Supporting Information

A Dienamine-Mediated Deconjugative Addition/Cylization Cascade of γ,γ-Disubstituted Enals with Carboxylic-Activated Enones: A Rapid Access to Highly Functionalized γ-Lactones

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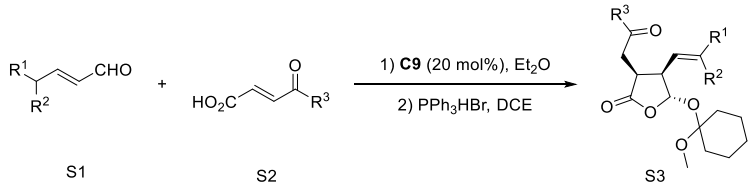
Contents

1 General Information

All ^{1}H NMR and ^{13}C NMR spectra were recorded on Bruker AVANCE III HD 400, 500 and 600 instruments and calibrated using residual solvent peaks as internal reference. Enantiomeric excesses were measured on Agilent HPLC and Waters UPC. High resolution ESI mass experiments were operated on a SolariX 7.0T FT ICRMS. Optical rotations were measured on a Rudolph Research Analytical (Autopol Ⅵ).

All chemicals and materials in the experiments were purchased from commercial suppliers and used as received unless otherwise noted. Flash Column chromatography was performed using 200-300 mesh silica gel, SiO_2. The α, β-unsaturated aldehydes[1], 4-oxa-α, β-unsaturated carboxylic acids[2,3] and 1-methoxycyclohex-1-ene[4] were prepared according to known procedures.

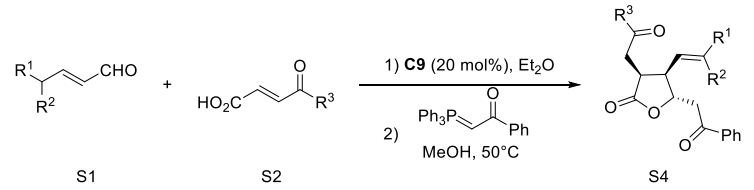
2 General Procedure for the Synthesis of γ-Lactones S3



S1 S2 S3

A reaction mixture of 4-oxa-α, β-unsaturated carboxylic acids **S2** (1 mmol, 1.0 eq.), α, β-unsaturated aldehydes **S1** (2 mmol, 2.0 eq.) and diphenylprolinol silyl ether **C9** (0.2 mmol, 0.2 eq.) in 5 ml Et_2O stirred at 25℃ for 24-72 h until completion of the reaction (monitored by TLC). The reaction mixture was concentrated in vacuo and the resulting residue was treated with PPh_3HBr (0.1 mmol, 0.1 eq.), 1-methoxycyclohex-1-ene (10 mmol, 10 eq.) and 10 ml DCE. After stirred at 25℃ for 6-12 h until completion of the reaction (monitored by TLC), The reaction mixture was concentrated in vacuo and purified by flash column chromatography to give the desired product **S3**.

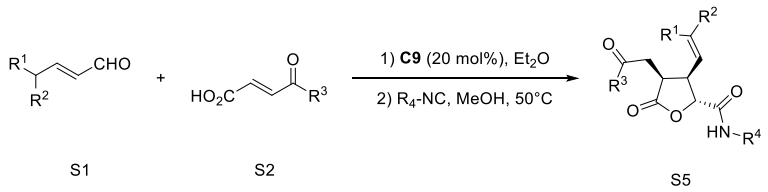
3 Synthetical Transformations



S1 S2 S4

A reaction mixture of 4-oxa-α, β-unsaturated carboxylic acids **S2** (1 mmol, 1.0 eq.), α, β-unsaturated aldehydes **S1** (2 mmol, 2.0 eq.) and diphenylprolinol silyl ether **C9** (0.2

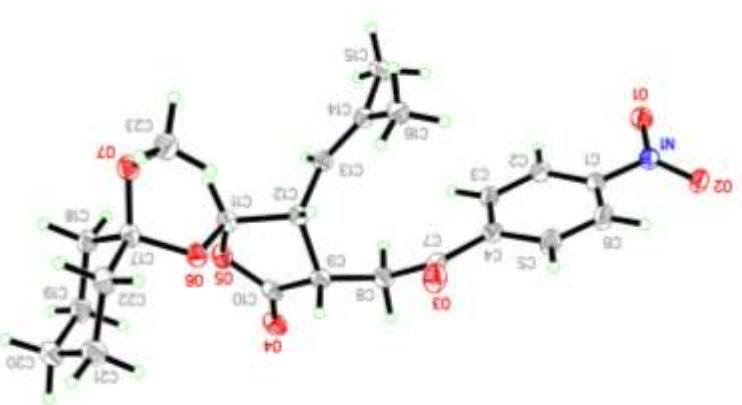
mmol, 0.2 eq.) in 5 ml Et_2O stirred at 25℃ for 24-72 h until completion of the reaction (monitored by TLC). The reaction mixture was concentrated in vacuo and the resulting residue was treated with (benzoylmethylene)triphenylphosphorane (3 mmol, 3.0 eq.) and 10 ml MeOH. After stirred at 50℃ for 6-12 h until completion of the reaction (monitored by TLC), The reaction mixture was concentrated in vacuo and purified by flash column chromatography to give the desired product **S4**.

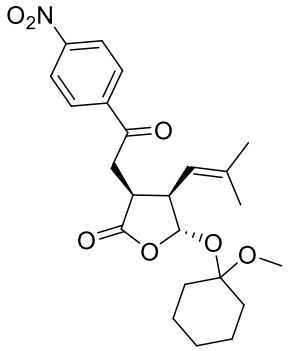


S1 S2 S5

A reaction mixture of 4-oxa-α, β-unsaturated carboxylic acids **S2** (1 mmol, 1.0 eq.), α, β-unsaturated aldehydes **S1** (2 mmol, 2.0 eq.) and diphenylprolinol silyl ether **C9** (0.2 mmol, 0.2 eq.) in 5 ml Et_2O stirred at 25℃ for 24-72 h until completion of the reaction (monitored by TLC). The reaction mixture was concentrated in vacuo and the resulting residue was treated with isonitrile (2.4 mmol, 2.4 eq.) and 10 ml MeOH. After stirred at 50℃ for 6-12 h until completion of the reaction (monitored by TLC), The reaction mixture was concentrated in vacuo and purified by flash column chromatography to give the desired product **S5**.

4 X-ray Crystallographic Data of Product 3m



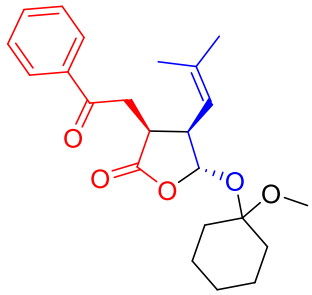


3m

X-Ray of 3m (CCDC:1936160)

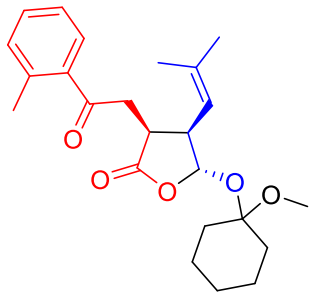
Identification code	ta_a
Empirical formula	C23 H29 N O7
Formula weight	431.47
Temperature	100(2) K
Wavelength	1.54178 A
Crystal system, space group	Orthorhombic, P2(1)2(1)2(1)
Unit cell dimensions	a = 7.0322(5) A alpha = 90 deg. b = 15.7295(11) A beta = 90 deg. c = 20.0907(14) A gamma = 90 deg.
Volume	2222.3(3) A^3
Z, Calculated density	4, 1.290 Mg/m^3
Absorption coefficient	0.790 mm^-1
F(000)	920
Crystal size	0.200 x 0.200 x 0.180 mm
Theta range for data collection	3.569 to 68.335 deg.
Limiting indices	-8<=h<=8, -18<=k<=18, -24<=l<=24
Reflections collected / unique	17072 / 4066 [R(int) = 0.0509]
Completeness to theta	= 67.679 99.9 %
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4066 / 0 / 283
Goodness-of-fit on F^2	1.022
Final R indices [I>2sigma(I)]	R1 = 0.0359, wR2 = 0.0939
R indices (all data)	R1 = 0.0376, wR2 = 0.0961
Absolute structure parameter	0.09(7)
Extinction coefficient	n/a
Largest diff. peak and hole	0.233 and -0.232 e.A^-3

5 Characterization Data for the Products



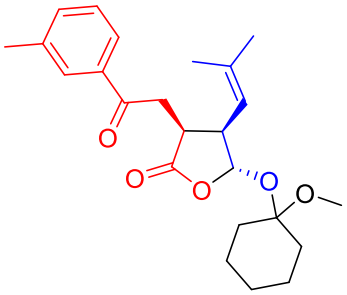
3a:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-phenylethyl)dihydrofuran-2(3H)-one

colourless oil; 225 mg; 58% yield; 99% ee; $[\alpha]_{D20}$ = 7.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d6) δ 8.09 - 7.95 (m, 2H), 7.69 - 7.60 (m, 1H), 7.59 - 7.47 (m, 2H), 5.52 (d, *J* = 1.2 Hz, 1H), 5.02 - 4.92 (m, 1H), 3.71 - 3.57 (m, 1H), 3.51 - 3.41 (m, 1H), 3.35 - 3.26 (m, 2H), 3.20 (s, 3H), 1.82 - 1.31 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d6) δ 198.2, 178.1, 138.2, 137.6, 134.0, 129.5, 128.7, 120.0, 103.1, 100.2, 48.3, 45.8, 38.9, 35.9, 35.6, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{30}O_5$ $[M+H]^+$: 387.21660, Found 387.21657. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.8 min, t_{minor} = 14.4 min



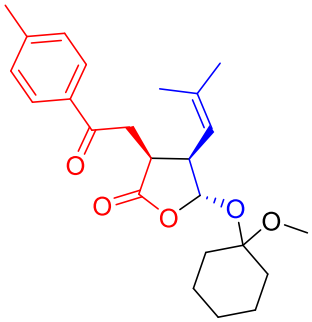
3b:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-(o-tolyl)ethyl)dihydrofuran-2(3H)-one

colourless oil; 228 mg; 57% yield; 96% ee; $[\alpha]_{D20}$ = -15.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 7.75 (dd, *J* = 7.5, 1.5 Hz, 1H), 7.46 - 7.39 (m, 1H), 7.37 - 7.24 (m, 2H), 5.51 (d, *J* = 1.0 Hz, 1H), 5.03 - 4.97 (m, 1H), 3.66 - 3.57 (m, 1H), 3.53 - 3.45 (m, 1H), 3.26 (dd, *J* = 18.5, 4.0 Hz, 1H), 3.22 - 3.13 (m, 4H), 2.44 (s, 3H), 1.80 - 1.35 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 202.0, 178.1, 138.6, 138.4, 138.2, 132.6, 132.2, 129.4, 126.7, 120.0, 103.2, 100.3, 48.3, 45.8, 38.8, 38.5, 35.9, 33.6, 25.9, 25.8, 23.5, 23.4, 21.1, 18.1. HRMS: calculated for $C_{24}H_{32}O_5$ $[M+H]^+$: 401.23225, Found 401.23220. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 10.8min, t_{minor} = 13.0 min



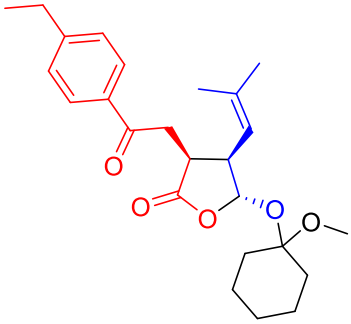
3c:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-(m-tolyl)ethyl)dihydrofuran-2(3H)-one

colourless oil; 272 mg; 68% yield; 98% ee; $[\alpha]_{D20}$ = 3.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 7.96 - 7.66 (m, 2H), 7.59 - 7.30 (m, 2H), 5.51 (d, *J* = 1.2 Hz, 1H), 5.01 - 4.91 (m, 1H), 3.71 - 3.57 (m, 1H), 3.52 - 3.39 (m, 1H), 3.35 - 3.24 (m, 2H), 3.20 (s, 3H), 2.41 (s, 3H), 1.82 - 1.31 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 198.3, 178.1, 139.3, 138.3, 137.7, 134.7, 129.4, 129.2, 125.9, 120.0, 103.2, 100.2, 48.3, 45.8, 38.9, 35.9, 35.7, 33.6, 25.8, 25.8, 23.5, 23.4, 21.3, 18.0. HRMS: calculated for $C_{24}H_{32}O_5$ $[M+H]^+$: 401.23225, Found 401.23221. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} =11.6 min, t_{minor} =13.5 min

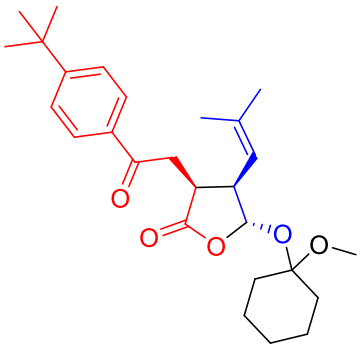


3d:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-(p-tolyl)ethyl)dihydrofuran-2(3H)-one

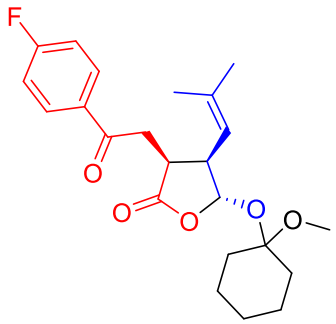
colourless oil; 304 mg; 76% yield; 98% ee; $[\alpha]_{D20}$ = -0.67 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.10 - 7.74 (m, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 5.51 (d, *J* = 1.2 Hz, 1H), 4.95 (dt, *J* = 10.9, 1.5 Hz, 1H), 3.71 - 3.55 (m, 1H), 3.51 - 3.39 (m, 1H), 3.31 - 3.22 (m, 2H), 3.20 (s, 3H), 2.41 (s, 3H), 1.81 - 1.28 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 197.7, 178.2, 144.8, 138.2, 135.2, 130.1, 128.8, 120.0, 103.1, 100.2, 48.3, 45.8, 38.9, 35.9, 35.5, 33.6, 25.8, 25.8, 23.5, 23.4, 21.5, 18.0. HRMS: calculated for $C_{24}H_{32}O_5$ $[M+H]^+$: 401.23225, Found 401.23219. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 13.4 min, t_{minor} = 14.9 min



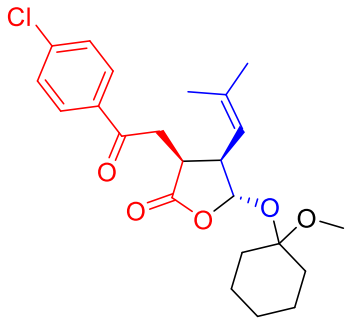
3e:(3S,4R,5R)-3-(2-(4-ethylphenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 323 mg; 78% yield; 99% ee; $[\alpha]_{D20}$ = -4.57 (*c* 0.35, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.12 - 7.73 (m, 2H), 7.56 - 7.13 (m, 2H), 5.51 (d, *J* = 1.2 Hz, 1H), 5.01 - 4.91 (m, 1H), 3.67 - 3.59 (m, 1H), 3.50 - 3.40 (m, 1H), 3.36 - 3.24 (m, 2H), 3.20 (s, 3H), 2.72 (q, *J* = 7.6 Hz, 2H), 1.82 - 1.30 (m, 16H), 1.24 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 197.7, 178.2, 150.9, 138.2, 135.4, 129.0, 128.9, 120.0, 103.1, 100.2, 48.3, 45.8, 38.9, 35.9, 35.5, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0, 15.6. HRMS: calculated for $C_{25}H_{34}O_5$ $[M+H]^+$: 415.24790, Found 415.24795. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 12.4 min, t_{minor} = 14.2 min



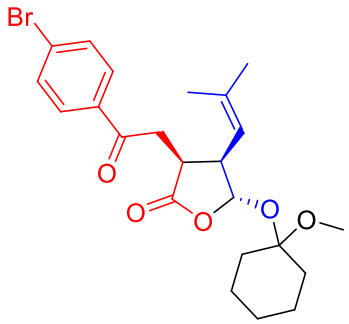
3f:(3S,4R,5R)-3-(2-(4-(tert-butyl)phenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 327 mg; 74% yield; 99% ee; $[\alpha]_{D20}$ = -4.00 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.07 - 7.77 (m, 2H), 7.66 - 7.50 (m, 2H), 5.52 (d, *J* = 1.2 Hz, 1H), 5.02 - 4.89 (m, 1H), 3.68 - 3.57 (m, 1H), 3.50 - 3.42 (m, 1H), 3.28 (d, *J* = 6.8 Hz, 2H), 3.20 (s, 3H), 1.80 - 1.30 (m, 25H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 197.7, 178.2, 157.6, 138.3, 135.2, 128.7, 126.4, 120.0, 103.1, 100.2, 48.3, 45.8, 38.9, 35.9, 35.6, 35.5, 33.6, 31.3, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{27}H_{38}O_5$ $[M+H]^+$: 443.27920, Found 443.27902. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.1 min, t_{minor}= 13.4 min



3g:(3S,4R,5R)-3-(2-(4-fluorophenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 302 mg; 75% yield; 99% ee; $[\alpha]_{D20}$ = 7.65 (*c* 0.34, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.19 - 7.96 (m, 2H), 7.48 - 7.07 (m, 2H), 5.51 (d, *J* = 0.8 Hz, 1H), 5.04 - 4.89 (m, 1H), 3.71 - 3.58 (m, 1H), 3.51 - 3.40 (m, 1H), 3.37 - 3.26 (m, 2H), 3.20 (s, 3H), 1.81 - 1.32 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 196.8, 178.1, 166.6 (d, *J* = 253.3 Hz), 138.3, 134.3 (d, *J* = 3.0 Hz), 131.7 (d, *J* = 9.4 Hz), 120.0, 116.4 (d, *J* = 21.9 Hz), 103.2, 100.2, 48.3, 45.8, 38.9, 35.9, 35.6, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}FO_5$ $[M+H]^+$: 405.20718, Found 405.20724. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.1 min, t_{minor} = 12.7 min

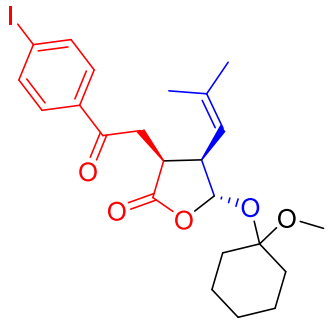


3h:(3S,4R,5R)-3-(2-(4-chlorophenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 340 mg; 81% yield; 99% ee; $[\alpha]_{D20}$ = -3.89 (*c* 0.36, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.10 - 7.94 (m, 2H), 7.68 - 7.40 (m, 2H), 5.51 (d, *J* = 1.2 Hz, 1H), 5.05 - 4.91 (m, 1H), 3.71 - 3.57 (m, 1H), 3.53 - 3.41 (m, 1H), 3.31 (d, *J* = 6.8 Hz, 2H), 3.20 (s, 3H), 1.82 - 1.31 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 197.3, 178.0, 139.8, 138.3, 136.2, 130.5, 129.7, 120.0, 103.2, 100.2, 48.3, 45.8, 38.9, 35.9, 35.6, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}ClO_5$ $[M+H]^+$: 421.17763, Found 421.17749. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.1 min, t_{minor} = 13.3 min



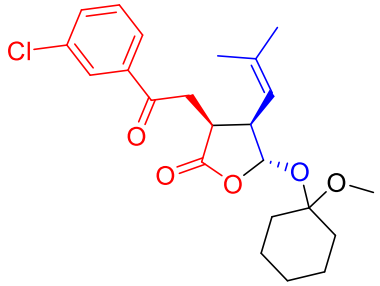
3i:(3S,4R,5R)-3-(2-(4-bromophenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one

colourless oil; 392 mg; 84% yield; 99% ee; $[\alpha]_{D20}$ = -4.50 (*c* 0.4, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 8.02 - 7.88 (m, 2H), 7.81 - 7.67 (m, 2H), 5.51 (d, *J* = 1.5 Hz, 1H), 5.02 - 4.89 (m, 1H), 3.69 - 3.59 (m, 1H), 3.51 - 3.41 (m, 1H), 3.30 (d, *J* = 6.5 Hz, 2H), 3.20 (s, 3H), 1.80 - 1.33 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 197.5, 178.0, 138.3, 136.6, 132.7, 130.6, 128.5, 120.0, 103.2, 100.2, 48.3, 45.8, 38.9, 35.9, 35.6, 33.6, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}BrO_5$ $[M+H]^+$: 465.12711, Found 465.12684. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.7 min, t_{minor} = 14.3 min



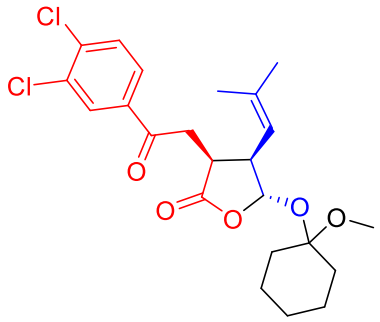
3j:(3S,4R,5R)-3-(2-(4-iodophenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one

white solid; 388 mg; 76% yield; 99% ee; $[\alpha]_{D20}$ = 11.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d6) δ 8.07 - 7.86 (m, 2H), 7.82 - 7.69 (m, 2H), 5.51 (d, *J* = 1.5 Hz, 1H), 5.01 - 4.89 (m, 1H), 3.69 - 3.58 (m, 1H), 3.49 - 3.41 (m, 1H), 3.29 (d, *J* = 7.0 Hz, 2H), 3.19 (s, 3H), 1.79 - 1.33 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d6) δ 197.8, 178.0, 138.8, 138.3, 137.0, 130.4, 119.9, 103.1, 101.4, 100.2, 48.3, 45.7, 38.9, 35.9, 35.5, 33.6, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}IO_5$ $[M+H]^+$: 513.11324, Found 513.11306. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 12.7 min, t_{minor} = 16.0 min



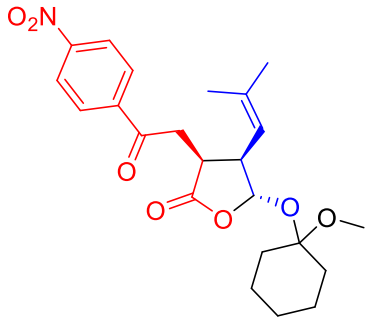
3k:(3S,4R,5R)-3-(2-(3-chlorophenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one

colourless oil; 313 mg; 75% yield; 98% ee; $[\alpha]_{D20}$ = 10.67 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.01 - 7.93 (m, 2H), 7.78 - 7.62 (m, 1H), 7.57 (t, *J* = 8.0 Hz, 1H), 5.52 (d, *J* = 1.2 Hz, 1H), 5.02 - 4.93 (m, 1H), 3.71 - 3.58 (m, 1H), 3.53 - 3.41 (m, 1H), 3.38 - 3.29 (m, 2H), 3.20 (s, 3H), 1.80 - 1.32 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 197.3, 177.9, 139.4, 138.4, 135.3, 133.8, 131.4, 128.5, 127.3, 120.0, 103.2, 100.3, 48.3, 45.8, 38.9, 35.9, 35.8, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}ClO_5$ $[M+H]^+$: 421.17763, Found 421.17751. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 10.8 min, t_{minor} = 13.9 min

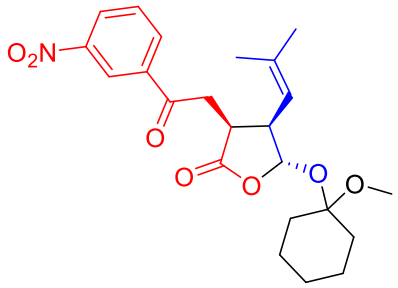


3l:(3S,4R,5R)-3-(2-(3,4-dichlorophenyl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one

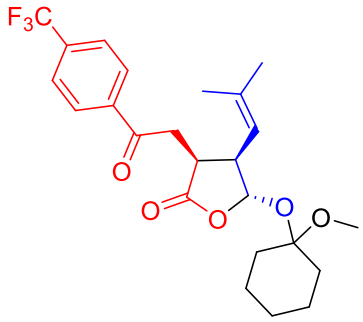
colourless oil; 304 mg; 67% yield; 99% ee; $[\alpha]_{D20}$ = 2.67 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.15 (d, *J* = 2.0 Hz, 1H), 8.01 - 7.94 (m, 1H), 7.75 (d, *J* = 8.4 Hz, 1H), 5.51 (d, *J* = 1.2 Hz, 1H), 5.05 - 4.90 (m, 1H), 3.71 - 3.58 (m, 1H), 3.51 - 3.41 (m, 1H), 3.34 (d, *J* = 6.8 Hz, 2H), 3.20 (s, 3H), 1.81 - 1.28 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 196.6, 177.9, 138.4, 137.7, 137.6, 133.4, 131.9, 130.7, 128.6, 120.0, 103.2, 100.3, 48.3, 45.8, 39.0, 35.9, 35.8, 33.6, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{28}Cl_2O_5$ $[M+H]^+$: 455.13866, Found 455.13844. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.4 min, t_{minor} = 14.1 min



3m:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-(4-nitrophenyl)-2-oxoethyl)dihydrofuran-2(3H)-one
white solid; 224 mg; 52% yield; 99% ee; $[\alpha]_{D20}$ = -1.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d6) δ 8.45 - 8.32 (m, 2H), 8.31 - 8.23 (m, 2H), 5.52 (d, *J* = 1.2 Hz, 1H), 5.07 - 4.89 (m, 1H), 3.74 - 3.61 (m, 1H), 3.54 - 3.44 (m, 1H), 3.44 - 3.35 (m, 2H), 3.20 (s, 3H), 1.79 - 1.35 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d6) δ 197.6, 177.9, 151.4, 142.1, 138.5, 130.1, 124.7, 119.9, 103.2, 100.3, 48.3, 45.8, 39.0, 36.2, 35.9, 33.6, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}NO_7$ $[M+NH_4]^+$: 449.22823, Found 449.22798. HPLC analysis: Chiralpak ID, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 15.9 min, t_{minor} = 12.9 min

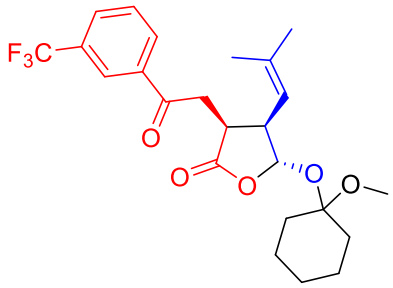


3n:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-(3-nitrophenyl)-2-oxoethyl)dihydrofuran-2(3H)-one
colourless oil; 245 mg; 57% yield; 98% ee; $[\alpha]_{D20}$ = 8.00 (*c* 0.4, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.75 (t, *J* = 2.0 Hz, 1H), 8.59 - 8.28 (m, 2H), 7.88 (t, *J* = 8.0 Hz, 1H), 5.53 (d, *J* = 1.2 Hz, 1H), 5.10 - 4.90 (m, 1H), 3.75 - 3.63 (m, 1H), 3.56 - 3.39 (m, 3H), 3.20 (s, 3H), 1.83 - 1.31 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 196.9, 177.9, 149.5, 138.8, 138.5, 134.7, 131.3, 128.2, 123.2, 120.0, 103.2, 100.3, 48.3, 45.8, 39.0, 36.0, 35.9, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{23}H_{29}NO_7$ $[M+H]^+$: 432.20168, Found 432.20143. HPLC analysis: Chiralpak ID, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 17.9 min, t_{minor} = 14.2 min



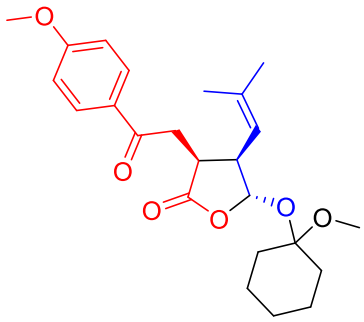
3o:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-(4-(trifluoromethyl)phenyl)ethyl)dihydrofuran-2(3H)-one

white solid; 254 mg; 56% yield; 99% ee; $[\alpha]_{D20}$ = 29.00 (*c* 0.2, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 8.22 (d, *J* = 8.0 Hz, 2H), 7.89 (d, *J* = 8.5 Hz, 2H), 5.52 (d, *J* = 1.0 Hz, 1H), 5.04 - 4.91 (m, 1H), 3.71 - 3.62 (m, 1H), 3.52 - 3.44 (m, 1H), 3.44 - 3.32 (m, 2H), 3.20 (s, 3H), 1.81 - 1.33 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 197.8, 177.9, 140.6, 138.4, 134.5 (q, *J* = 32.5 Hz), 129.5, 126.5 (q, *J* = 3.9 Hz), 124.8 (q, *J* = 270.1 Hz), 119.9, 103.2, 100.2, 48.3, 45.8, 38.9, 36.0, 35.9, 33.6, 25.8, 25.8, 23.5, 23.4, 17.9. HRMS: calculated for $C_{24}H_{29}F_3O_5$ $[M+H]^+$: 455.20399, Found 455.20402. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 8.0 min, t_{minor} = 9.4 min

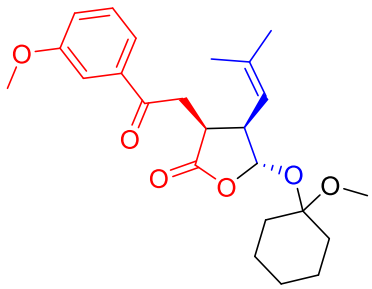


3p:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-(3-(trifluoromethyl)phenyl)ethyl)dihydrofuran-2(3H)-one

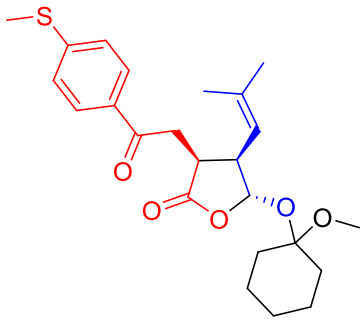
colourless oil; 278 mg; 61% yield; 99% ee; $[\alpha]_{D20}$ = 8.00 (*c* 0.4, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 8.38 - 8.24 (m, 2H), 8.00 (d, *J* = 8.0 Hz, 1H), 7.81 (t, *J* = 7.8 Hz, 1H), 5.52 (d, *J* = 1.0 Hz, 1H), 5.05 - 4.93 (m, 1H), 3.72 - 3.62 (m, 1H), 3.52 - 3.44 (m, 1H), 3.44 - 3.33 (m, 2H), 3.20 (s, 3H), 1.78 - 1.34 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 197.5, 177.9, 138.4, 138.3, 132.5, 131.4 (q, *J* = 22.3 Hz), 130.8, 130.4 (q, *J* = 3.6 Hz), 125.2 (q, *J* = 3.9 Hz), 124.9 (q, *J* = 270.1 Hz), 120.0, 103.2, 100.3, 48.3, 45.7, 39.0, 35.9, 35.8, 33.6, 25.8, 25.7, 23.5, 23.4, 18.0. HRMS: calculated for $C_{24}H_{29}F_3O_5$ $[M+H]^+$: 455.20399, Found 455.20382. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 7.9 min, t_{minor} = 9.9 min



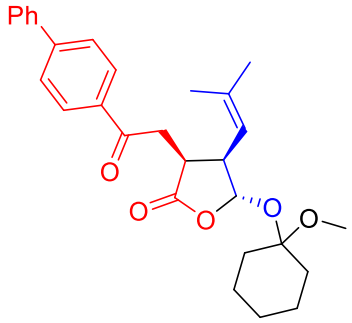
3q:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-3-(2-(4-methoxyphenyl)-2-oxoethyl)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 335 mg; 80% yield; 98% ee; $[\alpha]_{D20}$ = -9.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d6) δ 8.10 - 7.85 (m, 2H), 7.13 - 6.93 (m, 2H), 5.51 (d, *J* = 1.5 Hz, 1H), 4.99 - 4.89 (m, 1H), 3.89 (s, 3H), 3.67 - 3.57 (m, 1H), 3.48 - 3.39 (m, 1H), 3.28 - 3.21 (m, 2H), 3.19 (s, 3H)1.76 - 1.35 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d6) δ 196.5, 178.2, 164.6, 138.2, 131.0, 130.6, 120.0, 114.6, 103.1, 100.2, 55.9, 48.3, 45.8, 38.9, 35.9, 35.2, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. $[\alpha]_{D20}$ = -9.33, (*c* 0.3, $CHCl_3$); HRMS: calculated for $C_{24}H_{32}O_6$ $[M+H]^+$: 417.22717, Found 417.22706. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 12.6 min, t_{minor} = 14.4 min



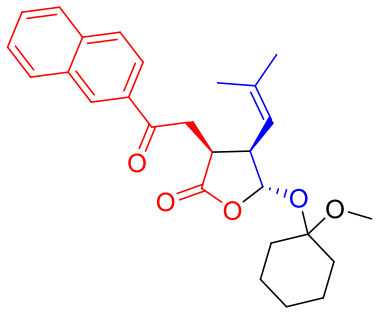
3r:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-3-(2-(3-methoxyphenyl)-2-oxoethyl)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 340 mg; 82% yield; 99% ee; $[\alpha]_{D20}$ = 12.00 (*c* 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 7.62 - 7.57 (m, 1H), 7.52 - 7.48 (m, 1H), 7.44 (t, *J* = 8.0 Hz, 1H), 7.22 - 7.18 (m, 1H), 5.52 (d, *J* = 1.5 Hz, 1H), 5.01 - 4.92 (m, 1H), 3.87 (s, 3H), 3.68 - 3.59 (m, 1H), 3.50 - 3.41 (m, 1H), 3.36 - 3.25 (m, 2H), 3.20 (s, 3H), 1.81 - 1.32 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 198.1, 178.1, 160.9, 139.0, 138.3, 130.6, 121.2, 120.0, 120.0, 113.3, 103.1, 100.3, 55.8, 48.3, 45.8, 38.9, 35.9, 35.8, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{24}H_{32}O_6$ $[M+H]^+$: 417.22717, Found 417.22707. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 9.7 min, t_{minor} = 12.0 min



3s:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-(4-(methylthio)phenyl)-2-oxoethyl)dihydrofuran-2(3H)-one
colourless oil; 295 mg; 68% yield; 99% ee; $[\alpha]_{D20}$ = -23.50 (*c* 0.4, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.14 - 7.79 (m, 2H), 7.50 - 7.27 (m, 2H), 5.51 (d, *J* = 1.2 Hz, 1H), 4.99 - 4.91 (m, 1H), 3.69 - 3.57 (m, 1H), 3.50 - 3.39 (m, 1H), 3.33 - 3.22 (m, 2H), 3.19 (s, 3H), 2.57 (s, 3H), 1.81 - 1.32 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 197.1, 178.1, 147.1, 138.3, 133.8, 129.2, 125.7, 120.0, 103.1, 100.2, 48.3, 45.8, 38.9, 35.9, 35.3, 33.6, 25.8, 23.5, 23.4, 18.0, 14.5. HRMS: calculated for $C_{24}H_{32}O_5S$ $[M+H]^+$: 433.20432, Found 433.20416. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 12.3 min, t_{minor} = 15.1 min

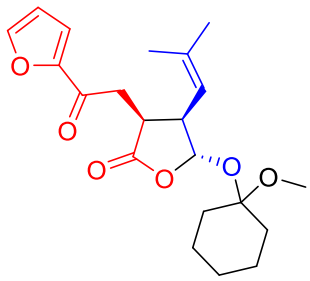


3t:(3S,4R,5R)-3-(2-([1,1'-biphenyl]-4-yl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one
colourless oil; 305 mg; 66% yield; 99% ee; $[\alpha]_{D20}$ = -17.00 (*c* 0.2, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 8.23 - 7.96 (m, 2H), 7.91 - 7.78 (m, 2H), 7.77 - 7.71 (m, 2H), 7.54 - 7.48 (m, 2H), 7.48 - 7.39 (m, 1H), 5.53 (d, *J* = 1.0 Hz, 1H), 5.03 - 4.93 (m, 1H), 3.71 - 3.63 (m, 1H), 3.52 - 3.45 (m, 1H), 3.38 - 3.27 (m, 2H), 3.21 (s, 3H), 1.83 - 1.32 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 197.8, 178.2, 146.4, 140.5, 138.3, 136.4, 129.9, 129.5, 129.2, 128.0, 127.9, 120.0, 103.2, 100.3, 48.3, 45.8, 38.9, 35.9, 35.7, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{29}H_{34}O_5$ $[M+H]^+$: 463.24790, Found 463.24761. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 10.5 min, t_{minor} = 14.3 min



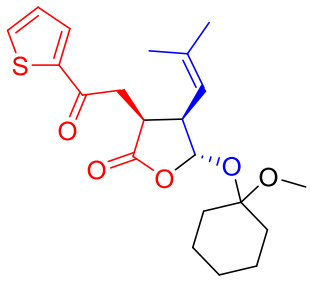
3u:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-(naphthalen-2-yl)-2-oxoethyl)dihydrofuran-2(3H)-one

white solid; 314 mg; 72% yield; 99% ee; $[\alpha]_{D20}$ = -17.00 (*c* 0.2, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 8.69 (s, 1H), 8.13 (d, *J* = 8.0 Hz, 1H), 8.06 - 7.97 (m, 3H), 7.70 - 7.59 (m, 2H), 5.54 (d, *J* = 1.0 Hz, 1H), 5.05 - 4.95 (m, 1H), 3.75 - 3.65 (m, 1H), 3.54 - 3.41 (m, 3H), 3.21 (s, 3H), 1.81 - 1.34 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 198.2, 178.2, 138.4, 136.5, 135.0, 133.6, 130.7, 130.5, 129.5, 129.2, 128.6, 127.7, 124.3, 120.0, 103.2, 100.3, 48.3, 45.8, 39.0, 35.9, 35.7, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{27}H_{32}O_5$ $[M+H]^+$: 437.23225, Found 437.23213. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 9.6 min, t_{minor} = 12.2 min



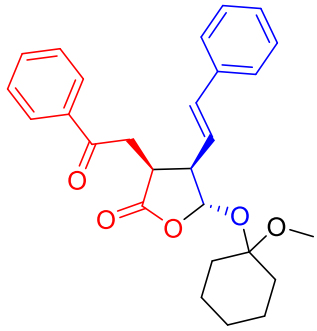
3v:(3S,4R,5R)-3-(2-(furan-2-yl)-2-oxoethyl)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)dihydrofuran-2(3H)-one

yellow oil; 241 mg; 64% yield; 99% ee; $[\alpha]_{D20}$ = 19.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, Acetone-d_6) δ 7.84 (d, *J* = 1.8 Hz, 1H), 7.37 (d, *J* = 3.6 Hz, 1H), 6.70 - 6.65 (m, 1H), 5.50 (d, *J* = 1.0 Hz, 1H), 5.02 – 4.91 (m, 1H), 3.67 - 3.55 (m, 1H), 3.47 - 3.36 (m, 1H), 3.19 (s, 3H), 3.15 - 3.08 (m, 2H), 1.78 - 1.34 (m, 16H). ^{13}C NMR (125 MHz, Acetone-d_6) δ 186.7, 177.9, 153.3, 148.0, 138.4, 119.8, 118.2, 113.1, 103.2, 100.2, 48.3, 45.7, 38.4, 35.9, 35.2, 33.6, 25.8, 23.5, 23.4, 17.9. HRMS: calculated for $C_{21}H_{28}O_6$ $[M+H]^+$: 377.19587, Found 377.19584. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 12.6 min, t_{minor} = 14.1 min



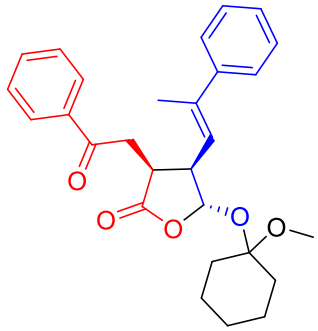
3w:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-4-(2-methylprop-1-en-1-yl)-3-(2-oxo-2-(thiophen-2-yl)ethyl)dihydrofuran-2(3H)-one

yellow oil; 265 mg; 68% yield; 98% ee; $[\alpha]_{D20}$ = 7.33 (*c* 0.3, $CHCl_3$); ^{1}H NMR (400 MHz, Acetone-d_6) δ 8.27 - 7.60 (m, 2H), 7.31 - 7.17 (m, 1H), 5.51 (d, *J* = 1.2 Hz, 1H), 5.05 - 4.90 (m, 1H), 3.70 - 3.55 (m, 1H), 3.49 - 3.35 (m, 1H), 3.34 - 3.12 (m, 5H), 1.79 - 1.33 (m, 16H). ^{13}C NMR (100 MHz, Acetone-d_6) δ 191.2, 177.9, 144.7, 138.5, 135.0, 133.6, 129.3, 119.9, 103.2, 100.2, 48.3, 45.8, 38.9, 36.0, 35.9, 33.6, 25.8, 25.8, 23.5, 23.4, 18.0. HRMS: calculated for $C_{21}H_{28}O_5S$ $[M+H]^+$: 393.17302, Found 393.17303. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 10.3 min, t_{minor} = 12.2 min



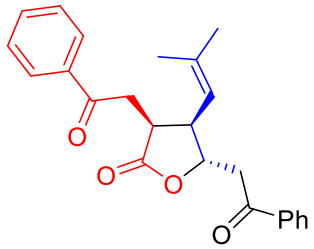
3x:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-3-(2-oxo-2-phenylethyl)-4-((E)-styryl) dihydrofuran-2(3H)-one

yellow oil; 122 mg; 28% yield; 99% ee; $[\alpha]_{D20}$ = 63.30 (*c* 0.1, $CHCl_3$); ^{1}H NMR (600 MHz, Acetone-d_6) δ 8.03 - 7.95 (m, 2H), 7.59 - 7.53 (m, 1H), 7.50 - 7.42 (m, 2H), 7.37 - 7.32 (m, 2H), 7.28 - 7.22 (m, 2H), 7.21 - 7.15 (m, 1H), 6.53 (d, *J* = 15.6 Hz, 1H), 6.19 - 6.12 (m, 1H), 5.75 (s, 1H), 3.75 - 3.68 (m, 1H), 3.50 - 3.43 (m, 2H), 3.41 - 3.31 (m, 1H), 3.22 (s, 3H), 1.83 - 1.32 (m, 10H). ^{13}C NMR (150 MHz, Acetone-d_6) δ 198.0, 177.8, 137.5, 137.4, 135.4, 134.0, 129.5, 129.3, 128.7, 128.6, 127.3, 125.0, 103.3, 99.6, 50.8, 48.4, 39.2, 35.9, 35.9, 33.6, 25.8, 23.5, 23.4. HRMS: calculated for $C_{27}H_{30}O_5$ $[M+H]^+$: 435.21660, Found 435.21643. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 7.9 min, t_{minor} = 9.3 min



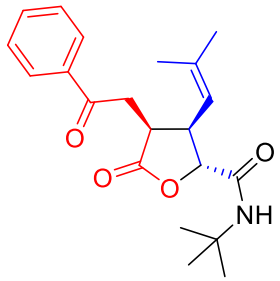
3y:(3S,4R,5R)-5-((1-methoxycyclohexyl)oxy)-3-(2-oxo-2-phenylethyl)-4-((E)-2-phenylprop-1-en-1-yl)dihydrofuran-2(3H)-one

yellow oil; 210 mg; 47% yield; 99% ee; $[\alpha]_{D20}$ = 63.00 (*c* 0.2, $CHCl_3$); ^{1}H NMR (600 MHz, Acetone-d_6) δ 8.03 - 7.98 (m, 2H), 7.63 - 7.57 (m, 1H), 7.50 - 7.45 (m, 2H), 7.29 - 7.25 (m, 2H), 7.25 - 7.17 (m, 3H), 5.71 (d, *J* = 1.2 Hz, 1H), 5.59 - 5.54 (m, 1H), 3.81 - 3.74 (m, 1H), 3.74 - 3.67 (m, 1H), 3.49 - 3.37 (m, 2H), 3.23 (s, 3H), 1.97 (d, *J* = 1.8 Hz, 3H), 1.89 - 1.23 (m, 10H). ^{13}C NMR (150 MHz, Acetone-d_6) δ 198.3, 177.9, 143.6, 141.1, 137.5, 134.1, 129.5, 129.0, 128.8, 128.1, 126.6, 123.0, 103.3, 100.1, 48.4, 46.4, 39.2, 36.0, 35.9, 33.7, 25.8, 23.5, 23.4, 16.4. HRMS: calculated for $C_{28}H_{32}O_5$ $[M+H]^+$: 449.23225, Found 449.23201. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 8.4 min, t_{minor} = 10.5 min



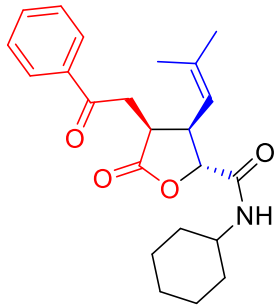
5:2,2'-((2S,3R,4S)-3-(2-methylprop-1-en-1-yl)-5-oxotetrahydrofuran-2,4-diyl)bis(1-phenylethan-1-one)

white solid; 274 mg; 73% yield; 2:1 dr; 95% ee; $[\alpha]_{D20}$ = 56.44 (*c* 0.3, $CHCl_3$); ^{1}H NMR (600 MHz, Acetone-d_6) δ 8.11 - 8.04 (m, 1H), 8.03 - 7.95 (m, 5H), 7.69 - 7.59 (m, 3H), 7.58 - 7.47 (m, 6H), 5.29 - 5.21 (m, 1H), 5.12 - 5.05 (m, 0.5H), 4.99 (d, *J* = 11.4 Hz, 1H), 4.89 - 4.83 (m, 0.5H), 3.85 - 3.77 (m, 1H), 3.74 - 3.63 (m, 2H), 3.60 - 3.53 (m, 0.5H), 3.53 - 3.36 (m, 3H), 3.33 - 3.18 (m, 2.5H), 1.53 (d, *J* = 1.2 Hz, 1.5H), 1.48 (d, *J* = 1.2 Hz, 1.5H), 1.46 (d, *J* = 1.2 Hz, 3H), 1.28 (d, *J* = 1.2 Hz, 3H). ^{13}C NMR (150 MHz, Acetone-d_6) δ 198.2, 198.2, 197.4, 197.3, 178.5, 177.9, 139.2, 137.9, 137.82, 137.8, 137.7, 137.3, 134.1, 134.0, 134.0, 134.0, 129.5, 129.5, 129.5, 129.0, 128.7, 128.7, 128.7, 122.1, 118.3, 81.4, 79.0, 43.1, 42.8, 42.2, 41.9, 39.8, 39.3, 36.0, 35.7, 25.9, 25.8, 18.0, 17.6. HRMS: calculated for $C_{24}H_{24}O_4$ $[M+H]^+$: 377.17474, Found 377.17463. UPC analysis: Acquity UPC^2 Trefoil^{TM} Cel2, 2.5μm, CO_2/MeOH = 90/10, flow rate 2.0 ml/min, λ = 240 nm, t_{major} = 8.0 min, t_{minor} = 7.5 min and t_{major} = 6.5 min, t_{minor} = 5.3 min



6:(2R,3R,4S)-N-(tert-butyl)-3-(2-methylprop-1-en-1-yl)-5-oxo-4-(2-oxo-2-phenylethyl)tetrahydrofuran-2-carboxamide

colourless oil; 243 mg; 68% yield; 5:1 dr; 98% ee; $[\alpha]_{D20}$ = 15.78 (*c* 0.3, $CHCl_3$); ^{1}H NMR (600 MHz, Acetone-d_6) δ 8.03 - 7.94 (m, 2H), 7.69 - 7.60 (m, 1H), 7.57 - 7.48 (m, 2H), 7.12 (s, 1H), 5.01 - 4.99 (m, 1H), 4.51 (d, *J* = 2.4 Hz, 1H), 3.72 - 3.65 (m, 1H), 3.65 - 3.58 (m, 1H), 3.38 - 3.30 (m, 1H), 3.29 - 3.21 (m, 1H), 1.53 (d, *J* = 1.8 Hz, 3H), 1.46 (d, *J* = 1.8 Hz, 3H), 1.39 (s, 9H). ^{13}C NMR (150 MHz, Acetone-d_6) δ 198.1, 178.4, 169.1, 137.6, 137.2, 134.0, 129.5, 128.7, 121.8, 82.4, 51.8, 42.3, 38.9, 36.0, 28.7, 25.7, 17.9. HRMS: calculated for $C_{21}H_{27}NO_4$ $[M+H]^+$: 358.20128, Found 358.20147. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 60/40, flow rate 1.0 ml/min, λ = 254 nm, t_{major} = 11.7 min, t_{minor} = 15.5 min



7:(2R,3R,4S)-N-cyclohexyl-3-(2-methylprop-1-en-1-yl)-5-oxo-4-(2-oxo-2-phenylethyl)tetrahydrofuran-2-carboxamide

colourless oil; 272 mg; 71% yield; 5:1 dr; 99% ee; $[\alpha]_{D20}$ = 4.22 (*c* 0.3, $CHCl_3$); ^{1}H NMR (600 MHz, Acetone-d_6) δ 8.02 - 7.95 (m, 2H), 7.66 - 7.60 (m, 1H), 7.56 - 7.48 (m, 2H), 7.41 (d, *J* = 7.8 Hz, 1H), 5.11 - 5.02 (m, 1H), 4.55 (d, *J* = 2.4 Hz, 1H), 3.76 (m, 1H), 3.72 - 3.66 (m, 1H), 3.62 - 3.55 (m, 1H), 3.38 - 3.30 (m, 1H), 3.29 - 3.22 (m, 1H), 1.94 - 1.83 (m, 2H), 1.78 - 1.68 (m, 2H), 1.66 - 1.57 (m, 1H), 1.53 (d, *J* = 1.2 Hz, 3H), 1.46 (d, *J* = 1.2 Hz, 3H), 1.40 - 1.27 (m, 4H), 1.22 - 1.13 (m, 1H). ^{13}C NMR (150 MHz, Acetone-d_6) δ 198.1, 178.3, 168.7, 137.6, 137.4, 134.0, 129.5, 128.7, 121.8, 82.4, 49.1, 42.4, 38.9, 35.9, 33.4, 33.2, 26.2, 25.7, 25.7, 17.9. HRMS: calculated for $C_{23}H_{29}NO_4$ $[M+H]^+$: 384.21693, Found 384.21690. HPLC analysis: Chiralpak IC, *n*-hexane/*i*-PrOH = 60/40, flow rate 1.0 ml/min, λ = 254 nm, t_{major} =16.0 min, t_{minor} = 35.2 min

6 References

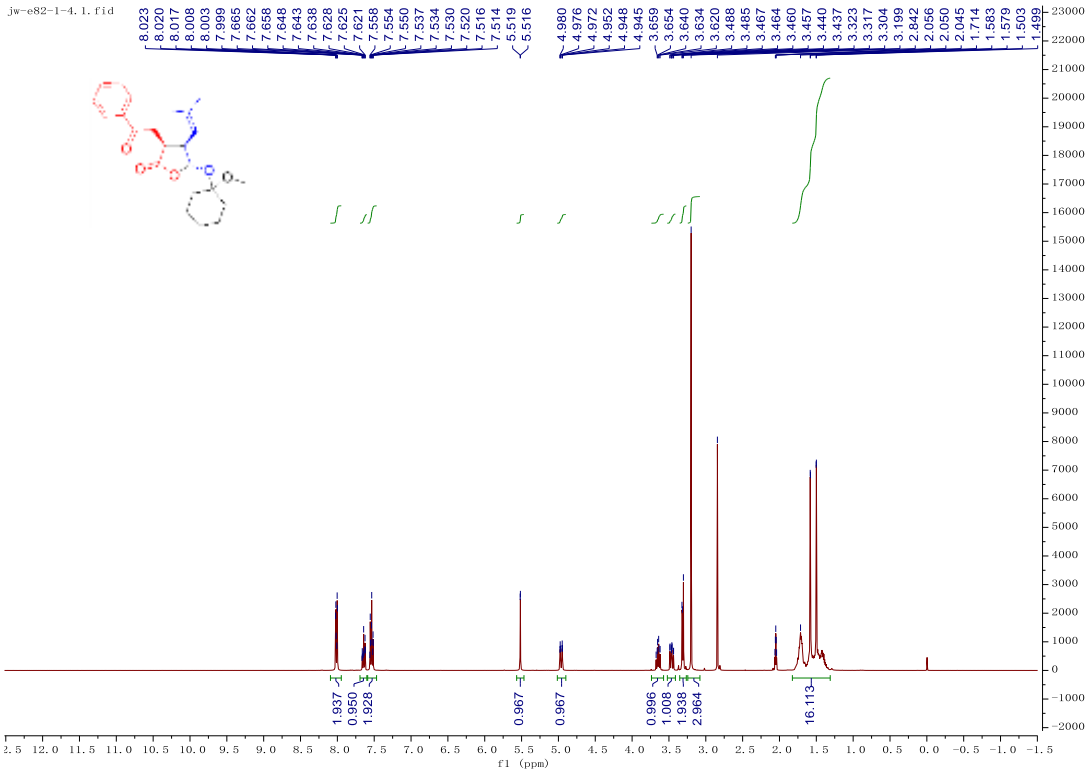
1. Juliette Sabbatani and Nuno Maulide, *Angew.Chem.Int. Ed.*, **2016**, *55*,6780–6783

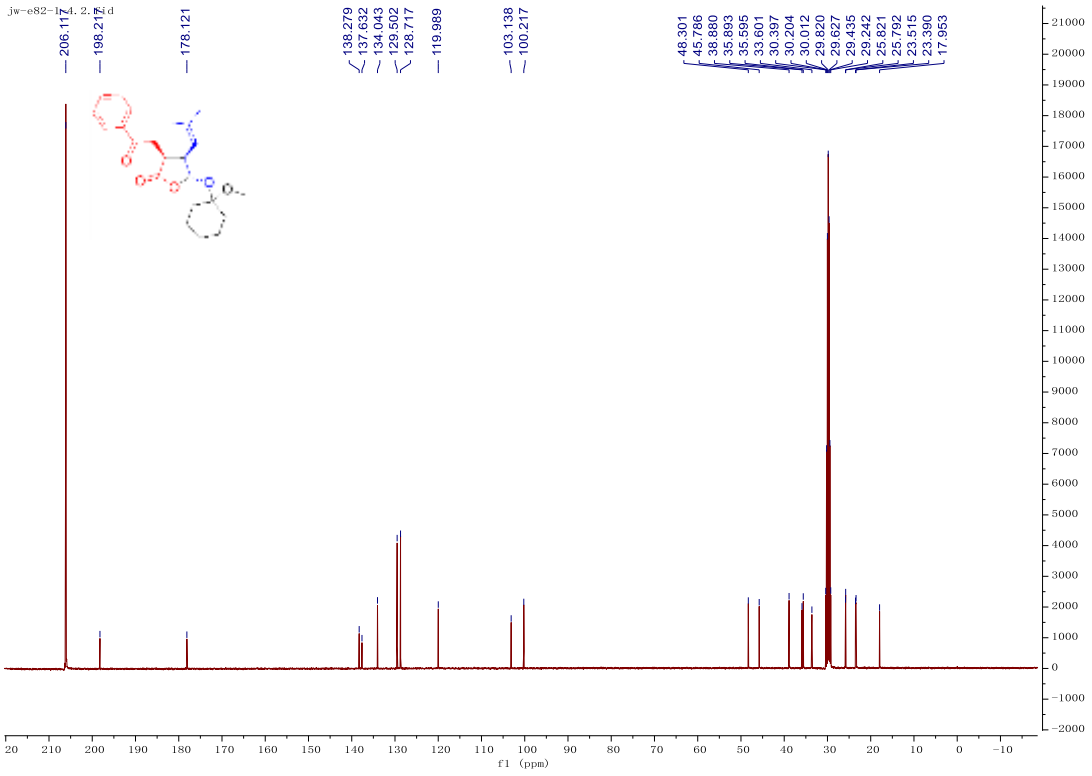
2. S. Zhao, J.-B. Lin, Y.-Y. Zhao, Y.-M. Liang, P.-F. Xu, *Org Lett.*, **2014**, *16*, 1802-1805

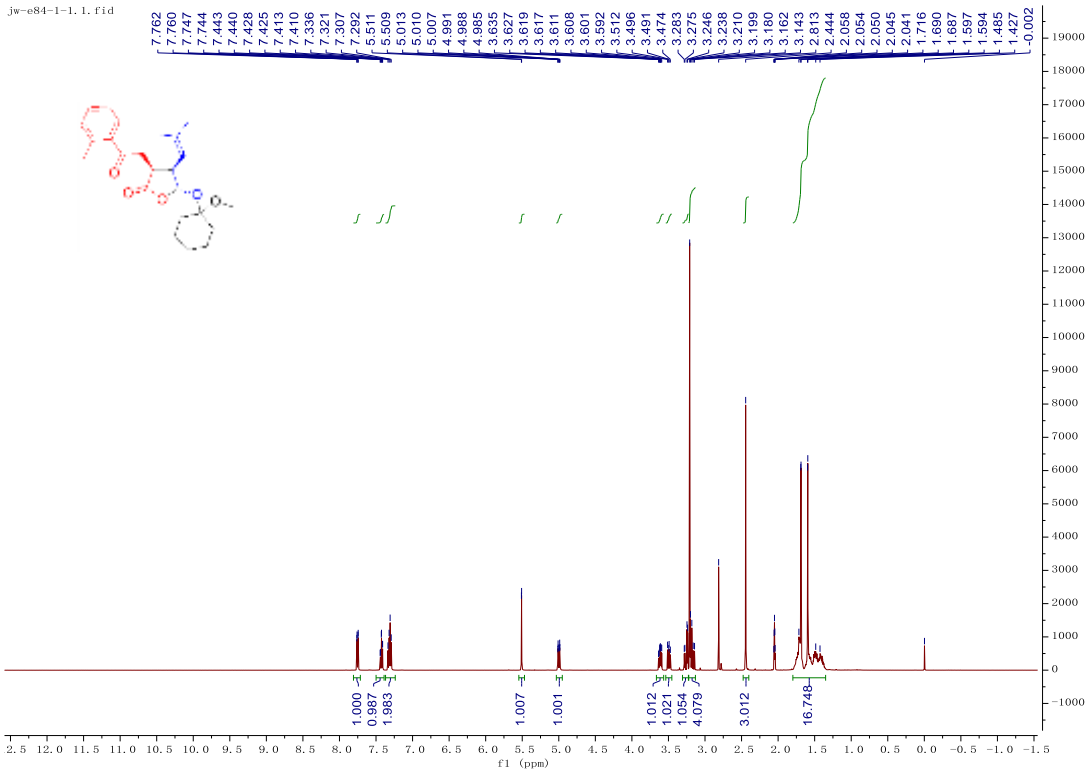
3. Wei-Wei Zhao and Yan-Kai Liu, *Org. Chem. Front.*, **2017**, *4*, 2358-2363

4. Kozo Shishido, Kou Hiroya, Yutaka Ueno and Keiichiro Fukumoto, *J. Chem. Soc. Perkin Trans. I* **1986**, 829-836

7 ^{1}H NMR and ^{13}C NMR Spectra



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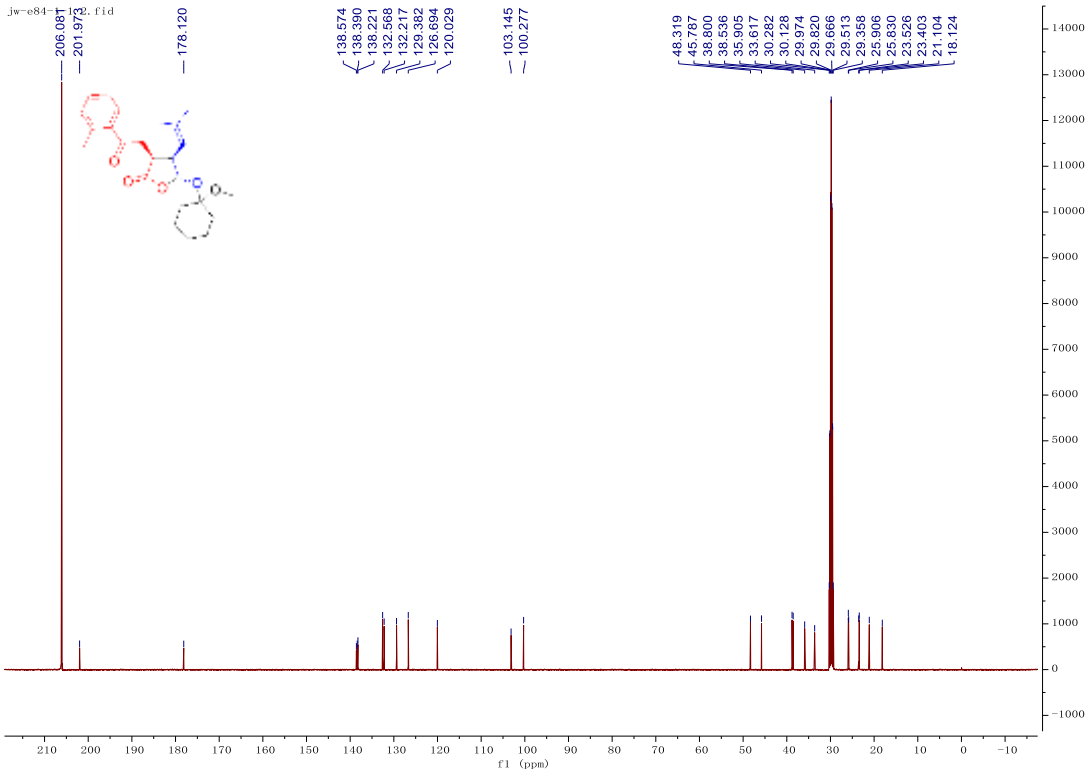
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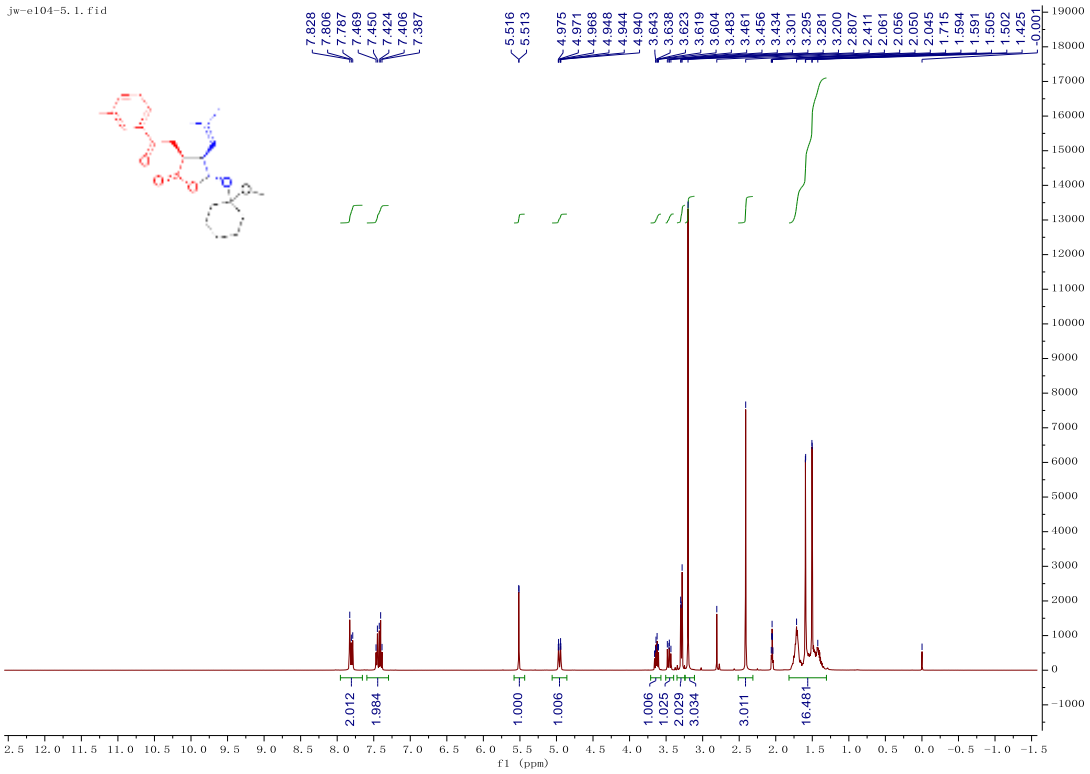
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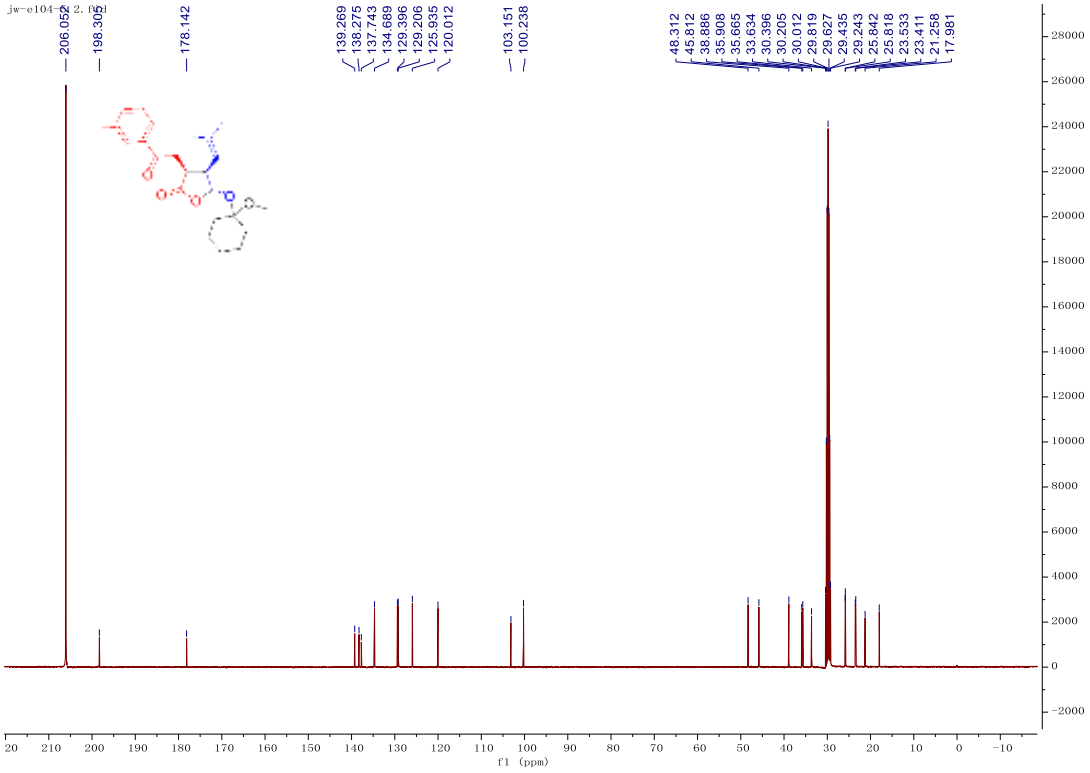
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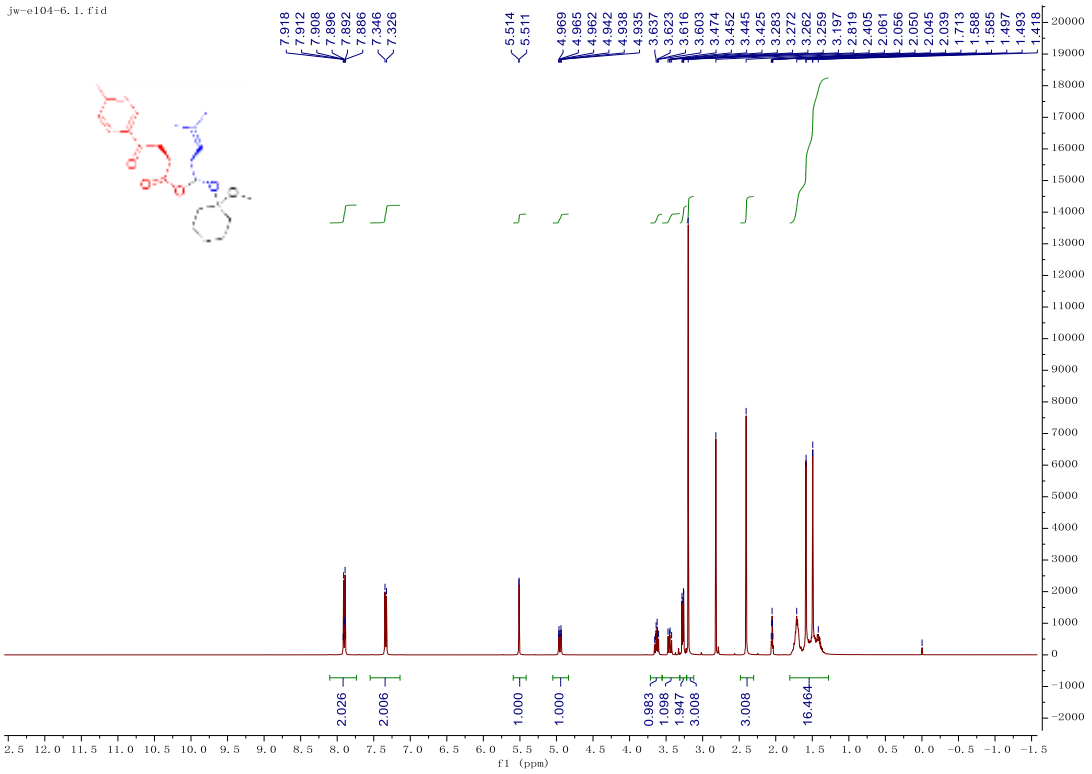
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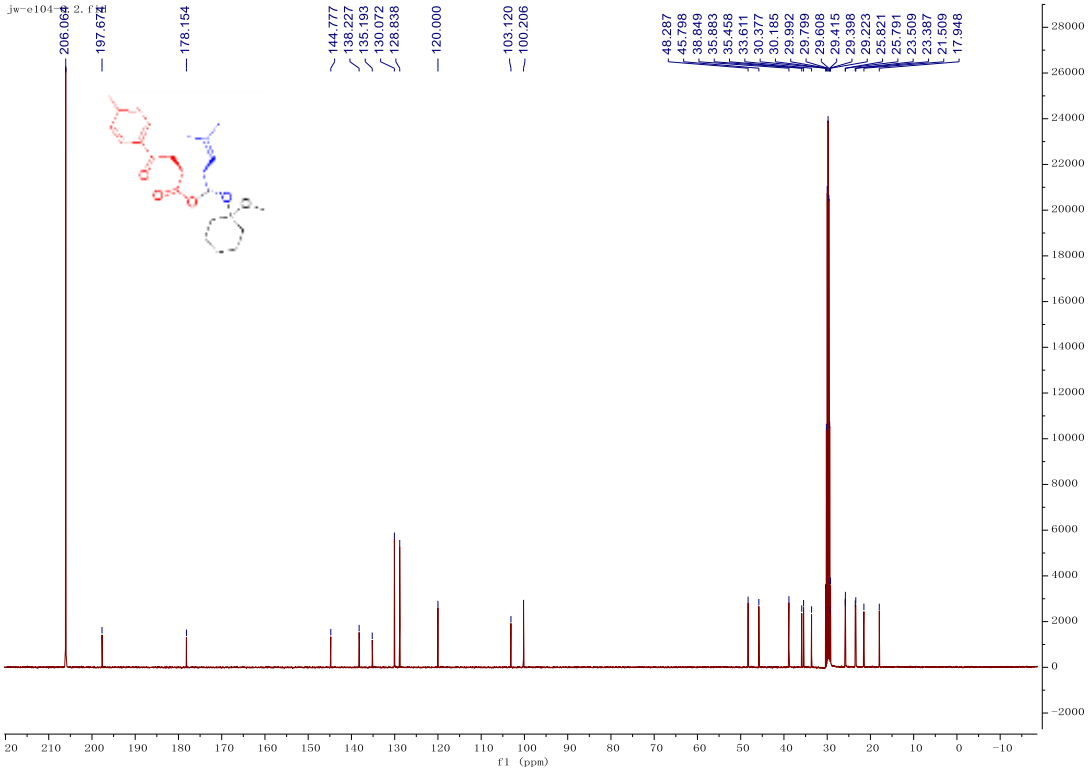
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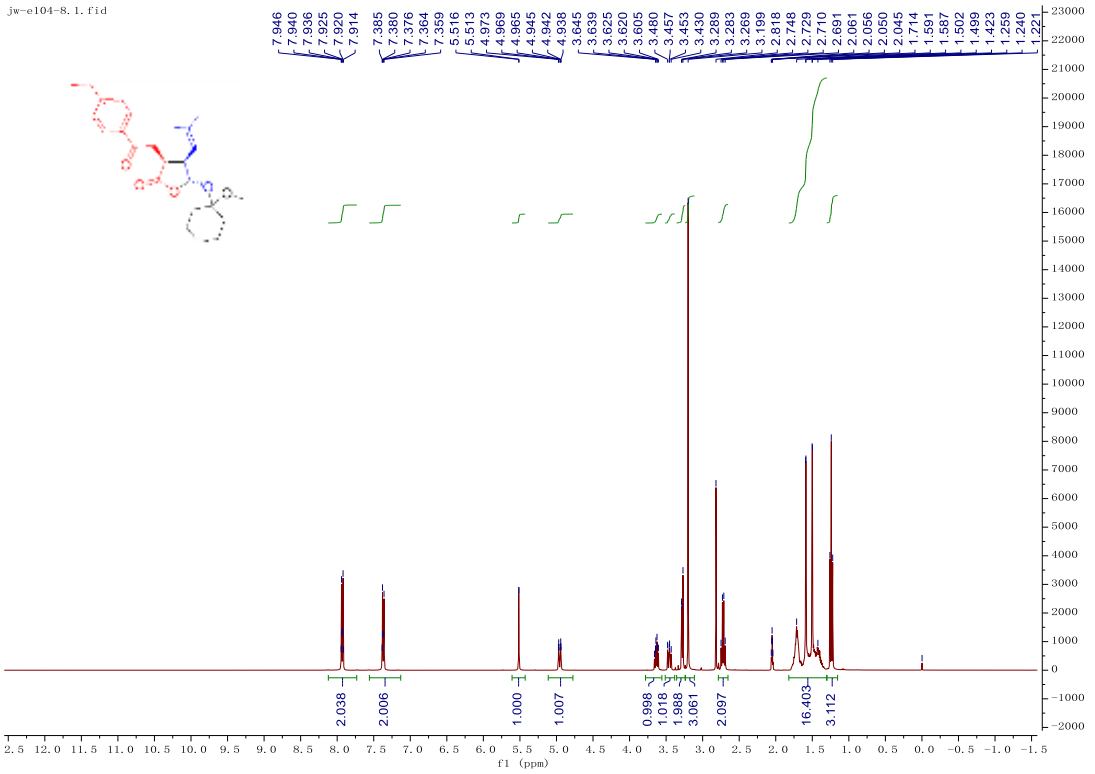
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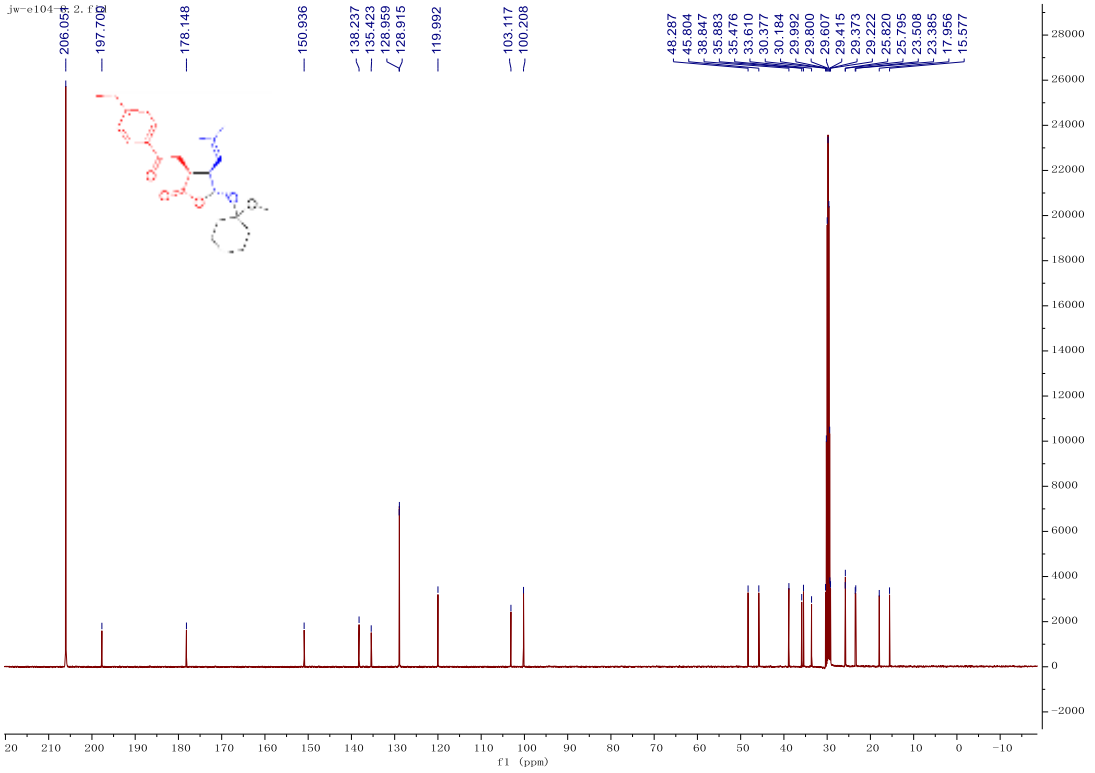
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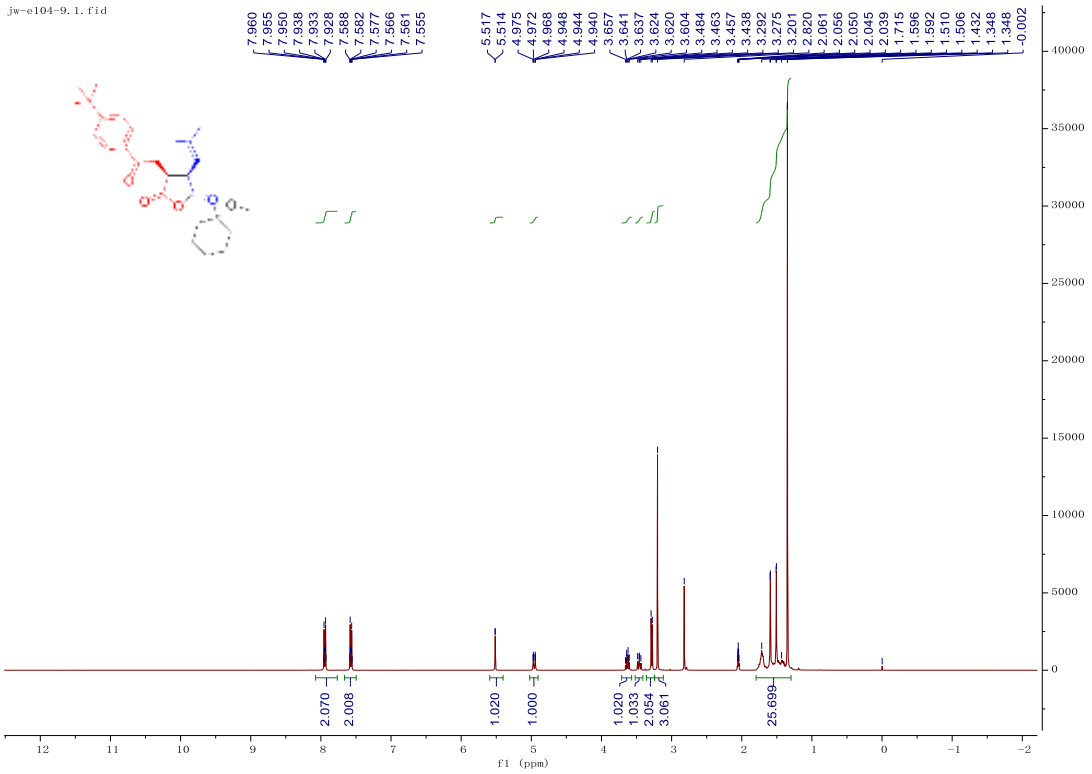
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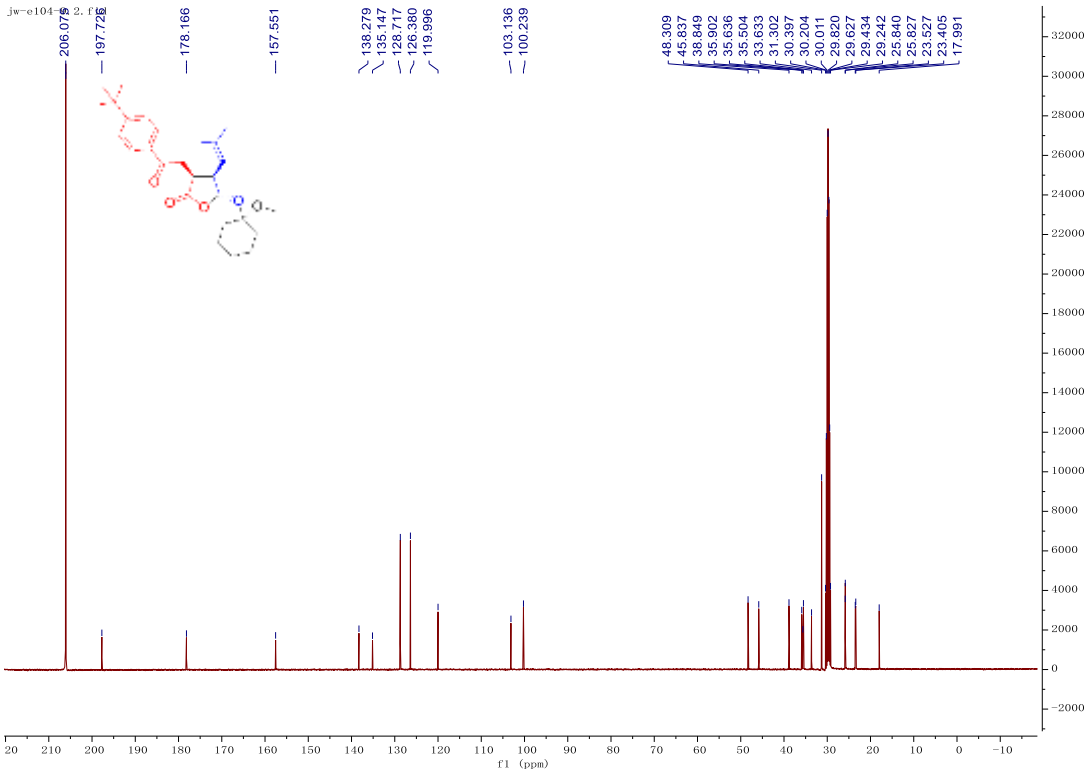
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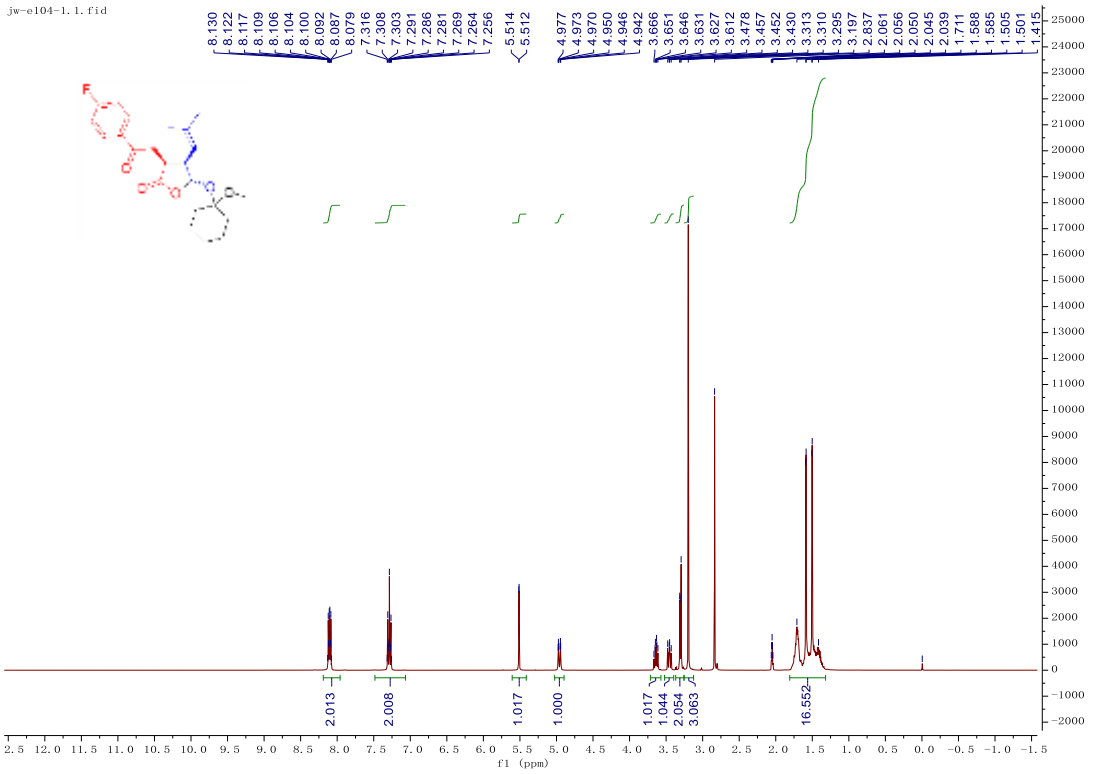
f1 (ppm)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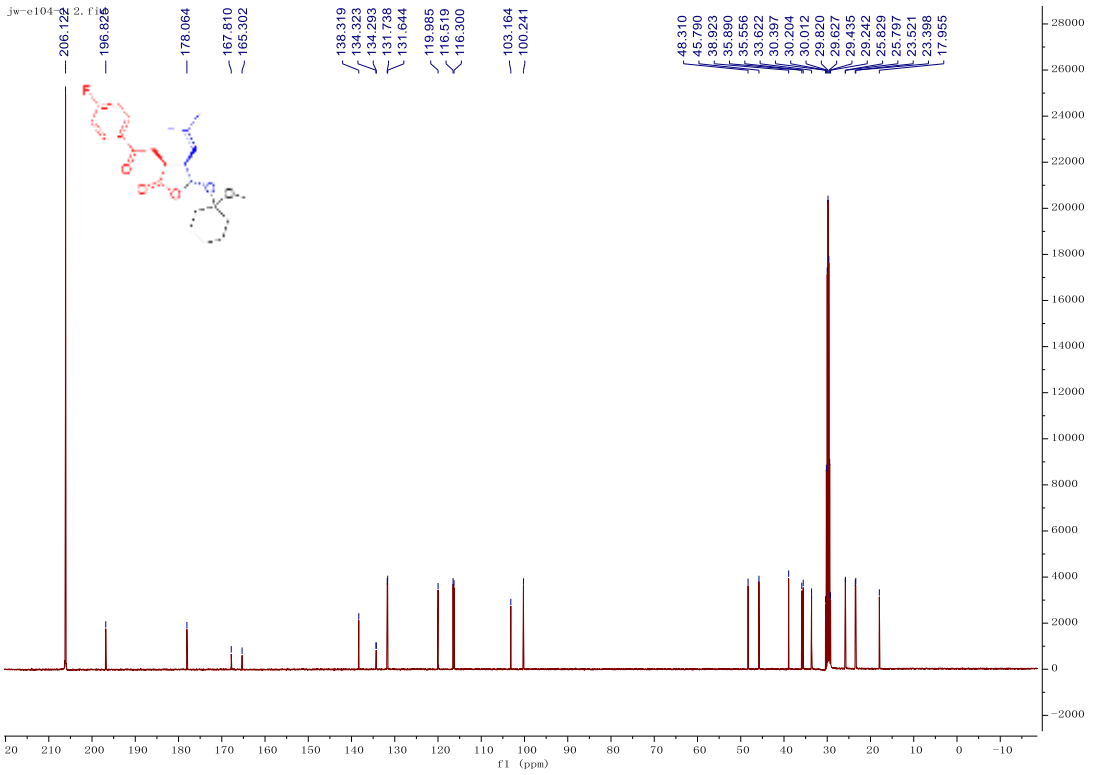
8.079
7.316
7.308
7.303
7.291
7.286
7.281
7.269
7.264
7.256
5.514
5.512
4.977
4.973
4.970
4.950
4.946
4.942
3.666
3.651
3.646
3.631
3.627
3.612
3.478
3.457
3.452
3.430
3.313
3.310
3.295
3.197
2.837
2.061
2.056
2.050
2.045
2.039
1.711
1.588
1.585
1.505
1.501
1.415
2.013
2.008
1.017
1.000
1.017
1.044
2.054
3.063
16.552
f1 (ppm)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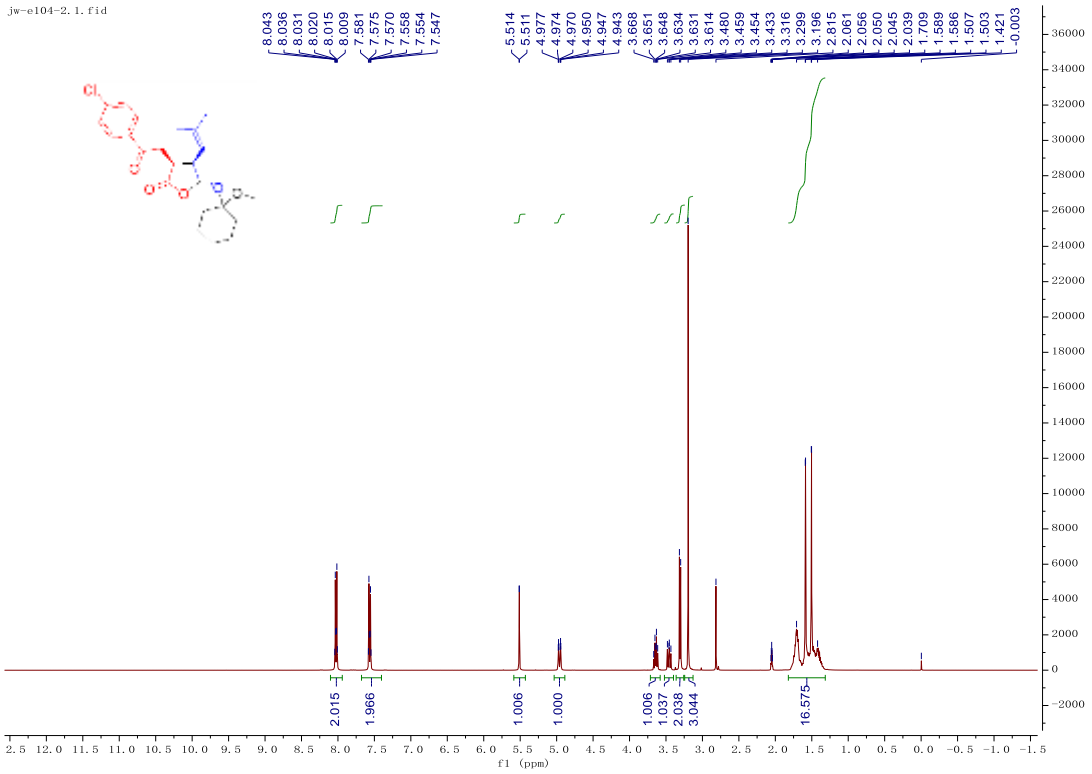
178.064
167.810
165.302
138.319
134.323
134.293
131.738
131.644
119.985
116.519
116.300
103.164
100.241
48.310
45.790
38.923
35.890
35.556
33.622
30.397
30.204
30.012
29.820
29.627
29.435
29.242
25.829
25.797
23.521
23.398
17.955
f1 (ppm)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8.009
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7.575
7.570
7.558
7.554
7.547
5.514
5.511
4.977
4.974
4.970
4.950
4.947
4.943
3.668
3.651
3.648
3.634
3.631
3.614
3.480
3.459
3.454
3.433
3.316
3.299
3.196
2.815
2.061
2.056
2.050
2.045
2.039
1.709
1.589
1.586
1.507
1.503
1.421
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1.966
1.006
1.000
1.006
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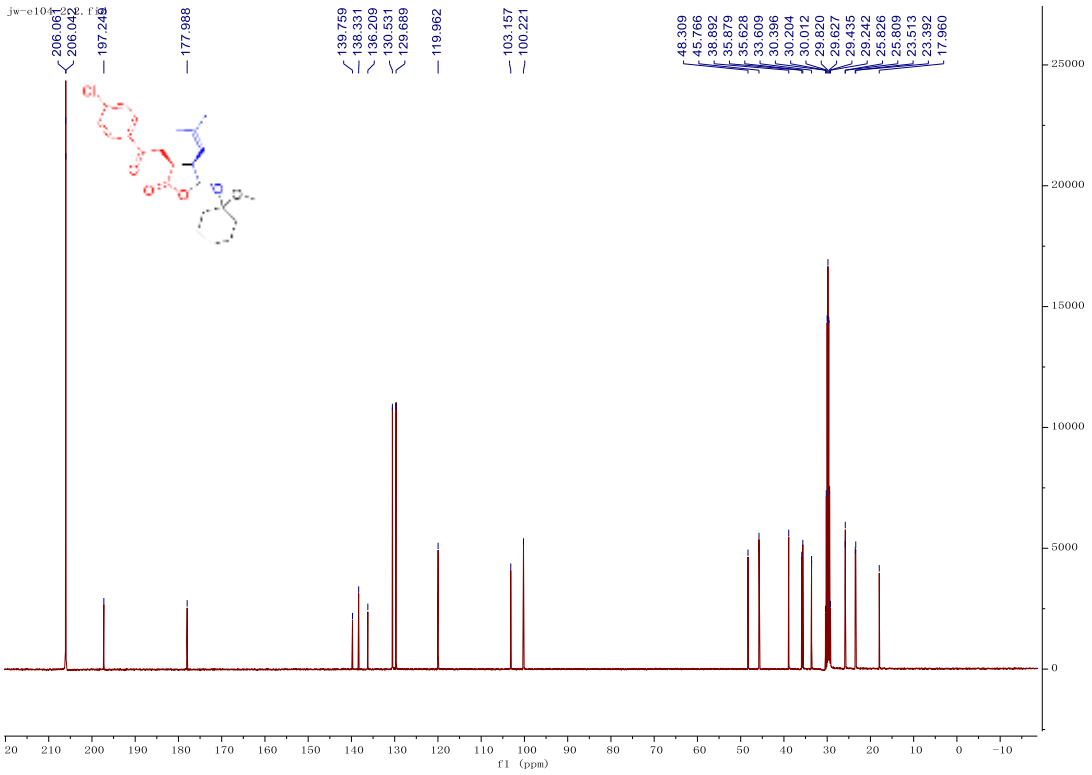
2.038
3.044
16.575
f1 (ppm)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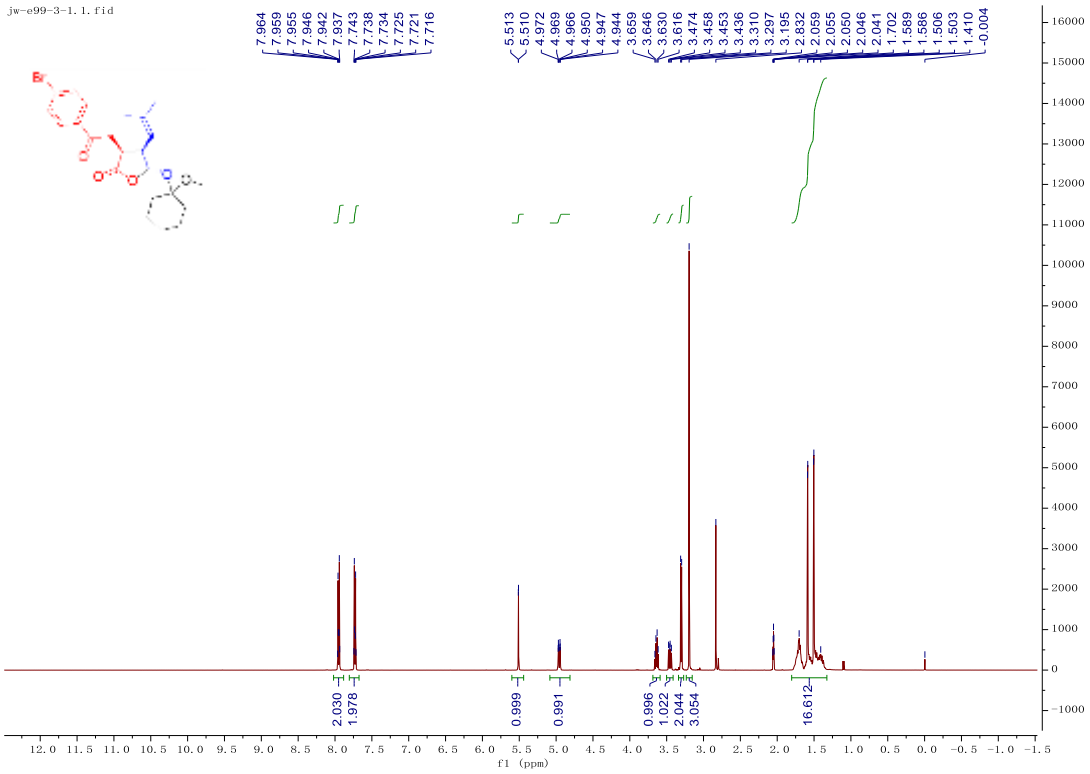
138.331
136.209
130.531
129.689
119.962
103.157
100.221
48.309
45.766
38.892
35.879
35.628
33.609
30.396
30.204
30.012
29.820
29.627
29.435
29.242
25.826
25.809
23.513
23.392
17.960
f1 (ppm)


jw-e99-3-1.1.fid
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7.955
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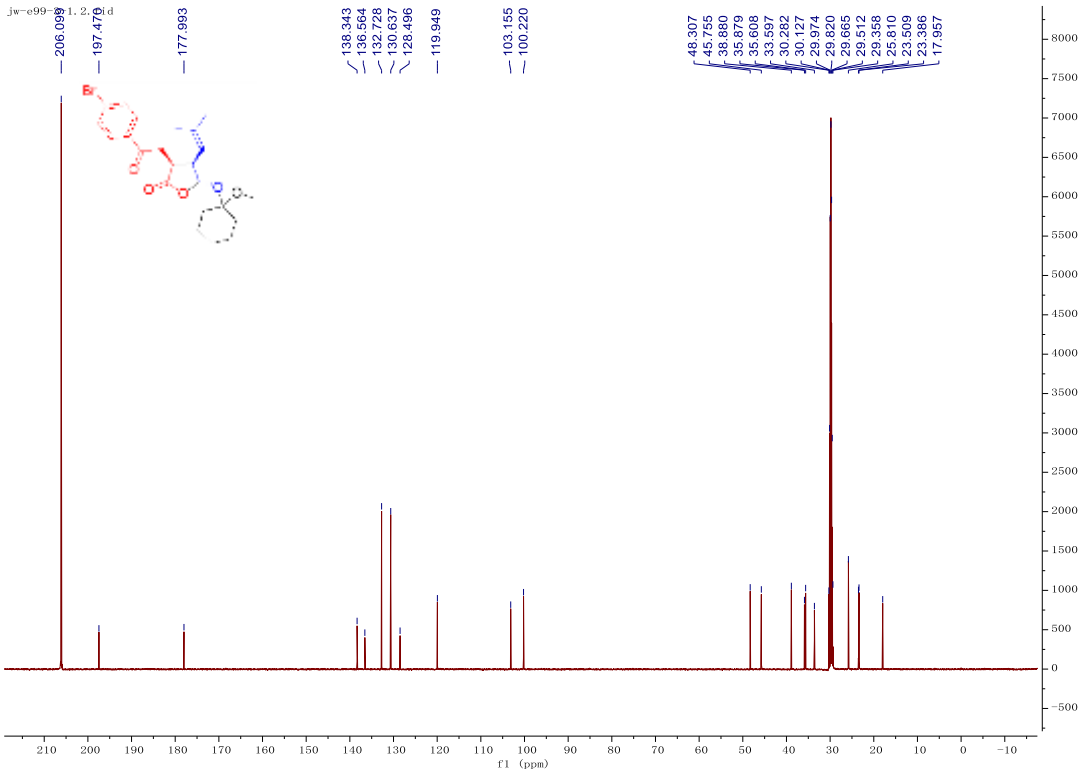
7.942
7.937
7.743
7.738
7.734
7.725
7.721
7.716
5.513
5.510
4.972
4.969
4.966
4.950
4.947
4.944
3.659
3.646
3.630
3.616
3.474
3.458
3.453
3.436
3.310
3.297
3.195
2.832
2.059
2.055
2.050
2.046
2.041
1.702
1.589
1.586
1.506
1.503
1.410
-0.004
2.030
1.978
0.999
0.991
0.996
1.022
2.044
3.054
16.612
f1 (ppm)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177.993
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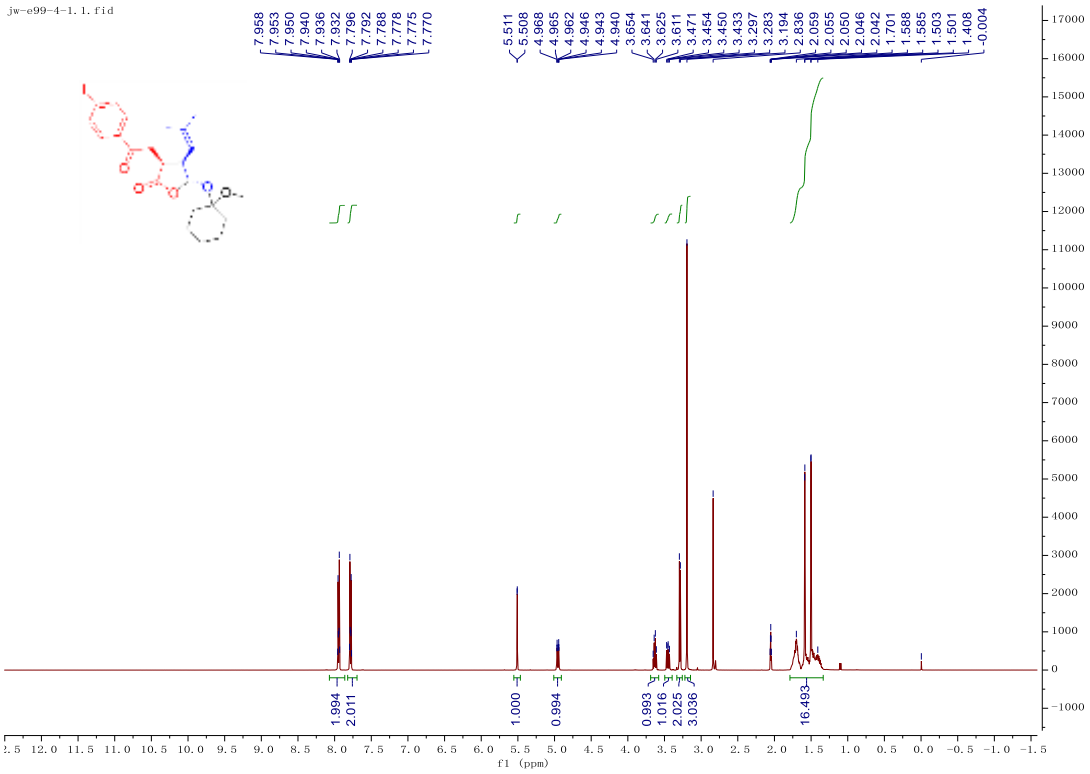
132.728
130.637
128.496
119.949
103.155
100.220
48.307
45.755
38.880
35.879
35.608
33.597
30.282
30.127
29.974
29.820
29.665
29.512
29.358
25.810
23.509
23.386
17.957
f1 (ppm)


jw-e99-4-1.1.fid
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7.950
7.940
7.936
7.932
7.796
7.792
7.788
7.778
7.775
7.770
5.511
5.508
4.968
4.965
4.962
4.946
4.943
4.940
3.654
3.641
3.625
3.611
3.471
3.454
3.450
3.433
3.297
3.283
3.194
2.836
2.059
2.055
2.050
2.046
2.042
1.701
1.588
1.585
1.503
1.501
1.408
-0.004
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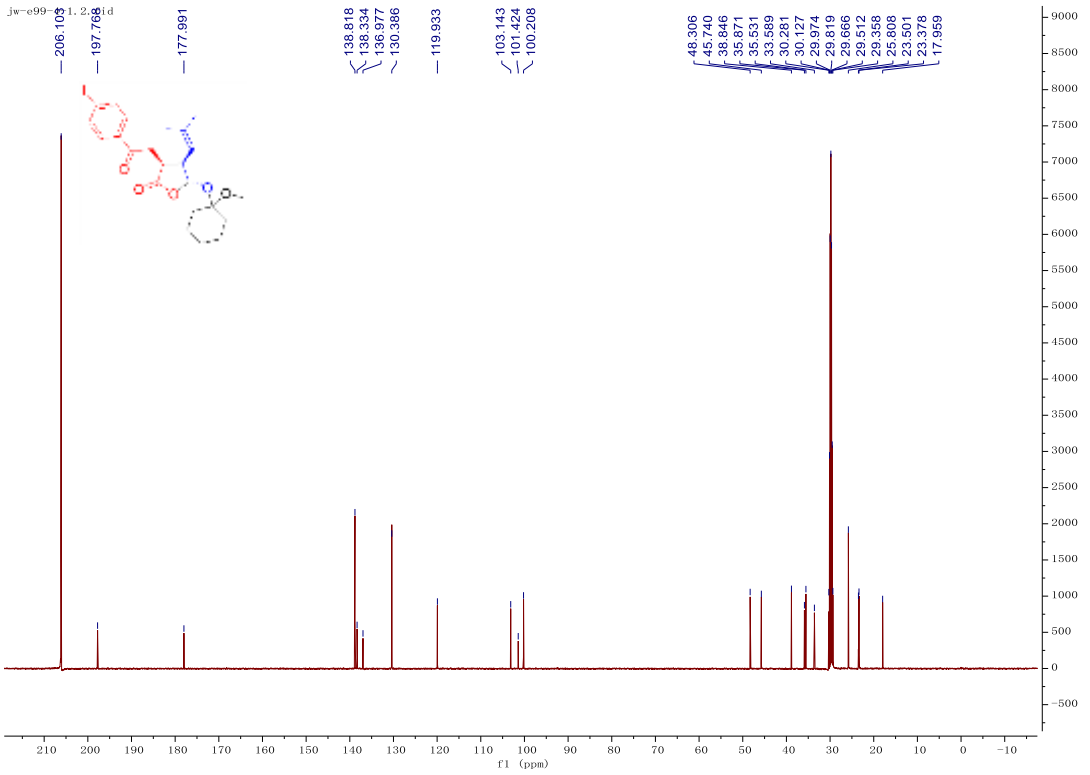
2.011
1.000
0.994
0.993
1.016
2.025
3.036
16.493
f1 (ppm)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197.768
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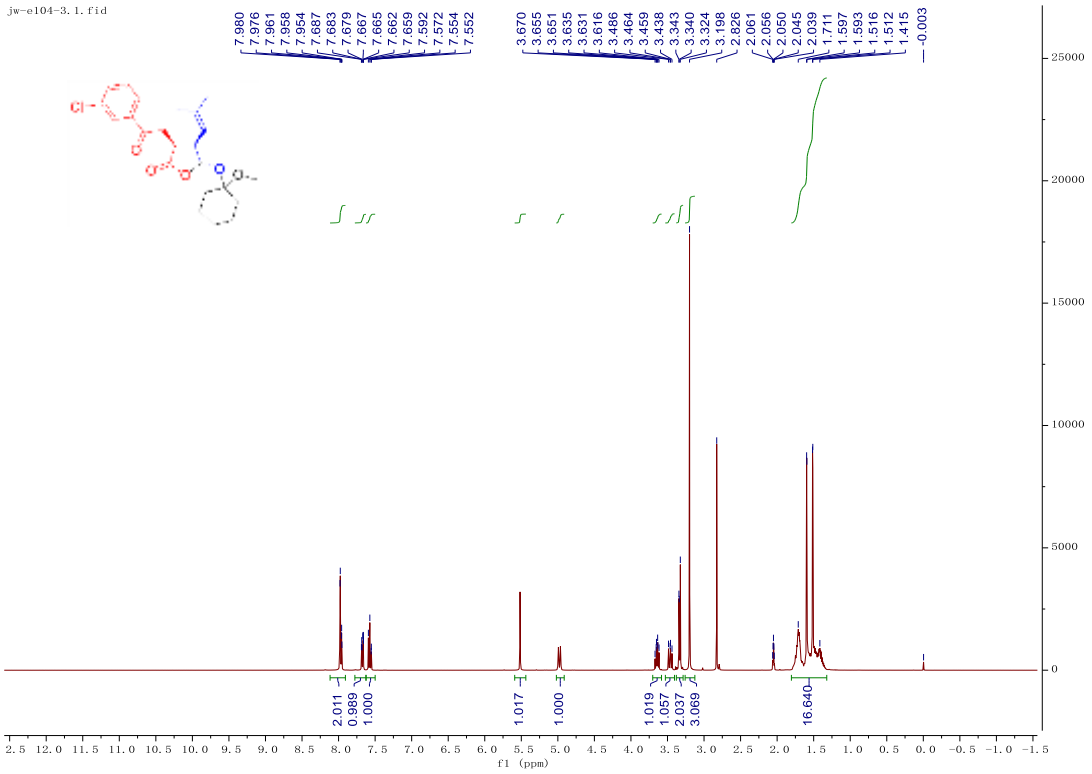
138.334
136.977
130.386
119.933
103.143
101.424
100.208
48.306
45.740
38.846
35.871
35.531
33.589
30.281
30.127
29.974
29.819
29.666
29.512
29.358
25.808
23.501
23.378
17.959
f1 (ppm)


jw-e104-3.1.fid
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7.958
7.954
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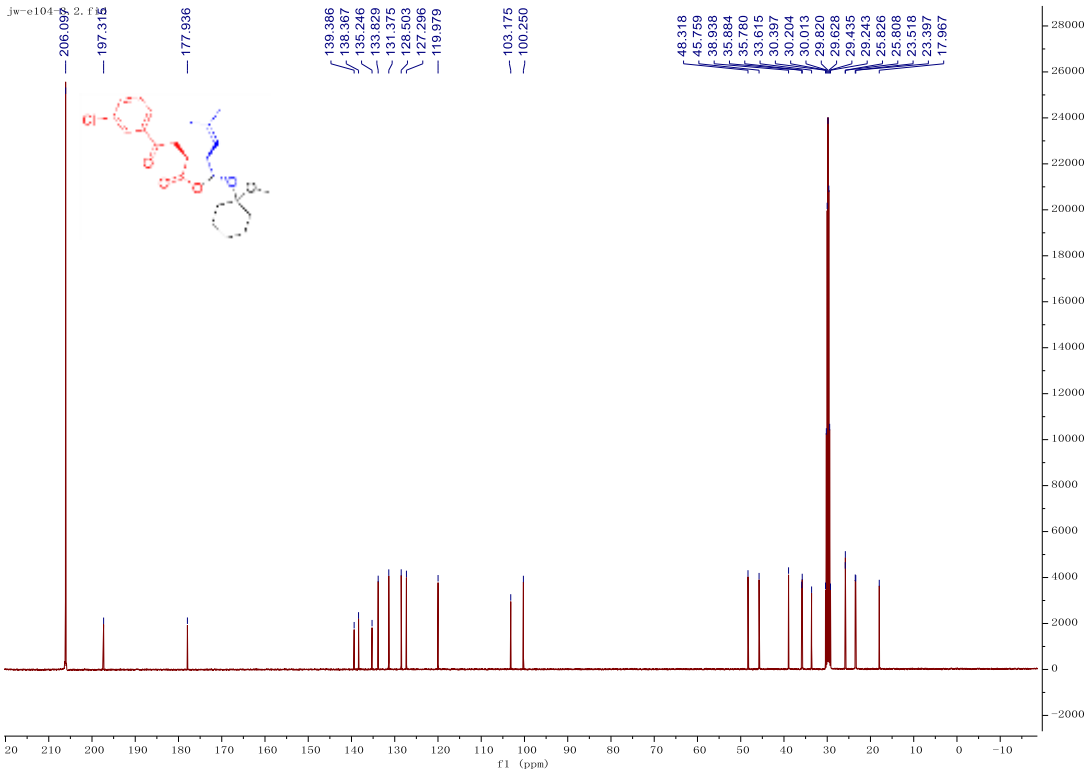
7.683
7.679
7.667
7.665
7.662
7.659
7.592
7.572
7.554
7.552
3.670
3.655
3.651
3.635
3.631
3.616
3.486
3.464
3.459
3.438
3.343
3.340
3.324
3.198
2.826
2.061
2.056
2.050
2.045
2.039
1.711
1.597
1.593
1.516
1.512
1.415
-0.003
Cl
2.011
0.989
1.000
1.017
1.000
1.019
1.057
2.037
3.069
16.640
f1 (ppm)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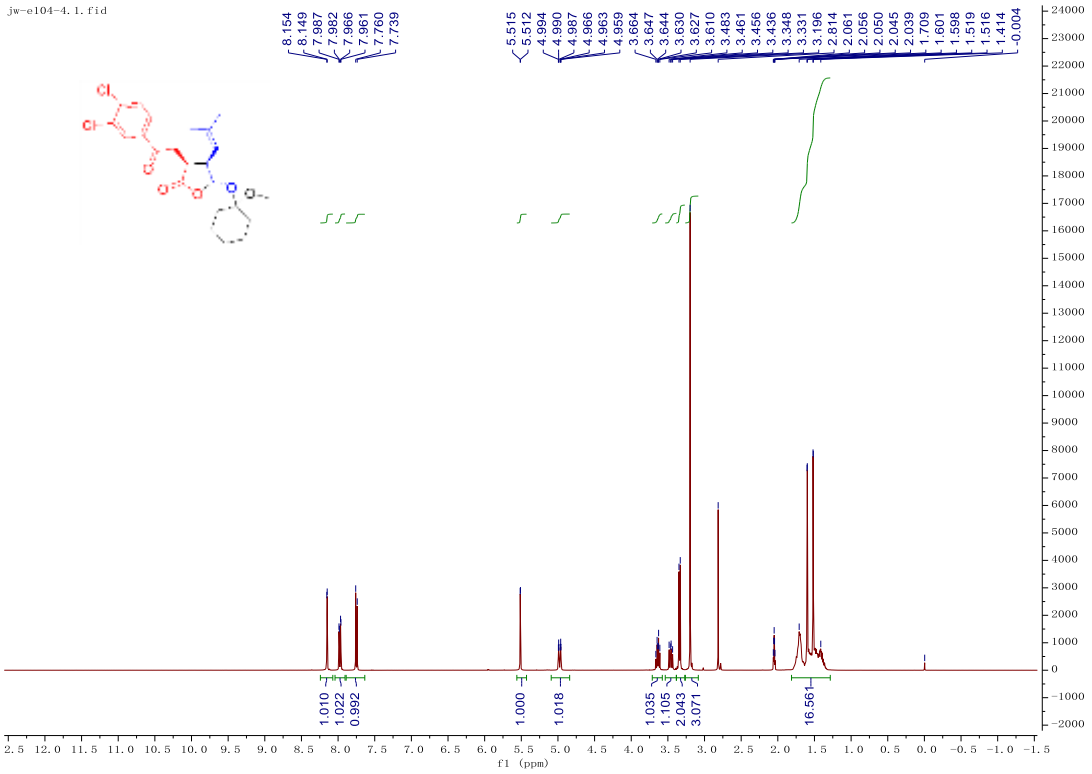
197.315
177.936
139.386
138.367
135.246
133.829
131.375
128.503
127.296
119.979
103.175
100.250
48.318
45.759
38.938
35.884
35.780
33.615
30.397
30.204
30.013
29.820
29.628
29.435
29.243
25.826
25.808
23.518
23.397
17.967
Cl
f1 (ppm)


jw-e104-4.1.fid
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7.987
7.982
7.966
7.961
7.760
7.739
5.515
5.512
4.994
4.990
4.987
4.966
4.963
4.959
3.664
3.647
3.644
3.630
3.627
3.610
3.483
3.461
3.456
3.436
3.348
3.331
3.196
2.814
2.061
2.056
2.050
2.045
2.039
1.709
1.601
1.598
1.519
1.516
1.414
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0.992
1.000
1.018
1.035
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2.043
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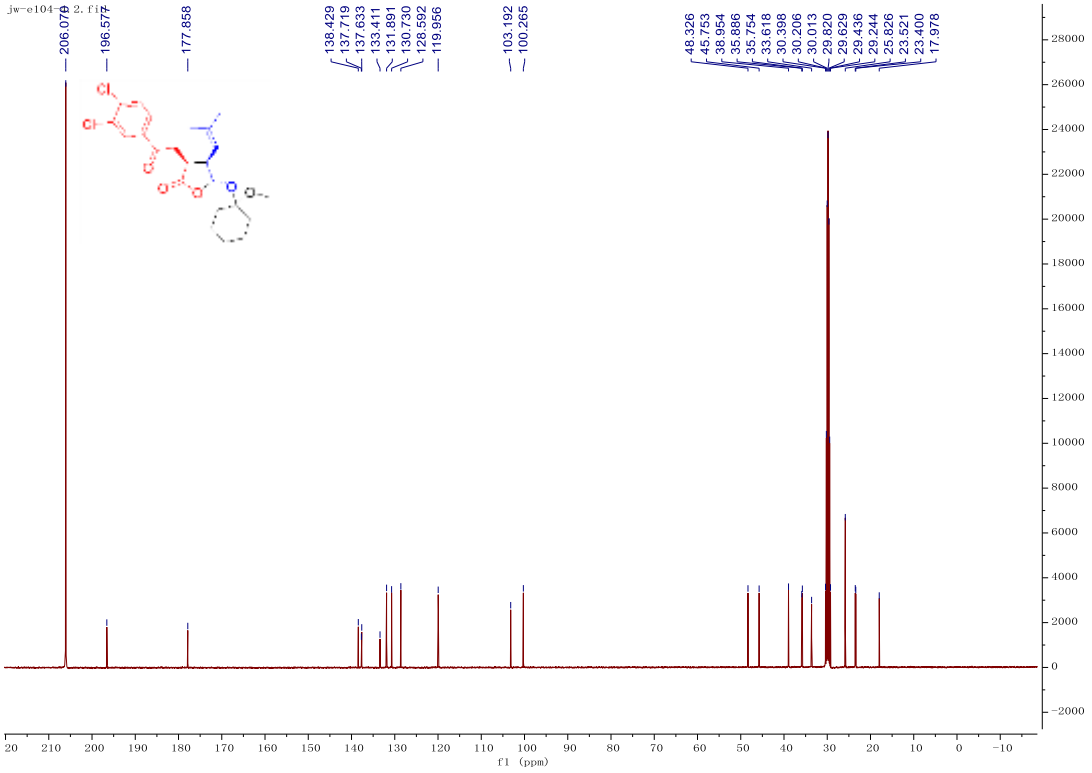
16.561
f1 (ppm)


jw-e104-2.fid
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138.429
137.719
137.633
133.411
131.891
130.730
128.592
119.956
103.192
100.265
48.326
45.753
38.954
35.886
35.754
33.618
30.398
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30.013
29.820
29.629
29.436
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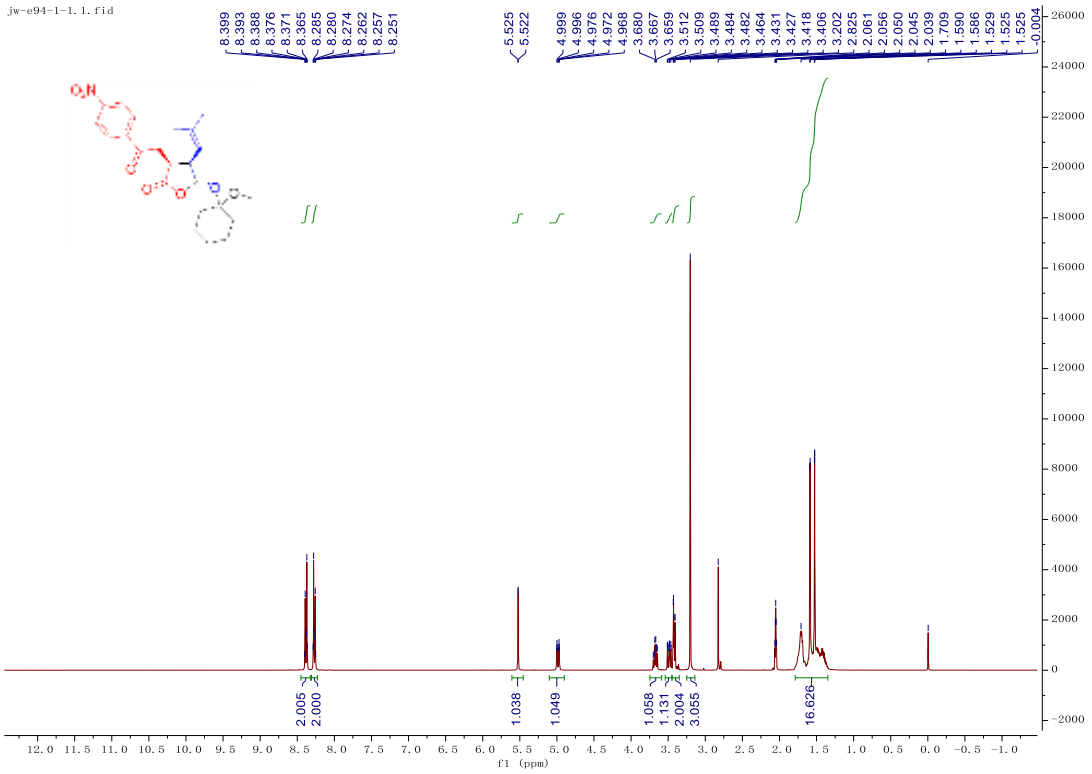
25.826
23.521
23.400
17.978
f1 (ppm)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8.274
8.262
8.257
8.251
5.525
5.522
4.999
4.996
4.976
4.972
4.968
3.680
3.667
3.659
3.512
3.509
3.489
3.484
3.482
3.464
3.431
3.427
3.418
3.406
3.202
2.825
2.061
2.056
2.050
2.045
2.039
1.709
1.590
1.586
1.529
1.525
1.525
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2.000
1.038
1.049
1.058
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2.004
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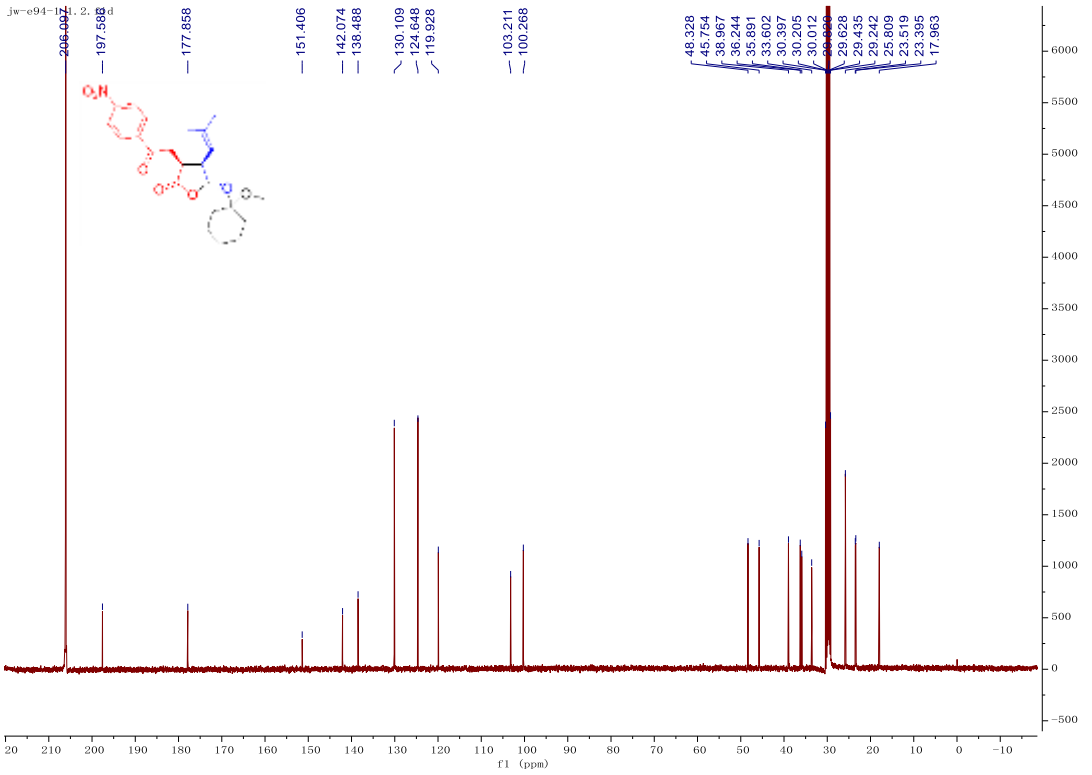
16.626
f1 (ppm)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151.406
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138.488
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124.648
119.928
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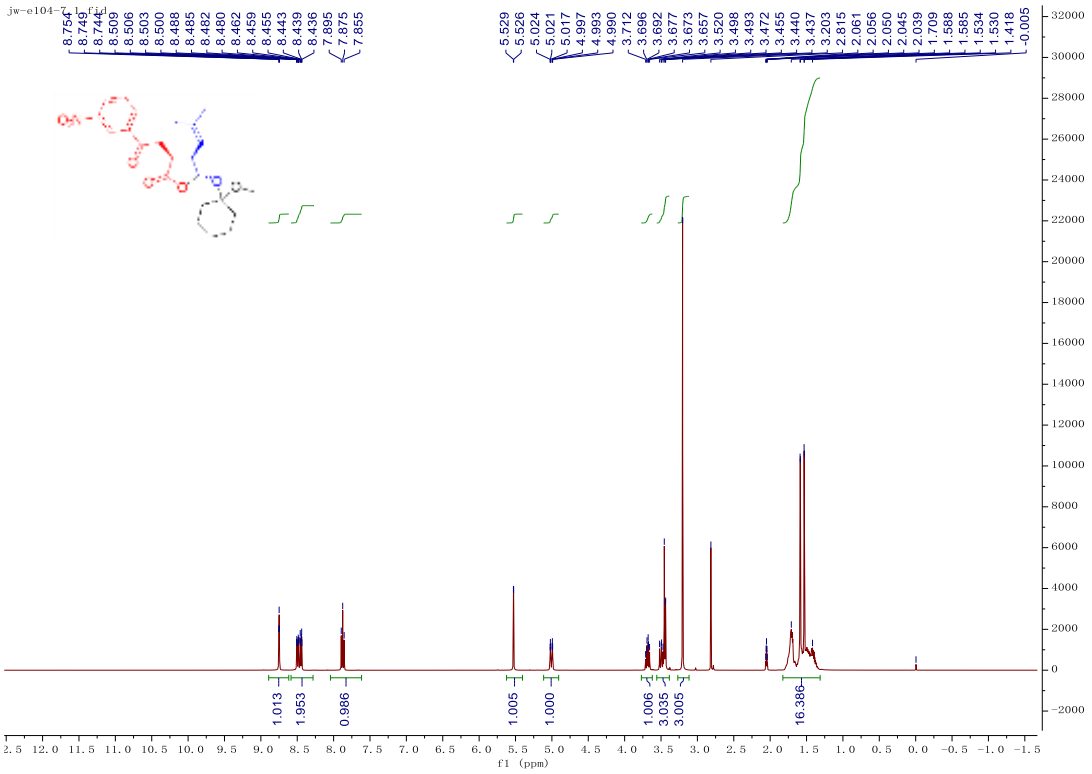
100.268
48.328
45.754
38.967
36.244
35.891
33.602
30.397
30.205
30.012
29.628
29.435
29.242
25.809
23.519
23.395
17.963
f1 (ppm)


jw-e104-7_1.fid
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8.480
8.462
8.459
8.455
8.443
8.439
8.436
7.895
7.875
7.855
5.529
5.526
5.024
5.021
5.017
4.997
4.993
4.990
3.712
3.696
3.692
3.677
3.673
3.657
3.520
3.498
3.493
3.472
3.455
3.440
3.437
3.203
2.815
2.061
2.056
2.050
2.045
2.039
1.709
1.588
1.585
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1.530
1.418
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3.005
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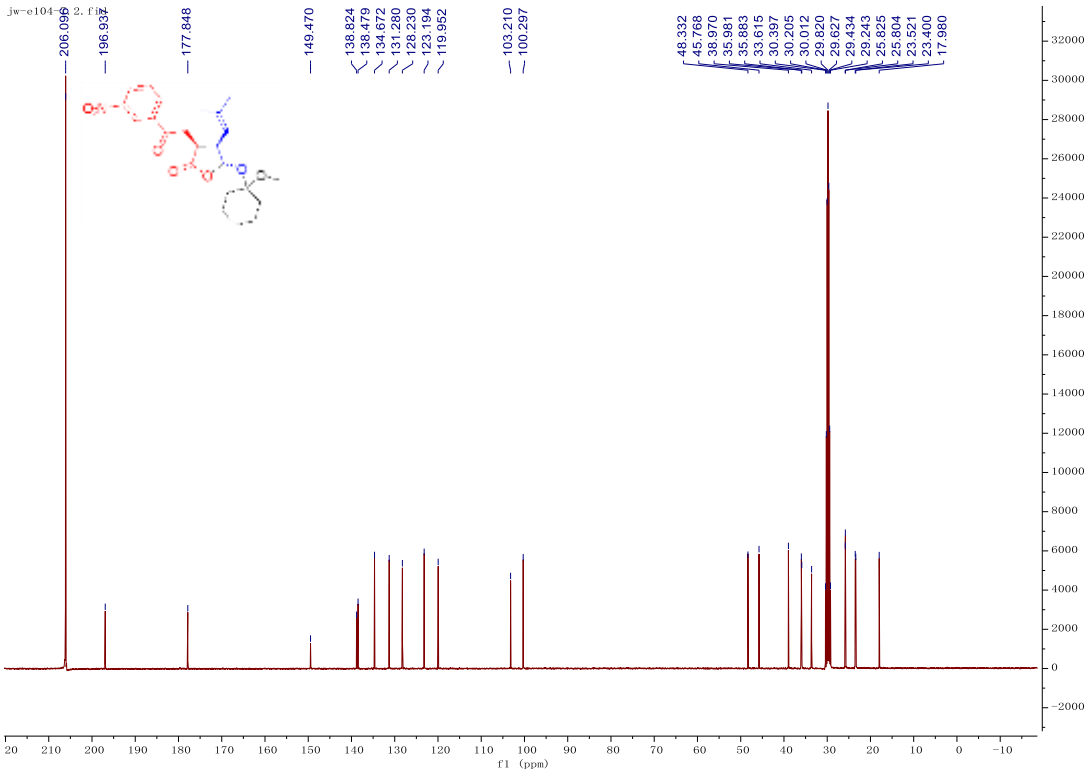
f1 (ppm)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128.230
123.194
119.952
103.210
100.297
48.332
45.768
38.970
35.981
35.883
33.615
30.397
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30.012
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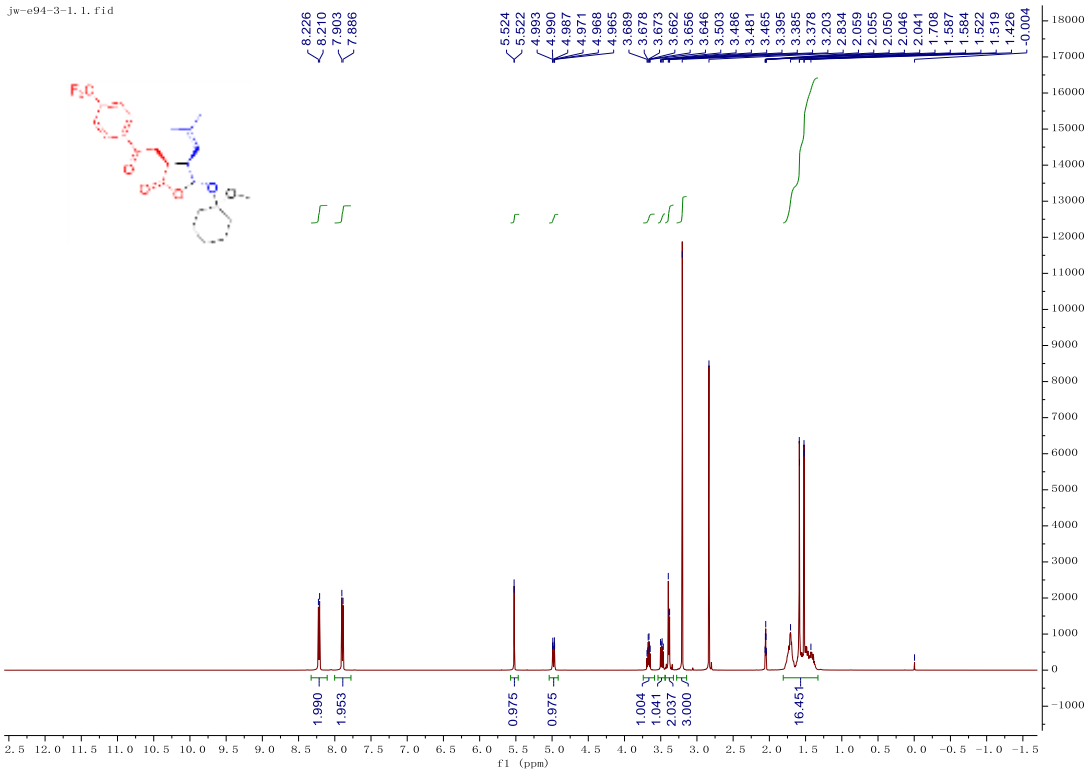
29.627
29.434
29.243
25.825
25.804
23.521
23.400
17.980
f1 (ppm)


jw-e94-3-1.1.fid
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5.522
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4.987
4.971
4.968
4.965
3.689
3.678
3.673
3.662
3.656
3.646
3.503
3.486
3.481
3.465
3.395
3.385
3.378
3.203
2.834
2.059
2.055
2.050
2.046
2.041
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1.584
1.522
1.519
1.426
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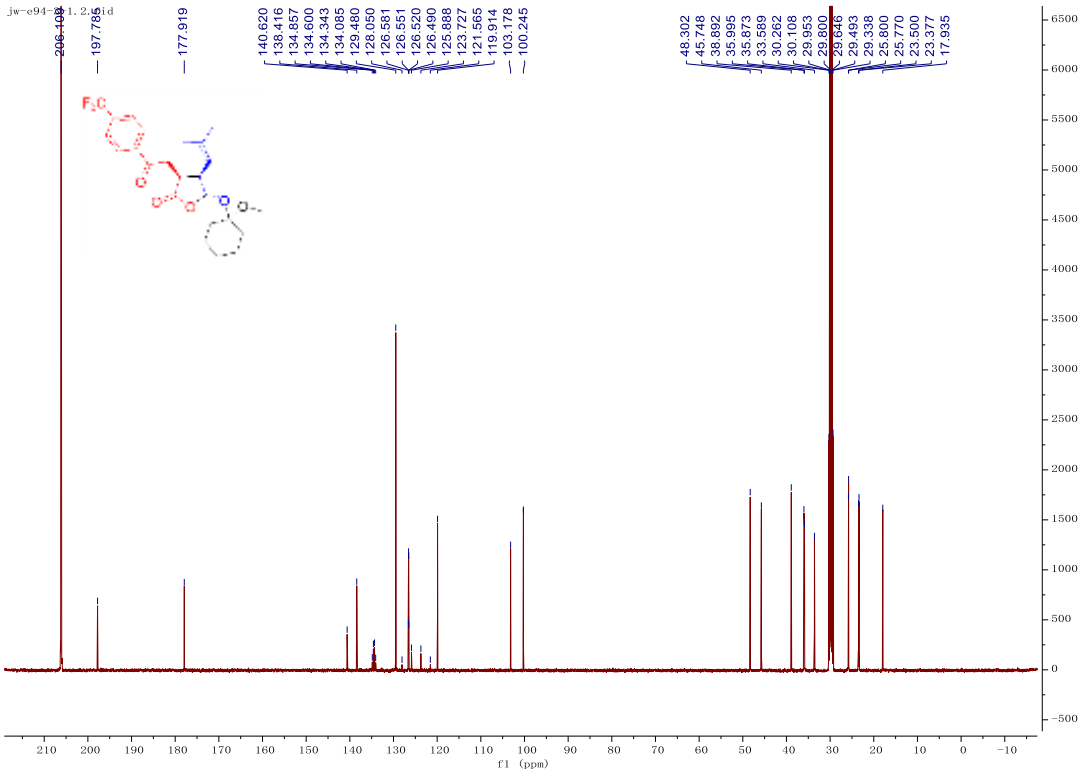
jw-e94-3-1.2.fid
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129.480
128.050
126.581
126.551
126.520
126.490
125.888
123.727
121.565
119.914
103.178
100.245
48.302
45.748
38.892
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35.873
33.589
30.262
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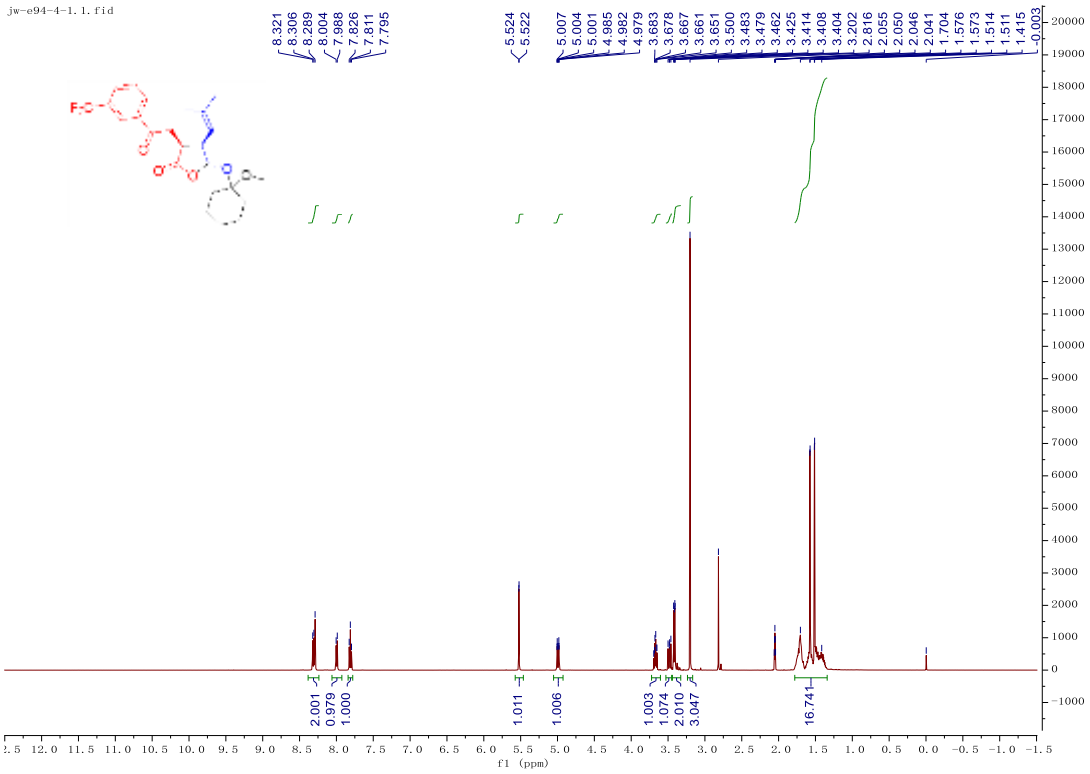
23.500
23.377
17.935
f1 (ppm)


jw-e94-4-1.1.fid
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5.522
5.007
5.004
5.001
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3.678
3.667
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3.651
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3.483
3.479
3.462
3.425
3.414
3.408
3.404
3.202
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1.704
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1.514
1.511
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16.741
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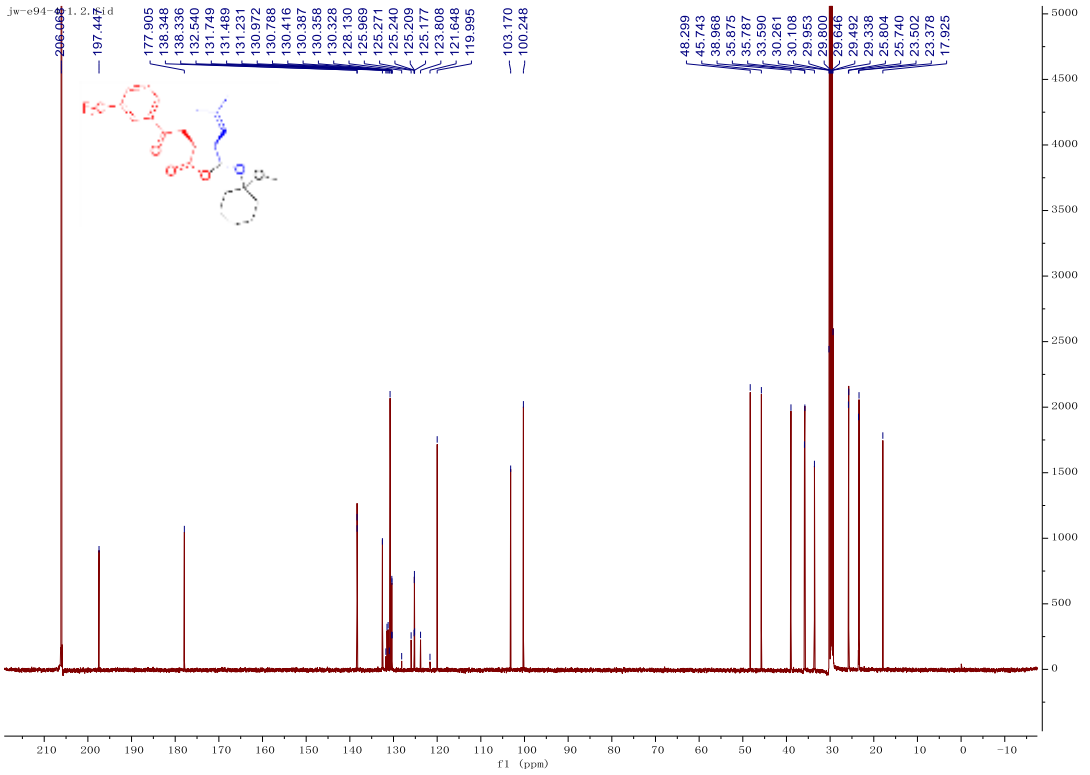
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131.231
130.972
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130.387
130.358
130.328
128.130
125.969
125.271
125.240
125.209
125.177
123.808
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45.743
38.968
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30.261
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29.492
29.338
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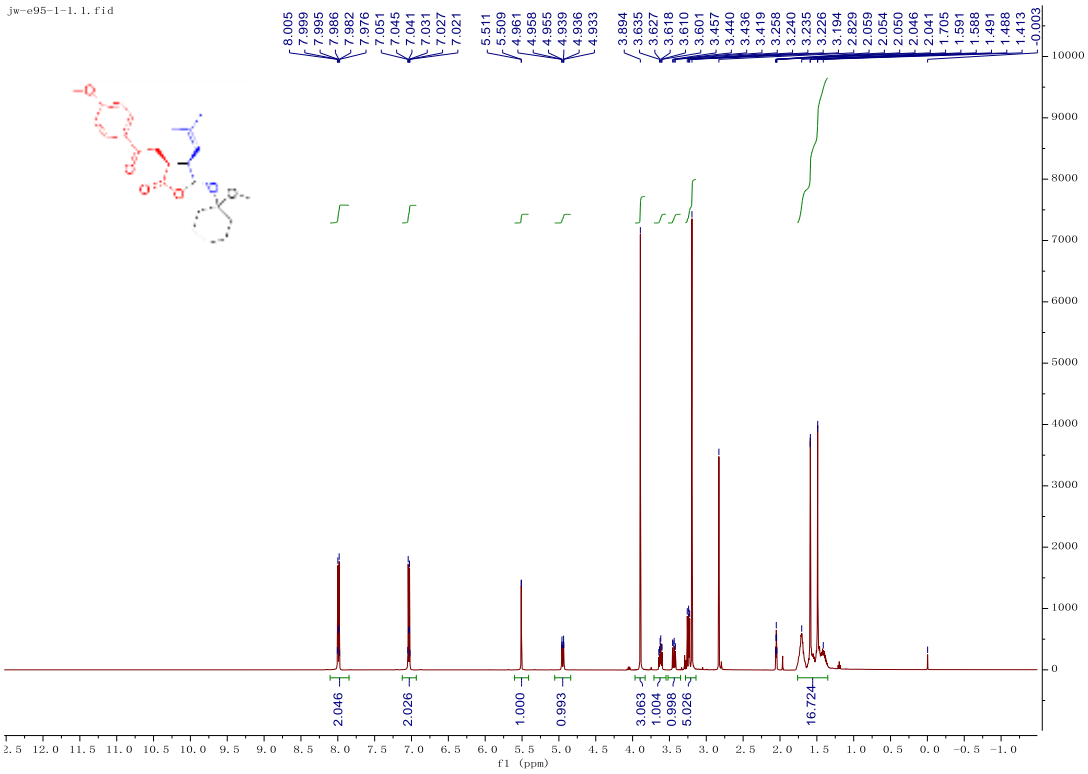
23.502
23.378
17.925
f1 (ppm)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7.027
7.021
5.511
5.509
4.961
4.958
4.955
4.939
4.936
4.933
3.894
3.635
3.627
3.618
3.610
3.601
3.457
3.440
3.436
3.419
3.258
3.240
3.235
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3.194
2.829
2.059
2.054
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2.046
2.041
1.705
1.591
1.588
1.491
1.488
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0.998
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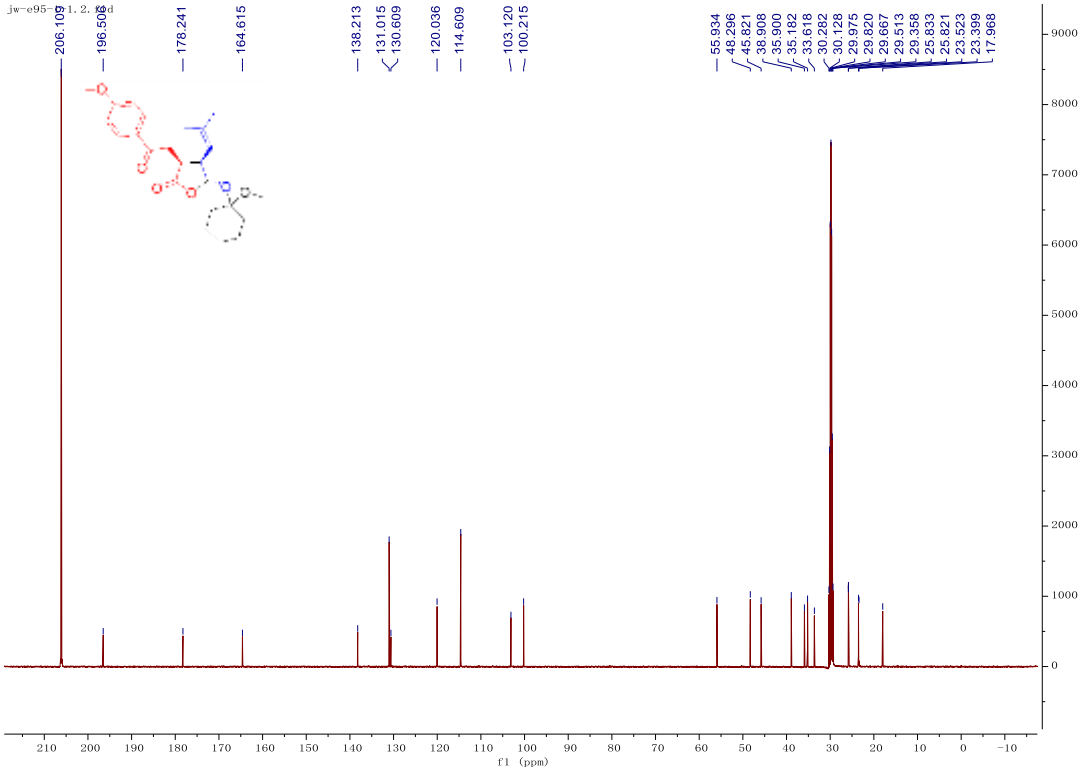
16.724
f1 (ppm)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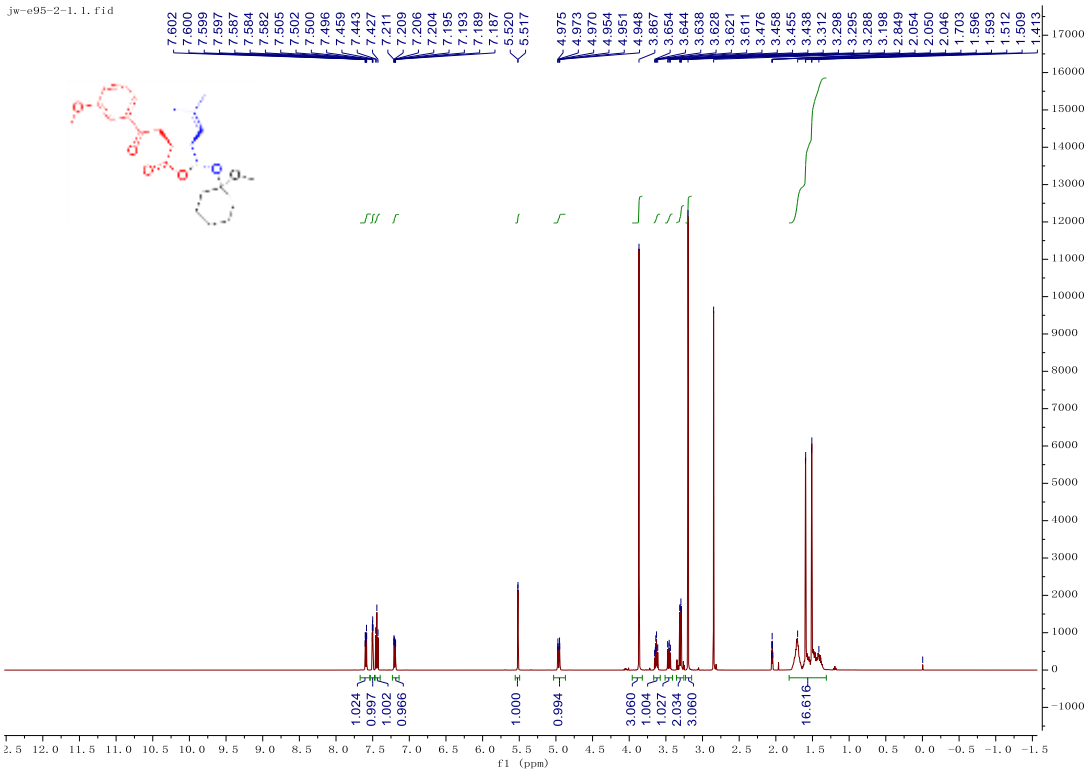
103.120
100.215
55.934
48.296
45.821
38.908
35.900
35.182
33.618
30.282
30.128
29.975
29.820
29.667
29.513
29.358
25.833
25.821
23.523
23.399
17.968
f1 (ppm)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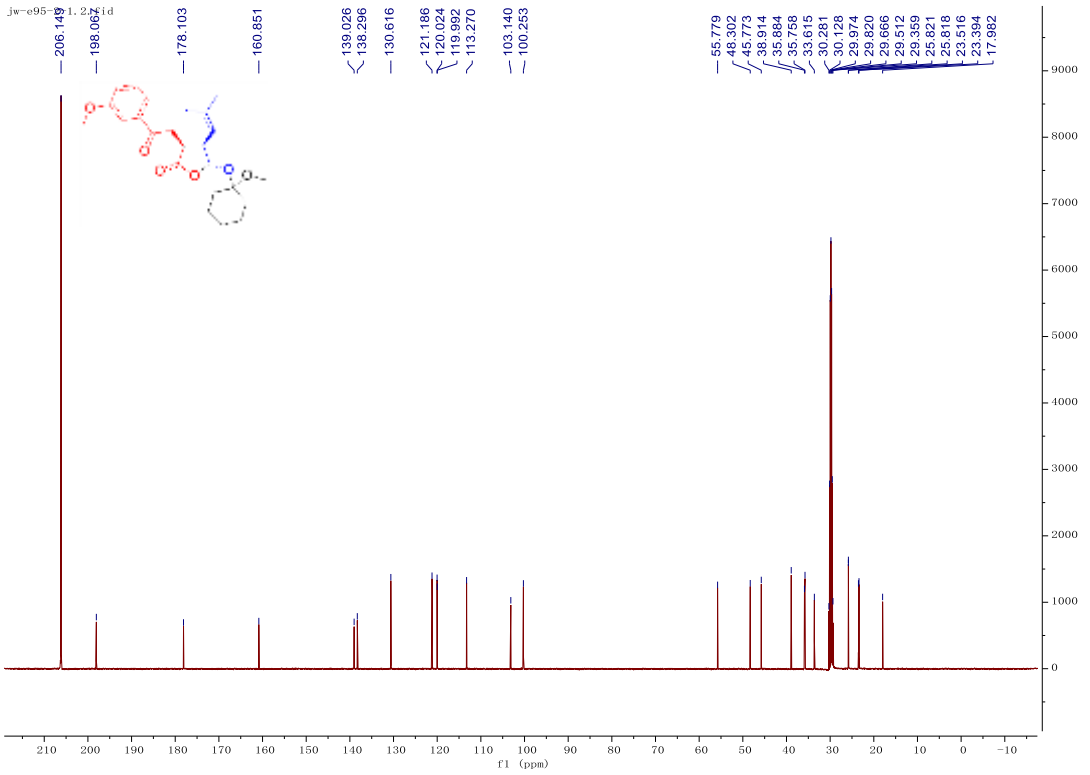
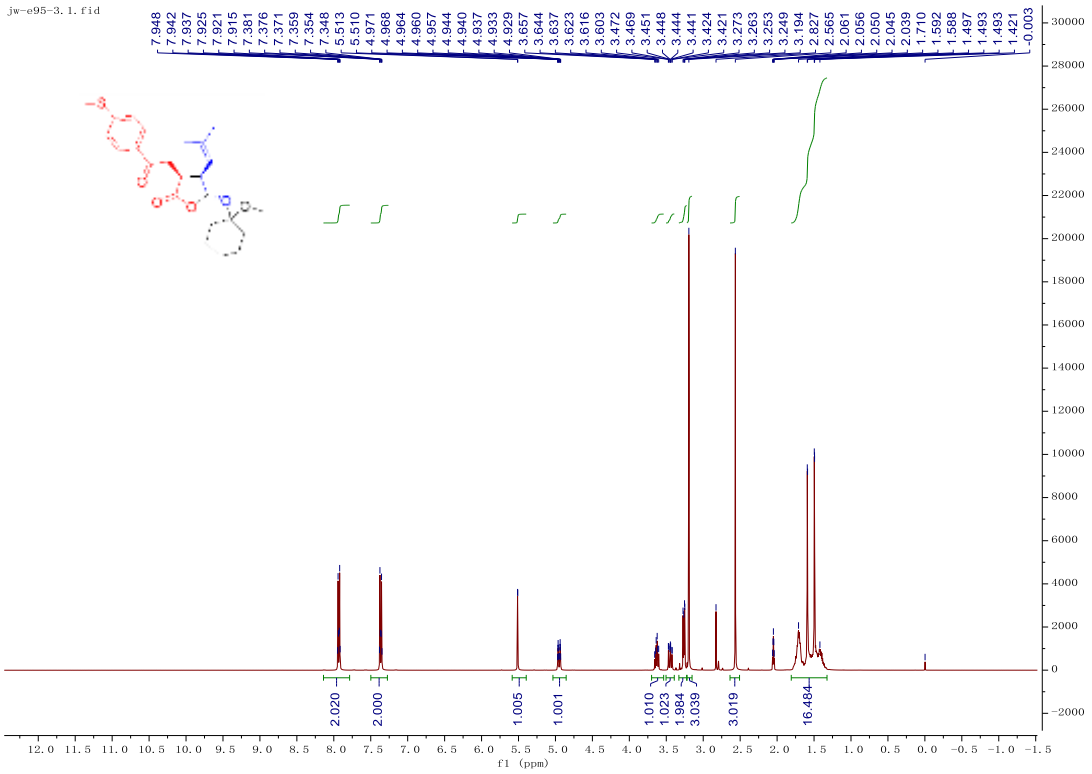
4.975 4.973 4.970 4.954 4.951 4.948 3.867 3.654 3.644 3.638 3.628 3.621 3.611 3.476 3.458 3.455 3.438 3.312 3.298 3.295 3.288 3.198 2.849 2.054 2.050 2.046 1.703 1.596 1.593 1.512 1.509 1.413
1.024 0.997 1.002 0.966 1.000 0.994 3.060 1.004 1.027 2.034 3.060 16.616
f1 (ppm)


jw-e95-1.2.fid
206.149 198.067 178.103 160.851 139.026 138.296 130.616 121.186 120.024 119.992 113.270 103.140 100.253
55.779 48.302 45.773 38.914 35.884 35.758 33.615 30.281 30.128 29.974 29.820 29.666 29.512 29.359 25.821 25.818 23.516 23.394 17.982
f1 (ppm)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7.359
7.354
7.348
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5.510
4.971
4.968
4.964
4.960
4.957
4.944
4.940
4.937
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4.929
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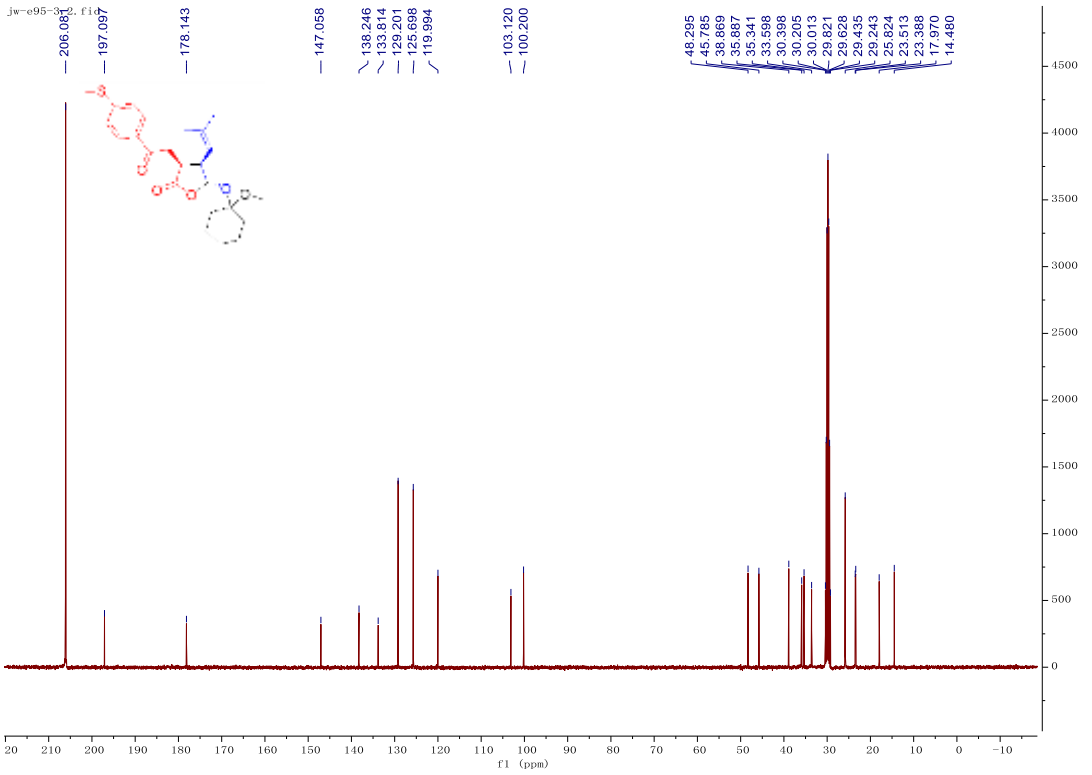
3.644
3.637
3.623
3.616
3.603
3.472
3.469
3.451
3.448
3.444
3.441
3.424
3.421
3.273
3.263
3.253
3.249
3.194
2.827
2.565
2.061
2.056
2.050
2.045
2.039
1.710
1.592
1.588
1.497
1.493
1.493
1.421
-0.003
2.020
2.000
1.005
1.001
1.010
1.023
1.984
3.039
3.019
16.484
f1 (ppm)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129.201
125.698
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100.200
48.295
45.785
38.869
35.887
35.341
33.598
30.398
30.205
30.013
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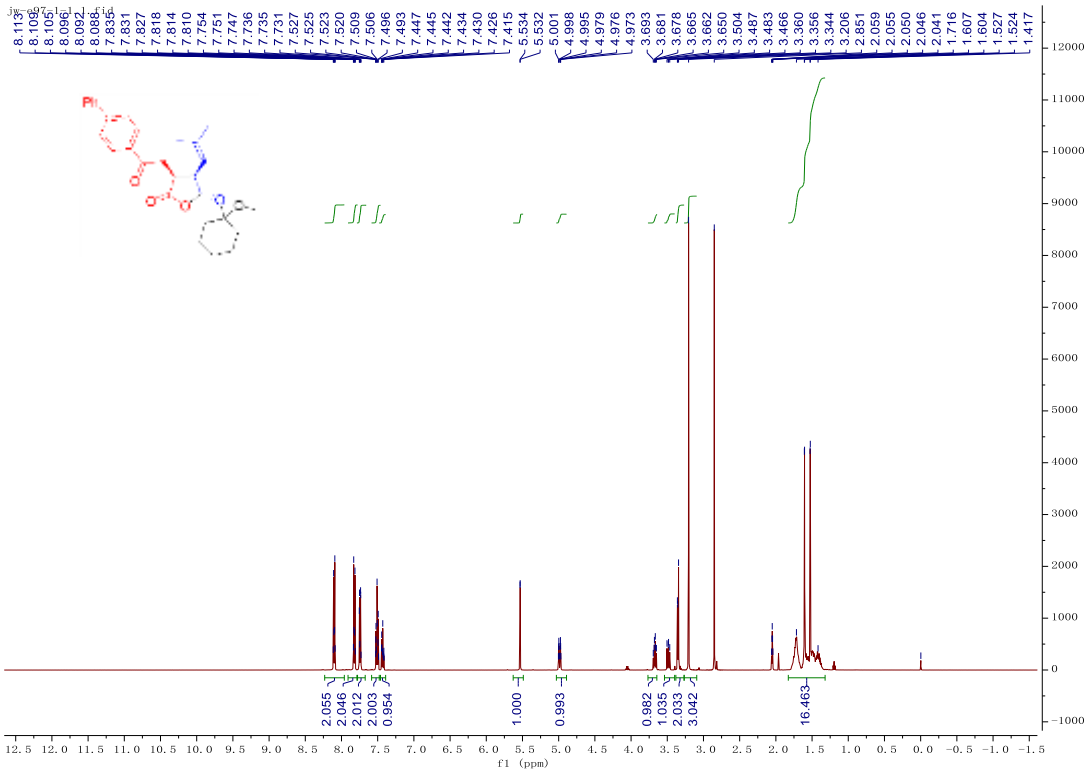
29.628
29.435
29.243
25.824
23.513
23.388
17.970
14.480
f1 (ppm)


jw-e97-1.1.fid
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8.109
8.105
8.096
8.092
8.088
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7.831
7.827
7.818
7.814
7.810
7.754
7.751
7.747
7.736
7.735
7.731
7.527
7.525
7.523
7.520
7.509
7.506
7.496
7.493
7.447
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7.426
7.415
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4.995
4.979
4.976
4.973
3.693
3.681
3.678
3.665
3.662
3.650
3.504
3.487
3.483
3.466
3.360
3.356
3.344
3.206
2.851
2.059
2.055
2.050
2.046
2.041
1.716
1.607
1.604
1.527
1.524
1.417
2.055
2.046
2.012
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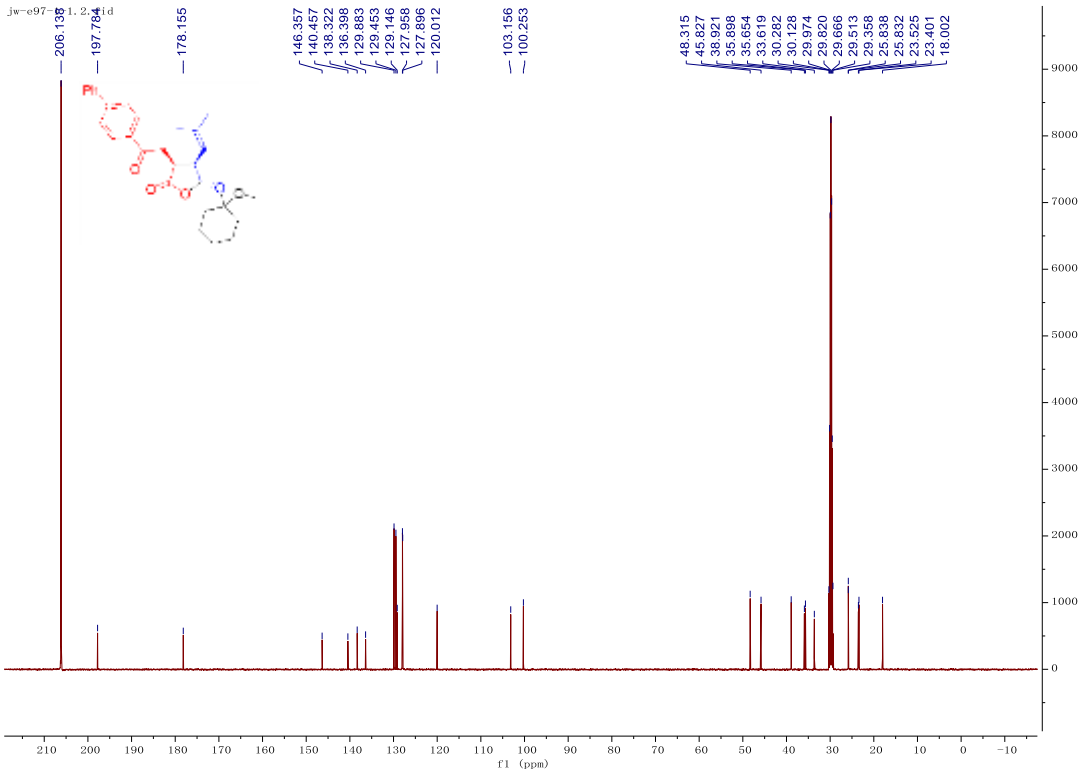
1.000
0.993
0.982
1.035
2.033
3.042
16.463
f1 (ppm)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129.453
129.146
127.958
127.896
120.012
103.156
100.253
48.315
45.827
38.921
35.898
35.654
33.619
30.282
30.128
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29.358
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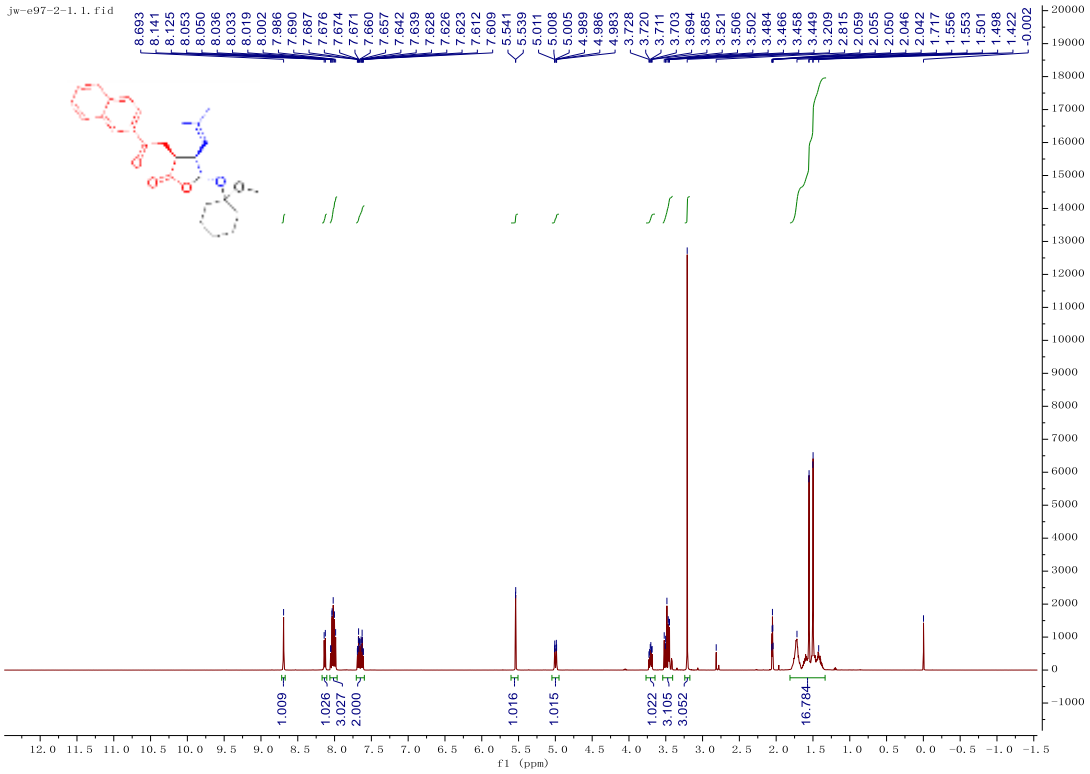
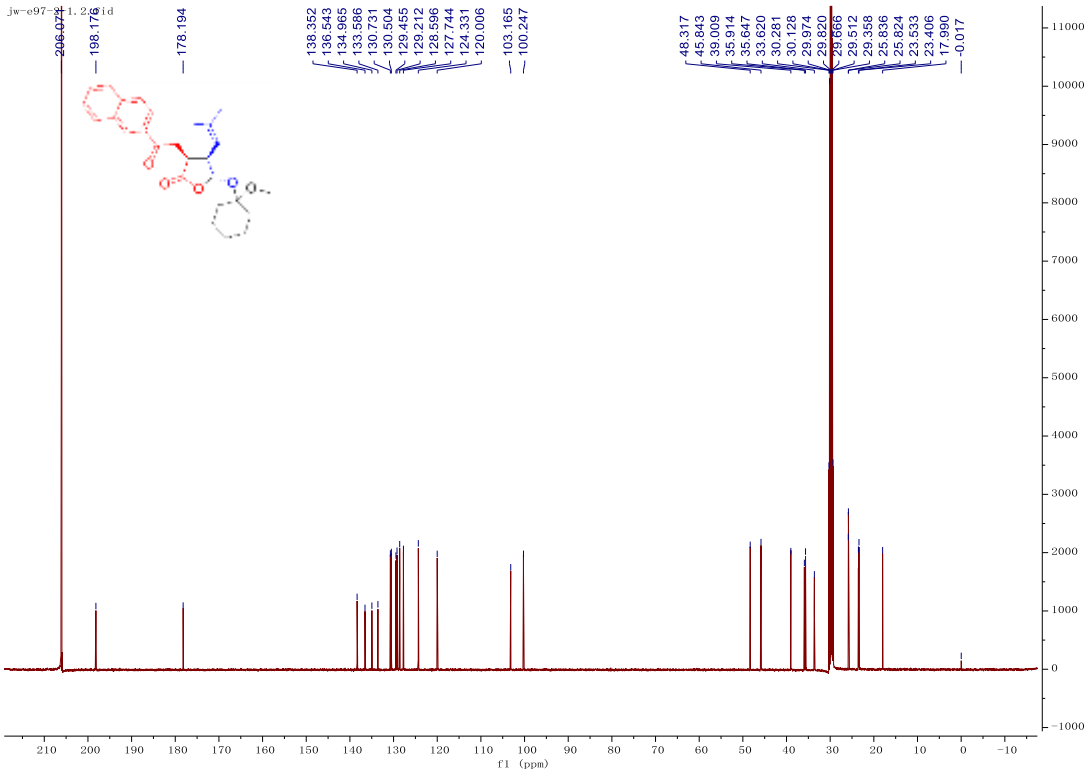
25.832
23.525
23.401
18.002
f1 (ppm)


jw-e97-2-1.1.fid
f1 (ppm)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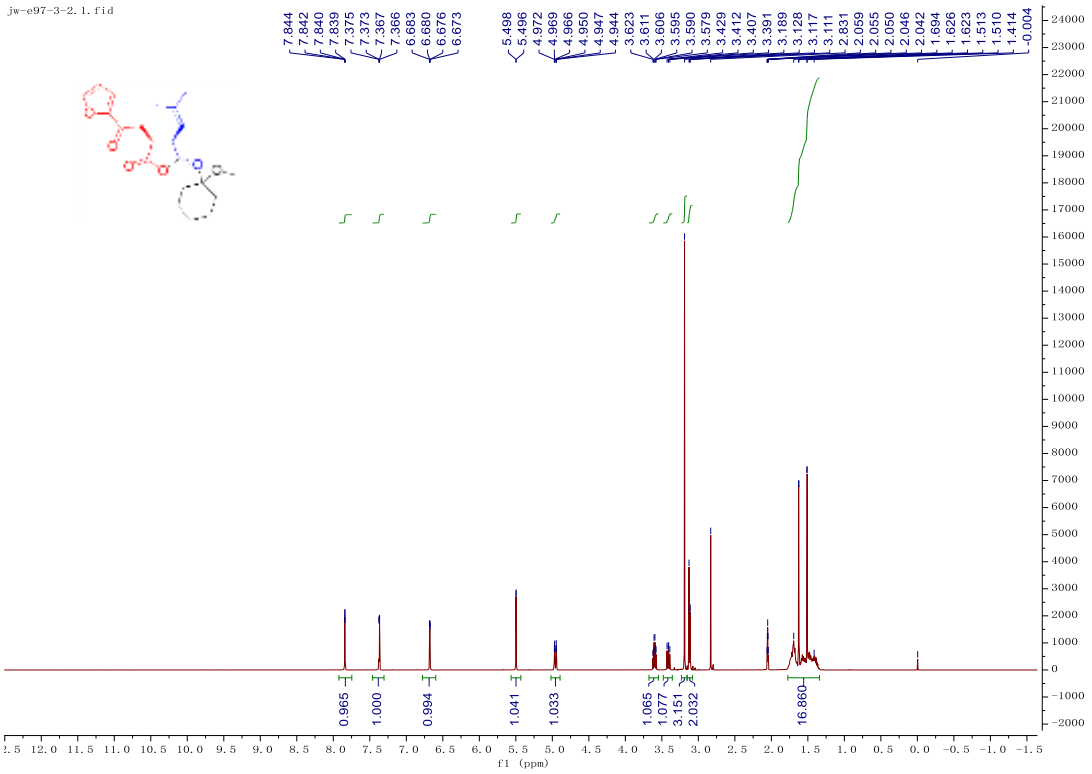
f1 (ppm)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7.366
6.683
6.680
6.676
6.673
5.498
5.496
4.972
4.969
4.966
4.950
4.947
4.944
3.623
3.611
3.606
3.595
3.590
3.579
3.429
3.412
3.407
3.391
3.189
3.128
3.117
3.111
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2.059
2.055
2.050
2.046
2.042
1.694
1.626
1.623
1.513
1.510
1.414
-0.004
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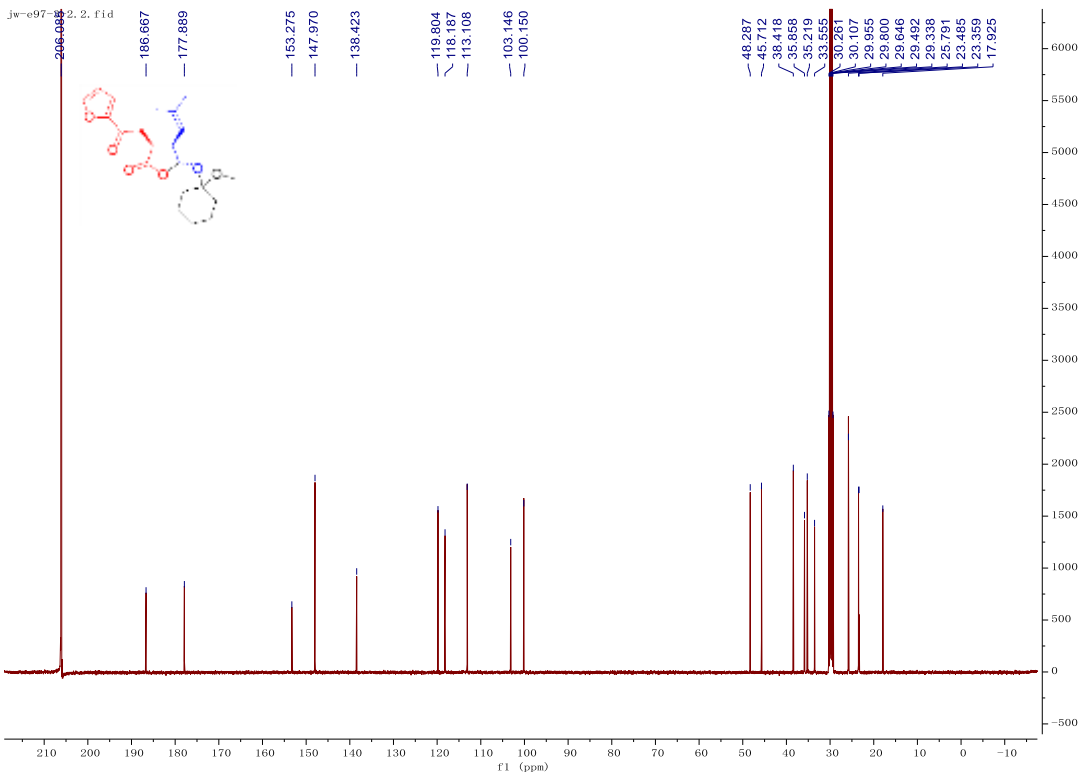
1.000
0.994
1.041
1.033
1.065
1.077
3.151
2.032
16.860
f1 (ppm)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113.108
103.146
100.150
48.287
45.712
38.418
35.858
35.219
33.555
30.261
30.107
29.955
29.800
29.646
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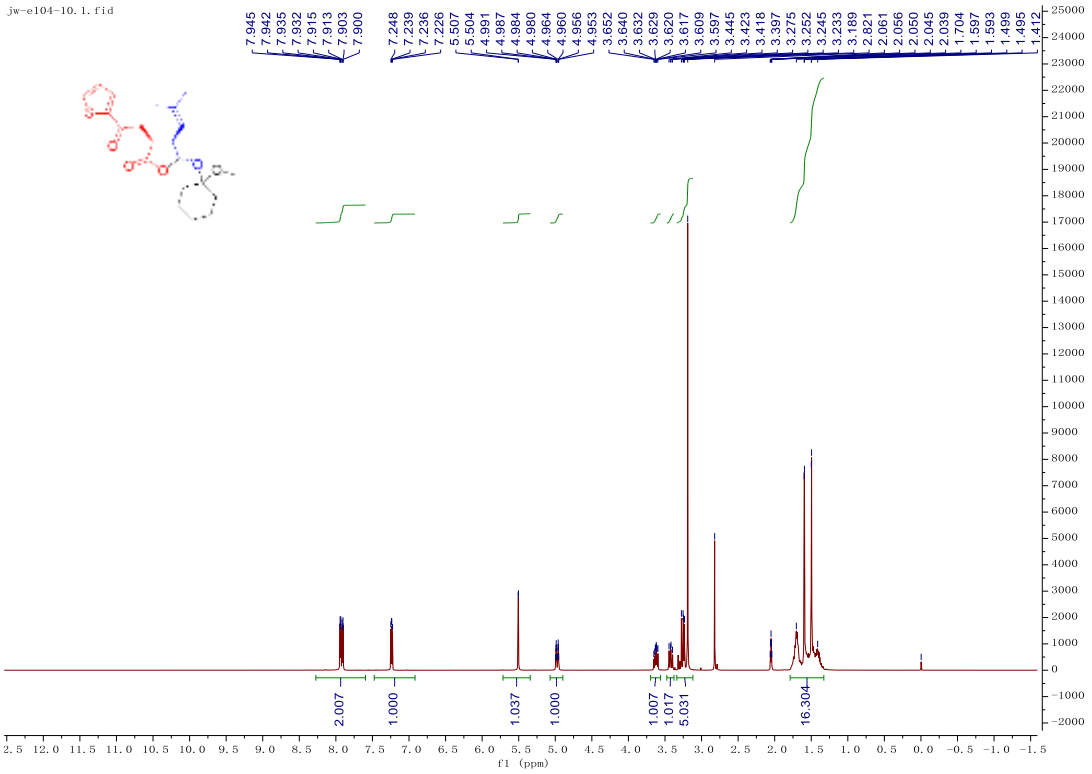
29.338
25.791
23.485
23.359
17.925
f1 (ppm)


jw-e104-10.1.fid
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4.956
4.953
3.652
3.640
3.632
3.629
3.620
3.617
3.609
3.597
3.445
3.423
3.418
3.397
3.275
3.252
3.245
3.233
3.189
2.821
2.061
2.056
2.050
2.045
2.039
1.704
1.597
1.593
1.499
1.495
1.412
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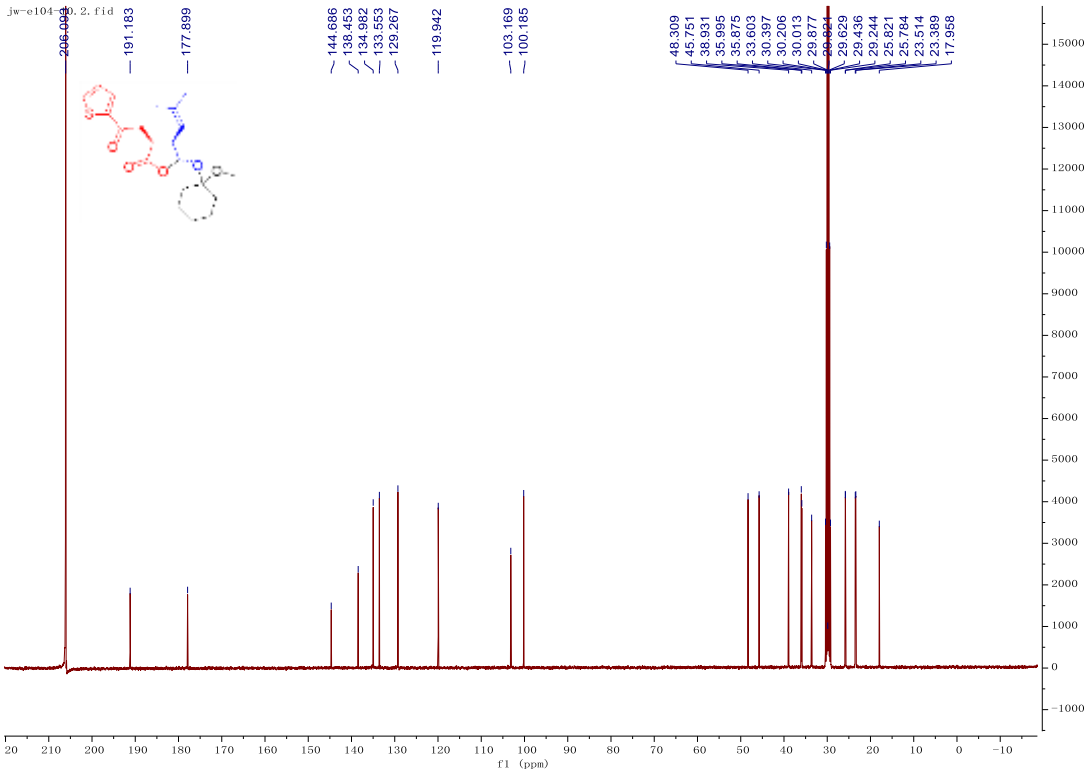
1.037
1.000
1.007
1.017
5.031
16.304
f1 (ppm)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134.982
133.553
129.267
119.942
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100.185
48.309
45.751
38.931
35.995
35.875
33.603
30.397
30.206
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29.629
29.436
29.244
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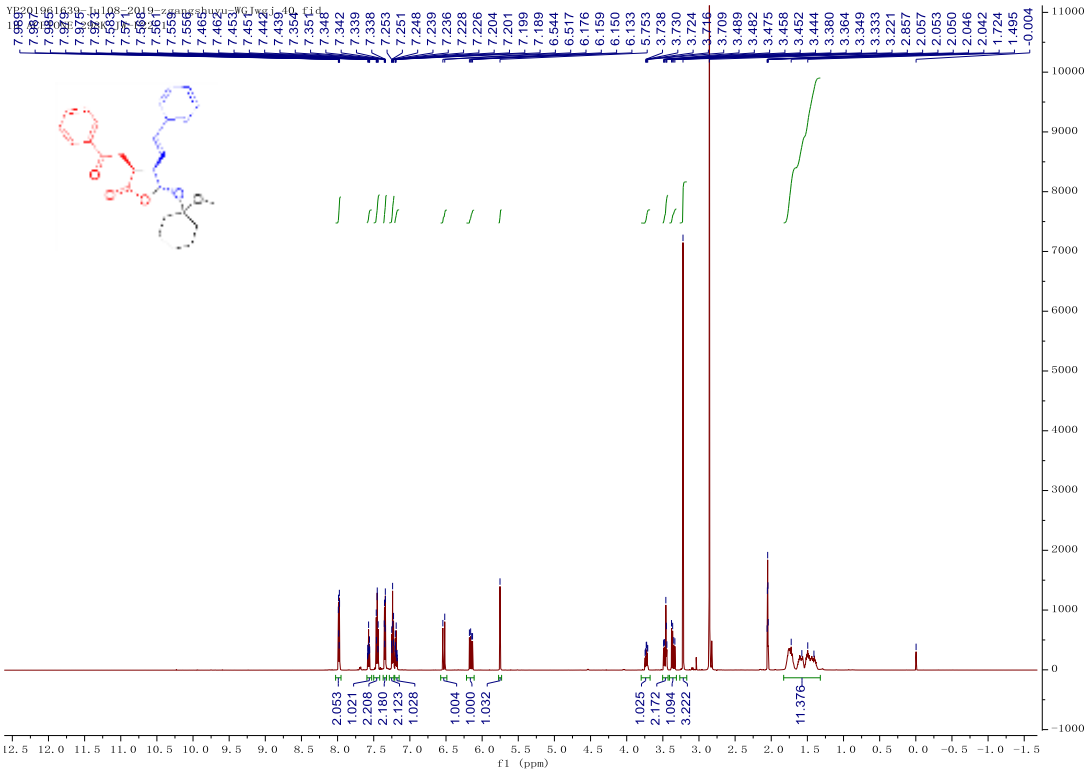
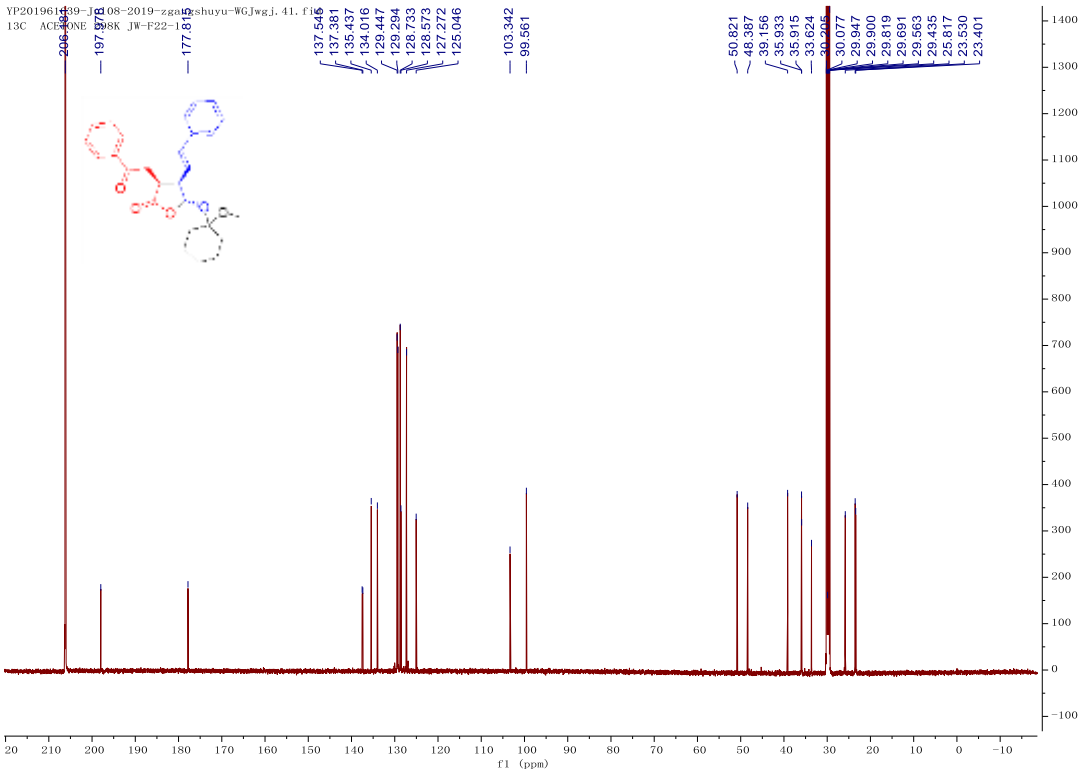
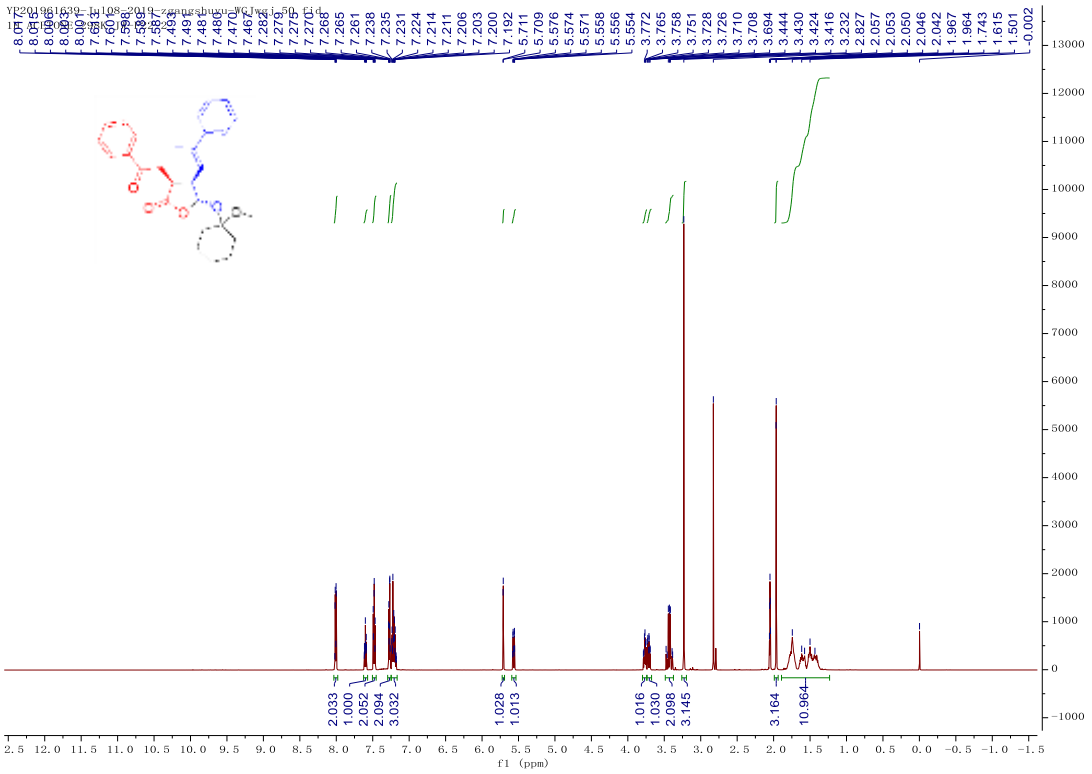
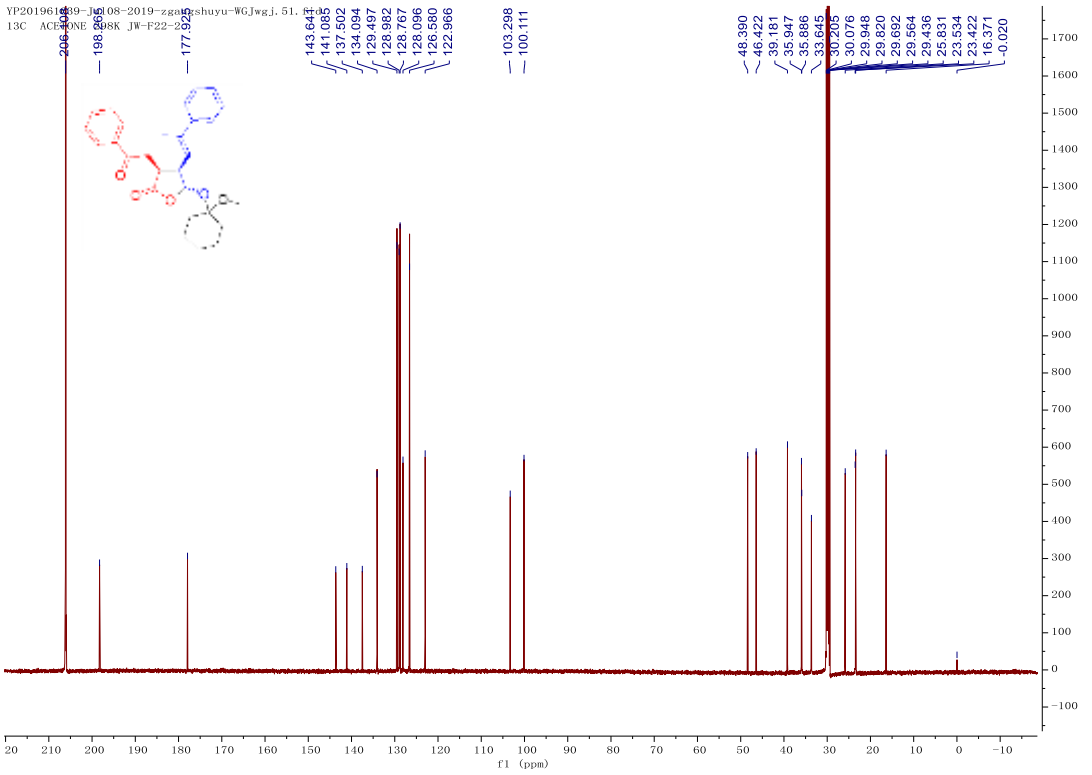
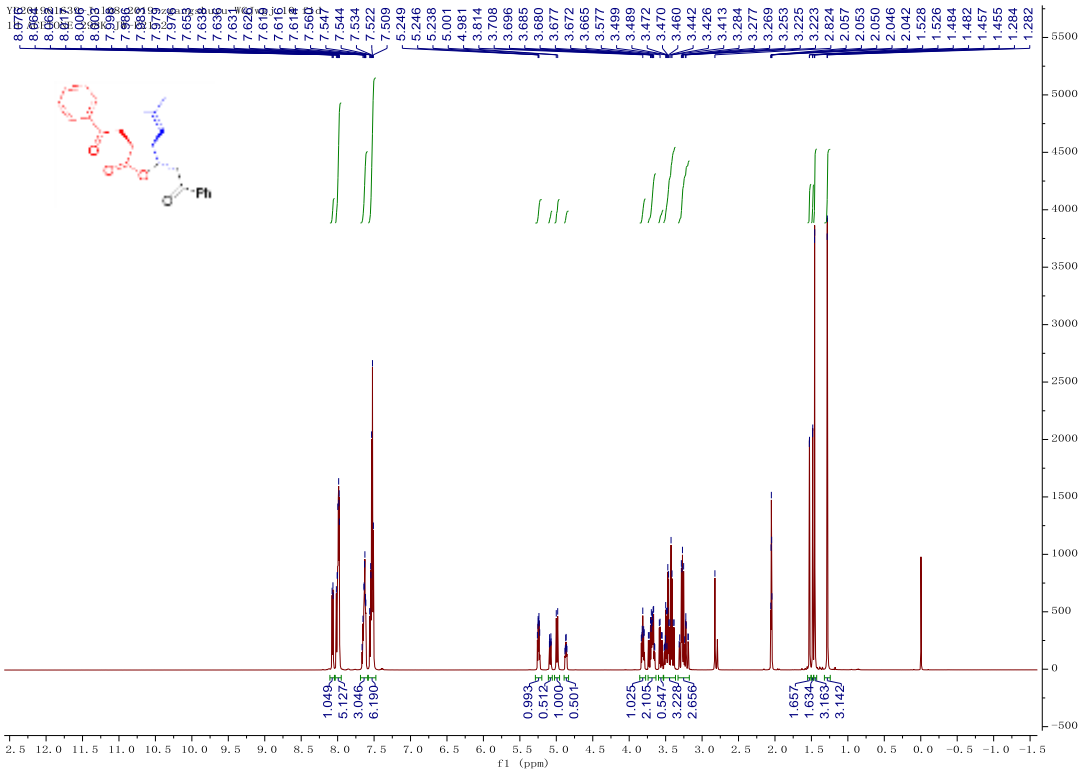
23.389
17.958
f1 (ppm)

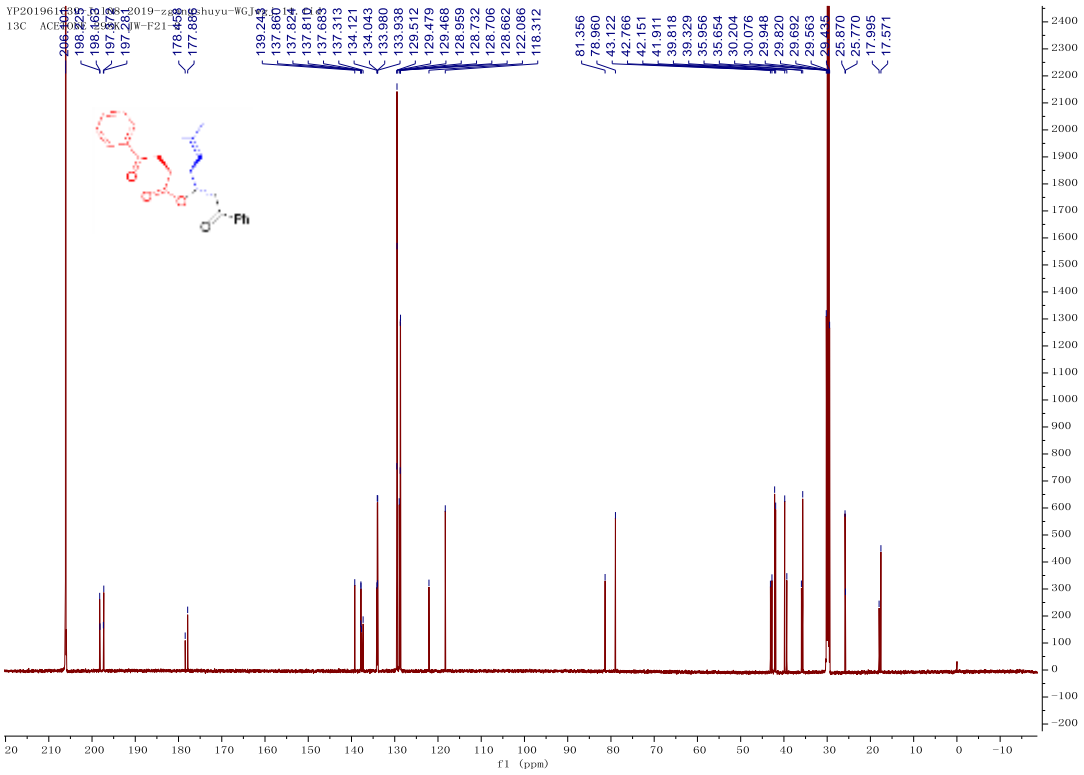


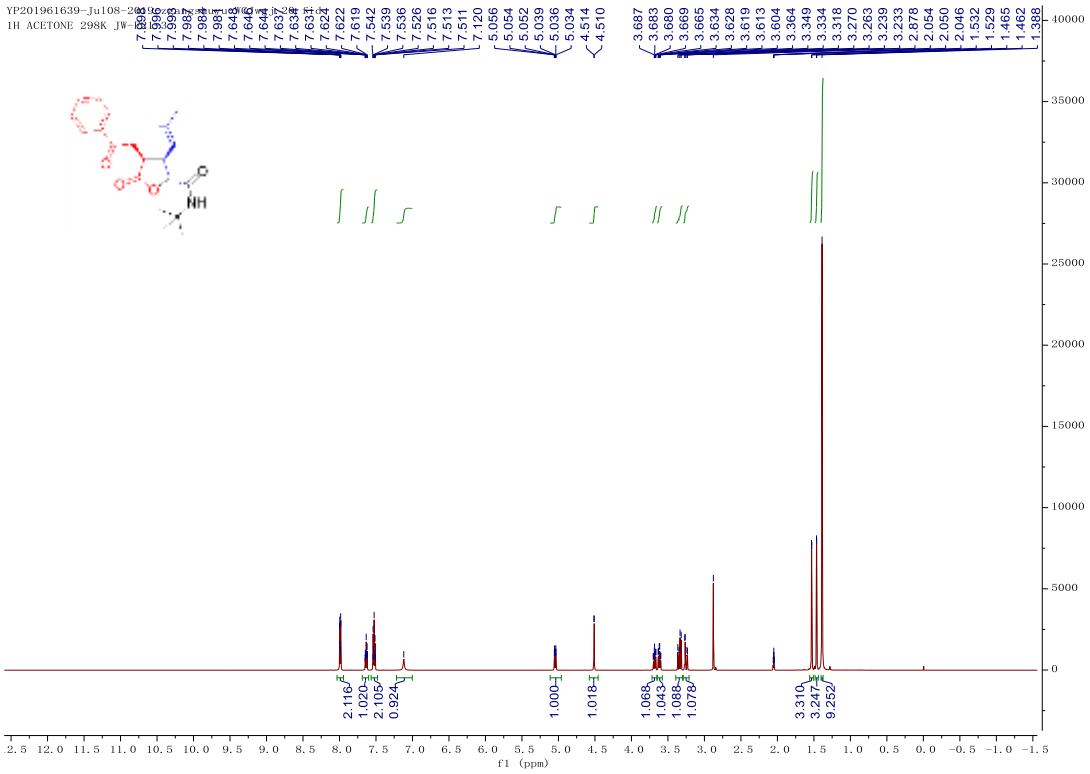


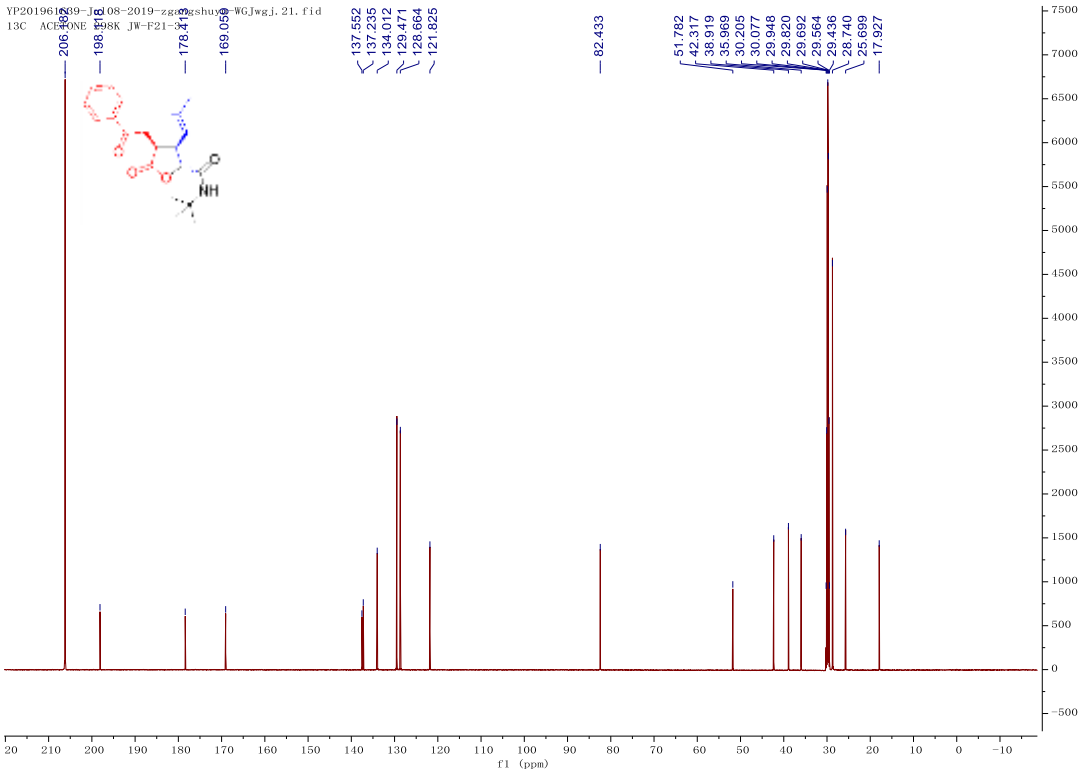


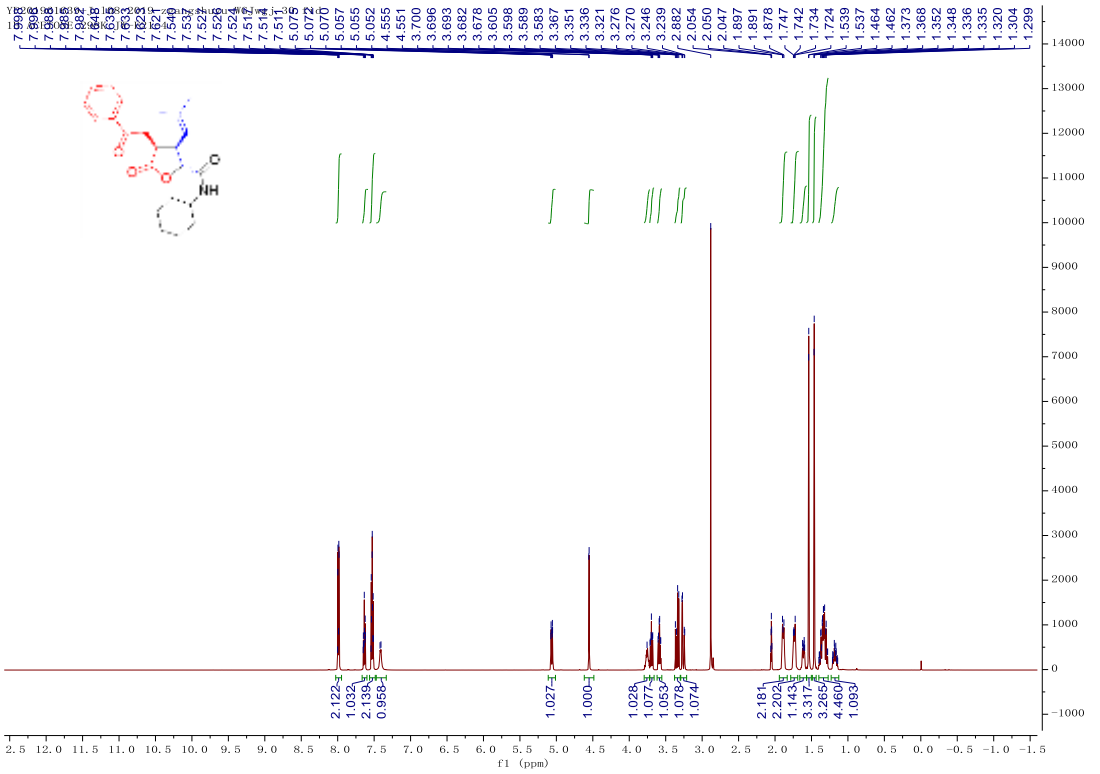


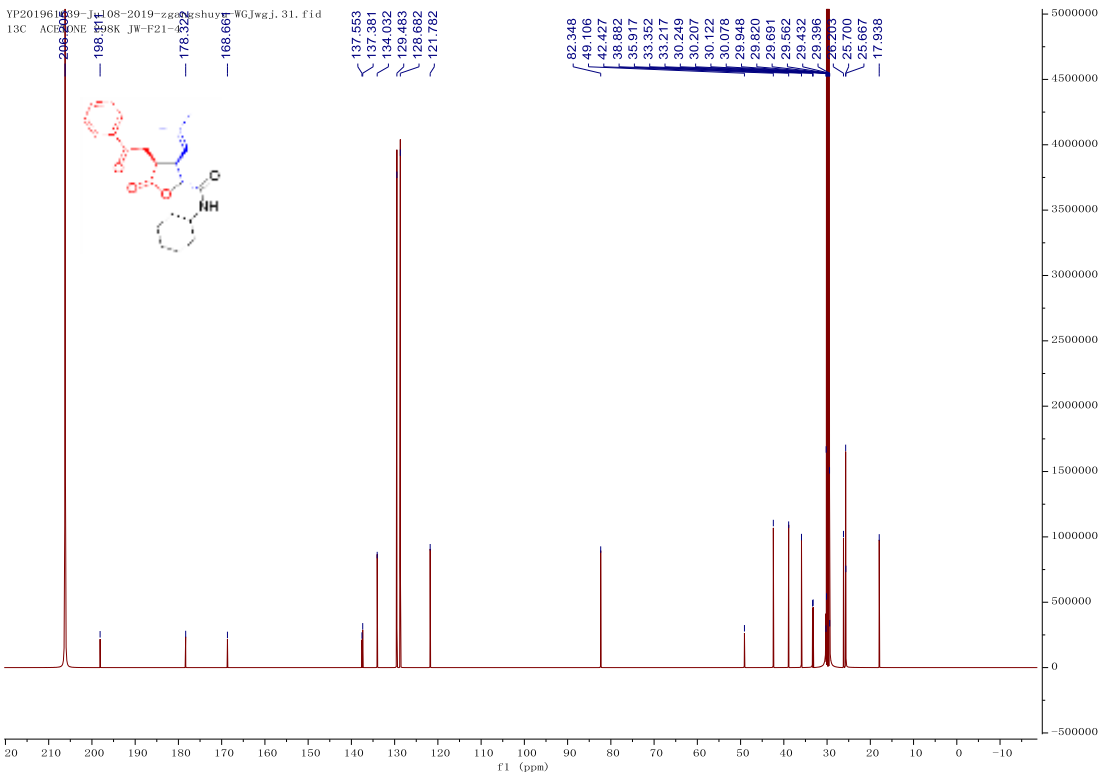




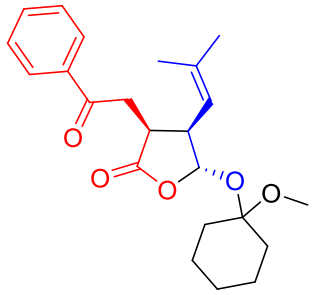




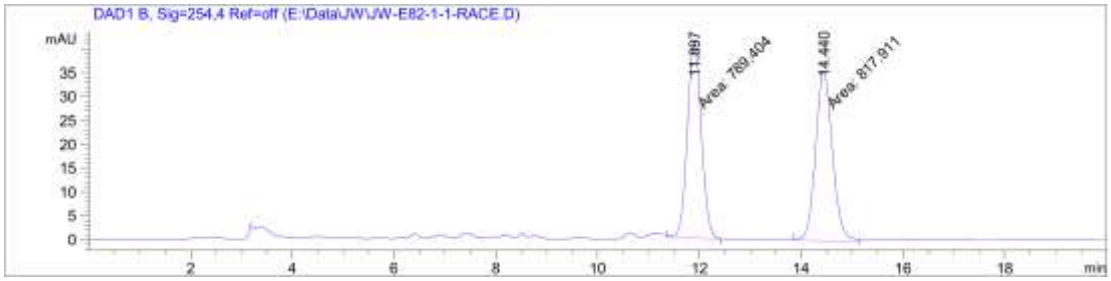




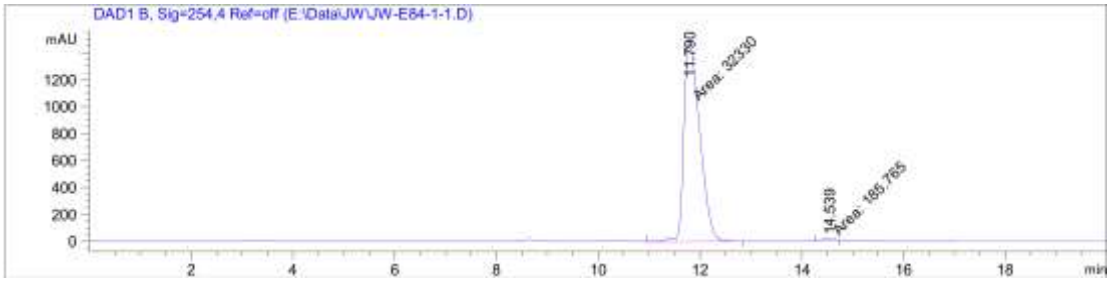
8 HPLC and UPC Trace



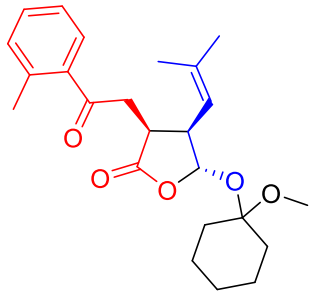
3a:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



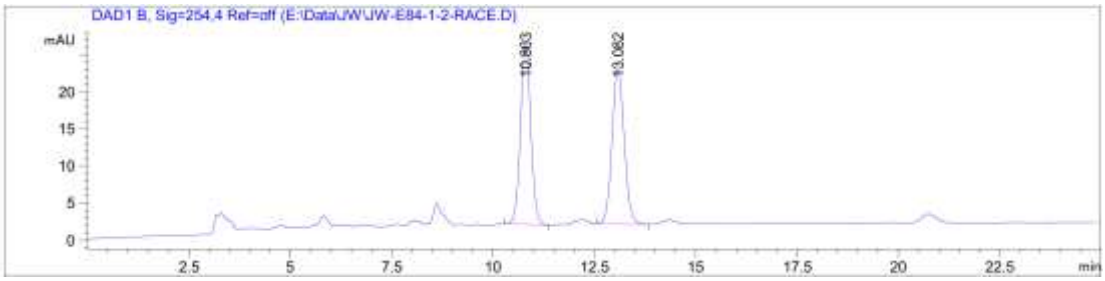
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.897	MM	0.3183	789.40442	41.33144	49.1132
2	14.440	MM	0.3846	817.91071	35.44087	50.8868
Totals :				1607.31512	76.77231	



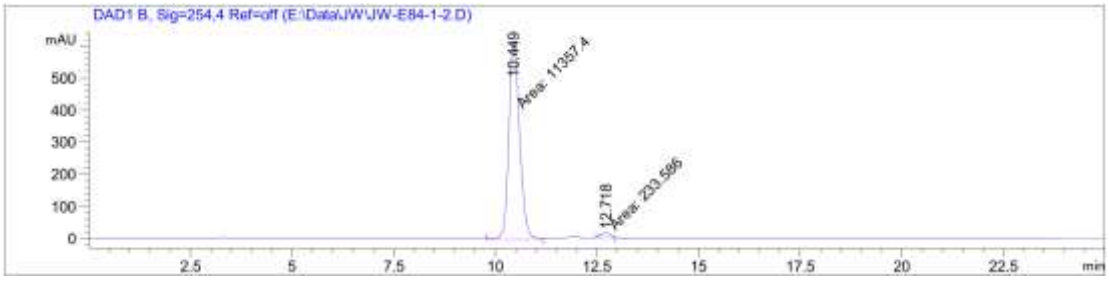
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.790	MM	0.3622	3.23300e4	1487.55579	99.4287
2	14.539	MM	0.2510	185.76512	12.33290	0.5713
Totals :				3.25158e4	1499.88869	



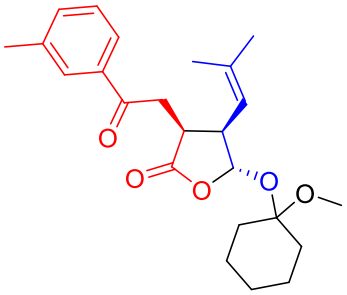
3b:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



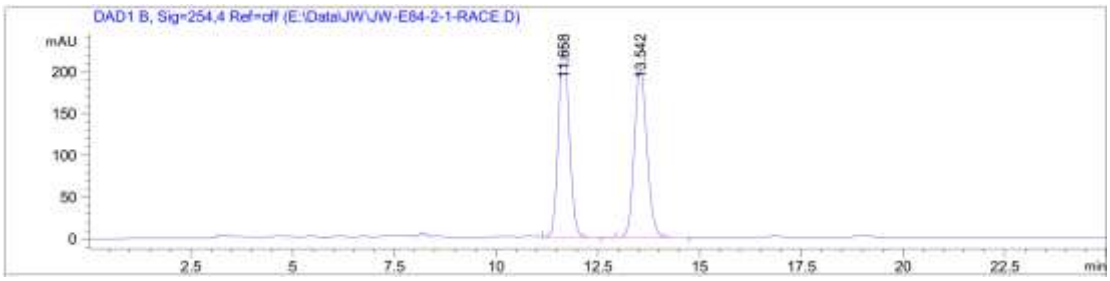
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.803	BB	0.2717	433.50116	24.58685	49.8537
2	13.082	BB	0.3194	436.04602	21.06939	50.1463
Totals :				869.54718	45.65624	



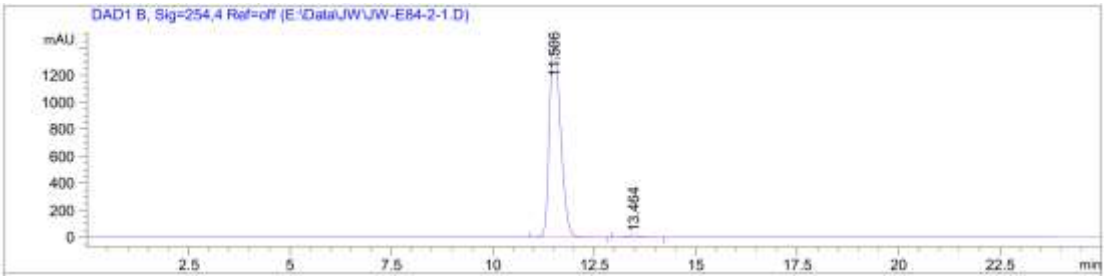
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.449	MM	0.3071	1.13574e4	616.39551	97.9848
2	12.718	MM	0.2762	233.58632	14.09410	2.0152
Totals :				1.15910e4	630.48961	



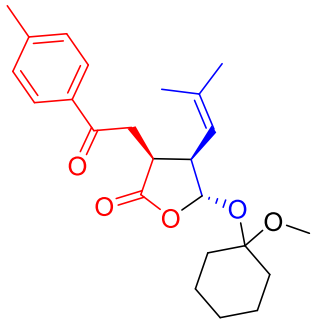
3c:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



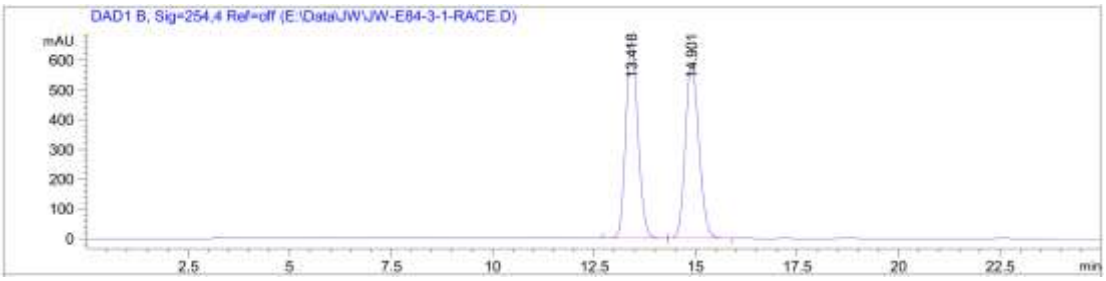
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.658	BB	0.2864	4299.24219	231.75517	49.9366
2	13.542	BB	0.3338	4310.15088	201.26230	50.0634
Totals :				8609.39307	433.01747	



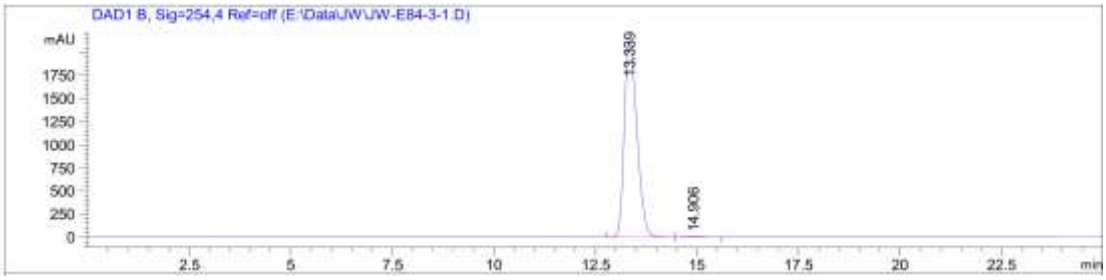
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.506	BB	0.2960	2.76020e4	1450.67505	99.1542
2	13.464	BB	0.3276	235.45113	11.18593	0.8458
Totals :				2.78375e4	1461.86098	



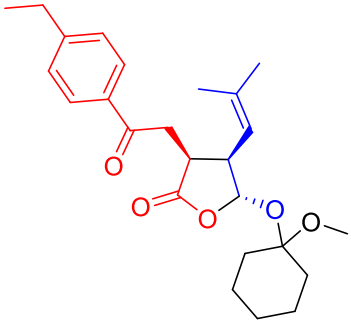
3d:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



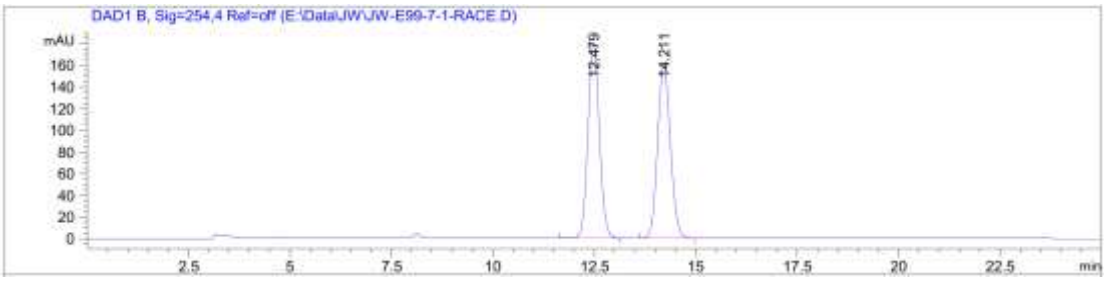
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.418	BB	0.3269	1.37980e4	657.20258	50.2394
2	14.901	BB	0.3594	1.36665e4	591.74060	49.7606
Totals :				2.74645e4	1248.94318	



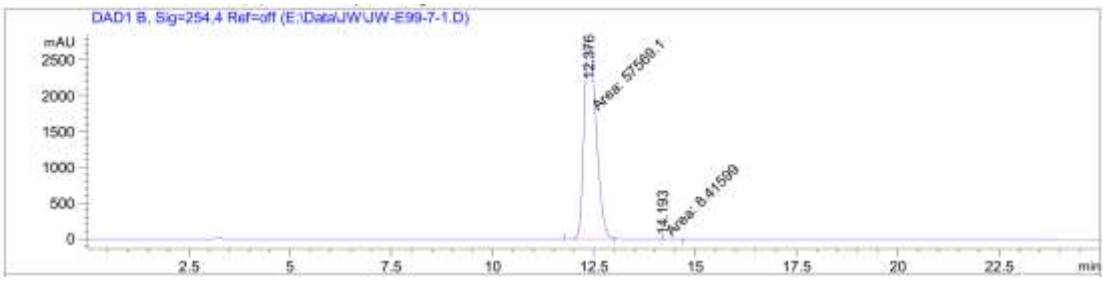
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.339	BB	0.3357	4.57579e4	2121.21924	99.3006
2	14.906	BB	0.3304	322.26904	15.13663	0.6994
Totals :				4.60801e4	2136.35586	



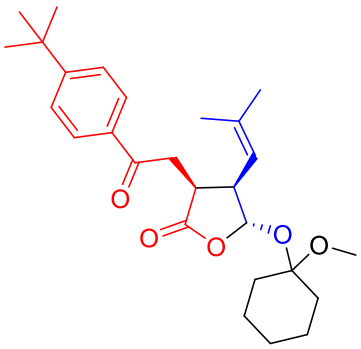
3e:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



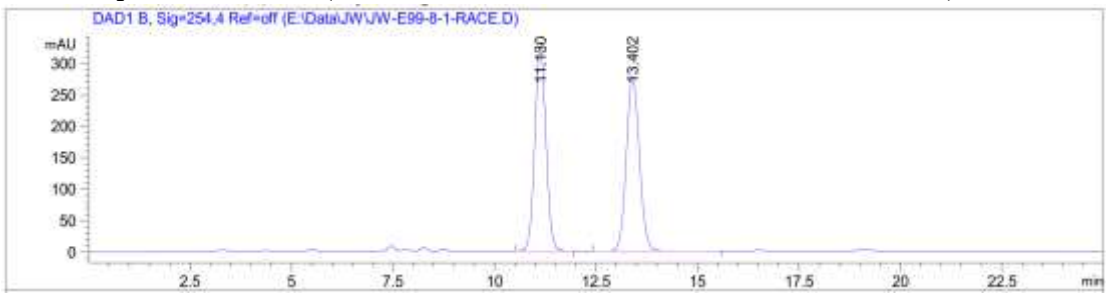
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.479	BB	0.3035	3518.38867	180.40329	50.0917
2	14.211	BB	0.3396	3505.50854	159.99940	49.9083
Totals :				7023.89722	340.40269	



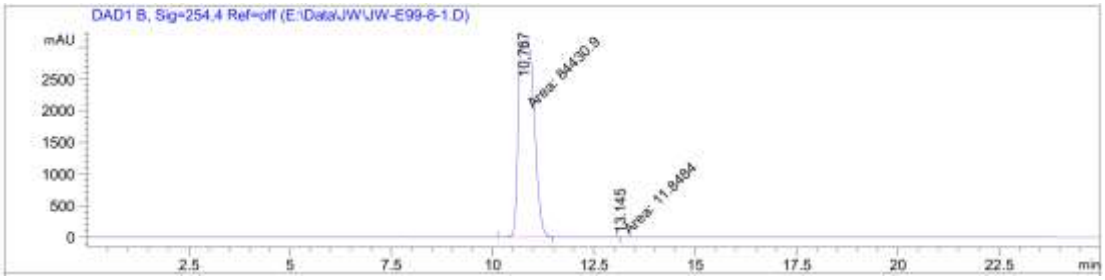
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.376	MF	0.3522	5.75691e4	2724.35913	99.9854
2	14.193	MF	0.2980	8.41599	4.70726e-1	0.0146
Totals :				5.75776e4	2724.82986	



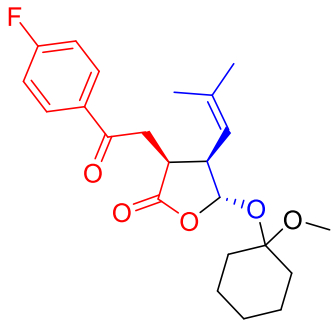
3f:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



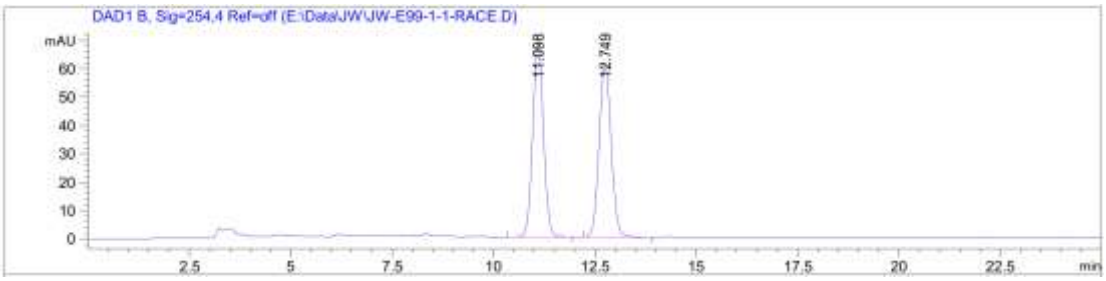
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.130	BB	0.2938	6169.54980	324.50223	49.9167
2	13.402	BB	0.3491	6190.15088	276.58530	50.0833
Totals :				1.23597e4	601.08752	



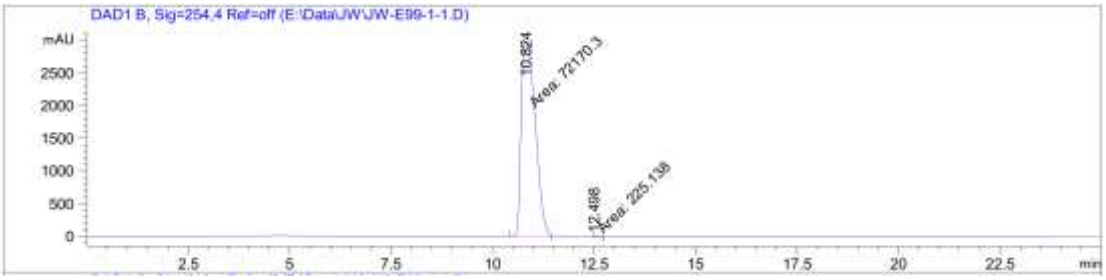
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.767	MF	0.4552	8.44309e4	3091.12769	99.9860
2	13.145	MM	0.0484	11.84841	4.08243	0.0140
Totals :				8.44428e4	3095.21012	



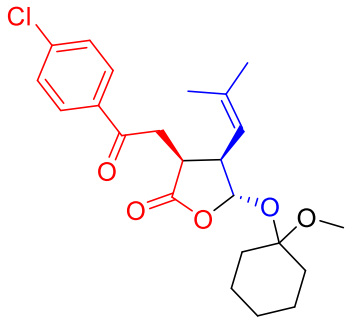
3g:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



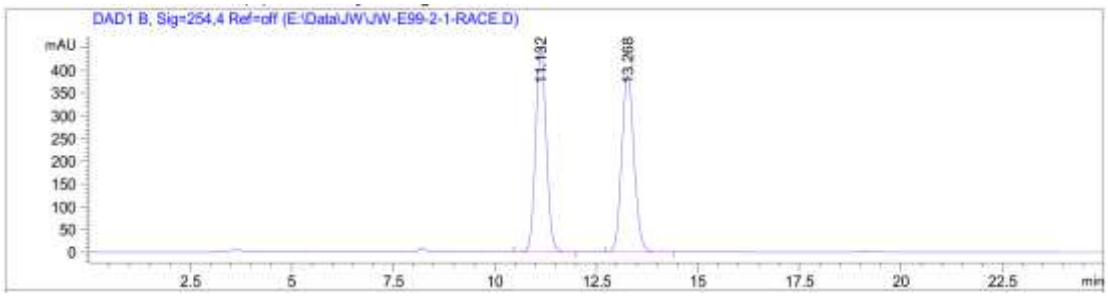
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.098	BB	0.2858	1268.06055	68.54590	50.1027
2	12.749	BB	0.3208	1262.86108	61.18249	49.8973
Totals :				2530.92163	129.72839	



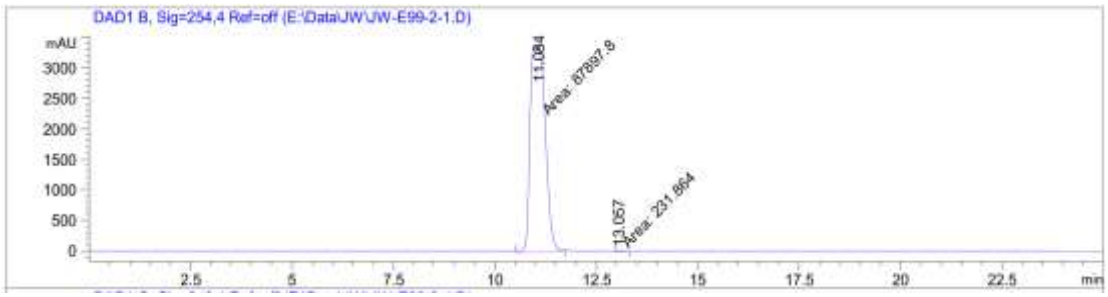
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.824	MF	0.4036	7.21703e4	2980.41772	99.6890
2	12.498	MM	0.1661	225.13841	16.13249	0.3110
Totals :				7.23954e4	2996.55022	



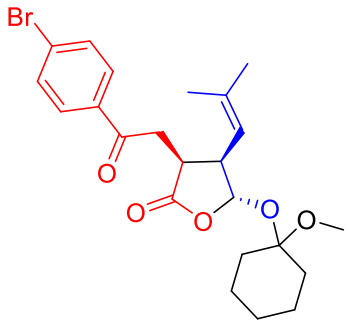
3h:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



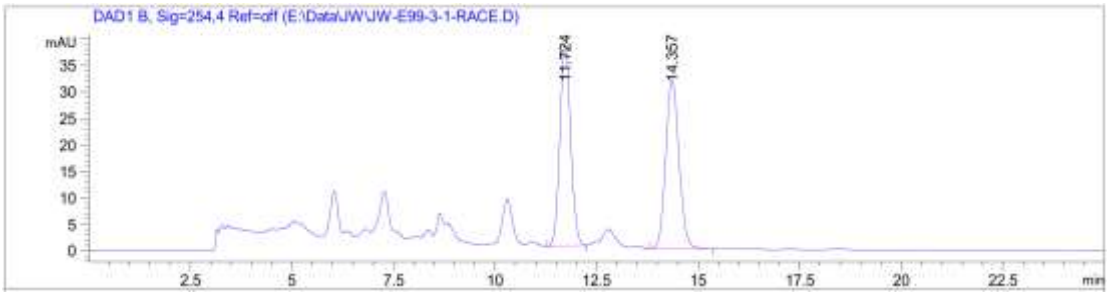
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.132	BB	0.2831	8247.19434	451.50742	50.0410
2	13.268	BB	0.3291	8233.68066	388.78067	49.9590
Totals :				1.64809e4	840.28809	



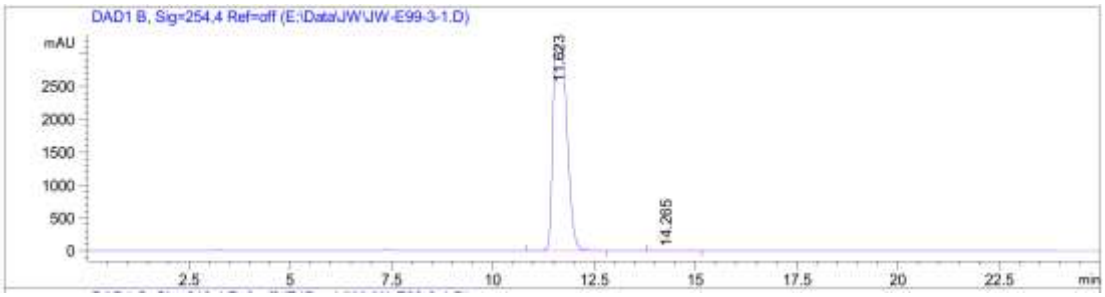
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.084	MM	0.4306	8.78978e4	3401.79541	99.7369
2	13.057	MM	0.1485	231.86388	18.97810	0.2631
Totals :				8.81297e4	3420.77351	



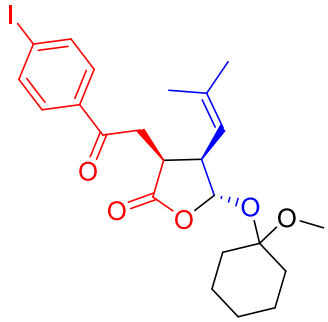
3i:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



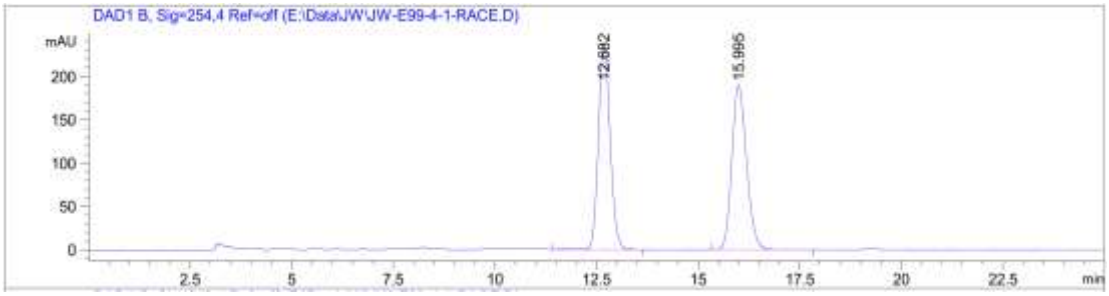
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.724	BB	0.2857	704.49622	38.10728	49.1746
2	14.357	BB	0.3514	728.14734	32.00572	50.8254
Totals :				1432.64355	70.11300	



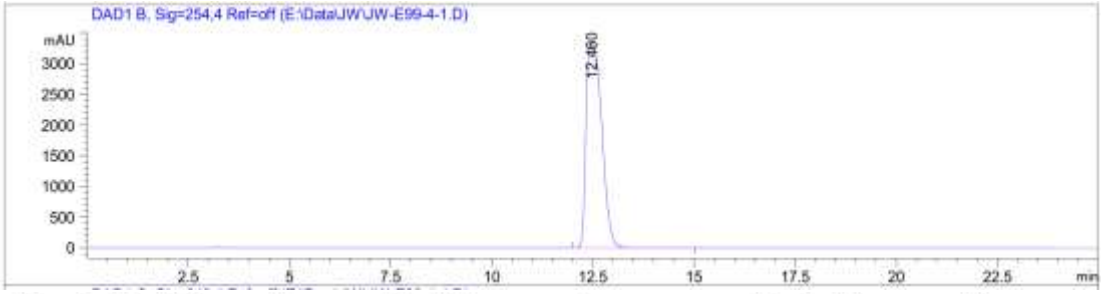
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.623	BB	0.3839	7.52251e4	3135.63940	99.9473
2	14.265	BB	0.3680	39.67209	1.55320	0.0527
Totals :				7.52648e4	3137.19260	



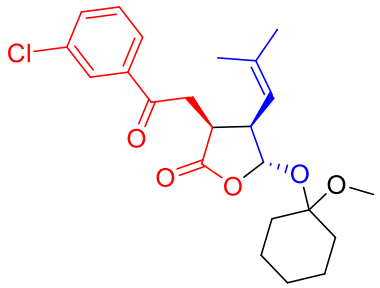
3j:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



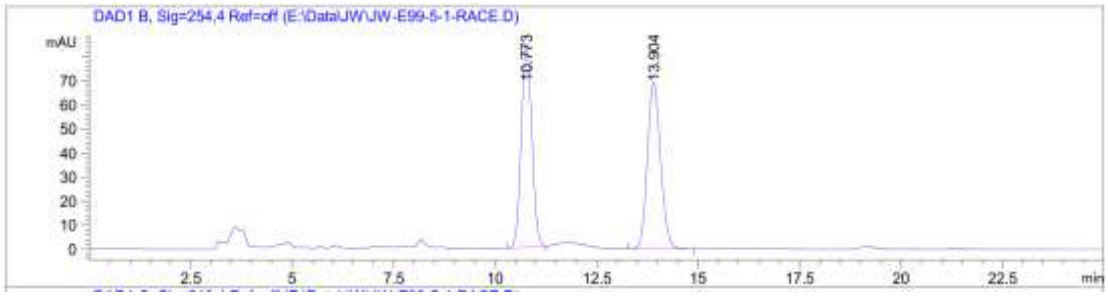
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.682	BB	0.3103	4763.28174	237.21007	50.0259
2	15.995	BB	0.3890	4758.34814	189.48361	49.9741
Totals :				9521.62988	426.69368	



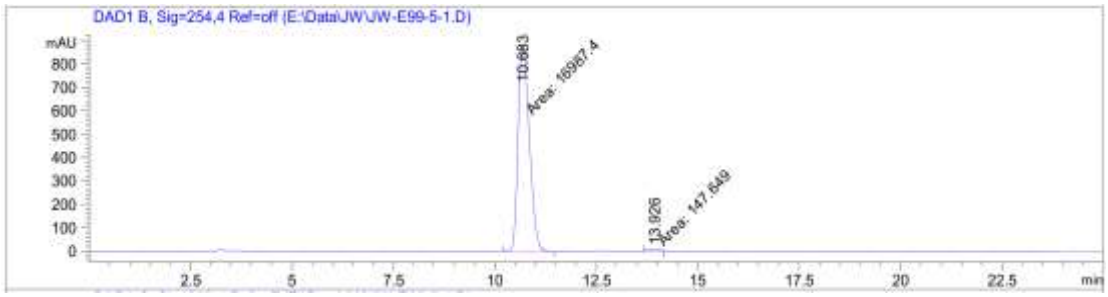
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.460	BB	0.4333	8.99283e4	3348.38623	100.0000
Totals :				8.99283e4	3348.38623	



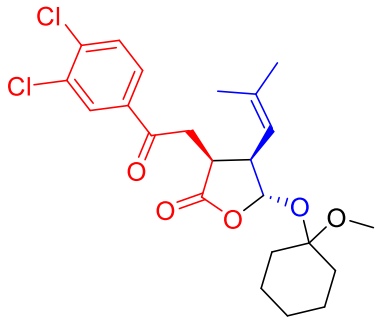
3k:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



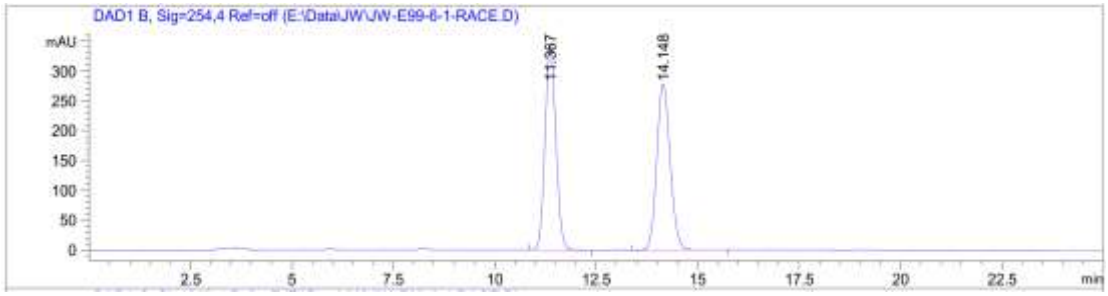
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.773	BB	0.2844	1538.17688	84.50094	49.5347
2	13.904	BB	0.3527	1567.07178	69.06185	50.4653
Totals :				3105.24866	153.56279	



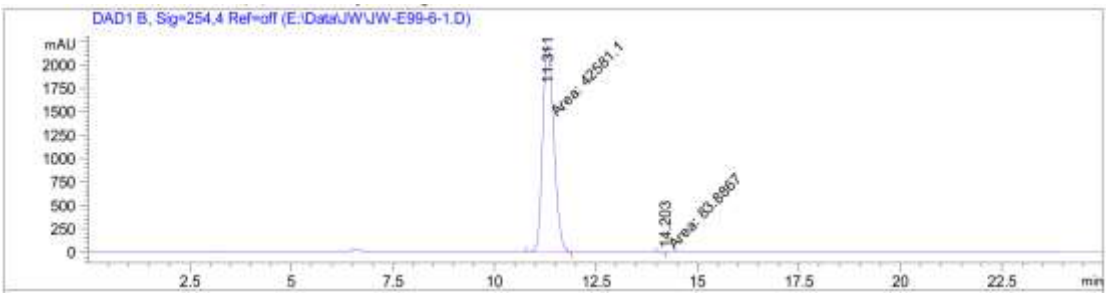
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.683	FM	0.3212	1.69874e4	881.43640	99.1383
2	13.926	MF	0.3344	147.64891	7.35906	0.8617
Totals :				1.71350e4	888.79546	



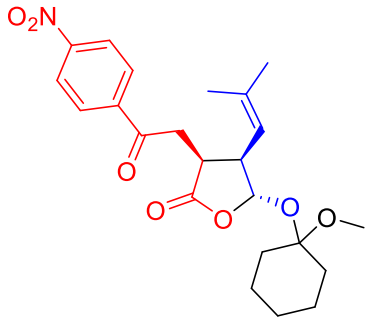
3l:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



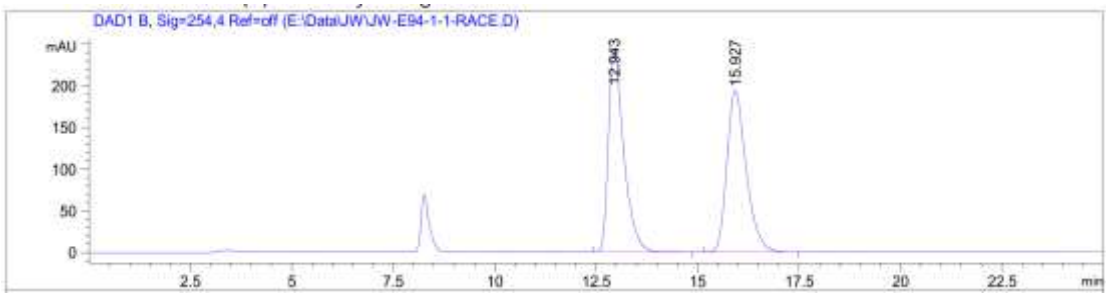
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.367	BB	0.2872	6365.09424	345.07767	50.0226
2	14.148	BB	0.3551	6359.33447	277.72601	49.9774
Totals :				1.27244e4	622.80368	



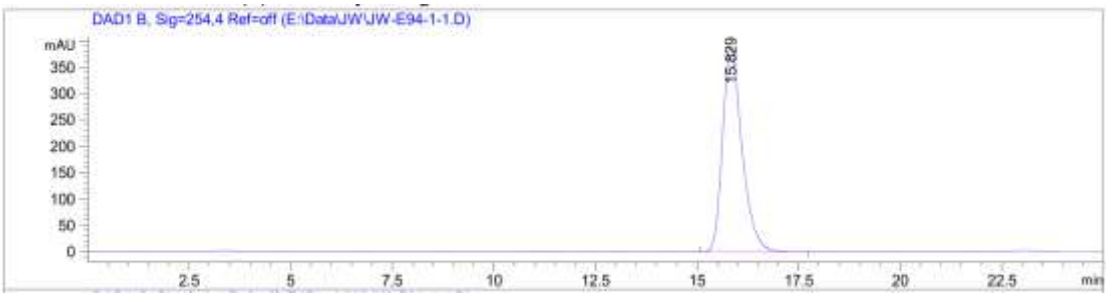
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.311	MF	0.3225	4.25811e4	2200.81909	99.8034
2	14.203	MM	0.1318	83.88667	10.60449	0.1966
Totals :				4.26650e4	2211.42358	



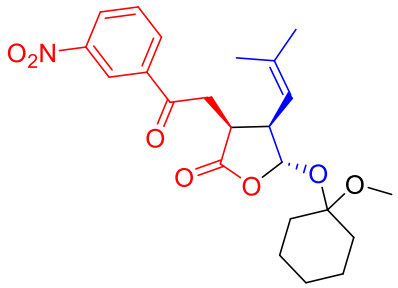
3m:Chiralpak ID Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



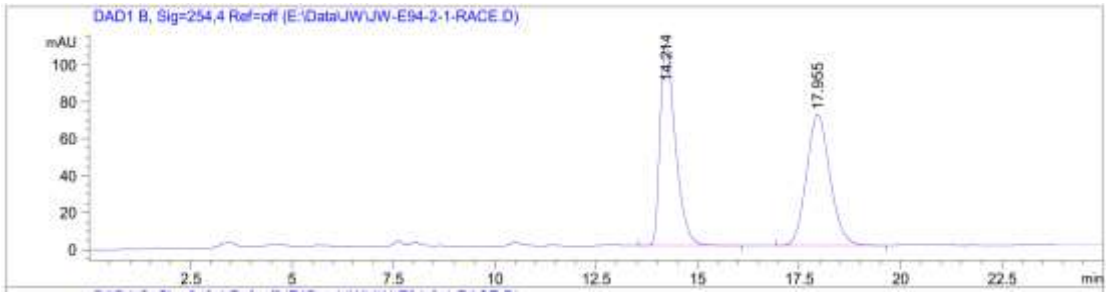
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.943	BB	0.3890	6377.62451	243.97502	49.9664
2	15.927	BB	0.5011	6386.19385	193.48125	50.0336
Totals :				1.27638e4	437.45627	



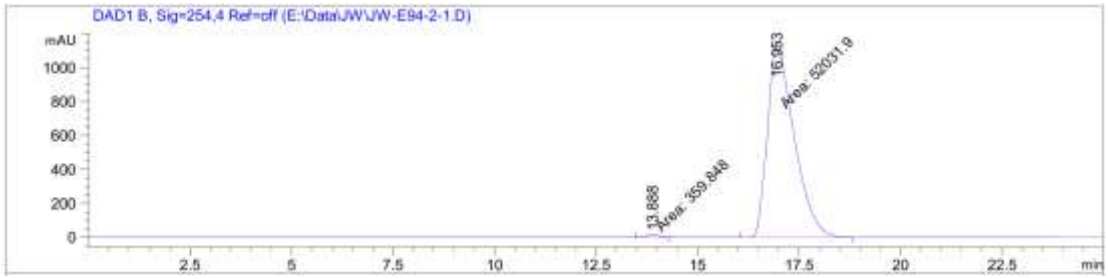
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	15.829	BB	0.5045	1.28553e4	388.03000	100.0000
Totals :				1.28553e4	388.03000	



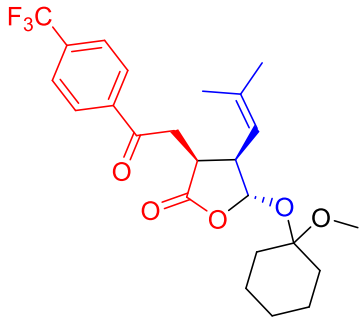
3n:Chiralpak ID Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



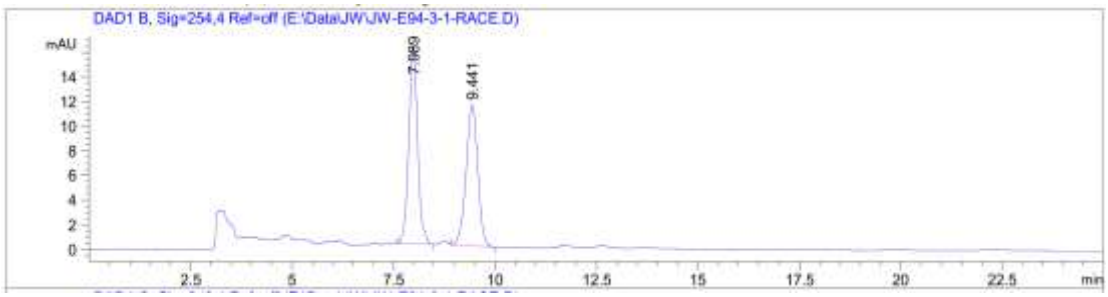
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	14.214	BB	0.3983	2861.28027	108.96965	50.1105
2	17.955	BB	0.6139	2848.65967	71.03410	49.8895
Totals :				5709.93994	180.00375	



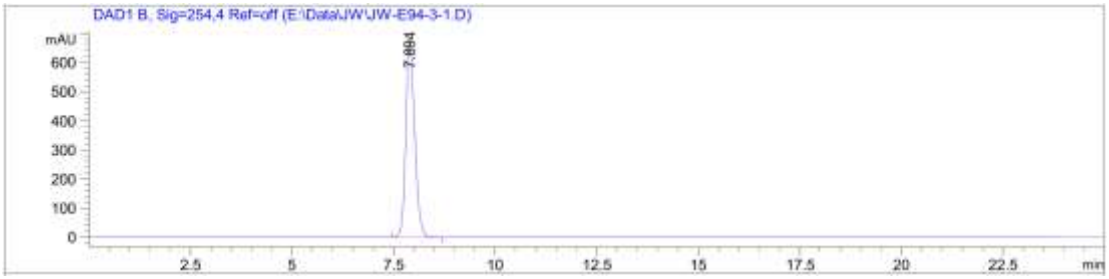
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.888	FM	0.4119	359.84802	14.55895	0.6868
2	16.953	MF	0.7541	5.20319e4	1149.95776	99.3132
Totals :				5.23918e4	1164.51672	



3o:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)

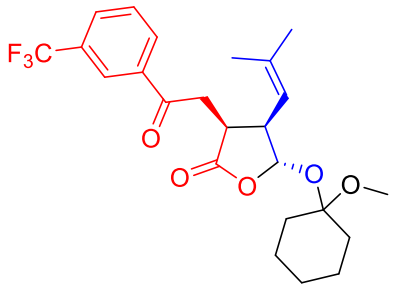


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.989	BB	0.2306	243.11800	16.06452	51.5596
2	9.441	BB	0.3060	228.41016	11.48444	48.4404
Totals :				471.52815	27.54897	

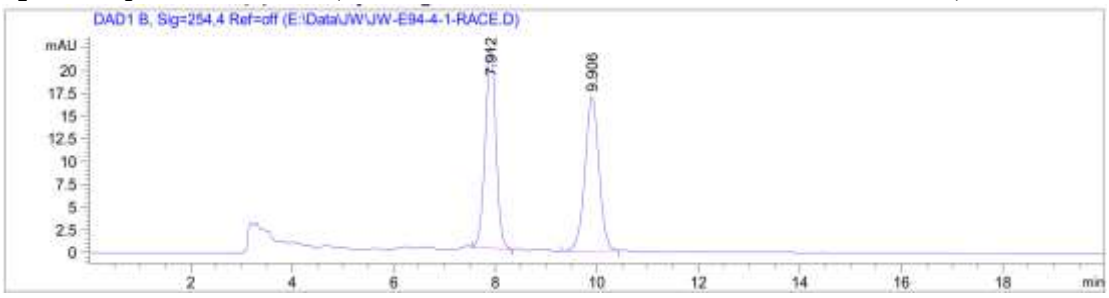


Signal 1: DAD1 B, Sig=254,4 Ref=off

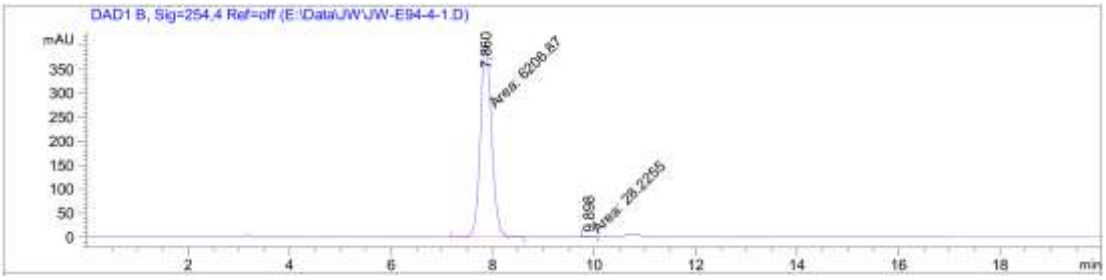
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.894	BB	0.2338	1.02558e4	672.95502	100.0000
Totals :				1.02558e4	672.95502	



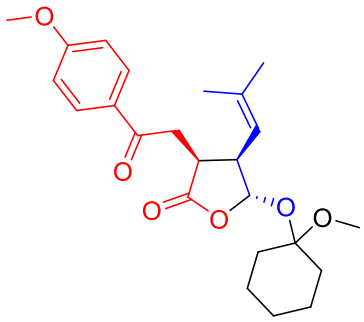
3p:Chiralpak IC Column (*n*-hexane/*i*-PrOH=90/10, 1.0 ml/min, λ=254 nm)



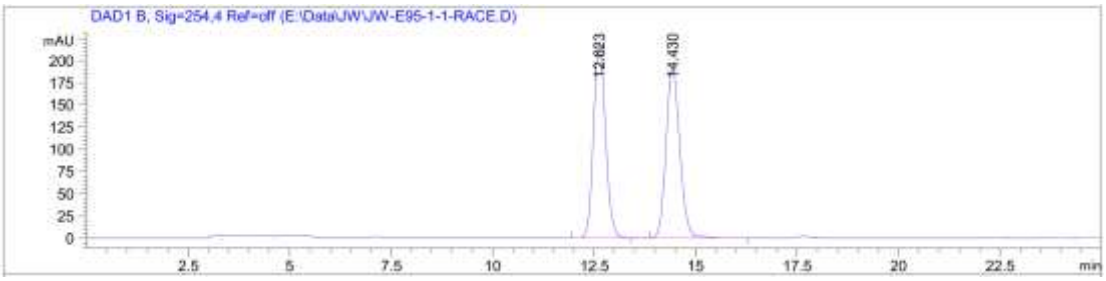
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.912	BB	0.2251	323.60822	22.06915	49.7979
2	9.906	BB	0.2918	326.23505	17.00517	50.2021
Totals :				649.84326	39.07432	



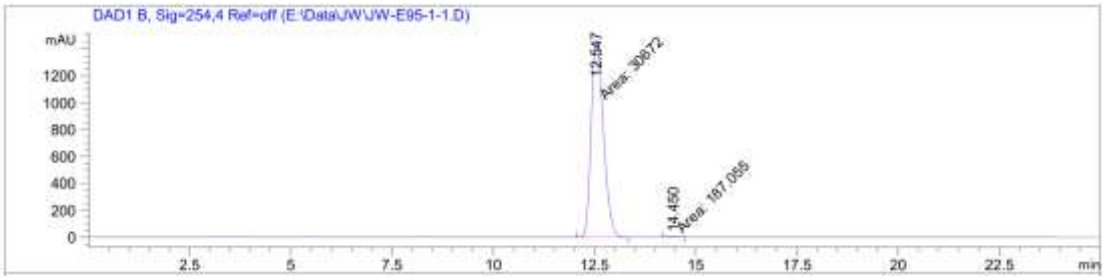
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.860	MF	0.2534	6206.86768	408.21896	99.5473
2	9.898	MF	0.2557	28.22549	1.83951	0.4527
Totals :				6235.09317	410.05848	



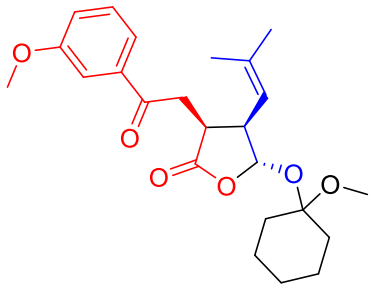
3q:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



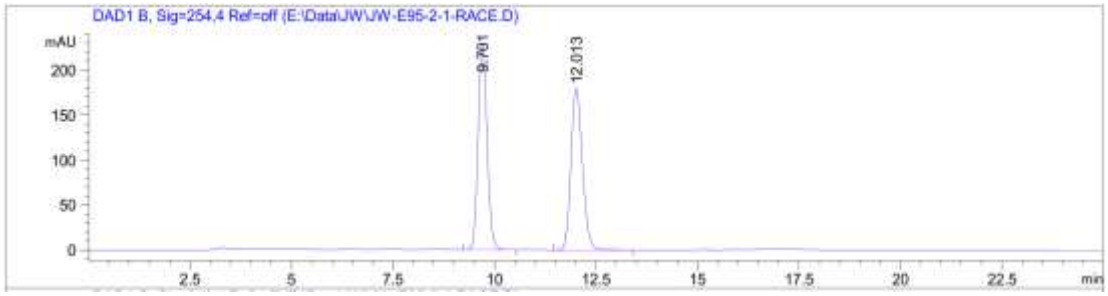
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.623	BB	0.3166	4490.36475	219.54633	49.8591
2	14.430	BB	0.3677	4515.74365	191.06319	50.1409
Totals :				9006.10840	410.60951	



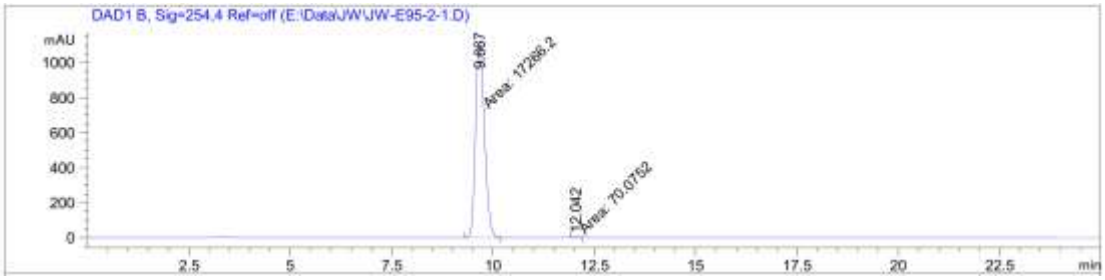
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.547	FM	0.3515	3.06720e4	1454.32239	99.3938
2	14.450	MF	0.3541	187.05470	8.80346	0.6062
Totals :				3.08591e4	1463.12585	



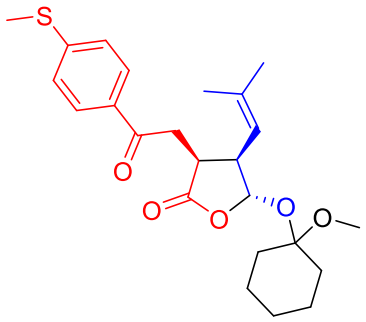
3r:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



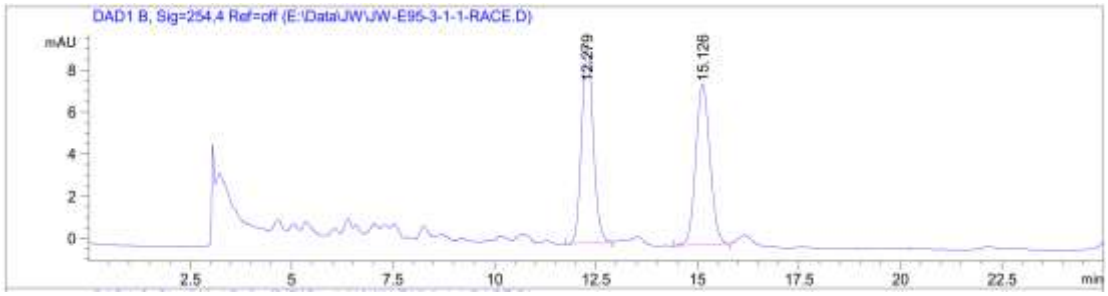
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.701	BB	0.2385	3502.60767	228.86508	49.9747
2	12.013	BB	0.3018	3506.15137	179.60115	50.0253
Totals :				7008.75903	408.46623	



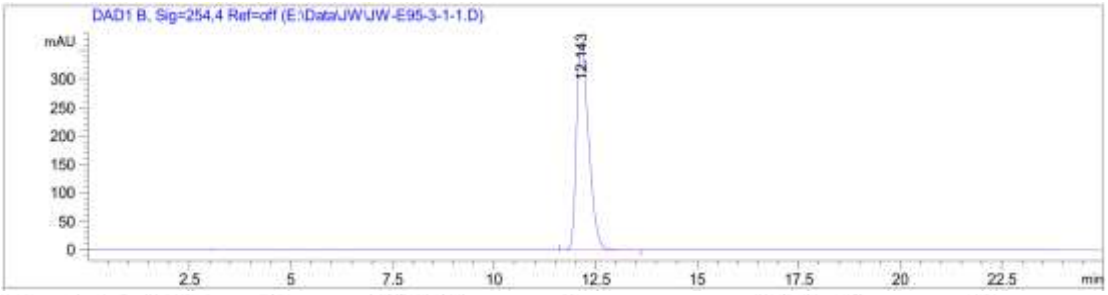
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.667	FM	0.2570	1.72662e4	1119.67480	99.5958
2	12.042	MF	0.2270	70.07519	5.14586	0.4042
Totals :				1.73362e4	1124.82067	



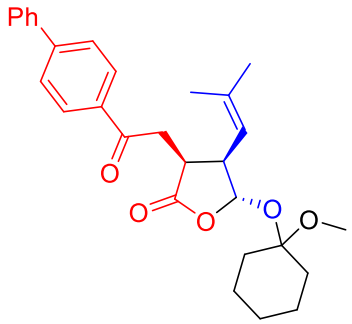
3s:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



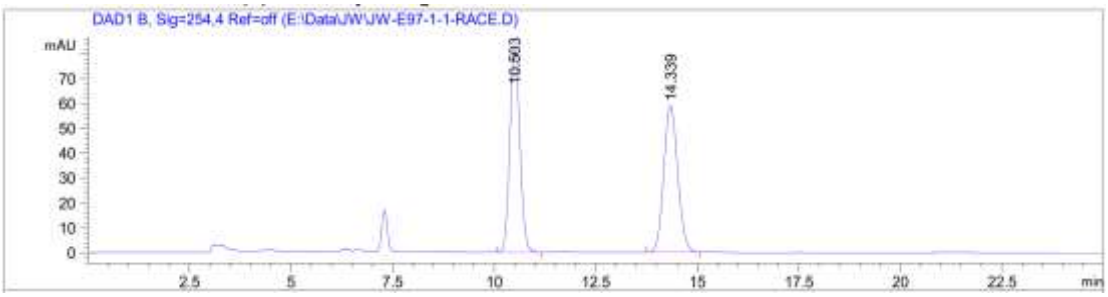
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.279	BB	0.3052	187.51254	9.46132	50.3367
2	15.126	BB	0.3790	185.00409	7.62806	49.6633
Totals :				372.51663	17.08939	



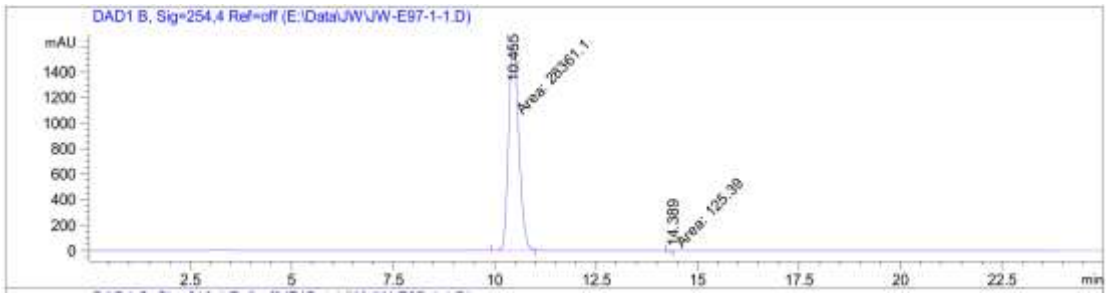
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.143	BB	0.3220	7597.25977	363.32620	100.0000
Totals :				7597.25977	363.32620	



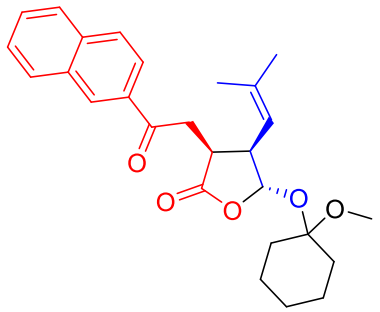
3t:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



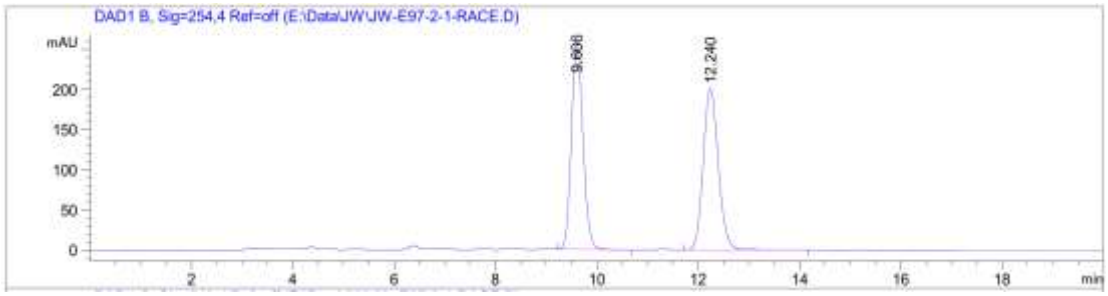
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.503	BB	0.2683	1418.22461	82.58879	50.1363
2	14.339	BB	0.3702	1410.51550	59.14673	49.8637
Totals :				2828.74011	141.73552	



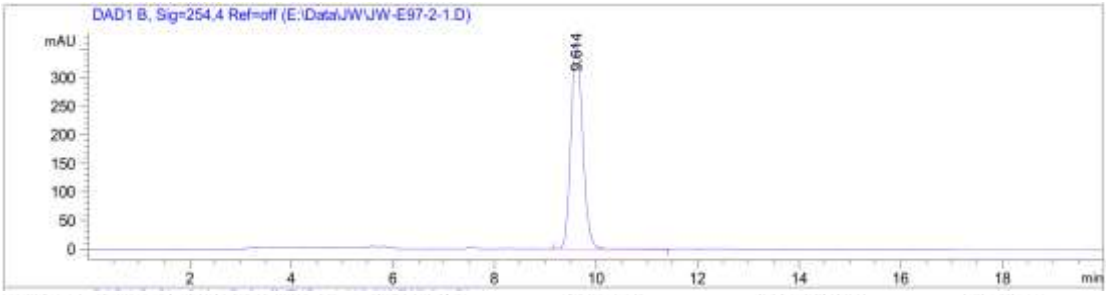
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.455	MF	0.2920	2.83611e4	1618.54102	99.5598
2	14.389	MM	0.1691	125.39048	12.35615	0.4402
Totals :				2.84864e4	1630.89717	



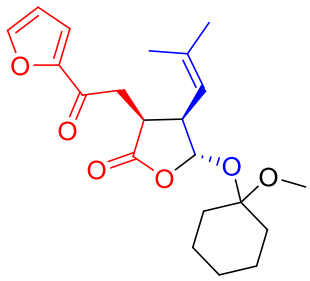
3u:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



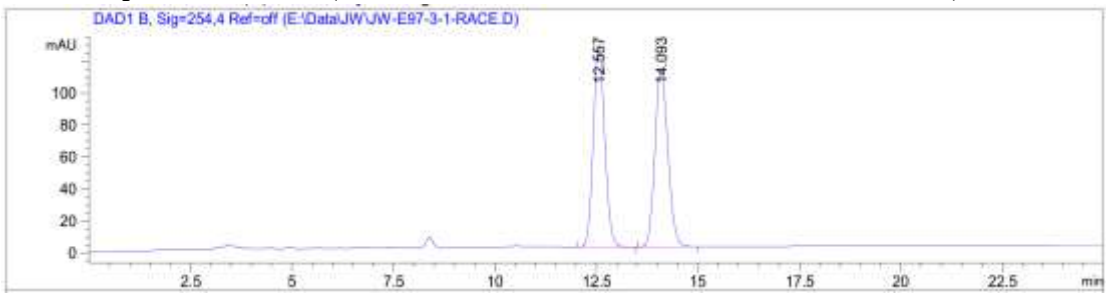
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.606	BB	0.2458	4069.45166	255.53871	49.4333
2	12.240	BB	0.3211	4162.75830	201.47086	50.5667
Totals :				8232.20996	457.00957	



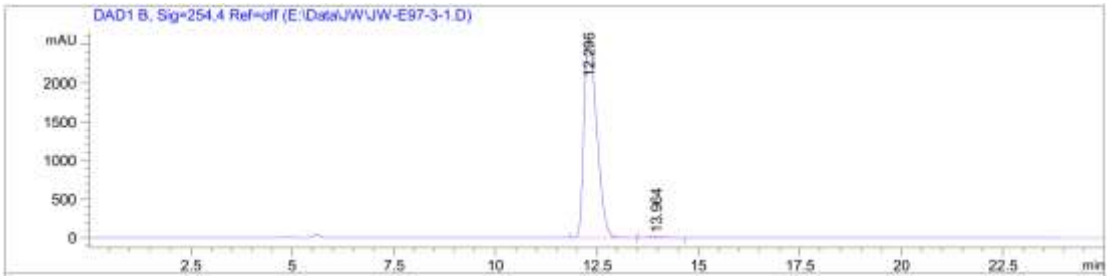
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.614	BB	0.2499	5799.76611	360.19412	100.0000
Totals :				5799.76611	360.19412	



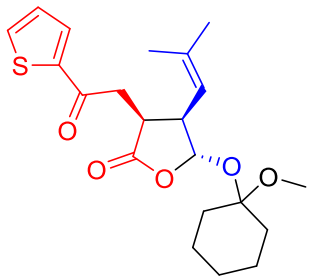
3v:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



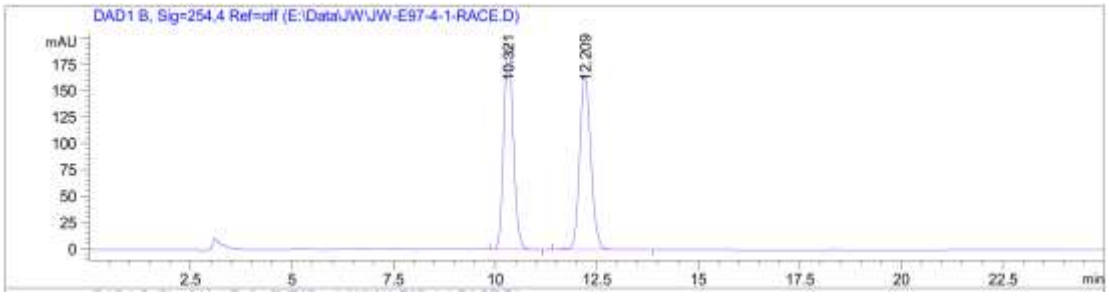
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.557	BB	0.3057	2466.32666	125.24831	50.0551
2	14.093	BB	0.3453	2460.89307	110.70823	49.9449
Totals :				4927.21973	235.95654	



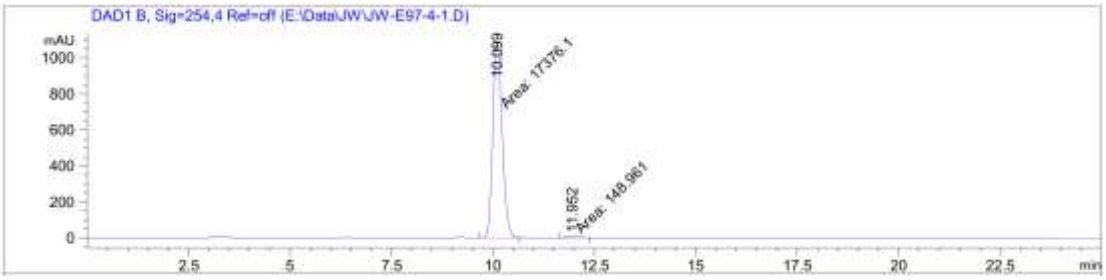
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.296	BB	0.3474	5.59028e4	2534.04443	99.5573
2	13.964	BB	0.3486	248.55556	11.12542	0.4427
Totals :				5.61514e4	2545.16986	



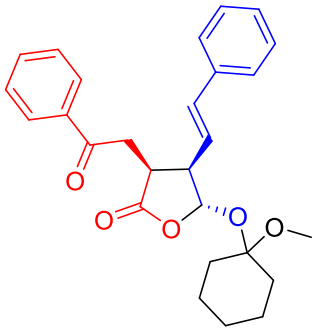
3w:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



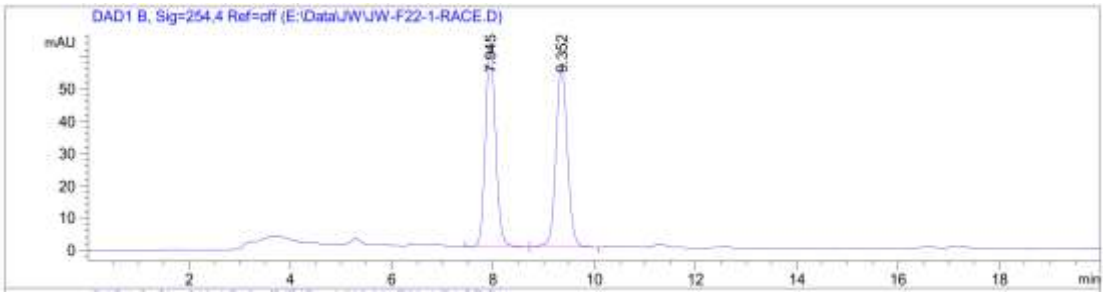
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.321	BB	0.2515	3178.94360	195.68979	49.8778
2	12.209	BB	0.2965	3194.52100	166.00899	50.1222
Totals :				6373.46460	361.69878	



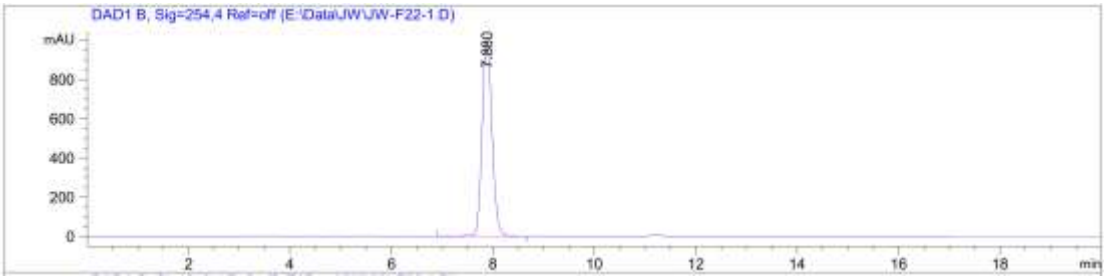
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.099	MF	0.2664	1.73761e4	1087.14819	99.1500
2	11.952	MF	0.3102	148.96147	8.00249	0.8500
Totals :				1.75251e4	1095.15069	



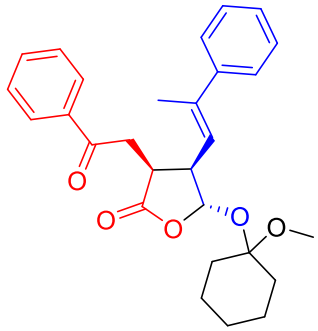
3x:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



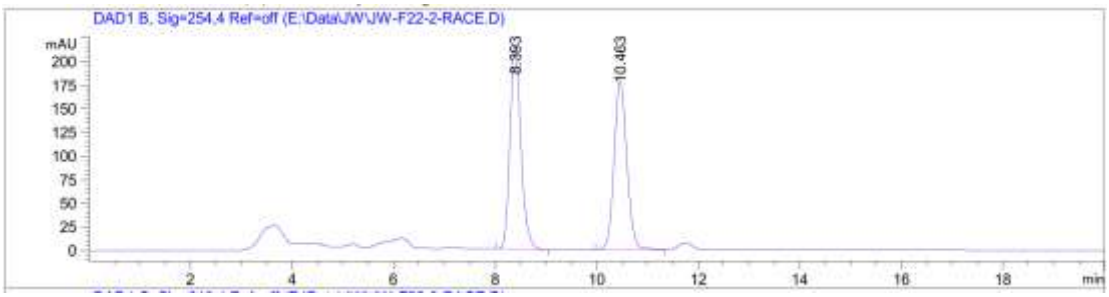
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.945	BB	0.2143	871.77960	62.66162	49.6739
2	9.352	BB	0.2396	883.22638	56.73471	50.3261
Totals :				1755.00598	119.39633	



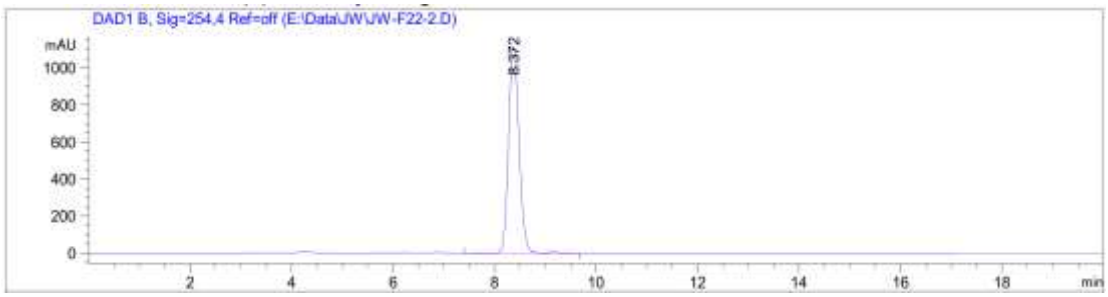
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.880	VB R	0.2103	1.35647e4	995.50220	100.0000
Totals :				1.35647e4	995.50220	



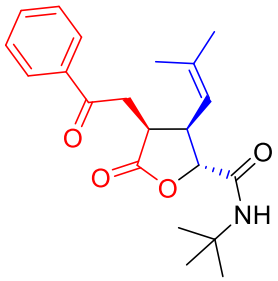
3y:Chiralpak IC Column (*n*-hexane/*i*-PrOH=80/20, 1.0 ml/min, λ=254 nm)



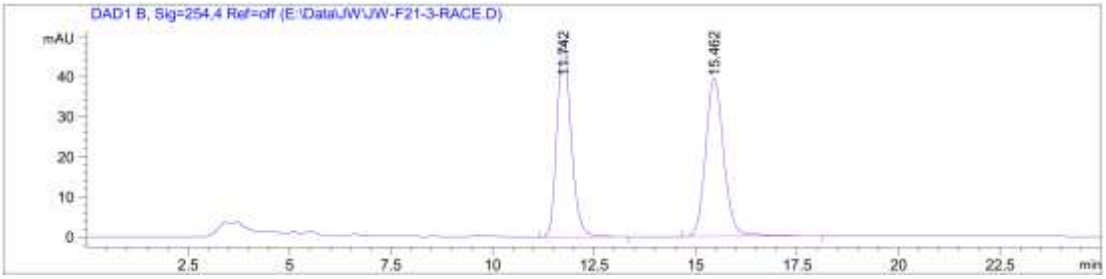
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.393	BB	0.2313	3233.55957	215.26169	50.9801
2	10.463	BB	0.2717	3109.22925	178.07690	49.0199
Totals :				6342.78882	393.33859	



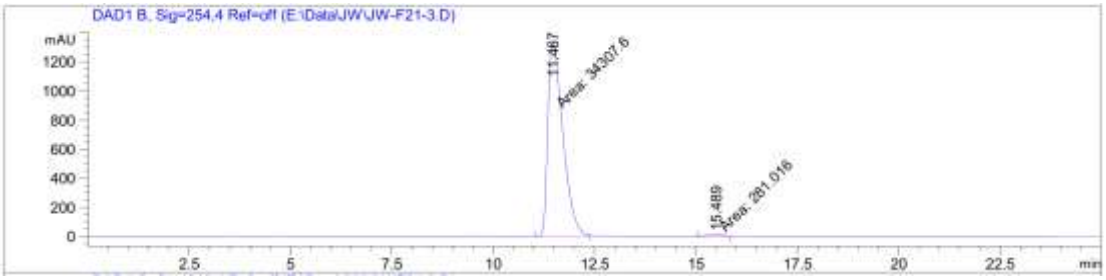
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.372	VV R	0.2227	1.60236e4	1113.00110	100.0000
Totals :				1.60236e4	1113.00110	



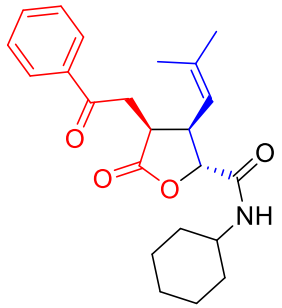
6:Chiralpak IC Column (*n*-hexane/*i*-PrOH=60/40, 1.0 ml/min, λ=254 nm)



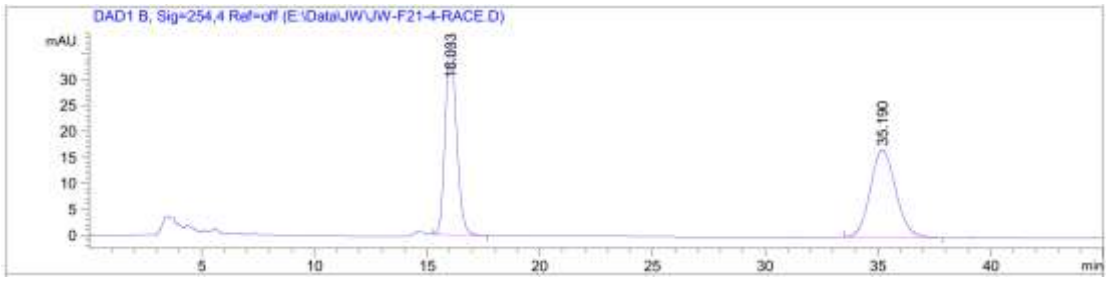
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.742	BB	0.3730	1189.94641	49.06217	49.1242
2	15.462	BB	0.4805	1232.37451	39.44189	50.8758
Totals :				2422.32092	88.50406	



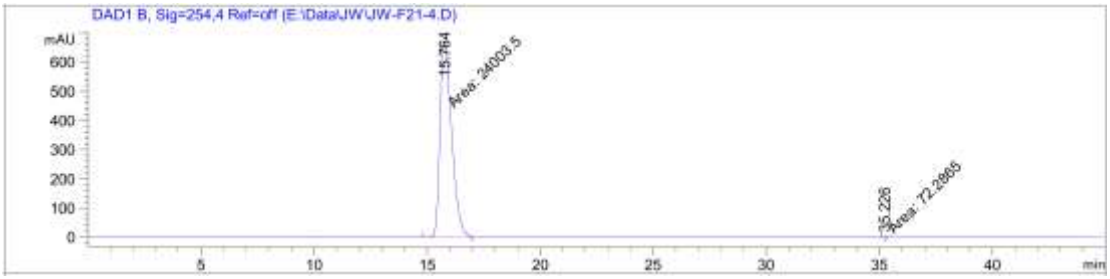
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.467	MF	0.4269	3.43076e4	1339.27563	99.1875
2	15.489	MF	0.4606	281.01611	10.16738	0.8125
Totals :				3.45886e4	1349.44301	



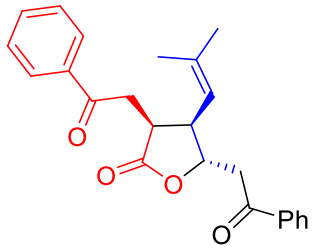
7:Chiralpak IC Column (*n*-hexane/*i*-PrOH=60/40, 1.0 ml/min, λ=254 nm)



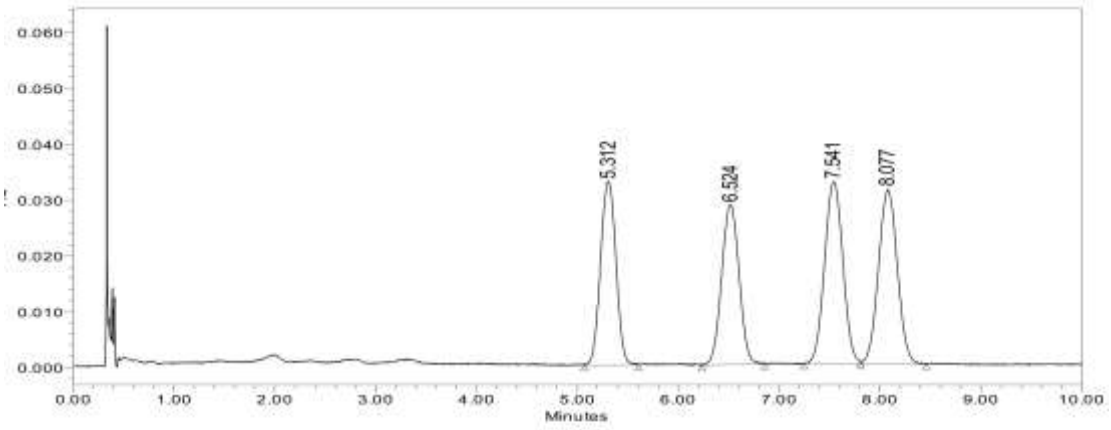
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	16.033	BB	0.5389	1292.24817	37.04837	49.7602
2	35.190	BB	1.1075	1304.70483	16.80935	50.2398
Totals :				2596.95300	53.85772	



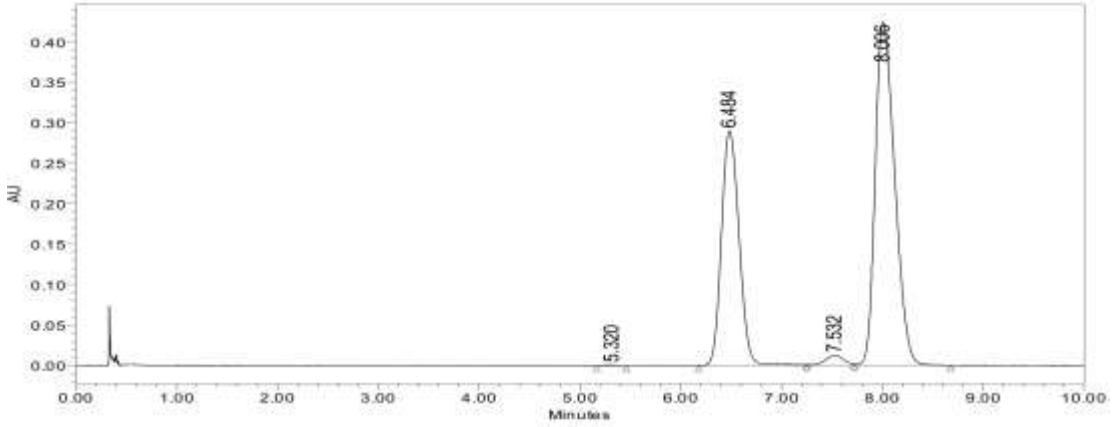
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	15.764	MF	0.5956	2.40035e4	671.73999	99.6998
2	35.226	FM	0.2034	72.28654	5.92425	0.3002
Totals :				2.40758e4	677.66424	



5:Acquity UPC^2 Trefoil^{TM} Cel2, 2.5 μ m Column (CO_2/MeOH= 90/10, 2.0 ml/min, λ=240 nm)



	RT	Area	% Area	Height
1	5.312	349972	23.15	32924
2	6.524	345184	22.83	28593
3	7.541	409297	27.07	32652
4	8.077	407508	26.95	31348



	RT	Area	% Area	Height
1	5.320	8964	0.10	960
2	6.484	3525657	37.46	290423
3	7.532	164112	1.74	12715
4	8.006	5714259	60.71	424583