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Supporting Information

Silicon-Free SuFEx Reactions of Sulfonimidoyl Fluorides: Scope, Enantioselectivity, and Mechanism

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2 General information and methods

All commercial chemicals were used as received and stored under argon. Reagents were used without further purification unless otherwise noted. Unless otherwise noted, all reactions were performed using glassware without further preparation. Certain reactions were carried out in anhydrous conditions. This utilized oven-dried glassware which was heated in an oven above 100 ℃ for at least 5 h or which was dried under vacuum with a heat gun (T > 200 ℃), under oxygen-free and water-free conditions. After weighing any solids, the glassware was connected to a Schlenk line, and then placed under vacuum and flushed with nitrogen gas (3x purged). Liquids were added via syringe, through a rubber stopper. Solvent abbreviations are: tetrahydrofuran (THF), ethyl acetate (EtOAc) and *N*-dimethylformamide (DMF), petroleum ether 40-60 (P.E.). Solvents were used as received without any distillation.

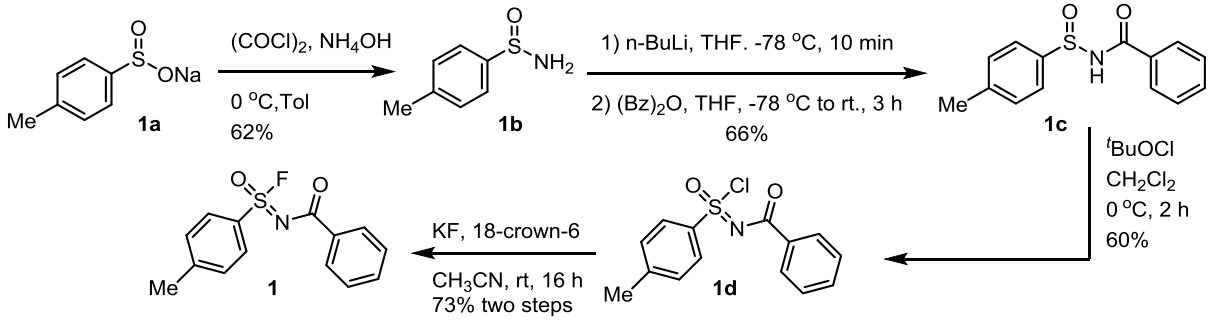
Flash column chromatography was performed using a Biotage® system and SiliCycle® precast silica columns (200−300 mesh or 300−400 mesh). TLC analysis was performed on pre-coated, alumina-backed silica gel plates. TLC plates were analyzed by UV fluorescence (254 nm) or I_2 stain.

^{1}H NMR, ^{13}C NMR, ^{19}F NMR spectra were recorded on a Bruker Avance 400 MHz spectrometer at 298 K. The chemical shifts are listed in ppm on the δ = scale and coupling constants were recorded in Hertz (Hz). Chemical shifts are calibrated relative to the signals corresponding of the non-deuterated solvents ($CHCl_3$: δ = 7.26 ppm for ^{1}H and 77.16 ppm for ^{13}C, CH_3CN: δ = 1.94 ppm for ^{1}H and 1.32 and 118.26 ppm for ^{13}C, C_6H_6: δ = 7.16 ppm for ^{1}H and 128.06 ppm for ^{13}C). Abbreviations are used in the description of NMR data as follows: chemical shift (δ = ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, dt = doublet of triplets, m = multiplet), coupling constant (*J*, Hz).

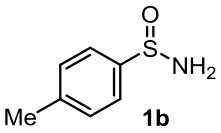
High-resolution mass spectra (HR-MS) were measured on a QTOF micro spectrometer using electrospray ionization (ESI) in positive mode (ESI+) or in negative mode (ESI-).

Enantioselectivity was monitored using an HPLC Chiralpak IA column. A reference, racemic product was synthesized to determine the column conditions for baseline separation. Unless specifically mentioned, these were found to be *n*-hexane propan-2-ol 90:10, flow rate 0.5 mL/min, oven temperature 40 ℃, detector wavelength 240 nm. Conditions were the same for the sulfonimidoyl starting material, also giving baseline separation.

3 Synthesis of starting materials and special phenols



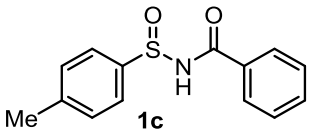
Scheme S1. The synthesis of sulfonimidoyl fluoride starting material **1**.



4-methylbenzenesulfinamide **1b**

Compound **1b** was synthesized according to literature.[1]

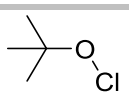
Oxalyl chloride (9.1 mL, 106 mmol) was added dropwise to sodium *p*-toluenesulfonic acid **1a** (17.8 g, 100 mmol) in anhydrous toluene (100 mL) at 0 ℃ in a 500 mL 3-necked round bottom flask. The mixture was stirred for 1 h at rt. Thereafter, 100 mL ethyl acetate and 100 mL NH_4OH were added, while at 0 ℃. The reaction mixture was then stirred for another hour. The mixture was diluted with 100 mL ethyl acetate, and the organic and aqueous phases separated. The aqueous phase was then extracted with ethyl acetate (2 x 100 mL). The combined organic layers were washed with brine (100 mL) and dried over Na_2SO_4. The volatiles were removed under vacuum evaporation yielding **1b** as a white powder (9.57 g, 61.7 mmol, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.63 (d, *J* = 8.0 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 4.31 (s, 2H), 2.41 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_7H_{10}NOS$: 156.0483, found: 156.0477. Spectral data are in accordance with literature.[1]



N-(*p*-tolylsulfinyl)benzamide **1c**

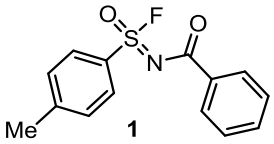
Compound **1c** was synthesized according to literature.[2]

Compound **1b** (5.0 g, 32.2 mmol) was dissolved in dry THF (100 mL) and cooled to -78 ℃. *n*-Butyl lithium (32 mL, 32.5 mmol) was then added dropwise over 10 min. The reaction was stirred at -78 ℃ for 10 min and warmed to room temperature and stirred for 3 h. The reaction was quenched with saturated $NaHCO_3$ (100 mL) and diluted with CH_2Cl_2 (150 mL). The organic layer was separated, and the aqueous phase was extracted with CH_2Cl_2 (5 x 50 mL). The combined organic layers were dried with $MgSO_4$, filtered and concentrated under vacuum. The product was recrystallized from hexane and ethyl acetate (2:1), yielding a white powder (5.6 g, 21.6 mmol, 67%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.24 (s, 1H), 7.79 (d, *J* = 8.4 Hz, 2H), 7.68 (d, *J* = 7.6 Hz, 2H), 7.57 (t, *J* = 7.4 Hz, 1H), 7.45 (t, *J* = 7.4 Hz, 2H), 7.36 (d, *J* = 8.0 Hz, 2H), 2.44 (s, 3H). Spectral data are in accordance with literature.[2]



tert-butyl hypochlorite

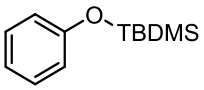
tert-butyl hypochlorite was synthesized according to literature.[3]
NaOCl (421 mL, 5% active chlorine, 275 mmol) was added to a 1 L round bottom flask, cooled to 0 ℃ and placed in the dark. Acetic acid (16.8 mL, 294 mmol) and *tert*-butyl alcohol (26.1 mL, 275 mmol) were added in one portion. The solution was stirred for 10 min. The aqueous and organic phases were then separated. The organic phase was washed with 10% $NaHCO_3$, water (5 mL) and dried over $CaCl_2$ to yield a yellow liquid (17.9 g, 165 mmol, 60%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 1.32 (s, H). Spectral data are in accordance with literature.[3]



1

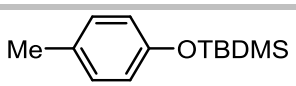
N-benzoyl-4-methylbenzenesulfonimidoyl fluoride **1**

Compound **1** was synthesized according to literature.[4]
tert-Butyl hypochlorite (3.05 g, 28 mmol) was added dropwise to a solution of compound **1c** (5.6 g, 21.6 mmol) in anhydrous CH_2Cl_2 (100 mL) at 0 ℃, under argon atmosphere. The mixture was stirred for 2 hours at 0 ℃. Subsequently, the volatiles were removed under vacuum. The residue was flushed with argon and dissolved in anhydrous CH_3CN (100 mL). KF (5.02 g, 85 mmol) and 18-crown-6 ether (265 mg, 1 mmol) were subsequently added and the mixture was stirred for 16 h at rt. The mixture was filtered, and the solvent was evaporated under vacuum. The remaining oil was purified by column chromatography (P.E.: EtOAc – 1:1), yielding **1** as an off-white powder (4.40 g, 15.9 mmol, 73%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.15 (d, J = 7.6 Hz, 2H), 8.06 (d, J = 7.6 Hz, 2H), 7.56 (t, J = 7.4 Hz, 1H), 7.45 (d, J = 7.6 Hz, 2H), 2.50 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.2, 147.3, 134.2, 133.3, 131.5 (d, J = 2.0 Hz), 130.4, 130.1, 128.4, 128.1, 22.0. ^{19}F NMR (376 MHz, $CDCl_3$) δ = 65.41 (s). HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{14}H_{13}FNO_2S$: 278.0651, found: 278.0638. Spectral data are in accordance with literature.[4]



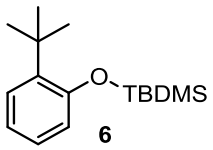
TBDMS-phenol

To a flame-dried flask, under Ar flow, phenol (2.00 g, 21.25 mmol, 1 equiv) was added and dissolved in 30 mL anhydrous CH_2Cl_2. Imidazole (3.18 g, 46.75 mmol, 2.2 equiv) and TBDMS-Cl (3.36 g, 22.31 mmol, 1.05 equiv) were added and a precipitate formed immediately. Stirring was continued for 5 h. The mixture was transferred to a separatory funnel and washed twice with water and twice with brine. After drying over Na_2SO_4, the volatiles were removed under reduced pressure, yielding a colorless oil. This oil was further purified via flash column chromatography (P.E. 40-60), and the product TBDMS-protected phenol was obtained as a colorless oil (3.74 g, 17.98 mmol, 85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.26 – 7.20 (m, 2H), 6.96 (t, J = 7.4 Hz, 1H), 6.86 (dd, J = 8.5, 1.0 Hz, 2H), 1.00 (s, 10H), 0.21 (s, 6H). Spectral data are in concurrence with literature.[5]



TBDMS-*p*-cresol

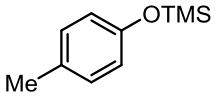
TBDMS-*p*-cresol was synthesized according to literature.[6]
p-Cresol (3.16 g, 29.22 mmol) and imidazole (2.98 g, 43.83 mmol) were dissolved in DMF (10 mL) in a 25 mL, 3-necked, roundbottom flask. After this, *tert*-butylchlorodimethylsilane (5.73 g, 38 mmol) was added, and the reaction mixture was stirred overnight. The solution was then diluted with diethyl ether (50 mL) and washed with water (3 x 50 mL). The organic layer was then dried over Na_2SO_4 and concentrated under reduced pressure. The residual product was purified with flash column chromatography (P.E.: EtOAc – 20:1) to TBDMS-*p*-cresol a colorless liquid (5.58 g, 27 mmol, 92%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.02 (d, *J* = 7.6 Hz, 2H), 6.73 (d, *J* = 7.2 Hz, 2H), 2.27 (s, 3H), 0.98 (s, 9H), 0.18 (s, 6H). Spectral data are in concurrence with literature.[6]



6

TBDMS-2-*tert*-butyl-phenol **6**

To a flame-dried flask, under Ar flow, 2-tBu-phenol (1.7 mL, 11.07 mmol, 1 equiv) was added and dissolved in 15 mL anhydrous CH_2Cl_2. Imidazole (1.60 g, 24.35 mmol, 2.2 equiv) and TBDMS-Cl (1.75 g, 11.62 mmol, 1.05 equiv) were added and a precipitate formed immediately. Stirring was continued for 5 h, after which the reaction had reached about 50% conversion based on TLC analysis. Additional imizadole (828 mg, 12.17 mmol, 1.1 equiv) and TBDMS-Cl (876 mg, 5.81 mmol, 0.52 equiv) were added and the reaction was stirred for 12 h. After this time, full conversion was not reached (approx. 90% conversion had occurred). The mixture was transferred to a separatory funnel and washed twice with water and twice with brine. After drying over Na_2SO_4, the volatiles were removed under reduced pressure, yielding a colorless oil. This oil was further purified via flash column chromatography (P.E. 40-60), and the product TBDMS-protected phenol was obtained as a colorless oil (2.33 g, 8.82 mmol, 80%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.31 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.09 (t, *J* = 7.6 Hz, 1H), 6.89 (t, *J* = 8.0 Hz, 1H), 6.84 (d, *J* = 8.0 Hz, 1H), 1.41 (s, 9H), 1.06 (s, 9H), 0.35 (s, 6H). Spectral data are in concurrence with literature.[7]

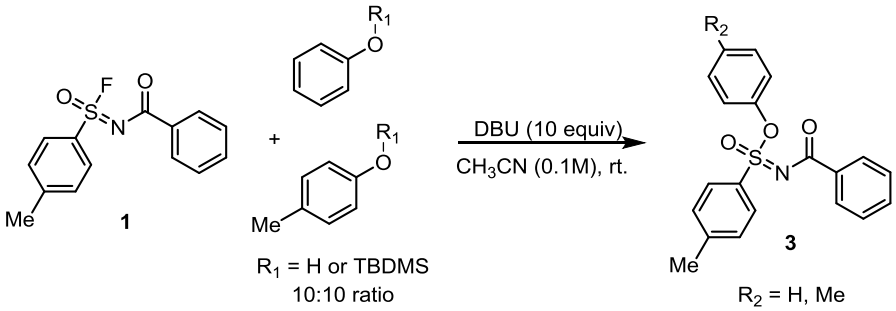


trimethyl(*p*-tolyloxy)silane

TMS-protected *p*-cresol was synthesized according to literature.[8] Hexamethyldisilazane (439.8mg, 2.72 mmol) and $KAl(SO_4)_2$*$12H_2O$ (Alum) (66 mg, 0.141 mmol) were dissolved in anhydrous CH_3CN (2.7 mL). *p*-cresol (294 mg, 2.77 mmol) was added and the mixture was stirred for 2.5 h at rt. The mixture was quenched with water (~20 mL) and diluted with CH_2Cl_2 (20 mL). The organic and aqueous layers were separated and the aqueous layer was washed twice with CH_2Cl_2 (20 mL). The combined organic layers were dried over Na_2SO_4 and concentrated *in vacuo* to yield the title compound. The title compound was obtained as a light yellow oil, and dried overnight under nitrogen flow and used without further purification (36.2mg, 0.200 mmol, 7%). The yield was diminished due to drying under nitrogen flow and subsequent evaporation due to its low boiling point. ^{1}H NMR (400 MHz, $CDCl_3$) δ = 7.06-6.98 (d, 2H), 6.78-6.69 (d, 2H), 2.32-2.24 (s, 3H), 0.30-0.21 (s, 9H). Spectral data are in concurrence with literature.[9]

4 Competition study between a phenol (phenolate) and Si-protected phenol in the SuFEx reaction

In our efforts to investigate the Si-free SuFEx reaction, we made a comparison with a traditional SuFEx reaction. Under pseudo-first-order conditions, a Si-protected phenol and free *p*-cresol were reacted with sulfonimidoyl fluoride **1**. Using these conditions, we can determine which phenol derivative reacts faster. This provides information on both the reaction rate, as well as on the relative reactivity of the traditional and Si-free SuFEx substrates.



Scheme S2. The competition reaction between a Si-protected and unprotected *p*-cresol and phenol

Procedures

p-Cresol vs TBDMS-phenol

p-Cresol (31.1 mg, 0.288 mmol, 10 equiv) and TBDMS-phenol (60.0 mg, 0.288 mmol, 10 equiv) were dissolved in CD_3CN (0.55 mL). Mesitylene (4.1 µL, internal reference) was added and the mixture was shaken well. DBU (43.1 µL, 0.288 mmol, 10 equiv) was added and the mixture was shaken well for 10 seconds. The mixture was transferred to a vial containing the sulfonimidoyl fluoride **1** (8.0 mg, 0.029 mmol, 1 equiv). The mixture was shaken well and transferred to an NMR tube. ^{1}H NMR was measured immediately, and again after approximately 15 min. The reaction was executed in duplicate, and measured twice. The ratios were determined using mesitylene as the internal reference, and the presented ratio is averaged over the four measurements.

TBDMS-*p*-cresol vs phenol

TDBMS-*p*-cresol (64.1 mg, 0.288 mmol, 10 equiv) and phenol (27.1 mg, 0.288 mmol, 10 equiv) were dissolved in CD_3CN (0.55 mL). Mesitylene (4.1 µL, internal reference) was added and the mixture was shaken well. DBU (43.1 µL, 0.288 mmol, 10 equiv) was added and the mixture was shaken well for 10 seconds. The mixture was transferred to a vial containing the sulfonimidoyl fluoride **1** (8.0 mg, 0.029 mmol, 1 equiv). The mixture was shaken well and transferred to an NMR tube. ^{1}H NMR was measured immediately, and again after approximately 15 min. The reaction was executed in duplicate and measured twice. The ratios were determined using mesitylene as the internal reference, and the presented ratio is averaged over the four measurements.

SUPPORTING INFORMATION

Table S1. Product distribution in competition experiments comparing the reactivity of SuFEx substrates with Si-protecting group and the Si-free SuFEx substrate.

Entry	Cresol	Phenol	Reaction time (min) [#]	Product ratio *p*-cresol : phenol[*]
1	TBDMS-*p*-cresol	Phenol	< 2	9: 91
2	*p*-cresol	TBDMS-Phenol	< 2	95: 5

[#]During the reaction time, the transfer of TBDMS-groups was negligible. Interconversion of products was not found, even after letting the reaction stand for 3 days at rt. [*]product distribution ratio was determined via ^{1}H-NMR spectroscopy, at rt, using mesitylene as an internal reference. Standard deviation: < 2%. Experimental error, given relatively small amounts of the minor fraction: ca. 3-4%.

Under these pseudo first-order conditions, the product formation was clearly in favor of the phenolate/cresolate. The traditional TBDMS-protected SuFEx substrates reacted much more slowly under these conditions. Although a small substituent effect (*para*-H vs *p*-Me) could be playing a role, the overwhelming preference for the phenolate shows the power of the Si-free SuFEx reaction. This shows that a roughly 10:1 ratio was found for the reaction rate of unprotected phenols versus Si-protected phenols under these reaction condition.

Pictured below are the ^{1}H NMR spectra after the completion of the reaction for both reactions, including the peaks of interest used to determine the final product distribution.

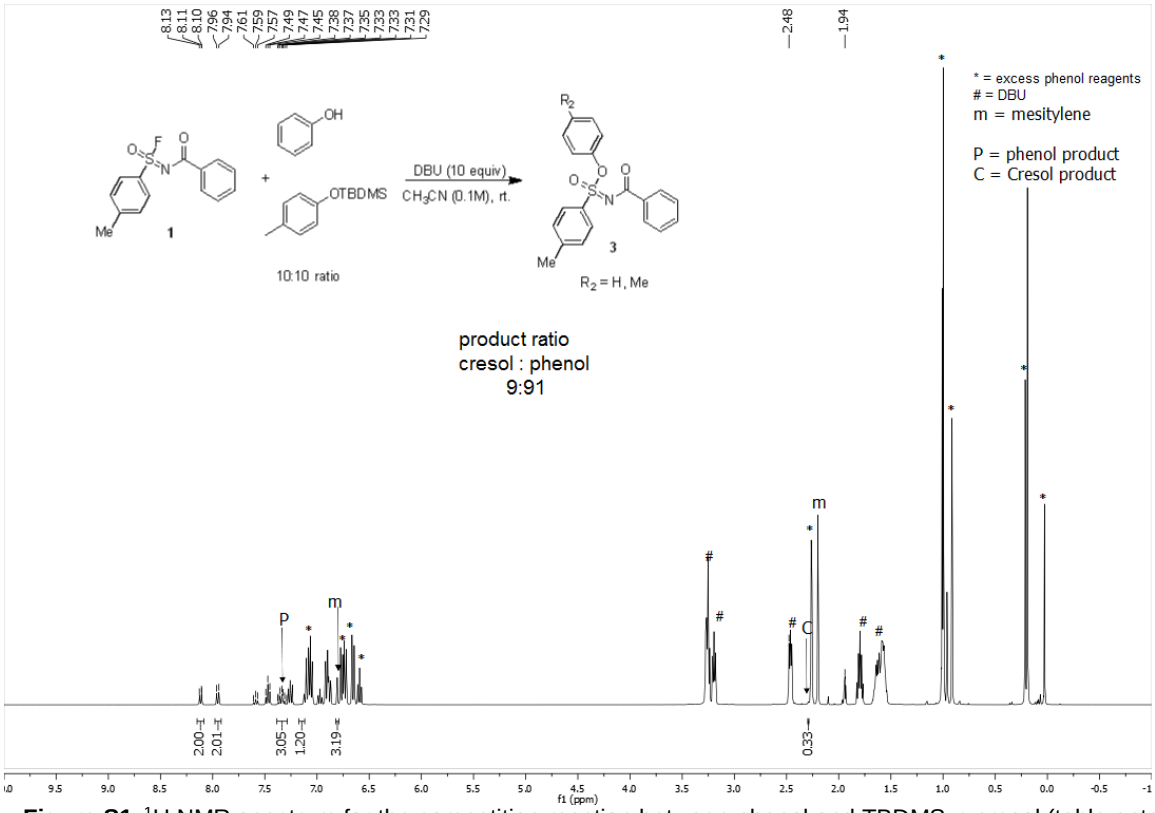


Figure S1. ^{1}H NMR spectrum for the competition reaction between phenol and TBDMS-*p*-cresol (table entry 1)

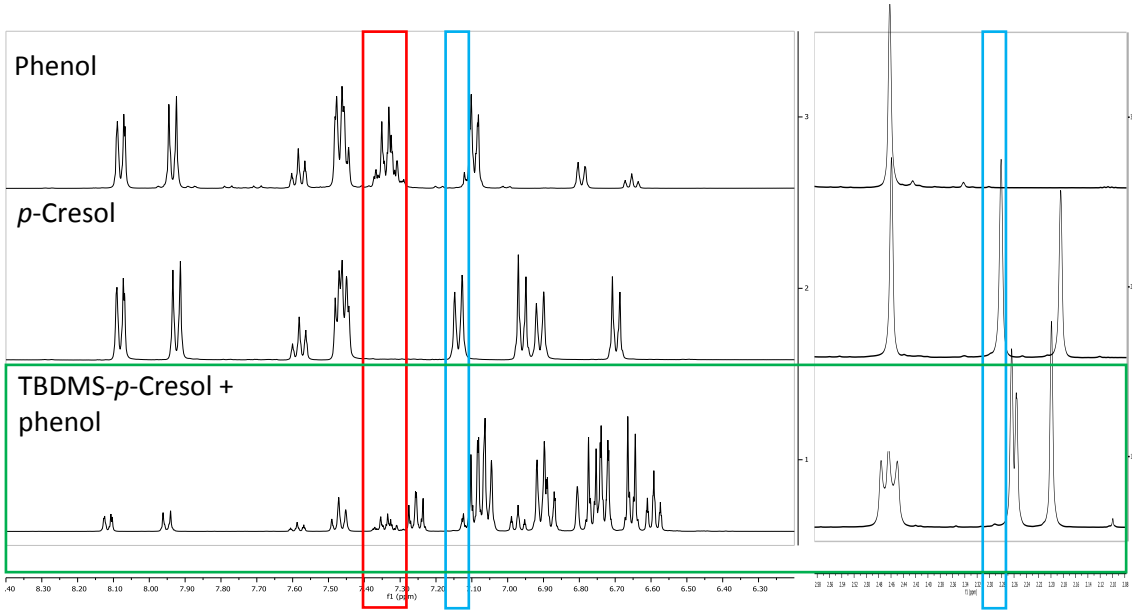


Figure S2. The ^{1}H NMR spectra of the phenol reaction mixture, the *p*-cresol reaction mixture and this pseudo first-order competition experiment in the aromatic region (δ 8.3-6.3) and aliphatic region (δ 2.35-2.10). Product ratios were determined using the integrals of the peaks of interest, belonging to the specific products. Peaks of interest belonging to the phenol product are highlighted in red. Peaks of interest belonging to the *p*-cresol product are highlighted in blue.

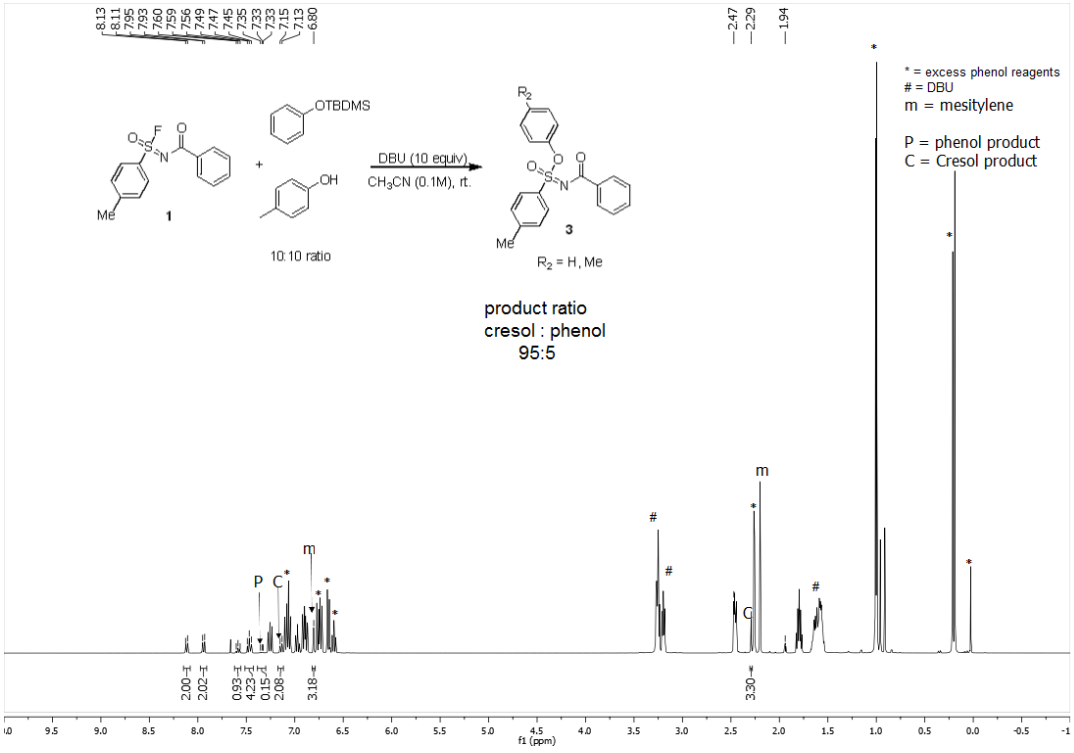


Figure S3. ^{1}H NMR spectrum for the competition reaction between TBDMS-phenol and *p*-cresol (table entry 2).

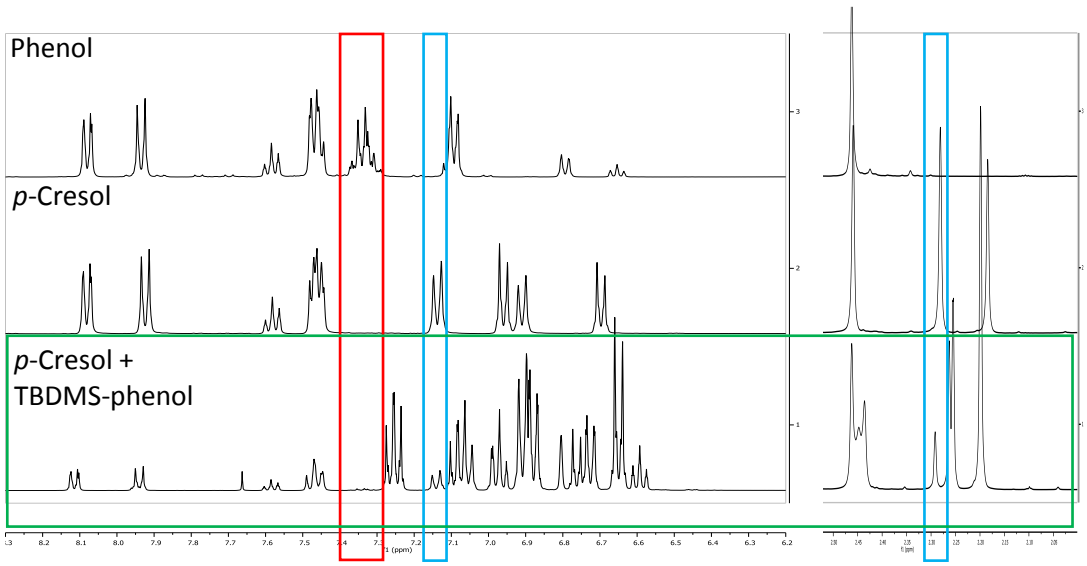


Figure S4. The ^{1}H NMR spectra of the phenol reaction mixture, the *p*-cresol reaction mixture and this pseudo first-order competition experiment in the aromatic region (δ 8.3-6.3) and aliphatic region (δ 2.35-2.10). Product ratios were determined using the integrals of the peaks of interest, belonging to the specific products. Peaks of interest belonging to the phenol product are highlighted in red. Peaks of interest belonging to the *p*-cresol product are highlighted in blue.

5 Mechanism Studies of Bifluoride-Catalyzed SuFEx reactions

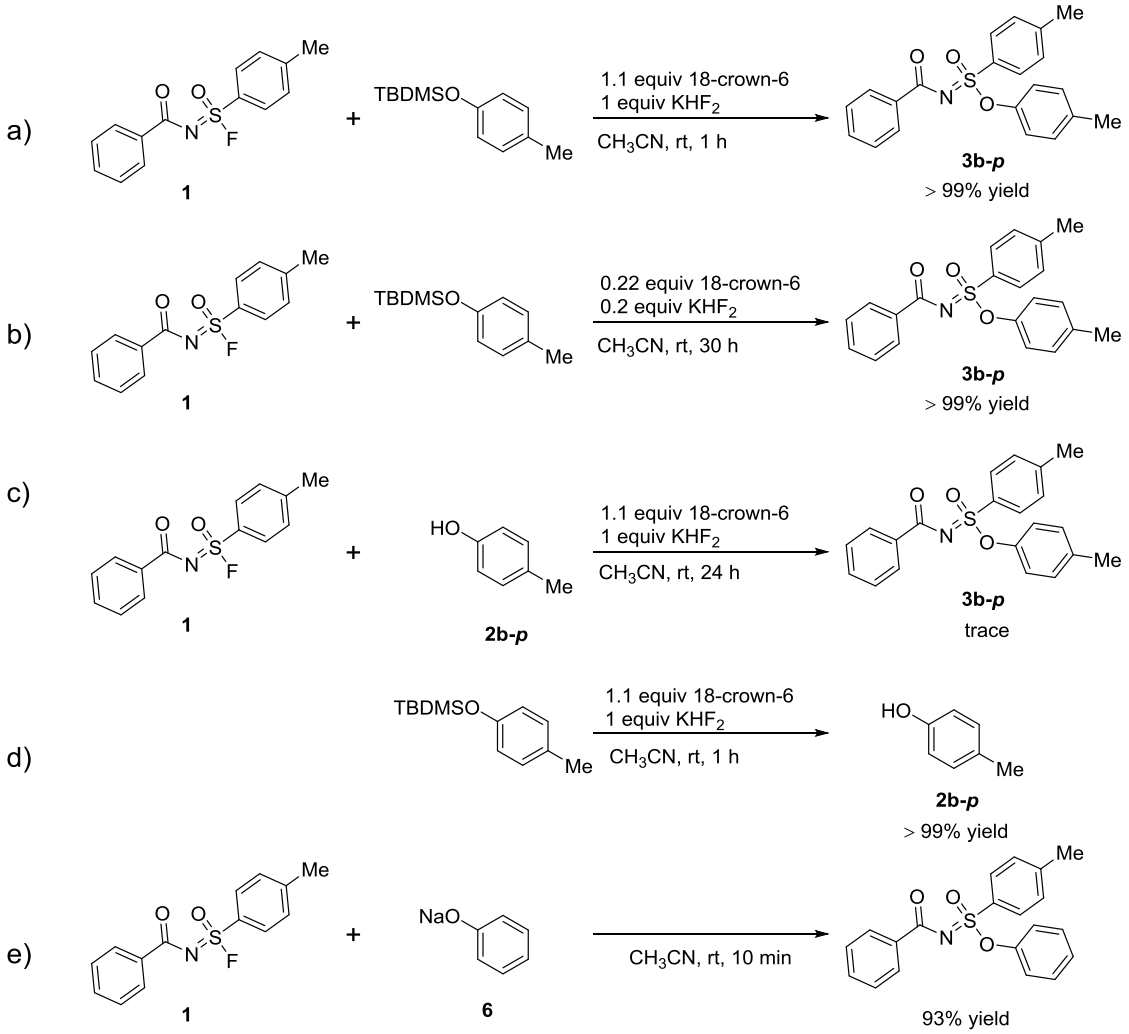


Figure S5.. Bifluoride-based (a) traditional SuFEx, (b) traditional SuFEx with 0.2 equiv of catalyst, (c) silicon-free SuFEx, (d) deprotection and (e) catalyst-free, silicon-free SuFEx. TBDMS, *tert*-butyldimethylsilyl

Procedures

Reaction of TBDMS-*p*-cresol (Figure S5a**)**

Compound **1** (83 mg, 0.3 mmol) and TBDMS-*p*-cresol (67 mg, 0.3 mmol) were added to a flame-dried 10 mL round bottom flask and dissolved in acetonitrile (3 mL). Then KHF_2 (26 mg, 0.3 mmol) and 18-crown-6 ether (87 mg, 0.33 mmol) were added, and the mixture was stirred for 1 h at rt, during which the reaction reached completion. The reaction mixture was then concentrated and subjected to column chromatography (petroleum ether 4:1 ethyl acetate). The final product was obtained as a white powder (109 mg, 0.3 mmol, >99%).(Full characterization data can be found in 6.4 Experimental data)

Reaction of TBDMS-*p*-cresol with catalytic KHF_2 (Figure S5b**)**

The procedure was the same as for the previous reaction, except that the amounts of the KHF_2 and 18-crown-6 ether were reduced to 0.2 equiv (5.2 mg, 0.06 mmol) and 0.22 equiv (17 mg, 0.066 mmol) respectively. The mixture

was stirred for 30 h at rt, at which time the reaction had reached completion. The final product was obtained as a white powder (108 mg, 0.3 mmol, >99%) after flash column chromatography (petroleum ether 4:1 ethyl acetate).

Reaction of *p*-cresol (Figure S5c)

Compound **1** (83 mg, 0.3 mmol) and *p*-cresol **2b-*p*** (33 mg, 0.3 mmol) were added to a flame dried 10 mL round bottom flask and dissolved in acetonitrile (3 mL). Then KHF_2(26 mg, 0.3 mmol) and 18-crown-6 ether (87 mg, 0.33 mmol) were added, and the mixture was stirred at rt. The reaction mixture was monitored by TLC analysis, and only trace products were found after 24 h.

Deprotection of TBDMS-*p*-cresol (Figure S5d**)**

TBDMS-*p*-cresol (55.6 mg, 0.25 mmol) was added to a flame dried 10 mL round bottom flask and dissolved in acetonitrile (2 mL). Then KHF_2 (20 mg, 0.25 mmol) and 18-crown-6 ether (73 mg, 0.28 mmol) were added, and the mixture was stirred for 1 h at rt. The reaction mixture was then concentrated and subjected to column chromatography (petroleum ether 3:1 ethyl acetate). The final product was obtained as a colorless oil (27 mg, 0.24 mmol, >99%).

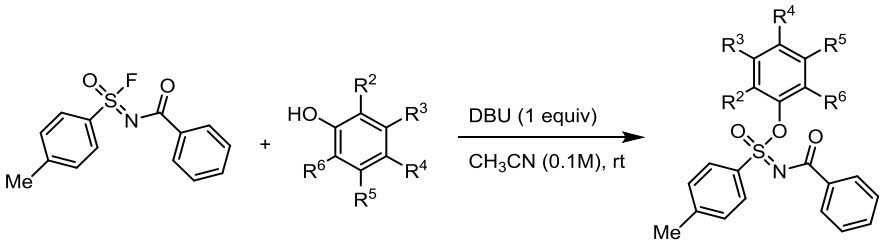
Reaction of Phenolate (Figure S5e**)**

Sodium phenoxide **6** (57.2 mg, 0.5 mmol) was added to a solution of compound **1** (136 mg, 0.5 mmol) in CH_3CN (5 mL) and was monitored until completion with TLC. After 10 min the reaction mixture was concentrated in vacuo. The title compound was obtained as a white powder from flash column chromatography on a silica column (heptane:CH_2Cl_2 = 15:85 to 0:100) (163 mg, 0.46 mmol, 93% yield). (Full characterization data can be found in 6.4 Experimental data)

Discussion

The difluoride is indeed an excellent SuFEx reaction catalyst and performed well with our specific substrate **1** in a traditional SuFEx (Figure S5a). When using catalytic amounts of HF_2 anion (0.2 equiv), the same reaction reached completion, albeit at a much slower pace (30h, Figure S5b).
Nevertheless, no SuFEx product was found in Si-free SuFEx (Figure S5c).
Potassium bifluoride is not a strong base, as the pH of the saturated aqueous solution of potassium bifluoride at room temperature is about 3.[16]
Therefore, we believe that the difluoride is used here to remove silyl protecting groups and generate phenolates bearing strong nucleophilicities, *in situ*. In fact, potassium bifluoride (combing with 18-crown-6 ether) is an excellent silyl deprotection reagent (Figure S5d). The reactivity of phenolates has been demonstrated in our experiments (Figure S5e).
The difluoride catalyst is indeed a valuable addition to the SuFEx chemistry. However, our investigations were focused on silicon-free SuFEx reactions, so only preliminary investigations were performed in this direction. As we have shown above, the difluoride catalyst does not play a role in this particular reaction.
So, bifluoride-based SuFEx polymerizations were likely triggered by phenolates resulting from the use of bifluorides. As fluoride ions are released from SuFExable agents during polymerization, the bifluoride catalyst loading can therefore be much lower than stoichiometric.

6 Si-free SuFEx reaction – phenol derivative substrate scope



6.1 Phenol derivatives

Table S2. Substrate scope of the Si-free SuFEx reaction using phenol derivatives.

* In the absence of descriptor, the substituent is H.

#	Phenol*					Meth.	Conv/%	Time	Isol yield	Hydroly-sis	Notes
	R^2	R^3	R^4	R^5	R^6						
3a						a	>95	5 min	93		Phenol
3b-*p*			Me			a	>95	6 min	87		
3b-*m*		Me				a	>95	6 min			
3b-*o*	Me					a	>95	6 min			
3c	Me		Me		Me	a	>95	10 min	91		
3d			OMe			a	>95	2 min	93		
3e		Pyr.				a	>95	3 min	87		3-hydroxy pyridine
3f			NH_2			a	>95	3 min		Y (2%)	
3g			OCF_3			a	>95	3 min			
3h			$CONH_2$			a	>95	10 min			
3i			COOH			c	>95	10 min			
3j			NHCOMe			a	>95	3 min			
3k		OH				d	>95	5 min	89		Resorcinol
3l			^{i}Pr-C_6H_5OH			d	>95	3 min			BPA
3m-*p*			F			a	>95	3 min			
3m-*m*		F				a	>95	5 min			
3m-*o*	F					a	>95	3 min			
3n		F	F	F		a	93	11 min		Y (5%)	
3o			Cl			a	>95	3 min	87		
3*p*-*p*			Br			a	>95	3 min			
3*p*-*m*		Br				a	>95	3 min			
3*p*-*o*	Br					a	>95	30 min	79	Y (3%)	
3q			I			a	>95	3 min			
3r-*p*			*t*-Bu			a	>95	15 min			
3r-*o*	*t*-Bu					a	>95	40 min			
3r-*o*	*t*-Bu					e	>95	2 min	92		
3s			COOMe			a	>95	25 min			
3t			CH_2OH			a	>95	5 min		Y (18%)	
3u			$B(OH)_2$			a	>95	30 min		Y (8%)	
3v			CF_3			a	>95	30 min			
3w			CHO			a	89	30 min		Y (4%)	
3x			SO_2-C_6H_6-O^{i}Pr			a	89	30 min		Y (5%)	
3y-*p*			CN			a	87	30 min		Y (3%)	
3y-*m*		CN				a	>95	15 min	33 [C]		
3z		CF_3		CF_3		a	88	21 h		Y (26%)	
3aa	*t*-Bu		Me		*t*-Bu	a	66	21 h		Y (>99%)	
3aa	*t*-Bu		Me		*t*-Bu	e	>95	42 min		Y (>99%)	
3ab	Cl				Cl	a	44	22 h		Y (6%)	
3ac	NO_2		Me			a	56	70 min	71[C]	Y (21%)	
3ad			NO_2			a	77	45 min		Y (53%)	
3zy	Cl	Cl	Cl	Cl	Cl	a	< 5	27 h		Y (>99%)	

6.2 Natural phenol derivatives

Table S3. Substrate scope of the Si-free SuFEx reaction using natural phenol derivatives.

#	Phenolic derivative	Cond.	Conv. /%	Time	Hydrolysis
4a	Eugenol	a	>95	3 min	
4b	Vanillic acid	c	>95	12 min	
4c	Raspberry ketone	a	>95	3 min	
4d	Tyrosol	a	>95	3 min	Y (7%)
4e	Sesamol	a	>95	5 min	
4f	Ferrulic acid	c	>95	6 min	
4g	Thymol	a	>95	15 min	
4h	Salicyl aldehyde	a	96	60 min	Y (2%)
4i	Vanillin	a	93	4h	Y (5%)
4z	Salicyclic acid	c	65	24h	Y (100%)
	Salicyclic acid	e	>95	45 min	Y (100%)

6.3 Experimental conditions

6.3.1 General observations and methods for determining conversion via ^{1}H-NMR

The SuFEx reactions were generally fast, clean, high-yielding reactions. The reactions were monitored via ^{1}H-NMR (in MeCN-d_3), whereby the disappearance of starting material (δ = 8.14 (t, J = 7.2 Hz, 4H)) coincided with the appearance of product (generally two doublets, with a typical shift around 8.10 and 7.98, both 2H). Furthermore, the starting material methyl peak also shifts upfield upon product formation, from 2.51 ppm to 2.46-2.49 ppm. Hydrolysis of the product can be observed by the formation of a singlet at 2.35/2.36 ppm corresponding to the Me-signal of the –OH hydrolysis product.

6.3.2 General procedures for substrate screening via ^{1}H-NMR

a) In an NMR tube, fluoride (1 equiv) and the phenol (1.05 equiv) were dissolved in CD_3CN (0.1M). DBU was added (1.0 equiv) and the reaction progress was monitored via ^{1}H NMR.

b) (used for determination isolated yield) in a flame-dried flask, under Ar flow, SF (1 equiv) and the phenol (1.05 equiv) were dissolved in anhydrous MeCN (0.1 M). DBU was added (1.0 equiv) and the reaction progress was monitored via TLC. Once full conversion was reached, the product was isolated via flash column chromatography.

c) in an NMR tube, SF (1 equiv) and the phenol (1.05 equiv) were dissolved in CD_3CN (0.1 M). DBU was added (2.0 equiv) and the reaction progress was monitored via ^{1}H NMR.

d) in an NMR tube, SF (2.01 equiv) and the phenol (1 equiv) were dissolved in CD_3CN (0.1 M). DBU was added (1.0 equiv) and the reaction progress was monitored via ^{1}H NMR.

e) in an NMR tube, SF (1 equiv) and the phenol (10 equiv) were dissolved in CD_3CN (0.1 M). DBU was added (10 equiv) and the reaction progress was monitored via ^{1}H NMR.

6.3.3 Examples of procedures

a) Sulfonimidoyl fluoride **1** (14.2 mg, 0.051 mmol, 1 equiv) was dissolved in 0.55 mL CD_3CN. Phenol (6.3 mg, 0.067 mmol, 1.3 equiv) was added and the reaction mixture was analyzed via ^{1}H NMR. DBU (8.1 µL, 0.054 mmol, 1.05 equiv) was added and the mixture was shaken well. Immediately after, ^{1}H NMR measurements were continued until the starting material had disappeared fully. Full conversion of the starting material towards the desired product was reached after 5 min.

b) Sulfonimidoyl fluoride **1** (138 mg, 0.50 mmol) was dissolved in anhydrous acetonitrile (5 mL, 0.1 M) in a 25 mL round bottom flask at room temperature. The unprotected phenol was added (0.50 mmol), followed by the addition of DBU (75 µL, 0.50 mmol). The reaction was monitored with TLC until the starting materials

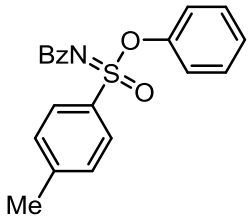
were not observed anymore, or until no change in the TLC was observed. After this, the reaction mixture was concentrated and purified by flash column chromatography, yielding the desired product. Eluents for the purification and the obtained yield are detailed in the data section 5.4.

c) Sulfonimidoyl fluoride **1** (15.0 mg, 0.054 mmol, 1 equiv) was dissolved in 0.55 mL CD_3CN. 4-hydroxybenzoic acid (8.22 mg, 0.060 mmol, 1.1 equiv) was added and the reaction mixture was analyzed via ^1H NMR. DBU (16 µL, 0.108 mmol, 2.0 equiv) was added and the mixture was shaken well. Immediately after, ^1H NMR measurements were continued until the starting material had disappeared fully. Full conversion of the starting material towards the desired product was reached after 10 min.

d) Sulfonimidoyl fluoride **1** (14.6 mg, 0.053 mmol, 2.2 equiv) was dissolved in 0.55 mL CD_3CN. Resorcinol (2.5 mg, 0.023 mmol, 1 equiv) was added and the reaction mixture was analyzed via ^1H NMR. DBU (8.0 µL, 0.055 mmol, 1.0 equiv) was added and the mixture was shaken well. Immediately after, ^1H NMR measurements were continued until the free phenol had disappeared fully (characteristic peak, a triplet at 7.01 (t, *J* = 8.1 Hz, 1H). The sulfonimidoyl fluoride starting material was added in excess and the usual peaks to determine full conversion could therefore not be used. Full conversion of the phenol towards the desired product was reached after 5 min.

e) Sulfonimidoyl fluoride **1** (8.0 mg, 0.029 mmol, 1 equiv) was dissolved in 0.55 mL CD_3CN. 2-*tert*-butyl-phenol (43.4 mg, 0.30 mmol, 10 equiv) was added and the reaction mixture was analyzed via ^1H NMR. DBU (43 µL, 0.29 mmol, 10 equiv) was added and the mixture was shaken well. Immediately after, ^1H NMR measurements were continued until the sulfonimidoyl fluoride starting material had disappeared fully. Full conversion to the desired SuFEx product was obtained after 3 min.

6.4 Experimental data



3a

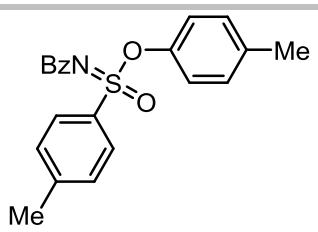
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^1H NMR (400 MHz, CD_3CN) δ = 8.08 (d, *J* = 8.0 Hz, 2H), 7.93 (d, *J* = 8.4 Hz, 2H), 7.58 (t, *J* = 7.4 Hz, 1H), 7.50 – 7.42 (m, 4H), 7.38–7.27 (m, 3H), 7.11–7.06 (m, 2H), 2.46 (s, 3H). HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{20}H_{18}NO_3S$: 352.1002, found: 352.0999.

Isolated product

The title compound was obtained as a grey powder from flash column chromatography on a silica gel (CH_2Cl_2:P.E. - 5:1) (163 mg, 93%). ^1H NMR (400 MHz, $CDCl_3$) δ = 8.14 (d, *J* = 7.1 Hz, 2H), 7.96 (d, *J* = 8.4 Hz, 2H), 7.52 (t, *J* = 7.4 Hz, 1H), 7.45-7,35 (m, 4H), 7.34–7.22 (m, 3H), 7.12 (d, *J* = 7.8 Hz, 2H), 2.47 (s, 3H). ^{13}C NMR (100 MHz, C_6D_6) δ = 171.4, 150.0, 145.0, 136.3, 134.6, 132.4, 130.2, 129.86, 129.82, 128.5, 128.4, 127.3, 123.4, 21.2. HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{20}H_{18}NO_3S$: 352.1002, found: 352.0999. IR (neat): 3062, 1640, 1585, 1267 cm^{-1}.



3b-*p*

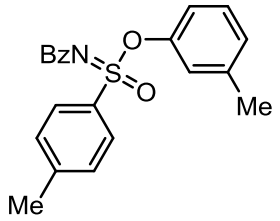
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 8.0 Hz, 2H), 7.92 (d, J = 8.0 Hz, 2H), 7.58 (t, J = 7.4 Hz, 1H), 7.48-7.42 (m, 4H), 7.14 (d, J = 8.3 Hz, 2H), 6.96 (d, J = 8.5 Hz, 2H), 2.46 (s, 3H), 2.28 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_3S$: 366.1158, found: 366.1148.

Isolated product

The title compound was obtained as a white powder from flash column chromatography on silica gel (CH_2Cl_2: P.E.-5:1) (160 mg, 87%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.14 (d, J = 8.3, 2H), 7.95 (d, J = 8.4 Hz, 2H), 7.51 (t, J = 7.4 Hz, 1H), 7.44–7.33 (m, 4H), 7.08 (d, J = 8.3 Hz, 2H), 6.99 (d, J = 8.6 Hz, 2H), 2.47 (s, 3H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 172.0, 147.1, 145.7, 137.4, 135.5, 133.5, 132.5, 130.3, 130.0, 129.8, 128.5, 128.2, 122.7, 21.9, 21.1. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_3S$: 366.1158, found: 366.1148. IR (neat): 3060, 2915, 1643, 1595, 1500, 1251 cm^{-1}.

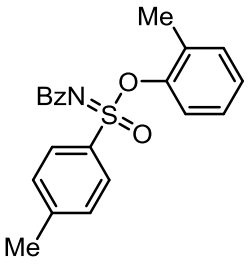


3b-*m*

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 7.4 Hz, 2H), 7.93 (d, J = 8.3 Hz, 2H), 7.58 (t, J = 7.4 Hz, 1H), 7.46 (t, J = 6.8 Hz, 4H), 7.21 (t, J = 7.9 Hz, 1H), 7.12 (d, J = 7.5 Hz, 1H), 6.92 (s, 1H), 6.87 (d, J = 8.1 Hz, 1H), 2.46 (s, 3H), 2.25 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_3S$: 366.1158, found: 366.1149.



3b-*o*

reaction mixture

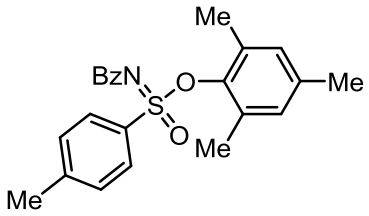
(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.06 (d, J = 7.2 Hz, 2H), 7.95 (d, J = 8.4 Hz, 2H), 7.58 (t, J = 7.4 Hz, 1H), 7.46 (t, J = 8.3 Hz, 4H), 7.30–7.12 (m, 4H), 2.46 (s, 3H), 2.16 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_3S$: 366.1158, found: 366.1150.

Isolated product

The title compound was obtained as a white powder from flash column chromatography on silica (hexane : CH_2Cl_2 = 15 : 85) (169 mg, 92%).

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.13 (d, J = 8.0 Hz, 2H), 7.97 (d, J = 8.0 Hz, 2H), 7.52 (t, J = 7.0 Hz, 1H), 7.45–7.33 (m, 4H), 7.23–7.08 (m, 4H), 2.48 (s, 3H), 2.22 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ = 171.9, 148.2, 145.8, 135.5, 134.1, 132.5, 132.1, 131.8, 130.1, 129.8, 128.2, 128.2, 127.4, 127.0, 122.9, 21.9, 16.7. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_3S$: 366.1158, found: 366.1150. IR (neat): 3068, 2918, 1642, 1596, 1270 cm^{-1}.



3c

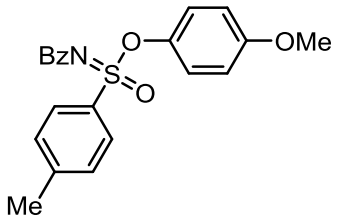
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 7.96-8.04 (m, 4H), 7.57 (t, J = 7.4 Hz, 1H), 7.49 (d, J = 8.3 Hz, 2H), 7.52-7.40 (m, 2H), 6.93 (s, 2H), 2.48 (s, 3H), 2.26 (s, 3H), 2.18 (s, 6H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{23}H_{24}NO_3S$: 394.1471, found: 394.1471.

Isolated product

The title compound was obtained as a white powder from flash column chromatography on a silica gel (CH_2Cl_2: P.E. - 4:1) (179 mg, 91%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.07 (d, J = 8.0 Hz, 2H), 8.00 (d, J = 8.4 Hz, 2H), 7.50 (t, J = 7.4 Hz, 1H), 7.45-7.34 (m, 4H), 6.85 (s, 2H), 2.47 (s, 3H), 2.26 (s, 3H), 2.19 (s, 6H). ^{13}C NMR* (100 MHz, $CDCl_3$) δ = 171.7, 145.4, 145.3, 136.8, 135.6, 135.2, 132.4, 130.1, 129.7, 128.2, 128.1, 21.9, 20.8, 17.8; (100 MHz, C_6D_6) δ = 171.2, 146.0, 144.8, 136.58, 136.55, 136.2, 132.7, 132.3, 130.3, 130.1, 129.9, 21.2, 20.6, 17.9. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{23}H_{24}NO_3S$: 394.1471, found: 394.1460. IR (neat): 3065, 2924, 1655, 1265 cm^{-1}. (The ^{13}C NMR was obtained with two different solvents to account for overlap of carbon peaks. For example, peaks located at 132.4 and 130.1 ppm in $CDCl_3$ are split into two peaks when C_6D_6 was adopted, respectively 132.7 & 132.3, 130.3 & 130.1. Peaks located at 128.2 and 128.1 ppm in $CDCl_3$ will overlap with C_6H_6 solvent residue peaks.



3d

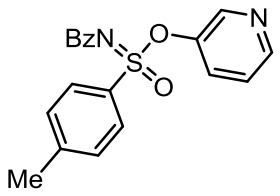
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 8.0 Hz, 2H), 7.91 (d, J = 8.0 Hz, 2H), 7.58 (t, J = 7.4 Hz, 1H), 7.50-7.43 (m, 4H), 6.99 (d, J = 9.1 Hz, 2H), 6.84 (d, J = 9.1 Hz, 2H), 3.73 (s, 3H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_4S$: 382.1108, found: 382.1096.

Isolated product

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.15 (d, J = 8.0 Hz, 2H), 7.93 (d, J = 8.0 Hz, 2H), 7.51 (t, J = 7.3 Hz, 1H), 7.45-7.30 (m, 4H), 7.01 (d, J = 9.1 Hz, 2H), 6.77 (d, J = 9.1 Hz, 2H), 3.74 (s, 3H), 2.45 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 172.0, 158.5, 145.7, 142.7, 135.4, 133.1, 132.5, 130.0, 129.7, 128.4, 128.2, 123.9, 114.6, 55.6, 21.8. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{20}NO_4S$: 382.1108, found: 382.1096.



3e

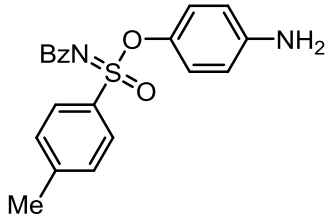
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.49 (d, *J* = 4.1 Hz, 1H), 8.28 (s, 1H), 8.08 (d, *J* = 7.5 Hz, 2H), 7.95 (d, *J* = 7.8 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.49 (q, J = 9.9, 8.4 Hz, 5H)., 7.35 (dd, *J* = 7.6, 5.1 Hz, 1H), 2.47 (s, 3H). HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{19}H_{17}N_2O_3S$: 353.0954, found: 353.0949.

Isolated product

The title compound was obtained as a yellow crystal from flash column chromatography on a silica gel (petroleum ether 2:1 ethyl acetate) (0.1534 g, 87%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.51 (d, *J* = 4.3 Hz, 1H), 8.23 (d, J = 1.4 Hz 1H), 8.14 (d, *J* = 8.0 Hz, 2H), 7.97 (d, *J* = 8.4 Hz, 2H), 7.66 (ddd, *J* = 8.4, 2.6, 1.4 Hz, 1H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.46–7.37 (m, 4H), 7.31 (dd, *J* = 8.4, 4.7 Hz, 1H), 2.49 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 171.7, 148.5, 146.5, 146.4, 144.4, 135.0, 132.8, 132.7, 131.0, 130.3, 129.8, 128.3, 128.3, 124.4, 21.9. HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{19}H_{17}N_2O_3S$: 353.0954, found: 353.0949. IR (neat, cm^{-1}): 3063, 2923, 1648, 1254, 1145.



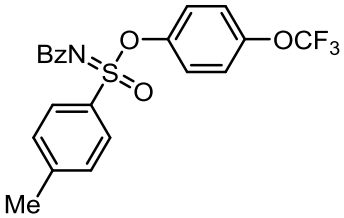
3f

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

During the reaction, a trace of hydrolysis product was obtained (<2%).

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, *J* = 8.0 Hz, 2H), 7.89 (d, *J* = 8.0 Hz, 2H), 7.58 (t, *J* = 7.4 Hz, 1H), 7.50-7.42 (m, 4H), 6.74 (d, *J* = 8.0 Hz, 2H), 6.50 (d, *J* = 8.0 Hz, 2H), 4.41 (br s, 2H*), 2.45 (s, 3H). *also starting material OH and NH. HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{20}H_{19}N_2O_3S$: 367.1111, found: 367.1098.

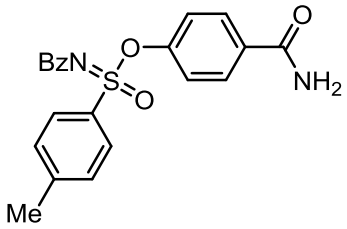


3g

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, *J* = 8.3 Hz, 2H), 7.95 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.51–7.42 (m, 4H), 7.27 (d, *J* = 8.0 Hz, 2H), 7.19 (d, *J* = 8.0 Hz, 2H), 2.47 (s, 3H). HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{21}H_{17}F_3NO_4S$: 436.0825, found: 436.0812.

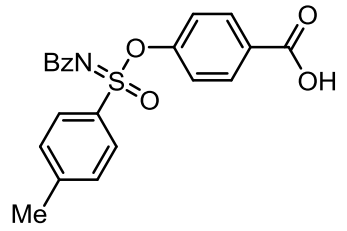


3h

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ 8.19 (br s, 1H), 8.08 (d, J = 7.1 Hz, 2H), 7.98-7.90 (m, 4H), 7.58 (t, J = 7.4 Hz, 1H), 7.50–7.42 (m, 4H), 7.13 (d, J = 8.8 Hz, 2H), 6.42 (br s, 1H), 2.45 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{19}N_2O_4S$: 395.1060, found: 395.1049.

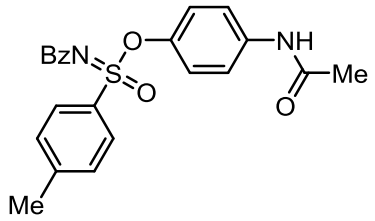


3i

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) *δ* = 8.08 (d, *J* = 8.0 Hz, 2H), 7.92 (d, *J* = 7.9 Hz, 2H), 7.86 (d, *J* = 8.1 Hz, 2H), 7.58 (t, *J* = 7.2 Hz, 1H), 7.49-7.43 (m, 4H), 6.97 (d, *J* = 8.2 Hz, 2H), 2.45 (s, 3H). HRMS (ESI) *m/z* [*M*-H]$^-$ calcd. for $C_{21}H_{16}NO_5S$: 394.0755, found: 394.0749.

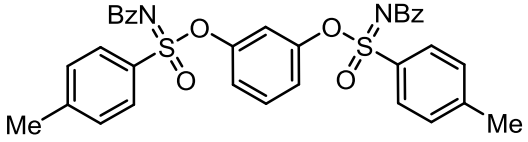


3j

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) *δ* = 8.08 (d, *J* = 8.3 Hz, 2H), 7.90 (d, *J* = 8.3 Hz, 2H), 7.63 (d, *J* = 9.0 Hz, 2H), 7.57 (t, *J* = 7.4 Hz, 1H), 7.48-7.41 (m, 4H), 6.93 (d, *J* = 9.1 Hz, 2H), 5.34 (br s, 1H)*, 2.44 (s, 3H), 2.02 (s, 3H). *NH overlaps with starting material. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{22}H_{21}N_2O_4S$: 409.1217, found: 409.1212.



3k

Reaction mixture

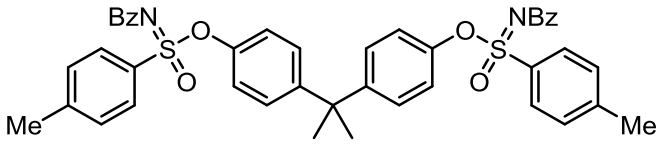
(from crude reaction mixture, also containing DBU and excess sulfonimidoyl fluoride)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.07 (d, J = 8.0 Hz, 4H), 7.90-7.84 (m, 4H), 7.62–7.57 (m, 2H), 7.50–7.42 (m, 8H), 7.32(td, J = 8.4, 1.6 Hz, 1H), 7.09-7.02 (m, 2H), 6.97 (t, J = 2.2 Hz, 1H), 2.46 (s, 6H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{34}H_{29}N_2O_6S_2$: 625.1462, found: 625.1446.

Isolated product

The title compound was obtained as a purple liquid by flash column chromatography on silica gel (P.E.: EtOAc – 3:2, 277 mg, 89%*). *both diastereoisomers.

^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.15–8.07 (m, 8H), 7.92-7.85 (m, 8H), 7.57–7.48 (m, 4H), 7.46-7.38 (m, 8H), 7.38-7.31 (m, 8H), 7.28 (d, 3.2 Hz, 1H), 7.24 (d, 2.8 Hz, 1H), 7.16-7.09 (m, 4H), 6.95 (t, J = 4 Hz, 1H), 6.90 (t, J = 4 Hz, 1H), 2.47 (s, 6H), 2.46 (s, 6H). Two sets of peaks can be found in a 1:1 ratio. The ratio was determined by comparing the integral of two triplets found at δ = 6.90-6.95. ^{13}C NMR (100 MHz, CDCl3) δ = 171.7, 157.5, 150.0, 149.6, 146.2, 135.1, 133.3, 132.9, 132.8, 132.7, 132.5, 130.3, 130.0, 130.1, 130.0, 129.82, 129.79, 128.4, 128.25, 128.18, 128.0, 122.2, 122.1, 118.0, 114.9, 114.4, 110.5, 29.71, 21.9, 21.8. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{34}H_{29}N_2O_6S_2$: 625.1462, found: 625.1446. **IR** (neat): 3026, 2924, 1647, 1595, 1260 cm^{-1}.

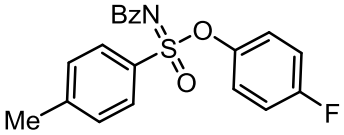


3l

Reaction mixture

(from crude reaction mixture, also containing DBU and excess sulfonimidoyl fluoride)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.04 (d, J = 8.0 Hz, 4H), 7.91 (d, J = 8.4 Hz, 4H), 7.57 (t, J = 7.4 Hz, 2H), 7.47-7.40 (m, 8H), 7.11 (d, J = 8.8 Hz, 4H), 6.98 (d, J = 8.8 Hz, 4H), 2.44 (s, 6H), 1.55 (s, 6H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{43}H_{39}N_2O_6S_2$: 743.2244, found: 743.2224.

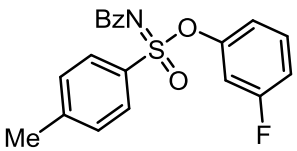


3m-*p*

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 8.3, 2H), 7.93 (d, J = 8.5 Hz, 2H), 7.59 (t, J = 7.4 Hz, 1H), 7.52-7.40 (m, 4H), 7.14–7.03 (m, 4H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}FNO_3$: 370.0908, found: 370.0898.

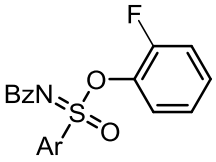


3m-*m*

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.10 (d, J = 8.2 Hz, 2H), 7.97 (d, J = 8.2 Hz, 2H), 7.61 (t, J = 6.9 Hz, 1H), 7.52-7.45 (m, 4H), 7.42-7.33 (m, 1H), 7.10 (td, J = 8.5, 2.3 Hz, 1H), 6.98-6.89 (m, 2H), 2.48 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}FNO_3$: 370.0908, found: 370.0897.

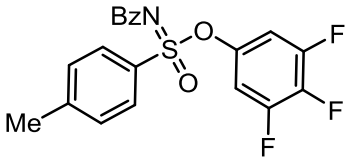


3m-*o*

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.07 (d, J = 7.9 Hz, 2H), 7.96 (d, J = 8.0 Hz, 2H), 7.59 (t, J = 7.3 Hz, 1H), 7.50-7.43 (m, 4H), 7.39-7.28 (m, 2H), 7.23–7.14 (m, 2H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}FNO_3$: 370.0908, found: 370.0896.



3n

The reaction with 3,4,5-trifluorophenol was rather fast, yielding a high conversion after 2 min. Conversion of the starting material increased, but after 11 min hydrolysis of the product started to diminish the yield of product.

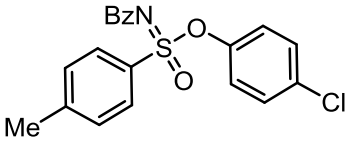
t = 2 min		**%**
	Conversion	85
Of which	Starting material	15
	Product	82
	Hydrolysis of product	2

t = 11 min	**%**
Conversion	93
Starting material	7
Product	87
Hydrolysis of product	5

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.11 (d, J = 7.9 Hz, 2H), 7.98 (d, J = 8.0 Hz, 2H), 7.62 (t, J = 7.1 Hz, 1H), 7.55 – 7.46 (m, 4H), 7.01–6.90 (m, 2H), 2.49 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{15}F_3NO_3S$: 406.0719, found: 406.0710.



3o

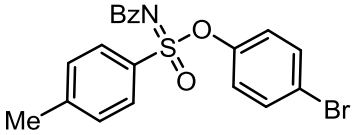
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 7.4 Hz, 2H), 7.93 (d, J = 8.4 Hz, 2H), 7.59 (t, J = 7.4 Hz, 1H), 7.52-7.43 (m, 4H),), 7.34 (d, J = 9.0 Hz, 2H), 7.07 (dd, J = 8.9, 2.1 Hz, 2H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}NO_3SCl$: 386.0612, found: 386.0598.

Isolated product

The title compound was obtained as a white powder by flash column chromatography (P.E.:EtOAc – 6:1) (168 mg 87%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.16 (d, J = 7.3 Hz, 2H), 7.97 (d, J = 8.4 Hz, 2H), 7.55 (t, J = 7.4 Hz, 1H), 7.48–7.38 (m, 4H), 7.29 (d, J = 6.8 Hz, 2H), 7.09 (d, J = 8.9 Hz, 2H), 2.51 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 171.8, 147.8, 146.1, 135.2, 133.2, 133.0, 132.7, 130.1, 129.9, 129.8, 128.4, 128.3, 124.4, 21.9. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}NO_3SCl$: 386.0612, found: 386.0605. IR (neat, cm^{-1}): 3062, 1650, 1483, 1248.

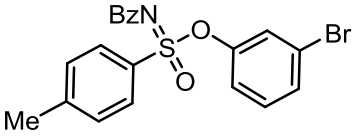


3p-p

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, *J* = 9.2 Hz, 2H), 7.93 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.53–7.42 (m, 6H), 7.07–6.97 (m, 2H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}BrNO_3S$: 430.0107, found: 430.0096.

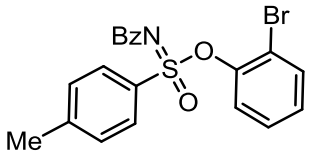


3p-m

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, *J* = 8.2, 2H), 7.95 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.52–7.43 (m, 5H), 7.30 (t, *J* = 2.1 Hz, 1H), 7.27 (t, *J* = 8.2 Hz, 1H), 7.08 (ddd, *J* = 8.3, 2.3, 0.9 Hz, 1H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}BrNO_3S$: 430.0107, found: 430.0096.



3p-o

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

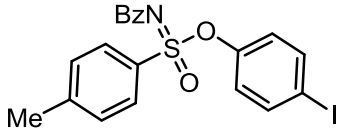
While the reaction proceeded to full conversion in 30 min, some hydrolysis of the final product was obtained as well.

t = 30 min		**%**
	Conversion	>95
Of which	Starting material	0
	Product	96.5
	Hydrolysis of product	3.5

^{1}H NMR (400 MHz, CD_3CN) δ = 8.07 (d, *J* = 7.2 Hz, 2H), 8.01 (d, *J* = 8.4 Hz, 2H), 7.66-7.58 (m, 2H), 7.58-53 (m, 1H), 7.53-7.44 (m, 4H), 7.42 (td, *J* = 7.9, 1.6 Hz, 1H), 7.25 (td, *J* = 8.0, 1.4 Hz, 1H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}BrNO_3S$: 430.0107, found: 430.0093.

Isolated product

The title compound was obtained as a white powder from flash column chromatography (CH_2Cl_2:P.E. - 5:1) (171 mg, 79%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.13 (d, *J* = 7.1 Hz, 2H), 8.03 (d, *J* = 8.4 Hz, 2H), 7.67 (dd, *J* = 8.2, 1.4 Hz, 1H), 7.57 – 7.49 (m, 2H), 7.40 (dd, *J* = 16.3, 8.2 Hz, 4H), 7.33 (d, *J* = 8.2 Hz, 1H), 7.15 (td, *J* = 7.9, 1.4 Hz, 1H), 2.48 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 171.3, 147.1, 146.1, 135.3, 134.0, 133.8, 132.7, 130.0, 129.9, 128.8, 128.6, 128.4, 128.3, 125.3, 116.6, 21.9. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd for $C_{20}H_{17}BrNO_3S$: 430.0107, found: 430.0099. IR (neat): 3078, 1642, 1468, 1271 cm^{-1}.

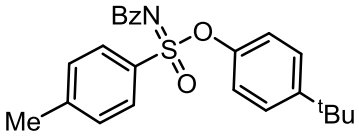


3q

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, *J* = 7.3 Hz, 2H), 7.93 (d, *J* = 8.4 Hz, 2H), 7.68 (d, *J* = 8.9 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.50–7.43 (m, 4H), 6.87 (d, *J* = 8.9 Hz, 2H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{17}INO_3S$: 477.9968, found: 477.9957.

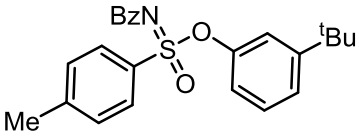


3r-*p*

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.07 (d, *J* = 7.9 Hz, 2H), 7.94 (d, *J* = 8.0 Hz, 2H), 7.58 (t, *J* = 7.3 Hz, 1H), 7.49-7,44 (m, 4H), 7.38 (d, *J* = 8.3 Hz, 2H), 7.02 (d, *J* = 8.4 Hz, 2H), 2.46 (s, 3H), 1.26 (s, 9H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{26}NO_3S$: 408.1628, found: 408.1618.



3r-*o*

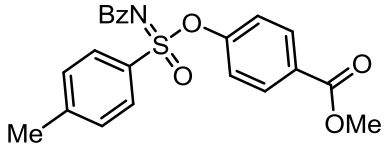
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08-8.01 (m, 4H), 7.57 (t, *J* = 7.4 Hz, 1H), 7.54–7.51 (m, 1H), 7.51–7.40 (m, 5H), 7.23–7.15 (m, 2H), 2.46 (s, 3H), 1.34 (s, 9H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{26}NO_3S$: 408.1628, found: 408.1617.

Isolated product

The title compound was obtained as a yellow oil from flash column chromatography on silica. (P.E.:CH_2Cl_2 - 15:85) (189 mg, 0.46 mmol, 92%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.13–8.05 (m, 4H), 7.58–7.53 (m, 1H), 7.53–7.47 (m, 1H), 7.43–7.36 (m, 5H), 7.20–7.12 (m, 2H), 2.47 (s, 3H), 1.37 (s, 9H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 171.6, 149.3, 145.6, 141.1, 135.5, 135.3, 132.5, 130.2, 129.8, 128.2, 128.13, 128.09, 127.4, 126.3, 120.8, 34.8, 30.5, 21.9. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{26}NO_3S$: 408.1628, found: 408.1616. IR (neat, cm^{-1}): 3068, 2918, 1642, 1597, 1270

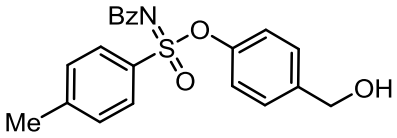


3s

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 8.0 Hz, 2H), 7.97-7.93 (m, 4H), 7.59 (t, J = 7.3 Hz, 1H), 7.50-7.42 (m, 4H), 7.19 (d, J = 8.3 Hz, 2H), 3.84 (s, 3H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{22}H_{20}NO_5S$: 410.1057, found: 410.1043.



3t

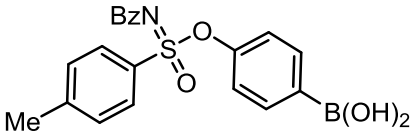
Hydrolysis occurred during the monitoring of the reaction. Full conversion of the starting material towards the product was achieved within 5 min. At this time, hydrolysis made up 18% of the final mixture composition. The peak relations in ^{1}H NMR were confirmed by COSY.

t = 5 min		**%**
	Conversion	>95
Of which	Starting material	0
	Product	82
	Hydrolysis of product	18

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 7.3 Hz, 2H), 7.93 (d, J = 8.3 Hz, 2H), 7.58 (t, J = 7.4 Hz, 1H), 7.49-7.42 (m, 4H), 7.30 (d, J = 8.3 Hz, 2H), 7.03 (t, J = 8.9 Hz, 2H), 4.50 (s, 1.5H)*, 4.39 (s, 0.5H)*, 2.46 (s, 3H). *(belong to benzyl CH_2). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{20}NO_4S$: 382.1108, found: 382.1093.



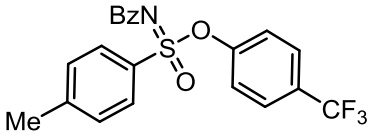
3u 4-hydroxy phenylboronic acid product

While the reaction proceeded to full conversion in 30 min, some hydrolysis of the final product was obtained as well. Moreover, LC-MS analysis also showed a product corresponding whereby loss of the boronic acid occurred.

t = 30 min		**%**
	Conversion	>95
Of which	Starting material	0
	Product	92
	Hydrolysis of product	8

Reaction mixture

^{1}H NMR (400 MHz, CD_3CN) δ = 8.13-8.06 (m, 2H), 7.94-7.89 (m, 2H), 7.67 (d, J = 7.6 Hz, 1H), 7.62–7.54 (m, 1H), 7.51–7.42 (m, 4H), 7.38-7,31 (m, 1H), 6.92 (d, J = 7.8 Hz, 1H), 6.83 (d, J = 8.3 Hz, 1H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{19}BNO_5S$: 396.1072, found: 396.1058.

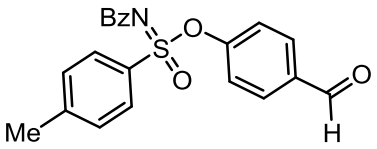


3v

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.08 (d, J = 7.5 Hz, 2H), 7.97 (d, J = 7.9 Hz, 2H), 7.68 (d, J = 8.2 Hz, 2H), 7.59 (t, J = 7.3 Hz, 1H), 7.54–7.42 (m, 4H), 7.29 (d, J = 8.2 Hz, 2H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{17}F_3NO_3S$: 420.0876, found: 420.0864.



3w

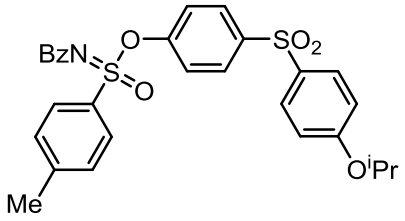
The reaction suffered from incomplete conversion of the starting material, as well as hydrolysis of the product. Conversion increased over time, but the amount of desired product decreased over time, due to hydrolysis of said product. At t=30 min, an optimum was reached.

t = 30 min		**%**
	Conversion	89
Of which	Starting material	11
	Product	85
	Hydrolysis of product	4

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 9.96 (s, 1H), 8.10 (d, *J* = 8.3, 2H), 7.98 (d, *J* = 8.5 Hz, 2H), 7.89 (d, *J* = 8.7 Hz, 2H), 7.60 (t, *J* = 7.4 Hz, 1H), 7.53-7.46 (m, 4H), 7.31 (d, *J* = 8.6 Hz, 2H), 2.48 (s, 3H). HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{21}H_{18}NO_4S$: 380.0951, found: 380.0940.



3x

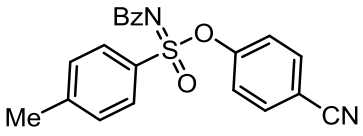
The reaction was monitored continuously via ^{1}H NMR. After 30 min, an optimum in conversion was reached, while hydrolysis of the product was not too significant. After this time, conversion did not improve significantly, while hydrolysis of the product increased.

t = 30 min		**%**
	Conversion	89
Of which	Starting material	11
	Product	84
	Hydrolysis of product	5

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.05 (d, *J* = 8.4 Hz, 2H), 7.95 (d, *J* = 8.4 Hz, 2H), 7.89 (d, *J* = 8.8 Hz, 2H), 7.80 (d, *J* = 8.9 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.50–7.41 (m, 4H), 7.27 (d, *J* = 8.8 Hz, 2H), 7.00 (d, *J* = 8.9 Hz, 2H), 4.73–4.64 (m, 1H), 2.46 (s, 3H). HRMS (ESI) *m/z* $[M+H]^+$ calcd. for $C_{29}H_{28}NO_6S_2$: 550.1353, found: 550.1335.



3y-*p*

Reaction mixture

The reaction was monitored continuously. After 30 min, an optimum in conversion was reached, while hydrolysis of the product was not too significant. After this time, conversion did not improve significantly, while hydrolysis of the product increased.

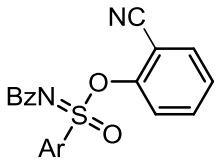
T = 70 min		%
	Conversion	87
Of which	Starting material	13
	Product	84
	Hydrolysis of product	3

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.09 (d, J = 7.4 Hz, 2H), 7.97 (d, J = 8.3 Hz, 2H), 7.74 (d, J = 8.7 Hz, 2H), 7.61 (t, J = 7.4 Hz, 1H), 7.54–7.44 (m, 4H), 7.29 (t, J = 7.7 Hz, 3H), 2.48 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{17}N_2O_3S$: 377.0954, found: 377.0935.

Isolated product

The title compound was obtained as a white powder from flash column chromatography (CH_2Cl_2: P.E. – 5:1) (60 mg, 33%). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.12 (d, J = 7.1 Hz, 2H), 7.97 (d, J = 8.4 Hz, 2H), 7.63 (d, J = 8.8 Hz, 2H), 7.55 (t, J = 7.4 Hz, 1H), 7.47-7.39 (m, 4H), 7.28 (d, J = 8.8 Hz, 2H), 2.50 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ = 171.6, 152.6, 146.5, 134.9, 134.0, 133.05, 132.96, 130.3, 129.8, 128.4, 128.2, 124.1, 117.9, 111.5, 21.9. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{17}N_2O_3S$: 377.0954, found: 377.0951. IR (neat): 3069, 2225, 1649, 1595, 1490, 1266 cm^{-1}.

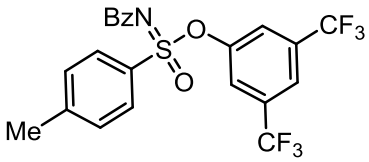


3y-*m*

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.12–8.06 (m, 2H), 7.97 (d, J = 8.4 Hz, 2H), 7.69 (d, J = 7.7 Hz, 1H), 7.61 (t, J = 7.4 Hz, 1H), 7.57–7.51 (m, 2H), 7.51–7.45 (m, 4H), 7.43 (ddd, J = 8.3, 2.3, 1.0 Hz, 1H), 2.49 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{17}N_2O_3S$: 377.0954, found: 377.0940.



3z

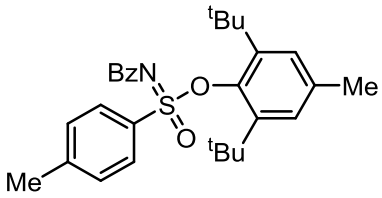
The reaction was monitored continuously. While conversion steadily grew, hydrolysis of the product eventually increased at a faster pace than conversion. When the reaction progress was compared between 3 and 21 h, conversion went up slightly, albeit at the cost of a higher proportion of hydrolysis. The results are presented after 21 h after the addition of DBU. After this time, conversion did not improve significantly, while hydrolysis of the product increased.

t = 21 h		%
	Conversion	88
Of which	Starting material	12
	Product	60
	Hydrolysis of product	28

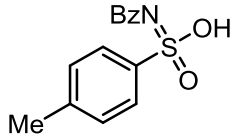
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.09 (d, J = 8.2, 2H), 7.99-7.99 (m, 2H), 7.62 (t, J = 7.4 Hz, 1H), 7.55-7.48 (m, 4H), 7.21 (s, 2H), 7.11 (s, 1H), 2.49 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{22}H_{16}F_6NO_3S$: 488.0750, found: 488.0728.



Desired product



Obtained product is the hydrolysis product

3aa

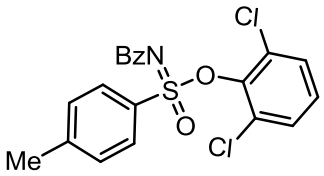
Data was taken from a sample reacted with 10 equivalents of phenol, as the conversion for the 1:1 reaction was very slow. Over time, no desired SuFEx product was formed. Instead, the hydrolysis product was obtained as the sole product, without forming the desired product as an intermediate. The data obtained are therefore in concurrence with the *hydrolysis product*.

Reaction mixture

(from crude reaction mixture, also containing 10 equivalents of DBU and 10 equivalents of phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.02 (d, J = 8.3, 2H), 7.87 – 7.81 (m, 2H), 7.40 – 7.28 (m, 3H), 7.21 (d, J = 8.0 Hz, 2H), 6.99 (s, 2H)* 2.38 (s, 3H), 2.25 (s, 3H)*, 1.44 (s, 18H)*. HR-MS (ESI) *m/z* [M-H]$^-$ calc for $C_{12}H_{12}NO_3S$, 274.0543, found 274.0545.

* overlaps with excess 2,6-di-tert-butyl-4-methyl-phenol.



3ab

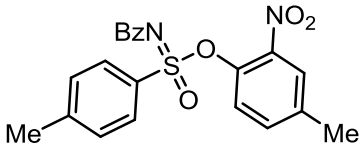
The reaction with 2,6-dichlorophenol was very slow and hydrolysis of the product occurred instantaneously. While conversion did increase over time, hydrolysis of the product occurred faster, hence the results after 22 h are presented.

T = 22h		**%**
	Conversion	45
Of which	Starting material	55
	Product	39
	Hydrolysis of product	6

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.10 (d, J = 8.0, 2H), 7.92 (d, J = 8.0 Hz, 2H), 7.57 (d, J = 8.3 Hz, 3H), 7.48 (d, J = 8.1 Hz, 2H), 7.43 (t, J = 7.7 Hz, 2H), 7.30 (dd, J = 8.6, 7.6 Hz, 1H), 2.49 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd for $C_{20}H_{16}Cl_2NO_3S$: 420.0222, found: 420.0207.



3ac

Reaction mixture

Using non-anhydrous conditions, the conversion was determined using ^{1}H-NMR.

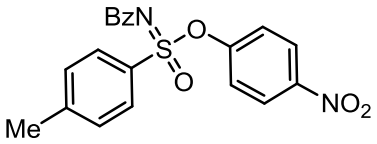
The reaction was monitored continuously. The reaction mixture analysis after 70 min is presented, because after this time the yield of product did not significantly increase. However, hydrolysis did increase significantly.

T = 70 min		**%**
	Conversion	56
Of which	Starting material	44
	Product	35
	Hydrolysis of product	21

Isolated product

The product was successfully isolated after performing the reaction in anhydrous conditions. This somewhat suppressed the formation of the hydrolysis product, but it was still present.

The title compound was obtained as a white powder from flash column chromatography (CH_2Cl_2:P.E. - 5:1), providing the product (145 mg, 71% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ = 8.07 (d, J = 7.5 Hz, 2H), 7.99 (d, J = 8.4 Hz, 2H), 7.73–7.70 (m, 1H), 7.68 (d, J = 8.4 Hz, 1H), 7.52 (t, J = 7.4 Hz, 1H), 7.45 (dd, J = 8.4, 2.0 Hz, 1H), 7.44-7.39 (m, 4H), 2.49 (s, 3H), 2.43 (s, 3H). ^{13}C NMR (100 MHz, C_6D_6) δ = 171.4, 145.9, 143.3, 139.4, 138.1, 135.8, 134.5, 133.8, 132.7, 130.2, 130.1, 128.5, 128.4, 126.5, 125.8, 21.3, 20.1. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{19}N_2O_5S$: 411.1009, found: 411.1002. IR (neat): 3068, 1642, 1530, 1266 cm^{-1}.



3ad *p*-nitrophenol product

Using non-anhydrous conditions, the conversion was determined using ^{1}H-NMR.

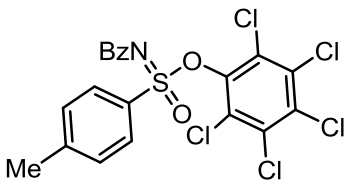
The reaction mixture analysis after 45 min is presented, because after this time the yield of product did not significantly increase. However, hydrolysis did increase significantly and was already the predominant product.

T = 45 min		**%**
	Conversion	77
Of which	Starting material	23
	Product	24
	Hydrolysis of product	53

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

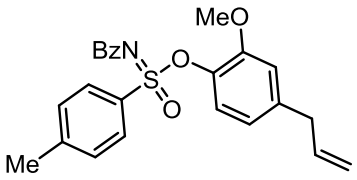
^{1}H NMR (400 MHz, CD_3CN) δ = 8.21 (d, J = 9.2 Hz, 2H), 8.10 (d, J = 7.1 Hz, 2H), 8.03-7.99 (m, 2H), 7.64–7.59 (m, 1H), 7.52–7.46 (m, 4H), 7.40–7.35 (m, 2H), 2.49 (s, 3H). HRMS (ESI) *m/z* [*M*-H]$^-$ calcd. for $C_{20}H_{16}N_2O_5S$: 395.0696, found 395.0696.



3zy

The conversion with pentachlorophenol was very low and product was very easily hydrolyzed.
With mass analysis, the only product found were starting material and the hydrolyzed product, while the desired product was not found. Therefore, no assigned ^{1}H NMR data are presented. HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{20}H_{12}Cl_5NO_3SNa$: 543.8873, found: 543.8876.

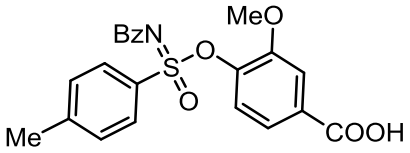
Natural phenol substrates



4a

Reaction mixture

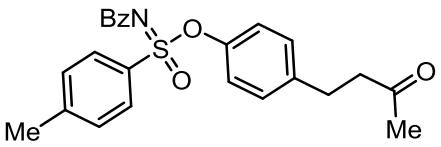
(from crude reaction mixture, also containing DBU and excess phenol)
^{1}H NMR (400 MHz, CD_3CN) δ = 8.07 (d, *J* = 7.3 Hz, 2H), 7.91 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.51–7.40 (m, 4H), 7.23 (d, *J* = 8.2 Hz, 1H), 6.80 (s, 1H), 6.76 (dd, *J* = 8.2, 1.8 Hz, 1H), 5.96 (ddt, *J* = 17.0, 10.3, 6.7 Hz, 1H), 5.13 – 5.02 (m, 2H), 3.46 (s, 3H), 3.30 (d, *J* = 6.0 Hz, 2H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{24}NO_4S$: 422.1421, found: 422.1409.



4b

Reaction mixture

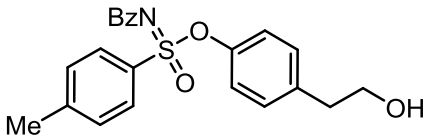
(from crude reaction mixture, also containing 2 equivalents of DBU and excess phenol)
1H NMR (400 MHz, CD_3CN) δ = 10.50 (br. s, 1H), 8.08 (d, *J* = 8.0 Hz, 2H), 7.90 (d, *J* = 7.9 Hz, 2H), 7.59 (t, *J* = 7.3 Hz, 1H), 7.53 (s, 1H), 7.50-7.45 (m, 3H), 7.42 (d, *J* = 8.0 Hz, 2H), 7.22 (d, *J* = 8.2 Hz, 1H), 3.47 (s, 3H), 2.45 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{22}H_{20}NO_6S$: 426.1006, found: 426.0991.



4c

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)
^{1}H NMR (400 MHz, CD_3CN) δ = 8.09 (d, *J* = 8.2, , 2H), 7.94 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.51-7.43 (m, 4H), 7.18 (d, *J* = 8.6 Hz, 2H), 7.00 (d, *J* = 8.6 Hz, 2H), 2.83 – 2.76 (m, 2H), 2.74 – 2.70 (m, 2H), 2.47 (s, 3H), 2.05 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{24}NO_4S$: 4422.1421, found: 422.1412.



4d

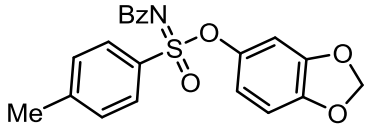
The reaction proceeded quickly to full conversion, within 3 minutes. Some hydrolysis product was obtained at that time, which was confirmed by HPLC-MS analysis.

t = 3 min		**%**
	Conversion	>99
Of which	Starting material	0
	Product	93
	Hydrolysis of product	7

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.09 (d, J = 7.1 Hz, 2H), 7.94 (d, J = 8.4 Hz, 2H), 7.59 (t, J = 7.4 Hz, 1H), 7.51–7.43 (m, 4H), 7.21 (d, J = 8.5 Hz, 2H), 7.00 (d, J = 8.6 Hz, 2H), 3.64 (t, J = 6.8 Hz, 2H), 2.74 (t, J = 6.7 Hz, 2H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{22}H_{22}NO_4S$: 396.1264, found: 396.1252.

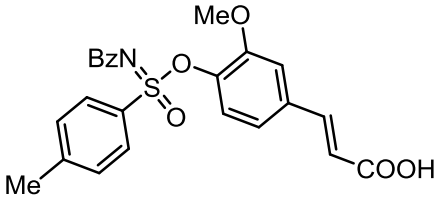


4e

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.10 (d, J = 7.2 Hz, 2H), 7.94 (d, J = 8.4 Hz, 2H), 7.60 (t, J = 7.4 Hz, 1H), 7.50-7.44 (m, 4H), 6.74 (d, J = 8.5 Hz, 1H), 6.62 (d, J = 2.3 Hz, 1H), 6.53 (dd, J = 8.5, 2.4 Hz, 1H), 5.98 (s, 2H), 2.48 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{18}NO_5S$: 396.0900, found: 396.0885.

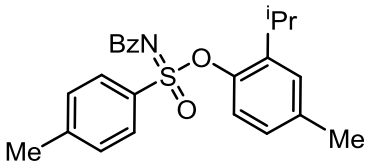


4f

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 9.79 (br. s, 1H), 8.08 (d, J = 8.0 Hz, 2H), 7.92 (d, J = 8.0 Hz, 2H), 7.59 (t, J = 7.3 Hz, 1H), 7.51–7.40 (m, 4H), 7.26 (d, J = 8.3 Hz, 1H), 7.17 (d, J = 15.8 Hz, 1H), 7.10 (s, 1H), 7.06 (d, J = 8.4 Hz, 1H), 6.45 (d, J = 15.9 Hz, 1H), 3.49 (s, 3H), 2.46 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{22}NO_6S$: 452.1162, found: 452.1148.

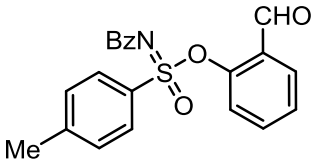


4g

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 8.07 (d, *J* = 7.1 Hz, 2H), 7.96 (d, *J* = 8.4 Hz, 2H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.52–7.42 (m, 4H), 7.26 (d, *J* = 8.0 Hz, 1H), 7.13 (d, *J* = 7.9 Hz, 1H), 7.03 (s, 1H), 3.29 – 3.18 (m, 1H), 2.47 (s, 3H), 2.24 (s, 3H), 1.09 (d, *J* = 6.9 Hz, 3H), 1.00 (d, *J* = 6.9 Hz, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{24}H_{26}NO_3S$: 408.1628, found: 408.1616.



4h

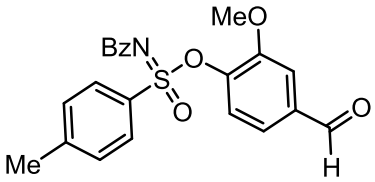
The reaction with salicyl aldehyde did not proceed to full completion. After 60 min of reaction time, conversion nearly halted and hydrolysis of the product occurred instead. When the reaction was left for longer, the conversion increased minutely, while hydrolysis of the product increased significantly.

t = 60 min		**%**
	Conversion	>95
Of which	Starting material	4
	Product	94
	Hydrolysis of product	2

Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 10.32 (s, 1H), 8.08 (d, *J* = 7.1 Hz, 2H), 7.97 (d, *J* = 8.4 Hz, 2H), 7.90 (dd, *J* = 7.7, 1.7 Hz, 1H), 7.67–7.56 (m, 2H), 7.52–7.46 (m, 5H), 7.15 (d, *J* = 7.5 Hz, 1H), 2.49 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{21}H_{18}NO_4S$: 380.0951, found: 380.0937.



4i

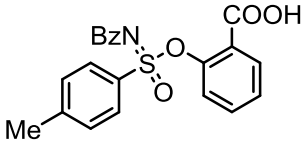
The reaction with vanillin did not proceed to full completion. Instead, hydrolysis of the product overtook the formation of desired product. After 4 h of reaction time, an optimum between conversion to the desired product and hydrolysis of said product was reached. When the reaction was left for longer, the conversion increased slightly, while hydrolysis of the product increased significantly.

t = 4h		**%**
	Conversion	93
Of which	Starting material	7
	Product	88
	Hydrolysis of product	5

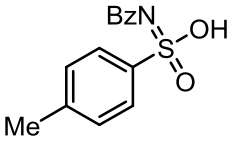
Reaction mixture

(from crude reaction mixture, also containing DBU and excess phenol)

^{1}H NMR (400 MHz, CD_3CN) δ = 9.93 (s, 1H), 8.08 (d, *J* = 7.7 Hz, 2H), 7.95 (d, *J* = 8.2 Hz, 2H), 7.60 (t, *J* = 7.4 Hz, 1H), 7.56 (d, *J* = 8.3 Hz, 1H), 7.54–7.43 (m, 6H), 3.56 (s, 3H), 2.47 (s, 3H). HRMS (ESI) *m/z* [*M*+H]$^+$ calcd. for $C_{22}H_{20}NO_5S$: 410.1057, found: 410.1043.



Desired product



Obtained product is the hydrolysis product

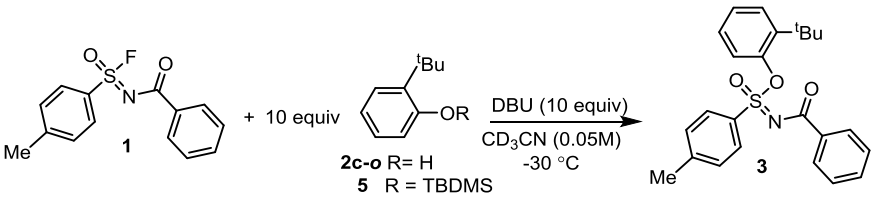
4z

Data was taken from a sample reacted with 10 equivalents of salicylic acid, as the conversion for the 1:1 reaction was very slow. Over time, no desired SuFEx product was formed. Instead, the hydrolysis product was obtained as the sole product, without forming the desired product as an intermediate. The data obtained are therefore in concurrence with the hydrolysis product.

Reaction mixture

(from crude reaction mixture, also containing 10 equivalents of DBU and 10 equivalents of salicylic acid). ^{1}H NMR (400 MHz, CD_3CN) δ = 7.97 (d, J = 7.1 Hz, 2H), 7.80 (s, 2H), 7.43 – 7.35 (m, 3H), 7.32 (t, J = 7.3 Hz, 3H), 2.35 (s, 3H).

7 Reaction kinetics comparison between a Si-free SuFEx and traditional SuFEx reaction



Scheme S3. The SuFEx reaction of which the kinetics were studied.

The reaction rates of traditional SuFEx reactions were compared to that of the corresponding Si-free SuFEx reactions. As a representative substrate from both groups, TBDMS-protected 2-*t*Bu-phenol and unprotected 2-tBu-phenol were compared. Kinetics were determined under pseudo-first-order conditions, whereby the phenol and DBU were added in 10-fold excess. Reactions were monitored using ^{1}H NMR spectroscopy. Mesitylene was added as an internal reference. Both reactions reached completion within 2 min at room temperature. To successfully monitor the kinetics, measurements were performed at -30 ℃.

Equipment and procedures

The NMR machine was cooled to -30 ℃. The NMR sample was pre-cooled using a cryostat set at -30 ℃, which was also used to cool DBU. For t=0, a measurement was taken without the addition of DBU. Then, DBU was added, the NMR tube was shaken quickly and placed back in the NMR machine. Once the sample was in place, a measurement was taken (number of scans, NS = 8) immediately. Subsequent measurements were taken using a 'multizg' command (dummy scans, DS = 7, NS = 8, measuring time 1 min) until the reaction had reached completion.

For 2-*t*Bu-phenol

In an HPLC vial, sulfonimidoyl fluoride **1** (8.0 mg, 0.029 mmol) and 2-tBu-phenol (43.3 mg, 0.29 mmol, 10 equiv) were dissolved in CD_3CN (0.55 mL, 0.05M). Mesitylene (4.1 µL, 0.029 mmol) was added as an internal reference and the mixture was shaken well. The solution was transferred to an NMR tube. The solution was cooled to -30 ℃. DBU (43 µL, 0.29 mmol, 10 equiv) was added to start the reaction and ^{1}H NMR measurements were commenced immediately.

NMR data were collated and globally processed using MestReNova software.
Mesitylene was integrated between δ = 2.260 and 2.160 and set to 1.0000 (Me = s, 9H).
Starting material was integrated between δ = 8.190 and 8.085 (signal = dd, 4H).
Product was integrated between δ = 8.085 and 8.000 (signal = dd, 4H).
The integral-data was used in the determination of the conversion and rate constant.

For TBDMS-2-*t*Bu-phenol

In an HPLC vial, sulfonimidoyl fluoride **1** (8.0 mg, 0.029 mmol) and TBDMS-2-tBu-phenol (76.4 mg, 0.29 mmol, 10 equiv) were dissolved in CD_3CN (0.55 mL, 0.05M). Mesitylene (4.1 µL, 0.029 mmol) was added as an internal reference and the mixture was shaken well. The solution was transferred to an NMR tube. The solution was cooled to -30 ℃, whereby the mixture become opaque and rather solid. DBU (43 µL, 0.29 mmol, 10 equiv) was added, whereby the sample became liquid again. ^{1}H NMR measurements were commenced immediately.

NMR data were collated and globally processed using MestReNova software.

Mesitylene was integrated between δ = 6.780 and 6.620 and set to 1.0000 (Ar-H = s, 3H).
Starting material was integrated between δ = 8.320 and 8.100 (signal = dd, 4H).
Product was integrated between δ = 8.100 and 7.990 (signal = dd, 4H).
This integral-data was used in the determination of the conversion and rate constant.

Rate constant determination

Equation **1** describes the second-order rate for the studied reaction ($mol^{-1} \cdot s^{-1}$), where [**1**] is the concentration of sulfonimodoyl fluoride and [**2**] the concentration of phenol, and k_2 is the second–order rate constant ($M^{-1}s^{-1}$). Since, the amount of phenol derivative (10 equivalents) is in large excess compared to the amount of sulfonimidoyl fluoride, it is assumed to be essentially constant throughout the entire kinetics experiment (equation 2). Thus, the SuFEx reaction can be reduced to pseudo–first order kinetics, with rate constant, k'. Therefore, from plots of ln $[(I_\infty - I_t)/(I_\infty - I_0)]$ versus time, the resulting pseudo first–order rate constant (k') can be obtained directly from the slope, as shown in equation 3.

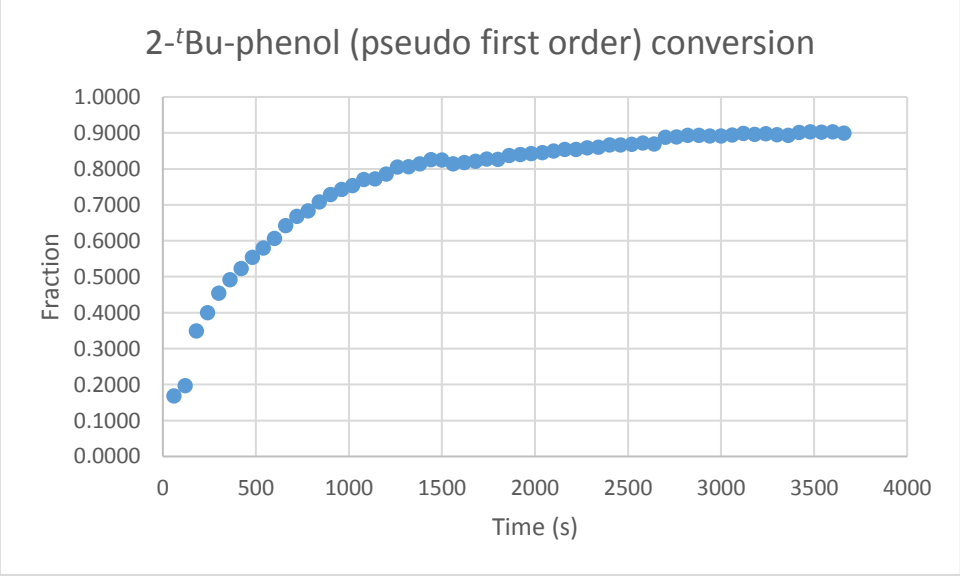
$$v = k_2[\mathbf{1}][\mathbf{2}] = \frac{d[\mathbf{1}]}{dt} \qquad (\mathbf{1})$$

$$v = k'[\mathbf{1}] \qquad \text{(since [2] >> [1])} \qquad (\mathbf{2})$$

$$\ln\left(\frac{I_\infty - I_t}{I_\infty - I_0}\right) = k't \qquad (\mathbf{3})$$

$$\text{So: } k' = k_2[\mathbf{2}],$$
$$k_2 = \frac{k'}{[\mathbf{2}]}$$

7.1 Si-free SuFEx reaction rate determination



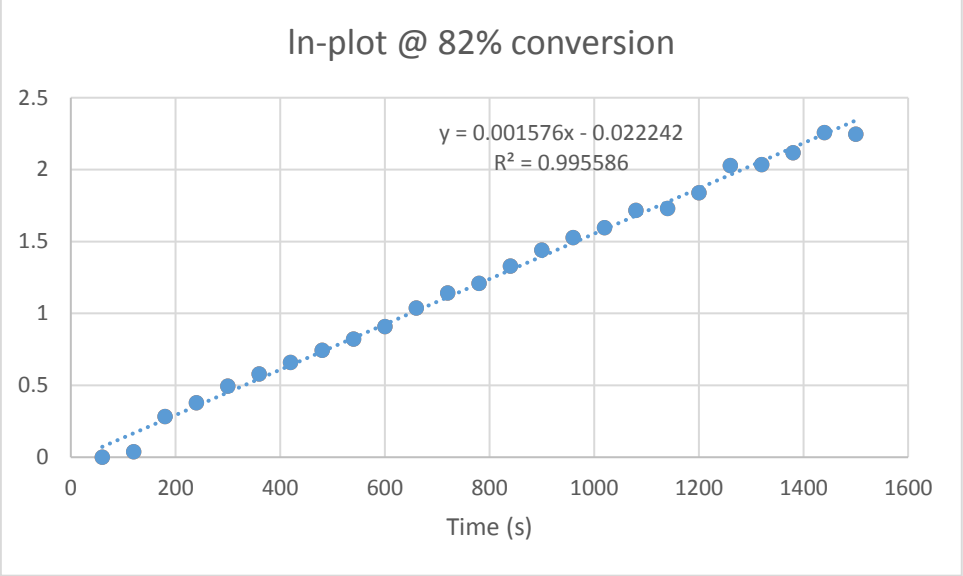


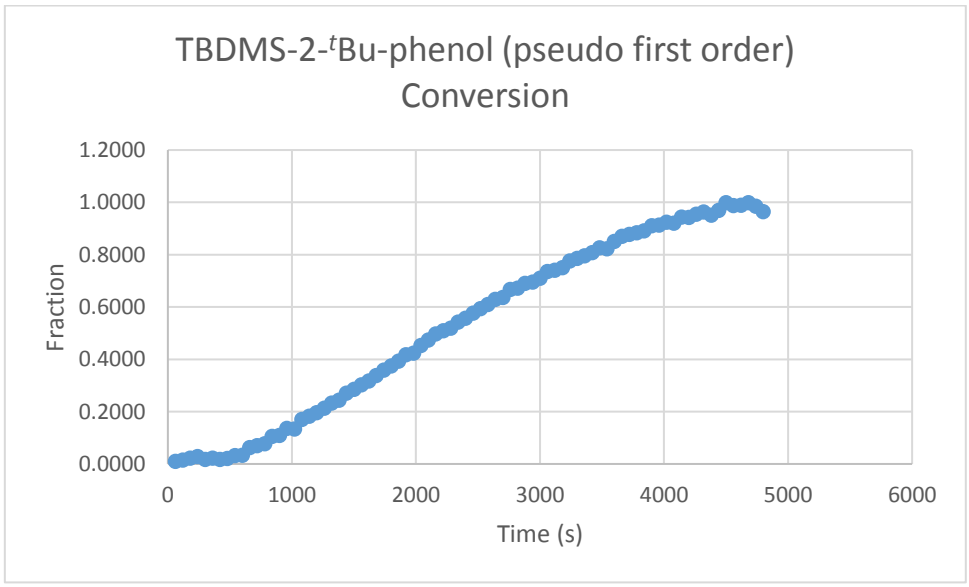
Figure S6. The conversion and Ln-plot of the Si-free SuFEx reaction between **1** and 2-^{t}Bu-phenol, at -30 °C.

From the conversion and the ln-plot (Figure S6), we can determine the *k*' as 0.001576 s^{-1}.
With [**2**] being 0.524 M/L, k_2 becomes 0.00300 $M^{-1}s^{-1}$.

From the duplicate experiment, we obtained a *k*' = 0.001607 s^{-1}. Using the same concentration for [**2**], k_2 becomes 0.00306 $M^{-1}s^{-1}$.

Therefore, an average rate of 3.03 x 10^{-3} $M^{-1}s^{-1}$ was found for the Si-free SuFEx reaction at -30 ℃.

7.2 Traditional SuFEx reaction rate determination



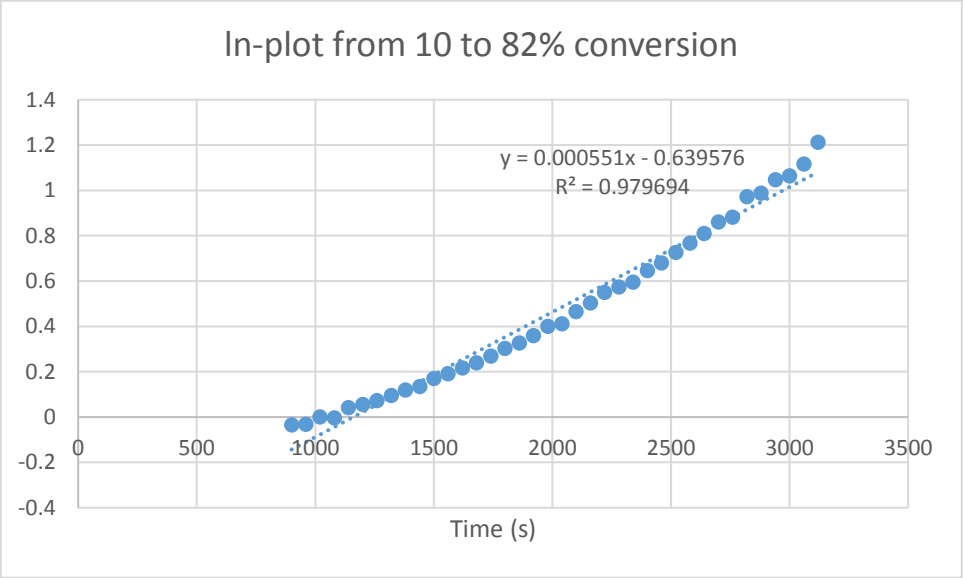


Figure S7. The conversion and Ln-plot of the Si-free SuFEx reaction between 1 and TBDMS-2-tBu-phenol, at -30 ℃.

The conversion plot for the traditional SuFEx reaction (Figure S7) shows the conversion as an S-plot, meaning the reaction goes through an activation phase before the reaction truly takes off. We hypothesize that this is due to desilylation of the substrate, prior to the occurrence of the reaction. Once the rate-determining desilylation has taken place, the SuFEx reaction occurs rapidly, thereby freeing F^- anion, driving the reaction forward. At -30 ℃, desilylation by F^- is also very rapid, which was demonstrated by a 1:1 reaction between TBDMS-*p*-cresol and tetramethyl ammonium fluoride (TMAF, $(CH_3)_4NF$). Full desilylation occurred within 2 min at this temperature. In our reactions, DBU can play a double role, as it has been reported to catalyze the desilylation,[10,11] while as a base, of course, it also increases the nucleophilicity of the phenol.

From Figure S7, it is clear that the Ln plot is non-linear. However, if we – for the assumption of getting some semi-quantitative information – assume that we can still plot it as linear, then we can determine the *k*' = 0.000551 s^{-1}. With [TBDMS-2] being 0.524 M/L, k_2 = 0.001052 $M^{-1}s^{-1}$. From the duplo experiment, we obtained a *k'* = 0.000508 s^{-1}. Using the same concentration for [TBDMS-2], k_2 = 0.00097 $M^{-1}s^{-1}$.

Therefore, an average rate of 1.01 x 10^{-3} $M^{-1}s^{-1}$ was found for the traditional SuFEx reaction at -30 ℃.
We do not hold this number to provide any other quantitative information that that it supports that the Si-protected phenol in the traditional SuFEx reactions reacts appreciably slower than phenolates in the Si-free SuFEx reaction.

8 Mechanistic studies

Combining previous reports,[12] three likely mechanisms were proposed (Figure S8). If one enantiomer is used as the substrate for the reaction, a racemized product will be obtained through the S_N1 reaction pathway. Conversely, a stereospecific product will be obtained through the S_N2 or addition-elimination pathway.

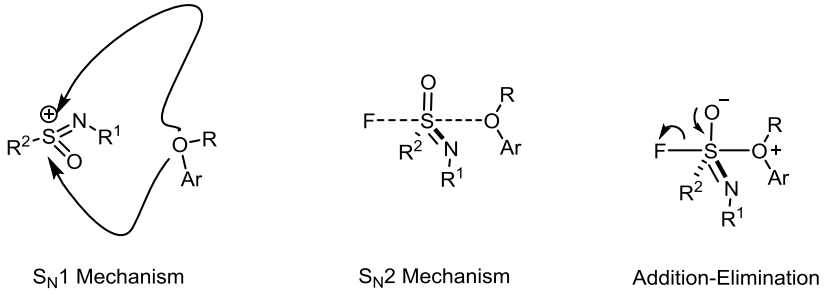
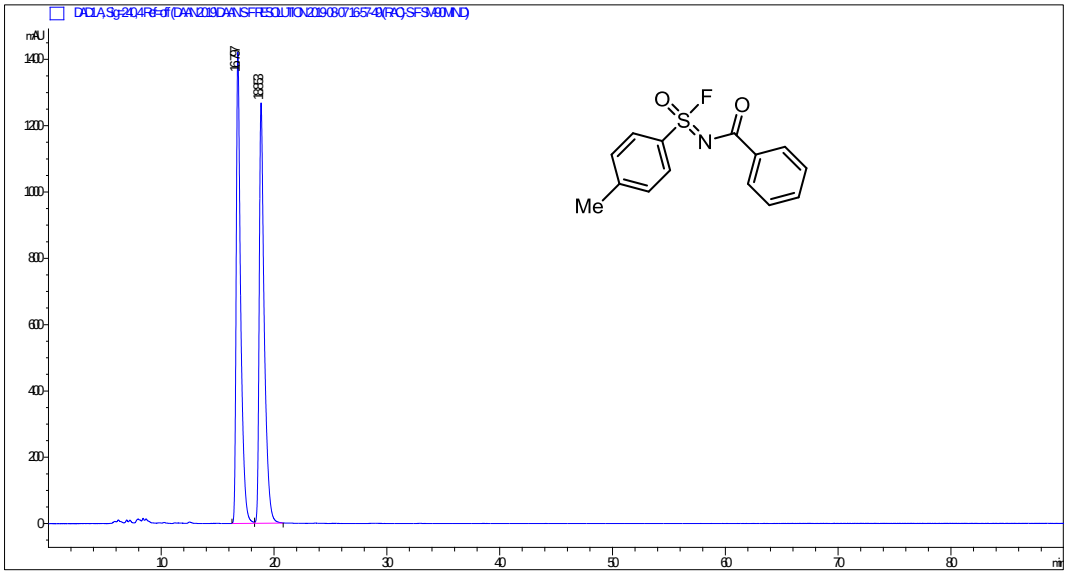


Figure S8. Possible mechanisms of SuFEx reaction

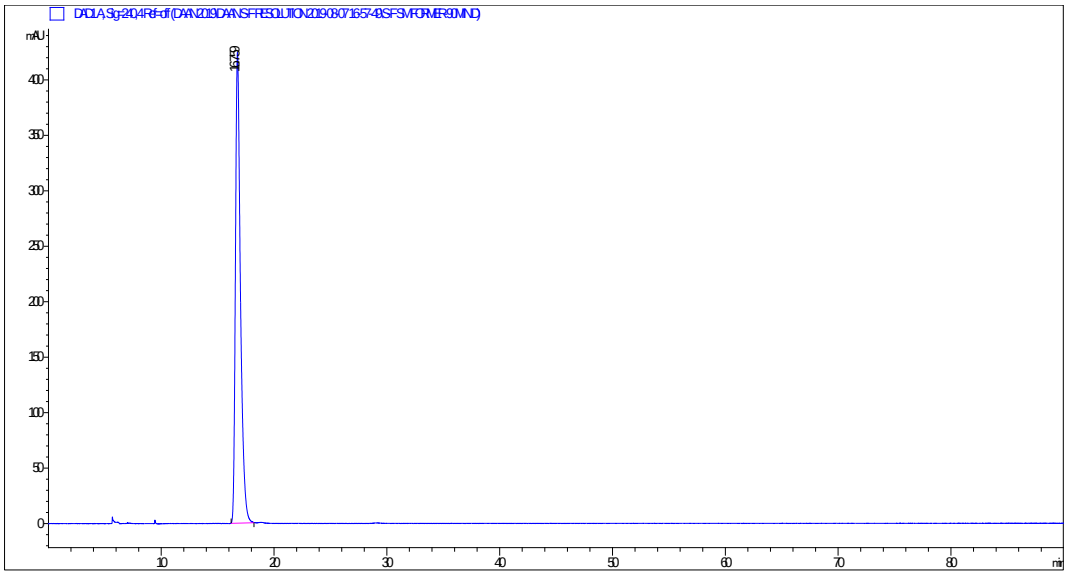
8.1 Separation of sulfonimidoyl fluoride enantiomers

The two enantiomers of the sulfonimidoyl fluoride were isolated by HPLC.
HPLC resolution conditions of the sulfonimidoyl fluoride: Chiralpak IA column, hexane/propan-2-ol 90:10, flow rate 0.5 mL/min, oven temperature 40 ℃, detector wavelength 240 nm; retention time **isomer-1** t_1 = 16.8 min, **isomer-2** t_2 = 18.8 min. The purity of each isolated enantiomer exceeded 99% (Figure S9).

a)



b)



c)

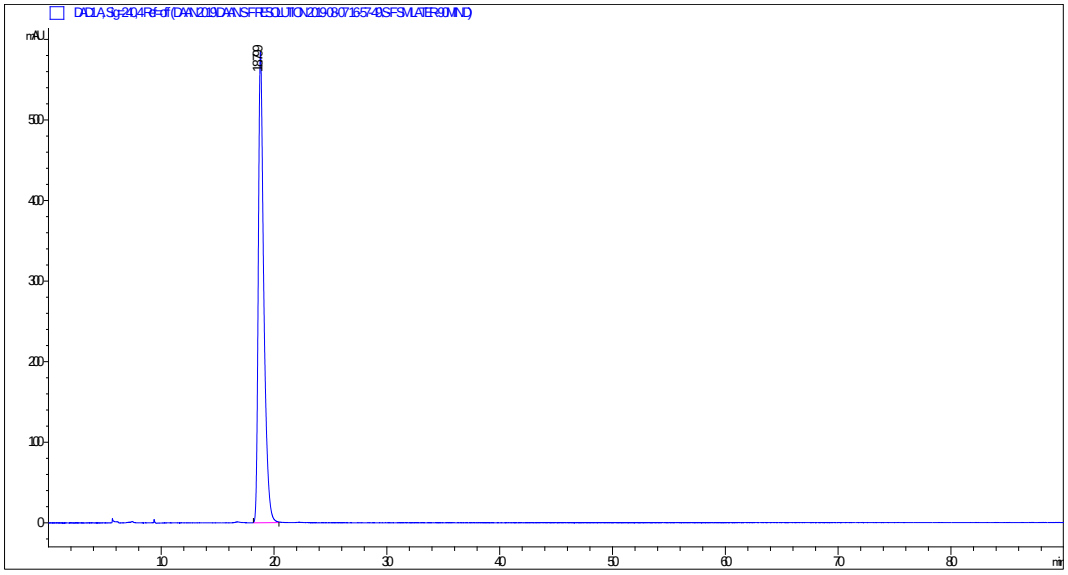
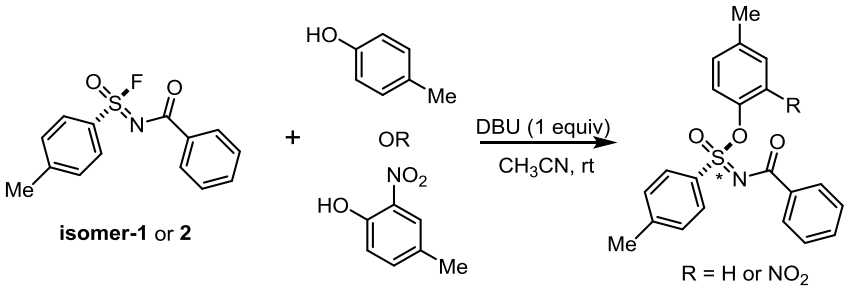


Figure S9. Chromatograms of a) the racemate b) **isomer-1** and c) **isomer-2**.

8.2 Stereoselectivity investigation of Si-Free SuFEx reactions

Two reaction substrates with widely different reaction rates were selected as the research targets. When *p*-cresol **2b-*p*** was used as a substrate, the reaction was completed in 5 min. However, when 4-methyl-2-nitrophenol **2ac** was used as a substrate, the reaction took more than 18 h to complete (Scheme S4).



Scheme S4. Model reactions in mechanism researches

To a solution of one enantiomer of **1** (1 mL, 3.61 mM, 1 equiv) in CH_3CN, a solution of *p*-cresol or 4-methyl-2-nitrophenol (0.5 mL, 14.4 mM, 1 equiv) in CH_3CN and DBU (0.25 mL, 14.4 mM, 1 equiv) were added. After 1.5 h, 0.5 mL reaction mixture was taken out and quenched with 0.5 mL of a saturated aqueous solution of ammonium chloride. The aqueous phase was extracted with ethyl acetate (2 x 0.2 mL). All the organic phases were combined and concentrated. The residue oil was dissolved with a mixed solution of *n*-hexane and isopropanol (90:10) as the sample for HPLC analysis.

% ee was calculated by

$$ee = \frac{majority - minority}{majority + minority} \times 100\% \qquad (\mathbf{4})$$

where majority and minority refer to the integral area of the respective peaks of the majority and minority products.

8.2.1 Reactions with *p*-cresol **2b-*p***

HPLC resolution conditions of the compound **3b-*p***:

Chiralpak IA column, hexane/propan-2-ol 98:2, flow rate 0.5 mL/min, oven temperature 40 °C, detector wavelength 240 nm; retention time t_1 = 39.0 min, t_2 = 50.0 min (Figure 10).

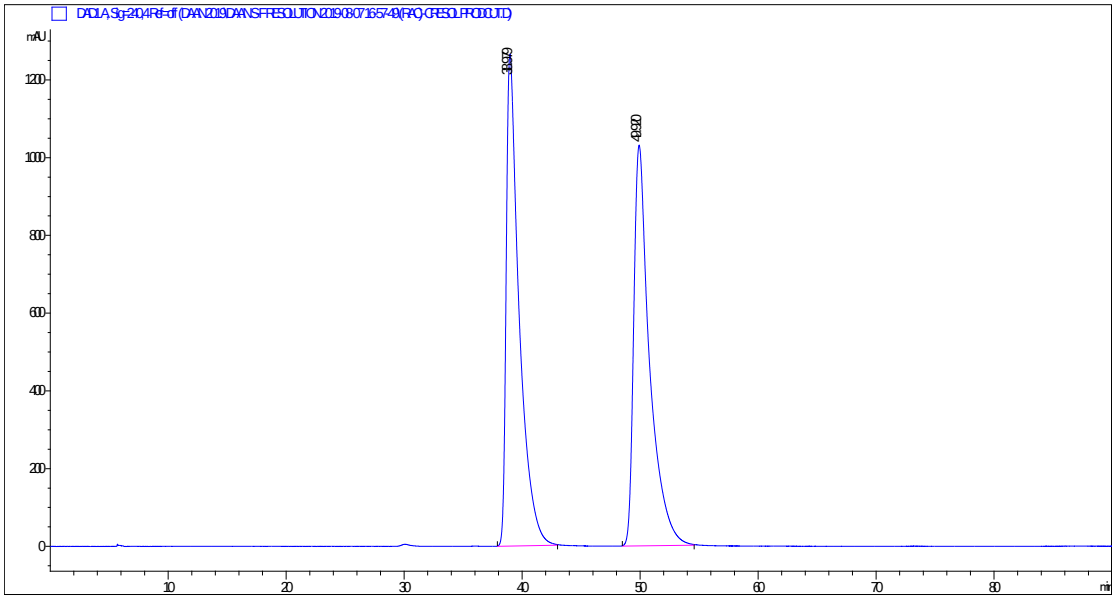
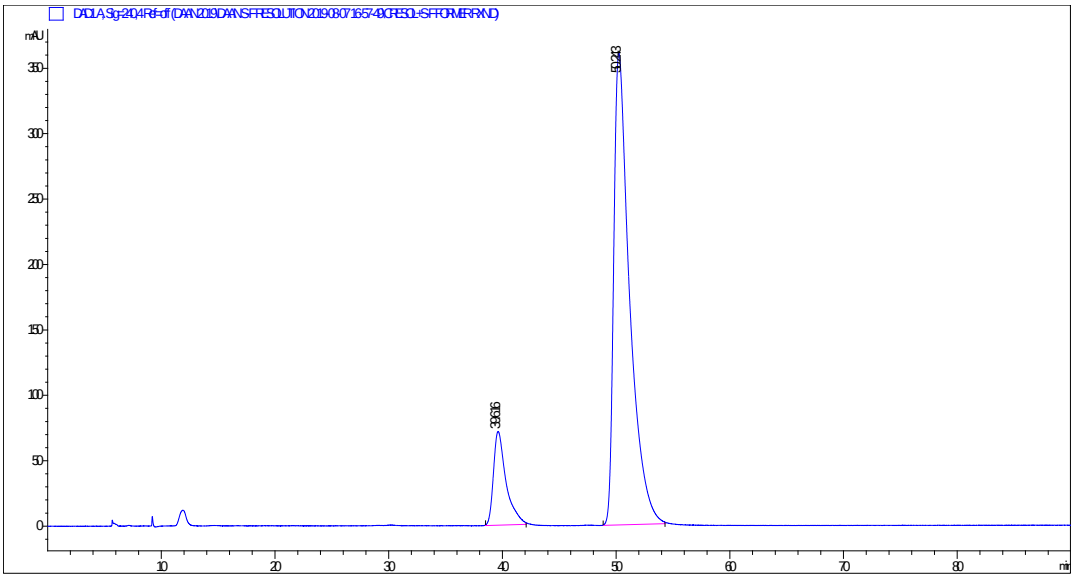


Figure S10. HPLC chromatogram of the racemate of the compound **3b-*p***.

When **isomer-1** (t_R = 16.8 min for sulfonimidoyl fluoride) was used as a starting material, the *% ee* of the product was 73% (Figure S11).

a)



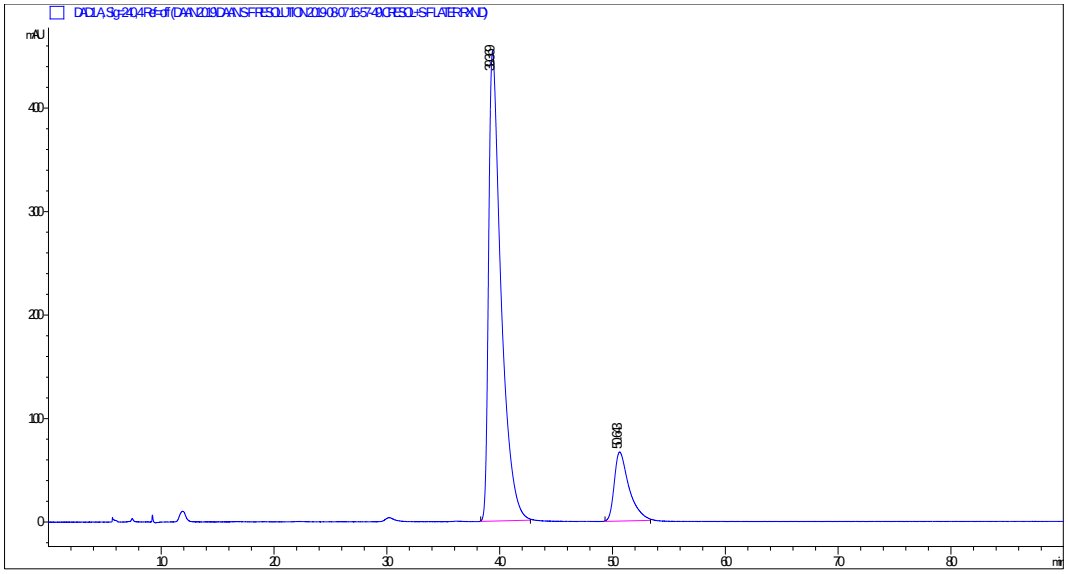
b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	39.616	1	BB	5513.60059	71.69714	13.6188
2	50.243	1	BB	3.49716e4	360.81323	86.3812

Figure S11. a) HPLC chromatogram and b) the result of the reaction with **isomer-1**.

When **isomer-2** (t_R = 18.8 min for sulfonimidoyl fluoride) was used as a starting material, the *% ee* of the product was 70% (Figure S12).

a)



b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	39.369	1	BB	3.47654e4	453.98547	85.2143
2	50.643	1	BB	6032.22852	66.83584	14.7857

Figure S12. a) HPLC chromatogram and b) the result of the reaction with **isomer-2**.

The above experiments showed that when the reactant is a single enantiomer, the reaction has enantioselectivity (although *% ee* of final products was only around 70%). If the reaction was via the S_N1 route, the final product should be a racemic mixture. However, no matter which configuration of sulfonimidoyl fluorides was used as the reaction substrate, more than 85% of the products were in a single configuration.
Based on these data, concerted S_N2 or addition-elimination mechanisms thus look more reasonable.

8.2.2 Reactions with 4-methyl-2-nitrophenol **2ac**

HPLC resolution conditions of the sulfonimidoyl fluoride: Chiralpak IA column, MeO^{t}Bu/methanol 400:1, flow rate 1.0 mL/min, oven temperature 40 ℃, detector wavelength 240 nm; retention time of sulfonimidoyl fluoride **isomer-1** t_1 = 4.7 min, **isomer-2** t_2 = 5.3 min (Figure S13).

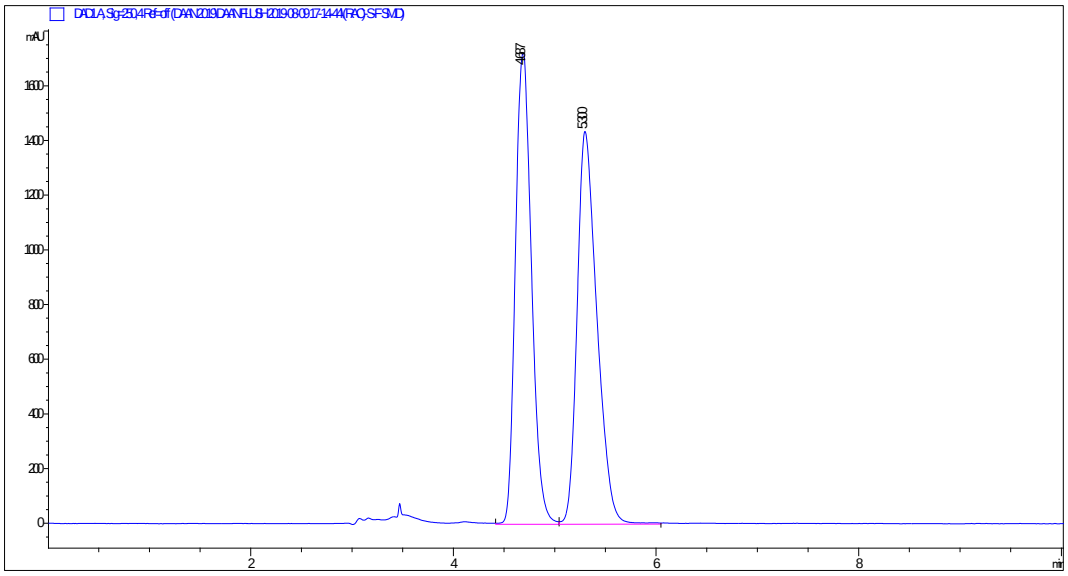


Figure S13. Chromatogram of the sulfonimidoyl fluoride racemate **3ac.**

HPLC resolution conditions of the product: Chiralpak IA column, MeO^{t}Bu/methanol 400:1, flow rate 1.0 mL/min, oven temperature 40 ℃, detector wavelength 240 nm; retention time t_1 = 7.9 min, t_2 = 9.5 min (Figure S14).

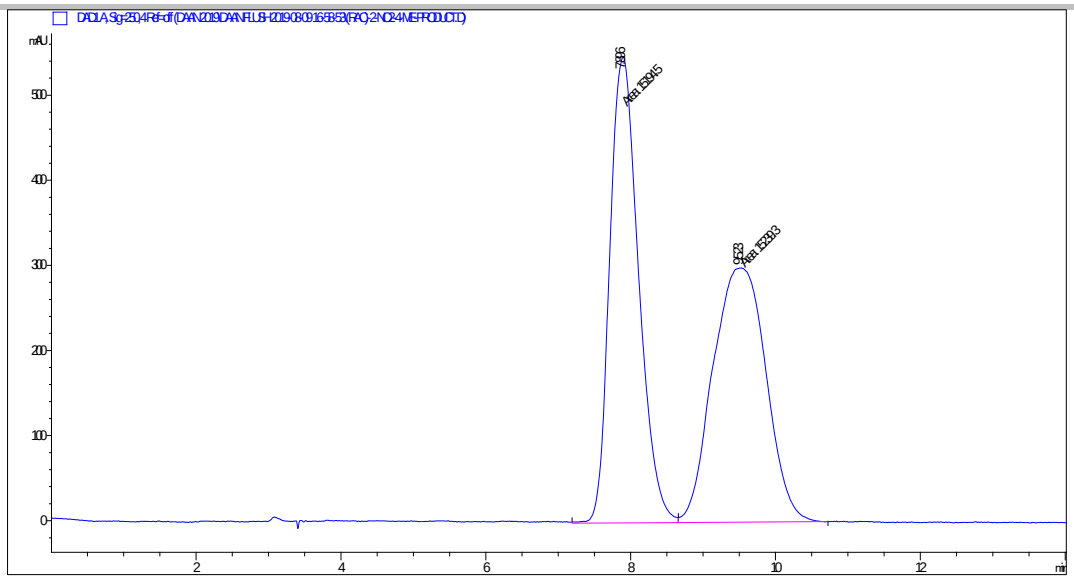
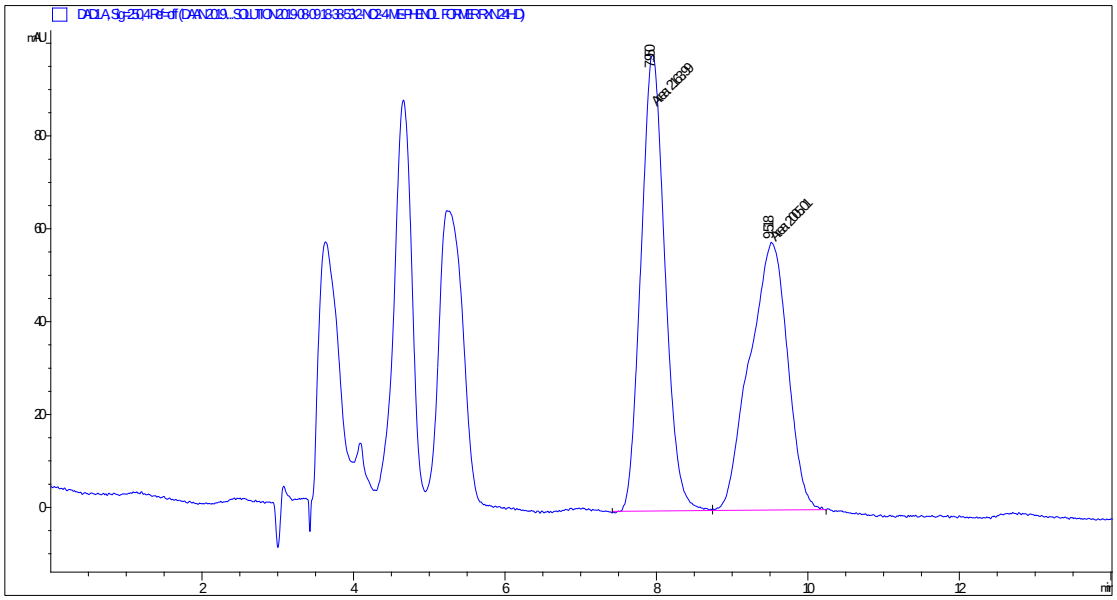


Figure S14. Chromatogram of the racemate of compound **3ac.**

The HPLC result of reaction with **isomer-1** (retention time of the sulfonimidoyl fluoride was 4.7 min) (Figure S15).

a)



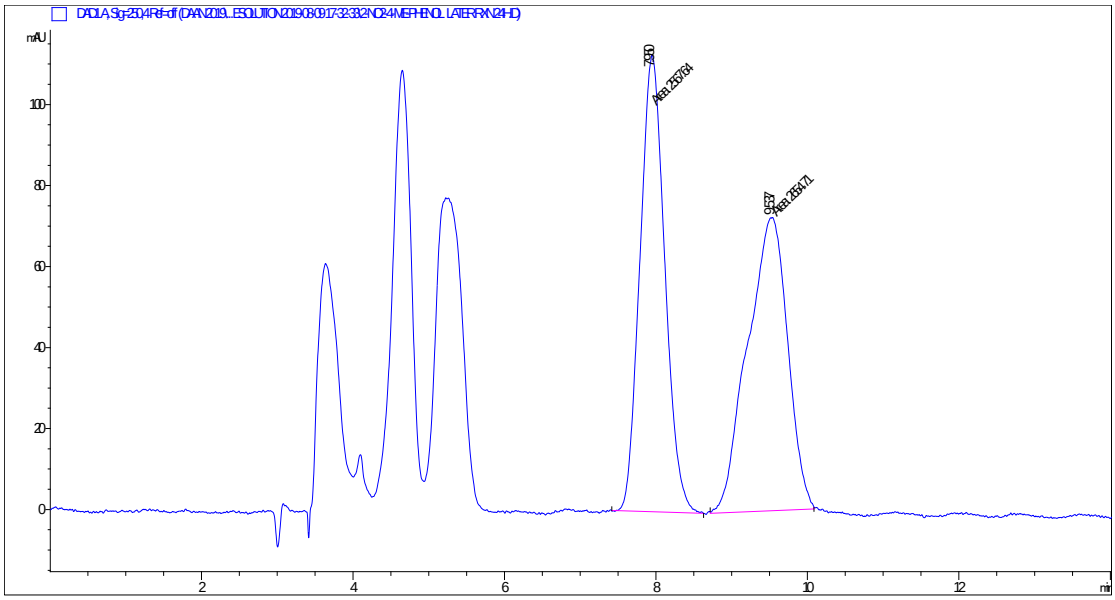
b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	7.950	1	MF	2163.98584	98.26740	51.9066
2	9.518	1	FM	2005.01331	57.74584	48.0934

Figure S15. a) HPLC chromatogram and b) the result of the reaction with **isomer-1**.

The HPLC result of the reaction with **isomer-2** (retention time of the sulfonimidoyl fluoride is 5.3 min) (Figure S16).

a)



b)

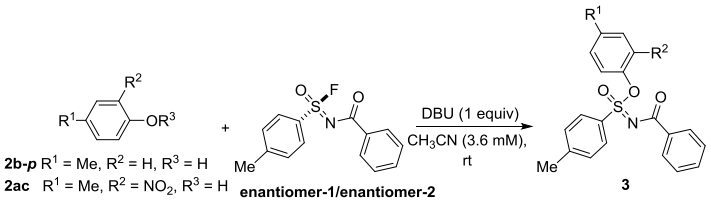
Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	7.950	1	MM	2567.64014	112.86387	49.1663
2	9.537	1	MM	2654.71436	72.37383	50.8337

Figure S16. a) HPLC chromatogram and b) the result of the reaction with **isomer-2**.

First, the chromatogram of this reaction appeared to be more complicated, mainly because of the lower reaction conversion and the presence of unreacted 4-methyl-2-nitrophenol and the sulfonimidoyl fluoride.
The above experiments showed that no matter which enantiomer was used as a reaction substrate, the enantioselectivity was not observed (*% ee* was less than 5%).

The above experimental results were summarized as follows (Table S4)

Table S4. Enantioselective silicon-free SuFEx reactions



Enantiomer[a]	phenol	*% ee*[b]
enantiomer-1	**2b-*p***	73%
	2ac	< 2%
enantiomer-2	**2b-*p***	71%
	2ac	< 2%

Reaction conditions: **enantiomer-1/enantiomer-2** (1 mL, 3.6 mM in CH_3CN), phenolic derivative (1 equiv), DBU (1 equiv), rt.

[a] **enantiomer-1** and **enantiomer-2** refer to two enantiomers with retention times of 16.8 and 18.8 min with chiral HPLC, respectively.

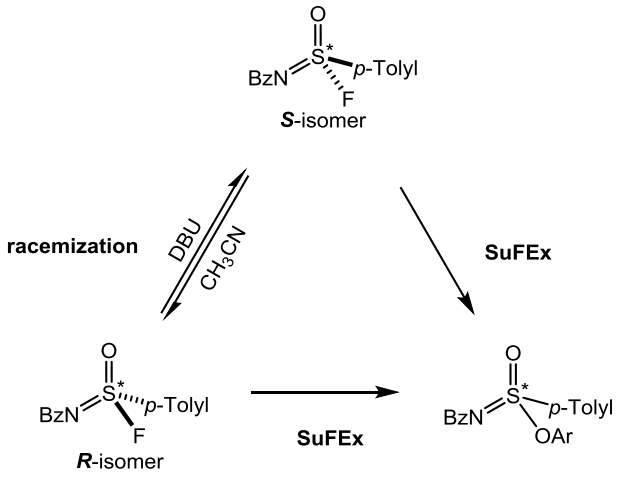
[b] *% ee* determined using chiral HPLC and calculated by

$$\%\ ee = \frac{majority - minority}{majority + minority} \times 100\%,$$

[c] 10 equiv **2b-*p*** used.

Kinetics of the racemization

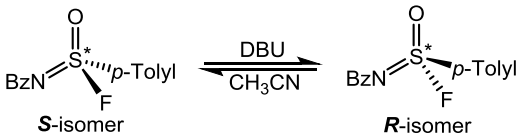
Surprisingly, however, in the reaction with 4-methyl-2-nitrophenol, unreacted sulfonimidoyl fluoride also appeared to be racemized. If the sulfonimidoyl fluoride suffered racemization, this could also cause the non-stereospecificity of the product formation (Scheme S5).



Scheme S5. Racemization of the sulfonimidoyl fluoride and SuFEx reactions.

In order to better evaluate the effect of the racemization reaction in SuFEx reaction, its kinetics were studied. Importantly, in the absence of the DBU, the enantiomers of the sulfonimidoyl fluoride were very stable, both in protic solvents such as isopropanol, as well as aprotic solvents, such as acetonitrile.

The kinetics of DBU-promoted sulfonimidoyl fluoride racemization were studied (Scheme S6).



Scheme S6. DBU-promoted sulfonimidoyl fluoride racemization

8.2.3 Modeling the racemization[13]

We assume that this racemization is second order related with the enantiomer and DBU, hence, its reaction rate can be given by

$$r = k \times c[\mathrm{DBU}] \times c[\mathrm{isomer}] \qquad (\mathbf{5})$$

where *c*[DBU] is the DBU concentration, and *c*[isomer] is the concentration of the ***S*** or ***R*** enantiomer, *k* is the second order rate constant.

If DBU is used in large excess in this racemization, then the reaction rate can be simplified to

$$r = k' \times c[\mathrm{isomer}] \qquad (\mathbf{6})$$

where *k'* is the pseudo-first order rate constant.

The concentration of the two enantiomers in solution can be described as

$$\frac{dc_S}{dt} = k'(c_S - c_R) \qquad (\mathbf{7})$$

$$\frac{dc_R}{dt} = k'(c_S - c_R) \qquad (\mathbf{8})$$

where c_S and c_R are the concentrations of the *S* and *R* enantiomer, respectively.

$$c_S + c_R = c_0 \qquad (\mathbf{9})$$

As the sum of the concentrations of two enantiomers is a constant, i.e. the initial reactant concentration c_0.

The enantiomeric excess is defined by

$$ee = \frac{c_S - c_R}{c_S + c_R} \qquad (\mathbf{10})$$

Eq 3 minus eq 4 gives

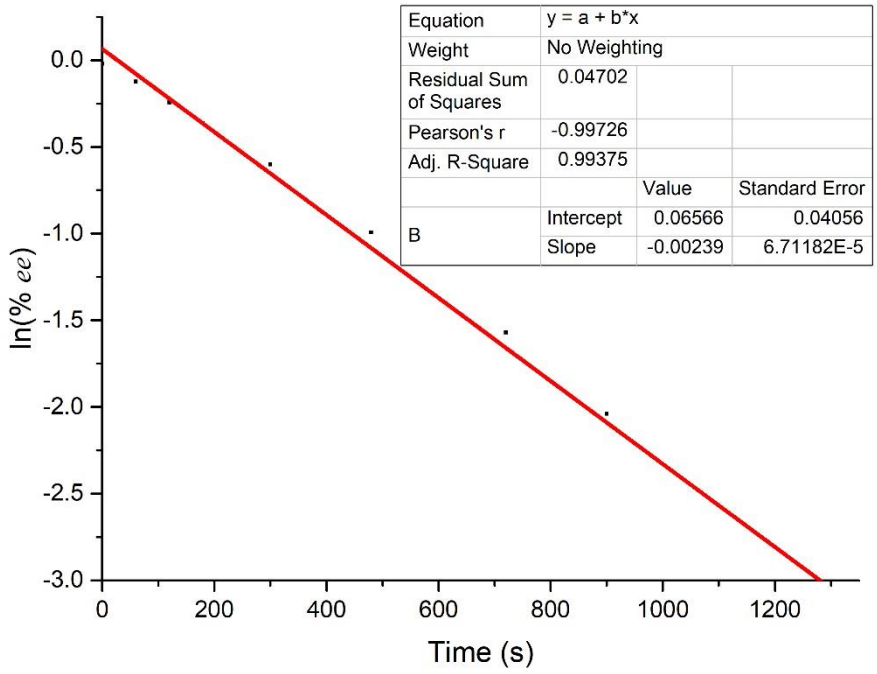
$$\frac{d(ee)}{dt} = -2k'(ee) \qquad (\mathbf{11})$$

Integrating eq 10 with $ee(0) = ee_0$

$$ln(ee) = -2k't + \ln(ee_0) \qquad (\mathbf{12})$$

8.2.4 Kinetic experiments

To the solution of **isomer-1** in CH_3CN (>99% *ee*,1 mM, 3 mL, 1 equiv) was added DBU (9 µL, 9.1 mg, 20 equiv) and the resulting solution was stirred at room temperature (20 ± 0.5 ℃). To monitor reaction progress, aliquots were removed at 1, 2, 3, 5, 8, 12, 15, 21, 26 min via syringe and analyzed by HPLC employing chiral column (Chiralpak IA column, hexane/propan-2-ol 85:15, flow rate 0.6 mL/min, oven temperature 40 ℃, detector wavelength 240 nm; retention time **isomer-1** t_1 = 12.3 min, **isomer-2** t_2 = 13.6 min). This reaction was performed twice. A plot of ln [% *ee*] versus time was linear to ~3 half-lives with a pseudo first-order rate constant of **k′=** (1.1 ± 0.1)× 10^{-3} s^{-1} obtained by a least–squares fit (R^2 > 0.95) (Figure S17). The second–order rate constant (k_2 = 0.056 ± 0.004 $M^{-1}s^{-1}$) is derived from here using the concentration of DBU (20 mM).



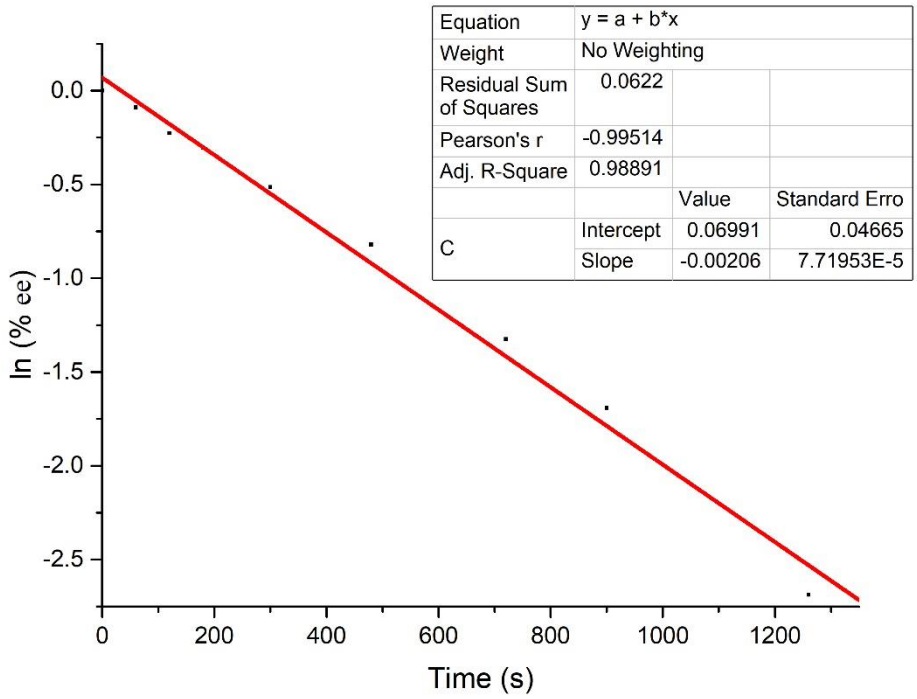
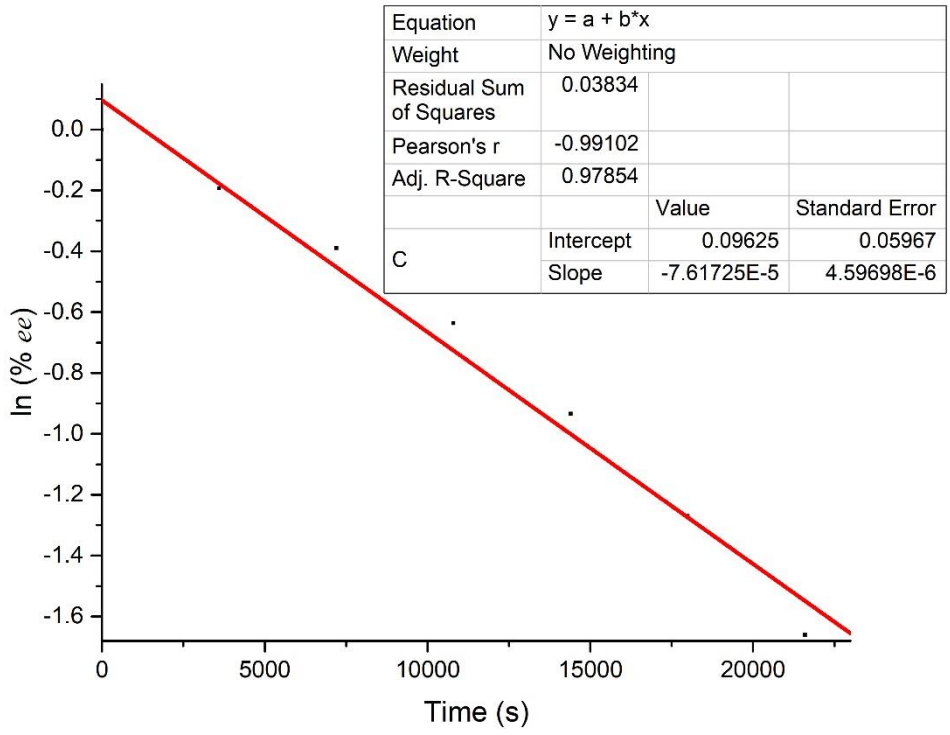


Figure S17. Pseudo first-order plots for the duplicate experiments for the racemization of **isomer-1** in CH_3CN at 20 ℃.

The same racemization experiment was performed at -30 ℃ twice again (Figure S18).

a)



b)

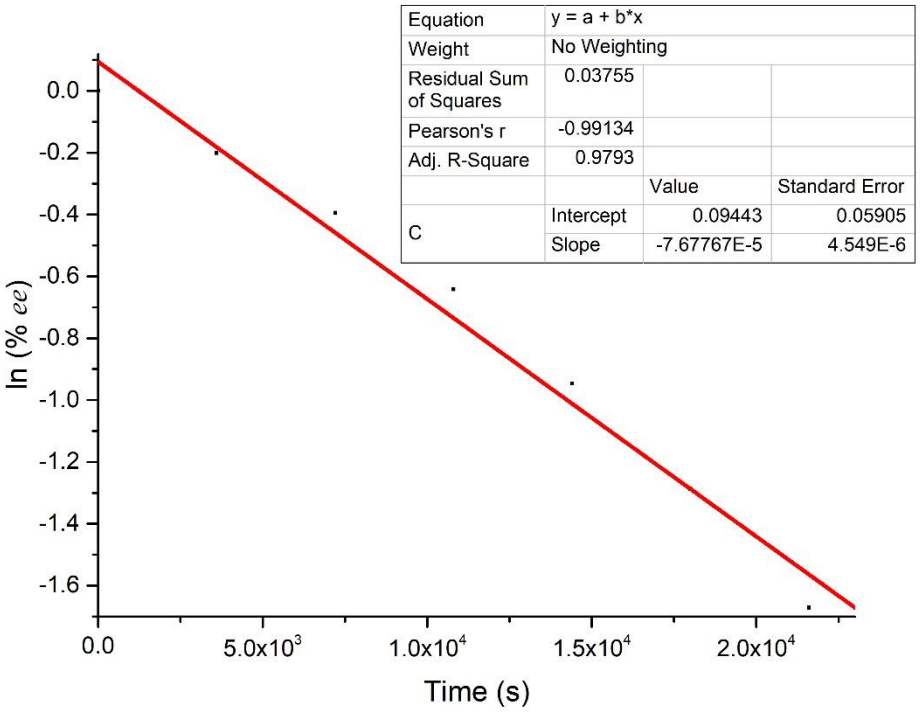


Figure S18. Pseudo first-order plots for the racemization of **isomer-1** in CH_3CN at -30 °C in duplicate.

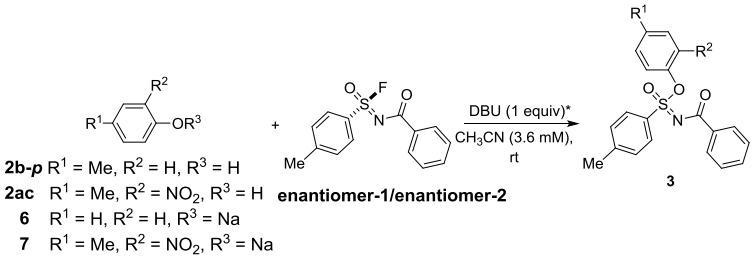
A plot of ln [*% ee*] versus time was linear to ~3 half-lives with a pseudo first-order rate constant of k′= (3.82 ± 0.02) × 10^{-5} s^{-1} obtained by a least–squares fit (R^2 > 0.95) (Figure S18). The second–order rate constant (k_2 = (1.9 ± 0.1) × 10^{-3} $M^{-1}s^{-1}$) is derived from here using the concentration of DBU (20 mM).

8.3 Stereospecific Si-free SuFEx reactions

The rate of this racemization reaction is around 0.002 $M^{-1}s^{-1}$ at -30 ℃, which is comparable to the rate of Si-free SuFEx reactions, but only slightly slower. If racemization was the main reason of low enantioselectivity, then the S_N2 reaction (either concerted or addition-elimination) and racemization are a pair of competitive reactions. Therefore, it follows that when the concentration of the nucleophile used is increased, the racemization reaction can be prevented. Consistent to the experimental results, 95% *ee* was achieved when 10 equiv *p*-cresol was used (Table S5 and Figure S19-20).

In addition, if DBU promoted the racemization of **1**, stereospecific results should be obtained in asymmetric SuFEx without DBU as base. When sodium phenolate **6** was used, >99% *ee* was found (Table S5, and Figure S21-22).

Table S5. Enantioselective silicon-free SuFEx reactions



Enantiomer[a]	phenol	*% ee*[b]
enantiomer-1	10 equiv **2b-*p***	95
	6	> 99%
	7	> 99%
enantiomer-2	10 equiv **2b-*p***	95[c]
	6	> 99%
	7	> 99%

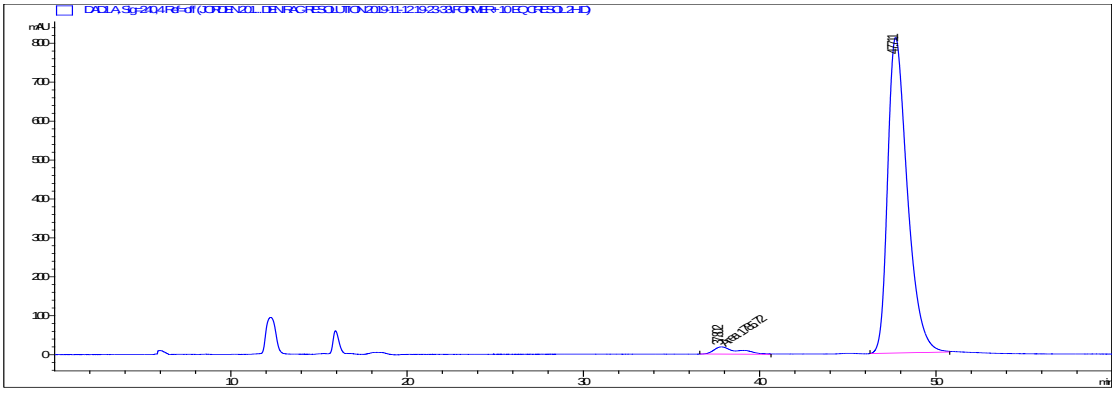
Reaction conditions: **enantiomer-1**/**enantiomer-2** (1 mL, 3.6 mM in CH_3CN), phenolic derivative (1 equiv), DBU (1 equiv), rt.

[a] **enantiomer-1** and **enantiomer-2** refer to two enantiomers with retention times of 16.8 and 18.8 min with chiral HPLC, respectively.

[b] *% ee* determined using chiral HPLC and calculated by

$$\%\ ee = \frac{majority - minority}{majority + minority} \times 100\%,$$

a)

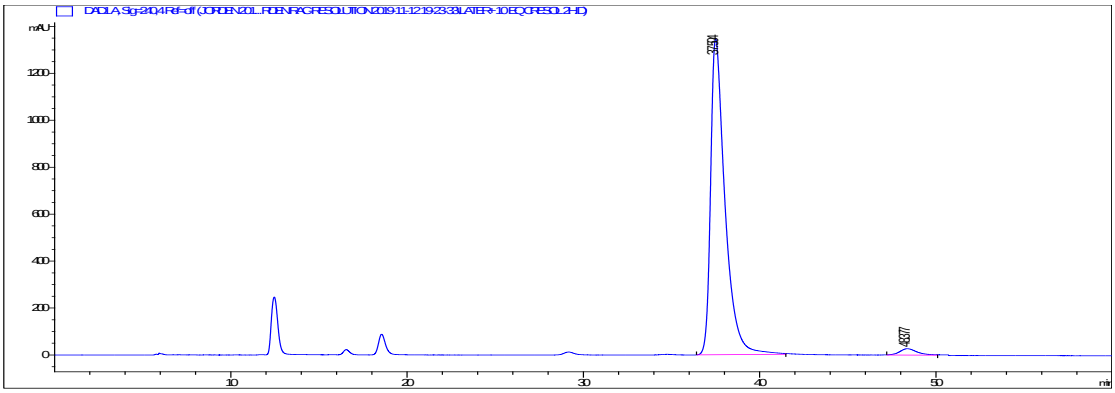


b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	37.802	1	MM	1785.72095	18.57775	2.7537
2	47.711	1	BB	6.30619e4	810.52191	97.2463

Figure S19. a) HPLC chromatogram and b) the result of the reaction with 10 equiv *p*-cresol and **isomer-1**

a)

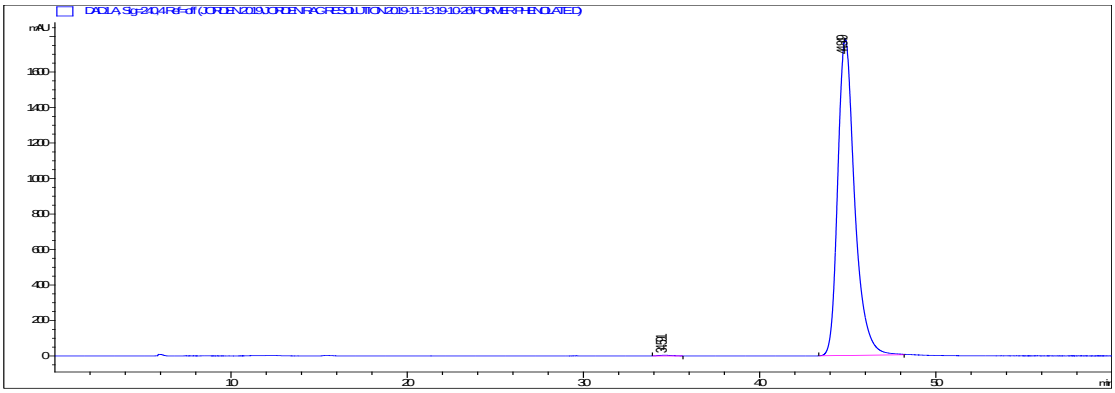


b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	37.504	1	BB	7.64126e4	1346.62268	97.5787
2	48.377	1	BB	1896.08752	27.23809	2.4213

Figure S20. a) HPLC chromatogram and b) the result of the reaction with 10 equiv *p*-cresol and **isomer-2.**

a)

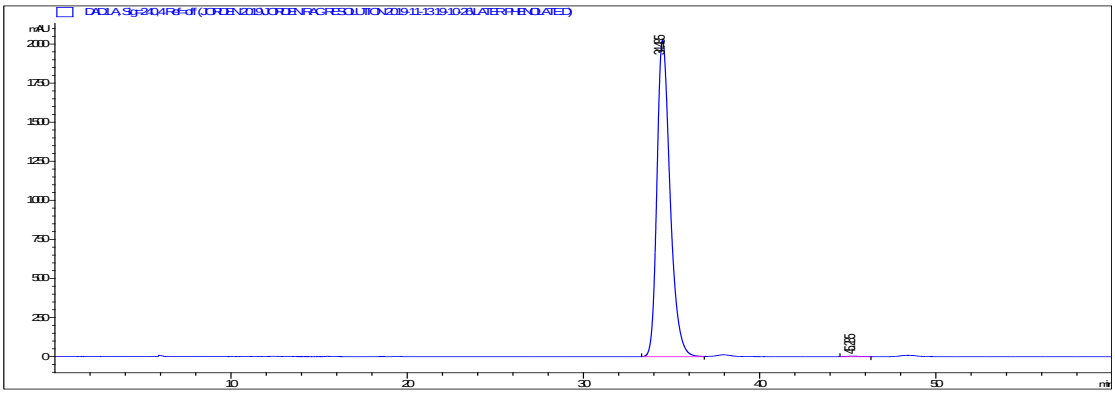


b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	34.591	1	BB	198.56409	4.15845	0.1667
2	44.849	1	BB	1.18891e5	1785.70947	99.8333

Figure S21. a) HPLC chromatogram and b) the result of the reaction with phenolate **6** and **isomer-1**.

a)



b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	34.485	1	BB	1.05111e5	2031.03003	99.7943
2	45.285	1	BB	216.68797	3.86853	0.2057

Figure S22. a) HPLC chromatogram and b) the result of the reaction with phenolate **6** and **isomer-2**.

As expected therefore, >99% *ee* was also achieved when sodium 4-methyl-2-nitrophenolate **7** was adopted (Table S5), even though 4-methyl-2-nitrophenol **2ac** was a really poor nucleophile.

Sodium 4-methyl-2-nitrophenolate **7** was prepared according to the following procedure. A flame-dried Schlenk flask, under Ar flow, was charged with NaH (60% suspension in mineral oil, 50 mg, 1.25 mmol). To remove the mineral oil, the solid was washed with anhydrous Et_2O (3x 2 mL), and the ether was removed via syringe. 4-methyl-2-nitrophenol **2ac** (210 mg, 1.37 mmol, 1.1 equiv) was dissolved in 1.2 mL anhydrous MeCN and was added dropwise to the washed NaH. The resulting orange suspension, with a maximum concentration of 1M phenolate was kept under Ar flow. The exact concentration of phenolate was not determined.

Unlike the previous reaction with phenolate **6**, these reactions were much slower. After 19 hours, there was still some fluoride **1** remaining. However, compound **1** was not racemized, while only stereospecific products were obtained (Figure S23-24).

a)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	3.109	1	MF	427.45465	35.44067	7.8458
2	3.449	1	FM	1013.53381	109.61823	18.6032
3	9.719	1	MM	4007.17725	135.96382	73.5509

b)

Peak #	RetTime [min]	Sig	Type	Area [mAU*s]	Height [mAU]	Area %
1	3.120	1	BV	483.68060	27.24945	9.2345
2	3.838	1	VB	1131.13550	126.20741	21.5959
3	7.403	1	BB	3622.91235	176.37514	69.1695

Figure S23. Results of reactions of a) **isomer-1** and b) **isomer-2** with phenolate **7**.

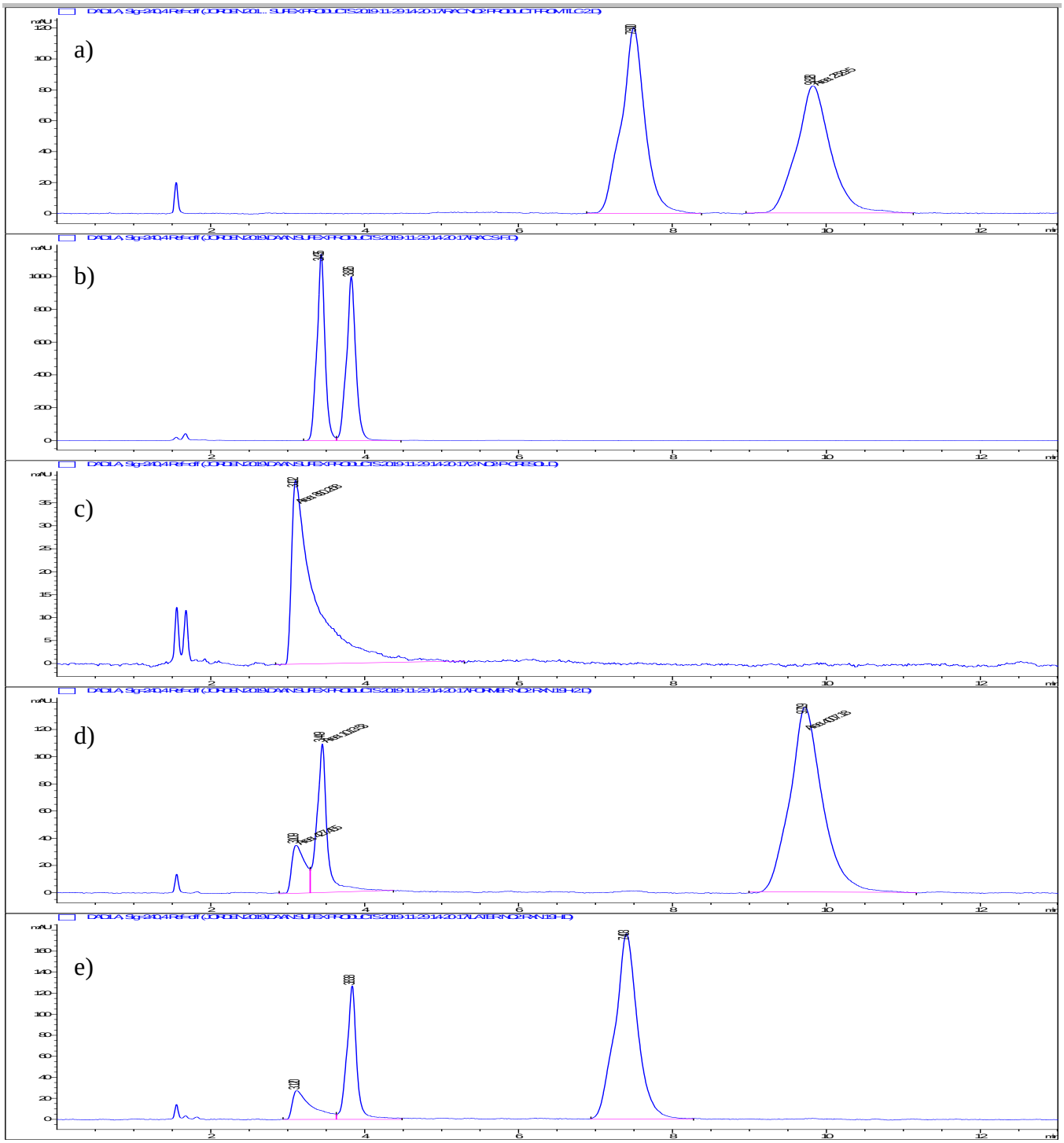
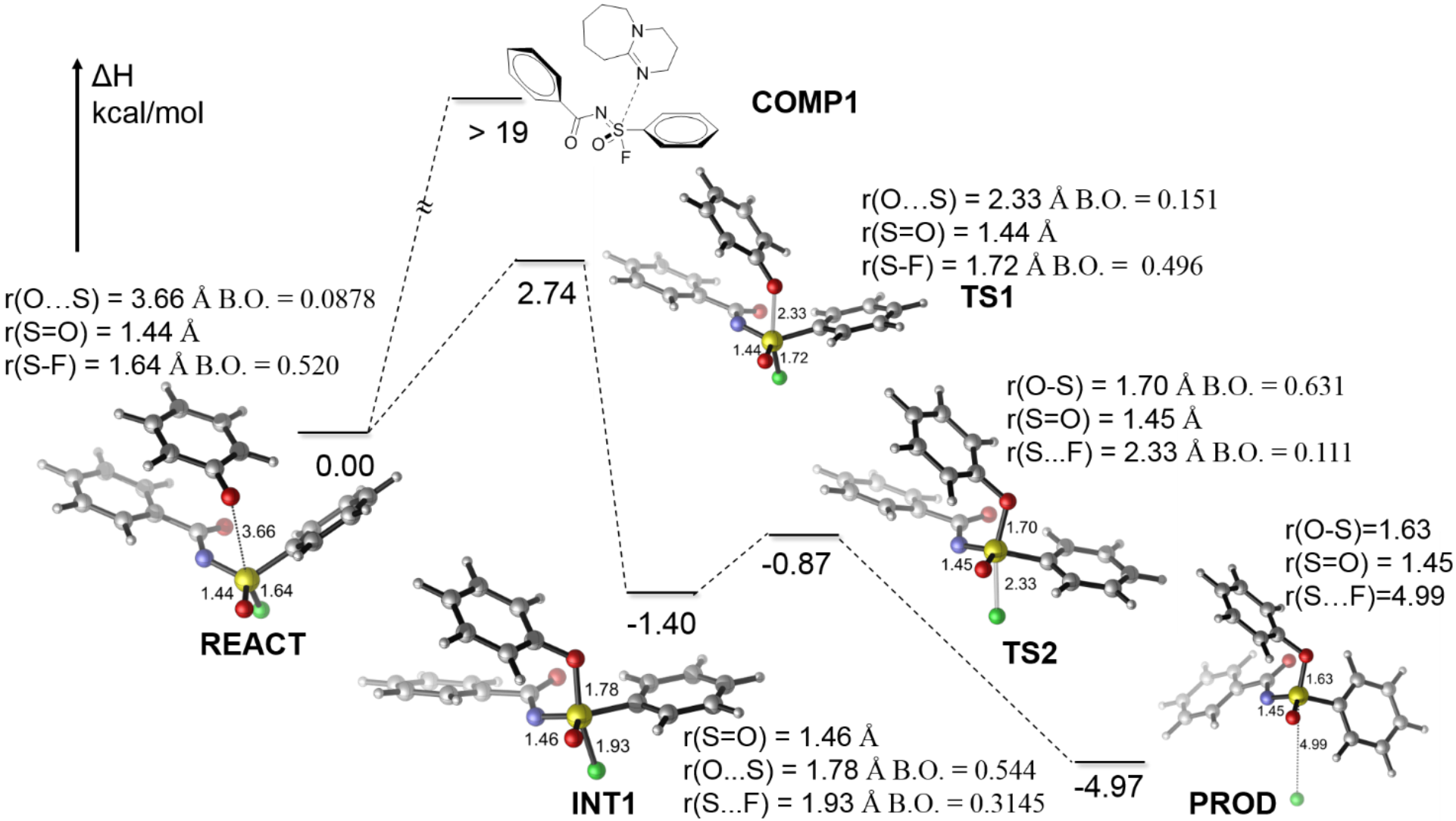


Figure S24. HPLC chromatograms of a) racemate of **3ac**, b) racemate of fluoride **1**, c) **2ac**, the reaction of d) **isomer-1** and e) **isomer-1** with phenolate **7**. Enantioselectivity was monitored using an HPLC Chiralpak IA column, Conditions were: *n*-hexane/methyl *tert*-butyl ether = 90:10, flow rate 2.0 mL/min, oven temperature 40 ˚C, detector wavelength 240 nm.

9 Computational studies

All calculations were performed with Gaussian 16 at the wb97xd/6–311+G(d,p) level of theory, using the SMD solvent model to represent CH_3CN as implemented in there.[14] Images of the 3D structures of molecules were generated using CYLview.[15] Frequency calculations were conducted for all stationary points to confirm them as either a minimum or a TS. Even if DBU was brought close to S atom, and with that an energy increase of 19 kcal/mol was observed, then the F still does not want to leave, nor is there an eventual lowering of the energy. So, a transition state closely related to **COMP1** was not obtained (Scheme S7).



Scheme S7. Potential energy surface for phenolate in SuFEx. B.O. is short for Wiberg bond order.

REACT

Zero-point correction = 0.298941 (Hartree/Particle)
Thermal correction to Energy = 0.320260
Thermal correction to Enthalpy = 0.321204
Thermal correction to Gibbs Free Energy = 0.246386
Sum of electronic and zero-point Energies = -1511.191721
Sum of electronic and thermal Energies = -1511.170402
Sum of electronic and thermal Enthalpies= -1511.169458
Sum of electronic and thermal Free Energies = -1511.244275

Center Number	Coordinates (Angstroms) X	Y	Z
S1	-1.487603	-1.541476	-0.829876
N2	0.021638	-1.387582	-0.689925
C3	0.710865	-1.331314	0.5147
C4	2.169897	-1.077419	0.345042
O5	0.208057	-1.518818	1.609189
C6	2.972649	-1.038997	1.486094
C7	4.33883	-0.830072	1.371361
C8	4.91142	-0.658358	0.113136
C9	4.114467	-0.694101	-1.02578
C10	2.746103	-0.901493	-0.911402
O11	-1.935485	-1.687508	-2.189518
F12	-1.912315	-2.932522	-0.070162
C13	-2.548905	-0.435821	0.056917
C14	-2.624711	-0.480679	1.445528
C15	-3.449622	0.433568	2.083832
C16	-4.17582	1.360744	1.340892
C17	-4.086811	1.380931	-0.046257
C18	-3.264117	0.478298	-0.706425
H19	2.513957	-1.173136	2.458245
H20	4.958593	-0.79946	2.260183
H21	5.979669	-0.494931	0.022252
H22	4.55818	-0.553146	-2.004657
H23	2.117941	-0.916848	-1.792208
H24	-2.044469	-1.199493	2.005697
H25	-3.525722	0.419062	3.164098
H26	-4.816621	2.072137	1.84882
H27	-4.651711	2.105059	-0.620148
H28	-3.161388	0.498599	-1.781149
O29	-0.796232	1.857837	-2.002899
C30	0.107672	2.063302	-1.113036
C31	1.47984	2.286159	-1.445917
C32	2.451103	2.503041	-0.480723
C33	2.135121	2.513068	0.878182
C34	0.803849	2.301941	1.241124
C35	-0.181151	2.090679	0.288021
H36	1.754567	2.267888	-2.49818

H37	3.48228	2.651181	-0.792266
H38	2.902152	2.665523	1.629368
H39	0.528241	2.299541	2.293416
H40	-1.209436	1.934445	0.599575

TS1

Zero-point correction = 0.299211 (Hartree/Particle)
Thermal correction to Energy = 0.320292
Thermal correction to Enthalpy = 0.321236
Thermal correction to Gibbs Free Energy = 0.247211
Sum of electronic and zero-point Energies = -1511.187360
Sum of electronic and thermal Energies = -1511.16628
Sum of electronic and thermal Enthalpies = -1511.165336
Sum of electronic and thermal Free Energies = -1511.239361
Imaginary frequency = -111.1 cm^{-1}

Center Number	Coordinates (Angstroms) X	Y	Z
S1	-1.32895	-0.777262	-1.1735
N2	0.18706	-0.859747	-0.89436
C3	0.803153	-1.344107	0.225035
C4	2.299023	-1.235444	0.152051
O5	0.259426	-1.832991	1.20792
C6	3.047743	-1.660861	1.249342
C7	4.43313	-1.566437	1.231866
C8	5.080936	-1.04752	0.114423
C9	4.338565	-0.6244	-0.98398
C10	2.952535	-0.717025	-0.96605
O11	-1.69671	-0.517509	-2.54425
F12	-1.7289	-2.44129	-1.05504
C13	-2.64867	-0.35627	-0.01996
C14	-2.5935	-0.754587	1.305119
C15	-3.66674	-0.432058	2.129956
C16	-4.76563	0.251547	1.623174
C17	-4.80038	0.621311	0.281275
C18	-3.73446	0.322057	-0.55566
H19	2.531537	-2.060452	2.113832
H20	5.008295	-1.895804	2.08978
H21	6.162553	-0.971853	0.100316
H22	4.840003	-0.218256	-1.85509
H23	2.368949	-0.379053	-1.81272
H24	-1.73189	-1.292477	1.677973
H25	-3.64078	-0.726523	3.172512
H26	-5.59884	0.494677	2.27227
H27	-5.65724	1.151385	-0.11737
H28	-3.73805	0.618404	-1.59557
O29	-1.07374	1.53153	-0.94482

C30	-0.00535	2.000343	-0.36178
C31	0.904381	2.841043	-1.05012
C32	2.051415	3.326326	-0.43763
C33	2.356037	2.993063	0.883003
C34	1.473669	2.171703	1.582356
C35	0.317356	1.691014	0.982716
H36	0.684423	3.093105	-2.08349
H37	2.724751	3.966799	-1.00045
H38	3.258477	3.366061	1.354368
H39	1.690741	1.900047	2.611555
H40	-0.36006	1.053553	1.542192

INT1

Zero-point correction = 0.300126 (Hartree /Particle)
Thermal correction to Energy = 0.321717
Thermal correction to Enthalpy = 0.322661
Thermal correction to Gibbs Free Energy = 0.247354
Sum of electronic and zero-point Energies= -1511.193957
Sum of electronic and thermal Energies = -1511.172365
Sum of electronic and thermal Enthalpies = -1511.171421
Sum of electronic and thermal Free Energies = -1511.246728

Center Number	Coordinates (Angstroms) X	Y	Z
S1	1.250062	0.131004	0.951593
N2	-0.19112	-0.540119	0.95423
C3	-0.7213	-1.284186	-0.03215
C4	-2.21568	-1.423205	0.101888
O5	-0.13474	-1.836103	-0.96779
C6	-2.85376	-2.503684	-0.504545
C7	-4.23502	-2.637344	-0.424047
C8	-4.98879	-1.679281	0.247613
C9	-4.35642	-0.590481	0.841767
C10	-2.97435	-0.465829	0.775656
O11	1.442445	1.072248	2.047286
F12	1.869392	-1.357059	2.017405
C13	2.802018	-0.25205	0.074016
C14	2.84364	-1.139426	-0.987109
C15	4.066121	-1.358243	-1.614014
C16	5.210496	-0.69283	-1.186154
C17	5.137394	0.198732	-0.121514
C18	3.92494	0.426912	0.521188
H19	-2.25849	-3.235477	-1.038042
H20	-4.72414	-3.48622	-0.888656
H21	-6.06718	-1.778697	0.304392
H22	-4.94193	0.164242	1.355041
H23	-2.47439	0.385239	1.22247

H24	1.938443	-1.640755	-1.305614
H25	4.119357	-2.05253	-2.444846
H26	6.158103	-0.867972	-1.682421
H27	6.024496	0.722591	0.215232
H28	3.856388	1.115319	1.353601
O29	0.937189	1.243626	-0.397048
C30	-0.28948	1.83855	-0.516962
C31	-0.75096	2.764794	0.417897
C32	-1.99674	3.354258	0.239587
C33	-2.77718	3.03991	-0.870131
C34	-2.30202	2.128651	-1.807222
C35	-1.0635	1.523322	-1.630318
H36	-0.13795	3.000712	1.278682
H37	-2.35857	4.067825	0.971871
H38	-3.74776	3.504073	-1.003154
H39	-2.90221	1.876607	-2.674589
H40	-0.68753	0.793732	-2.337978

TS2

Zero-point correction = 0.299896 (Hartree/Particle)
Thermal correction to Energy = 0.32107
Thermal correction to Enthalpy = 0.322014
Thermal correction to Gibbs Free Energy = 0.24719
Sum of electronic and zero-point Energies= -1511.193107
Sum of electronic and thermal Energies = -1511.171934
Sum of electronic and thermal Enthalpies = -1511.170989
Sum of electronic and thermal Free Energies = -1511.245814
Imaginary frequency = -72.0 cm^{-1}

Center Number	Coordinates (Angstroms) X	Y	Z
S1	1.223303	0.258933	0.827675
N2	-0.0949	-0.570583	0.912676
C3	-0.67671	-1.268476	-0.098898
C4	-2.15475	-1.450355	0.103468
O5	-0.12717	-1.730923	-1.094802
C6	-2.81905	-2.434204	-0.62786
C7	-4.19359	-2.591076	-0.501648
C8	-4.91446	-1.753461	0.344878
C9	-4.25627	-0.763081	1.068269
C10	-2.87975	-0.615264	0.953744
O11	1.428638	1.100612	1.989199
F12	2.111742	-1.504999	2.105418
C13	2.79385	-0.189175	0.057877
C14	2.838904	-1.010523	-1.055837
C15	4.074614	-1.248418	-1.64862
C16	5.227199	-0.659792	-1.139935
C17	5.15038	0.173012	-0.027847

C18	3.926362	0.415812	0.582894
H19	-2.24938	-3.070234	-1.29507
H20	-4.704	-3.362906	-1.066571
H21	-5.98852	-1.870326	0.437811
H22	-4.81712	-0.102993	1.720315
H23	-2.36133	0.162096	1.501598
H24	1.929369	-1.457088	-1.436429
H25	4.130942	-1.895749	-2.516134
H26	6.18549	-0.84817	-1.610127
H27	6.04542	0.635537	0.371442
H28	3.853919	1.051632	1.455104
O29	0.884741	1.322601	-0.452403
C30	-0.39056	1.859798	-0.537647
C31	-0.85787	2.754721	0.418437
C32	-2.13828	3.27735	0.282139
C33	-2.93401	2.921695	-0.803363
C34	-2.44497	2.038684	-1.759914
C35	-1.17084	1.499152	-1.627384
H36	-0.22803	3.023288	1.257157
H37	-2.51355	3.969387	1.027457
H38	-3.93155	3.333666	-0.902994
H39	-3.05922	1.758379	-2.607907
H40	-0.77765	0.792912	-2.348445

PROD

Zero-point correction = 0.299943 (Hartree /Particle)
Thermal correction to Energy = 0.322435
Thermal correction to Enthalpy = 0.323379
Thermal correction to Gibbs Free Energy = 0.242049
Sum of electronic and zero-point Energies = -1511.199643
Sum of electronic and thermal Energies = -1511.177150
Sum of electronic and thermal Enthalpies = -1511.176206
Sum of electronic and thermal Free Energies = -1511.257537

Center Number	Coordinates (Angstroms) X	Y	Z
S1	0.888703	0.833855	0.74649
N2	-0.194945	-0.277544	0.704939
C3	-0.5967	-0.859149	-0.47972
C4	-1.574263	-1.975712	-0.286792
O5	-0.224561	-0.521523	-1.594597
C6	-2.087888	-2.610574	-1.418511
C7	-2.998158	-3.649742	-1.283973
C8	-3.3997	-4.062414	-0.016313
C9	-2.888966	-3.43356	1.114969
C10	-1.978758	-2.392489	0.982098
O11	1.148759	1.249097	2.108888
F12	2.576103	-3.719395	1.893197
C13	2.418599	0.454131	-0.068791

C14	2.569083	0.61215	-1.442126
C15	3.78561	0.263979	-2.012562
C16	4.813552	-0.241404	-1.222172
C17	4.639053	-0.397271	0.148729
C18	3.434004	-0.04439	0.740837
H19	-1.765721	-2.28078	-2.398798
H20	-3.394289	-4.139339	-2.166157
H21	-4.109899	-4.874861	0.089469
H22	-3.1989	-3.755486	2.102434
H23	-1.576439	-1.900535	1.8584
H24	1.756676	0.99273	-2.043545
H25	3.927871	0.385922	-3.079357
H26	5.75772	-0.51471	-1.678539
H27	5.440923	-0.788858	0.762159
H28	3.289361	-0.150283	1.808492
O29	0.460711	2.119357	-0.157053
C30	-0.864926	2.576077	-0.063226
C31	-1.260192	3.308246	1.04544
C32	-2.562499	3.793369	1.087372
C33	-3.436673	3.549346	0.032681
C34	-3.011989	2.817253	-1.071792
C35	-1.714901	2.319861	-1.1257
H36	-0.561265	3.495575	1.851063
H37	-2.890394	4.36748	1.945825
H38	-4.449666	3.932384	0.070776
H39	-3.69118	2.628314	-1.894672
H40	-1.359358	1.736429	-1.965318

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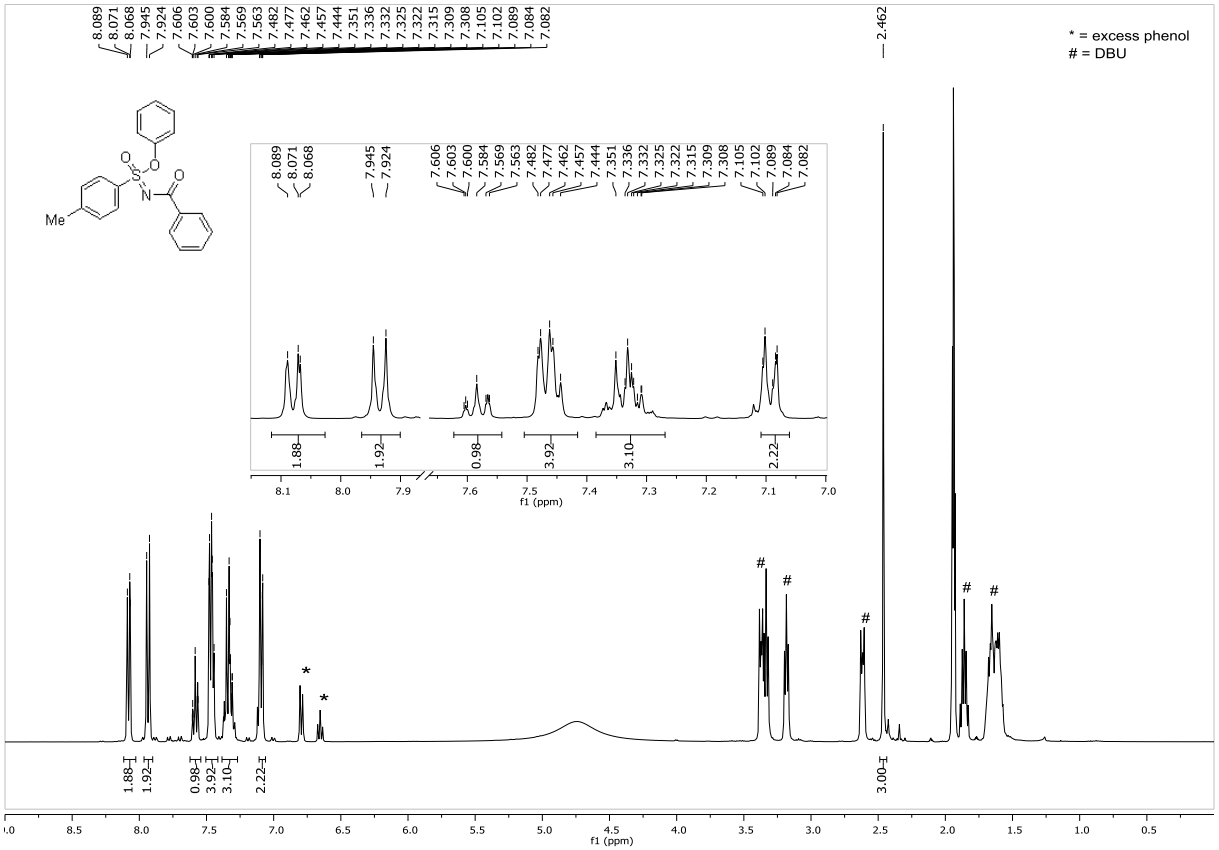
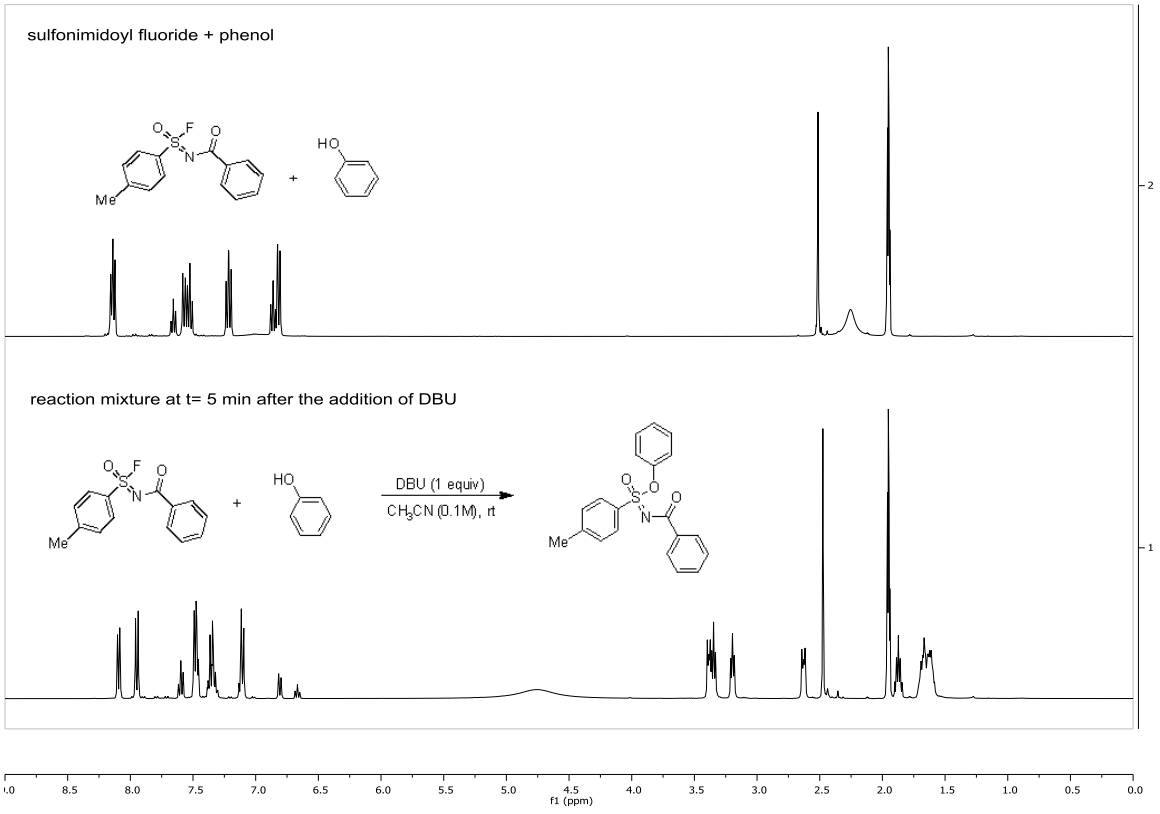
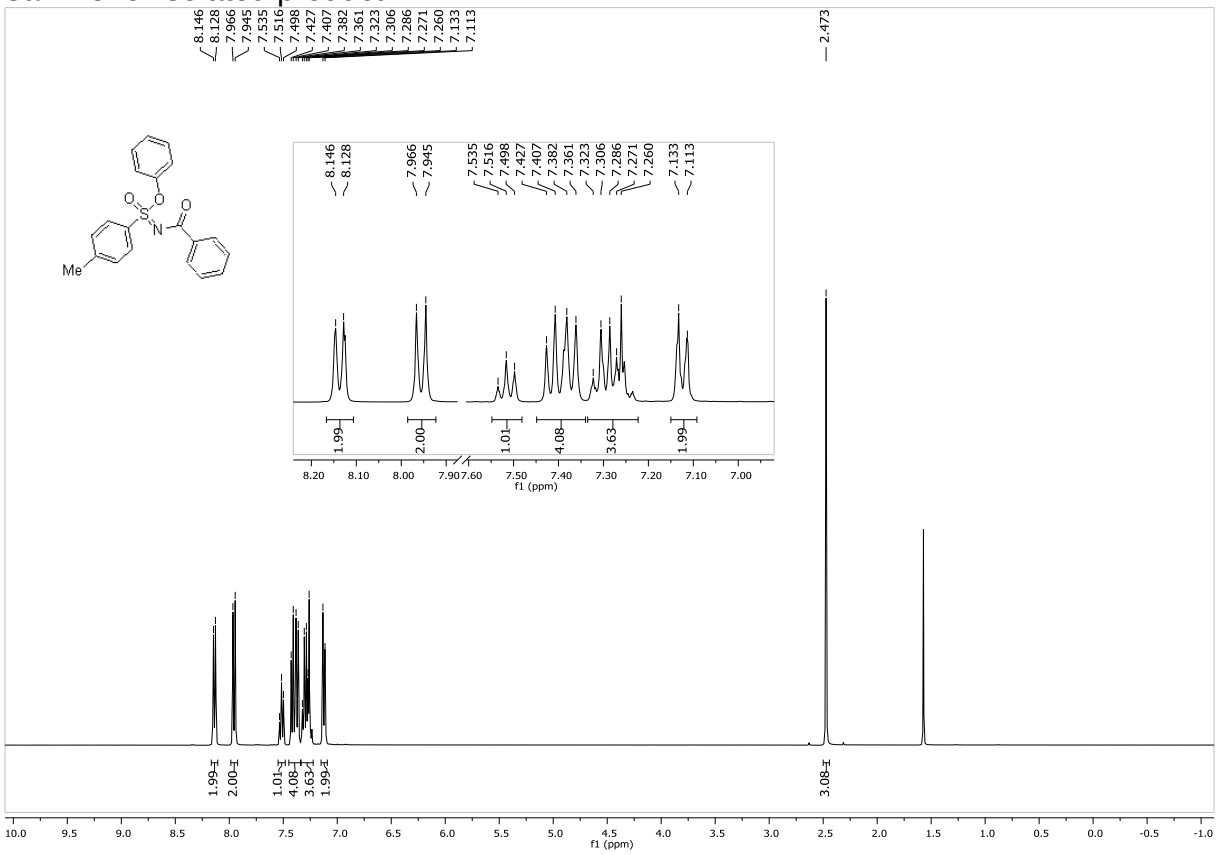
11 NMR spectra

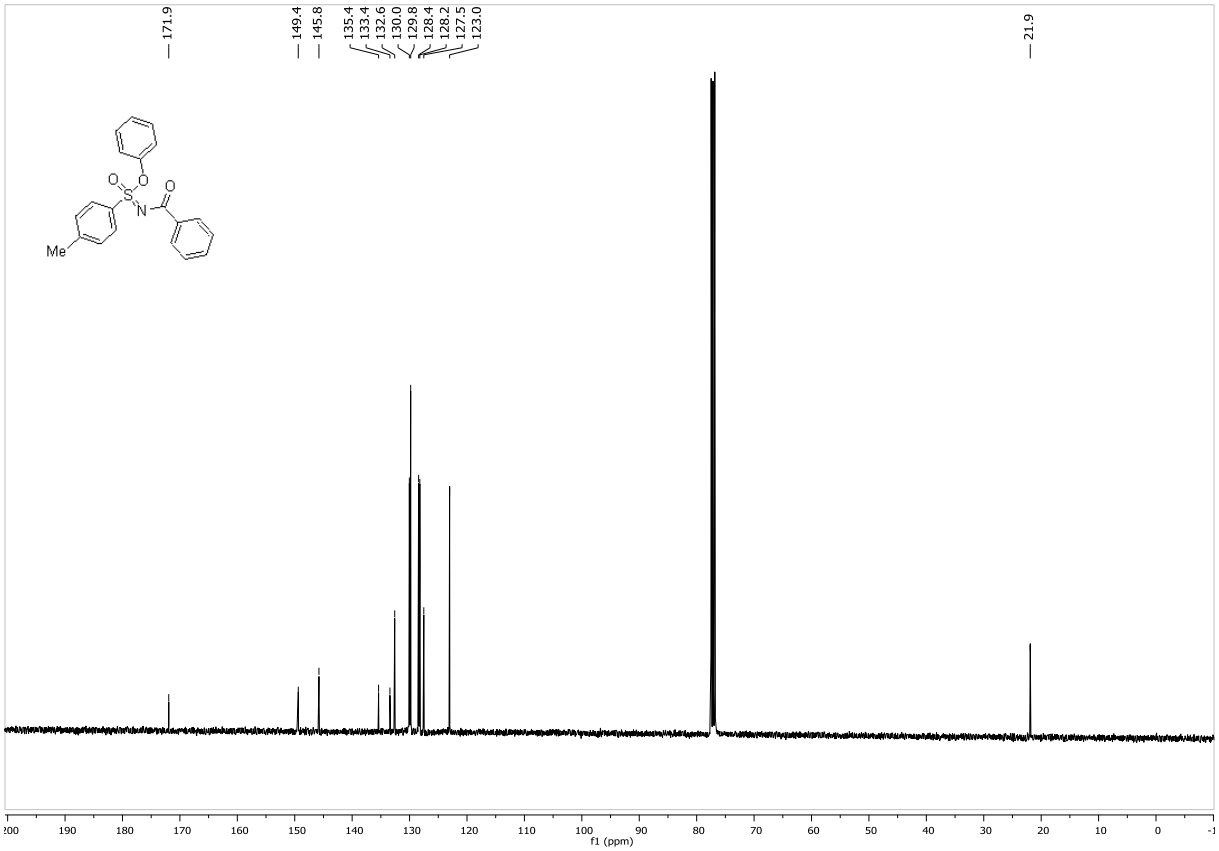
3a Phenol reaction mixture

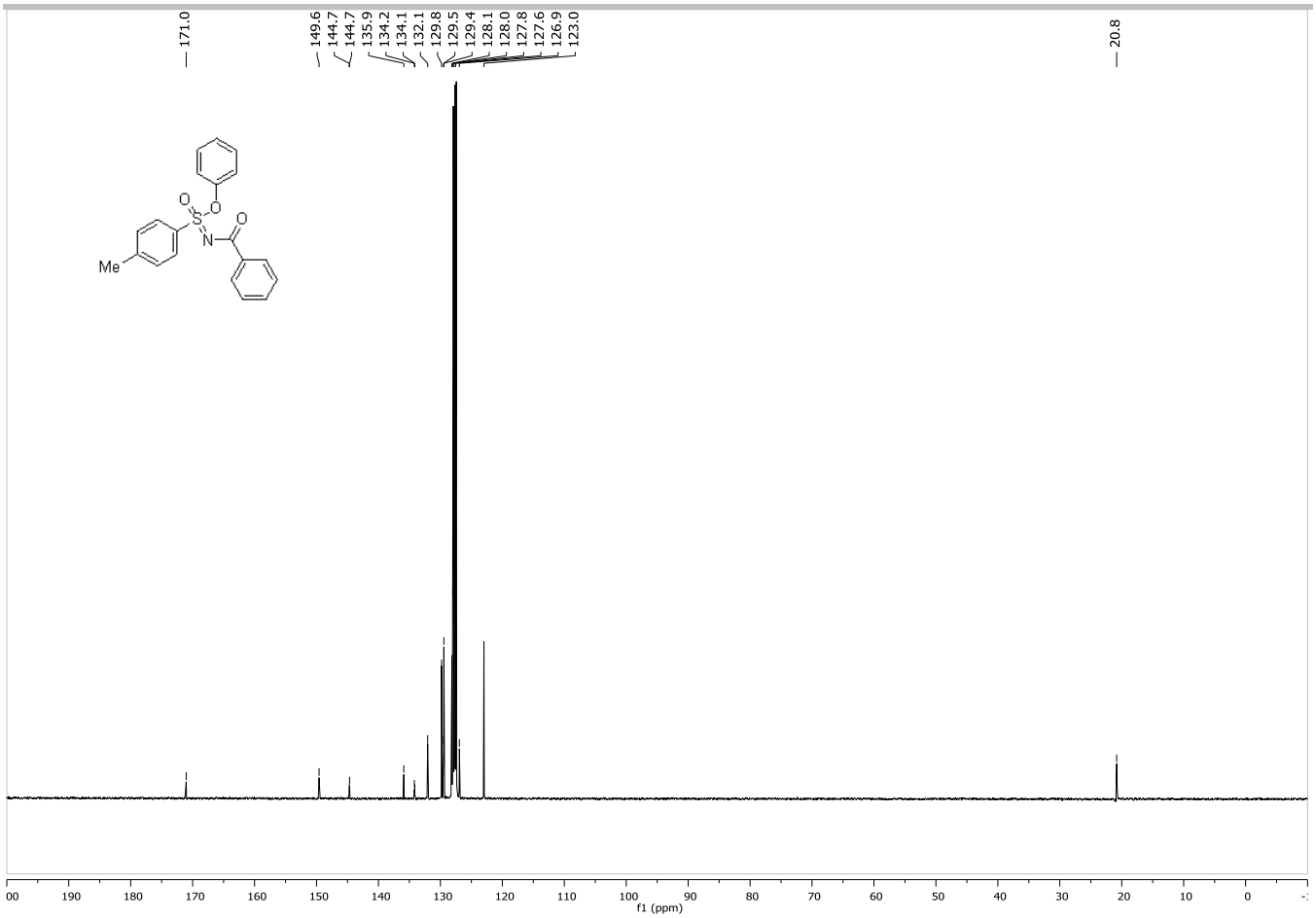




3a Phenol isolated product

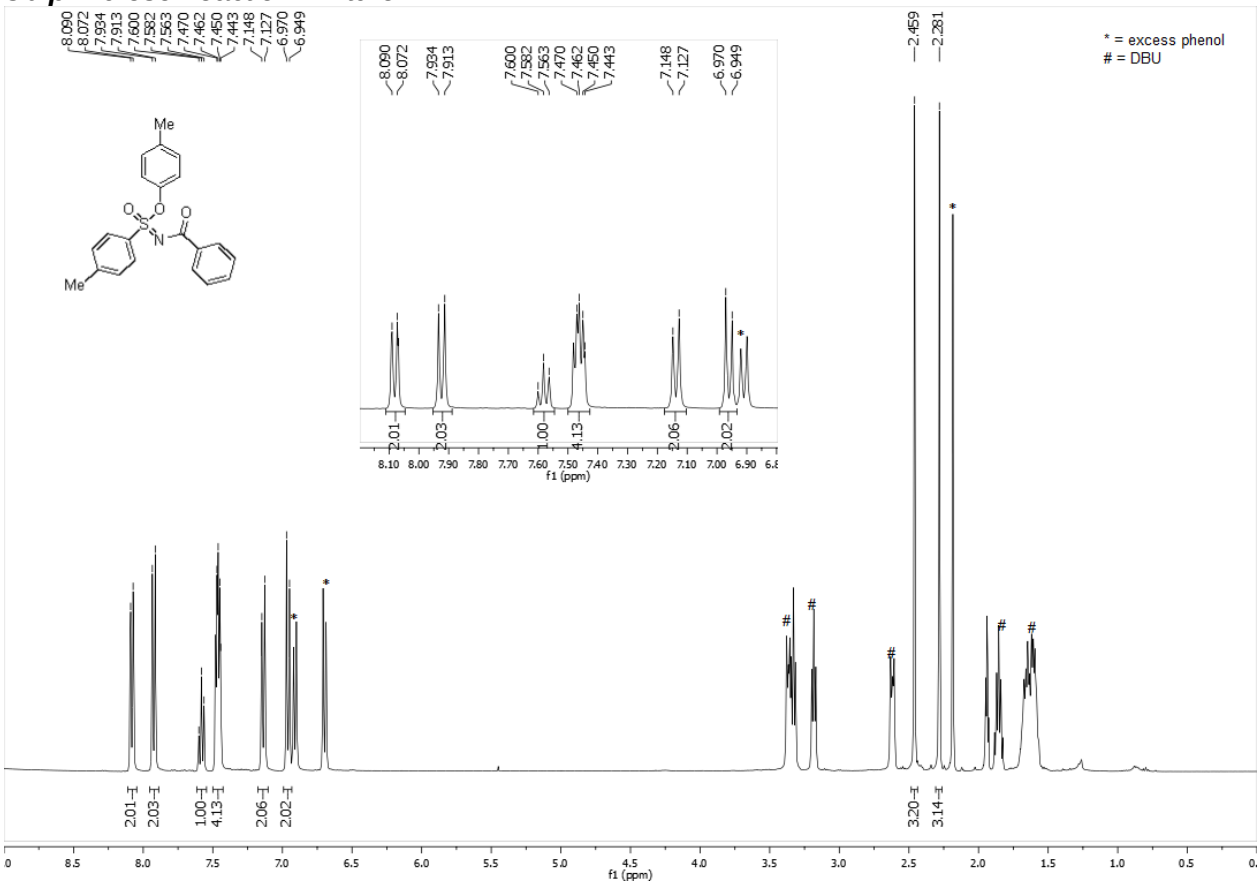


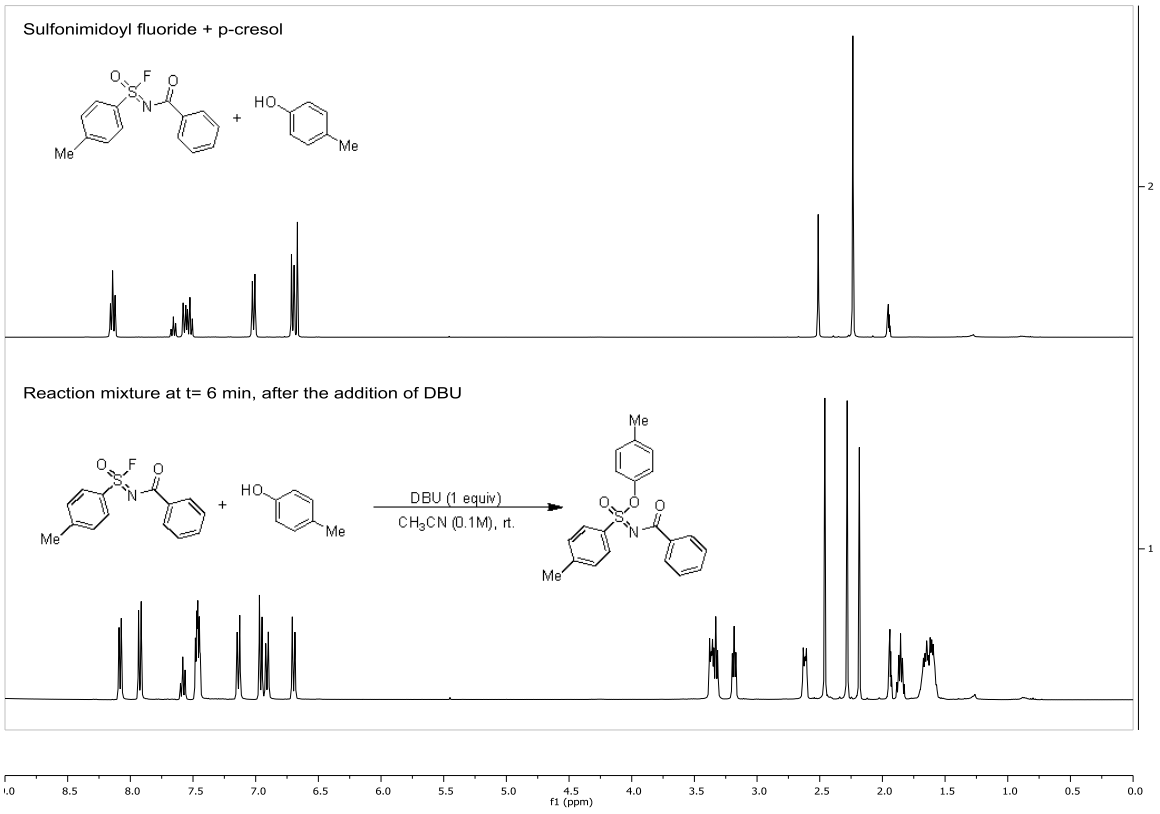



171.0
149.6
144.7
144.7
135.9
134.2
134.1
132.1
129.8
129.5
129.4
128.1
128.0
127.8
127.6
126.9
123.0
20.8
Me
f1 (ppm)

SUPPORTING INFORMATION

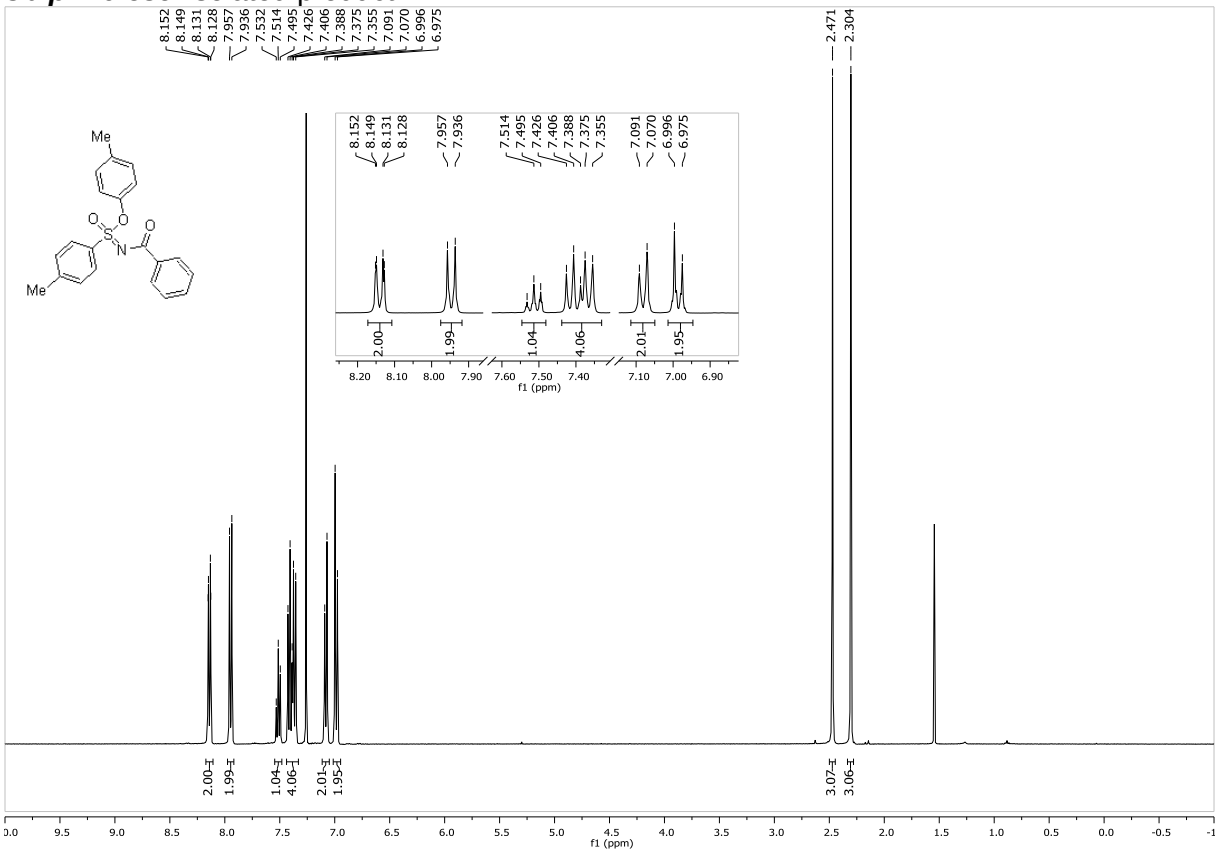
3b-*p* 4-cresol reaction mixture

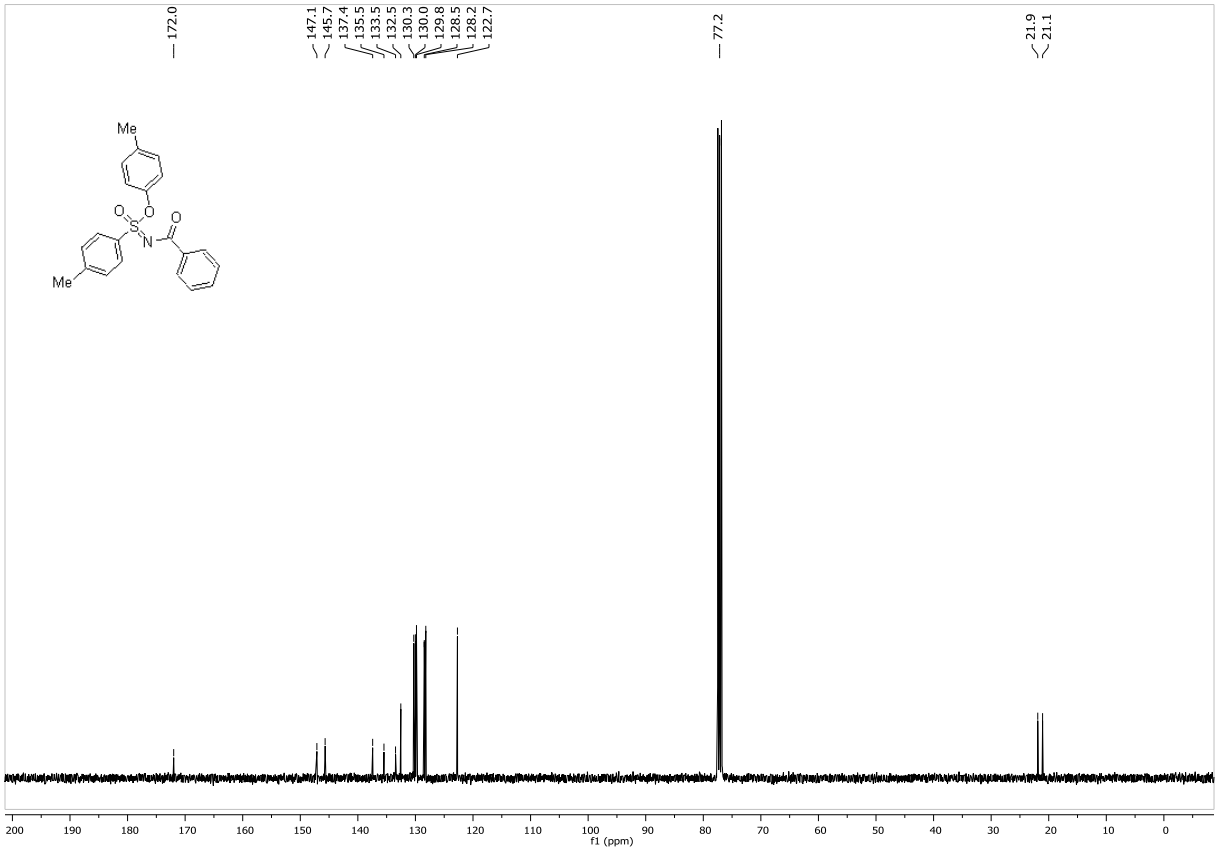




SUPPORTING INFORMATION

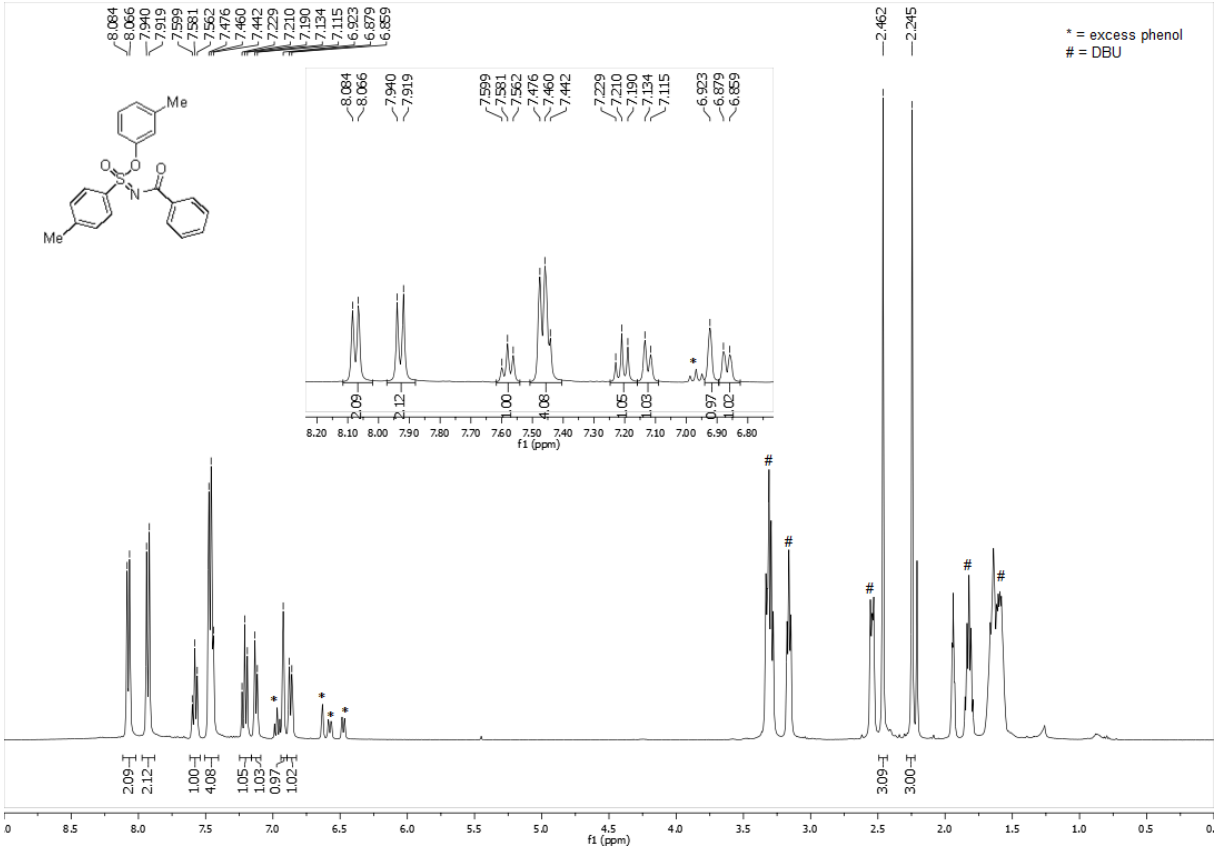
3b-*p* 4-cresol isolated product

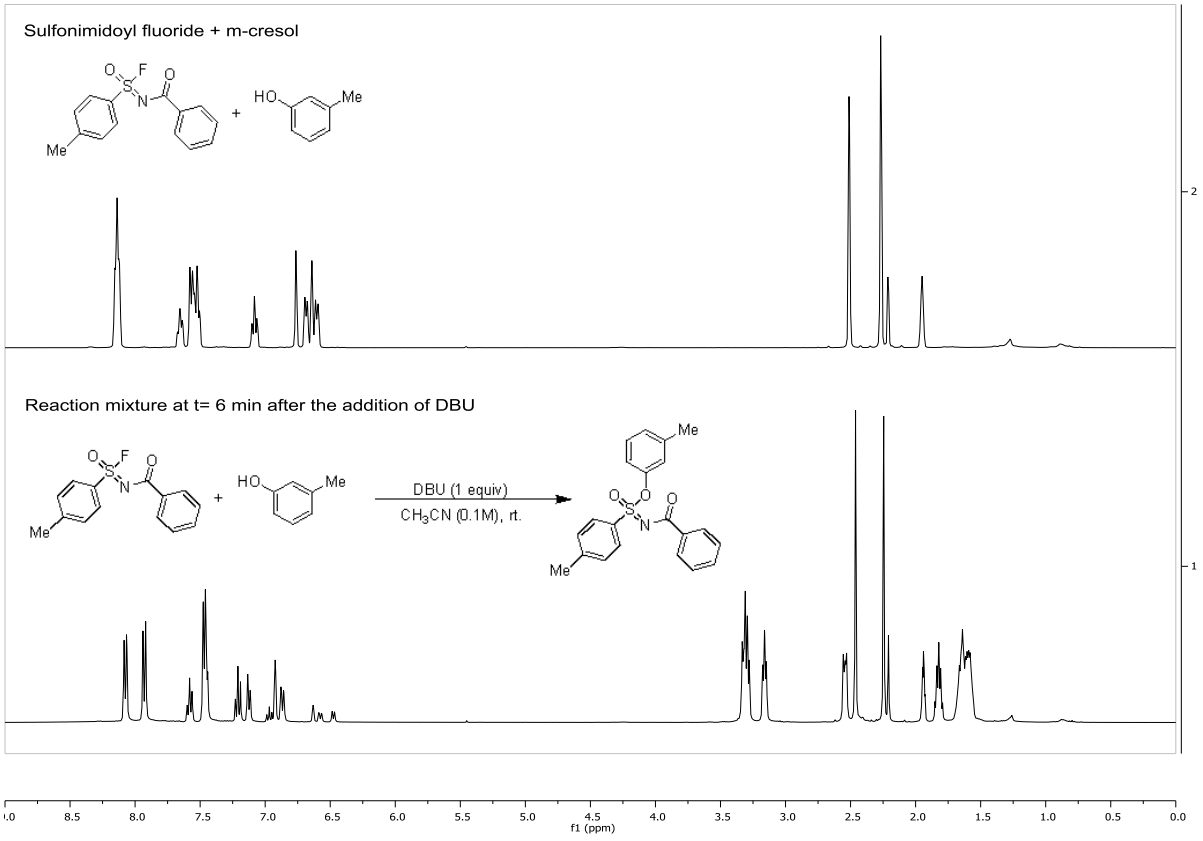




SUPPORTING INFORMATION

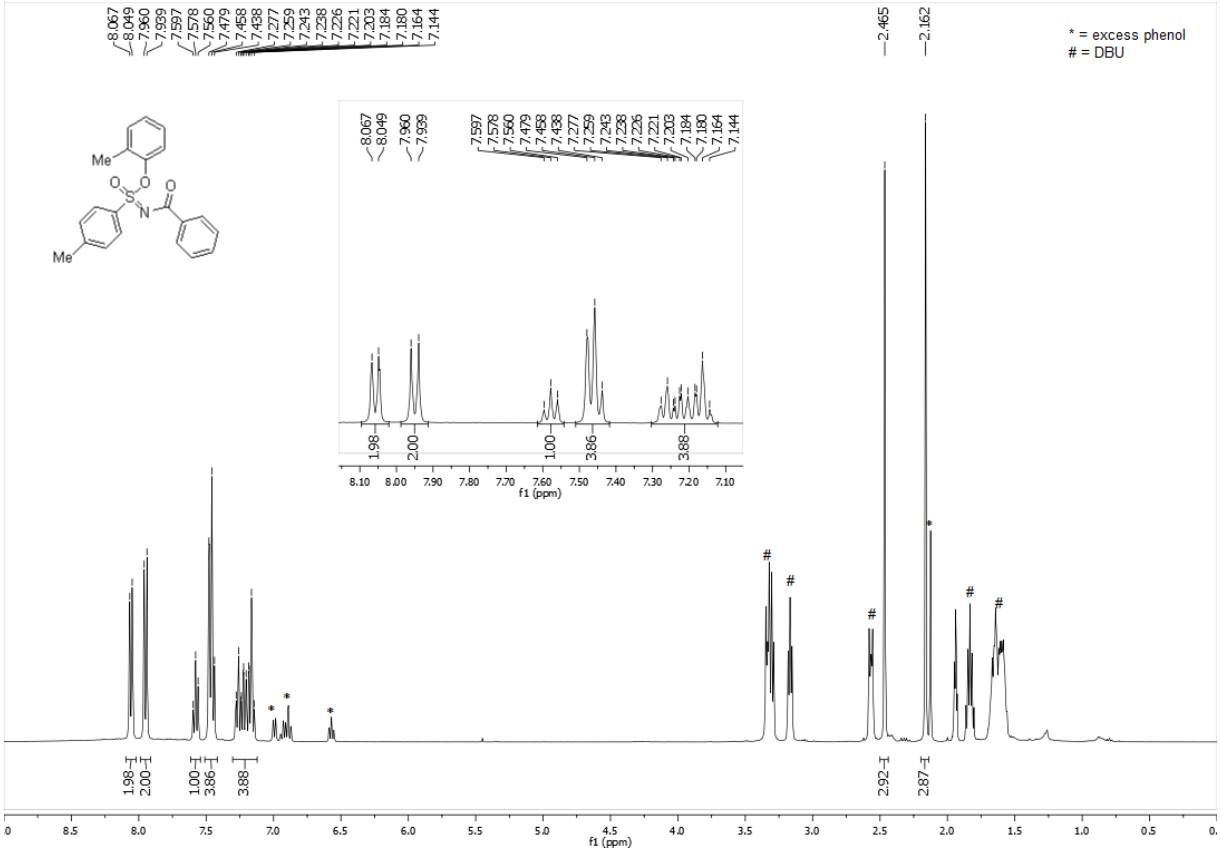
3b-*m* m-cresol reaction mixture

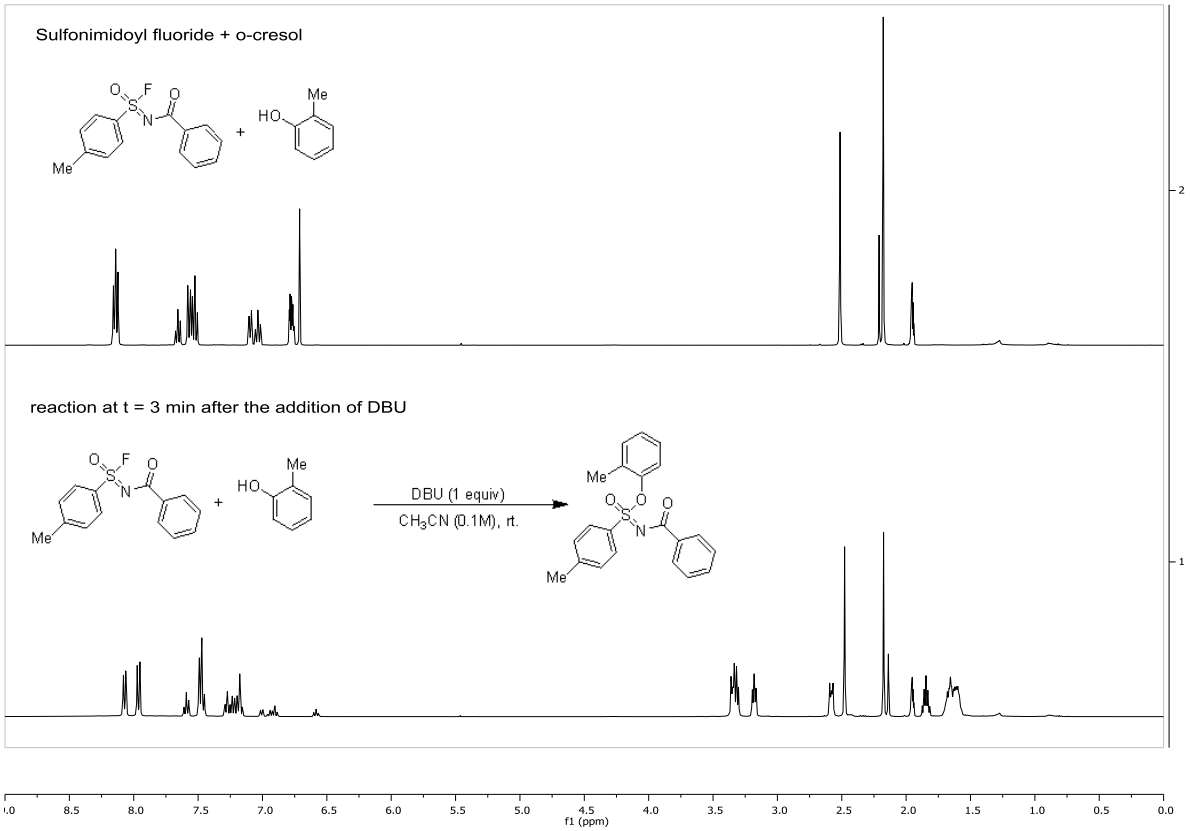




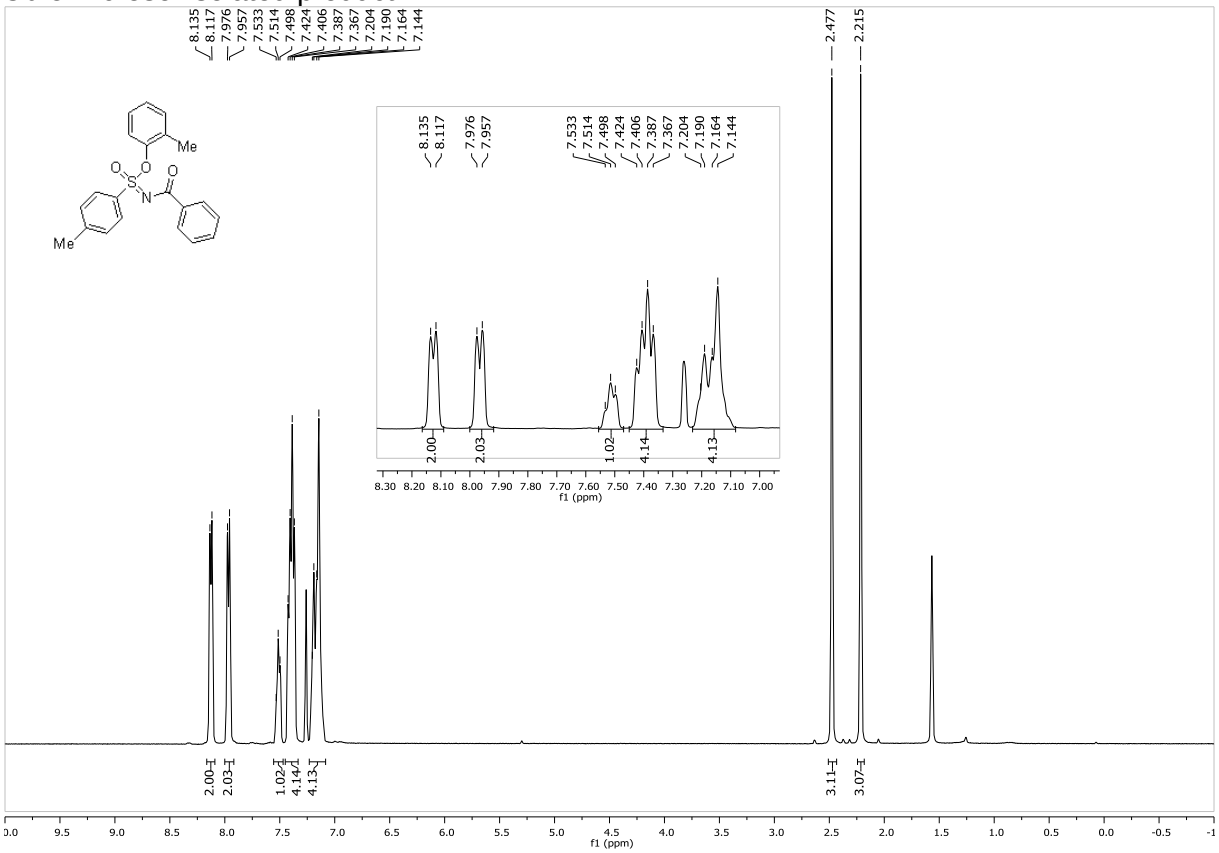
SUPPORTING INFORMATION

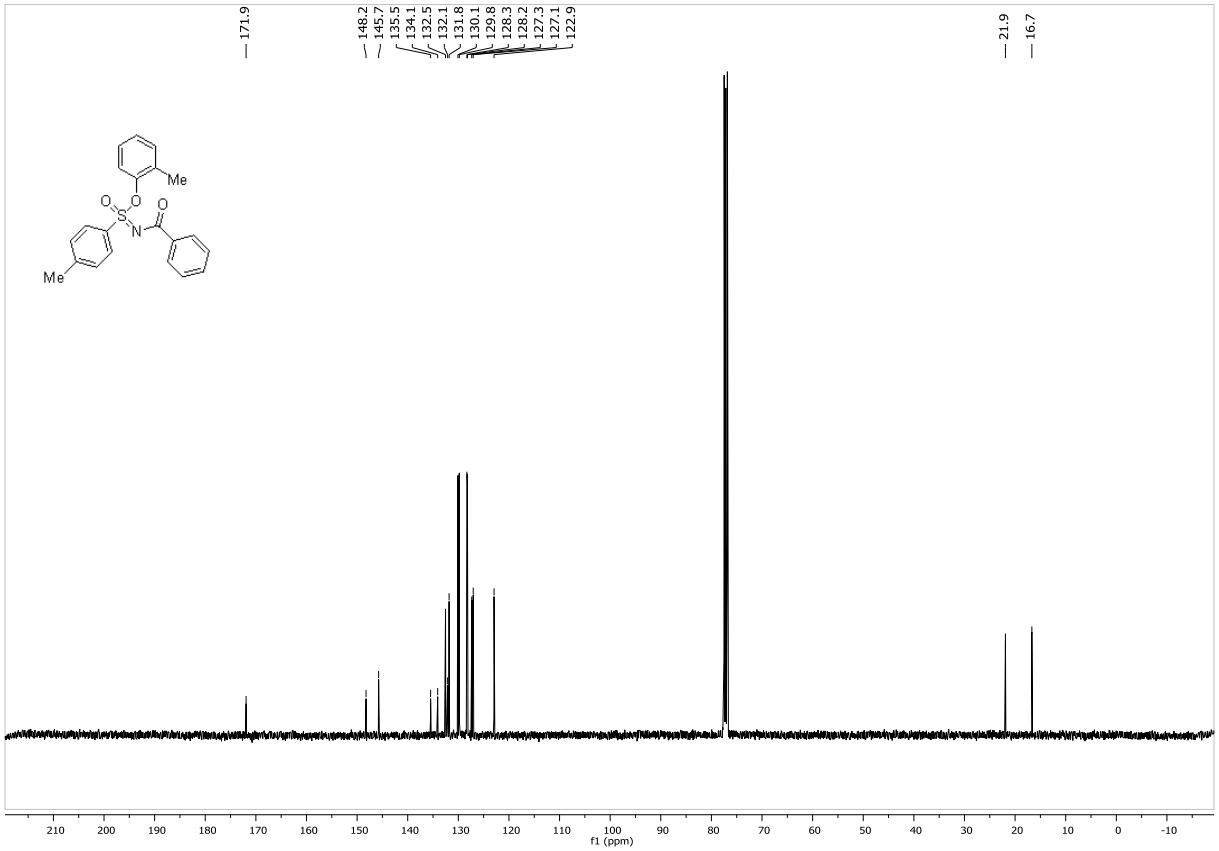
3b-*o* 2-cresol reaction mixture





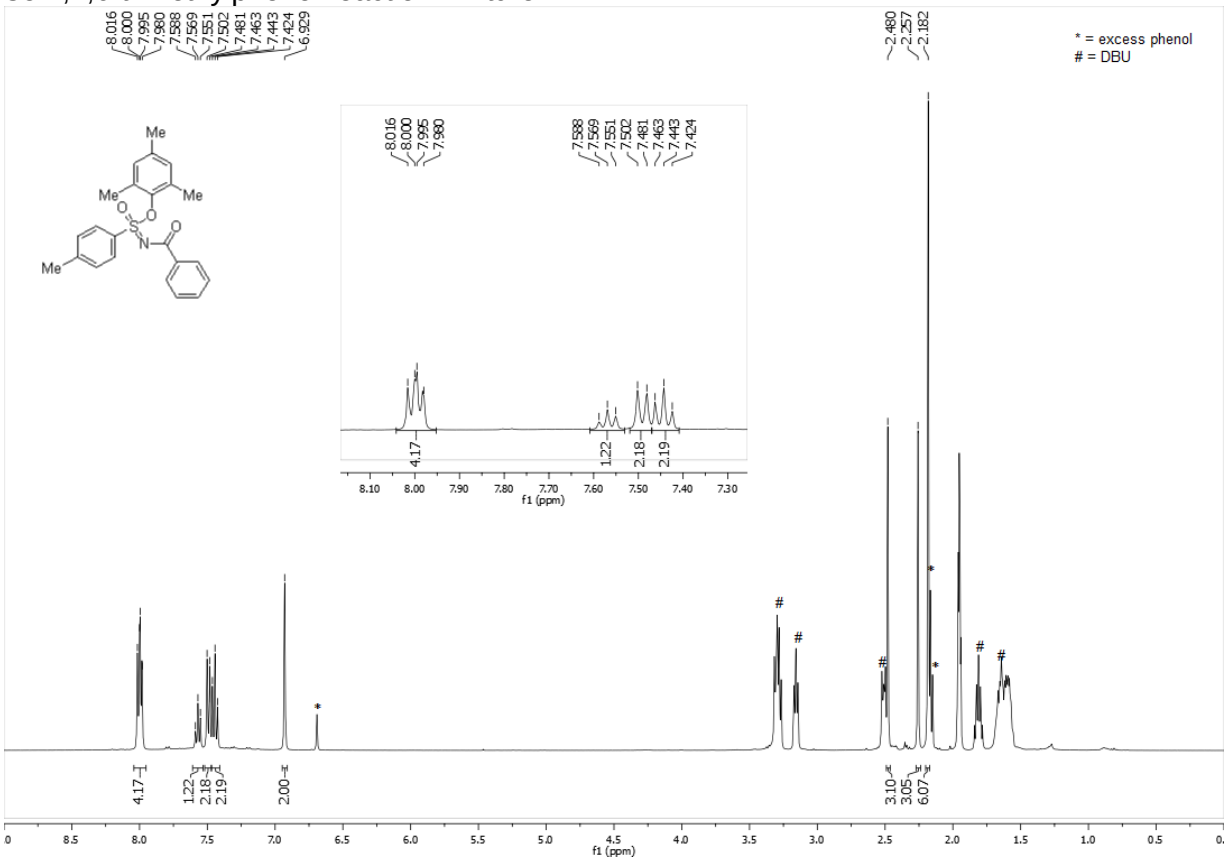
3b-*o* 2-cresol isolated product

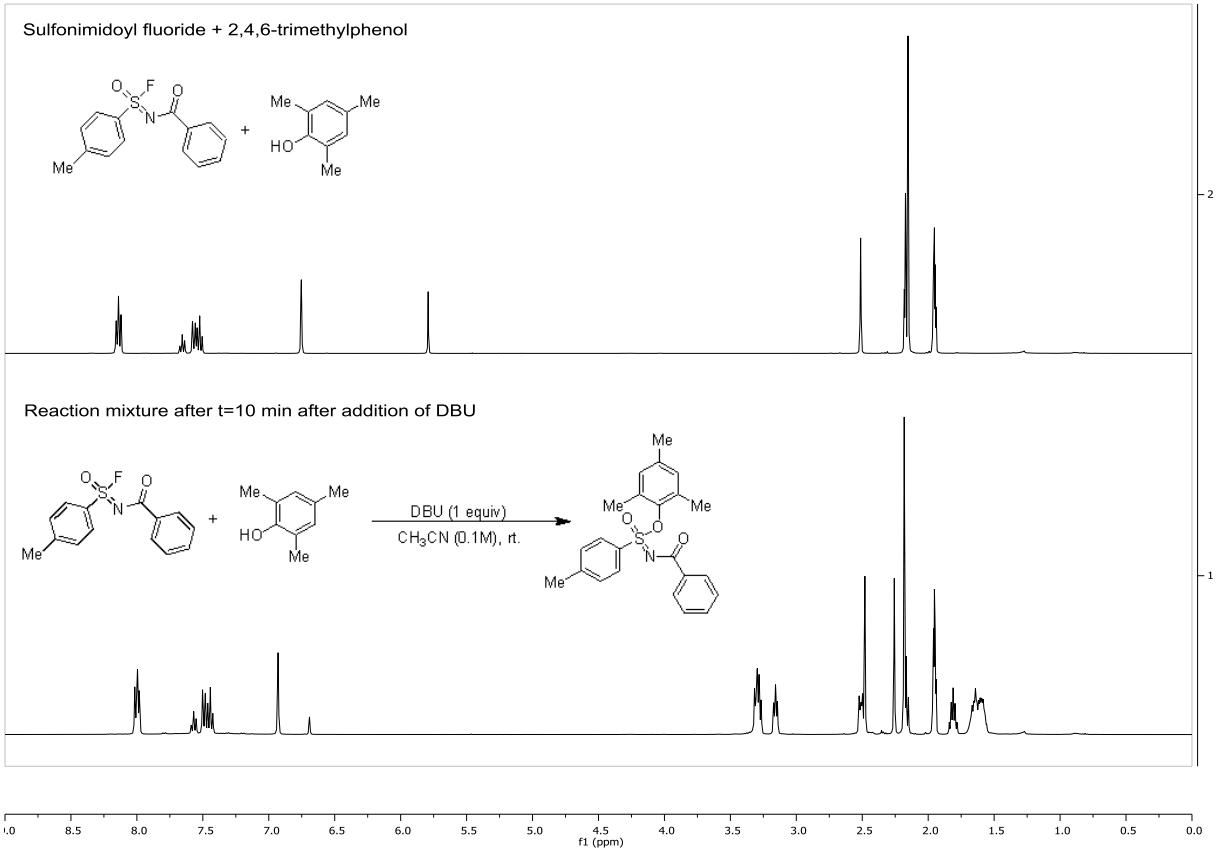




SUPPORTING INFORMATION

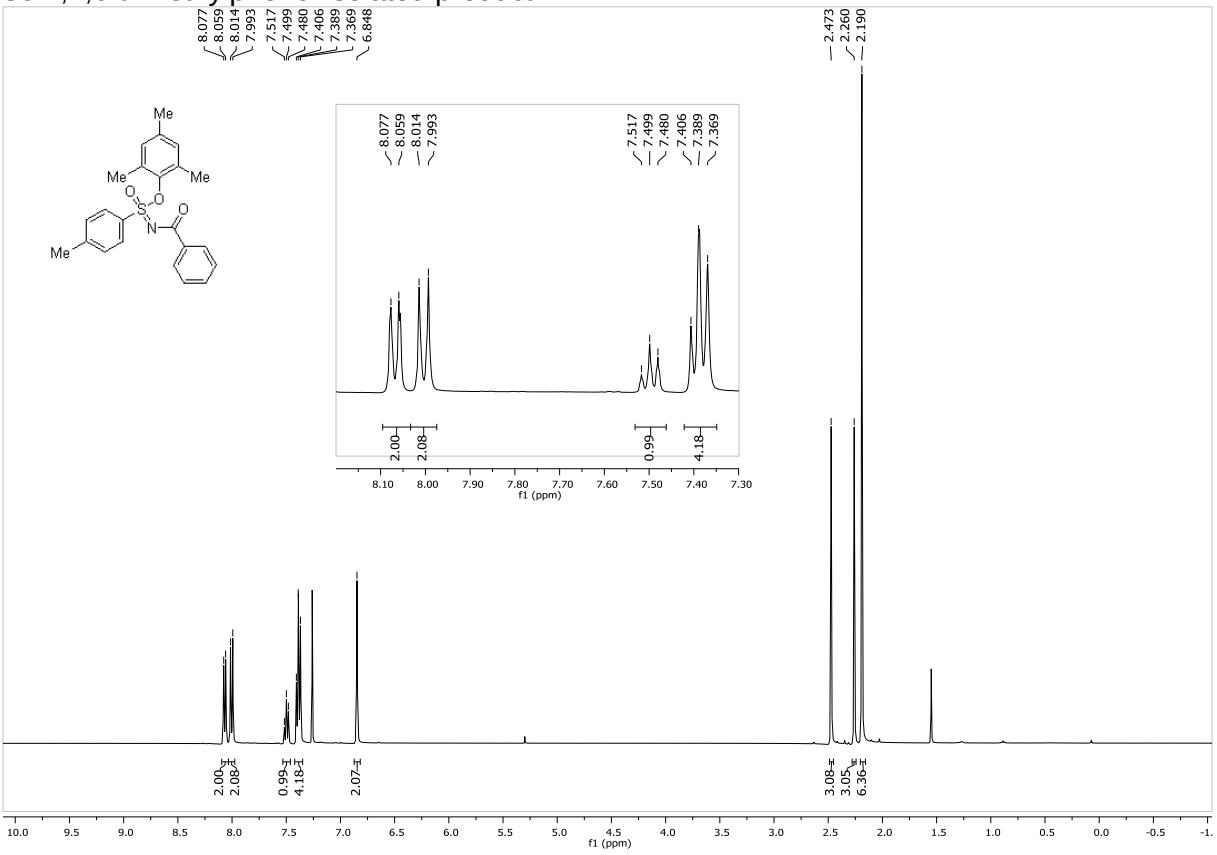
3c 2,4,6-trimethylphenol reaction mixture

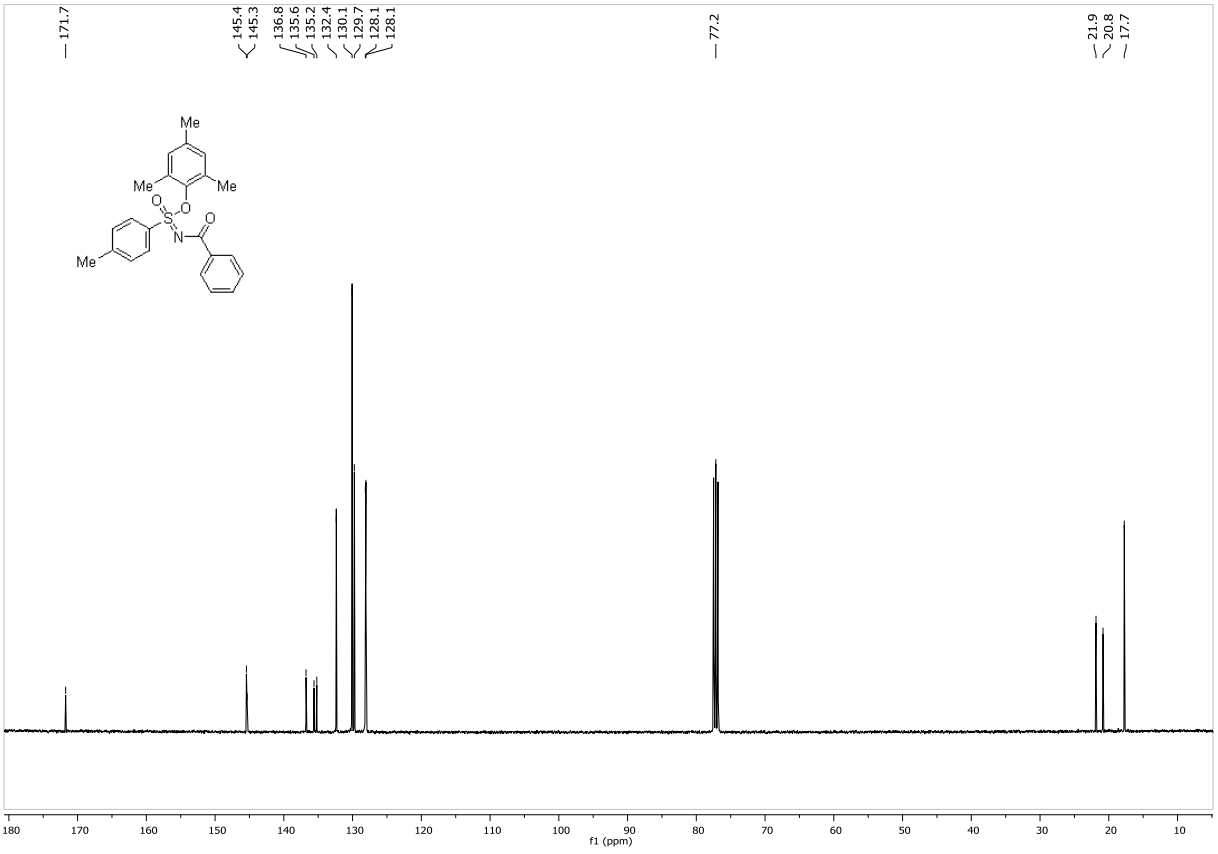


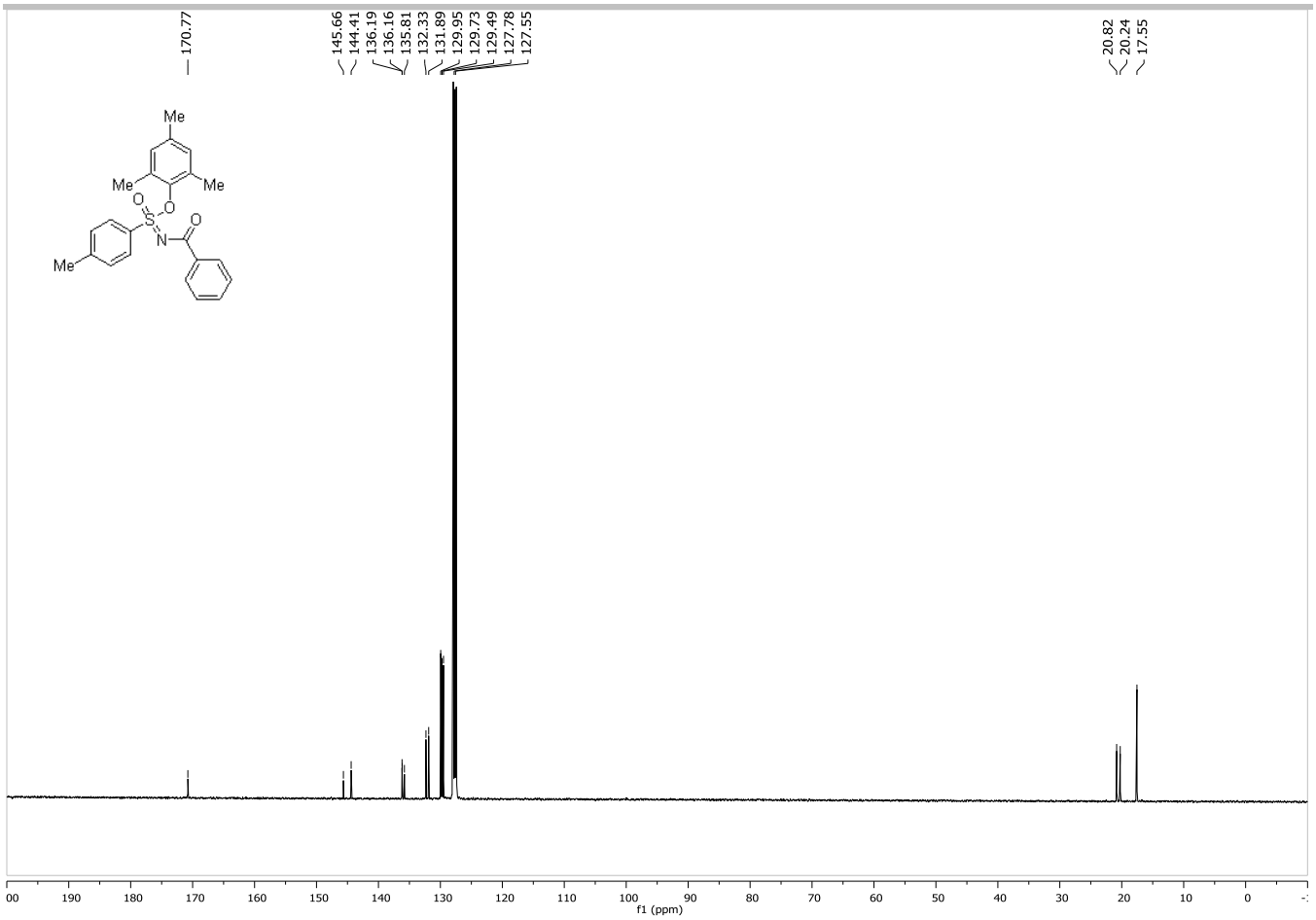


SUPPORTING INFORMATION

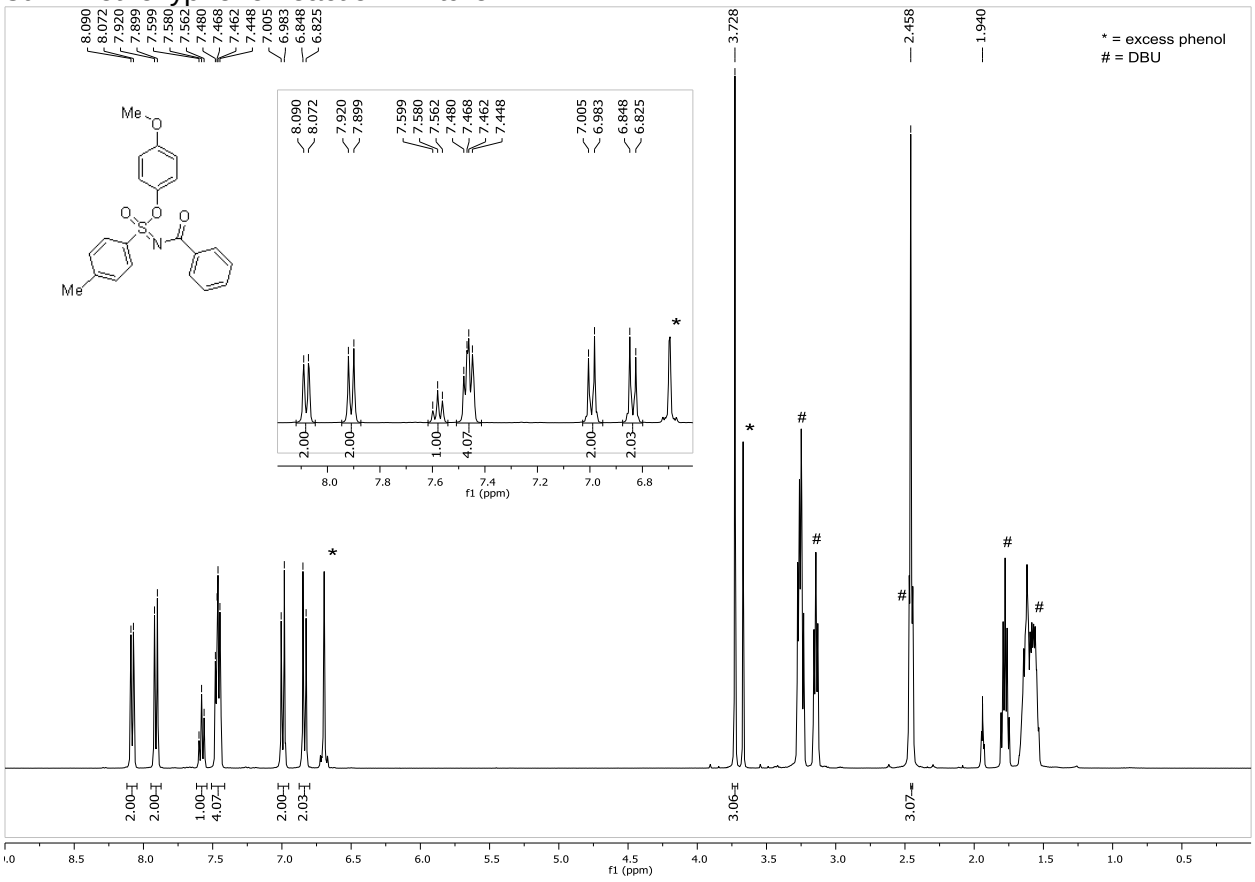
3c 2,4,6-trimethylphenol isolated product

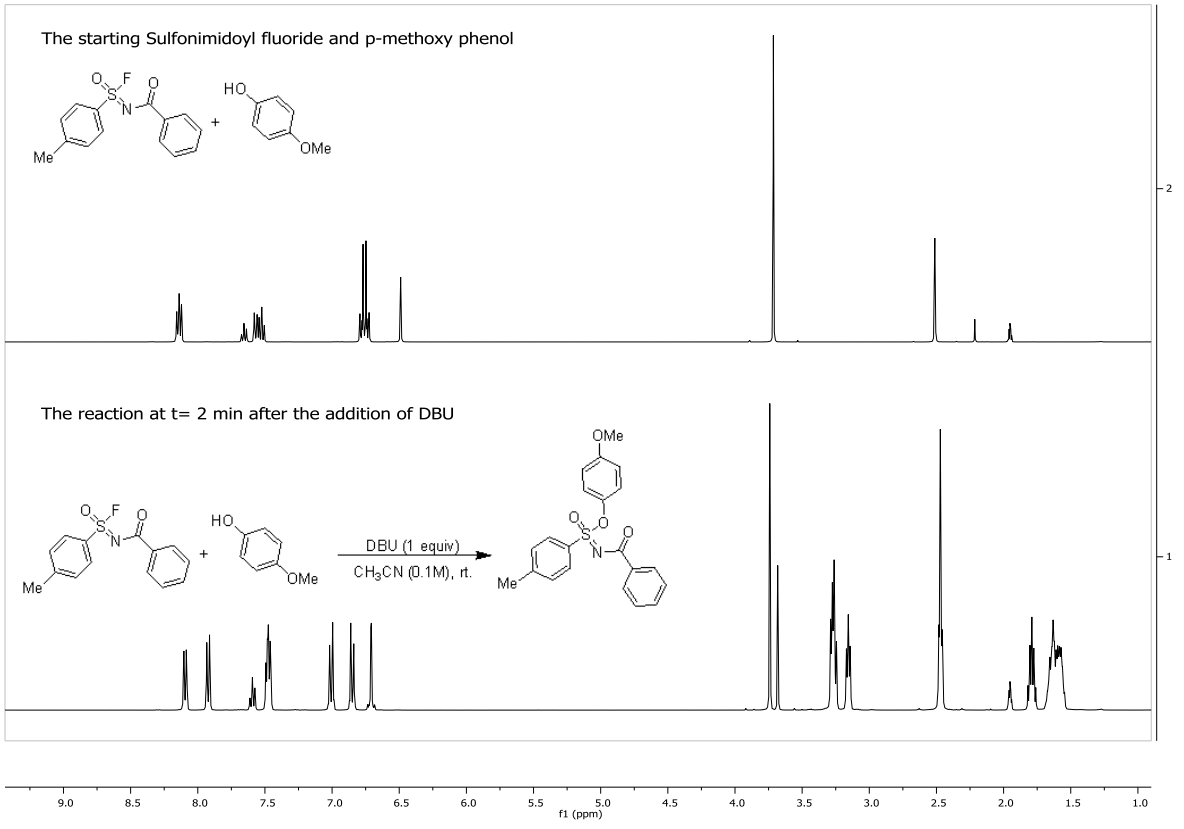





170.77
145.66
144.41
136.19
136.16
135.81
132.33
131.89
129.95
129.73
129.49
127.78
127.55
20.82
20.24
17.55
Me
Me
Me
Me
O
O
S
N
O
f1 (ppm)

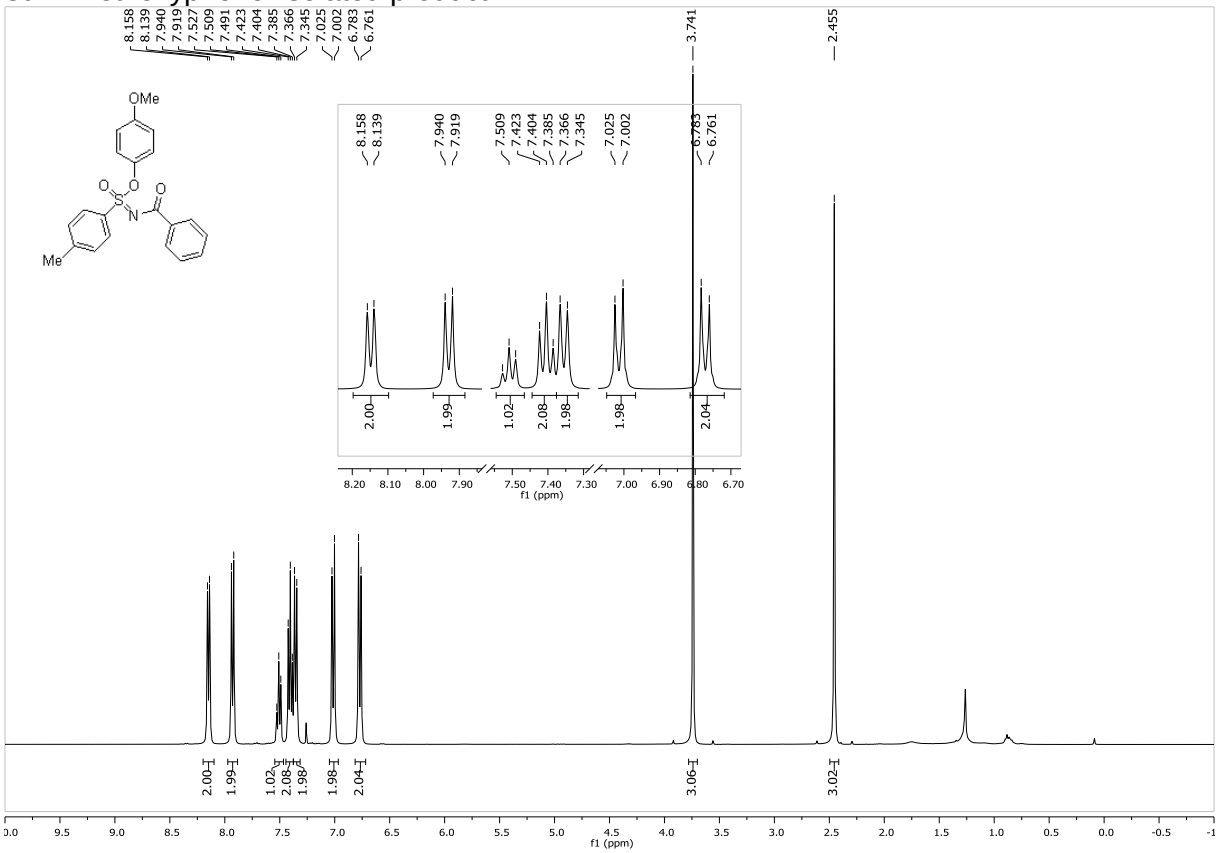
3d 4-methoxyphenol reaction mixture

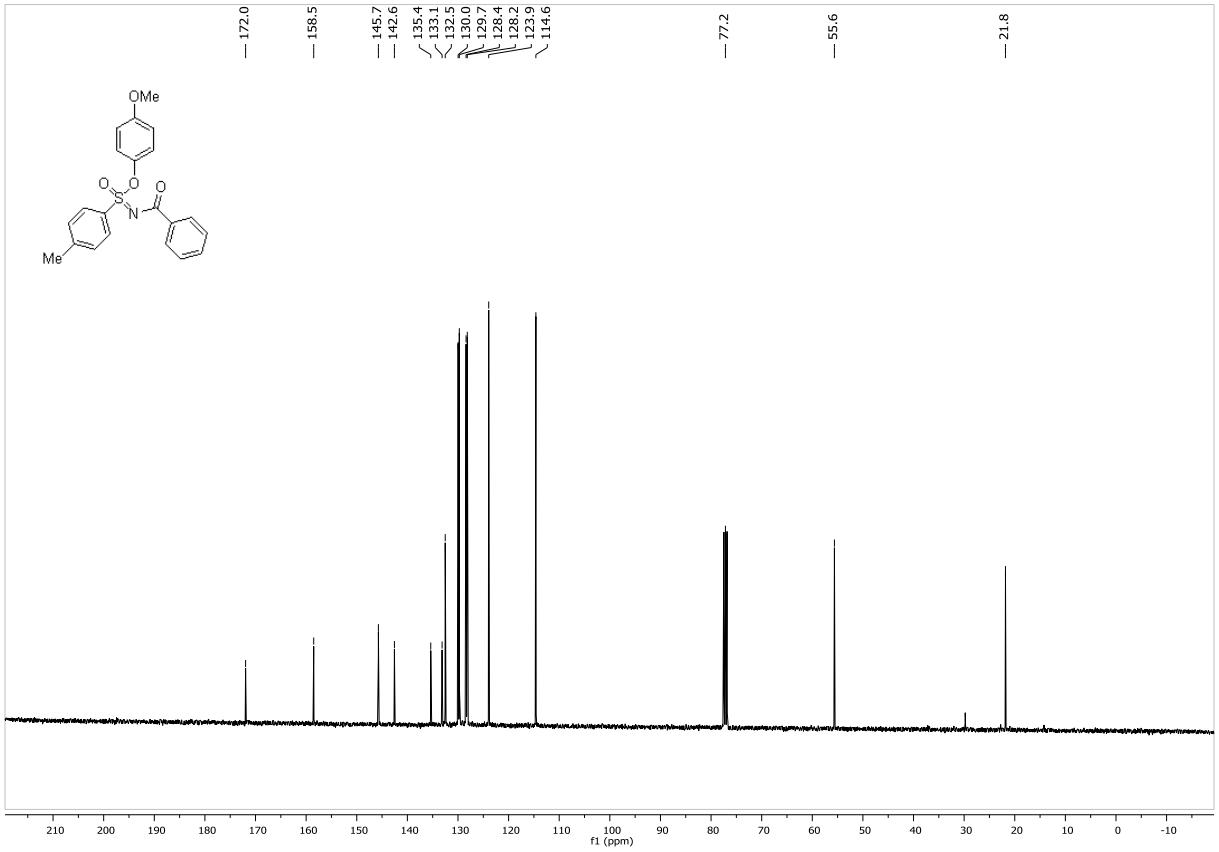




SUPPORTING INFORMATION

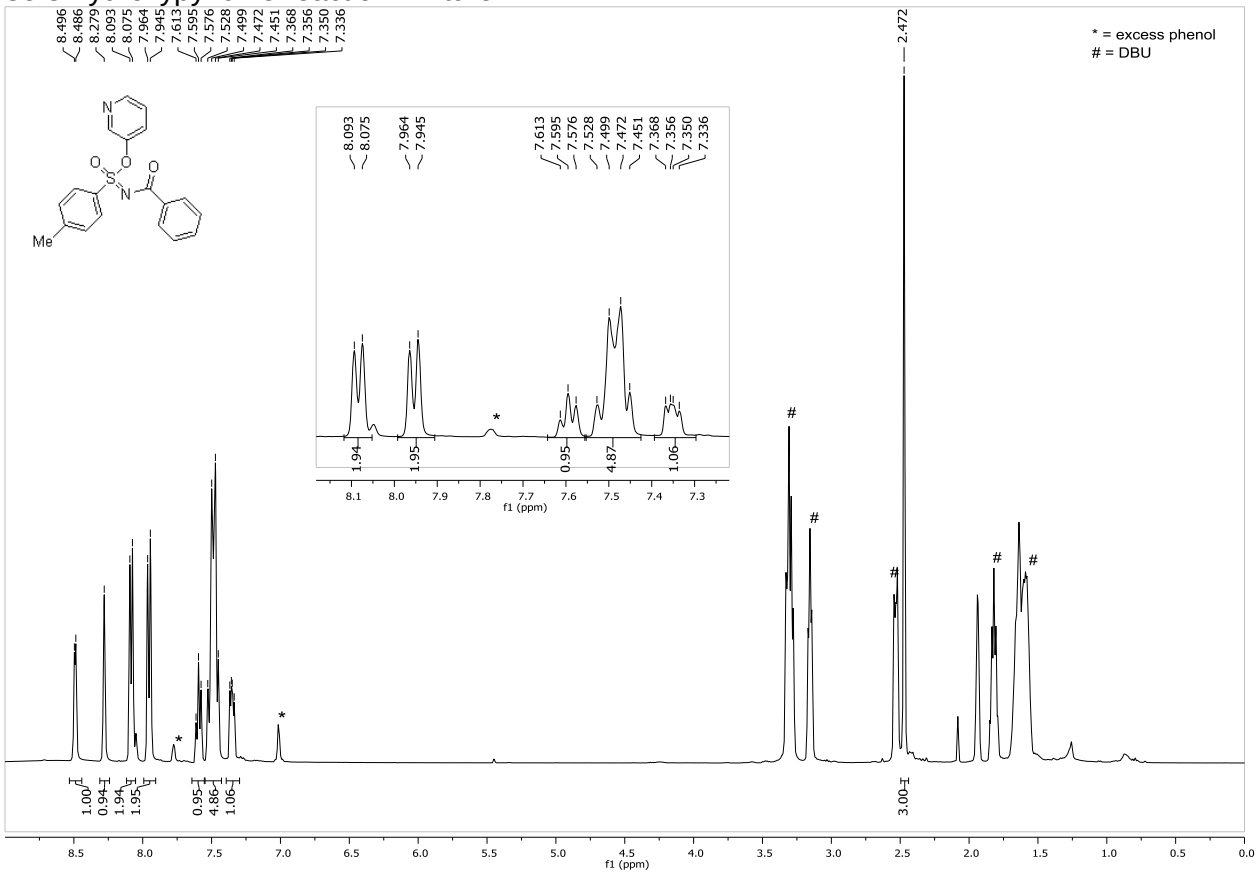
3d 4-methoxyphenol isolated product

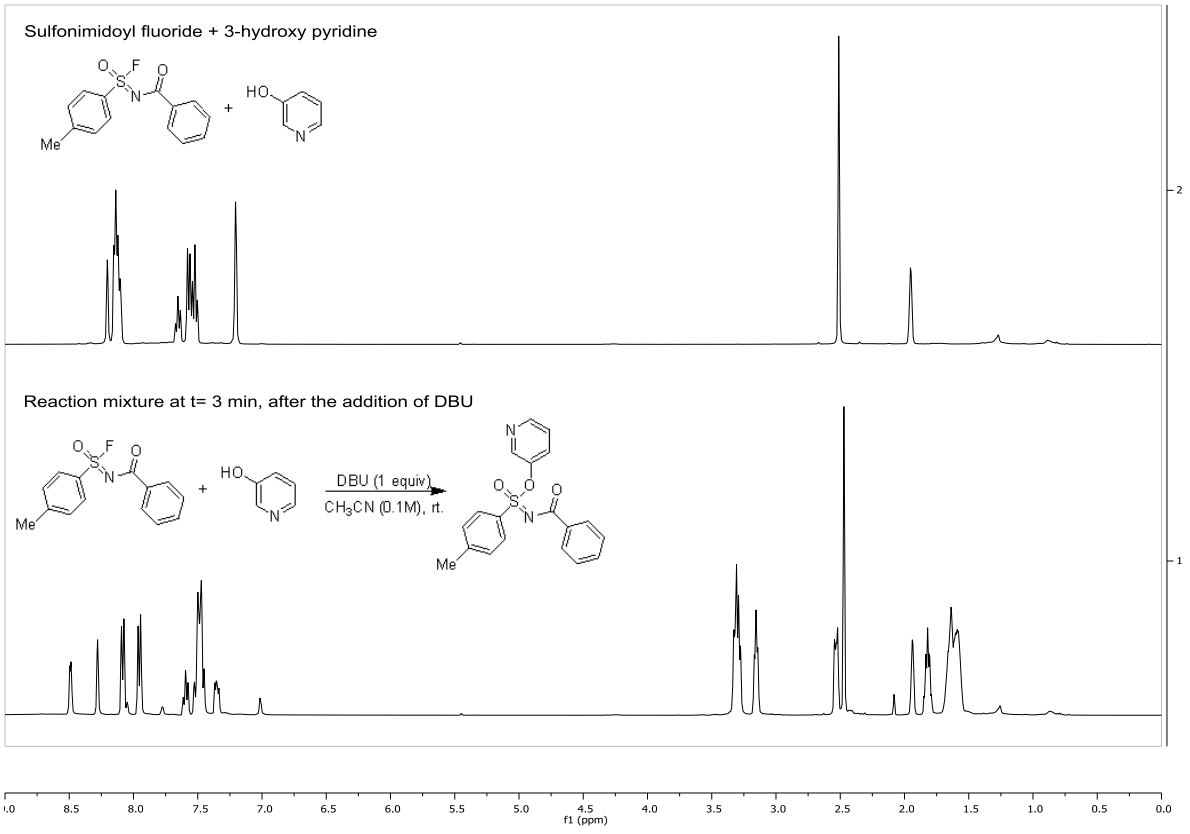




SUPPORTING INFORMATION

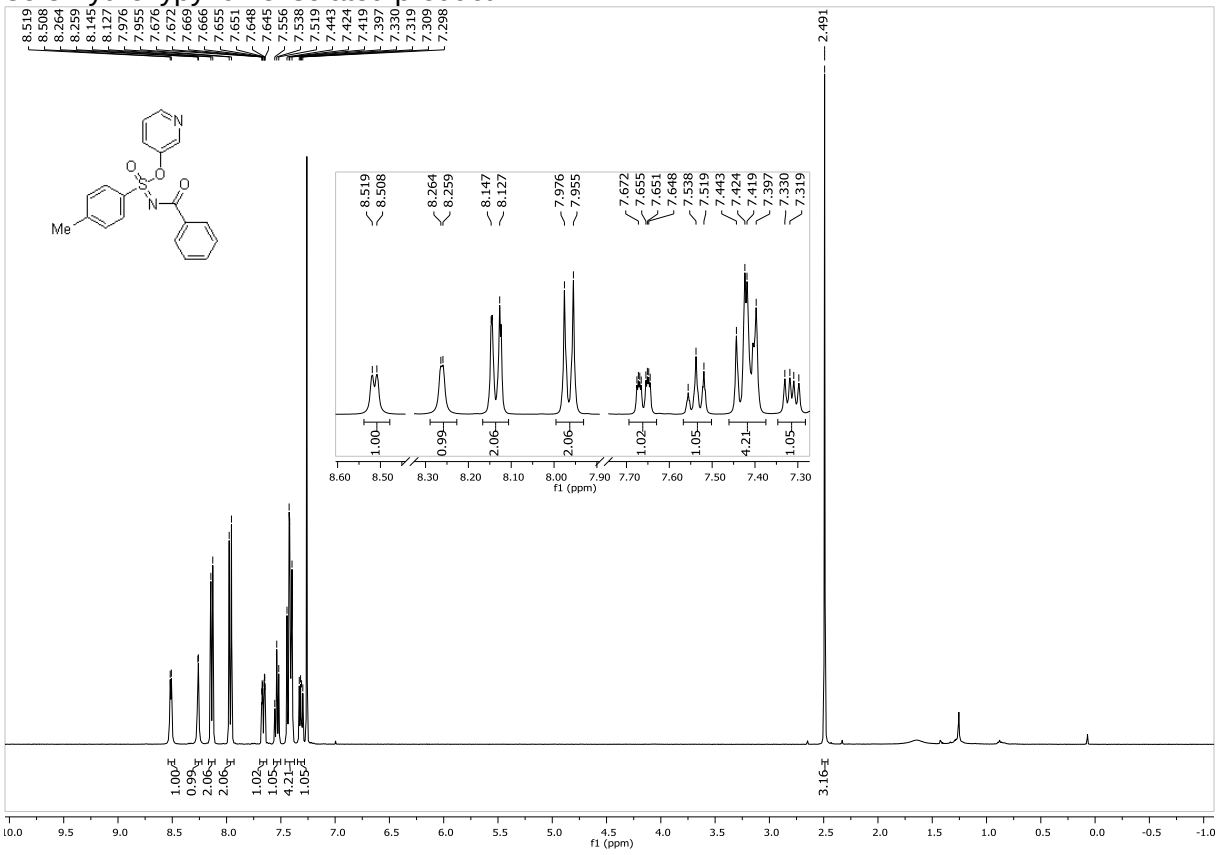
3e 3-hydroxypyridine reaction mixture

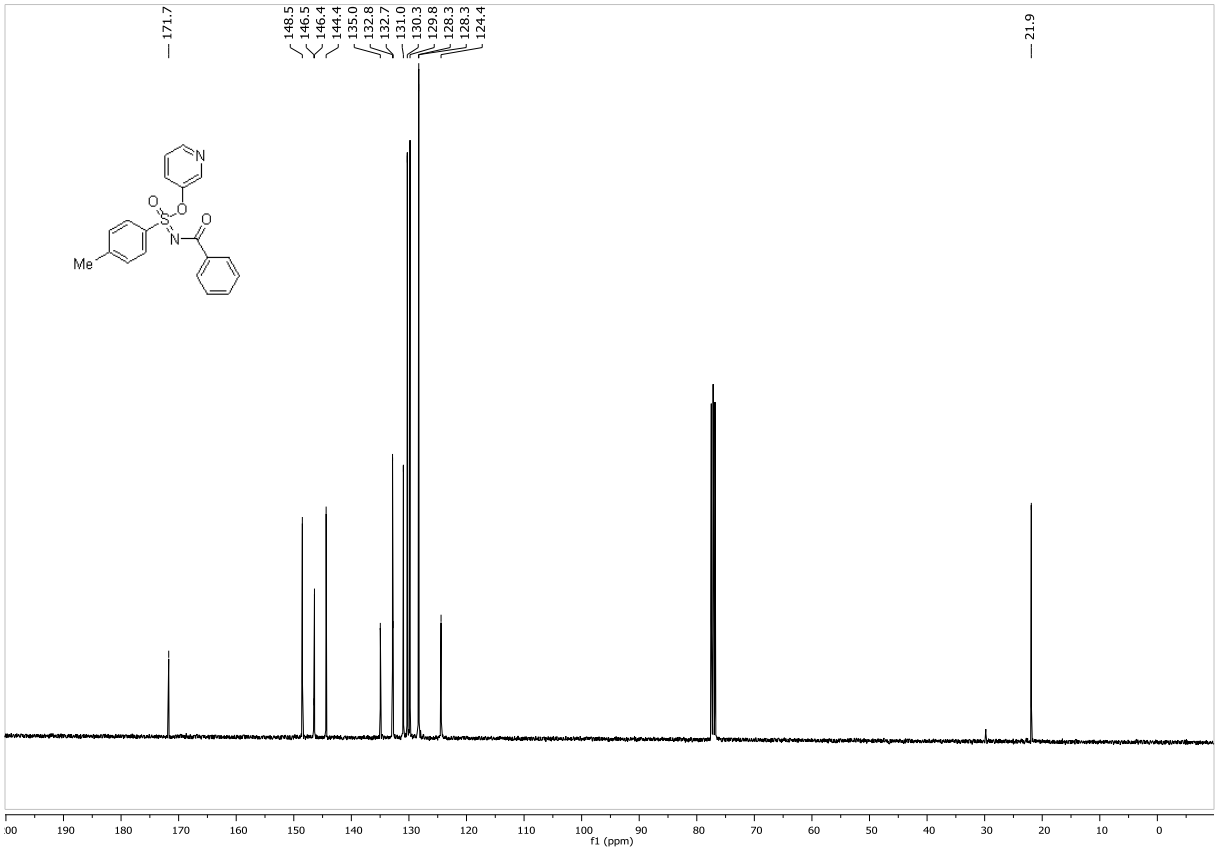




SUPPORTING INFORMATION

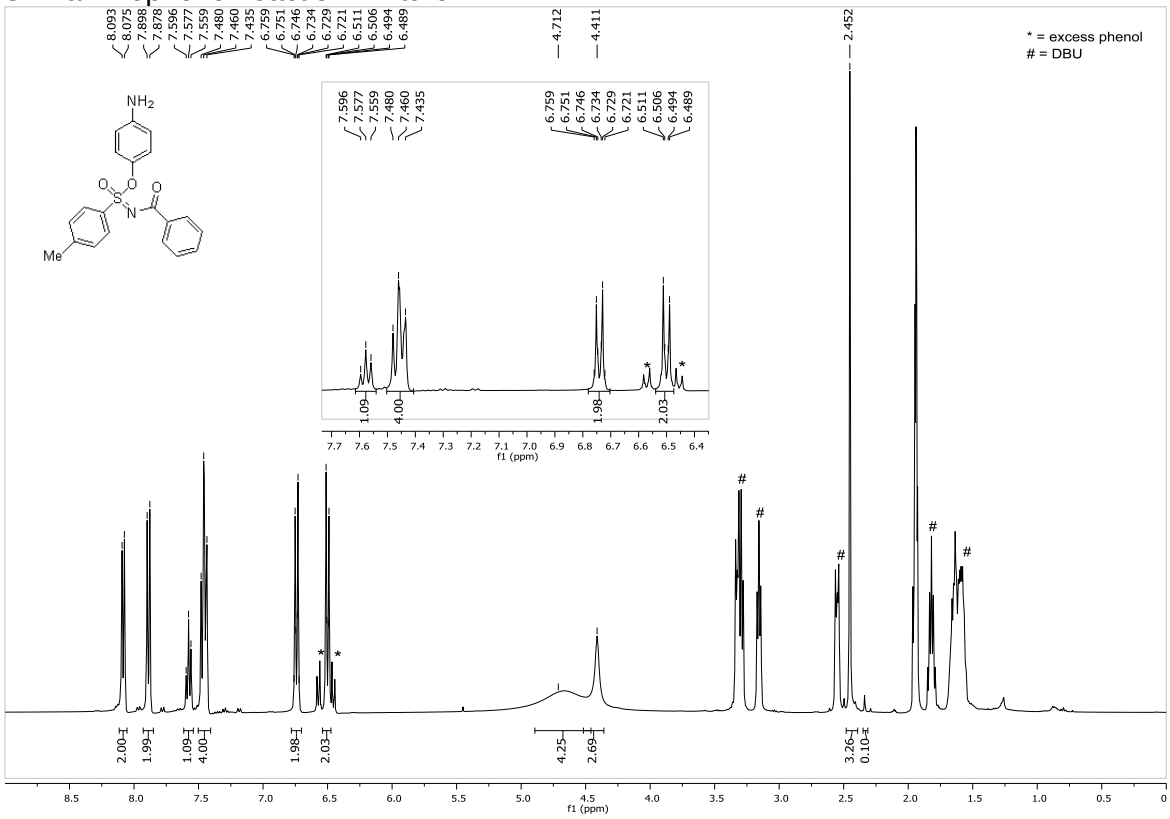
3e 3-hydroxypyridine isolated product

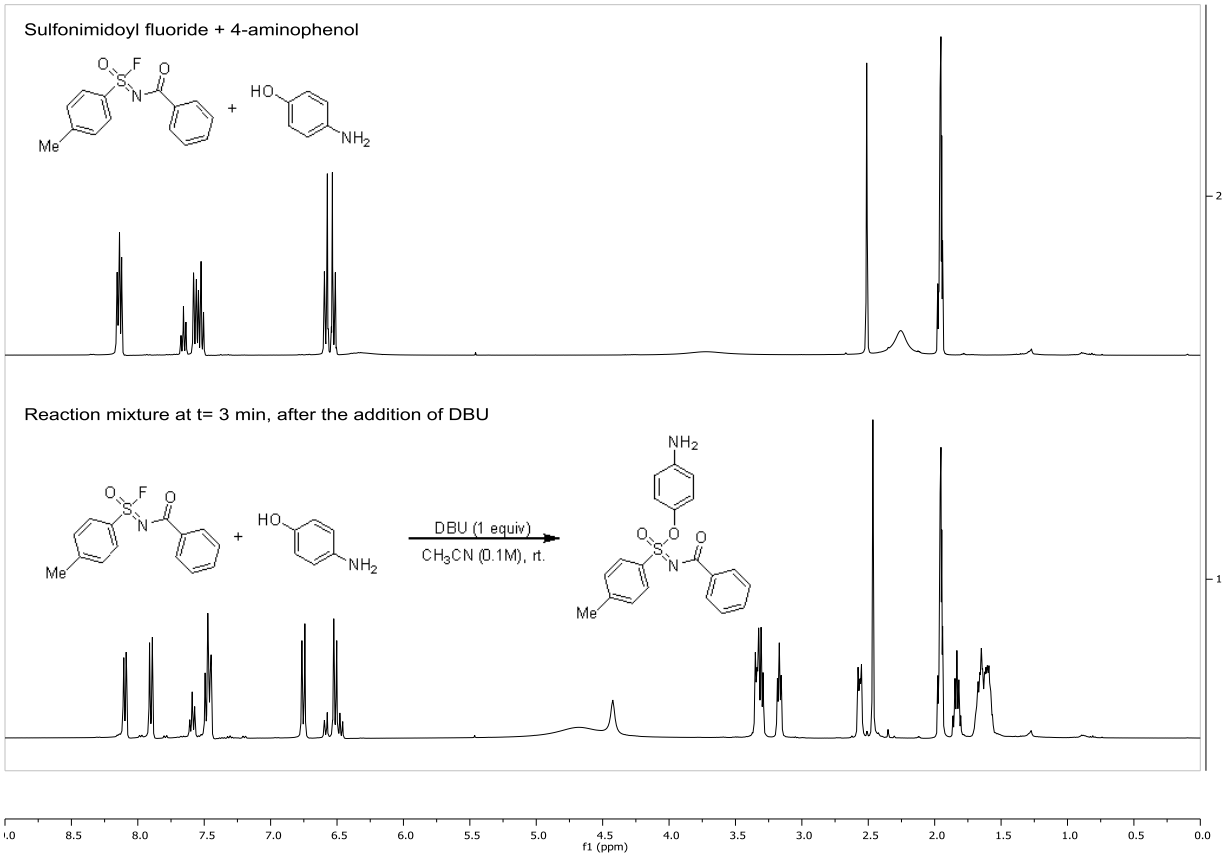




SUPPORTING INFORMATION

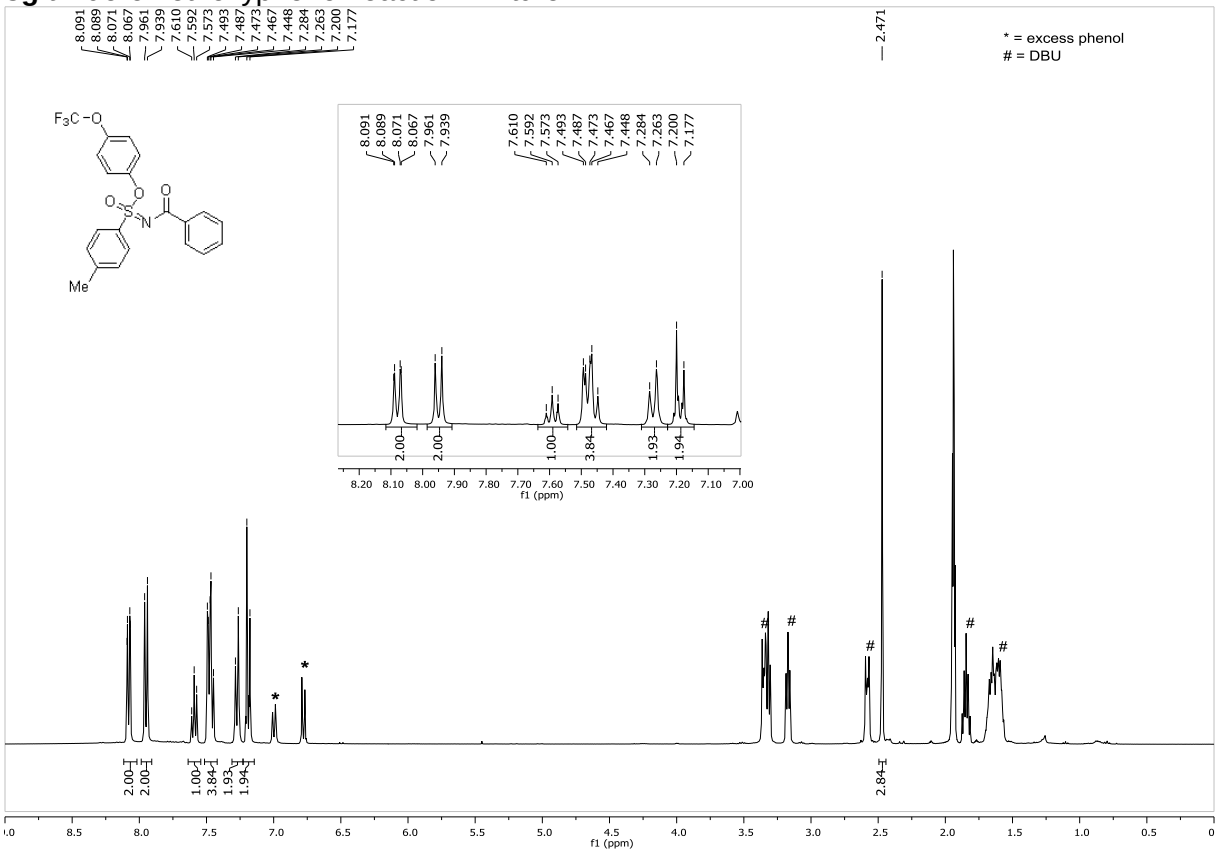
3f 4-aminophenol reaction mixture

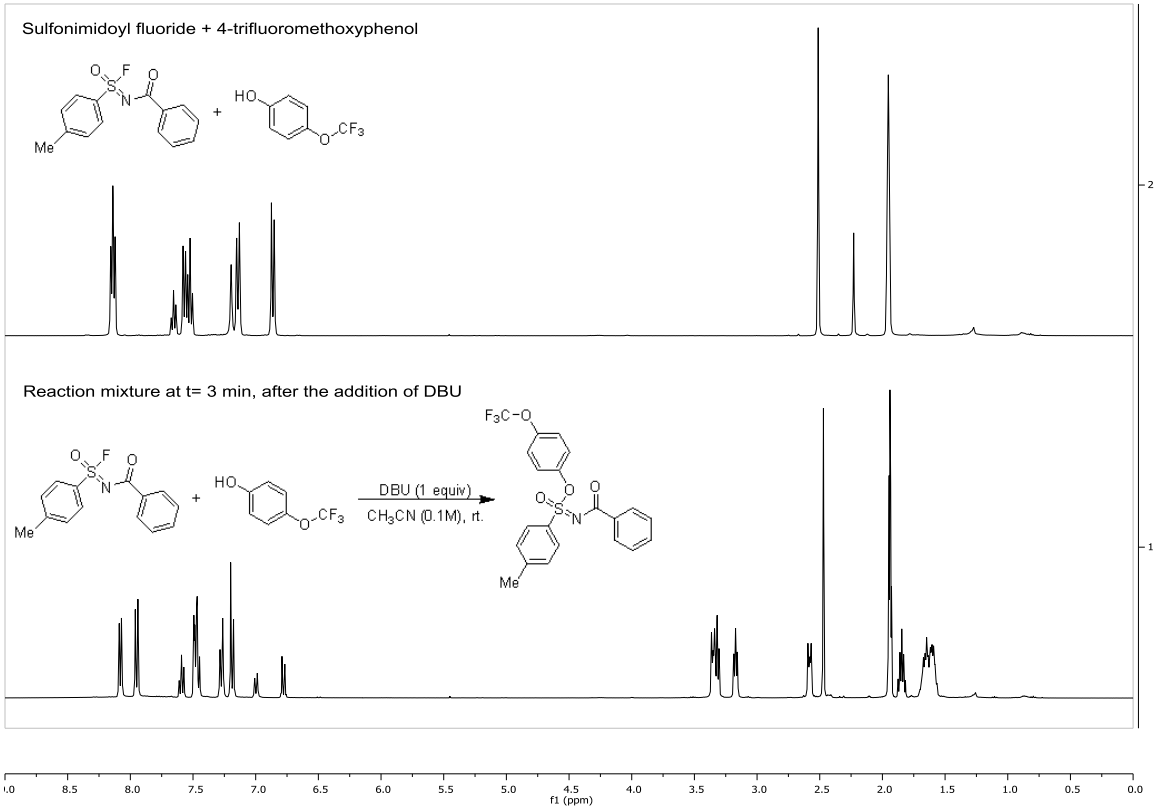




SUPPORTING INFORMATION

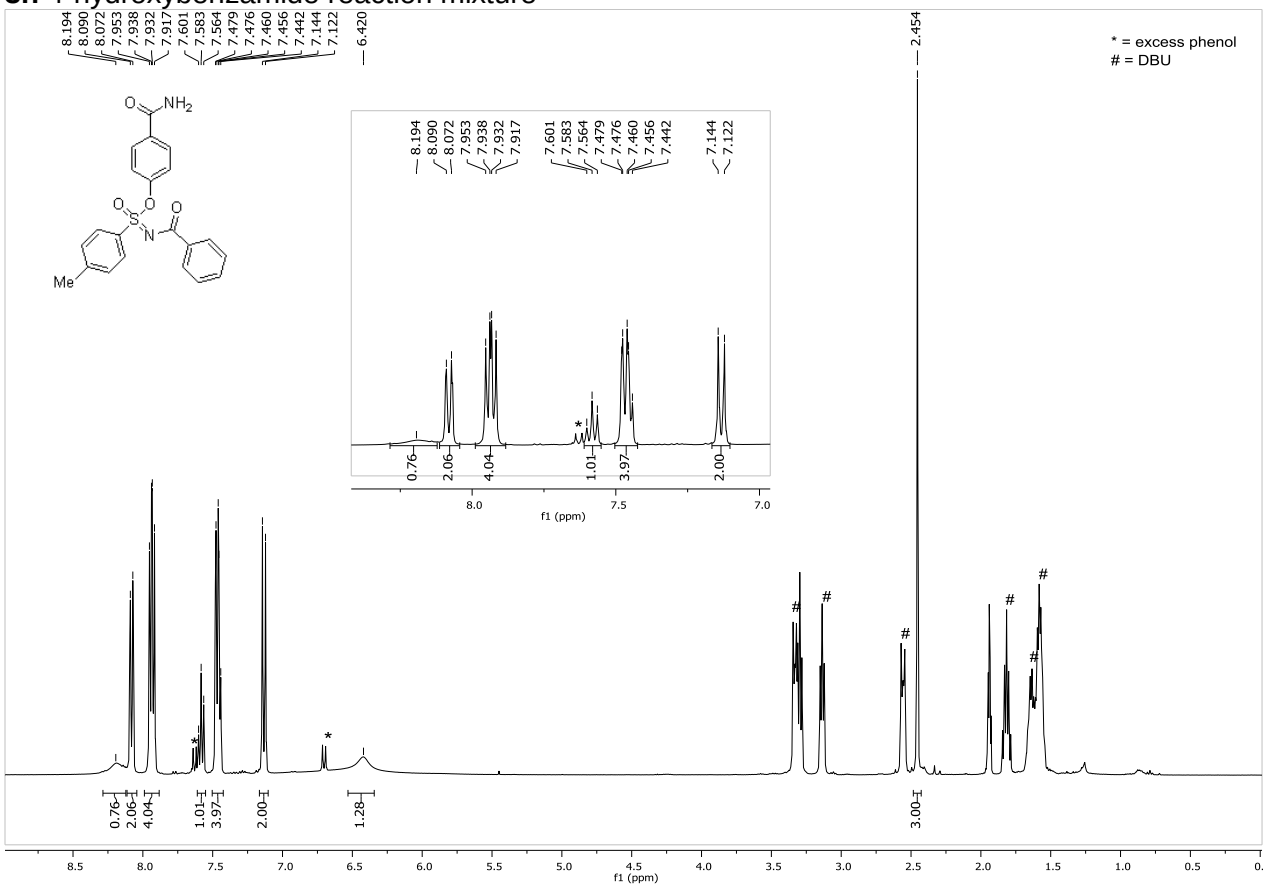
3g trifluoromethoxyphenol reaction mixture



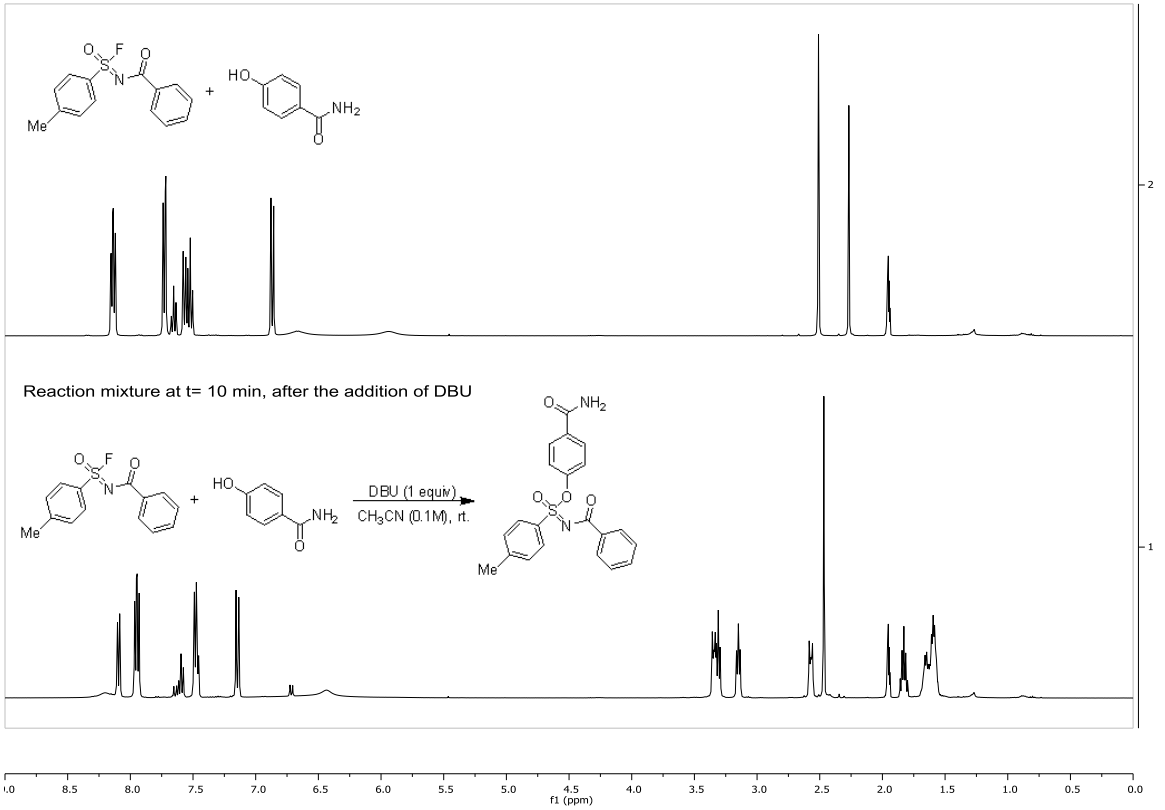


SUPPORTING INFORMATION

3h 4-hydroxybenzamide reaction mixture



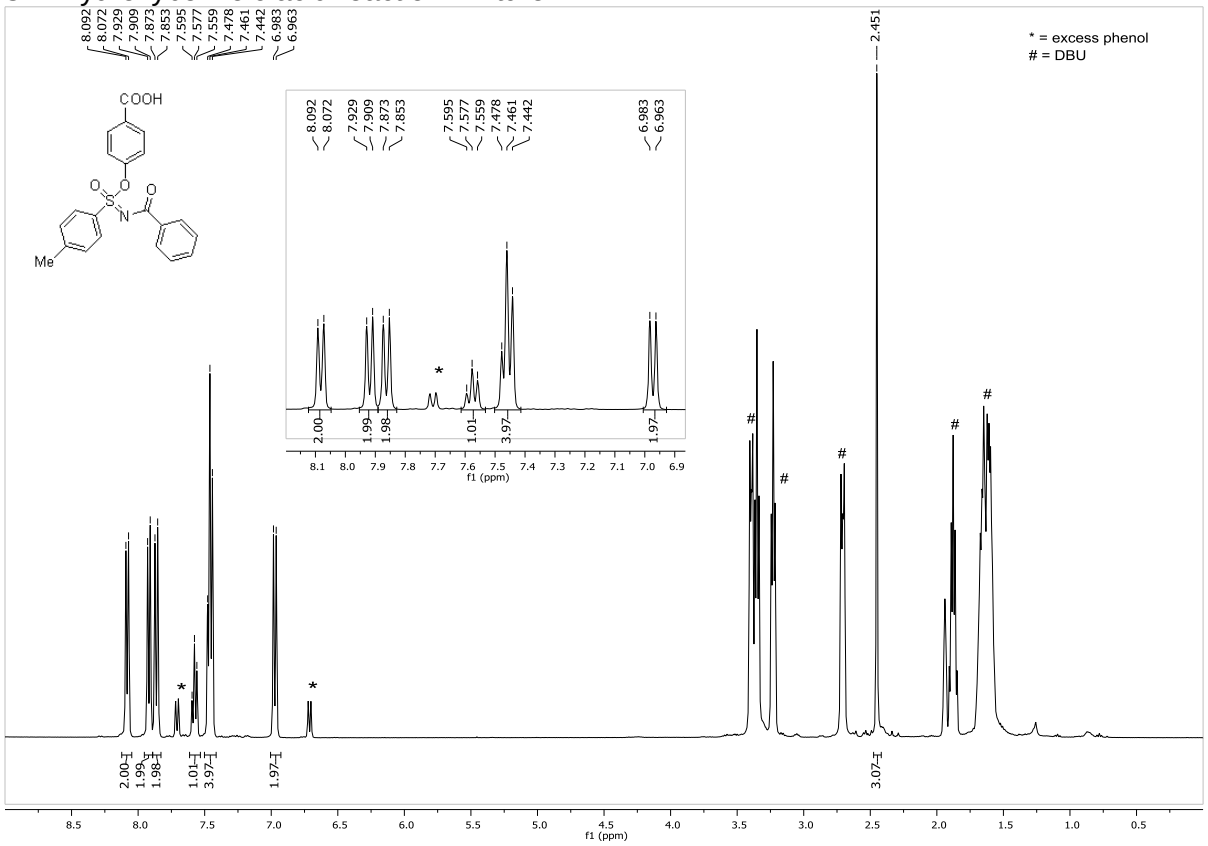
Sulfonimidoyl fluoride + p-hydroxybenzamide

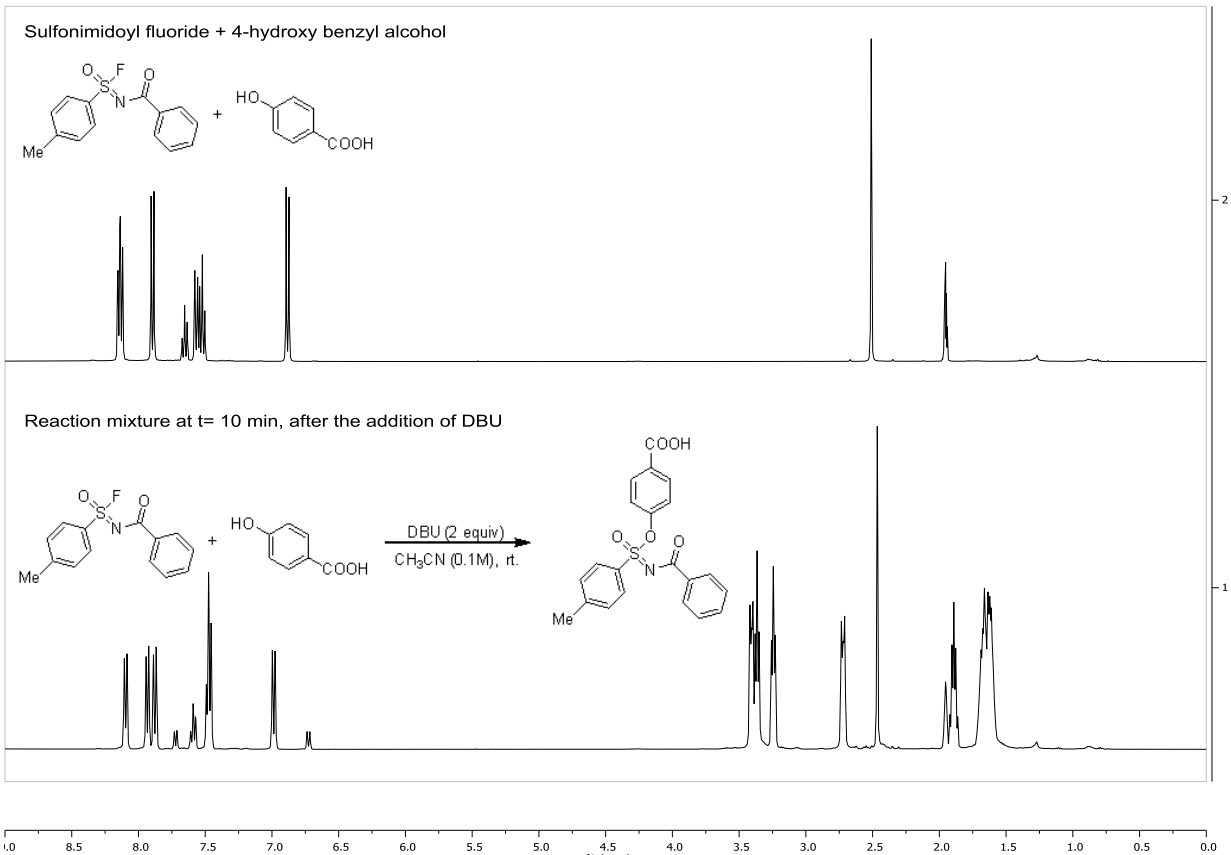


Reaction mixture at t= 10 min, after the addition of DBU

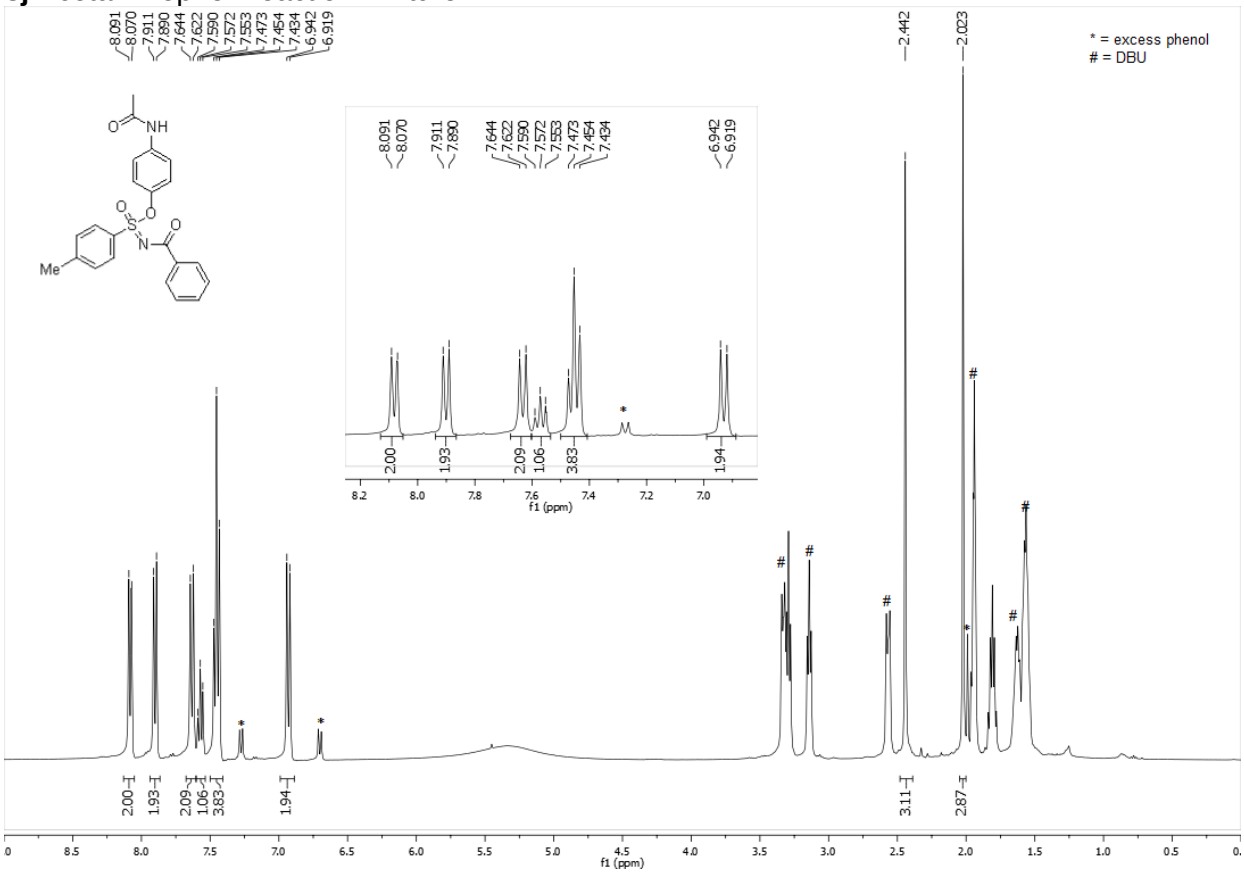
SUPPORTING INFORMATION

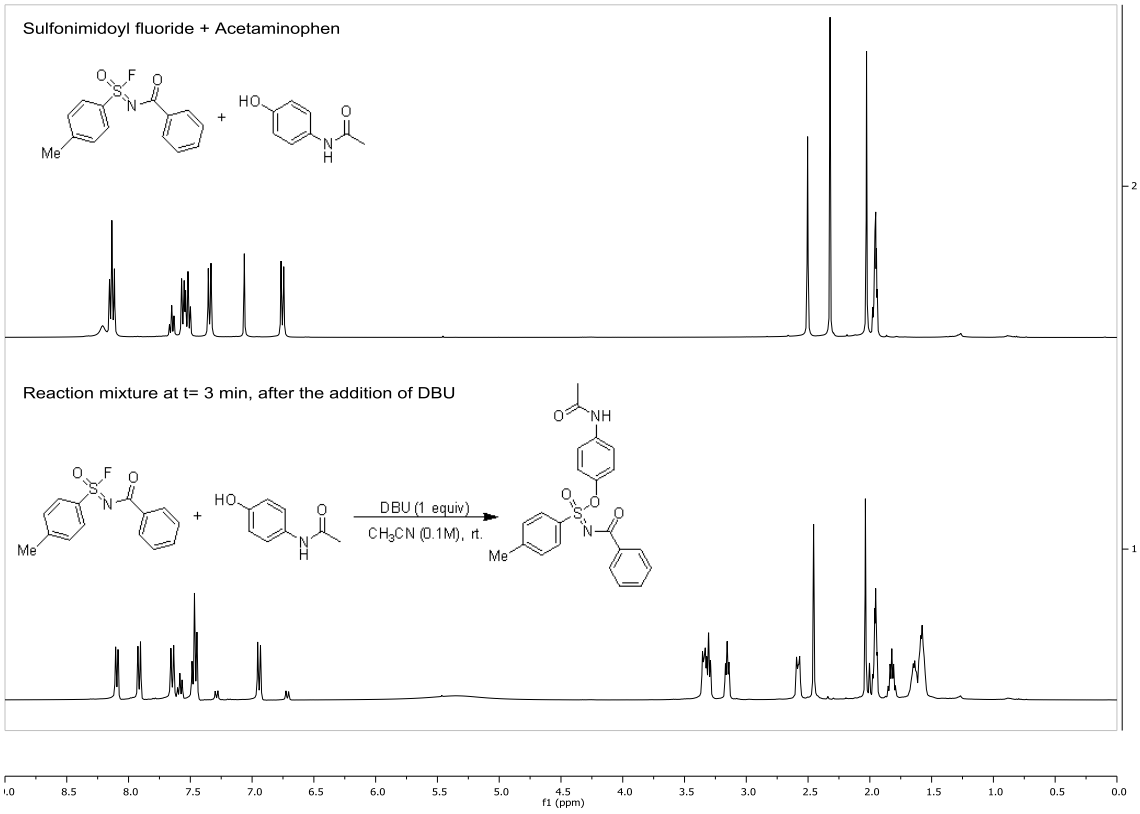
3i 4-hydroxybenzoic acid reaction mixture





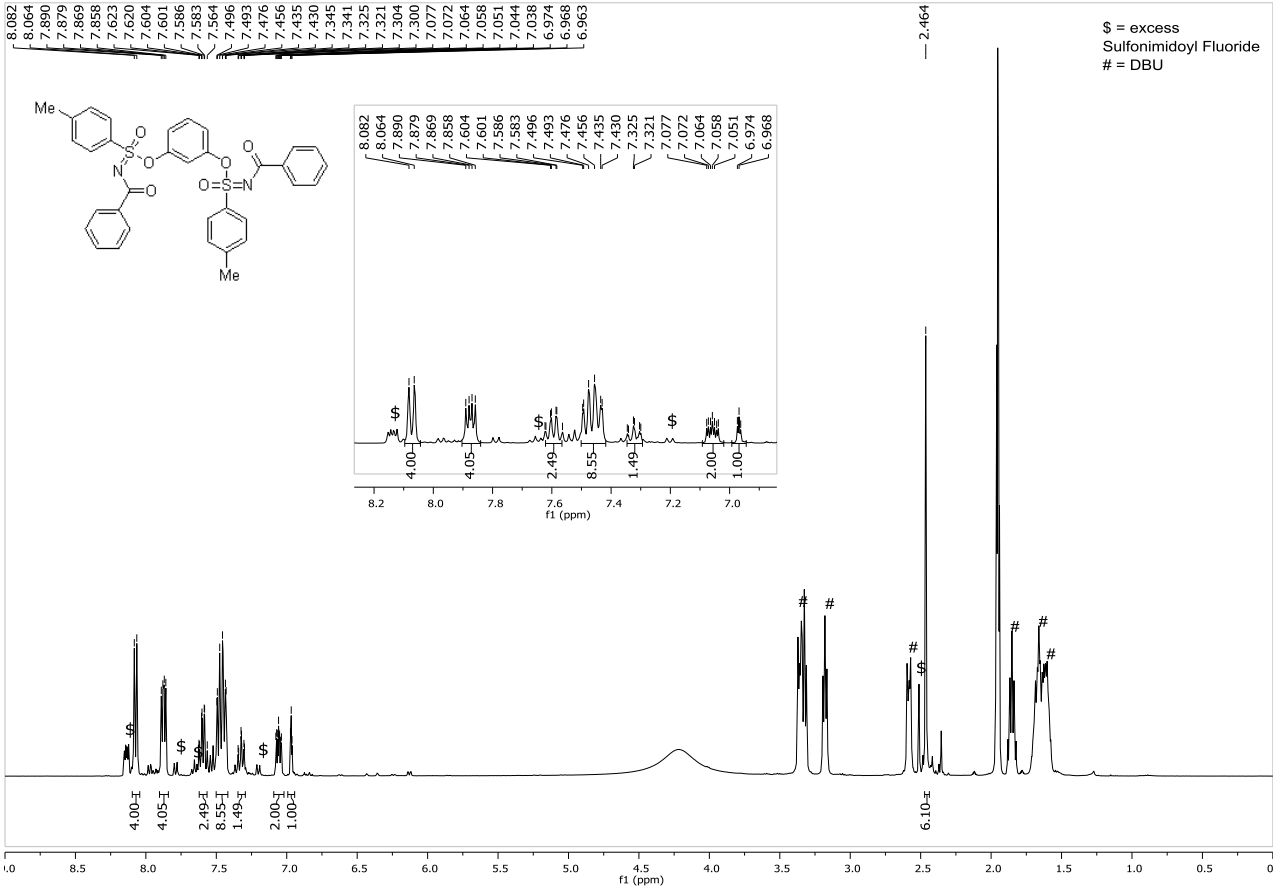
3j Acetaminophen reaction mixture

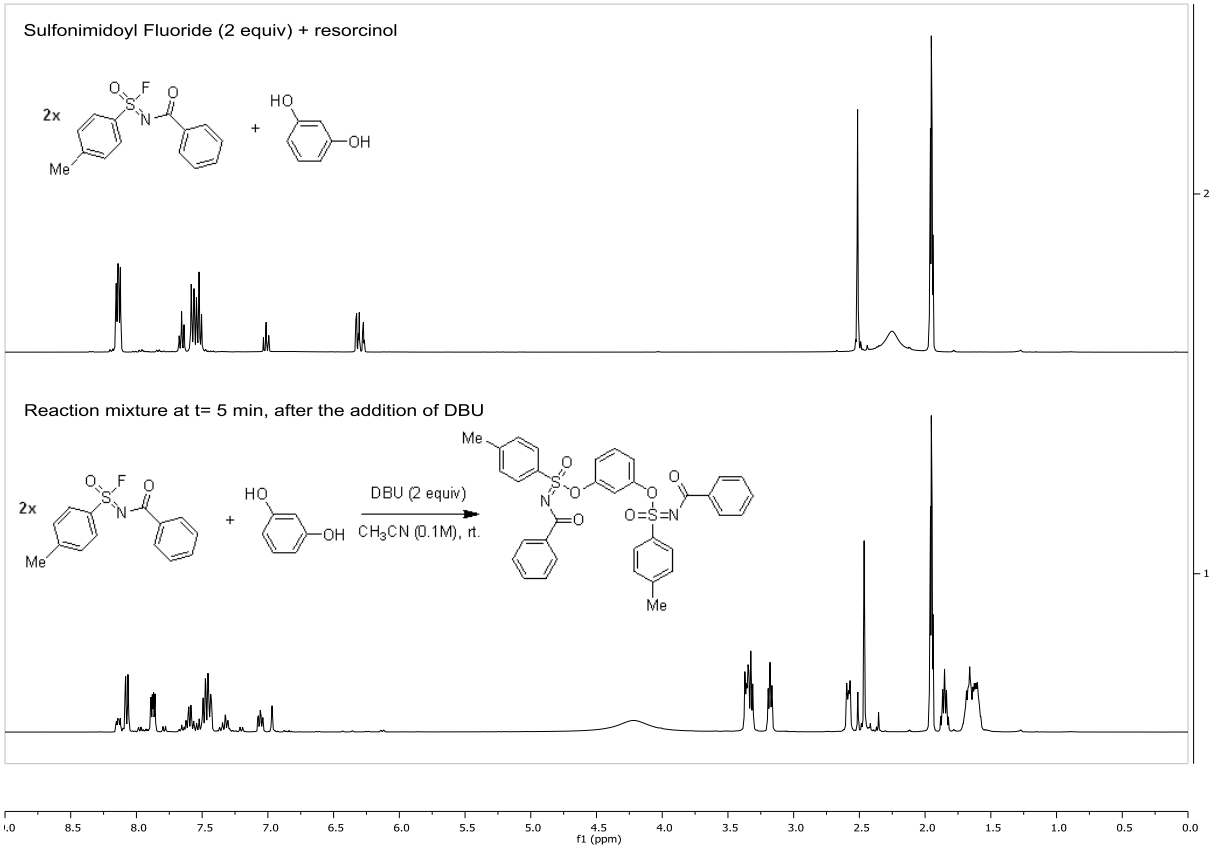




SUPPORTING INFORMATION

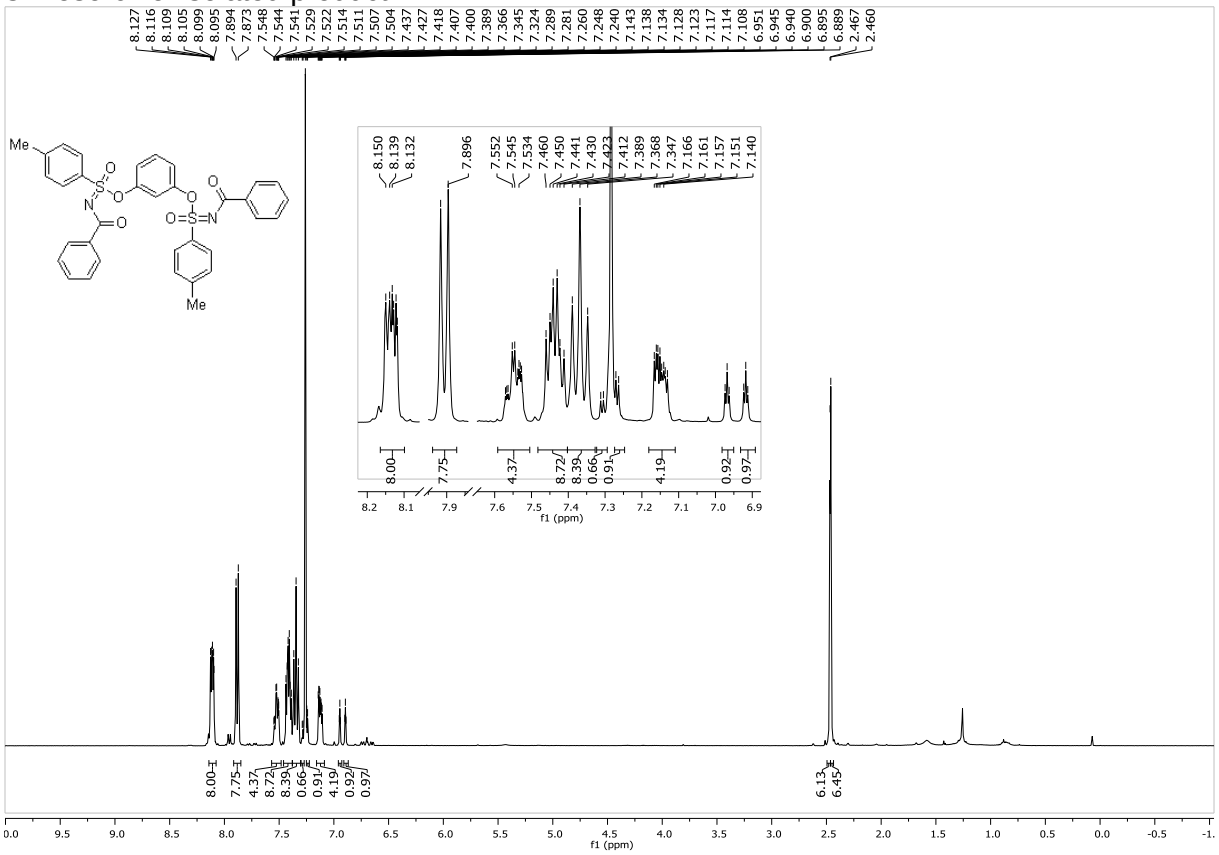
3k resorcinol reaction mixture

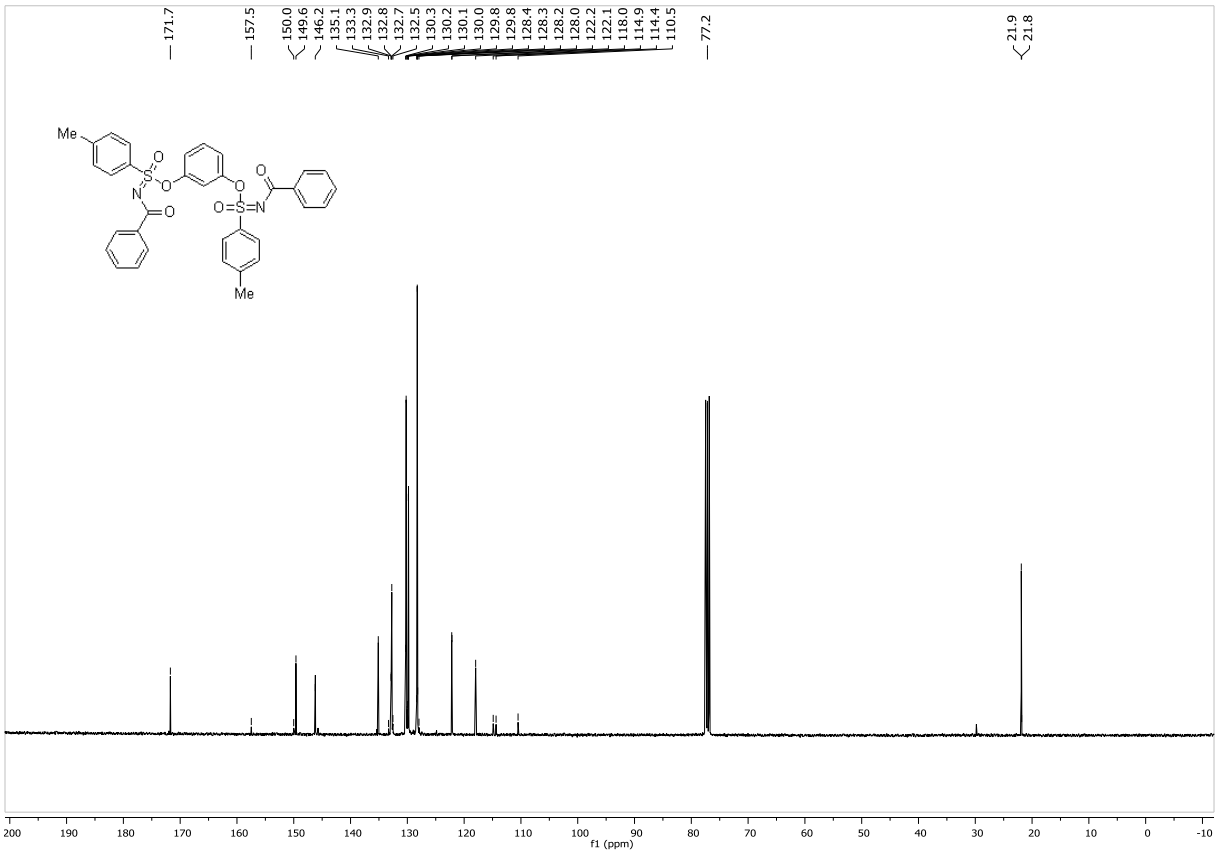




SUPPORTING INFORMATION

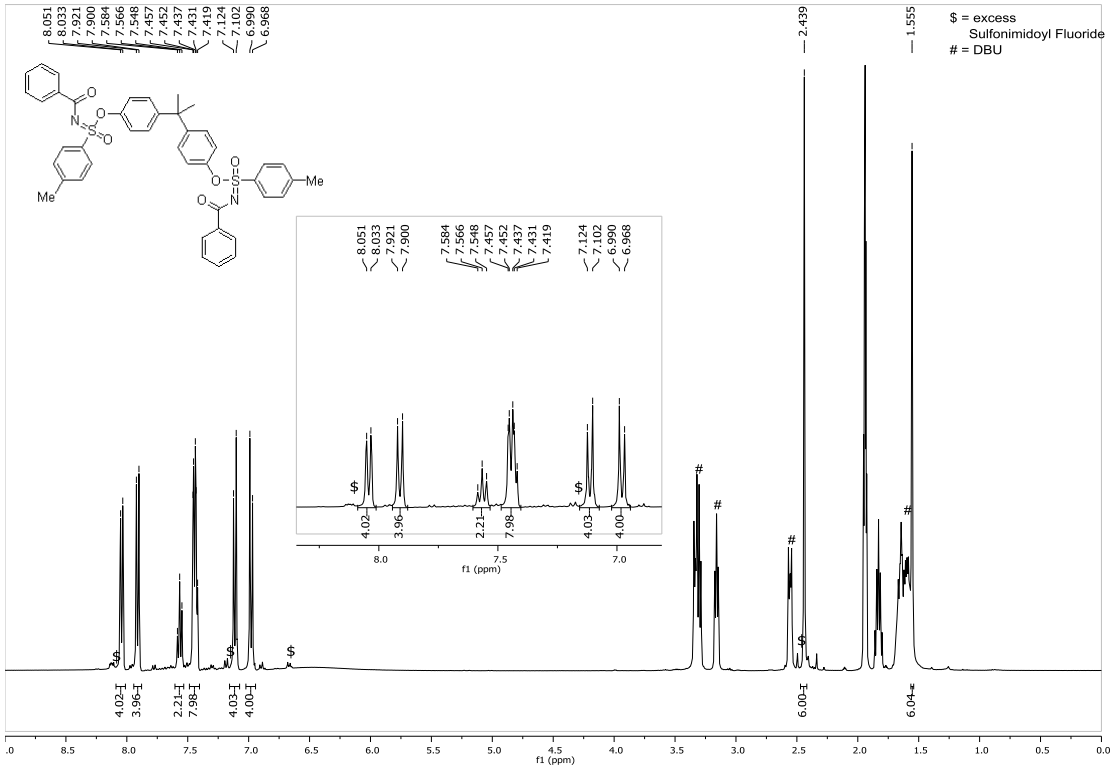
3k resorcinol isolated product

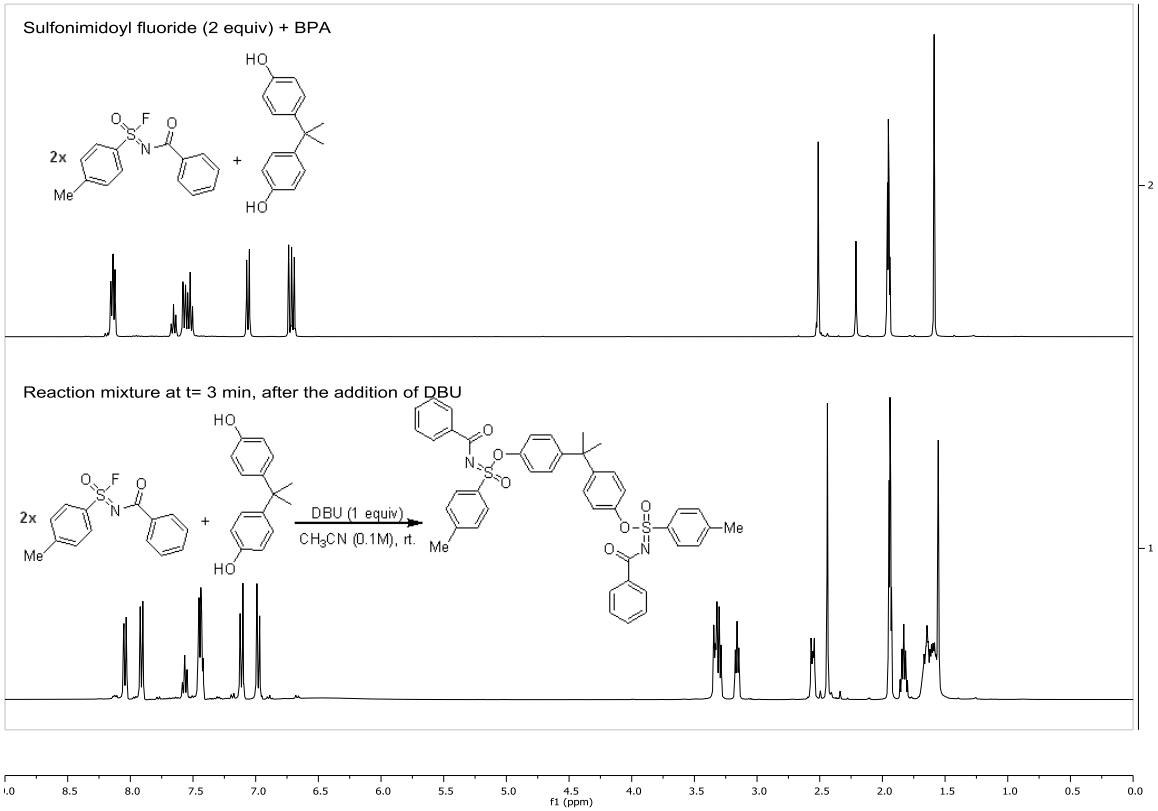




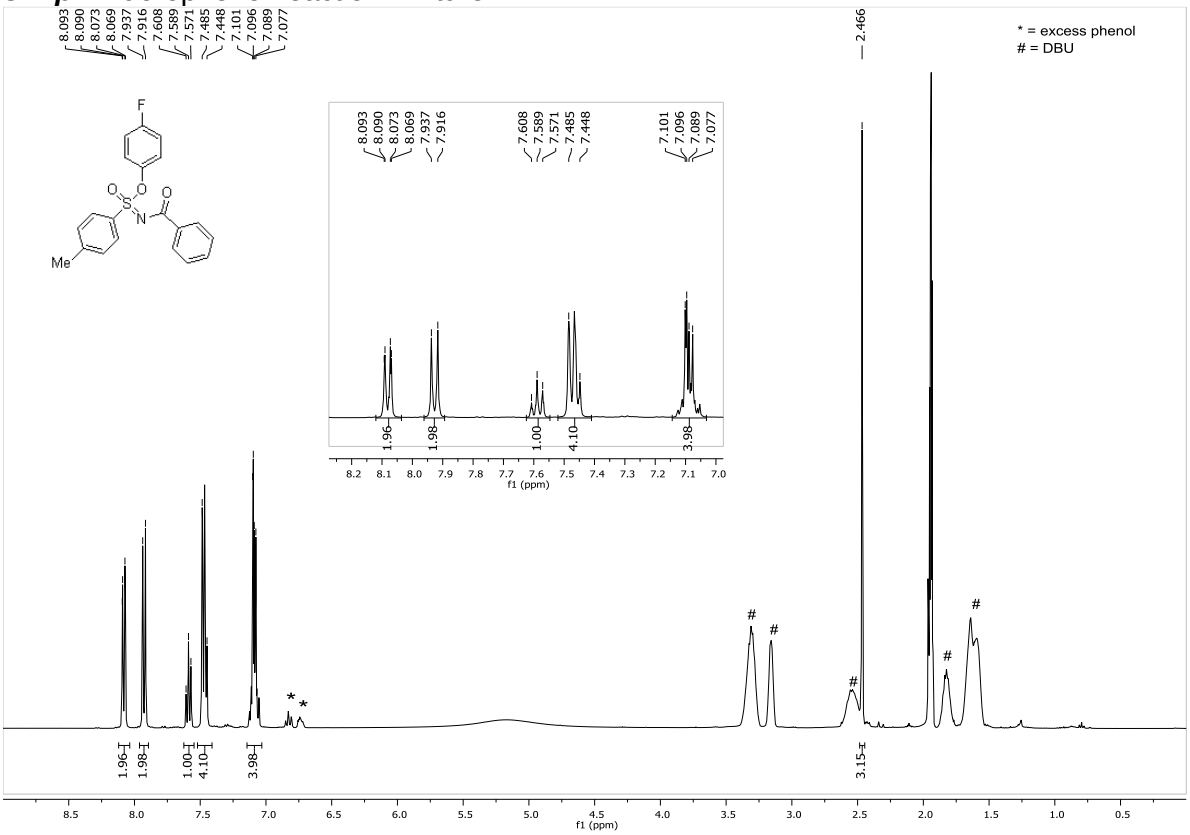
SUPPORTING INFORMATION

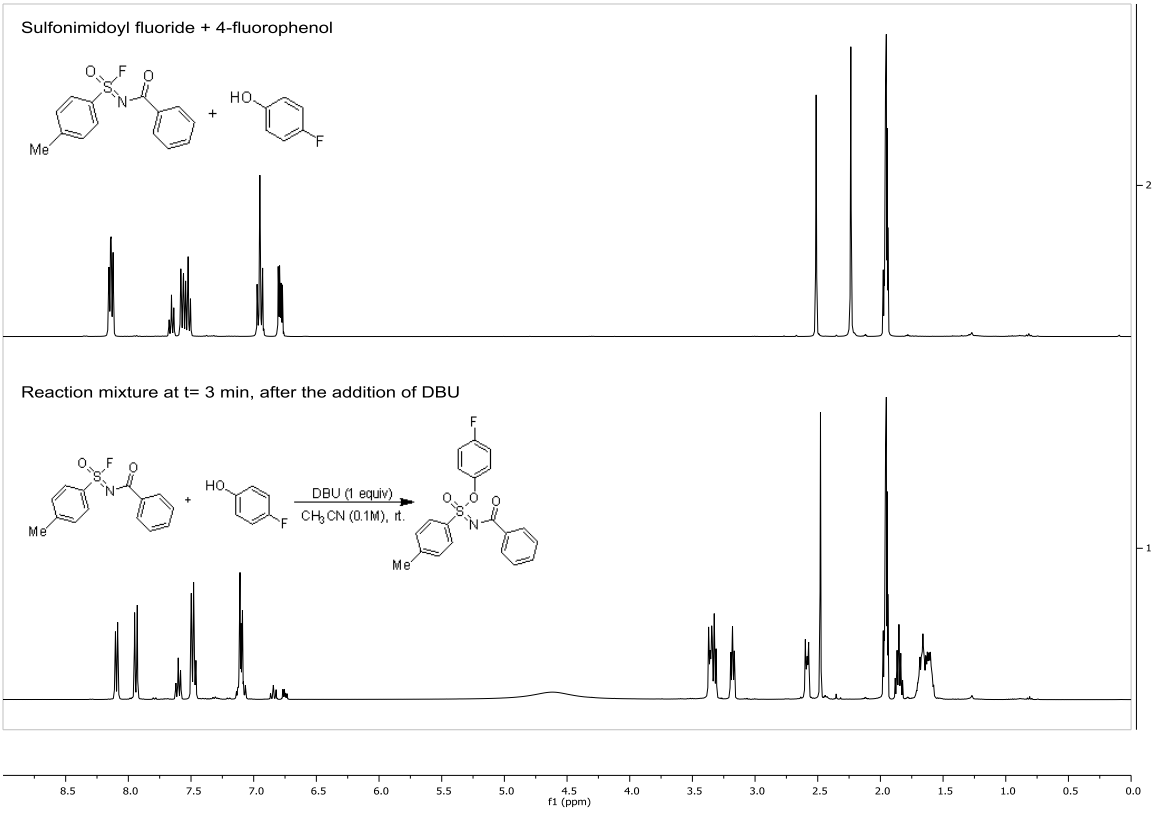
3l BPA reaction mixture





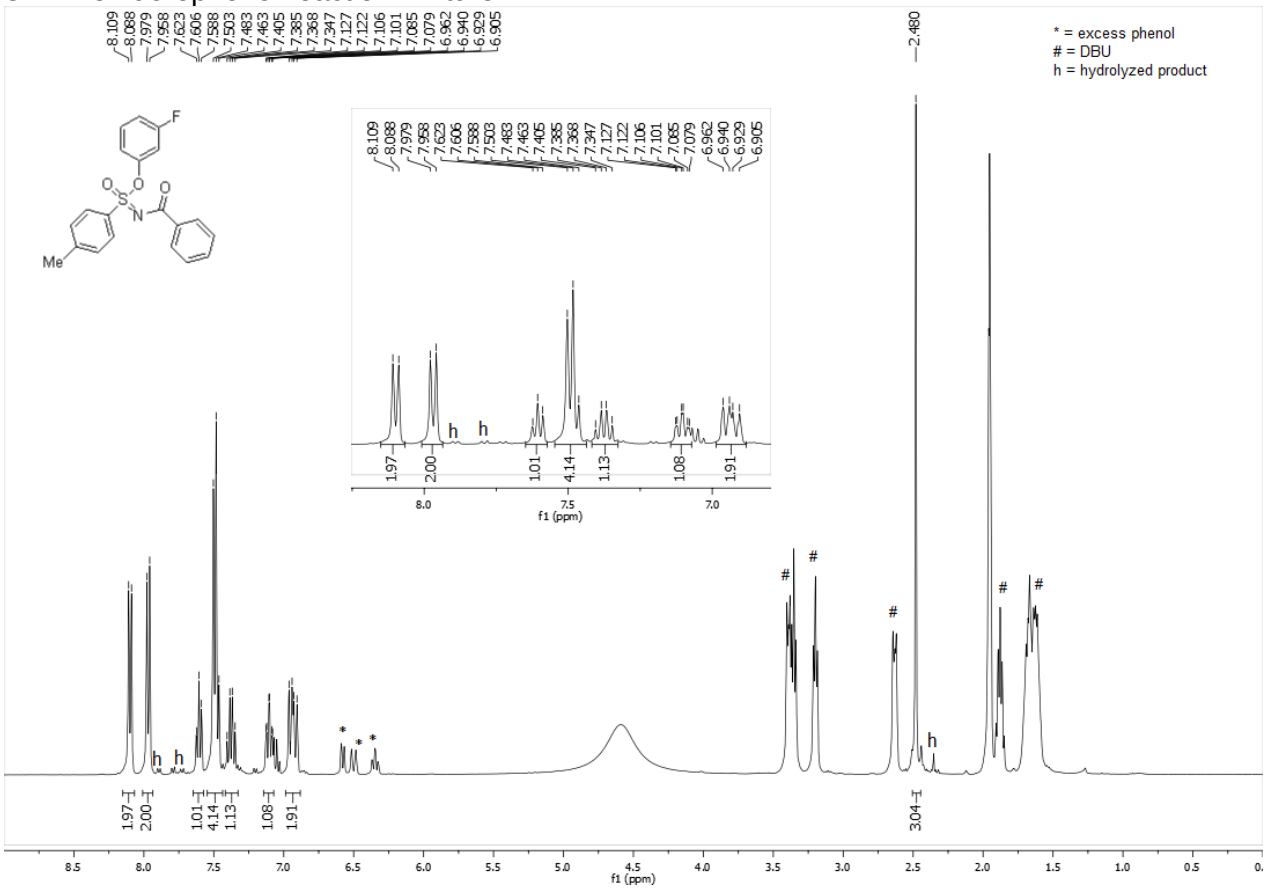
3m-*p* 4-fluorophenol reaction mixture

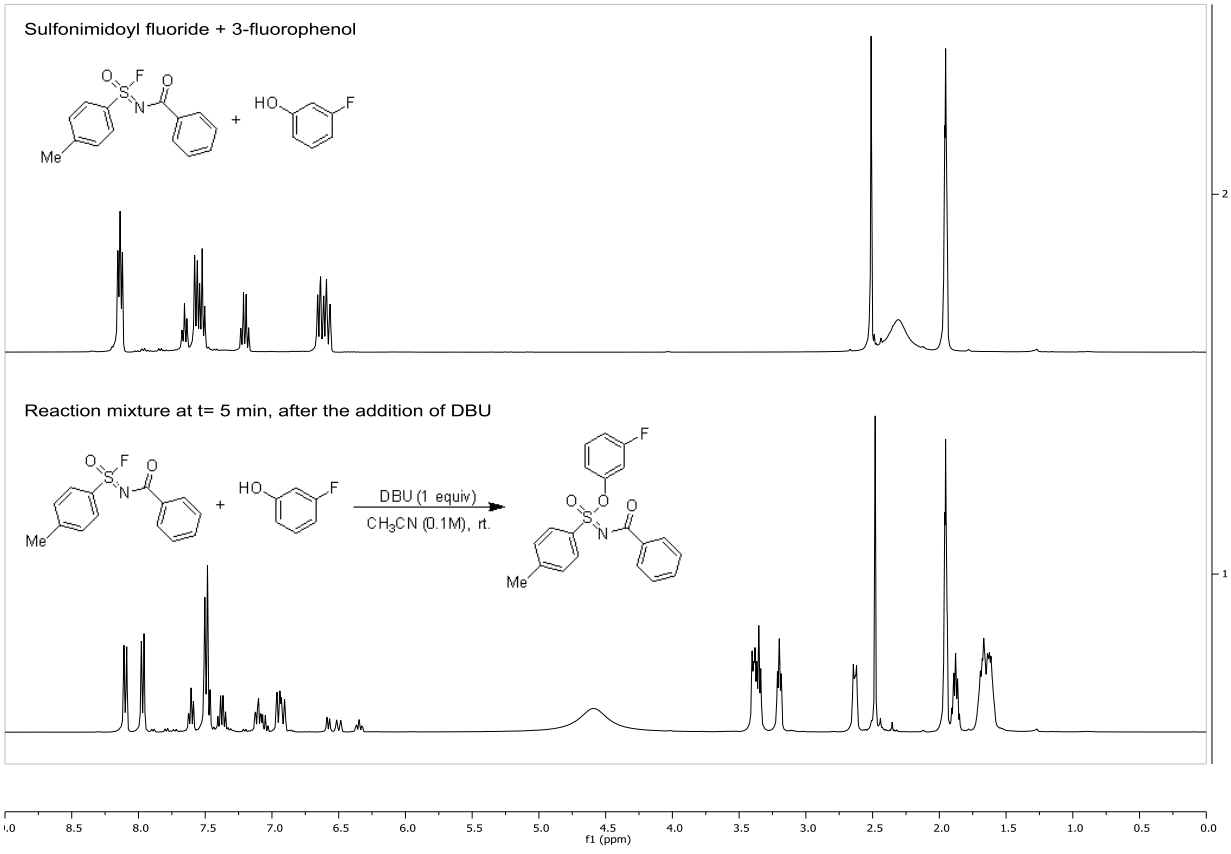




SUPPORTING INFORMATION

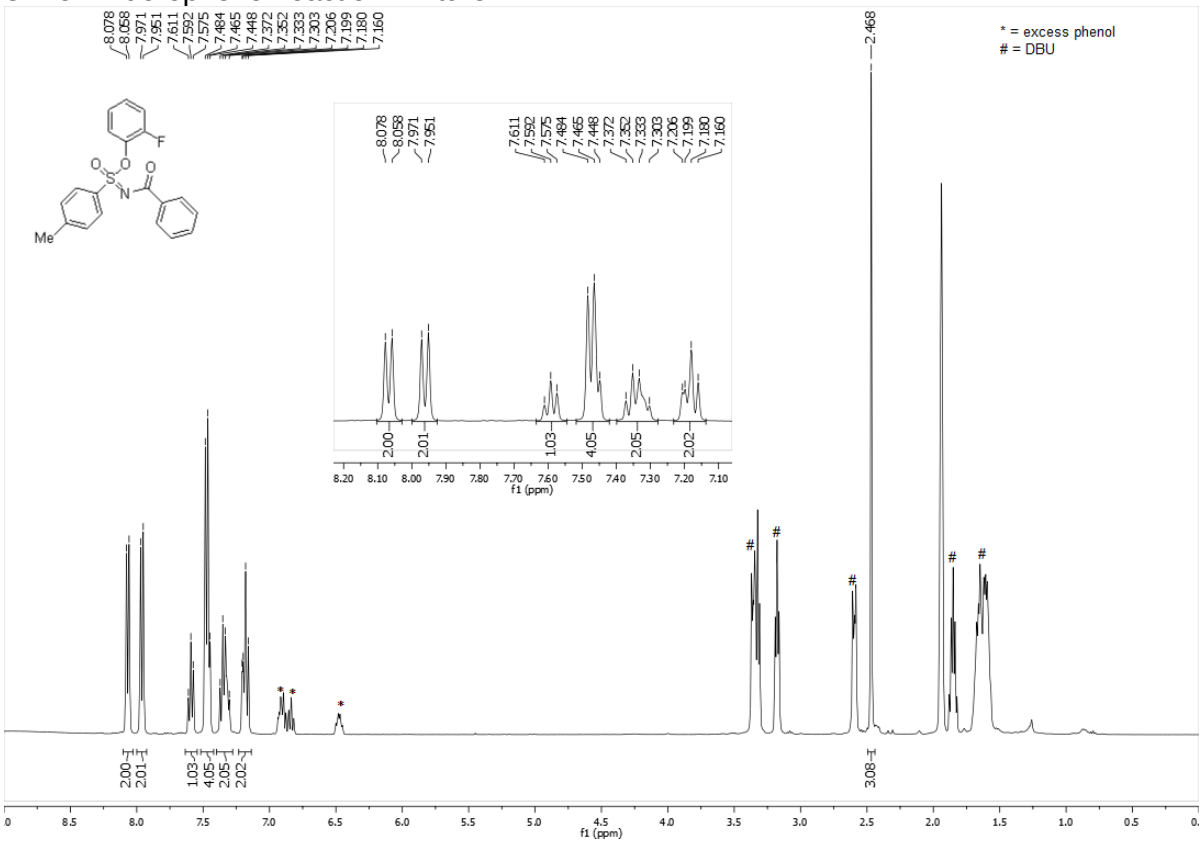
3m-*m* 3-fluorophenol reaction mixture

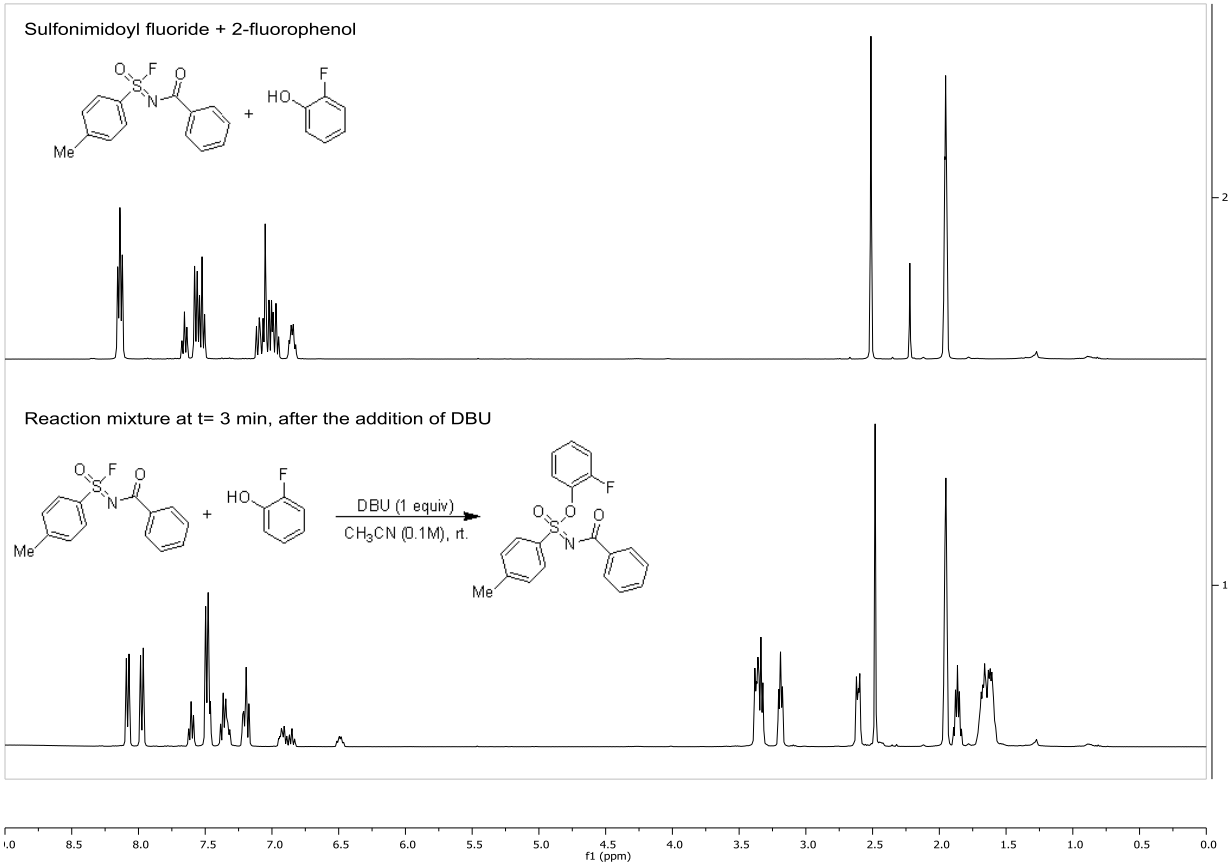




SUPPORTING INFORMATION

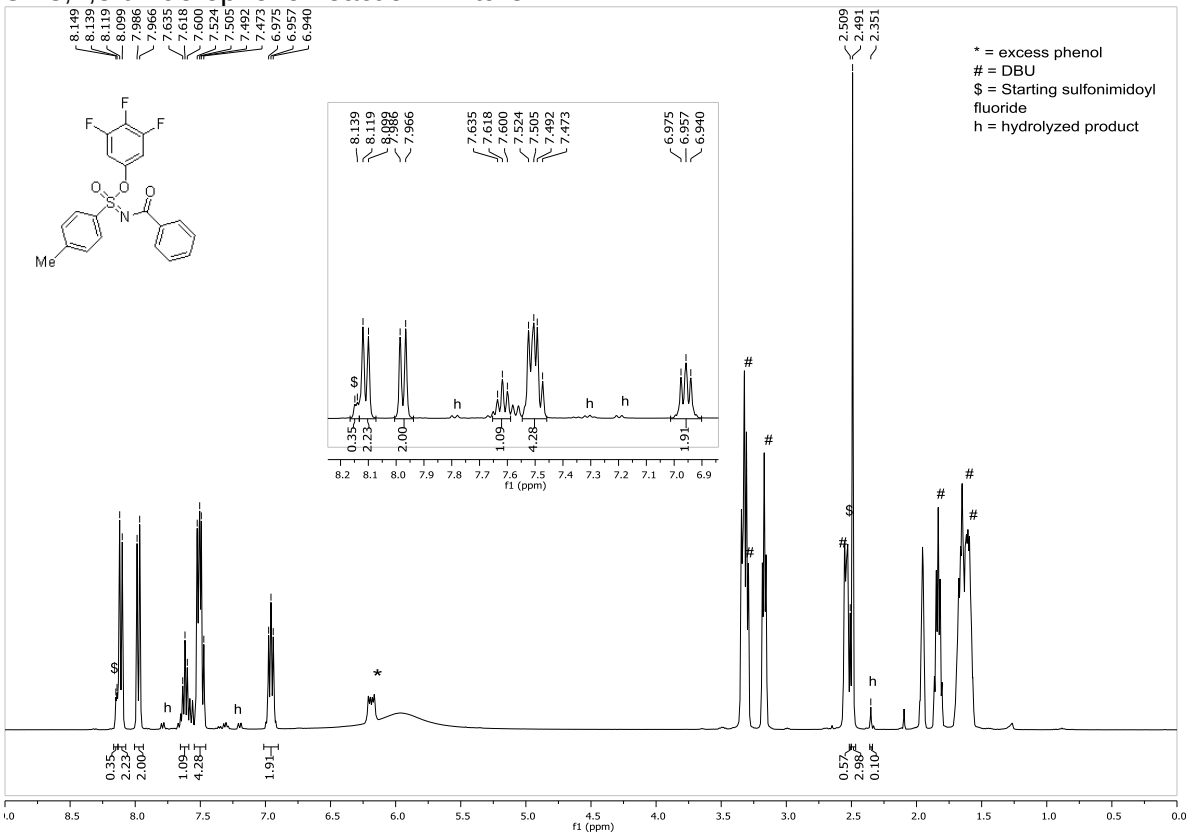
3m-*o* 2-fluorophenol reaction mixture

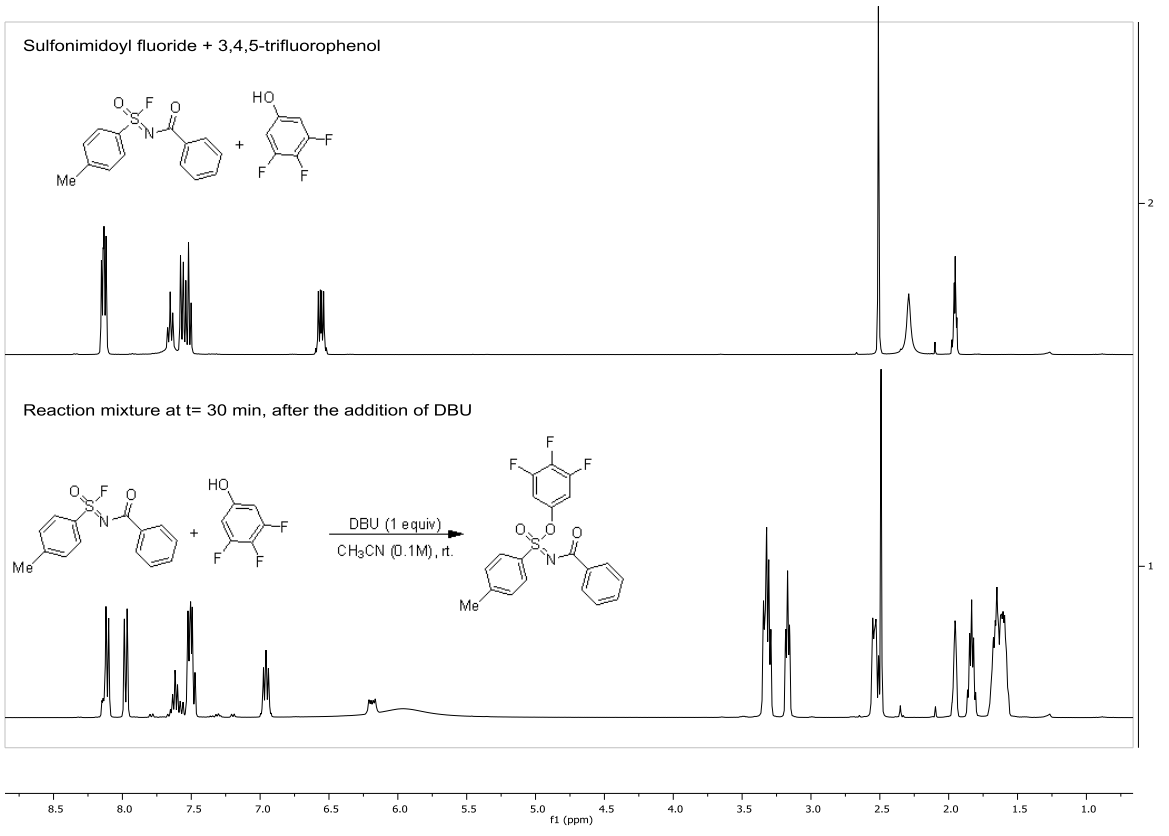




SUPPORTING INFORMATION

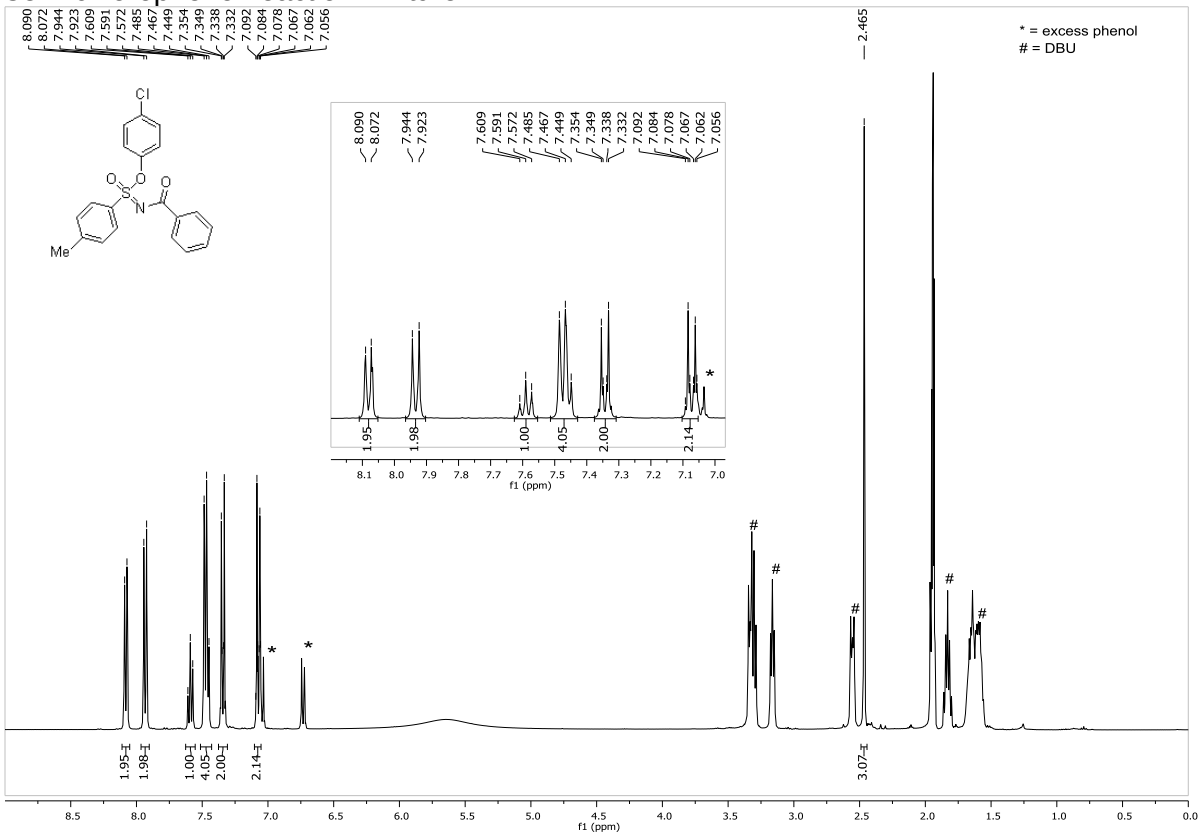
3n 3,4,5-trifluorophenol reaction mixture

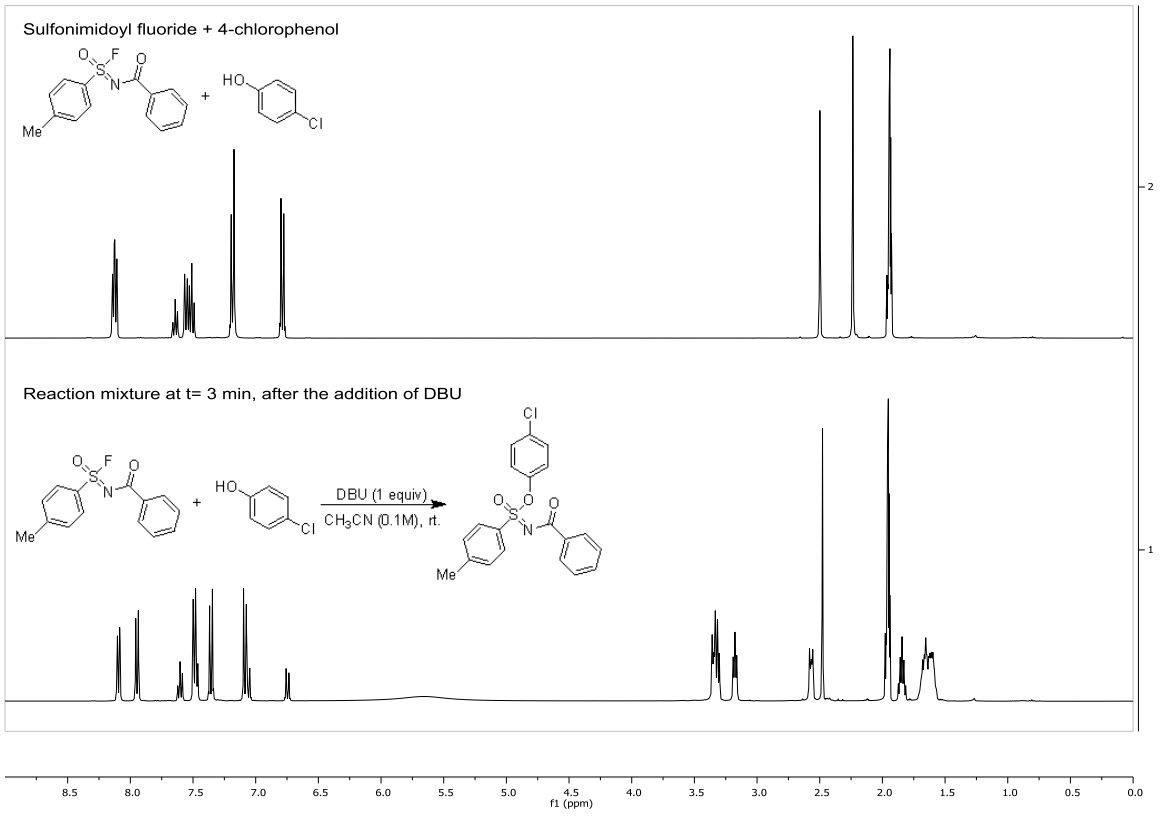




SUPPORTING INFORMATION

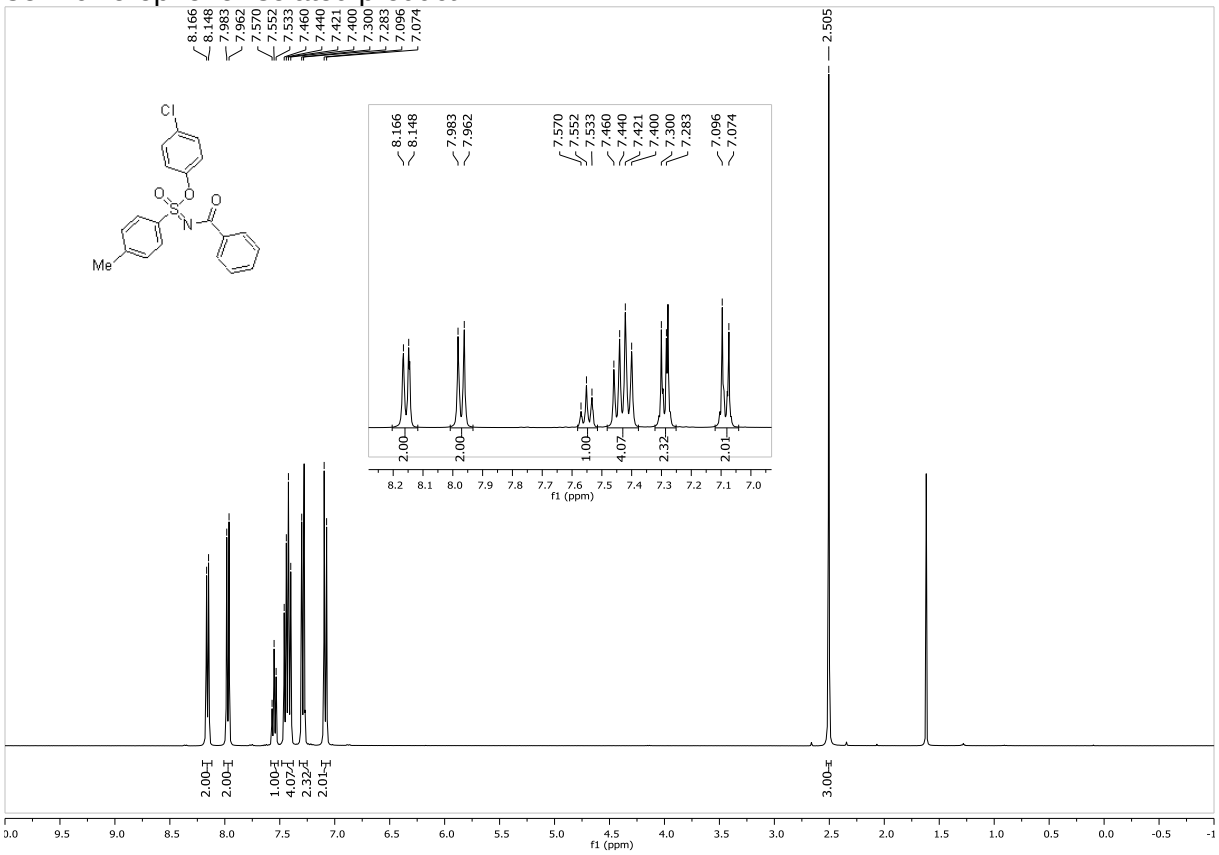
3o 4-chlorophenol reaction mixture

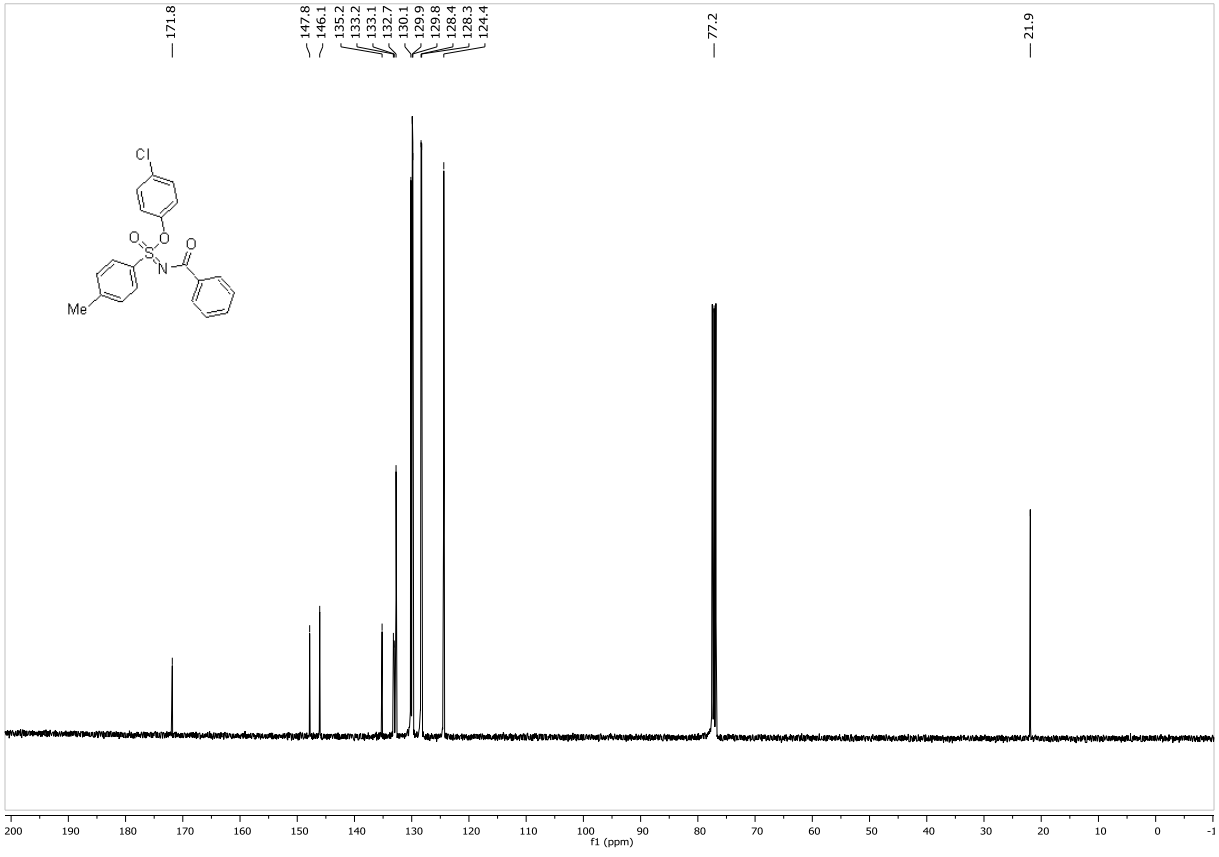




SUPPORTING INFORMATION

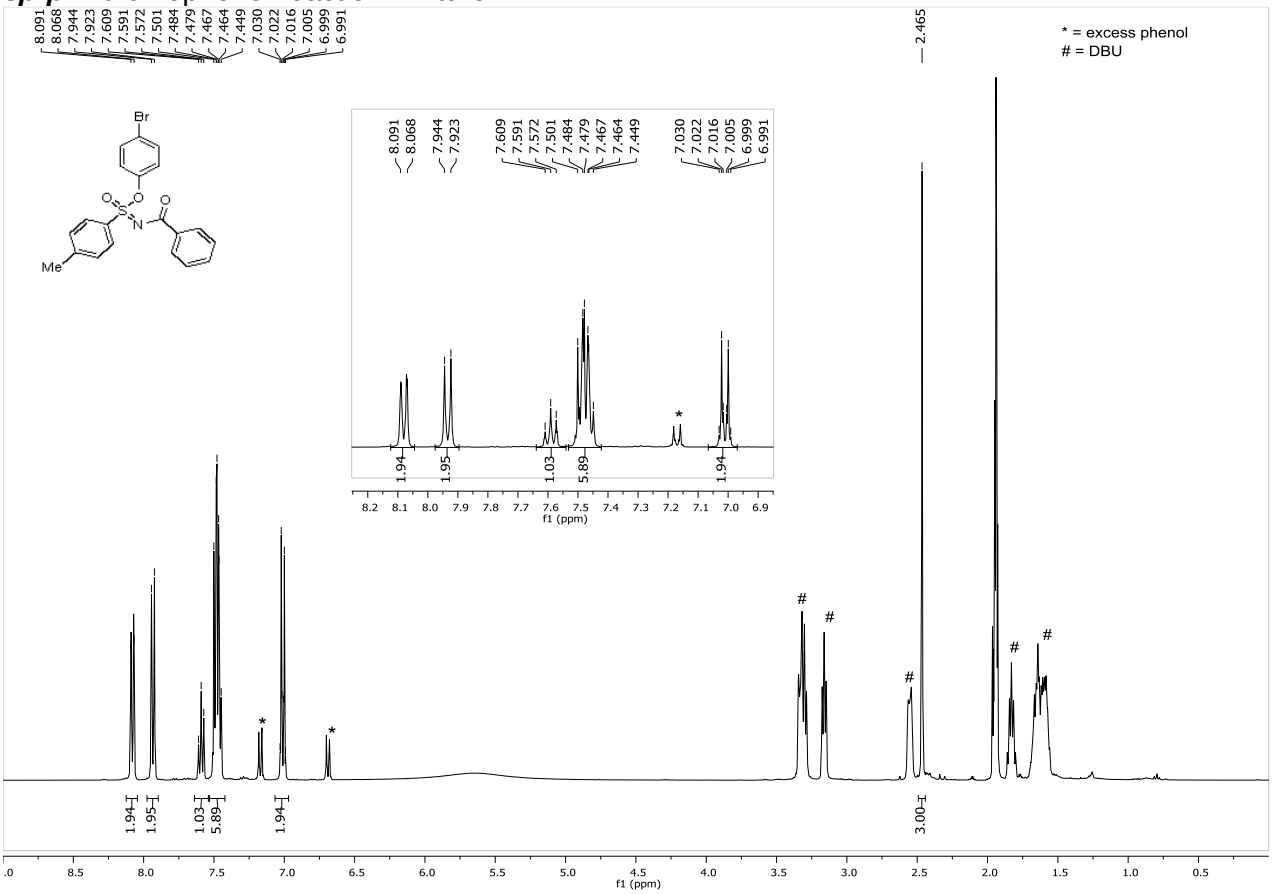
3o 4-chlorophenol isolated product

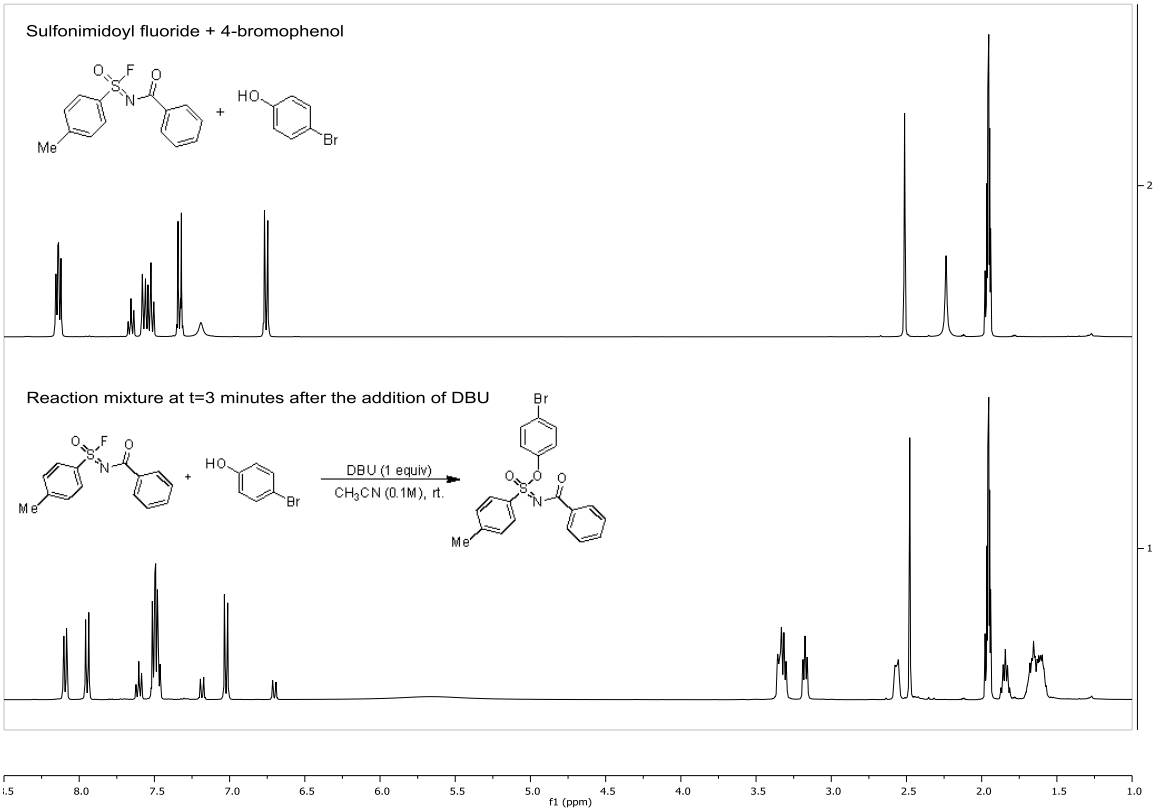




SUPPORTING INFORMATION

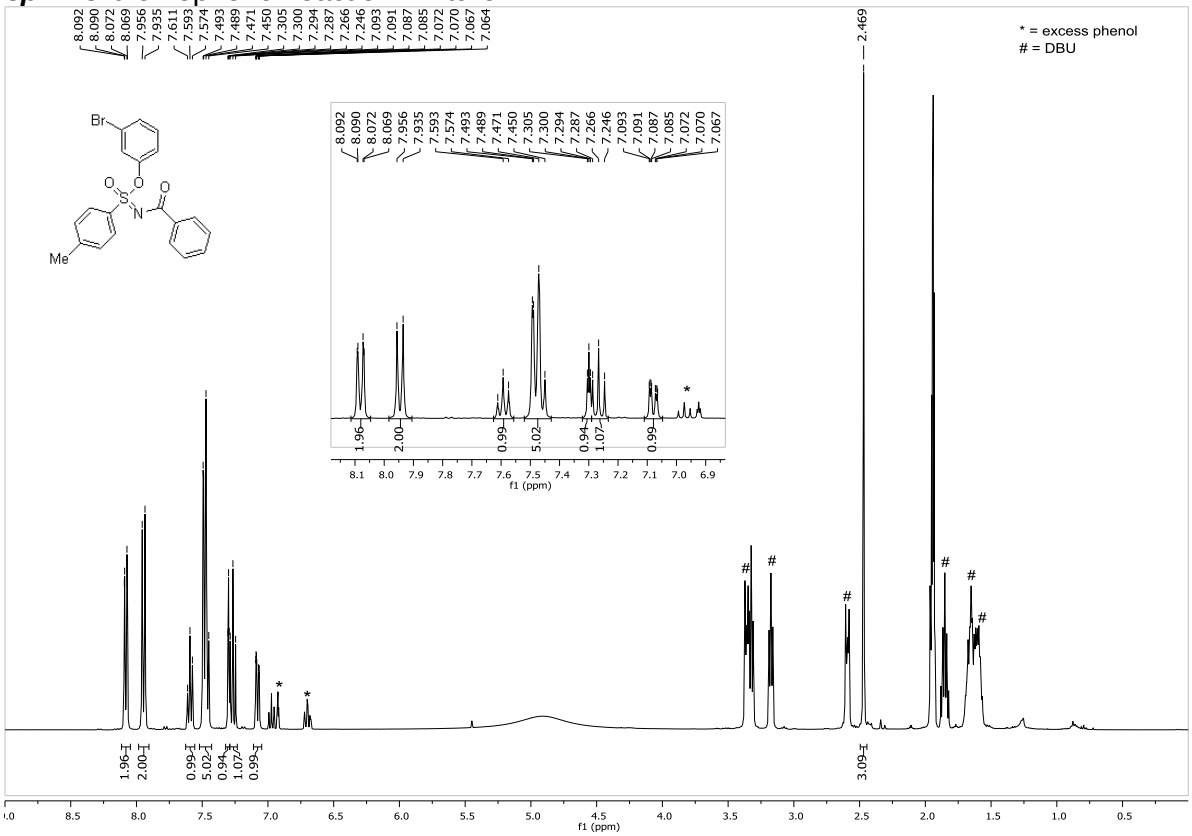
3*p-p* 4-bromophenol reaction mixture

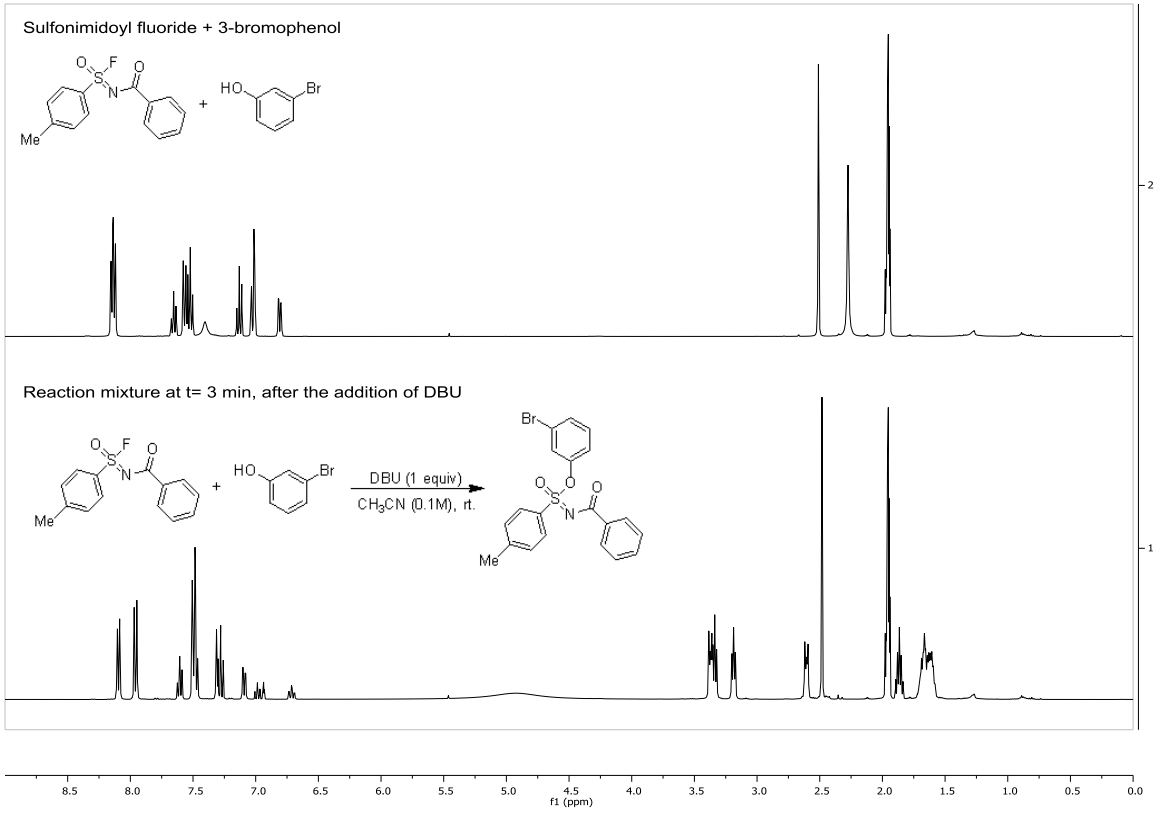




SUPPORTING INFORMATION

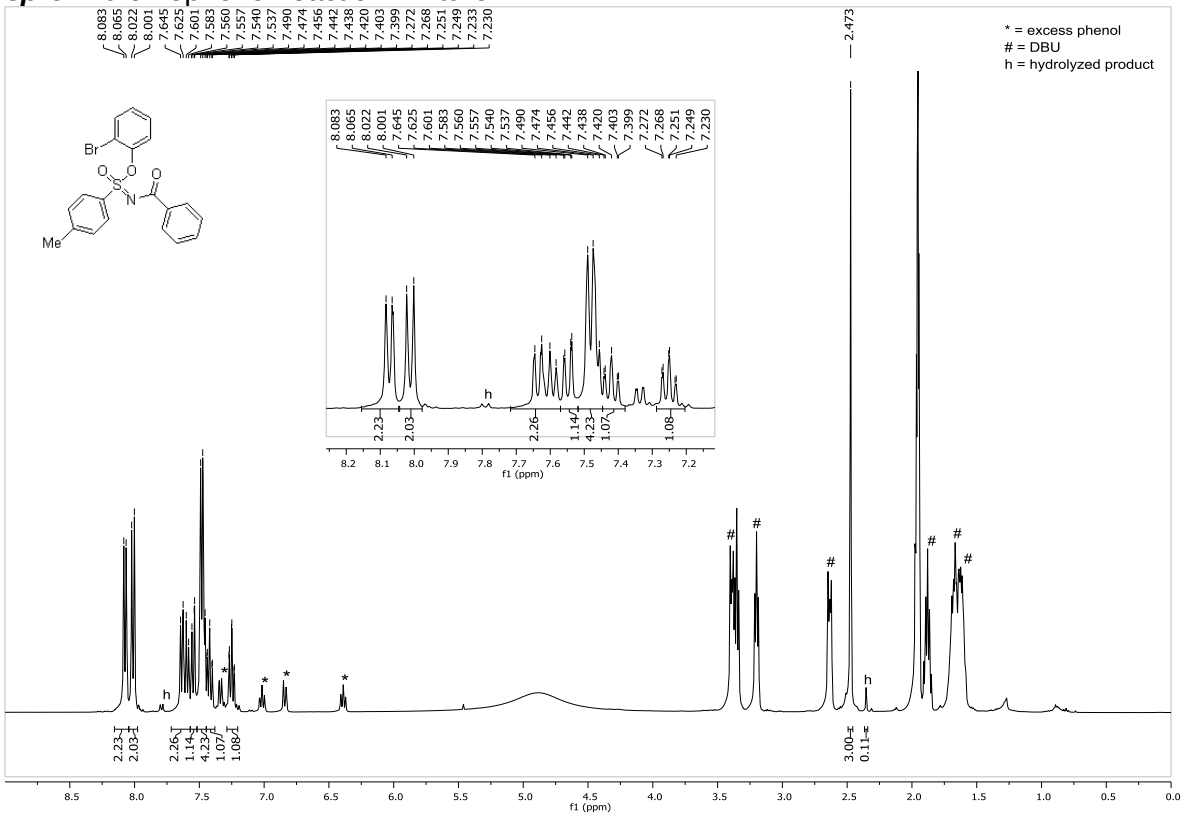
3*p-m* 3-bromophenol reaction mixture

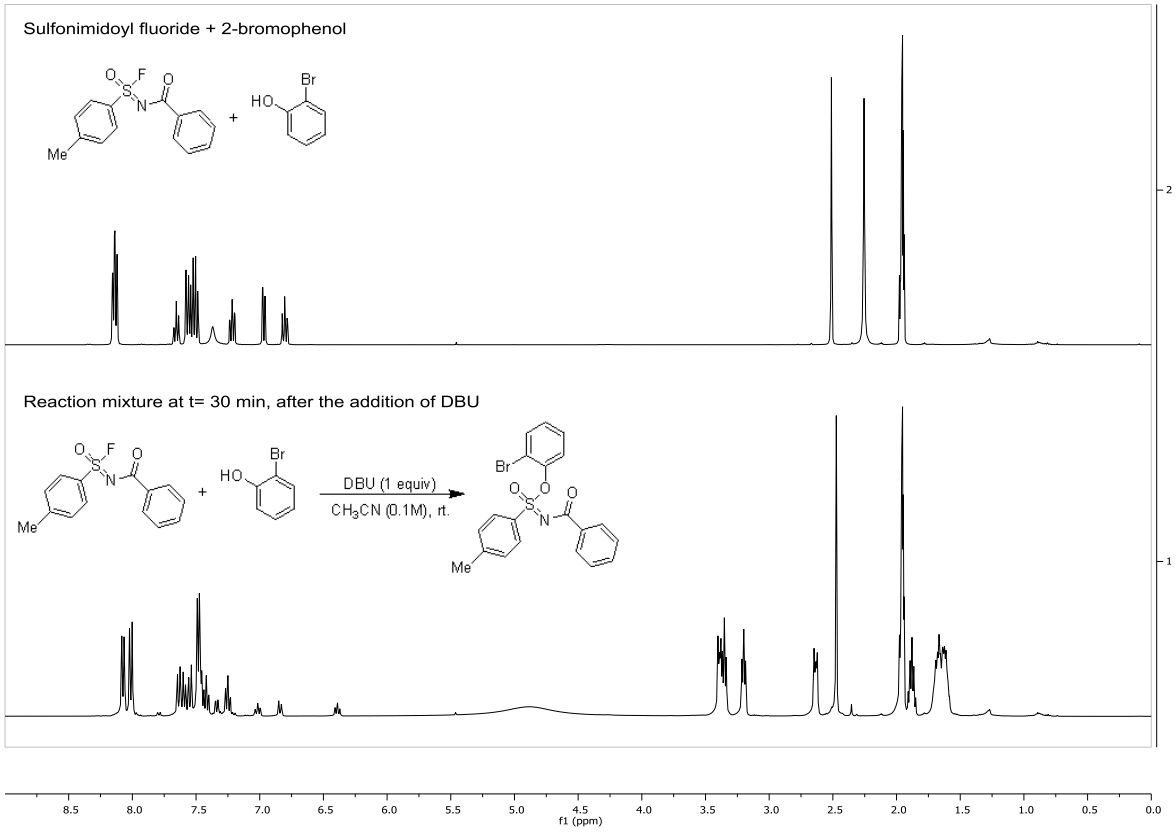




SUPPORTING INFORMATION

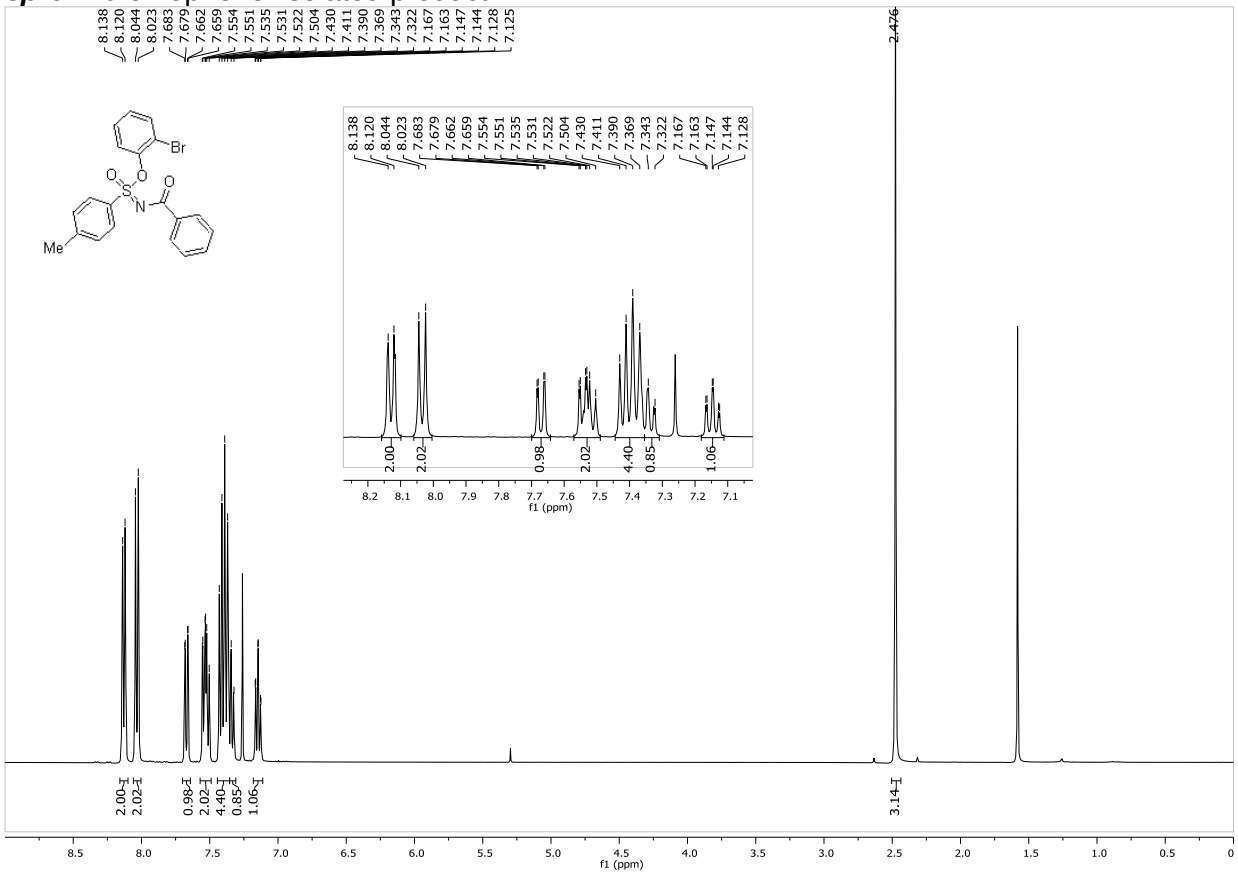
3*p-o* 2-bromophenol reaction mixture

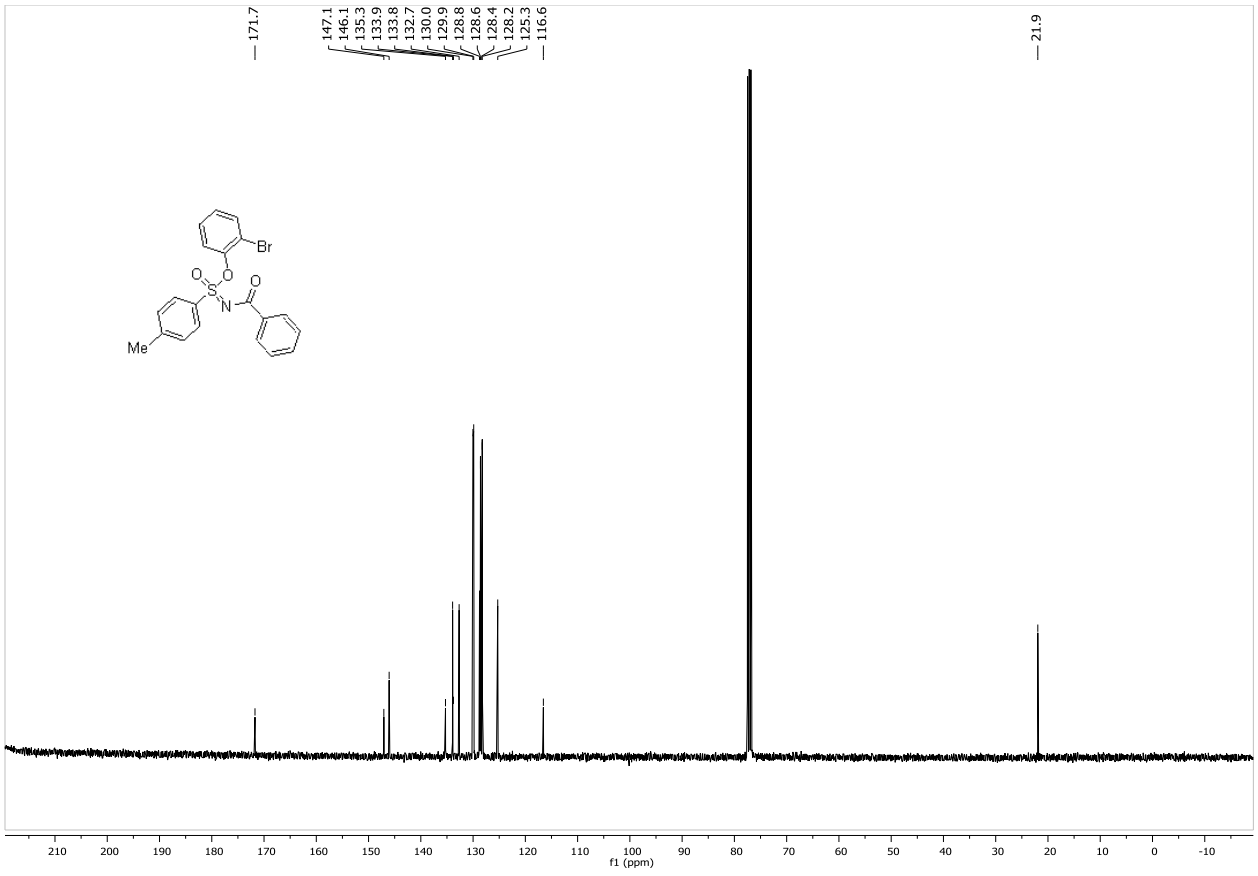




SUPPORTING INFORMATION

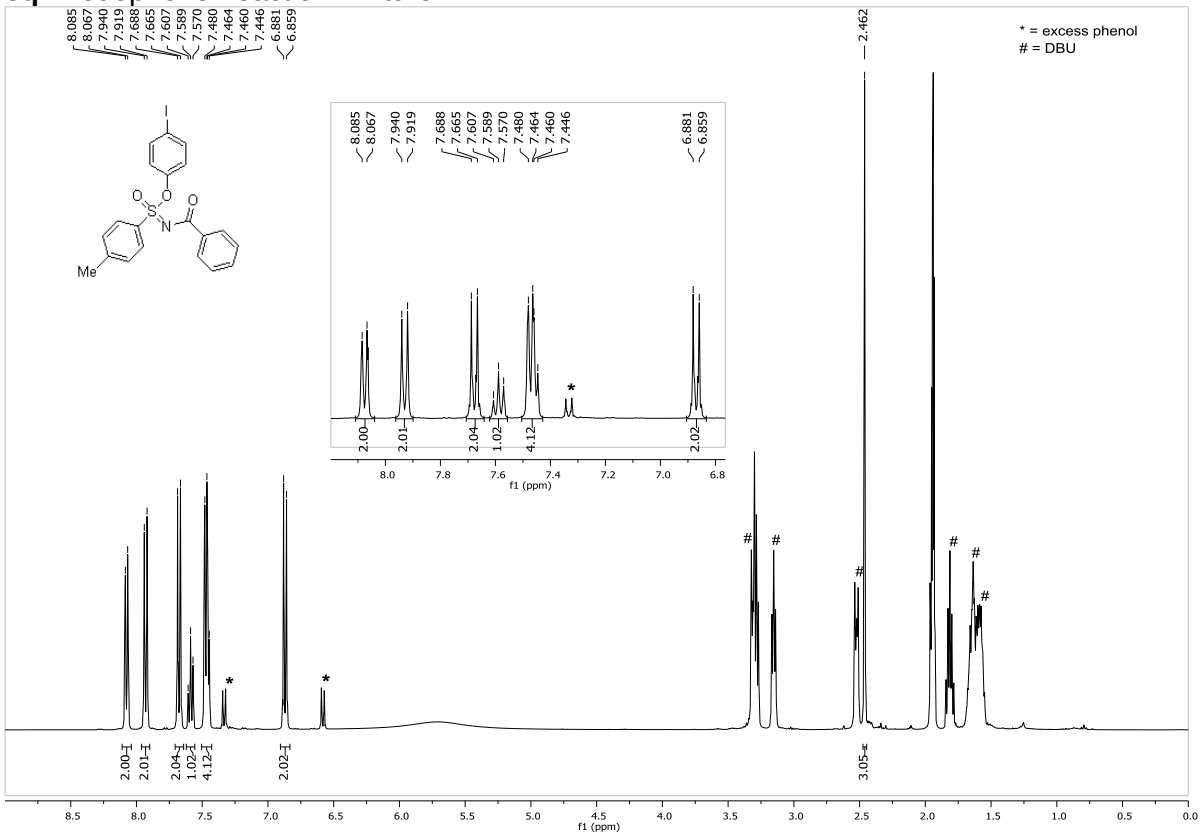
3*p-o* 2-bromophenol isolated product

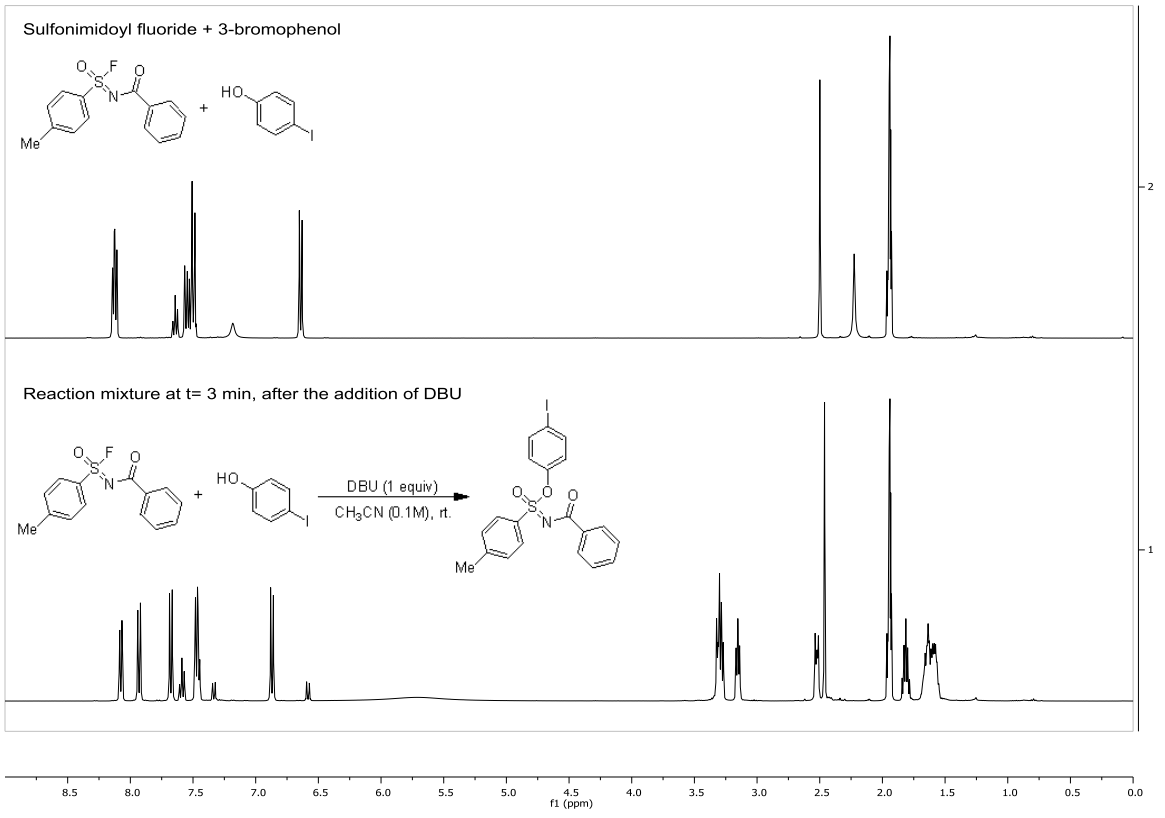




SUPPORTING INFORMATION

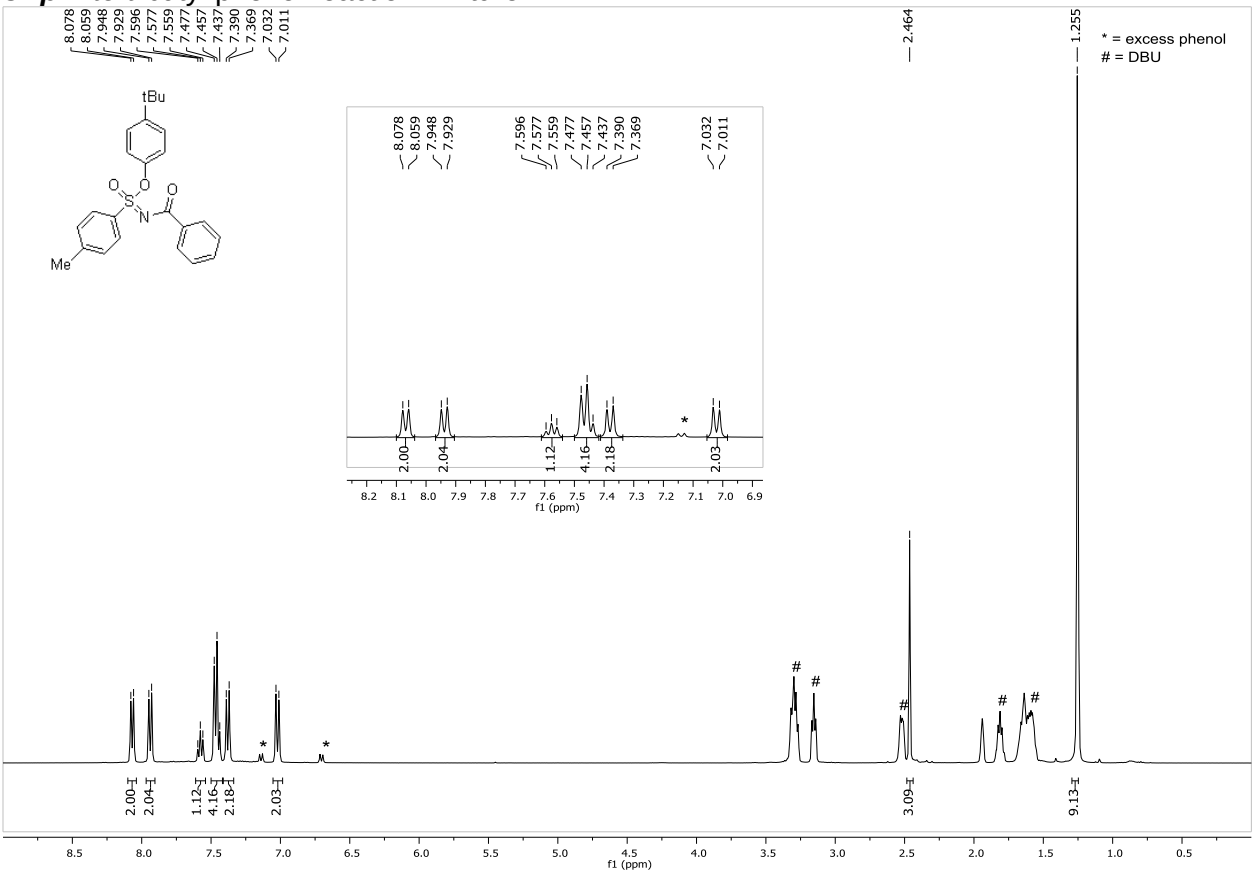
3q 4-iodophenol reaction mixture

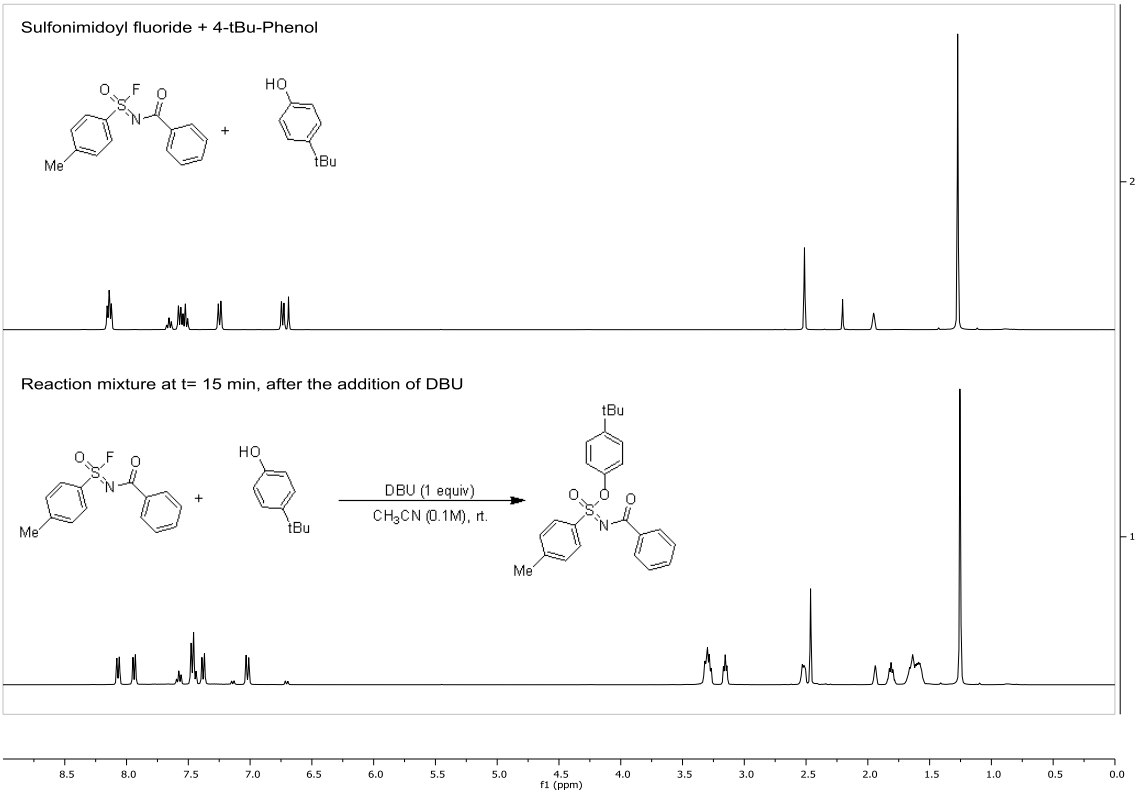




SUPPORTING INFORMATION

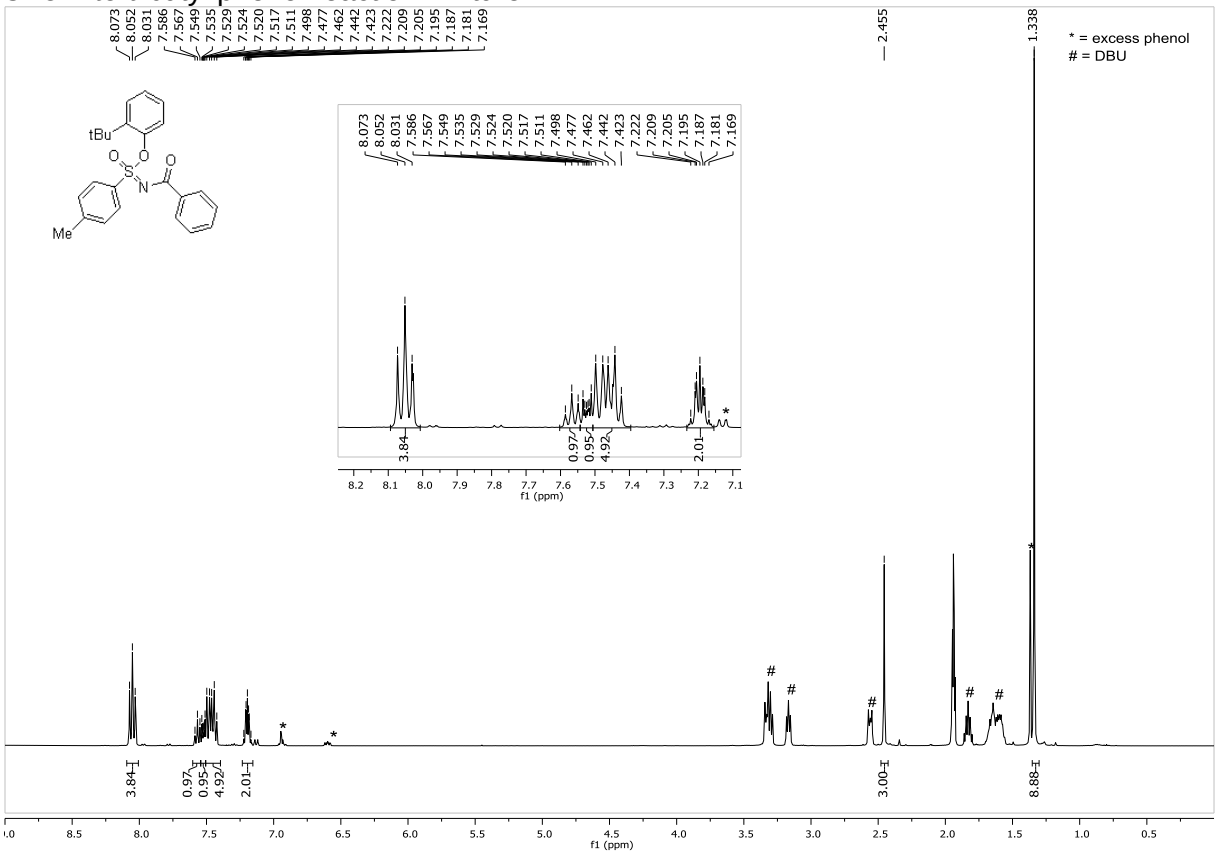
3r-*p* 4-*tert*-butyl phenol reaction mixture

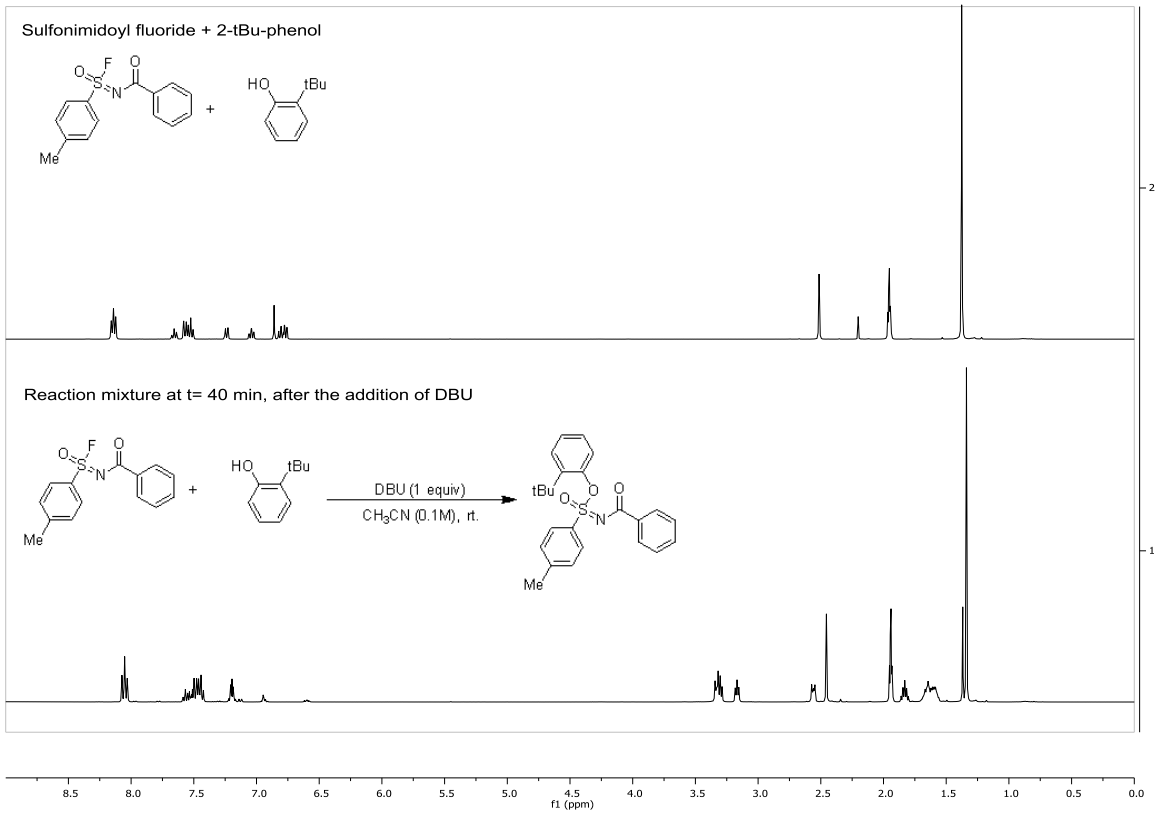




SUPPORTING INFORMATION

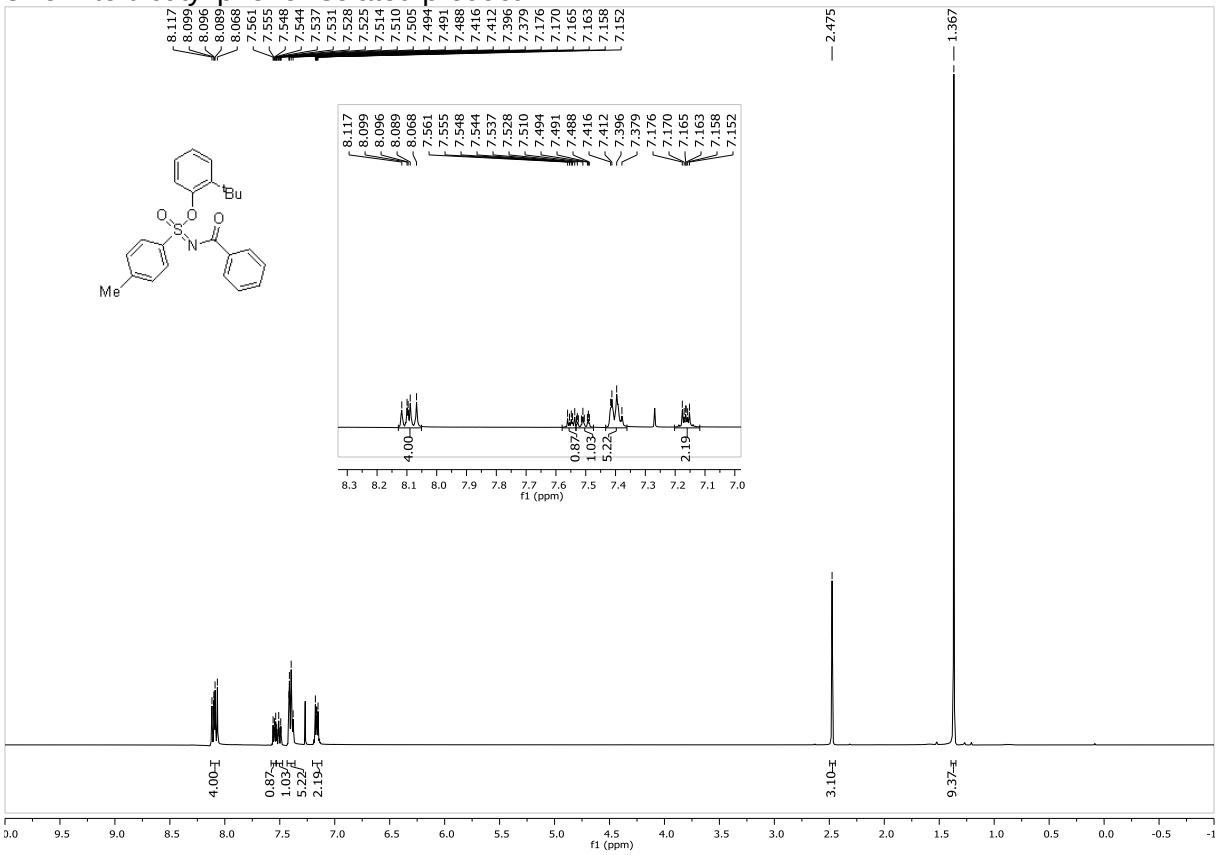
3r-*o* 2-*tert*-butyl phenol reaction mixture

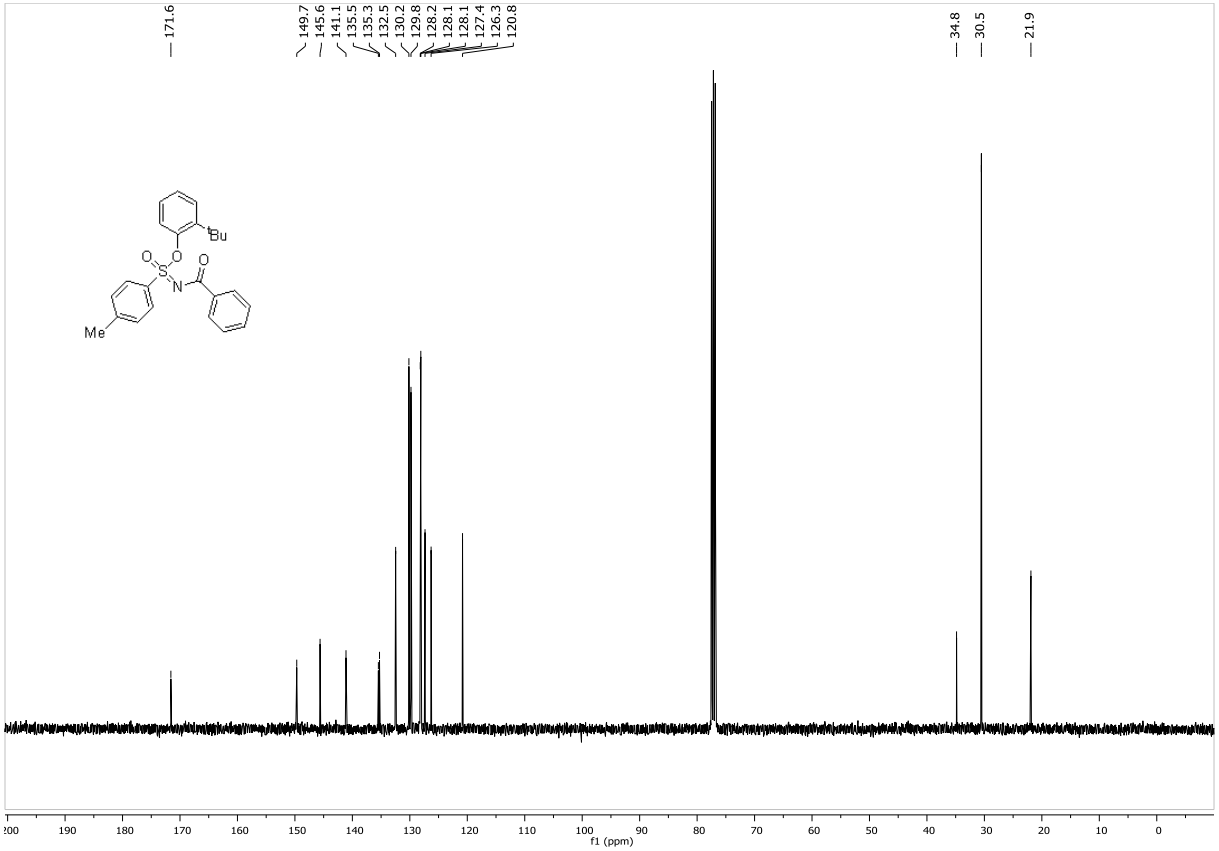




SUPPORTING INFORMATION

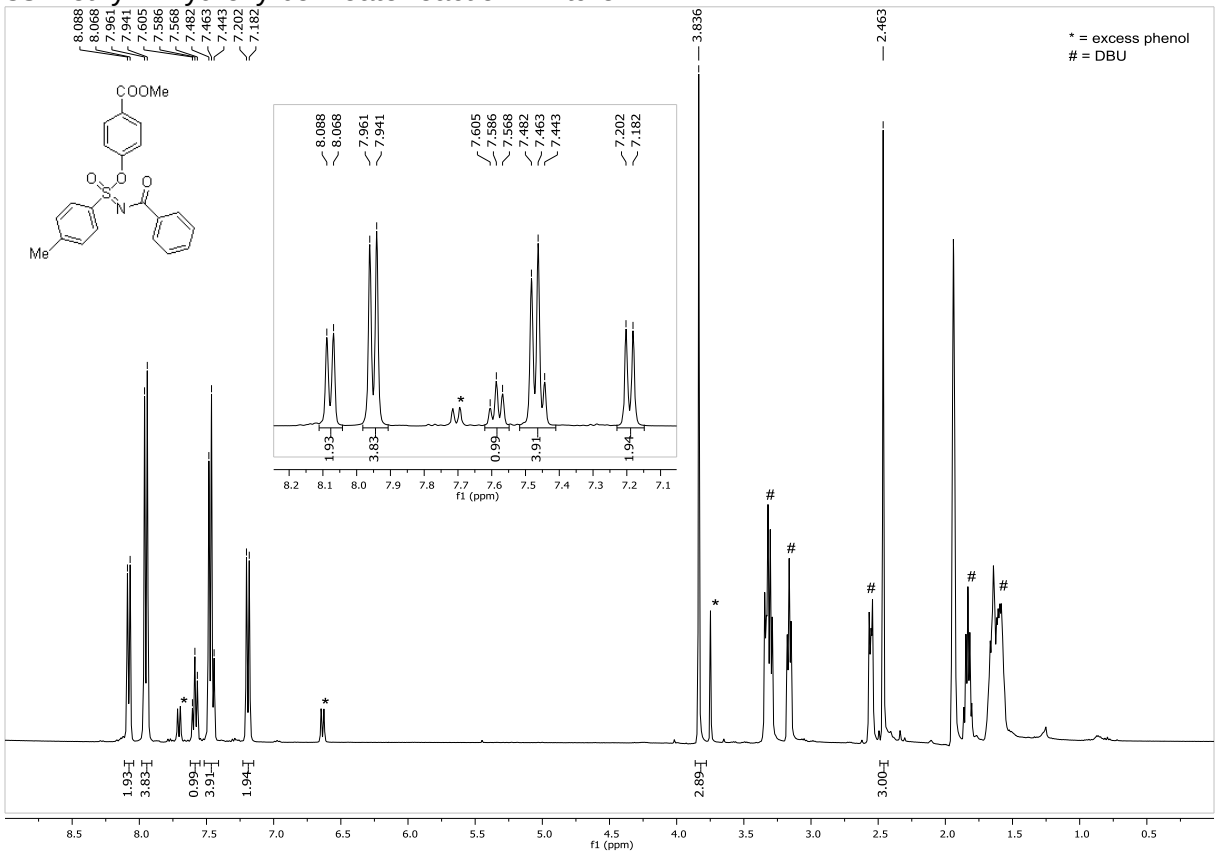
3r-*o* 2-*tert*-butyl phenol isolated product

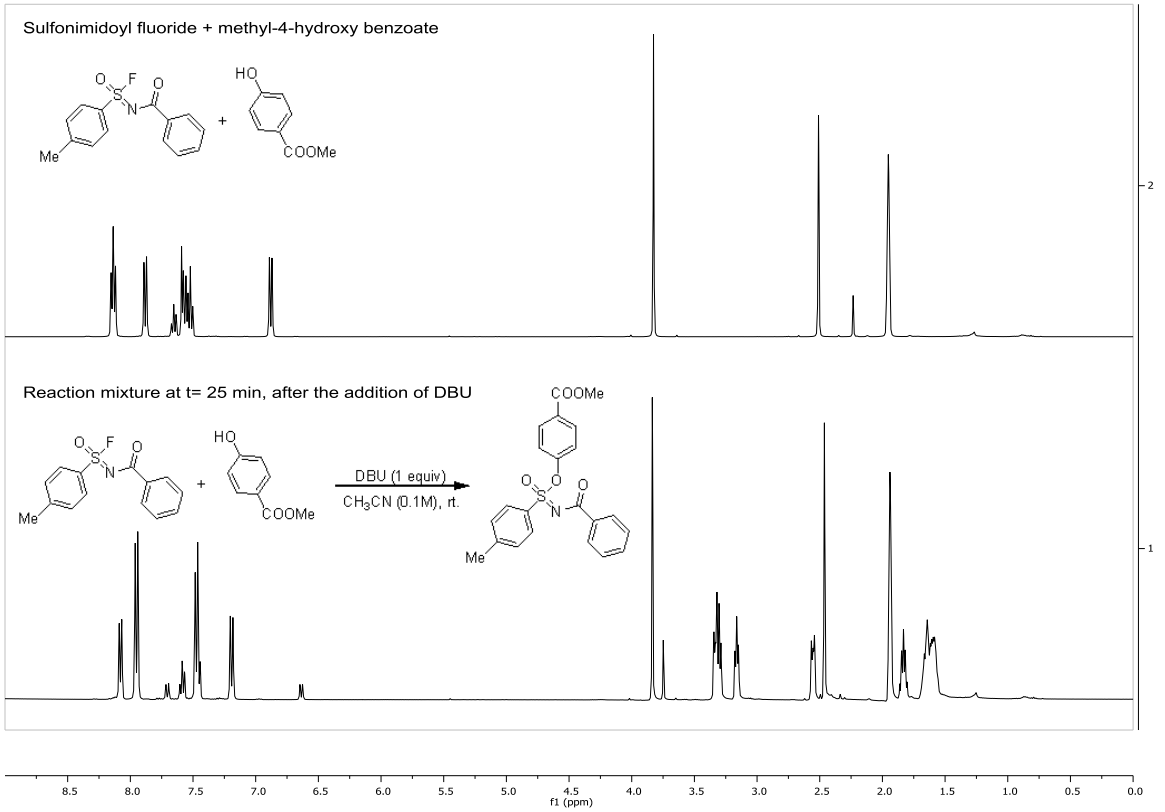




SUPPORTING INFORMATION

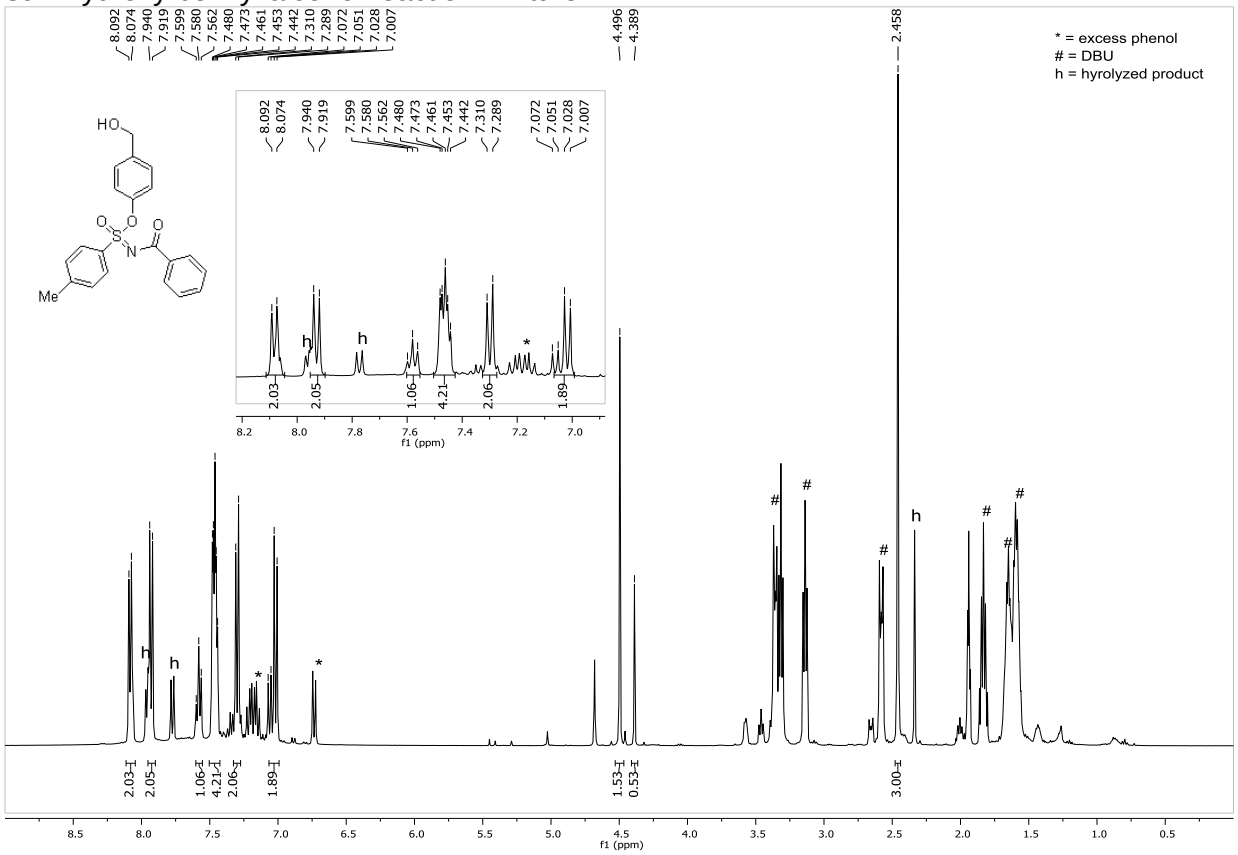
3s methyl-4-hydroxy benzoate reaction mixture

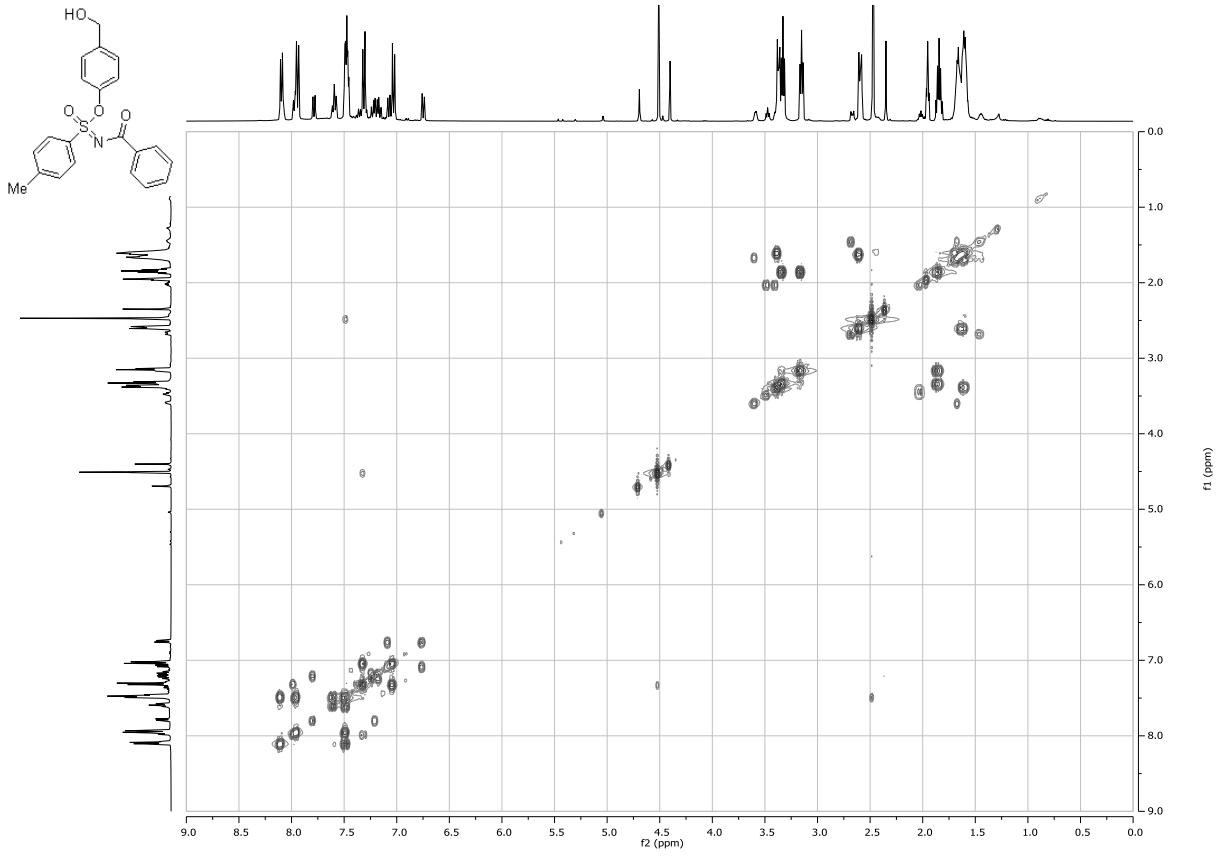


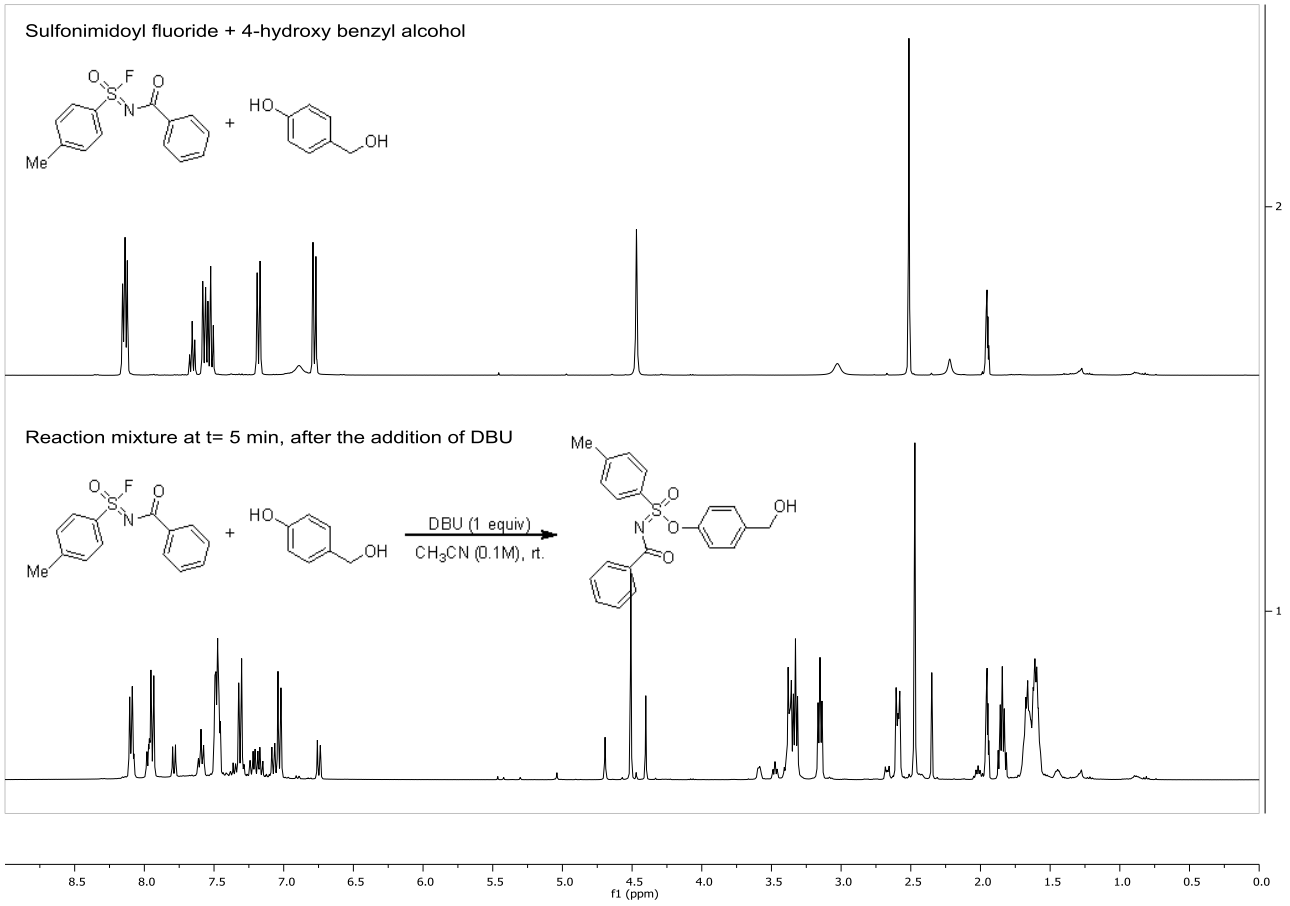


SUPPORTING INFORMATION

3t 4-hydroxy benzyl alcohol reaction mixture

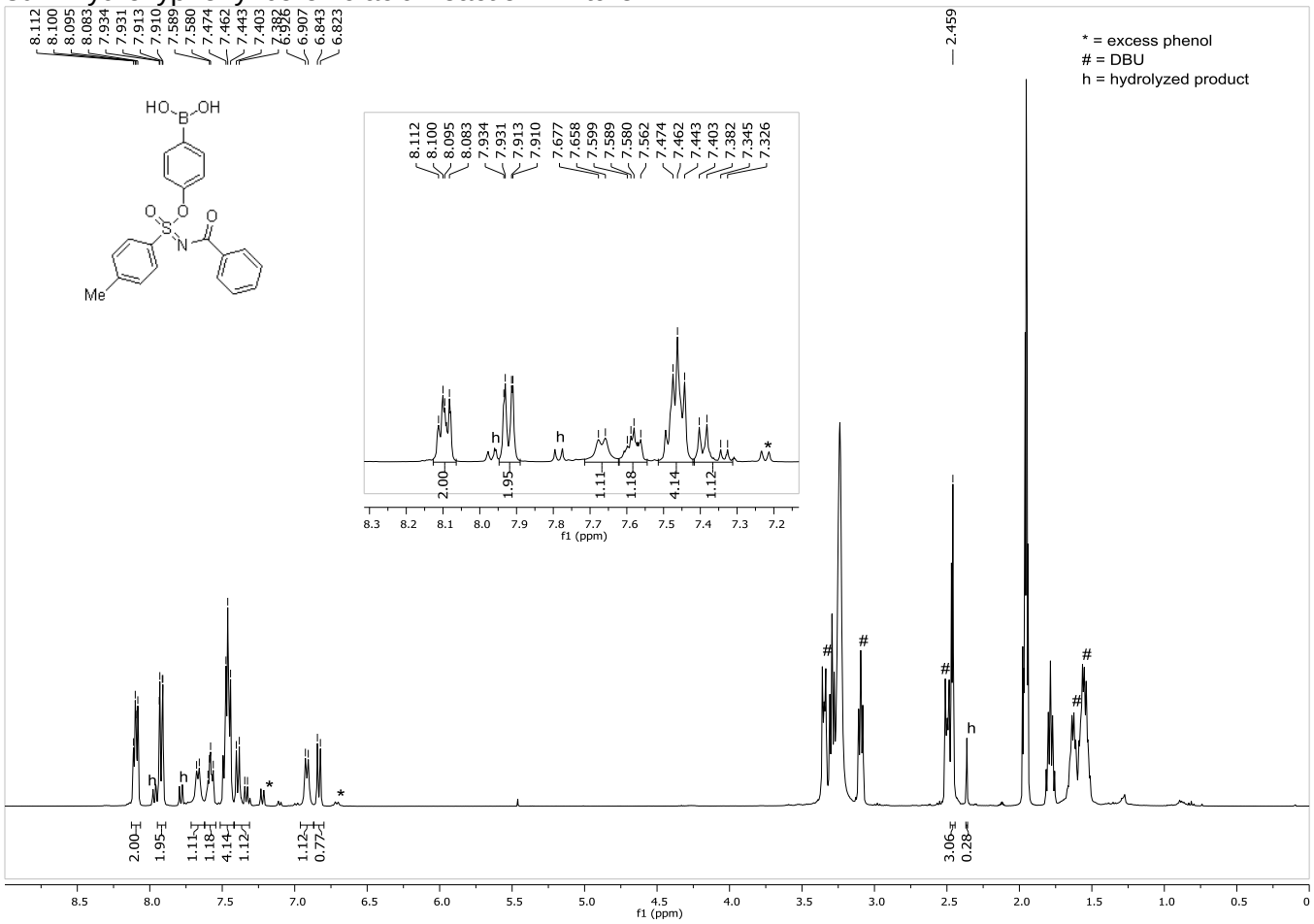


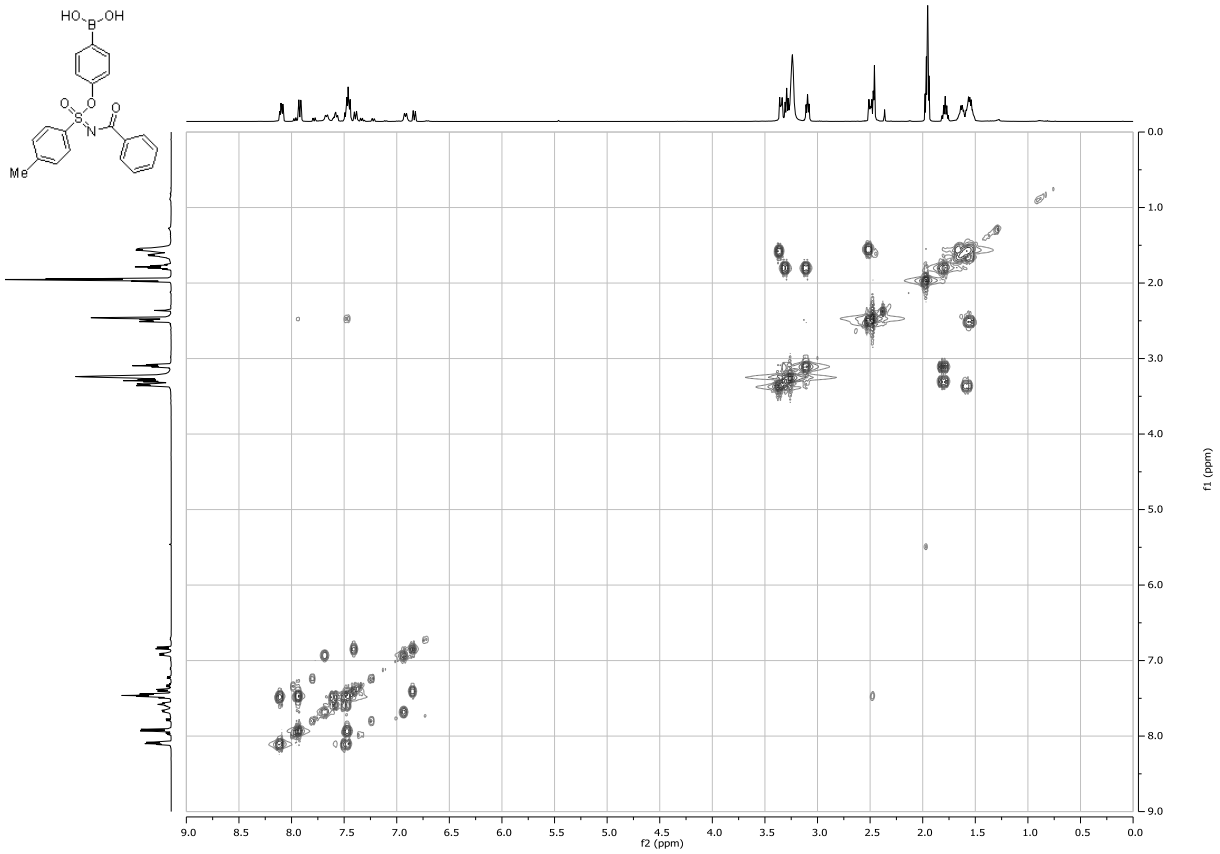


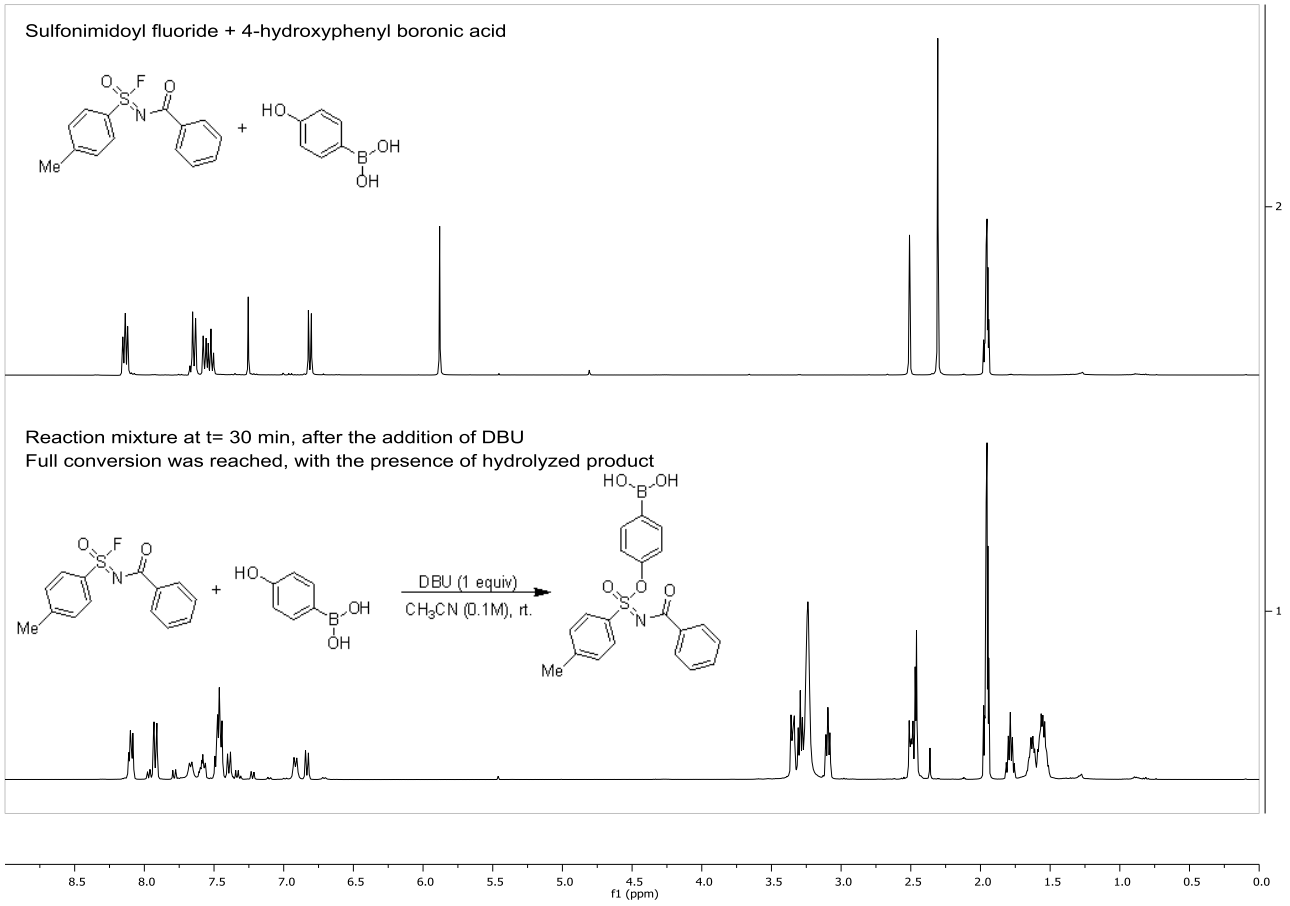

Sulfonimidoyl fluoride + 4-hydroxy benzyl alcohol
Me
HO
OH
Reaction mixture at t= 5 min, after the addition of DBU
DBU (1 equiv)
CH3CN (0.1M), rt.
2
1
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

SUPPORTING INFORMATION

3u 4-hydroxyphenyl boronic acid reaction mixture



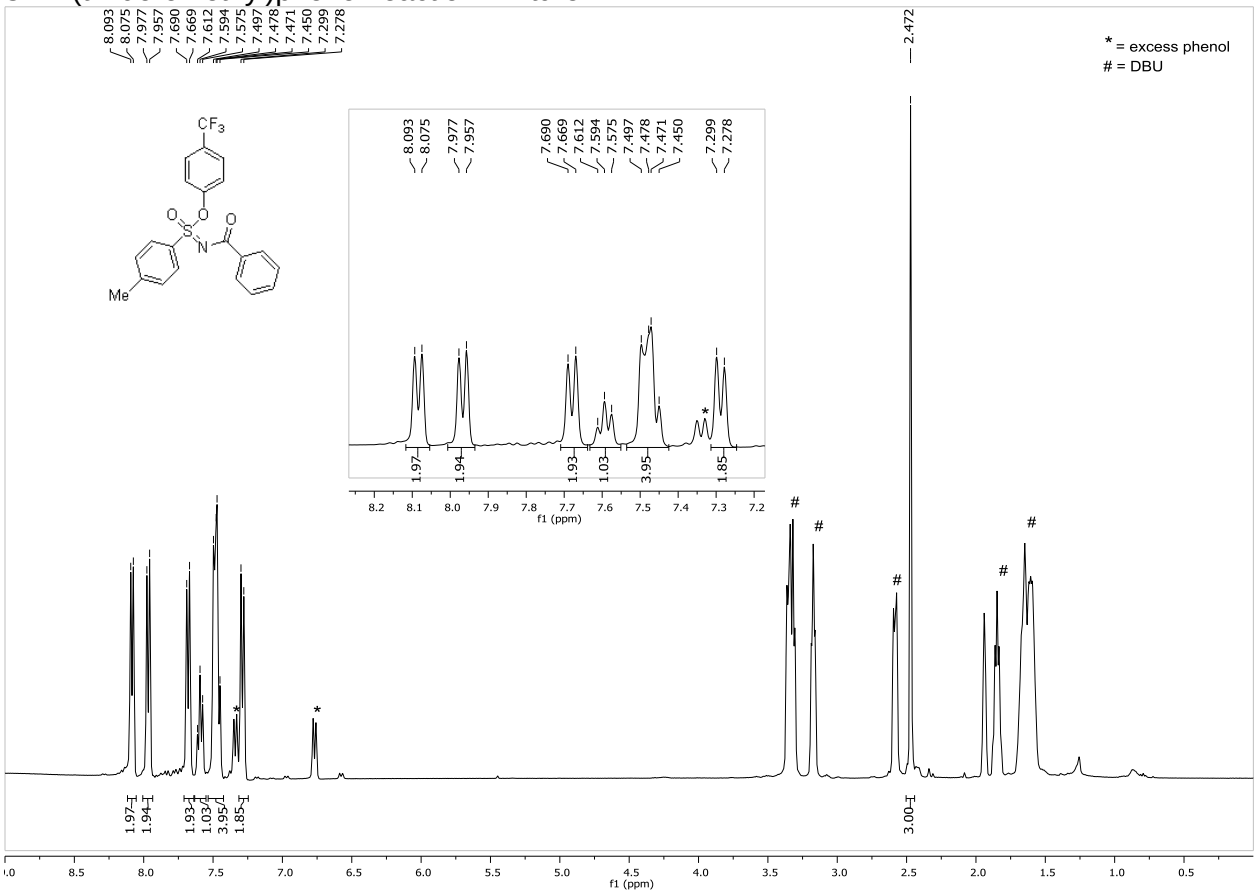


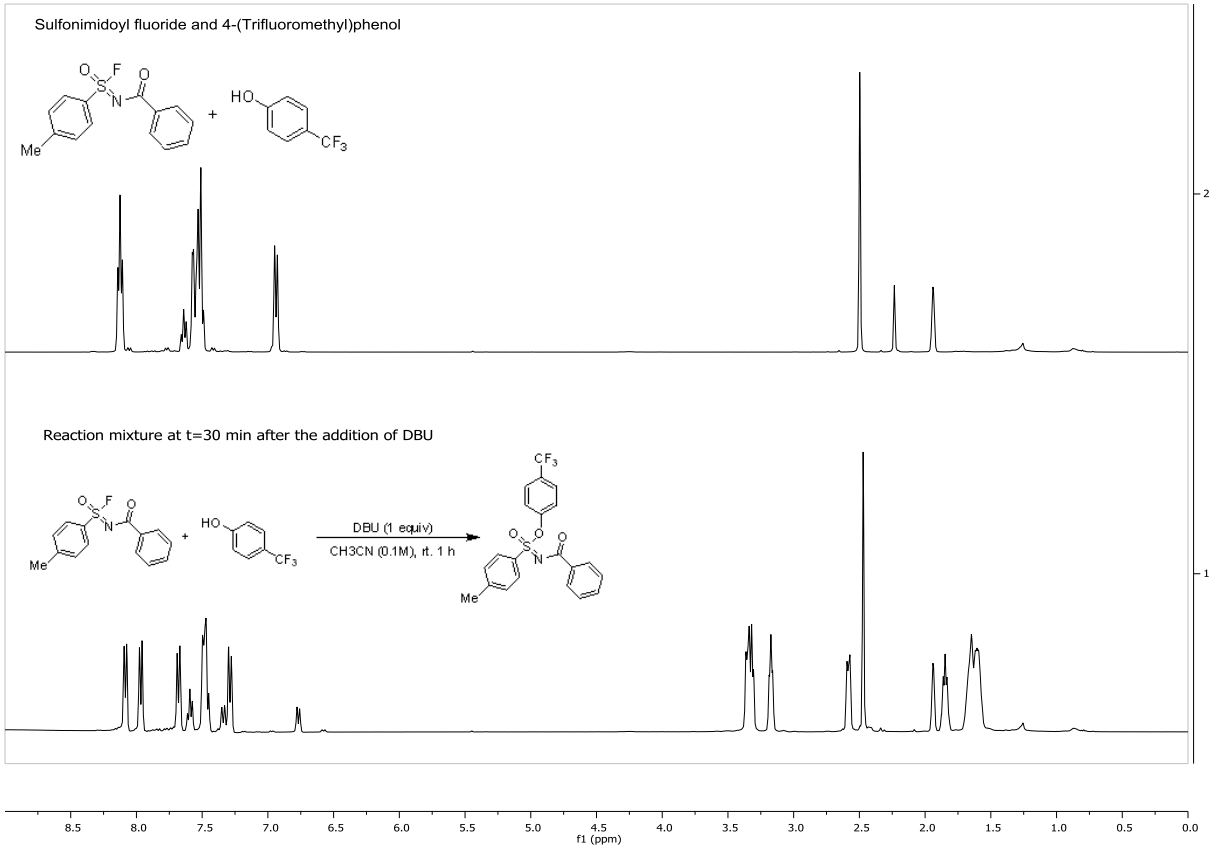

Sulfonimidoyl fluoride + 4-hydroxyphenyl boronic acid
Me
HO
B
OH
OH
Reaction mixture at t= 30 min, after the addition of DBU
Full conversion was reached, with the presence of hydrolyzed product
DBU (1 equiv)
CH3CN (0.1M), rt.
2
1

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

SUPPORTING INFORMATION

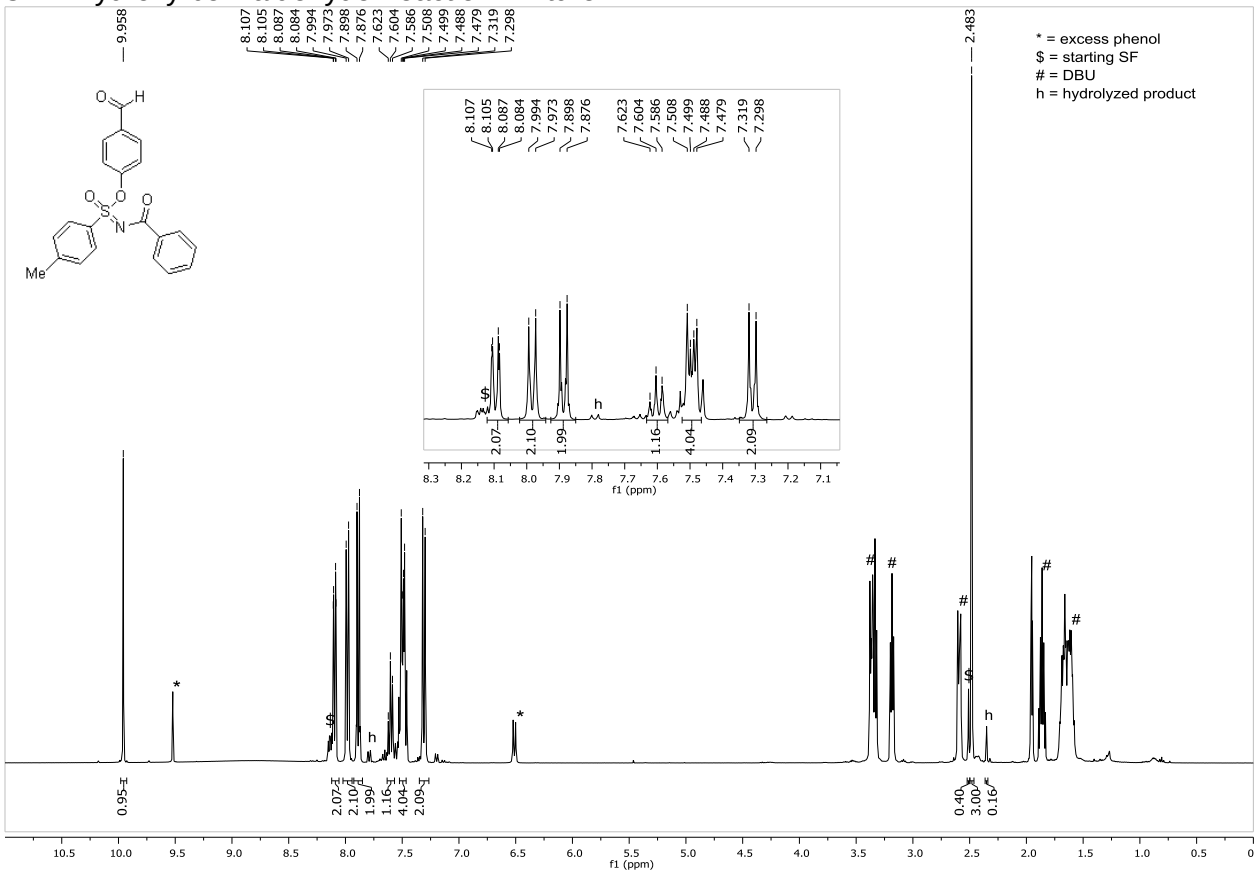
3v 4-(trifluoromethyl)phenol reaction mixture



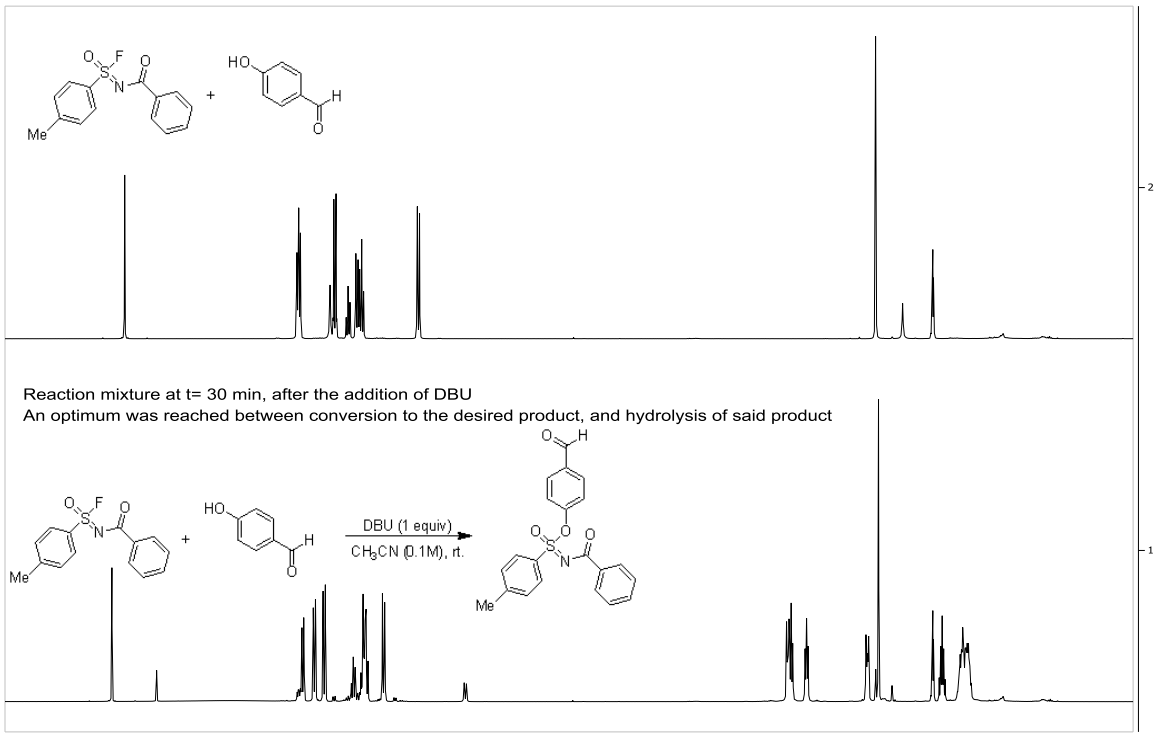


SUPPORTING INFORMATION

3w 4-hydroxy benzaldehyde reaction mixture



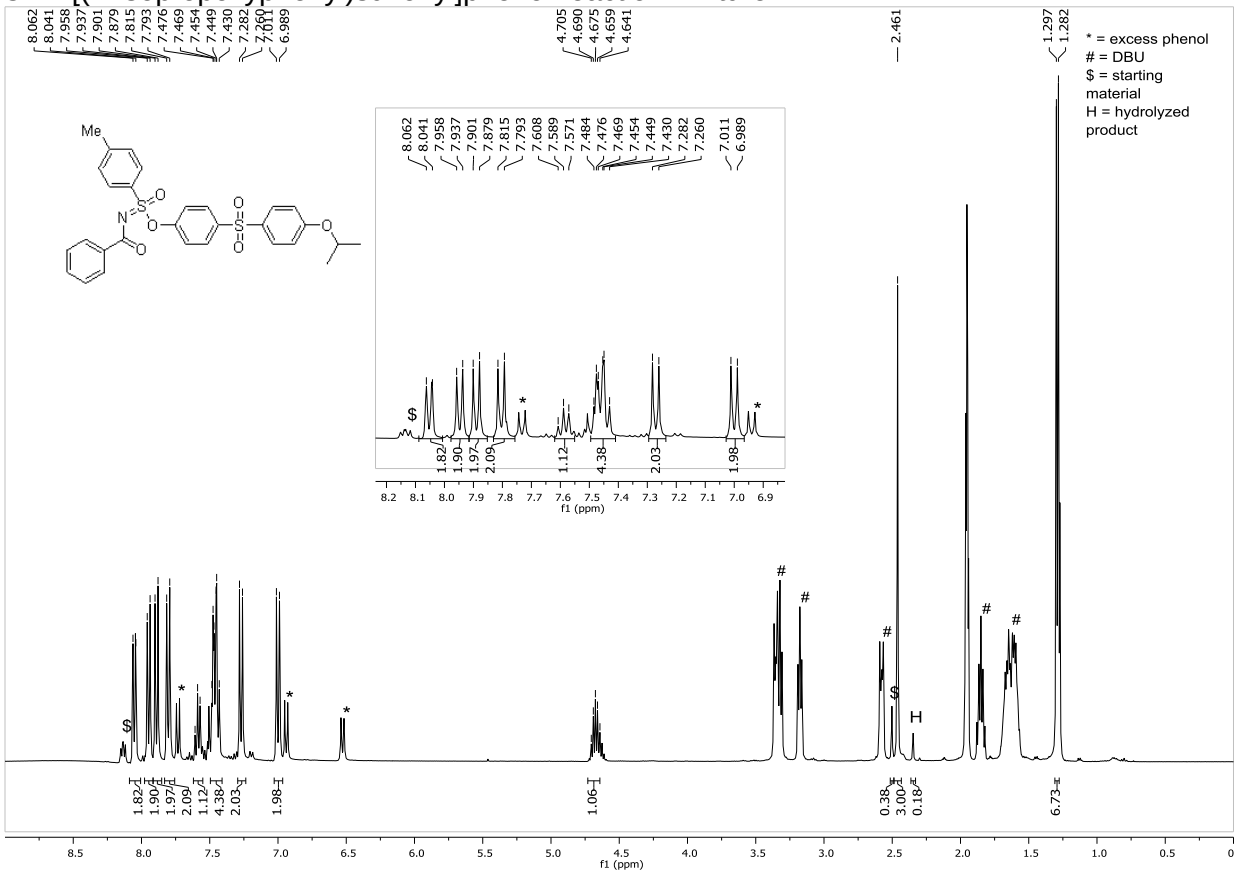
Sulfonimidoyl fluoride + p-hydroxy benzaldehyde

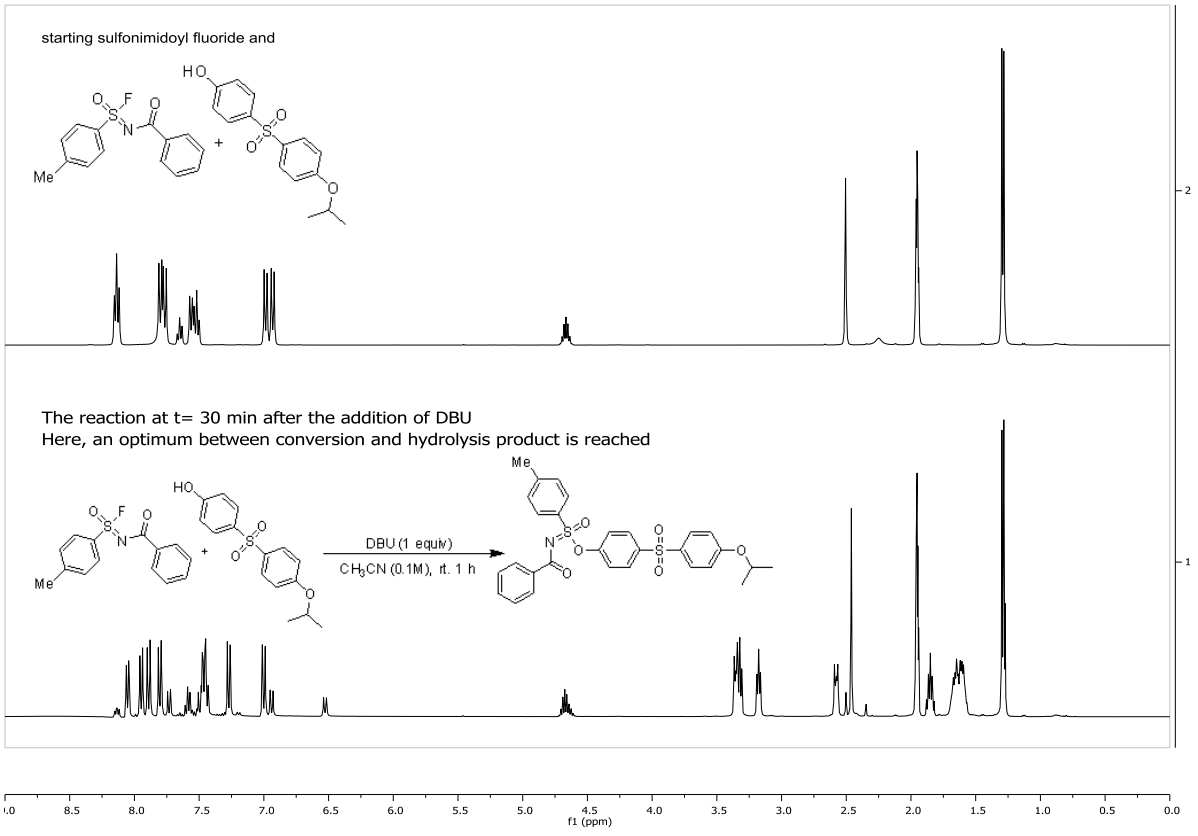


Reaction mixture at t= 30 min, after the addition of DBU
An optimum was reached between conversion to the desired product, and hydrolysis of said product

SUPPORTING INFORMATION

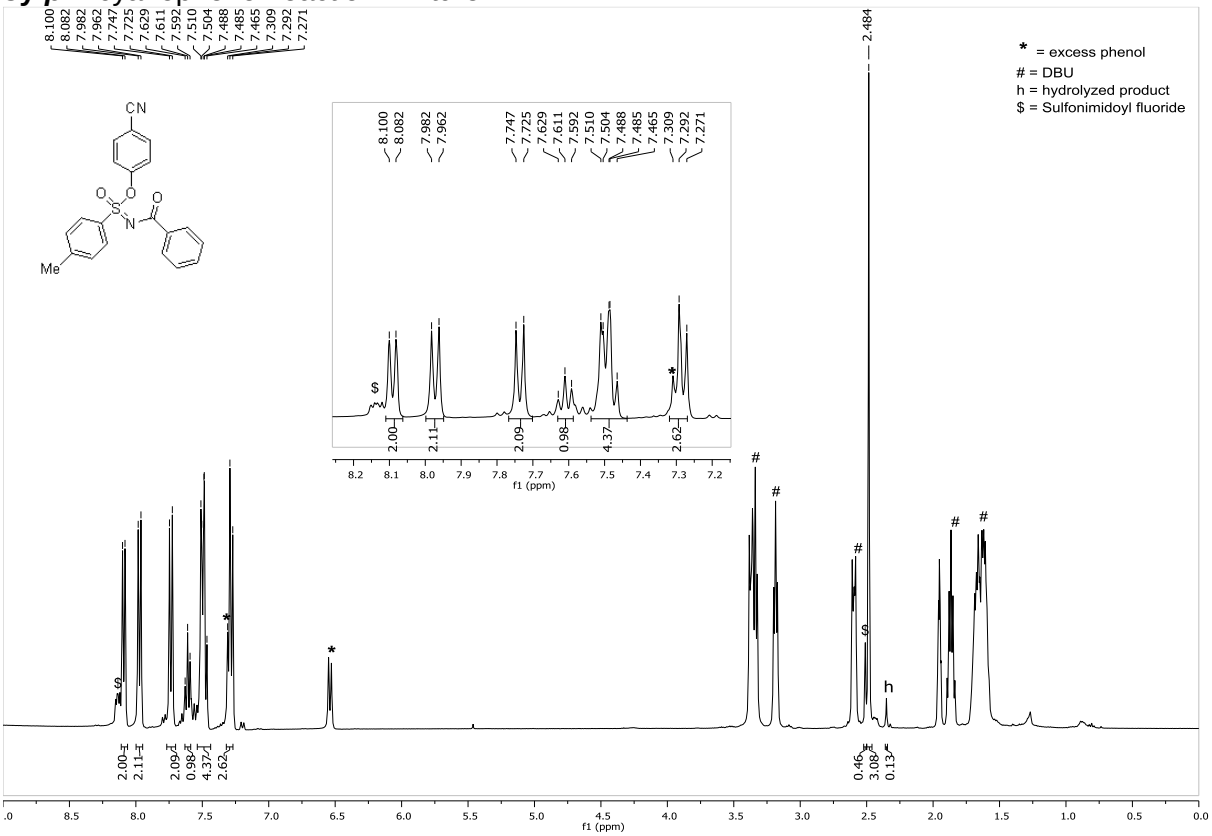
3x 4-[(4-Isopropoxyphenyl)sulfonyl]phenol reaction mixture

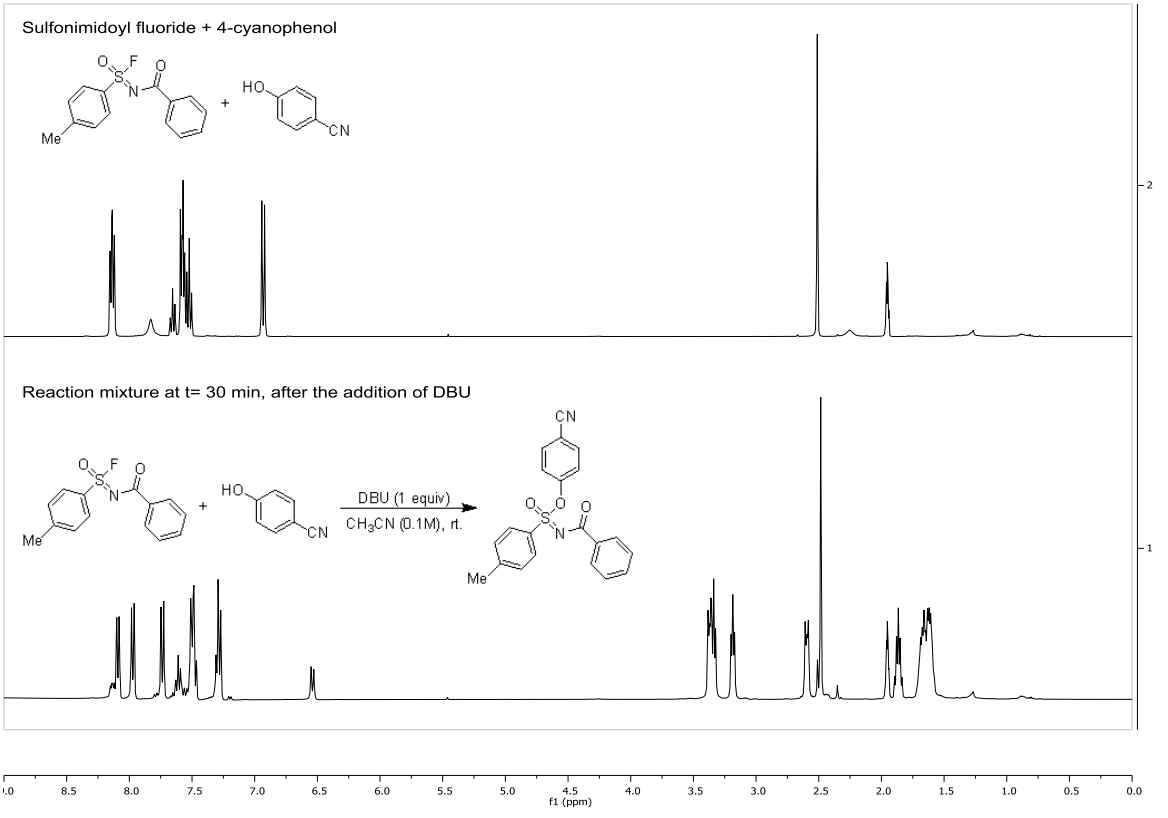




SUPPORTING INFORMATION

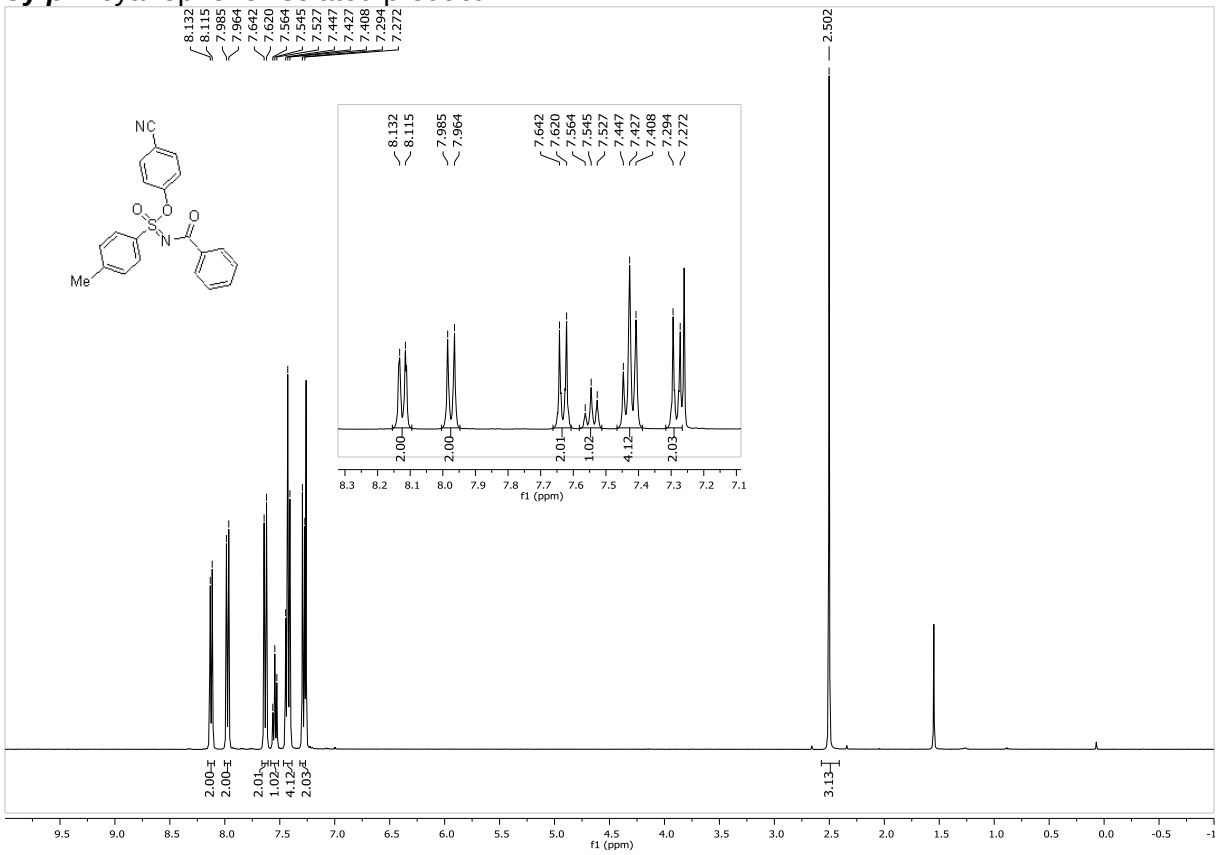
3y-*p* 4-cyanophenol reaction mixture

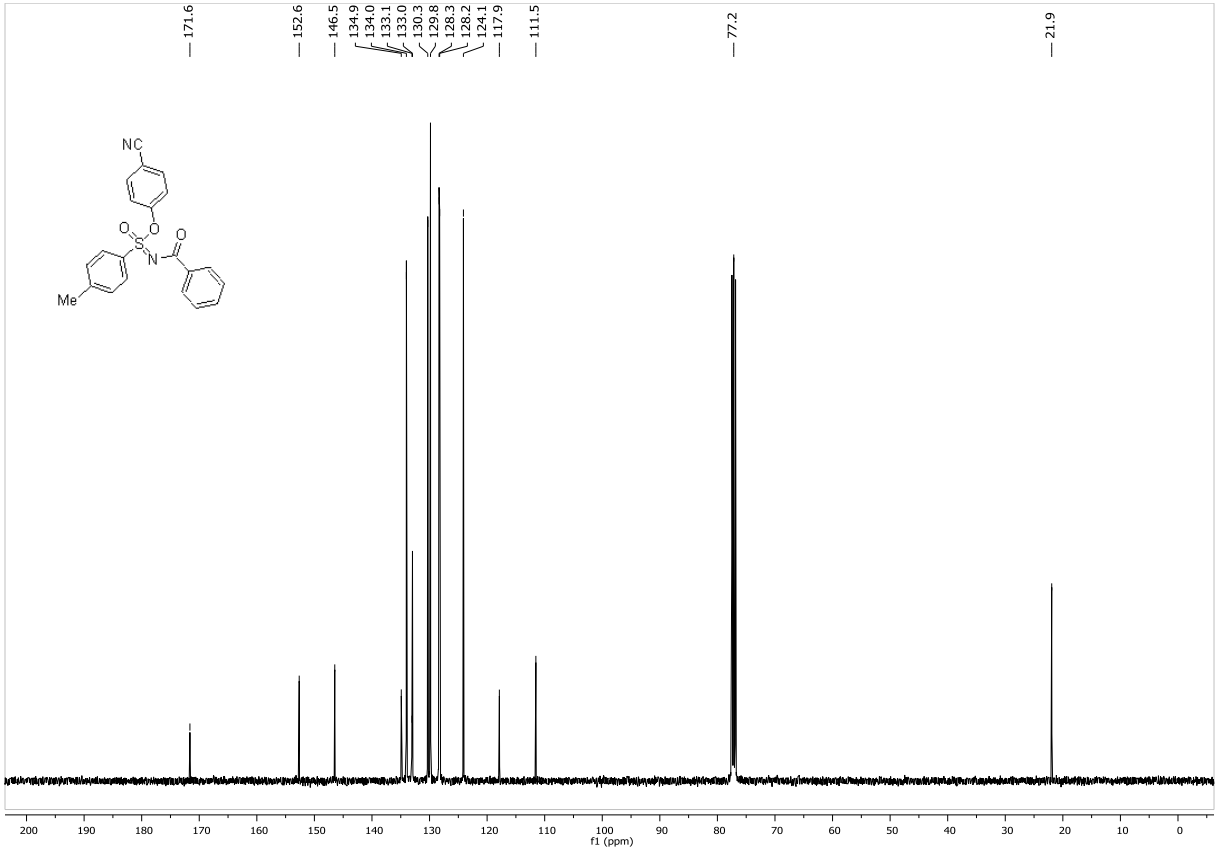




SUPPORTING INFORMATION

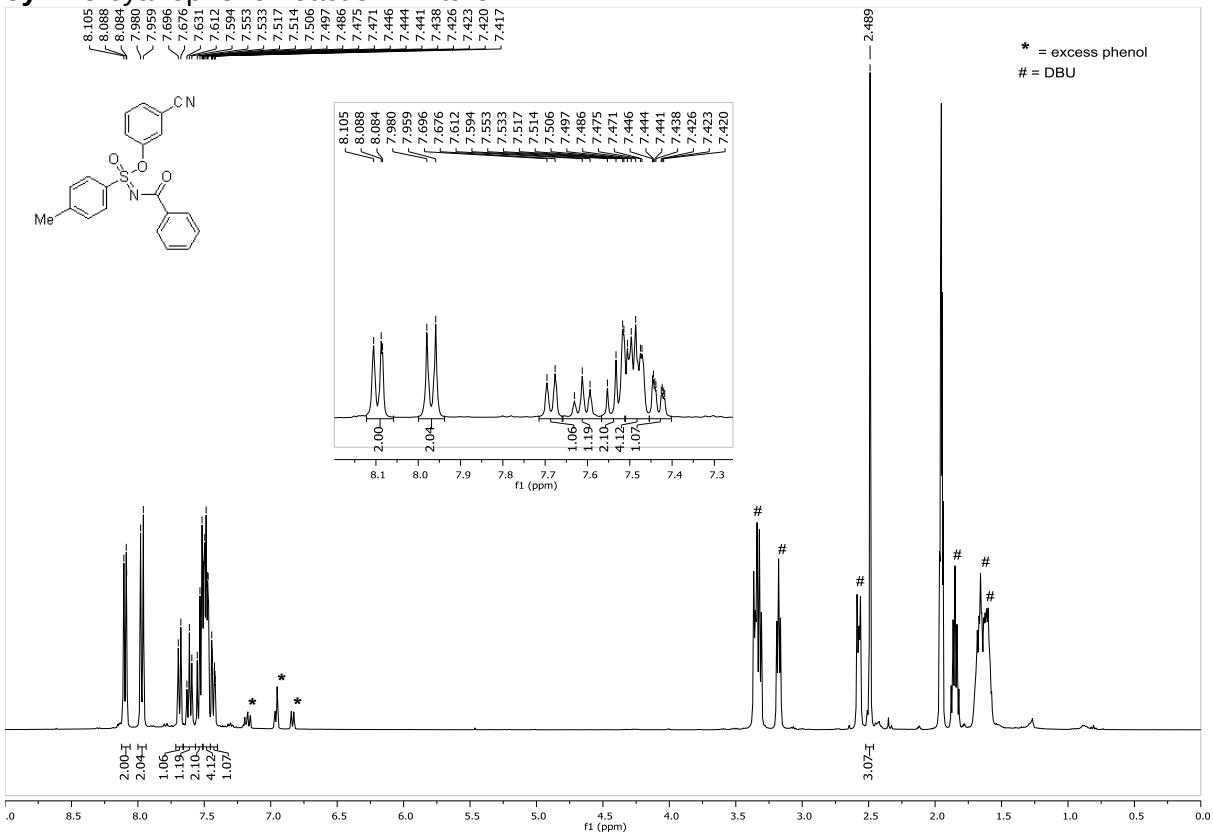
3y-*p* 4-cyanophenol isolated product

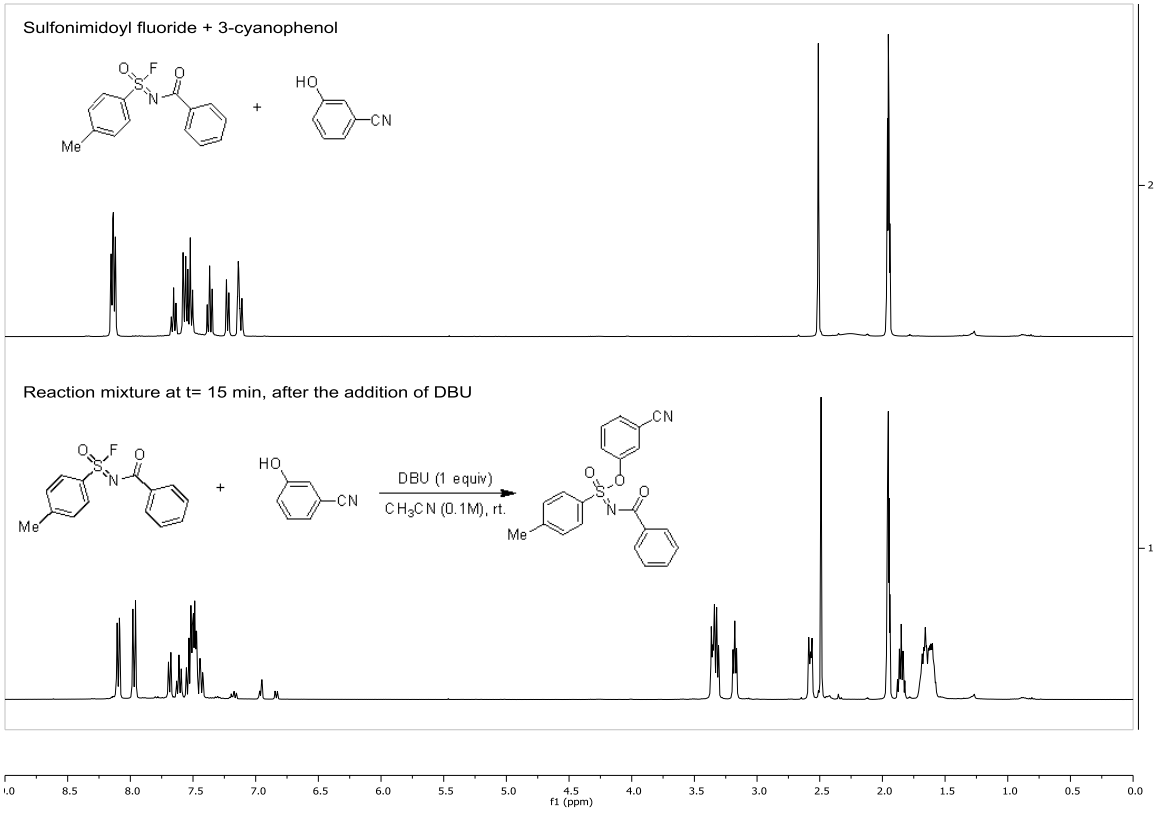




SUPPORTING INFORMATION

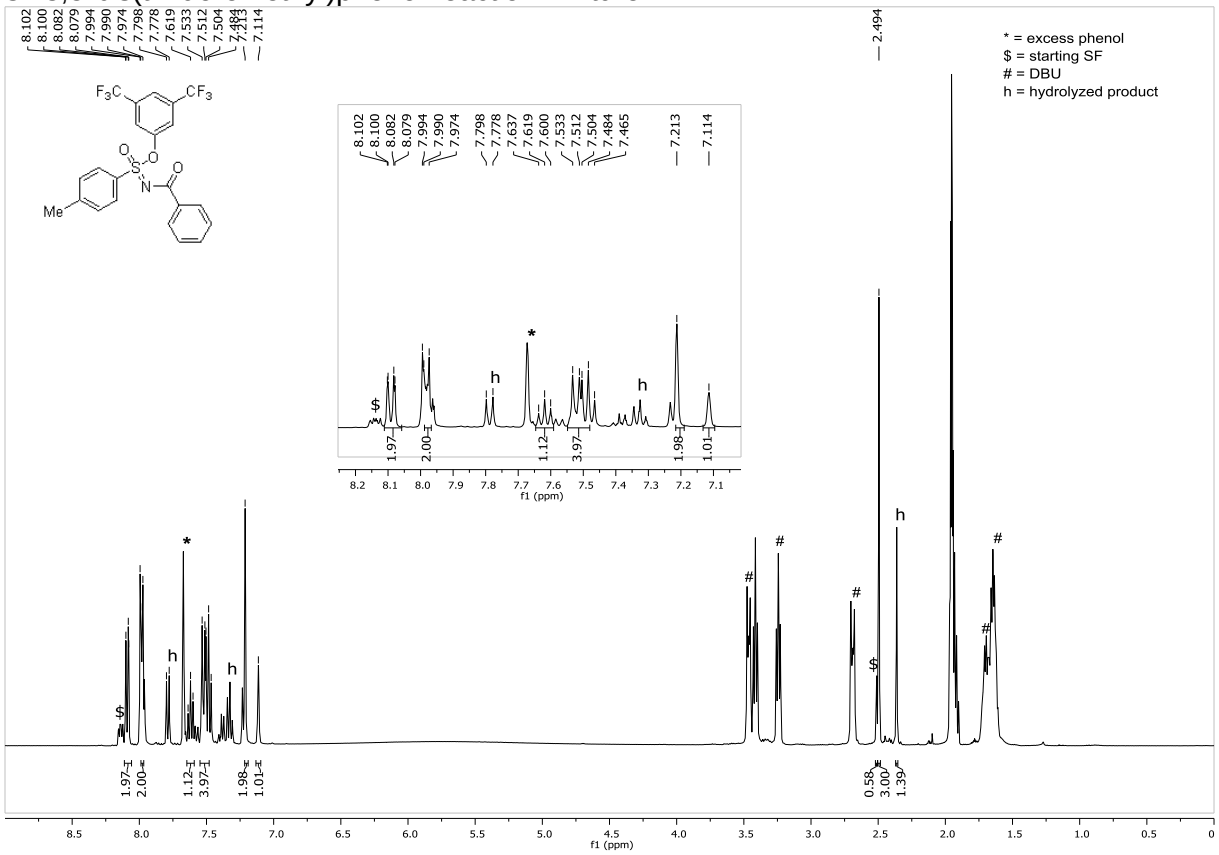
3y-*m* 3-cyanophenol reaction mixture

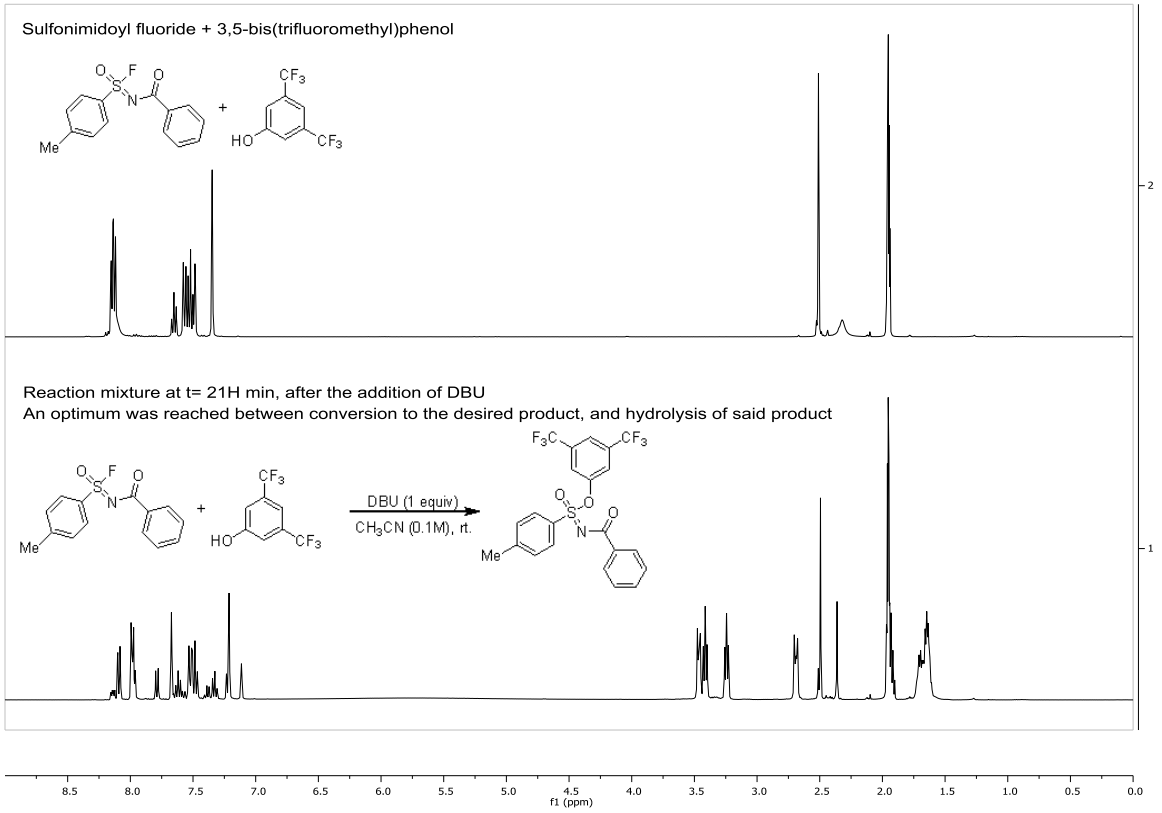




SUPPORTING INFORMATION

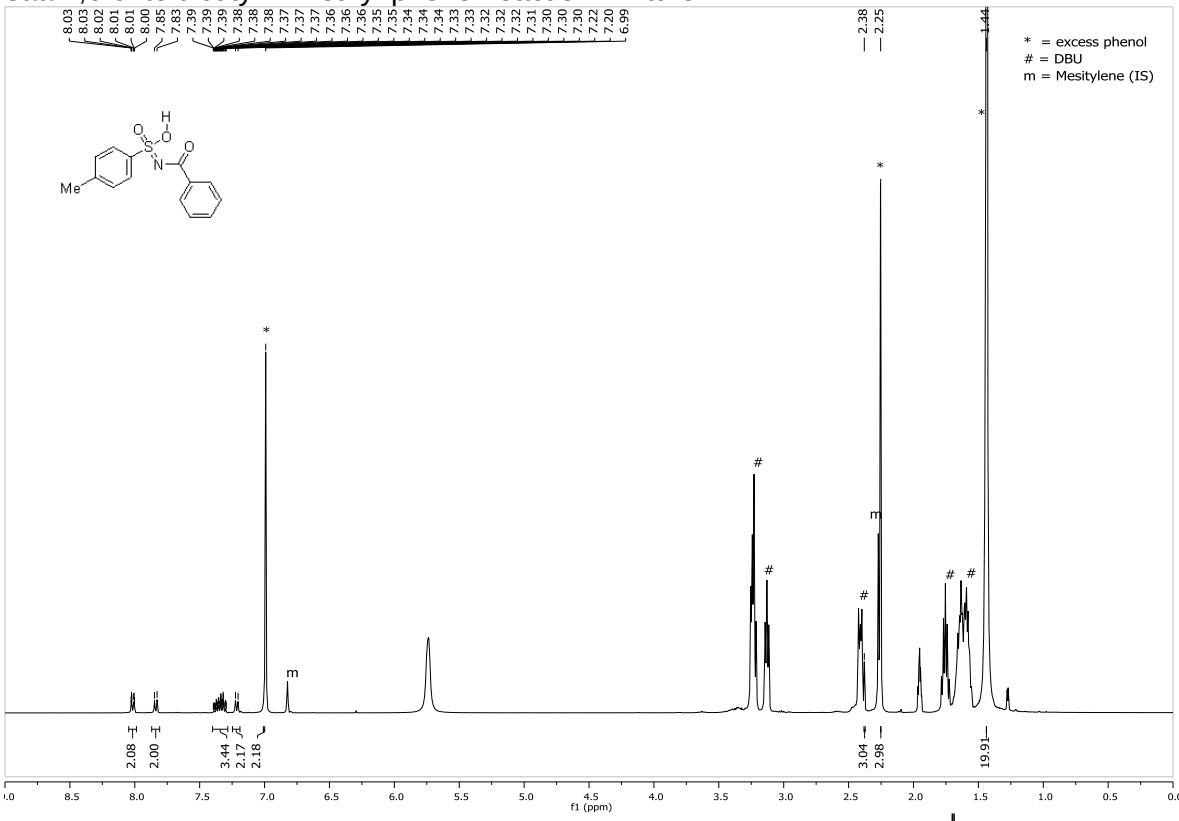
3z 3,5-bis(trifluoromethyl)phenol reaction mixture

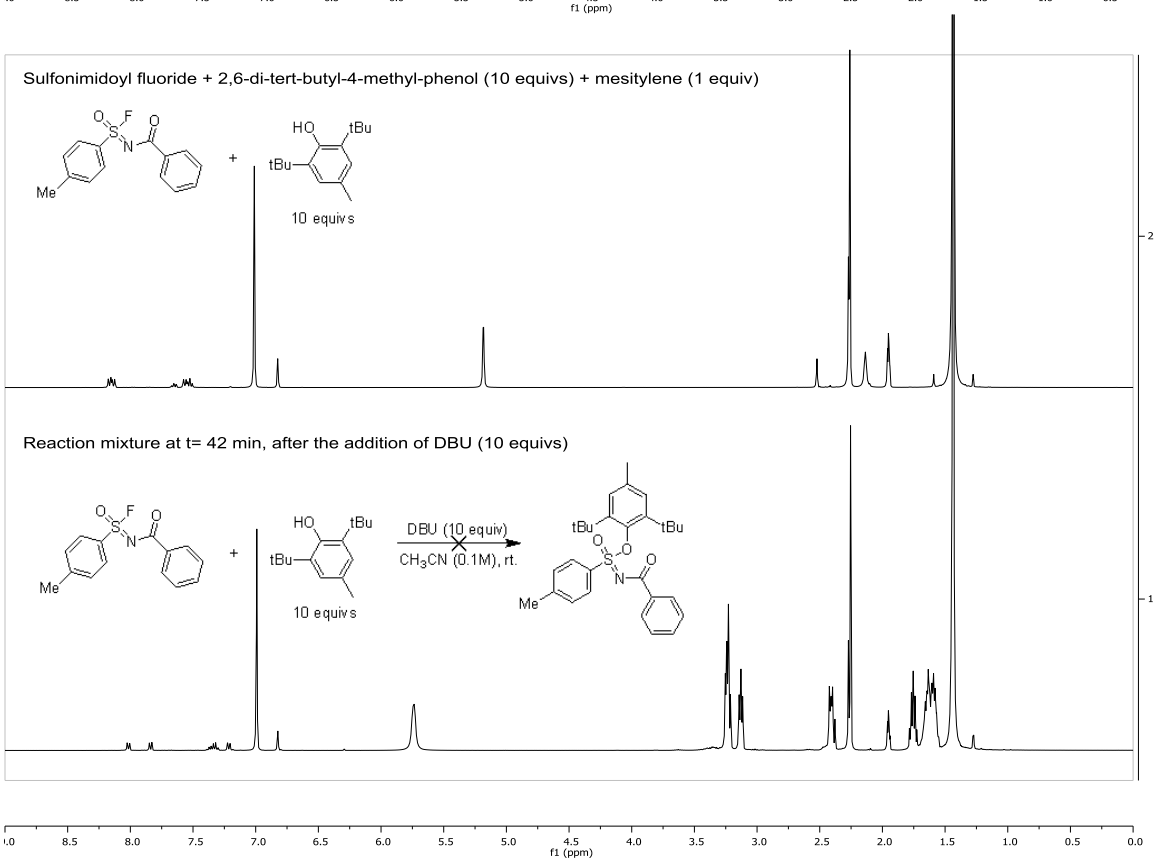




SUPPORTING INFORMATION

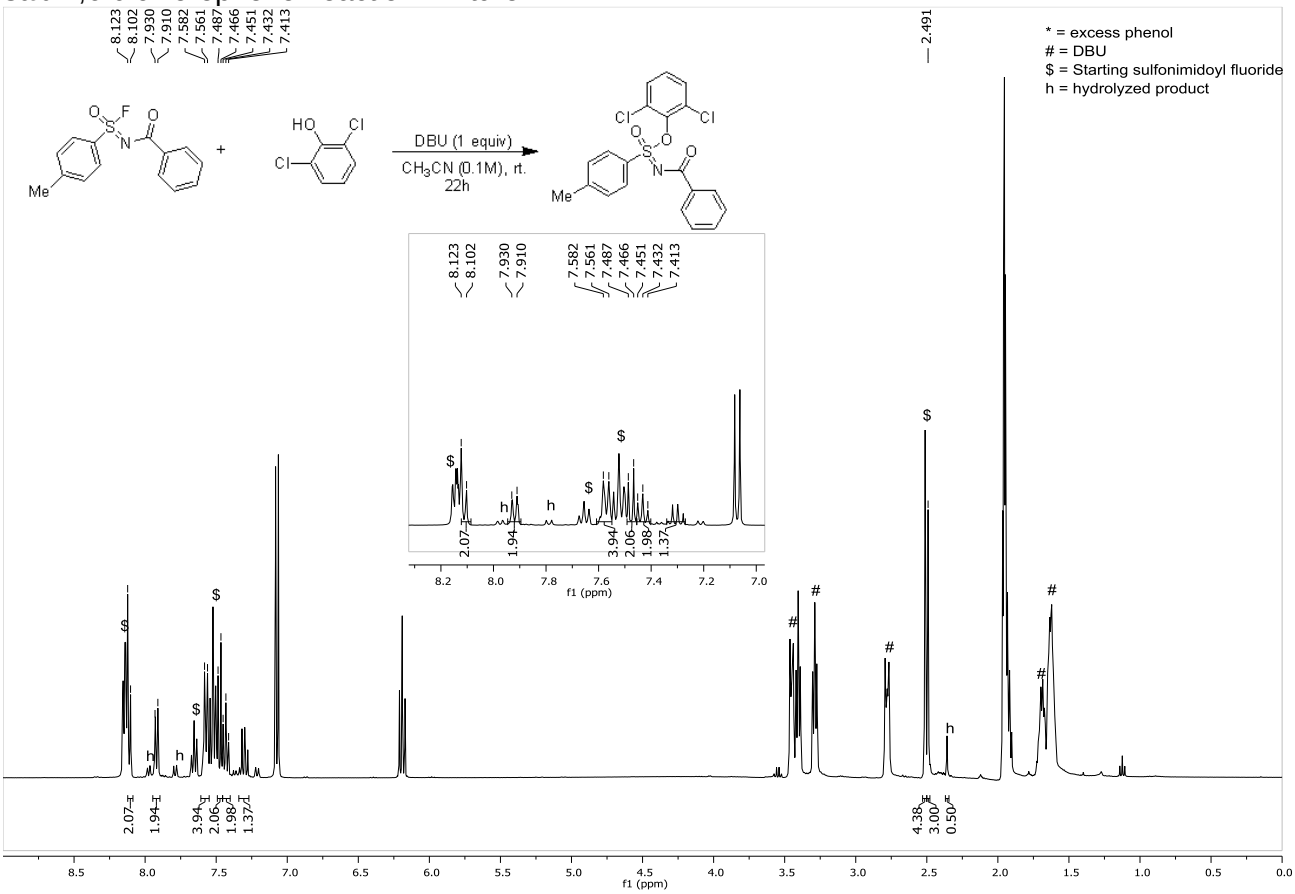
3aa 2,6-di-*tert*-butyl-4-methyl-phenol reaction mixture

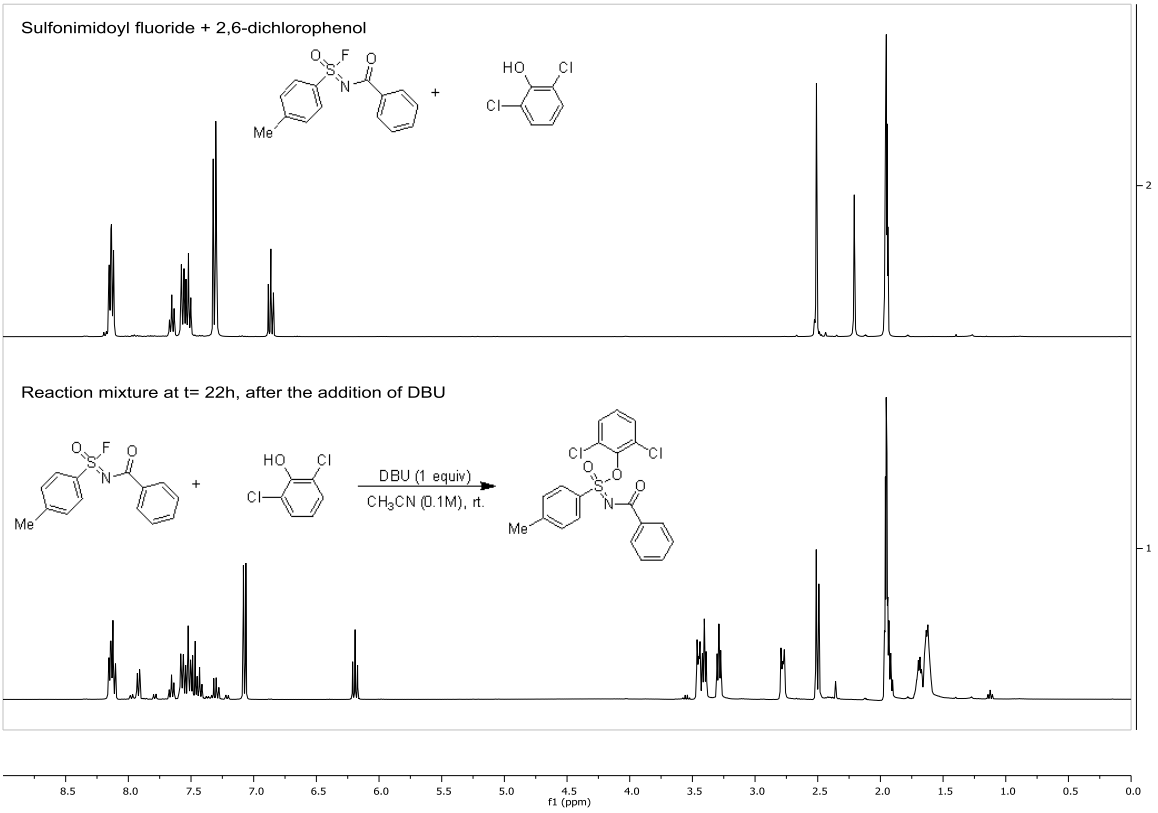




SUPPORTING INFORMATION

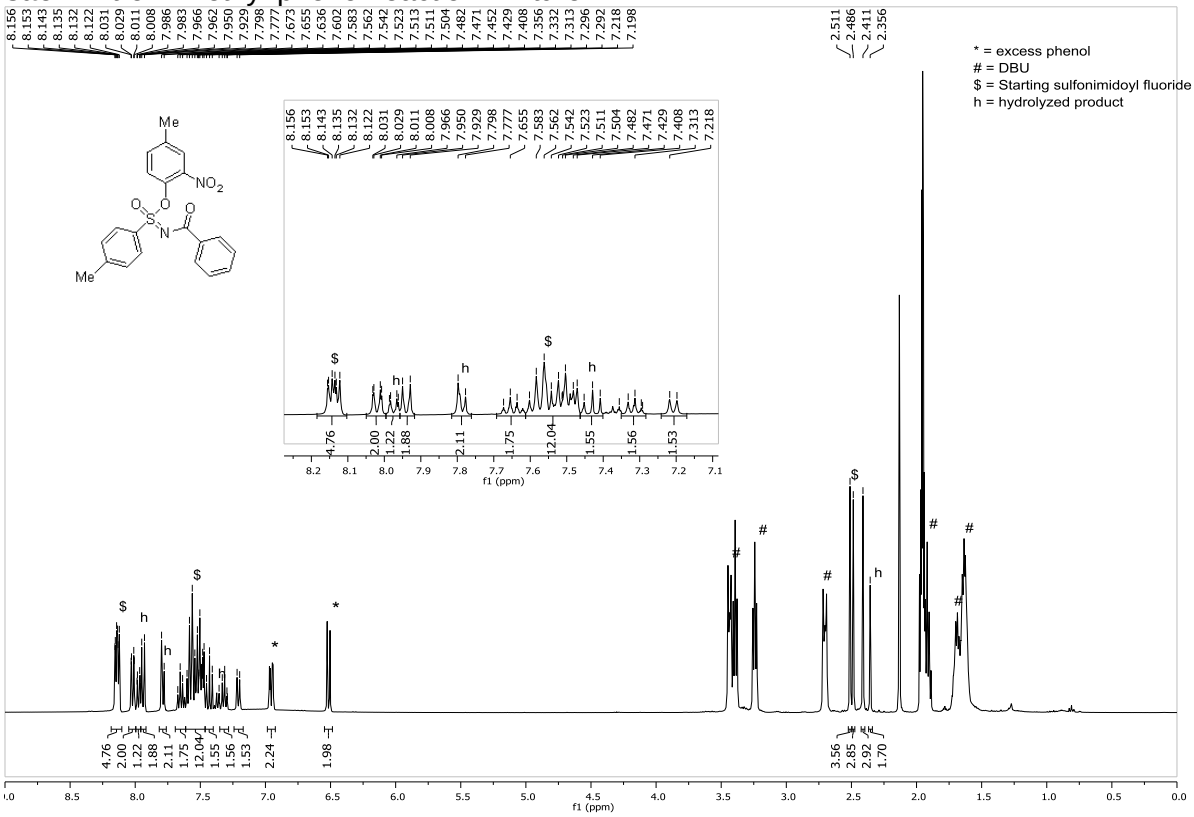
3ab 2,6-dichlorophenol reaction mixture

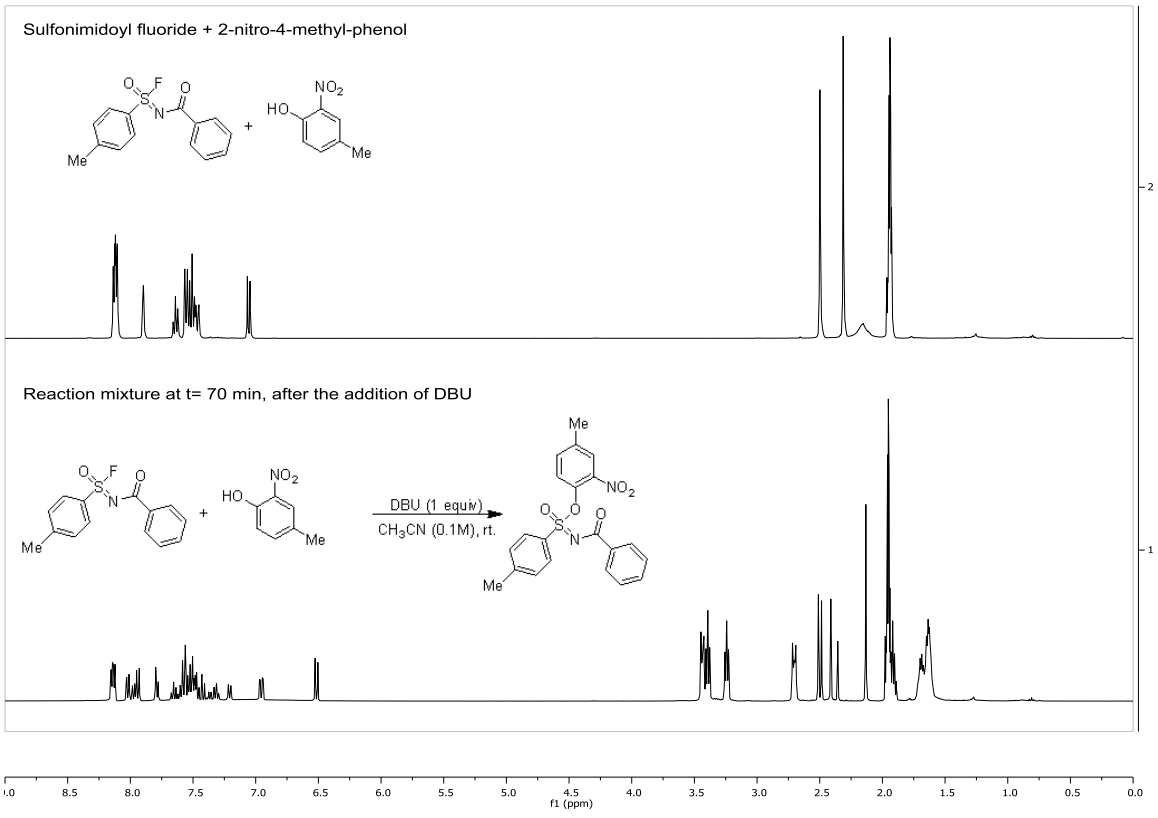




SUPPORTING INFORMATION

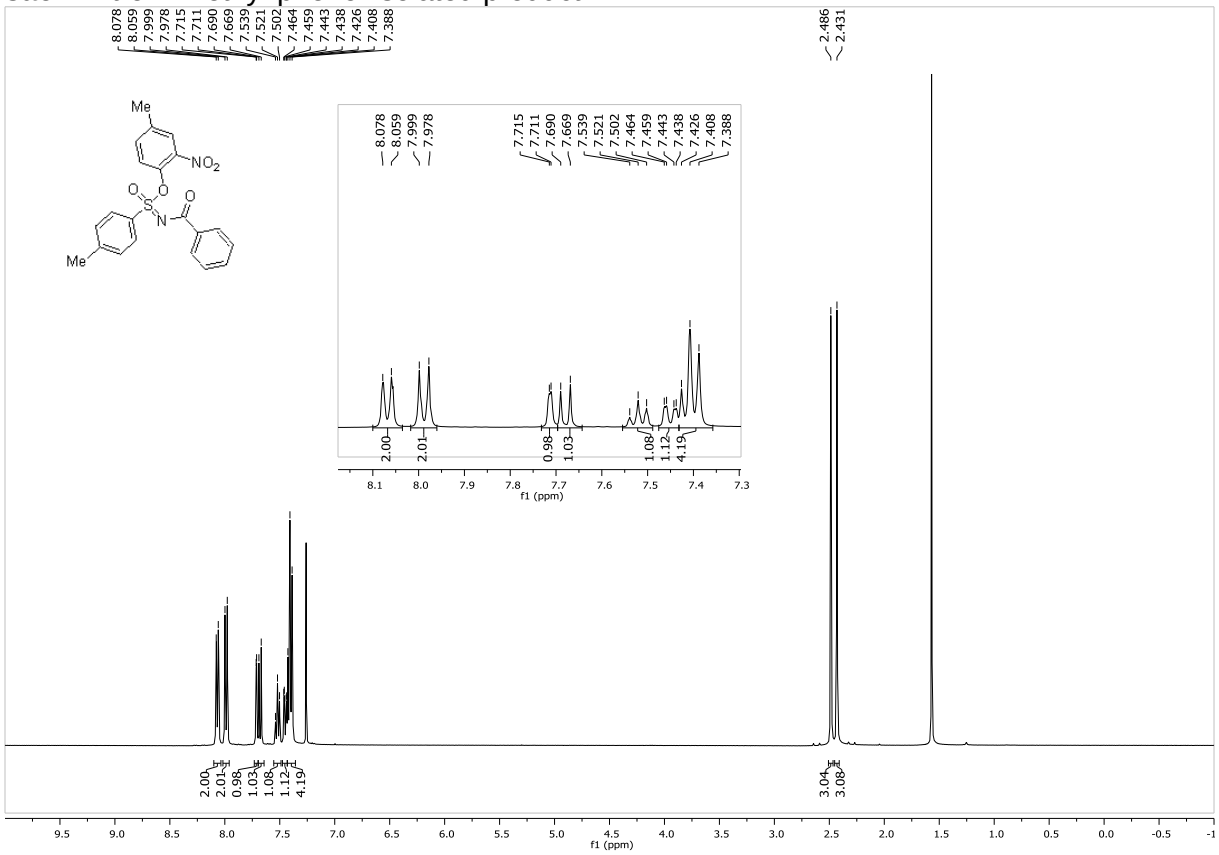
3ac 2-nitro-4-methyl-phenol reaction mixture

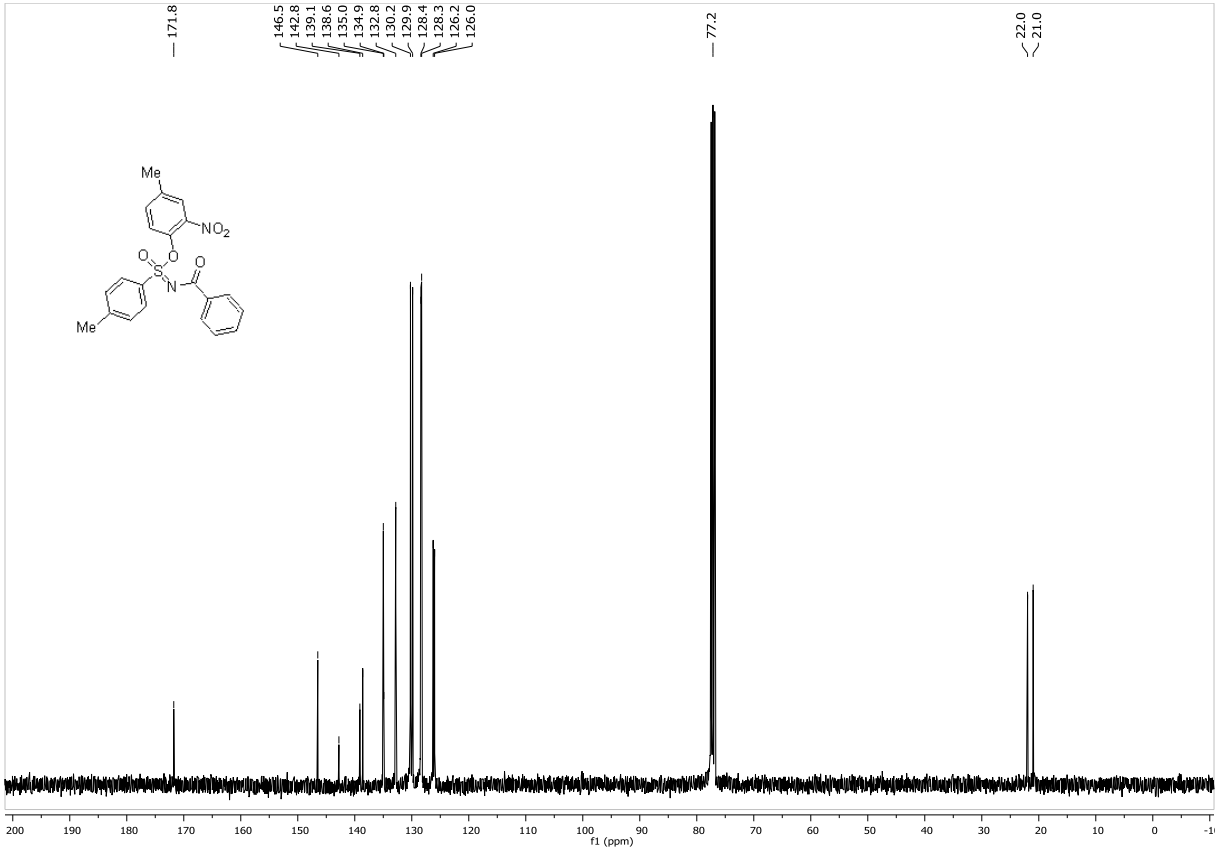


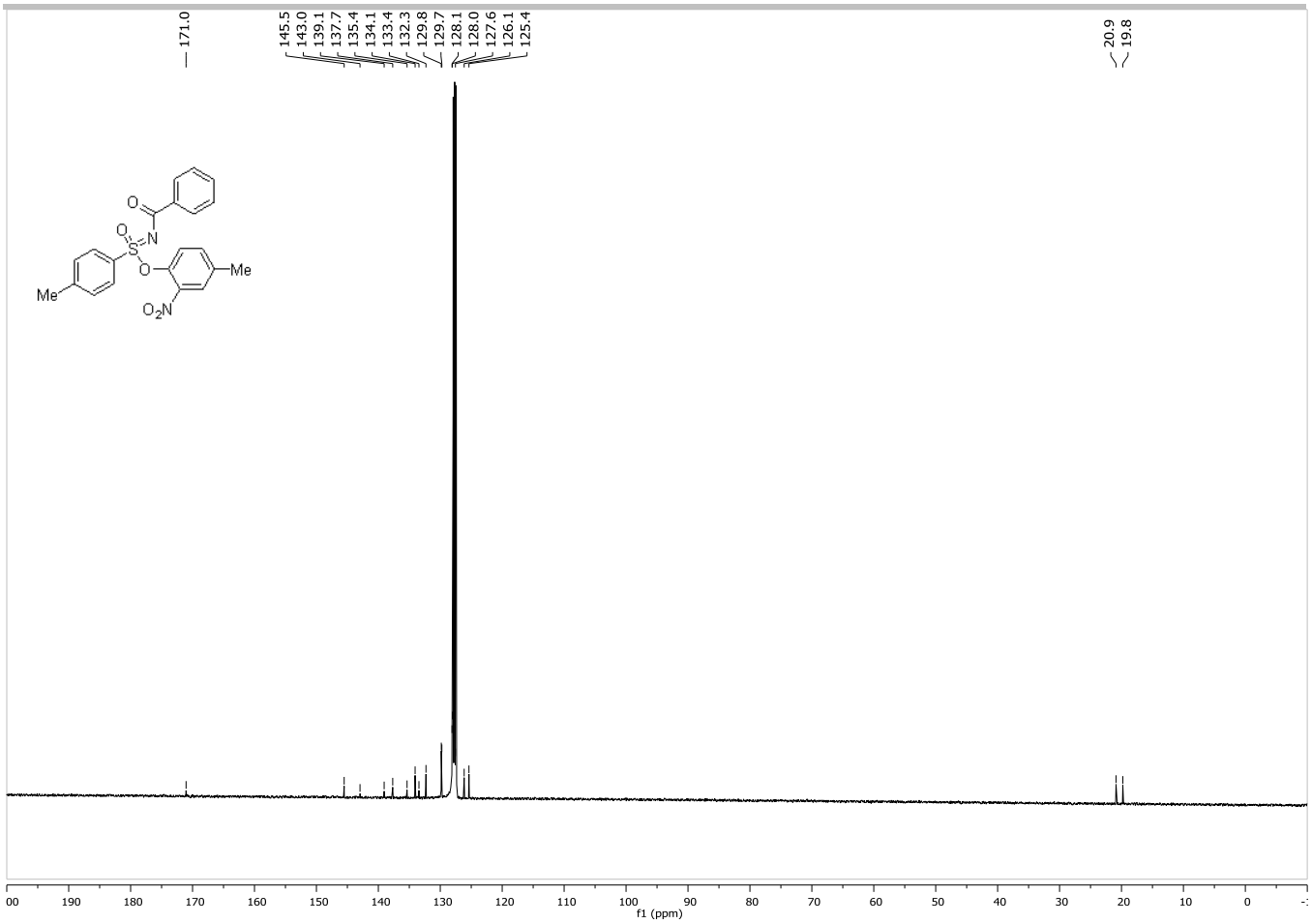


SUPPORTING INFORMATION

3ac 2-nitro-4-methyl-phenol isolated product



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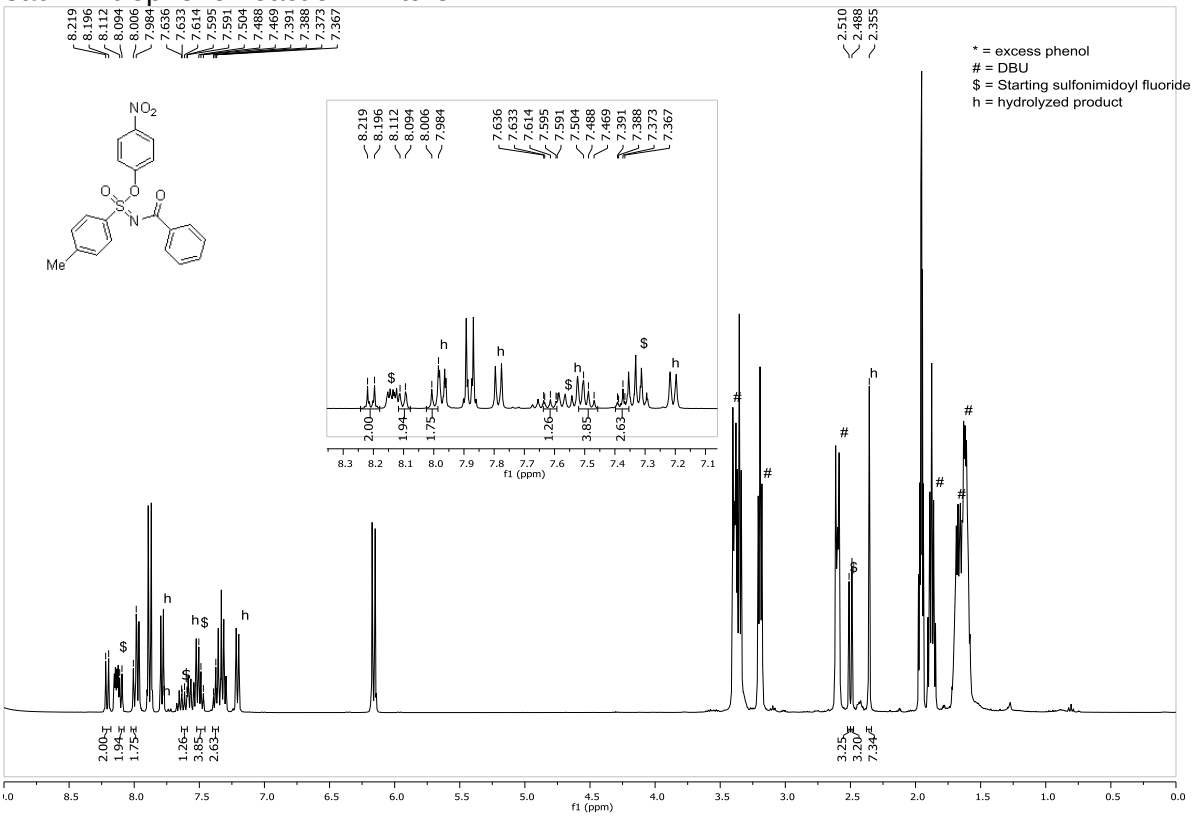
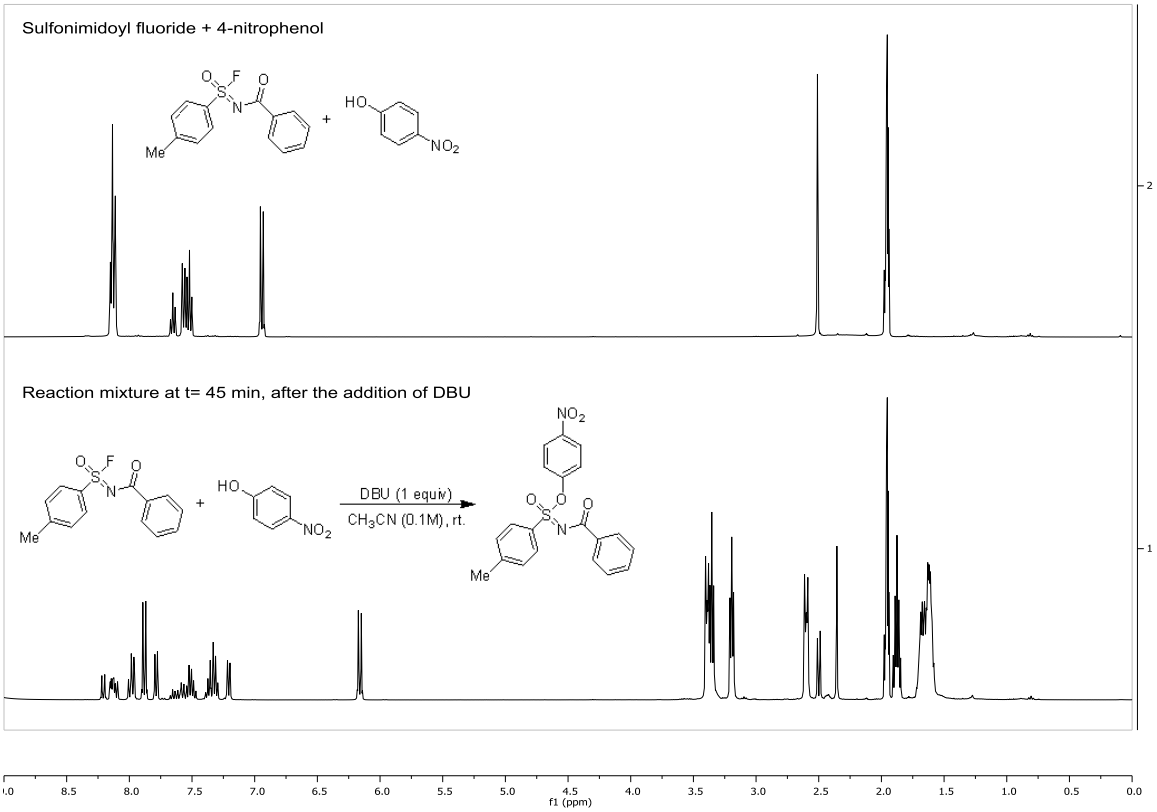
145.5
143.0
139.1
137.7
135.4
134.1
133.4
132.3
129.8
129.7
128.1
128.0
127.6
126.1
125.4
20.9
19.8
O
O
S
N
O
Me
Me
O2N
f1 (ppm)

SUPPORTING INFORMATION

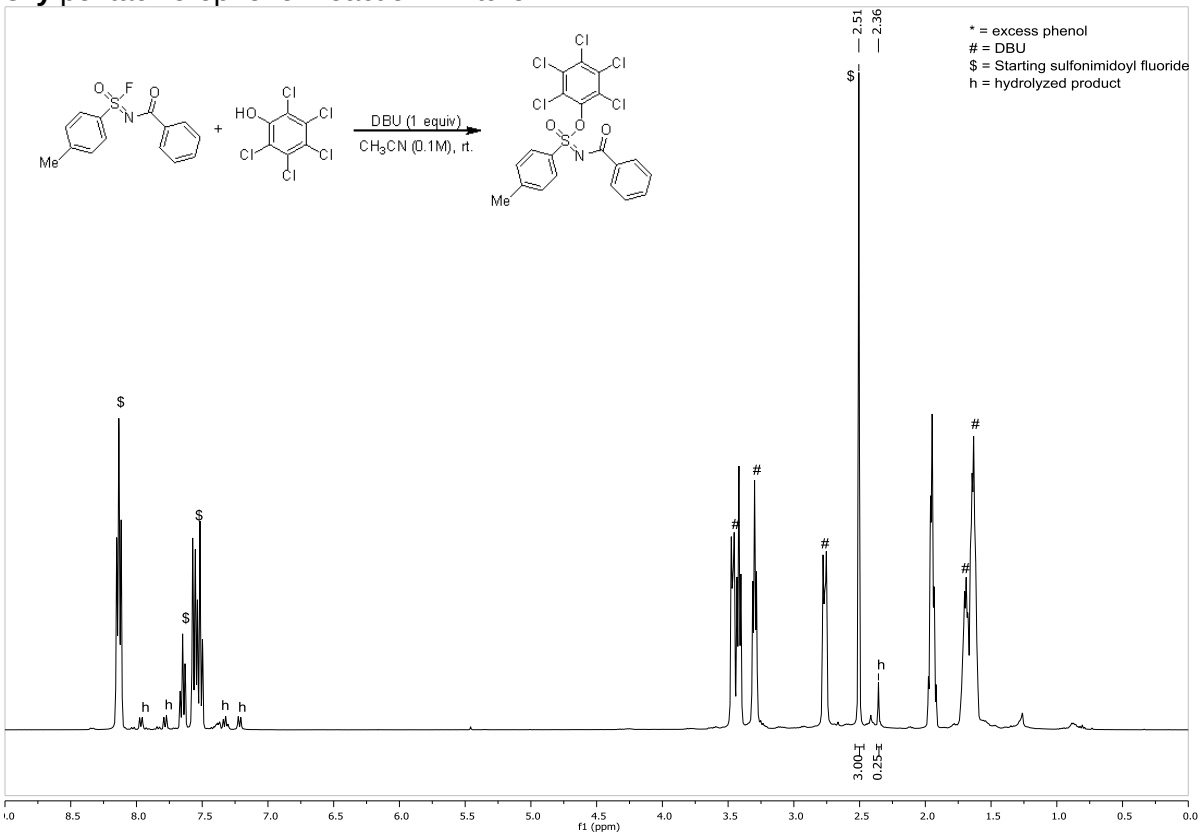
3ad 4-nitrophenol reaction mixture





SUPPORTING INFORMATION

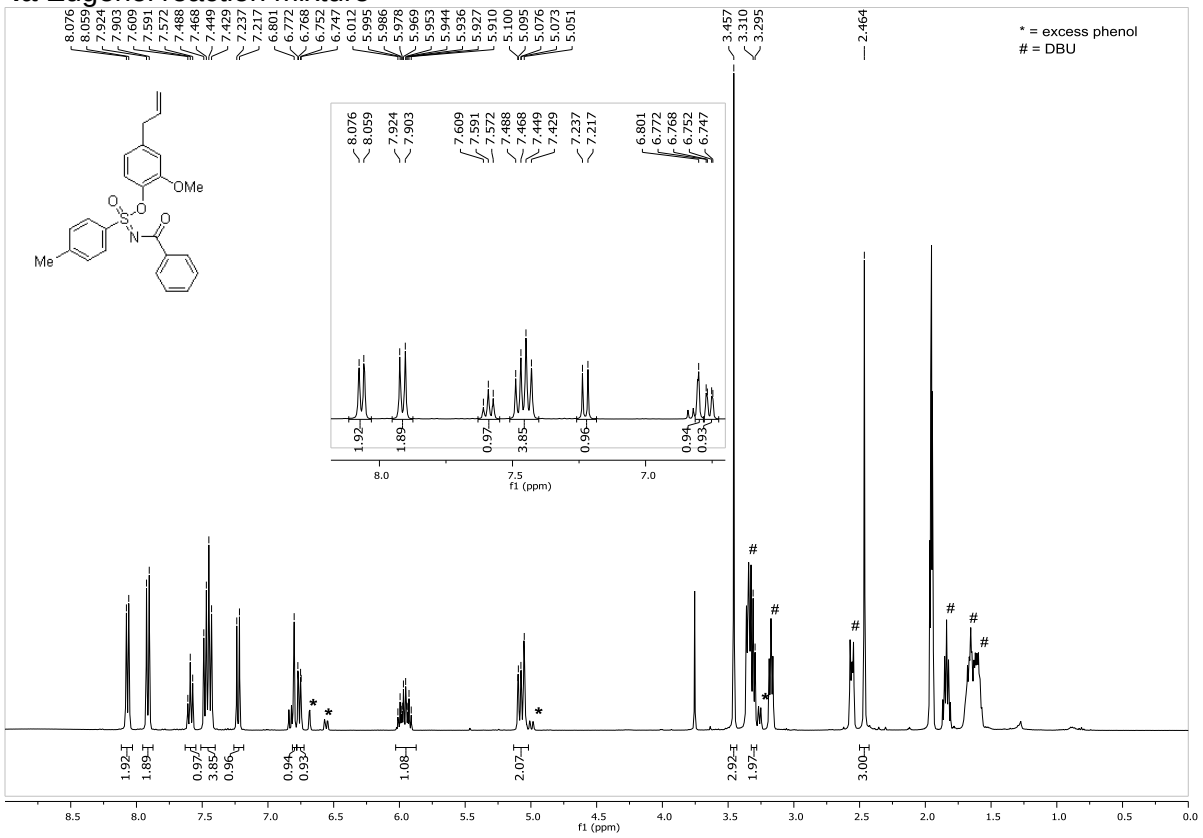
3zy pentachlorophenol reaction mixture

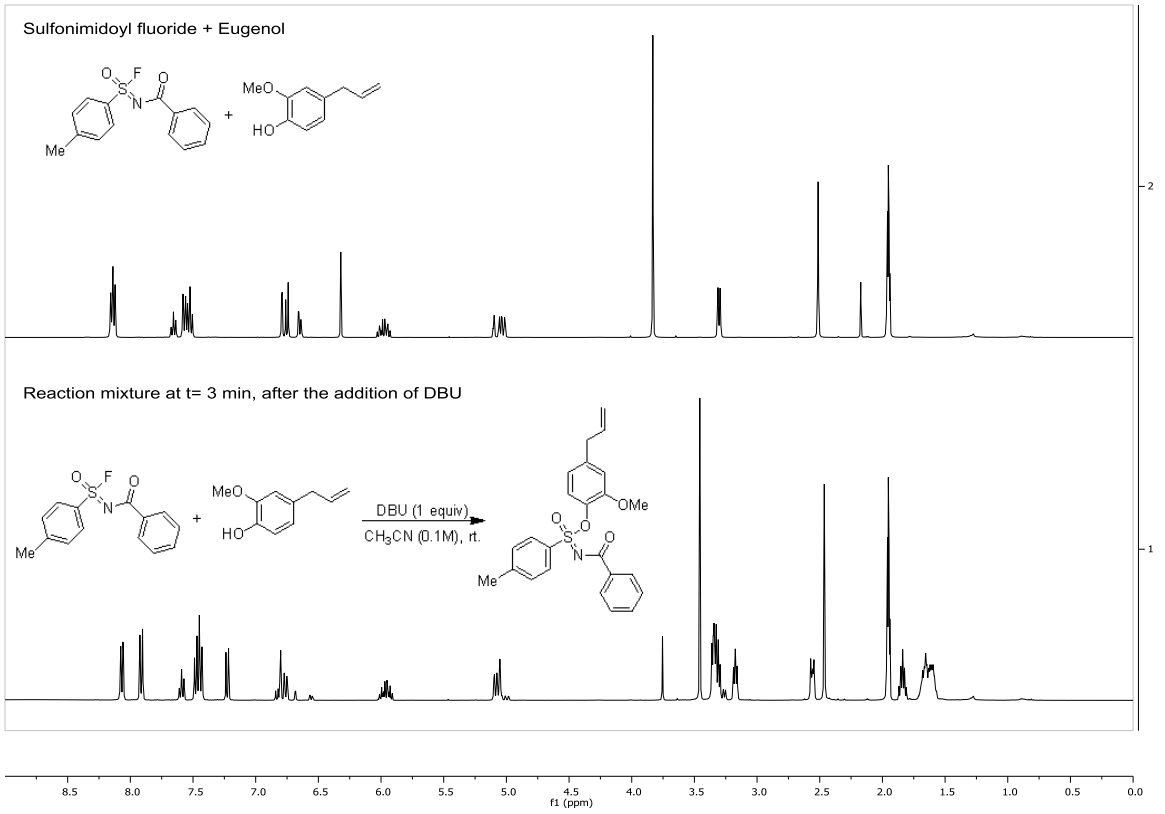


SUPPORTING INFORMATION

Natural phenols – reaction mixtures

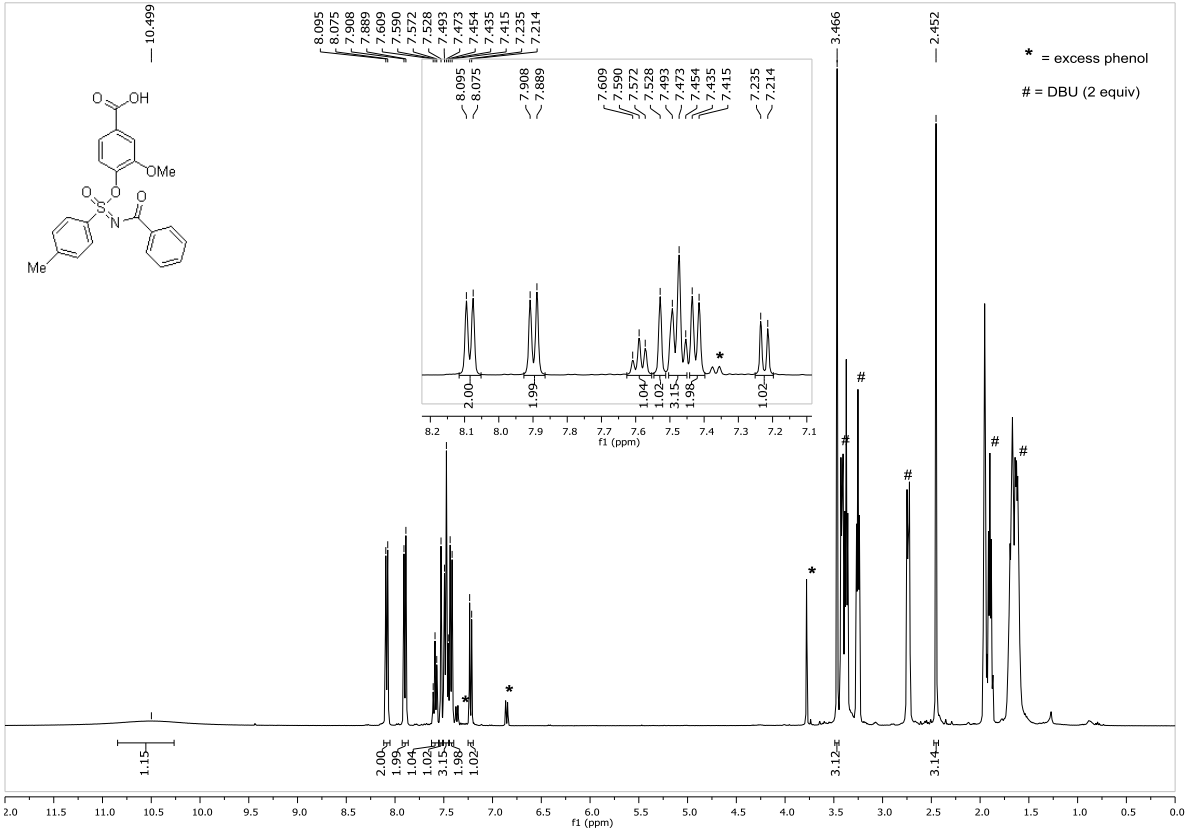
4a Eugenol reaction mixture

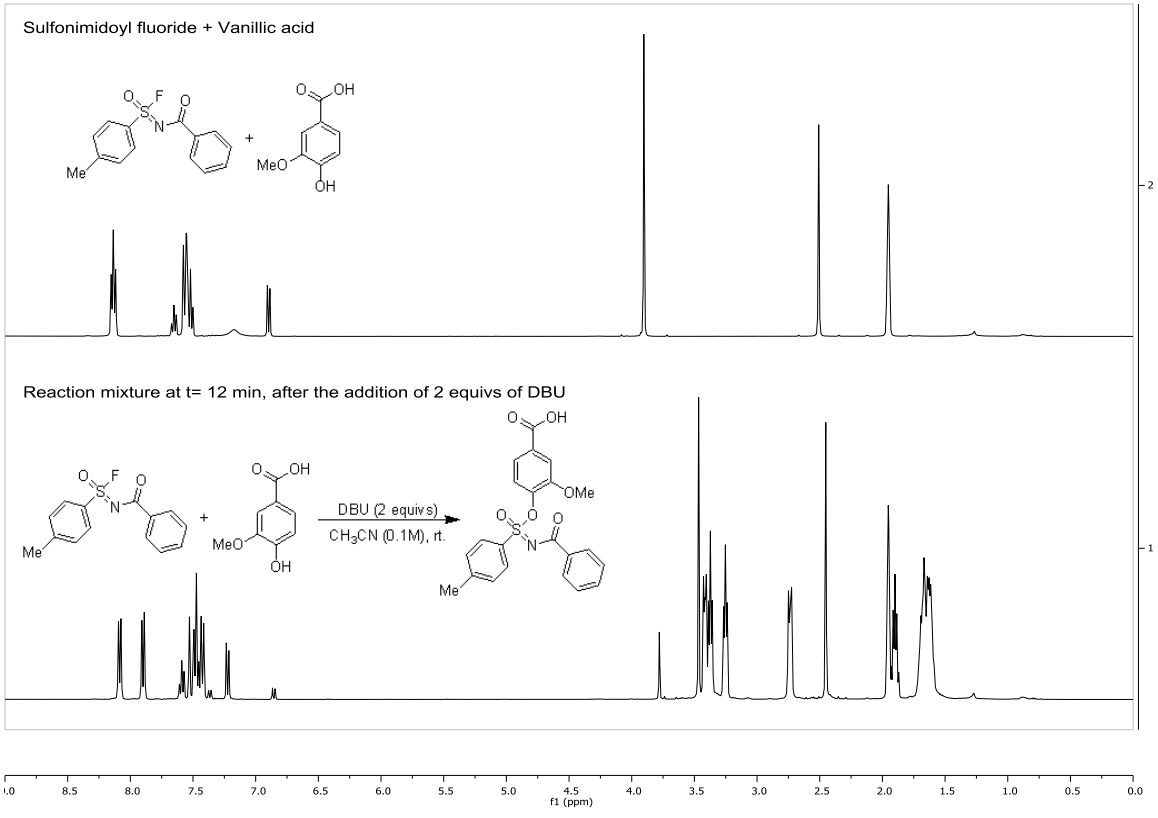




SUPPORTING INFORMATION

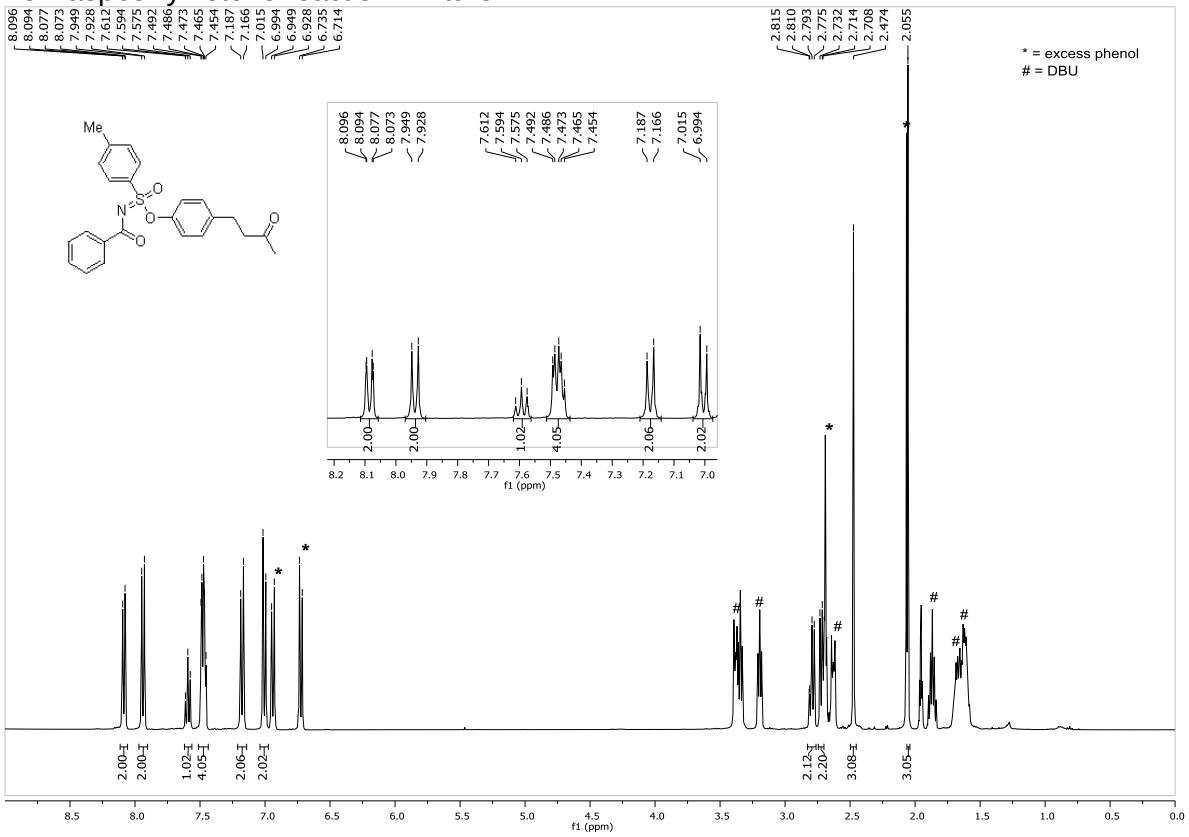
4b Vanillic acid reaction mixture

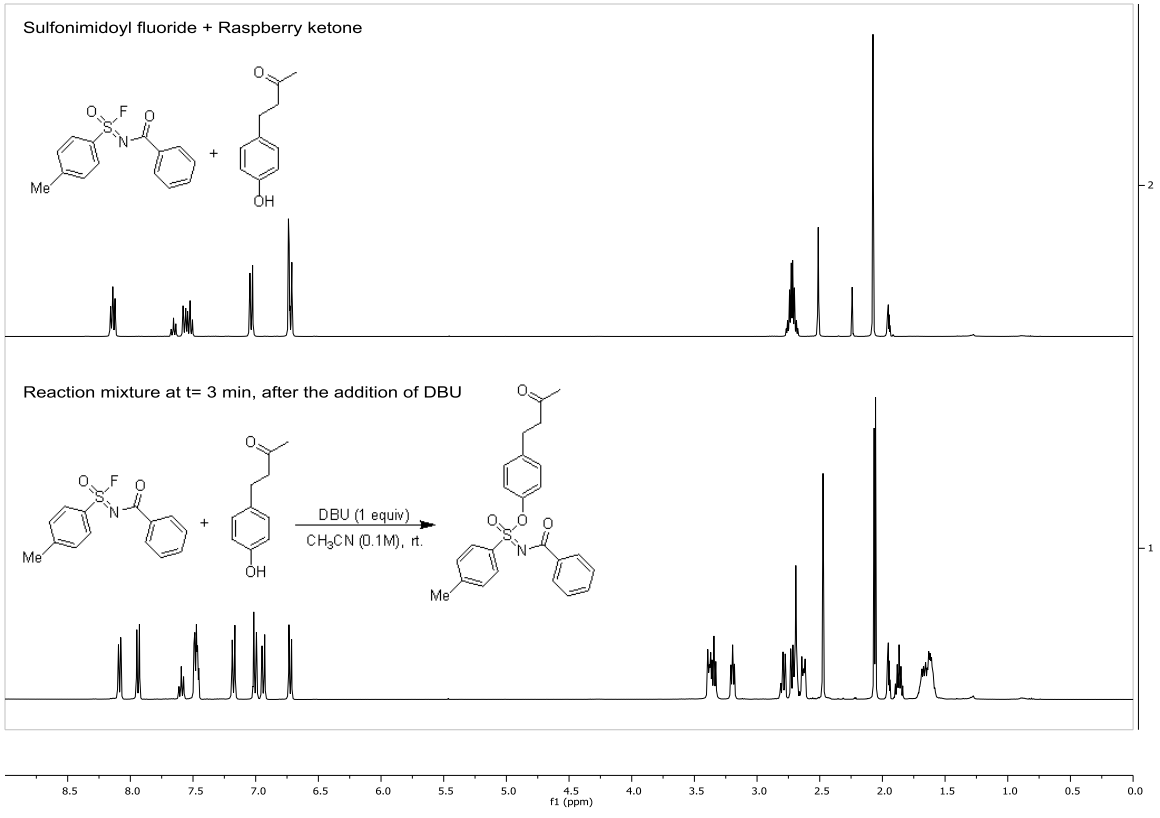




SUPPORTING INFORMATION

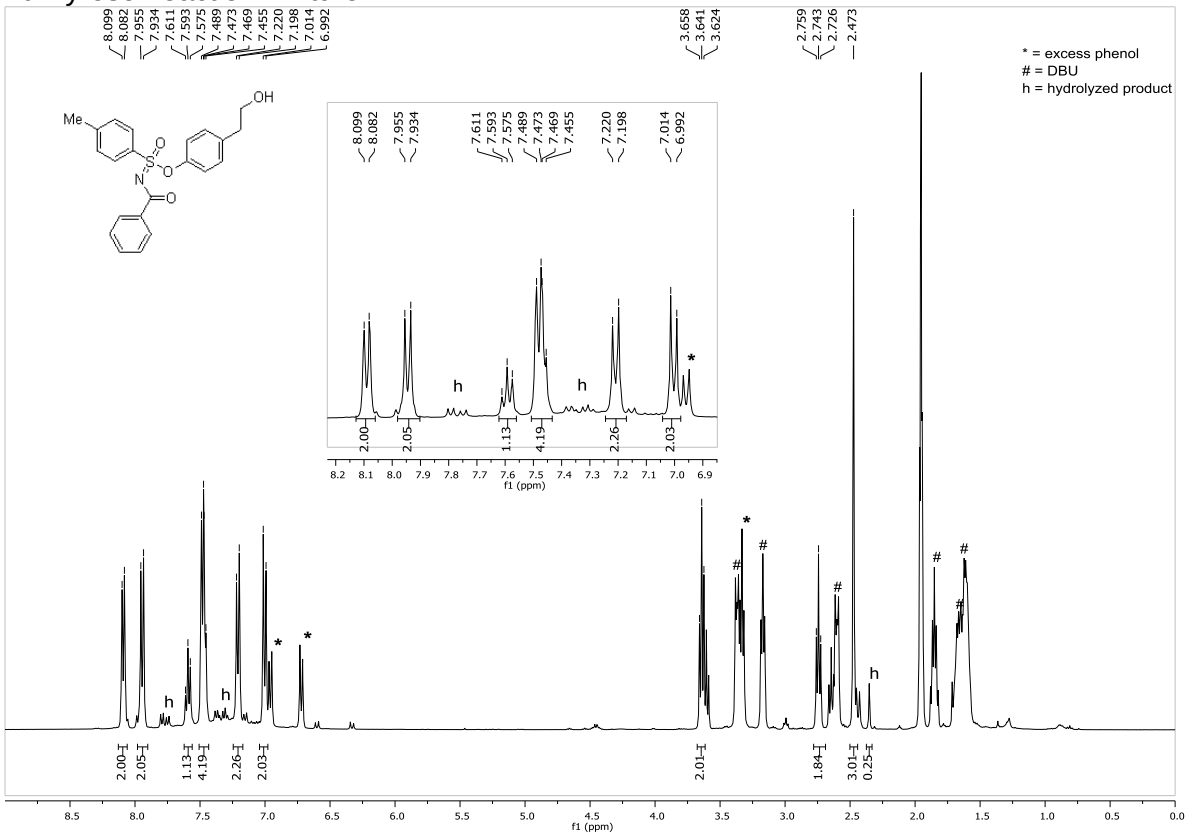
4c Raspberry ketone reaction mixture

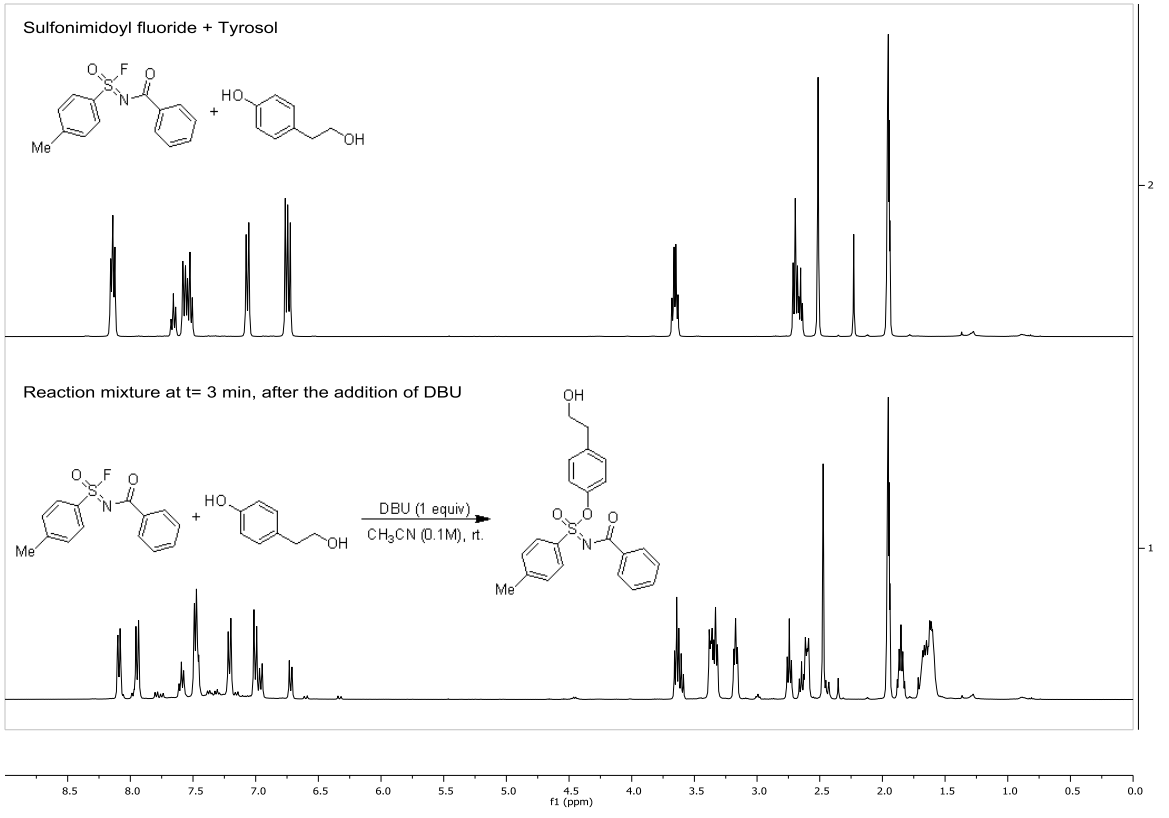




SUPPORTING INFORMATION

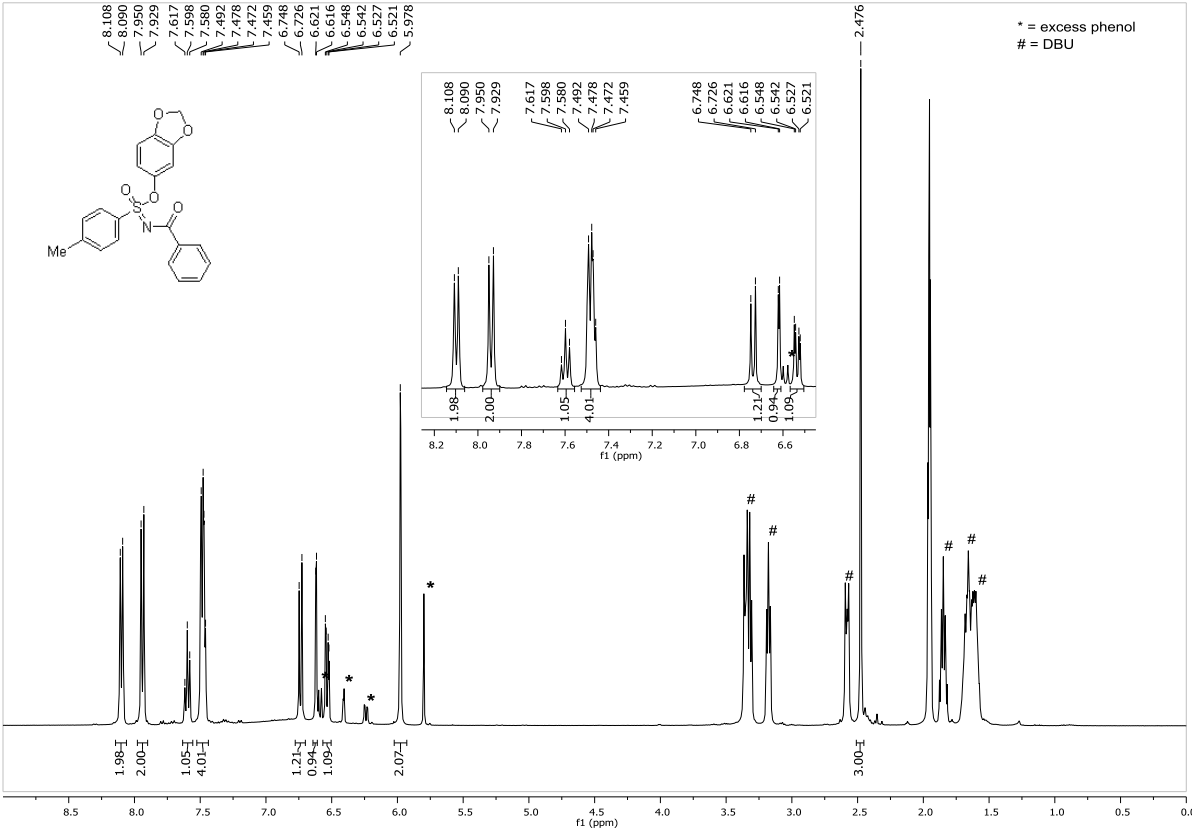
4d Tyrosol reaction mixture

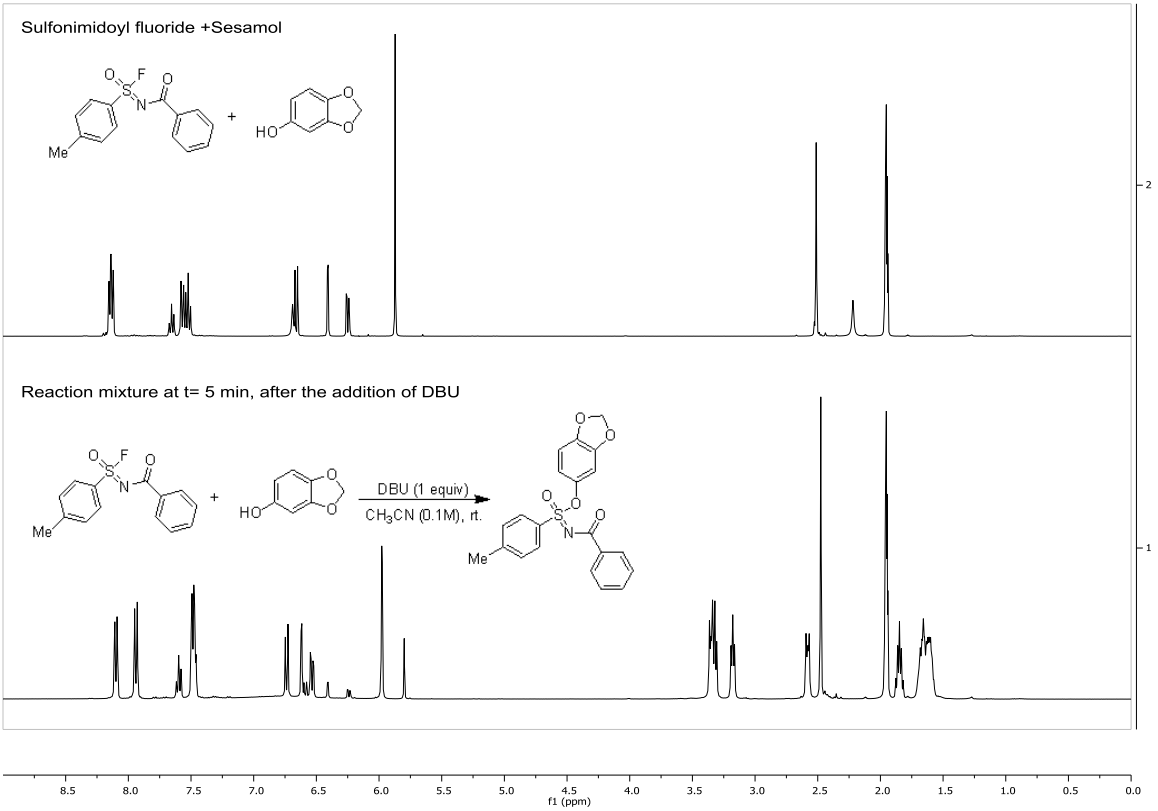




SUPPORTING INFORMATION

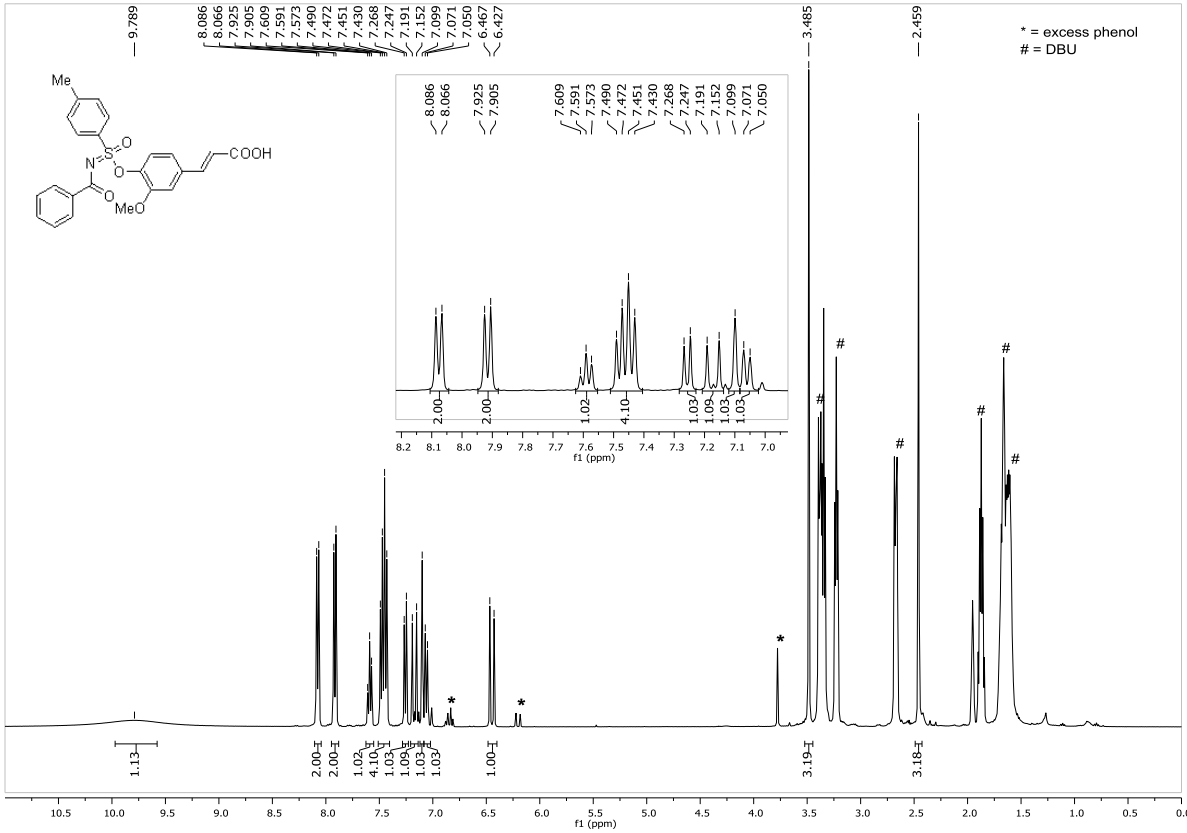
4e Sesamol reaction mixture

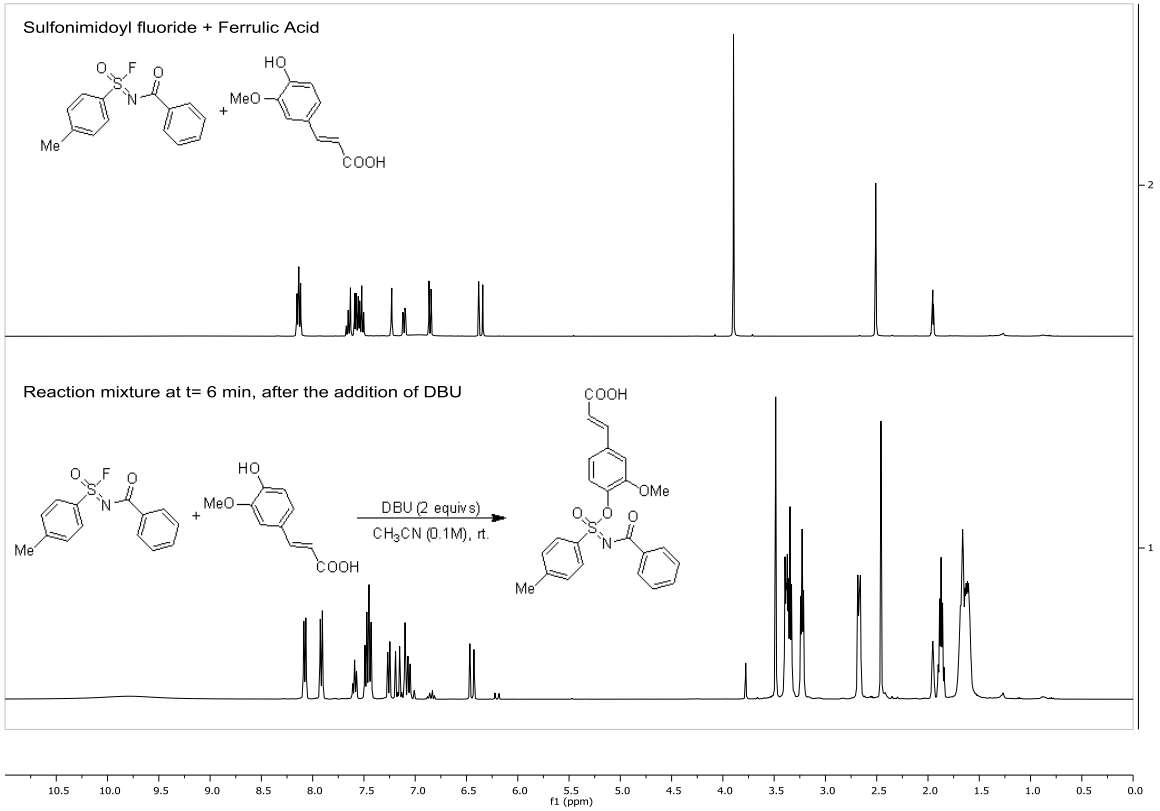




SUPPORTING INFORMATION

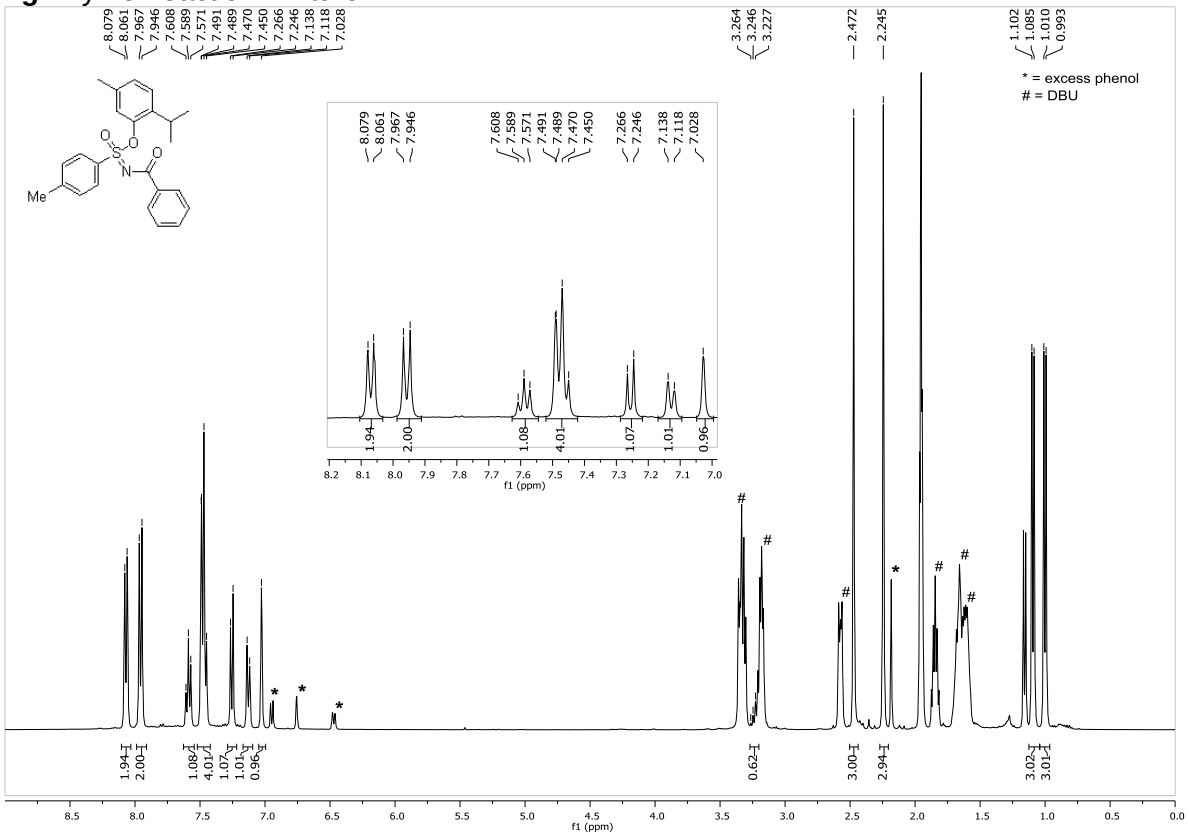
4f Ferrulic acid reaction mixture

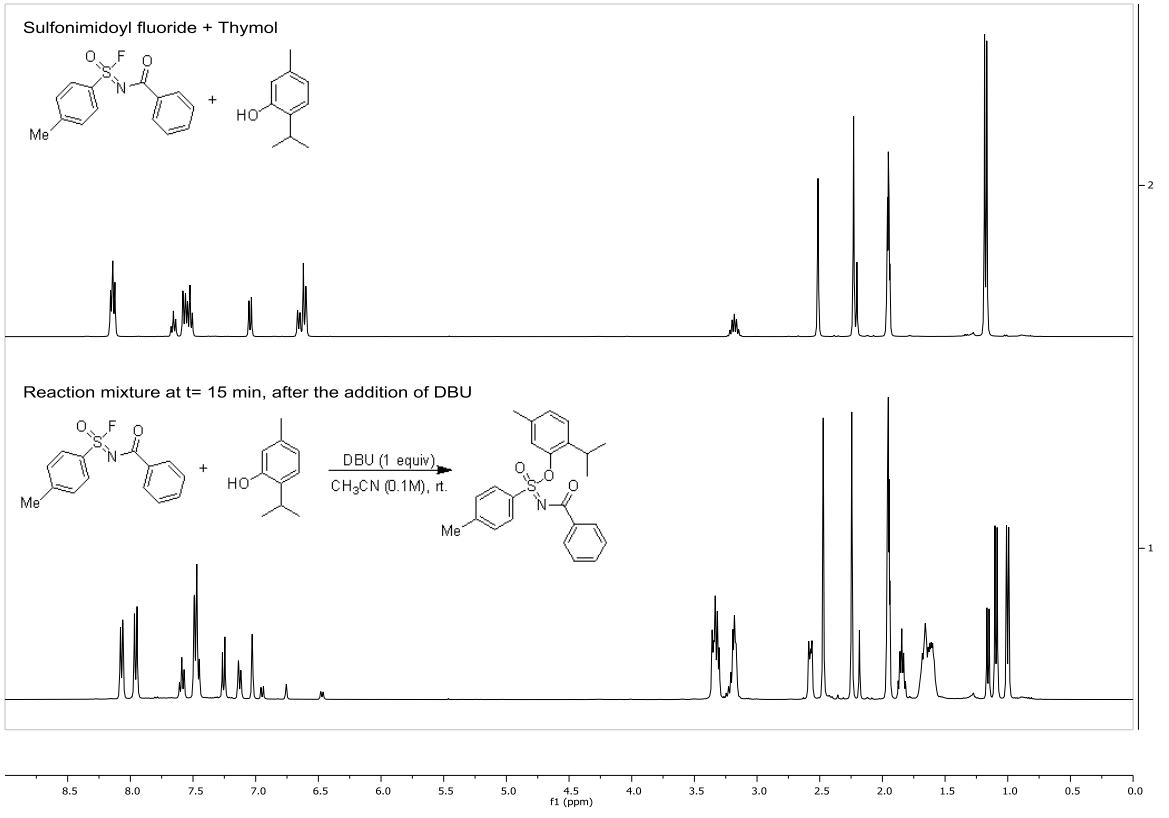




SUPPORTING INFORMATION

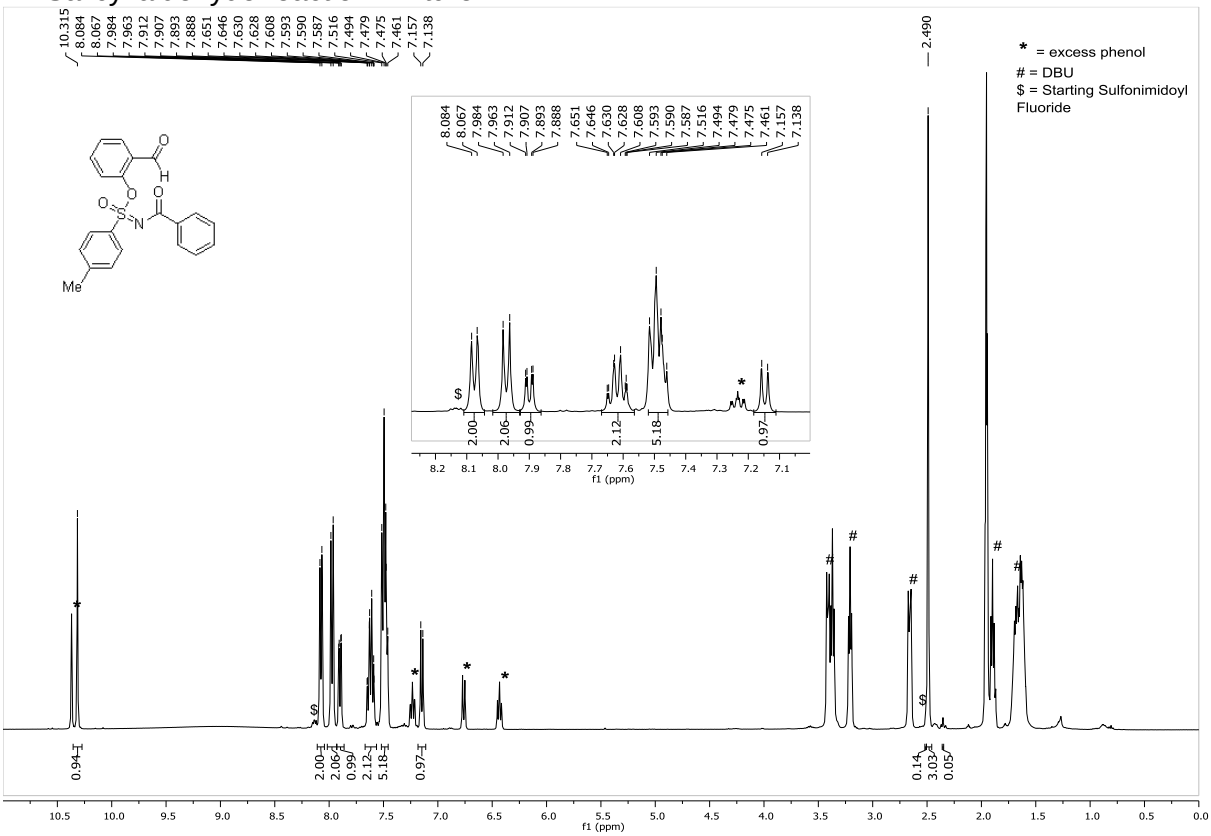
4g Thymol reaction mixture

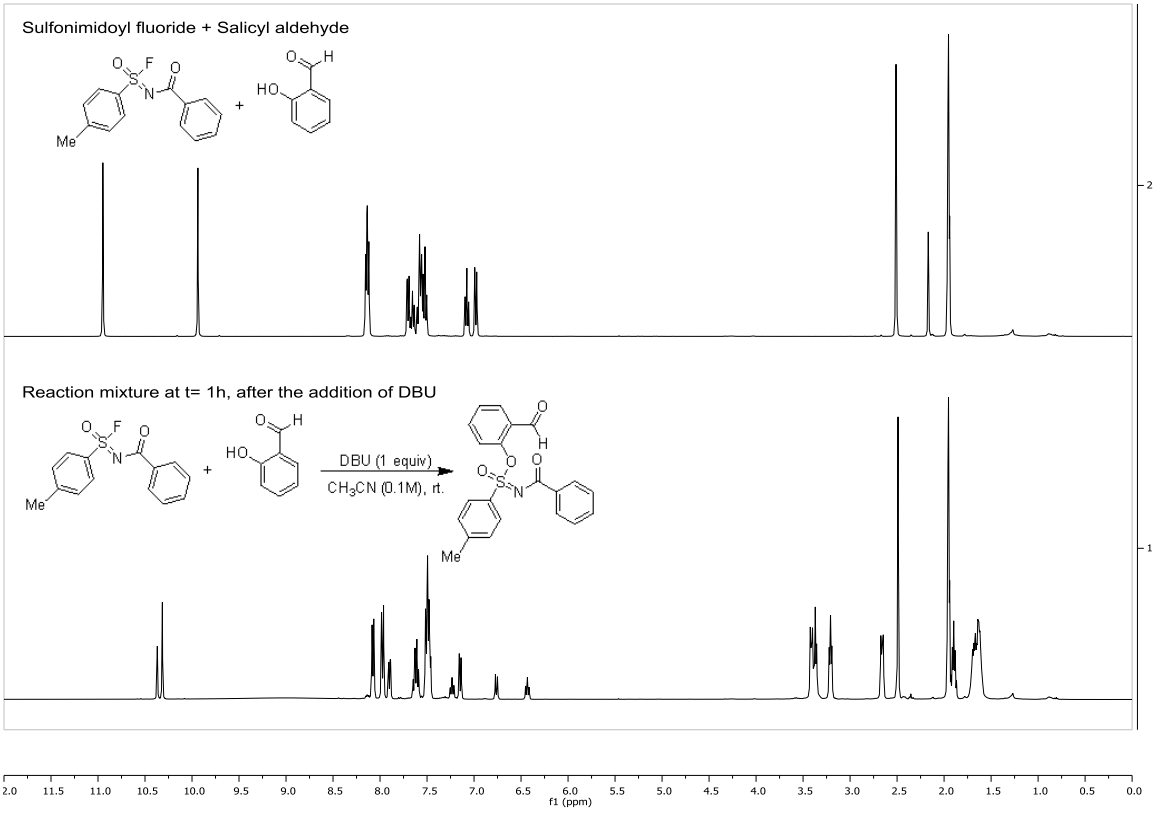




SUPPORTING INFORMATION

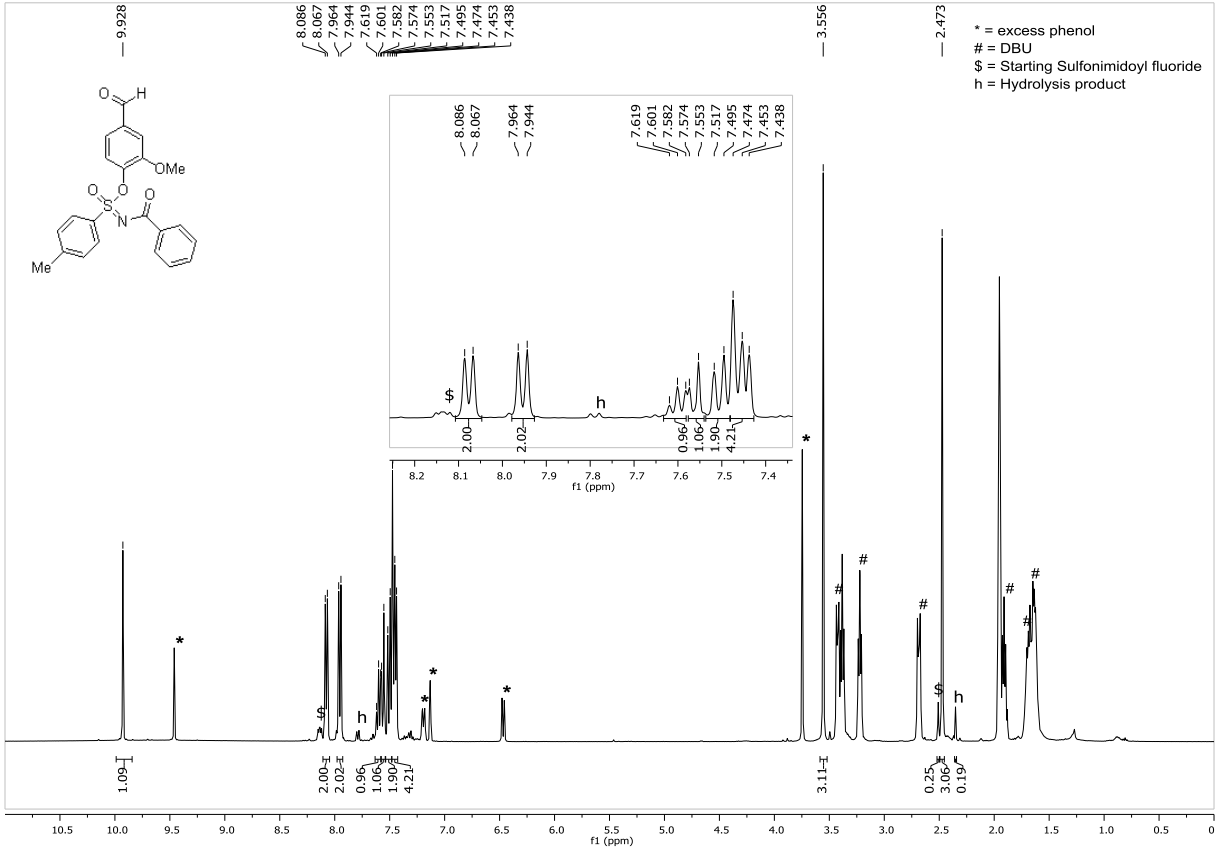
4h Salicyl aldehyde reaction mixture

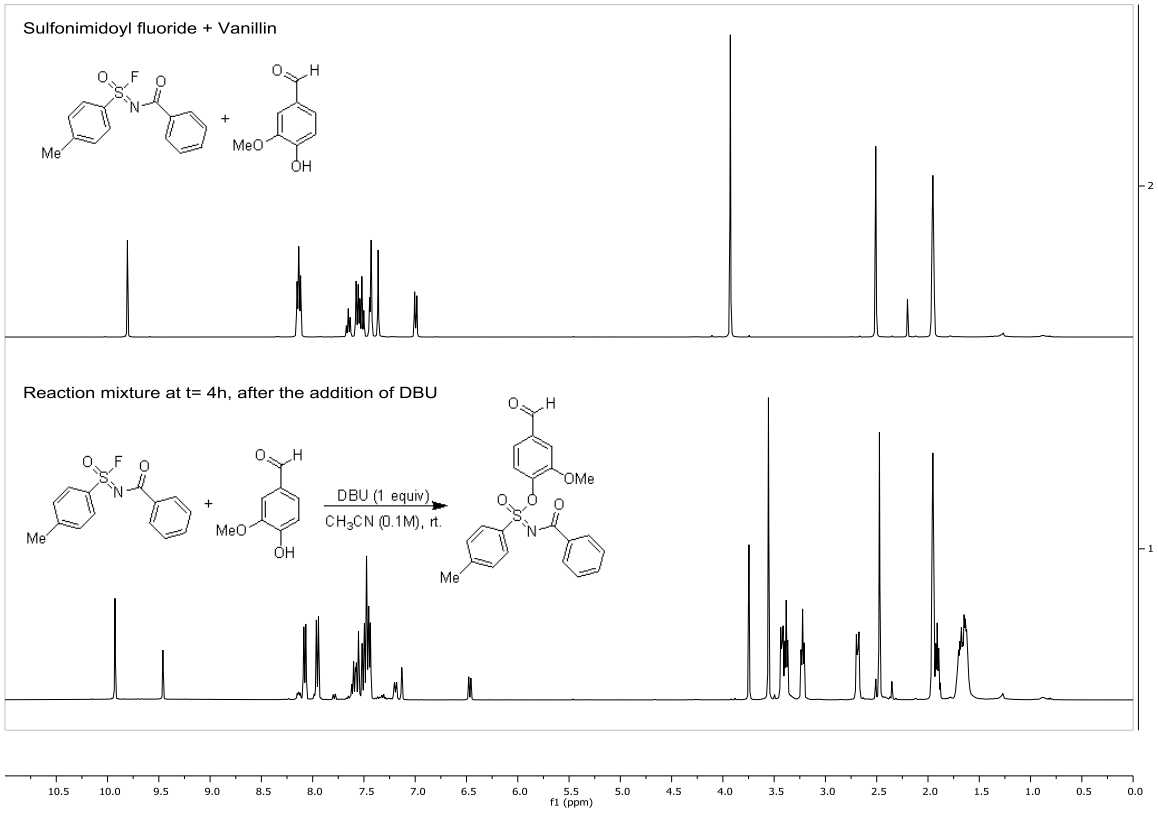




SUPPORTING INFORMATION

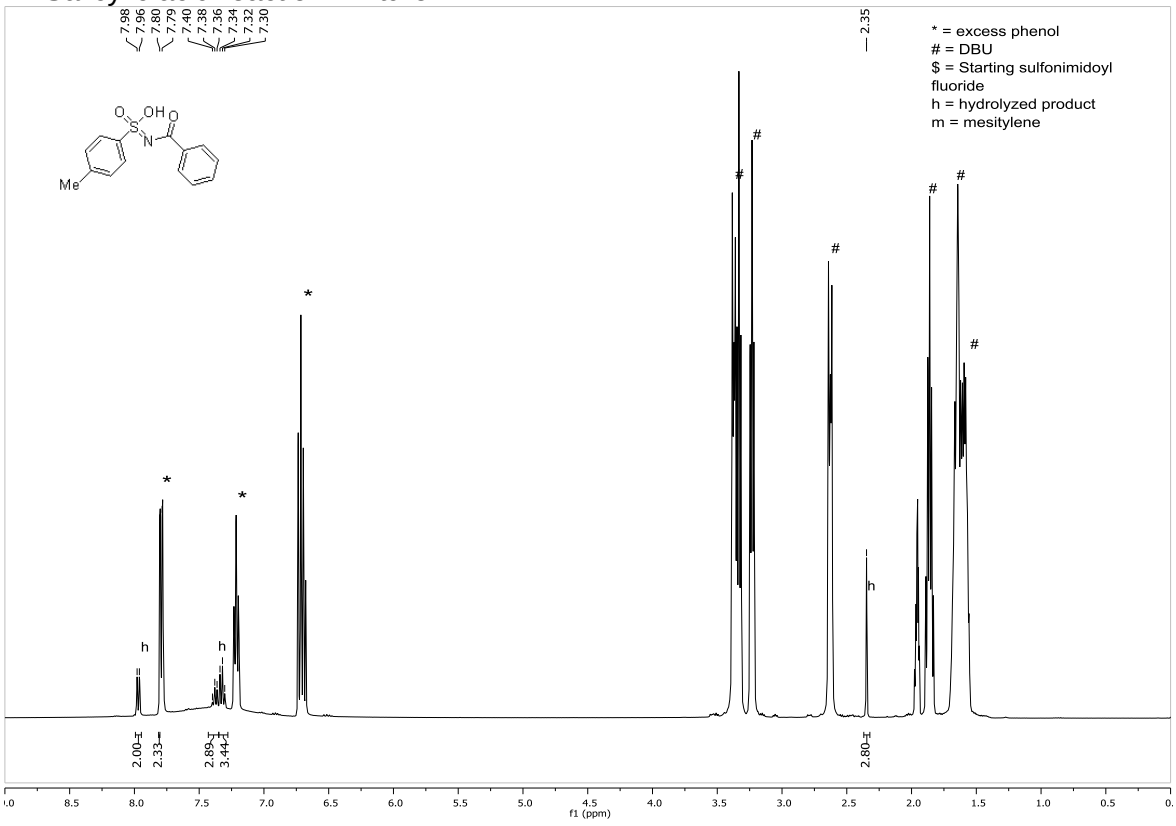
4i Vanillin reaction mixture

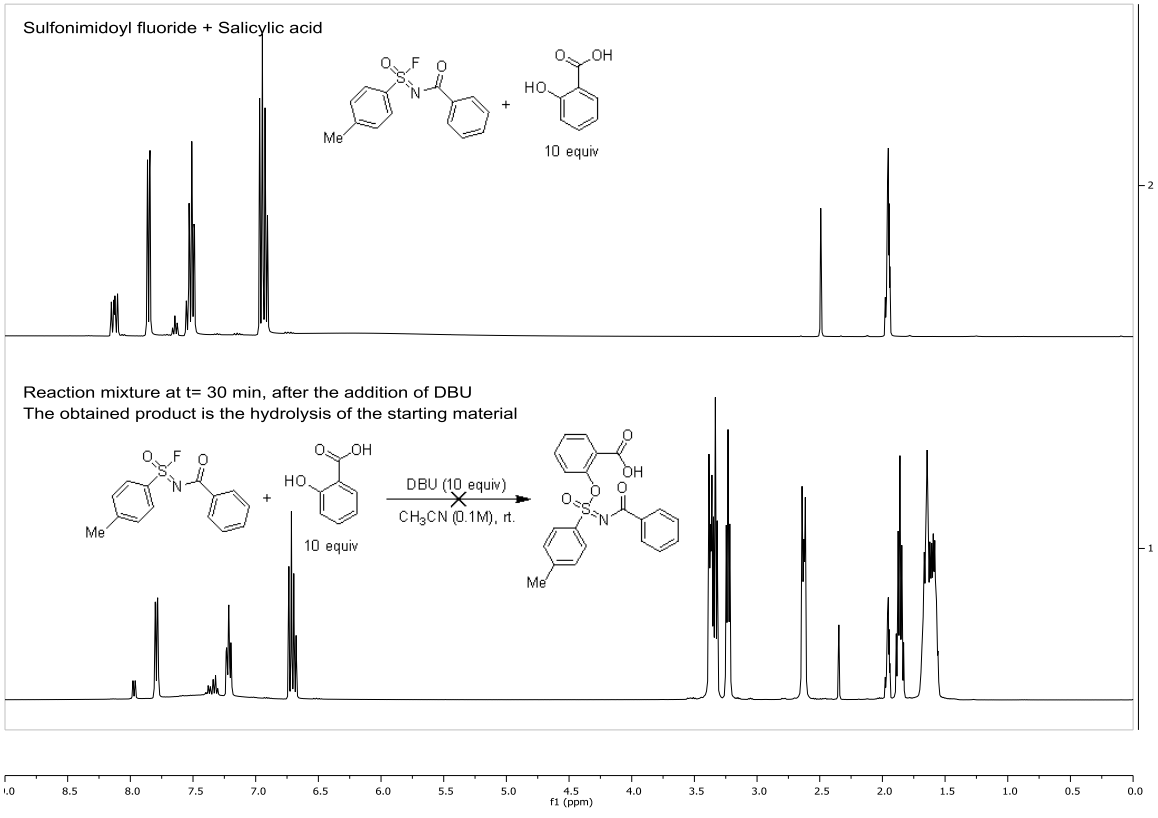




SUPPORTING INFORMATION

4z Salicylic acid reaction mixture





12 Author Contributions

All authors contributed to the writing of the paper and supporting information
Dong-Dong Liang: equal contribution - synthesis of starting materials, mechanistic studies, enantioselective SuFEx reactions.
Dieuwertje E. Streefkerk: equal contribution - competition reactions, substrate scope, kinetics.
Daan Jordaan and Jorden Wagemakers: supporting BSc students, who wrote BSc thesis on this topic - synthesis and isolation of starting materials and final SuFEx products.
Jacob Baggerman: supporting staff – instrumental for computational infrastructure.
Han Zuilhof: principal investigator - computational studies.