

Metal-free, Visible-Light Driven Multicomponent Reactions of Glycine Derivatives with Styrene and Disulfide Ether.

Donghao Wang,^{a,b} Chenlu Zheng,^b Chao Shen,^a Min Wang,^{b*} and Jiabin Shen^{a*}

^a *Zhejiang Collaborative Innovation Center for Full-Process Monitoring and Green Governance of Emerging Contaminants, College of Biology and Environmental Engineering, Zhejiang Shuren University, Hangzhou 310015, P. R. China*

^b *College of Material, Chemistry and Chemical Engineering, Key Laboratory of Organosilicon Chemistry and Material Technology, Ministry of Education, Hangzhou Normal University, Hangzhou, 311121, P. R. China*

E-mail: mawang@hznu.edu.cn. (M. Wang); shenjiabinhznu@163.com (J. Shen)

Supporting Information

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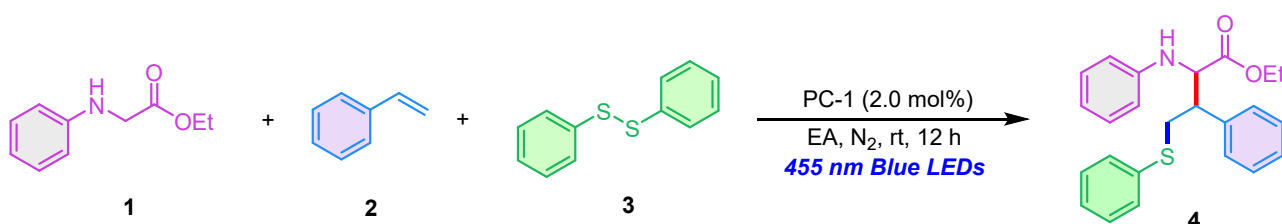
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1. General Information

All reagents and deuterated solvents were commercially available and used without further purification. All products were separated by silica gel (200-300 mesh) column chromatography with petroleum ether (PE) (60-90°C) and ethyl acetate (EA). ^1H , ^{13}C and ^{19}F NMR spectra were recorded on a Bruker Advance 500 spectrometer at ambient temperature with CDCl_3 as solvent and tetramethylsilane (TMS) as the internal standard. Melting points were determined on an X-5 Data microscopic melting point apparatus. Analytical thin layer chromatography (TLC) was performed on Merck precoated TLC (silica gel 60 F254) plates. Compounds for HRMS were analyzed by positive mode electrospray ionization (ESI) using Agilent 6530 QTOF mass spectrometer.

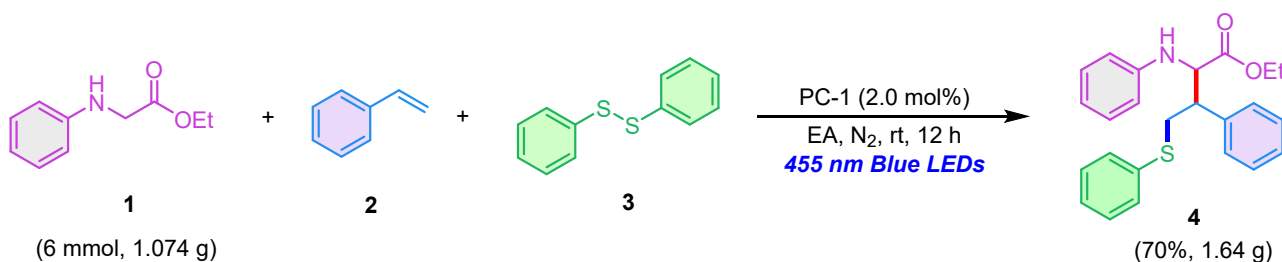
2. Experimental Section

2.1 General procedure for the synthesis of product 4.



To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added *N*-Phenylglycine Ethyl Ester (1, 0.2 mmol), Diphenyl disulfide (3, 0.3 mmol, 1.5 equiv.), 3DPA2FBN (2.6 mg, 2 mol %) successively. Air was then withdrawn and backfilled with nitrogen 3 times. Subsequently, Styrene (2, 0.5 mmol, 2.5 equiv.) and degassed EA (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na_2SO_4 . Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1) to provide products 4. The diastereomers could not be separated by standard purification methods.

2.2 General procedure for gram-scale synthesis of product 4.

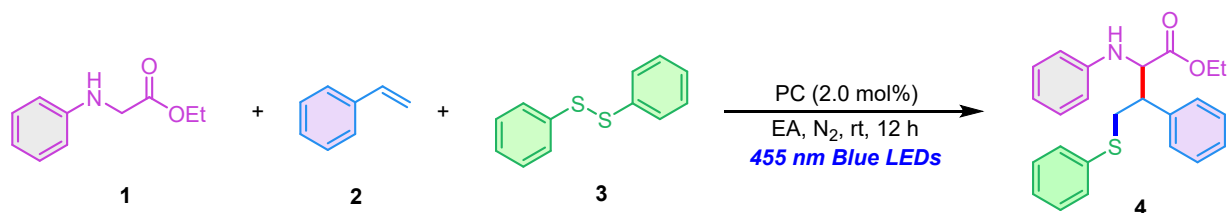


To a dried Schlenk tube (100 mL) with a magnetic stirring bar were added *N*-Phenylglycine Ethyl Ester (1, 6.0 mmol), Diphenyl disulfide (3, 9.0 mmol, 1.5 equiv.), 3DPA2FBN (79 mg, 5 mol %) successively. Air was then withdrawn and backfilled with nitrogen 3 times. Subsequently, Styrene (2, 15.0 mmol, 2.5 equiv.) and degassed EA (30 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution

and extracted with EtOAc (150 mL × 3). The collected organic layer was dried with Na₂SO₄. Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1) to provide products **4**.

3. Optimization of reaction condition

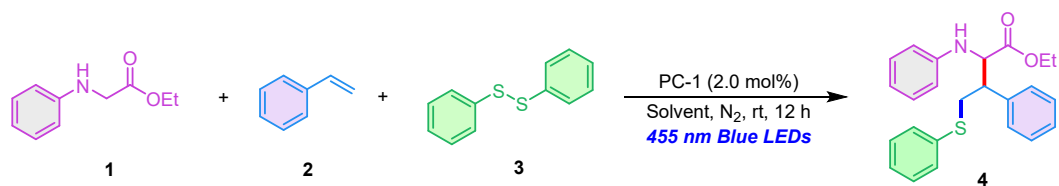
3.1 Table S1: Photocatalyst screening.^a



Entry	Photocatalyst (PC)	Yield (%) ^b
1	3DPA2FBN	77
2	4CzIPN	22
3	3DPAFIPN	54
4	3CzCIIPN	43
5	4MeOCzIPN	28
6	<i>fac</i> -Ir(ppy) ₃	30
7	[Ir(dtbbpy)(ppy) ₂] ₂ PF ₆	56
8	Ir[dF(CF ₃)ppy] ₂ (dtbbpy)PF ₆	40
9	[Ir(dFCF ₃ ppy) ₂ -(5,5'-dCF ₃ bpy)]PF ₆	30
10	[Ir{dF(CH ₃)ppy} ₂ (dtbbpy)]PF ₆	34
11	<i>fac</i> -[Ir(dF(tBu)ppy) ₃]	27
12	<i>fac</i> -[Ir(p-F(tBu)ppy) ₃]	35
13	[Acr-Mes] ⁺ ClO ₄ ⁻	Trace
14	Eosin Y	32
15	[Ru(bpy) ₃]Cl ₂ ·6H ₂ O	20
16	No PC	Trace

^a Reaction conditions: **1** (0.2 mmol), **2** (2.0 equiv.), **3** (1.5 equiv.), PC (2 mol%), EA (0.1 M, 2 mL), rt, N₂, 12 h, 455 nm Blue LEDs (20W). ^b Isolated yields.

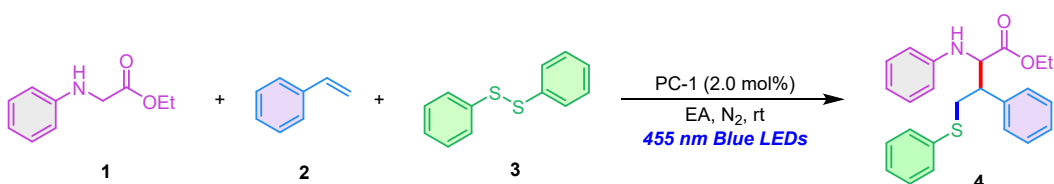
3.2 Table S2: Solvent screening.^a



Entry	Solvent	Yield (%) ^b
1	EA	77
2	DMF	44
3	DMA	53
4	DCE	30
5	DCM	28
6	MeCN	38
7	THF	51
8	MeOH	53
9	EtOH	44
10	H ₂ O	38
11	1,4-Dioxane	42
12	Cyrene	32
13	2-MeTHF	49
14	EG	51
15	EGDME	47

^a Reaction conditions: **1** (0.2 mmol), **2** (2.0 equiv.), **3** (1.5 equiv.), PC (2 mol%), Solvent (0.1 M, 2 mL), rt, N₂, 12 h, 455 nm Blue LEDs (20W). ^b Isolated yields.

3.3 Table S3: Time and temperature screening.^a

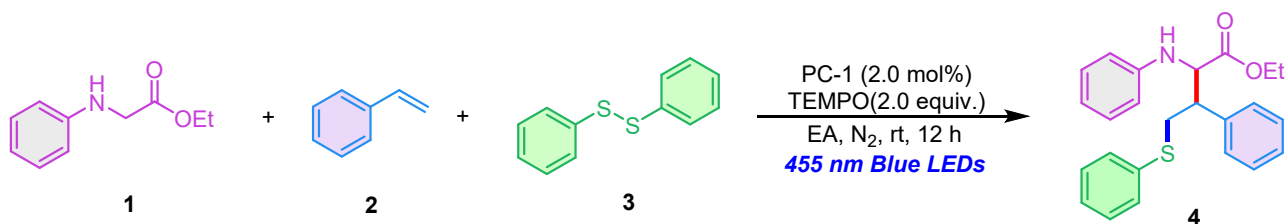


Entry	Time(h)	Yield (%) ^b
1	6	38
2	12	77
3	24	76
4 ^c	12	65
5 ^d	12	57

^a Reaction conditions: **1** (0.2 mmol), **2** (2.0 equiv.), **3** (1.5 equiv.), PC (2 mol%), EA (0.1 M, 2 mL), rt, N₂, 12 h, 455 nm Blue LEDs (20W). ^b Isolated yields. ^c 40 °C. ^d 60 °C.

4. Control experiment

4.1 Radical Trapping Experiments



To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added *N*-Phenylglycine Ethyl Ester (1, 0.2 mmol), Diphenyl disulfide (3, 0.3 mmol, 1.5 equiv.), 3DPA2FBN (2.6 mg, 2 mol %) and TEMPO (62.6 mg, 2.0 equiv.) successively. Air was then withdrawn and backfilled with nitrogen for 3 times. Subsequently, Styrene (2, 0.5 mmol, 2.5 equiv.) and degassed EA (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na₂SO₄. Finally, the organic solvent was removed under reduced pressure, then concentrated under reduced pressure after filtration, and detected by HRMS analysis of the reaction mixture (Figure S1).

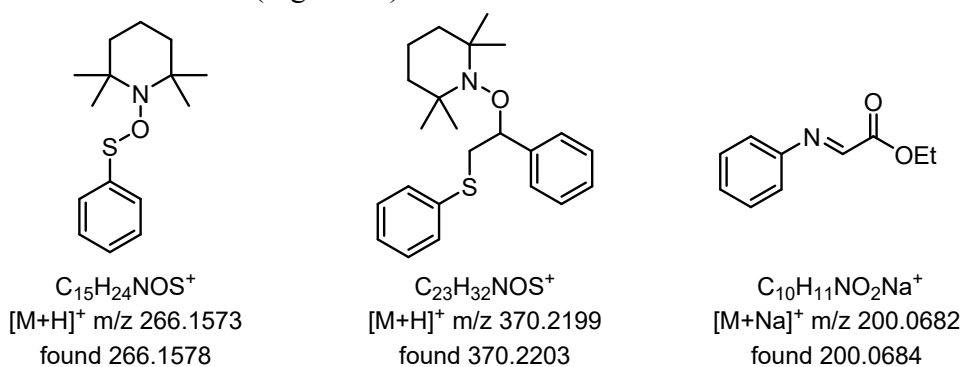
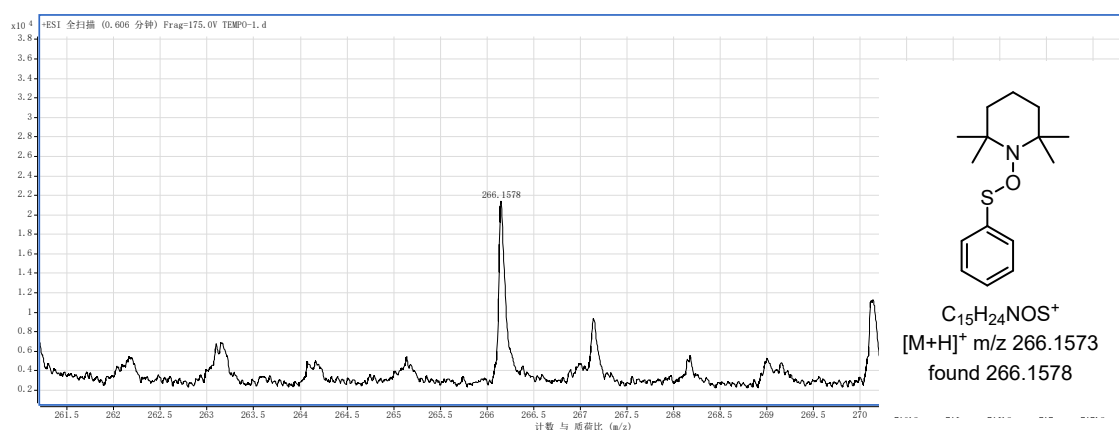
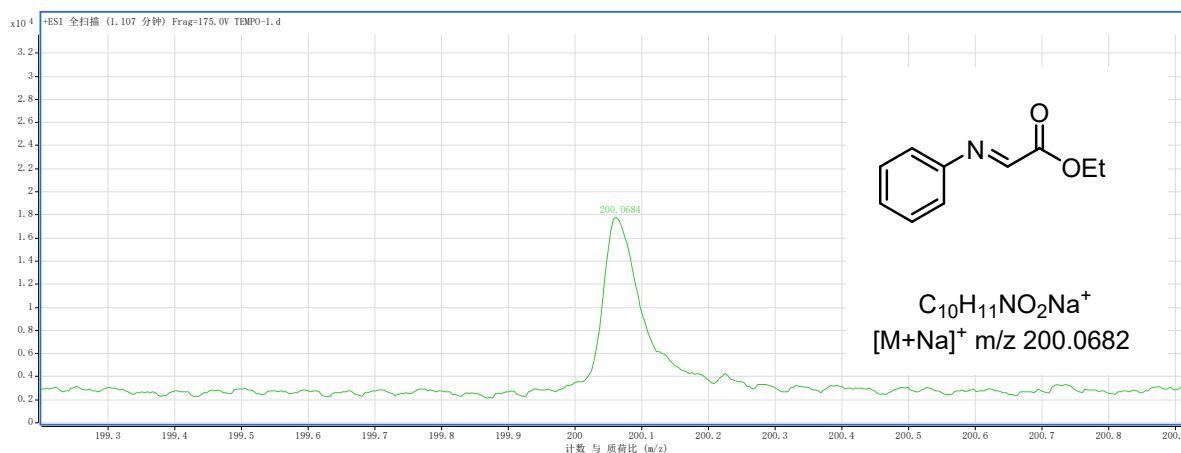
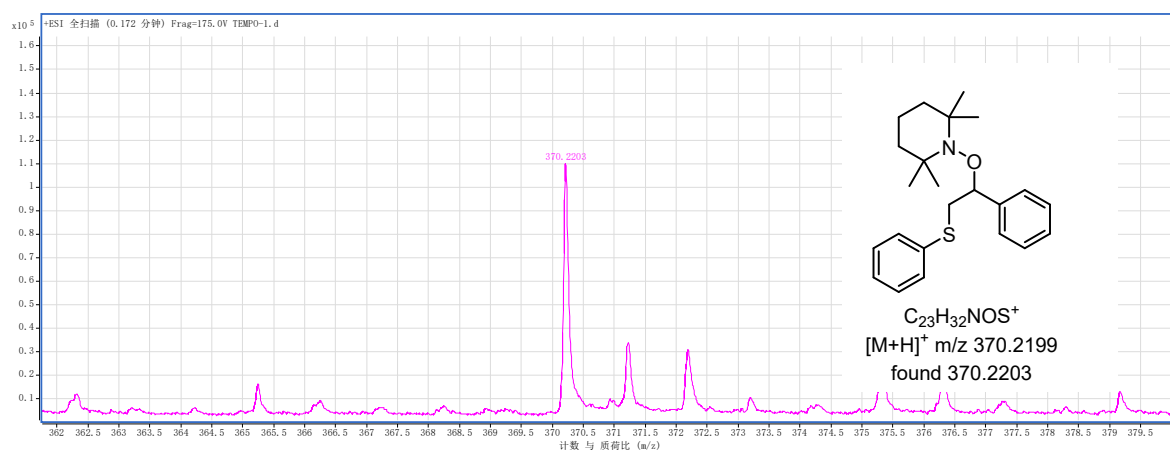
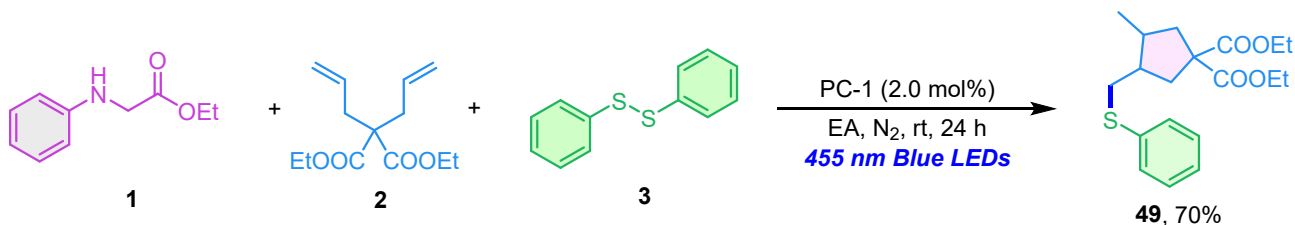


Figure S1. Radical trapping experiment



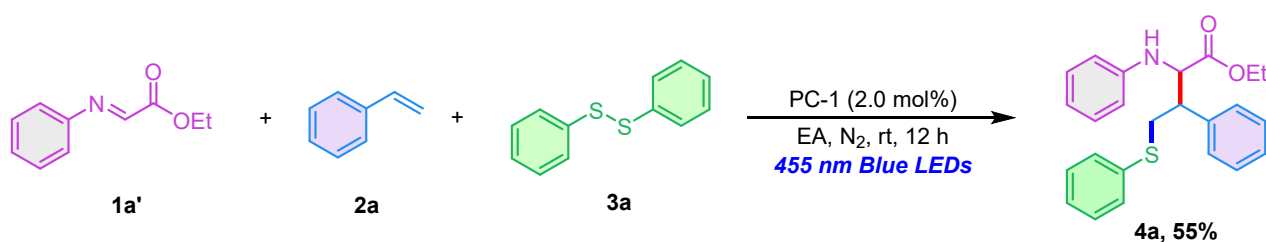


4.2 Radical Clock Experiments



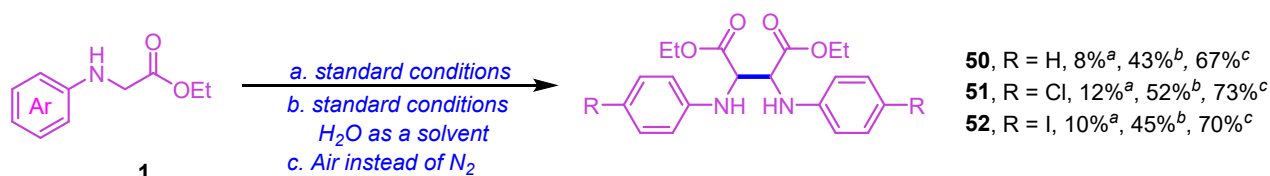
To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added N-Phenylglycine Ethyl Ester (1a, 0.2 mmol), Diphenyl disulfide (3a, 0.3 mmol, 1.5 equiv.), 3DPA2FBN (2.6 mg, 2 mol %) successively. Air was then withdrawn and backfilled with nitrogen for 3 times. Subsequently, Diethyl 2,2-diallylmalonate (2a', 0.2 mmol, 1.0 equiv.) and degassed EA (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na₂SO₄. Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1) to provide products 49 (49 mg, 70% in yield). ¹H NMR (400 MHz, Chloroform-*d*) δ 7.30 (dd, J = 8.4, 1.4 Hz, 2H), 7.26 – 7.21 (m, 2H), 7.16 – 7.12 (m, 1H), 4.16 – 4.11 (m, 4H), 2.94 (dd, J = 12.3, 6.0 Hz, 1H), 2.78 (dd, J = 12.2, 7.8 Hz, 1H), 2.43 (ddd, J = 13.4, 11.3, 6.6 Hz, 2H), 2.29 – 2.14 (m, 3H), 2.02 – 1.97 (m, 1H), 1.22 – 1.17 (m, 6H), 0.90 (d, J = 6.7 Hz, 3H). ¹³C NMR (101 MHz, Chloroform-*d*) δ 172.71, 136.69, 129.22, 128.90, 125.94, 61.49, 58.83, 41.80, 41.24, 38.15, 35.82, 34.57, 14.74, 14.07.

4.3 Three-component reaction of imine



To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added imine ($1a'$, 0.2 mmol), Diphenyl disulfide ($3a$, 0.3 mmol, 1.5 equiv.), 3DPA2FBN (2.6 mg, 2 mol%) successively. Air was then withdrawn and backfilled with nitrogen 3 times. Subsequently, Styrene ($2a$, 0.5 mmol, 2.5 equiv.) and degassed EA (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na_2SO_4 . Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1) to provide products **4** (yield: 55%). These results indicate that imine is the key intermediate in this transformation.

4.4 Homo-coupling of glycine derivatives



Method a: To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added N-Phenylglycine Ethyl Ester (**1**, 0.2 mmol), 3DPA2FBN (2.6 mg, 2 mol%) successively. Air was then withdrawn and backfilled with nitrogen 3 times. Subsequently, degassed EA (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na_2SO_4 . Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 50:1) to provide products **50-52** (yield: 8%).

Method b: To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added N-Phenylglycine Ethyl Ester (**1**, 0.2 mmol), 3DPA2FBN (2.6 mg, 2 mol%) successively. Air was then withdrawn and backfilled with nitrogen 3 times. Subsequently, degassed H_2O (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na_2SO_4 . Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 50:1) to provide products **50-52** (yield: 43%).

Method c: To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added N-Phenylglycine Ethyl Ester (**1**, 0.2 mmol), 3DPA2FBN (2.6 mg, 2 mol%) successively. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. After the completion (as

indicated by TLC), the reaction mixture was quenched with saturated NaCl aqueous solution and extracted with EtOAc (15 mL \times 3). The collected organic layer was dried with Na₂SO₄, Finally, the organic solvent was removed under reduced pressure, and the obtained residue was further purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 50:1) to provide products **50-52** (yield: 43%).

4.5 The Light on-off Experiment

To a dried Schlenk tube (10 mL) with a magnetic stirring bar were added N-Phenylglycine Ethyl Ester (1a, 0.2 mmol), Diphenyl disulfide (3a, 0.3 mmol, 1.5 equiv.), 3DPA2FBN (2.6 mg, 2 mol %) successively. Air was then withdrawn and backfilled with nitrogen for 3 times. Subsequently, Styrene (2a, 0.5 mmol, 2.5 equiv.) and degassed EA (2 mL, 0.2 M) were added under nitrogen atmosphere. Then, the reaction mixture was irradiated under 20 W blue LEDs for 12 hours. Six identical reactions were carried out simultaneously and yield was determined by ¹H NMR of the crude mixture using tetramethylsilane (TMS) as internal standard. These experiments with continuous intervals of irradiation and dark periods led to total interruption of the reaction proceed in the absence of light, and reactivity is restored under further light (Figure S2). These results indicated that light is an essential component of the reaction.

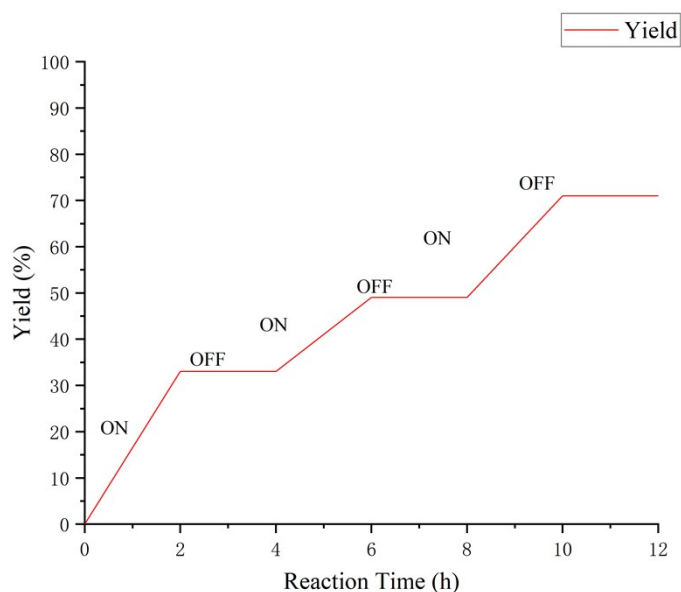


Figure S2. The light on-off experiment

4.6 Stern-Volmer Fluorescence Quenching Study

To a solution of 3DPA2FBN in anhydrous, N₂-saturated EA (5×10^{-4} mol/L) in a quartz cuvette, different amounts of N-Phenylglycine Ethyl Ester **1** and Styrene **2** and Diphenyl disulfide **3** were added, respectively, and the resulting changes in fluorescence intensity (concentration of **1** and **2** and **3**: 2.5×10^{-4} mol/L, 5×10^{-4} mol/L, 7.5×10^{-4} mol/L, 1.0×10^{-3} mol/L, 1.25×10^{-3} mol/L) were collected. The emission intensity at 536 nm was collected with excited wavelength of 455 nm. Result showed that Diphenyl disulfide (3a) efficiently quenches the excited state of PC-1, demonstrating that the reaction involves the interaction between the PC-1 and Diphenyl disulfide (**3a**). The results are shown in Figure S3.

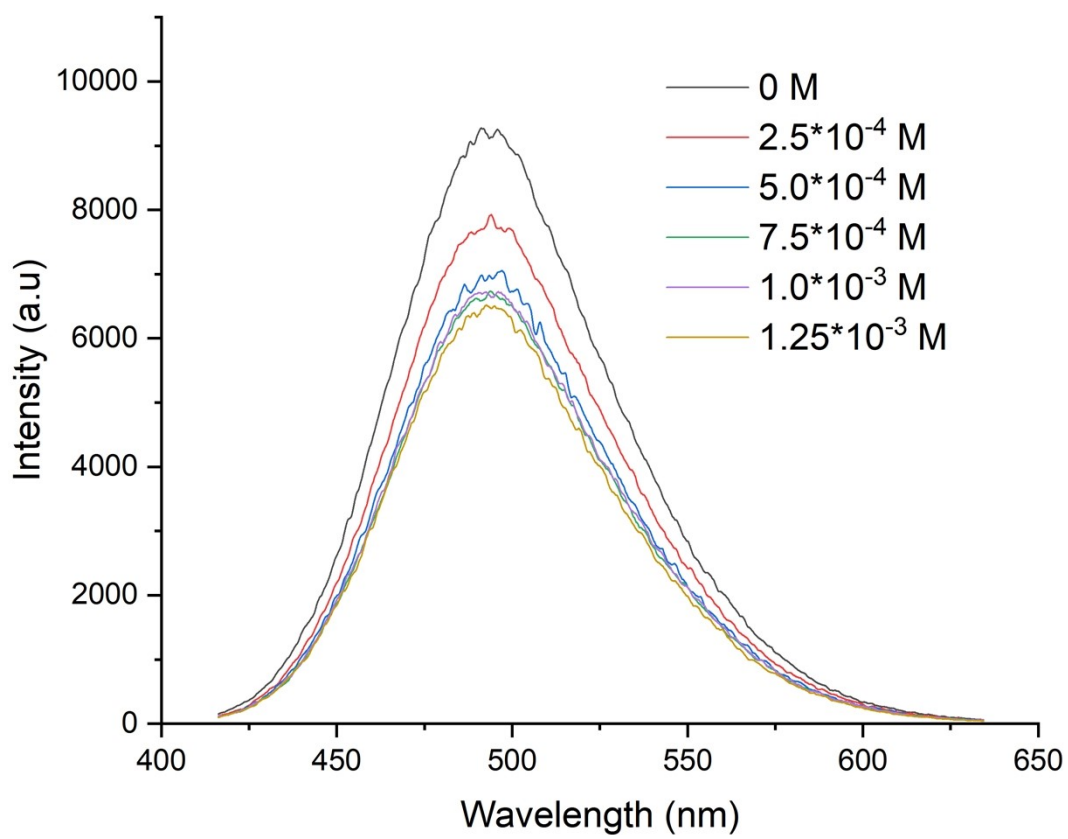
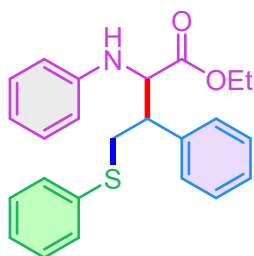


Figure S3. Stern-Volmer Fluorescence Quenching Study

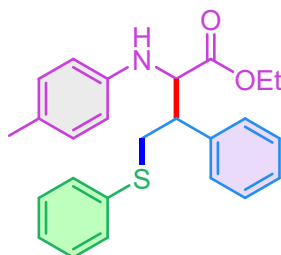
5. Characterization of products

Ethyl (2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoate (4)



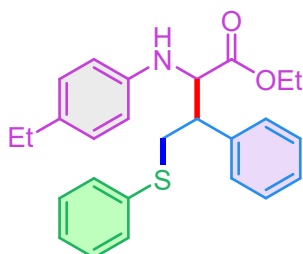
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (60 mg, 77% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.38 (d, $J = 7.6$ Hz, 2H), 7.30 (dd, $J = 9.0, 7.2$ Hz, 5H), 7.22 (s, 1H), 7.19 (d, $J = 9.7$ Hz, 1H), 7.15 (dd, $J = 7.7, 5.4$ Hz, 3H), 6.74 (dd, $J = 17.2, 7.8$ Hz, 3H), 4.77 (d, $J = 3.4$ Hz, 1H), 4.08 (q, $J = 7.1$ Hz, 2H), 3.53 – 3.44 (m, 2H), 3.33 (dd, $J = 11.7, 4.0$ Hz, 1H), 1.17 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.82, 147.55, 138.47, 135.41, 130.31, 129.36, 129.06, 128.66, 128.37, 127.83, 126.61, 118.99, 114.61, 61.28, 59.35, 47.35, 36.26, 14.22. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{25}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 392.1679, Found 392.1680.

Ethyl (2*R*,3*R*)-3-phenyl-4-(phenylthio)-2-(*p*-tolylamino)butanoate (5)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (70 mg, 87% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.25 – 7.17 (m, 7H), 7.13 – 7.08 (m, 3H), 6.90 – 6.84 (m, 2H), 6.45 (dd, $J = 8.5, 2.2$ Hz, 2H), 4.33 (d, $J = 6.6$ Hz, 1H), 3.84 (ddd, $J = 7.0, 4.6, 2.4$ Hz, 2H), 3.63 (dd, $J = 13.1, 5.9$ Hz, 1H), 3.31 – 3.16 (m, 2H), 2.15 (s, 3H), 0.91 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.25, 144.16, 138.88, 136.05, 129.86, 129.58, 129.01, 128.53, 128.51, 128.02, 127.68, 126.27, 114.21, 61.46, 61.06, 48.32, 36.39, 20.45, 13.91. HRMS (ESI⁺): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1839.

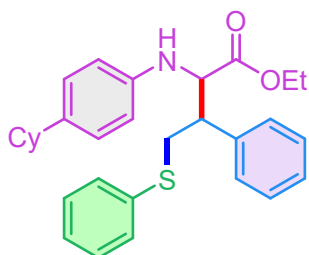
Ethyl (2*S*,3*S*)-2-((4-ethylphenyl)amino)-3-phenyl-4-(phenylthio)butanoate (6)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (68 mg, 80% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.37 (m, 2H), 7.31 – 7.28 (m, 4H), 7.26 – 7.17 (m, 2H), 7.15 – 7.12 (m, 2H), 7.01 (d, $J = 8.4$ Hz, 2H), 6.67 (d, $J = 8.4$ Hz, 2H), 4.73 (d, $J = 3.7$ Hz, 1H), 4.06 (t, $J = 7.2$ Hz, 2H), 3.52 (dd, $J = 12.5, 9.2$ Hz, 1H), 3.43

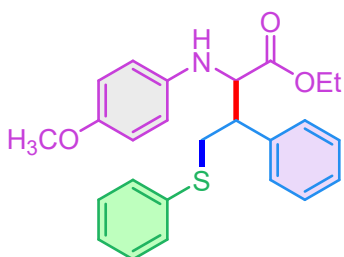
(dt, $J = 9.1, 4.2$ Hz, 1H), 3.33 (dd, $J = 12.5, 4.8$ Hz, 1H), 2.53 (d, $J = 7.6$ Hz, 2H), 1.18 (dt, $J = 7.6, 4.0$ Hz, 6H). ^{13}C NMR (101 MHz, Chloroform- d) δ 172.98, 145.47, 138.58, 135.50, 134.89, 130.27, 129.05, 128.68, 128.62, 128.39, 127.79, 126.56, 114.86, 61.21, 59.82, 47.34, 36.26, 27.98, 15.94, 14.24. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{26}\text{H}_{29}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^{+}$ 420.1992, Found 420.1993.

Ethyl (2*R*,3*R*)-2-((4-cyclohexylphenyl)amino)-3-phenyl-4-(phenylthio)butanoate (7)



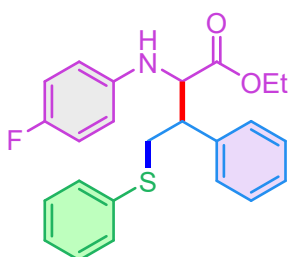
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 20:1), obtained as yellow liquid (65 mg, 69% yield); ^1H NMR (400 MHz, Chloroform- d) δ 7.41 – 7.37 (m, 2H), 7.32 – 7.28 (m, 4H), 7.25 – 7.18 (m, 2H), 7.14 (dd, $J = 7.8, 1.8$ Hz, 2H), 7.02 (d, $J = 8.5$ Hz, 2H), 6.68 (d, $J = 8.5$ Hz, 2H), 4.72 (d, $J = 3.7$ Hz, 1H), 4.08 (q, $J = 7.1$ Hz, 2H), 3.52 (dd, $J = 12.5, 9.1$ Hz, 1H), 3.46 – 3.41 (m, 1H), 3.33 (dd, $J = 12.5, 4.9$ Hz, 1H), 2.41 – 2.34 (m, 1H), 1.85 – 1.79 (m, 4H), 1.39 – 1.26 (m, 6H), 1.17 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform- d) δ 172.97, 145.54, 138.89, 138.62, 135.54, 130.28, 129.02, 128.58, 128.40, 127.75, 127.59, 126.54, 114.74, 61.18, 59.85, 47.41, 43.65, 36.29, 34.71, 27.01, 26.24, 14.21. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{30}\text{H}_{35}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^{+}$ 474.2461, Found 474.2463.

Ethyl (2*R*,3*R*)-2-((4-methoxyphenyl)amino)-3-phenyl-4-(phenylthio)butanoate (8)



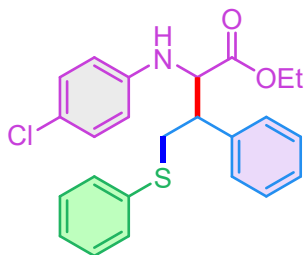
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (61 mg, 72% yield); ^1H NMR (400 MHz, Chloroform- d) δ 7.34 – 7.29 (m, 2H), 7.22 (q, $J = 7.4$ Hz, 5H), 7.16 – 7.12 (m, 1H), 7.09 – 7.05 (m, 2H), 6.68 (d, $J = 9.0$ Hz, 2H), 6.62 (d, $J = 8.9$ Hz, 2H), 4.62 – 4.53 (m, 1H), 3.99 (qd, $J = 7.1, 2.3$ Hz, 2H), 3.66 (s, 3H), 3.48 (d, $J = 3.5$ Hz, 1H), 3.37 – 3.24 (m, 2H), 1.09 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform- d) δ 173.12, 153.18, 141.58, 138.59, 135.47, 130.28, 129.04, 128.61, 128.36, 127.77, 126.57, 116.59, 114.77, 61.16, 60.85, 55.70, 47.25, 36.26, 14.22. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_3\text{S}$ $[\text{M}+\text{H}]^{+}$ 422.1784, Found 422.1789.

Ethyl (2*R*,3*R*)-2-((4-fluorophenyl)amino)-3-phenyl-4-(phenylthio)butanoate (9)



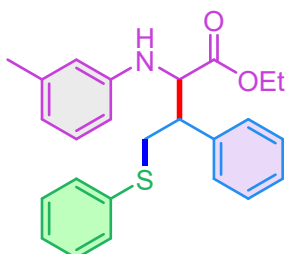
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (55 mg, 67% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.41 – 7.36 (m, 2H), 7.30 (dd, J = 8.0, 6.7 Hz, 4H), 7.26 – 7.20 (m, 2H), 7.15 – 7.11 (m, 2H), 6.85 (t, J = 8.7 Hz, 2H), 6.69 – 6.60 (m, 2H), 4.67 (d, J = 3.7 Hz, 1H), 4.12 – 4.02 (m, 2H), 3.51 (dd, J = 12.5, 9.4 Hz, 1H), 3.43 (dt, J = 9.2, 4.1 Hz, 1H), 3.32 (dd, J = 12.5, 4.7 Hz, 1H), 1.17 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.85, 156.71 (d, J = 236.9 Hz), 143.89 (d, J = 2.1 Hz), 138.42, 135.33, 130.37, 129.07, 128.50 (d, J = 36.2 Hz), 127.87, 126.68, 116.06 (d, J = 7.6 Hz), 115.74 (d, J = 22.3 Hz), 61.27, 60.33, 47.25, 36.29, 14.20. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -125.90. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{24}\text{FNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 410.1085, Found 410.1085.

Ethyl (2*R*,3*R*)-2-((4-chlorophenyl)amino)-3-phenyl-4-(phenylthio)butanoate (10)



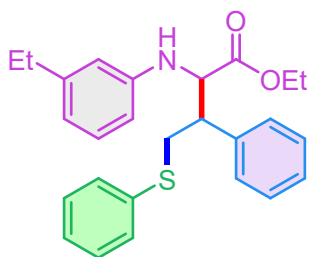
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (54 mg, 64% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.33 – 7.29 (m, 2H), 7.20 (dq, J = 19.3, 7.2 Hz, 8H), 7.03 (d, J = 8.8 Hz, 2H), 6.56 (d, J = 8.8 Hz, 2H), 4.65 (d, J = 3.0 Hz, 1H), 4.02 (q, J = 7.1 Hz, 2H), 3.42 – 3.34 (m, 2H), 3.26 (dd, J = 10.2, 8.3 Hz, 1H), 1.11 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.60, 146.15, 138.24, 135.19, 130.39, 129.16, 129.09, 128.73, 128.28, 127.93, 126.74, 123.61, 115.79, 61.39, 59.31, 47.21, 36.23, 14.21. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{24}\text{ClNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 426.1289, Found 426.1290.

Ethyl (2*R*,3*R*)-3-phenyl-4-(phenylthio)-2-(*m*-tolylamino)butanoate (11)



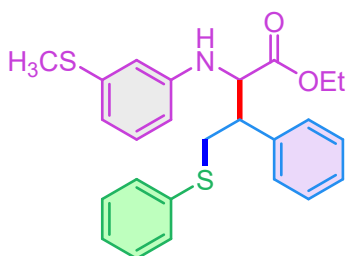
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as brown liquid (57 mg, 70% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.32 – 7.28 (m, 2H), 7.24 – 7.14 (m, 6H), 7.08 – 7.04 (m, 2H), 6.98 (td, J = 7.3, 1.4 Hz, 1H), 6.50 (d, J = 7.5 Hz, 1H), 6.46 (d, J = 7.1 Hz, 2H), 4.68 (d, J = 3.5 Hz, 1H), 4.01 (q, J = 7.1 Hz, 2H), 3.45 – 3.35 (m, 2H), 3.25 (dd, J = 11.8, 4.1 Hz, 1H), 2.17 (s, 3H), 1.10 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.87, 147.56, 139.17, 138.52, 135.50, 130.22, 129.23, 129.04, 128.63, 128.38, 127.80, 126.56, 119.88, 115.42, 111.55, 61.24, 59.29, 47.40, 36.23, 21.59, 14.23. HRMS (ESI⁺): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1845.

Ethyl (2*R*,3*R*)-2-((3-ethylphenyl)amino)-3-phenyl-4-(phenylthio)butanoate (12)



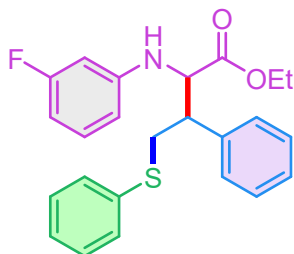
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (55 mg, 65% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.36 (m, 2H), 7.31 – 7.21 (m, 6H), 7.14 (dd, J = 7.7, 1.8 Hz, 2H), 7.00 (d, J = 8.1 Hz, 2H), 6.67 (d, J = 8.4 Hz, 2H), 4.72 (d, J = 3.7 Hz, 1H), 4.07 (q, J = 7.1 Hz, 2H), 3.54 – 3.42 (m, 2H), 3.33 (dd, J = 12.5, 4.9 Hz, 1H), 2.53 (q, J = 7.6 Hz, 2H), 1.17 (td, J = 7.4, 3.1 Hz, 6H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.97, 145.44, 138.57, 135.51, 134.90, 130.28, 129.03, 128.67, 128.61, 128.39, 127.77, 126.55, 114.86, 61.20, 59.85, 47.35, 36.27, 27.96, 15.91, 14.22. HRMS (ESI⁺): Calculated for: $\text{C}_{26}\text{H}_{29}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 420.1992, Found 420.1994.

Ethyl (2*R*,3*R*)-2-((3-(methylthio)phenyl)amino)-3-phenyl-4-(phenylthio)butanoate (13)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (39 mg, 45% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.41 – 7.37 (m, 2H), 7.33 – 7.29 (m, 4H), 7.27 (d, J = 4.5 Hz, 1H), 7.25 – 7.20 (m, 1H), 7.13 (dd, J = 7.7, 1.8 Hz, 2H), 7.07 (t, J = 7.9 Hz, 1H), 6.68 – 6.62 (m, 2H), 6.50 (ddd, J = 8.1, 2.4, 0.9 Hz, 1H), 4.77 (d, J = 3.2 Hz, 1H), 4.10 (q, J = 7.1 Hz, 2H), 3.50 – 3.42 (m, 2H), 3.35 – 3.29 (m, 1H), 2.45 (s, 3H), 1.19 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.66, 147.99, 139.53, 138.37, 135.26, 130.35, 129.66, 129.07, 128.68, 128.33, 127.87, 126.67, 117.05, 112.32, 111.41, 61.36, 59.12, 47.31, 36.21, 15.69, 14.23. HRMS (ESI⁺): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}_2$ $[\text{M}+\text{H}]^+$ 438.1556, Found 438.1558.

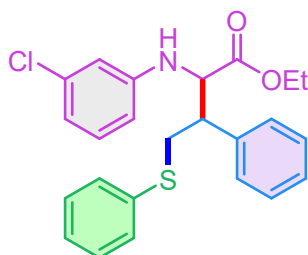
Ethyl (2*R*,3*R*)-2-((3-fluorophenyl)amino)-3-phenyl-4-(phenylthio)butanoate (14)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (45 mg, 55% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.41 – 7.37 (m, 2H), 7.34 – 7.27 (m, 5H), 7.25 – 7.21 (m, 1H), 7.14 – 7.11 (m, 2H), 7.10 – 7.05 (m, 1H), 6.48 – 6.40 (m, 3H), 4.74 (d, J = 3.3 Hz, 1H), 4.11 (q, J = 7.1 Hz, 2H), 3.46 (dd, J = 5.6, 2.3 Hz, 2H), 3.36 – 3.29 (m, 1H), 1.19 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.45, 163.94 (d, J =

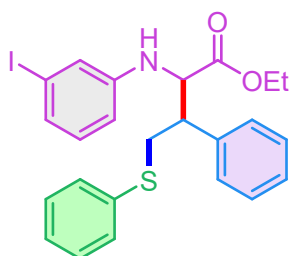
243.6 Hz), 149.33 (d, $J = 10.4$ Hz), 138.23, 135.21, 130.46, 130.38, 129.07, 128.50 (d, $J = 44.0$ Hz), 128.29, 127.92, 126.73, 110.15 (d, $J = 2.4$ Hz), 105.41 (d, $J = 21.4$ Hz), 101.31 (d, $J = 25.4$ Hz), 61.40, 58.98, 47.29, 36.28, 14.18. ^{19}F NMR (376 MHz, Chloroform- d) δ -112.48. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{24}\text{H}_{24}\text{FNO}_2\text{S}$ $[\text{M}+\text{H}]^{+}$ 410.1585, Found 410.1587.

Ethyl (2*R*,3*R*)-2-((3-chlorophenyl)amino)-3-phenyl-4-(phenylthio)butanoate (15)



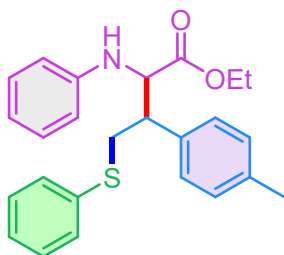
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (31 mg, 47% yield); ^1H NMR (400 MHz, Chloroform- d) δ 7.42 – 7.36 (m, 2H), 7.34 – 7.26 (m, 5H), 7.25 – 7.21 (m, 1H), 7.14 – 7.10 (m, 2H), 7.06 (t, $J = 8.0$ Hz, 1H), 6.75 – 6.68 (m, 2H), 6.59 – 6.55 (m, 1H), 4.75 (d, $J = 3.1$ Hz, 1H), 4.11 (q, $J = 7.1$ Hz, 2H), 3.48 – 3.41 (m, 2H), 3.37 – 3.29 (m, 1H), 1.20 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform- d) δ 172.44, 148.69, 138.16, 135.14, 135.02, 130.46, 130.32, 129.08, 128.75, 128.27, 127.96, 126.75, 118.84, 114.35, 112.59, 61.45, 58.83, 47.25, 36.25, 14.21. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{24}\text{H}_{24}\text{ClNO}_2\text{S}$ $[\text{M}+\text{H}]^{+}$ 426.1289, Found 426.1290.

Ethyl (2*R*,3*R*)-2-((3-iodophenyl)amino)-3-phenyl-4-(phenylthio)butanoate (16)



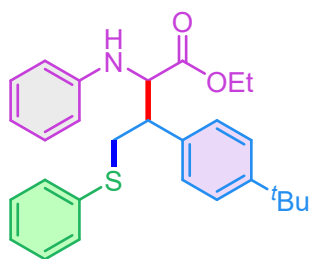
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (66 mg, 64% yield); ^1H NMR (400 MHz, Chloroform- d) δ 7.40 – 7.37 (m, 2H), 7.33 – 7.29 (m, 4H), 7.26 (d, $J = 5.5$ Hz, 1H), 7.23 (d, $J = 7.3$ Hz, 1H), 7.13 – 7.09 (m, 2H), 7.08 – 7.04 (m, 2H), 6.85 (t, $J = 8.2$ Hz, 1H), 6.65 (ddd, $J = 8.2, 2.3, 1.0$ Hz, 1H), 4.72 (d, $J = 3.2$ Hz, 1H), 4.10 (q, $J = 7.1$ Hz, 2H), 3.46 – 3.39 (m, 2H), 3.35 – 3.29 (m, 1H), 1.19 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform- d) δ 172.42, 148.74, 138.16, 135.16, 130.79, 130.43, 129.09, 128.75, 128.27, 127.96, 127.83, 126.75, 123.24, 113.54, 95.18, 61.46, 58.77, 47.25, 36.23, 14.23. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{24}\text{H}_{24}\text{INO}_2\text{S}$ $[\text{M}+\text{H}]^{+}$ 518.0645, Found 518.0654.

Ethyl (2*R*,3*R*)-2-(phenylamino)-4-(phenylthio)-3-(*p*-tolyl)butanoate (17)



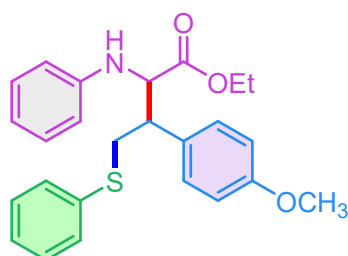
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (47 mg, 58% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.39 – 7.36 (m, 2H), 7.29 (d, J = 1.1 Hz, 1H), 7.25 (d, J = 4.6 Hz, 1H), 7.23 – 7.17 (m, 2H), 7.16 – 7.12 (m, 3H), 7.03 (d, J = 8.1 Hz, 2H), 6.78 – 6.73 (m, 1H), 6.73 – 6.69 (m, 2H), 4.74 (d, J = 3.6 Hz, 1H), 4.09 (q, J = 7.1 Hz, 2H), 3.51 – 3.40 (m, 2H), 3.32 (dd, J = 12.0, 4.5 Hz, 1H), 2.33 (s, 3H), 1.18 (t, J = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.92, 147.60, 137.48, 135.54, 135.31, 130.22, 129.38, 129.34, 129.03, 128.20, 126.53, 118.91, 114.58, 61.23, 59.35, 46.95, 36.34, 21.16, 14.24. HRMS (ESI+): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1839.

Ethyl (2*R*,3*R*)-3-(4-(tert-butyl)phenyl)-2-(phenylamino)-4-(phenylthio)butanoate (18)



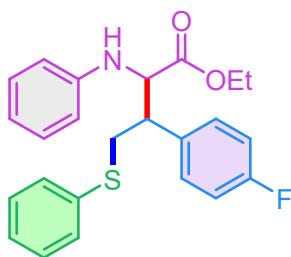
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (66 mg, 74% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.36 (m, 2H), 7.31 (d, J = 8.3 Hz, 2H), 7.28 – 7.23 (m, 2H), 7.22 – 7.14 (m, 3H), 7.05 (d, J = 8.4 Hz, 2H), 6.77 – 6.71 (m, 3H), 4.79 (d, J = 3.3 Hz, 1H), 4.08 (q, J = 7.2 Hz, 2H), 3.51 – 3.42 (m, 2H), 3.31 (dd, J = 11.5, 3.4 Hz, 1H), 1.31 (s, 9H), 1.16 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.95, 150.56, 147.60, 135.48, 135.29, 130.40, 129.34, 129.01, 127.97, 126.58, 125.54, 118.89, 114.57, 61.18, 59.11, 46.82, 36.32, 34.53, 31.36, 14.20. HRMS (ESI+): Calculated for: $\text{C}_{28}\text{H}_{33}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 448.2305, Found 448.2311.

2-((4-Bromo-2-fluorophenyl)amino)-*N,N*-dimethylacetamide (19)



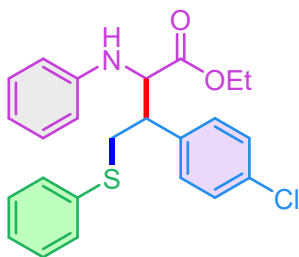
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (56 mg, 66% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.34 (m, 2H), 7.27 (t, J = 7.4 Hz, 2H), 7.22 – 7.14 (m, 3H), 7.06 (d, J = 8.7 Hz, 2H), 6.85 (d, J = 8.7 Hz, 2H), 6.78 – 6.70 (m, 3H), 4.72 (d, J = 3.5 Hz, 1H), 4.08 (q, J = 7.1 Hz, 2H), 3.79 (s, 3H), 3.49 – 3.38 (m, 2H), 3.30 (dd, J = 11.7, 4.4 Hz, 1H), 1.18 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.94, 159.11, 147.58, 135.53, 130.30, 130.23, 129.35, 129.03, 126.54, 118.95, 114.61, 114.03, 61.24, 59.45, 55.26, 46.56, 36.50, 14.25. HRMS (ESI+): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_3\text{S}$ $[\text{M}+\text{H}]^+$ 422.1784, Found 422.1790.

Ethyl (2*R*,3*R*)-3-(4-fluorophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (20)



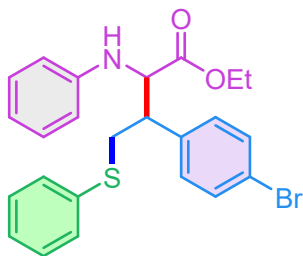
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (45 mg, 56% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.41 – 7.38 (m, 2H), 7.34 – 7.29 (m, 4H), 7.27 (d, $J = 4.2$ Hz, 1H), 7.24 – 7.22 (m, 1H), 7.16 – 7.12 (m, 3H), 6.63 – 6.58 (m, 2H), 6.55 (d, $J = 2.4$ Hz, 1H), 4.76 (d, $J = 3.1$ Hz, 1H), 4.11 (q, $J = 7.2$ Hz, 2H), 3.49 – 3.42 (m, 2H), 3.37 – 3.29 (m, 1H), 1.19 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.38, 149.67 (d, $J = 139.2$ Hz), 138.14, 135.13, 130.37 (d, $J = 12.8$ Hz), 129.08, 128.52 (d, $J = 49.3$ Hz), 127.97, 126.76, 120.47 (d, $J = 256.8$ Hz), 112.60, 110.71, 106.83, 61.47, 58.95, 47.25, 36.25, 14.16. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -114.46. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{FNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 410.1585, Found 410.1585.

Ethyl (2*R*,3*R*)-3-(4-chlorophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (21)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as brown liquid (57 mg, 67% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.35 (m, 2H), 7.32 – 7.27 (m, 4H), 7.25 – 7.22 (m, 1H), 7.20 – 7.16 (m, 2H), 7.08 (d, $J = 8.5$ Hz, 2H), 6.81 – 6.76 (m, 1H), 6.76 – 6.71 (m, 2H), 4.73 (s, 1H), 4.10 (q, $J = 7.1$ Hz, 2H), 3.51 – 3.38 (m, 2H), 3.29 (dd, $J = 11.5, 4.2$ Hz, 1H), 1.19 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.59, 147.41, 136.97, 135.15, 133.66, 130.42, 129.73, 129.40, 129.10, 128.78, 126.76, 119.20, 114.66, 61.42, 59.49, 46.95, 36.33, 14.23. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{ClNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 426.1289, Found 426.1290.

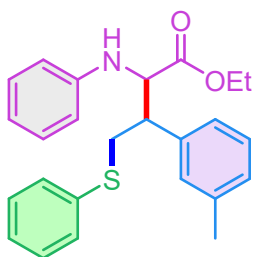
Ethyl (2*R*,3*R*)-3-(4-bromophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (22)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (60 mg, 60% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.45 (d, $J = 8.4$ Hz, 2H), 7.39 – 7.35 (m, 2H), 7.32 – 7.28 (m, 2H), 7.26 – 7.23 (m, 1H), 7.19 (dd, $J = 8.6, 7.3$ Hz, 2H), 7.03 (d, $J = 8.4$ Hz, 2H), 6.81 – 6.77 (m, 1H), 6.74 (dt, $J = 7.6, 1.1$ Hz, 2H), 4.74 (d, $J = 3.6$ Hz, 1H), 4.10 (q, $J = 7.1$ Hz, 2H), 3.49 – 3.39 (m, 2H), 3.29 (dd, $J = 12.0, 4.8$ Hz, 1H), 1.20 (t, $J = 7.1$ Hz,

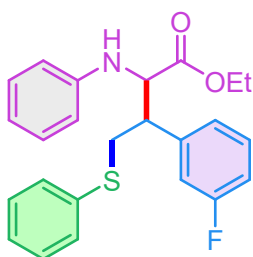
3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.58, 147.39, 137.49, 135.13, 131.73, 130.43, 130.09, 129.42, 129.11, 126.78, 121.82, 119.22, 114.67, 61.45, 59.43, 47.01, 36.26, 14.25. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{BrNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 470.0784, Found 470.0785.

Ethyl (2*R*,3*R*)-2-(phenylamino)-4-(phenylthio)-3-(*m*-tolyl)butanoate (23)



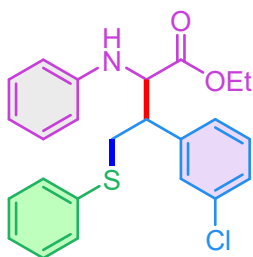
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (42 mg, 52% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.42 – 7.39 (m, 2H), 7.32 – 7.28 (m, 2H), 7.25 – 7.17 (m, 4H), 7.12 (d, $J = 7.5$ Hz, 1H), 6.96 (dd, $J = 7.1, 1.4$ Hz, 2H), 6.80 – 6.73 (m, 3H), 4.78 (d, $J = 3.7$ Hz, 1H), 4.11 (q, $J = 7.1$ Hz, 2H), 3.54 – 3.43 (m, 2H), 3.35 (dd, $J = 12.2, 4.6$ Hz, 1H), 2.34 (s, 3H), 1.20 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.90, 147.58, 138.37, 138.22, 135.54, 130.26, 129.35, 129.12, 129.04, 128.61, 128.52, 126.56, 125.34, 61.23, 59.39, 47.30, 36.24, 21.56, 14.23. HRMS (ESI+): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1846.

Ethyl (2*R*,3*R*)-3-(3-fluorophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (24)



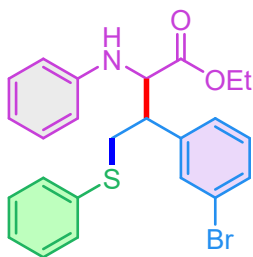
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (46 mg, 56% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.42 – 7.35 (m, 2H), 7.29 (dd, $J = 8.2, 6.4$ Hz, 3H), 7.26 – 7.22 (m, 1H), 7.21 – 7.15 (m, 2H), 6.99 (tdd, $J = 8.4, 2.6, 1.0$ Hz, 1H), 6.92 (dt, $J = 7.7, 1.3$ Hz, 1H), 6.89 – 6.83 (m, 1H), 6.82 – 6.70 (m, 3H), 4.75 (d, $J = 3.4$ Hz, 1H), 4.10 (q, $J = 7.2$ Hz, 2H), 3.51 – 3.41 (m, 2H), 3.35 – 3.26 (m, 1H), 1.19 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.57, 162.78 (d, $J = 246.5$ Hz), 147.42, 141.08 (d, $J = 7.0$ Hz), 135.11, 130.44, 130.09 (d, $J = 8.2$ Hz), 129.40, 129.11, 126.78, 124.08 (d, $J = 2.9$ Hz), 119.20, 115.39 (d, $J = 21.7$ Hz), 114.76 (d, $J = 21.0$ Hz), 114.70, 61.44, 59.43, 47.23 (d, $J = 1.6$ Hz), 36.16, 14.21. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -112.37. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{FNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 410.1585, Found 410.1588.

Ethyl (2*R*,3*R*)-3-(3-chlorophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (25)



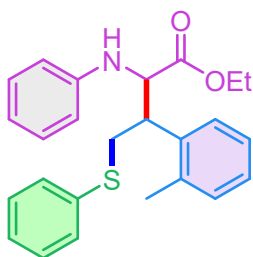
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (45 mg, 53% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.39 – 7.35 (m, 2H), 7.30 – 7.22 (m, 5H), 7.17 (dd, $J = 8.6, 7.3$ Hz, 2H), 7.12 (d, $J = 2.1$ Hz, 1H), 7.05 – 7.00 (m, 1H), 6.81 – 6.71 (m, 3H), 4.74 (d, $J = 3.6$ Hz, 1H), 4.10 (q, $J = 7.1$ Hz, 2H), 3.49 – 3.39 (m, 2H), 3.28 (dd, $J = 11.9, 4.5$ Hz, 1H), 1.19 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.51, 147.39, 140.64, 135.10, 134.47, 130.48, 129.82, 129.40, 129.11, 128.63, 127.97, 126.80, 126.52, 61.47, 59.51, 47.29, 36.14, 14.21. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{24}\text{ClNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 426.1289, Found 426.1290.

Ethyl (2*R*,3*R*)-3-(3-bromophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (26)



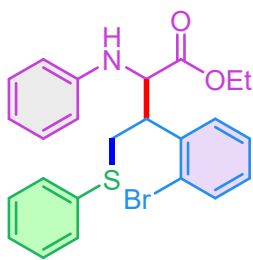
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (44 mg, 47% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.44 – 7.36 (m, 3H), 7.32 – 7.27 (m, 3H), 7.25 – 7.16 (m, 4H), 7.08 (dt, $J = 7.7, 1.4$ Hz, 1H), 6.81 – 6.73 (m, 3H), 4.74 (d, $J = 3.6$ Hz, 1H), 4.11 (qd, $J = 7.1, 1.0$ Hz, 2H), 3.50 – 3.39 (m, 2H), 3.29 (dd, $J = 12.1, 4.7$ Hz, 1H), 1.20 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.49, 147.38, 140.92, 135.08, 131.54, 130.89, 130.49, 130.11, 129.40, 129.11, 126.95, 126.81, 122.71, 119.23, 114.73, 61.48, 59.51, 47.28, 36.13, 14.22. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{24}\text{BrNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 470.0784, Found 470.0789.

Ethyl (2*R*,3*R*)-2-(phenylamino)-4-(phenylthio)-3-(*o*-tolyl)butanoate (27)



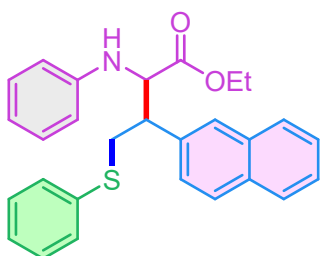
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (29 mg, 36% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.41 – 7.37 (m, 2H), 7.33 – 7.27 (m, 3H), 7.23 – 7.13 (m, 6H), 6.80 – 6.76 (m, 1H), 6.75 – 6.72 (m, 2H), 4.74 (d, $J = 4.5$ Hz, 1H), 4.11 (dd, $J = 10.8, 7.2$ Hz, 1H), 4.00 (dd, $J = 10.8, 7.1$ Hz, 1H), 3.71 (dt, $J = 8.8, 5.1$ Hz, 1H), 3.48 (dd, $J = 13.4, 8.7$ Hz, 1H), 3.24 (dd, $J = 13.5, 5.6$ Hz, 1H), 2.07 (s, 3H), 1.15 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 173.13, 147.34, 137.15, 136.64, 135.44, 130.77, 130.47, 129.37, 129.04, 127.44, 127.31, 126.65, 126.22, 119.02, 114.59, 61.29, 58.93, 41.77, 37.47, 19.46, 14.02. HRMS (ESI⁺): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1849.

Ethyl (2*R*,3*R*)-3-(2-bromophenyl)-2-(phenylamino)-4-(phenylthio)butanoate (28)



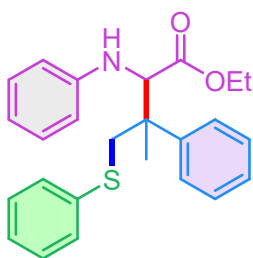
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (44 mg, 47% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.54 (dd, $J = 8.1, 1.3$ Hz, 1H), 7.36 (ddd, $J = 8.6, 5.6, 1.7$ Hz, 3H), 7.32 – 7.26 (m, 3H), 7.23 – 7.12 (m, 4H), 6.79 – 6.72 (m, 3H), 4.71 (d, $J = 4.9$ Hz, 1H), 4.13 (dd, $J = 10.7, 7.2$ Hz, 1H), 4.04 (td, $J = 7.2, 3.6$ Hz, 2H), 3.45 (dd, $J = 13.5, 8.1$ Hz, 1H), 3.26 (dd, $J = 13.4, 6.4$ Hz, 1H), 1.18 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.59, 147.01, 138.08, 135.07, 133.17, 130.59, 129.39, 129.05, 129.00, 127.53, 126.73, 119.06, 114.52, 61.53, 58.81, 45.19, 36.82, 14.01. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{24}\text{BrNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 470.0784, Found 470.0784.

Ethyl (2*R*,3*R*)-3-(naphthalen-2-yl)-2-(phenylamino)-4-(phenylthio)butanoate (29)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (43 mg, 49% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.81 (dd, $J = 13.1, 7.0$ Hz, 3H), 7.61 (d, $J = 1.7$ Hz, 1H), 7.51 – 7.45 (m, 2H), 7.41 – 7.36 (m, 2H), 7.29 – 7.13 (m, 6H), 6.79 – 6.69 (m, 3H), 4.83 (d, $J = 3.1$ Hz, 1H), 4.09 (qt, $J = 7.2, 3.9$ Hz, 2H), 3.65 – 3.56 (m, 2H), 3.48 – 3.40 (m, 1H), 1.15 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.86, 147.53, 135.99, 135.46, 133.29, 132.92, 130.30, 129.38, 129.08, 128.36, 127.86, 127.74, 127.48, 126.63, 126.35, 126.24, 126.08, 119.05, 114.65, 61.35, 59.65, 47.56, 36.39, 14.24. HRMS (ESI⁺): Calculated for: $\text{C}_{28}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 442.1835, Found 442.1846.

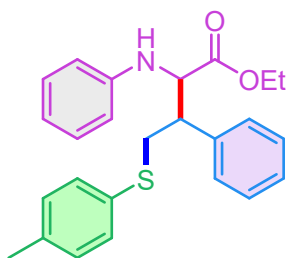
Ethyl (2*R*)-3-methyl-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoate (30)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (72 mg, 89% yield, dr 1:1); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.26 (m, 12H), 7.25 – 7.10 (m, 12H), 6.78 – 6.70 (m, 2H), 6.70 – 6.66 (m, 2H), 6.60 – 6.56 (m, 2H), 4.35 (d, $J = 9.2$ Hz, 2H), 4.00 (t, $J = 7.1$ Hz, 2H), 3.81 – 3.69 (m, 4H), 3.58 (d, $J = 12.3$ Hz, 1H), 3.46 (d, $J = 12.4$ Hz, 1H), 1.68 (s, 3H), 1.66 (s, 3H), 1.08 (t, $J = 7.1$ Hz, 3H), 0.83 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.17, 172.07, 147.28, 147.08, 141.65, 141.18, 137.64, 137.50,

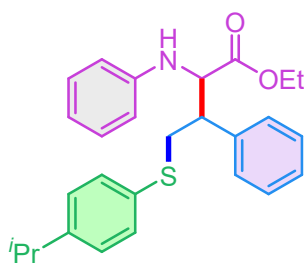
129.71, 129.59, 129.40, 129.27, 128.90, 128.85, 128.29, 128.25, 127.28, 127.22, 127.15, 126.09, 125.98, 119.04, 118.96, 114.43, 114.41, 65.88, 65.26, 61.04, 60.80, 46.36, 45.96, 44.98, 44.35, 21.84, 19.69, 14.09, 13.69. HRMS (ESI+): Calculated for: C₂₅H₂₇NO₂S [M+H]⁺ 406.1835, Found 406.1841.

Ethyl (2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(*p*-tolylthio)butanoate (31)



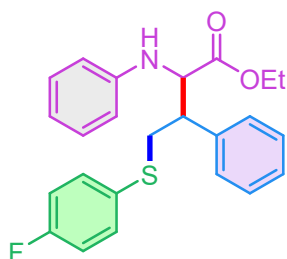
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (58 mg, 71% yield); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.34 – 7.28 (m, 5H), 7.19 – 7.10 (m, 6H), 6.80 – 6.75 (m, 1H), 6.75 – 6.71 (m, 2H), 4.82 – 4.77 (m, 1H), 4.10 (q, *J* = 7.1 Hz, 2H), 3.49 – 3.41 (m, 2H), 3.31 – 3.24 (m, 1H), 2.34 (s, 3H), 1.19 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, Chloroform-*d*) δ 172.90, 147.58, 138.57, 136.90, 131.28, 129.83, 129.33, 128.60, 128.39, 127.75, 118.92, 114.61, 61.22, 59.24, 47.34, 37.02, 21.10, 14.21. HRMS (ESI+): Calculated for: C₂₅H₂₇NO₂S [M+H]⁺ 406.1835, Found 406.1844.

Ethyl (2*R*,3*R*)-4-((4-isopropylphenyl)thio)-3-phenyl-2-(phenylamino)butanoate (32)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (52 mg, 60% yield); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.37 – 7.30 (m, 5H), 7.20 – 7.14 (m, 6H), 6.79 – 6.72 (m, 3H), 4.80 (d, *J* = 3.4 Hz, 1H), 4.10 (q, *J* = 7.3 Hz, 2H), 3.53 – 3.45 (m, 2H), 3.34 – 3.28 (m, 1H), 2.93 – 2.86 (m, 1H), 1.25 (d, *J* = 6.9 Hz, 6H), 1.19 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (101 MHz, Chloroform-*d*) δ 172.92, 147.80, 147.58, 138.56, 131.13, 129.35, 128.62, 128.41, 127.77, 127.22, 118.94, 114.61, 61.24, 59.31, 47.42, 36.90, 33.77, 23.98, 23.96, 14.23. HRMS (ESI+): Calculated for: C₂₇H₃₁NO₂S [M+H]⁺ 434.2148, Found 434.2150.

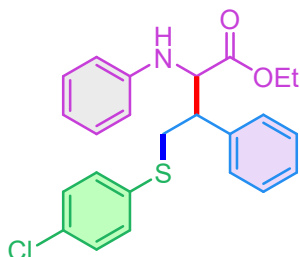
Ethyl (2*R*,3*R*)-4-((4-fluorophenyl)thio)-3-phenyl-2-(phenylamino)butanoate (33)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (49 mg, 60% yield); ¹H NMR (400 MHz, Chloroform-*d*) δ 7.40 (dd, *J* = 8.7, 5.2 Hz, 2H), 7.35 – 7.28 (m, 3H), 7.18 (dd, *J* = 8.5, 7.3 Hz, 2H), 7.15 – 7.10 (m, 2H), 7.00 (t, *J* = 8.7 Hz,

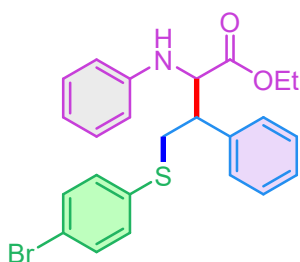
2H), 6.77 (tt, $J = 7.4, 1.1$ Hz, 1H), 6.75 – 6.70 (m, 2H), 4.78 (d, $J = 3.5$ Hz, 1H), 4.10 (q, $J = 7.1$ Hz, 2H), 3.48 – 3.38 (m, 2H), 3.27 (dd, $J = 11.9, 4.2$ Hz, 1H), 1.19 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.78, 162.17 (d, $J = 247.0$ Hz), 147.47, 138.29, 133.55 (d, $J = 8.1$ Hz), 130.15 (d, $J = 3.4$ Hz), 129.36, 128.51 (d, $J = 29.5$ Hz), 127.85, 119.03, 116.17 (d, $J = 21.9$ Hz), 114.59, 61.28, 59.19, 47.29, 37.54, 14.21. ^{19}F NMR (376 MHz, Chloroform-*d*) δ -114.63. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{FNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 410.1585, Found 410.1590.

Ethyl (2*R*,3*R*)-4-((4-chlorophenyl)thio)-3-phenyl-2-(phenylamino)butanoate (34)



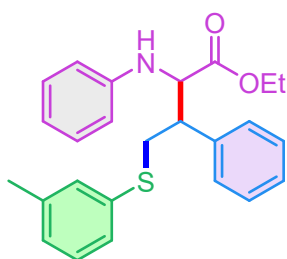
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (52 mg, 61% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.34 – 7.27 (m, 5H), 7.23 (d, $J = 8.5$ Hz, 2H), 7.19 – 7.11 (m, 4H), 6.76 (tt, $J = 7.2, 1.1$ Hz, 1H), 6.73 – 6.67 (m, 2H), 4.73 (d, $J = 3.6$ Hz, 1H), 4.08 (q, $J = 7.1$ Hz, 2H), 3.51 – 3.39 (m, 2H), 3.30 (dd, $J = 12.2, 4.6$ Hz, 1H), 1.17 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.68, 147.44, 138.22, 133.94, 131.66, 129.38, 129.18, 128.70, 128.33, 127.92, 119.06, 114.57, 61.32, 59.30, 47.31, 36.46, 14.22. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{ClNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 426.1289, Found 426.1290.

Ethyl (2*R*,3*R*)-4-((4-bromophenyl)thio)-3-phenyl-2-(phenylamino)butanoate (35)



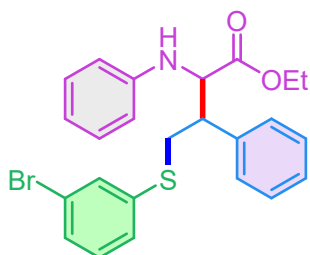
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (67 mg, 71% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.39 (d, $J = 8.5$ Hz, 2H), 7.33 (d, $J = 7.4$ Hz, 3H), 7.23 (d, $J = 8.5$ Hz, 2H), 7.20 – 7.13 (m, 4H), 6.77 (tt, $J = 7.3, 1.1$ Hz, 1H), 6.74 – 6.68 (m, 2H), 4.74 (d, $J = 3.6$ Hz, 1H), 4.09 (q, $J = 7.1$ Hz, 2H), 3.54 – 3.41 (m, 2H), 3.31 (dd, $J = 12.2, 4.6$ Hz, 1H), 1.18 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.68, 147.41, 138.18, 134.64, 132.09, 131.74, 129.38, 128.71, 128.32, 127.93, 120.53, 119.07, 114.56, 61.34, 59.28, 47.28, 36.21, 14.23. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{BrNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 470.0784, Found 470.0788.

Ethyl (2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(*m*-tolylthio)butanoate (36)



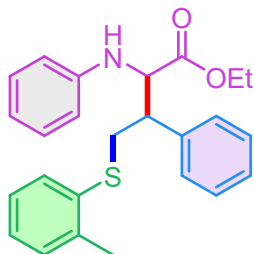
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (59 mg, 73% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.36 – 7.29 (m, 3H), 7.22 – 7.15 (m, 7H), 7.03 (dt, J = 5.9, 2.0 Hz, 1H), 6.79 – 6.71 (m, 3H), 4.79 (d, J = 3.2 Hz, 1H), 4.10 (q, J = 7.1 Hz, 2H), 3.54 – 3.45 (m, 2H), 3.36 – 3.29 (m, 1H), 2.31 (s, 3H), 1.19 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.86, 147.54, 138.84, 138.54, 135.15, 130.98, 129.35, 128.87, 128.64, 128.38, 127.81, 127.48, 127.30, 118.97, 114.60, 61.26, 59.31, 47.44, 36.26, 21.35, 14.23. HRMS (ESI+): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1833.

Ethyl (2*R*,3*R*)-4-((3-bromophenyl)thio)-3-phenyl-2-(phenylamino)butanoate (37)



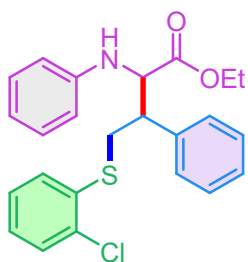
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (57 mg, 61% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.50 (t, J = 1.8 Hz, 1H), 7.35 – 7.26 (m, 5H), 7.20 – 7.12 (m, 5H), 6.79 – 6.75 (m, 1H), 6.74 – 6.69 (m, 2H), 4.73 (d, J = 3.7 Hz, 1H), 4.10 (q, J = 7.1 Hz, 2H), 3.55 – 3.43 (m, 2H), 3.33 (dd, J = 12.0, 4.5 Hz, 1H), 1.19 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.65, 147.40, 138.12, 137.96, 132.40, 130.33, 129.54, 129.38, 128.73, 128.35, 128.33, 127.97, 122.85, 119.08, 114.57, 61.37, 59.35, 47.33, 36.05, 14.25. HRMS (ESI+): Calculated for: $\text{C}_{24}\text{H}_{24}\text{BrNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 470.0784, Found 470.0784.

Ethyl (2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(*o*-tolylthio)butanoate (38)



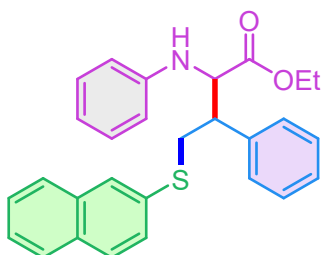
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (61 mg, 75% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.33 (dq, J = 6.3, 4.4 Hz, 4H), 7.17 (dtd, J = 14.4, 4.9, 1.5 Hz, 7H), 6.80 – 6.73 (m, 3H), 4.79 (d, J = 3.4 Hz, 1H), 4.10 (q, J = 7.1 Hz, 2H), 3.54 – 3.45 (m, 2H), 3.30 (dd, J = 11.5, 3.7 Hz, 1H), 2.42 (s, 3H), 1.19 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.80, 147.57, 138.64, 138.55, 134.72, 130.31, 129.60, 129.37, 128.64, 128.37, 127.81, 126.54, 126.44, 119.01, 114.64, 61.28, 59.57, 47.41, 35.57, 20.64, 14.22. HRMS (ESI+): Calculated for: $\text{C}_{25}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 406.1835, Found 406.1837.

Ethyl (2*R*,3*R*)-4-((2-chlorophenyl)thio)-3-phenyl-2-(phenylamino)butanoate (39)



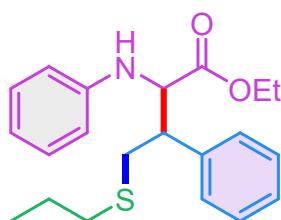
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (55 mg, 65% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.43 – 7.30 (m, 5H), 7.17 (ddt, $J = 9.4, 5.9, 2.1$ Hz, 6H), 6.81 – 6.72 (m, 3H), 4.76 (d, $J = 3.7$ Hz, 1H), 4.09 (q, $J = 7.1$ Hz, 2H), 3.59 – 3.47 (m, 2H), 3.38 (dd, $J = 11.9, 4.5$ Hz, 1H), 1.18 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.63, 147.49, 138.28, 134.86, 134.57, 129.94, 129.90, 129.38, 128.72, 128.31, 127.93, 127.24, 127.22, 119.05, 114.63, 61.33, 59.66, 47.22, 34.96, 14.21. HRMS (ESI⁺): Calculated for: $\text{C}_{24}\text{H}_{24}\text{ClNO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 426.1289, Found 426.1297.

Ethyl (2*R*,3*R*)-4-(naphthalen-2-ylthio)-3-phenyl-2-(phenylamino)butanoate (40)



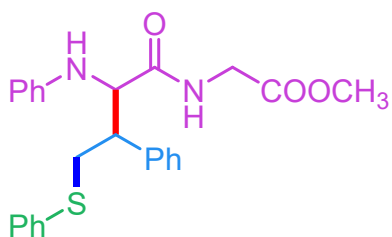
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (63 mg, 71% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.81 (dd, $J = 7.7, 2.0$ Hz, 2H), 7.76 (d, $J = 8.6$ Hz, 1H), 7.71 (dd, $J = 7.5, 2.0$ Hz, 1H), 7.49 – 7.46 (m, 2H), 7.35 – 7.31 (m, 3H), 7.18 (ddt, $J = 6.0, 3.8, 1.9$ Hz, 4H), 6.79 – 6.75 (m, 3H), 6.69 – 6.58 (m, 1H), 4.83 (d, $J = 3.7$ Hz, 1H), 4.18 (q, $J = 7.1$ Hz, 1H), 4.08 (d, $J = 7.2$ Hz, 2H), 3.62 (dd, $J = 12.4, 8.8$ Hz, 1H), 3.54 – 3.43 (m, 2H), 1.15 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.81, 147.53, 138.47, 133.78, 132.88, 132.01, 129.38, 128.69, 128.62, 128.39, 128.29, 128.00, 127.87, 127.74, 127.23, 126.61, 125.93, 119.01, 114.60, 61.29, 59.35, 47.39, 36.06, 14.20. HRMS (ESI⁺): Calculated for: $\text{C}_{28}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 442.1835, Found 442.1839.

Ethyl (2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(propylthio)butanoate (41)



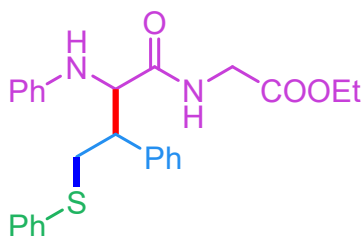
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 20:1), obtained as yellow liquid (17 mg, 24% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.35 – 7.29 (m, 3H), 7.20 – 7.15 (m, 4H), 6.77 – 6.71 (m, 3H), 4.74 (d, $J = 4.0$ Hz, 1H), 4.12 (q, $J = 7.1$ Hz, 2H), 3.45 (ddd, $J = 9.5, 5.6, 3.9$ Hz, 1H), 3.11 (dd, $J = 13.1, 9.4$ Hz, 1H), 2.96 (dd, $J = 13.1, 5.6$ Hz, 1H), 2.60 – 2.53 (m, 2H), 1.27 (d, $J = 7.4$ Hz, 3H), 1.21 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 173.06, 147.62, 138.82, 129.31, 128.60, 128.33, 127.73, 118.85, 114.51, 61.26, 59.37, 47.78, 33.80, 26.28, 14.79, 14.27. HRMS (ESI⁺): Calculated for: $\text{C}_{21}\text{H}_{27}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 358.1835, Found 358.1836.

Methyl ((2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoyl)glycinate (42)



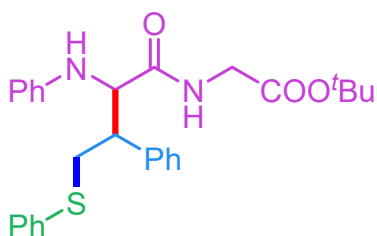
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 2:1), obtained as yellow liquid (60 mg, 69% yield, dr 1:1); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.27 (m, 12H), 7.25 – 7.15 (m, 12H), 7.05 (t, J = 5.6 Hz, 1H), 6.91 (t, J = 5.6 Hz, 1H), 6.82 – 6.76 (m, 2H), 6.63 – 6.56 (m, 4H), 4.41 (d, J = 5.5 Hz, 1H), 4.34 (d, J = 5.0 Hz, 1H), 4.00 – 3.81 (m, 6H), 3.69 (d, J = 1.3 Hz, 6H), 3.48 (ddd, J = 13.3, 7.8, 6.7 Hz, 2H), 3.39 (dt, J = 7.8, 3.9 Hz, 1H), 3.31 (dd, J = 13.3, 7.5 Hz, 1H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.79, 171.58, 169.79, 146.53, 146.22, 138.54, 138.14, 135.77, 135.55, 130.13, 129.62, 129.52, 129.44, 129.04, 129.00, 128.86, 128.62, 128.44, 128.00, 127.93, 126.47, 126.31, 119.45, 119.33, 114.12, 113.96, 61.50, 61.39, 52.34, 52.33, 48.13, 47.25, 41.12, 41.01, 36.49, 35.85. HRMS (ESI+): Calculated for: $\text{C}_{25}\text{H}_{26}\text{N}_2\text{O}_3\text{S}$ $[\text{M}+\text{H}]^+$ 435.1737, Found 435.1740.

Ethyl ((2R,3R)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoyl)glycinate (43)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 2:1), obtained as yellow liquid (60 mg, 67% yield, dr 1:1); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.38 – 7.27 (m, 10H), 7.25 – 7.16 (m, 10H), 7.16 – 7.12 (m, 4H), 7.03 (t, J = 5.4 Hz, 1H), 6.89 (t, J = 5.5 Hz, 1H), 6.81 – 6.77 (m, 1H), 6.77 – 6.74 (m, 1H), 6.64 – 6.57 (m, 2H), 6.57 – 6.50 (m, 2H), 4.39 (d, J = 5.5 Hz, 1H), 4.32 (d, J = 4.9 Hz, 1H), 4.13 (qd, J = 7.1, 1.5 Hz, 4H), 3.96 – 3.87 (m, 4H), 3.83 (dd, J = 13.2, 6.9 Hz, 1H), 3.62 (dd, J = 7.6, 5.4 Hz, 1H), 3.50 – 3.43 (m, 2H), 3.38 – 3.25 (m, 2H), 1.22 (td, J = 7.1, 2.4 Hz, 6H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.71, 171.51, 169.34, 146.55, 146.23, 138.56, 138.16, 135.75, 135.56, 130.10, 129.62, 129.52, 129.44, 129.04, 128.99, 128.85, 128.62, 128.43, 127.99, 127.92, 126.45, 126.30, 119.42, 119.30, 114.11, 113.95. HRMS (ESI+): Calculated for: $\text{C}_{26}\text{H}_{28}\text{N}_2\text{O}_3\text{S}$ $[\text{M}+\text{H}]^+$ 449.1893, Found 449.1896.

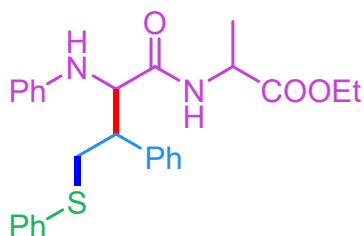
Tert-butyl ((2R,3R)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoyl)glycinate (44)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 2:1), obtained as yellow liquid (30 mg, 80% yield, dr 1:1); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.40 – 7.26 (m, 12H), 7.25 – 7.14 (m, 12H), 7.02 (t, J = 5.4 Hz, 1H), 6.87 (t, J = 5.4 Hz, 1H), 6.79 (tdd, J = 7.4, 5.2, 1.1 Hz, 2H), 6.65 – 6.53 (m, 4H), 4.40 (d, J = 5.6 Hz, 1H), 4.33 (d, J = 4.9 Hz, 1H), 3.96 – 3.87 (m, 2H), 3.85 (d, J = 2.3 Hz, 1H), 3.84 – 3.74 (m, 2H), 3.64 (dd, J = 7.6, 5.5 Hz, 1H), 3.51 (dd, J = 7.9,

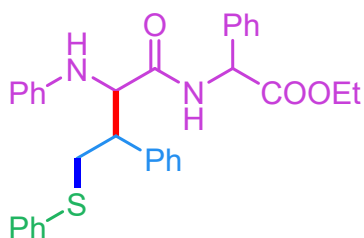
3.4 Hz, 1H), 3.50 – 3.46 (m, 1H), 3.44 – 3.37 (m, 1H), 3.32 (dd, $J = 13.3, 7.7$ Hz, 1H), 1.43 (s, 9H), 1.43 (s, 9H). ^{13}C NMR (101 MHz, Chloroform- d) δ 172.46, 171.29, 168.43, 146.66, 146.34, 138.65, 138.24, 135.83, 135.64, 130.06, 129.62, 129.52, 129.44, 129.02, 128.99, 128.83, 128.61, 128.44, 127.96, 127.87, 126.41, 126.27, 119.34, 119.22, 114.13, 113.95, 61.65, 61.47, 48.13, 47.32, 41.97, 41.85, 36.46, 35.74, 28.02. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{28}\text{H}_{32}\text{N}_2\text{O}_3\text{S}$ $[\text{M}+\text{H}]^{+}$ 477.2206, Found 477.2209.

Ethyl ((2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoyl)alaninate (45)



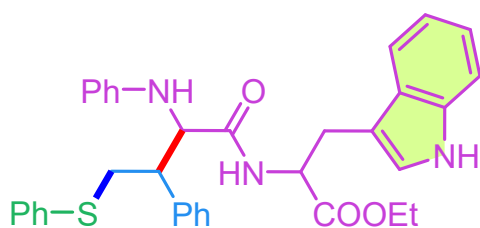
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 2:1), obtained as yellow liquid (42 mg, 45% yield); ^1H NMR (400 MHz, Chloroform- d) δ 7.34 (dd, $J = 9.0, 3.5$ Hz, 3H), 7.30 – 7.27 (m, 2H), 7.25 – 7.15 (m, 7H), 7.03 (d, $J = 7.7$ Hz, 1H), 6.79 (t, $J = 7.3$ Hz, 1H), 6.58 (d, $J = 8.0$ Hz, 2H), 4.57 – 4.48 (m, 1H), 4.32 (d, $J = 5.9$ Hz, 1H), 4.14 (dd, $J = 7.1, 1.9$ Hz, 2H), 3.62 – 3.53 (m, 1H), 3.48 (dd, $J = 13.2, 7.2$ Hz, 1H), 3.29 (dd, $J = 13.2, 7.8$ Hz, 1H), 1.29 (d, $J = 7.2$ Hz, 3H), 1.23 (d, $J = 7.1$ Hz, 3H). ^{13}C NMR (101 MHz, Chloroform- d) δ 172.46, 171.69, 146.46, 138.14, 135.62, 129.92, 129.47, 129.00, 128.95, 128.42, 127.99, 126.33, 119.42, 113.96, 61.67, 61.47, 47.98, 47.27, 36.37, 18.18, 14.15. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{27}\text{H}_{30}\text{N}_2\text{O}_3\text{S}$ $[\text{M}+\text{H}]^{+}$ 463.205, Found 463.205.

Ethyl 2-phenyl-2-((2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanamido)acetate (46)



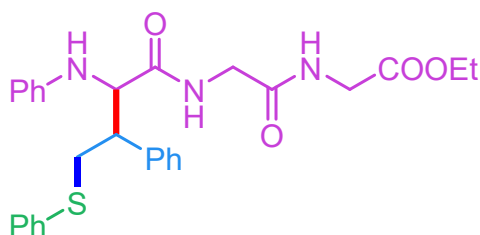
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 2:1), obtained as yellow liquid (42 mg, 40% yield, dr 10:3); ^1H NMR (400 MHz, Chloroform- d) δ 7.46 (d, $J = 7.3$ Hz, 1H), 7.34 – 7.28 (m, 6H), 7.24 (t, $J = 1.7$ Hz, 4H), 7.17 – 7.14 (m, 6H), 6.80 (d, $J = 7.4$ Hz, 1H), 6.67 (d, $J = 7.9$ Hz, 1H), 6.55 (d, $J = 7.9$ Hz, 2H), 5.49 (d, $J = 7.3$ Hz, 1H), 4.36 (d, $J = 5.4$ Hz, 1H), 4.18 (dd, $J = 10.8, 7.1$ Hz, 1H), 4.14 – 4.02 (m, 2H), 3.56 – 3.47 (m, 2H), 3.31 – 3.28 (m, 1H), 1.18 (t, $J = 7.1$ Hz, 3H), 1.11 (t, $J = 7.2$ Hz, 1H). ^{13}C NMR (101 MHz, Chloroform- d) δ 171.67, 170.31, 146.37, 138.10, 136.33, 135.53, 130.21, 129.99, 129.45, 129.00, 128.77, 128.41, 127.98, 127.29, 127.18, 126.51, 126.39, 119.51, 114.22, 61.93, 61.55, 56.33, 47.31, 36.34, 14.00. HRMS (ESI $^{+}$): Calculated for: $\text{C}_{32}\text{H}_{32}\text{N}_2\text{O}_3\text{S}$ $[\text{M}+\text{H}]^{+}$ 525.2206, Found 525.2207.

Ethyl ((2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoyl)tryptophanate (47)



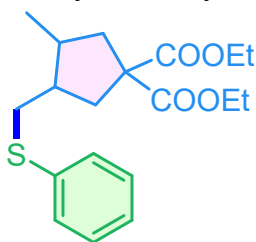
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 1:1), obtained as yellow liquid (36 mg, 31% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.67 (s, 1H), 7.39 (d, J = 7.9 Hz, 1H), 7.30 – 7.19 (m, 9H), 7.13 (ddd, J = 7.4, 5.0, 3.3 Hz, 6H), 7.06 – 6.97 (m, 2H), 6.79 (t, J = 7.3 Hz, 1H), 6.46 (d, J = 7.9 Hz, 1H), 6.28 (d, J = 2.4 Hz, 1H), 4.88 (dt, J = 8.4, 5.6 Hz, 1H), 4.29 (d, J = 5.3 Hz, 1H), 4.12 – 3.98 (m, 2H), 3.77 – 3.62 (m, 1H), 3.56 – 3.38 (m, 2H), 3.31 – 3.19 (m, 2H), 3.12 (dd, J = 14.8, 5.3 Hz, 1H), 1.15 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 171.92, 171.41, 146.57, 138.11, 135.91, 135.70, 129.80, 129.47, 128.97, 128.94, 128.39, 127.93, 127.25, 126.25, 123.01, 122.08, 119.55, 119.12, 118.53, 113.82, 111.08, 109.42, 61.46, 61.43, 52.16, 47.24, 36.45, 27.59, 14.05. HRMS (ESI⁺): Calculated for: $\text{C}_{35}\text{H}_{35}\text{N}_3\text{O}_3\text{S}$ $[\text{M}+\text{H}]^+$ 578.2472, Found 578.2472.

Ethyl ((2*R*,3*R*)-3-phenyl-2-(phenylamino)-4-(phenylthio)butanoyl)glycylglycinate (48)



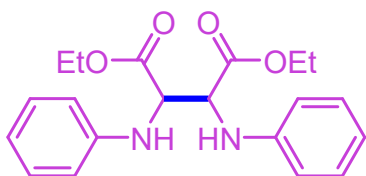
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 1:2), obtained as yellow liquid (73 mg, 73% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.36 – 7.27 (m, 12H), 7.24 – 7.16 (m, 12H), 6.78 (td, J = 7.3, 5.6 Hz, 2H), 6.63 (d, J = 8.0 Hz, 4H), 6.58 (t, J = 5.5 Hz, 1H), 6.45 (t, J = 5.6 Hz, 1H), 4.50 (d, J = 5.3 Hz, 1H), 4.40 (d, J = 5.9 Hz, 1H), 4.20 – 4.15 (m, 4H), 3.89 (d, J = 5.6 Hz, 4H), 3.86 – 3.78 (m, 4H), 3.77 – 3.71 (m, 1H), 3.63 (dd, J = 7.5, 5.3 Hz, 1H), 3.45 (ddd, J = 13.1, 10.7, 8.0 Hz, 2H), 3.32 (dd, J = 13.3, 7.1 Hz, 2H), 1.27 (d, J = 7.2 Hz, 6H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 173.25, 172.21, 169.56, 169.51, 168.92, 168.87, 146.36, 146.21, 138.77, 138.23, 135.77, 135.49, 130.00, 129.60, 129.52, 129.03, 128.80, 128.62, 128.39, 128.02, 127.88, 126.51, 126.32, 119.38, 119.22, 114.02, 113.82, 61.59, 61.58, 61.06, 48.42, 47.26, 42.96, 42.82, 41.15, 36.41, 36.35, 14.17. HRMS (ESI⁺): Calculated for: $\text{C}_{28}\text{H}_{31}\text{N}_3\text{O}_4\text{S}$ $[\text{M}+\text{H}]^+$ 506.2108, Found 506.2108.

Diethyl 3-methyl-4-((phenylthio)methyl)cyclopentane-1,1-dicarboxylate (49)



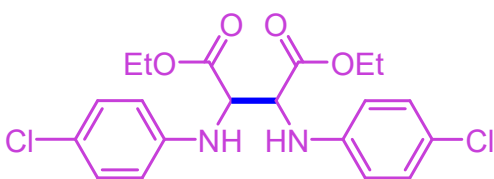
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (49 mg, 70% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.30 (dd, J = 8.4, 1.4 Hz, 2H), 7.26 – 7.21 (m, 2H), 7.16 – 7.12 (m, 1H), 4.16 – 4.11 (m, 4H), 2.94 (dd, J = 12.3, 6.0 Hz, 1H), 2.78 (dd, J = 12.2, 7.8 Hz, 1H), 2.43 (ddd, J = 13.4, 11.3, 6.6 Hz, 2H), 2.29 – 2.14 (m, 3H), 2.02 – 1.97 (m, 1H), 1.22 – 1.17 (m, 6H), 0.90 (d, J = 6.7 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 172.71, 136.69, 129.22, 128.90, 125.94, 61.49, 58.83, 41.80, 41.24, 38.15, 35.82, 34.57, 14.74, 14.07. HRMS (ESI⁺): Calculated for: $\text{C}_{19}\text{H}_{26}\text{O}_4\text{S}$ $[\text{M}+\text{H}]^+$ 351.1625, Found 351.1625.

Diethyl (2*R*,3*S*)-2,3-bis(phenylamino)succinate (50)



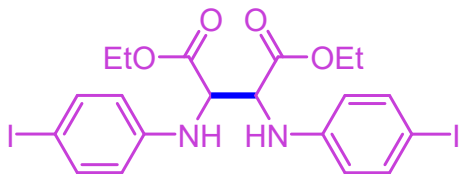
Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (31 mg, 43% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.21 – 7.15 (m, 4H), 6.79 (td, J = 7.3, 1.2 Hz, 2H), 6.75 – 6.61 (m, 4H), 4.66 (d, J = 13.8 Hz, 2H), 4.30 – 4.20 (m, 2H), 4.17 (t, J = 7.2 Hz, 2H), 1.30 (t, J = 7.1 Hz, 3H), 1.23 (t, J = 7.1 Hz, 3H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 171.16, 170.76, 146.55, 146.50, 129.45, 129.36, 119.35, 119.19, 114.44, 114.22, 62.12, 61.91, 59.39, 59.15, 14.21, 14.15. HRMS (ESI⁺): Calculated for: $\text{C}_{20}\text{H}_{24}\text{N}_2\text{O}_4$ $[\text{M}+\text{H}]^+$ 357.1809, Found 357.1810.

Diethyl (2*R*,3*S*)-2,3-bis((4-chlorophenyl)amino)succinate (51)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (44 mg, 52% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.13 (d, J = 8.8 Hz, 4H), 6.59 (d, J = 8.7 Hz, 4H), 4.55 (s, 2H), 4.24 (qt, J = 7.4, 3.7 Hz, 4H), 1.29 (d, J = 6.9 Hz, 6H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 170.30, 144.93, 129.35, 124.01, 115.32, 62.13, 59.06, 14.19. HRMS (ESI⁺): Calculated for: $\text{C}_{20}\text{H}_{22}\text{Cl}_2\text{N}_2\text{O}_4$ $[\text{M}+\text{H}]^+$ 452.1029, Found 452.1030.

Diethyl (2*R*,3*S*)-2,3-bis((4-iodophenyl)amino)succinate (52)



Purified by silica gel column chromatography (200-300 mesh silica gel, PE/EA = 100:1), obtained as yellow liquid (55 mg, 45% yield); ^1H NMR (400 MHz, Chloroform-*d*) δ 7.47 – 7.39 (m, 4H), 6.48 – 6.40 (m, 4H), 4.55 (s, 2H), 4.25 (qq, J = 6.9, 3.6 Hz, 4H), 1.30 (t, J = 7.1 Hz, 6H). ^{13}C NMR (101 MHz, Chloroform-*d*) δ 170.16, 145.97, 138.10, 116.25, 80.45, 62.18, 58.70, 14.20. HRMS (ESI⁺): Calculated for: $\text{C}_{20}\text{H}_{22}\text{I}_2\text{N}_2\text{O}_4$ $[\text{M}+\text{H}]^+$ 608.9742, Found 608.9745.

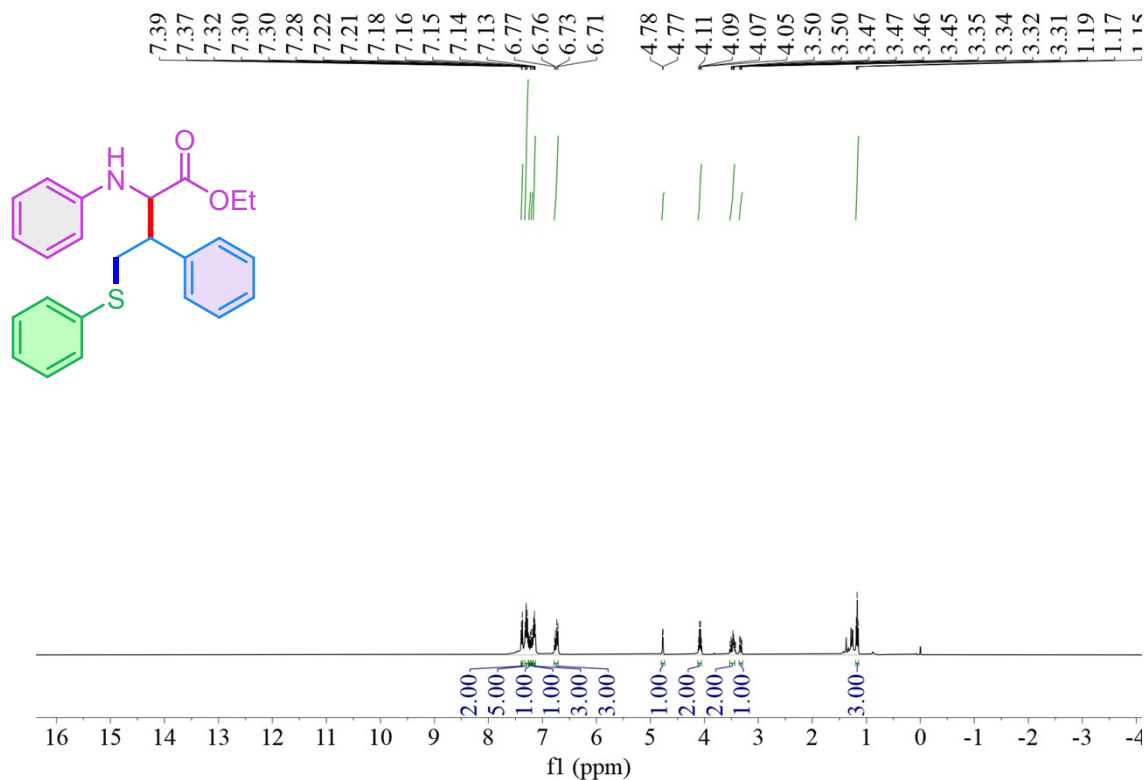
6. References

1. K. Huang, J. Cai, R. Wang, Y. Zhang, B. Wang, Y. Xia, W. Jin, X. Li, C. Liu, Electrochemical C(sp²)-H Bromination of Glycine Derivatives Enabled by Boron. *Chin. J. Org. Chem.*, **2024**, 44(3): 989-996.
2. X. Lv, Y. Cheng, Y. Zong, Q. Wang, G. An, J. Wang, G. Li, Visible-Light-Mediated Ruthenium-Catalyzed para-Selective Alkylation of Unprotected Anilines. *ACS Catal.* **2023**, 13(11): 7310-7321.

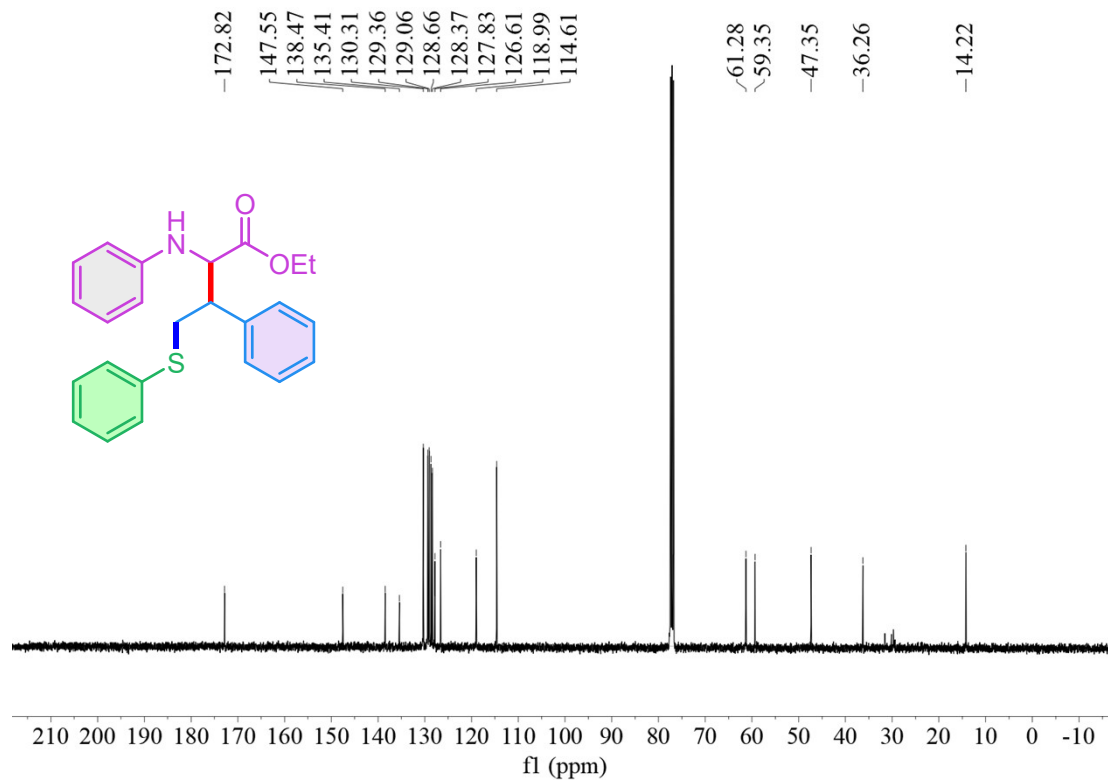
3. C. JA, G. IA, B.HE. A peptoid ribbon secondary structure. *Angew. Chem. Int. Ed.* **2013**, 52(19): 5079-5084.
4. J. Liang, Y. Fu, X. Bao, L. Ou, T. Sang, Y. Yuan, C. Huo, Cyanation of glycine derivatives. *Chem. Commun*, **2021**, 57(24):3014-3017.
5. Y. Akira, L. Matthew W, Z. Viktor V, (Tosylimino)phenyl- λ 3-iodane as a Reagent for the Synthesis of Methyl Carbamates via Hofmann Rearrangement of Aromatic and Aliphatic Carboxamides. *J. Org. Chem*, **2012**, 77(4), 2087-2091.
6. Y. Liao, B. Ruan, H. Hu, H. Cheng, B. Wang, F. Pan, Iron-Catalyzed Radical Hydrothiolation of gem-Difluoroalkenes. *Org. Lett.*, **2025**, 27(33): 9293-9298.

7. Copies of ^1H , ^{13}C and ^{19}F NMR Spectra

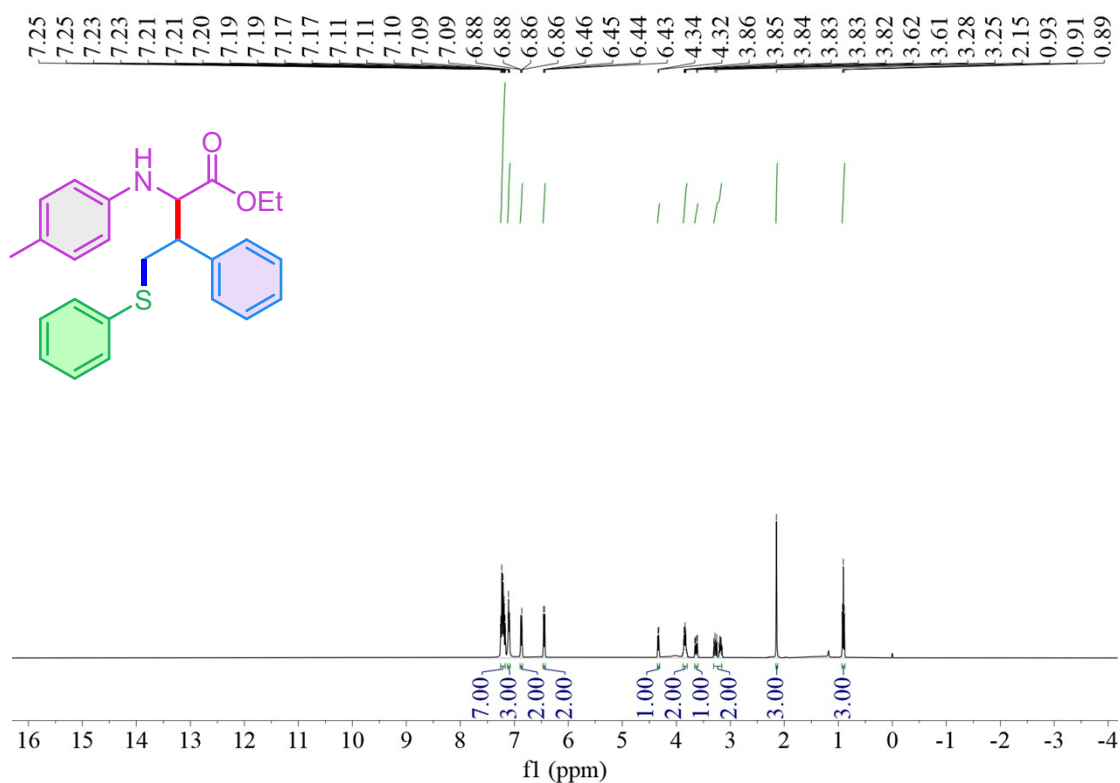
4 ^1H NMR (400 MHz, Chloroform-*d*)



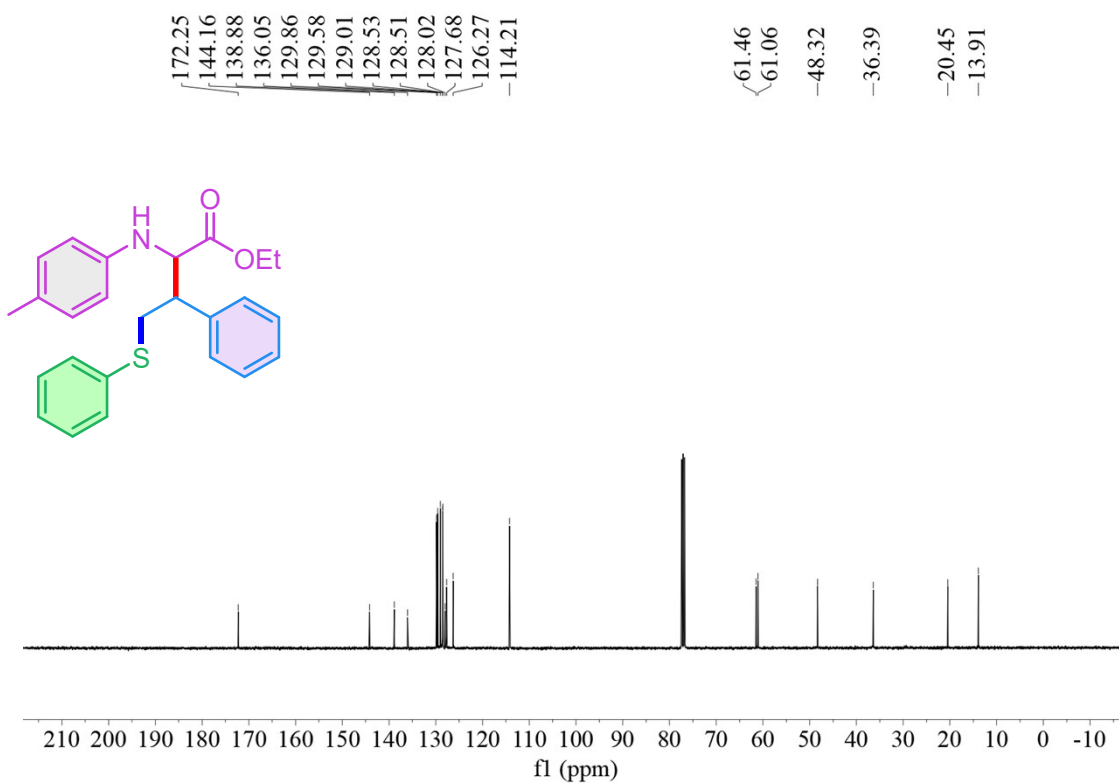
4 ^{13}C NMR (101 MHz, Chloroform-*d*)



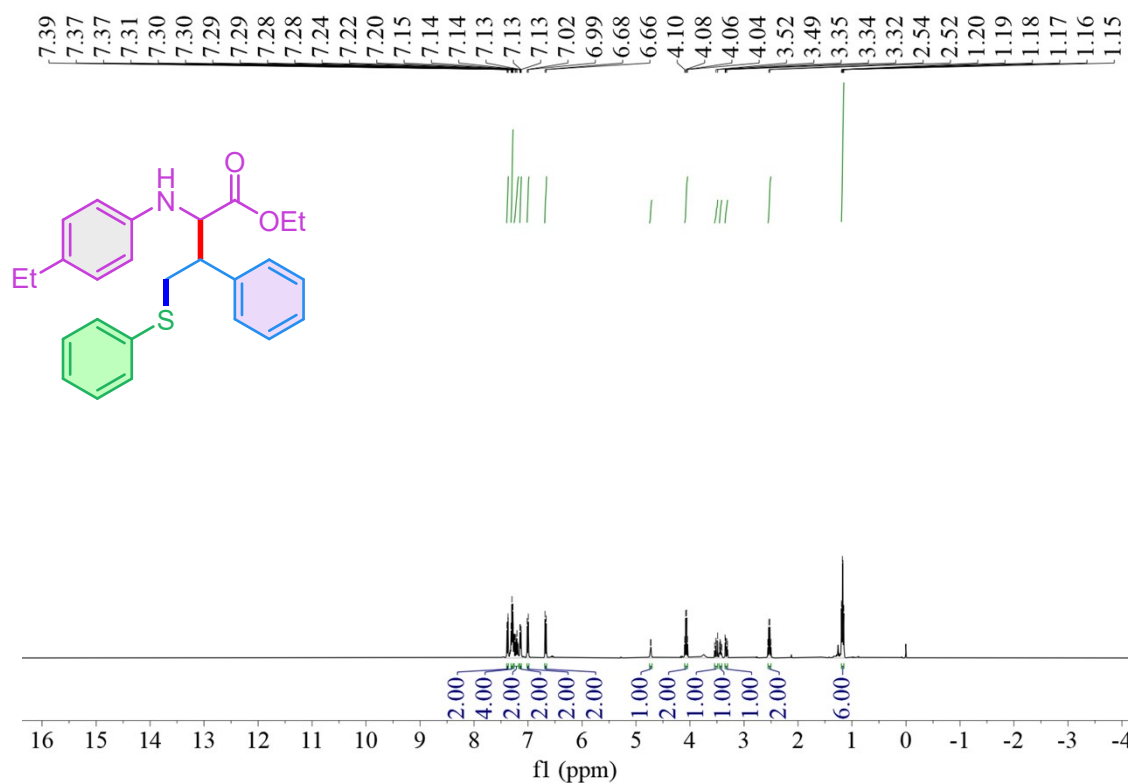
5 ¹H NMR (400 MHz, Chloroform-*d*)



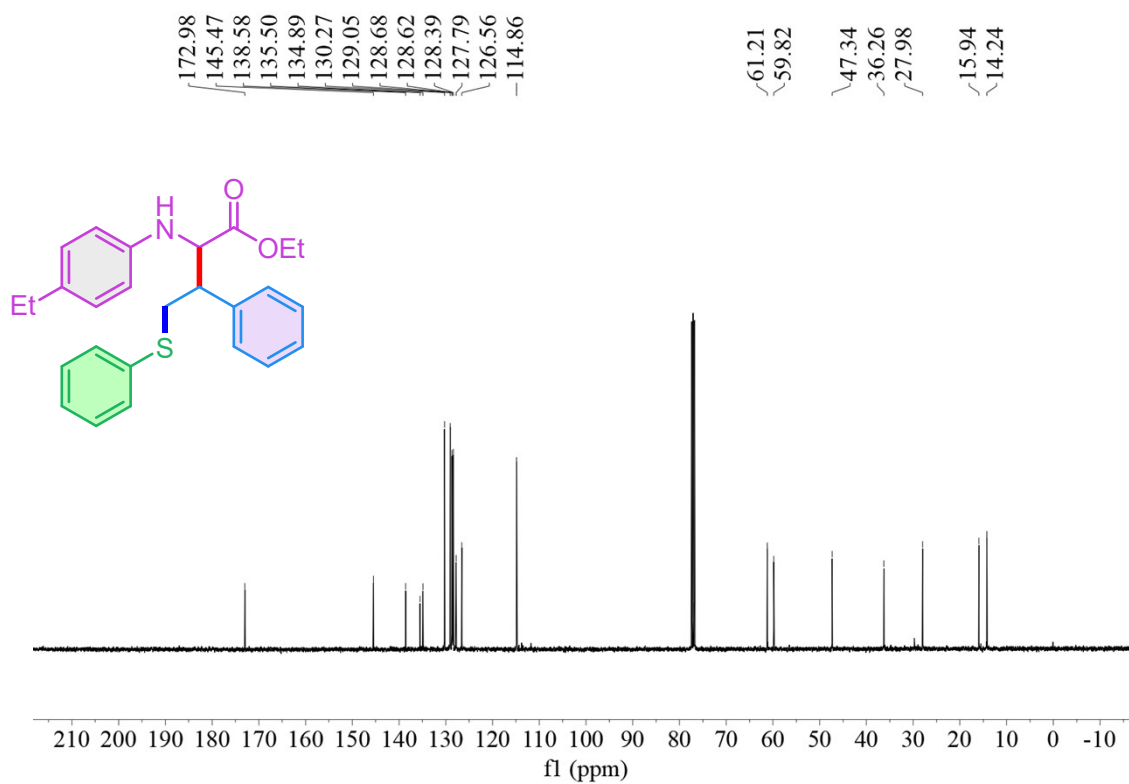
5 ¹³C NMR (126 MHz, Chloroform-*d*)



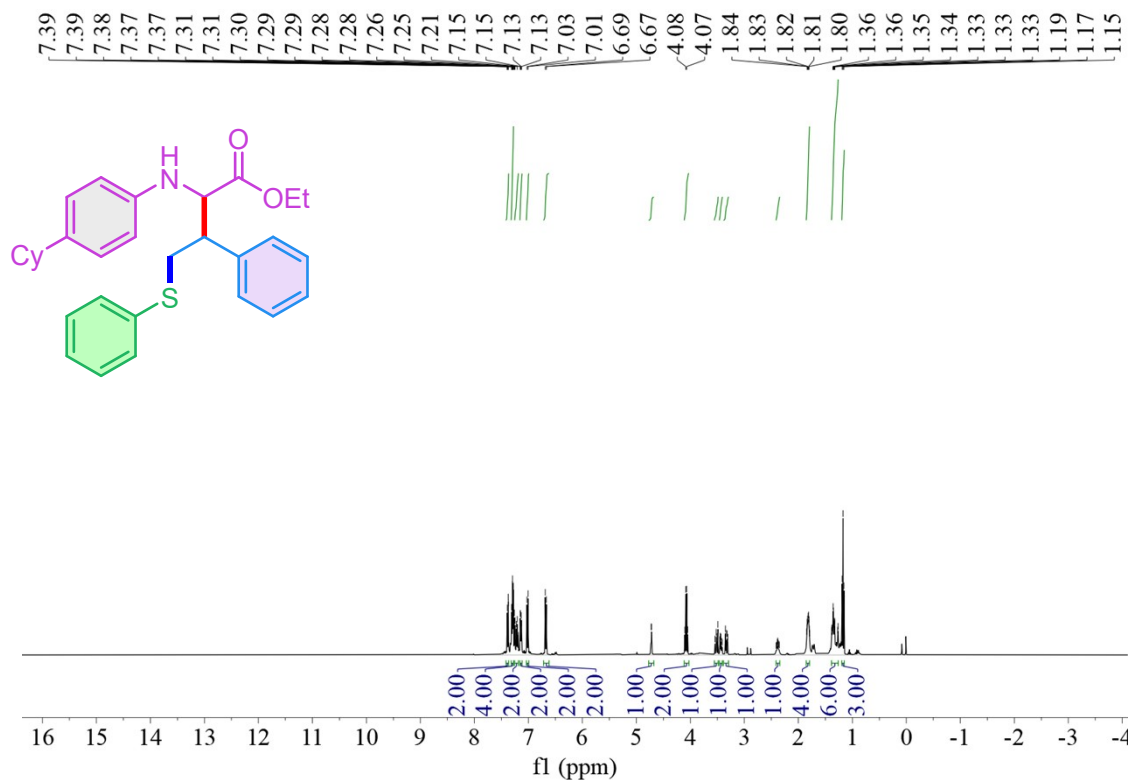
6 ¹H NMR (400 MHz, Chloroform-*d*)



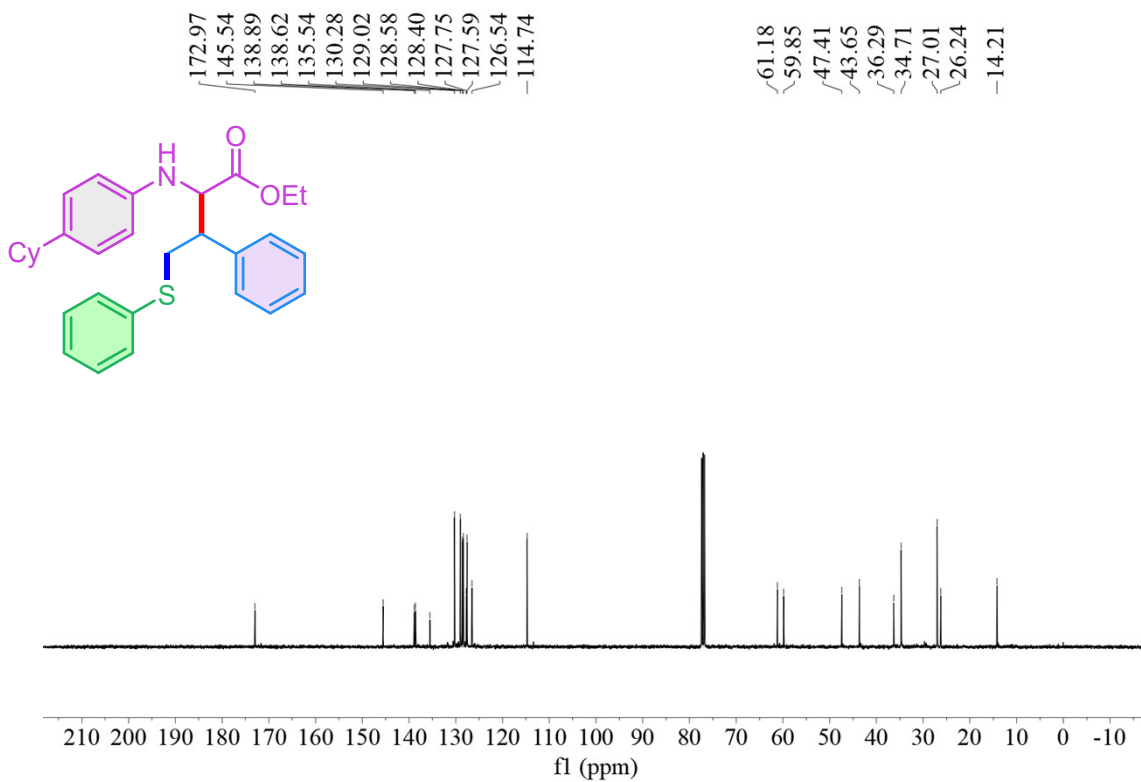
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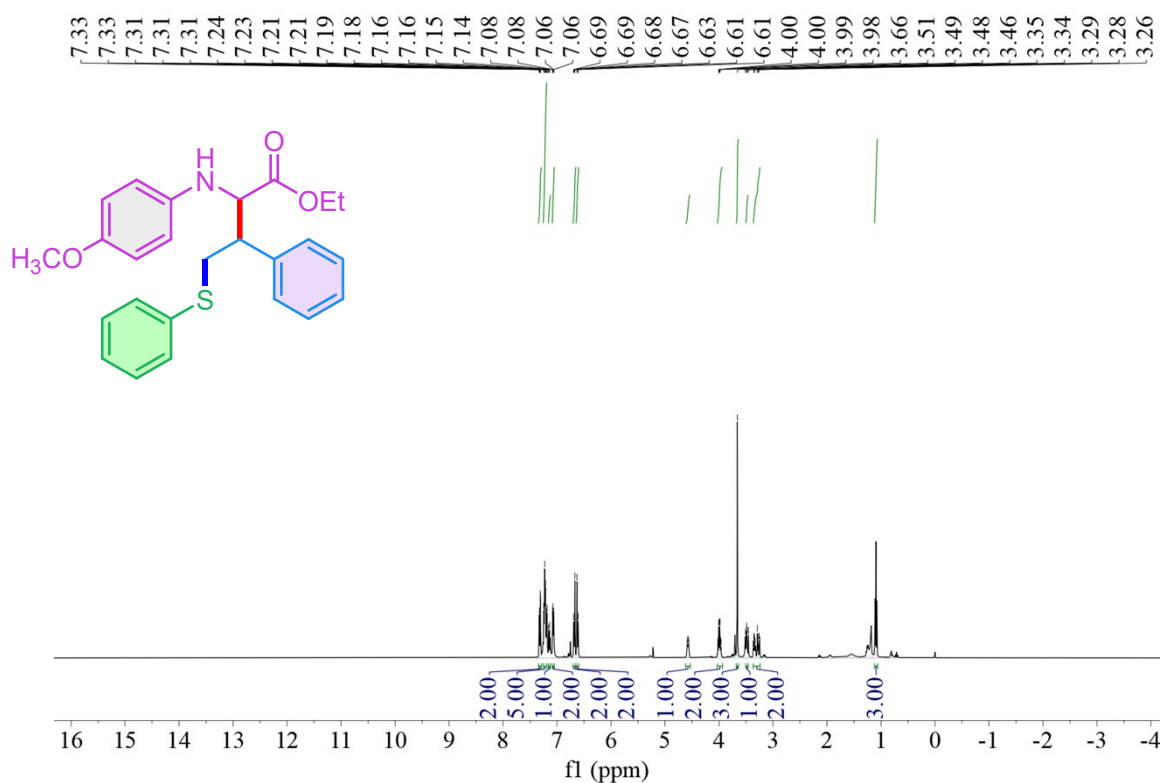
7 ¹H NMR (400 MHz, Chloroform-*d*)



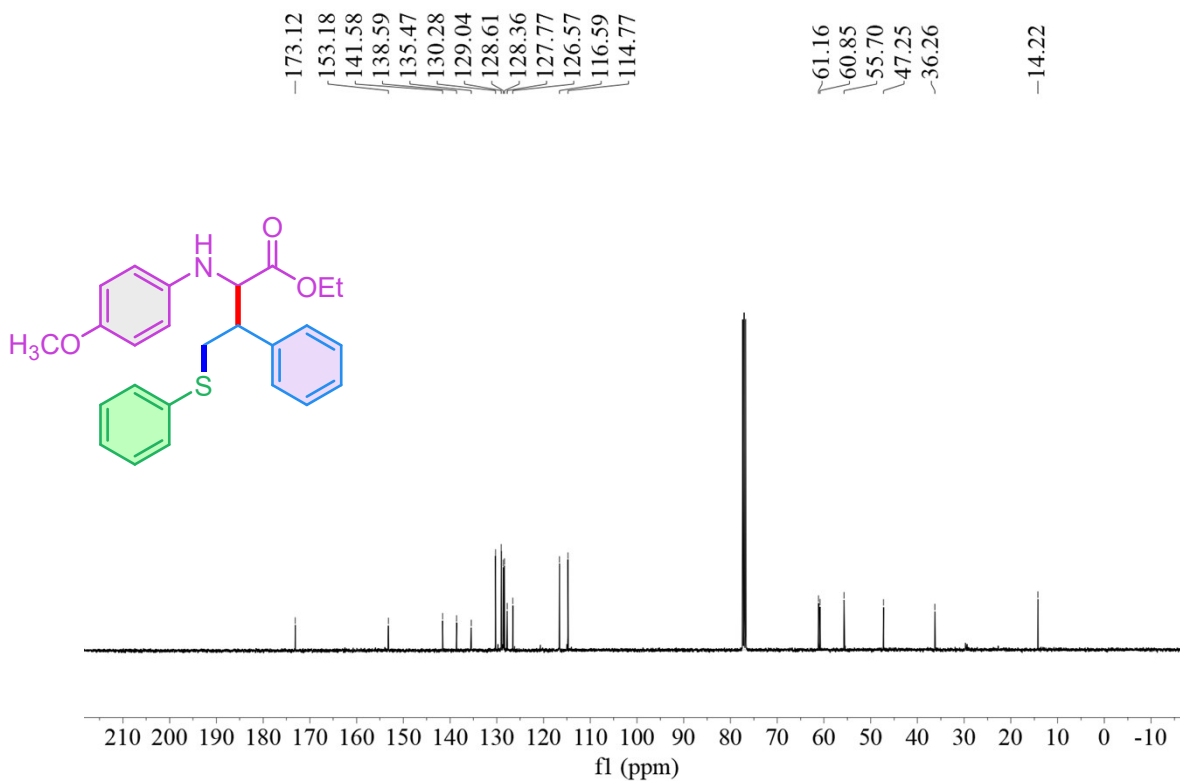
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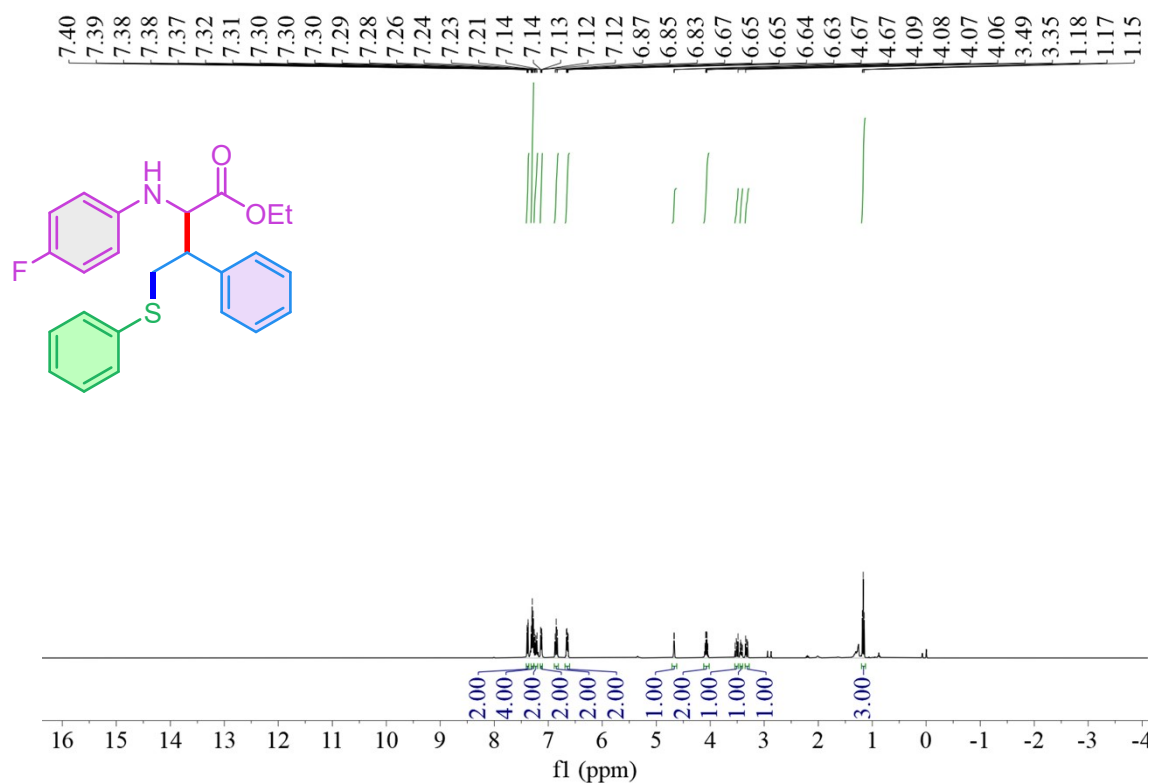
8 ¹H NMR (400 MHz, Chloroform-*d*)



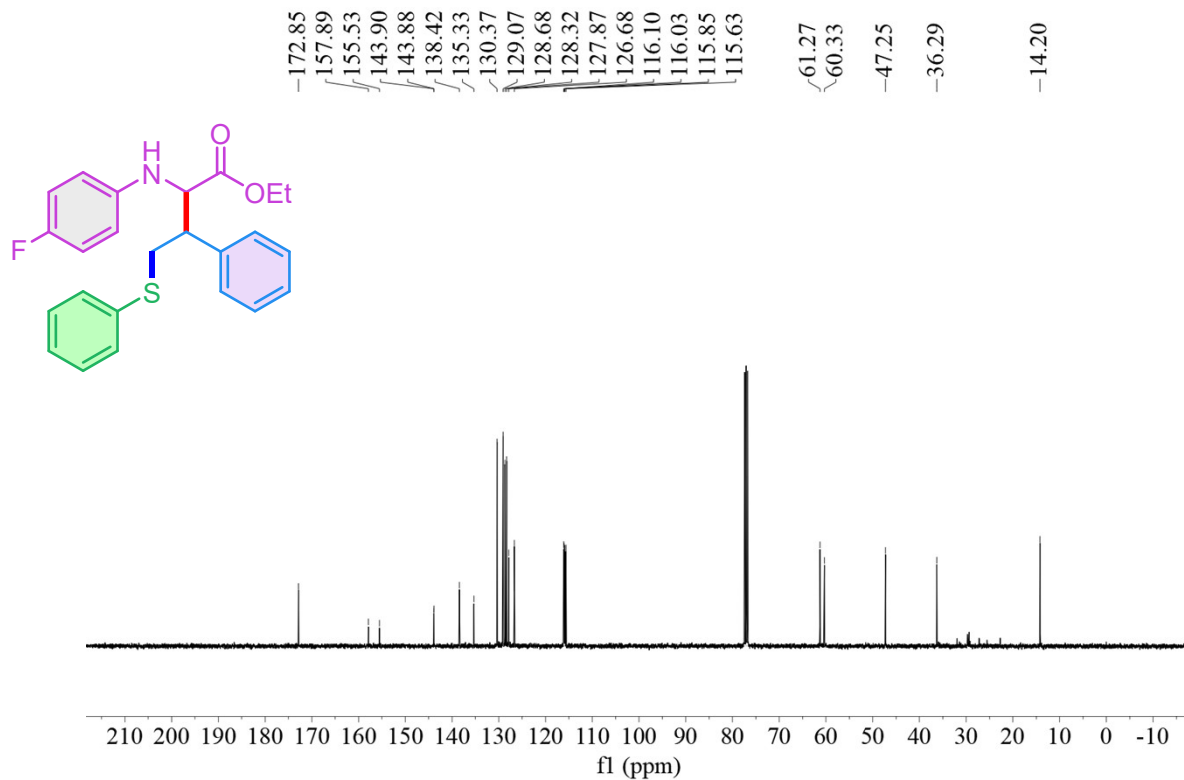
8 ¹³C NMR (101 MHz, Chloroform-*d*)



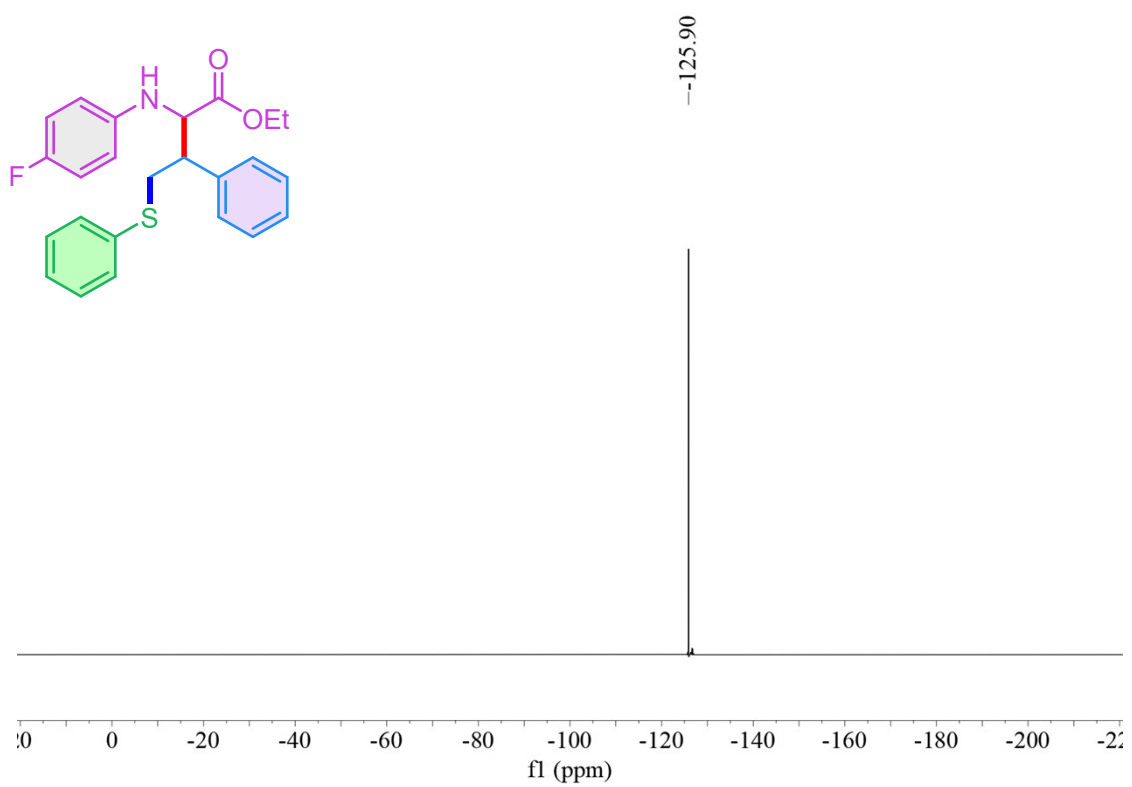
9 ¹H NMR (400 MHz, Chloroform-*d*)



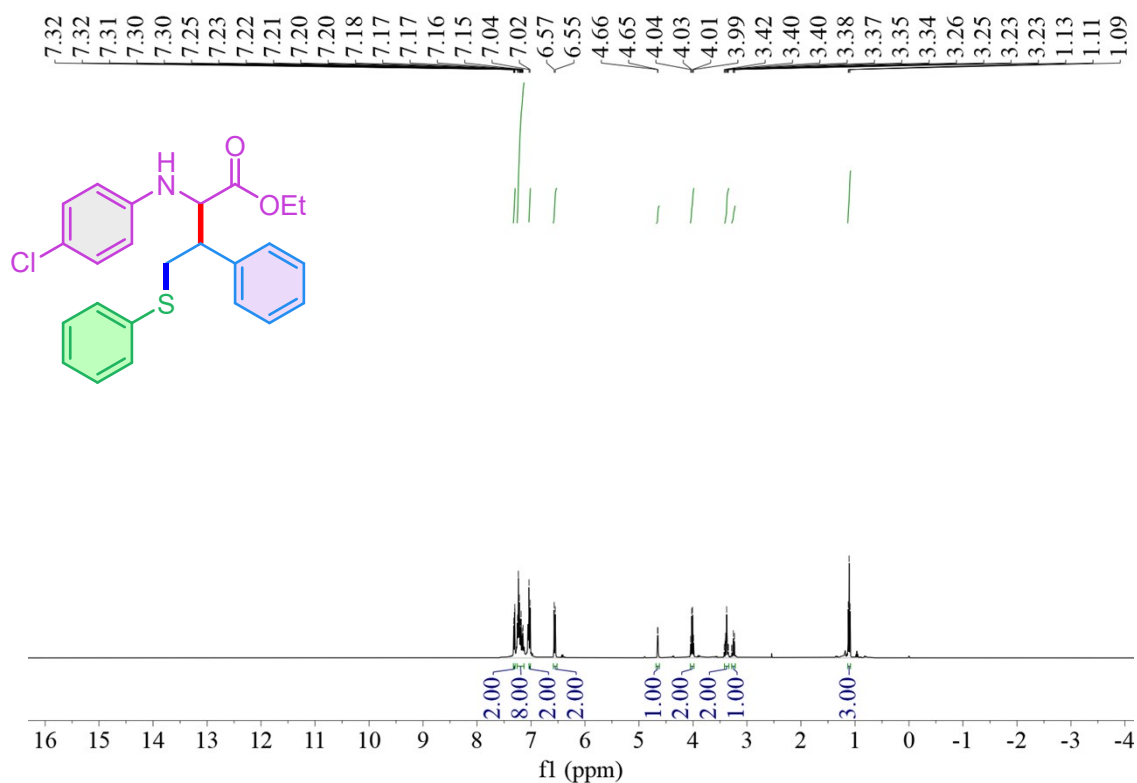
9 ¹³C NMR (101 MHz, Chloroform-*d*)



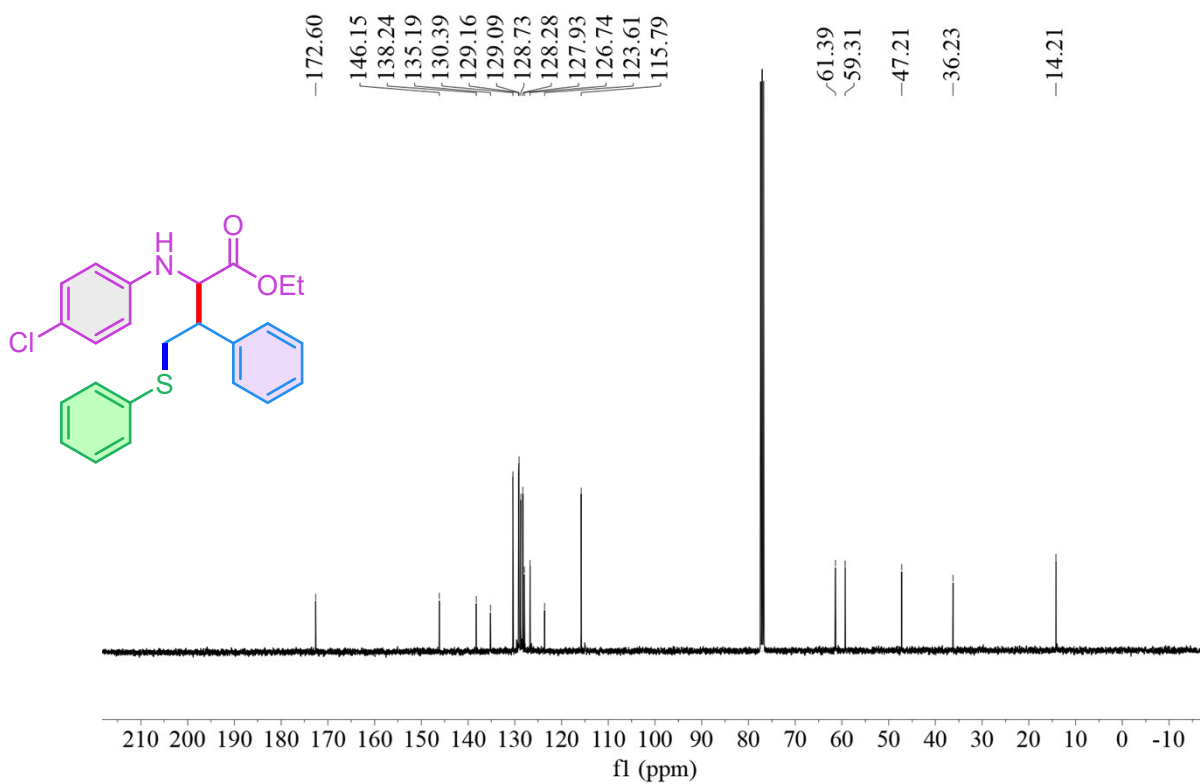
9 ^{19}F NMR (376 MHz, Chloroform-*d*)



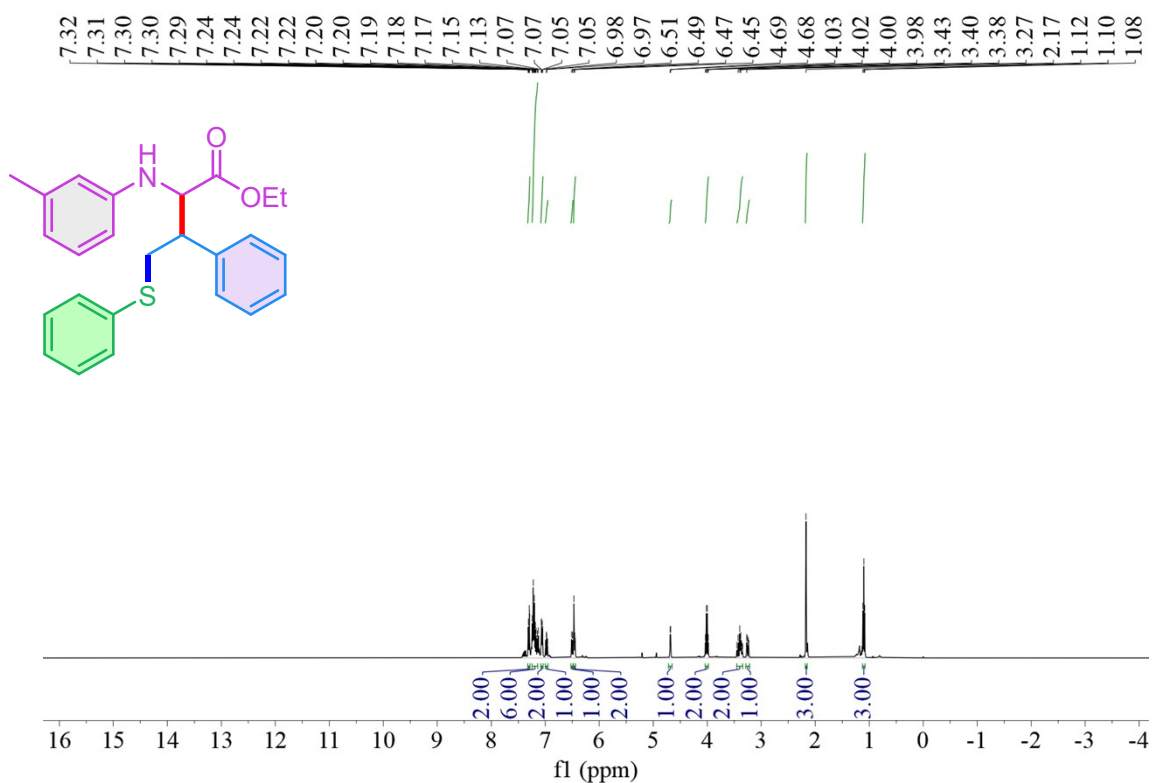
10 ¹H NMR (400 MHz, Chloroform-*d*)



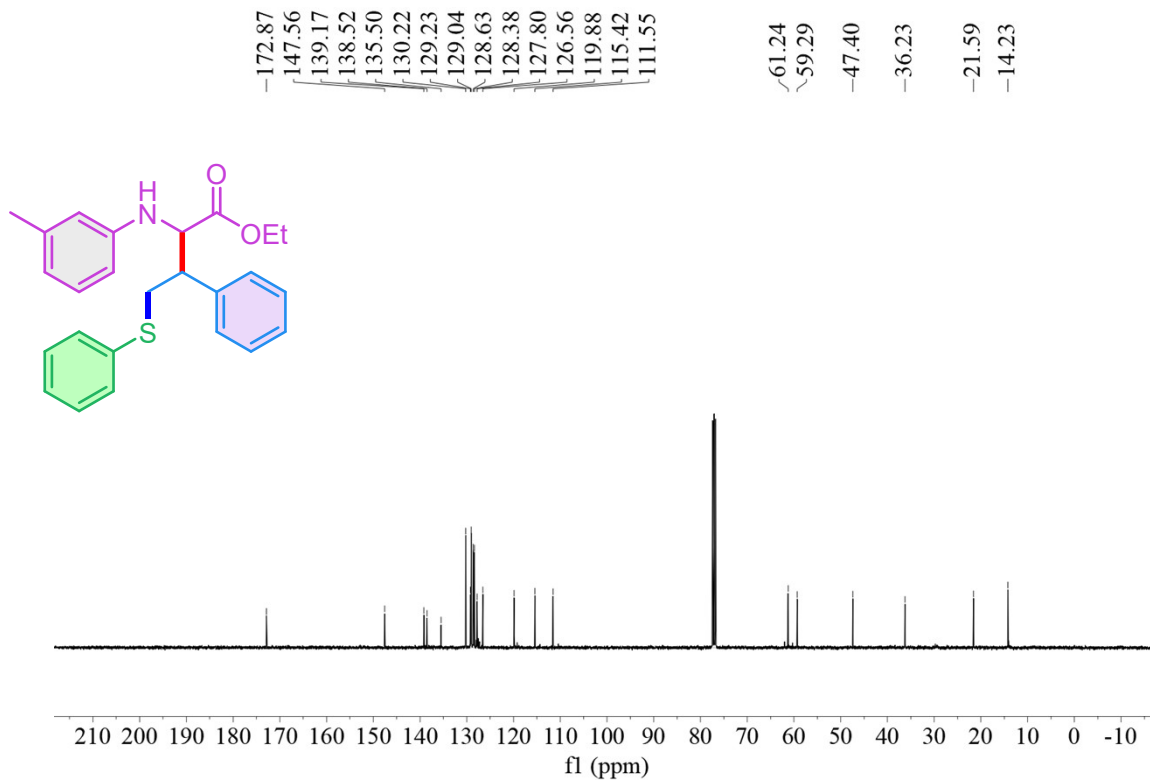
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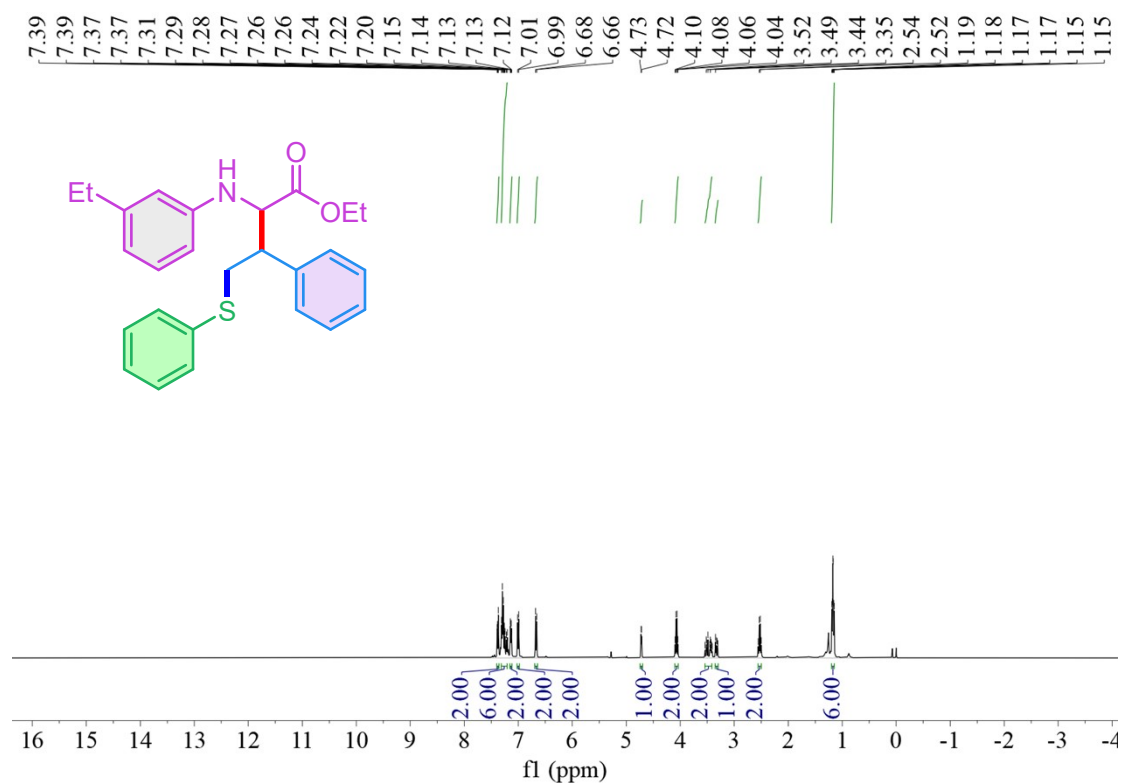
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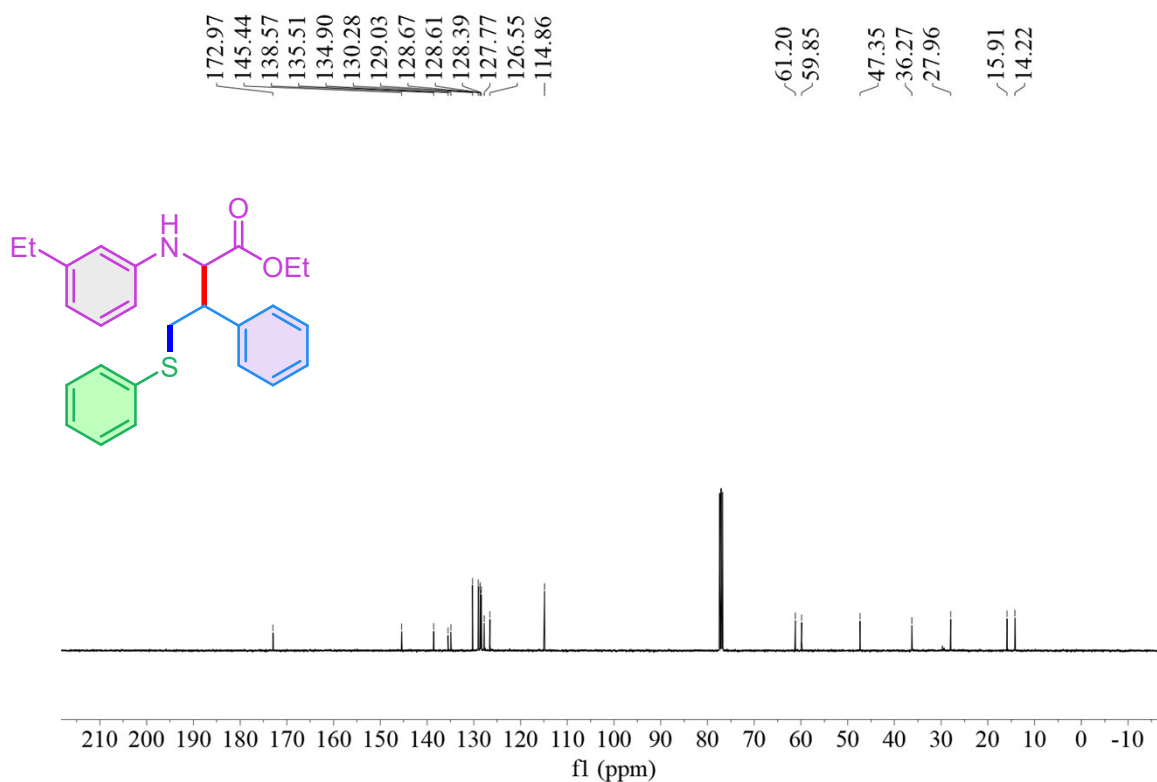
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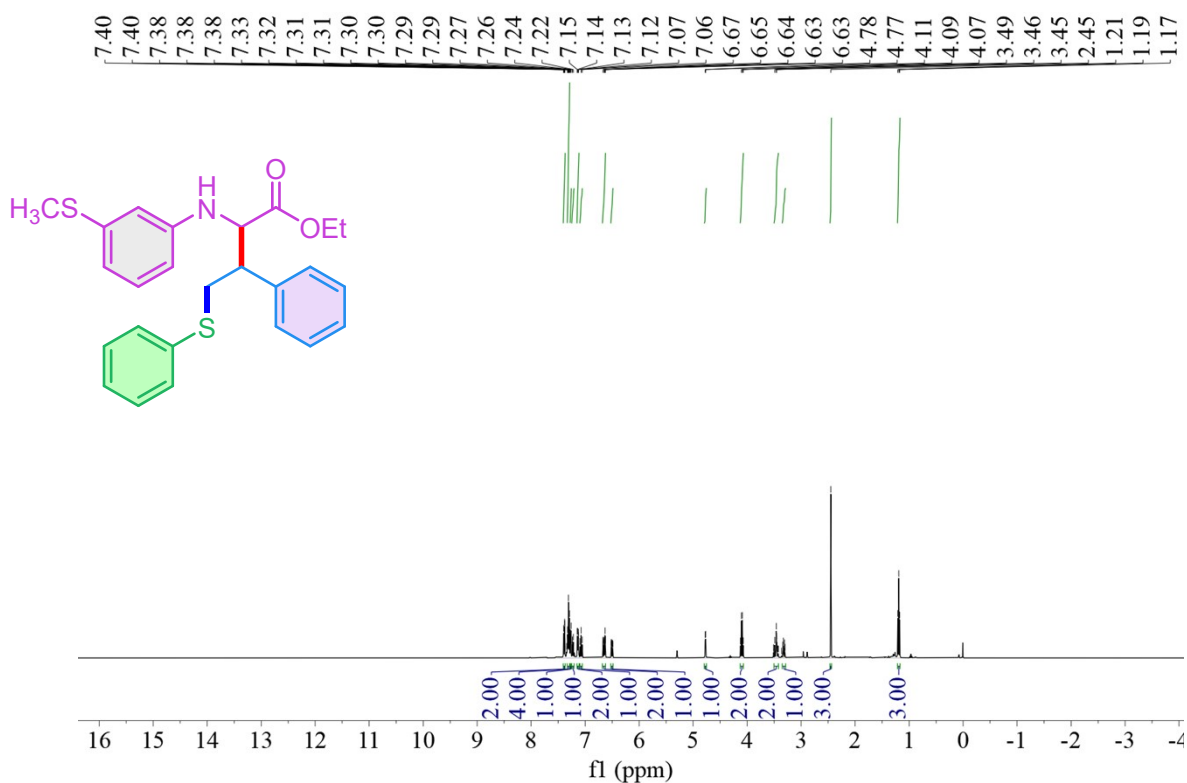
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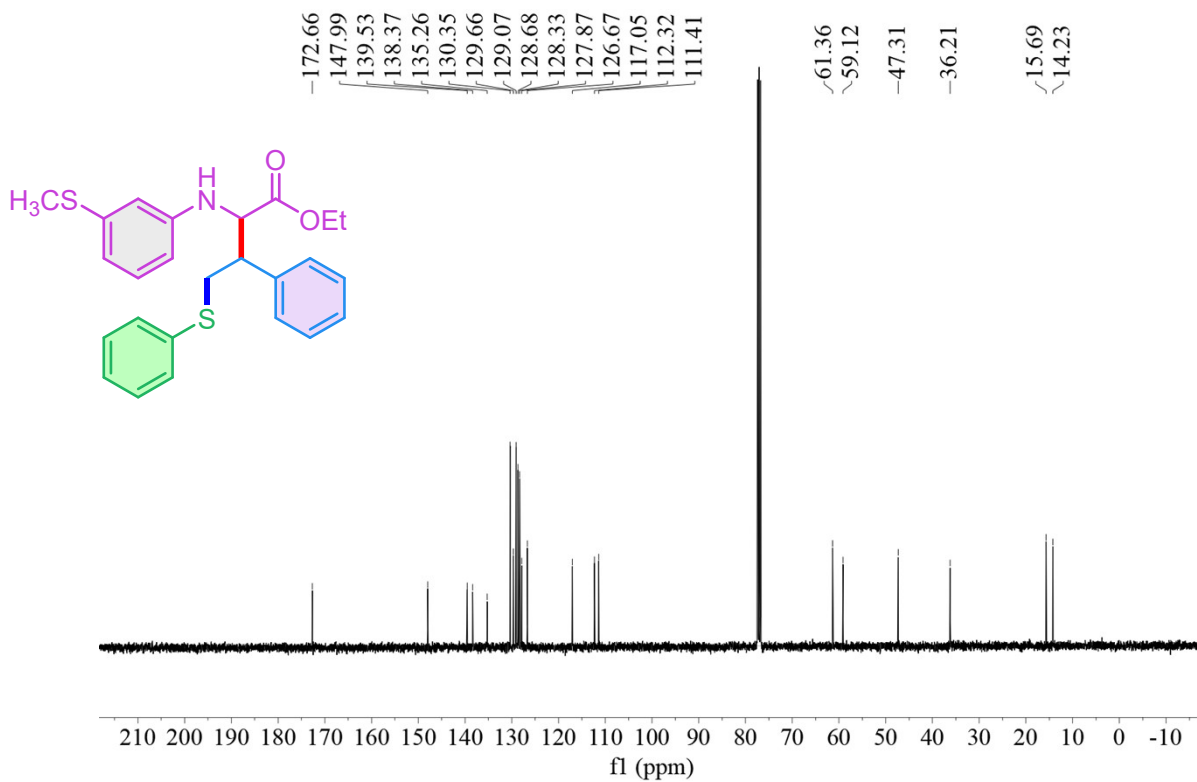
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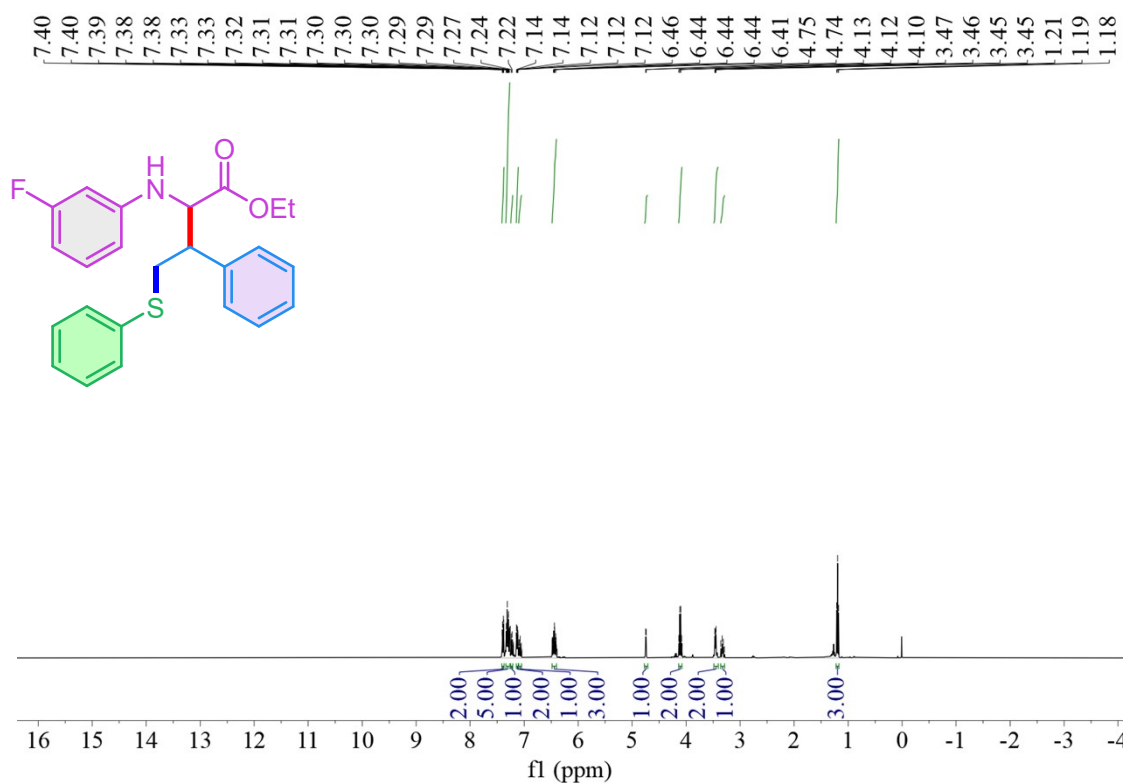
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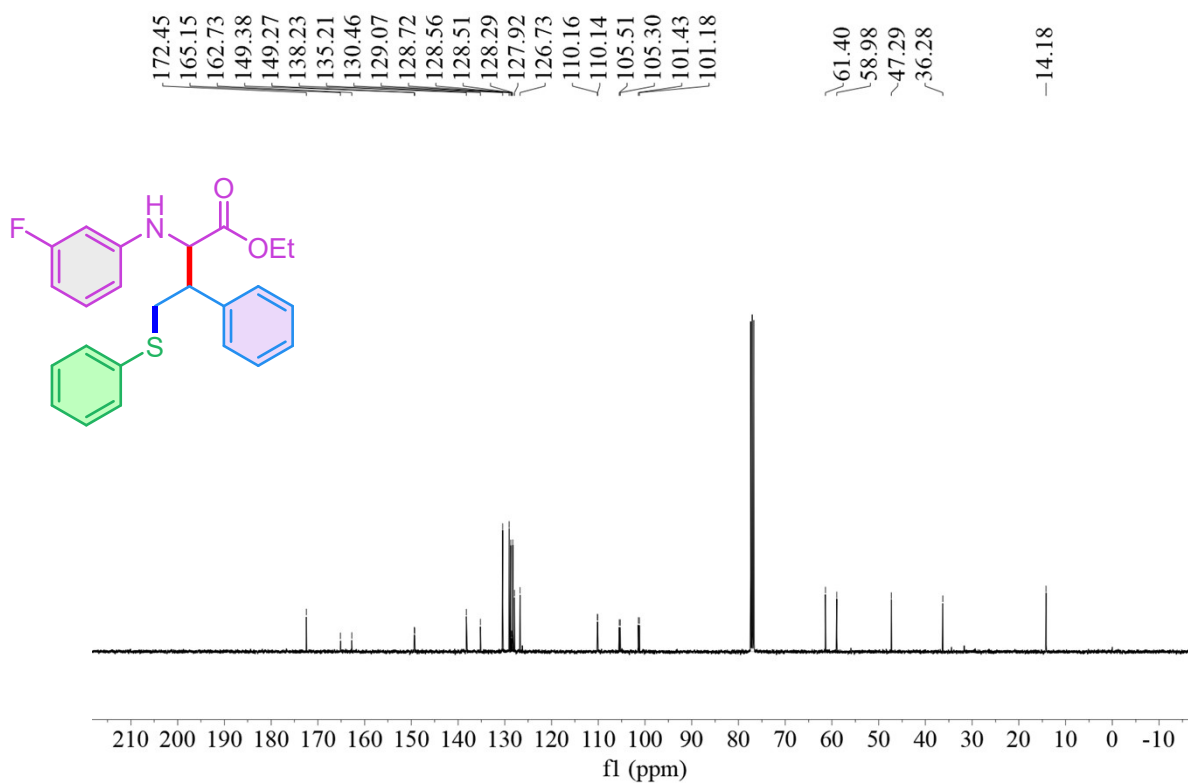
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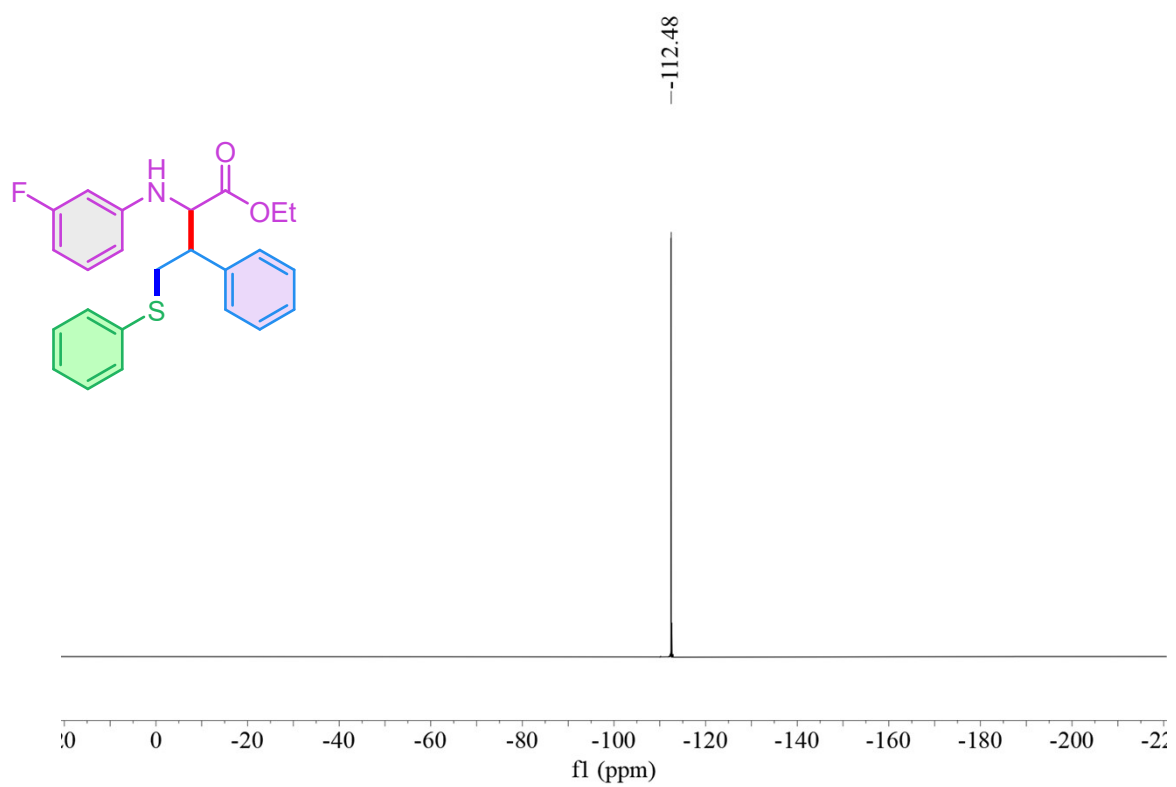
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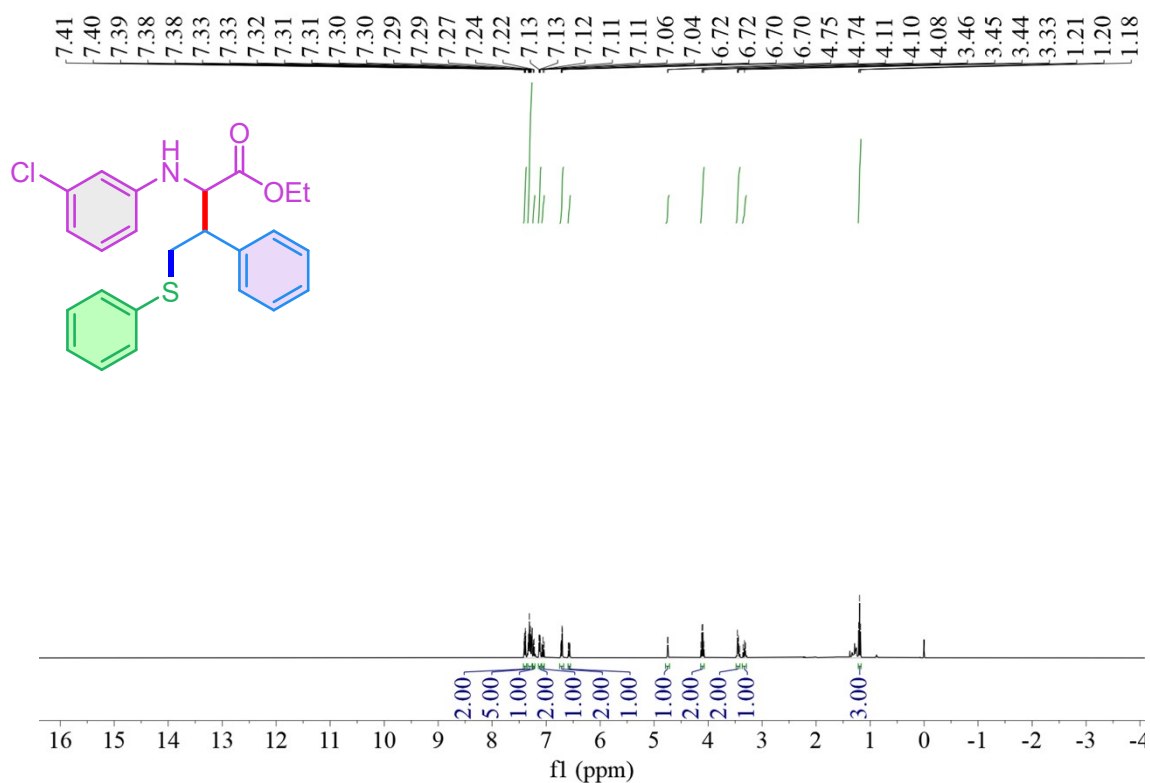
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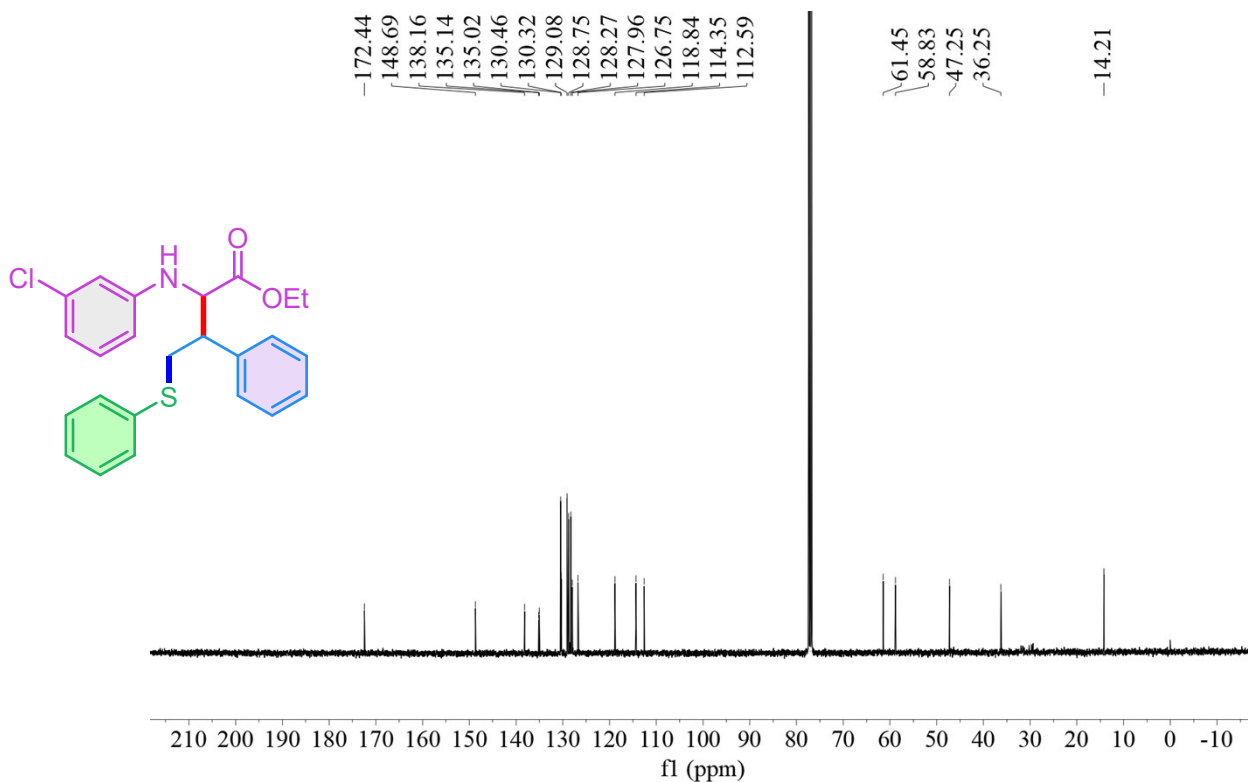
14 ^{19}F NMR (376 MHz, Chloroform-*d*)



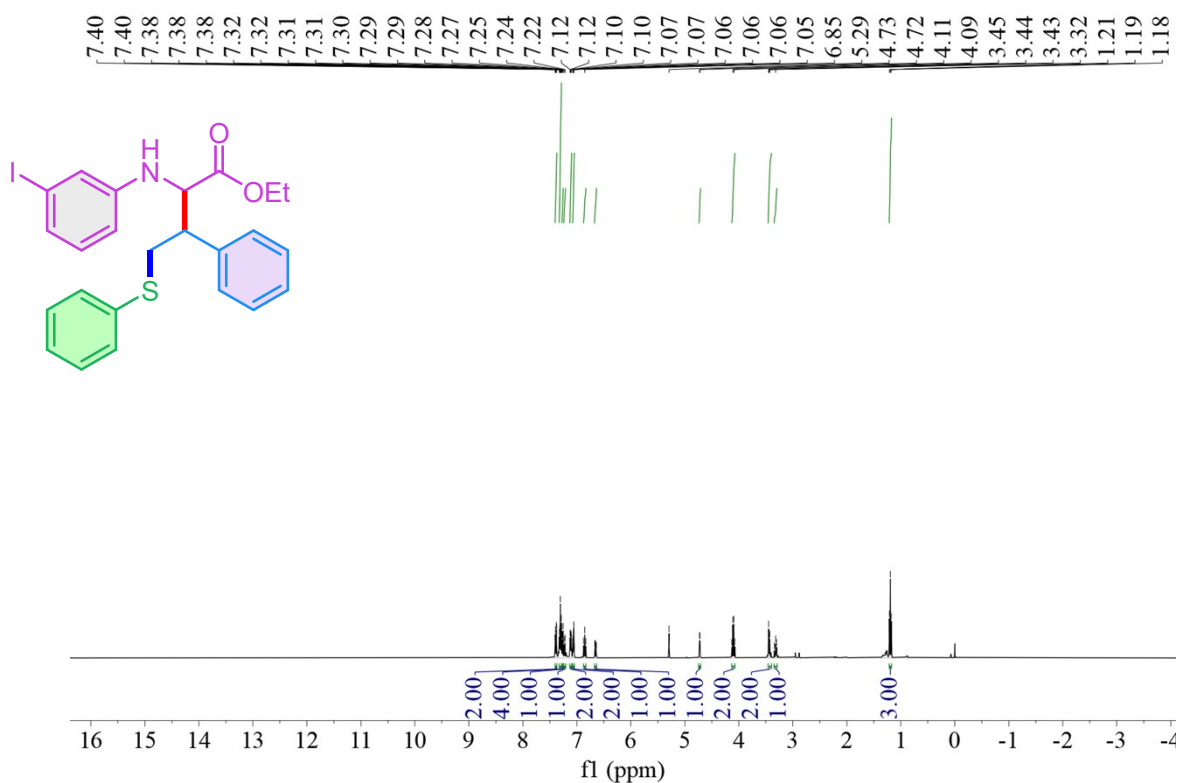
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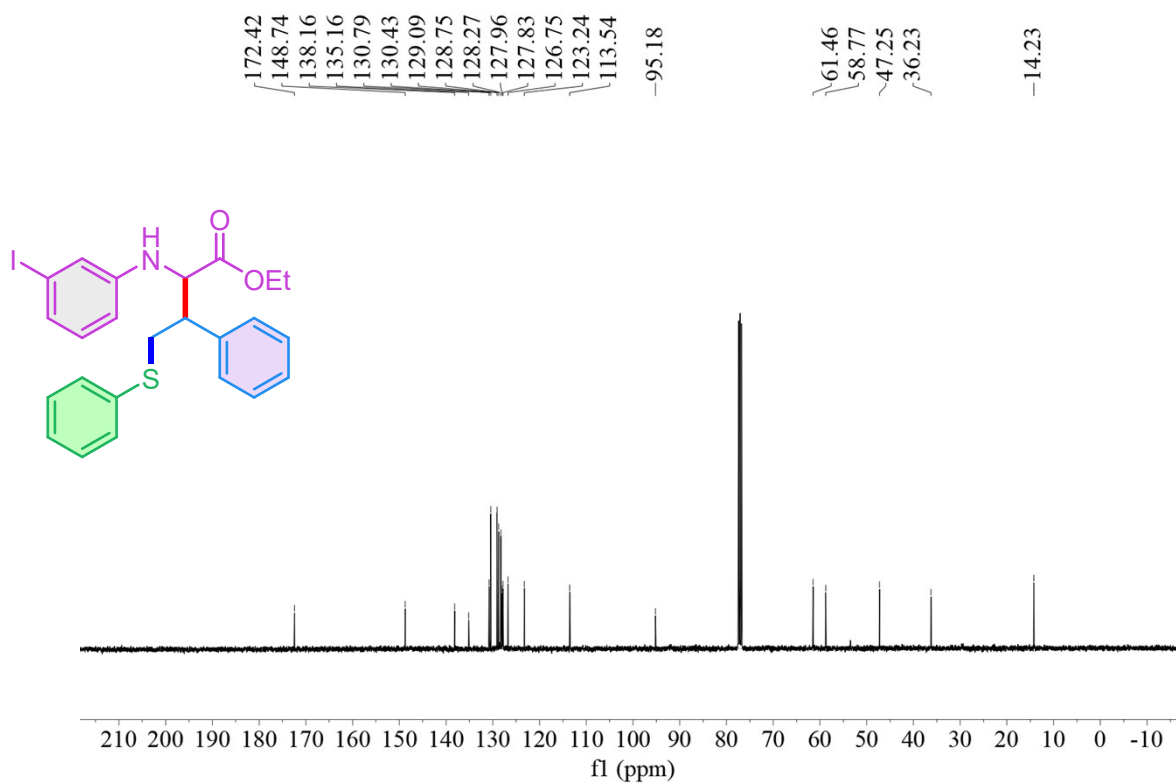
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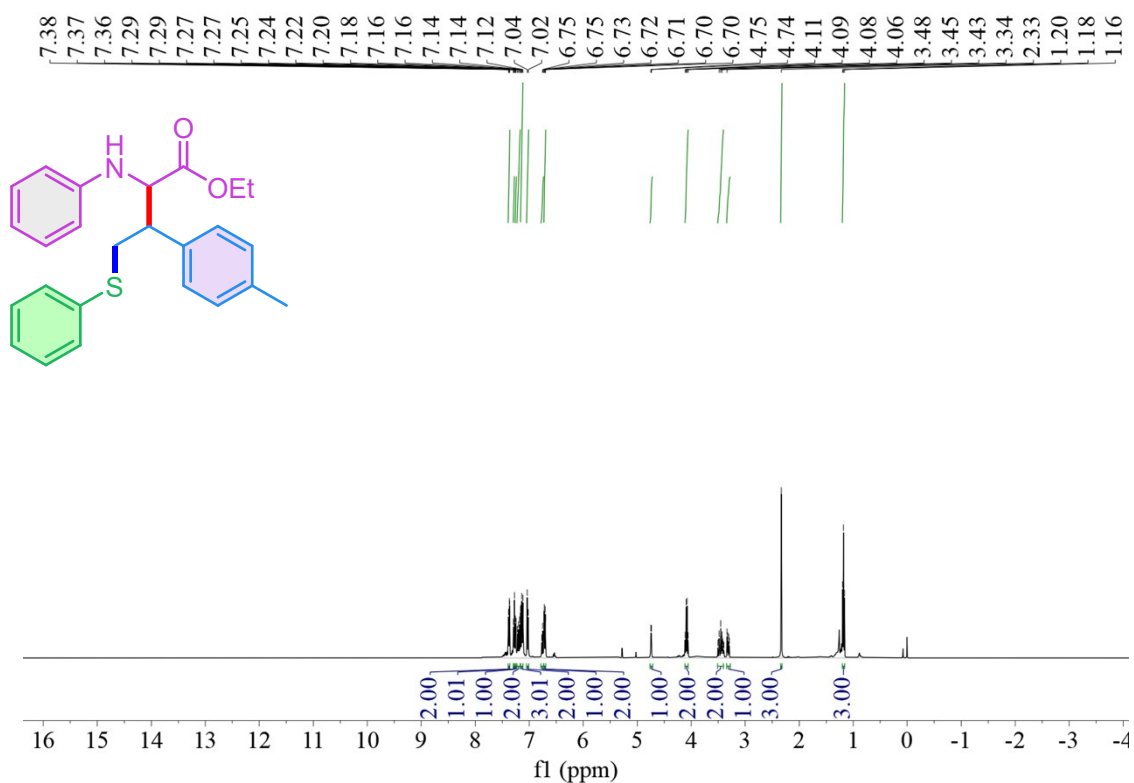
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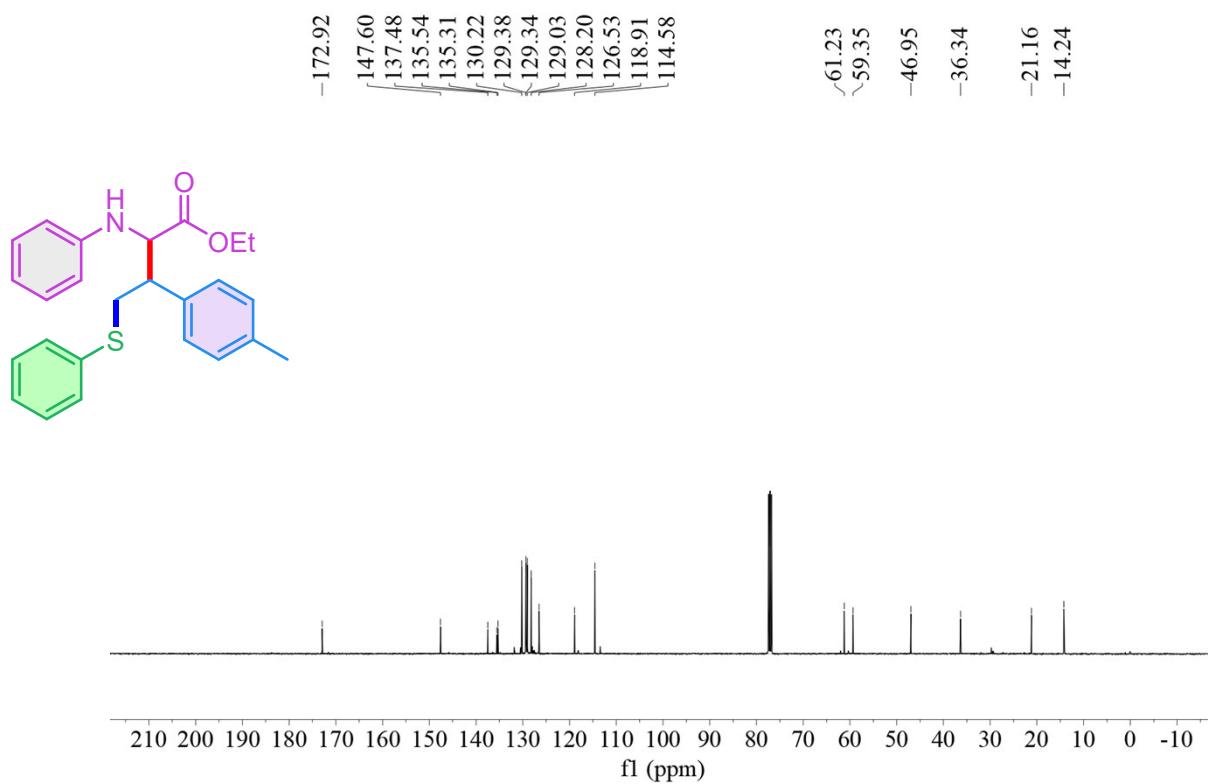
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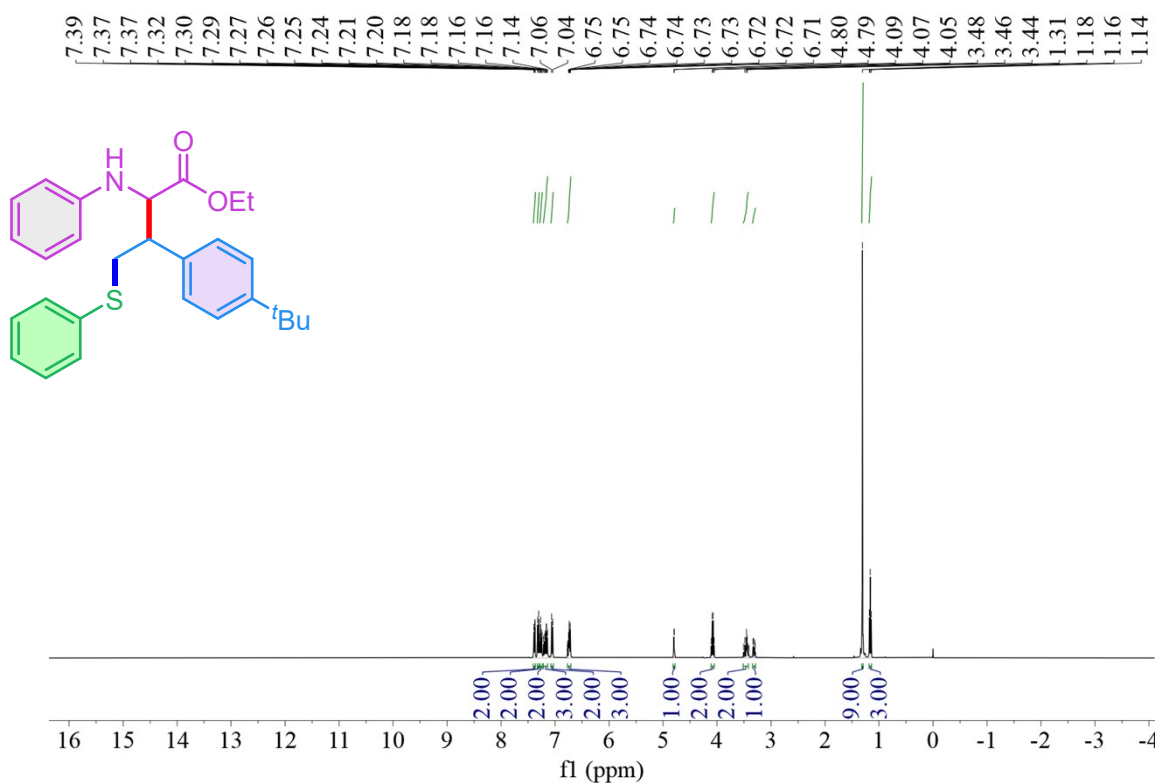
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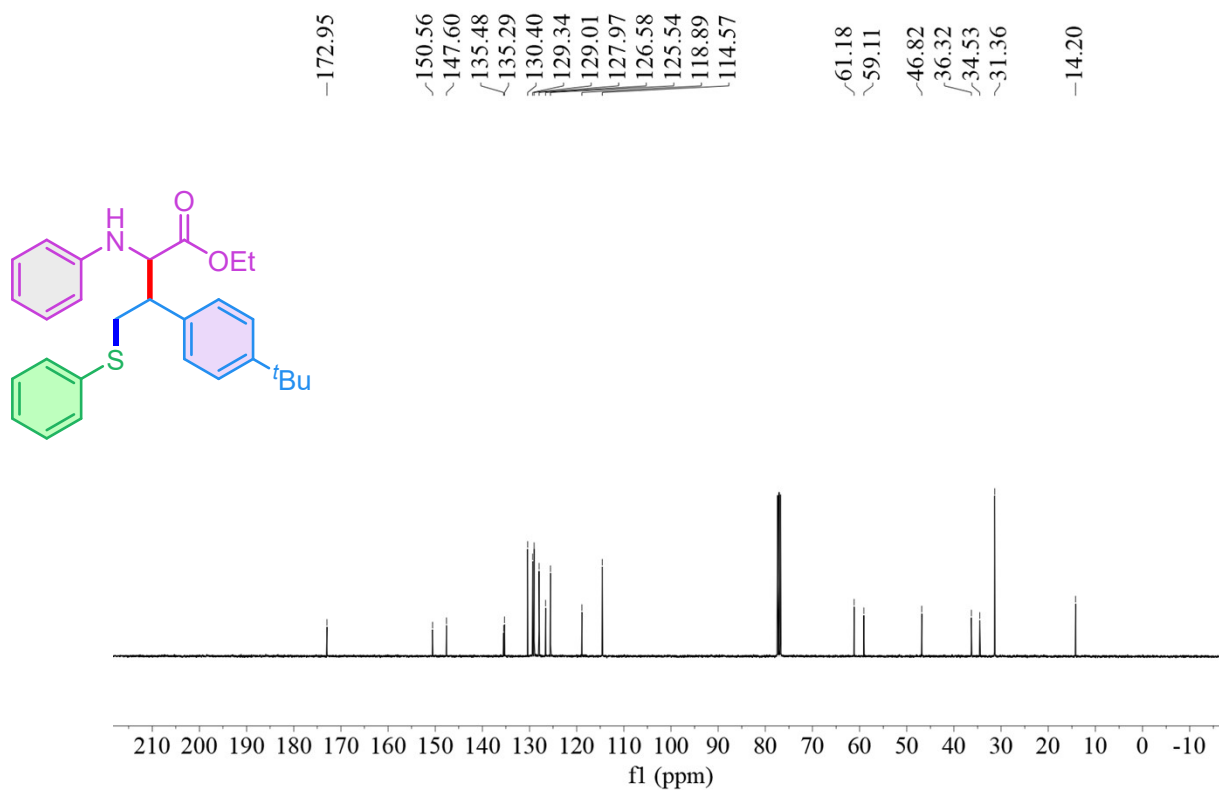
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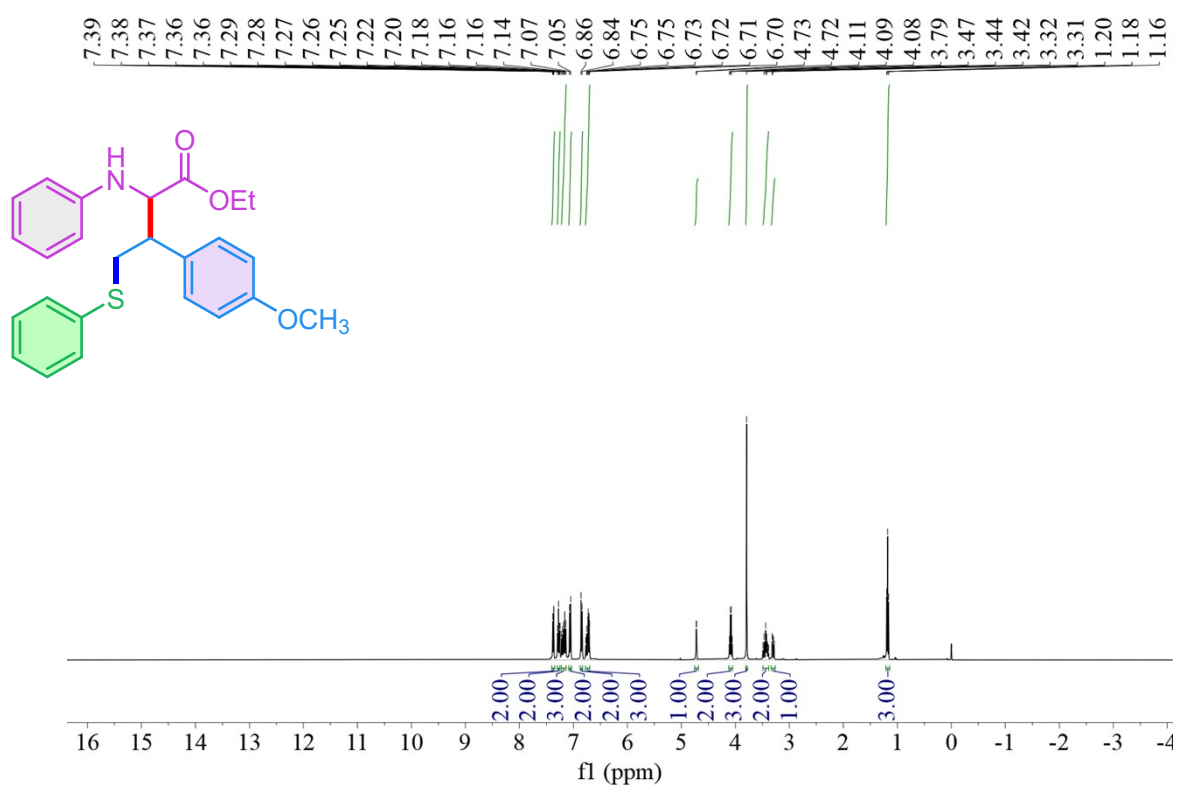
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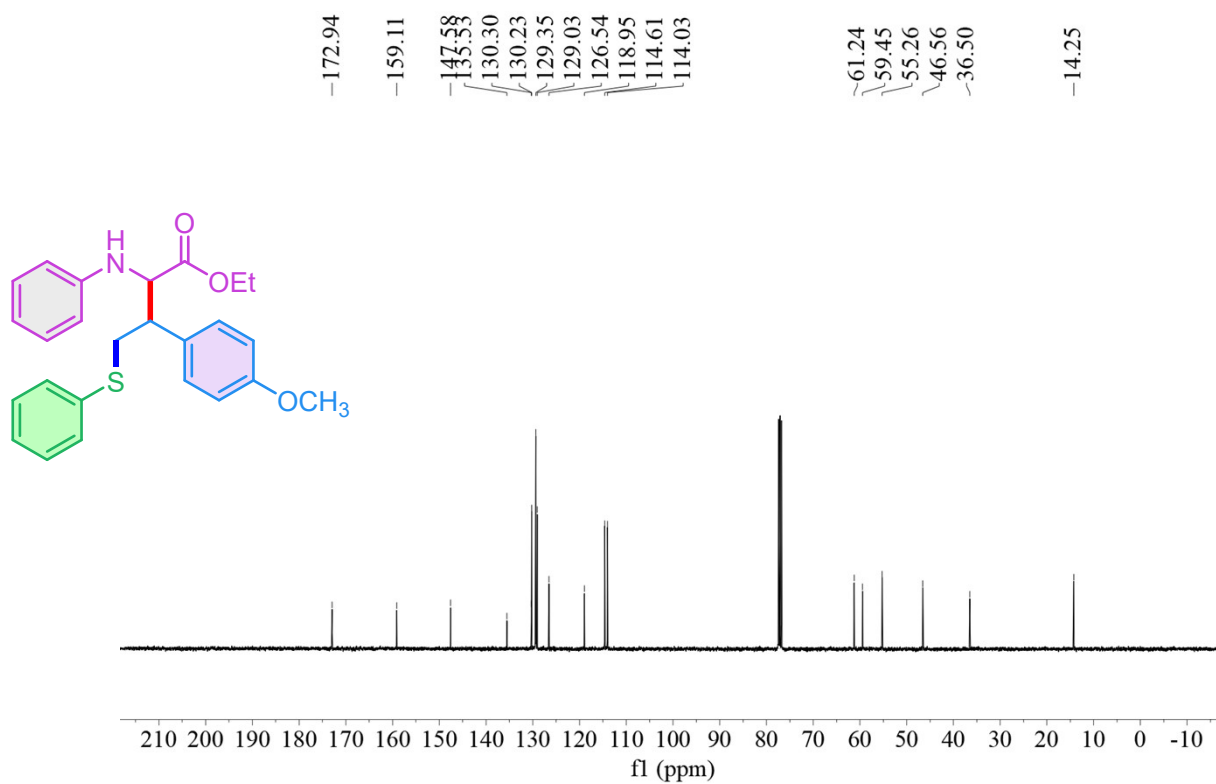
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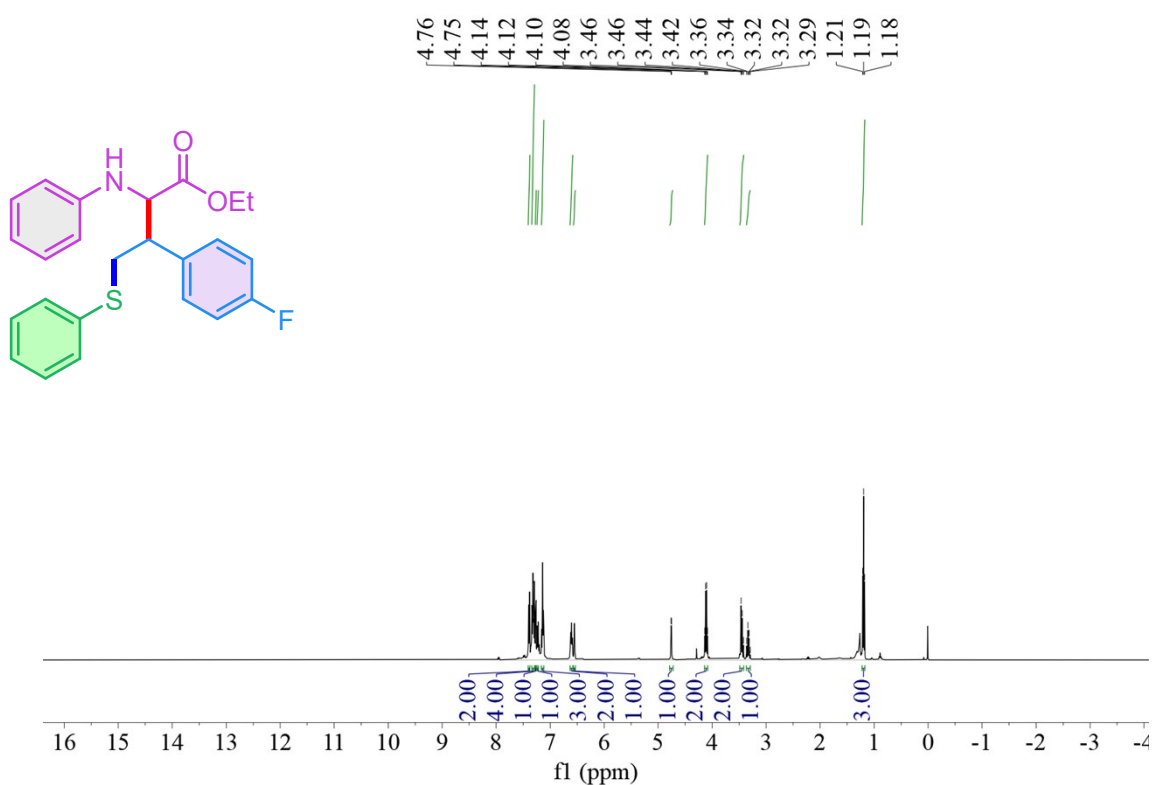
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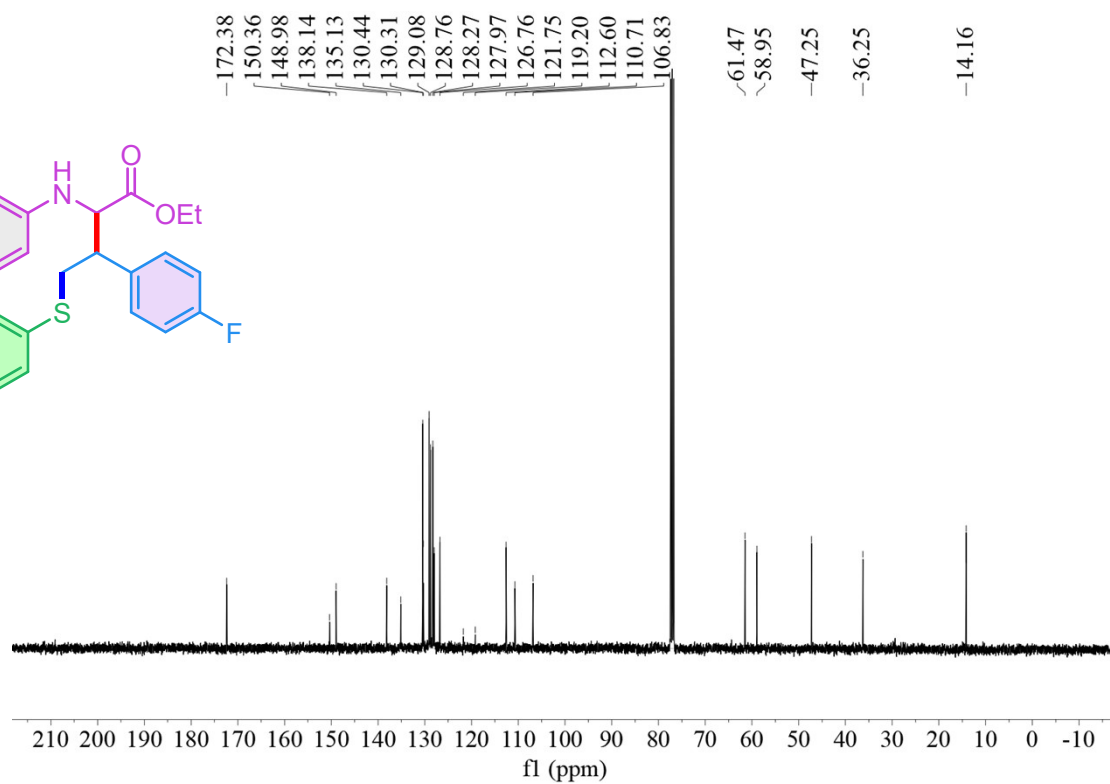
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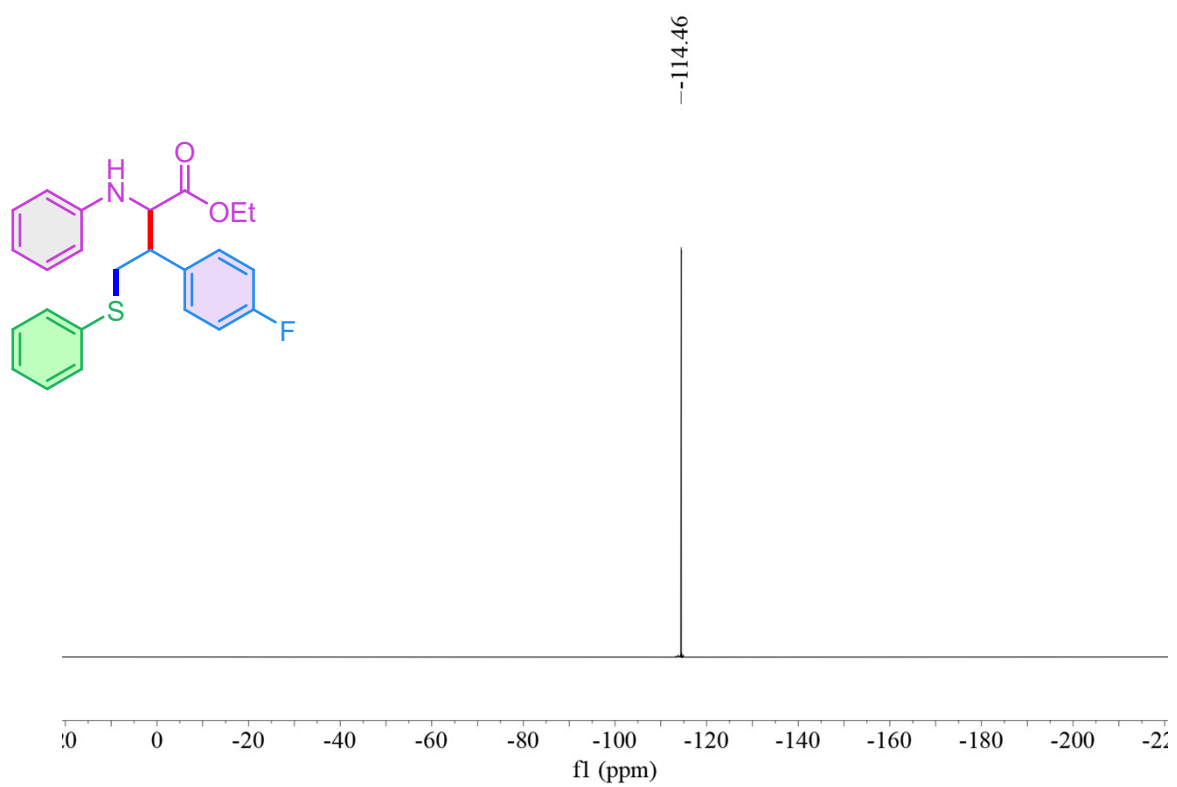
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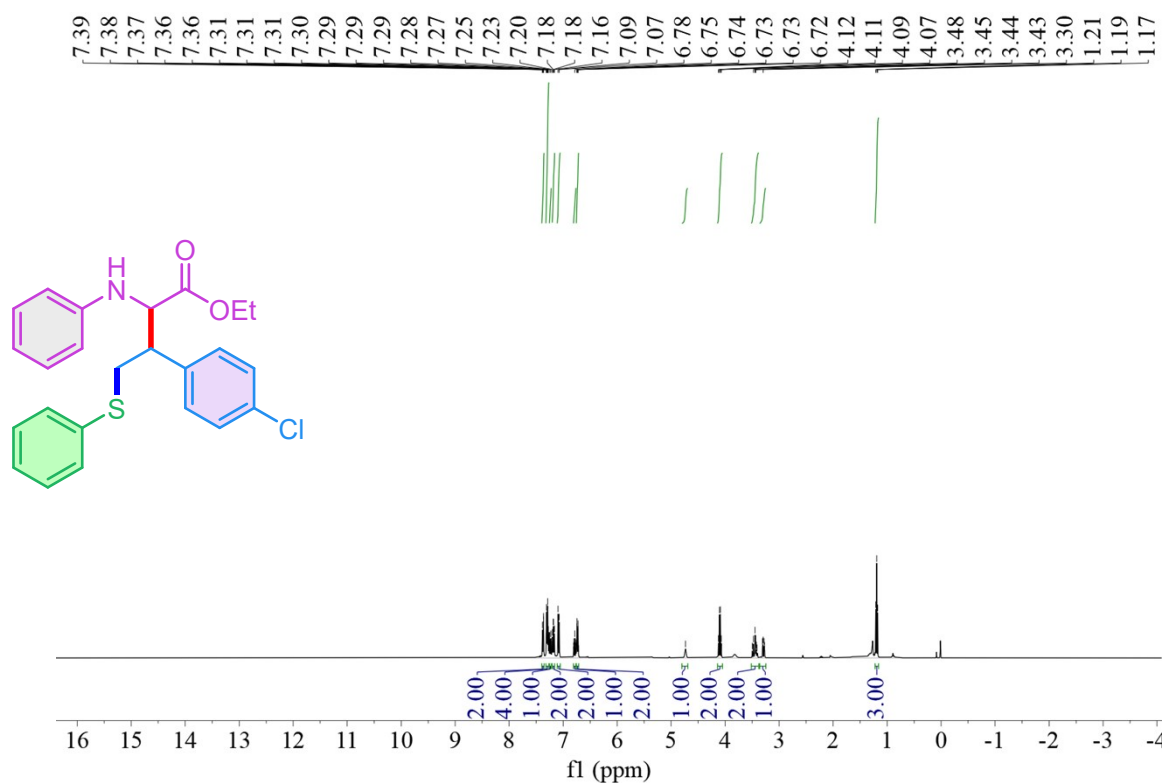
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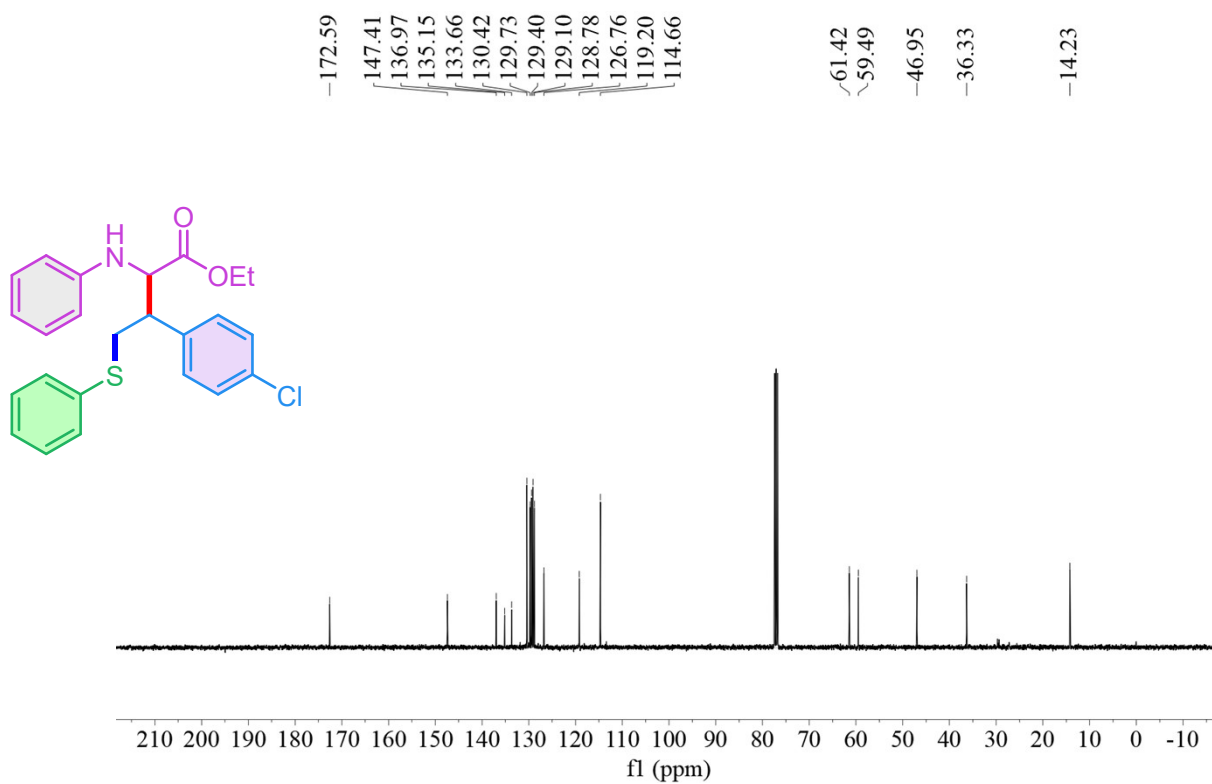
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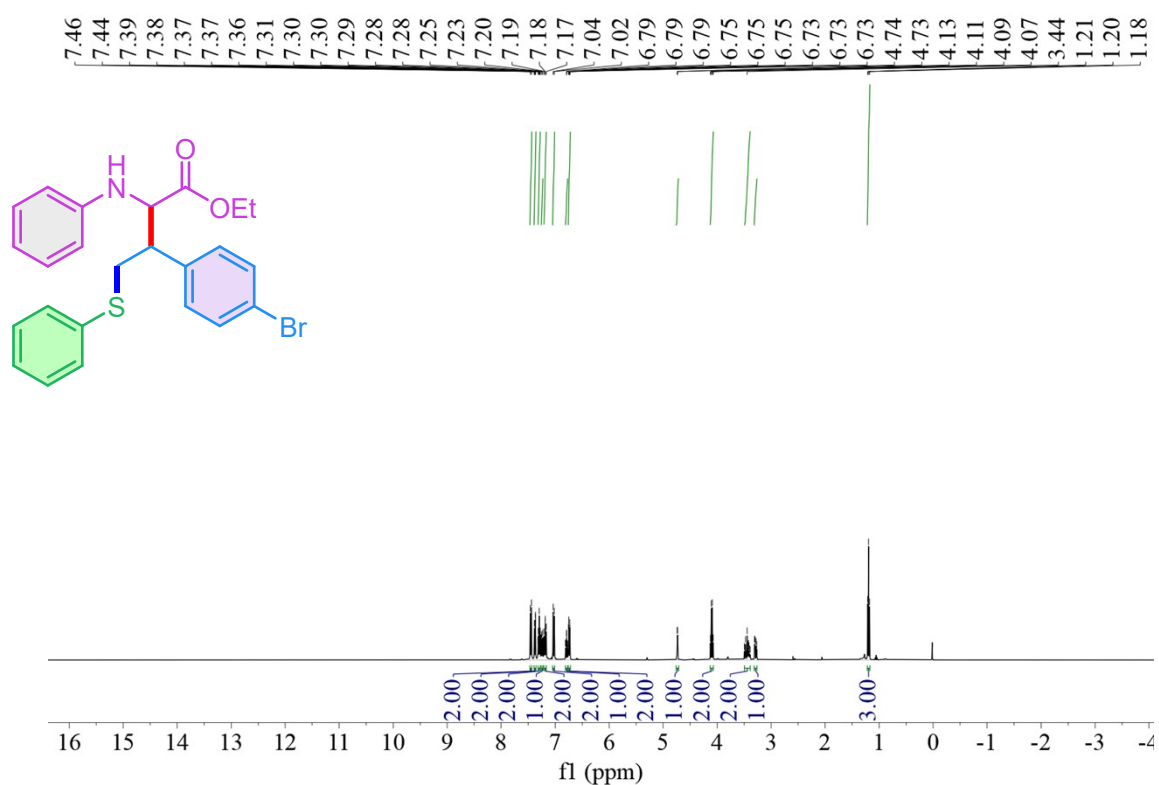
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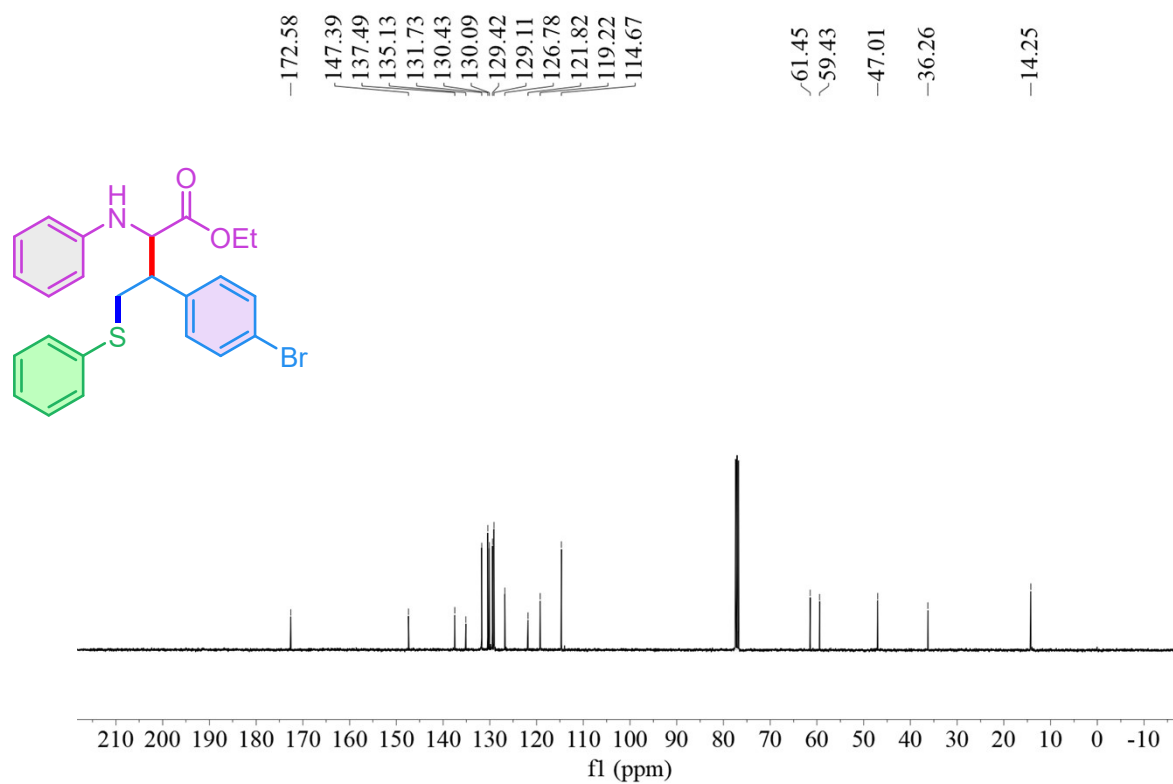
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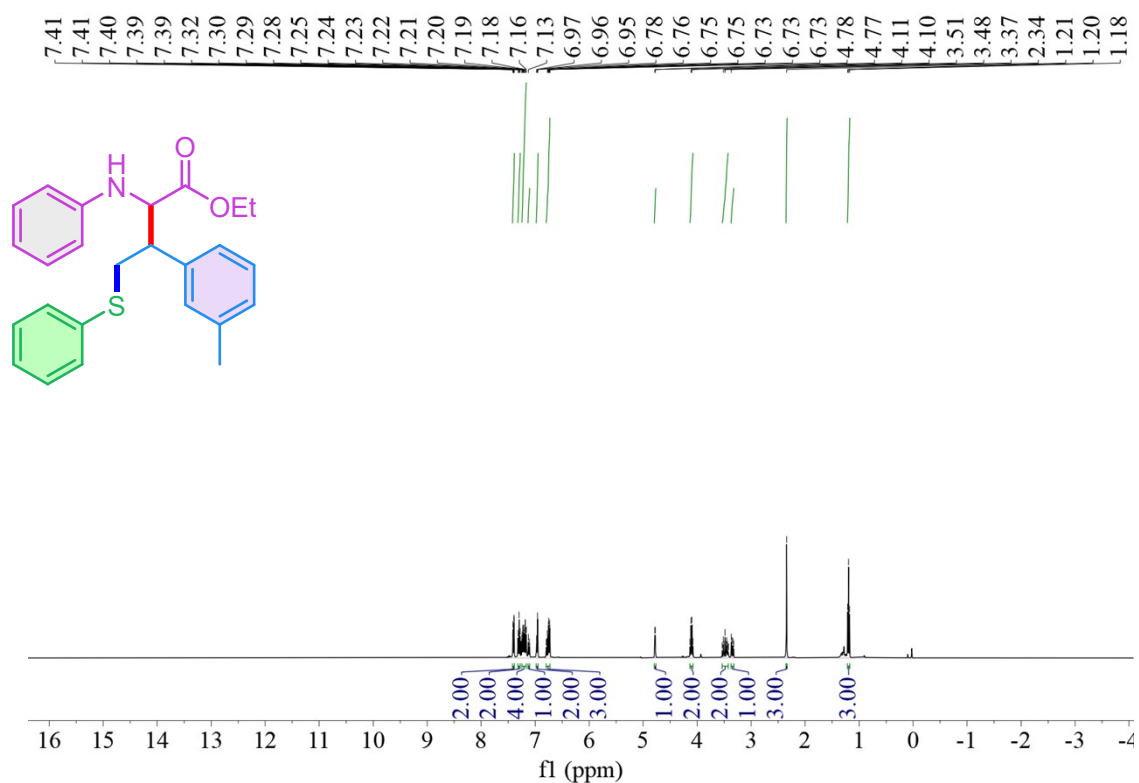
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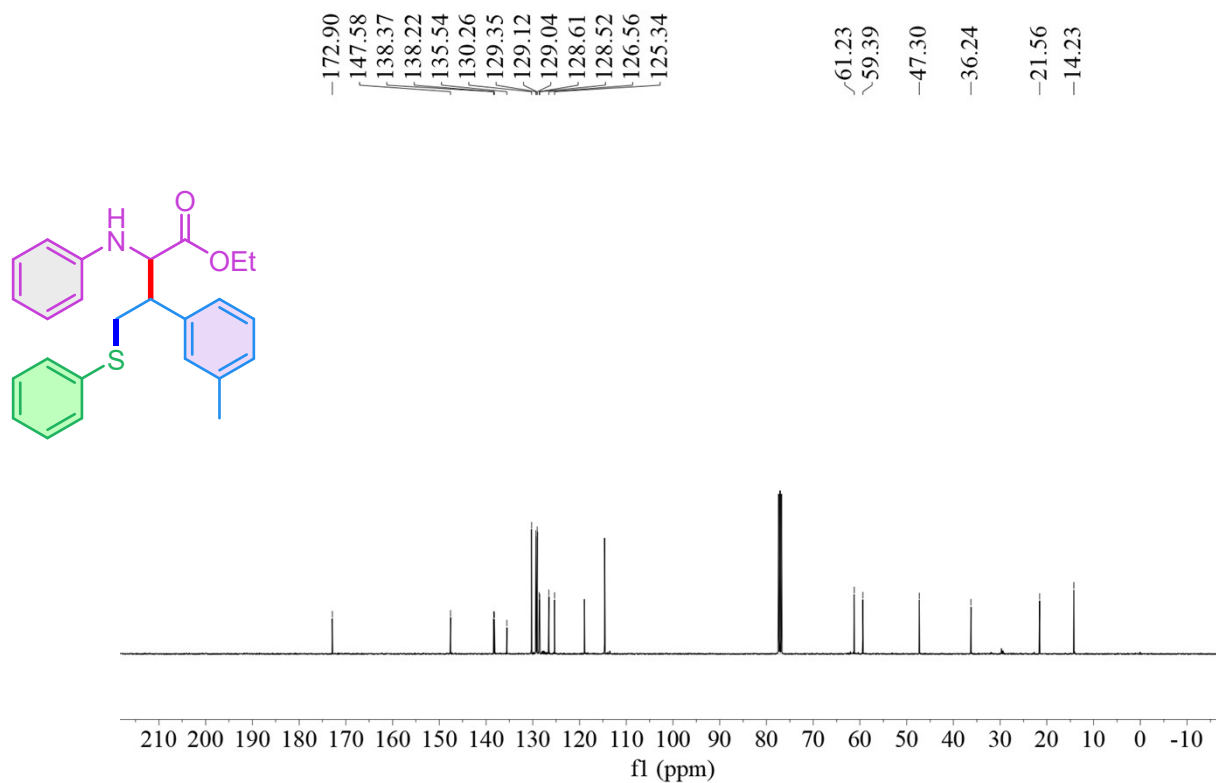
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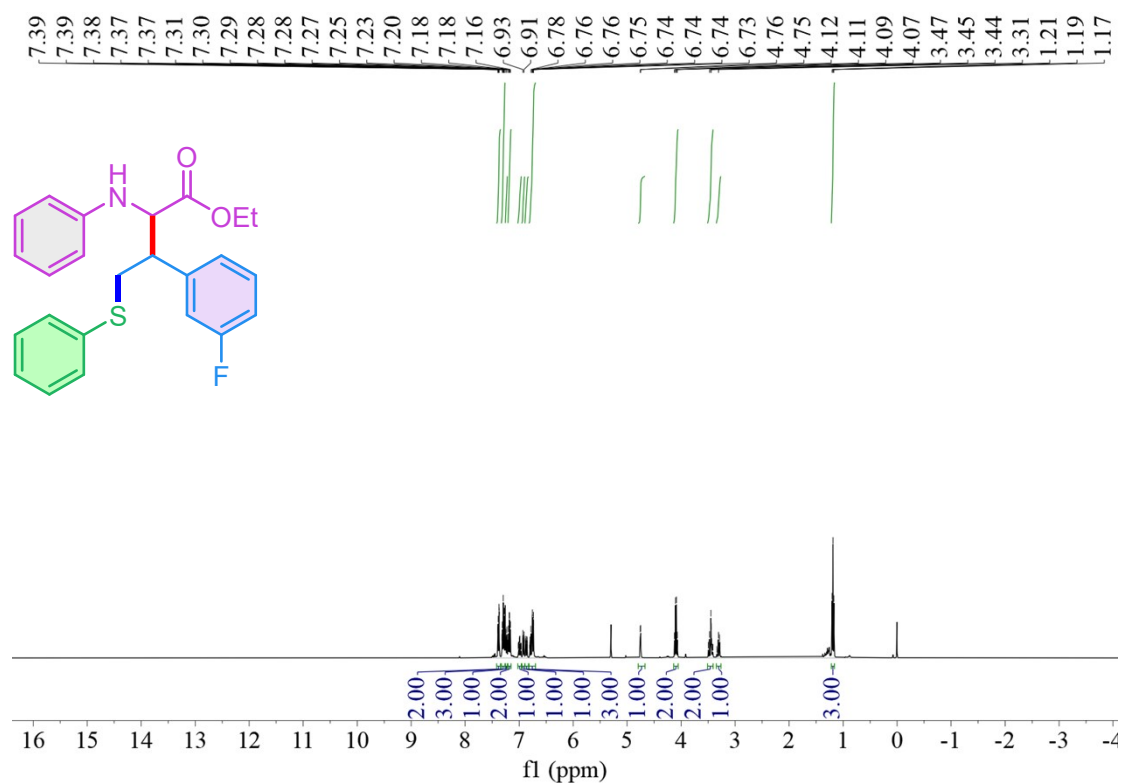
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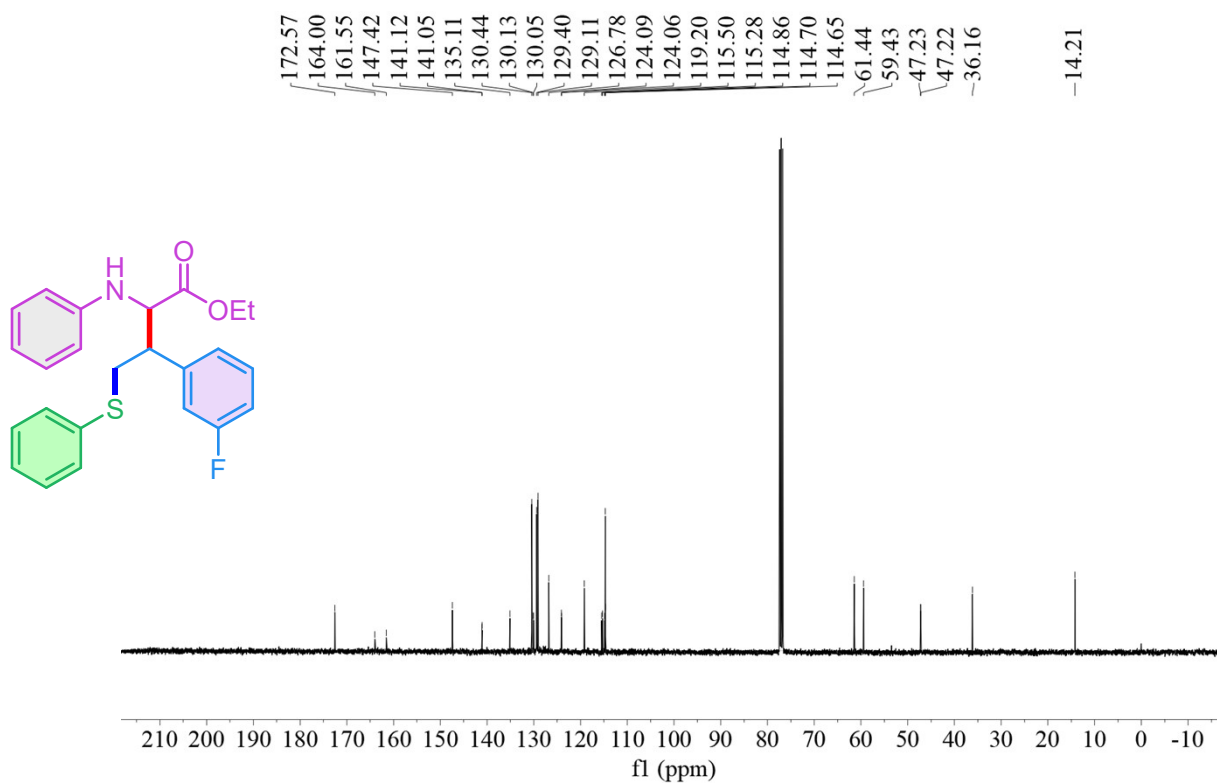
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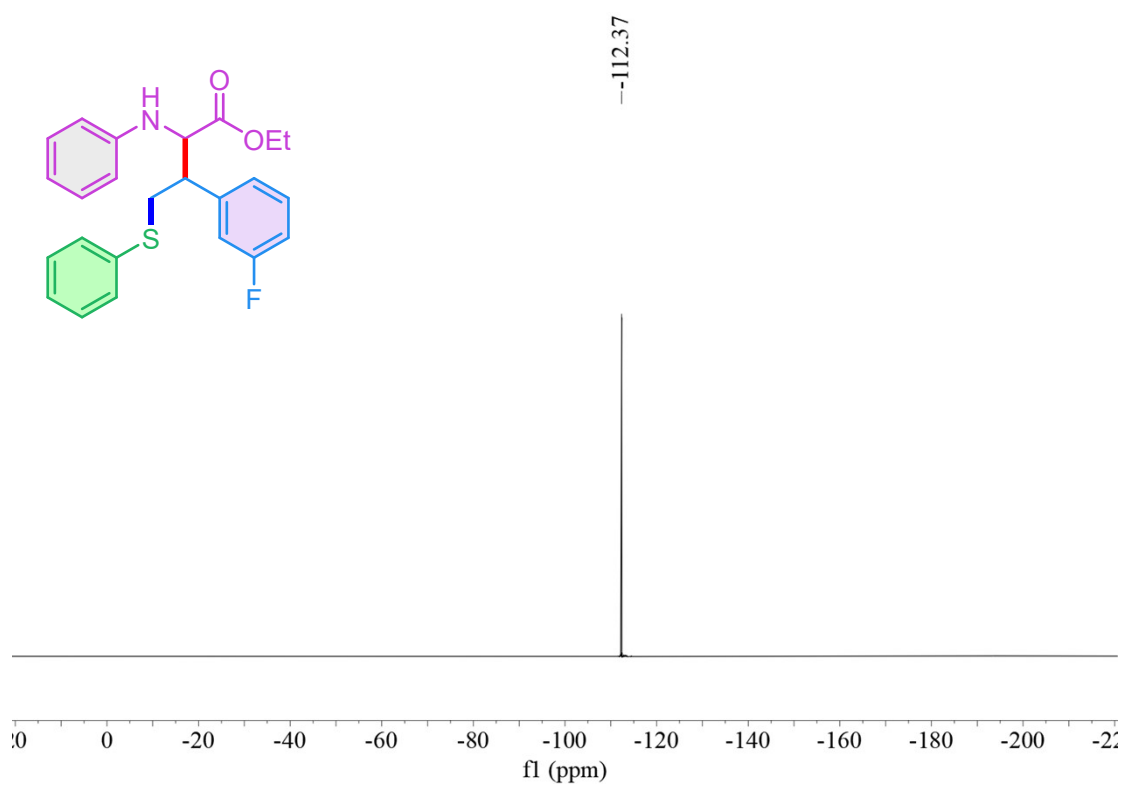
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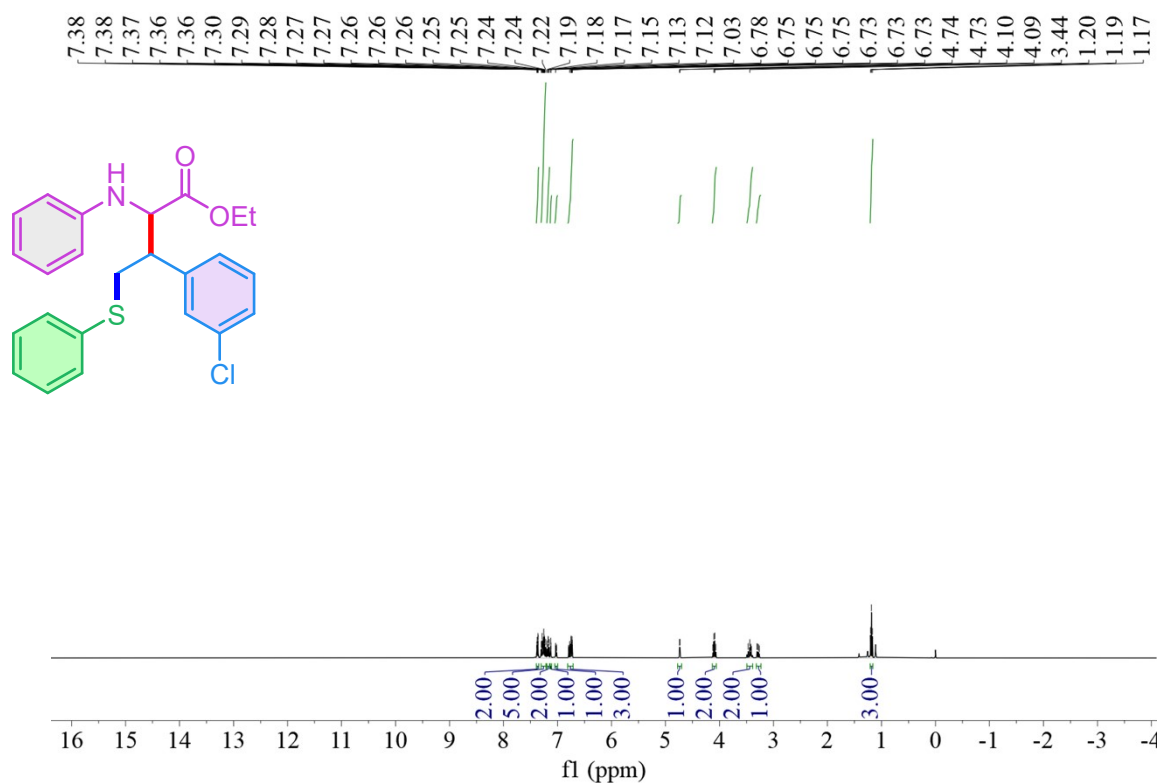
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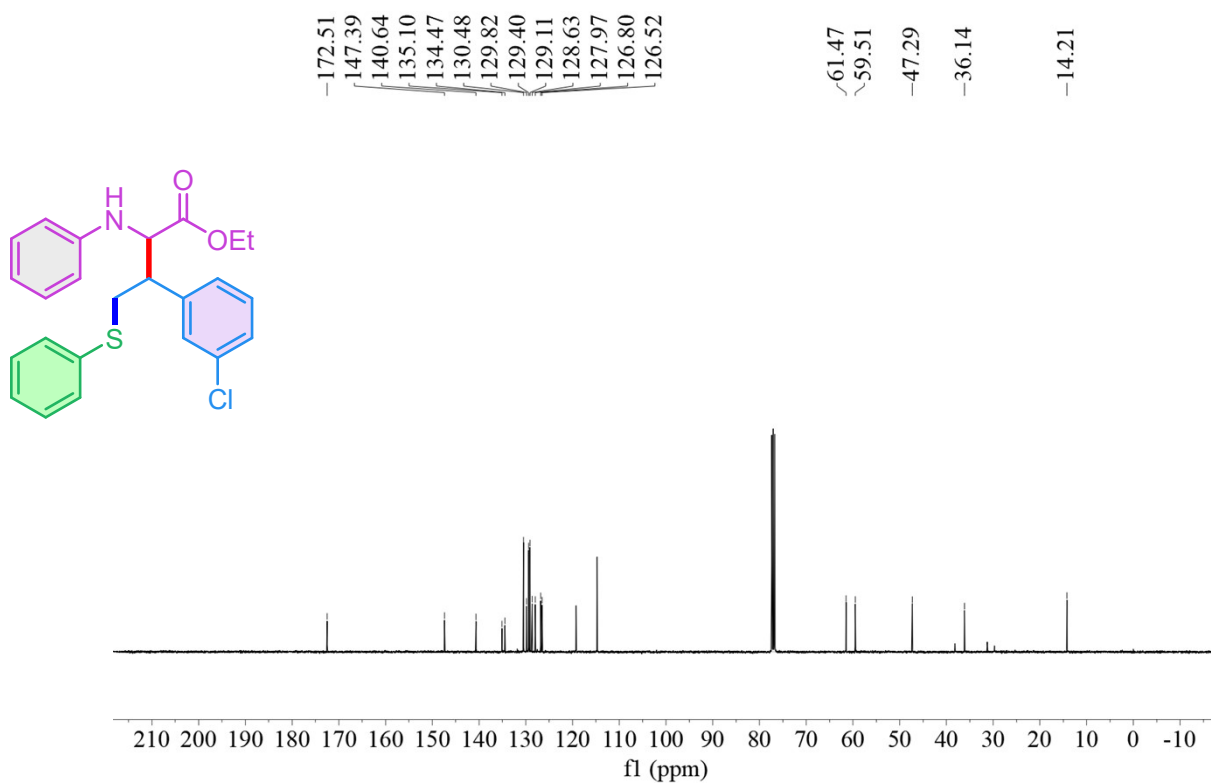
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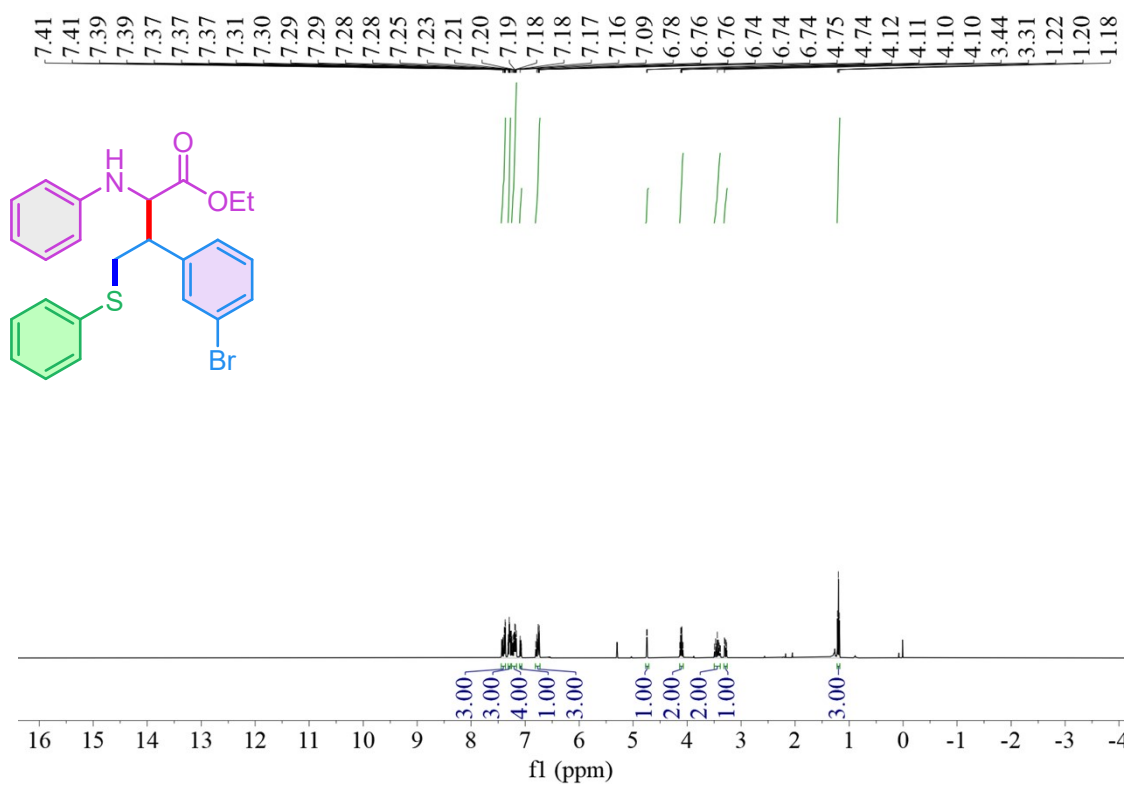
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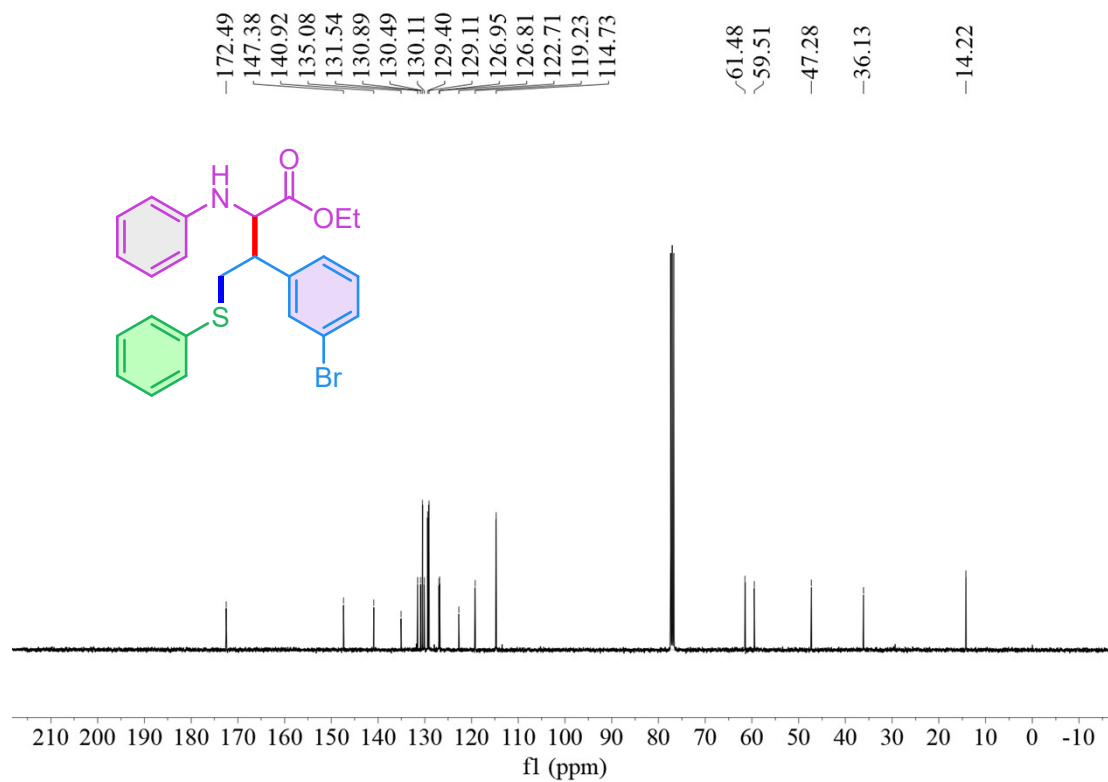
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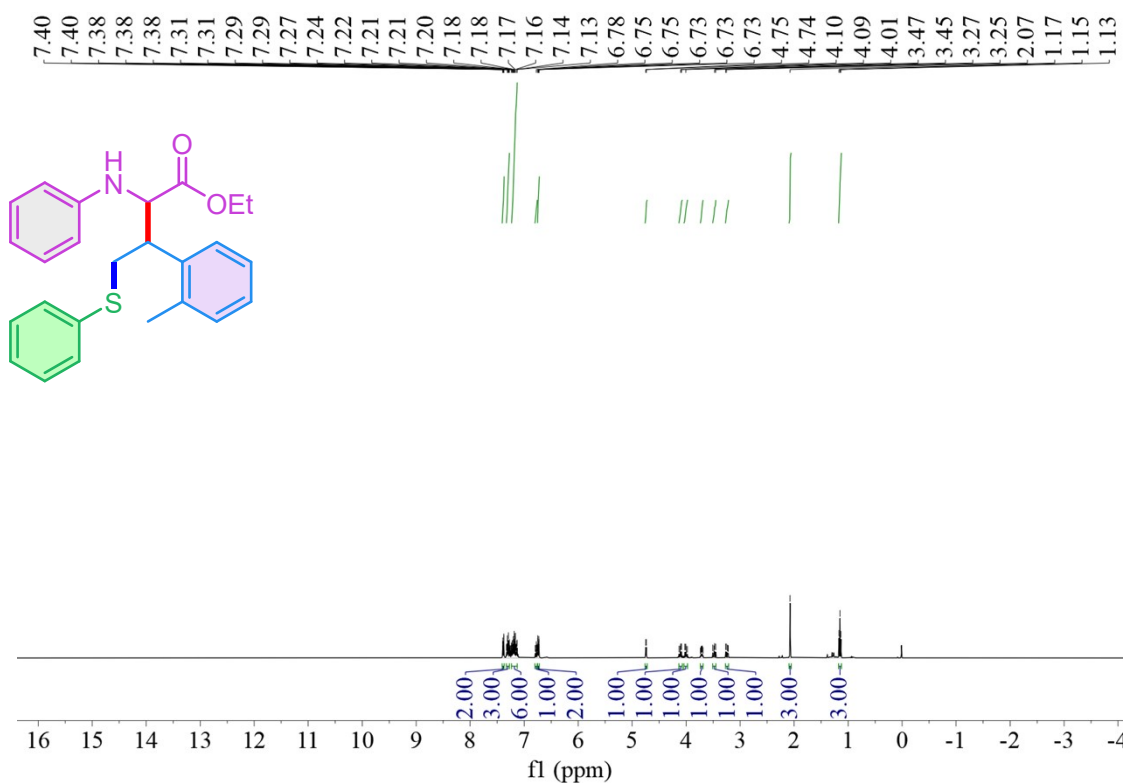
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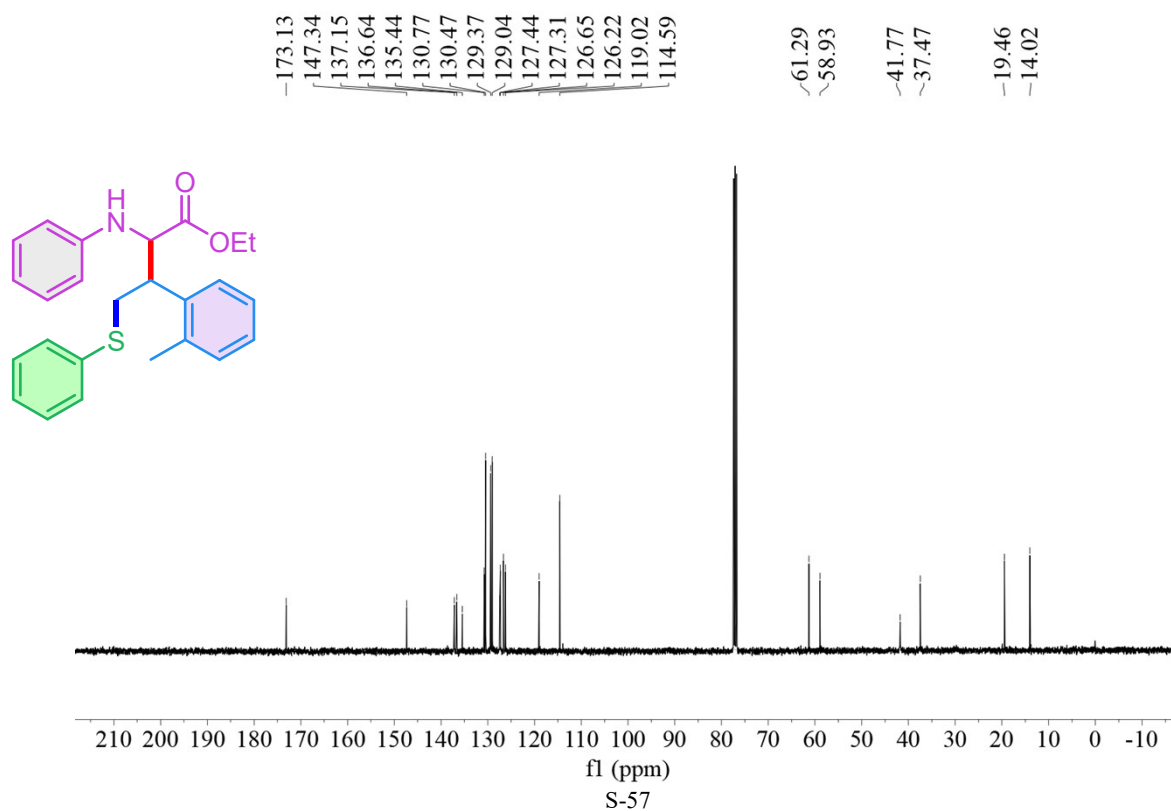
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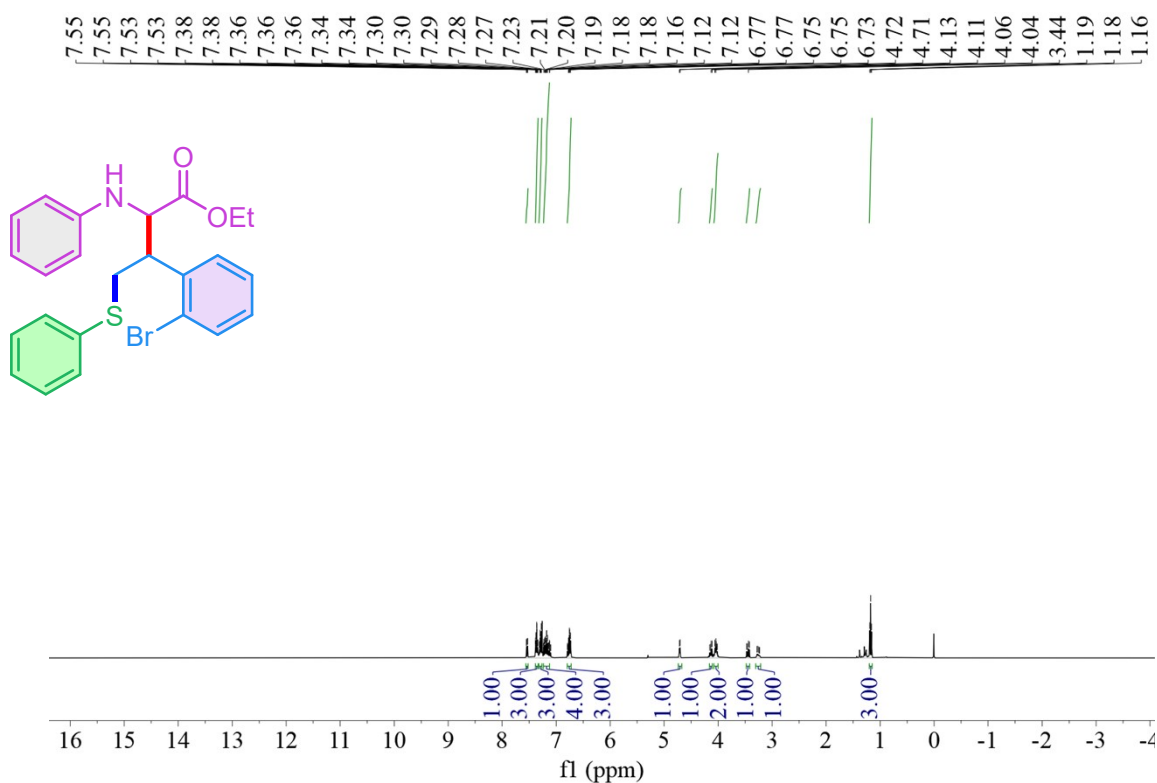
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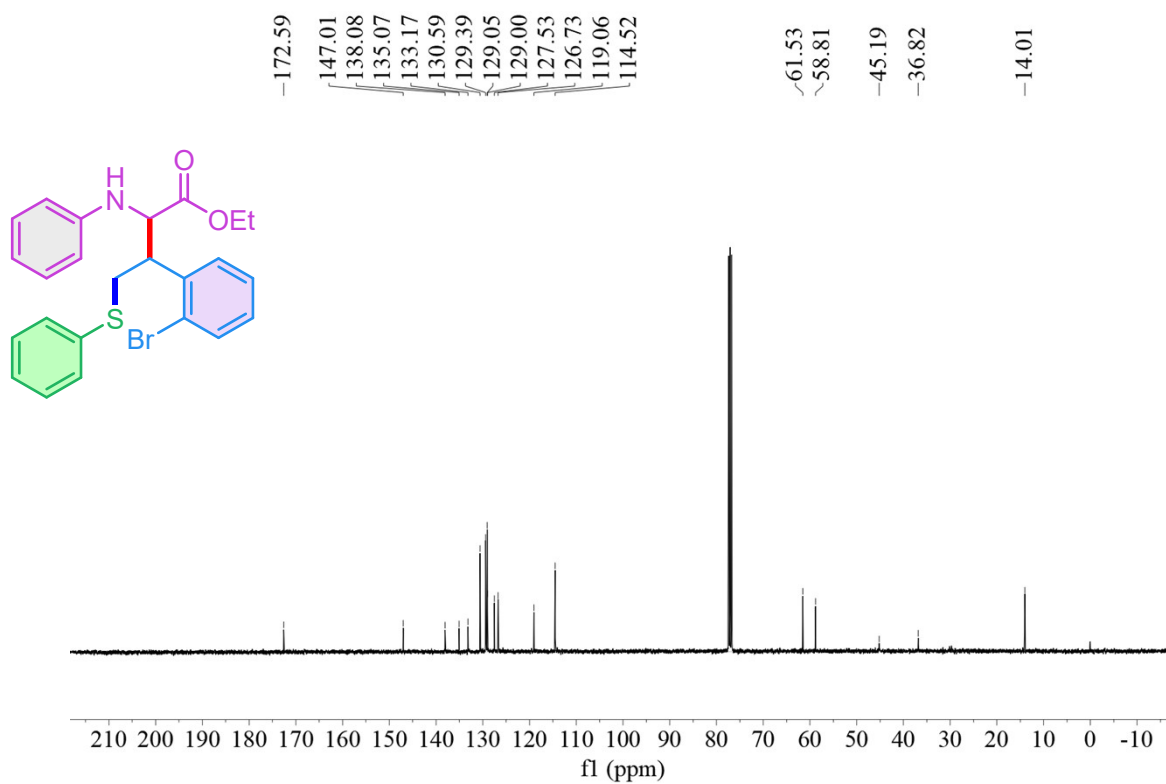
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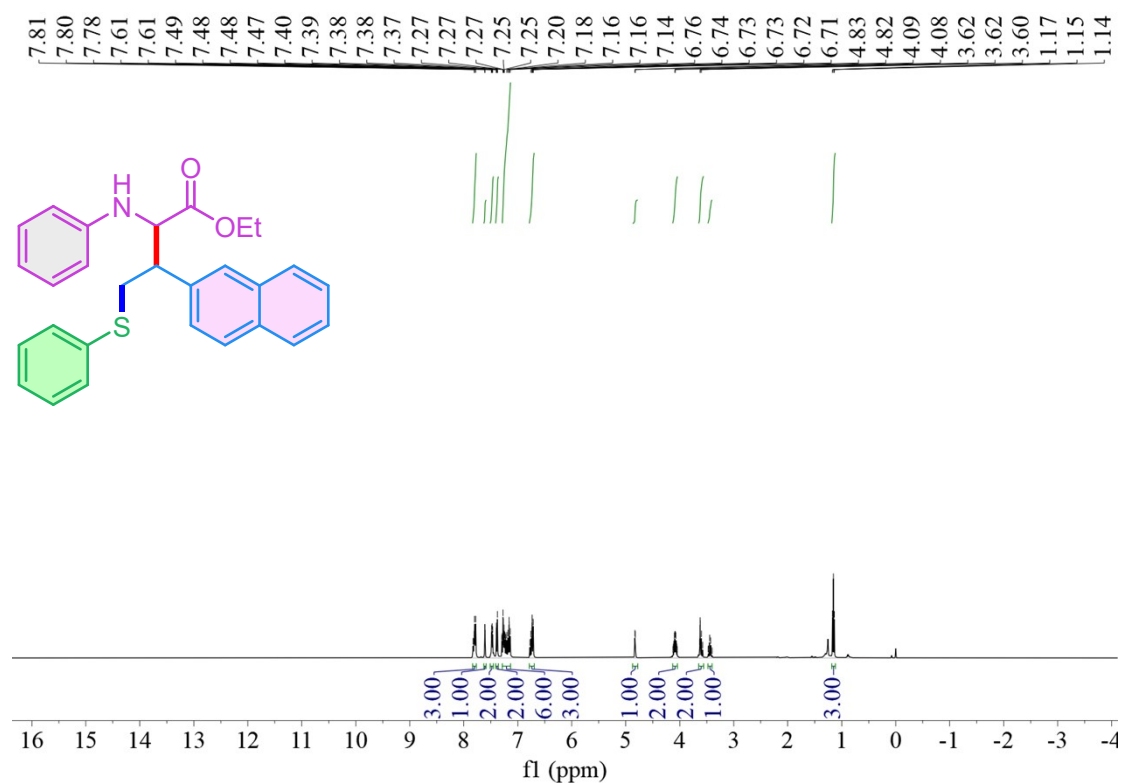
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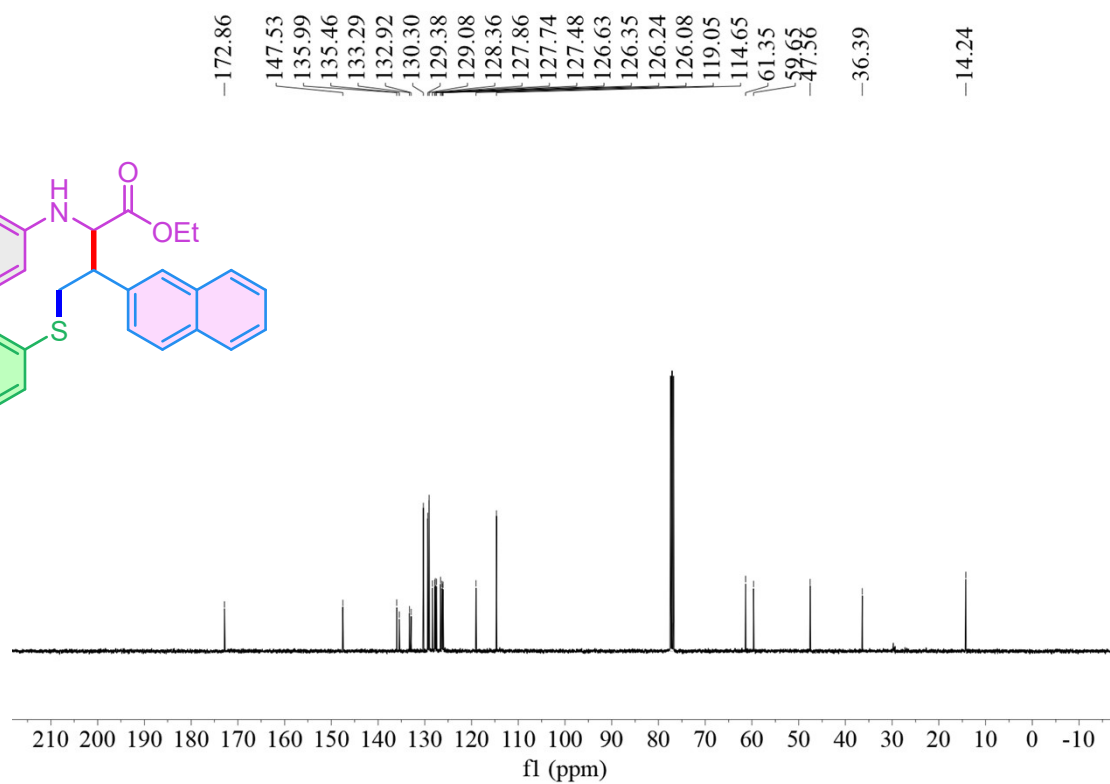
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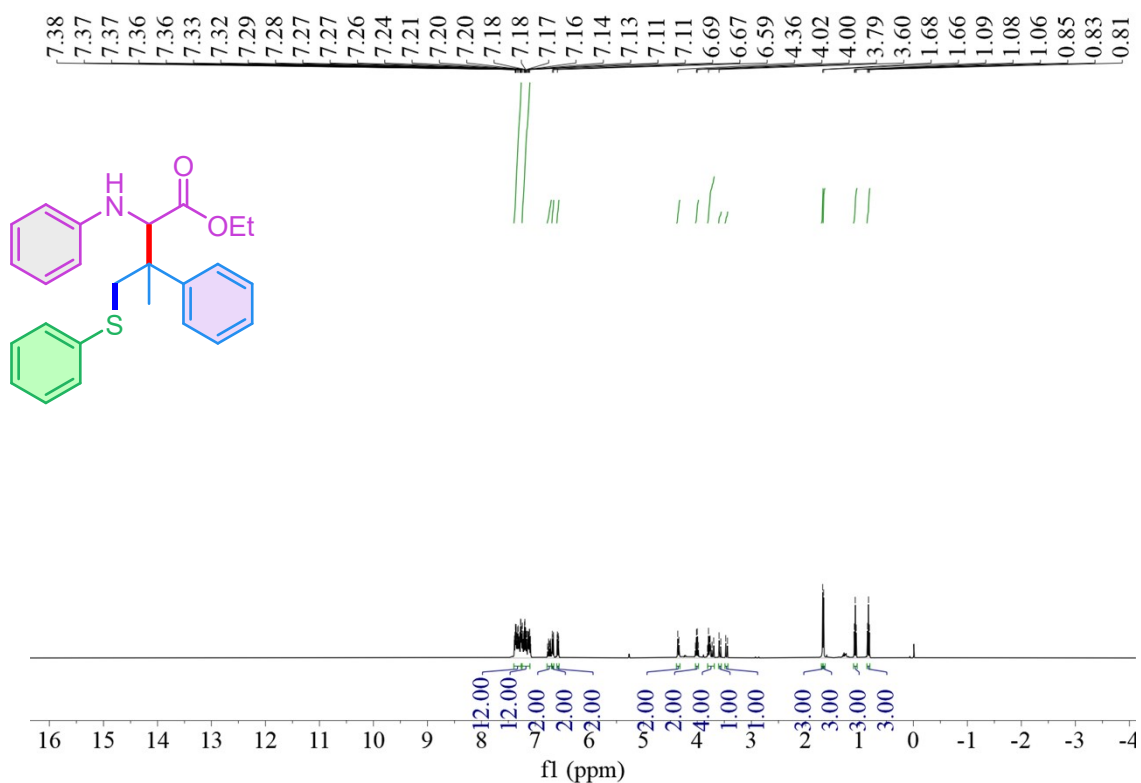
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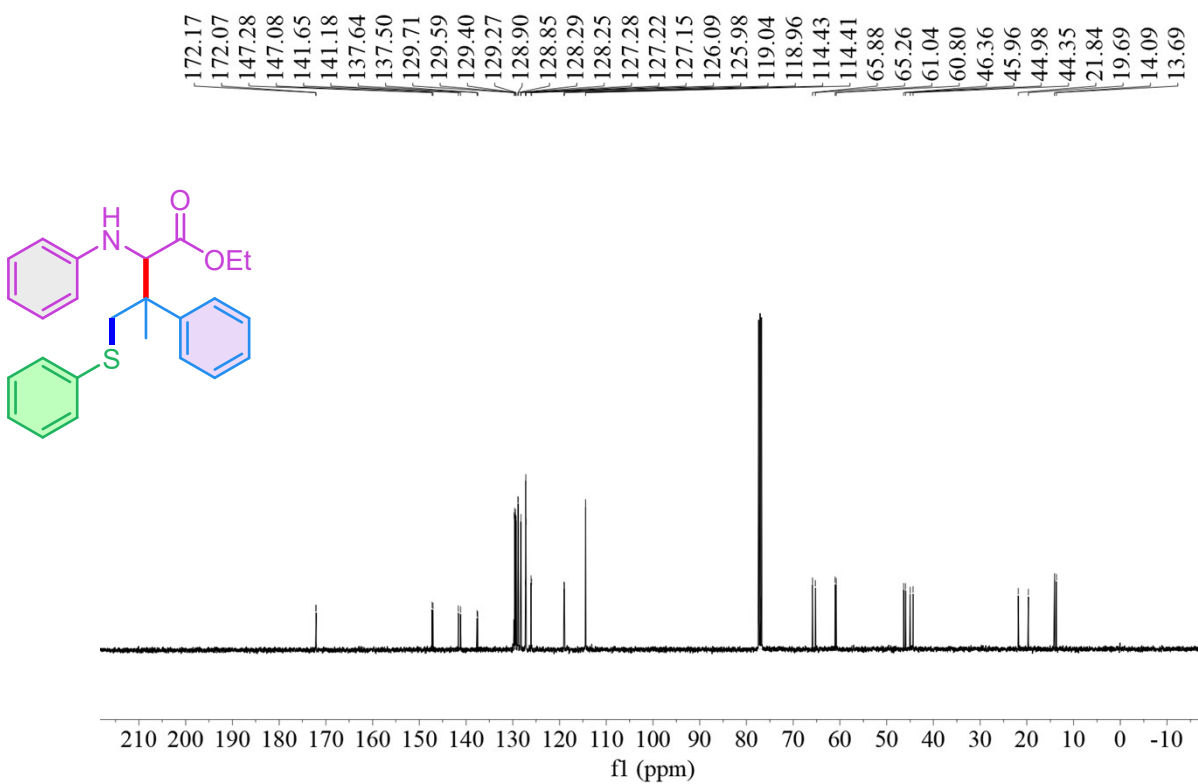
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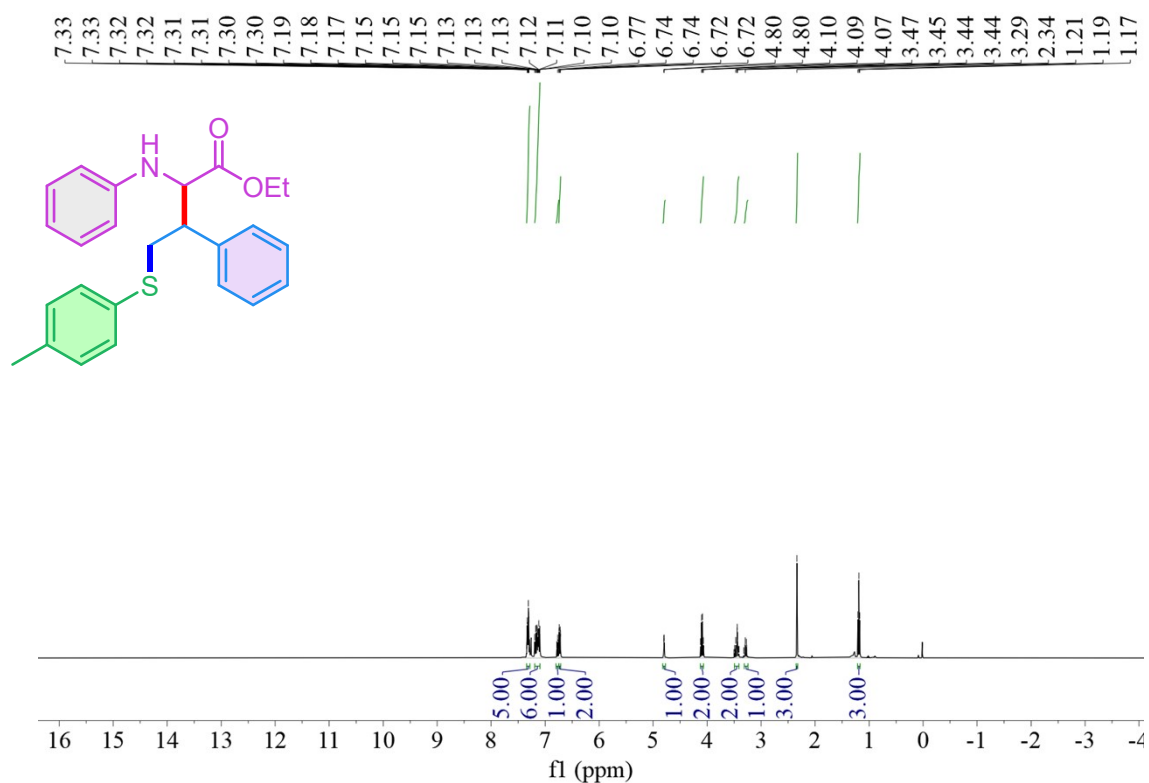
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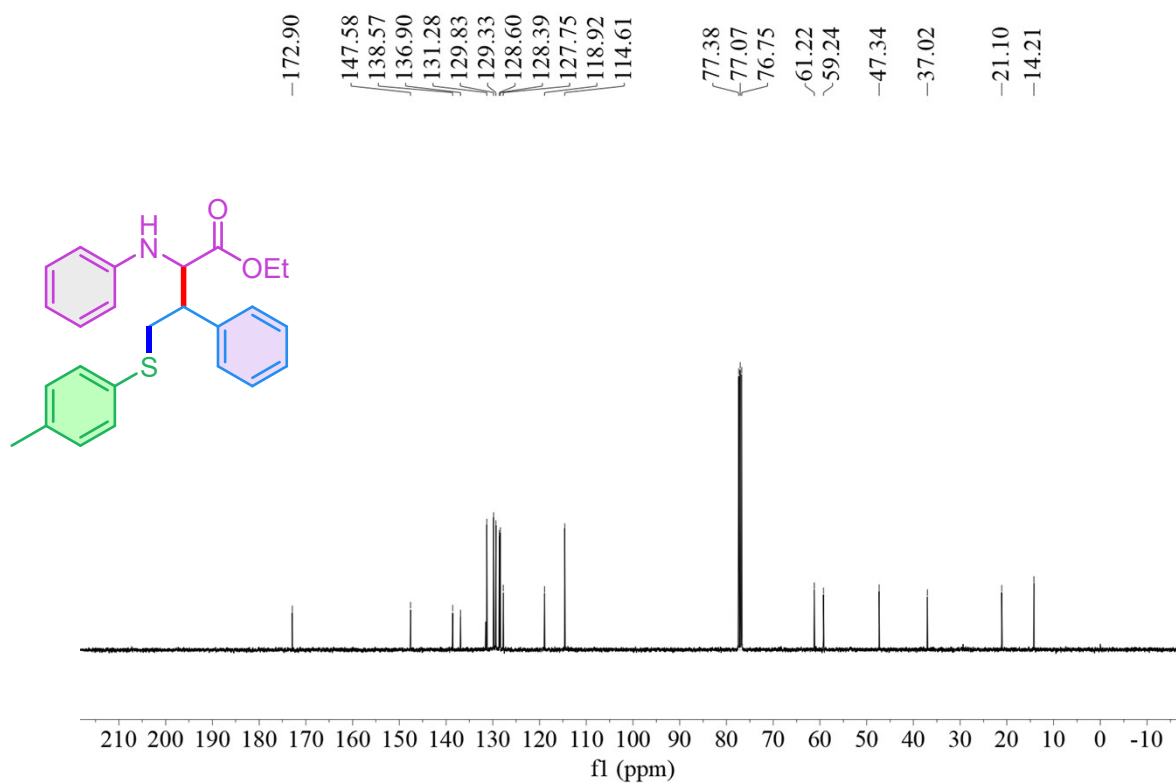
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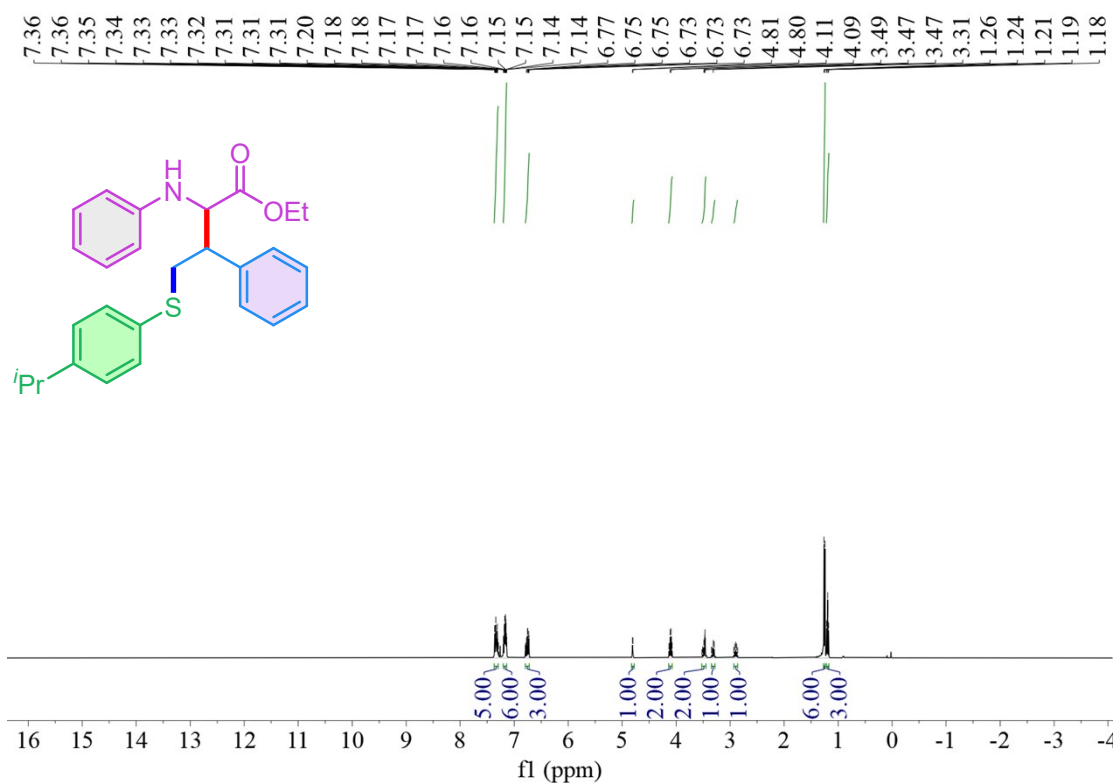
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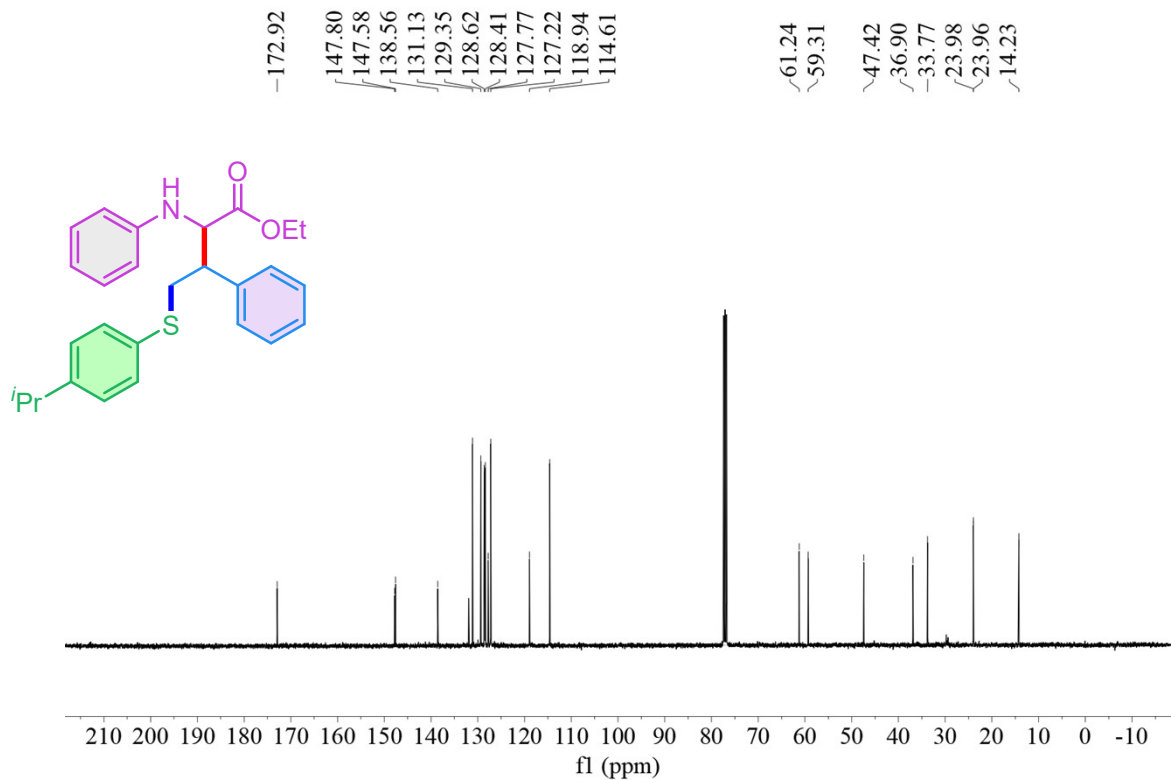
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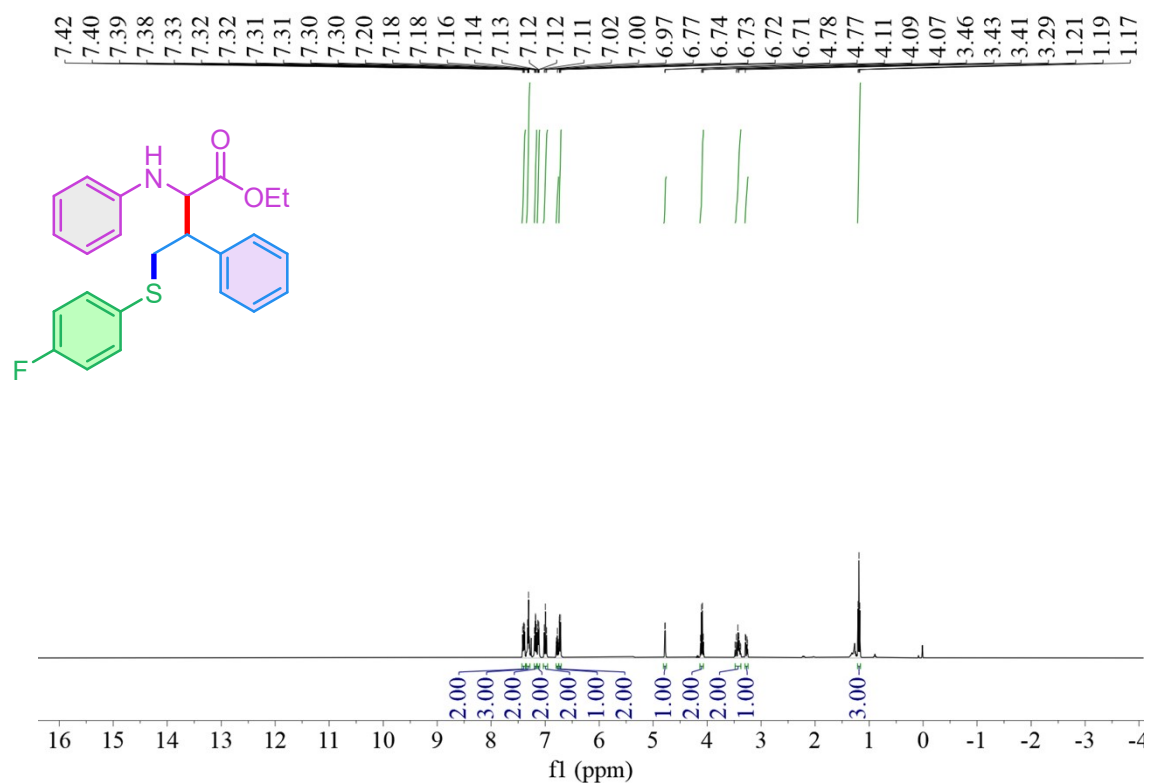
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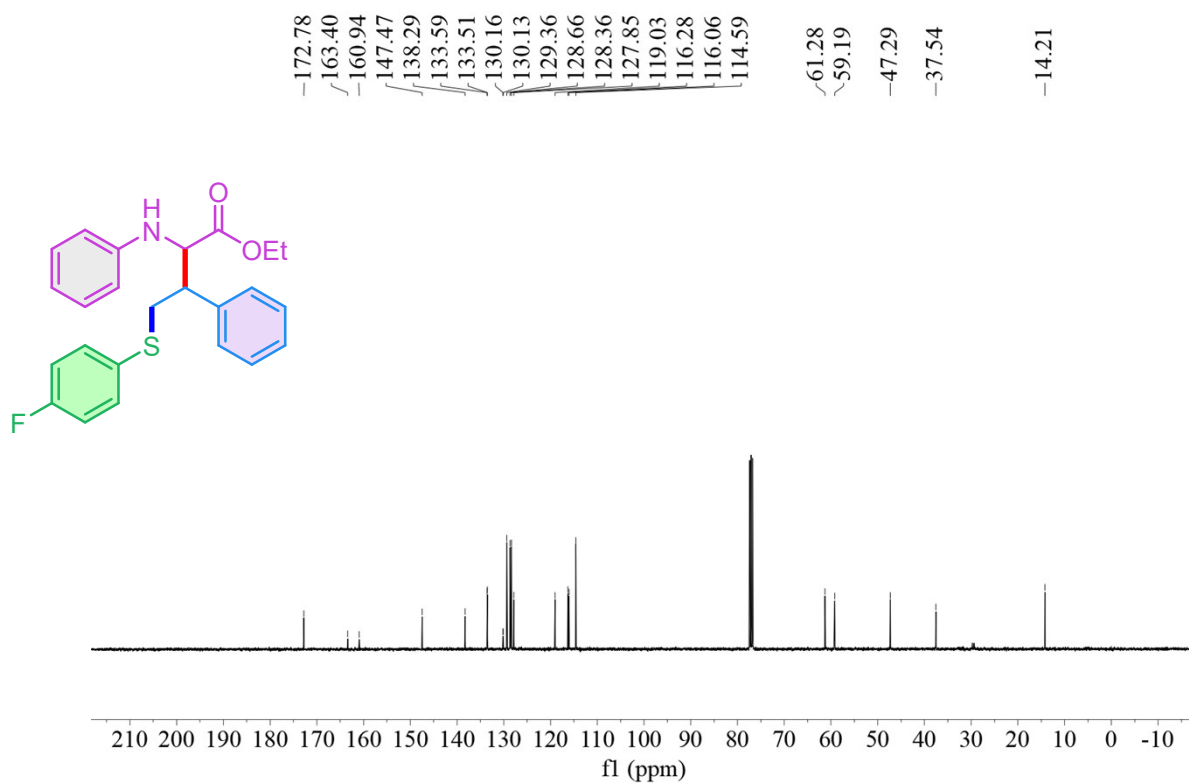
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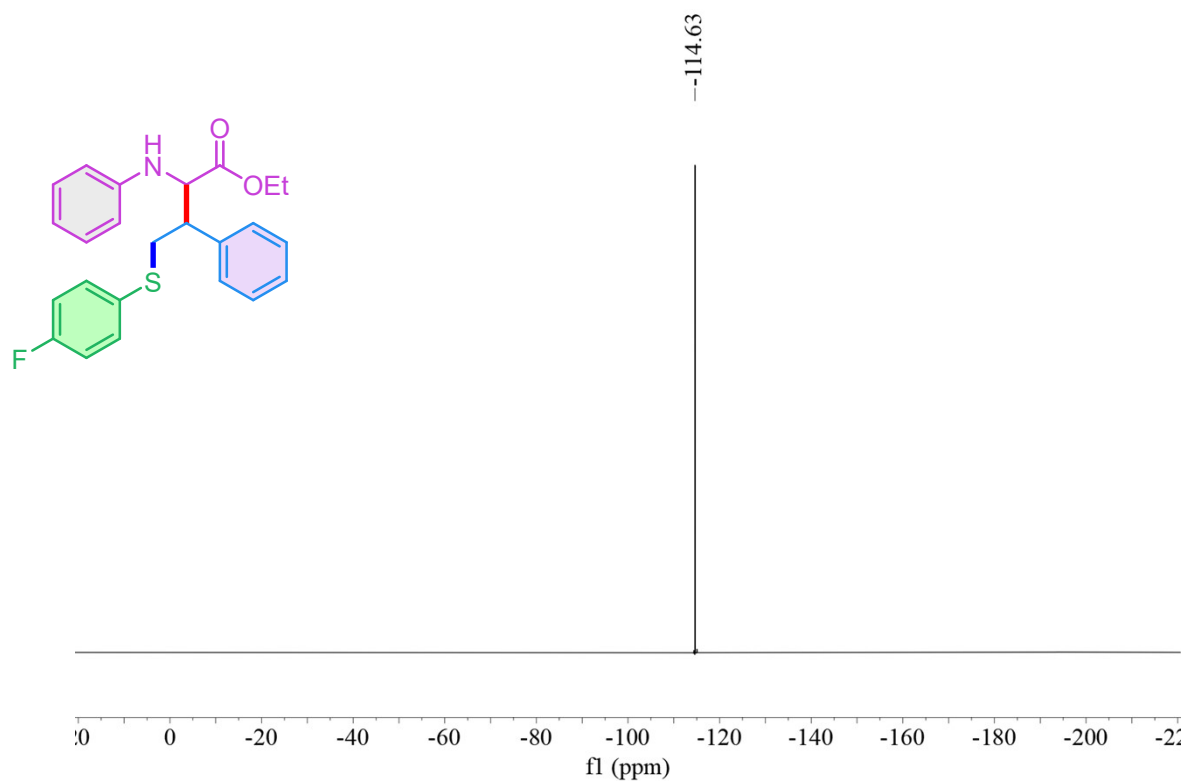
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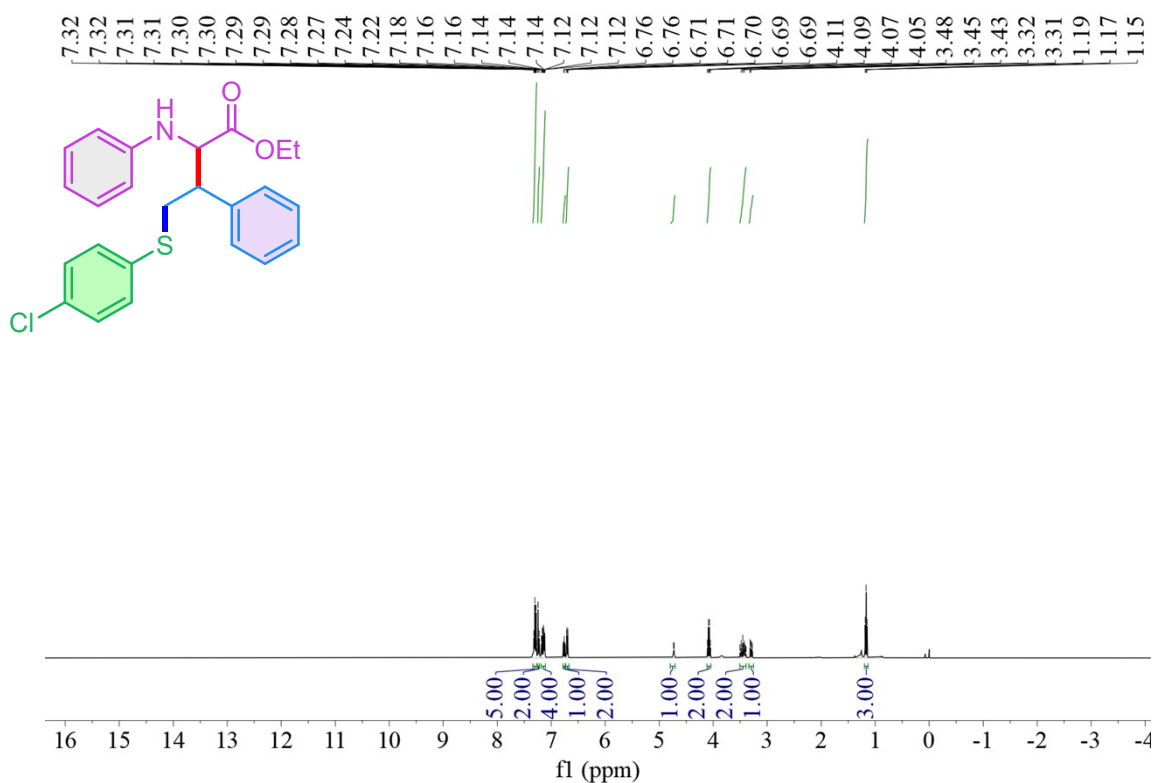
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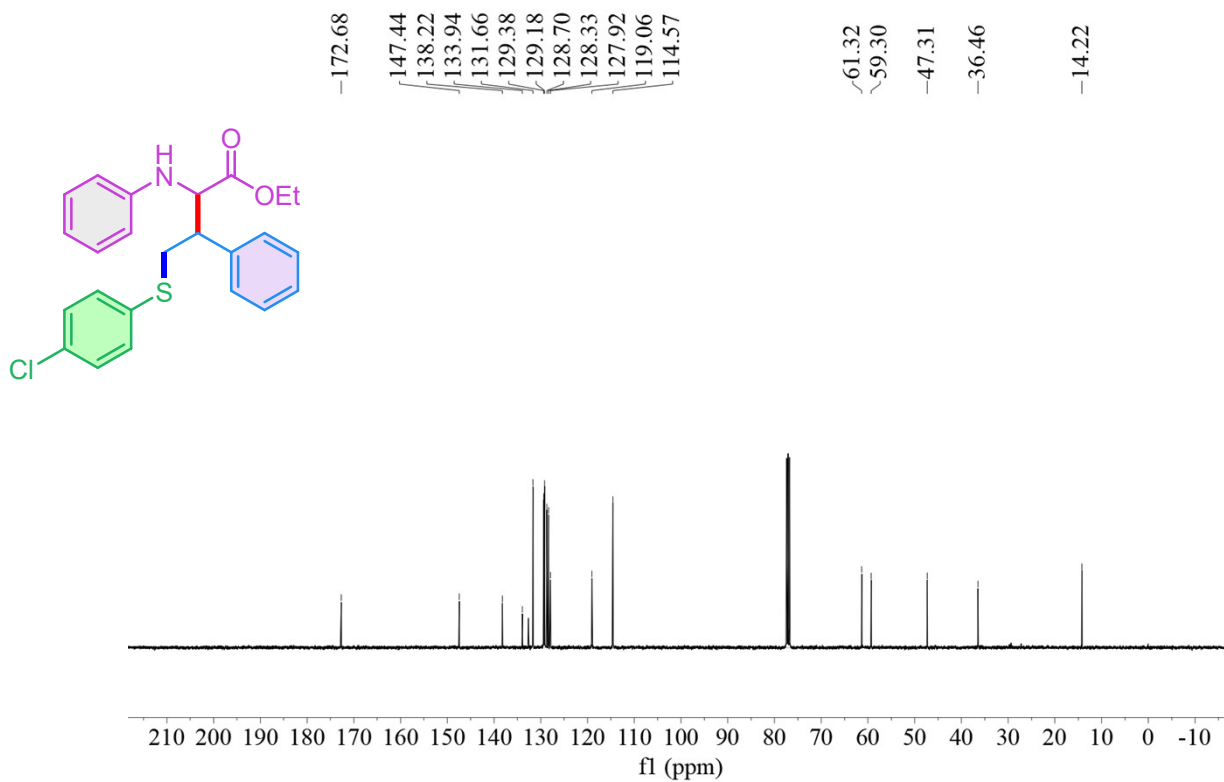
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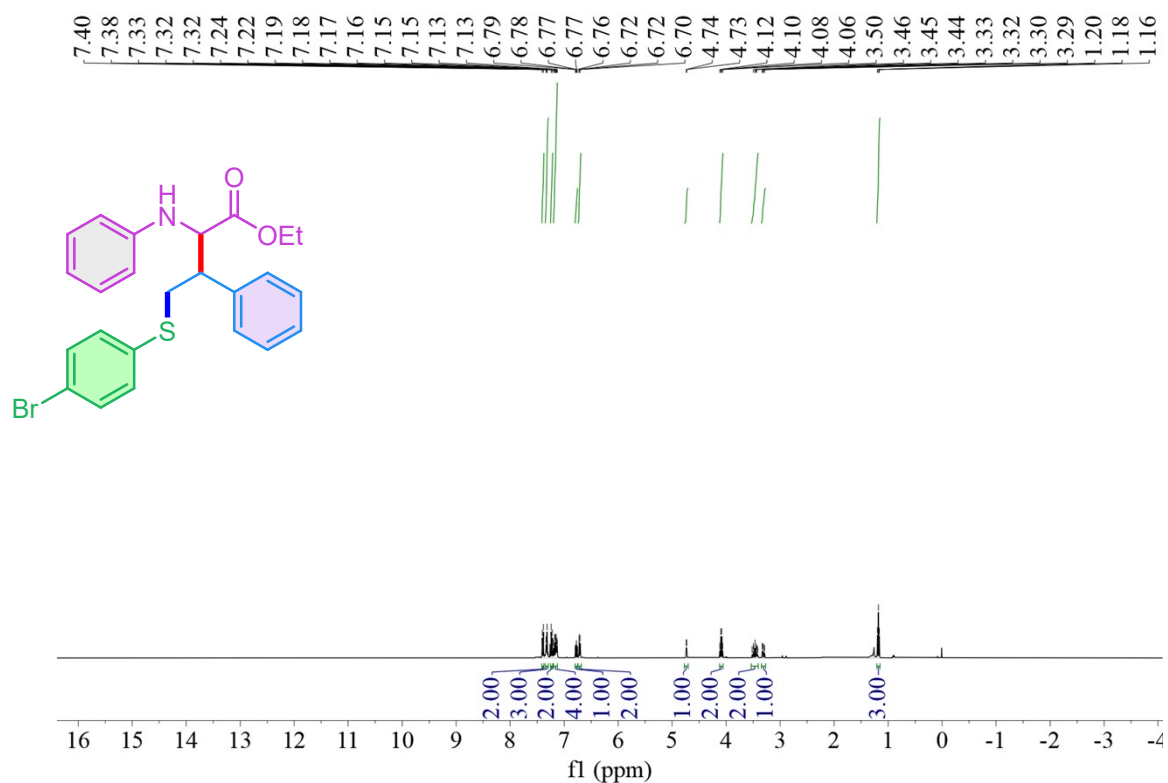
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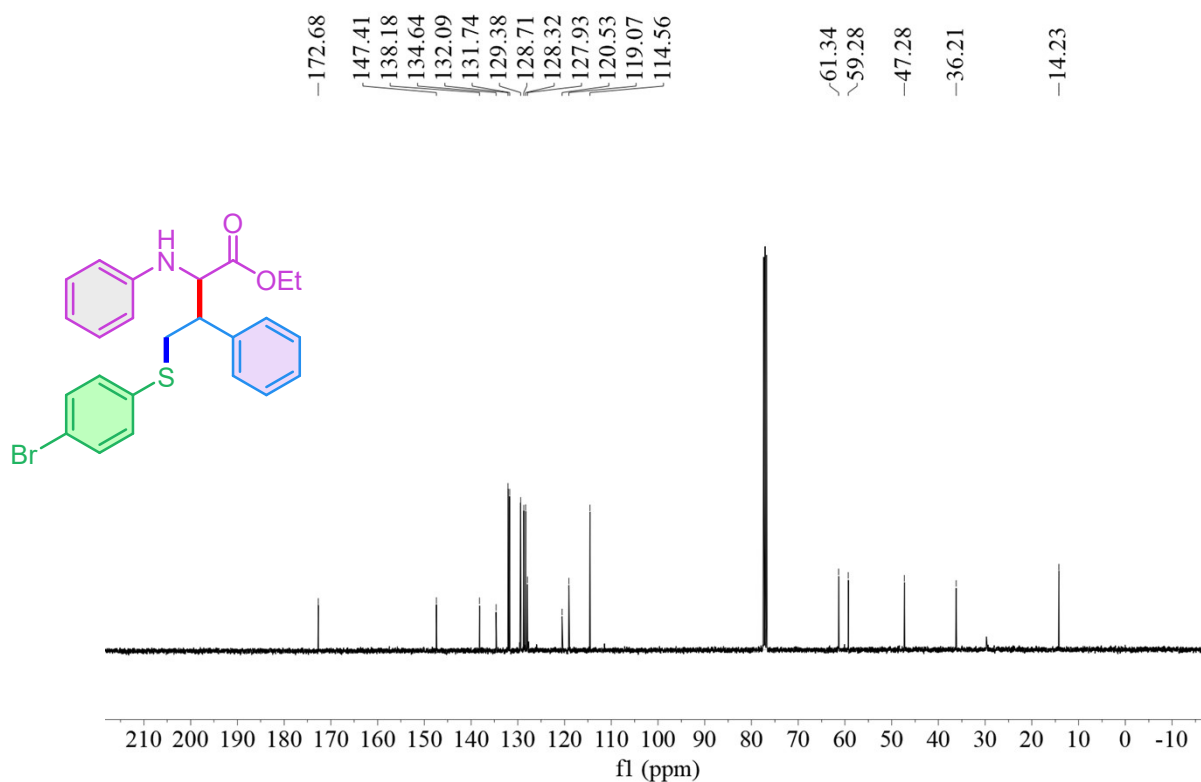
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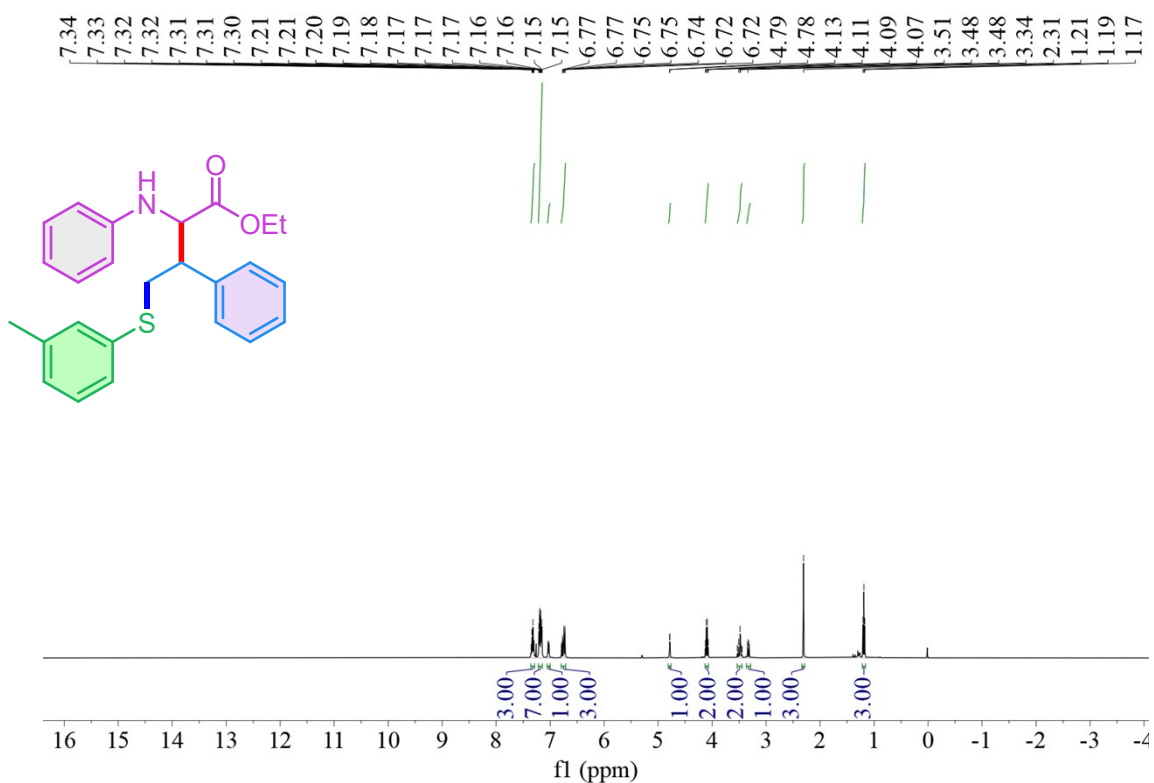
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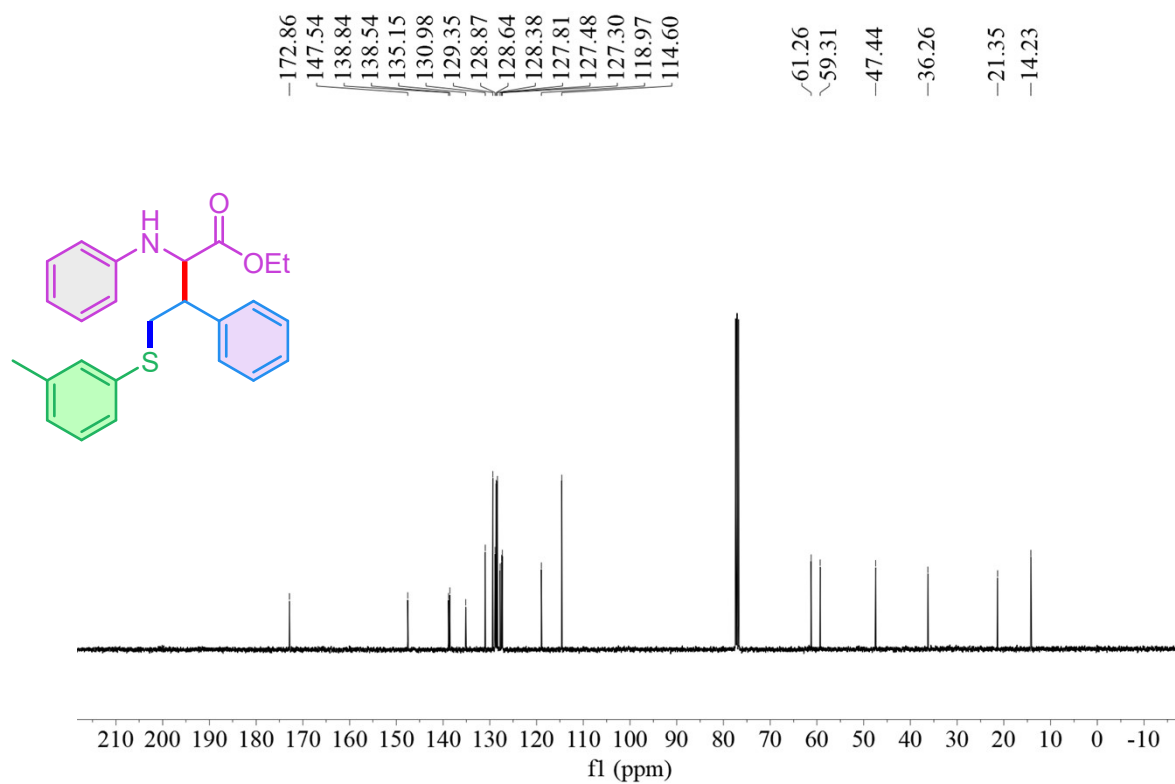
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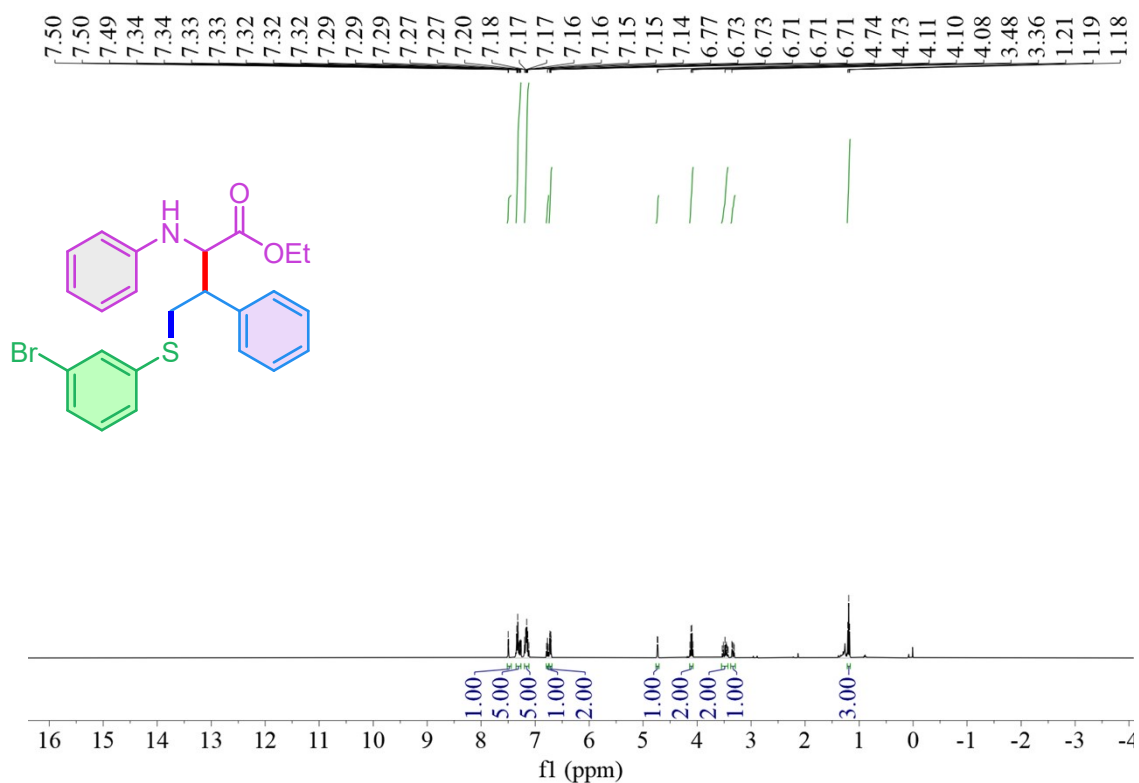
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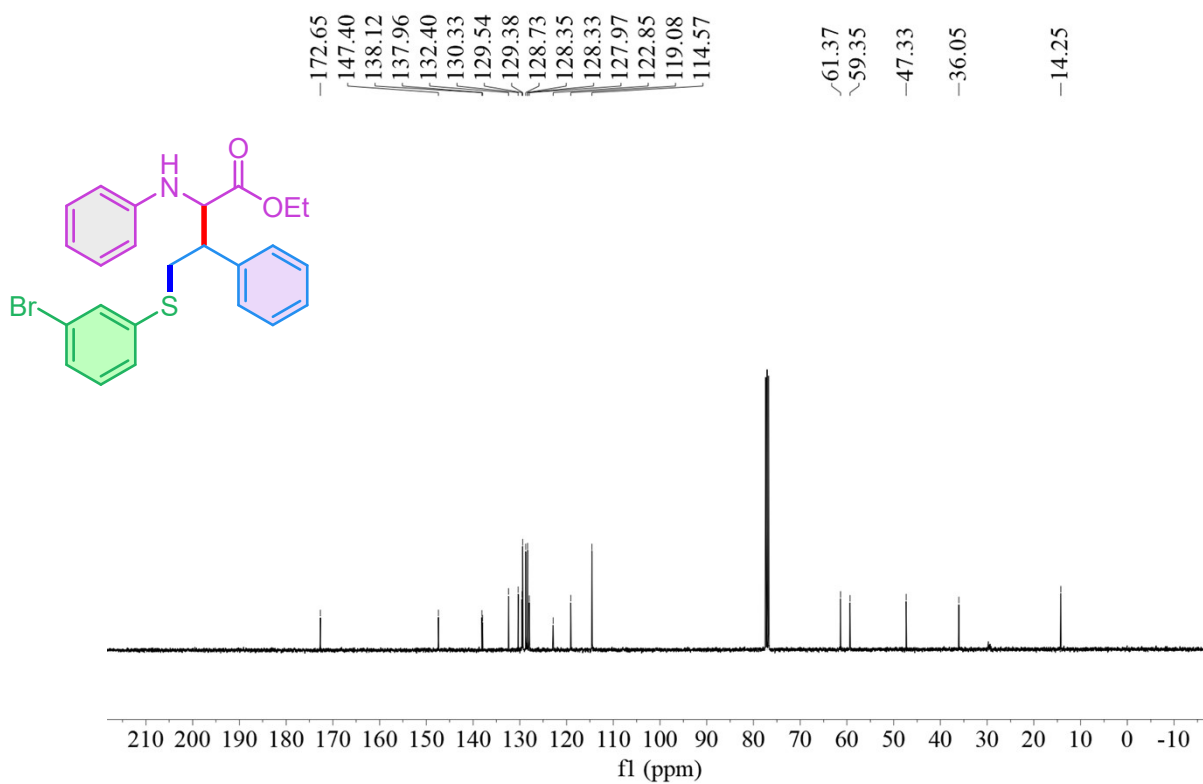
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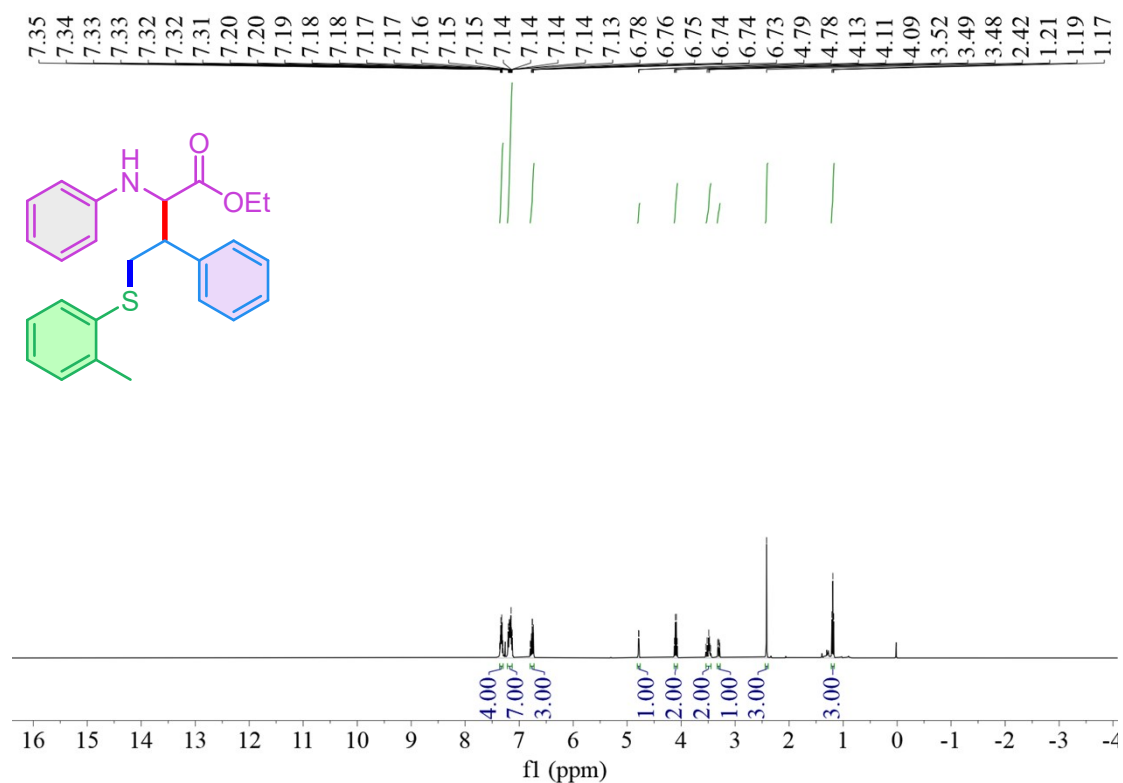
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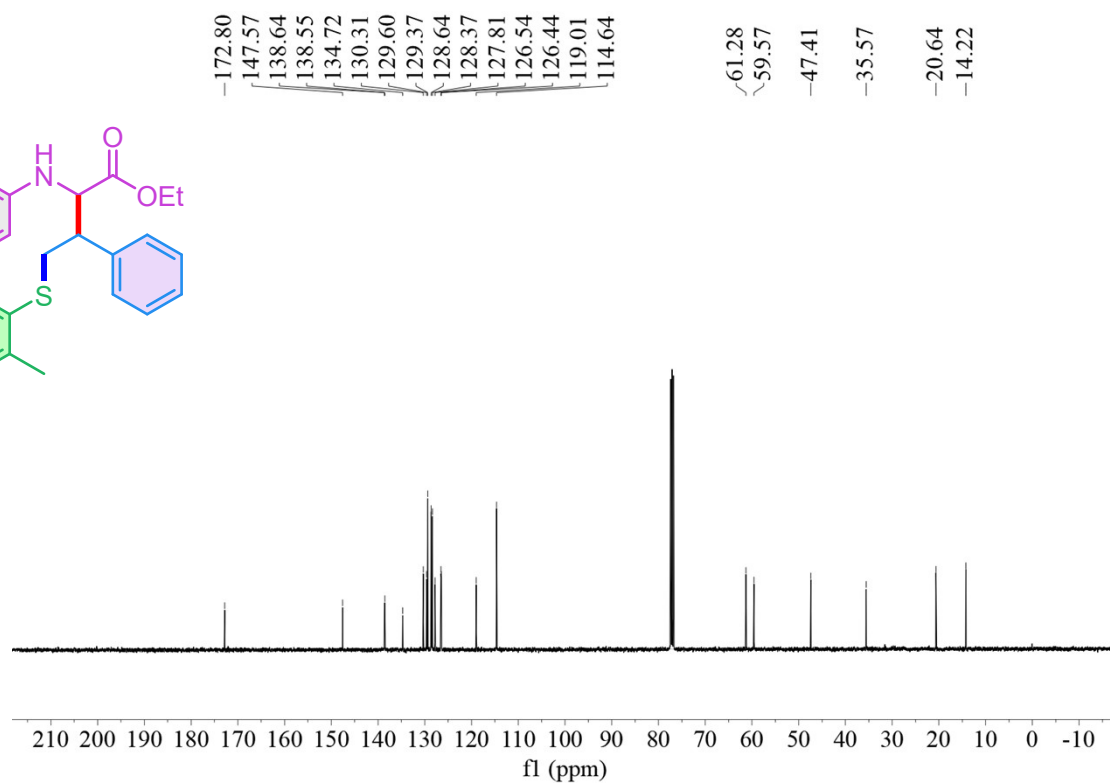
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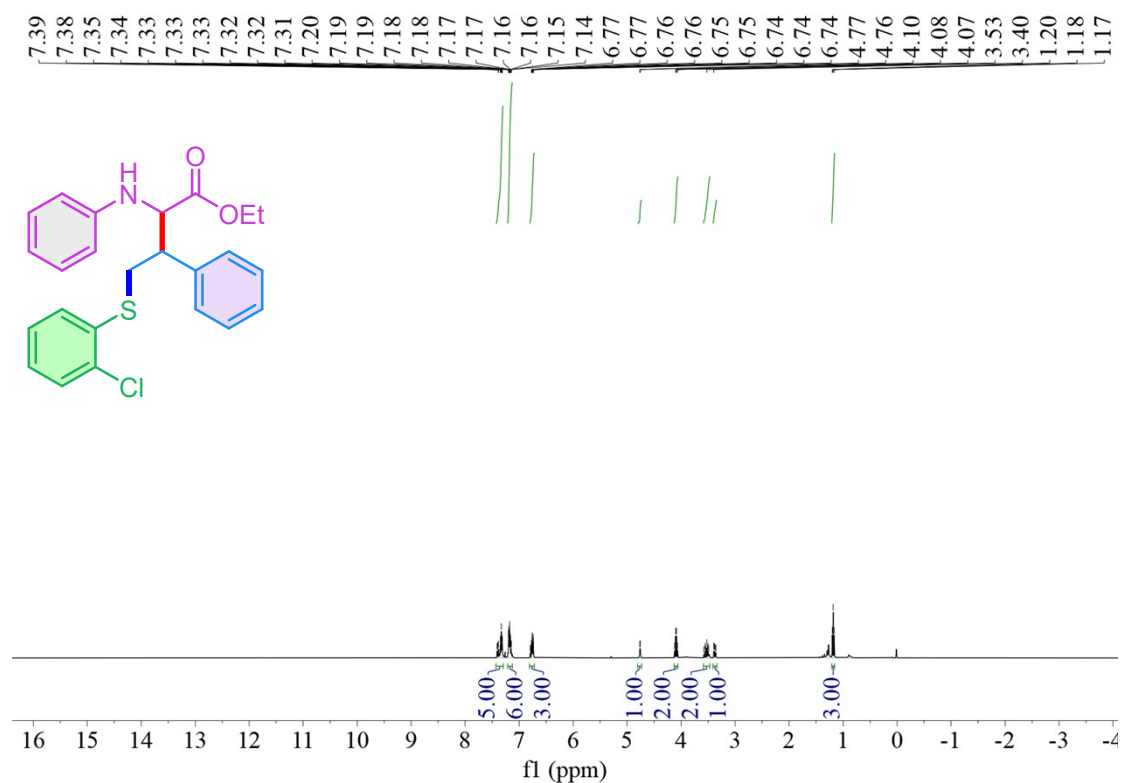
38 ¹H NMR (400 MHz, Chloroform-*d*)



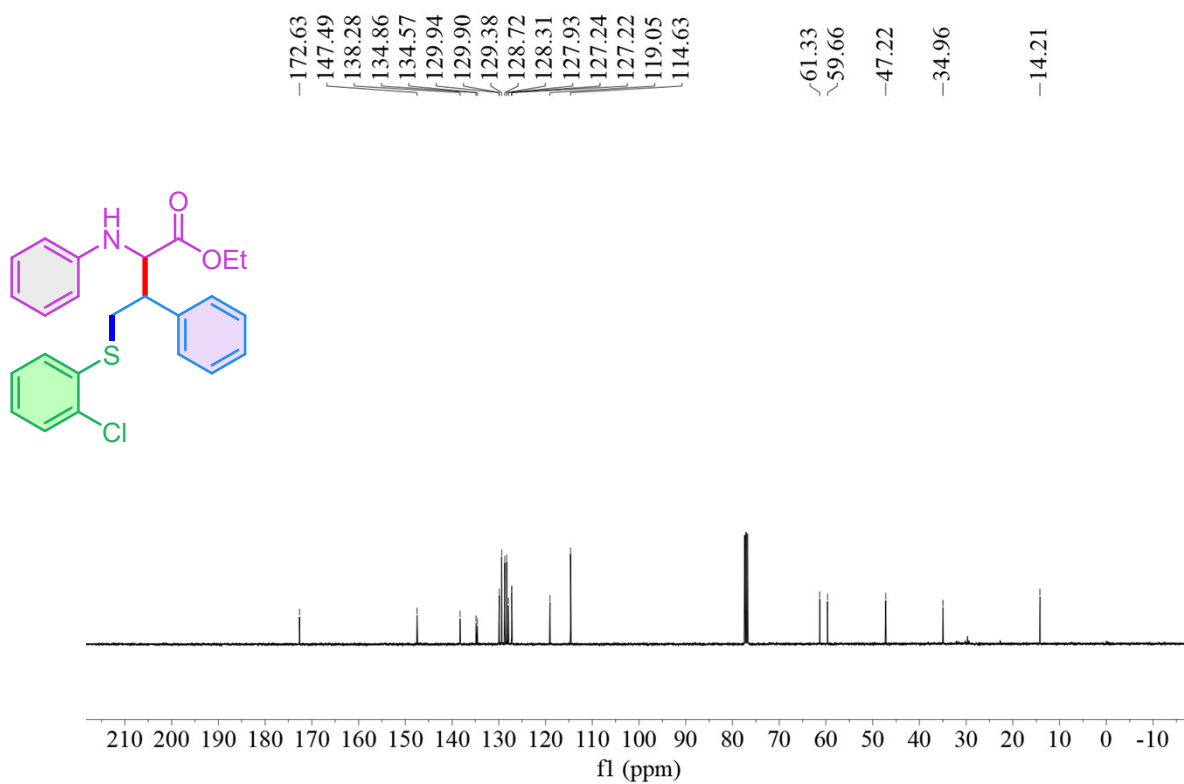
38 ¹³C NMR (101 MHz, Chloroform-*d*)



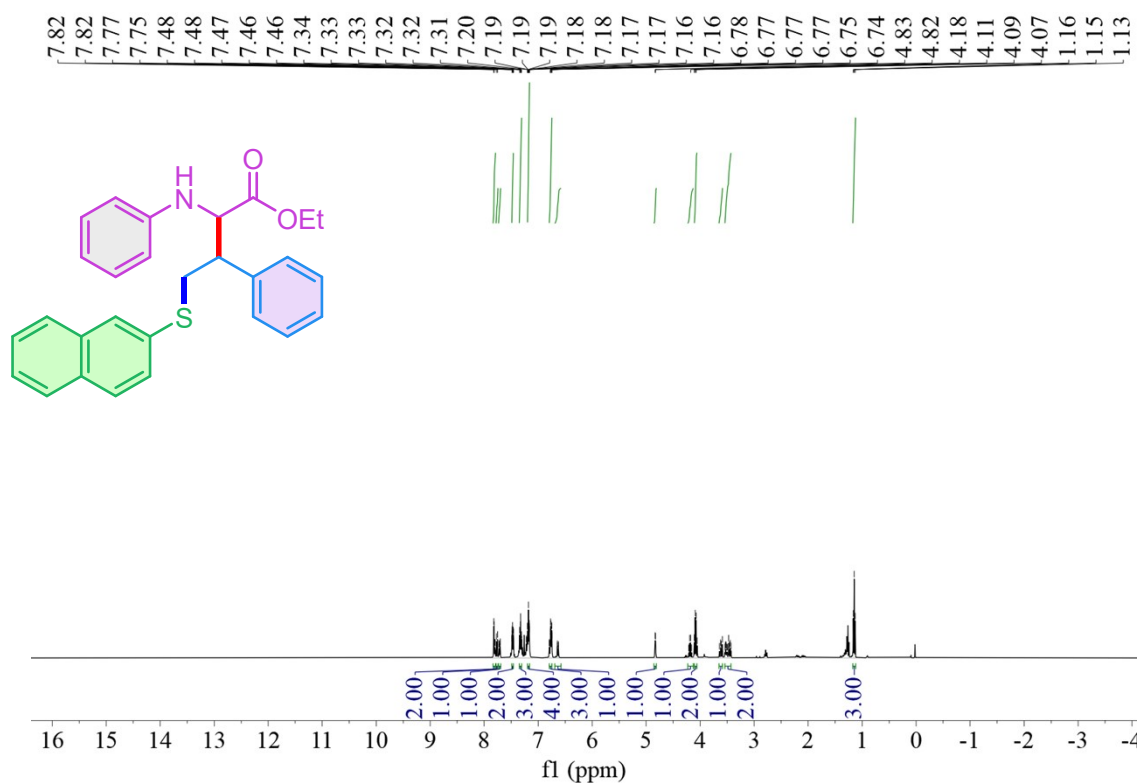
39 ¹H NMR (400 MHz, Chloroform-*d*)



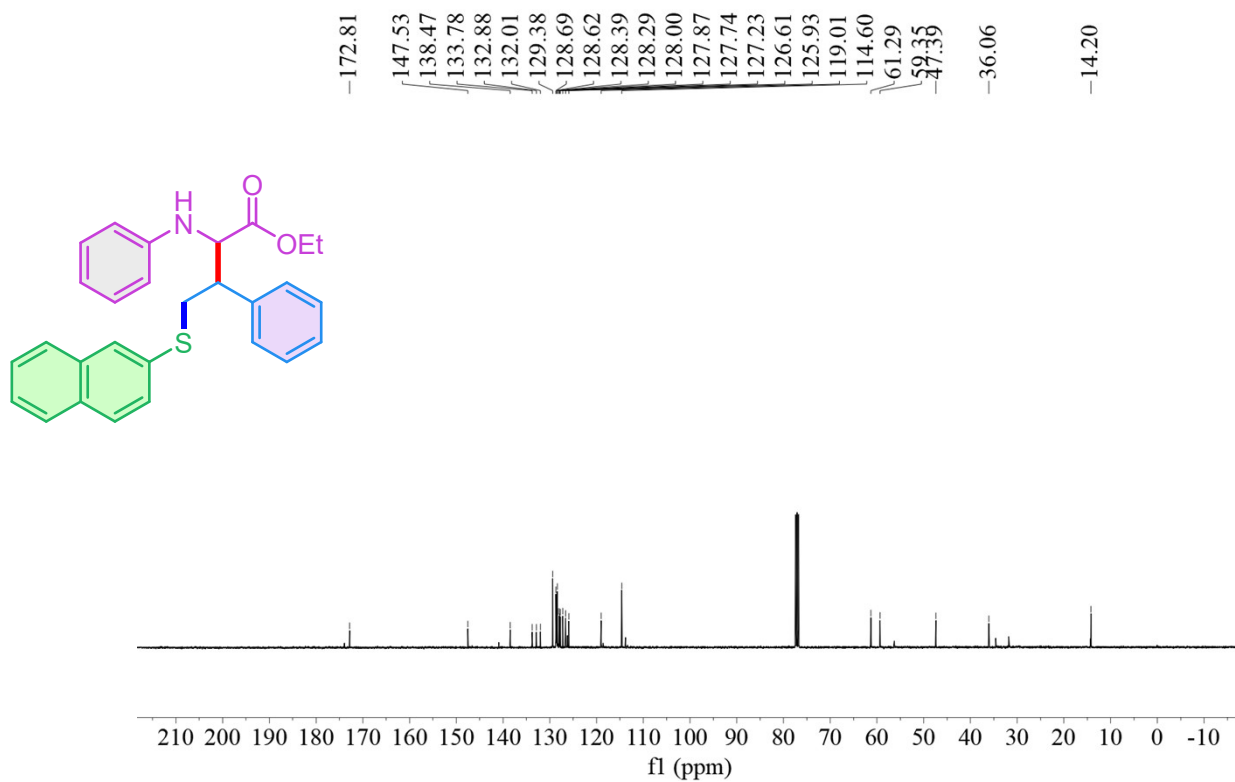
39 ¹³C NMR (101 MHz, Chloroform-*d*)



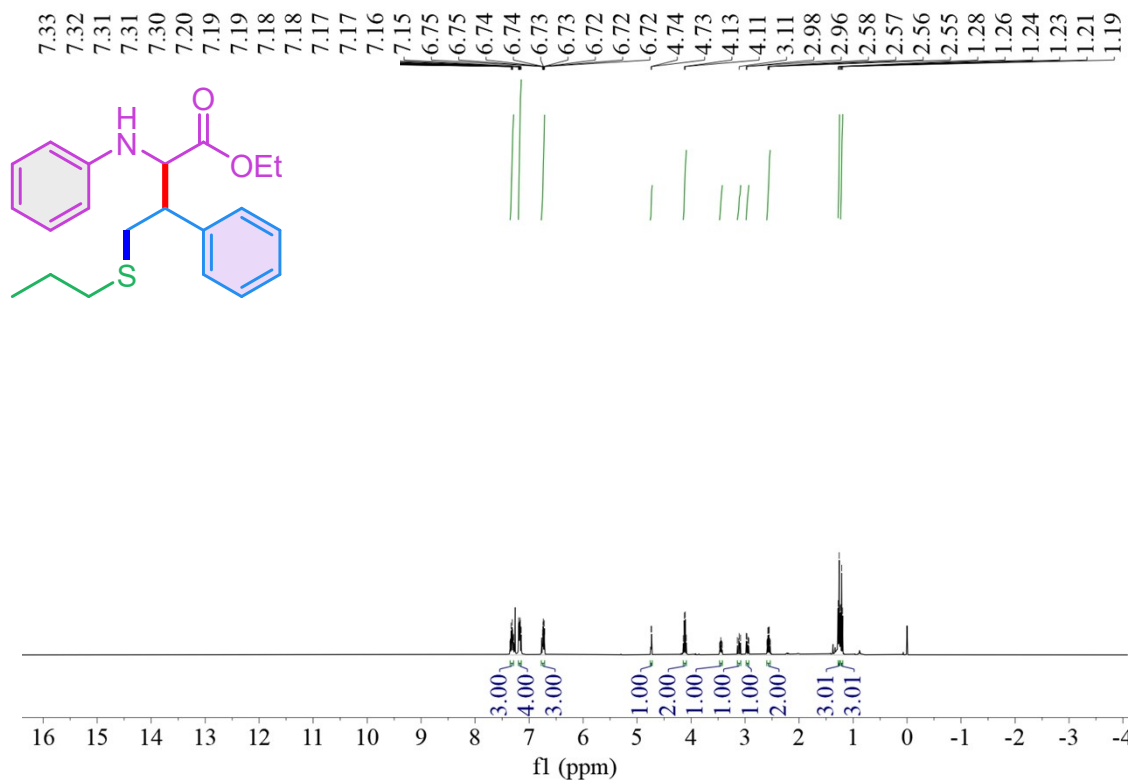
40 ^1H NMR (400 MHz, Chloroform-*d*)



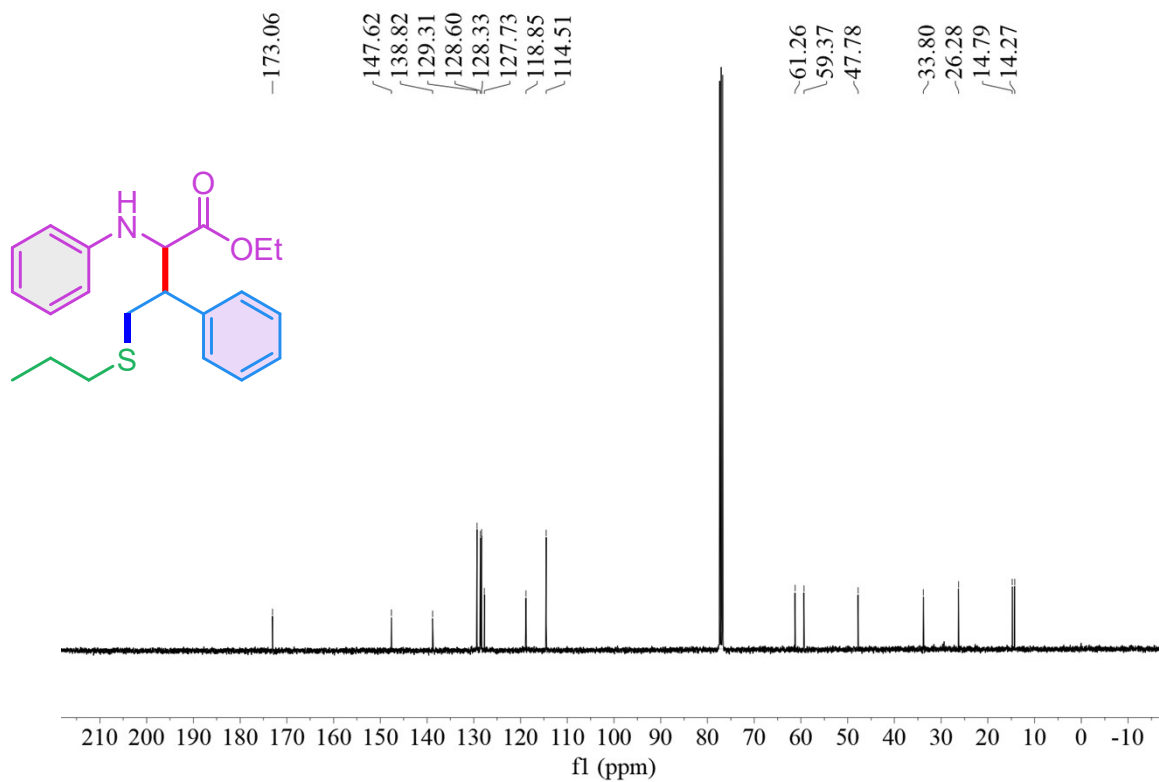
40 ^{13}C NMR (101 MHz, Chloroform-*d*)



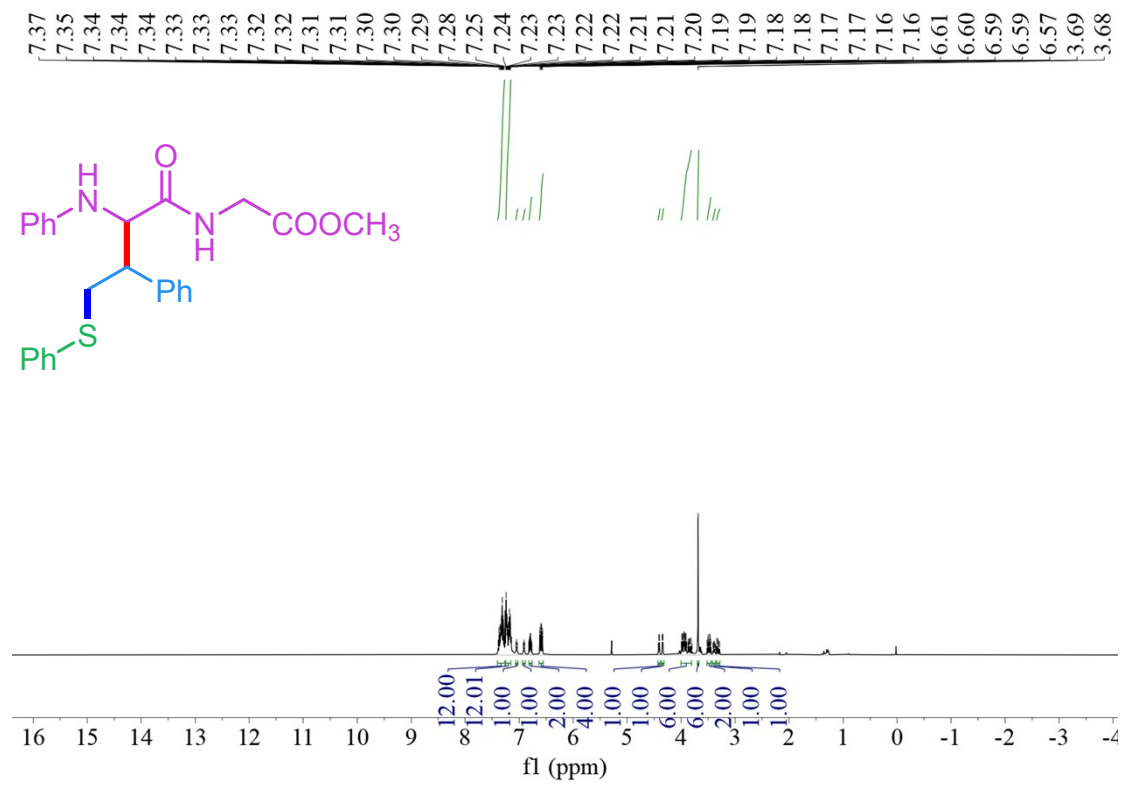
41 ¹H NMR (400 MHz, Chloroform-*d*)



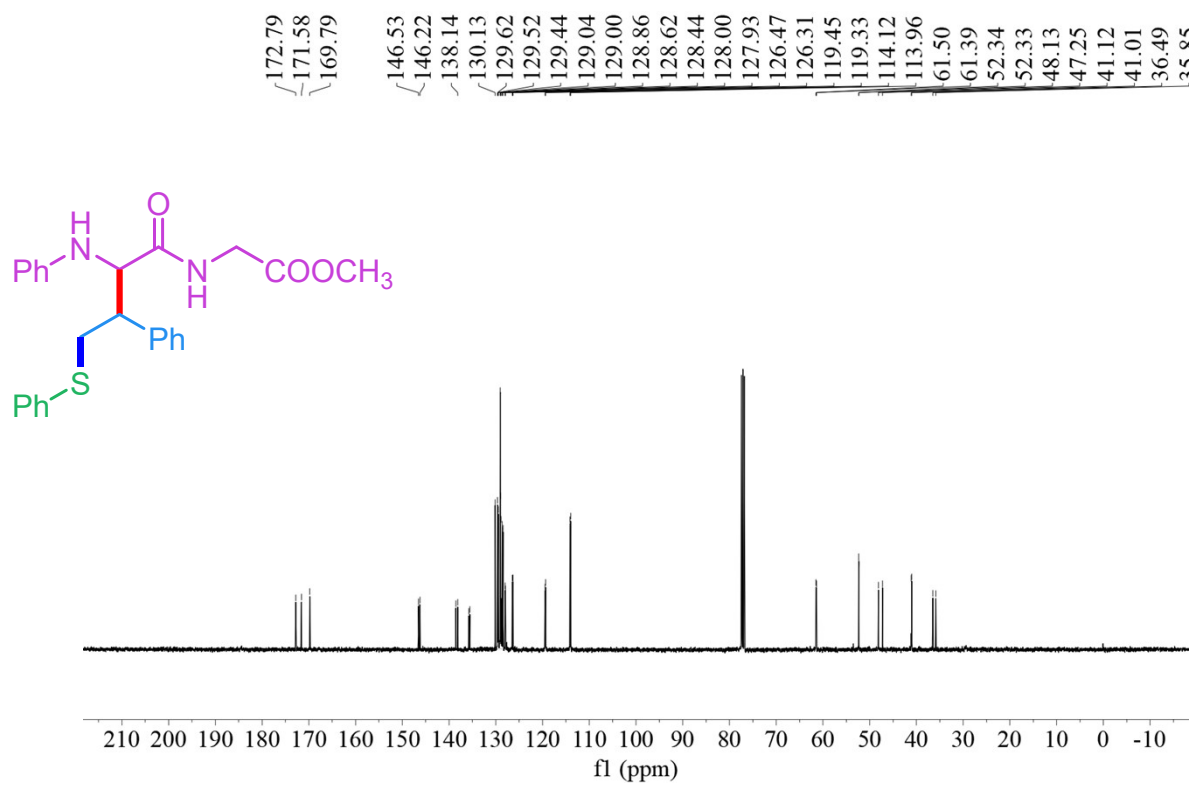
41 ¹³C NMR (101 MHz, Chloroform-*d*)



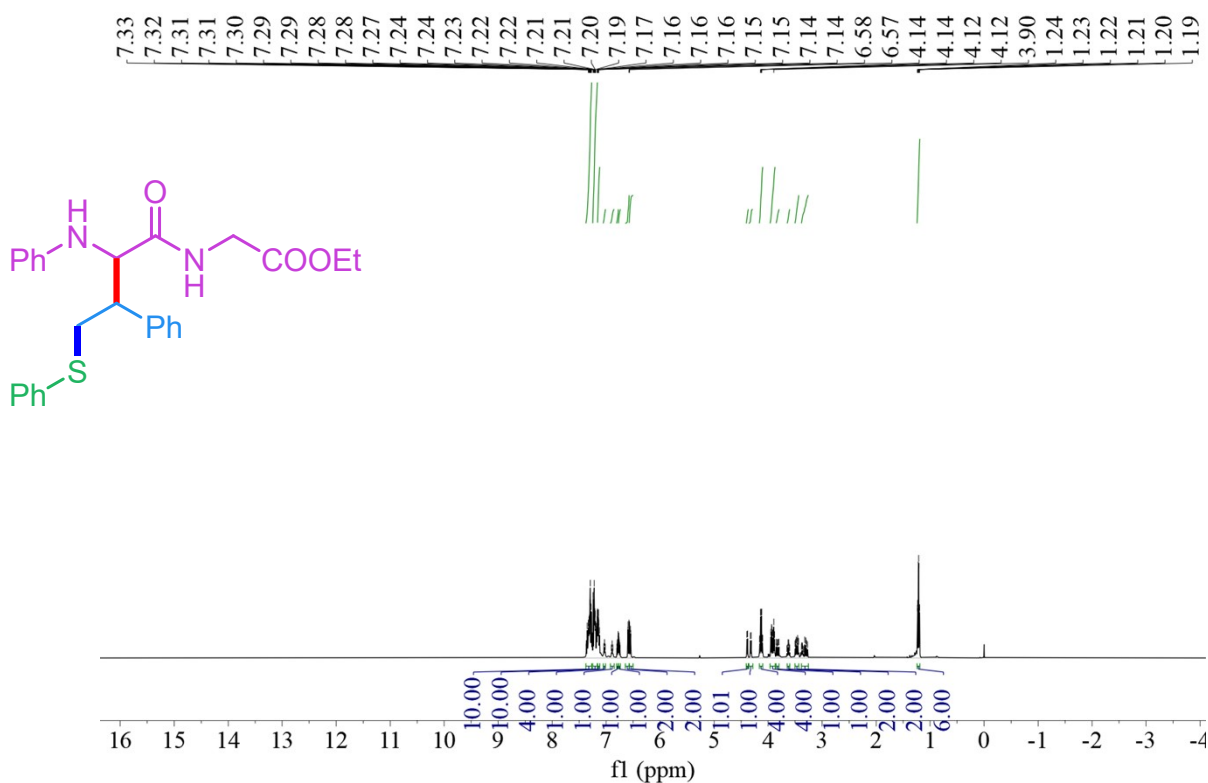
42 ¹H NMR (400 MHz, Chloroform-*d*)



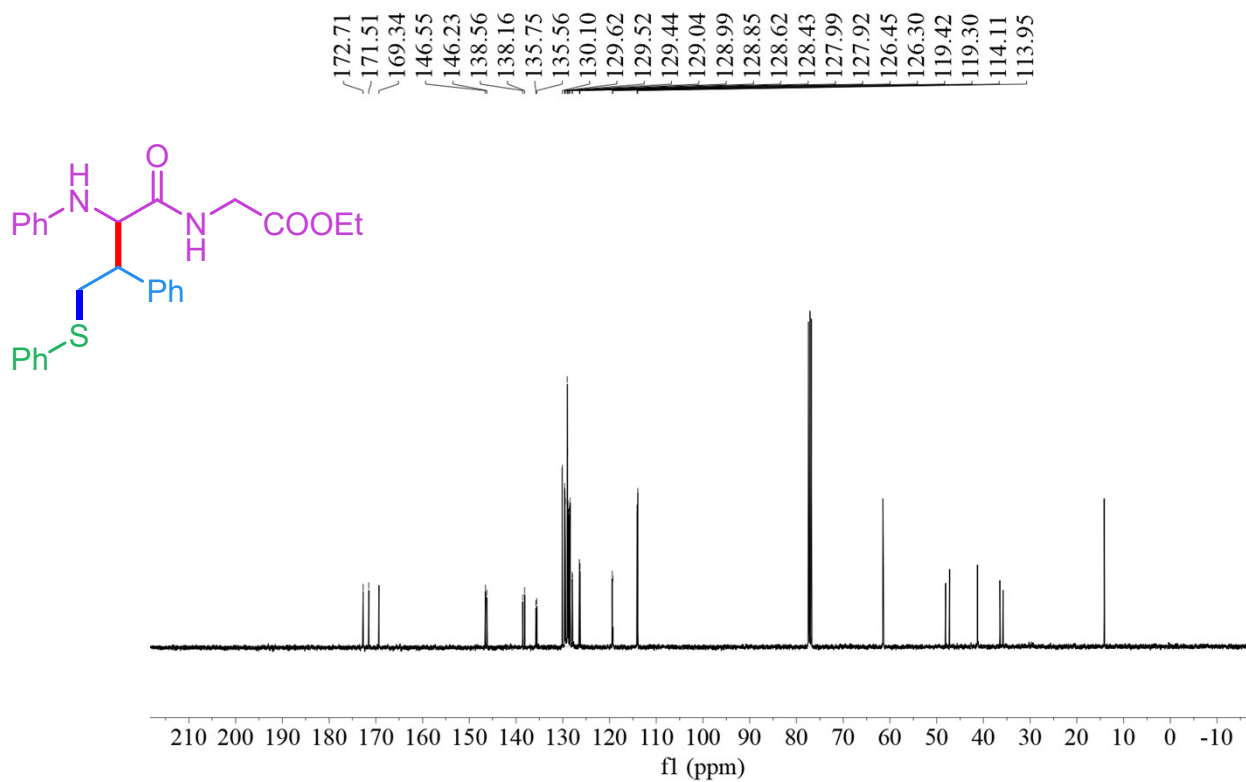
42 ¹³C NMR (101 MHz, Chloroform-*d*)



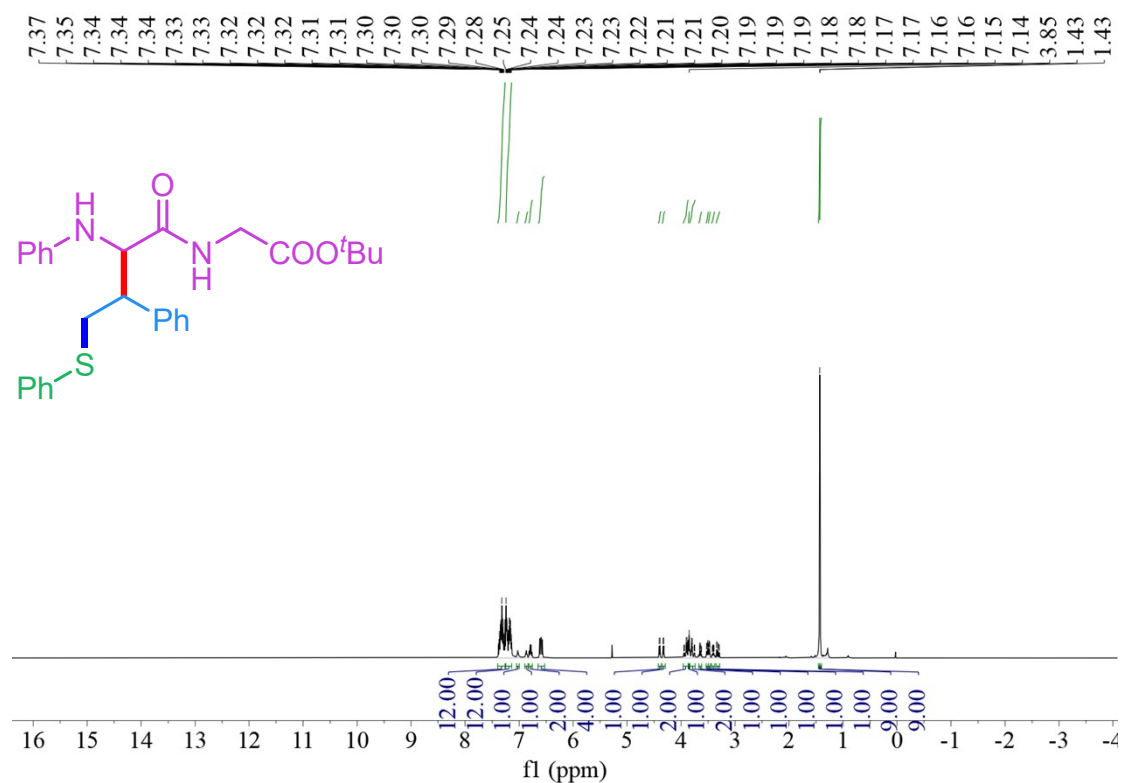
43 ¹H NMR (400 MHz, Chloroform-*d*)



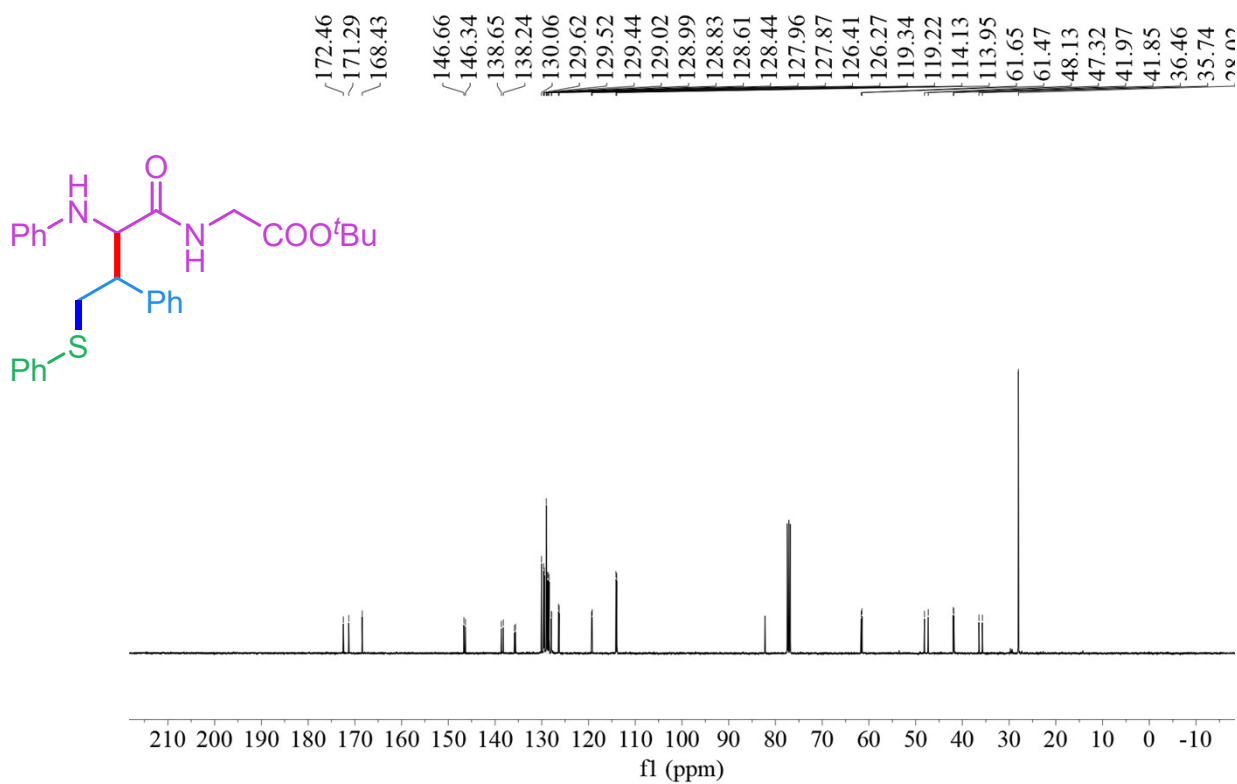
43 ¹³C NMR (101 MHz, Chloroform-*d*)



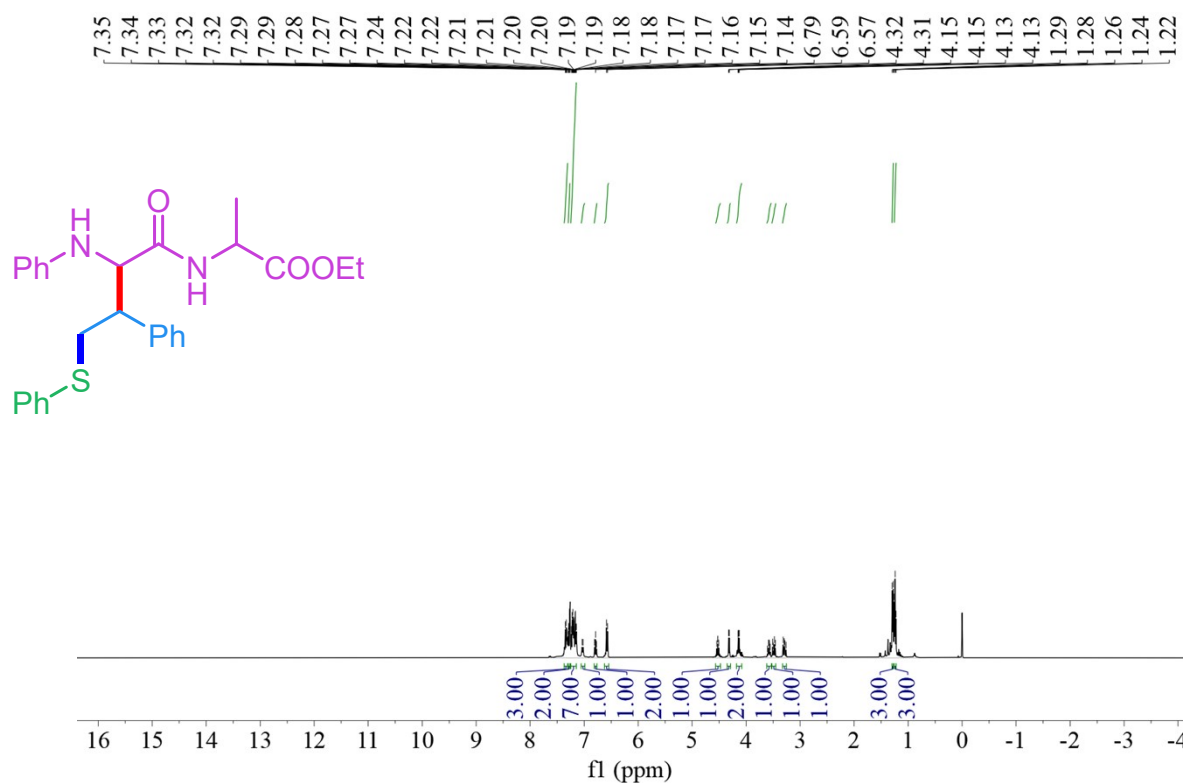
44 ¹H NMR (400 MHz, Chloroform-*d*)



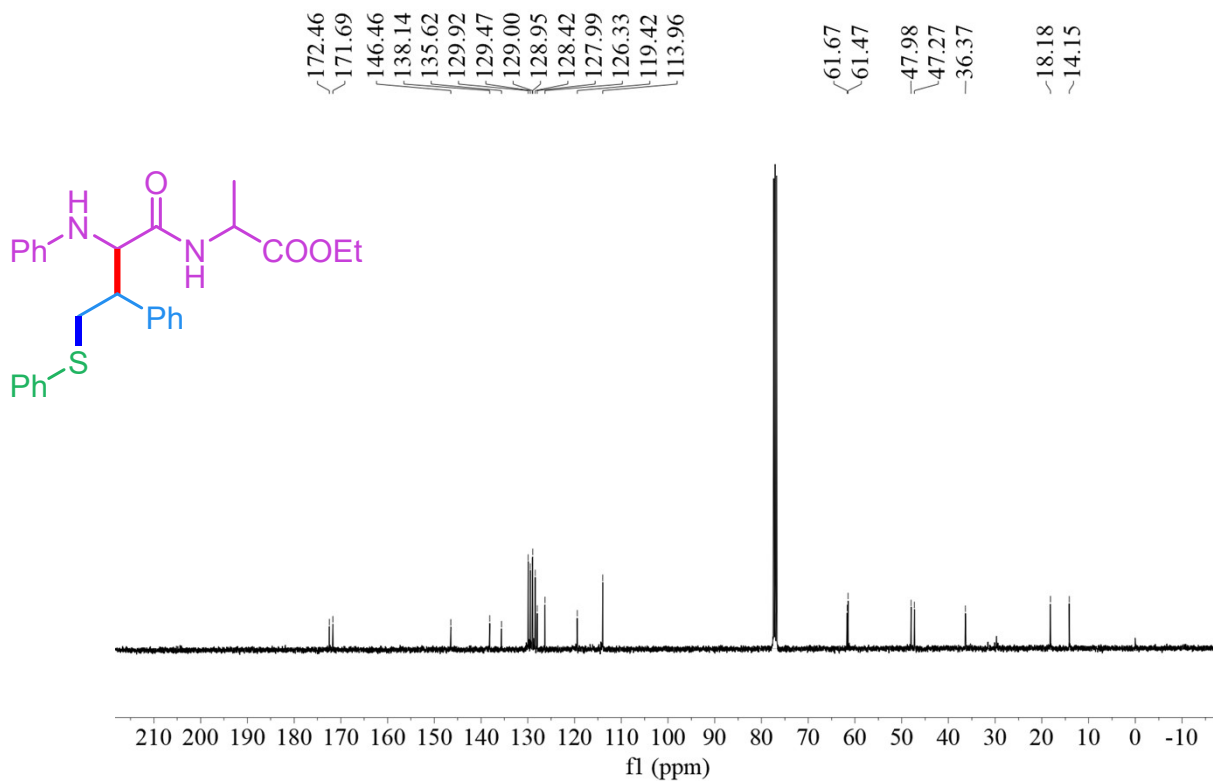
44 ¹³C NMR (101 MHz, Chloroform-*d*)



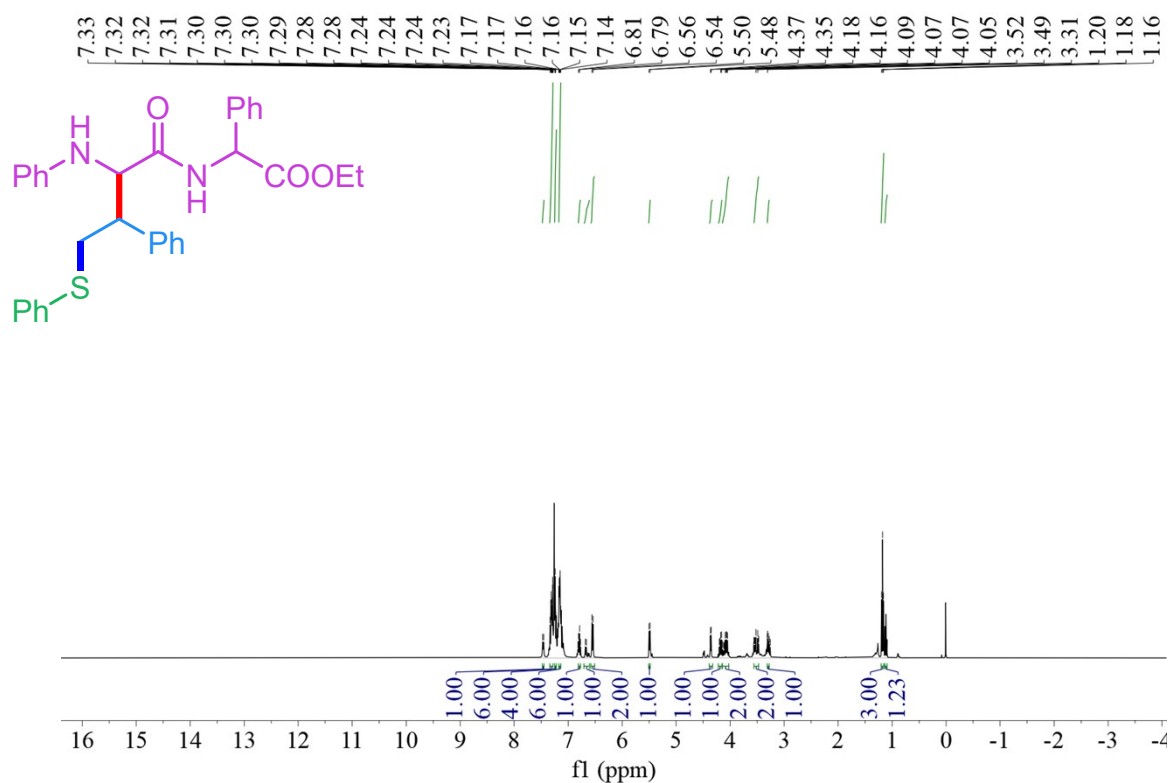
45 ¹H NMR (400 MHz, Chloroform-d)



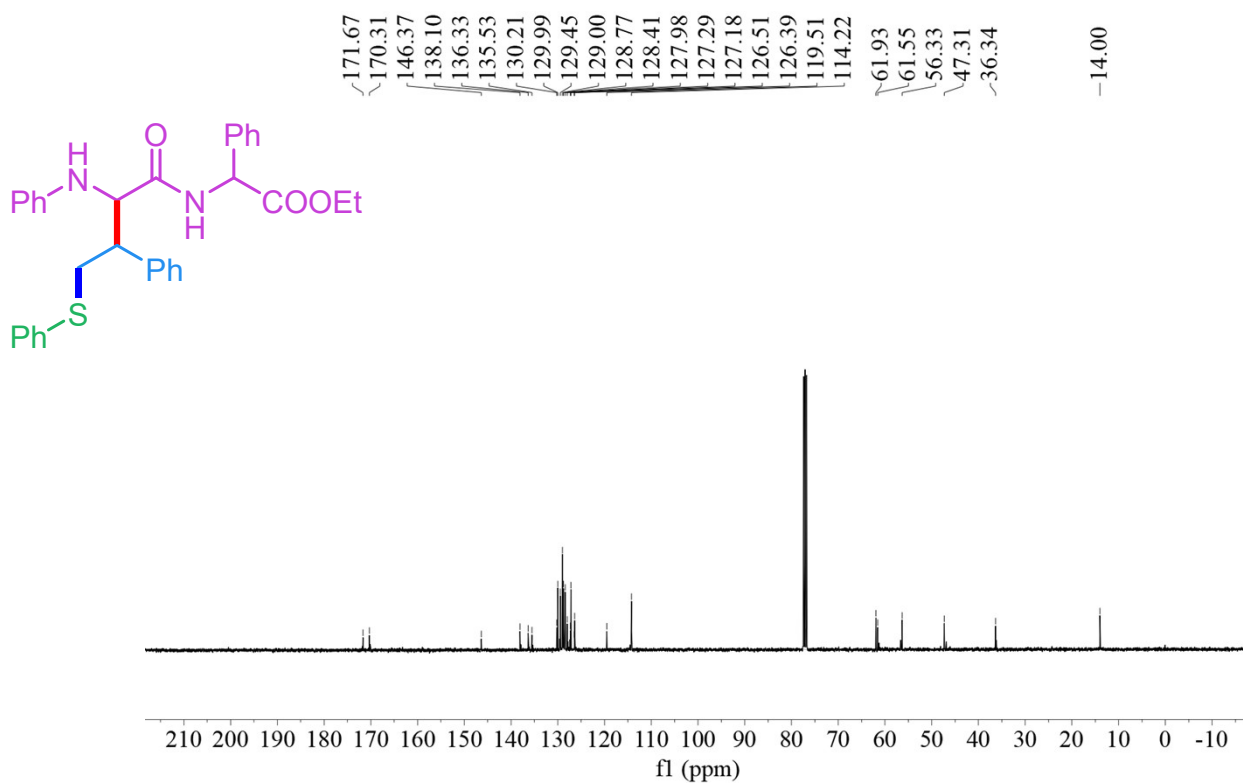
45 ¹³C NMR (101 MHz, Chloroform-d)



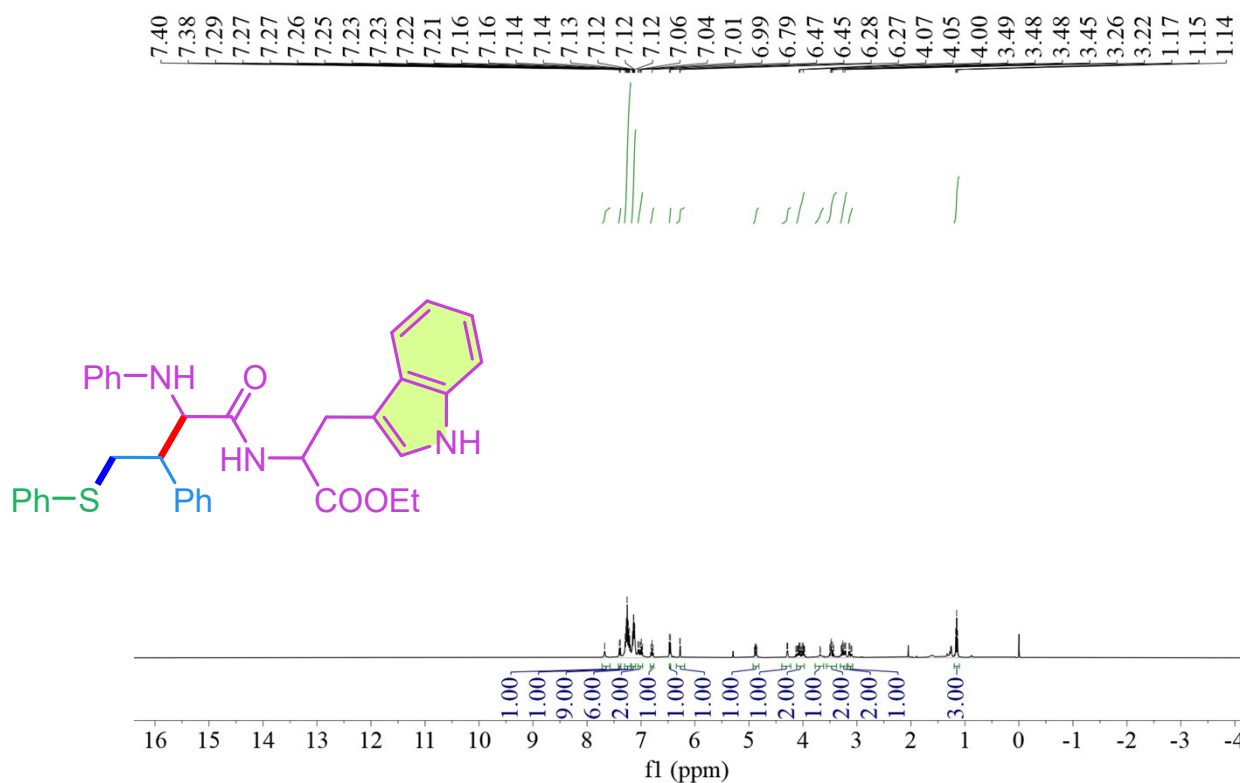
46 ¹H NMR (400 MHz, Chloroform-*d*)



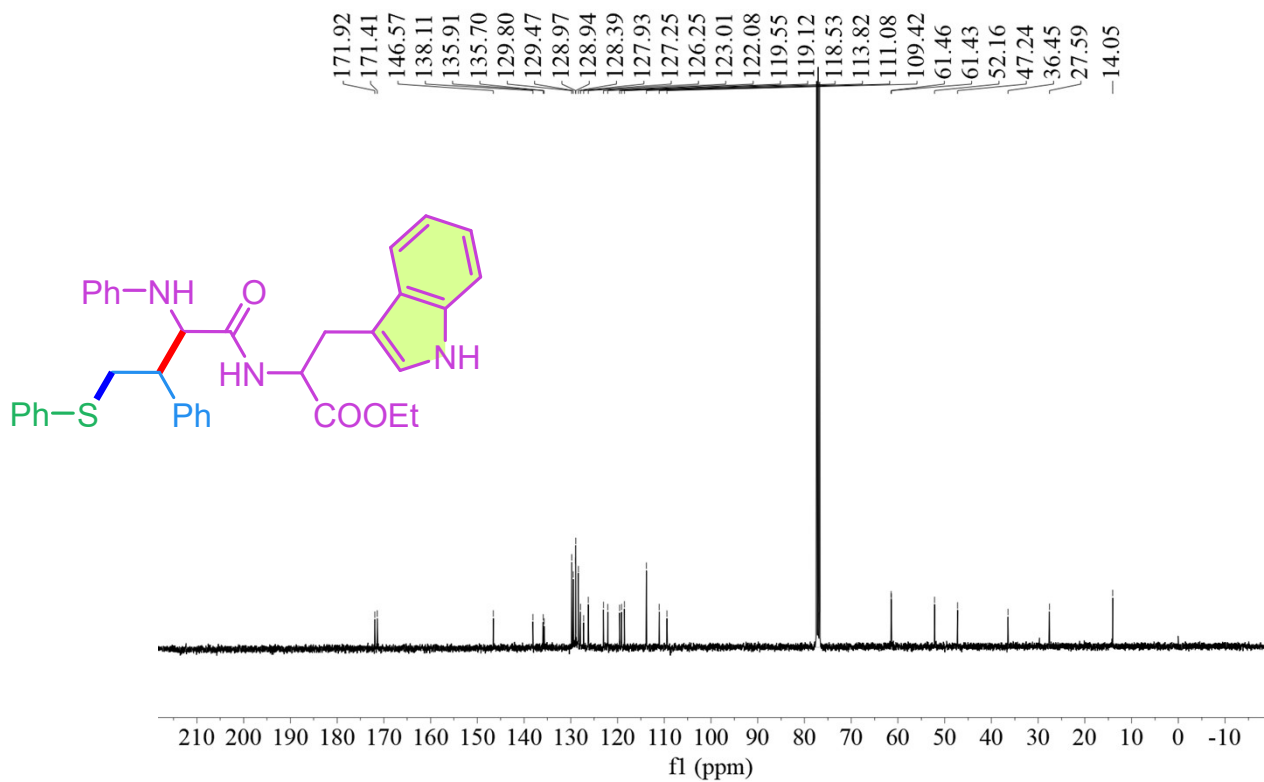
46 ¹³C NMR (101 MHz, Chloroform-*d*)



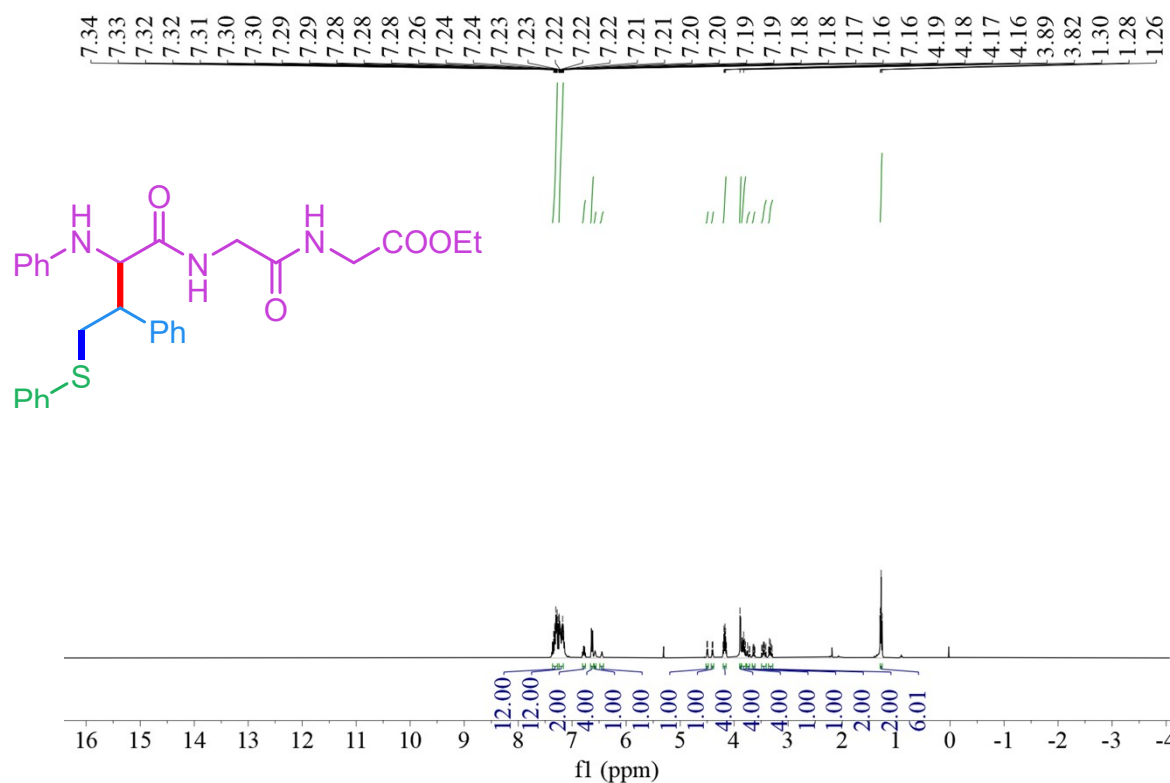
47 ¹H NMR (400 MHz, Chloroform-*d*)



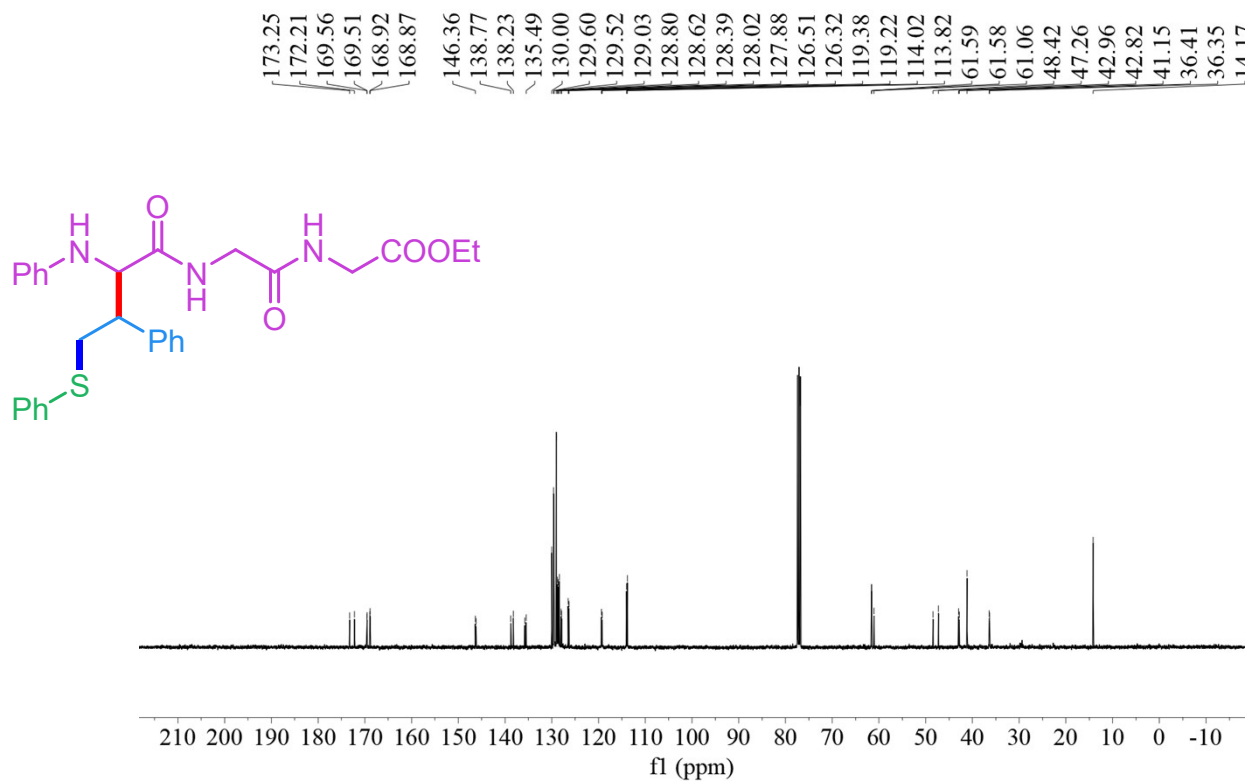
47 ¹³C NMR (101 MHz, Chloroform-*d*)



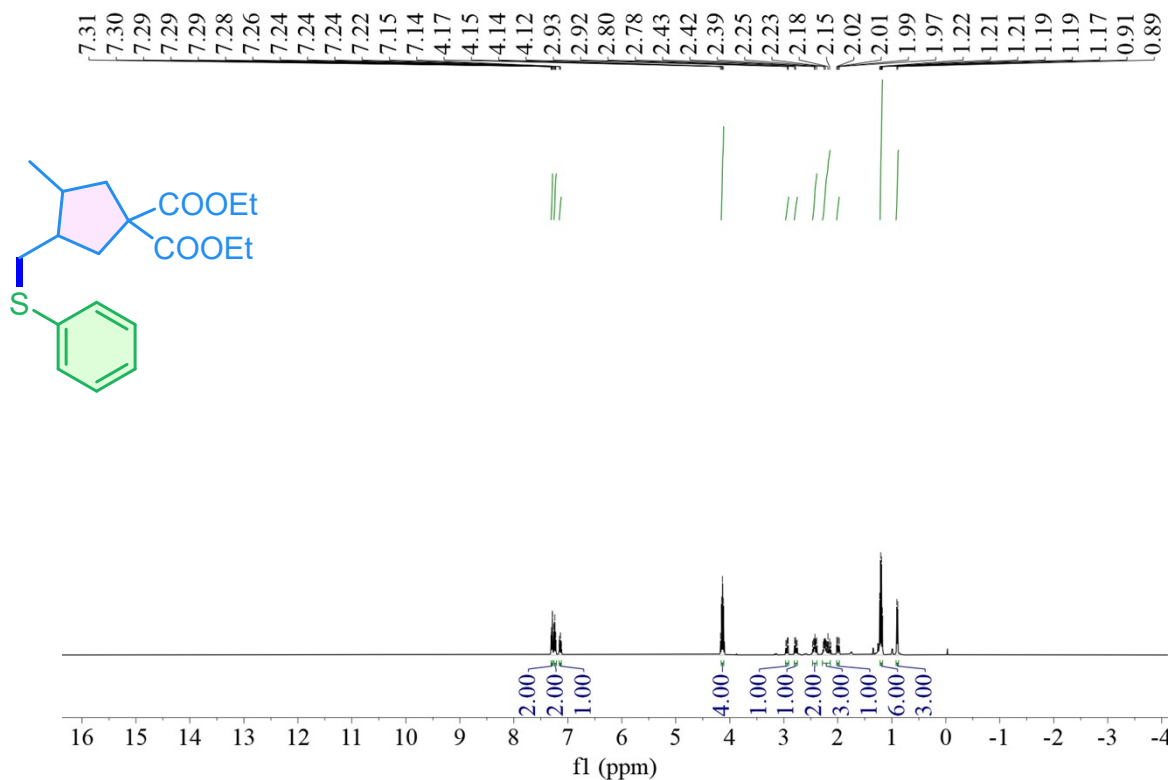
48 ¹H NMR (400 MHz, Chloroform-*d*)



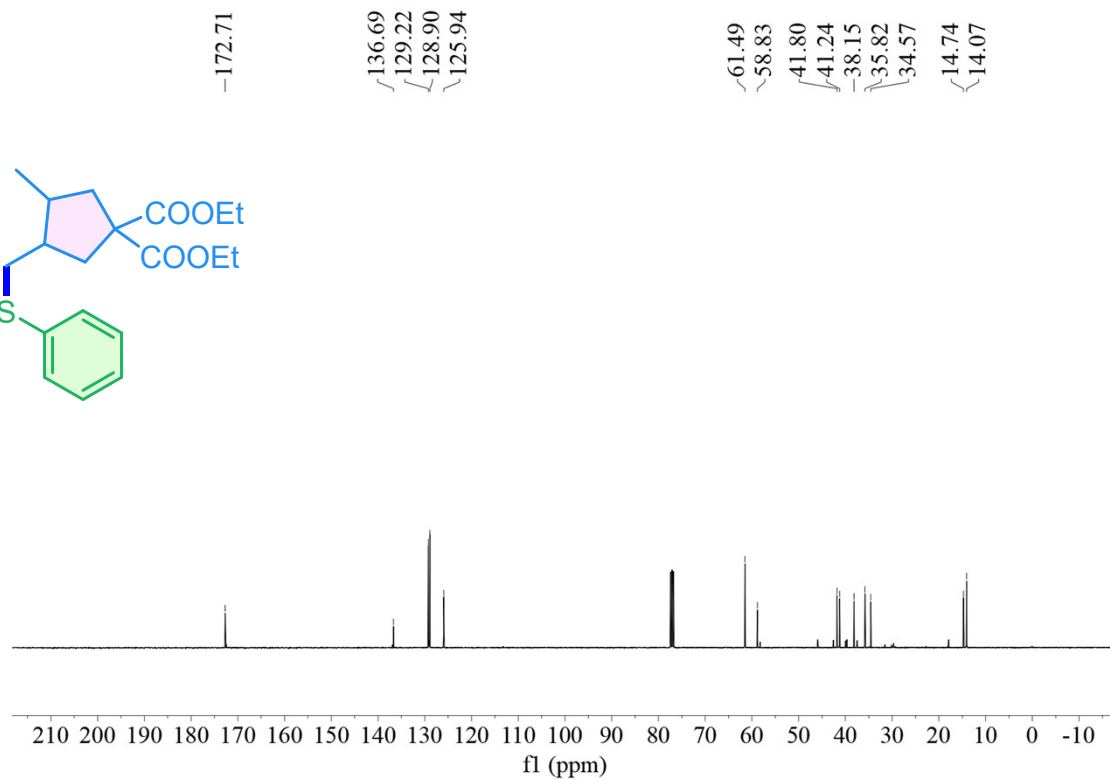
48 ¹³C NMR (101 MHz, Chloroform-*d*)



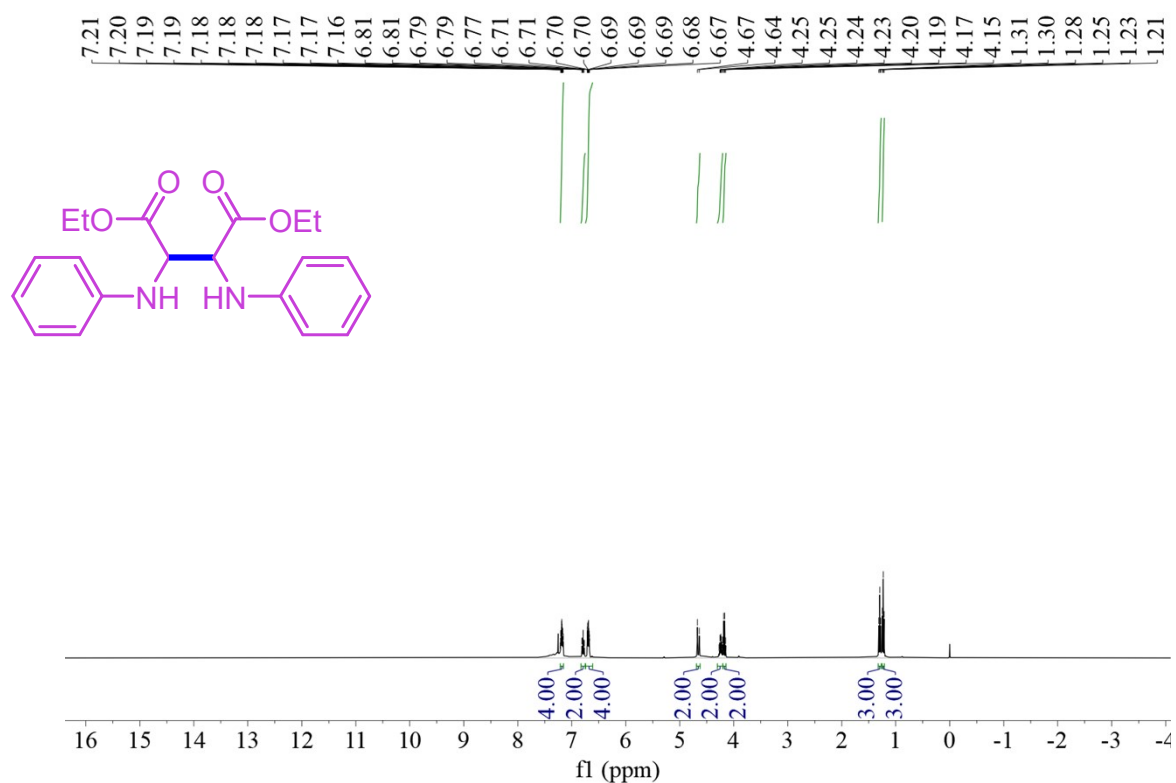
49 ¹H NMR (400 MHz, Chloroform-*d*)



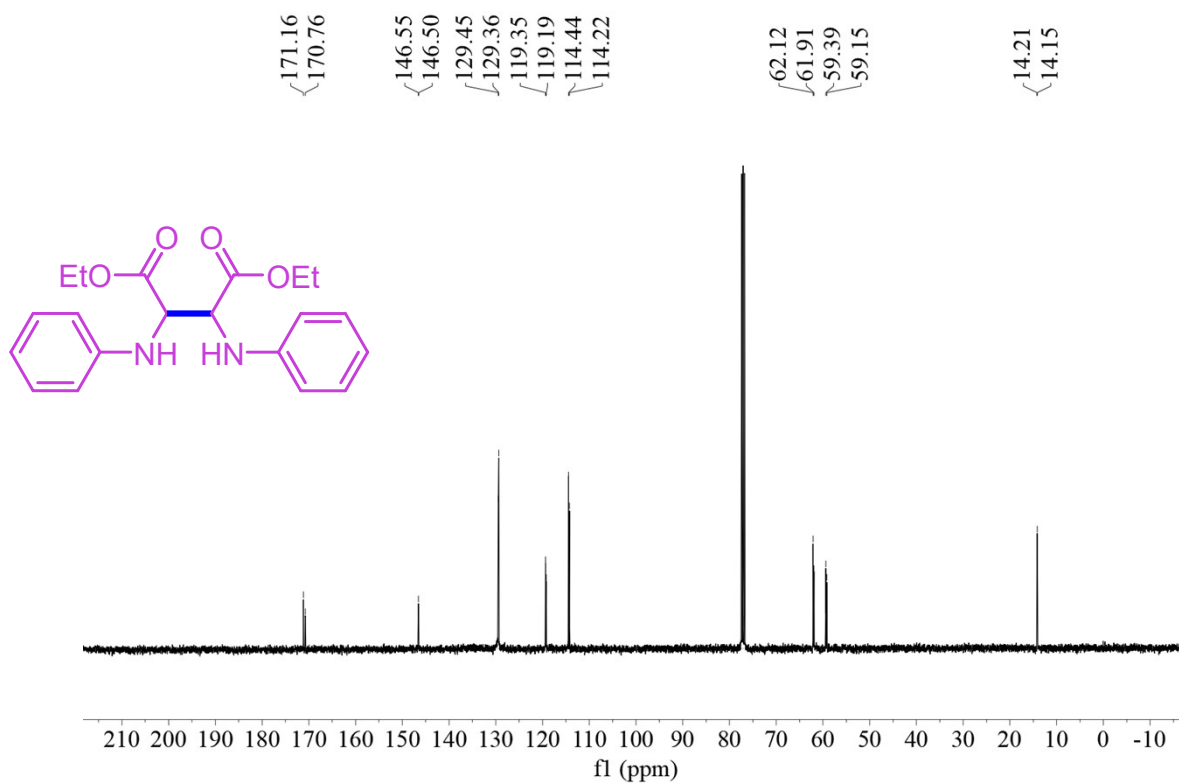
49 ¹³C NMR (101 MHz, Chloroform-*d*)



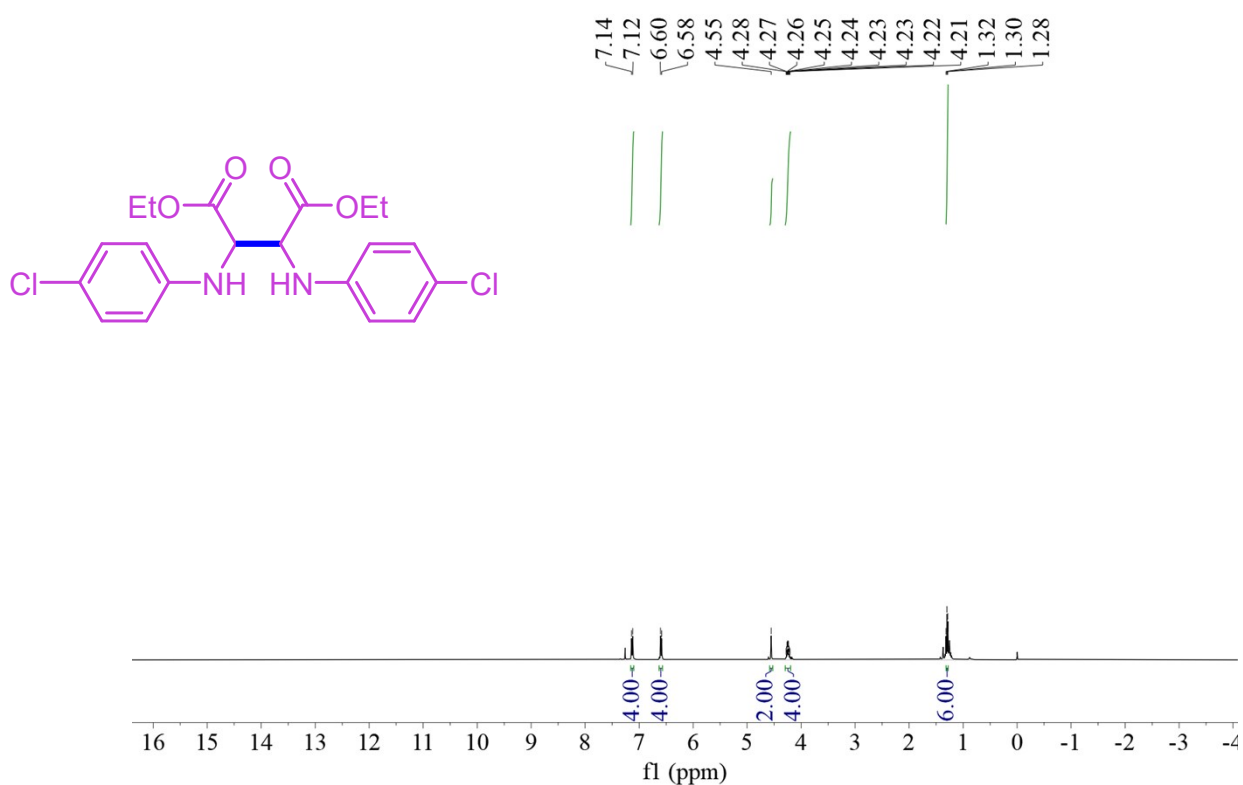
50 ¹H NMR (400 MHz, Chloroform-*d*)



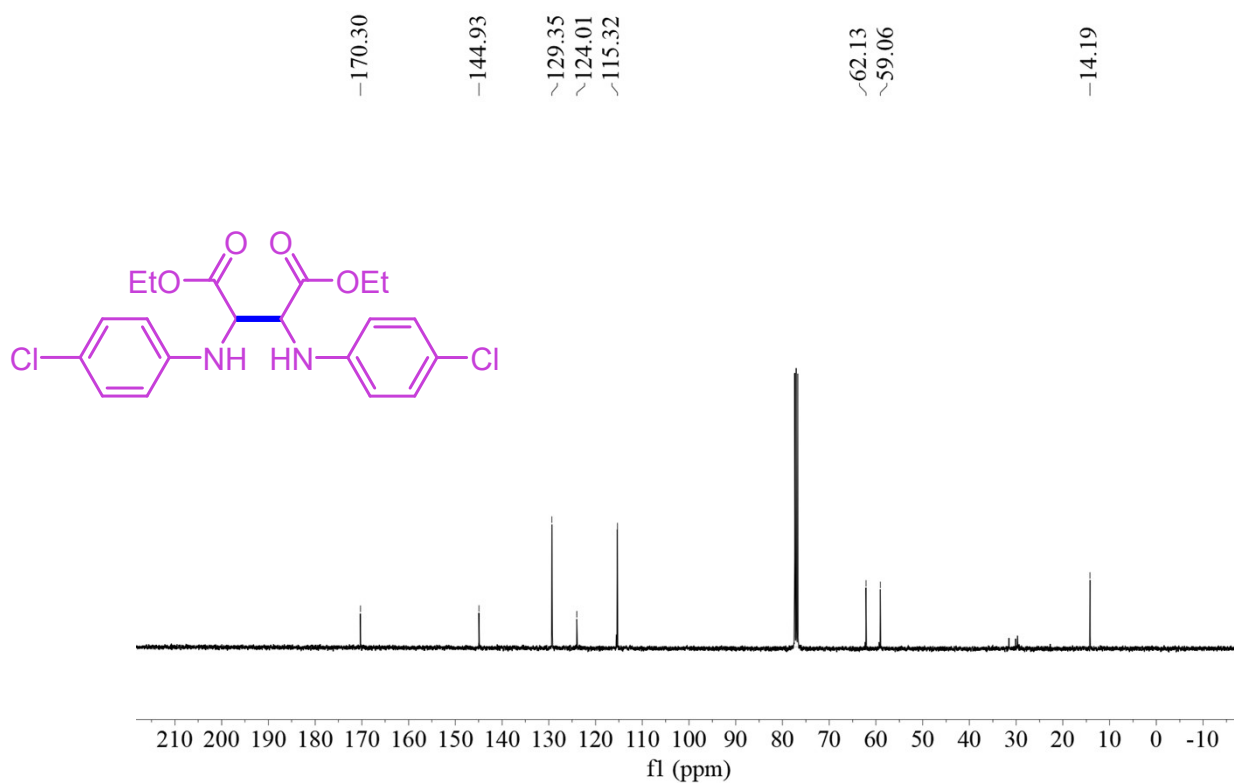
50 ¹³C NMR (101 MHz, Chloroform-*d*)



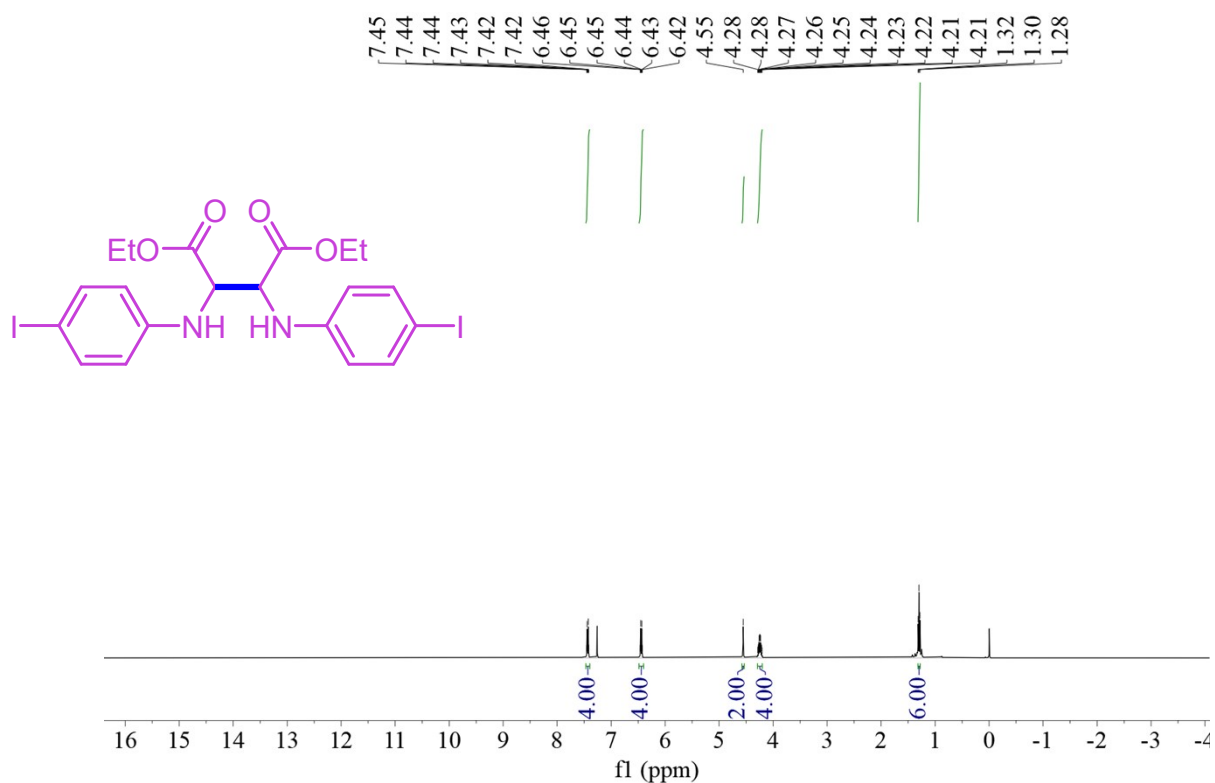
51 ¹H NMR (400 MHz, Chloroform-*d*)



51 ¹³C NMR (101 MHz, Chloroform-*d*)



52 ¹H NMR (400 MHz, Chloroform-*d*)



52 ¹³C NMR (101 MHz, Chloroform-*d*)

