−110 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 0.74 (t, 3H, J = 7.6 Hz), 1.11−1.18 (m, 2H), 1.54−1.61 (m, 2H), 3.96 (t, 2H, J = 7.6 Hz), 7.46−7.53 (m, 6H), 7.70−7.76 (m, 2H), 8.32 (d, 1H, J = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 13.6, 20.0, 30.9, 45.9, 121.1, 126.9, 127.1, 127.6, 127.9, 128.9, 129.9, 134.4, 135.7, 147.3, 156.4, 162.3. IR (KBr): 3037, 2959, 2926, 2860, 1669, 1585, 1464, 1362, 1073, 772, 700 cm^{-1}. HRMS (ESI): calcd. for $C_{18}H_{19}N_2O$ (MH^+) 279.1492; found 279.1484.

3-Butyl-2-(*p*-tolyl)quinazolin-4(3*H*)-one (10b). Yellow gummy (56 mg, 77%). ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 0.77 (t, 3H, J = 7.2 Hz), 1.12−1.22 (m, 2H), 1.54−1.62 (m, 2H), 2.43 (s, 3H), 3.98 (t, 2H, J = 7.6 Hz), 7.30 (d, 2H, J = 8.0 Hz), 7.41 (d, 2H, J = 7.6 Hz), 7.46−7.50 (m, 1H),7.70−7.75 (m, 2H), 8.31 (d, 1H, J = 8.0 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 13.6, 20.1, 21.6. 30.9, 45.9, 121.0, 126.9, 127.0, 127.6, 127.9, 129.5, 132.9, 134.4, 140.0, 147.4, 156.6, 162.4. IR (KBr): 3342, 2959, 2927, 2867, 1680, 1561, 1468, 1373, 1233, 1176, 1079, 1023, 821, 776, 700 cm^{-1}. HRMS (ESI): calcd. for $C_{19}H_{21}N_2O$ (MH^+) 293.1648; found 293.1655.

3-Butyl-2-(4-methoxyphenyl)quinazolin-4(3*H*)-one (10c). Yellow gummy (58 mg, 75%). ^1H NMR (400 MHz, $CDCl_3$) δ (ppm) 0.77 (t, 3H, J = 7.6 Hz), 1.13−1.22 (m, 2H), 1.54−1.61 (m, 2H), 3.86 (s, 3H), 4.00 (t, 2H, J = 7.6 Hz), 7.01 (d, 2H, J = 8.8 Hz), 7.45−7.49 (m, 3H), 7.69−7.75 (m, 2H), 8.30 (d, 1H, J = 8.4 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 13.7, 20.1, 31.0, 45.9, 55.6, 114.2, 121.0, 126.9, 127.0, 127.5, 128.2, 129.6, 134.4, 147.4, 156.3, 160.8, 162.5. IR (KBr): 3070, 2959, 2929, 2867, 1676, 1609, 1512, 1466, 1294, 1251, 1176, 1029, 838, 776 cm^{-1}. HRMS (ESI): calcd. for $C_{19}H_{21}N_2O_2$ (MH^+) 309.1598; found 309.1607.

3-Butyl-2-(4-chlorophenyl)quinazolin-4(3*H*)-one (10d). Yellow semisolid (54 mg, 69%). ^1H NMR (400 MHz, $CDCl_3$) δ (ppm) 0.78 (t, 3H, J = 7.6 Hz), 1.16−1.24 (m, 2H), 1.53−1.61 (m, 2H), 3.96 (t, 2H, J = 8.0 Hz), 7.50−7.53 (m, 5H), 7.70 (d, 1H, J = 8.0 Hz), 7.76 (t, 1H, J = 8.4 Hz), 8.32 (d, 1H, J = 7.6 Hz). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 13.7, 20.1, 31.0, 46.0, 121.1, 127.0, 127.4, 127.6, 129.3, 129.5, 134.2, 134.6, 136.2, 147.2, 155.3, 162.2. IR (KBr): 2960, 2927, 2864, 1684, 1599, 1466, 1366, 1231, 1083, 825, 786, 696 cm^{-1}. HRMS (ESI): calcd. for $C_{18}H_{18}ClN_2O$ (MH^+) 313.1102; found 313.1110.

2-Phenylquinazolin-4(3*H*)-one (11a). White solid (43 mg, 77%); mp 229−230 °C. ^1H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.51 (t, 1H, J = 8.4 Hz), 7.59 (bs, 3H), 7.79−7.86 (m, 2H), 8.27 (bs, 2H), 8.33 (d, 1H, J = 7.6 Hz), 11.83 (s,1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm) 121.1, 126.6, 127.0, 127.6, 128.2, 129.2, 131.9, 133.0, 135.1, 149.7, 151.9, 164.1. IR (KBr): 3196, 3067, 2956, 1669, 1603, 1476, 1292, 1144 cm^{-1}. HRMS (ESI): calcd. for $C_{14}H_{11}N_2O$ (MH^+) 223.0866; found 223.0874.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acssuschemeng.5b00817.

Scanned spectra (^1H and ^{13}C NMR) of all the synthesized compounds; crystallographic description of compound **3b** (PDF)

checkCIF/PLATON report (PDF)

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Notes

The authors declare no competing financial interest.

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