A Metal Free, Microwave Assisted Preparation of *N*-Sulfonyl and *N*-Sulfinyl Imines and Imidates

*Charlie Verrier, Sébastien Carret, and Jean-François Poisson**

Département de Chimie Moléculaire, CNRS UMR 5250, Université Grenoble-Alpes,

301 rue de la Chimie, 38000 Grenoble, France

E-mail: jean-francois.poisson@univ-grenoble-alpes.fr

This supporting information includes two Tables, 3 Figures (1-3) and 33 pages overall

Table of contents

General Methods

Thin-layer chromatography was performed on (0.2 mm) silica-gel aluminum backed plates, which were visualized by exposure to ultraviolet light followed by staining with basic potassium permanganate solution. Silica gel (0.040-0.063 mm) was employed for flash column chromatography. Melting points are uncorrected. A Fourier transform infrared spectrometer was used to record IR spectra. NMR spectra were recorded at 298 K, at the frequency stated and run as a dilute solution in CDCl3. Chemical shifts are expressed in ppm downfield with the solvent residual peak ($CDCl_3$ δ_H 7.26, δ_C 77.16) as the internal standard. All coupling constants are reported in Hertz (Hz) and multiplicity of each signal is designated by the following abbreviations: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; app, apparent; br, broad or some combinations thereof. Assignments of ^{13}C spectra were made with the aid of DEPT experiments. Mass spectra were recorded by using ESI techniques. HRMS were recorded on an Orbitrap apparatus (ESI). Molecular sieve was activated at 230 °C under vacuum overnight and stored at room temperature under vacuum.

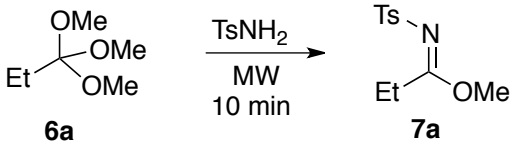
Microwave irradiation experiments were conducted in a CEM Discover S-Class apparatus (single mode technology) under magnetic stirring and internal (optical porbe) temperature measurements (and external IR view).

Small scale reactions (1 mmol) were all conducted in a 10 mL sealed CEM microwave reactor and the 30 mmol reaction was conducted in the 35 mL one.

HPLC separation for compound **4a** has been conducted on an Agilent 1260 Infinity Analytical SFC system. HPLC separation for compound **8d** has been conducted on a Waters Delta 600 system.

Table of reaction conditions optimization for imidates synthesis

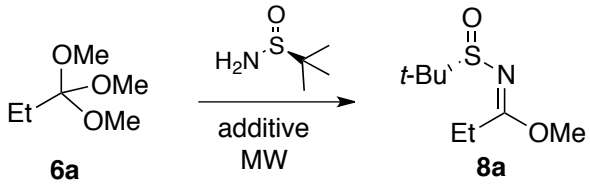
Table S1 Optimisation of the conditions for the microwave assisted preparation of *N*-tosylimidates



6a **7a**

Entry	T (°C)	Without MS Conv (%)	With MS Conv (%)	yield
1	120	63	59	/
2	140	86	87	/
3	160	97	97	/
4	180	100	/	99

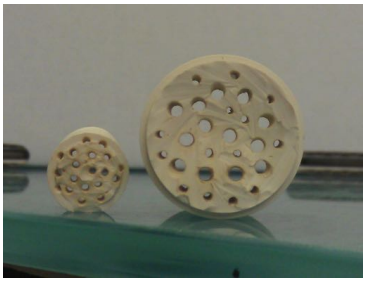
Table S2 Optimisation of the conditions for the microwave assisted preparation of sulfinylimidates



6a **8a**

Entry	T (°C)	t (min)	Solvant	PPTS	Conv (%)
1	80	30	*i*PrOH	0	0
2	80	30	*i*PrOH	10%	55
3	80	30	-	0	80
4	80	30	-	10%	100

Pictures of setting up the microwave tubes with molecular sieves and internal temperature probe

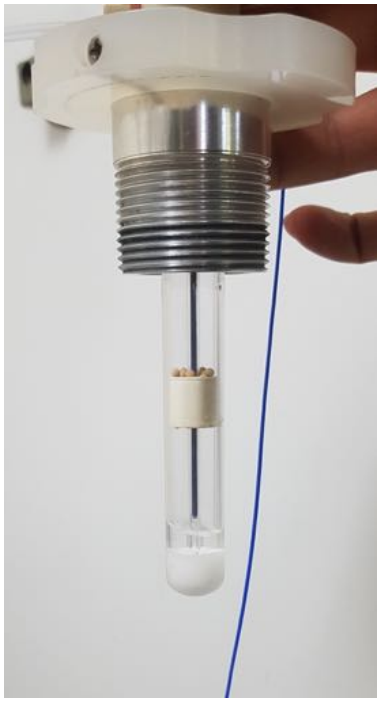


Septums with holes made with a hot needle

1. Reagents in the MW tube, and then septum introduce; the size prevent the septum from falling at the bottom

2. Introduction of the temperature probe through the septum; adjustment of the position of septum in the tube

3. Addition of the molecular sieves

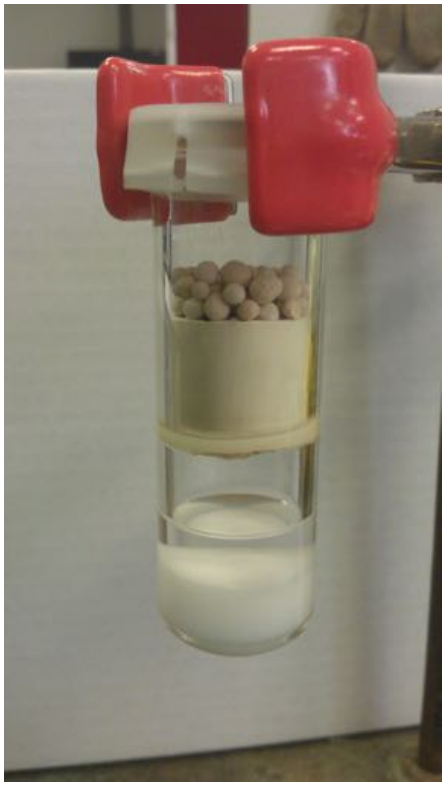


4. Lifting the tube to the top of the MW internal probe adaptor

5. Putting the tube with adaptor in the MW machine (here CEM); same principle with an Anton Paar machine

Pictures of setting up the microwave tubes with molecular sieves

The set up is similar to the previsou one, but much simpler to set up without the temperature probe. The reagents are charge in the tube, then the leaky septum, the molecular sieves and finally, the tube stopper. Standard introduction in the MW (same for CEM or Anton Paar)



General procedure for the microwave-assisted synthesis of *N*-Sulfonylimines 2 : A microwave-tube was charged with 4-methylbenzenesulfonamide (1 eq), dimethylacetal (1.2 eq), and a magnetic stirrer. A leaky septum filled with 4Å MS was placed 3 cm above the top of the tube and the reaction mixture was heated at 180 °C for 20 minutes. The crude imine was then recrystallized (pentane/AcOEt) and a filtration afforded the pure *N*-sulfonylimine.

Figure S1: Microwave temperature profile for 2a. *[grey: internal temperature (control) ; red: external temperature]*

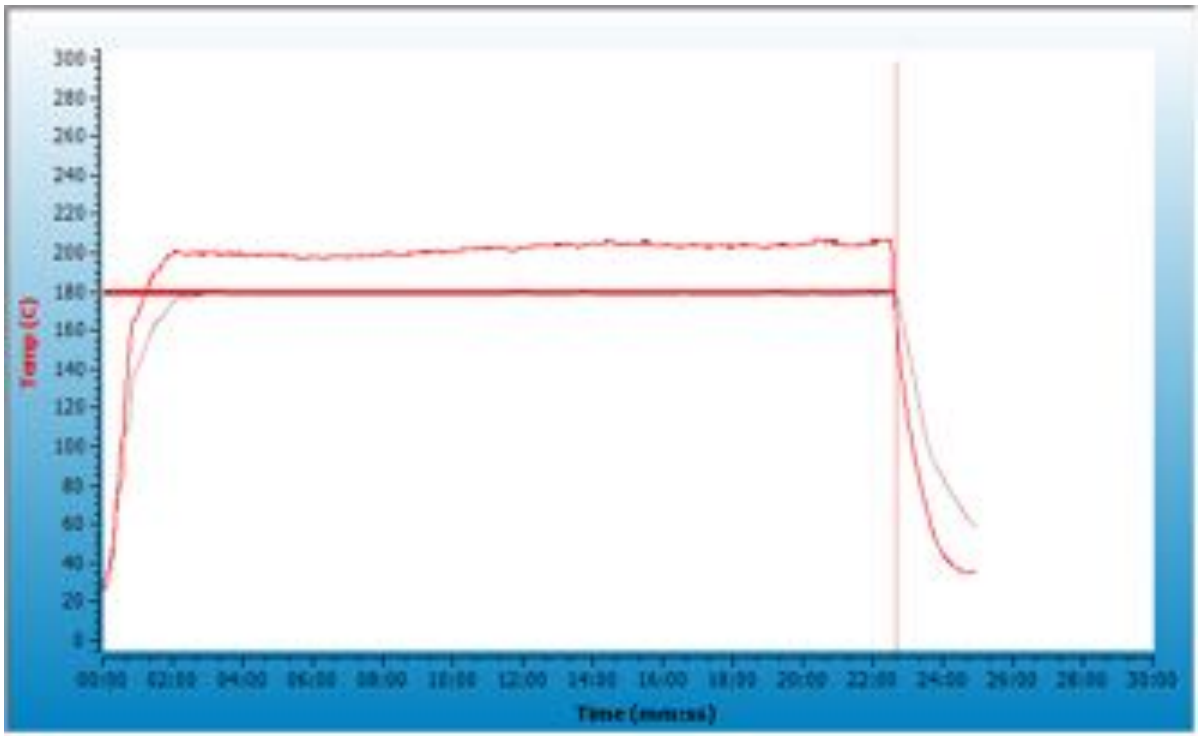
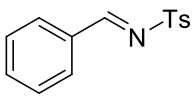


Figure S1



2a

(*E*)-*N*-Benzylidene-4-methylbenzenesulfonamide (2a). 4-methylbenzenesulfonamide (5.14 g, 29.4 mmol) and benzaldehyde dimethylacetal **1a** (5.37 g, 35.3 mmol) afforded 7.24 g (95 %) of imine **2a** as a white solid. m.p. 114-116 °C [litt. 114-116°C] [1]; IR (neat) 3071, 3003, 1595, 1573, 1316, 1154 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) : δ (ppm) 9.03 (s, 1H), 7.93 (d, J = 7.3 Hz, 2H), 7.89 (d, J = 8.2, 2H), 7.62 (t, J = 7.4 Hz, 1H), 7.49 (pseudo t, J = 7.7 Hz, 2H), 7.35 (d, J = 8.2 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 170.5, 144.9, 135.6, 135.3, 132.8, 131.7, 130.2, 129.5, 128.5, 22.0; MS (ESI) m/z 260.1 $[M+H]^+$, 282.0 $[M+Na]^+$.

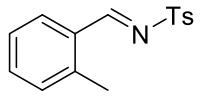
For this example, we have evaluated four different green chemistry metrics:

E-factor: (1.07 (remaining acetal) + 1.88 (2 eq of MeOH) + 13 (19 mL of Pentane + 1 mL of AcOEt for recrystallization) / 7.24 (weight of product)= 2.2

Atom Economy: 259.32/(152.19+171.22)= 0.8

Mass efficiency: 7.24 (5.37+5.14)= 0.688

Eco-Scale: penalty points (100-95)/2 + 0 (price) + 5 (toxicity of acetal) + 2 (unconventional warming) + 2 (heating < 2h) + 1 (crystallization) = 12.5 (Eco scale of 87.5)

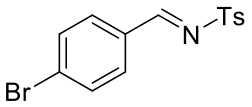


2b

(*E*)-4-Methyl-*N*-(2-methylbenzylidene)benzenesulfonamide (2b). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 2-methylbenzaldehyde dimethylacetal **1b** (200 mg, 1.2 mmol) afforded 242 mg (89%) of imine **2b** as a white solid. m.p. 95-97 °C; IR (neat) 3074, 3034, 1586, 1561, 1318, 1152 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) : δ (ppm) 9.37 (s, 1H), 8.03 (d, J = 7.6 Hz, 1H), 7.92 (d, J = 8.2 Hz, 2H), 7.50 (t, J = 7.6 Hz, 1H), 7.37 (d, J = 8.2 Hz, 2H), 7.31 (pseudo t, J = 8.7 Hz, 1H), 2.61 (s, 3H), 2.44 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$)

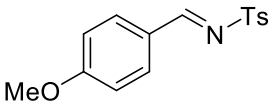
[1] Jin, T.; Feng, G.; Yang, M.; Li, T. *Synth. Commun.* **2004**, *34*, 1277.

: δ (ppm) 187.0, 144.8,142.5, 135.7, 134.9, 131.9, 131.0, 130.7, 130.1, 128.3, 126.9, 22.0, 20.0; MS (ESI) *m/z* 273.1 $[M+H]^+$, 296.1 $[M+Na]^+$.



2c

(*E*)-*N*-(4-Bromobenzylidene)-4-methylbenzenesulfonamide (2c). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 4-bromobenzaldehyde dimethylacetal **1c** (277 mg, 1.2 mmol) afforded 332 mg (98 %) of imine **2c** as a white solid. m.p. 195-197 °C [litt. 200-210 °C][2]; IR (neat) 3064, 3037, 1605, 1586, 1315, 1158 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) : δ (ppm) 8.98 (s, 1H), 7.88 (d, J = 8.2 Hz, 2H), 7.78 (d, J = 8.5 Hz, 2H), 7.64 (d, J = 8.5 Hz, 2H), 7.35 (d, J = 8.2 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 169.1, 145.14, 135.3, 133.0, 132.7, 131.6, 130.6, 130.2, 128.5, 22.0; MS (ESI) *m/z* 338.0 $[M+H]^+$, 359.9 $[M+Na]^+$ (^{79}Br).



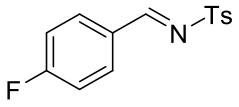
2d

(*E*)-*N*-(4-Methoxybenzylidene)-4-methylbenzenesulfonamide (2d). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 4-methoxybenzaldehyde dimethylacetal **1d** (219 mg, 1.2 mmol) afforded 275 mg (95 %) of imine **2d** as a white solid. m.p. 127-128 °C [litt. 126-127 °C] [1]; IR (neat) 3068, 2940, 1592, 1557, 1315, 1154 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) : δ (ppm) 8.94 (s, 1H), 7.93-7.83 (m, 4H), 7.33 (d, J = 8.1 Hz, 2H), 6.97 (d, J = 8.8 Hz, 1H), 3.88 (s, 3H),

---

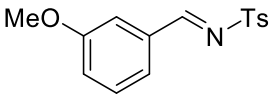
[2] Vaas, A.; Dudas, J.; Rajender, S. V. *Tetrahedron Lett*. **1999**, *40*, 4951.

2.43 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 169.5, 165.6, 144.6, 136.2, 134.1, 130.1, 128.3, 125.6, 115.0, 56.0, 22.0; MS (ESI) *m/z* 290.1 $[M+H]^+$, 312.1 $[M+Na]^+$.



2e

(*E*)-*N*-(4-Fluorobenzylidene)-4-methylbenzenesulfonamide (2e). 4-methylbenzene-sulfonamide (171.2 mg, 1 mmol) and 4-fluorobenzaldehyde dimethylacetal **1e** (204 mg, 1.2 mmol) afforded 260 mg (93 %) of imine **2e** as a white solid. m.p. 116-117 °C; IR (neat) 3116, 3090, 1581, 1318, 1149 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 9.00 (s, 1H), 8.00-7.91 (m, 2H), 7.88 (d, J = 8.24 Hz, 1H), 7.33 (dd, J = 15.90, 5.54 Hz, 2H), 7.22-7.13 (m, 2H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 168.8, 167.3 (d, $J_{F\text{-}C}$ = 257 Hz), 145.0, 135.5, 134.1 (d, $J_{F\text{-}C}$ = 10 Hz), 130.2, 129.2 (d, $J_{F\text{-}C}$ = 3 Hz), 128.5, 117.4 (d, $J_{F\text{-}C}$ = 22 Hz), 22.0; MS (ESI) *m/z* 278.1 $[M+H]^+$, 300.0 $[M+Na]^+$.



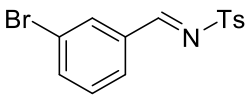
2f

(*E*)-*N*-(3-Methoxybenzylidene)-4-methylbenzenesulfonamide (2f). 4-methylbenzene-sulfonamide (171.2 mg, 1 mmol) and 3-methoxybenzaldehyde dimethylacetal **1f** (219 mg, 1.2 mmol) afforded 269 mg (93%) of imine **2f** as a white solid. m.p. 73-74 °C [litt. 78-79 °C] [3]; IR (neat) 3070, 3004, 1595, 1574, 1319, 1153 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 8.99 (s, 1H), 7.89 (d, J = 8.3 Hz, 2H), 7.49-7.32 (m, 5H), 7.22-7.16 (m, 1H), 3.84 (s, 3H), 2.44 (s, 3H);

---

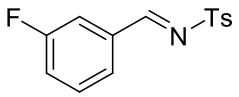
[3] Ruano, J. L. G.; Allemen, J.; Cid, M. B.; Parra, A. *Org. Lett.* **2005**, *7*, 179

^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 170.4, 160.4, 145.0, 135.4, 134.0, 130.4, 130.1, 128.4, 125.6, 122.5, 113.6, 55.8, 22.0; MS (ESI) *m/z* 290.1 $[M+H]^+$, 312.1 $[M+Na]^+$.



2g

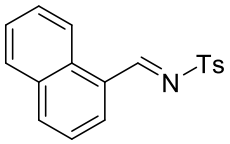
(*E*)-*N*-(3-Bromobenzylidene)-4-methylbenzenesulfonamide (2g). 4-methylbenzene-sulfonamide (171.2 mg, 1 mmol) and 3-bromobenzaldehyde dimethylacetal **1g** (277 mg, 1.2 mmol) afforded 315 mg (93 %) of imine **2g** as a white solid. m.p. 94-95 °C; IR (neat) 3059, 1607, 1557, 1319, 1159 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 8.96 (s, 1H), 8.09 (s, 1H), 7.89 (d, J = 8.3 Hz, 2H), 7.82 (d, J = 7.9 Hz, 1H), 7.72 (d, J = 7.9 Hz, 1H), 7.40-7.33 (m, 3H), 2.45 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 168.8, 145.3, 137.9, 135.1, 134.6, 133.6, 131.0, 130.5, 130.2, 128.6, 123.7, 22.0; MS (ESI) *m/z* 338.0 $[M+H]^+$, 359.9 $[M+Na]^+$ (^{79}Br).



2h

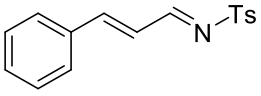
(*E*)-*N*-(3-Fluorobenzylidene)-4-methylbenzenesulfonamide (2h). 4-methylbenzene-sulfonamide (171.2 mg, 1 mmol) and 3-fluorobenzaldehyde dimethylacetal **1h** (204 mg, 1.2 mmol) afforded 249 mg (90 %) of imine **2h** as a white solid. m.p. 100-102 °C; IR (neat) 3088, 1608, 1573, 1319, 1157 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 9.00 (s, 1H), 7.89 (d, J = 8.1 Hz, 2H), 7.67 (pseudo t, J = 7.9 Hz, 2H), 7.52-7.44 (m, 1H), 7.36 (d, J = 8.0 Hz, 2H), 7.34-7.27 (m, 1H), 2.45 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 169.0 (d, $J_{F\text{-}C}$ = 3 Hz), 163.2 (d, $J_{F\text{-}C}$ = 248 Hz), 145.2, 135.2, 134.9 (d, $J_{F\text{-}C}$ = 8 Hz), 131.2 (d, $J_{F\text{-}C}$ = 8 Hz), 130.2, 128.5, 128.1

(d, $J_{F\text{-}C}$ = 3 Hz), 122.2 (d, $J_{F\text{-}C}$ = 22 Hz), 116.9 (d, $J_{F\text{-}C}$ = 22 Hz), 22.0; MS (ESI) *m/z* 278.1 $[M+H]^+$, 300.0 $[M+Na]^+$.



2i

(E)-4-Methyl-N-(naphthalen-1-ylmethylene)benzenesulfonamide (2i). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 1-naphtaldehyde dimethylacetal **1i** (243 mg, 1.2 mmol) afforded 257 mg (83 %) of imine **2i** as a white solid. m.p. 137-138 °C; IR (neat) 3065, 3034, 1586, 1315, 1118 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 9.59 (s, 1H), 8.97 (d, J = 8.6 Hz, 1H), 8.11 (d, J = 7.5 Hz, 1H), 8.07 (d, J = 8.2 Hz, 1H), 7.96 (d, J = 8.2 Hz, 2H), 7.89 (d, J = 8.1 Hz, 1H), 7.65 (t, J = 7.5, Hz, 1H), 7.60-7.50 (m, 2H), 7.34 (d, J = 8.1 Hz, 2H), 2.42 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 170.1, 144.8, 136.4, 135.7, 135.4, 134.0, 132.0, 130.1, 129.3, 129.2, 128.3, 127.8, 127.2, 125.4, 124.5, 21.9; MS (ESI) *m/z* 310.1 $[M+H]^+$, 332.0 $[M+Na]^+$.



2j

4-Methyl-*N*-((1*E*,2*E*)-3-phenylallylidene)benzenesulfonamide (2j). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and cinnamaldehyde dimethylacetal **1j** (214 mg, 1.2 mmol) afforded 274 mg (96 %) of imine **2j** as a yellow pale solid. m.p. 115-117 °C [litt. 110 °C][1]; IR (neat) 3046, 2923, 1578, 1508, 1312, 1150, cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) : δ (ppm) 8.78 (d, J = 9.4 Hz, 1H), 7.86 (d, J = 8.2 Hz, 2H), 7.58-7.53 (m, 2H), 7.52-7.39 (m, 4H), 7.34 (d, J = 8.2 Hz, 2H), 6.99 (dd, J = 15.8, 9.4 Hz, 1H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm)

171.2, 154.1, 144.8, 135.8, 134.6, 132.0, 130.2, 129.6, 129.0, 128.3, 125.2, 22.0; MS (ESI) *m/z* 286.1 $[M+H]^+$, 308.0 $[M+Na]^+$.

General procedure for the microwave-assisted synthesis of *N-tert*-butanesulfinylimines 4: A microwave-tube was charged with *tert*-butanesufinamide, dimethylacetal (1.2 eq), PPTS (10 mol%) and a magnetic stirrer in 1 mL of 2-propanol. The reaction mixture was heated at 80°C for 30 minutes. The crude material was then purified by flash chromatography on silica gel pretreated with 2.5% of triethylamine (eluent ethyl acetate/pentane) to afford the pure *N-tert*-butanesulfinylimine.

Figure S2. Microwave temperature profile for 4a. *[grey: internal temperature (control) ; red: external temperature]*

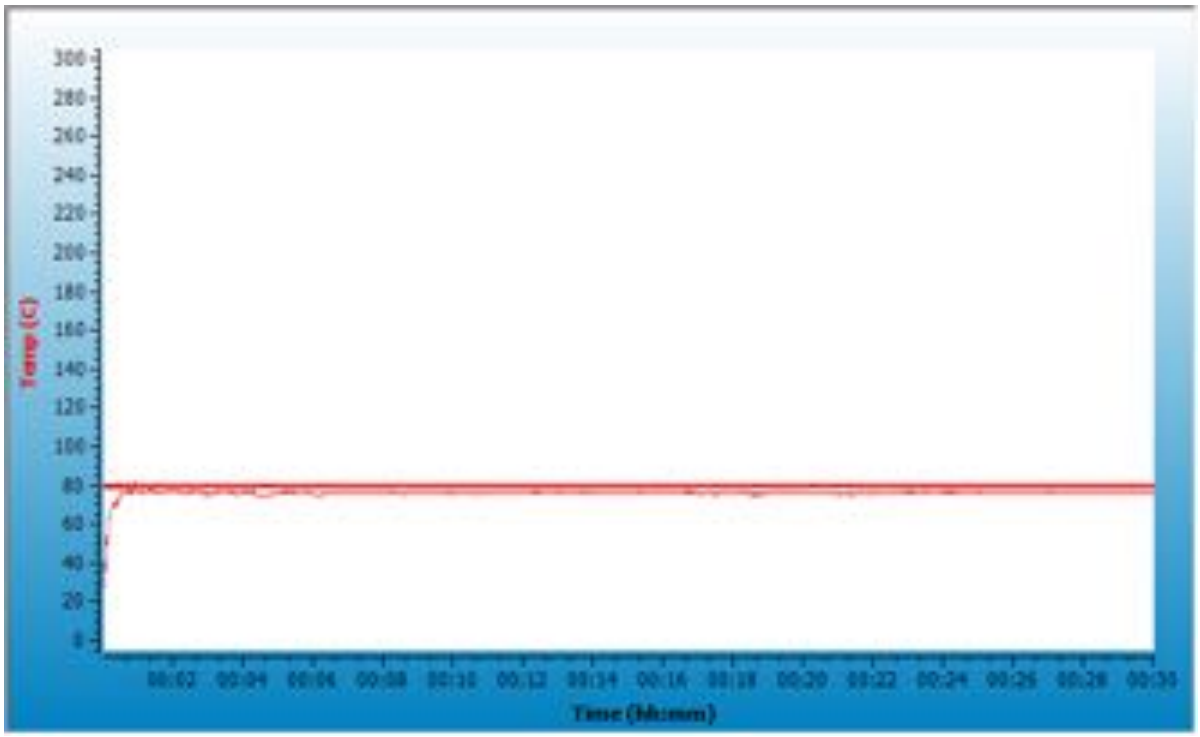
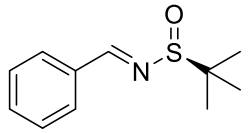
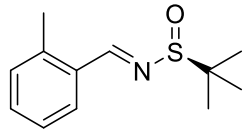


Figure S2



4a

(*S*,*E*)-*N*-Benzylidene-2-methylpropane-2-sulfinamide (4a). *tert*-butanesulfinamide (1.81 g, 15 mmol) and benzaldehyde dimethylacetal **1a** (2.74 g, 18 mmol) in 2-propanol (only 5 mL for this scale) afforded 2.97 g (95 %) of imine **4a** as a yellow pale oil. $[\alpha]^{20}_{D}$ + 117.5 (*c* 1.0, $CHCl_3$) [litt Rs -122][4]; IR (neat) 2978, 2924, 1605, 1572, 1082, cm^{-1}; ^1H NMR (500 MHz, *$CDCl_3$*) : δ (ppm) 8.55 (s, 1H), 7.82-7.78 (m, 2H), 7.49-7.38 (m, 3H), 1.22 (s, 1H); ^{13}C NMR (125 MHz, *$CDCl_3$*) : δ (ppm) 126.7, 134.0, 132.4, 129.3, 128.9, 57.7, 22.6; MS (ESI) *m/z* 210,1 $[M+H]^+$, 232,0 $[M+Na]^+$. HPLC (Daicel chiralpak ID-3, 20% MeOH/supercritical CO_2, 1.5 mL/min) : t = 3.02 (R_s), 3.28 (S_s) ; ee > 99 %.



4b

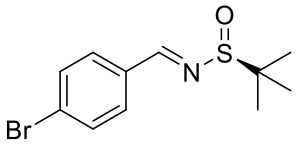
(*S*,*E*)-2-Methyl-*N*-(2-methylbenzylidene)propane-2-sulfinamide (4b). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 2-méthylbenzaldehyde dimethylacetal **1b** (200 mg, 1.2 mmol) afforded 197 mg (88 %) of imine **4b** as a colourless oil. $[\alpha]^{20}_{D}$ +138.7 (*c* 1.0, $CHCl_3$) [litt +135.2 (*c* 1.15, $CHCl_3$)][5]; IR (neat) 2958, 2924, 1589, 1566, 1080, cm^{-1}; ^1H NMR (400 MHz, *$CDCl_3$*) : δ (ppm) 8.86 (s, 1H), 7.94-7.87 (m, 1H), 7.39 (dt, *J* = 7.5, 1.4 Hz, 1H), 7.33-7.22 (m,

---

[4] Liu, G.; Cogan, D. A.; Owens, T. D.; Tang, T. P.; Ellman, J. A. *J. Org. Chem.* **1999**, *64*, 1278.

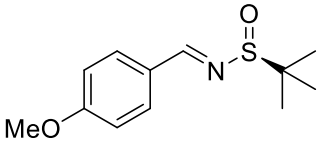
[5] Maji, M. S.; Fröhlich, R.; Studer, A. *Org. Lett.* **2008**, *10*, 1847.

2H), 2.61 (s, 3H), 1.27 (s, 9H); ^{13}C NMR (100 MHz, *CDCl$_3$*) : δ (ppm) 161.6, 139.4, 132.2, 132.0, 131.4, 129.5, 126.3, 57.4, 22.6, 19.9; MS (ESI) *m/z* 224.1 $[M+H]^+$, 246.1 $[M+Na]^+$.



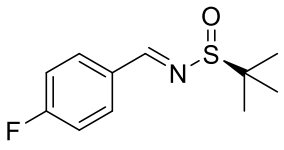
4c

(*S*,*E*)-4-Methyl-*N*-(4-bromobenzylidene)propane-2-sulfinamide (4c). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 4-bromobenzaldehyde dimethylacetal **1c** (277 mg, 1.2 mmol) afforded 216 mg (75 %) of imine **4c** as a colourless oil. $[\alpha]^{20}_D$ +60.4 (*c* 1.0, $CHCl_3$); IR (neat) 2959, 2923, 1586, 1561, 1068, cm^{-1}; ^{1}H NMR (300 MHz, *CDCl$_3$*) : δ (ppm) 8.49 (s, 1H), 7.71-7.62 (m, 2H), 7.60-7.52 (m, 2H), 1.21 (s, 9H); ^{13}C NMR (75 MHz, *CDCl$_3$*) : δ (ppm) 161.6, 132.9, 132.3, 130.6, 127.2, 27.9, 22.6; MS (ESI) *m/z* 287.9 $[M+H]^+$, 309.9 $[M+Na]^+$ (^{79}Br).



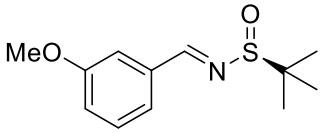
4d

(*S*,*E*)-4-Methyl-*N*-(4-mehoxybenzylidene)propane-2-sulfinamide (4d). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 4-methoxybenzaldehyde dimethylacetal **1d** (219 mg, 1.2 mmol) afforded 213 mg (89 %) of imine **4d** as a white solid. m.p. 90-92 °C [litt. 91-93 °C][4]; $[\alpha]^{20}_D$ +66.8 (*c* 1.0, $CHCl_3$) [litt Rs -70,2][4]; IR (neat) 2981, 2958, 1589, 1568, 1078 cm^{-1}; ^{1}H NMR (500 MHz, *CDCl$_3$*) : δ (ppm) 8.42 (s, 1H), 7.74-7.68 (m, 2H), 6.92-6.84 (m, 2H), 3.76 (s, 3H), 1.16 (s, 9H); ^{13}C NMR (125 MHz, *CDCl$_3$*) : δ (ppm) 163.3, 161.9, 131.5, 127.5, 114.6, 57.7, 55.7, 22.8; MS (ESI) *m/z* 240.1 $[M+H]^+$, 262.0 $[M+Na]^+$.



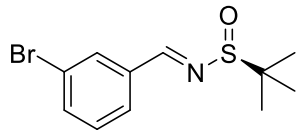
4e

(*S*,*E*)-4-Methyl-*N*-(4-fluorobenzylidene)propane-2-sulfinamide (4e). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 4-fluorobenzaldehyde dimethylacetal **1e** (204 mg, 1.2 mmol) afforded 213 mg (83 %) of imine **4e** as a colourless oil. $[\alpha]^{20}_{D}$ +113.1 (*c* 1.0, $CHCl_3$); IR (neat) 2983, 2961, 1600, 1580, 1078, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 8.48 (s, 1H), 7.83-7.74 (m, 2H), 7.14-7.03 (m, 2H), 1.18 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 165.2 (d, $J_{F\text{-}C}$ = 253 Hz), 161.3, 131.5 (d, $J_{F\text{-}C}$ = 9 Hz), 130.5 (d, $J_{F\text{-}C}$ = 3 Hz), 116.1 (d, $J_{F\text{-}C}$ = 22 Hz), 57.7, 22.5; MS (ESI) *m/z* 228.1 $[M+H]^+$, 250.1 $[M+Na]^+$. HRMS (ESI) m/z Calcd for $C_{11}H_{15}FNOS$ $[M+H]^+$: 228.0853; found: 228.0853.



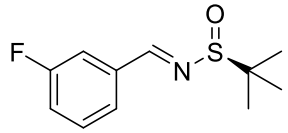
4f

(*S*,*E*)-4-Methyl-*N*-(3-mehoxybenzylidene)propane-2-sulfinamide (4f). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 3-methoxybenzaldehyde dimethylacetal **1f** (219 mg, 1.2 mmol) afforded 213 mg (89 %) of imine **4f** as a colourless oil. $[\alpha]^{20}_{D}$ +65.0 (*c* 1.0, $CHCl_3$; IR (neat) 2984, 2959, 1607, 1576, 1078, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 8.49 (s, 1H), 7.39-7.27 (m, 3H), 7.02-6.97 (m, 1H), 3.78 (s, 3H), 1.20 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 162.6, 160.0, 135.3, 130.0, 122.5, 118.7, 113.2, 57.7, 55.3, 22.6; MS (ESI) *m/z* 240.1 $[M+H]^+$, 262.0 $[M+Na]^+$. HRMS (ESI) m/z Calcd for $C_{12}H_{18}NO_2S$ $[M+H]^+$: 240.1053; found: 240.1054.



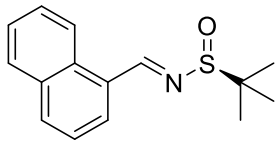
4g

(*S*,*E*)-4-Methyl-*N*-(3-bromobenzylidene)propane-2-sulfinamide (4g). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 3-bromobenzaldehyde dimethylacetal **1g** (277 mg, 1.2 mmol) afforded 110 mg (38 %) of imine **4g** as a colourless oil. $[\alpha]^{20}_{D}$ +59.5 (*c* 1.0, $CHCl_3$); IR (neat) 2958, 2925, 1597, 1561, 1081, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 8.50 (s, 1H), 7.99 (t, *J* = 1.6 Hz, 1H), 7.71 (d, *J* = 7.7 Hz, 1H), 7.63-7.59 (m, 1H), 7.33 (pseudo t, *J* = 7.7 Hz, 1H), 1.25 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 161.4, 135.9, 135.2, 131.6, 130.5, 128.4, 123.2, 58.0, 22.6; MS (ESI) *m/z* 287.9 $[M+H]^+$, 309.9 $[M+Na]^+$ (^{79}Br). HRMS (ESI) m/z Calcd for $C_{11}H_{15}BrNOS$ $[M+H]^+$: 288.0052; found: 288.0050.



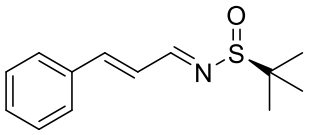
4h

(*S*,*E*)-4-Methyl-*N*-(3-fluorobenzylidene)propane-2-sulfinamide (4h). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 3-fluorobenzaldehyde dimethylacetal **1h** (204 mg, 1.2 mmol) afforded 91 mg (40 %) of imine **4h** as a colourless oil. $[\alpha]^{20}_{D}$ +96.8 (*c* 1.0, $CHCl_3$); IR (neat) 2996, 2927, 1605, 1578, 1084, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 8.47 (s, 1H), 7.52-7.48 (m, 2H), 7.40-7.33 (m, 1H), 7.16-7.08 (m, 1H), 1.19 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 163.1 (d, $J_{F\text{-}C}$ = 246 Hz), 161.6, (d, $J_{F\text{-}C}$ = 3 Hz), 136.2 (d, $J_{F\text{-}C}$ = 7 Hz), 130.7 (d, $J_{F\text{-}C}$ = 8 Hz), 125.8 (d, $J_{F\text{-}C}$ = 3 Hz), 119.5 (d, $J_{F\text{-}C}$ = 22 Hz), 115.1 (d, $J_{F\text{-}C}$ = 22 Hz), 58.0, 22.7; MS (ESI) *m/z* 228.1 $[M+H]^+$. HRMS (ESI) m/z Calcd for $C_{11}H_{15}FNOS$ $[M+H]^+$: 228.0853; found: 228.0853.



4i

(*S*,*E*)-2-Methyl-*N*-(naphthalen-1-ylmethylene)propane-2-sulfinamide (4i). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and 1-naphtaldehyde dimethylacetal **1i** (243 mg, 1.2 mmol) afforded 215 mg (83 %) of imine **4i** yellow oil. $[\alpha]^{20}_{D}$ +10.0 (*c* 1.0, $CHCl_3$) [litt Rs -4,5 (*c* 1.0, $CHCl_3$)][6]; IR (neat) 2977, 2959, 1596, 1581, 1078, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 9.12 (s, 1H), 8.97 (d, *J* = 8.6 Hz, 1H), 7.97 (dd, *J* = 7.2, 0.9 Hz, 1H), 7.91 (d, *J* = 8.2 Hz, 1H), 7.83 (d, *J* = 8.2 Hz, 1H), 7.58 (ddd, *J* = 8.6, 6.9, 1.3 Hz, 1H), 7.49 (dt, *J* = 8.0, 4.2 Hz, 2H), 1.28 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 162.3, 133.7, 133.2, 131.8, 131.1, 129.2, 128.7, 127.9, 126.4, 125.1, 124.2, 57.5, 22.5; MS (ESI) *m/z* 260.1 $[M+H]^+$, 282.0 $[M+Na]^+$.



4j

(*S*)-2-Methyl-N-((1*E*,2*E*)-3-phenylallylidene)propane-2-sulfinamide (4j). *tert*-butanesulfinamide (121.2 mg, 1 mmol) and cinnamaldehyde dimethylacetal **1j** (214 mg, 1.2 mmol) afforded 209 mg (89 %) of imine **4j** as a brown solid. m.p. 58-60 °C; $[\alpha]^{20}_{D}$ +287.1 (*c* 1.0, $CHCl_3$) [litt +329 (*c* 1.1, $CHCl_3$)]; IR (neat) 2960, 2924, 1579, 1568, 1072., cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) : δ (ppm) 8.37 (d, *J* = 9.2 Hz, 1H), 7.56-7.47 (m, 2H), 7.42-7.33 (m, 3H), 7.22 (d, *J* = 15.9 Hz, 1H), 7.07 (dd, *J* = 15.9, 9.2 Hz, 1H), 1.23 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ

---

[6] Collados, J. F.; Toledano, E.; Guijarro, D.; Yus, M. *J. Org. Chem.* **2012**, *77*, 5744.

(ppm) 164.1, 146.7, 135.4, 130.6, 129.3, 128.3, 125.9, 57.9, 22.8; MS (ESI) *m/z* 236.1 $[M+H]^+$, 258.0 $[M+Na]^+$.

General procedure for the microwave-assisted synthesis of *N*-Sulfonylimidates 7: A microwave-tube was charged with 4-methylbenzenesulfonamide, trimethylorthoester (1.2 eq), and a magnetic stirrer. A leaky septum filled with 4Å MS was 3 cm above the top of the tube and the reaction mixture was heated at 180°C for 10-30 minutes. The crude material was then purified by flash chromatography on silica gel (eluent ether/pentane) to afford the pure *N*-sulfonylimidate.

Figure S3. Microwave temperature profile for 7f. *[grey: internal temperature (control) ; red: external temperature]*

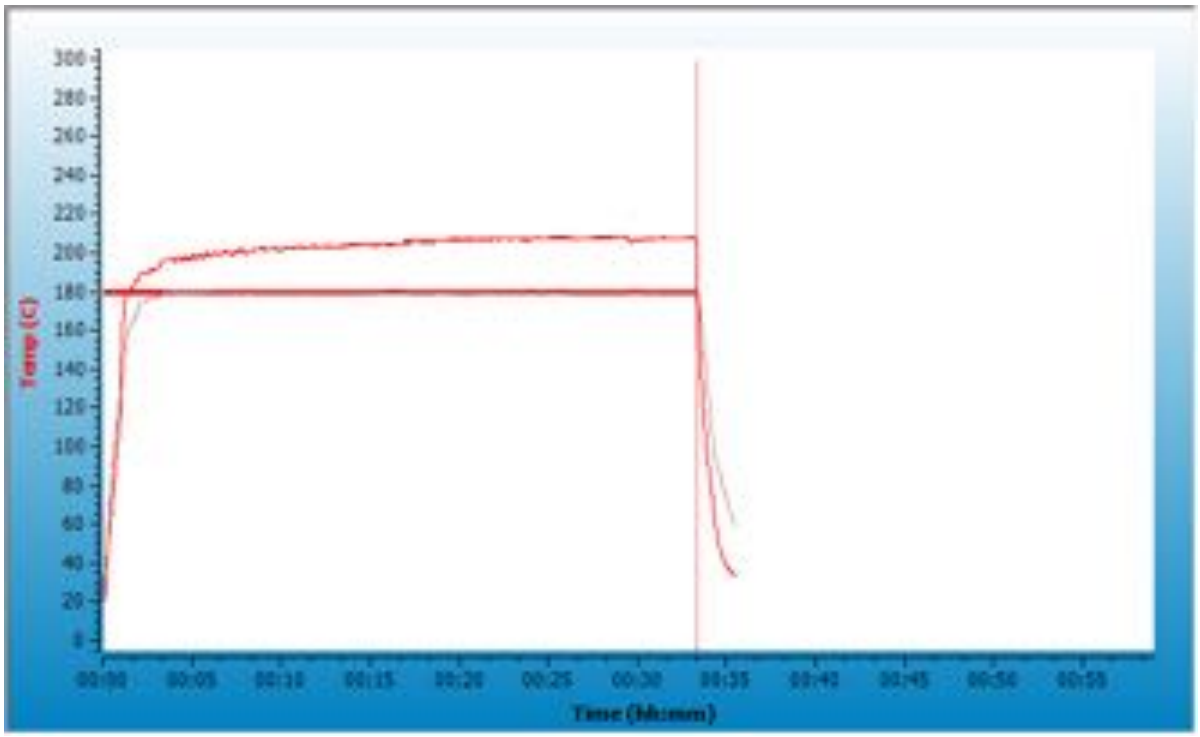
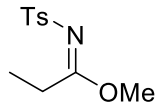
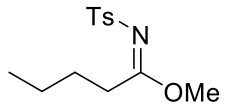


Figure S3



7a

Methyl (*E*)-*N*-tosylpropionimidate (7a). 4-methylbenzenesulfonamide (5.14 g, 30 mmol) and 1,1,1-trimethoxypropane **6a** (4.61 g, 33 mmol) afforded 6.87 g (95%) of imidate **7a** as a white solid. m.p. 42-44 °C [litt. 46 °C][7]; IR (neat) 3093, 2952, 1596, 1328, 1148 cm^{-1} ; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 7.84 (d, J = 8.2 Hz, 2H), 7.30 (d, J = 8.2 Hz, 2H), 3.74 (s, 3H), 2.94 (q, J = 7.5 Hz, 2H), 2.43 (s, 3H), 1.24 (t, J = 7.5 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 177.8, 143.5, 139.6, 129.7, 127.0, 55.7, 27.8, 21.9, 10.4; MS (ESI) m/z 242.1 $[M+H]^+$, 264.1 $[M+Na]^+$.

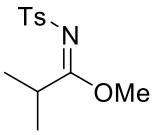


7b

Methyl (*E*)-*N*-tosylpentanimidate (7b). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 1,1,1-trimethoxypentane **6b** (195 mg, 1.2 mmol) afforded 264 mg (98 %) of imidate **7b** as a colourless oil. IR (neat) 3028, 2957, 1597, 1302, 1152 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 7.84 (d, J = 8.2 Hz, 2H), 7.30 (d, J = 8.2 Hz, 2H), 3.73 (s, 3H), 2.94-2.85 (t, J = 7.8 Hz, 2H), 2.43 (s, 3H), 1.68 (tt, J = 7.8, 6.7 Hz, 2H), 1.31-1.48 (td, J = 7.4, 6.7 Hz, 2H), 0.93 (t, J = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 177.2, 143.4, 139.7, 129.7, 127.0, 55.6, 33.9, 28.4, 22.8, 21.9, 14.0; MS (ESI) m/z 270.1 $[M+H]^+$, 292.1 $[M+Na]^+$.

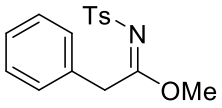
---

[7] Matsubara, R.; Berthiol, F.; Kobayashi, S. *J. Am. Chem. Soc.* **2008**, *130*, 1804.



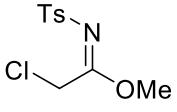
7c

Methyl (*E*)-*N*-tosylisobutyrimidate (7c). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 1,1,1-trimethoxy-2-methylpropane **6c** (178 mg, 1.2 mmol) afforded 232 mg (91 %) of imidate **7c** as a white solid. m.p. 57-58 °C; IR (neat) 3043, 2981, 1600, 1298, 1148 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 7.84 (d, J = 8.2 Hz, 2H), 7.30 (d, J = 8.2 Hz, 2H), 3.75 (hept, J = 6.8 Hz, 1H), 3.72 (s, 3H), 2.43 (s, 3H), 1.23 (d, J = 6.8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 180.4, 143.4, 139.8, 129.7, 127.0, 55.7, 33.7, 21.9, 19.8; MS (ESI) m/z 256.1 $[M+H]^+$, 278.1 $[M+Na]^+$.



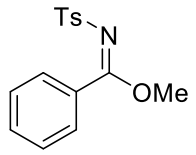
7d

Methyl (*E*)-2-phenyl-*N*-tosylacetimidate (7d). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and (2,2,2-trimethoxyethyl)benzene **6d** (235 mg, 1.2 mmol) afforded 297 mg (98 %) of imidate **7d** as a white solid. m.p. 80-82 °C; IR (neat) 3034, 2958, 1592, 1576, 1308, 1147 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 7.84(d, J = 8.3, 2H), 7.26-7.37 (m, 7H), 4.25 (s, 2H), 3.71 (s, 3H), 2.43 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 174.0, 143.7, 139.4, 133.9, 130.0, 129.7, 129.0, 127.6, 127.1, 56.0, 39.9, 21.9; MS (ESI) m/z 304.1 $[M+H]^+$, 326.1 $[M+Na]^+$.



7e

Methyl (*E*)-2-chloro-*N*-tosylacetimidate (7e). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and 2-chloro-1,1,1-trimethoxyethane **6e** (186 mg, 1.2 mmol) afforded 241 mg (92 %) of imidate **7e** as a white solid. m.p. 44-45 °C; IR (neat) 3037, 2951, 1615, 1279, 1145 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 7.85 (d, J = 8.2 Hz, 2H), 7.32 (d, J = 8.2 Hz, 2H), 4.69 (s, 2H), 3.83 (s, 3H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 168.7, 144.3, 138.3, 129.9, 127.3, 56.8, 38.9, 21.9; MS (ESI) *m/z* 262.0 $[M+H]^+$, 284.0 $[M+Na]^+$.

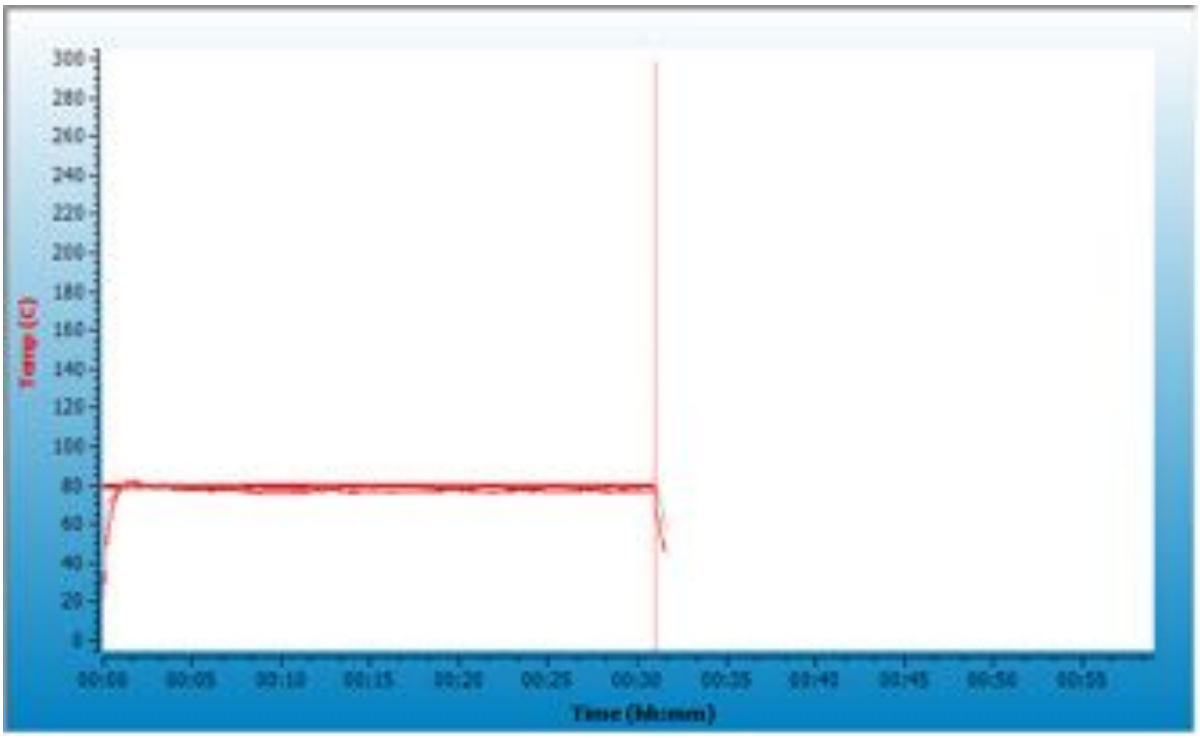


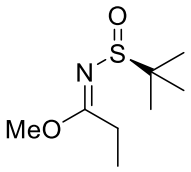
7f

Methyl (*E*)-*N*-tosylbenzimidate (7f). 4-methylbenzenesulfonamide (171.2 mg, 1 mmol) and (trimethoxymethyl)benzene **6f** (219 mg, 1.2 mmol) afforded 242 mg (84 %) of imidate **7f** as a white solid. m.p. 113-115 °C; IR (neat) 3069, 2953, 1594, 1569, 1281, 1151 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) : δ (ppm) 7.83-7.79 (m, 2H) 7.81 (d, J = 8.3 Hz, 2H), 7.60-7.53 (m, 1H), 7.49-7.42 (m, 2H), 7.27 (d, J = 8.2 Hz, 2H), 3.90 (s, 3H), 2.42 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) : δ (ppm) 170.5, 143.3, 139.9, 132.8, 131.6, 129.7, 129.6, 128.4, 127.0, 56.4, 21.9; MS (ESI) *m/z* 290.1 $[M+H]^+$, 312.1 $[M+Na]^+$.

General procedure for the microwave-assisted synthesis of *N*-*tert*-butanesulfinylimidates 8: A microwave-tube was charged with *tert*-butanesufinamide, PPTS (10 mol%), trimethyle orthoester (1.1 eq), and a magnetic stirrer. The reaction mixture was heated at 80 °C for 30-60 min. The crude material was then purified by flash chromatography on silica gel (eluent ether/pentane) to afford the pure N-*tert*-butanesulfinylimidates.

Microwave temperature profile for 8a. *[grey: internal temperature (control) ; red: external temperature]*

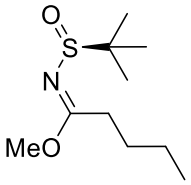




8a

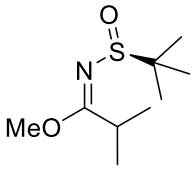
Methyl (*S*,*E*)-*N*-(*tert*-butylsulfinyl)propionimidate (8a). *tert*-butanesulfinamide (3.64 g, 30 mmol), PPTS (750 mg, 3 mmol) and 1,1,1-trimethoxypropane **6a** (4.61 g, 33 mmol) afforded 5.31 g (93 %) of imidate **8a** as a colourless oil. $[\alpha]^{20}_{D}$ +125.1 (*c* 1.0, $CHCl_3$) [litt *R*s -120.3 (*c* 2,9 $CHCl_3$)]; IR (neat) 2979, 2947, 1606, 1071, cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$) : δ (ppm) 3.77 (s, 3H), 2.76-2.62 (m, 2H), 1.21 (s, 9H), 1.20 (t, J = 7.3 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ

(ppm) 178.3, 56.0, 54.4, 26.6, 22.2, 11.1; MS (ESI) *m/z* 192.1 $[M+H]^+$. HRMS (ESI) m/z Calcd for $C_8H_{18}NO_2S$ $[M+H]^+$: 192.1053; found: 192.1056.



8b

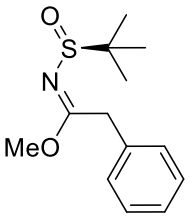
Methyl (*S*,*E*)-*N*-(*tert*-butylsulfinyl)pentanimidate (8b). *tert*-butanesulfinamide (364 mg, 3 mmol), PPTS (75 mg, 0.3 mmol) and 1,1,1-trimethoxypentane **6b** (535 mg, 3.3 mmol) afforded 616 mg (94 %) of imidate **8b** as a colourless oil. $[\alpha]^{20}_D$ +81.1 (*c* 1.0, $CHCl_3$) [litt -112,3 (*c* 5.0 $CHCl_3$)]; IR (neat) 2957, 2866, 1608, 1077, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 3.75 (s, 3H), 2.72-2.60 (m, 2H), 1.70-1.55 (m, 2H), 1.41-1.30 (m, 2H), 1.21 (s, 9H), 0.91 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 177.7, 56.0, 54.4, 32.7, 28.8, 22.8, 22.2, 14.0; MS (ESI) *m/z* 220.1 $[M+H]^+$, 242.1 $[M+Na]^+$. HRMS (ESI) m/z Calcd for $C_{10}H_{22}NO_2S$ $[M+H]^+$: 220.1366; found: 220.1368.



8c

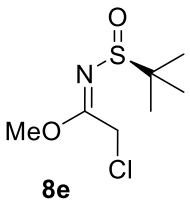
Methyl (*S*,*E*)-*N*-(*tert*-butylsulfinyl)isobutyrimidate (8c). *tert*-butanesulfinamide (364 mg, 3 mmol), PPTS (75 mg, 0.3 mmol) and 1,1,1-trimethoxy-2-methylpropane **6c** (489 mg, 3.3 mmol) afforded 564 mg (92 %) of imidate **8c** as a colourless oil. $[\alpha]^{20}_D$ +102.5 (*c* 1.0, $CHCl_3$); IR (neat) 2975, 2947, 1602, 1073, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 3.76 (s, 3H), 3.42 (sept, *J* = 6.8 Hz, 1H), 1.21 (s, 9H), 1.21 (d, *J* = 6.8 Hz, 3H), 1.16 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (125

MHz, *CDCl*$_3$) : δ (ppm) 180.9, 55.9, 54.4, 32.4, 22.2, 20.2, 19.8; MS (ESI) *m/z* 206.1 $[M+H]^+$, 228.1 $[M+Na]^+$. HRMS (ESI) m/z Calcd for $C_9H_{20}NO_2S$ $[M+H]^+$: 206.1209; found: 206.1210.



8d

Methyl (*S*,*E*)-*N*-(*tert*-butylsulfinyl)-2-phenylacetimidate (8d). *tert*-butanesulfinamide (364 mg, 3 mmol), PPTS (75 mg, 0.3 mmol) and (2,2,2-trimethoxyethyl)benzene **6d** (648 mg, 3.3 mmol) afforded 742 mg (98 %) of imidate **8d** as a colourless oil. $[\alpha]^{20}_D$ +142.5 (*c* 1.0, $CHCl_3$) [litt Rs -171][8]; IR (neat) 3029, 2979, 2946, 1611, 1598, 1073, cm^{-1}. ^1H NMR (400 MHz, *CDCl*$_3$) : δ (ppm) 7.35-7.28 (m, 3H), 7.27-7.21 (m, 2H), 4.09 (d, *J* = 14.2 Hz, 1H), 3.95 (d, *J* = 14.2 Hz, 1H), 3.75 (s, 3H), 1.20 (s, 9H); ^{13}C NMR (100 MHz, *CDCl*$_3$) : δ (ppm) 174.2, 134.8, 129.7, 128.9, 127.4, 56.5, 54.7, 38.9, 22.3; MS (ESI) *m/z* 254.0 $[M+H]^+$, 276.0 $[M+Na]^+$. HPLC (Daicel chiralcel OD-H, 10% *i*PrOH/Hexane, 0.5 mL/min) : t = 14.31 (R_s), 16.64 (S_s) ; ee > 99 %.



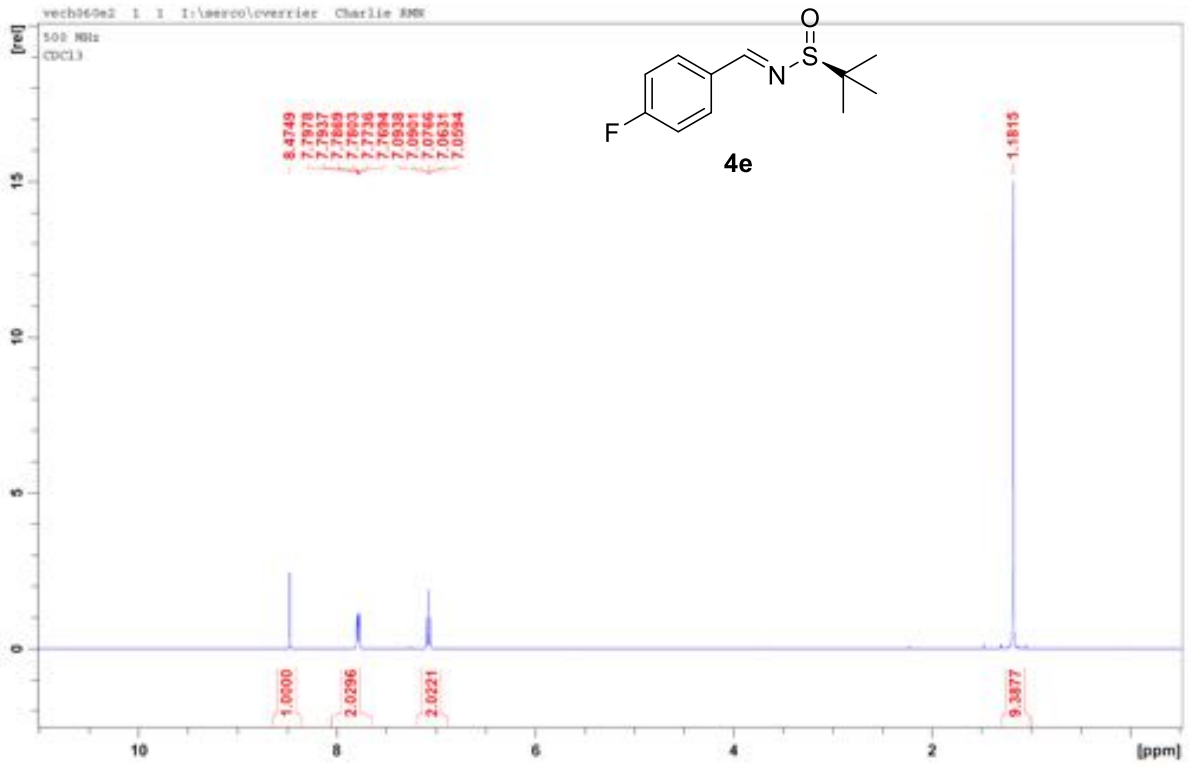
8e

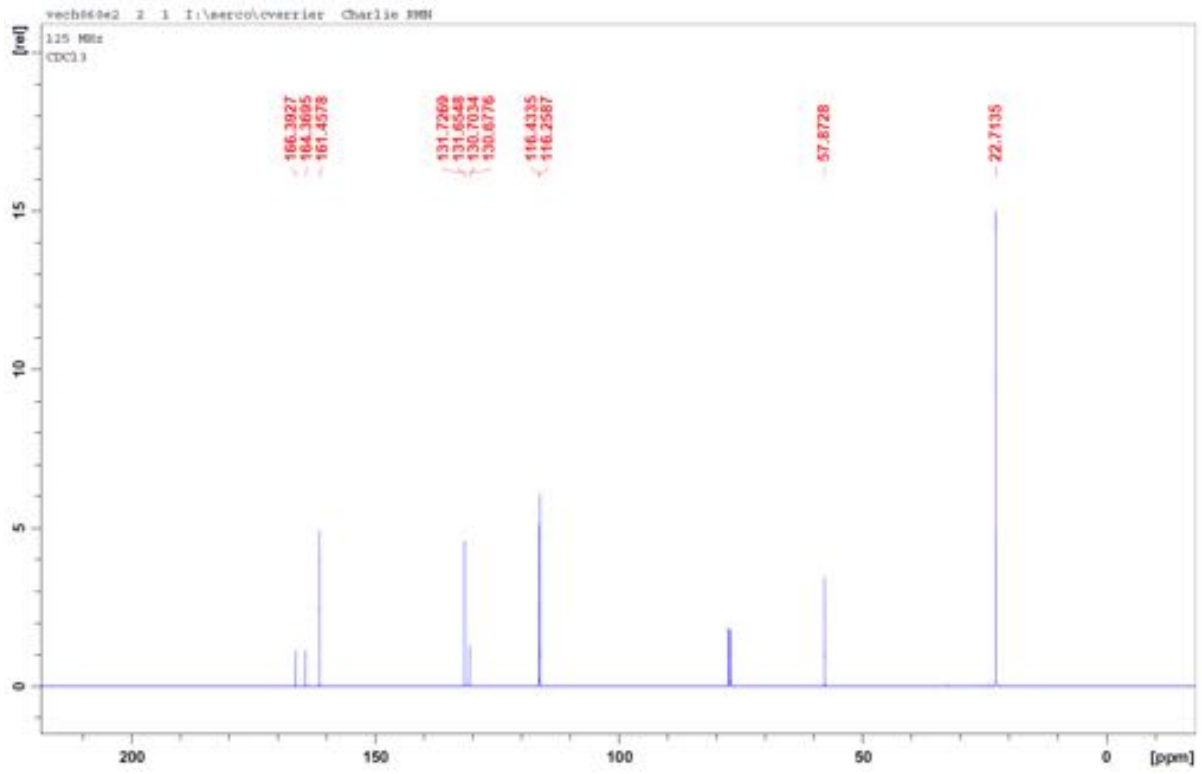
Methyl (*S*,*E*)-*N*-(*tert*-butylsulfinyl)-2-chloroacetimidate (8e). *tert*-butanesulfinamide (364 mg, 3 mmol), PPTS (75 mg, 0.3 mmol) and 2-chloro-1,1,1-trimethoxyethane **6e** (510 mg, 3.3

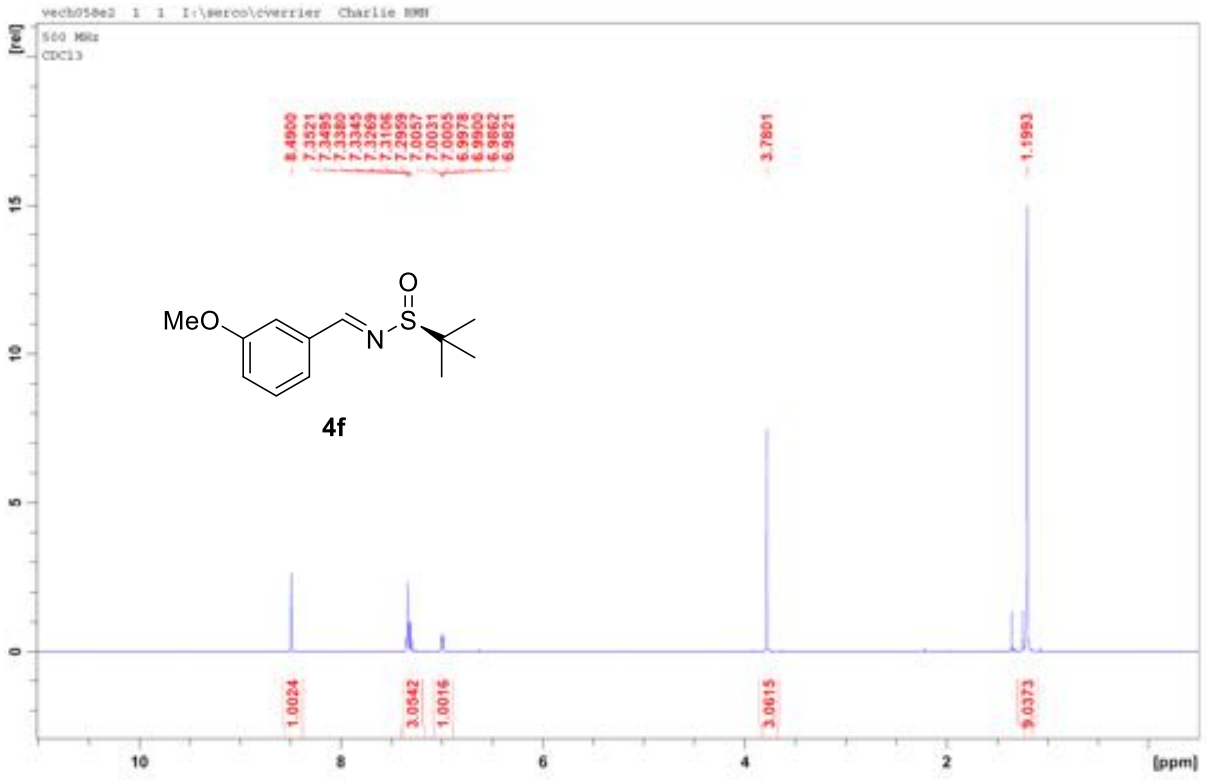
[8] Colpaer, F., Mangelinckx S., De Kimpe, N. J. Org. Chem. **2011**, 76, 234.

mmol) afforded 265 mg (40 %) of imidate **8e** as yellow pale oil. $[\alpha]^{20}_{D}$ +263.2 (*c* 1.0, $CHCl_3$) [litt Rs $[\alpha]^{20}_{D}$ -247.8 (*c* 1.2, $CHCl_3$)]; IR (neat) 2980, 2948, 1633, 1599, 1075, cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$) : δ (ppm) 4.60 (d, *J* = 12.0 Hz, 1H), 4.30 (d, *J* = 12.0 Hz, 1H), 3.82 (s, 3H), 1.24 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) : δ (ppm) 167.6, 57.4, 55.3, 38.0, 22.4; MS (ESI) *m/z* 212.1 $[M+H]^+$, 234.0 $[M+Na]^+$. HRMS (ESI) m/z Calcd for $C_7H_{15}NO_2S$ $[M+H]^+$: 212.0507; found: 212.0507.

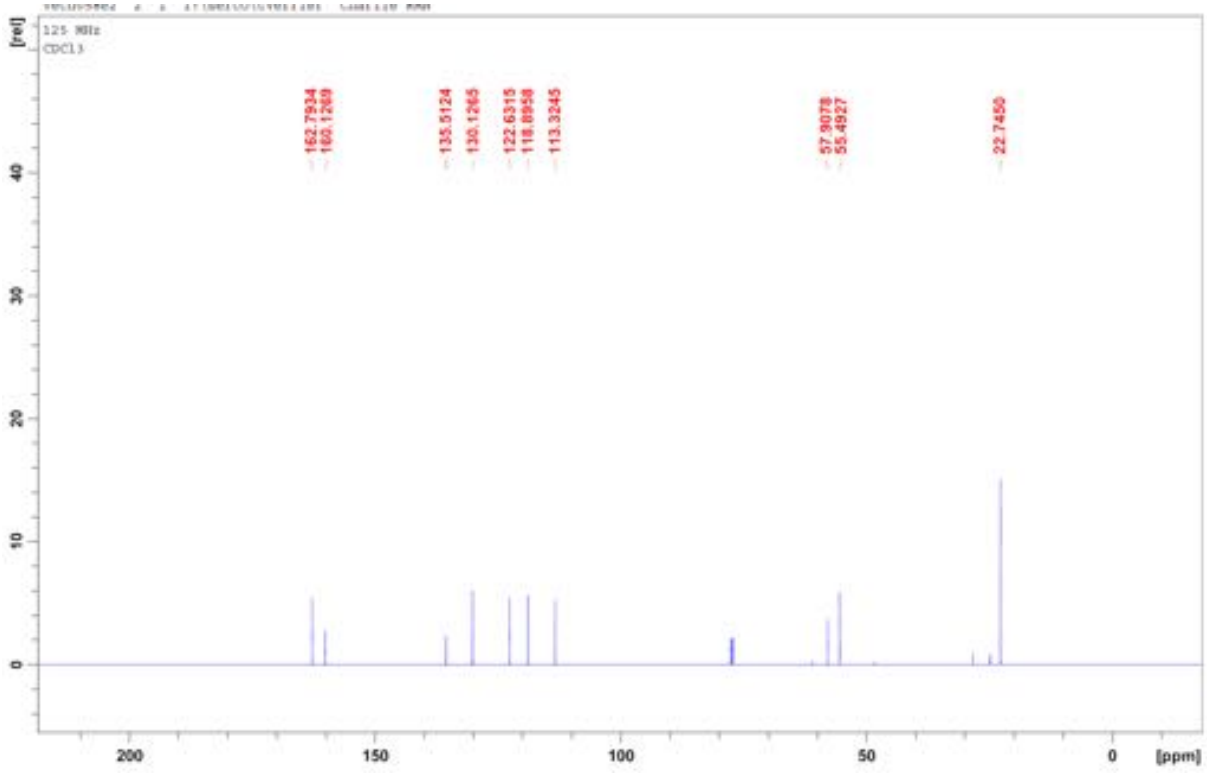
^{1}H and ^{13}C NMR spectra for **4e**, **4f**, **4g**, **4h**, **8a**, **8b**, **8c**, **8e**, **8f**

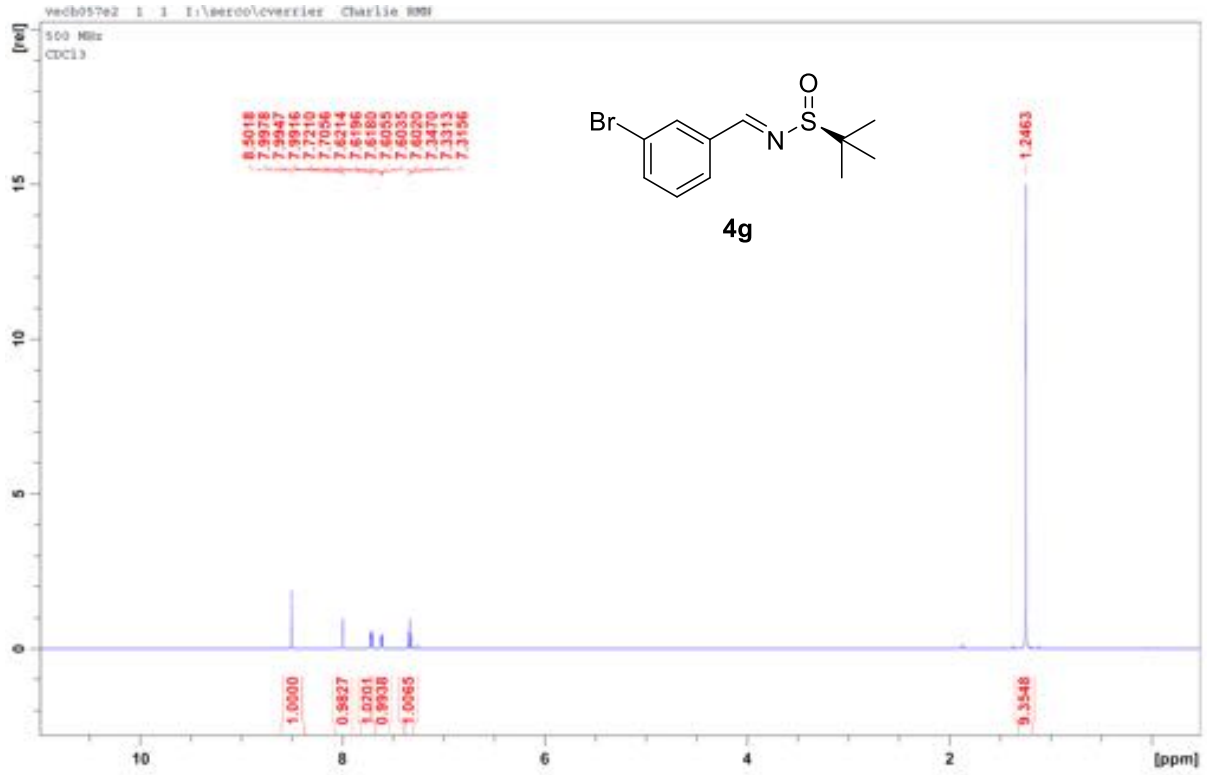




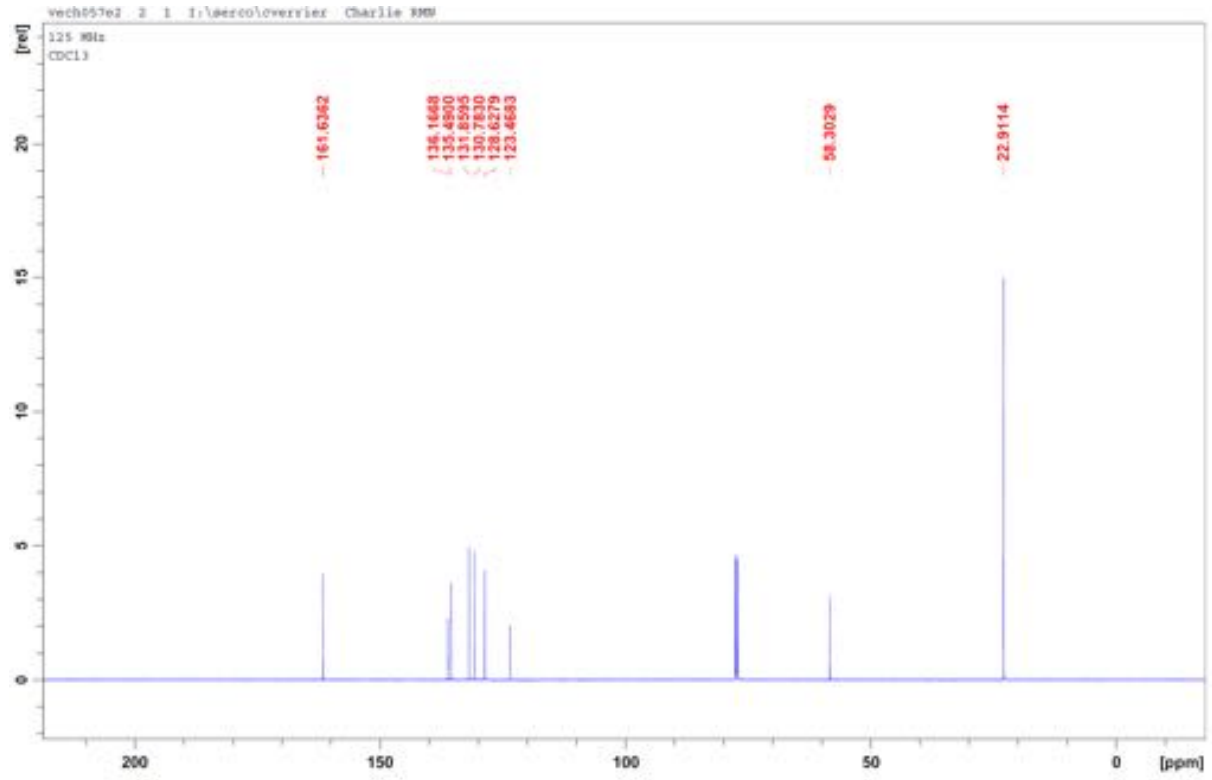

500 MHz
CDCl3
8.4900
7.3521
7.3495
7.3380
7.3345
7.3269
7.3106
7.2959
7.0057
7.0031
7.0005
6.9978
6.9900
6.9862
6.9821
3.7801
1.1993
1.0024
3.0542
1.0016
3.0615
9.0373
[rel]
[ppm]
MeO
N
S
O

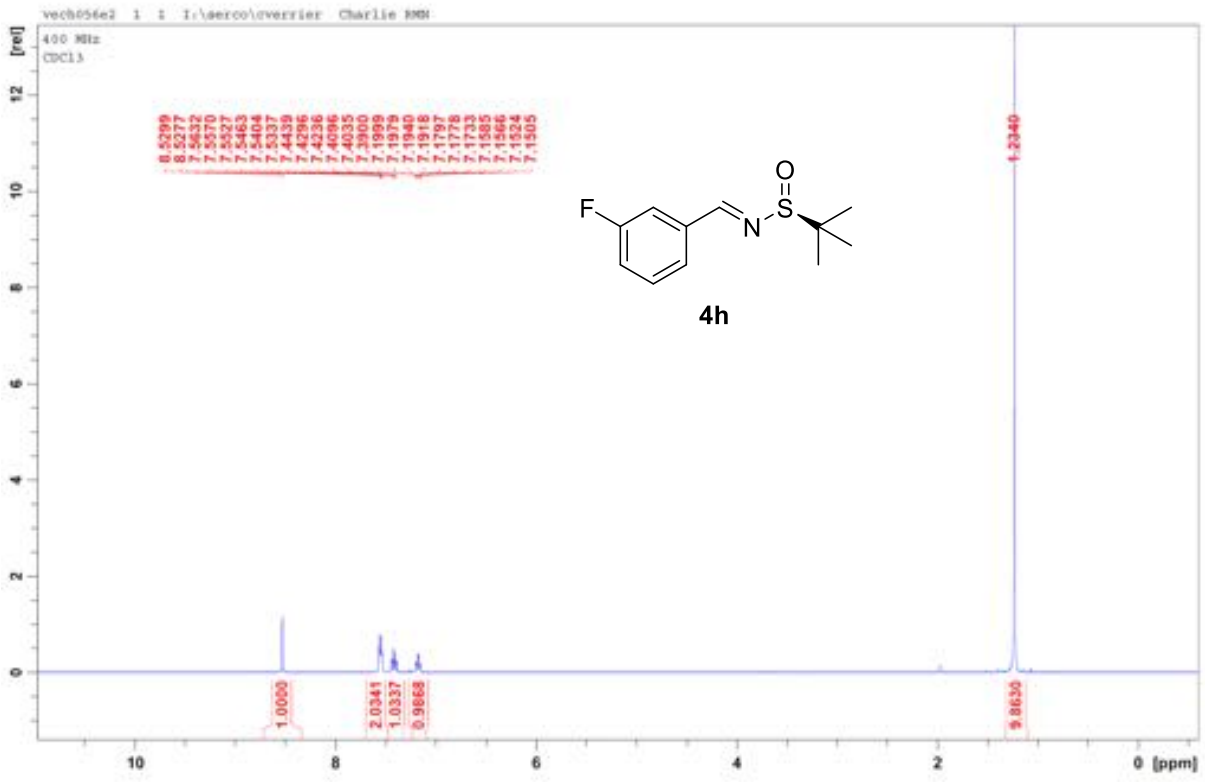
4f

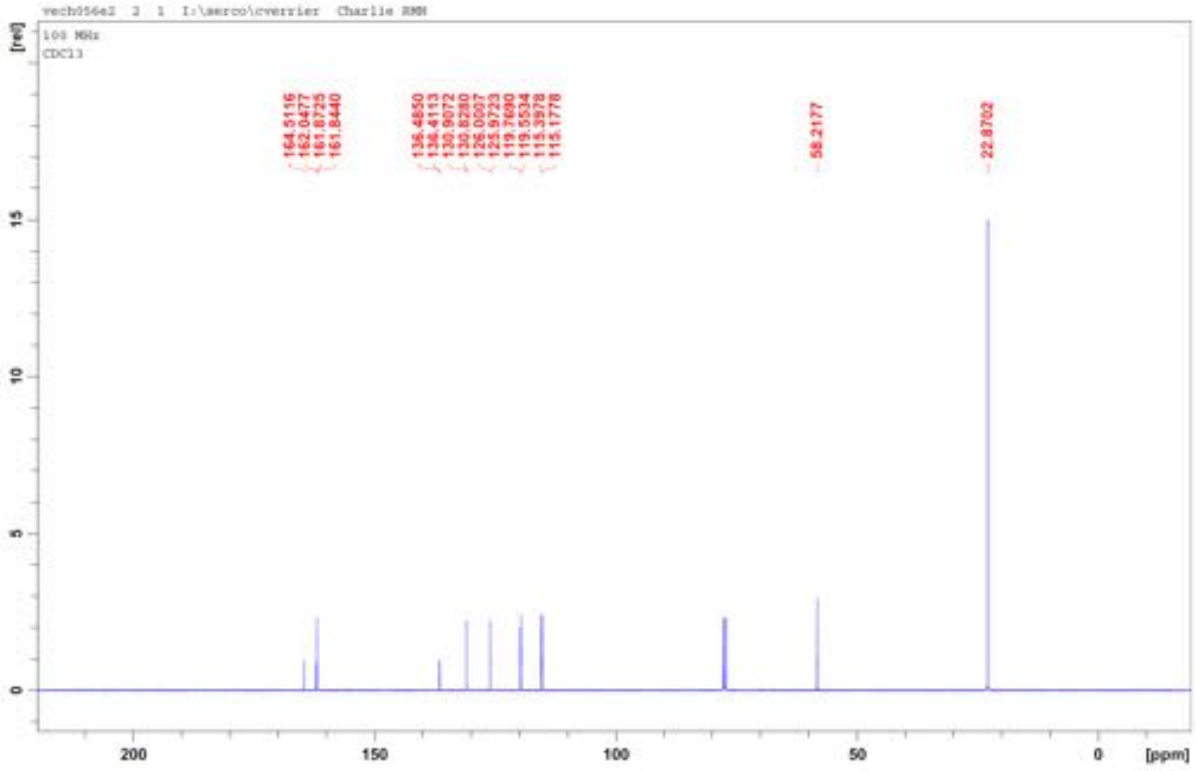

125 MHz
CDCl3
162.7934
160.1269
135.5124
130.1265
122.6315
118.8958
113.3245
57.9078
55.4927
22.7450
[rel]
[ppm]

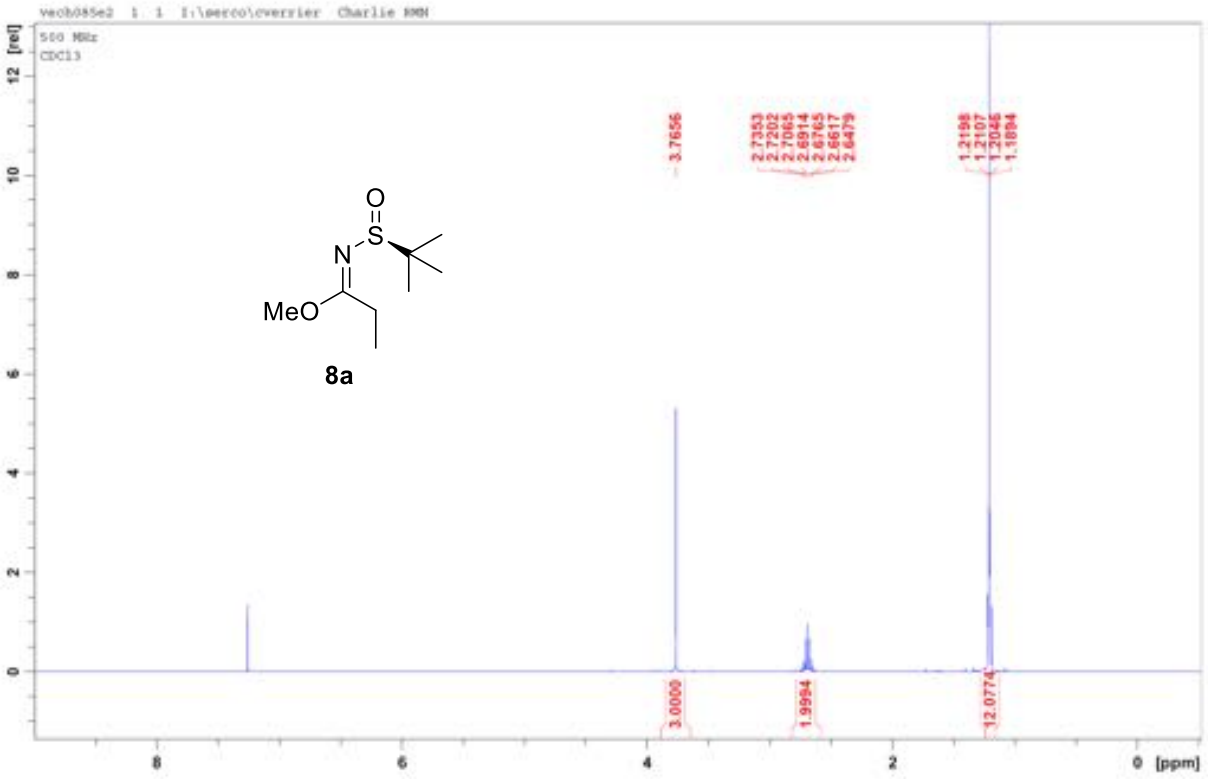

vech057e2 1 1 I:\nmrco\cverrier Charlie RMN
500 MHz
CDCl3
8.5018
7.9978
7.9947
7.9916
7.7210
7.7056
7.6214
7.6196
7.6180
7.6055
7.6035
7.6020
7.3470
7.3313
7.3156
1.2463
1.0000
0.9827
1.0201
0.9938
1.0065
9.3548
[rel]
[ppm]
Br
N
S
O

4g

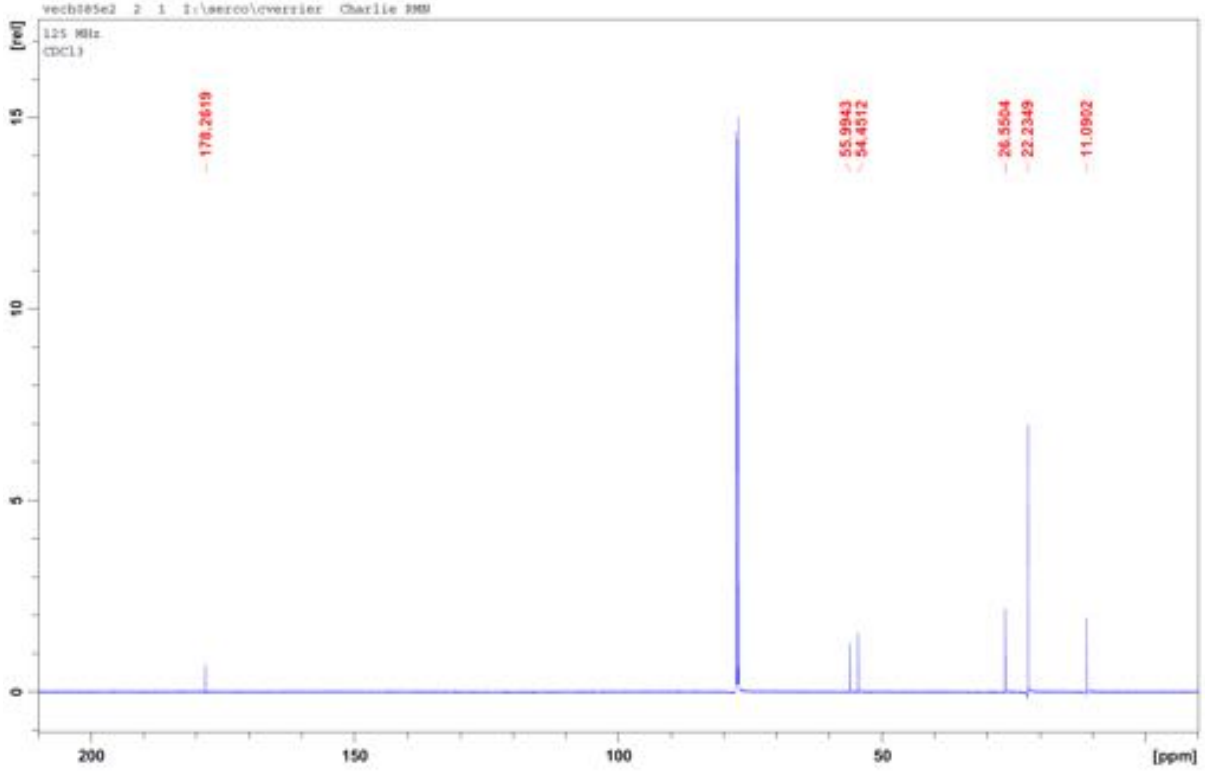

vech057e2 2 1 I:\nmrco\cverrier Charlie RMN
125 MHz
CDCl3
161.6362
136.1668
135.4900
131.8595
130.7830
128.6279
123.4683
58.3029
22.9114
[rel]
[ppm]

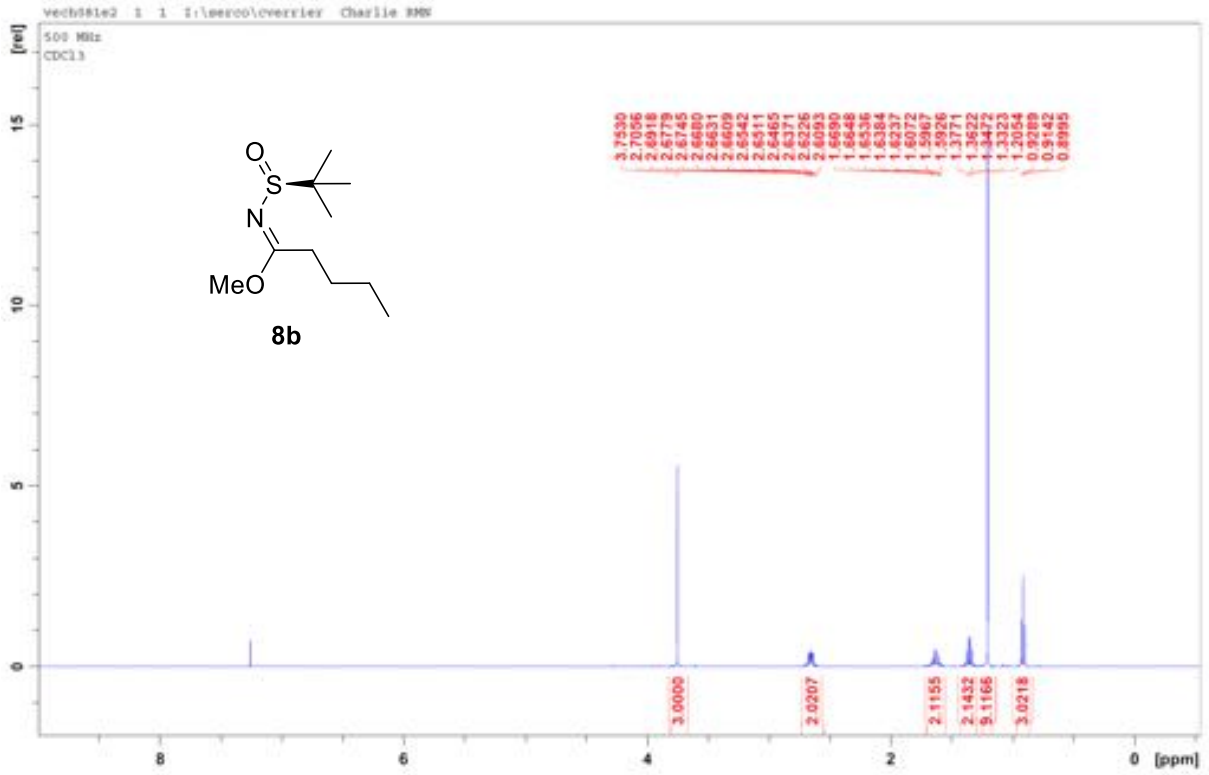

vech056e2 1 1 I:\aerco\cverrier Charlie RMN
400 MHz
CDCl3
8.5299
8.5277
7.5432
7.5370
7.5327
7.5463
7.5404
7.5337
7.4439
7.4296
7.4236
7.4096
7.4035
7.3900
7.1999
7.1979
7.1940
7.1918
7.1797
7.1778
7.1733
7.1585
7.1566
7.1524
7.1505
1.2340
1.0000
2.0341
1.0337
0.9868
9.8630
F
N
O
S
4h
[rel]
[ppm]


vech056e2 2 1 I:\aerco\cverrier Charlie RMN
100 MHz
CDCl3
164.5116
162.0477
161.8725
161.8440
136.4850
136.4113
130.9072
130.8280
126.0007
125.9723
119.7690
119.5534
115.3978
115.1778
58.2177
22.8702
[rel]
[ppm]

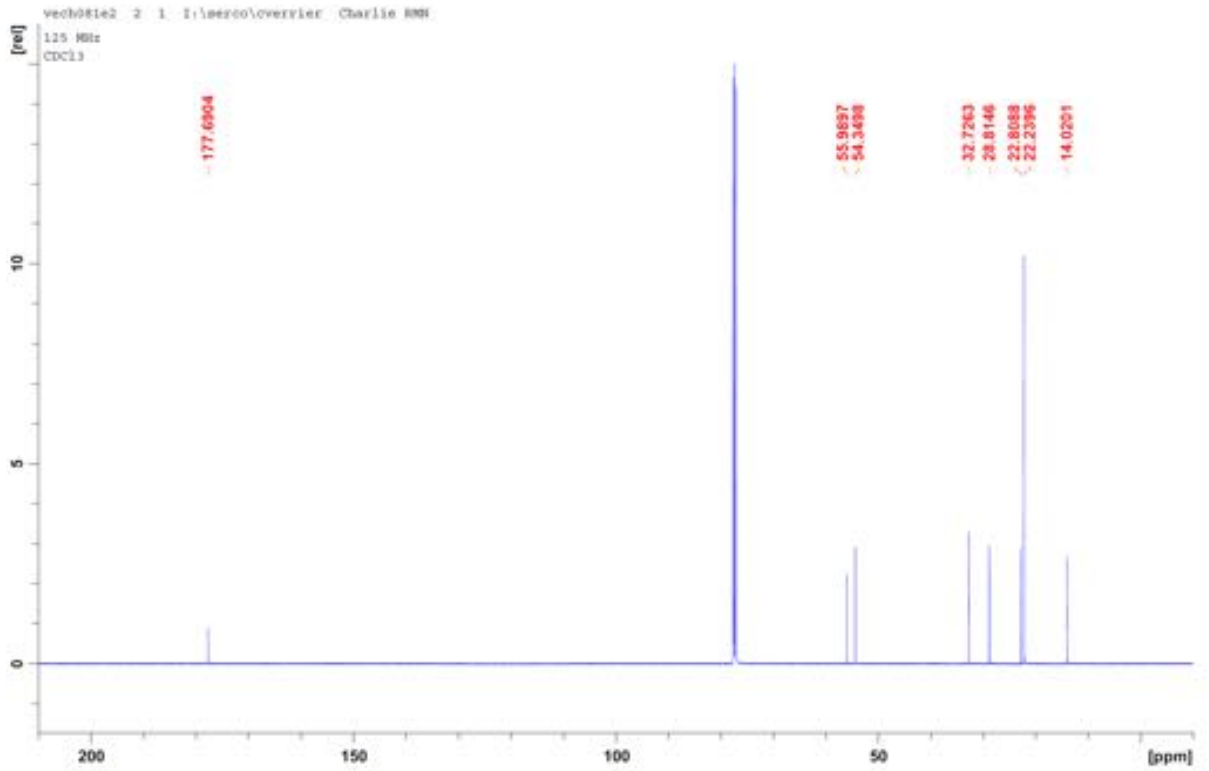

vech085e2 1 1 I:\perco\cverrier Charlie NMR
500 MHz
CDCl3
3.7656
2.7353
2.7202
2.7065
2.6914
2.6765
2.6617
2.6479
1.2198
1.2107
1.2046
1.1894
3.0000
1.9994
12.0774
[rel]
[ppm]

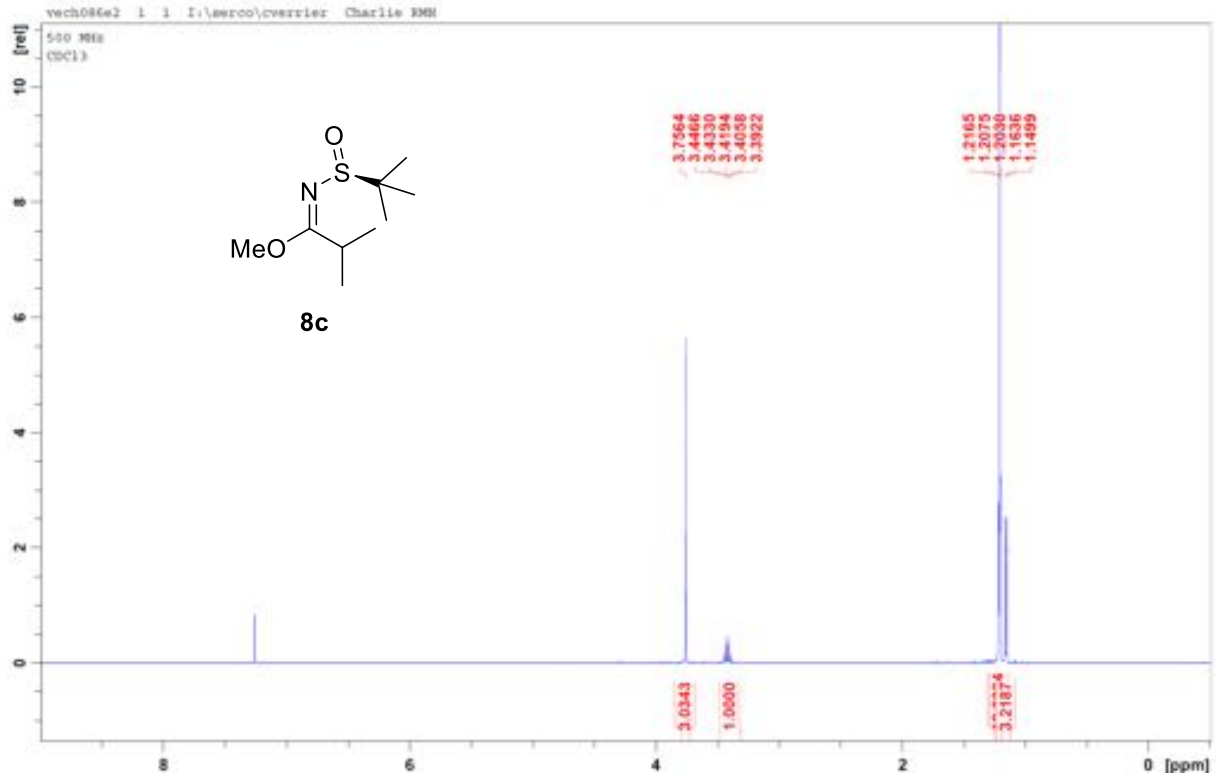
8a

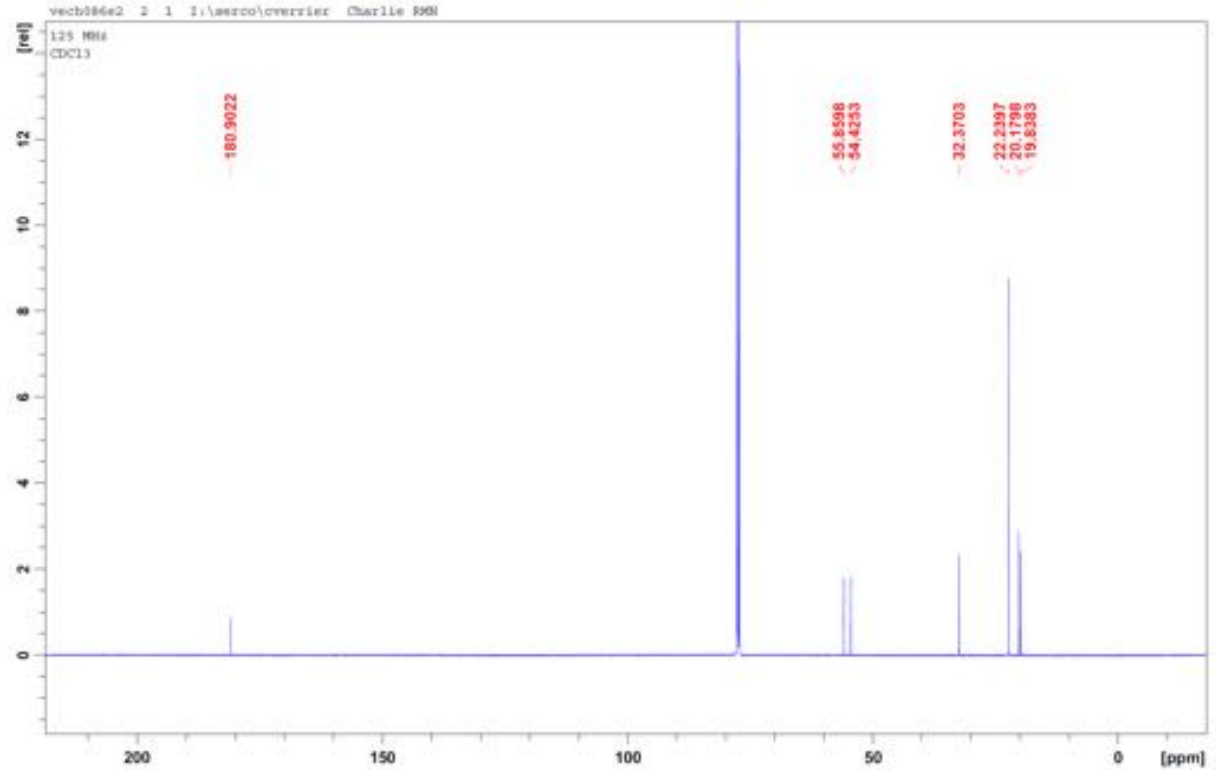

vech085e2 2 1 I:\perco\cverrier Charlie NMR
125 MHz
CDCl3
178.2619
55.9943
54.4512
26.5504
22.2349
11.0902
[rel]
[ppm]


vech081e2 1 1 I:\nmrco\cverrier Charlie RMN
500 MHz
CDCl3
[rel]
3.7530
2.7056
2.6918
2.6779
2.6745
2.6680
2.6631
2.6609
2.6542
2.6511
2.6465
2.6371
2.6226
2.6093
1.6690
1.6648
1.6536
1.6384
1.6237
1.6072
1.5967
1.3926
1.3771
1.3622
1.3472
1.3323
1.2054
0.9289
0.9142
0.8995
3.0000
2.0207
2.1155
2.1432
9.1166
3.0218
8
6
4
2
0 [ppm]

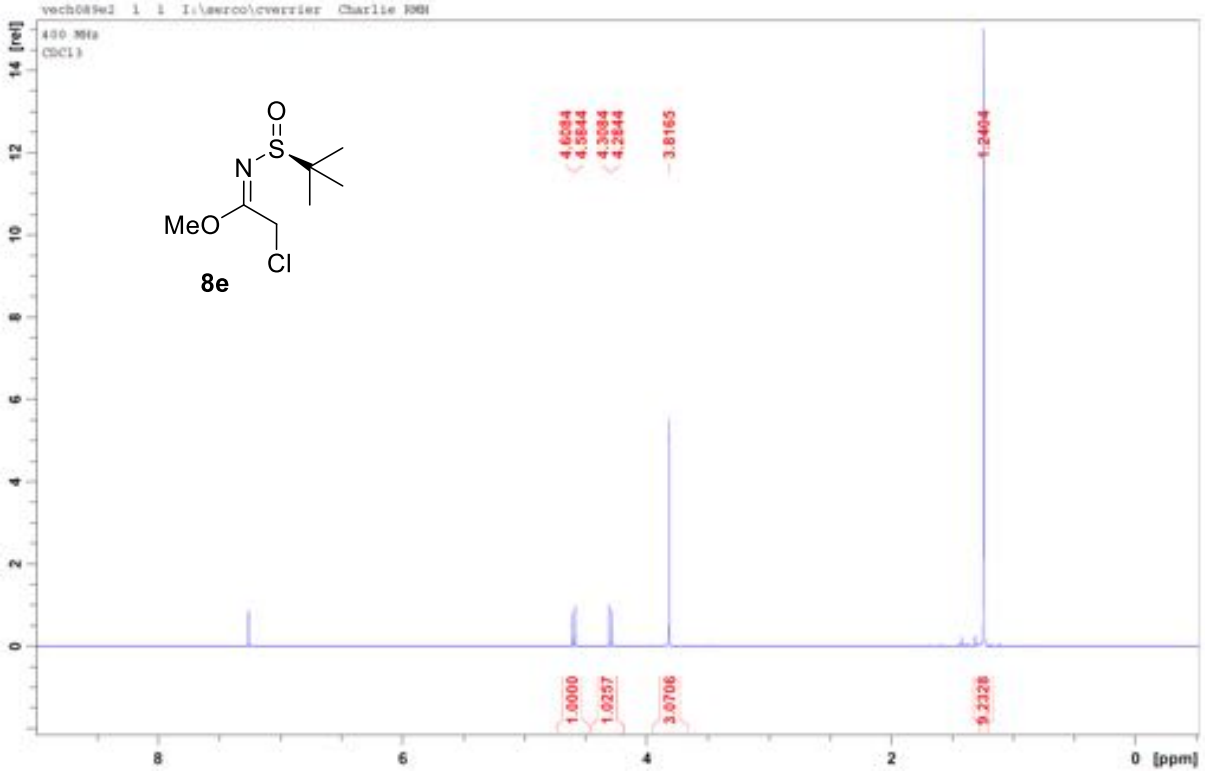
8b


vech081e2 2 1 I:\nmrco\cverrier Charlie RMN
125 MHz
CDCl3
[rel]
177.6904
55.9897
54.3498
32.7263
28.8146
22.8088
22.2396
14.0201
200
150
100
50
[ppm]

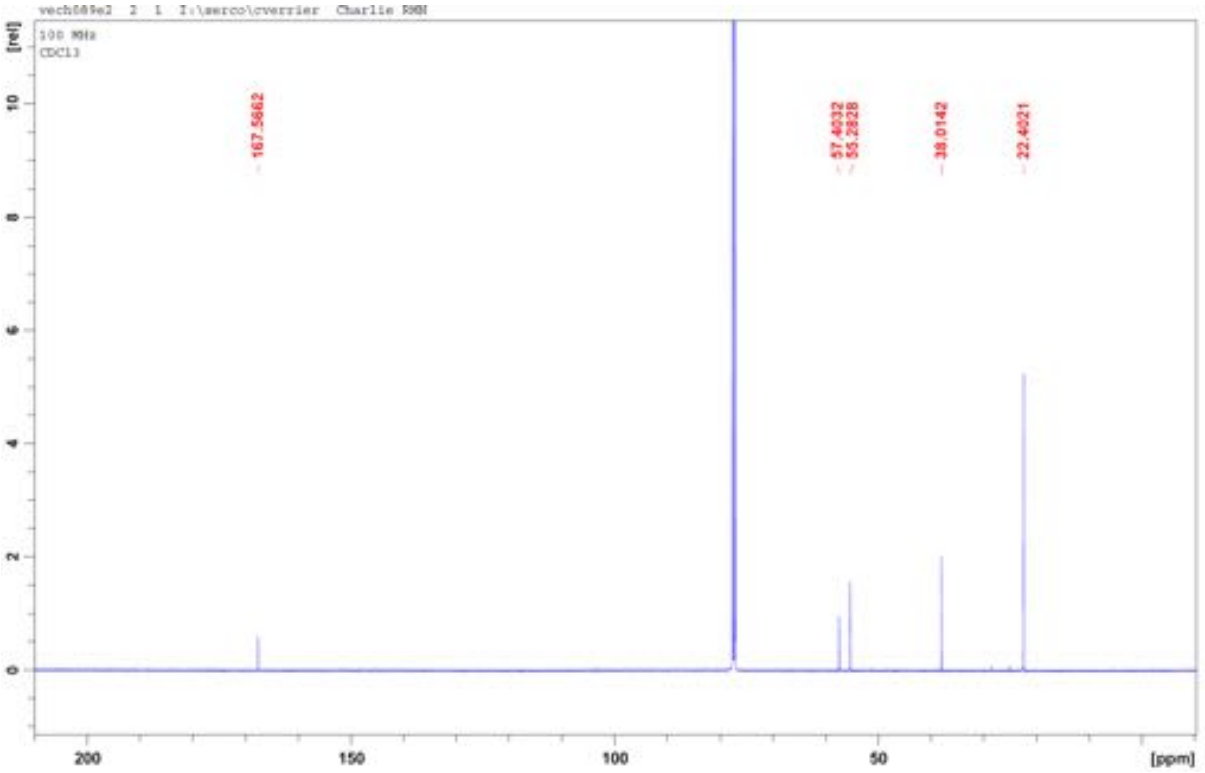

vech086e2 1 1 I:\aerco\cverrier Charlie RMN
500 MHz
CDCl3
[rel]
3.7564
3.4466
3.4330
3.4194
3.4058
3.3922
1.2165
1.2075
1.2030
1.1636
1.1499
3.0343
1.0000
3.2187
8
6
4
2
0 [ppm]

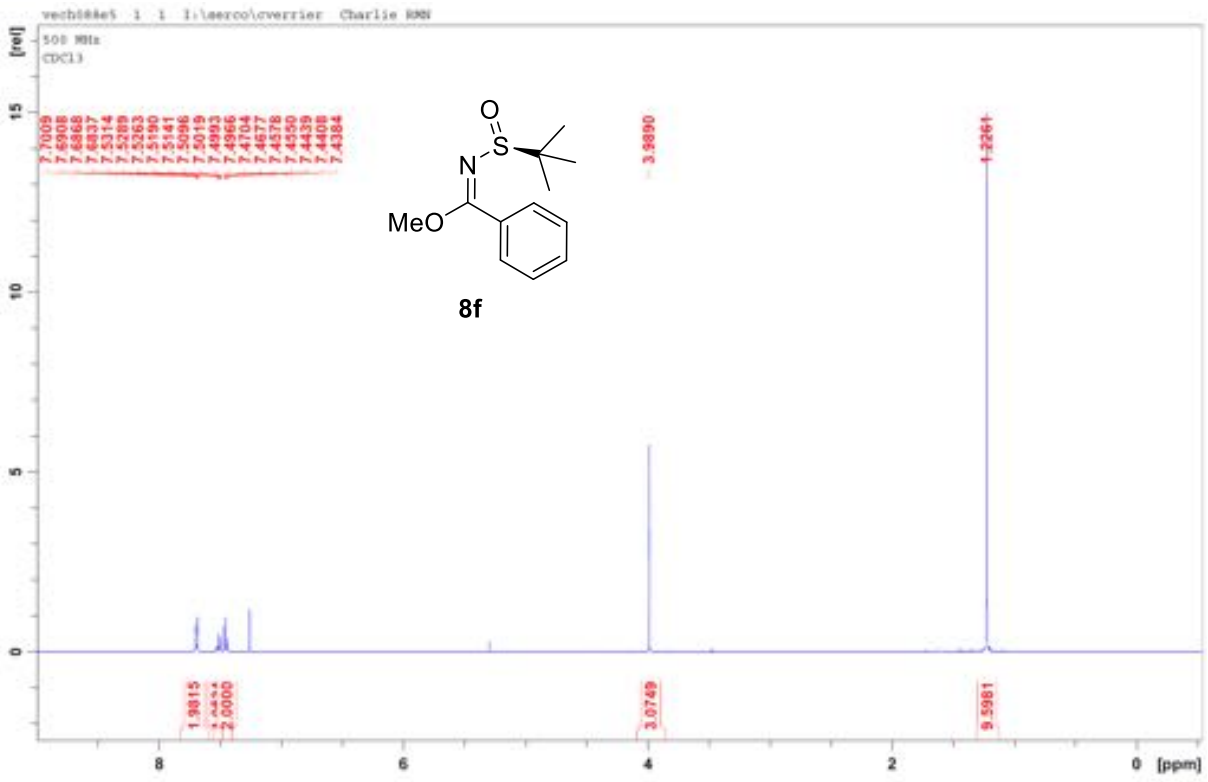

vech086e2 2 1 I:\aerco\cverrier Charlie RMN
125 MHz
CDCl3
[rel]
180.9022
55.8598
54.4253
32.3703
22.2397
20.1798
19.8383
200
150
100
50
0 [ppm]

8c


vech089e2 1 1 I:\aerco\cverrier Charlie NMR
400 MHz
CDCl3
4.6284
4.5844
4.3084
4.2844
3.8165
1.2404
1.0000
1.0257
3.0706
9.2328
[ppm]

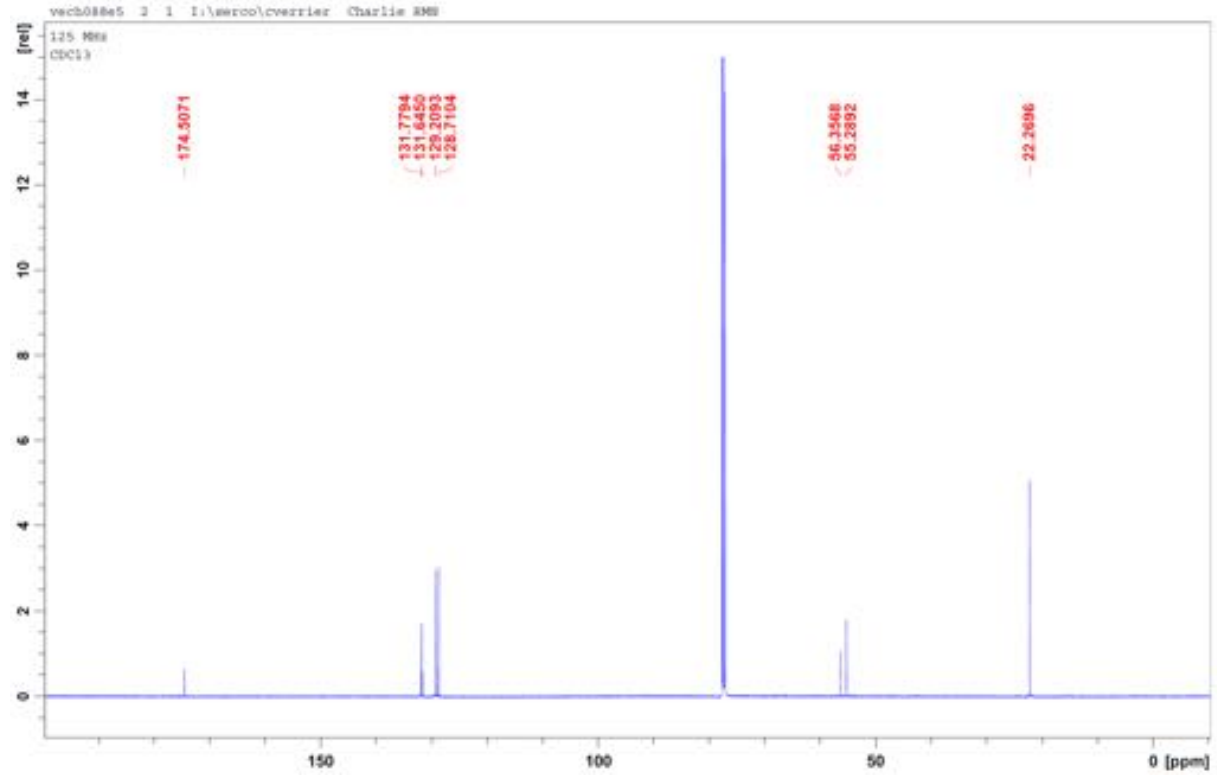
8e


vech089e2 2 1 I:\aerco\cverrier Charlie NMR
100 MHz
CDCl3
167.5862
57.4032
55.2828
38.0142
22.4021
[ppm]


vech088e5 1 1 I:\aerco\cverrier Charlie RMN
500 MHz
CDCl3
[rel]
7.7009
7.6908
7.6868
7.6837
7.5314
7.5289
7.5263
7.5190
7.5141
7.5096
7.5019
7.4993
7.4966
7.4704
7.4677
7.4578
7.4550
7.4439
7.4408
7.4384
3.8890
1.2261
1.9815
3.0749
9.5981
[ppm]

O
S
N
MeO

8f


vech088e5 2 1 I:\aerco\cverrier Charlie RMN
125 MHz
CDCl3
[rel]
174.5071
131.7784
131.6450
129.2093
128.7104
56.3568
55.2892
22.2696
[ppm]