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Palladium-Catalyzed C12-Selective Direct Arylation of [1,2-*c*]Quinazolin-6(5*H*)-ones

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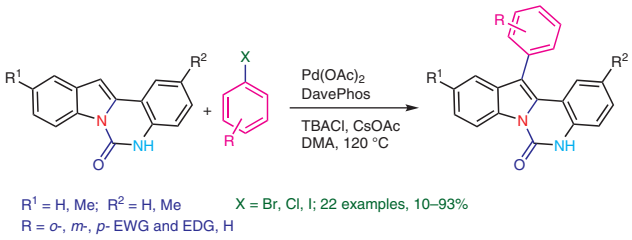

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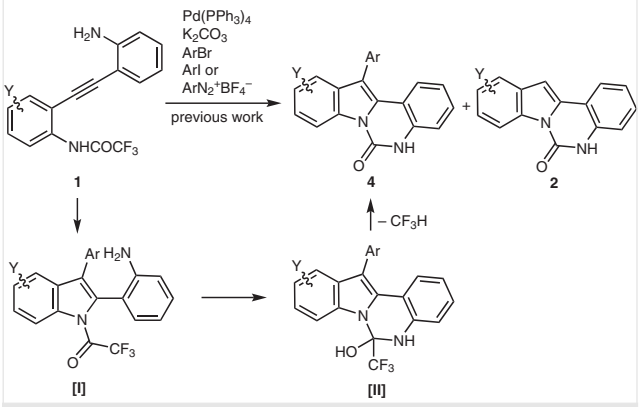
Abstract A straightforward approach to the synthesis of the challenging 12-arylindolo[1,2-*c*]quinazolin-6(5*H*)-ones through the palladium-catalyzed direct arylation of *N*-benzyl and NH-free [1,2-*c*]quinazolin-6(5*H*)-ones with aryl halides is described.

Key words indoles, quinazolinones, palladium, arylation, polycycles

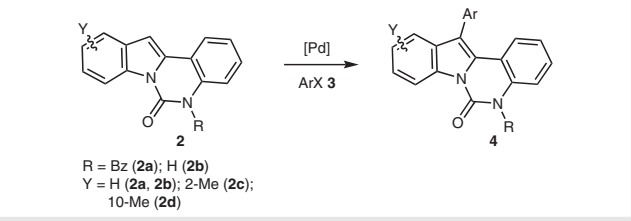
The quinazolinone nucleus is a key constituent of many natural products and represents a versatile building block for structurally diverse alkaloids and pharmaceuticals.[1] More specifically, the quinazolinones fused to an indole unit, and their synthetic congeners have been relevant targets due to their structural architectures and promising bioactivities. Indoloquinazolinones alkaloids exhibit antibiotic,[2] antiparasitic,[3] anticancer,[4] and antitubercular activities.[5] Recently, as part of our ongoing efforts in developing more sustainable methodologies of heterocycles, we focused on the synthesis of the challenging 12-arylindolo[1,2-*c*]quinazolin-6(5*H*)-ones through a straightforward one-pot approach involving the palladium-catalyzed aminoarylation of the triple bond of readily available *o*-[(*o*-aminophenyl)ethynyl]trifluoroacetanilides **1** with ArI, ArBr, and $ArN_2^+BF_4^-$, followed by cyclization of the resulting 2-(*o*-aminophenyl)-3-aryl-*N*-trifluoroacetylindole intermediate [**I**].[6] Then, the sequential process provided the title compounds **4** by means of a fairly rare elimination of trifluoromethane from the intermediate [**II**] (Scheme 1).[7] However, variable amounts (10–20%) of 12-unsubstituted indoloquinazolinone derivatives **2** were isolated as side product of the reaction.



Scheme 1 Previously reported approach to 12-arylindolo[1,2-*c*]quinazolin-6(5*H*)-ones **4**

A competitive base- or palladium-promoted cyclization of **1** has been supposed to be involved in the formation of type **2** products. To overcome this drawback, we envisaged to employ compounds **2** as alternative starting materials for the preparation of the desired compounds **4** through their palladium-catalyzed C12-selective direct arylation (Scheme 2), a topic that has received continuous attention and witnessed significant progress during the past decades.[8] In particular, transition-metal-catalyzed C–H bond activation has emerged as a powerful method in the field of organic synthesis. Although, since the seminal paper by Ohta and coworkers reporting the C2-arylation of several heteroaromatics, the palladium-catalyzed so-called direct arylation

of heteroaryl derivatives proved to be an extremely reliable method for the synthesis of a wide variety of arylated heterocycles, the selective arylation of [1,2-*c*]quinazolin-6(5*H*)-ones has not been explored so far.[9] Herein, we report on the regioselectivity and reactivity of *N*-benzyl and NH-free [1,2-*c*]quinazolin-6(5*H*)-ones in the presence of palladium complexes. The scope of the direct arylation with a variety of aryl halides was also examined.



Scheme 2 Palladium-catalyzed C12-selective direct arylation of [1,2-*c*]quinazolin-6(5*H*)-ones **3**

Initially, we explored the reaction of the N-substituted 5-benzylindolo[1,2-*c*]quinazolin-(5*H*)-one (**2a**) with an excess of 4-bromoanisole (**3a**) using 5 mol% of the palladium catalyst and different base/solvent/additive combinations at 120 °C. The results are gathered in Table 1. When 1,4-dioxane or toluene was used as the solvent, the reaction was disappointing with K_2CO_3 and CsOAc in the presence of $Pd(PPh_3)_4$ or $Pd(OAc)_2$/*t*-Bu_3PHBF_4 as the catalytic system with and without Me_3CO_2H as the additive (Table 1, entries 1–3). DMA proved to be the best-tested solvent in both bases. In the presence of $Pd(OAc)_2$ as the catalyst under ligandless conditions[10] and K_2CO_3 as the base, the regioselective arylation at C-12 occurred after prolonged reaction time, but in low yield (entry 4). A little better result was observed with the same palladium catalyst in DMA in the presence of CsOAc as the base and a stoichiometric amount of TBACl, which was supposed to give beneficial effect by stabilizing the Pd(0) species (entry 5).[11] Further improvement was obtained by the addition of 2 equivalents of *i*-Pr_2NH to facilitate both the reduction of Pd(II) and the subsequent oxidative addition of the aryl bromide **3a** to Pd(0) (entry 6). However, $Pd_2(dba)_3$ resulted as a less effective catalyst under these latter conditions (entry 7). When a set of combination of $Pd(OAc)_2$ with phosphine ligands was screened (Figure 1), DavePhos **A** proved to play a critical role in the success of this arylation reaction. Indeed, the formation of **4aa** occurred in 79% yield by using the $Pd(OAc)_2$/DavePhos

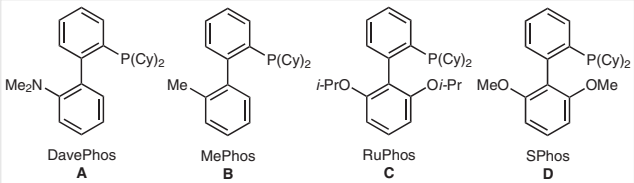
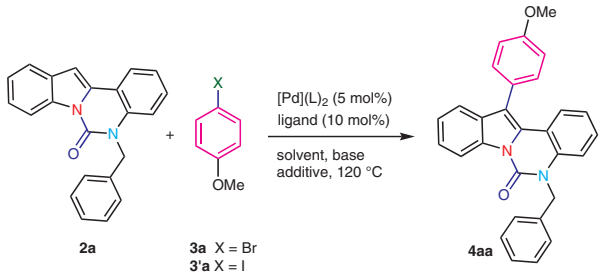


Figure 1 Buchwald ligands employed in screening reactions

Table 1 Optimization of the Synthesis of **4aa**[a]



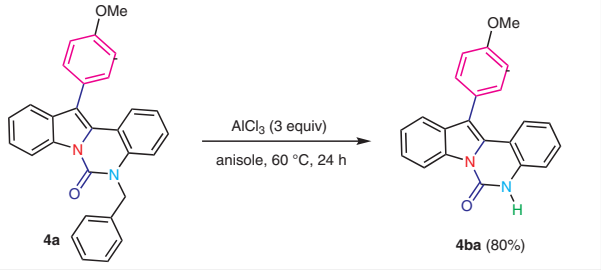
Entry	Solvent/base	Pd/ligand/additive (equiv)	X	Yield (%)[b,c] of **4aa**
1	1,4-dioxane /K_2CO_3	$Pd(PPh_3)_4$	Br	–
2	toluene/K_2CO_3	$Pd(OAc)_2$/*t*-Bu_3PHBF_4/Me_3CO_2H (3)	Br	10 (10)
3	toluene/CsOAc	$Pd(OAc)_2$/*t*-Bu_3PHBF_4/–	Br	– (–)
4	DMA/K_2CO_3	$Pd(OAc)_2$/–/–	Br	23 (52)
5	DMA/CsOAc	$Pd(OAc)_2$/–/TBACl (1)	Br	34 (55)
6	DMA/CsOAc	$Pd(OAc)_2$/–/TBACl (1), *i*-Pr_2NH (2)	Br	59 (30)
7	DMA/CsOAc	Pd_2dba_3/TBACl (1), *i*-Pr_2NH (2)	Br	25
8	DMA/CsOAc	$Pd(OAc)_2$/**A**/TBACl (1), *i*-Pr_2NH (2)	Br	66 (20)
9	**DMA/CsOAc**	**$Pd(OAc)_2$/A/TBACl (1)**	**Br**	**79 (16)**
10	DMA/CsOAc	$Pd(OAc)_2$/**A**/TBACl (3)	Br	64 (28)
11	DMA/CsOAc[d]	$Pd(OAc)_2$/**A**/TBACl (1)	Br	37 (50)
12	DMA/CsOAc	$Pd(OAc)_2$/**A**/TBABr (1)	Br	42 (41)
13	DMA/KOAc	$Pd(OAc)_2$/**A**/TBACl (1)	Br	68 (25)
14	DMA/CsOAc	$Pd(OAc)_2$/**A**/–	Br	39 (51)
15	DMA/CsOAc	$Pd(OAc)_2$/**B**/TBACl (1)	Br	56 (27)
16	DMA/CsOAc	$Pd(OAc)_2$/**C**/TBACl (1)	Br	52 (38)
17	DMA/CsOAc	$Pd(OAc)_2$/**D**/TBACl (1)	Br	56 (43)
18	DMA/Cs_2CO_3	$Pd(OAc)_2$/**D**/TBACl (1)	Br	– (51)
19	DMA/CsOAc	$Pd(OAc)_2$/**A**/TBACl (1)	I	63 (30)

[a] Reactions were carried out at 120 °C on a 0.308 mmol scale, using 3 equiv of **3**, 2 equiv of base, 0.10 equiv of ligand, and 0.05 equiv of Pd in 3 mL of solvent under argon atmosphere for 24–48 h.
[b] Yields are given for isolated products.
[c] Numbers in parentheses refer to the recovered **2a**.
[d] Reaction temperature: 130 °C

combination in the presence of 1 equivalent of TBACl, whereas under the presence of both TBACl and *i*-Pr_2NH the product was isolated in a lower yield (entries 8, 9). Increasing the amount of TBACl to 3 equivalents under the presence of the same catalytic system gave a lower yield of **4aa** as well as increasing the temperature to 130 °C (entries 10, 11). Worse results were observed by changing TBACl to TBABr (entry 12) and CsOAc to KOAc (entry 13). In the absence of any additive, the product **4aa** was isolated in only 39% yield (entry 14). Other bulky monodentate ligands **B**, **C**, and **D** (Figure 1) proved to be less effective for this coupling (entries 15–17) and the key role of the feature of the base is

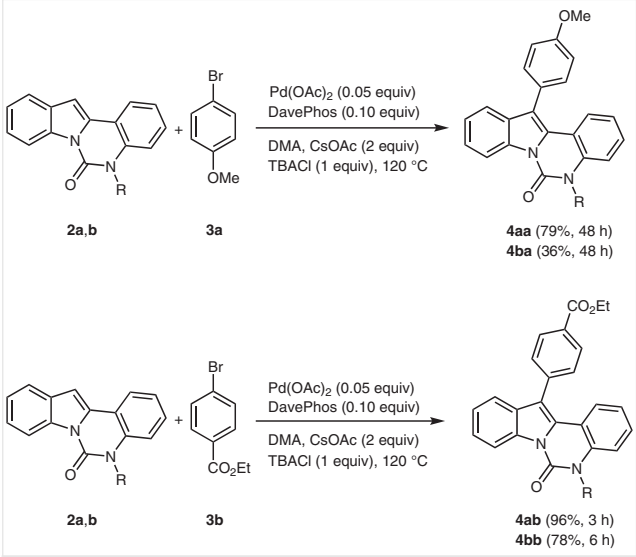
clearly highlighted by comparison of the results observed in entries 17 versus 18 of Table 1. When the direct arylation of **2a** was carried out under the best reaction conditions with 4-iodoanisole (**3'a**) as aryl donor, lower yield was observed (entry 9 vs 19).

The deprotection of **4a** was found to proceed smoothly in the presence of $AlCl_3$ in anisole at 60 °C (Scheme 3).[12]



Scheme 3 Deprotection of **4a**

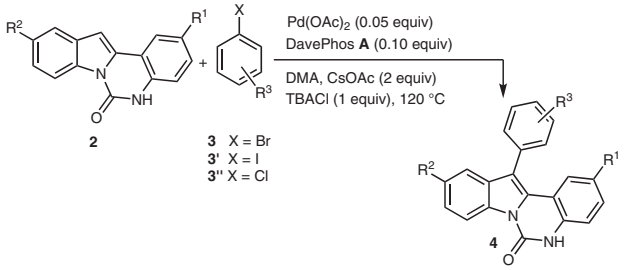
Interestingly, the direct arylation of the unprotected indolo[1,2-*c*]quinazolin-6(5*H*)-one (**2b**) can also occur in satisfactory yield under the best reaction conditions of entry 9 of Table 1. A comparison of the results observed in the reaction of **2a**,**b** with the aryl bromides **3a**,**b** is shown in the following Scheme 4.



Scheme 4 Comparative arylation of the N-protected and -unprotected indolo[1,2-*c*]quinazolin-6(5*H*)-ones **2a**,**b**

Then, these conditions were selected for exploring the scope and limitations of the direct arylation of the unprotected indolo[1,2-*c*]quinazolin-6(5*H*)-ones **2** with aryl bromides. The reaction of indolo[1,2-*c*]quinazolin-6(5*H*)-ones **2b–d** with different aryl bromides **3a–k** in the presence of $Pd(OAc)_2$/DavePhos catalytic system, TBACl as an additive, and CsOAc as the base in DMA at 120 °C proceeded to give the target NH-free indoloquinazolinones **4** in moderate to high yields (Table 2). Several substituents, including methoxy, carboxyethyl, methyl, chloro, cyano, formyl, and nitro groups, were tolerated on the aromatic ring of **3**. Higher yields were observed in the presence of electron-withdrawing substituents on the *para*-position of the aromatic ring of bromides. However, aryl bromides with *meta*-electron-donating substituents gave the target compounds **4** in satisfactory to good yields. In the presence of the 3-OMe group, an increased yield on the formation of the corresponding product **4bc** was observed by increasing the amount of the

Table 2 Scope of the Reaction of **2** with Aryl Halides **3**[a]



Entry	R^1	R^2	Ar–X, R^3	Time (h)	**4** Yield (%)[b]
1	H	H	**3a**, 4-OMe	48	**4ba** (36)
2	H	H	**3''a**, 4-OMe	48	**4ba** (30)
3	H	H	**3b**, 4-CO_2Et	6	**4bb** (78)
4	H	H	**3c**, 3-OMe	24	**4bc** (72)
5	H	H	**3c**, 3-OMe	27	**4bc** (88)[c]
6	H	H	**3d**, 4-CN	18	**4bd** (75)
7	H	H	**3e**, 4-Me	72	**4be** (41)
8	H	H	**3f**, 4-CHO	20	**4bf** (93)
9	H	H	**3g**, 3-Cl	48	**4bg** (50)
10	H	H	**3h**, H	48	**4bh** (76)
11	H	H	**3i**, 2-CN	48	**4bi** (48)
12	H	H	**3j**, 3-Me	48	**4bj** (84)
13	H	H	**3k**, 3-NO_2	24	**4bk** (86)
14	Me	H	**3b**, 4-CO_2Et	48	**4ca** (66)
15	Me	H	**3c**, 3-OMe	72	**4cc** (56)
16	Me	H	**3h**, H	48	**4ch** (62)
17	Me	H	**3j**, 3-Me	48	**4cj** (78)
18	H	Me	**3f**, 4-CHO	30	**4df** (65)
19	H	Me	**3h**, H	72	**4dh** (60)
20	H	H	**3''l**, 4-COMe	48	**4bl''** (67)
21	H	H	**3''d**, 4-CN	48	**4bd** (50)
22	H	H	**3''f**, 4-CHO	48	**4bf** (48)
23	H	H	**3''c**, 3-OMe	48	**4bc** (10)

[a] Reactions were carried out with 0.427 mmol of **2**, 1.281 mmol of **3**, 0.854 mmol of CsOAc, 0.427 mmol of TBACl, 0.043 mmol of DavePhos **A**, and 0.021 mmol of $Pd(OAc)_2$ in DMA (4 mL) at 120 °C under argon atmosphere.
[b] Isolated yield.
[c] TBACl: 0.93 mmol.

TBACl to 3 equivalents (Table 2, entry 5). The *ortho*-substituents on aryl halides generally have an important influence on the yield of the arylation due to their steric and/or coordination properties. Moderate yield was achieved in the presence of nitrile group at the *ortho*-position of ArBr (entry 11), while with more bulky substituents such as methoxy and acetyl groups the CH arylation does not work.

The use of aryl chlorides **3″** as a useful alternative to aryl bromides has been briefly investigated. Moderate yields were observed in the presence of electron-withdrawing substituents on the *para*-position of the aromatic ring of chlorides (Table 2, entries 20–22). However, less reactive aryl chloride gave the target compound **4** in unsatisfactory yield (entry 23). Further work is in progress to improve these results.

In conclusion, we have reported here a complementary protocol for the synthesis of challenging 12-arylindolo[1,2-*c*]quinazolin-6(5*H*)-ones **4** through a direct palladium-catalyzed arylation of both N-protected and NH-free indolo[1,2-*c*]quinazolin-6(5*H*)-ones **2** with aryl bromides, iodides, The methodology is quite versatile and tolerates a variety of useful functional groups. Substituents can be introduced also in the benzene ring of both indole and quinazolinone moieties. Further work is in progress to extend the methodology to other σ-donors.

Melting points are uncorrected. All of the reagents, catalysts, and solvents are commercially available and were used as purchased, without further purification. Indolo[1,2-*c*]quinazolin-6(5*H*)-ones **2a–c** were obtained by cyclization of the corresponding *o*-[(*o*-aminophenyl)ethynyl]trifluoroacetanilides **1a–c** with $PdCl_2(MeCN)_2$ followed by cyclization on the crude (DMSO, K_2CO_3, 110 °C).[13] The *o*-[(*o*-aminophenyl)ethynyl]trifluoroacetanilides **1a–c** were prepared via a Sonogashira cross-coupling of 2-iodotrifluoroacetanilides with 2-ethynylanilines according to the literature.[6,14] Starting materials were purified on axially compressed columns, packed with SiO_2 25–40 μm, connected to a preparative pump for solvent delivery and to a refractive index detector, and eluting with *n*-hexane/EtOAc mixtures. Reaction products were purified by flash chromatography using SiO_2 as stationary phase, eluting with *n*-hexane/EtOAc or hexane/EtOAc/MeOH or $CHCl_3/CH_2Cl_2$ mixtures, depending on the solubility. ^{1}H NMR (400.13 MHz), ^{13}C NMR (100.6 MHz), and ^{19}F NMR (376.5 MHz) spectra were recorded on a Bruker Avance 400 spectrometer. Standard abbreviations are used to denote the splitting patterns. Compound **4be** was derivatized as the *N*-methyl derivative for obtaining suitable NMR data. IR spectra were recorded on a Jasco FT/IR-430 spectrophotometer. ESI accurate mass measurements were recorded using an Orbitrap Exactive mass spectrometer with ESI source. The following compounds were identified by comparison of their physical and spectral data with those given in the cited references: **1a–c**,[6,15] **2b**,[7] **4ba–c**,**d**,**h**, **4ca**.[6]

Sequential Preparation of Indolo[1,2-*c*]quinazolin-6(5*H*)-ones 2; Indolo[1,2-*c*]quinazolin-6(5*H*)-one (2b); Typical Procedure

To a stirred solution of $PdCl_2(MeCN)_2$ (42.6 mg, 0.164 mmol) in MeCN (10 mL) was added *o*-[(*o*-aminophenyl)ethynyl]trifluoroacetanilide (**1a**; 1.0 g, 3.286 mmol) and the mixture was stirred at 80 °C for 24 h. Then the mixture was cooled to r.t. and concentrated under reduced pressure. The crude was dissolved in DMSO (20 mL) and K_2CO_3 (0.908 g, 6.572 mmol) was added. The mixture was stirred at 100 °C for 24 h, cooled to r.t., diluted with CH_2Cl_2 (200 mL), washed with brine (50 mL), dried (Na_2SO_4), and concentrated under reduced pressure. The residue was purified by flash chromatography (silica gel, *n*-hexane–EtOAc, 80:20 v/v) to afford **2b**; yield: 0.654 g (85%); white powder; mp 276–278 °C (Lit.[7] mp 280 °C); R_f = 0.2 (*n*-hexane–EtOAc 60:40).

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.37 (br s, 1 H), 8.60–8.52 (m, 1 H), 8.53 (dd, J_1 = 8.0 Hz, J_2 = 0.9 Hz, 1 H), 7.78–7.72 (m, 1 H), 7.48–4.41 (m, 1 H), 7.40–7.33 (m, 3 H), 7.31–7.22 (m, 2 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.6 (q), 134.7 (q), 134.6 (q), 133.8 (q), 130.1 (q), 129.9 (CH), 124.1 (CH), 123.9 (CH), 123.4 (overlapping, CH), 120.7 (CH), 115.9 (CH), 115.8 (CH), 114.1 (q), 98.7 (CH).

5-Benzylindolo[1,2-*c*]quinazolin-6(5*H*)-one (2a)

Yield: 0.527 g (95%); beige powder; mp 190–192 °C; R_f = 0.2 (*n*-hexane–EtOAc 80:20).

IR (KBr): 2920, 2850, 1681, 1471, 1383 cm^{-1}.

^{1}H NMR (400.13 MHz, $CDCl_3$): δ = 8.72–8.60 (m, 1 H), 7.88 (dd, J_1 = 7.8 Hz, J_2 = 1.3 Hz, 1 H), 7.67–7.60 (m, 1 H), 7.35–7.09 (m, 9 H), 7.05 (d, J = 8.3 Hz, 1 H), 7.02 (s, 1 H), 5.47 (s, 2 H).

^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 148.4 (q), 136.3 (q), 134.9 (q), 134.5 (q), 133.2 (q), 130.0 (q), 129.2 (CH), 128.9 (CH), 127.5 (CH), 126.5 (CH), 123.90 (CH), 123.87 (CH), 123.6 (CH), 123.2 (CH), 120.1 (CH), 116.5 (CH), 115.6 (q), 115.3 (CH), 98.4 (CH), 46.8 (CH_2).

HRMS: *m*/*z* [M + Na]$^+$ calcd for $C_{22}H_{16}N_2ONa$: 347.1155; found: 347.1162.

2-Methylindolo[1,2-*c*]quinazolin-6(5*H*)-one (2c)

Yield: 0.611 g (98%); beige powder; mp 265–268 °C; R_f = 0.2 (*n*-hexane–EtOAc 80:20).

IR (KBr): 3398, 2919, 1556, 1643, 1384 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.29 (br s, 1 H), 8.60–8.52 (m, 1 H), 7.92 (s, 1 H), 7.78–7.71 (m, 1 H), 7.40–7.31 (m, 3 H), 7.26 (dd, J_1 = 8.2 Hz, J_2 = 1.4 Hz, 1 H), 7.17 (d, J = 8.2 Hz, 1 H), 2.39 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.6 (q), 134.6 (q), 133.8 (q), 132.6 (q), 132.5 (q), 130.9 (CH), 130.1 (q), 123.9 (CH), 123.8 (CH), 123.3 (CH), 120.6 (CH), 115.9 (CH), 115.7 (CH), 113.9 (q), 98.4 (CH), 21.0 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{16}H_{11}N_2O$: 247.0877; found: 247.0876.

10-Methylindolo[1,2-*c*]quinazolin-6(5*H*)-one (2d)

Yield: 0.504 g (80%); beige powder; mp 281–282 °C; R_f = 0.2 (*n*-hexane–EtOAc 80:20).

IR (KBr): 3390, 2919, 2854, 1703, 1644, 1383, 1402 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.33 (br s, 1 H), 8.42 (d, J = 8.4 Hz, 1 H), 8.08 (dd, J_1 = 7.9 Hz, J_2 = 1.0 Hz, 1 H), 7.53 (s, 1 H), 7.45–7.40 (m, 1 H), 7.31–7.16 (m, 4 H) 2.46 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.9 (q), 134.7 (q), 134.6 (q), 132.9 (q), 132.1 (q), 130.4 (q), 129.8 (CH), 124.9 (CH), 124.1 (CH), 123.4 (CH), 120.3 (CH), 115.8 (CH), 115.6 (CH), 114.1 (q), 98.4 (CH), 21.7 (CH_3).

HRMS *m*/*z* [M – H]$^-$ calcd for $C_{16}H_{11}N_2O$: 247.0877; found: 247.0876.

12-Arylindolo[1,2-*c*]quinazolin-6(5*H*)-ones 4; Ethyl 4-(6-Oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzoate (4bb); Typical Procedure

In a 50 mL Carousel Tube Reactor (Radely Discovery Technology) containing a magnetic stirring bar, $Pd(OAc)_2$ (4.8 mg, 0.021 mmol) and DavePhos **A** (16.8 mg, 0.043 mmol) were dissolved in anhyd DMA (1.0 mL) at r.t. Then, indolo[1,2-*c*]quinazolin-6(5*H*)-one (**2b**; 0.100 g, 0.427 mmol), 1-bromo-4-carbethoxybenzene (**3b**; 0.293 g, 1.281 mmol), TBACl (0.118 g, 0.427 mmol), CsOAc (0.164 g, 0.854 mmol), and DMA (3 mL) were added. The reaction mixture was stirred for 6 h at 120 °C under argon. After this time, the mixture was cooled to r.t., diluted with EtOAc (200 mL), and washed with H_2O (50 mL). The organic extract was dried (Na_2SO_4) and concentrated under reduced pressure. The residue was purified by flash chromatography (silica gel, *n*-hexane–EtOAc 80:20 v/v; $CHCl_3$–CH_2Cl_2 75:25 v/v) to afford **4bb**; yield: 0.128 g (78%); white powder; mp 292–294 °C (Lit.[6] mp 292–294 °C); R_f = 0.2 ($CHCl_3$–CH_2Cl_2, 75:25).

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.51 (br s, 1 H), 8.67 (d, *J* = 8.2 Hz, 1 H), 8.19 (d, *J* = 8.4 Hz, 2 H), 7.73 (d, *J* = 8.4 Hz, 2 H), 7.48–7.34 (m, 5 H), 7.29 (dd, J_1 = 8.2 Hz, J_2 = 0.8 Hz, 1 H), 7.02–6.96 (m, 1 H), 4.40 (q, *J* = 7.1 Hz, 2 H), 1.39 (t, *J* = 7.1 Hz, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 166.0 (CO_2Et), 147.5 (q), 139.3 (q), 135.4 (q), 132.9 (q), 131.2 (CH), 130.5 (CH), 130.4 (q), 130.0 (CH), 129.8 (q), 129.3 (q), 124.4 (CH), 124.3 (CH), 123.8 (CH), 123.0 (CH), 118.7 (CH), 116.23 (CH), 116.20 (CH), 114.02 (q), 113.99 (q), 61.4 (CH_2), 14.7 (CH_3).

5-Benzyl-12-(4-methoxyphenyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4aa)

Yield: 0.145 g (79%); pale yellow powder; mp 181–183 °C; R_f = 0.2 (*n*-hexane–EtOAc 75:25).

IR (KBr): 2924, 1690, 1384, 1250, 1030 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 8.69 (d, *J* = 8.3 Hz, 1 H), 7.62 (dd, J_1 = 8.0 Hz, J_2 = 1.0 Hz, 1 H), 7.53–7.24 (m, 12 H), 7.19 (d, *J* = 8.8 Hz, 2 H), 7.06–7.00 (m, 1 H), 5.57 (s, 2 H), 3.88 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 159.5 (q), 148.3 (q), 137.1 (q), 135.3 (q), 133.2 (q), 131.9 (CH), 131.5 (q), 129.7 (CH), 129.2 (CH), 127.8 (q), 127.7 (CH), 127.0 (CH), 125.8 (CH), 124.4 (CH), 124.2 (CH), 123.2 (CH), 119.1 (CH), 116.4 (CH), 116.2 (CH), 115.9 (q), 115.3 (CH), 115.2 (CH), 55.7 (CH_3), 46.4 (CH_2).

HRMS: *m*/*z* [M + Na]$^+$ calcd for $C_{29}H_{22}N_2O_2Na$: 453.1573; found: 453.1584.

Ethyl 4-(5-Benzyl-6-oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzoate (4ab)

Yield: 0.187 g (96%); pale yellow powder; mp 196–198 °C; R_f = 0.2 (*n*-hexane–EtOAc 75:25).

IR (KBr): 2921, 1680, 1446, 1401, 1272, 1109 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 8.72 (d, *J* = 8.2 Hz, 1 H), 8.20 (d, *J* = 8.4 Hz, 2 H), 7.76 (d, *J* = 8.4 Hz, 2 H), 7.54 (dd, J_1 = 8.1 Hz, J_2 = 1.1 Hz, 1 H), 7.51–7.45 (m, 1 H), 7.43–7.24 (m, 9 H), 7.07–7.00 (m, 1 H), 5.59 (s, 2 H), 4.40 (q, *J* = 7.1 Hz, 2 H), 1.39 (t, *J* = 7.1 Hz, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 166.0 (CO_2Et), 148.2 (q), 139.3 (q), 137.0 (q), 135.4 (q), 133.4 (q), 131.2 (CH), 130.7 (q), 130.6 (CH), 130.1 (CH), 129.9 (q), 129.2 (CH), 128.3 (q), 127.7 (CH), 127.0 (CH), 124.7 (CH), 124.3 (CH), 123.4 (CH), 118.9 (CH), 116.6 (CH), 116.4 (CH), 115.4 (q), 114.2 (q), 61.4 (CH_2), 46.4 (CH_2), 14.7 (CH_3).

HRMS: *m*/*z* [M + Na]$^+$ calcd for $C_{31}H_{24}N_2O_3Na$: 495.1679; found 495.1689.

12-(4-Methoxyphenyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4ba)

Yield: 0.052 g (36%); pale yellow powder; mp 290–292 °C (Lit.[6] mp 290–292 °C); R_f = 0.2 (*n*-hexane–EtOAc 75:25).

^{1}H NMR (DMSO-d_6): δ = 11.41 (br s, 1 H), 8.64 (d, *J* = 8.0 Hz, 1 H), 7.50–7.31 (m, 7 H), 7.26 (d, *J* = 7.5 Hz, 1 H), 7.20 (d, *J* = 8.7 Hz, 2 H), 6.99–6.93 (m, 1 H), 3.87 (s, 3 H).

^{13}C NMR (DMSO-d_6): δ = 159.4 (q), 147.6 (q), 135.2 (q), 132.8 (q), 131.9 (CH), 131.2 (q), 129.6 (CH), 128.9 (CH), 125.8 (q), 124.14 (CH), 124.09 (CH), 123.7 (CH), 122.9 (CH), 119.0 (CH), 116.1 (CH), 116.0 (q), 115.2 (CH), 115.0 (q), 114.5 (q), 55.6 (CH_3).

12-(3-Methoxyphenyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4bc)

Yield: 0.128 g (88%); pale yellow powder; mp 215–217 °C (Lit.[6] mp 215–217 °C); R_f = 0.2 ($CHCl_3$–CH_2Cl_2 75:25).

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.44 (br s, 1 H), 8.65 (d, *J* = 8.2 Hz, 1 H), 7.56–7.46 (m, 2 H), 7.44–7.31 (m, 4 H), 7.27 (d, *J* = 8.0 Hz, 1 H), 7.13–7.06 (m, 3 H), 6.98 (t, *J* = 8.0 Hz, 1 H), 3.81 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 160.3 (q), 147.6 (q), 135.4 (q), 135.2 (q), 132.8 (q), 130.8 (overlapping, CH), 129.7 (CH), 128.9 (q), 124.2 (CH), 124.1 (CH), 123.9 (CH), 122.9 (CH), 122.8 (q), 118.9 (CH), 116.11 (CH), 116.07 (CH), 116.0 (CH), 115.1 (q), 114.3 (q), 114.2 (CH), 55.6 (CH_3).

4-(6-Oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzonitrile (4bd)

Yield: 0.107 g (75%); yellow powder; mp 262–264 °C (Lit.[6] mp 262–264 °C); R_f = 0.3 (*n*-hexane–EtOAc–MeOH 70:20:10).

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.54 (br s, 1 H), 8.67 (d, *J* = 8.2 Hz, 1 H), 8.08 (d, *J* = 8.2 Hz, 2 H), 7.79 (d, *J* = 8.2 Hz, 2 H), 7.47–7.33 (m, 5 H), 7.29 (d, *J* = 8.2 Hz, 1 H), 7.04–6.97 (m, 1 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.5 (q), 139.5 (q), 135.4 (q), 133.7 (CH), 133.0 (q), 132.0 (CH), 130.2 (q), 130.1 (CH), 129.5 (CH), 124.48 (CH), 124.45 (CH), 123.8 (CH), 123.1 (CH), 119.3 (q), 118.6 (CH), 116.3 (overlapping, q, CH), 113.8 (q), 113.5 (q), 111.2 (q).

12-(4-Tolyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4be)

Yield: 0.057 g (41%); pale yellow powder; mp 210–212 °C; R_f = 0.3 ($CHCl_3$–CH_2Cl_2 80:20).

IR (KBr): 3375, 2931, 1698, 1450 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ (as *N*-methyl derivative) = 8.68 (d, *J* = 8.2 Hz, 1 H), 7.60 (d, *J* = 7.9 Hz, 1 H), 7.51–7.46 (m, 2 H), 7.45–7.41 (m, 5 H), 7.37–7.34 (m, 2 H), 7.10–7.04 (m, 1 H), 3.70 (s, 3 H), 2.47 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ (as *N*-methyl derivative) = 147.8 (q), 137.8 (q), 136.2 (q), 133.2 (q), 131.1 (q), 131.0 (q), 130.54 (CH), 130.48 (CH), 129.9 (CH), 127.8 (q), 124.34 (CH), 124.27 (CH), 123.9 (CH), 123.1 (CH), 119.0 (CH), 116.3 (CH), 115.8 (CH), 115.5 (q), 115.1 (q), 30.8 (CH_3), 21.5 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{22}H_{15}N_2O$: 323.1190; found: 323.1191.

4-(6-Oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzaldehyde (4bf)

Yield: 0.134 g (93%); white powder; mp 266–268 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3389, 2921, 2850, 1650, 1407, 1380 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.52 (br s, 1 H), 10.15 (br s, 1 H), 8.67 (d, J = 8.1 Hz, 1 H), 8.13 (d, J = 7.8 Hz, 2 H), 7.80 (d, J = 7.8 Hz, 2 H), 7.47–6.23 (m, 6 H), 6.96 (t, J = 7.5 Hz, 1 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 193.3 (CHO), 147.5 (q), 140.6 (q), 136.0 (q), 135.4 (q), 133.0 (q), 131.7 (CH), 130.8 (CH), 130.3 (q), 130.0 (CH), 129.4 (q), 124.40 (CH), 124.37 (CH), 123.8 (CH), 123.0 (CH), 118.7 (CH), 116.2 (CH), 114.0 (q), 113.9 (q).

HRMS: m/z [M – H]$^-$ calcd for $C_{22}H_{13}N_2O_2$: 337.0983; found: 337.0977.

12-(3-Chlorophenyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4bg)

Yield: 0.074 g (50%); white powder; mp 274–276 °C; R_f = 0.2 (*n*-hexane–EtOAc 70:30).

IR (KBr): 3389, 2923, 1701, 1450, 1402 cm^{-1}.

^{1}H NMR (400.13 MHz, $CDCl_3$): δ = 9.87 (br s, 1 H), 8.62 (d, J = 8.2 Hz, 1 H), 7.51–7.24 (m, 8 H), 7.20–7.12 (m, 2 H), 6.94–6.87 (m, 1 H).

^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 148.7 (q), 136.0 (q), 135.0 (q), 133.9 (q), 133.0, (q) 130.9 (q), 130.6 (CH), 130.4 (CH), 129.2 (CH), 128.8 (CH), 128.2 (CH), 124.4 (CH), 124.2 (CH), 124.1 (CH), 123.2 (CH), 118.7 (CH), 116.2 (CH), 115.4 (CH), 114.5 (q), 114.9 (q), 114.6 (q).

HRMS: m/z [M – H]$^-$ calcd for $C_{21}H_{12}ClN_2O$: 343.0644; found: 343.0642.

12-Phenylindolo[1,2-*c*]quinazolin-6(5*H*)-one (4bh)

Yield: 0.101 g (76%); white powder; mp 274–276 °C (Lit.[6] mp 274–276 °C); R_f = 0.2 (*n*-hexane–EtOAc 85:15).

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.49 (br s, 1 H), 8.70 (d, J = 8.2 Hz, 1 H), 7.71–7.56 (m, 5 H), 7.51–7.36 (m, 5 H), 7.32 (dd, J_1 = 8.2 Hz, J_2 = 0.7 Hz, 1 H), 7.03–6.97 (m, 1 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.6 (q), 135.3 (q), 134.0 (q), 132.9 (q), 130.9 (q), 130.7 (CH), 129.75 (CH), 129.71 (CH), 128.9 (q), 128.6 (CH), 124.21 (CH), 124.17 (CH), 123.7 (CH), 122.8 (CH), 118.9 (CH), 116.14 (CH), 116.11 (CH), 115.2 (q), 114.3 (q).

2-(6-Oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzonitrile (4bi)

Yield: 0.069 g (48%); pale yellow powder; mp 275–277 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3399, 1551, 1252, 1008 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.6 (br s, 1 H), 8.69 (d, J = 8.0 Hz, 1 H), 8.14 (d, J = 7.6 Hz, 1 H), 7.96 (t, J = 7.6 Hz, 1 H), 7.82–7.75 (m, 2 H), 7.50–7.26 (m, 5 H), 7.08 (d, J = 8.0 Hz, 1 H), 6.99 (d, J = 8.0 Hz, 1 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.4 (q), 137.8 (q), 135.4 (q), 134.7 (CH), 134.4 (CH), 132.8 (q), 132.6 (CH), 130.30 (q), 130.29 (q), 130.27 (CH), 129.9 (CH), 124.5 (overlapping, CH), 123.4 (CH), 123.3 (CH), 118.6 (CH), 118.2 (q), 116.4 (CH), 116.4 (CH), 113.9 (q), 113.7 (q), 111.0 (q).

HRMS: m/z [M – H]$^-$ calcd for $C_{22}H_{12}N_3O$: 334.0987; found: 334.0987.

12-(3-Tolyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4bj)

Yield: 0.116 g (84%); beige powder; mp 235–237 °C; R_f = 0.2 ($CHCl_3$–CH_2Cl_2 80:20).

IR (KBr): 3417, 2929, 1697, 1608, 1450, 1402 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.43 (br s, 1 H), 8.65 (d, J = 8.2 Hz, 1 H), 7.53–7.39 (m, 3 H), 7.38–7.30 (m, 6 H), 7.27 (d, J = 8.0 Hz, 1 H), 6.96 (t, J = 7.6 Hz, 1 H), 2.42 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.6 (q), 138.9 (q), 135.2 (q), 133.9 (q), 132.8 (q), 131.2 (CH), 130.9 (q), 129.64 (CH), 129.61 (CH), 129.2 (CH), 128.8 (q), 127.8 (CH), 124.2 (CH), 124.1 (CH), 123.8 (CH), 122.8 (CH), 119.0 (CH), 116.11 (CH), 116.07 (CH), 115.3 (q), 114.3 (q), 21.5 (CH_3).

HRMS: m/z [M – H]$^-$ calcd for $C_{22}H_{15}N_2O$: 323.1190; found: 323.1191.

12-(3-Nitrophenyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4bk)

Yield: 0.130 g (86%); pale yellow powder; mp 268–270 °C; R_f = 0.2 ($CHCl_3$–CH_2Cl_2 70:30).

IR (KBr): 3376, 2925, 1384, 1107 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.54 (br s, 1 H), 8.67 (d, J = 8.2 Hz, 1 H), 8.40 (d, J = 8.2 Hz, 1 H), 8.36 (s, 1 H), 8.05 (d, J = 7.6 Hz, 1 H), 7.91 (t, J = 7.9 Hz, 1 H), 7.48–7.33 (m, 5 H), 7.30 (d, J = 8.3 Hz, 1 H), 6.98 (t, J = 7.6 Hz, 1 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 149.0 (q), 147.4 (q), 137.7 (CH), 135.9 (q), 135.4 (q), 132.9 (q), 131.4 (CH), 130.4 (CH), 129.8 (q), 125.4 (CH), 124.5 (CH), 124.4 (CH), 123.7 (CH), 123.5 (CH), 123.1 (CH), 118.5 (CH), 116.27 (CH), 116.26 (q), 113.8 (q), 112.6 (q).

HRMS: m/z [M – H]$^-$ calcd for $C_{21}H_{12}N_3O_3$: 354.0884; found: 354.0886.

Ethyl 4-(2-Methyl-6-oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzoate (4ca)

Yield: 0.108 g (66%); white powder; mp 276–278 °C (Lit.[6] mp 276–278 °C); R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.43 (br s, 1 H), 8.67 (d, J = 8.1 Hz, 1 H), 8.19 (d, J = 8.2 Hz, 2 H), 7.73 (d, J = 8.2 Hz, 2 H), 7.46–7.33 (m, 3 H), 7.26 (s, 1 H), 7.24–7.16 (m, 2 H), 4.40 (q, J = 7.1 Hz, 2 H), 2.07 (s, 3 H), 1.39 (t, J = 7.1 Hz, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 166.0 (CO_2Et), 147.5 (q), 139.3 (q), 133.2 (q), 133.0 (q), 131.8 (q), 131.3 (overlapping, CH), 130.9 (q), 130.39 (q), 130.37 (CH), 129.8 (q), 129.3 (q), 124.3 (CH), 123.8 (CH), 118.7 (CH), 116.2 (CH), 116.1 (CH), 113.9 (CH), 113.8 (q), 61.4 (CH_2), 21.1 (CH_3), 14.7 (CH_3).

12-(3-Methoxyphenyl)-2-methylindolo[1,2-c]quinazolin-6(5*H*)-one (4cc)

Yield: 0.111 g (56%); white powder; mp 246–278 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3388, 2921, 1697, 1384, 1047 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.37 (br s, 1 H), 8.70–8.63 (m, 1 H), 7.53 (t, J = 7.8 Hz, 1 H), 7.44–7.29 (m, 4 H), 7.23–7.07 (m, 5 H), 3.82 (s, 3 H), 2.09 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 160.3 (q), 147.6 (q), 135.4 (q), 133.1 (q), 132.9 (q), 131.6 (q), 130.8 (q), 130.7 (CH), 130.6 (CH), 129.0 (q), 124.14 (CH), 124.12 (CH), 124.0 (CH), 123.0 (CH), 119.0 (CH), 116.1 (CH), 116.0 (CH), 115.99 (CH), 114.9 (q), 114.3 (CH), 114.1 (q), 55.7 (CH_3), 21.2 (CH_3).

HRMS: m/z [M – H]$^-$ calcd for $C_{23}H_{17}N_2O_2$: 353.1296; found: 353.1298.

2-Methyl-12-phenylindolo[1,2-c]quinazolin-6(5*H*)-one (4ch)

Yield: 0.085 g (62%); white powder; mp 230–231 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3408, 2920, 1549, 1398 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.36 (br s, 1 H), 8.65 (d, J = 8.1 Hz, 1 H), 7.66–7.52 (m, 5 H), 7.39–7.32 (m, 3 H), 7.22 (s, 1 H), 7.21–7.15 (m, 2 H), 2.05 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.6 (q), 134.1 (q), 133.0 (q), 132.9 (q), 131.6 (q), 130.9 (q), 130.8 (CH), 130.6 (CH), 129.6 (CH), 129.0 (q), 128.6 (CH), 124.1 (CH), 123.8 (CH), 118.9 (CH), 116.1 (CH), 116.0 (CH), 115.1 (q), 114.1 (q), 21.1 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{22}H_{15}N_2O$: 323.1190; found: 323.1190.

2-Methyl-12-(*m*-tolyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4cj)

Yield: 0.112 g (78%); pale yellow powder; mp 251–252 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3380, 2921, 1696, 1450, 1397, 1120 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.35 (br s, 1 H), 8.66 (d, *J* = 8.1 Hz, 1 H), 7.50 (t, *J* = 8.0 Hz, 1 H), 7.45–7.31 (m, 6 H), 7.29 (s, 1 H), 7.22–7.15 (m, 2 H), 2.43 (s, 3 H), 2.07 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 147.6 (q), 138.8 (q), 133.9 (q), 133.0 (q), 132.9 (q), 131.5 (q), 131.3 (CH), 130.8 (q), 130.5 (CH), 129.5 (CH), 129.1 (CH), 128.9 (q), 127.8 (CH), 124.1 (overlapping, CH), 123.9 (CH), 118.9 (CH), 116.1 (CH), 115.9 (CH), 115.2 (q), 114.2 (q), 21.5 (CH_3), 21.1 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{23}H_{17}N_2O$: 337.1346; found: 337.1349.

4-(10-Methyl-6-oxo-5,6-dihydroindolo[1,2-*c*]quinazolin-12-yl)benzaldehyde (4df)

Yield: 0.097 g (65%); pale yellow powder; mp 286–288 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3354, 2920, 2850, 1682 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.43 (br s, 1 H), 10.16 (s, 1 H), 8.53 (d, *J* = 8.4 Hz, 1 H), 8.15 (d, *J* = 8.2 Hz, 2 H), 7.81 (d, *J* = 8.2 Hz, 2 H), 7.44–7.34 (m, 2 H), 7.31–7.23 (m, 2 H), 7.16 (s, 1 H), 7.01–6.94 (m, 1 H), 2.40 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 193.3 (CHO), 147.4 (q), 140.8 (q), 136.0 (q), 135.4 (q), 133.6 (q), 131.7 (CH), 131.3 (q), 130.8 (CH), 130.6 (q), 129.9 (CH), 129.4 (q), 125.9 (CH), 123.7 (CH), 123.0 (CH), 118.2 (CH), 116.2 (CH), 115.9 (CH), 114.0 (q), 113.7 (q), 21.6 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{23}H_{15}N_2O_2$: 351.1139; found: 351.1141.

10-Methyl-12-phenylindolo[1,2-*c*]quinazolin-6(5*H*)-one (4dh)

Yield: 0.083 g (60%); pale yellow powder; mp 261–262 °C; R_f = 0.2 (*n*-hexane–EtOAc–MeOH 70:20:10).

IR (KBr): 3455, 2924, 1606, 1513, 1400 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.42 (br s, 1 H), 8.51 (d, *J* = 8.5 Hz, 1 H), 7.66–7.58 (m, 2 H), 7.58–7.51 (m, 3 H), 7.40 (d, *J* = 7.7 Hz, 2 H), 7.38–7.32 (m, 1 H), 7.30–7.21 (m, 2 H), 7.12 (s, 1 H), 2.40 (s, 3 H).

^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 147.6 (q), 134.1 (q), 133.0 (q), 132.9 (q), 131.6 (q), 130.9 (q), 130.8 (q), 130.6 (CH), 129.6 (CH), 129.0 (CH), 128.6 (CH), 124.1 (CH), 123.8 (CH), 118.9 (CH), 116.1 (CH), 116.0 (CH), 115.1 (q), 114.1 (CH), 21.1 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{22}H_{15}N_2O$: 323.1190; found: 323.1191.

12-(4-Acetylphenyl)indolo[1,2-*c*]quinazolin-6(5*H*)-one (4bl″)

Yield: 0.100 g (67%); pale yellow powder; mp 181–183 °C; R_f = 0.2 (*n*-hexane–EtOAc 75:25).

IR (KBr): 3408, 2923, 1704, 1682, 1550, 1402, 1318 cm^{-1}.

^{1}H NMR (400.13 MHz, DMSO-d_6): δ = 11.52 (br s, 1 H), 8.68 (d, *J* = 8.2 Hz, 1 H), 8.19 (d, *J* = 8.3 Hz, 2 H), 7.74 (d, *J* = 8.3 Hz, 2 H), 7.50–7.35 (m, 5 H), 7.30 (d, *J* = 7.4 Hz, 1 H), 7.02–6.96 (m, 1 H), 2.70 (s, 3 H).

^{13}C NMR (100.6 MHz, DMSO-d_6): δ = 198.1 (CHO), 147.5 (q), 139.2 (q), 136.7 (q), 135.4 (q), 133.0 (q), 131.2 (CH), 130.5 (q), 130.0 (CH), 129.6 (CH), 129.3 (q), 124.40 (CH), 124.37 (CH), 123.8 (CH), 123.0 (CH), 118.7 (CH), 116.25 (CH), 116.23 (CH), 114.1 (q), 114.0 (q), 27.3 (CH_3).

HRMS: *m*/*z* [M – H]$^-$ calcd for $C_{23}H_{15}N_2O_2$: 351.1139; found: 351.1139.

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Supporting Information

Supporting information for this article is available online at https://doi.org/10.1055/s-0037-1610711.

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