

Supplementary Information for

Synthesis of Chiral Sulfones *via* Nickel-Catalyzed Asymmetric Hydrogenation

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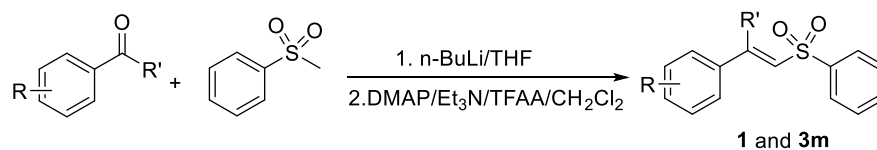
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1. Experimental Section

General Information: All the air or moisture sensitive reactions and manipulations were performed by using standard Schlenk techniques and in a nitrogen-filled glovebox. THF, dioxane and toluene were distilled from sodium benzophenone ketyl. DCM and DCE was distilled from calcium hydride. Anhydrous MeOH was distilled from magnesium. ^1H NMR and ^{13}C NMR spectra were recorded on Bruker AV (400 MHz) spectrometers and JEOL JNM-ECX600P and JNM-ECS600 (400 MHz or 600 MHz) spectrometers. (CDCl_3 was the solvent used for the NMR analysis, with TMS as the internal standard). Optical rotation was determined using Autopol III Automatic polarimeter (Rudolph research Analytical). HPLC analysis was conducted on Agilent 1260 series instrument. SFC analysis was conducted on Agilent 1260 series instrument. HRMS were recorded on a Waters LCT Premier XE mass spectrometer with TOF.

2. General procedure for the synthesis of substrates

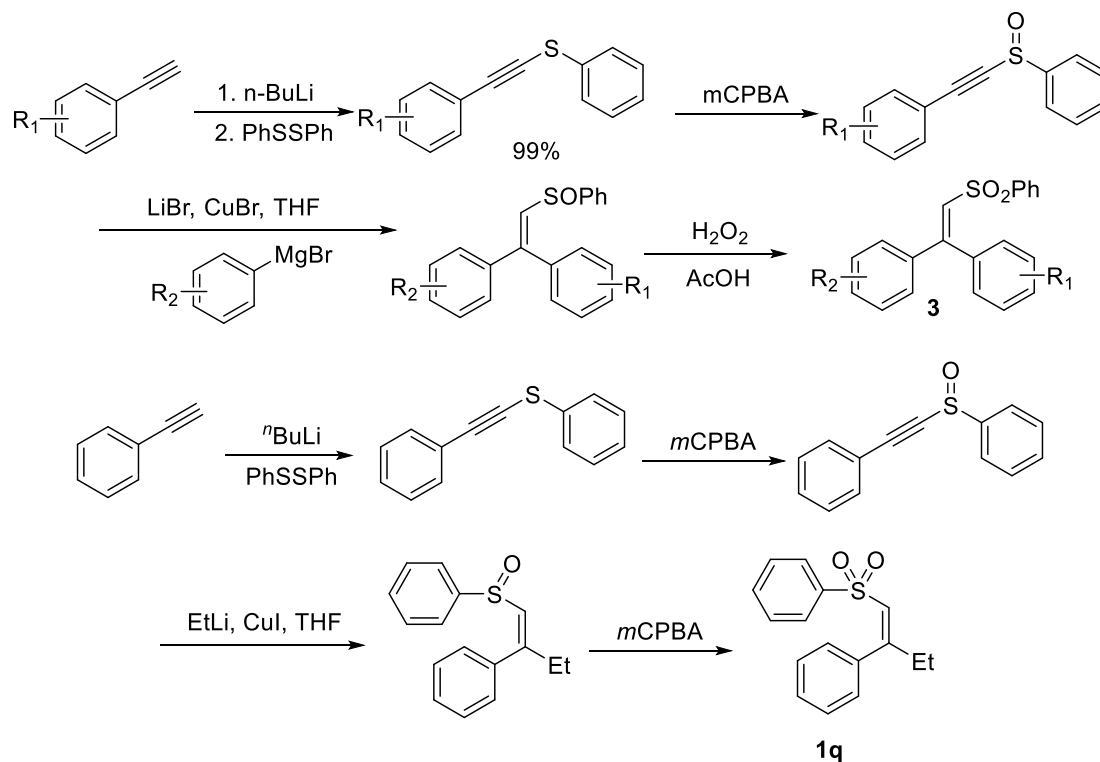
General Procedure 1¹



Methyl phenyl sulfon (1.00 eq.) was placed in an oven-dried 250 mL, three-neck round bottom flask. THF (6 mL/mmol) was added under nitrogen. The reaction mixture was cooled and n-BuLi (1.10 eq.) was added dropwise with stirring at $-78\text{ }^\circ\text{C}$. The solution was stirred for 30 min at $-78\text{ }^\circ\text{C}$. And then, the corresponding ketones (1.10 eq.) were added to the solution dropwise, maintained $-78\text{ }^\circ\text{C}$. The solution was stirred for 1 h until no starting material was detected by TLC. The reaction mixture was quenched with saturated aqueous NH_4Cl solution and extracted with ethyl acetate. The combined organic layers were washed with brine, dried over Na_2SO_4 , and concentrated. The crude product and DMAP (0.10 eq.) was dissolved in DCM (30 mL), the reaction mixture was cooled, Et_3N (2.00 eq.) and TFAA (1.20 eq.) was added with stirring at $0\text{ }^\circ\text{C}$, then the reaction mixture was rise to room temperature after 30 min and stirred overnight. The reaction mixture was quenched with saturated aqueous NH_4Cl solution and

extracted with DCM. The combined organic layers were washed with brine, dried over Na_2SO_4 , and concentrated. The residue was purification by chromatography on silica gel gave **1** and **3m**.

General Procedure 2¹



Phenylacetylene (1.00 eq.) was placed in an oven-dried 250 mL three-neck round bottom flask. THF (4 mL/mmol) was added under nitrogen. The reaction mixture was cooled and $n\text{-BuLi}$ (1.10 eq.) was added dropwise with stirring at $0\text{ }^\circ\text{C}$. The solution was stirred at $0\text{ }^\circ\text{C}$ for 1.5 h. And then, 1,2-diphenyldisulfane (1.00 eq.) was added to the solution in one portion, maintained $0\text{ }^\circ\text{C}$ for 2 h. Then the solution was stirred at room temperature for 2 d. The reaction mixture was quenched with distilled water and extracted with ethyl acetate. The combined organic layers were washed three times with aqueous NaOH (0.1 M), and brine, dried over Na_2SO_4 , and concentrated. The residue was purification by flash chromatography gave phenyl(phenylethynyl)sulfane. To a mixture of phenyl(phenylethynyl)sulfane (1.00 eq.) in DCM (20 mL/mmol) was added $m\text{CPBA}$ (1.00 eq.) at $0\text{ }^\circ\text{C}$ and the reaction mixture was stirred at $0\text{ }^\circ\text{C}$ for 2 h. The solution was quenched with 30% aqueous Na_2SO_3 and extracted with CH_2Cl_2 , then

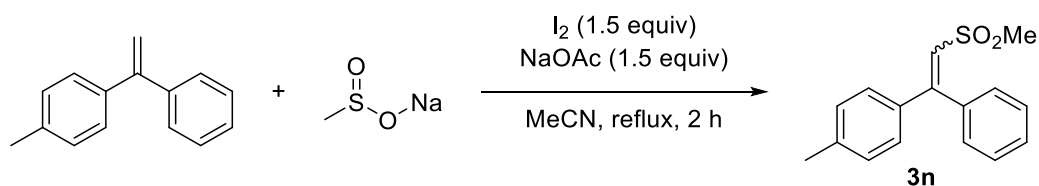
washed with saturated aqueous NaHCO_3 and brine, and dried over Na_2SO_4 , concentrated in vacuo to give crude product ((phenylethynyl)sulfinyl)benzene.

CuX (1.28 eq.) was added to an oven-dried 250 mL three-neck round bottom flask under nitrogen, THF (4 mL/mmol) was added and the reaction mixture was cooled to $-20\text{ }^\circ\text{C}$. Then LiBr ($\text{CuX} = \text{CuBr}$, 1.28 eq.) in THF (0.8 mL/mmol) was added, followed by stirring for 10 min. The RLi (1.25 eq., CuI used) or RMgX (1.25 eq.) (CuBr/LiBr used) was added dropwise at $-20\text{ }^\circ\text{C}$, followed by stirring for 15 min. After that, the solution was cooled to $-78\text{ }^\circ\text{C}$ and a solution of crude product ((phenylethynyl)sulfinyl)benzene (1.00 eq.) in THF (4 mL/mmol) was added dropwise and stirred at $-78\text{ }^\circ\text{C}$ for 1 h. The reaction was quenched with MeOH , and a saturated solution of NH_4Cl was added, then extracted three times with DCM . The combined organic extracts were washed with water, brine and then dried over Na_2SO_4 , concentrated in vacuo to give crude product sulfoxide without purification.

The crude product sulfoxide (1.00 eq.) was suspended in glacial AcOH (1.11 mL/mmol) then, 30% H_2O_2 (6.50 eq.) was slowly added. The mixture was heated to $100\text{ }^\circ\text{C}$ and stirred for 1 h. The reaction mixture was cooled to room temperature, then saturated aqueous NaHCO_3 (bring the $\text{pH} \approx 7$) was added, and extracted with DCM . The organic extracts were washed with brine and dried over Na_2SO_4 and concentrated in vacuo. The residue was purified by chromatography gave **3**.

The crude product sulfoxide (1.00 eq.) was dissolved in DCM (20 mL/mmol), mCPBA was added (1.00 eq.) at $0\text{ }^\circ\text{C}$ and the reaction mixture was stirred at $0\text{ }^\circ\text{C}$ for 2 h. The solution was quenched with 30% aqueous Na_2SO_3 and extracted with CH_2Cl_2 , then washed with saturated aqueous NaHCO_3 and brine, and dried over Na_2SO_4 , concentrated in vacuo. The residue was purified by chromatography gave **1q**.

General Procedure 3²

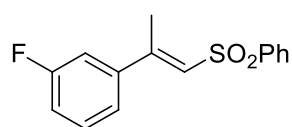


Add I_2 (1.5 eq.) to a suspension mixture of styrene derivative (3.0 mmol), Sodium

methanesulfinate (3 eq.) and NaOAc (1.5eq.) in MeCN (15 mL). Stir the reaction mixture at refluxing temperature for 2 hours. Quench the reaction mixture by the addition of saturated aqueous sodium thiosulfate. Basify the mixture with saturated aqueous sodium hydrogen carbonate. Stir the mixture by extraction with ethyl acetate. Wash the combined organic extracts with water, brine. The organic extracts were washed with brine and dried over Na₂SO₄ and concentrated in vacuo. The residue was purified by chromatography gave **3n**.

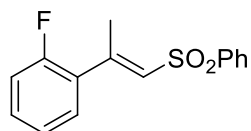
3. NMR and HRMS data of substrates

(*E*)-1-fluoro-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1a**)



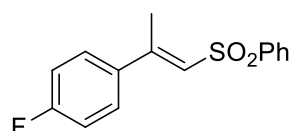
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.60 g, yield: 58%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.00-7.95 (m, 2H), 7.66-7.62 (m, 1H), 7.59-7.55 (m, 2H), 7.35-7.31 (m, 1H), 7.19-7.16 (m, 1H), 7.10-7.06 (m, 2H), 6.63-6.58 (m, 1H), 2.53 (d, *J* = 1.2 Hz, 3H). MP: 49-51 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(*E*)-1-fluoro-2-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1b**)



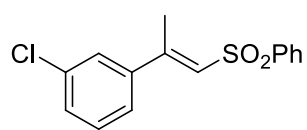
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.61 g, yield: 61%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.01-7.96 (m, 2H), 7.66-7.62 (m, 1H), 7.59-7.55 (m, 2H), 7.35-7.30 (m, 1H), 7.25-7.21 (m, 1H), 7.15-7.11 (m, 1H), 7.08-7.04 (m, 1H), 6.55-6.51 (m, 1H), 2.51 (t, *J* = 1.4 Hz, 3H). MP: 65-68 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(*E*)-1-fluoro-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1c**)



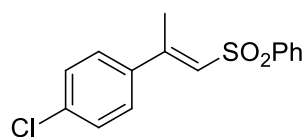
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.98 g, yield: 72%; ¹H NMR (400 MHz, Chloroform-*d*) δ 8.01-7.94 (m, 2H), 7.66-7.60 (m, 1H), 7.59-7.54 (m, 2H), 7.41-7.36 (m, 2H), 7.08-7.02 (m, 2H), 6.57 (s, 1H), 2.52 (d, *J* = 1.2 Hz, 3H). MP: 54-56 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-chloro-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (1d)



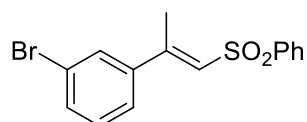
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.54 g, yield: 53%; ¹H NMR (400 MHz, Chloroform-*d*) δ 8.02-7.93 (m, 2H), 7.67-7.61 (m, 1H), 7.60-7.55 (m, 2H), 7.37-7.26 (m, 4H), 6.59 (q, *J* = 1.2 Hz, 1H), 2.52 (d, *J* = 1.3 Hz, 3H). MP: 68-70 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-chloro-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (1e)



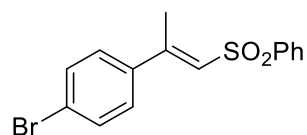
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.25 g, yield: 43%; ¹H NMR (400 MHz, Chloroform-*d*) δ 7.99-7.95 (m, 2H), 7.66-7.61 (m, 1H), 7.56 (t, *J* = 7.5 Hz, 2H), 7.36-7.31 (m, 4H), 6.58 (d, *J* = 1.2 Hz, 1H), 2.51 (d, *J* = 0.9 Hz, 3H). MP: 99-101 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.³

(E)-1-bromo-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (1f)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.74 g, yield: 52%; ¹H NMR (400 MHz, Chloroform-*d*) δ 8.00-7.95 (m, 2H), 7.67-7.62 (m, 1H), 7.60-7.55 (m, 2H), 7.52-7.48 (m, 2H), 7.33-7.29 (m, 1H), 7.26-7.20 (m, 1H), 6.61-6.54 (m, 1H), 2.52 (d, *J* = 1.3 Hz, 3H). MP: 80-82 °C. (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

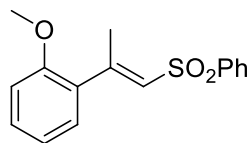
(E)-1-bromo-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (1g)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.47 g, yield: 44%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.00-7.93 (m, 2H), 7.64-7.60 (m, 1H), 7.58-7.53 (m, 2H), 7.50-7.44 (m, 2H), 7.27-7.22 (m, 2H), 6.60-6.55 (m, 1H), 2.50 (d, *J* = 1.1 Hz, 3H). ¹³C NMR (100 MHz, Chloroform-*d*) δ = 152.0, 141.8, 138.9, 133.3, 131.8, 129.2, 127.8, 127.8, 127.2, 124.2, 17.0; MP: 113-115 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₁₅H₁₄O₂BrS ([M+H]⁺):

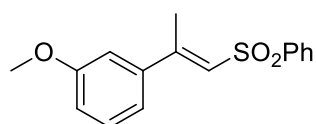
336.9892, found 336.9896, 338.9876.

(E)-1-methoxy-2-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1h**)



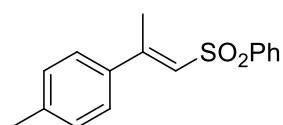
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as colorless solid; 1.76 g, yield: 45%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.00-7.97 (m, 2H), 7.63-7.61 (m, 1H) 7.56 (t, *J* = 7.6 Hz, 2H), 7.32-7.28 (m, 1H), 7.08 (dd, *J* = 7.5, 1.7 Hz, 1H), 6.92-6.89 (m, 1H), 6.87 (d, *J* = 8.3 Hz, 1H), 6.45-6.42 (m, 1H), 3.77 (s, 3H), 2.46 (d, *J* = 1.3 Hz, 3H). MP: 69-71 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-methoxy-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1i**)



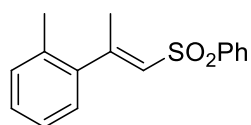
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.64 g, yield: 64%; ¹H NMR (600 MHz, Chloroform-*d*) δ 7.97 (d, *J* = 7.8 Hz, 2H), 7.62 (t, *J* = 7.5 Hz, 1H), 7.56 (t, *J* = 7.7 Hz, 2H), 7.29-7.26 (m, 1H), 6.99-6.96 (m, 1H), 6.93-6.89 (m, 2H), 6.61 (s, 1H), 3.81 (s, 3H), 2.52 (s, 3H). MP: 65-67 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.⁴

(E)-1-methyl-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1j**)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.27 g, yield: 47%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.00-7.95 (m, 2H), 7.61 (t, *J* = 7.4 Hz, 1H), 7.55 (t, *J* = 7.6 Hz, 2H), 7.30 (d, *J* = 8.2 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.63-6.58 (m, 1H), 2.53-2.50 (m, 3H), 2.35 (s, 3H). MP: 70-72°C; The analytical data are consistent with the literature.⁴

(E)-1-methyl-2-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1k**)

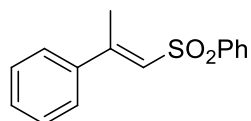


Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as light yellow liquid; 1.76 g, yield: 65%; ¹H NMR (600 MHz, Chloroform-*d*) δ 7.98-7.96 (m, 2H), 7.63 (t, *J* = 7.0 Hz, 1H), 7.56 (t, *J* = 7.6 Hz, 2H), 7.21-7.18 (m, 1H), 7.16-7.12 (m,

2H), 6.99 (d, $J = 7.8$ Hz, 1H), 6.28-6.23 (m, 1H), 2.42 (d, $J = 1.3$ Hz, 3H), 2.17 (s, 3H).

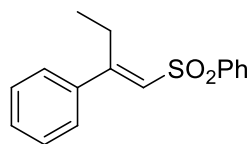
The analytical data are consistent with the literature.¹

(E)-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1l**)



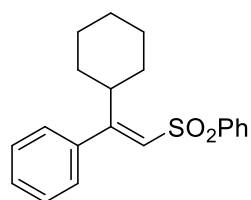
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 1.75 g, yield: 68%; ¹H NMR (400 MHz, Chloroform-*d*) δ 8.01-7.95 (m, 2H), 7.65-7.60 (m, 1H), 7.59-7.54 (m, 2H), 7.41-7.35 (m, 5H), 6.61 (q, $J = 1.2$ Hz, 1H), 2.55-2.51 (m, 3H). MP: 81-83 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.³

(E)-((2-phenylbut-1-en-1-yl)sulfonyl)benzene (**1m**)



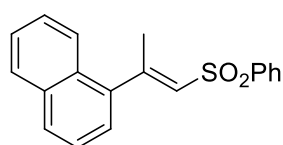
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as light yellow liquid; 0.87 g, yield: 32%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.00-7.97 (m, 2H), 7.64-7.61 (m, 1H), 7.57-7.54 (m, 2H), 7.38-7.34 (m, 5H), 6.48 (s, 1H), 3.07 (q, $J = 7.5$ Hz, 2H), 0.97 (t, $J = 7.5$ Hz, 3H). The analytical data are consistent with the literature.¹

(E)-(1-cyclohexyl-2-(phenylsulfonyl)vinyl)benzene (**1n**)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as white solid; 1.50 g, yield: 46%; ¹H NMR (400 MHz, Chloroform-*d*) δ 7.46-7.41 (m, 3H), 7.31-7.24 (m, 3H), 7.22-7.18 (m, 2H), 6.90-6.87 (m, 2H), 6.48 (d, $J = 1.2$ Hz, 1H), 2.20-2.09 (m, 1H), 1.77-1.70 (m, 4H), 1.65-1.60 (m, 1H), 1.21-1.06 (m, 5H). ¹³C NMR (150 MHz, Chloroform-*d*) δ 163.5, 141.8, 136.4, 132.7, 128.6, 128.4, 128.0, 127.7, 127.6, 47.9, 31.3, 26.3, 25.9. MP: 81-83 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₂₀H₂₃O₂S ([M+H]⁺): 327.1413, found 327.1417.

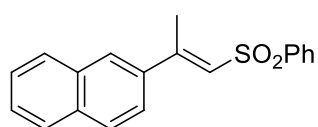
(E)-1-(1-(phenylsulfonyl)prop-1-en-2-yl)naphthalene (**1o**)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as colorless solid; 2.09 g, yield: 68%; ¹H NMR (400 MHz, Chloroform-*d*) δ 8.07-8.01 (m,

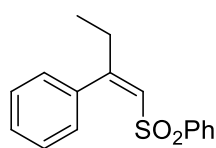
2H), 7.87-7.79 (m, 2H), 7.71-7.65 (m, 2H), 7.61 (t, $J = 7.4$ Hz, 2H), 7.52-7.45 (m, 2H), 7.42 (t, $J = 7.7$ Hz, 1H), 7.23 (d, $J = 7.0$ Hz, 1H), 6.56-6.43 (m, 1H), 2.62 (d, $J = 1.2$ Hz, 3H). MP: 74-76 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.⁴

(E)-2-(1-(phenylsulfonyl)prop-1-en-2-yl)naphthalene (**1p**)



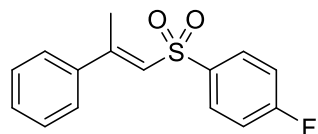
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as colorless solid; 2.20 g, yield: 72%; ¹H NMR (400 MHz, Chloroform-*d*) δ 8.03-7.98 (m, 2H), 7.87 (d, $J = 1.5$ Hz, 1H), 7.84-7.80 (m, 3H), 7.65-7.61 (m, 1H), 7.59-7.54 (m, 2H), 7.52-7.46 (m, 3H), 6.75 (d, $J = 1.2$ Hz, 1H), 2.63 (d, $J = 1.2$ Hz, 3H). MP: 120-122 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.³

(Z)-((2-phenylbut-1-en-1-yl)sulfonyl)benzene (**1q**)



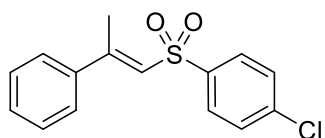
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as light yellow liquid; 1.30 g, yield: 48% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.46 (dd, $J = 21.5, 7.8$ Hz, 3H), 7.33-7.27 (m, 3H), 7.26-7.21 (m, 2H), 6.98 (d, $J = 7.2$ Hz, 2H), 6.51 (s, 1H), 2.39 (q, $J = 7.3$ Hz, 2H), 1.01 (t, $J = 7.3$ Hz, 3H). The analytical data are consistent with the literature.¹

(E)-1-fluoro-4-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1r**)



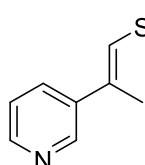
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) afforded the product as light yellow liquid; 1.35 g, yield: 49%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.01-7.97 (m, 2H), 7.40-7.35 (m, 5H), 7.25-7.21 (m, 2H), 6.60-6.57 (m, 1H), 2.54 (d, $J = 1.1$ Hz, 3H). ¹³C NMR (150 MHz, Chloroform-*d*) δ = 165.5 (d, $J = 256.7$ Hz), 153.7, 140.0, 138.3, 130.1, 130.0, 128.8, 127.3, 126.3, 116.5, 17.2. TOF-HRMS Calculated for C₁₅H₁₄O₂FS ([M+H]⁺): 277.0693, found 277.0699.

(E)-1-chloro-4-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1s**)



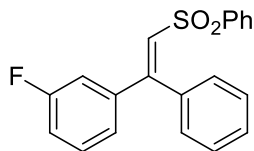
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 22 cm) afforded the product as white solid; 1.52 g, yield: 52%; ¹H NMR (600 MHz, Chloroform-*d*) δ = 7.91 (d, *J* = 8.4 Hz, 2H), 7.53 (d, *J* = 8.4 Hz, 2H), 7.42-7.34 (m, 5H), 6.58 (s, 1H), 2.53 (s, 3H); MP: 79-81 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.⁵

(E)-3-(1-(phenylsulfonyl)prop-1-en-2-yl)pyridine (1t)



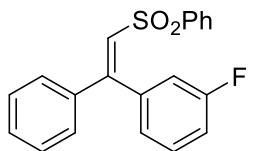
Purification by column chromatography (silica gel, PE:EA = 1:1, 5 × 20 cm) afforded the product as white solid; 0.99 g, yield: 38%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.63-8.62 (m, 1H), 8.60-8.59 (m, 1H), 7.97 (dt, *J* = 7.3, 1.4 Hz, 2H), 7.68 (ddd, *J* = 8.1, 2.5, 1.5 Hz, 1H), 7.65-7.62 (m, 1H), 7.58-7.55 (m, 2H), 7.31-7.28 (m, 1H), 6.61 (d, *J* = 1.3 Hz, 1H), 2.55 (d, *J* = 1.4 Hz, 3H). ¹³C NMR (151 MHz, Chloroform-*d*) δ 150.8, 150.0, 147.3, 141.6, 135.8, 133.6, 133.5, 129.3, 128.9, 127.3, 123.4, 17.0. MP: 96-97 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₁₄H₁₄NO₂S ([M+H]⁺): 260.0740, found 260.0742.

(E)-1-fluoro-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (3a)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.95 g, yield: 28% (three steps); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.59-7.54 (m, 2H), 7.51-7.46 (m, 1H), 7.39-7.32 (m, 3H), 7.31-7.26 (m, 3H), 7.09-7.03 (m, 3H), 7.03-7.00 (m, 2H), 6.89-6.84 (m, 1H). MP: 109-111 °C. (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

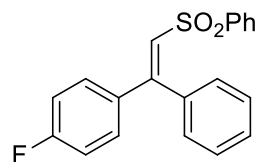
(Z)-1-fluoro-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (3a)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.91 g, yield: 27% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.63 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.55-7.51 (m, 1H), 7.42-7.38 (m, 3H), 7.34-7.29 (m, 3H), 7.22-7.19 (m, 2H), 7.09-7.05 (m, 1H), 7.03 (s, 1H), 6.98-6.95 (m,

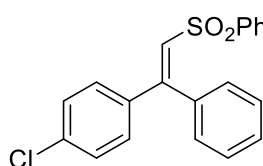
1H), 6.72-6.68 (m, 1H). MP: 81-83 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-fluoro-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3b**)



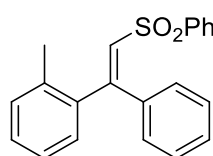
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 22 cm) and recrystallization afforded the product as white solid; 1.08 g, yield: 32% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.57 (d, *J* = 7.9 Hz, 2H), 7.49 (t, *J* = 7.4 Hz, 1H), 7.39-7.33 (m, 3H), 7.29 (t, *J* = 7.6 Hz, 2H), 7.20 (dd, *J* = 8.6, 5.4 Hz, 2H), 7.06 (d, *J* = 7.5 Hz, 2H), 7.02-6.96 (m, 3H). MP: 121-123 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-chloro-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3c**)



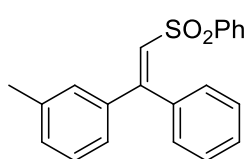
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 1.09 g, Yield: 31% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.62-7.56 (m, 2H), 7.51-7.47 (m, 1H), 7.40-7.33 (m, 4H), 7.32-7.27 (m, 3H), 7.17-7.12 (m, 2H), 7.11-6.98 (m, 3H). MP: 96-98 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-methyl-2-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3d**)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.96 g, yield: 29% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.76-7.68 (m, 2H), 7.56-7.49 (m, 1H), 7.38 (t, *J* = 7.9 Hz, 2H), 7.33-7.28 (m, 3H), 7.26-7.24 (m, 3H), 7.15 (dd, *J* = 14.7, 7.4 Hz, 2H), 7.06 (d, *J* = 7.6 Hz, 1H), 6.63 (d, *J* = 14.2 Hz, 1H), 2.04 (s, 3H). MP: 111-113 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

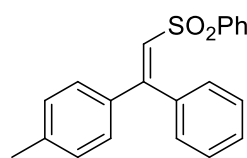
(E)-1-methyl-3-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3e**)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as yellow solid; 0.90 g, yield: 27% (three steps); ¹H NMR (600 MHz,

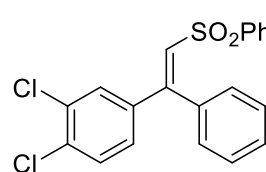
Chloroform-*d*) δ 7.60-7.55 (m, 2H), 7.50-7.46 (m, 1H), 7.38-7.32 (m, 3H), 7.28 (d, $J = 7.8$ Hz, 2H), 7.20-7.17 (m, 2H), 7.09-7.05 (m, 2H), 7.04 (s, 1H), 7.01 (d, $J = 1.9$ Hz, 1H), 6.99-6.97 (m, 1H), 2.30 (s, 3H). MP: 119-121 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(*E*)-1-methyl-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3f**)



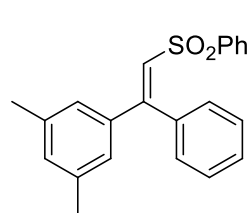
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.83 g, yield: 25% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.58-7.55 (m, 2H), 7.47 (t, $J = 7.9$ Hz, 1H), 7.40-7.31 (m, 5H), 7.29 (s, 2H), 7.10 (s, 4H), 7.07-7.04 (m, 2H), 7.00 (d, $J = 3.9$ Hz, 1H), 2.34 (s, 3H). MP: 113-115 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(*E*)-1,2-dichloro-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3g**)



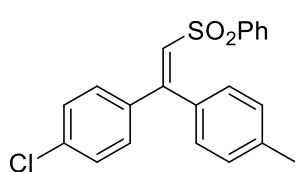
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 1.47 g, yield: 38% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.64 (d, $J = 8.1$ Hz, 2H), 7.57 (t, $J = 7.4$ Hz, 1H), 7.48-7.39 (m, 4H), 7.34 (t, $J = 7.4$ Hz, 2H), 7.20 (d, $J = 7.6$ Hz, 2H), 7.14-6.98 (m, 3H). MP: 108-110 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(*E*)-1,3-dimethyl-5-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3h**)



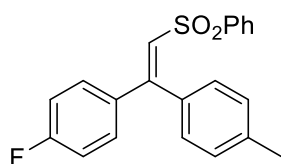
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.87 g, yield: 25% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.64-7.55 (m, 2H), 7.47 (t, $J = 7.4$ Hz, 1H), 7.40-7.32 (m, 3H), 7.32-7.27 (m, 2H), 7.13-6.97 (m, 4H), 6.81 (s, 2H), 2.25 (s, 6H). MP: 123-125 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(*E*)-1-chloro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)vinyl)benzene (**3i**)



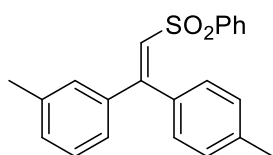
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.85 g, yield: 23% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.61 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.52-7.49 (m, 1H), 7.38-7.35 (m, 2H), 7.28-7.26 (m, 2H), 7.15-7.13 (m, 2H), 7.11 (d, *J* = 7.8 Hz, 2H), 6.99-6.96 (m, 2H), 6.93 (s, 1H), 2.39 (s, 3H). ¹³C NMR (100 MHz, Chloroform-*d*) δ 153.5, 140.9, 138.8, 137.4, 136.0, 132.4, 131.7, 129.3, 129.1, 128.3, 128.2, 127.2, 20.9. MP: 76-78 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₂₁H₁₈O₂ClS ([M+H]⁺): 369.0711, found 369.0715.

(E)-1-fluoro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)vinyl)benzene (3j)



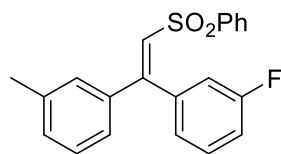
Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as light yellow solid; 1.09 g, yield: 31% (three steps); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.64-7.58 (m, 2H), 7.53-7.47 (m, 1H), 7.39-7.34 (m, 2H), 7.22-7.17 (m, 2H), 7.13-7.08 (m, 2H), 7.01-6.95 (m, 4H), 6.91 (s, 1H), 2.39 (s, 3H). MP: 110-112 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-1-methyl-3-(2-(phenylsulfonyl)-1-(*p*-tolyl)vinyl)benzene (3k)



Purification by column chromatography (silica gel, PE : EA = 15 : 1, 5 × 20 cm) and recrystallization afforded the product as white solid; Yield: 32% (three steps); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.61 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.51-7.47 (m, 1H), 7.37-7.33 (m, 2H), 7.18 (d, *J* = 4.8 Hz, 2H), 7.09 (d, *J* = 7.8 Hz, 2H), 7.03 (s, 1H), 7.00-6.96 (m, 3H), 6.94 (s, 1H), 2.39 (s, 3H), 2.30 (s, 3H). MP: 127-129 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

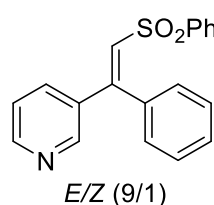
(Z)-1-fluoro-3-(2-(phenylsulfonyl)-1-(*m*-tolyl)vinyl)benzene (3l)



Purification by column chromatography (silica gel, PE:EA = 10:1, 5 × 20 cm) and recrystallization afforded the product as white solid; 0.81 g, yield: 27% (three steps); ¹H NMR (600

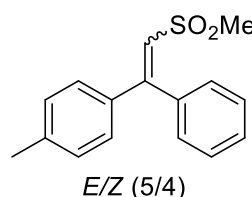
MHz, Chloroform-*d*) δ 7.66-7.61 (m, 2H), 7.55-7.51 (m, 1H), 7.39 (t, $J = 6.3$ Hz, 2H), 7.32-7.27 (m, 1H), 7.24-7.18 (m, 2H), 7.09-7.02 (m, 3H), 7.00-6.92 (m, 2H), 6.76-6.65 (m, 1H), 2.31 (s, 3H). MP: 77-79 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

(E)-3-(1-phenyl-2-(phenylsulfonyl)vinyl)pyridine (**3m**)



Purification by column chromatography (silica gel, PE:EA = 1:1, 5 \times 20 cm) afforded the product as white solid; 1.81 g, yield: 56%; ¹H NMR (600 MHz, Chloroform-*d*) δ 8.85 (dd, $J = 4.9, 1.8$ Hz, 1H), 8.49 (d, $J = 2.2$ Hz, 1H), 7.87-7.85 (m, 2H), 7.78-7.74 (m, 2H), 7.66-7.60 (m, 3H), 7.57-7.50 (m, 3H), 7.42-7.40 (m, 2H), 7.31 (s, 1H). ¹³C NMR (151 MHz, Chloroform-*d*) δ 151.5, 150.1, 149.6, 141.4, 138.4, 137.4, 133.5, 130.9, 130.1, 129.2, 129.0, 128.2, 127.6, 122.9. MP: 90-92 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₁₉H₁₆NO₂S ([M+H]⁺): 322.0896, found 322.0902.

1-Methyl-4-(2-(methylsulfonyl)-1-phenylvinyl)benzene (**3n**)



Purification by column chromatography (silica gel, PE:EA = 5:1, 5 \times 20 cm) afforded the product as white solid; 0.65 g, yield: 79%; ¹H NMR (600 MHz, Chloroform-*d*) δ 7.46-7.44 (m, 2H), 7.38-7.36 (m, 2H), 7.29-7.28 (m, 2H), 7.26-7.25 (m, 1H), 7.17 (s, 2H), 6.84 (s, 1H), 2.66 (s, 3H), 2.37 (s, 3H). MP: 104-106 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.⁶

4. General procedure for asymmetric hydrogenation of **1** and **3**.

A stock solution was made by mixing 1.0 mol % Ni(OAc)₂·H₂O with 1.1 mol % (*S,S*)-Ph-BPE in solvent (CF₃CH₂OH) at room temperature for 12 hours in a nitrogen-filled glovebox. An aliquot of the catalyst solution (1.0 mL, 0.00125 mmol) was transferred by syringe into the vials charged with different substrates (0.125 mmol for each) and added additive HOAc. The vials were subsequently transferred into which hydrogen gas was charged. The reaction was then stirred under H₂ (50 atm) at 80 °C for 24 h. The hydrogen gas was released slowly and carefully. The solution was passed through a short column of silica gel to remove the metal complex. The conversion of products

were determined by GC or ^1H NMR analysis. The crude products were concentrated and purified by flash column chromatography and the ee values were determined by HPLC, SFC analysis on a chiral stationary phase.

Gram scale experiment: A stock solution was made by mixing 1 mol % $\text{Ni}(\text{OAc})_2 \cdot \text{H}_2\text{O}$ with 1.1 mol % (*S,S*)-Ph-BPE in solvent ($\text{CF}_3\text{CH}_2\text{OH}$) at room temperature for 24 hours in a nitrogen-filled glovebox. An aliquot of the catalyst solution (5.0 mL, 0.00125 mmol) was transferred by syringe into the vials charged with substrates (*E*)-**1a** (3.62 mmol, 1.0 g) and added additive HOAc. The vials were subsequently transferred into which hydrogen gas was charged. The reaction was then stirred under H_2 (50 atm) at 80 °C for 24 h. The hydrogen gas was released slowly and carefully. The solution was passed through a short column of silica gel to remove the metal complex. The solid was washed with CH_2Cl_2 , and filtered to give the product **2a** as a white solid (0.96 g, 95% yield) with 94% ee determined by SFC with a chiral column.

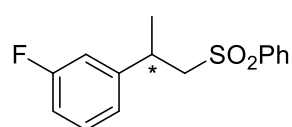
A stock solution was made by mixing 1 mol % $\text{Ni}(\text{OAc})_2 \cdot \text{H}_2\text{O}$ with 1.1 mol % (*R,R*)-Ph-BPE in solvent ($\text{CF}_3\text{CH}_2\text{OH}$) at room temperature for 24 hours in a nitrogen-filled glovebox. An aliquot of the catalyst solution (0.003 mmol) was transferred by syringe into the vials charged with substrates (*E*)-**1p** (3 mmol, 0.93 g) and added additive HOAc. The vials were subsequently transferred into which hydrogen gas was charged. The reaction was then stirred under H_2 (80 atm) at 80 °C for 4 d. The hydrogen gas was released slowly and carefully. The solution was passed through a short column of silica gel to remove the metal complex. The solid was washed with CH_2Cl_2 , and filtered to give the product **2p** as a white solid (0.88 g, 94% yield) with 97% ee determined by SFC with a chiral column.

A stock solution was made by mixing 1 mol % $\text{Ni}(\text{OAc})_2 \cdot \text{H}_2\text{O}$ with 1.1 mol % (*R,R*)-Ph-BPE in solvent ($\text{CF}_3\text{CH}_2\text{OH}$) at room temperature for 24 hours in a nitrogen-filled glovebox. An aliquot of the catalyst solution (0.003 mmol) was transferred by syringe into the vials charged with substrates (*E*)-**3h** (3 mmol, 1.05 g) and added additive HOAc. The vials were subsequently transferred into which hydrogen gas was

charged. The reaction was then stirred under H₂ (80 atm) at 80 °C for 4 d. The hydrogen gas was released slowly and carefully. The solution was passed through a short column of silica gel to remove the metal complex. The solid was washed with CH₂Cl₂, and filtered to give the product **4h** as a white solid (0.66 g, 63% yield) with 99% ee determined by SFC with a chiral column.

5. NMR, GC or HPLC, optical rotation and HRMS Data of compound **2** and **4**.

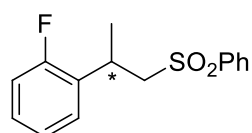
1-Fluoro-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2a**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 33.3 mg, yield: 96%; 94 ee; $[\alpha]_D^{20} = +9.1$ (c = 1.0, CH₂Cl₂); SFC

conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 4.0$ min (minor), 4.8 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.81-7.77 (m, 2H), 7.60-7.56 (m, 1H), 7.50-7.46 (m, 2H), 7.19-7.15 (m, 1H), 6.87-6.81 (m, 2H), 6.76-6.72 (m, 1H), 3.43-3.37 (m, 2H), 3.34-3.29 (m, 1H), 1.42 (d, $J = 6.9$ Hz, 3H). MP: 71-73 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

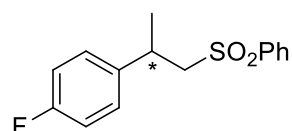
1-Fluoro-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2b**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 33.7 mg, yield: 97%; 98% ee; $[\alpha]_D^{20} = +21.1$ (c = 1.0, CH₂Cl₂); SFC conditions (Lux

5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 2.5$ min (minor), 2.7 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.79 (dd, $J = 8.3, 1.1$ Hz, 2H), 7.59-7.55 (m, 1H), 7.46 (d, $J = 7.8$ Hz, 2H), 7.14-7.10 (m, 2H), 7.03-6.99 (m, 1H), 6.88-6.83 (m, 1H), 3.60-3.54 (m, 2H), 3.41-3.35 (m, 1H), 1.45 (d, $J = 6.9$ Hz, 3H). MP: 47-49 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

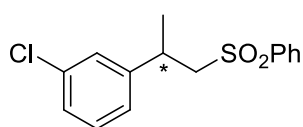
1-Fluoro-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2c**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 33.7 mg,

yield: 97%; 96% ee; $[\alpha]_{\text{D}}^{20} = +4.5$ ($c = 1.7$, CH_2Cl_2); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, $\text{MeOH}/\text{CO}_2 = 20/80$, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 4.3$ min (major), 5.0 min (minor); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.80-7.75 (m, 2H), 7.61-7.57 (m, 1H), 7.50-7.45 (m, 2H), 7.06-7.01 (m, 2H), 6.92-6.86 (m, 2H), 3.44-3.30 (m, 3H), 1.41 (d, $J = 6.8$ Hz, 3H). MP: 59-61 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

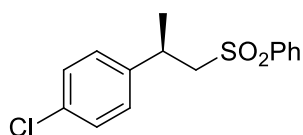
1-Chloro-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2d**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as light yellow liquid; 36.0 mg, yield: 98%; 96% ee; $[\alpha]_{\text{D}}^{20} = +10.8$ ($c = 1.0$, CH_2Cl_2);

SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, $\text{MeOH}/\text{CO}_2 = 20/80$, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 2.9$ min (minor), 3.5 min (major); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.78 (dd, $J = 8.3, 1.1$ Hz, 2H), 7.61-7.56 (m, 1H), 7.47 (t, $J = 7.7$ Hz, 2H), 7.15-7.10 (m, 2H), 7.02-6.96 (m, 2H), 3.43-3.38 (m, 2H), 3.36-3.29 (m, 1H), 1.42 (d, $J = 6.6$ Hz, 3H). The analytical data are consistent with the literature.¹

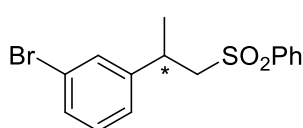
(*R*)-1-chloro-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2e**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 35.3 mg, yield: 96%; 92% ee; $[\alpha]_{\text{D}}^{20} = +6.3$ ($c = 1.0$, CHCl_3); SFC

conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, $\text{MeOH}/\text{CO}_2 = 20/80$, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 4.3$ min (major), 5.0 min (minor); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.80-7.74 (m, 2H), 7.62-7.57 (m, 1H), 7.50-7.44 (m, 2H), 7.19-7.14 (m, 2H), 7.03-6.97 (m, 2H), 3.43-3.31 (m, 3H), 1.41 (d, $J = 6.7$ Hz, 3H). MP: 63-65 °C (from ethyl acetate-hexane). The absolute configuration of (*R*)-**2e** was determined by comparison with optical rotation data for the reported literature.³

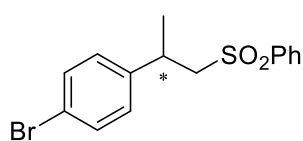
1-Bromo-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2f**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as light yellow liquid; 41.0 mg, yield: 97%; 95% ee; $[\alpha]_{\text{D}}^{20} = +2.3$ ($c = 1.0$, CH_2Cl_2);

SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $l = 210$ nm) $t_R = 6.1$ min (minor), 7.7 min (major); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.80-7.74 (m, 2H), 7.61-7.56 (m, 1H), 7.47 (d, $J = 15.5$ Hz, 2H), 7.29-7.25 (m, 1H), 7.16 (t, $J = 1.8$ Hz, 1H), 7.08 (t, $J = 7.8$ Hz, 1H), 7.04-6.99 (m, 1H), 3.44-3.36 (m, 2H), 3.36-3.30 (m, 1H), 1.41 (d, $J = 6.6$ Hz, 3H). The analytical data are consistent with the literature.¹

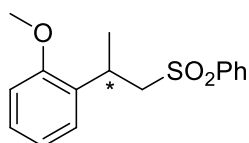
1-Bromo-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2g**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 41.0 mg, yield: 97%; 92% ee; $[\alpha]_D^{20} = +12.3$ ($c = 1.0$, CH₂Cl₂); SFC

conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $l = 210$ nm) $t_R = 5.5$ min (major), 6.7 min (minor); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.79-7.74 (m, 2H), 7.62-7.58 (m, 1H), 7.47 (t, $J = 7.9$ Hz, 2H), 7.31 (dd, $J = 8.7, 2.0$ Hz, 2H), 6.94 (d, $J = 8.4$ Hz, 2H), 3.41-3.37 (m, 2H), 3.32 (dd, $J = 15.8, 9.1$ Hz, 1H), 1.40 (d, $J = 6.7$ Hz, 3H). ¹³C NMR (100 MHz, Chloroform-*d*) $\delta = 142.7, 139.7, 133.4, 131.7, 129.1, 128.5, 127.7, 120.6, 63.1, 34.6, 22.2$; MP: 85-87 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₁₅H₁₆O₂BrS ([M+H]⁺): 339.0048, found 339.0053.

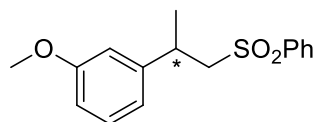
1-Methoxy-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2h**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 34.8 mg, yield: 96%; 94% ee; $[\alpha]_D^{20} = +8.5$ ($c = 1.0$, CH₂Cl₂); SFC conditions (Lux 5u

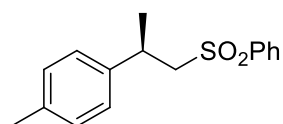
Cellulose-4, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $l = 210$ nm) $t_R = 4.4$ min (major), 5.0 min (minor); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.78 (dd, $J = 8.3, 1.2$ Hz, 2H), 7.59-7.54 (m, 1H), 7.48-7.44 (m, 2H), 6.86-6.82 (m, 1H), 7.06 (dd, $J = 7.5, 1.6$ Hz, 1H), 6.86-6.82 (m, 1H), 6.66 (d, $J = 8.2$ Hz, 1H), 3.64-3.57 (m, 5H), 3.31 (dd, $J = 14.1, 7.6$ Hz, 1H), 1.43 (d, $J = 7.0$ Hz, 3H). MP: 50-52 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Methoxy-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2i**)



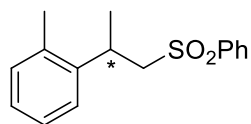
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as light yellow liquid; 34.0 mg, yield: 94%; 96% ee; $[\alpha]_{\text{D}}^{20} = + 11.2$ ($c = 1.1$, CH_2Cl_2); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/ $\text{CO}_2 = 20/80$, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 4.3$ min (major), 4.7 min (minor); $^1\text{H NMR}$ (600 MHz, Chloroform-*d*) δ 7.83-7.77 (m, 2H), 7.61-7.55 (m, 1H), 7.48 (t, $J = 7.8$ Hz, 2H), 7.13 (t, $J = 7.9$ Hz, 1H), 6.70-6.65 (m, 2H), 6.60-6.57 (m, 1H), 3.74 (s, 3H), 3.43-3.36 (m, 2H), 3.35-3.31 (m, 1H), 1.43 (d, $J = 6.7$ Hz, 3H). The analytical data are consistent with the literature.¹

(R)-1-methyl-4-(1-(phenylsulfonyl)propan-2-yl)benzene (2j)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 33.6 mg, yield: 98%; 97% ee; $[\alpha]_{\text{D}}^{20} = + 10.3$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/ $\text{CO}_2 = 10/90$, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 6.4$ min (major), 7.4 min (minor); $^1\text{H NMR}$ (600 MHz, Chloroform-*d*) δ 7.83-7.77 (m, 2H), 7.61-7.56 (m, 1H), 7.47 (t, $J = 7.8$ Hz, 2H), 7.02 (d, $J = 7.9$ Hz, 2H), 6.96 (d, $J = 8.0$ Hz, 2H), 3.42-3.31 (m, 3H), 2.28 (s, 3H), 1.42 (d, $J = 6.8$ Hz, 3H). MP: 59-61 °C (from ethyl acetate-hexane). The absolute configuration of (*R*)-**2j** was determined by comparison with optical rotation data for the reported literature.⁷

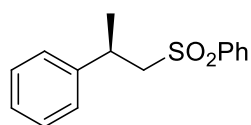
1-Methyl-2-(1-(phenylsulfonyl)propan-2-yl)benzene (2k)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as light yellow liquid; 33.2 mg, yield: 97%; 93% ee; $[\alpha]_{\text{D}}^{20} = - 4.2$ ($c = 1.0$, CH_2Cl_2); SFC conditions (Lux 5u Cellulose-4, column temperature: 37.0 °C, MeOH/ $\text{CO}_2 = 20/80$, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 3.8$ min (major), 4.5 min (minor); $^1\text{H NMR}$ (600 MHz, Chloroform-*d*) δ 7.81 (d, $J = 8.2$ Hz, 2H), 7.61-7.56 (m, 1H), 7.48 (t, $J = 7.6$ Hz, 2H), 7.09-7.03 (m, 3H), 7.00 (q, $J = 4.9, 4.2$ Hz, 1H), 3.70-3.64 (m, 1H) 3.39-3.31 (m, 2H), 2.24 (s, 3H), 1.43 (d, $J = 6.9$ Hz, 3H). The analytical data are consistent with the

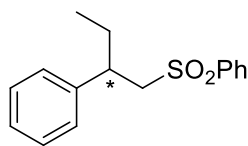
literature.¹

(R)-((2-phenylpropyl)sulfonyl)benzene (2l)



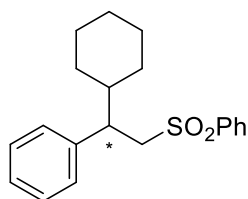
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 31.5 mg, yield: 97%; 99.9% ee; $[\alpha]_D^{20} = +6.2$ ($c = 1.7$, CHCl_3); SFC conditions (Lux 5u Cellulose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 2.4$ min (major), 2.5 min (minor); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.81 (d, $J = 7.6$ Hz, 2H), 7.60-7.55 (m, 1H), 7.47 (t, $J = 7.8$ Hz, 2H), 7.24-7.19 (m, 2H), 7.18-7.13 (m, 1H), 7.10-7.03 (m, 2H), 3.45-3.32 (m, 3H), 1.45 (d, $J = 6.5$ Hz, 3H). MP: 83-85 °C (from ethyl acetate-hexane). The absolute configuration of (*R*)-**2l** was determined by comparison with optical rotation data for the reported literature.³

((2-Phenylbutyl)sulfonyl)benzene (2m)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as light yellow solid; 32.8 mg, yield: 96%; 91% ee; $[\alpha]_D^{20} = +6.9$ ($c = 1.0$, CH_2Cl_2); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 2.9$ min (major), 3.1 min (minor); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.72 (d, $J = 8.3$ Hz, 2H), 7.53 (t, $J = 7.5$ Hz, 1H), 7.41 (t, $J = 7.8$ Hz, 2H), 7.23-7.11 (m, 3H), 7.00 (d, $J = 7.0$ Hz, 2H), 3.44 (dd, $J = 6.6, 3.3$ Hz, 2H), 3.24-3.07 (m, 1H), 2.06-1.87 (m, 1H), 1.70-1.61 (m, 1H), 0.75 (t, $J = 7.3$ Hz, 3H). MP: 60-62 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

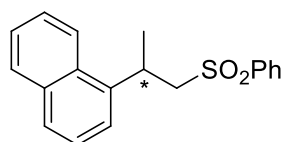
(1-Cyclohexyl-2-(phenylsulfonyl)ethyl)benzene (2n)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 40.2 mg, yield: 98%; 99% ee; $[\alpha]_D^{20} = -4.7$ ($c = 1.0$, CH_2Cl_2); SFC conditions (Lux 5u Cellulose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 3.0$ min (minor), 3.3 min (major); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.64-7.57 (m, 2H), 7.50-7.43 (m, 1H), 7.36-7.30 (m, 2H),

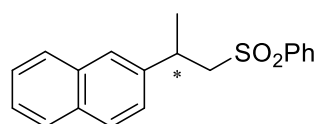
7.12-7.05 (m, 3H), 6.93-6.85 (m, 2H), 3.62-3.52 (m, 2H), 3.08-2.99 (m, 1H), 1.84-1.65 (m, 2H), 1.61-1.38 (m, 4H), 1.21-1.12 (m, 1H), 1.11-0.97 (m, 2H), 0.88-0.72 (m, 2H). ¹³C NMR (150 MHz, Chloroform-*d*) δ 140.2, 139.9, 133.1, 128.9, 128.6, 128.1, 127.9, 126.7, 59.7, 46.6, 43.2, 31.1, 29.9, 26.3, 26.3, 26.2. MP: 85-87 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₂₀H₂₅O₂S ([M+H]⁺): 329.1570, found 329.1576.

1-(1-(Phenylsulfonyl)propan-2-yl)naphthalene (**2o**)



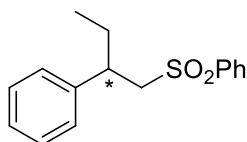
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 37.5 mg, yield: 97%; 89% ee; [α]_D²⁰ = - 95.7 (c = 1.0, CH₂Cl₂); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, l = 210 nm) t_R = 4.3 min (minor), 4.9 min (major); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.96-7.91 (m, 1H), 7.83 (t, *J* = 5.9 Hz, 3H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.57 (t, *J* = 7.4 Hz, 1H), 7.51-7.43 (m, 4H), 7.35 (t, *J* = 7.6 Hz, 1H), 7.29 (d, *J* = 7.1 Hz, 1H), 4.38-4.25 (m, 1H), 3.57-3.48 (m, 1H), 3.41-3.32 (m, 1H), 1.67 (d, *J* = 6.9 Hz, 3H). MP: 49-51 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

2-(1-(Phenylsulfonyl)propan-2-yl)naphthalene (**2p**)



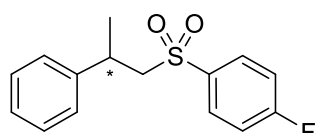
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 37.9 mg, yield: 97%; 97% ee; [α]_D²⁰ = + 9.8 (c = 1.0, CHCl₃); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, l = 210 nm) t_R = 5.4 min (minor), 5.7 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.79-7.74 (m, 3H), 7.73-7.67 (m, 2H), 7.53-7.50 (m, 1H), 7.49-7.42 (m, 3H), 7.39-7.34 (m, 2H), 7.20-7.15 (m, 1H), 3.63-3.56 (m, 1H), 3.55-3.41 (m, 2H), 1.53 (d, *J* = 6.9 Hz, 3H). MP: 59-61 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.³

((2-Phenylbutyl)sulfonyl)benzene (**2q**)



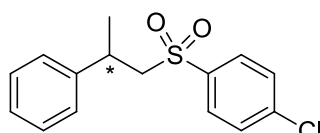
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as light yellow solid; 32.9 mg, yield: 96%; 99% ee; $[\alpha]_{\text{D}}^{20} = -7.3$ ($c = 1.7$, CH_2Cl_2); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 2.9$ min (minor), 3.0 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.72 (d, $J = 8.3$ Hz, 2H), 7.53 (t, $J = 7.5$ Hz, 1H), 7.41 (t, $J = 7.8$ Hz, 2H), 7.23- 7.11 (m, 3H), 7.00 (d, $J = 7.0$ Hz, 2H), 3.44 (dd, $J = 6.6, 3.3$ Hz, 2H), 3.24-3.07 (m, 1H), 2.06-1.87 (m, 1H), 1.70-1.61 (m, 1H), 0.75 (t, $J = 7.3$ Hz, 3H). MP: 60-62 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Fluoro-4-((2-phenylpropyl)sulfonyl)benzene (**2r**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 31.6 mg, yield: 91%; 94% ee; $[\alpha]_{\text{D}}^{20} = +9.5$ ($c = 1.0$, CH_2Cl_2); SFC conditions (Lux 5u Cellulose-4, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 4.4$ min (major), 4.7 min (minor); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.79-7.74 (m, 2H), 7.23-7.19 (m, 2H), 7.18-7.15 (m, 1H), 7.13-7.08 (m, 2H), 7.07-7.03 (m, 2H), 3.45-3.39 (m, 2H), 3.38-3.33 (m, 1H), 1.43 (d, $J = 6.8$ Hz, 3H). ¹³C NMR (100 MHz, Chloroform-*d*) $\delta = 165.5$ (d, $J = 254.0$ Hz), 143.6, 135.9, 130.7, 130.6, 128.7, 126.8, 116.3, 63.4, 35.2, 22.4; MP: 62-64 °C (from ethyl acetate-hexane); TOF-HRMS Calculated for C₁₅H₁₆FO₂S ($[\text{M}+\text{H}]^+$): 279.0849, found 279.0845.

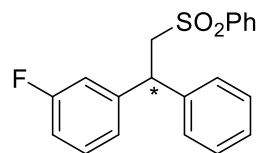
1-Chloro-4-((2-phenylpropyl)sulfonyl)benzene (**2s**)



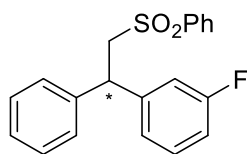
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 36.0 mg, yield: 98%; 98% ee; $[\alpha]_{\text{D}}^{20} = +16.2$ ($c = 1.3$, CH_2Cl_2); SFC conditions (Lux 5u Cellulose-4, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 5.4$ min (minor), 5.8 min (major); ¹H NMR (400 MHz, Chloroform-*d*) $\delta = 7.67$ (d, $J = 8.6$ Hz, 2H), 7.40 (d, $J = 8.5$ Hz, 2H), 7.22-

7.16 (m, 3H), 7.05 (d, $J = 6.8$ Hz, 2H), 3.46-3.32 (m, 3H), 1.43 (d, $J = 6.5$ Hz, 3H); MP: 86-90 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.⁸

1-Fluoro-3-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4a**)

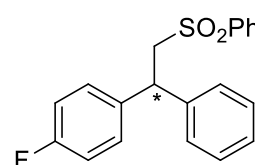


E-olefin: Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 41.7 mg, yield: 98%; 98% ee; $[\alpha]_{\text{D}}^{20} = -6.3$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 6.2$ min (minor), 6.5 min (major); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.66 (dd, $J = 8.4, 1.1$ Hz, 2H), 7.54-7.47 (m, 1H), 7.40-7.33 (m, 2H), 7.23-7.10 (m, 6H), 6.95 (d, $J = 7.7$ Hz, 1H), 6.87-6.77 (m, 2H), 4.63 (t, $J = 7.1$ Hz, 1H), 3.89 (dd, $J = 7.1, 1.4$ Hz, 2H). MP: 159-161 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹



Z-olefin: Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 41.2 mg, yield: 97%; 90% ee; $[\alpha]_{\text{D}}^{20} = +5.3$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 6.3$ min (major), 6.7 min (minor); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.66 (dd, $J = 8.4, 1.1$ Hz, 2H), 7.54-7.47 (m, 1H), 7.40-7.33 (m, 2H), 7.23-7.10 (m, 6H), 6.95 (d, $J = 7.7$ Hz, 1H), 6.87-6.77 (m, 2H), 4.63 (t, $J = 7.1$ Hz, 1H), 3.89 (dd, $J = 7.1, 1.4$ Hz, 2H). MP: 159-161 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

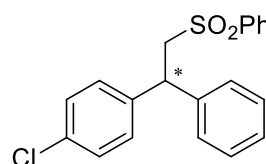
1-Fluoro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4b**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 41.2 mg, yield: 97%; 99% ee; $[\alpha]_{\text{D}}^{20} = -2.7$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 10/90, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_{\text{R}} = 6.5$ min (minor), 7.6 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.63 (d, $J = 7.1$ Hz, 2H), 7.55-7.46 (m, 2H), 7.41-7.32 (m, 2H), 7.25 (s, 1H), 7.21-

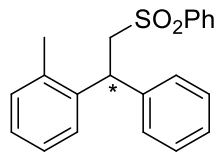
7.05 (m, 6H), 6.87 (d, $J = 8.1$ Hz, 2H), 4.74-4.59 (m, 1H), 3.99-3.82 (m, 2H). MP: 159-161 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Chloro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4c**)



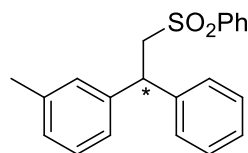
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 43.6 mg, yield: 98%; 95% ee; $[\alpha]_{\text{D}}^{20} = -5.9$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 3.2$ min (minor), 3.4 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.64 (d, $J = 7.5$ Hz, 2H), 7.52 (t, $J = 7.5$ Hz, 1H), 7.39-7.35 (m, 2H), 7.22-7.13 (m, 6H), 7.10 (d, $J = 7.2$ Hz, 2H), 7.06 (s, 1H), 4.62 (t, $J = 7.1$ Hz, 1H), 3.92-3.84 (m, 2H). MP: 91-93 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Methyl-2-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4d**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 39.9 mg, yield: 95%; 90% ee; $[\alpha]_{\text{D}}^{20} = -15.8$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 2.5$ min (major), 2.9 min (minor); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.65 (d, $J = 7.4$ Hz, 2H), 7.49 (t, $J = 7.4$ Hz, 1H), 7.35 (t, $J = 7.8$ Hz, 2H), 7.21-7.18 (m, 2H), 7.14 (d, $J = 7.2$ Hz, 3H), 7.10-6.97 (m, 4H), 4.96-4.86 (m, 1H), 3.88 (d, $J = 8.8$ Hz, 2H), 2.32 (s, 3H). MP: 65-67 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

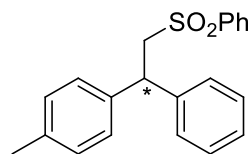
1-Methyl-3-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4e**)



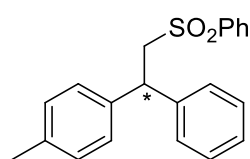
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 40.3 mg, yield: 96%; 95% ee; $[\alpha]_{\text{D}}^{20} = -1.6$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 2.6$ min (minor), 3.0 min (major); ¹H NMR (400 MHz, Chloroform-*d*)

δ 7.63 (d, $J = 7.4$ Hz, 2H), 7.48 (t, $J = 7.4$ Hz, 1H), 7.33 (t, $J = 7.7$ Hz, 2H), 7.20-7.11 (m, 5H), 7.06 (d, $J = 7.6$ Hz, 1H), 6.95-6.85 (m, 3H), 4.59 (t, $J = 7.0$ Hz, 1H), 3.91 (d, $J = 7.1$ Hz, 2H), 2.21 (s, 3H). MP: 91-93 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Methyl-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4f**)

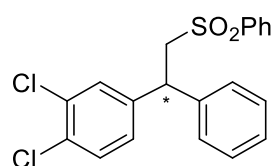


E-olefin: Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 39.9 mg, yield: 95%; 97% ee; $[\alpha]_D^{20} = -2.5$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 2.6$ min (minor), 2.9 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.64 (d, $J = 8.0$ Hz, 2H), 7.49 (t, $J = 7.4$ Hz, 1H), 7.36-7.32 (m, 2H), 7.19-7.16 (m, 2H), 7.14-7.10 (m, 3H), 7.03-6.98 (m, 4H), 4.59 (t, $J = 7.2$ Hz, 1H), 3.90 (d, $J = 7.2$ Hz, 2H), 2.25 (s, 3H). MP: 149-151 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹



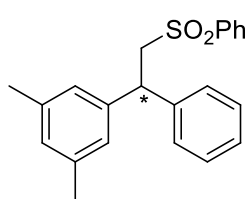
E/Z (4/5): Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 39.5 mg, yield: 94%; 8% ee; $[\alpha]_D^{20} = -5.2$ ($c = 1.0$, CH_2Cl_2); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 4.1$ min (minor), 5.1 min (major).

1,2-Dichloro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4g**)



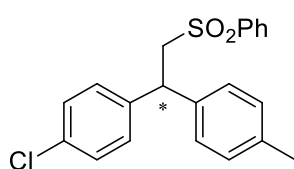
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 47.2 mg, yield: 97%; 91% ee; $[\alpha]_D^{20} = -6.4$ ($c = 1.1$, CHCl_3); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 4.6$ min (minor), 4.9 min (major); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.67-7.63 (m, 2H), 7.53 (t, $J = 7.4$ Hz, 1H), 7.45-7.33 (m, 3H), 7.24-7.18 (m, 3H), 7.15 (d, $J = 2.0$ Hz, 1H), 7.10 (d, $J = 7.0$ Hz, 2H), 7.00 (dd, $J = 8.3, 2.0$ Hz, 1H), 4.64-4.55 (m, 1H), 3.92-3.79 (m, 2H). MP: 99-101 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1,3-Dimethyl-5-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4h**)



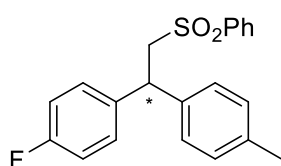
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 40.7 mg, yield: 93%; 99% ee; $[\alpha]_{\text{D}}^{20} = -5.0$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 2.1$ min (minor), 2.5 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.68-7.58 (m, 2H), 7.54-7.40 (m, 1H), 7.36-7.30 (m, 2H), 7.21-7.11 (m, 5H), 6.72 (d, $J = 22.4$ Hz, 3H), 4.54 (t, $J = 7.1$ Hz, 1H), 3.90 (d, $J = 7.2$ Hz, 2H), 2.18 (s, 6H). MP: 103-105 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Chloro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4i**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 42.6 mg, yield: 92%; 94% ee; $[\alpha]_{\text{D}}^{20} = +4.3$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 3.0$ min (major), 3.4 min (minor); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.66-7.61 (m, 2H), 7.56-7.50 (m, 1H), 7.36 (t, $J = 7.9$ Hz, 2H), 7.15-7.12 (m, 2H), 7.08-7.03 (m, 2H), 7.02-6.96 (m, 4H), 4.58 (t, $J = 7.2$ Hz, 1H), 3.91-3.83 (m, 2H), 2.26 (s, 3H). ¹³C NMR (100 MHz, Chloroform-*d*) δ 159.9, 139.2, 137.8, 136.7, 136.3, 132.7, 128.9, 128.7, 128.6, 128.4, 127.4, 126.8, 115.1, 114.9, 61.1, 44.5, 20.4. MP: 156-158 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for C₂₁H₂₀ClO₂S ($[\text{M}+\text{H}]^+$): 371.0867 found 371.0869.

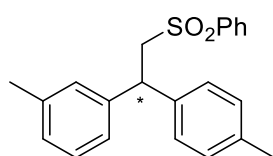
1-Fluoro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4j**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 42.0 mg, yield: 95%; 96% ee; $[\alpha]_{\text{D}}^{20} = +2.7$ ($c = 1.0$, CHCl_3); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $l = 210$ nm) $t_{\text{R}} = 5.4$ min (major), 5.9 min (minor); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.64 (d, $J = 9.0$ Hz, 2H), 7.52 (t, $J = 7.4$ Hz, 1H), 7.36 (t,

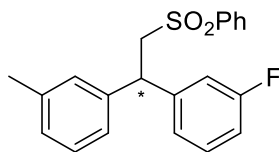
$J = 7.7$ Hz, 2H), 7.12-7.05 (m, 2H), 6.99 (d, $J = 8.9$ Hz, 4H), 6.86 (t, $J = 8.6$ Hz, 2H), 4.59 (t, $J = 7.1$ Hz, 1H), 3.89-3.78 (m, 2H), 2.26 (s, 3H). MP: 154-156 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Methyl-3-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4k**)



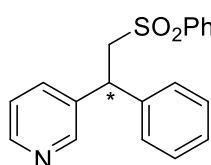
Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 41.5 mg, yield: 95%; 97% ee; $[\alpha]_D^{20} = +1.8$ (c = 1.0, CHCl₃); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 2.8$ min (major), 3.0 min (minor); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.62 (d, $J = 7.5$ Hz, 2H), 7.48 (t, $J = 7.4$ Hz, 1H), 7.33 (t, $J = 7.7$ Hz, 2H), 7.06 (t, $J = 7.6$ Hz, 1H), 7.03-6.97 (m, 4H), 6.92 (d, $J = 7.3$ Hz, 2H), 6.88 (s, 1H), 4.55 (t, $J = 7.1$ Hz, 1H), 3.89 (d, $J = 7.1$ Hz, 2H), 2.23 (d, $J = 26.0$ Hz, 6H). MP: 116-118 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

1-Fluoro-3-(2-(phenylsulfonyl)-1-(*m*-tolyl)ethyl)benzene (**4l**)



Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as white solid; 40.7 mg, yield: 92%; 96% ee; $[\alpha]_D^{20} = -2.2$ (c = 1.1, CHCl₃); SFC conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min, $\lambda = 210$ nm) $t_R = 2.2$ min (minor), 2.6 min (major); ¹H NMR (600 MHz, Chloroform-*d*) δ 7.71-7.62 (m, 2H), 7.56-7.48 (m, 1H), 7.41-7.33 (m, 2H), 7.20-7.14 (m, 1H), 7.09 (t, $J = 7.6$ Hz, 1H), 7.02-6.91 (m, 3H), 6.89 (d, $J = 20.2$ Hz, 1H), 6.87-6.76 (m, 2H), 4.59 (t, $J = 7.1$ Hz, 1H), 3.88 (dd, $J = 7.1, 1.8$ Hz, 2H), 2.23 (s, 3H). MP: 100-102 °C (from ethyl acetate-hexane). The analytical data are consistent with the literature.¹

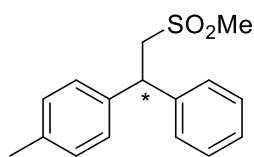
3-(1-Phenyl-2-(phenylsulfonyl)ethyl)pyridine (**4m**)



E/Z (9/1): Purification by flash column chromatography (silica gel, PE:EA = 1:2) afforded the product as white solid; 8.1 mg, yield: 20%; 78% ee; $[\alpha]_D^{20} = -0.6$ (c = 0.2, CH₂Cl₂); SFC conditions (Lux 5u Amylose-1, column temperature: 37.0 °C, MeOH/CO₂ = 30/70, flow rate = 3.0 mL/min,

$l = 210 \text{ nm}$) $t_R = 9.5 \text{ min}$ (minor), 12.1 min (major); $^1\text{H NMR}$ (600 MHz, Chloroform-*d*) δ 8.5 (s, 1H), 8.39 (d, $J = 4.0 \text{ Hz}$, 1H), 7.68-7.66 (m, 2H), 7.53-7.50 (m, 1H), 7.45 (dt, $J = 7.9, 2.0 \text{ Hz}$, 1H), 7.39-7.36 (m, 2H), 7.23-7.21 (m, 2H), 7.18-7.15 (m, 1H), 7.13-7.09 (m, 3H), 4.67-4.64 (m, 1H), 3.95-3.88 (m, 2H). $^{13}\text{C NMR}$ (151 MHz, Chloroform-*d*) δ 149.2, 148.3, 140.4, 139.4, 136.8, 134.9, 133.5, 129.1, 129.0, 127.9, 127.4, 123.4, 60.9, 43.8. MP: 109-110 °C (from ethyl acetate-hexane). TOF-HRMS Calculated for $\text{C}_{19}\text{H}_{18}\text{NO}_2\text{S}$ ($[\text{M}+\text{H}]^+$): 324.1053, found 324.1059.

1-Methyl-4-(2-(methylsulfonyl)-1-phenylethyl)benzene (**4n**)



E/Z (5/4): Purification by flash column chromatography (silica gel, PE:EA = 5:1) afforded the product as colorless oil; 32.6 mg, yield: 95%; 14% ee; $[\alpha]_{\text{D}}^{20} = + 2.1$ ($c = 1.0$, CH_2Cl_2); SFC

conditions (Lux 5u Cellulose-3, column temperature: 37.0 °C, MeOH/CO₂ = 20/80, flow rate = 3.0 mL/min, $l = 210 \text{ nm}$) $t_R = 3.1 \text{ min}$ (minor), 3.3 min (major); $^1\text{H NMR}$ (600 MHz, Chloroform-*d*) δ 7.35-7.33 (m, 1H), 7.33-7.30 (m, 3H), 7.26-7.23 (m, 1H), 7.22-7.21 (m, 2H), 7.15 (d, $J = 7.9 \text{ Hz}$, 2H), 4.64 (t, $J = 7.3 \text{ Hz}$, 1H), 3.80-3.73 (m, 2H), 2.32 (s, 3H), 2.31 (s, 3H). $^{13}\text{C NMR}$ (151 MHz, Chloroform-*d*) δ 141.9, 138.6, 137.2, 129.9, 129.2, 127.7, 127.7, 127.4, 61.0, 46.0, 42.1, 21.1. TOF-HRMS Calculated for $\text{C}_{16}\text{H}_{19}\text{O}_2\text{S}$ ($[\text{M}+\text{H}]^+$): 275.1100, found 275.1108.

6. References

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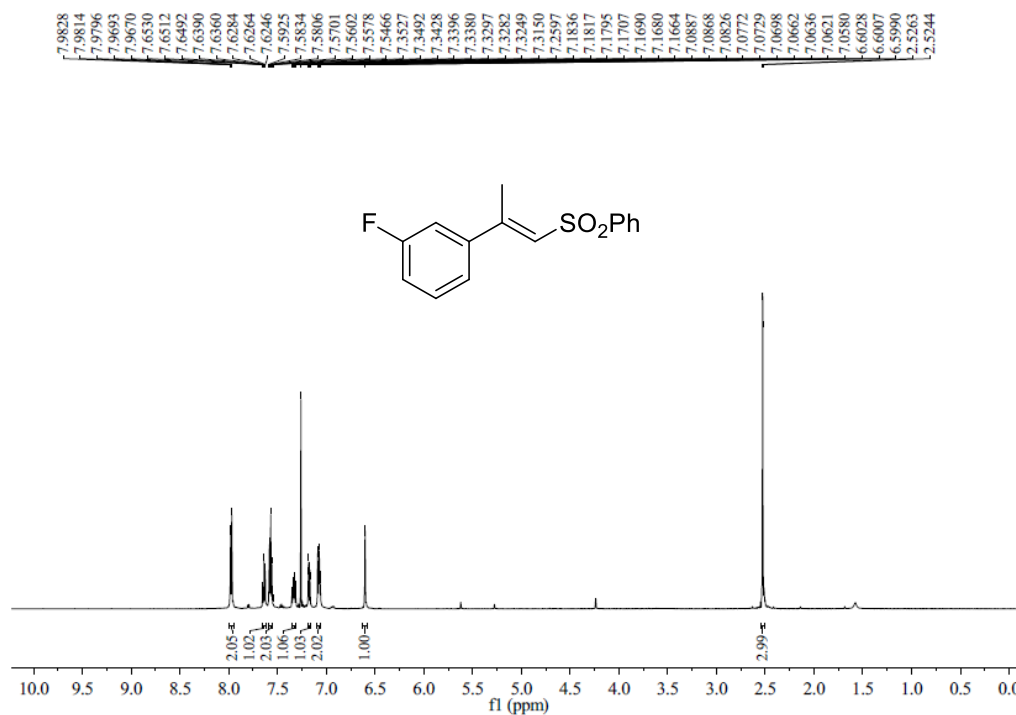
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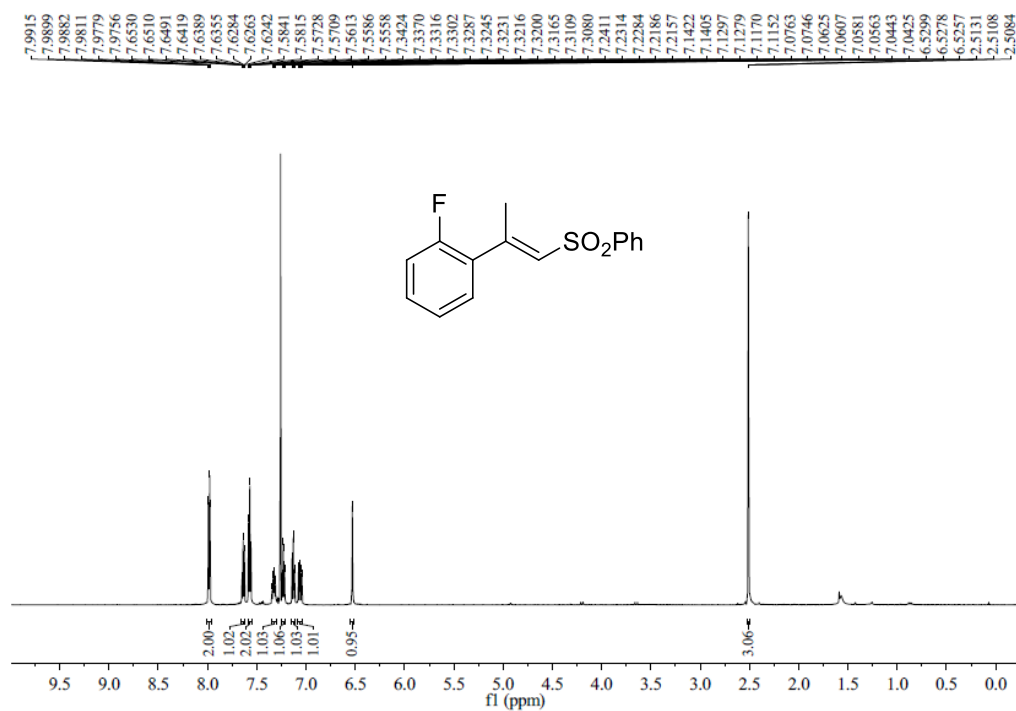
7. NMR, SFC and HPLC spectra

(*E*)-1-fluoro-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1a**)



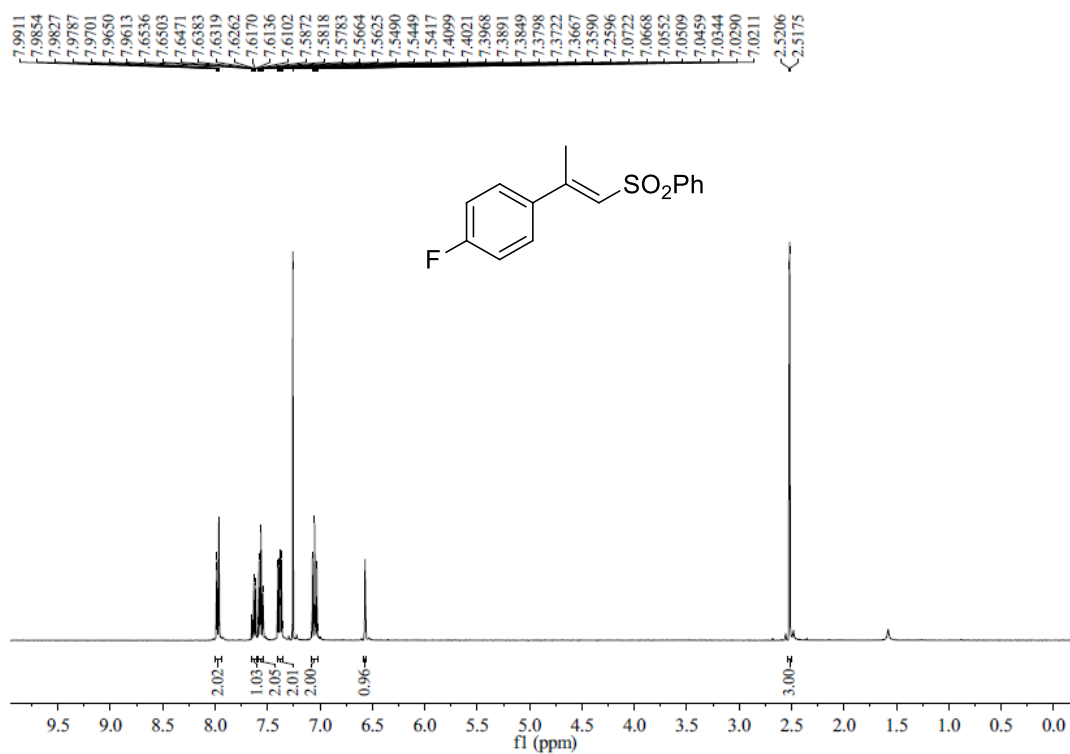
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1-fluoro-2-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1b**)



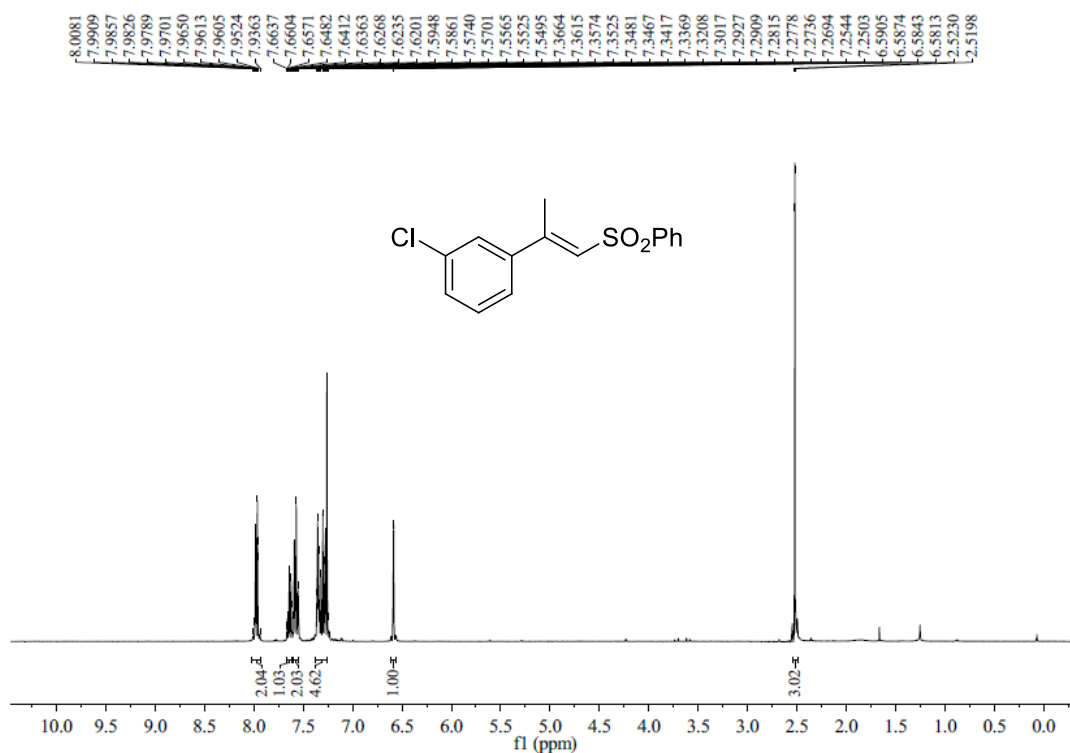
¹H NMR (600 MHz, Chloroform-*d*)

(E)-1-fluoro-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1c**)



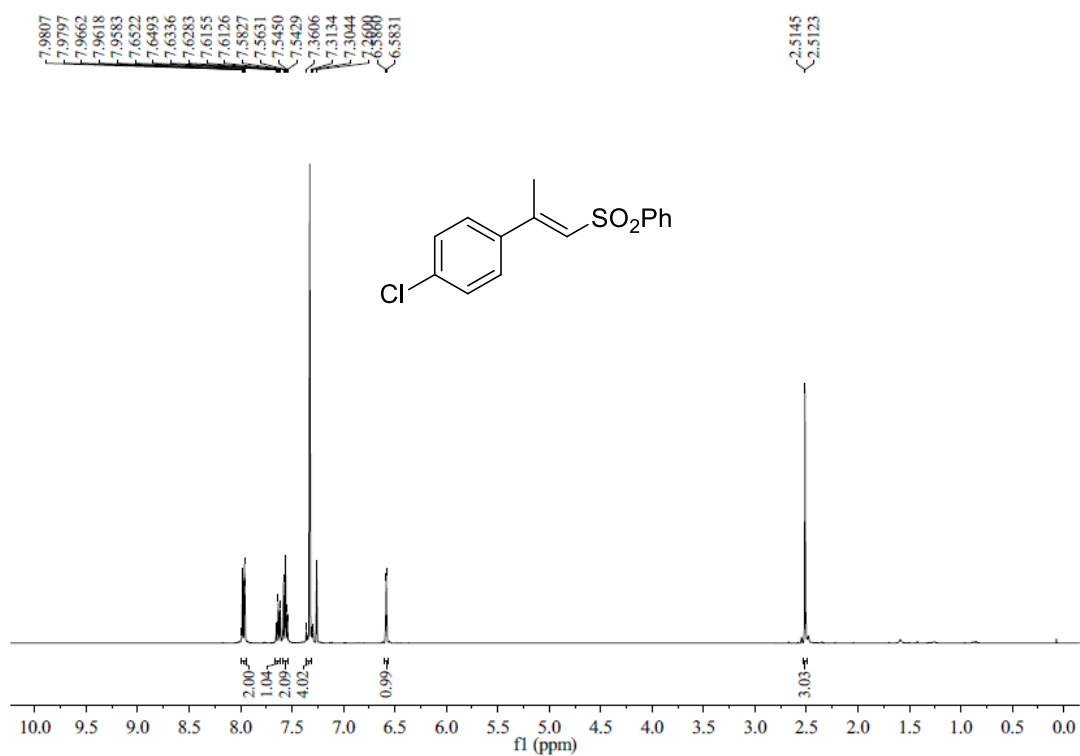
¹H NMR (400 MHz, Chloroform-*d*)

(E)-1-chloro-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1d**)



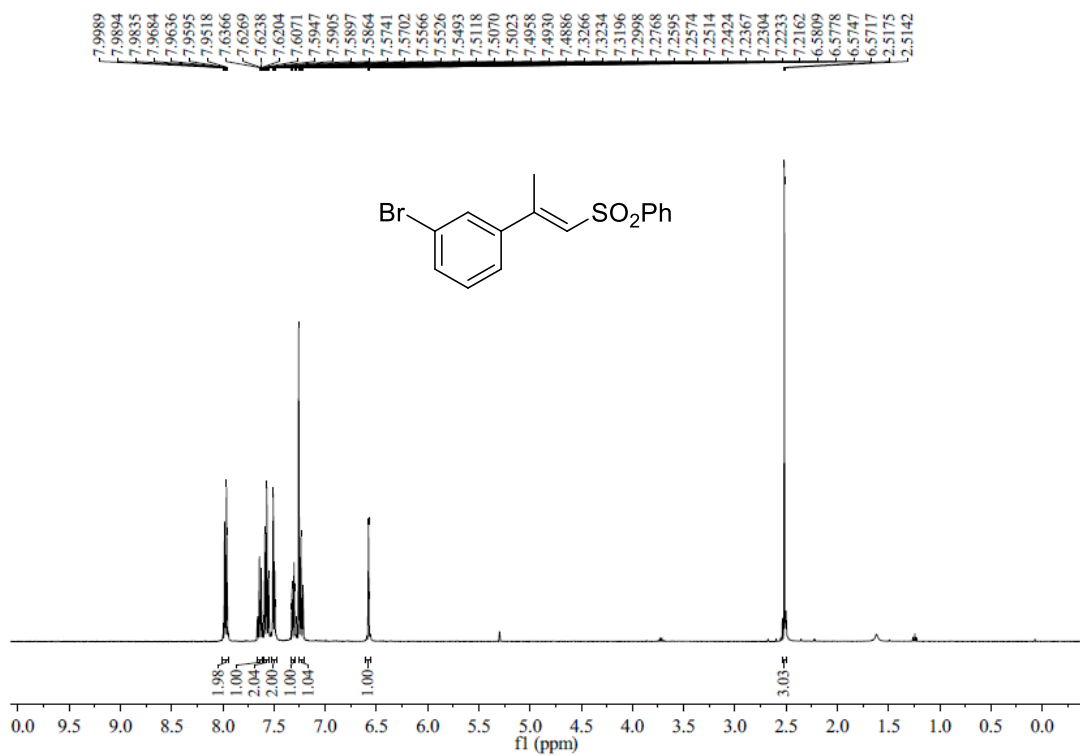
¹H NMR (400 MHz, Chloroform-*d*)

(E)-1-chloro-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1e**)



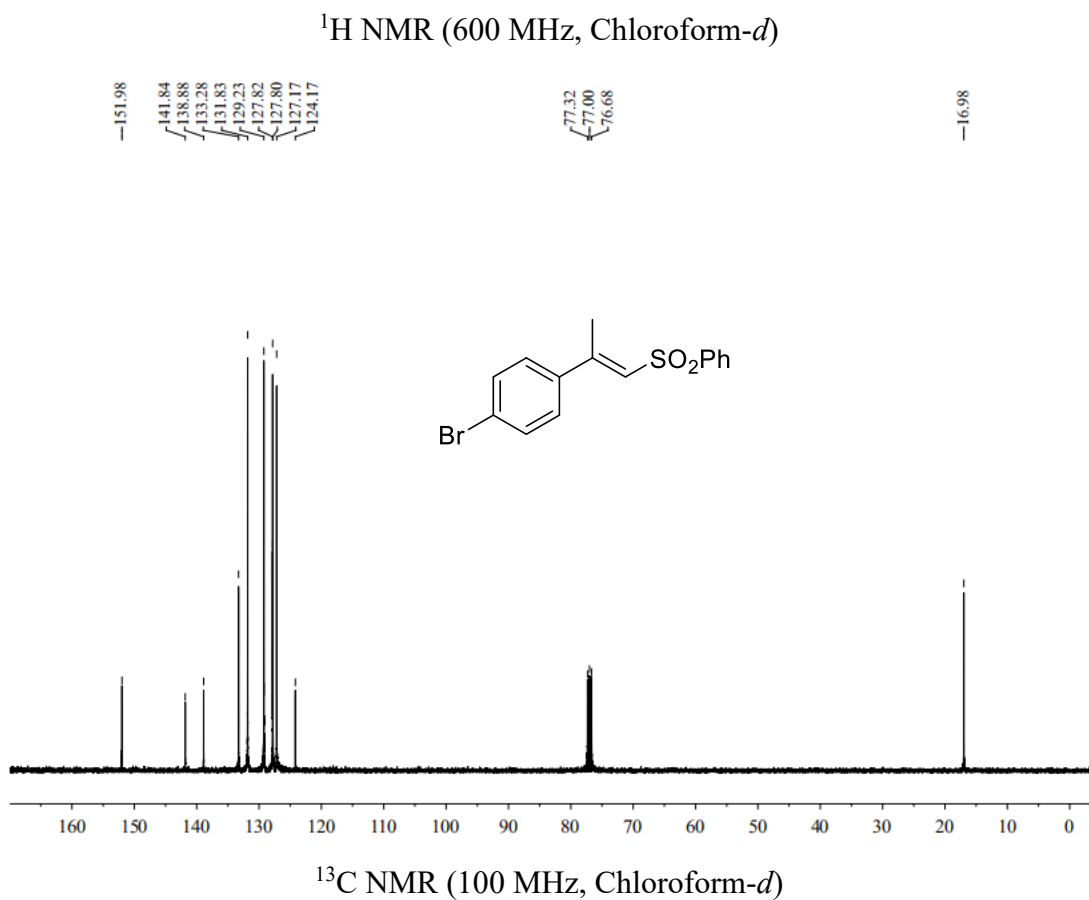
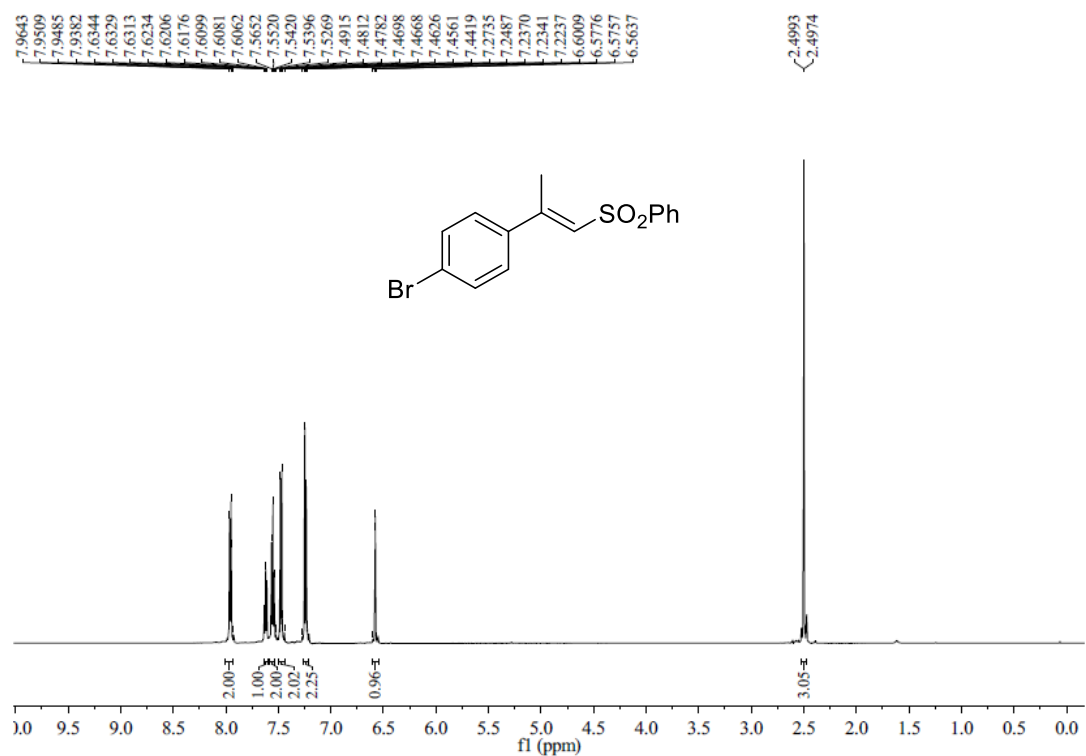
¹H NMR (400 MHz, Chloroform-*d*)

(E)-1-bromo-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1f**)

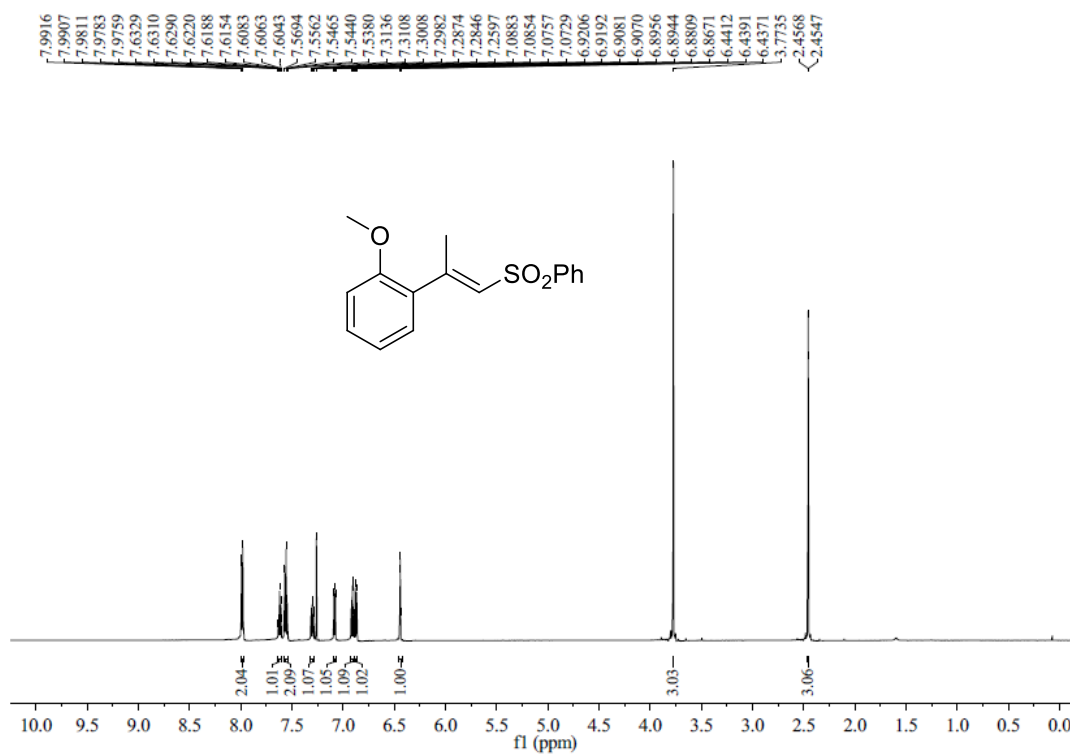


¹H NMR (400 MHz, Chloroform-*d*)

(*E*)-1-bromo-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1g**)

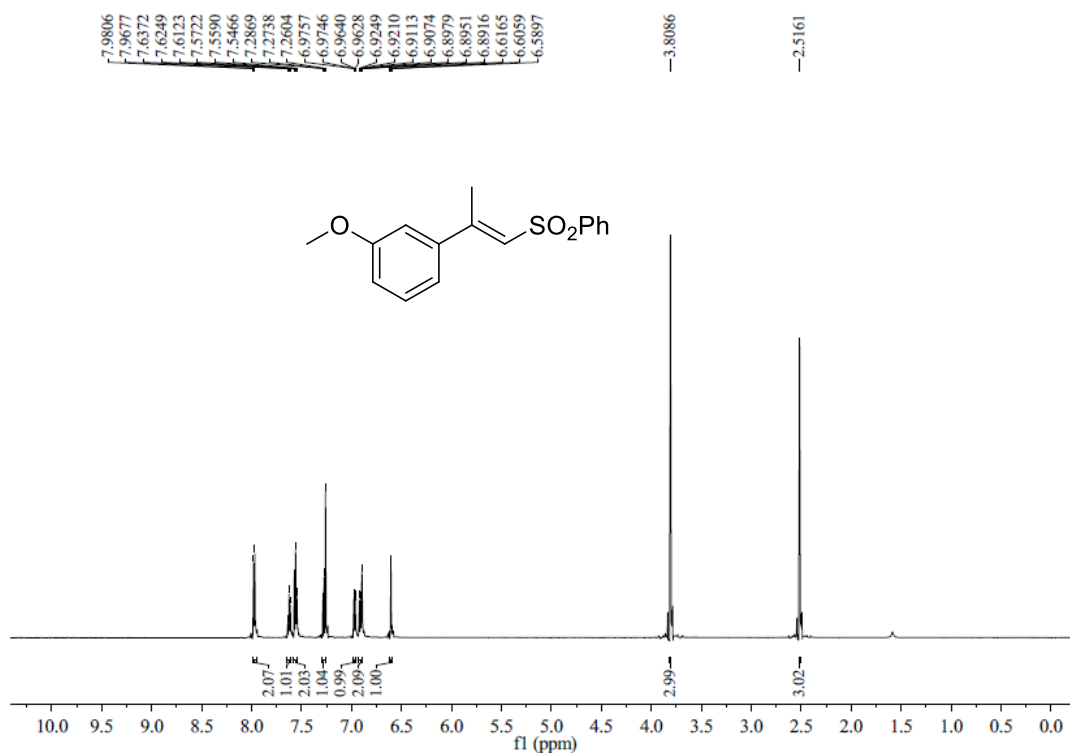


(E)-1-methoxy-2-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1h**)



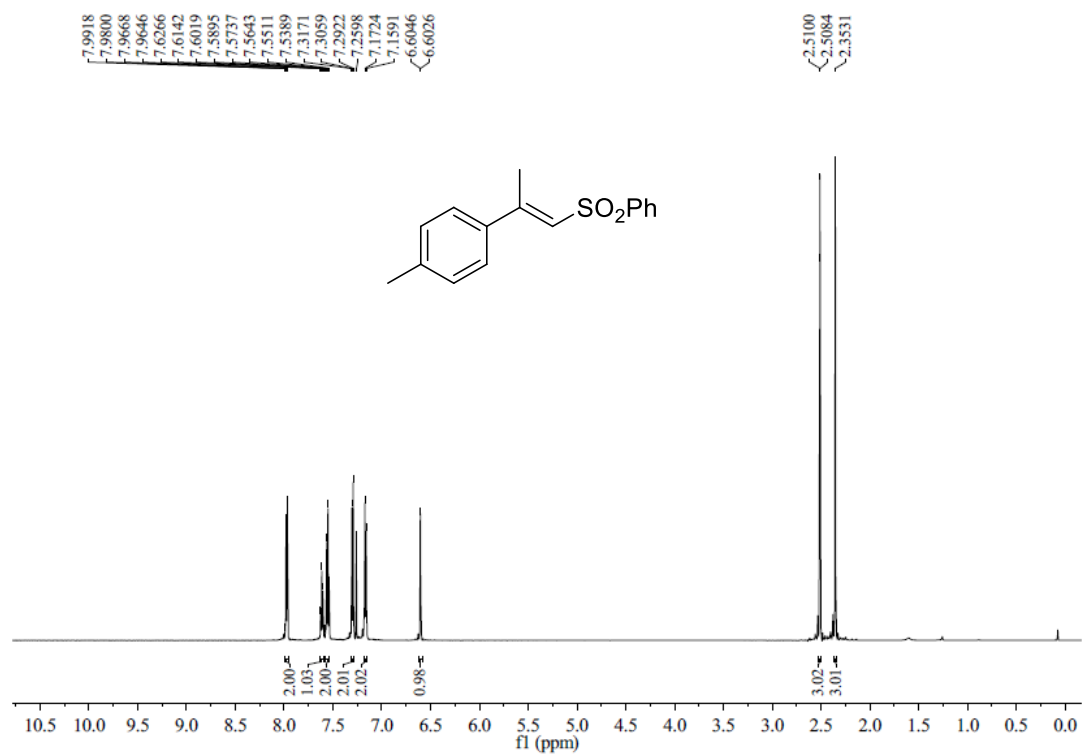
¹H NMR (600 MHz, Chloroform-*d*)

(E)-1-methoxy-3-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1i**)



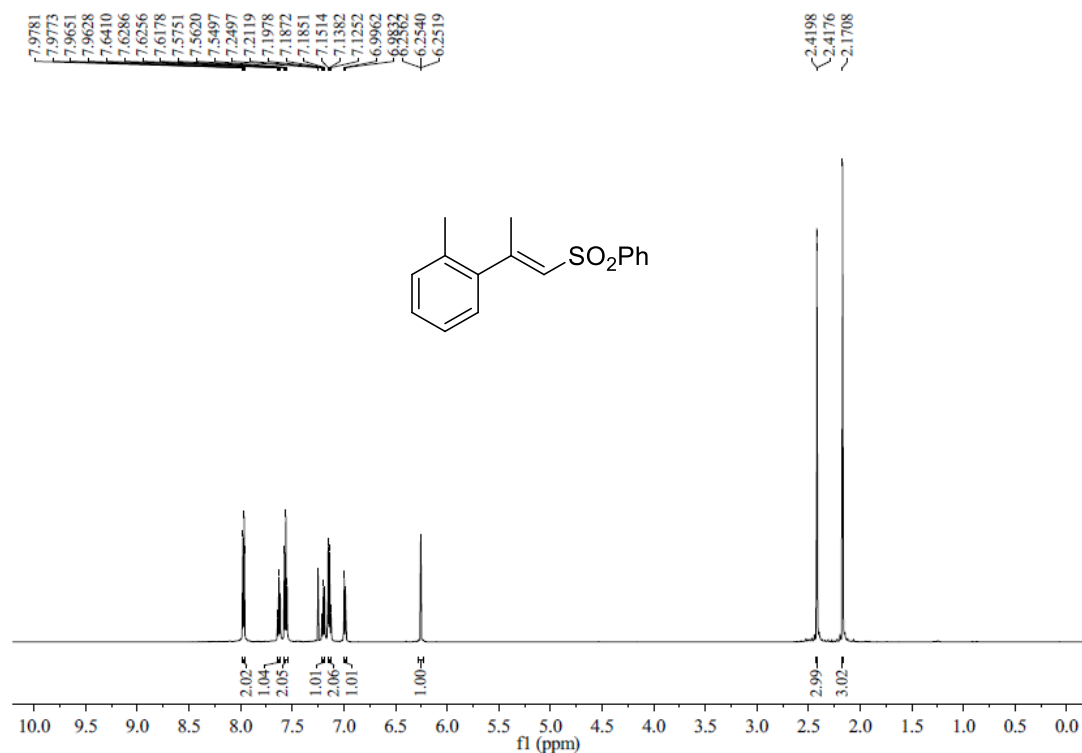
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1-methyl-4-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1j**)



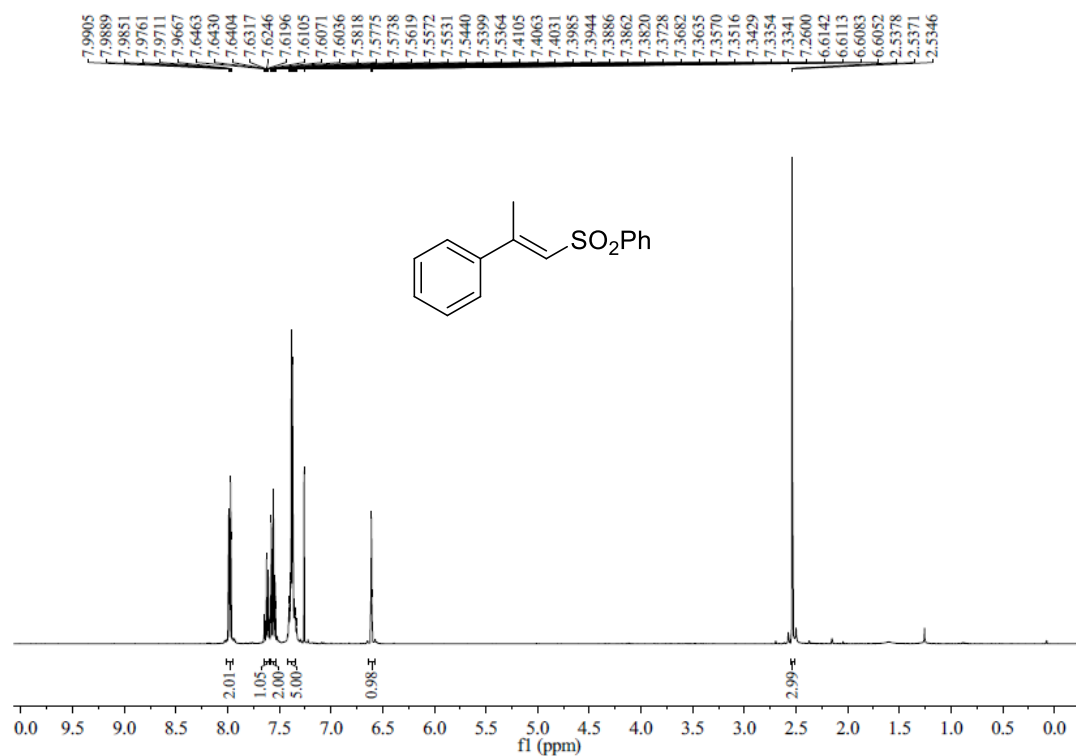
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1-methyl-2-(1-(phenylsulfonyl)prop-1-en-2-yl)benzene (**1k**)



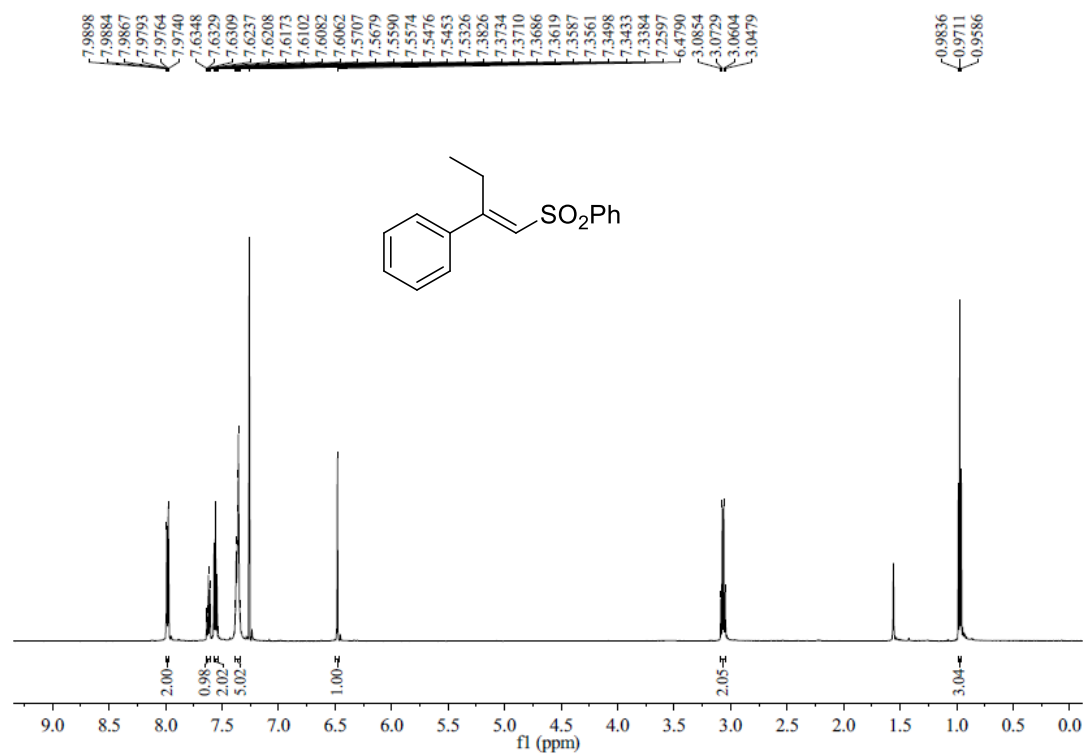
¹H NMR (600 MHz, Chloroform-*d*)

(E)-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1l**)



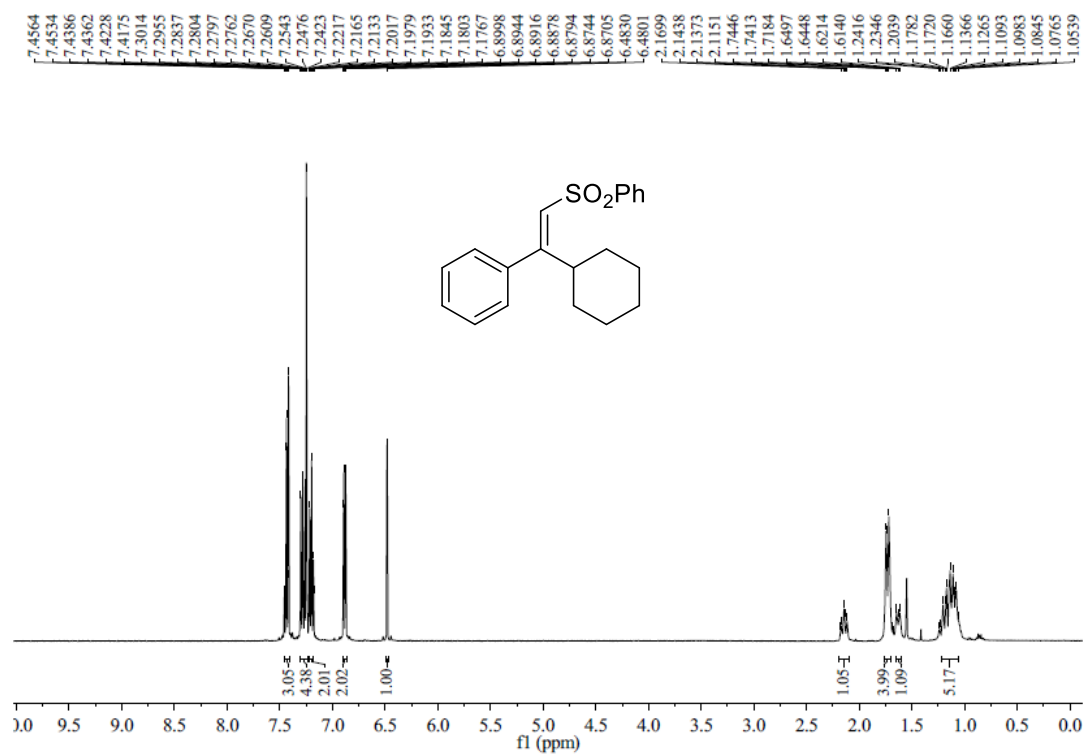
¹H NMR (400 MHz, Chloroform-*d*)

(E)-((2-phenylbut-1-en-1-yl)sulfonyl)benzene (**1m**)

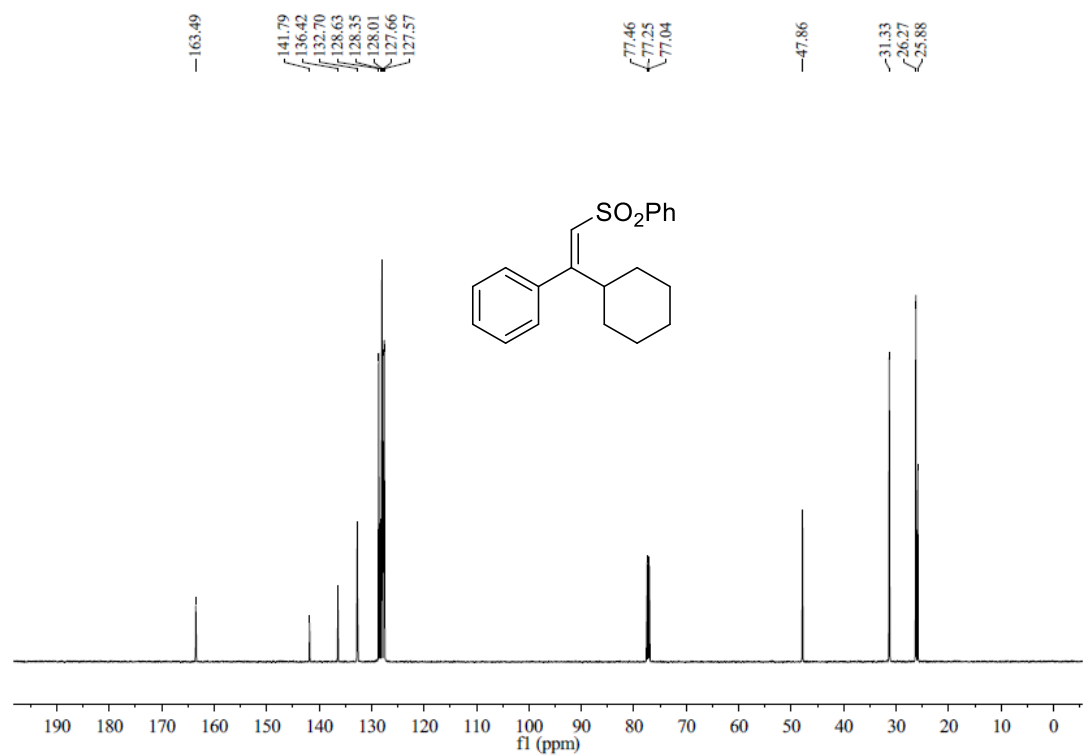


¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-(1-cyclohexyl-2-(phenylsulfonyl)vinyl)benzene (**1n**)

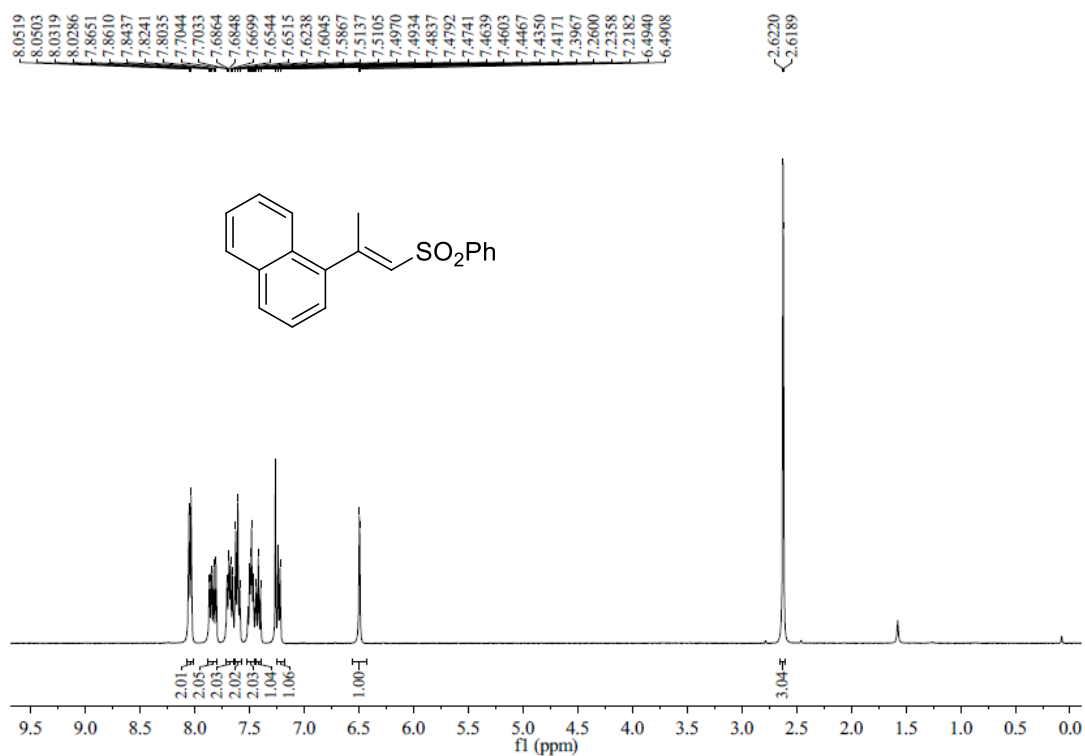


¹H NMR (400 MHz, Chloroform-*d*)



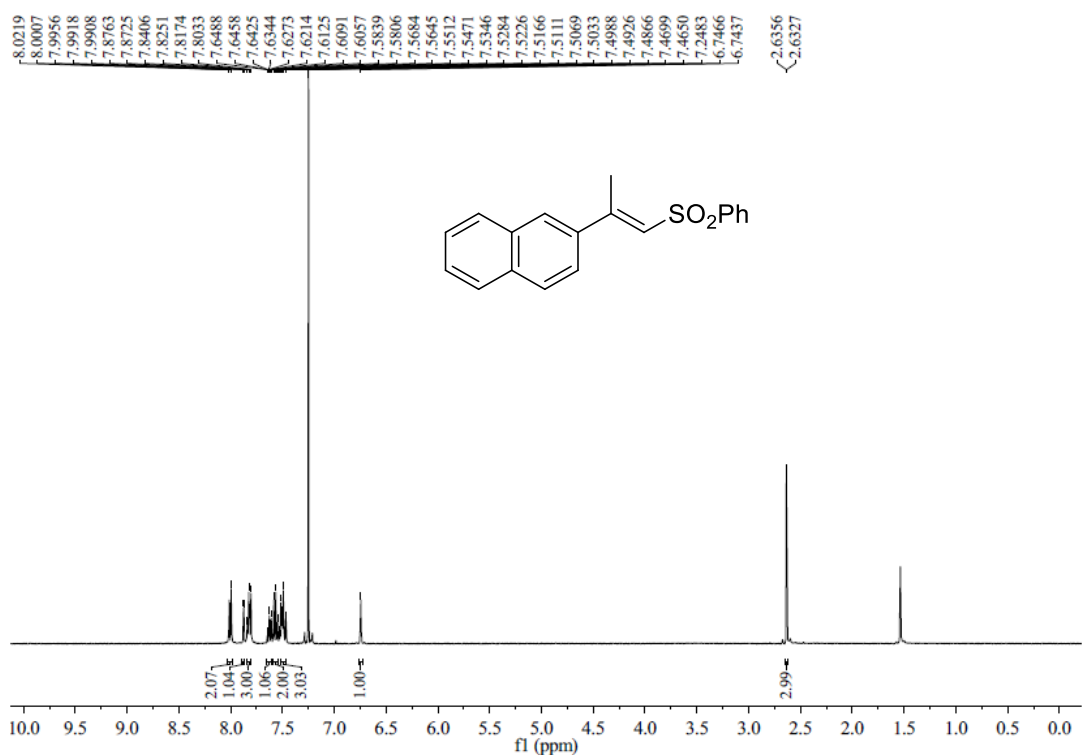
¹³C NMR (150 MHz, Chloroform-*d*)

(E)-1-(1-(phenylsulfonyl)prop-1-en-2-yl)naphthalene (**1o**)



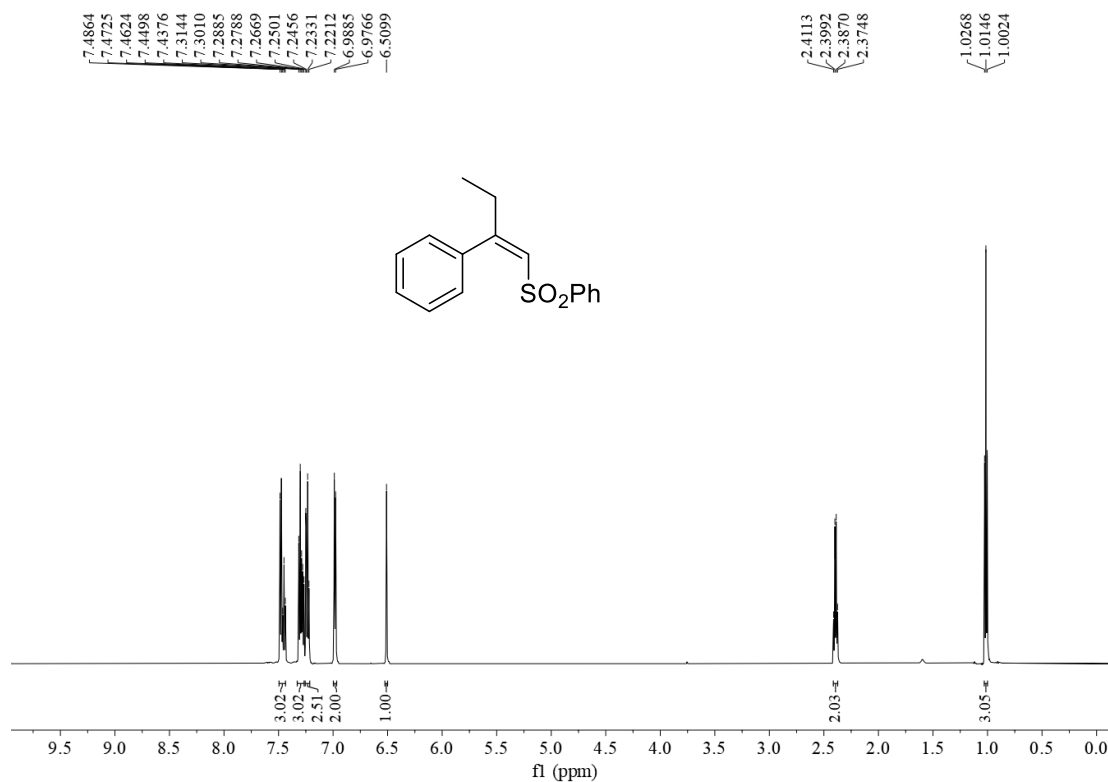
¹H NMR (400 MHz, Chloroform-*d*)

(E)-2-(1-(phenylsulfonyl)prop-1-en-2-yl)naphthalene (**1p**)



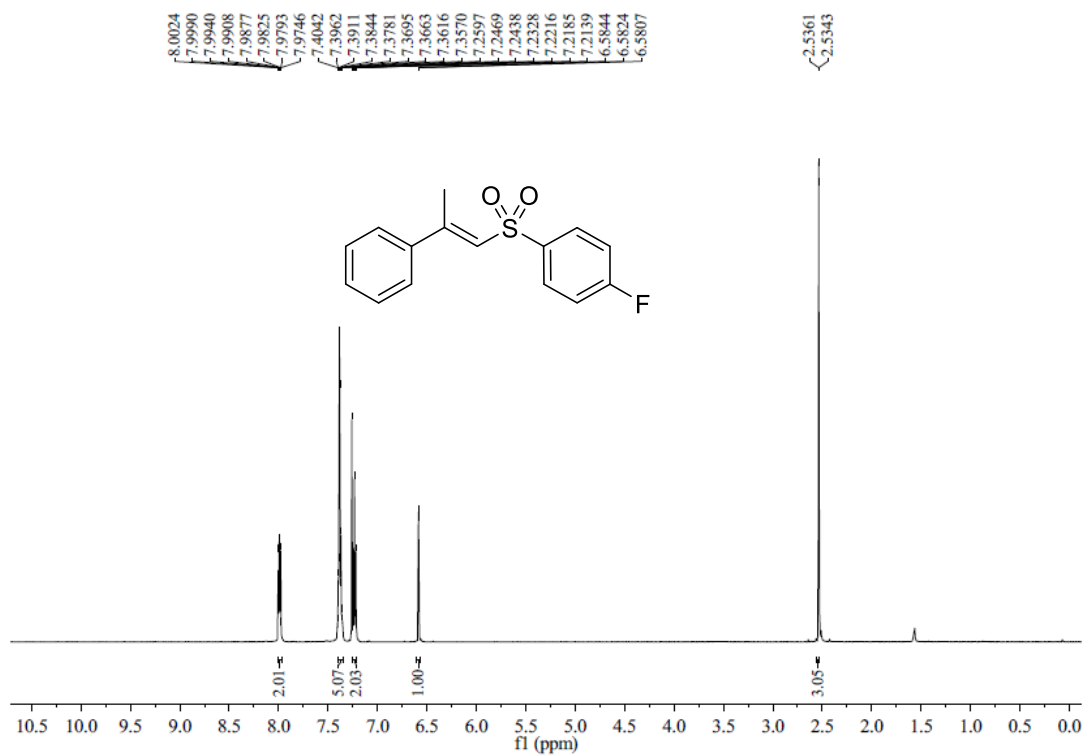
¹H NMR (400 MHz, Chloroform-*d*)

(Z)-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1q**)

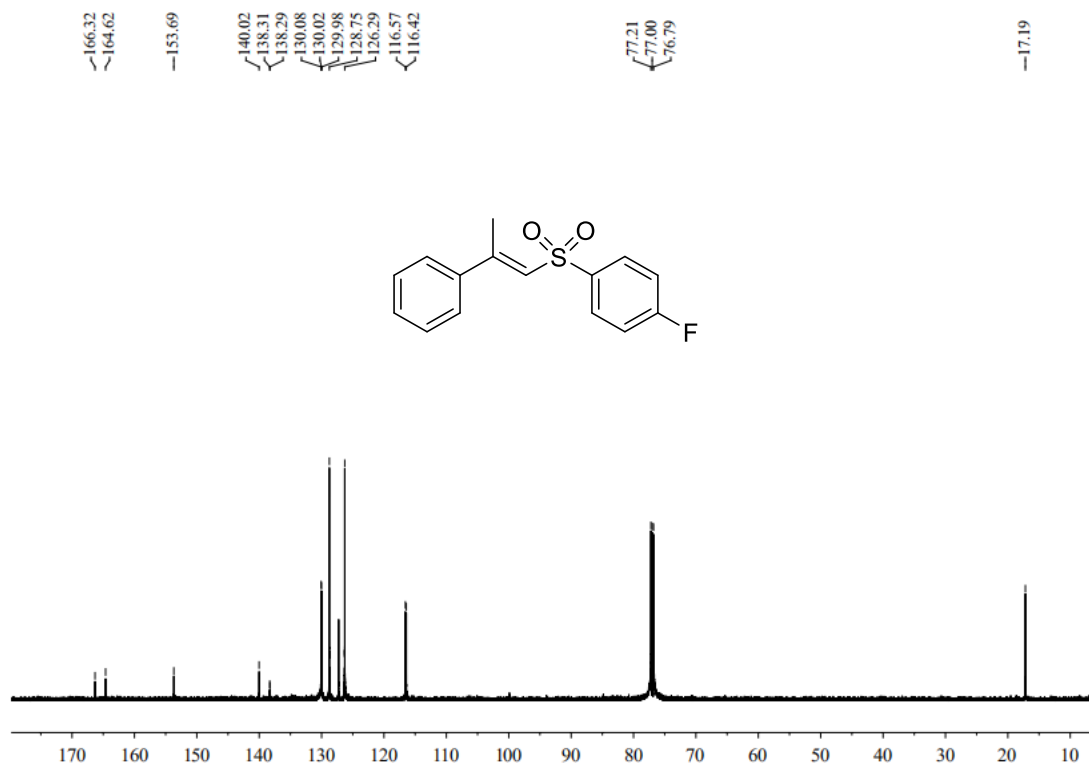


¹H NMR (400 MHz, Chloroform-*d*)

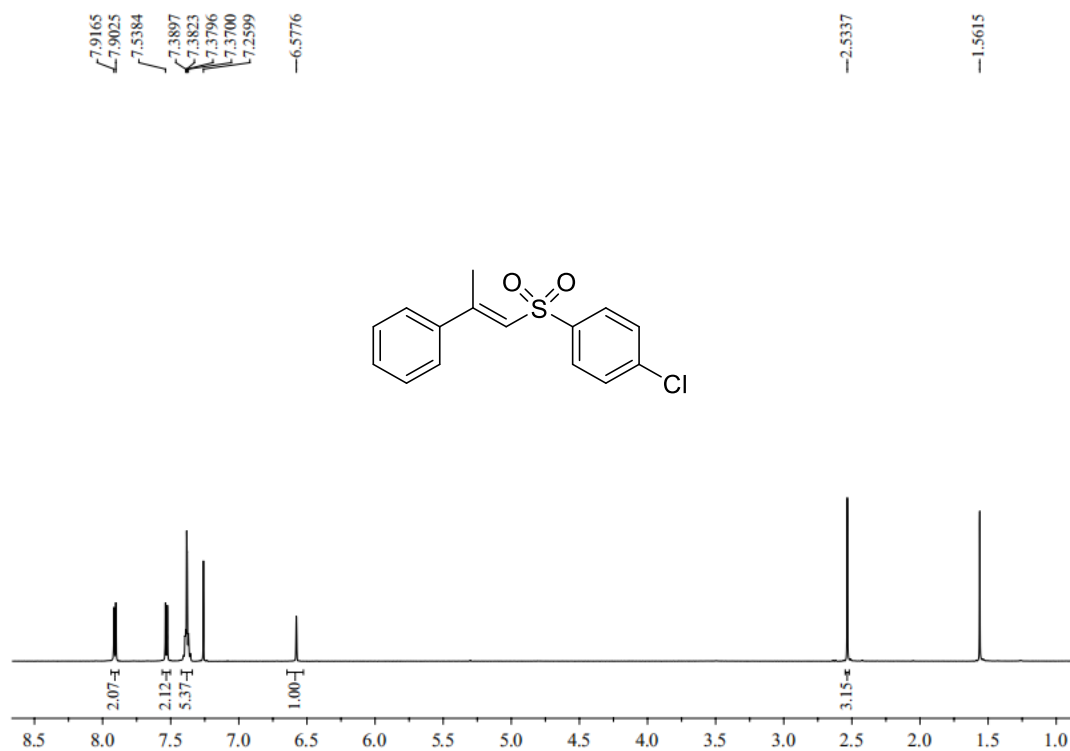
(E)-1-fluoro-4-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1r**)



¹H NMR (600 MHz, Chloroform-*d*)

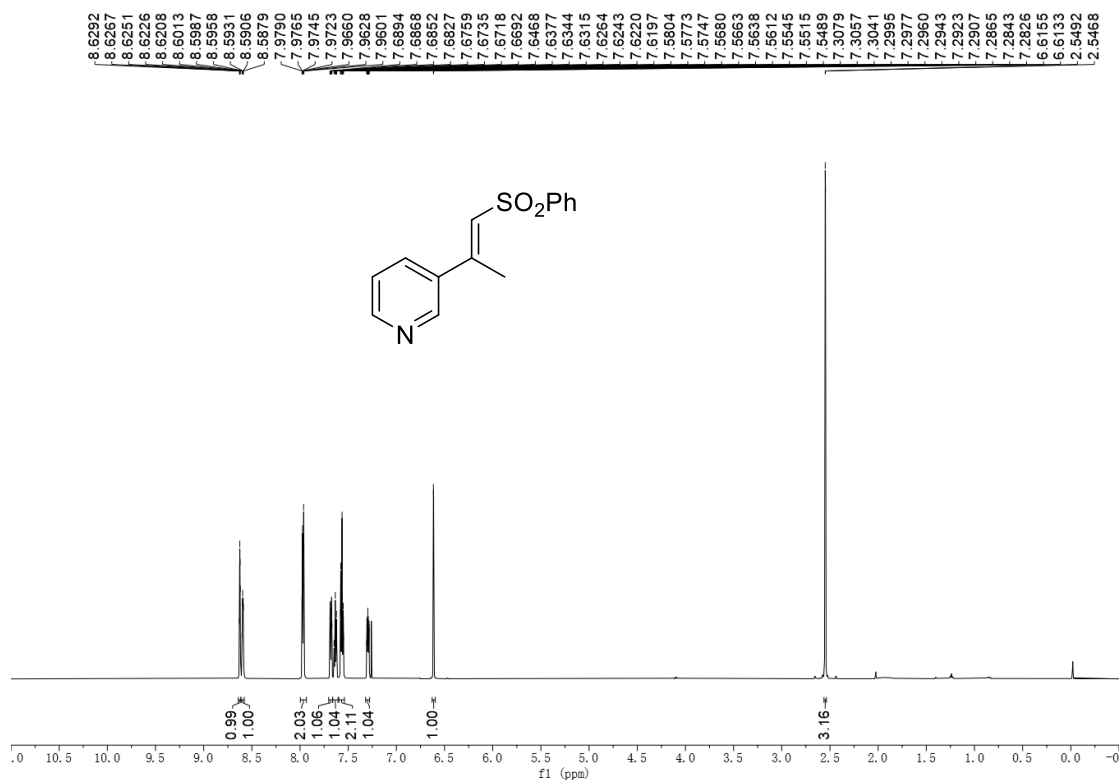


^{13}C NMR (150 MHz, Chloroform-*d*)
(E)-1-chloro-4-((2-phenylprop-1-en-1-yl)sulfonyl)benzene (**1s**)

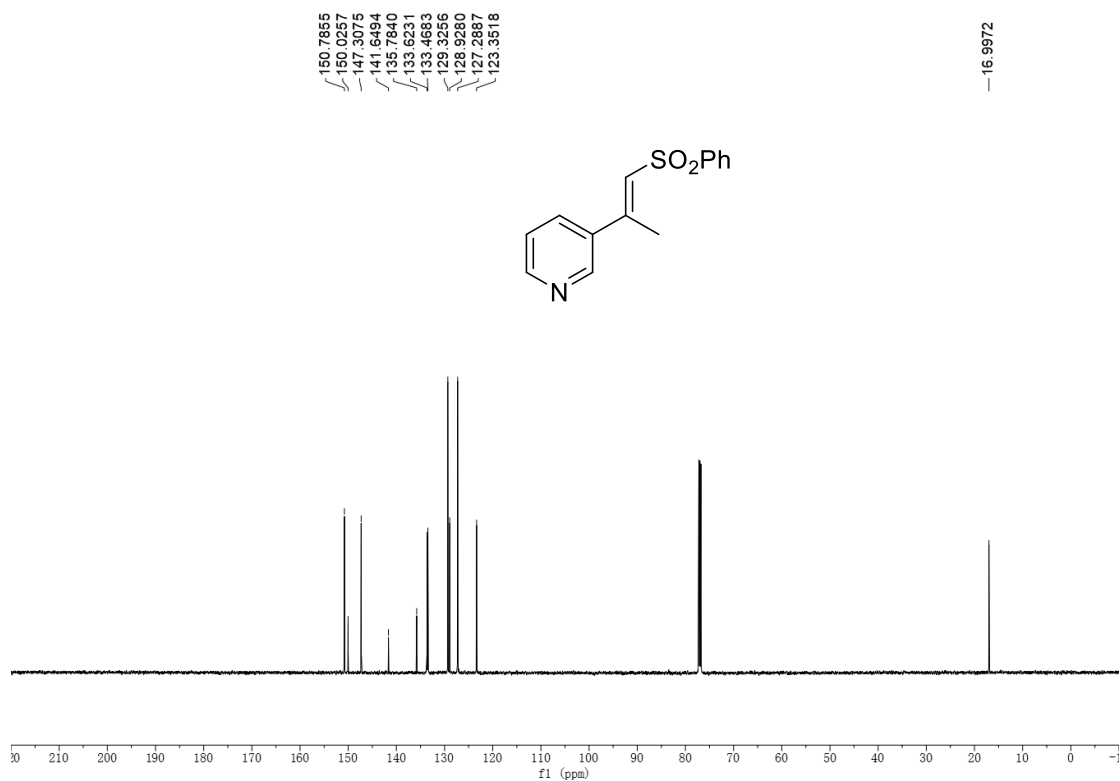


^1H NMR (600 MHz, Chloroform-*d*)

(E)-3-(1-(phenylsulfonyl)prop-1-en-2-yl)pyridine (**1t**)

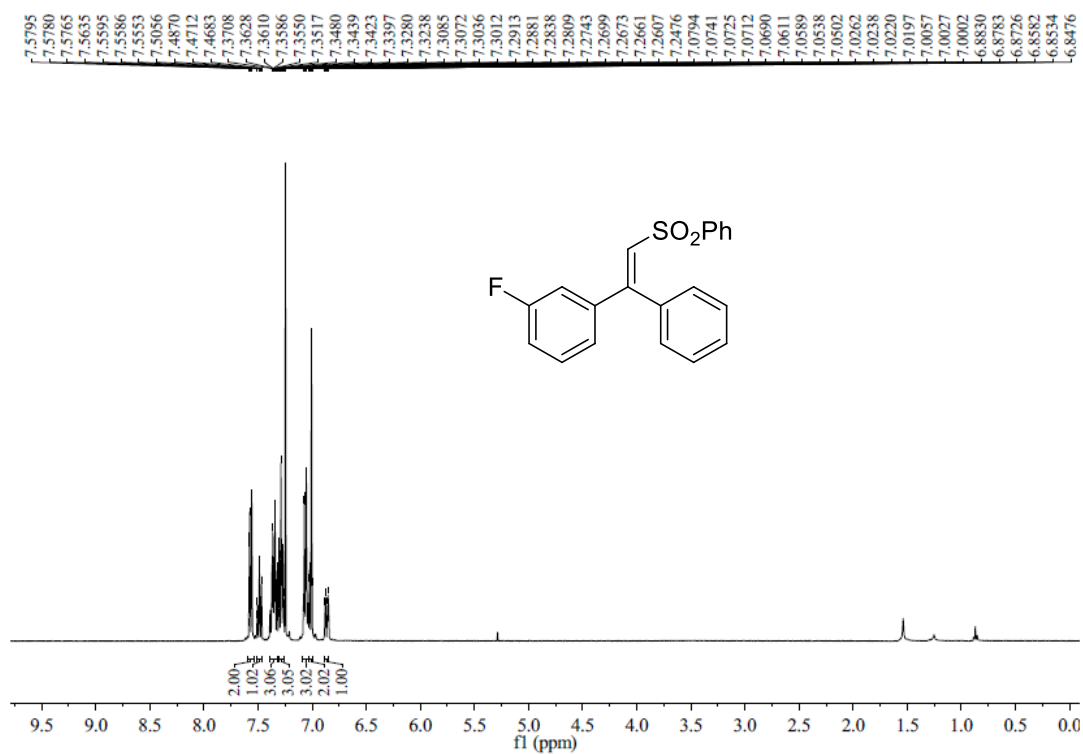


¹H NMR (600 MHz, Chloroform-*d*)



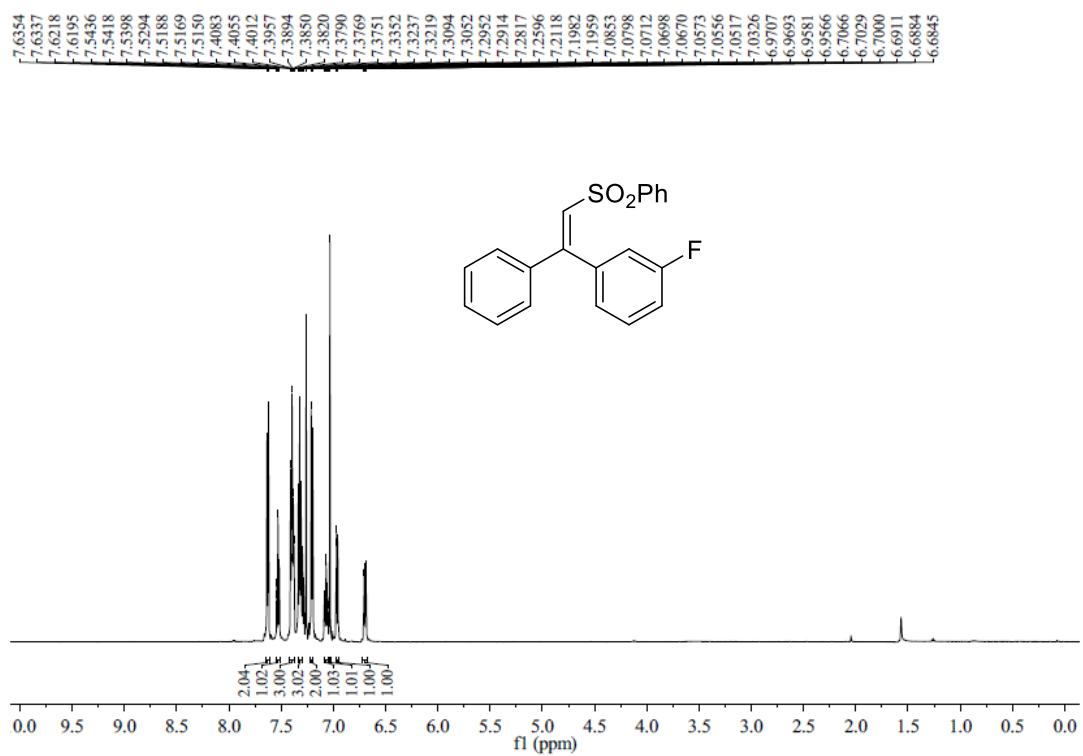
¹³C NMR (151 MHz, Chloroform-*d*)

(E)-1-fluoro-3-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3a**)



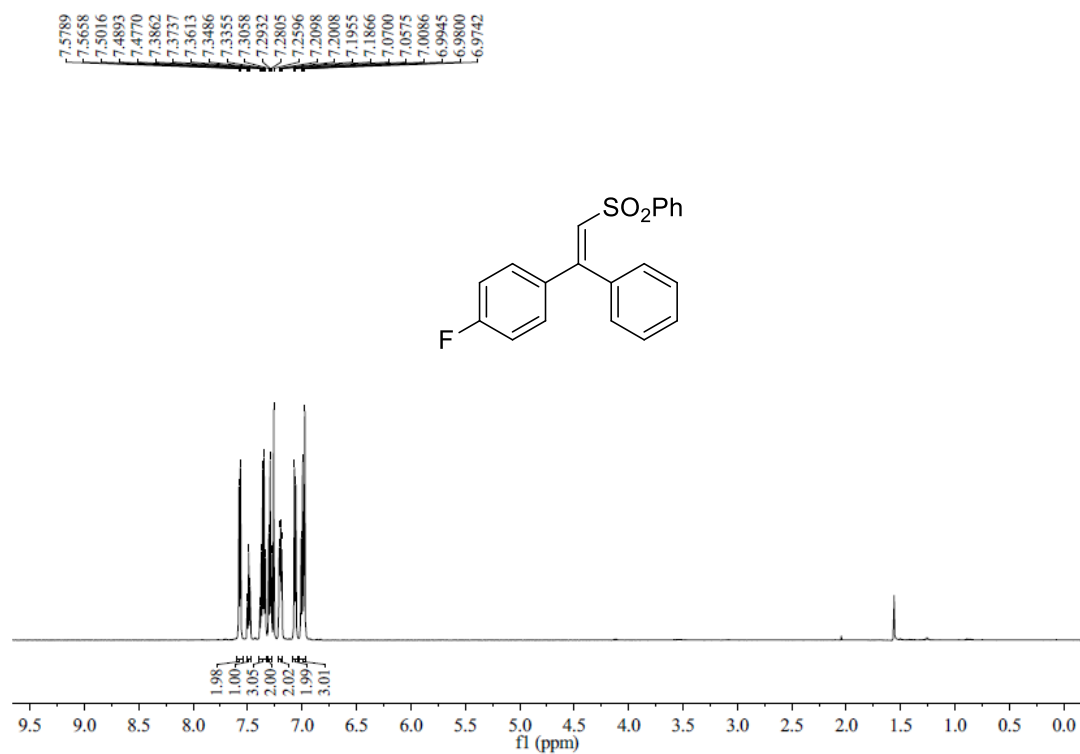
¹H NMR (400 MHz, Chloroform-*d*)

(Z)-1-fluoro-3-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3a**)

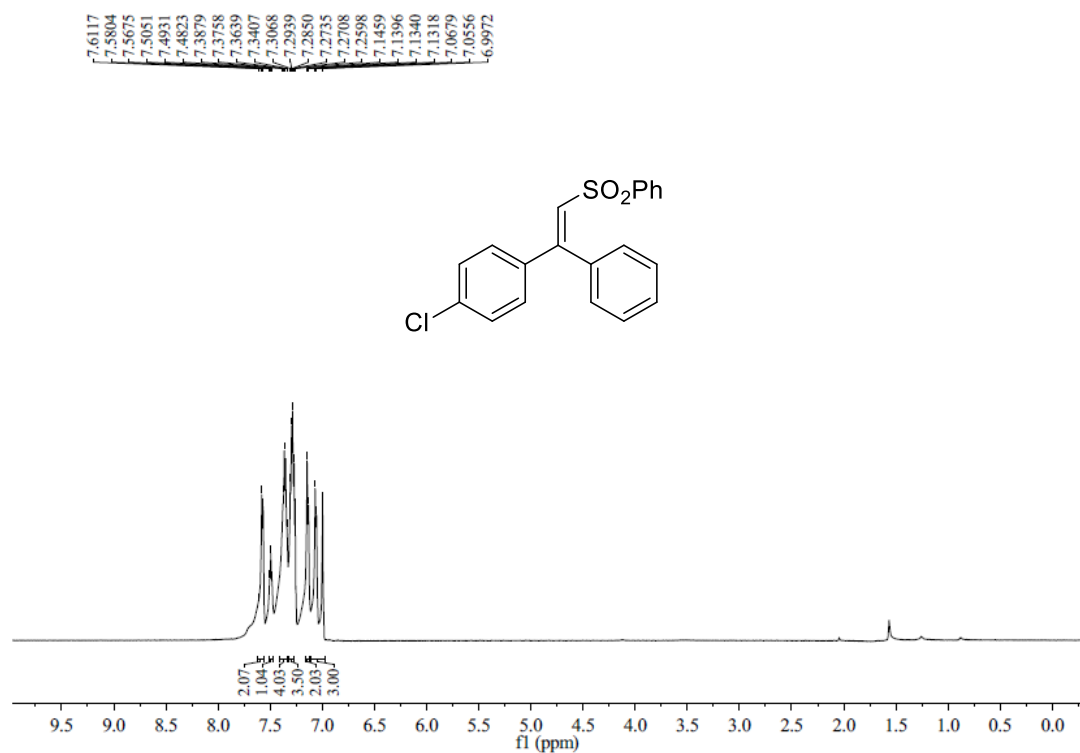


¹H NMR (600 MHz, Chloroform-*d*)

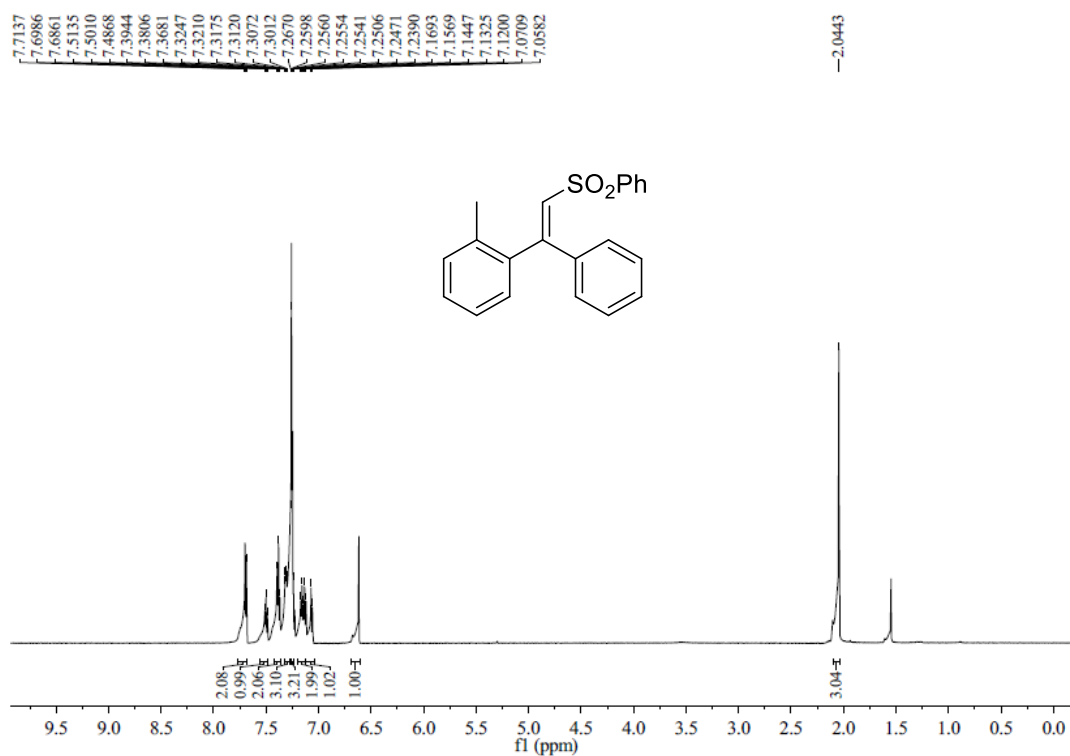
(*E*)-1-fluoro-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3b**)



(*E*)-1-chloro-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3c**)

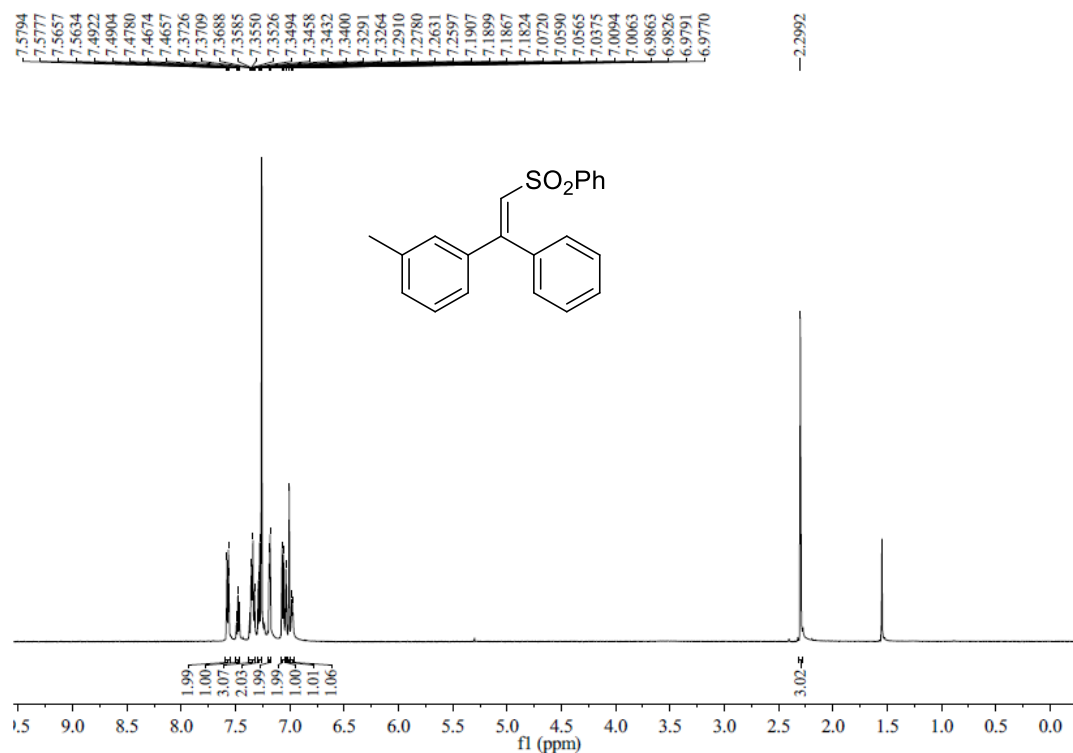


(*E*)-1-methyl-2-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3d**)



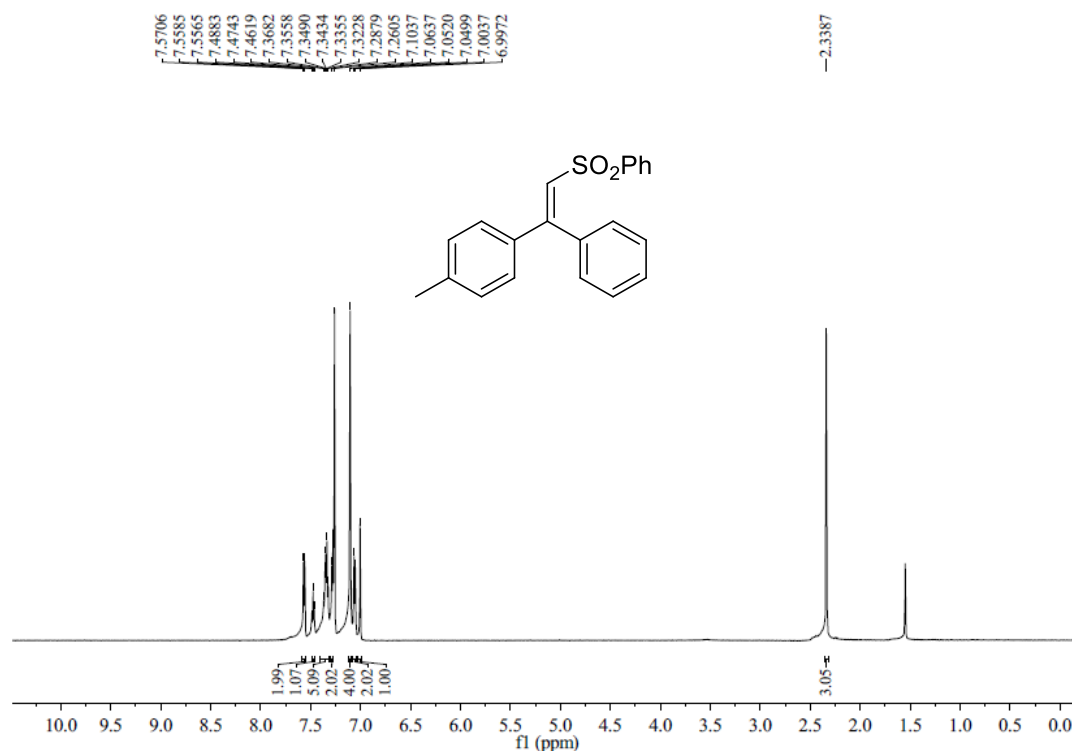
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1-methyl-3-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3e**)



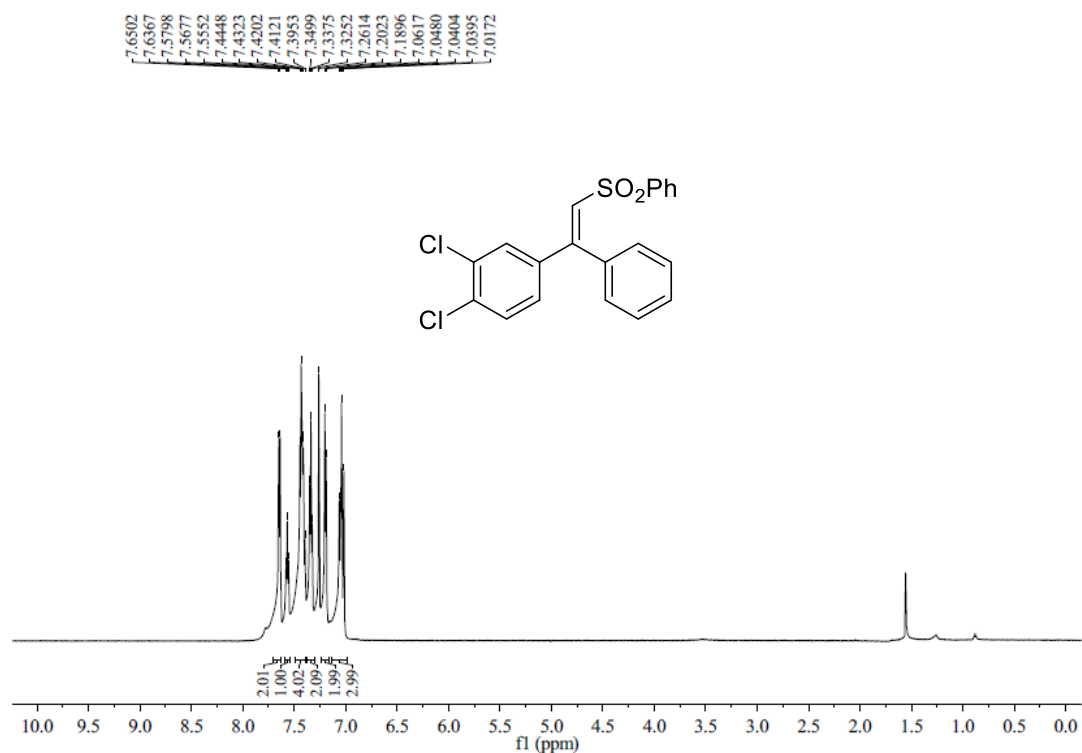
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1-methyl-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3f**)



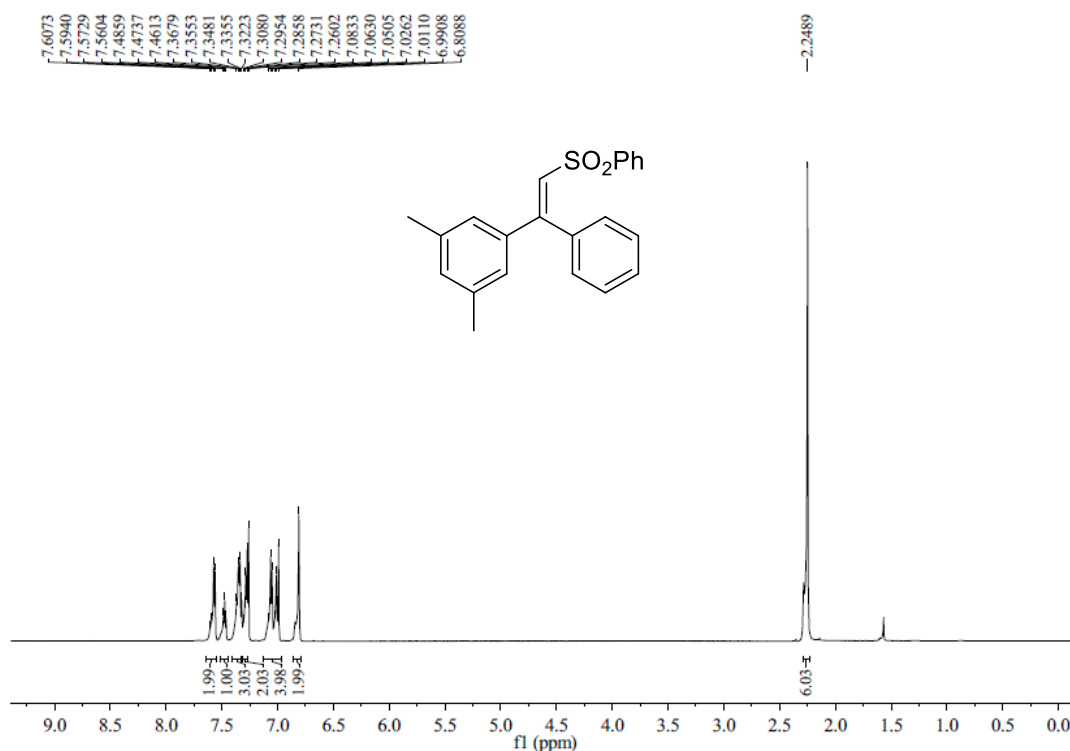
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1,2-dichloro-4-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3g**)



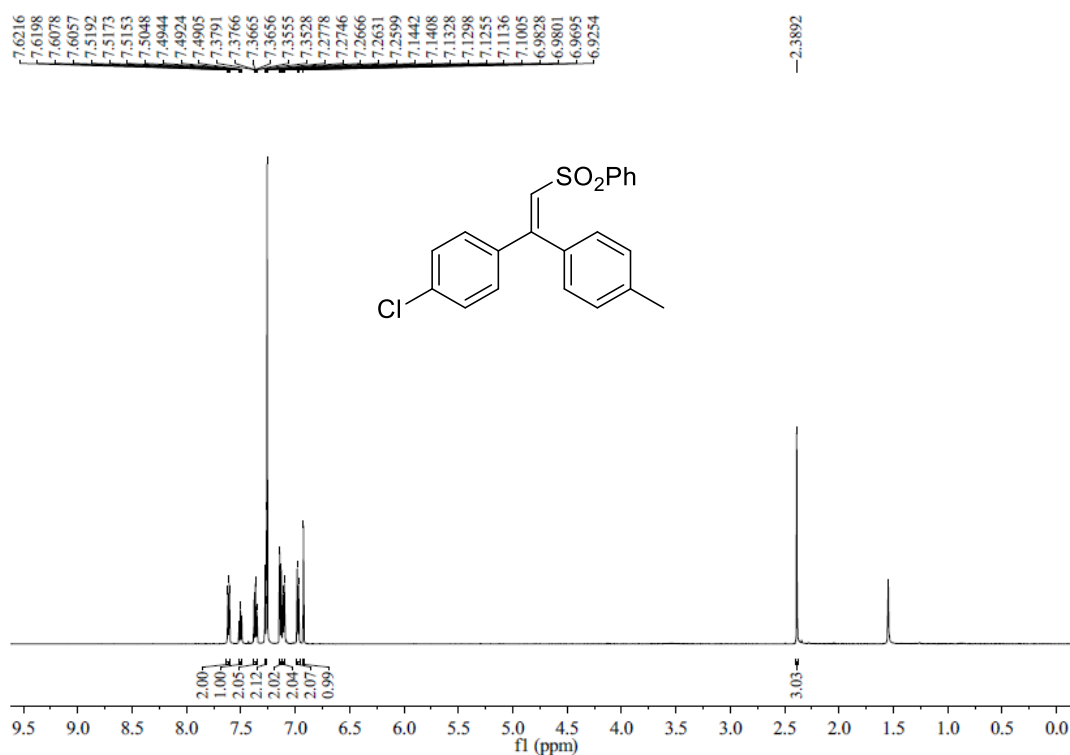
¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1,3-dimethyl-5-(1-phenyl-2-(phenylsulfonyl)vinyl)benzene (**3h**)

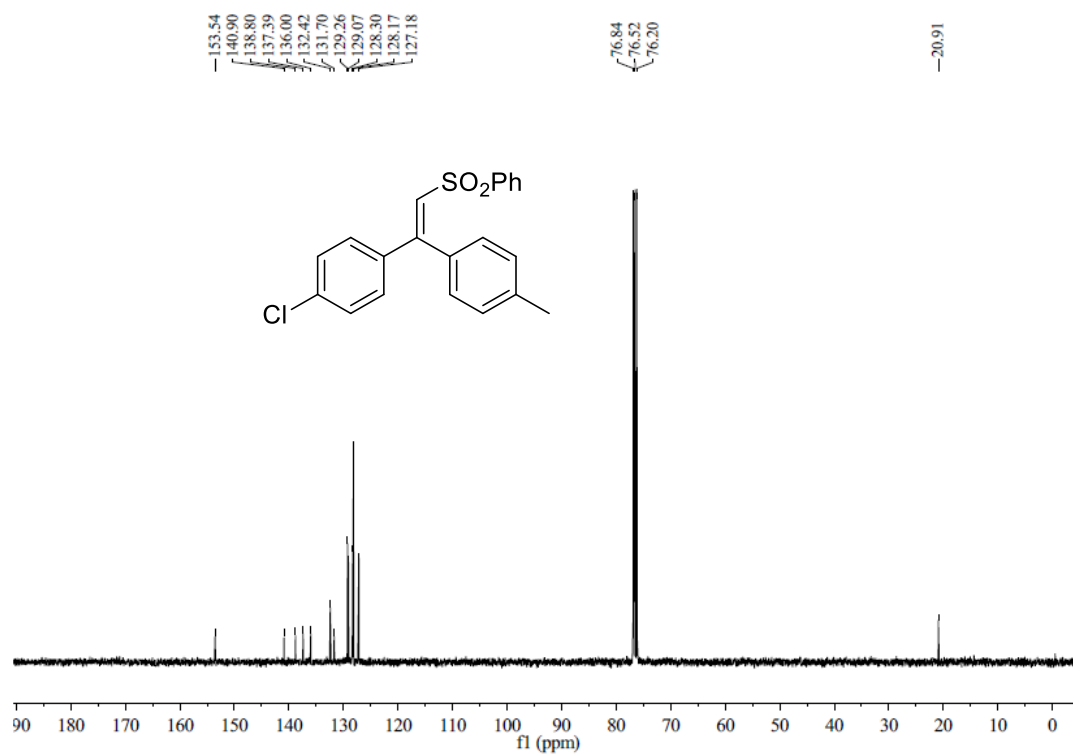


¹H NMR (600 MHz, Chloroform-*d*)

(*E*)-1-chloro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)vinyl)benzene (**3i**)

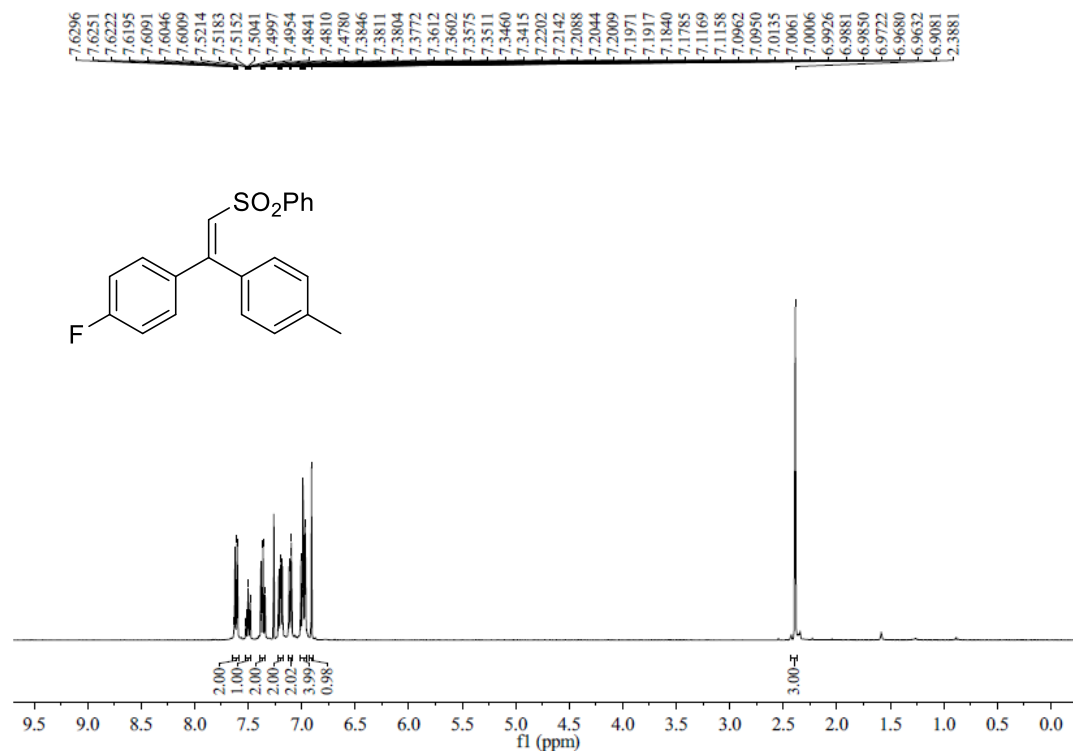


¹H NMR (600 MHz, Chloroform-*d*)



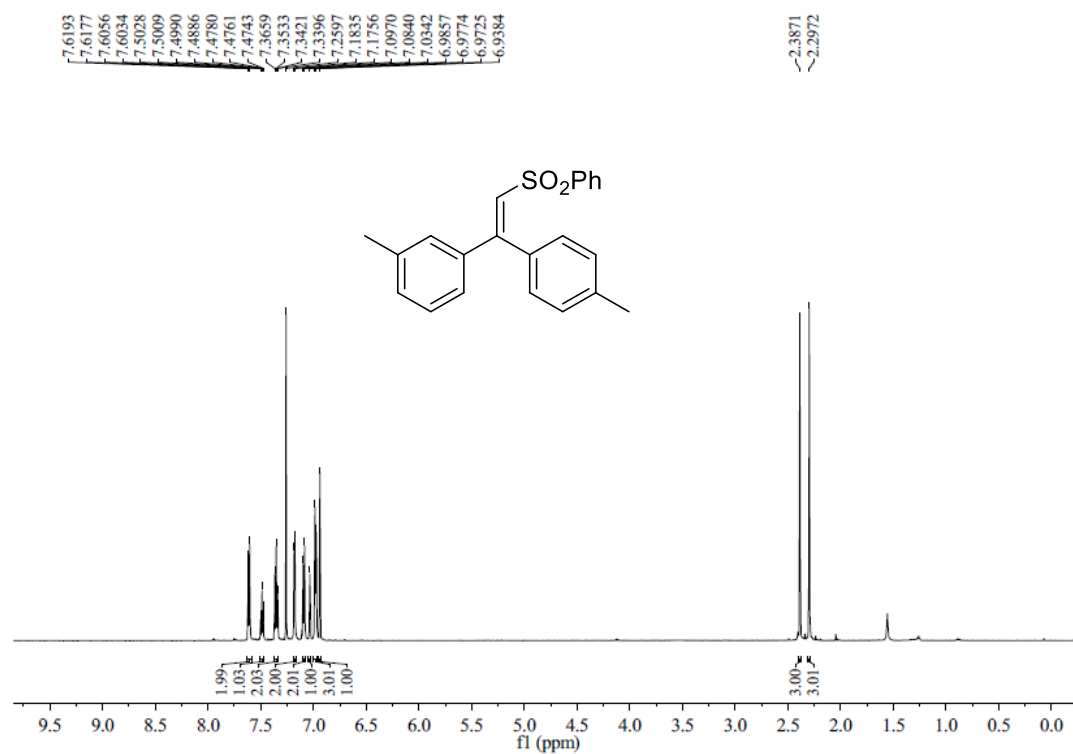
^{13}C NMR (100 MHz, Chloroform-*d*)

(*E*)-1-fluoro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)vinyl)benzene (**3j**)



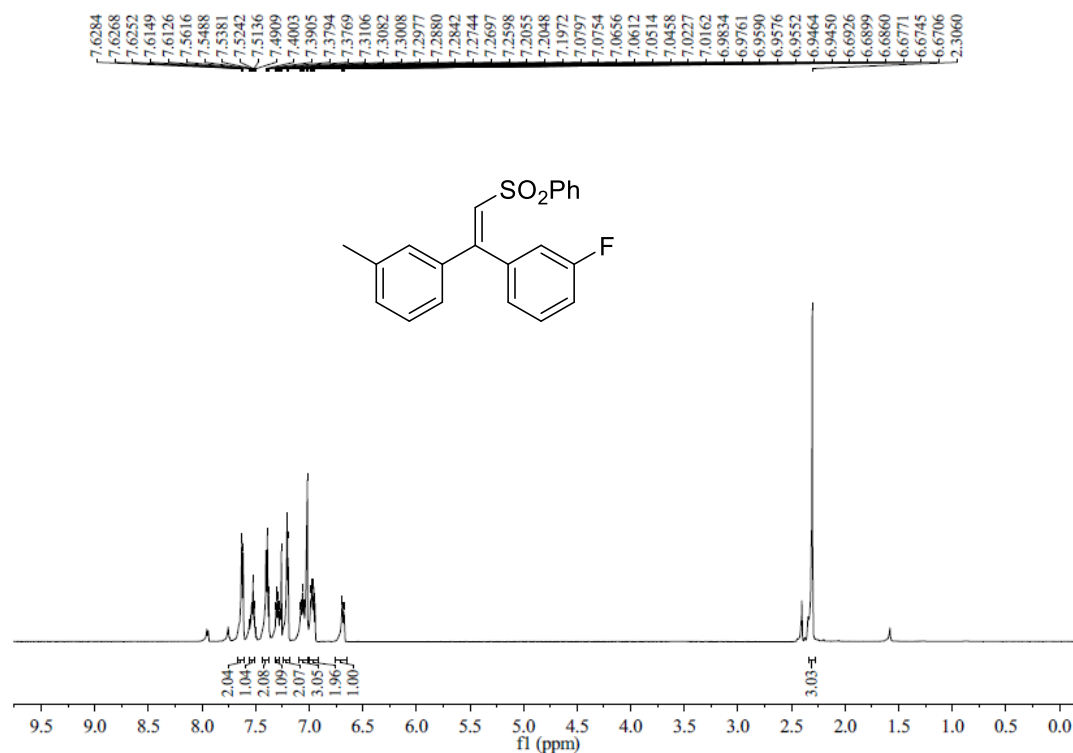
^1H NMR (400 MHz, Chloroform-*d*)

(*E*)-1-methyl-3-(2-(phenylsulfonyl)-1-(*p*-tolyl)vinyl)benzene (**3k**)



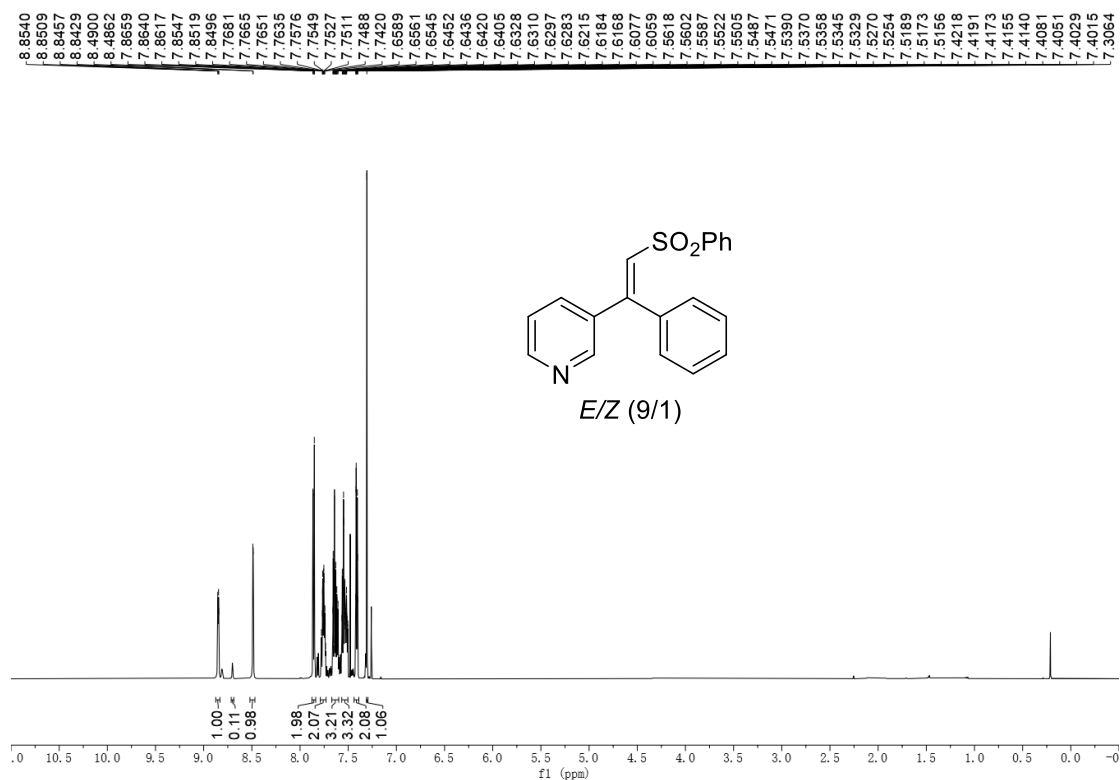
¹H NMR (600 MHz, Chloroform-*d*)

(*Z*)-1-fluoro-3-(2-(phenylsulfonyl)-1-(*m*-tolyl)vinyl)benzene (**3l**)

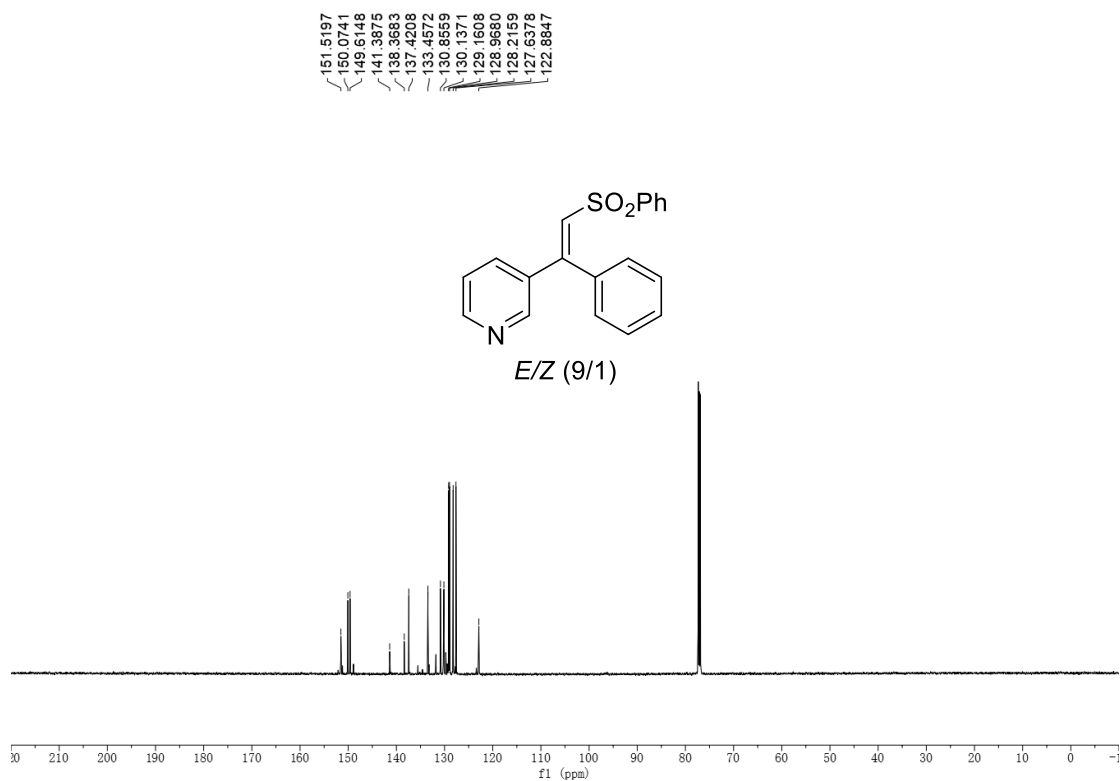


¹H NMR (600 MHz, Chloroform-*d*)

(E)-3-(1-phenyl-2-(phenylsulfonyl)vinyl)pyridine (**3m**)

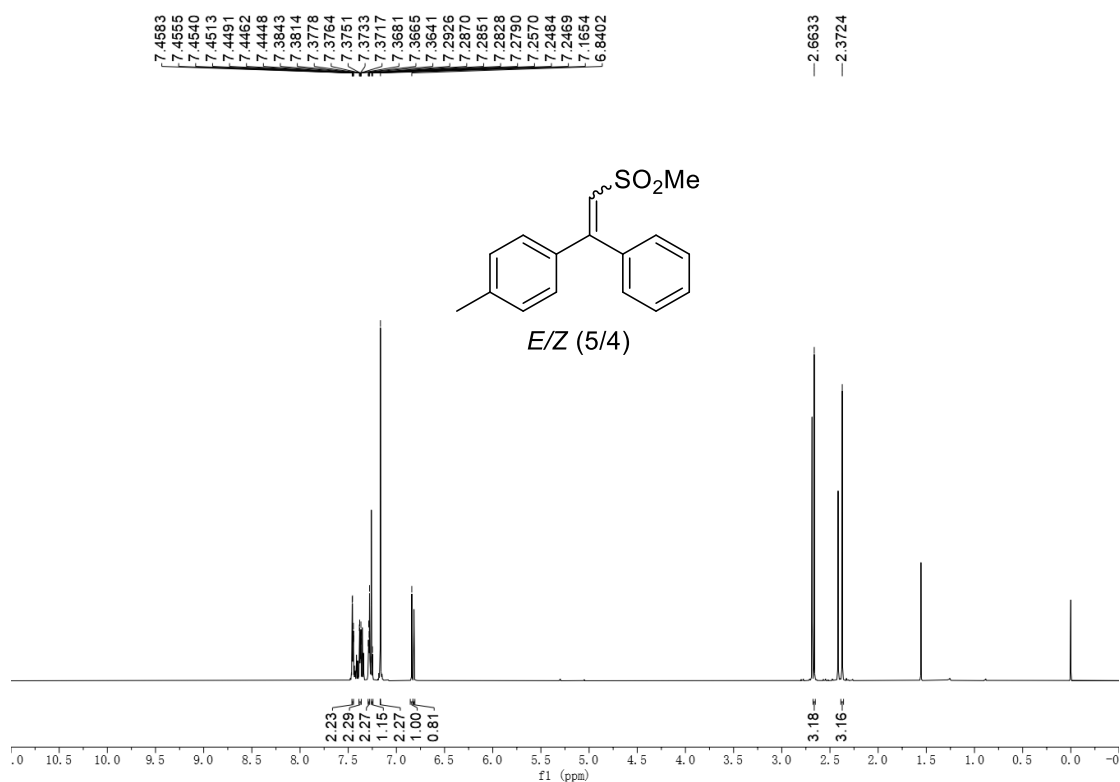


¹H NMR (600 MHz, Chloroform-*d*)



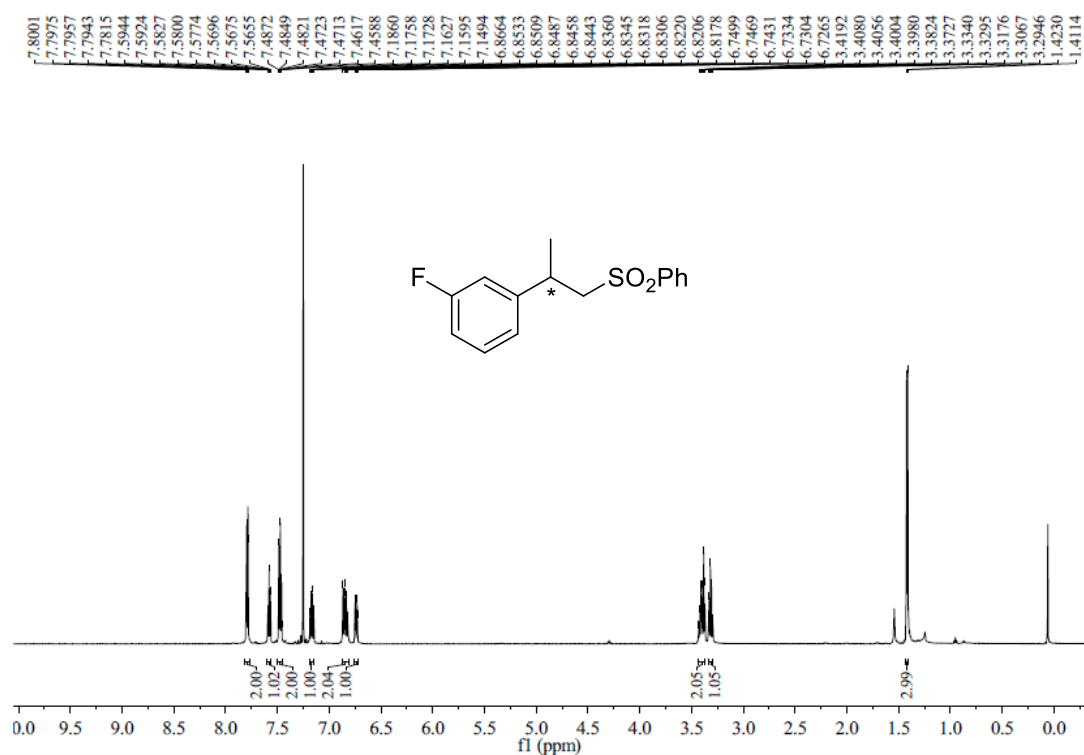
¹³C NMR (151 MHz, Chloroform-*d*)

1-Methyl-4-(2-(methylsulfonyl)-1-phenylvinyl)benzene (**3n**)



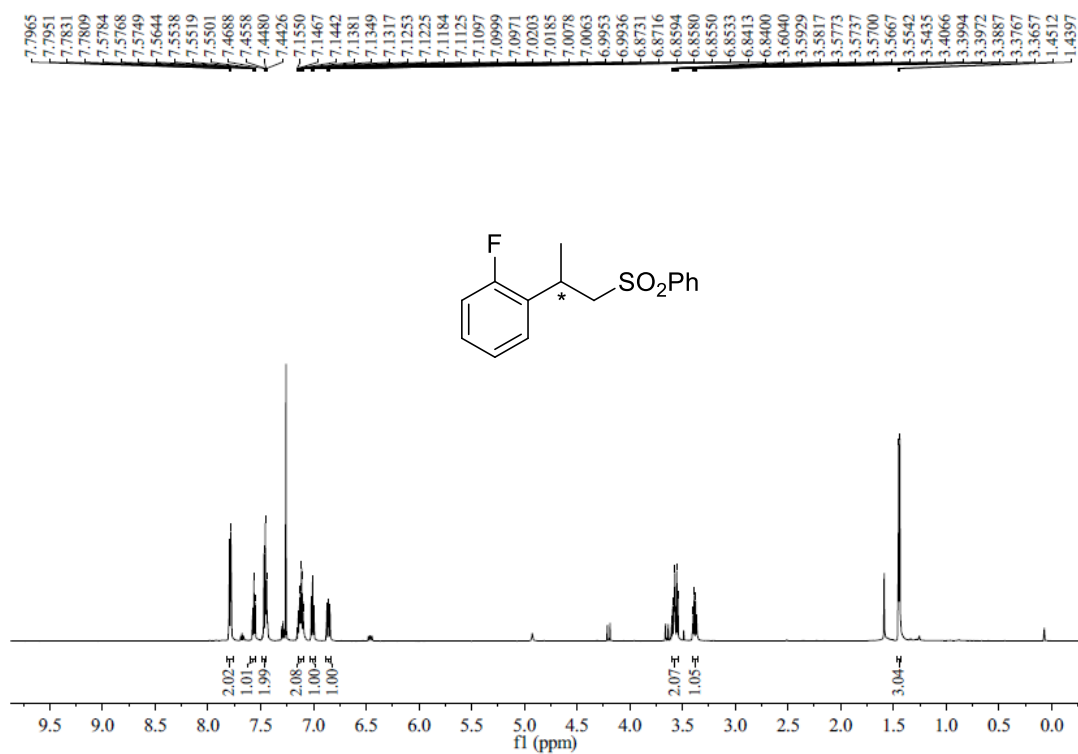
¹H NMR (600 MHz, Chloroform-*d*)

1-Fluoro-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2a**)



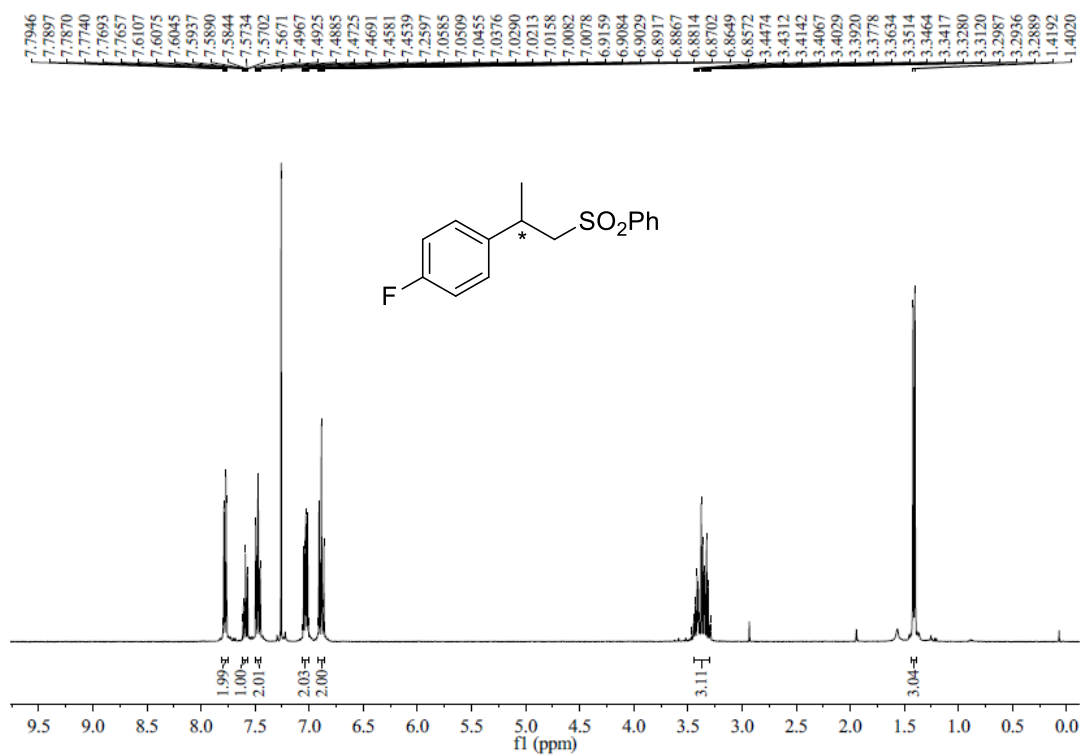
¹H NMR (600 MHz, Chloroform-*d*)

1-Fluoro-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2b**)



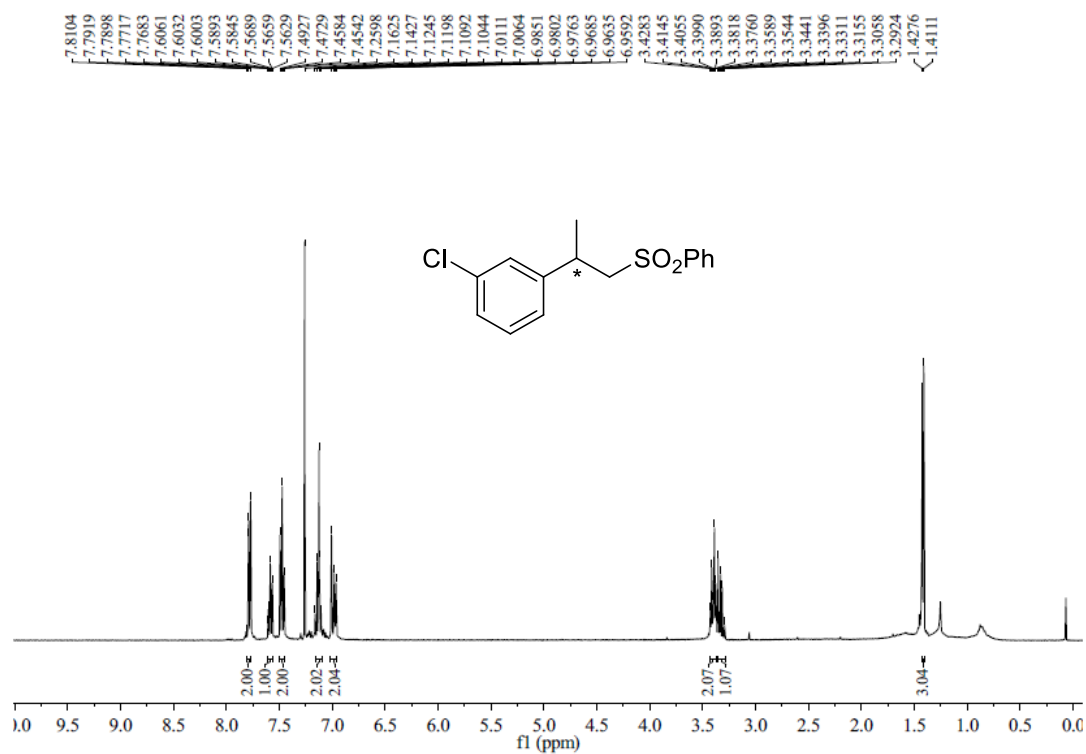
¹H NMR (600 MHz, Chloroform-*d*)

1-Fluoro-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2c**)



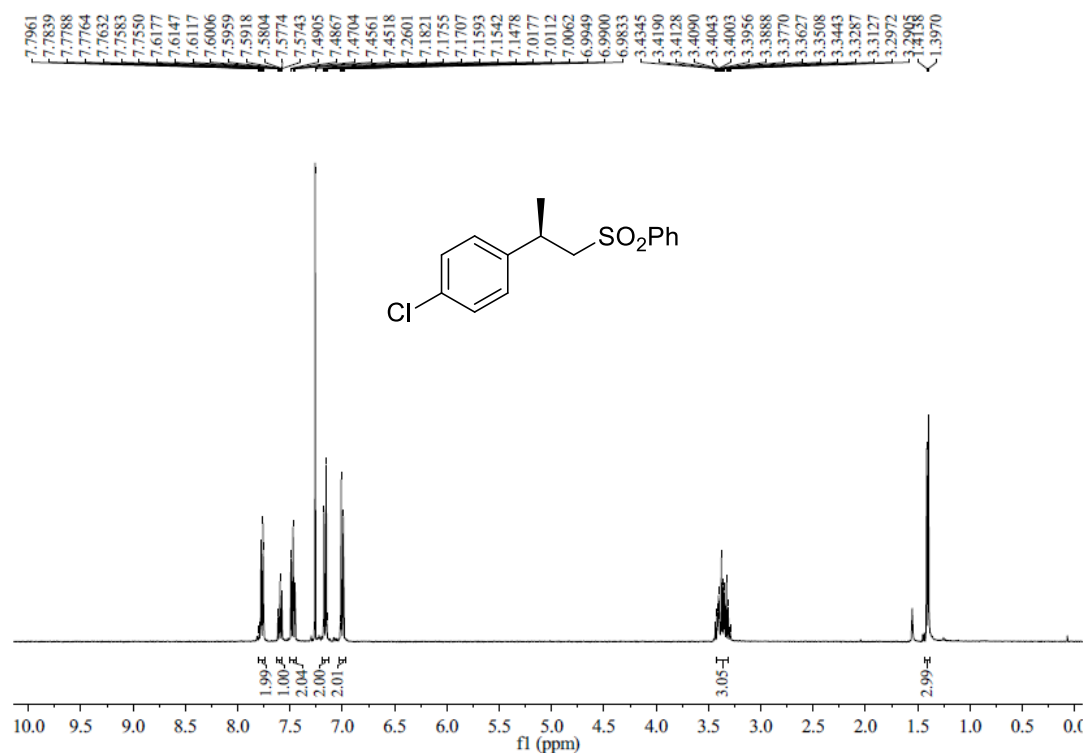
¹H NMR (400 MHz, Chloroform-*d*)

1-Chloro-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2d**)



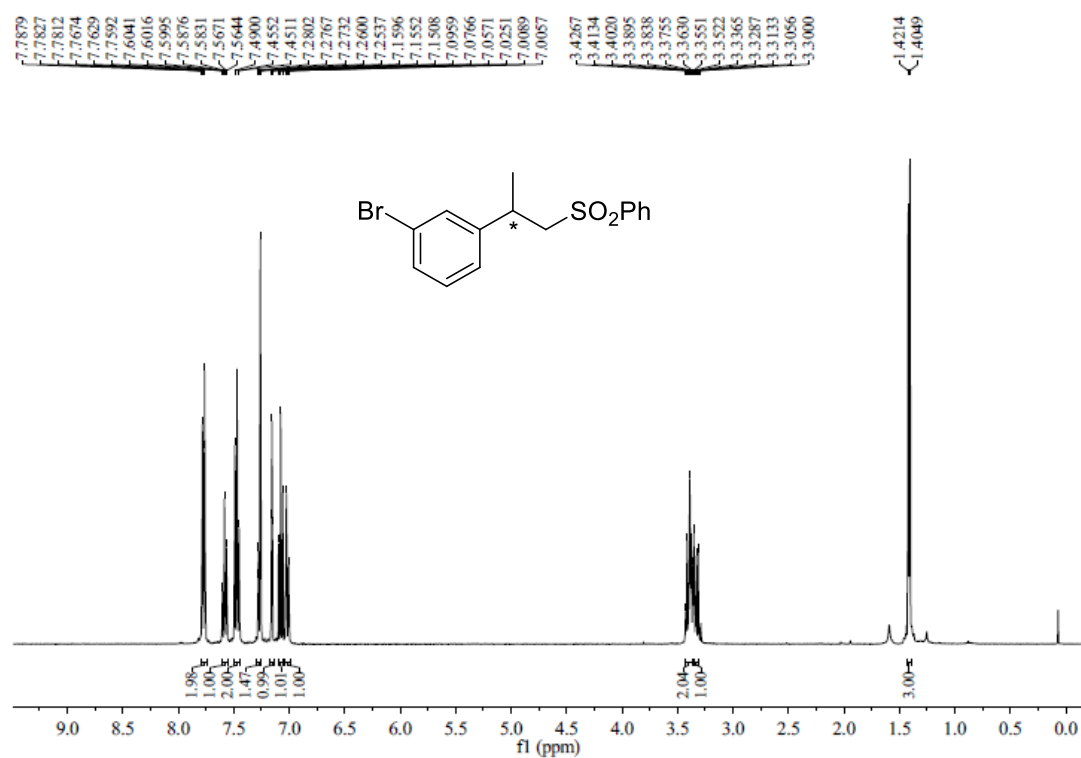
¹H NMR (400 MHz, Chloroform-*d*)

(*R*)-1-chloro-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2e**)



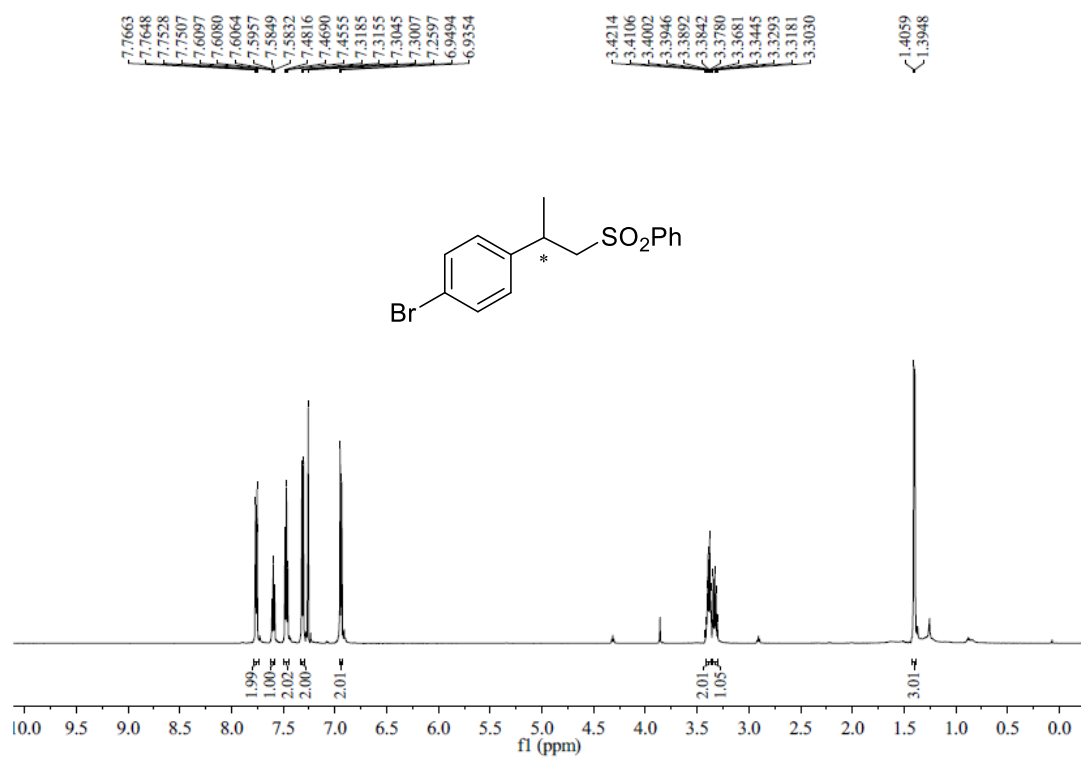
¹H NMR (400 MHz, Chloroform-*d*)

1-Bromo-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2f**)

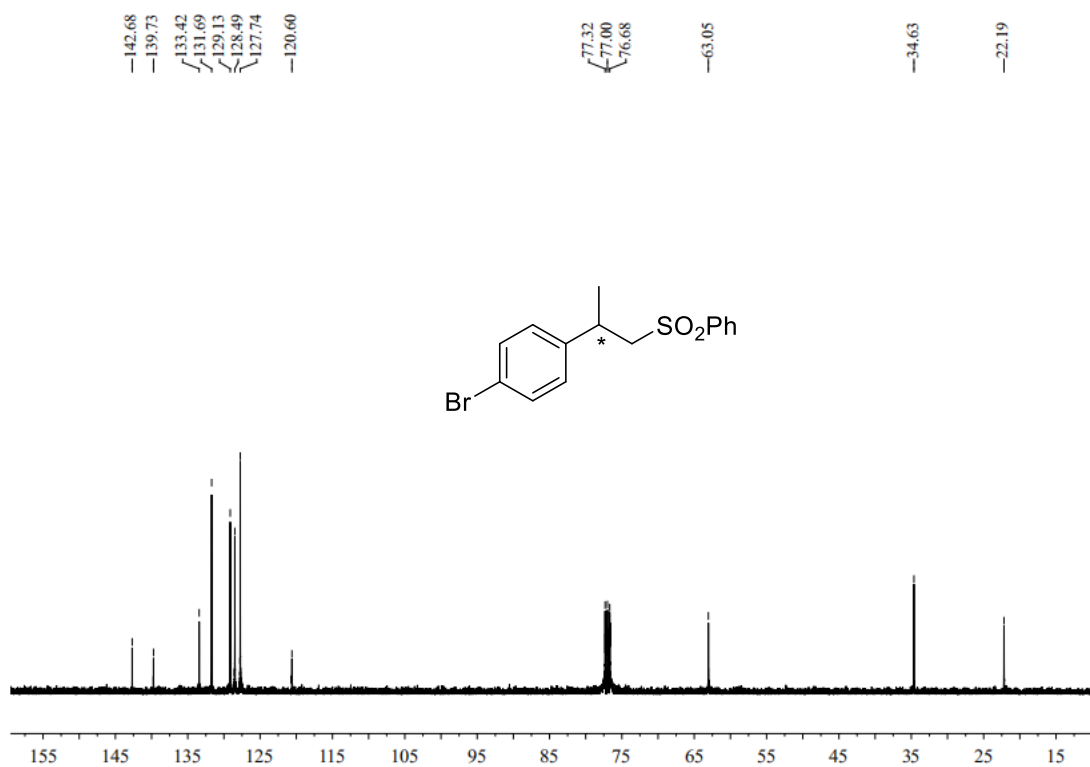


¹H NMR (400 MHz, Chloroform-*d*)

1-Bromo-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2g**)

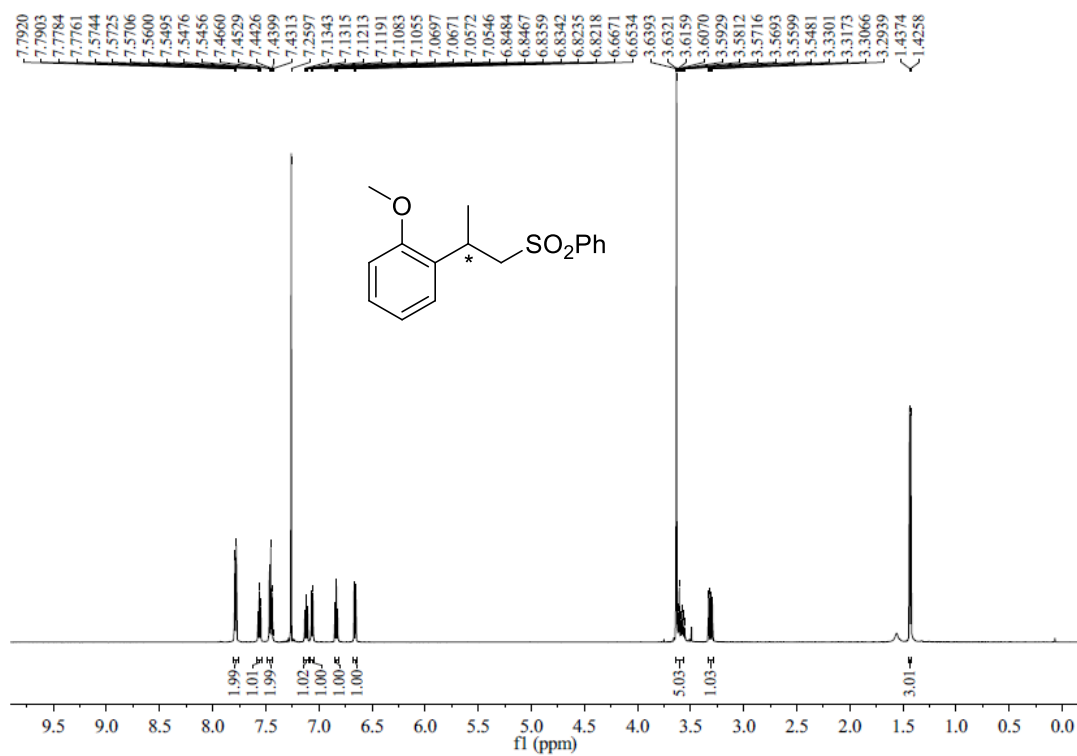


¹H NMR (600 MHz, Chloroform-*d*)



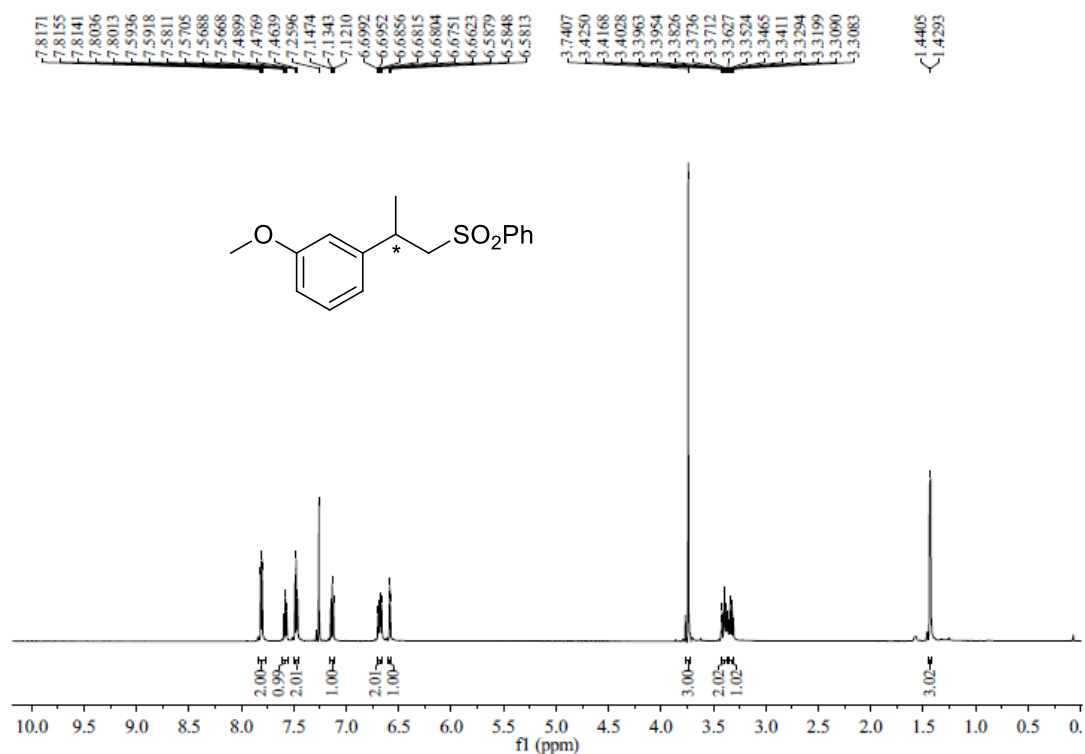
¹³C NMR (100 MHz, Chloroform-*d*)

1-Methoxy-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2h**)



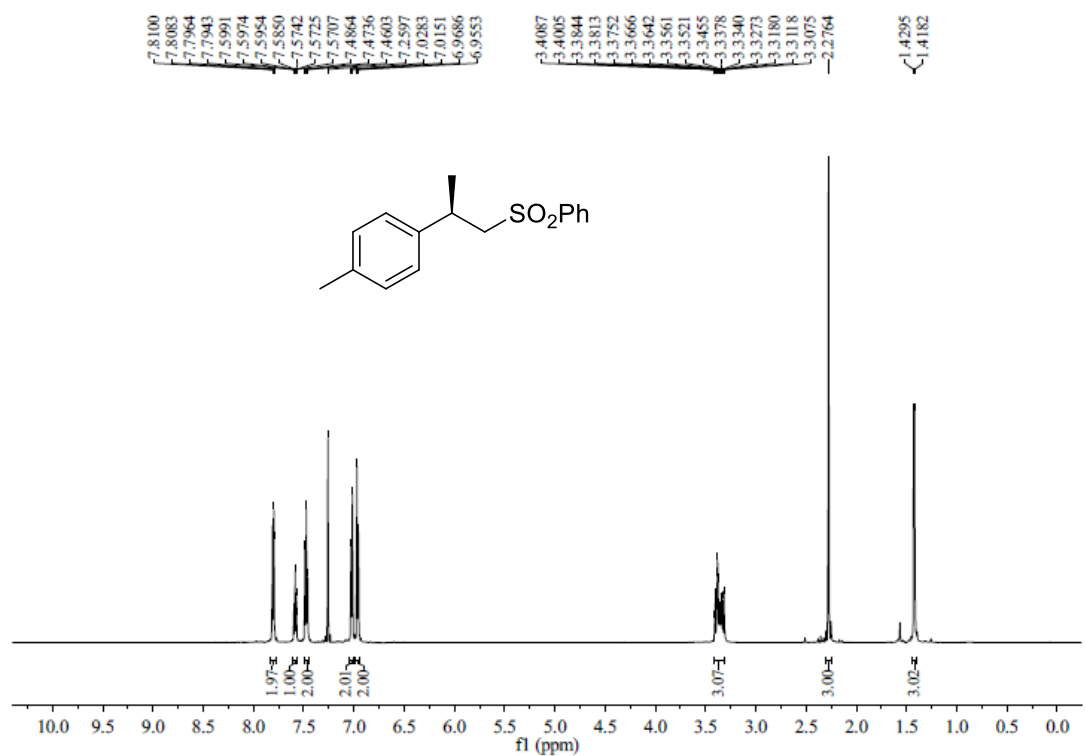
¹H NMR (600 MHz, Chloroform-*d*)

1-Methoxy-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2i**)



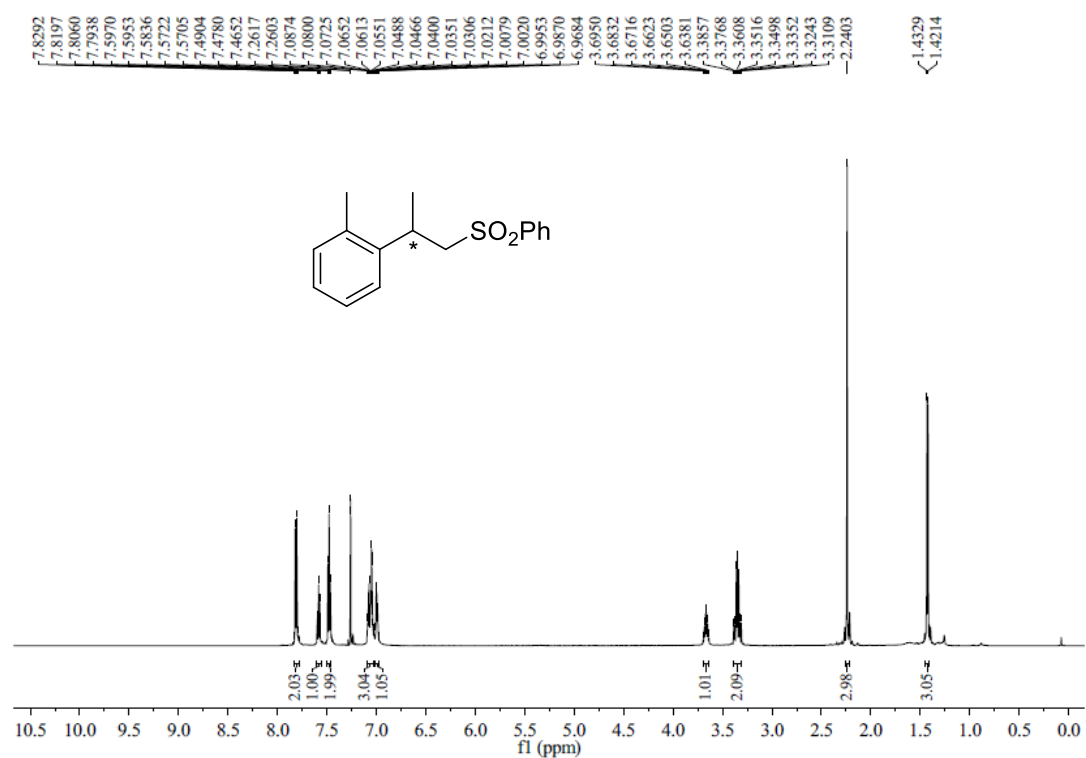
¹H NMR (600 MHz, Chloroform-*d*)

(*R*)-1-methyl-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2j**)



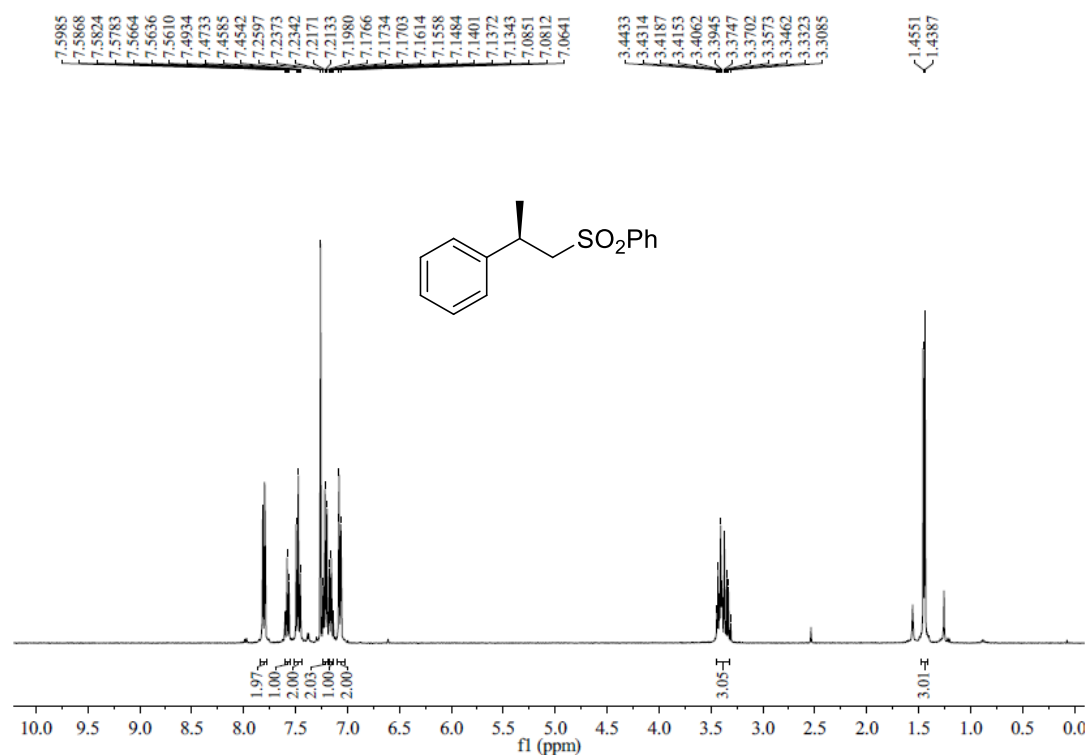
¹H NMR (600 MHz, Chloroform-*d*)

1-Methyl-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2k**)

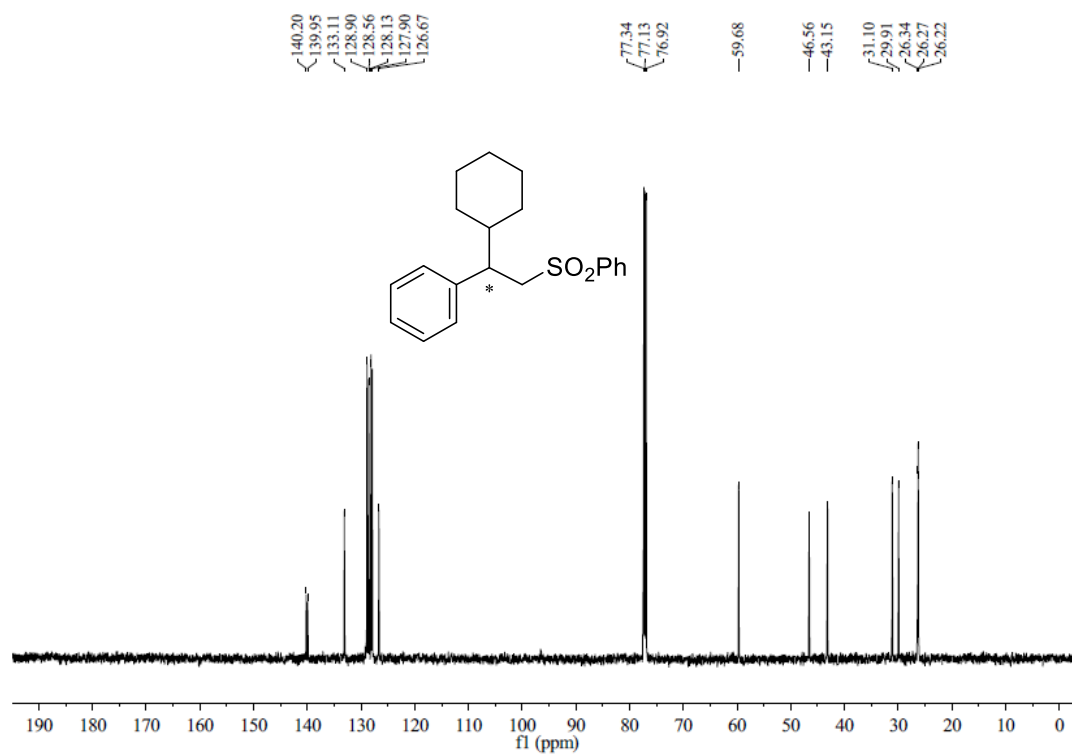


¹H NMR (600 MHz, Chloroform-*d*)

(*R*)-((2-phenylpropyl)sulfonyl)benzene (**2l**)

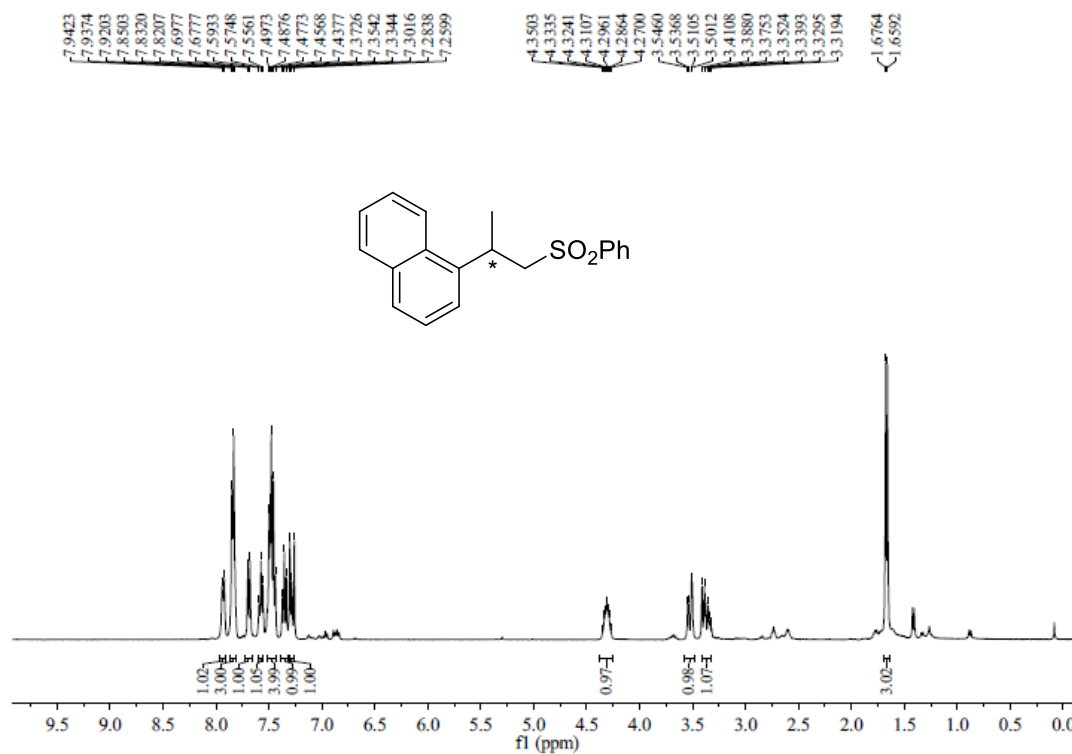


¹H NMR (400 MHz, Chloroform-*d*)



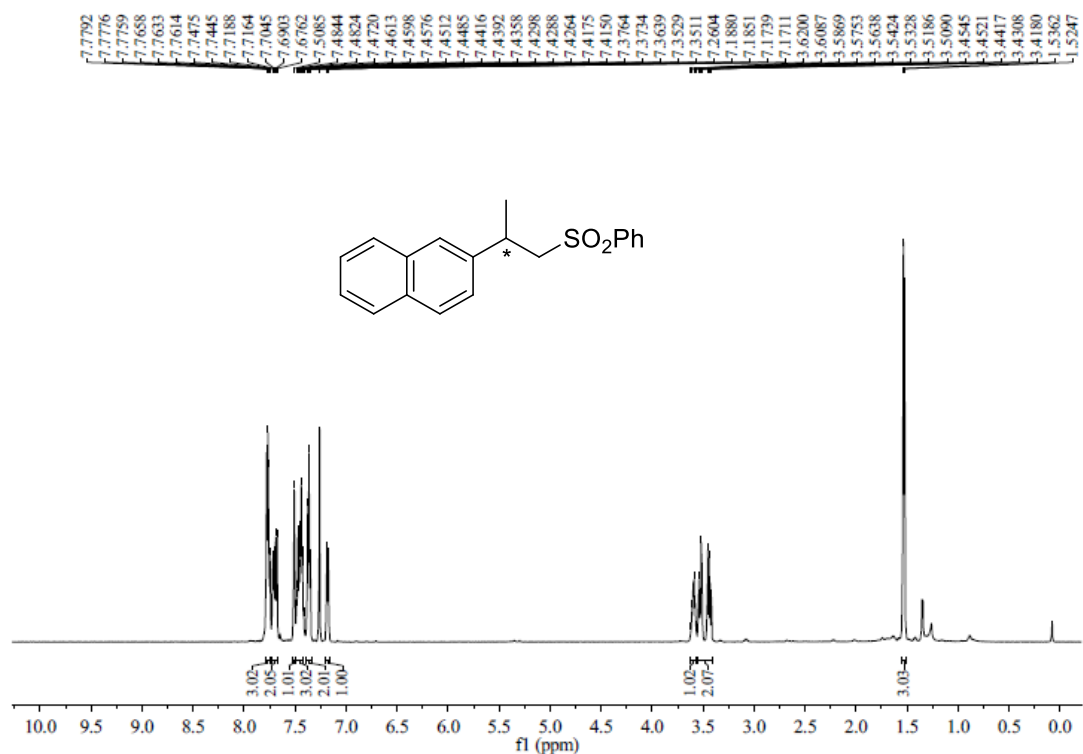
^{13}C NMR (150 MHz, Chloroform-*d*)

1-(1-(Phenylsulfonyl)propan-2-yl)naphthalene (**2o**)



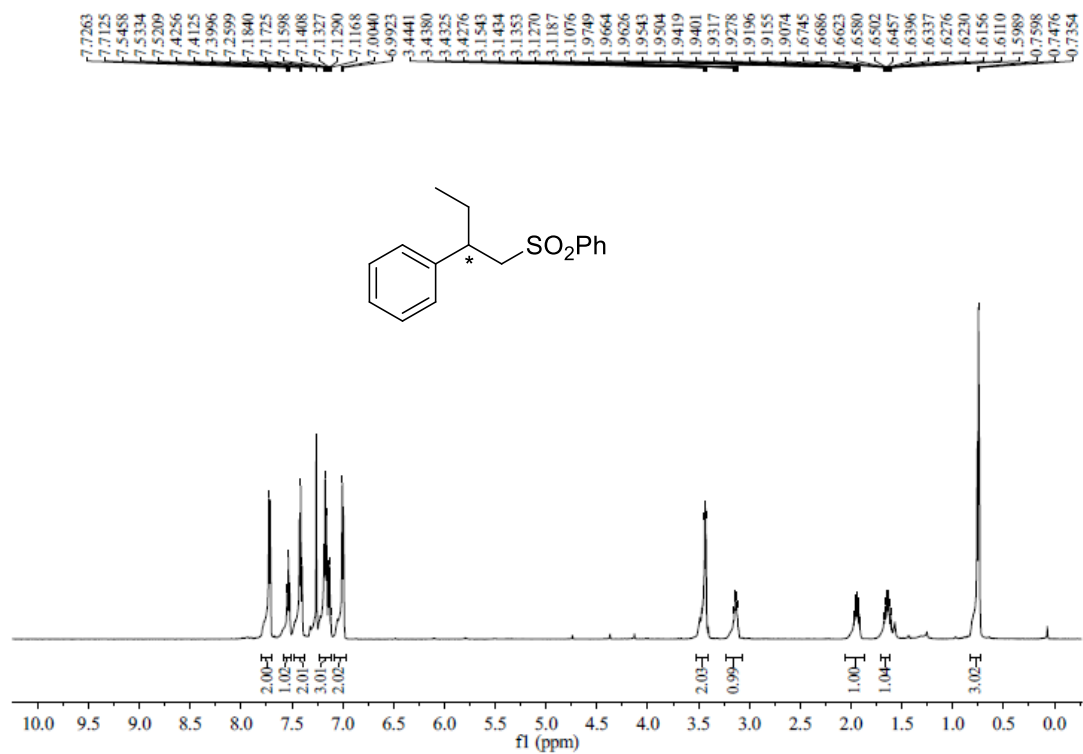
^1H NMR (400 MHz, Chloroform-*d*)

2-(1-(Phenylsulfonyl)propan-2-yl)naphthalene (**2p**)



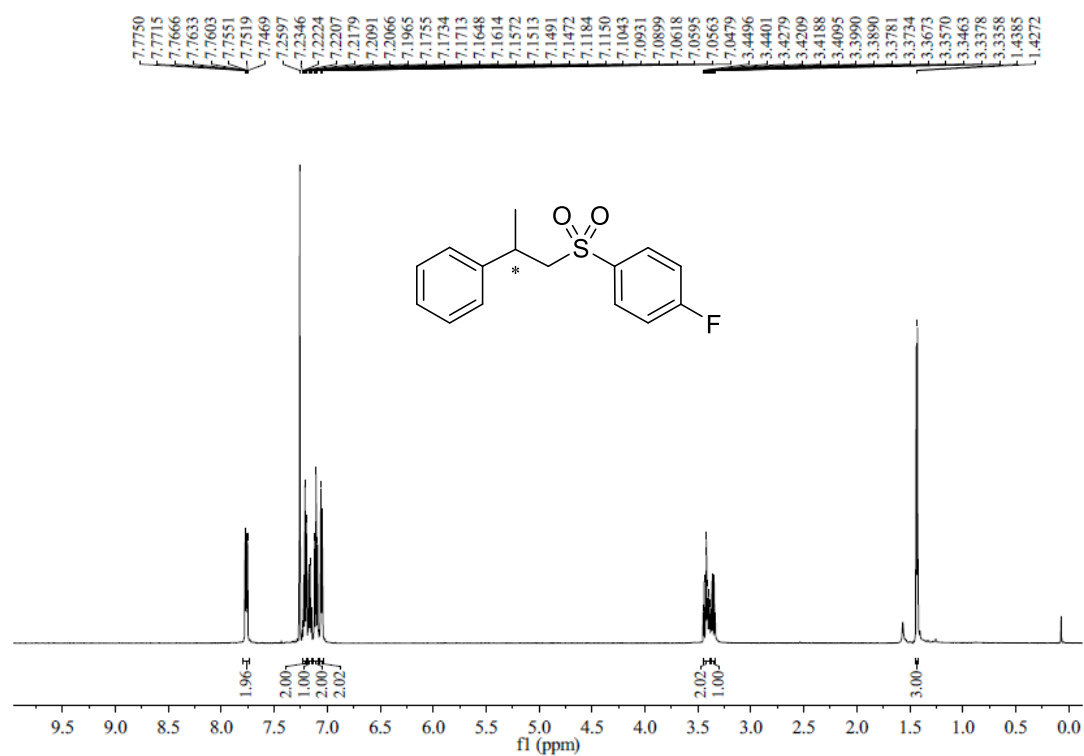
¹H NMR (600 MHz, Chloroform-*d*)

((2-Phenylbutyl)sulfonyl)benzene (**2q**)

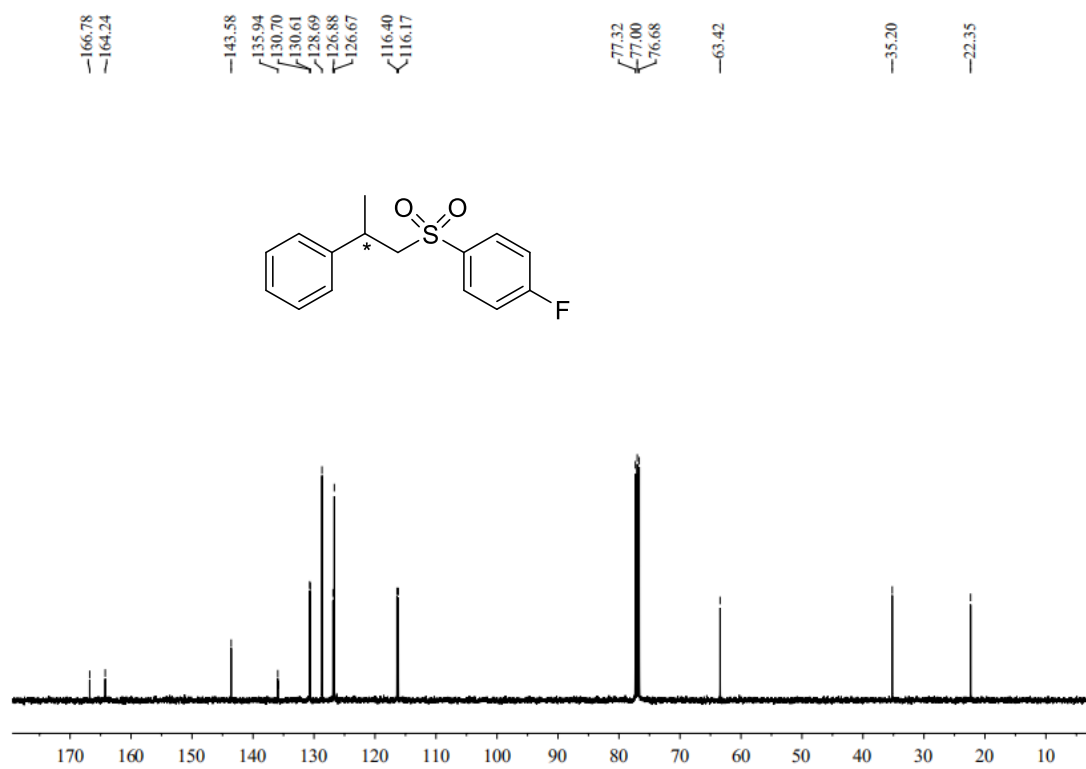


¹H NMR (600 MHz, Chloroform-*d*)

1-Fluoro-4-((2-phenylpropyl)sulfonyl)benzene (**2r**)

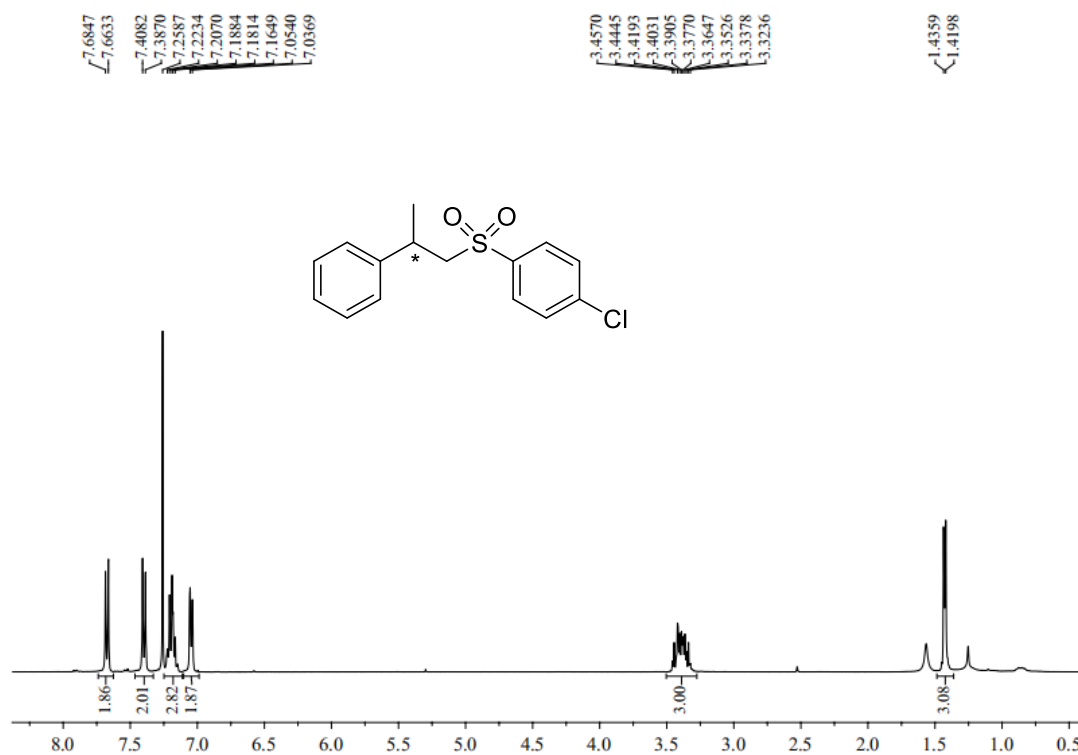


¹H NMR (600 MHz, Chloroform-*d*)



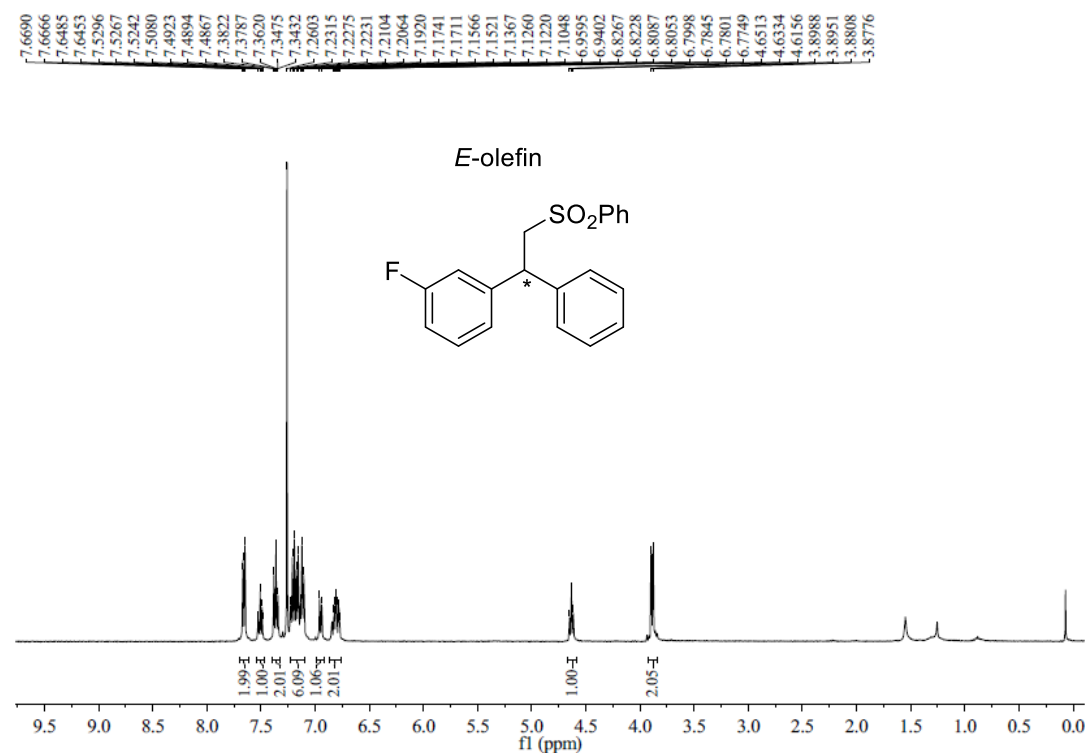
¹³C NMR (100 MHz, Chloroform-*d*)

1-Chloro-4-((2-phenylpropyl)sulfonyl)benzene (**2s**)

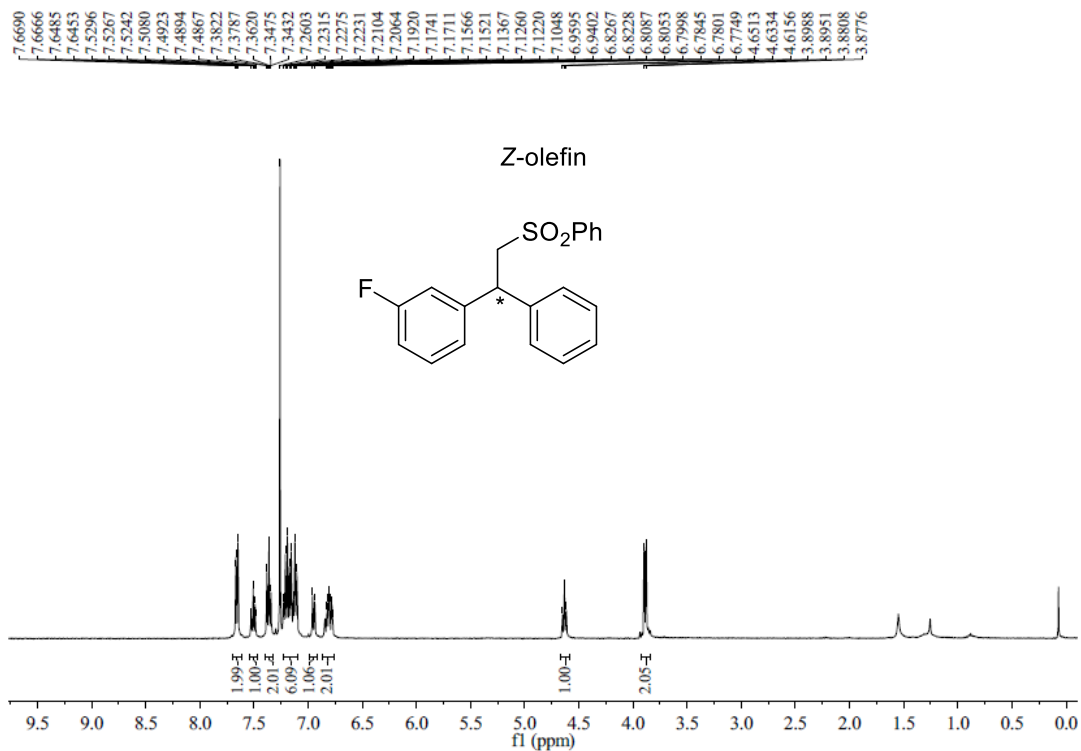


¹H NMR (400 MHz, Chloroform-*d*)

1-Fluoro-3-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4a**)

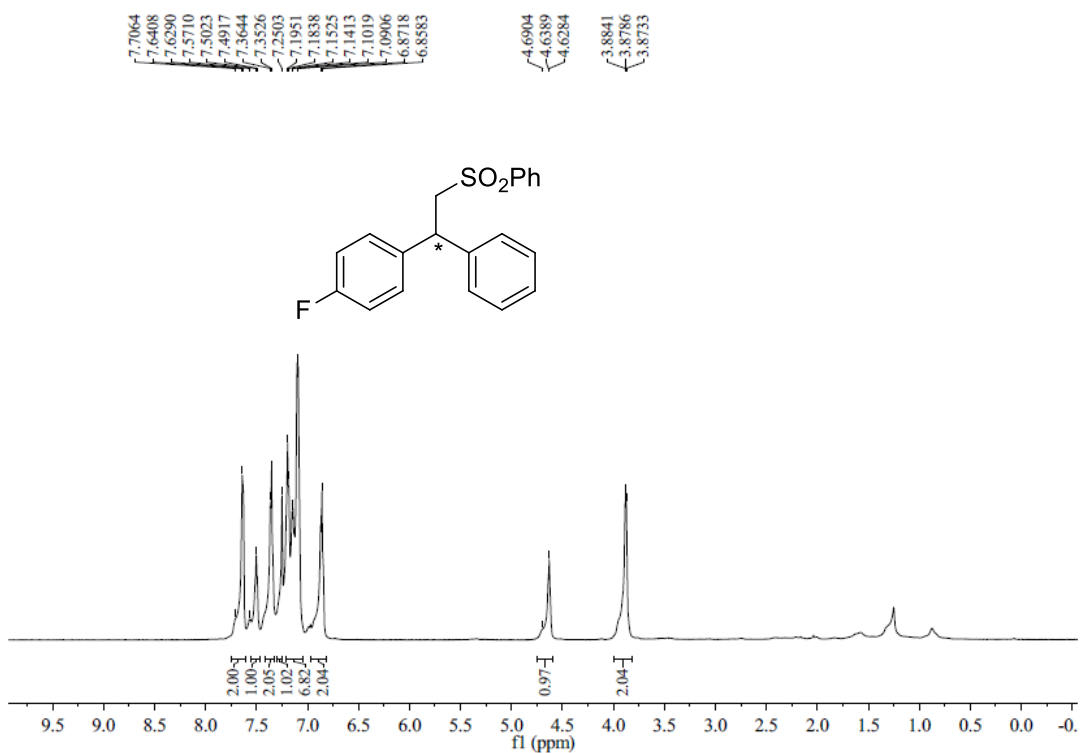


¹H NMR (400 MHz, Chloroform-*d*)



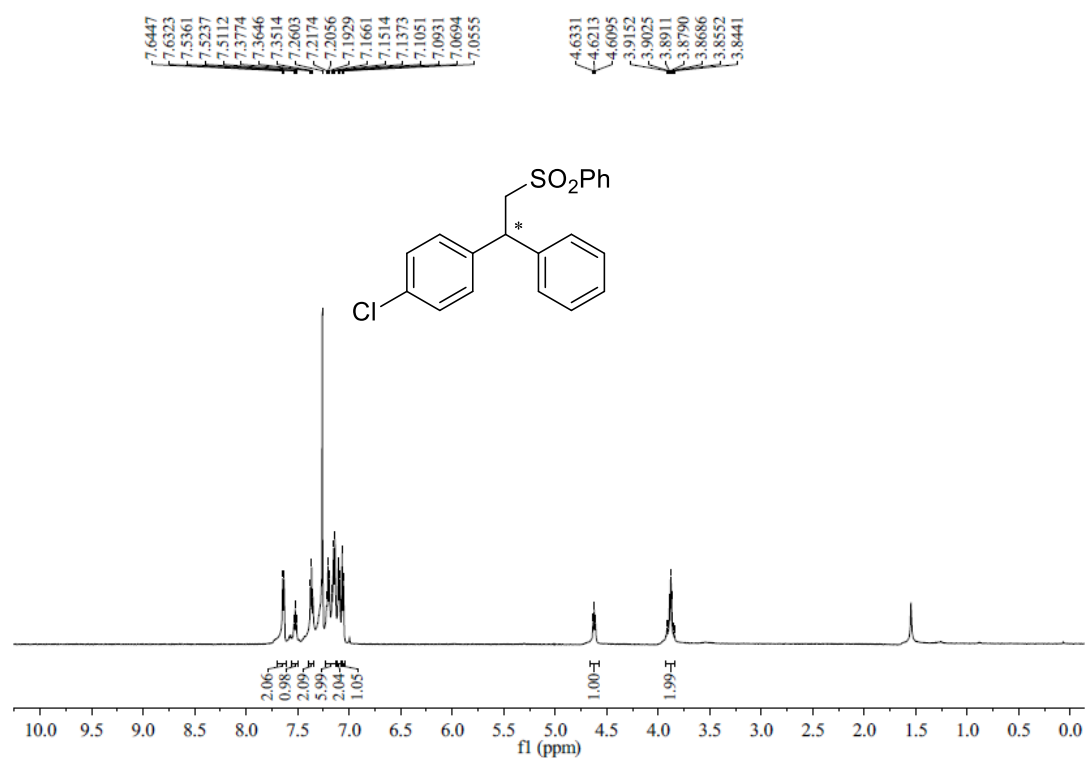
¹H NMR (400 MHz, Chloroform-*d*)

1-Fluoro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4b**)



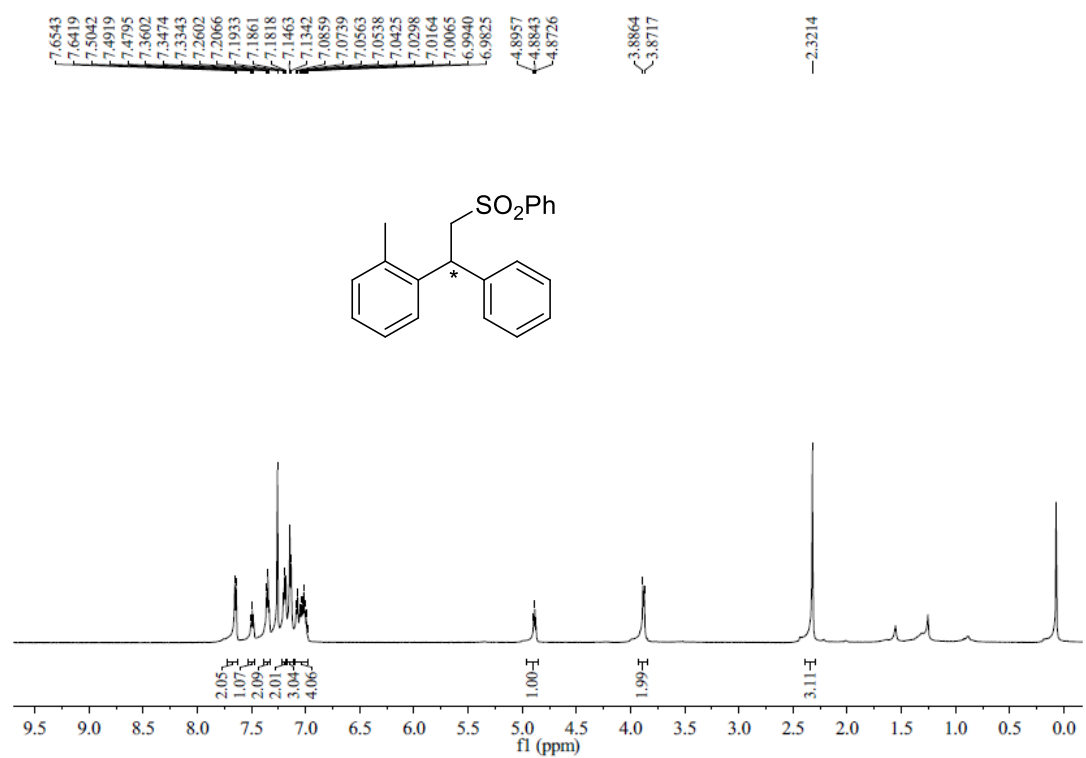
¹H NMR (600 MHz, Chloroform-*d*)

1-Chloro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4c**)



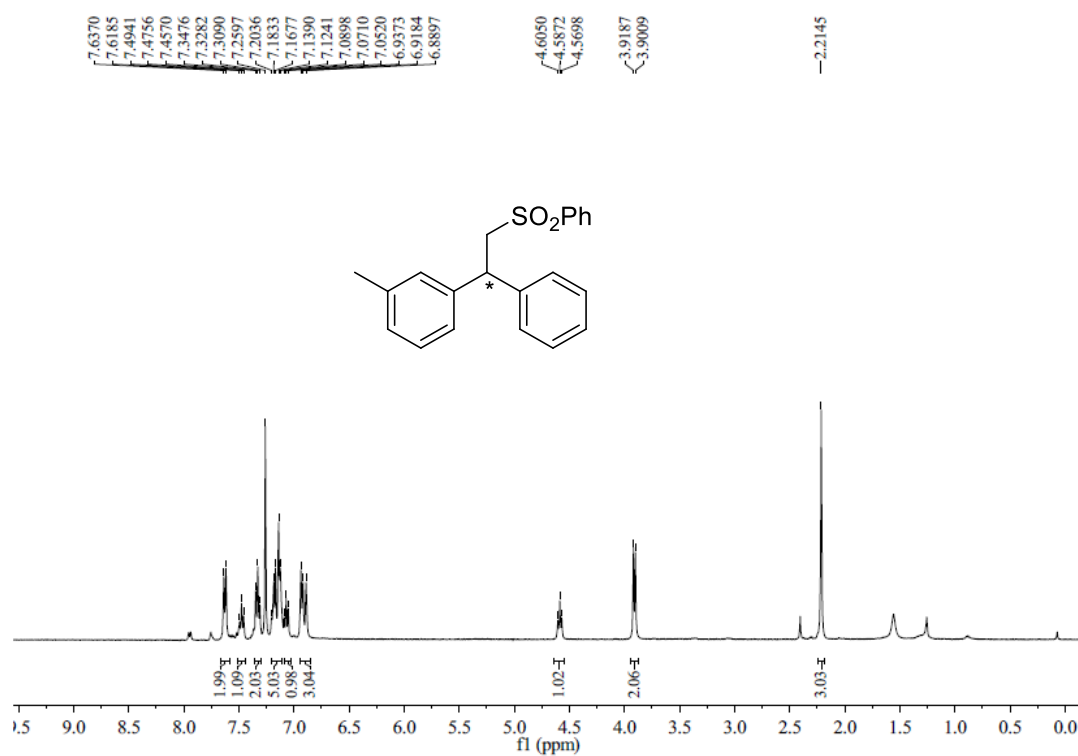
¹H NMR (600 MHz, Chloroform-*d*)

1-Methyl-2-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4d**)



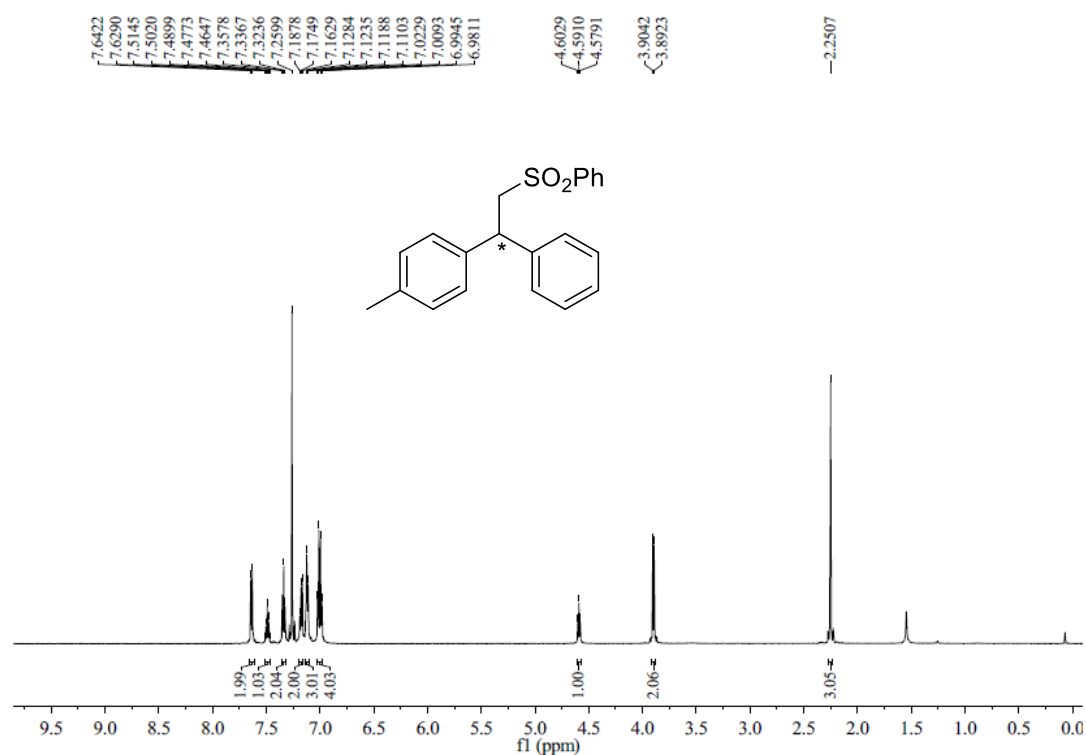
¹H NMR (600 MHz, Chloroform-*d*)

1-Methyl-3-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4e**)



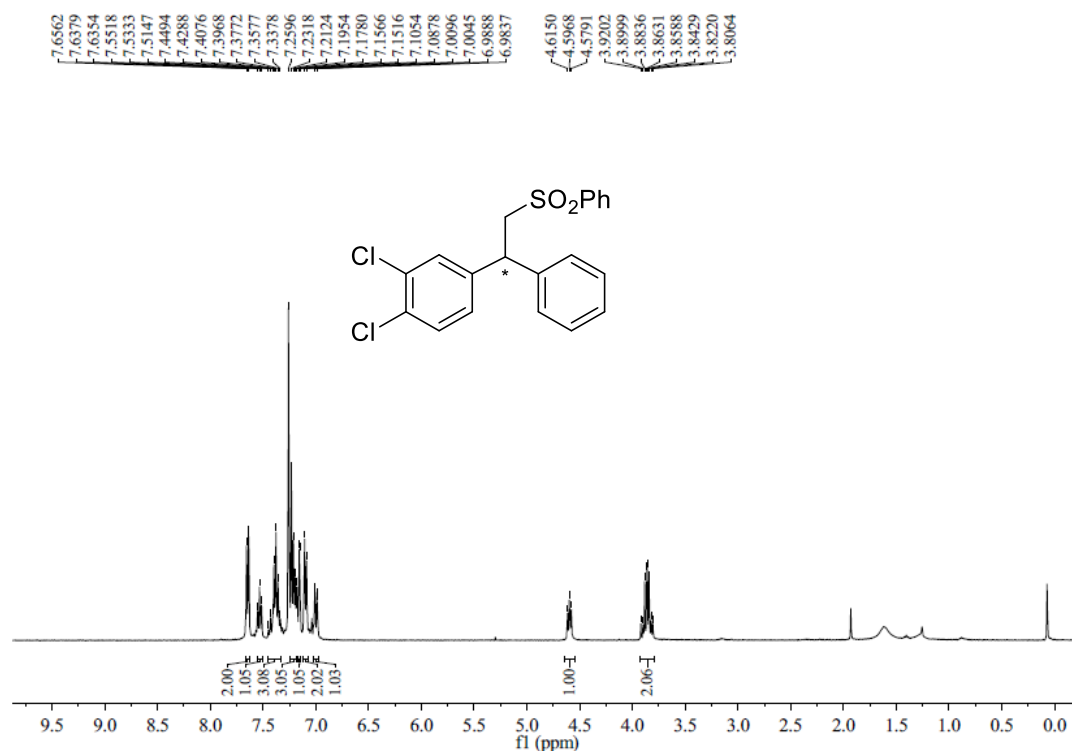
¹H NMR (400 MHz, Chloroform-*d*)

1-Methyl-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4f**)



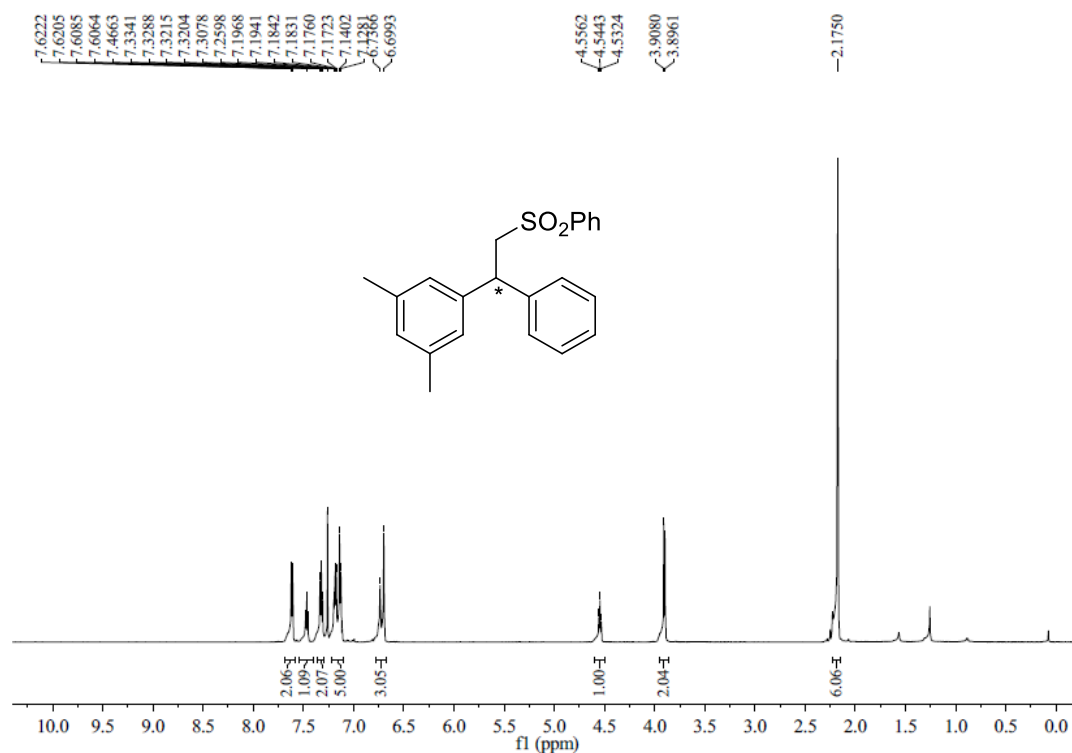
¹H NMR (600 MHz, Chloroform-*d*)

1,2-Dichloro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4g**)



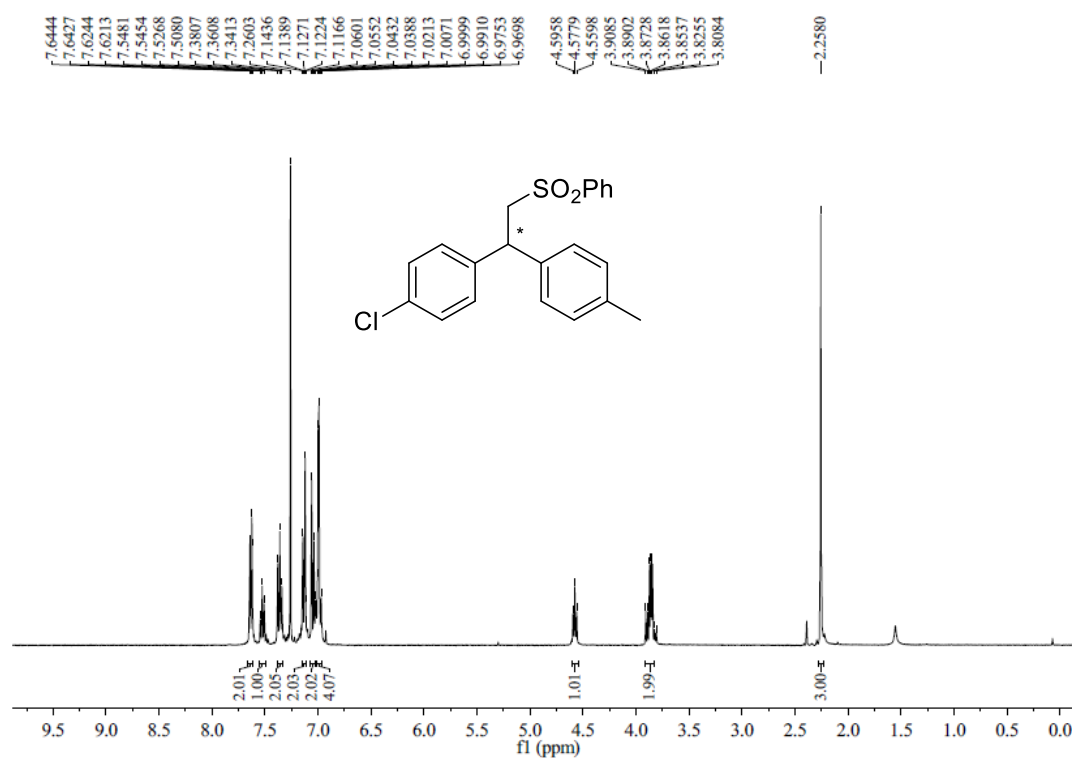
¹H NMR (400 MHz, Chloroform-*d*)

1,3-Dimethyl-5-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4h**)

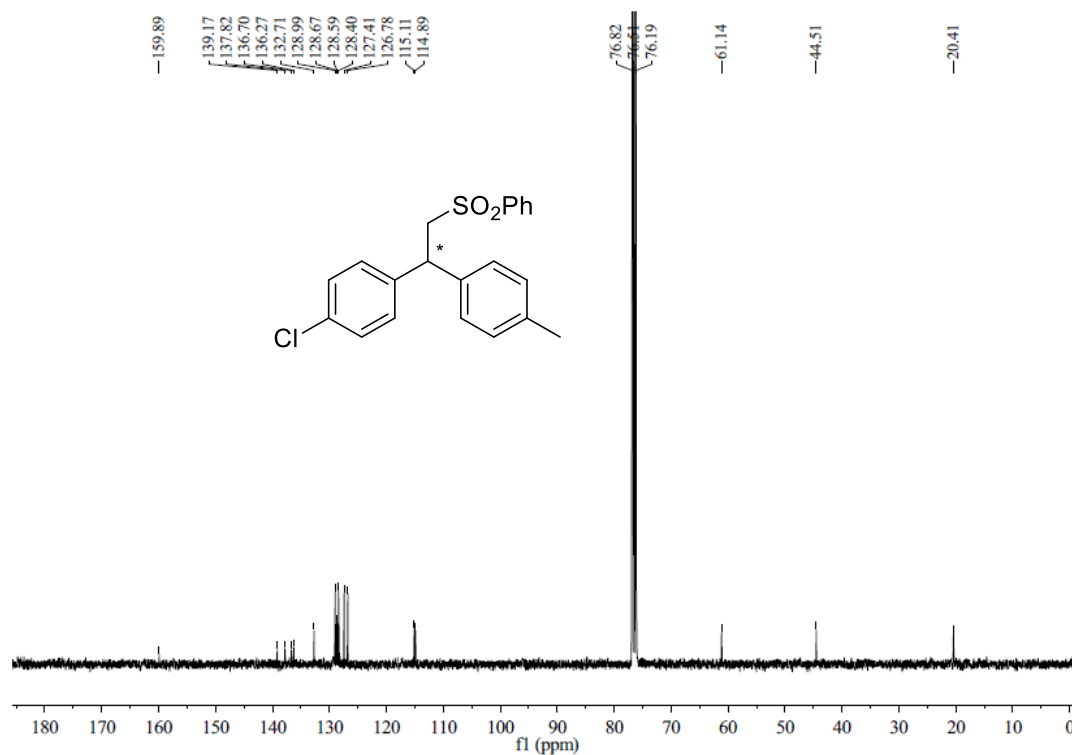


¹H NMR (600 MHz, Chloroform-*d*)

1-Chloro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4i**)

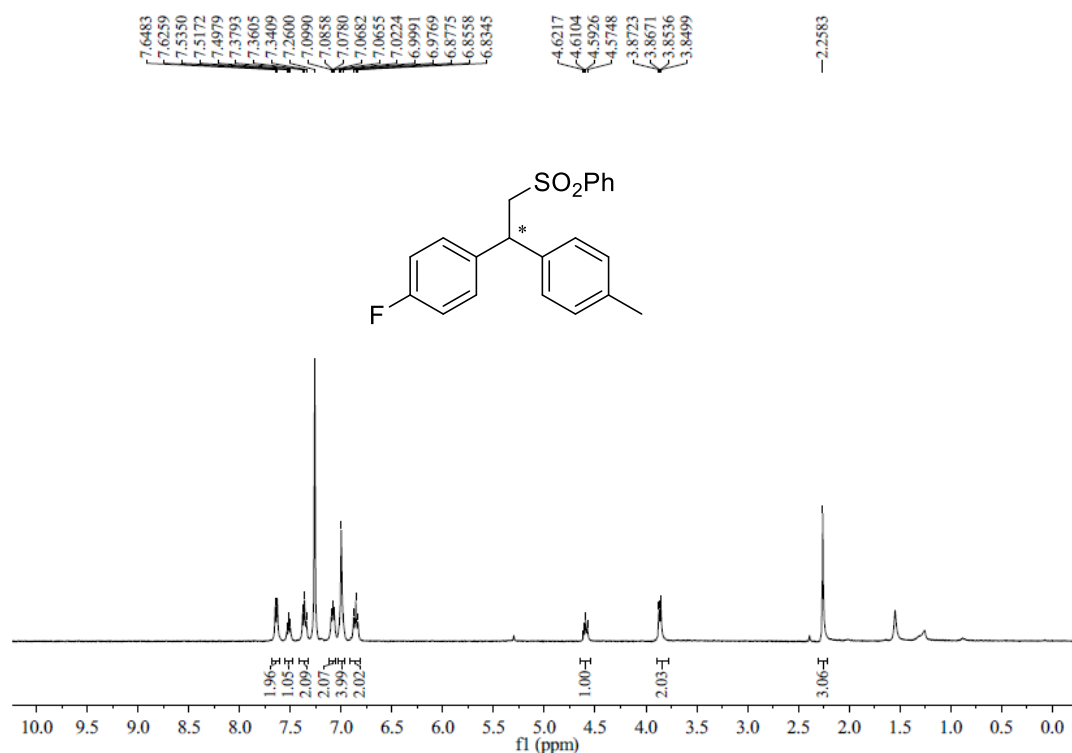


¹H NMR (400 MHz, Chloroform-*d*)



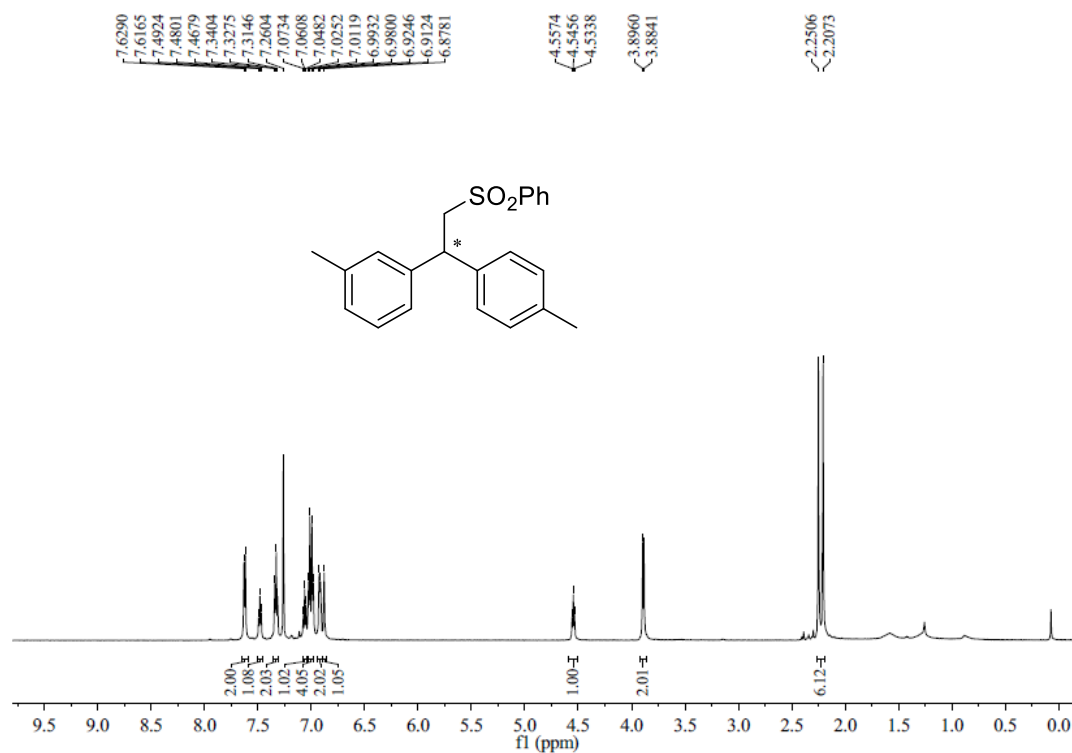
¹³C NMR (100 MHz, Chloroform-*d*)

1-Fluoro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4j**)



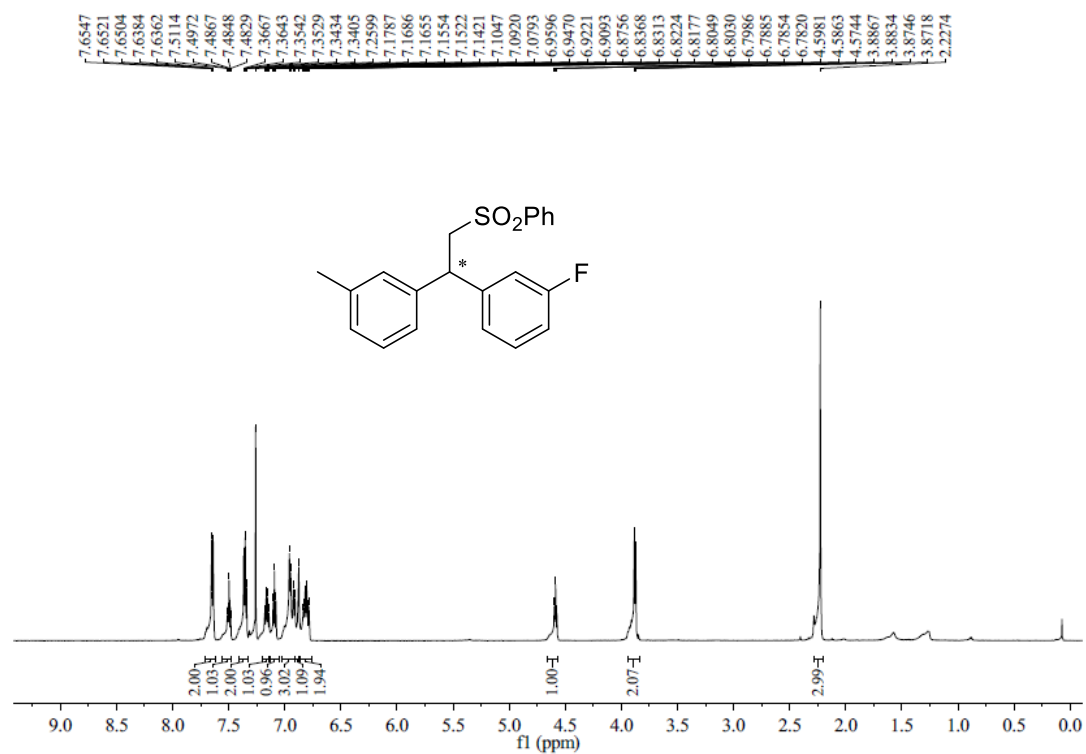
¹H NMR (400 MHz, Chloroform-*d*)

1-Methyl-3-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4k**)

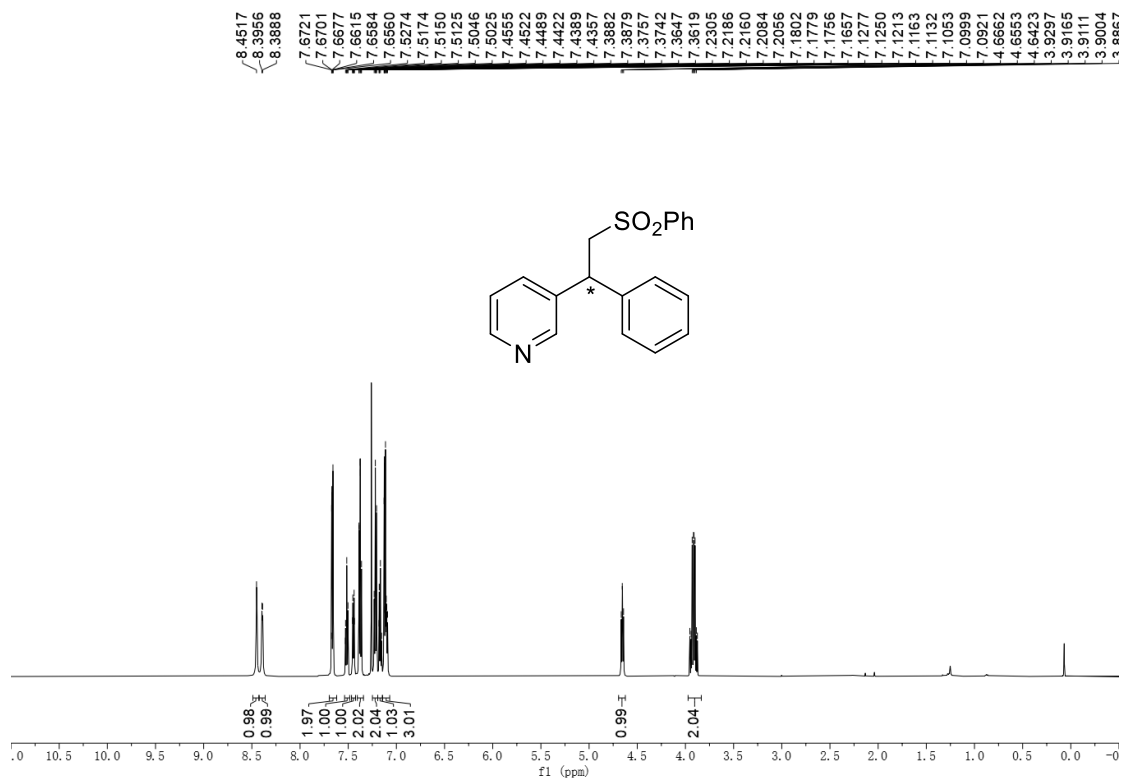


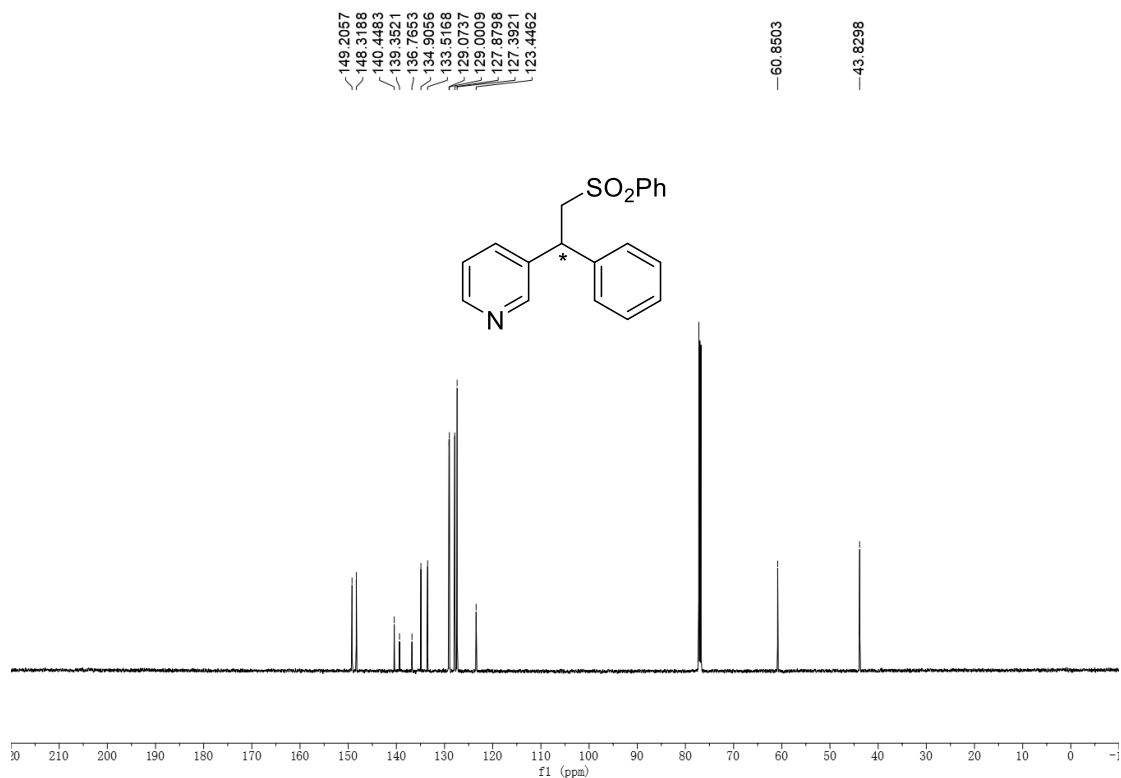
¹H NMR (600 MHz, Chloroform-*d*)

1-Fluoro-3-(2-(phenylsulfonyl)-1-(*m*-tolyl)ethyl)benzene (**4l**)



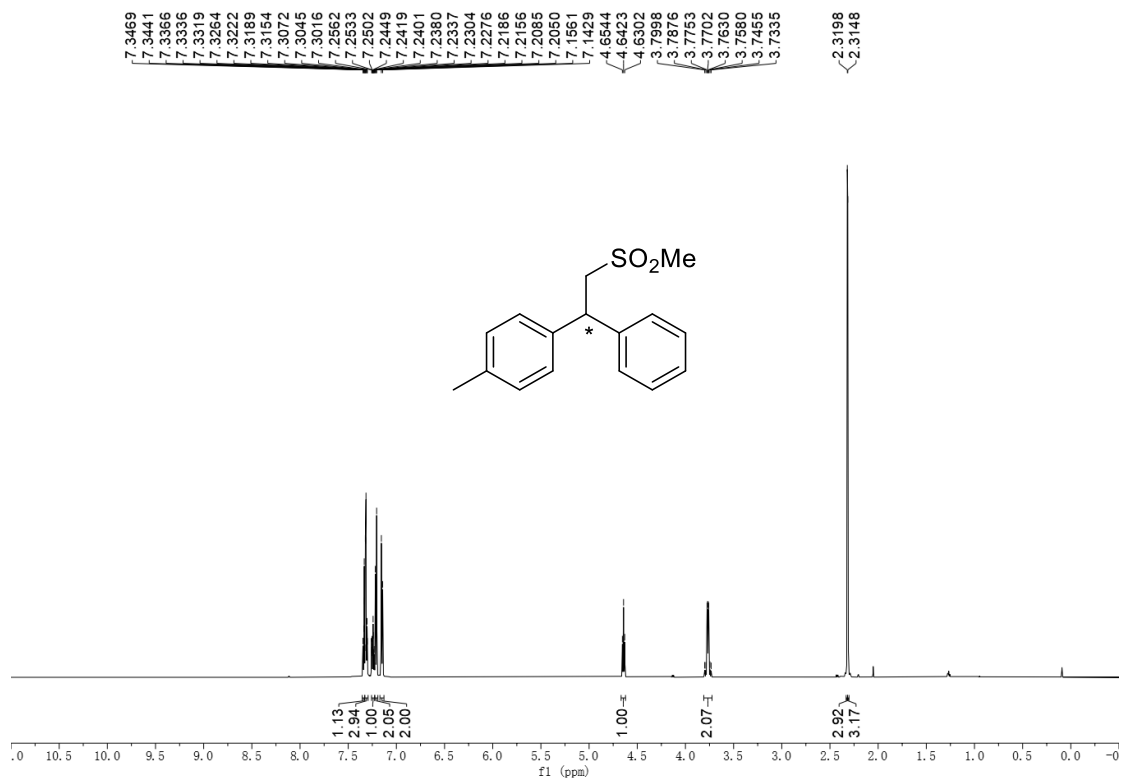
3-(1-Phenyl-2-(phenylsulfonyl)ethyl)pyridine (**4m**)





¹³C NMR (151 MHz, Chloroform-*d*)

1-Methyl-4-(2-(methylsulfonyl)-1-phenylethyl)benzene (**4n**)



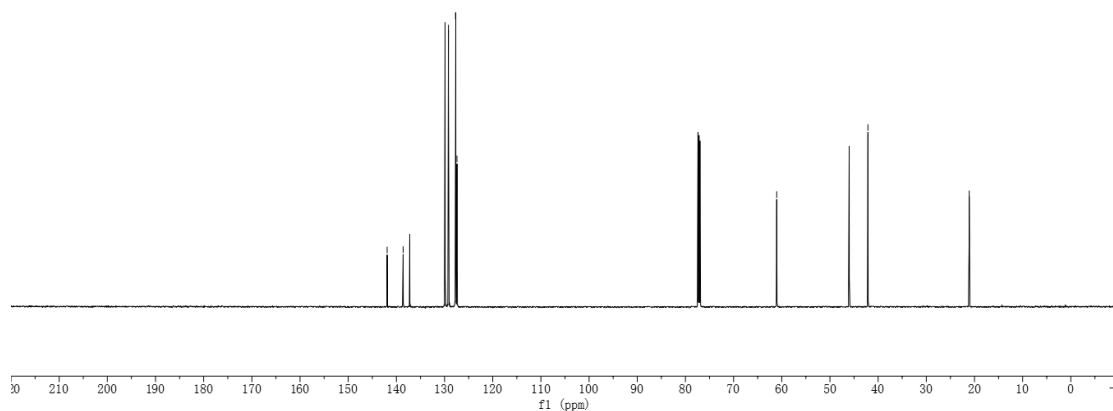
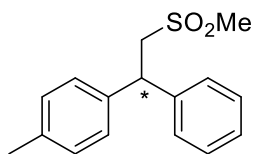
¹H NMR (600 MHz, Chloroform-*d*)

141.9220
138.5983
137.2338
129.8946
129.1946
127.7336
127.6729
127.4228

61.0487

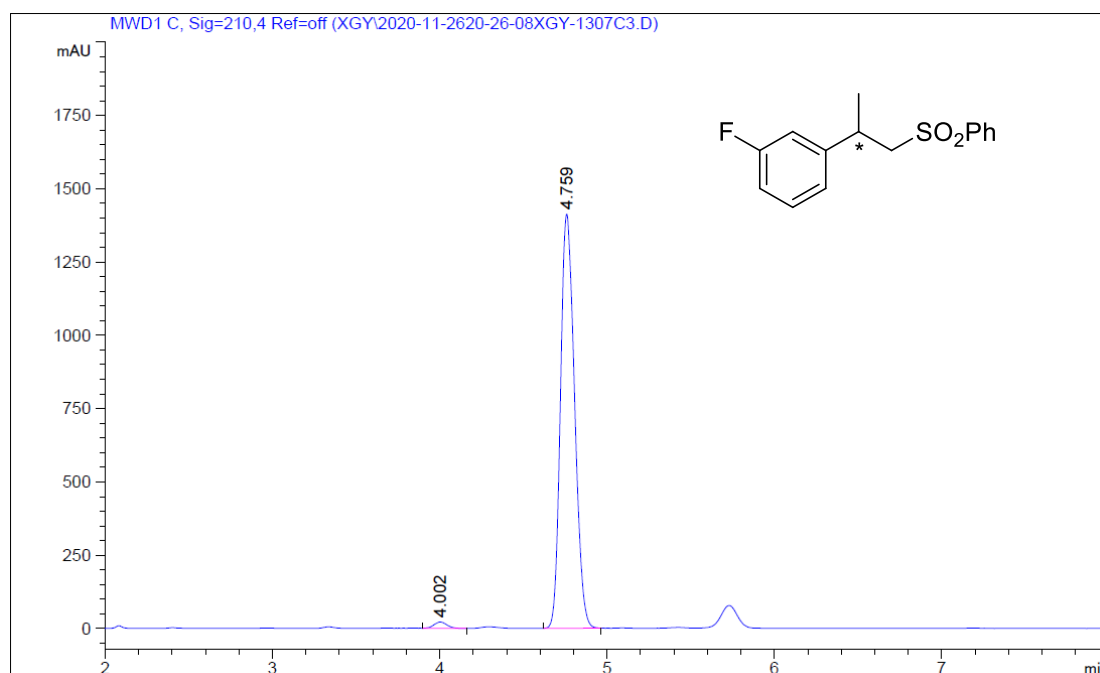
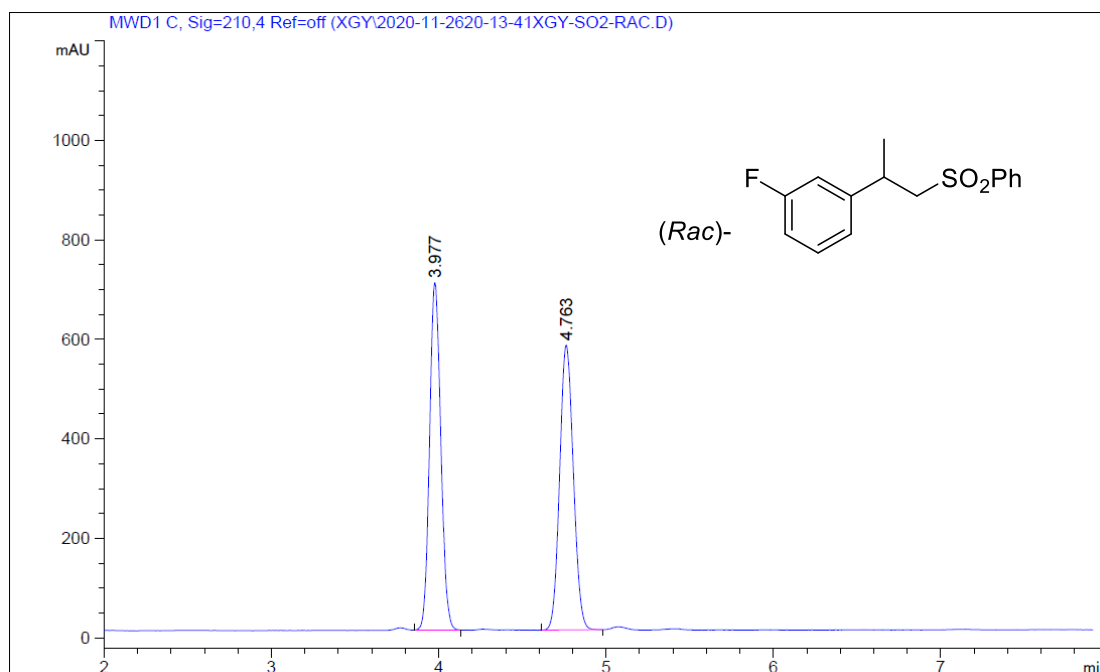
46.0062
42.1130

21.0905



¹³C NMR (151 MHz, Chloroform-*d*)

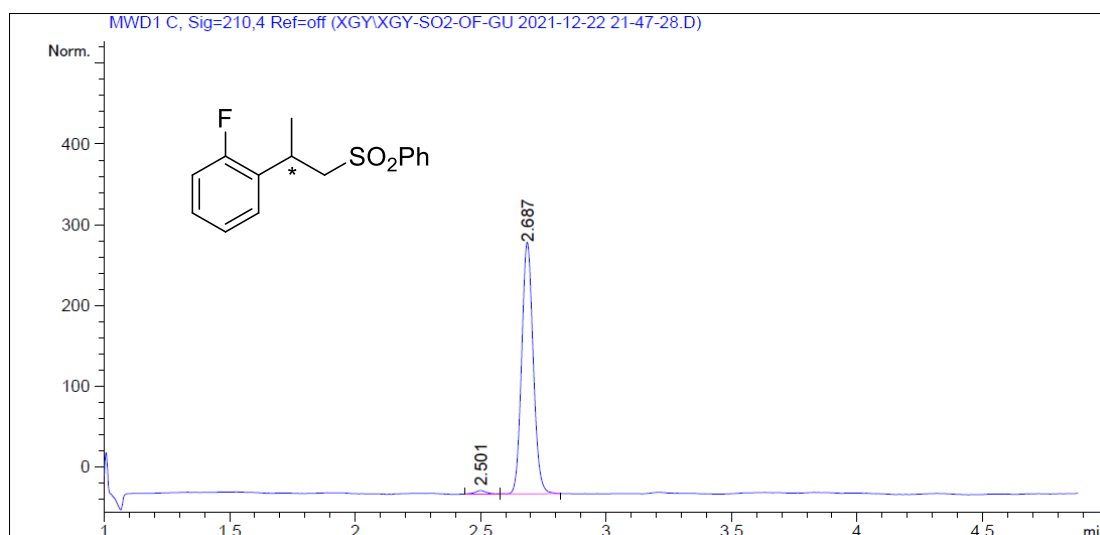
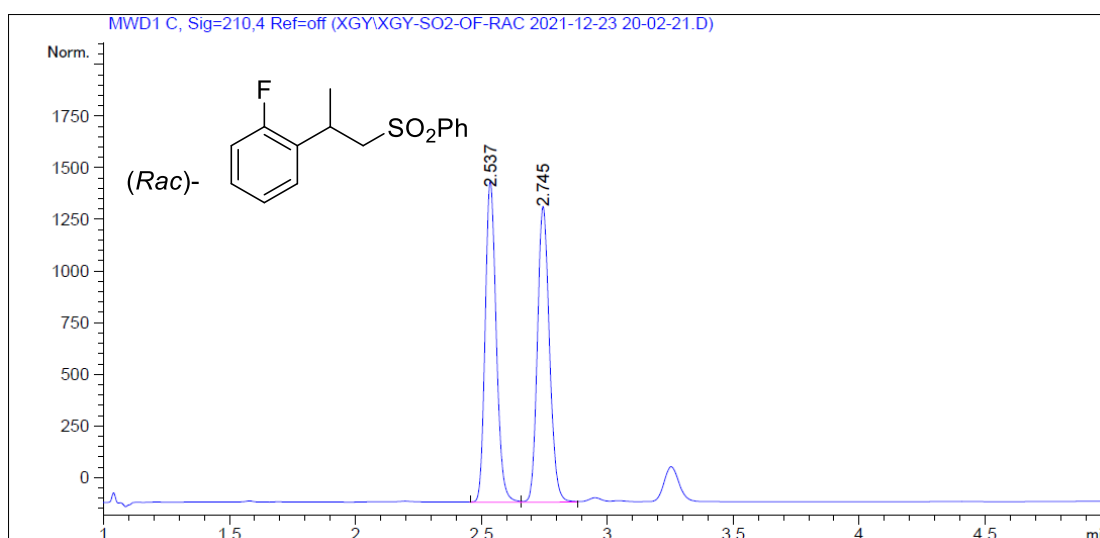
1-Fluoro-3-(1-(phenylsulfonyl)propan-2-yl)benzene (2a)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.002	BB	0.0788	115.46550	21.46290	1.3749
2	4.759	BB	0.0919	8282.41113	1412.36768	98.6251

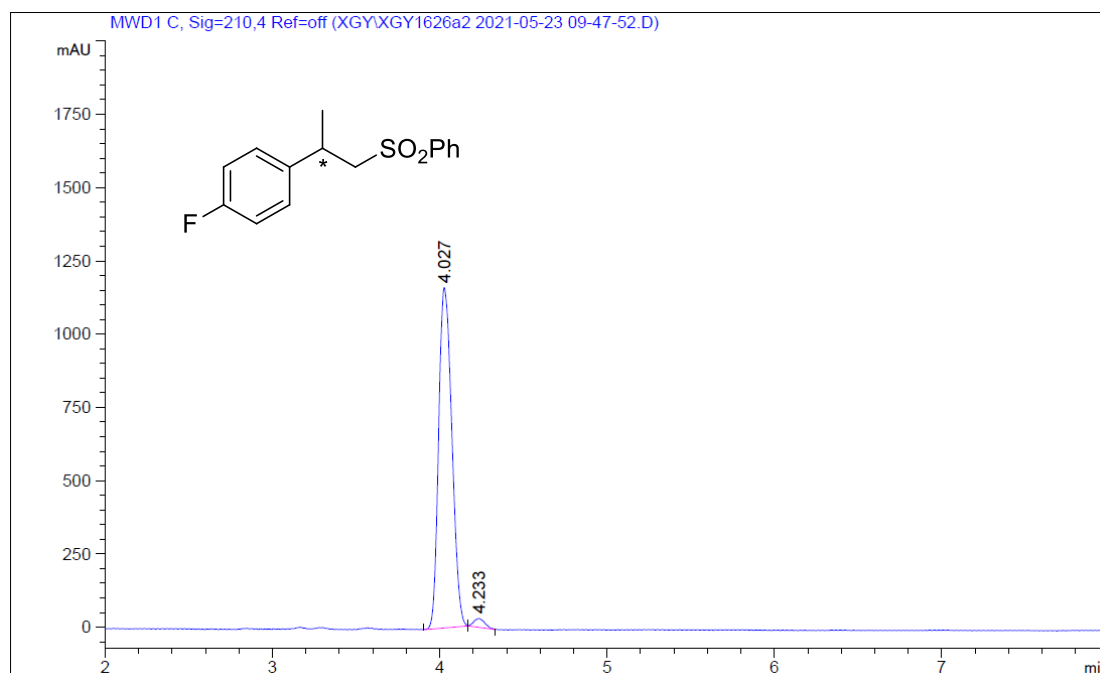
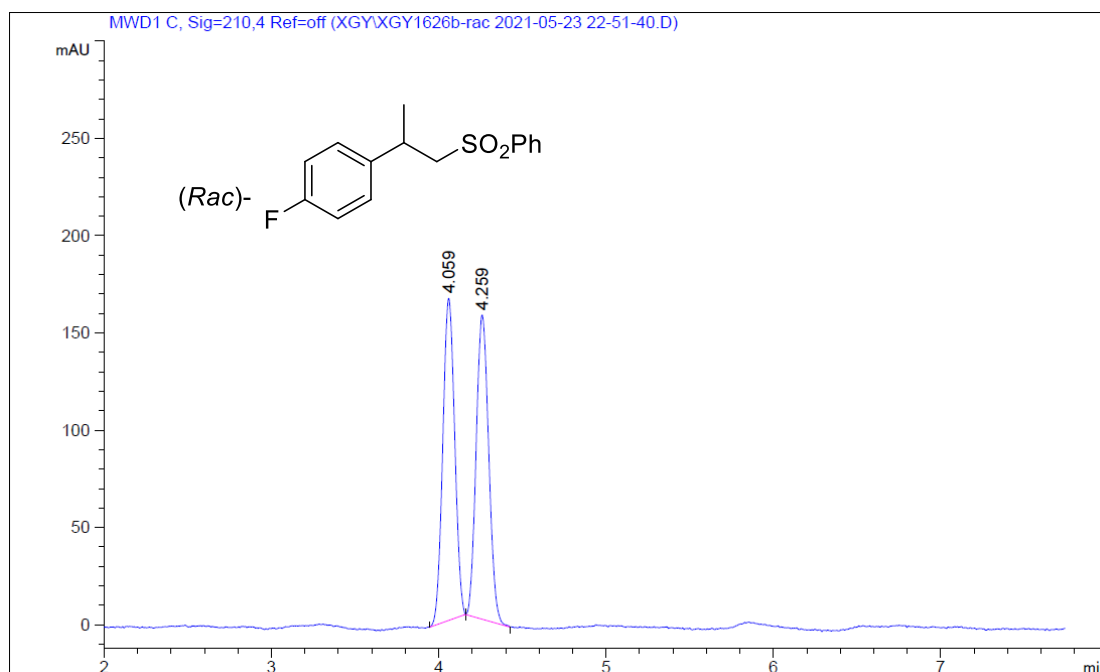
1-Fluoro-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2b**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.501	BV	0.0472	9.30723	3.08132	1.1836
2	2.687	VB	0.0499	777.01752	239.02773	98.8164

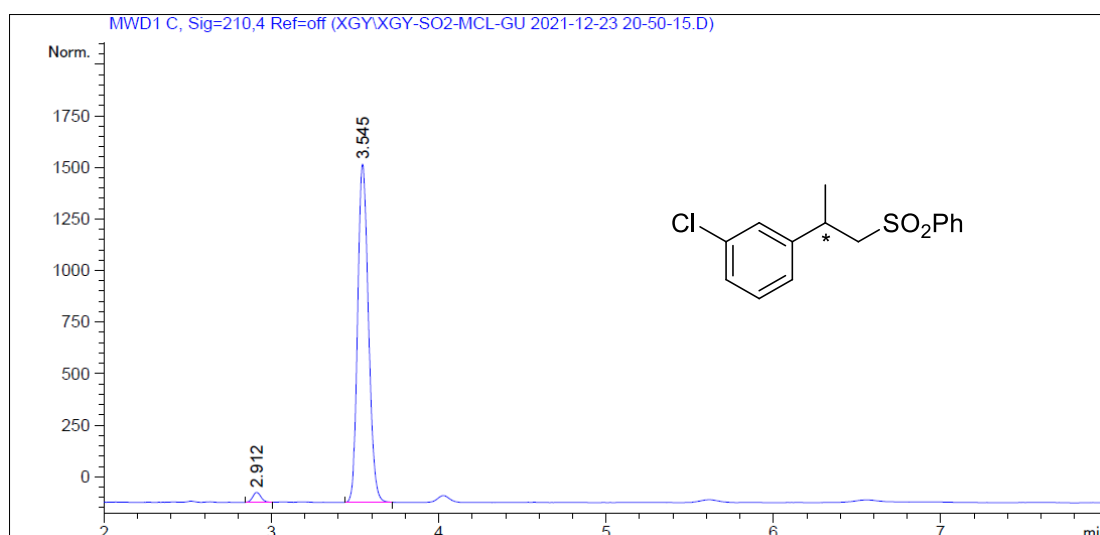
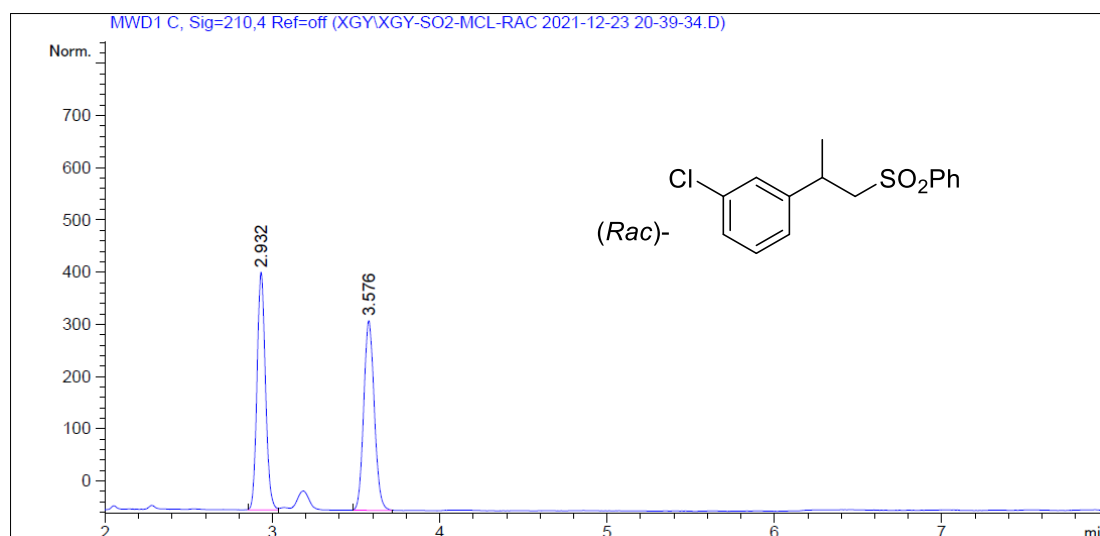
1-Fluoro-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2c**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.027	BB	0.0840	6378.52734	1161.85779	97.8981
2	4.233	BB	0.0584	136.94913	30.17833	2.1019

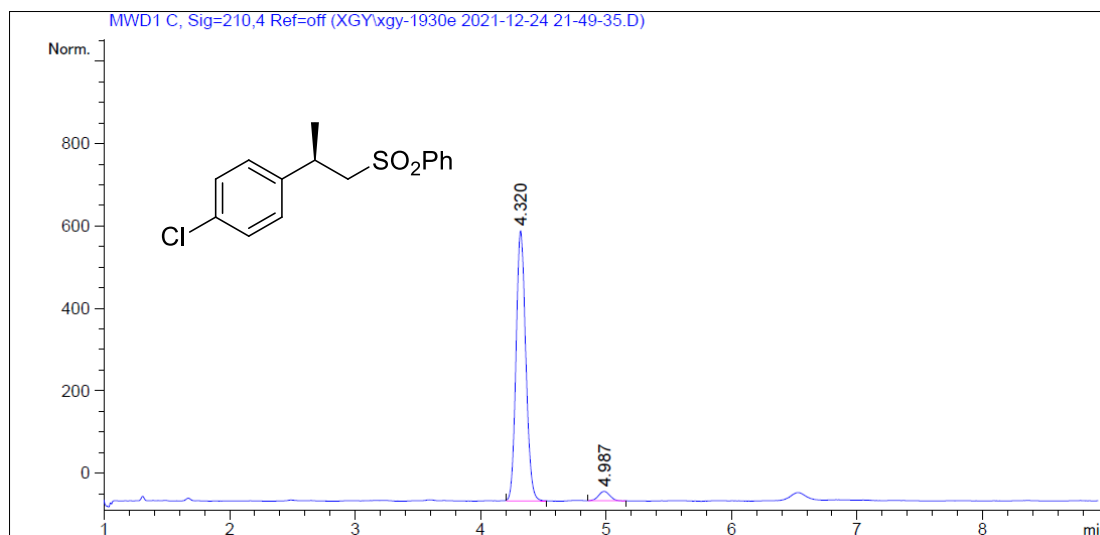
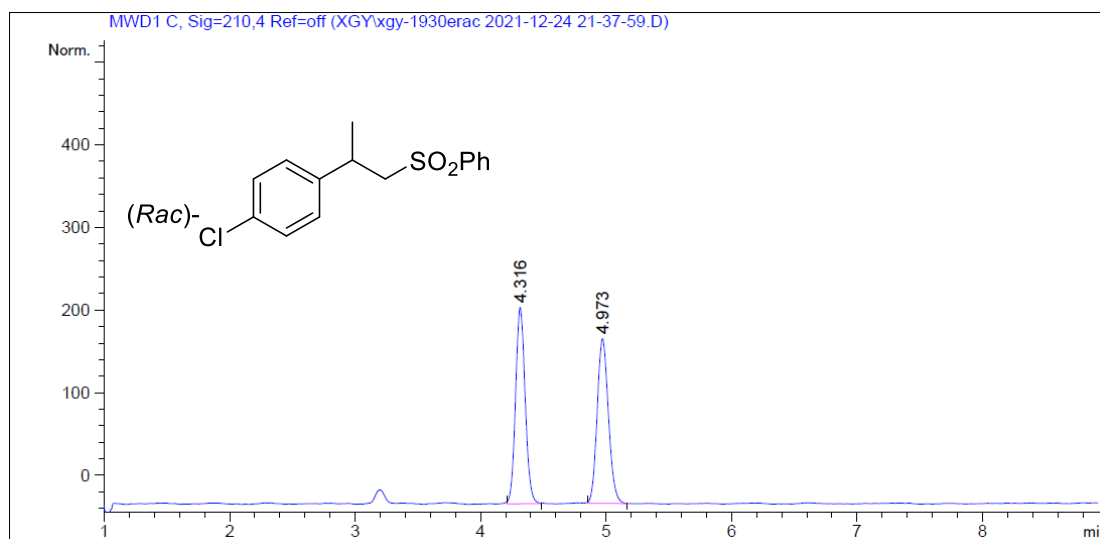
1-Chloro-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2d**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

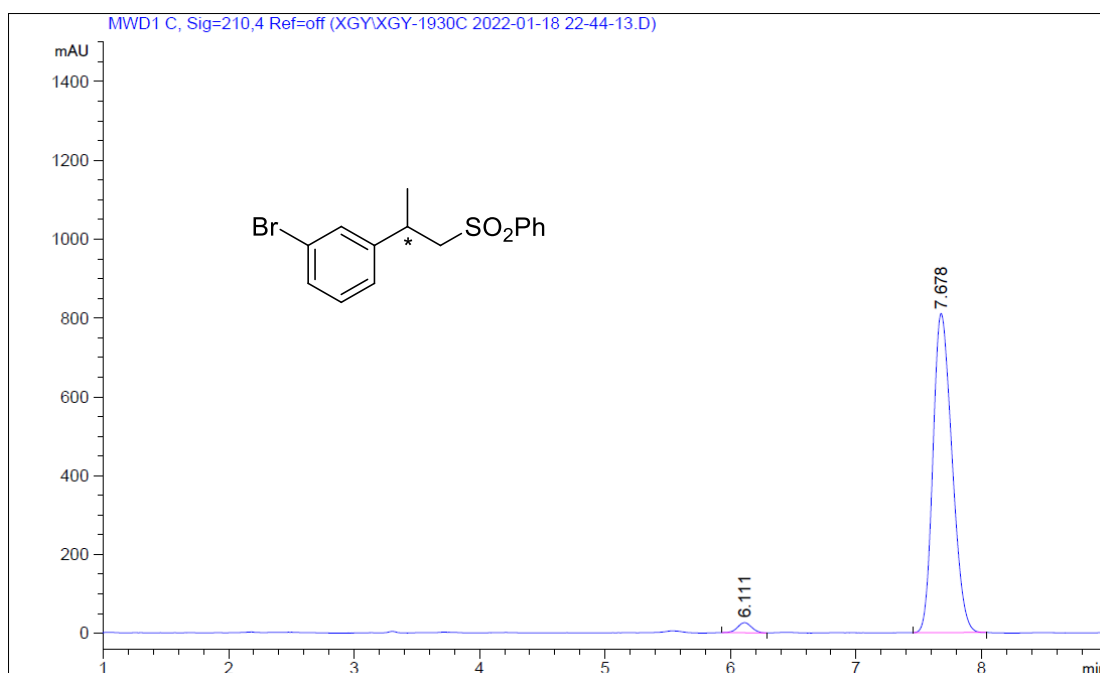
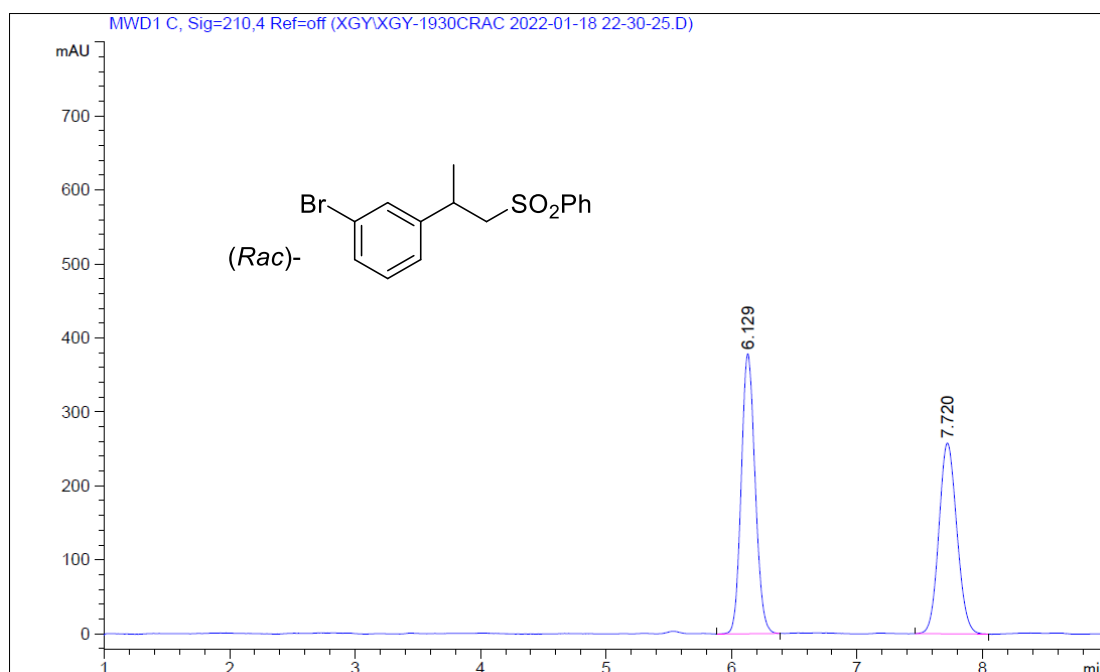
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.912	BB	0.0531	137.62511	40.53836	2.1557
2	3.545	BB	0.0698	6246.64551	1393.34827	97.8443

(R)-1-chloro-4-(1-(phenylsulfonyl)propan-2-yl)benzene (2e)



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.320	BB	0.0838	2790.52832	518.01605	96.1888
2	4.987	BB	0.0981	110.56622	17.88206	3.8112

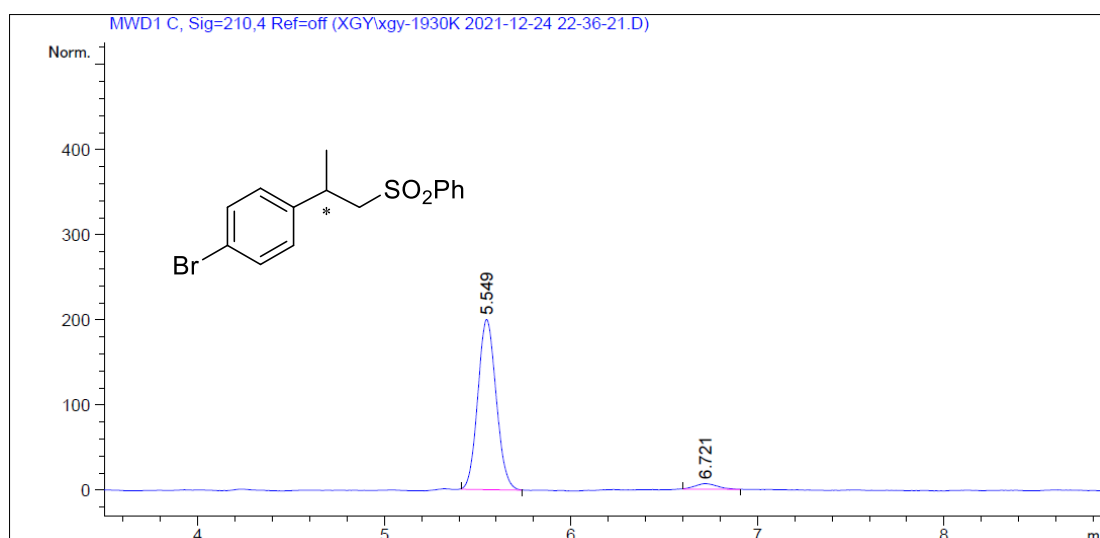
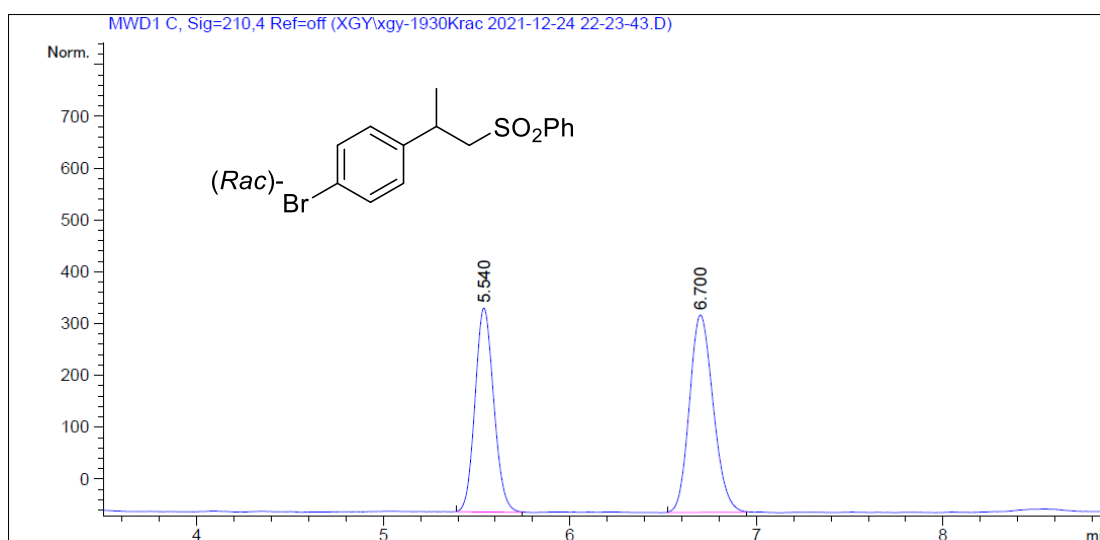
1-Bromo-3-(1-(phenylsulfonyl)propan-2-yl)benzene (**2f**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	6.111	BB	0.1171	201.45493	25.80639	2.3052
2	7.678	BB	0.1616	8537.56348	809.39941	97.6948

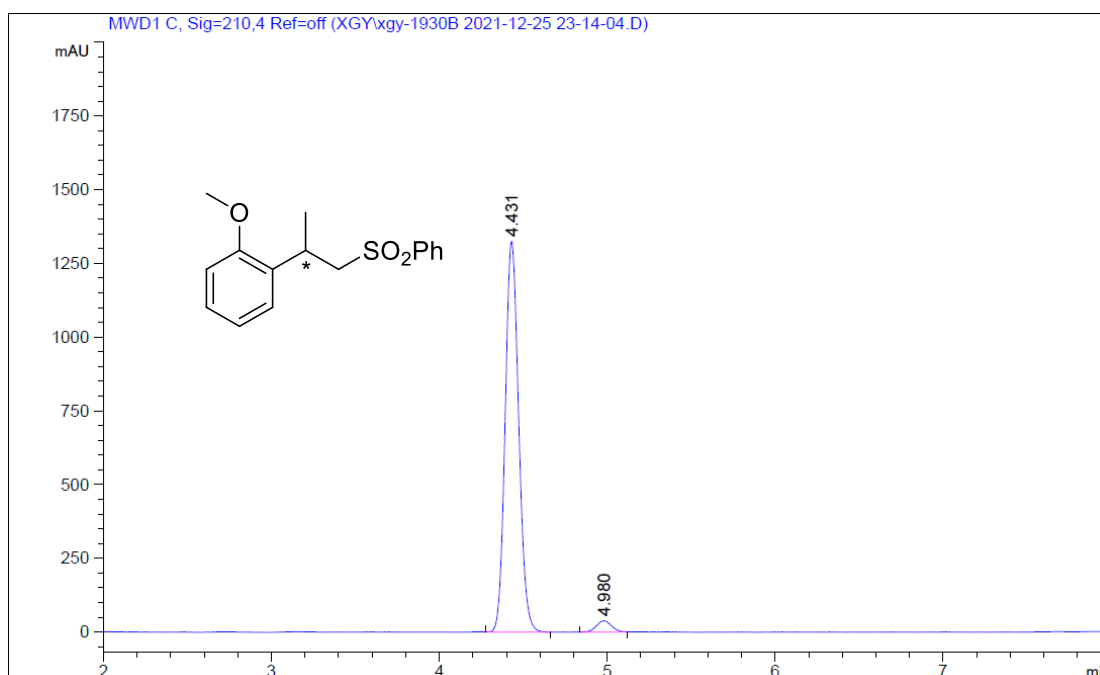
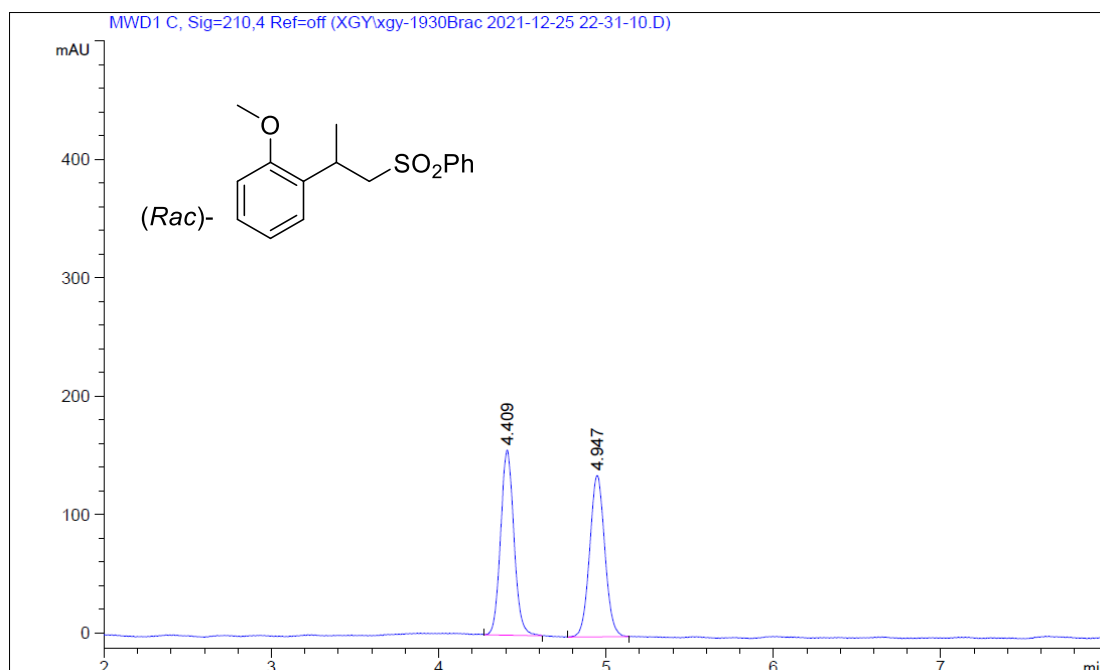
1-Bromo-4-(1-(phenylsulfonyl)propan-2-yl)benzene (2g)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	5.549	BB	0.1074	1369.08960	199.91602	96.1020
2	6.721	BB	0.1014	55.53214	6.65008	3.8980

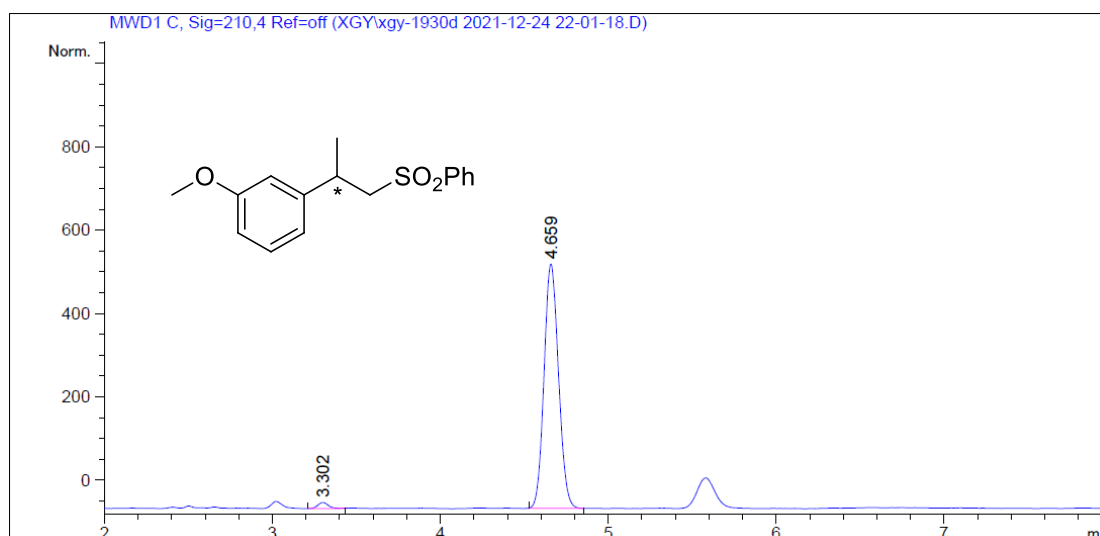
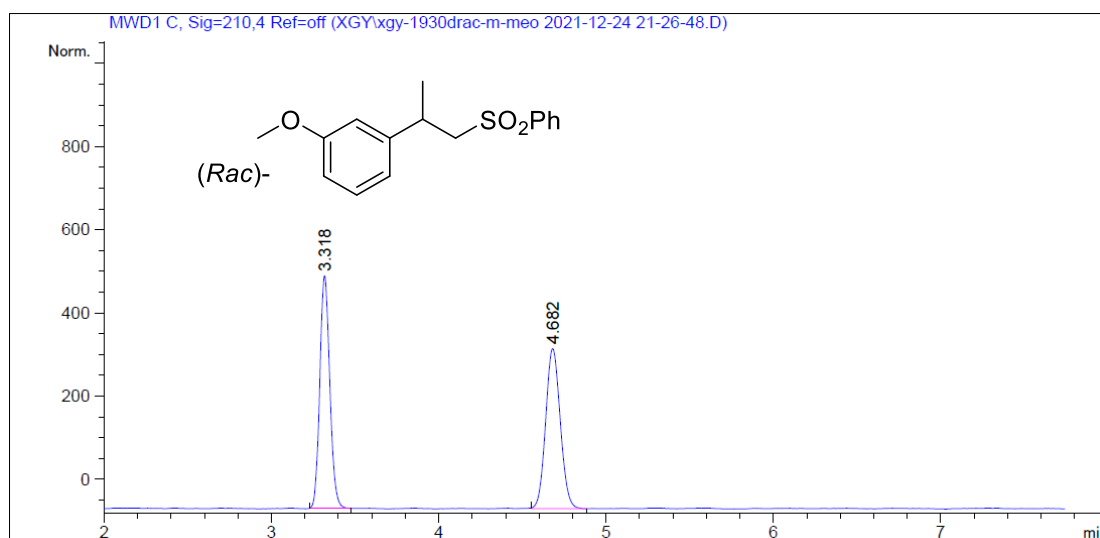
1-Methoxy-2-(1-(phenylsulfonyl)propan-2-yl)benzene (**2h**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.431	VV R	0.0862	7409.10791	1325.61169	96.8916
2	4.980	VV R	0.0777	237.69336	38.39271	3.1084

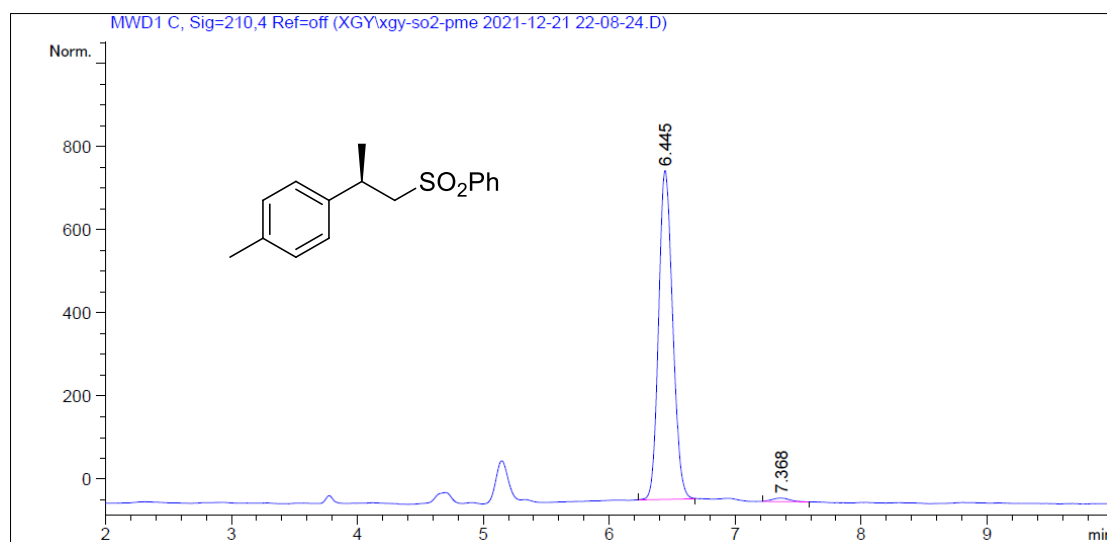
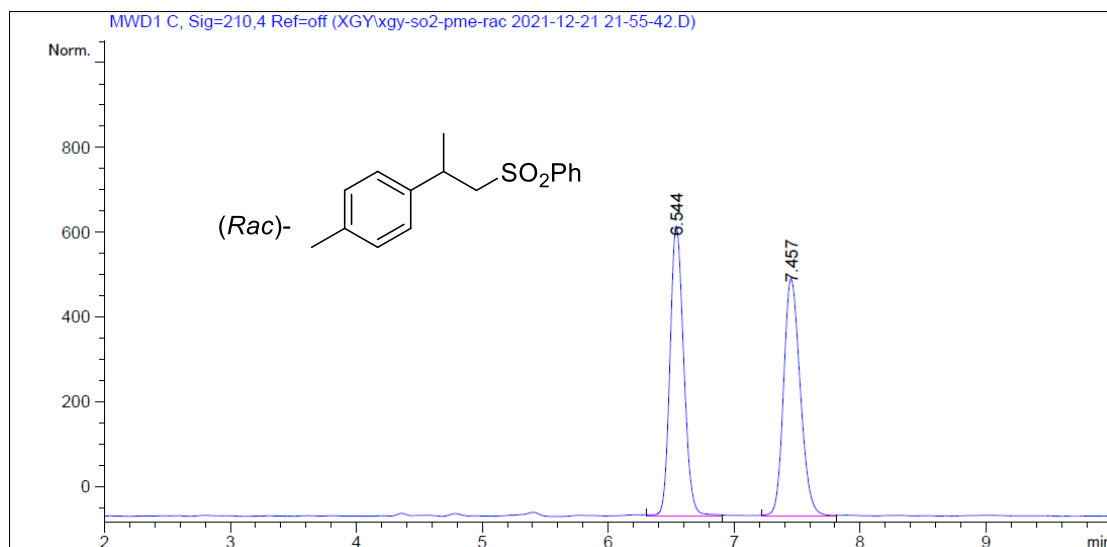
1-Methoxy-3-(1-(phenylsulfonyl)propan-2-yl)benzene (2i)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.302	BB	0.0645	47.55404	10.97623	1.7555
2	4.659	BB	0.0928	2661.29272	444.53748	98.2445

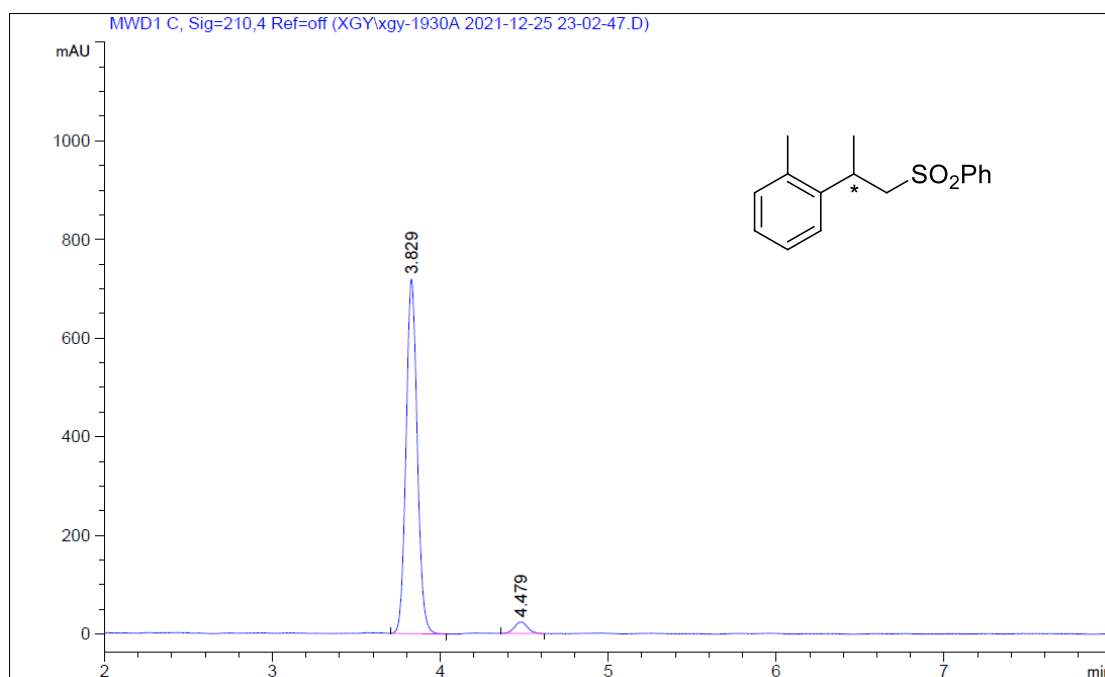
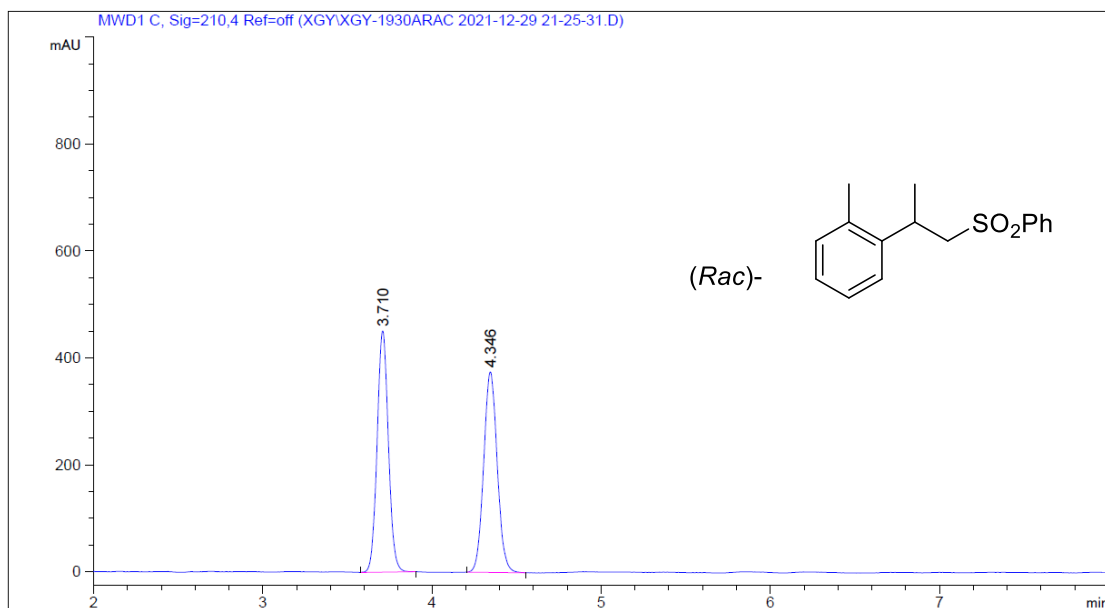
(R)-1-methyl-4-(1-(phenylsulfonyl)propan-2-yl)benzene (**2j**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	6.445	BB	0.1211	5206.78857	670.57794	98.6587
2	7.368	BB	0.1178	70.78779	7.35318	1.3413

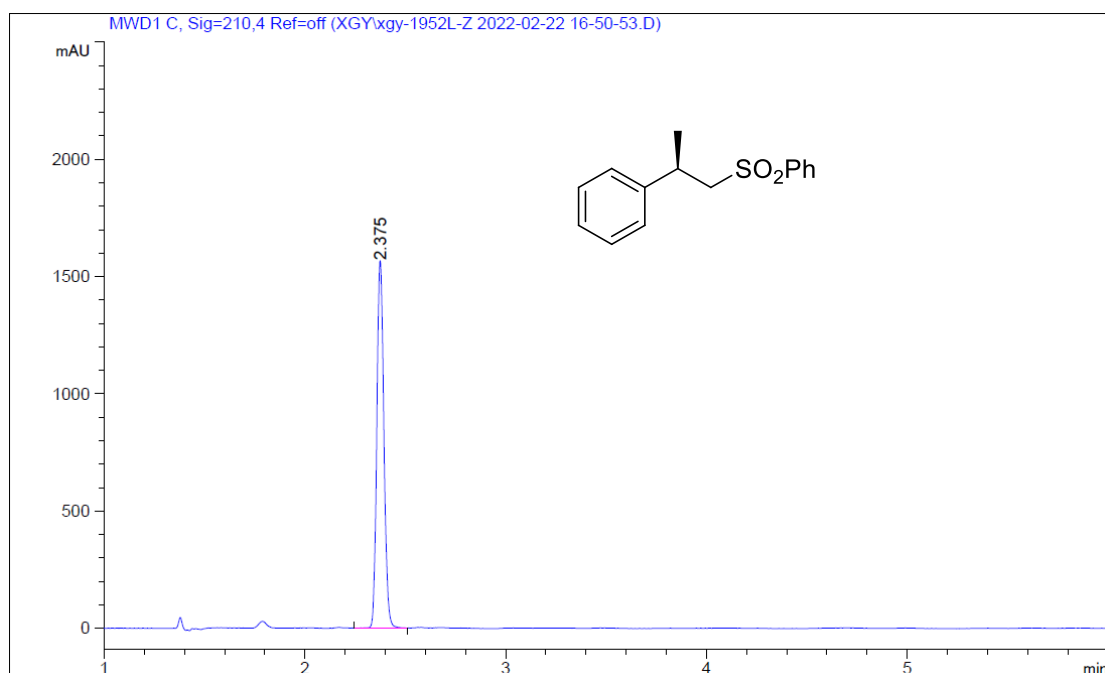
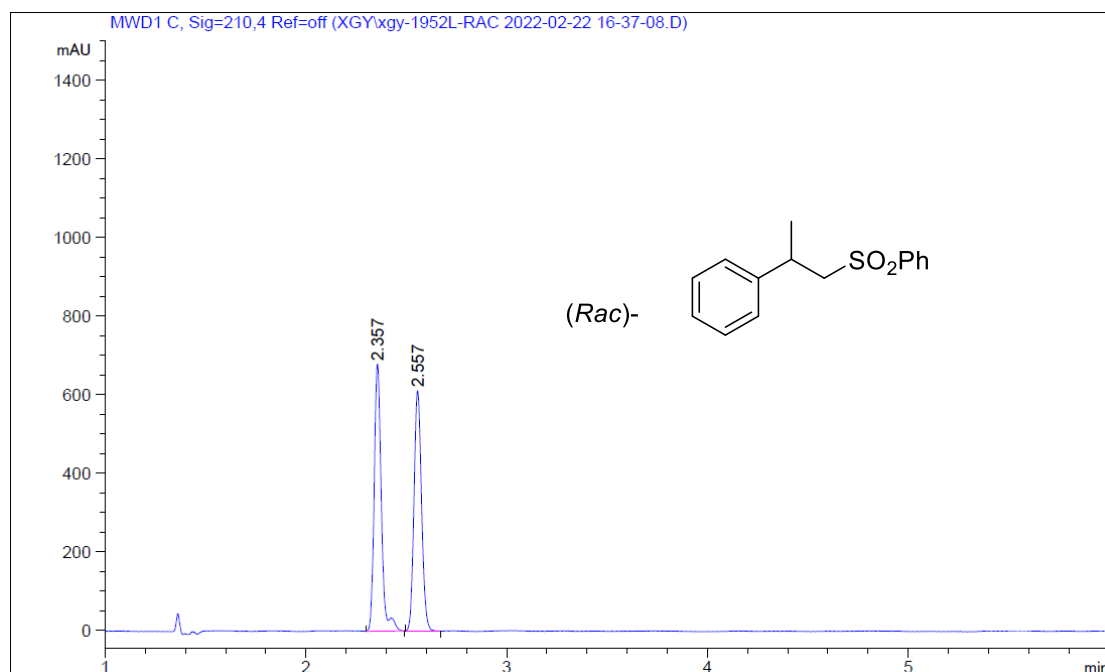
1-Methyl-2-(1-(phenylsulfonyl)propan-2-yl)benzene (2k)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.829	BV R	0.0712	3337.61011	718.83392	96.3407
2	4.479	VV R	0.0734	126.77312	23.50399	3.6593

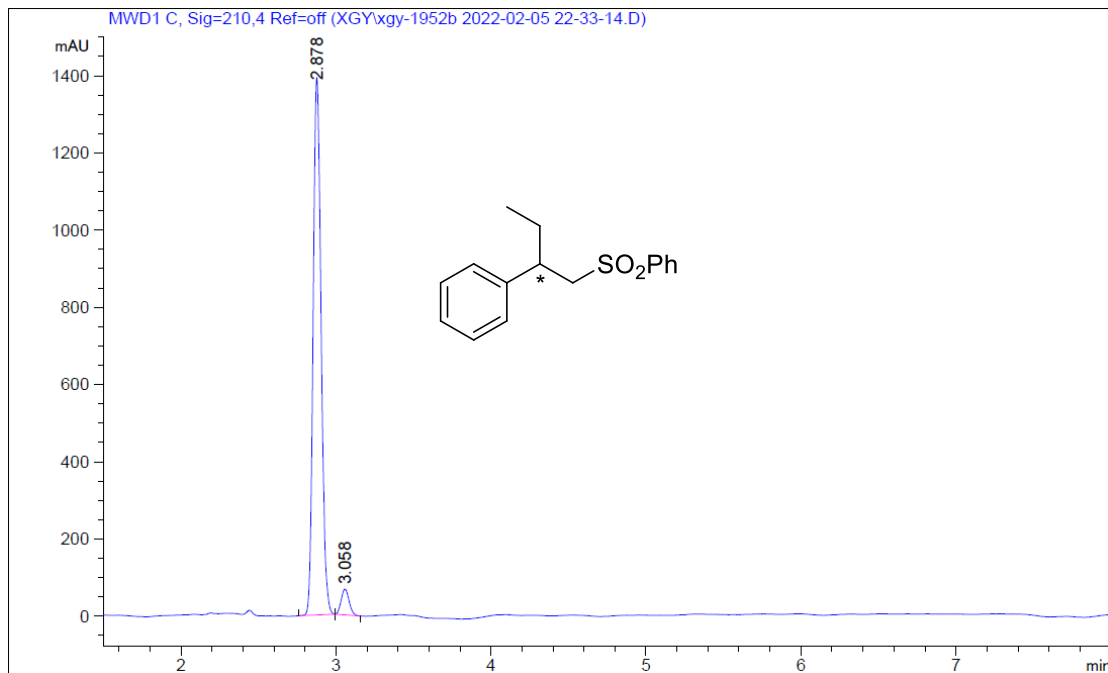
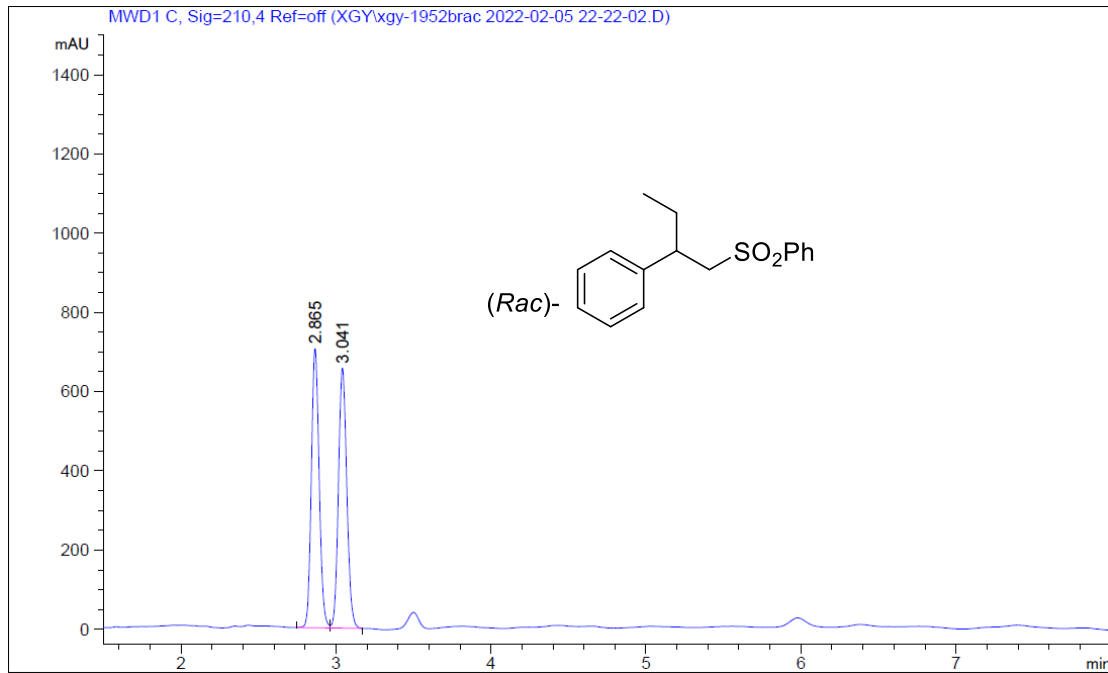
(R)-((2-phenylpropyl)sulfonyl)benzene (**21**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.375	BB	0.0388	3830.64575	1550.33508	100.0000

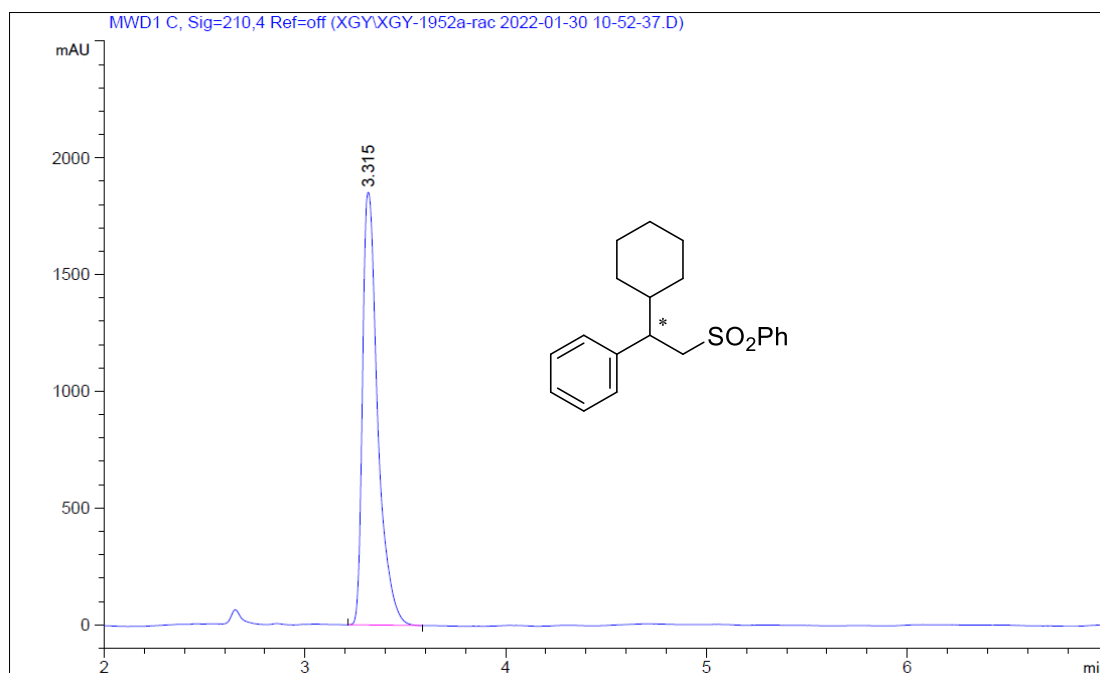
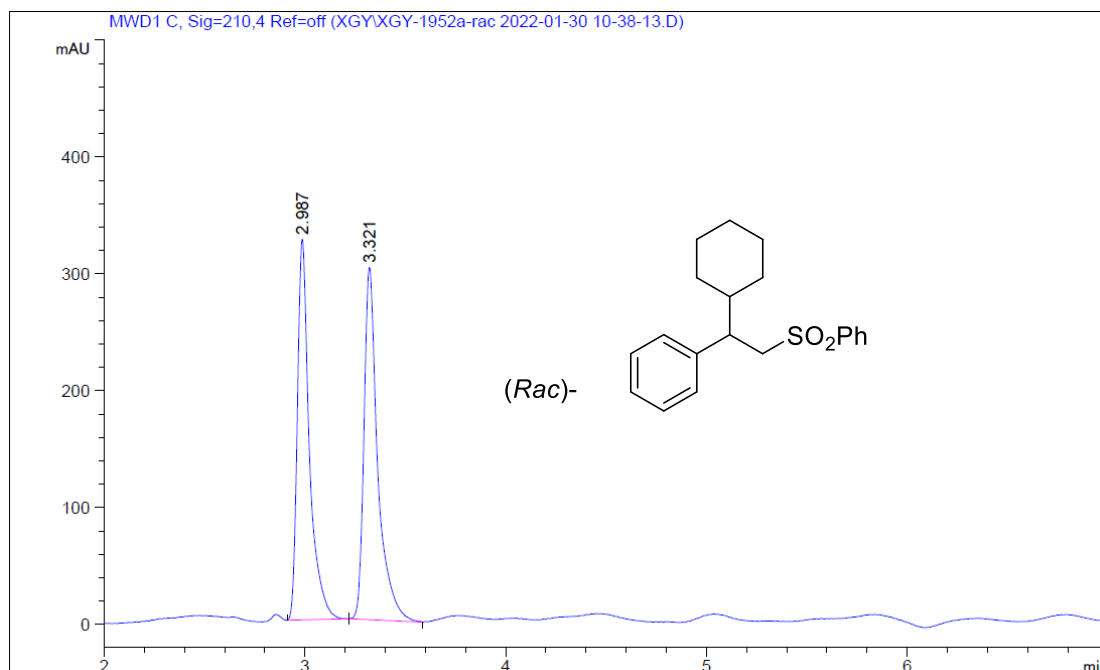
((2-Phenylbutyl)sulfonyl)benzene (2m)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.878	BB	0.0561	4963.22998	1392.55737	95.4108
2	3.058	BB	0.0565	238.73029	67.08261	4.5892

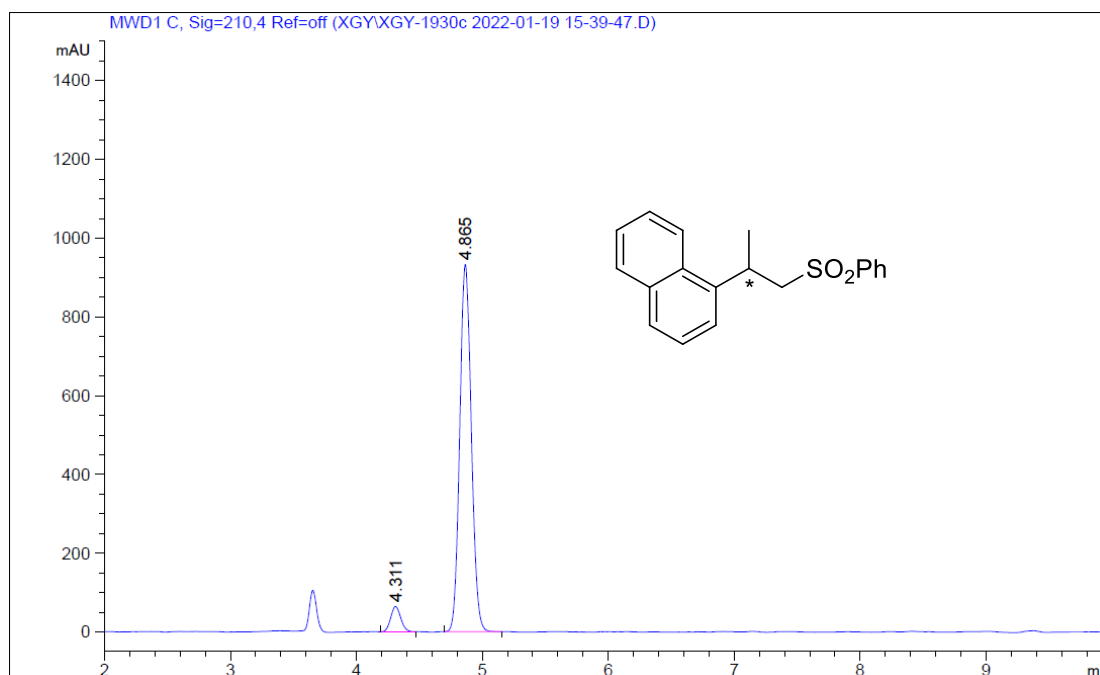
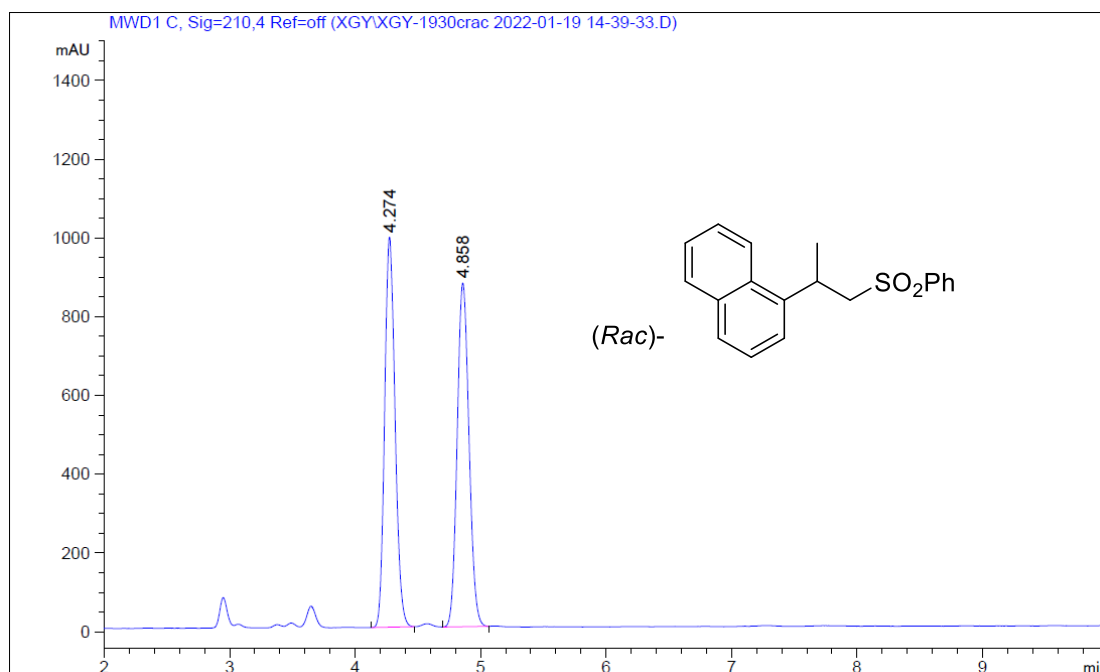
(1-Cyclohexyl-2-(phenylsulfonyl)ethyl)benzene (**2n**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.315	BB	0.0794	9746.99609	1852.45313	100.0000

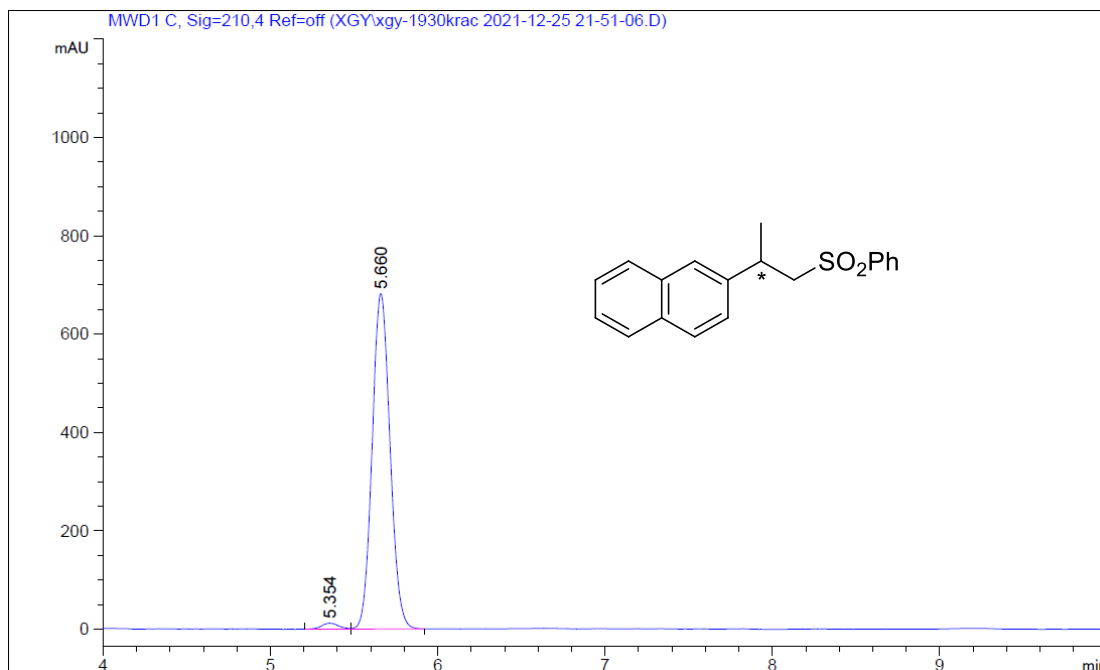
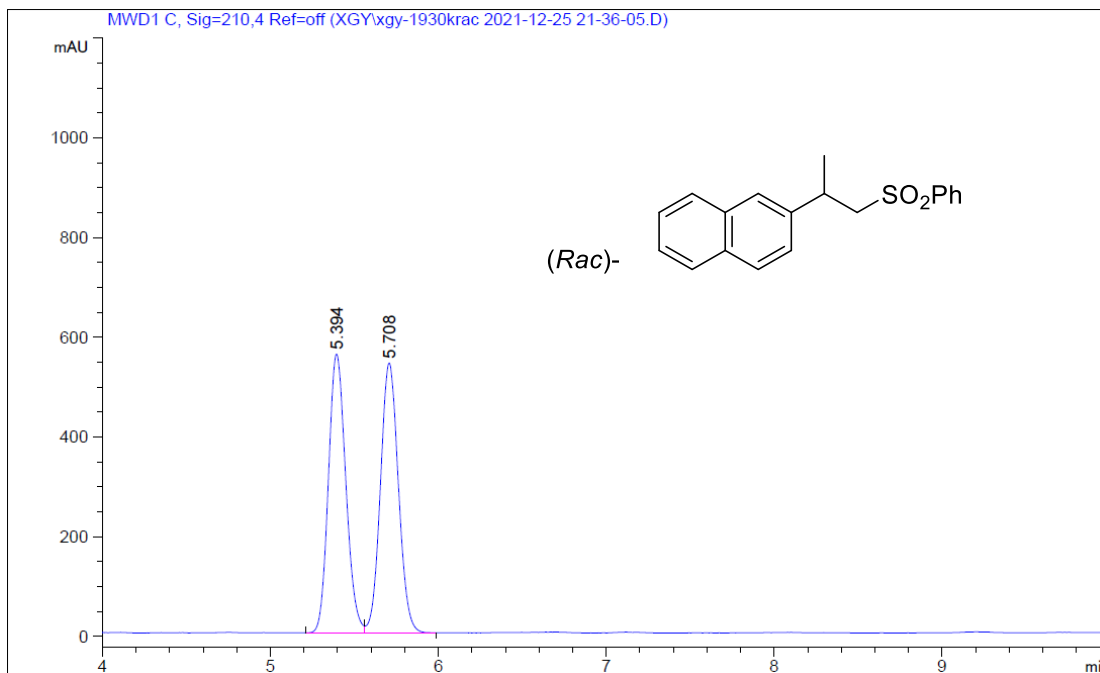
1-(1-(Phenylsulfonyl)propan-2-yl)naphthalene (**2o**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.311	BB	0.0868	357.13080	64.28927	5.6516
2	4.865	BB	0.1011	5961.92969	932.38525	94.3484

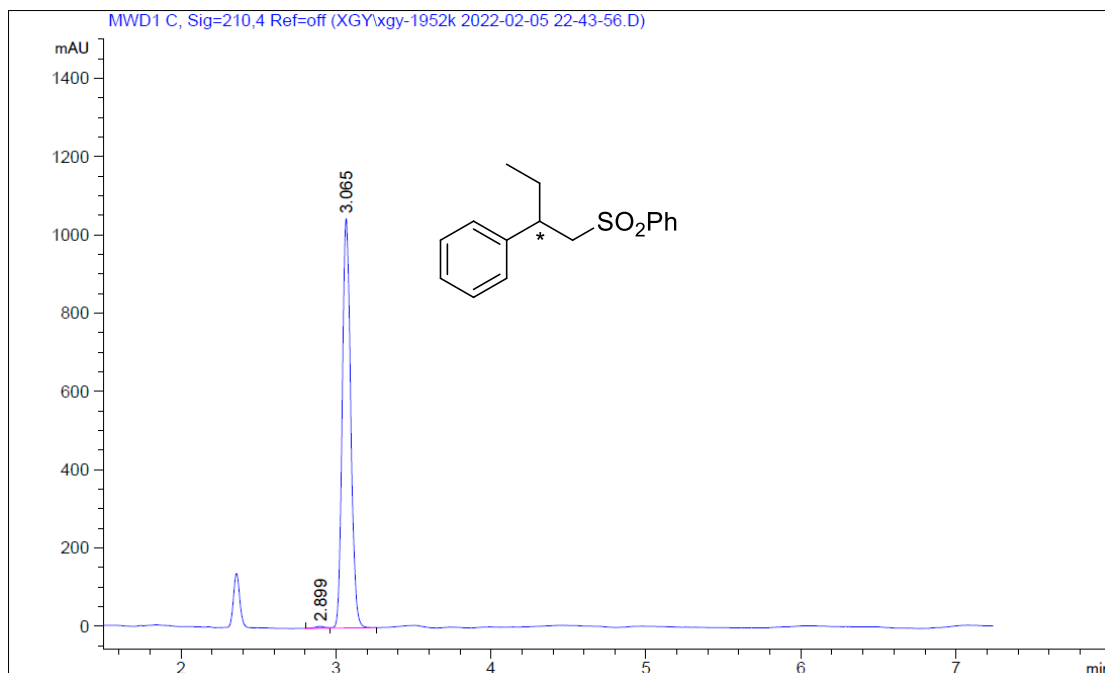
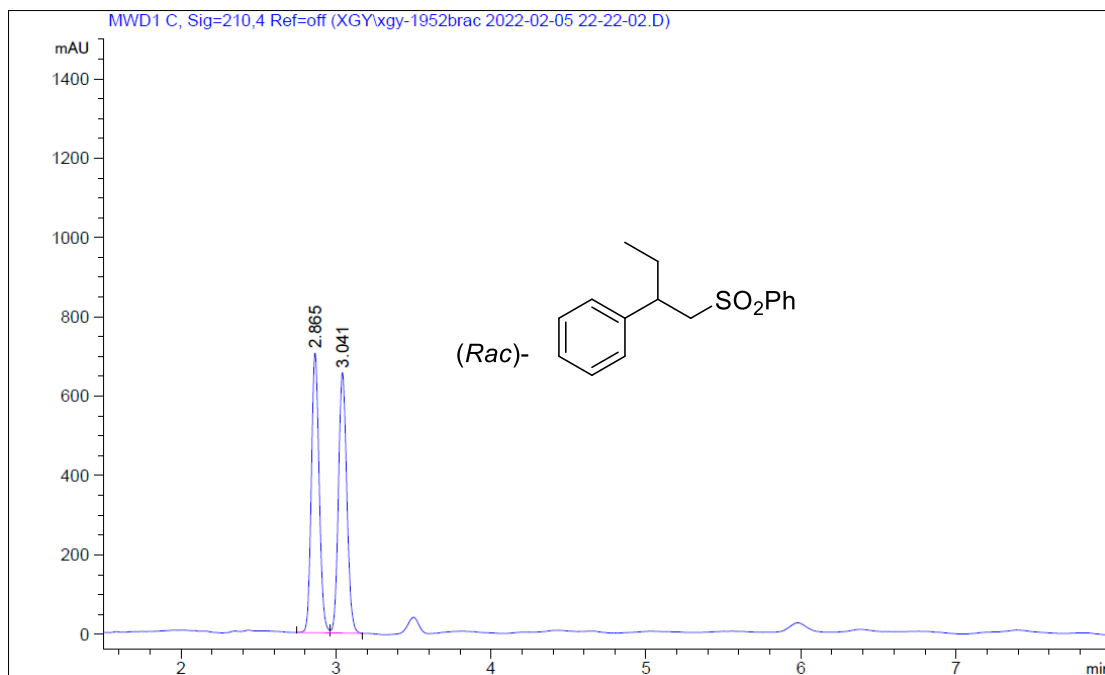
2-(1-(Phenylsulfonyl)propan-2-yl)naphthalene (**2p**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	5.354	VV R	0.0900	86.67672	12.11042	1.6817
2	5.660	VV R	0.1152	5067.42188	682.26141	98.3183

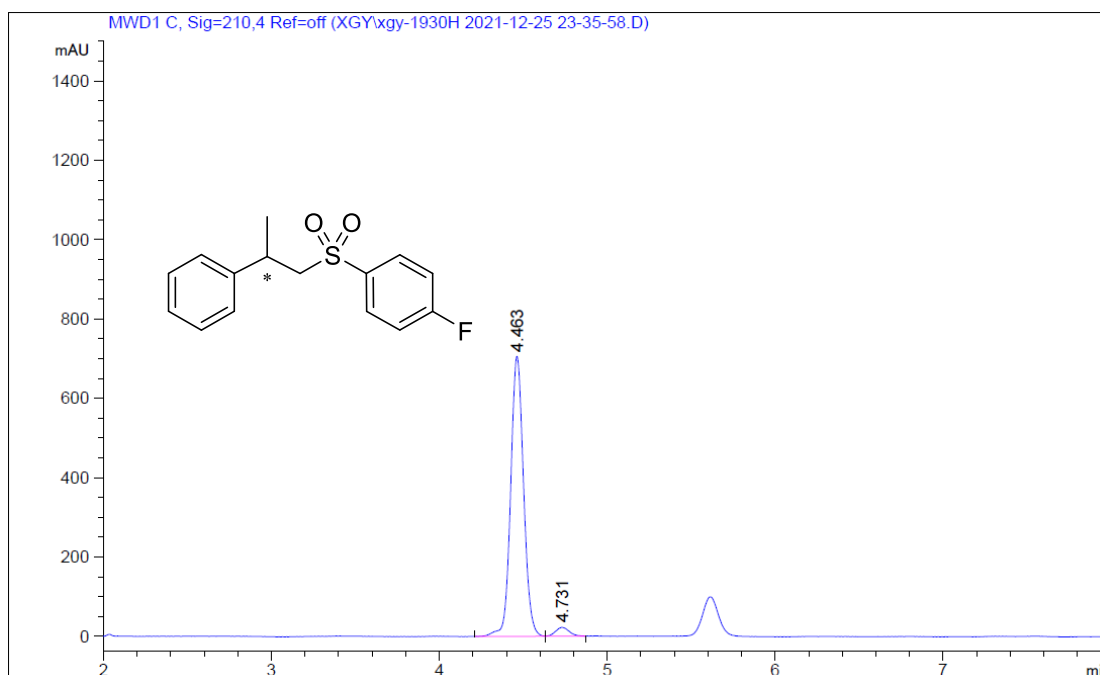
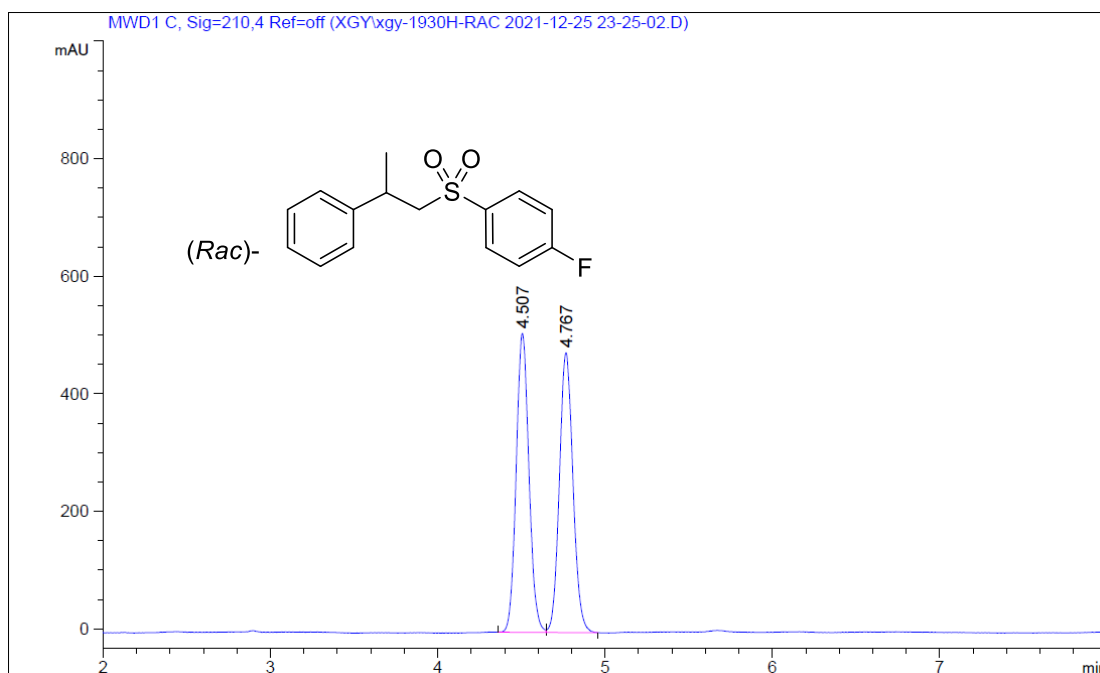
((2-Phenylbutyl)sulfonyl)benzene (2q)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.899	BV E	0.0572	21.39146	4.60173	0.5347
2	3.065	VV R	0.0594	3978.92700	1046.16272	99.4653

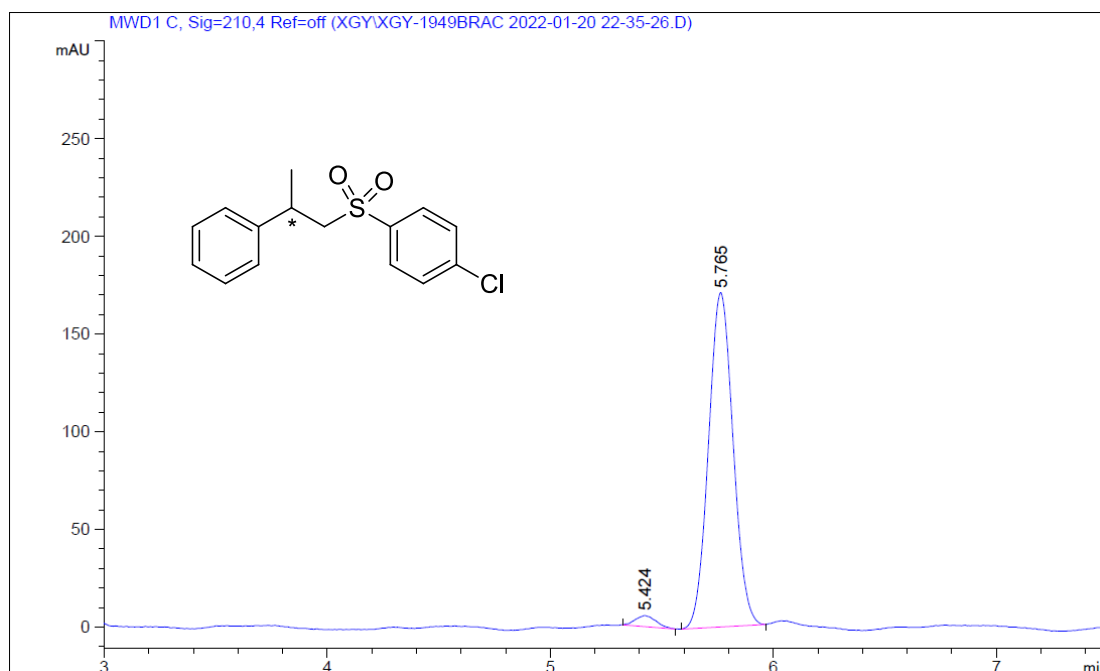
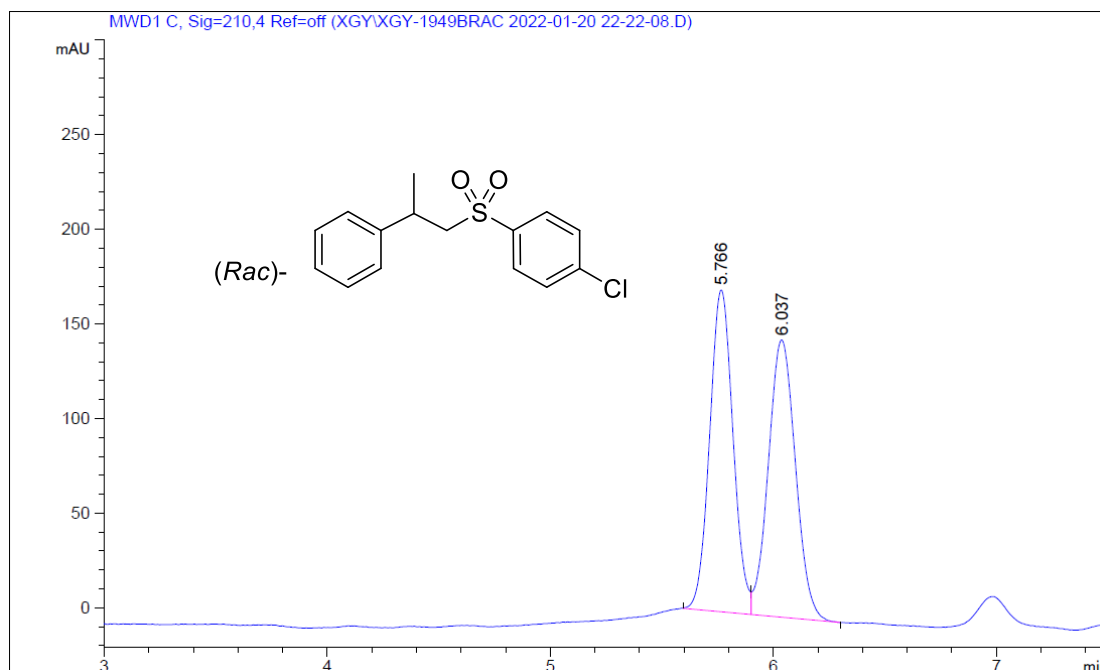
1-Fluoro-4-((2-phenylpropyl)sulfonyl)benzene (**2r**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.463	VV R	0.0830	3777.97437	705.66827	96.7882
2	4.731	VV R	0.0709	125.36704	22.36466	3.2118

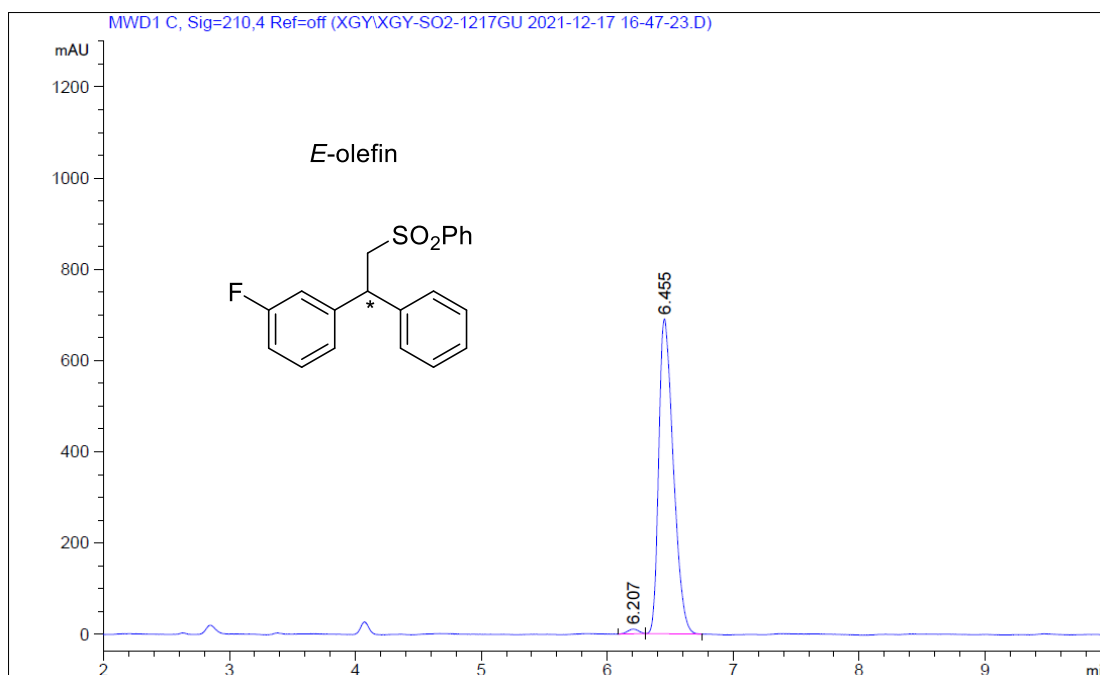
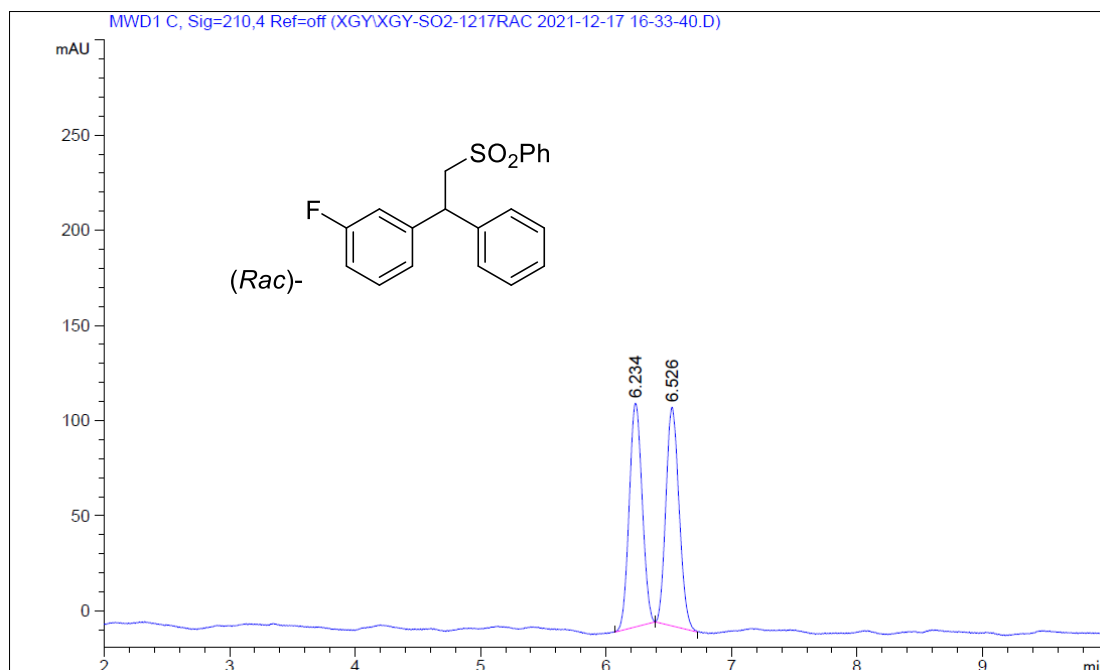
1-Chloro-4-((2-phenylpropyl)sulfonyl)benzene (**2s**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

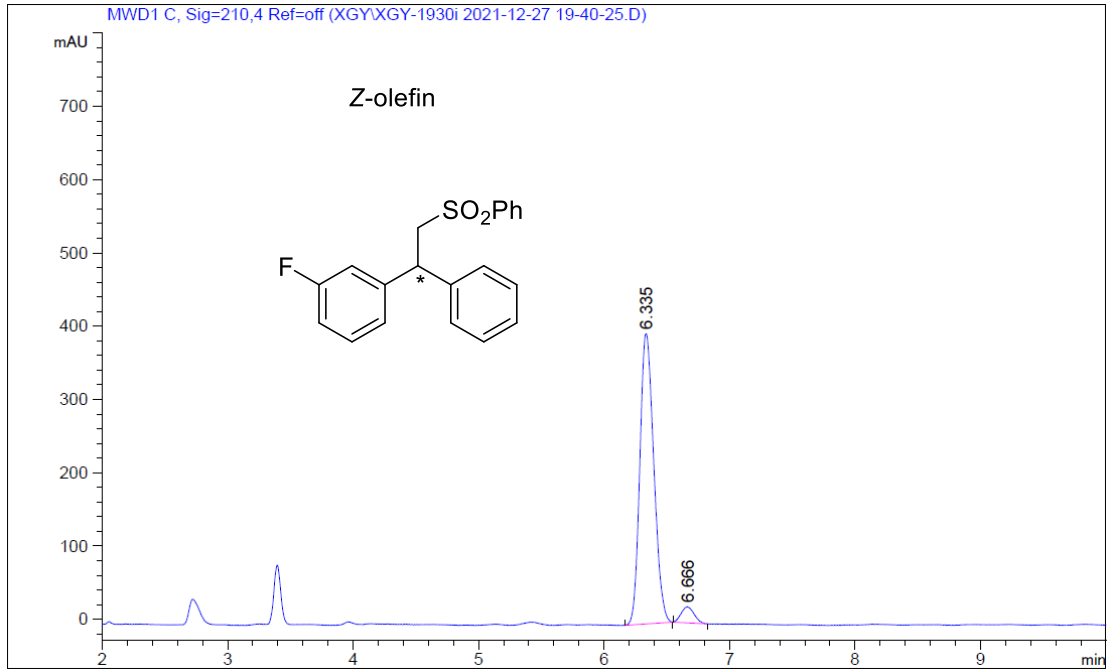
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	5.424	BB	0.0780	36.73730	5.74934	2.7246
2	5.765	BB	0.1204	1311.61792	171.18588	97.2754

1-Fluoro-3-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (4a)



Signal 1: MWD1 C, Sig=210,4 Ref=off

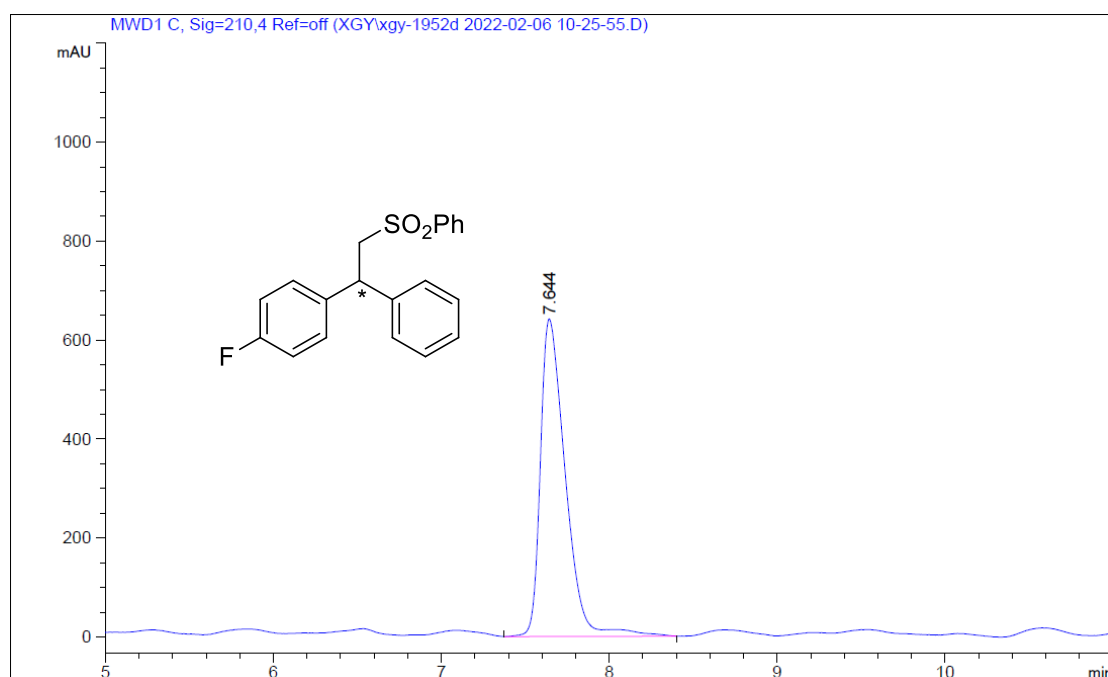
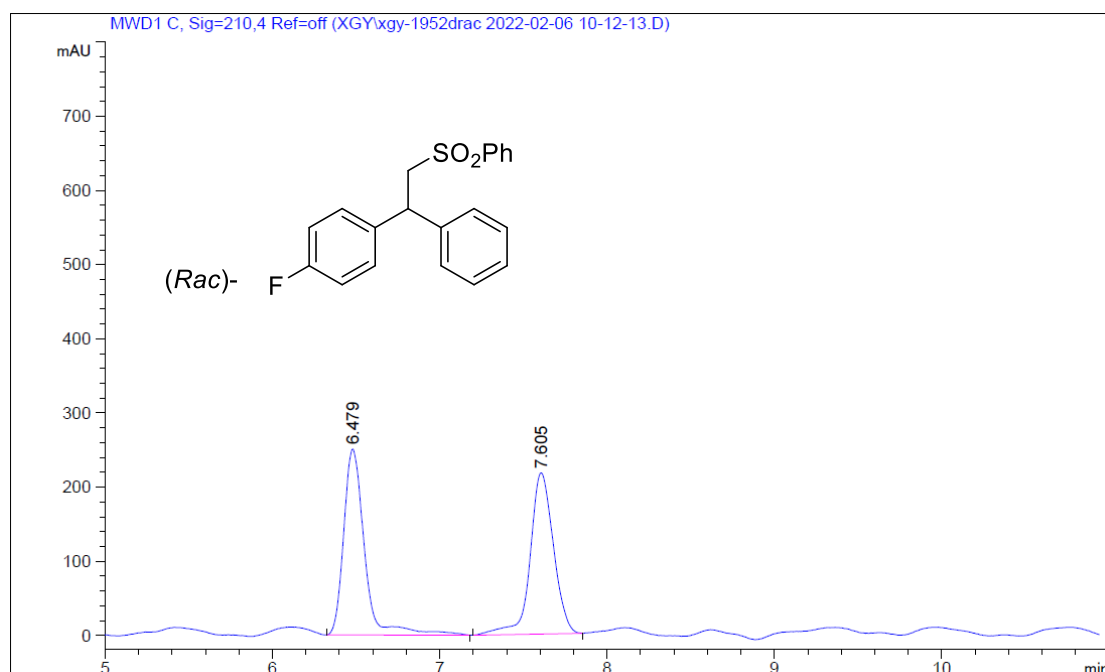
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	6.207	BB	0.0748	62.70038	10.41199	1.1179
2	6.455	BB	0.1183	5546.20654	690.14642	98.8821



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	6.335	BB	0.1145	3056.06982	396.06067	95.0724
2	6.666	BB	0.0879	158.39606	22.01792	4.9276

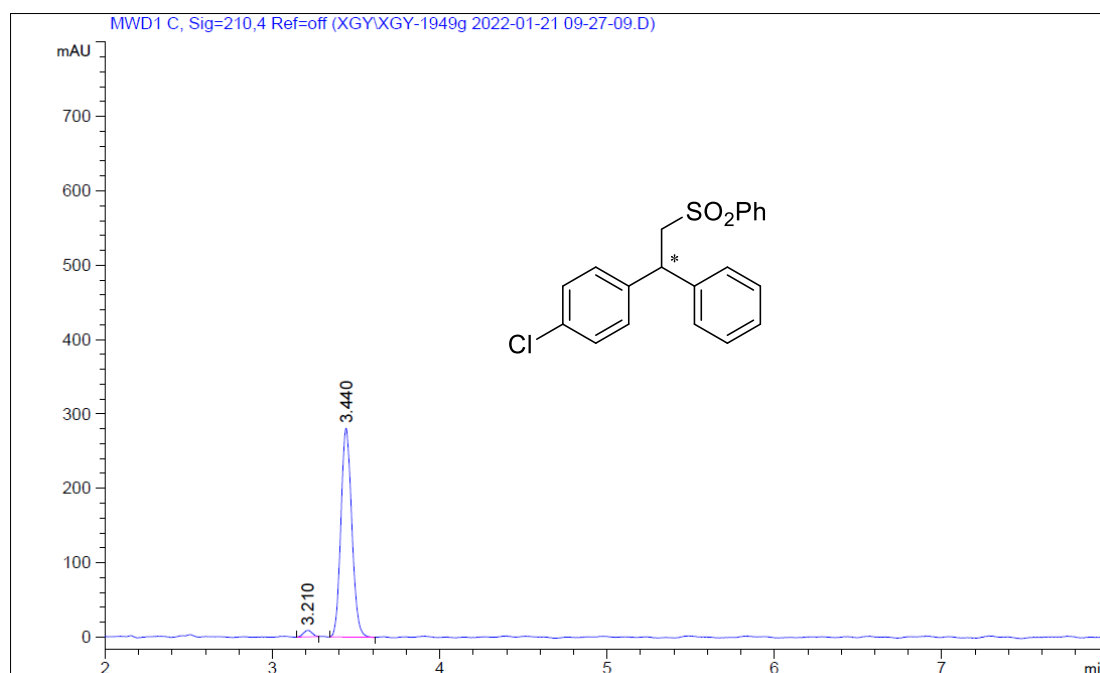
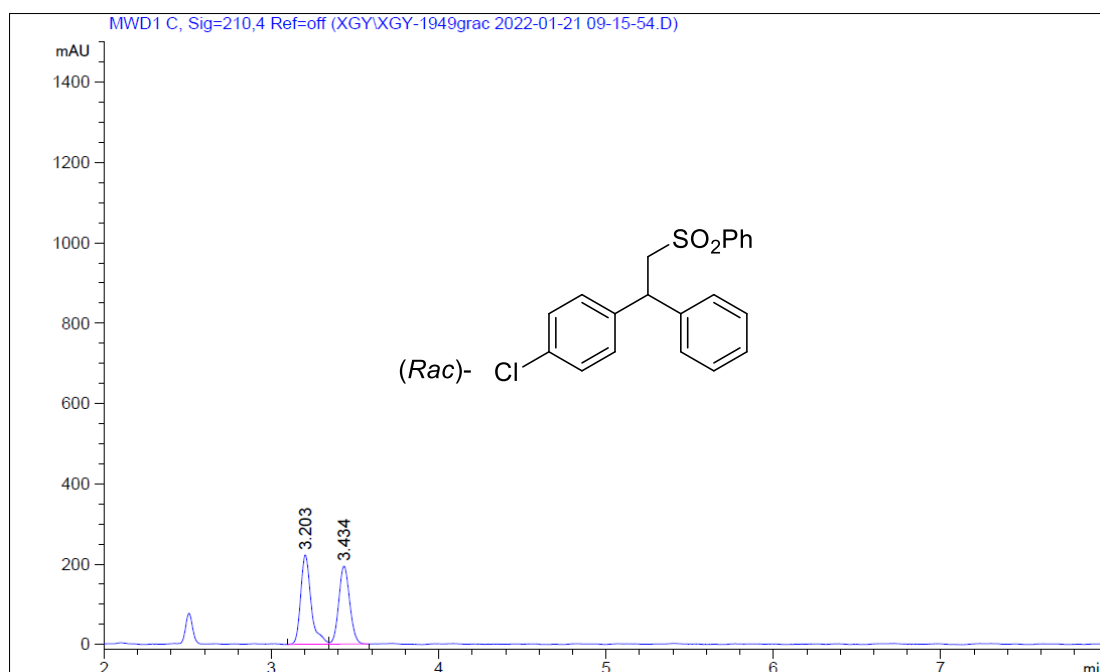
1-Fluoro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4b**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.644	BB	0.1568	6643.99414	641.76239	100.0000

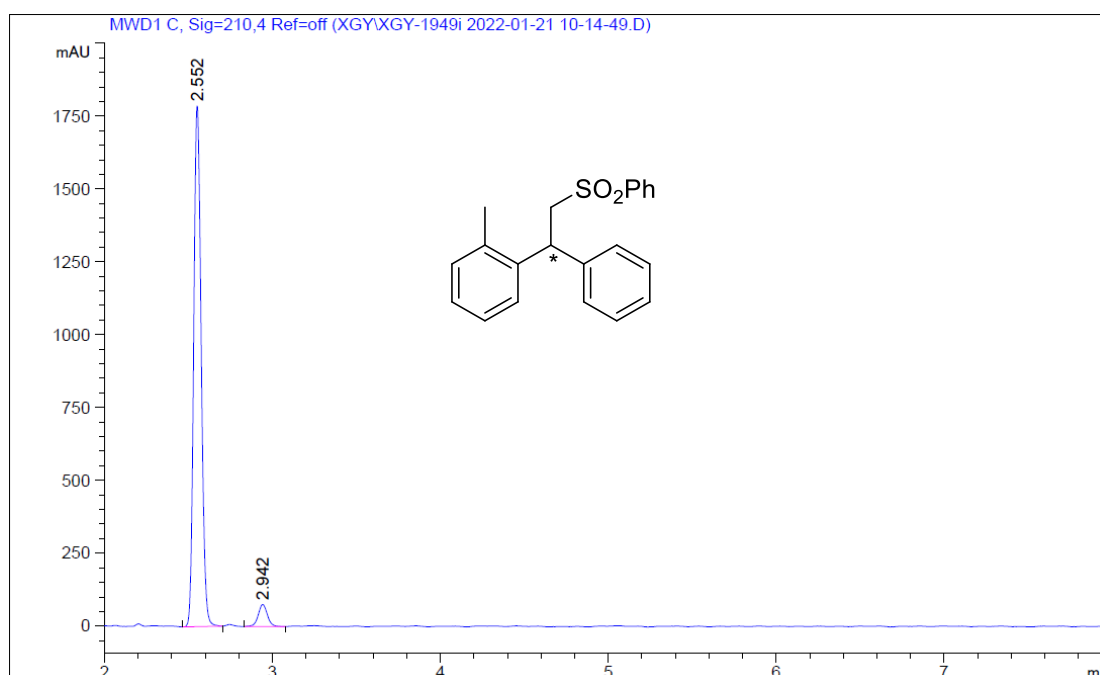
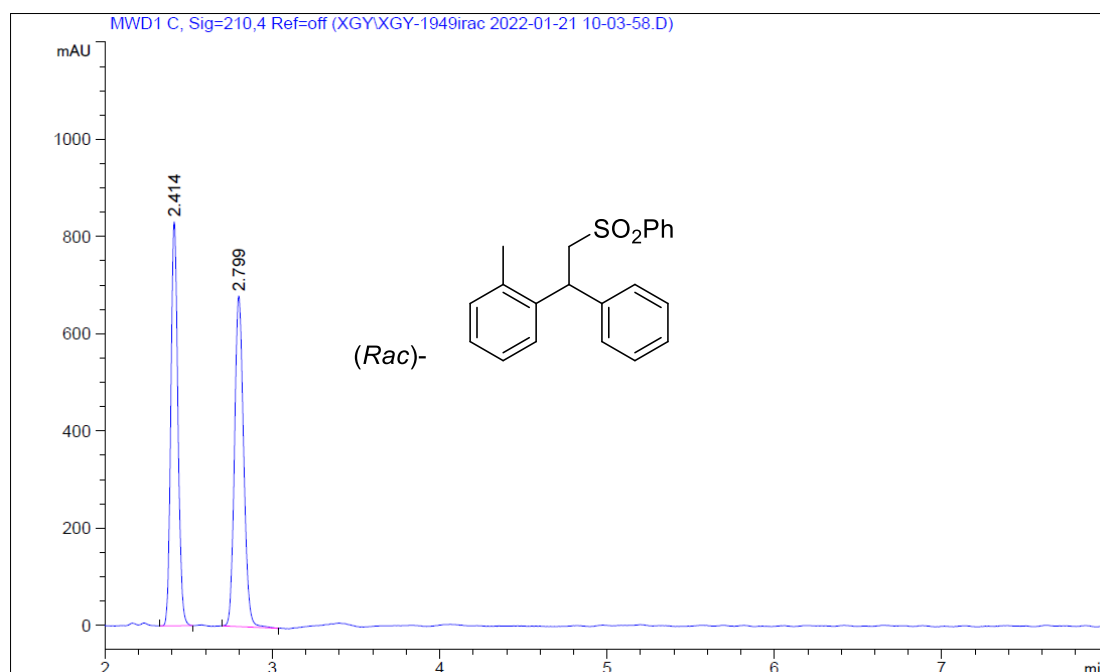
1-Chloro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4c**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.210	BB	0.0540	32.31395	8.76984	2.4747
2	3.440	BB	0.0709	1273.44043	280.76254	97.5253

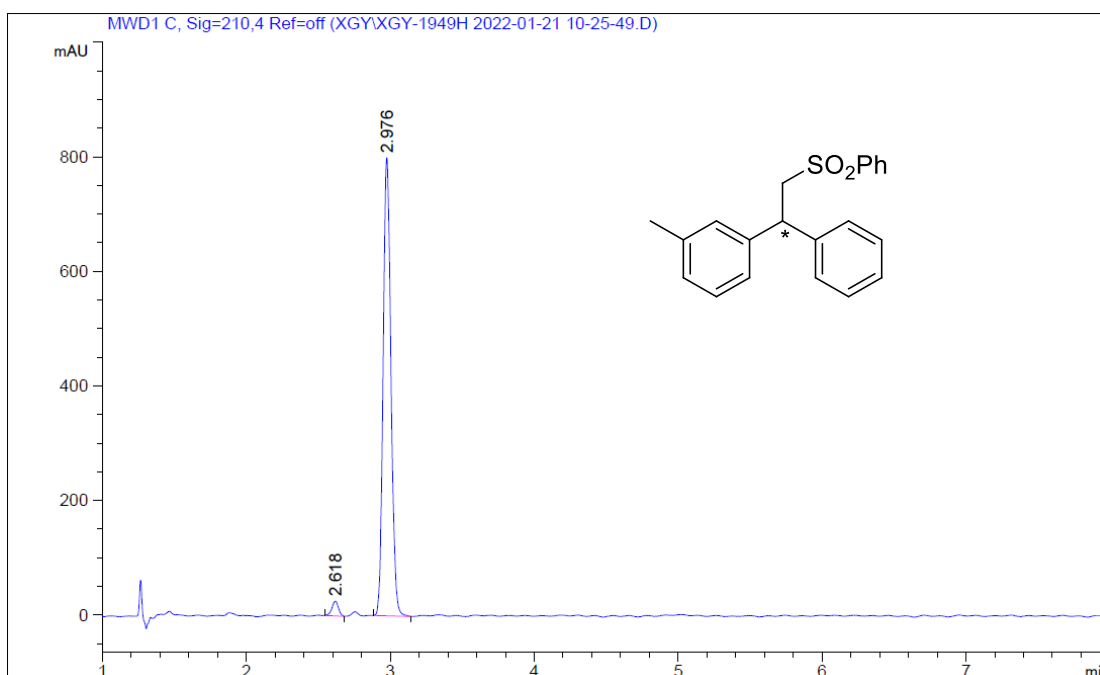
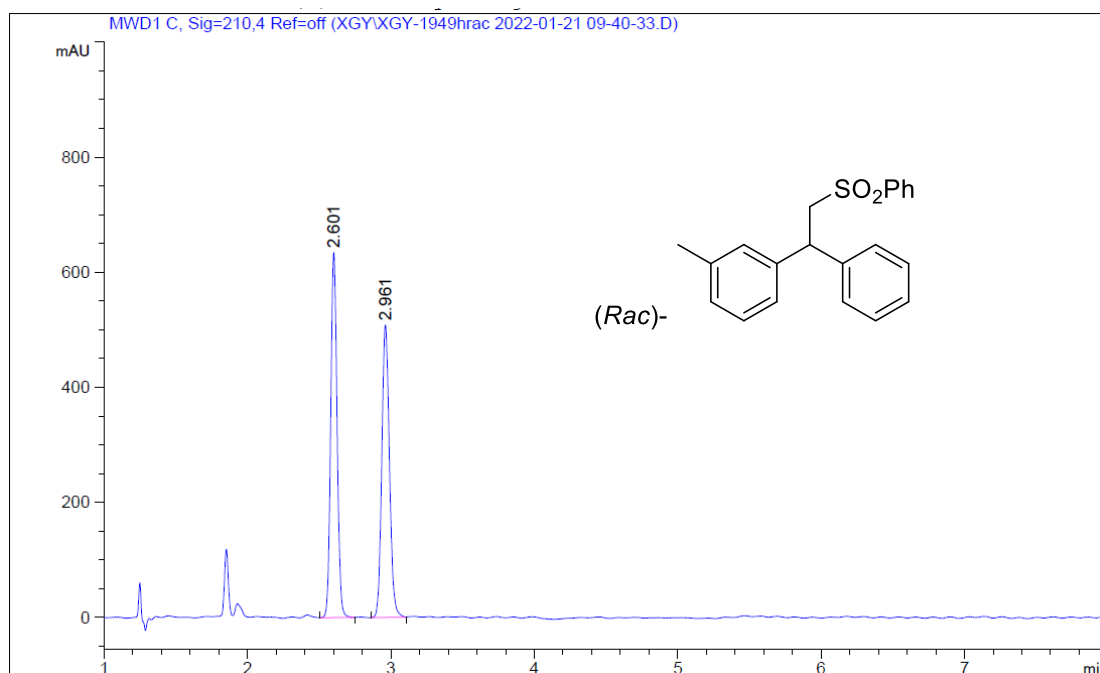
1-Methyl-2-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4d**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.552	BB	0.0480	5513.82666	1787.08691	95.0071
2	2.942	BB	0.0591	289.76743	75.85313	4.9929

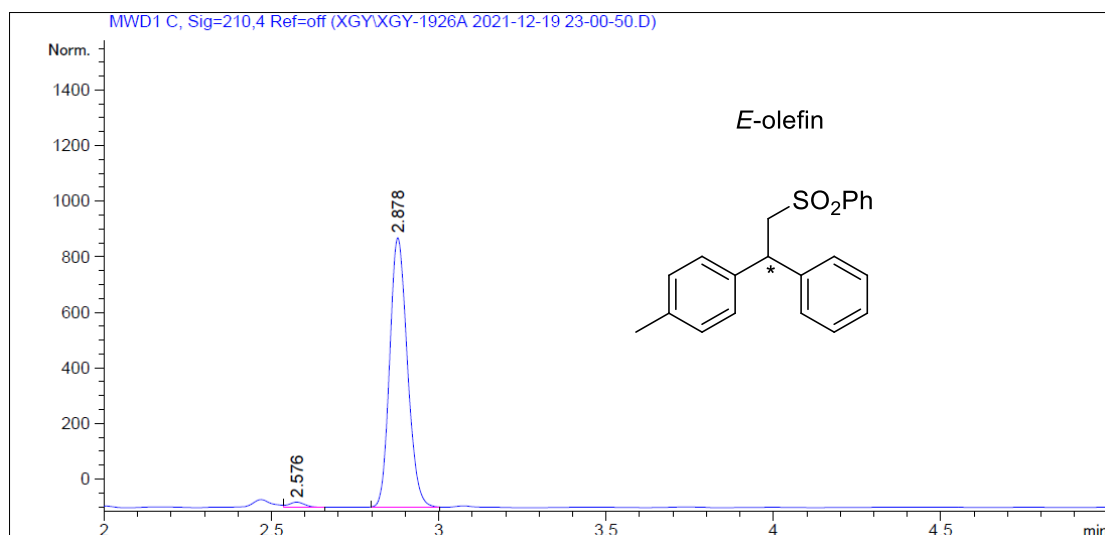
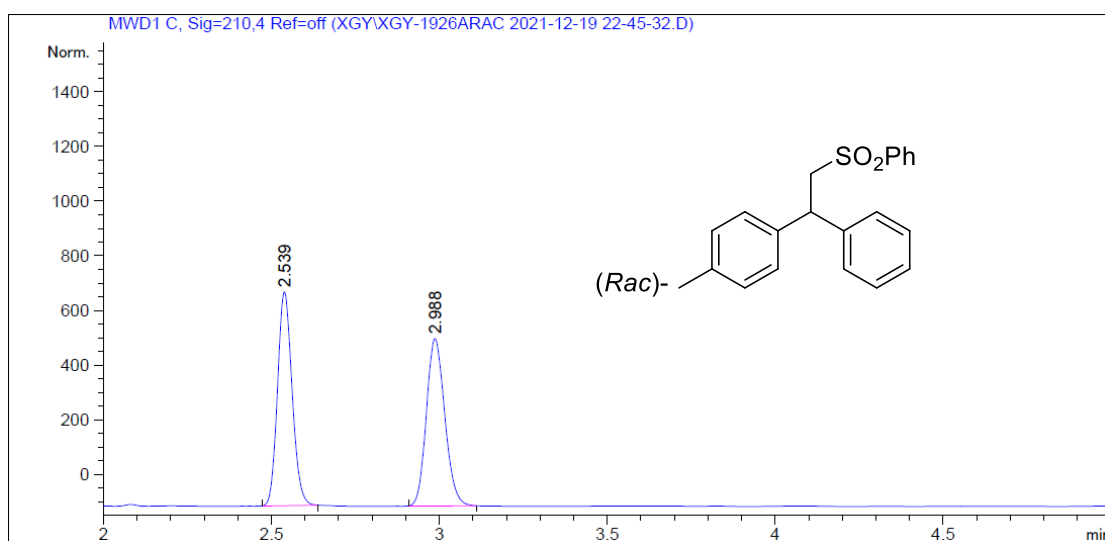
1-Methyl-3-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4e**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.618	BB	0.0477	80.98259	25.76103	2.6166
2	2.976	BB	0.0585	3014.02026	799.62219	97.3834

1-Methyl-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (4f)

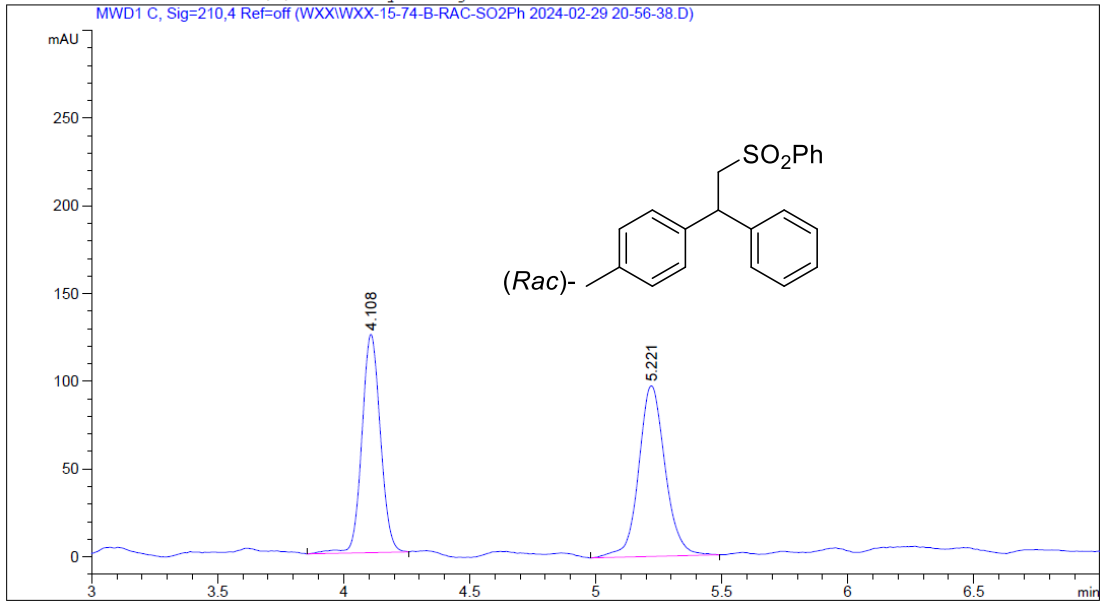


Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.576	VB	0.0493	46.37800	14.32139	1.6351
2	2.878	BB	0.0567	2790.09741	761.91626	98.3649

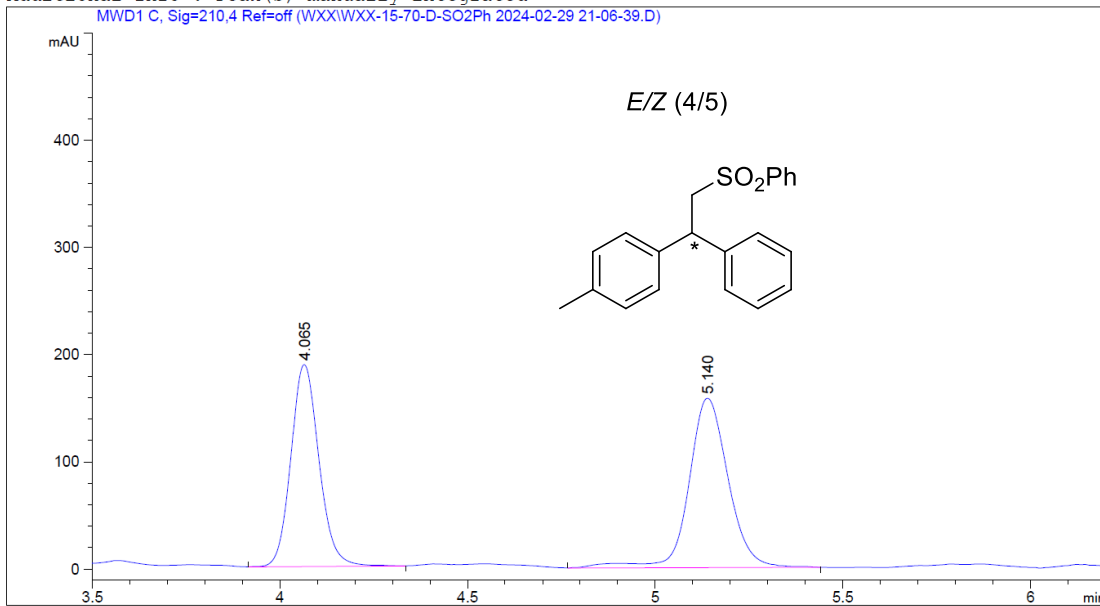
Additional Info : Peak(s) manually integrated

MWD1 C, Sig=210,4 Ref=off (WXX\WXX-15-74-B-RAC-SO2Ph 2024-02-29 20-56-38.D)



Additional Info : Peak(s) manually integrated

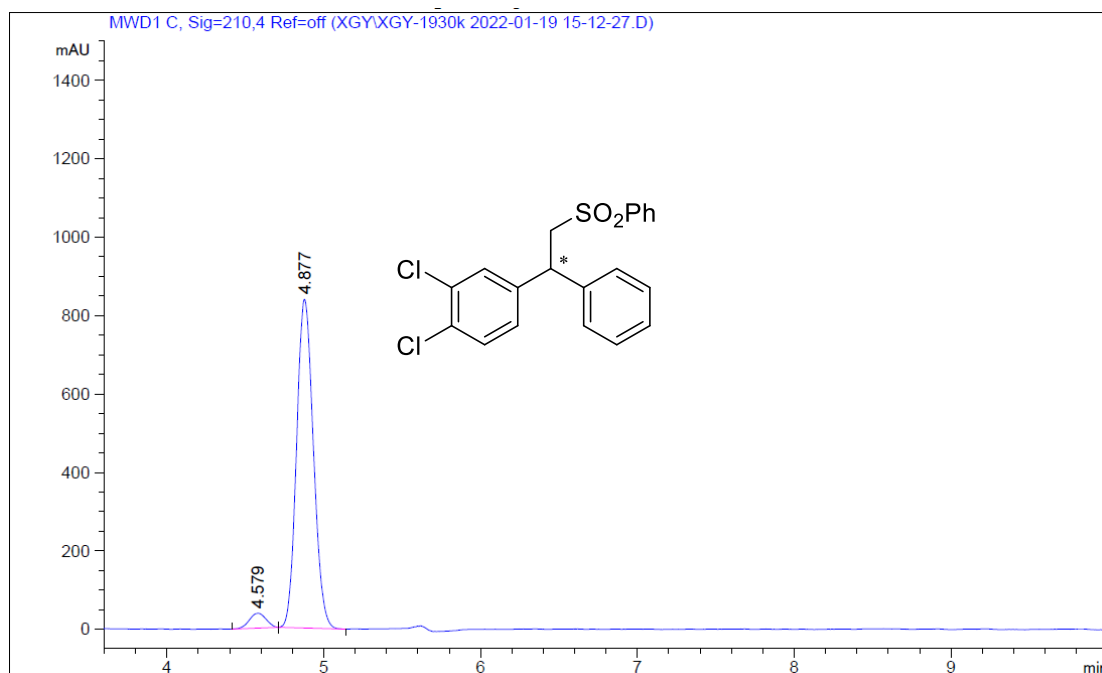
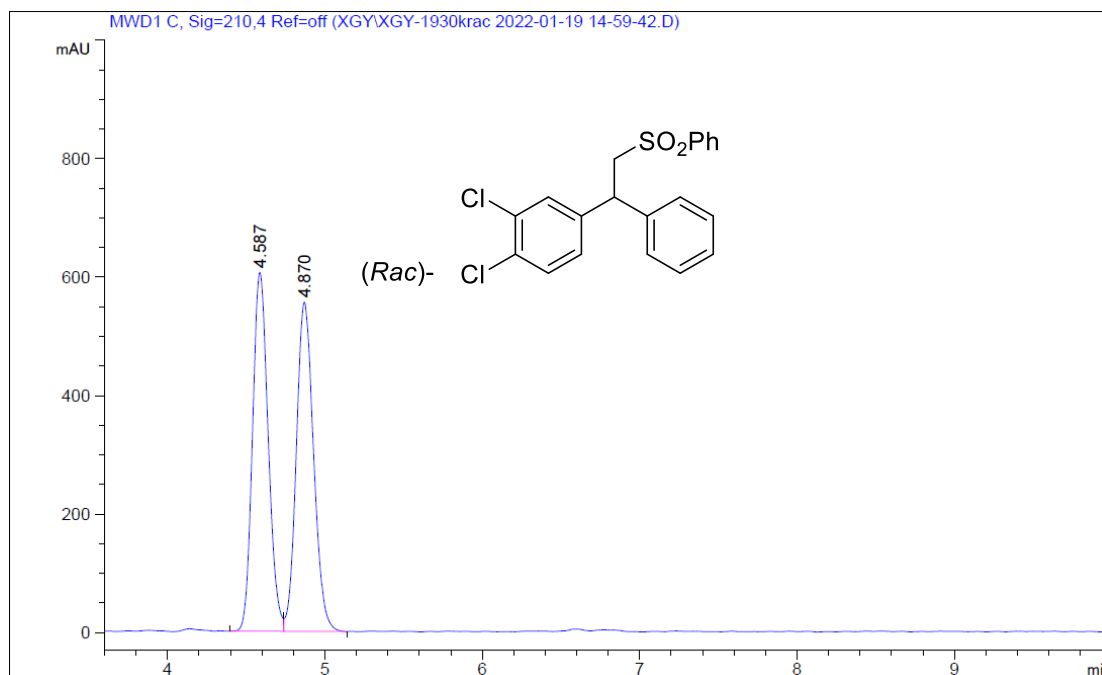
MWD1 C, Sig=210,4 Ref=off (WXX\WXX-15-70-D-SO2Ph 2024-02-29 21-06-39.D)



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.065	BV R	0.0803	982.20819	188.52686	45.8732
2	5.140	VV R	0.1126	1158.92908	157.96118	54.1268

Totals : 2141.13727 346.48804

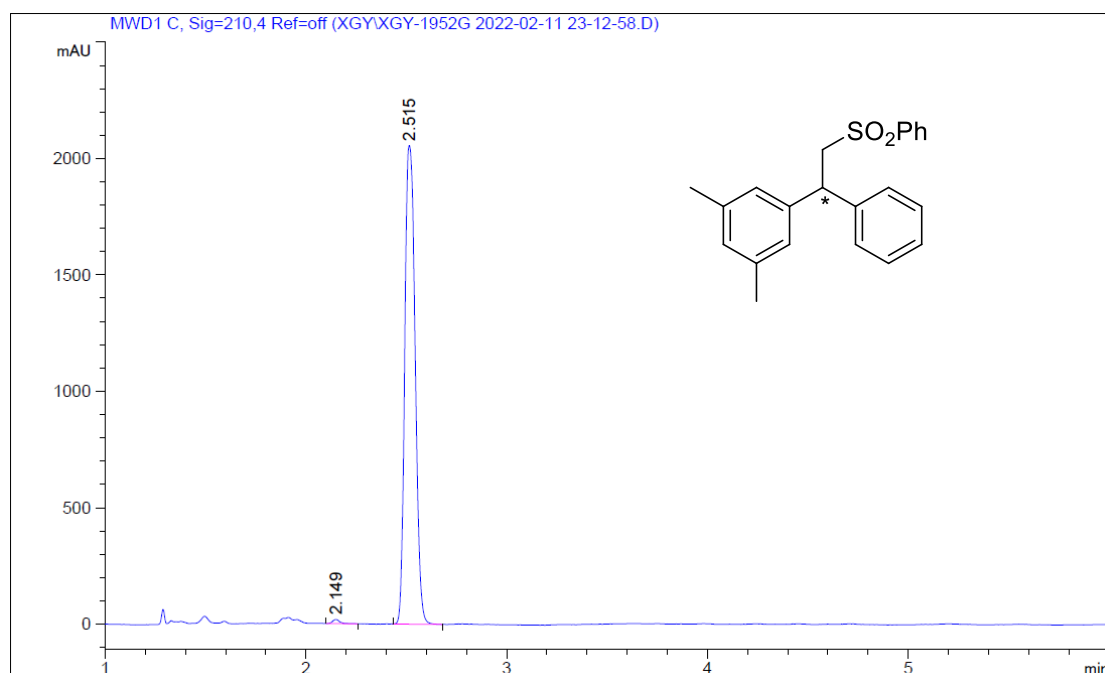
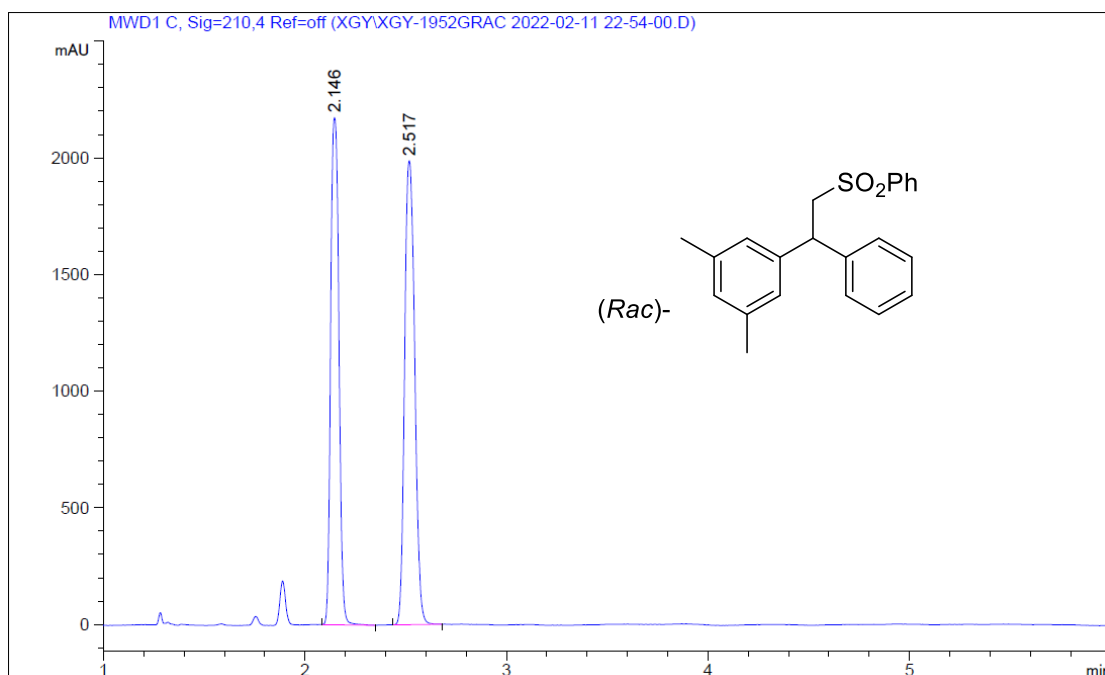
1,2-Dichloro-4-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4g**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	4.579	BB	0.1106	281.28049	38.32268	4.3048
2	4.877	BB	0.1165	6252.83057	838.26489	95.6952

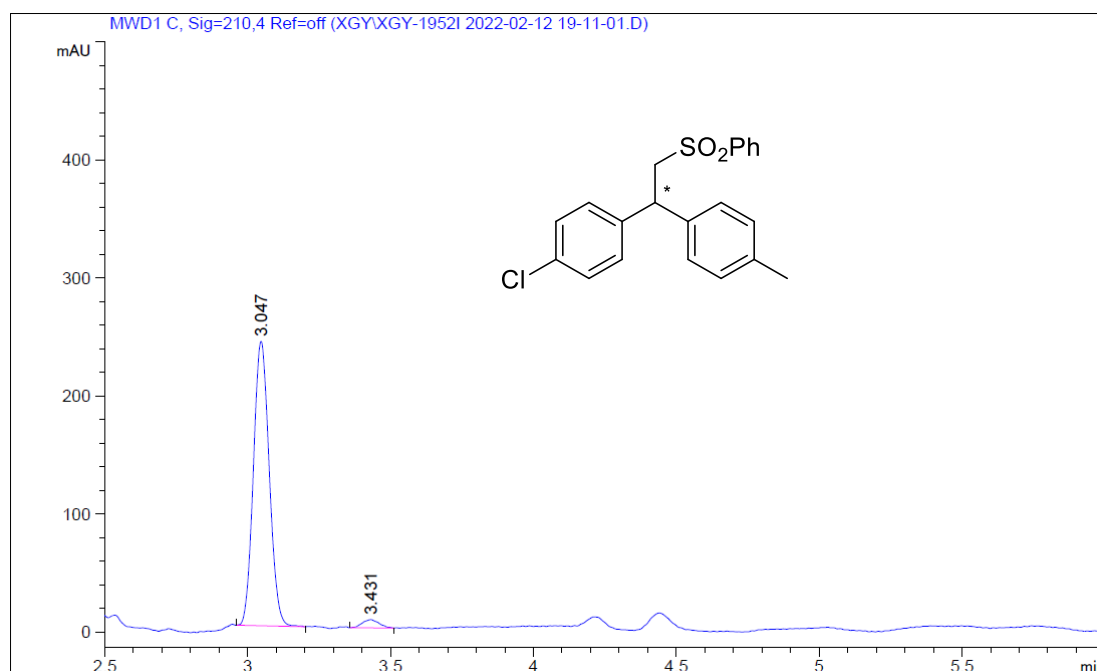
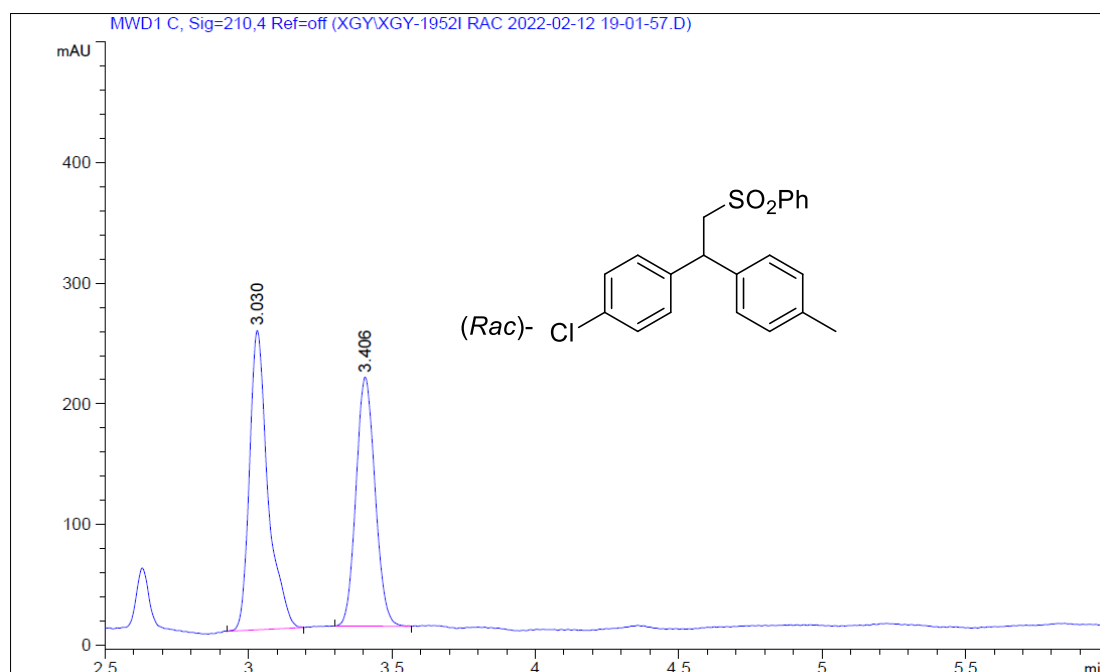
1,3-Dimethyl-5-(1-phenyl-2-(phenylsulfonyl)ethyl)benzene (**4h**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.149	BB	0.0394	45.01714	17.54111	0.6071
2	2.515	BB	0.0568	7370.02051	2056.44751	99.3929

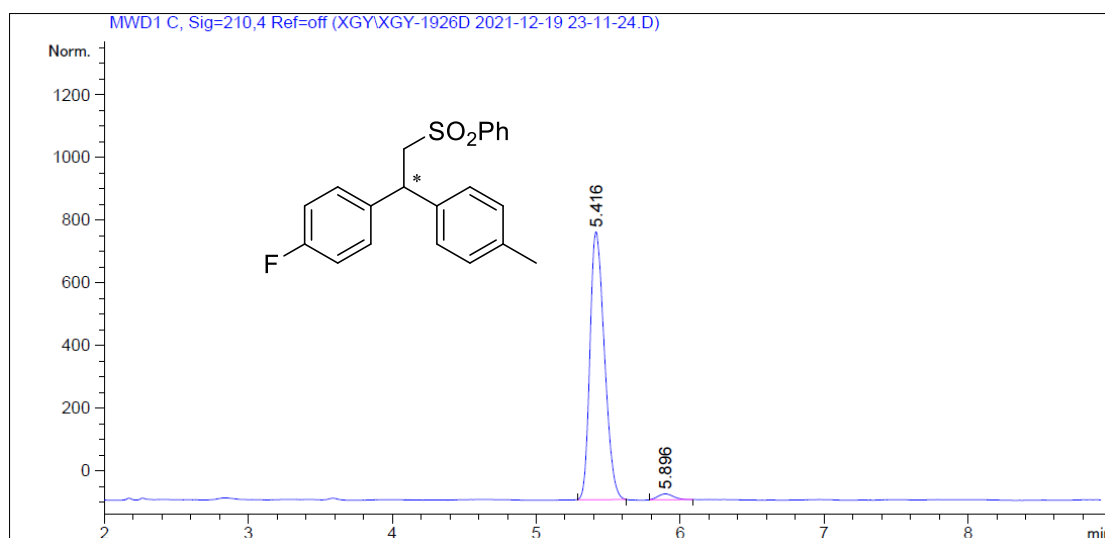
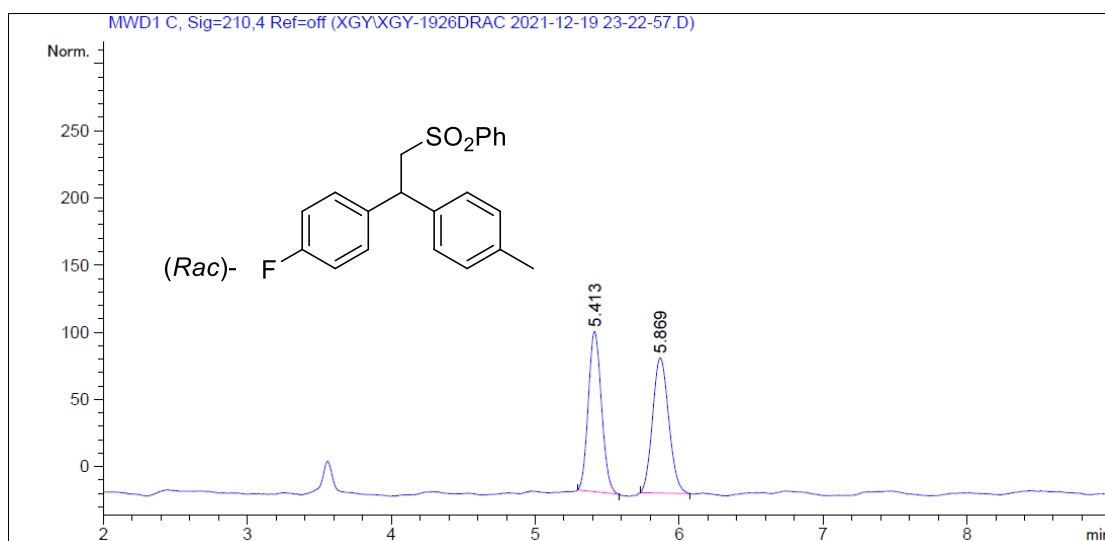
1-Chloro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4i**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.047	BB	0.0599	927.22400	240.98590	97.0106
2	3.431	BB	0.0522	28.57242	7.06819	2.9894

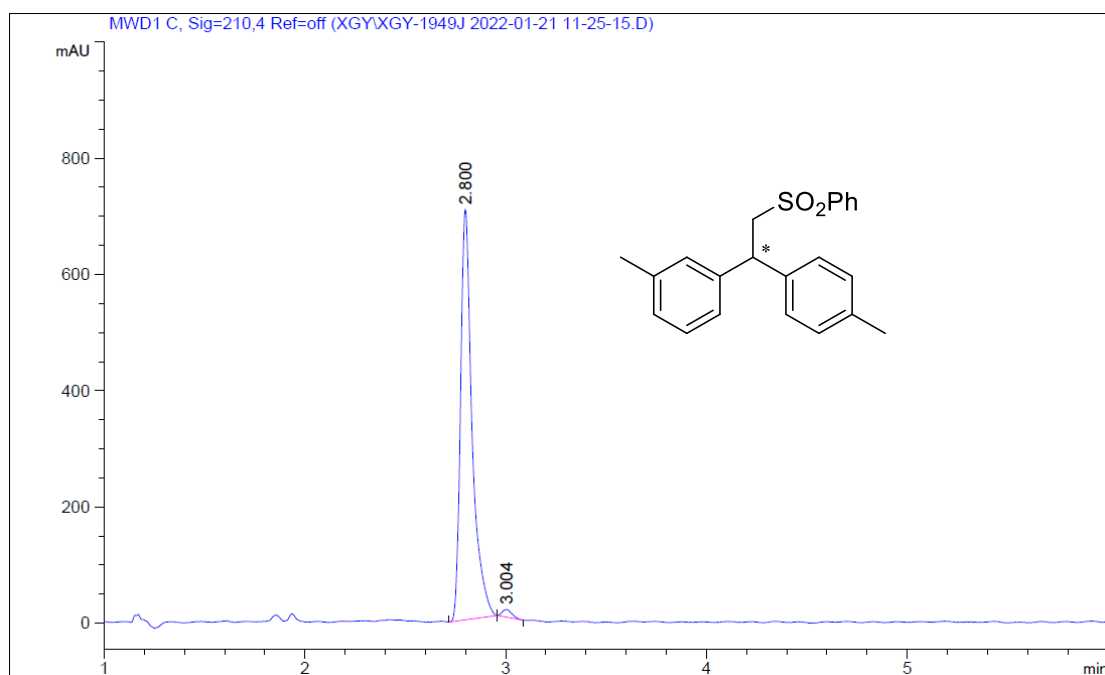
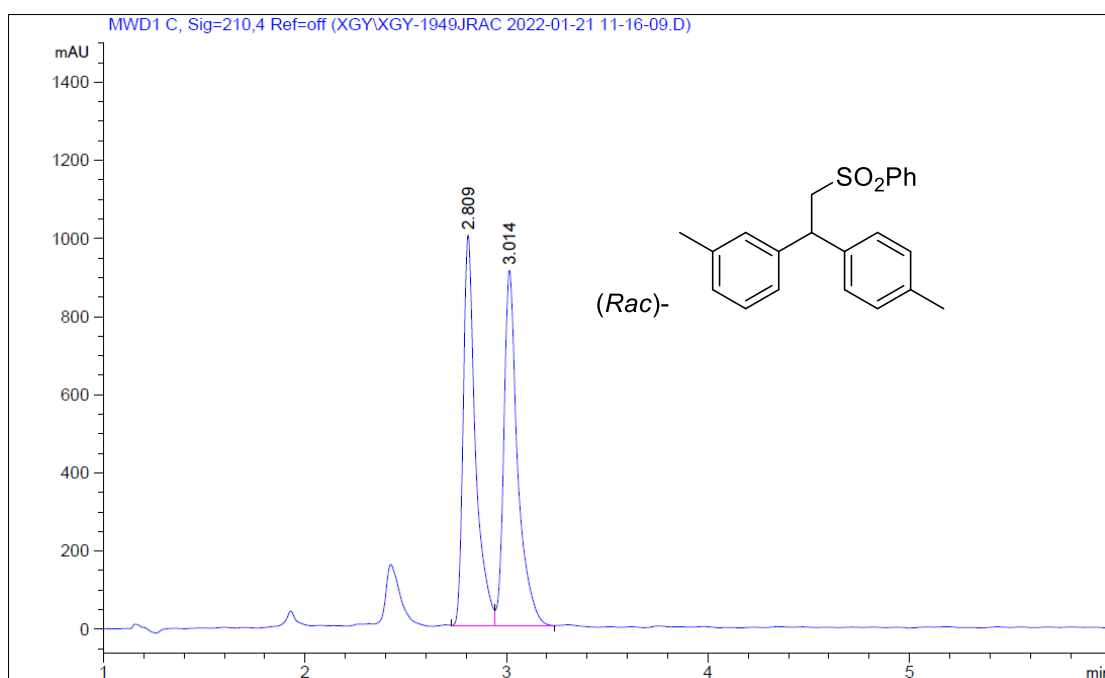
1-Fluoro-4-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4j**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	5.416	BB	0.1096	4663.15771	667.00916	97.7510
2	5.896	BB	0.0961	107.28853	14.53341	2.2490

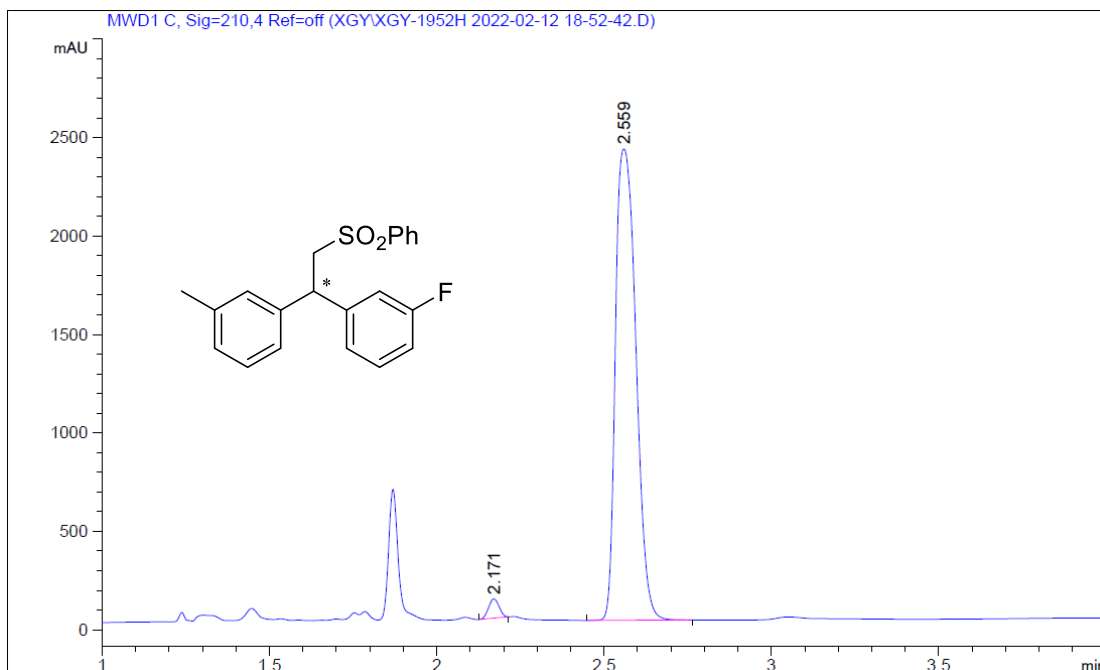
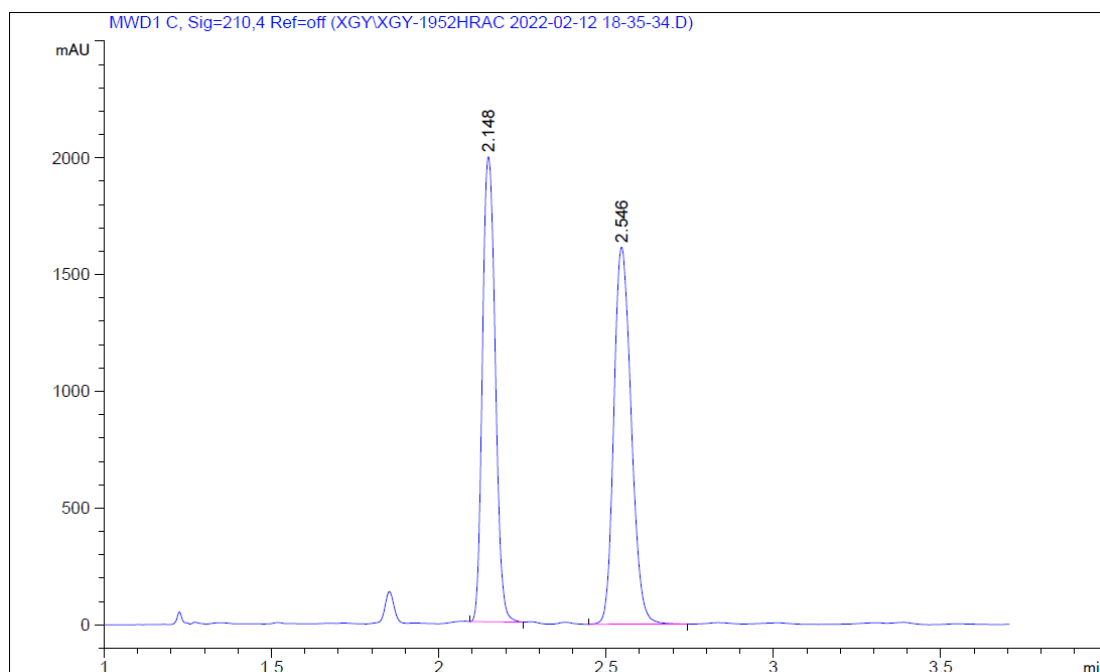
1-Methyl-3-(2-(phenylsulfonyl)-1-(*p*-tolyl)ethyl)benzene (**4k**)



Signal 1: MWD1 C, Sig=210,4 Ref=off

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.800	BB	0.0591	2822.07251	706.34753	98.4496
2	3.004	BB	0.0511	44.44292	12.92914	1.5504

1-Fluoro-3-(2-(phenylsulfonyl)-1-(*m*-tolyl)ethyl)benzene (**4I**)

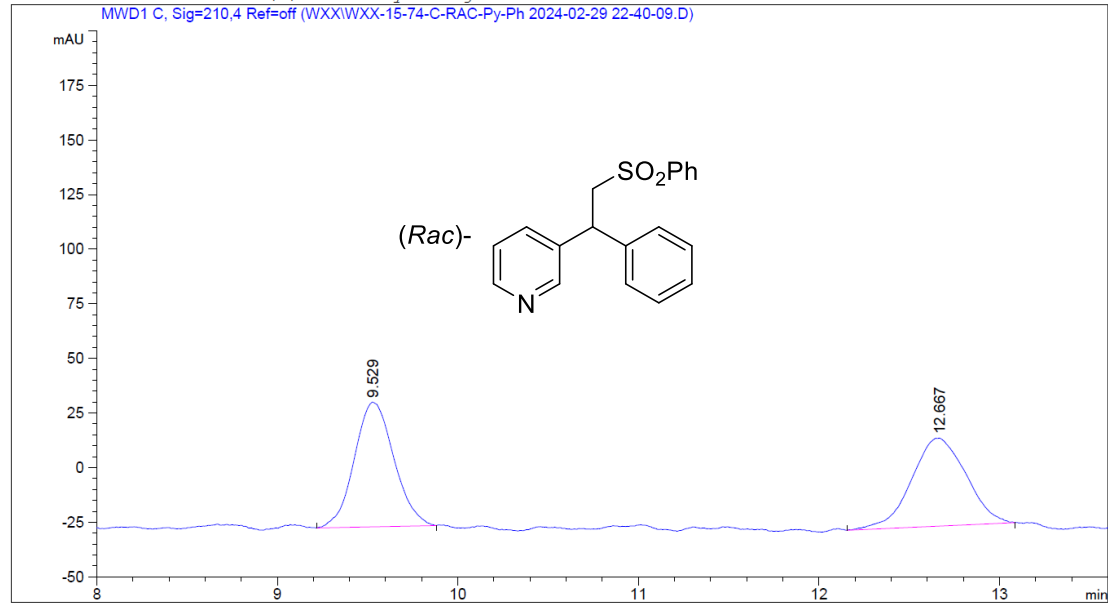


Signal 1: MWD1 C, Sig=210,4 Ref=off

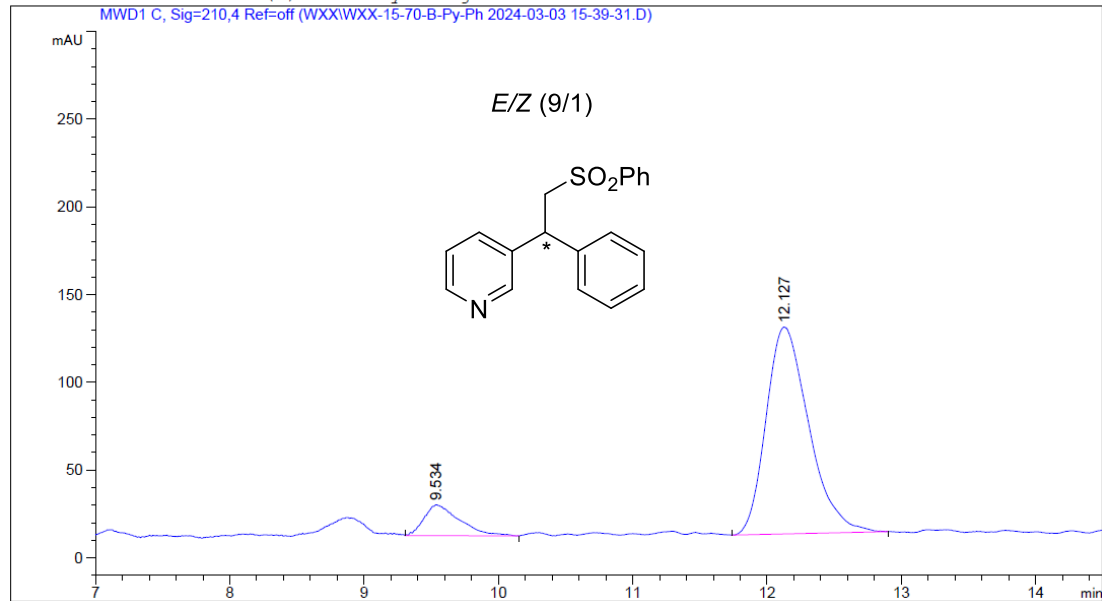
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	2.171	BB	0.0338	212.57639	98.08105	2.0557
2	2.559	BB	0.0679	1.01281e4	2393.42065	97.9443

3-(1-Phenyl-2-(phenylsulfonyl)ethyl)pyridine (**4m**)

Additional Info : Peak(s) manually integrated



Additional Info : Peak(s) manually integrated

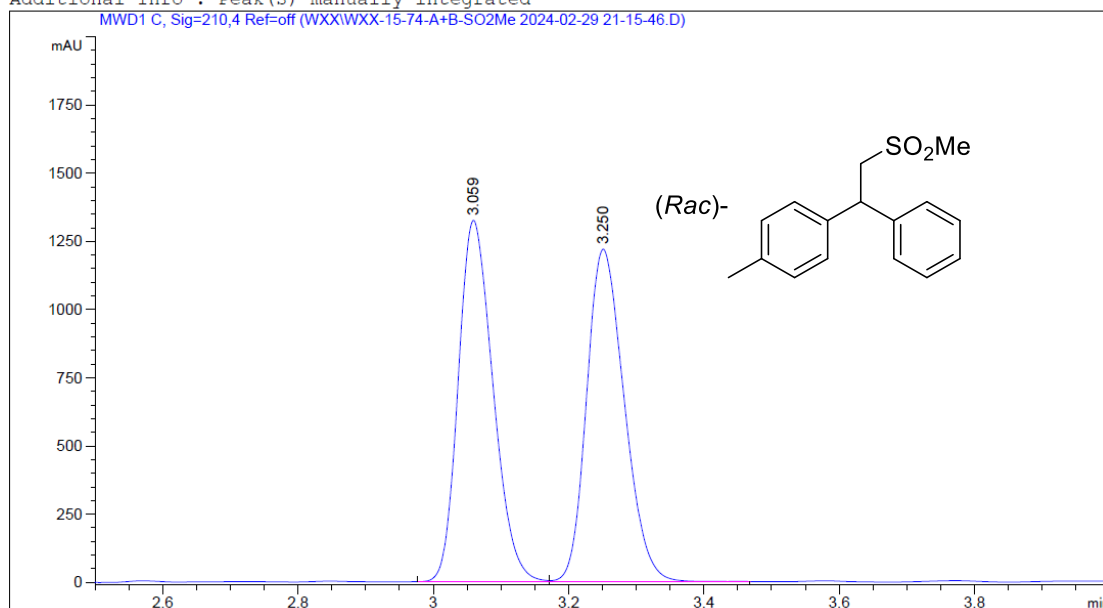


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.534	VB R	0.2178	323.61502	17.57754	11.0413
2	12.127	BV R	0.2829	2607.32568	117.96249	88.9587

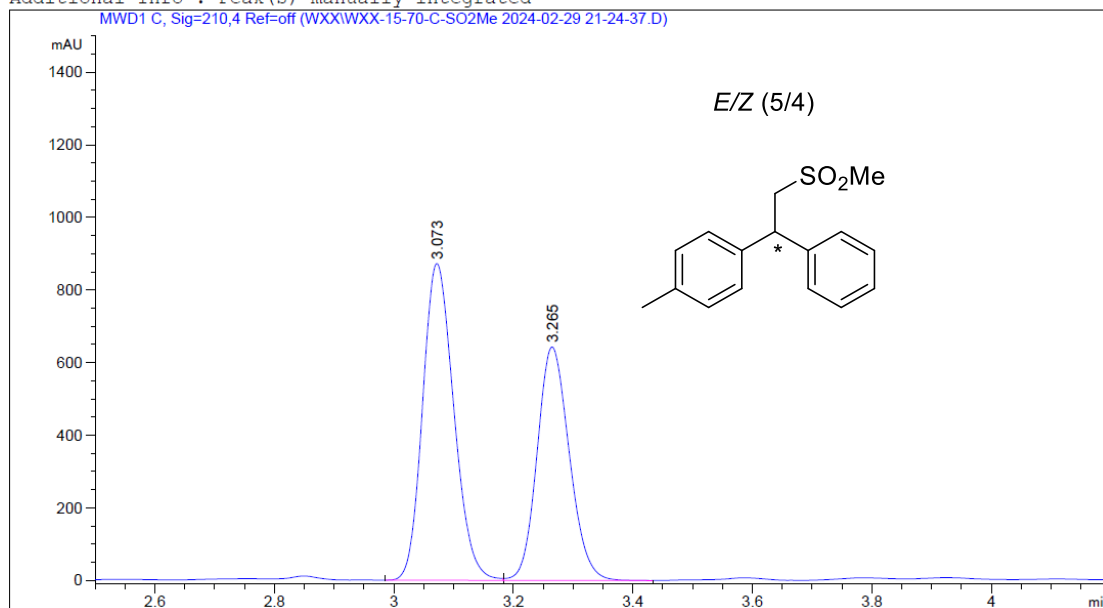
Totals : 2930.94070 135.54003

1-Methyl-4-(2-(methylsulfonyl)-1-phenylethyl)benzene (4n)

Additional Info : Peak(s) manually integrated



Additional Info : Peak(s) manually integrated



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.073	BV	0.0563	3163.39990	872.72650	56.7655
2	3.265	VB	0.0582	2409.35107	643.03876	43.2345

Totals : 5572.75098 1515.76526