Electronic Supplementary Material (ESI) for Chemical Science.

Supporting Information

Construction of Polycyclic Structures with Vicinal All-Carbon Quaternary Stereocenters via Enantioselective Photoenolization/Diels–Alder Reaction

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Contents

I. General Information

General Experimental Procedures. All reactions were carried out under nitrogen except noted. Anhydrous dichloromethane, toluene, acetonitrile and dimethylformamide were purified by the PS-MD5 (Innovative Technology) solvent purification system. Tetrahydrofuran and anhydrous diethyl ether were distilled from sodium-benzophenone ketyl. All other commercial reagents were used as received. Flash column chromatography was performed as described by Still, employing Qingdao Haiyang silica gel 60 (200–300 mesh). TLC analyses were performed on EMD 250 μm Silica Gel HSGF254 plates and visualized by quenching of UV fluorescence (λ_{max} = 254 nm), or by staining ceric ammonium molybdate, phosphomolybdic acid, or potassium permanganate. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker 500, 400 spectrometer. Chemical shifts for ^{1}H and ^{13}C NMR spectra are reported in ppm (δ) relative to residue protium in the solvent ($CDCl_3$: δ 7.26, 77.0 ppm, and the multiplicities are presented as follows: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, brs = broad single. High-resolution mass spectra (HRMS) were acquired on Waters Micromass GCT Premier or Bruker Daltonics, Inc. APEXIII 7.0 TESLA FTMS. Mass spectra were acquired on Agilent 5975C. The $[\alpha]_D$ was recorded using Anton Paar MCP 5500. Infrared (IR) spectra were obtained using a Shimatzu IRTracer-100 fourier transform infrared spectroscopy (FTIR). Electronic circular dichroism (ECD) spectra and corresponding ultraviolet– visual spectra were obtained on a JASCO J-815 CD spectrometer. HPLC analysis on chiral stationary phase was performed on an Agilent 1200-series instrument, employing Daicel Chiralpak OD-H, AS-H, OJ-H and IG chiral columns. The photo reactor used for this photolysis is Rayonet RPR-200 (Southern New England Ultraviolet Company). The peristaltic pump used for this flow PEDA reaction is BT 100-1F (Longer precision pump Co., Ltd.).

II. UV-vis absorption spectrum

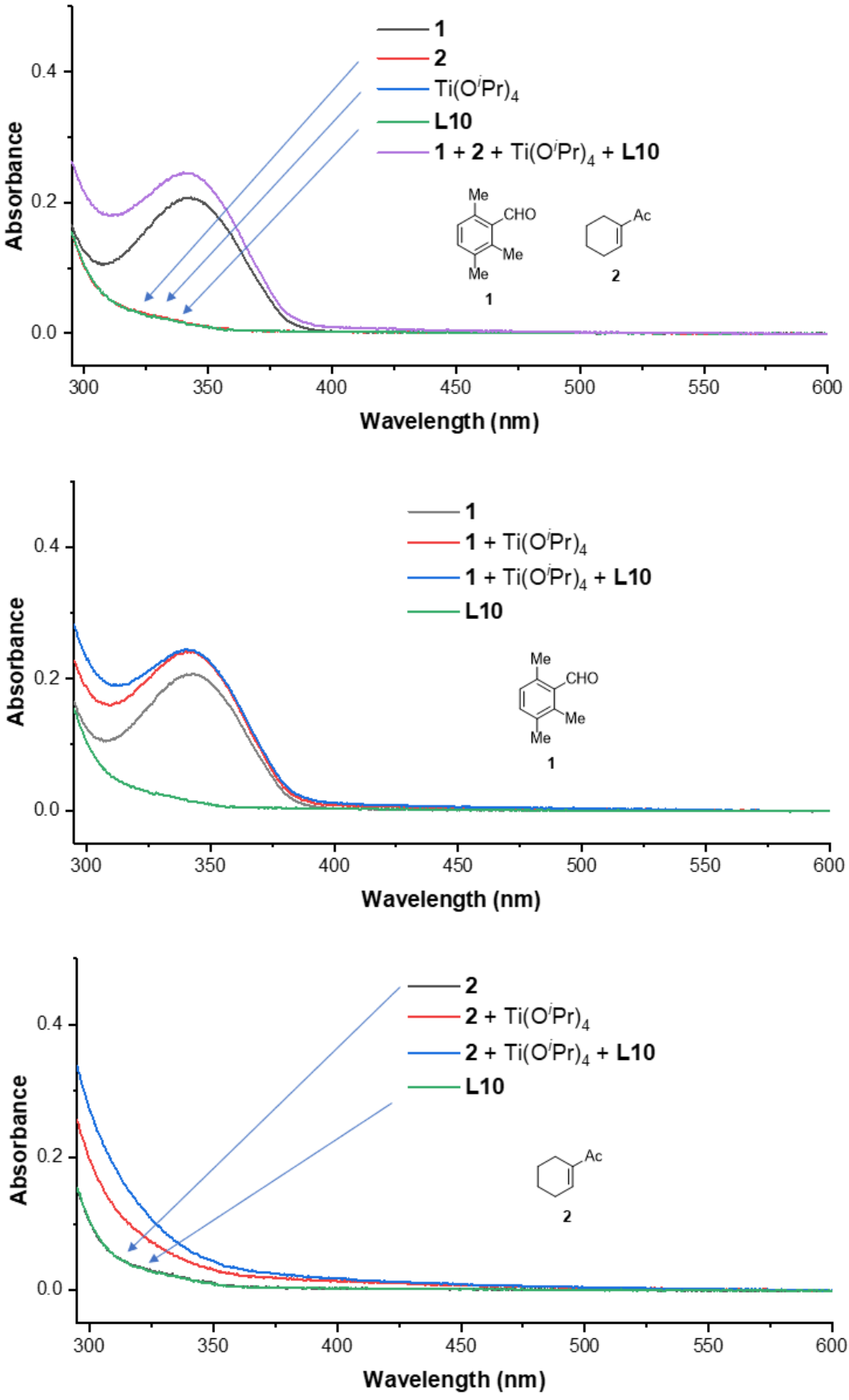
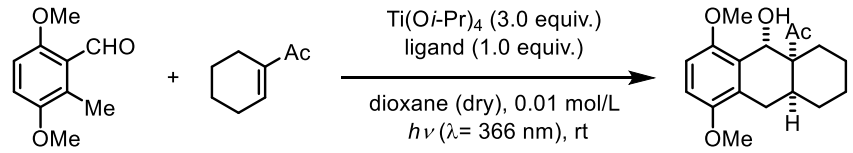


Figure S1. Absorption spectra of the reaction mixture in toluene (5×10^{-5} M)

III. Control Experiments

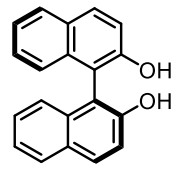
Table S1. Investigation of different kinds of ligands.



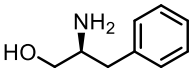
1, 0.1 mmol **2**, 0.2 mmol **3**

entry	ligand	T/^{o}C	time	conversion (%)[a]	yield(%)[a]	ee(%)
1	**La**	36	3 h	100	ND	ND
2	**Lb**	25	3 h	96	ND	ND
3	**Lc**	25	3 h	98	12	0
4	**Ld**	25	4 h	62	18	5
5	**Le**	24	3 h	36	10	47
6	**Lf**	24	3 h	56	18	45
7	**Lg**	24	3 h	64	20	50
8	**Lh**	24	4 h	62	16	0
9	**Li**	36	3 h	42	ND	ND
10	**Lj**	36	3 h	60	ND	ND
11	**Lk**	36	3 h	100	70	67

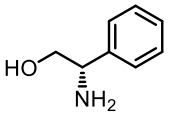
[a]Crude ^{1}H NMR convertion and yield with 1,3,5-Trimethoxybenzene as internal standard.



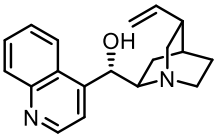
La, (S)-BINOL



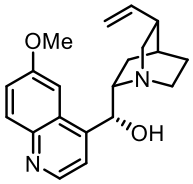
Lb



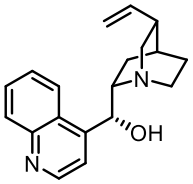
Lc



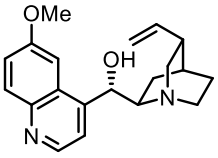
Ld, cinchonine



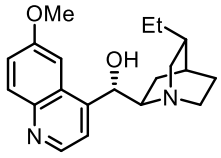
Le, quinine



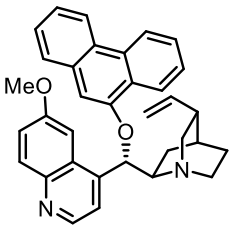
Lf, cinchonidine



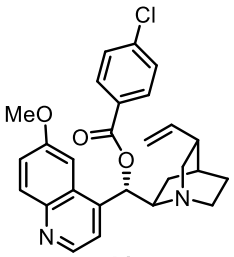
Lg, quinidine



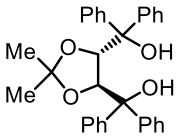
Lh



Li

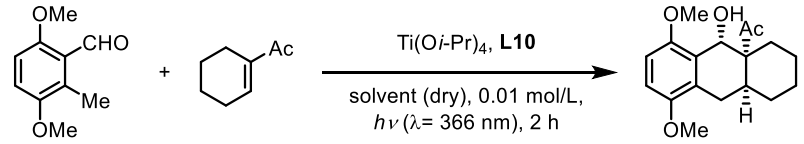


Lj



Lk, TADDOL

Table S2. Condition optimization: solvent, dosage of Ti(O*i*-Pr)$_4$ and **L10**.

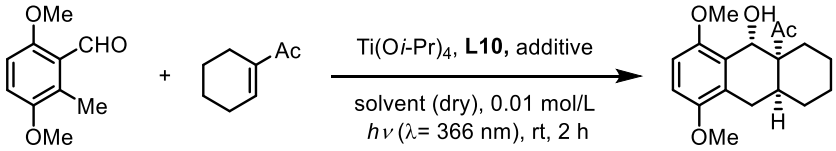


1, 0.1 mmol **2**, 0.2 mmol **3**

entry	Ti(O*i*-Pr)$_4$	**L10**	solvent	yield(%)[a]	ee(%)
1	3.0 equiv.	1.0 equiv.	dioxane	79	85
2	3.0 equiv.	1.0 equiv.	THF	48	72
3	3.0 equiv.	1.0 equiv.	DCM	57	90
4	3.0 equiv.	1.0 equiv.	DCE	67	90
5	3.0 equiv.	1.0 equiv.	toluene	70	91
6	2.0 equiv.	1.0 equiv.	toluene	64	93
7	1.0 equiv.	1.0 equiv.	toluene	62	91
8	1.0 equiv.	0.5 equiv.	toluene	50	89
9	0.5 equiv.	0.5 equiv.	toluene	47	82
10	0.8 equiv.	0.4 equiv.	toluene	38	85
11	0.6 equiv.	0.3 equiv.	toluene	22	78
12	0.4 equiv.	0.2 equiv.	toluene	trace	-
13	0.2 equiv.	0.1 equiv.	toluene	trace	-
14	2.0 equiv.	0.8 equiv.	toluene	54	89
15	2.0 equiv.	0.5 equiv.	toluene	48	89
16	2.0 equiv.	0.2 equiv.	toluene	45	70
17[b]	1.0 equiv.	0.5 equiv.	toluene	78	90
18[c]	1.0 equiv.	0.5 equiv.	toluene	72	90

[a]Yields determined by ^{1}H NMR analysis using internal standard.
[b]dossage of **2** is 1.5 equiv.; [c]dossage of **2** is 1.0 equiv.

Table S3. Condition optimization: additive screening.



1 **2** **3**

entry	solvent	additive	yield(%)[c]	ee(%)
1[a]	toluene	--	70	91
2[b]	toluene	--	78	90
3[b]	toluene	Et_3N	64	88
4[b]	toluene	IMD.	52	91
5[b]	toluene	HMTA	85	88
6[b]	toluene	DABCO	82	92
7[b]	toluene	Quin.	89	91

[a] The reaction was conducted in **1** (1.0 equiv.), **2** (2.0 equiv.), Ti(O*i*-Pr)$_4$ (3.0 equiv.), **L10** (1.0 equiv.)
[b] The reaction was conducted in **1** (1.0 equiv.), **2** (1.5 equiv.), Ti(O*i*-Pr)$_4$ (1.0 equiv.), **L10** (0.5 equiv.) and additive (1.0 equiv.).
[c] Crude ^{1}H NMR yield with 1,3,5-trimethoxybenzene as internal standard.

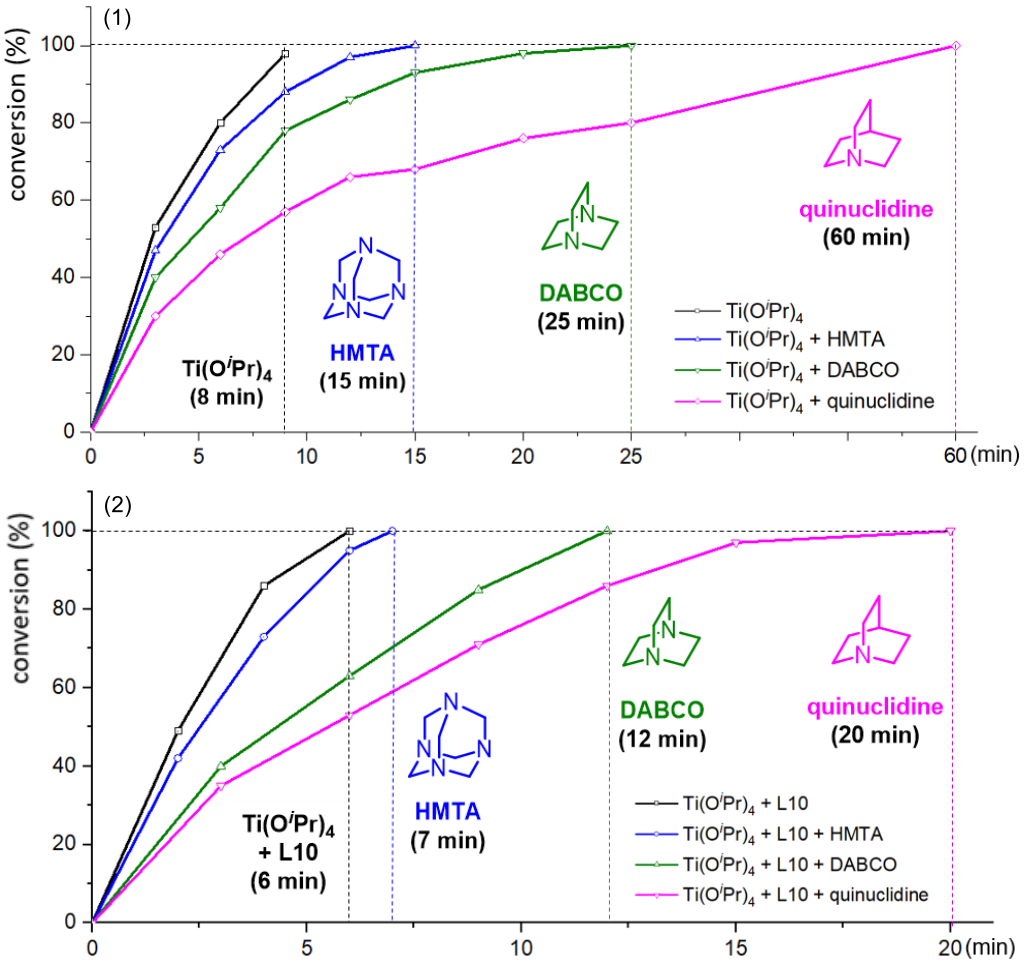
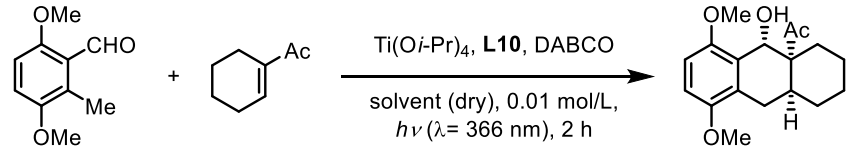


Figure S2. Dynamic studies.

Table S4. Condition optimization: dosage of DABCO.

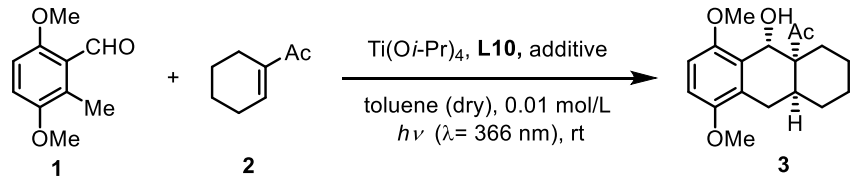


1, 0.1 mmol **2**, 0.15 mmol **3**

entry	Ti(O*i*-Pr)$_4$	**L10**	DABCO	yield(%)[a]	ee(%)
1	1.0 equiv.	0.5 equiv.	0.5 equiv.	78	90
2	1.0 equiv.	0.5 equiv.	1.0 equiv.	82	92
3	1.0 equiv.	0.5 equiv.	2.0 equiv.	70	94
4	1.0 equiv.	0.5 equiv.	3.0 equiv.	68	95
5	1.0 equiv.	0.4 equiv.	1.0 equiv.	60	90
6	0.8 equiv.	0.4 equiv.	0.8 equiv.	56	92
7	0.6 equiv.	0.3 equiv.	0.6 equiv.	54	93
8	0.4 equiv.	0.2 equiv.	0.4 equiv.	52	93

[a]Yields determined by ^{1}H NMR analysis using internal standard.

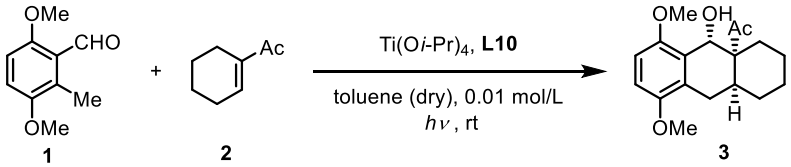
Table S5-1. Catalytic asymmetric PEDA reaction: additive screening.



entry[a]	Ti(O*i*-Pr)$_4$	**L10**	additive	time	convertion	yield[c]	ee
1	0.4 equiv.	0.2 equiv.	-	1 h	100%	60%	82%
2[b]	0.4 equiv.	0.2 equiv.	-	1 h	100%	53%	87%
3	0.4 equiv.	0.2 equiv.	^{i}PrOH	1 h	100%	53%	83%
4	0.4 equiv.	0.2 equiv.	HFIP	1 h	100%	9%	70%
5	0.4 equiv.	0.2 equiv.	DABCO	1 h	100%	58%	75%

[a] The reaction was conducted in **1** (1.0 equiv.), **2** (1.5 equiv.), additive (1.0 equiv.).
[b] Prepared chiral catalyst (wituout ^{i}PrOH) was used.
[c] Crude ^{1}H NMR yield with 1,3,5-trimethoxybenzene as internal standard.

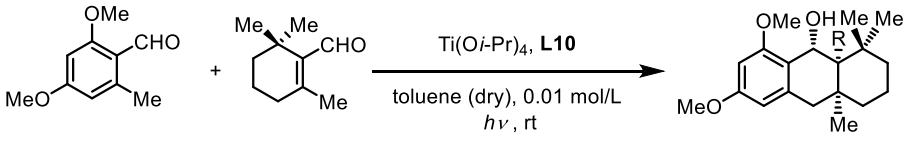
Table S5-2. Catalytic asymmetric PEDA reaction: wavelength screening.



entry[a]	Ti(O*i*-Pr)$_4$	**L10**	*hν* (nm)	time	convertion	yield[c]	ee
1	1.0 equiv.	0.5 equiv.	300	1 h	100%	28%	77%
2	1.0 equiv.	0.5 equiv.	366	1 h	100%	78%	90%
3	0.4 equiv.	0.2 equiv.	366	1 h	100%	60%	82%
4	1.0 equiv.	0.5 equiv.	419	1 h	58%	50%	92%
5	0.4 equiv.	0.2 equiv.	419	1 h	42%	37%	91%
6[b]	0.4 equiv.	0.2 equiv.	419	1 h	32%	22%	87%
7	1.0 equiv.	0.5 equiv.	575	1 h	48%	39%	89%
8	0.4 equiv.	0.2 equiv.	575	1 h	45%	27%	89%

[a] The reaction was conducted in **1** (1.0 equiv.), **2** (1.5 equiv.).
[b] Prepared chiral catalyst (wituout ^{i}PrOH) was used.
[c] Crude ^{1}H NMR yield with 1,3,5-trimethoxybenzene as internal standard.

Table S5-3. Catalytic asymmetric PEDA reaction: the ratio of titanium to ligand screening.



entry[a]	Ti(O*i*-Pr)$_4$	**L10**	*hν* (nm)	time	convertion	yield[c]	ee
1	0.4 equiv.	0.2 equiv.	366	1.5 h	100%	49%	94%
2[b]	0.4 equiv.	0.2 equiv.	366	1.5 h	64%	15%	92%
3	0.4 equiv.	0.2 equiv.	419/366	2+1 h	48%	23%	95%
4	0.5 equiv.	0.2 equiv.	366	1.5 h	100%	84%	96%
5	0.5 equiv.	0.2 equiv.	419/366	3+1.5 h	67%	27%	94%
6	0.6 equiv.	0.2 equiv.	366	1.5 h	100%	88%	89%
7	0.6 equiv.	0.2 equiv.	419/366	2+1 h	88%	74%	96%
8	0.6 equiv.	0.2 equiv.	419/366	2.5+1.5 h	100%	83%	93%
9	1.0 equiv.	0.2 equiv.	366	1.5 h	100%	92%	78%
10	1.0 equiv.	0.2 equiv.	419	6 h	30%	26%	84%
11	2.0 equiv.	0.2 equiv.	366	1.5 h	100%	81%	68%
12	2.0 equiv.	0.2 equiv.	419	6 h	24%	20%	78%

[a] The reaction was conducted in **1a** (1.0 equiv.), **45** (1.5 equiv.). [b] Prepared chiral catalyst (wituout ^{i}PrOH) was used.
[c] Crude ^{1}H NMR yield with 1,3,5-trimethoxybenzene as internal standard.

Table S5-4. Catalytic asymmetric PEDA reaction.

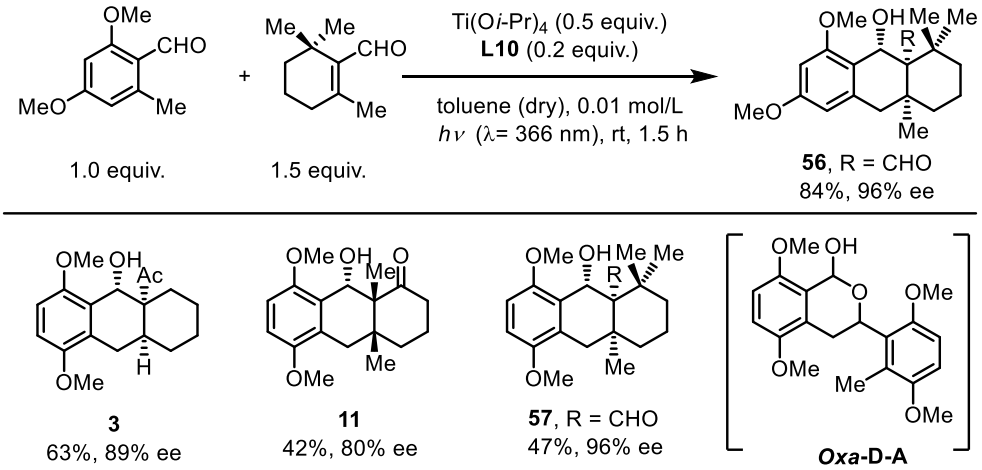
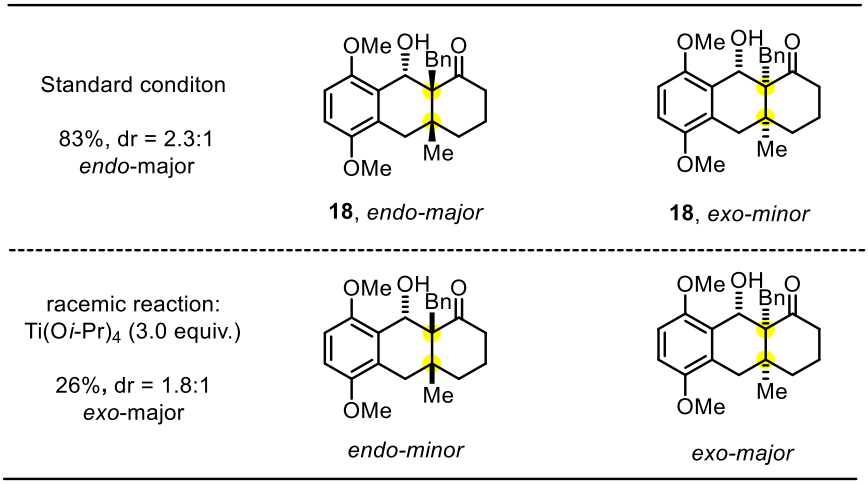


Table S6. Controlling of diastereoselectivity in PEDA reaction.



IV. Nonlinear effect of the ligand accelerated enantioselective PEDA reaction: To a solution of aromatic aldehyde (0.1 mmol, 1.0 equiv.), chiral ligand (e.e. value of ligand was calculated and regulated by mixing the racemic with chiral ligand) and 1,4-diazabicyclo[2.2.2]octane (DABCO) in anhydrous toluene (10 mL, 0.01 M) was added dienophile (0.15 mmol, 1.5 equiv.) under N_2 in quartz tube sealed with rubber plug. Then, titanium (IV) isopropoxide (Ti(O*i*-Pr)$_4$) was added, after homogeneous mixing, the solution was photolyzed at room temperature in a Rayonet chamber reactor (16 lamps) at λ_{max} = 366 nm for 1.5 h. Afterward, the reaction mixture was poured into saturated sodium bicarbonate and stirred over 30 min, the above mixture was extracted three times with ethyl acetate, the combined organic phases were washed twice with brine and dried over anhydrous sodium sulfate. The dried solution was filtered and the filtrate was concentrated under vacuum. The crude product was purified by PTLC to give the corresponding product for e.e. value test.

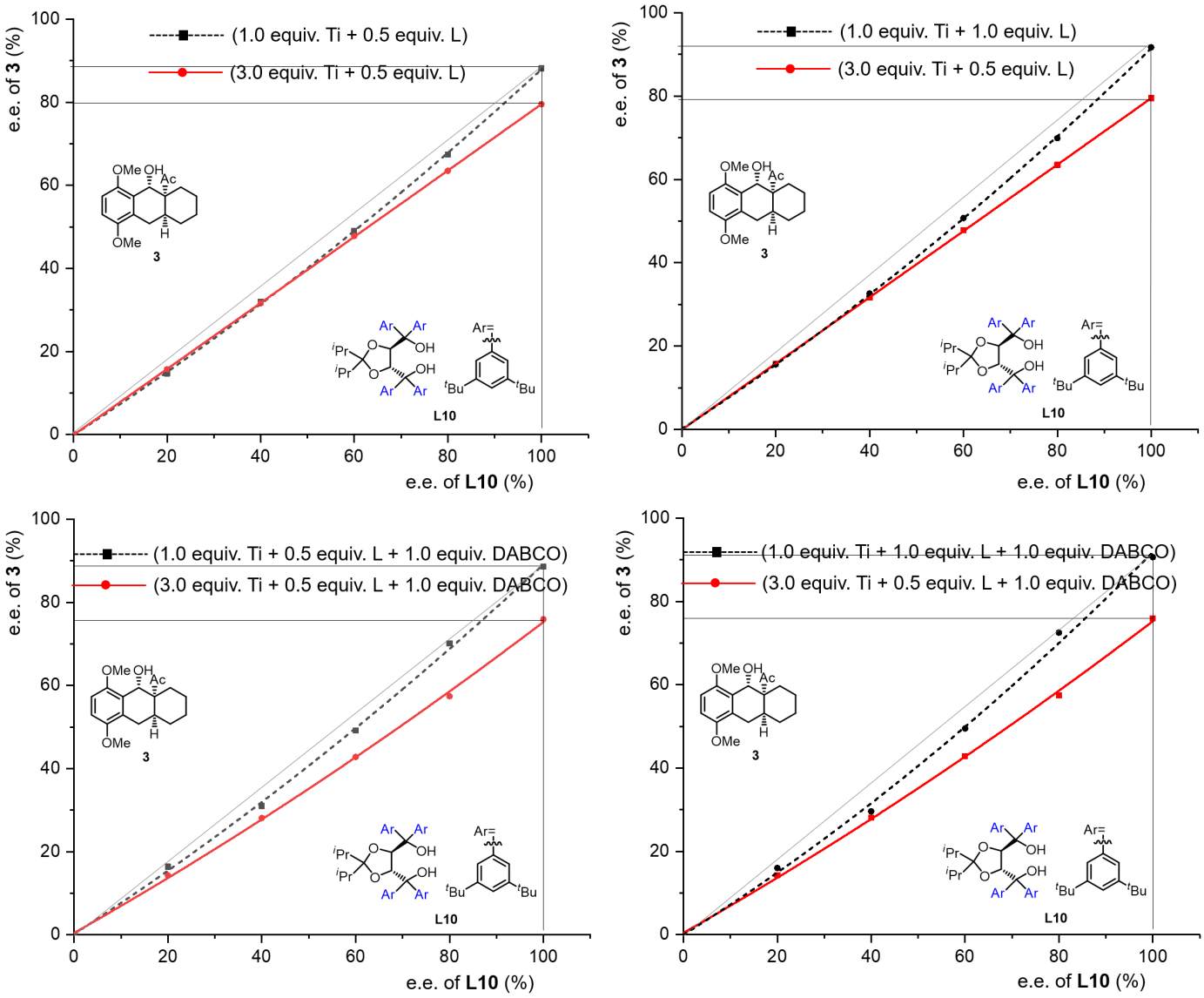


Figure S3. Nonlinear effect of the product **3**

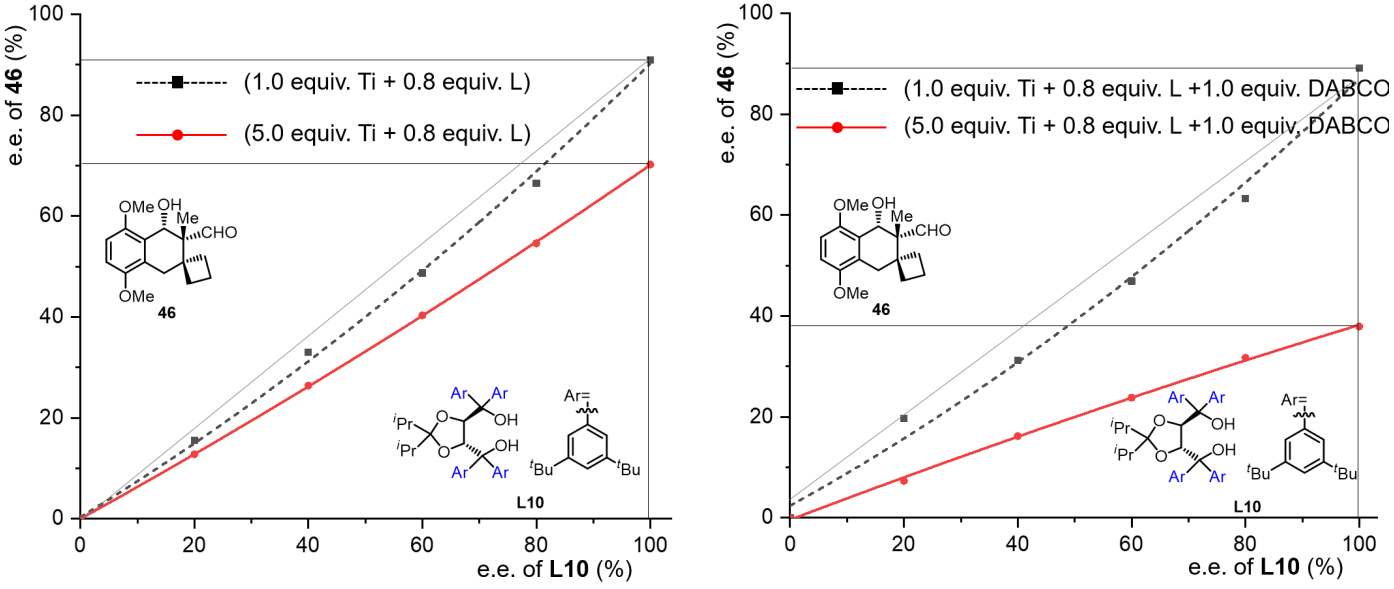
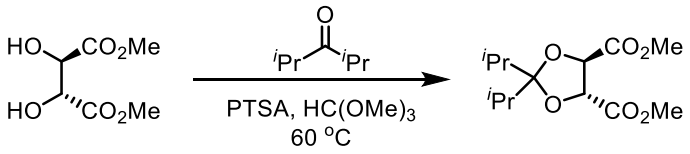


Figure S4. Nonlinear effect of the product **46**

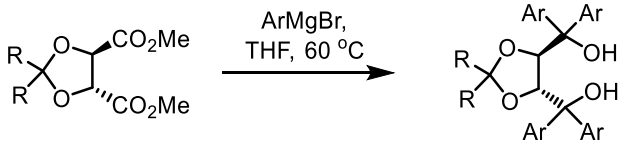
V. Preparation of TADDOL-type chiral ligands

Synthetic pathways for preparing the ketal

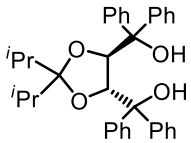


Ketal. To a 500 mL round bottom flask was added *p*-toluenesulfonic acid (PTSA, 2 g, 10.5 mmol) and trimethyl orthoformate (60 ml, 550 mmol) into a solution of dimethyl (*2R,3R*)-tartrate (38 g, 213 mmol) in 2,4-dimethyl-3-pentanone (180 mL, 1.27 mol). The resulting mixture was heated to 60 °C. After stirring for 24 h at the same tempreture, the reaction mixture was cooling to room temperature, then neutralized with 1 N sodium bicarbonate solution and extracted three times with ethyl acetate. The combined organic extract was washed with brine and dried over anhydrous sodium sulfate, and the solvent was removed in vacuo and the residue was purified by silica-gel chromatography (0 - 30% ethyl acetate – petroleum ether) to afford the desired ketal in 88% yield as a yellow oil: R_f = 0.55 (20% ethyl acetate – petroleum ether); $[\alpha]_D^{20}$ -21.1 (c 0.136, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.68 (s, 2H), 3.82 (s, 6H), 2.16 (hept, *J* = 6.8 Hz, 2H), 0.97 (d, *J* = 5.5 Hz, 6H), 0.96 (d, *J* = 5.5 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 169.0 (2C), 121.4, 78.5 (2C), 52.7 (2C), 34.2 (2C), 17.2 (2C), 17.1 (2C) ppm; IR ν_{max} 3057, 1606, 1597, 1465, 1151, 1112, 1068, 1031, 866, 740 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+H]^+$ calcd for $C_{13}H_{23}O_6$, 275.1489; found, 275.1478.

Synthetic pathways for preparing the TADDOL-type ligands

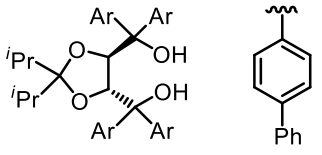


General procedure: preparation of TADDOL-type ligands. To a solution of the corresponding ketal (1.0 equiv.) in anhydrous tetrahydrofuran (0.2 M), was slowly added the corresponding Grignard reagent (1.0 M, 4.5 equiv.). The resulting mixture was heated to 60 °C and stirred for 4 h. Thereafter, the reaction was slowly quenched with saturated ammonium chloride solution and extracted twice with ethyl acetate. The combined organic extracts was washed twice with brine, and then dried over anhydrous sodium sulfate. The solvent was removed in vacuo and the residue purified by silica-gel chromatography (0 - 10% ethyl acetate – petroleum ether) to afford the desired chiral TADDOL-type ligands.



L3

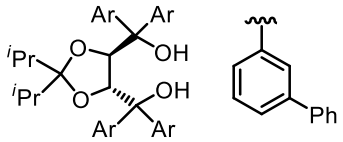
L3 (2.0 g, 85% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 134 – 136 °C; $[\alpha]_D^{20}$ -30.5 (c 1.16, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.49 – 7.42 (m, 8H), 7.32 – 7.26 (m, 12H), 4.77 (s, 2H), 4.38 (s, 2H), 1.69 (hept, *J* = 6.9 Hz, 2H), 0.79 (d, *J* = 6.9 Hz, 6H), 0.59 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 146.5 (2C), 142.4 (2C), 129.0 (4C), 128.1 (4C), 127.7 (4C), 127.5 (2C), 127.2 (2C), 127.1 (4C), 114.1, 80.2 (2C), 78.7 (2C), 34.2 (2C), 18.3 (2C), 17.5 (2C) ppm; IR ν_{max} 1421, 1267, 896, 742, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{35}H_{38}O_4Na$, 545.2662; found, 545.2662.



L5

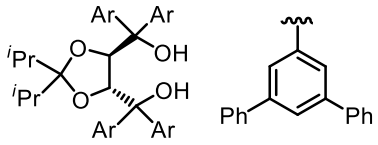
L5 (2.8 g, 81% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 161 – 163 °C; $[\alpha]_D^{20}$ -80.6 (c 0.68, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.66 – 7.55 (m, 24H), 7.44 (dt, *J* = 14.7, 7.6 Hz, 8H), 7.38 – 7.32 (m, 4H), 5.18 – 5.06 (m, 2H), 4.52 (d, *J* = 1.2 Hz, 2H), 1.80 (hept, *J* = 6.9 Hz, 2H), 0.86 (d, *J* = 6.9 Hz, 6H), 0.67 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 145.3 (2C), 141.4 (2C), 140.7 (2C), 140.6 (2C), 140.3 (2C), 139.9 (2C), 129.5 (4C), 128.8 (4C), 128.7 (4C), 128.1 (4C), 127.29 (4C), 127.26 (4C), 127.0

(4C), 126.8 (4C), 125.8 (4C), 114.3, 80.3 (2C), 78.6 (2C), 34.3 (2C), 18.4 (2C), 17.6 (2C) ppm; IR ν_{max} 3055, 1421, 1267, 896, 744, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{59}H_{54}O_4Na$, 849.3914; found, 849.3915.



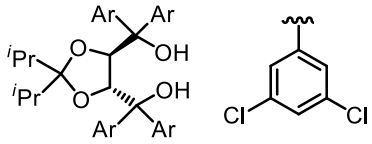
L6

L6 (1.8 g, 72% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 106 – 108 °C; $[\alpha]_D^{20}$ -38.1 (c 0.72, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (dt, *J* = 5.9, 1.9 Hz, 4H), 7.58 – 7.50 (m, 16H), 7.42 – 7.35 (m, 12H), 7.33 – 7.27 (m, 4H), 4.85 – 4.79 (m, 2H), 4.62 (s, 2H), 1.74 (hept, *J* = 6.9 Hz, 2H), 0.73 (d, *J* = 6.9 Hz, 6H), 0.58 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 146.9 (2C), 142.9 (2C), 141.2 (2C), 141.2 (2C), 141.0 (2C), 140.1 (2C), 128.7 (4C), 128.7 (4C), 128.6 (2C), 128.1 (2C), 127.7 (2C), 127.7 (2C), 127.2 (6C), 127.2 (4C), 127.1 (2C), 126.7 (2C), 126.5 (2C), 126.4 (2C), 126.2 (2C), 114.4, 80.7 (2C), 78.9 (2C), 34.4 (2C), 18.2 (2C), 17.5 (2C) ppm; IR ν_{max} 3055, 1421, 1267, 896, 744, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{59}H_{54}O_4Na$, 849.3914; found, 849.3900.



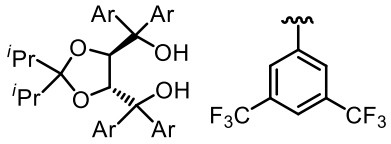
L7

L7 (2.0 g, 76% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.7 (10% ethyl acetate-petroleum ether); m.p. 158 – 160 °C; $[\alpha]_D^{20}$ -59.0 (c 0.48, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.89 (dd, *J* = 8.8, 1.7 Hz, 8H), 7.76 – 7.71 (m, 4H), 7.60 – 7.56 (m, 8H), 7.54 (d, *J* = 7.5 Hz, 8H), 7.40 – 7.28 (m, 24H), 5.07 (s, 2H), 4.87 (d, *J* = 2.1 Hz, 2H), 1.78 (hept, *J* = 6.9 Hz, 2H), 0.69 (d, *J* = 6.9 Hz, 6H), 0.56 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 147.3 (2C), 143.5 (2C), 141.6 (4C), 141.09 (4C), 141.07 (4C), 140.8 (4C), 128.68 (8C), 128.65 (8C), 127.32 (4C), 127.27 (8C), 127.25 (8C), 126.8 (4C), 125.6 (4C), 125.5 (4C), 125.4 (4C), 114.7, 81.2 (2C), 79.1 (2C), 34.5 (2C), 18.1 (2C), 17.5 (2C) ppm; IR ν_{max} 3055, 1479, 1419, 1265, 744, 705 cm^{-1}.



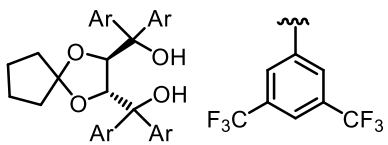
L8

L8 (1.8 g, 72% yield) was prepared according to general procedure to afford the title compound as a yellow solid: R_f = 0.65 (10% ethyl acetate-petroleum ether); m.p. 122 – 124 °C; $[\alpha]_D^{20}$ -87.0 (c 0.92, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (s, 6H), 7.29 (d, *J* = 1.9 Hz, 2H), 7.26 (s, 2H), 7.20 (d, *J* = 1.9 Hz, 2H), 5.69 (s, 1H), 4.17 (s, 2H), 1.85 (hept, *J* = 6.9 Hz, 2H), 0.97 (d, *J* = 6.9 Hz, 6H), 0.81 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 147.0 (2C), 144.5 (2C), 135.0 (4C), 134.7 (4C), 128.4 (2C), 128.3 (4C), 126.5 (2C), 125.6 (4C), 115.7, 80.5 (2C), 77.5 (2C), 34.4 (2C), 18.4 (2C), 17.8 (2C) ppm; IR ν_{max} 3055, 1419, 1265, 896, 802, 742, 705 cm^{-1}.



L9

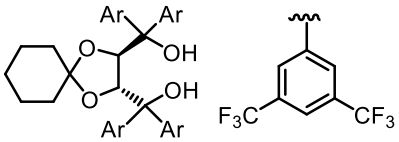
L9 (5.2 g, 84% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 136 – 138 °C; $[\alpha]_D^{20}$ -15.3 (c 3.2, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (s, 4H), 7.96 (s, 4H), 7.92 (s, 2H), 7.86 (s, 2H), 5.68 (s, 2H), 4.23 (s, 2H), 1.80 (hept, *J* = 6.9 Hz, 2H), 0.82 (d, *J* = 6.9 Hz, 6H), 0.66 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.1 (2C), 143.3 (2C), 132.2 (q, *J* = 33.6 Hz, 4C), 131.7 (q, *J* = 33.6 Hz, 4C), 128.3 (q, *J* = 3.9 Hz, 4C), 127.4 (q, *J* = 3.9 Hz, 4C), 125.7 (dd, *J* = 272.9, 8.3 Hz, 2C), 122.7 (m, 8C), 120.3 (dd, *J* = 272.9, 8.3 Hz, 2C), 115.9, 80.7 (2C), 77.3 (2C), 34.5 (2C), 17.7 (2C), 17.0 (2C) ppm; IR ν_{max} 1471, 1373, 1280, 1180, 1139, 900, 744, 707 cm^{-1}.



L9A

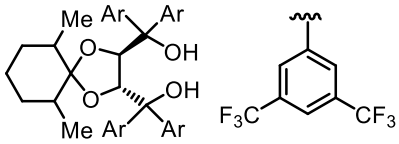
L9A (2.6 g, 86% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 90 – 92 °C; $[\alpha]_D^{20}$ -17.8 (c 1.4, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.08 (s, 4H), 7.95 (s, 2H), 7.87 (s, 4H), 7.85 (s, 2H), 4.79 – 4.73 (m, 2H), 4.35 (s, 2H), 1.71 – 1.62 (m, 2H), 1.62 – 1.44 (m, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 145.8 (2C), 143.5 (2C), 132.2 (q, *J* = 33.6 Hz, 4C), 131.8 (q, *J* = 33.6 Hz, 4C), 128.1 (q, *J* = 3.6 Hz, 4C), 127.5 (q, *J* = 3.8 Hz, 4C), 125.2 (dd, *J* = 272.8, 20.7 Hz, 2C), 122.7 (m, 8C),

120.9 (dd, *J* = 272.8, 20.7 Hz, 2C), 120.8, 81.1 (2C), 77.1 (2C), 36.7 (2C), 22.4 (2C) ppm; IR ν_{max} 1371, 1280, 1267, 1178, 1141, 900, 742, 705, 682 cm^{-1}.



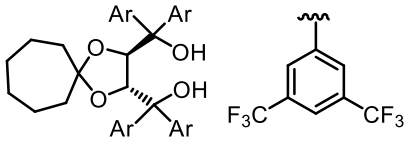
L9B

L9B (2.2 g, 85% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 74 – 76 °C; $[\alpha]_D^{20}$ -26.1 (c 8.0, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.14 (s, 4H), 7.95 (s, 2H), 7.94 (s, 4H), 7.85 (s, 2H), 5.30 (s, 2H), 4.25 (s, 2H), 1.62 – 1.48 (m, 4H), 1.44 – 1.36 (m, 4H), 1.35 – 1.28 (m, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 146.0 (2C), 143.4 (2C), 132.2 (q, *J* = 33.5 Hz, 4C), 131.7 (q, *J* = 33.5 Hz, 4C), 128.2 (q, *J* = 3.8 Hz, 4C), 127.6 (q, *J* = 3.9 Hz, 4C), 125.3 (dd, *J* = 272.7, 19.1 Hz, 2C), 122.7 (m, 8C), 121.0 (dd, *J* = 272.6, 19.1 Hz, 2C), 111.6, 80.9 (2C), 76.9 (2C), 36.3 (2C), 24.6, 23.7 (2C) ppm; IR ν_{max} 3751, 1373, 1280, 1178, 1139, 902, 844, 744, 682 cm^{-1}.



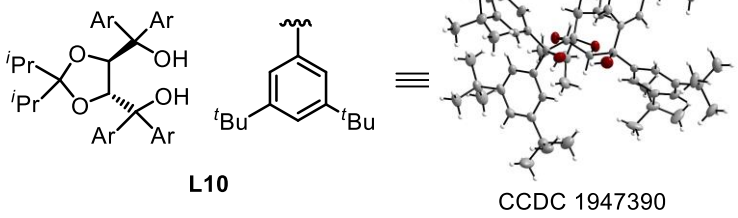
L9C

L9C (2.0 g, 76% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 90 – 92 °C; $[\alpha]_D^{20}$ -30.0 (c 5.4, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.10 (s, 2H), 8.05 (s, 2H), 7.96 (s, 2H), 7.94 (s, 4H), 7.87 (s, 2H), 5.07 (s, 2H), 4.29 (s, 1H), 4.25 (s, 1H), 1.81 – 1.71 (m, 1H), 1.68 – 1.55 (m, 3H), 1.50 – 1.35 (m, 3H), 1.34 – 1.23 (m, 1H), 0.68 (d, *J* = 6.5 Hz, 3H), 0.59 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 146.1 (2C), 143.3 (2C), 132.3 (q, *J* = 33.5 Hz, 4C), 131.8 (q, *J* = 33.5 Hz, 4C), 128.2 (q, *J* = 3.8 Hz, 4C), 127.4 (q, *J* = 3.9 Hz, 4C), 124.7 (dd, *J* = 272.7, 19.1 Hz, 2C), 122.7 (m, 8C), 121.5 (dd, *J* = 272.6, 19.1 Hz, 2C), 114.5, 80.7 (2C), 77.5 (2C), 35.4, 31.2 (2C), 19.3 (2C), 14.3 (2C) ppm; IR ν_{max} 1373, 1280, 1267, 1178, 900, 844, 744, 707, 682 cm^{-1}.



L9D

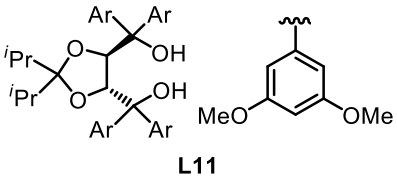
L9D (2.2 g, 78% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 70 – 72 °C; $[\alpha]_D^{20}$ -15.1 (c 2.2, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.11 (s, 4H), 7.93 (s, 2H), 7.86 (s, 4H), 7.83 (s, 2H), 5.10 – 5.02 (m, 2H), 4.09 (s, 2H), 1.66 – 1.56 (m, 4H), 1.53 – 1.47 (m, 4H), 1.47 – 1.35 (m, 4H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 145.6 (2C), 143.3 (2C), 132.1 (q, *J* = 33.5 Hz, 4C), 131.6 (q, *J* = 33.5 Hz, 4C), 128.0 (q, *J* = 3.8 Hz, 4C), 127.5 (q, *J* = 3.9 Hz, 4C), 125.2 (dd, *J* = 272.7, 19.1 Hz, 2C), 122.7 (m, 8C), 120.9 (dd, *J* = 272.6, 19.1 Hz, 2C), 114.6, 80.6 (2C), 76.7 (2C), 39.5 (2C), 28.1 (2C), 21.4 (2C) ppm; IR ν_{max} 1373, 1282, 1267, 1180, 1141, 900, 744, 707 cm^{-1}.



L10

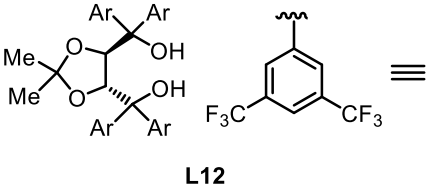
CCDC 1947390

L10 (8.0 g, 82% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.8 (10% ethyl acetate-petroleum ether); m.p. 160 – 162 °C; $[\alpha]_D^{20}$ -20.0 (c 1.48, DCM); and it was recrystallized from ethyl acetate /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947390). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.43 (s, 4H), 7.33 – 7.29 (m, 6H), 7.27 (d, *J* = 1.8 Hz, 2H), 4.65 (s, 2H), 4.57 (s, 2H), 1.77 (hept, *J* = 6.9 Hz, 2H), 1.29 – 1.27 (m, 36H), 1.25 – 1.23 (m, 36H), 0.59 (d, *J* = 6.9 Hz, 6H), 0.41 (d, *J* = 6.9 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 149.6 (4C), 148.8 (4C), 145.9 (2C), 142.1 (2C), 123.7 (4C), 122.0 (4C), 120.73 (2C), 120.69 (2C), 113.5, 81.3 (2C), 79.6 (2C), 35.0 (4C), 34.9 (4C), 34.8 (12C), 31.54 (12C), 31.49 (2C), 18.0 (2C), 17.2 (2C) ppm; IR ν_{max} 1280, 1267, 1180, 1141, 898, 742, 705, 682 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{67}H_{102}O_4Na$, 993.7670; found, 993.7662.

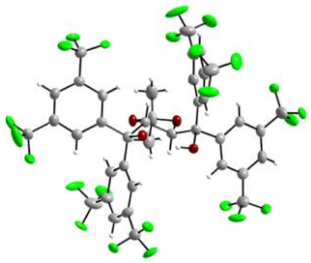


L11

L11 (1.6 g, 75% yield) was prepared according to general procedure to afford the title compound as a white solid: R_f = 0.5 (10% ethyl acetate-petroleum ether); m.p. 160 – 162 °C; $[\alpha]_D^{20}$ -45.5 (c 0.4, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.68 (d, *J* = 2.3 Hz, 4H), 6.65 (d, *J* = 2.3 Hz, 4H), 6.35 (t, *J* = 2.3 Hz, 2H), 6.31 (t, *J* = 2.3 Hz, 2H), 5.06 – 4.98 (m, 2H), 4.41 (s, 2H), 3.69 (s, 12H), 3.67 (s, 12H), 1.79 (hept, *J* = 7.0 Hz, 2H), 0.83 (d, *J* = 7.0 Hz, 6H), 0.68 (d, *J* = 7.0 Hz, 6H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.2 (4C), 159.6 (4C), 148.2 (2C), 144.7 (2C), 113.9, 107.5 (4C), 105.8 (4C), 99.5 (2C), 99.1 (2C), 80.7 (2C), 78.6 (2C), 55.3 (4C), 55.2 (4C), 34.3 (2C), 18.3 (2C), 17.6 (2C) ppm; IR ν_{max} 1598, 1421, 1280, 1267, 1180, 1141, 898, 744, 705, 682 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{43}H_{54}O_{12}Na$, 785.3507; found, 785.3502.



L12



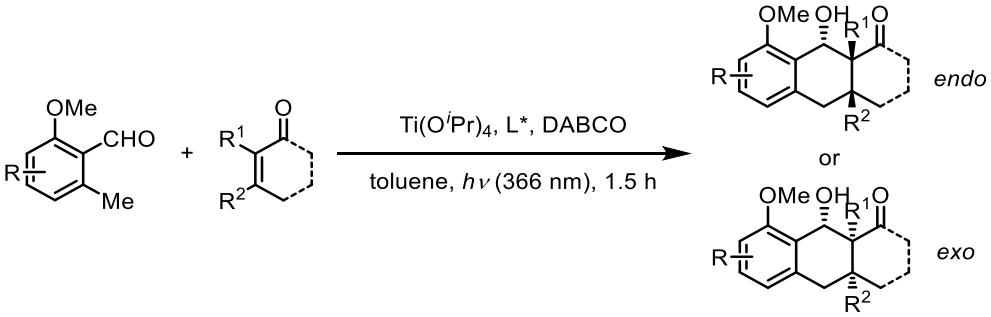
CCDC 1947392

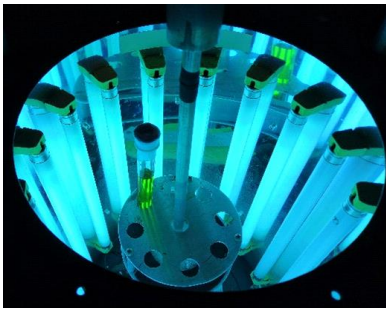
L12 was recrystallized from ethyl acetate /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947392).

Known compound:

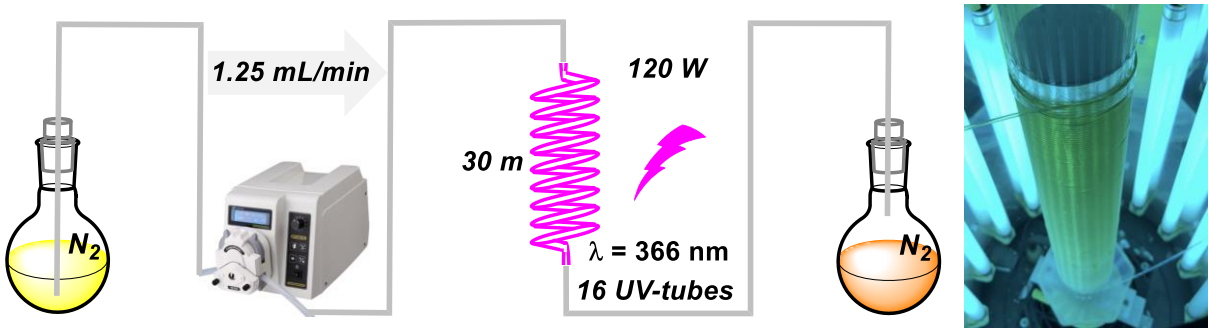
D.-C. A. Falk, B. S. A.-L. Göderz, H.-G. Schmalz, *Angew. Chem. Int. Ed.* 2013, **52**, 1576 –1580.

VI. General Procedures for Asymmetric Photoenolization/Diels–Alder Reaction (APEDA)

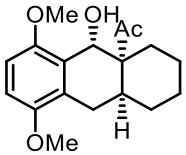




To a solution of aromatic aldehyde (0.3 mmol, 1.0 equiv.), chiral ligand (0.15 mmol, 0.5 equiv.) and 1,4-diazabicyclo[2.2.2]octane (DABCO) (0.3 mmol, 1.0 equiv.) in anhydrous toluene (30 mL, 0.01 M) was added dienophile (0.45 mmol, 1.5 equiv.) (if the dienophile was solid, it was added before the addition of solvent) under N_2, in quartz tube sealed with rubber plug. Then, titanium (IV) isopropoxide (Ti(O*i*-Pr)$_4$, 0.3 mmol, 1.0 equiv.) was added, after homogeneous mixing, the solution was photolyzed at room temperature in a Rayonet chamber reactor (16 lamps) at λ_{max} = 366 nm for 1.5 h. Then the reaction mixture was poured into saturated sodium bicarbonate and stirred over 30 min, the above mixture was extracted three times with ethyl acetate, the combined organic phases were washed twice with brine and dried over anhydrous sodium sulfate. The dried solution was filtered and the filtrate was concentrated under vacuum. The residue was purified by silica gel column chromatography to give the corresponding cycloadducts, and the ligand could be recovered over 95% yield.



General Procedure for flow APEDA reaction: In a round-bottom flask, the aromatic aldehyde (6.0 mmol, 1.0 equiv.) and chiral ligand (3.0 mmol, 0.5 equiv.) was dissolved in anhydrous toluene (300 mL, 0.02 M) and followed by addition of titanium tetraisopropanolate (6.0 mmol, 1.0 equiv.) and dienophile (9.0 mmol, 1.5 equiv.) under nitrogen. The round-bottom flask was connected to double-ended needle and the other end of the double-ended needle was connected to the silicone tubing (1.0 mm ID, 3.0 mm OD) which was connected to peristaltic pump. The peristaltic pump was connected to FEP (fluorinated ethylene propylene) tubing (0.8 mm ID, 1.6 mm OD, 30.0 m length) wrapped around a cylinder placed in a Rayonet chamber hosting 16 UV lamps which allowed the flowing solution receive the highest photon flux. The reaction mixture was pumped through the FEP tubing wrapped around a cylinder placed in a Rayonet chamber (16 lamps) at 366 nm and collected in a round-bottom flask. The flow rate is 1.25 ml/min. When all of the reaction mixture had been pumped in to the tubing, anhydrous toluene was pumped through the tubing at the same flow rate until all solution containing the reaction mixture was collected. The reaction mixture was poured into sat. sodium bicarbonate and stirred over 30 mins, the above mixture was extracted with ethyl acetate, washed with brine and dried over anhydrous sodium sulfate, filtered, concentrated, and purified by silica gel column chromatography (10% ethyl acetate in petroleum ether), and the ligand could be recovered over 95% yield.



3

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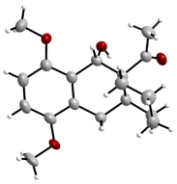
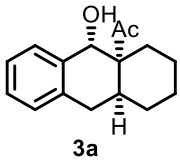


CCDC 1947396

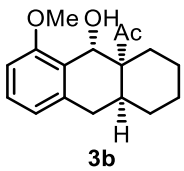
3 (75 mg) was prepared according to general procedure in 82% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.12 (20% ethyl acetate-petroleum ether); m.p. 114 – 116 °C; $[\alpha]_D^{20}$ +35.8 (c 0.84, DCM); and it was recrystallized from ethyl acetate /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947396). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.72 (d, *J* = 8.8 Hz, 1H), 6.68 (d, *J* = 8.8 Hz, 1H), 4.90 (s, 1H), 3.82 (s, 3H), 3.80 (s, 3H), 2.79 (dd, *J* = 17.3, 6.1 Hz, 1H), 2.73 – 2.64 (m, 1H), 2.60 (dd, *J* = 17.2, 10.7 Hz, 1H), 2.31 (s, 3H), 2.20 (s, 1H), 2.05 – 1.91 (m, 1H), 1.80 (ddt, *J* = 13.4, 3.6, 1.9 Hz, 1H), 1.61 – 1.44 (m, 4H), 1.25 (td, *J* = 13.5, 3.0 Hz, 1H), 1.13 (tt, *J* = 12.9, 2.9 Hz, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 211.3, 151.6, 151.1, 125.9, 125.7, 108.8, 107.1, 68.4, 55.6 (t, *J* = 3.4 Hz, 2C), 54.2, 27.1, 26.6, 26.3 (d, *J* = 2.5 Hz, 1C), 26.2, 24.7, 22.7, 20.1 ppm; IR ν_{max} 1720, 1481, 1259, 1087, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1567; found, 327.1563; Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 240 nm): t_R = 14.419 min (major), t_R = 18.018 min (minor).



3a

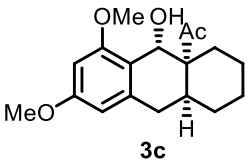
3a (35.2 mg) was prepared according to general procedure A from in 48% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.30 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +10.0 (c 0.40, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.62 (d, *J* = 7.6 Hz, 1H), 7.22 (t, *J* = 7.4 Hz, 1H), 7.17 (t, *J* = 7.4 Hz, 1H), 7.03 (d, *J* = 7.5 Hz, 1H), 4.84 (d, *J* = 8.2 Hz, 1H), 3.22 – 3.10 (m, 1H), 2.90 (dd, *J* = 17.7, 6.6 Hz, 1H), 2.62 (dd, *J* = 17.7, 4.2 Hz, 1H), 2.54 – 2.43 (m, 1H), 2.23 (s, 3H), 2.09 – 1.97 (m, 1H), 1.82 – 1.73 (m, 1H), 1.73 – 1.33 (m, 5H) ppm; ^{13}C NMR (125

MHz, $CDCl_3$) δ 214.7, 138.0, 133.4, 128.6, 127.3, 127.1, 126.4, 69.4, 55.3, 34.5, 32.5, 28.6, 27.4, 24.8, 24.2, 21.0 ppm; IR ν_{max} 1267, 896, 744, 705, 507 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{16}H_{20}O_2Na$, 267.1356; found, 267.1351; Enantiomeric excess: 22%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 34.327min (major), t_R = 37.110 min (minor).



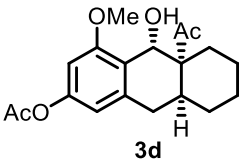
3b

3b (65 mg) was prepared according to general procedure in 79% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.1 (20% ethyl acetate-petroleum ether); m.p. 142 – 144 °C; $[\alpha]_D^{20}$ +24.1 (c 0.20, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20 (t, *J* = 7.9 Hz, 1H), 6.77 (d, *J* = 7.7 Hz, 1H), 6.71 (d, *J* = 8.1 Hz, 1H), 4.92 (s, 1H), 3.86 (s, 3H), 2.98 – 2.85 (m, 1H), 2.81 – 2.67 (m, 2H), 2.32 (s, 3H), 2.19 (s, 1H), 2.04 – 1.91 (m, 1H), 1.83 (dt, *J* = 13.8, 3.4 Hz, 1H), 1.61 – 1.41 (m, 4H), 1.29 (td, *J* = 13.5, 3.1 Hz, 1H), 1.21 – 1.06 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 211.2, 157.8, 136.9, 128.6, 124.7, 121.2, 107.3, 68.3, 55.4, 54.6, 30.0, 27.1, 26.8, 26.6, 26.3, 22.8, 20.1 ppm; IR ν_{max} 2926, 1708, 1591, 1265, 1083, 740 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{22}O_3Na$, 297.1461; found, 297.1459; Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.301 min (major), t_R = 13.581 min (minor).



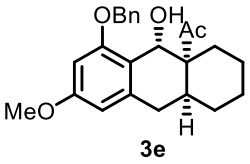
3c

3c (72.2 mg) was prepared according to general procedure A from in 92% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.24 (30% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +17.9 (c 0.47, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.31 (d, *J* = 2.3 Hz, 1H), 6.27 (d, *J* = 2.3 Hz, 1H), 4.86 (d, *J* = 3.7 Hz, 1H), 3.84 (s, 3H), 3.79 (s, 3H), 2.94 – 2.83 (m, 1H), 2.78 – 2.69 (m, 2H), 2.31 (s, 3H), 2.03 – 1.93 (m, 2H), 1.85 – 1.78 (m, 1H), 1.57 – 1.40 (m, 4H), 1.32 – 1.24 (m, 1H), 1.20 – 1.06 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 211.3, 160.2, 159.0, 137.9, 117.6, 103.7, 96.4, 68.1, 55.4, 55.3, 54.8, 30.5, 27.1, 26.8, 26.6, 26.2, 22.8, 20.1 ppm; IR ν_{max} 3053, 1610, 1456, 1267, 1151, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1567; found, 327.1563; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 21.293 min (major), t_R = 23.830 min (minor).



3d

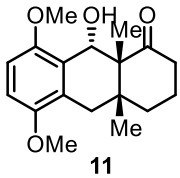
3d (84.6 mg) was prepared according to general procedure A from in 85% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.20 (35% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +2.9 (c 0.96, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.51 (d, *J* = 2.3 Hz, 1H), 6.46 (d, *J* = 2.1 Hz, 1H), 4.87 (s, 1H), 3.84 (s, 3H), 2.90 (dd, *J* = 19.7, 13.1 Hz, 1H), 2.75 (dd, *J* = 13.4, 6.3 Hz, 2H), 2.31 (s, 3H), 2.29 (s, 3H), 2.06 (s, 1H), 1.97 (tdd, *J* = 13.7, 7.8, 4.1 Hz, 1H), 1.81 (d, *J* = 13.9 Hz, 1H), 1.65 – 1.53 (m, 2H), 1.52 – 1.38 (m, 2H), 1.27 (td, *J* = 13.8, 3.6 Hz, 1H), 1.18 – 1.05 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 211.0, 169.5, 158.6, 150.9, 138.0, 122.4, 113.5, 102.0, 68.0, 55.6, 54.6, 30.2, 27.0, 26.7, 26.5, 26.2, 22.7, 21.2, 20.0 ppm; IR ν_{max} 1267, 1211, 1029, 744, 507 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{24}O_5Na$, 355.1516; found, 355.1501; Enantiomeric excess: 81%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 65/35, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 21.296 min (major), t_R = 23.696 min (minor).



3e

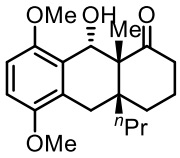
3e (83.2 mg) was prepared according to general procedure A from in 73% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.15 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +8.6 (c 0.96, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.29 (m, 5H), 6.38 (d, *J* = 2.3 Hz, 1H), 6.29 (d, *J* = 2.3 Hz, 1H), 5.12 (d, *J* = 12.0 Hz, 1H), 5.08 (d, *J* = 12.0 Hz, 1H), 4.91 (s, 1H), 3.77 (s, 3H), 2.90 (dd, *J* = 19.7, 13.4 Hz, 1H), 2.81 – 2.69 (m, 2H), 2.29 (s, 3H), 2.10 (s, 1H), 2.02 – 1.90 (m, 1H), 1.81 (d, *J* = 13.9 Hz, 1H), 1.61 – 1.40 (m, 3H), 1.28 (td, *J* = 13.5, 3.2 Hz, 1H), 1.19 – 1.08 (m, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 211.3, 160.0, 158.0, 138.0, 136.6, 128.7

(2C), 128.1, 127.2 (2C), 118.1, 104.2, 97.9, 70.2, 68.34, 55.25, 54.7, 30.6, 27.01, 27.0, 26.6, 26.4, 22.7, 20.1 ppm; IR ν_{max} 1606, 1267, 1151, 1072, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{24}H_{28}O_4Na$, 403.1880; found, 403.1872; Enantiomeric excess: 72%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 31.923 min (major), t_R = 34.506 min (minor).



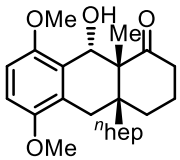
11

11 (70.1 mg) was prepared according to general procedure in 77% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.31 (20% ethyl acetate-petroleum ether); m.p. 129 - 131 °C; $[\alpha]_D^{20}$ +59.9 (c 0.5, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.72 (d, *J* = 8.9 Hz, 1H), 6.70 (d, *J* = 8.9 Hz, 1H), 4.66 (d, *J* = 3.9 Hz, 1H), 3.82 (s, 3H), 3.79 (s, 3H), 3.38 (d, *J* = 3.9 Hz, 1H), 2.88 – 2.80 (m, 1H), 2.77 (d, *J* = 18.2 Hz, 1H), 2.51 – 2.44 (m, 1H), 2.42 – 2.34 (m, 1H), 2.38 (d, *J* = 18.1 Hz, 1H), 2.01 – 1.81 (m, 2H), 1.27 (m, 1H), 1.09 (s, 3H), 1.04 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 216.0, 151.7, 151.1, 126.0, 124.3, 108.6, 107.3, 71.2, 55.6, 55.5, 53.8, 39.4, 36.0, 34.9, 32.4, 24.8, 19.8, 16.9 ppm; IR ν_{max} 2987, 1419, 1282, 1267, 1178, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{18}H_{24}O_4$, 304.1675; found, 304.1671; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.699 min (major), t_R = 13.042 min (minor).



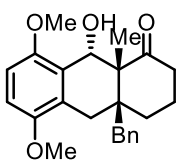
12

12 (88.7 mg) was prepared according to general procedure in 89% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.36 (20% ethyl acetate-petroleum ether); m.p. 133 - 135 °C; $[\alpha]_D^{20}$ +60.5 (c 0.75, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.72 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.66 (d, *J* = 3.6 Hz, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 3.31 (d, *J* = 3.6 Hz, 1H), 2.94 – 2.84 (m, 1H), 2.92 (d, *J* = 18.4 Hz, 1H), 2.51 – 2.44 (m, 1H), 2.41 – 2.34 (m, 1H), 2.29 (d, *J* = 18.3 Hz, 1H), 1.85 – 1.73 (m, 2H), 1.45 – 1.28 (m, 5H), 1.04 (s, 3H), 0.93 (t, *J* = 7.0 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 216.2, 151.6, 151.2, 126.0, 124.1, 108.5, 107.1, 71.4, 55.52, 55.47, 54.5, 39.8, 38.7, 38.0, 32.0, 27.0, 19.4, 16.4, 15.9, 15.0 ppm; IR ν_{max} 3055, 1691, 1282, 1178, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{20}H_{28}O_4$, 332.1988; found, 332.1986; Enantiomeric excess: 87%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 7.358 min (major), t_R = 11.298 min (minor).



13

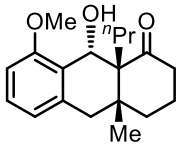
13 (87 mg) was prepared according to general procedure in 75% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.41 (20% ethyl acetate-petroleum ether); m.p. 124 - 126 °C; $[\alpha]_D^{20}$ +49.9 (c 0.41, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.72 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.66 (d, *J* = 3.6 Hz, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 3.30 (d, *J* = 3.6 Hz, 1H), 2.95 – 2.85 (m, 1H), 2.90 (d, *J* = 18.0 Hz, 1H), 2.51 – 2.43 (m, 1H), 2.43 – 2.33 (m, 1H), 2.28 (d, *J* = 18.2 Hz, 1H), 1.85 – 1.75 (m, 2H), 1.44 – 1.38 (m, 1H), 1.34 – 1.22 (m, 12H), 1.04 (s, 3H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 216.2, 151.6, 151.2, 126.0, 124.2, 108.5, 107.1, 71.5, 55.53, 55.47, 54.5, 39.8, 37.9, 36.3, 32.0, 31.9, 30.5, 29.3, 26.9, 22.6 (2C), 19.4, 16.4, 14.1 ppm; IR ν_{max} 3053, 2322, 0697, 1282, 1267, 1178, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{24}H_{36}O_4Na$, 411.2506; found, 411.2504; Enantiomeric excess: 85%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 6.464 min (major), t_R = 7.953 min (minor).



14

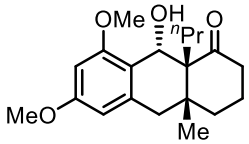
14 (72.4 mg) was prepared according to general procedure in 63% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.19 (20% ethyl acetate-petroleum ether); m.p. 165 - 167 °C; $[\alpha]_D^{20}$ +28.7 (c 0.29, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.26 – 7.19 (m, 3H), 7.02 (m, 2H), 6.75 (d, *J* = 8.8 Hz, 1H), 6.73 (d, *J* = 8.8 Hz, 1H), 4.80 (d, *J* = 6.2 Hz, 1H), 3.95 (d, *J* = 6.2 Hz, 1H), 3.86 (s, 3H), 3.75 (s, 3H), 2.74 – 2.54 (m, 4H), 2.51 (s, 2H), 2.14 – 2.03 (m, 1H), 1.92 – 1.77 (m, 2H), 1.69 – 1.63 (m, 1H), 1.46 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ

216.7, 152.0, 151.0, 137.4, 130.7 (2C), 127.8 (2C), 126.5, 126.2, 124.3, 108.9, 108.3, 72.3, 55.8, 55.6, 54.7, 42.4, 39.6, 38.4, 29.2, 27.6, 20.7, 17.6 ppm; IR ν_{max} 3055, 1691, 1280, 1267, 1139, 742, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{24}H_{28}O_4Na$, 403.1880; found, 403.1872; Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 15.999 min (major), t_R = 25.205 min (minor).



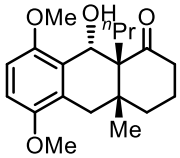
15

15 (86 mg) was prepared according to general procedure in 95% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.6 (20% ethyl acetate-petroleum ether); m.p. 60 - 62 °C; $[\alpha]_D^{20}$ -110 (c 0.52, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.13 (t, *J* = 7.9 Hz, 1H), 6.73 (d, *J* = 8.2 Hz, 1H), 6.63 (d, *J* = 7.7 Hz, 1H), 5.39 (d, *J* = 3.1 Hz, 1H), 3.87 (s, 3H), 2.89 (dt, *J* = 3.1, 1.4 Hz, 1H), 2.84 (d, *J* = 16.8 Hz, 1H), 2.61 (dt, *J* = 14.2, 10.9 Hz, 1H), 2.36 – 2.25 (m, 2H), 2.23 (d, *J* = 16.9 Hz, 1H), 2.17 (dtd, *J* = 14.1, 3.9, 1.3 Hz, 1H), 1.99 (tt, *J* = 7.3, 2.3 Hz, 2H), 1.91 (td, *J* = 12.7, 3.5 Hz, 1H), 1.66 – 1.53 (m, 1H), 1.35 (dtd, *J* = 14.1, 3.9, 1.3 Hz, 1H), 1.13 (s, 3H), 0.99 (t, *J* = 6.5 Hz, 3H), 0.96 – 0.89 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 214.6, 157.2, 134.5, 127.7, 126.1, 121.3, 107.6, 62.0, 58.4, 55.2, 38.8, 38.6, 36.9, 33.0, 31.3, 23.5, 21.9, 17.1, 14.8 ppm; IR ν_{max} 2968, 1373, 1267, 1180, 1141, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+K]^+$ calcd for $C_{19}H_{26}O_3K$, 341.1514; found, 341.1504; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 6.583 min (major), t_R = 7.651 min (minor).



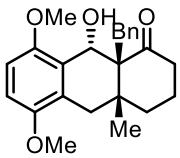
16

16 (71.8 mg) was prepared according to general procedure in 72% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil; R_f = 0.39 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ -88.0 (c 0.54, DCM); ^{1}H NMR (400 Hz, $CDCl_3$) δ 6.33 (d, *J* = 2.3 Hz, 1H), 6.13 (d, *J* = 2.3 Hz, 1H), 5.30 (s, 1H), 3.86 (s, 3H), 3.75 (s, 3H), 2.82 (d, *J* = 16.9 Hz, 1H), 2.70 (s, 1H), 2.65 – 2.54 (m, 1H), 2.34 – 2.21 (m, 2H), 2.21 – 2.13 (m, 2H), 2.04 – 1.95 (m, 2H), 1.89 (td, *J* = 12.8, 3.4 Hz, 1H), 1.62 – 1.53 (m, 1H), 1.33 (dq, *J* = 14.1, 2.9 Hz, 1H), 1.13 (s, 3H), 0.97 (t, *J* = 6.2 Hz, 3H), 0.94 – 0.85 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 214.6, 159.5, 158.4, 135.3, 119.1, 104.2, 96.6, 61.9, 58.4, 55.3, 55.2, 39.2, 39.1, 37.0, 33.1, 31.4, 23.7, 22.0, 17.1, 14.9 ppm; IR ν_{max} 3053, 2966, 1674, 1492, 1271, 827, 738 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{20}H_{28}O_4$, 332.1988; found, 332.1990; Enantiomeric excess: 87%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.241 min (minor), t_R = 13.851 min (major).



17

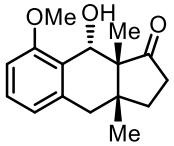
17 (77 mg) was prepared according to general procedure in 77% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.3 (20% ethyl acetate-petroleum ether); m.p. 104-106 °C; $[\alpha]_D^{20}$ -72.8 (c 0.25, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.71 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 8.9 Hz, 1H), 4.94 (d, *J* = 7.6 Hz, 1H), 4.25 (d, *J* = 7.6 Hz, 1H), 3.84 (s, 3H), 3.76 (s, 3H), 2.69 (d, *J* = 17.8 Hz, 1H), 2.62 – 2.44 (m, 2H), 2.40 (d, *J* = 17.8 Hz, 1H), 2.12 – 1.94 (m, 3H), 1.93 – 1.73 (m, 3H), 1.58 – 1.51 (m, 1H), 1.36 – 1.21 (m, 1H), 0.94 (s, 3H), 0.90 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 218.1, 152.0, 150.8, 127.7, 124.6, 108.7, 108.4, 71.3, 57.1, 56.0, 55.6, 40.8, 39.4, 37.0, 33.9, 33.5, 22.9, 21.8, 19.2, 15.4 ppm; IR ν_{max} 3055, 1691, 1280, 1267, 1178, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{20}H_{28}O_4Na$, 355.1880; found, 355.1876; Enantiomeric excess: 99%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.047 min (major), t_R = 22.223 min (minor).



18

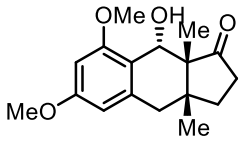
18 (94.6 mg, d.r. = 2.3:1) was prepared according to general procedure in 83% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.38 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +59.2 (c 0.10, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.12 – 7.01 (m, 5H), 6.75 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.69 (d, *J* = 3.6 Hz, 1H), 3.82 (s, 3H), 3.65 (s, 3H), 3.31 (d, *J* = 13.9 Hz, 1H), 3.09 – 2.96 (m, 2H), 2.79 (d, *J* =

18.6 Hz, 1H), 2.64 (d, *J* = 18.6 Hz, 1H), 2.60 (dt, *J* = 18.6, 5.8 Hz, 1H), 2.49 (d, *J* = 13.9 Hz, 1H), 2.53 – 2.43 (m, 1H), 2.05 – 1.82 (m, 2H), 1.33 – 1.27 (m, 1H), 1.09 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 216.1, 151.5, 151.2, 139.3, 131.5 (2C), 127.5 (2C), 126.4, 125.7, 124.5, 108.8, 107.8, 67.0, 58.2, 55.7, 55.6, 40.6, 37.9, 36.6, 35.8, 33.8, 24.4, 20.3 ppm; IR ν_{max} 3055, 1697, 1282, 1267, 1178, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{24}H_{28}O_4Na$, 403.1880; found, 403.1875; Enantiomeric excess: 99%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 7.432 min (major), t_R = 13.839 min (minor).



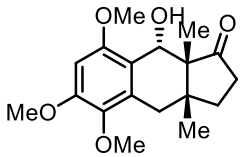
19

19 (66.2 mg, d.r. = 12:1) was prepared according to general procedure in 85% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.2 (20% ethyl acetate-petroleum ether); m.p. 110 – 112 °C; $[\alpha]_D^{20}$ +89.4 (c 0.48, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.21 (t, *J* = 8.0 Hz, 1H), 6.78 (d, *J* = 7.6 Hz, 1H), 6.74 (d, *J* = 8.2 Hz, 1H), 4.88 (d, *J* = 3.0 Hz, 1H), 3.83 (s, 3H), 2.96 (d, *J* = 16.8 Hz, 1H), 2.75 (d, *J* = 3.5 Hz, 1H), 2.67 (d, *J* = 16.8 Hz, 1H), 2.46 – 2.36 (m, 1H), 2.27 (q, *J* = 9.9, 9.2 Hz, 1H), 2.23 – 2.14 (m, 1H), 1.63 – 1.55 (m, 1H), 0.95 (s, 3H), 0.93 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 221.7, 157.6, 136.6, 128.6, 124.6, 121.3, 107.9, 69.6, 55.4 (d, *J* = 3.0 Hz), 54.2, 40.0, 38.9, 37.2, 32.5, 25.9, 16.6 ppm; IR ν_{max} 2308, 1531, 1492, 1398, 1267, 904, 798, 748, 698, 653 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{16}H_{20}O_3Na$, 283.1305; found, 283.1301; Enantiomeric excess: 98%, determined by HPLC (Daicel Chiralpak AS-H, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 32.496 min (minor), t_R = 44.993 min (major).



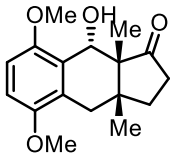
20

20 (81.7 mg, d.r. = 5:1) was prepared according to general procedure in 94% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.17 (20% ethyl acetate-petroleum ether); m.p. 132 - 134 °C; $[\alpha]_D^{20}$ +95.9 (c 0.28, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.33 (d, *J* = 2.3 Hz, 1H), 6.29 (d, *J* = 2.4 Hz, 1H), 4.82 (d, *J* = 2.8 Hz, 1H), 3.81 (s, 3H), 3.80 (s, 3H), 2.92 (d, *J* = 16.8 Hz, 1H), 2.64 (d, *J* = 16.8 Hz, 1H), 2.58 (d, *J* = 3.6 Hz, 1H), 2.47 – 2.34 (m, 1H), 2.32 – 2.14 (m, 3H), 0.95 (s, 3H), 0.92 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 221.8, 160.2, 158.7, 137.4, 117.3, 104.4, 96.5, 69.4, 55.4, 55.3, 54.3, 40.1, 39.4, 37.3, 32.6, 25.9, 16.6 ppm; IR ν_{max} 2306, 1735, 1305, 1267, 1122, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{22}O_4Na$, 313.1410; found, 313.1408; Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 29.535 min (minor), t_R = 60.764 min (major).

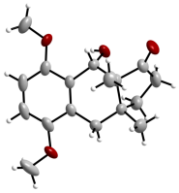


21

21 (61.5 mg) was prepared according to general procedure in 64% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.11 (20% ethyl acetate-petroleum ether); m.p. 128 - 130 °C; $[\alpha]_D^{20}$ +85.4 (c 1.13, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.40 (s, 1H), 4.84 (d, *J* = 3.4 Hz, 1H), 3.88 (s, 3H), 3.83 (s, 3H), 3.77 (s, 3H), 3.00 (d, *J* = 17.2 Hz, 1H), 2.61 (d, *J* = 17.2 Hz, 1H), 2.61 (d, *J* = 3.5 Hz, 1H), 2.44 – 2.34 (m, 1H), 2.32 – 2.10 (m, 2H), 1.65 – 1.57 (m, 1H), 0.96 (s, 3H), 0.90 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 222.0, 154.1, 152.5, 140.2, 130.4, 117.1, 94.6, 69.5, 60.4, 55.9, 55.7, 54.0, 39.8, 37.3, 32.9, 32.7, 26.1, 16.7 ppm; IR ν_{max} 3055, 1734, 1492, 1236, 1074, 738 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_5Na$, 343.1516; found, 343.1510; Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 13.698 min (major), t_R = 19.137 min (minor).

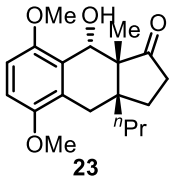


22



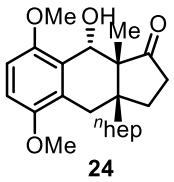
CCDC 1947384

22 (69.1 mg) was prepared according to general procedure in 79% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.18 (20% ethyl acetate-petroleum ether); m.p. 147 – 149 °C; $[\alpha]_D^{20}$ +75.5 (c 0.55, DCM); and it was recrystallized from ethyl acetate /hexane (V/V = 1/5) at 25 °C, to obtain colorless crystals, CCDC (1947384). ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.81 (d, *J* = 3.6 Hz, 1H), 3.81 (s, 3H), 3.80 (s, 3H), 2.95 (d, *J* = 18.2 Hz, 1H), 2.88 (d, *J* = 3.6 Hz, 1H), 2.47 (d, *J* = 18.2 Hz, 1H), 2.41 – 2.33 (m, 1H), 2.27 – 2.15 (m, 2H), 1.60 – 1.52 (m, 1H), 0.99 (s, 3H), 0.93 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 221.8, 151.6, 151.1, 125.5, 124.8, 109.0, 107.2, 69.7, 55.7, 55.5, 53.4, 39.0, 37.1, 32.3, 32.2, 26.2, 16.0 ppm; IR ν_{max} 3053, 1735, 1267, 1180, 1139, 740 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{17}H_{22}O_4$, 290.1518; found, 290.1514; Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.883 min (major), t_R = 17.052 min (minor).



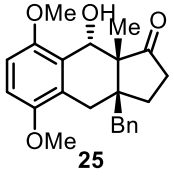
23

23 (78.4 mg) was prepared according to general procedure in 82% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.18 (20% ethyl acetate-petroleum ether); m.p. 110 – 112 °C; $[\alpha]_D^{20}$ +73.9 (c 0.68, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.68 (d, *J* = 8.8 Hz, 1H), 4.80 (d, *J* = 3.3 Hz, 1H), 3.83 (s, 3H), 3.82 (s, 3H), 3.02 (d, *J* = 18.2 Hz, 1H), 3.01 (s, 1H), 2.45 (d, *J* = 18.2 Hz, 1H), 2.38 – 2.29 (m, 1H), 2.20 – 2.10 (m, 1H), 2.09 – 2.00 (m, 1H), 1.85 – 1.77 (m, 1H), 1.52 – 1.35 (m, 2H), 1.27 – 1.09 (m, 2H), 0.95 (s, 3H), 0.92 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 222.2, 151.6, 151.2, 125.5, 124.8, 108.9, 107.3, 70.0, 55.62, 55.56, 54.3, 41.8, 39.8, 36.7, 29.6, 27.0, 16.8, 15.7, 15.0 ppm; IR ν_{max} 3061, 1735, 1267, 1171, 1060, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{19}H_{26}O_4$, 318.1831; found, 318.1834; Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.074 min (major), t_R = 14.873 min (minor).



24

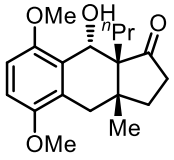
24 (95.5 mg) was prepared according to general procedure in 85% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.29 (20% ethyl acetate-petroleum ether); m.p. 114 – 116 °C; $[\alpha]_D^{20}$ +58.6 (c 0.40, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.80 (d, *J* = 2.7 Hz, 1H), 3.81 (s, 3H), 3.80 (s, 3H), 3.00 (d, *J* = 18.2 Hz, 1H), 2.96 (d, *J* = 3.6 Hz, 1H), 2.41 (d, *J* = 18.2 Hz, 1H), 2.37 – 2.30 (m, 1H), 2.14 (m, 1H), 2.09 – 2.00 (m, 1H), 1.85 – 1.77 (m, 1H), 1.48 – 1.23 (m, 10H), 1.21 – 1.08 (m, 2H), 0.95 (s, 3H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 222.2, 151.6, 151.2, 125.5, 124.8, 108.9, 107.3, 70.0, 55.61, 55.56, 54.4, 41.8, 37.3, 36.8, 31.9, 30.5, 29.5, 29.3, 27.0, 23.6, 22.6, 15.7, 14.1 ppm; IR ν_{max} 3062, 1735, 1267, 1171, 1139, 740 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{23}H_{34}O_4Na$, 397.2349; found, 397.2344; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.896 min (major), t_R = 10.430 min (minor).



25

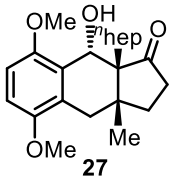
25 (94.5 mg) was prepared according to general procedure in 86% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.21 (20% ethyl acetate-petroleum ether); m.p. 184 – 186 °C; $[\alpha]_D^{20}$ +70.7 (c 0.58, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 – 7.30 (m, 2H), 7.31 – 7.25 (m, 1H), 7.23 – 7.17 (m, 2H), 6.74 (d, *J* = 8.8 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 4.87 (d, *J* = 3.8 Hz, 1H), 3.82 (s, 3H), 3.79 (s, 3H), 3.13 (d, *J* = 3.8 Hz, 1H), 2.88 (d, *J* = 18.0 Hz, 1H), 2.64 (d, *J* = 18.0 Hz, 1H), 2.57 (d, *J* = 12.7 Hz, 1H), 2.48 – 2.28 (m, 3H), 1.94 – 1.83 (m, 1H), 1.77 – 1.65 (m, 1H), 1.12 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 221.4, 151.5, 151.2, 137.8, 130.4 (2C), 128.1 (2C), 126.4, 125.4, 124.3, 109.0, 107.4, 70.3, 55.62, 55.59, 54.7, 43.2, 42.6, 36.8, 29.3, 26.5, 15.8 ppm; IR ν_{max} 3651, 1735, 1479, 1265, 1012, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{23}H_{26}O_4$, 366.1831; found, 366.1826; Enantiomeric excess: 95%, determined by HPLC (Daicel

Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.349 min (major), t_R = 15.958 min (minor).



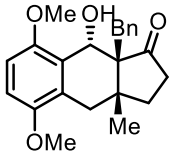
26

26 (74.4 mg) was prepared according to general procedure in 78% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.26 (20% ethyl acetate-petroleum ether); m.p. 124 – 126 °C; $[\alpha]_D^{20}$ +72.2 (c 0.22, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.73 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.94 (s, 1H), 3.81 (s, 3H), 3.81 (s, 3H), 3.01 (d, *J* = 3.4 Hz, 1H), 2.93 (d, *J* = 18.4 Hz, 1H), 2.55 (d, *J* = 18.4 Hz, 1H), 2.38 – 2.28 (m, 1H), 2.27 – 2.07 (m, 2H), 1.77 (td, *J* = 13.9, 3.9 Hz, 1H), 1.54 – 1.47 (m, 1H), 1.36 (td, *J* = 13.9, 3.9 Hz, 1H), 1.18 – 1.09 (m, 1H), 1.06 (s, 3H), 0.99 – 0.88 (m, 1H), 0.78 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 221.6, 151.1, 150.9, 126.8, 124.8, 108.6, 107.1, 68.0, 55.8, 55.54, 55.48, 39.4, 36.8, 35.3, 34.3, 33.1, 25.6, 16.6, 15.2 ppm; IR ν_{max} 3053, 1735, 1282, 1267, 1139, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{19}H_{26}O_4$, 318.1831; found, 366.1826; Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.404 min (major), t_R = 14.586 min (minor).



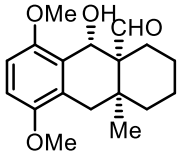
27

27 (84.9 mg) was prepared according to general procedure in 76% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.32 (20% ethyl acetate-petroleum ether); m.p. 100 – 102 °C; $[\alpha]_D^{20}$ +67.1 (c 0.31, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 4.93 (s, 1H), 3.82 (s, 3H), 3.81 (s, 3H), 3.04 (d, *J* = 3.4 Hz, 1H), 2.93 (d, *J* = 18.4 Hz, 1H), 2.55 (d, *J* = 18.4 Hz, 1H), 2.37 – 2.28 (m, 1H), 2.26 – 2.07 (m, 2H), 1.83 – 1.73 (m, 1H), 1.50 (m, 1H), 1.43 – 1.35 (m, 1H), 1.26 – 1.09 (m, 9H), 1.06 (s, 3H), 1.00 – 0.87 (m, 1H), 0.82 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 221.7, 151.1, 150.9, 126.9, 124.9, 108.7, 107.1, 68.1, 55.7, 55.6, 55.5, 39.5, 36.8, 34.2, 33.0, 32.9, 31.8, 30.6, 28.7, 25.5, 22.9, 22.5, 14.0 ppm; IR ν_{max} 3053, 1735, 1282, 1267, 1139, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{23}H_{34}O_4Na$, 397.2349; found, 397.2345; Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.097 min (major), t_R = 11.136 min (minor).



28

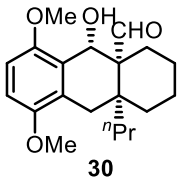
28 (93.7 mg) was prepared according to general procedure in 85% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.26 (20% ethyl acetate-petroleum ether); m.p. 129 - 131 °C; $[\alpha]_D^{20}$ +101 (c 0.44, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.12 – 7.07 (m, 2H), 7.05 – 6.99 (m, 3H), 6.64 (d, *J* = 8.8 Hz, 1H), 6.60 (d, *J* = 8.8 Hz, 1H), 5.11 (d, *J* = 3.4 Hz, 1H), 3.74 (s, 3H), 3.73 (s, 3H), 3.11 (d, *J* = 14.3 Hz, 1H), 2.82 (d, *J* = 18.5 Hz, 1H), 2.76 (d, *J* = 3.9 Hz, 1H), 2.55 (d, *J* = 14.3 Hz, 1H), 2.44 – 2.18 (m, 4H), 1.56 – 1.49 (m, 1H), 1.20 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 220.9, 151.12, 151.06, 137.6, 130.5 (2C), 127.5 (2C), 126.0, 125.8, 124.9, 109.0, 107.3, 66.5, 57.0, 55.72, 55.66, 39.9, 36.99, 36.98, 33.2, 32.9, 25.9 ppm; IR ν_{max} 3055, 1421, 1267, 1178, 1139, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{23}H_{26}O_4Na$, 389.1723; found, 389.1718; Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.963 min (major), t_R = 18.918 min (minor).



29

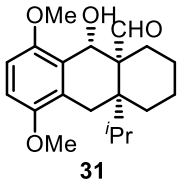
29 (86 mg) was prepared according to general procedure in 94% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.32 (20% ethyl acetate-petroleum ether); m.p. 85 – 87 °C; $[\alpha]_D^{20}$ +23.3 (c 0.88, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 6.75 (d, *J* = 8.9 Hz, 1H), 6.72 (d, *J* = 8.9 Hz, 1H), 5.13 (s, 1H), 3.86 (s, 3H), 3.80 (s, 3H), 3.63 (s, 1H), 2.76 (d, *J* = 18.3 Hz, 1H), 2.55 (d, *J* = 18.3 Hz, 1H), 1.88 (dt, *J* = 17.2, 5.7 Hz, 1H), 1.66 (s, 1H), 1.57 – 1.40 (m, 6H), 1.16 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 205.8, 151.7, 151.3, 125.4, 124.8, 108.7, 107.3, 68.3, 55.6, 55.5, 53.9, 35.0, 34.7, 33.7, 24.1, 20.8, 20.6

ppm; IR ν_{max} 1373, 1282, 1267, 1180, 1141, 800, 744, 707 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1567; found, 327.1556; Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 13.622 min (major), t_R = 22.610 min (minor).



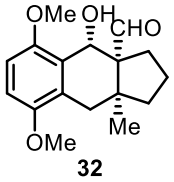
30

30 (94 mg) was prepared according to general procedure in 94% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.35 (20% ethyl acetate-petroleum ether); m.p. 116 – 118 °C; $[\alpha]_D^{20}$ +35.6 (c 1.44, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.81 (s, 1H), 6.75 (d, *J* = 8.8 Hz, 1H), 6.72 (d, *J* = 8.8 Hz, 1H), 5.21 (s, 1H), 3.96 (s, 1H), 3.86 (s, 3H), 3.80 (s, 3H), 2.80 (d, *J* = 18.4 Hz, 1H), 2.63 (d, *J* = 18.4 Hz, 1H), 2.05 – 1.86 (m, 2H), 1.73 (d, *J* = 14.6 Hz, 1H), 1.66 – 1.45 (m, 5H), 1.37 – 1.24 (m, 3H), 1.14 (s, 1H), 0.89 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.7, 151.8, 151.4, 125.4, 124.9, 108.7, 107.4, 67.6, 55.6 (dd, *J* = 12.1, 5.2 Hz, 2C), 54.7, 36.9, 36.8, 31.7, 29.7, 22.5, 20.5, 20.3, 15.8, 14.9 ppm; IR ν_{max} 2954, 1724, 1479, 1255, 1082, 800, 742, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{20}H_{28}O_4Na$, 355.1880; found, 355.1866; Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.734 min (major), t_R = 12.232 min (minor).



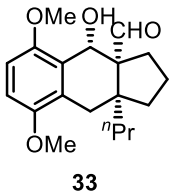
31

31 (56 mg) was prepared according to general procedure in 56% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.3 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +61.3 (c 0.90, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.02 (s, 1H), 6.74 (d, *J* = 8.9 Hz, 1H), 6.71 (d, *J* = 8.9 Hz, 1H), 5.27 (s, 1H), 4.02 (s, 1H), 3.85 (s, 3H), 3.81 (s, 3H), 2.94 (d, *J* = 18.4 Hz, 1H), 2.59 (d, *J* = 18.4 Hz, 1H), 2.41 (hept, *J* = 6.8 Hz, 1H), 1.97 – 1.86 (m, 1H), 1.86 – 1.76 (m, 1H), 1.70 – 1.60 (m, 3H), 1.56 – 1.49 (m, 2H), 1.48 – 1.35 (m, 1H), 0.92 (d, *J* = 6.8 Hz, 3H), 0.87 (d, *J* = 6.8 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 207.2, 151.7, 151.5, 125.1, 125.0, 108.6, 107.4, 67.9, 55.6, 55.5, 54.4, 40.5, 29.0, 28.8, 26.2, 20.0, 19.4, 19.2(2C), 18.2 ppm; IR ν_{max} 1396, 1267, 1051, 904, 746, 698, 651 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{20}H_{28}O_4Na$, 355.1880; found, 355.1867; Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): tR = 14.467min (major), tR = 18.503 min (minor).



32

32 (41.4 mg) was prepared according to general procedure in 48% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.42 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +8.4 (c 0.12, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.83 (s, 1H), 6.77 (d, *J* = 8.9 Hz, 1H), 6.72 (d, *J* = 8.9 Hz, 1H), 5.17 (d, *J* = 2.1 Hz, 1H), 3.83 (s, 3H), 3.80 (s, 3H), 2.80 (d, *J* = 16.6 Hz, 1H), 2.72 (d, *J* = 16.6 Hz, 1H), 2.19 – 2.08 (m, 1H), 1.71 – 1.57 (m, 3H), 1.53 – 1.37 (m, 2H), 1.22 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 206.2, 151.38, 151.33, 126.5, 125.8, 109.9, 108.3, 68.4, 61.2, 55.98, 55.96, 43.7, 41.1, 34.3, 31.3, 25.0, 21.5 ppm; IR ν_{max} 2985, 1697, 1280, 1267, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{22}O_4Na$, 313.1410; found, 313.1406; Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.239 min (major), t_R = 11.706 min (minor).



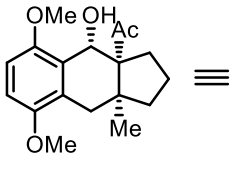
33

33 (88 mg) was prepared according to general procedure in 92% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.35 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +14.3 (c 0.96, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.83 (s, 1H), 6.77 (d, *J* = 8.9 Hz, 1H), 6.71 (d, *J* = 8.9 Hz, 1H), 5.20 (d, *J* = 1.8 Hz, 1H), 3.84 (d, *J* = 1.8 Hz, 1H), 3.82 (s, 3H), 3.79 (s, 3H), 2.94 (d, *J* = 16.4 Hz, 1H), 2.62 (d, *J* = 16.4 Hz, 1H), 2.85 – 1.99 (m, 1H), 1.83 – 1.73 (m, 1H), 1.70 – 1.58 (m, 2H), 1.57 – 1.52 (m, 1H), 1.51 – 1.45 (m, 3H), 1.44 – 1.28 (m, 2H), 0.88 (t, *J* = 6.5 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.7, 151.5, 151.4, 126.9,

125.9, 110.2, 108.5, 68.2 (d, *J* = 3.0 Hz), 62.3, 56.2 (t, *J* = 3.0 Hz, 2C), 48.1, 40.1, 38.6, 31.6, 30.7, 22.1, 18.5, 15.0 ppm; IR ν_{max} 2956, 1714, 1489, 1265, 1085, 742 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{26}O_4Na$, 341.1723; found, 341.1714; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.717 min (minor), t_R = 13.171 min (major).

34

34 (75 mg) was prepared according to general procedure A from **7** (0.3 mmol) and **16** in 79% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.55 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +3.79 (c 1.52, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.95 (s, 1H), 6.77 (d, *J* = 8.9 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 5.34 (s, 1H), 3.80 (s, 3H), 3.79 (s, 3H), 3.53 (s, 1H), 2.95 (d, *J* = 15.5 Hz, 1H), 2.65 (d, *J* = 15.5 Hz, 1H), 2.14 (hept, *J* = 6.8 Hz, 1H), 1.94 (dt, *J* = 13.7, 7.4 Hz, 1H), 1.89 – 1.83 (m, 1H), 1.65 – 1.57 (m, 1H), 1.56 – 1.47 (m, 1H), 1.35 – 1.27 (m, 1H), 1.16 – 1.07 (m, 1H), 1.02 (d, *J* = 6.7 Hz, 3H), 0.95 (d, *J* = 6.7 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 207.0, 151.12, 151.09, 128.6, 125.9, 110.6, 108.4, 66.8, 62.1, 56.2, 56.1, 53.1, 41.9, 34.6, 32.7, 26.5, 23.4, 19.6, 19.5 ppm; IR ν_{max} 2956, 1265, 1207, 1151, 1068, 1031, 740, 704 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{26}O_4Na$, 341.1723; found, 341.1709; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 92/8, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 20.294 min (major), t_R = 23.006 min (minor).



35

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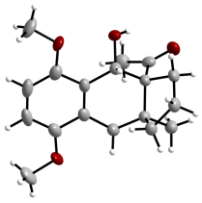
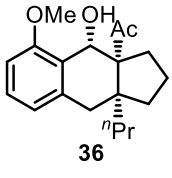
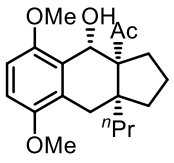

CCDC 1947385

35 (72.1 mg) was prepared according to general procedure in 79% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.26 (20% ethyl acetate-petroleum ether); m.p. 76 - 78 °C; $[\alpha]_D^{20}$ +47.3 (c 0.50, DCM); and it was recrystallized from ethyl acetate /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947385). ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.75 (d, *J* = 8.9 Hz, 1H), 6.73 (d, *J* = 8.8 Hz, 1H), 4.98 (s, 1H), 4.36 (d, *J* = 1.8 Hz, 1H), 3.86 (s, 3H), 3.81 (s, 3H), 2.81 (d, *J* = 18.1 Hz, 1H), 2.71 (d, *J* = 18.1 Hz, 1H), 2.55 – 2.45 (m, 1H), 2.14 (s, 3H), 2.04 – 1.94 (m, 1H), 1.83 – 1.72 (m, 1H), 1.71 – 1.56 (m, 3H), 1.05 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 210.8, 151.6, 151.2, 126.3, 125.7, 108.6, 107.7, 70.6, 63.2, 55.61, 55.57, 42.8, 38.9, 33.3, 31.9, 29.7, 24.7, 18.9 ppm; IR ν_{max} 3053, 1697, 1421, 1267, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{18}H_{24}O_4$, 304.1675; found, 304.1679; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.803 min (major), t_R = 14.162 min (minor).



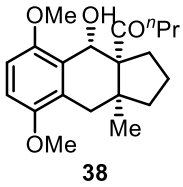
36

36 (77 mg, d.r. = 16 :1) was prepared according to general procedure in 85% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.4 (20% ethyl acetate-petroleum ether); m.p. 100 - 102 °C; $[\alpha]_D^{20}$ +98.4 (c 0.30, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.18 (t, *J* = 7.9 Hz, 1H), 6.76 (d, *J* = 8.0 Hz, 1H), 6.74 (d, *J* = 8.5 Hz, 1H), 5.10 (s, 1H), 4.28 (d, *J* = 1.9 Hz, 1H), 3.86 (s, 3H), 3.06 (d, *J* = 16.6 Hz, 1H), 2.66 (d, *J* = 16.6 Hz, 1H), 2.38 – 2.29 (m, 1H), 2.18 (s, 3H), 1.84 (ddd, *J* = 11.9, 8.6, 5.4 Hz, 1H), 1.76 (ddd, *J* = 13.5, 9.4, 3.6 Hz, 1H), 1.72 – 1.60 (m, 1H), 1.53 – 1.43 (m, 3H), 1.39 – 1.17 (m, 3H), 0.90 (t, *J* = 6.9 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 212.7, 157.3, 137.9, 128.3, 124.8, 121.5, 108.1, 70.2, 64.6, 55.4, 47.6, 39.3, 37.6, 35.9, 32.6, 30.2, 20.4, 17.6, 15.0 ppm; IR ν_{max} 2956, 1591, 1471, 1375, 1280, 1180, 744, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{26}O_3Na$, 325.1774; found, 325.1762; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.839 min (minor), t_R = 11.127 min (major).



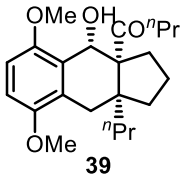
37

37 (74.3 mg) was prepared according to general procedure in 75% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.36 (20% ethyl acetate-petroleum ether); m.p. 94 - 96 °C; $[\alpha]_D^{20}$ +43.7 (c 0.36, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.73 (d, *J* = 9.0 Hz, 1H), 6.70 (d, *J* = 9.0 Hz, 1H), 4.99 (s, 1H), 4.31 (d, *J* = 1.9 Hz, 1H), 3.84 (s, 3H), 3.79 (s, 3H), 2.79 (d, *J* = 18.0 Hz, 1H), 2.69 (d, *J* = 18.0 Hz, 1H), 2.49 – 2.38 (m, 1H), 2.13 (s, 3H), 1.94 – 1.79 (m, 2H), 1.75 – 1.64 (m, 1H), 1.61 – 1.56 (m, 1H), 1.51 – 1.42 (m, 3H), 1.38 – 1.30 (m, 1H), 1.19 – 1.09 (m, 1H), 0.90 (t, *J* = 6.8 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 211.3, 151.5, 151.3, 126.1, 125.9, 108.7, 107.6, 70.6, 64.1, 55.7, 55.6, 46.2, 38.5, 34.6, 31.9, 30.3, 29.9, 19.2, 17.3, 15.0 ppm; IR ν_{max} 3055, 1697, 1241, 1267, 1105, 804 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{20}H_{28}O_4$, 332.1988; found, 332.1982; Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.967 min (minor), t_R = 12.793 min (major).



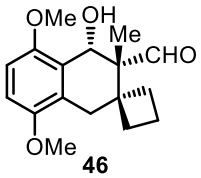
38

38 (72.1 mg) was prepared according to general procedure in 72% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.52 (20% ethyl acetate-petroleum ether); m.p. 79 - 81 °C; $[\alpha]_D^{20}$ +55.4 (c 0.14, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.72 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 8.9 Hz, 1H), 4.93 (s, 1H), 4.32 (d, *J* = 1.8 Hz, 1H), 3.83 (s, 3H), 3.79 (s, 3H), 2.74 (d, *J* = 2.1 Hz, 2H), 2.53 – 2.44 (m, 2H), 2.44 – 2.35 (m, 1H), 2.01 (m, 1H), 1.82 – 1.71 (m, 1H), 1.70 – 1.63 (m, 1H), 1.58 – 1.53 (m, 3H), 1.23 (d, *J* = 17.6 Hz, 1H), 1.02 (s, 3H), 0.86 (t, *J* = 7.4 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 213.1, 151.5, 151.3, 126.3, 126.1, 108.6, 107.6, 71.0, 62.6, 55.7, 55.6, 43.9, 43.1, 38.7, 33.4, 31.8, 24.7, 19.1, 17.0, 13.9 ppm; IR ν_{max} 3736, 3055, 1697, 1421, 1267, 1107 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{20}H_{28}O_4$, 332.1988; found, 332.1990; Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.652 min (minor), t_R = 11.045 min (major).



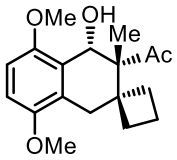
39

39 (52 mg) was prepared according to general procedure in 46% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.55 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +48.5 (c 0.20, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.71 (d, *J* = 8.9 Hz, 1H), 6.68 (d, *J* = 8.9 Hz, 1H), 4.97 (d, *J* = 1.7 Hz, 1H), 4.30 (d, *J* = 1.8 Hz, 1H), 3.82 (s, 3H), 3.78 (s, 3H), 2.76 (d, *J* = 18.0 Hz, 1H), 2.71 (d, *J* = 18.0 Hz, 1H), 2.53 – 2.45 (m, 1H), 2.41 (ddt, *J* = 11.1, 8.4, 5.7 Hz, 2H), 1.98 – 1.90 (m, 1H), 1.86 – 1.77 (m, 1H), 1.74 – 1.66 (m, 1H), 1.64 – 1.54 (m, 3H), 1.48 – 1.39 (m, 3H), 1.38 – 1.30 (m, 1H), 1.17 – 1.09 (m, 1H), 0.89 (t, *J* = 6.9 Hz, 3H), 0.86 (t, *J* = 7.4 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 213.6, 151.4, 151.3, 126.04, 125.99, 108.6, 107.4, 70.8, 63.4, 55.6, 55.5, 46.4, 44.0, 38.3, 34.2, 31.7, 30.2, 19.3, 17.2, 17.0, 15.0, 13.8 ppm; IR ν_{max} 1701, 1465, 1371, 1180, 1141, 744, 701 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{22}H_{32}O_4Na$, 383.2193; found, 383.2178; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.014 min (minor), t_R = 13.248 min (major).



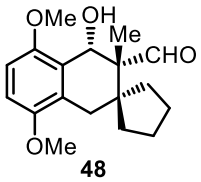
46

46 (48 mg, d.r. = 9:1) was prepared according to general procedure in 55% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.35 (20% ethyl acetate-petroleum ether); m.p. 100 - 102 °C; $[\alpha]_D^{20}$ +16.6 (c 0.32, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.07 (s, 1H), 6.74 (d, *J* = 8.9 Hz, 1H), 6.72 (d, *J* = 9.1 Hz, 1H), 4.88 (d, *J* = 1.8 Hz, 1H), 3.84 (s, 3H), 3.81 (s, 3H), 3.54 (d, *J* = 2.4 Hz, 1H), 2.99 (d, *J* = 18.0 Hz, 1H), 2.85 (d, *J* = 18.0 Hz, 1H), 2.64 (dt, *J* = 11.9, 9.1 Hz, 1H), 2.26 (dt, *J* = 11.9, 9.1 Hz, 1H),, 2.11 – 2.01 (m, 1H), 1.93 – 1.83 (m, 1H), 1.71 – 1.63 (m, 1H), 1.61 – 1.53 (m, 1H), 1.14 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 207.4, 151.63, 151.59, 126.5, 124.9, 108.8, 107.8, 70.7, 55.6, 55.5, 52.2, 40.9, 34.5, 29.3, 28.5, 15.6, 13.8 ppm; IR ν_{max},2966, 1722, 1456, 1267, 744, 704 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{22}O_4Na$, 313.1410; found, 313.1407; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 15.752 min (major), t_R = 21.974 min (minor).



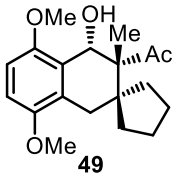
47

47 (68 mg, d.r. = 6:1) was prepared according to general procedure in 75% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.2 (20% ethyl acetate-petroleum ether); m.p. 152 - 154 °C; $[\alpha]_D^{20}$ +12.9 (c 0.32, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.73 (d, *J* = 9.0 Hz 1H), 6.71 (d, *J* = 9.0 Hz 1H), 4.94 (d, *J* = 2.4 Hz, 1H), 3.84 (s 3H), 3.81 (s, 3H), 3.32 (d, *J* = 3.5 Hz, 1H), 2.97 (d, *J* = 18.1 Hz, 1H), 2.73 (d, *J* = 18.1 Hz, 1H), 2.70 (ddd, *J* = 11.9, 9.9, 8.1 Hz, 1H), 2.56 (ddd, *J* = 11.9, 9.9, 8.1 Hz, 1H), 2.25 (s, 3H), 2.09 – 1.94 (m, 2H), 1.54 – 1.45 (m, 2H), 1.18 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 211.5, 151.6, 151.5, 126.8, 125.2, 108.7, 107.8, 70.8, 55.62, 55.58, 54.8, 40.6, 35.4, 29.3, 29.0, 28.1, 16.5, 15.3 ppm; IR ν_{max} 2958, 1722, 1469, 1265, 1085, 1014, 746 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1567; found, 327.1563; Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 30.903 min (major), t_R = 32.791 min (minor).



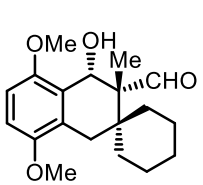
48

48 (55 mg) was prepared according to general procedure in 60% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.4 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +19.0 (c 0.20, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.91 (s, 1H), 6.73 (s, 2H), 4.88 (d, *J* = 2.1 Hz, 1H), 3.91 (d, *J* = 2.1 Hz, 1H), 3.85 (s, 3H), 3.78 (s, 3H), 2.66 (d, *J* = 18.1 Hz, 1H), 2.57 (d, *J* = 18.1 Hz, 1H), 2.06 (ddd, *J* = 13.3, 8.3, 6.8 Hz, 1H), 1.75 – 1.56 (m, 5H), 1.37 – 1.25 (m, 2H), 1.20 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.4, 151.7, 151.5, 126.8, 125.8, 108.7, 107.8, 72.1, 55.6, 55.52, 55.49, 53.3, 45.9, 34.7, 34.4, 25.6, 24.8, 14.3 ppm; IR ν_{max} 1701, 1371, 1282, 1267, 1180, 1141, 902, 844, 744, 707 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1567; found, 327.1561; Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.605 min (major), t_R = 14.471 min (minor).



49

49 (90 mg, d.r. = 10:1) was prepared according to general procedure in 94% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.3 (20% ethyl acetate-petroleum ether); m.p. 132 – 134 °C; $[\alpha]_D^{20}$ +12.9 (c 0.32, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.71 (s, 2H), 5.00 (d, *J* = 3.2 Hz, 1H), 3.86 (s, 3H), 3.78 (s, 3H), 3.24 (d, *J* = 3.2 Hz, 1H), 2.70 (d, *J* = 18.1 Hz, 1H), 2.40 (d, *J* = 18.1 Hz, 1H), 2.26 (s, 3H), 2.13 – 1.99 (m, 2H), 1.84 – 1.60 (m, 5H), 1.30 – 1.25 (m, 1H), 1.23 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 210.9, 151.7, 151.4, 126.7, 126.3, 108.6, 107.3, 71.6, 55.8, 55.6, 55.5, 45.2, 36.3, 35.6, 34.2, 28.2, 26.0, 25.0, 18.6 ppm; IR ν_{max} 2964, 1701, 1371, 1282, 1265, 1180, 1141, 902, 802, 744, 707 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{26}O_4Na$, 341.1723; found, 341.1720; Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 28.209 min (minor), t_R = 30.850 min (major).



50

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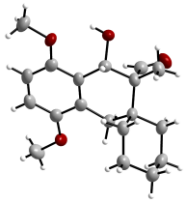
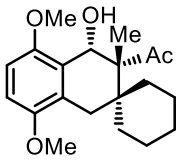
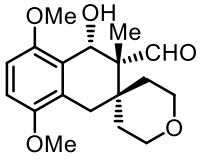

CCDC 1947395

50 (88 mg, d.r. = 10:1) was prepared according to general procedure in 92% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white foam: R_f = 0.4 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +5.71 (c 0.80, DCM); and it was recrystallized from DCM /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947395). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 6.76 (d, *J* = 8.8 Hz, 1H), 6.74 (d, *J* = 8.8 Hz, 1H), 4.86 (s, 1H), 4.15 (d, *J* = 1.7 Hz, 1H), 3.86 (s, 3H), 3.81 (s, 3H), 3.26 (d, *J* = 18.5 Hz, 1H), 2.34 (d, *J* = 18.8 Hz, 1H), 1.70 – 1.63 (m, 2H), 1.54 (dt, *J* = 10.1, 3.1 Hz, 2H), 1.45 – 1.33 (m, 5H), 1.26 (s, 3H), 1.18 – 1.06 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 207.3, 151.7, 151.5, 126.3, 125.3, 108.9, 107.9, 71.7, 55.7, 55.5, 54.9, 37.9, 32.1, 28.8, 27.9, 26.0, 21.1, 21.0, 12.2 ppm; IR ν_{max} 2935, 1722, 1479, 1265, 1082, 1024, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{26}O_4Na$, 341.1723; found, 341.1720; Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 84/16, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 19.210 min (minor), t_R = 20.349 min (major).



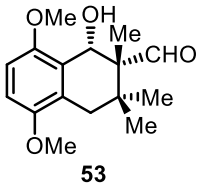
51

51 (46 mg, d.r. = 5.2:1) was prepared according to general procedure in 46% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.35 (20% ethyl acetate-petroleum ether); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.73 (d, *J* = 8.9 Hz, 1H), 6.71 (d, *J* = 9.0 Hz, 1H), 4.90 (d, *J* = 1.7 Hz, 1H), 3.99 (d, *J* = 2.2 Hz, 1H), 3.84 (s, 3H), 3.80 (s, 3H), 2.99 (d, *J* = 18.3 Hz, 1H), 2.54 (d, *J* = 18.3 Hz, 1H), 2.16 (s, 3H), 1.85 – 1.74 (m, 1H), 1.70 – 1.65 (m, 2H), 1.55 – 1.50 (m, 2H), 1.48 – 1.43 (m, 2H), 1.38 (s, 3H), 1.34 (d, *J* = 2.7 Hz, 1H), 1.28 – 1.23 (m, 1H), 1.22 – 1.13 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 212.1, 151.42, 151.37, 126.8, 126.0, 108.7, 107.5, 72.6, 57.2, 55.7, 55.5, 37.6, 31.4, 30.7, 29.6, 27.9, 25.9, 21.63, 21.55, 17.6 ppm; IR ν_{max}.2937, 1602, 1465, 1265, 1255, 1141, 1093, 742, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{20}H_{28}O_4Na$, 355.1880; found, 355.1873; Enantiomeric excess: 83%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 34.910 min (minor), t_R = 38.588 min (major).



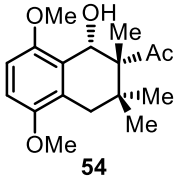
52

52 (85 mg) was prepared according to general procedure in 89% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.4 (20% ethyl acetate-petroleum ether); m.p. 82 - 84 °C; $[\alpha]_D^{20}$ +6.61 (c 1.15, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.91 (s, 1H), 6.76 (s, 2H), 4.87 (d, *J* = 1.4 Hz, 1H), 4.02 (d, *J* = 2.0 Hz, 1H), 3.86 (s, 3H), 3.81 (s, 3H), 3.78 – 3.59 (m, 4H), 3.24 (d, *J* = 18.5 Hz, 1H), 2.58 (d, *J* = 18.4 Hz, 1H), 2.15 (ddd, *J* = 14.0, 12.6, 5.3 Hz, 1H), 1.89 (ddd, *J* = 14.0, 12.6, 5.3 Hz, 1H), 1.29 – 1.14 (m, 5H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 206.7, 151.7, 151.4, 126.0, 124.3, 109.0, 108.1, 71.2, 63.3, 62.9, 55.6, 54.0, 35.5, 31.7, 29.7, 27.5, 12.5 ppm; IR ν_{max} 1718, 1481, 1390, 1257, 1083, 798, 744, 698, 651 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_5Na$, 343.1516; found, 343.1512; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 18.671min (major), t_R = 21.838 min (minor).



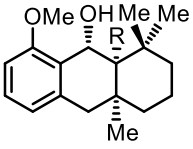
53

53 (47 mg) was prepared according to general procedure in 56% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.35 (20% ethyl acetate-petroleum ether); m.p. 78 – 80 °C; $[\alpha]_D^{20}$ +9.68 (c 0.28, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.81 (s, 1H), 6.75 (s, 2H), 4.88 (s, 1H), 4.20 (d, *J* = 1.7 Hz, 1H), 3.87 (s, 3H), 3.80 (s, 3H), 2.65 (d, *J* = 18.2 Hz, 1H), 2.56 (d, *J* = 18.2 Hz, 1H), 1.24 (s, 3H), 1.04 (s, 3H), 0.94 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.0, 151.8, 151.4, 126.3, 125.7, 108.8, 108.0, 72.1, 55.62, 55.57, 54.1, 36.2, 35.1, 25.4, 24.3, 13.0 ppm; IR ν_{max} 1730, 1602, 1477, 1371, 1280, 1180, 1141, 742, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{16}H_{22}O_4Na$, 301.1410; found, 301.1401; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.040 min (major), t_R = 14.544 min (minor).



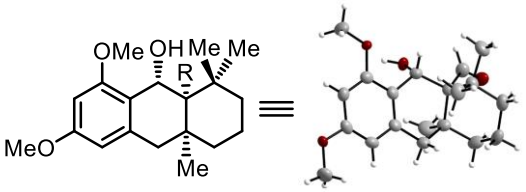
54

54 (22 mg, d.r. = 10:1) was prepared according to general procedure in 25% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.35 (20% ethyl acetate-petroleum ether); m.p. 105 – 107 °C; $[\alpha]_D^{20}$ +33.6 (c 0.32, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.72 (s, 2H), 4.95 (d, *J* = 1.6 Hz, 1H), 3.86 (s, 3H), 3.79 (s, 3H), 2.57 (d, *J* = 18.0 Hz, 1H), 2.50 (d, *J* = 18.0 Hz, 1H), 2.20 (s, 3H), 1.31 (s, 3H), 1.11 (s, 3H), 1.07 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 211.5, 151.6, 151.2, 126.5, 126.2, 108.7, 107.4, 72.5, 55.9, 55.6, 55.5, 37.3, 34.4, 29.6, 25.6, 25.4, 18.3 ppm; IR ν_{max} 2358, 2330, 1274, 1267, 763, 748, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{24}O_4Na$, 315.1567; found, 315.1568; Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): tR = 9.179 min (major), tR = 10.041 min (minor).



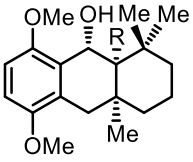
R = CHO, **55**

55 (74 mg) was prepared according to general procedure in 82% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.25 (20% ethyl acetate-petroleum ether); m.p. 115 – 117 °C; $[\alpha]_D^{20}$ +1.40 (c 0.88, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.09 (s, 1H), 7.19 (t, *J* = 7.9 Hz, 1H), 6.74 (d, *J* = 8.3 Hz, 1H), 6.72 (d, *J* = 7.9 Hz, 1H), 5.51 (d, *J* = 3.2 Hz, 1H), 3.91 (s, 3H), 3.29 (d, *J* = 18.1 Hz, 1H), 3.12 (d, *J* = 3.3 Hz, 1H), 2.37 (d, *J* = 17.8 Hz, 1H), 2.30 – 2.36 (m, 1H), 1.80 – 1.68 (m, 1H), 1.64 – 1.53 (m, 2H), 1.35 – 1.28 (m, 1H), 1.28 – 1.20 (m, 1H), 1.17 (s, 3H), 1.12 (s, 3H), 0.72 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.1 (d, *J* = 2.0 Hz, 1C), 156.9, 136.6, 128.2, 126.4, 121.4, 107.5, 64.6 (d, *J* = 4.7 Hz, 2C), 57.3, 55.5 (d, *J* = 5.5 Hz, 2C), 41.7, 38.2, 36.8, 36.7, 33.8, 28.7, 28.7, 25.8, 18.5 ppm; IR ν_{max} 2958, 1716, 1595, 1265, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{19}H_{26}O_3Na$, 325.1774; found, 325.1765; Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.100 min (major), t_R = 9.998 min (minor).



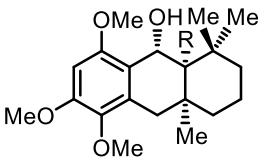
R = CHO, **56** CCDC 1947393

56 (90 mg) was prepared according to general procedure in 90% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.25 (20% ethyl acetate-petroleum ether); m.p. 47 - 49 °C; $[\alpha]_D^{20}$ +4.78 (c 0.74, DCM); and it was recrystallized from DCM /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947393). ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.07 (s, 1H), 6.33 (d, *J* = 2.3 Hz, 1H), 6.21 (d, *J* = 2.3 Hz, 1H), 5.44 (s, 1H), 3.88 (s, 3H), 3.78 (s, 3H), 3.26 (d, *J* = 18.1 Hz, 1H), 2.97 (s, 1H), 2.40 – 2.28 (m, 2H), 1.73 (d, *J* = 13.4 Hz, 1H), 1.60 (dd, *J* = 6.9, 3.3 Hz, 1H), 1.29 (dt, *J* = 14.5, 3.3 Hz, 1H), 1.25 – 1.20 (m, 1H), 1.17 (s, 3H), 1.10 (s, 3H), 0.72 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.2, 159.8, 158.1, 137.4, 119.4, 104.0, 96.5, 64.4, 57.4, 55.5, 55.2, 42.3, 38.2, 36.8, 36.7, 33.9, 28.9, 28.7, 25.8, 18.5 ppm; IR ν_{max} 1371, 1282, 1180, 1141, 904, 844, 746, 707 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{20}H_{28}O_4Na$, 355.1880; found, 355.1869; Enantiomeric excess: 98%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.526 min (major), t_R = 16.350 min (minor).



R = CHO, **57**

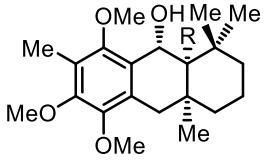
57 (77 mg) was prepared according to general procedure in 77% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.45 (20% ethyl acetate-petroleum ether); m.p. 109 – 111 °C; $[\alpha]_D^{20}$ +10.2 (c 0.87, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.09 (s, 1H), 6.70 (s, 2H), 5.49 (d, *J* = 3.1 Hz, 1H), 3.87 (s, 3H), 3.79 (s, 3H), 3.18 (d, *J* = 3.3 Hz, 1H), 2.95 (d, *J* = 18.9 Hz, 1H), 2.43 (d, *J* = 18.9 Hz, 1H), 2.36 (td, *J* = 13.5, 4.1 Hz, 1H), 1.85 – 1.71 (m, 1H), 1.63 – 1.53 (m, 2H), 1.39 (dt, *J* = 13.7, 3.2 Hz, 1H), 1.26 – 1.19 (m, 1H), 1.15 (s, 3H), 1.09 (s, 3H), 0.67 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.3 (d, *J* = 2.0 Hz, 1C), 151.2, 150.8, 127.5, 125.6, 108.4, 107.2, 64.6 (d, *J* = 3.0 Hz, 1C), 56.9, 55.7 (d, *J* = 3.3 Hz, 1C), 55.5 (d, *J* = 3.1 Hz, 1C), 38.2, 36.83, 36.78, 36.4, 33.2, 29.1, 28.6, 25.8, 18.6 ppm; IR ν_{max} 1529, 1456, 1396, 1265, 1051, 904, 798, 748, 698, 651 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{20}H_{28}O_4Na$, 355.1880; found, 355.1868; Enantiomeric excess: 99%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.289 min (minor), t_R = 9.444 min (major).



R = CHO, **58**

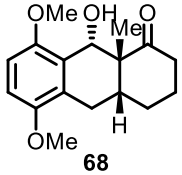
58 (72 mg) was prepared according to general procedure in 66% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.2 (20% ethyl acetate-petroleum ether); m.p. 75 – 77 °C; $[\alpha]_D^{20}$ -3.5 (c 0.16, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.08 (s, 1H), 6.42 (s, 1H), 5.45 (s, 1H), 3.90 (s, 3H), 3.88 (s, 3H), 3.74 (s, 3H), 3.09 (s, 1H), 3.06 (d, *J* = 18.7 Hz, 1H), 2.47 (d, *J* = 18.7 Hz, 1H), 2.34 (td, *J* = 13.6, 4.3 Hz, 1H), 1.76 (ddd, *J* = 14.6, 10.3, 7.2 Hz, 1H), 1.61 – 1.56 (m, 2H), 1.38 (dt, *J* = 14.2, 3.2 Hz, 1H), 1.27 – 1.19 (m, 1H), 1.16 (s, 3H), 1.08 (s, 3H), 0.69 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 207.4, 153.4, 152.0, 140.1, 130.5, 119.1,

94.6, 64.4, 60.1, 57.0, 55.9, 55.8, 38.3, 36.8, 36.7, 36.5, 33.4, 29.1, 28.7, 25.9, 18.5 ppm; IR ν_{max} 1371, 1282, 1267, 1180, 1141, 900, 844, 744, 707 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{21}H_{30}O_5Na$, 385.1985; found, 385.1967; Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 13.596 min (major), t_R = 15.106 min (minor).



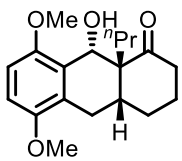
R = CHO, **59**

59 (82 mg) was prepared according to general procedure in 73% yield. Ligand **L12** (0.15 mmol, 0.5 equiv.) was used instead of **L10**. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.4 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ -14.3 (c 1.28, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.14 (s, 1H), 5.43 (d, *J* = 2.8 Hz, 1H), 3.86 (s, 3H), 3.82 (s, 3H), 3.78 (s, 3H), 3.36 (d, *J* = 3.2 Hz, 1H), 3.03 (d, *J* = 18.5 Hz, 1H), 2.49 (d, *J* = 18.5 Hz, 1H), 2.28 (td, *J* = 13.7, 4.3 Hz, 1H), 2.20 (s, 3H), 1.81 (dd, *J* = 13.4, 3.9 Hz, 1H), 1.69 – 1.61 (m, 2H), 1.48 – 1.40 (m, 1H), 1.30 – 1.22 (m, 1H), 1.18 (s, 3H), 1.05 (s, 3H), 0.68 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 208.4, 152.6, 151.3, 146.8, 127.3, 127.2, 123.1, 64.7, 61.3, 60.1, 59.8, 57.5, 38.7, 37.1, 36.5, 36.1, 33.2, 29.7, 28.8, 26.2, 18.6, 9.5 ppm; IR ν_{max} 2360, 1463, 1267, 1078, 748, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{22}H_{32}O_5Na$, 399.2142; found, 399.2125; Enantiomeric excess: 85%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 6.816 min (major), t_R = 8.958 min (minor).



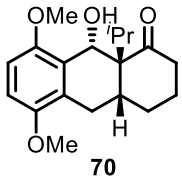
68

68 (52.2 mg) was prepared according to general procedure in 60% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.46 (20% ethyl acetate-petroleum ether); m.p. 137 - 139 °C; $[\alpha]_D^{20}$ +96.8 (c 0.47, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 4.69 (d, *J* = 3.0 Hz, 1H), 3.81 (s, 3H), 3.80 (s, 3H), 2.96 (d, *J* = 3.2 Hz, 1H), 2.88 – 2.72 (m, 3H), 2.59 – 2.48 (m, 1H), 2.26 – 2.14 (m, 1H), 2.13 – 1.95 (m, 2H), 1.84 – 1.70 (m, 1H), 1.57 – 1.49 (m, 1H), 1.09 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 215.3, 151.7, 151.4, 126.1, 123.8, 108.8, 107.3, 68.6, 55.6, 55.5, 50.3, 41.2, 38.9, 27.8, 26.5, 23.7, 20.9 ppm; IR ν_{max} 3055, 1697, 1423, 1265, 1107, 808 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{17}H_{22}O_4$, 290.1518; found, 290.1522; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.785 min (major), t_R = 11.375 min (minor).



69

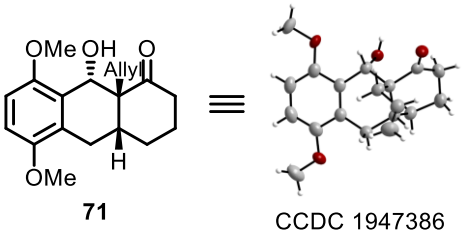
69 (69 mg) was prepared according to general procedure in 72% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.5 (20% ethyl acetate-petroleum ether); m.p. 116 - 118 °C; $[\alpha]_D^{20}$ +90.9 (c 0.18, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.75 (d, *J* = 8.8 Hz, 1H), 6.71 (d, *J* = 8.8 Hz, 1H), 4.70 (d, *J* = 3.3 Hz, 1H), 3.82 (s, 6H), 2.93 (d, *J* = 3.4 Hz, 1H), 2.86 – 2.80 (m, 1H), 2.73 – 2.65 (m, 2H), 2.55 – 2.47 (m, 1H), 2.41 – 2.33 (m, 1H), 2.25 – 2.12 (m, 1H), 2.04 – 1.96 (m, 1H), 1.95 – 1.87 (m, 1H), 1.86 – 1.75 (m, 1H), 1.64 – 1.55 (m, 1H), 1.36 – 1.24 (m, 1H), 1.22 – 1.12 (m, 1H), 1.11 – 1.03 (m, 1H), 0.84 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 215.4, 151.6, 151.3, 126.3, 124.1, 108.7, 107.2, 69.4, 55.6, 55.5, 53.7, 41.2, 35.8, 33.1, 27.0, 26.1, 22.5, 18.3, 14.7 ppm; IR ν_{max} 3738, 3055, 1697, 1267, 1105, 802, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{19}H_{26}O_4$, 318.1831; found, 318.1829; Enantiomeric excess: 98%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.407 min (major), t_R = 10.959 min (minor).



70

70 (52.3 mg) was prepared according to general procedure in 55% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.29 (20% ethyl acetate-petroleum ether); m.p. 85 - 87 °C; $[\alpha]_D^{20}$ +59.6 (c 0.05, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.68 (d, *J* = 8.8 Hz, 1H), 5.41 (d, *J* = 3.5 Hz, 1H), 3.80 (s, 3H), 3.79 (s, 3H), 3.01 (dd, *J* = 16.9, 7.0 Hz, 1H), 2.68 (dd, *J* = 16.9, 6.7 Hz, 1H), 2.55 – 2.46

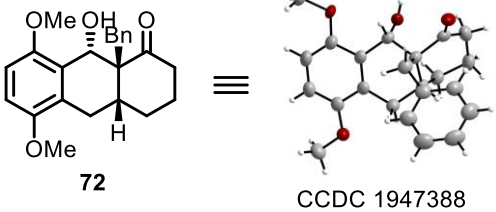
(m, 3H), 2.40 – 2.29 (m, 1H), 2.00 – 1.78 (m, 5H), 0.86 (d, *J* = 6.8 Hz, 3H), 0.77 (d, *J* = 7.0 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 217.6, 150.80, 150.76, 127.4, 126.5, 109.8, 107.9, 67.4, 57.7, 55.9, 55.8, 41.3, 34.5, 34.2, 30.0, 27.0, 20.8, 18.6, 18.5 ppm; IR ν_{max} 3055, 2306, 1697, 1267, 1105, 802, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{19}H_{26}O_4$, 318.1831; found, 318.1836; Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.371 min (major), t_R = 21.511 min (minor).



71

CCDC 1947386

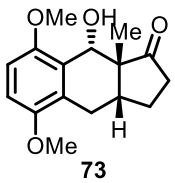
71 (72.5 mg) was prepared according to general procedure in 76% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.5 (20% ethyl acetate-petroleum ether); m.p. 121 - 123 °C; $[\alpha]_D^{20}$ +57.1 (c 0.44, DCM); and it was recrystallized from DCM /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947386). ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.74 (d, *J* = 8.8 Hz, 1H), 6.69 (d, *J* = 8.8 Hz, 1H), 5.72 – 5.59 (m, 1H), 5.04 – 5.01 (m, 1H), 5.00 (d, *J* = 1.5 Hz, 1H), 4.69 (d, *J* = 3.1 Hz, 1H), 3.81 (s, 6H), 2.94 (d, *J* = 3.3 Hz, 1H), 2.85 – 2.65 (m, 4H), 2.54 – 2.45 (m, 1H), 2.35 – 2.25 (m, 1H), 2.23 – 2.13 (m, 1H), 2.01 – 1.91 (m, 1H), 1.81 – 1.72 (m, 2H), 1.59 – 1.51 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 214.8, 151.8, 151.6, 135.0, 126.2, 124.3, 117.8, 109.0, 107.4, 68.9, 55.9, 55.7, 53.8, 41.7, 38.2, 33.5, 27.3, 25.7, 23.0 ppm; IR ν_{max} 3055, 1697, 1267, 1105, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{19}H_{24}O_4$, 316.1675; found, 316.1673; Enantiomeric excess: 87%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.109 min (major), t_R = 12.277 min (minor).



72

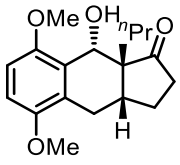
CCDC 1947388

72 (80.5 mg) was prepared according to general procedure in 73% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.36 (20% ethyl acetate-petroleum ether); m.p. 145 - 147 °C; $[\alpha]_D^{20}$ +58.9 (c 0.12, DCM); and it was recrystallized from DCM /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947388). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 – 7.16 (m, 3H), 7.16 – 7.10 (m, 2H), 6.77 (d, *J* = 8.8 Hz, 1H), 6.73 (d, *J* = 8.8 Hz, 1H), 4.91 (d, *J* = 3.5 Hz, 1H), 3.84 (s, 3H), 3.83 (s, 3H), 3.58 (d, *J* = 13.7 Hz, 1H), 2.91 – 2.84 (m, 2H), 2.75 (d, *J* = 18.2 Hz, 1H), 2.59 (ddd, *J* = 16.6, 9.4, 7.0 Hz, 1H), 2.41 – 2.32 (m, 1H), 2.21 (d, *J* = 13.7 Hz, 1H), 2.15 – 2.04 (m, 2H), 1.92 – 1.83 (m, 1H), 1.66 – 1.59 (m, 1H), 1.52 – 1.46 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 216.1, 151.6, 151.4, 138.2, 130.1 (2C), 128.2 (2C), 126.3, 125.8, 123.9, 108.9, 107.3, 69.0, 55.7, 55.5, 55.0, 41.2, 39.3, 31.5, 26.8, 25.9, 21.2 ppm; IR ν_{max} 3691, 3055, 1697, 1267, 1105, 804 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{23}H_{26}O_4$, 366.1831; found, 366.1826; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.404 min (major), t_R = 13.115 min (minor).



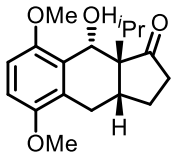
73

73 (76.2 mg) was prepared according to general procedure in 92% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.18 (20% ethyl acetate-petroleum ether); m.p. 122 - 124 °C; $[\alpha]_D^{20}$ +104 (c 0.23, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.77 (d, *J* = 8.8 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 4.95 (d, *J* = 2.5 Hz, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 2.99 (dd, *J* = 17.8, 7.6 Hz, 1H), 2.86 (dd, *J* = 17.8, 4.0 Hz, 1H), 2.51 – 2.41 (m, 1H), 2.38 (d, *J* = 3.3 Hz, 1H), 2.30 – 2.16 (m, 2H), 2.06 – 1.93 (m, 2H), 0.96 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 222.4, 151.6, 151.3, 126.2, 124.9, 109.7, 107.7, 67.6, 55.81, 55.76, 50.1, 40.3, 38.7, 26.7, 24.0, 21.2 ppm; IR ν_{max} 3736, 3055, 1697, 1421, 1267, 1107 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{16}H_{20}O_4Na$, 299.1254; found, 299.1251; Enantiomeric excess: 86%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.862 min (major), t_R = 15.564 min (minor).



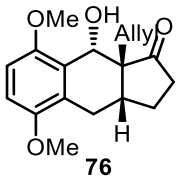
74

74 (87 mg) was prepared according to general procedure in 95% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.2 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +91.8 (c 0.84, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.76 (d, *J* = 8.9 Hz, 1H), 6.68 (d, *J* = 8.9 Hz, 1H), 5.00 (s, 1H), 3.80 (s, 3H), 3.78 (s, 3H), 3.01 (dd, *J* = 17.2, 7.6 Hz, 1H), 2.80 (dd, *J* = 17.2, 5.1 Hz, 1H), 2.50 – 2.38 (m, 2H), 2.29 (s, 1H), 2.25 – 2.12 (m, 1H), 2.08 – 1.90 (m, 2H), 1.65 – 1.56 (m, 1H), 1.18 (ddt, *J* = 15.1, 7.8, 3.6 Hz, 1H), 1.10 – 1.00 (m, 2H), 0.78 (t, *J* = 7.0 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 222.3, 151.3, 151.1, 126.8, 125.6, 109.8, 107.8, 67.9, 55.8 (t, *J* = 3.0 Hz, 2C), 54.6, 39.6, 37.0, 36.5, 26.7, 24.6, 17.8, 14.6 ppm; IR ν_{max} 1481, 1394, 1265, 1085, 904, 798, 744, 698, 651 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1567; found, 327.1562; Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.261 min (major), t_R = 13.630 min (minor).



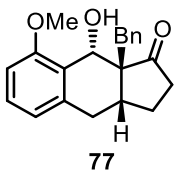
75

75 (55.1 mg) was prepared according to general procedure in 60% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.19 (20% ethyl acetate-petroleum ether); m.p. 121 - 123 °C; $[\alpha]_D^{20}$ +153 (c 0.25, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.75 (d, *J* = 8.8 Hz, 1H), 6.68 (d, *J* = 8.8 Hz, 1H), 5.21 (d, *J* = 3.1 Hz, 1H), 3.80 (s, 6H), 3.11 (dd, *J* = 16.4, 7.3 Hz, 1H), 2.73 (dd, *J* = 16.4, 7.3 Hz, 1H), 2.51 – 2.38 (m, 2H), 2.27 – 2.14 (m, 2H), 2.12 – 1.98 (m, 2H), 1.94 – 1.83 (m, 1H), 0.80 (d, *J* = 6.8 Hz, 3H), 0.55 (d, *J* = 7.0 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 223.0, 150.9, 150.4, 128.0, 126.8, 110.0, 108.0, 67.3, 58.7, 55.9, 55.8, 39.8, 35.0, 33.8, 27.2, 26.0, 19.0, 17.8 ppm; IR ν_{max} 3055, 1691, 1489, 1267, 1105, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{24}O_4Na$, 327.1572; found, 327.1562; Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 13.622 min (major), t_R = 15.511 min (minor).



76

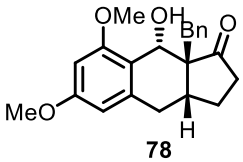
76 (86 mg) was prepared according to general procedure in 95% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.2 (20% ethyl acetate-petroleum ether); m.p. 85 - 87 °C; $[\alpha]_D^{20}$ +87.2 (c 0.36, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.77 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 8.9 Hz, 1H), 5.61 – 5.50 (m, 1H), 5.00 (d, *J* = 2.5 Hz, 1H), 4.97 (d, *J* = 1.3 Hz, 1H), 4.96 – 4.92 (m, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 2.95 (dd, *J* = 17.5, 7.6 Hz, 1H), 2.81 (dd, *J* = 17.5, 4.6 Hz, 1H), 2.50 – 2.40 (m, 3H), 2.38 (d, *J* = 3.5 Hz, 1H), 2.15 (ddd, *J* = 18.2, 9.6, 8.5 Hz, 1H), 2.02 – 1.93 (m, 2H), 1.83 (dd, *J* = 13.7, 8.7 Hz, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 221.5, 151.3, 151.2, 133.8, 126.2, 125.3, 118.2, 109.7, 107.7, 67.3, 55.8, 55.7, 54.2, 39.4, 38.9, 36.0, 26.6, 24.0 ppm; IR ν_{max} 2358, 2330, 2108, 1504, 1456, 744, 624 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{18}H_{22}O_4Na$, 325.1410; found, 325.1404; Enantiomeric excess: 99.5%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.144 min (major), t_R = 16.277 min (minor).



77

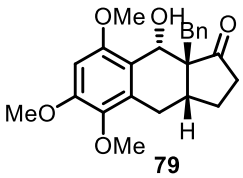
77 (98 mg, d.r. = 10:1) was prepared according to general procedure in 98% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.3 (20% ethyl acetate-petroleum ether); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 – 7.22 (m, 1H), 7.22 – 7.15 (m, 3H), 7.03 – 6.99 (m, 2H), 6.84 (d, *J* = 7.6 Hz, 1H), 6.77 (d, *J* = 8.3 Hz, 1H), 5.23 (s, 1H), 3.84 (s, 3H), 3.27 (d, *J* = 13.3 Hz, 1H), 2.95 (t, *J* = 6.1 Hz, 2H), 2.37 (ddd, *J* = 17.8, 8.4, 4.6 Hz, 1H), 2.33 – 2.23 (m, 2H), 2.10 (d, *J* = 13.3 Hz, 1H), 1.89 (dt, *J* = 17.5, 8.6 Hz, 1H), 1.83 – 1.76 (m, 1H), 1.61 (ddt, *J* = 11.8, 7.9, 3.8 Hz, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 222.2, 157.3, 137.5, 137.4, 130.1 (2C), 129.0, 128.1 (2C), 126.4, 125.1, 121.1, 108.2, 67.7, 57.0, 55.4, 40.7, 39.8, 36.0, 31.4, 26.5 ppm; IR ν_{max} 1732, 1589, 1280, 1340, 786, 736, 702, 682 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{21}H_{22}O_3Na$, 345.1461; found, 345.1455; Enantiomeric excess:

97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.952 min (major), t_R = 10.329 min (minor).



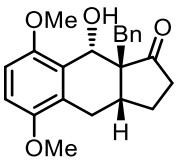
78

78 (98.8 mg, d.r. = 5:1) was prepared according to general procedure in 94% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid; R_f = 0.46 (30% ethyl acetate-petroleum ether); ^{1}H NMR (500 Hz, $CDCl_3$) δ 7.21 – 7.15 (m, 3H), 7.02 (d, *J* = 6.9 Hz, 2H), 6.36 (d, *J* = 2.3 Hz, 1H), 6.35 (d, *J* = 2.3 Hz, 1H), 5.14 (s, 1H), 3.83 (s, 3H), 3.82 (s, 3H), 3.26 (d, *J* = 13.4 Hz, 1H), 2.95 – 2.89 (m, 2H), 2.42 – 2.32 (m, 1H), 2.30 – 2.21 (m, 1H), 2.16 (s, 1H), 2.11 (d, *J* = 13.3 Hz, 1H), 1.93 – 1.76 (m, 2H), 1.64 – 1.57 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 222.3, 160.4, 158.5, 138.5, 137.5, 130.1 (2C), 128.2 (2C), 126.4, 117.9, 104.6, 96.3, 67.6, 57.1, 55.5, 55.3, 40.7, 39.8, 36.0, 31.8, 26.6 ppm; IR ν_{max} 2966, 1741, 1492, 1265, 1095, 813, 746 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{22}H_{24}O_4$, 352.1675; found, 352.1678; Enantiomeric excess: 98% (major), determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 13.803 min (minor), t_R = 18.339 min (major); Enantiomeric excess: 96% (minor), determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.880 min (major), t_R = 14.961 min (minor).



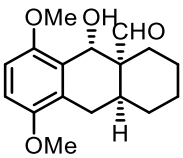
79

79 (98.6 mg, d.r. = 9:1) was prepared according to general procedure in 86% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid; R_f = 0.28 (30% ethyl acetate-petroleum ether); ^{1}H NMR (400 Hz, $CDCl_3$) δ 7.22 – 7.14 (m, 3H), 7.03 – 6.97 (m, 2H), 6.42 (s, 1H), 5.17 (d, *J* = 2.4 Hz, 1H), 3.91 (s, 3H), 3.85 (s, 3H), 3.78 (s, 3H), 3.23 (d, *J* = 13.3 Hz, 1H), 3.17 – 3.08 (m, 1H), 2.79 (dd, *J* = 16.7, 6.3 Hz, 1H), 2.42 – 2.31 (m, 1H), 2.31 – 2.21 (m, 1H), 2.10 (d, *J* = 13.3 Hz, 2H), 1.95 – 1.76 (m, 2H), 1.67 – 1.60 (m, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 222.4, 154.0, 153.0, 140.3, 137.4, 131.1, 130.1 (2C), 128.2 (2C), 126.5, 117.7, 94.7, 67.8, 60.7, 56.8, 56.0, 40.9, 39.8, 35.8, 26.9, 25.0 ppm; IR ν_{max} 2962, 1734, 1489, 1259, 1095, 796, 744 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{23}H_{26}O_5$, 382.1780; found, 382.1777; Enantiomeric excess: 97% (major), determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 7.685 min (major), t_R = 9.340 min (minor).



80

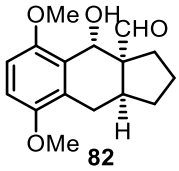
80 (101 mg) was prepared according to general procedure in 96% yield. Ligand **L10** (0.24 mmol, 0.8 equiv.) was used. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.3 (20% ethyl acetate-petroleum ether); m.p. 108 – 110 °C; $[\alpha]_D^{20}$ +62.4 (c 0.76, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.23 – 7.15 (m, 3H), 7.08 – 7.02 (m, 2H), 6.79 (d, *J* = 8.8 Hz, 1H), 6.72 (d, *J* = 8.8 Hz, 1H), 5.08 (d, *J* = 2.7 Hz, 1H), 3.83 (s, 3H), 3.82 (s, 3H), 3.33 (d, *J* = 13.4 Hz, 1H), 2.96 (dd, *J* = 18.0, 7.8 Hz, 1H), 2.80 (dd, *J* = 18.0, 3.7 Hz, 1H), 2.44 (d, *J* = 3.5 Hz, 1H), 2.40 – 2.31 (m, 1H), 2.24 – 2.13 (m, 2H), 1.95 – 1.82 (m, 2H), 1.74 – 1.65 (m, 1H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 221.9, 151.6, 151.3 137.7, 130.1 (2C), 128.2 (2C), 126.4, 126.0, 125.0, 109.7, 107.7, 67.63, 67.61, 55.8 (dd, *J* = 5.3, 3.2 Hz, 1C), 55.7, 39.7, 39.6, 34.5, 26.5, 23.9 ppm; IR ν_{max} 1720, 1481, 1265, 1089, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{22}H_{24}O_4Na$, 375.1567; found, 375.1561; Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.387 min (major), t_R = 14.498 min (minor).



81

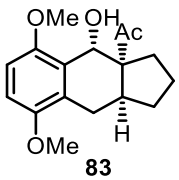
81 (73 mg) was prepared according to general procedure in 84% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.25 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +40.9 (c 0.70, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.86 (s, 1H), 6.73 (d, *J* = 8.9 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 5.05 (s, 1H), 3.83 (s, 3H), 3.80 (s, 3H), 2.96 (s, 1H), 2.84 (dd, *J* = 18.7, 6.9 Hz, 1H), 2.63 (dd, *J* = 18.7, 7.9 Hz, 1H), 2.54 – 2.46

(m, 1H), 1.75 – 1.66 (m, 2H), 1.65 – 1.57 (m, 1H), 1.55 – 1.36 (m, 5H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 207.7, 151.7, 151.3, 125.8, 125.7, 108.9, 107.4, 67.59, 67.57, 55.59, 55.56, 51.3, 29.8, 27.2, 25.7, 25.1, 21.6 ppm; IR ν_{max} 1720, 1481, 1259, 1087, 904, 798, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{22}O_4Na$, 313.1410; found, 313.1406; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 240 nm): t_R = 16.842 min (major), t_R = 20.397 min (minor).



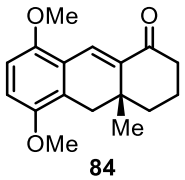
82

82 (56 mg) was prepared according to general procedure in 68% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.25 (20% ethyl acetate-petroleum ether); m.p. 46 – 48 °C; $[\alpha]_D^{20}$ -10.3 (c 0.68, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.79 (s, 1H), 6.79 (d, *J* = 8.8 Hz, 1H), 6.71 (d, *J* = 8.9 Hz, 1H), 5.44 (s, 1H), 3.81 (s, 3H), 3.78 (s, 3H), 2.99 – 2.92 (m, 1H), 2.86 (t, *J* = 4.6 Hz, 2H), 2.43 (s, 1H), 1.99 – 1.90 (m, 2H), 1.41 (ddd, *J* = 13.3, 6.4, 3.4 Hz, 1H), 1.31 – 1.21 (m, 1H), 1.13 – 1.05 (m, 2H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 203.9, 151.7, 151.3, 128.2, 126.4, 111.0, 108.5, 65.9, 61.4, 56.2, 56.0, 34.3, 34.0, 33.0, 24.5, 23.6 ppm; IR ν_{max} 2949, 1718, 1489, 1257, 1082, 740 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{16}H_{20}O_4Na$, 299.1254; found, 299.1250; Enantiomeric excess: 86%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 92/8, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 35.280 min (major), t_R = 37.406 min (minor).



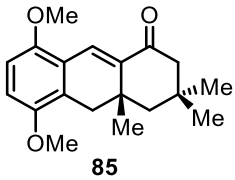
83

83 (83 mg) was prepared according to general procedure in 95% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.2 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ -21.1 (c 0.92, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.78 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 8.9 Hz, 1H), 5.52 (s, 1H), 3.80 (s, 3H), 3.77 (s, 3H), 3.30 – 3.23 (m, 1H), 2.86 (dd, *J* = 15.7, 3.0 Hz, 1H), 2.80 (dd, *J* = 15.7, 6.4 Hz, 1H), 2.38 (s, 3H), 2.04 (s, 1H), 1.96 – 1.87 (m, 2H), 1.34 – 1.25 (m, 1H), 1.23 – 1.09 (m, 2H), 1.05 – 0.94 (m, 1H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 210.7, 151.7, 151.3, 128.3, 126.8, 111.0, 108.2, 66.2, 63.6, 56.2, 55.9, 35.6, 34.4, 33.9, 26.1, 24.9, 23.9 ppm; IR ν_{max} 3068, 1255, 705 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{22}O_4Na$, 313.1410; found, 313.1408; Enantiomeric excess: 84%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.026 min (minor), t_R = 13.877 min (major).



84

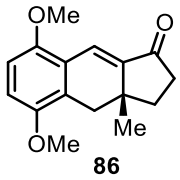
84 (80 mg) was prepared according to general procedure in 87% yield. The reaction was quenched with hydrochloric acid (HCl, 1 N) instead of saturated sodium bicarbonate. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.35 (20% ethyl acetate-petroleum ether); m.p. 126 – 128 °C; $[\alpha]_D^{20}$ -30.4 (c 0.12, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (s, 1H), 6.83 (d, *J* = 8.9 Hz, 1H), 6.67 (d, *J* = 8.9 Hz, 1H), 3.80 (d, *J* = 3.4 Hz, 6H), 3.09 (d, *J* = 16.4 Hz, 1H), 2.61 (ddd, *J* = 17.6, 4.7, 2.3 Hz, 1H), 2.50 (d, *J* = 16.3 Hz, 1H), 2.38 (ddd, *J* = 17.6, 12.3, 7.4 Hz, 1H), 2.06 – 1.91 (m, 2H), 1.91 – 1.82 (m, 1H), 1.77 (dd, *J* = 13.0, 4.1 Hz, 1H), 0.99 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 199.9, 151.9, 150.7, 139.8, 126.7, 125.8, 122.2, 113.0, 108.6, 56.1, 55.8, 39.9, 37.9, 37.1, 33.9, 23.3, 18.7 ppm; IR ν_{max} 1672, 1483, 1261, 1099, 910, 732 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+H]^+$ calcd for $C_{17}H_{21}O_3$, 273.1485; found, 273.1479; Enantiomeric excess: 66%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 1.0 mL/min, T = 25 °C, 230 nm): t_R = 7.072 min (major), t_R = 8.418 min (minor).



85

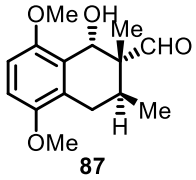
85 (63 mg) was prepared according to general procedure in 66% yield. The reaction was quenched with hydrochloric acid (HCl, 1 N) instead of saturated sodium bicarbonate. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow oil: R_f = 0.55 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ -50.2 (c 0.52, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (s, 1H), 6.81 (d, *J* = 9.0 Hz, 1H), 6.67 (d, *J* = 8.9 Hz, 1H), 3.79

(d, *J* = 4.1 Hz, 6H), 3.04 (d, *J* = 16.5 Hz, 1H), 2.61 (d, *J* = 16.5 Hz, 1H), 2.36 (d, *J* = 16.3 Hz, 1H), 2.29 (d, *J* = 16.3 Hz, 1H), 1.76 (d, *J* = 12.0 Hz, 1H), 1.72 (d, *J* = 12.0 Hz, 1H), 1.08 (s, 3H), 1.06 (s, 3H), 1.05 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 200.6, 151.9, 150.8, 139.0, 126.6, 125.9, 122.3, 113.0, 108.6, 56.1, 55.8, 52.7, 51.3, 38.5, 32.7, 32.2, 30.9, 29.7, 27.6 ppm; IR ν_{max} 1678, 1485, 1261, 1190, 1097, 910, 796, 732 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+H]^+$ calcd for $C_{19}H_{25}O_3$, 301.1798; found, 301.1791; Enantiomeric excess: 75%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 15.053 min (major), t_R = 17.159 min (minor).



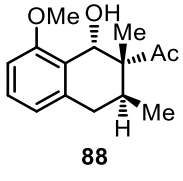
86

86 (33 mg) was prepared according to general procedure in 43% yield. The reaction was quenched with hydrochloric acid (HCl, 1 N) instead of saturated sodium bicarbonate. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a yellow solid: R_f = 0.4 (20% ethyl acetate-petroleum ether); m.p. 104 – 106 °C; $[\alpha]_D^{20}$ -65.8 (c 0.60, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.61 (s, 1H), 6.85 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 9.0 Hz, 1H), 3.799 (s, 3H), 3.796 (s, 3H), 3.34 (d, *J* = 16.3 Hz, 1H), 2.55 – 2.39 (m, 3H), 2.09 (ddd, *J* = 12.5, 8.2, 1.6 Hz, 1H), 1.81 (td, *J* = 12.2, 8.7 Hz, 1H), 1.01 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 206.6, 152.5, 151.1, 142.7, 125.5, 122.9, 122.3, 113.5, 109.0, 56.2, 56.0, 37.3, 37.0, 35.9, 35.5, 22.4 ppm; IR ν_{max} 1705, 1629, 1483, 1261, 1226, 1109, 1091, 910, 798, 732 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+H]^+$ calcd for $C_{16}H_{19}O_3$, 259.1329; found, 259.1325; Enantiomeric excess: 82%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.967 min (minor), t_R = 11.633 min (major).



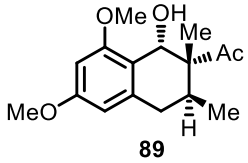
87

87 (58.1 mg) was prepared according to general procedure in 81% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.22 (20% ethyl acetate-petroleum ether); m.p. 75 - 77 °C; $[\alpha]_D^{20}$ +99.6 (c 0.67, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.93 (s, 1H), 6.74 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 8.9 Hz, 1H), 4.92 (s, 1H), 3.81 (s, 3H), 3.80 (s, 3H), 2.96 (dd, *J* = 18.3, 5.6 Hz, 1H), 2.82 – 2.70 (m, 1H), 2.49 (s, 1H), 2.18 (dd, *J* = 18.3, 11.5 Hz, 1H), 1.04 (d, *J* = 6.8 Hz, 3H), 0.85 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 208.9, 151.6, 150.8, 126.2, 125.9, 109.0, 107.4, 70.0, 55.56, 55.55, 50.5, 28.6, 25.9, 15.8, 10.6 ppm; IR ν_{max} 3055, 1718, 1483, 1625, 1085, 744 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{15}H_{20}O_4Na$, 287.1254; found, 287.1251; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 25.834 min (major), t_R = 31.518 min (minor).



88

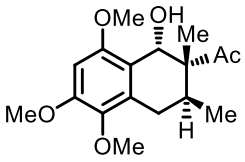
88 (66 mg) was prepared according to general procedure in 89% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.2 (20% ethyl acetate-petroleum ether); m.p. 88 – 90 °C; $[\alpha]_D^{20}$ +51.2 (c 0.64, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 (t, *J* = 7.9 Hz, 1H), 6.74 (d, *J* = 7.8 Hz, 1H), 6.72 (d, *J* = 8.2 Hz, 1H), 4.92 (s, 1H), 3.85 (s, 3H), 2.86 (dd, *J* = 17.7, 5.8 Hz, 1H), 2.75 – 2.66 (m, 1H), 2.51 – 2.40 (m, 2H), 2.32 (s, 3H), 1.03 (d, *J* = 6.5 Hz, 3H), 0.99 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 212.6, 158.0, 137.2, 128.5, 124.8, 120.9, 107.6, 69.2, 55.4, 53.5, 34.8, 27.6, 26.6, 17.0, 13.2 ppm; IR ν_{max} 2956, 1710, 1589, 1469, 1259, 1099, 740, 561 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{15}H_{20}O_3Na$, 271.1305; found, 271.1301; Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 20.782 min (major), t_R = 21.418 min (minor).



89

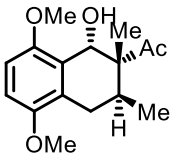
89 (70.1 mg) was prepared according to general procedure in 84% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.23 (30% ethyl acetate-petroleum ether); m.p. 97 - 99 °C; $[\alpha]_D^{20}$ +49.6 (c 0.36, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.31 (d, *J* = 2.3 Hz, 1H), 6.23 (d, *J* = 2.3 Hz, 1H), 4.86 (s, 1H), 3.83 (s, 3H), 3.78 (s, 3H), 2.82 (dd, *J* = 17.7, 5.8 Hz, 1H), 2.75 – 2.63 (m, 1H), 2.41 (dd,

J = 17.7, 11.9 Hz, 1H), 2.30 (s, 3H), 1.02 (d, *J* = 6.5 Hz, 3H), 0.98 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 212.5, 160.1, 159.1, 138.1, 117.7, 103.6, 96.5, 69.1, 55.4, 55.3, 53.6, 35.3, 27.4, 26.7, 17.0, 13.2 ppm; IR ν_{max} 3053, 2304, 1610, 1267, 1149, 941, 740 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{16}H_{22}O_4$, 278.1518; found, 278.1522; Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 80/20, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.037 min (minor), t_R = 11.962 min (major).



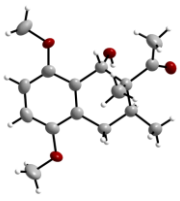
90

90 (46.1 mg) was prepared according to general procedure in 50% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.15 (30% ethyl acetate-petroleum ether); m.p. 117 - 119 °C; $[\alpha]_D^{20}$ +39.6 (c 0.28, DCM); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.41 (s, 1H), 4.87 (s, 1H), 3.88 (s, 3H), 3.85 (s, 3H), 3.76 (s, 3H), 2.98 (dd, *J* = 18.4, 5.9 Hz, 1H), 2.75 – 2.53 (m, 1H), 2.42 (s, 1H), 2.31 (s, 3H), 2.22 (dd, *J* = 18.4, 11.9 Hz, 1H), 1.06 (d, *J* = 6.6 Hz, 3H), 0.96 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 213.0, 154.5, 152.3, 139.7, 131.0, 117.4, 94.7, 69.2, 60.1, 55.9, 55.7, 53.3, 29.5, 27.7, 26.3, 17.1, 13.2 ppm; IR ν_{max} 3053, 1708, 1492, 1236, 1124, 738 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{17}H_{24}O_5Na$, 331.1516; found, 331.1515; Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 17.420 min (minor), t_R = 22.880 min (major).

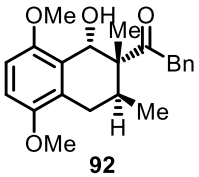


91

≡

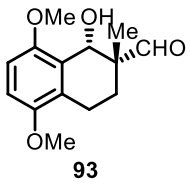

CCDC 1947387

91 (73.5 mg) was prepared according to general procedure in 88% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.15 (20% ethyl acetate-petroleum ether); m.p. 111 - 113 °C; $[\alpha]_D^{20}$ +77.6 (c 0.74, DCM); and it was recrystallized from DCM /hexane (V/V = 1/4) at 25 °C, to obtain colorless crystals, CCDC (1947387). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.72 (d, *J* = 8.9 Hz, 1H), 6.69 (d, *J* = 8.9 Hz, 1H), 4.90 (s, 1H), 3.82 (s, 3H), 3.79 (s, 3H), 2.93 (dd, *J* = 18.6, 6.0 Hz, 1H), 2.69 – 2.60 (m, 1H), 2.54 (s, 1H), 2.31 (s, 3H), 2.12 (dd, *J* = 18.5, 11.7 Hz, 1H), 1.06 (d, *J* = 6.5 Hz, 3H), 0.97 (s, 3H) ppm; ^{13}C NMR (125 MHz, $CDCl_3$) δ 212.9, 151.7, 150.8, 126.2, 125.9, 108.9, 107.4, 69.4, 55.6, 55.5, 53.1, 29.4, 27.6, 26.1, 17.1, 13.2 ppm; IR ν_{max} 3055, 1710, 1265, 1105, 744, 677 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{16}H_{22}O_4Na$, 301.1410; found, 301.1409; Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.622 min (major), t_R = 13.047 min (minor).



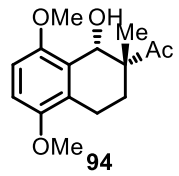
92

92 (73.4 mg) was prepared according to general procedure in 69% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.21 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +21.9 (c 0.22, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.26 (m, 4H), 7.26 – 7.21 (m, 1H), 6.74 (d, *J* = 8.9 Hz, 1H), 6.71 (d, *J* = 8.9 Hz, 1H), 5.03 (s, 1H), 4.05 (d, *J* = 16.5 Hz, 1H), 3.98 (d, *J* = 16.5 Hz, 1H), 3.84 (s, 3H), 3.80 (s, 3H), 2.97 (dd, *J* = 18.6, 6.0 Hz, 1H), 2.80 – 2.68 (m, 1H), 2.55 (s, 1H), 2.16 (dd, *J* = 18.6, 11.7 Hz, 1H), 1.10 (d, *J* = 6.6 Hz, 3H), 1.04 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 211.4, 151.8, 150.9, 135.3, 130.0 (2C), 128.2 (2C), 126.5, 126.2, 126.0, 109.0, 107.5, 69.7, 55.7, 55.6, 53.6, 45.6, 29.5, 26.2, 17.3, 13.2 ppm; IR ν_{max} 3055, 1710, 1483, 1317, 1267, 1107, 744, 677 cm^{-1}; HRMS–ESI (*m*/*z*): $[M+Na]^+$ calcd for $C_{22}H_{26}O_4Na$, 377.1729; found, 377.1717; Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 14.045 min (major), t_R = 15.956 min (minor).



93

93 (59.9 mg) was prepared according to general procedure in 83% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a colorless oil: R_f = 0.18 (20% ethyl acetate-petroleum ether); $[\alpha]_D^{20}$ +34.9 (c 0.37, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.81 (s, 1H), 6.74 (d, *J* = 8.8 Hz, 1H), 6.71 (d, *J* = 8.8 Hz, 1H), 5.04 (s, 1H), 3.84 (s, 3H), 3.79 (s, 3H), 2.99 – 2.88 (m, 1H), 2.65 (s, 1H), 2.56 – 2.45 (m, 1H), 2.20 – 2.09 (m, 1H), 1.82 – 1.73 (m, 1H), 0.99 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 205.6, 151.9, 151.3, 126.4, 125.8, 109.1, 107.6, 67.3, 55.7, 55.6, 48.1, 21.9, 19.4, 16.3 ppm; IR ν_{max} 3055, 1697, 1280, 1265, 1105, 742 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{14}H_{18}O_4$, 250.1205; found, 250.1208; Enantiomeric excess: 85%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 23.790 min (major), t_R = 25.744 min (minor).



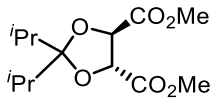
94

94 (28.5 mg) was prepared according to general procedure in 36% yield. The reaction time was 90 min under 366 nm light. The product was isolated through silica gel column chromatography (6% to 20% ethyl acetate-petroleum ether) as a white solid: R_f = 0.12 (20% ethyl acetate-petroleum ether); m.p. 103 - 105; $[\alpha]_D^{20}$ +89.3 (c 0.18, DCM); ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.73 (d, *J* = 8.8 Hz, 1H), 6.70 (d, *J* = 8.8 Hz, 1H), 5.90 (d, *J* = 1.9 Hz, 1H), 3.84 (s, 3H), 3.79 (s, 3H), 2.95 (ddd, *J* = 18.6, 6.2, 1.6 Hz, 1H), 2.54 – 2.41 (m, 2H), 2.33 (s, 3H), 2.11 (m, 1H), 1.95 – 1.84 (m, 1H), 1.00 (s, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 212.7, 152.0, 151.2, 126.2, 126.0, 109.0, 107.6, 67.4, 55.7, 55.6, 49.9, 25.6, 22.3, 20.1, 18.2 ppm; IR ν_{max} 3055, 1697, 1483, 1265, 1107, 743 cm^{-1}; HRMS–EI (*m*/*z*): $[M]^+$ calcd for $C_{15}H_{20}O_4$, 264.1362; found, 264.1357; Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 80/20, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 20.123 min (major), t_R = 21.728 min (minor).

VII. NMR and HPLC Spectra

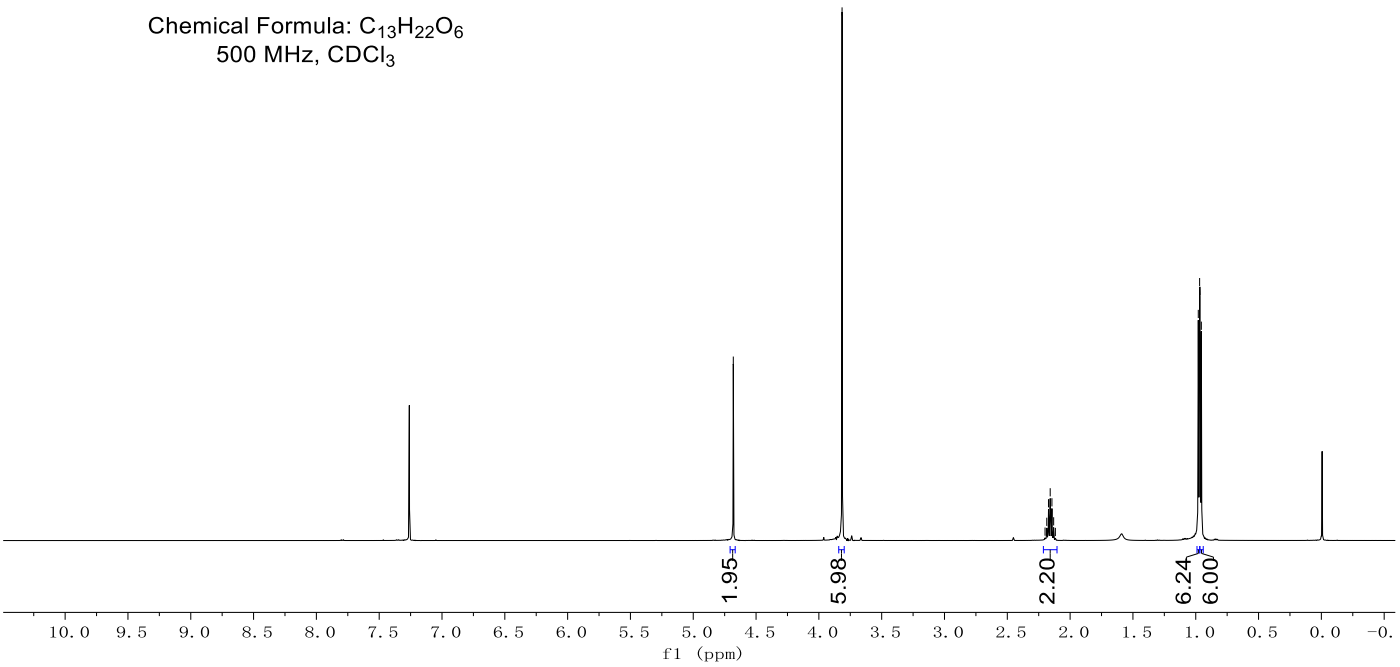
HM-V-60-1/1
HM-V-60-1

4.68
3.82
2.20
2.19
2.17
2.16
2.14
2.13
2.12
0.98
0.97
0.97
0.96



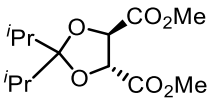
Ketal

Chemical Formula: $C_{13}H_{22}O_6$
500 MHz, $CDCl_3$



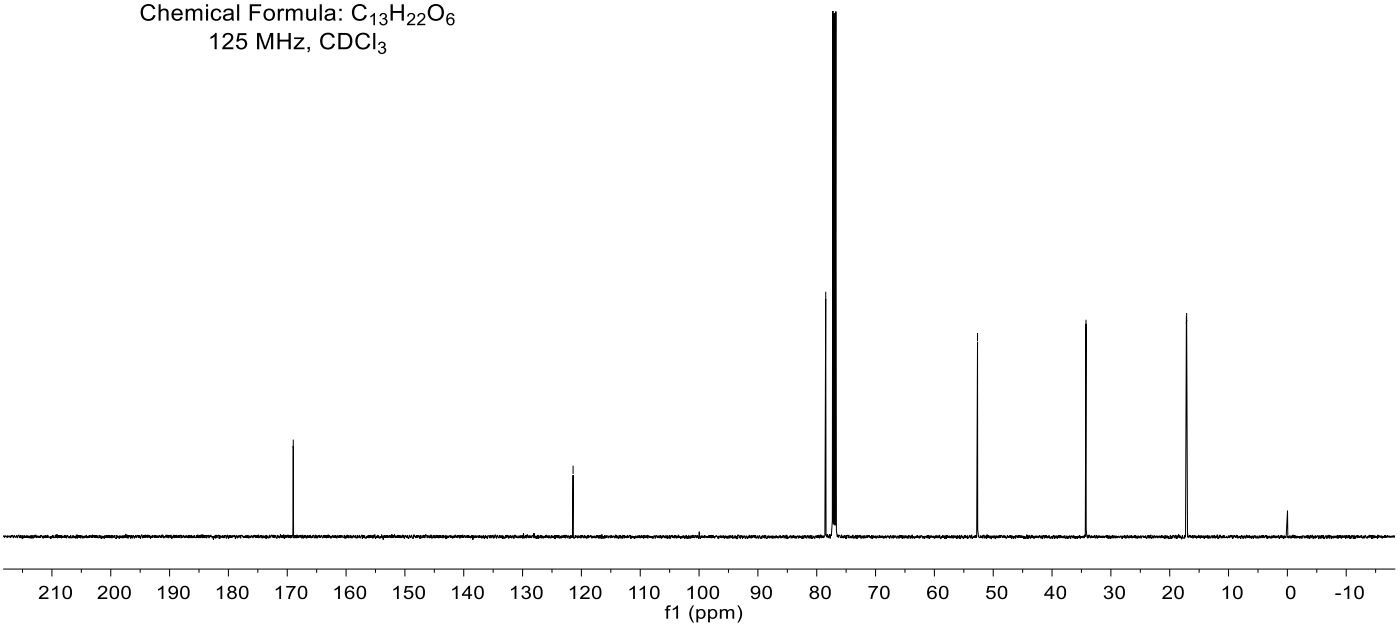
HM-V-60-1 C/2
HM-V-60-1 C

168.98
121.41
78.47
52.67
34.23
17.17
17.12

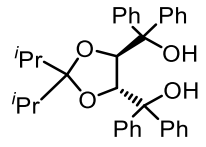


Ketal

Chemical Formula: $C_{13}H_{22}O_6$
125 MHz, $CDCl_3$

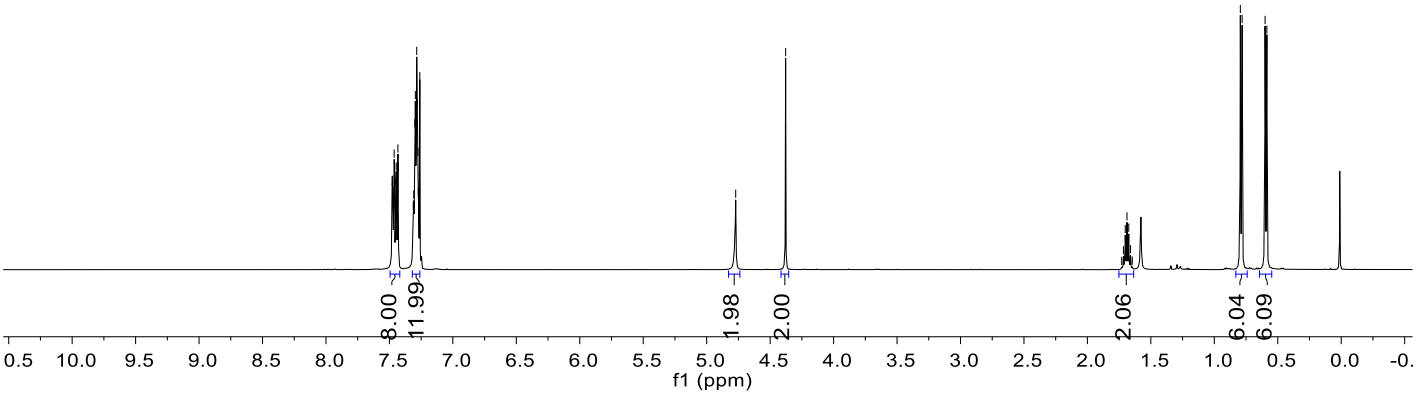


HM-L3

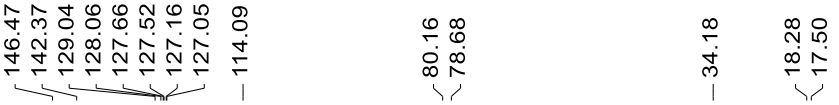


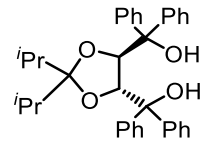
L3

Chemical Formula: $C_{35}H_{38}O_4$
500 MHz, $CDCl_3$



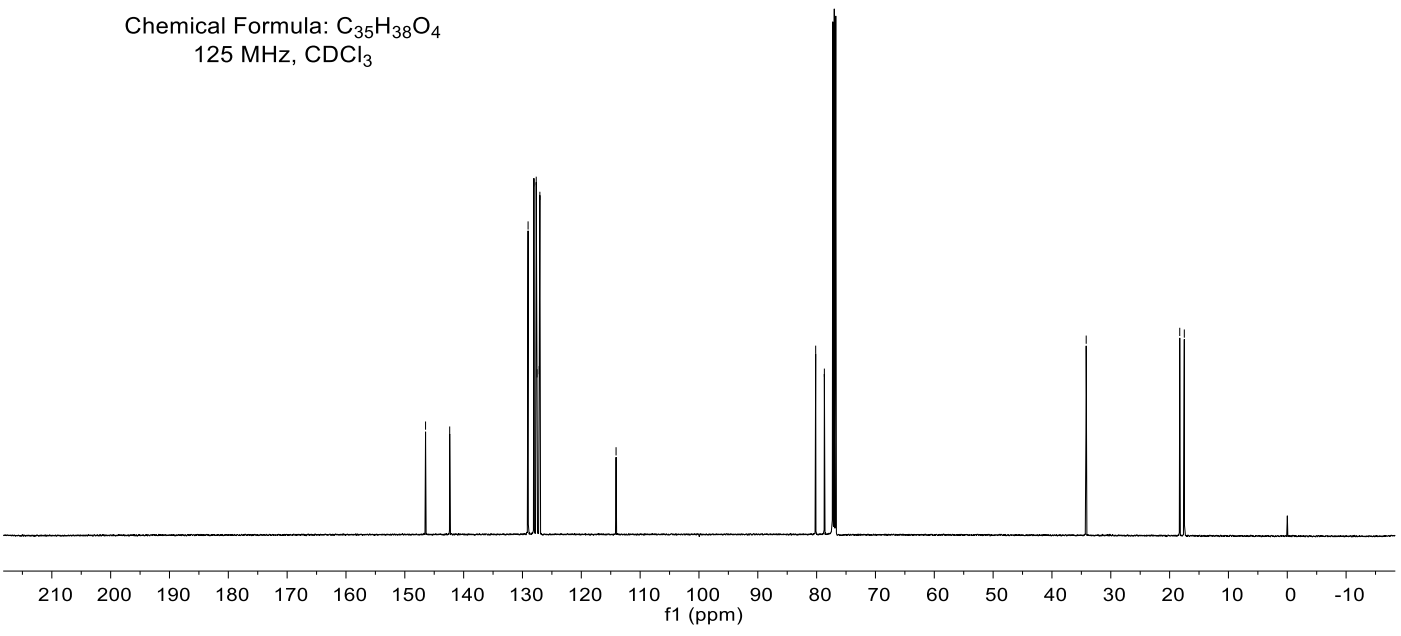
HM-L3 C





L3

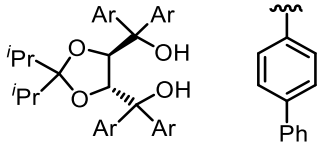
Chemical Formula: $C_{35}H_{38}O_4$
125 MHz, $CDCl_3$



HM-L5

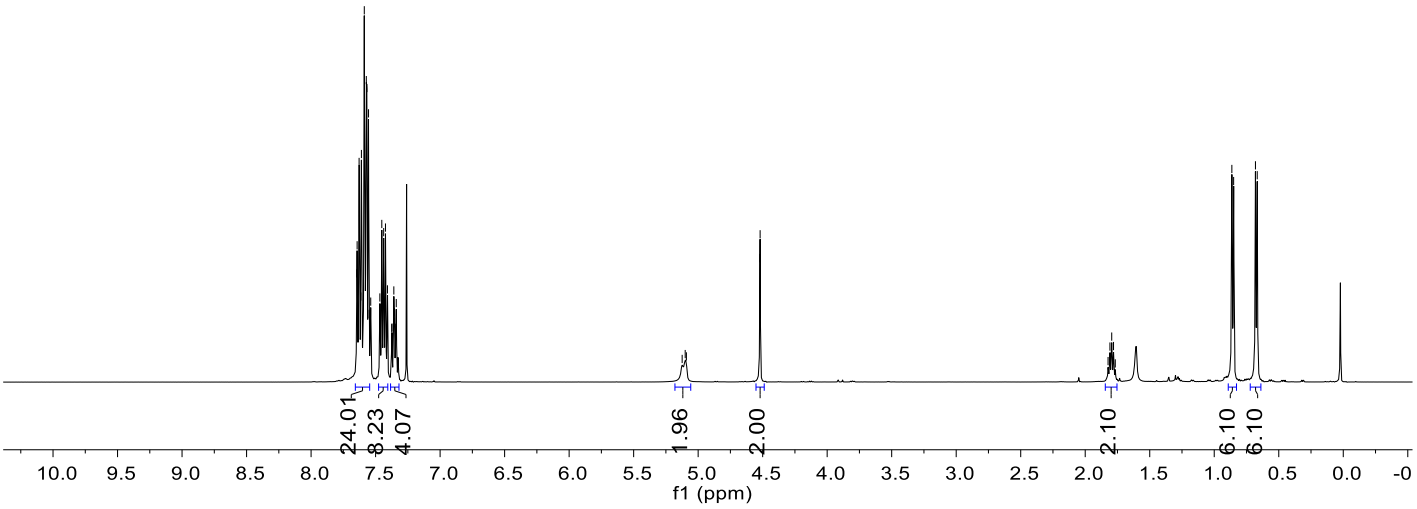
7.65 7.64 7.63 7.61 7.61 7.59 7.57 7.57 7.55 7.55 7.54 7.54 7.47 7.45 7.44 7.42 7.41 7.37 7.37 7.36 7.35 7.34 7.34 5.12 5.10 5.09 4.52 4.52

1.82 1.81 1.79 1.78 1.77 0.86 0.85 0.68 0.67



L5

Chemical Formula: $C_{59}H_{54}O_4$
500 MHZ, $CDCl_3$



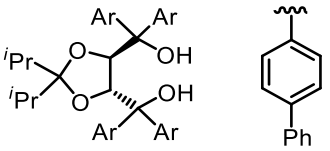
HM-L5 C

145.33 141.41 140.73 140.57 140.32 139.91 129.53 128.75 128.72 128.12 127.29 127.26 127.04 126.83 125.78 114.32

80.34 78.61

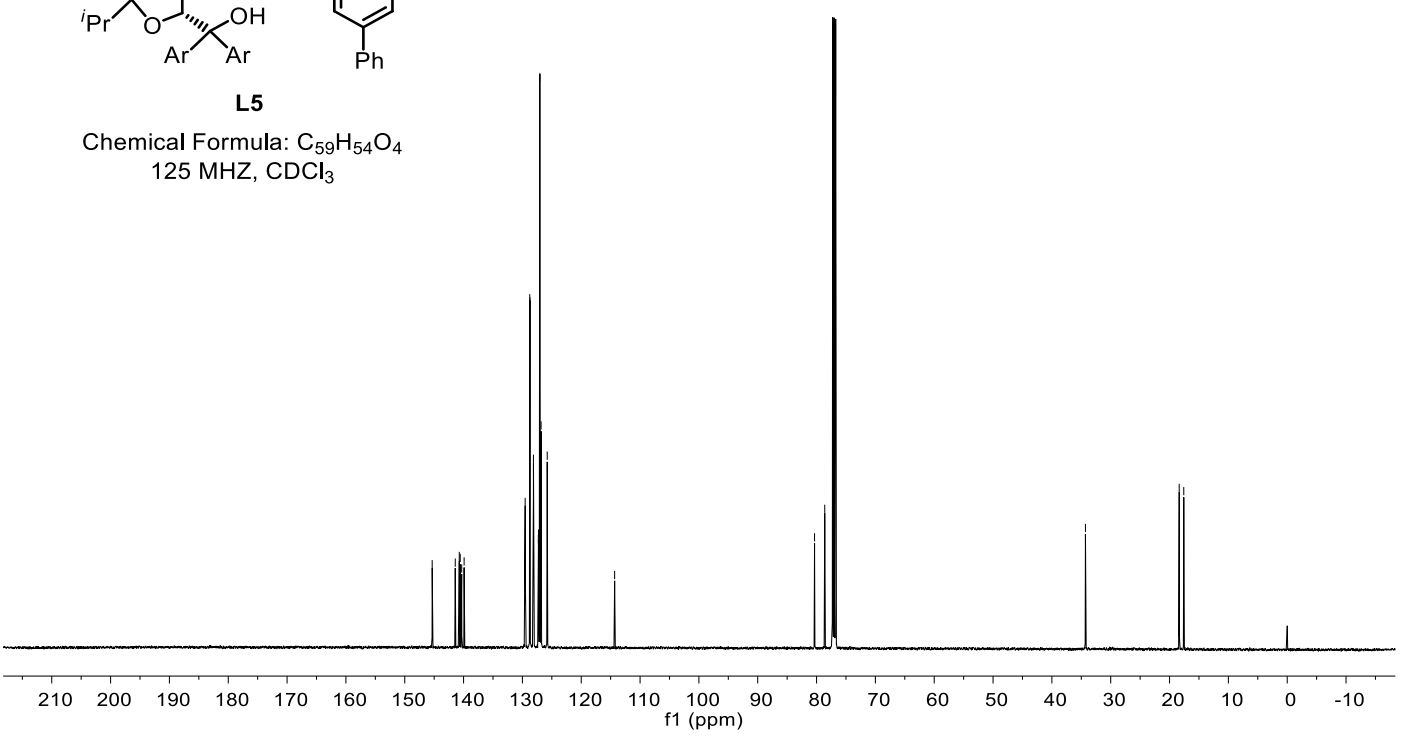
34.29

18.35 17.58



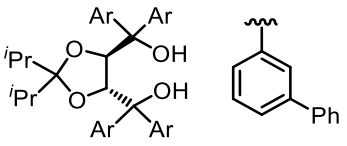
L5

Chemical Formula: $C_{59}H_{54}O_4$
125 MHZ, $CDCl_3$



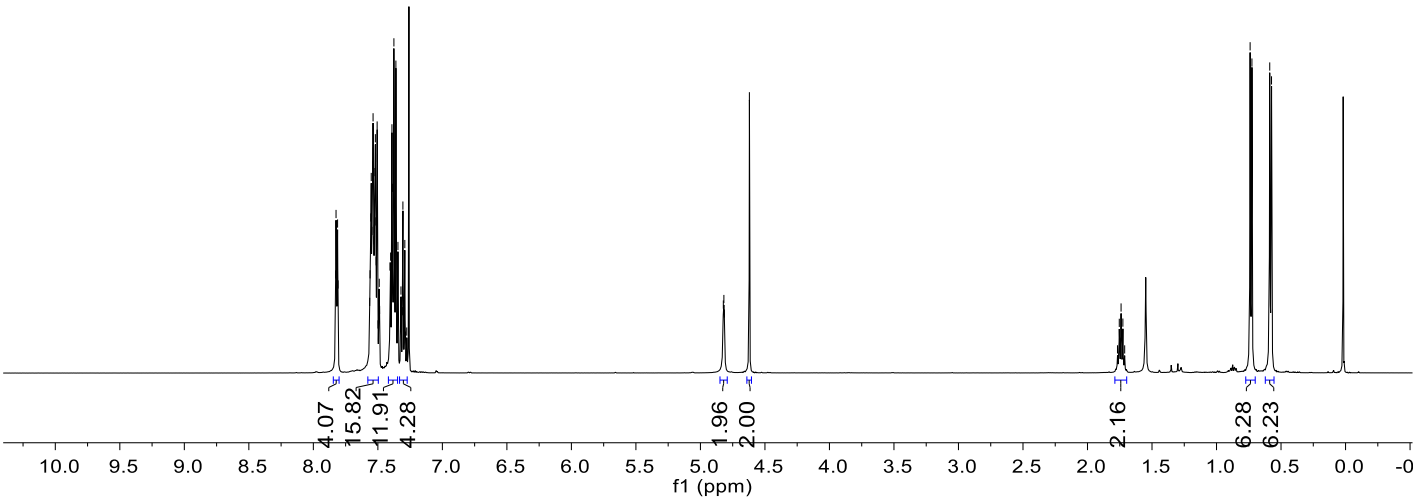
HM-L6

7.83 7.82 7.82 7.82 7.81 7.81 7.56 7.56 7.55 7.55 7.55 7.54 7.54 7.53 7.53 7.53 7.52 7.52 7.52 7.51 7.51 7.51 7.50 7.49 7.49 7.49 7.41 7.40 7.39 7.39 7.38 7.37 7.36 7.36 7.35 7.34 7.32 7.31 7.31 7.30 7.29 7.29 4.82 4.82 4.81 4.62 1.74 0.74 0.73 0.59 0.57



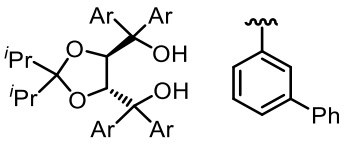
L6

Chemical Formula: $C_{59}H_{54}O_4$
500 MHz, $CDCl_3$



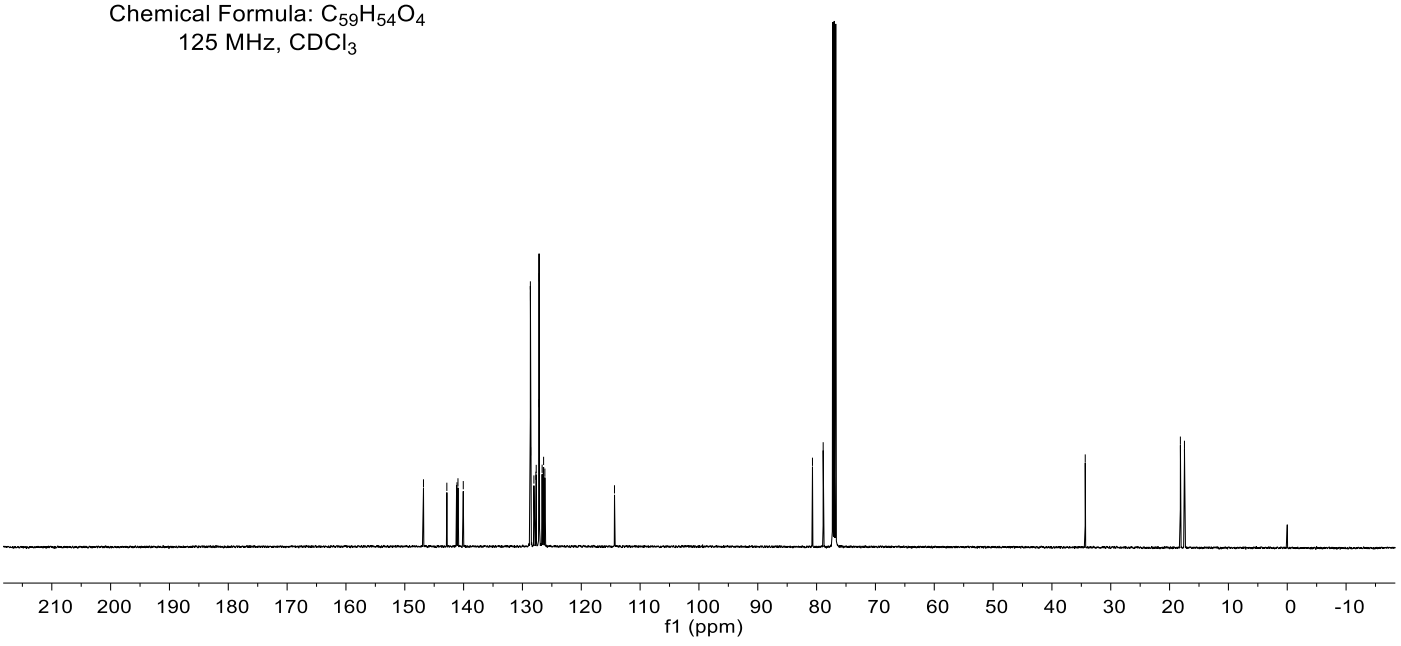
HM-L6 C

146.82 142.85 141.21 141.12 140.96 140.06 128.65 128.64 128.61 128.05 127.71 127.66 127.19 127.17 127.11 126.65 126.46 126.40 126.19 114.35 80.70 78.88 34.34 18.16 17.47



L6

Chemical Formula: $C_{59}H_{54}O_4$
125 MHz, $CDCl_3$

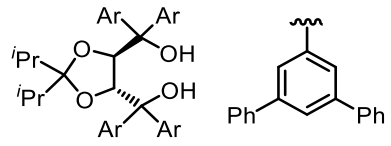


HM-L7

7.90 7.89 7.88 7.88 7.74 7.74 7.73 7.72 7.72 7.59 7.59 7.59 7.58 7.58 7.57 7.55 7.53 7.37 7.36 7.35 7.34 7.34 7.32 7.31 7.30 7.29 7.29 7.28 7.28 5.07 4.88 4.88 4.87 4.87

1.81 1.79 1.78 1.76 1.75

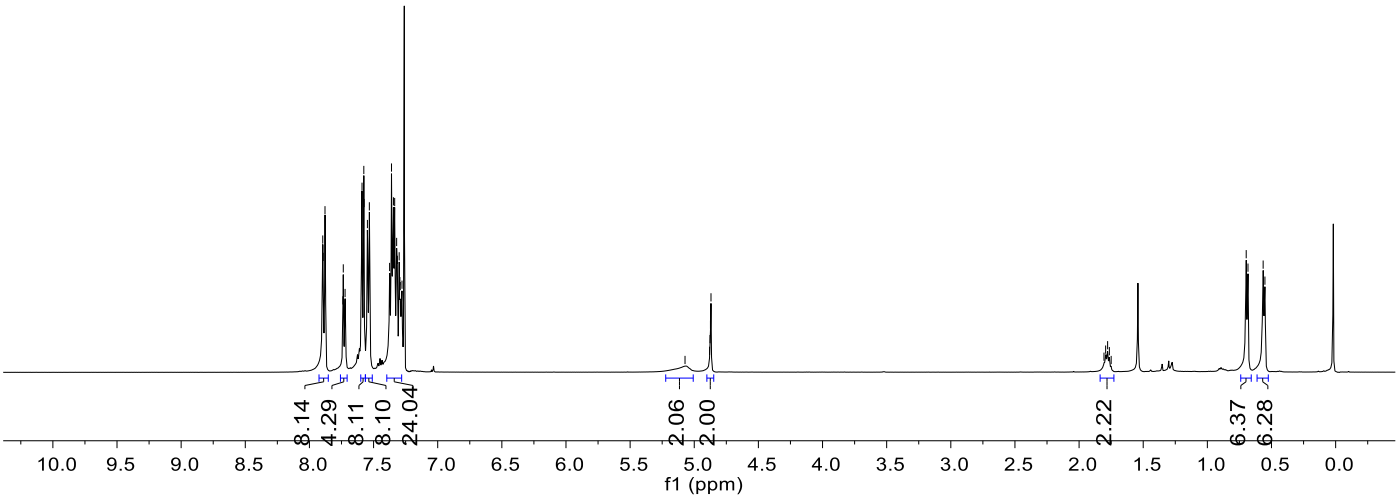
0.70 0.68 0.57 0.55



L7

Chemical Formula: $C_{83}H_{70}O_4$

500 MHz, $CDCl_3$



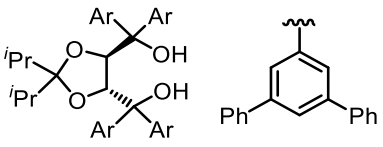
HM-L7 C

147.27 143.42 141.59 141.09 141.07 140.80 128.68 128.65 127.32 127.27 127.25 126.75 125.57 125.45 125.40 114.65

81.16 79.08

34.48

18.07 17.46

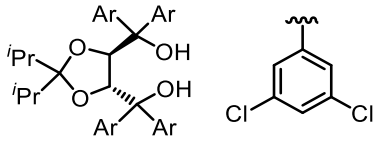


L7

Chemical Formula: $C_{83}H_{70}O_4$

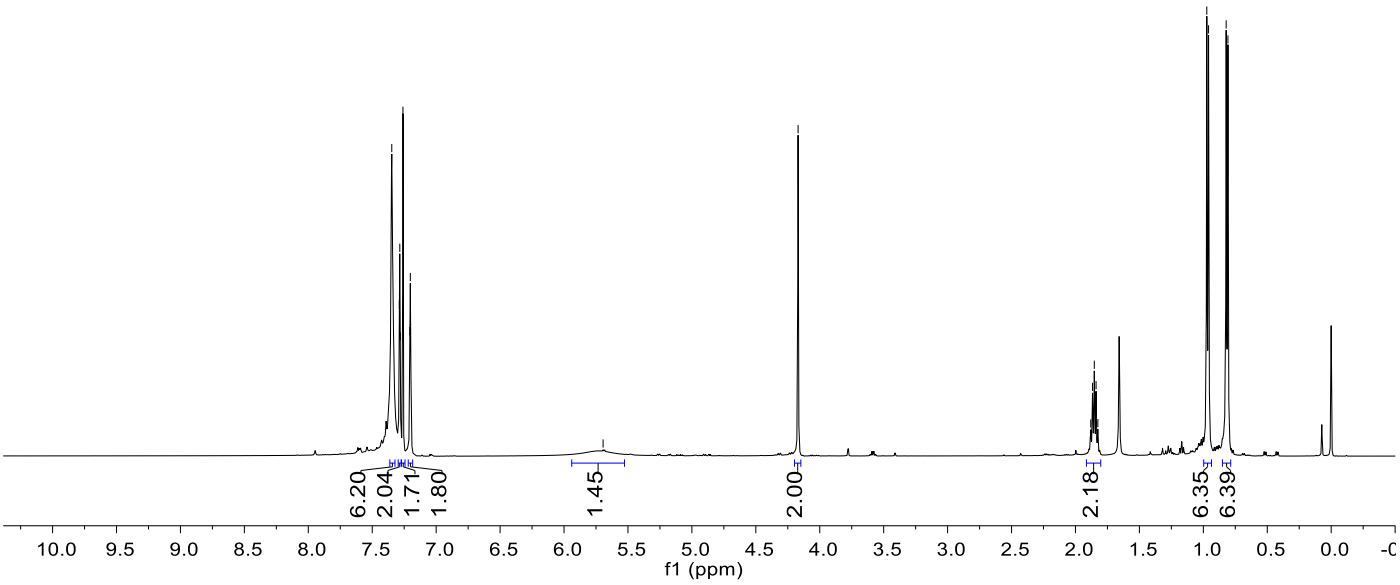
125 MHz, $CDCl_3$

HM-L8

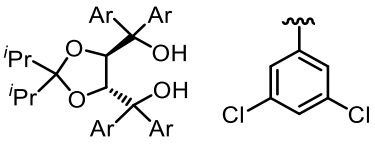


L8

Chemical Formula: $C_{35}H_{30}Cl_8O_4$
500 MHz, $CDCl_3$



HM-L8 C

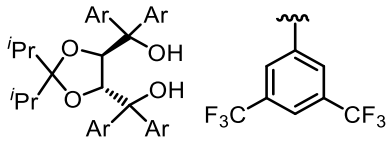


L8

Chemical Formula: $C_{35}H_{30}Cl_8O_4$
125 MHz, $CDCl_3$

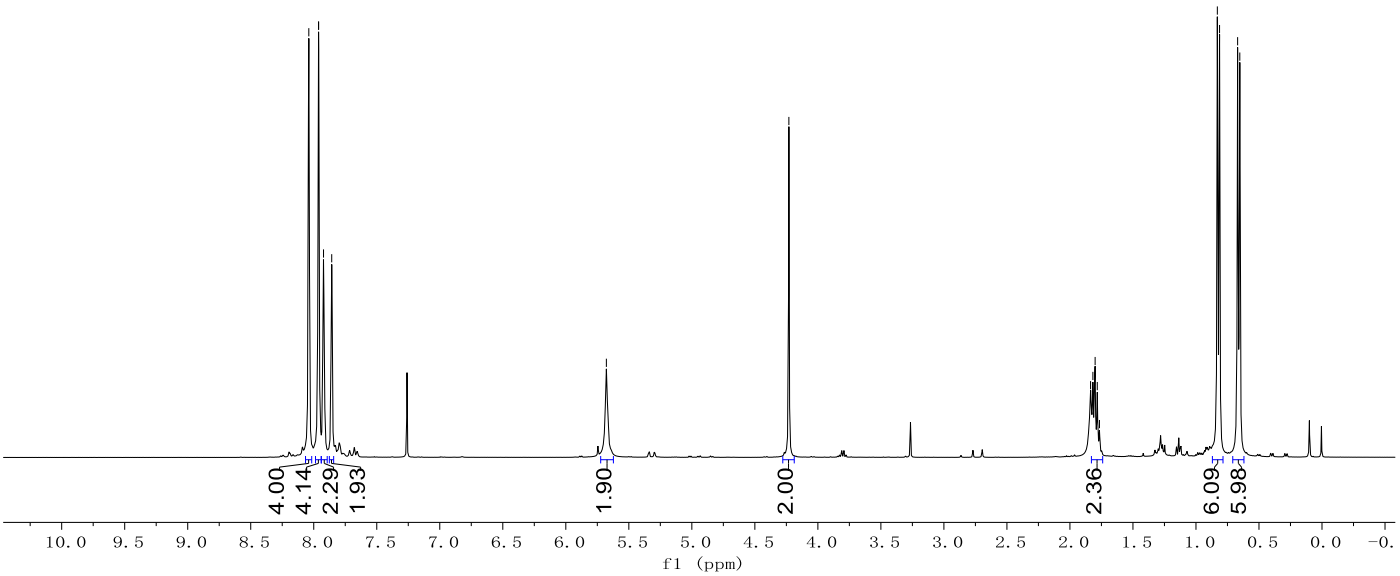
HM-L9.30.fid
HM-L9

8.04 7.96 7.96 7.92 7.86 — 5.68 — 4.23 1.84 1.82 1.80 1.80 1.78 1.77 0.83 0.81 0.67 0.65



L9

Chemical Formula: $C_{43}H_{30}F_{24}O_4$
400 MHz, $CDCl_3$

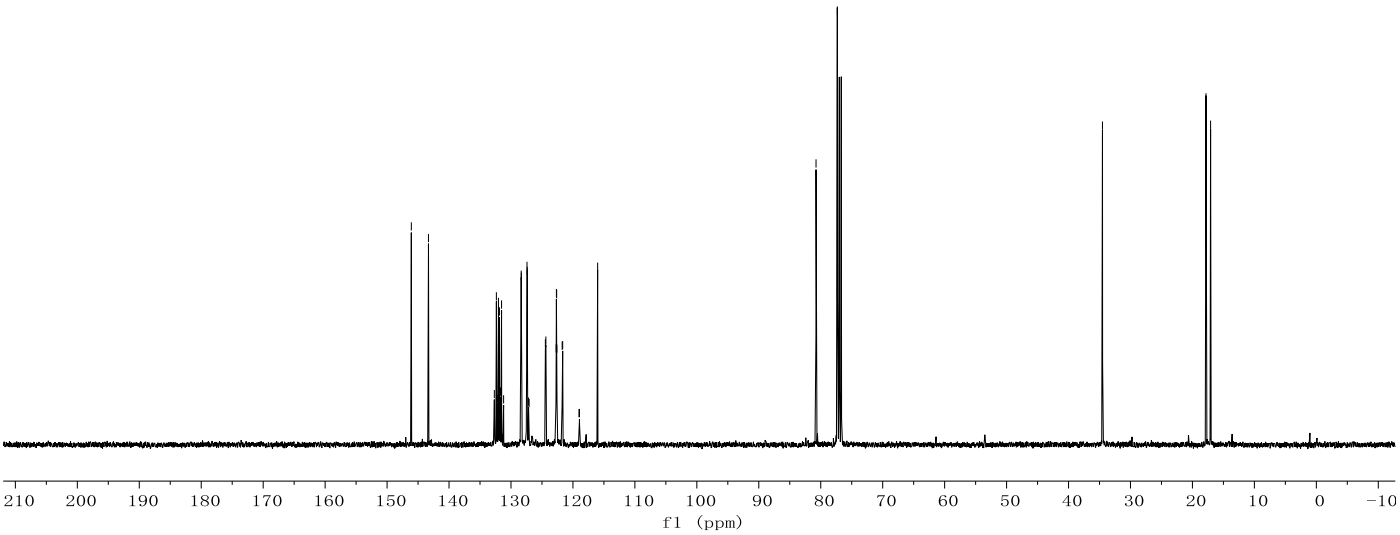


HM-L9.30.fid
HM-L9

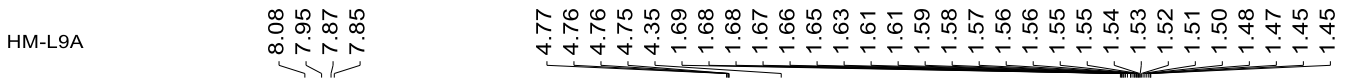
146.09 143.32 132.69 132.36 132.19 132.02 131.86 131.69 131.53 131.19 128.36 128.32 127.42 127.38 127.16 127.08 124.45 124.37 122.71 122.67 122.63 122.59 121.74 121.66 119.03 118.94 116.01 80.76 77.32 — 34.52 17.82 17.07

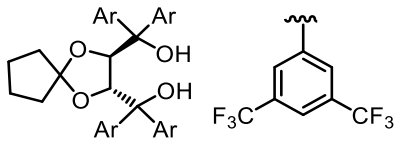
L9

Chemical Formula: $C_{43}H_{30}F_{24}O_4$
100 MHz, $CDCl_3$



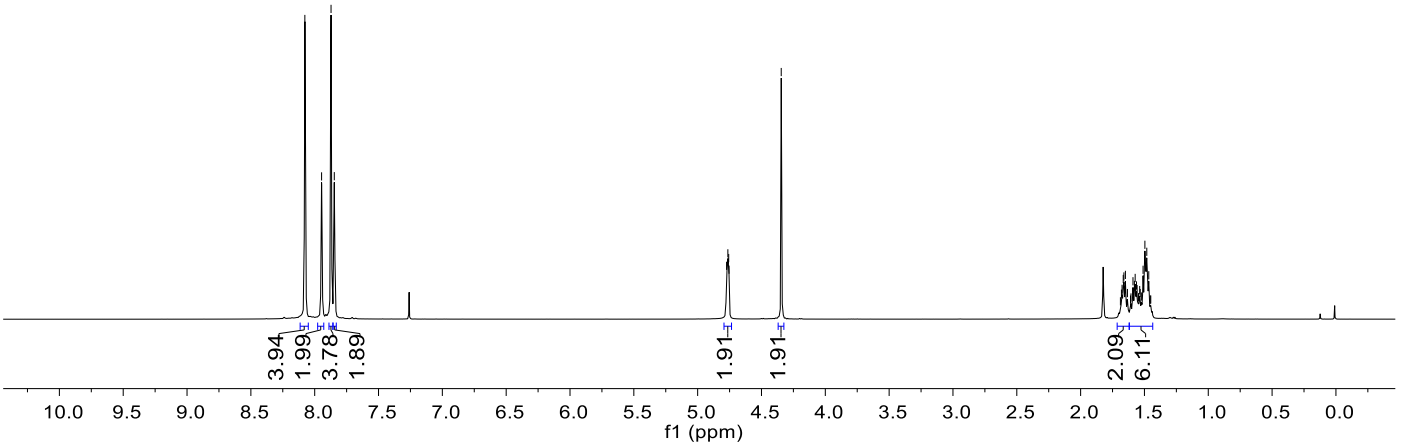
HM-L9A



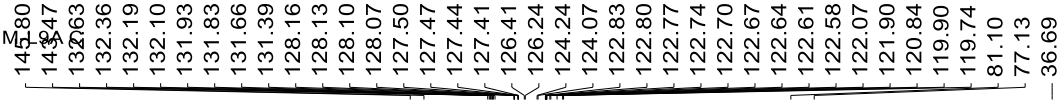


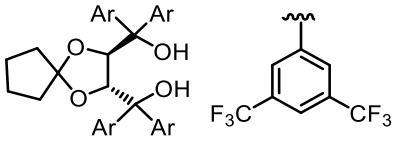
L9A

Chemical Formula: $C_{41}H_{24}F_{24}O_4$
500 MHz, $CDCl_3$



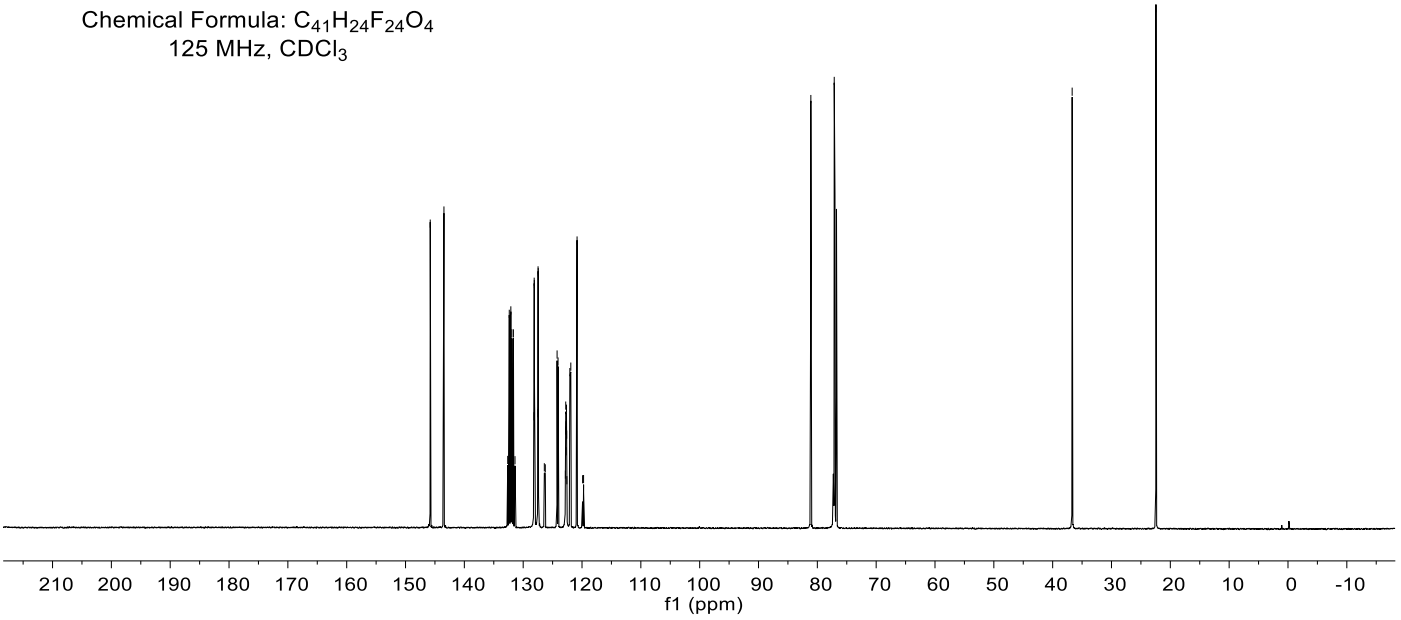
HM-L9A





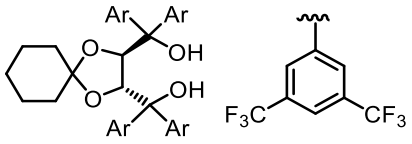
L9A

Chemical Formula: $C_{41}H_{24}F_{24}O_4$
125 MHz, $CDCl_3$



HM-L9B

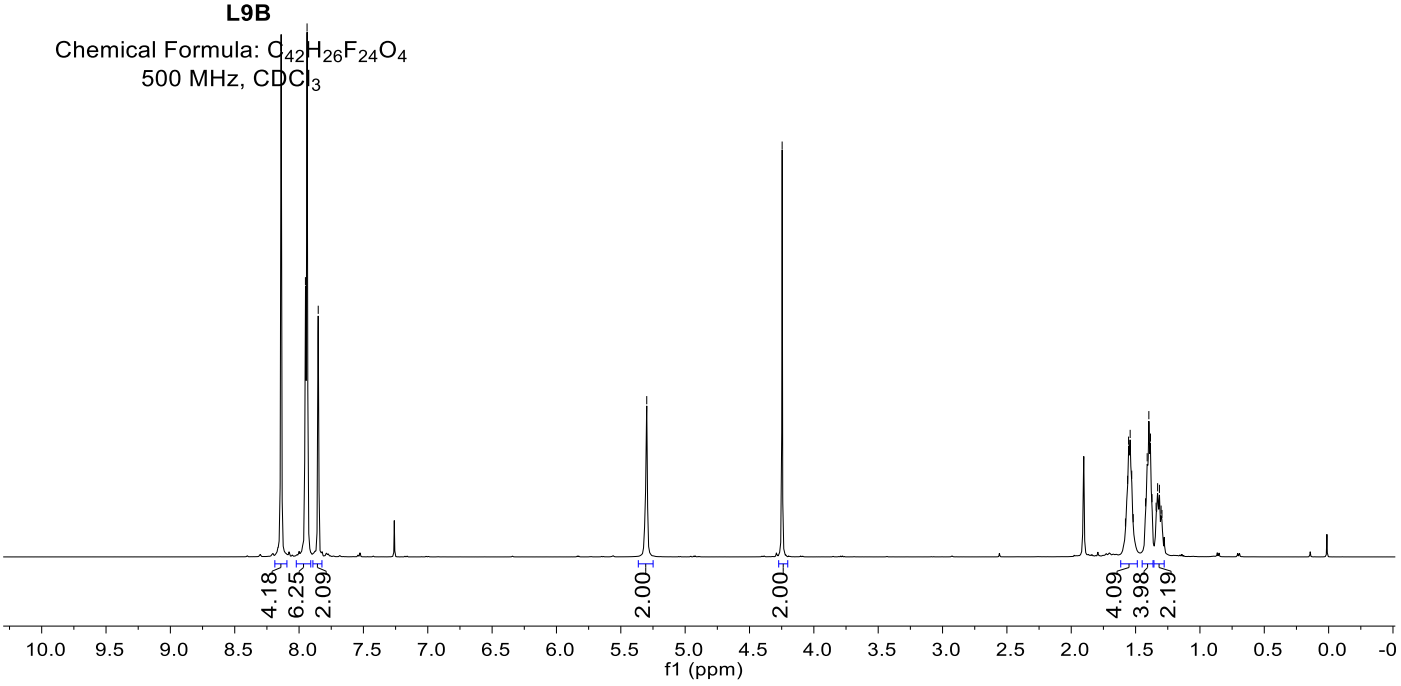
8.14 7.95 7.94 7.85 5.30 4.25 1.58 1.56 1.55 1.54 1.53 1.52 1.42 1.41 1.40 1.38 1.37 1.34 1.33 1.31 1.30 1.30



L9B

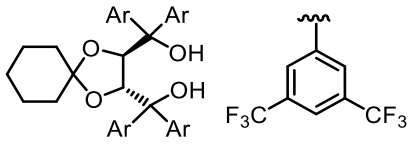
Chemical Formula: $C_{42}H_{26}F_{24}O_4$

500 MHz, $CDCl_3$



HM-L9B C

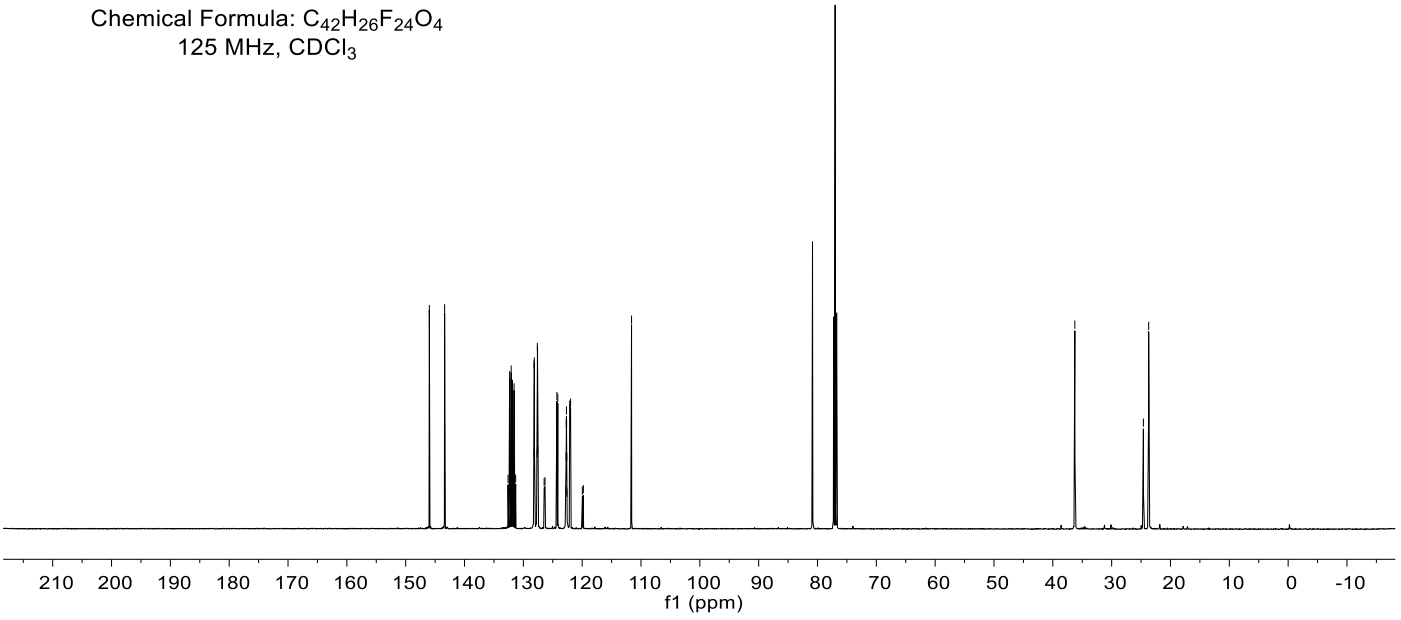
145.98 143.38 132.60 132.33 132.11 132.07 131.84 131.80 131.57 131.31 128.20 128.17 128.14 128.10 127.65 127.62 127.59 127.56 126.47 126.31 124.30 124.14 122.77 122.74 122.71 122.68 122.65 122.62 122.58 122.13 121.98 119.96 119.81 111.61 80.85 36.26 24.60 23.71



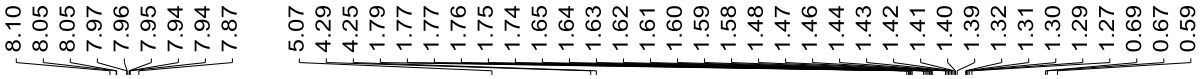
L9B

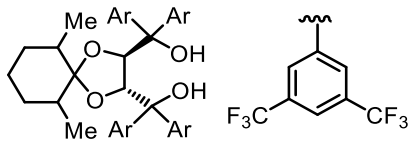
Chemical Formula: $C_{42}H_{26}F_{24}O_4$

125 MHz, $CDCl_3$



HM-L9C

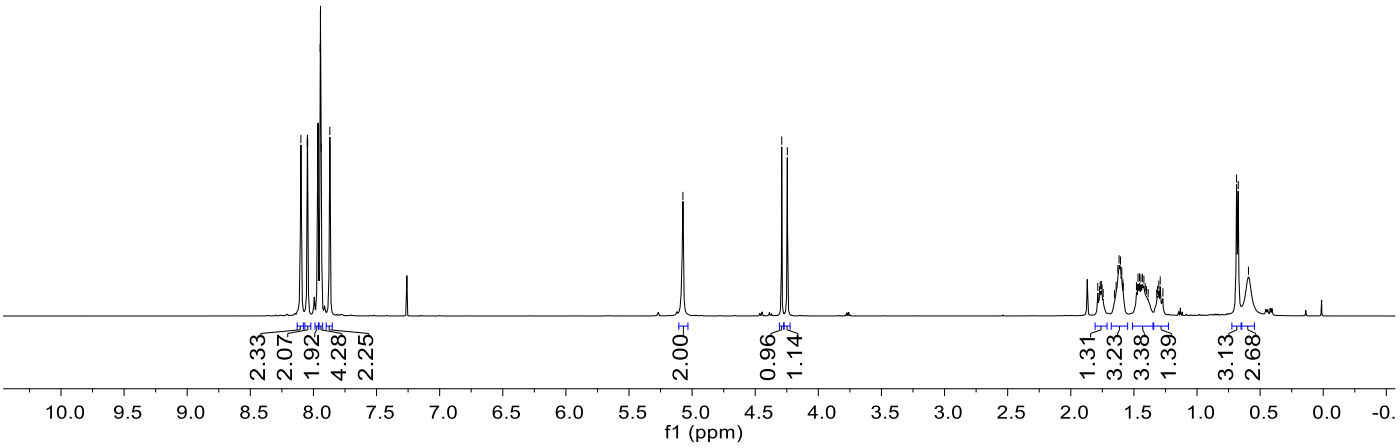




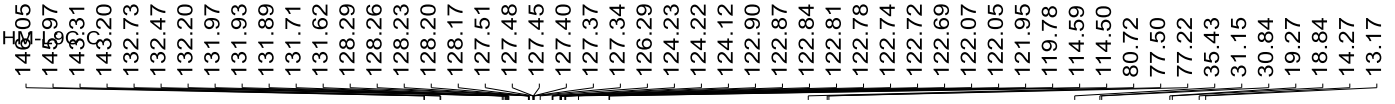
L9C

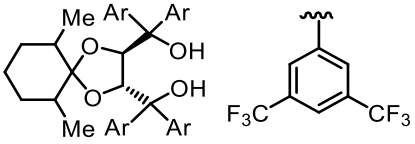
Chemical Formula: $C_{44}H_{30}F_{24}O_4$

500 MHz, $CDCl_3$



HM-L9C

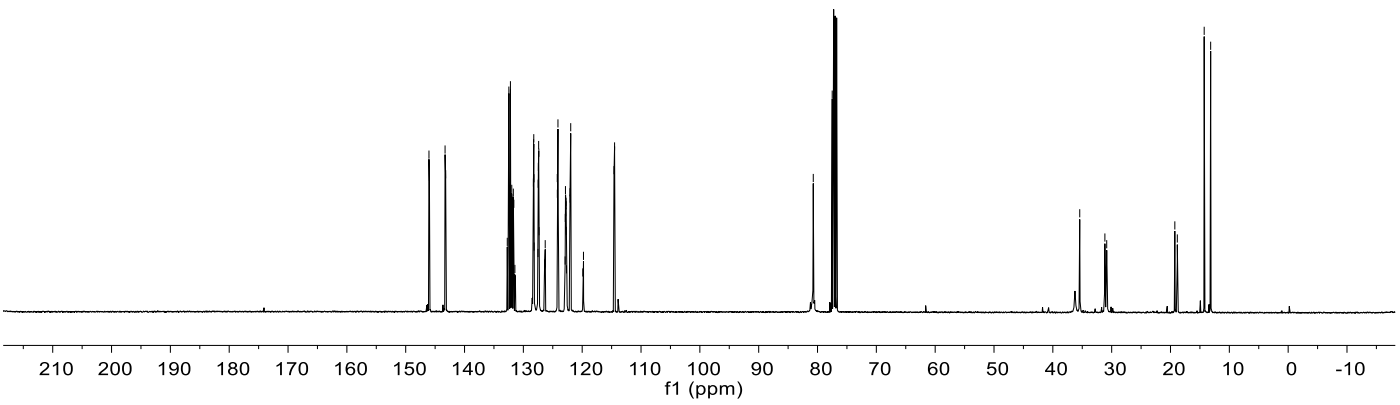




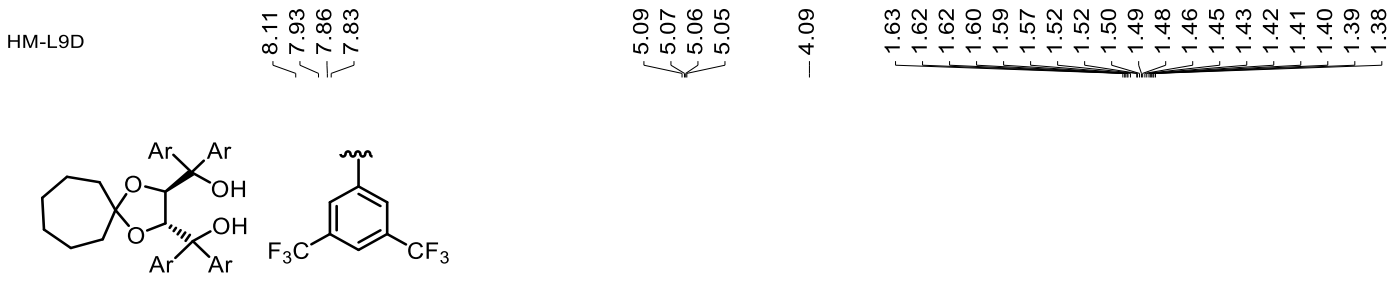
L9C

Chemical Formula: $C_{44}H_{30}F_{24}O_4$

125 MHz, $CDCl_3$



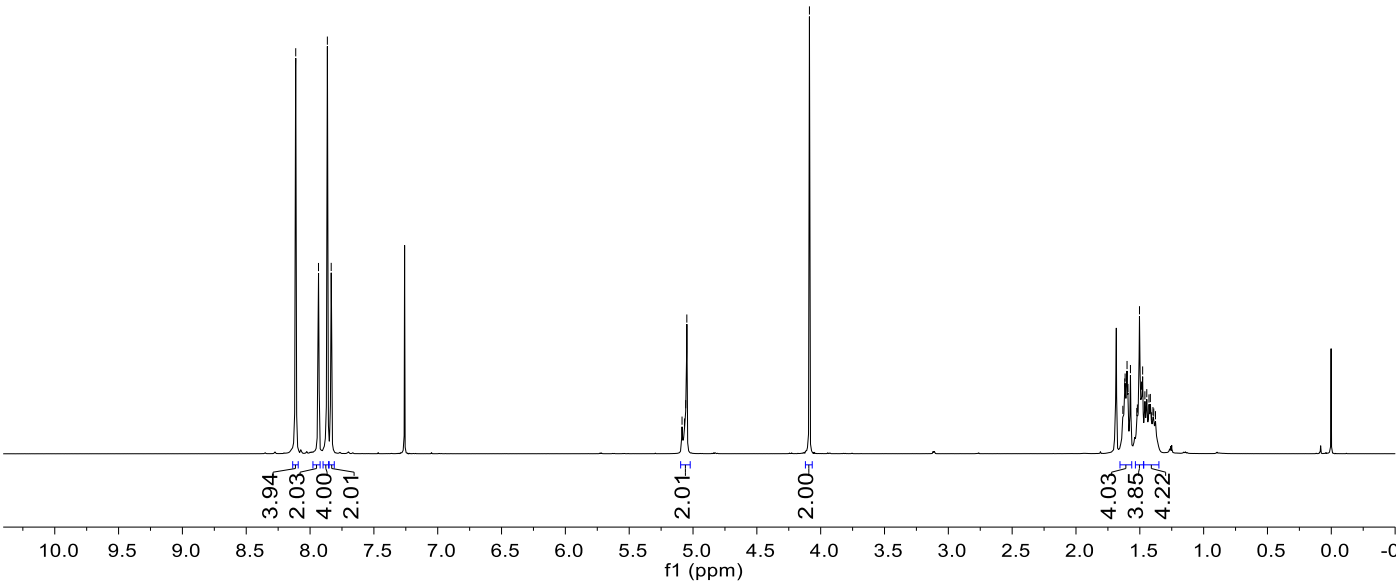
HM-L9D



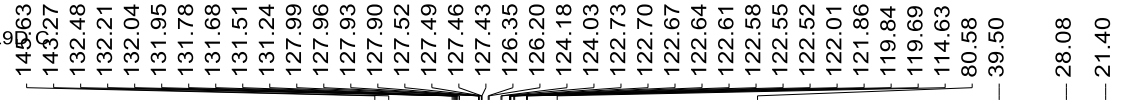
L9D

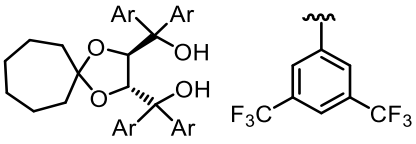
Chemical Formula: $C_{43}H_{28}F_{24}O_4$

500 MHz, $CDCl_3$



HM-L9D-C

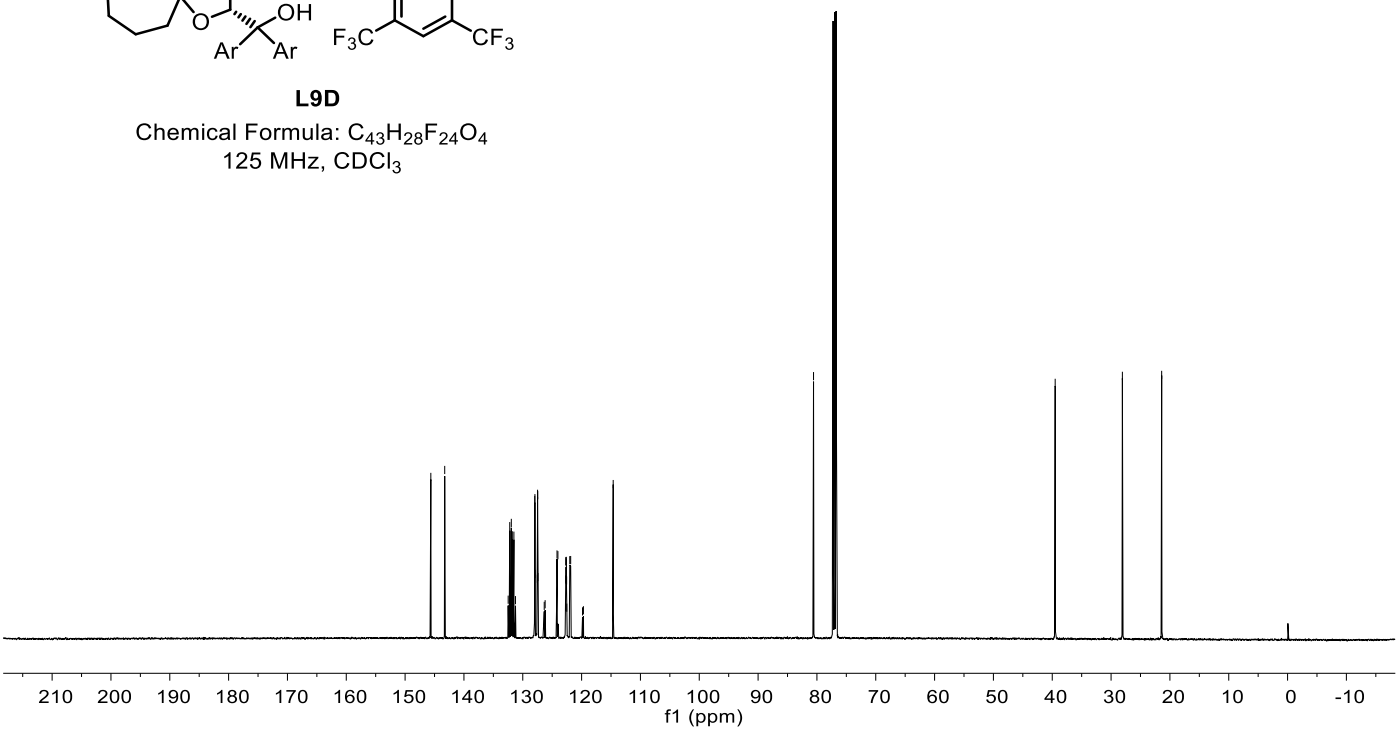




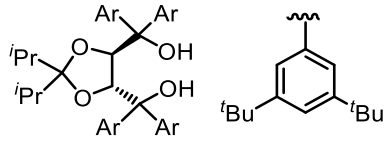
L9D

Chemical Formula: $C_{43}H_{28}F_{24}O_4$

125 MHz, $CDCl_3$



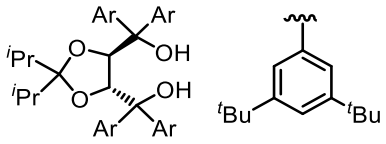
HM-L10



L10

Chemical Formula: $C_{67}H_{102}O_4$
500 MHz, $CDCl_3$

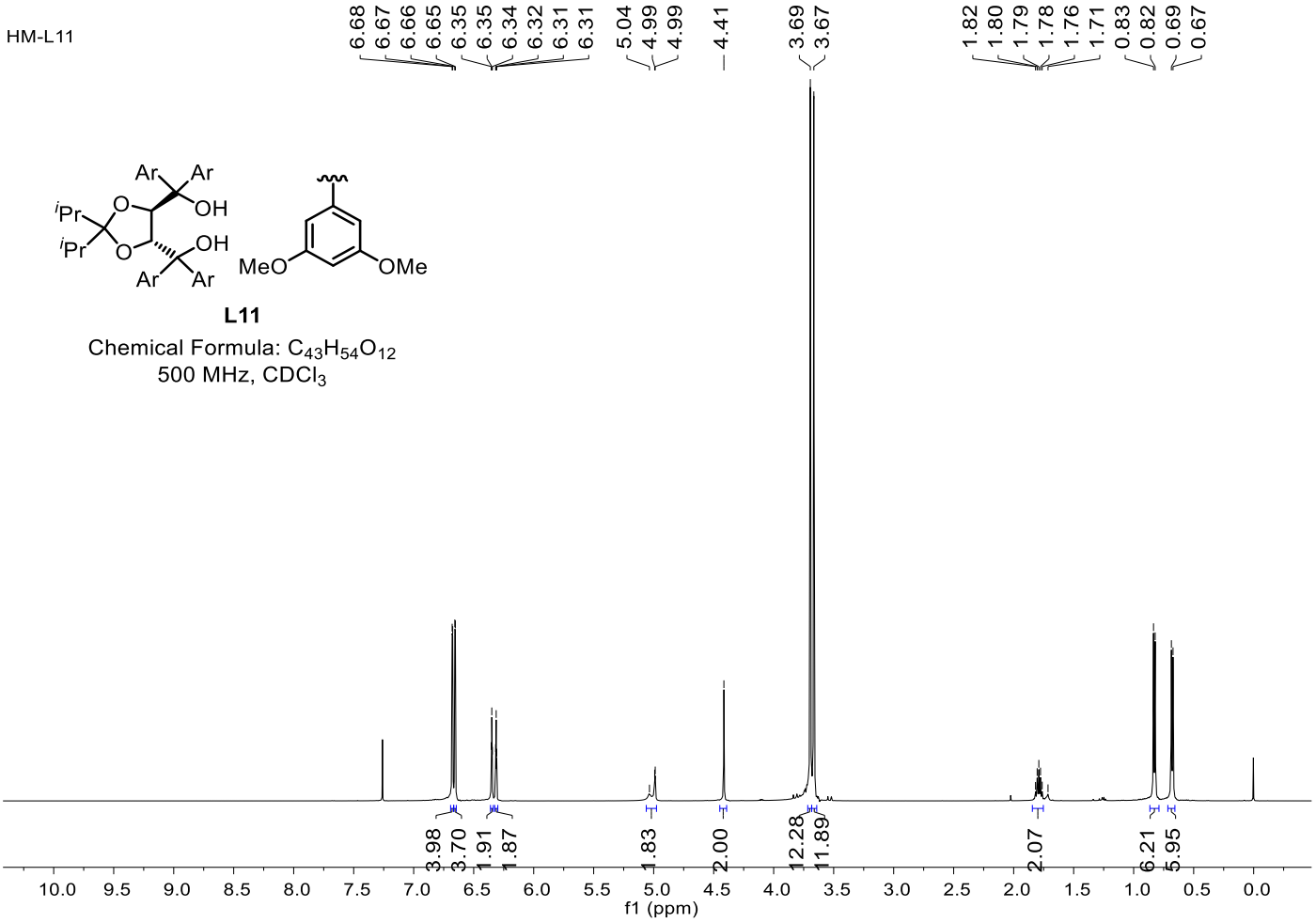
HM-L10 C



L10

Chemical Formula: $C_{67}H_{102}O_4$
125 MHz, $CDCl_3$

HM-L11

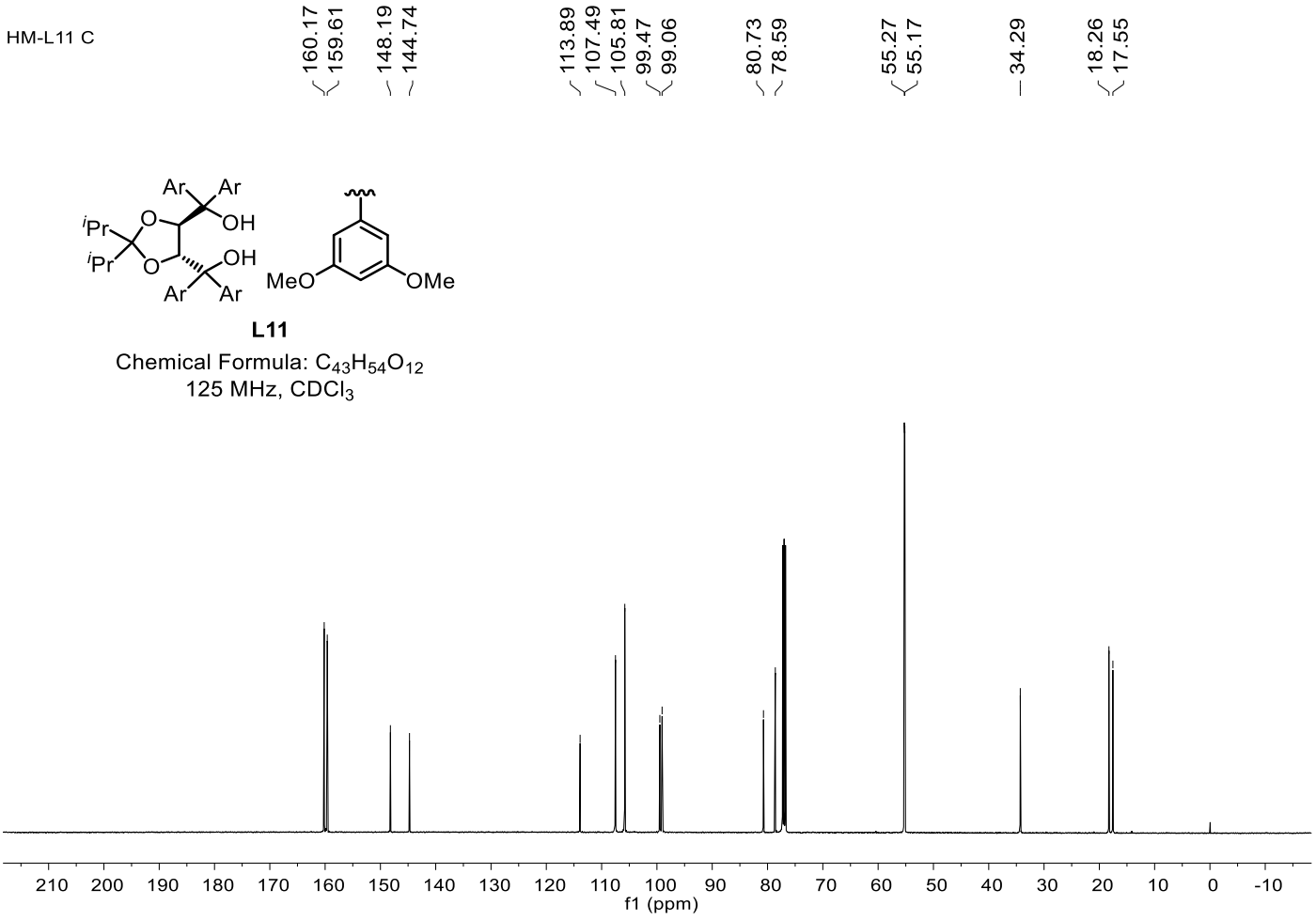


L11

Chemical Formula: $C_{43}H_{54}O_{12}$

500 MHz, $CDCl_3$

HM-L11 C



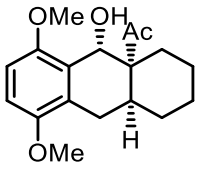
L11

Chemical Formula: $C_{43}H_{54}O_{12}$

125 MHz, $CDCl_3$

HM-K-139B-1

7.73 7.71 7.69 7.66 4.90 3.83 3.82 3.80 2.82 2.81 2.78 2.76 2.68 2.67 2.67 2.66 2.66 2.65 2.63 2.60 2.59 2.56 2.31 2.20 2.20 1.99 1.98 1.96 1.82 1.82 1.81 1.79 1.79 1.78 1.78 1.57 1.56 1.55 1.53 1.52 1.51 1.50 1.50 1.49 1.49 1.25 1.24 1.21 1.21 1.13 1.10



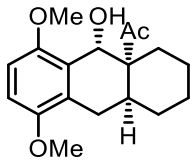
3

Chemical Formula: $C_{18}H_{24}O_4$
400 MHz, $CDCl_3$

HM-K-139B-1 C

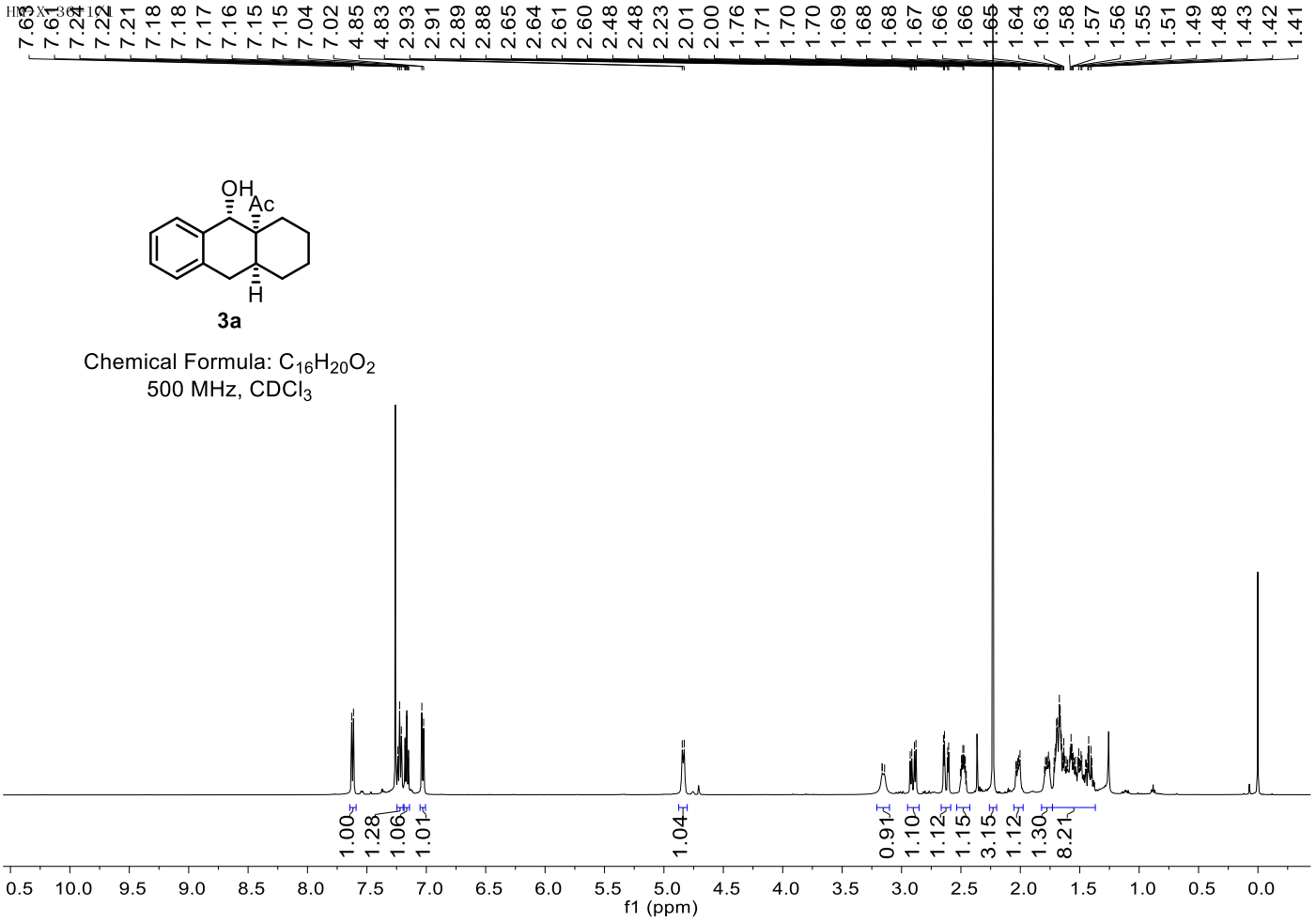
211.29

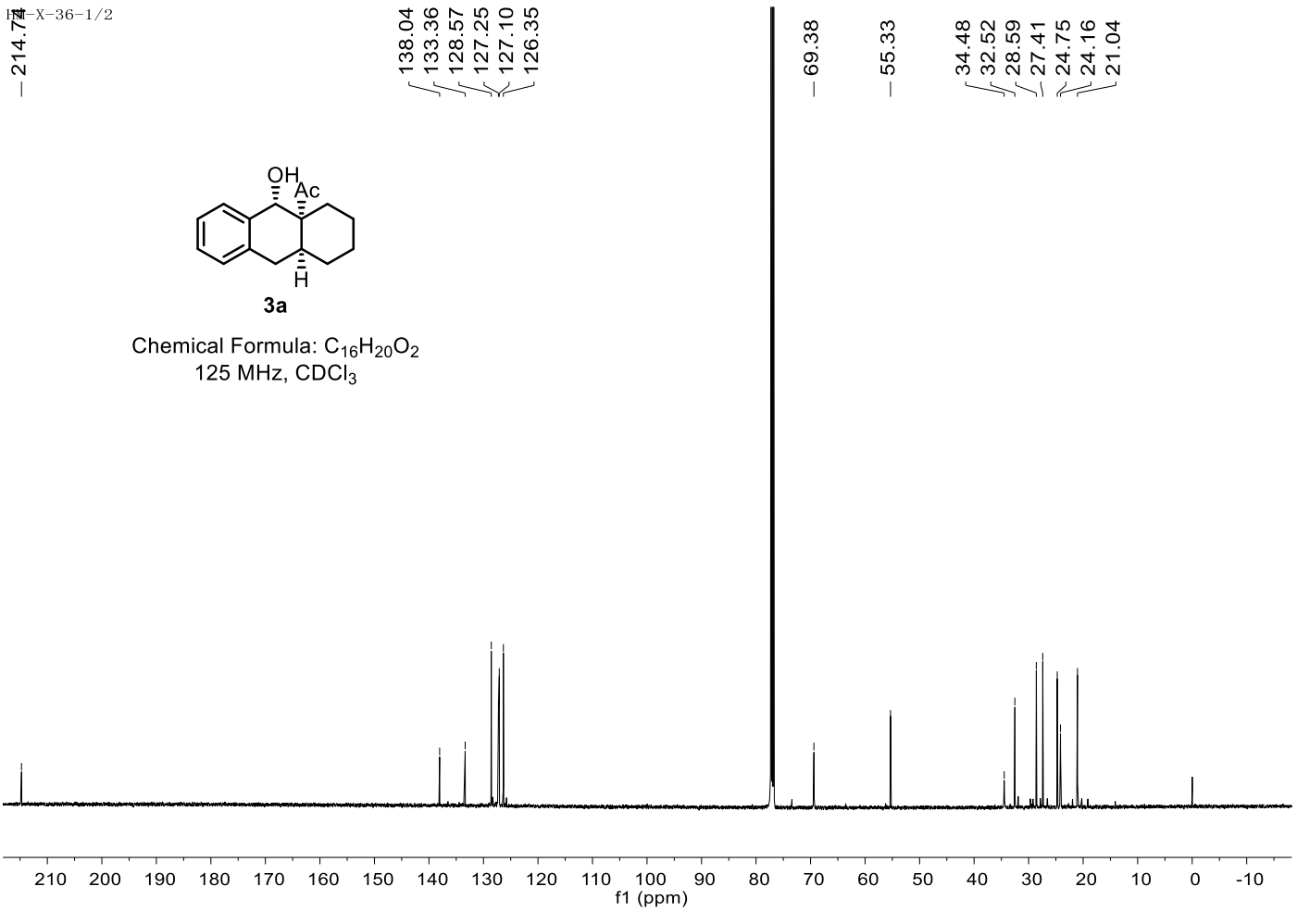
151.57 151.11 125.86 125.74 108.78 107.11 68.38 55.59 55.56 55.52 54.23 27.10 26.63 26.30 26.27 26.15 24.65 22.74 20.08

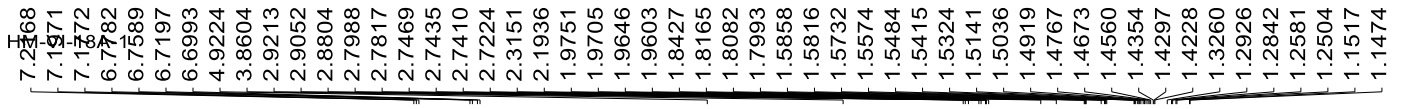


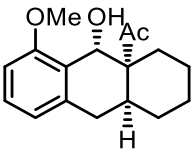
3

Chemical Formula: $C_{18}H_{24}O_4$
100 MHz, $CDCl_3$


7.63 7.61 7.24 7.22 7.21 7.18 7.18 7.17 7.16 7.15 7.15 7.04 7.02 4.85 4.83 2.93 2.91 2.89 2.88 2.65 2.64 2.61 2.60 2.48 2.48 2.23 2.01 2.00 1.76 1.71 1.70 1.70 1.69 1.68 1.68 1.67 1.66 1.66 1.65 1.64 1.63 1.58 1.57 1.56 1.55 1.51 1.49 1.48 1.43 1.42 1.41
OH
Ac
H
3a
Chemical Formula: C16H20O2
500 MHz, CDCl3
1.00 1.28 1.06 1.01 1.04 0.91 1.10 1.12 1.15 3.15 1.12 1.30 8.21
f1 (ppm)

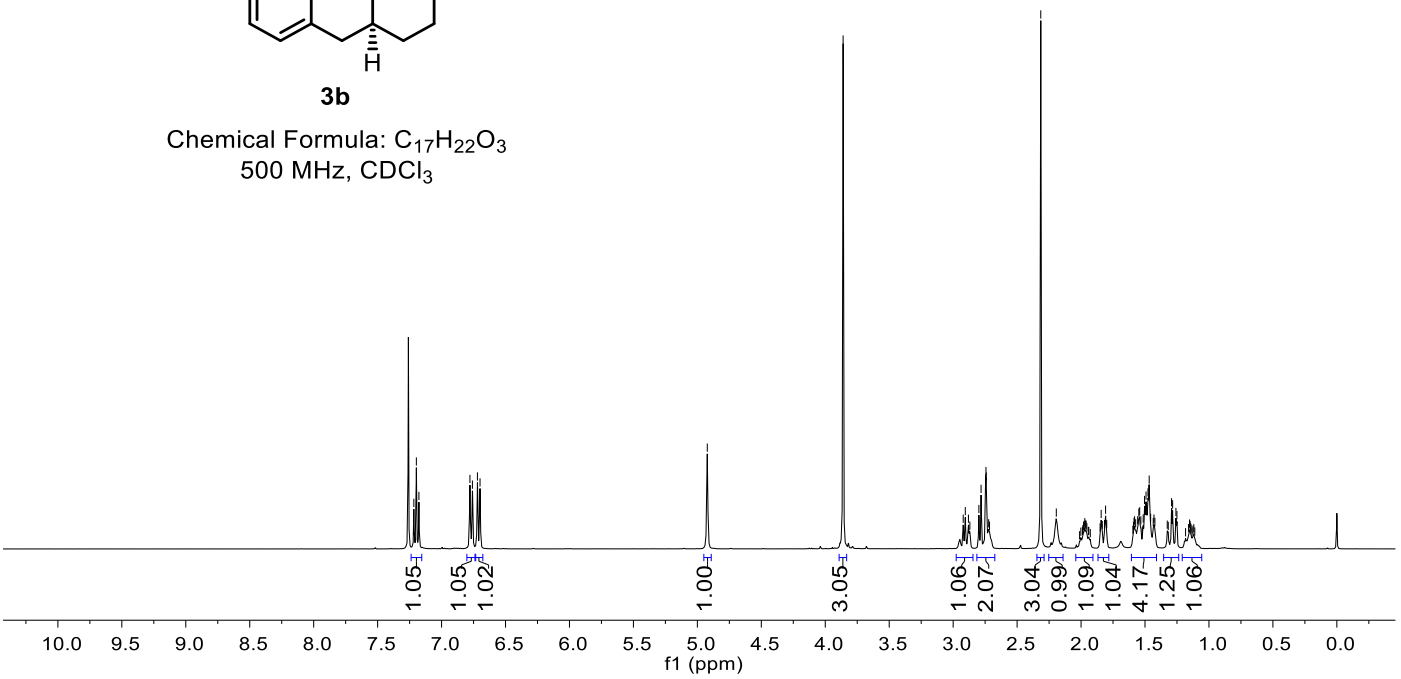

214.74
138.04 133.36 128.57 127.25 127.10 126.35
69.38
55.33
34.48 32.52 28.59 27.41 24.75 24.16 21.04
OH
Ac
H
3a
Chemical Formula: C16H20O2
125 MHz, CDCl3
f1 (ppm)

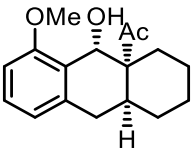




3b

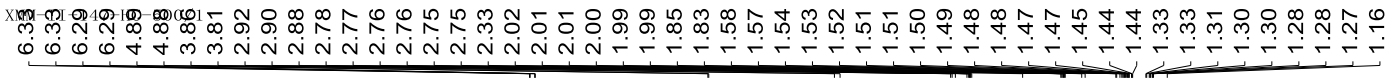
Chemical Formula: $C_{17}H_{22}O_3$
500 MHz, $CDCl_3$

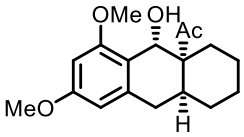




3b

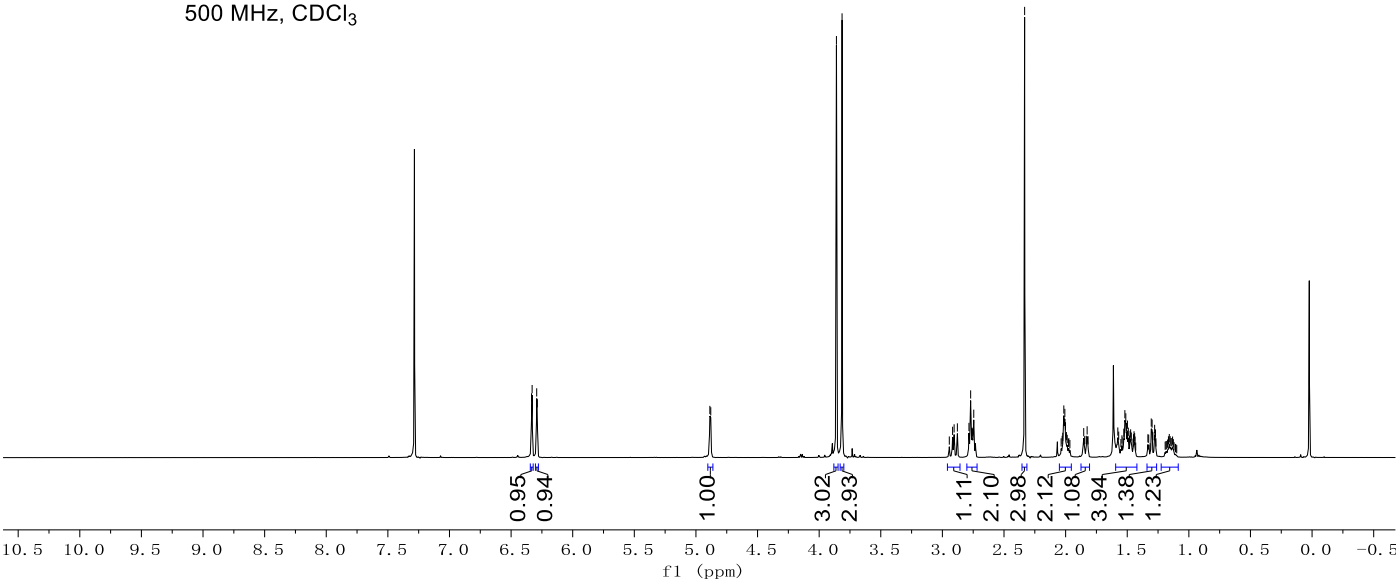
Chemical Formula: $C_{17}H_{22}O_3$
125 MHz, $CDCl_3$

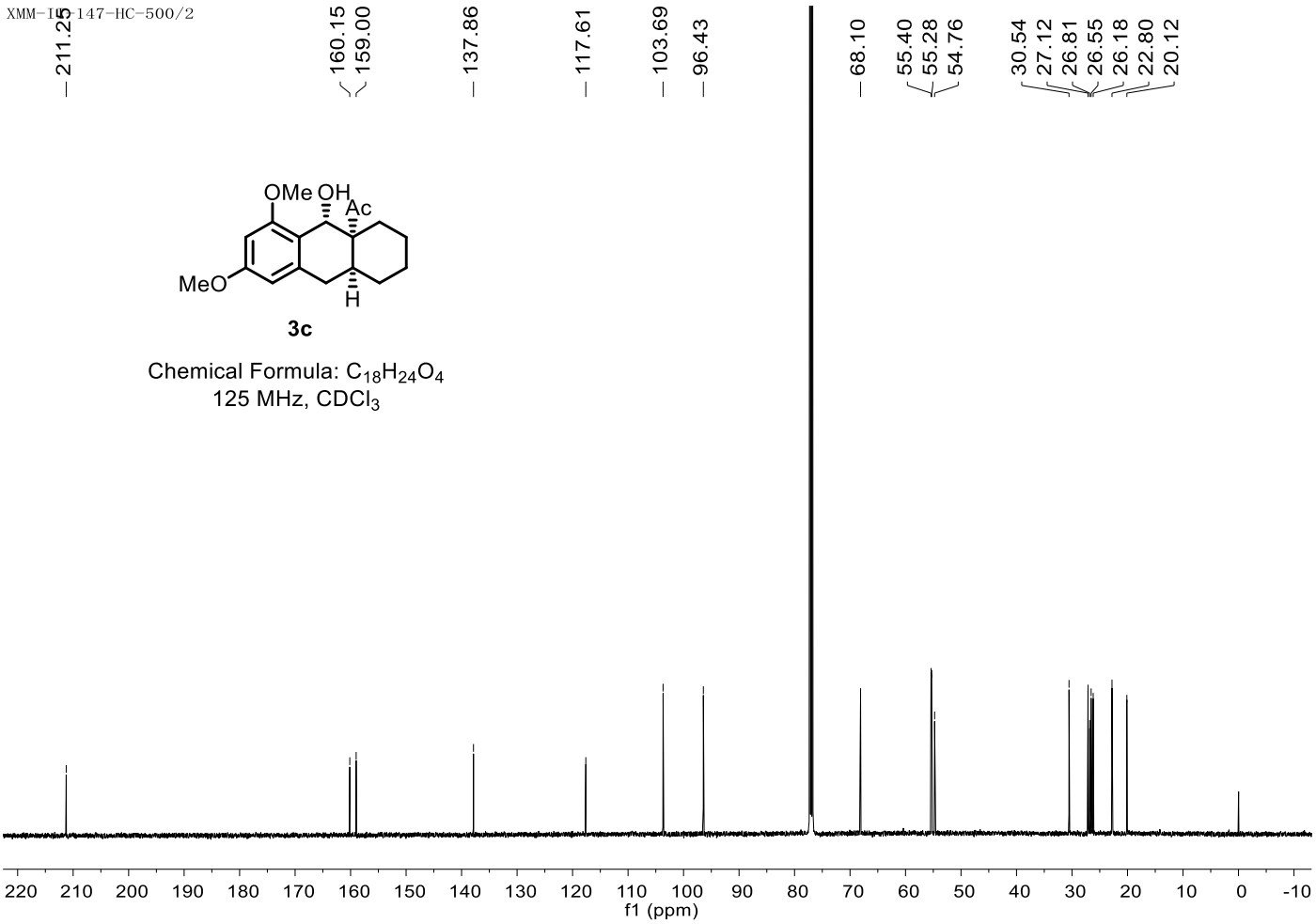




3c

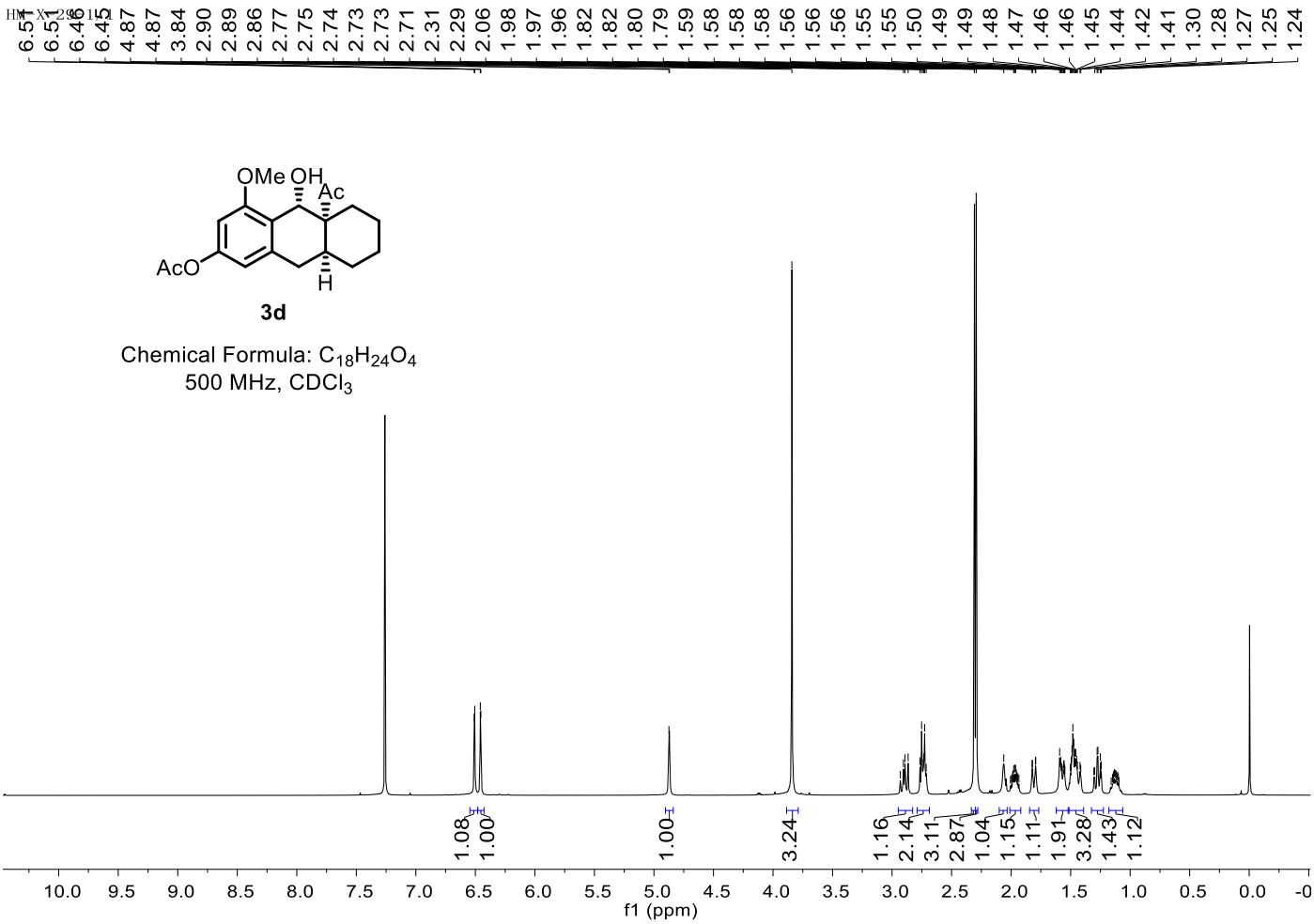
Chemical Formula: $C_{18}H_{24}O_4$
500 MHz, $CDCl_3$

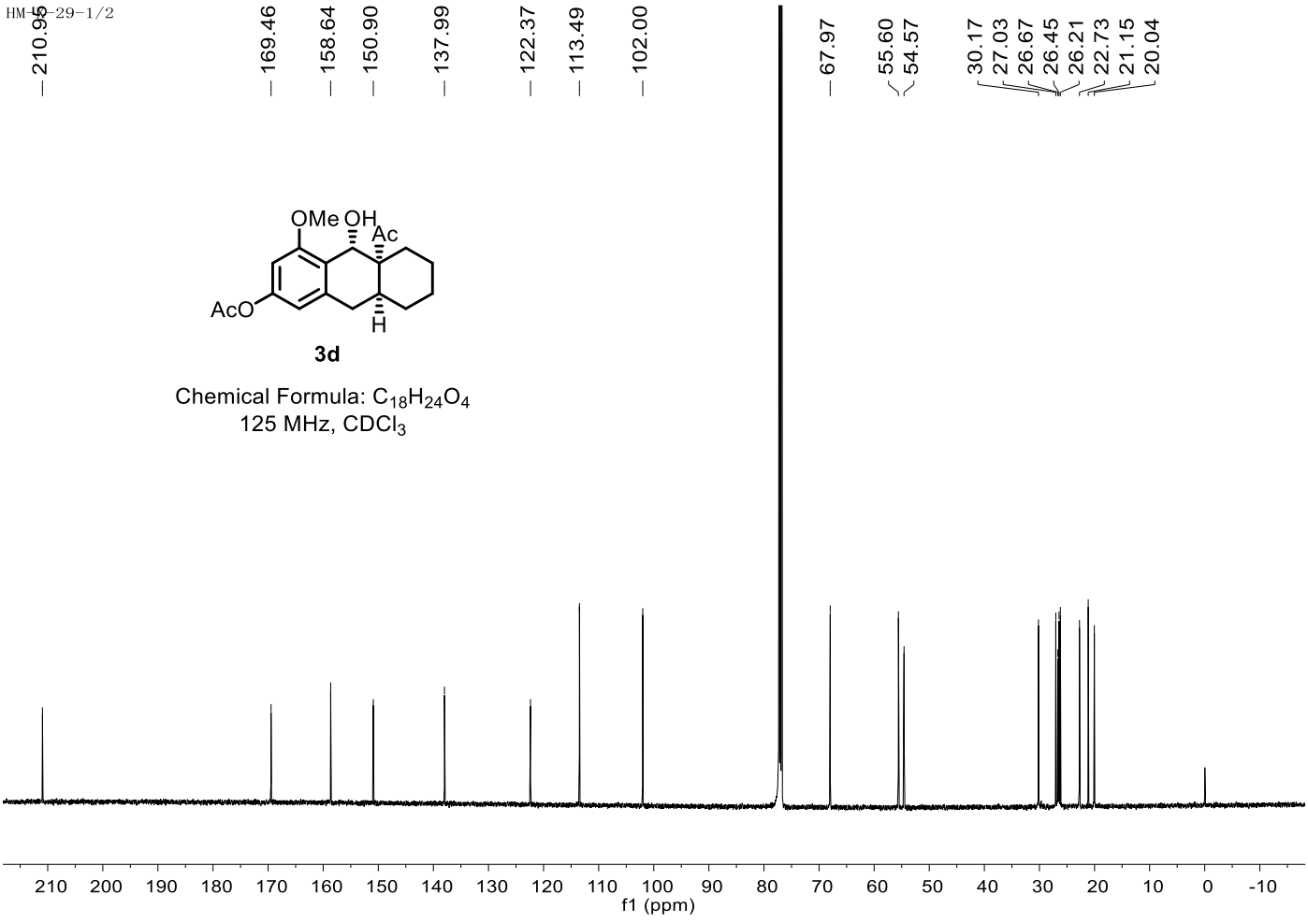


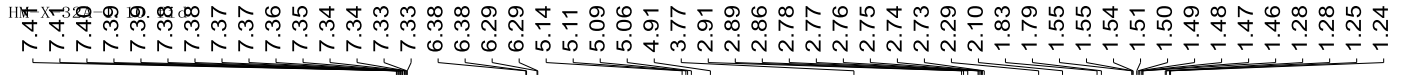


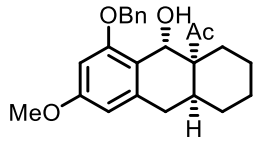
3c

Chemical Formula: $C_{18}H_{24}O_4$
125 MHz, $CDCl_3$


6.51 6.51 6.45 6.45 4.87 4.87 3.84 2.90 2.89 2.86 2.77 2.75 2.74 2.73 2.73 2.71 2.31 2.29 2.06 1.98 1.97 1.96 1.82 1.82 1.80 1.79 1.59 1.58 1.58 1.58 1.56 1.56 1.56 1.55 1.55 1.50 1.49 1.49 1.48 1.47 1.46 1.46 1.45 1.44 1.42 1.41 1.30 1.28 1.27 1.25 1.24
OMe OH Ac
AcO
H
3d
Chemical Formula: C18H24O4
500 MHz, CDCl3
1.08 1.00 1.00 3.24 1.16 2.14 3.11 2.87 1.04 1.15 1.11 1.91 3.28 1.43 1.12
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0
f1 (ppm)

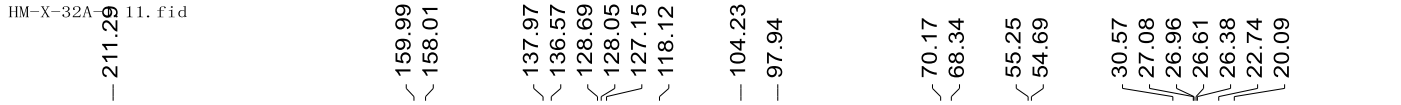

HM-X-29-1/2
210.95 169.46 158.64 150.90 137.99 122.37 113.49 102.00 67.97 55.60 54.57 30.17 27.03 26.67 26.45 26.21 22.73 21.15 20.04
OMe OH Ac
AcO
H
3d
Chemical Formula: C18H24O4
125 MHz, CDCl3
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

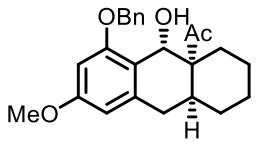




3e

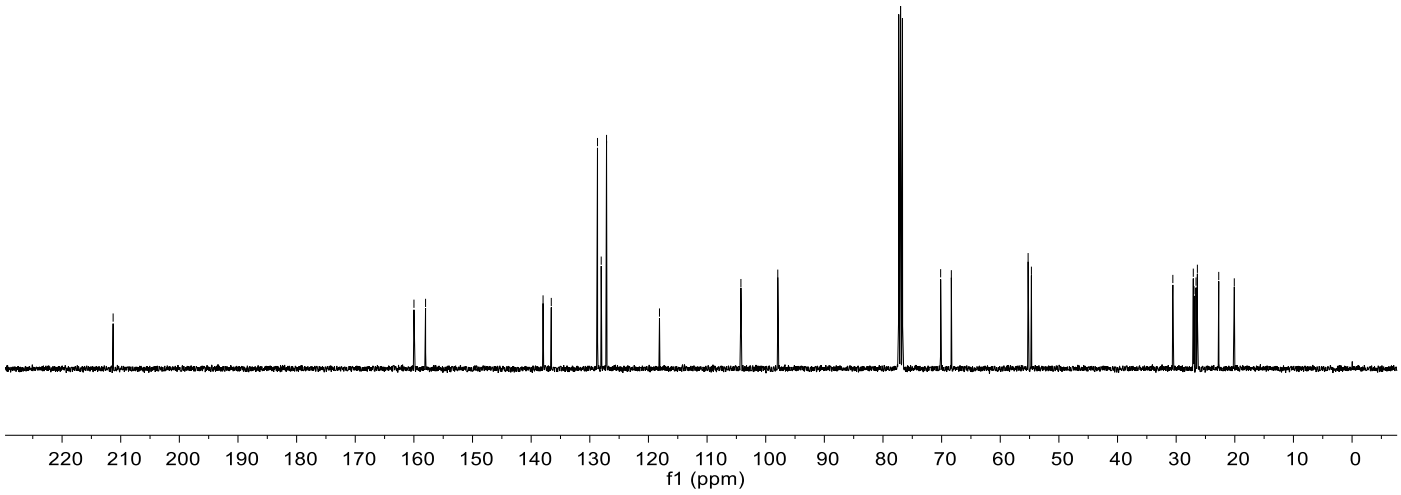
Chemical Formula: $C_{18}H_{24}O_4$
400 MHz, $CDCl_3$

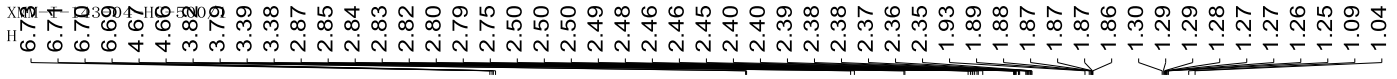


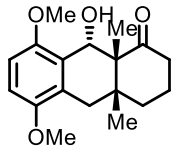


3e

Chemical Formula: $C_{18}H_{24}O_4$
100 MHz, $CDCl_3$

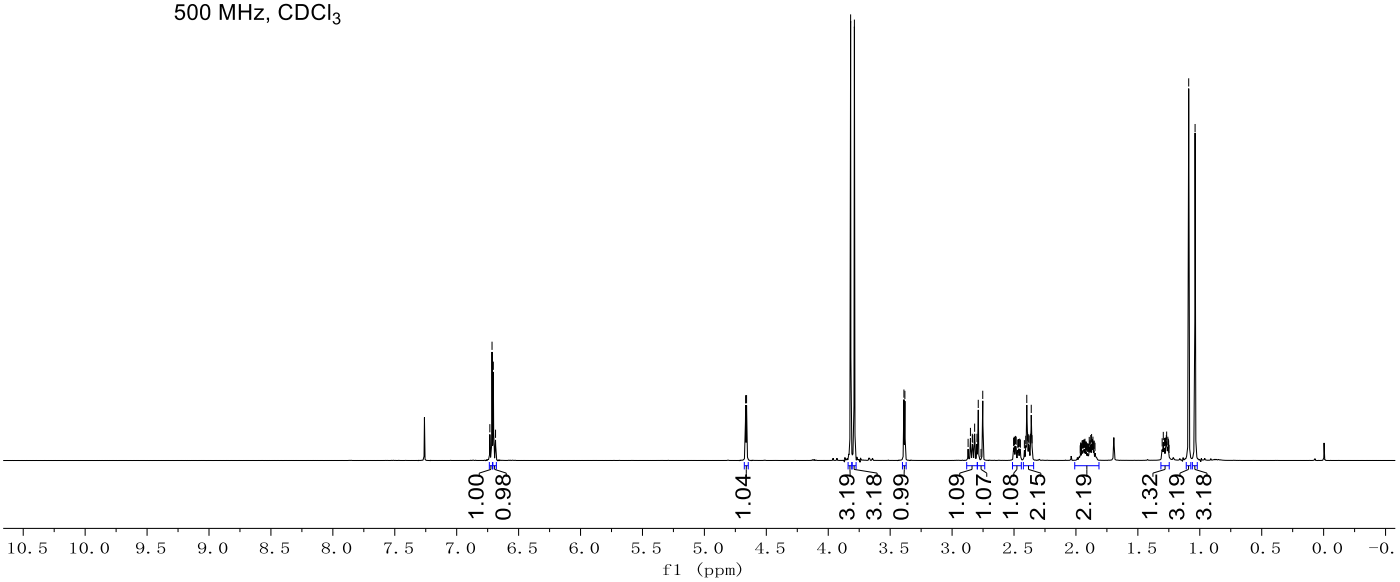


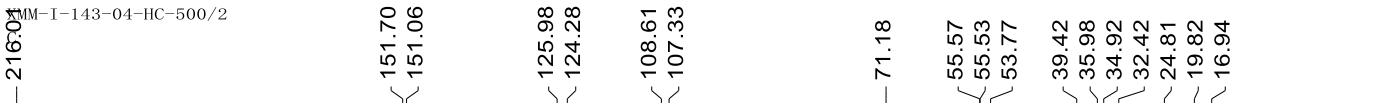


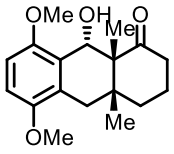


11

Chemical Formula: $C_{18}H_{24}O_4$
500 MHz, $CDCl_3$

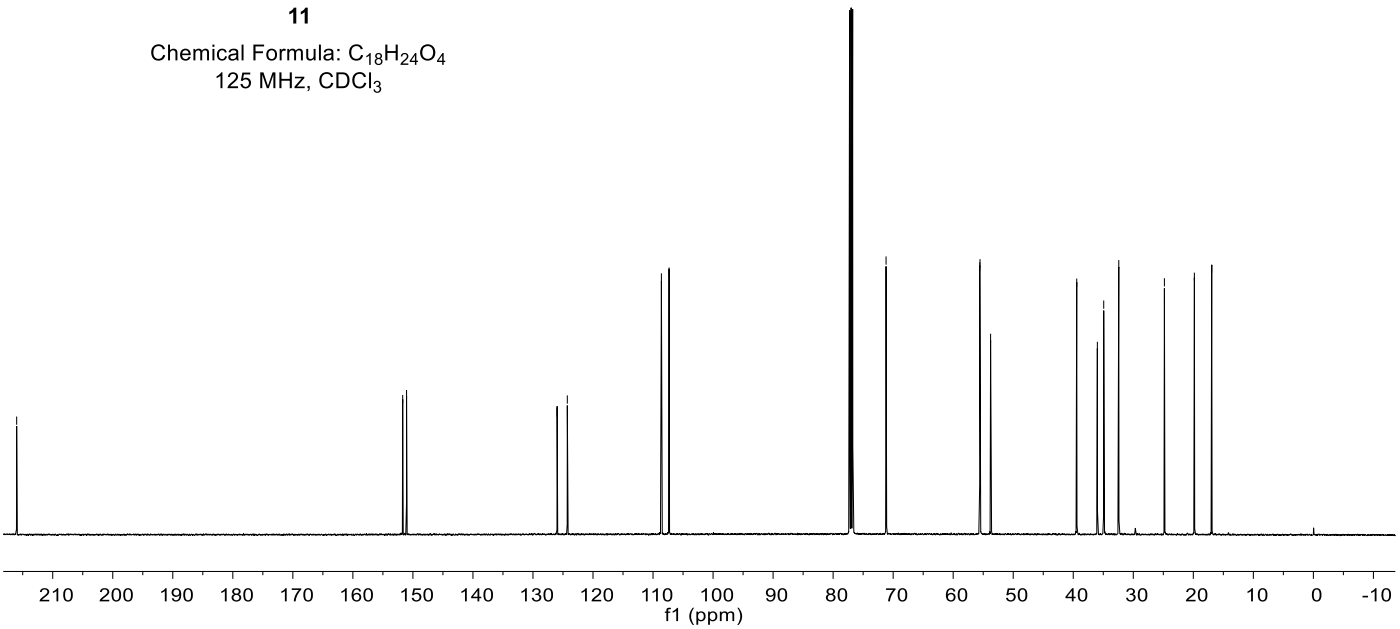


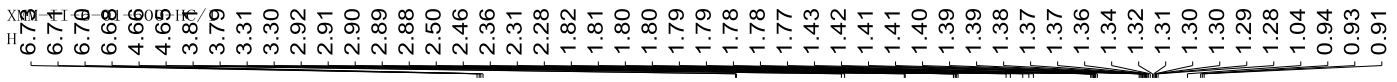


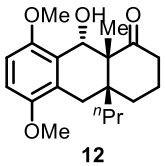


11

Chemical Formula: $C_{18}H_{24}O_4$
125 MHz, $CDCl_3$

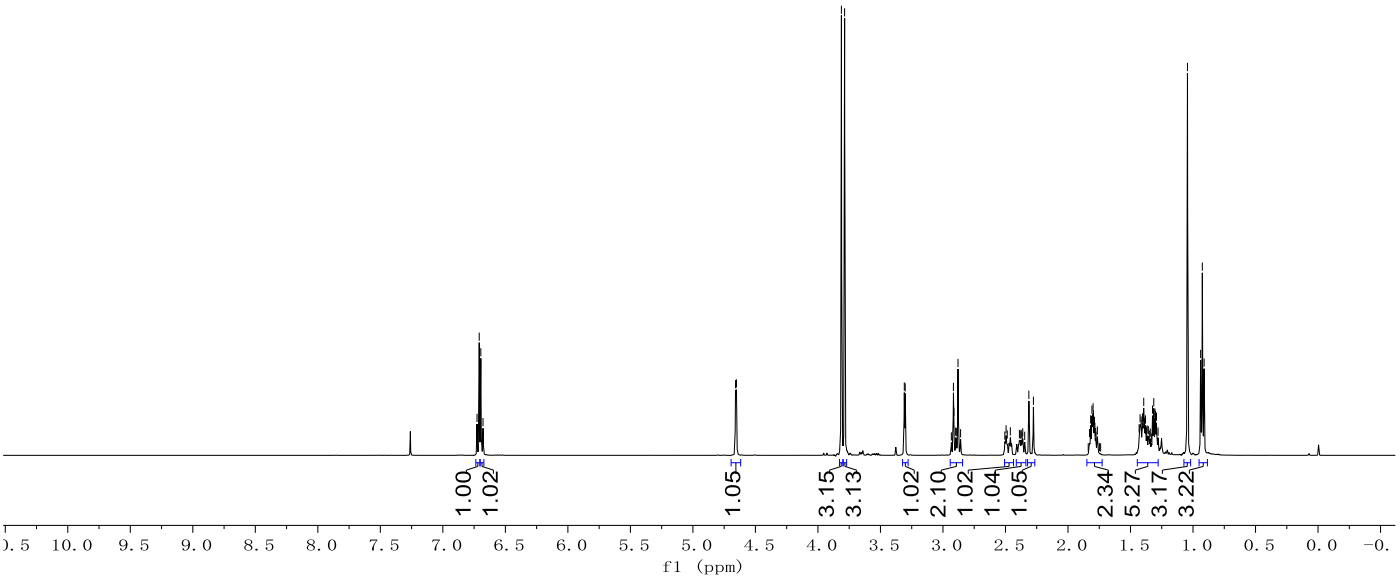


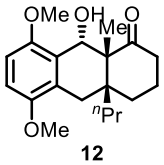




12

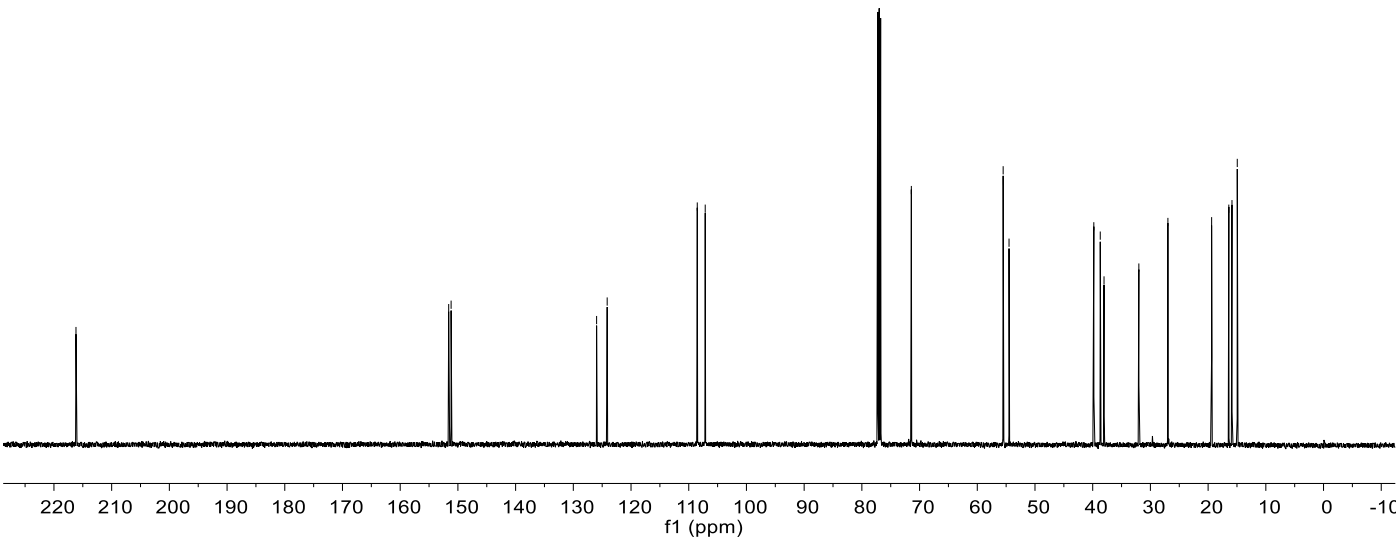
Chemical Formula: $C_{20}H_{28}O_4$
500 MHz, $CDCl_3$

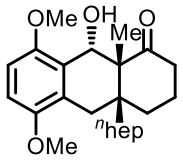




12

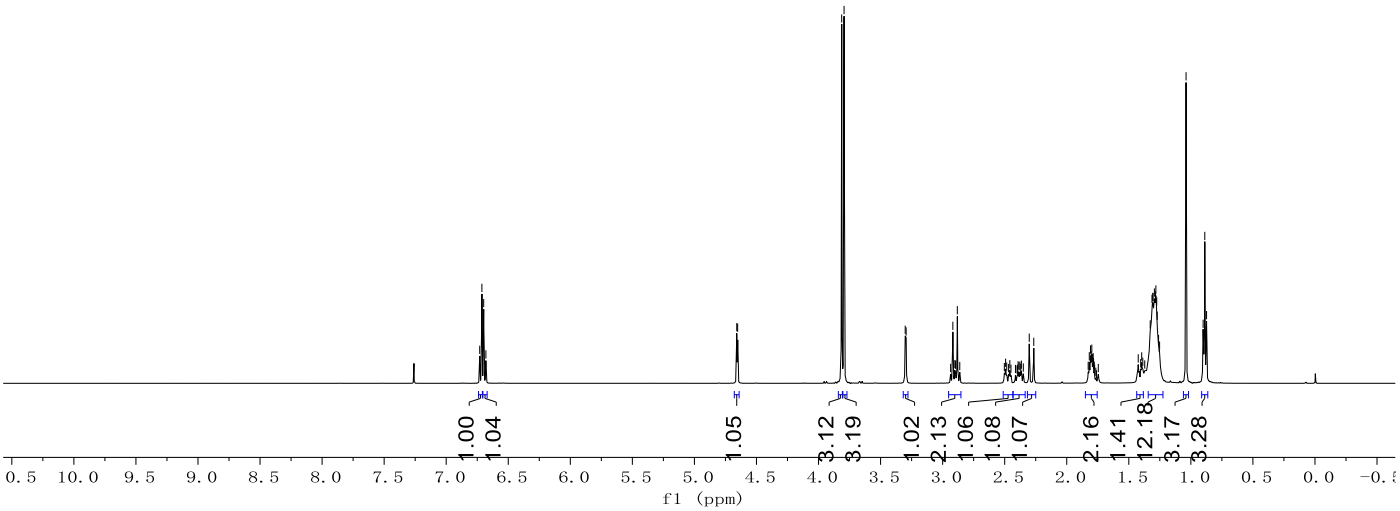
Chemical Formula: $C_{20}H_{28}O_4$
125 MHz, $CDCl_3$

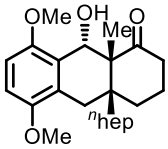




13

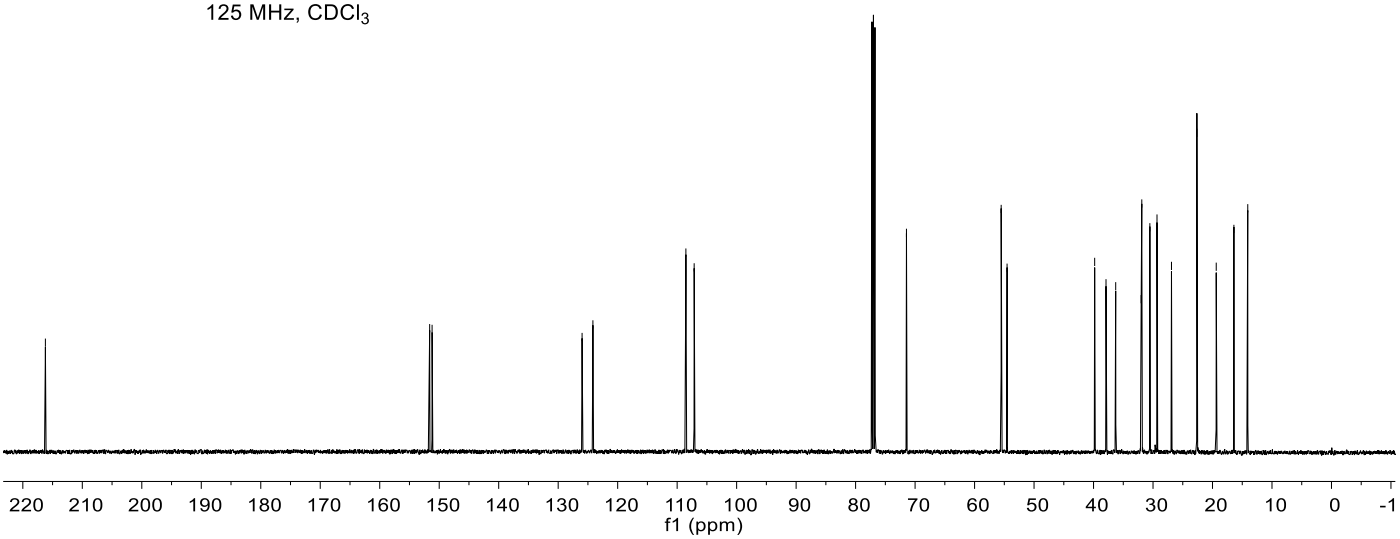
Chemical Formula: $C_{24}H_{36}O_4$
500 MHz, $CDCl_3$

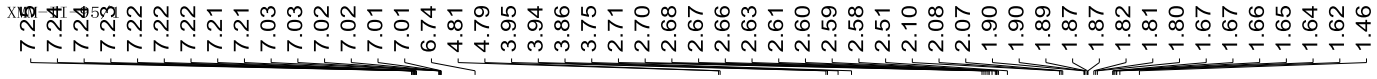


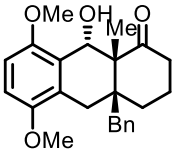


13

Chemical Formula: $C_{24}H_{36}O_4$
125 MHz, $CDCl_3$



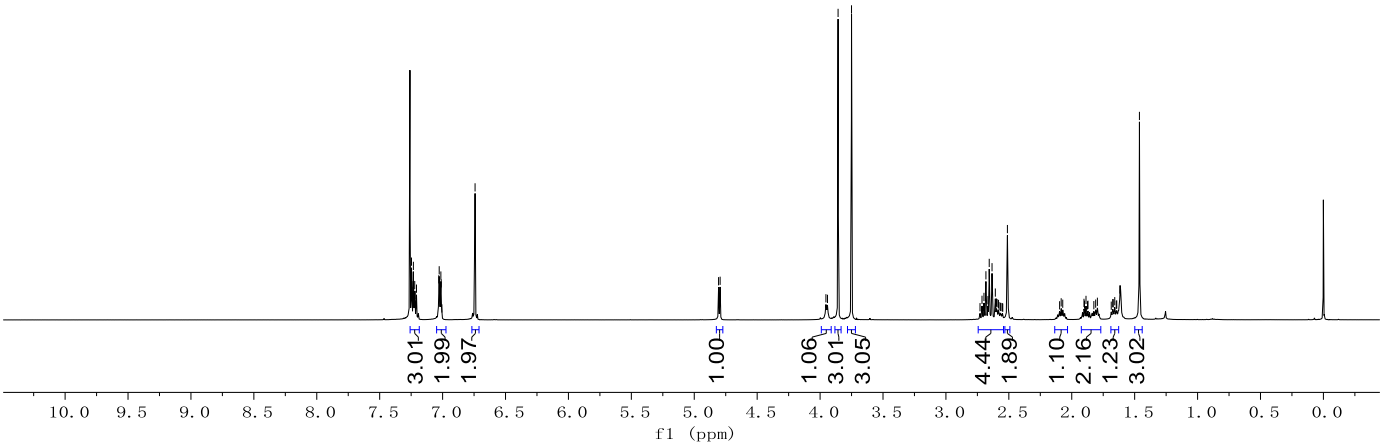




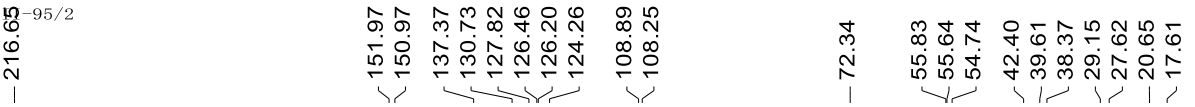
14

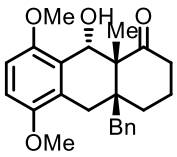
Chemical Formula: $C_{24}H_{28}O_4$

500 MHz, $CDCl_3$



XMM-[illegible]-95/2

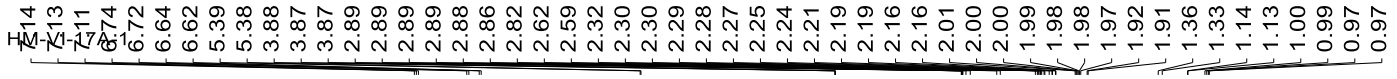


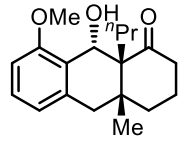


14

Chemical Formula: $C_{24}H_{28}O_4$

125 MHz, $CDCl_3$

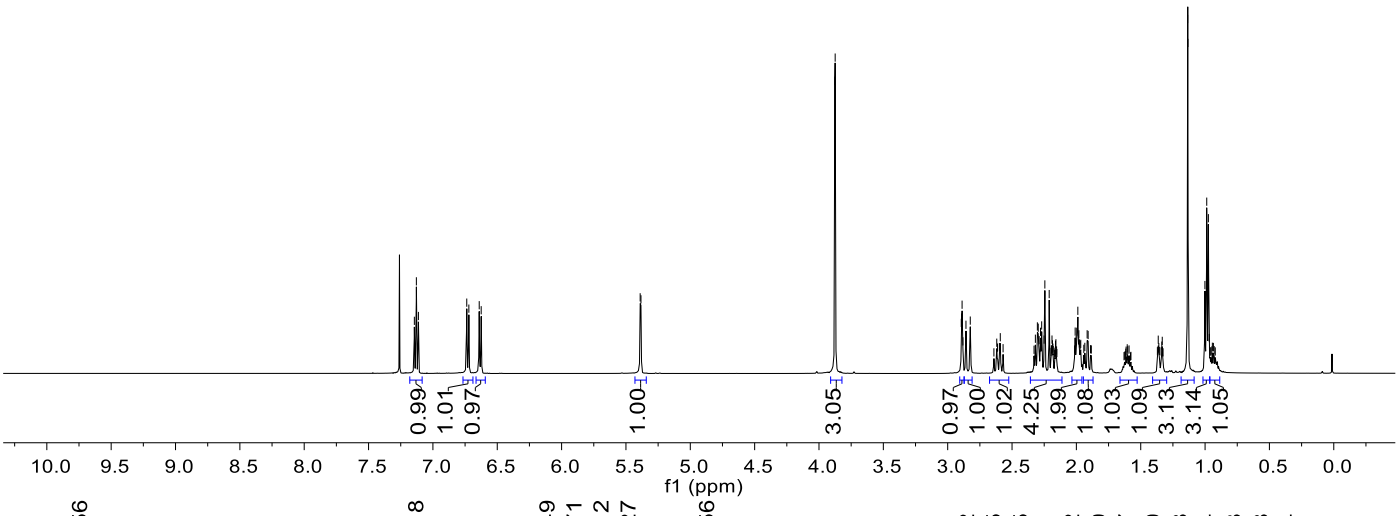


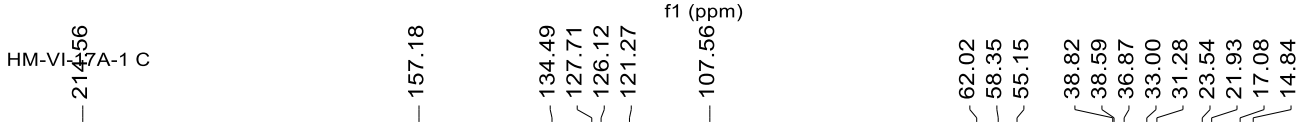


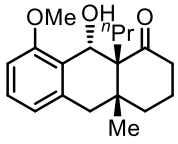
15

ChemicalFormula: $C_{19}H_{26}O_3$

500 MHz, $CDCl_3$



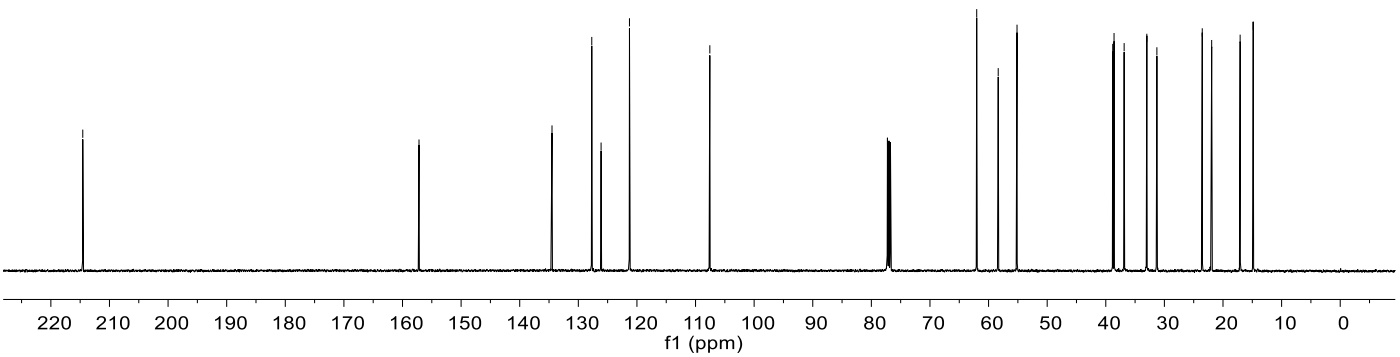


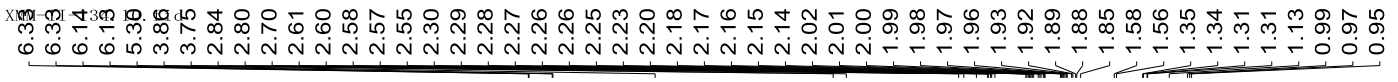


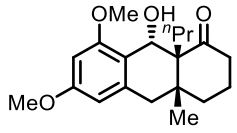
15

ChemicalFormula: $C_{19}H_{26}O_3$

125 MHz, $CDCl_3$

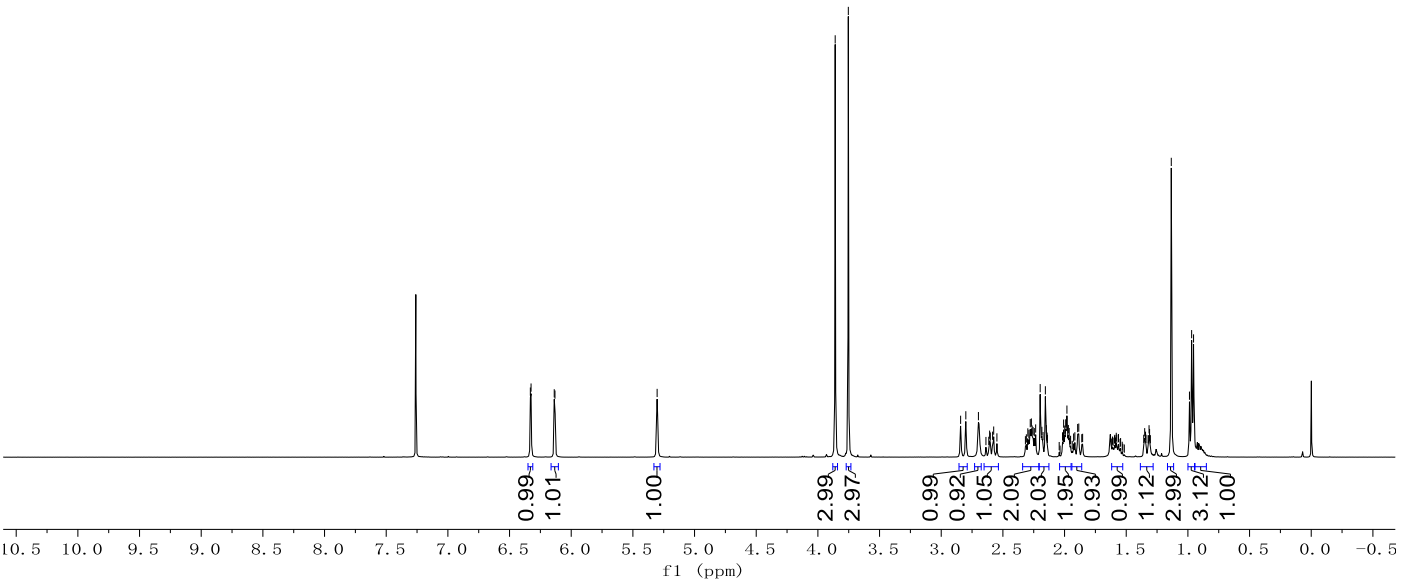


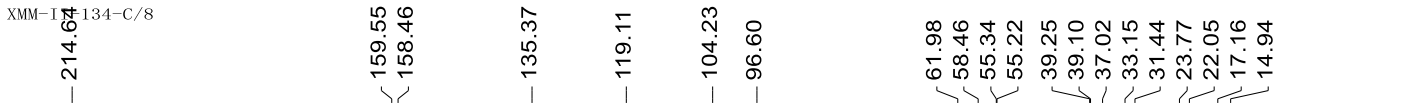


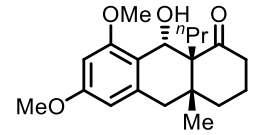


16

Chemical Formula: $C_{20}H_{28}O_4$
400 MHz, $CDCl_3$

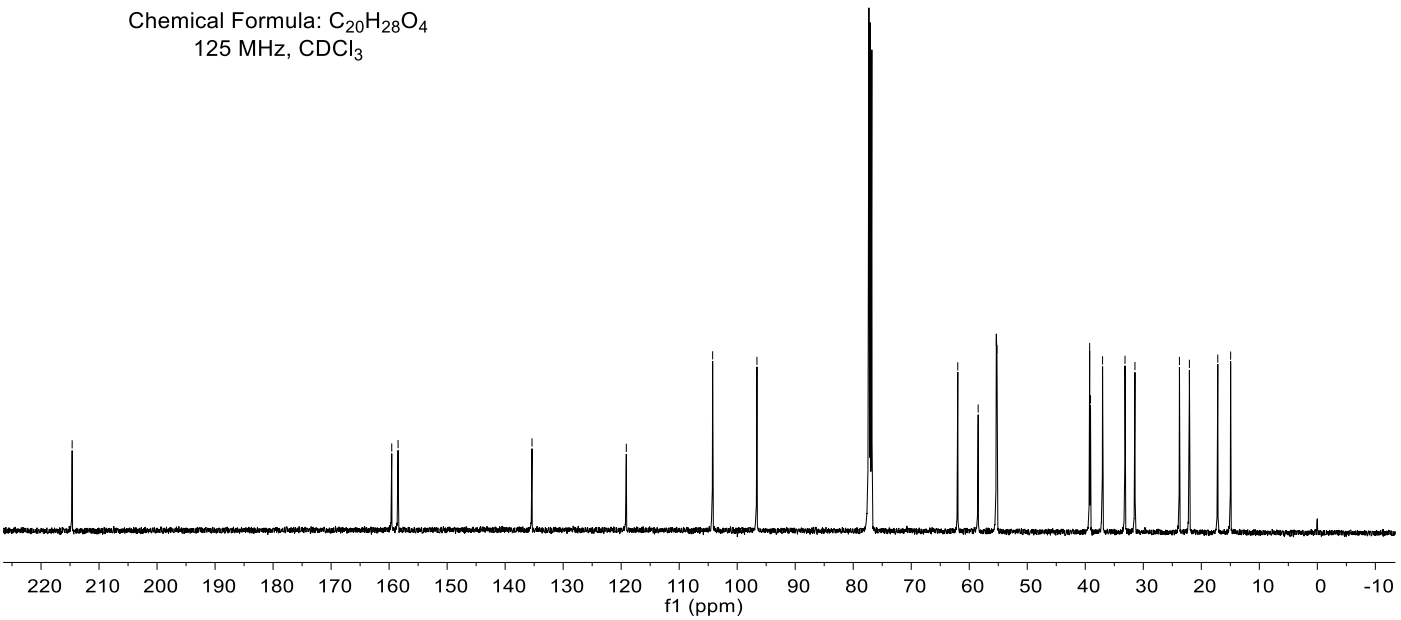


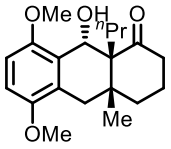




16

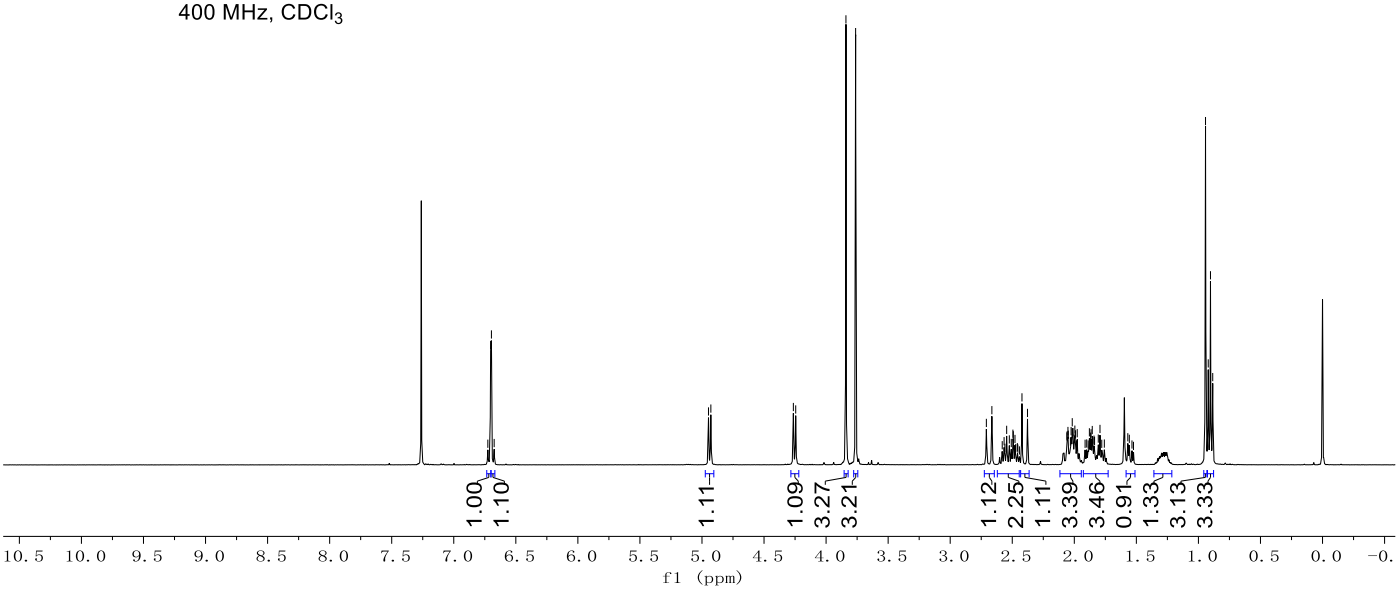
Chemical Formula: $C_{20}H_{28}O_4$
125 MHz, $CDCl_3$

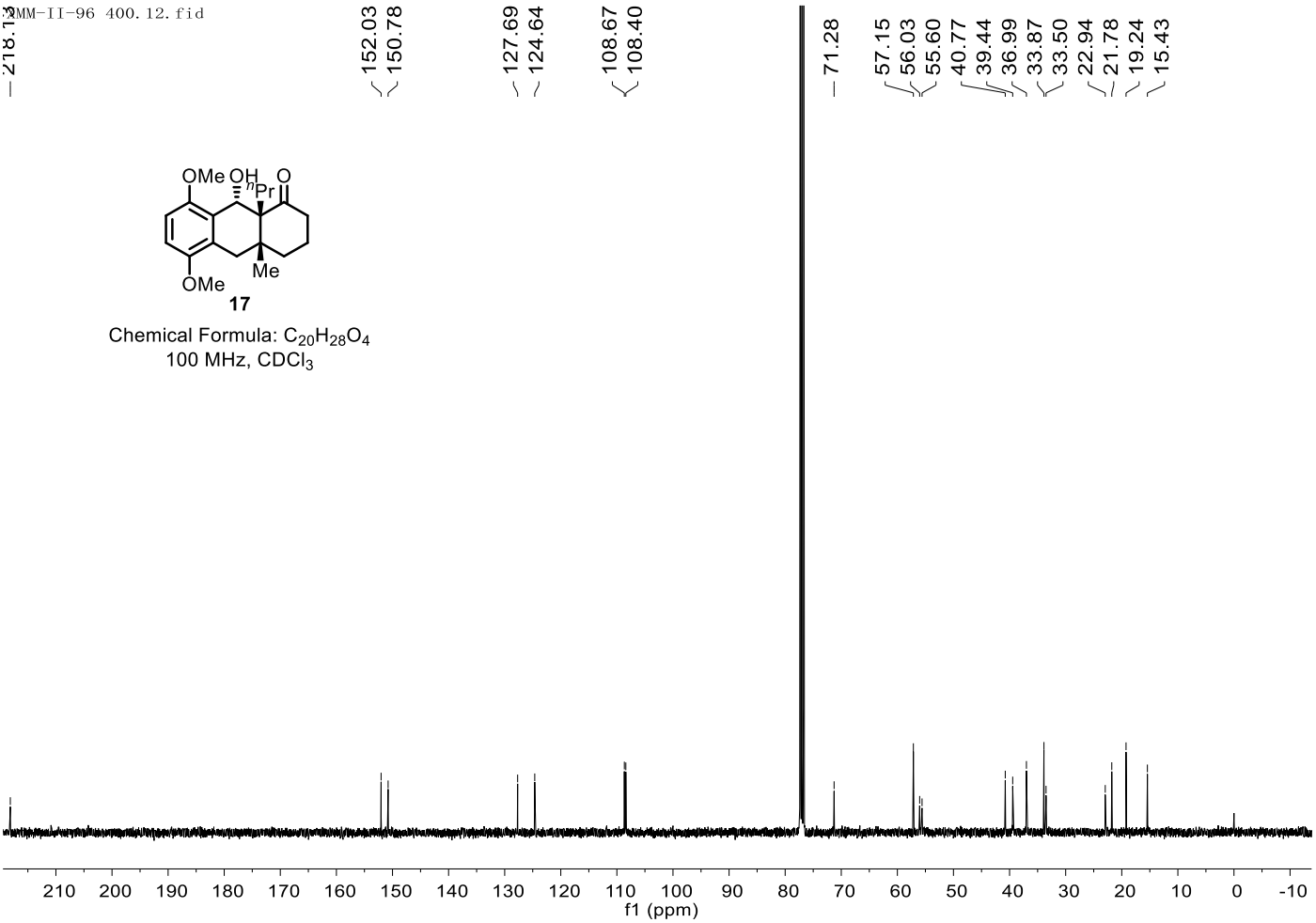




17

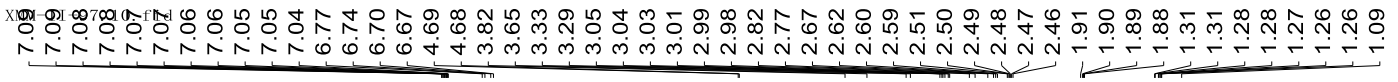
Chemical Formula: $C_{20}H_{28}O_4$
400 MHz, $CDCl_3$

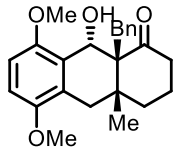




17

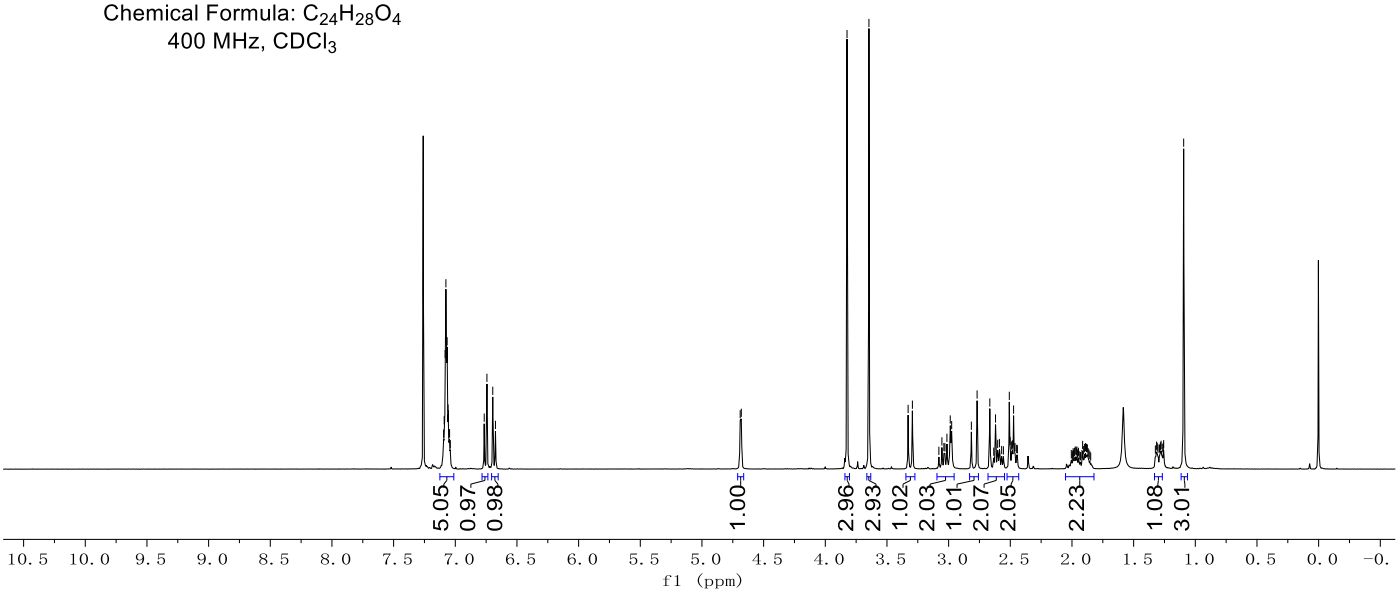
Chemical Formula: $C_{20}H_{28}O_4$
100 MHz, $CDCl_3$

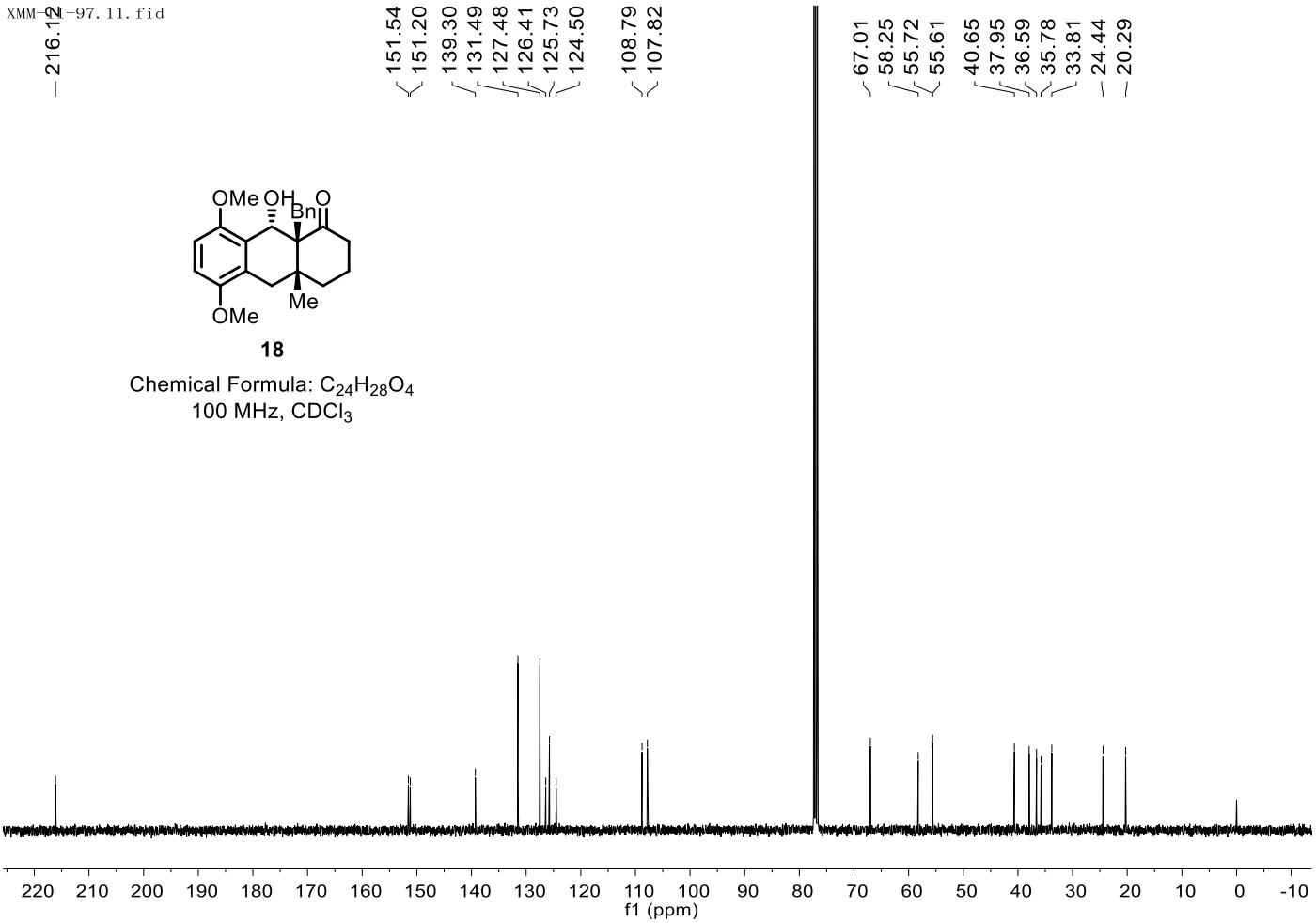




18

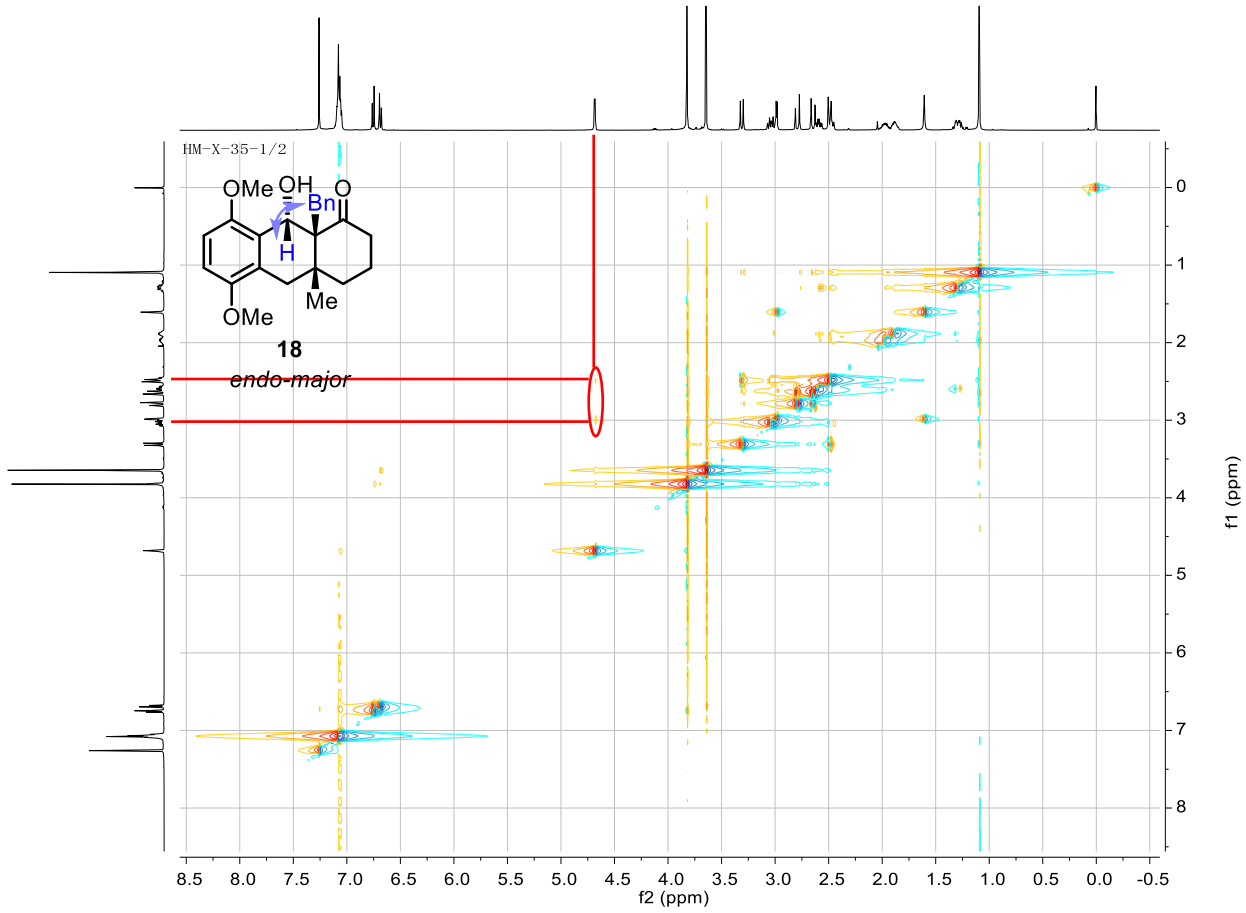
Chemical Formula: $C_{24}H_{28}O_4$
400 MHz, $CDCl_3$

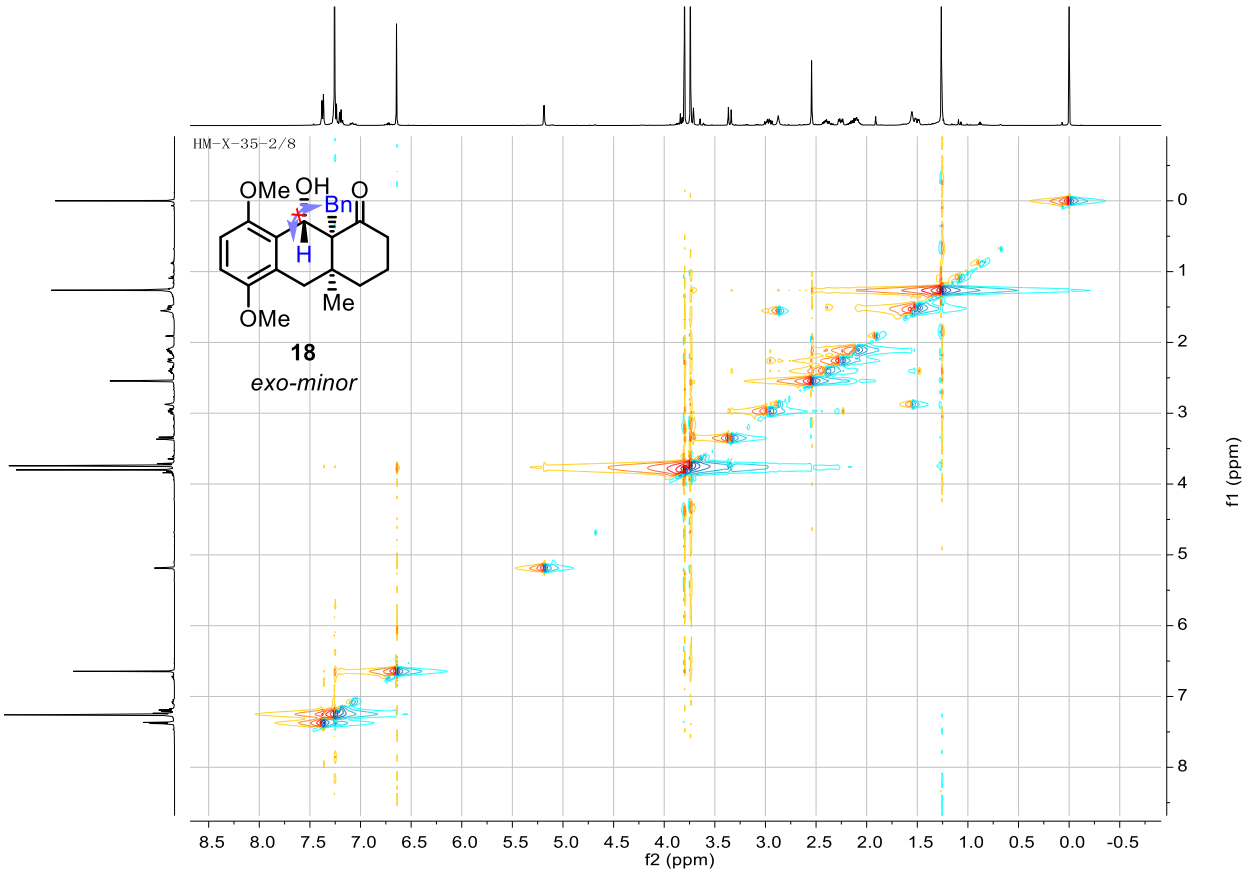




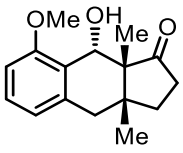
18

Chemical Formula: $C_{24}H_{28}O_4$
100 MHz, $CDCl_3$


HM-X-35-1/2
OMe
OH
O
Bn
H
Me
OMe
18
endo-major
f2 (ppm)
f1 (ppm)


HM-X-35-2/8
OMe
OH
O
Bn
H
Me
OMe
18
exo-minor
f2 (ppm)
f1 (ppm)

HM-IV-17B-1

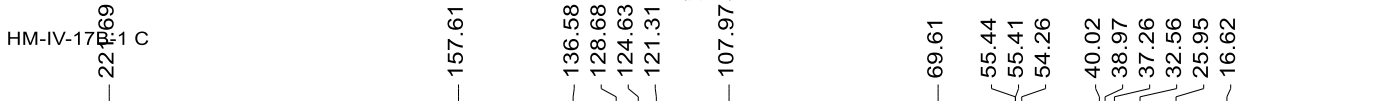


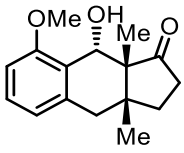
19

Chemical Formula: $C_{16}H_{20}O_3$

400 MHz, $CDCl_3$

HM-IV-17B-1 C

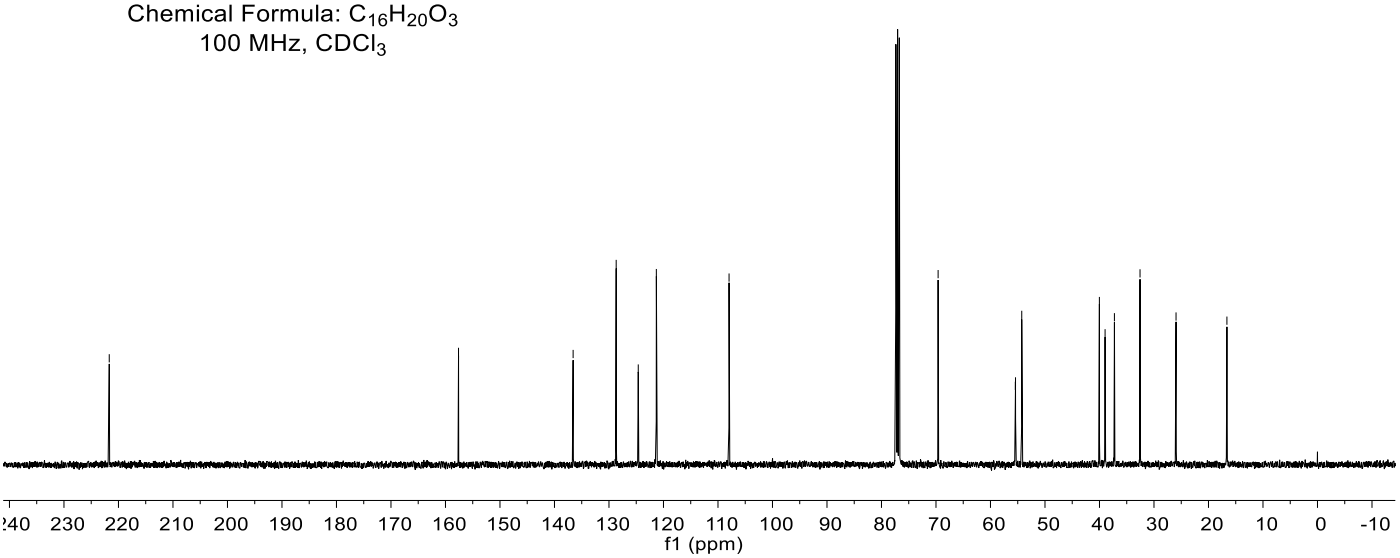


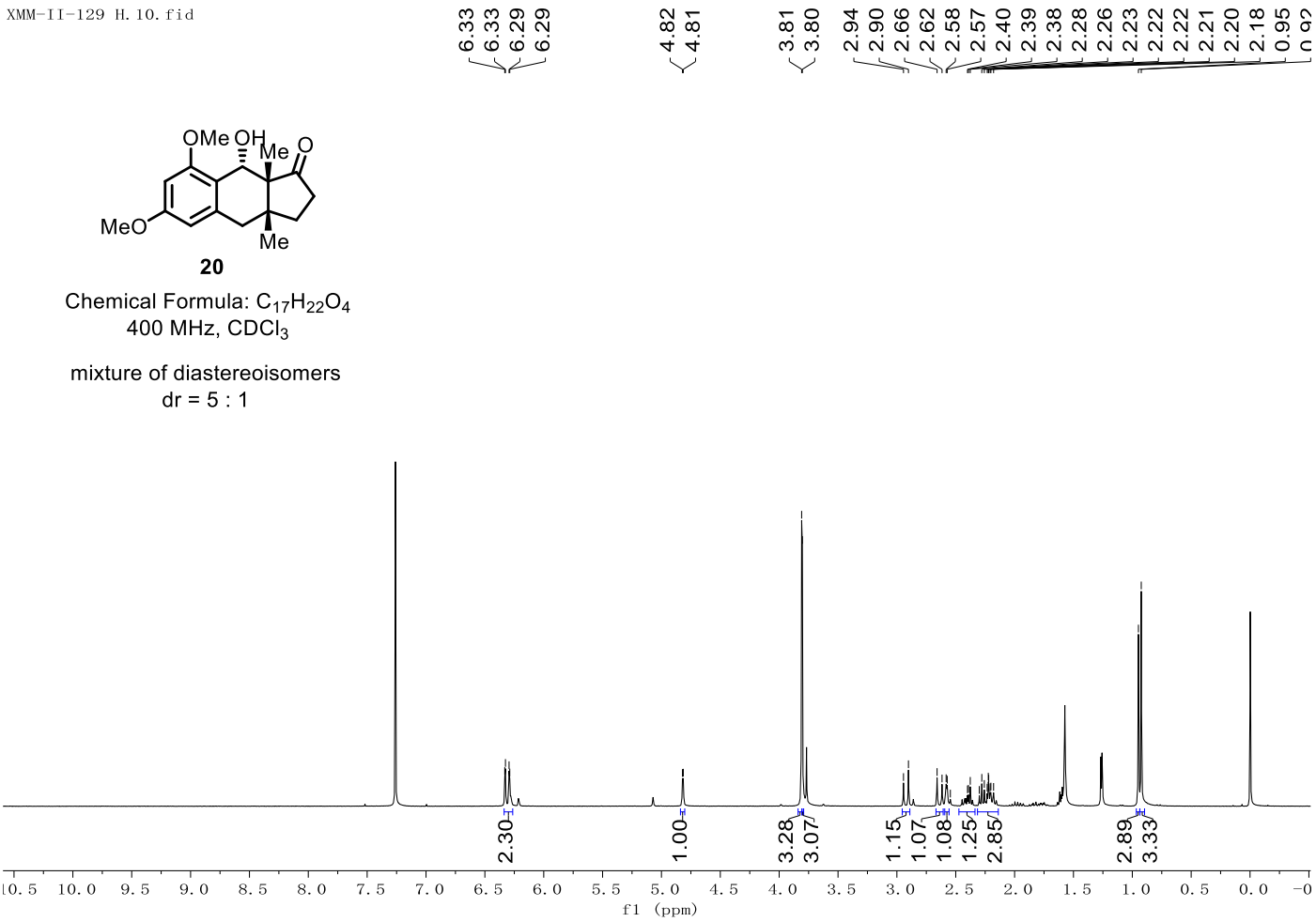


19

Chemical Formula: $C_{16}H_{20}O_3$

100 MHz, $CDCl_3$

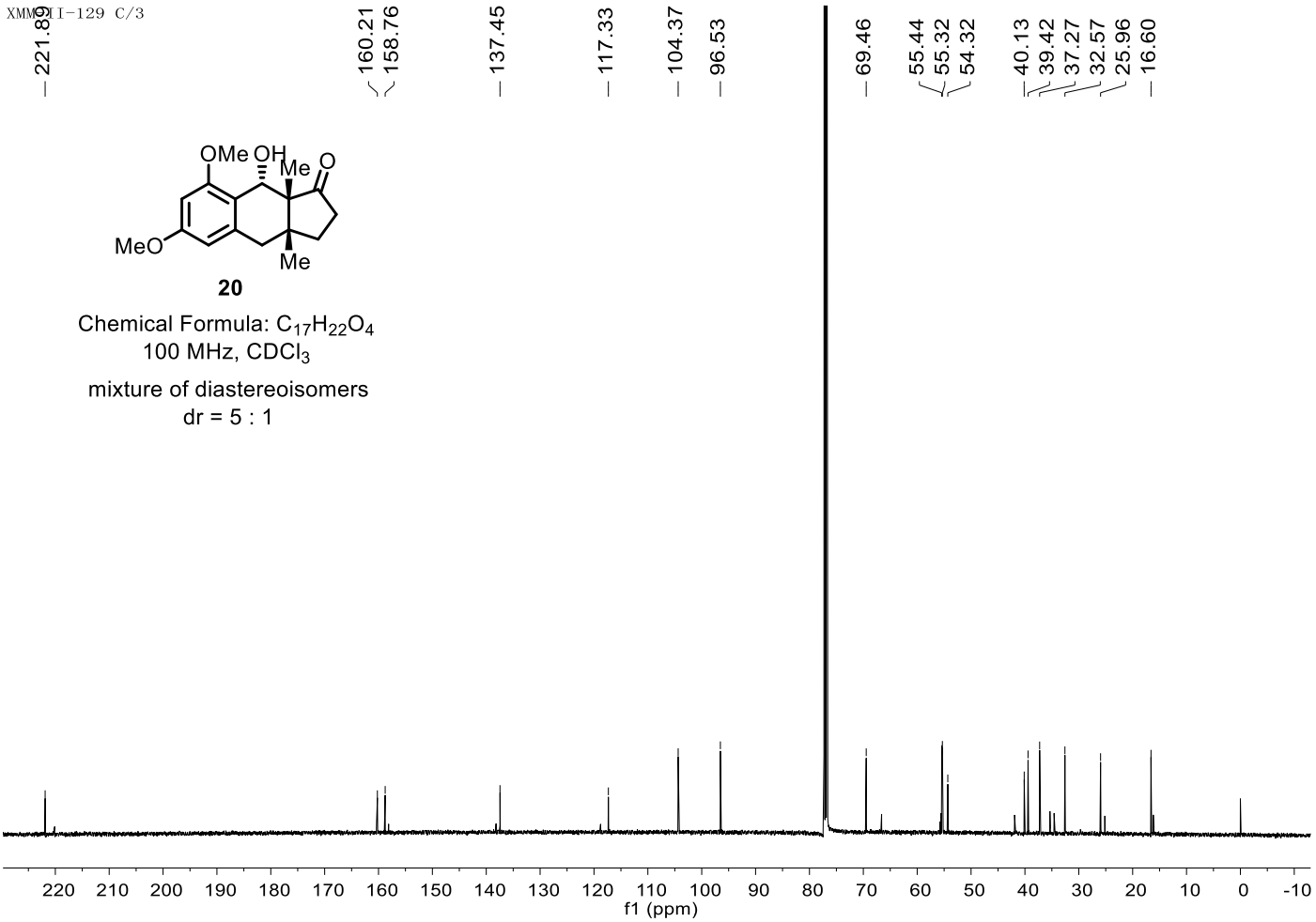




20

Chemical Formula: $C_{17}H_{22}O_4$
400 MHz, $CDCl_3$

mixture of diastereoisomers
dr = 5 : 1

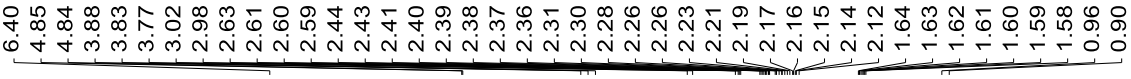


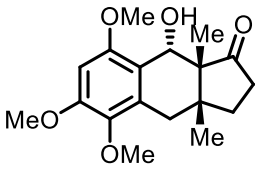
20

Chemical Formula: $C_{17}H_{22}O_4$
100 MHz, $CDCl_3$

mixture of diastereoisomers
dr = 5 : 1

XMM-II-131.10.fid

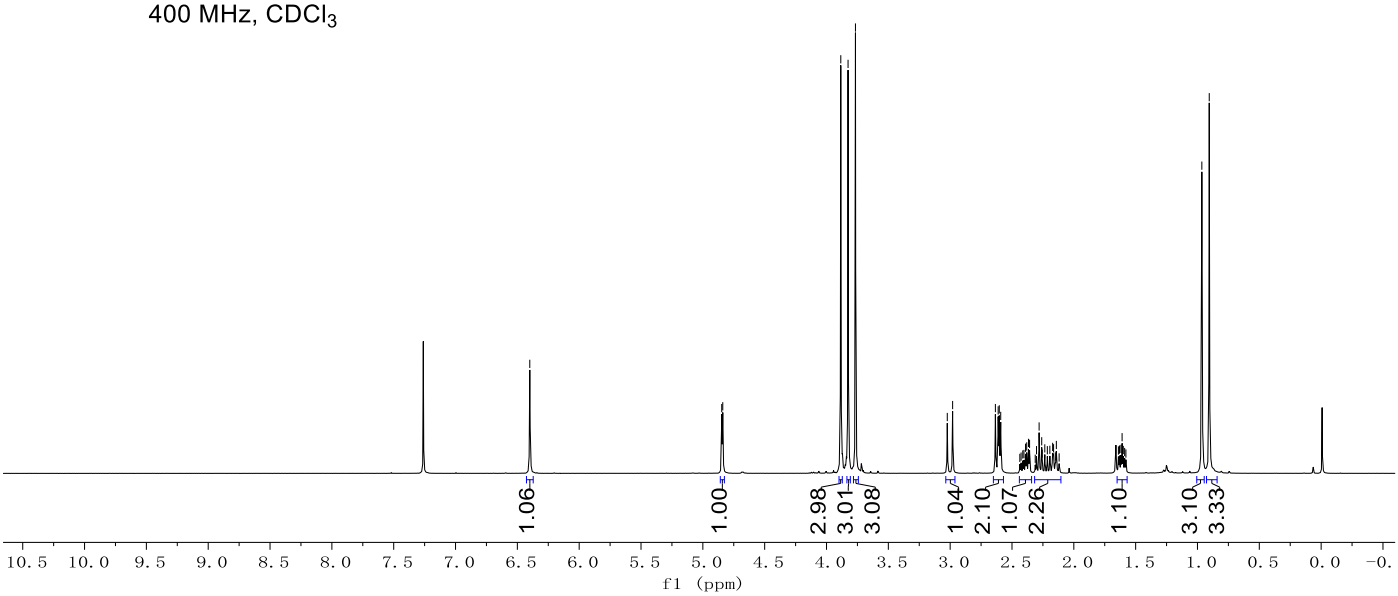




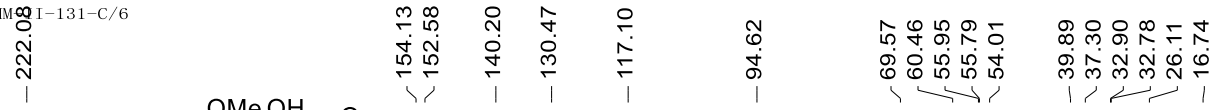
21

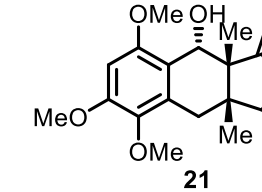
Chemical Formula: $C_{18}H_{24}O_5$

400 MHz, $CDCl_3$



XMM-II-131-C/6

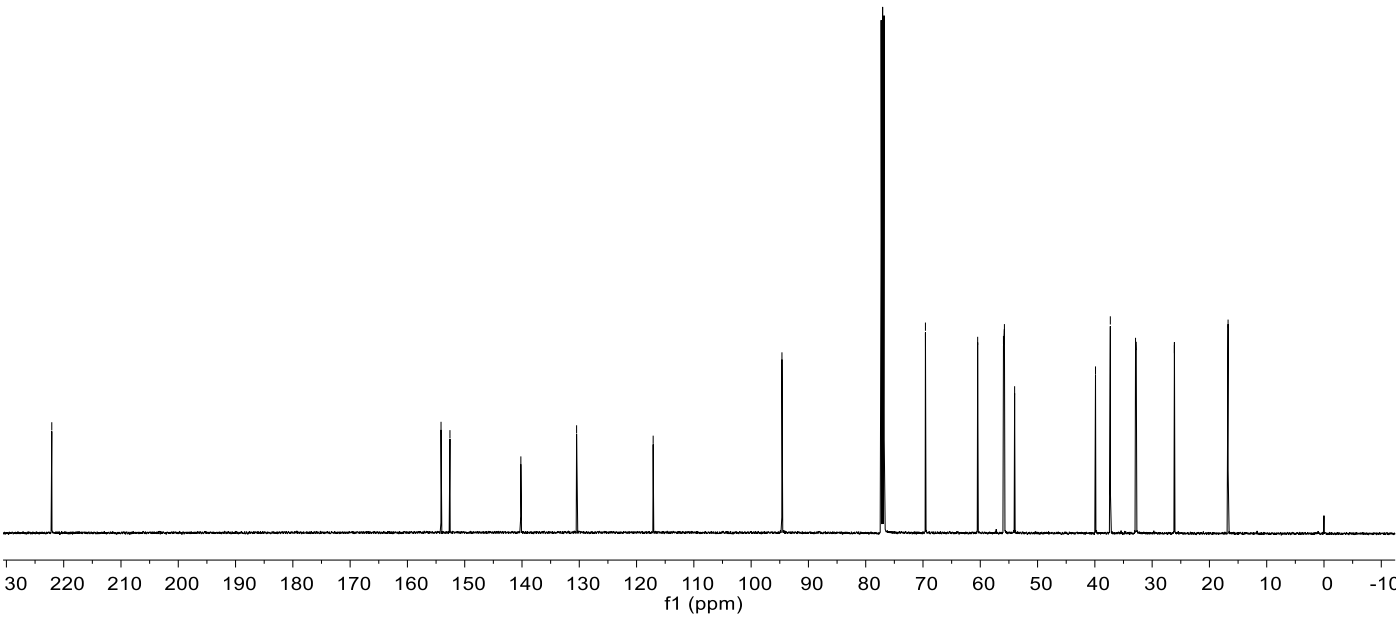




21

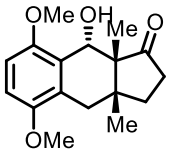
Chemical Formula: $C_{18}H_{24}O_5$

126 MHz, $CDCl_3$



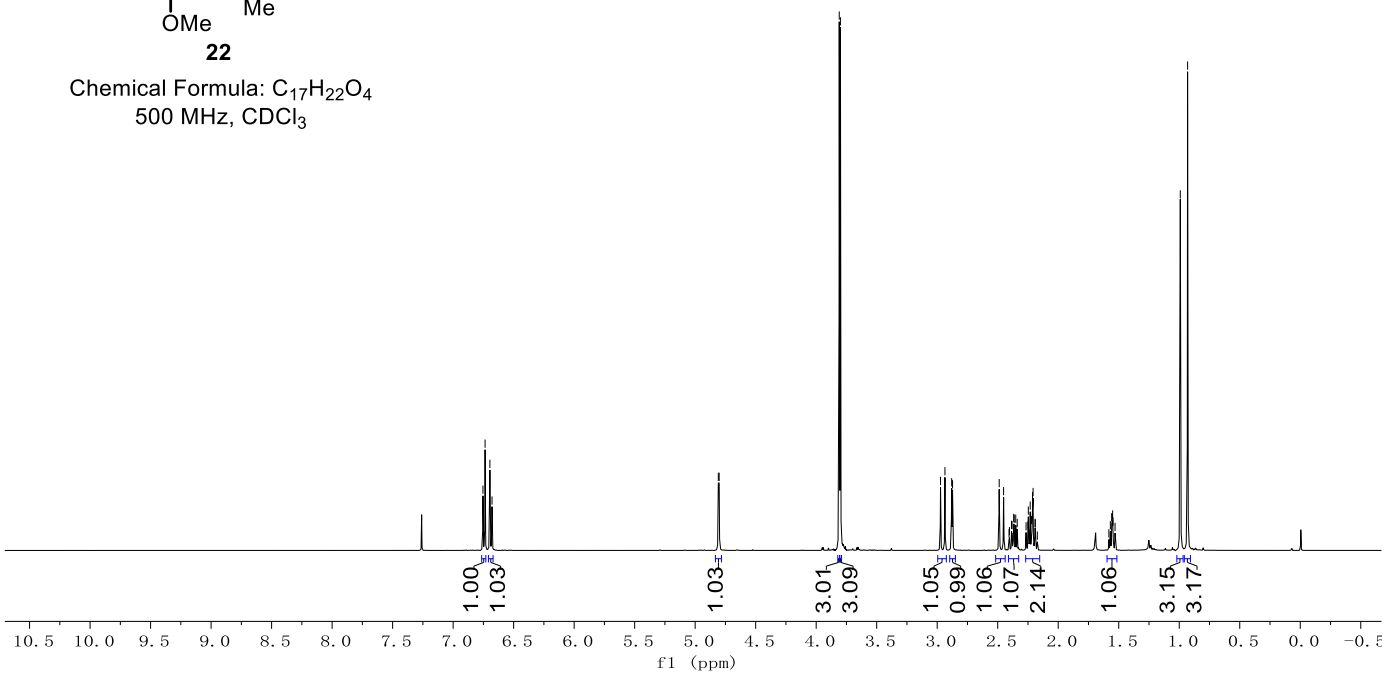
XMM-I-143-02-HC-500/1
H

6.75 6.74 6.70 6.68 4.81 4.80 3.81 3.80 2.97 2.94 2.88 2.87 2.49 2.45 2.41 2.40 2.39 2.38 2.37 2.37 2.36 2.35 2.34 2.27 2.25 2.25 2.24 2.23 2.22 2.21 2.21 2.19 2.19 2.17 1.58 1.57 1.56 1.55 1.55 1.55 1.53 0.99 0.93



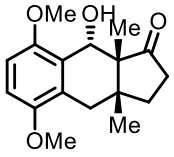
22

Chemical Formula: $C_{17}H_{22}O_4$
500 MHz, $CDCl_3$



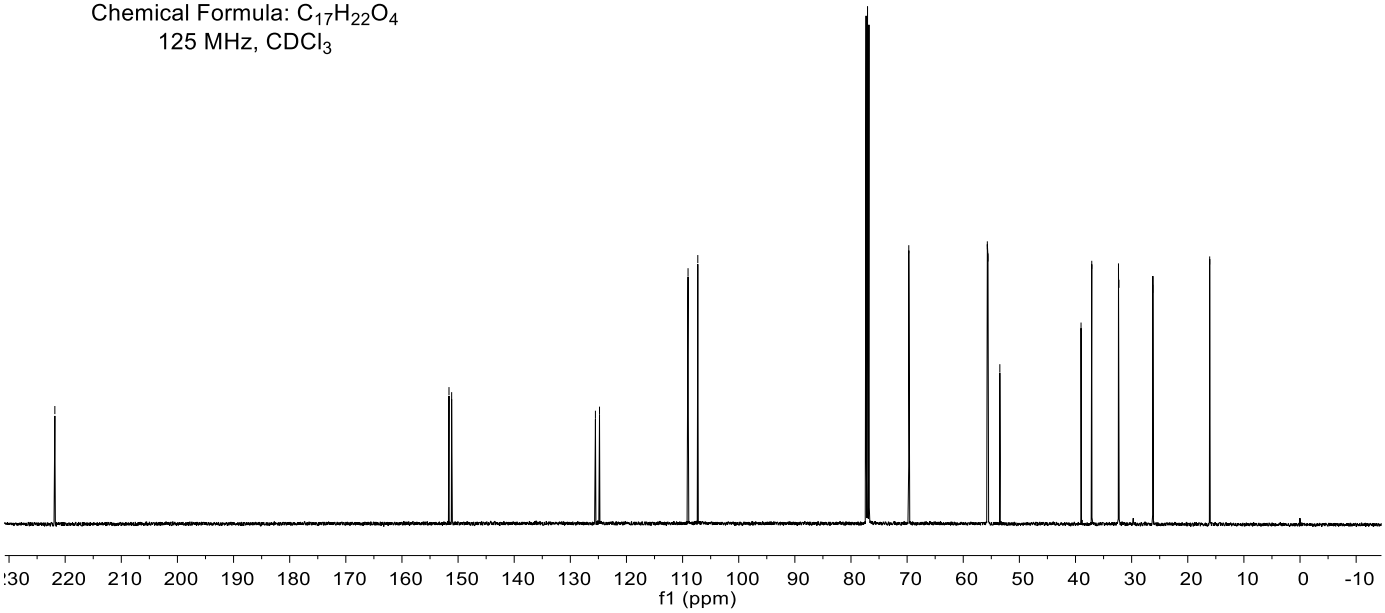
XMM-I-143-02-HC-500/2
XMM-I-143-02-C

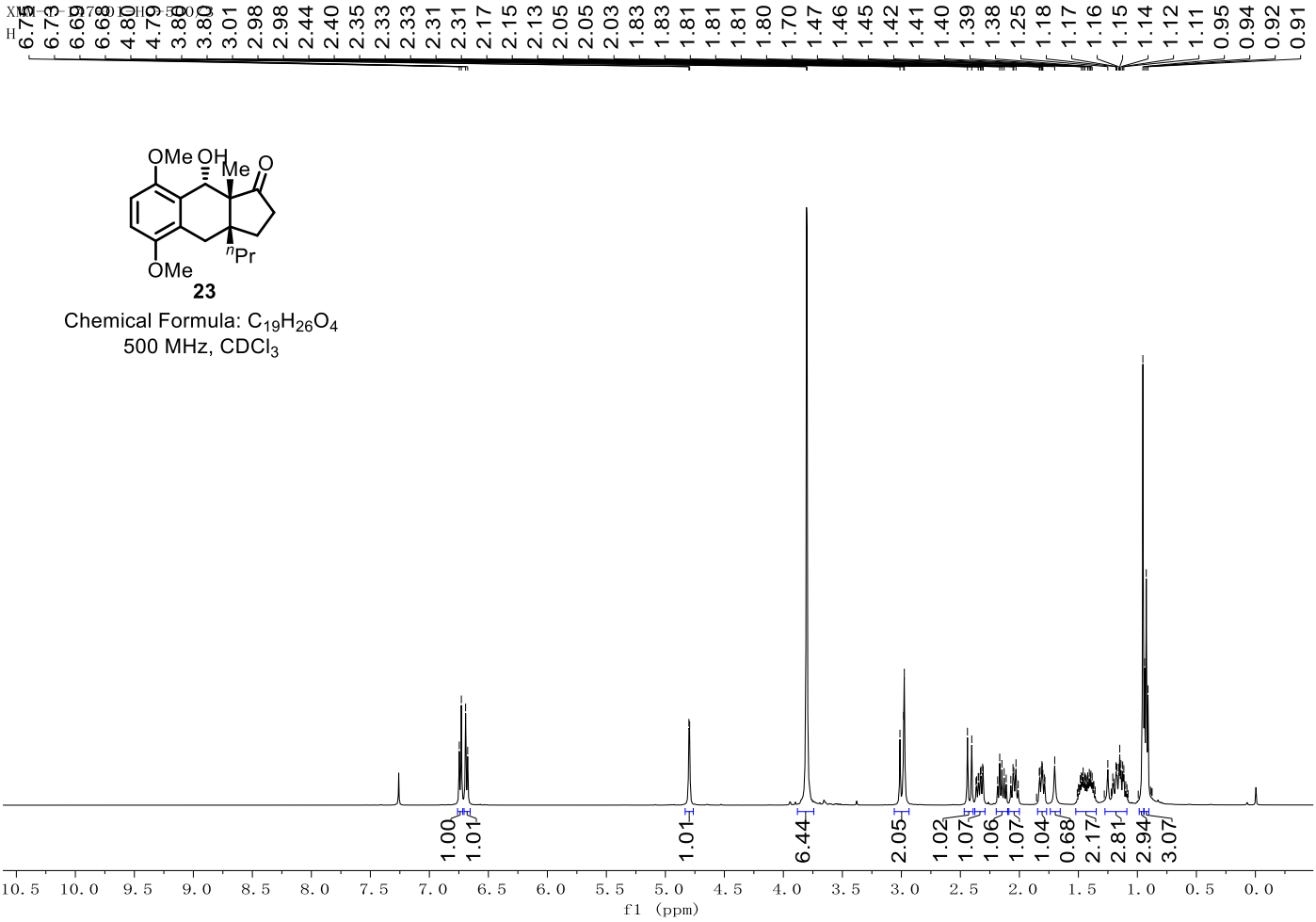
221.84 151.62 151.14 125.53 124.80 109.03 107.29 69.70 55.71 55.59 53.48 39.01 37.11 32.34 32.26 26.22 16.09

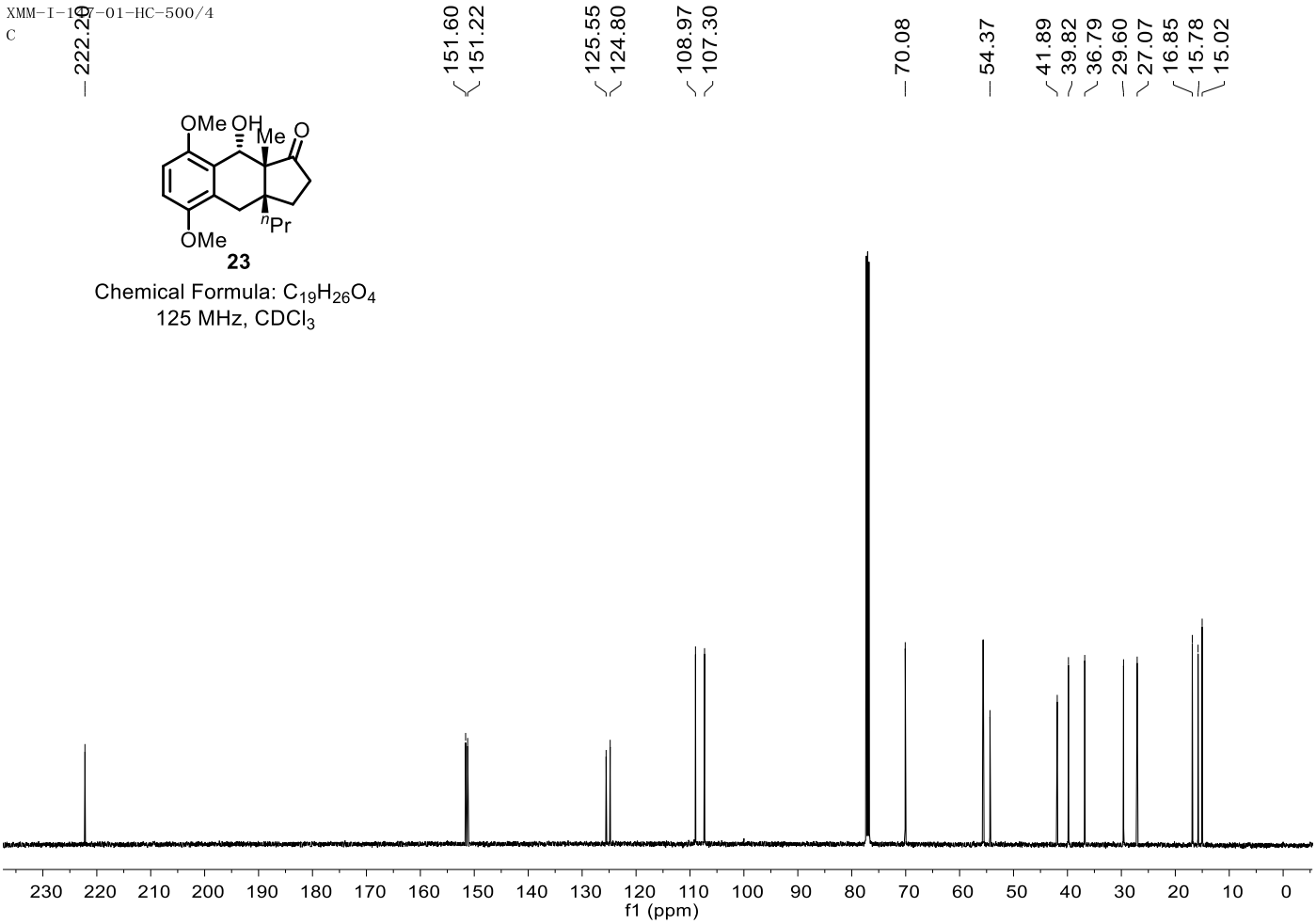


22

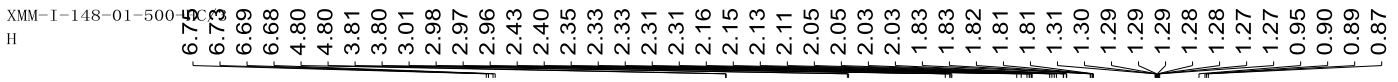
Chemical Formula: $C_{17}H_{22}O_4$
125 MHz, $CDCl_3$

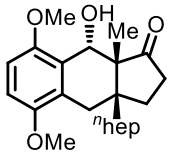



OMe OH
Me
O
nPr
OMe
23
Chemical Formula: C19H26O4
500 MHz, CDCl3
f1 (ppm)


OMe OH
Me
O
nPr
OMe
23
Chemical Formula: C19H26O4
125 MHz, CDCl3
f1 (ppm)

XMM-I-148-01-500-HCC3
H

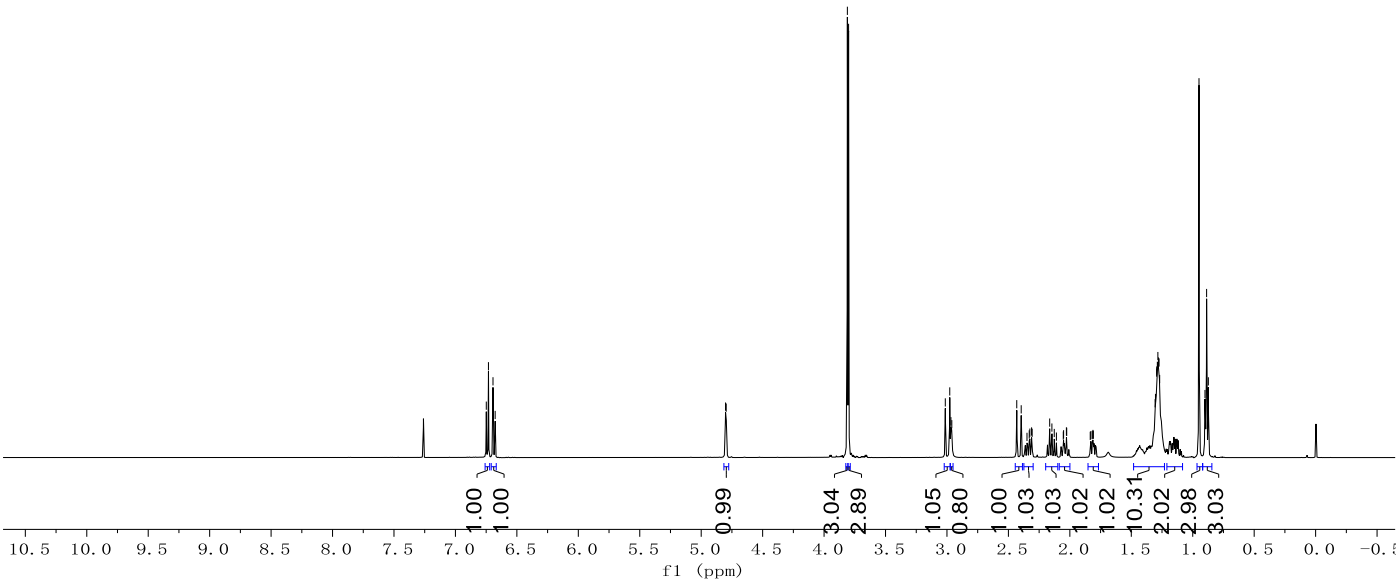




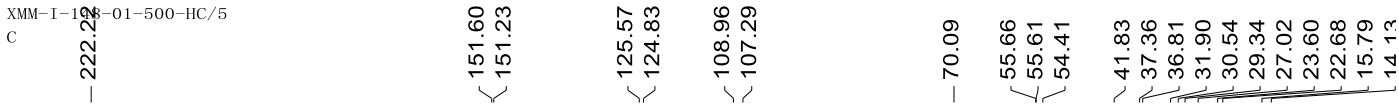
24

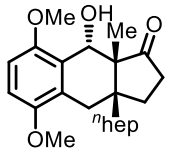
Chemical Formula: $C_{18}H_{24}O_4$

500 MHz, $CDCl_3$



XMM-I-148-01-500-HC/5
C

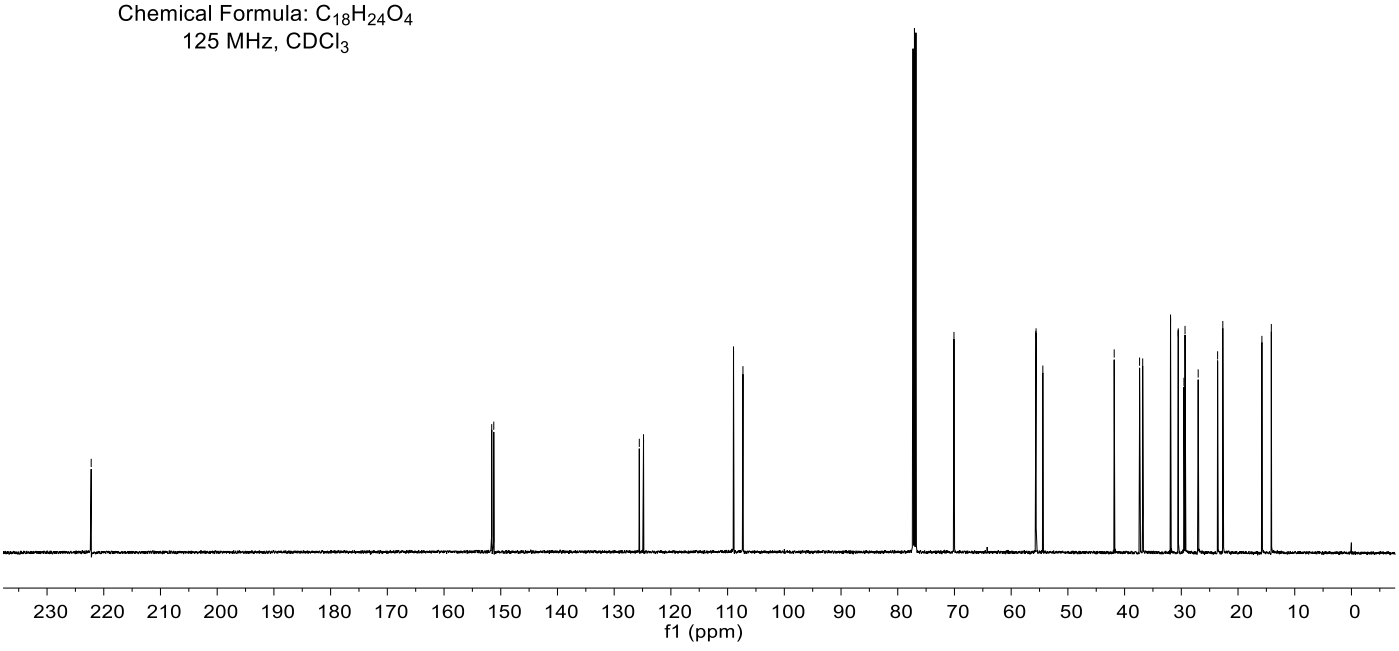


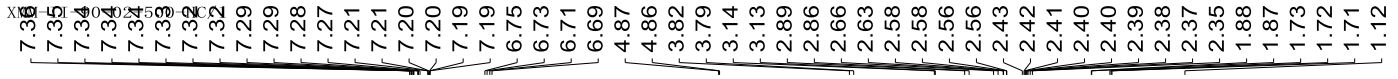


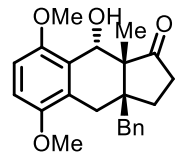
24

Chemical Formula: $C_{18}H_{24}O_4$

125 MHz, $CDCl_3$



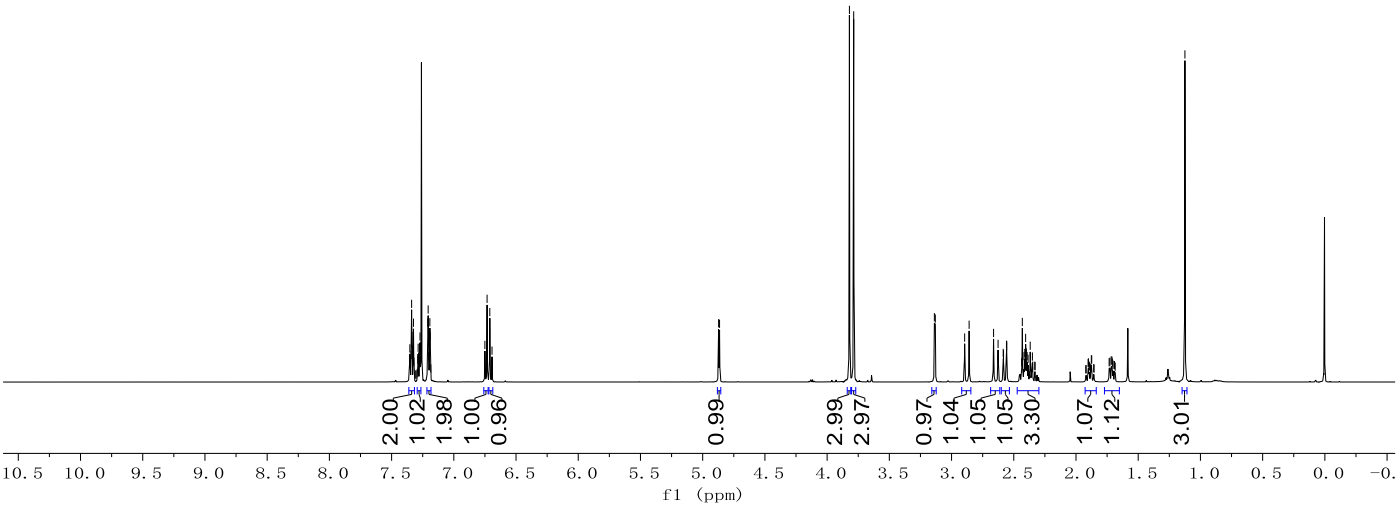




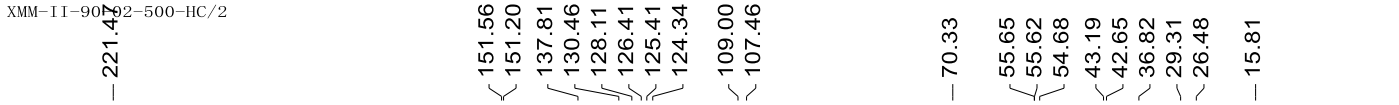
25

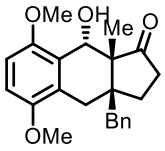
Chemical Formula: $C_{23}H_{26}O_4$

500 MHz, $CDCl_3$



XMM-II-90792-500-HC/2

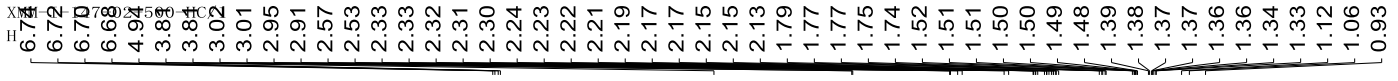


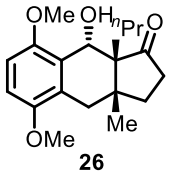


25

Chemical Formula: $C_{23}H_{26}O_4$

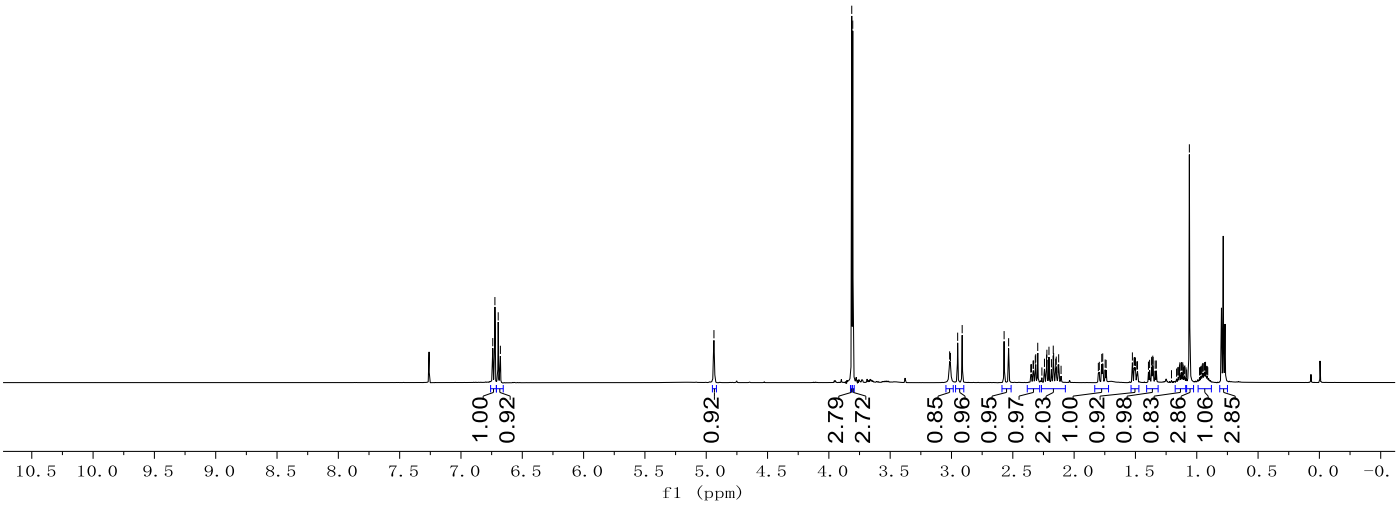
125 MHz, $CDCl_3$

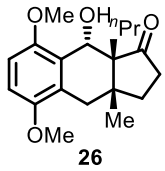




26

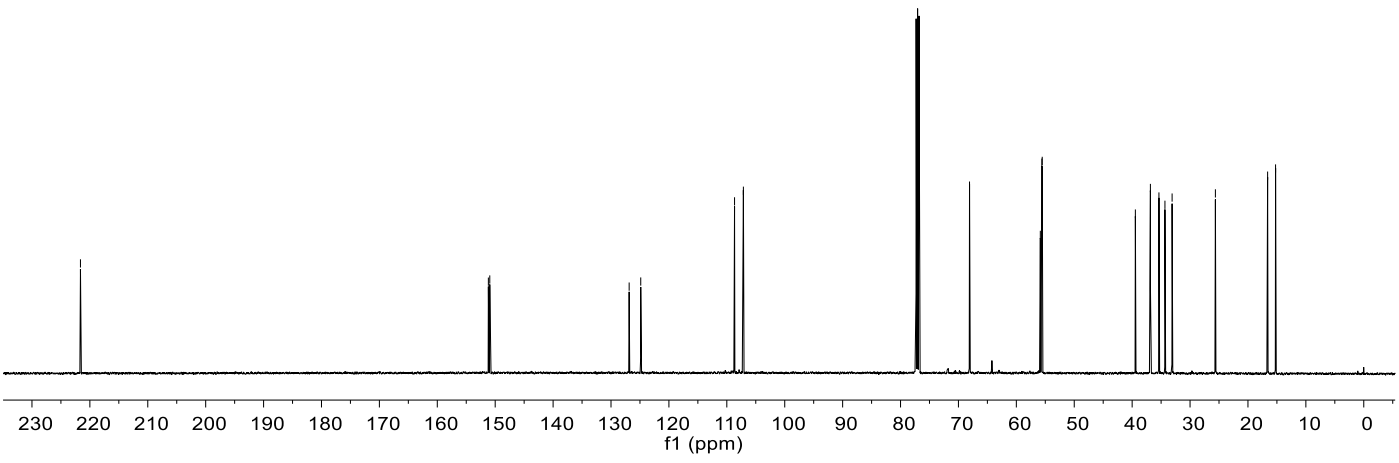
Chemical Formula: $C_{19}H_{26}O_4$
500 MHz, $CDCl_3$

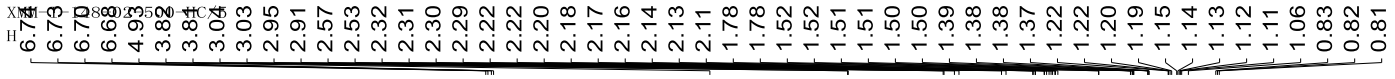


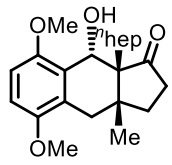


26

Chemical Formula: $C_{19}H_{26}O_4$
125 MHz, $CDCl_3$



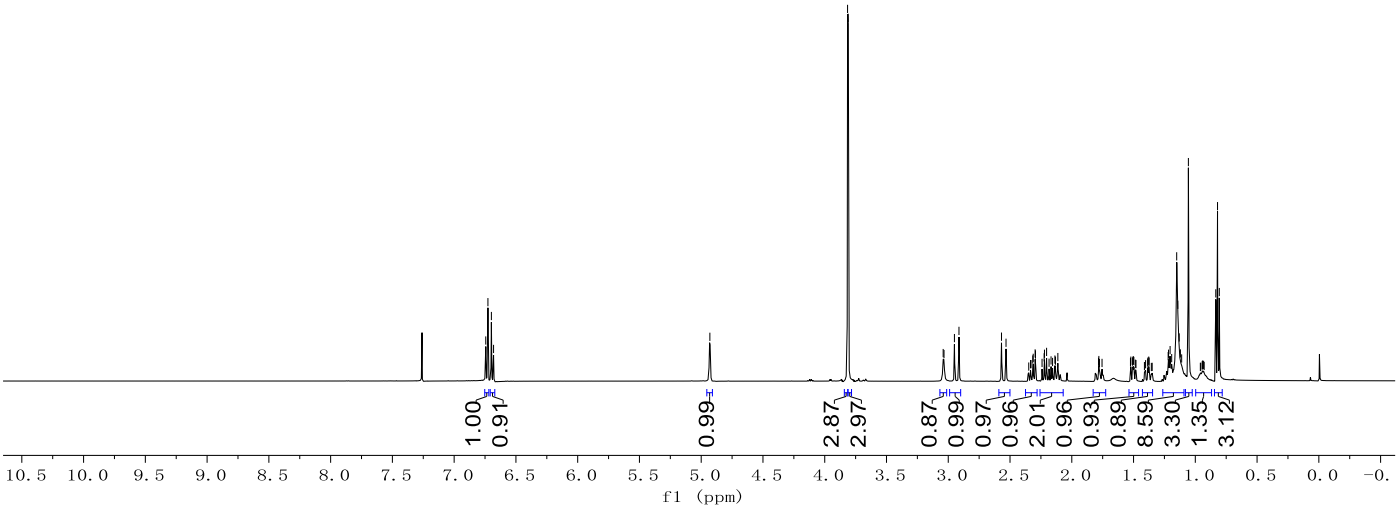


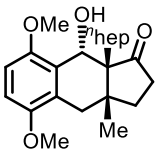


27

Chemical Formula: $C_{23}H_{34}O_4$

500 MHz, $CDCl_3$

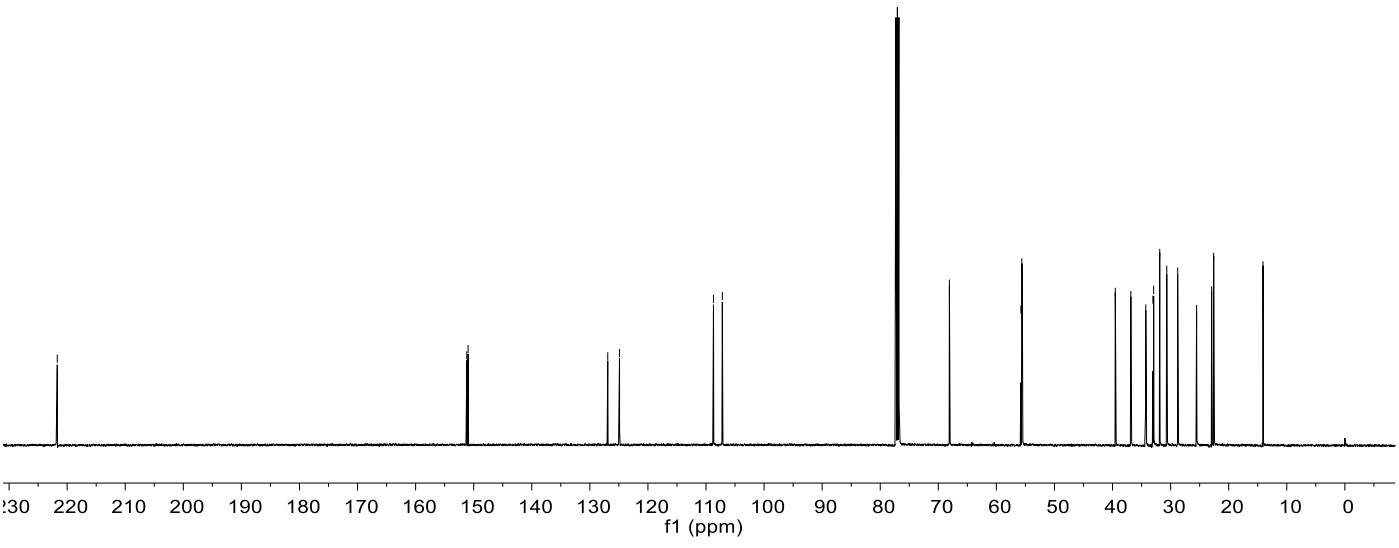


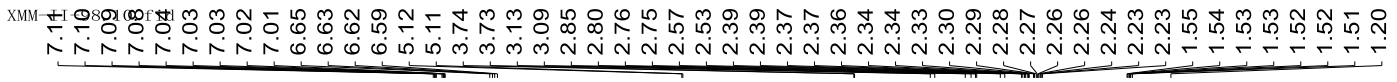


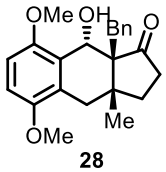
27

Chemical Formula: $C_{23}H_{34}O_4$

125 MHz, $CDCl_3$



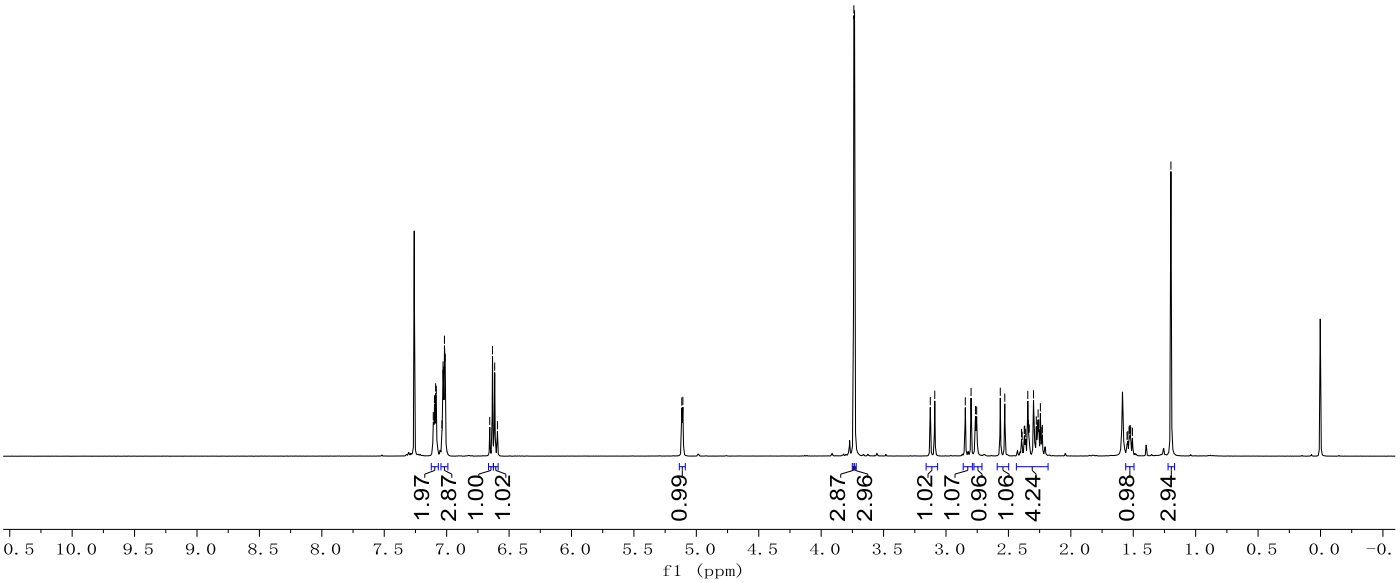


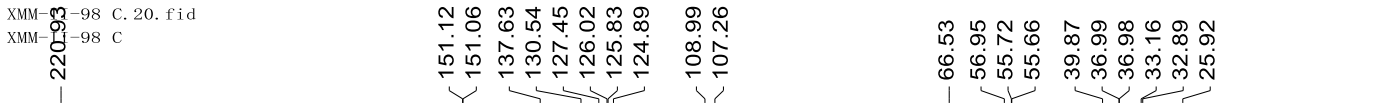


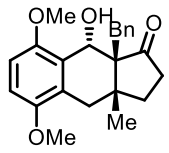
28

Chemical Formula: $C_{23}H_{26}O_4$

400 MHz, $CDCl_3$



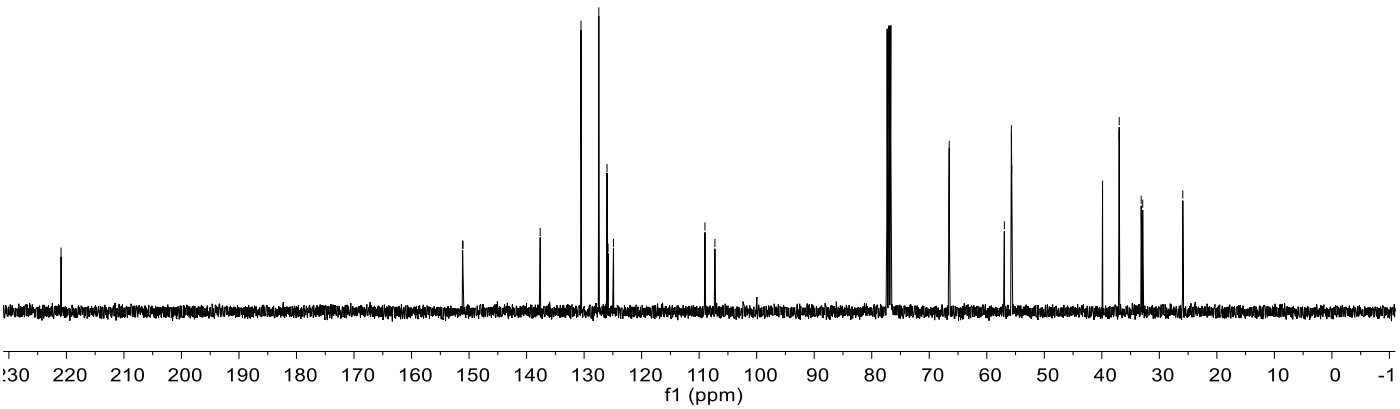




28

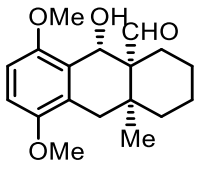
Chemical Formula: $C_{23}H_{26}O_4$

100 MHz, $CDCl_3$



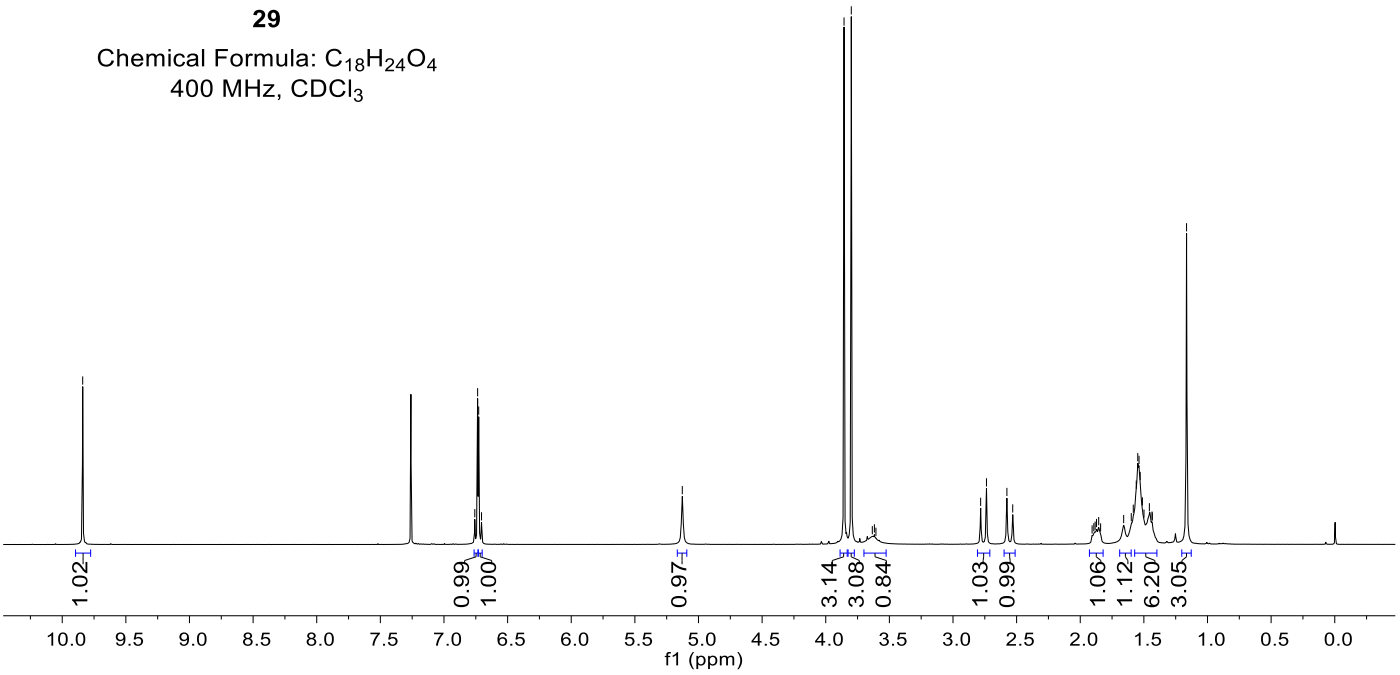
HM-VI-89C-1

9.84 | 6.76 6.74 6.73 6.71 | 5.13 | 3.86 3.80 3.63 3.62 3.61 | 2.78 2.74 2.58 2.53 | 1.66 1.60 1.58 1.56 1.55 1.54 1.53 1.51 1.50 1.46 1.44 1.43 1.16



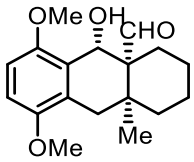
29

Chemical Formula: $C_{18}H_{24}O_4$
400 MHz, $CDCl_3$



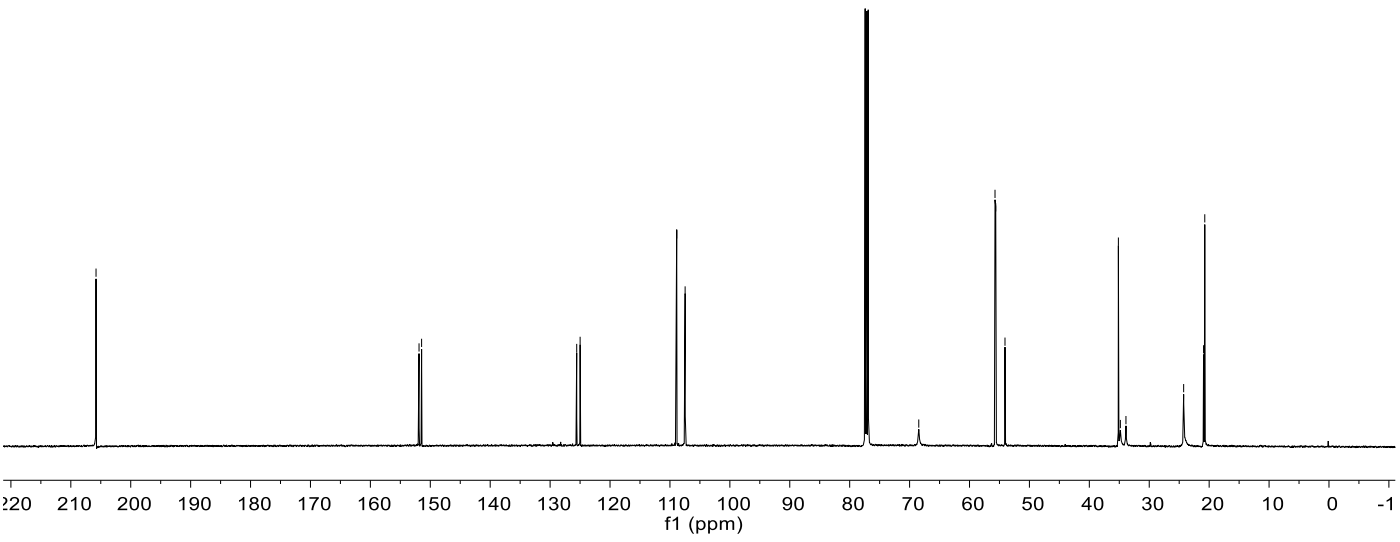
HM-VI-89C-1 C

205.79 | 151.88 151.45 | 125.56 124.99 | 108.87 107.46 | 68.47 | 55.74 55.62 54.08 | 35.15 34.82 33.89 | 24.26 | 20.93 20.73



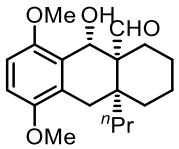
29

Chemical Formula: $C_{18}H_{24}O_4$
125 MHz, $CDCl_3$



HM-VI-93A-1

9.81 6.76 6.74 6.73 6.71 5.21 3.96 3.86 3.80 2.82 2.77 2.65 2.61 2.00 1.99 1.98 1.97 1.96 1.94 1.94 1.93 1.92 1.91 1.89 1.75 1.71 1.65 1.61 1.60 1.58 1.58 1.47 1.46 1.46 1.45 1.45 1.36 1.34 1.33 1.32 1.31 1.30 1.29 1.27 1.27 1.26 1.25 1.14 0.91 0.89 0.87



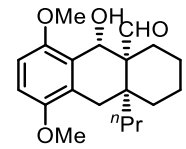
30

Chemical Formula: $C_{20}H_{28}O_4$

400 MHz, $CDCl_3$

HM-VI-93A-1 C

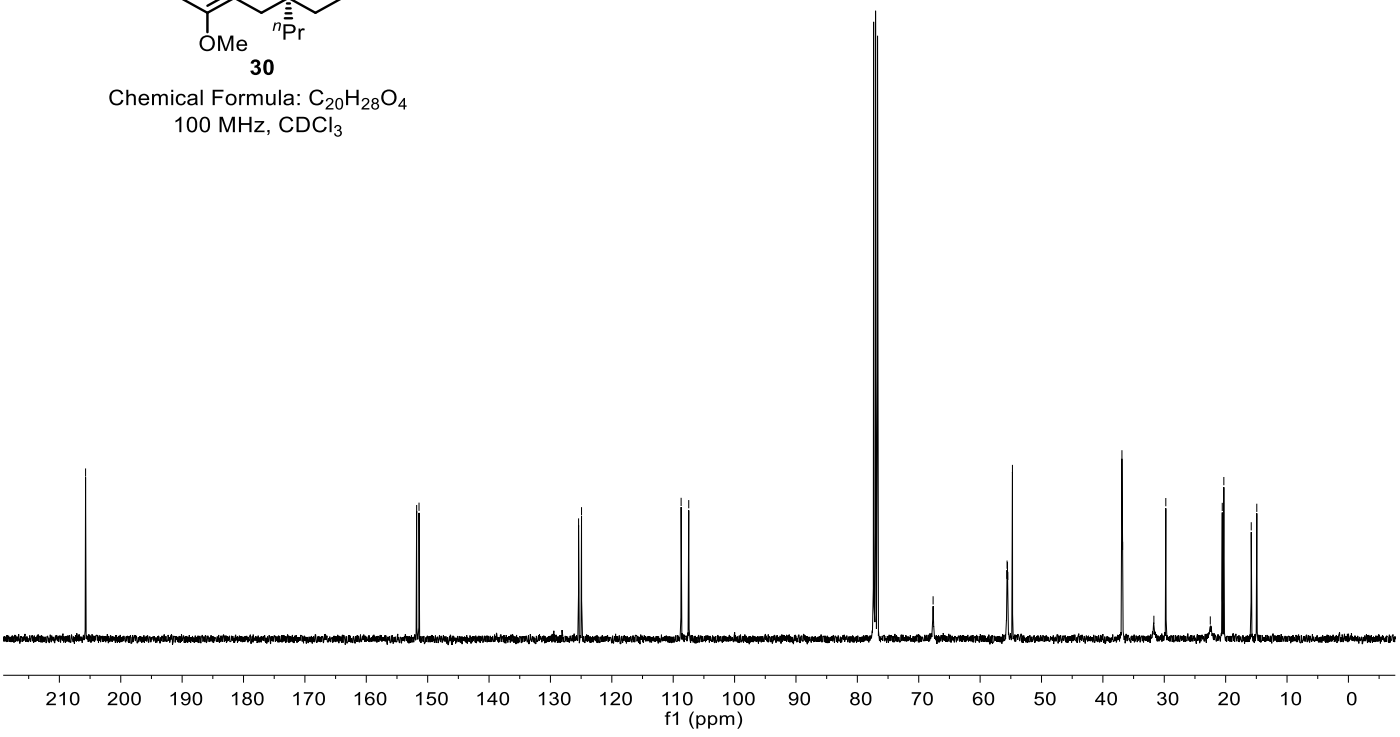
209.73 151.80 151.41 125.41 124.94 108.71 107.47 67.66 55.66 55.61 55.54 55.49 54.73 36.90 36.79 31.69 29.75 22.50 20.55 20.30 15.83 14.93

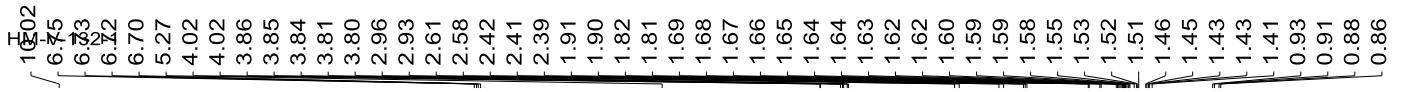


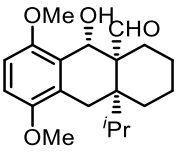
30

Chemical Formula: $C_{20}H_{28}O_4$

100 MHz, $CDCl_3$

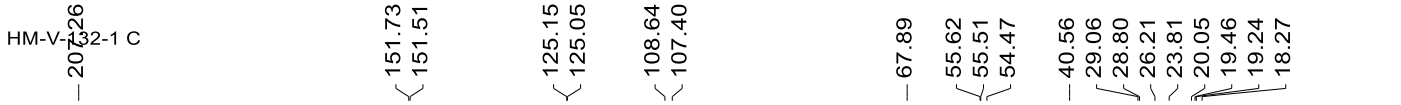


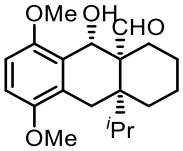




31

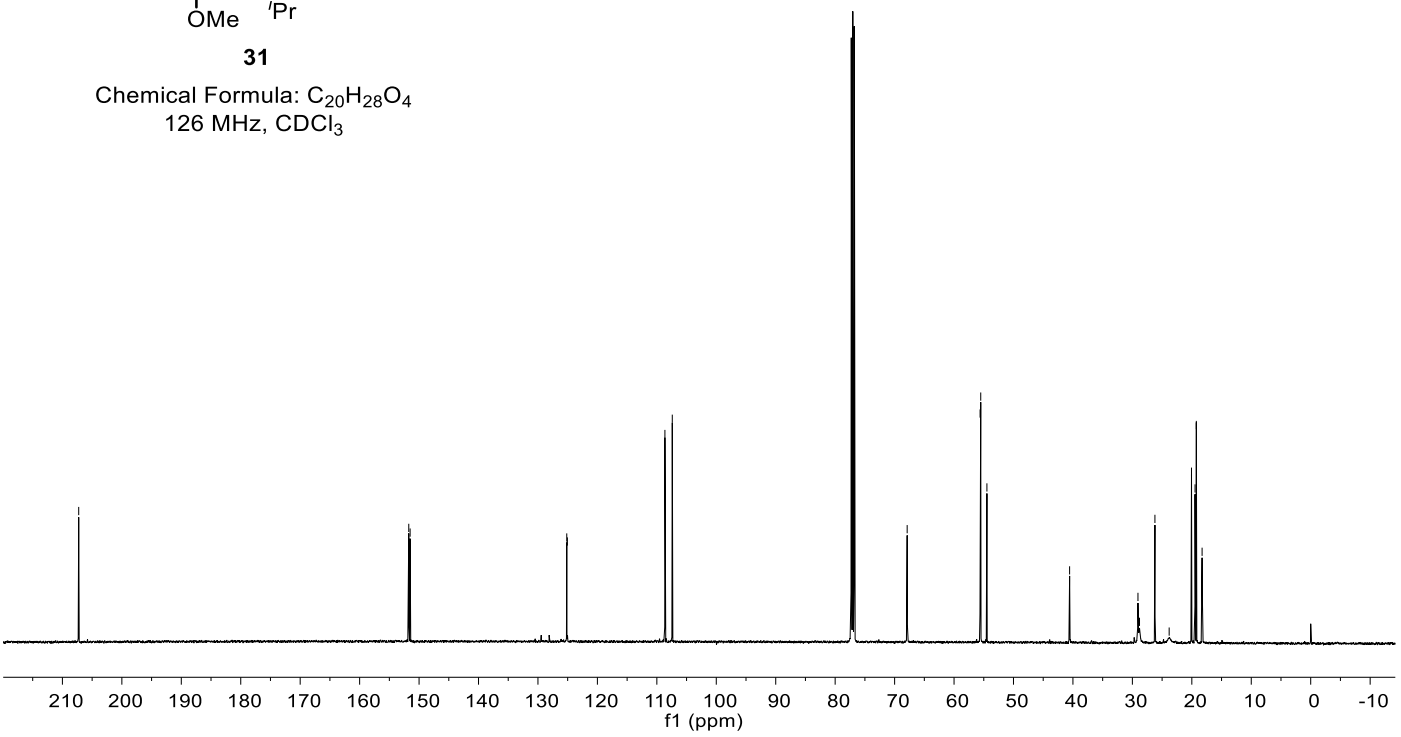
Chemical Formula: $C_{20}H_{28}O_4$
500 MHz, $CDCl_3$

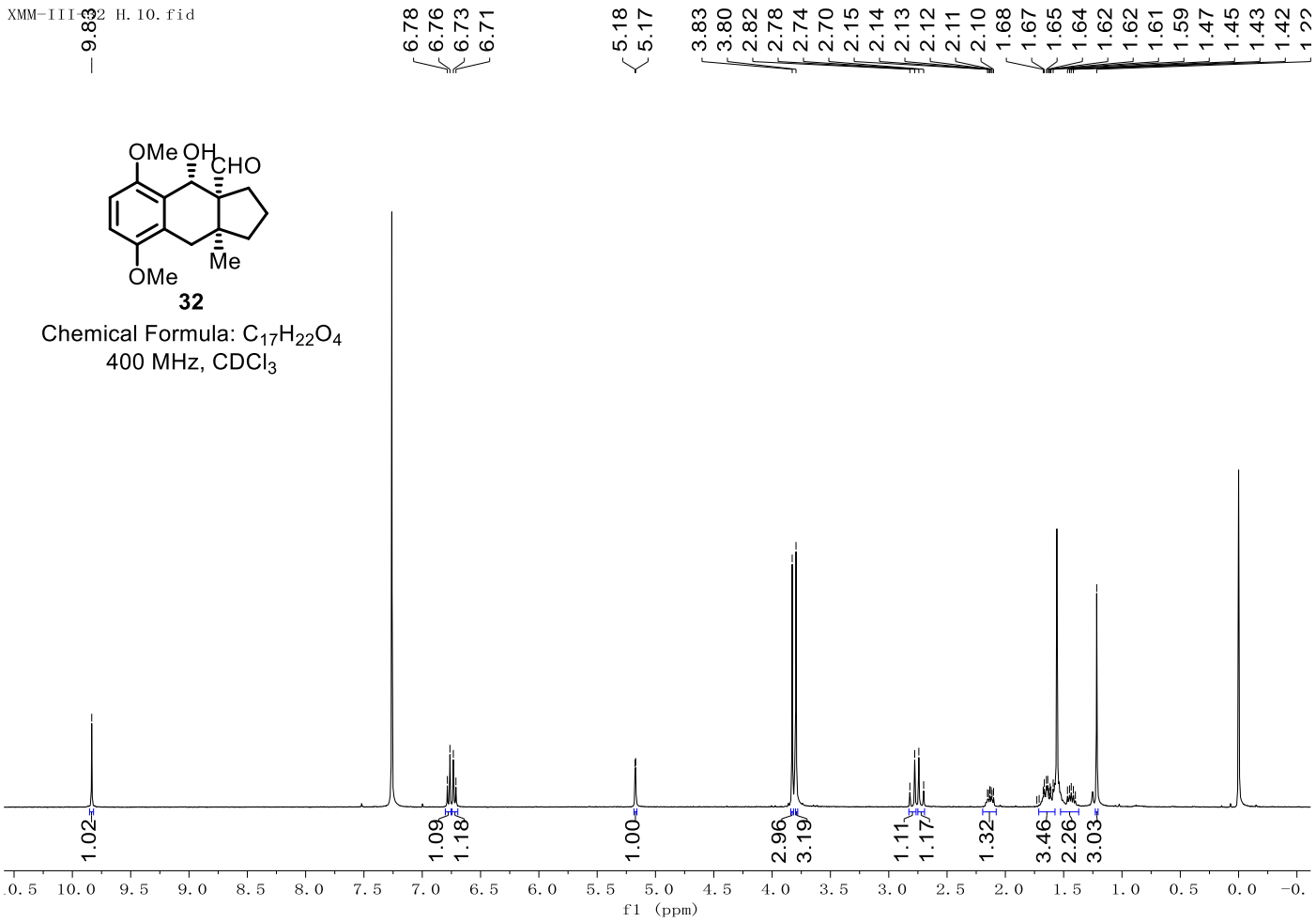


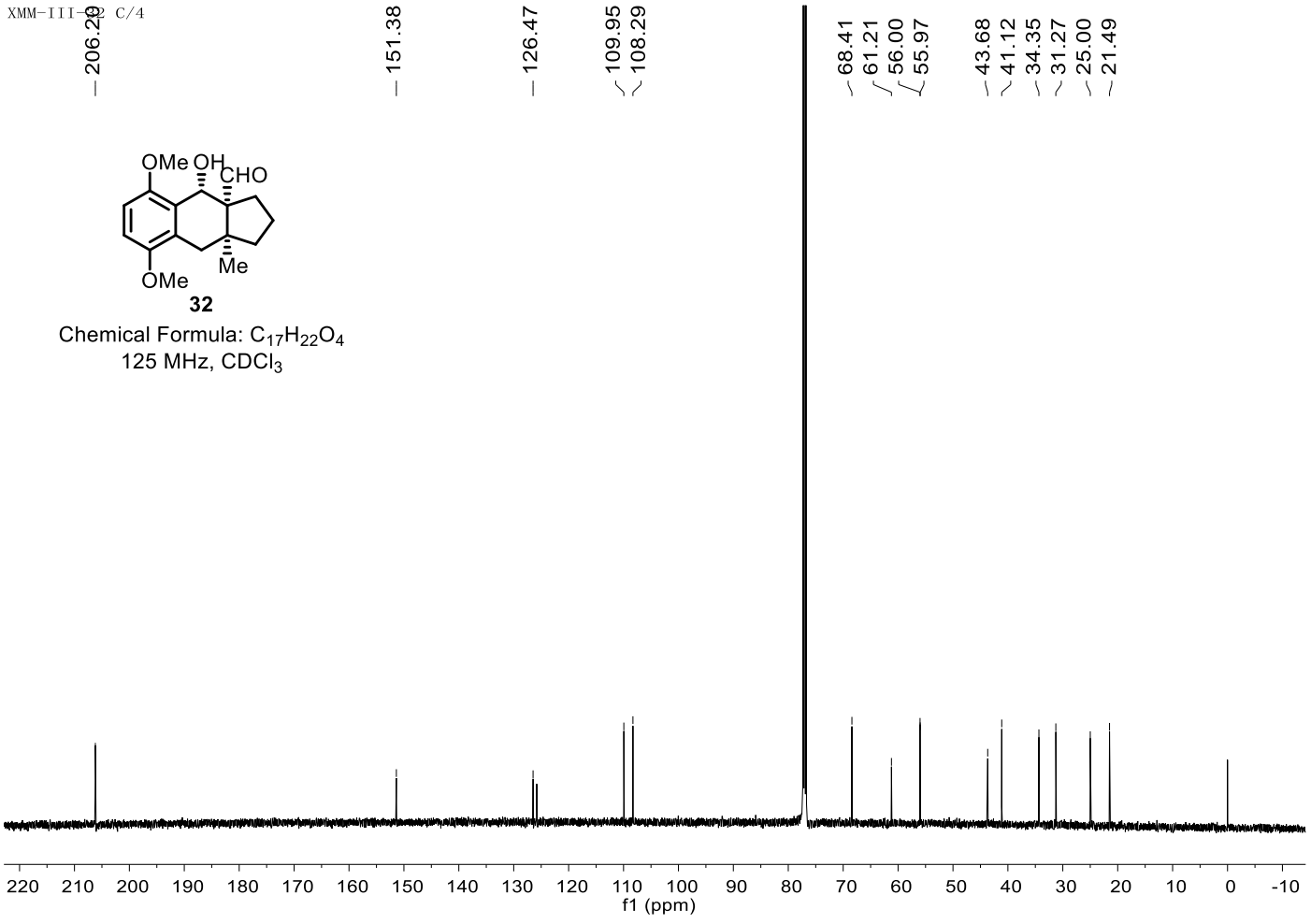


31

Chemical Formula: $C_{20}H_{28}O_4$
126 MHz, $CDCl_3$

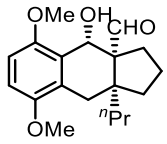



XMM-III-32 H.10.fid
9.83
6.78
6.76
6.73
6.71
5.18
5.17
3.83
3.80
2.82
2.78
2.74
2.70
2.15
2.14
2.13
2.12
2.11
2.10
1.68
1.67
1.65
1.64
1.62
1.62
1.61
1.59
1.47
1.45
1.43
1.42
OMe OH CHO
Me
OMe
32
Chemical Formula: C17H22O4
400 MHz, CDCl3
1.02
1.09
1.18
1.00
2.96
3.19
1.11
1.17
1.32
3.46
2.26
3.03
f1 (ppm)


XMM-III-32 C/4
206.20
151.38
126.47
109.95
108.29
68.41
61.21
56.00
55.97
43.68
41.12
34.35
31.27
25.00
21.49
OMe OH CHO
Me
OMe
32
Chemical Formula: C17H22O4
125 MHz, CDCl3
f1 (ppm)

HM-V-124-1

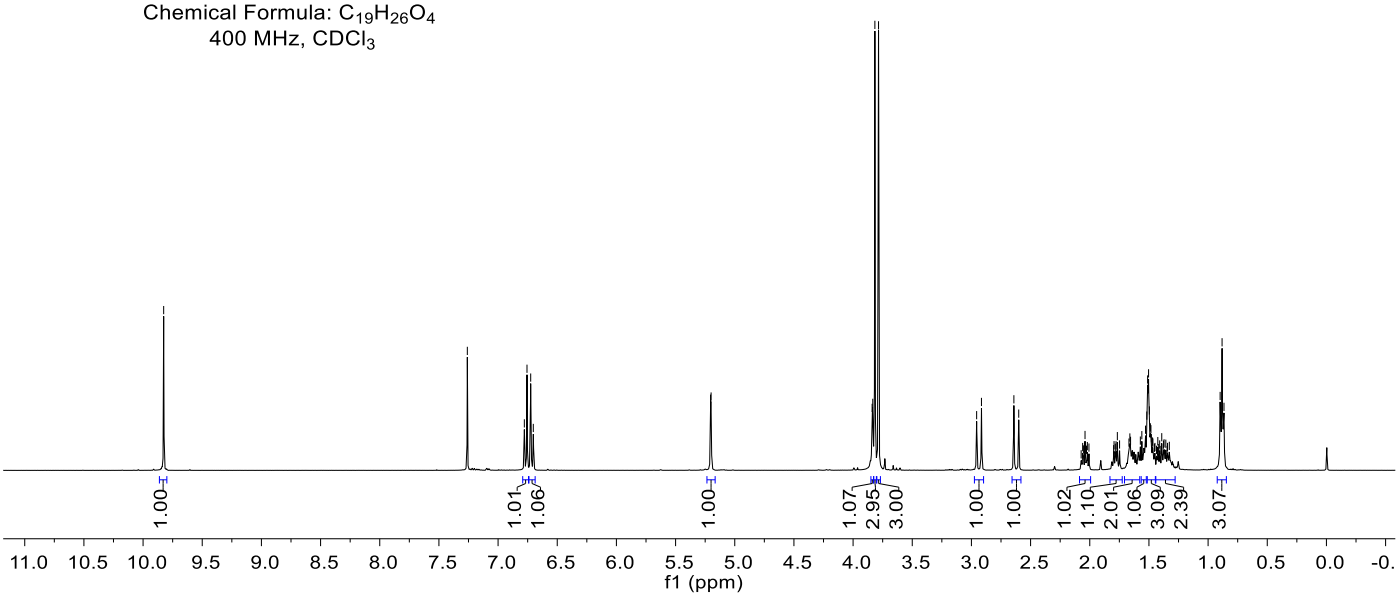
9.8760 7.2598 6.7780 6.7557 6.7244 6.7023 5.2044 5.1999 3.8391 3.8338 3.8158 3.7850 2.9560 2.9151 2.6412 2.6003 2.0601 2.0536 2.0401 2.0277 2.0204 2.0069 1.7984 1.7948 1.7842 1.7781 1.7669 1.7481 1.6688 1.6612 1.6552 1.5724 1.5600 1.5287 1.5178 1.5113 1.5031 1.4959 1.4877 1.4831 1.4793 1.4742 1.4694 1.4666 1.4534 1.4490 1.4361 1.4249 1.4208 1.4092 1.3916 1.3772 1.3720 1.3573 1.3429 1.3277 0.8982 0.8819 0.8657



33

Chemical Formula: $C_{19}H_{26}O_4$

400 MHz, $CDCl_3$

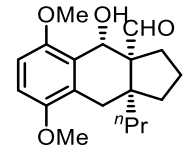


HM-V-124-1 C

206.66

151.48 151.44 126.94 125.90 110.23 108.54

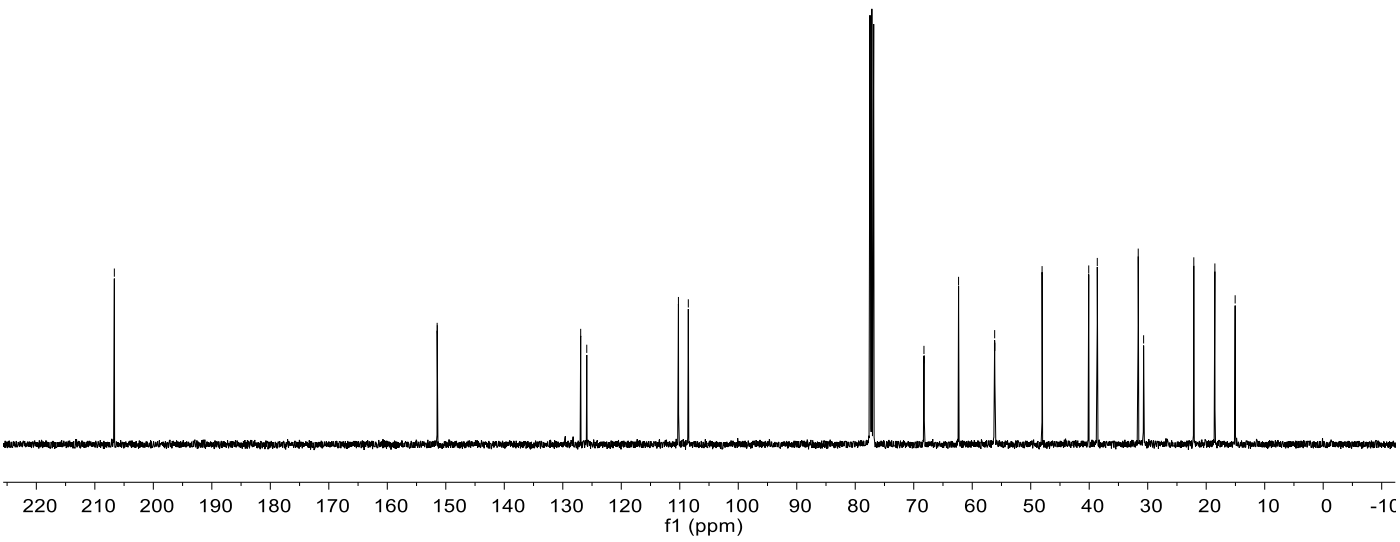
68.25 68.22 62.34 56.20 56.17 56.14 48.06 40.08 38.62 31.62 30.70 22.12 18.52 15.05

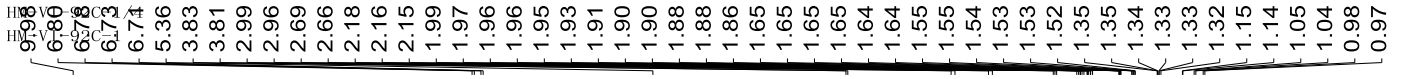


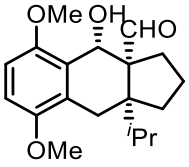
33

Chemical Formula: $C_{19}H_{26}O_4$

100 MHz, $CDCl_3$



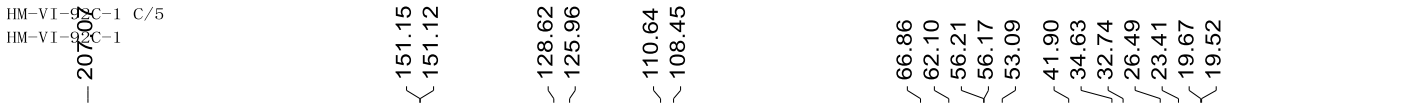


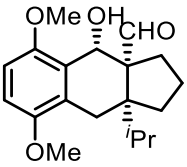


34

Chemical Formula: $C_{19}H_{26}O_4$

500 MHz, $CDCl_3$

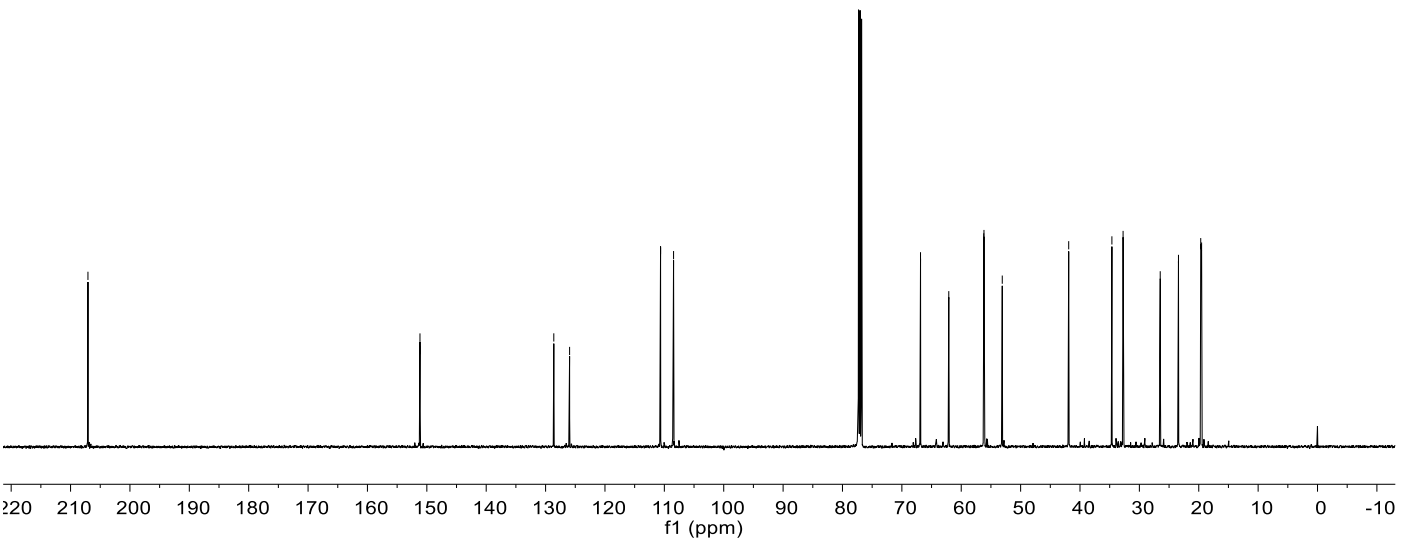


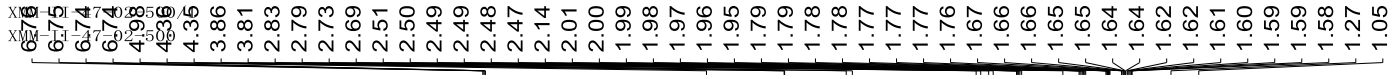


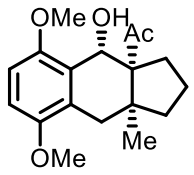
34

Chemical Formula: $C_{19}H_{26}O_4$

125 MHz, $CDCl_3$



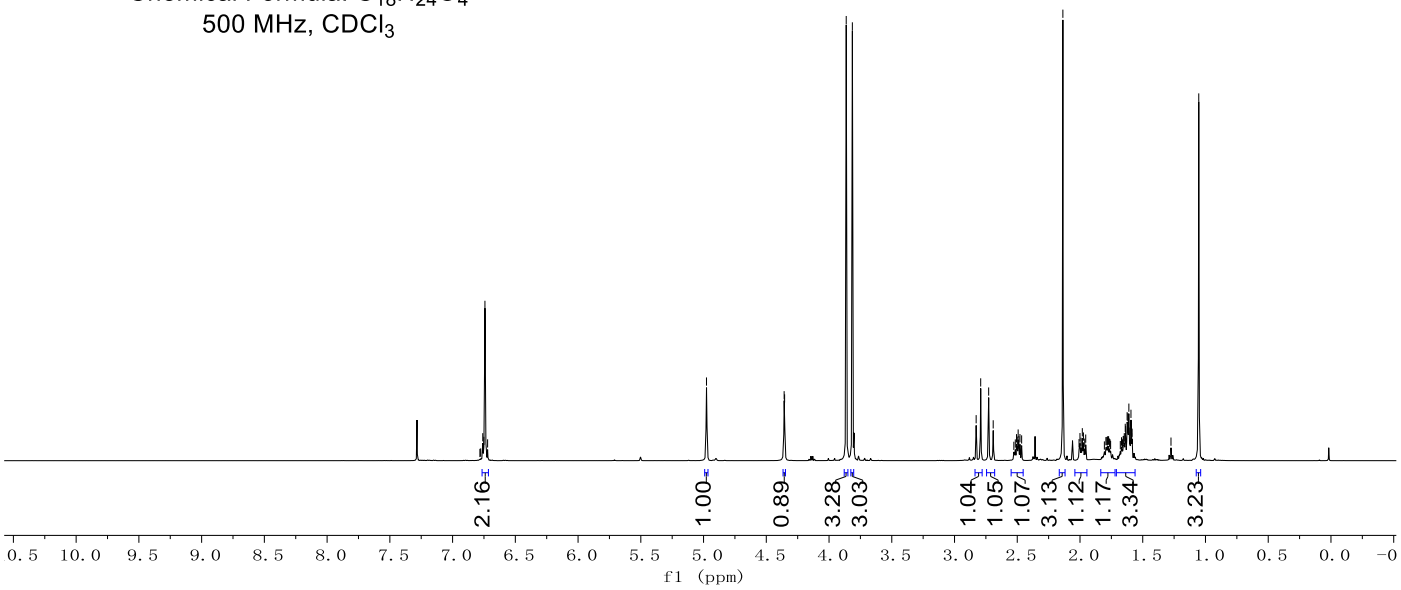


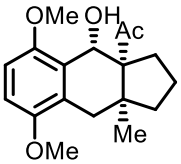


35

Chemical Formula: $C_{18}H_{24}O_4$

500 MHz, $CDCl_3$

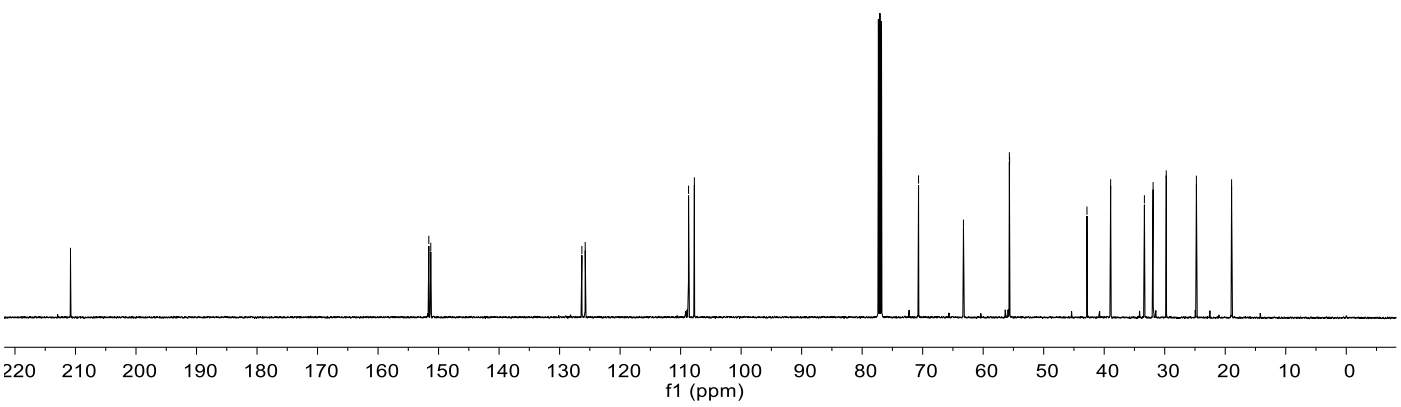


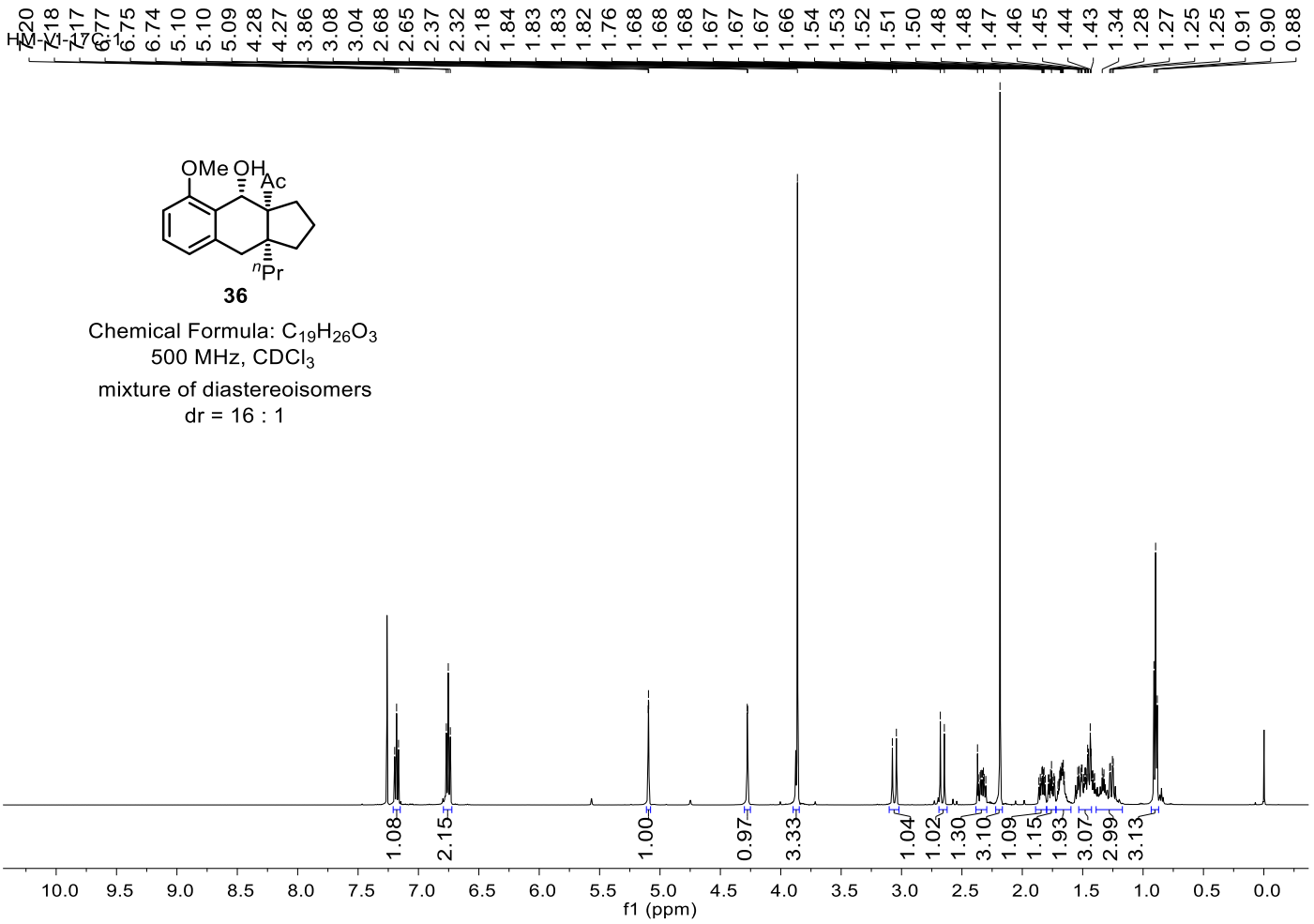


35

Chemical Formula: $C_{18}H_{24}O_4$

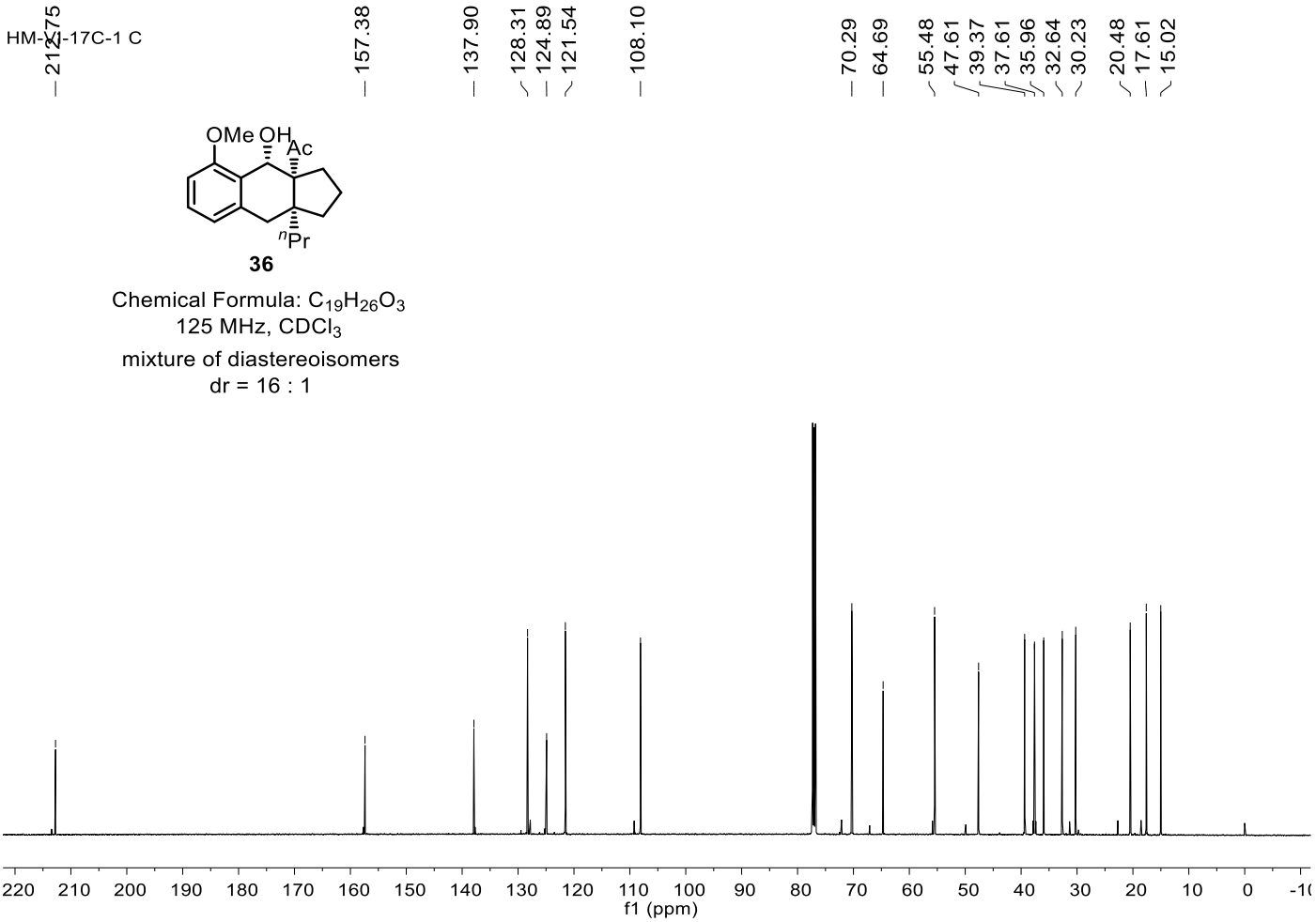
125 MHz, $CDCl_3$





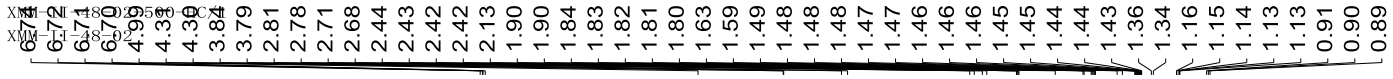
36

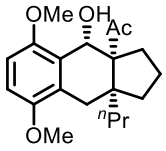
Chemical Formula: $C_{19}H_{26}O_3$
500 MHz, $CDCl_3$
mixture of diastereoisomers
dr = 16 : 1



36

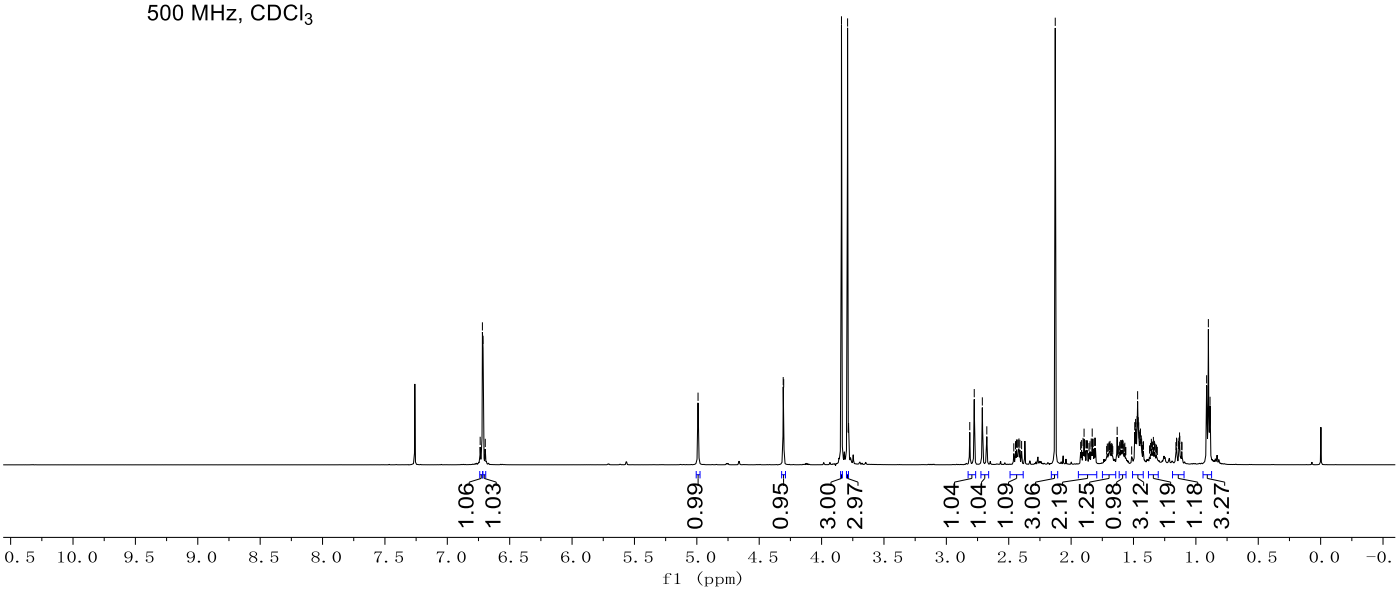
Chemical Formula: $C_{19}H_{26}O_3$
125 MHz, $CDCl_3$
mixture of diastereoisomers
dr = 16 : 1



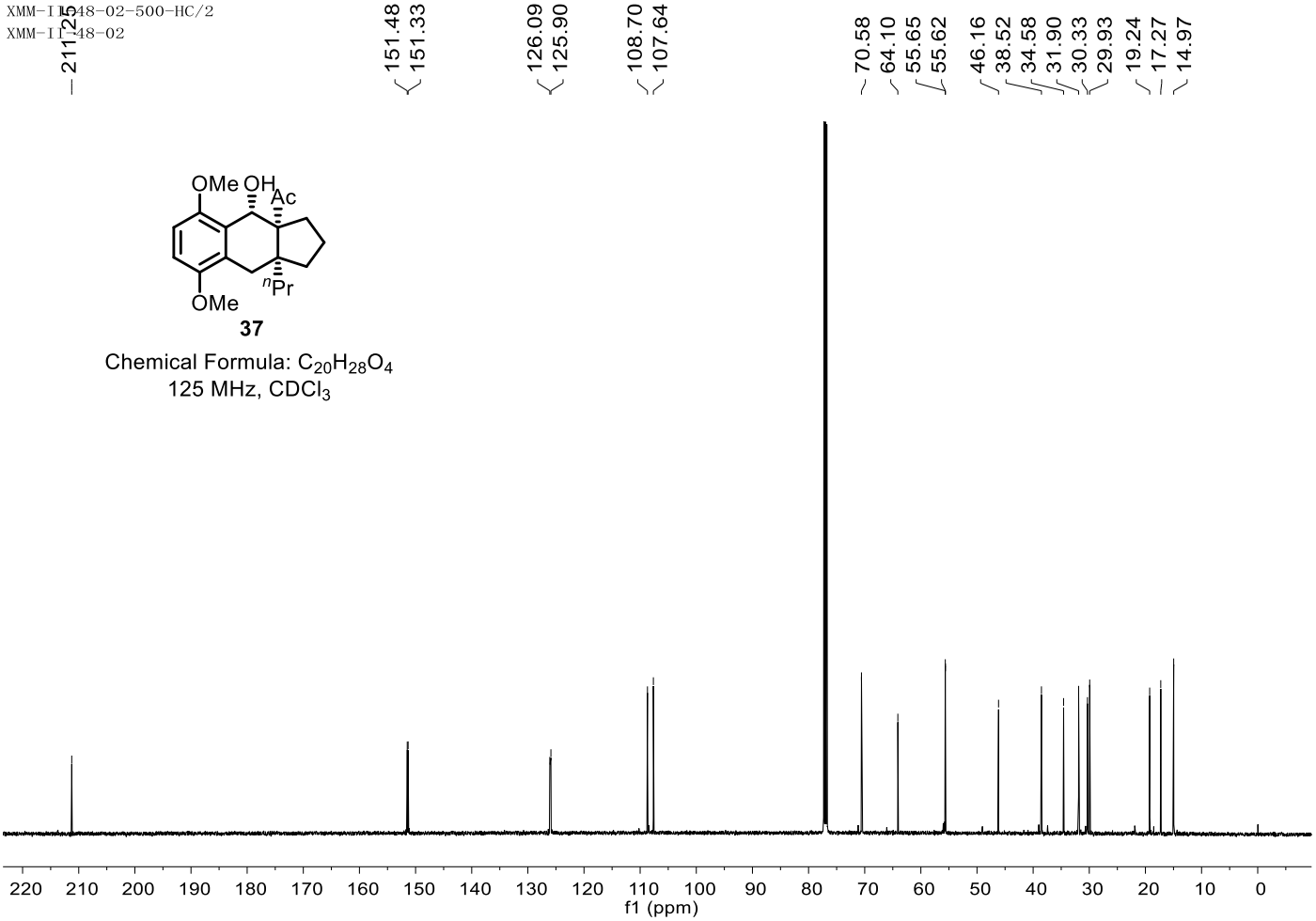


37

Chemical Formula: $C_{20}H_{28}O_4$
500 MHz, $CDCl_3$

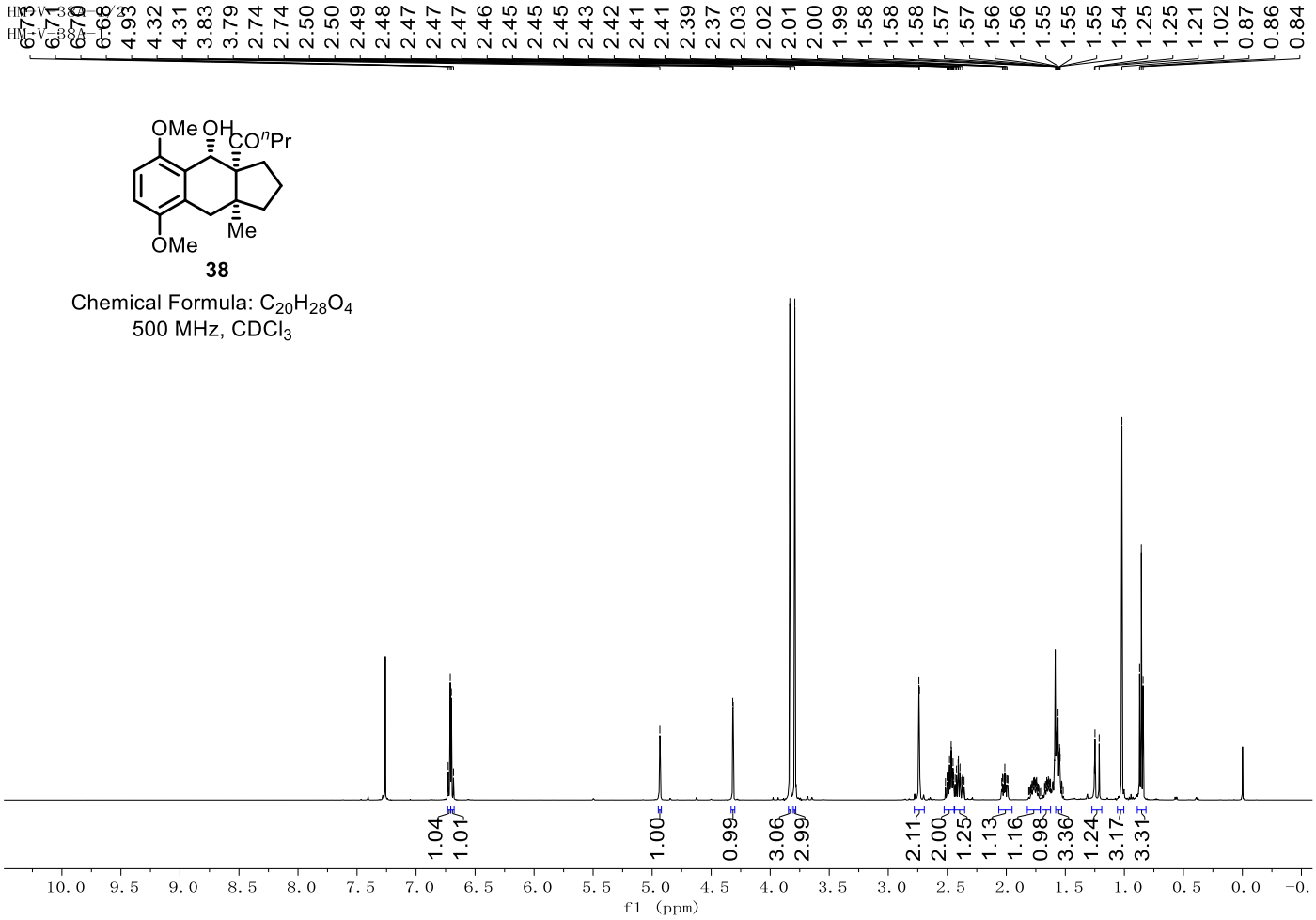


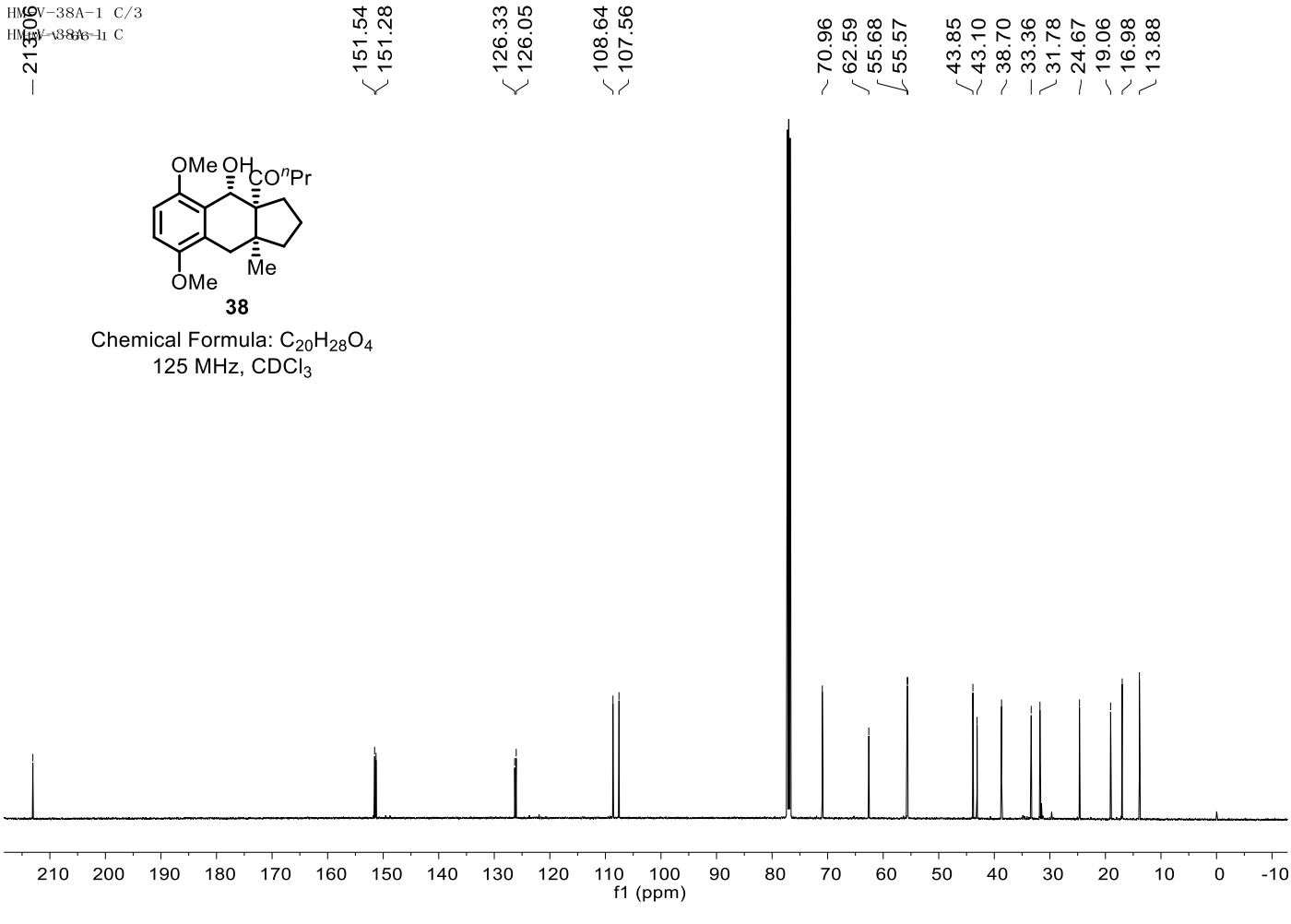
XMM-II-48-02-500-HC/2
XMM-II-48-02

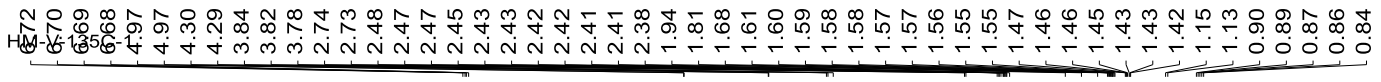


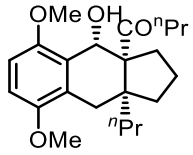
37

Chemical Formula: $C_{20}H_{28}O_4$
125 MHz, $CDCl_3$


OMe OH CO^{n}Pr
Me
OMe
38
Chemical Formula: $C_{20}H_{28}O_4$
500 MHz, $CDCl_3$
f1 (ppm)

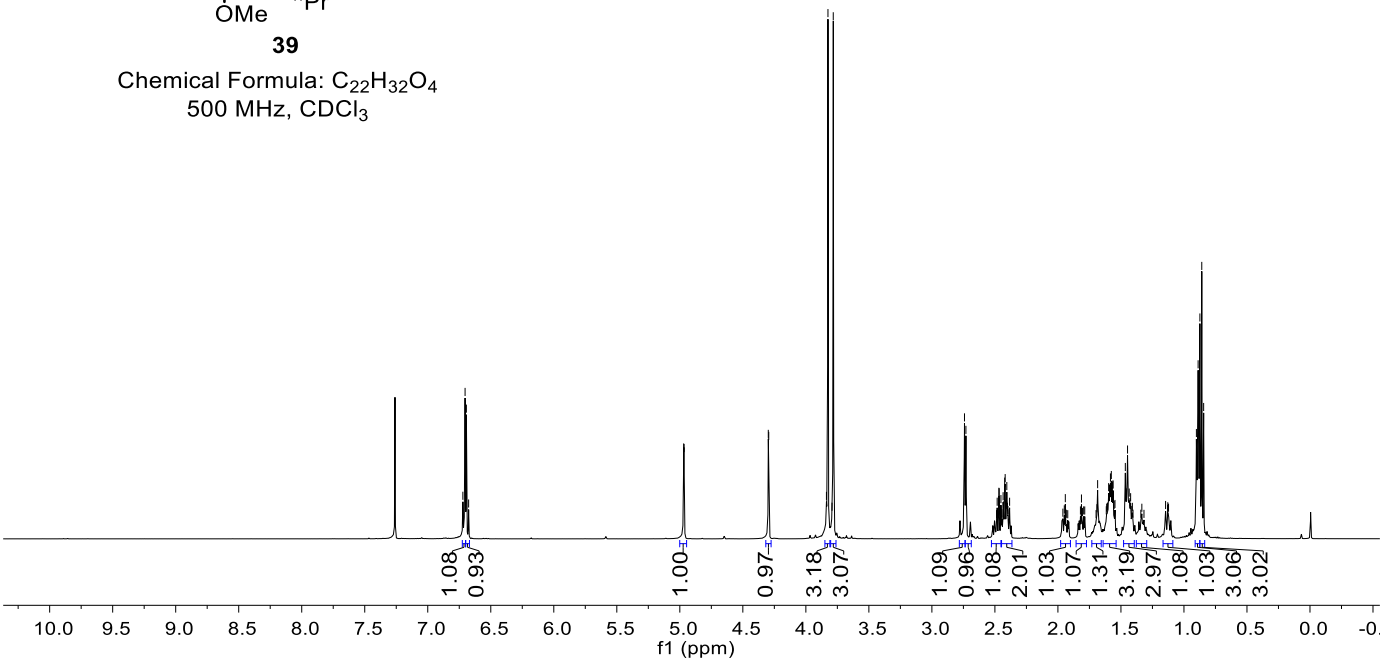

OMe OH CO^{n}Pr
Me
OMe
38
Chemical Formula: $C_{20}H_{28}O_4$
125 MHz, $CDCl_3$
f1 (ppm)

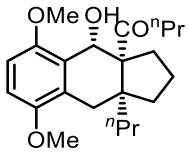




39

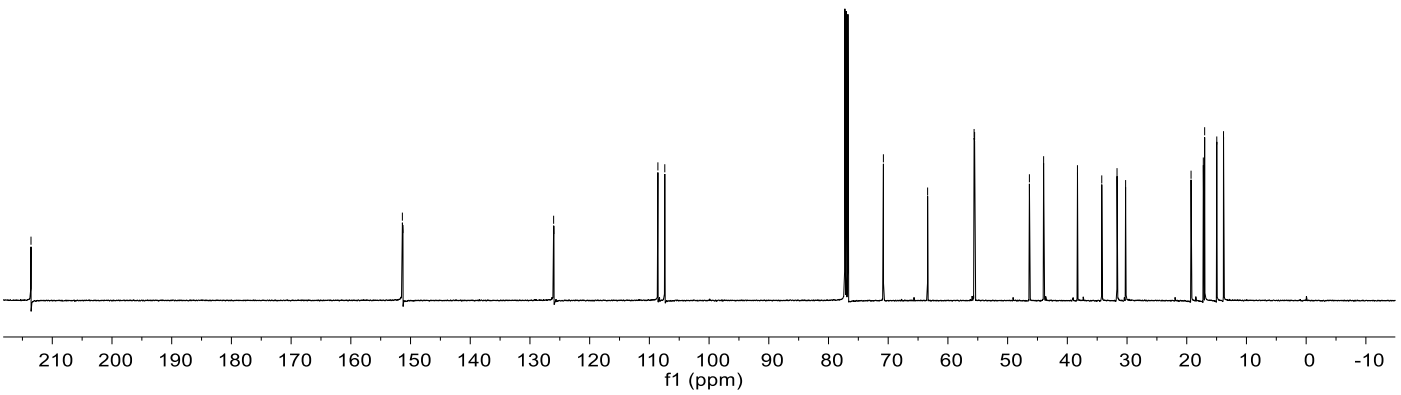
Chemical Formula: $C_{22}H_{32}O_4$
500 MHz, $CDCl_3$

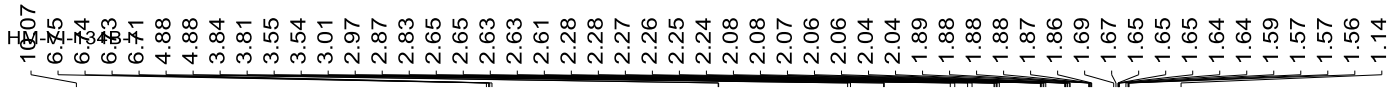


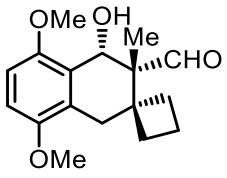


39

Chemical Formula: $C_{22}H_{32}O_4$
125 MHz, $CDCl_3$

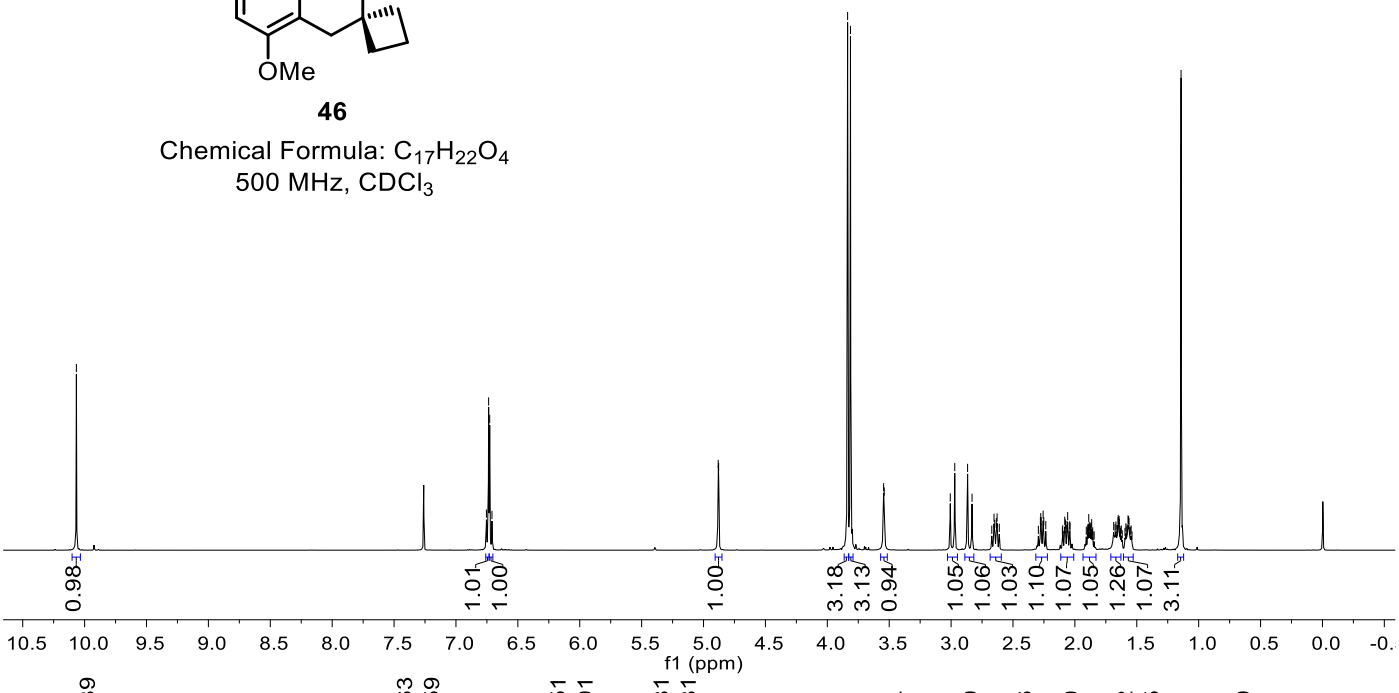


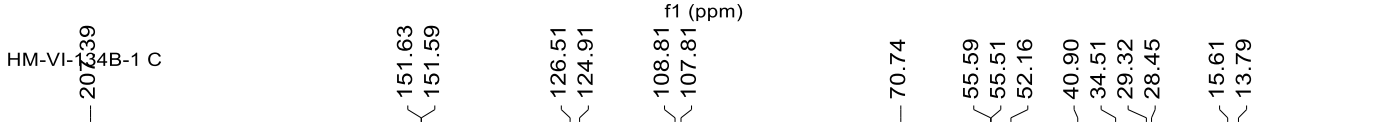


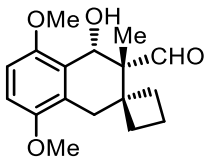


46

Chemical Formula: $C_{17}H_{22}O_4$
500 MHz, $CDCl_3$

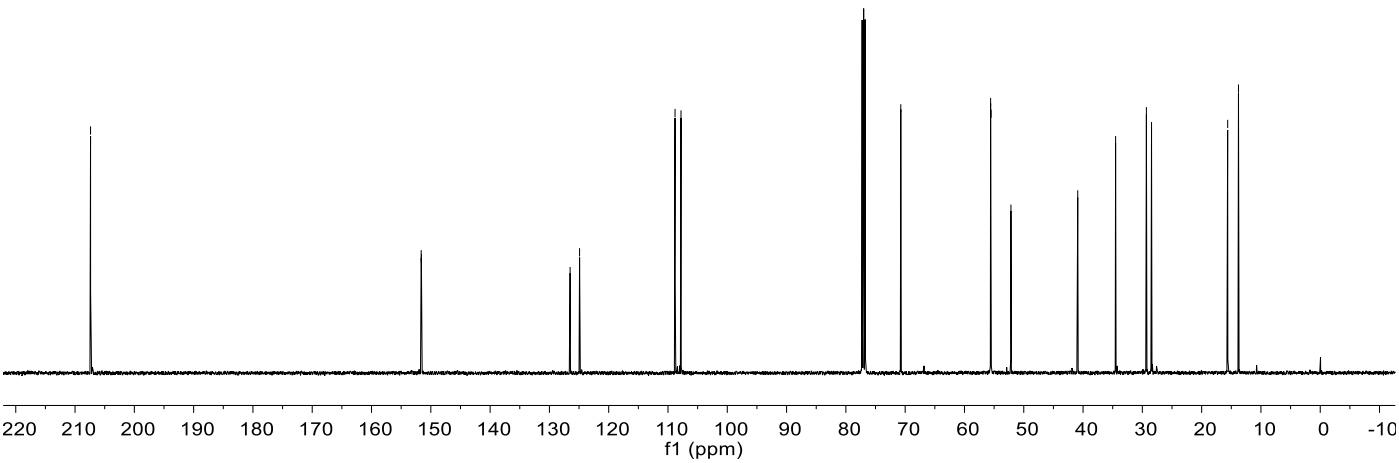






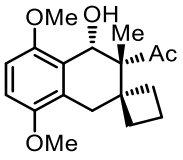
46

Chemical Formula: $C_{17}H_{22}O_4$
125 MHz, $CDCl_3$



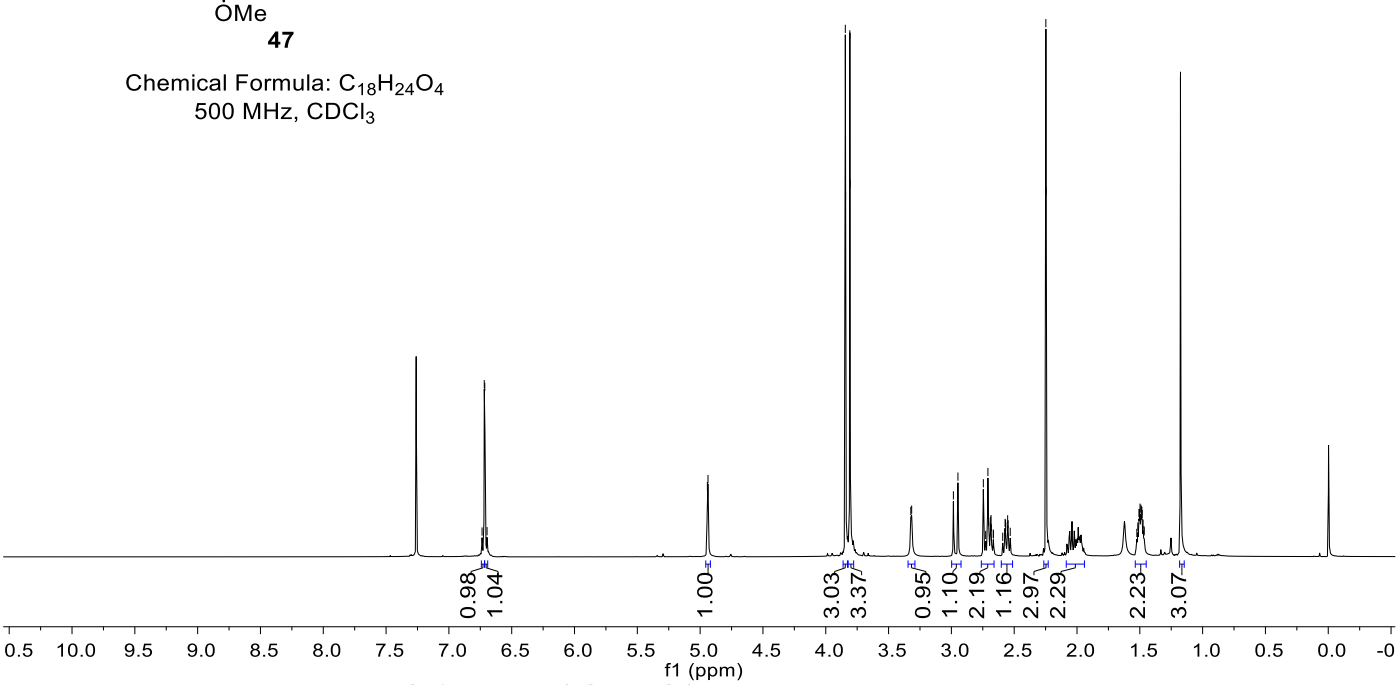
HM-VI-126B-1 H

6.74 6.72 6.71 6.70 4.94 4.94 3.84 3.84 3.81 3.81 3.32 3.32 2.98 2.95 2.75 2.73 2.71 2.70 2.69 2.69 2.68 2.68 2.67 2.66 2.59 2.58 2.57 2.57 2.56 2.55 2.55 2.53 2.25 2.25 1.52 1.52 1.51 1.50 1.50 1.49 1.49 1.48 1.48 1.47 1.47 1.47 1.18



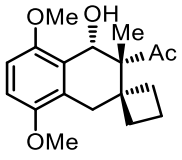
47

Chemical Formula: $C_{18}H_{24}O_4$
500 MHz, $CDCl_3$



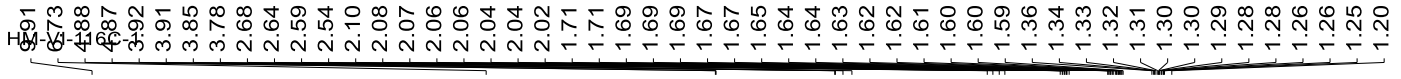
HM-VI-126B-1 C

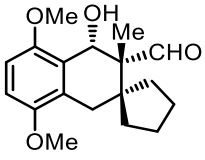
211.45 151.60 151.54 126.83 125.20 108.70 107.77 70.75 55.62 55.58 54.79 40.62 35.39 29.29 29.03 28.12 16.53 15.27



47

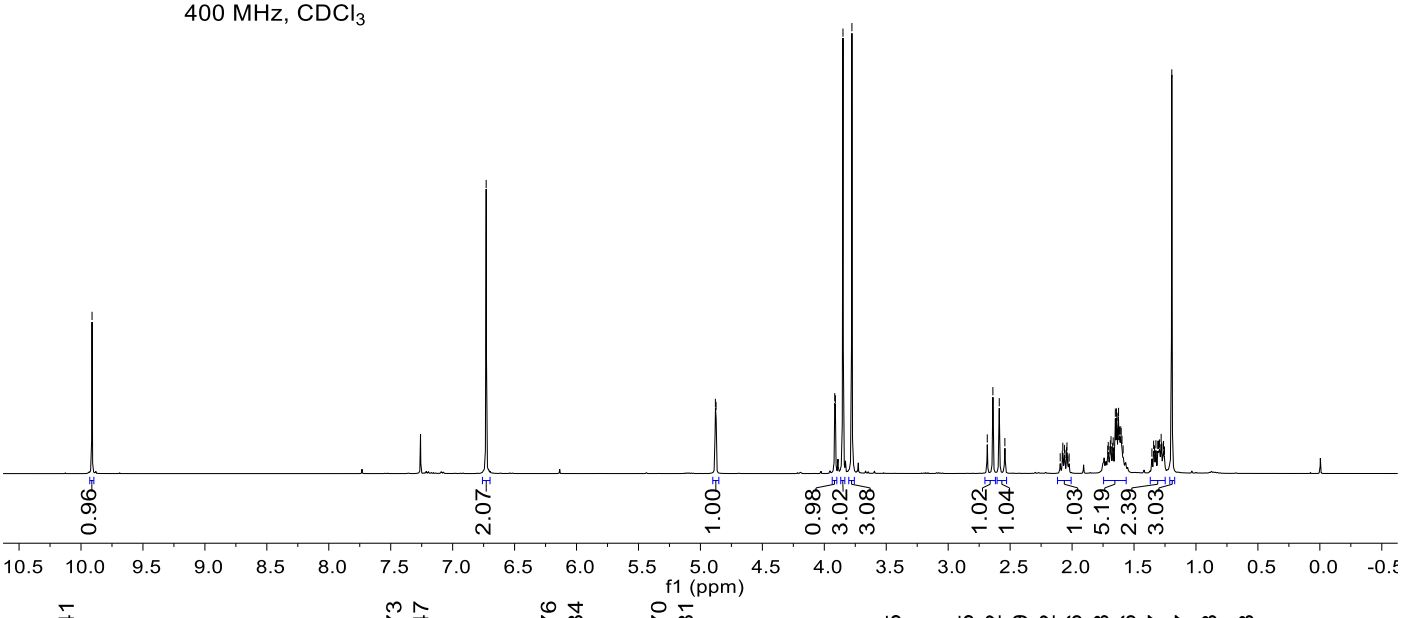
Chemical Formula: $C_{18}H_{24}O_4$
125 MHz, $CDCl_3$

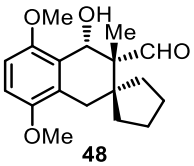




48

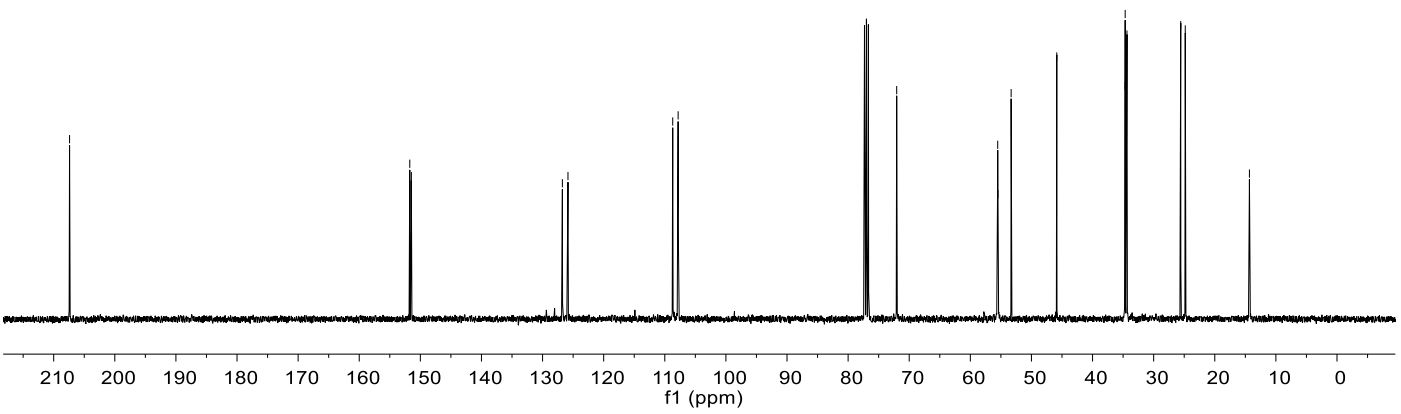
Chemical Formula: $C_{18}H_{24}O_4$
400 MHz, $CDCl_3$



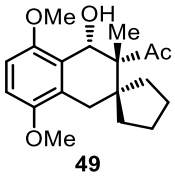


48

Chemical Formula: $C_{18}H_{24}O_4$
100 MHz, $CDCl_3$



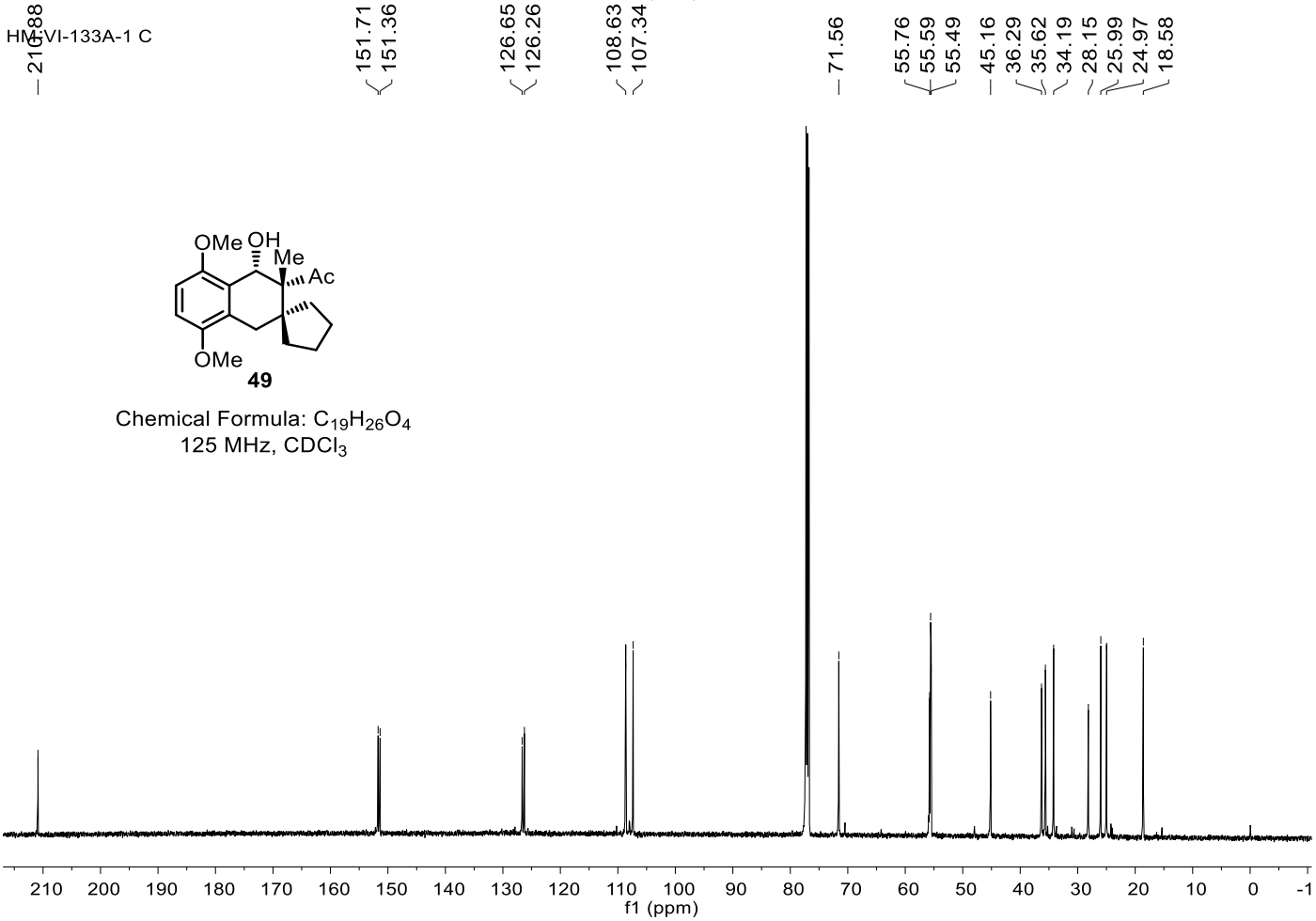
HM-VI-133A-1



49

Chemical Formula: $C_{19}H_{26}O_4$
400 MHz, $CDCl_3$

HM-VI-133A-1 C

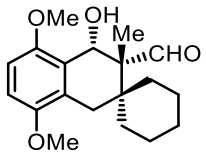


49

Chemical Formula: $C_{19}H_{26}O_4$
125 MHz, $CDCl_3$

HM-VI-134C-1

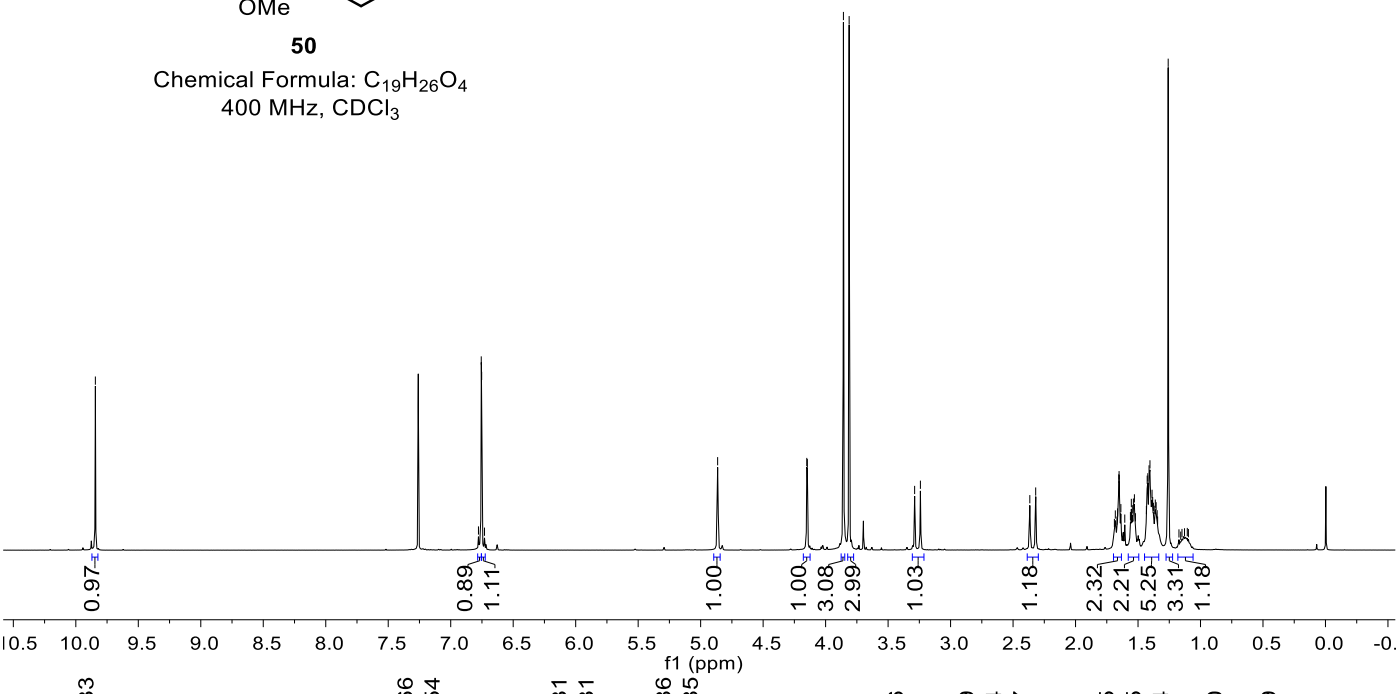
9.84 6.78 6.76 6.75 6.73 4.86 4.15 4.15 3.86 3.81 3.29 3.24 2.37 2.32 1.69 1.68 1.67 1.66 1.65 1.65 1.65 1.64 1.61 1.56 1.55 1.55 1.54 1.53 1.52 1.43 1.43 1.42 1.41 1.40 1.39 1.38 1.38 1.37 1.36 1.36 1.35 1.34 1.26 1.17 1.16 1.15 1.13 1.11 1.10



50

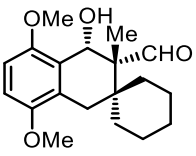
Chemical Formula: $C_{19}H_{26}O_4$

400 MHz, $CDCl_3$



HM-VI-134C-1 C

207.33 151.66 151.54 126.31 125.31 108.86 107.85 71.66 55.69 55.54 54.87 37.91 32.05 28.75 27.94 26.01 21.10 21.01 12.19

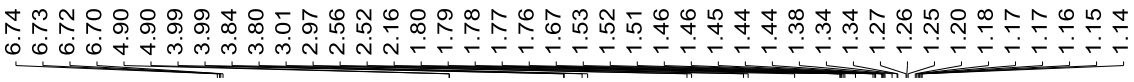


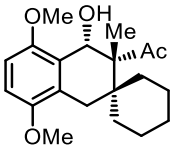
50

Chemical Formula: $C_{19}H_{26}O_4$

125 MHz, $CDCl_3$

HM-VI-133B-1





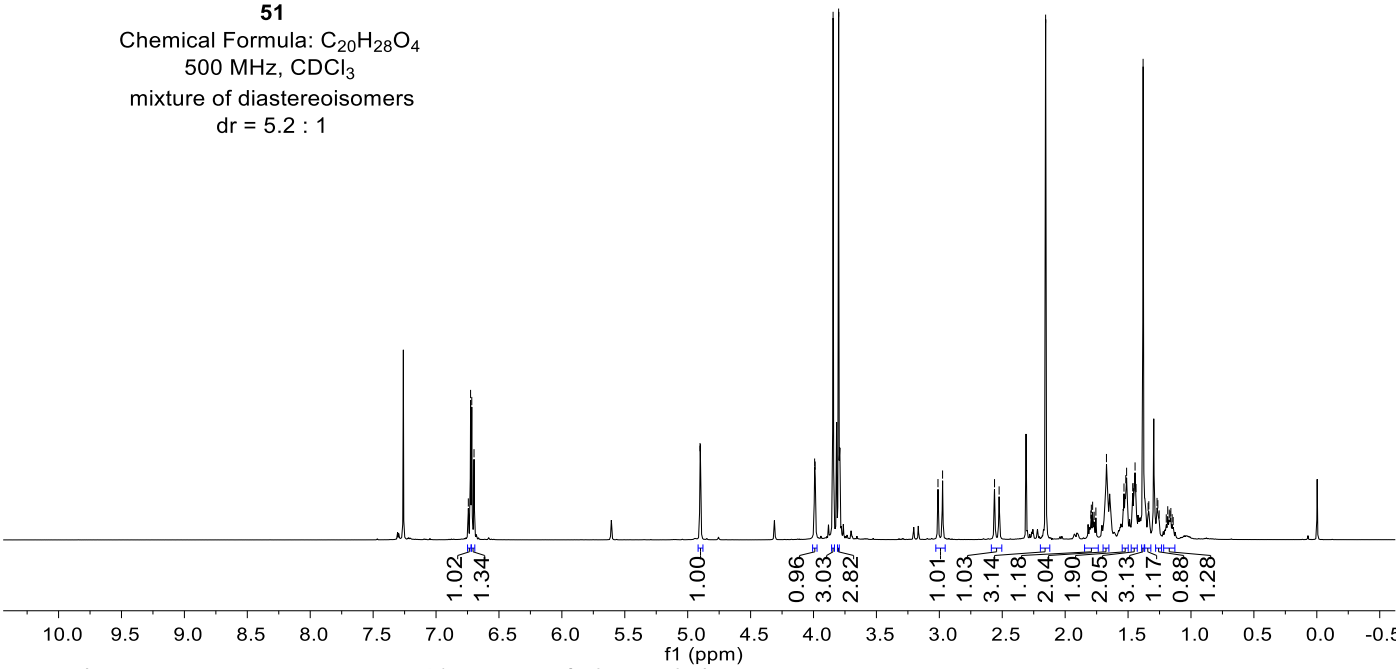
51

Chemical Formula: $C_{20}H_{28}O_4$

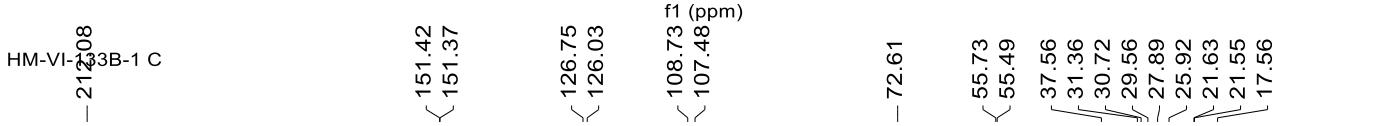
500 MHz, $CDCl_3$

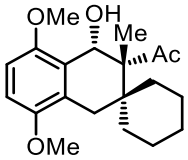
mixture of diastereoisomers

dr = 5.2 : 1



HM-VI-133B-1 C





51

Chemical Formula: $C_{20}H_{28}O_4$

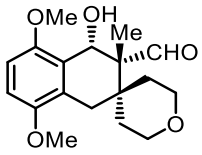
125 MHz, $CDCl_3$

mixture of diastereoisomers

dr = 5.2 : 1

HM-VI-132B-1

9.91 6.76 4.88 4.87 4.87 4.02 3.86 3.81 3.71 3.71 3.70 3.69 3.69 3.68 3.68 3.66 3.65 3.65 3.63 3.62 3.26 3.22 2.60 2.56 2.19 2.17 2.16 2.15 2.14 2.14 2.12 2.11 1.90 1.89 1.88 1.86 1.86 1.86 1.85 1.85 1.29 1.29 1.28 1.24 1.20 1.19 1.19 1.18 1.16 1.15

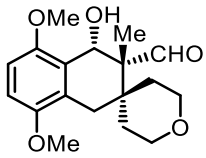


52

Chemical Formula: $C_{18}H_{24}O_5$
400 MHz, $CDCl_3$

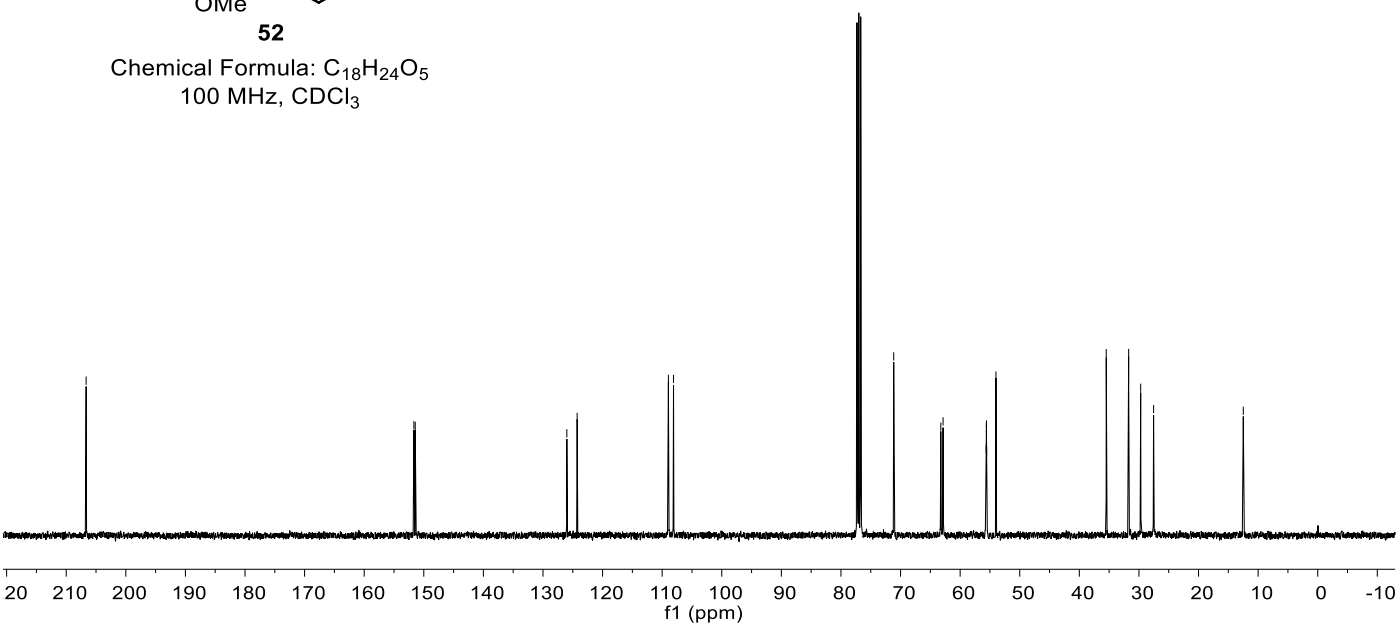
HM-VI-132B-1 C

206.66 151.67 151.43 126.00 124.26 108.95 108.10 71.15 63.25 62.87 55.64 55.60 55.59 55.55 53.99 35.49 31.72 29.71 27.54 12.49



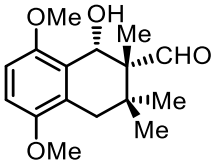
52

Chemical Formula: $C_{18}H_{24}O_5$
100 MHz, $CDCl_3$



HM-VI-126C-1

9.81 6.75 4.88 4.20 4.20 3.87 3.80 2.67 2.63 2.57 2.54 1.63 1.24 1.04 0.94

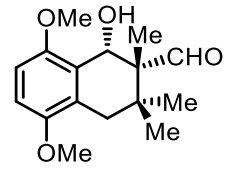


53

Chemical Formula: $C_{16}H_{22}O_4$
500 MHz, $CDCl_3$

HM-VI-126C-1 C

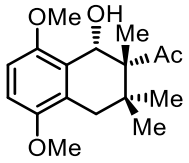
206.97 151.78 151.35 126.31 125.67 108.83 107.95 72.09 55.62 55.57 54.07 36.24 35.10 25.42 24.33 13.02



53

Chemical Formula: $C_{16}H_{22}O_4$
100 MHz, $CDCl_3$

HM-VI-131

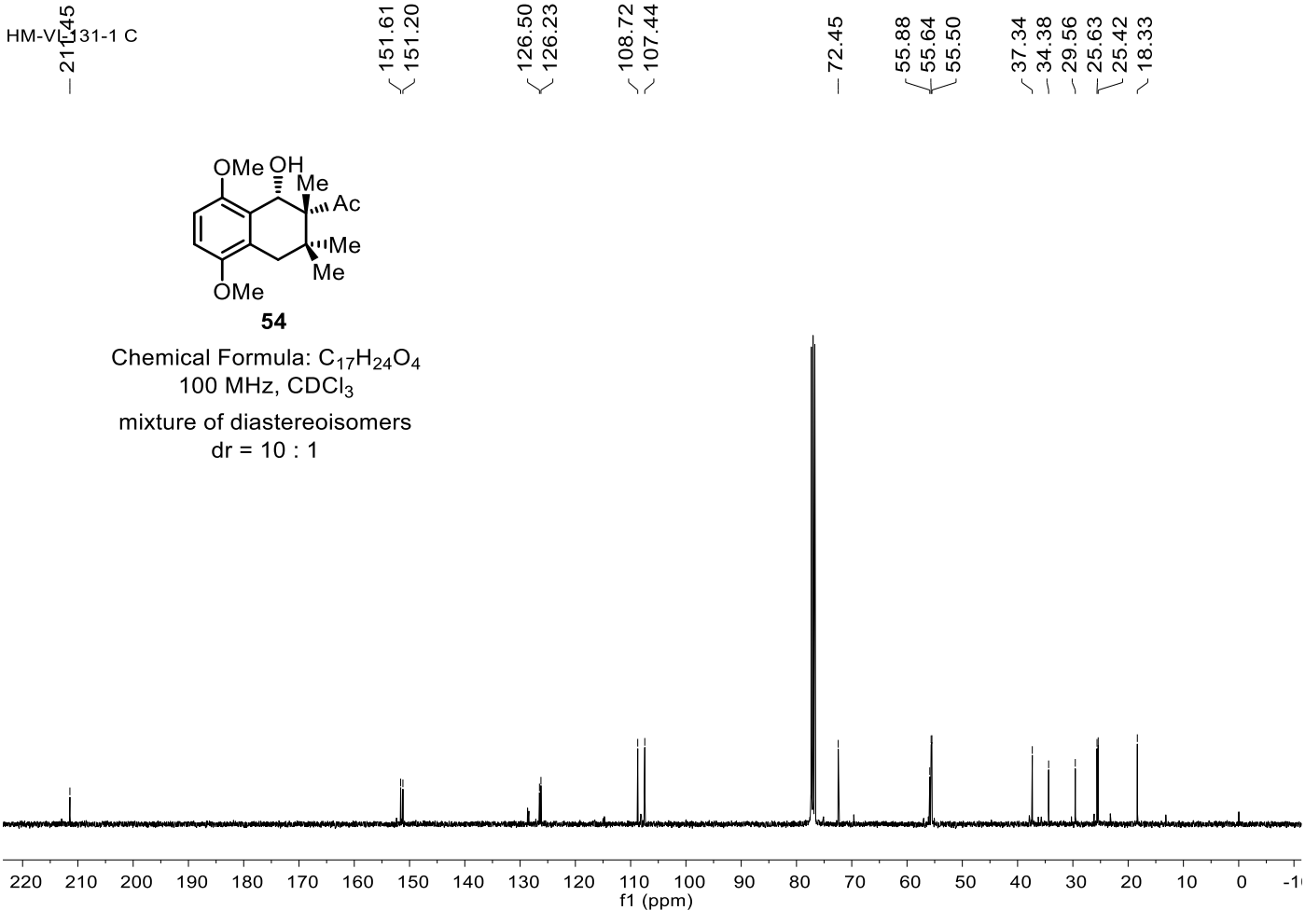


54

Chemical Formula: $C_{17}H_{24}O_4$
400 MHz, $CDCl_3$

mixture of diastereoisomers
dr = 10 : 1

HM-VI-131-1 C

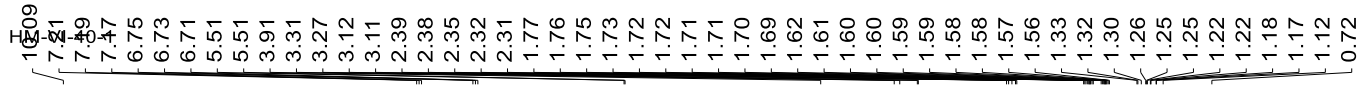


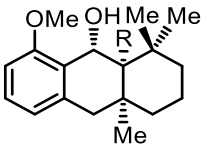
54

Chemical Formula: $C_{17}H_{24}O_4$
100 MHz, $CDCl_3$

mixture of diastereoisomers
dr = 10 : 1

HM-VI-40-1



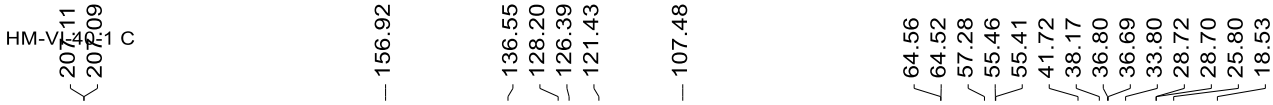


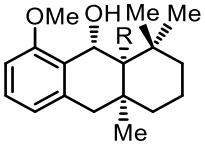
R = CHO, **55**

Chemical Formula: $C_{19}H_{26}O_3$

400 MHz, $CDCl_3$

HM-VI-40-1 C

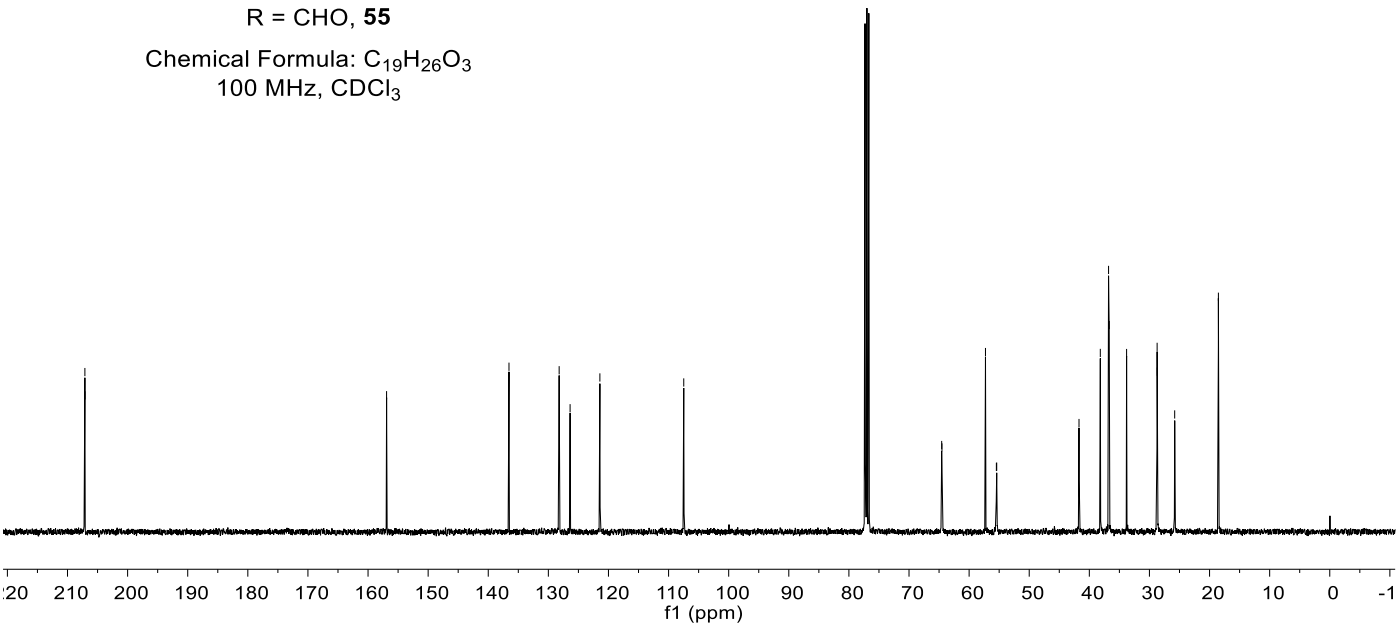


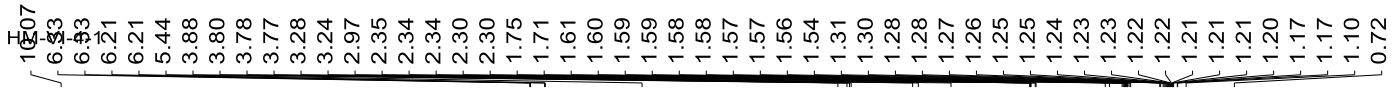


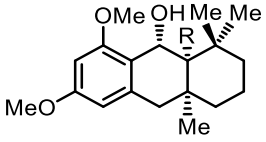
R = CHO, **55**

Chemical Formula: $C_{19}H_{26}O_3$

100 MHz, $CDCl_3$

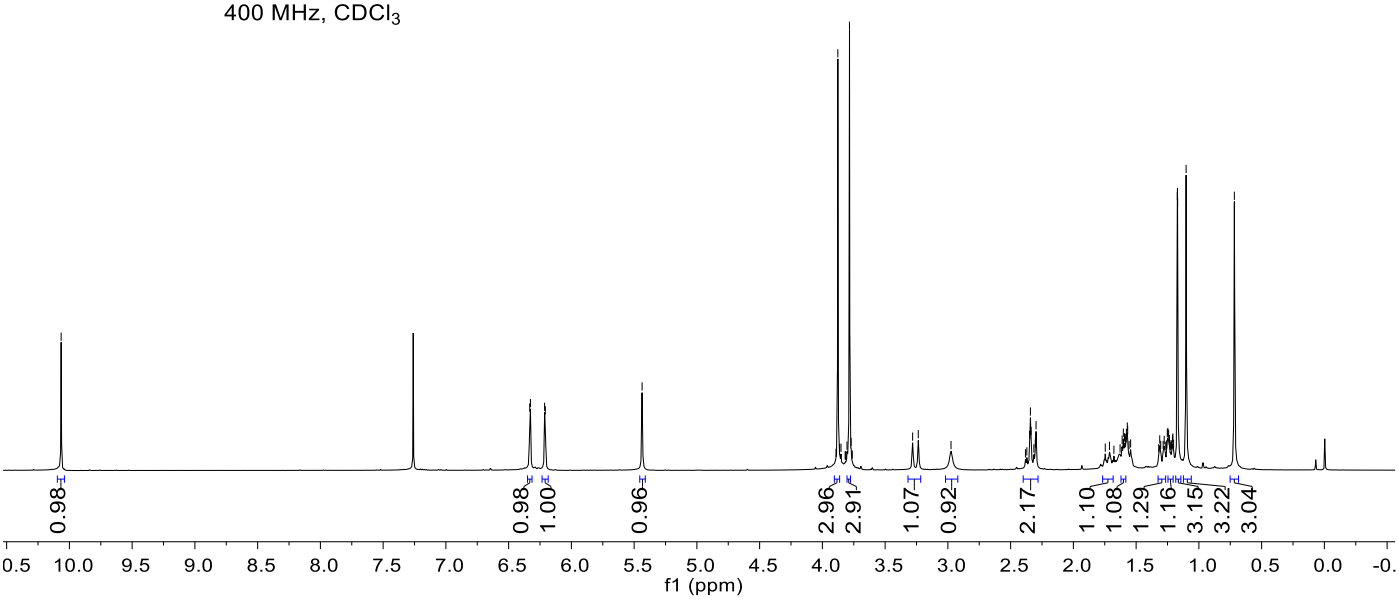


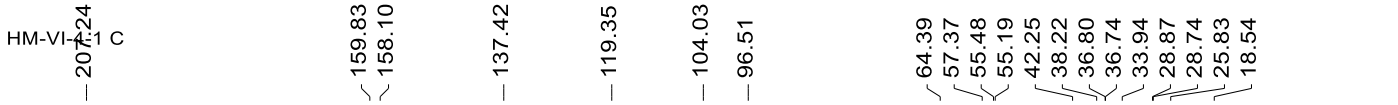


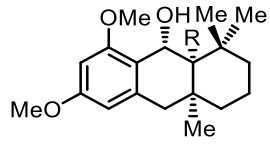


R = CHO, **56**

Chemical Formula: $C_{20}H_{28}O_4$
400 MHz, $CDCl_3$



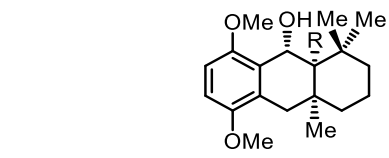




R = CHO, **56**

Chemical Formula: $C_{20}H_{28}O_4$
100 MHz, $CDCl_3$

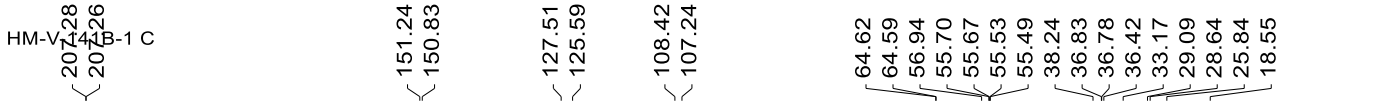
HM-7-141B-

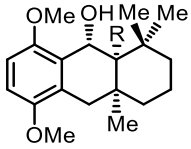


R = CHO, **57**

Chemical Formula: $C_{20}H_{28}O_4$
400 MHz, $CDCl_3$

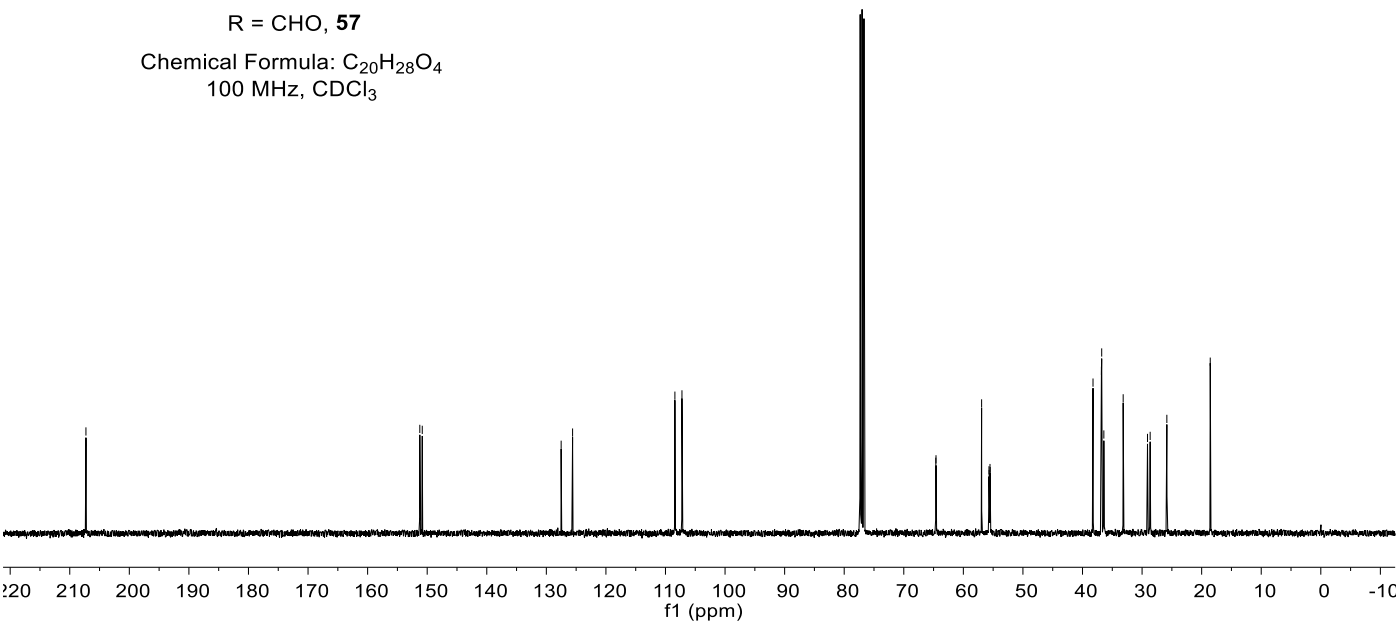
HM-V-141B-1 C



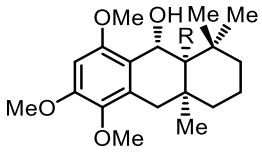


R = CHO, **57**

Chemical Formula: $C_{20}H_{28}O_4$
100 MHz, $CDCl_3$

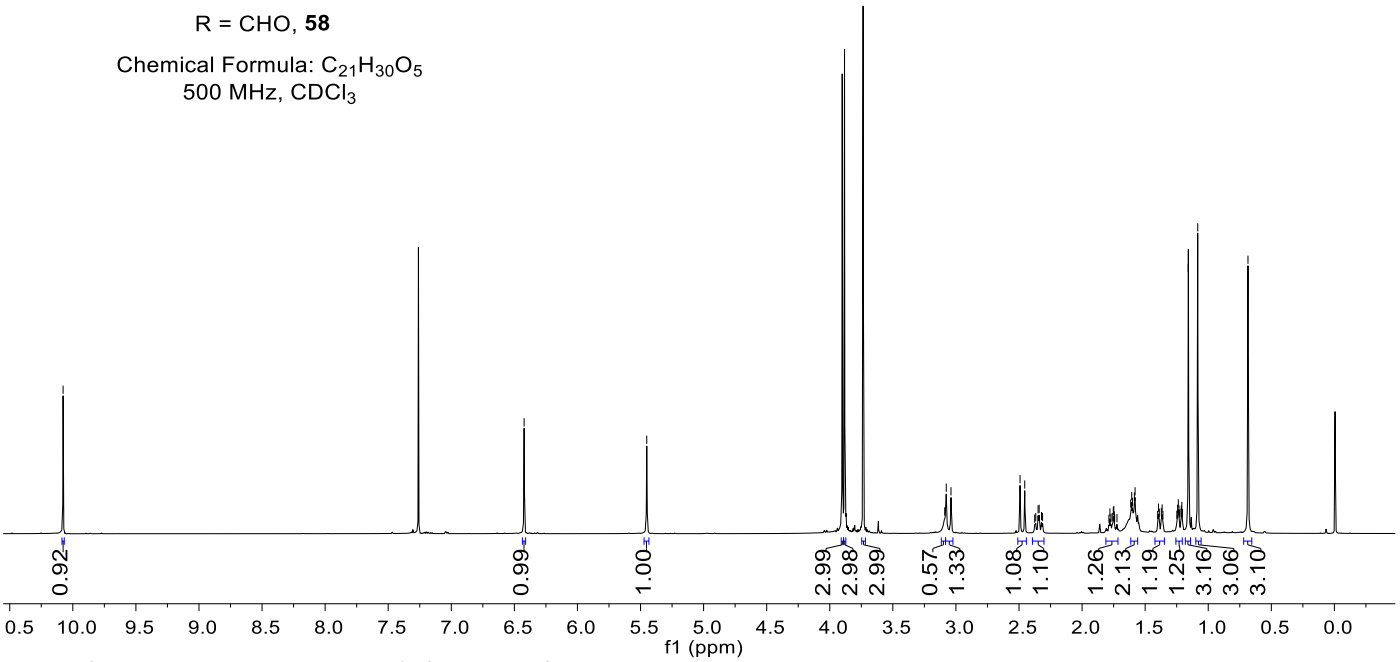


HM-VI-54-1

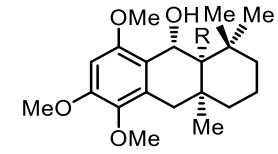


R = CHO, **58**

Chemical Formula: $C_{21}H_{30}O_5$
500 MHz, $CDCl_3$



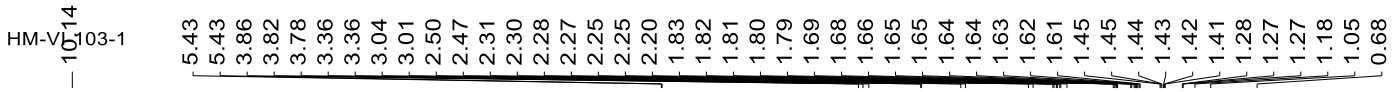
HM-VI-54-1 C

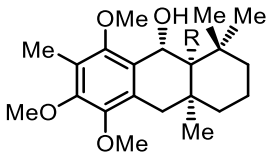


R = CHO, **58**

Chemical Formula: $C_{21}H_{30}O_5$
125 MHz, $CDCl_3$

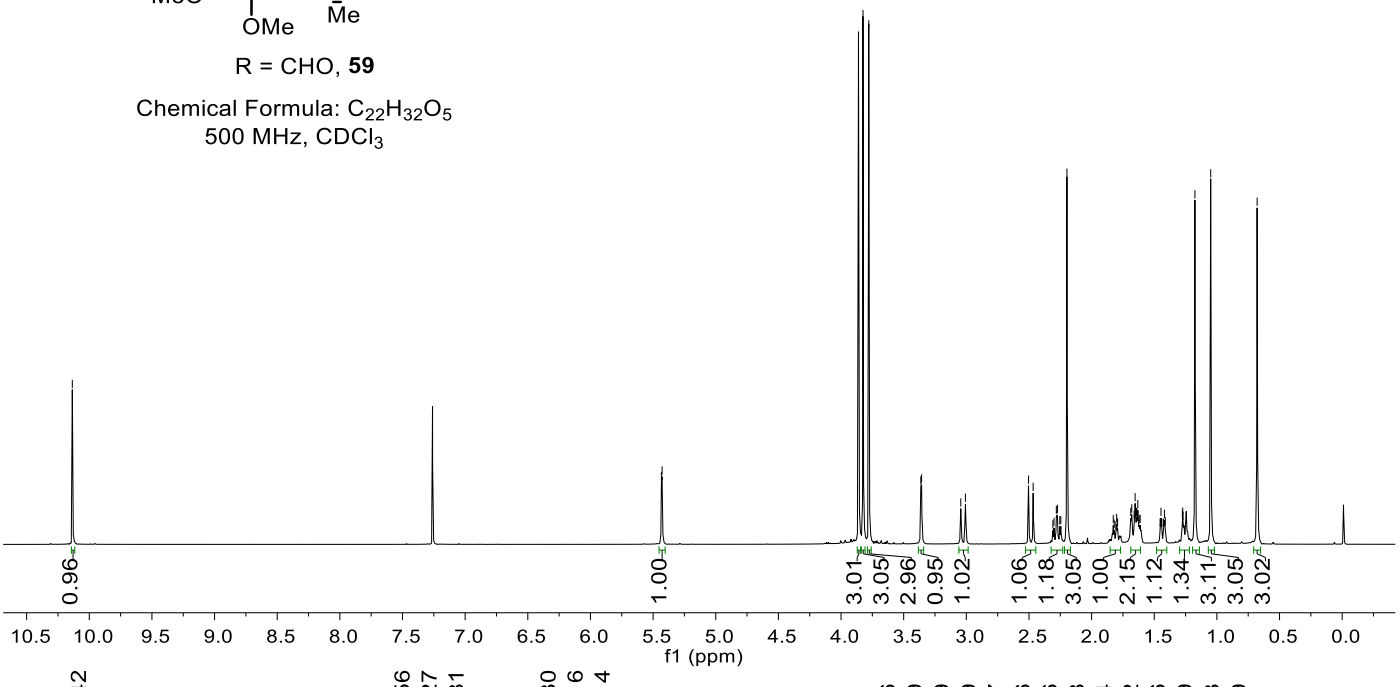
HM-VI-103-1



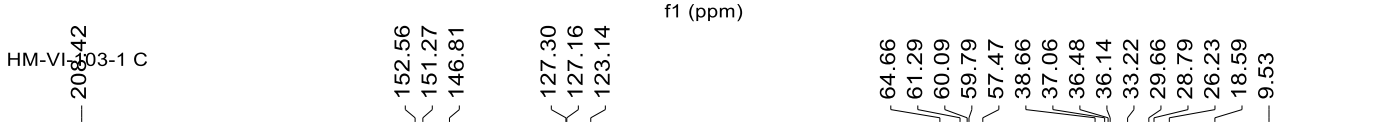


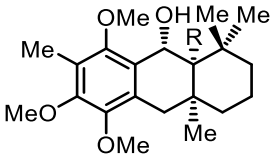
R = CHO, **59**

Chemical Formula: $C_{22}H_{32}O_5$
500 MHz, $CDCl_3$



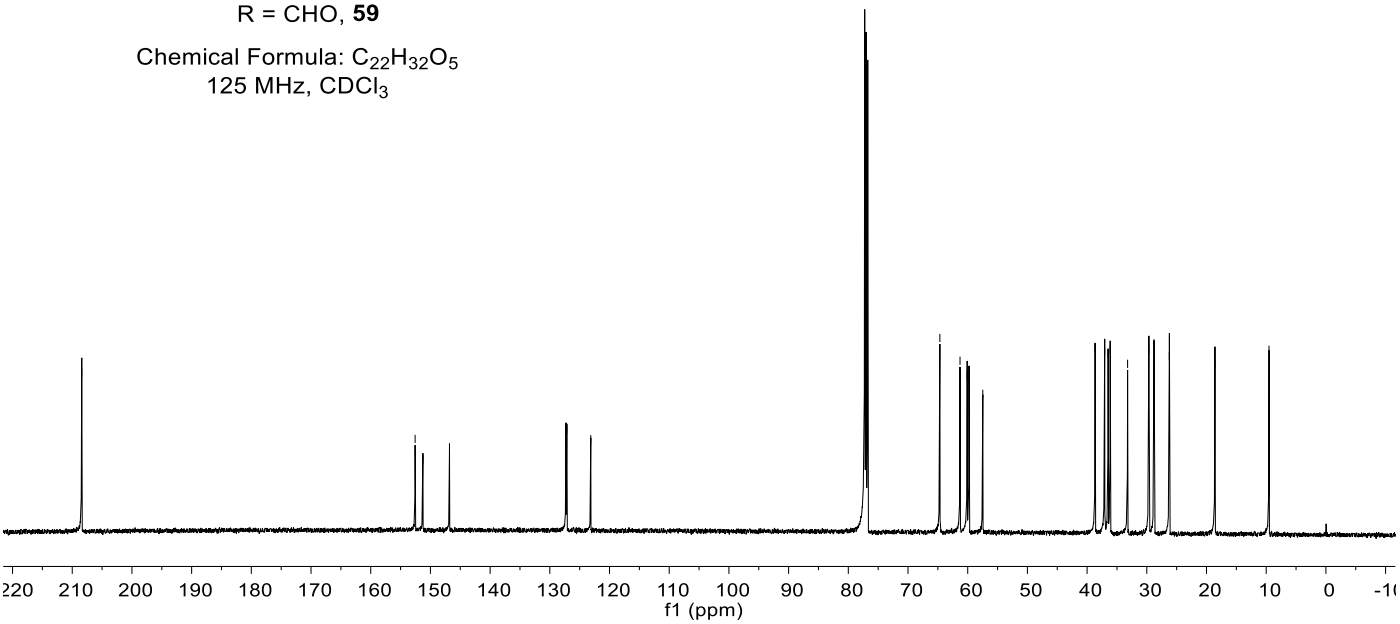
HM-VI-103-1 C

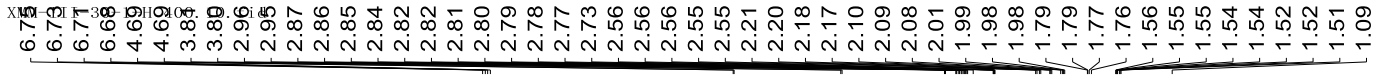


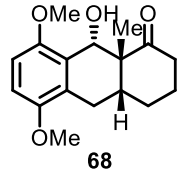


R = CHO, **59**

Chemical Formula: $C_{22}H_{32}O_5$
125 MHz, $CDCl_3$

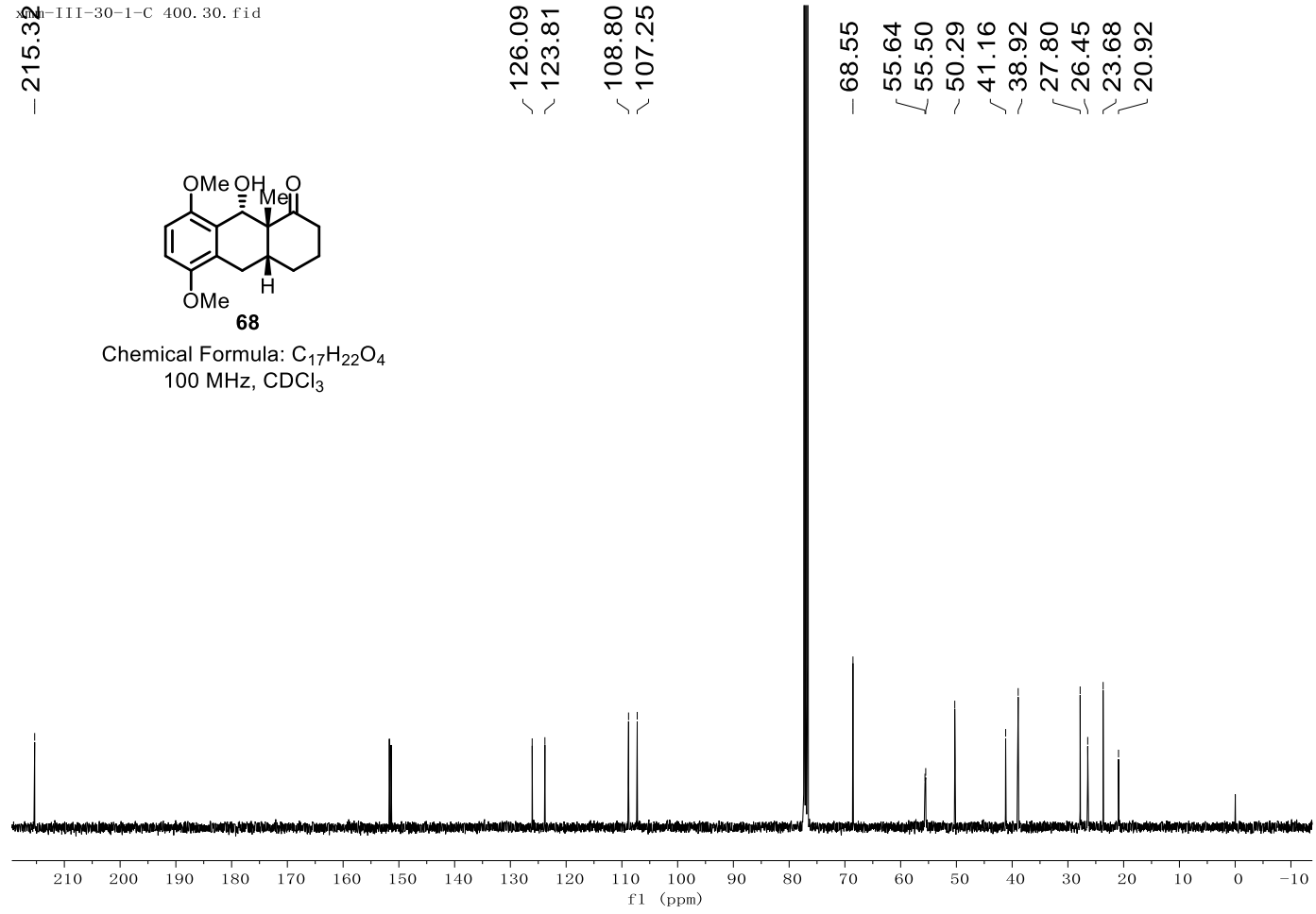






68

Chemical Formula: $C_{17}H_{22}O_4$
400 MHz, $CDCl_3$

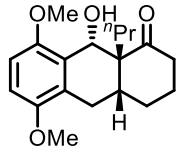


68

Chemical Formula: $C_{17}H_{22}O_4$
100 MHz, $CDCl_3$

HM-V-66-1

6.76 6.74 6.72 6.70 4.70 4.70 3.82 2.94 2.93 2.85 2.85 2.81 2.81 2.73 2.71 2.71 2.70 2.70 2.69 2.68 2.67 2.66 2.66 2.53 2.53 2.53 2.36 2.20 2.19 2.18 2.17 1.99 1.92 1.92 1.91 1.89 1.81 1.61 1.60 1.58 1.31 1.30 1.29 1.28 1.10 1.09 1.08 1.07 0.86 0.84 0.83



69

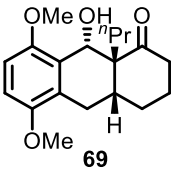
Chemical Formula: $C_{19}H_{26}O_4$

500 MHz, $CDCl_3$

HM-V-66-1

215.36

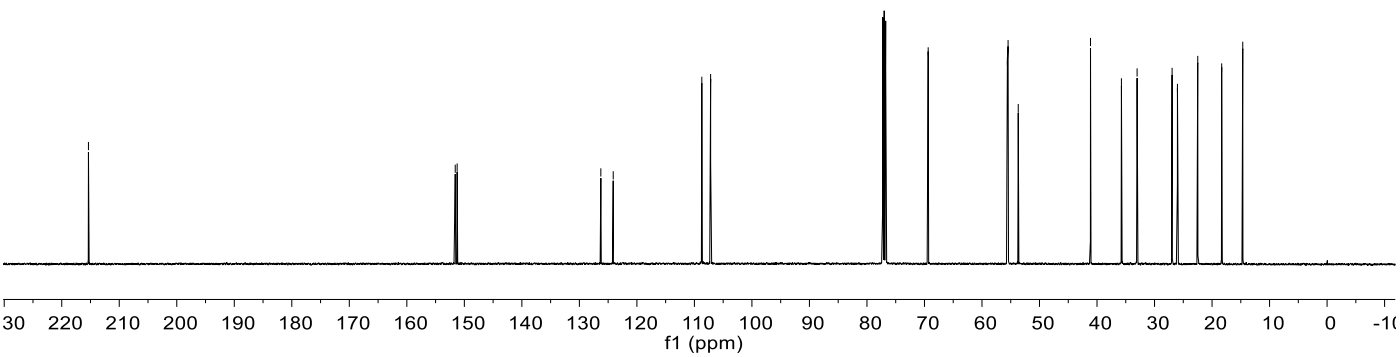
151.58 151.25 126.27 124.12 108.71 107.18 69.35 55.58 55.46 53.69 41.13 35.75 33.03 26.95 26.02 22.49 18.33 14.66

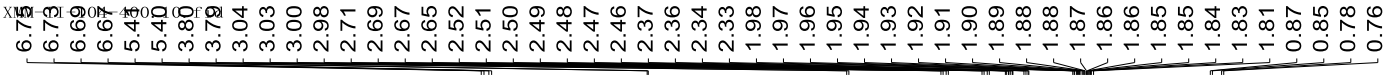


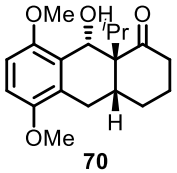
69

Chemical Formula: $C_{19}H_{26}O_4$

125 MHz, $CDCl_3$

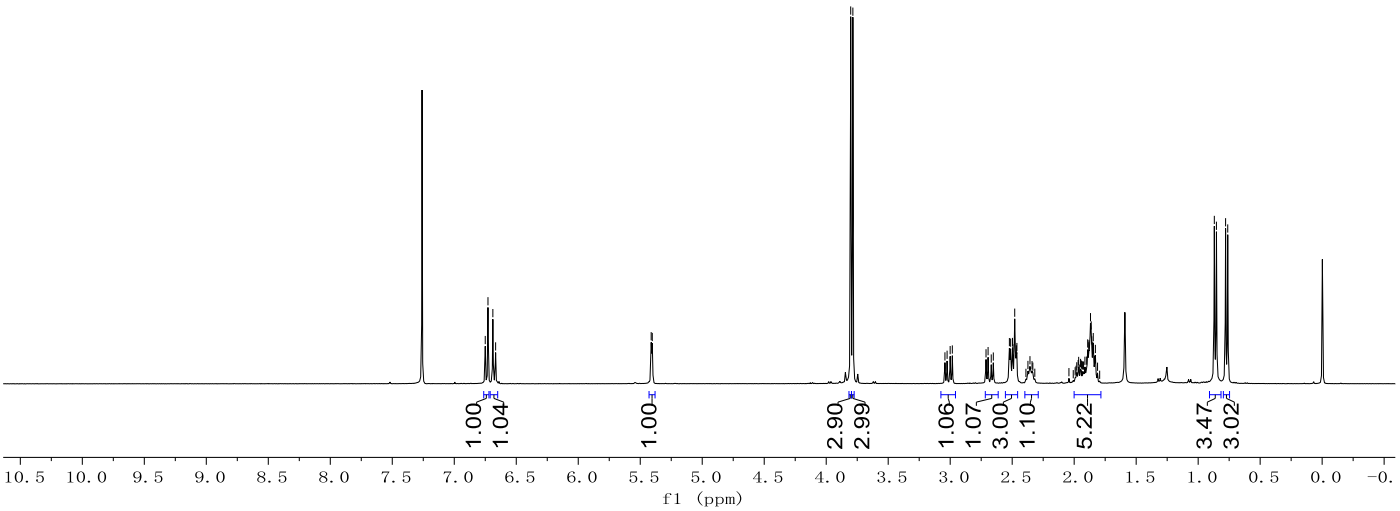


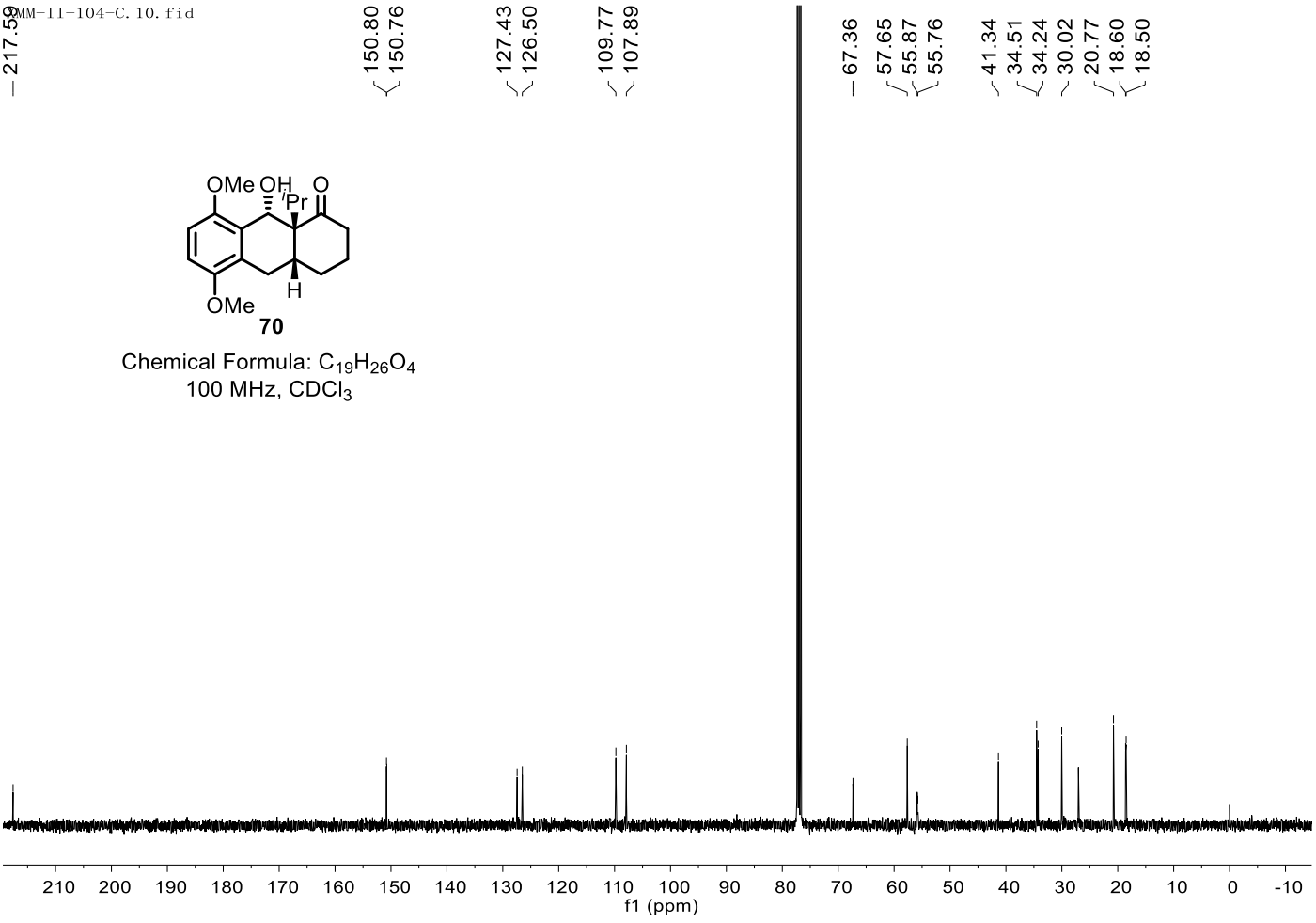




70

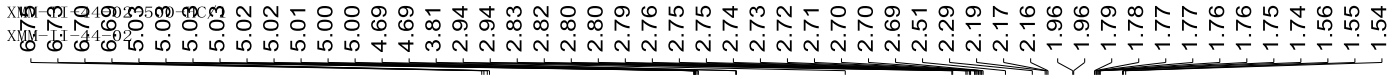
Chemical Formula: $C_{19}H_{26}O_4$
400 MHz, $CDCl_3$

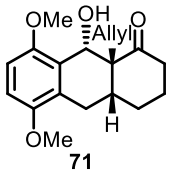




70

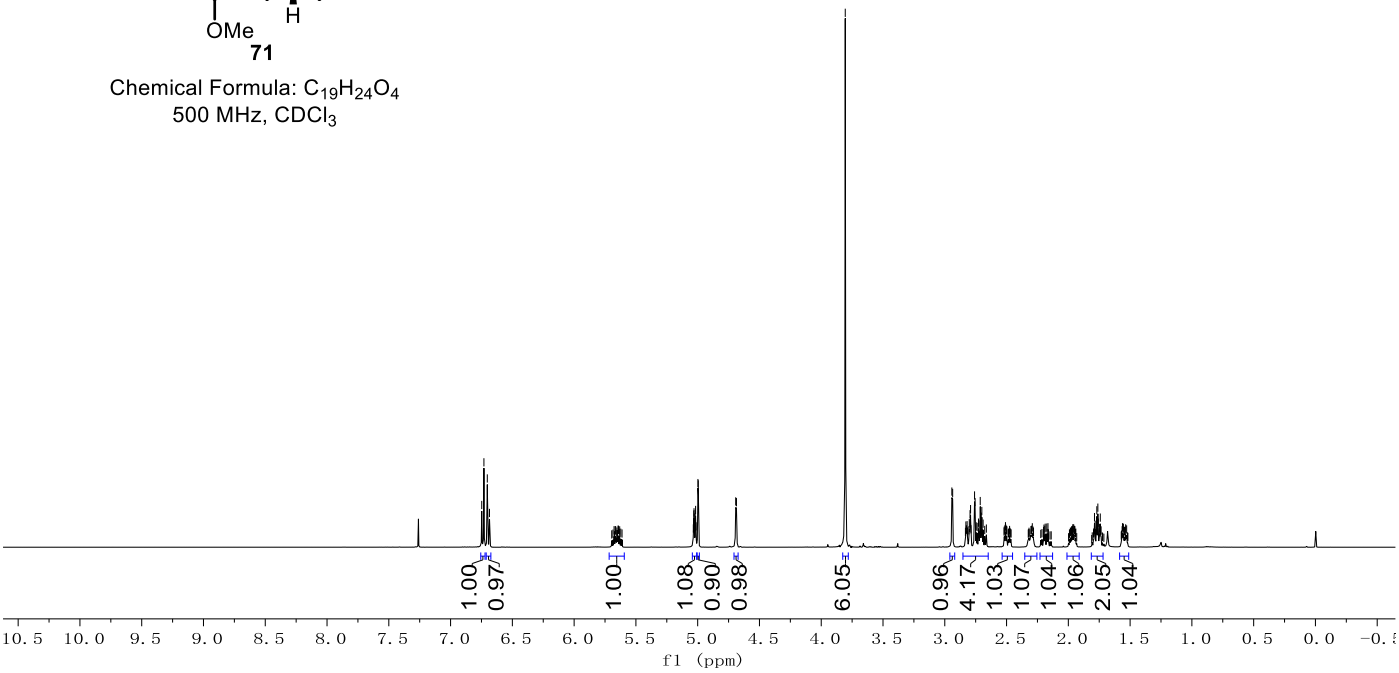
Chemical Formula: $C_{19}H_{26}O_4$
100 MHz, $CDCl_3$





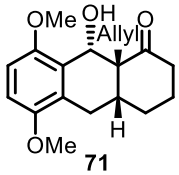
71

Chemical Formula: $C_{19}H_{24}O_4$
500 MHz, $CDCl_3$



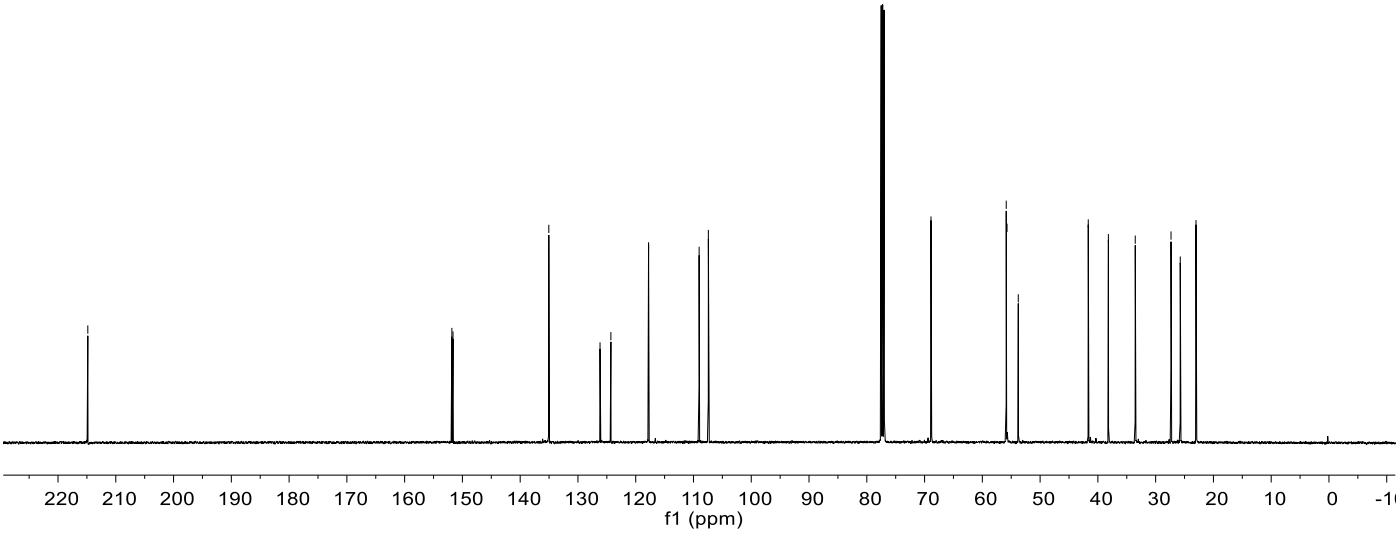
XMM-II-44-02-500-HC/2
XMM-II-44-02

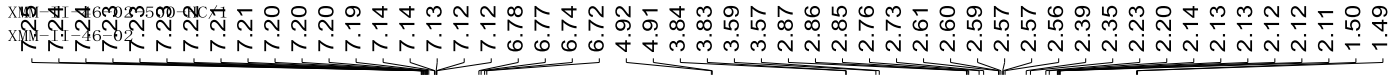
214.84
151.83
151.63
135.04
126.18
124.30
117.78
109.02
107.42
68.89
55.86
55.73
53.78
41.66
38.18
33.53
27.34
25.74
23.02

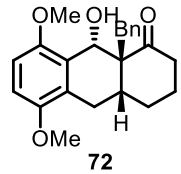


71

Chemical Formula: $C_{19}H_{24}O_4$
125 MHz, $CDCl_3$



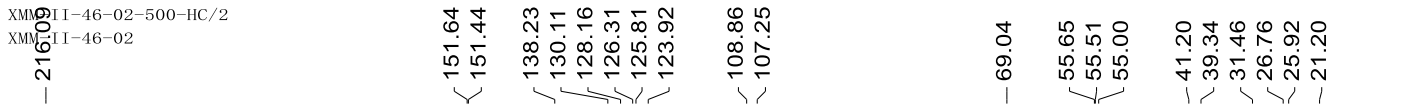


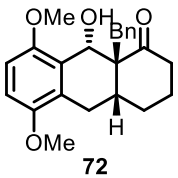


72

Chemical Formula: $C_{23}H_{26}O_4$

500 MHz, $CDCl_3$





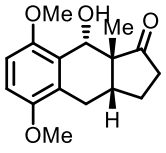
72

Chemical Formula: $C_{23}H_{26}O_4$

125 MHz, $CDCl_3$

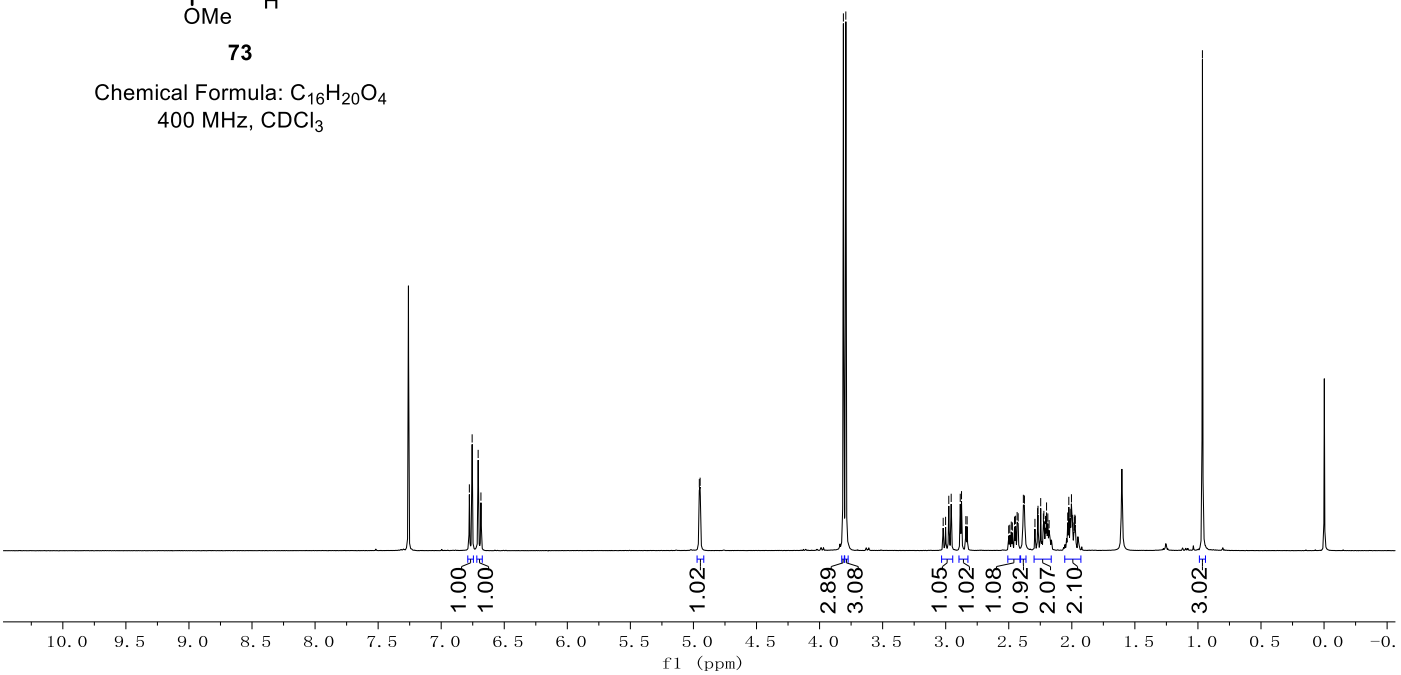
XMM-II-102.10.fid

6.78 6.75 6.71 6.68 4.95 4.95 3.81 3.79 3.02 3.00 2.98 2.96 2.88 2.87 2.84 2.83 2.50 2.49 2.48 2.47 2.45 2.45 2.43 2.43 2.38 2.38 2.29 2.27 2.27 2.25 2.23 2.22 2.22 2.21 2.20 2.19 2.18 2.03 2.02 2.01 2.00 1.99 1.98 1.98 1.98 1.97 0.96



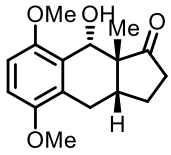
73

Chemical Formula: $C_{16}H_{20}O_4$
400 MHz, $CDCl_3$



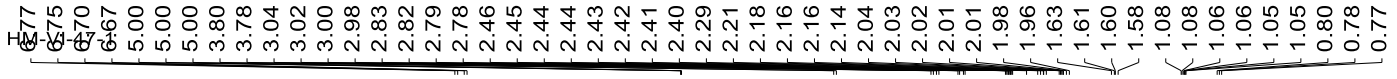
HM-2550.fid

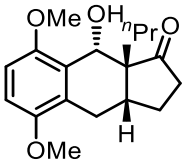
222.35
151.61
151.25
126.16
124.91
109.66
107.72
67.61
55.81
55.76
50.31
40.31
38.73
26.67
24.04
21.15



73

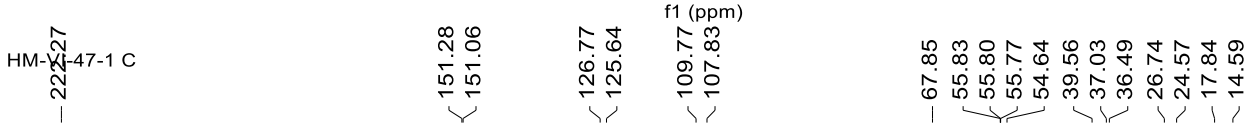
Chemical Formula: $C_{16}H_{20}O_4$
100 MHz, $CDCl_3$

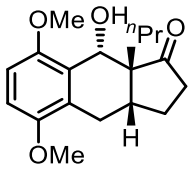




74

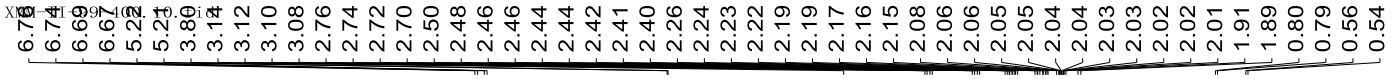
Chemical Formula: $C_{18}H_{24}O_4$
400 MHz, $CDCl_3$

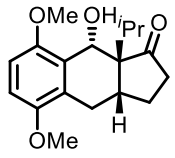




74

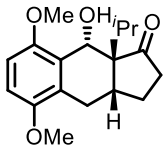
Chemical Formula: $C_{18}H_{24}O_4$
100 MHz, $CDCl_3$





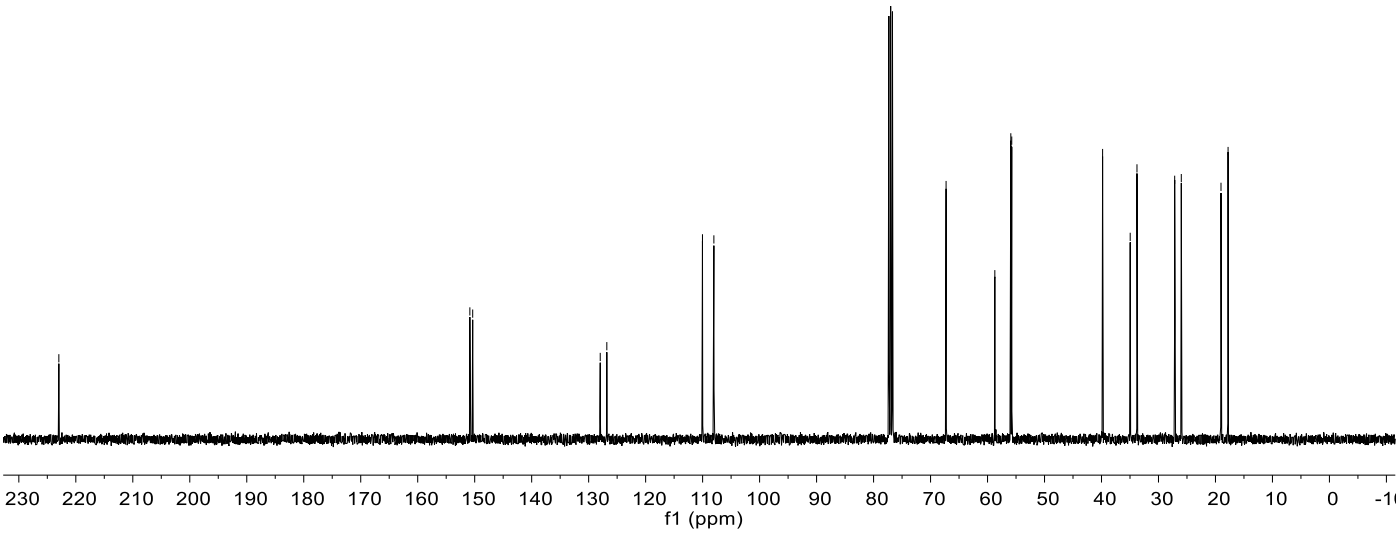
75

Chemical Formula: $C_{18}H_{24}O_4$
400 MHz, $CDCl_3$

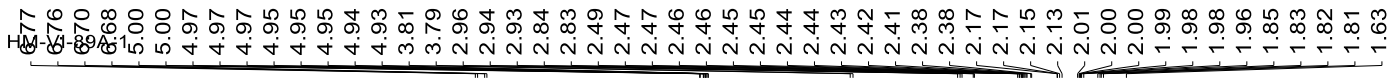


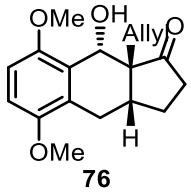
75

Chemical Formula: $C_{18}H_{24}O_4$
100 MHz, $CDCl_3$



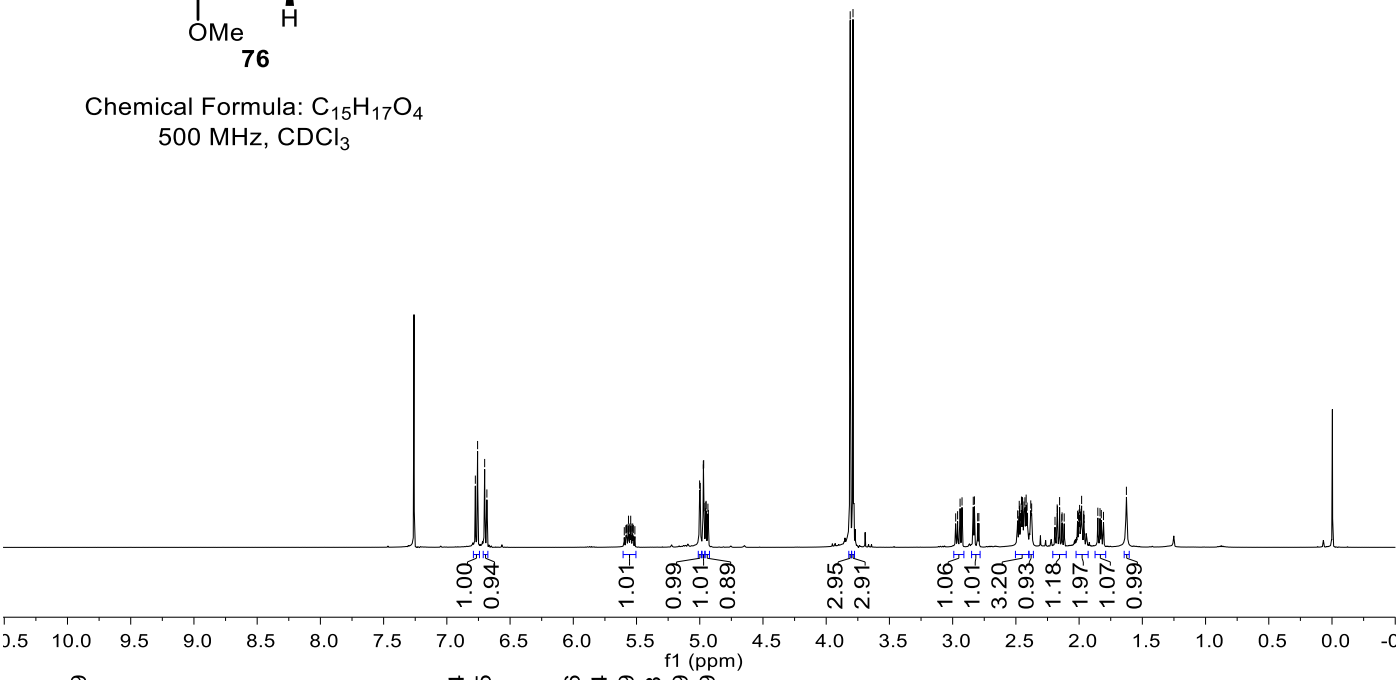
HM-VI-89A-1



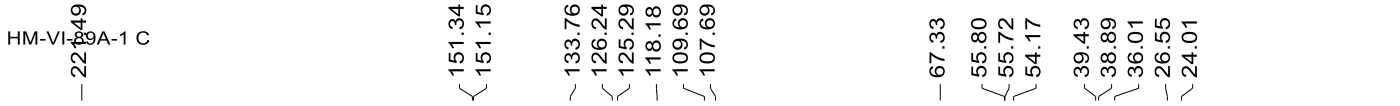


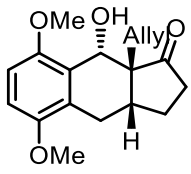
76

Chemical Formula: $C_{15}H_{17}O_4$
500 MHz, $CDCl_3$



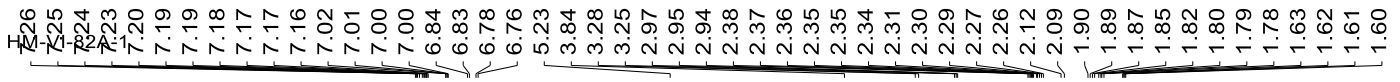
HM-VI-89A-1 C

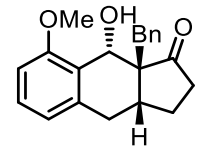




76

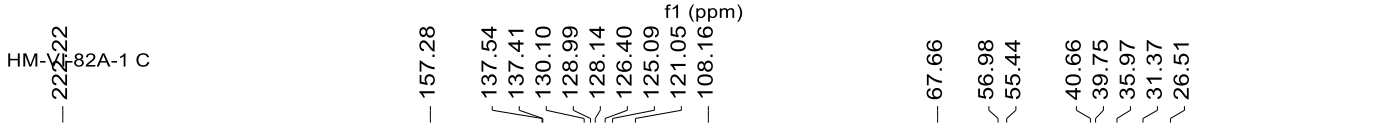
Chemical Formula: $C_{15}H_{17}O_4$
125 MHz, $CDCl_3$

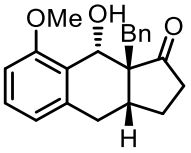




77

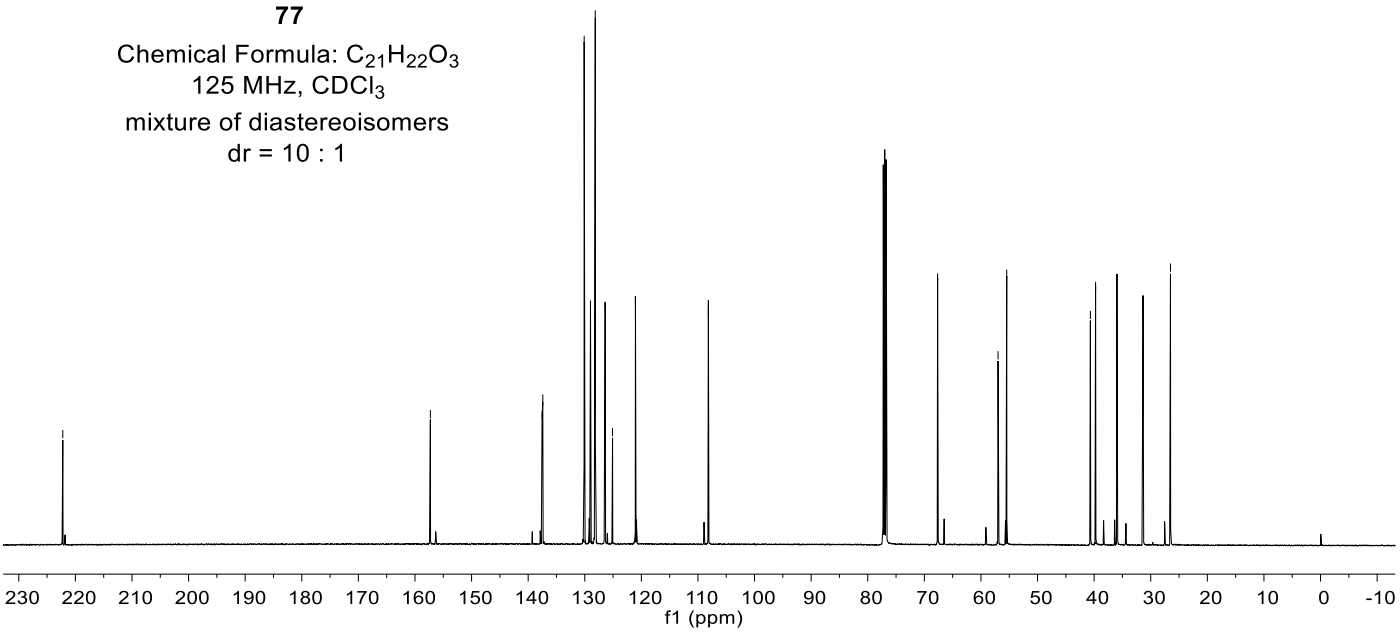
Chemical Formula: $C_{21}H_{22}O_3$
500 MHz, $CDCl_3$
mixture of diastereoisomers
dr = 10 : 1

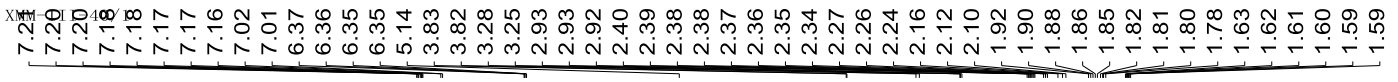


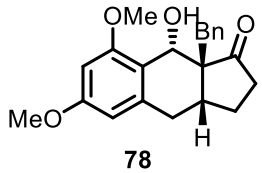


77

Chemical Formula: $C_{21}H_{22}O_3$
125 MHz, $CDCl_3$
mixture of diastereoisomers
dr = 10 : 1

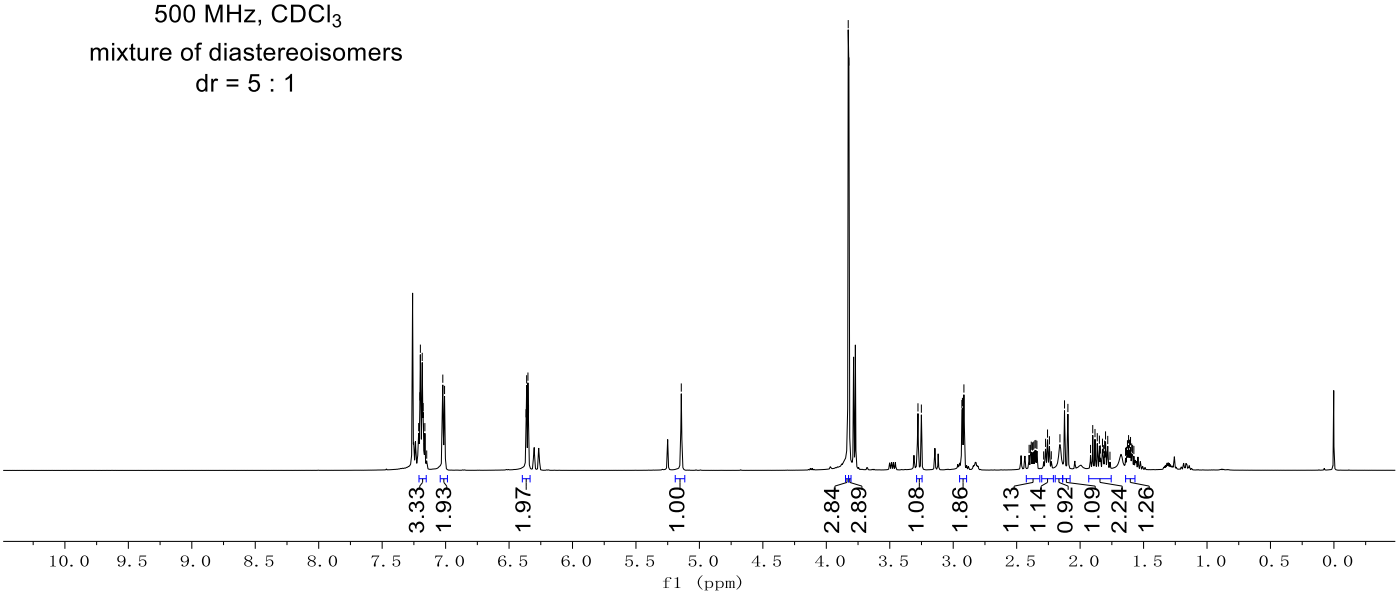


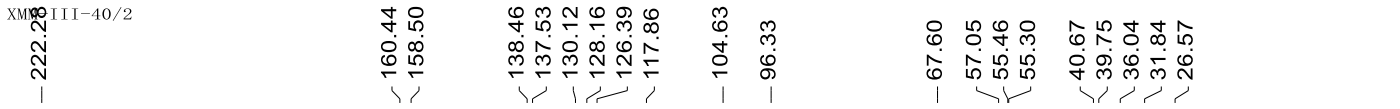


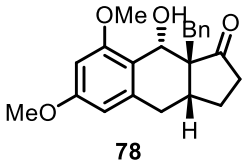


78

Chemical Formula: $C_{22}H_{24}O_4$
500 MHz, $CDCl_3$
mixture of diastereoisomers
dr = 5 : 1

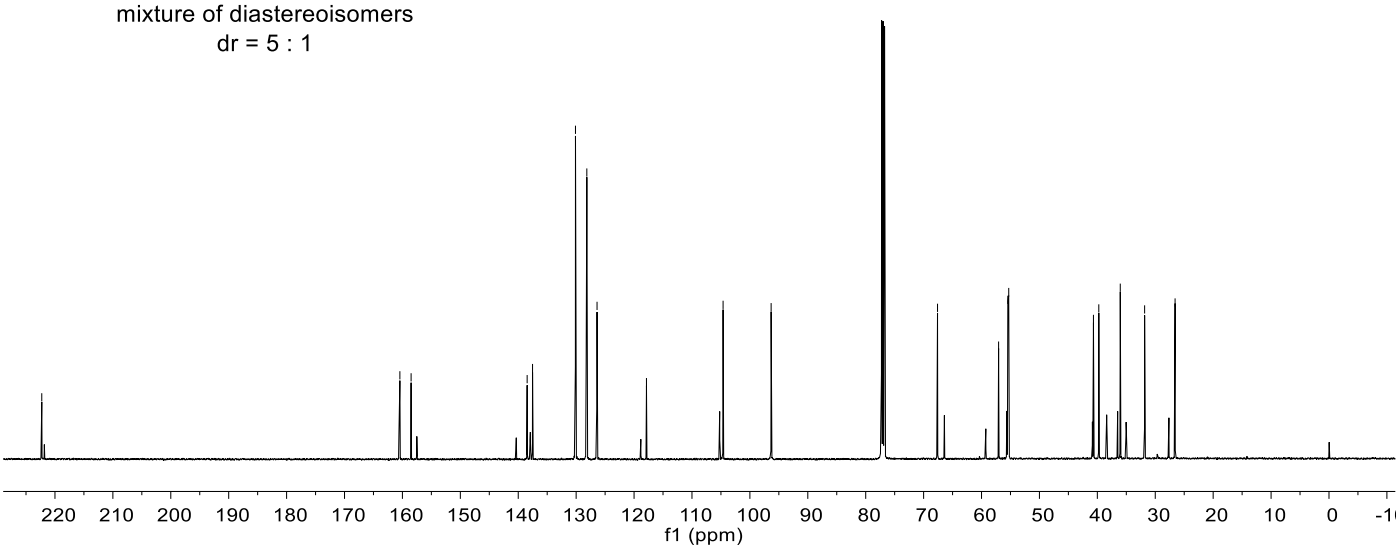


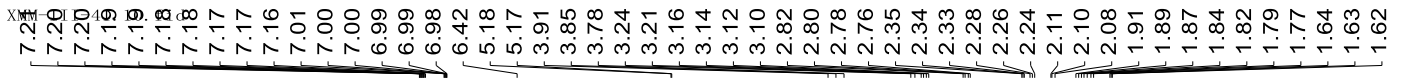


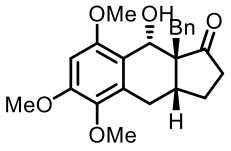


78

Chemical Formula: $C_{22}H_{24}O_4$
125 MHz, $CDCl_3$
mixture of diastereoisomers
dr = 5 : 1



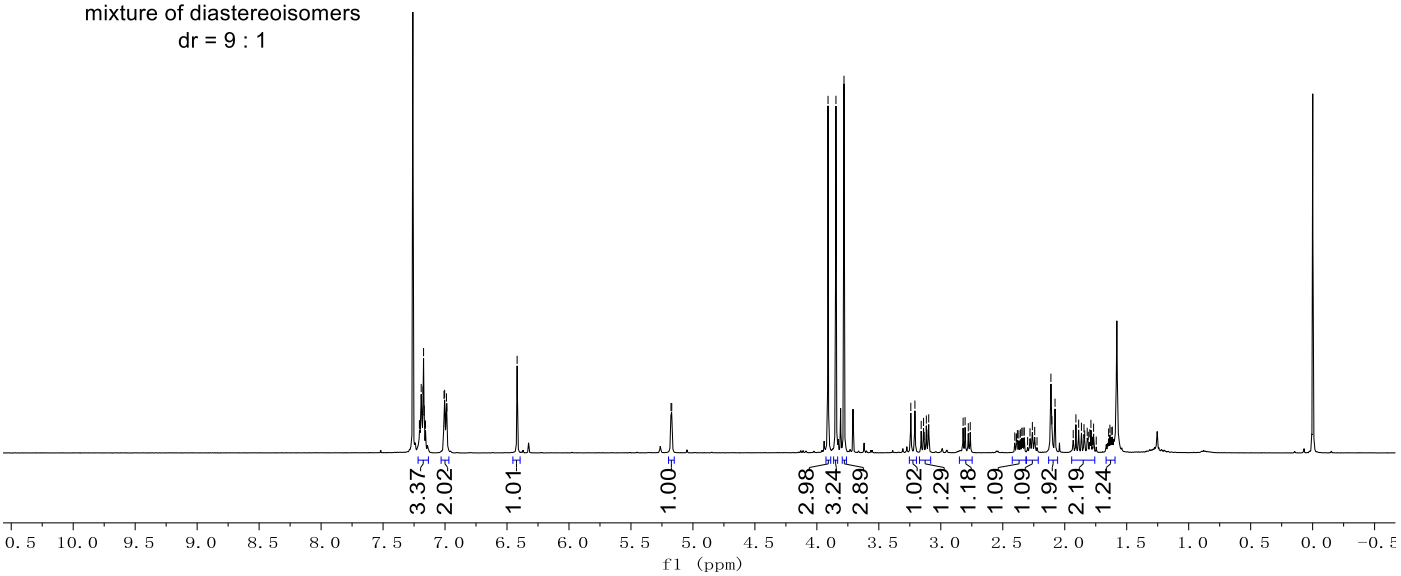


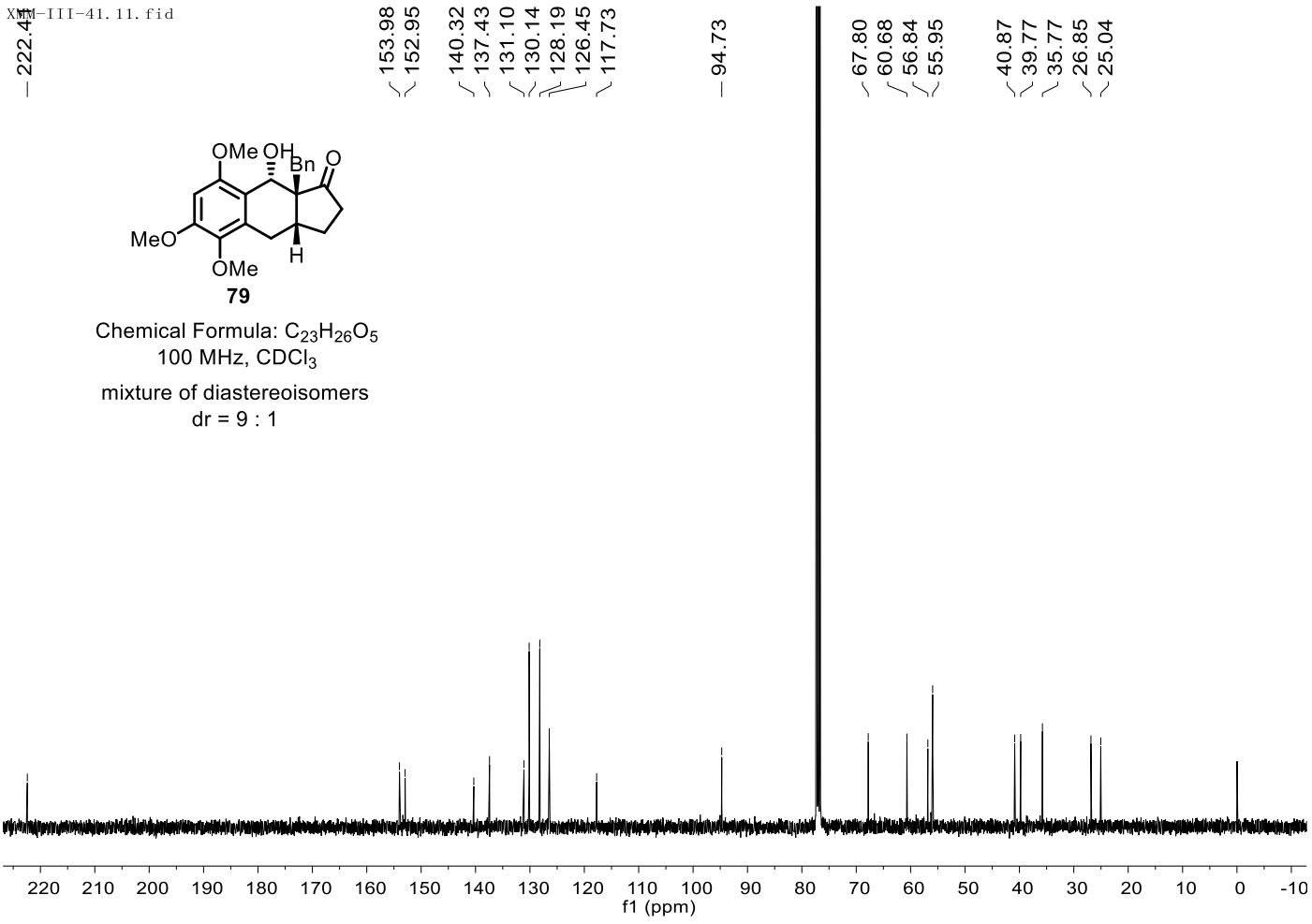


79

Chemical Formula: $C_{23}H_{26}O_5$
400 MHz, $CDCl_3$

mixture of diastereoisomers
dr = 9 : 1

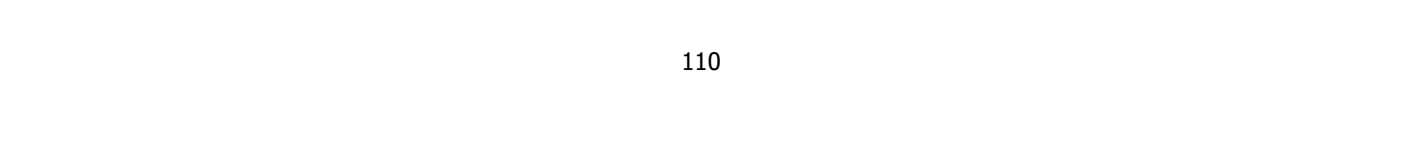




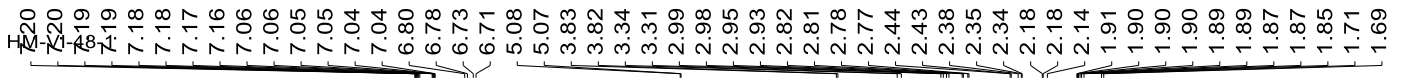
79

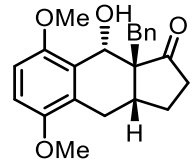
Chemical Formula: $C_{23}H_{26}O_5$
100 MHz, $CDCl_3$

mixture of diastereoisomers
dr = 9 : 1



HM-VI-48-1



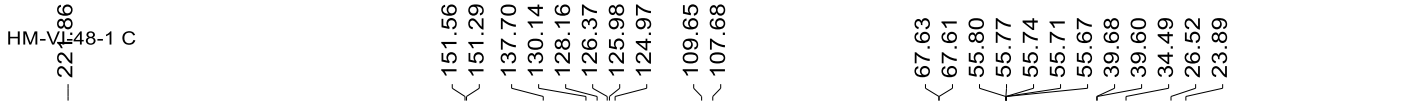


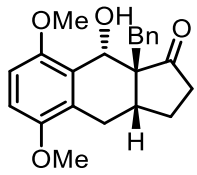
80

Chemical Formula: $C_{22}H_{24}O_4$

400 MHz, $CDCl_3$

HM-VI-48-1 C



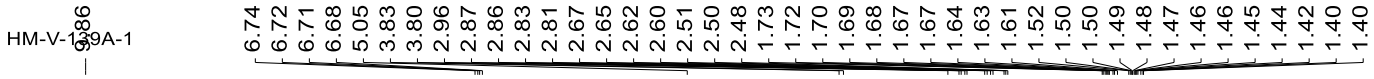


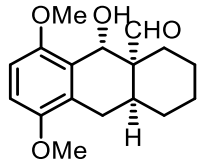
80

Chemical Formula: $C_{22}H_{24}O_4$

100 MHz, $CDCl_3$

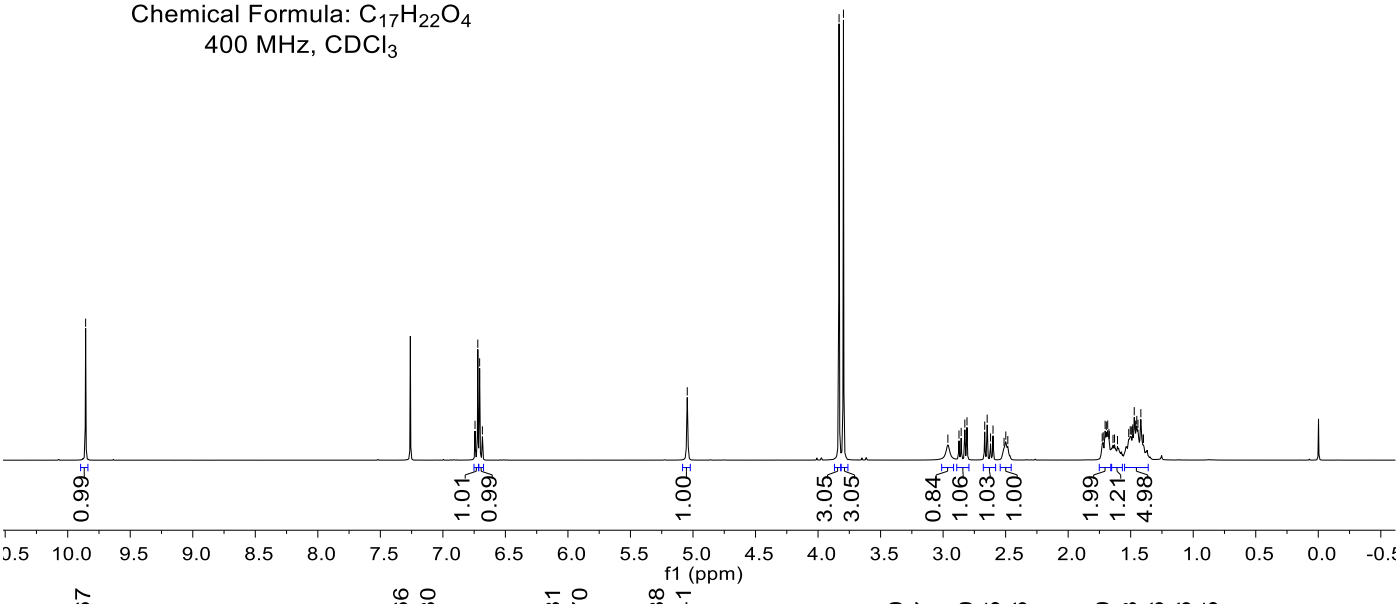
HM-V-139A-1



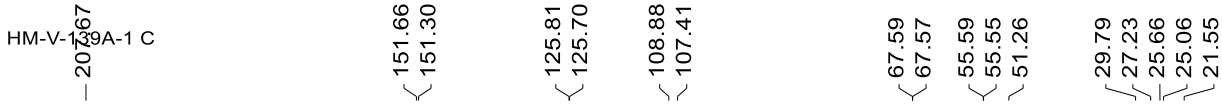


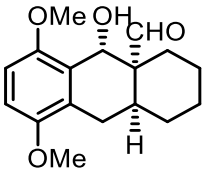
81

Chemical Formula: $C_{17}H_{22}O_4$
400 MHz, $CDCl_3$



HM-V-139A-1 C



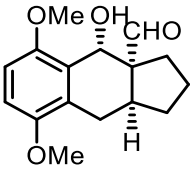


81

Chemical Formula: $C_{17}H_{22}O_4$
100 MHz, $CDCl_3$

HM-C-136-1

9.79 6.80 6.78 6.72 6.70 5.44 3.81 3.78 2.96 2.95 2.94 2.87 2.86 2.85 2.43 1.98 1.98 1.97 1.97 1.96 1.96 1.95 1.95 1.94 1.94 1.93 1.92 1.42 1.42 1.41 1.41 1.40 1.39 1.28 1.27 1.26 1.25 1.12 1.12 1.12 1.11 1.11 1.10 1.10 1.09 1.09 1.08 1.08 1.08 1.07 1.06



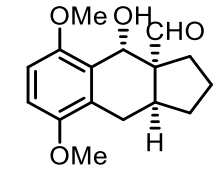
82

Chemical Formula: $C_{16}H_{20}O_4$

500 MHz, $CDCl_3$

HM-C-136-1 C

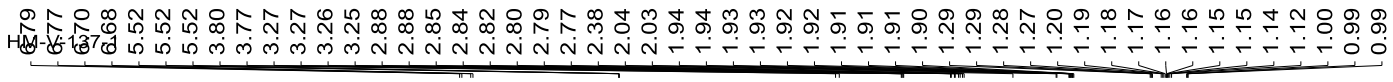
203.94 151.74 151.29 128.21 126.41 110.99 108.46 65.87 61.36 56.22 56.04 34.33 34.03 32.97 24.52 23.55

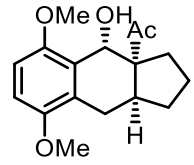


82

Chemical Formula: $C_{16}H_{20}O_4$

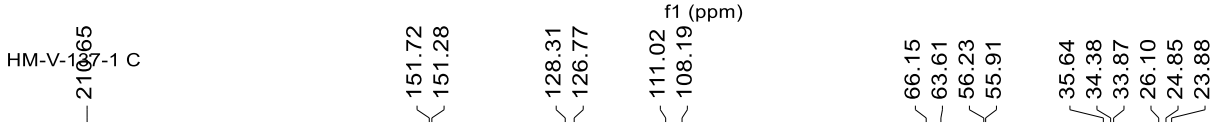
125 MHz, $CDCl_3$

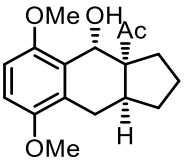




83

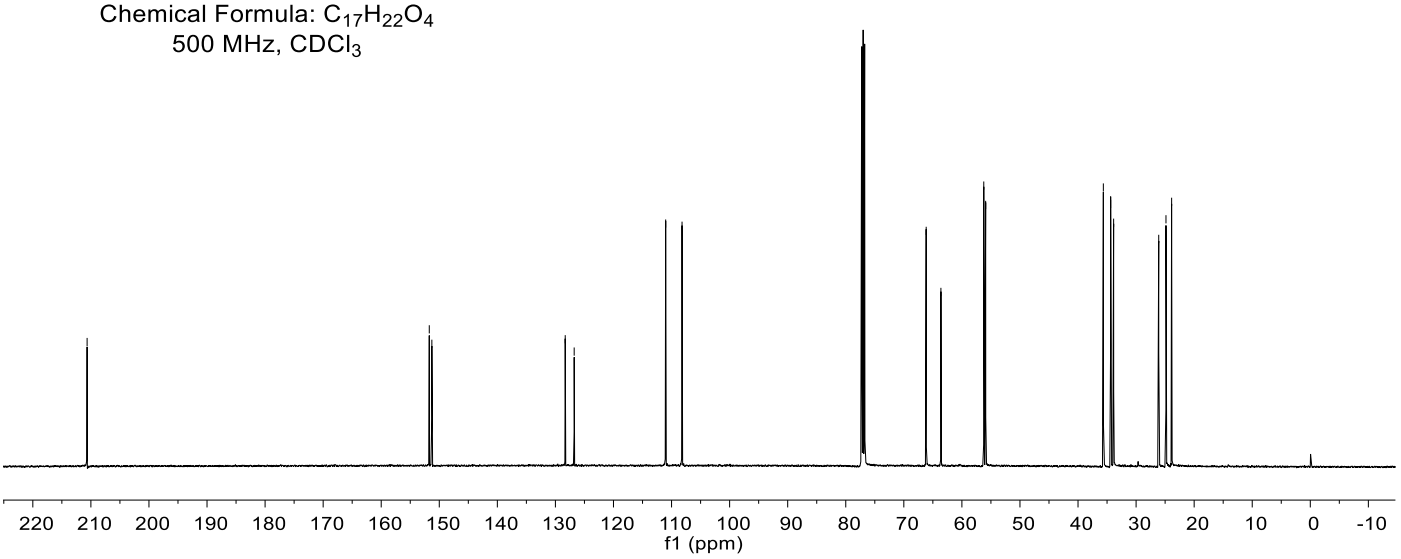
Chemical Formula: $C_{17}H_{22}O_4$
500 MHz, $CDCl_3$





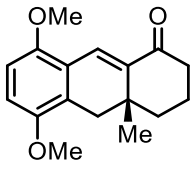
83

Chemical Formula: $C_{17}H_{22}O_4$
500 MHz, $CDCl_3$



HM-V-140B-1

8.07 8.05 7.67 7.65 6.72 5.23 4.82 4.81 3.84 3.81 2.84 2.83 2.82 2.80 2.78 2.77 2.76 2.75 2.74 2.73 2.71 2.70 2.67 2.66 2.47 2.46 2.45 2.45 2.43 2.42 2.41 1.69 1.68 1.67 1.66 1.65 1.56 1.55 1.54 1.53 1.51 1.50 1.49 1.48 1.47 1.46 1.44 1.43 0.99 0.98 0.96

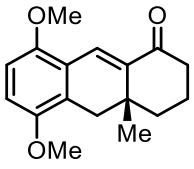


84

Chemical Formula: $C_{17}H_{20}O_3$
500 MHz, $CDCl_3$

HM-V-140B-1 C

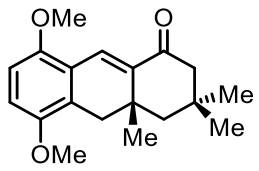
193.91 151.90 150.71 139.76 126.72 125.75 122.15 112.98 108.57 56.14 55.81 39.86 37.86 37.06 33.87 23.34 18.68



84

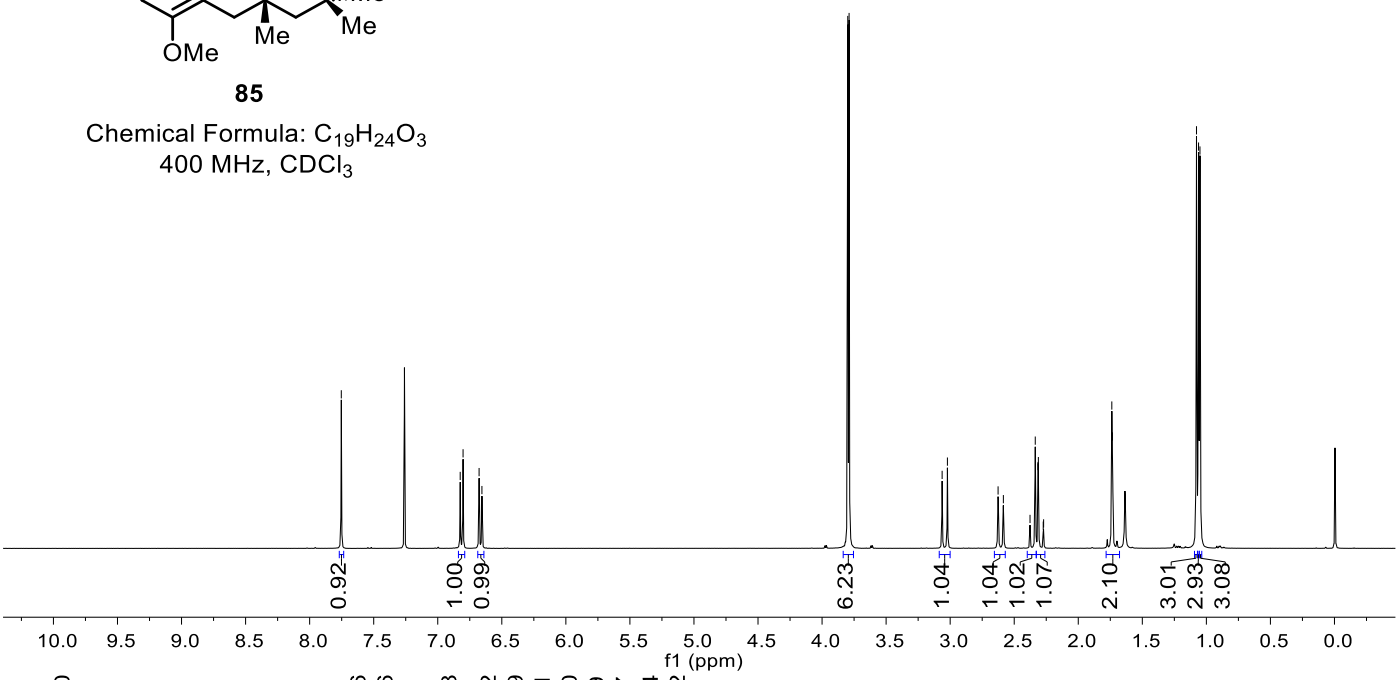
Chemical Formula: $C_{17}H_{20}O_3$
125 MHz, $CDCl_3$

HM-VI-25-1

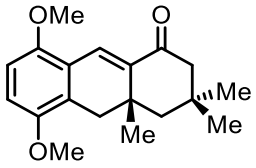


85

Chemical Formula: $C_{19}H_{24}O_3$
400 MHz, $CDCl_3$



HM-VI-25-1 C

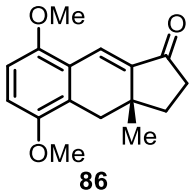


85

Chemical Formula: $C_{19}H_{24}O_3$
125 MHz, $CDCl_3$

HM-V-143B-1

7.61 6.86 6.84 6.70 6.70 6.68 6.68 3.80 3.80 3.35 3.32 2.54 2.52 2.51 2.50 2.50 2.48 2.48 2.47 2.46 2.46 2.45 2.44 2.44 2.42 2.42 2.40 2.40 2.11 2.11 2.10 2.10 2.09 2.09 2.07 2.07 1.84 1.82 1.81 1.80 1.79 1.77 1.01

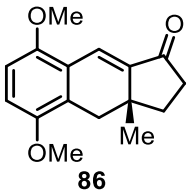


86

Chemical Formula: $C_{16}H_{18}O_3$
500 MHz, $CDCl_3$

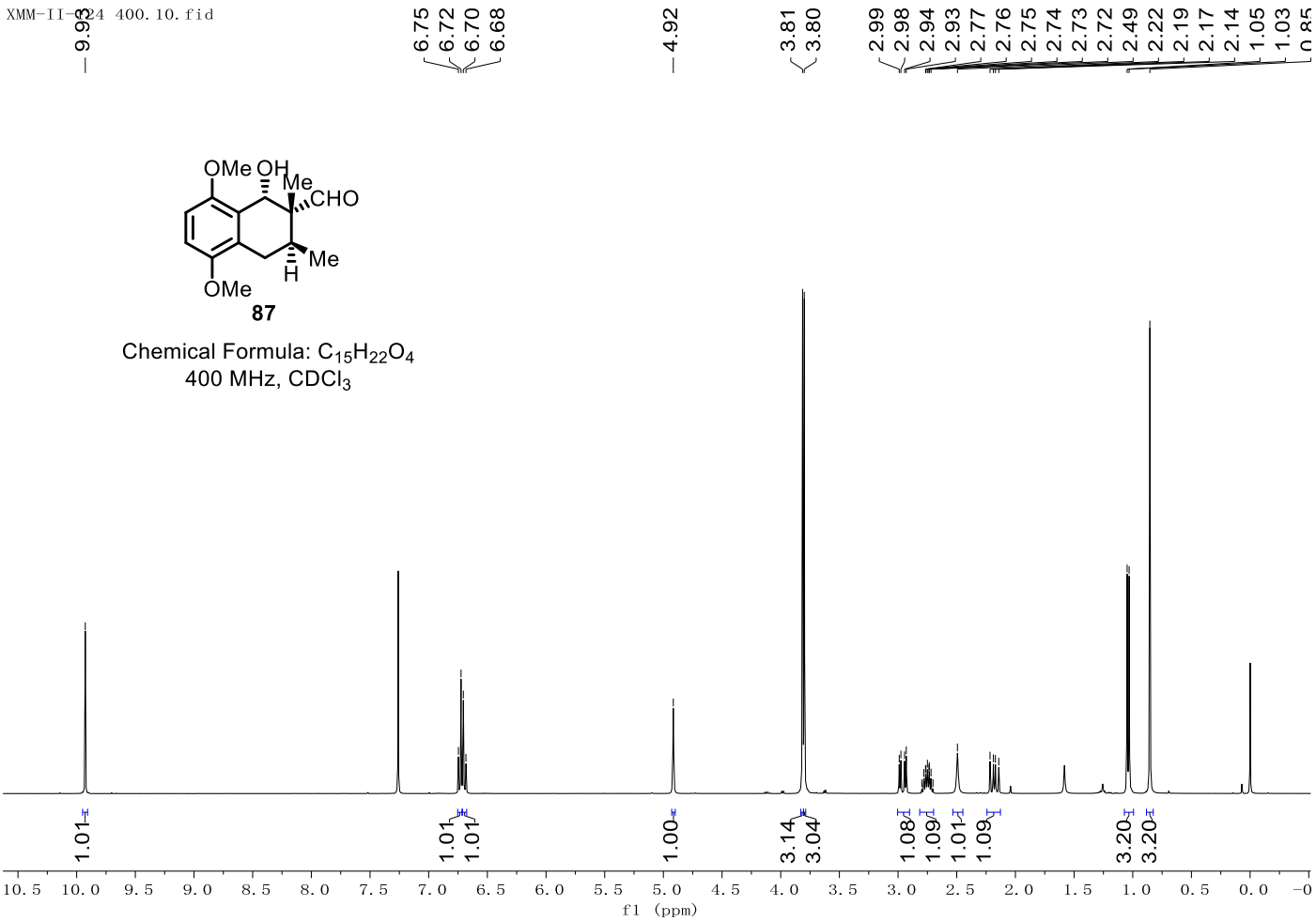
HM-V-143B-1 C

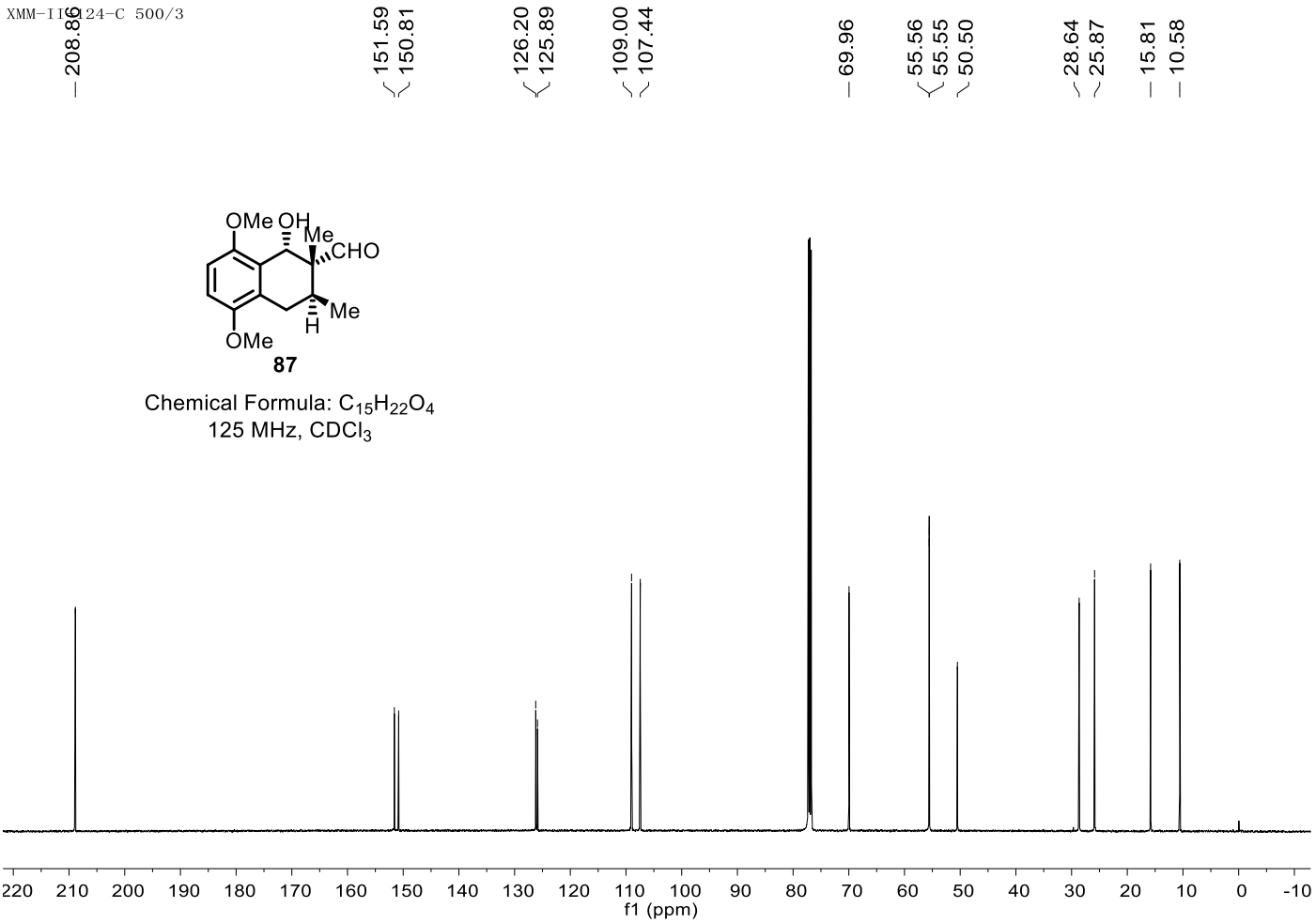
206.55 152.53 151.12 142.70 125.47 122.85 122.27 113.53 108.95 56.18 55.93 37.29 37.04 35.96 35.92 35.50 22.44



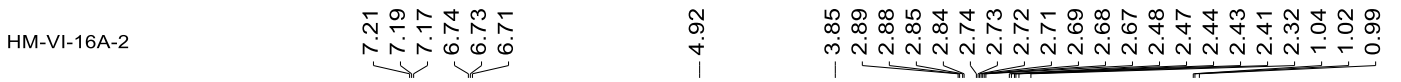
86

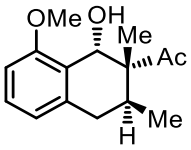
Chemical Formula: $C_{16}H_{18}O_3$
125 MHz, $CDCl_3$


XMM-II-124 400.10.fid
9.93
6.75
6.72
6.70
6.68
4.92
3.81
3.80
2.99
2.98
2.94
2.93
2.77
2.76
2.75
2.74
2.73
2.72
2.49
2.22
2.19
2.17
2.14
1.05
1.03
OMe OH
Me
CHO
Me
H
OMe
87
Chemical Formula: C15H22O4
400 MHz, CDCl3
1.01
1.01
1.01
1.00
3.14
3.04
1.08
1.09
1.01
1.09
3.20
3.20
f1 (ppm)


XMM-II-124-C 500/3
208.86
151.59
150.81
126.20
125.89
109.00
107.44
69.96
55.56
55.55
50.50
28.64
25.87
15.81
10.58
OMe OH
Me
CHO
Me
H
OMe
87
Chemical Formula: C15H22O4
125 MHz, CDCl3
f1 (ppm)

HM-VI-16A-2

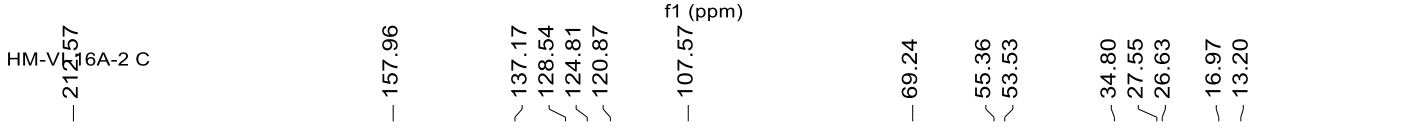


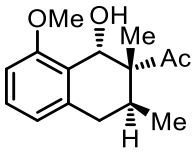


88

Chemical Formula: $C_{15}H_{20}O_3$
500 MHz, $CDCl_3$

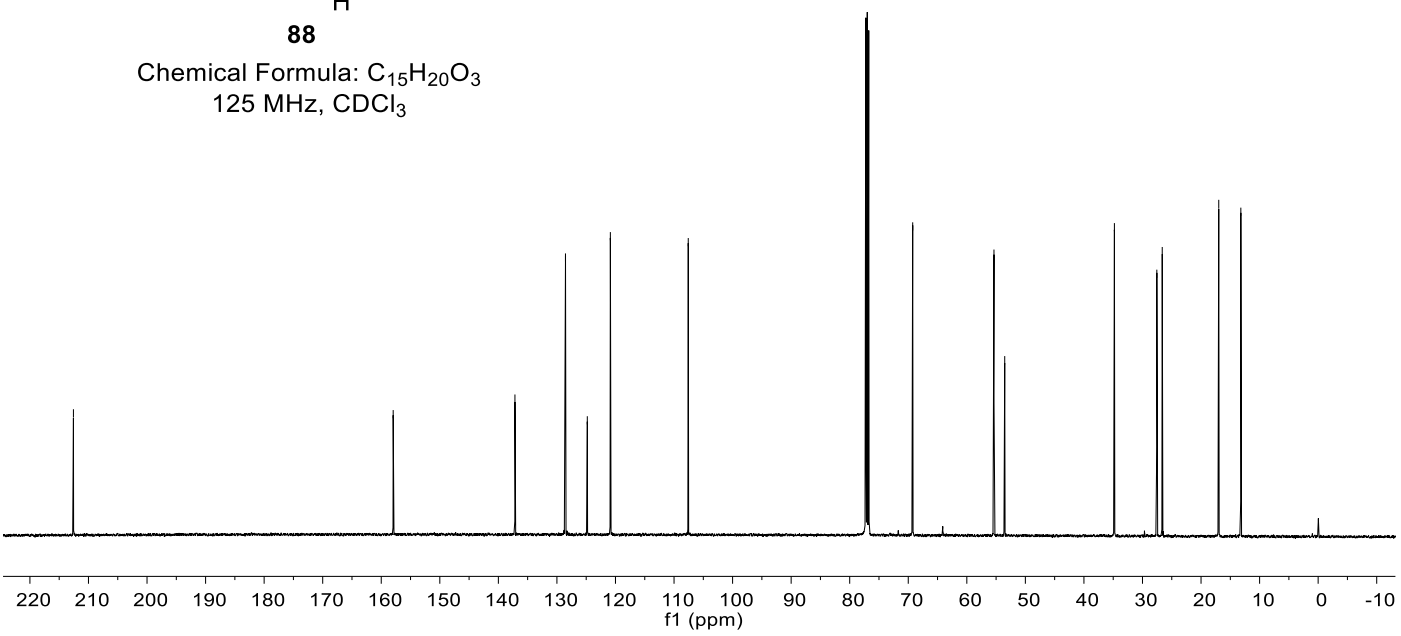
HM-VI-16A-2 C





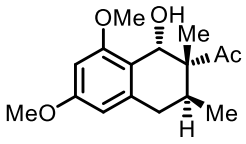
88

Chemical Formula: $C_{15}H_{20}O_3$
125 MHz, $CDCl_3$



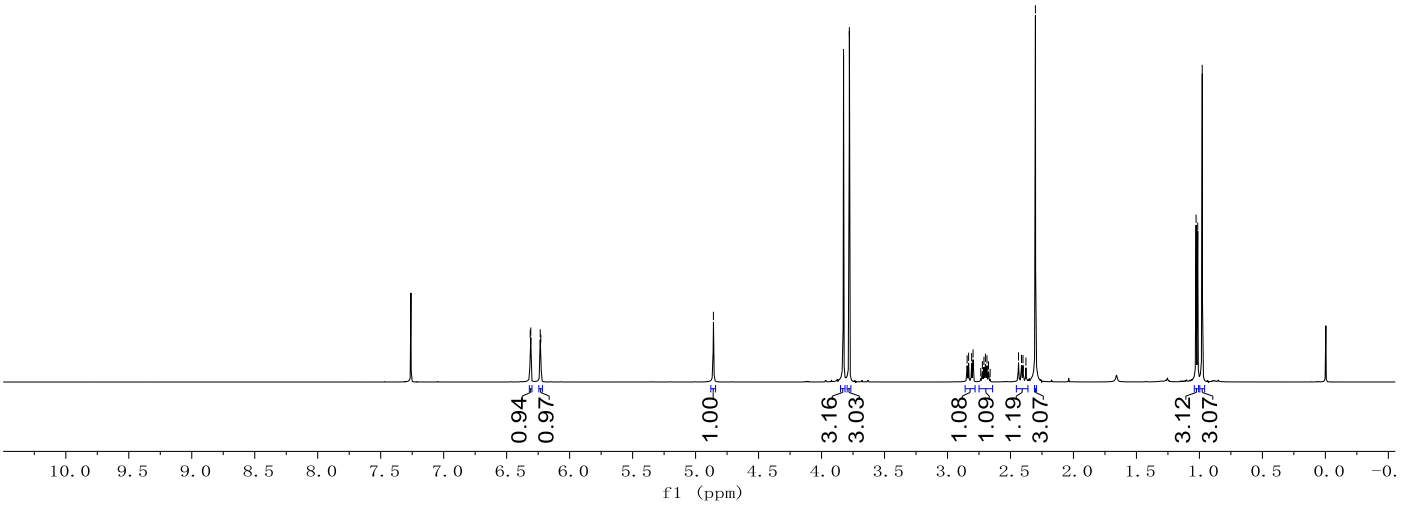
XMM-III-5-HC-500/5

6.31 6.31 6.23 6.23 4.86 3.83 3.78 2.84 2.83 2.81 2.80 2.74 2.72 2.71 2.70 2.69 2.67 2.66 2.44 2.41 2.40 2.38 2.30 1.03 1.01 0.98



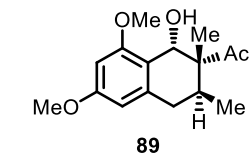
89

Chemical Formula: $C_{16}H_{22}O_4$
500 MHz, $CDCl_3$



XMM-III-5-HC-500/7

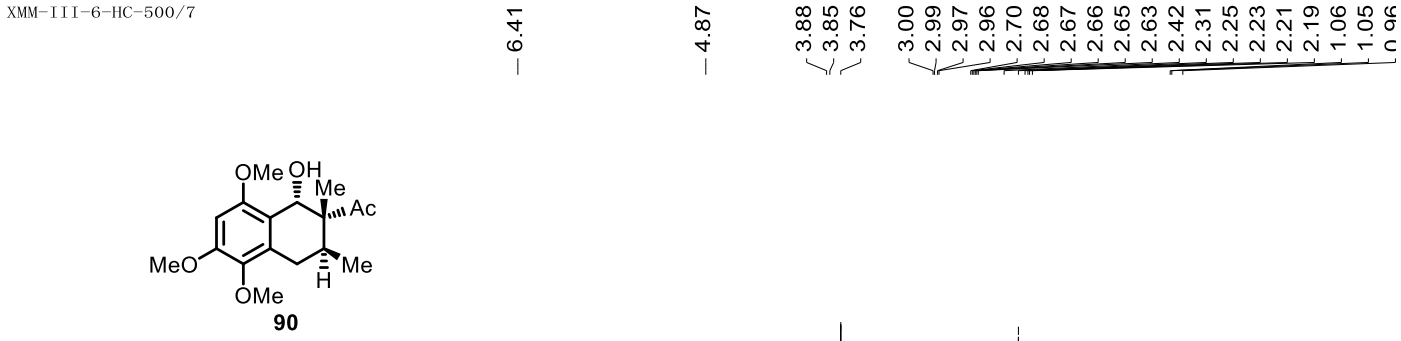
212.45 160.07 159.13 138.12 117.74 103.58 96.50 69.08 55.39 55.25 53.64 35.32 27.40 26.66 16.98 13.23



89

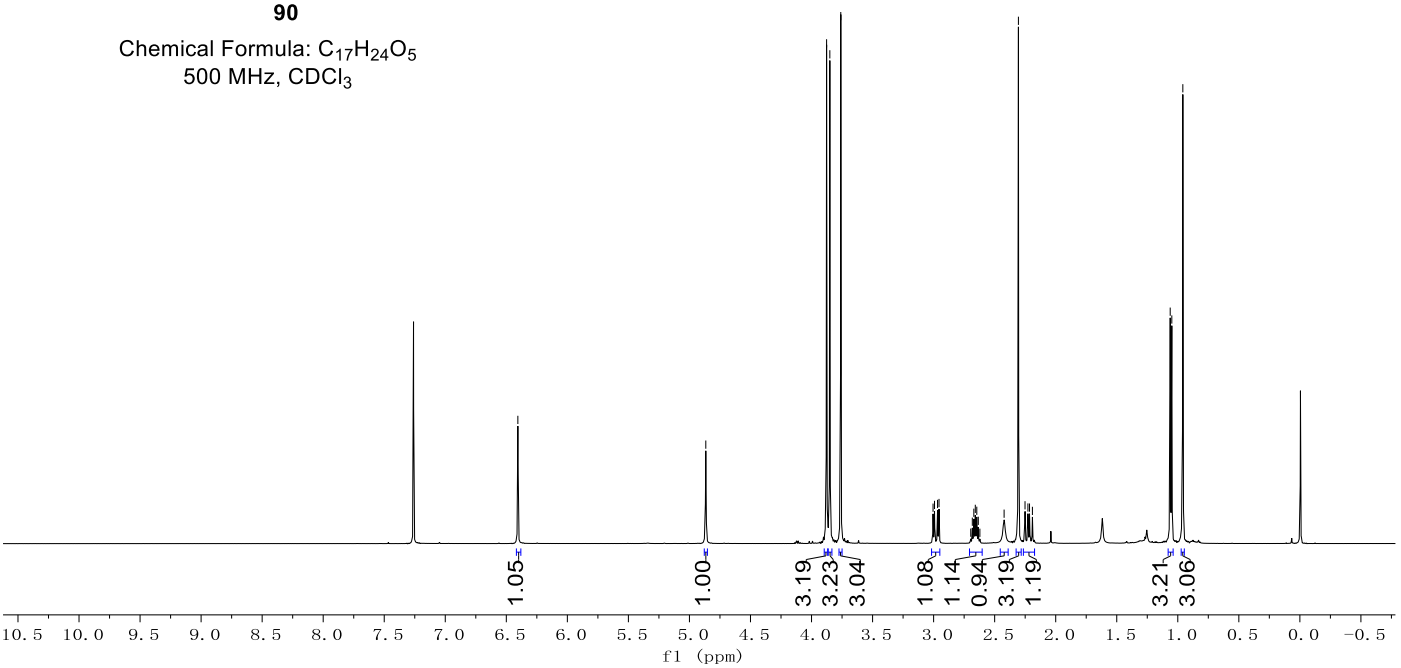
Chemical Formula: $C_{16}H_{22}O_4$
125 MHz, $CDCl_3$

XMM-III-6-HC-500/7

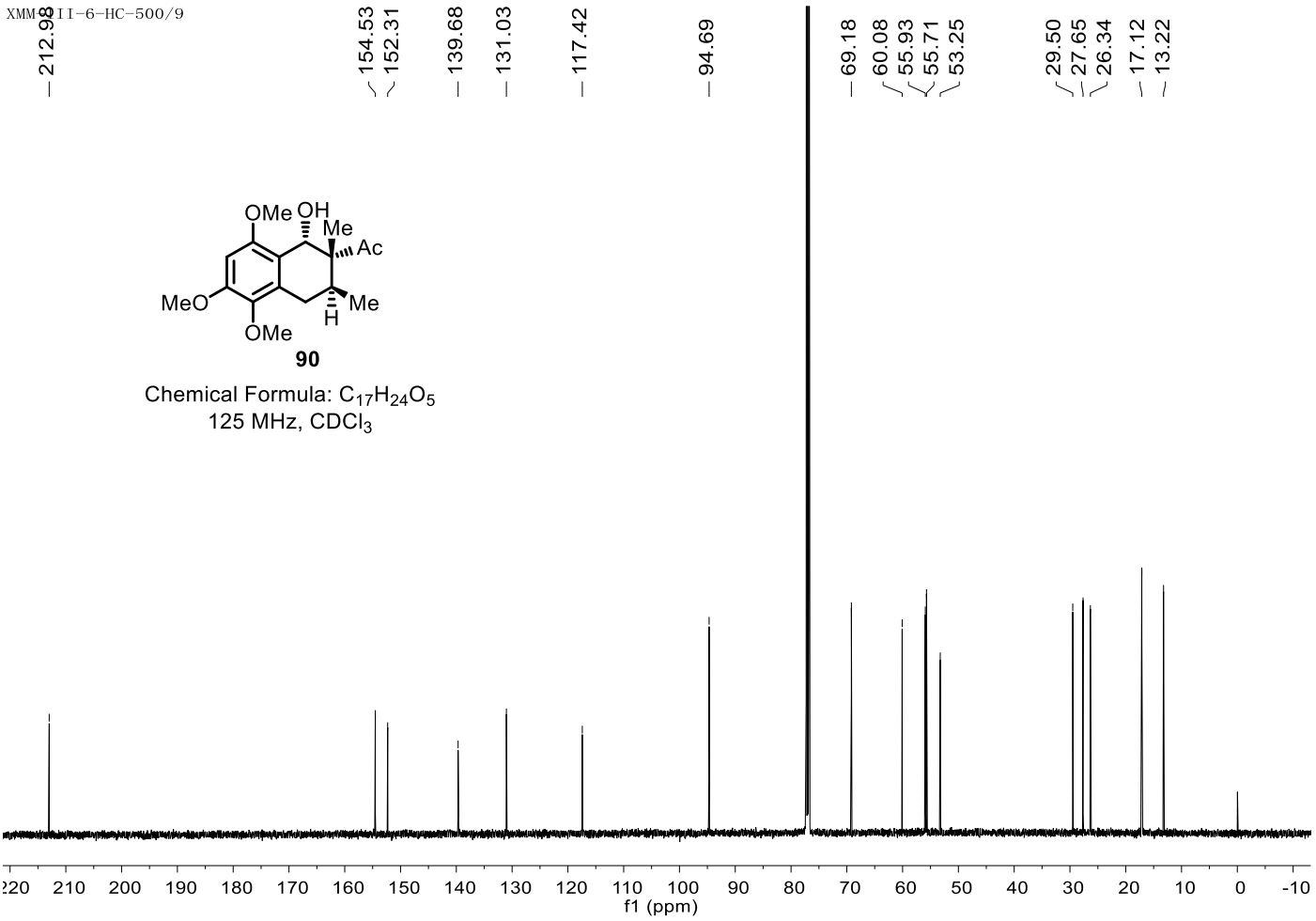


90

Chemical Formula: $C_{17}H_{24}O_5$
500 MHz, $CDCl_3$



XMM-III-6-HC-500/9

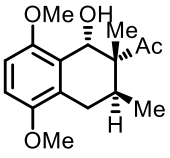


90

Chemical Formula: $C_{17}H_{24}O_5$
125 MHz, $CDCl_3$

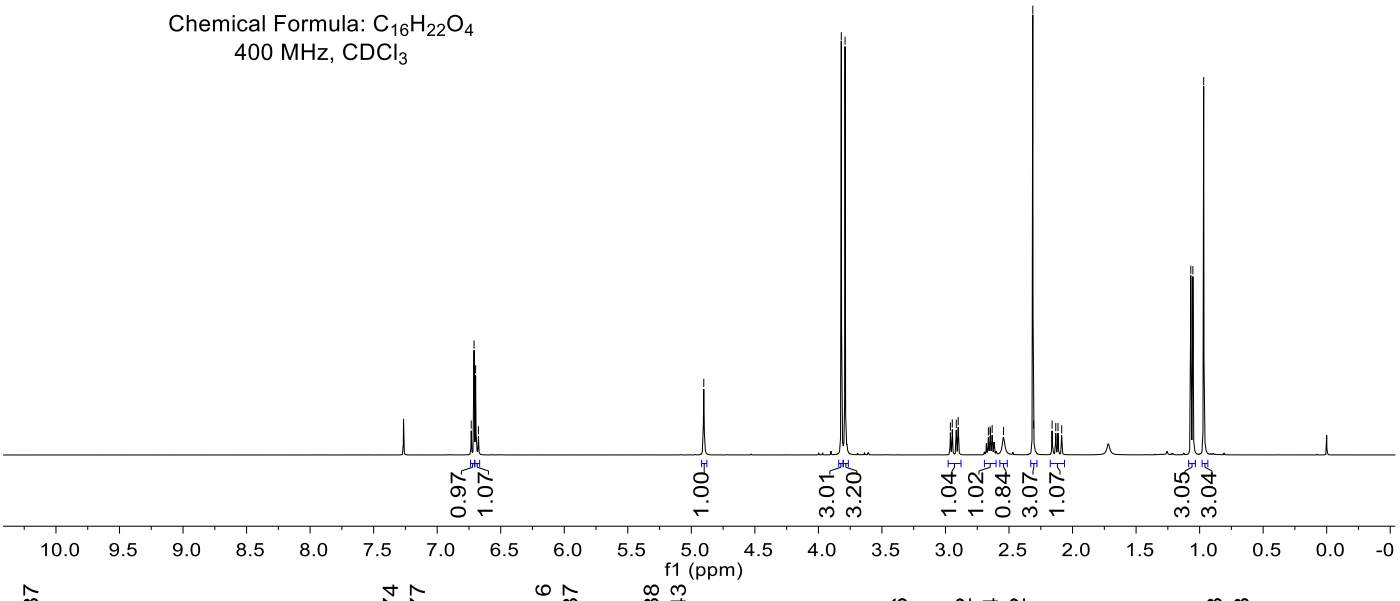
HM-IV-98-1

6.7321
6.7100
6.6976
6.6754
4.9020
3.8198
3.7903
2.9613
2.9464
2.9148
2.9000
2.6624
2.6486
2.6462
2.6326
2.5431
2.3128
2.3064
2.1610
2.1319
2.1145
2.0854
1.0693
1.0530
0.9680



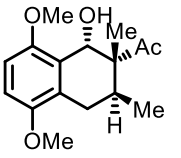
91

Chemical Formula: $C_{16}H_{22}O_4$
400 MHz, $CDCl_3$



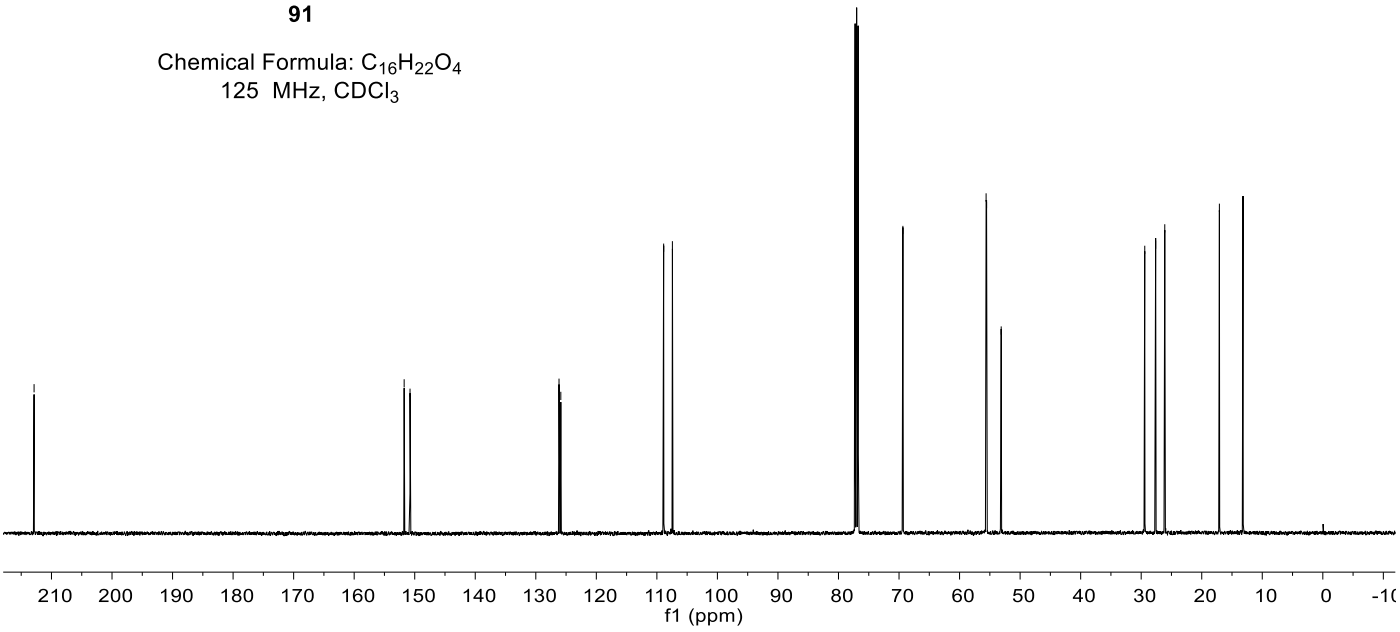
HM-IV-98-1 C

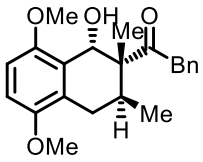
212.87
151.74
150.77
126.16
125.87
108.88
107.43
69.36
55.62
55.54
53.12
29.41
27.61
26.11
17.08
13.18



91

Chemical Formula: $C_{16}H_{22}O_4$
125 MHz, $CDCl_3$

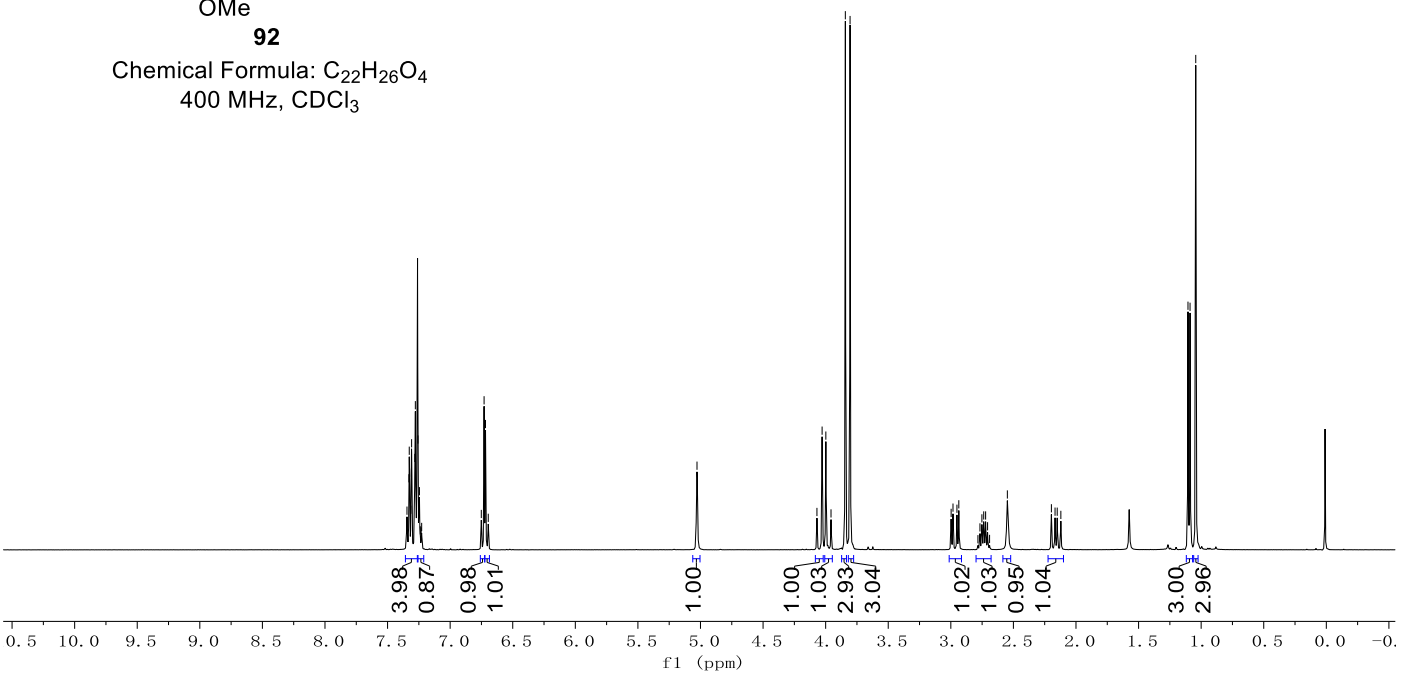




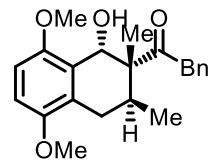
92

Chemical Formula: $C_{22}H_{26}O_4$

400 MHz, $CDCl_3$



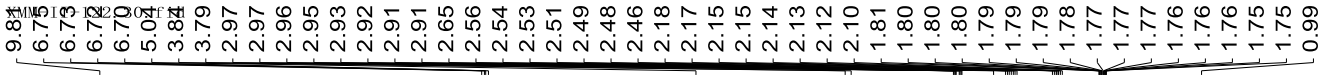
XMM-II-113-HC 400.11.fid

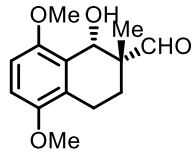


92

Chemical Formula: $C_{22}H_{26}O_4$

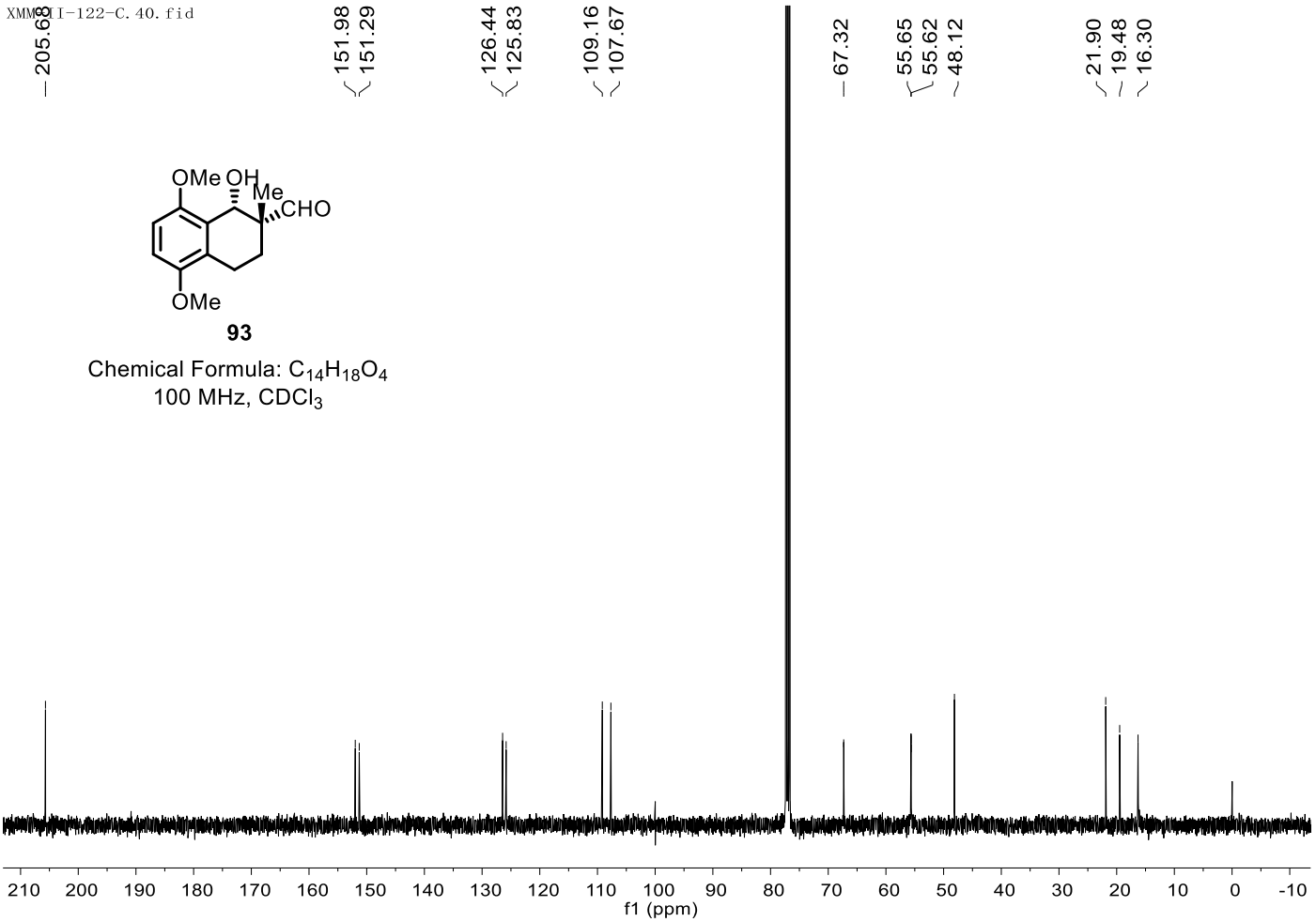
100 MHz, $CDCl_3$





93

Chemical Formula: $C_{14}H_{18}O_4$
400 MHz, $CDCl_3$

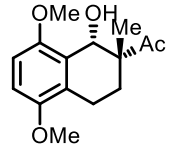


93

Chemical Formula: $C_{14}H_{18}O_4$
100 MHz, $CDCl_3$

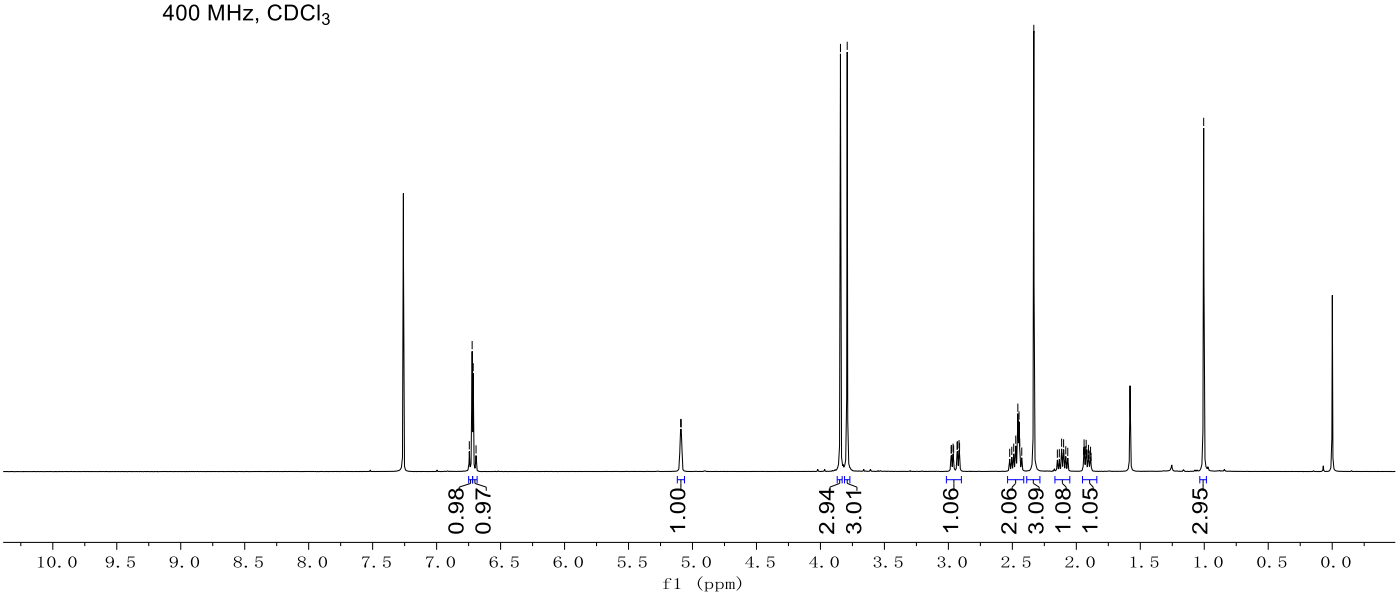
XMM-II-123.40.fid

6.74 6.72 6.71 6.69 5.09 5.09 3.84 3.79 2.98 2.97 2.96 2.96 2.93 2.93 2.92 2.91 2.52 2.50 2.49 2.47 2.46 2.45 2.44 2.43 2.33 2.15 2.13 2.11 2.10 2.08 2.07 1.94 1.94 1.94 1.93 1.92 1.92 1.91 1.91 1.90 1.89 1.89 1.88 1.00



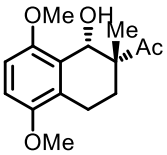
94

Chemical Formula: $C_{15}H_{20}O_4$
400 MHz, $CDCl_3$



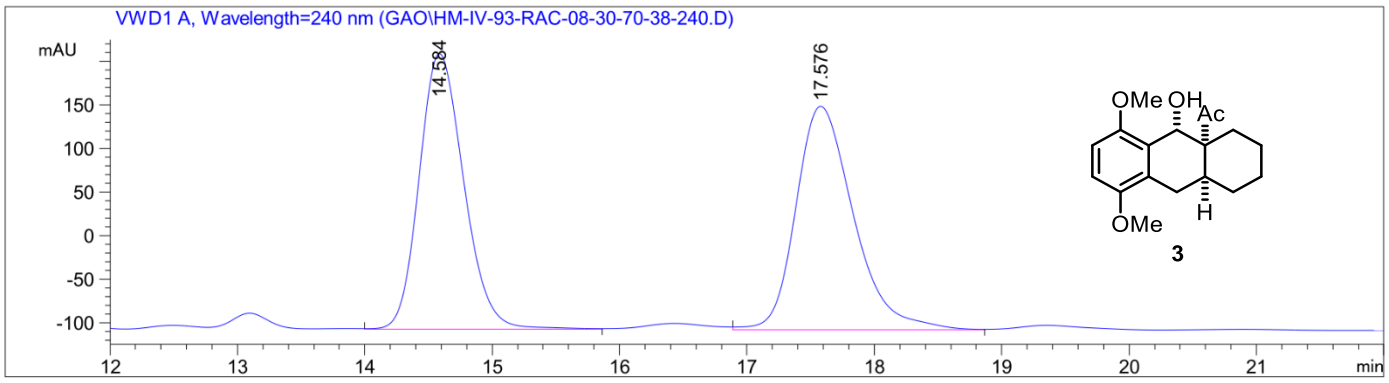
xmm-II-123-C 400.20.fid

212.76 152.03 151.24 126.24 125.99 109.04 107.56 67.40 55.65 55.60 49.88 25.57 22.31 20.05 18.17

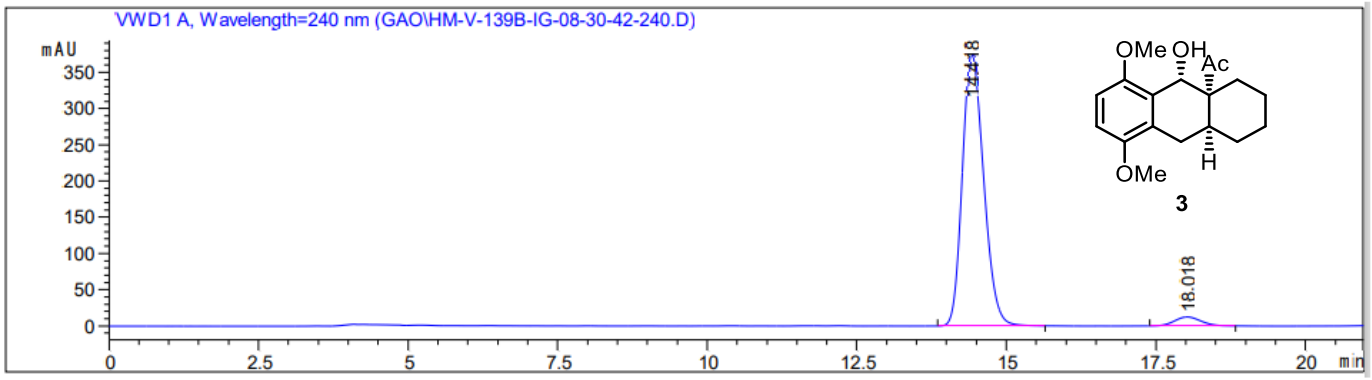


94

Chemical Formula: $C_{15}H_{20}O_4$
100 MHz, $CDCl_3$

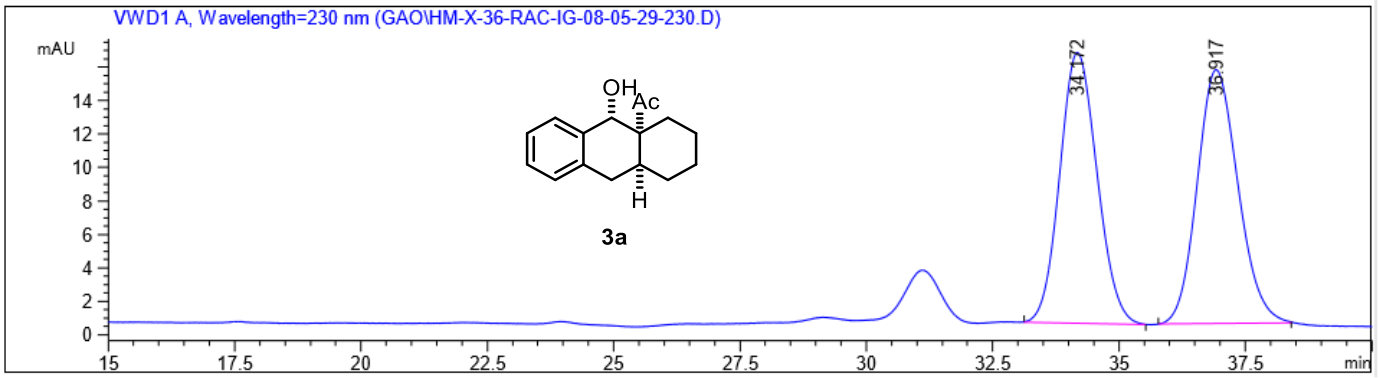


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.584	VV	0.3786	7742.40674	316.42886	48.9214
2	17.576	VV	0.4844	8083.81689	256.30850	51.0786

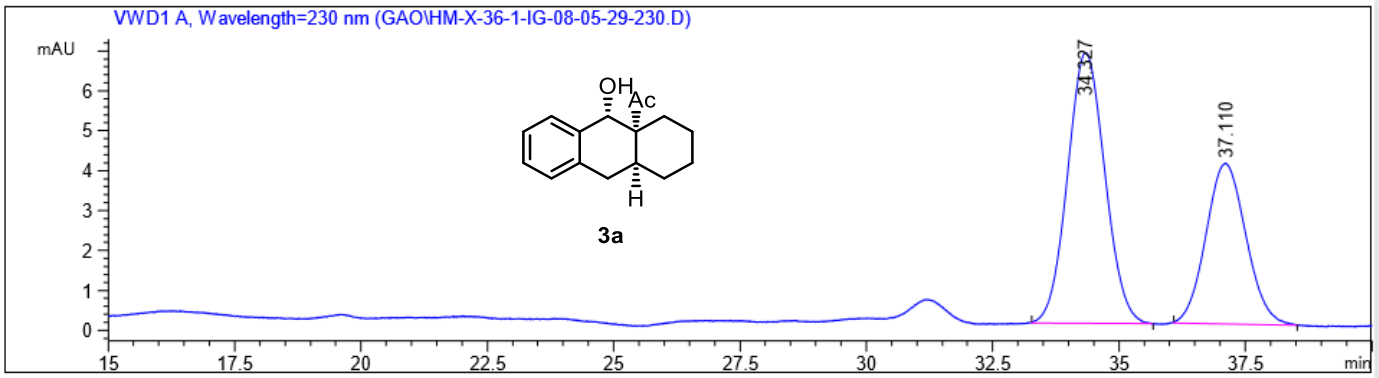


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.418	BB	0.3888	9327.41992	375.53195	96.0662
2	18.018	BB	0.4689	381.95126	12.38961	3.9338

Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 240 nm): t_R = 14.419min (major), t_R = 18.018 min (minor).

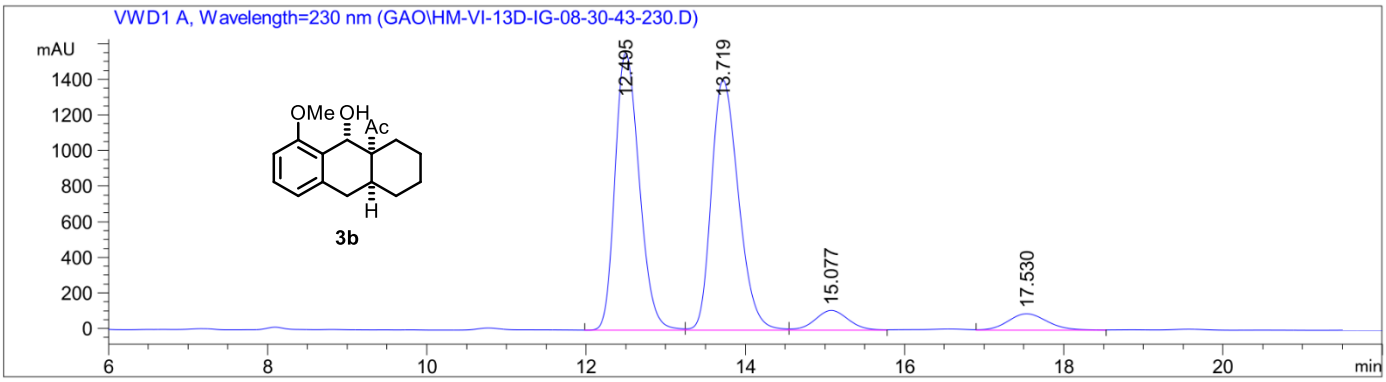


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	34.172	BB	0.6182	831.04413	16.17837	49.3291
2	36.917	BB	0.6667	853.65051	15.18756	50.6709

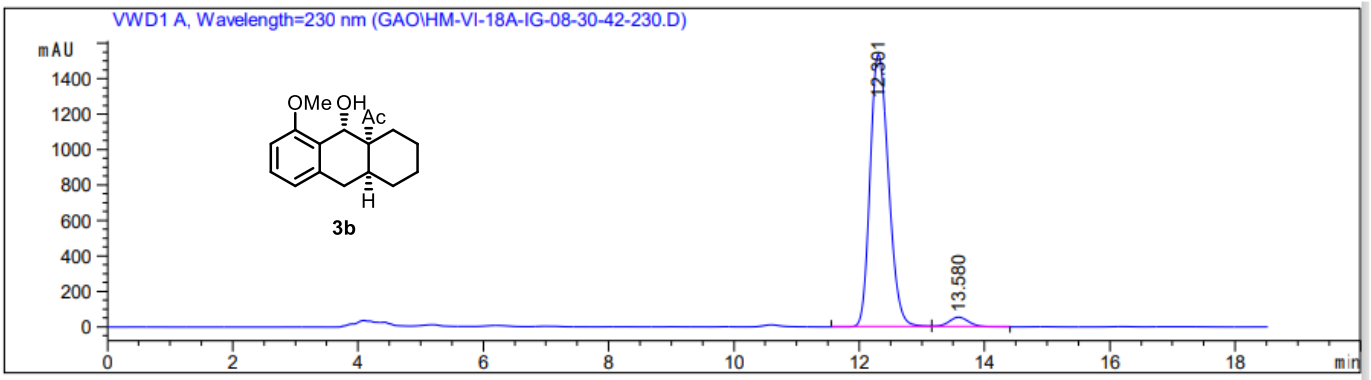


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	34.327	BB	0.6075	348.75992	6.77919	61.1792
2	37.110	BB	0.6503	221.30283	4.02006	38.8208

Enantiomeric excess: 22%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 ºC, 240 nm): t_R = 34.327min (major), t_R = 37.110 min (minor).

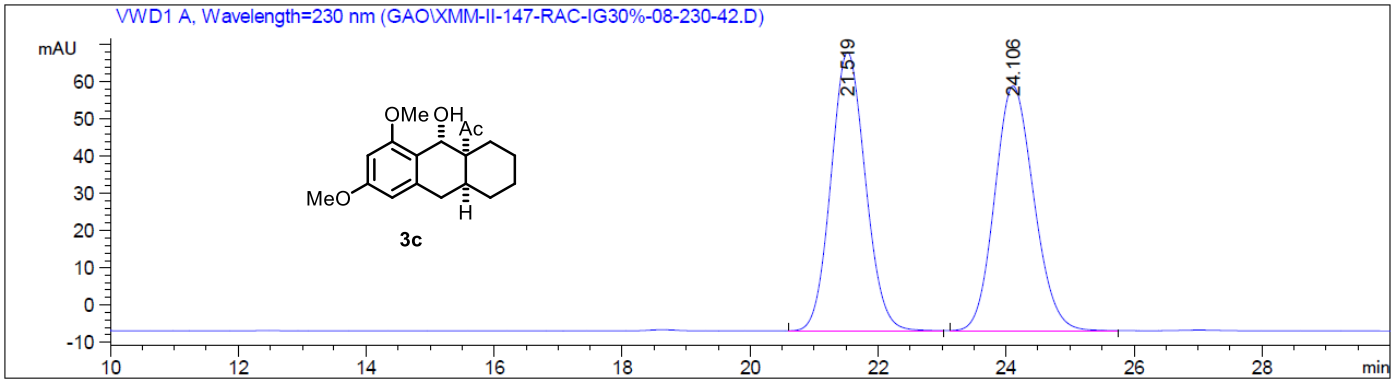


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.495	VV	0.3344	3.29942e4	1558.34326	45.2059
2	13.719	VV	0.3698	3.33606e4	1406.79871	45.7078
3	15.077	VV	0.4589	3318.84814	112.12900	4.5472
4	17.530	VV	0.5415	3312.96265	93.49844	4.5391

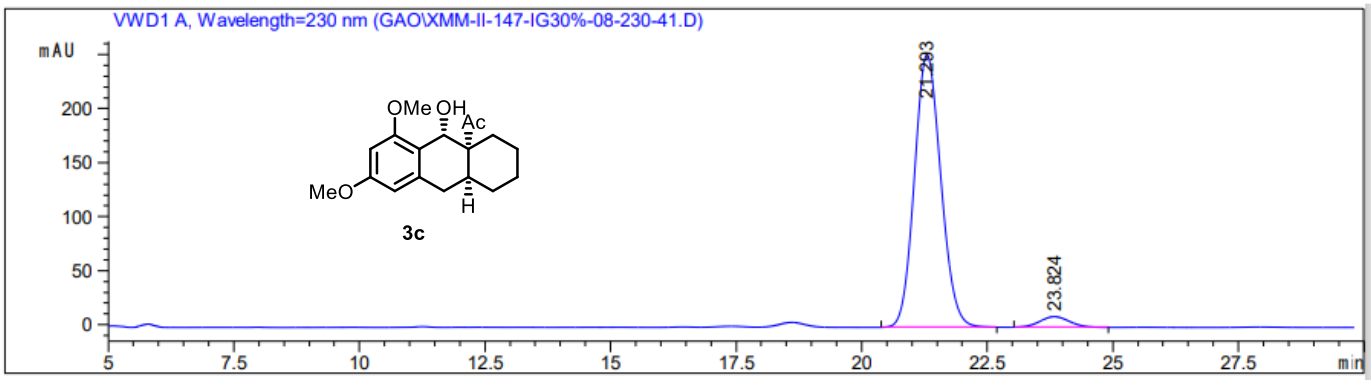


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.301	BV	0.3199	3.14012e4	1537.19604	96.1887
2	13.580	VB	0.3478	1244.21631	54.81236	3.8113

Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 12.301min (major), t_R = 13.580 min (minor).

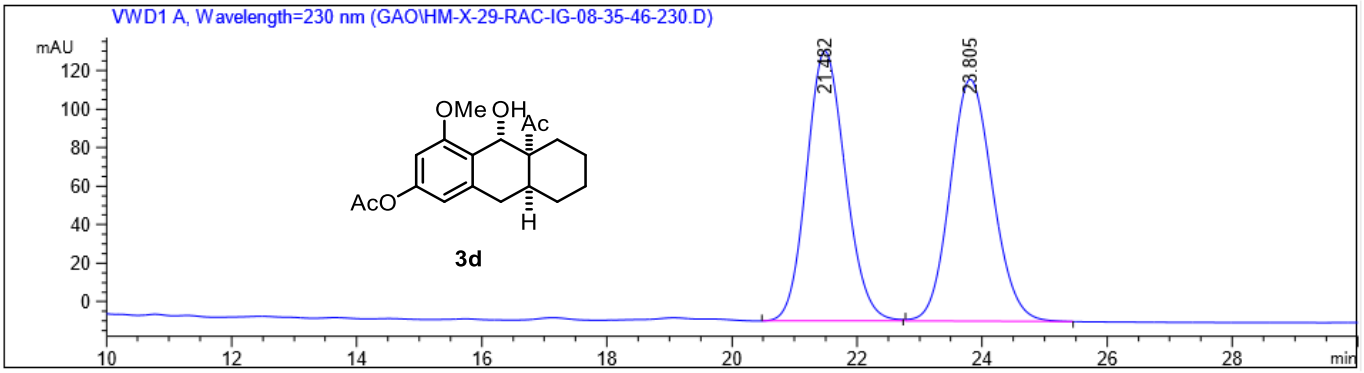


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	21.519	BB	0.5815	2794.86011	74.79503	49.9747
2	24.106	BB	0.6597	2797.69116	65.72850	50.0253

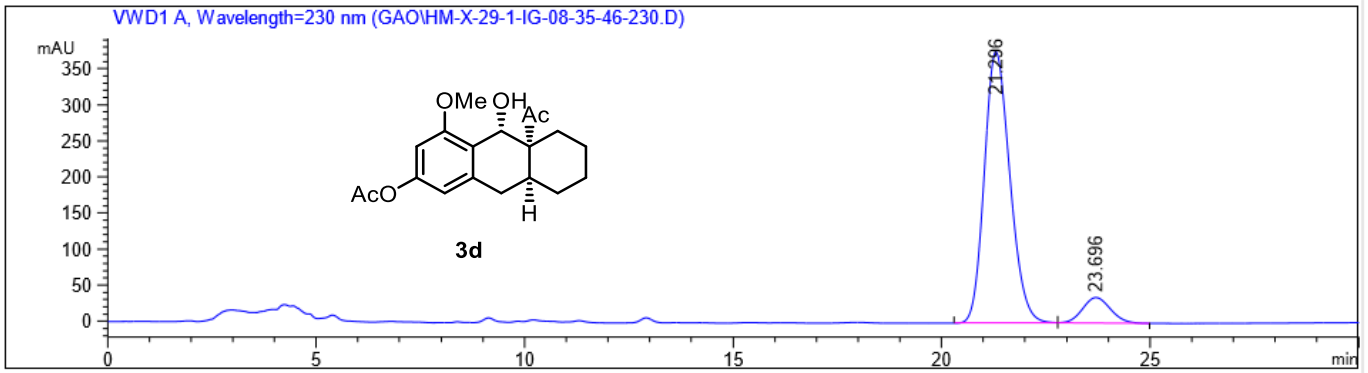


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	21.293	BB	0.5708	9231.90332	252.00615	95.7885
2	23.824	BB	0.5332	405.89114	9.85000	4.2115

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 21.293 min (major), t_R = 23.830 min (minor).

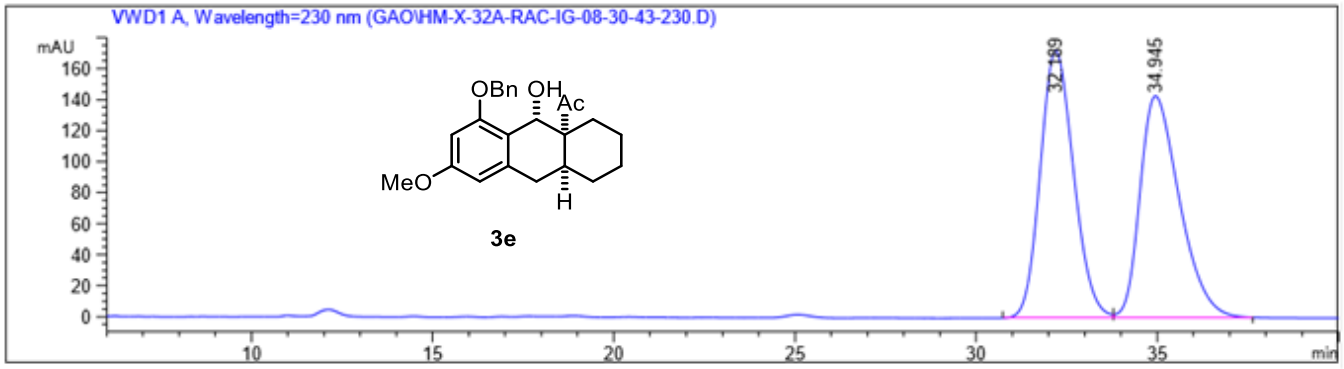


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	21.482	BB	0.6667	6054.22070	140.23820	50.3307
2	23.805	BB	0.7373	5974.65332	125.68867	49.6693

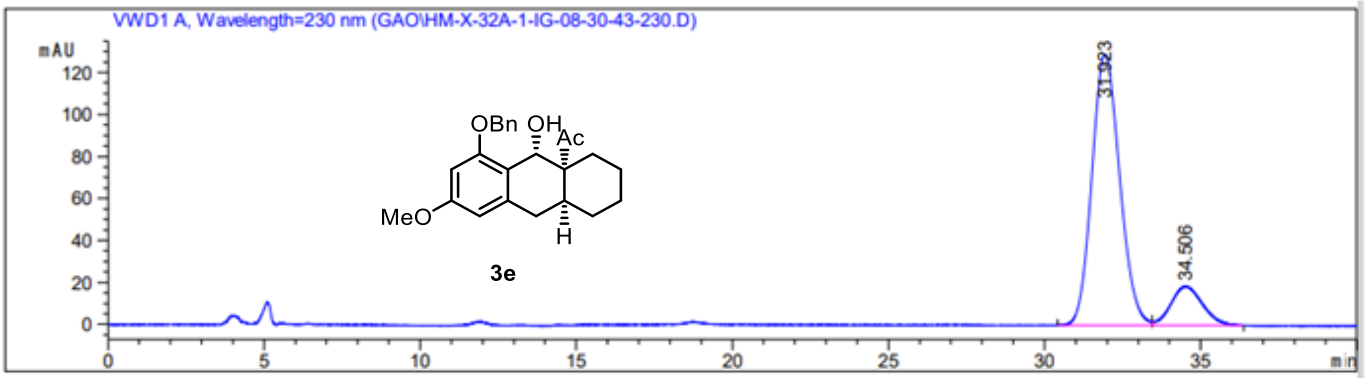


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	21.296	BB	0.6510	1.60832e4	376.11768	90.4950
2	23.696	BB	0.6746	1689.27344	35.68293	9.5050

Enantiomeric excess: 81%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 65/35, flow rate 0.8 mL/min, T = 25 ºC, 240 nm): t_R = 21.296min (major), t_R = 23.696 min (minor).

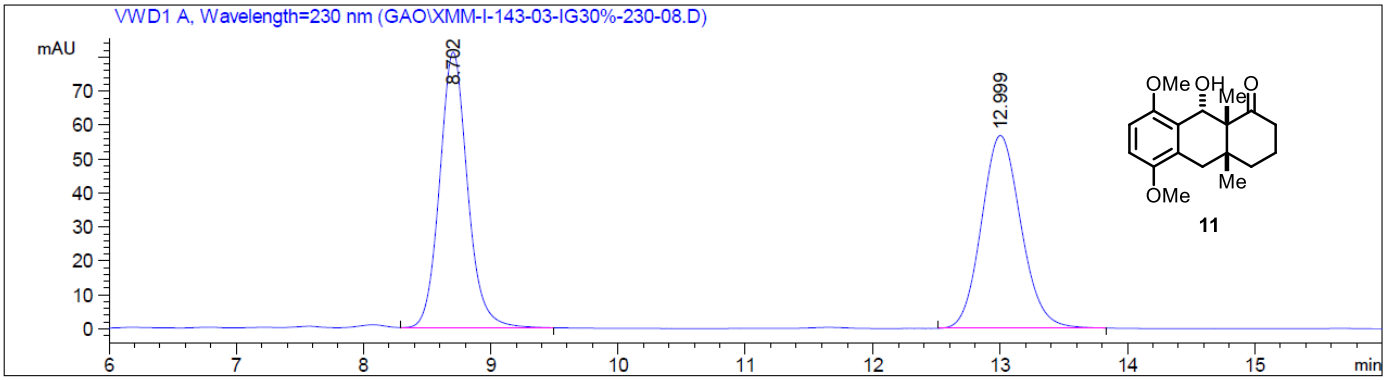


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	32.189	BV	0.9815	1.10193e4	172.08437	50.4288
2	34.945	VB	1.1202	1.08319e4	142.89584	49.5712

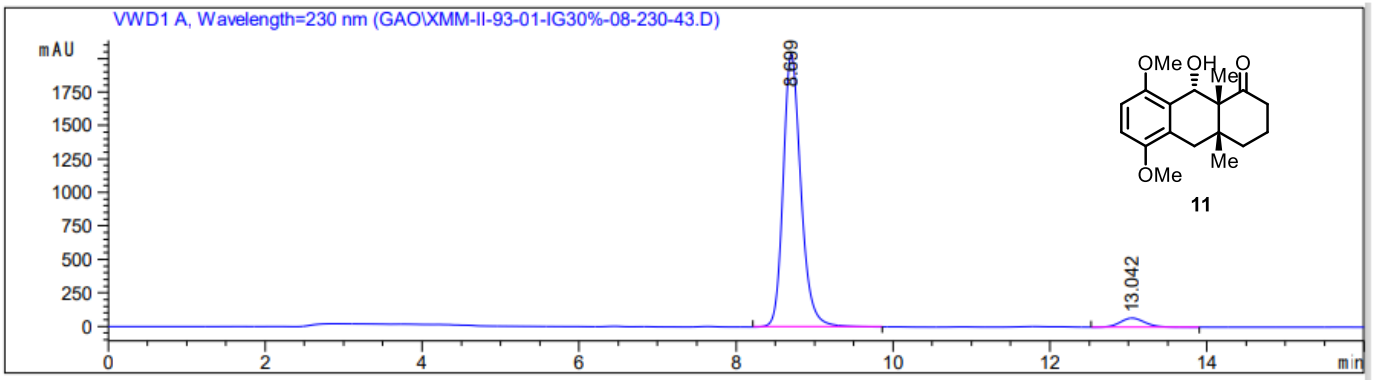


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	31.923	VV	0.8041	7986.17139	128.95233	85.8895
2	34.506	VB	0.8312	1312.02454	18.57775	14.1105

Enantiomeric excess: 72%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 31.923 min (major), t_R = 34.506 min (minor).

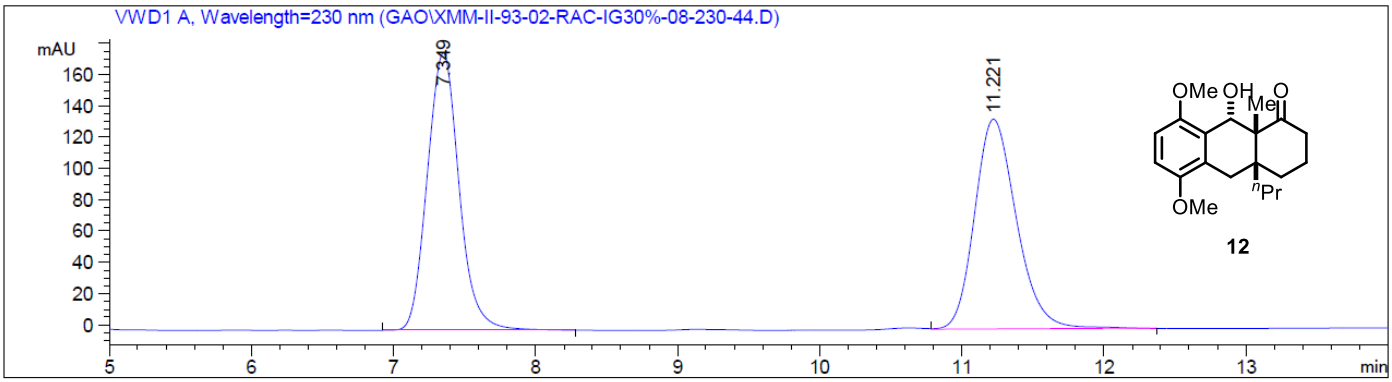


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.702	VB	0.2326	1239.49573	81.24094	50.2443
2	12.999	BB	0.3336	1227.44226	56.80318	49.7557

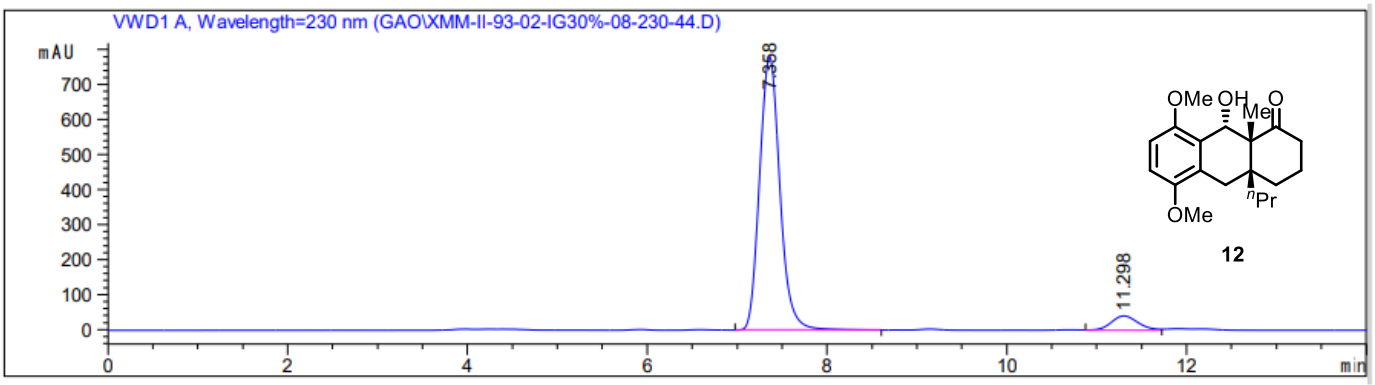


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.699	VV	0.2402	3.20545e4	2038.73926	95.6176
2	13.042	VB	0.3324	1469.15637	67.53069	4.3824

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.699 min (major), t_R = 13.042 min (minor).

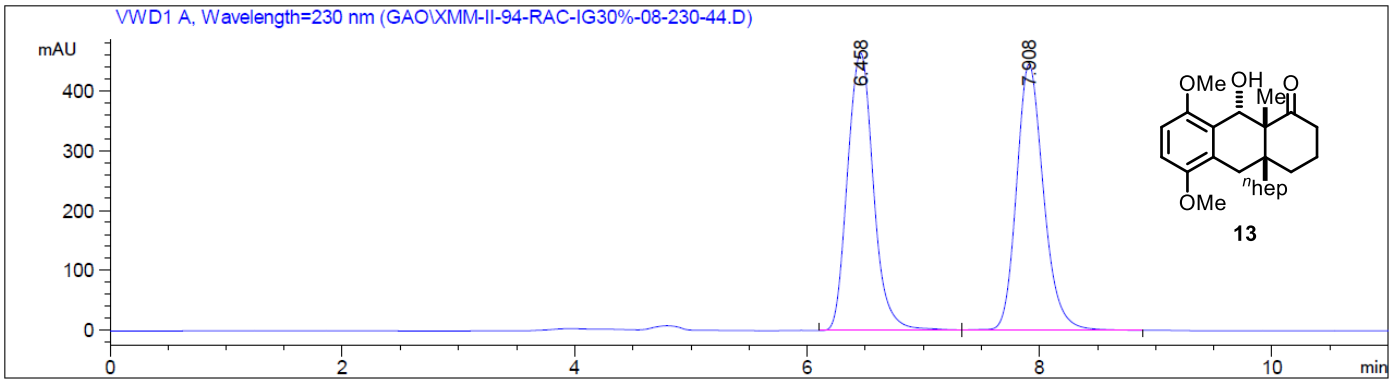


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.349	BB	0.2444	2761.93896	177.22623	49.9978
2	11.221	VB	0.3157	2762.17798	134.29800	50.0022

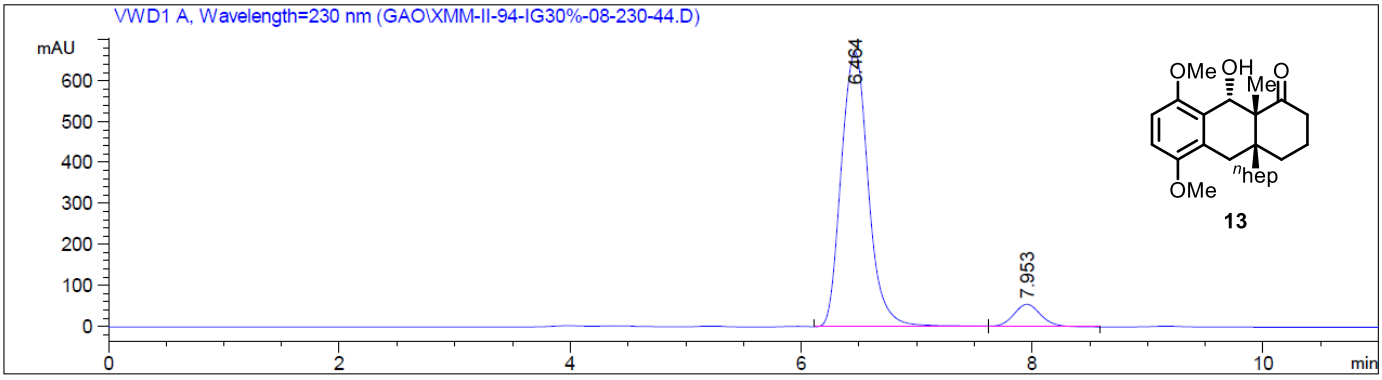


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.358	VB	0.2471	1.23142e4	781.64874	93.4949
2	11.298	VV	0.3224	856.78107	41.12295	6.5051

Enantiomeric excess: 87%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 7.358 min (major), t_R = 11.298 min (minor).

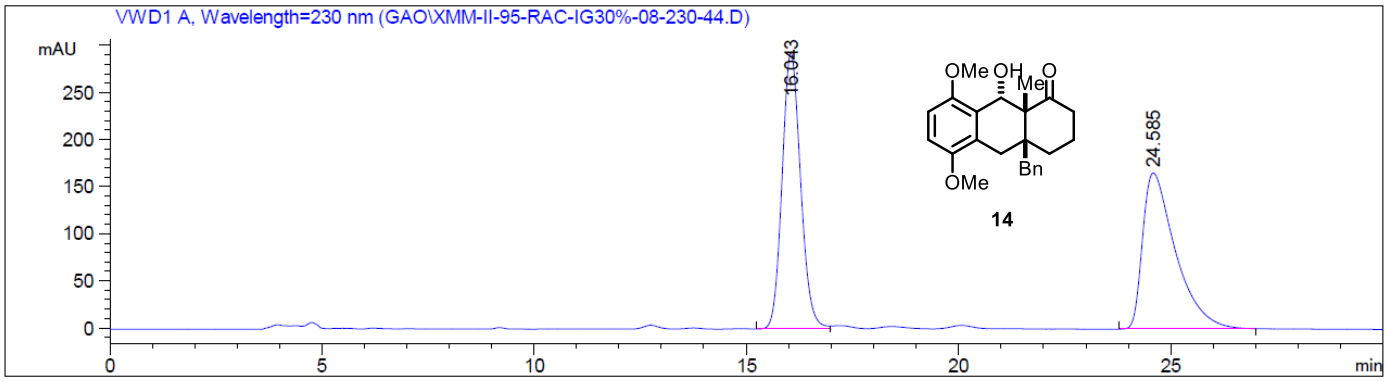


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.458	VV	0.2461	7266.35498	465.60486	49.9458
2	7.908	VB	0.2498	7282.11377	446.86960	50.0542

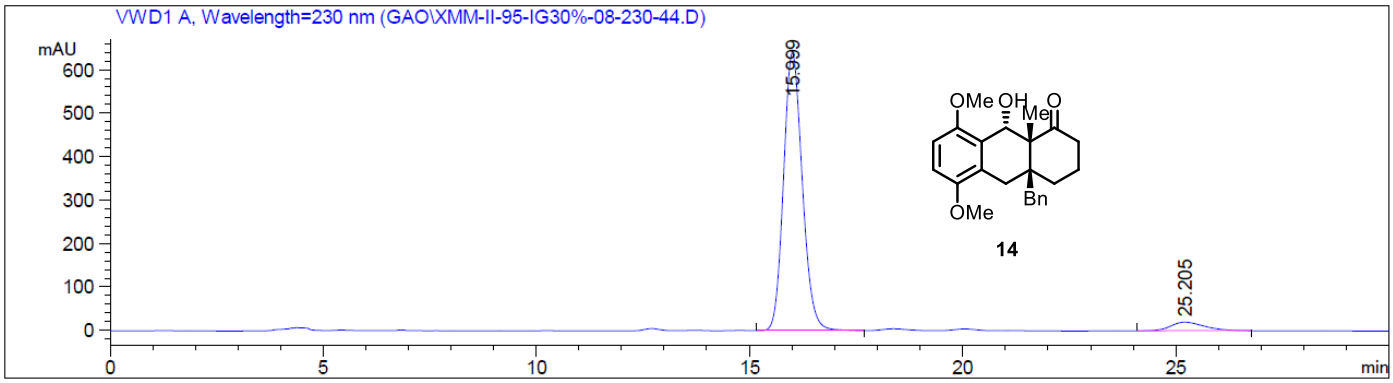


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.464	VV	0.2594	1.10486e4	672.37842	92.2692
2	7.953	VB	0.2562	925.70123	55.36491	7.7308

Enantiomeric excess: 85%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 6.464 min (major), t_R = 7.953 min (minor).

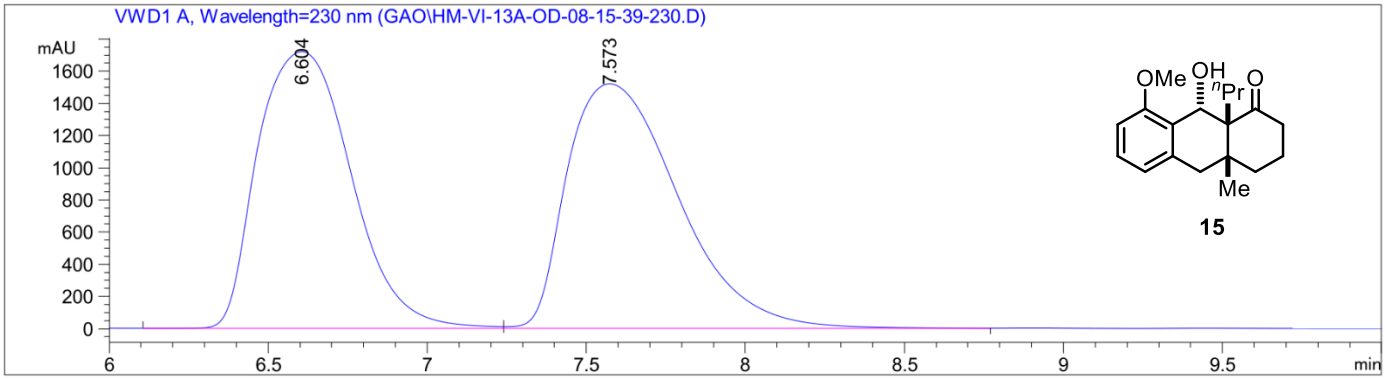


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	16.043	VB	0.4683	8903.23438	293.39984	49.9186
2	24.585	BB	0.7873	8932.26660	165.78864	50.0814

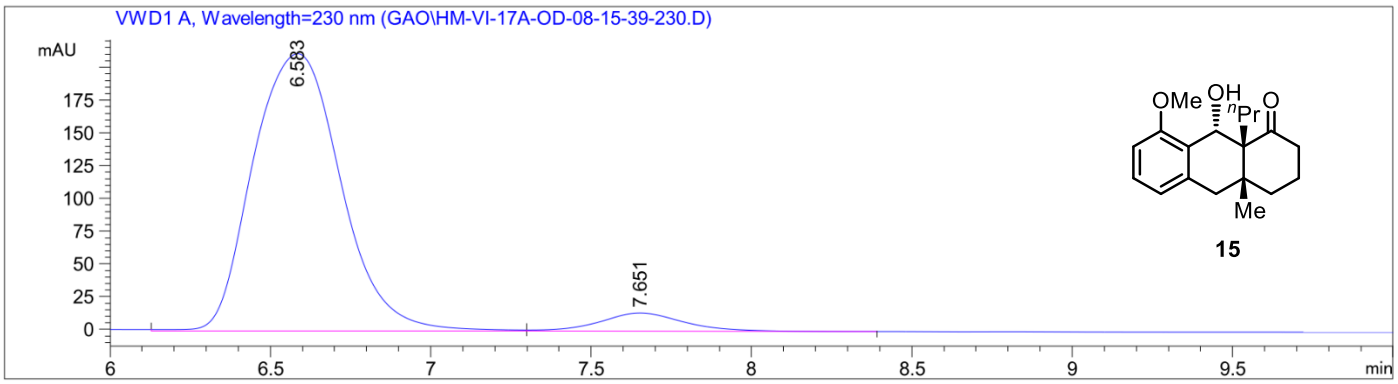


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.999	VB	0.4744	1.96450e4	640.25769	94.6324
2	25.205	BB	0.7685	1114.28162	20.00558	5.3676

Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 15.999 min (major), t_R = 25.205 min (minor).

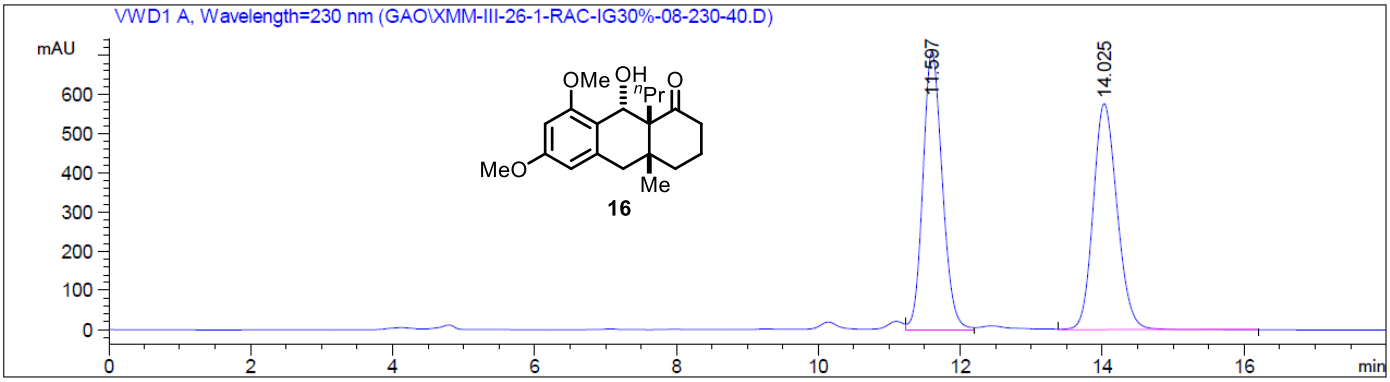


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.604	VV	0.3362	3.54479e4	1722.24304	48.7037
2	7.573	VV	0.3909	3.73349e4	1522.50806	51.2963

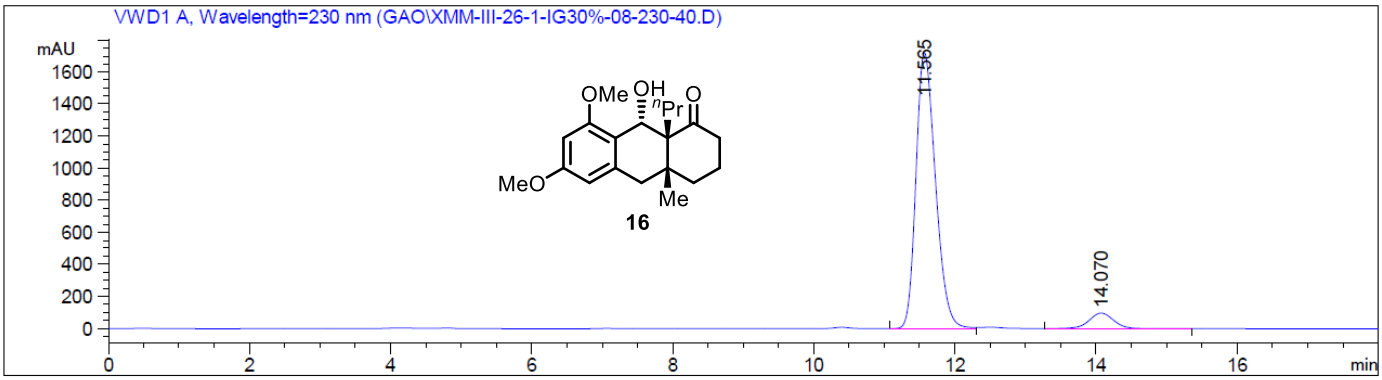


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.583	VV	0.3105	4049.63037	211.77802	93.8295
2	7.651	VB	0.2814	266.31747	14.10828	6.1705

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 6.583min (major), t_R = 7.651 min (minor).

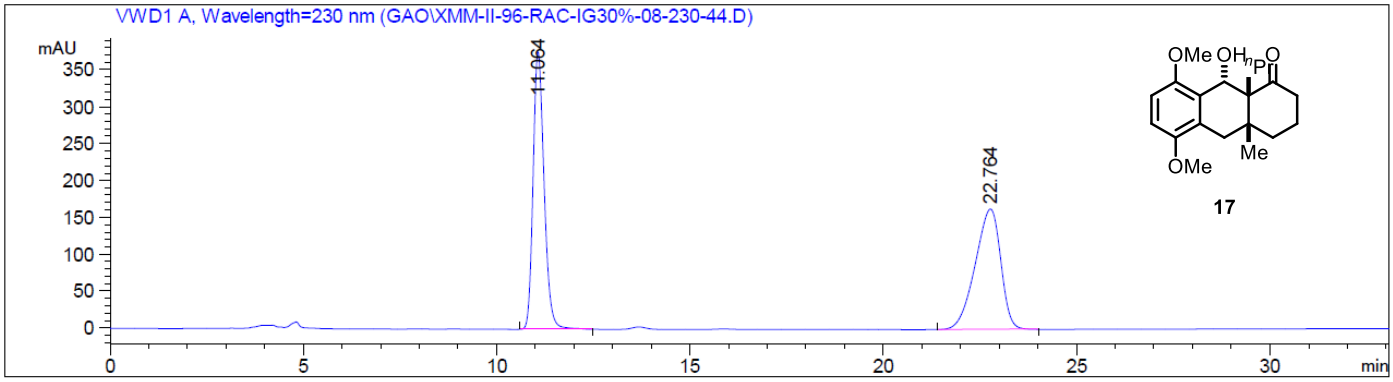


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.597	VV	0.2976	1.34634e4	707.95532	49.8411
2	14.025	VB	0.3614	1.35492e4	576.73859	50.1589

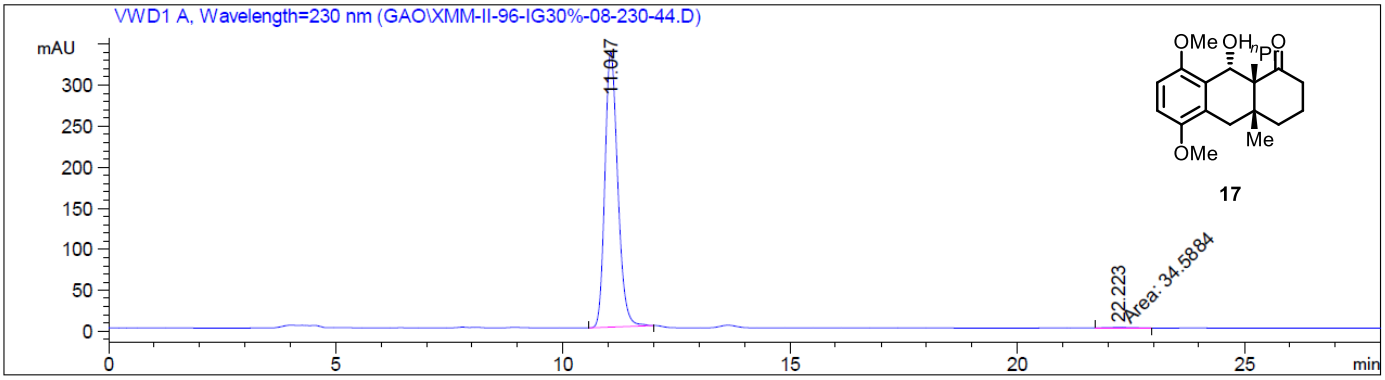


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.565	VV	0.2942	3.30865e4	1720.99097	93.3149
2	14.070	VB	0.3776	2370.34595	97.23190	6.6851

Enantiomeric excess: 87%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 10.241 min (minor), t_R = 13.851 min (major).

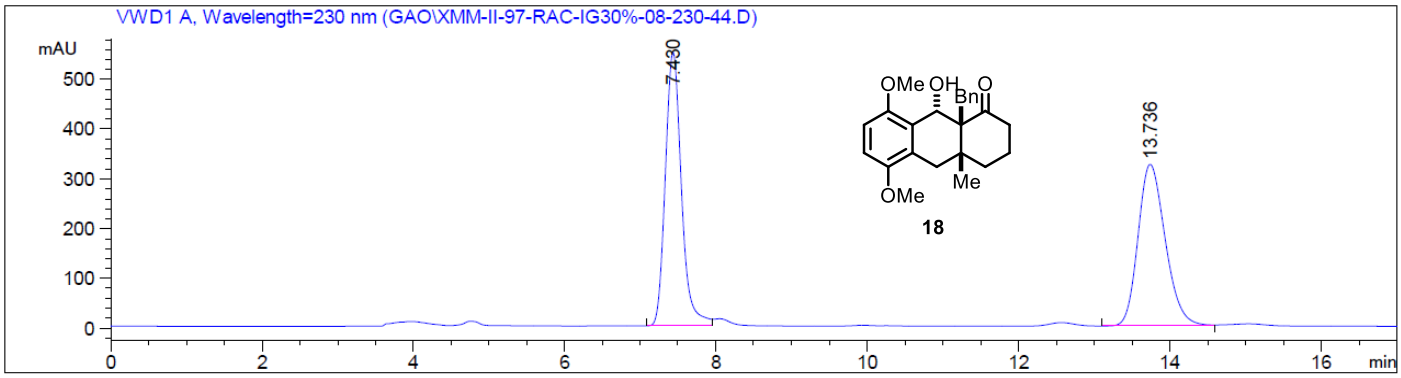


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.064	BB	0.3046	7447.39893	376.04016	49.8076
2	22.764	BB	0.7081	7504.94775	163.25385	50.1924

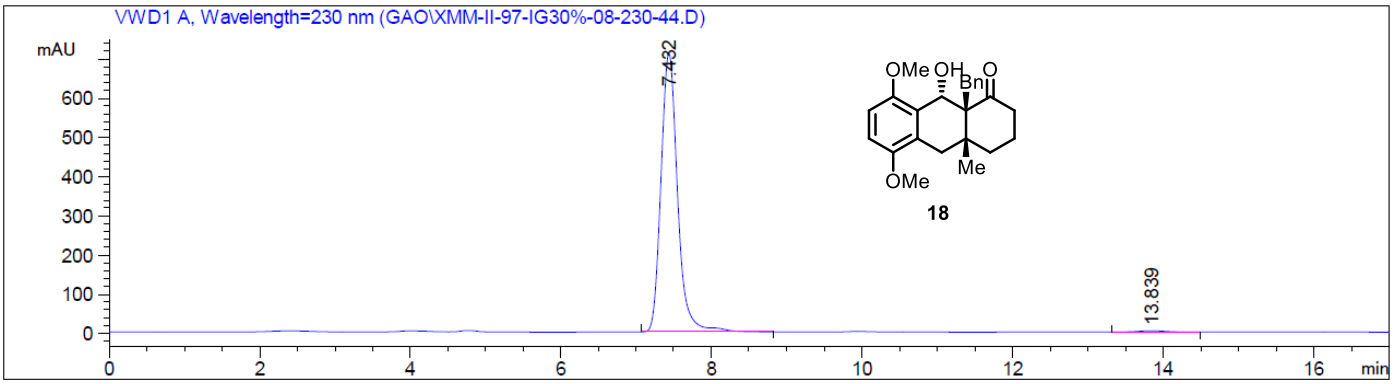


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.047	BB	0.3024	6609.92529	335.87555	99.4794
2	22.223	MM	0.7453	34.58845	7.73501e-1	0.5206

Enantiomeric excess: 99%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.047 min (major), t_R = 22.223 min (minor).

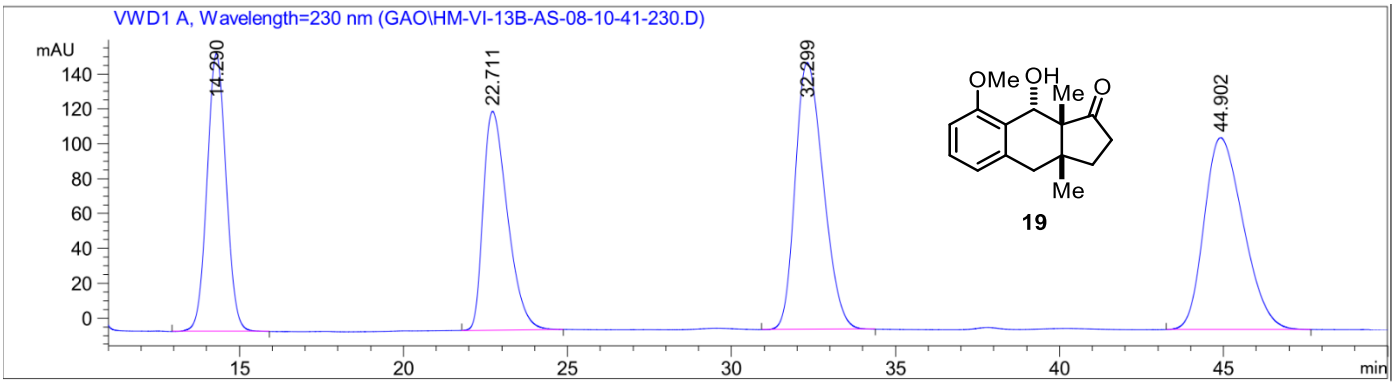


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.430	VV	0.2296	8182.88623	550.22595	50.0690
2	13.736	VV	0.3889	8160.32617	325.18521	49.9310

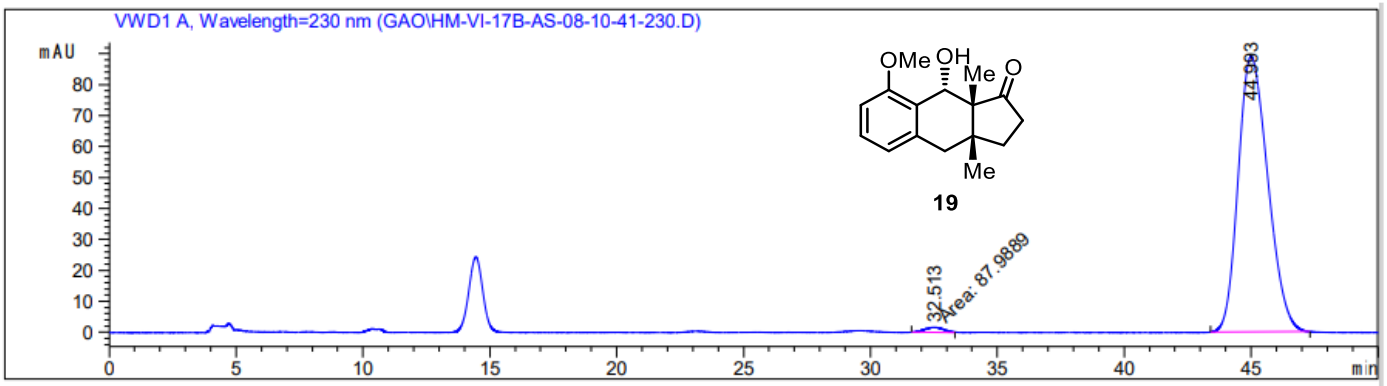


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.432	BB	0.2369	1.08857e4	710.78900	99.2580
2	13.839	BB	0.3317	81.37498	3.27091	0.7420

Enantiomeric excess: 99%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 7.432 min (major), t_R = 13.839 min (minor).

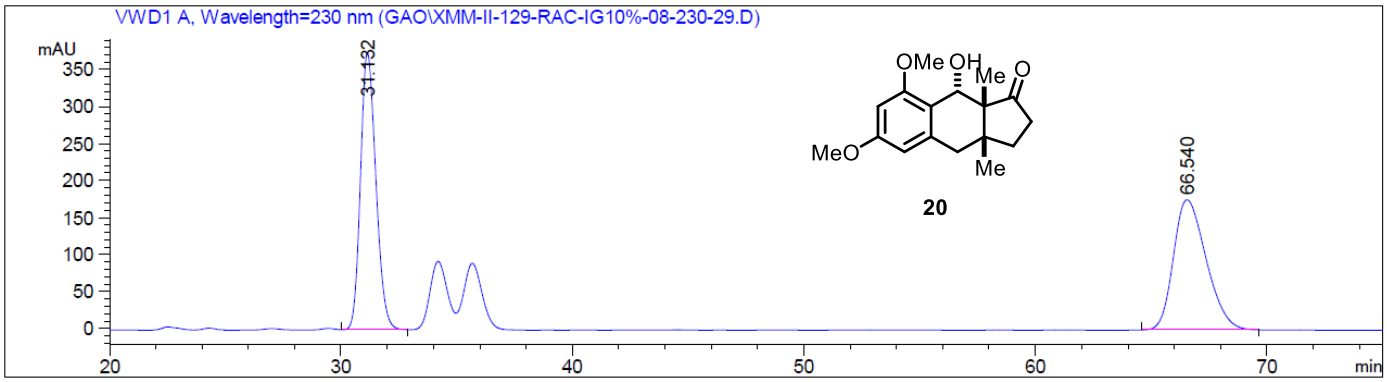


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.290	VB	0.6318	6440.63379	159.32704	20.6731
2	22.711	BB	0.7958	6467.65430	125.61745	20.7598
3	32.299	VB	0.9326	9104.18652	153.09525	29.2225
4	44.902	BB	1.2984	9142.24902	110.03580	29.3447

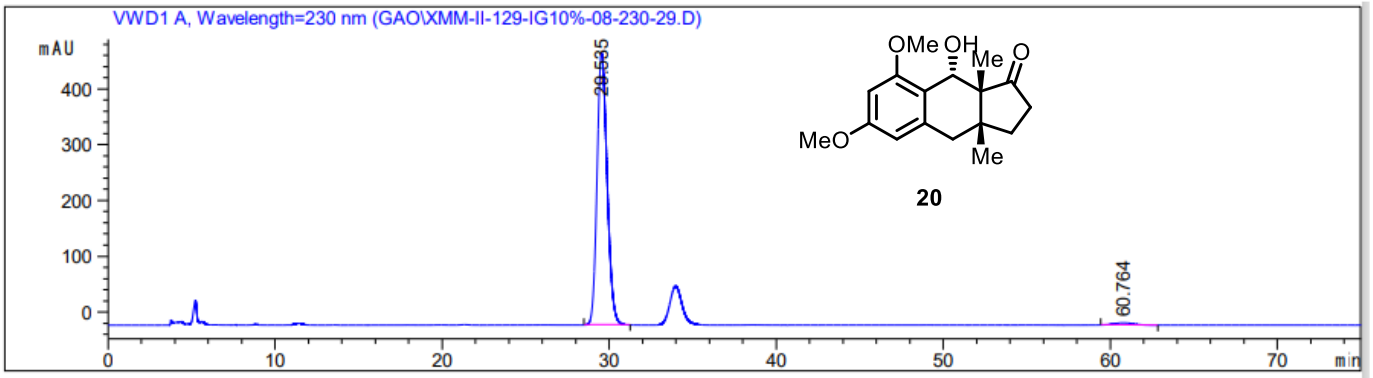


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	32.513	MM	0.8882	87.98892	1.65107	1.1990
2	44.993	BB	1.1531	7250.47559	89.11454	98.8010

Enantiomeric excess: 98%, determined by HPLC (Daicel Chiralpak AS-H, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 32.496 min (minor), t_R = 44.993 min (major).

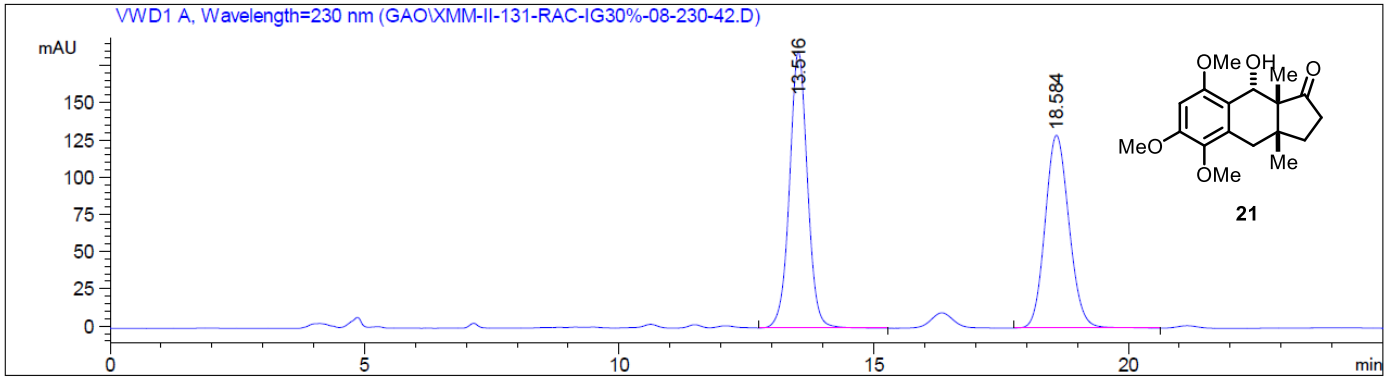


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	31.132	VB	0.7182	1.72943e4	374.26773	49.9883
2	66.540	BB	1.4296	1.73024e4	175.96263	50.0117

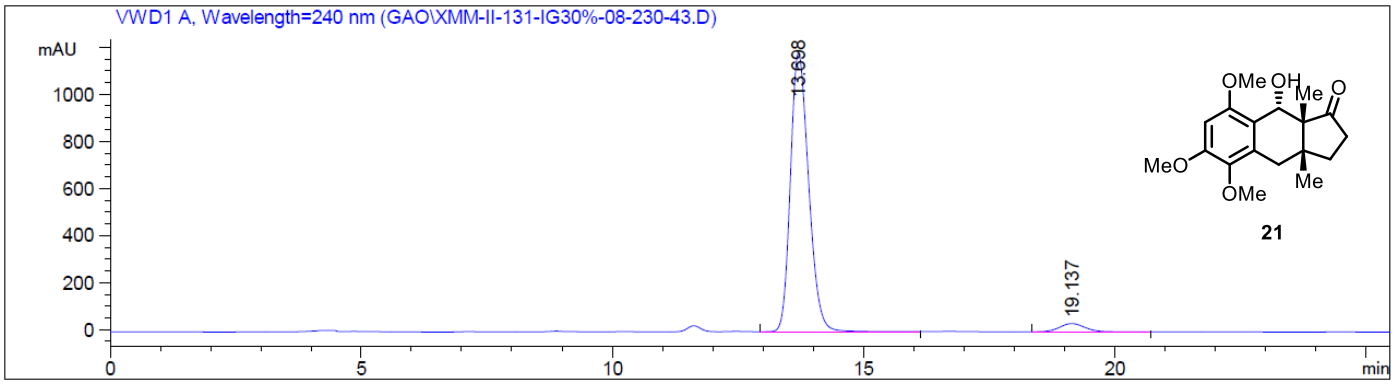


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	29.535	BB	0.6436	2.03959e4	487.75369	98.4076
2	60.764	BB	0.9460	330.03918	4.08612	1.5924

Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 29.535 min (minor), t_R = 60.764 min (major).

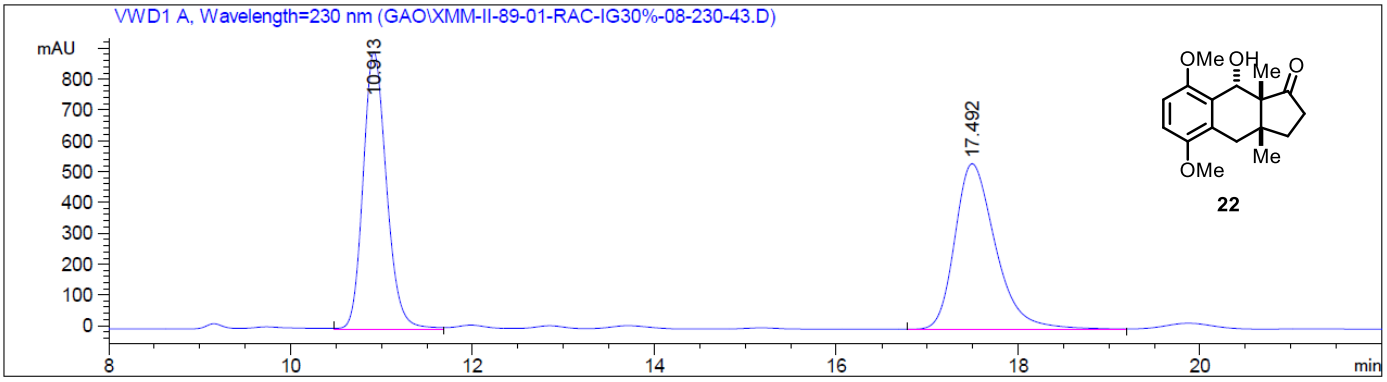


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.516	VB	0.3741	4571.07715	185.97832	51.7102
2	18.584	BV	0.5062	4268.71631	129.73679	48.2898

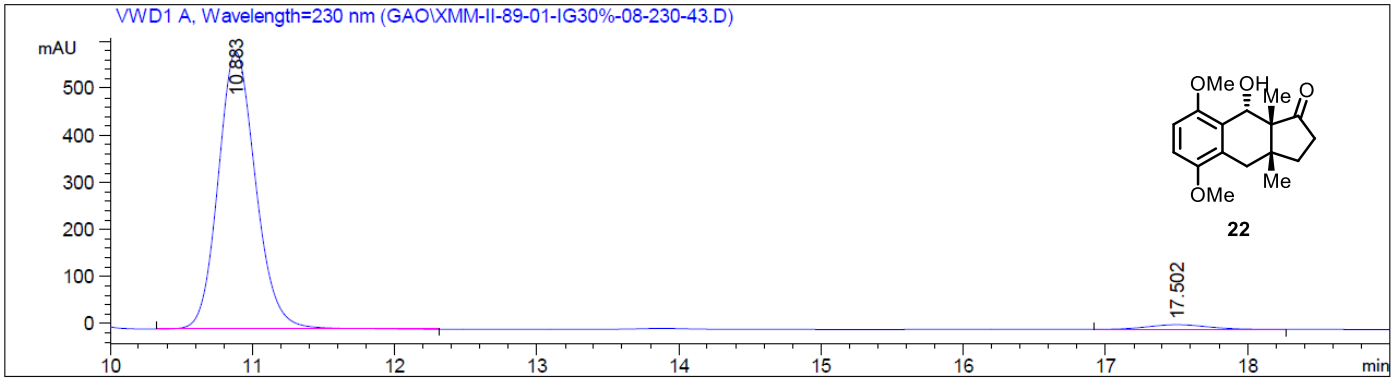


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.698	VV	0.3887	2.99810e4	1183.42285	95.9030
2	19.137	BB	0.5562	1280.78699	35.38463	4.0970

Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 13.698 min (major), t_R = 19.137 min (minor).

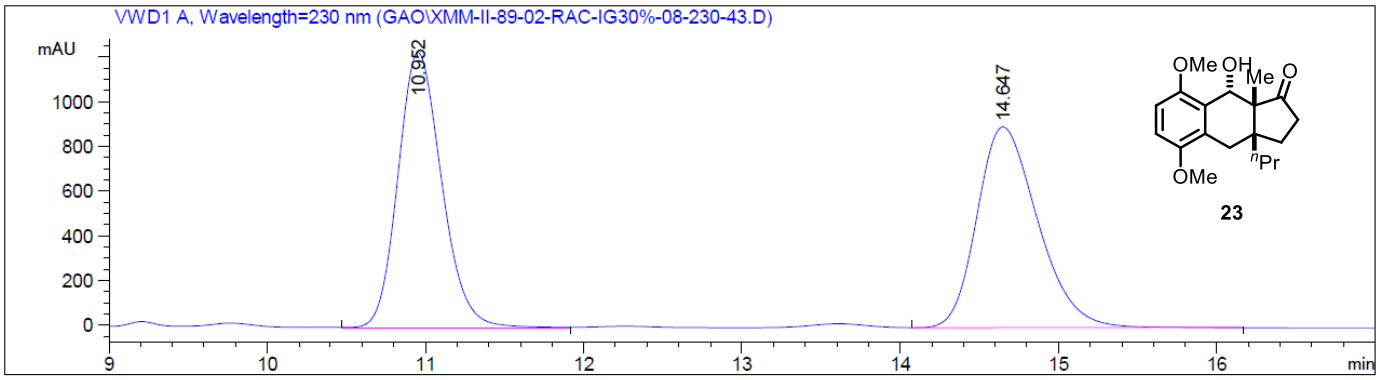


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.913	BV	0.2754	1.60520e4	898.58929	49.0307
2	17.492	BV	0.4764	1.66867e4	536.55139	50.9693

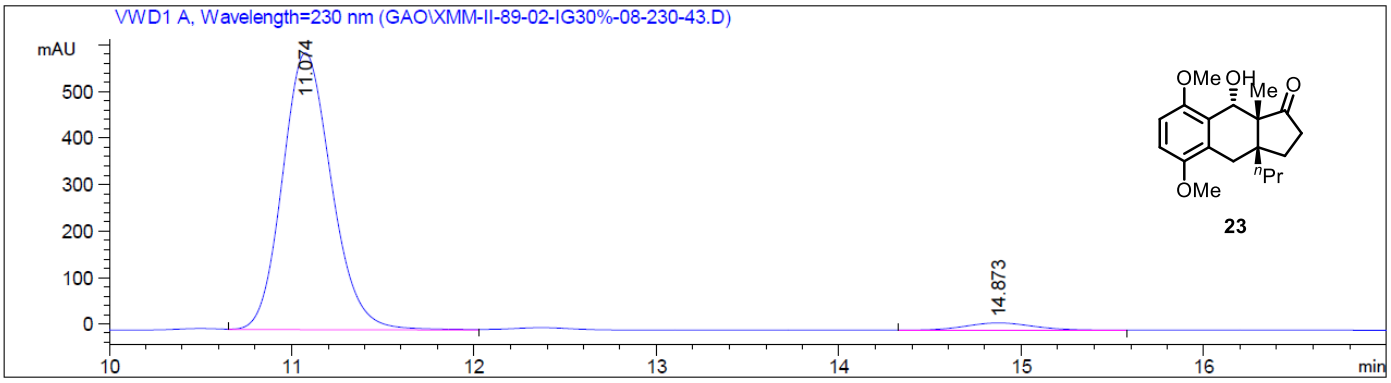


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.883	BB	0.2827	1.08270e4	589.56323	97.3873
2	17.502	BB	0.4412	290.46341	9.92347	2.6127

Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.883min (major), t_R = 17.052 min (minor).

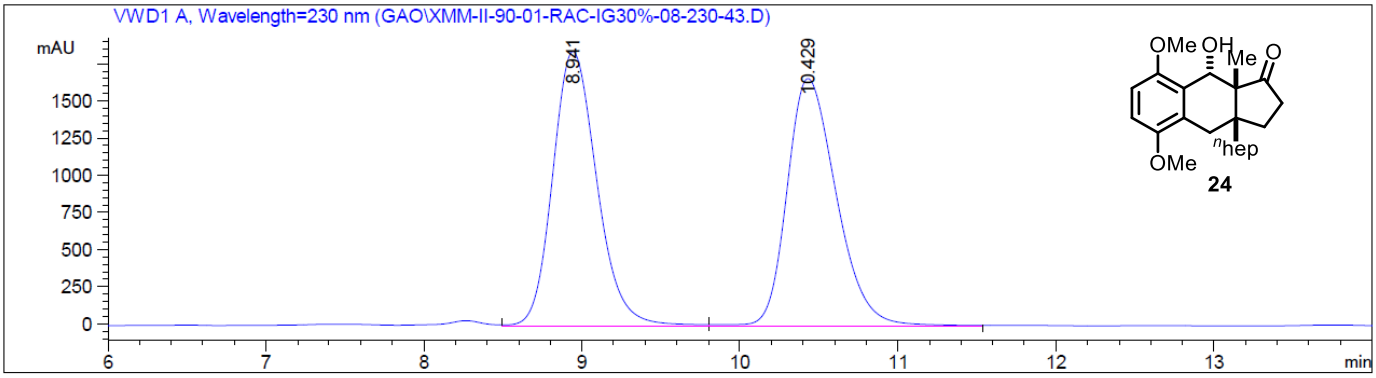


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.952	VV	0.2991	2.37396e4	1231.75000	49.6729
2	14.647	VB	0.4135	2.40522e4	898.60345	50.3271

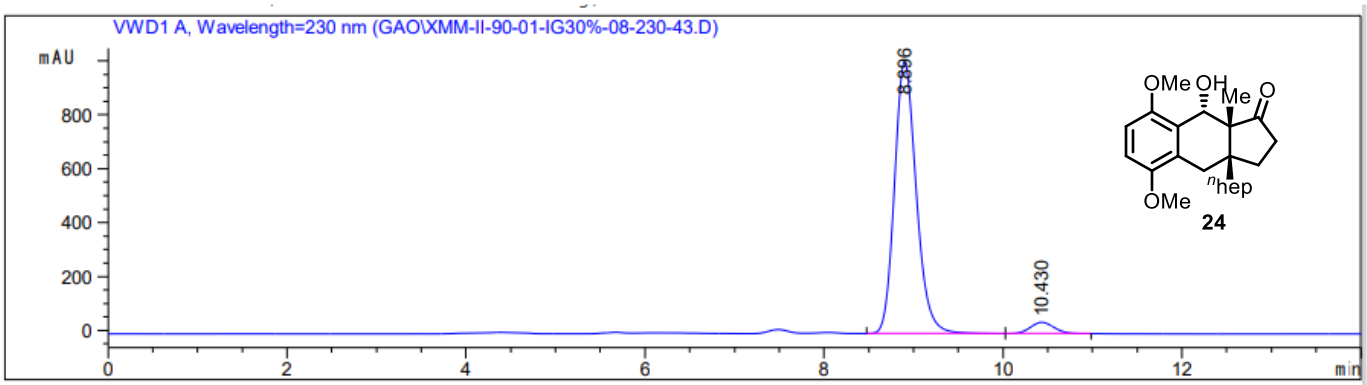


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.074	VB	0.2895	1.11715e4	595.37744	96.5600
2	14.873	BB	0.3948	397.98874	15.54604	3.4400

Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 11.074 min (major), t_R = 14.873 min (minor).

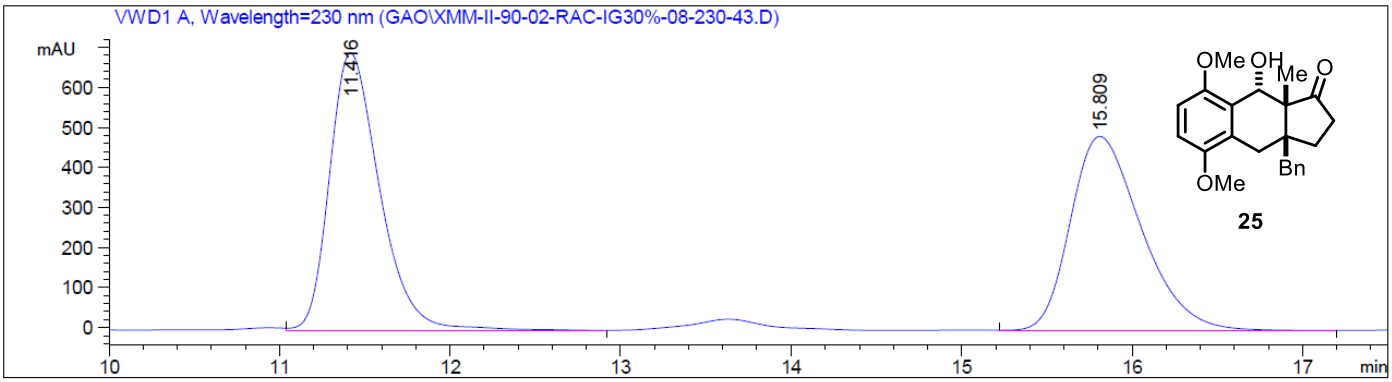


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.941	VV	0.3019	3.60145e4	1846.08203	49.8897
2	10.429	VV	0.3359	3.61738e4	1663.67249	50.1103

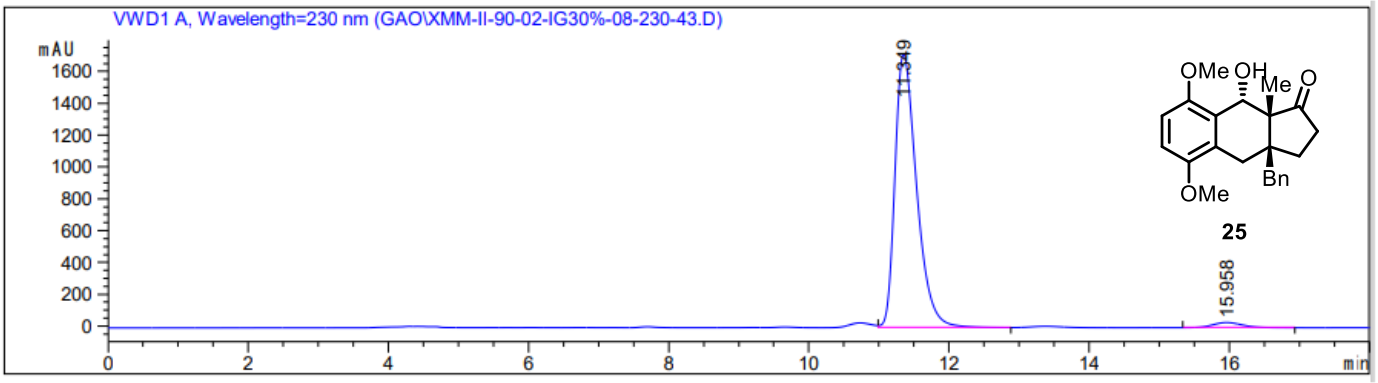


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.896	VV	0.2612	1.71091e4	1008.81042	95.5961
2	10.430	VB	0.2896	788.18201	42.13999	4.4039

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.896 min (major), t_R = 10.430 min (minor).

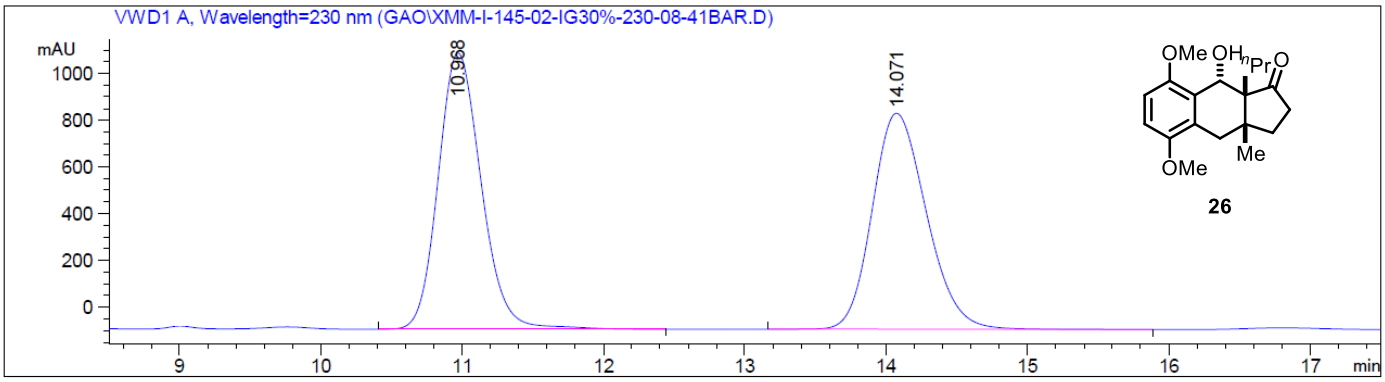


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.416	VV	0.3162	1.43830e4	695.78857	50.2663
2	15.809	VB	0.4508	1.42306e4	487.11670	49.7337

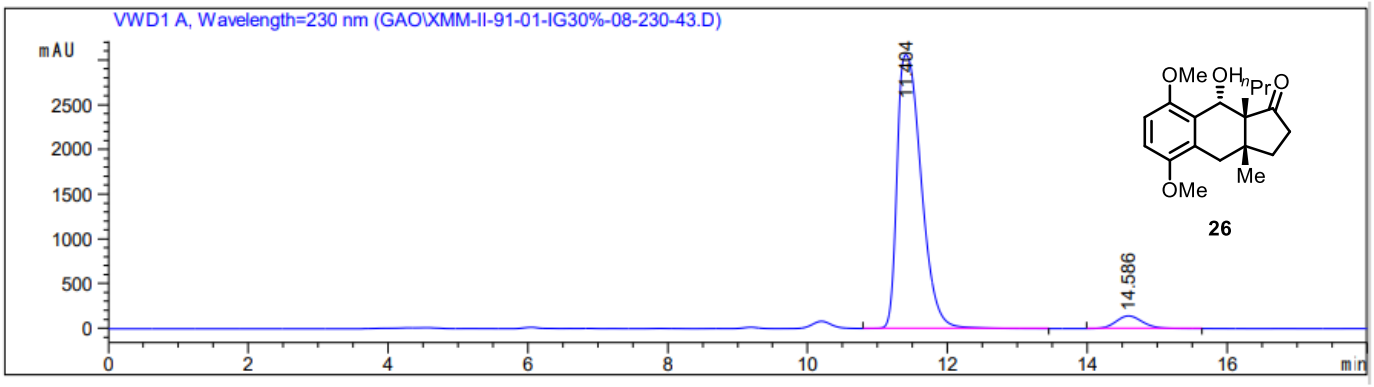


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.349	VB	0.3292	3.69608e4	1720.89087	97.4799
2	15.958	BB	0.4444	955.51581	32.69065	2.5201

Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.349 min (major), t_R = 15.958 min (minor).

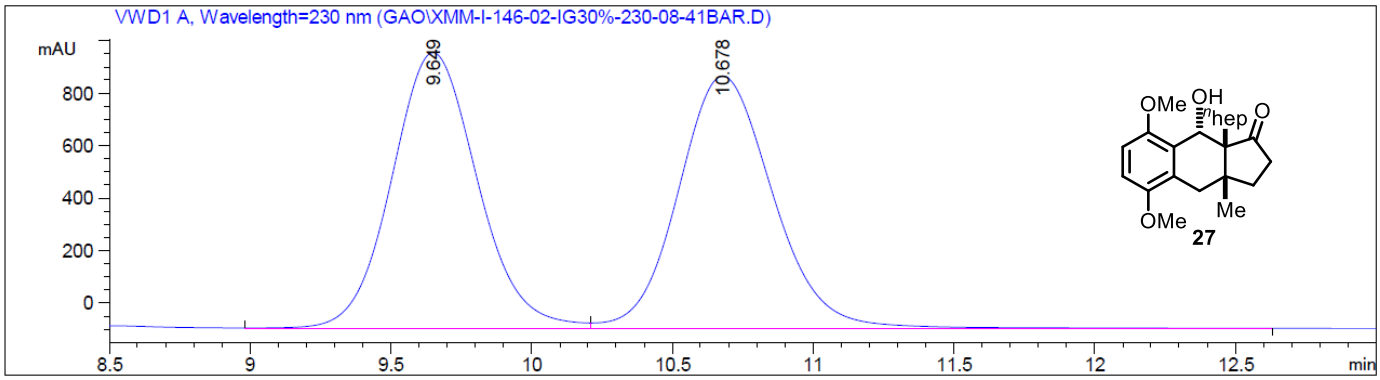


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.968	BB	0.3276	2.50131e4	1182.59705	50.2881
2	14.071	VB	0.4151	2.47265e4	925.27222	49.7119

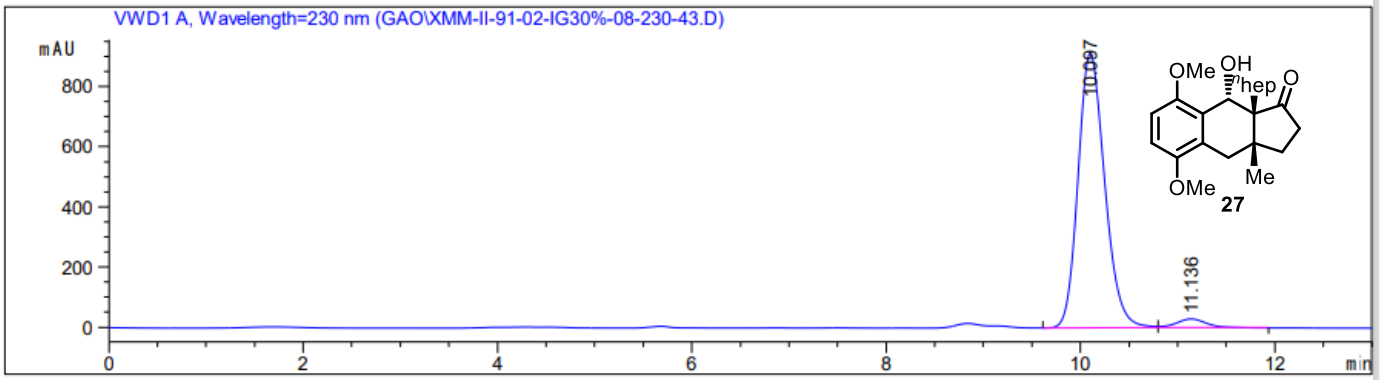


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.404	VB	0.3724	7.33294e4	3063.48804	95.1212
2	14.586	BB	0.4100	3761.07422	142.09029	4.8788

Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.404 min (major), t_R = 14.586 min (minor).

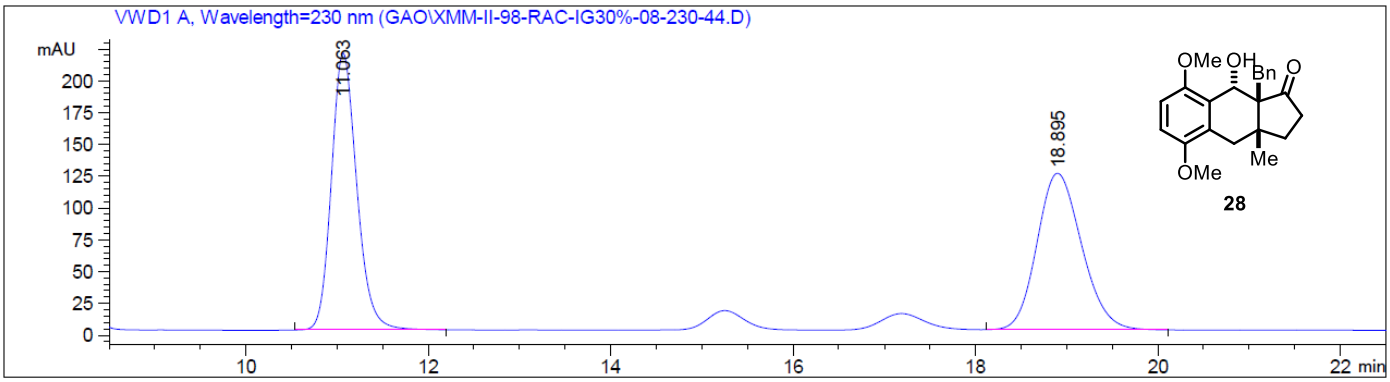


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.649	VV	0.3275	2.23016e4	1051.52698	49.6263
2	10.678	VB	0.3606	2.24790e4	962.22943	50.0210

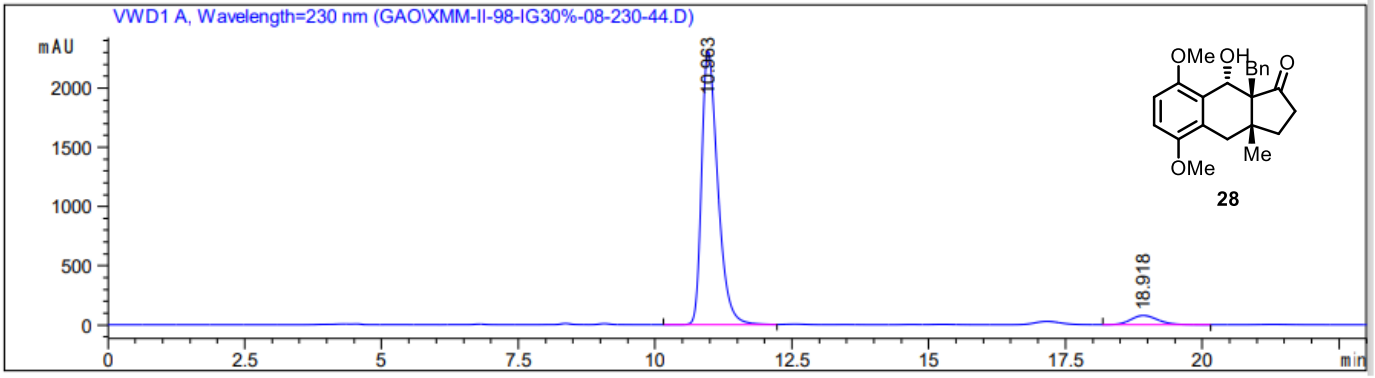


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.097	BV	0.2955	1.74167e4	912.51208	96.2408
2	11.136	VB	0.3415	680.31110	29.94142	3.7592

Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.097 min (major), t_R = 11.136 min (minor).

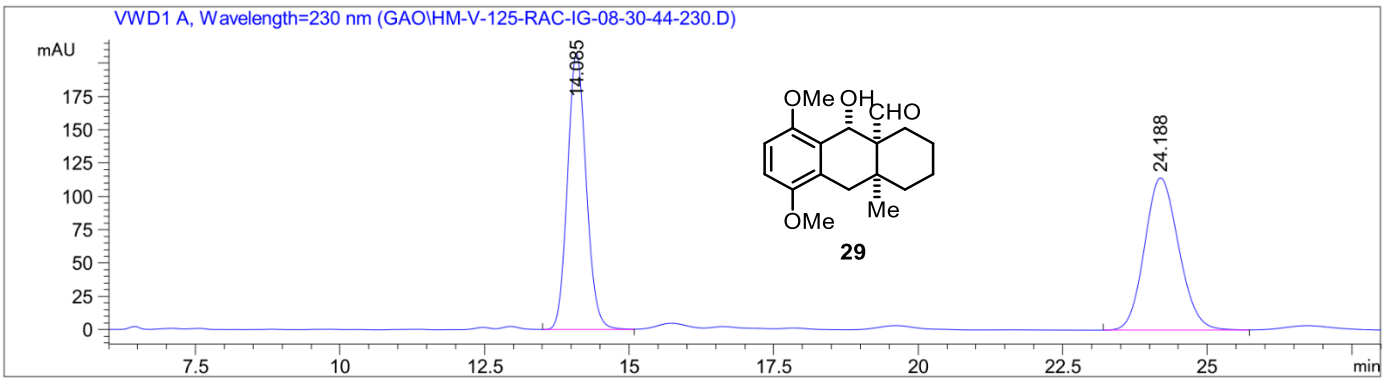


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.063	BB	0.2986	4218.15479	217.90086	50.0567
2	18.895	BB	0.5270	4208.59521	123.32570	49.9433

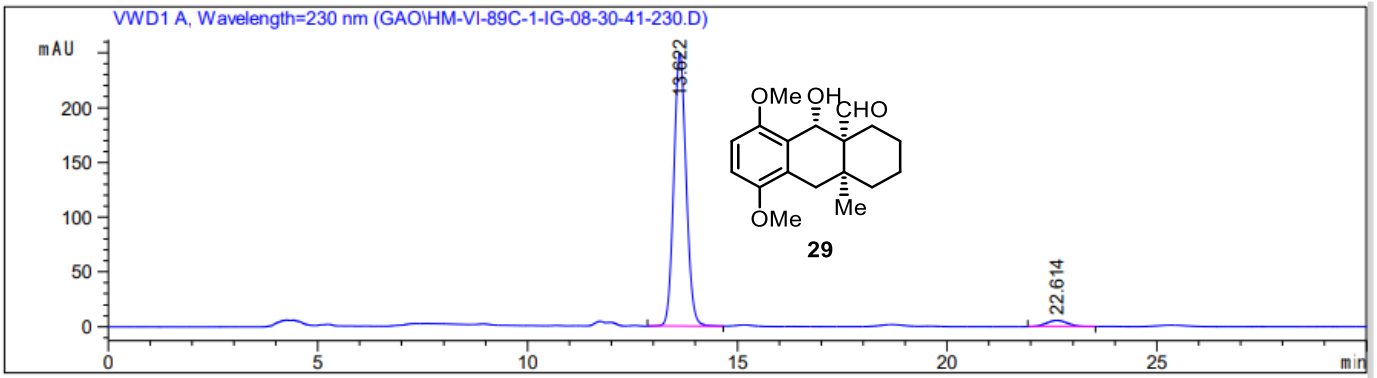


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.963	BV	0.3159	4.73926e4	2308.97485	94.5926
2	18.918	BB	0.5292	2709.18848	78.09605	5.4074

Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.963 min (major), t_R = 18.918 min (minor).

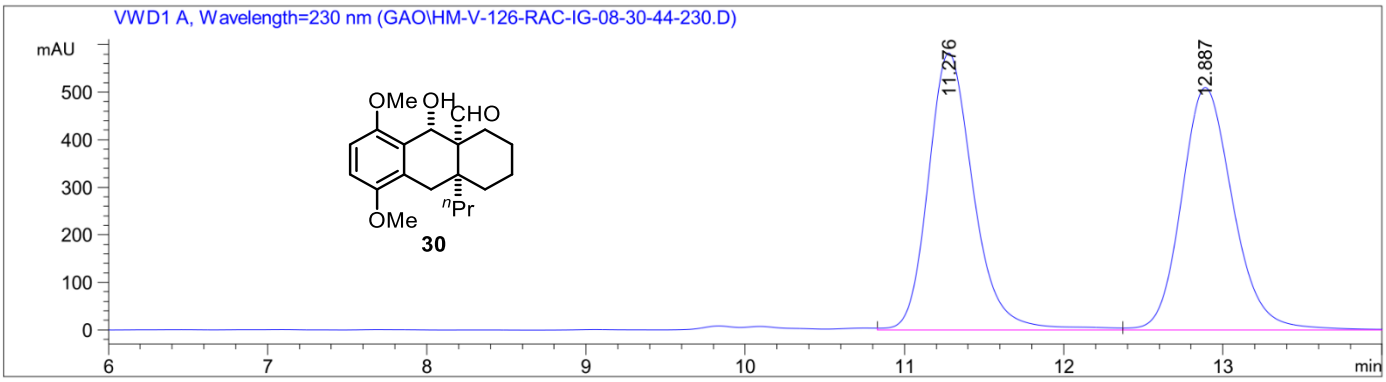


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.085	VV	0.3515	4695.98584	207.39476	49.9541
2	24.188	BV	0.6377	4704.61768	114.24416	50.0459

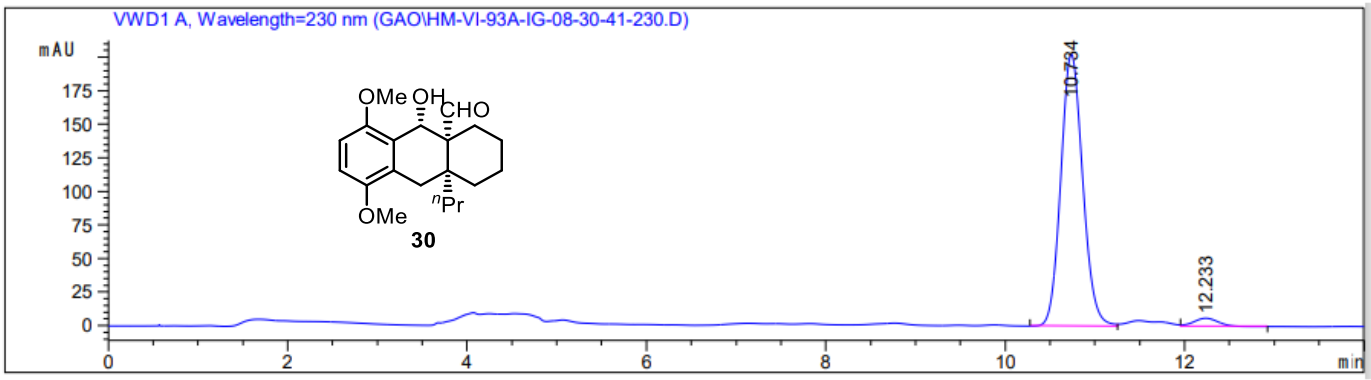


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.622	VB	0.3177	5110.14502	249.36041	96.2619
2	22.614	BB	0.4130	198.44046	5.69550	3.7381

Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 13.622min (major), t_R = 22.610 min (minor).

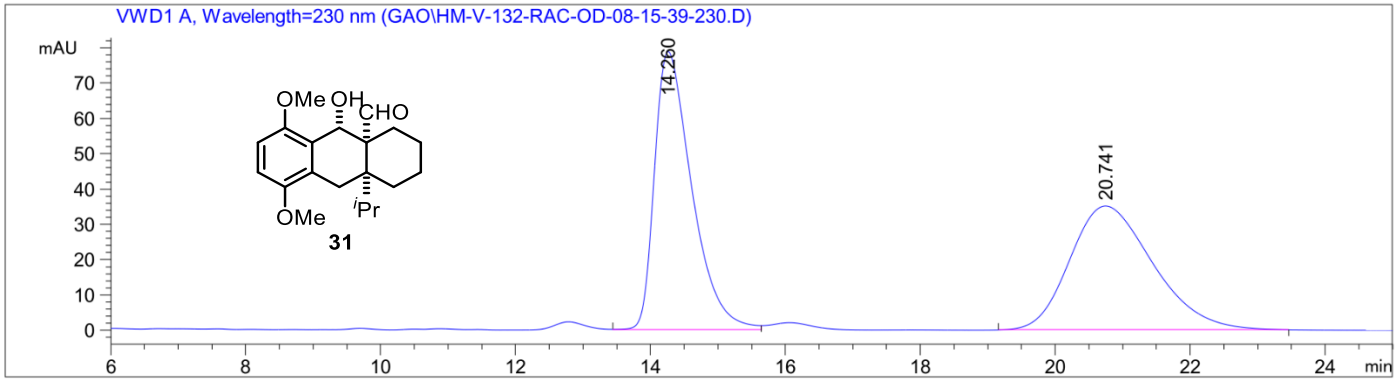


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.276	VV	0.3038	1.15414e4	582.92084	50.0172
2	12.887	VV	0.3481	1.15335e4	510.32614	49.9828

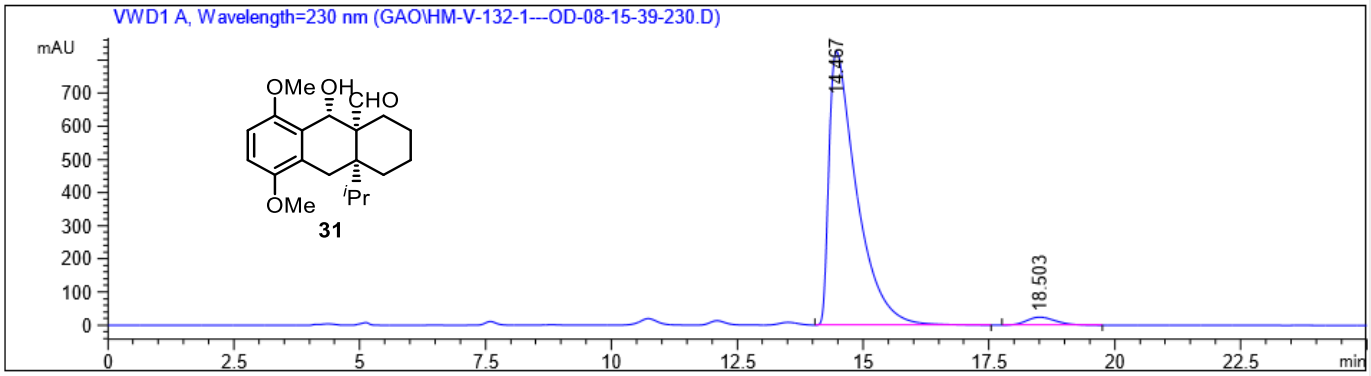


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.734	VV	0.2625	3434.88330	202.73489	96.7437
2	12.233	VB	0.2890	115.61331	6.09463	3.2563

Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.734min (major), t_R = 12.232 min (minor).

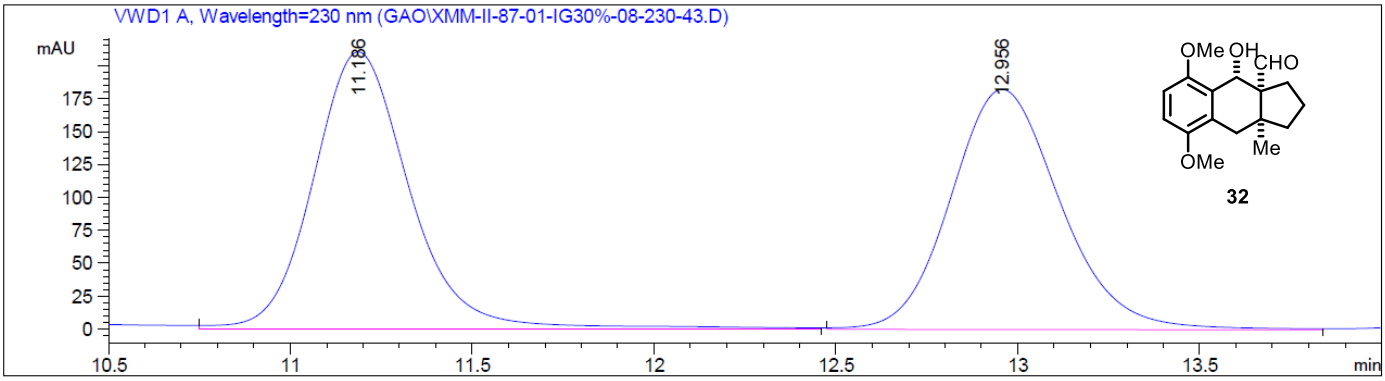


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.260	VV	0.5859	3031.88867	78.77032	50.1295
2	20.741	BB	1.3427	3016.22046	35.11826	49.8705

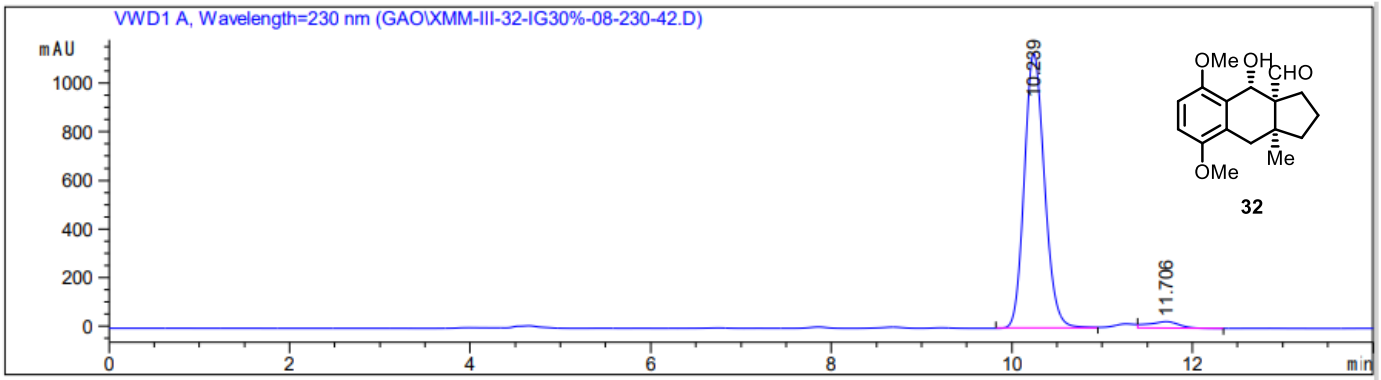


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.467	VB	0.5640	3.16466e4	826.32013	96.9771
2	18.503	BB	0.6027	986.47345	24.21560	3.0229

Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 14.467min (major), t_R = 18.503 min (minor).

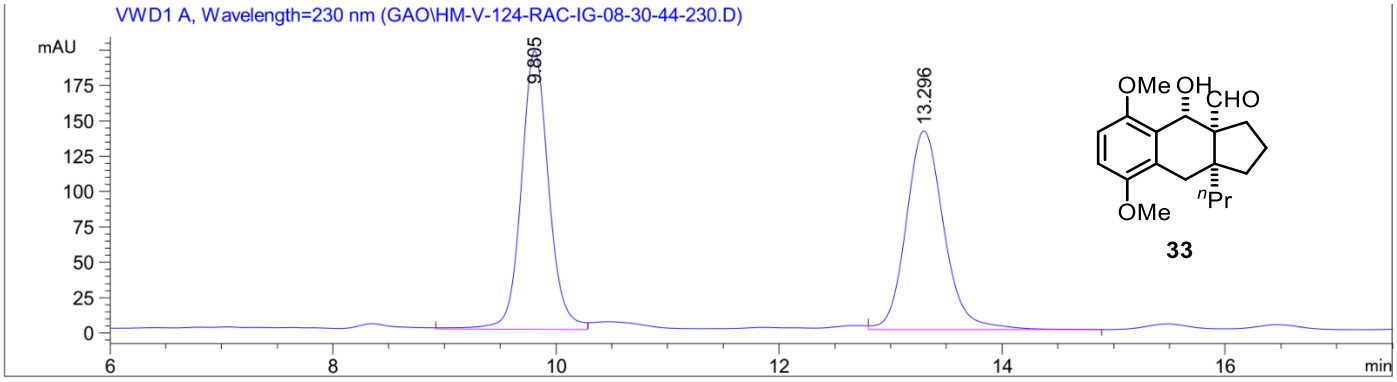


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.186	VB	0.2869	3960.56055	210.81316	50.7043
2	12.956	BV	0.3248	3850.53784	182.48087	49.2957

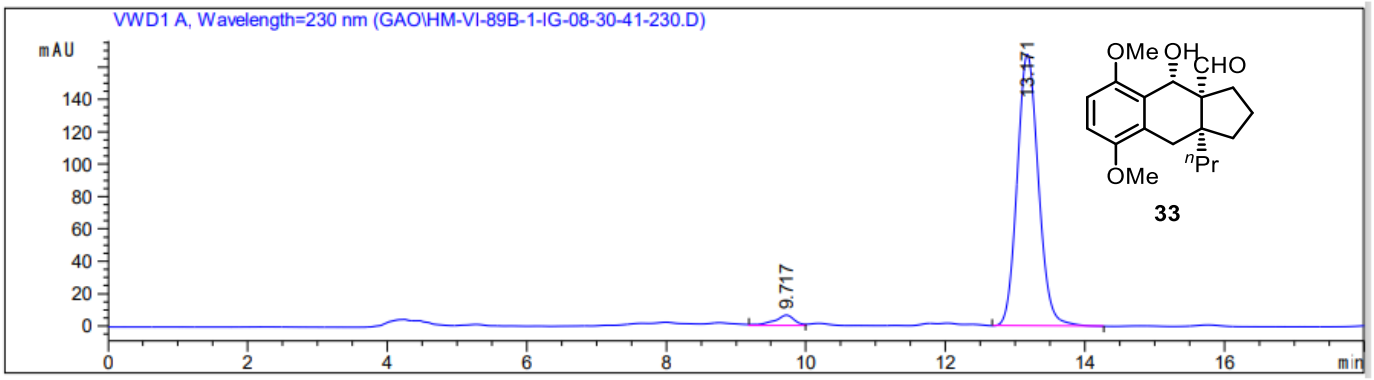


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.239	BV	0.2415	1.76156e4	1130.55688	96.3076
2	11.706	VB	0.3451	675.38568	27.96367	3.6924

Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.239 min (major), t_R = 11.706 min (minor).

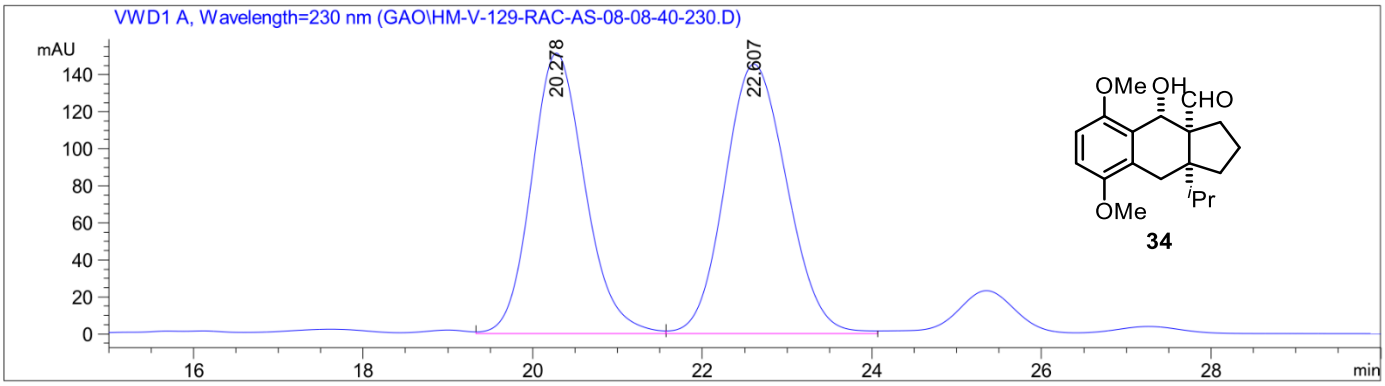


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.805	VV	0.2642	3378.17700	196.92525	50.5308
2	13.296	VB	0.3619	3307.20752	140.52245	49.4692

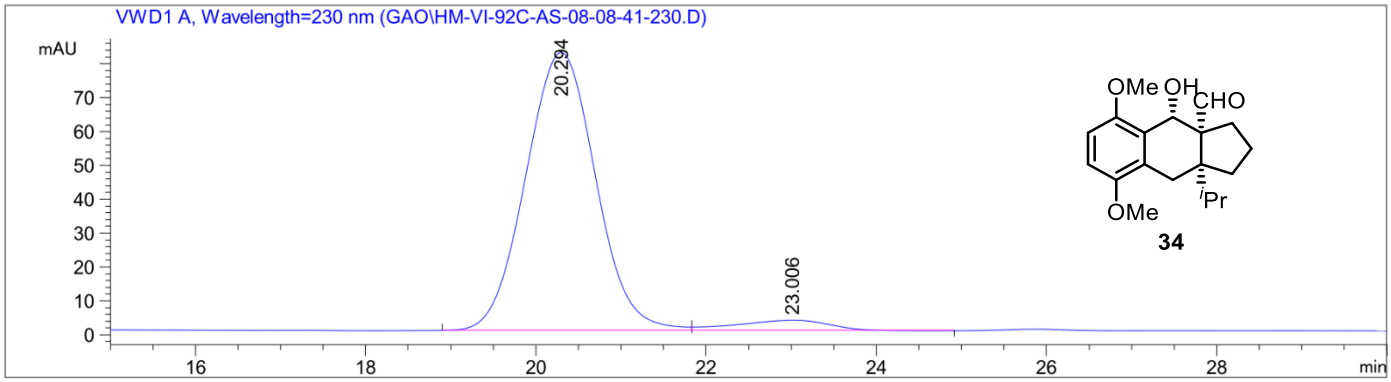


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.717	VV	0.2959	135.70982	6.50262	3.6781
2	13.171	VB	0.3281	3553.91309	167.68407	96.3219

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.717min (minor), t_R = 13.171 min (major).

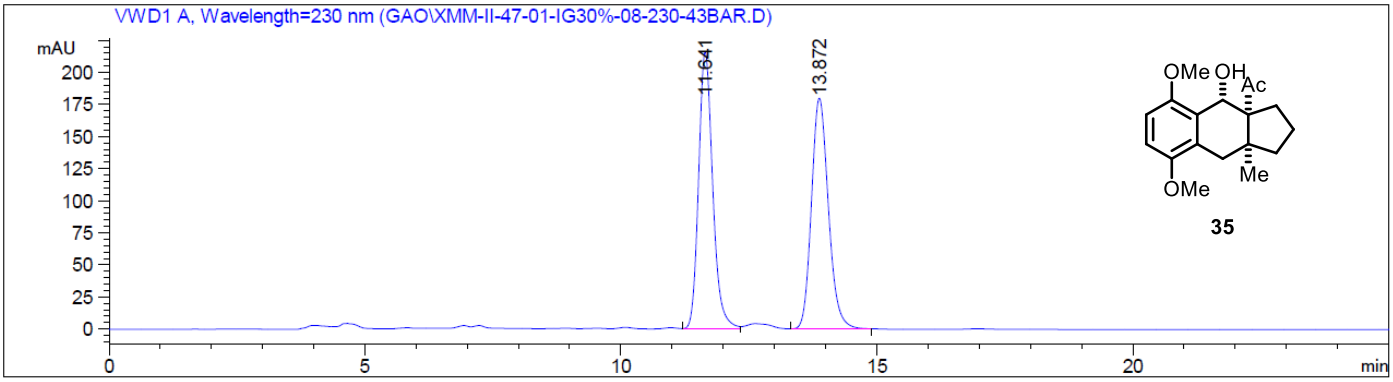


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	20.278	VV	0.6802	6640.19482	151.51505	47.1790
2	22.607	VV	0.8053	7434.29004	145.61319	52.8210

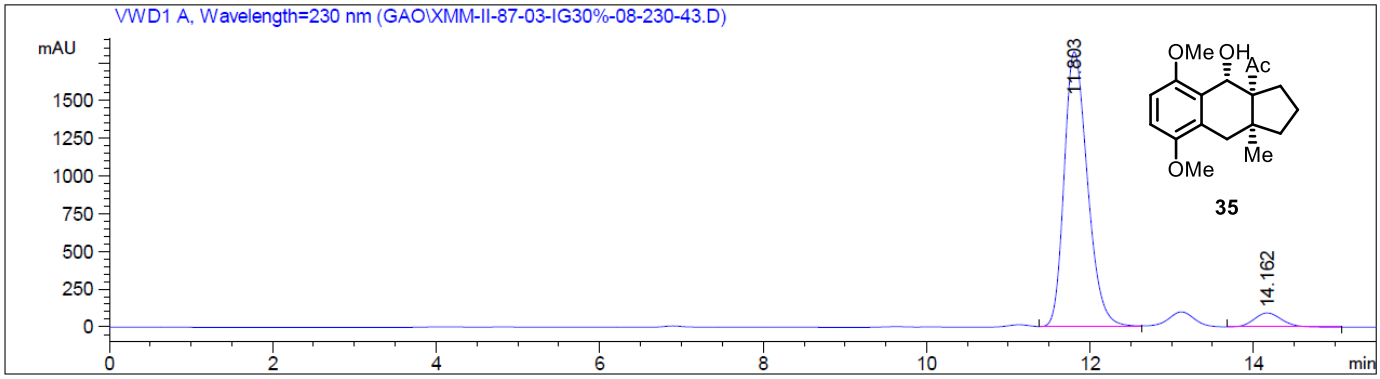


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	20.294	BV	0.8994	4690.43701	82.11388	95.2358
2	23.006	VB	1.1384	234.63815	3.06262	4.7642

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 92/ 8, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 20.294 min (major), t_R = 23.006 min (minor).

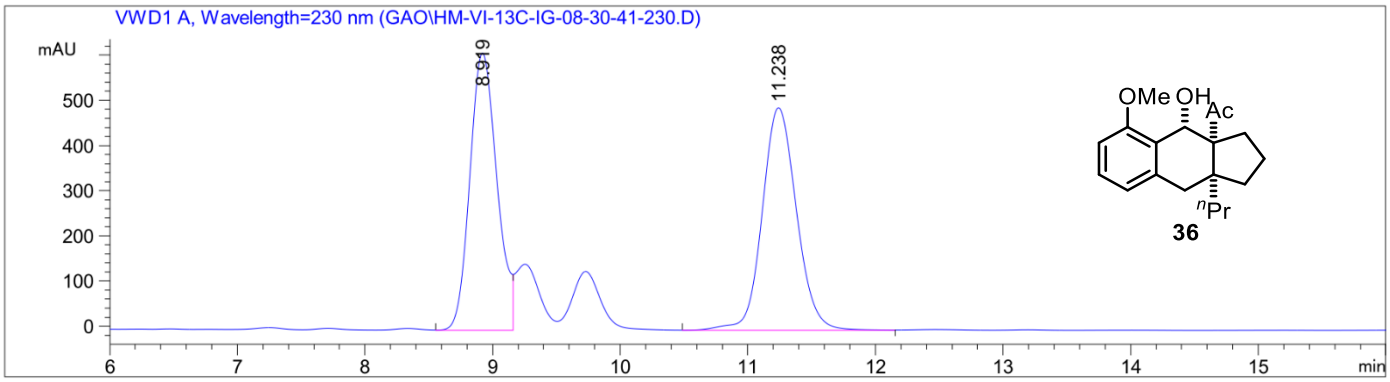


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.641	VV	0.2939	4143.94287	215.86278	50.0252
2	13.872	VB	0.3545	4139.77197	179.79817	49.9748

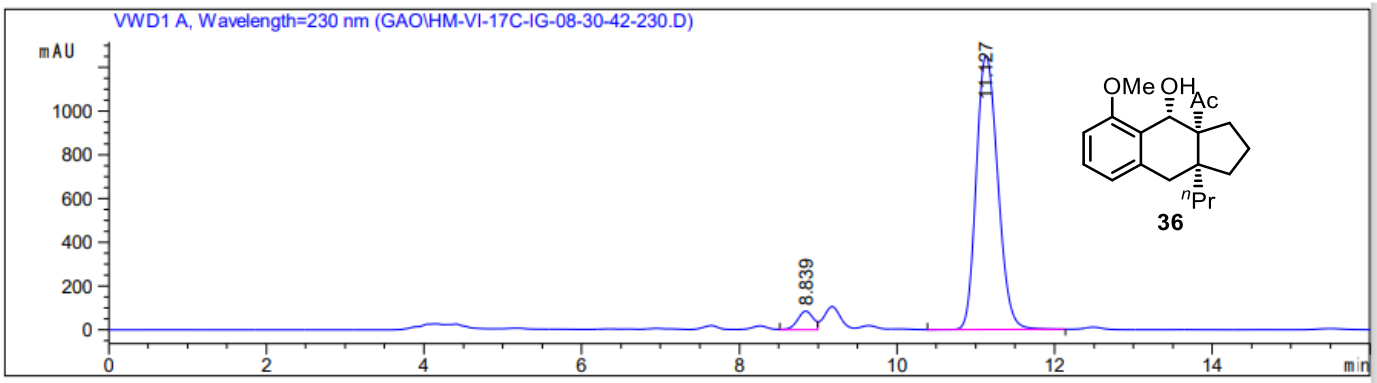


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.803	VV	0.3085	3.63772e4	1823.32031	94.1707
2	14.162	VB	0.3694	2251.78735	94.13214	5.8293

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ºC, 230 nm): t_R = 11.803 min (major), t_R = 14.162 min (minor).

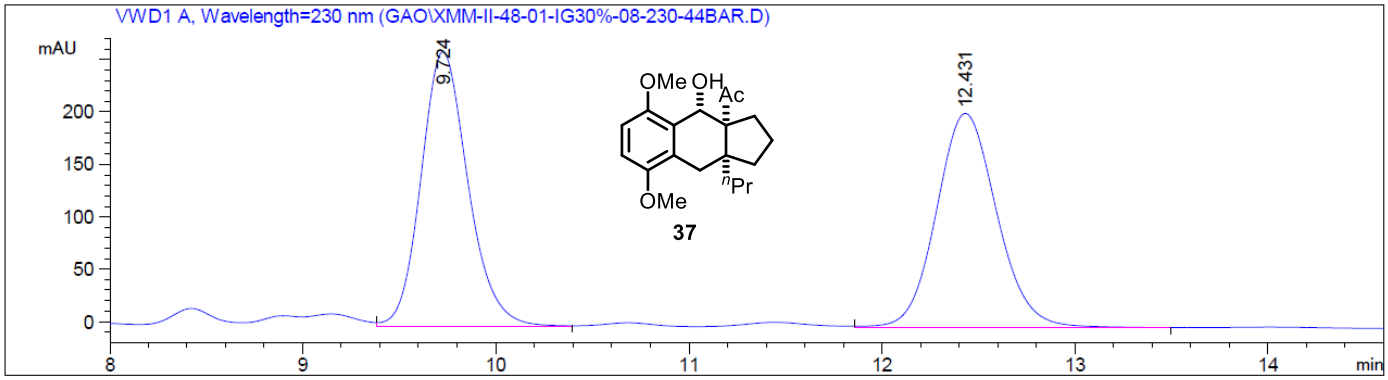


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.919	VV	0.2310	9099.61523	614.43304	49.3957
2	11.238	VV	0.2903	9322.27344	493.34305	50.6043

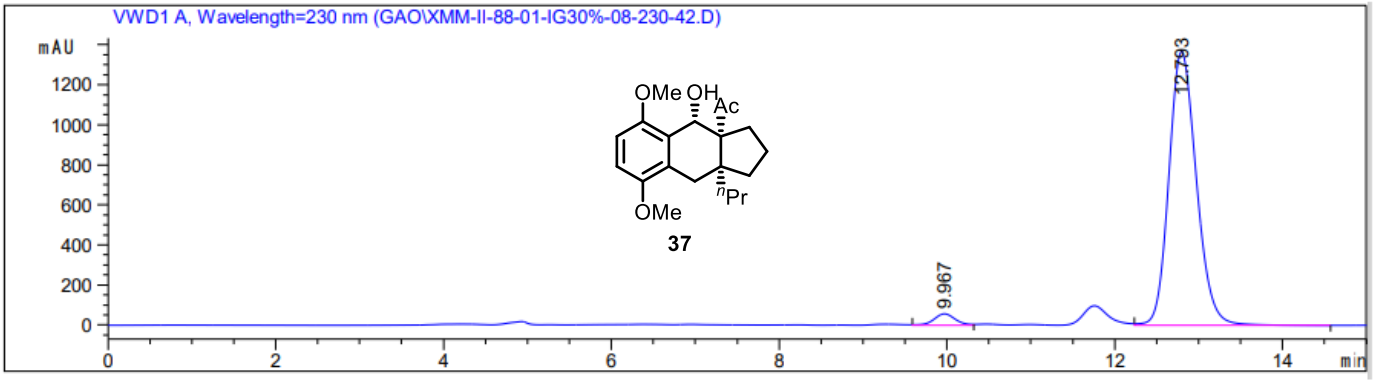


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.839	VV	0.2130	1191.78076	85.43179	4.7471
2	11.127	VV	0.3005	2.39136e4	1253.55078	95.2529

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.839min (minor), t_R = 11.127 min (major).

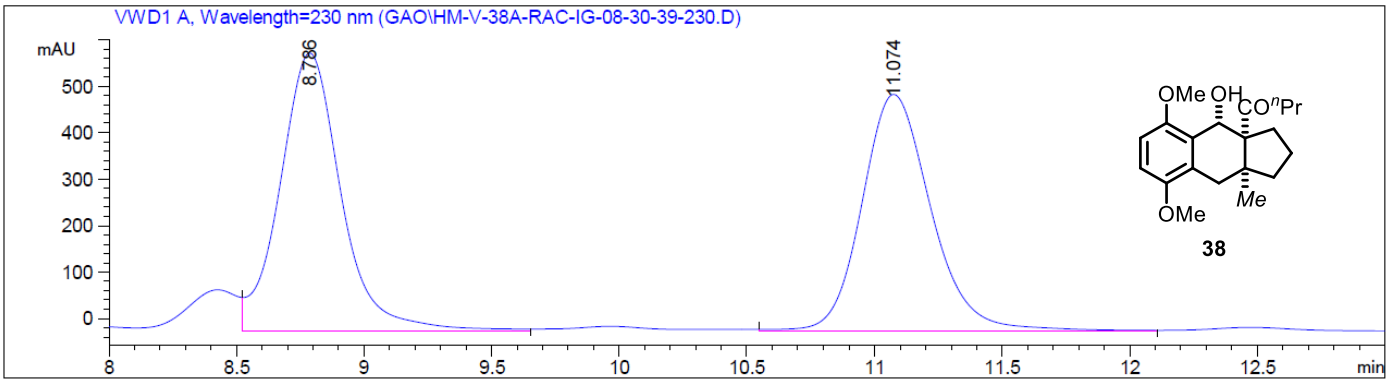


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.724	VV	0.2609	4451.59082	261.95108	50.1266
2	12.431	VB	0.3365	4429.10156	203.86688	49.8734

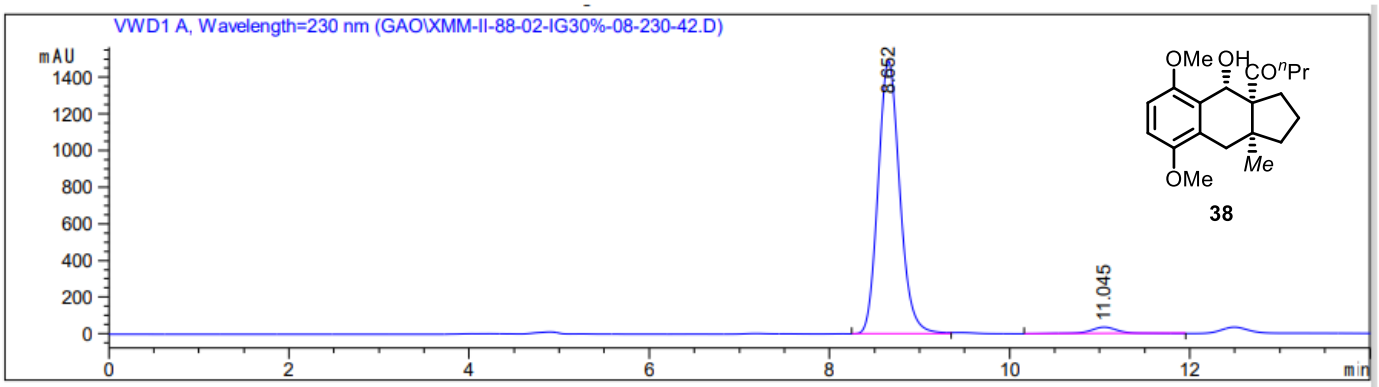


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.967	VV	0.2740	1032.44739	57.56564	3.2063
2	12.793	VB	0.3535	3.11677e4	1366.42444	96.7937

Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.967 min (minor), t_R = 12.793 min (major).

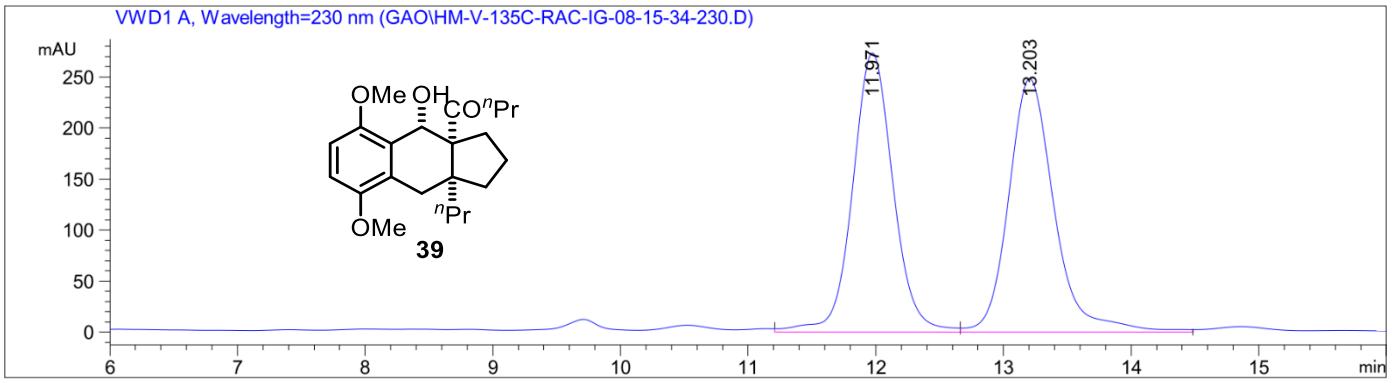


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.786	VB	0.2534	9971.59668	598.20306	50.9646
2	11.074	BV	0.2898	9594.13379	508.99625	49.0354

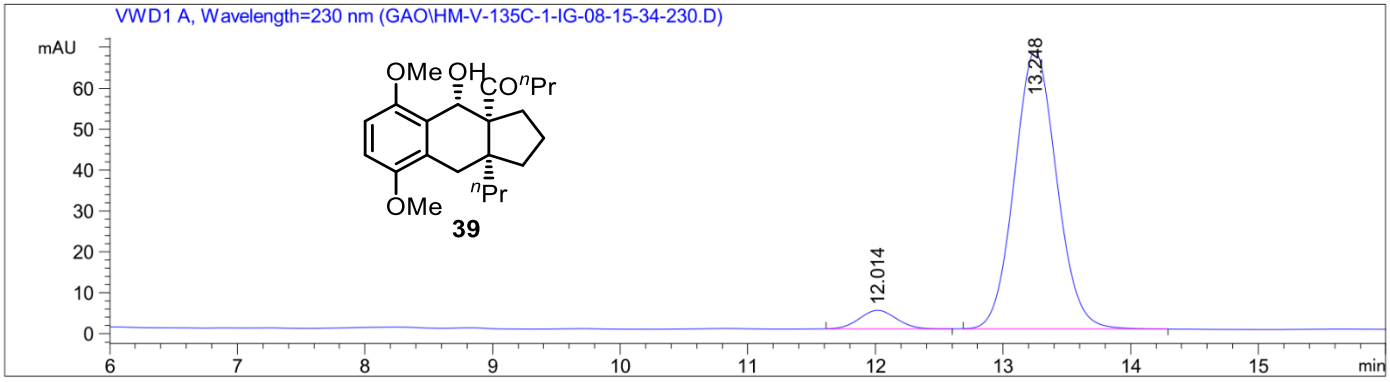


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.652	VV	0.2590	2.49034e4	1490.74963	96.9523
2	11.045	BB	0.3325	782.83569	35.36593	3.0477

Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.652 min (minor), t_R = 11.045 min (major).

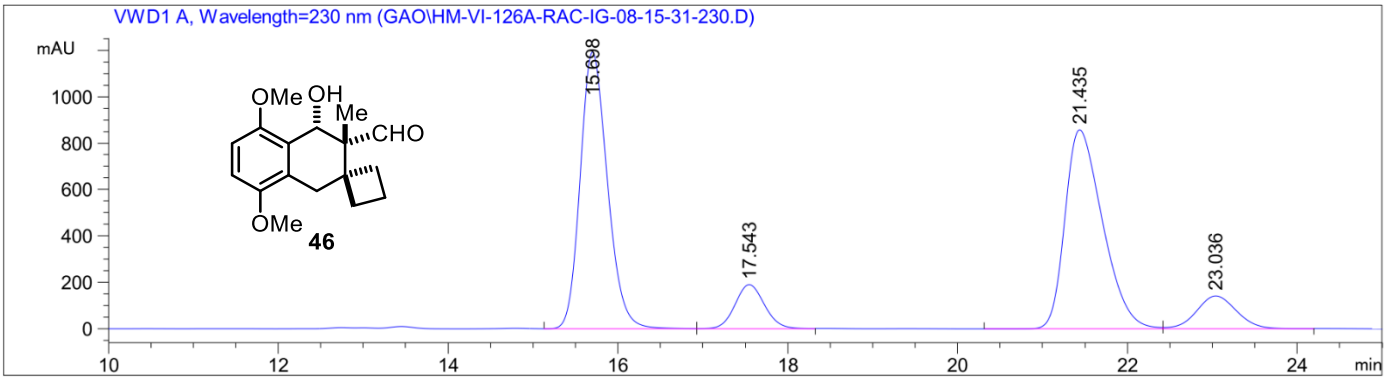


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.971	VV	0.3404	6066.05420	273.39597	49.5135
2	13.203	VV	0.3809	6185.24902	248.29532	50.4865

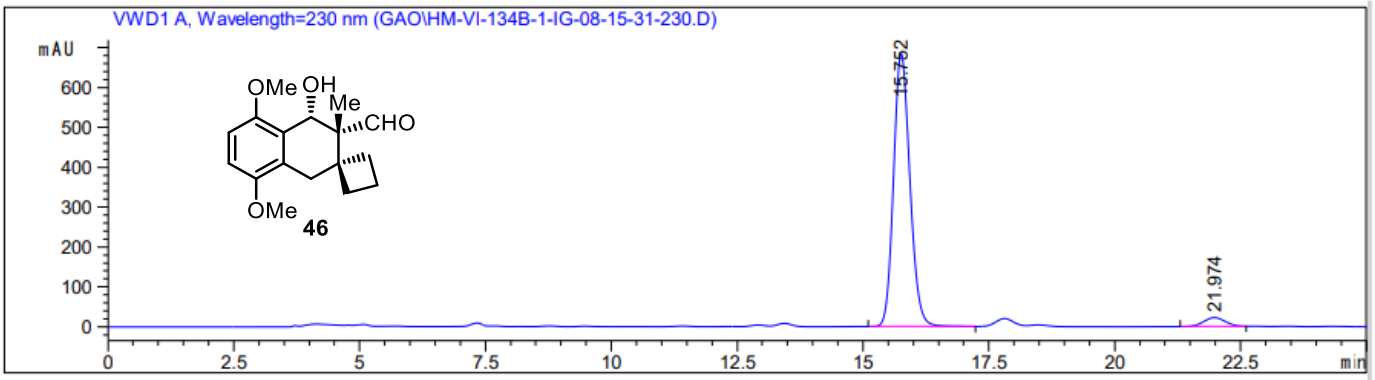


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.014	BB	0.3243	97.25022	4.61764	5.8376
2	13.248	BB	0.3600	1568.68762	67.84757	94.1624

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.014min (minor), t_R = 13.248 min (major).

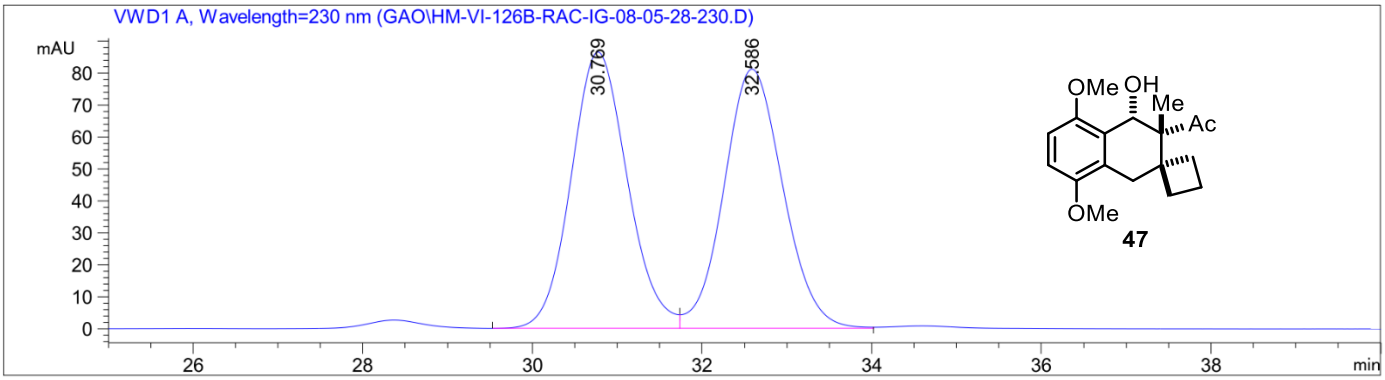


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.698	VV	0.3419	2.66329e4	1193.17090	42.6974
2	17.543	VV	0.3780	4656.98730	190.73026	7.4660
3	21.435	VV	0.4755	2.63985e4	857.82233	42.3217
4	23.036	VB	0.5139	4687.47803	141.74501	7.5149

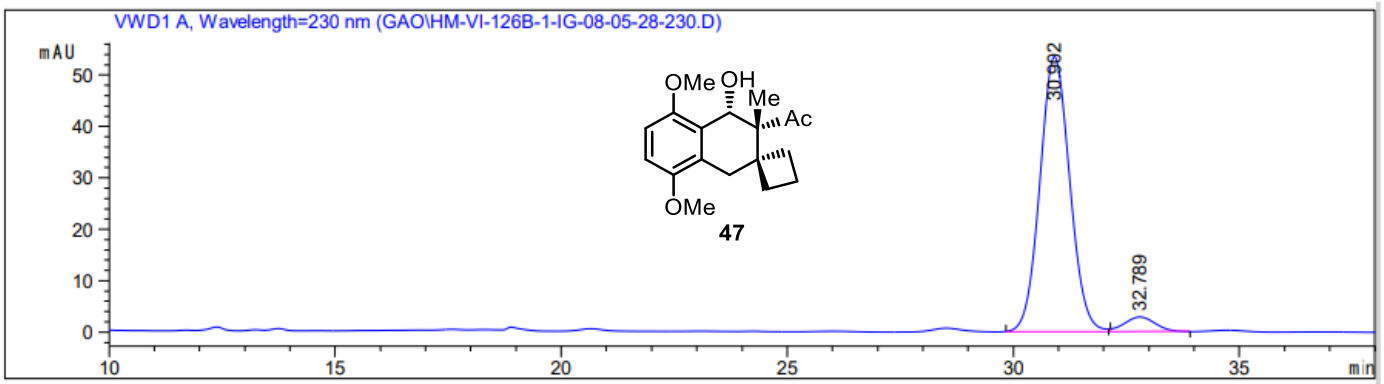


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.752	VB	0.3500	1.55056e4	684.86066	95.6946
2	21.974	BV	0.4780	697.61133	22.69722	4.3054

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 15.752min (major), t_R = 21.974 min (minor).

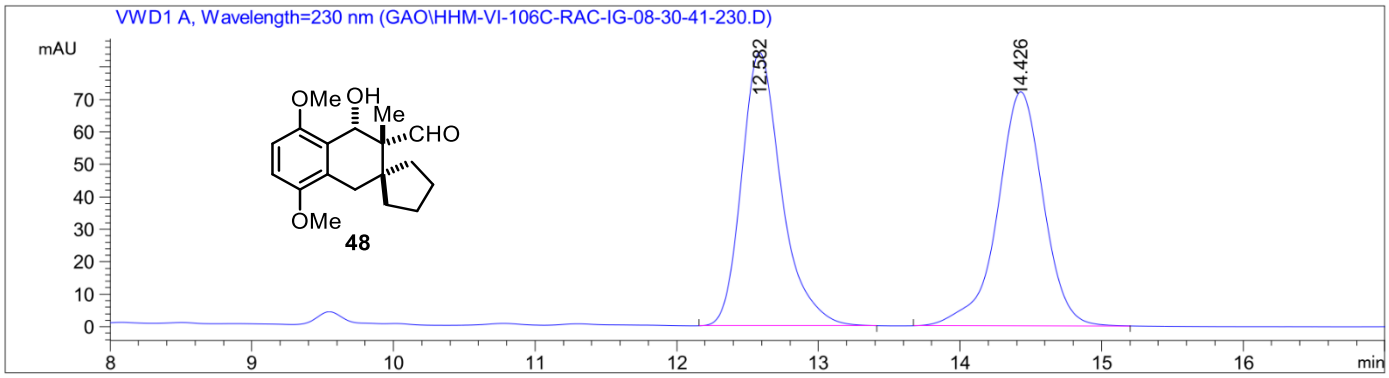


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	30.769	VV	0.7132	3994.93408	86.55660	50.3527
2	32.586	VV	0.7522	3938.96436	81.22150	49.6473

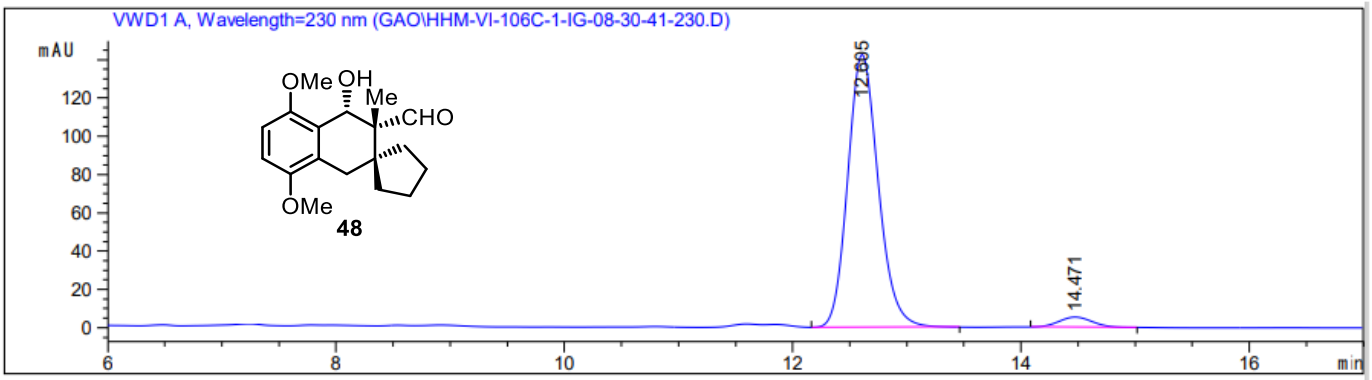


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	30.902	BB	0.7095	2451.68994	53.48070	94.7706
2	32.789	BB	0.6803	135.28242	2.85097	5.2294

Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 30.903min (major), t_R = 32.791 min (minor).

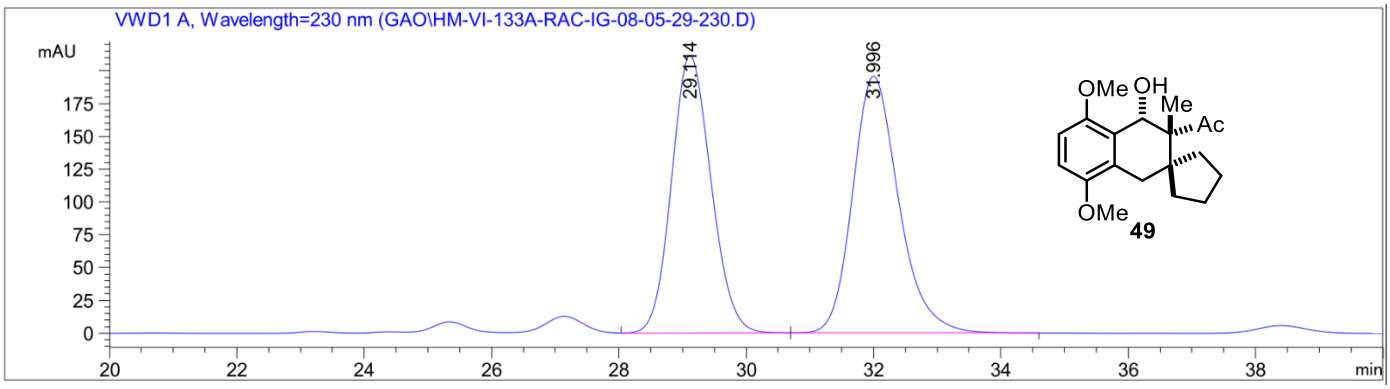


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.582	BB	0.2965	1646.69763	84.23983	50.3107
2	14.426	BB	0.3432	1626.35913	72.12217	49.6893

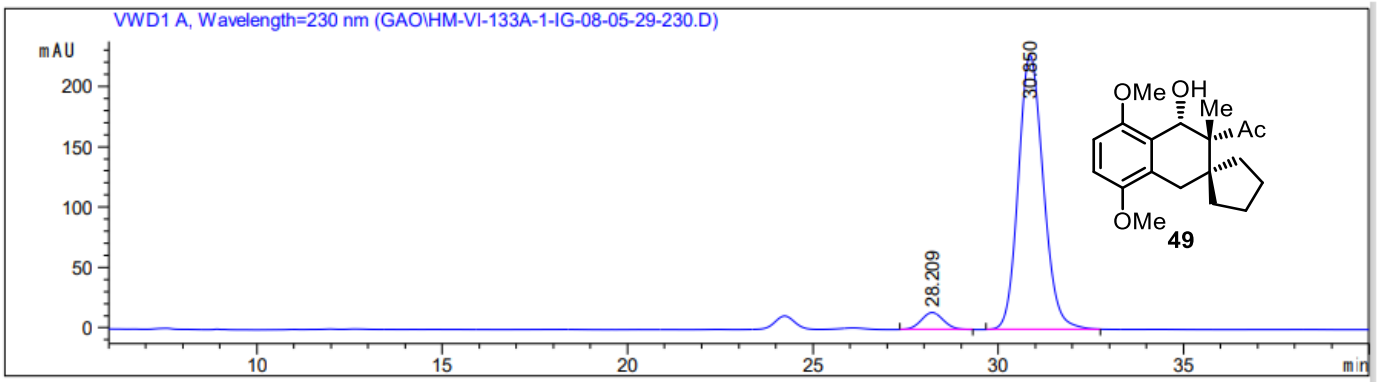


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.605	VB	0.2884	2650.11499	142.43793	96.1121
2	14.471	BB	0.3190	107.20310	5.26781	3.8879

Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.605min (major), t_R = 14.471 min (minor).

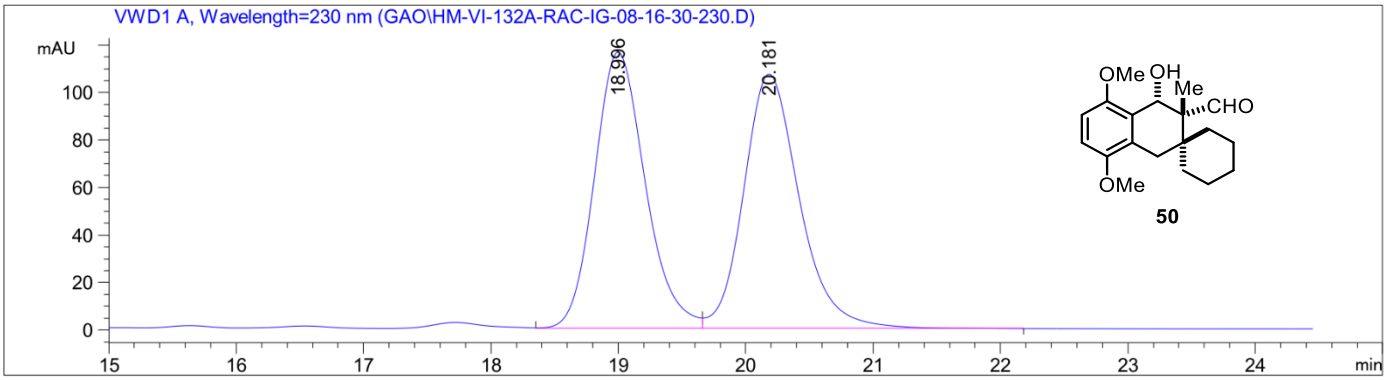


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	29.114	VV	0.6728	9150.82617	211.88100	48.0599
2	31.996	VB	0.7753	9889.64063	195.91074	51.9401

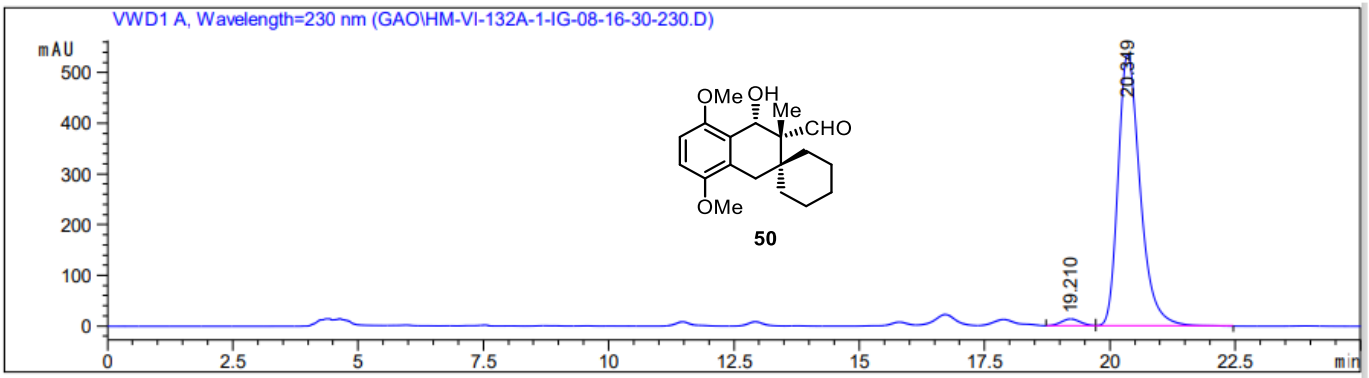


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	28.209	BB	0.6471	588.37555	14.09695	5.2339
2	30.850	BB	0.7272	1.06533e4	227.36209	94.7661

Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 28.209min (minor), t_R = 30.850 min (major).

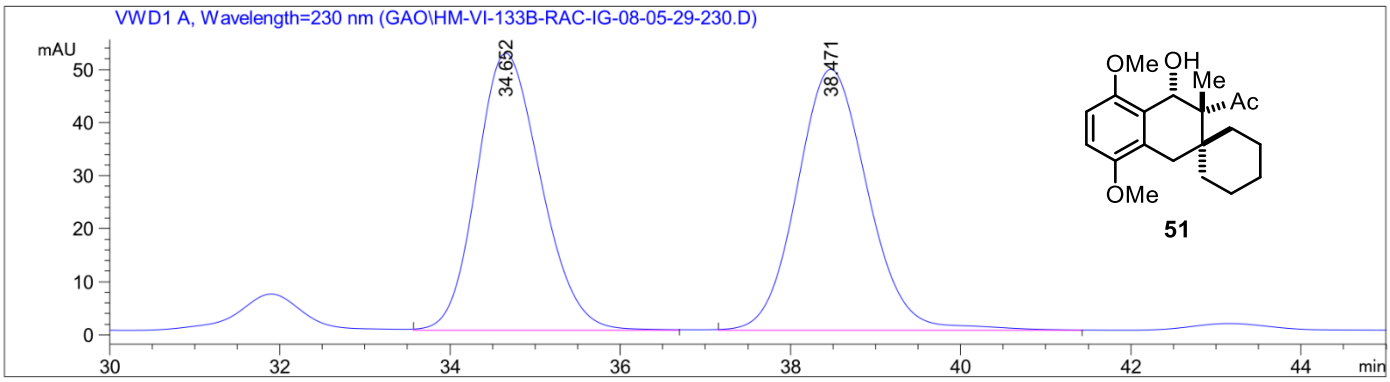


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	18.996	VV	0.4229	3231.56323	116.38920	49.7453
2	20.181	VB	0.4661	3264.64966	107.14812	50.2547

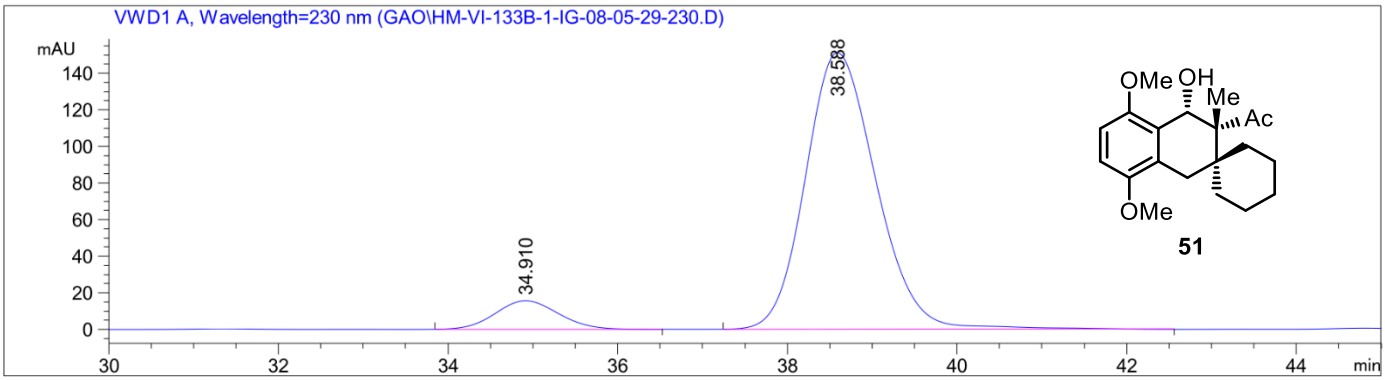


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	19.210	VV	0.4206	398.09787	14.12131	2.3618
2	20.349	VB	0.4710	1.64573e4	537.15363	97.6382

Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 84/ 16, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 19.210min (minor), t_R = 20.349 min (major).

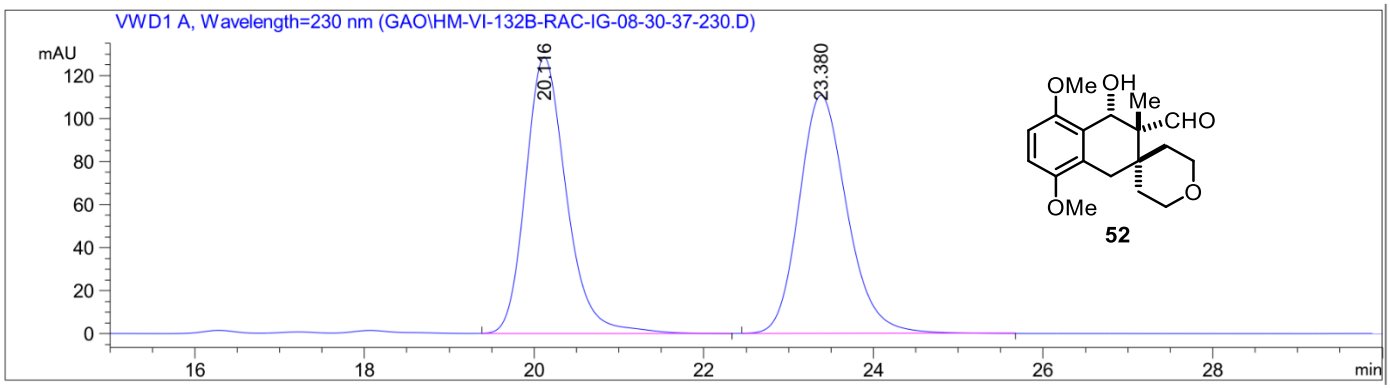


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	34.652	BB	0.8166	2743.20532	52.23180	48.9982
2	38.471	BB	0.8984	2855.37598	49.20101	51.0018

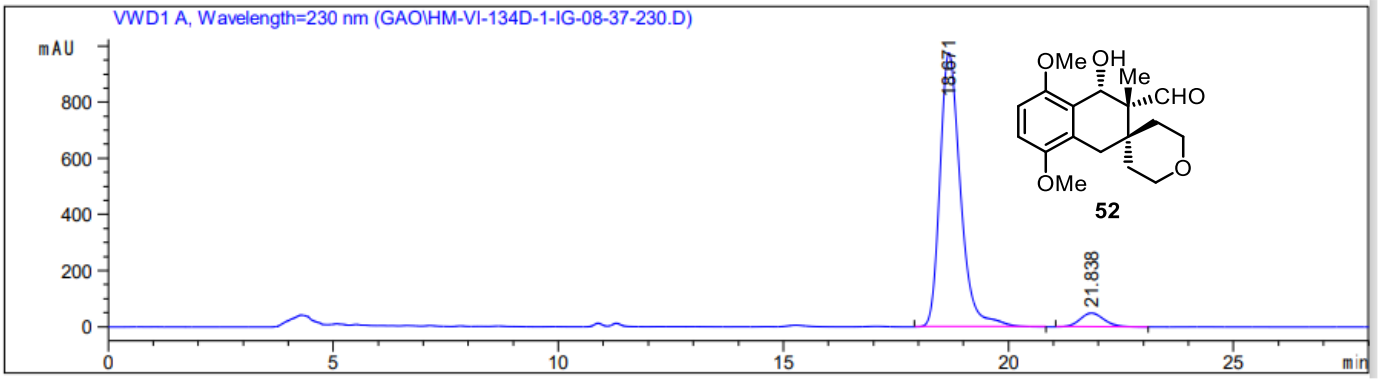


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	34.910	BB	0.8122	814.52606	15.62094	8.4962
2	38.588	BB	0.9039	8772.37207	151.23659	91.5038

Enantiomeric excess: 83%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 95/5, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 34.910 min (minor), t_R = 38.588 min (major).

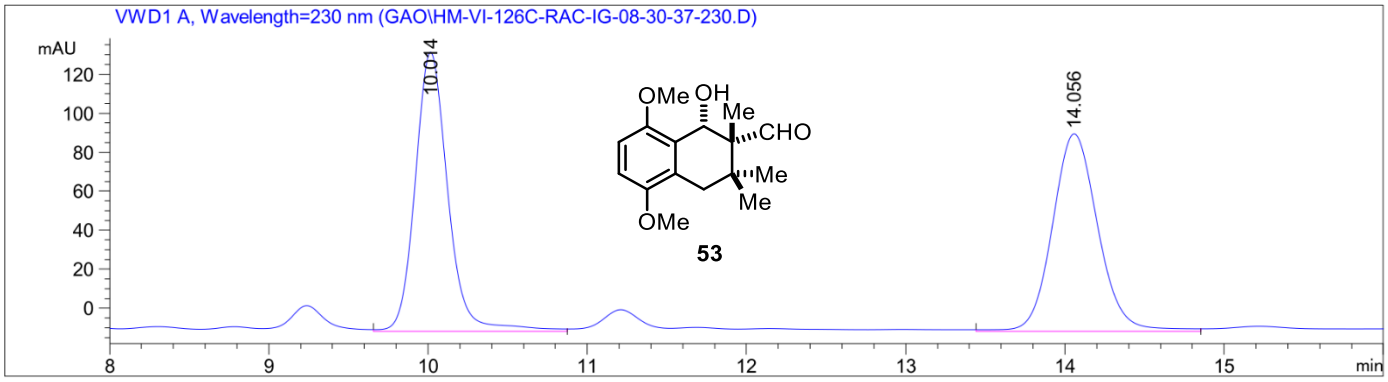


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	20.116	BB	0.5129	4301.58838	128.48643	49.6492
2	23.380	BB	0.6052	4362.38184	110.73411	50.3508

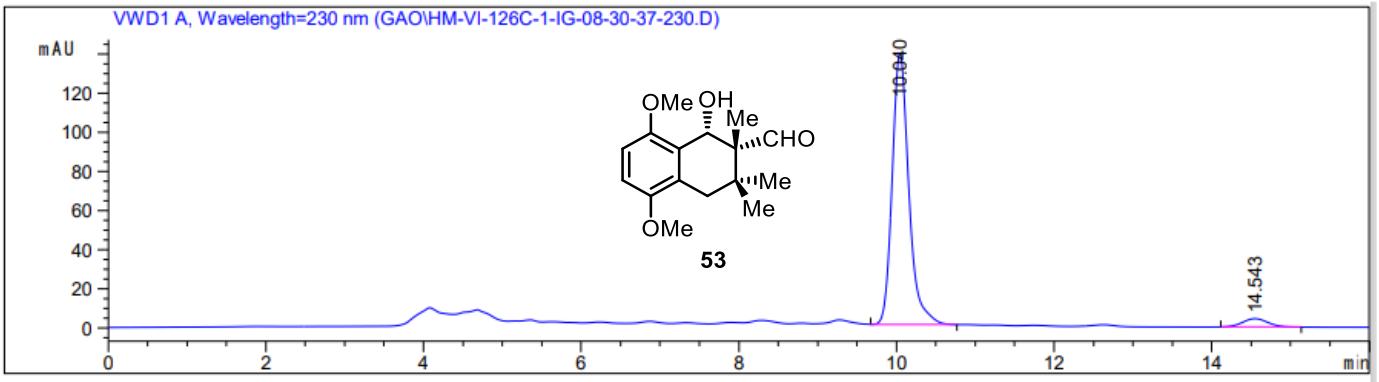


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	18.671	BB	0.4851	3.09650e4	976.13391	94.3965
2	21.838	BB	0.5657	1838.13525	49.33276	5.6035

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 18.671min (major), t_R = 21.838 min (minor).

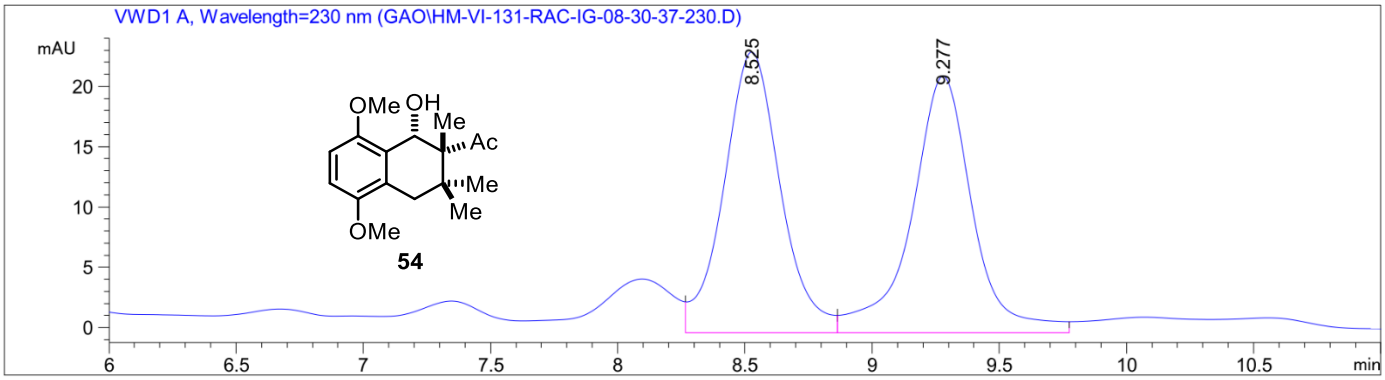


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.014	VV	0.2206	2063.43115	143.09569	50.3545
2	14.056	VV	0.3099	2034.38037	101.36061	49.6455

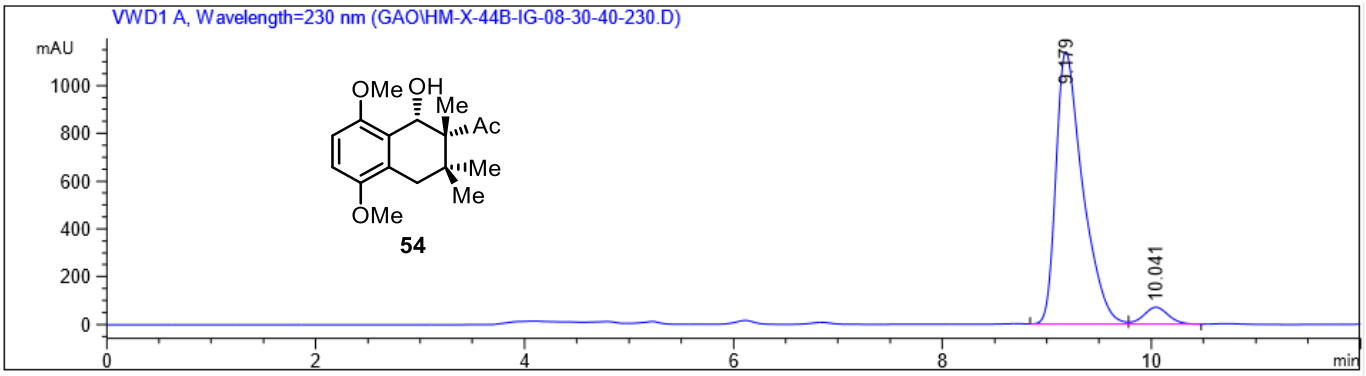


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.040	VB	0.2238	2039.23950	138.78944	95.4781
2	14.543	BB	0.3511	96.57851	4.29516	4.5219

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.040 min (major), t_R = 14.544 min (minor).

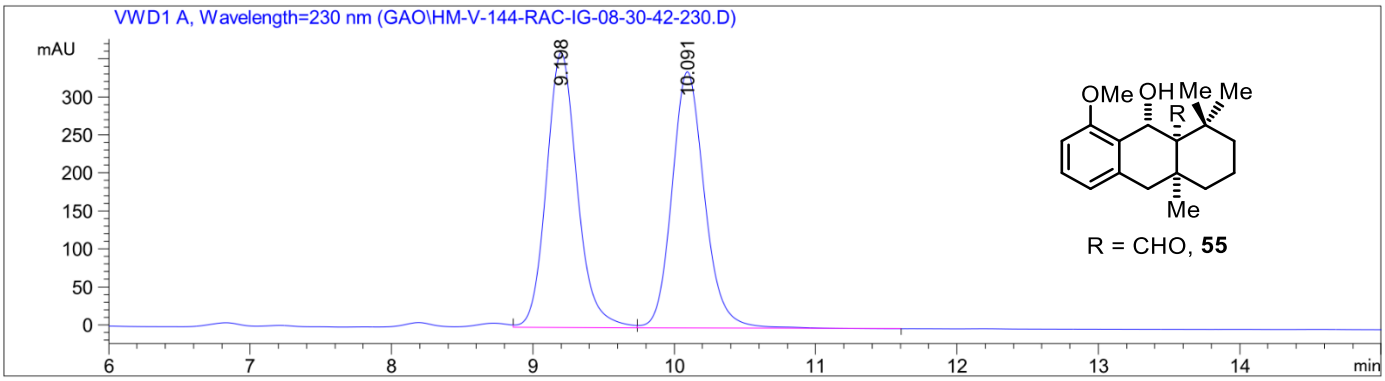


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.525	VV	0.2329	359.48547	23.24142	50.2941
2	9.277	VV	0.2534	355.28177	21.23619	49.7059

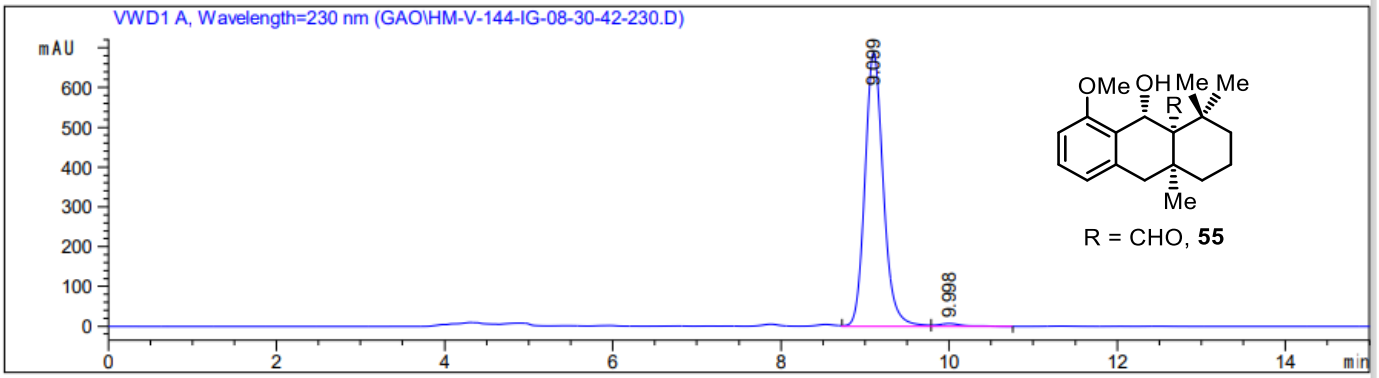


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.179	VV	0.2643	2.03672e4	1141.06433	94.4638
2	10.041	VV	0.2563	1193.66260	71.61625	5.5362

Enantiomeric excess: 89%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 9.179 min (major), t_R = 10.041 min (minor).

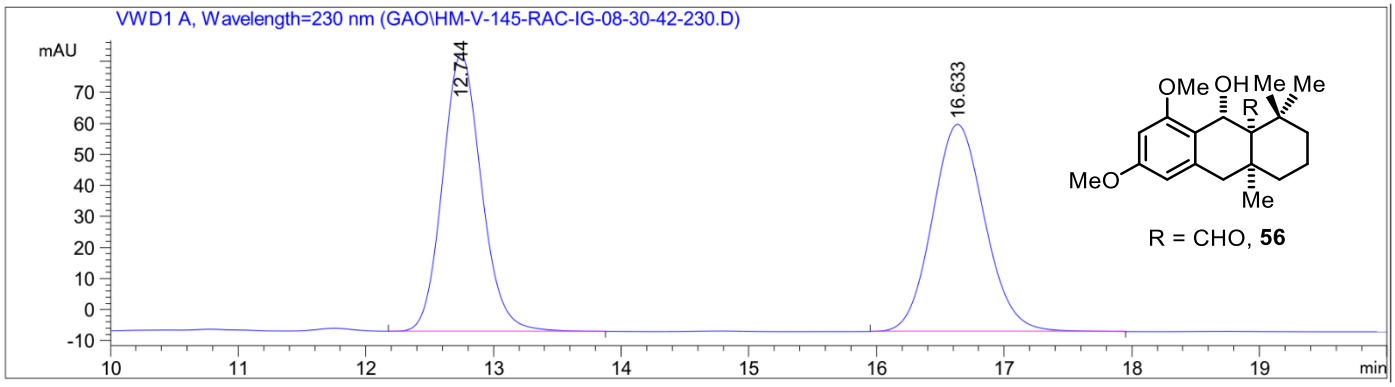


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.198	VV	0.2327	5497.01807	361.66394	50.3769
2	10.091	VB	0.2486	5414.76221	337.08356	49.6231

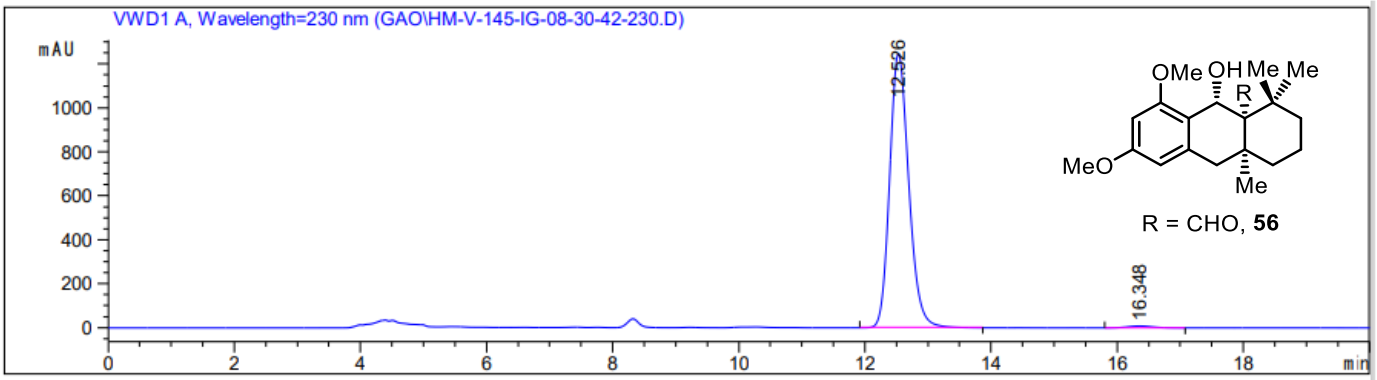


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.099	VV	0.2341	1.04569e4	688.05212	98.6297
2	9.998	VB	0.2857	145.28128	7.19936	1.3703

Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.100min (major), t_R = 9.998 min (minor).

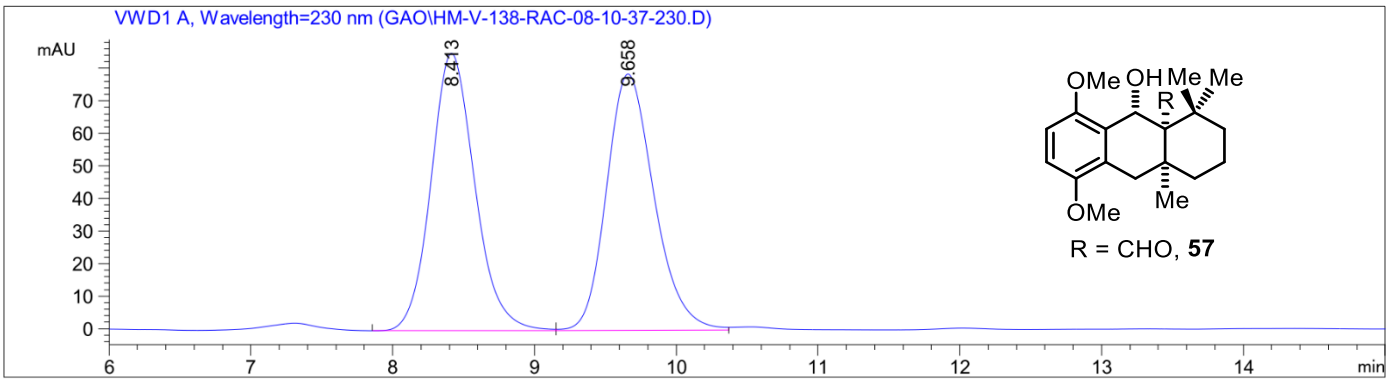


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.744	VB	0.3294	1898.85303	89.36530	49.8594
2	16.633	BB	0.4443	1909.56213	66.77644	50.1406

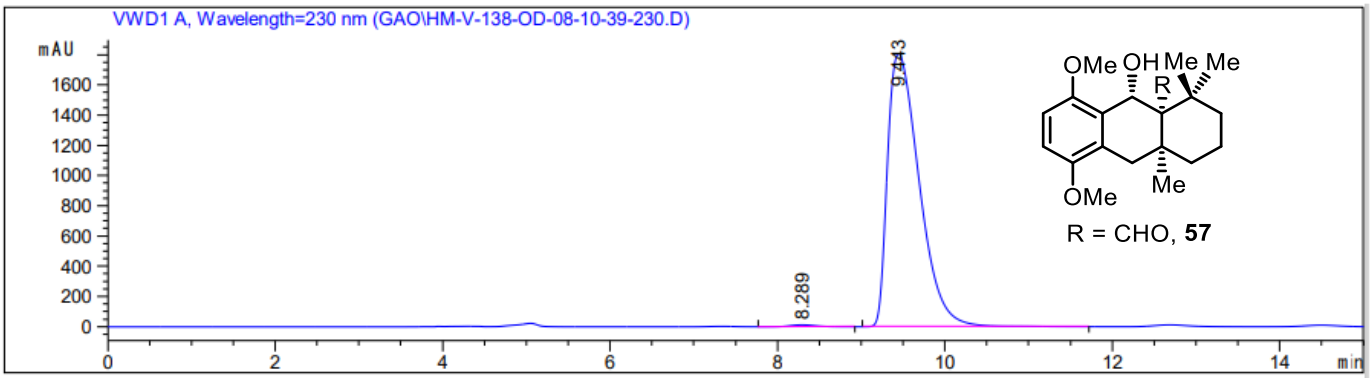


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.526	BB	0.3255	2.63073e4	1246.69666	99.0776
2	16.348	BB	0.4090	244.93130	8.88408	0.9224

Enantiomeric excess: 98%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 12.526min (major), t_R = 16.350 min (minor).

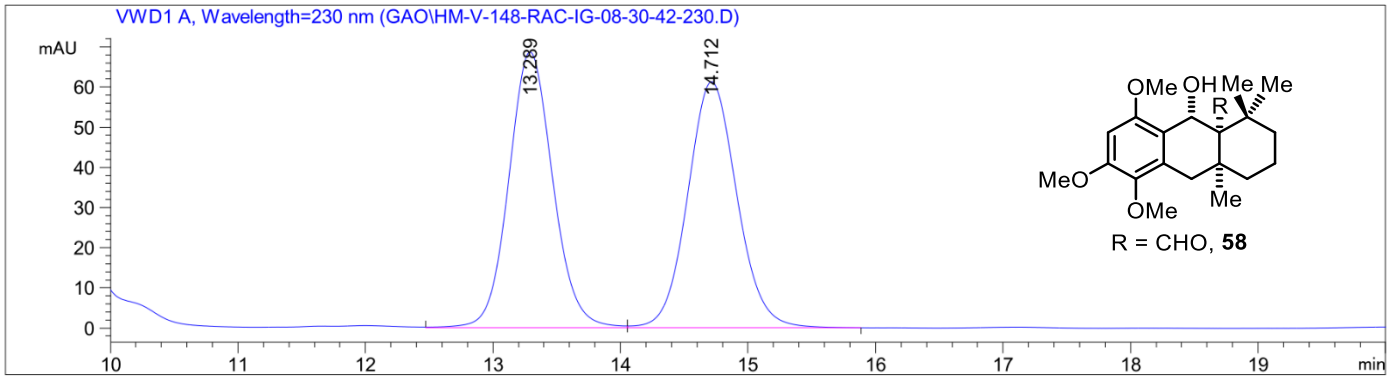


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.413	VV	0.3328	1835.69800	85.24306	49.8922
2	9.658	VV	0.3602	1843.63147	78.82996	50.1078

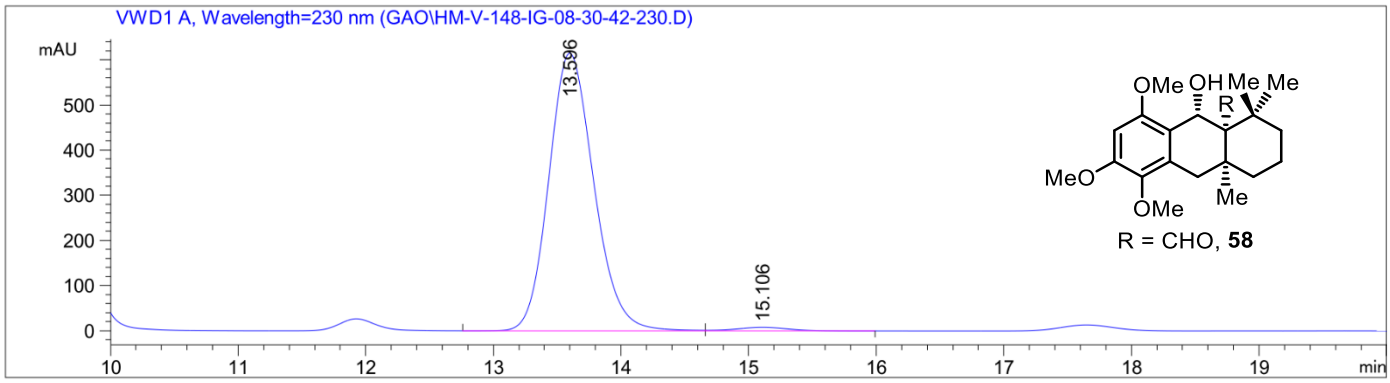


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.289	VB	0.3340	275.27118	12.86779	0.5755
2	9.443	BB	0.4111	4.75568e4	1807.56763	99.4245

Enantiomeric excess: 99%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 8.289min (minor), t_R = 9.444 min (major).

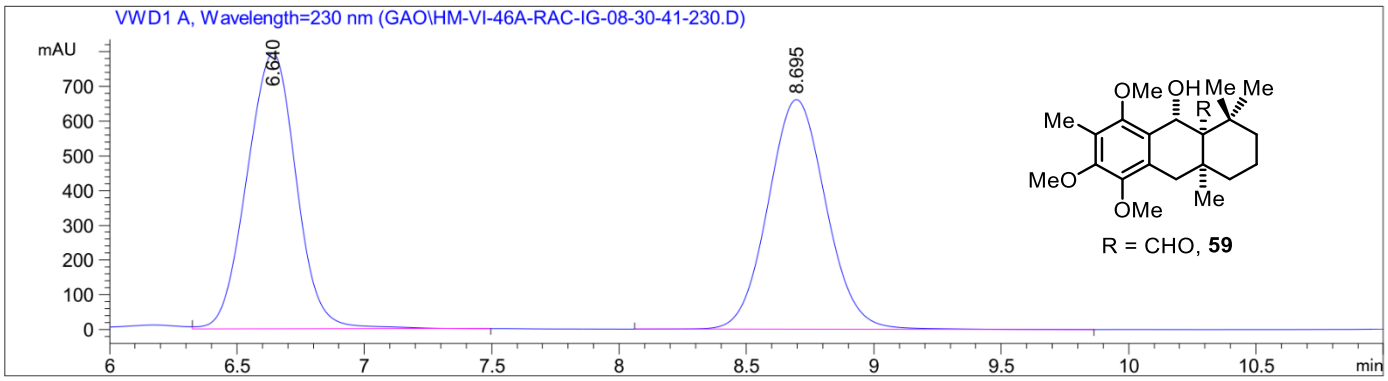


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.289	VV	0.3747	1659.60181	68.76693	50.0847
2	14.712	VB	0.4165	1653.98694	61.33215	49.9153

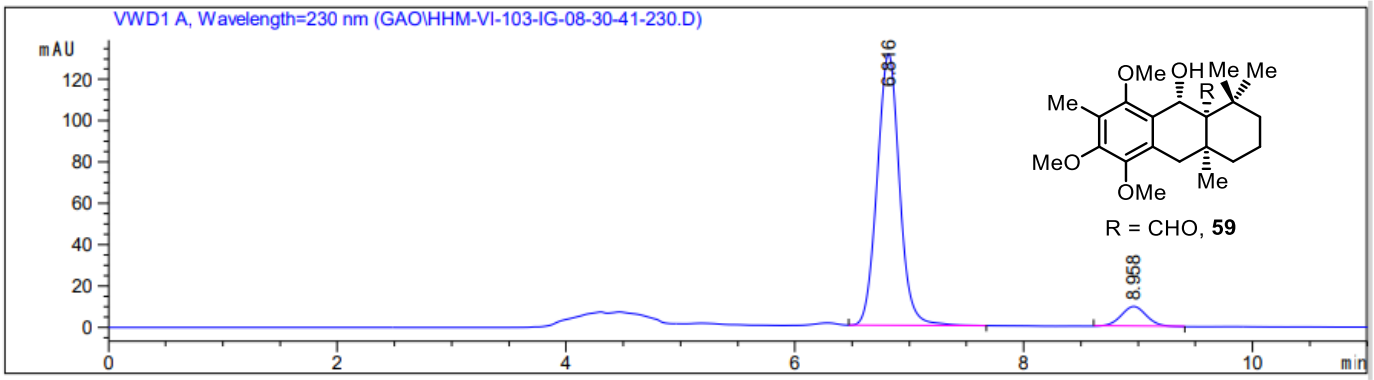


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.596	VV	0.3797	1.51120e4	615.25031	98.4621
2	15.106	VB	0.4493	236.04254	7.99548	1.5379

Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 13.596min (major), t_R = 15.106 min (minor).

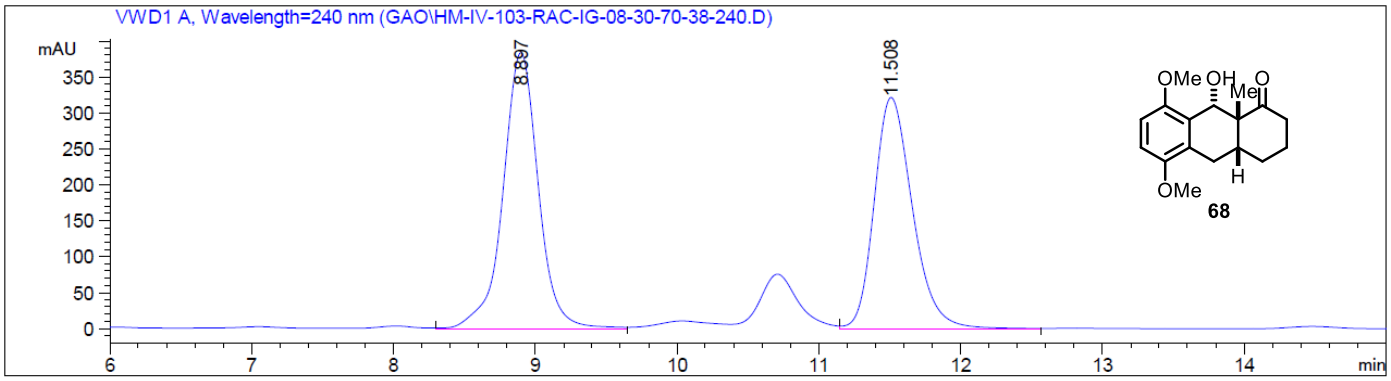


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.640	VB	0.2135	1.07152e4	794.03949	50.5896
2	8.695	BB	0.2466	1.04654e4	661.00677	49.4104

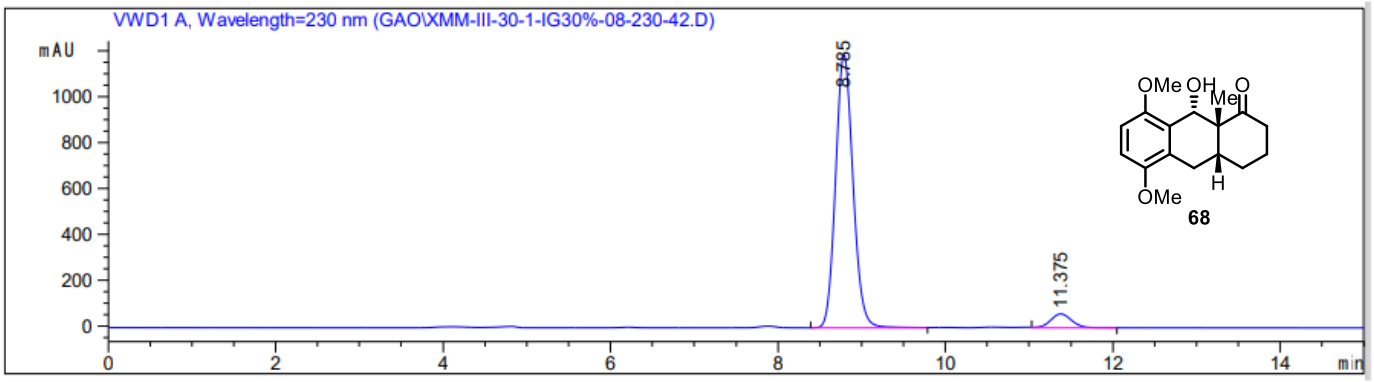


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.816	VB	0.2107	1786.66296	131.69502	92.2402
2	8.958	BB	0.2398	150.30482	9.65612	7.7598

Enantiomeric excess: 85%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 6.816min (major), t_R = 8.958 min (minor).

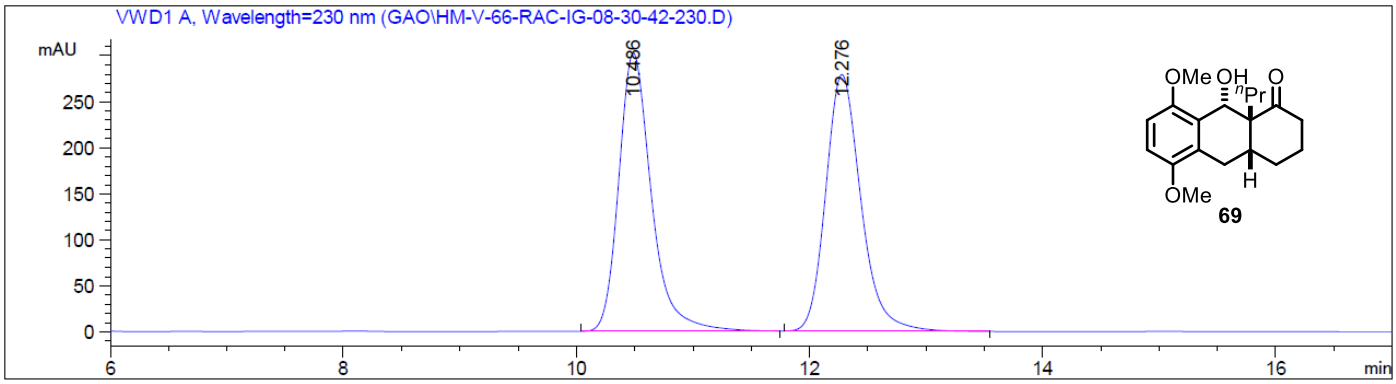


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.897	VV	0.2656	6683.90967	384.19742	52.5170
2	11.508	VB	0.2889	6043.22754	321.85696	47.4830

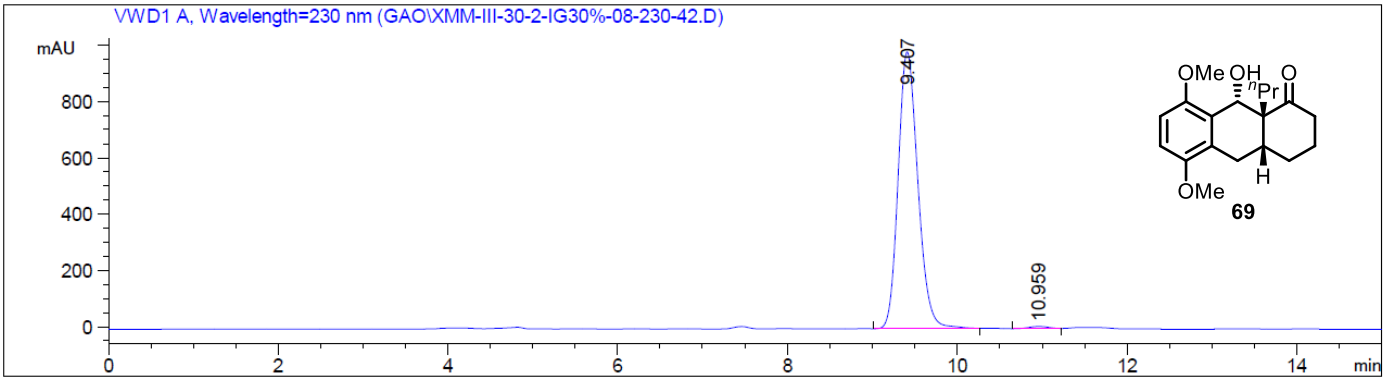


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.785	BV	0.2245	1.72702e4	1191.25793	94.1754
2	11.375	VB	0.2720	1068.12903	60.77779	5.8246

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ºC, 230 nm): t_R = 8.785 min (major), t_R = 11.375 min (minor).

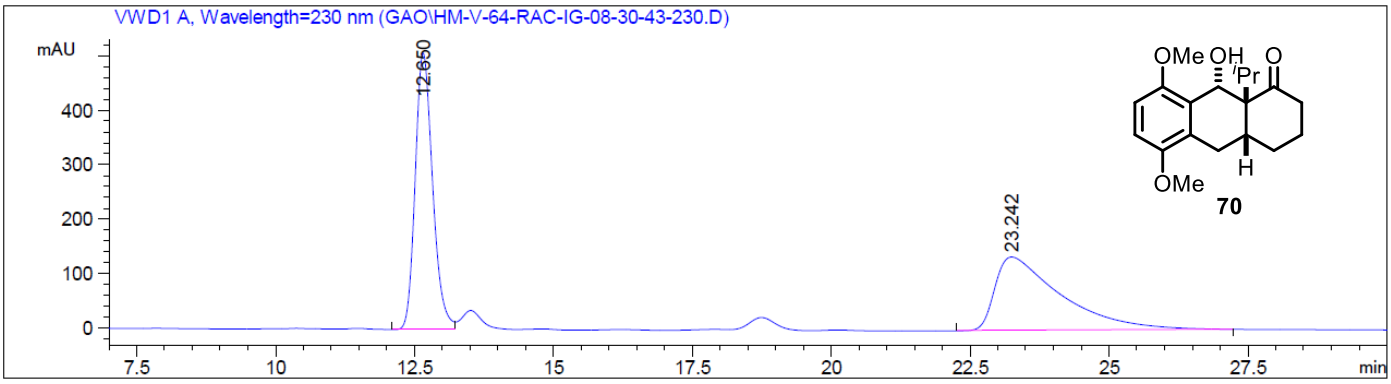


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.486	BB	0.2963	5906.99561	302.49463	50.1467
2	12.276	BB	0.3225	5872.44336	279.29257	49.8533

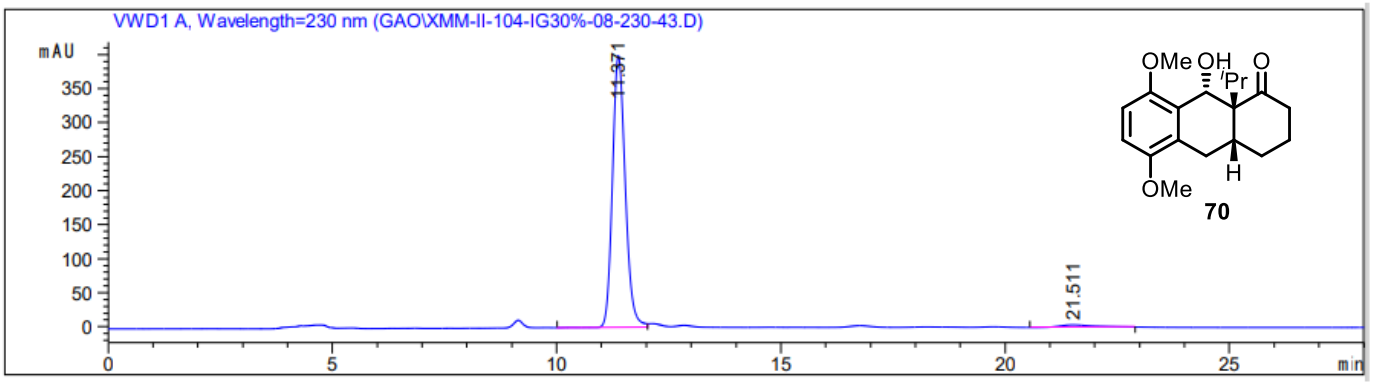


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.407	VV	0.2512	1.59631e4	983.51563	98.9578
2	10.959	VV	0.2819	168.12074	9.15797	1.0422

Enantiomeric excess: 98%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 9.407 min (major), t_R = 10.959 min (minor).

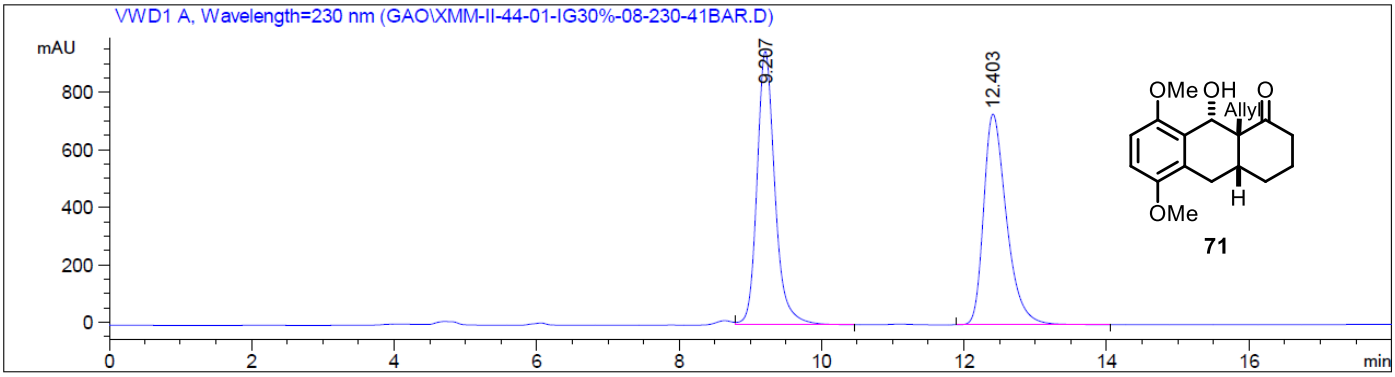


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.650	VV	0.3363	1.10732e4	508.52756	49.7386
2	23.242	BB	1.1618	1.11896e4	135.35439	50.2614

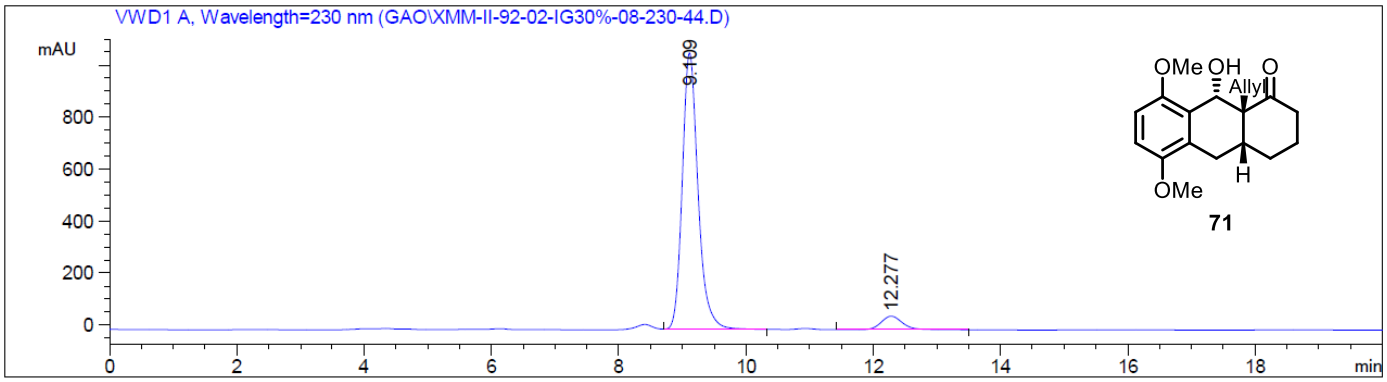


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.371	BV	0.3071	7951.16162	399.72507	97.6185
2	21.511	VB	0.6289	193.97537	3.62334	2.3815

Enantiomeric excess: 95%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.371 min (major), t_R = 21.511 min (minor).

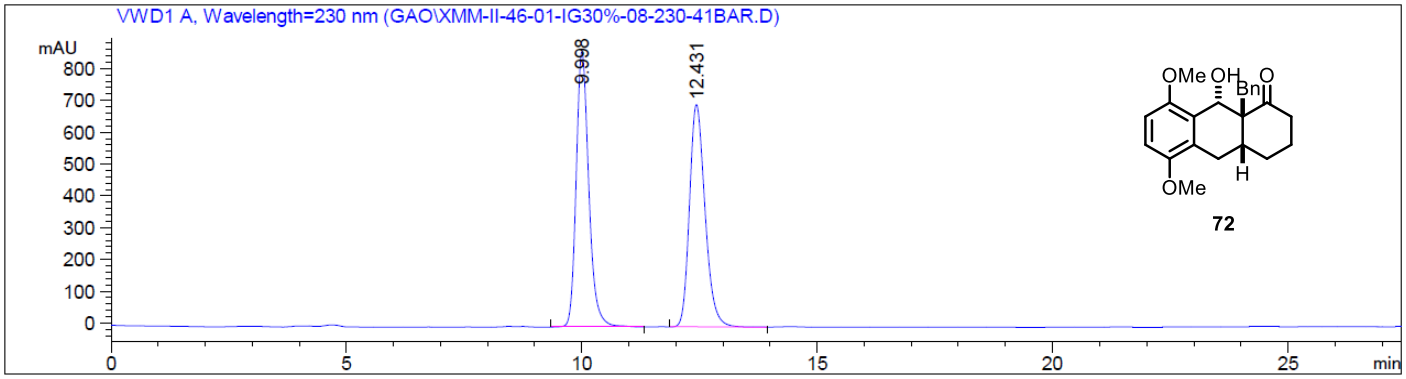


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.207	VB	0.2657	1.66242e4	951.53357	50.4328
2	12.403	BB	0.3395	1.63388e4	732.63623	49.5672

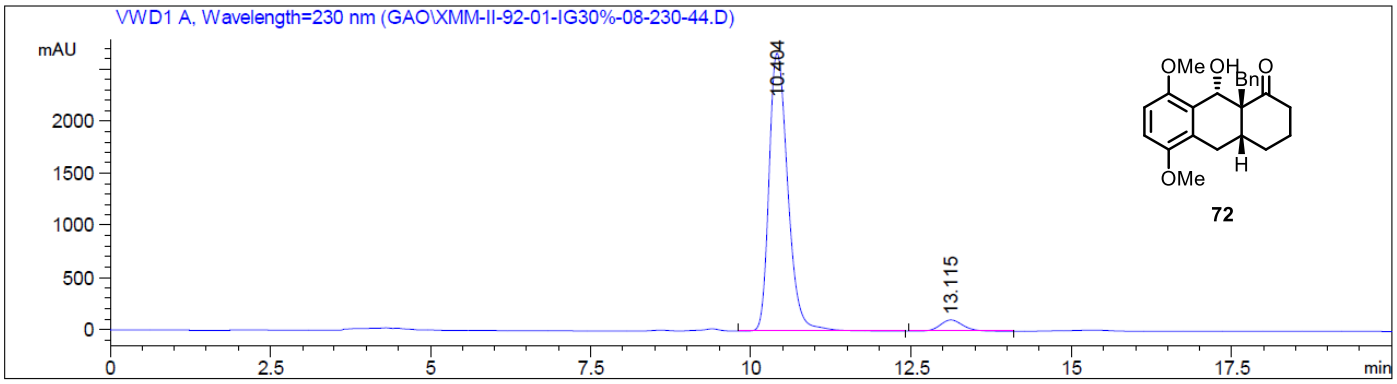


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.109	VB	0.2618	1.82931e4	1063.43567	93.6748
2	12.277	BB	0.3633	1235.19958	52.08578	6.3252

Enantiomeric excess: 87%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 9.109 min (major), t_R = 12.277 min (minor).

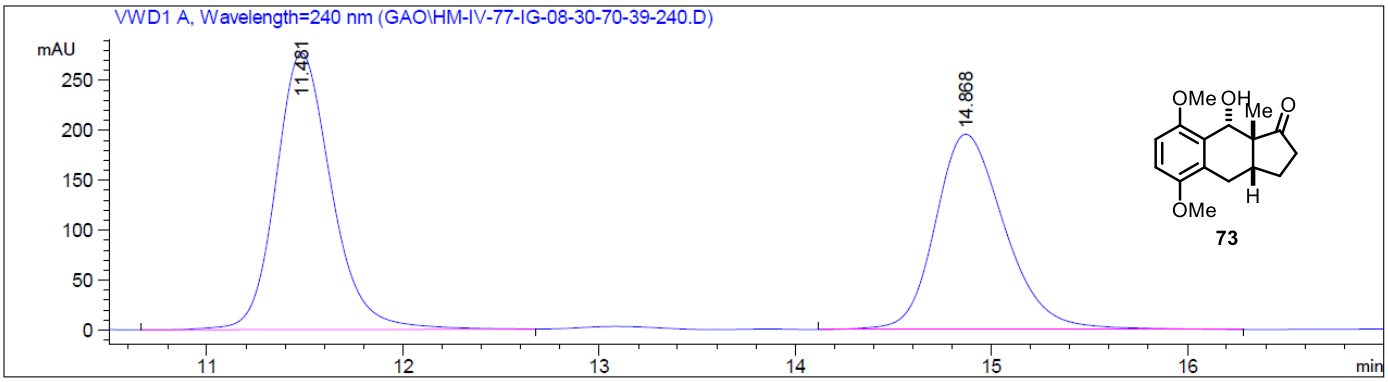


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.998	BB	0.2855	1.62257e4	866.18048	50.0757
2	12.431	VB	0.3548	1.61766e4	700.06726	49.9243

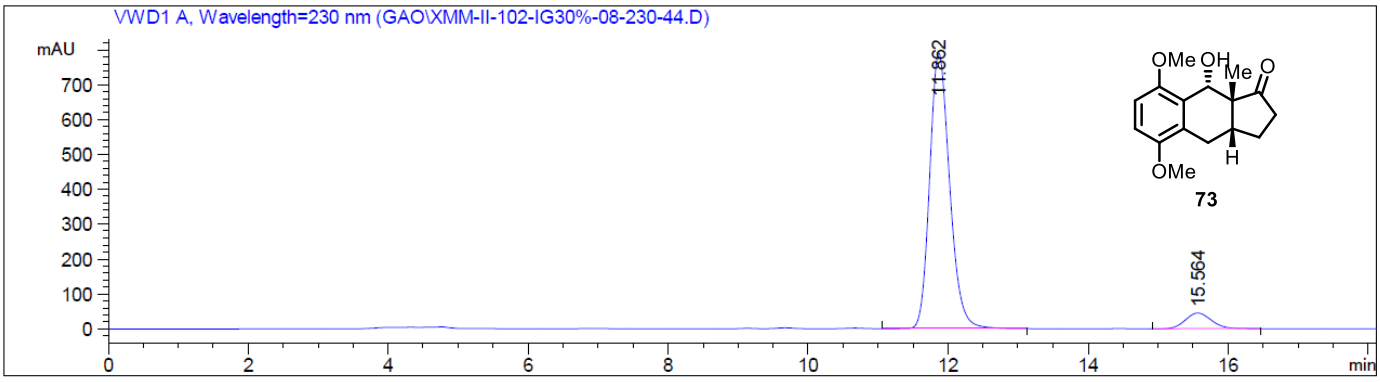


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.404	VB	0.3152	5.42699e4	2668.65454	95.2449
2	13.115	BB	0.3821	2709.42383	108.59829	4.7551

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 10.404 min (major), t_R = 13.115 min (minor).

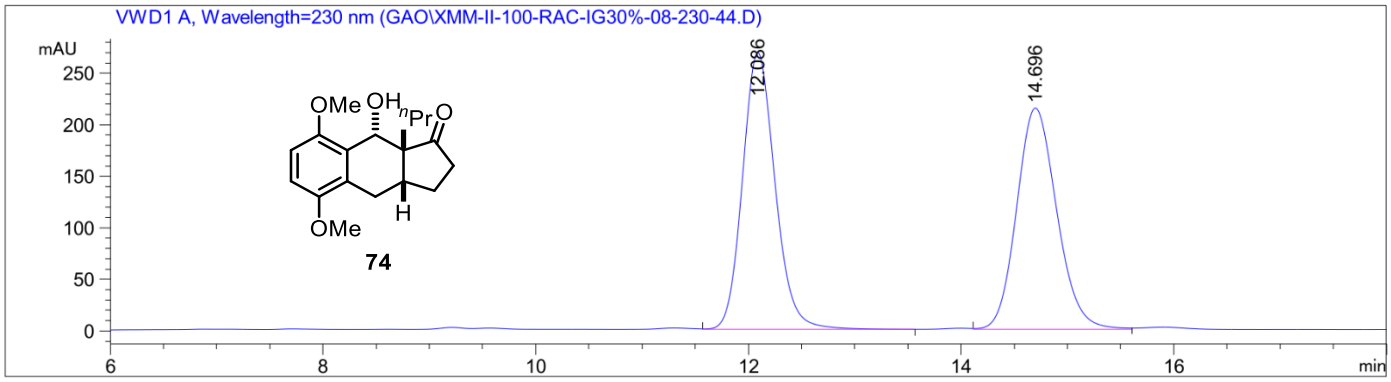


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.481	VB	0.3046	5502.63965	277.00732	53.2396
2	14.868	VB	0.3787	4832.96484	195.48167	46.7604

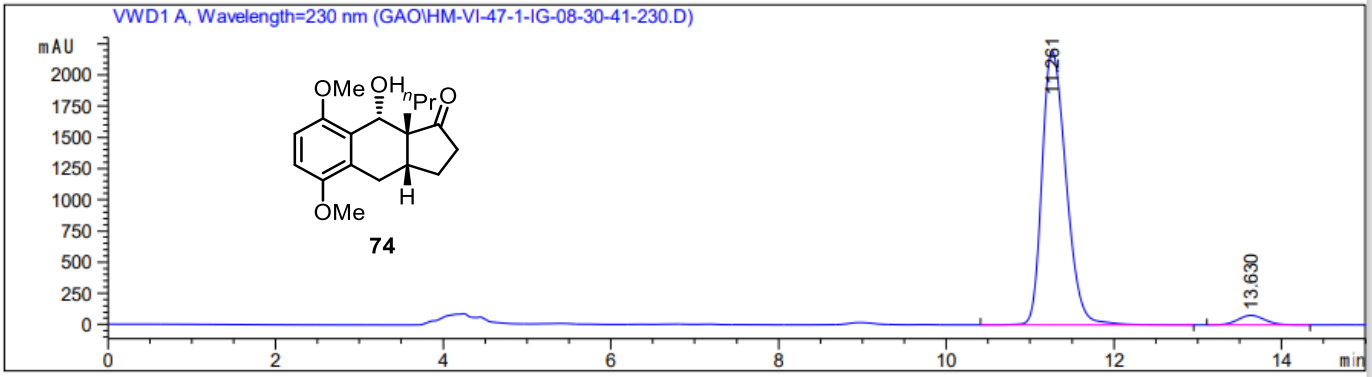


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.862	VB	0.3066	1.57336e4	792.47992	93.0247
2	15.564	VB	0.4020	1179.75159	45.31004	6.9753

Enantiomeric excess: 86%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ºC, 230 nm): t_R = 11.862 min (major), t_R = 15.564 min (minor).

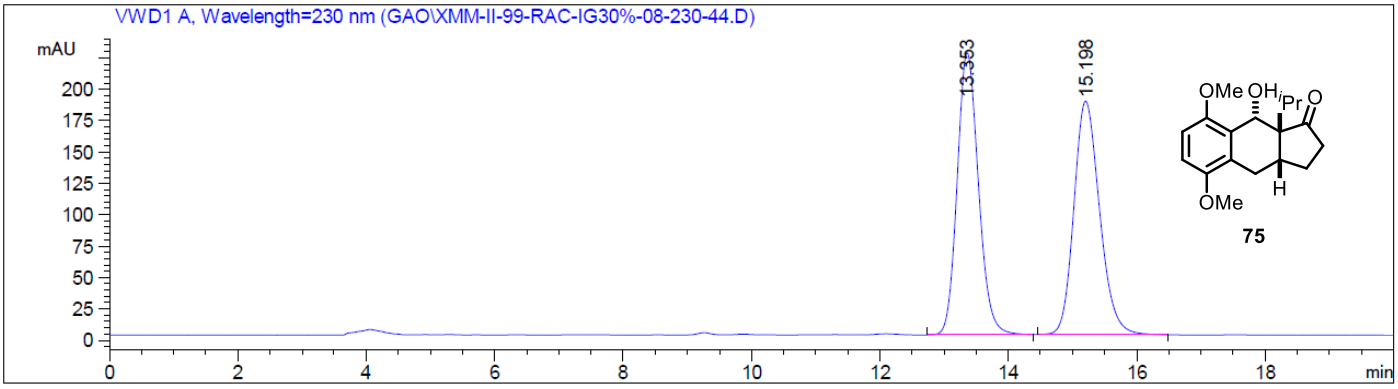


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.086	VB	0.3306	5731.04541	268.45203	50.4117
2	14.696	VV	0.4082	5637.43359	214.74913	49.5883

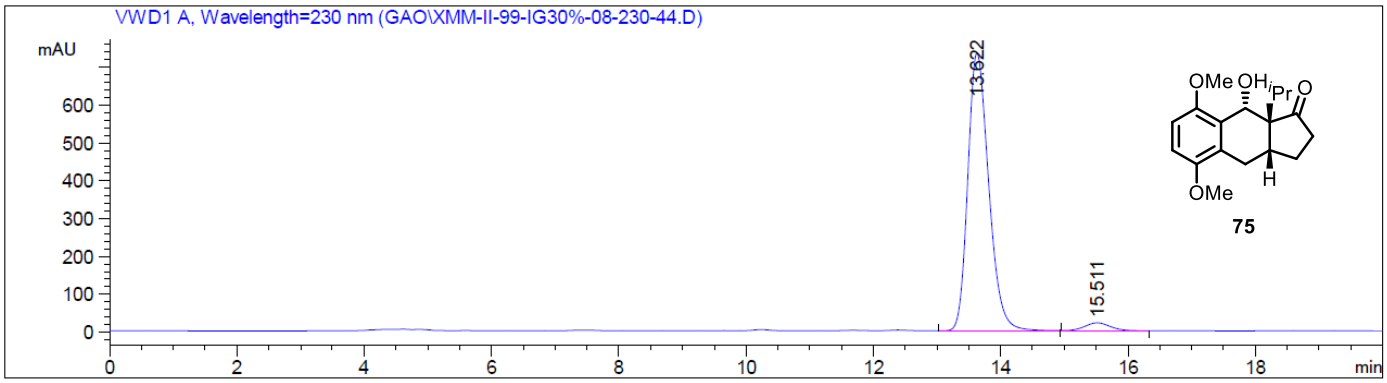


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.261	BB	0.3109	4.36758e4	2194.17139	96.2412
2	13.630	BB	0.3489	1705.80994	76.30073	3.7588

Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.261min (major), t_R = 13.630 min (minor).

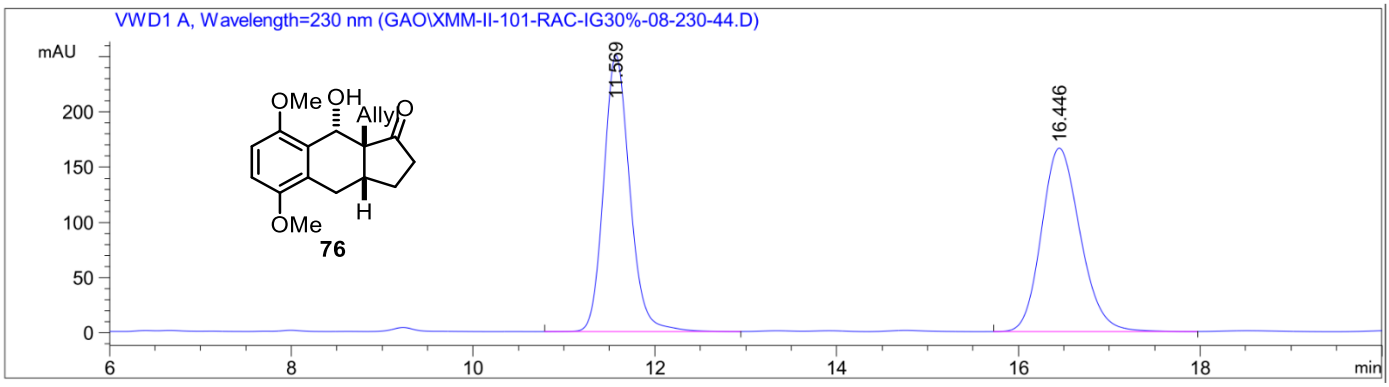


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.353	BB	0.3556	5186.08887	224.96513	49.8908
2	15.198	BB	0.4317	5208.79785	186.30989	50.1092

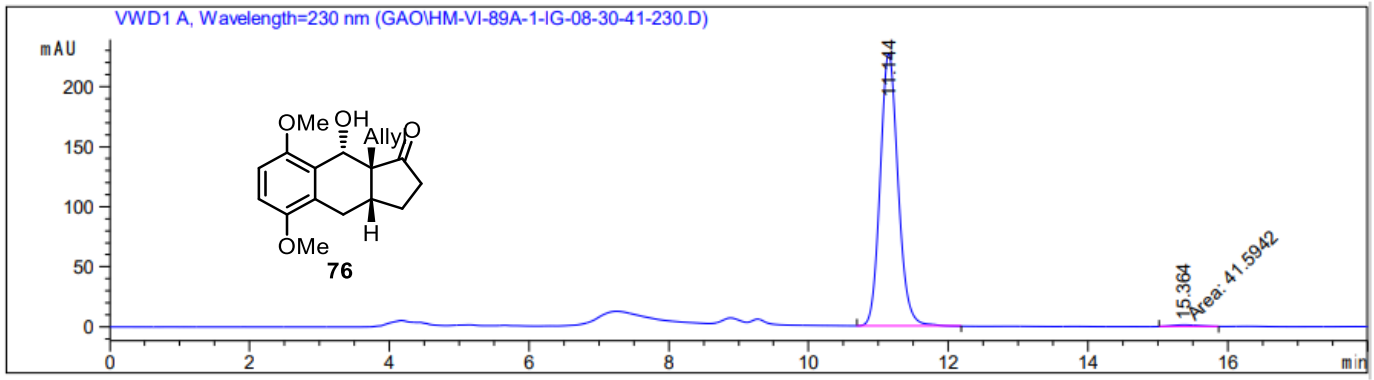


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.622	BB	0.3518	1.67148e4	733.52979	96.5864
2	15.511	BB	0.4310	590.74915	20.98689	3.4136

Enantiomeric excess: 93%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ºC, 230 nm): t_R = 13.622 min (major), t_R = 15.511 min (minor).

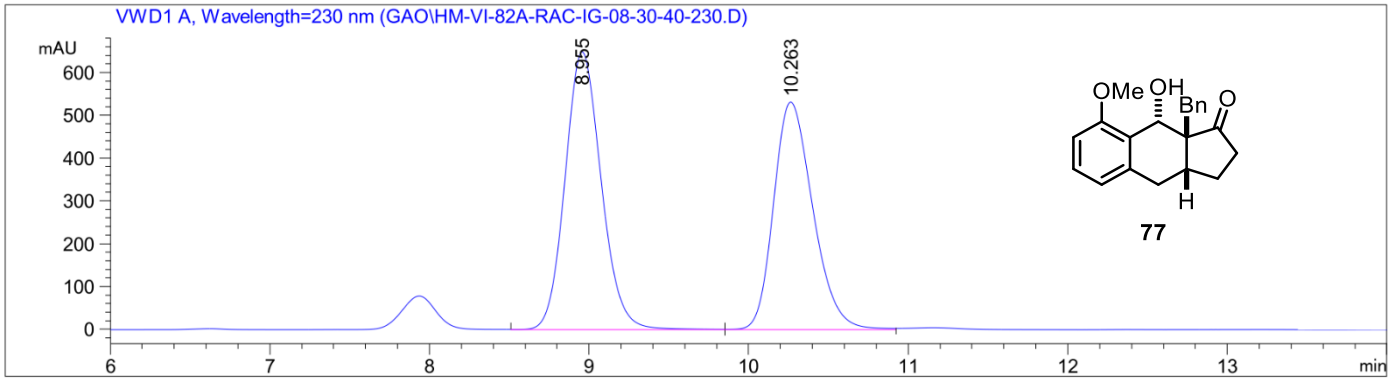


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.569	BV	0.3089	4996.25537	249.92201	50.3100
2	16.446	BB	0.4601	4934.67383	166.12189	49.6900

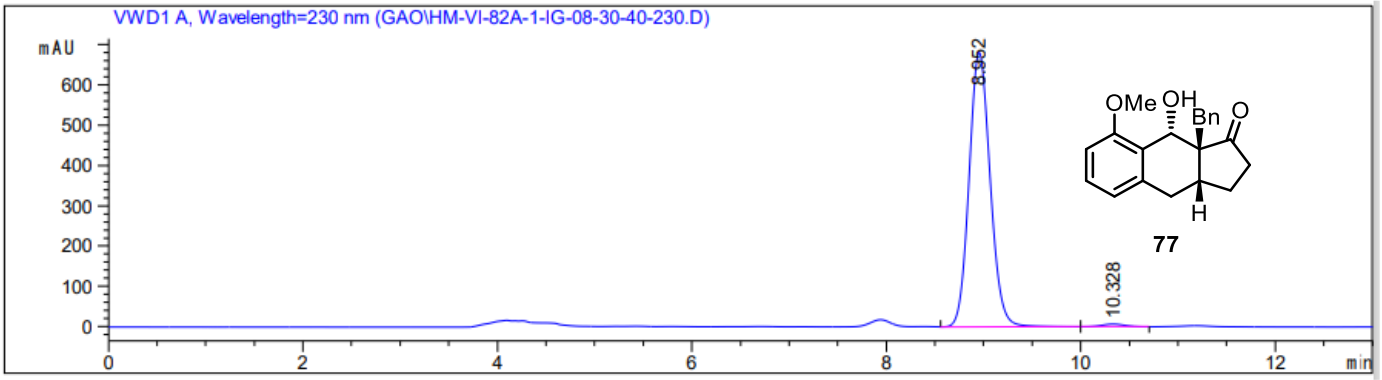


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.144	BB	0.2736	4039.92627	227.26149	98.9809
2	15.364	MM	0.4642	41.59419	1.49348	1.0191

Enantiomeric excess: 99.5%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 11.144min (major), t_R = 16.277 min (minor).

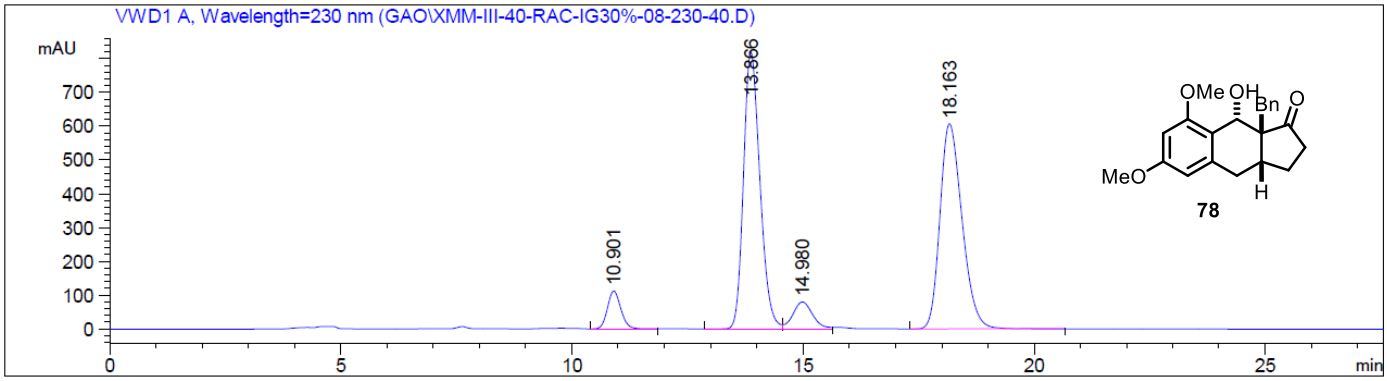


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.955	VV	0.2459	1.02742e4	648.88989	52.9614
2	10.263	VV	0.2672	9125.21777	531.79669	47.0386

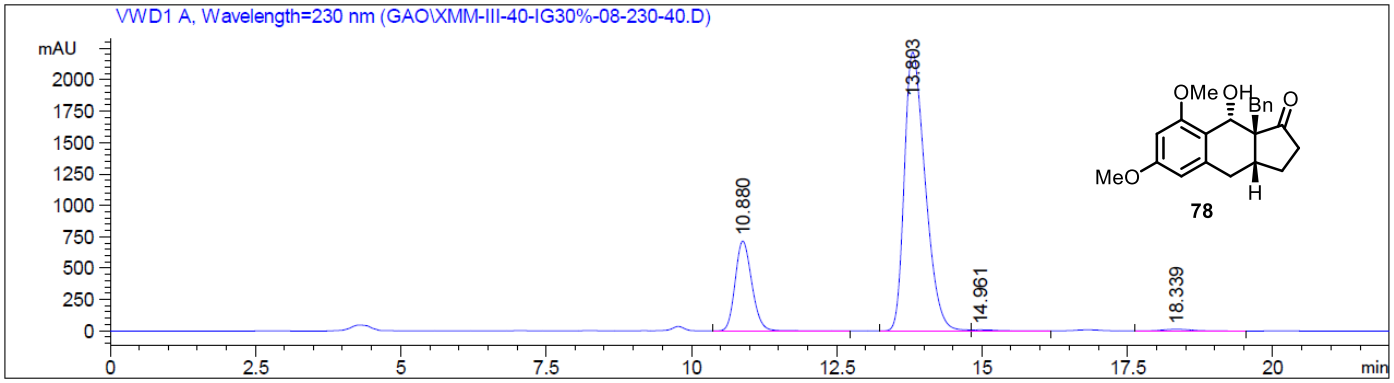


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.952	VB	0.2330	1.02955e4	681.52472	98.7004
2	10.328	BV	0.2817	135.56325	7.24202	1.2996

Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 8.952 min (major), t_R = 10.329 min (minor).

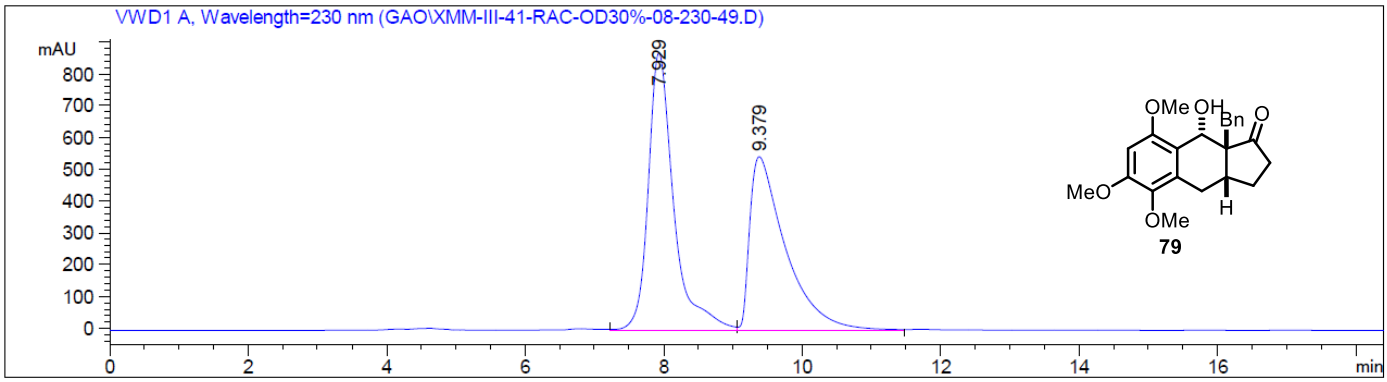


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.901	VV	0.3139	2292.34839	112.28703	5.0710
2	13.866	VV	0.3877	2.02943e4	820.03088	44.8935
3	14.980	VV	0.4582	2389.81934	80.23035	5.2866
4	18.163	VB	0.5166	2.02289e4	607.56891	44.7489

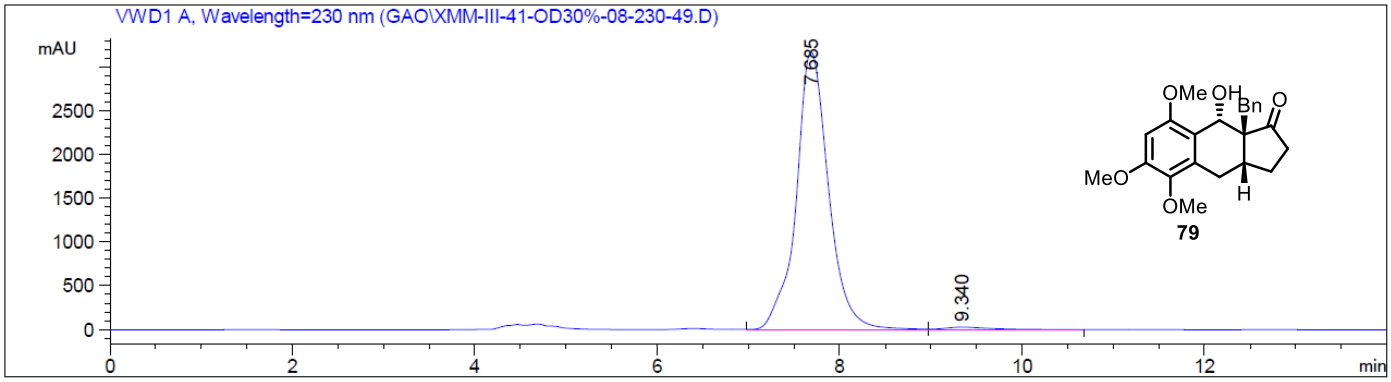


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.880	VB	0.3092	1.43332e4	716.09564	20.2626
2	13.803	BV	0.3855	5.56490e4	2220.89697	78.6701
3	14.961	VV	0.4713	277.80914	8.57191	0.3927
4	18.339	VB	0.5269	477.12805	13.96011	0.6745

Enantiomeric excess: 96% (minor), determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ºC, 230 nm): t_R = 10.880 min (major), t_R = 14.961 min (minor).

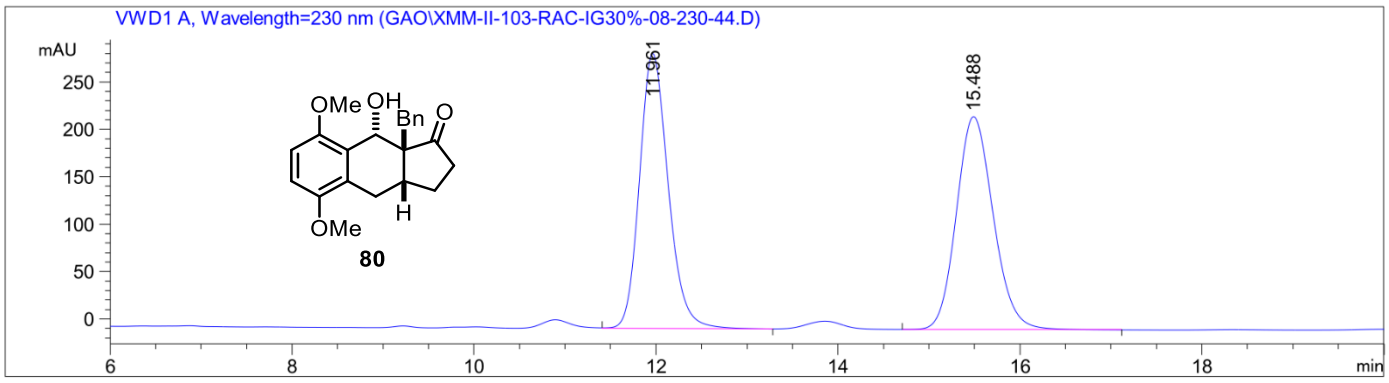


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.929	VV	0.3867	2.23473e4	870.89496	53.3136
2	9.379	VV	0.5239	1.95694e4	544.80219	46.6864

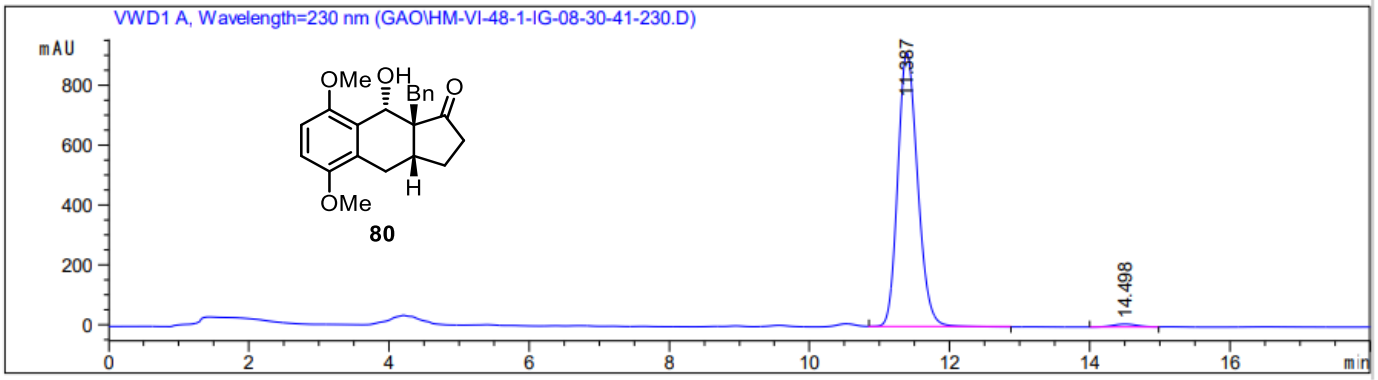


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.685	VV	0.3710	7.85844e4	3167.73633	98.6441
2	9.340	VV	0.5280	1080.13416	29.37355	1.3559

Enantiomeric excess: 97% (major), determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 7.685 min (major), t_R = 9.340 min (minor).

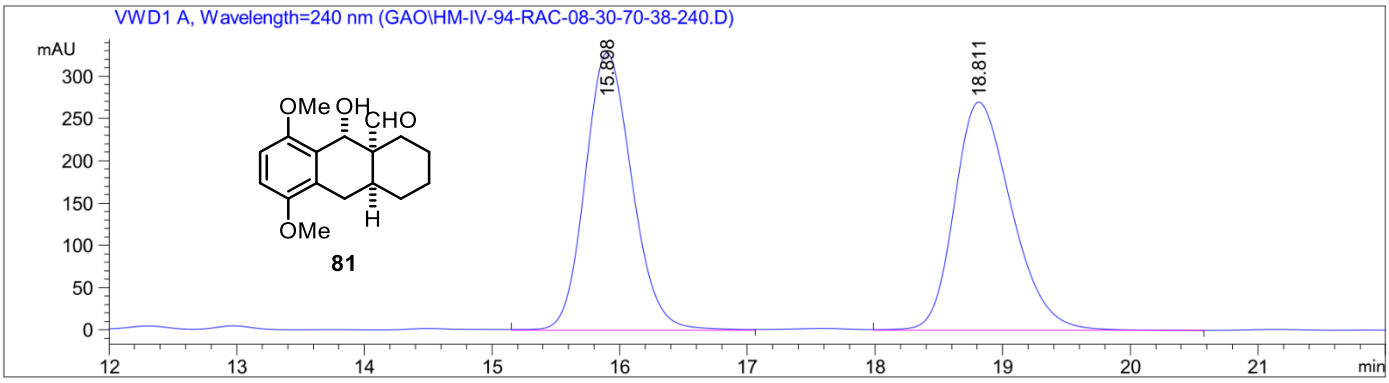


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.961	VV	0.3407	6371.28760	290.07532	50.1976
2	15.488	VB	0.4393	6321.12305	224.40778	49.8024

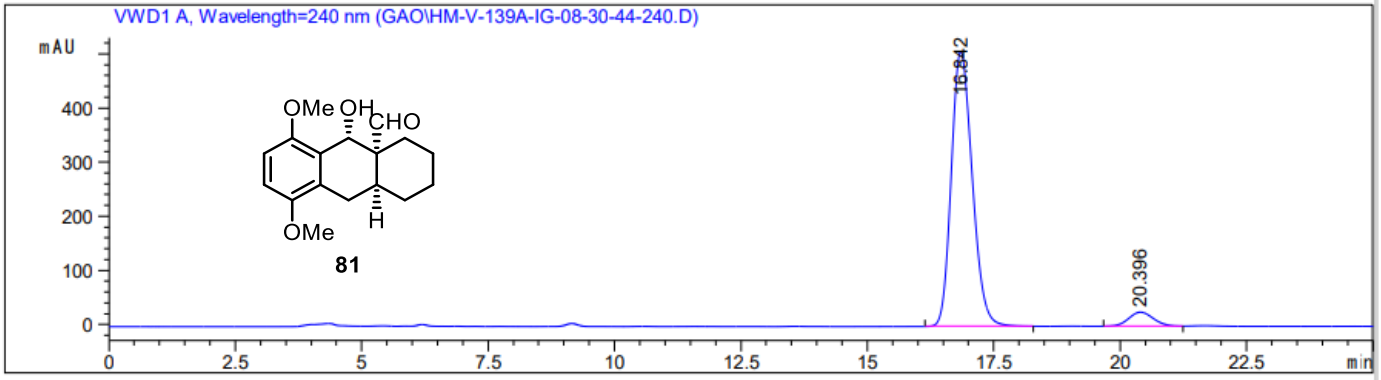


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.387	VB	0.3051	1.80526e4	915.12561	98.6579
2	14.498	BV	0.3758	245.57904	9.85835	1.3421

Enantiomeric excess: 97%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 11.387min (major), t_R = 14.498 min (minor).

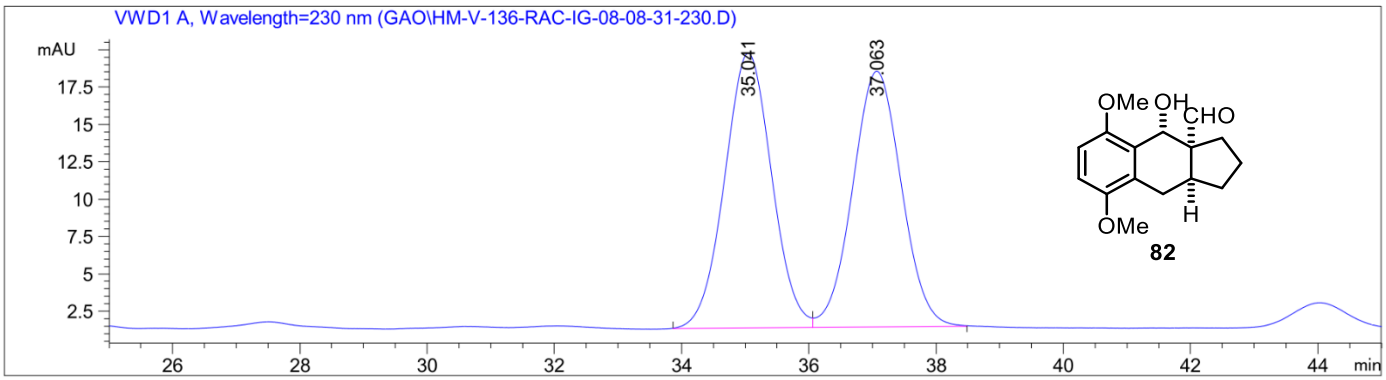


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.898	VV	0.3977	8396.88379	328.00305	49.9018
2	18.811	VB	0.4810	8429.93848	269.83829	50.0982

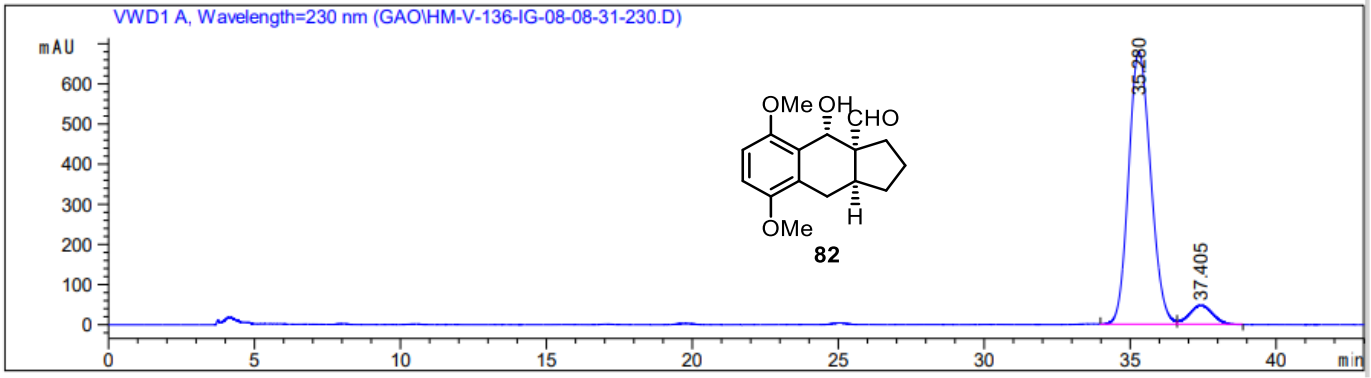


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	16.842	BB	0.4506	1.46472e4	508.12021	94.2399
2	20.396	BV	0.5280	895.25989	26.17001	5.7601

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 240 nm): t_R = 16.842min (major), t_R = 20.397 min (minor).

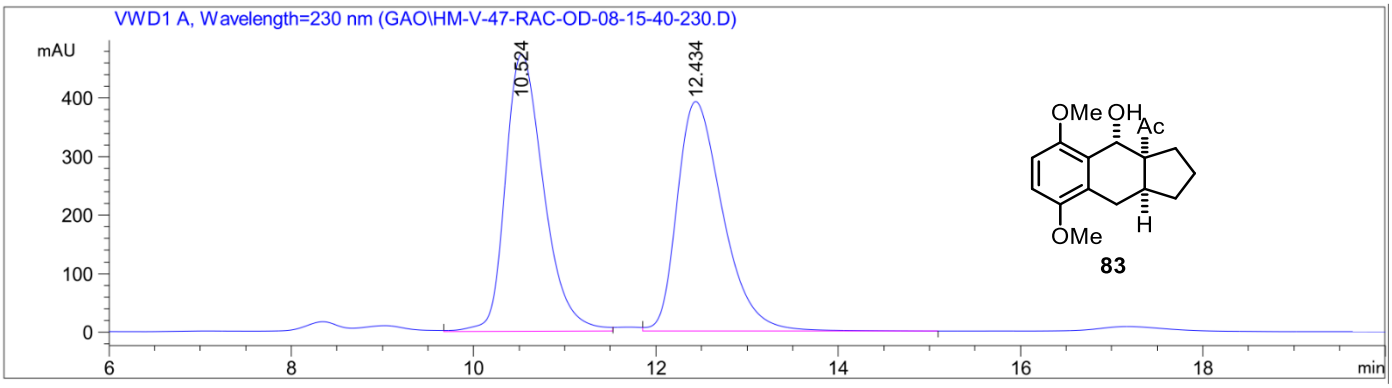


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	35.041	BV	0.7970	949.80927	18.41123	50.9160
2	37.063	VB	0.8303	915.63251	17.13253	49.0840

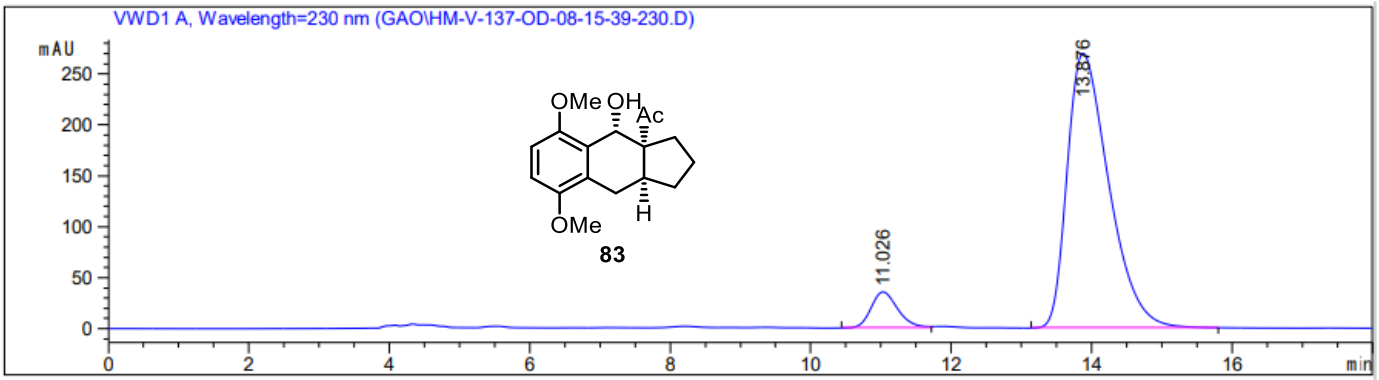


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	35.280	VV	0.8133	3.58152e4	679.95966	93.0756
2	37.405	VB	0.8220	2664.50049	48.13437	6.9244

Enantiomeric excess: 86%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 92/ 8, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 35.280min (major), t_R = 37.406 min (minor).

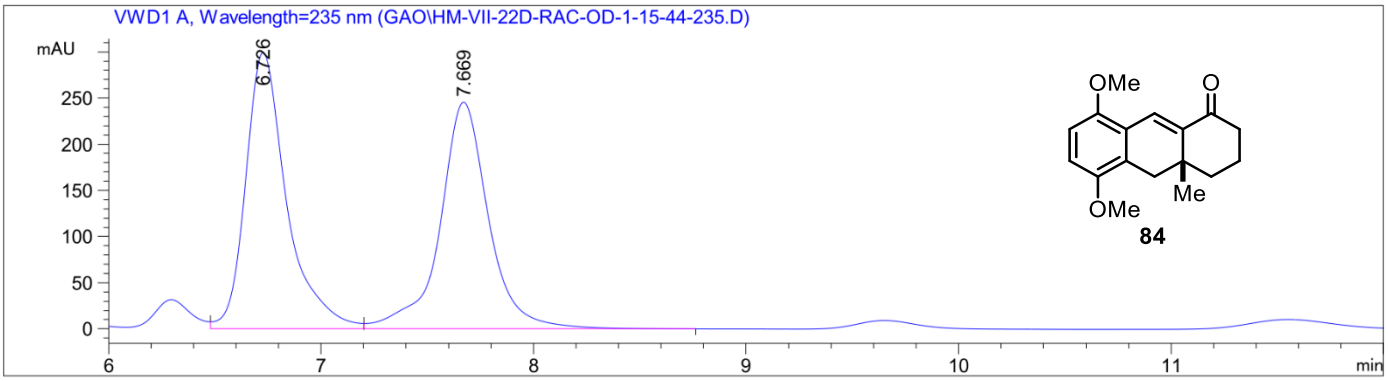


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.524	VV	0.4521	1.38727e4	474.07541	50.2562
2	12.434	VB	0.5362	1.37313e4	392.57886	49.7438

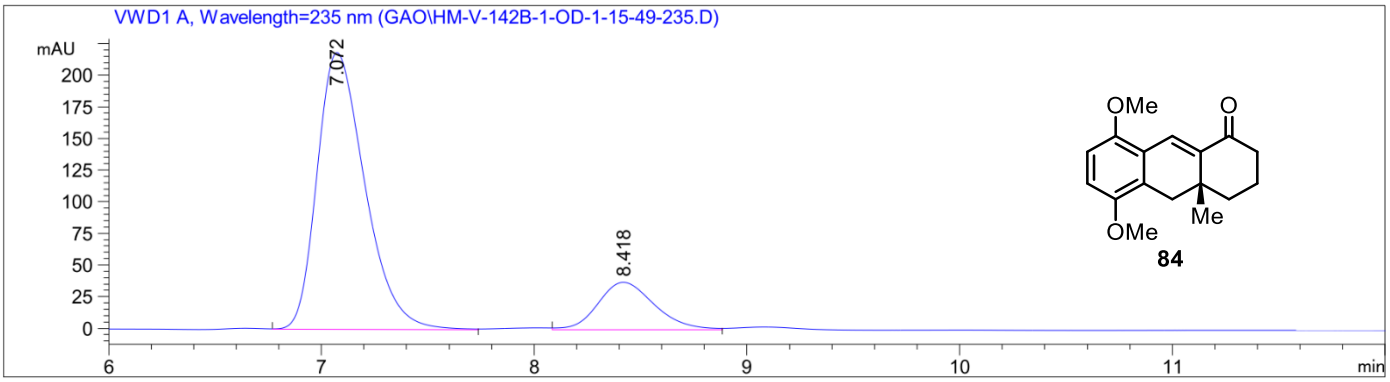


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.026	BB	0.4064	939.60706	35.32189	7.8020
2	13.876	BB	0.6315	1.11036e4	269.41302	92.1980

Enantiomeric excess: 84%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 11.026min (minor), t_R = 13.877 min (major).

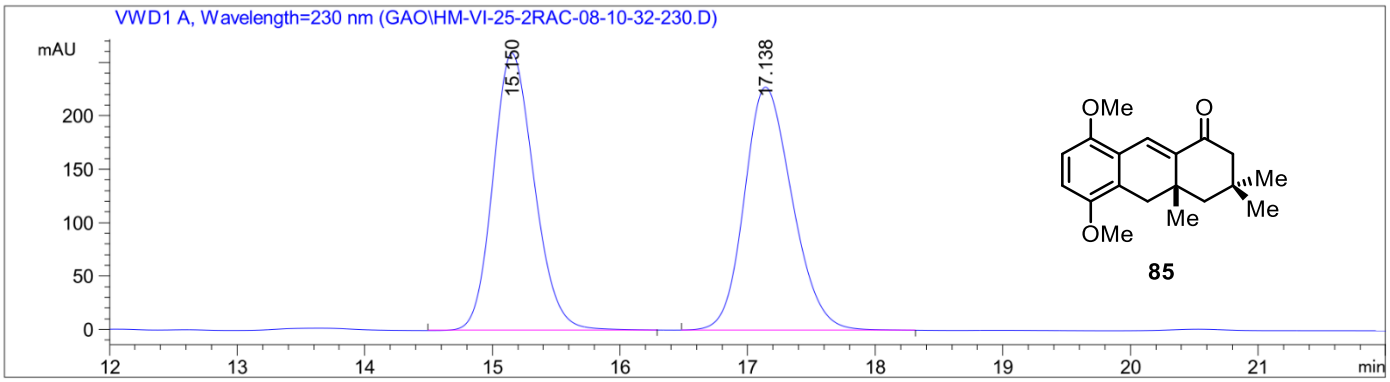


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.726	VV	0.2016	4035.46069	299.51355	50.6375
2	7.669	VB	0.2378	3933.85034	245.63168	49.3625

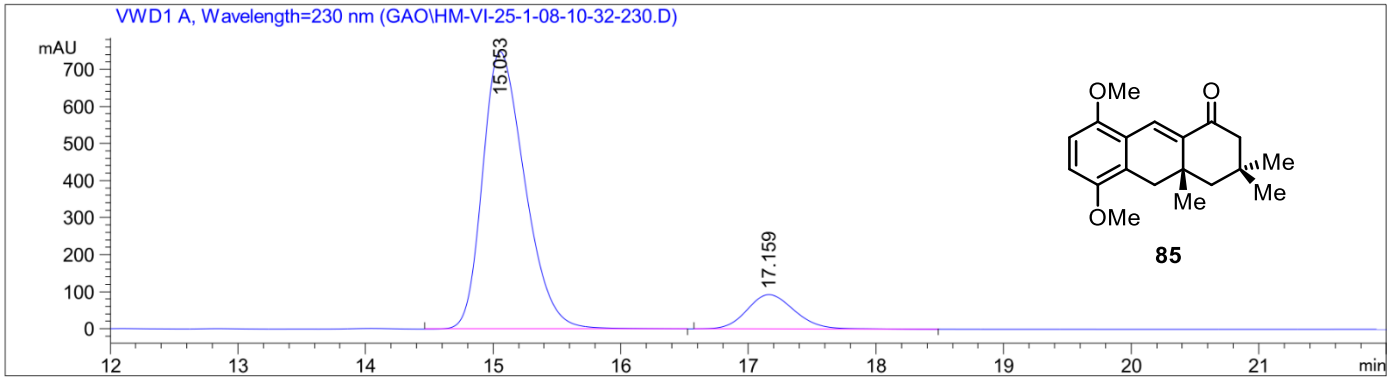


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.072	VV	0.2423	3423.85718	218.77513	83.0116
2	8.418	VV	0.2873	700.69684	37.59260	16.9884

Enantiomeric excess: 66%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 85/15, flow rate 1.0 mL/min, T = 25 ^{o}C, 230 nm): t_R = 7.072 min (major), t_R = 8.418 min (minor).

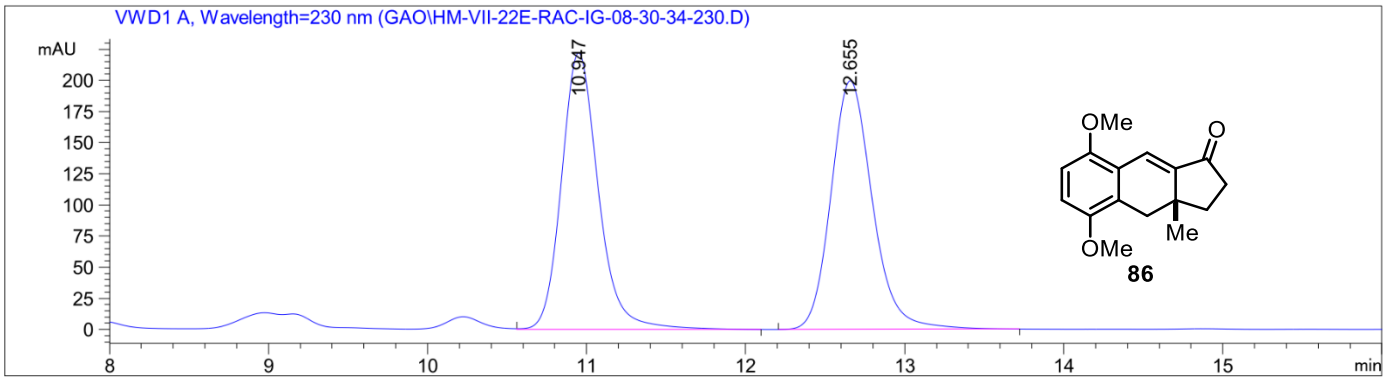


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.150	VB	0.3489	5818.88086	259.52960	49.5131
2	17.138	BB	0.4026	5933.33008	227.49292	50.4869

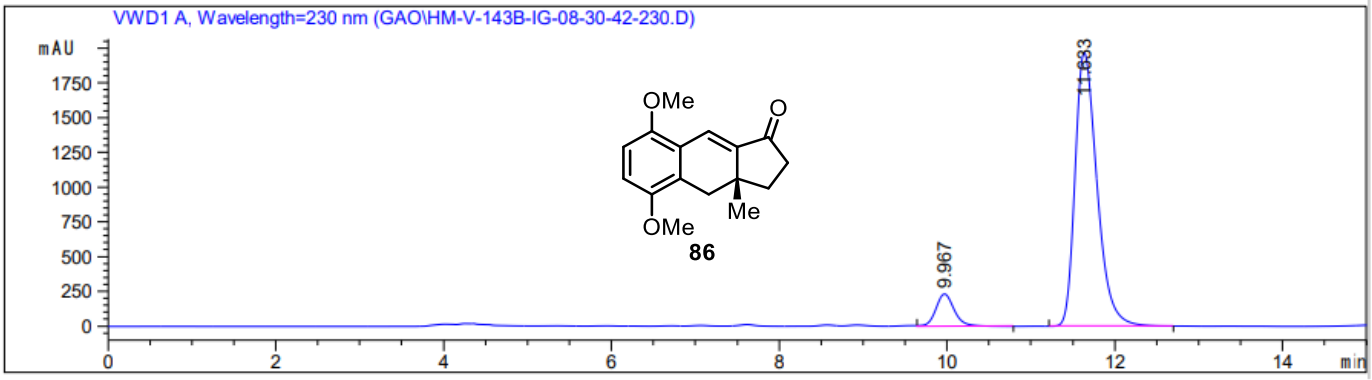


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.053	VB	0.3576	1.72517e4	748.70978	87.5250
2	17.159	BB	0.4084	2458.89697	93.16177	12.4750

Enantiomeric excess: 75%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 15.053 min (major), t_R = 17.159 min (minor).

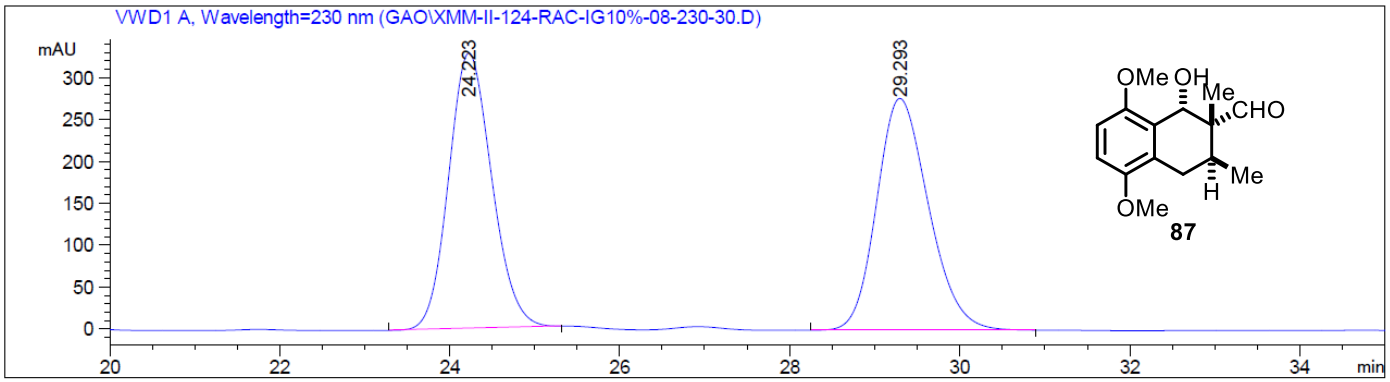


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.947	VB	0.2479	3583.23389	222.09529	49.7557
2	12.655	BB	0.2793	3618.41821	199.52766	50.2443

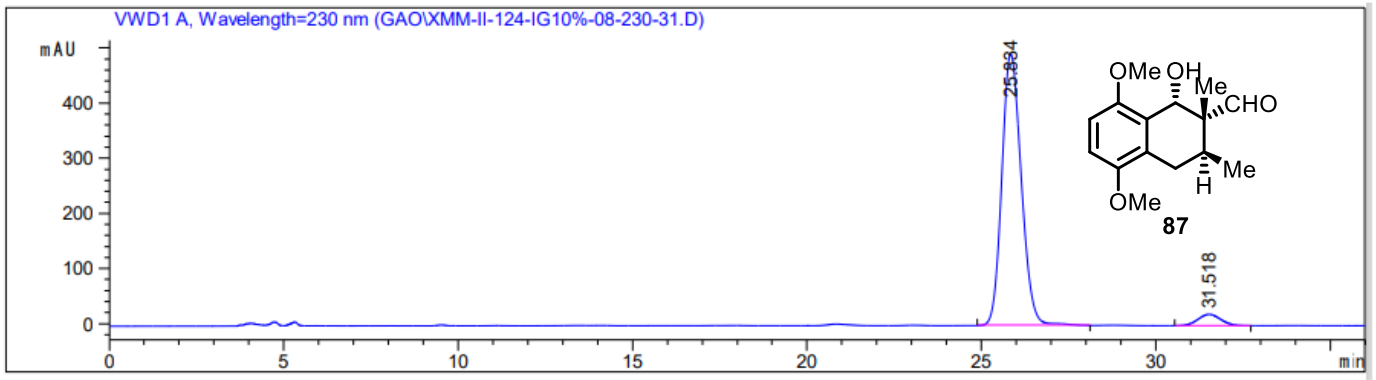


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.967	VV	0.2347	3563.56787	232.66928	9.0614
2	11.633	VB	0.2813	3.57631e4	1967.09167	90.9386

Enantiomeric excess: 82%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 9.967 min (minor), t_R = 11.633 min (major).

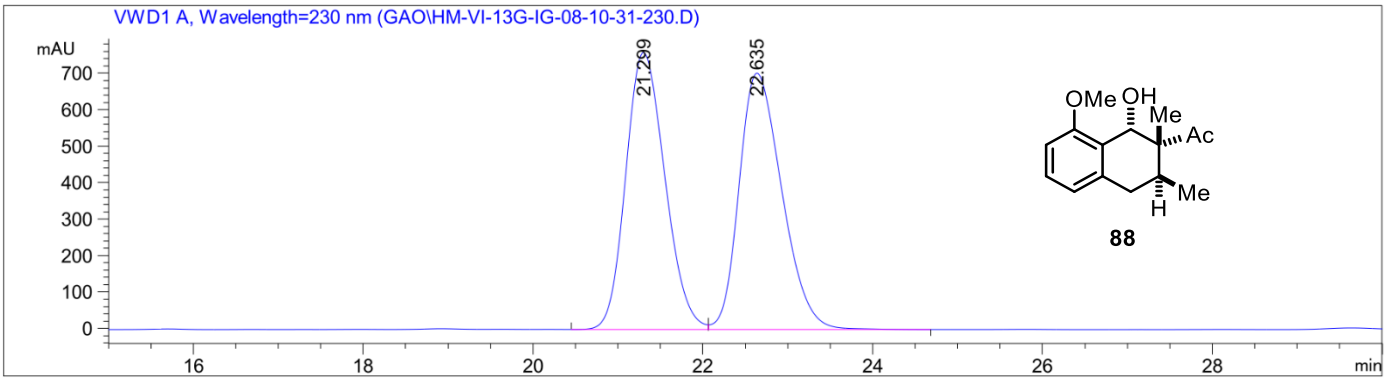


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	24.223	BB	0.5405	1.15735e4	328.62750	49.6603
2	29.293	BB	0.6513	1.17319e4	276.65631	50.3397

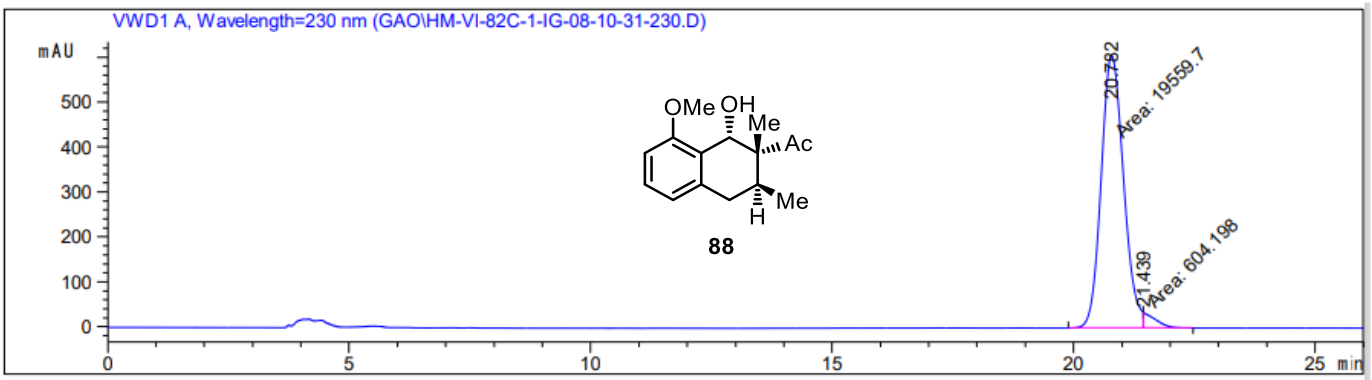


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	25.834	BB	0.6006	1.90821e4	492.42712	95.3283
2	31.518	BB	0.6618	935.14429	20.49733	4.6717

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 25.834 min (major), t_R = 31.518 min (minor).

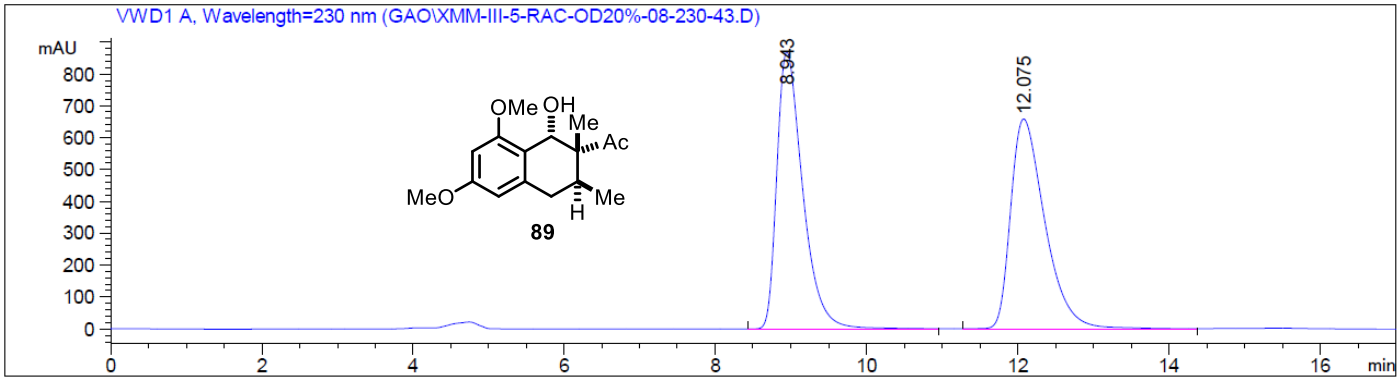


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	21.299	VV	0.5021	2.43578e4	759.82867	49.7396
2	22.635	VB	0.5481	2.46128e4	703.15405	50.2604

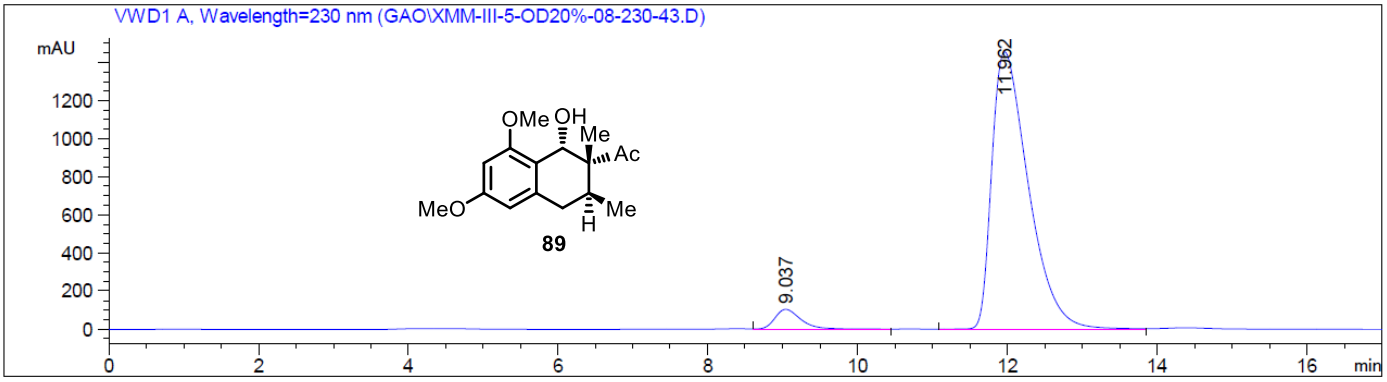


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	20.782	MF	0.5375	1.95597e4	606.46667	97.0036
2	21.439	FM	0.2880	604.19836	34.96772	2.9964

Enantiomeric excess: 94%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 90/10, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 20.782min (major), t_R = 21.418 min (minor).

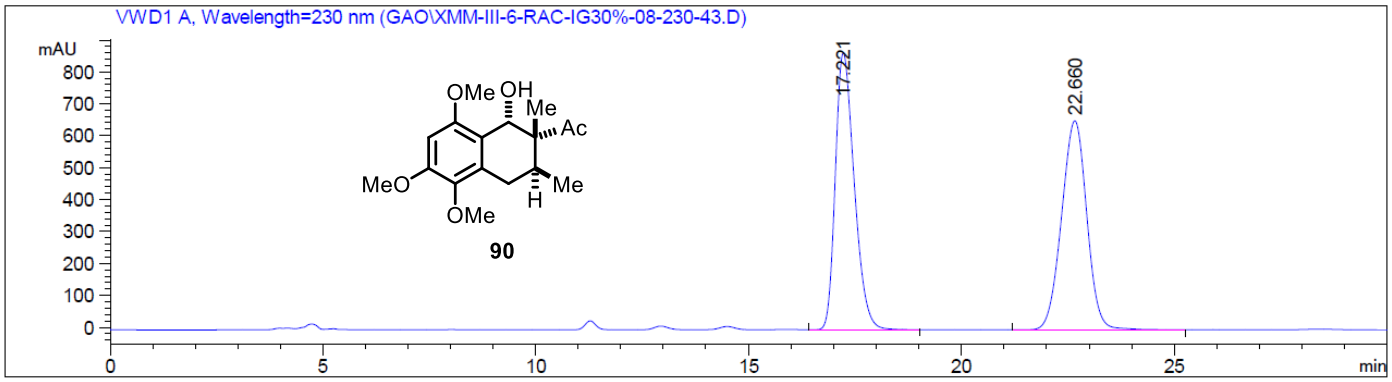


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.943	VV	0.3595	2.07208e4	869.66071	49.8441
2	12.075	VV	0.4798	2.08505e4	658.99695	50.1559

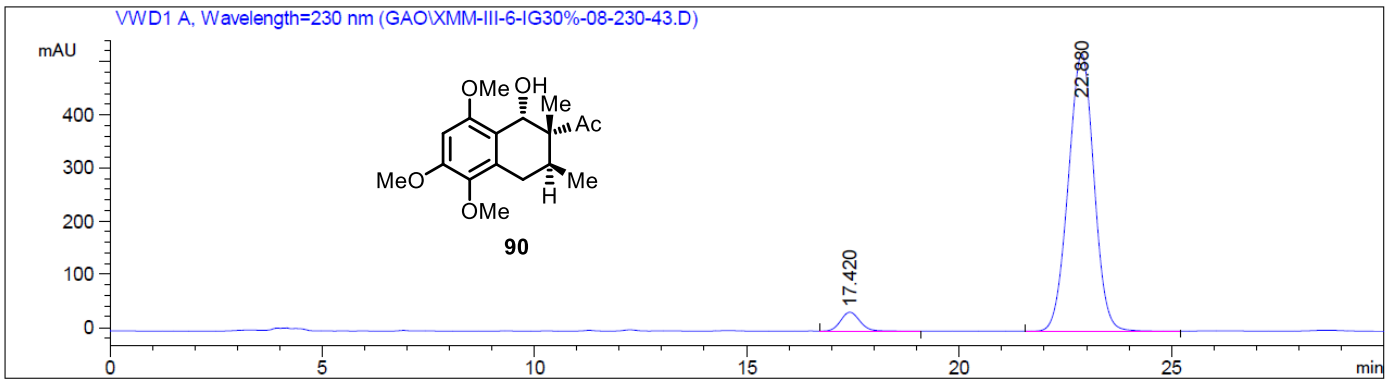


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.037	VV	0.3745	2570.51733	104.45625	4.9388
2	11.962	VV	0.5245	4.94774e4	1456.26233	95.0612

Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak OD-H, hexane/isopropanol = 80/ 20, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 9.037 min (minor), t_R = 11.962 min (major).

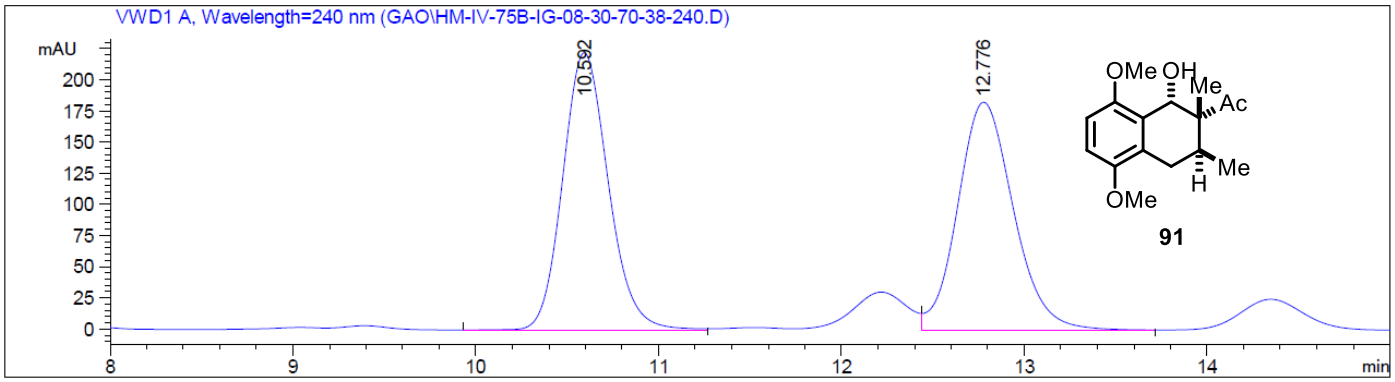


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	17.221	VV	0.4774	2.68280e4	867.21112	49.8399
2	22.660	VV	0.6384	2.70003e4	654.66901	50.1601

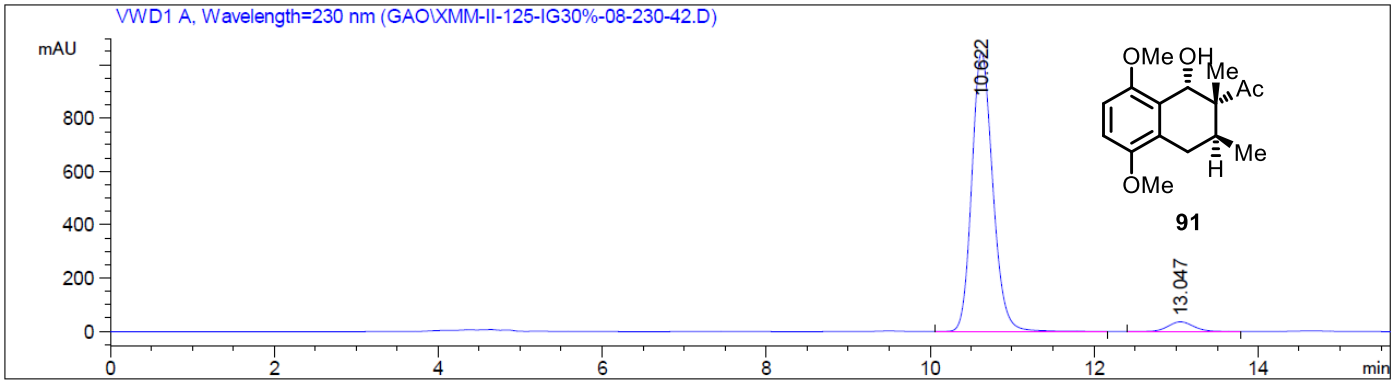


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	17.420	VB	0.4972	1150.90259	35.81416	4.9924
2	22.880	VB	0.6533	2.19021e4	521.25177	95.0076

Enantiomeric excess: 90%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 17.420 min (minor), t_R = 22.880 min (major).

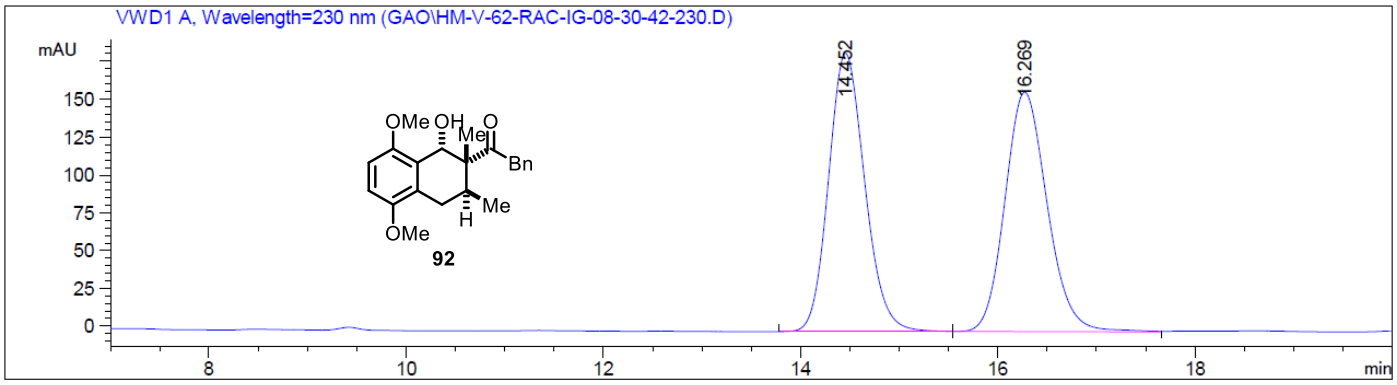


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.592	VV	0.2716	3907.70850	222.84355	49.9169
2	12.776	VB	0.3312	3920.71362	183.23918	50.0831

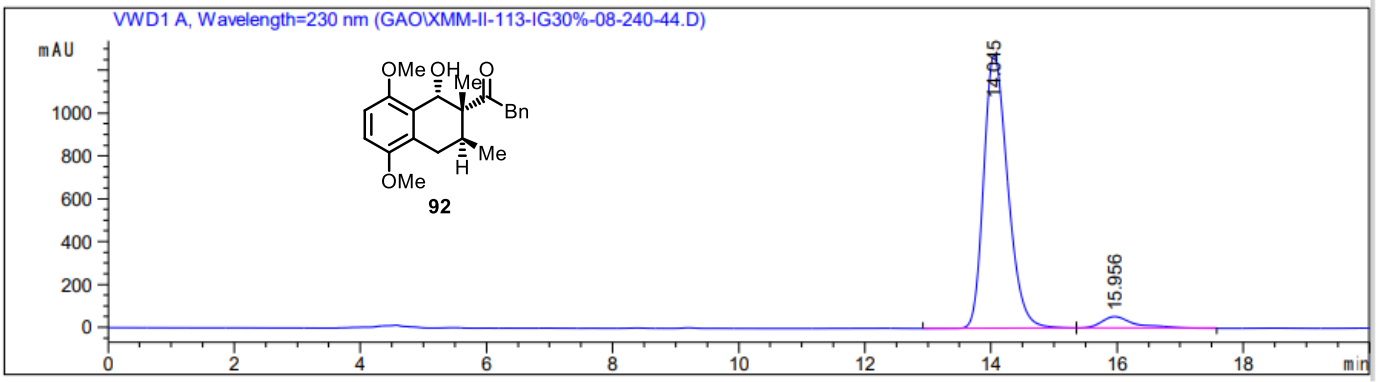


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.622	BB	0.2739	1.85833e4	1047.90479	95.9796
2	13.047	BB	0.3357	778.40924	36.15012	4.0204

Enantiomeric excess: 92%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 10.622 min (major), t_R = 13.047 min (minor).

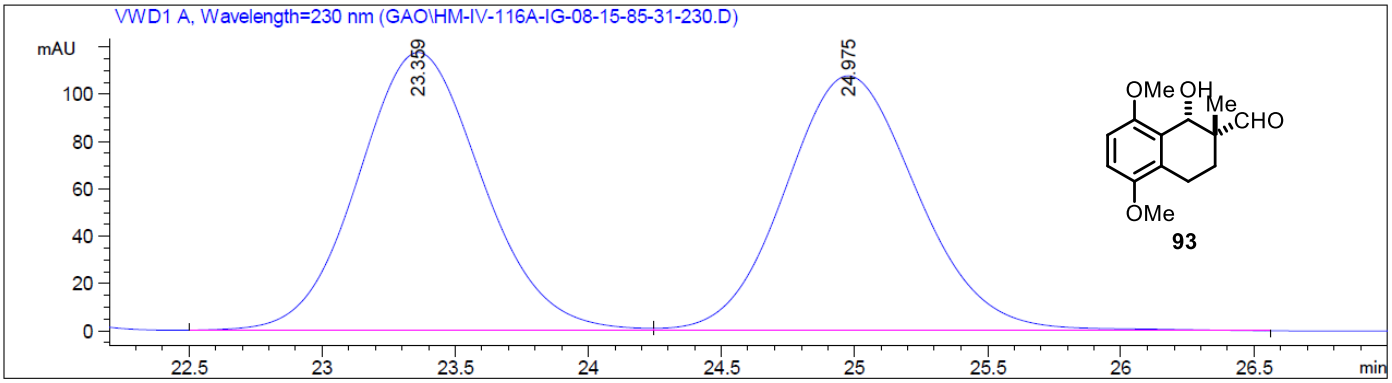


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.452	BV	0.3968	4702.10693	183.79681	49.8618
2	16.269	VB	0.4606	4728.16406	158.28783	50.1382

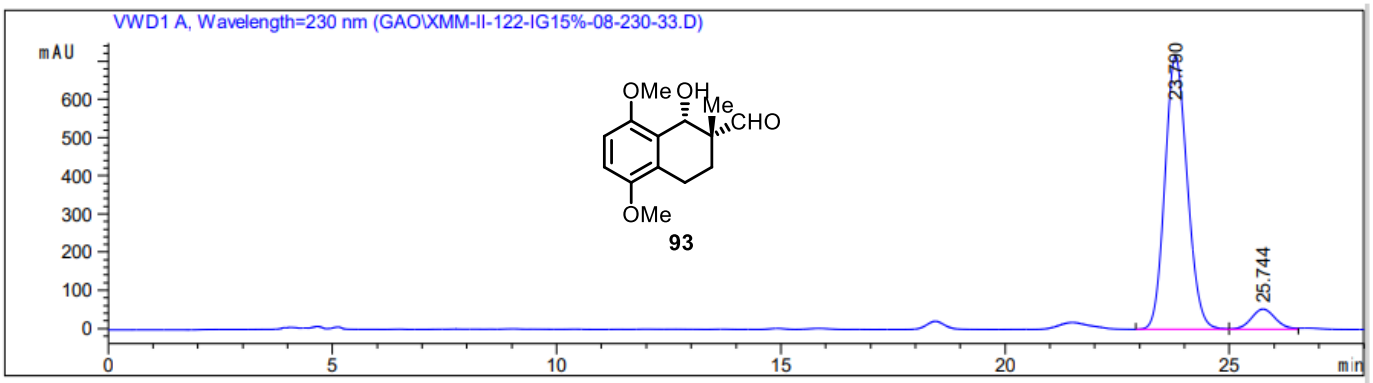


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.045	BV	0.4112	3.39108e4	1279.30872	94.2216
2	15.956	VB	0.5520	2079.66919	54.88683	5.7784

Enantiomeric excess: 88%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 70/30, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 14.045 min (major), t_R = 15.956 min (minor).

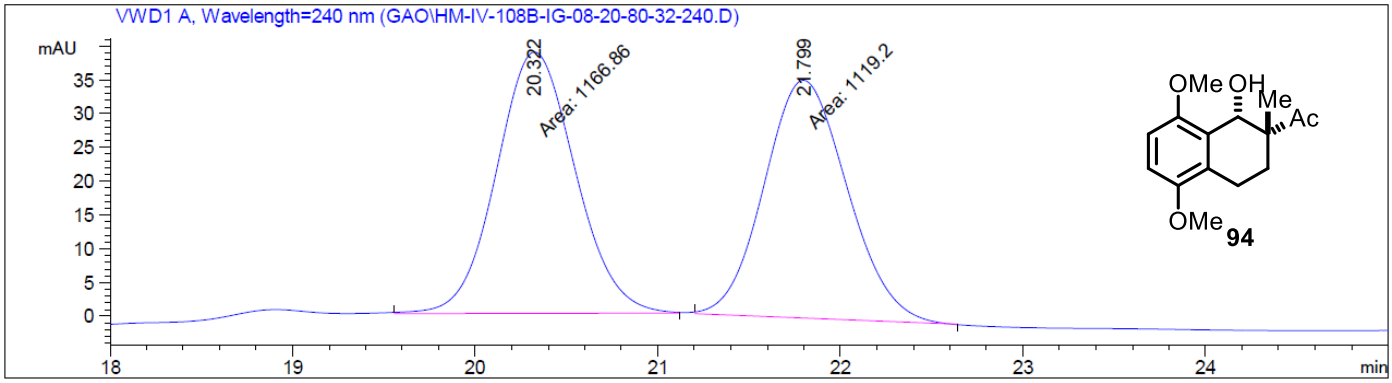


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	23.359	BV	0.5060	3841.94629	117.72424	50.5788
2	24.975	VB	0.5365	3754.02002	107.83559	49.4212

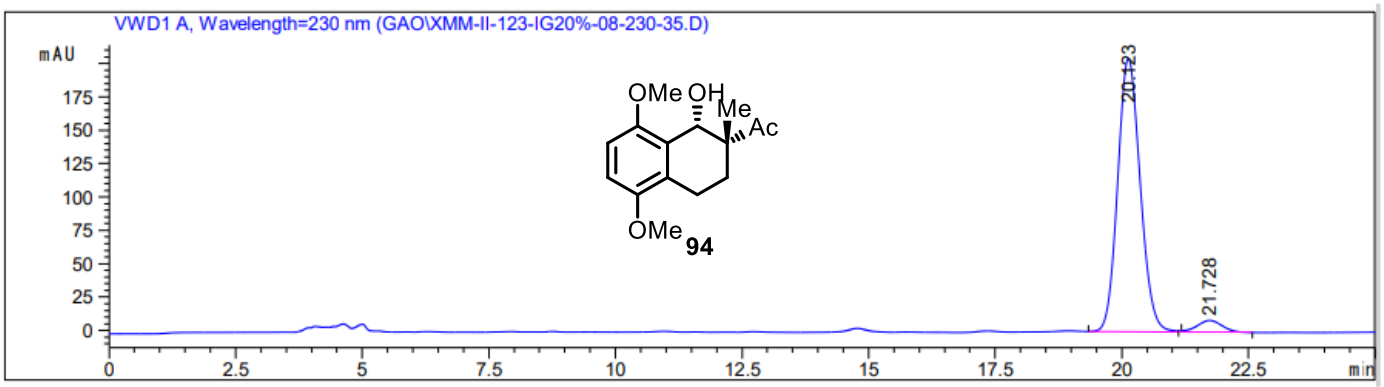


Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	23.790	BV	0.5448	2.48040e4	714.50989	92.4791
2	25.744	VV	0.5803	2017.20850	53.25030	7.5209

Enantiomeric excess: 85%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 85/15, flow rate 0.8 mL/min, T = 25 °C, 230 nm): t_R = 23.790 min (major), t_R = 25.744 min (minor).



Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	20.322	MM	0.5016	1166.85547	38.76876	51.0422
2	21.799	MM	0.5284	1119.20471	35.30024	48.9578



Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	20.123	VB	0.4793	6345.43750	204.84413	95.3144
2	21.728	BB	0.5039	311.93539	8.90752	4.6856

Enantiomeric excess: 91%, determined by HPLC (Daicel Chiralpak IG, hexane/isopropanol = 80/ 20, flow rate 0.8 mL/min, T = 25 ^{o}C, 230 nm): t_R = 20.123 min (major), t_R = 21.728 min (minor).