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Copper-Mediated C-H Amination of Imidazopyridines with *N*-Fluorobenzenesulfonimide

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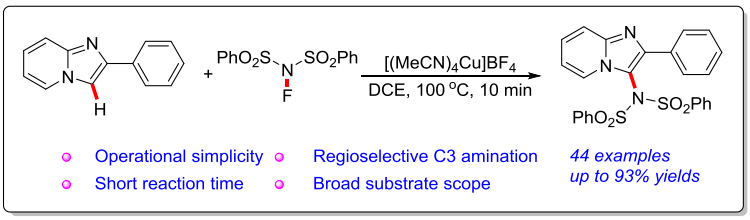
Supporting Information

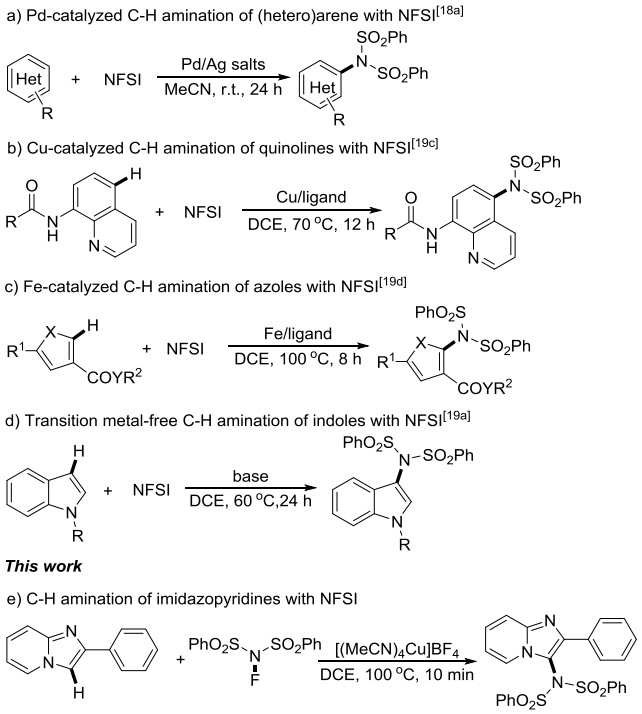


ABSTRACT: A copper-mediated direct C3 amination of imidazopyridines has been disclosed under additive-free conditions in short reaction times. This methodology utilizes commercial available *N*-fluorobenzenesulfonimide (NFSI) as the amino source, which exhibits broad substrate scope and good functional group tolerance. The obtained C3-aminated imidazopyridines can undergo further desulfonylation transformations. Control experiments suggest that this reaction probably proceed via a free radical mechanism. Moreover, NFSI also shows potential application in C-H fluorination of imidazopyridines.

INTRODUCTION

Aminoarenes are ubiquitous scaffolds due to their high synthetic value and wide application in various natural products, pharmaceuticals, functional materials, and ligands for organometallic catalysis.[1] Accordingly, intensive efforts have been devoted to prepare nitrogen-containing compounds in the past decades.[2] The conventional approach to amines involved nitration/reduction sequence, amination of aryl halide, including Ullmann-Goldberg, Buchwalk-Hartwig, and Chan-Evans-Lam Amination.[3] Other typical methods employed electrophilic nitrogen strategy between oxidized nitrogen reagents and carbon necleophiles.[4] Recently, significant achievements have been made in the C-H amination, which avoids prefunctionalization of coupling partners, and thus being more efficient and environmental benign.[5] Various electrophilic amination reagents, including azides,[6a] dioxazolones,[6b,c] chloroamines,[6d] azodicarboxylates,[6e] and hydroxyamines[6f,g] have been successfully utilized to achieve C-H amination in the presence of transition-metal catalysts.

On the other hand, imidazo[1,2-*a*]pyridine moiety is an important class of *N*-heterocycles present in biologically active pharmaceuticals and optoelectronics.[7] In recent years, there is an increasing interest in the preparation and functionalization of imidazopyridines.[8] Up to now, tremendous efforts have been made to construct C-C,[9] C-S,[10] C-O,[11a] C-F,[11b] and C-P[12] bonds via direct C3 functionalizations. However, the formation of C-N bond is less investigated.[13,14] Recently, the Gryko group prepared polycyclic imidazopyridines via oxidative intramolecular C-H amination.[14a] Subsequently, the Hajra group achieved oxidative C-H amination of imidazopyridines in the presence of (Diacetoxy)iodobenzene.[14b] At the same time, the Sun group reported a visible light induced C-H sul-



Scheme 1 Methodologies for C-H amination using NFSI.

fonamidation methodology.[14c] Despite the above achievements, the diversity of amino source is still limited.

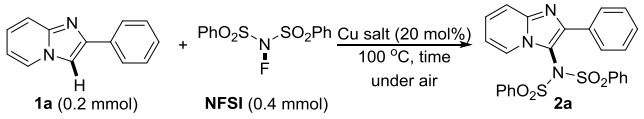
As a commercial available amination reagent, *N*-fluorobenzenesulfonimide (NFSI) has attracted much attention since the pioneering work of the Zhang and other group.[15] Up to now, great achievements have been made for difunctionalization of olefins, such as cyanoamination,[16a,b] fluoroamination,[16c,d] alkoxyamination,[16e] carboamination,[16f] and other transformations.[16g,h] Meanwhile, NFSI could also react with allenes,[17a] alkynes,[17b] benzylic carbon,[17c] and diazocarbonyl compounds[17d] to accomplish C-H amination. Notably, the Zhang, the Ritter, the Itami, and other groups have also reported C-H amination of (hetero)arenes in the presence of Pd, Cu, Fe, and metal-free conditions (Scheme 1a-d).[18,19]

In our previous work, our group have achieved C-H tosylmethylation,[9c] sulfonylation and sulfenylation,[10d] and cyanation[20d] of imdazopyridines. Inspired by the above achievements and our previous work,[20] we herein firstly developed direct C-H amination of imidazopyridines using NFSI as the nitrogen source (Scheme 1e).

RESULTS AND DISCUSSION

2-phenylimidazo[1,2-α]pyridine **1a** (0.2 mmol) and NFSI (0.4 mmol) was selected as model substrates to optimize the reaction conditions (Table 1). Initially, different copper salts (20 mol%) was examined in DCE at 100 °C, and $[(MeCN)_4Cu]BF_4$

Table 1 Optimization of reaction conditions[a]

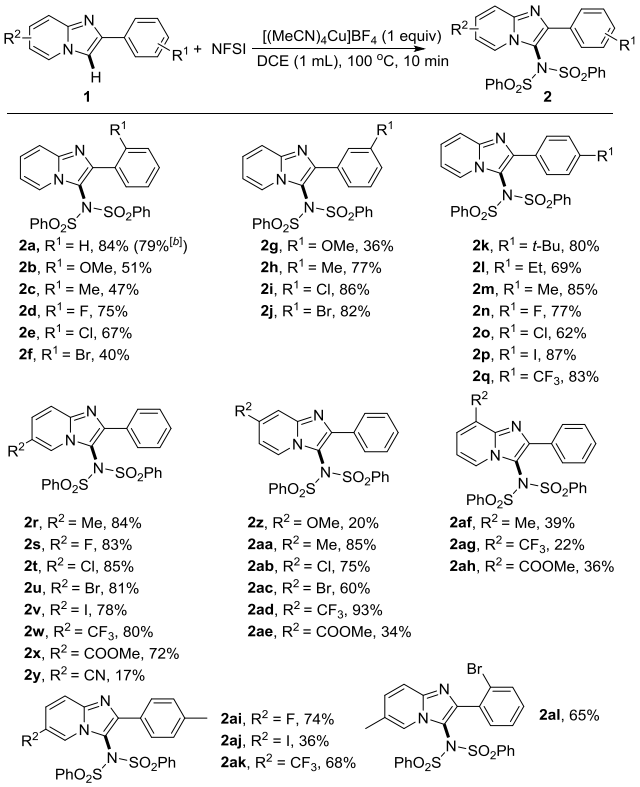


Entry	Copper salts	Solvent	Time	Yield [%][b]
1	CuCl	DCE	12 h	13
2	CuBr	DCE	12 h	11
3	CuI	DCE	12 h	13
4	$[(MeCN)_4Cu]BF_4$	DCE	12 h	21
5	$[(MeCN)_4Cu]PF_6$	DCE	12 h	20
6[c]	$[(MeCN)_4Cu]BF_4$	DCE	12 h	38
7[d]	$[(MeCN)_4Cu]BF_4$	DCE	12 h	82
8[d]	$[(MeCN)_4Cu]BF_4$	toluene	12 h	trace
9[d]	$[(MeCN)_4Cu]BF_4$	dioxane	12 h	34
10[d]	$[(MeCN)_4Cu]BF_4$	MeCN	12 h	30
11[d]	$[(MeCN)_4Cu]BF_4$	THF	12 h	18
12[d]	$[(MeCN)_4Cu]BF_4$	DCE	0.5 h	82
13[d]	**$[(MeCN)_4Cu]BF_4$**	**DCE**	**10 min**	**84**
14[d]	$[(MeCN)_4Cu]BF_4$	DCE	5 min	73
15[d, e]	$[(MeCN)_4Cu]BF_4$	DCE	10 min	73
16[d, f]	$[(MeCN)_4Cu]BF_4$	DCE	10 min	64
17[g]	$[(MeCN)_4Cu]PF_6$	DCE	10 min	73

[a]Reaction conditions: **1a** (0.2 mmol), NFSI (0.4 mmol), Cu salt (20 mol%), solvent (1 mL), under air, 100 °C. [b]Isolated yields. [c]$[(MeCN)_4Cu]BF_4$ (0.5 equiv). [d]$[(MeCN)_4Cu]BF_4$ (1.0 equiv). [e]Under Ar. [f]Under O_2. [g]$[(MeCN)_4Cu]PF_6$ (1.0 equiv).

exhibited the best performance to afford the desired product **2a** in 21% yield (Table 1, entry 4). The combination of additional ligands led to decreased efficiency (see the Supporting Info). Subsequently, the catalytic loading of $[(MeCN)_4Cu]BF_4$ was investigated, indicating 1 equiv of Cu salt was required to provide **2a** in 82% yield (Table 1, entry 7). Next, other solvents were screened (Table 1, entries 8-11), which showed inferior efficiency compared with DCE. To our delight, the amination of imidazopyridine **1a** could still be efficiently achieved in 10 min (Table 1, entry 13). Further shortening the reaction time to 5 min resulted in decreased yield (Table 1, entry 14). When the reaction was carried out under argon or oxygen atmosphere, decreased yields were observed (Table 1, entries 15 and 16). We also tested the reaction in the presence of 1 equiv of $[(MeCN)_4Cu]PF_6$, which only delivered **2a** in 73% yield (Table 1, entry 17). The structure of **2a** was further confirmed by X-ray diffraction (see the Supporting Info).

Scheme 2 Substrate scope of 2-phenyllimidazo[1,2-α]pyridines[a]



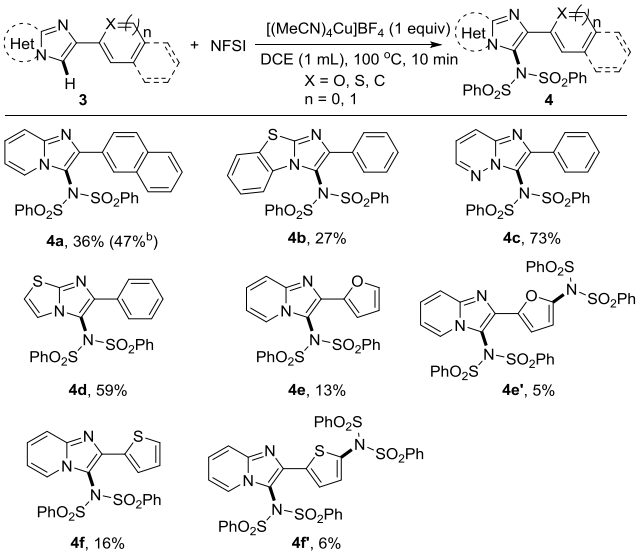
[a]Reaction conditions: **1** (0.2 mmol), NFSI (0.4 mmol), $[(MeCN)_4Cu]BF_4$ (0.2 mmol), DCE (1 mL), under air, 100 °C, 10 min. [b]**1a** (6.0 mmol), NFSI (12.0 mmol).

With the optimized condition in hand (Table 1, entry 13), the substrate scope of 2-phenylimidazo[1,2-α]pyridines was investigated. Initially, various substitutions on the benzene ring at the C2 position of imidazo[1,2-α]pyridines was examined (Scheme 2). In general, both electron-donating (R = OMe, t-Bu, Et, Me) and electron-withdrawing groups (F, Cl, Br, I, CF_3) at the para-, meta-, and ortho-positions proceeded

smoothly to provide the aminated products in 40-87% yields. Compared with strong electron-withdrawing groups (R1 = CF_3), decreased yields were obtained for OMe- substituted products **2b** (51%) and **2g** (36%). Next, the effect of substitutions at the C6, C7, and C8 position on the amination reactivity was evaluated. Similarly, a wide range of functional groups, including alkyl (**1r** and 1aa), halogen (**1s-v** and **1ab-ac**), CF_3 (**1w** and **1ad**), and ester (**1x**), were well tolerated under the current catalytic system. The compatibility of halogen-substituted imidazopyridines could be utilized for further transformations. However, low yields were obtained for CN (**2y**, 17%), OMe (**2z**, 20%), and C8-substituted imidazopyridines (**2af**, 39%; **2ag**, 22%; and **2ah**, 36%). Finally, disubstituted 2-phenylimidazo[1,2-α]pyridines could also react with NFSI to provide the corresponding products **2ai-al** in 36-74% yields. To uncover the synthetic potential for this protocol, a gram-scale production of amination of 1a was also conducted, furnishing the desired product **2a** in 79% yield.

To further extend the scope of amination reaction, we next explored various imidazoheterocycles as the reactants (Scheme 3). Compared with 2-phenylimidazo[1,2-α]pyridines, decreased yields were observed for **4a** and **4b**, probably due to the steric hindrance between $N(SO_2Ph)_2$ and substrates. Nevertheless, imidazopyridazine and imidazothiazole were successfully underwent C3-amination to deliver products **4c** and **4d** in 73% and 59% yields, respectively. For substrates with 2-furan and 2-thiophene substitutions, a mixture of **4e**, **4e'** and **4f**, **4f'** was isolated in low yields, respectively.

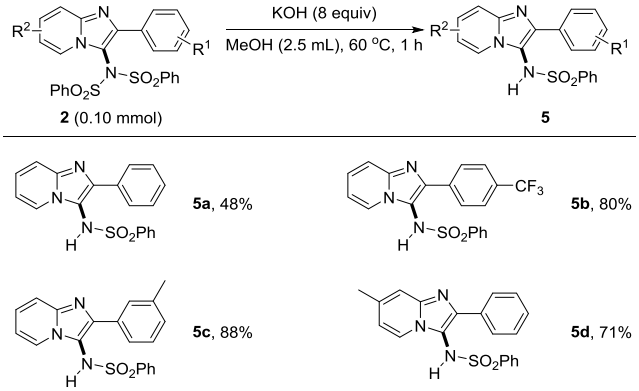
Scheme 3 Substrate scope of imidazoheterocycles[a]



[a]Reaction conditions: **3** (0.2 mmol), NFSI (0.4 mmol), $[(MeCN)_4Cu]BF_4$ (0.2 mmol), DCE (1 mL), under air, 100 °C, 10 min. [b]2 h.

Encouraged by the above results, we next sought to investigate desulfonylation of obtained products according to previous literatures.[18a,21] However, complete desulfonylation of aminated products was proved to be unsuccessful under various conditions. Nevertheless, monodesulfonylated products **5** was obtained in 48-88% yields in the presence of KOH in MeOH at 60 °C for 1 h (Scheme 4).

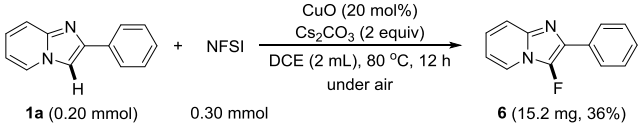
Scheme 4 Desulfonylation of aminated imidazo[1,2-α]pyridines[a]



[a]Reaction conditions: **2** (0.1 mmol), KOH (8 equiv), MeOH (2.5 mL), 60 °C, 1 h.

Apart from acting as amination reagent, NFSI can be also utilized as the fluoride source.[22] Recently, the Sun group have reported fluorination of imidazopyridines was also achieved using selectfluor as the electrophilic fluorinating reagent.[11b] Inspired by the above work, fluorinated product **6** was isolated in 36% yield under preliminary investigation (Scheme 5). Further optimization of conditions is currently in progress in our lab.

Scheme 5 Substrate scope of 2-phenyllimidazo[1,2-α]pyridines[a]

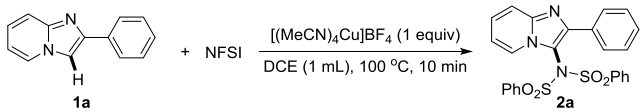


[a]Reaction conditions: **1a** (0.2 mmol), NFSI (0.3 mmol), CuO (20 mol%), DCE (2 mL), 80 °C, 12 h, under air.

To explore the reaction mechanism, a set of control experiments were performed (Scheme 6). The aminated product could not be detected in the absence of $[(MeCN)_4Cu]BF_4$, indicating the necessity of Cu salt. Under the optimized conditions, addition of a radical scavenger TEMPO (1 equiv) completely suppressed the amination reaction. Also, When 1 equiv BHT was added, the aminated product **2a** was isolated in only 16% yield. These results suggest that the amination transformation is likely to proceed via a radical pathway.

On the basis of above discussion and relevant literatures,[16a,19d,23] a plausible amination mechanism was proposed (Scheme 7). Initially, oxidation of $[(MeCN)_4Cu]BF_4$ with NFSI provides $L_4CuIII(BF_4)F(NSI)$ **A**, which is in equilibrium with Cu(II)-stabilized species **B**. Subsequently, radical addition of between Cu(II) species **B** and imidazopyridine **1a** selectively produces

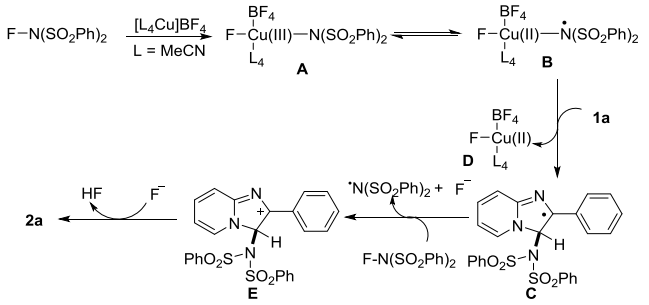
Scheme 6 Control experiments



w/o $[(MeCN)_4Cu]BF_4$	NR
w/ 1 equiv TEMPO	NR
w/ 1 equiv BHT	16%

C3-functionalized intermediate **C** and Cu(II) species **D**. Next, imidazopyridine radical **C** is oxidized by NFSI to generate imidazopyridine cation **E**, bis-sulfonylamidyl radical, and F^- through a SET process.[19c] Finally, the deprotonation of **E** afforded the desired product **2a** and HF.

Scheme 7 Proposed mechanism



CONCLUSION

In conclusion, we have developed a facile and efficient strategy for regioselective C3 amination of imidazo[1,2-α]pyridine with NFSI in the presence of $[(MeCN)_4Cu]BF_4$. Under the optimized conditions, a broad range of functionalities were well tolerated to effieienty deliver the desired aminated products, which could further undergo desulfonylation to produce the corresponding benzenesulfonamide derivatives. The current methodology was featured with several advantages such as operational simplicity, short reaction time, and broad substrate scope. Moreover, the gram-scale production of aminated imidazopyridine, as well as potential fluorination of imidazopyridine, probably possesses application in medicinal chemistry.

EXPERIMENTAL SECTION

General Experimental Details. Unless otherwise indicated, all the starting materials and reagents were commercially available and used without further purification. Imidazo[1,2-α]pyridines **1** and imidazoheterocycles **3** were prepared according to previous literatures.[7a, 24] All reactions were carried out using 15 mL sealed tube. Melting points were measured on a melting point apparatus. ^1H, ^{13}C and ^{19}F NMR spectra were recorded on Bruker DPX 400 or Bruker DPX 600 instruments using TMS as an internal standard. Data are reported as follows: chemical shift (δ ppm), multiplicity (s = single, d = doublet, t = triplet, q = quartet, m = multiplet), integration, and coupling constants (J) in hertz (Hz). HRMS were determined on a Q-Tof Micro MS/MS System ESI spectrometer.

General procedure for the C-H amination of imidazopyridines. To a 15 mL sealed tube were added imidazo[1,2-α]pyridines **1** or imidazoheterocycles **3** (0.2 mmol), NFSI (0.4 mmol, 126 mg), and $[(MeCN)_4Cu]BF_4$ (0.2 mmol, 63 mg) in DCE (1 mL) under air. The reaction mixture was stirred at 100 ℃ for 10 min and then cooled to room temperature. After removal of solvent under reduced pressure, the residue was purified by preparative TLC on silica gel plates using petroleum ether/EtOAc as the eluent to give the corresponding products **2** or **4**.

General procedure for desulfonylation of C3-aminated imidazopyridines. To a 15 mL sealed tube were added **2a** or **2h** or **2q** or **2aa** (0.1 mmol), KOH (0.4 mmol, 42.5 mg) in MeOH (2.5 mL) under air. The reaction mixture was heated at 60 ℃ for 1 h and then cooled to room temperature. After removal of solvent under reduced pressure, the residue was purified by preparative TLC on silica gel plates using petroleum ether/EtOAc as the eluent to give the target product **5**.

General procedure for the C-H fluorination of imidazopyridine 1a. To a 15 mL sealed tube were added 2-phenylimidazo[1,2-α]pyridine **1a** (0.2 mmol, mg), NFSI (0.3 mmol, 94.6 mg), CuO (0.04 mmol, 3.2 mg), and Cs_2CO_3 (0.4 mmol, 130.3 mg) in DCE (2 mL) under air. The reaction mixture was heated at 80 ℃ for 12 h and then cooled to room temperature. After removal of solvent under reduced pressure, the residue was purified by preparative TLC on silica gel plates using petroleum ether: EtOAc = 2: 1 as the eluent to give the target product **6**.

*N-(2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2a**).* Yellow solid (82.3 mg, 84%), m.p. = 107-108 °C. ^1H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.9 Hz, 4H), 7.72 (d, J = 7.7 Hz, 2H), 7.64 (d, J = 8.9 Hz, 1H), 7.58 (t, J = 7.4 Hz, 2H), 7.51 (d, J = 6.8 Hz, 1H), 7.40 (t, J = 7.7 Hz, 4H), 7.29-7.28 (m, 1H), 7.17 (t, J = 7.3 Hz, 1H), 7.11 (t, J = 7.6 Hz, 2H), 6.65 (t, J = 6.8 Hz, 1H). $^{13}C\{^1H\}$ NMR (150 MHz, $CDCl_3$) δ 145.6, 144.5, 139.1, 134.6, 131.8, 129.1, 129.0, 128.4, 128.1, 127.5, 126.8, 123.9, 118.0, 112.6, 111.1. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{20}N_3O_4S_2^+$: 490.0890, found 490.0882.

*N-(2-(2-methoxyphenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2b**).* Yellow solid (53.2 mg, 51%), m.p. = 203-204 °C. ^1H NMR (600 MHz, $CDCl_3$) δ 7.87 (d, J = 7.1 Hz, 4H), 7.67-7.63 (m, 2H), 7.56-7.55 (m, 3H), 7.36 (t, J = 6.6 Hz, 4H), 7.26-7.20 (m, 2H), 6.82 (t, J = 6.5 Hz, 1H), 6.70-6.69 (m, 2H), 3.67 (s, 3H). $^{13}C\{^1H\}$ NMR (150 MHz, $CDCl_3$) δ 157.5, 145.0, 144.2, 139.0, 134.2, 131.3, 130.1, 128.8, 128.8, 126.4, 123.9, 121.1, 119.9, 118.2, 112.5, 112.1, 110.7, 55.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_5S_2^+$: 520.0995, found 520.1001.

*N-(phenylsulfonyl)-N-(2-(o-tolyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**2c**).* Yellow solid (48.2 mg, 47%), m.p. = 193-194 °C. ^1H NMR (600 MHz, $CDCl_3$) δ 7.78 (d, J = 7.3 Hz, 4H), 7.64-7.56 (m, 4H), 7.45 (d, J = 7.0 Hz, 1H), 7.36 (t, J = 7.0 Hz, 4H), 7.28-7.26 (m, 1H), 7.19 (t, J = 7.0 Hz, 1H), 7.09 (d, J = 7.0 Hz, 1H), 7.03 (t, J = 6.8 Hz, 1H), 6.68 (t, J = 5.6 Hz, 1H), 2.15 (s, 3H). $^{13}C\{^1H\}$ NMR (150 MHz, $CDCl_3$) δ 147.8, 144.2, 138.9, 138.1, 134.3, 131.4, 130.4, 129.7, 129.0, 128.7, 126.5, 125.1, 124.0, 118.0, 112.7, 111.8, 20.5. HRMS

(positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_4S_2^+$: 504.1046, found 504.1051.

N-(2-(2-fluorophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2d***). Green solid (75.6 mg, 75%), m.p. = 163-164 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.91 (d, J = 7.5 Hz, 4H), 7.72-7.65 (m, 3H), 7.56 (t, J = 7.0 Hz, 2H), 7.39 (t, J = 7.3 Hz, 4H), 7.30 (t, J = 7.6 Hz, 1H), 7.19 (m, 1H), 6.97 (t, J = 7.1 Hz, 1H), 6.86 (t, J = 9.2 Hz, 1H), 6.73 (t, J = 6.4 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 160.9, 159.2, 144.5, 142.2, 138.7, 134.6, 131.1, 130.4 (d, J = 8.1 Hz), 129.0, 128.9, 126.9, 124.1, 123.6 (d, J = 3.3 Hz), 120.3 (d, J = 12.8 Hz), 118.3, 116.0 (d, J = 21.7 Hz), 113.0, 112.2. ^{19}F NMR (565 MHz, $CDCl_3$) δ -111.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}FN_3O_4S_2^+$: 508.0796, found 508.0799.

N-(2-(2-chlorophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2e***). Yellow solid (70.1 mg, 67%), m.p. = 169-170 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.91 (d, J = 7.6 Hz, 4H), 7.75 (d, J = 7.3 Hz, 1H), 7.67 (d, J = 8.9 Hz, 1H), 7.62 (d, J = 6.5 Hz, 1H), 7.57 (t, J = 7.2 Hz, 2H), 7.40 (t, J = 7.4 Hz, 4H), 7.29 (t, J = 7.7 Hz, 1H), 7.24 (d, J = 7.8 Hz, 1H), 7.18 (t, J = 7.3 Hz, 1H), 7.14 (t, J = 7.3 Hz, 1H), 6.71 (t, J = 6.5 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.0, 144.2, 138.8, 134.4, 134.4, 131.4, 131.0, 130.1, 129.8, 129.1, 128.8, 126.8, 126.1, 123.9, 118.4, 113.0, 112.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}ClN_3O_4S_2^+$: 524.0500, found 524.0502.

N-(2-(2-bromophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2f***). White solid (45.4 mg, 40%), m.p. = 184-185 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (d, J = 7.2 Hz, 4H), 7.76 (d, J = 7.3 Hz, 1H), 7.68 (d, J = 8.8 Hz, 1H), 7.58 (s, 3H), 7.47 (d, J = 7.7 Hz, 1H), 7.41 (t, J = 7.1 Hz, 4H), 7.29 (t, J = 7.0 Hz, 1H), 7.20 (t, J = 6.9 Hz, 1H), 7.11 (t, J = 7.5 Hz, 1H), 6.70 (t, J = 5.9 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 146.1, 144.0, 138.9, 134.4, 133.3, 132.8, 131.5, 130.0, 129.1, 128.8, 126.7, 126.7, 124.3, 123.9, 118.5, 112.9, 112.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}BrN_3O_4S_2^+$: 567.9995, found 567.9999.

N-(2-(3-methoxyphenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2g***). Yellow solid (37 mg, 36%), m.p. = 172-173 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.6 Hz, 4H), 7.64 (d, J = 8.9 Hz, 1H), 7.58 (t, J = 7.2 Hz, 2H), 7.47 (d, J = 6.5 Hz, 1H), 7.40 (t, J = 7.4 Hz, 4H), 7.36-7.35 (m, 2H), 7.28-7.27 (m, 1H), 7.06 (t, J = 7.7 Hz, 1H), 6.74 (d, J = 8.0 Hz, 1H), 6.65 (t, J = 6.2 Hz, 1H), 3.69 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 159.3, 145.6, 144.5, 139.2, 134.6, 133.2, 129.1, 129.0, 129.0, 126.8, 123.8, 120.4, 118.0, 115.9, 112.7, 111.5, 111.2, 55.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_5S_2^+$: 520.0995, found 520.0996.

N-(phenylsulfonyl)-N-(2-(m-tolyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (***2h***). White solid (77.7 mg, 77%), m.p. = 160-161 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.90 (m, 4H), 7.64-7.53 (m, 6H), 7.40-7.36 (m, 4H), 7.28-7.23 (m, 1H), 7.02-6.96 (m, 2H), 6.65 (td, J = 6.8, 1.0 Hz, 1H), 2.18 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.7, 144.5, 139.1, 137.5, 134.6, 131.7, 129.3, 129.0, 128.1, 128.0, 126.8, 124.7, 123.9, 117.9, 112.6, 111.0, 21.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_4S_2^+$: 504.1046, found 504.1049.

N-(2-(3-chlorophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2i***). White solid (90.1 mg, 86%), m.p. = 157-158 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (dd, J = 7.4, 1.0 Hz, 4H), 7.67-7.56 (m, 6H), 7.41 (t, J = 8.2 Hz, 4H), 7.30-7.26 (m, 1H), 7.14-7.11 (m, 1H), 7.03 (t, 7.8 Hz, 1H), 6.69 (td, J = 6.8, 1.0 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.5, 144.0, 138.7, 134.8, 134.1, 133.7, 129.4, 129.2, 128.9, 128.5, 127.4, 127.2, 125.6, 124.0, 118.0, 113.0, 111.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}ClN_3O_4S_2^+$: 524.0500, found 524.0503.

N-(2-(3-bromophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2j***). White solid (93.4 mg, 82%), m.p. = 191-192 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92-7.90 (m, 4H), 7.83 (t, J = 1,7 Hz, 1H), 7.69-7.57 (m, 5H), 7.44-7.40 (m, 4H), 7.31-7.27 (m, 2H), 6.97 (t, J = 7.9 Hz, 1H), 6.70 (td, J = 6.8, 1.0 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.6, 144.0, 138.8, 134.8, 134.0, 131.4, 130.4, 129.6, 129.2, 128.9, 127.2, 126.0, 124.0, 122.4, 118.0, 113.0, 111.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}BrN_3O_4S_2^+$: 567.9995, found 567.9999.

N-(2-(4-(tert-butyl)phenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2k***). White solid (87.7 mg, 80%), m.p. = 204-205 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.3 Hz, 4H), 7.68 (d, J = 7.7 Hz, 2H), 7.62 (d, J = 8.8 Hz, 1H), 7.54 (t, J = 6.5 Hz, 2H), 7.48 (d, J = 6.2 Hz, 1H), 7.37 (t, J = 7.0 Hz, 4H), 7.24 (t, J = 7.3 Hz, 1H), 7.12 (d, J = 7.7 Hz, 2H), 6.62 (t, J = 5.9 Hz, 1H), 1.29 (s, 9H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 151.2, 145.7, 144.5, 139.2, 134.6, 129.1, 129.0, 128.9, 127.2, 126.7, 125.0, 123.8, 117.9, 112.5, 110.8, 34.6, 31.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{29}H_{28}N_3O_4S_2^+$: 546.1516, found 546.1518.

N-(2-(4-ethylphenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2l***). White solid (71.6 mg, 69%), m.p. = 169-170 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92-7.90 (m, 4H), 7.66-7.61 (m, 3H), 7.55 (t, J = 7.5 Hz, 2H), 7.48 (d, J = 6.9 Hz, 1H), 7.37 (t, J = 8.1 Hz, 4H), 7.26-7.22 (m, 1H), 6.93 (d, J = 8.3 Hz, 2H), 6.62 (td, J = 6.8, 0.9 Hz, 1H), 2.57 (q, J = 7.6 Hz, 2H), 1.22 (t, J = 7.6 Hz, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.7, 144.5, 144.5, 139.1, 134.6, 129.2, 129.0, 129.0, 127.7, 127.5, 126.7, 123.8, 117.8, 112.6, 110.8, HRMS (positive ESI): $[M+H]^+$ calcd for $C_{27}H_{24}N_3O_4S_2^+$: 518.1203, found 518.1205.

N-(phenylsulfonyl)-N-(2-(p-tolyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (***2m***). White solid (85.6 mg, 85%), m.p. = 182-183 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92-7.90 (m, 4H), 7.26-7.55 (m, 5H), 7.48 (d, J = 6.8 Hz, 1H), 7.38 (t, J = 8.2 Hz, 4H), 7.26-7.22 (m, 1H), 6.90 (d, J = 8.0 Hz, 2H), 6.61 (td, J = 6.8, 0.8 Hz, 1H), 2.28 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.7, 144.5, 139.2, 138.2, 134.4, 129.0, 129.0, 128.8, 127.4, 126.7, 123.8, 117.8, 112.5, 110.8, 21.1. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_4S_2^+$: 504.1046, found 504.1050.

N-(2-(4-fluorophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2n***). Yellow solid (77.8 mg, 77%), m.p. = 193-194 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (d, J = 7.6 Hz, 4H), 7.73-7.71 (m, 2H), 7.63-7.61 (m, 3H), 7.48 (d, J = 6.8 Hz, 1H), 7.43 (t, J = 7.9 Hz, 4H), 7.29-7.27 (m, 1H), 6.80 (t, J = 8.7 Hz, 2H), 6.66 (t, J = 6.7 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 162.9 (d, J = 246.9 Hz), 144.7, 144.5, 139.1, 134.7, 129.4 (d, J = 8.3 Hz), 129.1, 129.0, 128.1, 126.9, 123.8, 117.9, 115.1 (d, J = 21.6 Hz), 112.7, 110.9. ^{19}F NMR (565 MHz, $CDCl_3$) δ -113.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}FN_3O_4S_2^+$: 508.0796, found 508.0799.

N-(2-(4-chlorophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (***2o***). White solid (64.7

mg, 62%), m.p. = 195-196 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (dd, J = 8.4, 1.0 Hz, 4H), 7.67-7.60 (m, 5H), 7.48 (d, J = 6.9 Hz, 1H), 7.43-7.40 (m, 4H), 7.29-7.25 (m, 1H), 7.08-7.05 (m, 2H), 6.65 (td, J = 6.8, 1.0 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.5, 144.4, 139.0, 134.7, 134.4, 130.4, 129.2, 129.0, 128.8, 128.3, 127.0, 123.8, 118.0, 112.9, 111.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}ClN_3O_4S_2^+$: 524.0500, found 524.0503.

*N-(2-(4-iodophenyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2p**).* White solid (107.1 mg, 87%), m.p. = 189-190 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92-7.90 (m, 4H), 7.66-7.61 (m, 3H), 7.48-7.40 (m, 9H), 7.29-7.25 (m, 1H), 6.66 (td, J = 6.8, 1.0 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.6, 144.5, 139.0, 137.2, 134.7, 131.4, 129.2, 129.0, 127.1, 123.8, 118.0, 112.9, 111.3, 94.9. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}IN_3O_4S_2^+$: 615.9856, found 615.9858.

*N-(phenylsulfonyl)-N-(2-(4-(trifluoromethyl)phenyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**2q**).* White solid (92.5 mg, 83%), m.p. = 211-212 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.91 (m, 4H), 7.86 (d, J = 8.1 Hz, 2H), 7.65 (d, J = 9.0 Hz, 1H), 7.59-7.55 (m, 2H), 7.51-7.49 (m, 1H), 7.41-7.35 (m, 6H), 7.31-7.27 (m,1H), 6.68 (td, J = 6.8, 1.0 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 144.6, 143.9, 138.9, 135.5, 134.9, 129.9 (q, J = 32.1 Hz), 129.2, 129.0, 127.7, 127.5 (q, J = 232.8 Hz), 127.2, 125.0 (q, J = 3.45 Hz), 124.1 (q, J = 270.4 Hz), 123.9, 118.1, 113.1, 111.9. ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{19}F_3N_3O_4S_2^+$: 558.0764, found 558.0765.

*N-(6-methyl-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2r**).* White solid (84.6 mg, 84%), m.p. = 191-192 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.91 (m, 4H), 7.74-7.72 (m, 2H), 7.58-7.50 (m, 3H), 7.39-7.36 (m, 4H), 7.17-7.06 (m, 5H), 2.06 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.4, 143.5, 139.3, 134.5, 132.1, 129.8, 129.1, 129.0, 128.3, 128.1, 127.5, 122.4, 121.7, 117.2, 18.1. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_4S_2^+$: 504.1046, found 504.1048.

*N-(6-fluoro-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2s**).* Yellow solid (84.3 mg, 83%), m.p. = 209-210 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.91 (m, 4H), 7.72-7.70 (m, 2H), 7.61-7.56 (m, 3H), 7.42-7.38 (m, 4H), 7.36-7.35 (m, 1H), 7.19-7.14 (m, 2H), 7.12-7.08 (m, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 154.5, 152.1, 146.7 (d, J = 2.1 Hz), 142.0, 139.0, 134.9, 131.6, 129.2, 129.0, 128.6, 128.2, 127.4, 118.8 (d, J = 25.5 Hz), 118.5 (d, J = 8.7 Hz), 112.5, 111.0 (d, J = 38.5 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -138.4. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}FN_3O_4S_2^+$: 508.0796, found 508.0797.

*N-(6-chloro-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2t**).* White solid (88.5 mg, 85%), m.p. = 195-196 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.91 (m, 4H), 7.74-7.72 (m, 2H), 7.61-7.55 (m, 3H), 7.42-7.38 (m, 4H), 7.34-7.34 (m, 1H), 7.21-7.15 (m, 2H), 7.13-7.09 (m, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 146.3, 142.8, 139.0, 134.9, 131.5, 129.2, 128.9, 128.7, 128.2, 127.5, 121.9, 121.9, 121.2, 118.3, 111.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}ClN_3O_4S_2^+$: 524.0500, found 524.0502.

*N-(6-bromo-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2u**).* White solid (91.6 mg, 81%), m.p. = 188-189 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (d, J = 8.1 Hz, 4H), 7.74 (d, J = 8.0 Hz, 2H), 7.60 (t, J = 7.4 Hz, 2H), 7.50 (d, J = 9.4 Hz, 1H), 7.43-7.41 (m, 5H), 7.29 (d, J = 9.4 Hz, 1H), 7.18 (t, J = 7.4 Hz, 1H), 7.12 (t, J = 7.5 Hz, 2H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 146.1, 142.9, 139.0, 134.9, 131.5, 130.3, 129.2, 128.9, 128.7, 128.2, 127.5, 124.1, 118.6, 111.6, 107.6. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}BrN_3O_4S_2^+$: 567.9995, found 567.9996.

*N-(6-iodo-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2v**).* Yellow solid (96.1 mg, 78%), m.p. = 195-196 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.91 (m, 4H), 7.75-7.73 (m, 2H), 7.62-7.58 (m, 2H), 7.51 (t, J = 1.0 Hz, 1H), 7.43-7.39 (m, 6H), 7.19-7.15 (m, 1H), 7.13-7.09 (m, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.6, 143.0, 139.0, 135.0, 134.8, 131.4, 129.9, 129.3, 128.9, 128.7, 128.2, 127.5, 118.9, 111.1, 75.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}IN_3O_4S_2^+$: 615.9856, found 615.9857.

*N-(2-phenyl-6-(trifluoromethyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2w**).* Yellow solid (89.2 mg, 80%), m.p. = 183-184 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94-7.91 (m, 4H), 7.79-7.77 (m, 2H), 7.71 (d, J = 9.4 Hz, 1H), 7.66 (s, 1H), 7.61-7.57 (m, 2H), 7.42-7.36 (m, 5H), 7.22-7.18 (m, 1H), 7.15-7.11 (m, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 147.1, 144.2, 138.9, 135.0, 131.2, 129.3, 129.0, 128.8, 128.3, 127.6, 123.0 (q, J = 269.8 Hz), 122.7 (q, J = 16.3 Hz), 118.7, 117.1 (q, J = 34.3 Hz), 112.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.1. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{19}F_3N_3O_4S_2^+$: 558.0764, found 558.0768.

*methyl 2-phenyl-3-(N-(phenylsulfonyl)phenylsulfonamido)imidazo[1,2-a]pyridine-6-carboxylate (**2x**).* White solid (78.8 mg, 72%), m.p. = 193-194 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.17 (s, 1H), 7.94 (d, J = 7.2 Hz, 4H), 7.83 (d, J = 9.1 Hz, 1H), 7.75 (d, J = 6.9 Hz, 2H), 7.64 (d, J = 9.1 Hz, 1H), 7.59-7.58 (m, 2H), 7.41 (t, J = 7.0 Hz, 4H), 7.19-7.18 (m, 1H), 7.14-7.13 (m, 2H), 3.85 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 164.5, 147.2, 145.0, 139.0, 134.7, 131.3, 129.2, 129.0, 128.9, 128.2, 127.7, 127.6, 126.6, 117.4, 116.9, 112.2, 52.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{27}H_{22}N_3O_6S_2^+$: 548.0945, found 548.0947.

*N-(6-cyano-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2y**).* Yellow solid (17.3 mg, 17%), m.p. = 192-193 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (d, J = 7.8 Hz, 4H), 7.75 (d, J = 7.7 Hz, 2H), 7.69-7.65 (m, 3H), 7.62 (s, 1H), 7.46 (t, J = 7.7 Hz, 4H), 7.34 (d, J = 9.2 Hz, 1H), 7.23 (t, J = 7.1 Hz,1H), 7.14 (t, J = 7.4 Hz, 2H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 147.4, 143.6, 138.8, 135.2, 130.8, 129.8, 129.4, 129.3, 128.9, 128.3, 127.7, 126.5, 118.9, 115.7, 112.7, 99.0. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{19}N_4O_4S_2^+$: 515.0842, found 515.0846.

*N-(7-methoxy-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2z**).* Yellow solid (20.7 mg, 20%), m.p. = 184-185 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.1 Hz, 4H), 7.68 (d, J = 6.7 Hz, 2H), 7.57-7.56 (m, 2H), 7.39 (t, J = 6.7 Hz, 4H), 7.29 (d, J = 6.7 Hz, 1H), 7.15-7.14 (m, 1H), 7.10-7.09 (m, 2H), 6.91 (s, 1H), 6.36-6.35 (m, 1H), 3.88 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 159.4, 146.2, 145.3, 139.1, 134.6, 131.9, 129.1, 129.0, 128.3, 128.0, 127.3, 124.3, 109.9, 107.5, 95.2, 55.7. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_5S_2^+$: 520.0995, found 520.0996.

N-(7-methyl-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-

*(phenylsulfonyl)benzenesulfonamide (**2aa**)*. White solid (85.2 mg, 85%), m.p. = 173-174 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91-7.89 (m, 4H), 7.70-7.68 (m, 2H), 7.56-7.52 (m, 2H), 7.39-7.35 (m, 6H), 7.16-7.06 (m, 3H), 6.48 (dd, J = 7.2, 1.2 Hz, 1H), 2.38 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.5, 145.0, 139.1, 138.0, 134.6, 132.0, 129.0, 129.0, 128.3, 128.0, 127.4, 123.1, 116.4, 115.3, 110.4, 21.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_4S_2^+$: 504.1046, found 504.1049.

*N-(7-chloro-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2ab**)*. White solid (78.3mg, 75%), m.p. = 206-207 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.90 (d, J = 7.7 Hz, 4H), 7.69 (d, J = 7.7 Hz, 2H), 7.62 (s, 1H), 7.57 (t, J = 7.3 Hz, 2H), 7.40-7.38 (m, 5H), 7.17 (t, J = 6.8 Hz, 1H), 7.10 (t, J = 7.5 Hz, 2H). 6.63 (d, J = 7.1 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 146.3, 144.3, 138.9, 134.8, 133.4, 131.4, 129.2, 129.0, 128.7, 128.2, 127.5, 124.2, 116.8, 114.3, 111.4. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}ClN_3O_4S_2^+$: 524.0500, found 524.0504.

*N-(7-bromo-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2ac**)*. White solid (68.2mg, 60%), m.p. = 204-205 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91-7.89 (m, 4H), 7.82 (d, J = 1.2 Hz, 1H), 7.70-7.68 (m, 2H), 7.59-7.55 (m, 2H), 7.41-7.37 (m, 4H), 7.34 (dd, J = 7.2, 0.5 Hz, 1H), 7.19-7.15 (m, 1H), 7.12-7.08 (m, 2H). 6.75 (dd, J = 7.2, 1.9 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 146.1, 144.5, 138.9, 134.8, 131.3, 129.8, 129.2, 129.0, 128.8, 128.2, 127.5, 124.2, 121.0, 120.2, 116.6, 111.5. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{25}H_{19}BrN_3O_4S_2^+$: 567.9995, found 567.9998.

*N-(2-phenyl-7-(trifluoromethyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2ad**)*. Yellow solid (103.5 mg, 93%), m.p. = 212-213 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.95 (s, 1H), 7.91 (d, J = 7.9 Hz, 4H), 7.72 (d, J = 7.7 Hz, 2H), 7.59 (t, J = 7.5 Hz, 3H), 7.40 (t, J = 7.4 Hz, 4H), 7.19 (t, J = 7.1 Hz, 1H), 7.12 (t, J = 7.2 Hz, 2H), 6.82 (d, J = 7.1 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 147.3, 142.7, 138.9, 134.9, 131.2, 129.2, 129.0, 128.9, 128.6 (q, J = 34.3 Hz), 128.2, 127.6, 124.8, 122.9 (q, J = 271.0 Hz), 116.0 (q, J = 4.7 Hz), 112.6, 108.4 (q, J = 2.5 Hz). ^{19}F NMR (565 MHz, $CDCl_3$) δ -63.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{19}F_3N_3O_4S_2^+$: 558.0764, found 558.0767.

*Methyl 2-phenyl-3-(N-(phenylsulfonyl)phenylsulfonamido)imidazo[1,2-a]pyridine-7-carboxylate (**2ae**)*. Yellow solid (36.7mg, 34%), m.p. = 205-206 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35-8.34 (m, 1H), 7.93-7.91 (m, 4H), 7.76-7.74 (m, 2H), 7.62-7.58 (m, 2H), 7.48 (dd, J = 7.2, 0.8 Hz, 1H), 7.43-7.39 (m, 4H), 7.24-7.18 (m, 2H), 7.15-7.11 (m, 2H), 3.98 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 165.2, 147.4, 143.4, 139.0, 134.8, 131.4, 129.2, 129.0, 128.8, 128.2, 127.6, 123.6, 120.4, 112.7, 111.9, 52.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{27}H_{22}N_3O_6S_2^+$: 548.0945, found 548.0948.

*N-(8-methyl-2-phenylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2af**)*. Yellow solid (39.1mg, 39%), m.p. = 170-171 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93-7.90 (m, 4H), 7.75-7.73 (m, 2H), 7.59-7.55 (m, 2H), 7.41-7.36 (m, 5H), 7.18-7.04 (m, 4H), 6.55 (t, J = 6.8 Hz, 1H), 2.66 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.2, 144.8, 139.2, 134.5, 132.2, 129.0, 129.0, 128.2, 128.1, 128.0, 127.7, 125.4, 121.7, 112.6, 111.3, 16.5. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{22}N_3O_4S_2^+$: 504.1046, found 504.1049.

*N-(2-phenyl-8-(trifluoromethyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2ag**)*. Yellow solid (24.7mg, 22%), m.p. = 171-172 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.4 Hz, 4H), 7.75 (d, J = 7.2 Hz, 2H), 7.63-7.60 (m, 4H), 7.41 (t, J = 7.3 Hz, 4H), 7.17 (t, J = 6.8 Hz, 1H), 7.10 (t, J = 7.3 Hz, 2H), 6.70 (t, J = 6.4 Hz, 1H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 146.3, 140.1, 138.9, 134.8, 131.2, 129.2, 129.0, 128.8, 128.1, 127.8, 127.1, 125.1 (q, J = 5.2 Hz), 122.5 (q, J = 270.8 Hz), 119.6 (q, J = 33.6 Hz), 112.2, 110.8. ^{19}F NMR (565 MHz, $CDCl_3$) δ -63.0. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{19}FN_3O_4S_2^+$: 558.0764, found 558.0769.

*methyl 2-phenyl-3-(N-(phenylsulfonyl)phenylsulfonamido)imidazo[1,2-a]pyridine-8-carboxylate (**2ah**)*. White solid (39 mg, 36%), m.p. = 81-82 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.02 (d, J = 7.1 Hz, 1H), 7.90 (d, J = 7.8 Hz, 4H), 7.77 (d, J = 7.7 Hz, 2H), 7.68 (d, J = 6.7 Hz, 1H), 7.59 (t, J = 7.4 Hz, 2H), 7.40 (t, J = 7.4 Hz, 4H), 7.17 (t, J = 7.4 Hz, 1H), 7.09 (t, J = 7.3 Hz, 2H), 6.72 (t, J = 6.8 Hz, 1H), 4.07 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 164.7, 146.3, 142.0, 139.0, 134.8, 131.5, 131.2, 129.2, 129.0, 128.7, 128.0, 127.8, 127.6, 120.1, 111.9, 111.5, 52.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{27}H_{22}N_3O_6S_2^+$: 548.0945, found 548.0949.

*N-(6-fluoro-2-(p-tolyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2ai**)*. Yellow solid (77.1 mg, 74%), m.p. = 187-188 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.4 Hz, 4H), 7.59 (d, J = 6.4 Hz, 5H), 7.40 (t, J = 7.0 Hz, 4H), 7.33 (s, 1H), 7.14 (t, J = 8.3 Hz, 1H), 6.90 (d, J = 7.1 Hz, 2H), 2.27 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 154.0, 152.4, 146.8, 142.0, 139.1, 138.5, 134.7, 129.2, 129.0, 128.9, 128.8, 127.3, 118.6 (d, J = 25.1 Hz), 118.4 (d, J = 8.6 Hz), 112.3, 111.0 (d, J = 41.9 Hz), 21.2. ^{19}F NMR (565 MHz, $CDCl_3$) δ -138.6. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{21}FN_3O_4S_2^+$: 522.0952, found 522.0953.

*N-(6-iodo-2-(p-tolyl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2aj**)*. Yellow solid (44.9 mg, 36%), m.p. = 209-210 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (d, J = 7.6 Hz, 4H), 7.64-7.61 (m, 4H), 7.49 (s, 1H), 7.44 (t, J = 7.5 Hz, 4H), 7.39 (s, 2H), 6.91 (d, J = 7.5 Hz, 2H), 2.29 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 145.8, 143.0, 139.2, 138.6, 134.7, 134.7, 129.2, 129.0, 128.9, 128.8, 128.5, 127.4, 118.8, 110.8, 75.5, 21.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{21}IN_3O_4S_2^+$: 630.0013, found 630.0016.

*N-(phenylsulfonyl)-N-(2-(p-tolyl)-6-(trifluoromethyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**2ak**)*. White solid (77.2 mg, 68%), m.p. = 212-213 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, J = 7.6 Hz, 4H), 7.70 (d, J = 9.2 Hz, 1H), 7.66-7.59 (m, 5H), 7.41 (t, J = 7.3 Hz, 4H), 7.36 (d, J = 9.2 Hz, 1H), 6.93 (d, J = 7.4 Hz, 2H), 2.29 (s, 3H). ^{13}C{^{1}H} NMR (150 MHz, $CDCl_3$) δ 147.3, 144.2, 139.0, 139.0, 134.8, 129.3, 129.0, 128.9, 128.3, 127.5, 123.1 (q, J = 269.7 Hz), 122.7 (q, J = 5.6 Hz), 122.5, 118.6, 117.0 (q, J = 34.4 Hz), 112.4, 21.2. ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.1. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{27}H_{21}F_3N_3O_4S_2^+$: 572.0920, found 572.0923.

*N-(2-(2-bromophenyl)-6-methylimidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**2al**)*. Yellow solid (76 mg, 65%), m.p. = 197-198 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.94 (d, J = 7.9 Hz, 4H), 7.76 (d, J = 7.6 Hz, 1H), 7.59-7.56 (m, 3H), 7.47 (d, J = 8.0 Hz, 1H), 7.41 (t, J = 7.6 Hz, 4H),

7.22 (s, 1H), 7.18 (t, *J* = 7.4 Hz, 1H), 7.12-7.08 (m, 2H), 2.12 (s, 3H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 145.8, 143.1, 139.1, 134.3, 133.3, 133.0, 131.5, 129.9, 129.7, 129.0, 128.9, 126.7, 124.4, 122.7, 121.7, 117.7, 111.9, 18.1. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{26}H_{21}BrN_3O_4S_2^+$: 582.0151, found 582.0154.

*N-(2-(naphthalen-2-yl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**4a**).* Yellow solid (38.4 mg, 36%), m.p. = 188-189 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.22 (s, 1H), 7.93-7.87 (m, 5H), 7.74-7.68 (m, 2H), 7.62-7.58 (m, 3H), 7.46-7.37 (m, 4H), 7.31-7.26 (m, 5H), 6.69 (t, *J* = 5.5 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 145.5, 144.7, 139.1, 134.4, 133.3, 133.0, 129.2, 129.0, 129.0, 128.8, 127.7, 127.3, 127.0, 126.9, 126.4, 125.8, 125.1, 123.9, 118.0, 112.8, 111.4. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{29}H_{22}N_3O_4S_2^+$: 540.1046, found 540.1049.

*N-(2-phenylbenzo[d]imidazo[2,1-b]thiazol-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**4b**).* Yellow solid (29.6 mg, 27%), m.p. = 220-221 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.96 (d, *J* = 7.9 Hz, 4H), 7.66 (d, *J* = 7.7 Hz, 2H), 7.63 (d, *J* = 8.0 Hz, 1H), 7.54 (t, *J* = 7.4 Hz, 2H), 7.35 (t, *J* = 7.6 Hz, 4H), 7.21 (t, *J* = 6.8 Hz, 1H), 7.11 (t, *J* = 7.0 Hz, 1H), 7.05 (t, *J* = 7.4 Hz, 2H), 6.93-6.89 (m, 2H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 149.0, 138.8, 134.6, 129.8, 129.5, 128.9, 128.0, 126.9, 125.6, 124.8, 123.7, 114.4. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{27}H_{20}N_3O_4S_3^+$: 546.0610, found 546.0613.

*N-(2-phenylimidazo[1,2-b]pyridazin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**4c**).* Yellow solid (51.2 mg, 52%), m.p. = 211-212 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.09 (s, 1H), 7.95 (d, *J* = 7.4 Hz, 5H), 7.87 (d, *J* = 7.0 Hz, 2H), 7.53 (t, *J* = 6.7 Hz, 2H), 7.36 (t, *J* = 7.1 Hz, 4H), 7.21-7.16 (m, 3H), 7.10-7.08 (m, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 145.6, 142.7, 139.4, 138.4, 134.3, 131.6, 129.3, 128.9, 128.6, 128.3, 127.6, 125.7, 119.2, 115.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{24}H_{19}N_4O_4S_2^+$: 491.0842, found 491.0845.

*N-(6-phenylimidazo[2,1-b]thiazol-5-yl)-N-(phenylsulfonyl)benzenesulfonamide (**4d**).* Yellow solid (58.9 mg, 59%), m.p. = 175-176 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 (d, *J* = 7.0 Hz, 4H), 7.59-7.56 (m, 4H), 7.41 (t, *J* = 6.8 Hz, 4H), 7.14-7.13 (m, 1H), 7.10-7.08 (m, 2H), 6.69 (d, *J* = 16.6 Hz, 2H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 150.1, 147.1, 138.9, 134.6, 131.9, 129.1, 128.9, 128.1, 128.1, 126.7, 118.1, 113.0, 112.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{23}H_{18}N_3O_4S_3^+$: 496.0454, found 496.0453.

*N-(2-(furan-2-yl)imidazo[1,2-a]pyridin-3-yl)-N-(phenylsulfonyl)benzenesulfonamide (**4e**).* Red solid (15.6 mg, 16%), m.p. = 64-65 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.95 (d, *J* = 7.6 Hz, 4H), 7.67-7.62 (m, 4H), 7.47 (t, *J* = 7.9 Hz, 4H), 7.30 (t, *J* = 7.4 Hz, 1H), 6.93 (s, 1H), 6.74 (t, *J* = 6.7 Hz, 1H), 6.70 (d, *J* = 3.2 Hz, 1H), 6.21-6.20 (m, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 146.9, 144.9, 142.9, 139.4, 137.6, 134.5, 129.0, 128.9, 127.2, 123.8, 117.8, 113.0, 111.1, 109.8, 109.7. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{23}H_{18}N_3O_5S_2^+$: 480.0682, found 480.0684.

*N-(phenylsulfonyl)-N-(2-(4-(N-(phenylsulfonyl)phenylsulfonamido)furan-2-yl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**4e'**).* Yellow solid (9.7 mg, 6%), m.p. = 176-177 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.07 (d, *J* = 7.8 Hz, 4H), 7.99 (d, *J* = 7.8 Hz, 4H), 7.64 (t, *J* = 7.3 Hz, 2H), 7.60 (d, *J* = 8.9 Hz, 1H), 7.54-7.52 (m, 6H), 7.48-7.44 (m, 5H), 7.23 (t, *J* = 7.6 Hz, 1H), 6.84 (d, *J* = 2.8 Hz, 1H), 6.55 (t, *J* = 6.7 Hz, 1H), 6.03 (d, *J* = 2.9 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 148.0, 144.7, 139.3, 138.8, 138.8, 136.7, 134.8, 134.2, 129.3, 129.1, 128.9, 128.9, 127.1, 123.6, 118.0, 114.3, 113.2, 111.9, 110.4. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{35}H_{27}N_4O_9S_4^+$: 775.0655, found 775.0663.

*N-(phenylsulfonyl)-N-(2-(thiophen-2-yl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**4f**).* Green solid (12.7 mg, 13%), m.p. = 160-161 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.97 (d, *J* = 7.9 Hz, 4H), 7.62-7.61 (m, 3H), 7.45 (t, *J* = 7.2 Hz, 5H), 7.27-7.25 (m, 1H), 7.17 (d, *J* = 4.8 Hz, 1H), 7.06 (d, *J* = 2.5 Hz, 1H), 6.69-6.68 (m, 1H), 6.65 (t, *J* = 6.7 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 144.6, 141.3, 139.5, 134.7, 134.7, 129.1, 128.9, 127.7, 127.0, 126.6, 125.9, 123.6, 117.7, 112.8, 109.8. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{23}H_{18}N_3O_4S_3^+$: 496.0454, found 496.0455.

*N-(phenylsulfonyl)-N-(5-(3-(N-(phenylsulfonyl)phenylsulfonamido)imidazo[1,2-a]pyridin-2-yl)thiophen-2-yl)benzenesulfonamide (**4f'**).* Yellow solid (8.5 mg, 5%), m.p. = 91-92 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.00 (d, *J* = 7.7 Hz, 4H), 7.97 (d, *J* = 7.7 Hz, 4H), 7.72-7.66 (m, 4H), 7.60-7.57 (m, 5H), 7.49 (t, *J* = 7.6 Hz, 4H), 7.45 (d, *J* = 6.7 Hz, 1H), 7.30-7.27 (m, 1H), 6.82 (d, *J* = 3.8 Hz, 1H), 6.67 (t, *J* = 6.6 Hz, 1H), 6.30 (d, *J* = 3.8 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 144.5, 140.1, 139.0, 139.0, 137.9, 135.2, 134.2, 132.2, 129.4, 129.1, 128.9, 128.7, 127.3, 123.8, 123.7, 117.9, 113.2, 110.3. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{35}H_{27}N_4O_8S_5^+$: 791.0427, found 791.0448.

*N-(2-phenylimidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**5a**).* White solid (16.7 mg, 48%), m.p. = 218-219 °C. ^{1}H NMR (600 MHz, DMSO) δ 10.68 (s, 1H), 8.13 (d, *J* = 6.4 Hz, 1H), 7.70 (d, *J* = 4.4 Hz, 2H), 7.58 (d, *J* = 8.9 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 2H), 7.44 (t, *J* = 7.2 Hz, 1H), 7.35-7.29 (m, 3H), 7.16 (s, 3H), 6.95 (t, *J* = 6.5 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, DMSO) δ 142.8, 140.6, 140.2, 133.5, 133.0, 129.5, 128.3, 128.0, 127.2, 127.0, 126.5, 124.1, 117.3, 113.7, 112.9, HRMS (positive ESI): $[M+H]^+$ calcd for $C_{19}H_{16}N_3O_2S^+$: 350.0958, found 350.0957.

*N-(2-(4-(trifluoromethyl)phenyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**5b**).* Yellow solid (33.4mg, 80%), m.p. = 260-261 °C. ^{1}H NMR (600 MHz, DMSO) δ 10.83 (s, 1H), 8.23 (d, *J* = 6.4 Hz, 1H), 7.86 (d, *J* = 7.6 Hz, 2H), 7.62 (d, *J* = 8.9 Hz, 1H), 7.49 (t, *J* = 5.7 Hz, 4H), 7.40-7.35 (m, 2H), 7.25 (t, *J* = 7.1 Hz, 2H), 7.01 (t, *J* = 6.2 Hz, 1H). $^{13}C\{^{1}H\}$ NMR (150 MHz, DMSO) δ 143.1, 140.3, 138.7, 137.1, 133.4, 129.4, 128.1 (q, *J* = 31.6 Hz), 127.7, 127.0, 127.0, 125.2 (q, *J* = 3.5 Hz), 124.7 (q, *J* = 270.1 Hz), 124.4, 117.5, 114.7, 113.3. ^{19}F NMR (565 MHz, DMSO) δ -61.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{20}H_{15}F_3N_3O_2S^+$: 418.0832, found 418.0835.

*N-(2-(m-tolyl)imidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**5c**).* Yellow solid (31.9 mg, 88%), m.p. = 208-209 °C. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.29 (d, *J* = 6.4 Hz, 1H), 7.58 (d, *J* = 8.8 Hz, 1H), 7.45 (d, *J* = 7.3 Hz, 2H), 7.28-7.24 (m, 2H), 7.08-7.06 (m, 4H), 6.86-6.83 (m, 3H), 2.08 (s, 3H). $^{13}C\{^{1}H\}$ NMR (150 MHz, $CDCl_3$) δ 143.4, 141.4, 138.7, 137.5, 132.9, 131.9, 128.6, 128.5, 127.9, 127.8, 127.1, 126.2, 124.3, 124.0, 117.1, 112.6, 112.6, 21.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{20}H_{18}N_3O_2S^+$: 364.1114, found 364.1115.

*N-(7-methyl-2-phenylimidazo[1,2-a]pyridin-3-yl)benzenesulfonamide (**5d**).* White solid (25.8 mg, 71%), m.p. = 221-222 °C. ^{1}H NMR (600 MHz, DMSO) δ 10.60 (s, 1H), 8.01 (d, *J* = 5.1 Hz, 1H), 7.67-7.67 (m, 2H), 7.52 (d, *J* = 7.4

Hz, 2H), 7.43 (t, *J* = 6.8 Hz, 1H), 7.34-7.29 (m, 3H), 7.15 (s, 3H), 6.80 (d, *J* = 5.9 Hz, 1H), 2.37 (s, 3H). $^{13}C\{^1H\}$ NMR (150 MHz, DMSO) δ 143.1, 140.7, 137.2, 133.4, 133.1, 129.4, 129.2, 128.3, 127.8, 127.1, 126.9, 123.5, 115.5, 115.3, 113.3, 21.2. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{20}H_{18}N_3O_2S^+$: 364.1114, found 364.1117.

3-fluoro-2-phenylimidazo[1,2-a]pyridine ***(6)***. Yellow solid (15.2 mg, 36%), m.p. = 94-95 °C. ^1H NMR (600 MHz, $CDCl_3$) δ 8.02 (d, *J* = 7.6 Hz, 2H), 7.92 (d, *J* = 6.7 Hz, 1H), 7.54 (d, *J* = 9.1 Hz, 1H), 7.47 (t, *J* = 7.4 Hz, 2H), 7.34 (t, *J* = 7.3 Hz, 1H), 7.15 (t, *J* = 7.2 Hz, 1H), 6.85 (t, *J* = 6.6 Hz, 1H). $^{13}C\{^1H\}$ NMR (150 MHz, $CDCl_3$) δ 138.7 (d, *J* = 273.2 Hz), 136.9 (d, *J* = 5.6 Hz), 131.7 (d, *J* = 5.2 Hz), 128.8, 127.8, 126.3 (d, *J* = 4.0 Hz), 123.8, 122.7, 120.4, 117.9, 112.6. ^{19}F NMR (565 MHz, $CDCl_3$) δ -154.9. HRMS (positive ESI): $[M+H]^+$ calcd for $C_{13}H_{10}FN_2^+$: 213.0823, found 213.0824.

ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge on the ACS Publications website.

X-ray data for **2a** (CIF)

Optimization of reaction conditions, crystallography of product **2a**, and NMR spectra (PDF)

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Notes

The authors declare no competing financial interest.

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