Oxidative C–H Sulfonylation of Hydrazones Enabled by Electrochemistry

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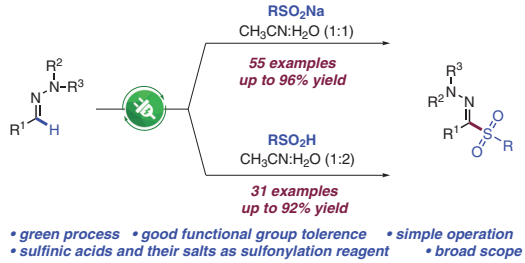

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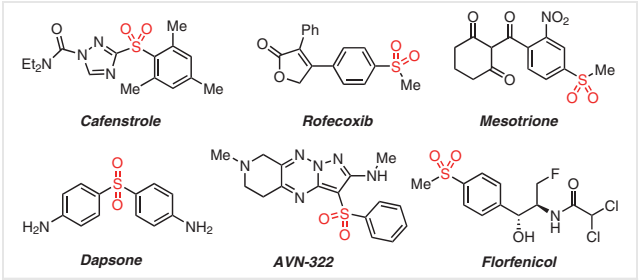
Abstract An efficient electrochemical oxidative C(sp^2)–H sulfonylation of aldehyde hydrazones is described. A variety of sodium sufinates or sulfinic acids participate effectively in this protocol, which provides facile access to an array of alkyl and aromatic sulfonylated hydrazones with up to 96% yield. Large-scale synthesis and product derivatization show the potential utility of this methodology. Preliminary mechanistic investigations including radical-inhibition, electricity on/off experiments, and cyclic voltammetry support a radical pathway.

Key words electrochemical synthesis, radical, sulfonylation, hydrazones, sulfinic acid

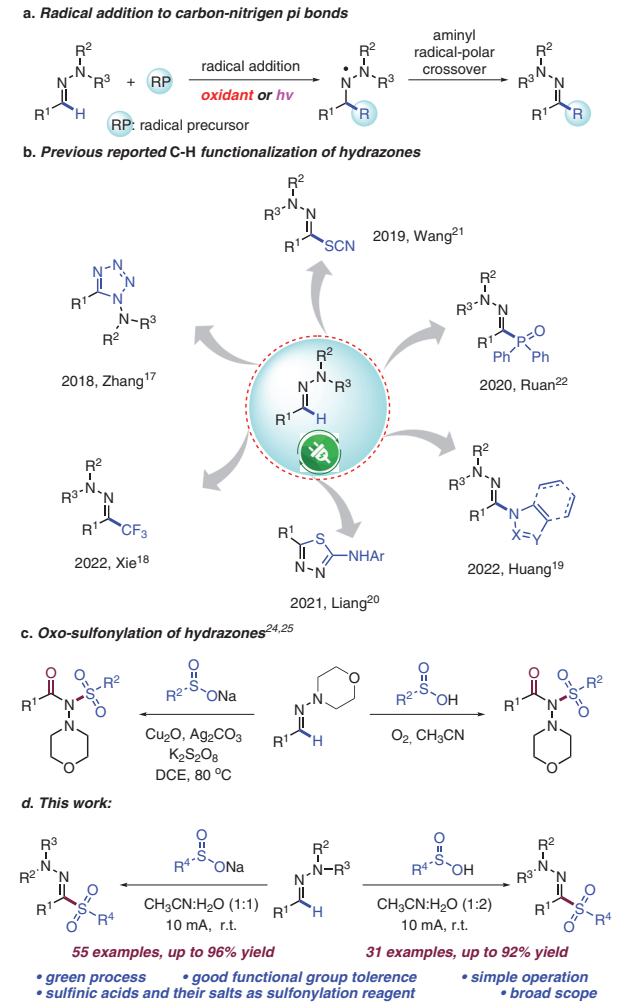
A wide range of natural and unnatural compounds that have broad applications in the fields of agrochemicals, pharmaceuticals, and materials chemistry, contain organosulfones (Scheme 1).[1] These compounds are also known for their synthetic versatility as key intermediates[2] in well-known organic transformations such as the Smiles rearrangement,[3] Ramberg–Backlund reaction,[4] van Leusen oxazole synthesis,[5] and Julia olefination.[6] On the other hand, many natural and synthetic hydrazones possess multifaceted biological activities including antidepressant,[7] antimicrobial,[8] anti-inflammatory,[9] analgesic, anticonvulsant,[10] antimalarial,[11] and anticancer properties,[12] making them interesting target compounds for drug design. Conceptually, the integration of such a structural motif and sulfone group together into one molecule might open new windows of opportunity for the discovery of novel bioactive molecules.



Scheme 1 Important examples of sulfones

The chemistry of functionalized hydrazones has gained considerable momentum over the last few decades due to their important applications in organic synthesis.[13] Hydrazones are versatile synthetic building blocks that participate in a plethora of synthetic transformations in which they act not only as carbonyl surrogates but also as precursors of nitrogen-containing compounds.[14] Among the various hydrazone-based transformations, those that employ the C=N bonds as radical acceptors for diverse C(sp^2)–H bond functionalizations are among the most desirable strategies (Scheme 2a).[15] In recent years, electricity-initiated organic transformations have flourished as a powerful tool for the construction of chemical bonds because they

utilize safe, traceless, renewable, and eco-friendly electrons as the sole redox reagents.[16] In this context, elegant examples of direct radical functionalization of hydrazones under electrochemical conditions have been documented. In 2018, Zhang et al.[17] developed an electrochemical [3+2] cycloaddition for the synthesis of tetrazoles from azides and hydrazones. Subsequently, electrochemically enabled direct C(sp^2)–H bond functionalization of hydrazones for the construction of C–C, C–N, C–S, and C–P bonds were independently reported by Xie,[18] Huang,[19] Liang,[20] Wang,[21] and Ruan[22] (Scheme 2b). Nevertheless, despite this important progress, the direct C(sp^2)–H sulfonylation of hydrazones, which offers a promising complement to existing strategies, remains under-explored.[23]



Scheme 2 Electrochemical strategies for sulfonylating C(sp^2)–H bonds of hydrazones

Recently, the synthesis of *N*-acylsulfonamides through oxo-sulfonylation of hydrazones was reported by Hajra et al.[24] and Liu et al.[25] employing sulfinic acids and sodium sufinates, respectively, as the sulfonyl radical precursors under transition-metal-free and metal-catalysis approaches (Scheme 2c). In sharp contrast, we herein disclose an efficient, mild, and sustainable protocol for the preparation of a wide variety of (*E*)-sulfonylated hydrazones via electrochemical oxidative C(sp^2)–H sulfonylation of aldehyde-derived hydrazones based on sulfinic acids/salts as sulfonylating reagents (Scheme 2d).

As shown in Table 1, we commenced the study with the reaction of readily accessible aldehyde hydrazone **1a** with 4-methylbenzenesulfinate **2a** as a sulfonyl donor. When the reaction was conducted in an undivided cell equipped with two Pt plate electrodes with ^{n}Bu$_4$NBF$_4$ as the supporting electrolyte and MeCN/H$_2$O (4:1, 3 mL) as solvent, the expected product **6a** was obtained in 52% yield at 27 °C. Employing ^{n}Bu$_4$NPF$_6$, ^{n}Bu$_4$NClO$_4$, or LiClO$_4$ resulted in decreased reaction yields (entries 2–4). Electrode materials also had a clear influence on this reaction. Replacing the anode with graphite felt increased the yield of the sulfonylated product **6a** to 61% (entry 5). When Ni foam plate, Fe sheet, or graphite rod were used as the cathodic material, the yield of **6a** was reduced to 53, 52, and 47%, respectively (entries 6–8). After intensive investigation of a range of solvents, it was found that a solvent mixture of MeCN/H$_2$O at a 1:1 ratio was the best chose (entries 9–13). Gratifyingly, decreasing the concentration of reagents in the solvent to 0.05 M led to further improvement of the isolated yield of **6a** to 90% (entry 14). When the electrolysis was carried out in the absence of supporting electrolytes, the yield of **2a** dropped to 83% (entry 15). It was observed that either decreasing or increasing the current intensity resulted in decreased reaction yield (entries 16 and 17). No desired product was obtained without the application of electricity (entry 18).

To our delight, sulfinic acid also served as a suitable sulfonyl source for our current protocol to prepare sufonylated hydrazones. Different to Hajra's work,[24] when the reaction of **1a** with *p*-methylbenzenesulfonic acid **3a** was carried out under the optimized conditions as detailed in Table 1 (entry 14), the desired product **6a** could be obtained in 79% yield, and *N*-acylsulfonamide **6a′** was also isolated as a byproduct in 9% yield (entry 19). In this case, increasing the amount of H$_2$O proved to be necessary to achieve higher yield of **6a** and less byproduct. A notable 87% isolated yield of **6a** was obtained when the relative proportion of acetonitrile to water was 1:2 (entry 20). Interestingly, attempts at electrochemical C–H sulfonylation using either *p*-toluenesulfonyl hydrazide **4** or sulfonyl chloride **5** as the sulfonylating reagents failed to give any desired product (entries 21 and 22).

Table 1 Optimization of Reaction Conditions[a]

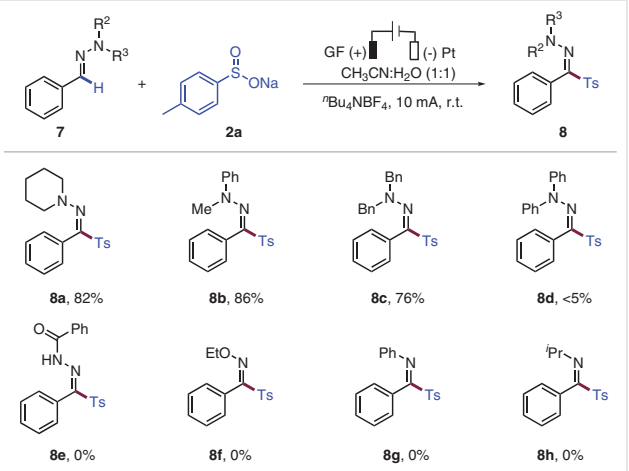
$TolSO_2$ source: $TolSO_2Na$ (**2a**), $TolSO_2H$ (**3a**), $TolSO_2NHNH_2$ (**4**); $TolSO_2Cl$ (**5**)

Entry	$TolSO_2$ source (equiv)	Anode/Cathode	Electrolyte	Current (mA)	Solvent	Yield of **6a**/**6a'** (%)[b]
1	**2a** (2.0)	Pt(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (4:1, 3 mL)	52/0
2	**2a** (2.0)	Pt(+)/Pt(–)	$^nBu_4NPF_6$	10	CH_3CN/H_2O (4:1, 3 mL)	34/0
3	**2a** (2.0)	Pt(+)/Pt(–)	$^nBu_4NClO_4$	10	CH_3CN/H_2O (4:1, 3 mL)	39/0
4	**2a** (2.0)	Pt(+)/Pt(–)	$LiClO_4$	10	CH_3CN/H_2O (4:1, 3 mL)	36/0
5	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (4:1, 3 mL)	61/0
6	**2a** (2.0)	GF(+)/Ni(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (4:1, 3 mL)	53/0
7	**2a** (2.0)	GF(+)/Fe(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (4:1, 3 mL)	52/0
8	**2a** (2.0)	GF(+)/C(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (4:1, 3 mL)	47/0
9	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	TFE/H_2O (4:1, 3 mL)	44/0
10	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	THF/H_2O (4:1, 3 mL)	28/0
11	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN (3 mL)	<5/0
12	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	H_2O (3 mL)	0/0
13	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (1:1, 3 mL)	88/0
14	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (1:1, 6 mL)	92 (90)[c]/0
15	**2a** (2.0)	GF(+)/Pt(–)	–	10	CH_3CN/H_2O (1:1, 6 mL)	83/0
16[d]	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	5	CH_3CN/H_2O (1:1, 6 mL)	83/0
17[e]	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	15	CH_3CN/H_2O (1:1, 6 mL)	71/0
18	**2a** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	–	CH_3CN/H_2O (1:1, 6 mL)	0/0
19	**3a** (1.5)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (1:1, 6 mL)	79/9
20	**3a** (1.5)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (1:2, 6 mL)	89 (87)[c]/<5
21	**4** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (1:1, 6 mL)	0/0
22	**5** (2.0)	GF(+)/Pt(–)	$^nBu_4NBF_4$	10	CH_3CN/H_2O (1:1, 6 mL)	0/0

[a] Reaction conditions unless otherwise stated: **1** (0.2 mmol), **2a** (0.4 mmol, 2.0 equiv) in CH_3CN/H_2O (1:1 v/v, 6 mL), graphic felt anode (10 × 15 × 2 mm^3), Pt cathode (10 × 10 × 0.2 mm^3), undivided cell, room temperature (ca. 27 °C), 10 mA.
[b] Yield determined by ^1H NMR analysis with CH_2Br_2 as an internal standard.
[c] Isolated yield in parentheses.
[d] Reaction time: 5.0 h.
[e] Reaction time: 1.5 h.

With the optimized conditions in hand, we first investigated the effect of different *N*-substituents of hydrazones (Scheme 3). The results showed that dialkyl hydrazones **7a–c** were effective coupling partners, whereas diphenylhydrazone with much less electron-donating capacity proved to be essentially unreactive under identical conditions (**7d**). In the case of *N*-Bz hydrazone (**7e**), the reaction resulted in the consumption of the starting materials, giving rise to a complex mixture of side products. Additionally, no reaction was observed using either oxime ethers (**7f**) or imines (**7g** and **7h**) as the substrates. These results suggest that the *N*,*N*-disubstituted structural motif is crucial for the desired transformation, and the alkyl group is likely an important activation unit.

With the optimal conditions in hand, the generality of this reaction was first evaluated with sodium sulfinate **2a** and sulfinic acid **3a** under conditions A and B, respectively (Scheme 4). Both **2a** and **3a** could react with various aryl aldehyde-derived hydrazones possessing either electron-donating [methyl (**6b**, **6c**), *tert*-butyl (**6d**), methoxy (**6e**)], neutral (**6f**), or electron-withdrawing [fluoro (**6g**, **6h**), chloro (**6i**), bromo (**6j**, **6k**), iodo (**6l**), ester (**6m**), cyano (**6n**), nitro



Scheme 3 Investigation into the effect of the N-substituents. *Reagents and conditions*: Graphite Felt anode (10 × 15 × 2 mm^3), Pt cathode (10 × 10 × 0.2 mm^3), **7** (0.2 mmol), **2a** (0.4 mmol), $^nBu_4NBF_4$ (0.05 M), CH_3CN/H_2O (1:1 v/v, 6 mL), room temperature (ca. 27 °C), 10 mA. Isolated yields given.

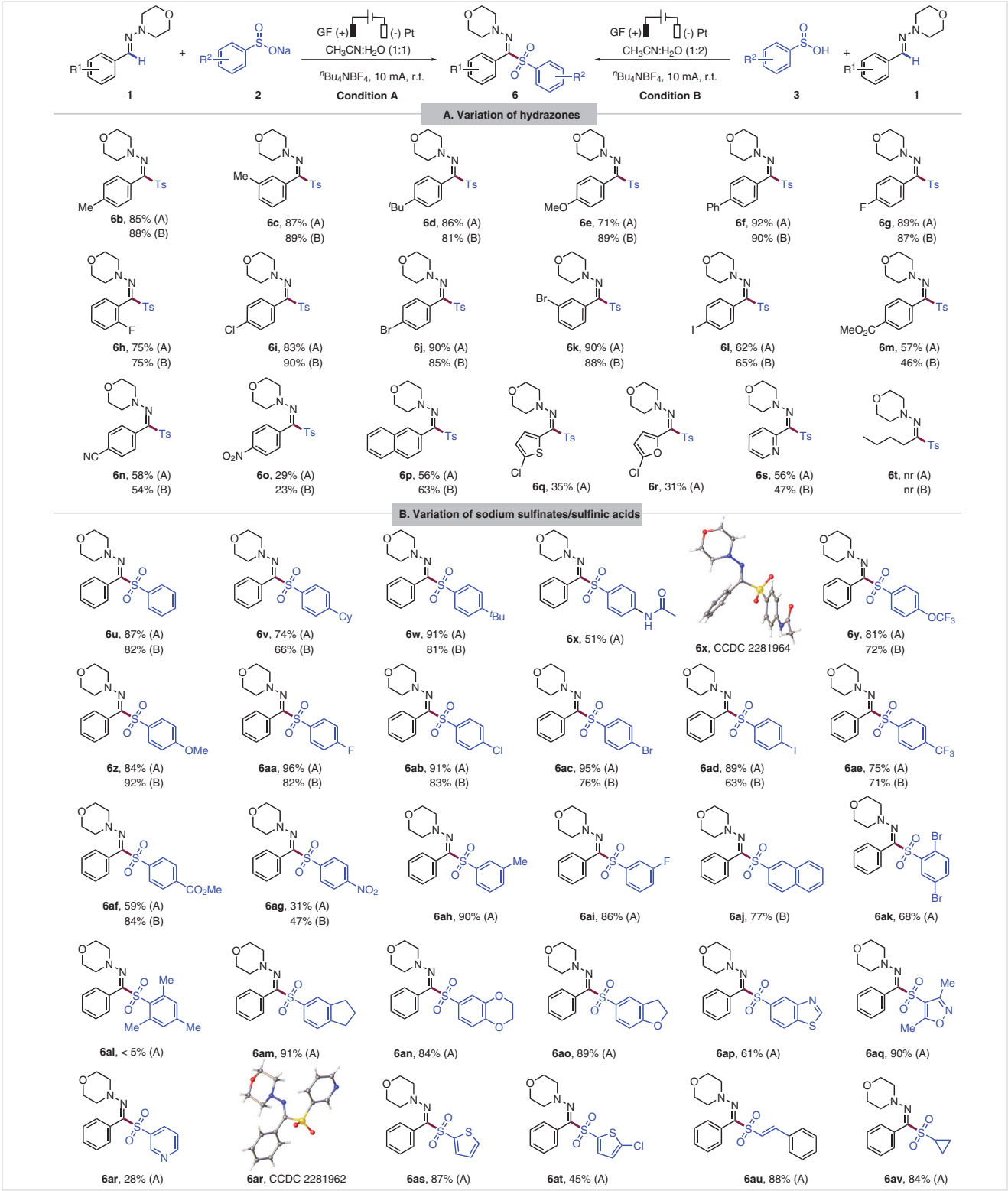
(**6o**)] functionalities smoothly to deliver the corresponding sulfonylated product in moderate to excellent yields (23–92%). However, the electronic properties of the substituent had a big influence, and substrates bearing strong electron-withdrawing groups provided much lower yields than those with electron-donating groups. The substrates with naphthyl, thienyl, furanyl, or pyridyl substituents were all suitable, giving the corresponding products **6p–s**, albeit with lower efficiency (31–63%). Unfortunately, aliphatic aldehyde-derived hydrazone remained a challenging substrate for this transformation (**6t**).

Subsequently, we moved on to investigate the scope of sodium sulfinates (Scheme 4). Fortunately, various sodium benzene sulfinate derivatives bearing electron-donating groups (-^{t}Bu, -OMe, -OCF_3, -Cy, -NHAc), halogens (-F, -Cl, -Br, -I,) and electron-withdrawing substituents (-CF_3, -CO_2CH_3, -NO_2) at different positions reacted with **1a** smoothly in satisfactory yields (**6u–ak**, 31–96%). However, in the case of the sodium 2,4,6-trimethylbenzenesulfinate, only a trace amount of product **6al** was observed; this may be a result of the high steric hindrance. Pleasingly, the sodium sulfinates containing annulated arenes and heteroarenes such as indane (**6am**), 2,3-dihydrobenzo[*b*][1,4]dioxine (**6an**), 2,3-dihydrobenzofuran (**6ao**), benzo[*d*]thiazole (**6ap**), 3,5-dimethylisoxazole (**6aq**), pyridine (**6ar**), and thiophene (**6as–at**) were also well-tolerated under the electrochemical protocol. The yields of the expected products ranged from 28 to 91%. Other than (hetero)aromatic sodium sulfinates, vinyl and aliphatic sodium sulfinates also served as suitable candidates to participate in this reaction to produce the corresponding products **6au** and **6av** in 88 and 84% yields, respectively. The structures of sulfonylated hydrazone frameworks **6x** (CCDC 2281964) and **6ar** (CCDC 2281962) were determined by X-ray crystallography.[26]

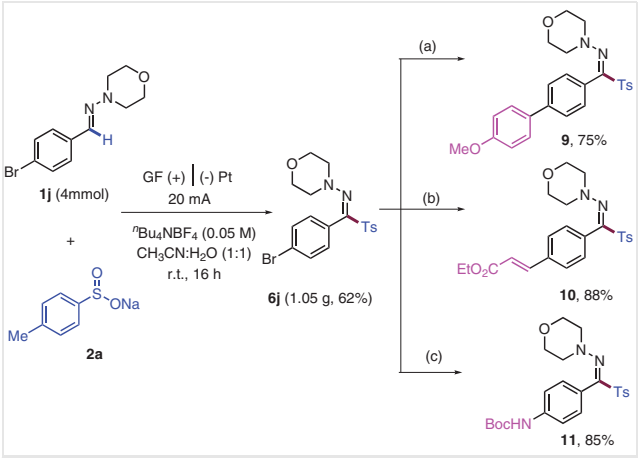
The tolerance of the benzenesulfinic acid moiety was also studied (Scheme 4). Overall, the reactivity of sulfinic acids in the reaction showed similarities to that of sodium sulfinates discussed above. Sulfonylation of aldehyde hydrazone **1a** with various substituted sulfinic acids (**6u–w**, **6y–ag**, **6aj**) was successful and very similar reaction outcomes to those obtained with sodium sulfinates as substrates were achieved.

Next, we continued our study by conducting the sulfonylation on a gram scale (Scheme 5). Thus, a 4-mmol scale reaction of **1j** was performed with sodium 4-methylbenzenesulfnate **2a** under constant-current electrolysis at 20 mA for 16 h, which gratifyingly provided 1.05 g of **6j** in 62% yield. Subsequently, structural elaborations of **6j** were investigated. A series of cross-coupling reactions (Suzuki, Heck, and Buchwald–Hartwig) with **6j** were performed, which proceeded smoothly yielding the cross-coupled products **9** (75%), **10** (88%), and **11** (85%), respectively.

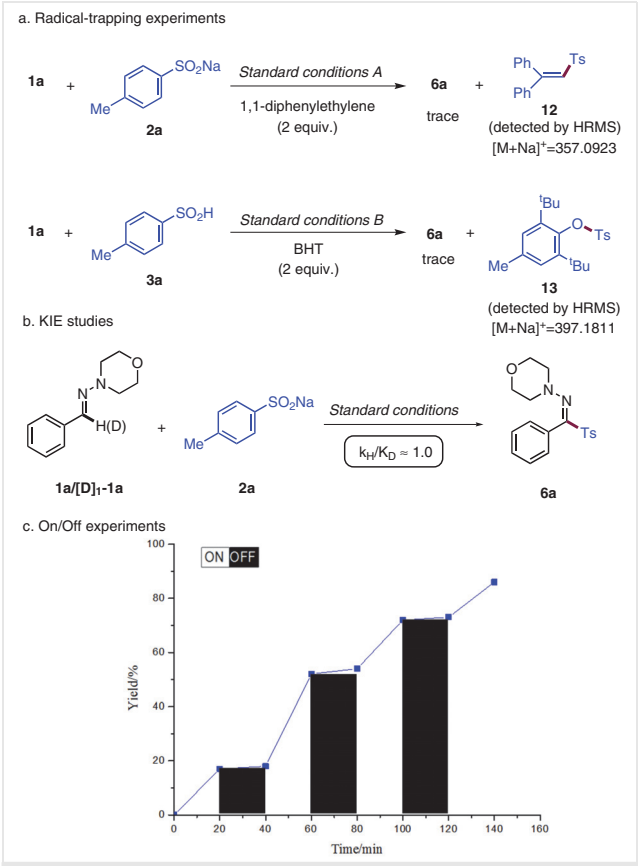
To elucidate a plausible mechanism, we performed a series of control experiments. Under standard conditions, the reactions of **2a** or **3a** with **1a** were suppressed completely after adding two equivalents of 1,1-diphenylethylene or 2,6-di-*tert*-butyl-4-methylphenol (BHT). The corresponding radical trapping adducts **12** and **13** could be detected by high-resolution mass spectrometry (HRMS) (Scheme 6a).[27] The formation of **12** and **13** indicates that tosyl radical may be involved. A minor kinetic isotope effect (KIE) of $k_H/k_D \approx 1.0$ was observed (Scheme 6b), suggesting a facile C–H cleavage. Additionally, we conducted electricity on/off experiments (Scheme 6c). The transformations were fully suppressed in the absence of electricity, thereby ruling out a radical-chain process. Furthermore, we carried out cyclic voltammetry to analyze the redox potential of the substrates (Figure 1). An oxidation peak of **1a** was found at ca. 0.81 V, while the oxidation peaks of $ArSO_2Na$ and $ArSO_2H$ were observed at ca. 0.40 V and ca. 0.62 V vs. SCE, respectively. Based on these results, it can be inferred that **2a** or **3a** might undergo preferential oxidation at the anode, leading to the generation of a tosyl radical.



Scheme 4 Substrate scope. Conditions A: Graphite Felt anode (10 × 15 × 2 mm^3), Pt cathode (10 × 10 × 0.2 mm^3), **1** (0.2 mmol), **2** (0.4 mmol), $^nBu_4NBF_4$ (0.05 M), MeCN/H_2O (1:1 v/v, 6 mL), room temperature (ca. 27 °C), 10 mA. Conditions B: Graphite Felt anode (10 × 15 × 2 mm^3), Pt cathode (10 × 10 × 0.2 mm^3), **1** (0.2 mmol), **3** (0.3 mmol), $^nBu_4NBF_4$ (0.05 M), MeCN/H_2O (1:2 v/v, 6 mL), room temperature (ca. 27 °C), 10 mA. Isolated yields given.



Scheme 5 Synthetic applications. *Reagents and conditions*: (a) $Pd(PPh_3)_4$, Cs_2CO_3, DMF/toluene (4:1), 120 °C, 12 h, N_2; (b) $Pd(OAc)_2$, K_2CO_3, PPh_3, DMF, 120 °C, 12 h, N_2; (c) Cs_2CO_3, X-Phos, $Pd(OAc)_2$, dioxane, 100 °C, overnight, N_2.



Scheme 6 Control experiments

Based on the current results and on literature precedents,[15] we proposed a plausible reaction pathway for this electrochemical sulfonylation of hydrazones, as outlined in Scheme 7. Initially, anodic oxidation of sodium sulfinate **2a** or sulfinic acid **3a** generates tosyl radical **A**. Thereafter, tosyl radical **A** would be trapped by the hydrazone to generate the sulfonylated aminyl radical intermediate **B**, which would be oxidized at the anode to produce aminyl cationic species **C**. Further tautomerization and deprotonation of aminyl cation **D** would afford **6a**.

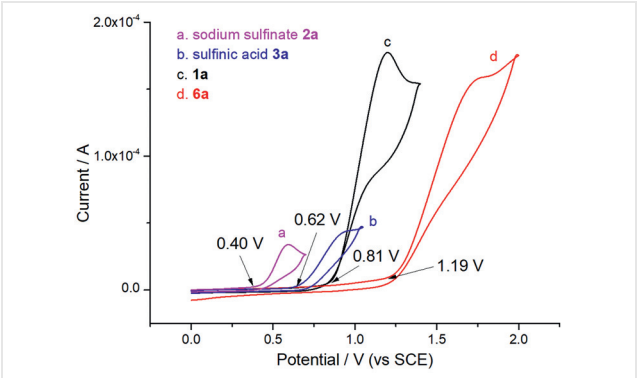
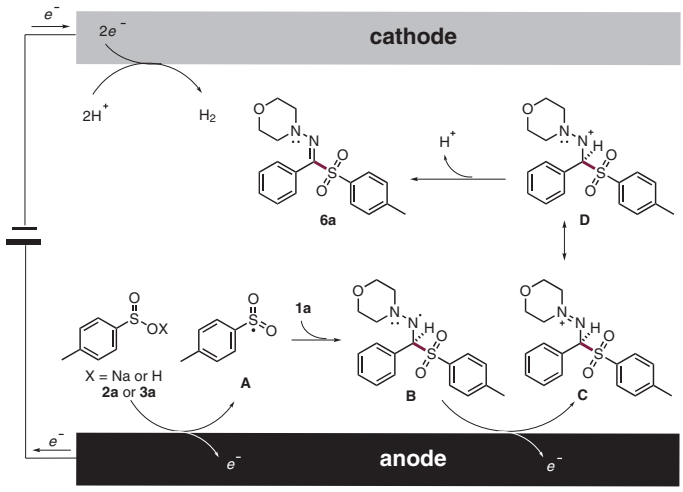


Figure 1 Cyclic voltammograms recorded on a glassy carbon disk working electrode (diameter, 3 mm) in $MeCN/H_2O$ (9:1) with 0.1 M $^nBu_4NPF_6$. (a) **2a** (5 mM); (b) **3a** (5 mM); (c) **1a** (5 mM); (d) **6a** (2 mM).

In conclusion, we have developed a practical and efficient electrochemical procedure for the direct C(sp^2)–H bond sulfonylation of (hetero)aromatic aldehyde hydrazones using stable and easy-to-handle sodium sulfinates or sulfinic acids as sulfonylating agent. This method is of great synthetic value due to its desirable features such as being free from external oxidants, and because of its high atom-economy, high functional group tolerance, operational simplicity, and use of an eco-friendly energy source. Preliminary mechanistic investigations suggest the involvement of an aminyl radical/polar crossover process in the transformation.

All the reagents and solvents were obtained from commercial sources and were used without further purification unless otherwise stated. The hydrazones were prepared according to reported methods.[28] The sulfinic acids and sodium sulfinates were synthesized according to reported procedures.[29] The conversion of starting materials was monitored by thin-layer chromatography using silica gel plates, and components were visualized by observation under UV light (254 and 365 nm). ^1H NMR spectra were recorded at 400 MHz or 600 MHz. The ^{13}C NMR spectra were recorded at 100 MHz or 150 MHz. ^{19}F NMR spectra were recorded at 376 MHz. Chemical shifts are expressed in parts per million (δ) downfield from the internal standard tetramethylsilane (TMS), and are reported as s (singlet), d (doublet), t (triplet), dd (doublets of doublet), dt (doublets of triplet), td (triplets of doublet), and m (multiplet). The residual solvent signals were used as references and the chemical shifts are converted to the TMS scale ($CDCl_3$: δ H = 7.26 ppm, δ C = 77.16 ppm). The coupling constants *J* are given in Hz. High-resolution mass spectra (HRMS) were obtained in ESI mode with an Agilent Q-TOF 6540 mass spectrometer.



Scheme 7 Proposed mechanism

Preparation of 6: General Procedure

Conditions A

The electrocatalysis was carried out in an undivided cell with a graphite felt anode (10 mm × 15 mm × 2 mm) and a Pt cathode (10 mm × 10 mm × 0.2 mm). Hydrazone **1** (0.20 mmol, 1.0 equiv), sodium sulfinate **2** (0.40 mmol, 2.0 equiv), and $^{n}Bu_4NBF_4$ (98.7 mg, 0.30 mmol) were dissolved in CH_3CN/H_2O (1:1, 6.0 mL). The electrocatalysis was performed at 27 °C with a constant current of 10.0 mA. After electrolysis was complete, the GF anode was washed with CH_2Cl_2 (3 × 15 mL). Evaporation of the solvent and subsequent purification by column chromatography (PE/EtOAc, 5:1) on silica gel afforded the corresponding product **6**.

Conditions B

The electrocatalysis was carried out in an undivided cell with a graphite felt anode (10 mm × 15 mm × 2 mm) and a Pt cathode (10 mm × 10 mm × 0.2 mm). Hydrazone **1** (0.20 mmol, 1.0 equiv), sulfinic acid **3** (0.30 mmol, 1.5 equiv), and $^{n}Bu_4NBF_4$ (98.7 mg, 0.30 mmol) were dissolved in CH_3CN/H_2O (1:2, 6.0 mL). The electrocatalysis was performed at 27 °C with a constant current of 10.0 mA. After electrolysis was complete, the GF anode was washed with CH_2Cl_2 (3 × 15 mL). Evaporation of the solvent and subsequent purification by column chromatography (PE/EtOAc, 5:1) on silica gel afforded the corresponding product **6**.

Gram-Scale Synthesis of 6j

The gram-scale reaction was conducted in a 150 mL straight undivided five-port electrolytic cell. The substrates **1j** (1.076 g, 4.0 mmol), **2a** (1.424 g, 8.0 mmol) and $^{n}Bu_4NBF_4$ (1.383 g, 6.0 mmol) were dissolved in the mixture solvent CH_3CN/H_2O (60:60 mL). The electrolysis was carried out at 27 °C using a constant current of 20 mA for 16 hours. After the reaction, the solvent was extracted with ethyl acetate (3 × 120 mL), dried over Na_2SO_4, and concentrated in vacuo. The resulting residue was purified by chromatography through silica gel (petroleum ether/EtOAc, 5:1) to afford the corresponding product **6j** (1.054 g, 62%) as yellow solid.

(*E*)-*N*-Morpholino-1-phenyl-1-tosylmethanimine (6a)

Method A: 90% (61.9 mg), Method B: 87% (59.9 mg); white solid; mp 131–135 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.61 (d, *J* = 8.4 Hz, 2 H), 7.39–7.30 (m, 3 H), 7.24–7.20 (m, 4 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.02 (t, *J* = 4.8 Hz, 4 H), 2.39 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.9, 142.7, 136.3, 130.8, 130.0, 130.0, 129.3, 128.8, 128.6, 66.0, 54.1, 21.6.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{20}N_2NaO_3S^+$: 367.1087; found: 367.1087.

(*E*)-*N*-Morpholino-1-(*p*-tolyl)-1-tosylmethanimine (6b)

Method A: 85% (60.9 mg), Method B: 88% (63.1 mg); white solid; mp 79–80 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.62 (d, *J* = 8.4 Hz, 2 H), 7.22 (d, *J* = 8.0 Hz, 2 H), 7.13 (s, 4 H), 3.57 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H), 2.40 (s, 3 H), 2.35 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.9, 143.2, 140.4, 136.5, 129.9, 129.4, 129.3, 128.9, 127.7, 66.1, 54.1, 21.7, 21.6.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{22}N_2NaO_3S^+$: 381.1243; found: 381.1242.

(*E*)-*N*-Morpholino-1-(*m*-tolyl)-1-tosylmethanimine (6c)

Method A: 87% (62.4 mg), Method B: 89% (63.8 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.62 (d, *J* = 8.4 Hz, 2 H), 7.25–7.16 (m, 4 H), 7.08 (s, 1 H), 6.99 (d, *J* = 6.8 Hz, 1 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.02 (t, *J* = 4.8 Hz, 4 H), 2.40 (s, 3 H), 2.31 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.9, 143.2, 138.5, 136.5, 130.9, 130.7, 130.5, 129.3, 129.0, 128.5, 127.1, 66.1, 54.1, 21.7, 21.4.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{19}H_{23}N_2O_3S^+$: 359.1424; found: 359.1420.

(*E*)-1-(4-(*tert*-Butyl)phenyl)-*N*-morpholino-1-tosylmethanimine (6d)

Method A: 86% (68.9 mg), Method B: 81% (64.9 mg); white solid; mp 100–104 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.63 (d, *J* = 8.4 Hz, 2 H), 7.35 (d, *J* = 8.4 Hz, 2 H), 7.23 (d, *J* = 8.0 Hz, 2 H), 7.19 (d, *J* = 8.4 Hz, 2 H), 3.57 (t, *J* = 4.8 Hz, 4 H), 3.02 (t, *J* = 4.8 Hz, 4 H), 2.41 (s, 3 H), 1.31 (s, 9 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.5, 143.9, 143.6, 136.6, 129.7, 129.3, 129.0, 127.6, 125.6, 66.2, 54.2, 35.0, 31.3, 21.8.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{22}H_{29}N_2O_3S^+$: 401.1893; found: 401.1893.

(*E*)-1-(4-Methoxyphenyl)-*N*-morpholino-1-tosylmethanimine (6e)

Method A: 71% (53.2 mg), Method B: 89% (66.7 mg); white solid; mp 69–70 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.61 (d, *J* = 8.4 Hz, 2 H), 7.23–7.15 (m, 4 H), 6.84 (d, *J* = 8.8 Hz, 2 H), 3.80 (s, 3 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.02 (t, *J* = 4.8 Hz, 4 H), 2.38 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 160.8, 143.9, 143.4, 136.5, 131.4, 129.3, 128.9, 122.4, 114.1, 66.1, 55.4, 54.1, 21.7.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{19}H_{23}N_2O_3S^+$: 375.1373; found: 375.1371.

(*E*)-1-([1,1′-Biphenyl]-4-yl)-*N*-morpholino-1-tosylmethanimine (6f)

Method A: 92% (77.4 mg), Method B: 90% (75.7 mg); yellow solid; mp 86–92 °C.

^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.67 (d, *J* = 8.4 Hz, 2 H), 7.62–7.57 (m, 4 H), 7.45 (t, *J* = 7.2 Hz, 1 H), 7.34 (d, *J* = 8.4 Hz, 2 H), 7.24 (d, *J* = 7.8 Hz, 2 H), 3.60 (t, *J* = 4.8 Hz, 4 H), 3.09 (t, *J* = 4.8 Hz, 3 H), 2.41 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.0, 142.8, 139.9, 136.5, 130.5, 129.6, 129.4, 129.1, 129.0, 128.2, 127.23, 127.19, 66.2, 54.2, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{24}H_{24}N_2NaO_3S^+$: 443.1400; found: 443.1400.

(*E*)-1-(4-Fluorophenyl)-*N*-morpholino-1-tosylmethanimine (6g)

Method A: 89% (64.5 mg), Method B: 87% (63.1 mg); white solid; mp 122–123 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.62 (d, *J* = 8.0 Hz, 2 H), 7.28–7.23 (m, 4 H), 7.05 (t, *J* = 8.4 Hz, 2 H), 3.59 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H), 2.41 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.6 (d, J_{C-F} = 250.0 Hz), 144.2, 141.7, 136.2, 132.2 (d, J_{C-F} = 7.0 Hz), 129.4, 128.9, 126.8 (d, J_{C-F} = 4.0 Hz), 116.0 (d, J_{C-F} = 21.0 Hz), 66.1, 54.2, 21.7.

^{19}F NMR (376 MHz, $CDCl_3$): δ = –110.0.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{19}FN_2NaO_3S^+$: 385.0993; found: 385.0991.

(*E*)-1-(2-Fluorophenyl)-*N*-morpholino-1-tosylmethanimine (6h)

Method A: 75% (54.4 mg), Method B: 75% (54.4 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.63 (d, *J* = 8.0 Hz, 2 H), 7.44–7.33 (m, 2 H), 7.22 (d, *J* = 8.0 Hz, 2 H), 7.16 (t, *J* = 7.6 Hz, 1 H), 7.00 (t, *J* = 8.4 Hz, 1 H), 3.60 (t, *J* = 4.8 Hz, 4 H), 3.11 (s, 4 H), 2.39 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 160.1 (d, J_{C-F} = 248.0 Hz), 144.0, 136.7, 134.5, 132.5 (d, J_{C-F} = 7.0 Hz), 132.2 (d, J_{C-F} = 3.0 Hz), 129.4, 128.7, 124.4 (d, J_{C-F} = 4.0 Hz), 119.2 (d, J_{C-F} = 17.0 Hz), 115.7 (d, J_{C-F} = 21.0 Hz), 66.2, 53.4, 21.7.

^{19}F NMR (376 MHz, $CDCl_3$): δ = –109.4.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{19}FN_2NaO_3S^+$: 385.0993; found: 385.0990.

(*E*)-1-(4-Chlorophenyl)-*N*-morpholino-1-tosylmethanimine (6i)

Method A: 83% (62.9 mg), Method B: 90% (68.2 mg); white solid; mp 130–131 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.61 (d, *J* = 8.0 Hz, 2 H), 7.35–7.30 (m, 2 H), 7.24 (d, *J* = 8.0 Hz, 2 H), 7.22–7.17 (m, 2 H), 3.59 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H), 2.41 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.2, 141.4, 136.5, 136.3, 131.5, 129.5, 129.3, 129.1, 128.9, 66.1, 54.2, 21.8.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{18}H_{20}ClN_2NaO_3S^+$: 379.0878; found: 379.0876.

(*E*)-1-(4-Bromophenyl)-*N*-morpholino-1-tosylmethanimine (6j)

Method A: 90% (76.1 mg), Method B: 85% (71.9 mg); white solid; mp 140–141 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.59 (d, *J* = 8.0 Hz, 2 H), 7.46 (d, *J* = 8.0 Hz, 2 H), 7.22 (d, *J* = 8.0 Hz, 2 H), 7.11 (d, *J* = 8.0 Hz, 2 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.02 (t, *J* = 4.8 Hz, 4 H), 2.38 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.1, 141.1, 136.2, 131.9, 131.6, 129.7, 129.4, 128.8, 124.7, 66.0, 54.1, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{19}BrN_2NaO_3S^+$: 445.0192; found: 445.0193.

(*E*)-1-(3-Bromophenyl)-*N*-morpholino-1-tosylmethanimine (6k)

Method A: 90% (76.1 mg), Method B: 88% (74.6 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.62 (d, *J* = 8.4 Hz, 2 H), 7.53 (td, *J* = 7.6, 1.6 Hz, 1 H), 7.38 (t, *J* = 1.6 Hz, 1 H), 7.28–7.17 (m, 4 H), 3.59 (t, *J* = 4.8 Hz, 4 H), 3.01 (t, *J* = 4.8 Hz, 4 H), 2.42 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.3, 140.6, 136.2, 133.3, 133.0, 132.8, 130.1, 129.5, 128.9, 128.8, 122.7, 66.1, 54.2, 21.8.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{19}BrN_2NaO_3S^+$: 445.0192; found: 445.0190.

(*E*)-1-(4-Iodophenyl)-*N*-morpholino-1-tosylmethanimine (6l)

Method A: 62% (84.6 mg), Method B: 65% (61.1 mg); white solid; mp 123–127 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.69 (d, *J* = 8.0 Hz, 2 H), 7.61 (d, *J* = 8.0 Hz, 2 H), 7.24 (d, *J* = 7.6 Hz, 2 H), 6.99 (d, *J* = 8.0 Hz, 2 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H), 2.41 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.2, 141.4, 137.9, 136.3, 131.7, 130.4, 129.5, 128.9, 96.8, 65.7, 54.2, 21.1.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{19}BrN_2NaO_3S^+$: 493.0053; found: 493.0050.

Methyl (*E*)-4-((Morpholinoimino)(tosyl)methyl)benzoate (6m)

Method A: 57% (45.9 mg), Method B: 46% (37.1 mg); white solid; mp 140–144 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.99 (d, *J* = 8.4 Hz, 2 H), 7.60 (d, *J* = 8.4 Hz, 2 H), 7.33 (d, *J* = 8.4 Hz, 2 H), 7.22 (d, *J* = 8.0 Hz, 2 H), 3.92 (s, 3 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H), 2.40 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.4, 144.3, 141.1, 136.3, 135.8, 131.5, 130.3, 129.7, 129.5, 128.9, 66.1, 54.3, 52.6, 21.8.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{20}H_{22}N_2NaO_5S^+$: 425.1142; found: 425.1146.

(*E*)-4-((Morpholinoimino)(tosyl)methyl)benzonitrile (6n)

Method A: 58% (42.9 mg), Method B: 54% (39.9 mg); white solid; mp 173–174 °C.

^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.63 (d, *J* = 8.4 Hz, 2 H), 7.59 (d, *J* = 8.4 Hz, 2 H), 7.38 (d, *J* = 8.4 Hz, 2 H), 7.24 (d, *J* = 8.4 Hz, 2 H), 3.57 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H), 2.40 (s, 3 H).

^{13}C NMR (150 MHz, $CDCl_3$): δ = 144.5, 139.6, 136.1, 132.2, 131.0, 129.6, 128.8, 118.0, 113.9, 66.0, 54.3, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{19}N_3NaO_3S^+$: 392.1039; found: 392.1045.

(*E*)-*N*-Morpholino-1-(4-nitrophenyl)-1-tosylmethanimine (6o)

Method A: 29% (22.6 mg), Method B: 23% (19.7 mg); yellow solid; mp 175–176 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.21 (d, *J* = 8.8 Hz, 2 H), 7.62 (d, *J* = 8.4 Hz, 2 H), 7.47 (d, *J* = 8.8 Hz, 2 H), 7.26 (d, *J* = 8.0 Hz, 2 H), 3.60 (t, *J* = 4.8 Hz, 4 H), 3.06 (t, *J* = 4.8 Hz, 4 H), 2.43 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.6, 139.3, 138.0, 136.1, 131.4, 129.7, 128.9, 123.7, 66.0, 54.4, 29.8, 21.8.

HRMS (ESI): *m*/*z* [M + K]$^+$ calcd. for $C_{18}H_{19}KN_3O_5S^+$: 428.0677; found: 428.0682.

(*E*)-*N*-Morpholino-1-(naphthalen-2-yl)-1-tosylmethanimine (6p)

Method A: 56% (44.2 mg), Method B: 63% (49.7 mg); white semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85–7.77 (m, 4 H), 7.63 (d, *J* = 8.0 Hz, 2 H), 7.58–7.49 (m, 2 H), 7.29 (dd, *J* = 8.4, 2.0 Hz, 1 H), 7.21 (d, *J* = 8.0 Hz, 2 H), 3.55 (t, *J* = 4.8 Hz, 4 H), 3.06 (t, *J* = 4.8 Hz, 4 H), 2.39 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.0, 142.9, 136.5, 133.6, 132.7, 130.2, 129.4, 128.9, 128.6, 128.4, 128.1, 127.9, 127.7, 127.0, 126.5, 66.1, 54.3, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{22}H_{22}N_2NaO_3S^+$: 417.1243; found: 417.1242.

(*E*)-1-(5-Chlorothiophen-2-yl)-*N*-morpholino-1-tosylmethanimine (6q)

Method A: 35% (26.9 mg); yellow solid; mp 107–112 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84 (d, *J* = 8.4 Hz, 2 H), 7.55 (s, 1 H), 7.52 (d, *J* = 4.0 Hz, 1 H), 7.27 (d, *J* = 8.0 Hz, 1 H), 6.91 (d, *J* = 4.0 Hz, 1 H), 3.83 (t, *J* = 4.8 Hz, 4 H), 3.14 (t, *J* = 4.8 Hz, 4 H), 2.38 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.4, 144.3, 141.0, 139.3, 133.2, 130.0, 127.9, 127.4, 123.8, 66.2, 51.3, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{16}H_{17}ClN_2NaO_3S_2^+$: 407.0261; found: 407.0253.

(*E*)-1-(5-Chlorothiophen-2-yl)-*N*-morpholino-1-tosylmethanimine (6r)

Method A: 31% (22.9 mg); white semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.85 (d, *J* = 8.0 Hz, 2 H), 7.29 (d, *J* = 8.0 Hz, 2 H), 7.16 (d, *J* = 4.0 Hz, 1 H), 6.57 (d, *J* = 3.6 Hz, 1 H), 3.81 (t, *J* = 4.8 Hz, 4 H), 3.13 (t, *J* = 4.8 Hz, 4 H), 2.39 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.0, 148.9, 145.3, 137.3, 130.0, 127.9, 123.8, 119.1, 109.1, 66.2, 51.1, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{16}H_{17}ClN_2NaO_4S^+$: 391.0490; found: 391.0483.

(*E*)-*N*-Morpholino-1-(pyridin-2-yl)-1-tosylmethanimine (6s)

Method A: 56% (38.7 mg), Method B: 47% (32.5 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.58–8.55 (m, 1 H), 7.76 (td, *J* = 7.6, 1.6 Hz, 1 H), 7.66 (d, *J* = 8.0 Hz, 3 H), 7.32–7.27 (m, 1 H), 7.23 (d, *J* = 8.0 Hz, 2 H), 3.61 (t, *J* = 5.2 Hz, 4 H), 3.06 (t, *J* = 5.2 Hz, 4 H), 2.39 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 150.8, 149.8, 144.0, 138.9, 137.2, 136.6, 129.5, 128.7, 127.0, 124.3, 66.1, 54.2, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{19}N_3NaO_3S^+$: 368.1039; found: 368.1039.

(*E*)-*N*-Morpholino-1-phenyl-1-(phenylsulfonyl)methanimine (6u)

Method A: 87% (57.5 mg), Method B: 82% (54.2 mg); yellow solid; mp 128–133 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.76–7.72 (m, 2 H), 7.56–7.52 (m, 1 H), 7.45–7.40 (m, 2 H), 7.40–7.36 (m, 1 H), 7.35–7.30 (m, 2 H), 7.25–7.21 (m, 2 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 142.3, 139.4, 133.1, 130.8, 130.2, 130.1, 128.9, 128.7, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{18}N_2NaO_3S^+$: 353.0930; found: 353.0927.

(*E*)-1-((4-Cyclohexylphenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6v)

Method A: 74% (61.1 mg), Method B: 66% (54.4 mg); white solid; mp 104–107 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.63 (d, *J* = 8.4 Hz, 2 H), 7.40–7.28 (m, 3 H), 7.27–7.20 (m, 4 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H), 2.58–2.49 (m, 1 H), 1.90–1.70 (m, 5 H), 1.46–1.31 (m, 4 H), 1.29–1.20 (m, 1 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.8, 142.9, 136.6, 131.0, 130.10, 130.08, 129.0, 128.6, 127.2, 66.1, 54.2, 44.7, 34.2, 26.7, 26.0.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{23}H_{29}N_2O_3S^+$: 413.1893; found: 413.1885.

(*E*)-1-{[4-(*tert*-Butyl)phenyl]sulfonyl}-*N*-morpholino-1-phenylmethanimine (6w)

Method A: 91% (70.3 mg), Method B: 81% (62.6 mg); white solid; mp 92–97 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.65 (d, *J* = 8.8 Hz, 2 H), 7.43 (d, *J* = 8.8 Hz, 2 H), 7.41–7.30 (m, 3 H), 7.26–7.22 (m, 2 H), 3.57 (t, *J* = 5.2 Hz, 4 H), 3.04 (t, *J* = 5.2 Hz, 4 H), 1.32 (s, 9 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.0, 143.0, 136.5, 131.0, 130.2, 130.1, 128.8, 128.7, 125.7, 66.2, 54.2, 36.0, 31.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{21}H_{26}N_2NaO_3S^+$: 409.1556; found: 409.1563.

(*E*)-*N*-(4-{[(Morpholinoimino)(phenyl)methyl]sulfonyl}phenyl)acetamide (6x)

Method A: 51% (39.5 mg); white solid; mp 68–72 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.56 (s, 1 H), 7.60 (dd, *J* = 12.8, 9.2 Hz, 4 H), 7.39–7.27 (m, 3 H), 7.21–7.17 (m, 2 H), 3.54 (t, *J* = 4.8 Hz, 4 H), 3.00 (t, *J* = 4.8 Hz, 4 H), 2.12 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.5, 143.7, 141.8, 133.2, 130.6, 130.3, 130.1, 129.9, 128.7, 119.8, 66.0, 54.1, 24.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{21}N_3NaO_4S^+$: 410.1145; found: 410.1149.

(*E*)-*N*-Morpholino-1-phenyl-1-{[4-(trifluoromethoxy)phenyl]sulfonyl}methanimine (6y)

Method A: 81% (67.1 mg), Method B: 72% (59.6 mg); white solid; mp 73–77 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.83–7.78 (m, 2 H), 7.45–7.33 (m, 3 H), 7.29–7.24 (m, 4 H), 3.58 (t, *J* = 5.2 Hz, 4 H), 3.05 (t, *J* = 5.2 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 152.7, 141.6, 137.9, 131.1, 130.5, 130.4, 130.2, 128.8, 120.5, 120.4 (d, J_{C-F} = 257.0 Hz), 66.1, 54.2.

^{19}F NMR (376 MHz, $CDCl_3$): δ = –57.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{17}F_3N_2NaO_4S^+$: 437.0753; found: 437.0750.

(*E*)-1-((4-Methoxyphenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6z)

Method A: 84% (60.6 mg), Method B: 92% (66.3 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.66–7.61 (m, 2 H), 7.45–7.29 (m, 3 H), 7.25–7.21 (m, 2 H), 6.91–6.85 (m, 2 H), 3.83 (s, 3 H), 3.55 (t, *J* = 4.8 Hz, 4 H), 3.01 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.4, 143.2, 131.0, 130.9, 130.8, 130.08, 130.05, 128.6, 113.9, 66.1, 55.7, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{20}N_2NaO_4S^+$: 383.1036; found: 383.1036.

(*E*)-1-((4-Fluorophenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6aa)

Method A: 96% (66.9 mg), Method B: 82% (57.1 mg); white solid; mp 180–185 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.79–7.72 (m, 2 H), 7.43–7.32 (m, 3 H), 7.27–7.23 (m, 2 H), 7.11 (t, *J* = 8.8 Hz, 2 H), 3.57 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.6 (d, J_{C-F} = 254.0 Hz), 142.1, 135.4 (d, J_{C-F} = 3.0 Hz), 131.7 (d, J_{C-F} = 10.0 Hz), 130.6, 130.3, 130.2, 128.8, 116.0 (d, J_{C-F} = 22.0 Hz), 66.1, 54.2.

^{19}F NMR (376 MHz, $CDCl_3$): δ = –104.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{17}FN_2NaO_3S^+$: 371.0836; found: 371.0842.

(*E*)-1-((4-Chlorophenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6ab)

Method A: 91% (66.4 mg), Method B: 83% (60.5 mg); yellow solid; mp 91–95 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.68 (d, *J* = 8.4 Hz, 2 H), 7.44–7.39 (m, 3 H), 7.39–7.33 (m, 2 H), 7.27–7.23 (m, 2 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.05 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 141.8, 140.3, 139.8, 138.1, 130.6, 130.4, 130.2, 129.1, 128.8, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{17}ClN_2NaO_3S^+$: 387.0541; found: 387.0546.

(*E*)-1-((4-Bromophenyl)sulfonyl)-*N*-morpholino-1-Phenylmethanimine (6ac)

Method A: 95% (77.7 mg), Method B: 76% (62.2 mg); white solid; mp 101–103 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.63–7.55 (m, 4 H), 7.44–7.32 (m, 3 H), 7.28–7.23 (m, 2 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.05 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 141.6, 138.7, 132.0, 130.5, 130.42, 130.37, 130.2, 128.8, 128.4, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{18}BrN_2NaO_3S^+$: 409.0216; found: 409.0208.

(*E*)-1-((4-Iodophenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6ad)

Method A: 89% (81.2 mg), Method B: 63% (57.5 mg); white solid; mp 180–183 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.68 (d, *J* = 8.4 Hz, 2 H), 7.44–7.39 (m, 3 H), 7.36 (t, *J* = 7.6 Hz, 2 H), 7.27–7.23 (m, 2 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.05 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 141.7, 139.4, 138.0, 130.6, 130.4, 130.3, 130.2, 128.8, 101.0, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{17}IN_2NaO_3S^+$: 478.9897; found: 478.9906.

(*E*)-*N*-Morpholino-1-phenyl-1-{[4-(trifluoromethyl)phenyl]sulfonyl}methanimine (6ae)

Method A: 75% (59.7 mg), Method B: 71% (56.6 mg); white solid; mp 130–135 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.91 (d, *J* = 8.4 Hz, 2 H), 7.72 (d, *J* = 8.4 Hz, 2 H), 7.47–7.35 (m, 3 H), 7.29–7.24 (m, 2 H), 3.59 (t, *J* = 4.8 Hz, 4 H), 3.07 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.4, 141.0, 134.7 (d, J_{C-F} = 32.0 Hz), 130.5, 130.4, 130.3, 129.4, 128.9, 125.8 (q, J_{C-F} = 4.0 Hz), 123.4 (d, J_{C-F} = 269.0 Hz), 66.1, 54.2.

^{19}F NMR (376 MHz, $CDCl_3$): δ = –63.1.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{17}F_3N_2NaO_3S^+$: 421.0804; found: 421.0797.

Methyl (*E*)-4-{[(Morpholinoimino)(phenyl)methyl]sulfonyl}benzoate (6af)

Method A: 59% (45.8 mg), Method B: 84% (65.3 mg); white solid; mp 111–114 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.08 (d, *J* = 8.4 Hz, 2 H), 7.82 (d, *J* = 8.4 Hz, 2 H), 7.43–7.31 (m, 3 H), 7.25–7.21 (m, 2 H), 3.93 (s, 3 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.0, 143.0, 136.5, 131.0, 130.2, 130.1, 128.8, 128.7, 125.7, 66.2, 54.2, 36.0, 31.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{20}N_2NaO_5S^+$: 411.0985; found: 411.0982.

(*E*)-*N*-Morpholino-1-((4-nitrophenyl)sulfonyl)-1-phenylmethanimine (6ag)

Method A: 31% (23.3 mg), Method B: 47% (35.3 mg); white solid; mp 132–136 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.29 (d, *J* = 8.8 Hz, 2 H), 7.96 (d, *J* = 8.8 Hz, 2 H), 7.48–7.42 (m, 1 H), 7.42–7.36 (m, 2 H), 7.29–7.24 (m, 2 H), 3.59 (t, *J* = 4.8 Hz, 4 H), 3.08 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 150.5, 145.7, 140.2, 130.7, 130.3, 130.2, 130.1, 129.0, 123.9, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{17}N_3NaO_5S^+$: 398.0781; found: 398.0781.

(*E*)-*N*-Morpholino-1-phenyl-1-(*m*-tolylsulfonyl)methanimine (6ah)

Method A: 90% (62.0 mg); white solid; mp 107–110 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.50–7.48 (m, 2 H), 7.40–7.27 (m, 5 H), 7.25–7.19 (m, 2 H), 3.55 (t, *J* = 4.8 Hz, 4 H), 3.02 (t, *J* = 4.8 Hz, 4 H), 2.33 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 142.5, 139.2, 138.8, 133.9, 130.9, 130.2, 130.1, 129.2, 128.6, 128.5, 126.1, 66.1, 54.2, 21.3.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{20}N_2NaO_3S^+$: 367.1087; found: 367.1089.

(*E*)-1-((3-Fluorophenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6ai)

Method A: 86% (60.0 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.54 (d, *J* = 8.0 Hz, 1 H), 7.50–7.32 (m, 5 H), 7.29–7.22 (m, 3 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.06 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 163.5, 161.0, 141.7 (d, J_{F-C} = 6.0 Hz), 141.3, 130.5 (d, J_{C-F} = 7.0 Hz), 130.4, 130.2, 128.8, 124.7 (d, J_{C-F} = 3.0 Hz), 120.3 (d, J_{C-F} = 21.0 Hz), 116.1 (d, J_{C-F} = 25.0 Hz), 66.1, 54.2.

^{19}F NMR (376 MHz, $CDCl_3$): δ = –110.4.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{17}H_{17}FN_2NaO_3S^+$: 371.0836; found: 371.0829.

(*E*)-*N*-morpholino-1-(naphthalen-2-ylsulfonyl)-1-phenylmethanimine (6aj)

Method B: 77% (58.6 mg); white solid; mp 151–156 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.31 (s, 1 H), 7.89 (dd, *J* = 8.8, 2.4 Hz, 3 H), 7.75 (dd, *J* = 8.8, 2.0 Hz, 1 H), 7.66–7.54 (m, 2 H), 7.42–7.29 (m, 3 H), 7.29–7.23 (m, 2 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 142.4, 136.6, 135.1, 132.2, 130.9, 130.4, 130.23, 130.20, 129.5, 129.0, 128.8, 128.7, 128.0, 127.4, 124.0, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{21}H_{20}N_2NaO_3S^+$: 403.1087; found: 403.1087.

(*E*)-1-((2,5-Dibromophenyl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6ak)

Method A: 68% (66.4 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.24 (d, *J* = 2.4 Hz, 1 H), 7.56–7.47 (m, 4 H), 7.44–7.37 (m, 3 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.01 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 140.5, 140.3, 136.9, 136.1, 135.0, 130.7, 130.2, 129.3, 128.9, 121.5, 120.7, 66.1, 54.1.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{17}H_{17}Br_2N_2O_3S^+$: 486.9321; found: 486.9320.

(*E*)-1-((2,3-Dihydro-1*H*-inden-5-yl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6am)

Method A: 91% (67.6 mg); white solid; mp 114–118 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.57 (s, 1 H), 7.47 (dd, *J* = 8.0, 2.0 Hz, 1 H), 7.41–7.29 (m, 3 H), 7.26–7.21 (m, 3 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H), 2.96–2.85 (m, 4 H), 2.14–2.05 (m, 2 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 150.4, 145.1, 143.1, 137.2, 131.0, 130.11, 130.05, 128.6, 127.2, 124.7, 124.4, 66.1, 54.2, 33.0, 32.6, 25.4.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{20}H_{22}N_2NaO_3S^+$: 393.1243; found: 393.1243.

(*E*)-1-((2,3-Dihydrobenzo[*b*][1,4]dioxin-6-yl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6an)

Method A: 84% (65.3 mg); white solid; mp 99–104 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.40–7.29 (m, 3 H), 7.27 (d, *J* = 2.0 Hz, 1 H), 7.26–7.22 (m, 2 H), 7.17 (dd, *J* = 8.4, 2.0 Hz, 1 H), 6.84 (d, *J* = 8.4 Hz, 1 H), 4.30–4.22 (m, 4 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.03 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 147.9, 143.4, 142.9, 131.8, 131.0, 130.10, 130.06, 128.6, 122.7, 118.4, 117.4, 66.1, 64.7, 64.2, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{20}N_2NaO_5S^+$: 411.0985; found: 411.0986.

(*E*)-1-((2,3-Dihydrobenzofuran-5-yl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6ao)

Method A: 89% (66.3 mg); yellow semisolid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.54 (s, 1 H), 7.48 (dd, *J* = 8.4, 2.0 Hz, 1 H), 7.42–7.31 (m, 3 H), 7.29–7.23 (m, 2 H), 6.75 (d, *J* = 8.8 Hz, 1 H), 4.66 (t, *J* = 8.8 Hz, 2 H), 3.58 (t, *J* = 4.8 Hz, 4 H), 3.20 (t, *J* = 8.8 Hz, 2 H), 3.03 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 164.4, 144.1, 131.5, 130.8, 130.7, 130.11, 130.08, 128.6, 128.0, 126.1, 109.8, 73.2, 66.2, 53.7, 29.0.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{19}H_{21}N_2O_4S^+$: 373.1217; found: 373.1215.

(*E*)-1-(Benzo[*d*]thiazol-5-ylsulfonyl)-*N*-morpholino-1-phenylmethanimine (6ap)

Method A: 61% (47.3 mg); white solid; mp 165–170 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.19 (s, 1 H), 8.40 (d, *J* = 1.6 Hz, 1 H), 8.16 (d, *J* = 8.4 Hz, 1 H), 7.87 (dd, *J* = 8.4, 1.6 Hz, 1 H), 7.46–7.34 (m, 3 H), 7.30–7.22 (m, 2 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 158.2, 155.9, 141.8, 136.8, 133.9, 130.6, 130.3, 130.2, 128.8, 126.5, 123.8, 123.7, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{18}H_{17}N_3NaO_3S_2^+$: 410.0604; found: 410.0606.

(*E*)-1-((3,5-Dimethylisoxazol-4-yl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6aq)

Method A: 90% (62.9 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.48–7.37 (m, 3 H), 7.33–7.27 (m, 2 H), 3.62 (t, *J* = 4.8 Hz, 4 H), 3.08 (t, *J* = 4.8 Hz, 4 H), 2.36 (s, 3 H), 2.29 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 174.8, 158.8, 142.1, 130.6, 130.3, 130.1, 129.0, 115.4, 66.1, 54.2, 12.4, 11.0.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{16}H_{19}N_3NaO_4S^+$: 372.0988; found: 372.0987.

(*E*)-*N*-Morpholino-1-phenyl-1-(pyridin-3-ylsulfonyl)methanimine (6ar)

Method A: 28% (18.6 mg); white solid; mp 89–93 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.95 (d, *J* = 1.6 Hz, 1 H), 8.76 (dd, *J* = 4.8, 1.6 Hz, 1 H), 8.04 (dt, *J* = 8.0, 2.0 Hz, 1 H), 7.45–7.34 (m, 4 H), 7.30–7.25 (m, 2 H), 3.56 (t, *J* = 4.8 Hz, 4 H), 3.04 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.5, 149.8, 141.2, 136.4, 136.1, 130.5, 130.2, 130.1, 128.9, 123.4, 66.0, 54.1.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{16}H_{17}N_3NaO_3S^+$: 354.0883; found: 354.0882.

(*E*)-*N*-Morpholino-1-phenyl-1-(thiophen-2-ylsulfonyl)methanimine (6as)

Method A: 87% (58.5 mg); yellow solid; mp 105–109 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.62 (dd, *J* = 4.8, 1.6 Hz, 1 H), 7.44 (dd, *J* = 4.0, 1.6 Hz, 1 H), 7.42–7.30 (m, 3 H), 7.29–7.24 (m, 2 H), 7.02 (dd, *J* = 5.2, 3.6 Hz, 1 H), 3.57 (t, *J* = 4.8 Hz, 4 H), 3.07 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 141.9, 140.3, 134.5, 134.2, 130.5, 130.3, 130.2, 128.7, 127.4, 66.1, 54.1.

HRMS (ESI): *m*/*z* [M + H]$^+$ calcd. for $C_{15}H_{17}N_2O_3S_2^+$: 337.0675; found: 337.0677.

(*E*)-1-((5-Chlorothiophen-2-yl)sulfonyl)-*N*-morpholino-1-phenylmethanimine (6at)

Method A: 45% (33.4 mg); yellow solid; mp 106–109 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.45–7.34 (m, 3 H), 7.32–7.27 (m, 2 H), 7.24 (d, *J* = 4.0 Hz, 1 H), 6.87 (d, *J* = 4.0 Hz, 1 H), 3.60 (t, *J* = 4.8 Hz, 4 H), 3.10 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 141.1, 139.4, 138.4, 133.8, 130.5, 130.3, 130.2, 128.8, 126.8, 66.1, 54.2.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{15}H_{15}ClN_2NaO_3S_2^+$: 393.0105; found: 393.0105.

(*E*)-*N*-Morpholino-1-phenyl-1-{[(*E*)-styryl]sulfonyl}methanimine (6au)

Method A: 88% (62.7 mg); yellow solid; mp 107–110 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.49–7.35 (m, 11 H), 6.96 (d, *J* = 15.6 Hz, 1 H), 3.62 (t, *J* = 4.8 Hz, 4 H), 3.10 (t, *J* = 4.8 Hz, 4 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.4, 143.1, 133.0, 131.1, 130.4, 130.1, 129.2, 128.9, 128.6, 125.3, 66.2, 54.3.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{20}N_2NaO_3S^+$: 379.1087; found: 379.1085.

(*E*)-1-(Cyclopropylsulfonyl)-*N*-morpholino-1-phenylmethanimine (6av)

Method A: 84% (49.5 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.50–7.44 (m, 2 H), 7.44–7.36 (m, 3 H), 3.63 (t, *J* = 4.8 Hz, 4 H), 3.09 (t, *J* = 4.8 Hz, 4 H), 2.59–2.50 (m, 1 H), 1.20–1.13 (m, 2 H), 1.00–0.93 (m, 2 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.4, 130.8, 130.3, 129.8, 128.9, 66.2, 54.3, 29.3, 5.4.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{14}H_{18}N_2NaO_3S^+$: 317.0930; found: 317.0930.

(*E*)-1-Phenyl-*N*-(piperidin-1-yl)-1-tosylmethanimine (8a)

Method A: 82% (56.2 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.61 (d, *J* = 8.4 Hz, 2 H), 7.38–7.27 (m, 3 H), 7.23–7.18 (m, 4 H), 3.05 (t, *J* = 4.8 Hz, 4 H), 2.38 (s, 3 H), 1.44 (s, 6 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.5, 138.6, 137.3, 131.7, 130.3, 129.6, 129.2, 128.7, 128.4, 54.8, 25.1, 23.7, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{19}H_{22}N_2NaO_2S^+$: 365.1294; found: 365.1295.

(*E*)-1-Methyl-1-phenyl-2-(phenyl(tosyl)methylene)hydrazine (8b)

Method A: 86% (62.6 mg); white solid; mp 182–184 °C.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.75 (d, *J* = 5.6 Hz, 2 H), 7.46–7.42 (m, 1 H), 7.40–7.35 (m, 4 H), 7.29 (d, *J* = 5.2 Hz, 2 H), 7.25–7.21 (m, 2 H), 7.03 (d, *J* = 4.8 Hz, 2 H), 6.99 (t, *J* = 4.8 Hz, 1 H), 2.98 (s, 3 H), 2.45 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 147.9, 144.0, 140.1, 136.8, 131.1, 130.9, 130.0, 129.5, 129.2, 129.0, 128.2, 122.7, 116.0, 40.3, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{21}H_{20}N_2NaO_2S^+$: 387.1138; found: 387.1138.

(*E*)-1,1-Dibenzyl-2-(phenyl(tosyl)methylene)hydrazine (8c)

Method A: 76% (69.1 mg); yellow semi-solid.

^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.62 (d, *J* = 8.4 Hz, 2 H), 7.24–7.17 (m, 9 H), 7.08 (t, *J* = 8.0 Hz, 2 H), 6.97–6.93 (m, 2 H), 6.92–6.87 (m, 4 H), 4.23 (s, 4 H), 2.39 (s, 3 H).

^{13}C NMR (100 MHz, $CDCl_3$): δ = 143.5, 137.8, 137.5, 136.1, 130.9, 130.4, 129.6, 129.3, 128.7, 128.6, 127.8, 127.7, 127.6, 59.0, 21.7.

HRMS (ESI): *m*/*z* [M + Na]$^+$ calcd. for $C_{28}H_{26}N_2NaO_2S^+$: 477.1607; found: 477.1607.

Conflict of Interest

The authors declare no conflict of interest.

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Supporting Information

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