

Supporting Materials

Chiral phosphine catalyzed allylic alkylation of benzylidene succinimides with Morita-Baylis-Hillman carbonates

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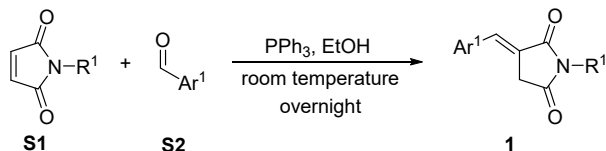
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I. General Information

All chemicals were used without further purification as commercially available unless otherwise noted. Thin-layer chromatography (TLC) was performed on silica gel plates (60F-254) using UV-light (254 and 365 nm). Flash chromatography was conducted on silica gel (300 400 mesh). NMR (400, 500 or 600 MHz for ^1H NMR, 100 or 126 MHz for ^{13}C NMR, 376 MHz for ^{19}F NMR) spectra were recorded in CDCl_3 with TMS as the internal standard. Chemical shifts are reported in ppm and coupling constants are given in Hz. Data for ^1H NMR are recorded as follows: chemical shift (ppm), multiplicity (s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; dd, doublet-doublet), coupling constant (Hz), integration. Data for ^{13}C NMR are reported in terms of chemical shift (δ , ppm). Data for ^{19}F NMR are reported in terms of chemical shift (δ , ppm). High resolution mass spectral (HRMS) analyses were recorded on a Thermo Scientific Q Exactive Orbitrap mass spectrometer (Bremen, Germany) with ESI source. The crystal structure and data were recorded on a Rigaku Homelab diffractometer.

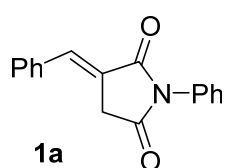
II. Substrate Preparation

Synthesis of α -benzylidene succinimides **1**.



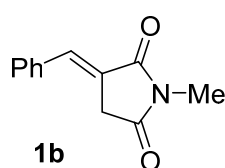
The procedure was according to the reported literature.¹ To a solution of pyrrole-2,5-dione **S1** (1.73 g, 10mmol, 1.0 equiv.) and aldehyde **S2** (11 mmol, 1.1 equiv.) in EtOH (100 mL), was added triphenylphosphine (PPh₃, 2.75 g, 10.5 mmol, 1.05 equiv.) at room temperature. The reaction mixture was stirred at room temperature overnight. When the reaction was completed (monitored by TLC), the reaction mixture was filtered, the precipitation was washed with ethanol and dried to afford **1**.

(*E*)-3-benzylidene-1-phenylpyrrolidine-2,5-dione (**1a**)



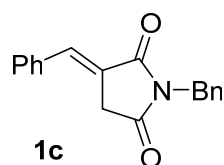
white solid, 95% yield, 2.50g, mp:192.2 – 193.7°C. ¹H NMR (400 MHz, CDCl₃): δ 7.75 (t, J = 2.4 Hz, 1H), 7.57 – 7.36 (m, 10H), 3.77 (d, J = 2.4 Hz, 2H). ¹³C NMR (101 MHz, CDCl₃): δ 173.2, 170.2, 135.6, 134.2, 132.1, 130.5, 130.4, 129.3, 129.3, 128.7, 126.6, 123.1, 34.4. HRMS (CI⁺) Calcd for C₁₇H₁₄NO₂⁺ [M + H]⁺: 264.1025, Found: 264.1016.

(*E*)-3-benzylidene-1-methylpyrrolidine-2,5-dione (**1b**)



white solid, 87% yield, 1.75g, mp:161.8 – 165.1°C. ¹H NMR (500 MHz, CDCl₃): δ 7.62 (t, J = 2.4 Hz, 1H), 7.51 – 7.40 (m, 5H), 3.57 (d, J = 2.4 Hz, 2H), 3.12 (s, 3H). ¹³C NMR (126 MHz, CDCl₃): δ 174.3, 171.3, 134.4, 134.2, 130.3, 130.3, 129.3, 123.6, 34.2, 25.1. HRMS (CI⁺) Calcd for C₁₂H₁₂NO₂⁺ [M + H]⁺: 202.0868, Found: 202.0862.

(*E*)-1-benzyl-3-benzylidenepyrrolidine-2,5-dione (**1c**)

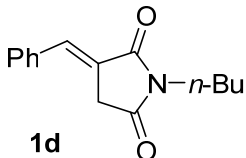


white solid, 93% yield, 2.57g, mp:186.5 – 188.8°C. ¹H NMR (500 MHz, CDCl₃): δ 7.62 (t, J = 2.4 Hz, 1H), 7.48 – 7.40 (m, 7H), 7.35 – 7.26 (m, 3H), 4.79 (s, 2H), 3.57 (d, J = 2.4 Hz, 2H).

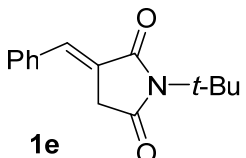
¹ L. Yan, W. Yang, L. Li, Y. Sheng, Z. Jiang, *Chin. J. Chem.* **2011**, 29, 1906-1910.

¹³C NMR (126 MHz, CDCl₃): δ 173.8, 170.8, 136.0, 134.7, 134.2, 130.3, 130.3, 129.2, 129.0, 128.8, 128.1, 123.5, 42.6, 34.2. **HRMS** (CI⁺) Calcd for C₁₈H₁₆NO₂⁺ [M + H]⁺: 278.1181, Found: 278.1174.

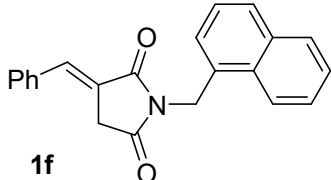
(E)-3-benzylidene-1-butylpyrrolidine-2,5-dione (1d)

 white solid, 96% yield, 2.33g, mp:115.6 – 117.7°C. **¹H NMR** (500 MHz, CDCl₃): δ 7.60 (s, 1H), 7.49 – 7.41 (m, 5H), 3.63 (t, *J* = 7.4 Hz, 2H), 3.56 (s, 2H), 1.61 (p, *J* = 7.4 Hz, 2H), 1.35 (h, *J* = 7.4 Hz, 2H), 0.94 (t, *J* = 7.4 Hz, 3H). **¹³C NMR** (126 MHz, CDCl₃): δ 174.2, 171.2, 134.3, 134.2, 130.2, 130.2, 129.2, 123.7, 38.9, 34.2, 30.0, 20.3, 13.8. **HRMS** (CI⁺) Calcd for C₁₅H₁₈NO₂⁺ [M + H]⁺: 244.1338, Found: 244.1330.

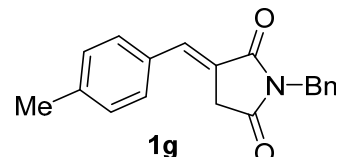
(E)-3-benzylidene-1-(tert-butyl)pyrrolidine-2,5-dione (1e)

 white solid, 96% yield, 2.33g, mp:119.2 – 120.9°C. **¹H NMR** (500 MHz, CDCl₃): δ 7.51 (t, *J* = 2.5 Hz, 1H), 7.49 – 7.35 (m, 5H), 3.47 (d, *J* = 2.5 Hz, 2H), 1.65 (s, 9H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.2, 172.3, 134.5, 133.0, 130.1, 129.9, 129.1, 124.2, 58.8, 34.9, 28.7. **HRMS** (CI⁺) Calcd for C₁₅H₁₈NO₂⁺ [M + H]⁺: 244.1338, Found: 244.1330.

(E)-3-benzylidene-1-(naphthalen-1-ylmethyl)pyrrolidine-2,5-dione (1f)

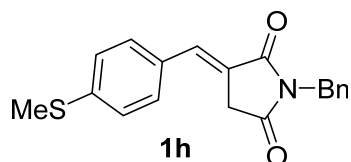
 white solid, 92% yield, 2.98g, mp:190.1 – 193.3°C. **¹H NMR** (500 MHz, CDCl₃): δ 8.37 (d, *J* = 8.5 Hz, 1H), 7.83 (dd, *J* = 26.0, 8.2 Hz, 2H), 7.67 – 7.56 (m, 3H), 7.53 – 7.40 (m, 7H), 5.28 (s, 2H), 3.60 (d, *J* = 2.4 Hz, 2H). **¹³C NMR** (126 MHz, CDCl₃): δ 174.0, 171.0, 134.9, 134.2, 133.9, 131.4, 130.9, 130.4, 130.3, 129.2, 128.9, 128.8, 128.0, 126.7, 126.0, 125.4, 123.8, 123.4, 40.5, 34.3. **HRMS** (CI⁺) Calcd for C₂₂H₁₈NO₂⁺ [M + H]⁺: 328.1338, Found: 328.1328.

(E)-1-benzyl-3-(4-methylbenzylidene)pyrrolidine-2,5-dione (1g)

 white solid, 86% yield, 2.50g, mp:164.0 – 165.8°C. **¹H NMR** (400 MHz, CDCl₃): δ 7.62 (t, *J* = 2.4 Hz, 1H), 7.46 (d, *J* = 7.0 Hz, 2H), 7.39 (d, *J* = 7.8 Hz, 2H), 7.37 – 7.24 (m, 5H), 4.81 (s, 2H), 3.57 (d, *J* = 2.4 Hz, 2H), 2.41 (s, 3H). **¹³C NMR** (101 MHz, CDCl₃): δ 173.2, 170.2, 135.6, 134.2, 132.1, 130.5, 130.4, 129.3, 129.3, 128.7, 126.6,

123.1, 34.4. **HRMS** (CI⁺) Calcd for C₁₉H₁₈NO₂⁺ [M + H]⁺: 292.1338, Found: 292.1328.

(E)-1-benzyl-3-(4-(methylthio)benzylidene)pyrrolidine-2,5-dione (1h)

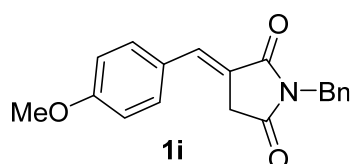


white solid, 92% yield, 2.97g, mp:177.2 – 180.5°C. ¹H

NMR (500 MHz, CDCl₃): δ 7.55 (t, *J* = 2.4 Hz, 1H), 7.42 (d, *J* = 6.7 Hz, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 7.32 –

7.24 (m, 5H), 4.77 (s, 2H), 3.53 (d, *J* = 2.3 Hz, 2H), 2.50 (s, 3H). ¹³C **NMR** (126 MHz, CDCl₃): 173.8, 170.9, 142.5, 136.0, 134.2, 130.6, 130.5, 129.0, 128.8, 128.1, 126.0, 122.3, 42.6, 34.3, 15.1. **HRMS** (CI⁺) Calcd for C₁₉H₁₈NO₂S⁺ [M + H]⁺: 324.1058, Found: 324.1049.

(E)-1-benzyl-3-(4-(methoxy)benzylidene)pyrrolidine-2,5-dione (1i)

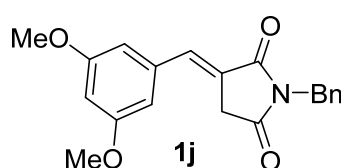


white solid, 90% yield, 2.91g, mp:170.4 – 172.5°C. ¹H

NMR (500 MHz, CDCl₃): δ 7.57 (t, *J* = 2.3 Hz, 1H), 7.46 – 7.40 (m, 4H), 7.34 – 7.25 (m, 3H), 6.97 – 6.93

(m, 2H), 4.78 (s, 2H), 3.85 (s, 3H), 3.53 (d, *J* = 2.3 Hz, 2H). ¹³C **NMR** (126 MHz, CDCl₃): δ 174.0, 171.1, 161.3, 136.1, 134.4, 132.1, 129.0, 128.8, 128.0, 126.9, 120.7, 114.7, 55.5, 42.5, 34.3. **HRMS** (CI⁺) Calcd for C₁₉H₁₈NO₃⁺ [M + H]⁺: 308.1287, Found: 308.1277.

(E)-1-benzyl-3-(3,5-dimethoxybenzylidene)pyrrolidine-2,5-dione (1j)

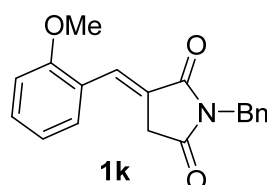


white solid, 95% yield, 3.20g, mp:134.7– 136.2°C. ¹H

NMR (500 MHz, CDCl₃): δ 7.53 (t, *J* = 2.4 Hz, 1H), 7.47 – 7.39 (m, 2H), 7.33 – 7.28 (m, 3H), 6.59 (d, *J* =

2.2 Hz, 2H), 6.51 (t, *J* = 2.3 Hz, 1H), 4.78 (s, 2H), 3.81 (s, 6H), 3.57 (d, *J* = 2.4 Hz, 2H). ¹³C **NMR** (126 MHz, CDCl₃): δ 173.8, 170.8, 161.2, 135.9, 135.9, 134.8, 129.0, 128.8, 128.1, 124.0, 108.3, 102.3, 55.6, 42.6, 34.2. **HRMS** (CI⁺) Calcd for C₂₀H₂₀NO₄⁺ [M + H]⁺: 338.1392, Found: 338.1381.

(E)-1-benzyl-3-(2-methoxybenzylidene)pyrrolidine-2,5-dione (1k)

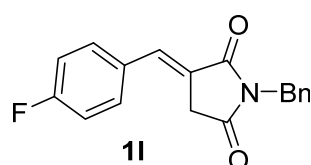


white solid, 90% yield, 2.91g, mp:151.9 – 154.0°C. ¹H **NMR**

(400 MHz, CDCl₃): δ 8.04 (t, *J* = 2.4 Hz, 1H), 7.50 – 7.42 (m,

2H), 7.40 – 7.26 (m, 5H), 7.04 – 6.97 (m, 1H), 6.94 (d, $J = 8.2$ Hz, 1H), 4.79 (s, 2H), 3.88 (s, 3H), 3.51 (d, $J = 2.4$ Hz, 2H). ^{13}C NMR (101 MHz, CDCl_3): δ 174.2, 170.9, 158.6, 136.1, 131.8, 129.8, 129.3, 129.0, 128.7, 128.0, 123.3, 123.2, 120.7, 111.3, 55.7, 42.5, 34.3. HRMS (CI+) Calcd for $\text{C}_{19}\text{H}_{18}\text{NO}_3^+$ $[\text{M} + \text{H}]^+$: 308.1287, Found: 308.1277.

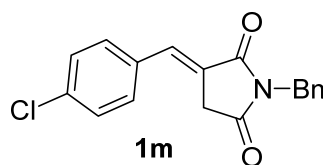
(E)-1-benzyl-3-(4-fluorobenzylidene)pyrrolidine-2,5-dione (1l)



1l

white solid, 87% yield, 2.56g, mp:161.4 – 162.6°C. ^1H NMR (500 MHz, CDCl_3): δ 7.59 (t, $J = 2.4$ Hz, 1H), 7.50 – 7.41 (m, 4H), 7.35 – 7.27 (m, 3H), 7.17 – 7.10 (m, 2H), 4.79 (s, 2H), 3.54 (d, $J = 2.4$ Hz, 2H). ^{13}C NMR (101 MHz, CDCl_3): δ 173.6, 170.8, 164.7, 162.7, 135.9, 133.5, 132.3(d, $J = 8.7$), 130.5 (d, $J = 3.3$), 128.9 (d, $J = 27.8$), 128.1, 123.1, 123.1, 116.5 (d, $J = 22.2$), 42.7, 34.1. ^{19}F NMR (376 MHz, CDCl_3): δ -108.6. HRMS (CI+) Calcd for $\text{C}_{18}\text{H}_{15}\text{FNO}_2^+$ $[\text{M} + \text{H}]^+$: 296.1087, Found: 296.1069.

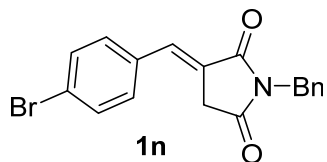
(E)-1-benzyl-3-(4-chlorobenzylidene)pyrrolidine-2,5-dione (1m)



1m

white solid, 96% yield, 2.99g, mp:186.8 – 187.4°C. ^1H NMR (500 MHz, CDCl_3): δ 7.56 (t, $J = 2.4$ Hz, 1H), 7.47 – 7.36 (m, 6H), 7.36 – 7.21 (m, 3H), 4.78 (s, 2H), 3.53 (d, $J = 2.4$ Hz, 2H). ^{13}C NMR (126 MHz, CDCl_3): δ 173.5, 170.6, 136.4, 135.8, 133.3, 132.6, 131.4, 129.5, 129.0, 128.8, 128.1, 124.1, 42.7, 34.1. HRMS (CI+) Calcd for $\text{C}_{18}\text{H}_{15}\text{ClNO}_2^+$ $[\text{M} + \text{H}]^+$: 312.0791, Found: 312.0782.

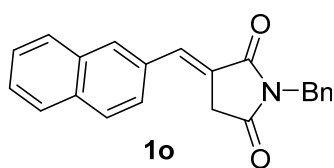
(E)-1-benzyl-3-(4-bromobenzylidene)pyrrolidine-2,5-dione (1n)



1n

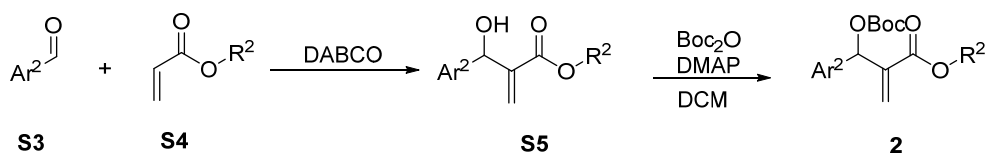
white solid, 95% yield, 3.30g, mp:206.5 – 210.1°C. ^1H NMR (500 MHz, CDCl_3): δ 7.61 – 7.53 (m, 3H), 7.46 – 7.40 (m, 2H), 7.37 – 7.27 (m, 5H), 4.79 (s, 2H), 3.53 (d, $J = 2.4$ Hz, 2H). ^{13}C NMR (126 MHz, CDCl_3): δ 173.5, 170.6, 135.8, 133.4, 133.0, 132.5, 131.5, 129.1, 128.8, 128.2, 124.8, 124.2, 42.7, 34.1. HRMS (CI+) Calcd for $\text{C}_{18}\text{H}_{15}\text{BrNO}_2^+$ $[\text{M} + \text{H}]^+$: 356.0286, Found: 356.0275.

(E)-1-benzyl-3-(naphthalen-2-ylmethylene)pyrrolidine-2,5-dione (1o)



white solid, 96% yield, 3.13g, mp:214.7 – 217.5°C. ¹H NMR (500 MHz, CDCl₃): δ 7.96 (d, *J* = 1.7 Hz, 1H), 7.91 – 7.82 (m, 3H), 7.78 (t, *J* = 2.5 Hz, 1H), 7.59 – 7.51 (m, 3H), 7.50 – 7.43 (m, 2H), 7.37 – 7.26 (m, 3H), 4.82 (s, 2H), 3.68 (d, *J* = 2.4 Hz, 2H). ¹³C NMR (126 MHz, CDCl₃): δ 173.9, 170.9, 136.0, 134.9, 133.9, 133.3, 131.7, 131.6, 129.1, 129.0, 128.8, 128.8, 128.1, 127.9, 127.1, 126.1, 123.5, 42.7, 34.4. HRMS (CI⁺) Calcd for C₂₂H₁₈NO₂⁺ [M + H]⁺: 328.1338, Found: 328.1328.

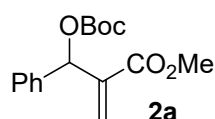
Synthesis of MBH carbonates 2.



The procedure was according to the reported literature.² To a solution of aldehyde **S3** (10 mmol) in acrylate **S4** (20 mL), was added 1,4-diazabicyclo[2.2.2]octane (DABCO, 10.5 mmol) at room temperature. The reaction mixture was stirred at room temperature for 3-7 days. When the reaction was completed (monitored by TLC), the reaction mixture was purified by silica gel column chromatography to afford MBH alcohol **S5**.

To a solution of MBH alcohol **S5** and Boc-anhydride (15 mmol) in CH₂Cl₂ (30 mL) was added 4-(dimethylamino)pyridine (DMAP, 2.08 mmol) in batches. When the reaction was completed (monitored by TLC), the organic phase was washed with distilled water (2 x 20 mL), dried over anhydrous Na₂SO₄ and the solvent was removed under reduced pressure. The residue was purified by silica gel column chromatography affording MBH carbonate **2**.

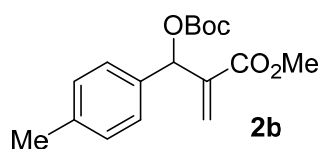
Methyl 2-(((tert-butoxycarbonyl)oxy)(phenyl)methyl)acrylate (**2a**)



white solid, 81% yields, 2.37g. ¹H NMR (600 MHz, CDCl₃): δ 7.41 – 7.29 (m, 5H), 6.48 (s, 1H), 6.41 (s, 1H), 5.91 (s, 1H), 3.71 (s, 3H), 1.46 (s, 9H). ¹³C NMR (151 MHz, CDCl₃): δ 165.5, 152.5, 139.8, 137.6, 128.6, 128.6, 127.8, 126.0, 82.8, 75.9, 52.1, 27.9.

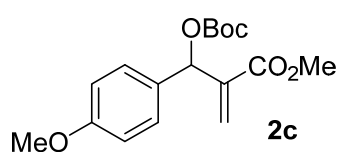
Methyl 2-(((tert-butoxycarbonyl)oxy)(p-tolyl)methyl)acrylate (**2b**)

² J. T. M. Correia, L.V. Acconcia, F. Coelho, *Eur. J. Org. Chem.* **2016**, 11, 1972-1976.



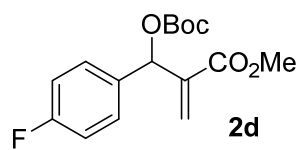
white solid, 72% yields, 2.20g. ^1H NMR (500 MHz, CDCl_3): δ 7.28 (d, J = 8.2 Hz, 2H), 7.14 (d, J = 7.9 Hz, 2H), 6.45 (s, 1H), 6.39 (t, J = 1.0 Hz, 1H), 5.91 (t, J = 1.3 Hz, 1H), 3.70 (s, 3H), 2.33 (s, 3H), 1.46 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 165.58, 152.57, 139.85, 138.40, 134.61, 129.29, 127.75, 125.72, 82.67, 75.85, 52.11, 27.89, 21.33.

Methyl 2-(((tert-butoxycarbonyl)oxy)(4-methoxyphenyl)methyl)acrylate (2c)



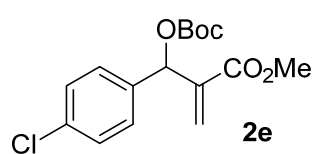
white solid, 75% yields, 2.42g. ^1H NMR (600 MHz, CDCl_3): δ 7.35 – 7.29 (m, 2H), 6.89 – 6.82 (m, 2H), 6.43 (s, 1H), 6.38 (s, 1H), 5.92 (s, 1H), 3.79 (s, 3H), 3.70 (s, 3H), 1.45 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 165.6, 159.8, 152.6, 139.9, 129.6, 129.3, 125.3, 114.0, 82.7, 75.7, 55.4, 52.1, 27.9.

Methyl 2-(((tert-butoxycarbonyl)oxy)(4-fluorophenyl)methyl)acrylate (2d)



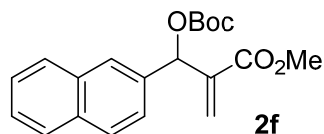
yellow solid, 59% yields, 1.83g. ^1H NMR (500 MHz, CDCl_3): δ 7.42 – 7.35 (m, 2H), 7.02 (t, J = 8.7 Hz, 2H), 6.44 (d, J = 1.1 Hz, 1H), 6.40 (t, J = 0.9 Hz, 1H), 5.94 (dd, J = 1.5, 0.9 Hz, 1H), 3.71 (s, 3H), 1.46 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 165.3, 162.7 (d, J = 248.2 Hz), 152.3, 139.5, 133.4 (d, J = 3.2 Hz), 129.6 (d, J = 8.6), 125.6, 115.4 (d, J = 21.4), 82.9, 52.1, 27.7. ^{19}F NMR (565 MHz, CDCl_3): δ -113.4.

Methyl 2-(((tert-butoxycarbonyl)oxy)(4-chlorophenyl)methyl)acrylate (2e)



white solid, 62% yields, 2.02g. ^1H NMR (500 MHz, CDCl_3): δ 7.36 – 7.29 (m, 4H), 6.43 (d, J = 1.2 Hz, 1H), 6.41 (t, J = 0.9 Hz, 1H), 5.94 (dd, J = 1.5, 0.8 Hz, 1H), 3.71 (s, 3H), 1.46 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 165.3, 152.4, 139.4, 136.3, 134.5, 129.2, 128.8, 126.1, 83.1, 75.2, 52.2, 27.9.

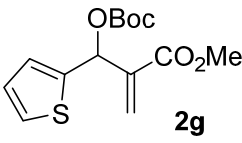
Methyl 2-(((tert-butoxycarbonyl)oxy)(naphthalen-2-yl)methyl)acrylate (2f)



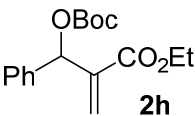
white solid, 77% yields, 2.63g. ^1H NMR (500 MHz, CDCl_3): δ 7.90 – 7.78 (m, 4H), 7.54 – 7.45 (m, 3H), 6.66 (s, 1H), 6.45 (d, J = 0.9 Hz, 1H), 6.04 – 5.97 (m, 1H), 3.71 (s, 3H), 1.47 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 165.6, 152.6, 139.7, 135.0,

133.4, 133.2, 128.4, 128.4, 127.8, 127.2, 126.5, 126.3, 126.3, 125.3, 82.9, 76.0, 52.2, 27.9.

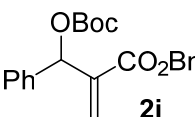
Methyl 2-(((tert-butoxycarbonyl)oxy)(thiophen-2-yl)methyl)acrylate (2g)

**2g** Colorless oil, 75% yields, 2.24g. ¹H NMR (500 MHz, CDCl₃): δ 7.31 – 7.27 (m, 1H), 7.09 – 7.08 (m, 1H), 6.97 – 6.94 (m, 1H), 6.73 (s, 1H), 6.44 (s, 1H), 6.07 – 6.03 (m, 1H), 3.73 (s, 3H), 1.47 (s, 9H). ¹³C NMR (126 MHz, CDCl₃): δ 165.3, 152.3, 140.5, 139.4, 127.5, 126.9, 126.6, 125.9, 83.1, 71.0, 52.3, 27.9.

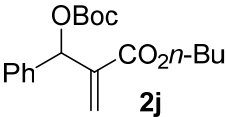
Ethyl 2-(((tert-butoxycarbonyl)oxy)(phenyl)methyl)acrylate (2h)

**2h** Colorless oil, 80% yields, 2.45g. ¹H NMR (500 MHz, CDCl₃): δ 7.41 – 7.29 (m, 5H), 6.49 – 6.47 (m, 1H), 6.40 (t, *J* = 1.0 Hz, 1H), 5.90 – 5.88 (m, 1H), 4.22 – 4.10 (m, 2H), 1.46 (s, 9H), 1.22 (t, *J* = 7.1 Hz, 3H). ¹³C NMR (126 MHz, CDCl₃): δ 165.1, 152.6, 140.0, 137.7, 128.6, 128.5, 127.9, 125.7, 82.8, 76.0, 61.1, 27.9, 14.1.

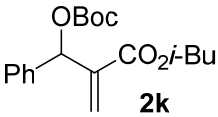
Benzyl 2-(((tert-butoxycarbonyl)oxy)(phenyl)methyl)acrylate (2i)

**2i** Colorless oil, 67% yields, 2.47g. ¹H NMR (600 MHz, CDCl₃): δ 7.41 – 7.28 (m, 8H), 7.25 – 7.20 (m, 2H), 6.49 (s, 1H), 6.46 (s, 1H), 5.94 (s, 1H), 5.20 – 5.08 (m, 2H), 1.44 (s, 9H). ¹³C NMR (151 MHz, CDCl₃): δ 164.9, 152.5, 139.7, 137.6, 135.6, 128.64, 128.61, 128.3, 128.2, 127.9, 127.1, 126.3, 82.8, 76.0, 66.9, 27.9.

Butyl 2-(((tert-butoxycarbonyl)oxy)(phenyl)methyl)acrylate (2j)

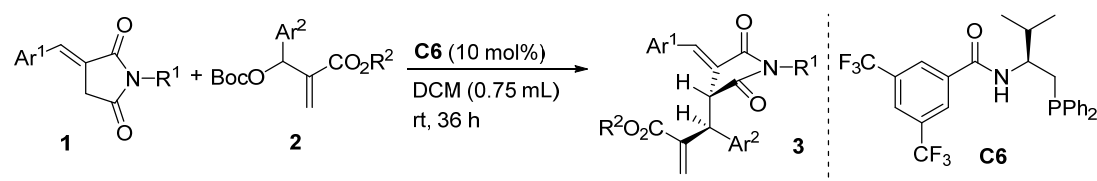
**2j** Colorless oil, 71% yields, 2.37g. ¹H NMR (500 MHz, CDCl₃): δ 7.41 – 7.37 (m, 2H), 7.35 – 7.29 (m, 3H), 6.47 (s, 1H), 6.41 (t, *J* = 1.1 Hz, 1H), 5.91 – 5.85 (m, 1H), 4.14 – 4.07 (m, 2H), 1.59 – 1.55 (m, 2H), 1.46 (s, 9H), 1.29 – 1.25 (m, 2H), 0.88 (t, *J* = 7.4 Hz, 3H). ¹³C NMR (126 MHz, CDCl₃): δ 165.2, 152.5, 139.9, 137.7, 128.6, 128.1, 127.9, 125.8, 82.8, 76.0, 65.0, 30.6, 27.9, 19.2, 13.8.

Isobutyl 2-(((tert-butoxycarbonyl)oxy)(phenyl)methyl)acrylate (2k)

**2k** Colorless oil, 76% yields, 2.54g. ¹H NMR (500 MHz, CDCl₃): δ

7.42 – 7.29 (m, 5H), 6.48 (s, 1H), 6.43 (t, $J = 1.0$ Hz, 1H), 5.89 (t, $J = 1.3$ Hz, 1H), 3.94 – 3.83 (m, 2H), 1.95 – 1.83 (m, 1H), 1.46 (s, 9H), 0.86 (dd, $J = 6.8, 2.4$ Hz, 6H).
 ^{13}C NMR (126 MHz, CDCl_3): δ 165.2, 152.6, 139.9, 137.7, 128.6 (2C), 127.9, 126.0, 82.7, 76.0, 71.2, 27.9, 19.2.

III. Chiral phosphine catalyzed allylic alkylations



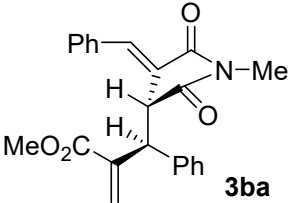
To a solution of DCM (0.75 mL) were added *N*-protected succinimide substrate **1** (1 equiv, 0.05 mmol), MBH carbonate **2** (1.2 equiv, 0.06 mmol) and catalyst **C6** (2.5 mg, 10 mol%, 0.005 mmol). The reaction mixture was stirred at r.t. for 36 h. Then the mixture was purified by preparative TLC (eluent: PE/EA = 2:1) to yield the desired product **3**.

Methyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-2,5-dioxo-1-phenylpyrrolidin-3-yl)(phenyl) methyl)acrylate (**3aa**)

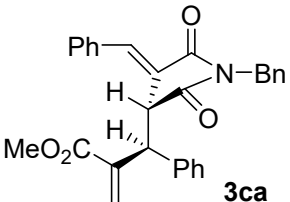
pale yellow solid, 96% yield (21.0 mg, 11:1 dr), mp: 160.6 – 161.6 °C. $[\alpha]_D^{25}$: +110 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IF-3 column; 20% *i*PrOH in hexanes; 1.0 mL/min; retention times: 12.52 min (major), 14.788 min (minor). 81% ee. ¹H NMR (500 MHz, CDCl₃): δ 7.74 (d, *J* = 2.2 Hz, 1H), 7.73 – 7.68 (m, 2H), 7.59 – 7.49 (m, 3H), 7.43 – 7.40 (m, 2H), 7.38 – 7.36 (m, 1H), 7.28 – 7.21 (m, 3H), 6.97 – 6.90 (m, 4H), 6.63 (d, *J* = 1.2 Hz, 1H), 6.29 (d, *J* = 1.8 Hz, 1H), 4.87 (t, *J* = 2.7 Hz, 1H), 4.66 – 4.61 (m, 1H), 3.75 (s, 3H). ¹³C NMR (126 MHz, CDCl₃): δ 174.7, 169.4, 167.3, 140.0, 136.3, 136.0, 133.5, 131.8, 130.63, 130.62, 129.4, 129.1, 129.0, 128.73, 128.71, 128.65, 128.1, 127.7, 126.5, 52.3, 46.5, 46.5. HRMS (CI⁺) Calcd for C₂₈H₂₄NO₄⁺ [M + H]⁺: 438.1705, Found: 438.1700.

Methyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-methyl-2,5-dioxopyrrolidin-3-yl)(phenyl) methyl)acrylate (**3ba**)

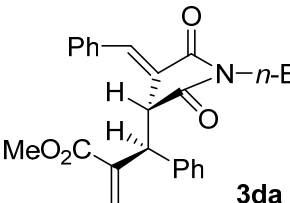
white solid, 91% yield (17.1 mg, 5:1 dr), mp: 74.0 – 76.0 °C. $[\alpha]_D^{25}$: +240 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 18.694 min (minor), 19.832 min (major). 81% ee. ¹H NMR (400 MHz, CDCl₃): δ 7.63 (dd, *J* = 7.1, 1.8 Hz, 2H), 7.56


3ba (d, $J = 2.1$ Hz, 1H), 7.54 – 7.27 (m, 5H), 7.21 – 7.09 (m, 3H), 6.80 – 6.71 (m, 2H), 6.55 (d, $J = 1.4$ Hz, 1H), 6.10 (d, $J = 1.8$ Hz, 1H), 4.70 (m, 1H), 4.52 – 4.46 (m, 1H), 3.74 (s, 3H), 2.82 (s, 3H). ^{13}C NMR (101 MHz, CDCl_3): δ 175.9, 170.4, 167.4, 140.0, 136.2, 134.9, 133.6, 130.5, 129.3, 129.0, 128.7, 128.5, 128.4, 127.9, 127.8, 52.3, 46.24, 46.18, 24.6. HRMS (CI⁺) Calcd for $\text{C}_{23}\text{H}_{22}\text{NO}_4^+$ [$\text{M} + \text{H}$]⁺: 376.1549, Found: 376.1540.

Methyl 2-((S)-((R)-1-benzyl-4-((E)-benzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl) methyl)acrylate (3ca)

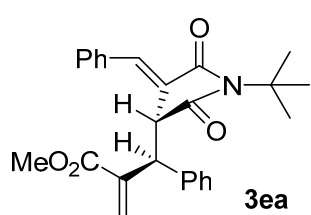

3ca white solid, 96% yield (21.7 mg, 11:1 dr), mp: 75.6 – 77.0 °C. $[\alpha]_{\text{D}}^{25}$: +158 (c = 1.0, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 13.358 min (minor), 14.456 min (major). 92% ee. ^1H NMR (500 MHz, CDCl_3): δ 7.57 – 7.52 (m, 2H), 7.48 (d, $J = 2.3$ Hz, 1H), 7.46 – 7.36 (m, 3H), 7.21 – 7.18 (m, 5H), 7.00 – 6.94 (m, 1H), 6.84 – 6.77 (m, 2H), 6.50 – 6.44 (m, 2H), 6.41 (d, $J = 1.6$ Hz, 1H), 5.78 (d, $J = 1.8$ Hz, 1H), 4.67 (dd, $J = 4.0, 2.3$ Hz, 1H), 4.50 (s, 2H), 4.44 – 4.40 (m, 1H), 3.68 (s, 3H). ^{13}C NMR (126 MHz, CDCl_3): δ 175.5, 170.1, 167.5, 140.2, 135.9, 133.7, 130.4, 130.3, 129.24, 129.23, 128.8, 128.7, 128.5, 128.4, 127.9, 127.7, 127.6, 52.3, 45.8, 45.6, 42.5. HRMS (CI⁺) Calcd for $\text{C}_{29}\text{H}_{26}\text{NO}_4^+$ [$\text{M} + \text{H}$]⁺: 452.1862, Found: 452.1857.

Methyl 2-((S)-((R)-4-((E)-benzylidene)-1-butyl-2,5-dioxopyrrolidin-3-yl)(phenyl) methyl)acrylate (3da)


3da white solid, 91% yield (19.0 mg, 11:1 dr), mp: 71.6 – 73.0 °C. $[\alpha]_{\text{D}}^{25}$: +315 (c = 1.0, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 13.312 min (minor), 14.771 min (major). 82% ee. ^1H NMR (400 MHz, CDCl_3): δ 7.63 – 7.55 (m, 3H), 7.52 – 7.42 (m, 3H), 7.19 – 7.07 (m, 3H), 6.84 – 6.76 (m, 2H), 6.59 (d, $J = 1.2$

Hz, 1H), 6.23 (d, $J = 1.7$ Hz, 1H), 4.63 (t, $J = 2.7$ Hz, 1H), 4.52 – 4.50 (m, 1H), 3.70 (s, 3H), 3.35 (td, $J = 7.1, 4.0$ Hz, 2H), 1.21 (dt, $J = 14.3, 7.8$ Hz, 2H), 1.16 – 1.02 (m, 2H), 0.83 (t, $J = 7.2$ Hz, 3H). ^{13}C NMR (126 MHz, CDCl_3): δ 175.7, 170.4, 167.3, 140.4, 136.3, 134.8, 133.6, 130.5, 130.3, 129.3, 128.9, 128.49, 128.47, 128.0, 127.9, 52.3, 46.2, 45.9, 38.6, 29.7, 20.2, 13.8. HRMS (CI⁺) Calcd for $\text{C}_{26}\text{H}_{28}\text{NO}_4^+ [\text{M} + \text{H}]^+$: 418.2018, Found: 418.2008.

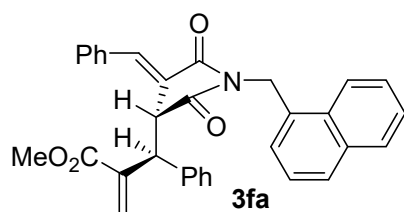
Methyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ea)



white solid, 94% yield (19.6 mg, 14:1 dr), mp: 63.2 – 64.7 °C. $[\alpha]_{\text{D}}^{25}$: +310 ($c = 1.0$, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% $i\text{PrOH}$ in hexanes; 1.0 mL/min; retention times: 7.653 min (minor),

8.803 min (major). 92% ee. ^1H NMR (400 MHz, CDCl_3): δ 7.62 – 7.39 (m, 6H), 7.19 – 7.17 (m, 3H), 6.93 – 6.83 (m, 2H), 6.59 (t, $J = 0.9$ Hz, 1H), 6.29 (d, $J = 1.6$ Hz, 1H), 4.49 (t, $J = 2.6$ Hz, 1H), 4.47 – 4.45 (m, 1H), 3.68 (s, 3H), 1.35 (s, 9H). ^{13}C NMR (101 MHz, CDCl_3): δ 176.6, 171.5, 167.3, 140.6, 136.4, 133.8, 133.7, 130.4, 130.1, 130.0, 129.2, 129.0, 128.51, 128.47, 128.3, 127.8, 58.5, 52.3, 46.5, 46.4, 28.3. HRMS (CI⁺) Calcd for $\text{C}_{26}\text{H}_{28}\text{NO}_4^+ [\text{M} + \text{H}]^+$: 418.2018, Found: 418.2013.

Methyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(naphthalen-1-ylmethyl)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3fa)

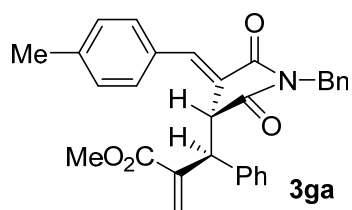


white solid, 91% yield (22.8 mg, 13:1 dr), mp: 97.6 – 99.8 °C. $[\alpha]_{\text{D}}^{25}$: +120 ($c = 1.0$, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% $i\text{PrOH}$ in hexanes; 1.0 mL/min;

retention times: 23.246 min (minor), 24.53 min (major). 81% ee. ^1H NMR (500 MHz, CDCl_3): δ 8.33 – 8.21 (m, 1H), 7.87 – 7.85 (m, 1H), 7.80 – 7.78 (m, 1H), 7.67 – 7.58 (m, 3H), 7.52 – 7.47 (m, 3H), 7.47 – 7.42 (m, 1H), 7.38 – 7.32 (m, 2H), 6.82 (tt, $J = 7.2, 1.2$ Hz, 1H), 6.61 (t, $J = 7.8$ Hz, 2H), 6.53 – 6.45 (m, 3H), 5.95 (d, $J = 1.8$ Hz, 1H), 5.04 (q, $J = 12.4$ Hz, 2H), 4.72 (t, $J = 3.0$ Hz, 1H), 4.49 – 4.48 (m, 1H), 3.72 (s,

3H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.7, 170.2, 167.4, 140.1, 135.7, 135.6, 133.9, 133.6, 131.6, 130.52, 130.47, 130.4, 129.3, 128.72, 128.66, 128.63, 128.56, 128.4, 128.2, 127.6, 127.5, 126.6, 125.9, 125.4, 124.0, 52.3, 46.1, 45.7, 40.4. **HRMS** (CI⁺) Calcd for C₃₃H₂₈NO₄⁺ [M + H]⁺: 502.2018, Found: 502.2012.

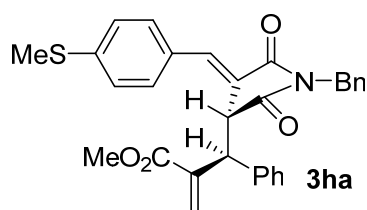
Methyl 2-((*S*)-((*R*)-1-benzyl-4-((*E*)-4-methylbenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl) acrylate (3ga)



white solid, 86% yield (20.0 mg, 10:1 dr), mp: 76.7 – 77.8 °C. [α]_D²⁵: +152 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 18.464

min (minor), 23.692 min (major). 90% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.49 – 7.41 (m, 3H), 7.23 (d, *J* = 7.9 Hz, 2H), 7.20 - 7.16 (m, 5H), 6.97 (t, *J* = 7.4 Hz, 1H), 6.81 (t, *J* = 7.8 Hz, 2H), 6.49 (dd, *J* = 8.2, 1.3 Hz, 2H), 6.41 (d, *J* = 1.4 Hz, 1H), 5.82 (d, *J* = 1.8 Hz, 1H), 4.63 (dd, *J* = 4.0, 2.3 Hz, 1H), 4.48 (s, 2H), 4.47 - 4.46 (m, 1H), 3.69 (s, 3H), 2.34 (s, 3H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.6, 170.3, 167.6, 140.9, 140.2, 136.0, 135.5, 130.8, 130.6, 130.4, 130.0, 129.2, 128.8, 128.7, 128.4, 128.3, 127.9, 127.7, 126.5, 52.3, 45.9, 45.6, 42.5, 21.7. **HRMS** (CI⁺) Calcd for C₃₀H₂₈NO₄⁺ [M + H]⁺: 466.2018, Found: 466.2008.

Methyl 2-((*S*)-((*R*)-1-benzyl-4-((*E*)-4-(methylthio)benzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ha)



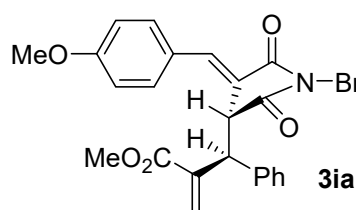
white solid, 93% yield (23.1 mg, 11:1 dr), mp: 91.6 – 92.3 °C. [α]_D²⁵: +165 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 27.053

min (minor), 29.227 min (major). 84% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.54 (d, *J* = 8.5 Hz, 2H), 7.46 (d, *J* = 2.1 Hz, 1H), 7.31 (d, *J* = 8.5 Hz, 2H), 7.25 (d, *J* = 3.7 Hz, 5H), 7.06 – 6.99 (m, 1H), 6.87 (t, *J* = 7.8 Hz, 2H), 6.55 (dd, *J* = 8.1, 1.4 Hz, 2H), 6.47 (d, *J* = 1.5 Hz, 1H), 5.83 (d, *J* = 1.9 Hz, 1H), 4.69 (dd, *J* = 4.1, 2.2 Hz, 1H), 4.55 (s, 2H), 4.51 (dd, *J* = 4.0, 1.9 Hz, 1H), 3.77 (s, 3H), 2.53 (s, 3H). **¹³C NMR** (126 MHz,

CDCl₃): δ 175.5, 170.2, 167.6, 142.4, 140.1, 135.9, 135.5, 134.9, 130.9, 129.9, 129.3, 128.8, 128.7, 128.5, 128.4, 127.9, 127.8, 126.4, 126.0, 52.4, 45.8, 45.6, 42.5, 15.1.

HRMS (CI⁺) Calcd for C₃₀H₂₈NO₄S⁺ [M + H]⁺: 498.1739, Found: 498.1731.

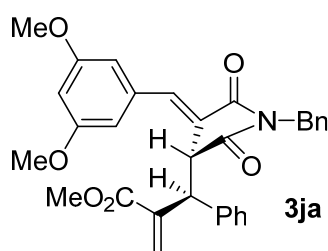
Methyl 2-((*S*)-((*R*)-1-benzyl-4-((*E*)-4-methoxybenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ia)



white solid, 92% yield (22.1 mg, 9:1 dr), mp: 102.9 – 103.6 °C. [α]_D²⁵: +168 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 35.278

min (minor), 37.542 min (major). 91% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.59 (d, *J* = 8.8 Hz, 2H), 7.50 (d, *J* = 2.2 Hz, 1H), 7.29 – 7.24 (m, 5H), 7.07 – 6.97 (m, 3H), 6.89 (t, *J* = 7.8 Hz, 2H), 6.63 – 6.56 (m, 2H), 6.50 (d, *J* = 1.4 Hz, 1H), 5.93 (d, *J* = 1.8 Hz, 1H), 4.68 – 4.64 (m, 1H), 4.57 – 4.55 (m, 1H), 4.54 (s, 2H), 3.88 (s, 3H), 3.76 (s, 3H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.6, 170.4, 167.6, 161.3, 140.3, 135.9, 135.6, 135.2, 132.5, 129.2, 128.8, 128.7, 128.40, 128.36, 127.8, 127.7, 126.2, 124.9, 114.7, 55.6, 52.3, 45.9, 45.6, 42.4. **HRMS** (CI⁺) Calcd for C₃₀H₂₈NO₅⁺ [M + H]⁺: 482.1967, Found: 482.1958.

Methyl 2-((*S*)-((*R*)-1-benzyl-4-((*E*)-3,5-dimethoxybenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ja)

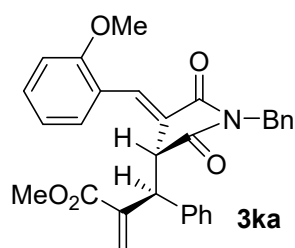


white solid, 90% yield (23.0 mg, 11:1 dr), mp: 84.5 – 86.7 °C. [α]_D²⁵: +101 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IF-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 18.95 min (minor), 20.149 min (major). 98% ee. **¹H NMR** (500

MHz, CDCl₃): δ 7.47 (d, *J* = 2.3 Hz, 1H), 7.29 – 7.26 (m, 5H), 7.05 (t, *J* = 7.4 Hz, 1H), 6.90 (t, *J* = 7.6 Hz, 2H), 6.72 (d, *J* = 2.3 Hz, 2H), 6.61 – 6.56 (m, 2H), 6.55 (t, *J* = 2.3 Hz, 1H), 6.47 (d, *J* = 1.5 Hz, 1H), 5.84 (d, *J* = 1.9 Hz, 1H), 4.77 (dd, *J* = 4.2, 2.3 Hz, 1H), 4.56 (s, 3H), 3.85 (s, 6H), 3.74 (s, 3H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.3, 170.0, 167.3, 161.1, 140.4, 135.9, 135.5, 135.4, 129.1, 128.7, 128.6, 128.3,

128.2, 127.9, 127.8, 127.6, 107.9, 103.0, 55.6, 52.2, 45.9, 45.6, 42.4. **HRMS** (CI⁺) Calcd for C₃₁H₃₀NO₆⁺ [M + H]⁺: 512.2073, Found: 512.2065.

Methyl 2-((S)-((R)-1-benzyl-4-((E)-2-methoxybenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ka)



white solid, 94% yield (22.6 mg, 3:1 dr), mp: 59.9 – 62.3 °C.

[α]_D²⁵: +40 (c = 1.0, CHCl₃). HPLC analysis of the product:

Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes;

1.0 mL/min; retention times: 25.547 min (minor), 31.706 min

(major). 28% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.86 (d, *J* =

2.4 Hz, 1H), 7.57 – 7.55 (m, 1H), 7.44 – 7.40 (m, 1H), 7.25 – 7.14 (m, 5H), 7.08 –

7.02 (m, 2H), 6.97 (d, *J* = 8.3 Hz, 1H), 6.88 (t, *J* = 7.7 Hz, 2H), 6.55 (d, *J* = 7.8 Hz,

2H), 6.44 (d, *J* = 1.3 Hz, 1H), 5.89 (d, *J* = 1.8 Hz, 1H), 4.69 – 4.66 (m, 1H), 4.58 (d, *J*

= 4.0 Hz, 2H), 4.33 – 4.29 (m, 1H), 3.88 (s, 3H), 3.69 (s, 3H). **¹³C NMR** (126 MHz,

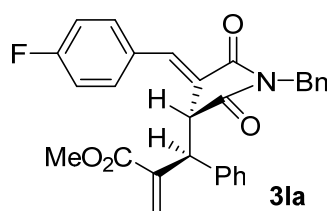
CDCl₃): δ 175.6, 170.0, 167.3, 158.3, 140.6, 136.1, 135.5, 131.7, 131.5, 130.0, 129.1,

129.0, 128.7, 128.5, 128.2, 127.9, 127.7, 127.4, 122.7, 120.7, 111.0, 55.6, 52.1, 46.2,

45.4, 42.3. **HRMS** (CI⁺) Calcd for C₃₀H₂₈NO₅⁺ [M + H]⁺: 482.1967, Found:

482.1958.

Methyl 2-((S)-((R)-1-benzyl-4-((E)-4-fluorobenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3la)



white solid, 92% yield (21.6 mg, 9:1 dr), mp: 62.8 –

63.5 °C. [α]_D²⁵: +102 (c = 1.0, CHCl₃). HPLC analysis of

the product: Daicel CHIRALPAK IE-3 column; 10%

*i*PrOH in hexanes; 1.0 mL/min; retention times: 13.027

min (minor), 14.371 min (major). 76% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.67 – 7.60

(m, 2H), 7.50 (d, *J* = 2.4 Hz, 1H), 7.28 – 7.27 (m, 4H), 7.23 – 7.15 (m, 2H), 7.07 –

7.01 (m, 1H), 6.88 (t, *J* = 7.8 Hz, 2H), 6.53 (dt, *J* = 8.3, 1.4 Hz, 2H), 6.47 (d, *J* = 1.5

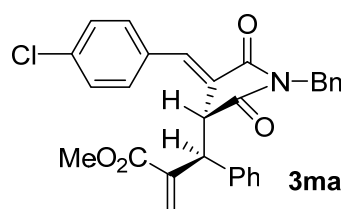
Hz, 1H), 5.79 (d, *J* = 1.8 Hz, 1H), 4.70 (dd, *J* = 4.2, 2.3 Hz, 1H), 4.58 (s, 2H), 4.47 –

4.44 (m, 1H), 3.78 (s, 3H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.3, 169.9, 167.5, 163.6

(d, *J* = 253.1 Hz), 139.9, 135.6, 135.3, 134.1, 132.4 (d, *J* = 8.6 Hz), 129.79, 129.76,

129.2, 129.1, 128.64, 128.62, 128.41, 128.36, 127.9, 127.7, 127.1 (d, $J = 2.0$ Hz), 116.4 (d, $J = 21.9$ Hz), 52.3, 45.5, 45.4, 42.4. ^{19}F NMR (376 MHz, CDCl_3): δ -108.8. HRMS (CI $^+$) Calcd for $\text{C}_{29}\text{H}_{25}\text{FNO}_4^+$ $[\text{M} + \text{H}]^+$: 470.1768, Found: 470.1757.

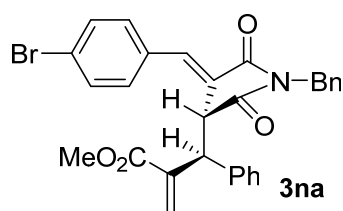
Methyl 2-((*S*)-((*R*)-1-benzyl-4-((*E*)-4-chlorobenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ma)



white solid, 93% yield (22.6 mg, 13:1 dr), mp: 89.4 – 92.0 °C. $[\alpha]_{\text{D}}^{25}$: +85 ($c = 1.0$, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% i PrOH in hexanes; 1.0 mL/min; retention times: 13.149

min (minor), 14.72 min (major). 78% ee. ^1H NMR (500 MHz, CDCl_3): δ 7.60 – 7.55 (m, 2H), 7.50 – 7.45 (m, 3H), 7.29 (s, 5H), 7.05 (tt, $J = 7.4, 1.2$ Hz, 1H), 6.87 (t, $J = 7.8$ Hz, 2H), 6.54 – 6.49 (m, 2H), 6.46 (d, $J = 1.7$ Hz, 1H), 5.75 (d, $J = 1.9$ Hz, 1H), 4.76 – 4.68 (m, 1H), 4.59 (d, $J = 1.6$ Hz, 2H), 4.45 – 4.43 (m, 1H), 3.79 (s, 3H). ^{13}C NMR (126 MHz, CDCl_3): δ 175.3, 169.9, 167.6, 139.9, 136.4, 135.7, 135.4, 134.1, 132.1, 131.6, 129.6, 129.3, 128.8, 128.7, 128.54, 128.50, 128.1, 128.0, 127.8, 52.4, 45.63, 45.58, 42.6. HRMS (CI $^+$) Calcd for $\text{C}_{29}\text{H}_{25}\text{ClNO}_4^+$ $[\text{M} + \text{H}]^+$: 486.1472, Found: 486.1464.

Methyl 2-((*S*)-((*R*)-1-benzyl-4-((*E*)-4-bromobenzylidene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3na)

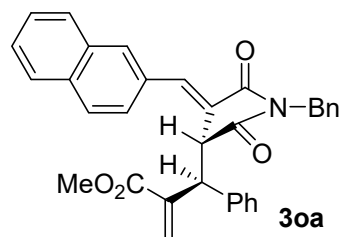


white solid, 92% yield (24.4 mg, 11:1 dr), mp: 90.4 – 93.4 °C. $[\alpha]_{\text{D}}^{25}$: +98 ($c = 1.0$, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% i PrOH in hexanes; 1.0 mL/min; retention times: 13.869

min (minor), 15.455 min (major). 79% ee. ^1H NMR (500 MHz, CDCl_3): δ 7.68 – 7.62 (m, 2H), 7.54 – 7.48 (m, 2H), 7.45 (d, $J = 2.3$ Hz, 1H), 7.29 – 7.29 (m, 4H), 7.11 – 7.00 (m, 1H), 6.90 – 6.81 (m, 2H), 6.54 – 6.49 (m, 2H), 6.46 (d, $J = 1.5$ Hz, 1H), 5.74 (d, $J = 1.9$ Hz, 1H), 4.74 – 4.69 (m, 1H), 4.59 (d, $J = 1.9$ Hz, 2H), 4.46 – 4.41 (m, 1H), 3.79 (s, 3H). ^{13}C NMR (126 MHz, CDCl_3): δ 175.3, 169.9, 167.6, 139.9, 135.7, 135.4, 134.1, 132.55, 132.52, 131.8, 129.4, 128.8, 128.7, 128.54, 128.50, 128.3,

128.0, 127.8, 124.8, 52.4, 45.57, 45.56, 42.6. **HRMS** (CI⁺) Calcd for C₂₉H₂₅BrNO₄⁺ [M + H]⁺: 530.0967, Found: 530.0956.

Methyl 2-((S)-((R,E)-1-benzyl-4-(naphthalen-2-ylmethylene)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3oa)



white solid, 93% yield (23.3 mg, 11:1 dr), mp: 81.3 –

82.1 °C. [α]_D²⁵: +158 (c = 1.0, CHCl₃). HPLC analysis of

the product: Daicel CHIRALPAK IE-3 column; 10%

ⁱPrOH in hexanes; 1.0 mL/min; retention times: 20.734

min (minor), 24.482 min (major). 85% ee. **¹H NMR** (500 MHz, CDCl₃): δ 8.20 (s,

1H), 7.99 – 7.94 (m, 2H), 7.91 – 7.86 (m, 1H), 7.73 – 7.66 (m, 2H), 7.61 – 7.52 (m,

2H), 7.29 (s, 5H), 7.04 (tt, *J* = 7.2, 1.2 Hz, 1H), 6.86 (t, *J* = 7.8 Hz, 2H), 6.56 – 6.44

(m, 3H), 5.80 (d, *J* = 1.9 Hz, 1H), 4.89 (dd, *J* = 4.1, 2.3 Hz, 1H), 4.60 (d, *J* = 5.7 Hz,

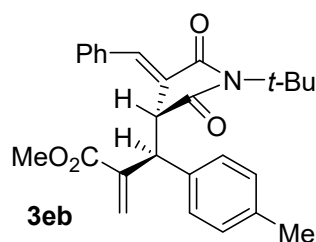
3H), 3.76 (s, 3H). **¹³C NMR** (126 MHz, CDCl₃): δ 175.6, 170.2, 167.6, 140.2, 135.8,

135.54, 135.51, 133.9, 133.4, 131.4, 131.1, 129.3, 129.00, 128.96, 128.8, 128.7,

128.5, 128.4, 127.95, 127.87, 127.8, 127.7, 127.6, 127.0, 126.8, 52.3, 46.0, 45.7, 42.6.

HRMS (CI⁺) Calcd for C₃₃H₂₈NO₄⁺ [M + H]⁺: 502.2018, Found: 502.2007.

Methyl 2-((S)-((R)-4-((E)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(p-tolyl)methyl)acrylate (3eb)



white solid, 91% yield (19.6 mg, 15:1 dr), mp: 57.5 –

59.1 °C. [α]_D²⁵: +323 (c = 1.0, CHCl₃). HPLC analysis of

the product: Daicel CHIRALPAK IE-3 column; 1% ⁱPrOH

in hexanes; 1.0 mL/min; retention times: 9.767 min

(minor), 17.787 min (major). 92% ee. **¹H NMR** (500 MHz,

CDCl₃): δ 7.60 – 7.55 (m, 2H), 7.51 (d, *J* = 2.3 Hz, 1H), 7.49 – 7.39 (m, 3H), 6.97 (d,

J = 7.8 Hz, 2H), 6.77 – 6.71 (m, 2H), 6.55 (d, *J* = 1.8 Hz, 1H), 6.21 (d, *J* = 2.1 Hz,

1H), 4.50 – 4.47 (m, 1H), 4.44 – 4.41 (m, 1H), 3.70 (s, 3H), 2.25 (s, 3H), 1.37 (s, 9H).

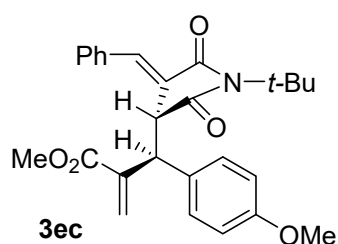
¹³C NMR (126 MHz, CDCl₃): δ 176.7, 171.6, 167.4, 140.7, 137.4, 133.9, 133.6,

133.3, 130.4, 130.0, 129.20, 129.18, 128.9, 128.5, 128.1, 58.5, 52.2, 46.4, 46.1, 28.3,

21.1. **HRMS** (CI⁺) Calcd for C₂₇H₃₀NO₄⁺ [M + H]⁺: 432.2175, Found: 432.2164.

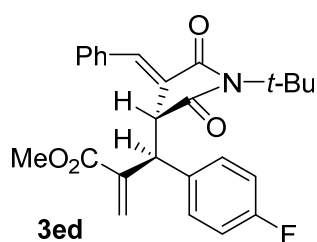
Methyl 2-((S)-((R)-4-((E)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(4-

methoxyphenyl)methyl)acrylate (3ec)



white solid, 94% yield (21.0 mg, 10:1 dr), mp: 58.8 – 60.1 °C. $[\alpha]_D^{25}$: +287 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% ⁱPrOH in hexanes; 1.0 mL/min; retention times: 9.515 min (minor), 11.816 min (major). 93% ee. ¹H NMR (500 MHz, CDCl₃): δ 7.59 – 7.56 (m, 2H), 7.53 – 7.39 (m, 4H), 6.81 – 6.75 (m, 2H), 6.72 – 6.67 (m, 2H), 6.55 (s, 1H), 6.21 (d, *J* = 2.0 Hz, 1H), 4.50 – 4.46 (m, 1H), 4.43 – 4.39 (m, 1H), 3.73 (s, 3H), 3.70 (s, 3H), 1.38 (s, 9H). ¹³C NMR (101 MHz, CDCl₃): δ 176.7, 171.6, 167.4, 159.2, 140.9, 133.9, 133.7, 130.4, 130.09, 130.08, 129.2, 128.6, 128.4, 128.0, 113.9, 58.5, 55.3, 52.3, 46.5, 45.7, 28.4. HRMS (CI+) Calcd for C₂₇H₃₀NO₅⁺ [M + H]⁺: 448.2124, Found: 448.2114.

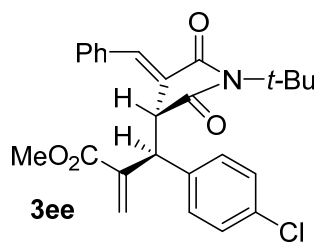
Methyl 2-((R)-((S)-4-((E)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(4-fluorophenyl)methyl)acrylate (3ed)



white solid, 90% yield (19.6 mg, 10:1 dr), mp: 64.7 – 68.1 °C. $[\alpha]_D^{25}$: +246 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% ⁱPrOH in hexanes; 1.0 mL/min; retention times: 6.348 min (minor), 7.008 min (major). 94% ee. ¹H NMR (400 MHz, CDCl₃): δ 7.59 – 7.52 (m, 3H), 7.51 – 7.38 (m, 3H), 6.90 – 6.83 (m, 4H), 6.59 (d, *J* = 1.1 Hz, 1H), 6.29 (d, *J* = 1.8 Hz, 1H), 4.48 (t, *J* = 2.5 Hz, 1H), 4.45 – 4.43 (m, 1H), 3.68 (s, 3H), 1.37 (s, 9H). ¹³C NMR (101 MHz, CDCl₃): δ 176.4, 171.3, 167.1, 162.4 (d, *J* = 247.7 Hz), 140.5, 133.9, 133.7, 132.2 (d, *J* = 3.3 Hz), 130.65, 130.57, 130.4, 130.2, 129.3, 128.3 (d, *J* = 7.9 Hz), 115.4 (d, *J* = 21.4 Hz), 58.6, 52.3, 46.3, 45.7, 28.3. ¹⁹F NMR (376 MHz, CDCl₃): δ -114.7. HRMS (CI+) Calcd for C₂₆H₂₇FNO₄⁺ [M + H]⁺: 436.1924, Found: 436.1914.

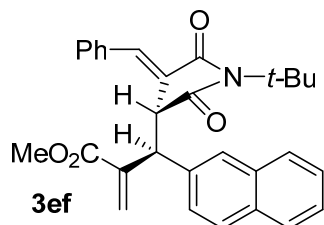
Methyl 2-((S)-((R)-4-((E)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(4-chlorophenyl)methyl)acrylate (3ee)

white solid, 92% yield (20.7 mg, 11:1 dr), mp: 72.7 – 73.8 °C. $[\alpha]_D^{25}$: +287 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10%



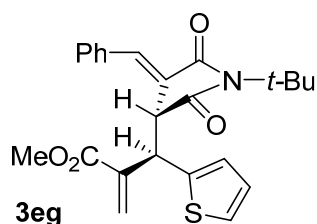
*i*PrOH in hexanes; 1.0 mL/min; retention times: 6.412 min (minor), 7.338 min (major). 93% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.56 – 7.53 (m, 3H), 7.50 – 7.41 (m, 4H), 7.16 (d, J = 8.4 Hz, 2H), 6.81 (d, J = 8.4 Hz, 2H), 6.60 (s, 1H), 6.26 (d, J = 1.7 Hz, 1H), 4.51 – 4.47 (m, 1H), 4.45 – 4.40 (m, 1H), 3.69 (s, 3H), 1.38 (s, 9H). **¹³C NMR** (126 MHz, CDCl₃): δ 176.2, 171.2, 167.0, 140.1, 135.0, 133.9, 133.7, 133.6, 130.3, 130.2, 130.1, 130.0, 129.2, 128.6, 128.0, 58.6, 52.2, 46.0, 45.7, 28.2. **HRMS** (CI⁺) Calcd for C₂₆H₂₇ClNO₄⁺ [M + H]⁺: 452.1629, Found: 452.1620.

Methyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(naphthalen-2-yl)methyl)acrylate (3ef)



white solid, 91% yield (21.0 mg, 14:1 dr), mp: 106.3 – 108.1 °C. [α]_D²⁵: +424 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% *i*PrOH in hexanes; 1.0 mL/min; retention times: 8.056 min (minor), 9.841 min (major). 95% ee. **¹H NMR** (400 MHz, CDCl₃): δ 7.78 – 7.72 (m, 1H), 7.71 – 7.33 (m, 11H), 6.99 (dd, J = 8.5, 1.8 Hz, 1H), 6.63 – 6.56 (m, 1H), 6.21 (d, J = 1.8 Hz, 1H), 4.65 – 4.63 (m, 1H), 4.62 – 4.61 (m, 1H), 3.71 (s, 3H), 1.27 (s, 9H). **¹³C NMR** (101 MHz, CDCl₃): δ 176.7, 171.3, 167.4, 140.7, 134.0, 133.9, 133.3, 132.9, 130.4, 130.1, 129.3, 128.9, 128.4, 128.3, 128.2, 128.0, 127.9, 127.7, 127.0, 126.3, 126.1, 58.5, 52.3, 46.5, 46.3, 28.2. **HRMS** (CI⁺) Calcd for C₃₀H₃₀NO₄⁺ [M + H]⁺: 468.2175, Found: 468.2166.

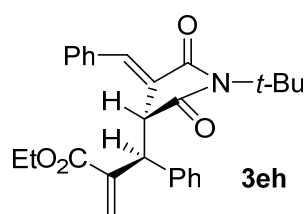
Methyl 2-((*R*)-((*R*)-4-((*E*)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(thiophen-2-yl)methyl)acrylate (3eg)



white solid, 91% yield (19.2 mg, >20:1 dr), mp: 76.2 – 79.3 °C. [α]_D²⁵: +190 (c = 1.0, CHCl₃). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 5% *i*PrOH in hexanes; 1.0 mL/min; retention times: 12.029 min (minor), 13.145 min (major). 92% ee. **¹H NMR** (500 MHz, CDCl₃): δ 7.61 – 7.54 (m, 3H), 7.50 – 7.43 (m, 2H), 7.45 – 7.39 (m, 1H), 7.10 (dd, J = 5.2, 1.2 Hz, 1H), 6.86 –

6.82 (m, 1H), 6.56 – 6.51 (m, 2H), 6.20 (d, $J = 1.7$ Hz, 1H), 4.78 – 4.72 (m, 1H), 4.54 – 4.46 (m, 1H), 3.75 (s, 3H), 1.48 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 176.3, 171.5, 167.2, 140.3, 138.5, 134.3, 133.8, 130.3, 129.7, 129.2, 128.5, 128.0, 126.9, 124.9, 58.7, 52.4, 46.4, 41.1, 28.4. HRMS (CI+) Calcd for $\text{C}_{24}\text{H}_{26}\text{NO}_4\text{S}^+$ [$\text{M} + \text{H}$] $^+$: 424.1583, Found: 424.1576.

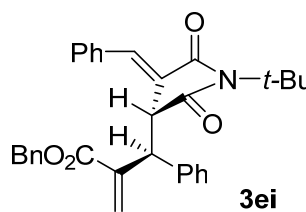
Ethyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3eh)



white solid, 88% yield (19.0 mg, 7:1 dr), mp: 63.2 – 64.1 °C. $[\alpha]_{\text{D}}^{25}$: +247 ($c = 1.0$, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% i PrOH in hexanes; 1.0 mL/min; retention times: 6.883 min (minor),

7.641 min (major). 91% ee. ^1H NMR (500 MHz, CDCl_3): δ 7.60 – 7.52 (m, 3H), 7.49 – 7.36 (m, 4H), 7.20 – 7.14 (m, 3H), 6.89 (dd, $J = 7.1, 2.5$ Hz, 2H), 6.61 (s, 1H), 6.31 (d, $J = 1.7$ Hz, 1H), 4.48 (t, $J = 2.4$ Hz, 1H), 4.45 (d, $J = 2.7$ Hz, 1H), 4.15 – 4.07 (m, 2H), 1.34 (s, 9H), 1.14 (t, $J = 7.1$ Hz, 3H). ^{13}C NMR (126 MHz, CDCl_3): δ 176.5, 171.4, 166.8, 140.9, 136.6, 133.9, 133.6, 130.4, 130.1, 129.2, 129.0, 128.6, 128.5, 128.0, 127.7, 61.0, 58.5, 46.5, 46.4, 28.3, 14.1. HRMS (CI+) Calcd for $\text{C}_{27}\text{H}_{30}\text{NO}_4^+$ [$\text{M} + \text{H}$] $^+$: 432.2175, Found: 432.2165.

Benzyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(tert-butyl)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ei)

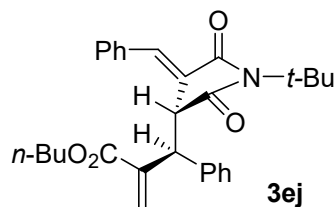


white solid, 94% yield (23.2 mg, 15:1 dr), mp: 65.5 – 68.7 °C. $[\alpha]_{\text{D}}^{25}$: +232 ($c = 1.0$, CHCl_3). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 10% i PrOH in hexanes; 1.0 mL/min; retention times: 8.376 min

(minor), 8.871 min (major). 92% ee. ^1H NMR (500 MHz, CDCl_3): δ 7.56 – 7.50 (m, 3H), 7.43 – 7.37 (m, 3H), 7.29 – 7.26 (m, 3H), 7.20 – 7.15 (m, 3H), 7.14 – 7.09 (m, 2H), 6.92 – 6.87 (m, 2H), 6.69 (s, 1H), 6.43 (d, $J = 1.7$ Hz, 1H), 5.14 – 5.03 (m, 2H), 4.49 – 4.42 (m, 2H), 1.32 (s, 9H). ^{13}C NMR (126 MHz, CDCl_3): δ 176.4, 171.4, 166.5, 140.6, 136.4, 135.9, 133.7, 133.6, 130.4, 130.1, 129.3, 129.0, 128.8, 128.7, 128.55, 128.53, 128.1, 127.9, 127.8, 66.7, 58.5, 46.6, 46.5, 28.2. HRMS (CI+) Calcd

for $C_{32}H_{32}NO_4^+$ $[M + H]^+$: 494.2331, Found: 494.2321.

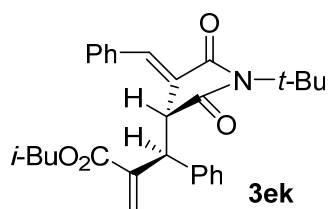
Butyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(*tert*-butyl)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ej)



white solid, 91% yield (20.9 mg, 7:1 dr), mp: 52.0 – 54.4 °C. $[\alpha]_D^{25}$: +280 ($c = 1.0$, $CHCl_3$). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 5% i PrOH in hexanes; 1.0 mL/min; retention times: 9.202 min

(minor), 10.105 min (major). 93% ee. 1H NMR (500 MHz, $CDCl_3$): δ 7.58 – 7.53 (m, 3H), 7.48 – 7.40 (m, 3H), 7.21 – 7.14 (m, 3H), 6.92 – 6.87 (m, 2H), 6.63 (s, 1H), 6.42 – 6.37 (m, 1H), 4.47 – 4.41 (m, 2H), 4.06 – 3.99 (m, 2H), 1.48 – 1.42 (m, 2H), 1.32 (s, 9H), 1.21 – 1.12 (m, 2H), 0.81 (t, $J = 7.4$ Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 176.5, 171.4, 166.8, 140.9, 136.6, 133.8, 133.6, 130.4, 130.1, 129.3, 129.0, 128.7, 128.5, 128.1, 127.7, 64.9, 58.5, 46.7, 46.5, 30.6, 28.3, 19.1, 13.8. HRMS (CI+) Calcd for $C_{29}H_{34}NO_4^+$ $[M + H]^+$: 460.2488, Found: 460.2480.

Isobutyl 2-((*S*)-((*R*)-4-((*E*)-benzylidene)-1-(*tert*-butyl)-2,5-dioxopyrrolidin-3-yl)(phenyl)methyl)acrylate (3ek)

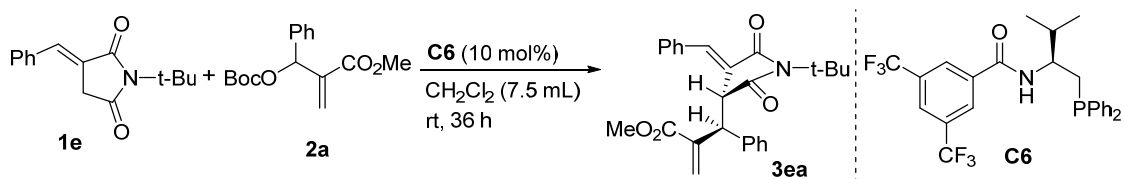


white solid, 91% yield (20.9 mg, 8:1 dr), mp: 53.1 – 55.5 °C. $[\alpha]_D^{25}$: +330 ($c = 1.0$, $CHCl_3$). HPLC analysis of the product: Daicel CHIRALPAK IE-3 column; 5% i PrOH in hexanes; 1.0 mL/min; retention times: 8.803 min

(minor), 9.844 min (major). 92% ee. 1H NMR (500 MHz, $CDCl_3$): δ 7.59 – 7.52 (m, 3H), 7.49 – 7.37 (m, 3H), 7.21 – 7.12 (m, 3H), 6.95 – 6.88 (m, 2H), 6.66 (d, $J = 1.0$ Hz, 1H), 6.44 (d, $J = 1.2$ Hz, 1H), 4.44 (d, $J = 1.7$ Hz, 2H), 3.84 – 3.71 (m, 2H), 1.76 (hept, $J = 13.3, 6.7$ Hz, 1H), 1.30 (s, 9H), 0.73 (d, $J = 6.7$ Hz, 6H). ^{13}C NMR (126 MHz, $CDCl_3$): δ 176.4, 171.4, 166.7, 140.9, 136.6, 133.8, 133.6, 130.4, 130.1, 129.3, 129.0, 128.9, 128.8, 128.5, 128.2, 127.7, 71.1, 58.5, 46.7, 28.2, 27.7, 19.0. HRMS (CI+) Calcd for $C_{29}H_{34}NO_4^+$ $[M + H]^+$: 460.2488, Found: 460.2481.

IV. Scale-up of the allylic alkylation

Scale -up reaction:



To a solution of DCM (7.5 mL) were added (*E*)-3-benzylidene-1-(tert-butyl)pyrrolidine-2,5-dione **1e** (122mg, 1equiv, 0.5 mmol), MBH carbonate **2a** (175mg, 1.2 equiv, 0.6 mmol) and catalyst **C6** (25mg, 10 mol%, 0.05 mmol). The reaction mixture was stirred at r.t. for 36h. Then the mixture was purified by silica gel column chromatography (eluent: PE/EA = 2:1) to yield the desired product **3ea** in 92% yield (196 mg, 94% ee, dr: 14:1).

V. Determination of the Stereochemistry

The absolute stereochemistry of products **3la** was determined by X-ray diffraction (CCDC 2244711 for **3la**). The stereochemistry of other products was assumed by analogy.

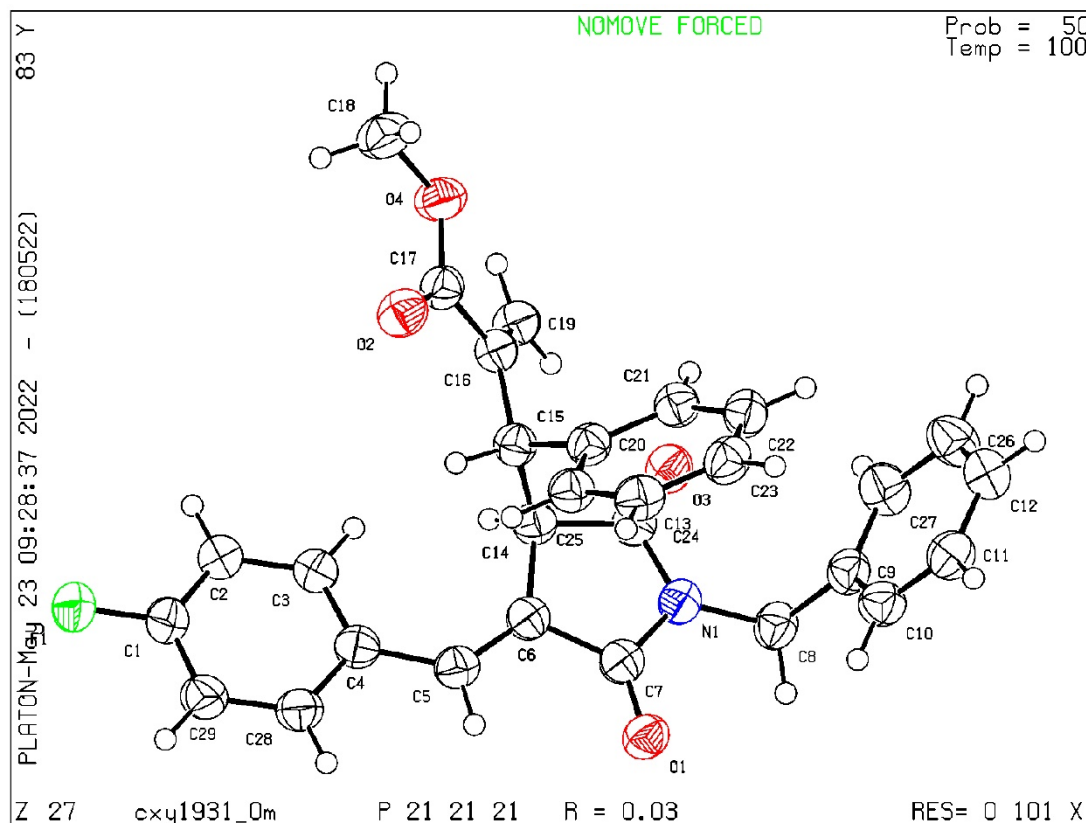
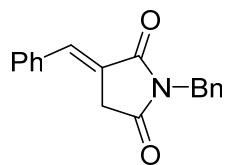


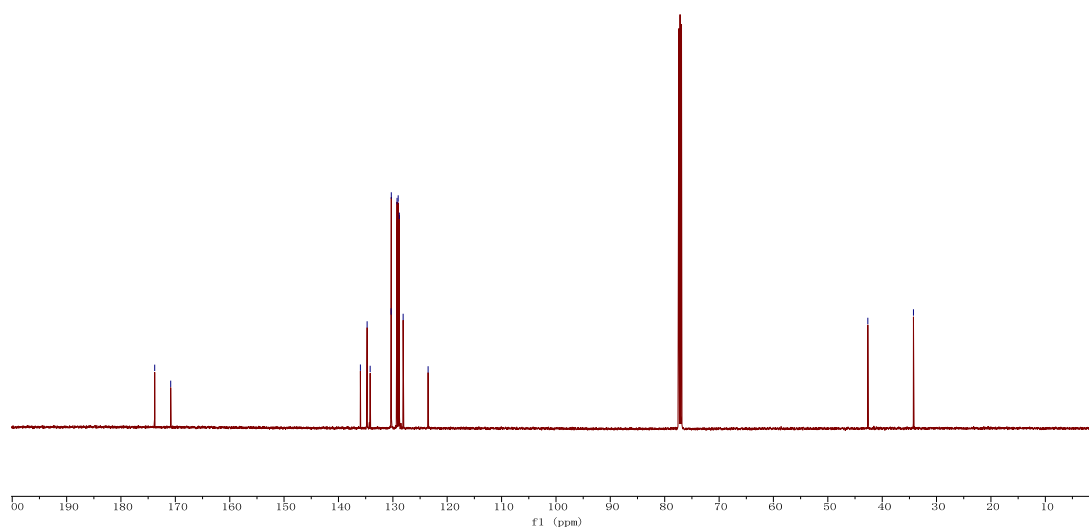
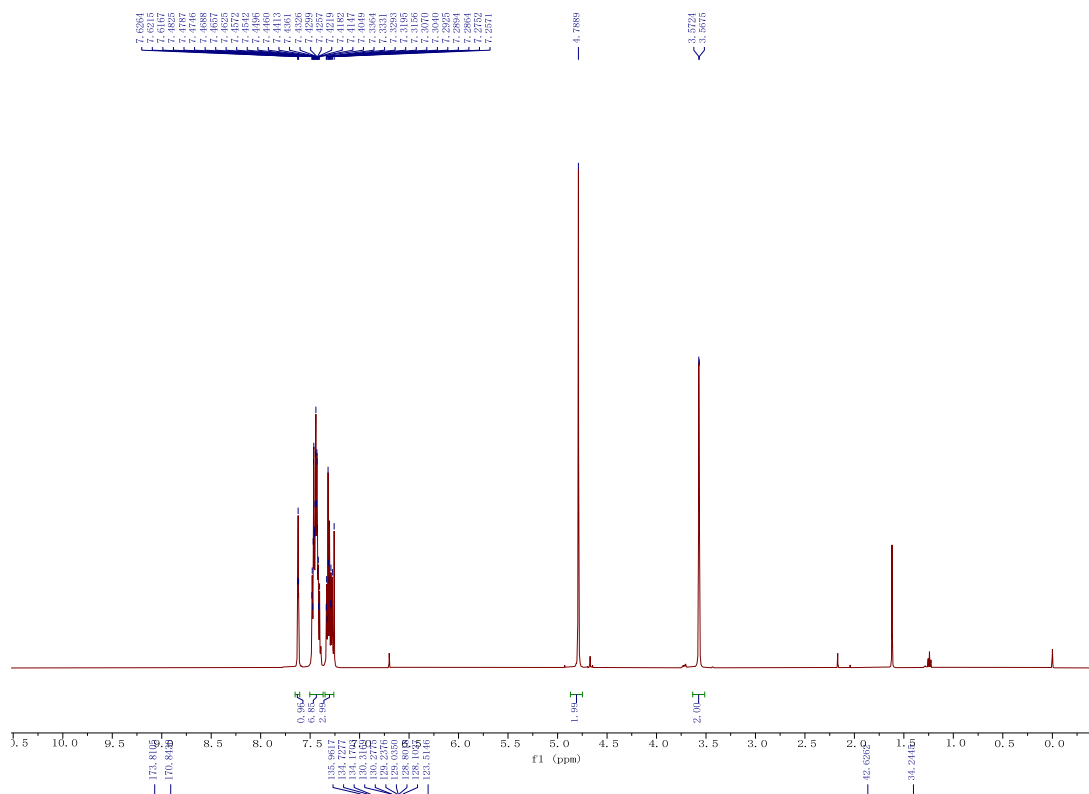
Table S1. Crystal data and structure refinement for 3la.

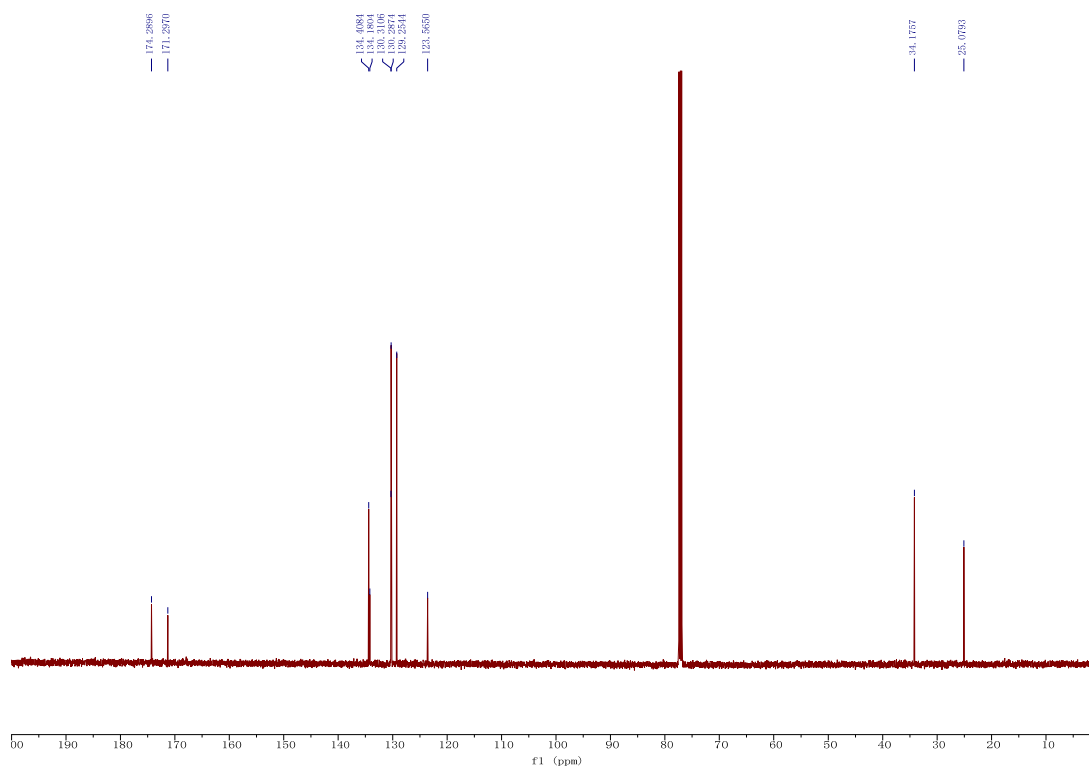
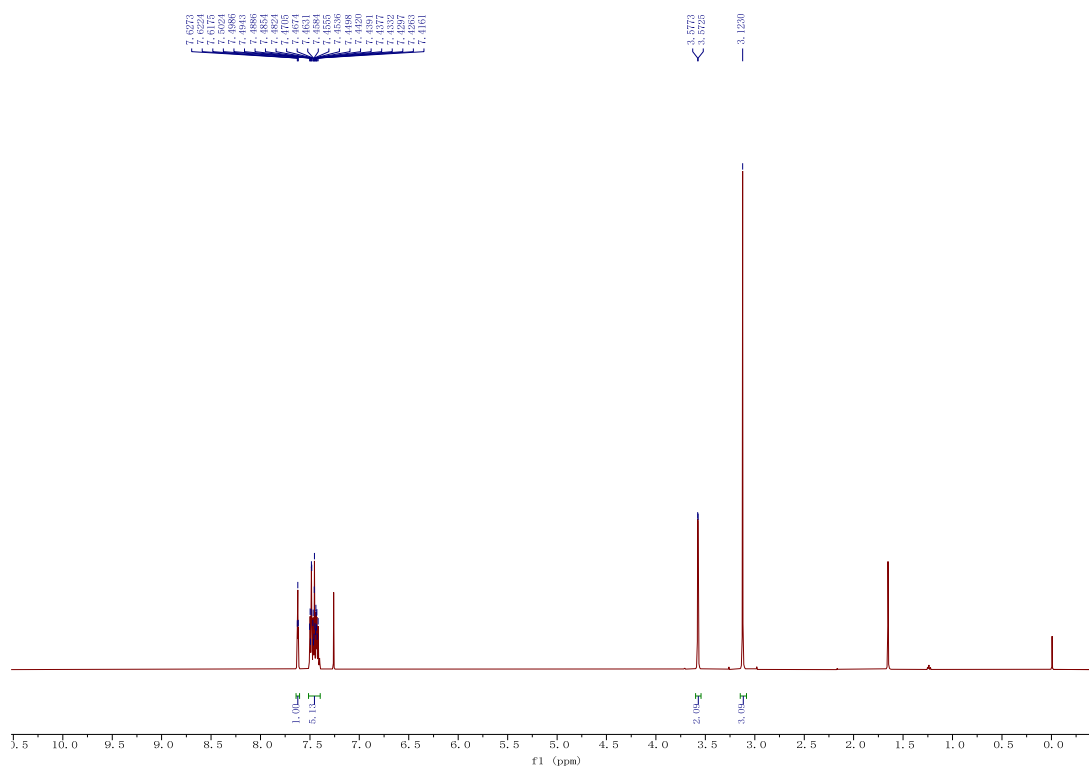
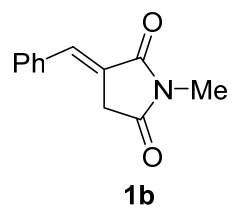
Identification code	cxy1931_0m
Empirical formula	C ₂₉ H ₂₄ FNO ₄
Formula weight	469.49
Temperature/K	100(2)
Crystal system	orthorhombic
Space group	P2 ₁ 2 ₁ 2 ₁
a/Å	9.0198(3)
b/Å	13.0367(4)
c/Å	20.2824(6)
$\alpha/^\circ$	90
$\beta/^\circ$	90
$\gamma/^\circ$	90
Volume/Å ³	2384.98(13)
Z	4
$\rho_{\text{calc}}/\text{cm}^3$	1.308
μ/mm^{-1}	0.756
F(000)	984.0
Crystal size/mm ³	0.36 × 0.33 × 0.29
Radiation	CuK α (λ = 1.54178)
2 Θ range for data collection/ $^\circ$	8.062 to 148.94
Index ranges	-11 ≤ h ≤ 10, -15 ≤ k ≤ 16, -22 ≤ l ≤ 24
Reflections collected	22241
Independent reflections	4844 [R_{int} = 0.0403, R_{sigma} = 0.0250]
Data/restraints/parameters	4844/0/318
Goodness-of-fit on F ²	1.056
Final R indexes [$I \geq 2\sigma(I)$]	R_1 = 0.0277, wR_2 = 0.0725
Final R indexes [all data]	R_1 = 0.0292, wR_2 = 0.0737
Largest diff. peak/hole / e Å ⁻³	0.14/-0.13
Flack parameter	0.01(5)

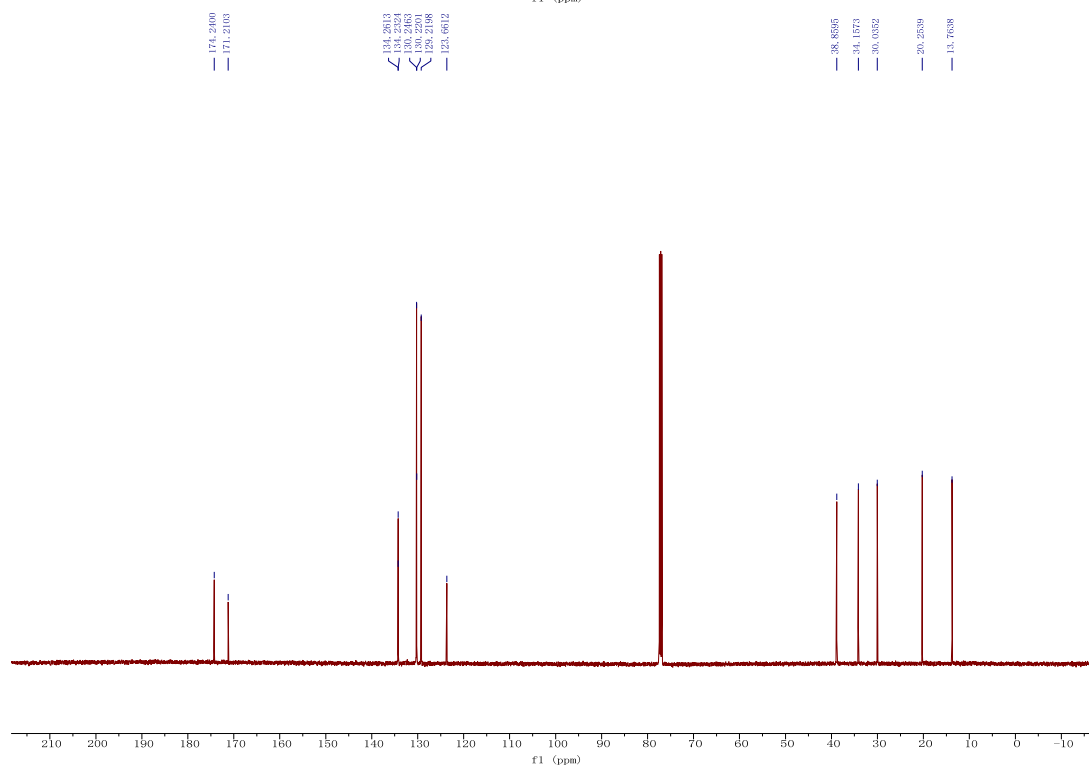
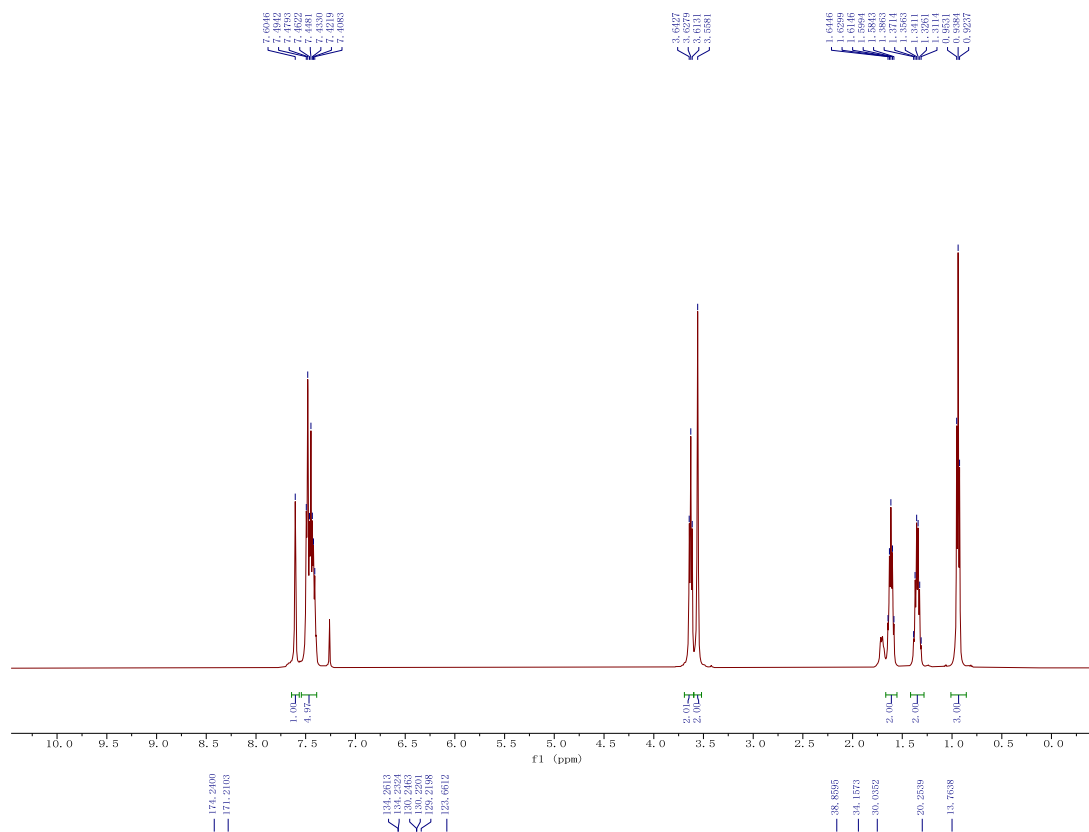
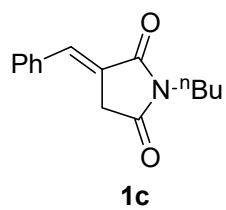
VI. Copies of NMR of substrates

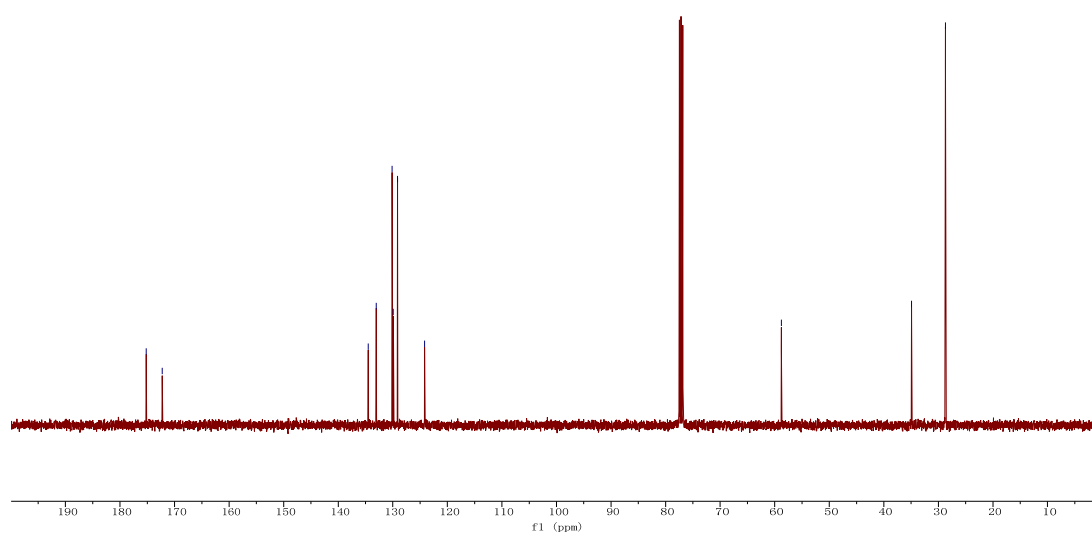
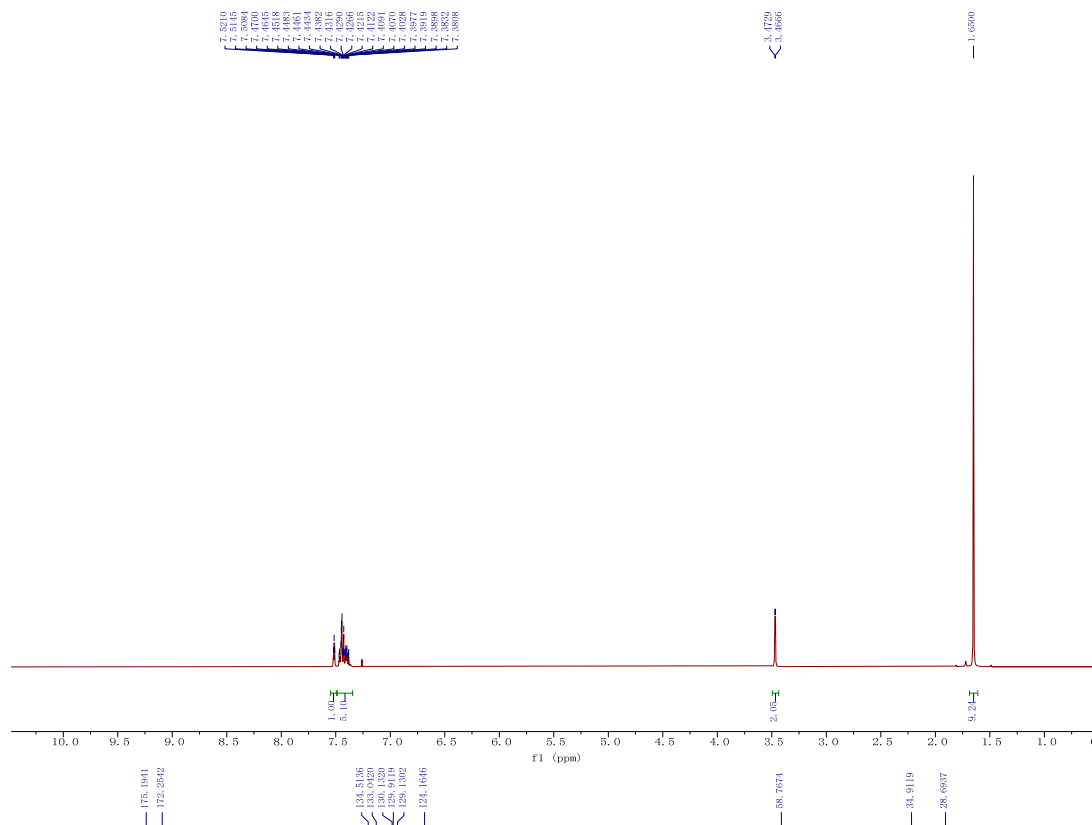
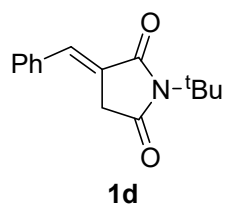


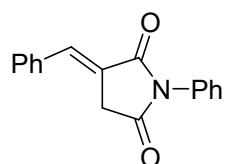
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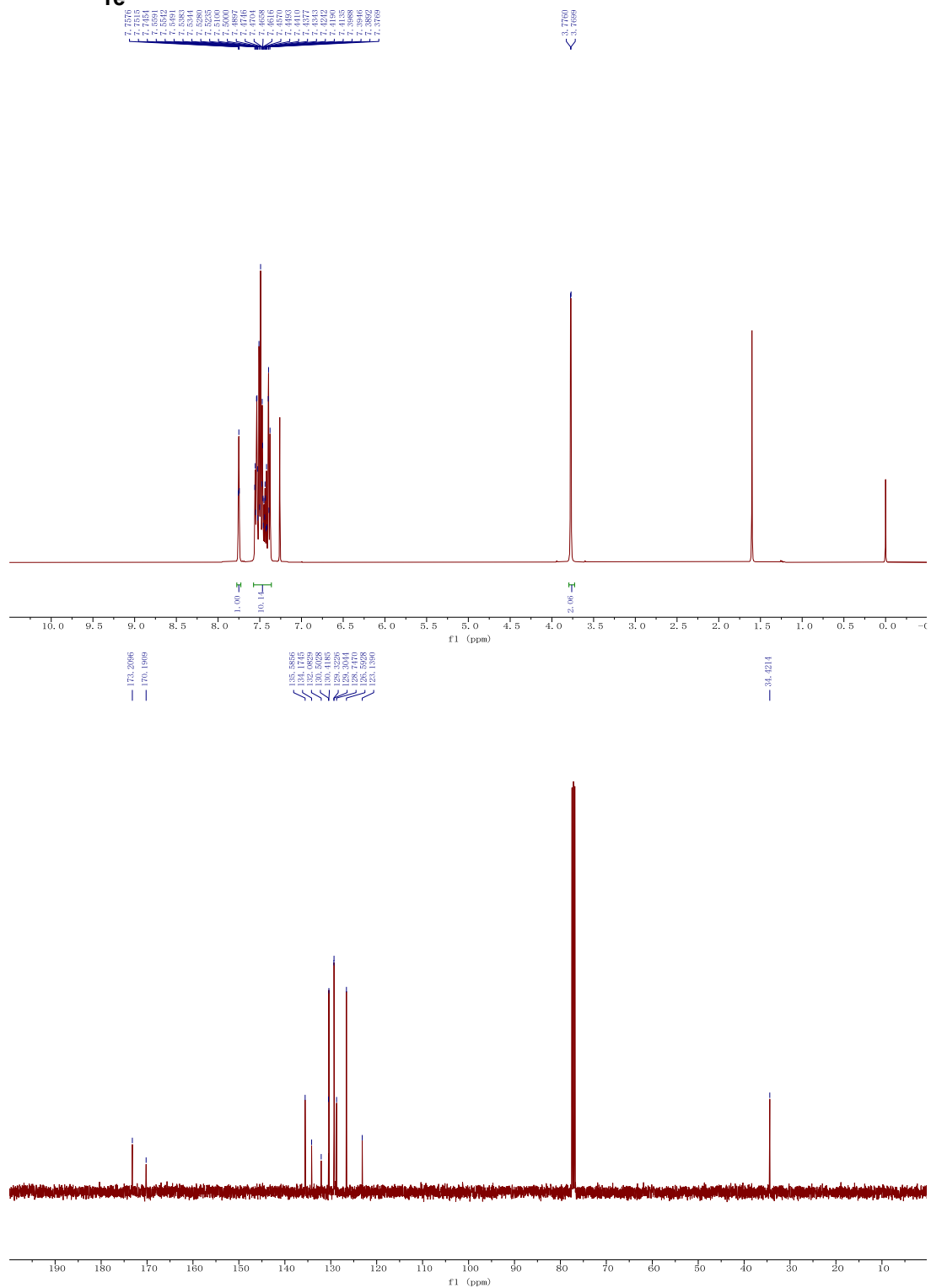


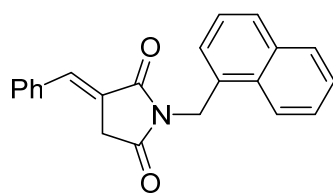




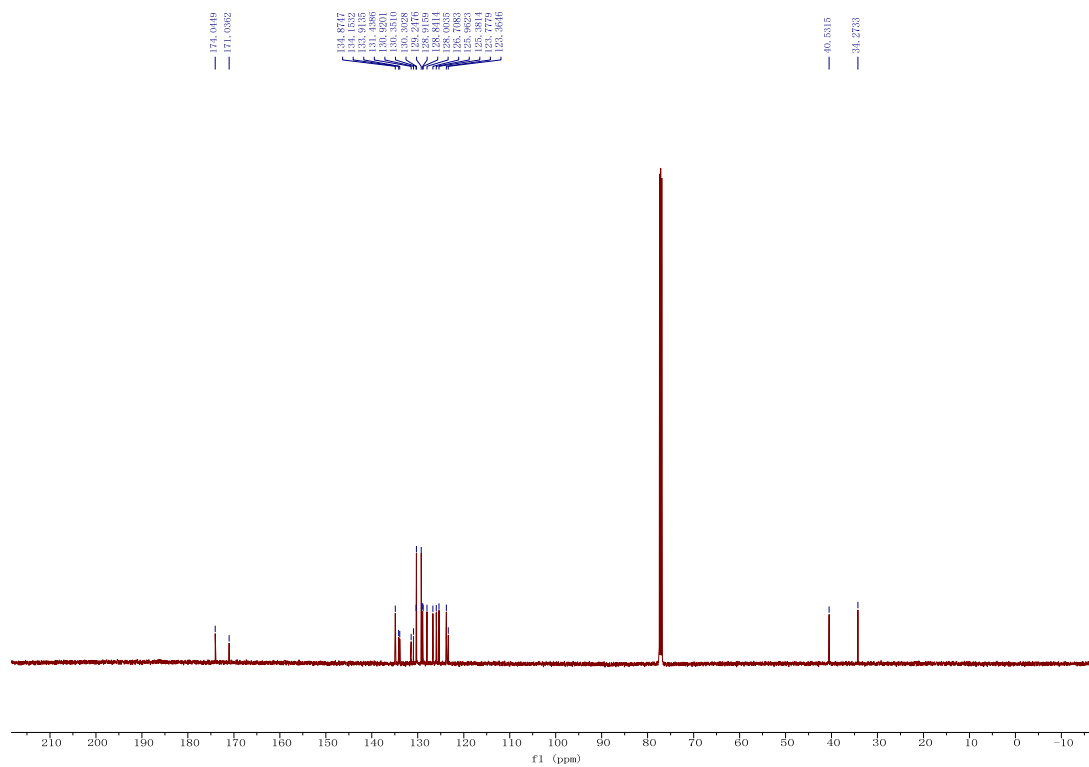
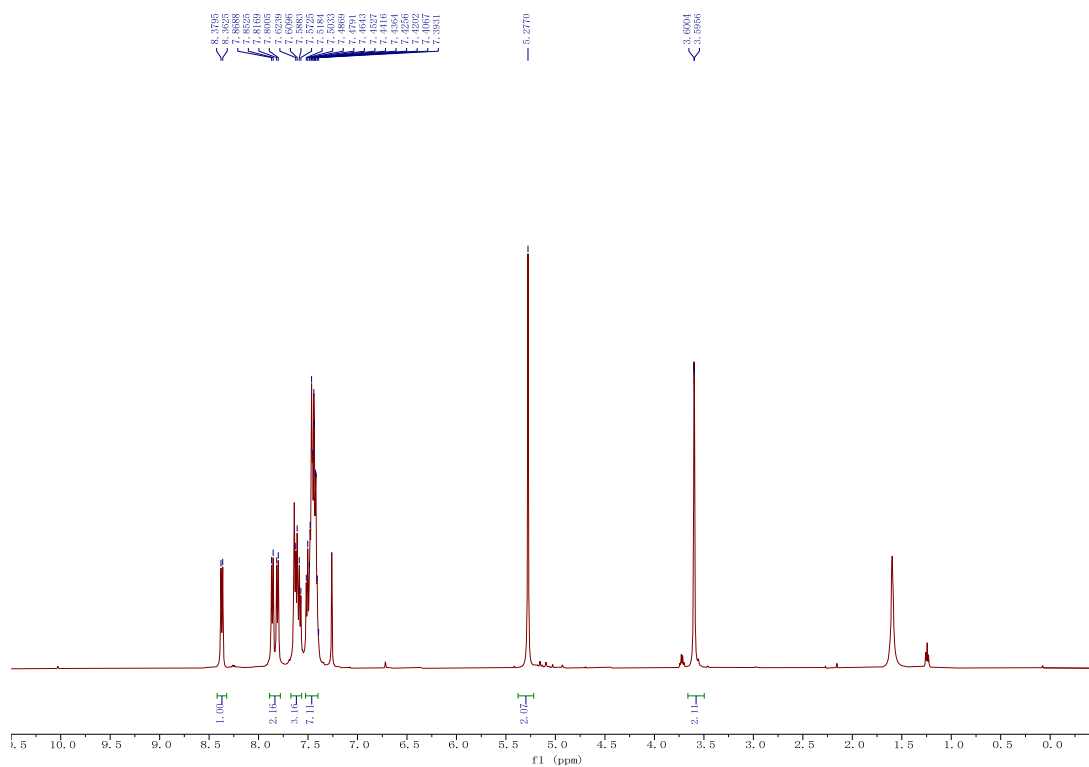


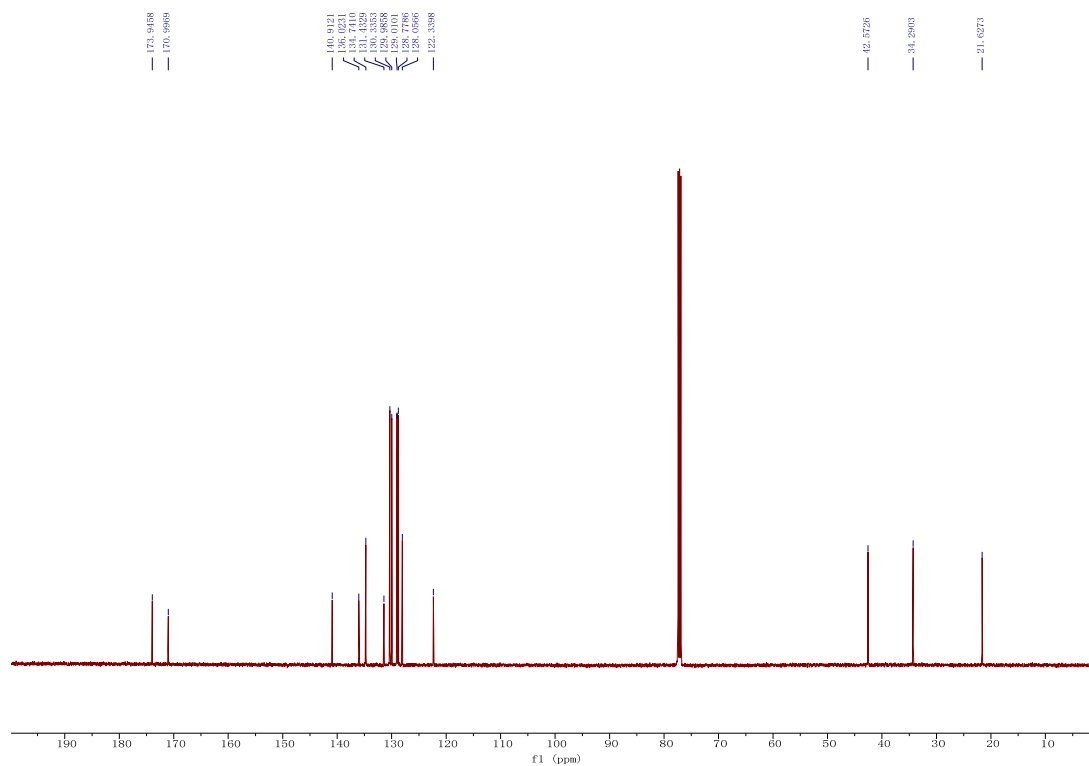
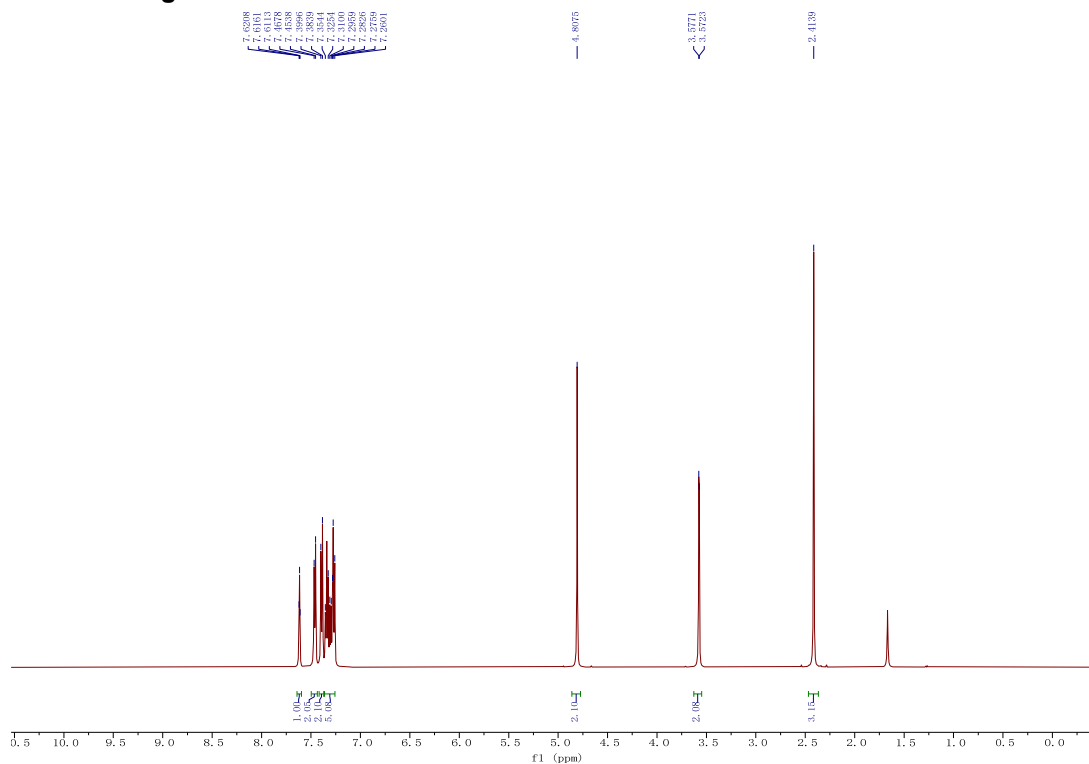
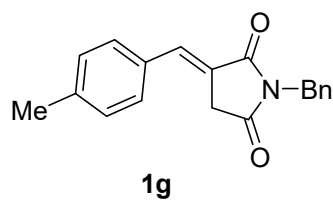
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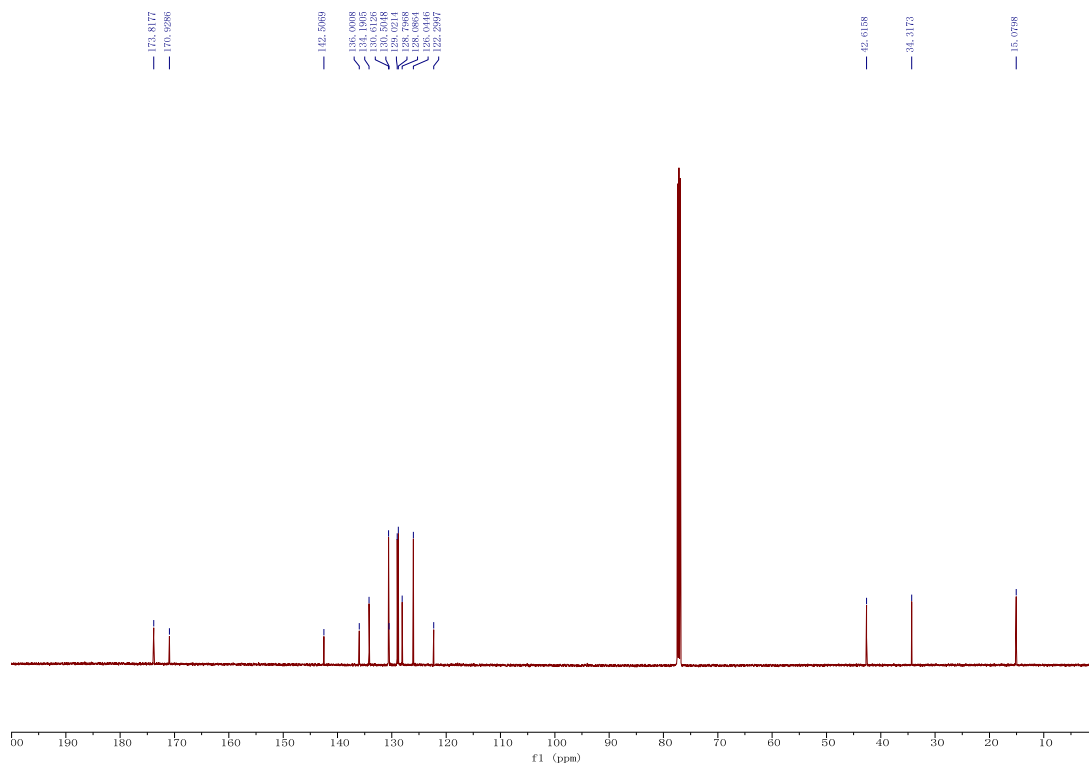
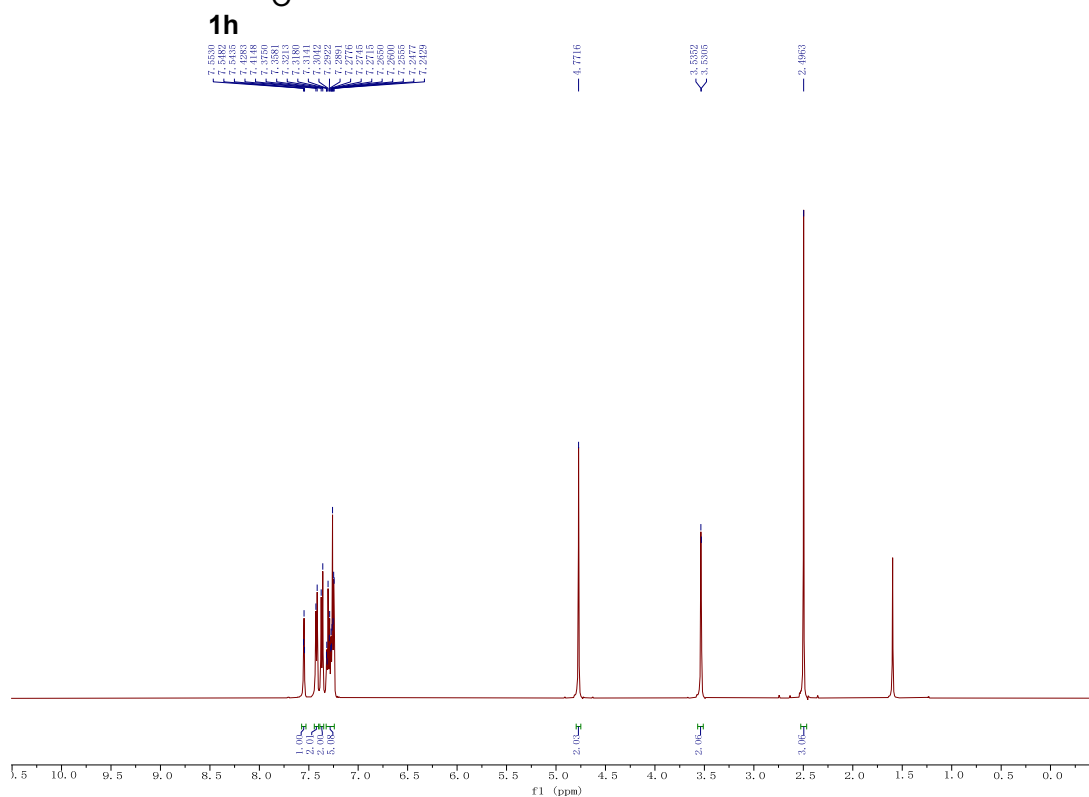
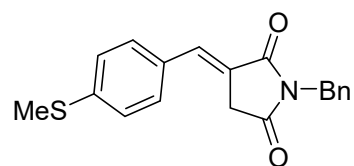


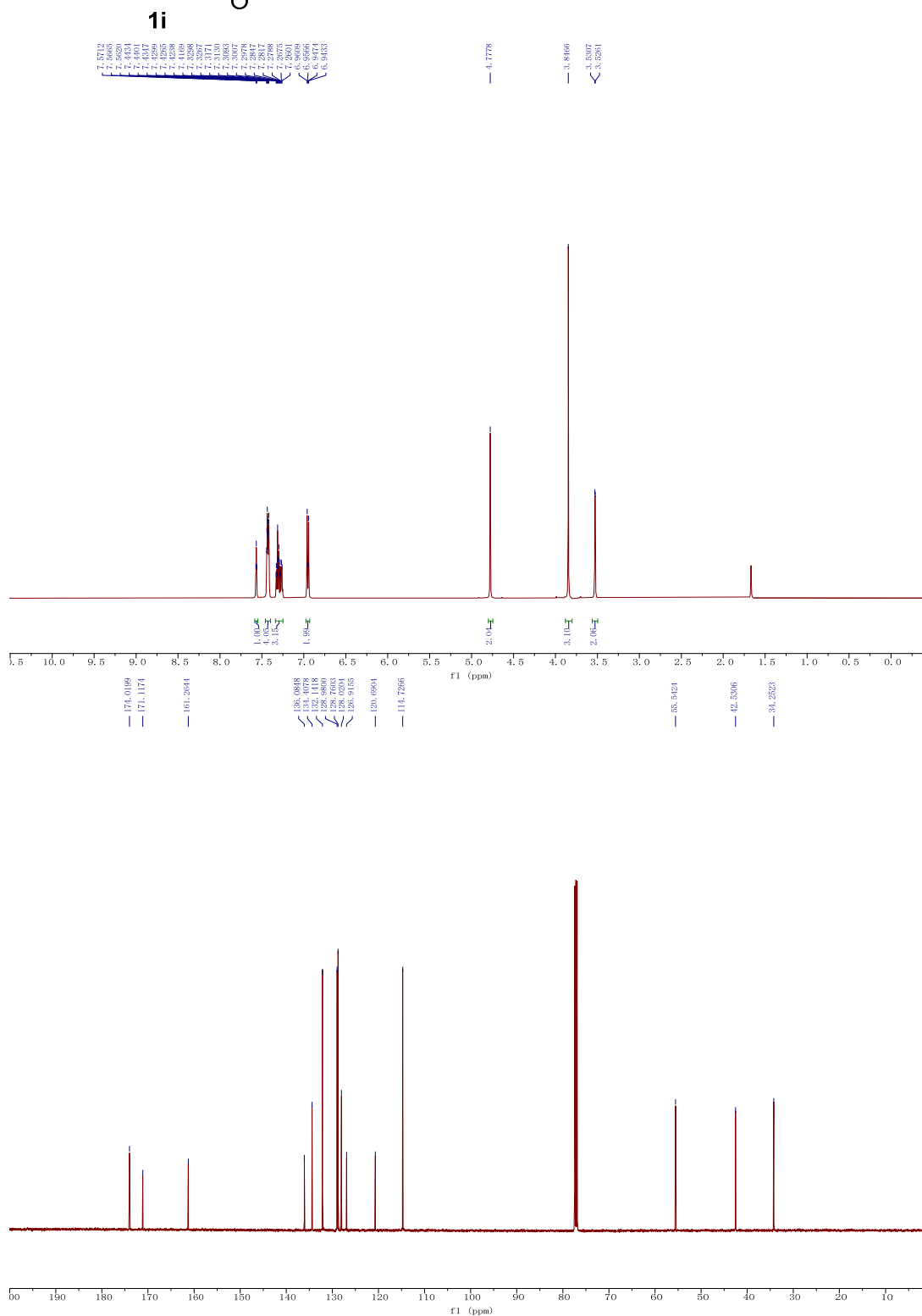
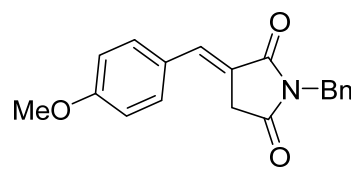


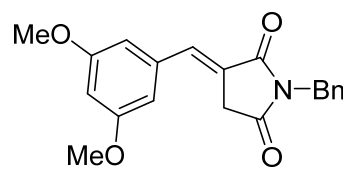
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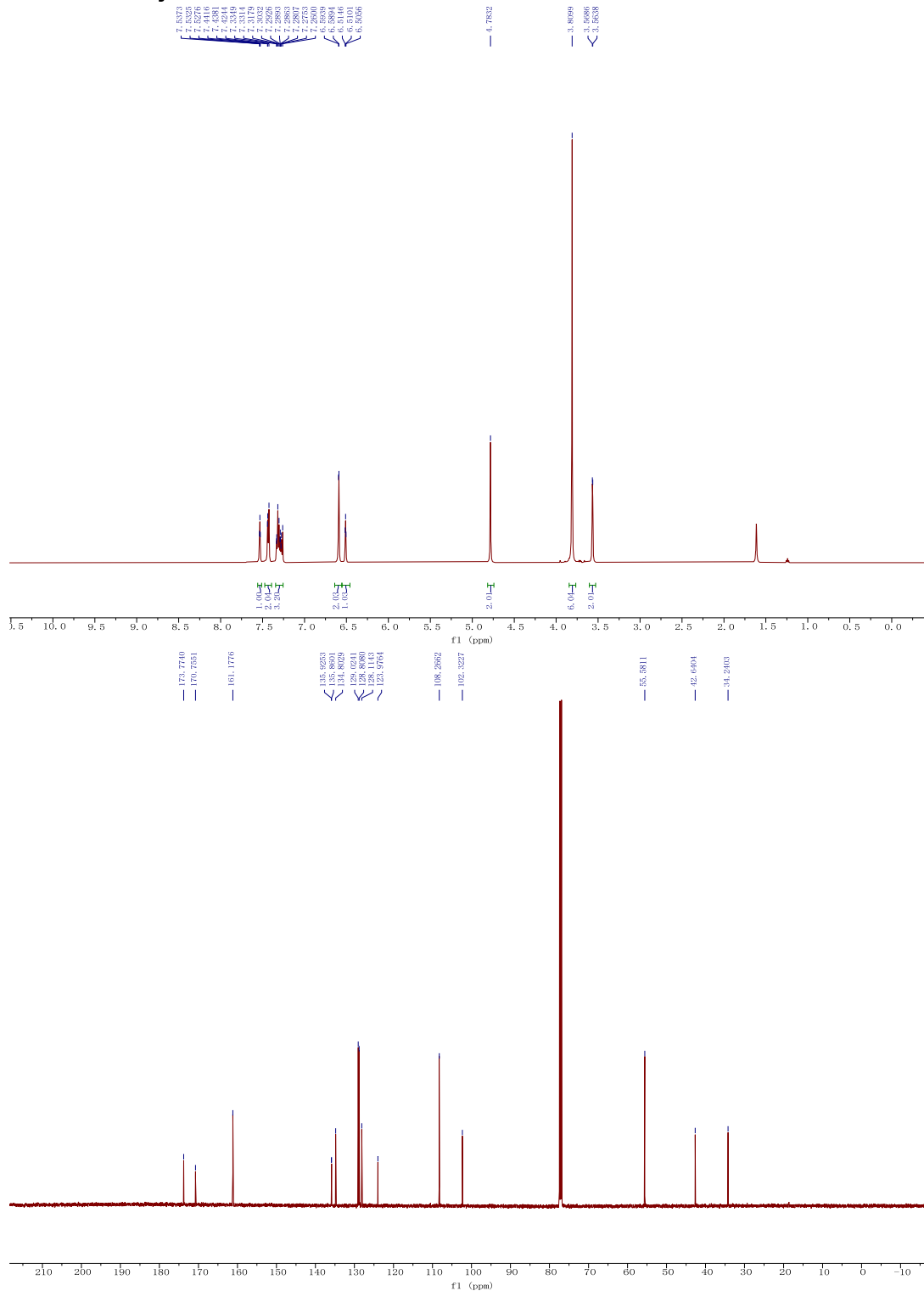


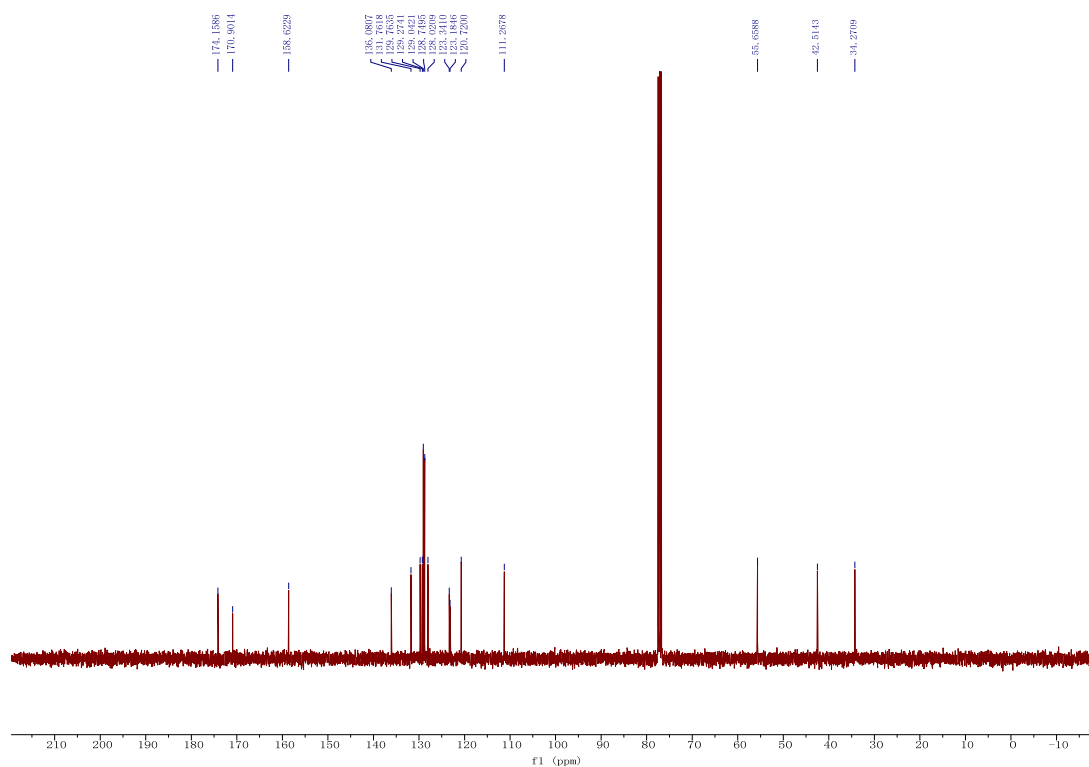
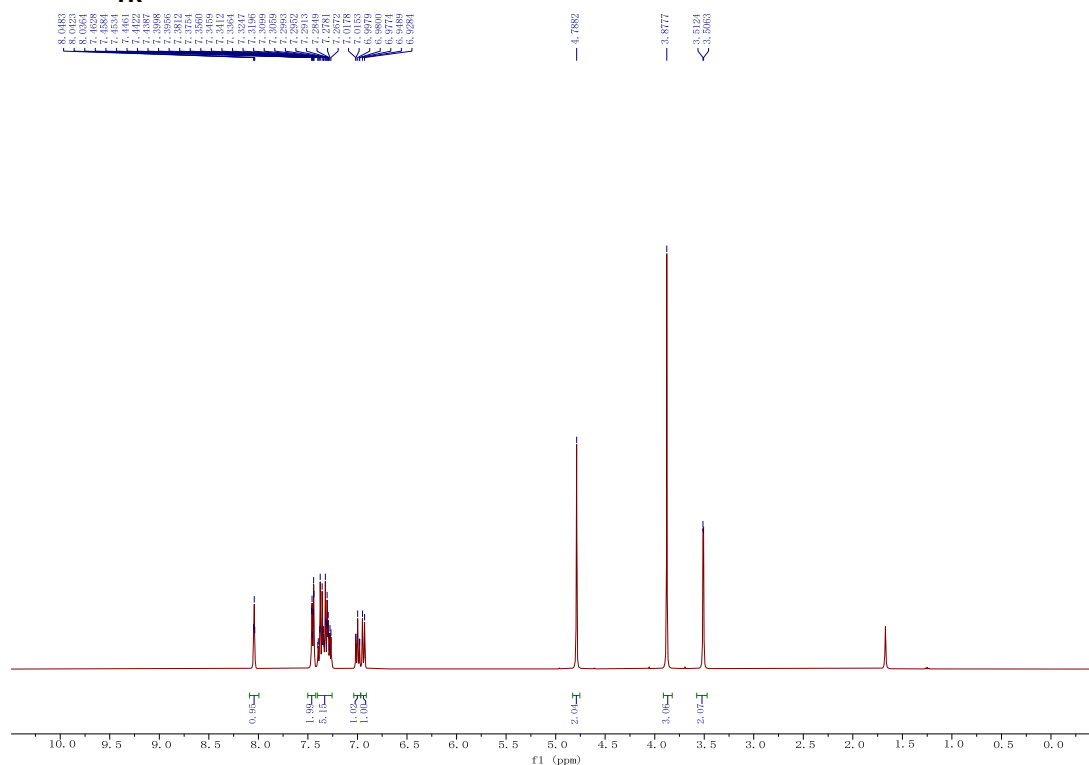
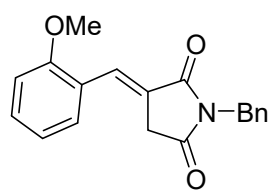


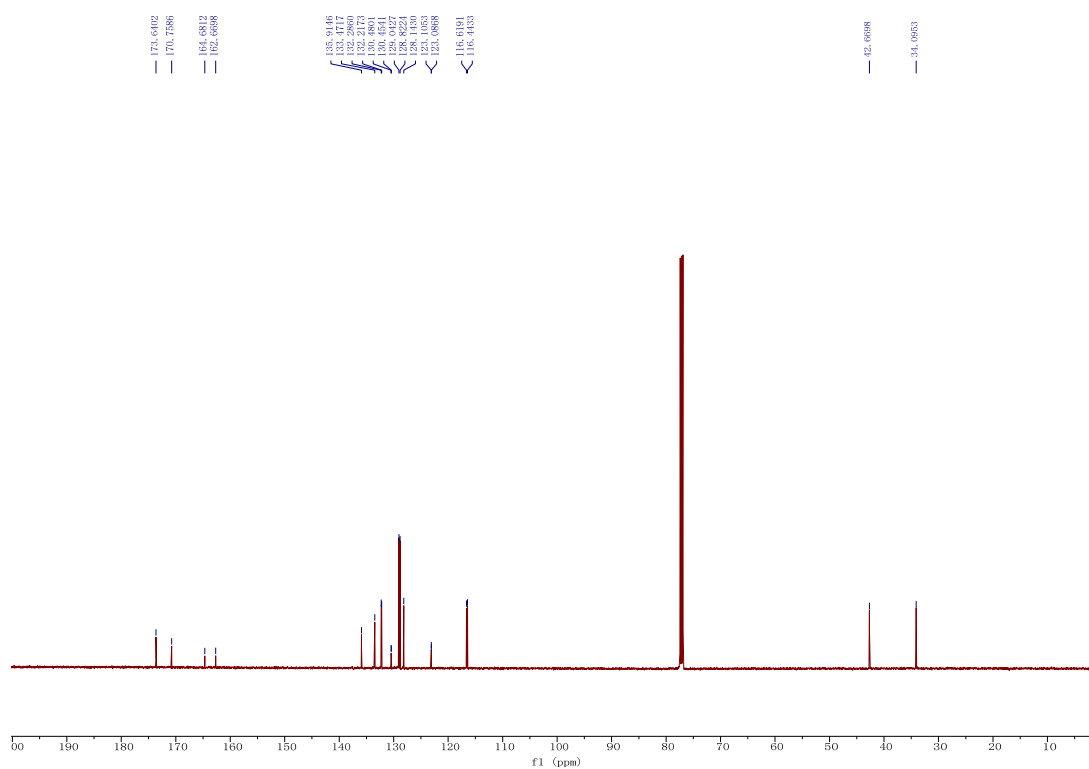


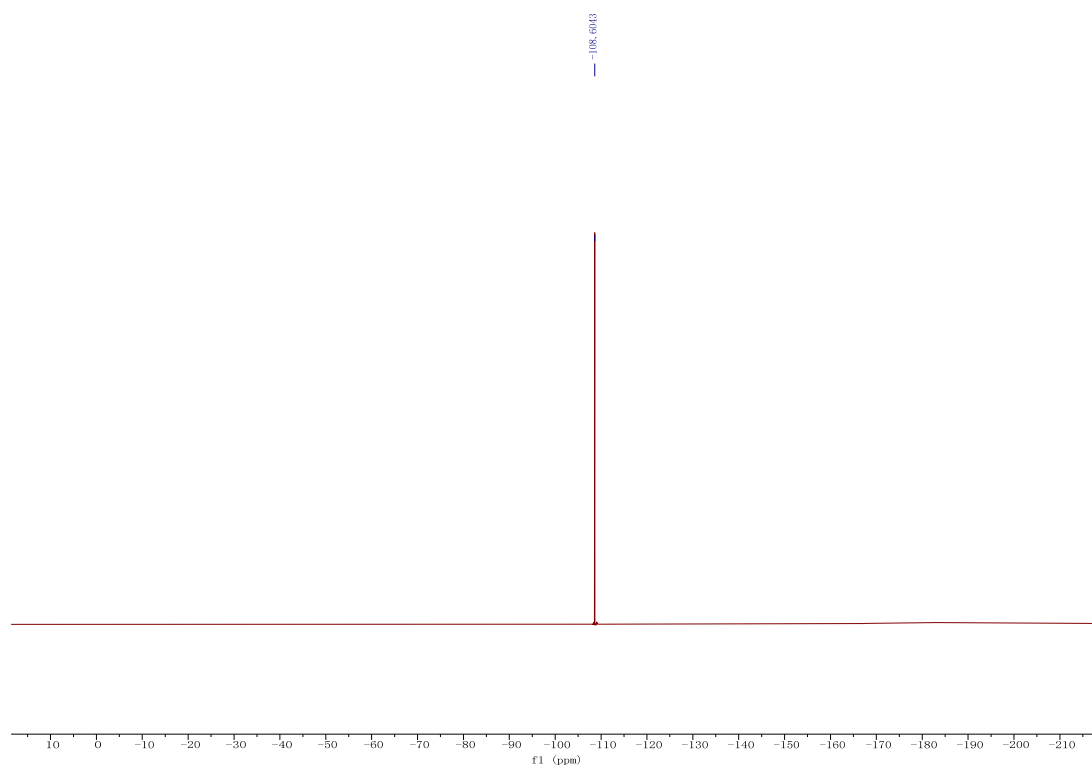


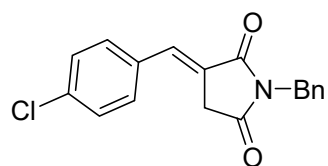
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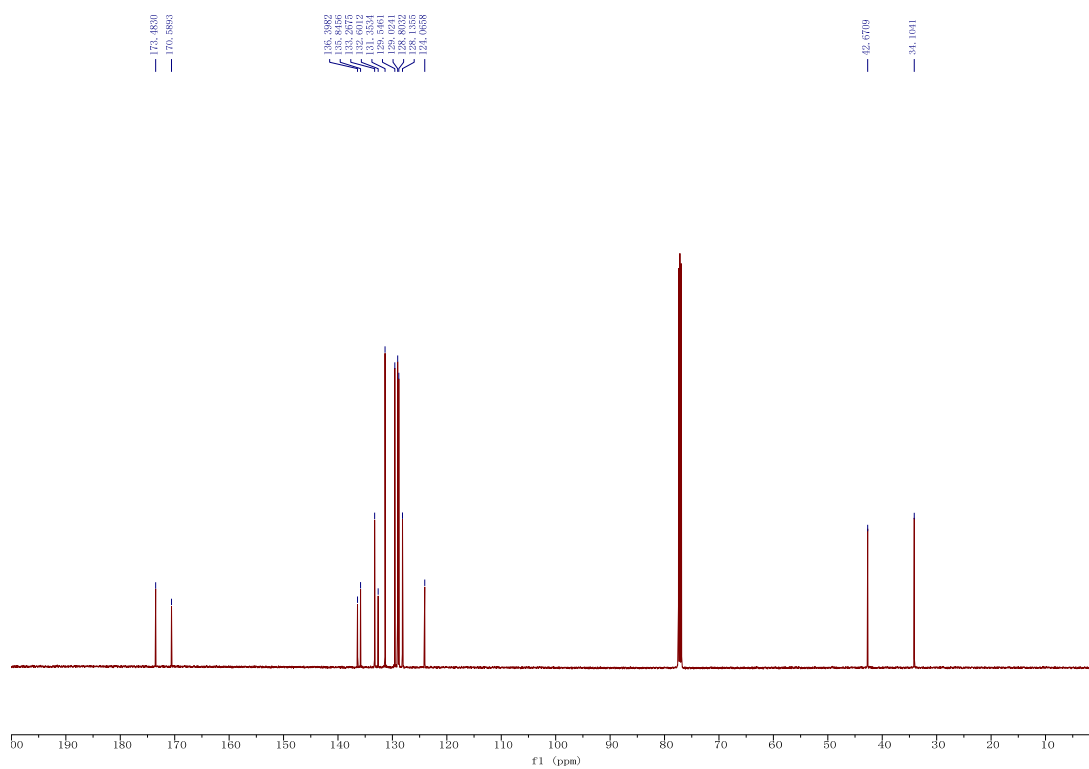
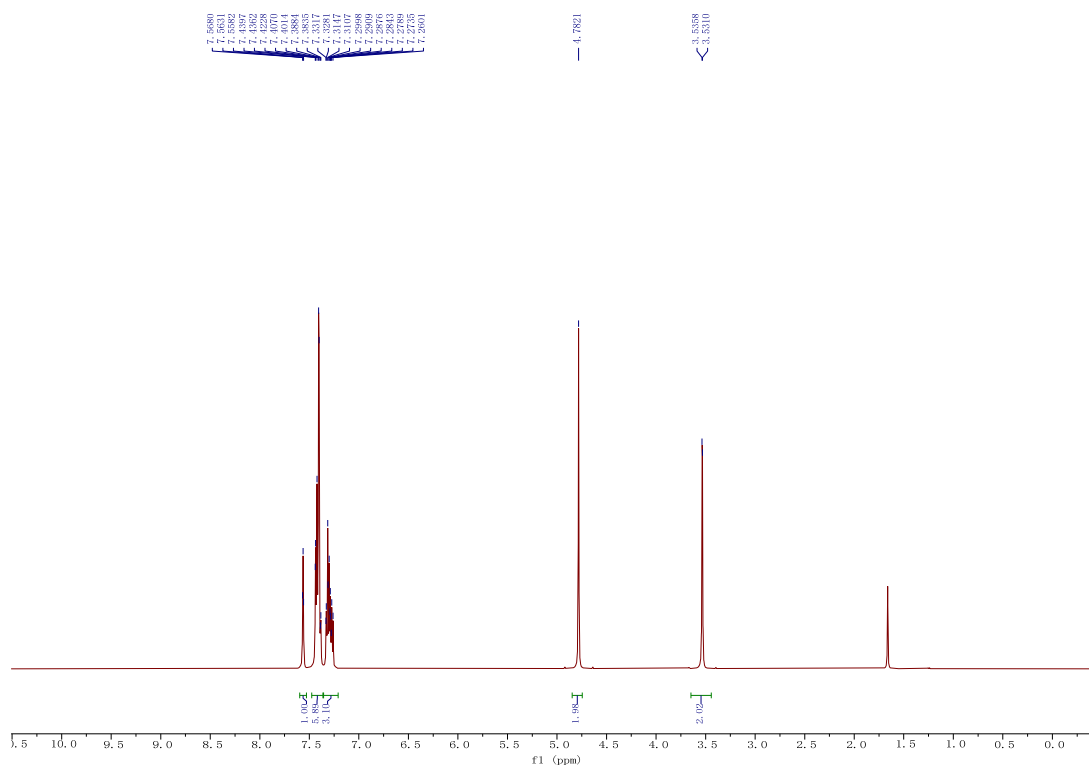


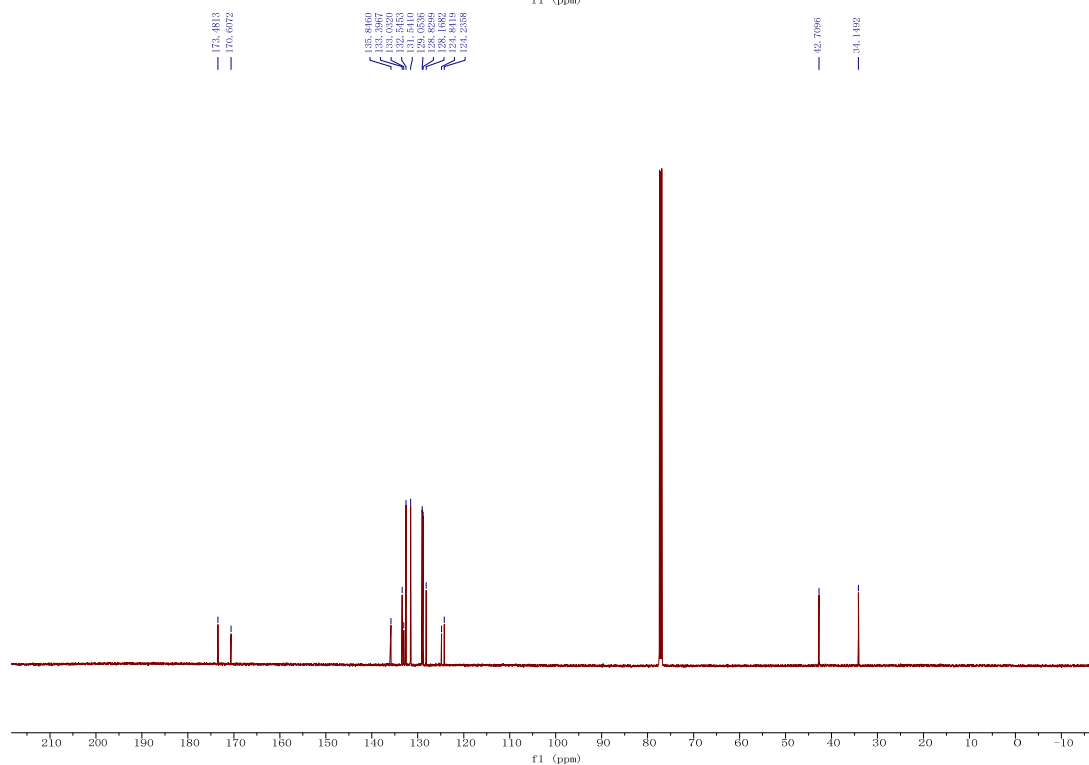


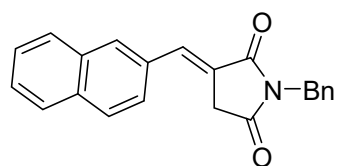




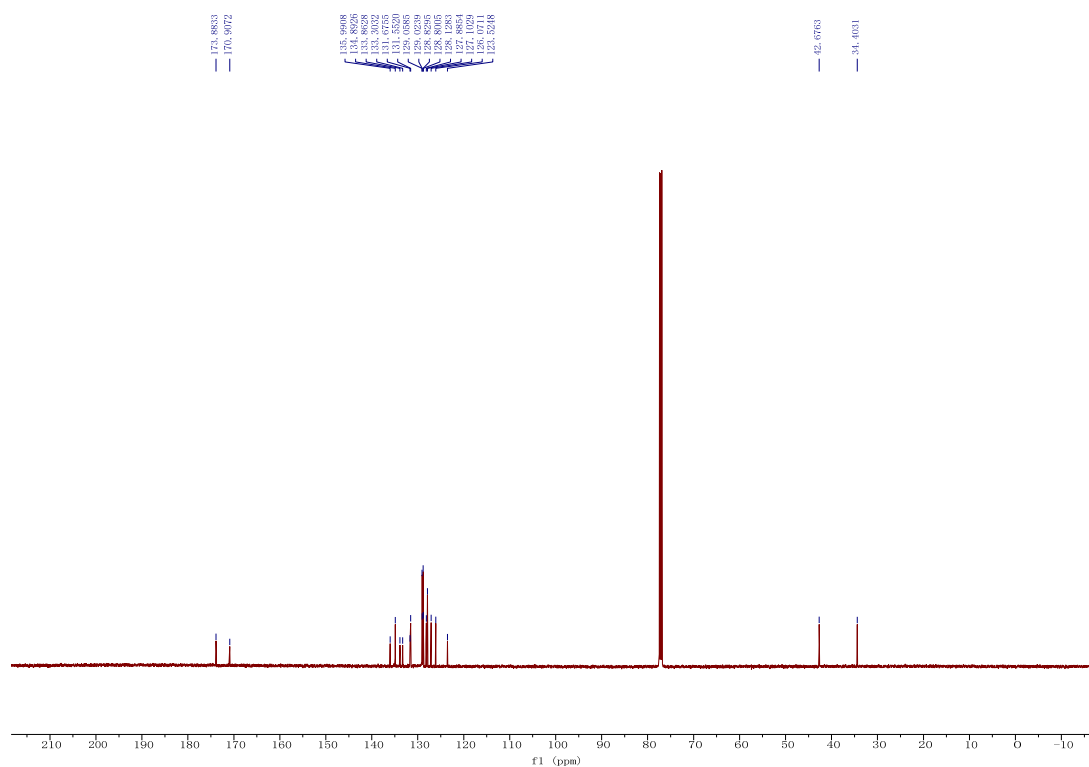
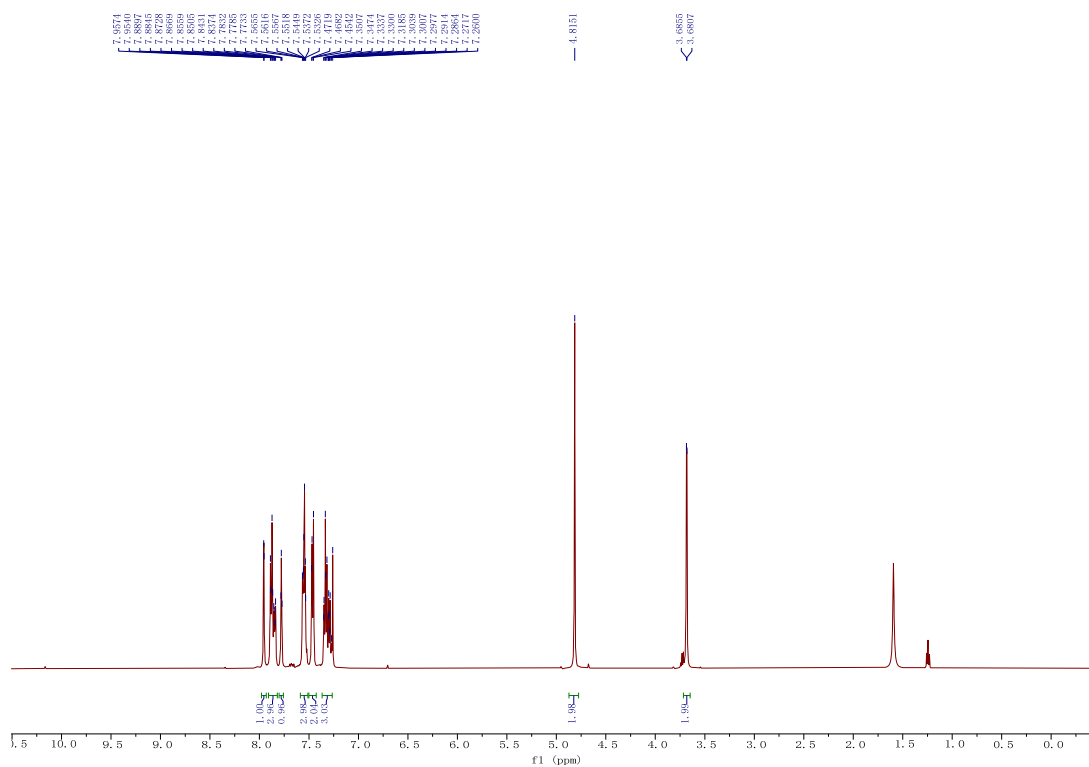
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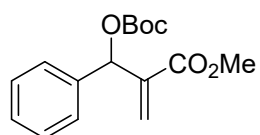




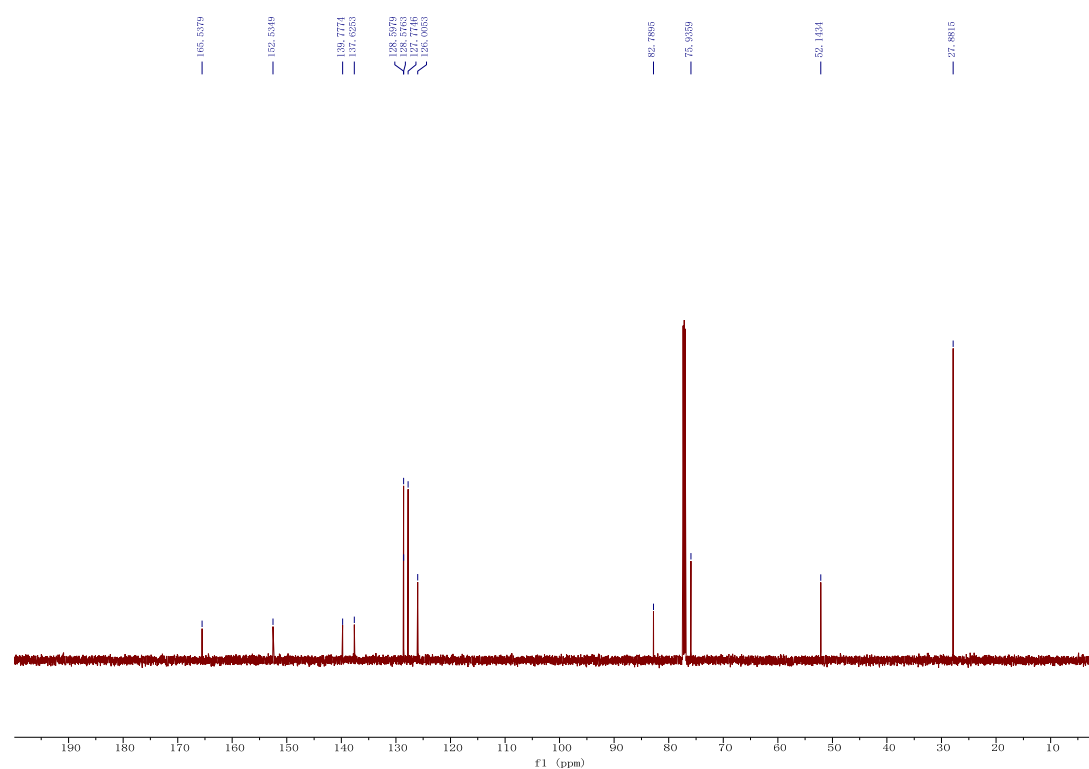
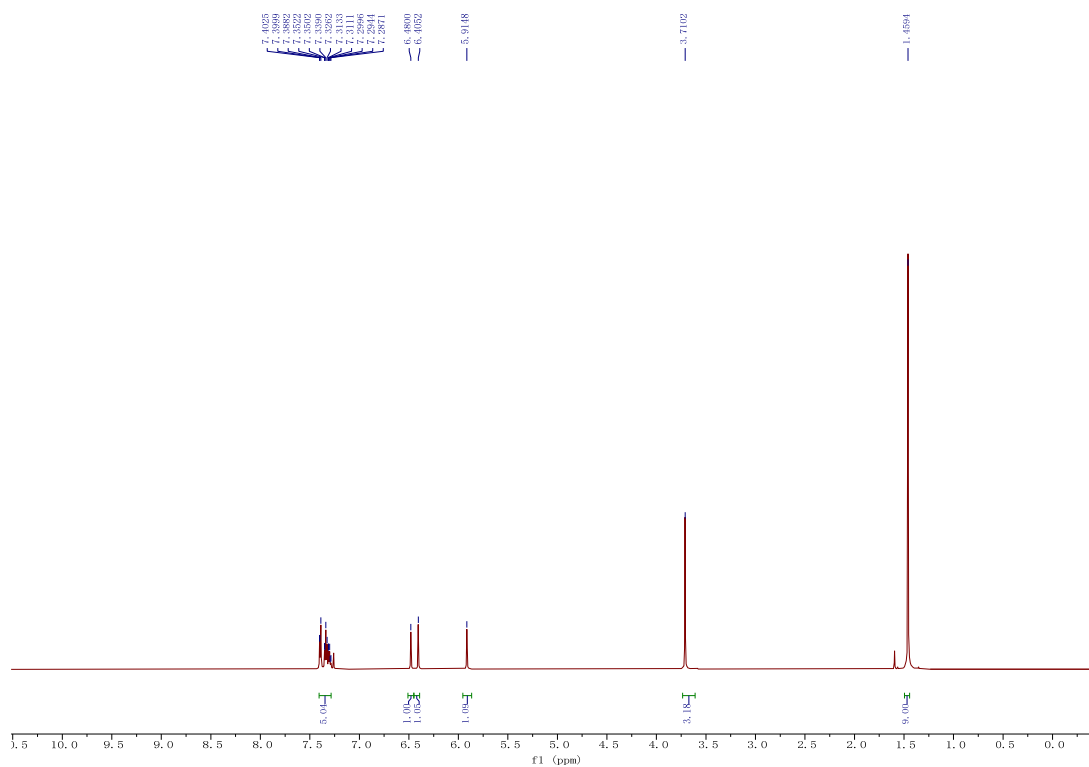


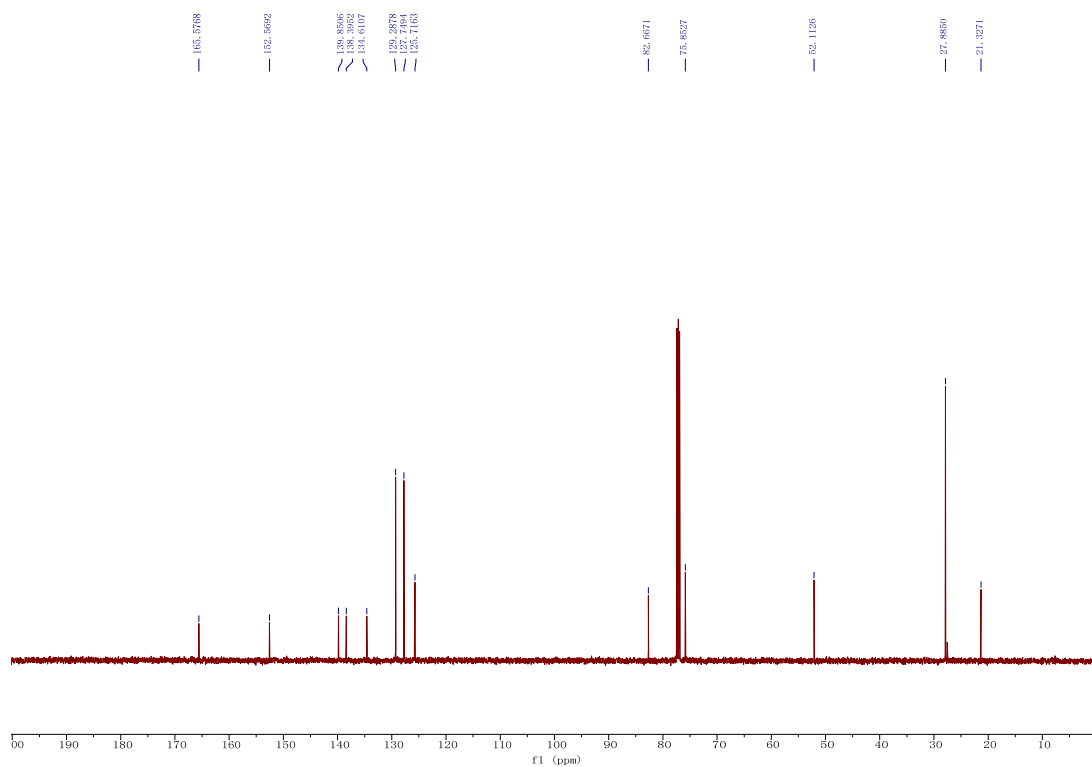
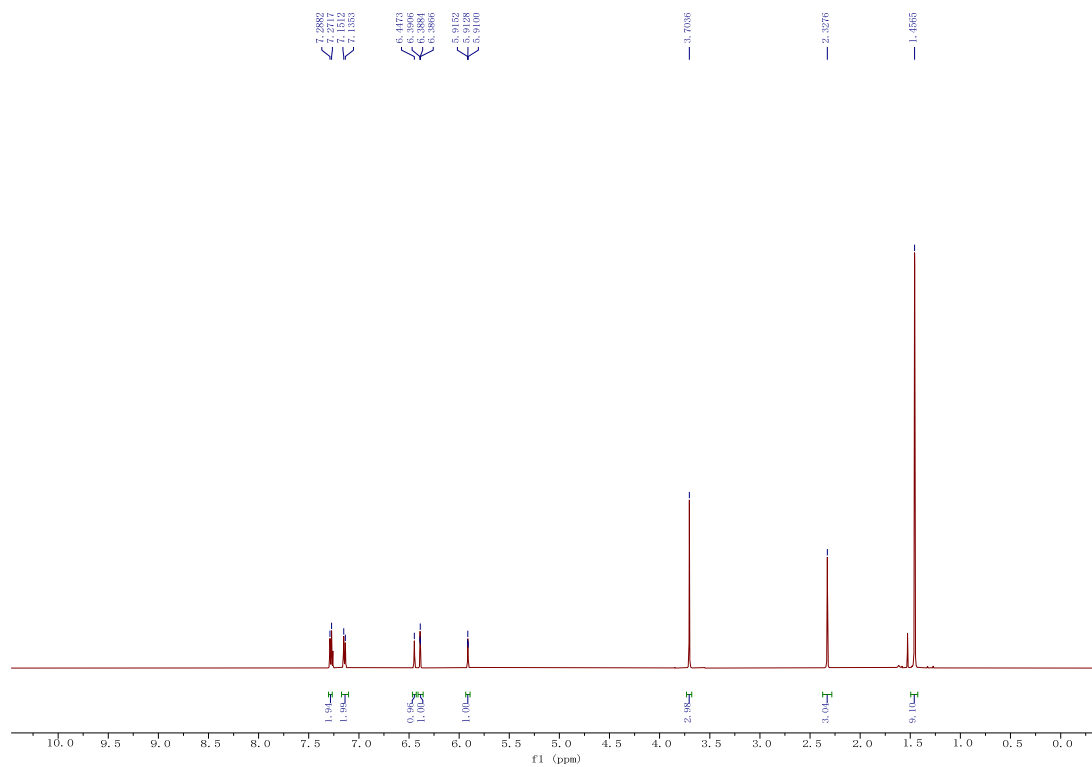
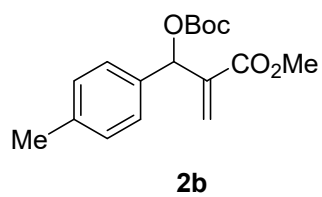
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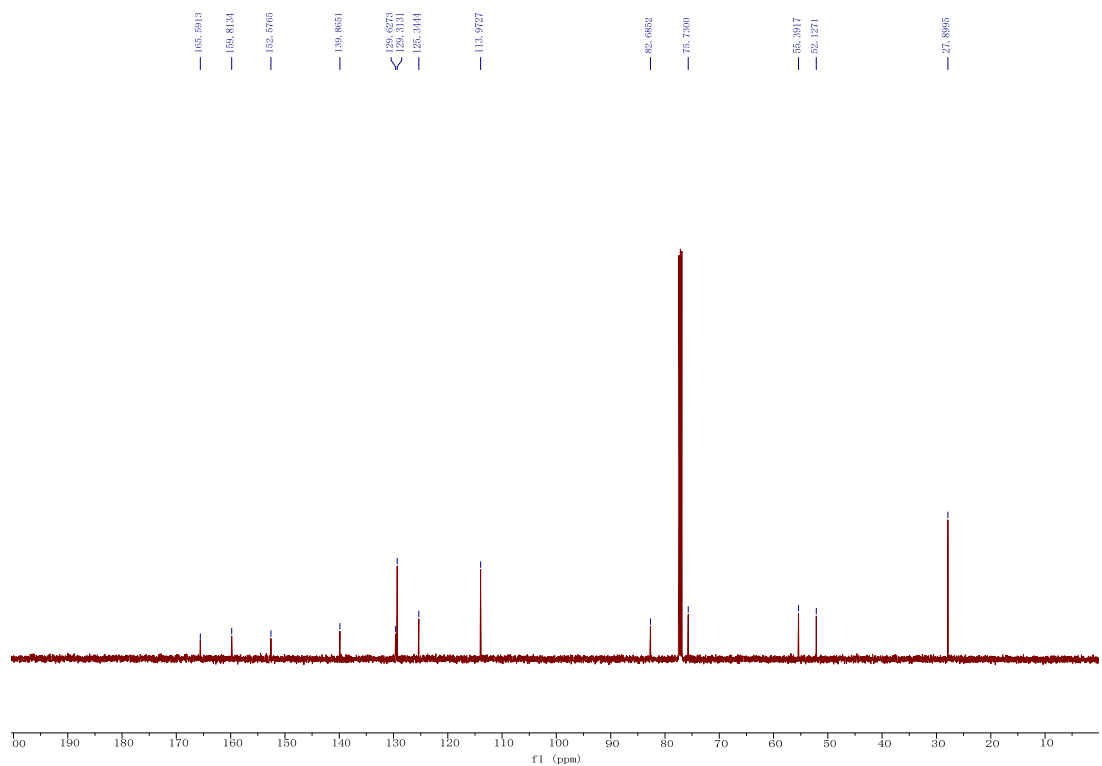
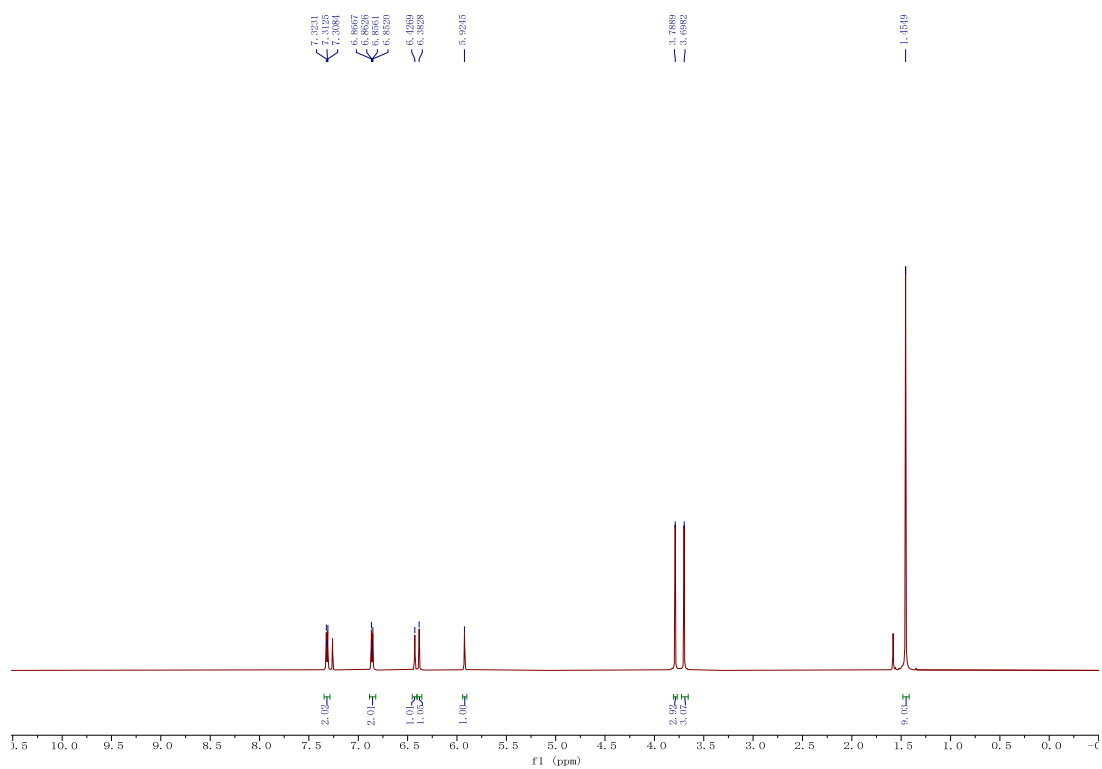
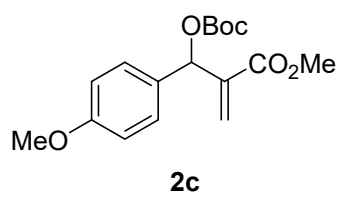


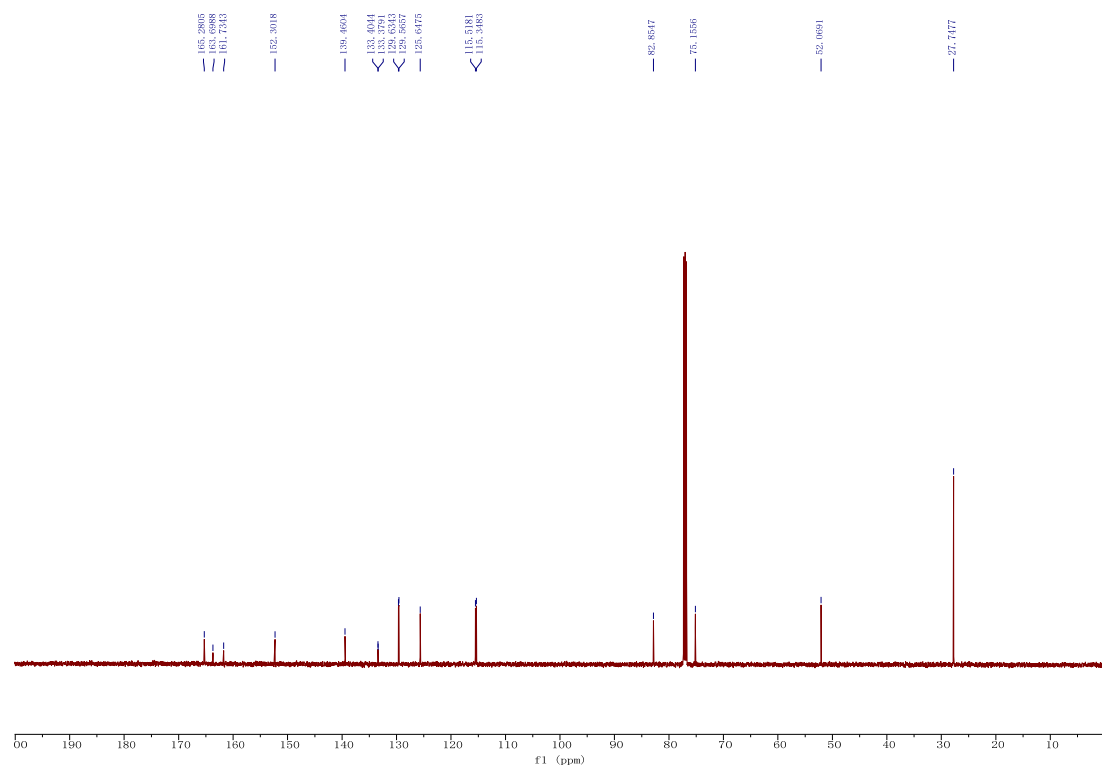
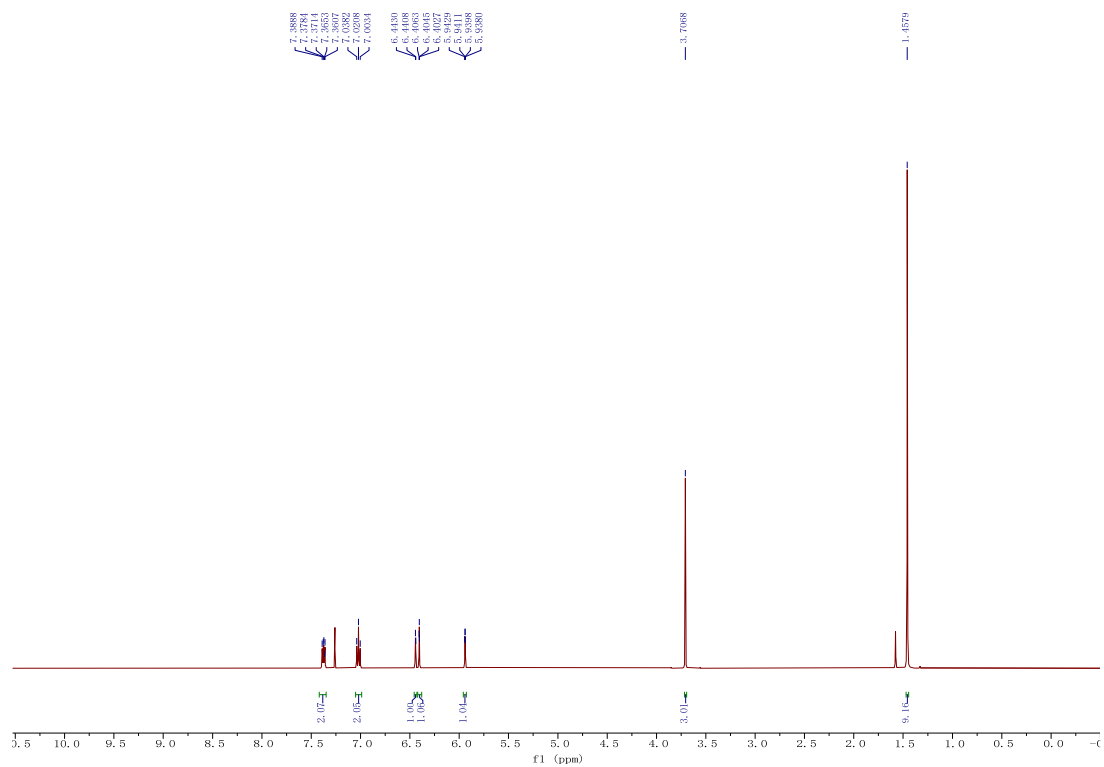
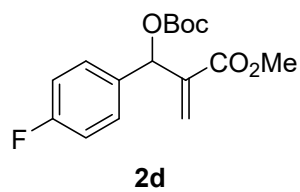


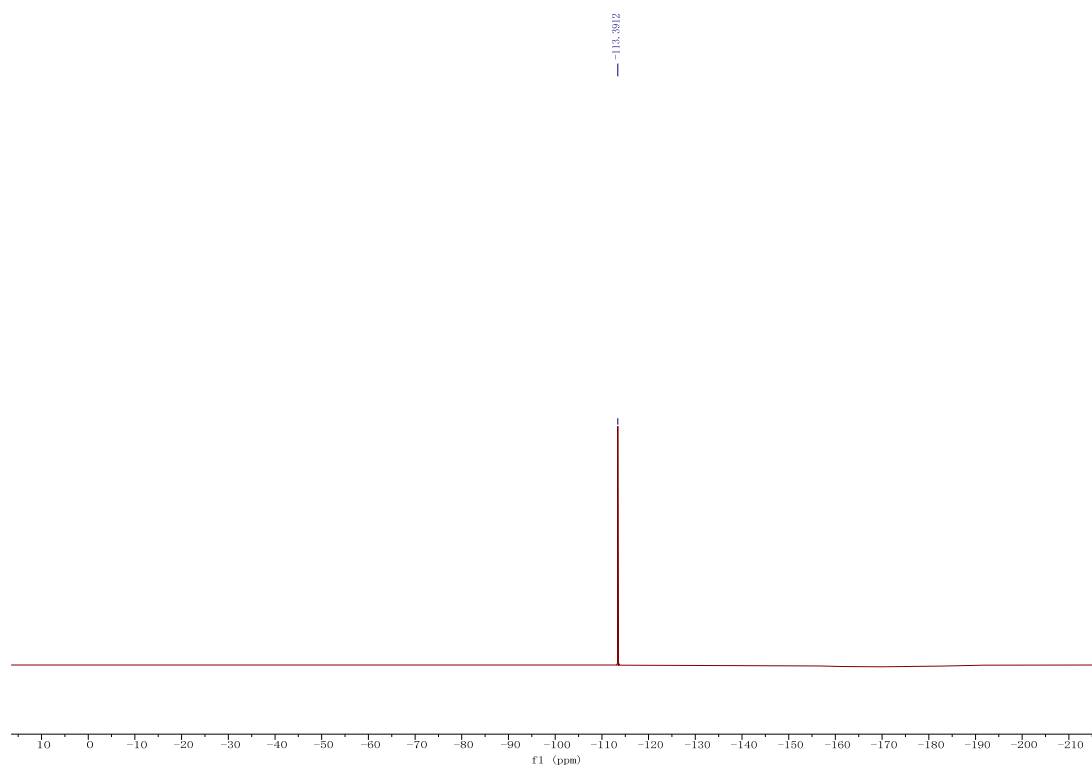
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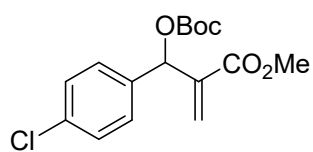




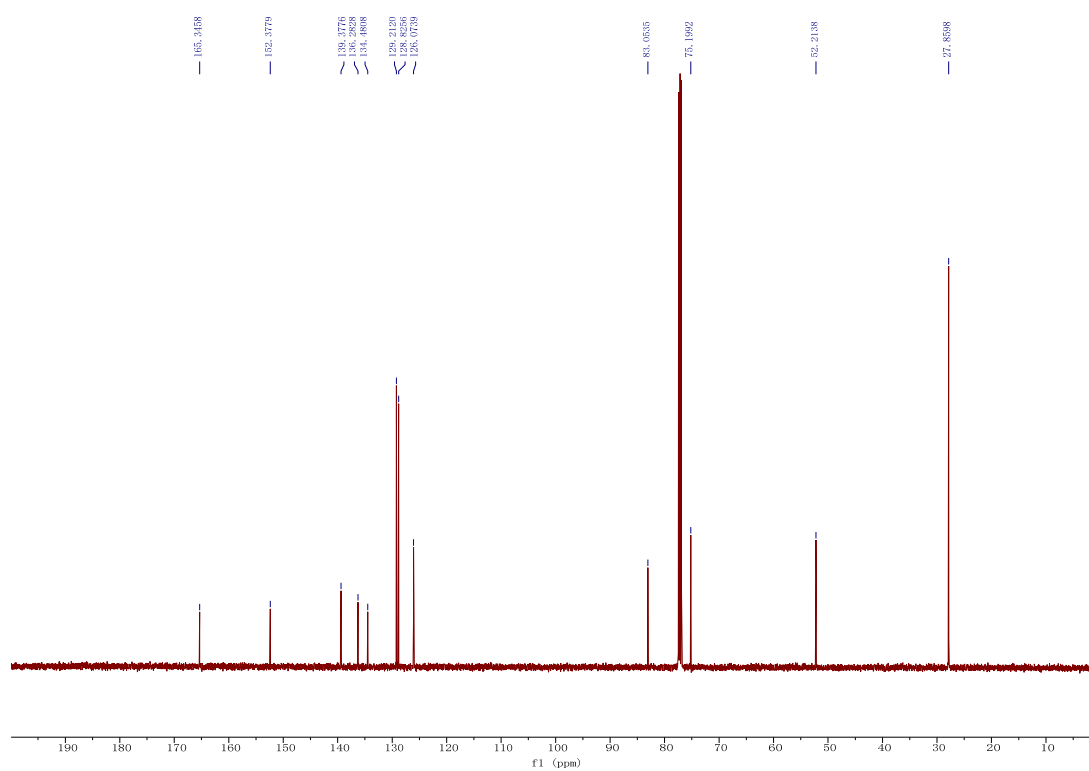
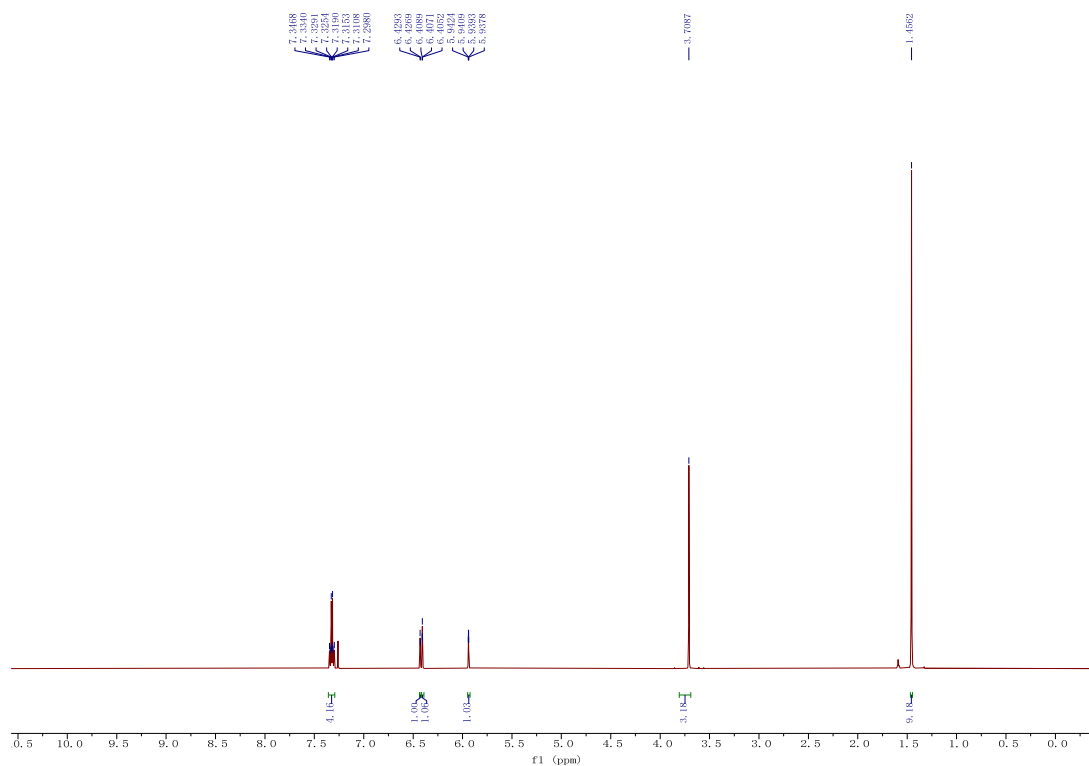


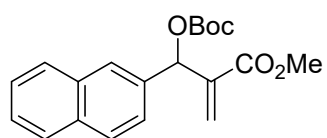




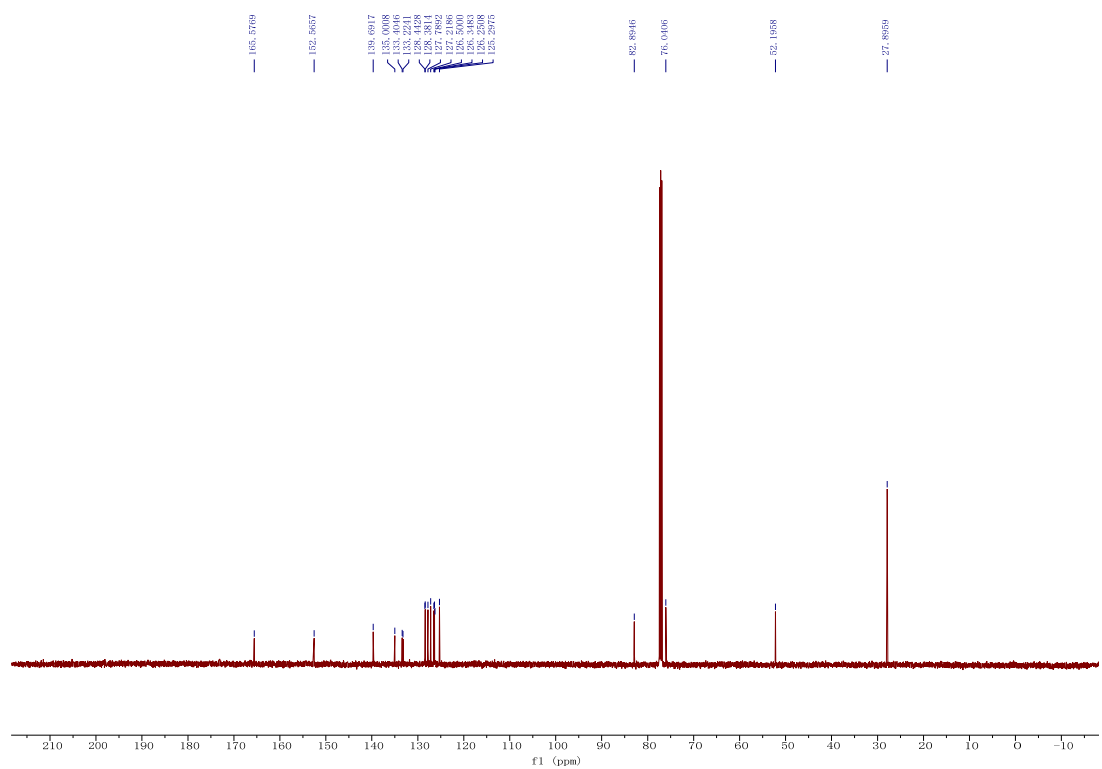
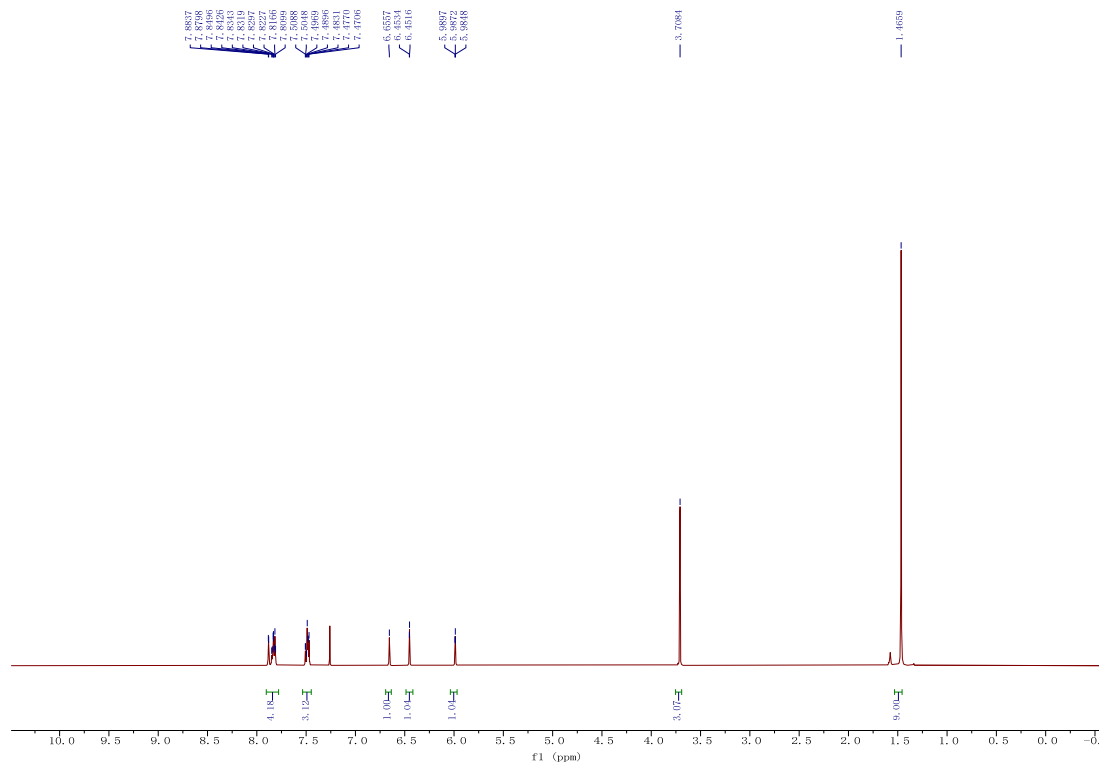


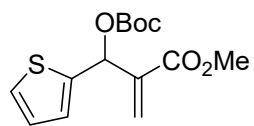
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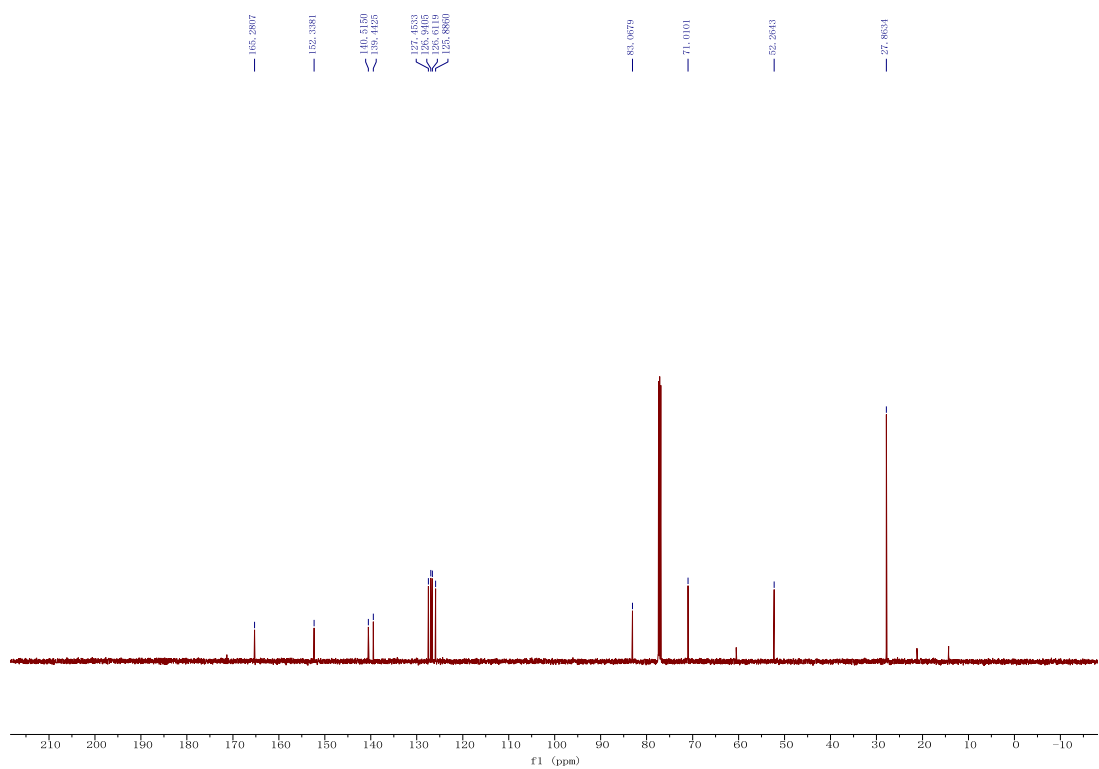
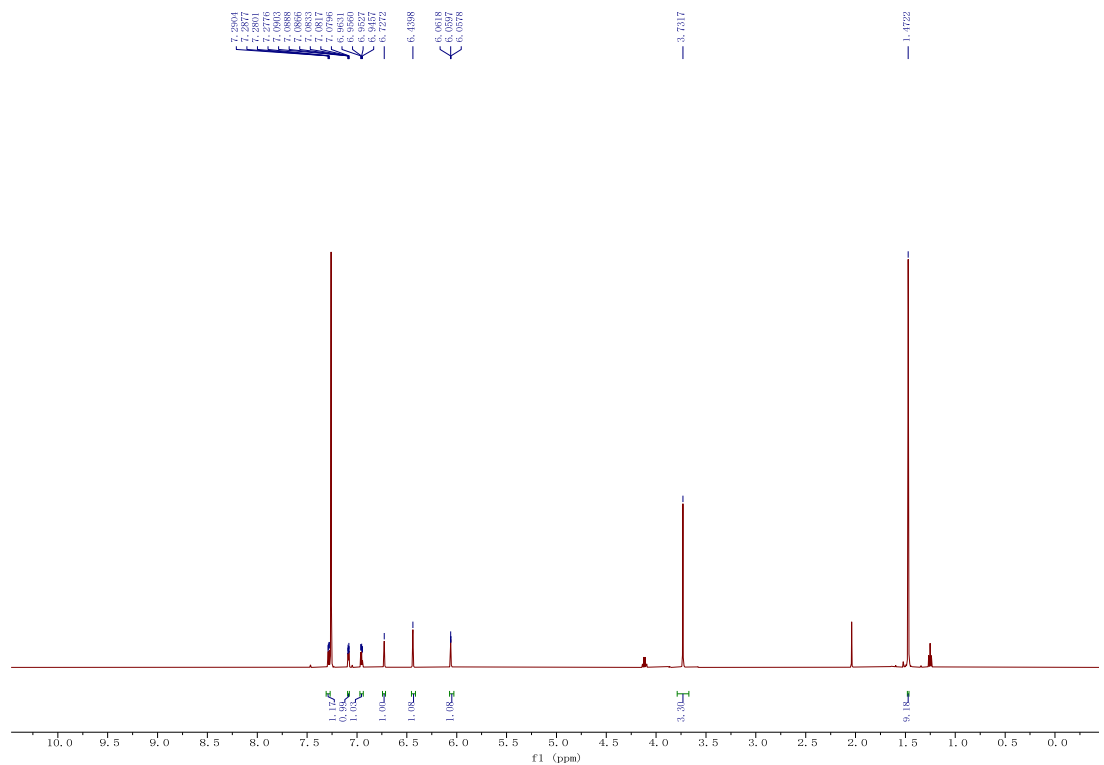


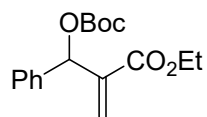
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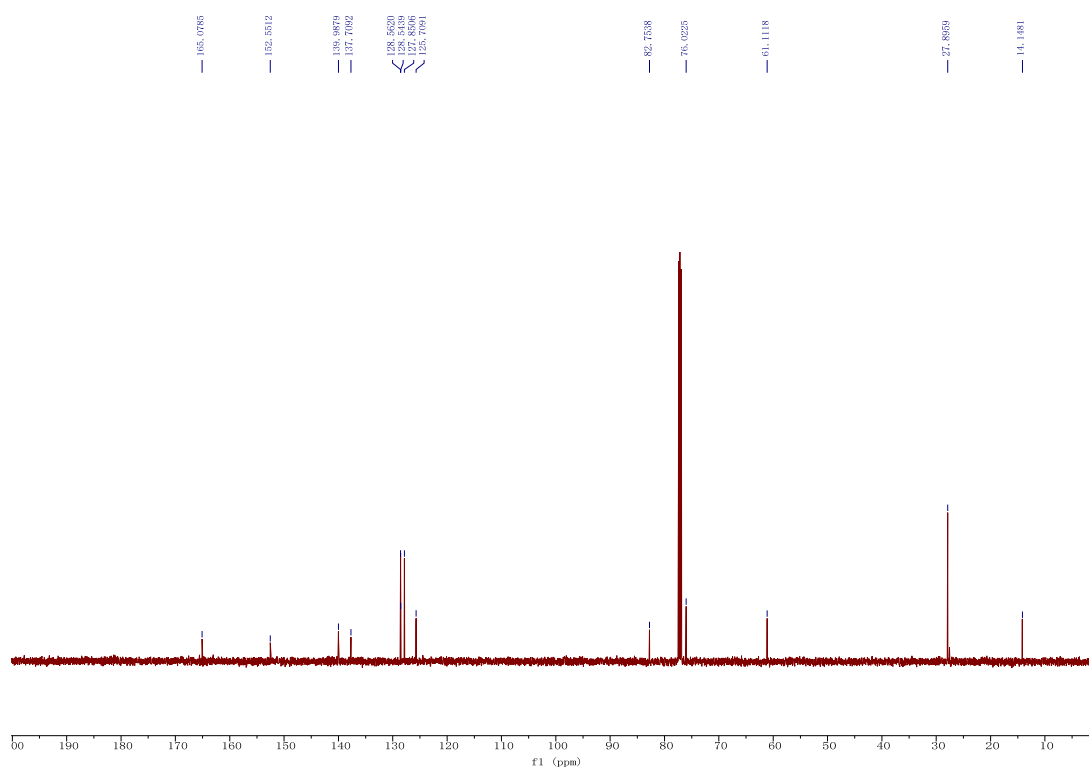
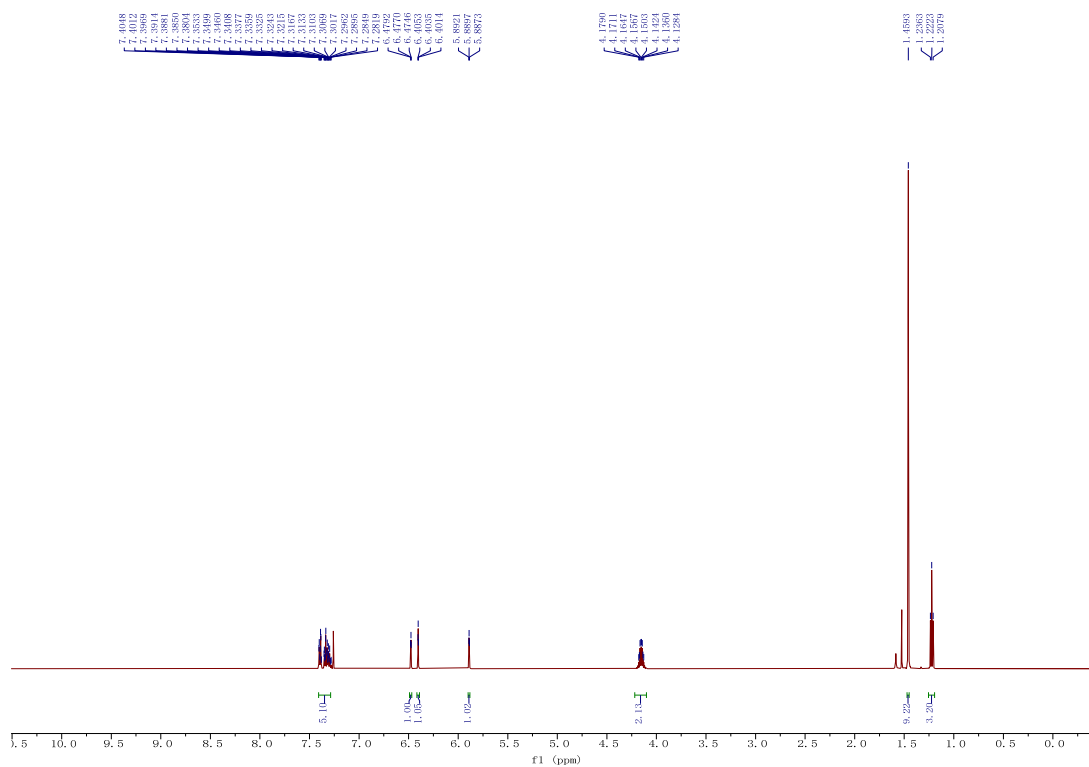


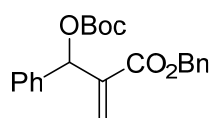
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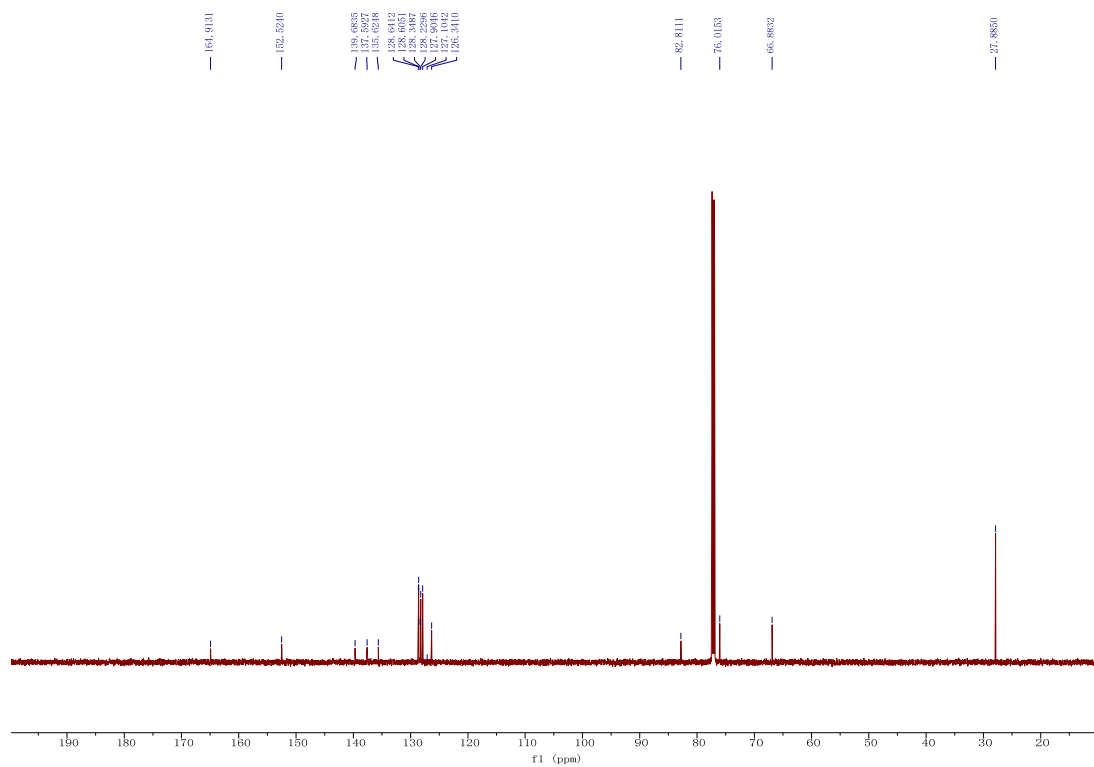
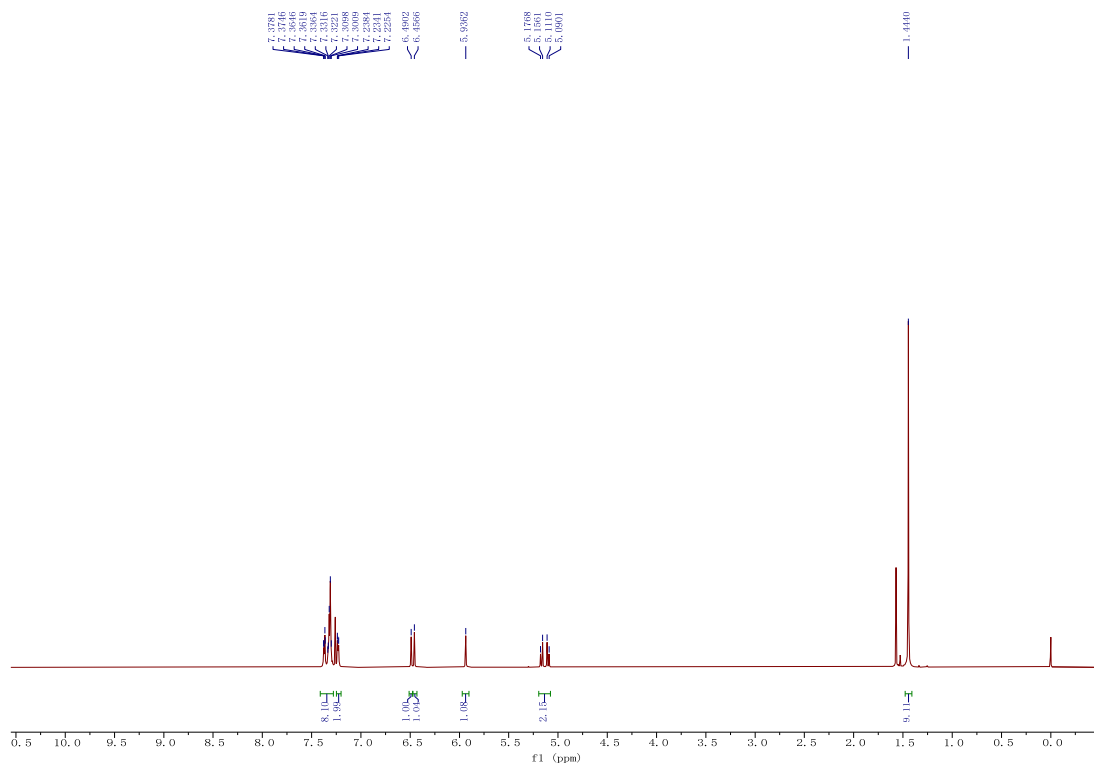


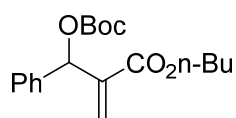
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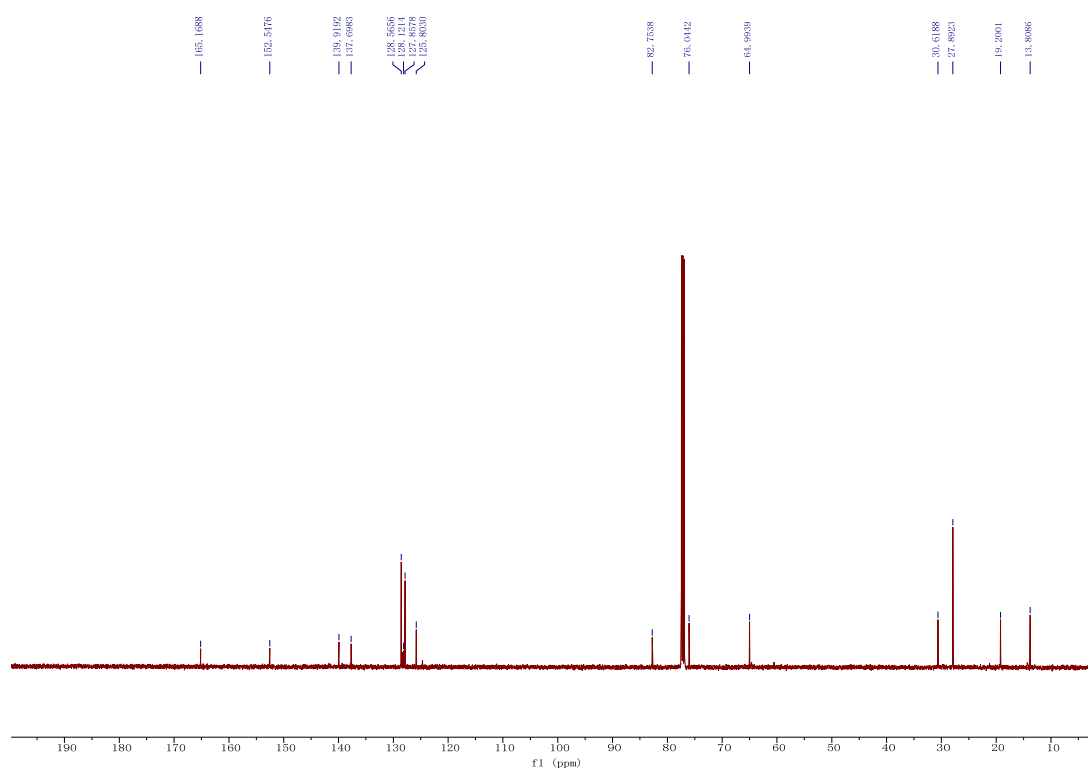
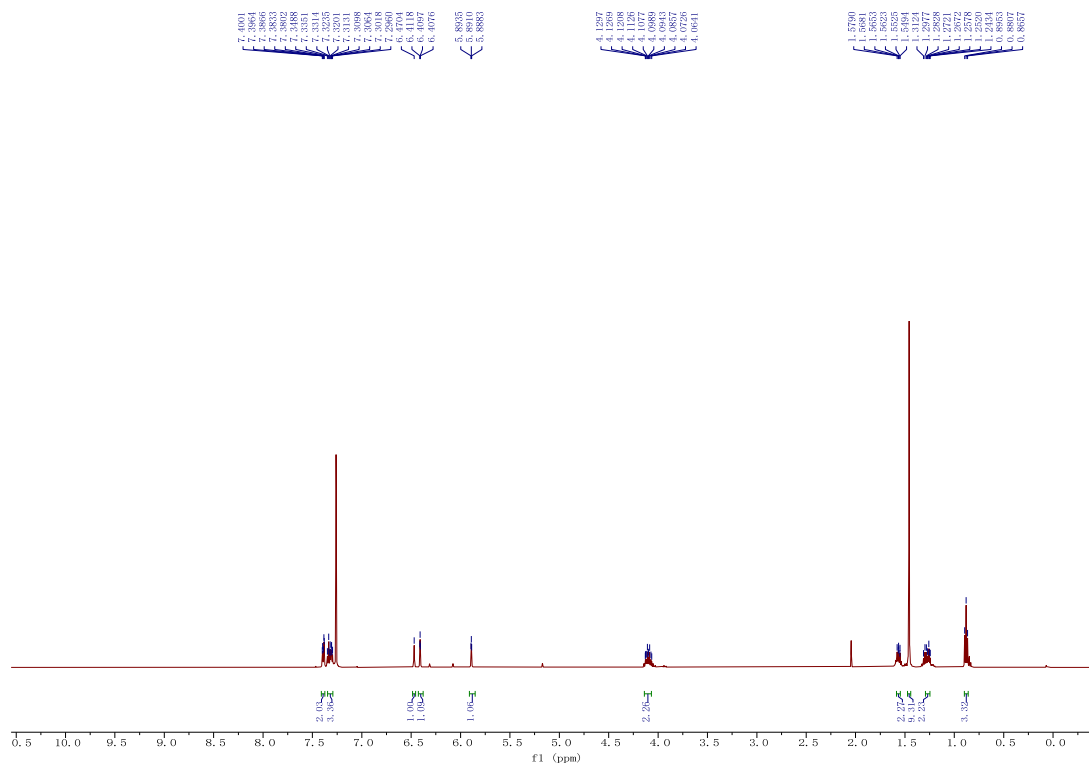


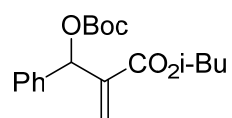
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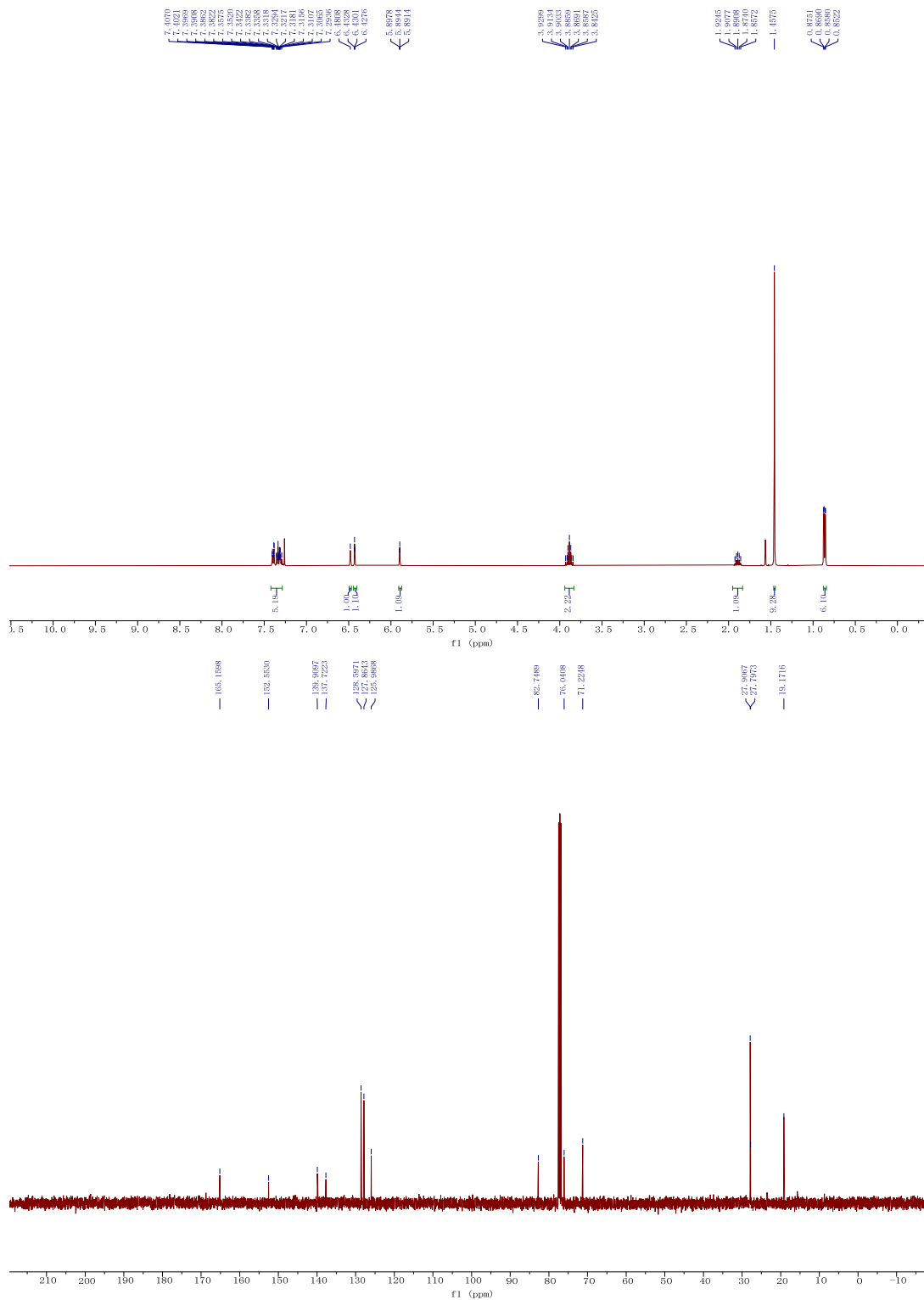


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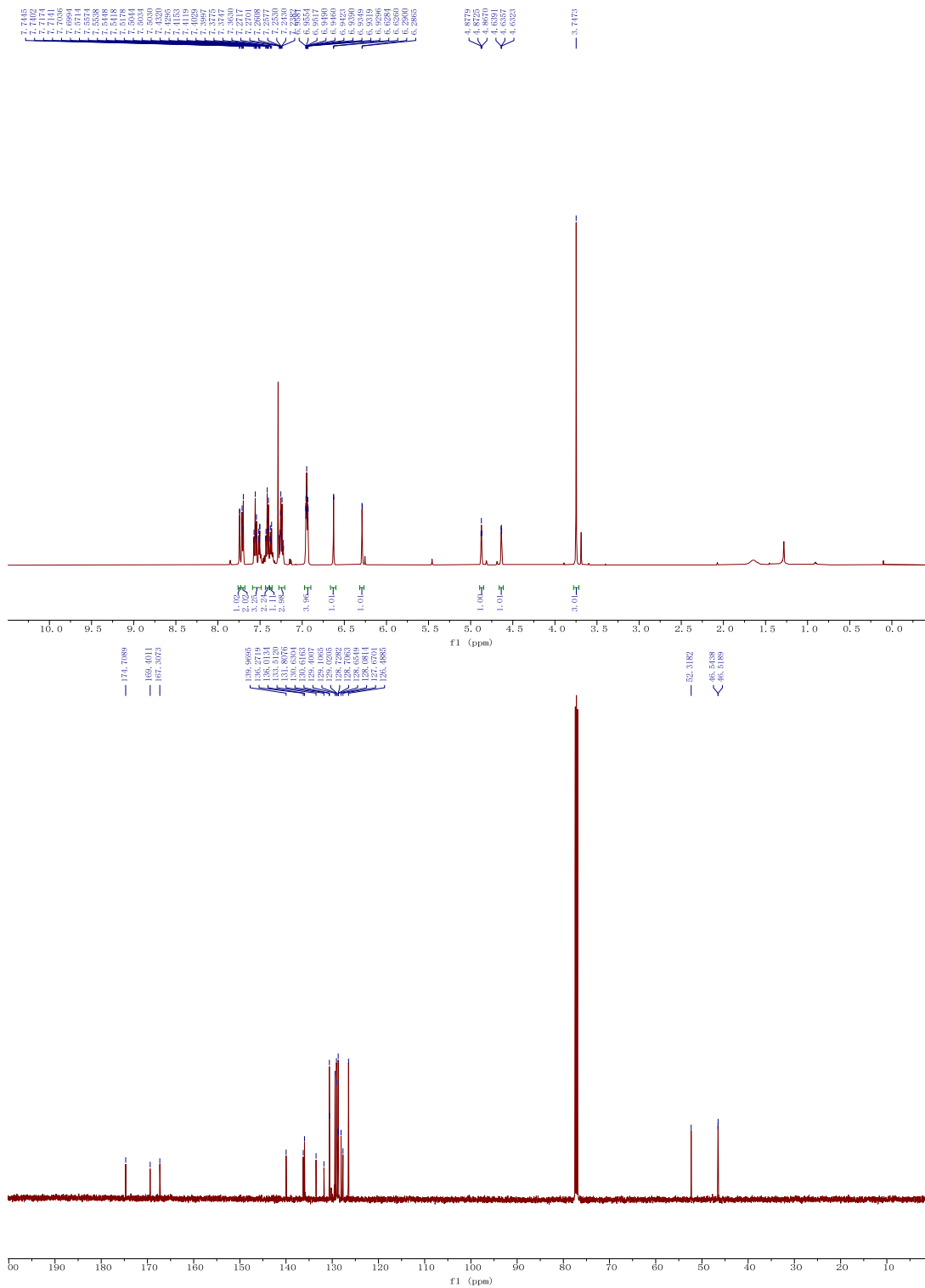
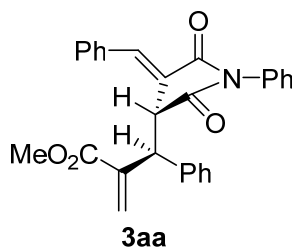




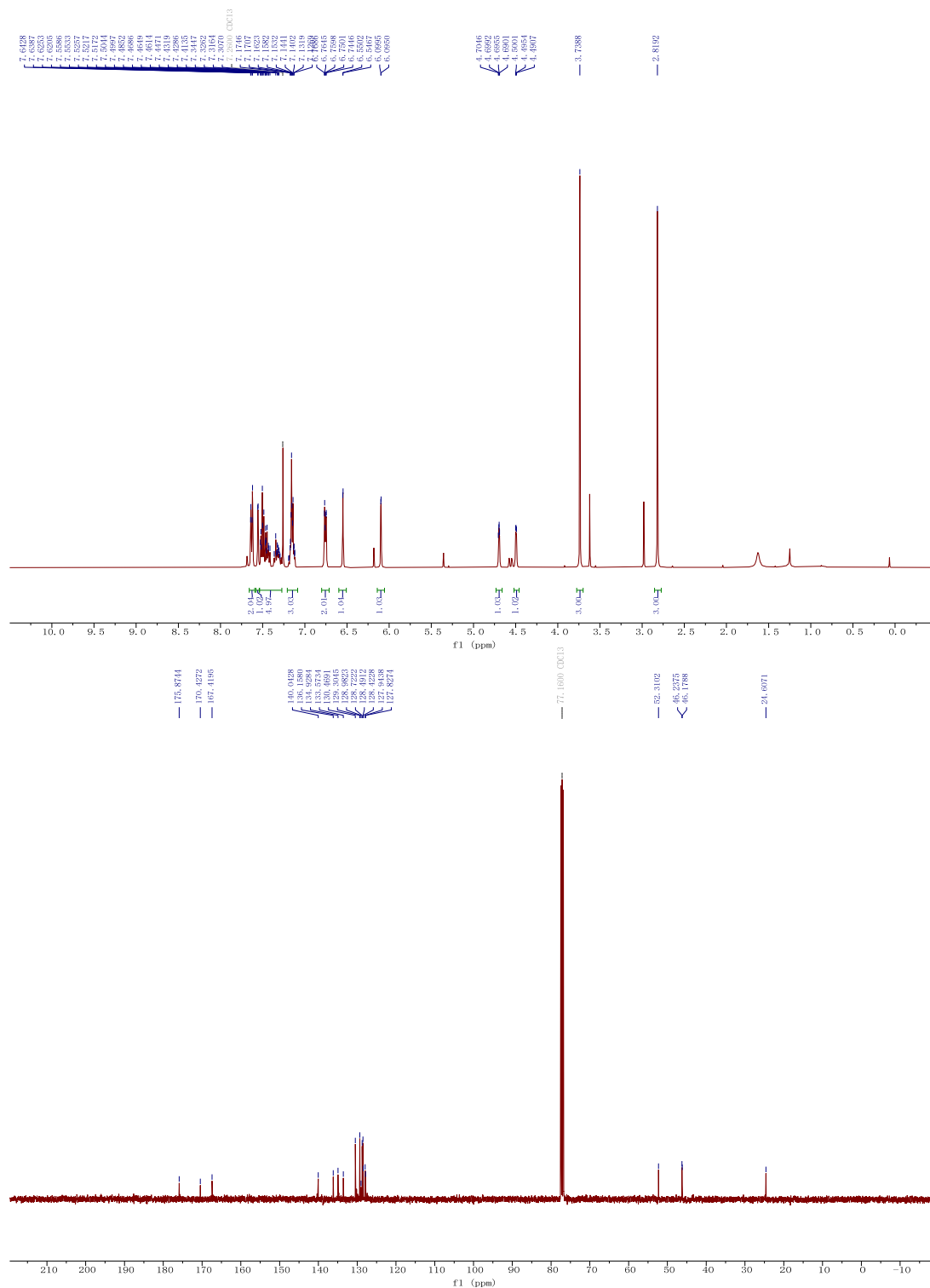
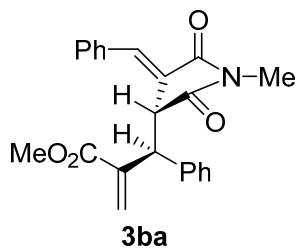
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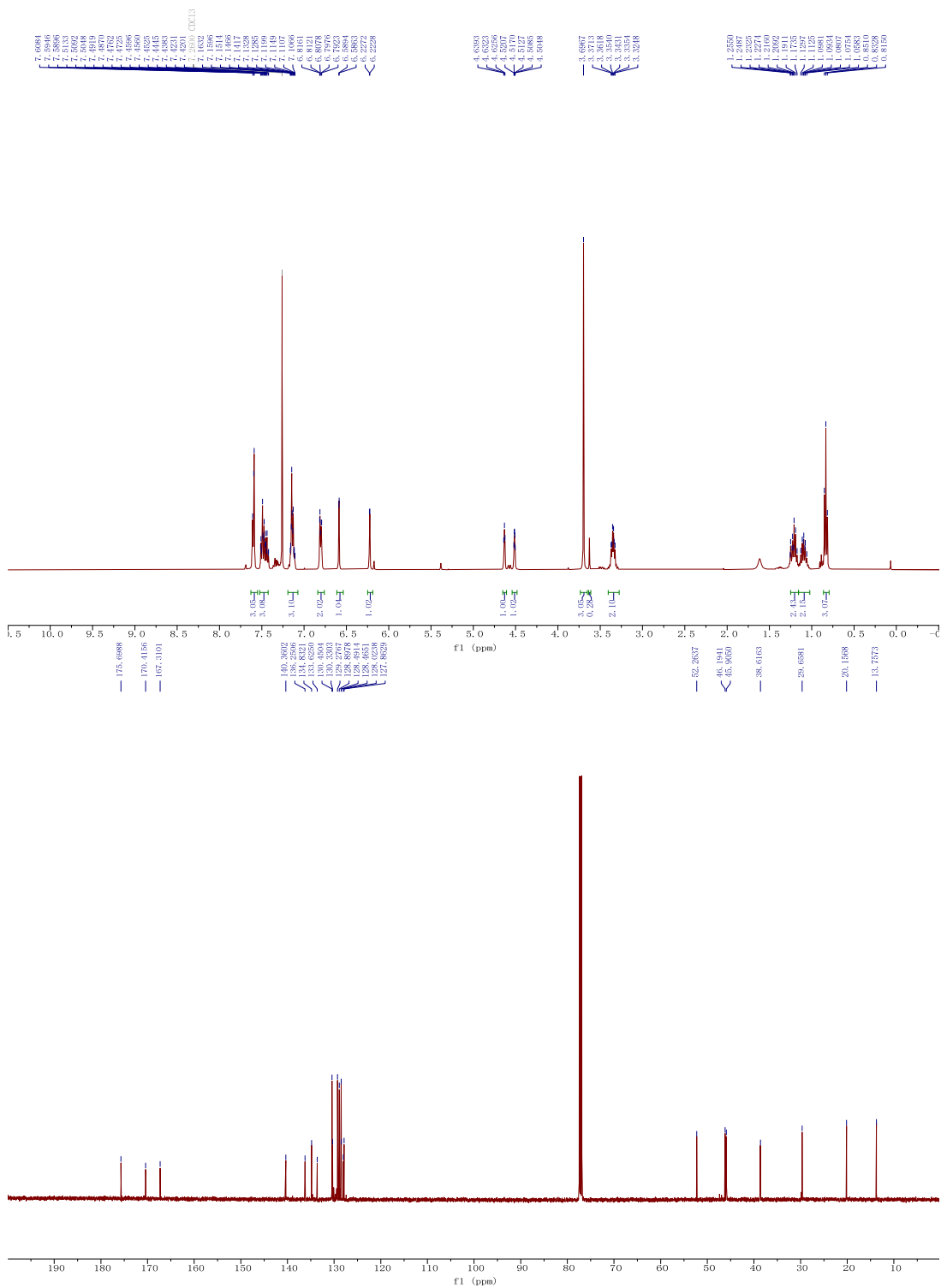
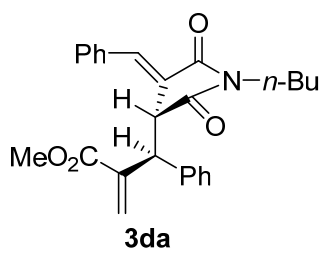


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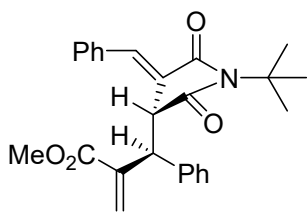




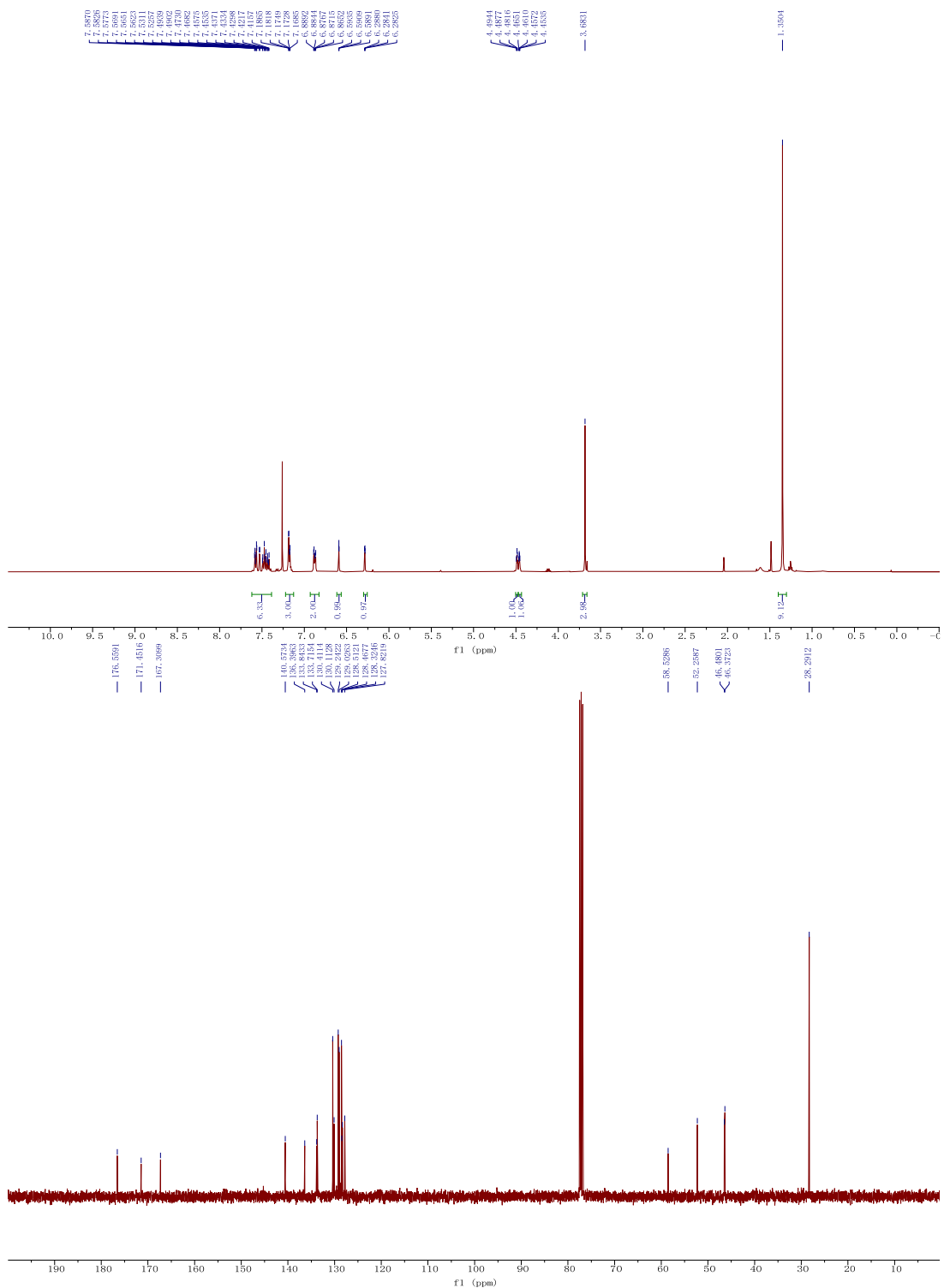
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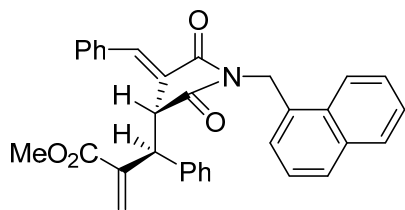
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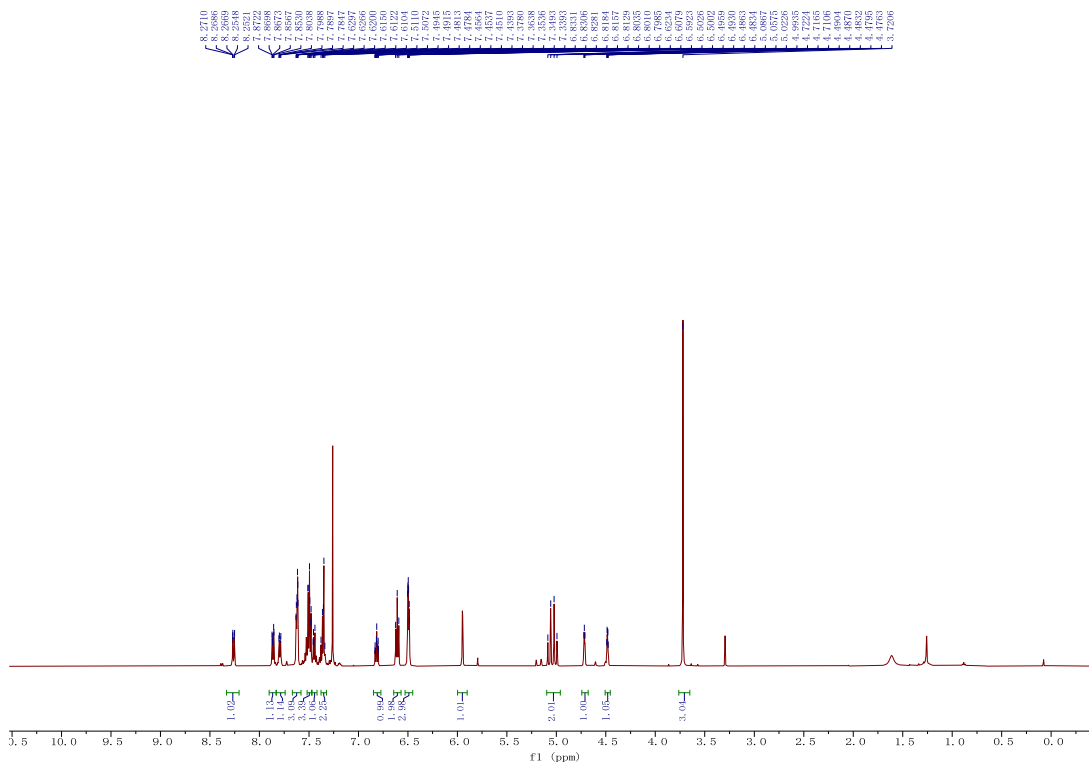
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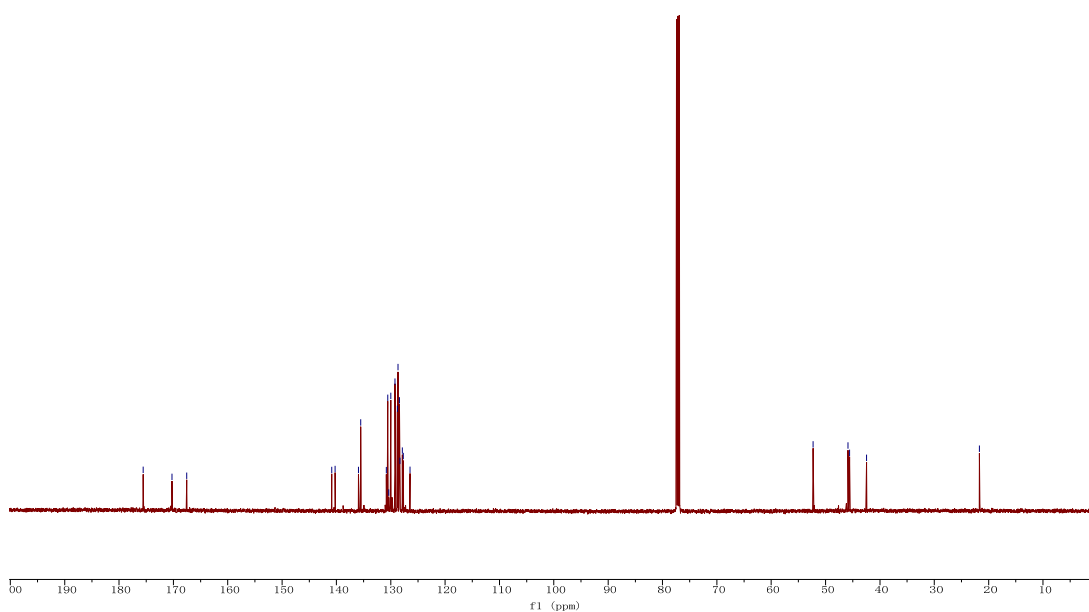
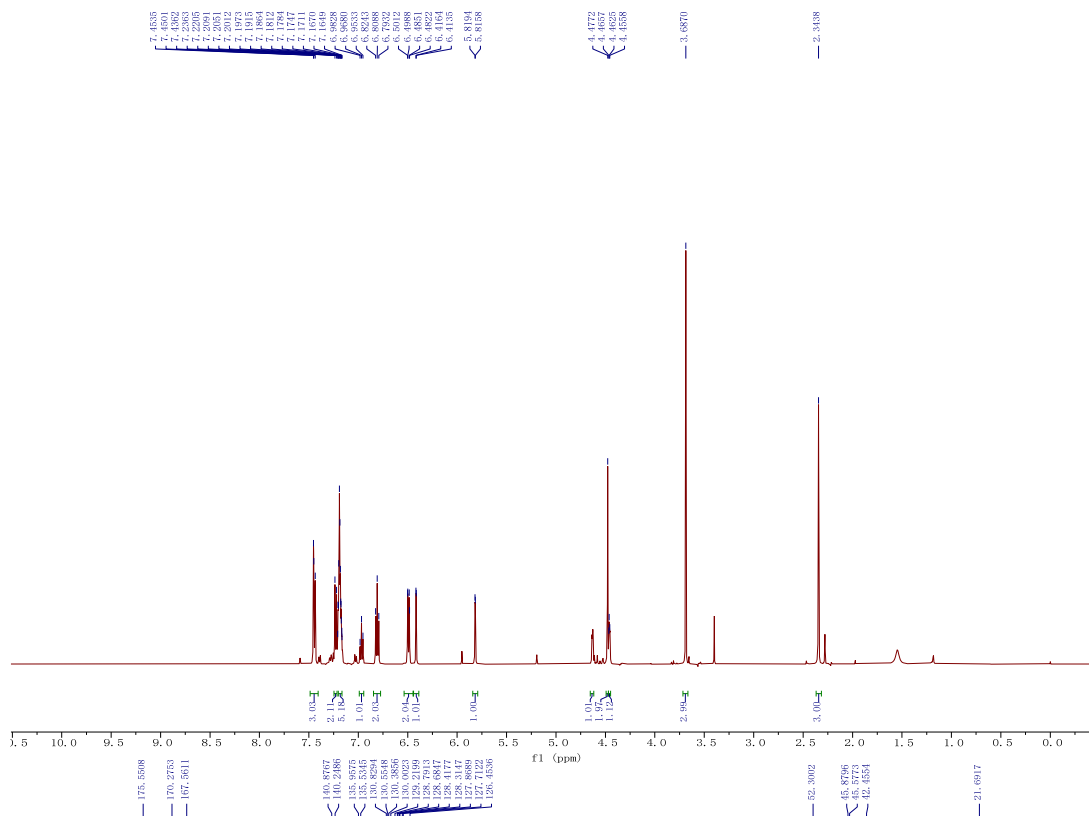


3fa



7.45361
7.4501
7.4362
7.4263
7.2205
7.2091
7.2051
7.2012
7.1973
7.1915
7.1864
7.1812
7.1784
7.1747
7.1711
7.1670
7.1619
6.9828
6.9680
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6.8088
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6.5012
6.4988
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6.4822
6.4154
6.4135

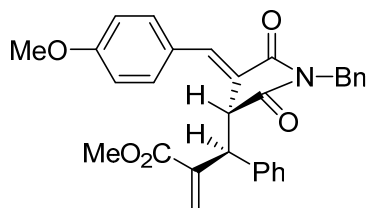
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4.4625
4.4558



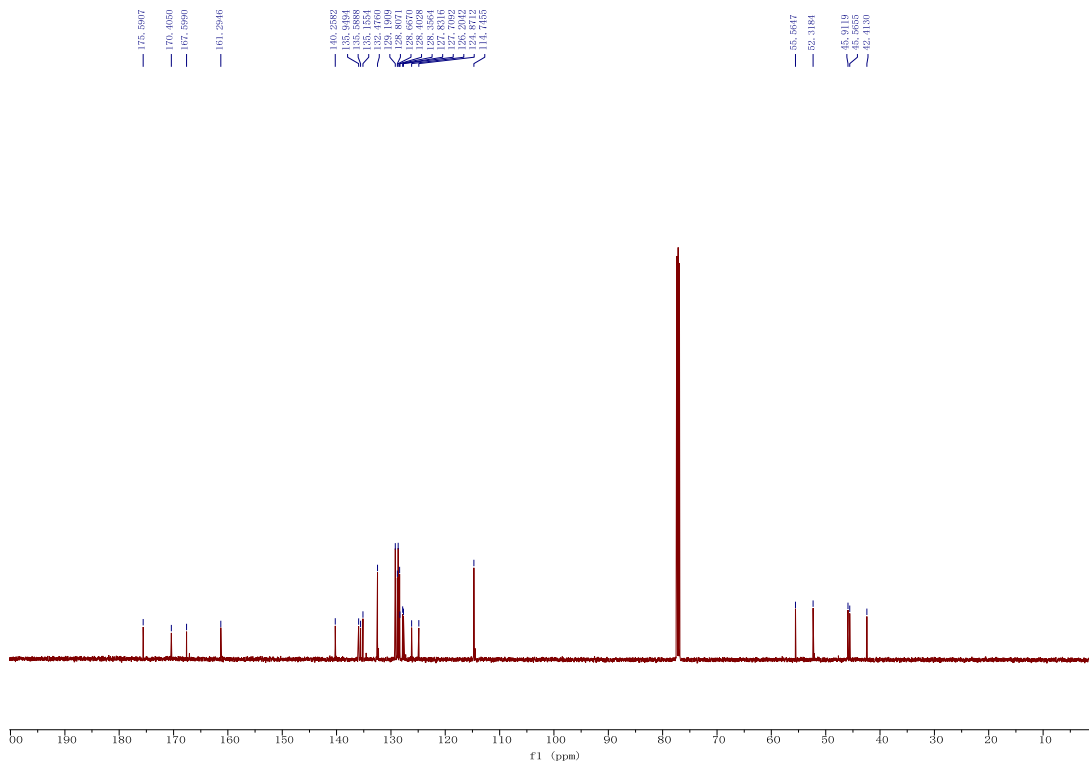
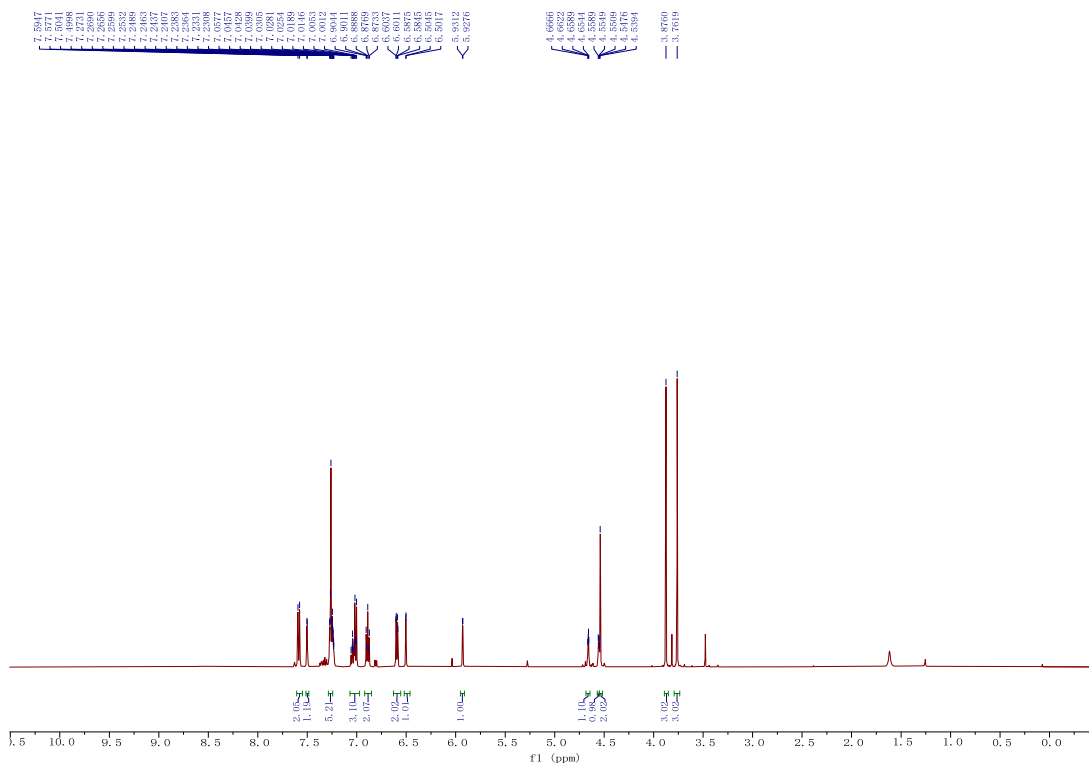
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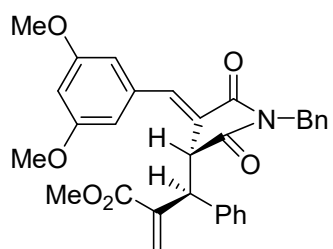
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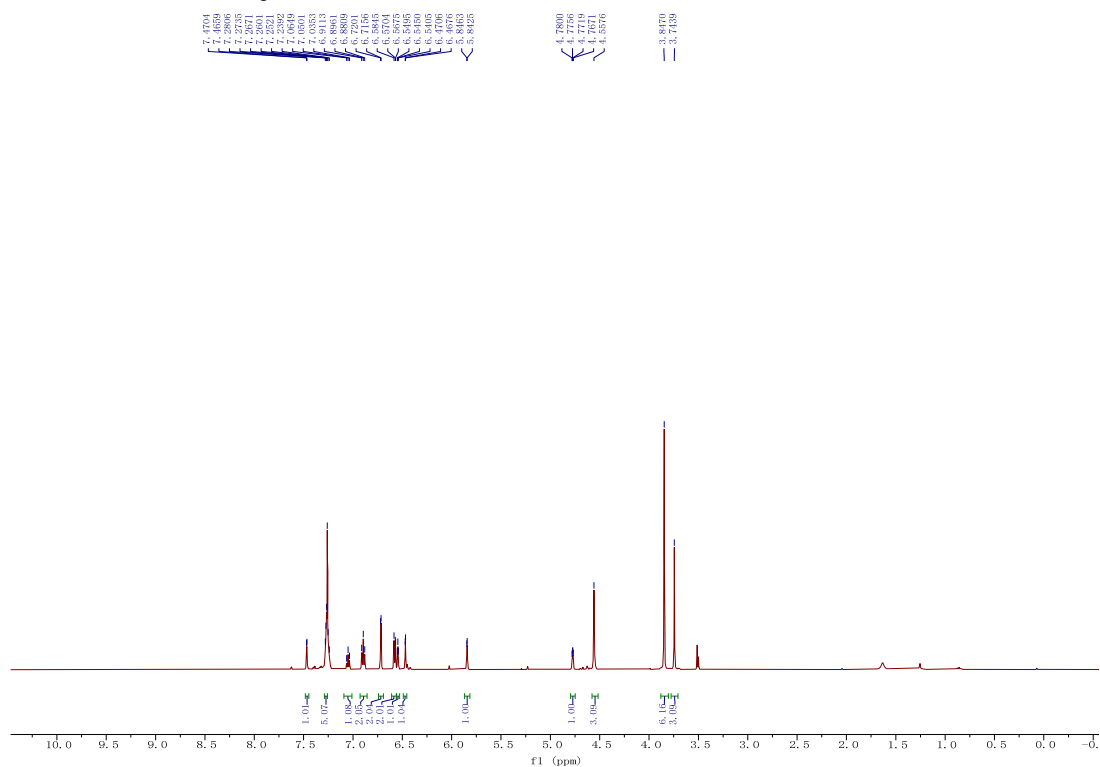
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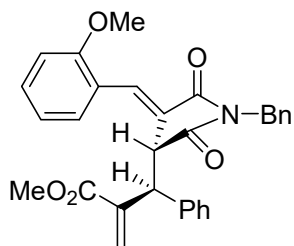
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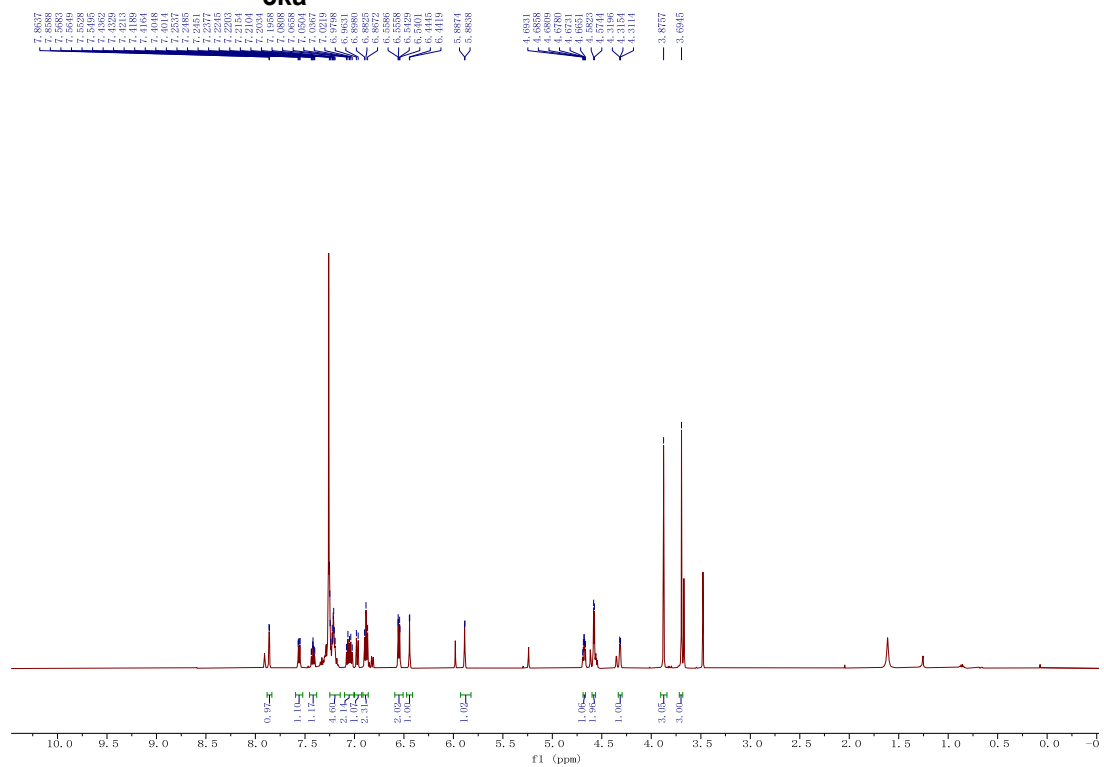
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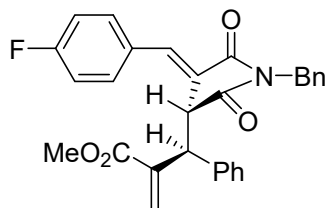
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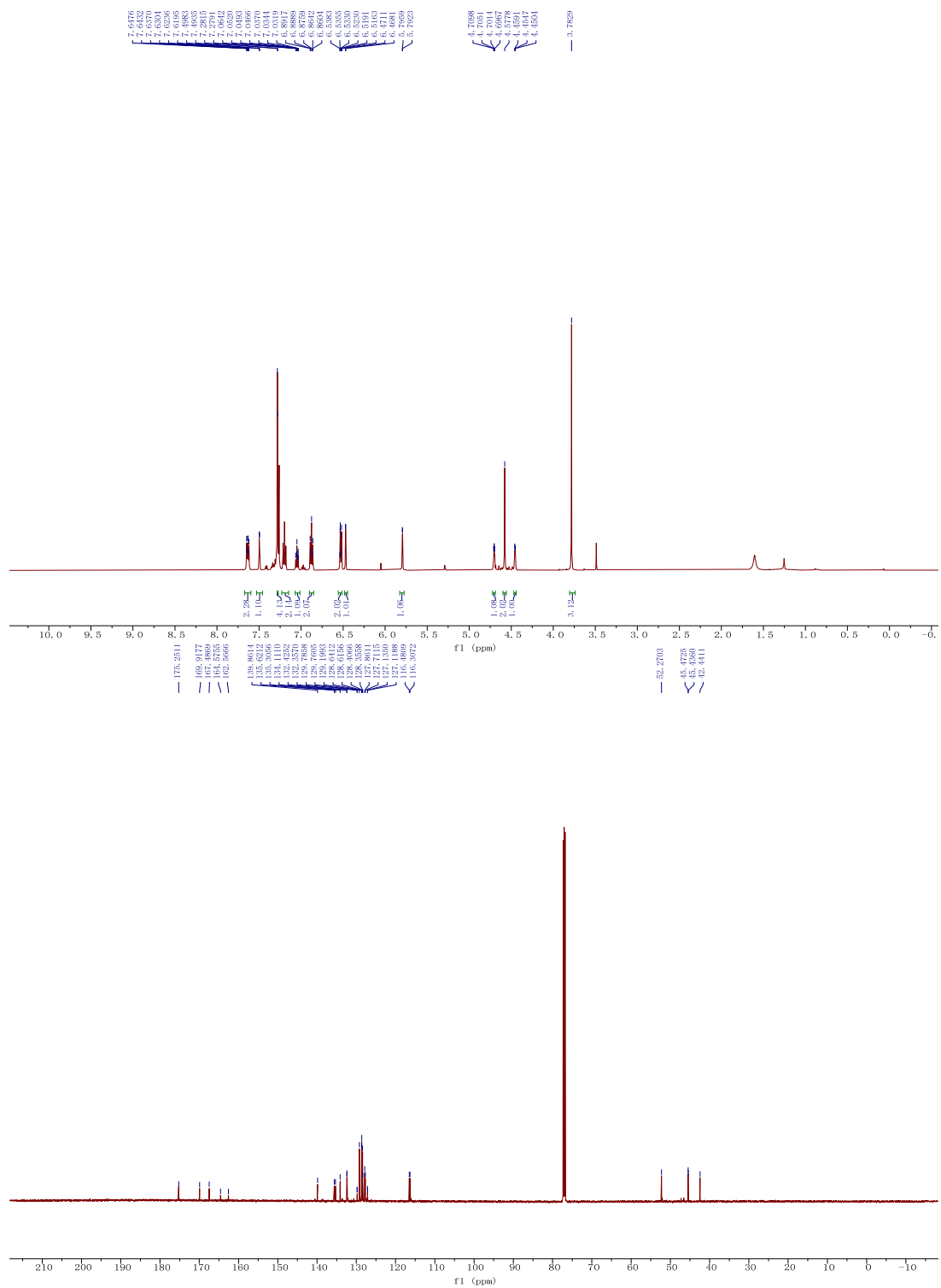
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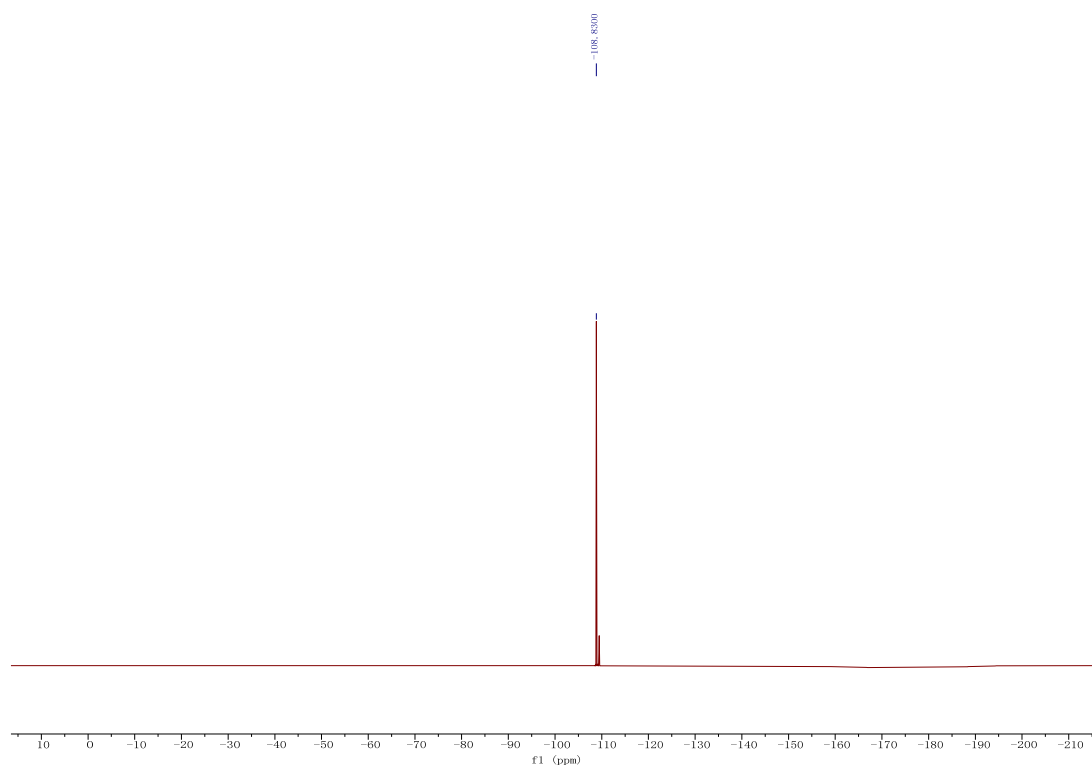


3la

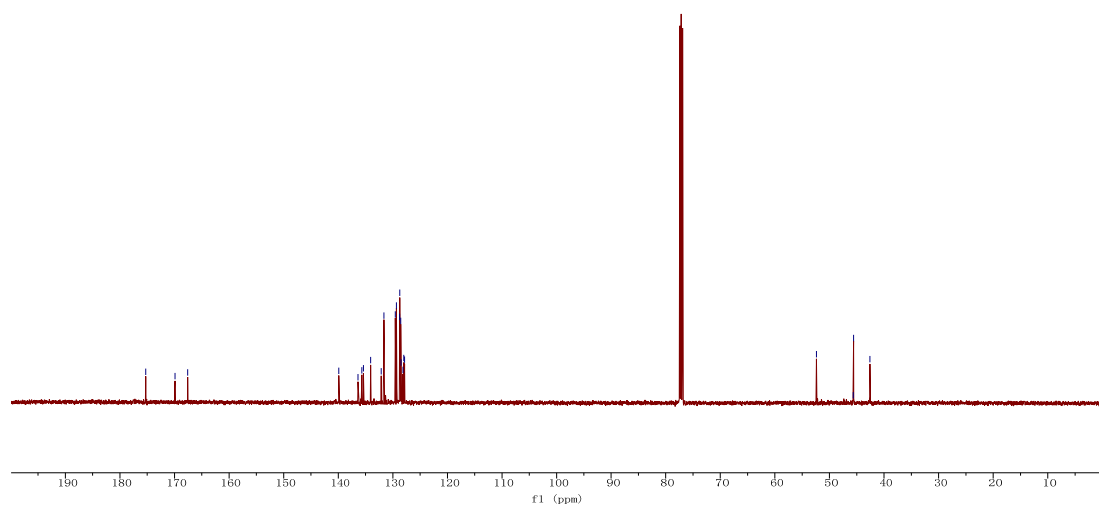
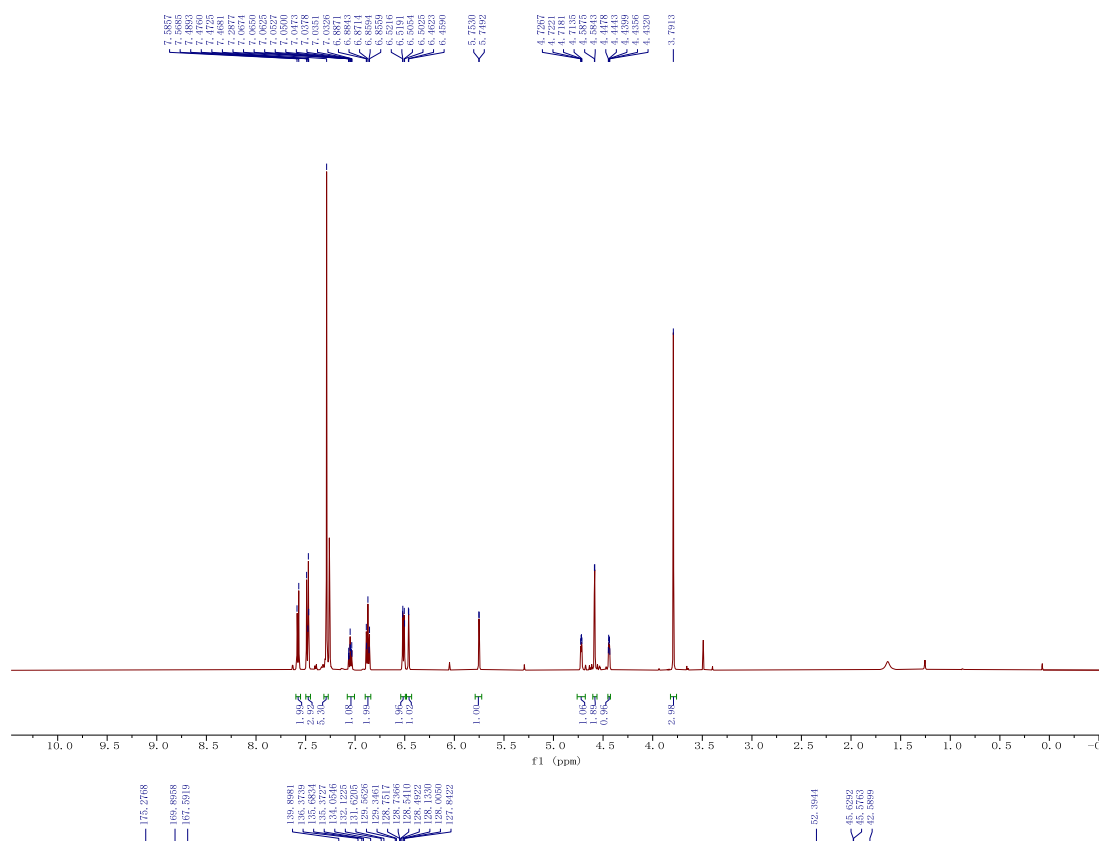


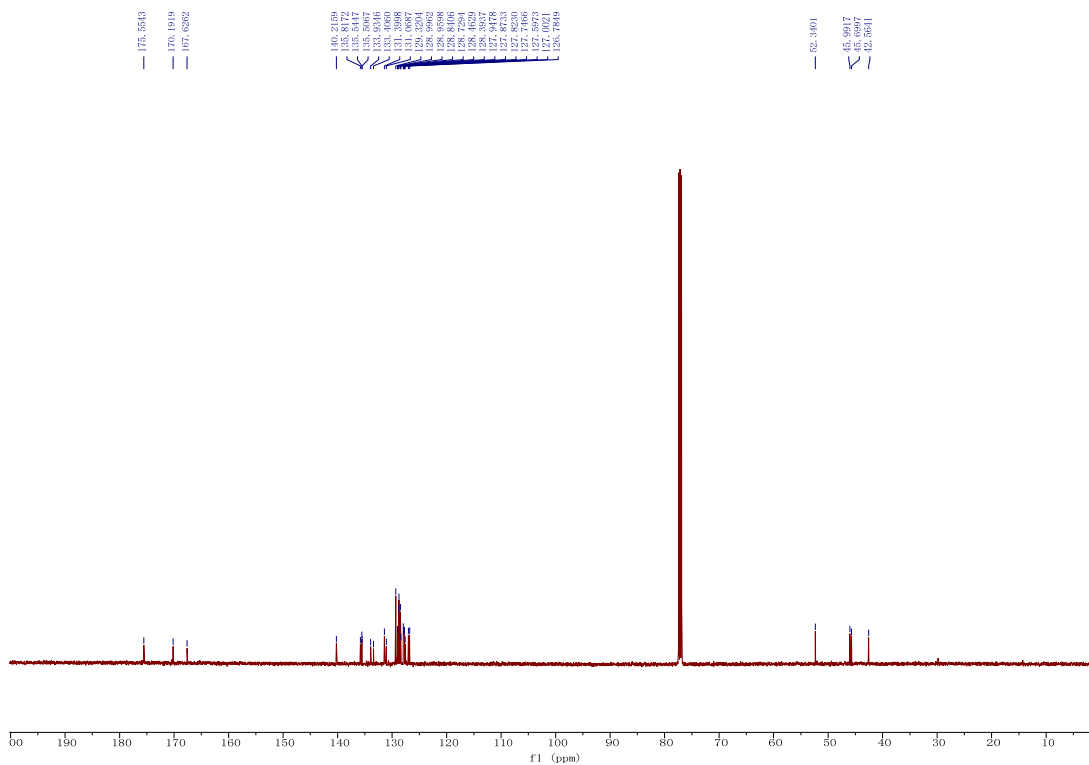
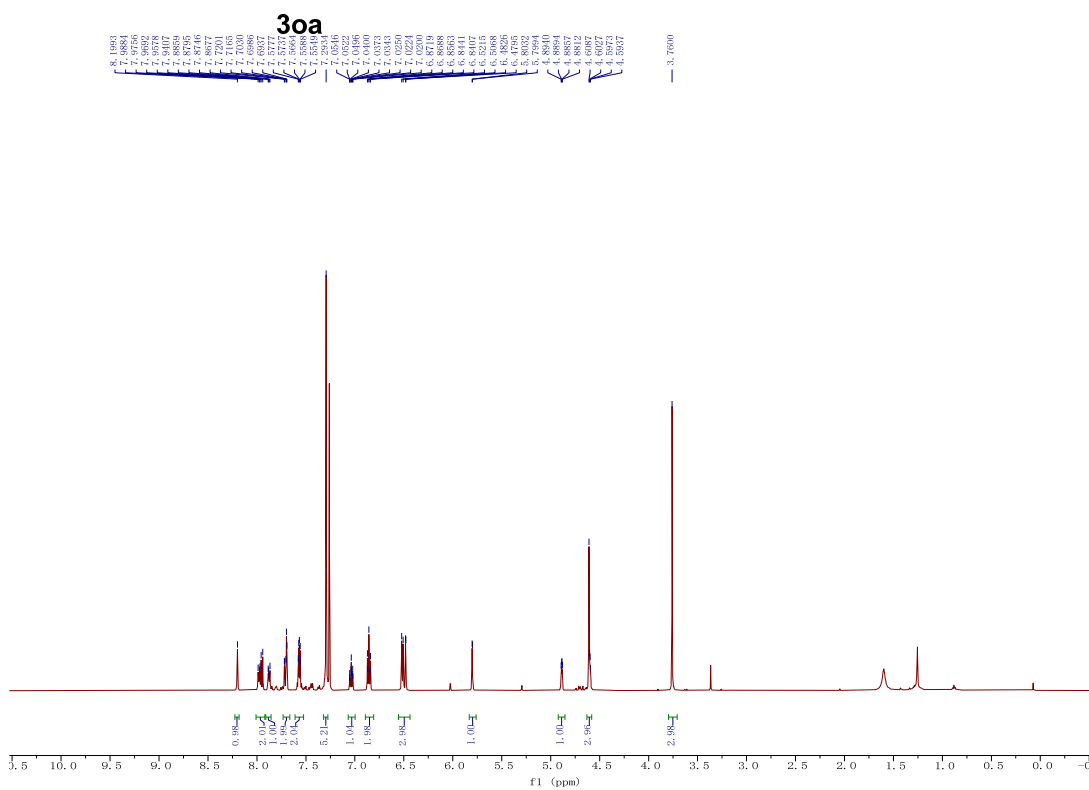
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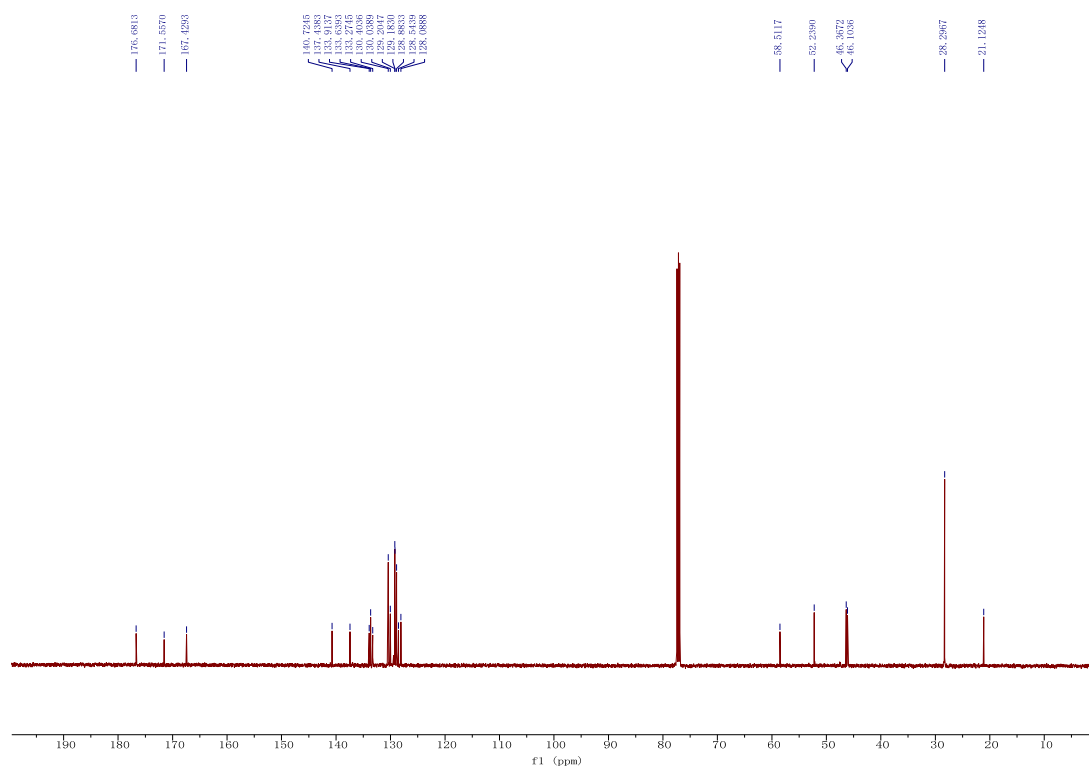
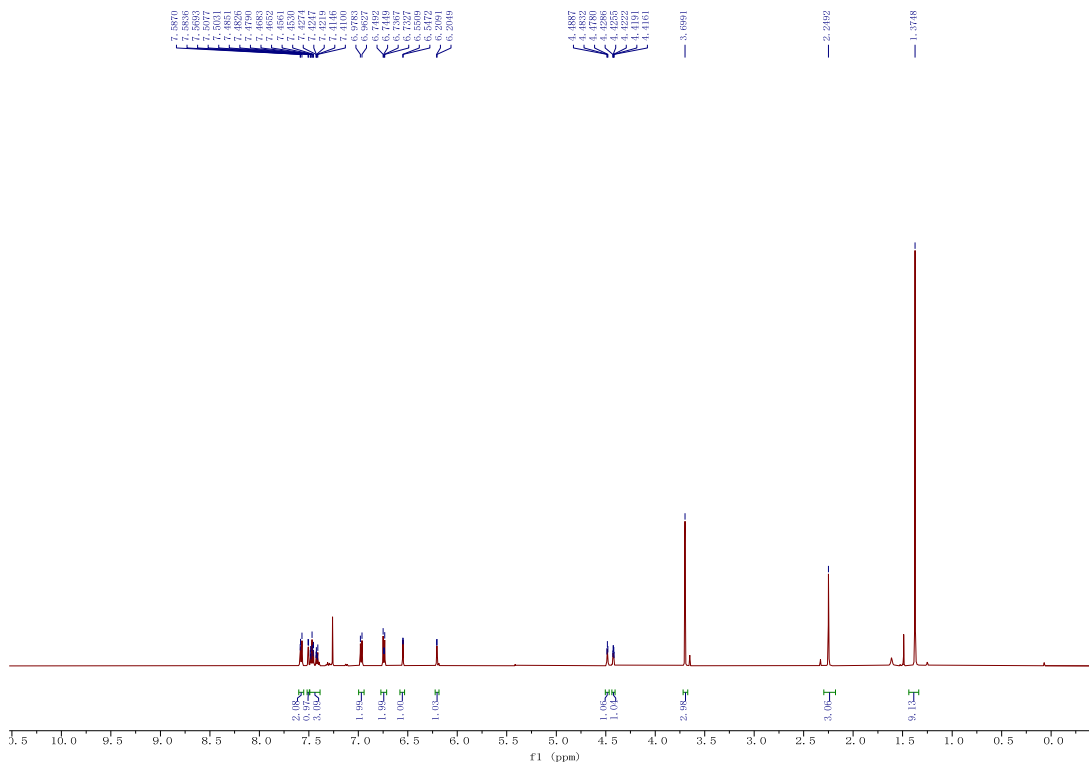




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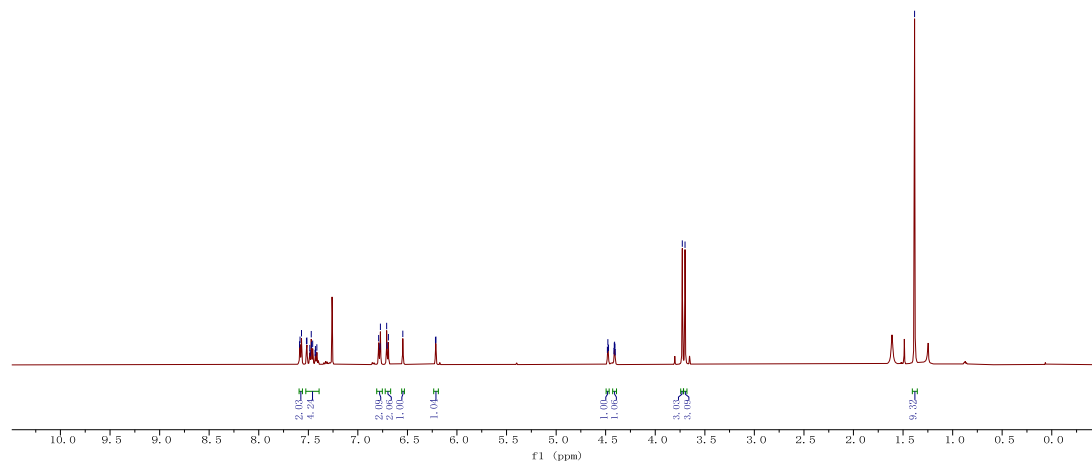




7.5873
7.5839
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7.5180
7.5132
7.4848
7.4811
7.4708
7.4671
7.4552
7.4311
7.4280
7.4253
7.4137
6.7910
6.7779
6.7733
6.7098
6.7053
6.6921
6.5460
6.5165
6.2125

$$\begin{array}{r} 4.4826 \\ 4.4771 \\ 4.4719 \\ 4.4164 \\ 4.4133 \\ 4.4103 \\ 4.4072 \\ 4.4039 \end{array} \quad \begin{array}{r} 3.7272 \\ 3.7000 \end{array}$$

— 1.3843



— 176,7276
— 171,5580
— 167,4493
— 159,1736

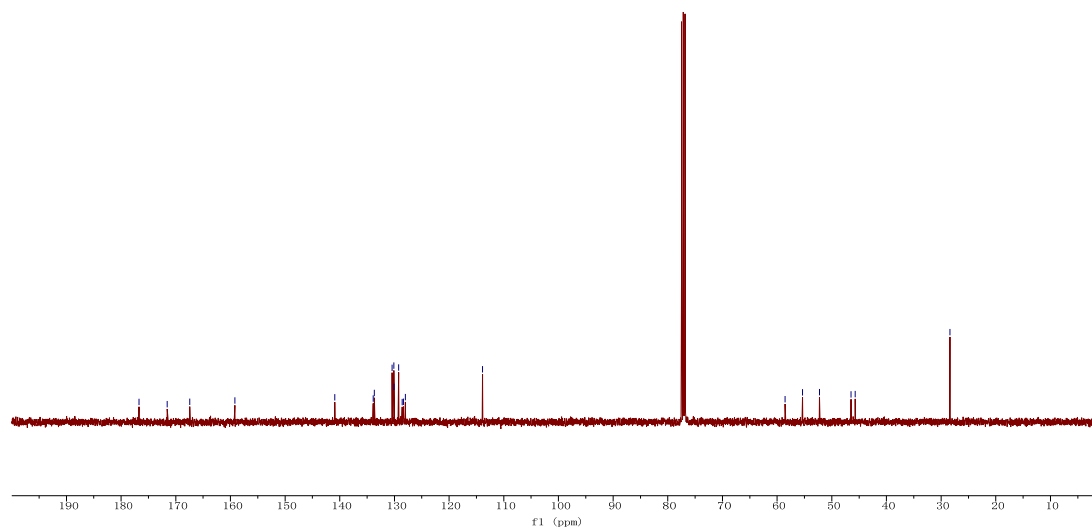
— 140, 8977
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133, 6683
130, 4164
130, 0992
130, 0773
129, 2315
128, 5899
128, 3565
128, 0029

— 113,8904

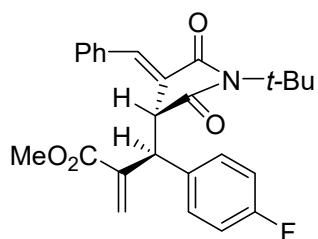
$$\begin{array}{r} \text{58,5451} \\ \text{55,3479} \\ \text{52,2563} \end{array} \quad \begin{array}{r} \text{46,4779} \\ \text{45,7123} \end{array}$$

— 28,3734

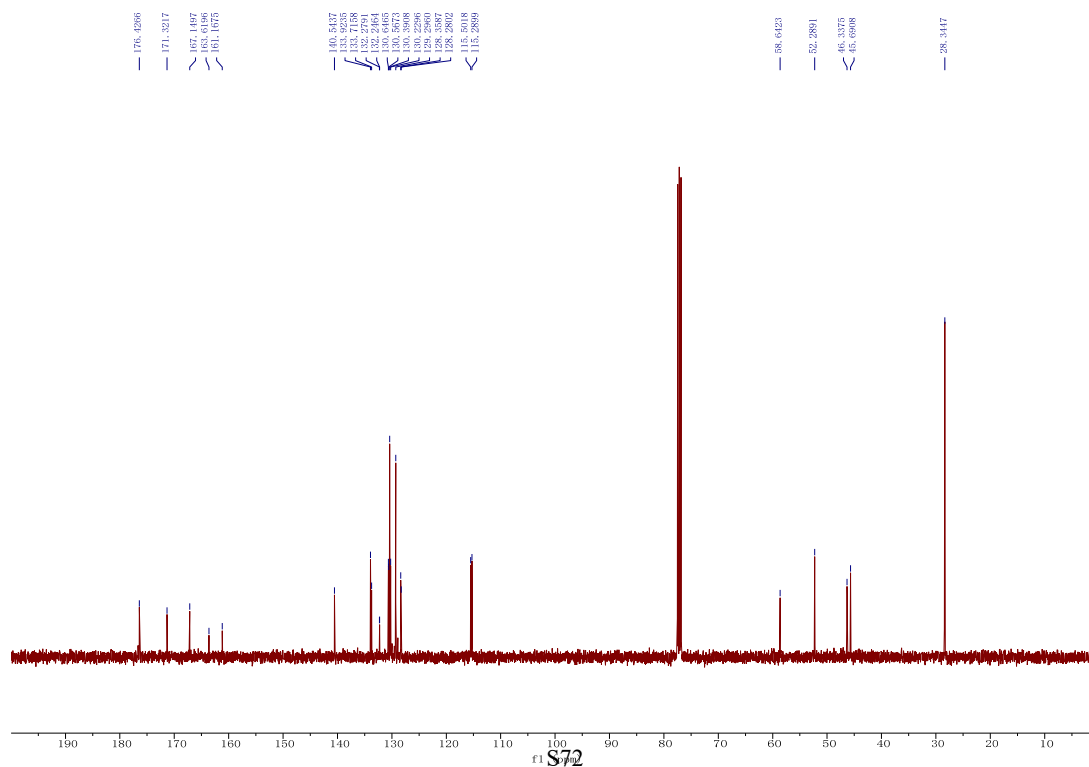
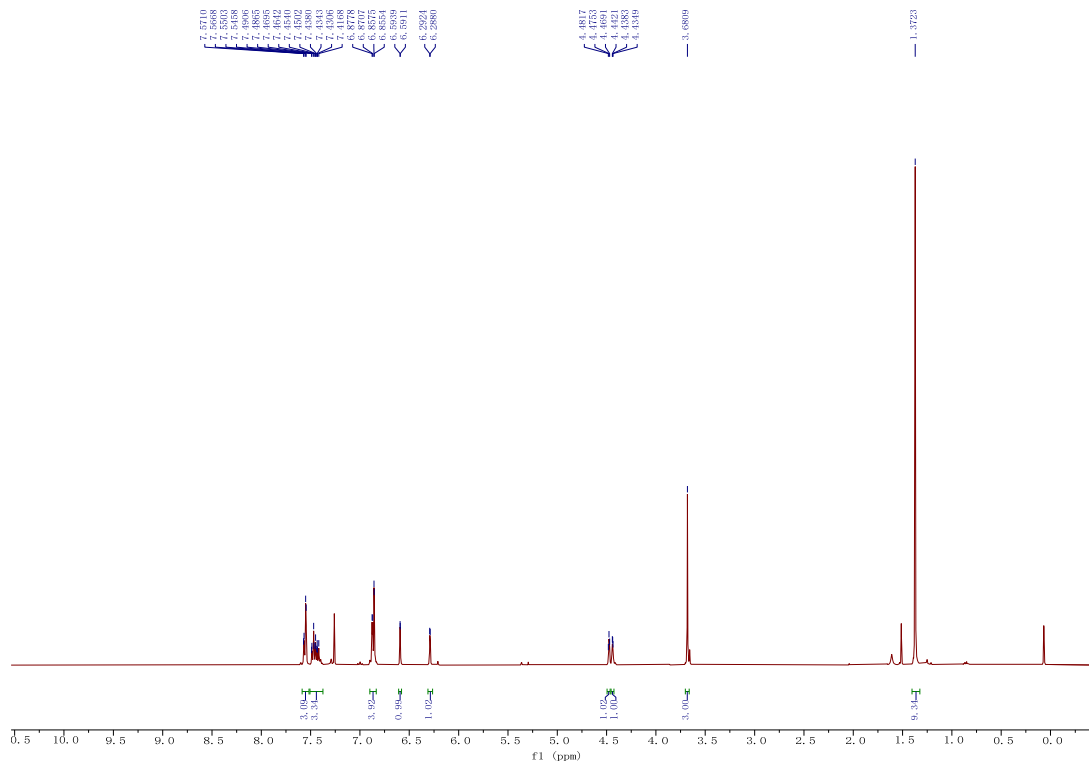
— 28. 3734

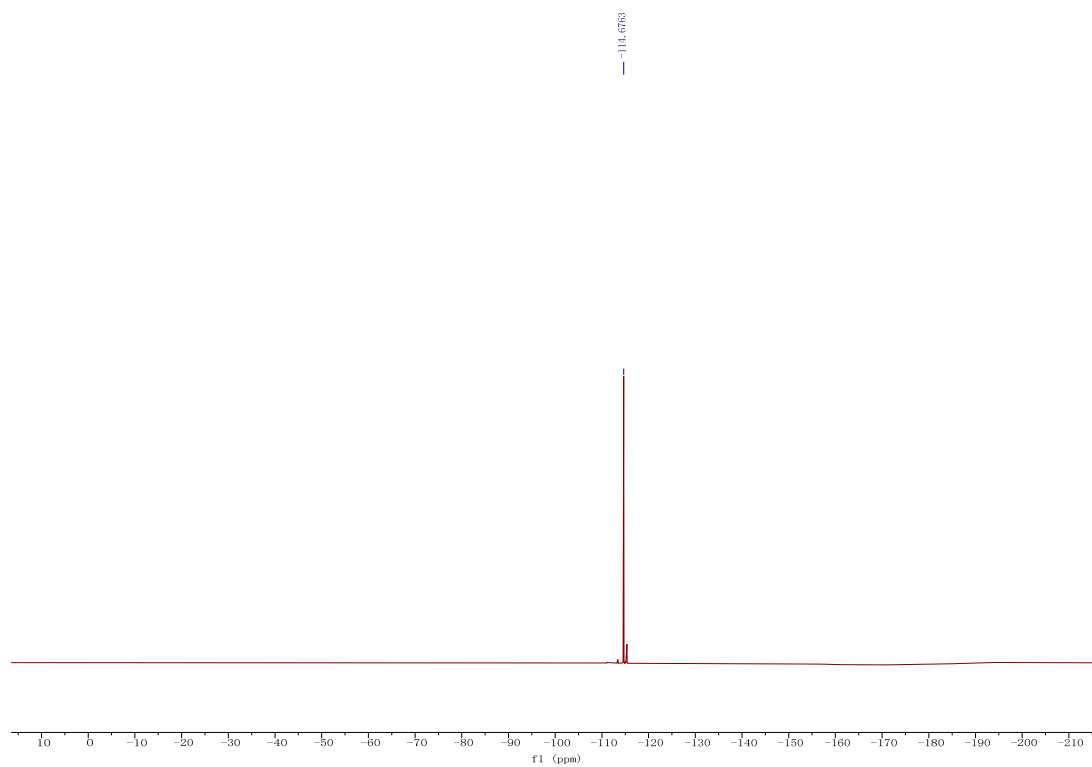


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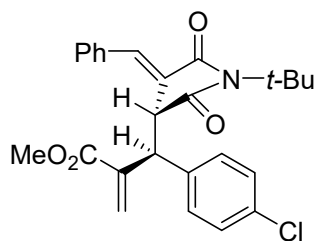


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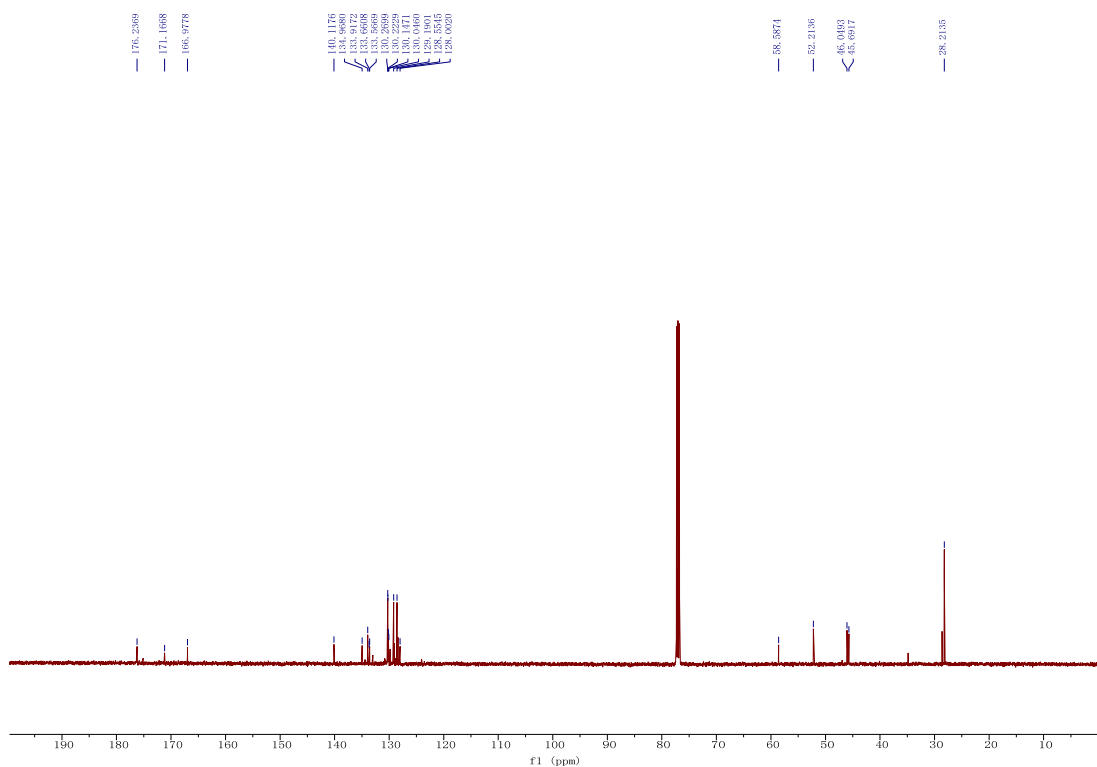
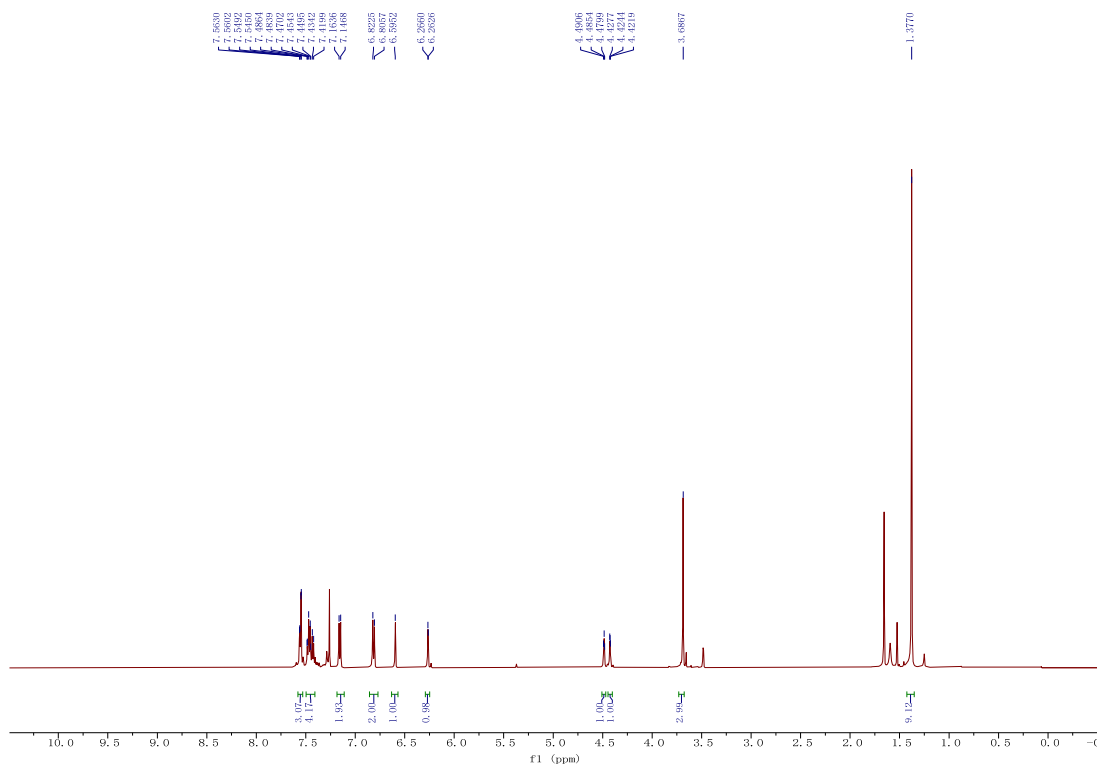




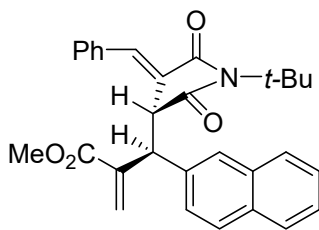
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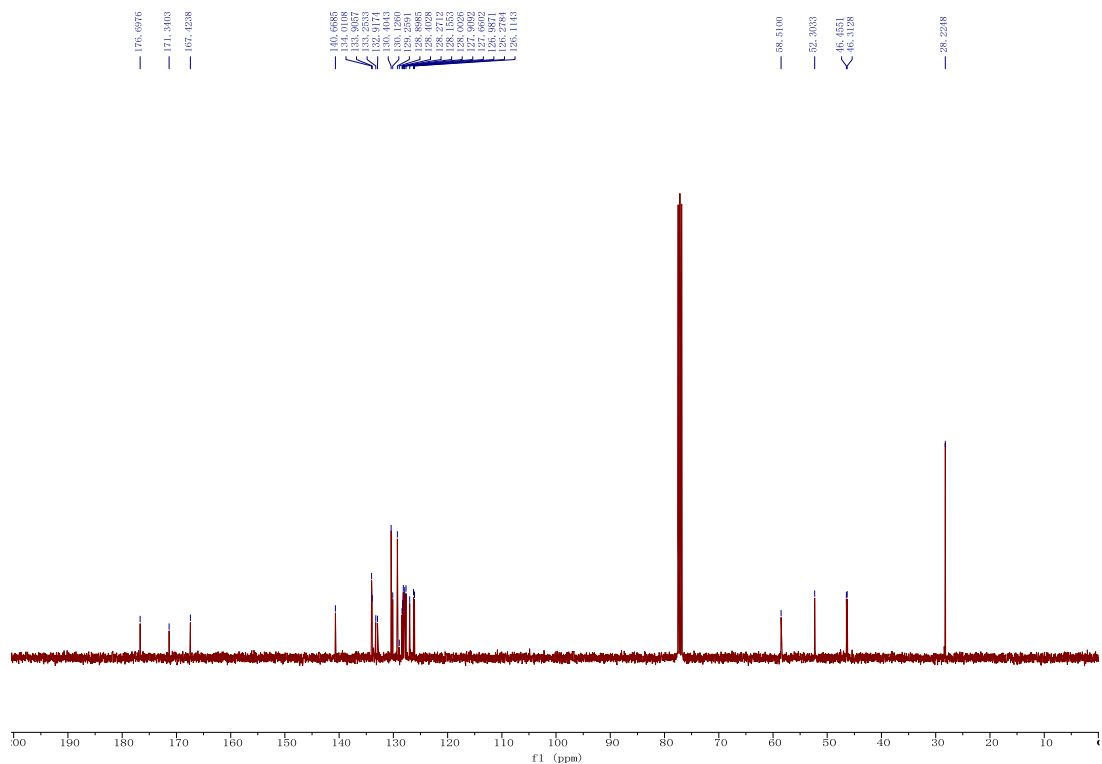
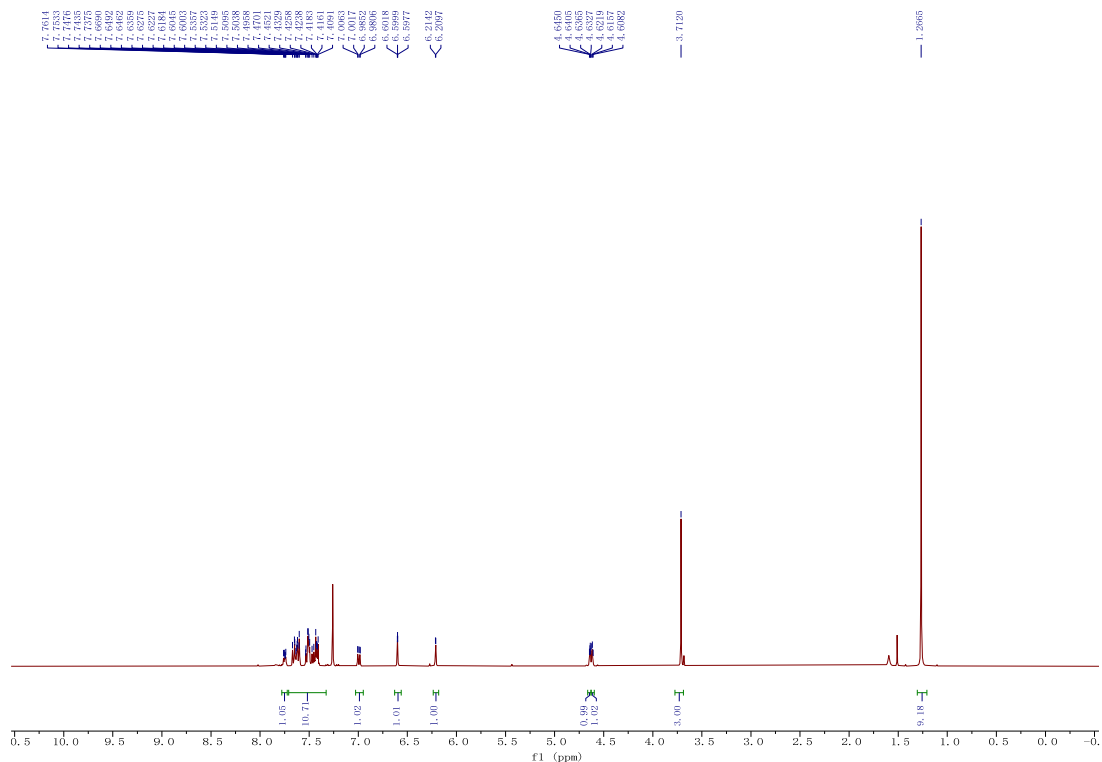
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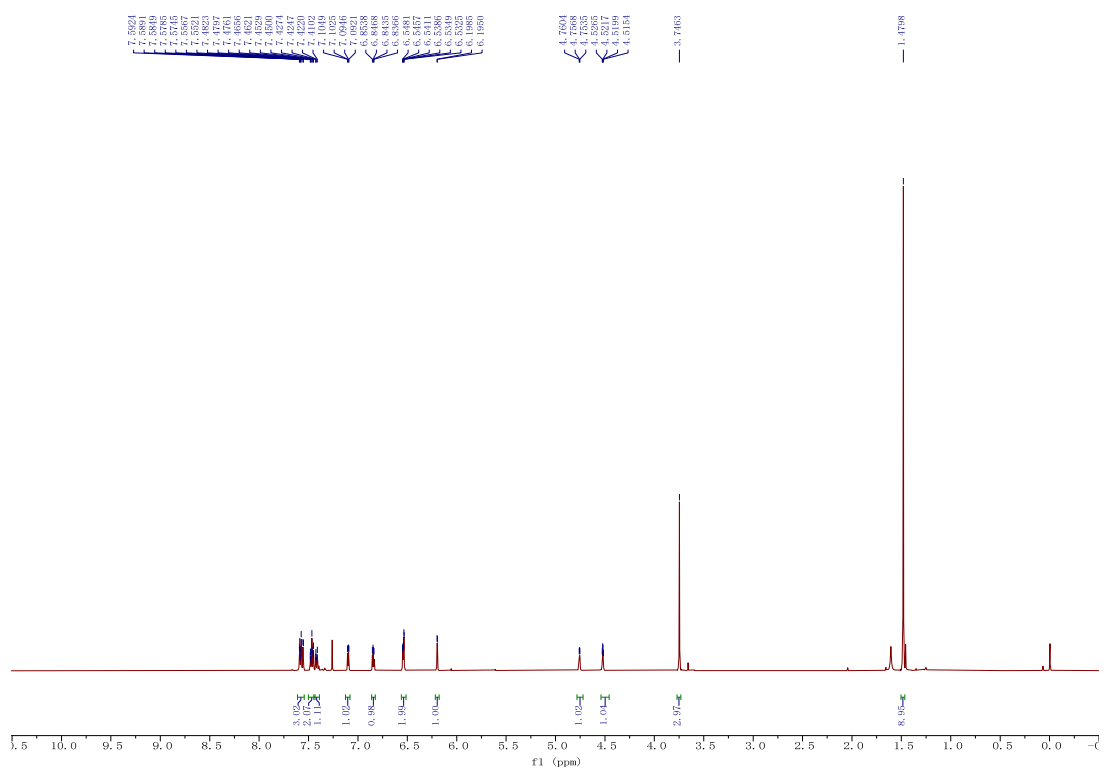
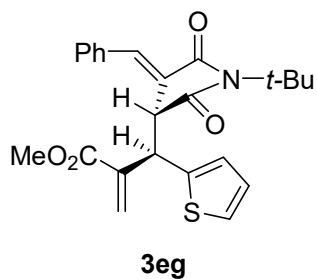
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3ef



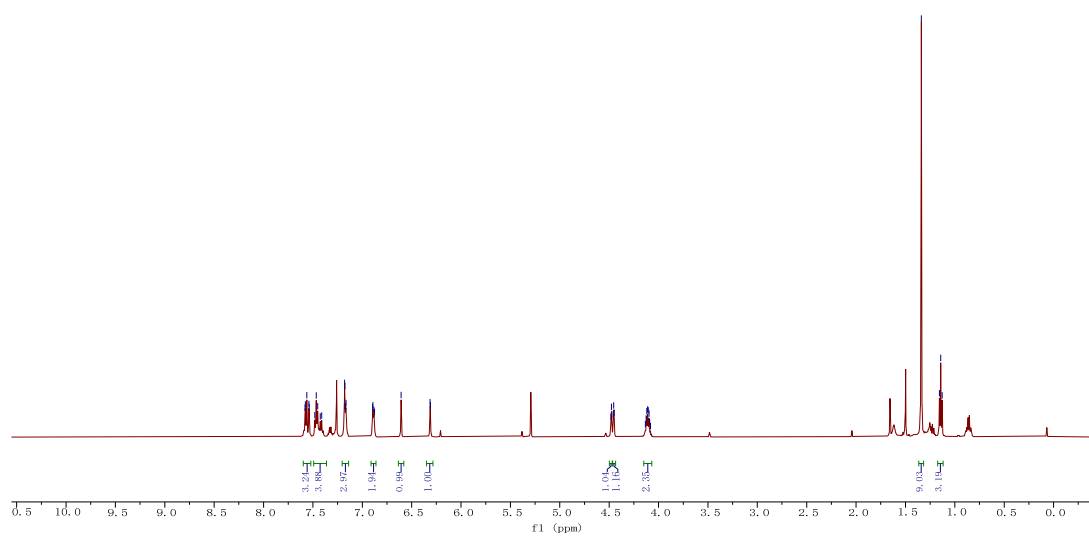
3eg



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6.8825
6.8766
6.6067
6.3131
6.3097

4. 4820
4. 4770
4. 4724
4. 4724
4. 4549
4. 4496
4. 1330
4. 1250
4. 1189
4. 1106
4. 1044
4. 0964
4. 0898
4. 0822

1.3383
1.1562
1.1420
1.1280



— 176, 5108

— 171.4448

— 166,7575

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— 58.4936

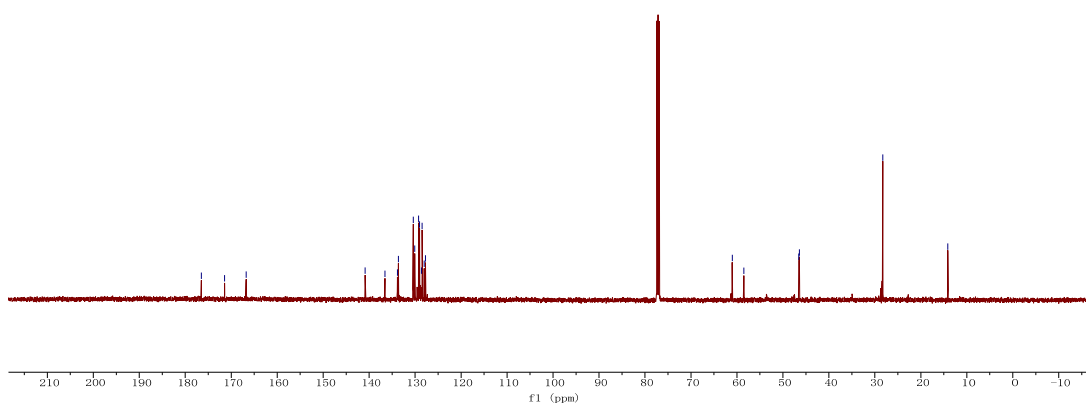
— 58.4936

46.5397
46.4210

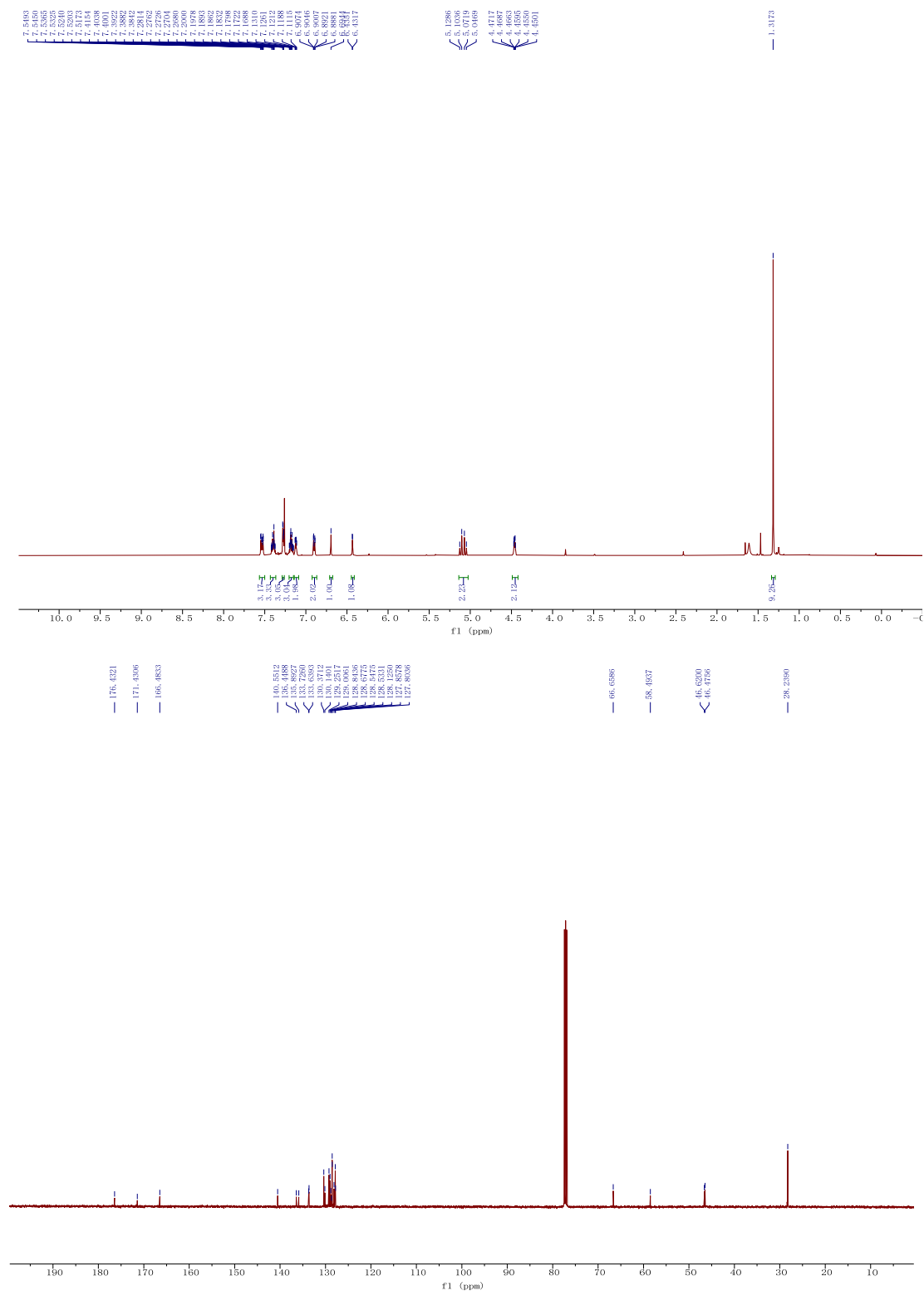
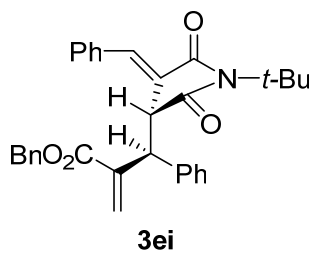
46.4210

— 28. 2752

— 14. 1307



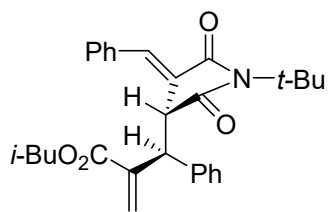
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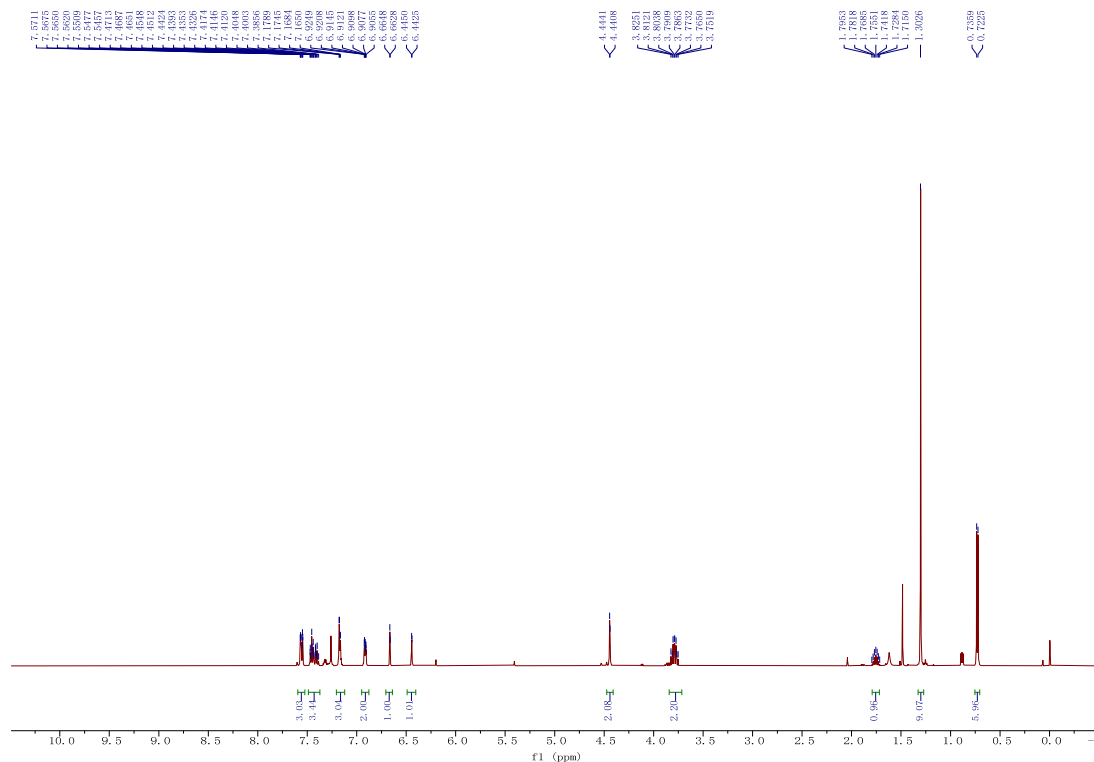
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3ek

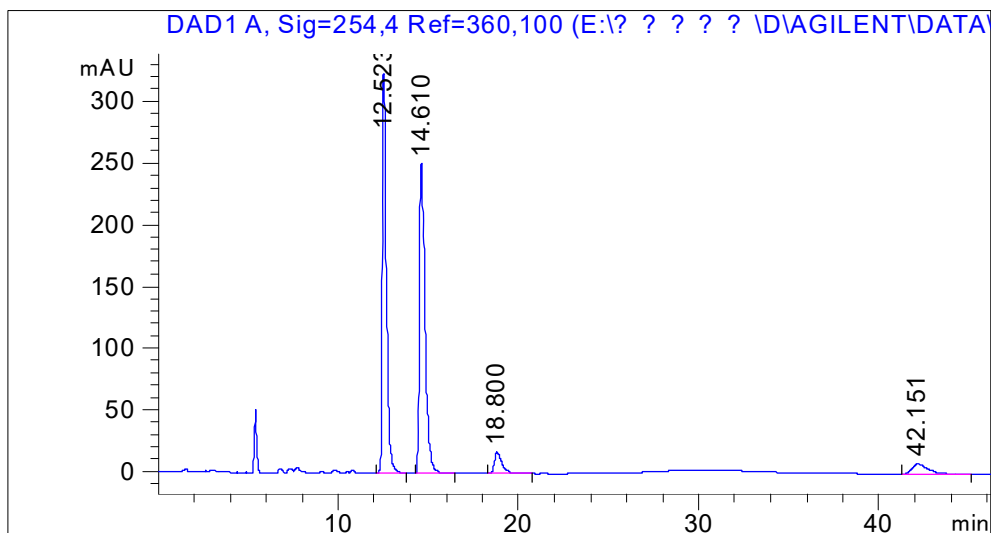


3ek



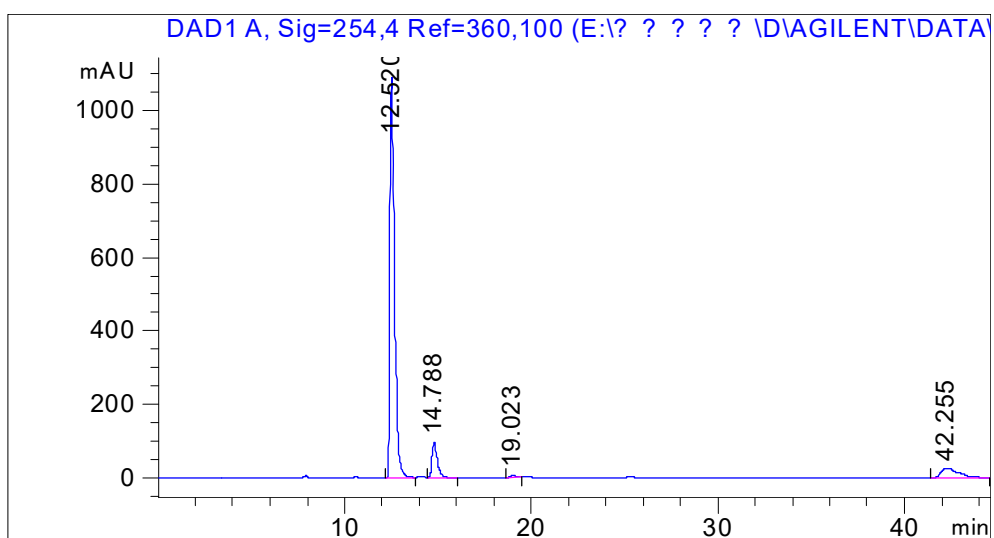
VII. Copies of Chiral HPLC analysis

3aa-racmic

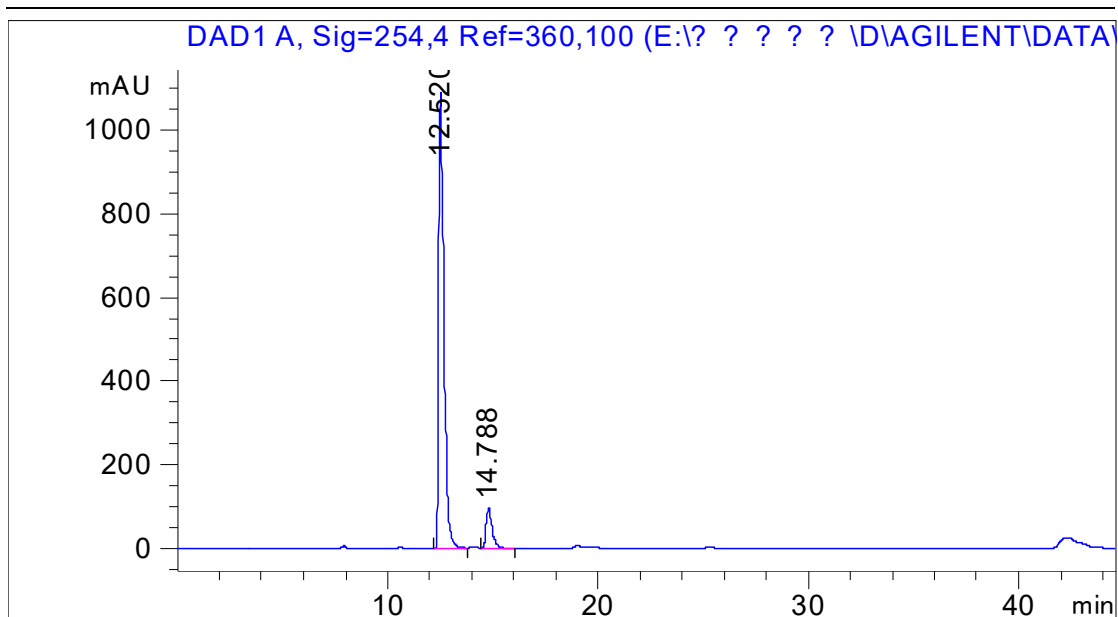


#	Time	Area	Height	Width	Area%	Symmetry
1	12.523	5296	323.6	0.247	45.664	0.572
2	14.61	5296	251.4	0.3178	45.664	0.474
3	18.8	509.5	17.4	0.4368	4.393	0.479
4	42.151	496.4	8.1	0.9191	4.280	0.509

3aa-chiral

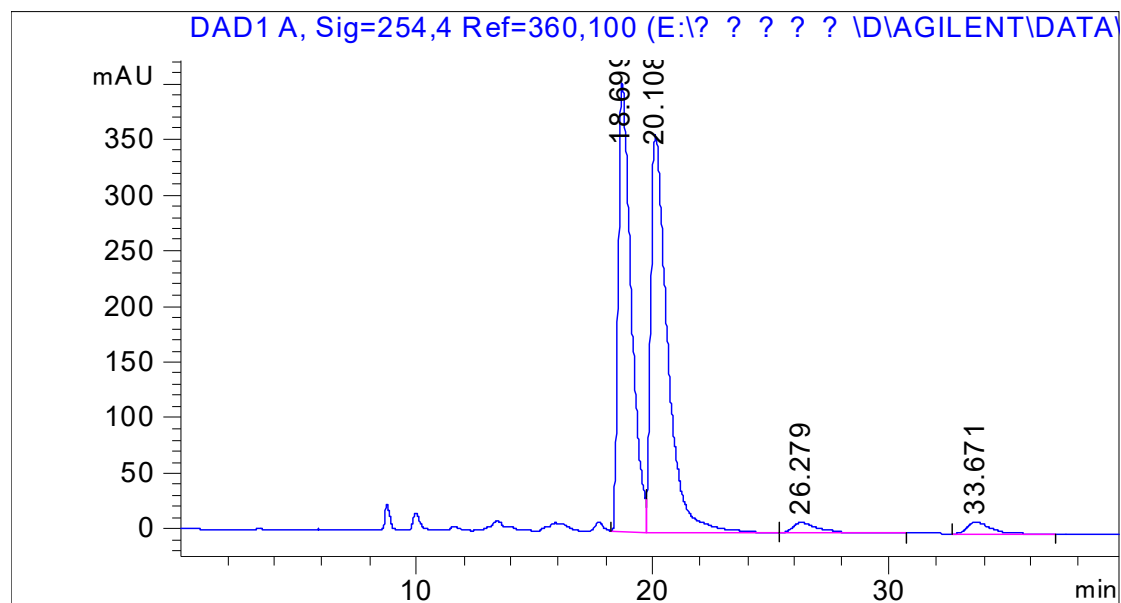


#	Time	Area	Height	Width	Area%	Symmetry
1	12.52	18383.7	1089.4	0.2549	82.954	0.502
2	14.788	1953	98.2	0.302	8.812	0.58
3	19.023	135.3	5.8	0.3709	0.610	0.79
4	42.255	1689.5	25.7	0.9562	7.624	0.425



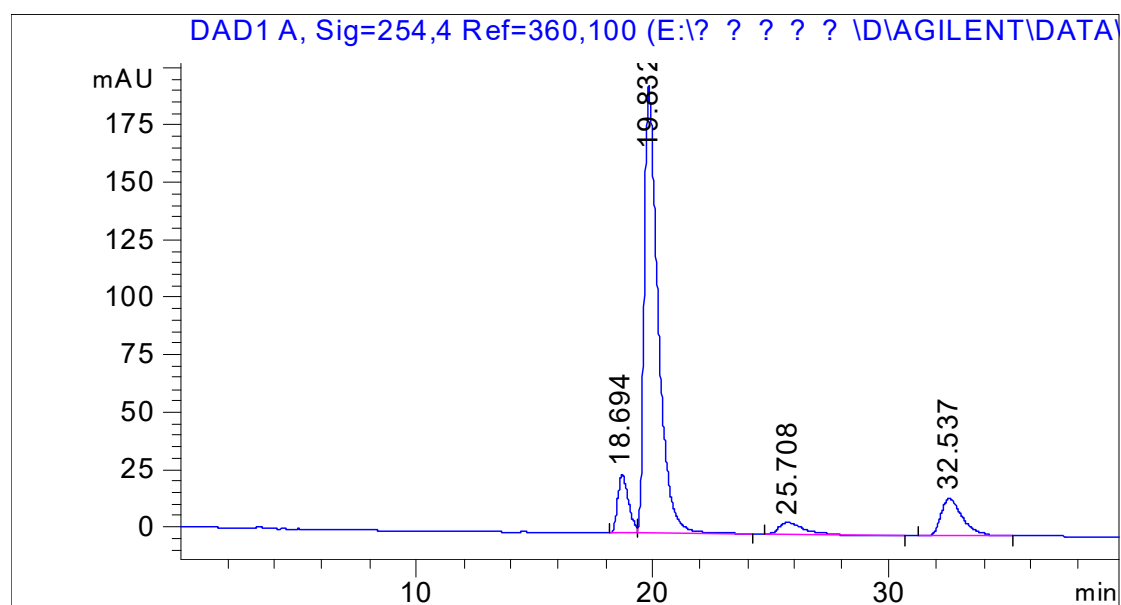
#	Time	Area	Height	Width	Area%	Symmetry
1	12.52	18383.7	1089.4	0.2549	90.397	0.502
2	14.788	1953	98.2	0.302	9.603	0.58

3ba-racmic

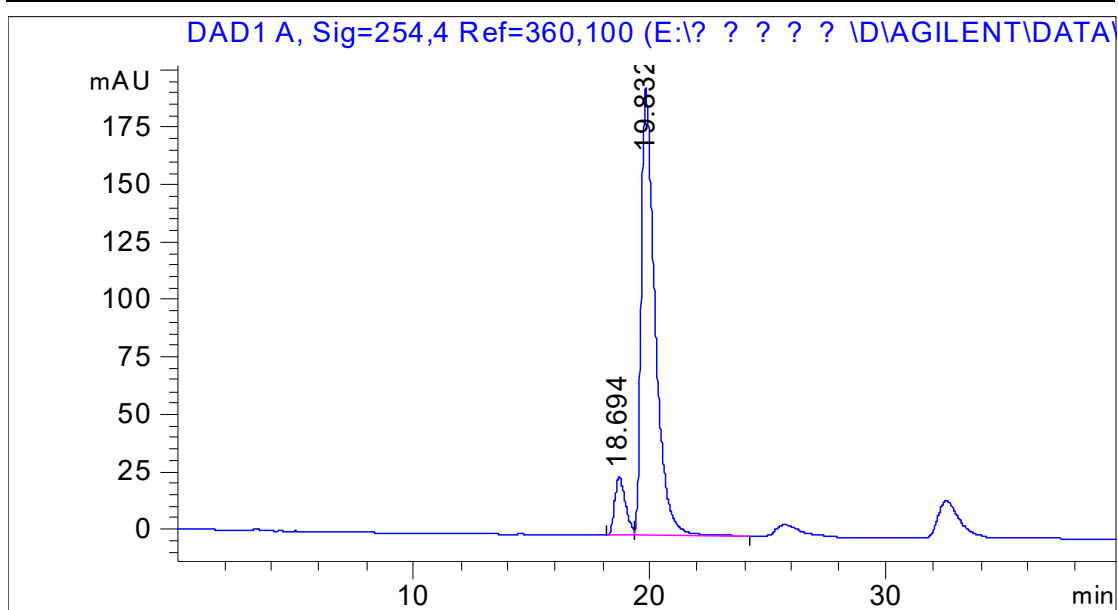


#	Time	Area	Height	Width	Area%	Symmetry
1	18.699	15608.3	403.4	0.5814	45.295	0.406
2	20.108	17496.2	356.6	0.7204	50.774	0.338
3	26.279	659.2	8.7	1.0637	1.913	0.431
4	33.671	695.3	10.3	0.9704	2.018	0.532

3ba-chiral

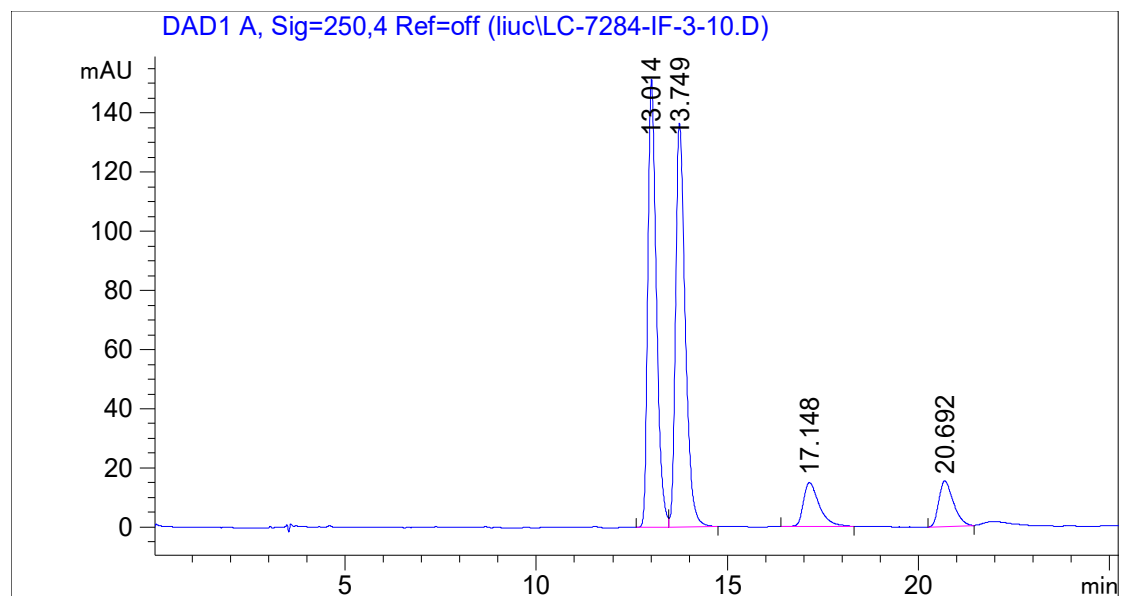


#	Time	Area	Height	Width	Area%	Symmetry
1	18.694	831.1	25.6	0.5012	8.123	0.648
2	19.832	7972.2	195.1	0.6047	77.911	0.451
3	25.708	397.8	5.4	1.0469	3.887	0.481
4	32.537	1031.3	16.2	0.9381	10.079	0.563

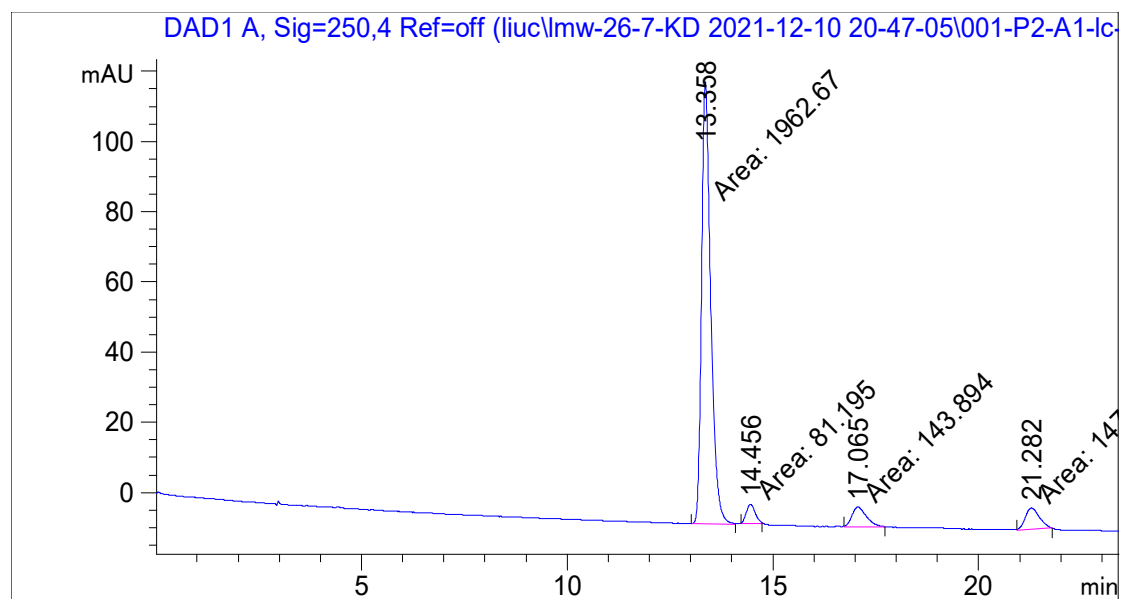


#	Time	Area	Height	Width	Area%	Symmetry
1	18.694	831.1	25.6	0.5012	9.441	0.648
2	19.832	7972.2	195.1	0.6047	90.559	0.451

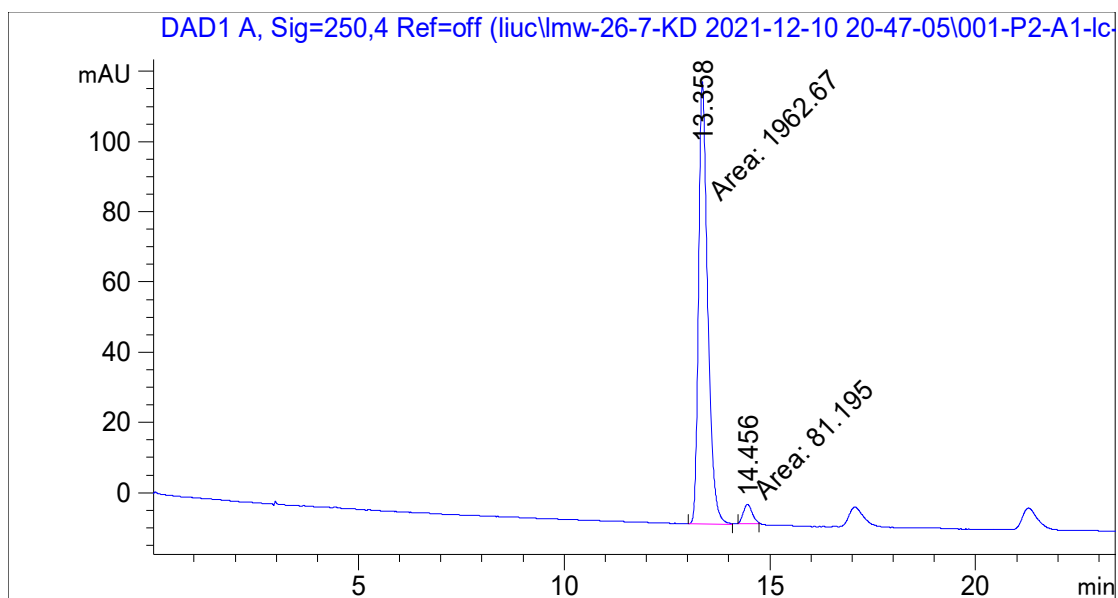
3ca-racmic



3ca-chiral

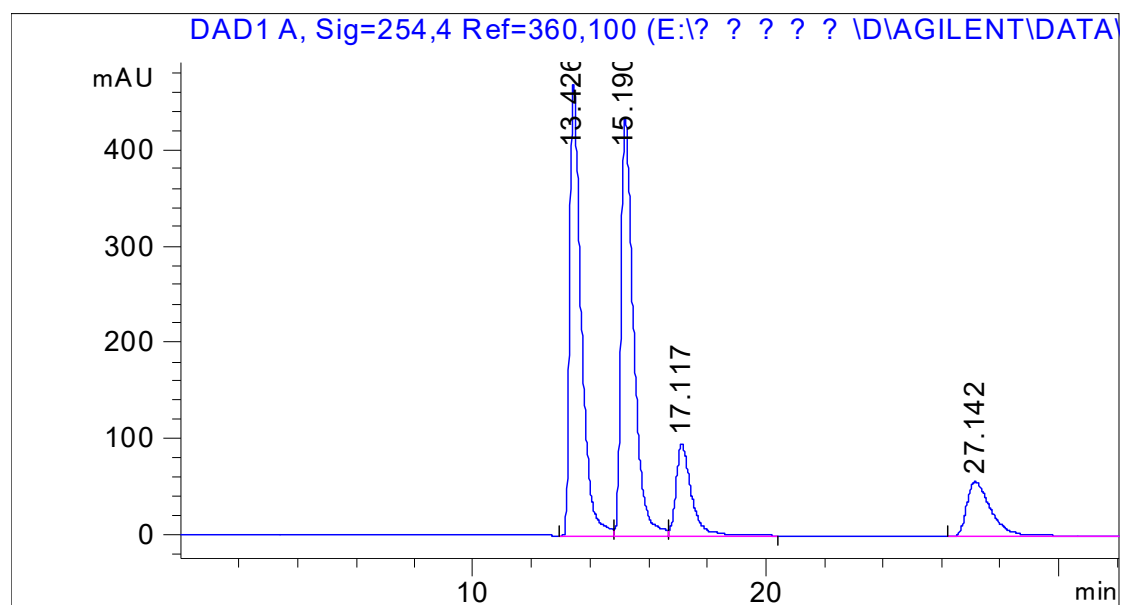


#	Time	Area	Height	Width	Area%	Symmetry
1	13.358	1962.7	126	0.2596	84.029	0.669
2	14.456	81.2	5.5	0.247	3.476	0.848
3	17.065	143.9	5.8	0.4159	6.161	0.651
4	21.282	148	6.1	0.4038	6.334	0.739



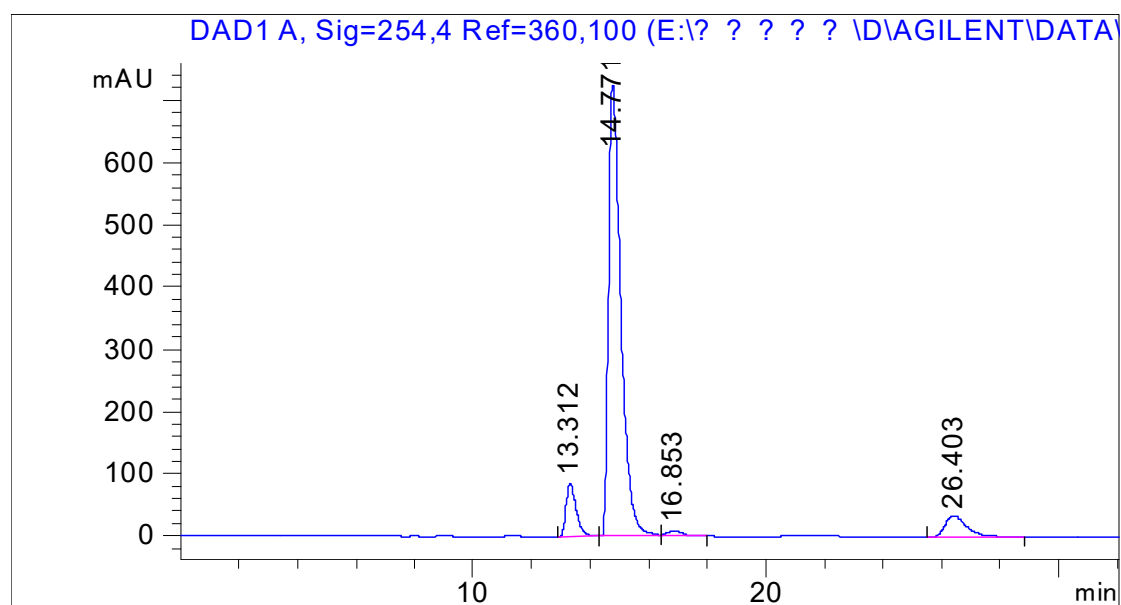
#	Time	Area	Height	Width	Area%	Symmetry
1	13.358	1962.7	126	0.2596	96.027	0.669
2	14.456	81.2	5.5	0.247	3.973	0.848

3da-racmic

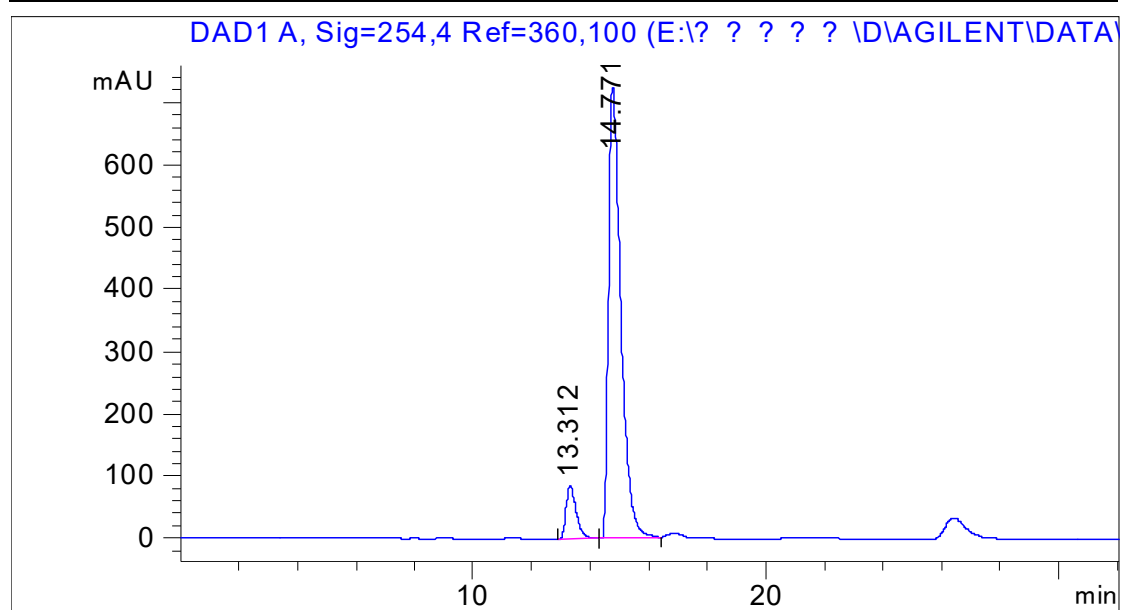


#	Time	Area	Height	Width	Area%	Symmetry
1	13.426	12792.9	468.2	0.4008	39.520	0.429
2	15.19	12975.7	432	0.4444	40.084	0.453
3	17.117	3455.1	95.6	0.5336	10.674	0.525
4	27.142	3147.3	56.6	0.9261	9.723	0.514

3da-chiral

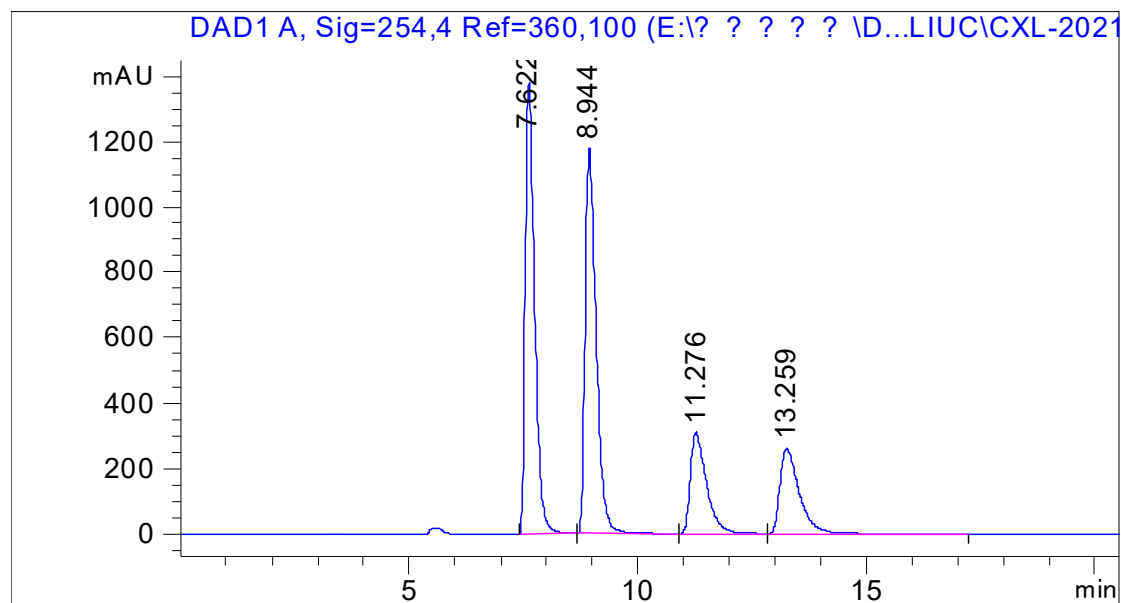


#	Time	Area	Height	Width	Area%	Symmetry
1	13.312	2037.8	85.9	0.3628	8.112	0.62
2	14.771	21132	722.9	0.437	84.122	0.491
3	16.853	220.1	7.1	0.4783	0.876	0.632
4	26.403	1730.7	34	0.7707	6.890	0.576



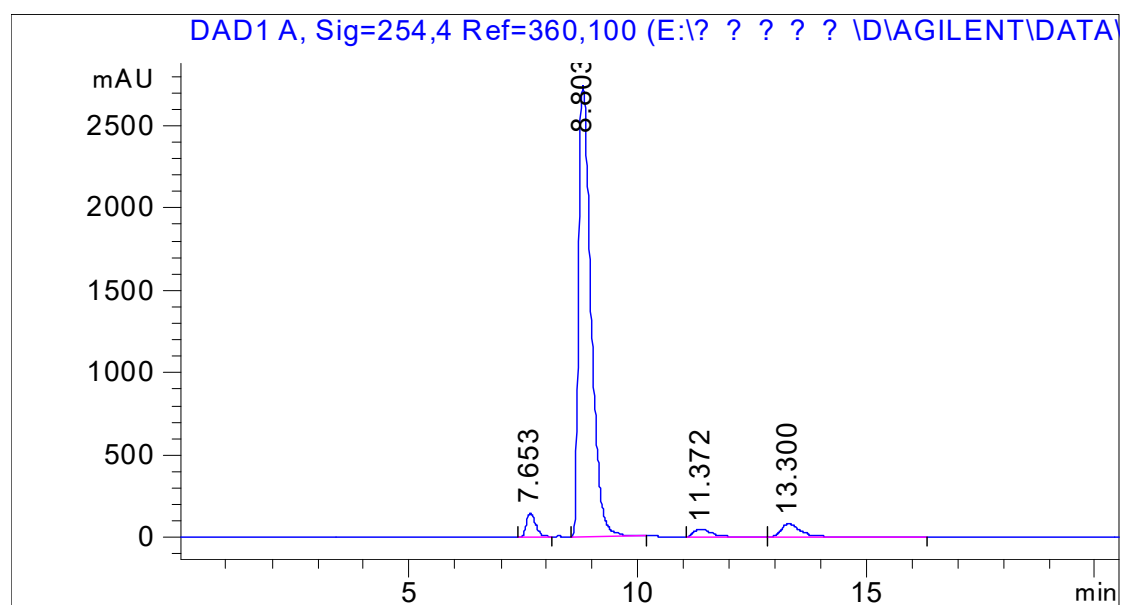
#	Time	Area	Height	Width	Area%	Symmetry
1	13.312	2037.8	85.9	0.3628	8.795	0.62
2	14.771	21132	722.9	0.437	91.205	0.491

3ea-racmic

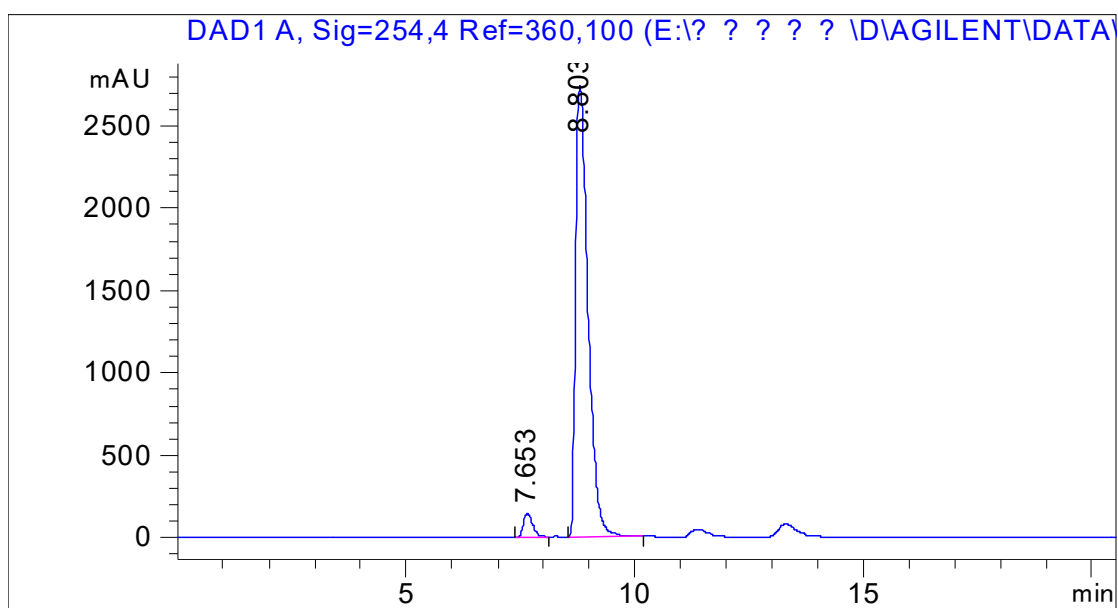


#	Time	Area	Height	Width	Area%	Symmetry
1	7.622	19601.2	1378.9	0.2178	35.871	0.562
2	8.944	19660.8	1179.3	0.2525	35.980	0.555
3	11.276	7666.6	309	0.3714	14.030	0.489
4	13.259	7715.2	261	0.4409	14.119	0.483

3ea-chiral

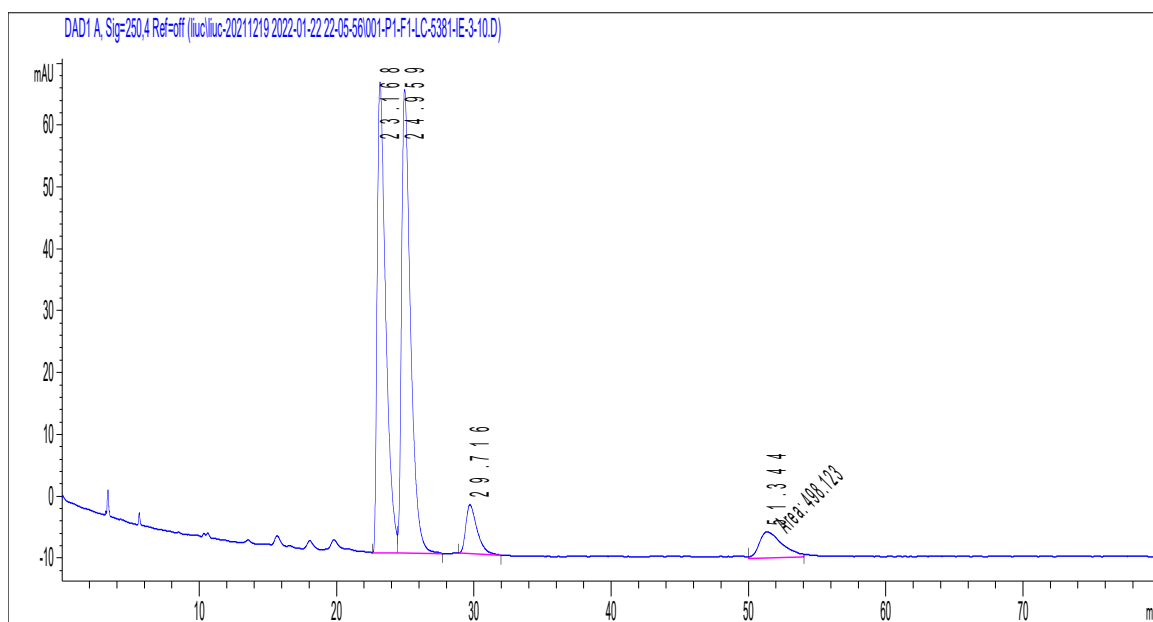


#	Time	Area	Height	Width	Area%	Symmetry
1	7.653	2048.5	150.4	0.2109	3.581	0.654
2	8.803	51552.9	2741.1	0.2834	90.108	0.466
3	11.372	1332.8	51	0.3968	2.330	0.529
4	13.3	2277.8	78.5	0.4364	3.981	0.546

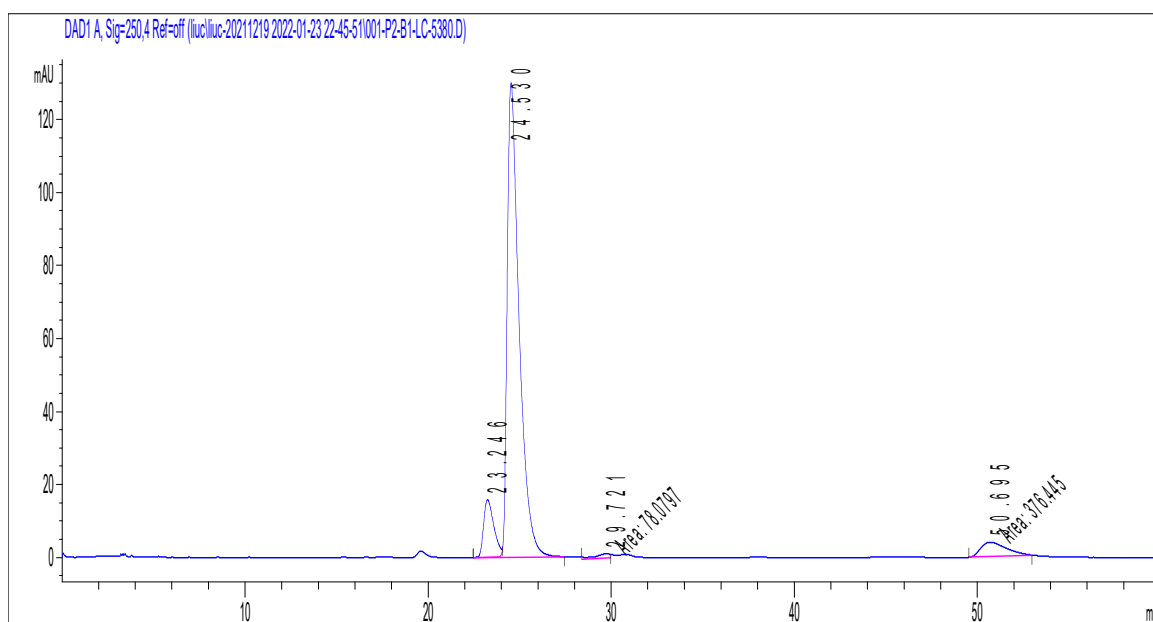


#	Time	Area	Height	Width	Area%	Symmetry
1	7.653	2048.5	150.4	0.2109	3.822	0.654
2	8.803	51552.9	2741.1	0.2834	96.178	0.466

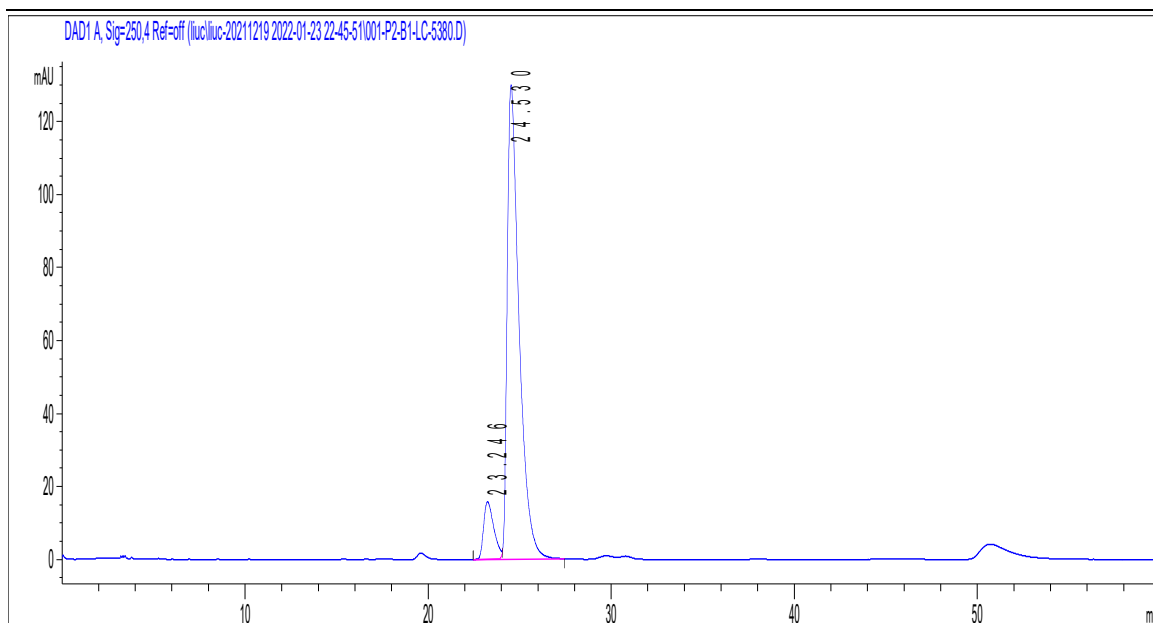
3fa-racmic



3fa-chiral

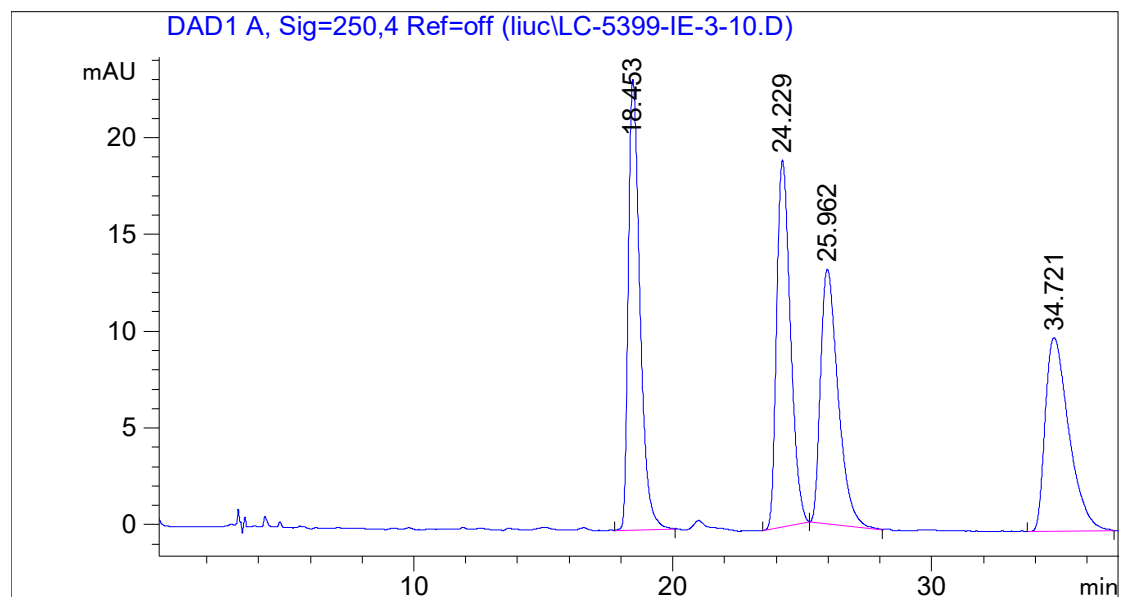


#	Time	Area	Height	Width	Area%	Symmetry
1	23.246	616.8	15.8	0.5926	8.876	0.595
2	24.53	5877.8	129.9	0.6738	84.583	0.757
3	29.721	78.1	1.3	1.0258	1.124	3.231
4	50.695	376.4	3.9	1.5992	5.417	0.547



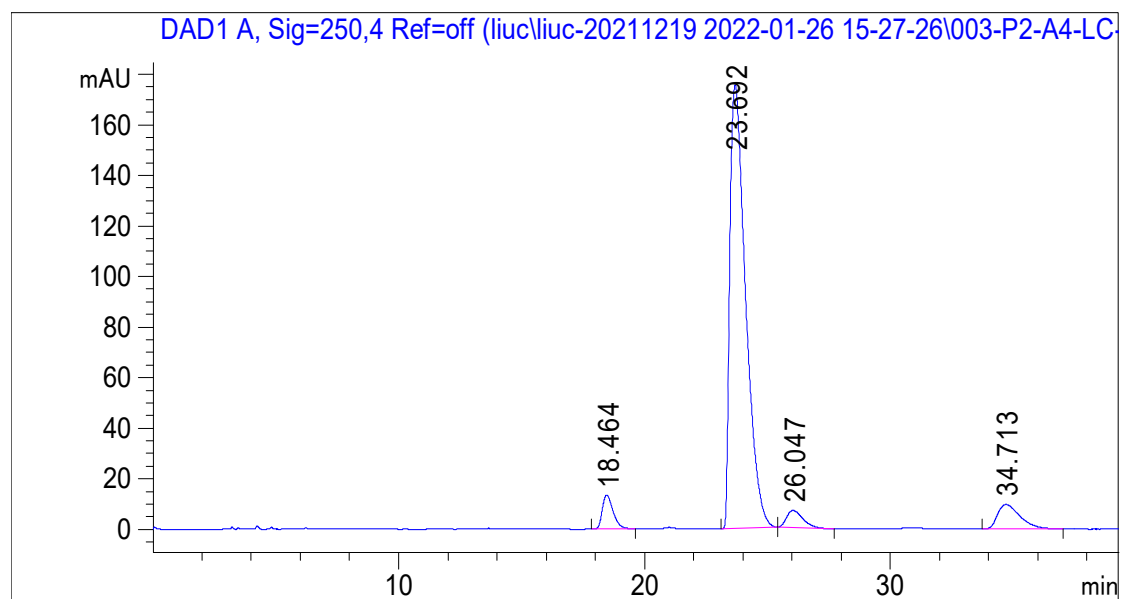
#	Time	Area	Height	Width	Area%	Symmetry
1	23.246	616.8	15.8	0.5926	9.497	0.595
2	24.53	5877.8	129.9	0.6738	90.503	0.757

3ga-racmic

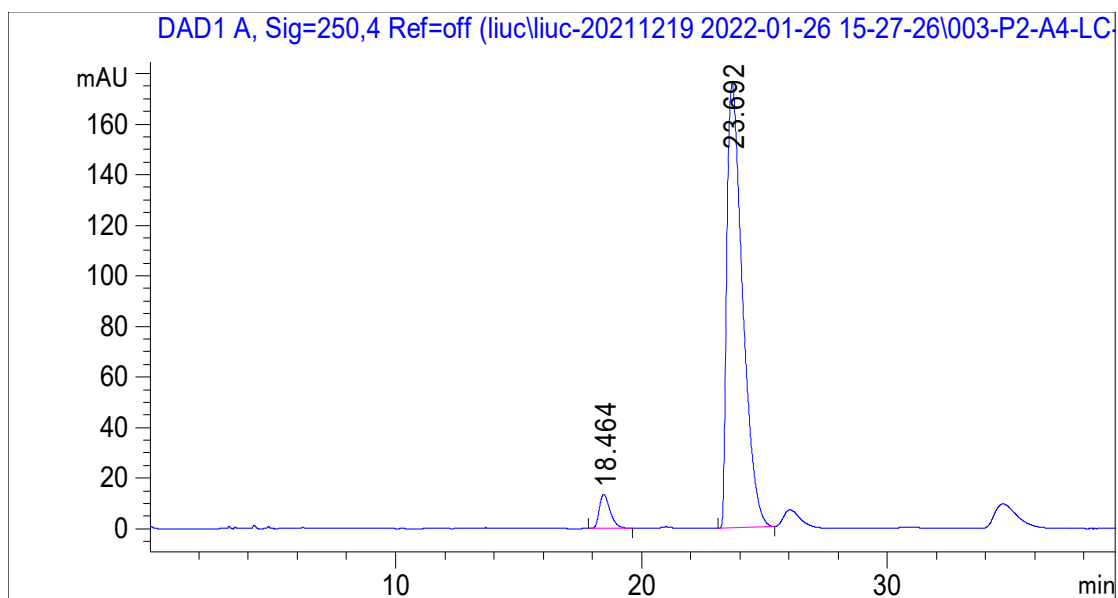


#	Time	Area	Height	Width	Area%	Symmetry
1	18.453	726.3	23.3	0.4758	27.060	0.595
2	24.229	701	19	0.5751	26.116	0.679
3	25.962	620.5	13.2	0.7098	23.115	0.59
4	34.721	636.4	10	0.9166	23.708	0.56

3ga-chiral

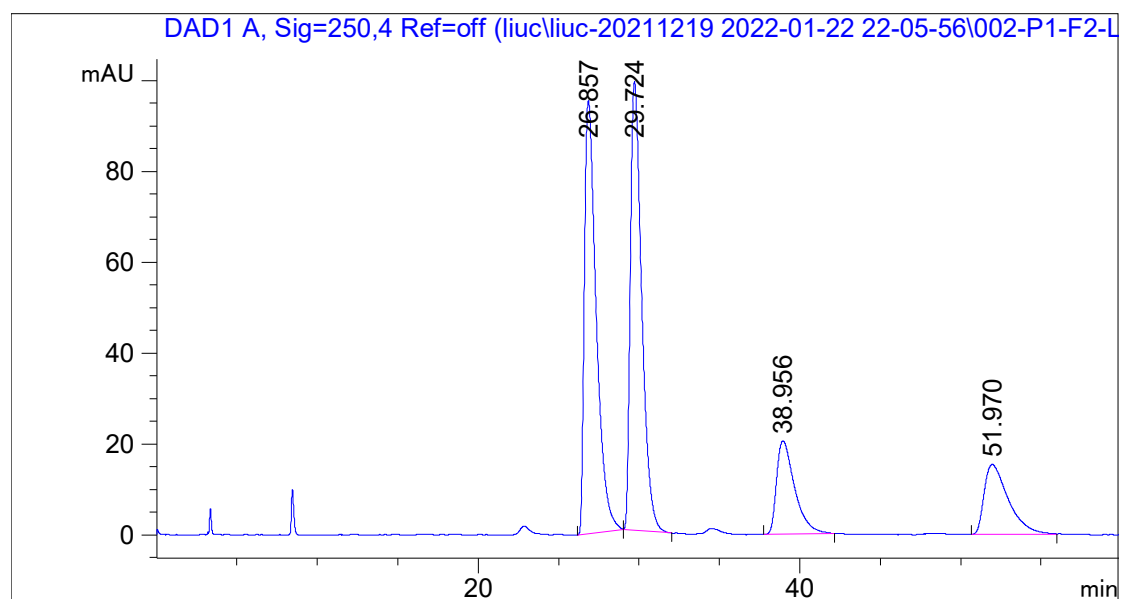


#	Time	Area	Height	Width	Area%	Symmetry
1	18.464	412.2	13.5	0.4673	4.498	0.638
2	23.692	7814.9	175.6	0.6753	85.290	0.463
3	26.047	315.4	6.8	0.6853	3.442	0.619
4	34.713	620.3	9.7	0.9221	6.770	0.565



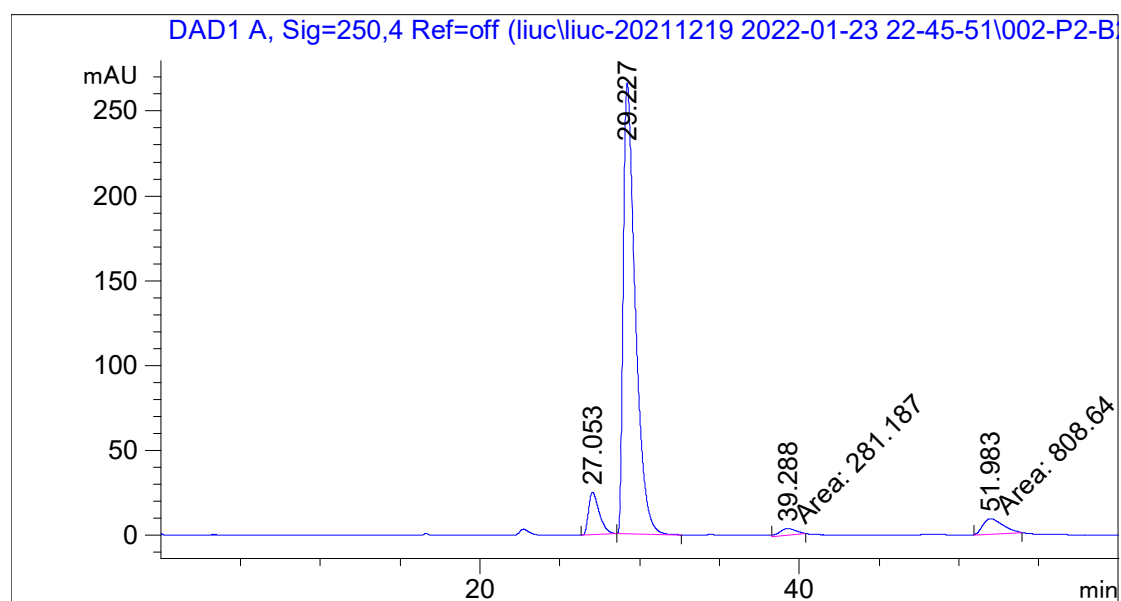
#	Time	Area	Height	Width	Area%	Symmetry
1	18.464	412.2	13.5	0.4673	5.010	0.638
2	23.692	7814.9	175.6	0.6753	94.990	0.463

3ha-racmic

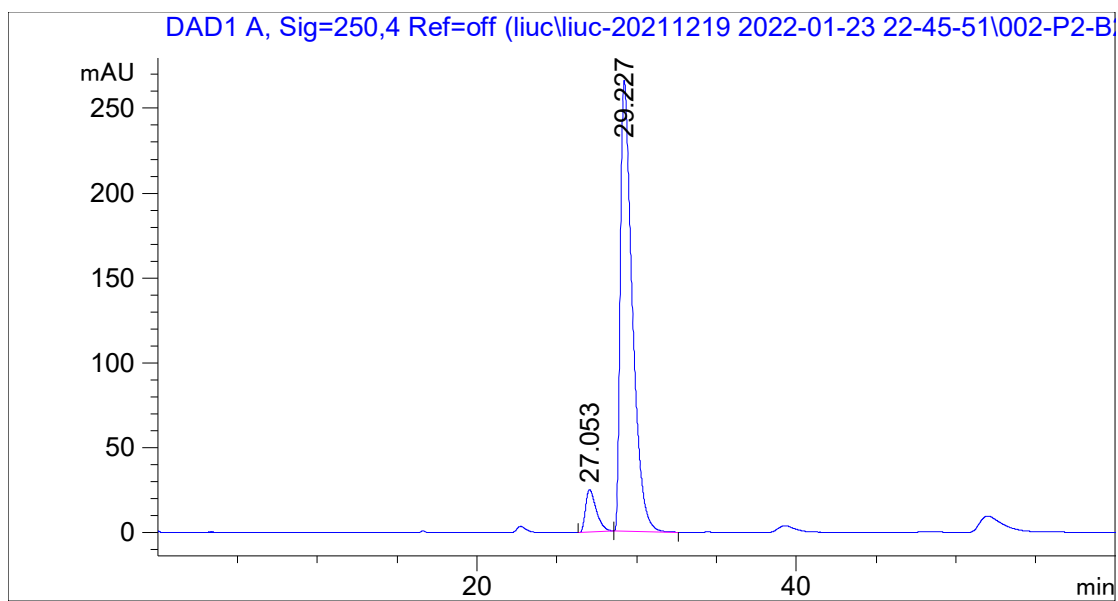


#	Time	Area	Height	Width	Area%	Symmetry
1	26.857	4844.6	95.1	0.764	37.608	0.461
2	29.724	4831.9	98.7	0.7431	37.509	0.534
3	38.956	1604.8	20.6	1.1263	12.457	0.512
4	51.97	1600.8	15.4	1.3908	12.426	0.471

3ha-chiral

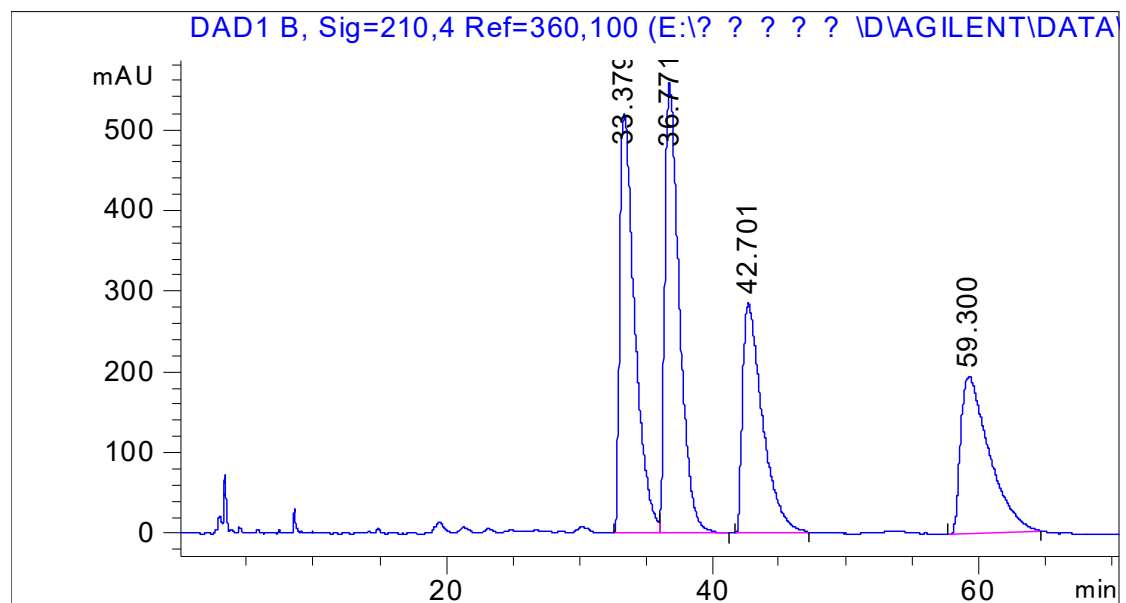


#	Time	Area	Height	Width	Area%	Symmetry
1	27.053	1167.4	25.1	0.6942	7.248	0.553
2	29.227	13849.4	265.7	0.7781	85.986	0.445
3	39.288	281.2	3.9	0.8494	1.746	1.034
4	51.983	808.6	9.1	1.4758	5.021	0.604



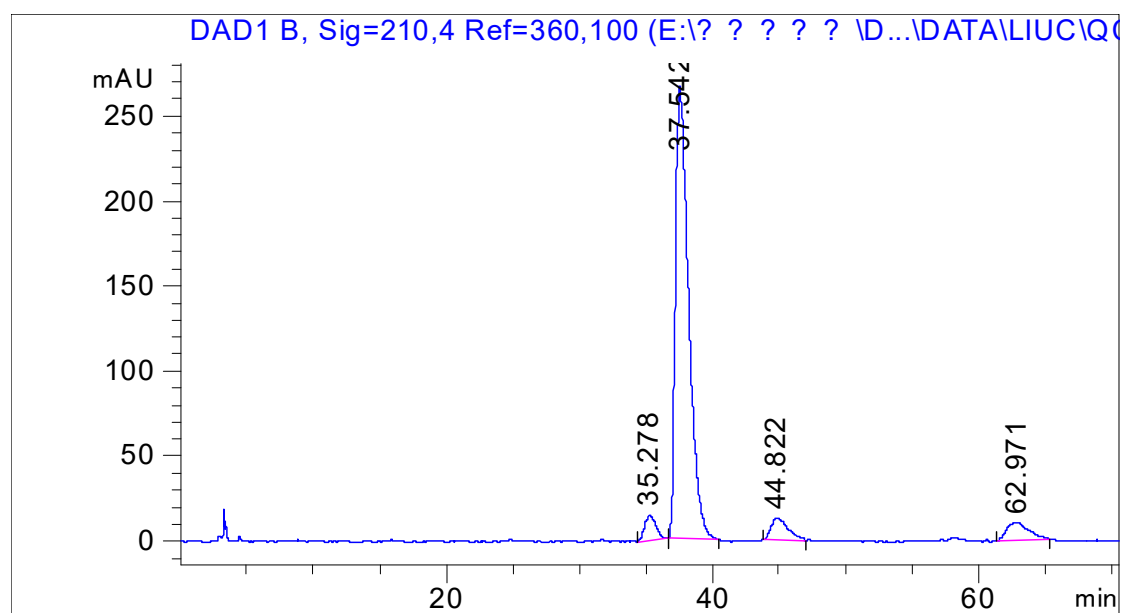
#	Time	Area	Height	Width	Area%	Symmetry
1	27.053	1167.4	25.1	0.6942	7.774	0.553
2	29.227	13849.4	265.7	0.7781	92.226	0.445

3ia-racmic

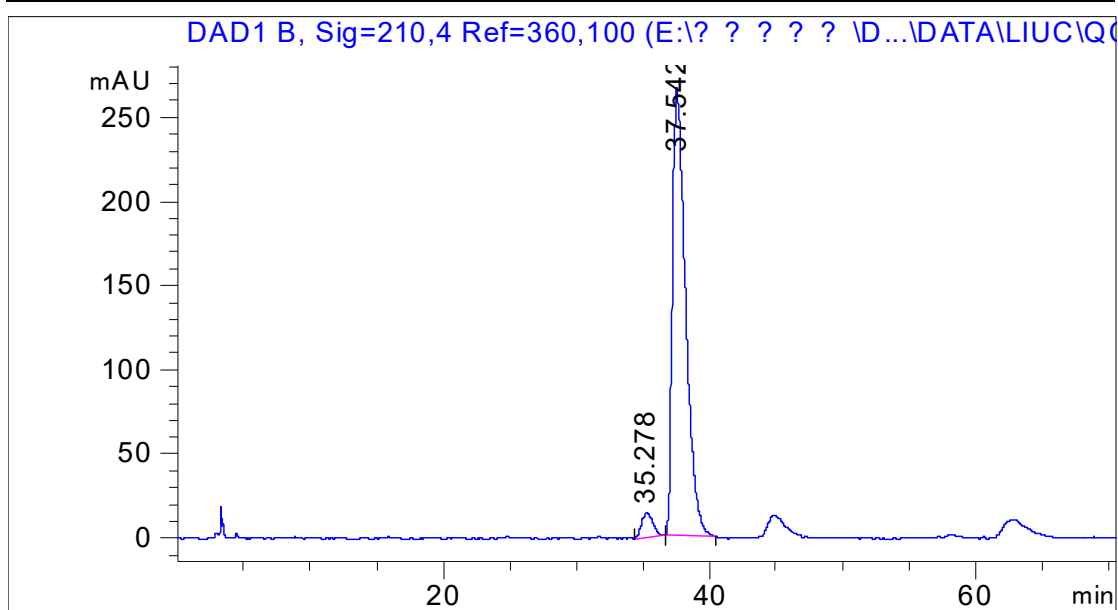


#	Time	Area	Height	Width	Area%	Symmetry
1	33.378	15491	196.4	1.1562	29.304	0.407
2	36.77	16021.3	211.4	1.1322	30.307	0.438
3	42.702	10638.6	102.5	1.4944	20.125	0.373
4	59.300	10712.3	70.2	2.1457	20.264	0.371

3ia-chiral

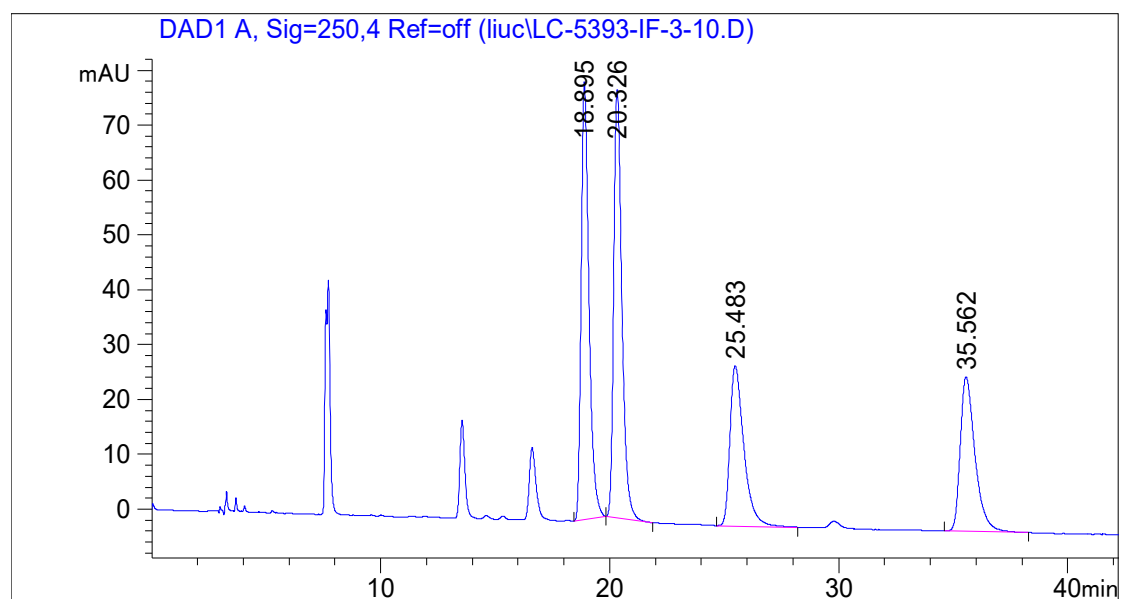


#	Time	Area	Height	Width	Area%	Symmetry
1	35.278	330.9	5.5	0.8741	3.953	0.716
2	37.542	6916.1	100.1	1.0321	82.620	0.462
3	44.822	491.8	5.1	1.5962	5.875	0.585
4	62.971	632.2	4.8	1.5591	7.552	0.637



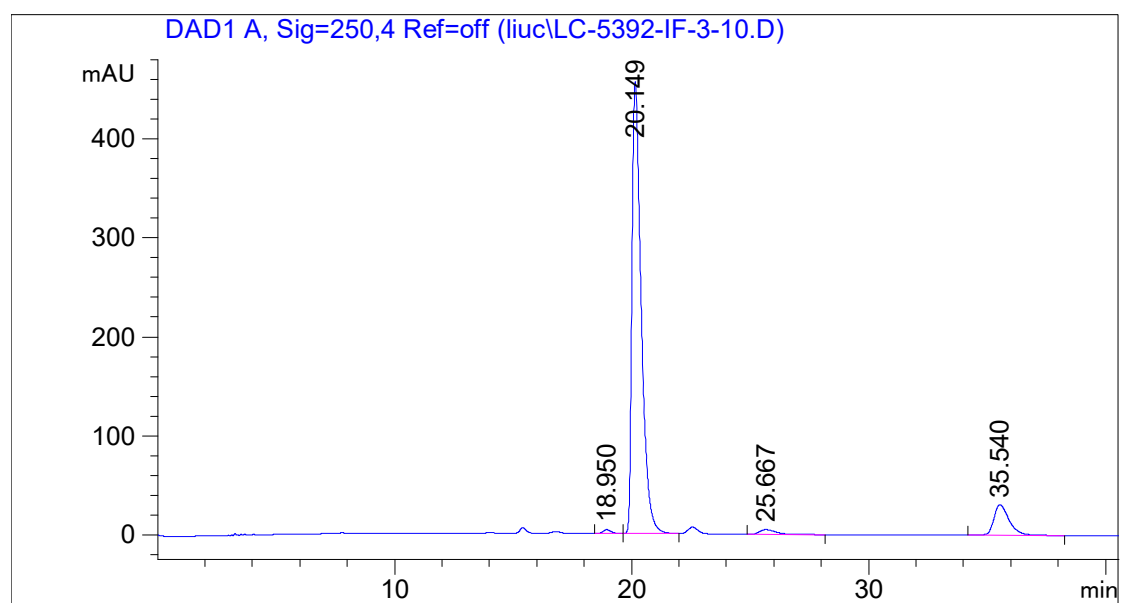
#	Time	Area	Height	Width	Area%	Symmetry
1	35.278	330.9	5.5	0.8741	4.566	0.716
2	37.542	6916.1	100.1	1.0321	95.434	0.462

3ja-racmic

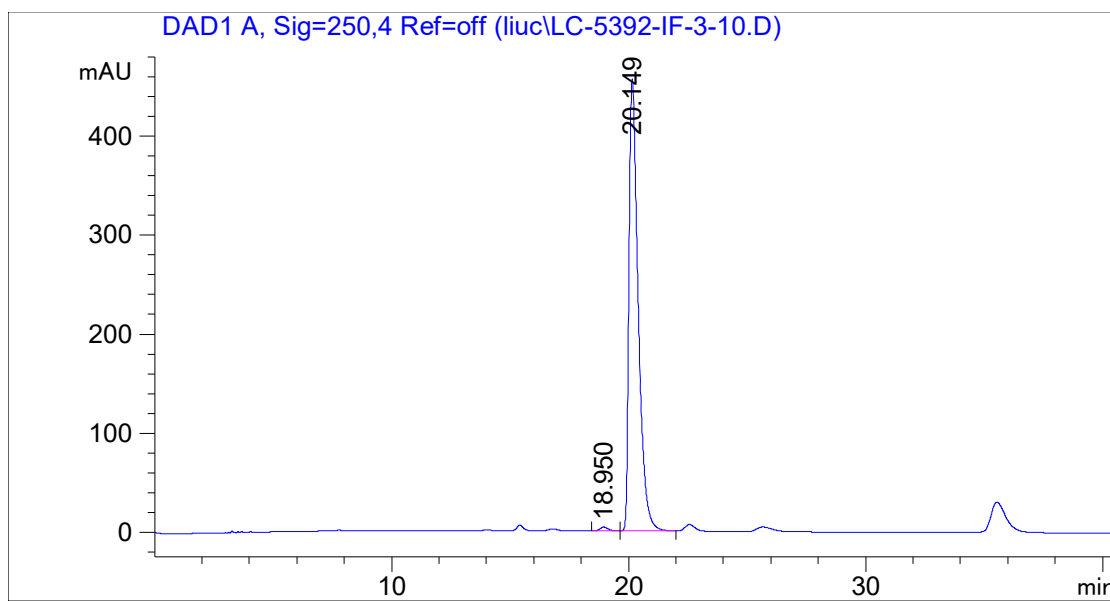


#	Time	Area	Height	Width	Area%	Symmetry
1	18.895	1883.9	79.8	0.3573	29.821	0.644
2	20.326	1933.8	78.1	0.377	30.612	0.663
3	25.483	1234	29.2	0.6334	19.533	0.568
4	35.562	1265.7	28.2	0.6782	20.035	0.602

3ja-chiral

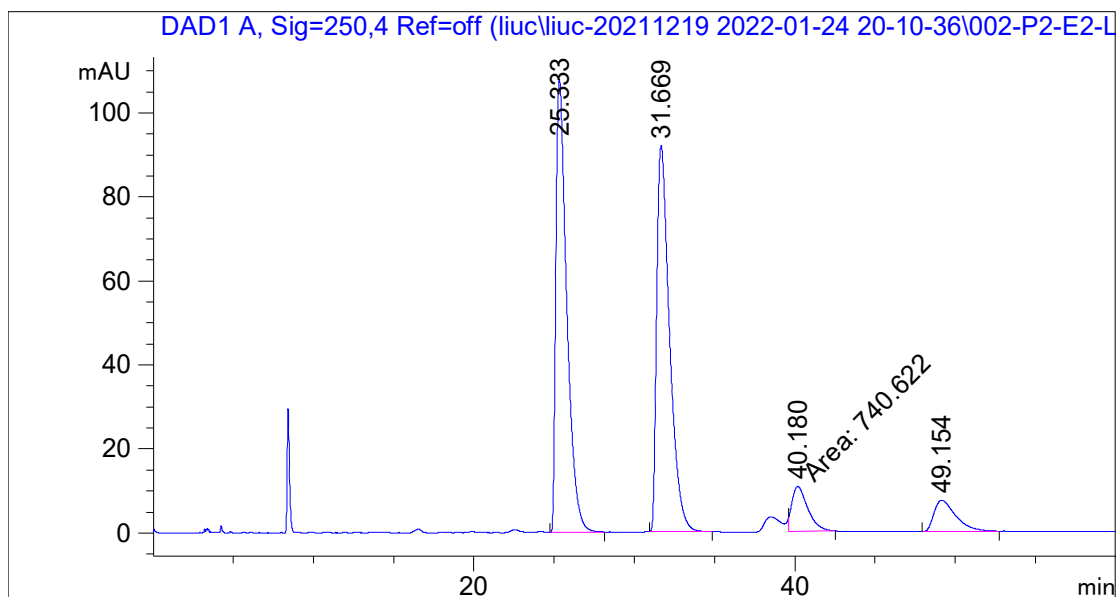


#	Time	Area	Height	Width	Area%	Symmetry
1	18.95	96.2	4	0.3613	0.688	0.755
2	20.149	12257.8	455.6	0.4059	87.667	0.479
3	25.667	246.7	4.8	0.7106	1.764	0.534
4	35.54	1381.6	30.9	0.6699	9.881	0.636



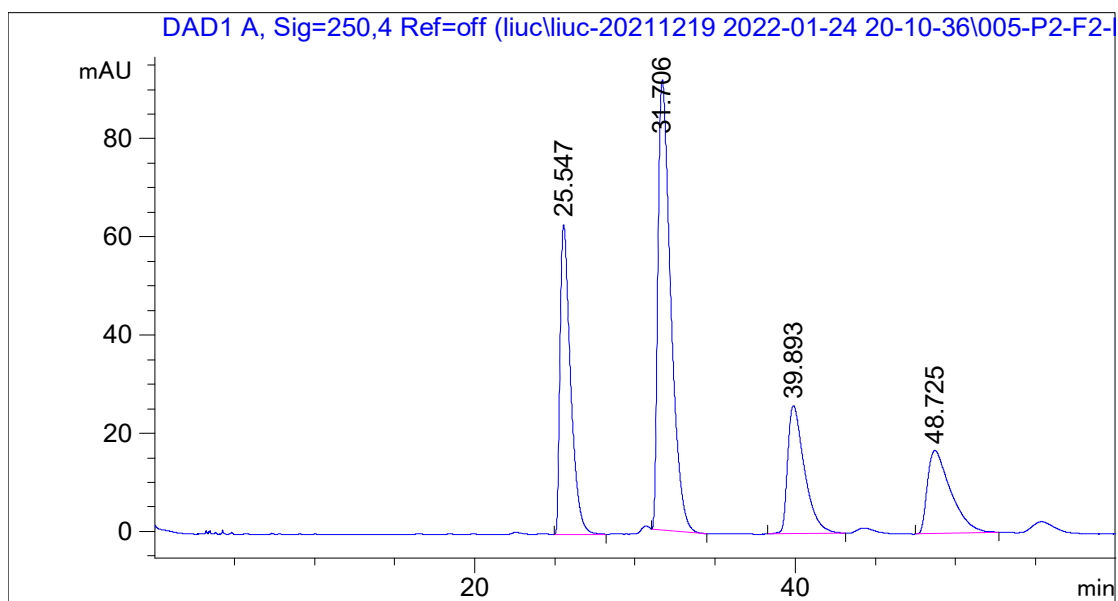
#	Time	Area	Height	Width	Area%	Symmetry
1	18.95	96.2	4	0.3613	0.779	0.755
2	20.149	12257.8	455.6	0.4059	99.221	0.479

3ka-racmic

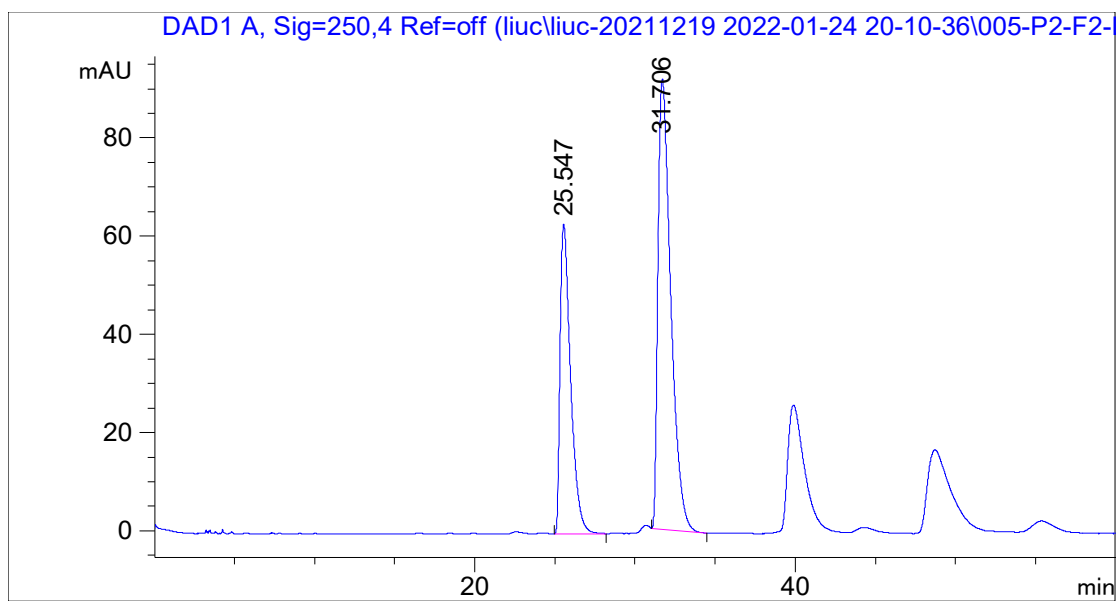


#	Time	Area	Height	Width	Area%	Symmetry
1	25.333	5114.7	107.9	0.7073	43.761	0.442
2	31.669	5130.8	92	0.8366	43.898	0.474
3	40.18	740.6	10.8	1.1458	6.337	0.542
4	49.154	701.8	7.5	1.1129	6.005	0.515

3ka-chiral

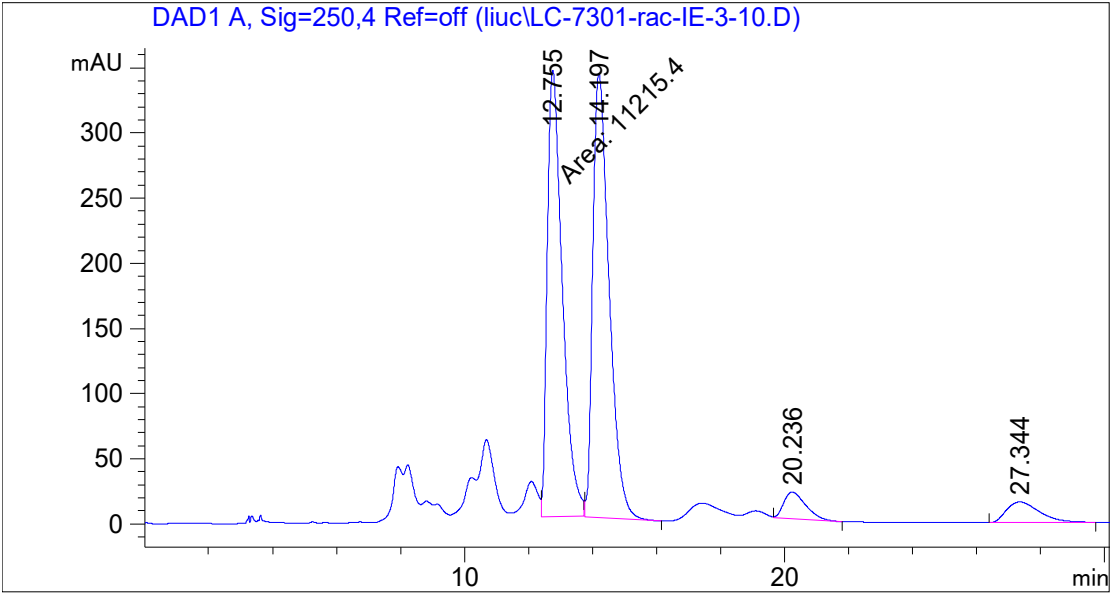


#	Time	Area	Height	Width	Area%	Symmetry
1	25.547	2867.2	63.1	0.6821	24.731	0.469
2	31.706	5103.6	91.8	0.8368	44.021	0.473
3	39.893	1914.9	26.1	1.0774	16.517	0.487
4	48.725	1707.8	17	1.3733	14.731	0.436



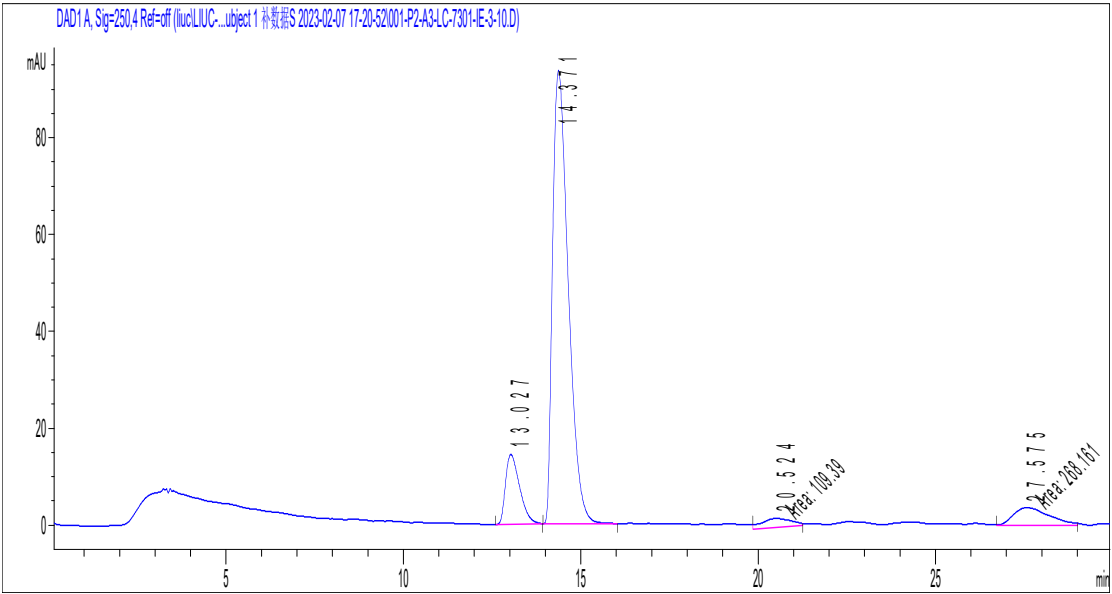
#	Time	Area	Height	Width	Area%	Symmetry
1	25.547	2867.2	63.1	0.6821	35.971	0.469
2	31.706	5103.6	91.8	0.8368	64.029	0.473

3la-racmic

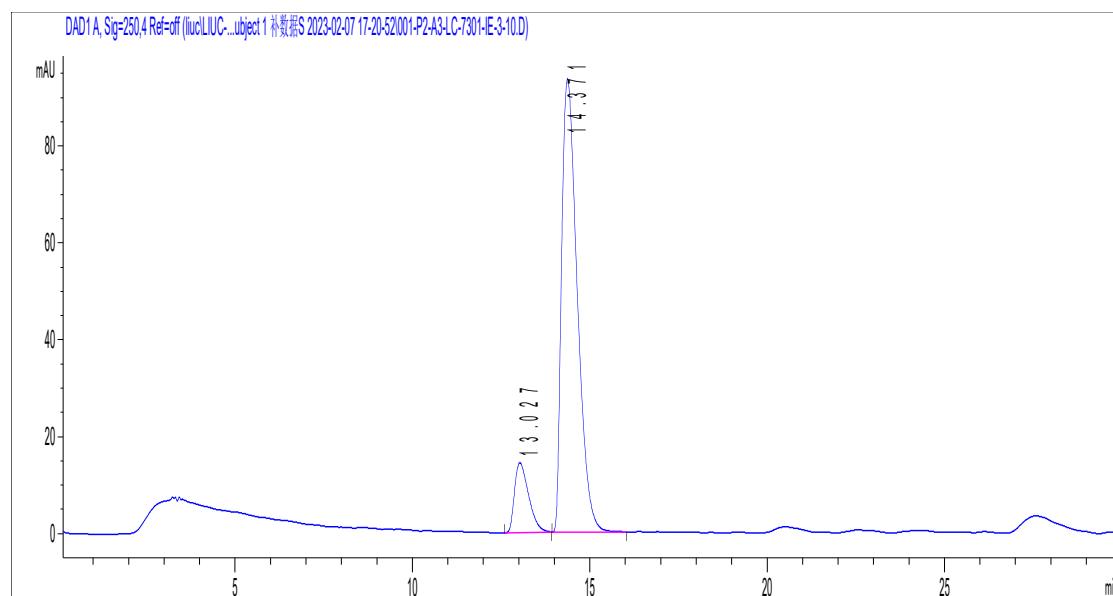


#	Time	Area	Height	Width	Area%	Symmetry
1	12.755	11215.4	342.6	0.5456	44.173	0.54
2	14.197	12081.4	340.7	0.5477	47.584	0.552
3	20.236	979.5	20.5	0.6978	3.858	0.584
4	27.344	1113.2	15.8	0.9752	4.385	0.622

3la-chiral

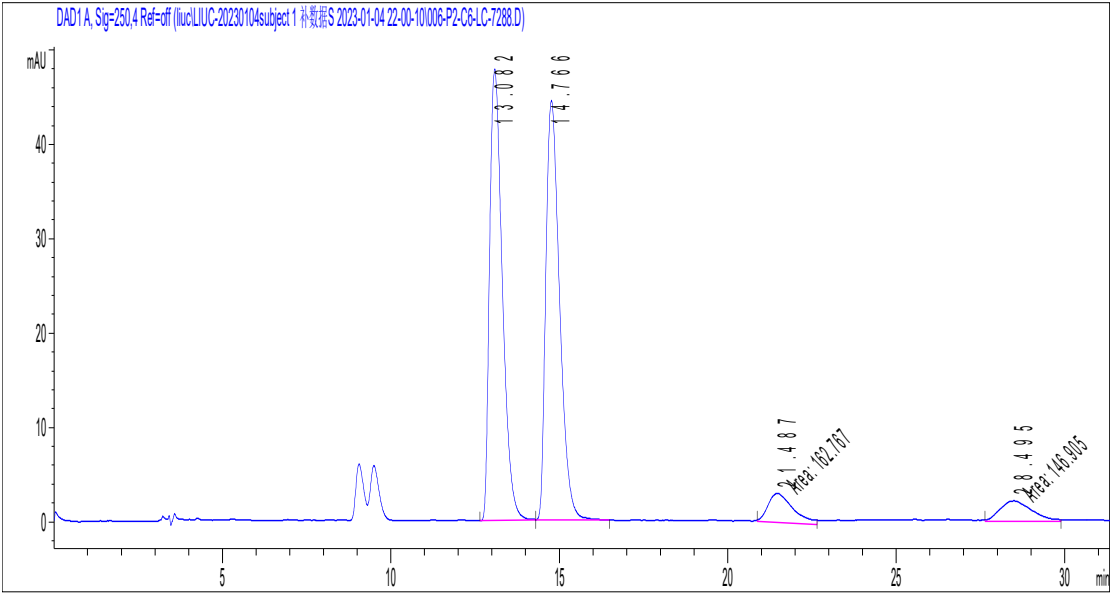


#	Time	Area	Height	Width	Area%	Symmetry
1	13.027	399.1	14.4	0.4249	10.930	0.578
2	14.371	2874.4	93.7	0.4781	78.729	0.568
3	20.524	109.4	1.9	0.9766	2.996	1.05
4	27.575	268.2	3.7	1.1943	7.345	0.587



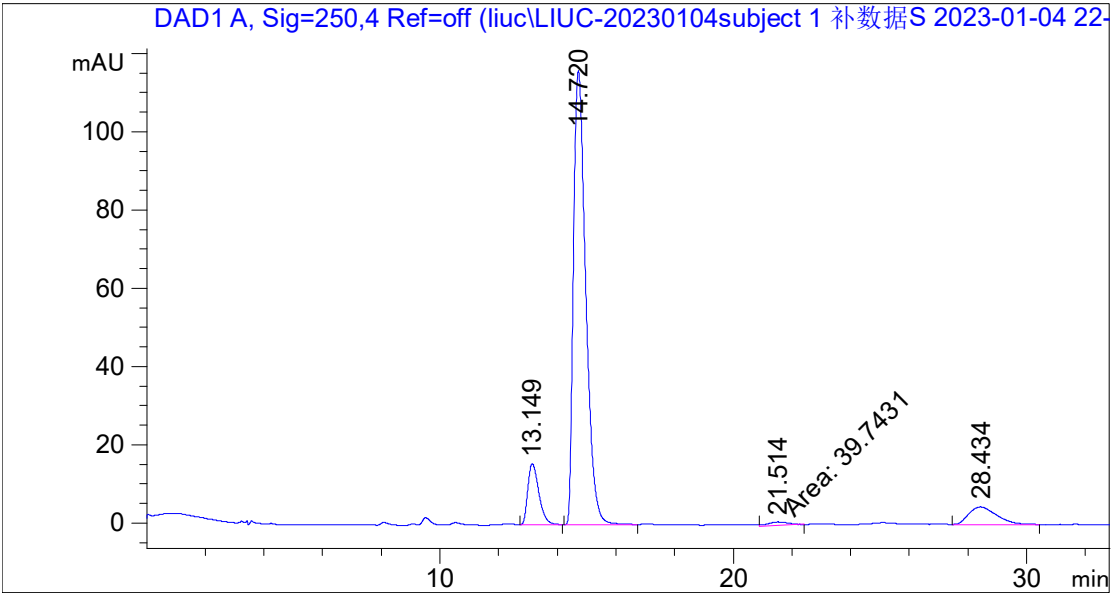
#	Time	Area	Height	Width	Area%	Symmetry
1	13.027	399.1	14.4	0.4249	12.191	0.578
2	14.371	2874.4	93.7	0.4781	87.809	0.568

3ma-racmic

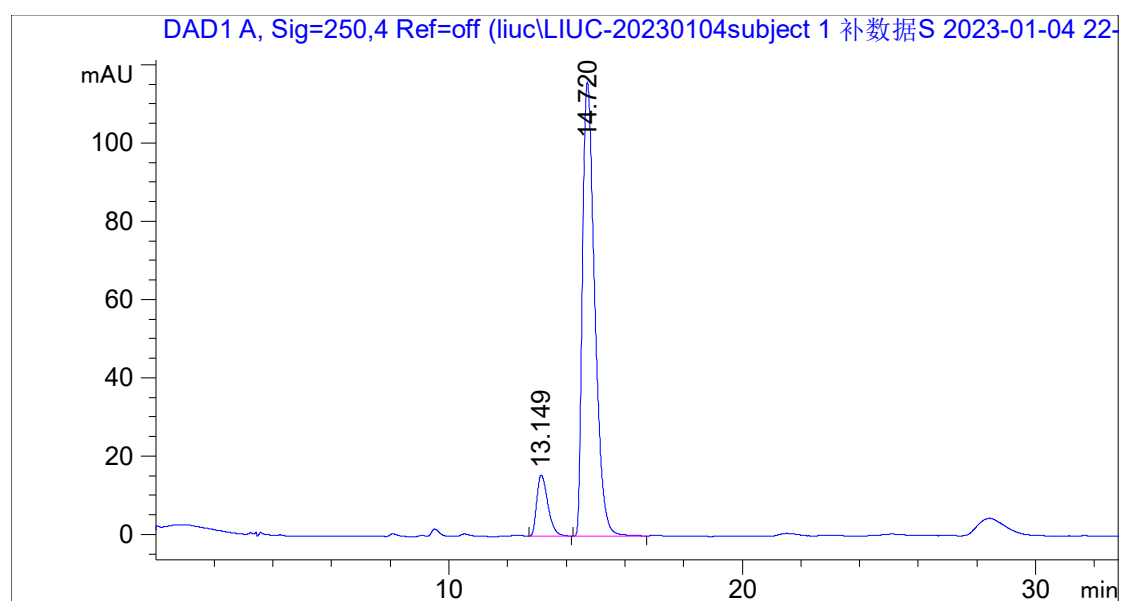


#	Time	Area	Height	Width	Area%	Symmetry
1	13.082	1256.1	47.8	0.4104	44.452	0.618
2	14.766	1259.9	44.4	0.441	44.589	0.633
3	21.487	162.8	3.1	0.8706	5.760	0.596
4	28.495	146.9	2.2	1.114	5.199	0.754

3ma-chiral

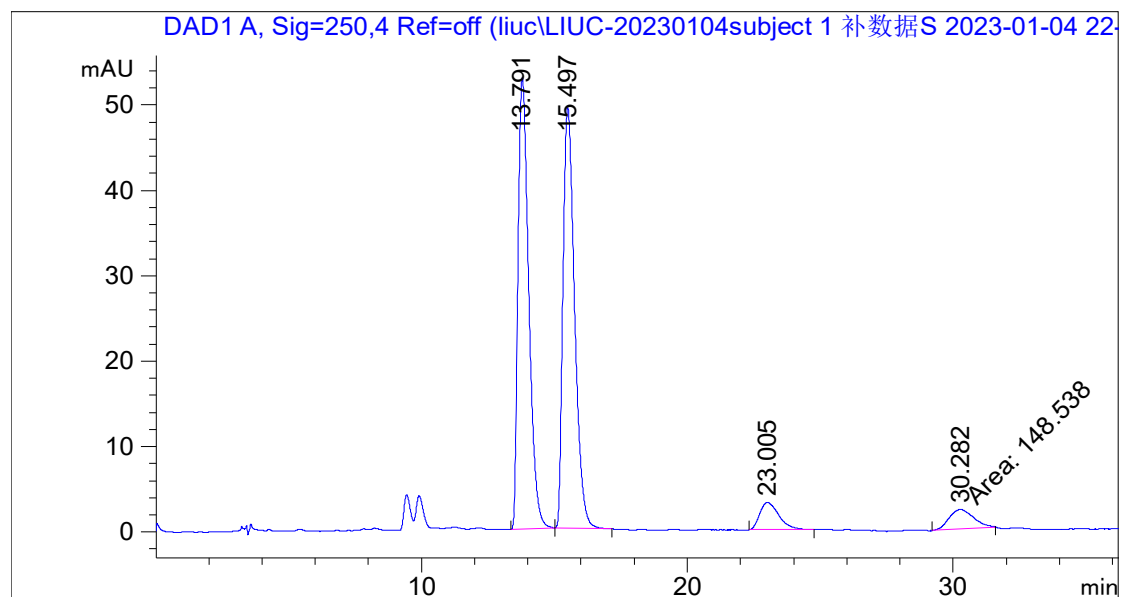


#	Time	Area	Height	Width	Area%	Symmetry
1	13.149	407.9	15.6	0.404	9.913	0.64
2	14.72	3371.8	115.9	0.4554	81.943	0.613
3	21.514	39.7	8.5E-1	0.7762	0.966	0.997
4	28.434	295.4	4.5	0.7808	7.179	0.719



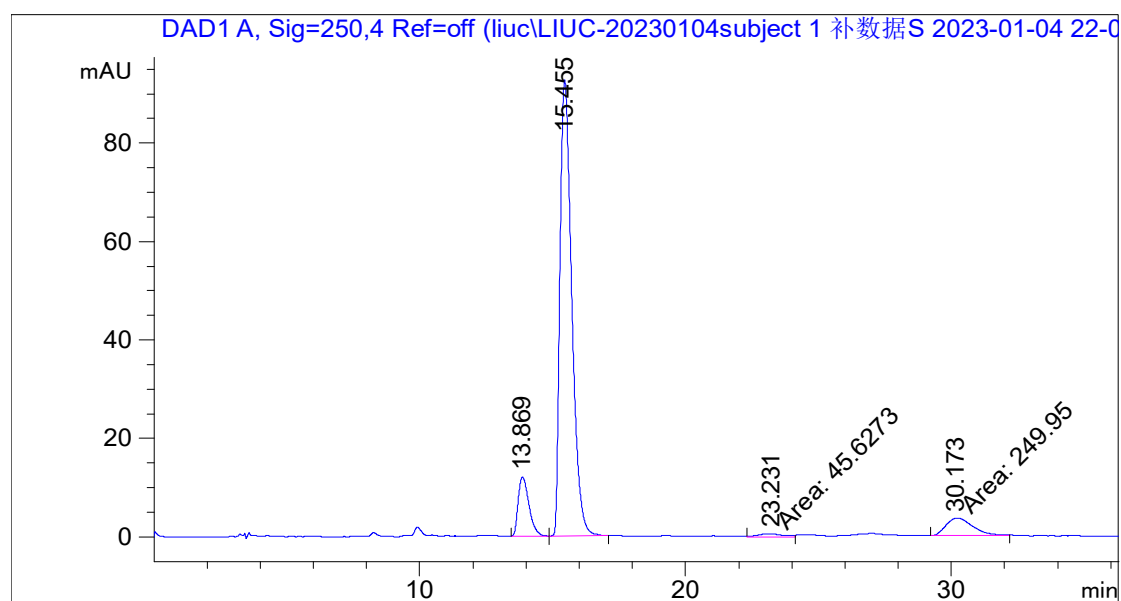
#	Time	Area	Height	Width	Area%	Symmetry
1	13.149	407.9	15.6	0.404	10.792	0.64
2	14.72	3371.8	115.9	0.4554	89.208	0.613

3na-racmic

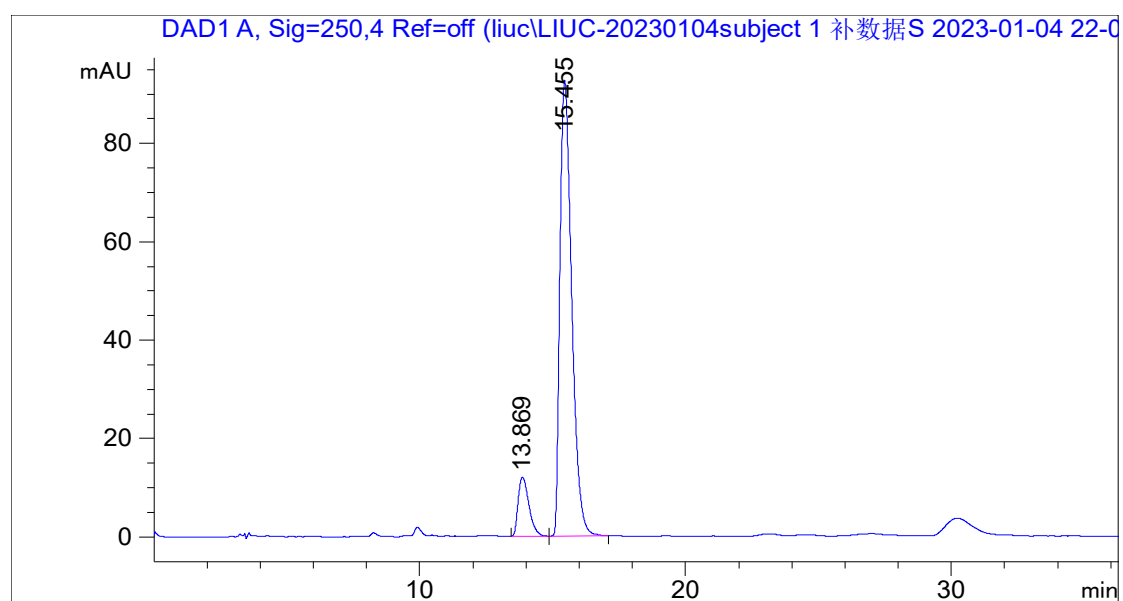


#	Time	Area	Height	Width	Area%	Symmetry
1	13.791	1485.9	52.8	0.438	45.276	0.616
2	15.497	1486.9	49.3	0.4701	45.307	0.627
3	23.005	160.5	3.2	0.6057	4.891	0.619
4	30.282	148.5	2.3	1.0743	4.526	0.863

3na-chiral

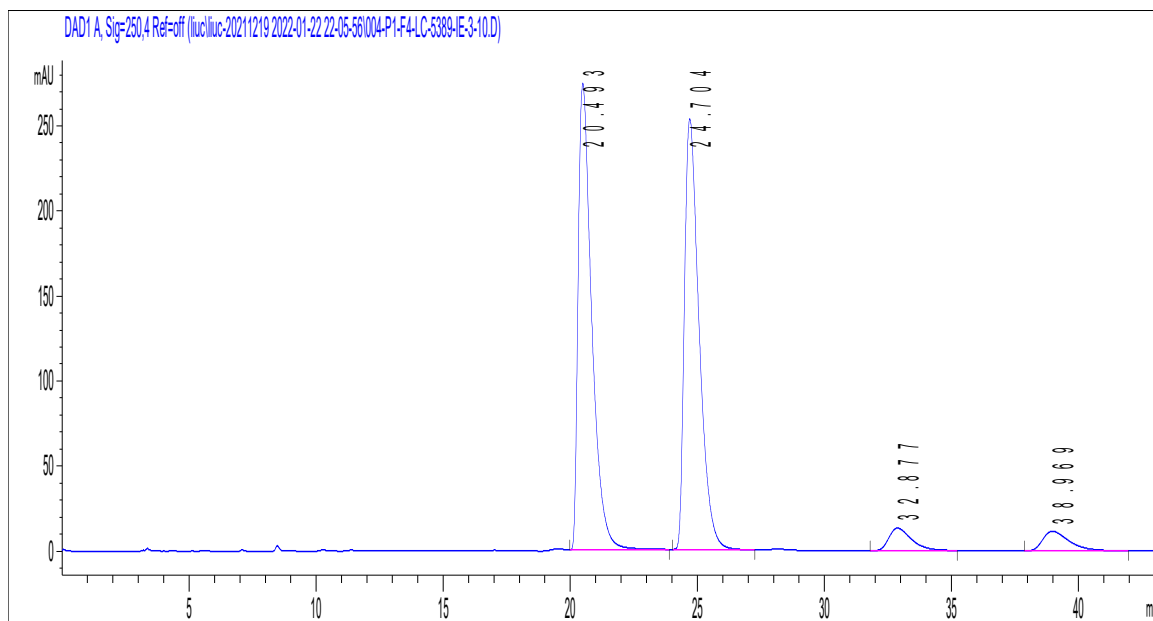


#	Time	Area	Height	Width	Area%	Symmetry
1	13.869	338.3	12	0.434	9.742	0.633
2	15.455	2839.1	92.6	0.4775	81.747	0.613
3	23.231	45.6	6.8E-1	1.1136	1.314	1.119
4	30.173	249.9	3.5	1.1759	7.197	0.572



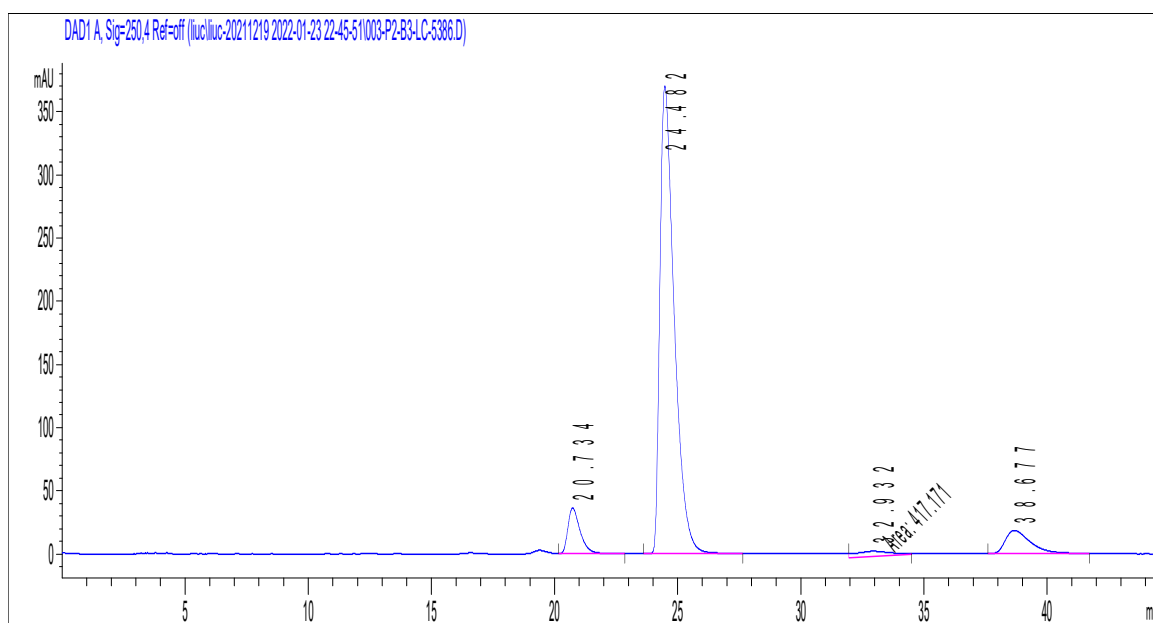
#	Time	Area	Height	Width	Area%	Symmetry
1	13.869	338.3	12	0.434	10.648	0.633
2	15.455	2839.1	92.6	0.4775	89.352	0.613

3oa-racmic

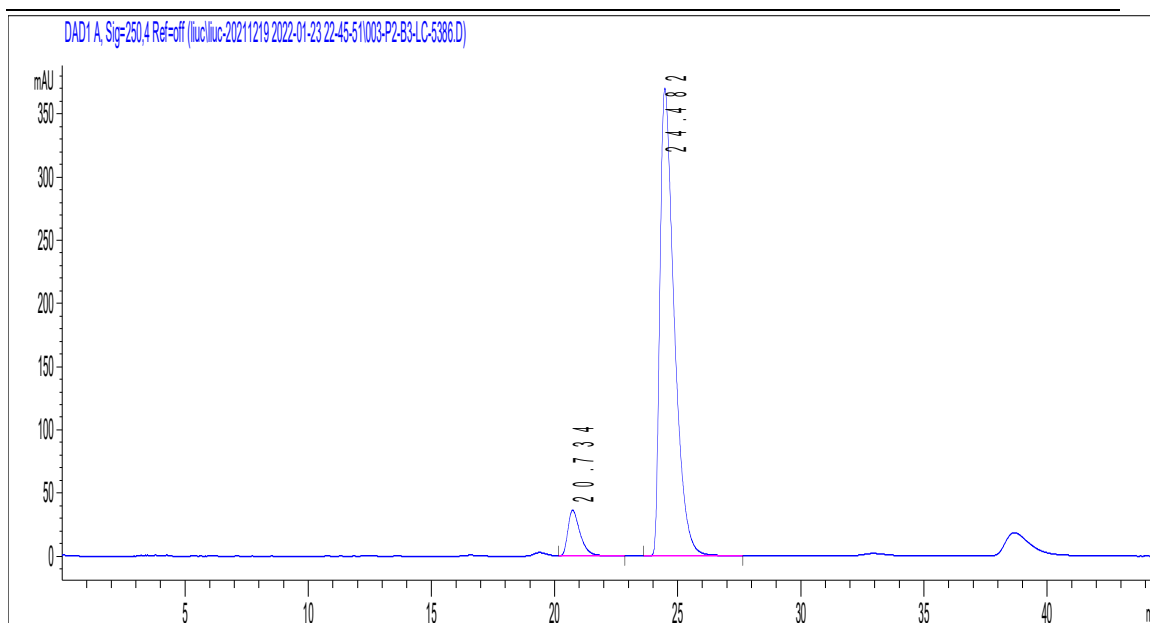


#	Time	Area	Height	Width	Area%	Symmetry
1	20.493	10202.2	274.4	0.5577	46.353	0.472
2	24.704	10155.8	253.1	0.6122	46.143	0.53
3	32.877	821	13.3	0.8965	3.730	0.576
4	38.969	830.6	11.5	0.9953	3.774	0.539

3oa-chiral

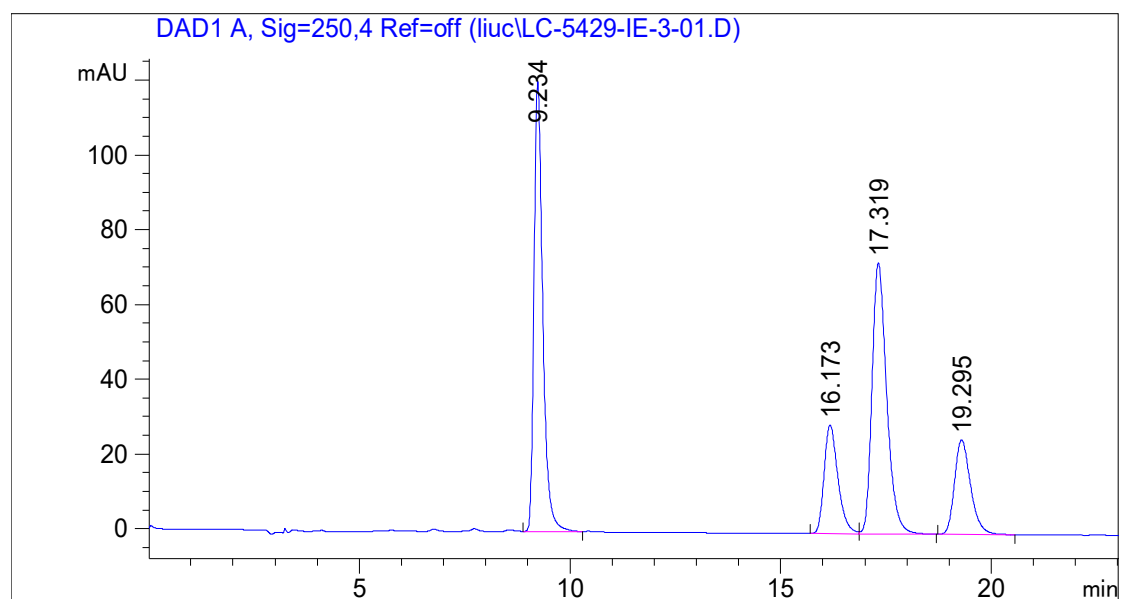


#	Time	Area	Height	Width	Area%	Symmetry
1	20.734	1246.7	36.1	0.5229	6.954	0.578
2	24.482	14963.3	370	0.6118	83.459	0.492
3	32.932	417.2	4.2	1.1535	2.327	1.107
4	38.677	1301.8	18.3	1.0124	7.261	0.529



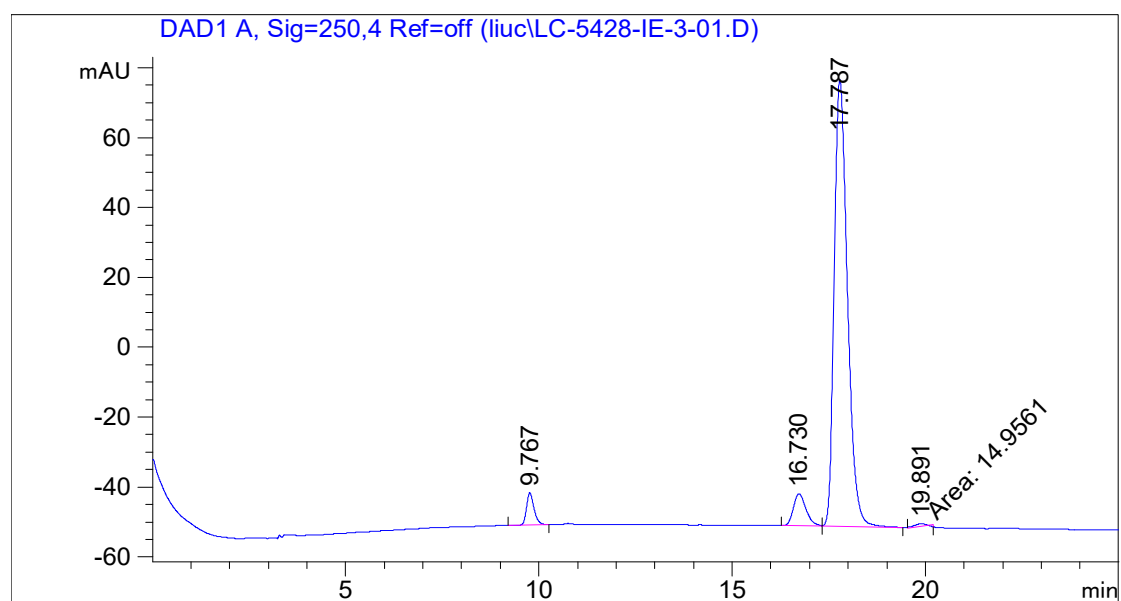
#	Time	Area	Height	Width	Area%	Symmetry
1	20.734	1246.7	36.1	0.5229	7.691	0.578
2	24.482	14963.3	370	0.6118	92.309	0.492

3eb-racmic

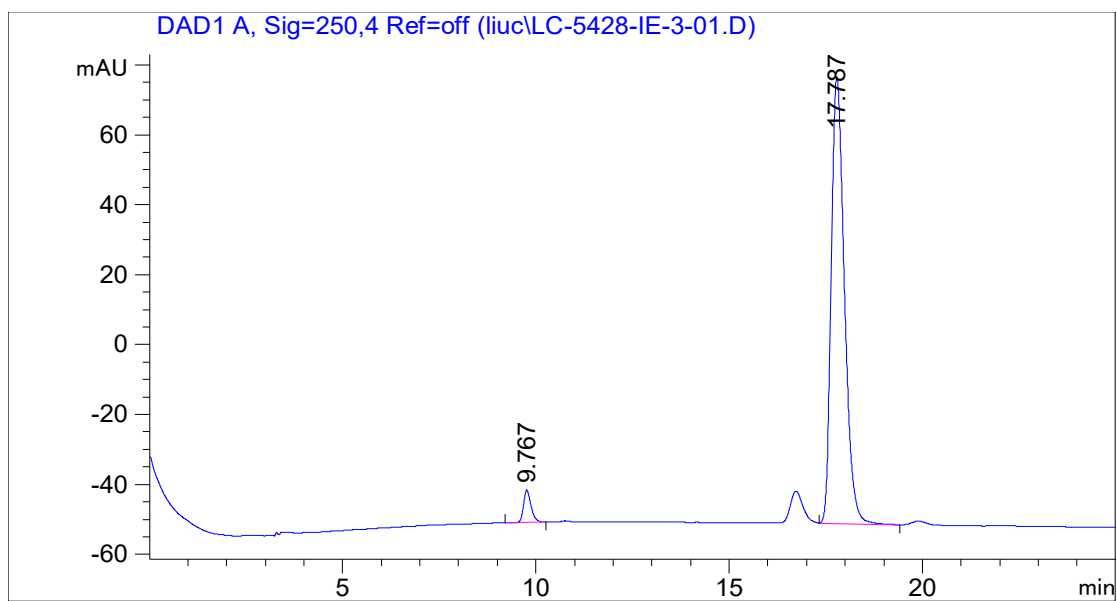


#	Time	Area	Height	Width	Area%	Symmetry
1	9.234	1740.2	120.5	0.2185	36.142	0.661
2	16.173	663.2	29	0.3484	13.774	0.704
3	17.319	1744.1	72.4	0.3691	36.224	0.704
4	19.295	667.3	25.2	0.4065	13.860	0.731

3eb-racmic

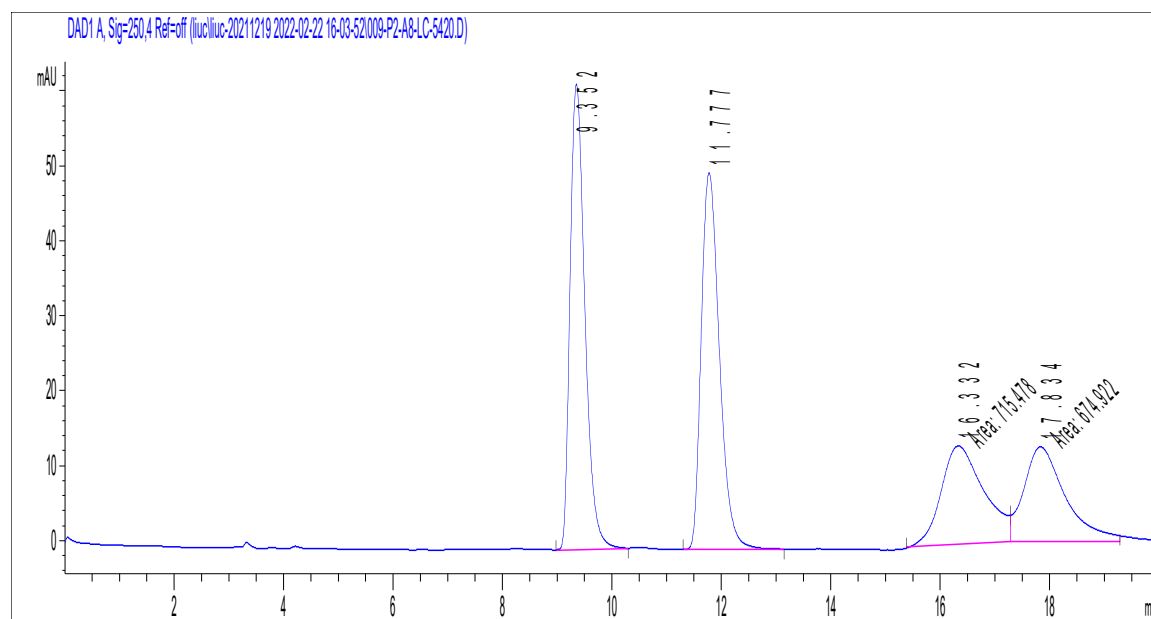


#	Time	Area	Height	Width	Area%	Symmetry
1	9.767	123.5	9.3	0.2037	3.593	0.737
2	16.73	207.1	9.2	0.343	6.025	0.748
3	17.787	3026.3	127.8	0.3643	88.035	0.684
4	19.891	80.7	2	0.6603	2.347	0.589

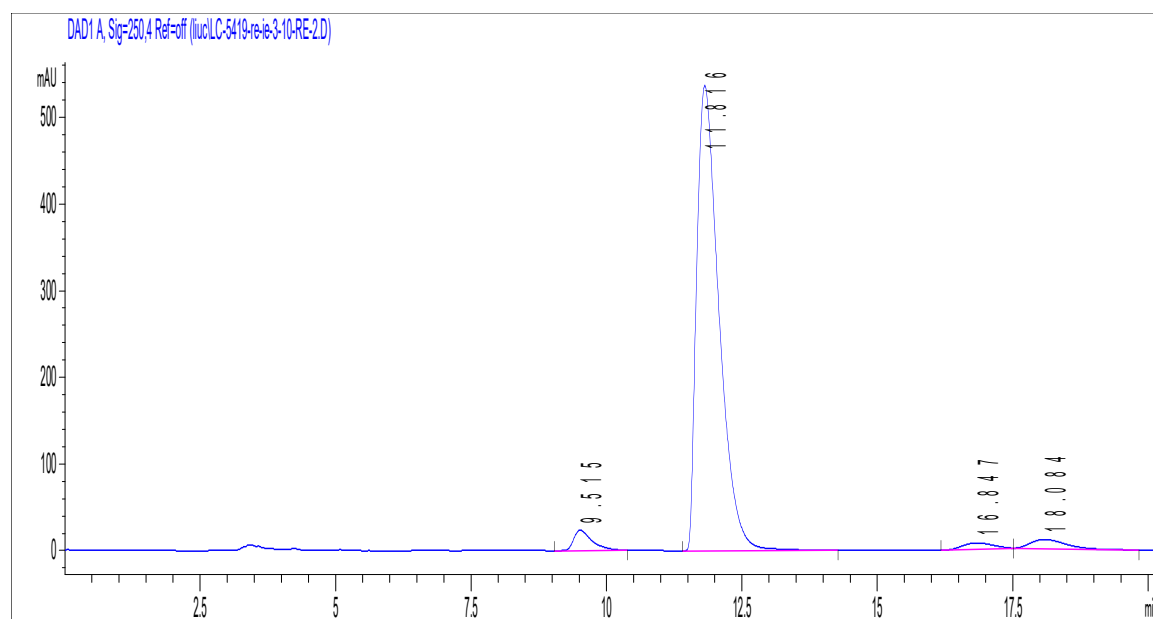


#	Time	Area	Height	Width	Area%	Symmetry
1	9.767	123.5	9.3	0.2037	3.922	0.737
2	17.787	3026.3	127.8	0.3643	96.078	0.684

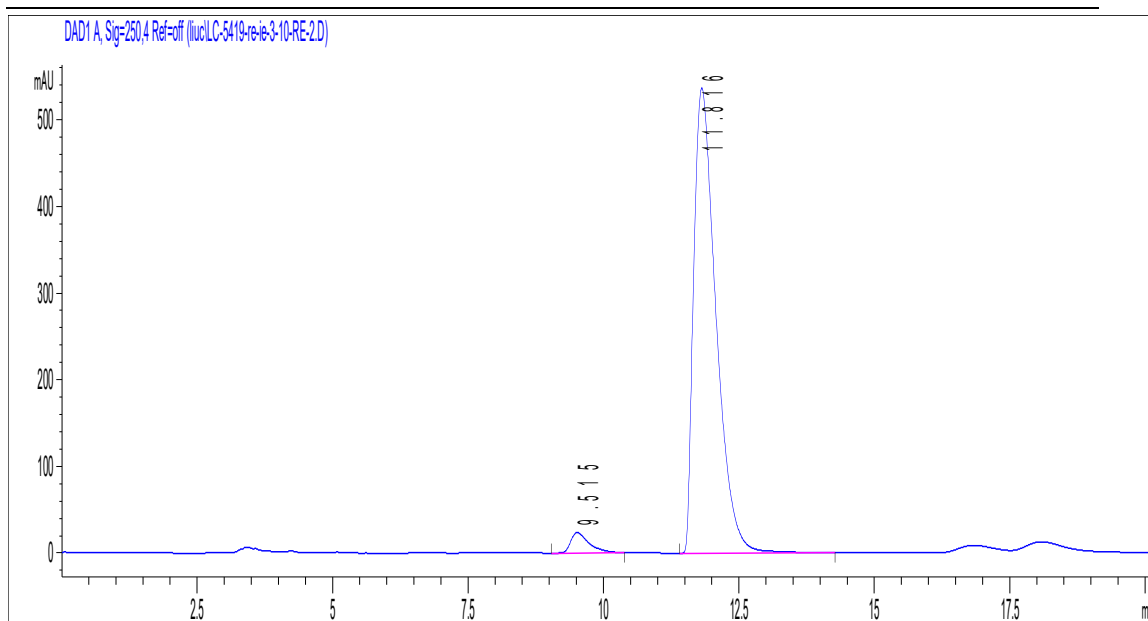
3ec-racmic



3ec-chiral

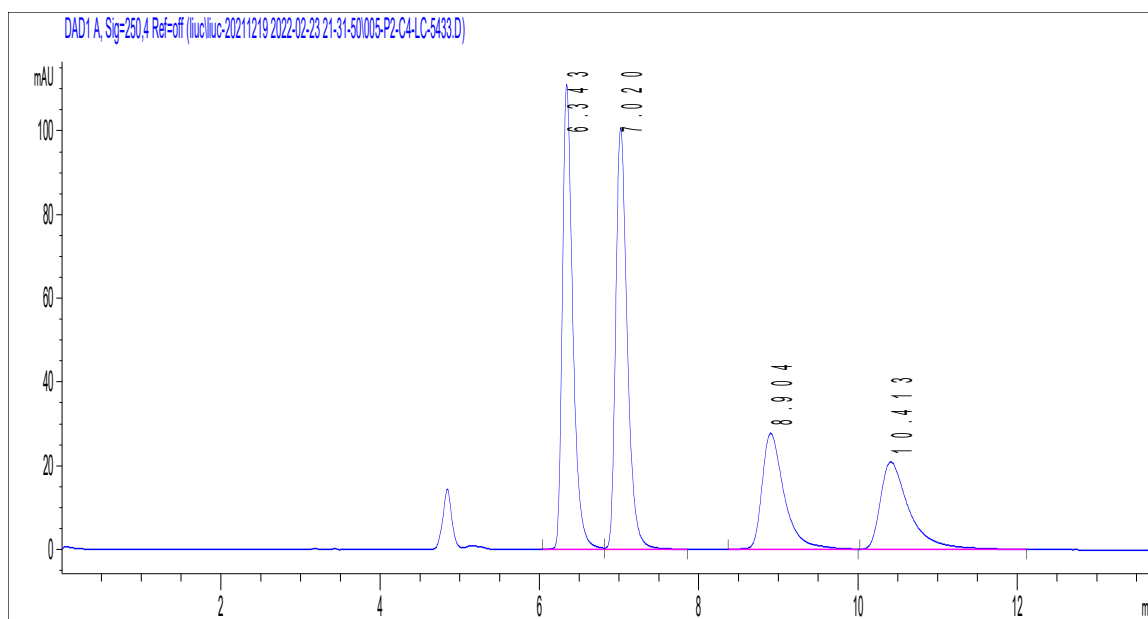


#	Time	Area	Height	Width	Area%	Symmetry
1	9.515	548.6	23.5	0.3525	3.296	0.508
2	11.816	15334.4	537.3	0.443	92.117	0.525
3	16.847	285.1	7.3	0.6106	1.713	0.958
4	18.084	478.6	10.5	0.6825	2.875	0.594



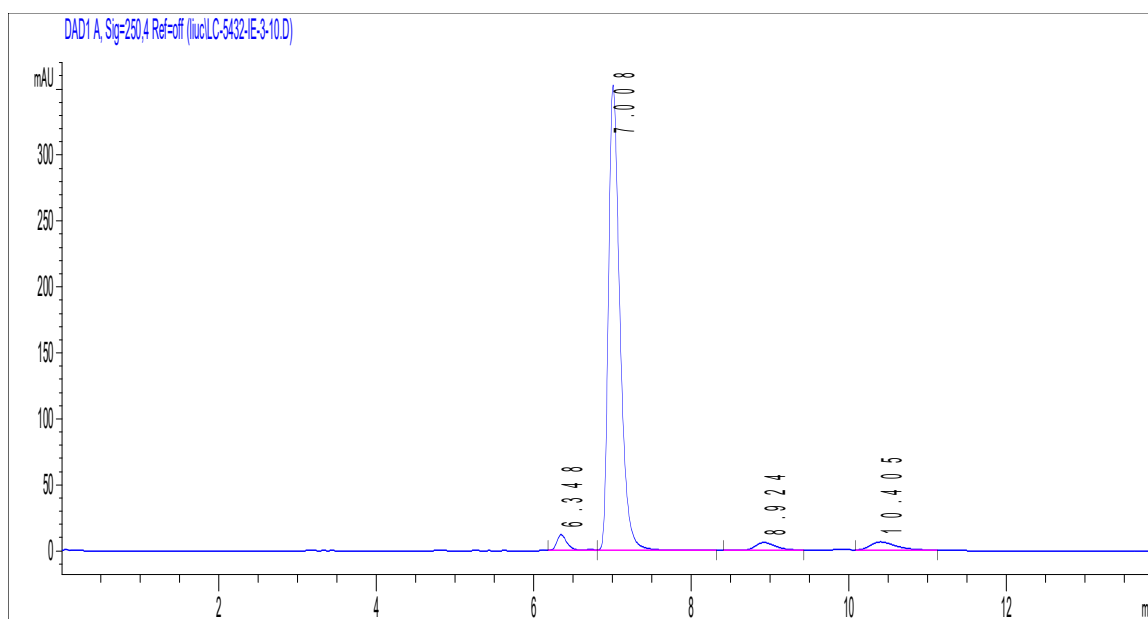
#	Time	Area	Height	Width	Area%	Symmetry
1	9.515	548.6	23.5	0.3525	3.454	0.508
2	11.816	15334.4	537.3	0.443	96.546	0.525

3ed-racmic

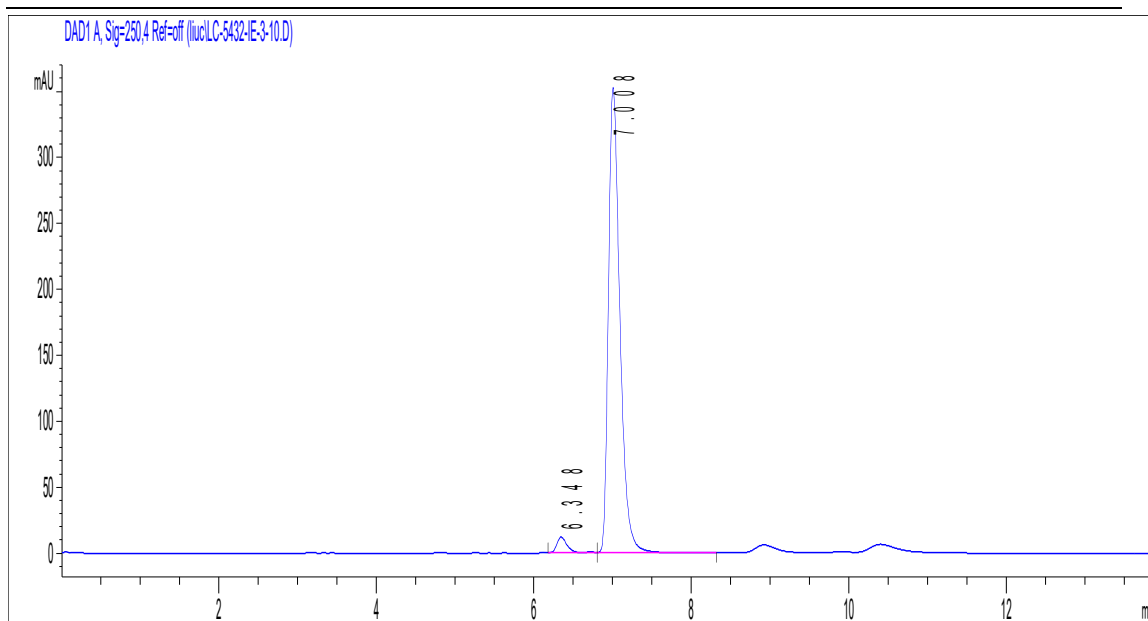


#	Time	Area	Height	Width	Area%	Symmetry
1	6.343	1013.1	111.1	0.1384	32.852	0.657
2	7.02	1014.3	100.9	0.1533	32.890	0.678
3	8.904	536.7	27.8	0.2894	17.402	0.584
4	10.413	519.8	20.8	0.3689	16.856	0.52

3ed-chiral

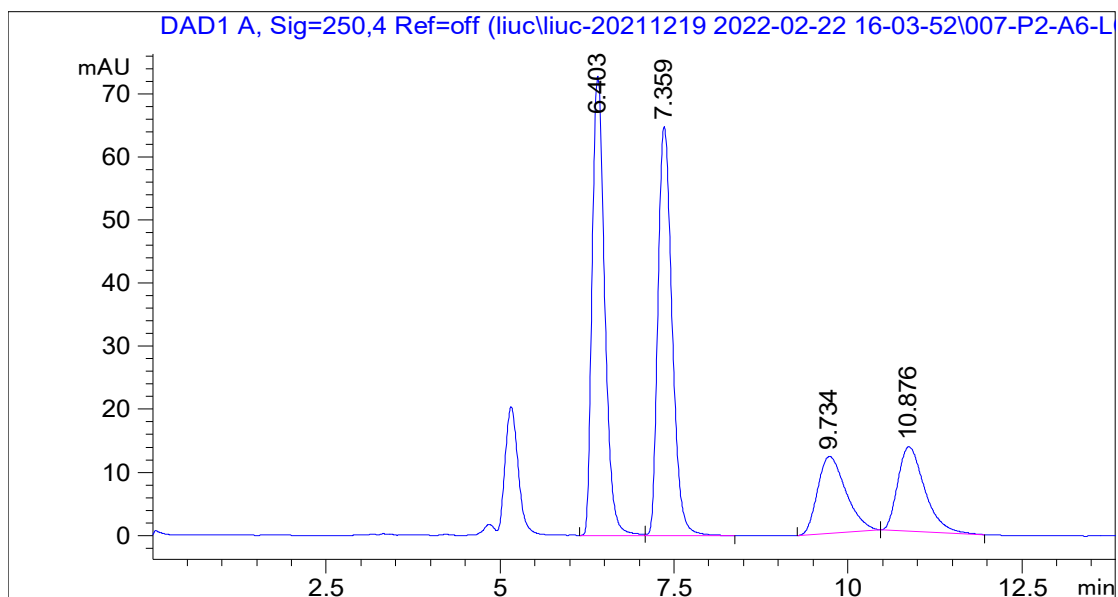


#	Time	Area	Height	Width	Area%	Symmetry
1	6.348	110.4	11.9	0.1404	2.815	0.625
2	7.008	3566.5	352.9	0.1539	90.979	0.632
3	8.924	105.9	5.9	0.2735	2.702	0.751
4	10.405	137.3	6.1	0.3396	3.503	0.604



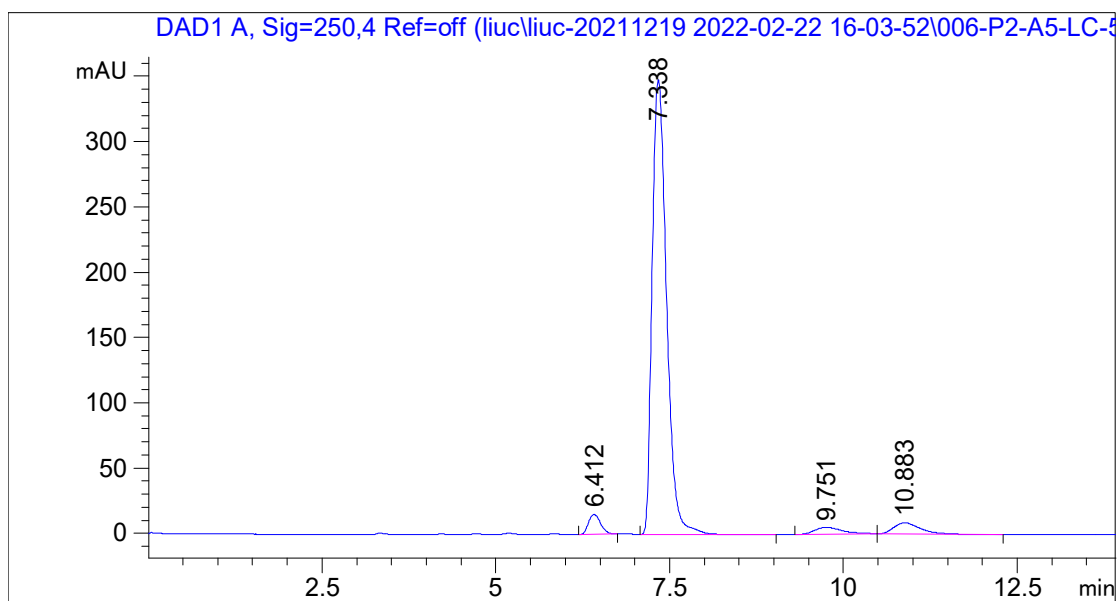
#	Time	Area	Height	Width	Area%	Symmetry
1	6.348	110.4	11.9	0.1404	3.002	0.625
2	7.008	3566.5	352.9	0.1539	96.998	0.632

3ee-racmic

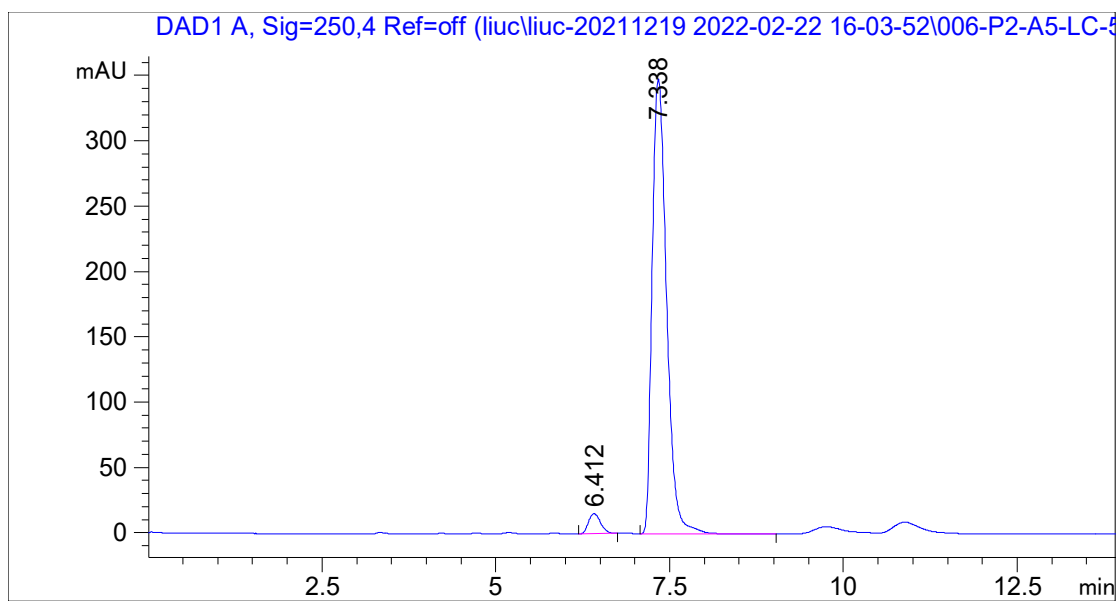


#	Time	Area	Height	Width	Area%	Symmetry
1	6.403	913.5	72.7	0.1965	36.027	0.726
2	7.359	916.8	64.8	0.2231	36.159	0.733
3	9.734	345.3	12.2	0.4357	13.620	0.684
4	10.876	359.9	13.4	0.4096	14.194	0.658

3ee-chiral

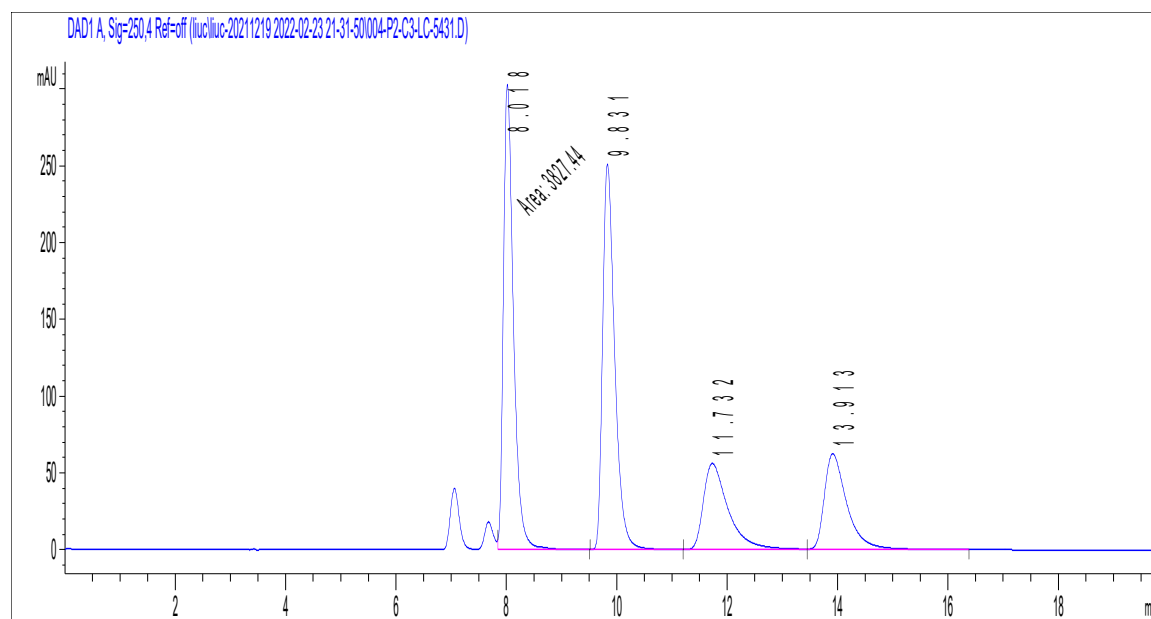


#	Time	Area	Height	Width	Area%	Symmetry
1	6.412	186.7	15.3	0.1926	3.353	0.781
2	7.338	5001.2	348.5	0.2254	89.835	0.686
3	9.751	149.7	5.2	0.4409	2.689	0.658
4	10.883	229.5	8.5	0.4086	4.123	0.638

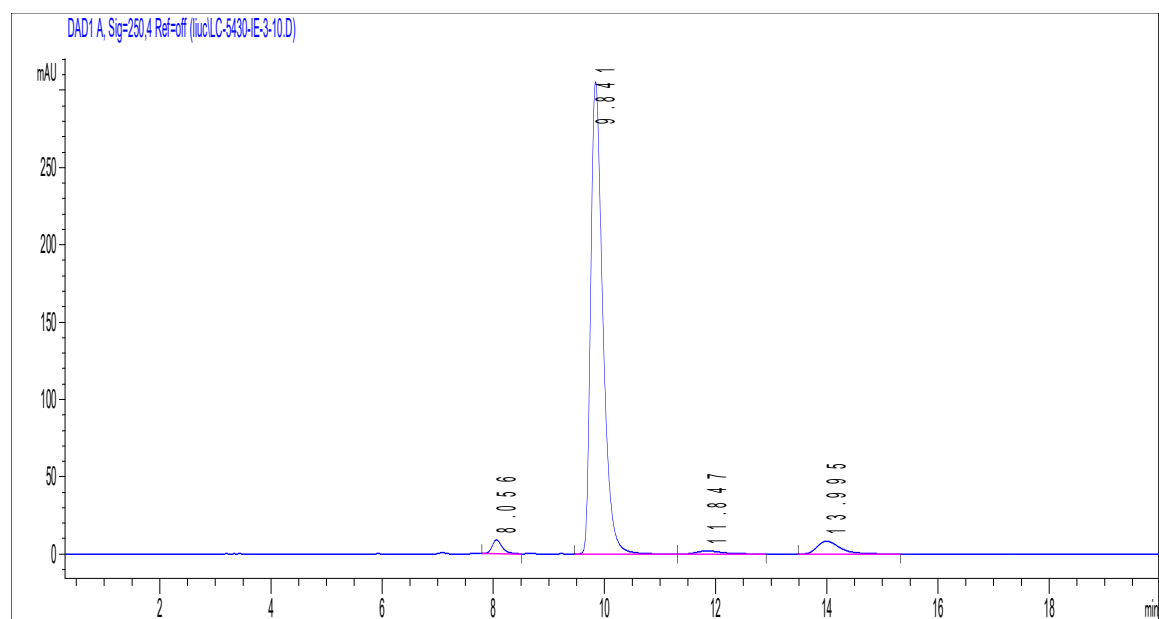


#	Time	Area	Height	Width	Area%	Symmetry
1	6.412	186.7	15.3	0.1926	3.598	0.781
2	7.338	5001.2	348.5	0.2254	96.402	0.686

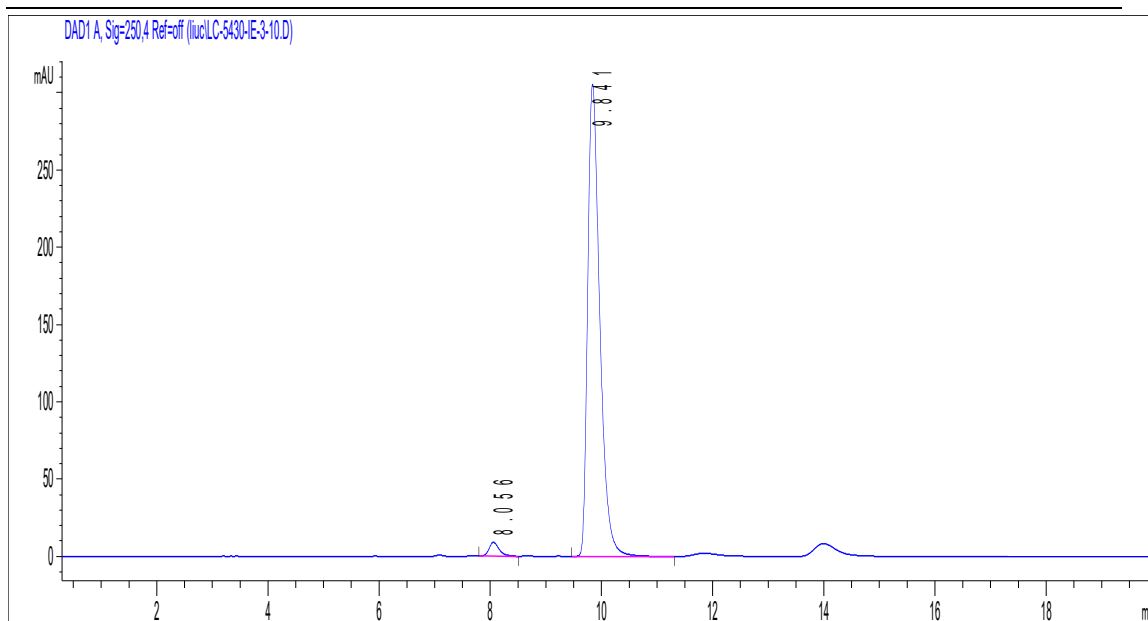
3ef-racmic



3ef-chiral

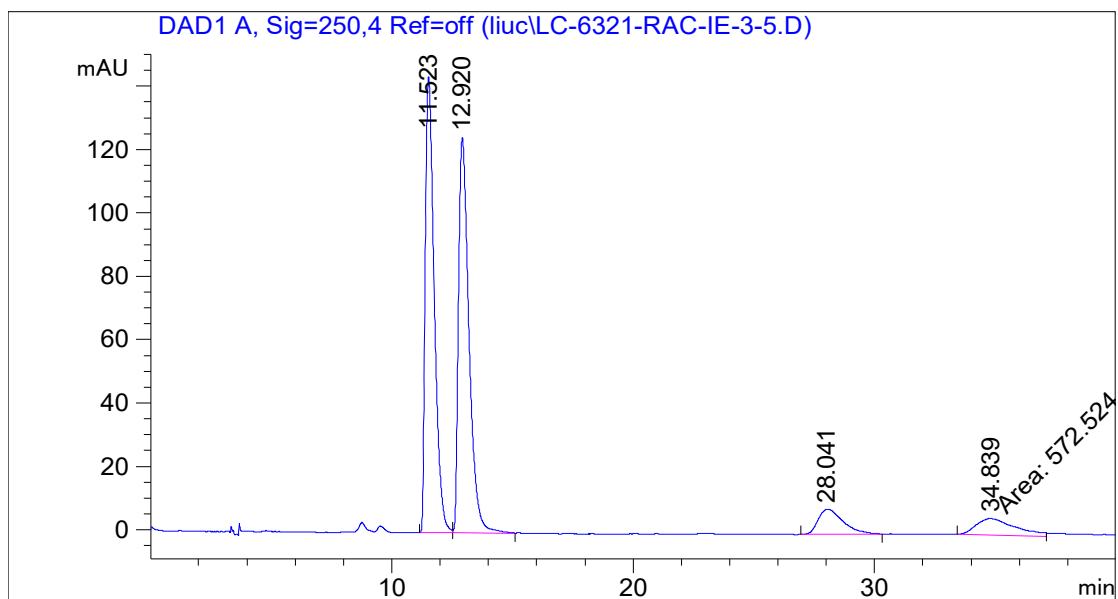


#	Time	Area	Height	Width	Area%	Symmetry
1	8.056	113.9	9	0.1922	2.256	0.692
2	9.841	4626.2	305.6	0.2326	91.625	0.613
3	11.847	64.1	2.1	0.4444	1.269	0.63
4	13.995	244.9	8.4	0.4468	4.850	0.617



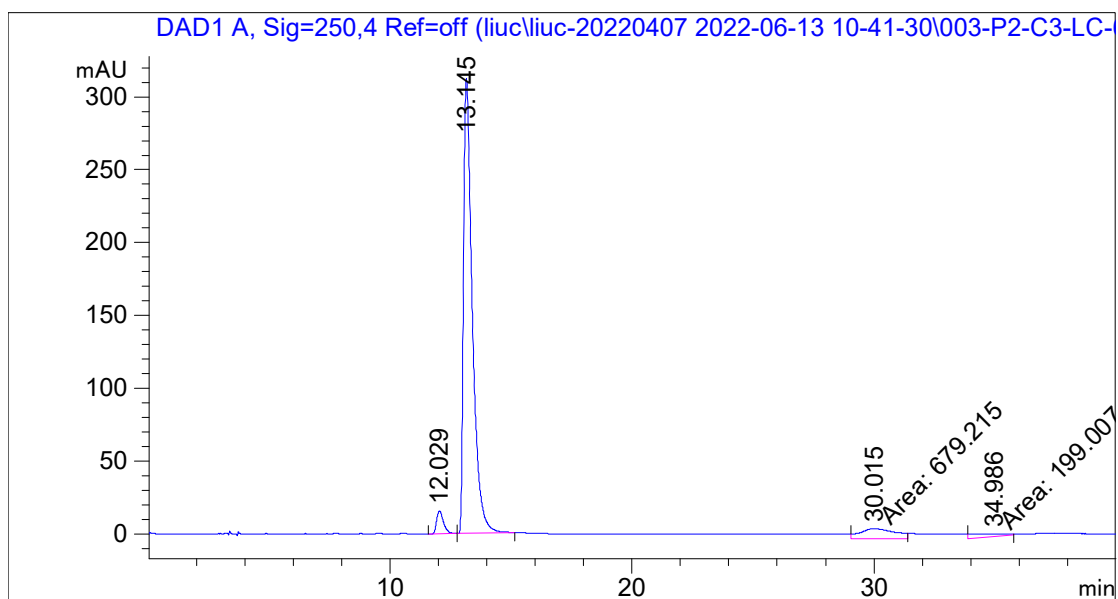
#	Time	Area	Height	Width	Area%	Symmetry
1	8.056	113.9	9	0.1922	2.403	0.692
2	9.841	4626.2	305.6	0.2326	97.597	0.613

3eg-racmic

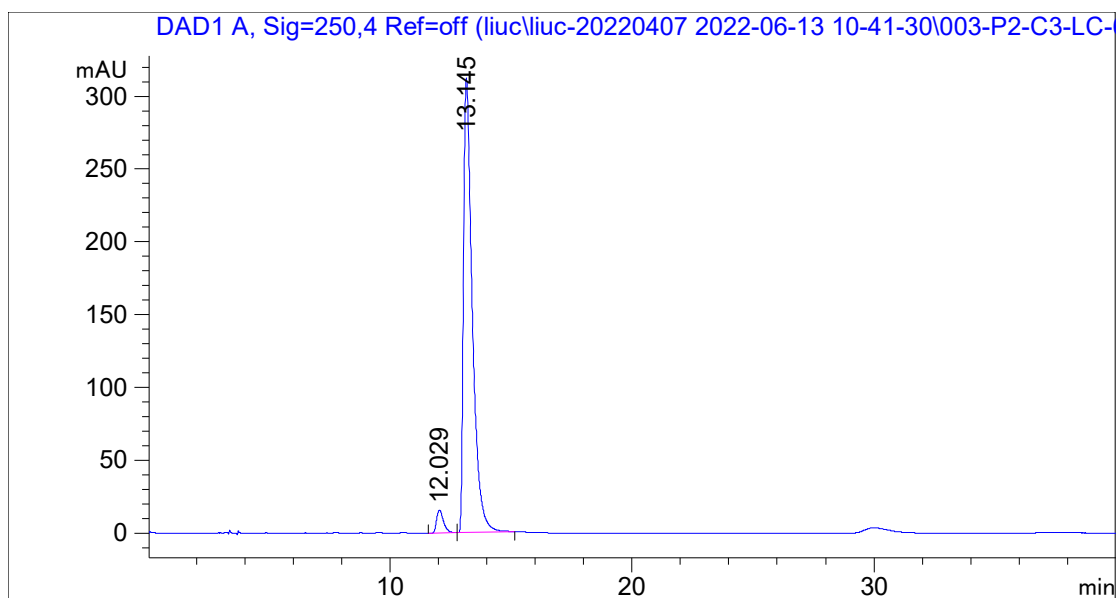


#	Time	Area	Height	Width	Area%	Symmetry
1	11.523	3742.1	143.8	0.4036	43.291	0.538
2	12.92	3764.6	124.7	0.4641	43.552	0.522
3	28.041	564.8	7.9	0.8565	6.534	0.565
4	34.839	572.5	5.1	1.8542	6.623	0.504

3eg-chiral

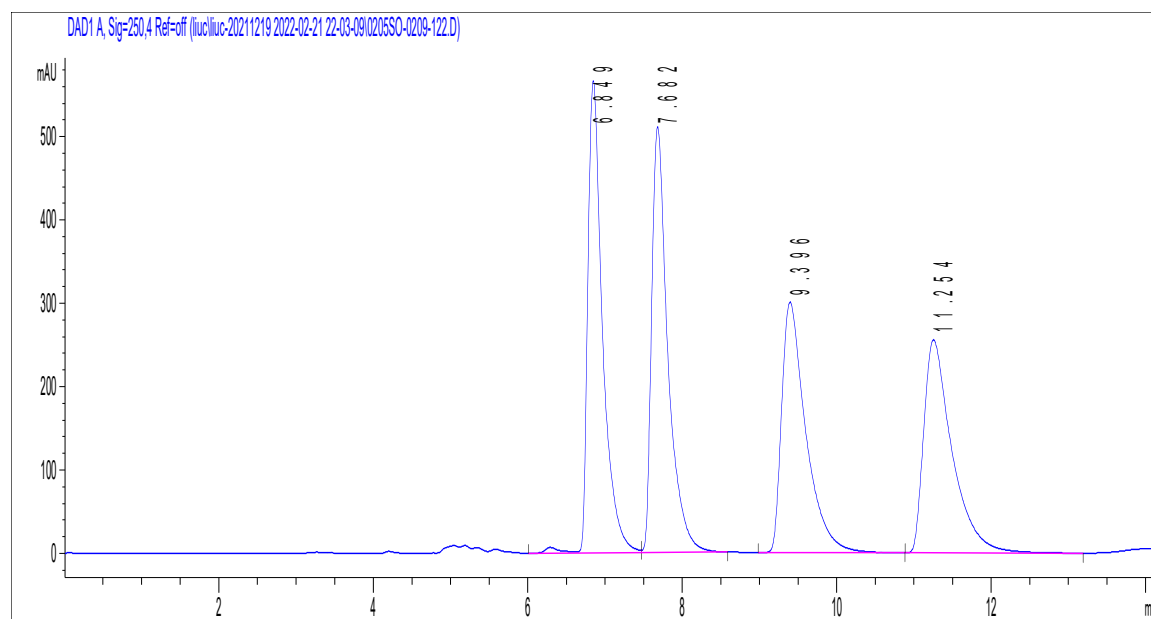


#	Time	Area	Height	Width	Area%	Symmetry
1	12.029	317.3	15.9	0.3047	3.471	0.646
2	13.145	7947.8	312.2	0.381	86.924	0.445
3	30.015	679.2	6.7	1.6892	7.429	0.659
4	34.986	199	1.6	1.4528	2.177	0



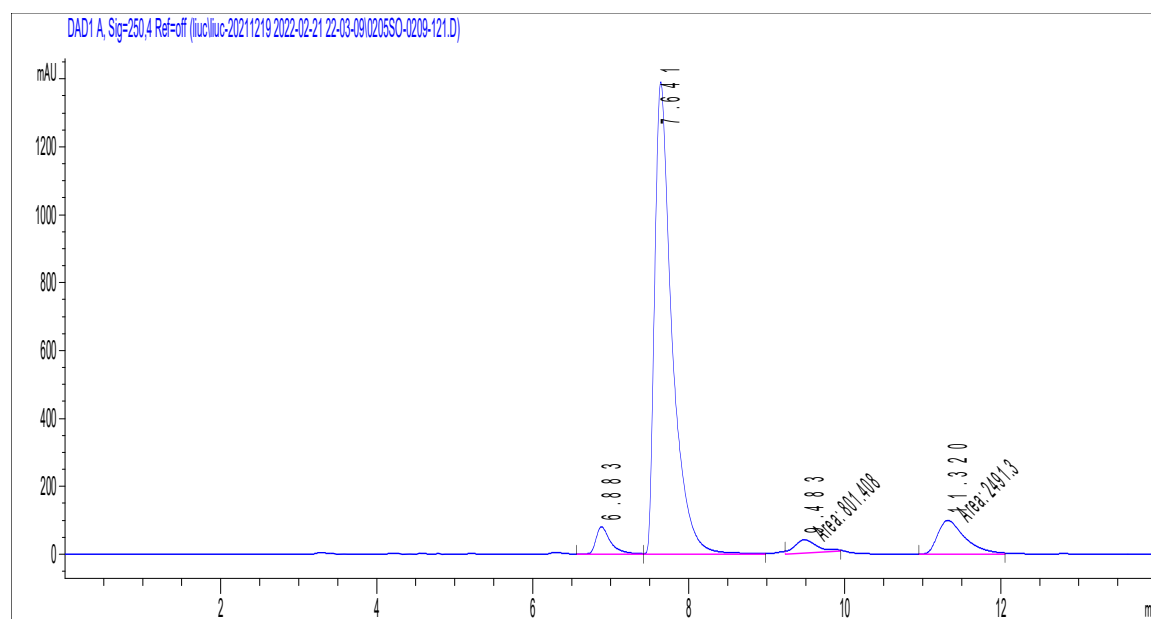
#	Time	Area	Height	Width	Area%	Symmetry
1	12.029	317.3	15.9	0.3047	3.839	0.646
2	13.145	7947.8	312.2	0.381	96.161	0.445

3eh-racmic

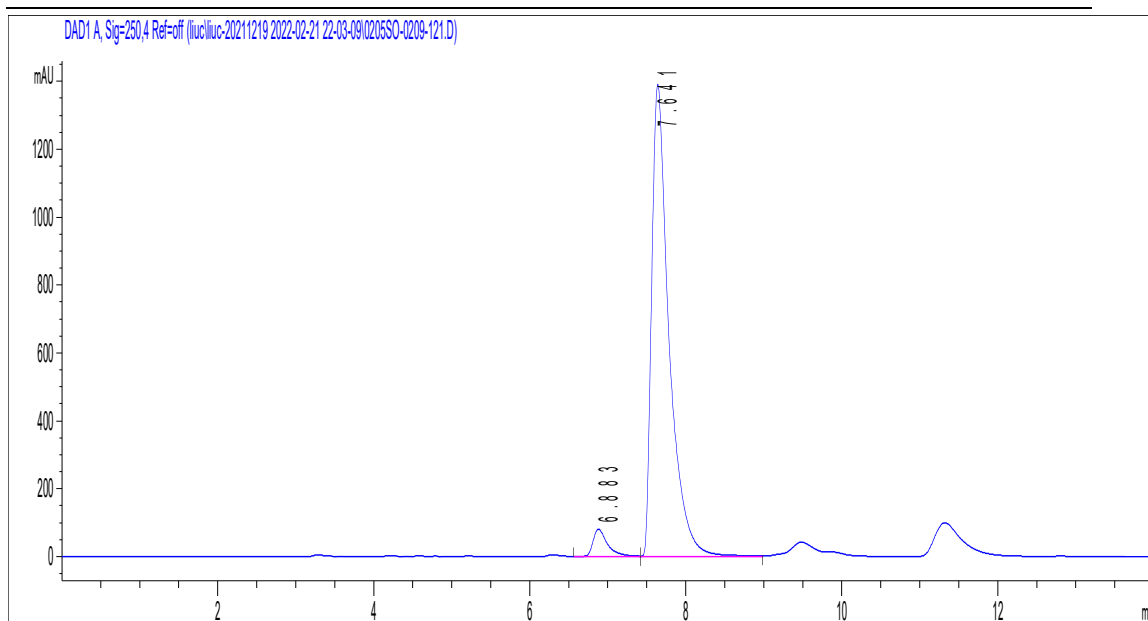


#	Time	Area	Height	Width	Area%	Symmetry
1	6.849	7561.8	566.5	0.1978	26.926	0.567
2	7.682	7454.9	511.2	0.2182	26.546	0.53
3	9.396	6544.9	301	0.3197	23.305	0.483
4	11.254	6521.6	255.9	0.3733	23.222	0.48

3eh-chiral

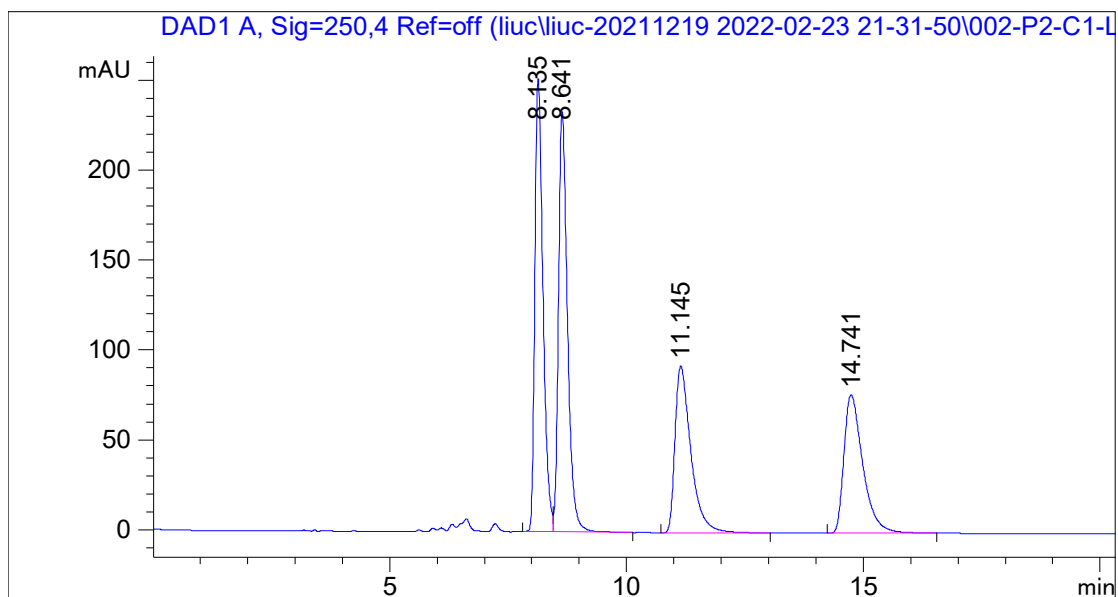


#	Time	Area	Height	Width	Area%	Symmetry
1	6.883	1009.8	79.9	0.1915	3.922	0.573
2	7.641	21447.1	1390.3	0.23	83.291	0.487
3	9.483	801.4	39.8	0.336	3.112	0.801
4	11.32	2491.3	100.6	0.4128	9.675	0.56



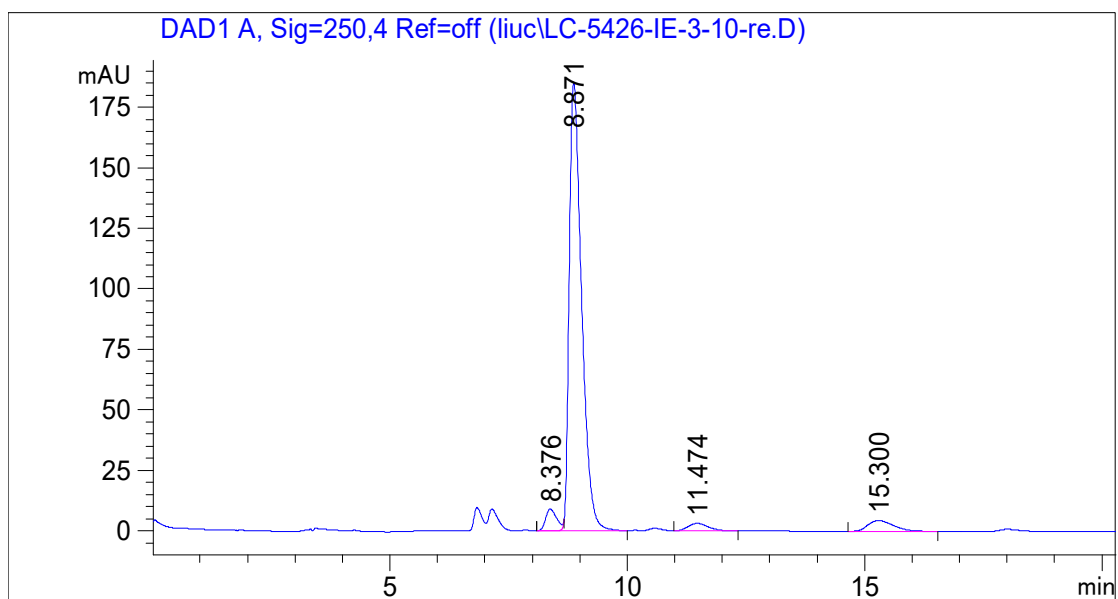
#	Time	Area	Height	Width	Area%	Symmetry
1	6.883	1009.8	79.9	0.1915	4.497	0.573
2	7.641	21447.1	1390.3	0.23	95.503	0.487

3ei-racmic

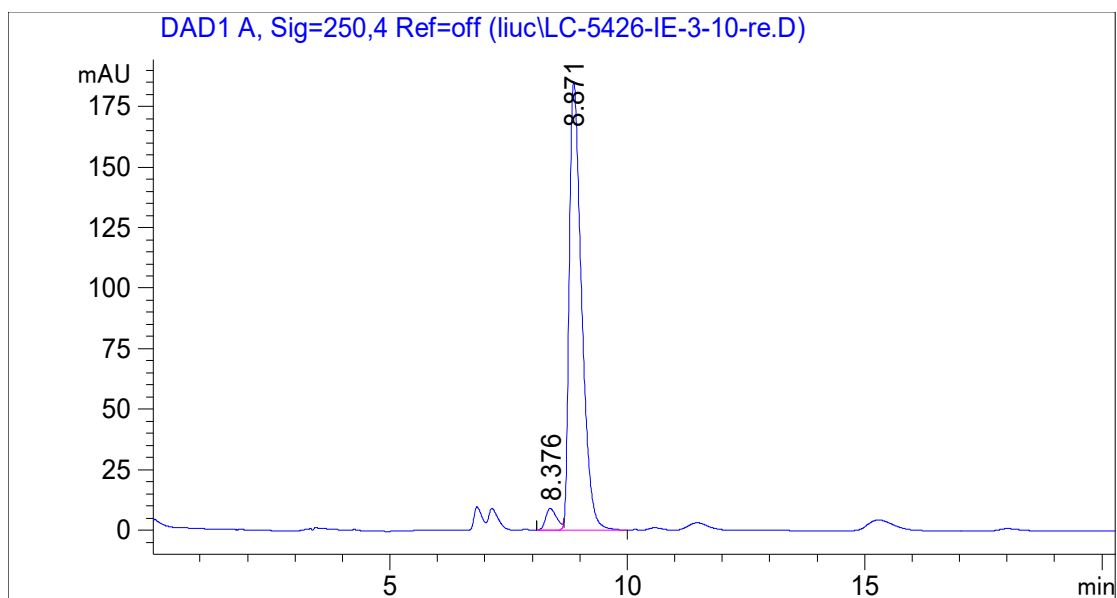


#	Time	Area	Height	Width	Area%	Symmetry
1	8.135	3002.7	252.1	0.183	28.882	0.65
2	8.641	3095.9	233.9	0.2024	29.778	0.644
3	11.145	2156.3	92.8	0.347	20.740	0.522
4	14.741	2141.7	77.1	0.4223	20.600	0.565

3ei-chiral

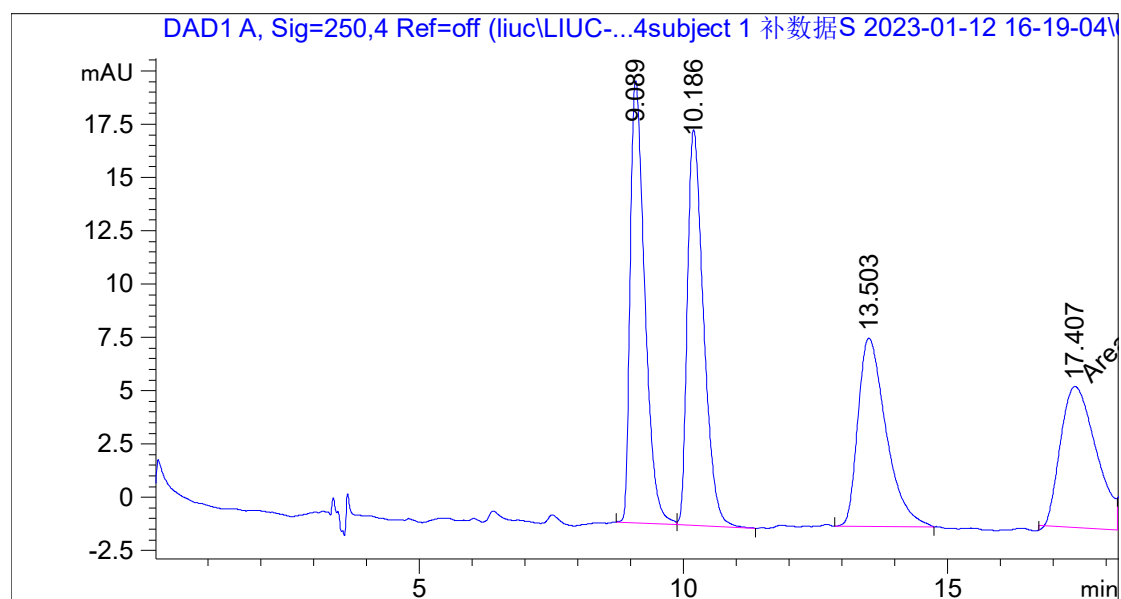


#	Time	Area	Height	Width	Area%	Symmetry
1	8.376	143.2	9	0.2439	3.806	0.672
2	8.871	3352.6	185.2	0.2752	89.095	0.673
3	11.474	91.1	3.1	0.4161	2.422	0.801
4	15.3	176	4.5	0.5447	4.676	0.657



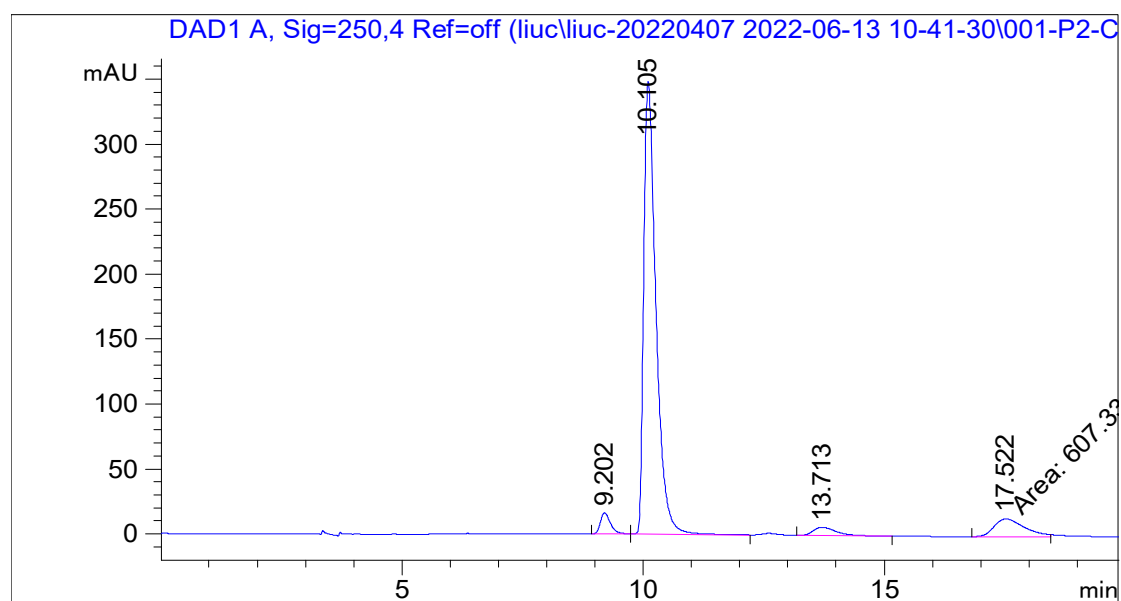
#	Time	Area	Height	Width	Area%	Symmetry
1	8.376	143.2	9	0.2439	4.097	0.672
2	8.871	3352.6	185.2	0.2752	95.903	0.673

3ej-racmic

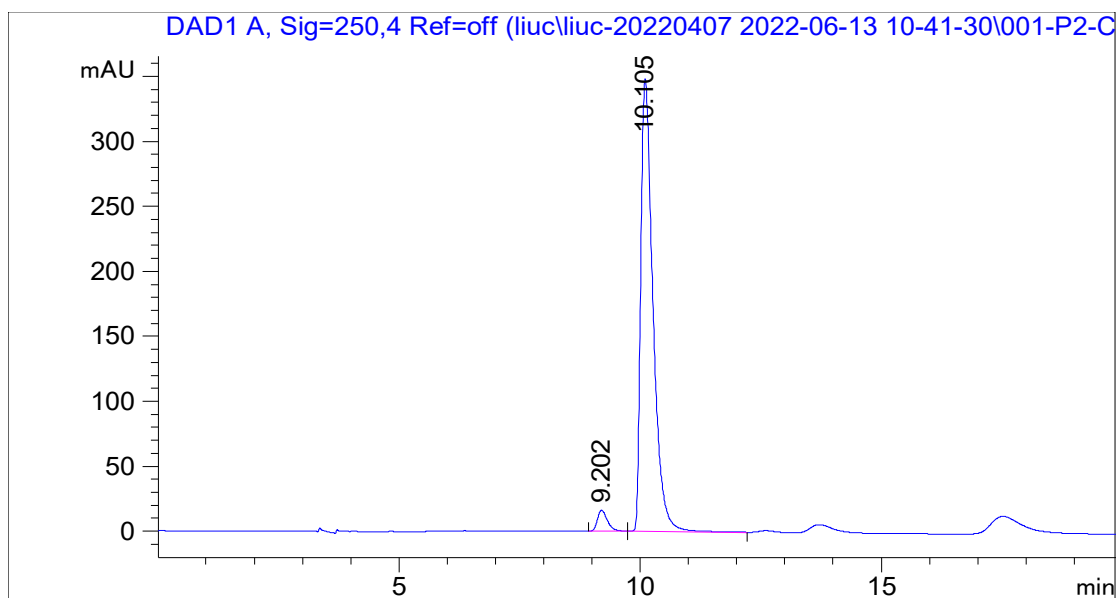


#	Time	Area	Height	Width	Area%	Symmetry
1	9.089	397.5	20.7	0.2916	27.613	0.548
2	10.186	396.2	18.6	0.325	27.523	0.579
3	13.503	325.6	8.8	0.548	22.619	0.591
4	17.407	320.2	6.8	0.7905	22.244	0.677

3ej-chiral

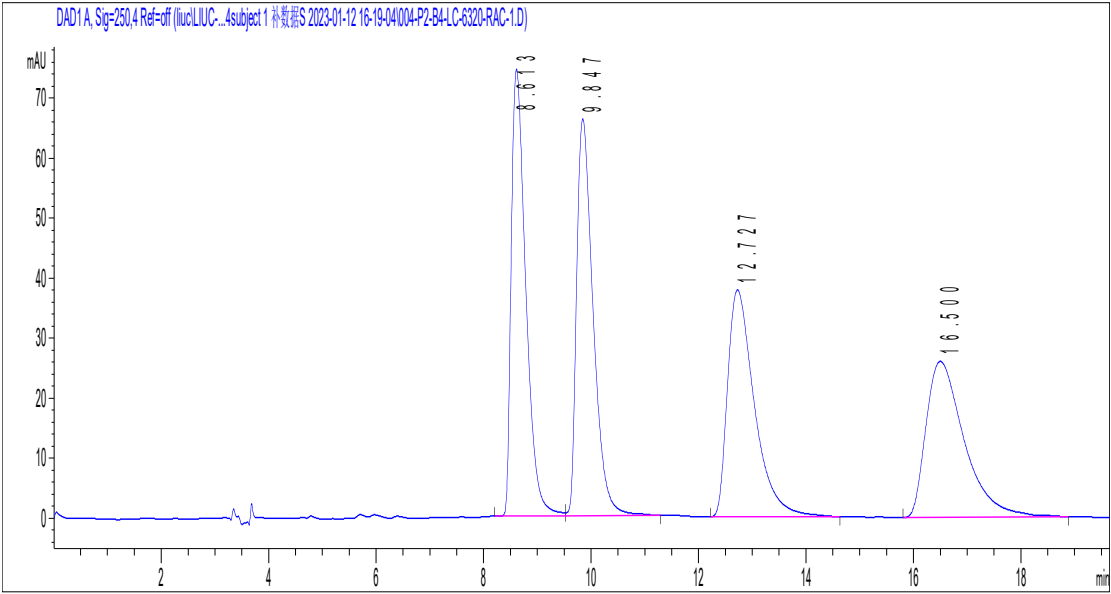


#	Time	Area	Height	Width	Area%	Symmetry
1	9.202	228.3	16	0.2203	3.182	0.683
2	10.105	6123.8	348.4	0.2671	85.358	0.512
3	13.713	214.8	6.5	0.4945	2.995	0.592
4	17.522	607.3	13.7	0.7373	8.466	0.604



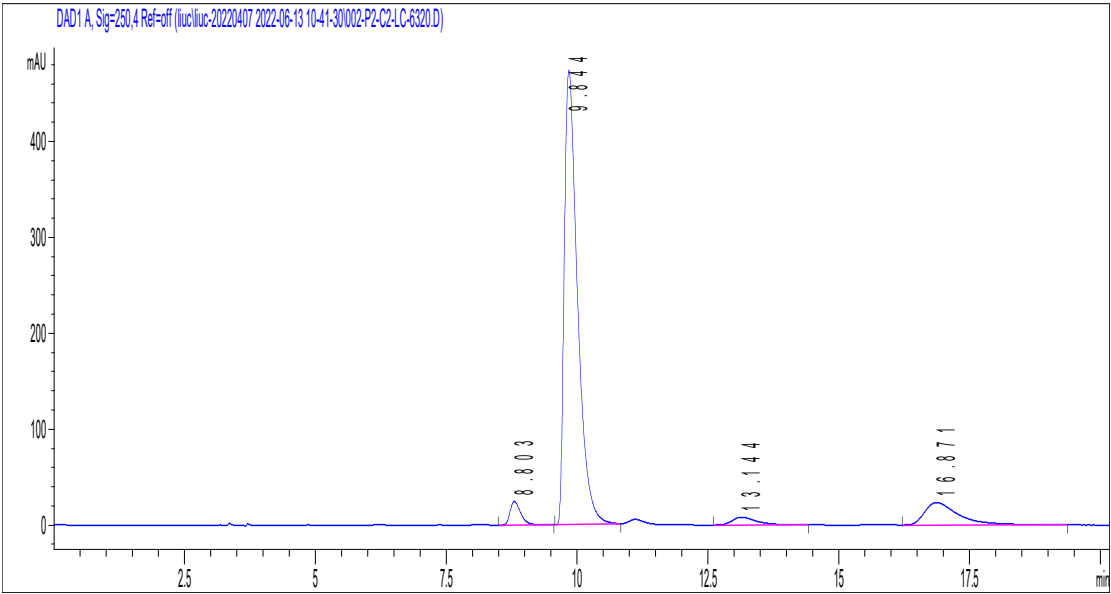
#	Time	Area	Height	Width	Area%	Symmetry
1	9.202	228.3	16	0.2203	3.594	0.683
2	10.105	6123.8	348.4	0.2671	96.406	0.512

3ek-racmic

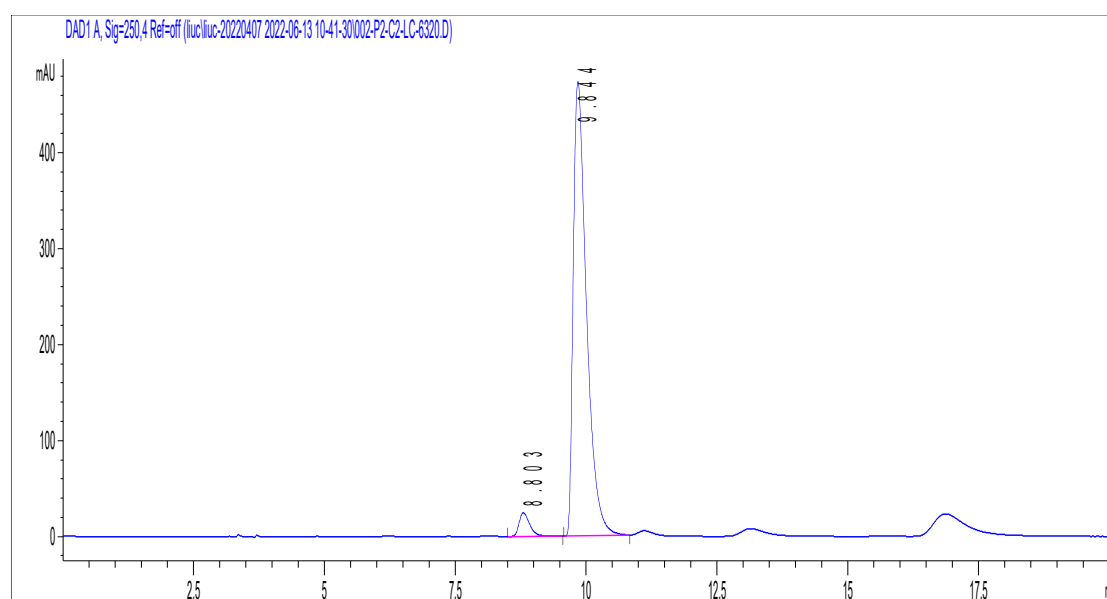


#	Time	Area	Height	Width	Area%	Symmetry
1	8.613	1404.2	74.5	0.2859	25.901	0.52
2	9.847	1412.9	66.2	0.327	26.061	0.548
3	12.727	1317.1	37.8	0.524	24.295	0.54
4	16.5	1287.2	26	0.7494	23.743	0.553

3ek-chiral



#	Time	Area	Height	Width	Area%	Symmetry
1	8.803	346.9	24.6	0.2163	3.470	0.642
2	9.844	8330.1	473.8	0.2651	83.311	0.492
3	13.144	262.8	8.1	0.4828	2.628	0.584
4	16.871	1059	23.3	0.6712	10.591	0.498



#	Time	Area	Height	Width	Area%	Symmetry
1	8.803	346.9	24.6	0.2163	3.998	0.642
2	9.844	8330.1	473.8	0.2651	96.002	0.492