Electronic Supplementary Material (ESI) for Chemical Communication.

Electronic Supporting Information

Enantioselective Three-component Reaction of Diazoacetates with Indoles and Enals by Iridium/Iminium Co-catalysis

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1. General Information and Materials

All ^{1}H NMR (400 MHz) and ^{13}C NMR (100 MHz) and ^{19}F NMR (376 MHz) spectra were recorded on Brucker spectrometers in $CDCl_3$. Tetramethylsilane (TMS) served as an internal standard (δ = 0) for ^{1}H NMR, and $CDCl_3$ was used as internal standard (δ = 77.0) for ^{13}C NMR. Chemical shifts are reported in parts per million as follows: chemical shift, multiplicity (s =singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad). High-resolution mass spectrometry (HRMS) was performed on IonSpec FT-ICR or Waters Micromass Q-TOF micro Synapt High Definition Mass Spectrometer. HPLC analysis was performed on Dalian Elite (UV230+ UV/Vis Detector and P230P High Pressure Pump). Chiralpak IC and AD-H column was purchased from Daicel Chemical Industries, LTD. Melting points were uncorrected. Single crystal X-ray diffraction data were recorded on Bruker-AXS SMART APEX II single crystal X-ray diffractometer. The racemic standards used in HPLC studies were prepared according to the general procedure by using racemic (*S*)-2-(diphenyl((trimethylsilyl)oxy)methyl)pyrrolidine catalysts. Yields for all compounds were total yield of isolated *anti* and *syn* products unless otherwise indicated.

All reactions and manipulations were carried out under an argon atmosphere in a flame-dried or oven-dried flask containing magnetic stir bar. Dichloromethane (DCM), 1, 2-dichloroethane (DCE), $CHCl_3$ and toluene was distilled over calcium hydride. Cinnamaldehydes **3** were prepared from palladium-catalyzed synthesis of cinnamaldehydes from acrolein diethyl acetal and aryl iodides according to the literature method.[1] Diarylprolinol silyl ethers **4a-d** were prepared according to the literature procedure.[2] Indoles **2** were prepared according to the literature method.[3] Solvents for the column chromatography were distilled before use. 4 Å molecular sieves were dried in a Muffle furnace at 250 ^{o}C over 5 hrs.

2. General Procedure for Optimization of Reaction Conditions

General procedure for the preparation of racemic three-component products:

A mixture of $Rh_2(OAc)_4$ (5 mol%), substituted cinnamaldehydes **3**(0.1mmol), 3, 5- $(CF_3)_2C_6H_3COOH$ (40 mol%), *rac*-**4a** (20 mol%), and 4 Å MS (25 mg) in 0.35 mL of DCM under an argon atmosphere was cooled to 0 ℃. The mixture of diazo compounds **1** (0.2 mmol) and indoles **2** (0.2 mmol) in 0.35 mL of DCM was then added over 0.35 h via a syringe pump. After completion of the addition, the reaction mixture was stirred for another 48 h under 0 ℃. After the completion of the reaction (monitored by TLC, until diazo compounds **1** disappeared), the reaction mixture was filtrated and evaporated *in vacuo* to give the crude product. The crude products was purified by flash chromatography on silica gel (EtOAc/light petroleum ether = 1:50 ~ 1:20) to give the pure product.

General procedure for the preparation of enantioselective three-component products:

A mixture of $[Ir(COD)Cl]_2$ (10 mol%), substituted cinnamaldehydes **3**(0.1mmol), 3, 5-$(CF_3)_2C_6H_3COOH$ (40 mol%), (*S*)-**4a** (20 mol%), and 4 Å MS (25 mg) in 0.35 mL of DCM under an argon atmosphere was cooled to 0 ℃. The mixture of diazo compounds **1** (0.2 mmol) and indoles **2** (0.2 mmol) in 0.35 mL of DCM was then added over 0.35 h via a syringe pump. After completion of the addition, the reaction mixture was stirred for another 48 h under 0 ℃. After the completion of the reaction (monitored by TLC, until diazo compounds **1** disappeared), the reaction mixture was filtrated and evaporated *in vacuo* to give the crude product. The crude products was purified by flash chromatography on silica gel (EtOAc/light petroleum ether = 1:50 ~ 1:20) to give the pure product.

General procedure for the formation of iminium ion II:

A mixture of $[Ir(COD)Cl]_2$ (10 mol%), cinnamaldehyde **3a** (0.1mmol), 3, 5-$(CF_3)_2C_6H_3COOH$ (40 mol%), (*S*)-**4a** (20 mol%), and 4 Å MS (25 mg) in 0.35 mL of DCM under an argon atmosphere was cooled to 0 ℃. After stirring 1h, the mixture was monitored by LC-MS, **i**minium ion II (EM: 440.24) was detected, 440.34 was

found.

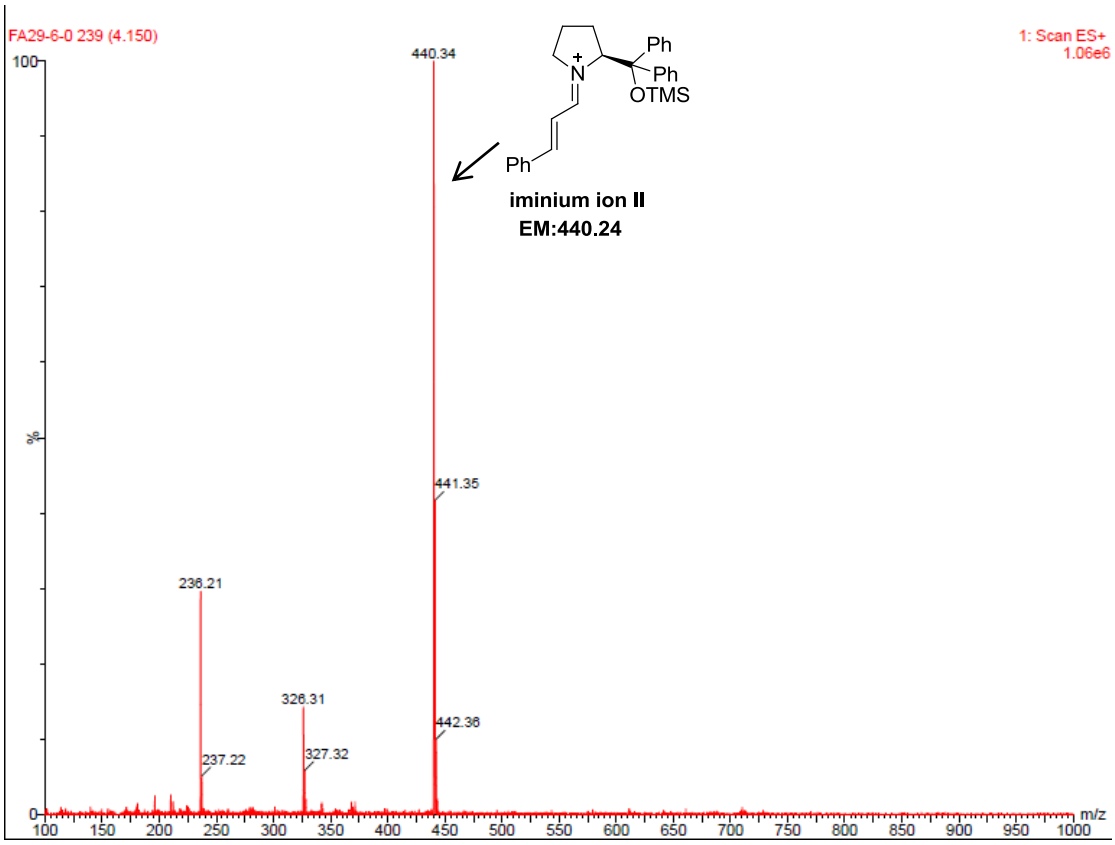
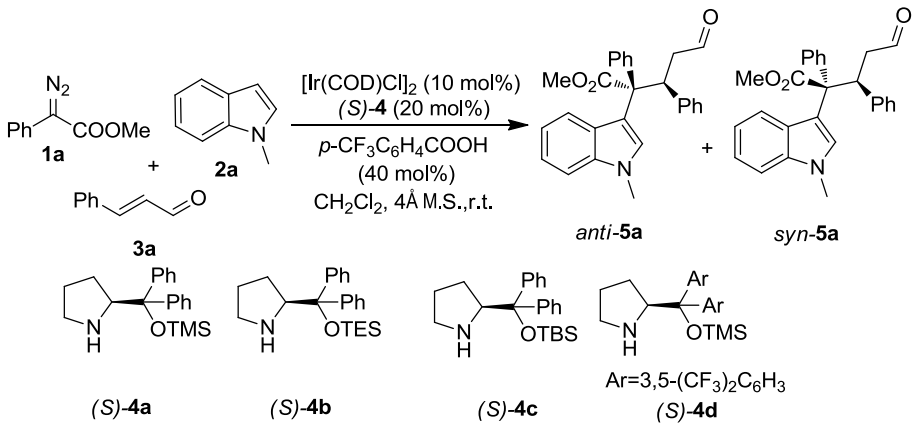


Figure S1. The formation of iminium ion II monitored by LC-MS.

Table S1: Screening of chiral diphenylprolinol cocatalysts [a]

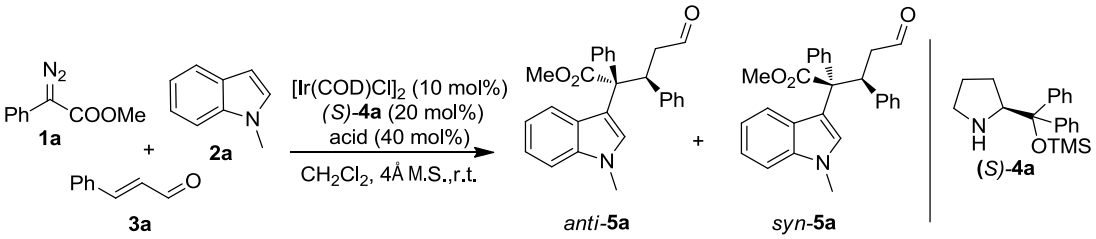


entry	cocatalyst	Yield (%)[b]	dr(*anti/syn*)[c]	ee (%)[d]
1	(*S*)-**4a**	67	61:39	78/95
2	(*S*)-**4b**	56	64: 36	98/98
3	(*S*)-**4c**	62	64: 36	92/94
4	(*S*)-**4d**	39	50: 50	97/96

[a] General reaction conditions: $[Ir(COD)Cl]_2$: (*S*)-**4**: acid : **1a**: **2a**: **3a** = 0.1:0.2:0.4:2:2:1. The mixture of **1a** and **2a** in CH_2Cl_2 was added to a suspension of

$[Ir(COD)Cl]_2$, (*S*)-**4**, acid, **3a** and 4Å M.S. in CH_2Cl_2 over 0.35 h by a syringe pump. [b] Total yield of isolated *anti* and *syn* products. [c] Determined by ^1H NMR analysis of the crude mixture. [d] Determined by chiral HPLC analysis. M.S.= molecular sieves.

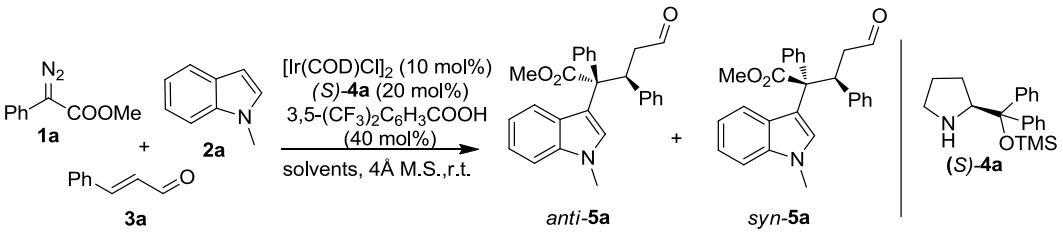
Table S2: Screening of addictive of acids [a]



entry	acid	yield(%)[b]	dr(*anti/syn*)[c]	ee(%)[d]
1	*p*-$NO_2C_6H_4COOH$	53	64:36	86/97
2	PhCOOH	43	50:50	89/93
3	*p*-ClC_6H_4COOH	44	52: 48	89/94
4	*p*-$CF_3C_6H_4COOH$	67	61: 39	78/95
5	3,5-$(CF_3)_2C_6H_3COOH$	56	67: 33	95/97
6[e]	3,5-$(CF_3)_2C_6H_3COOH$	45	66:34	94/96
7[f]	3,5-$(CF_3)_2C_6H_3COOH$	53	67:33	94/97
8	TFA	0	-	-
9	TsOH H_2O	0	-	-
10[g]	-	0	-	-

[a], [b], [c], [d]: Reaction conditions as performed in Table 1. [e] The amount of 3,5-$(CF_3)_2C_6H_3COOH$ is 20 mol%. [f] The amount of 3,5-$(CF_3)_2C_6H_3COOH$ is 50 mol%. [g] No acid is added.

Table S3: Screening of solvents [a]

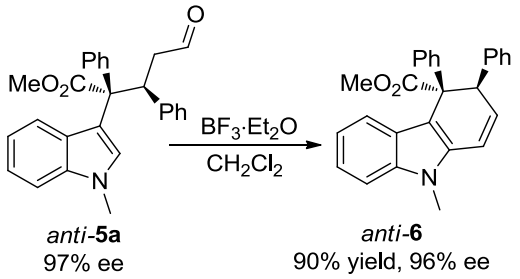


entry	solvent	yield(%)[b]	dr(*anti/syn*)[c]	ee(%)[d]
1	CH_2Cl_2	56	67:33	95/97

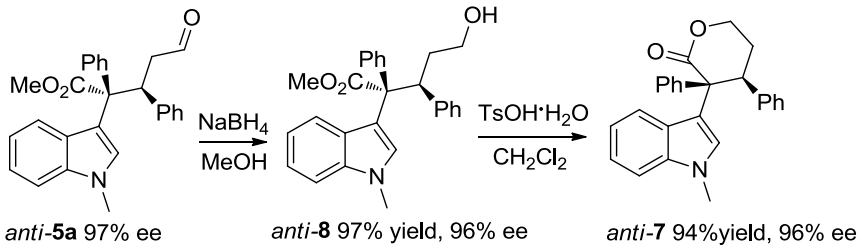
2	toluene	53	65:35	92/94
3	THF	39	69:31	94/90
4	$CHCl_3$	43	69:31	94/98
5	DCE	54	64:36	93/97
6[e]	CH_2Cl_2	54	65:35	94/96

[a], [b], [c], [d]: Reaction conditions as performed in Table 1. [e] The amount of (*S*)-**4a** is 30 mol%.

The procedure for derivation of the three-component product



To a flask charged with (*2S, 3S*)-*anti*-**5a** (0.03 mmol) in CH_2Cl_2 (4 mL) was stirred at 25 ^oC. $BF_3{\cdot}Et_2O$ (0.4 mmol%, 16 μL) was added. After the completion of the reaction (monitored by TLC), the reaction mixture was quenched with saturated aqueous solution of $NaHCO_3$. Then the product was extracted with CH_2Cl_2. The combined organic phases were washed by water and brine, and dried over Na_2SO_4. The product was then purified by flash chromatography (EtOAc/light petroleum ether = 1:50 ~ 1:10) to give the pure product *anti*-**6**.

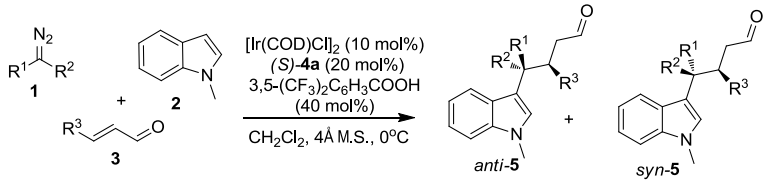


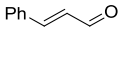
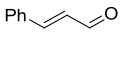
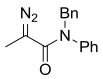
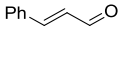
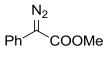
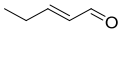
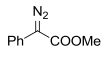
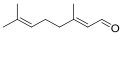
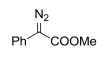
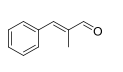
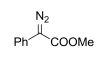
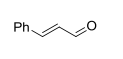
To a flask charged with (*2S,3S*)-*anti*-**5a** (0.2 mmol) in methanol (1 mL) was stirred at 25 ^oC. $NaBH_4$ (0.3 mmol) was added in batches. After the completion of the reaction (monitored by TLC), the reaction mixture was quenched with saturated aqueous solution of NH_4Cl. Then the product was extracted with AcOEt. The

combined organic phases were washed by water and brine, and dried over Na_2SO_4. The product was then purified by flash chromatography (EtOAc/light petroleum ether = 1:50 ~ 1:10) to give the pure product **8**.

To a flask charged with (*2S,3S*)-*anti*-**8** (0.2 mmol) in CH_2Cl_2 (1 mL) was stirred at 25 ^oC. Then TsOH $\cdot H_2O$(0.1 mmol) was added. After the completion of the reaction (monitored by TLC), the reaction mixture was extracted with water. The combined organic phases were dried over Na_2SO_4 and the solvent was evaporated in vacuo. The product was then purified by flash chromatography (EtOAc/light petroleum ether = 1:50 ~ 1:10) to give the pure product **7**.

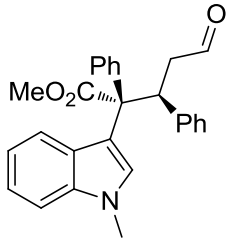
Several additional substrates used to test this reaction



entry	diazo	indole	enal	product	yield(%)	dr(*anti/syn*)	ee(%)
1				a trace amount	-	-	-
2				a trace amount	-	-	-
3				a trace amount	-	-	-
4				no reaction	-	-	-
5				no reaction	-	-	-
6				no reaction	-	-	-
7				mess	-	-	-

3. Characterization Data of Compounds

(*2S,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5a)



(*2S,3S*)-*anti*-**5a**

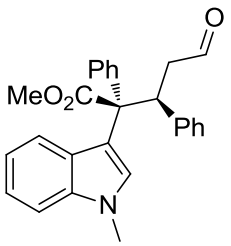
(*2S,3S*)-*anti*-**5a**: 97% **ee**. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.49 – 7.43 (m, 2H), 7.42 – 7.25 (m, 5H), 7.17 – 7.07 (m, 4H), 6.84 (t, J = 7.5 Hz, 1H), 6.77 (d, J = 7.3 Hz, 2H), 6.57 (d, J = 8.2 Hz, 1H), 5.09 – 4.97 (m, 1H), 3.77 (s, 3H), 3.56 (s, 3H), 3.17 (m, 1H), 2.90 – 2.60 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.62, 173.68, 140.02, 139.04, 136.61, 132.70, 130.64, 129.28, 128.20, 127.66, 127.39, 127.37, 127.27, 122.38, 120.96, 118.90, 110.54, 109.35, 61.06, 52.18, 46.42, 44.59, 32.93.

HRMS(ESI) : Calcd. for C_{27} H_{26} NO_3 $[M+H]^+$: 412.1913, Found: 412.1902.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =0.8 mL/min), t_{major} = 18.83 min, t_{minor} = 14.53 min.

(*2R,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5a)



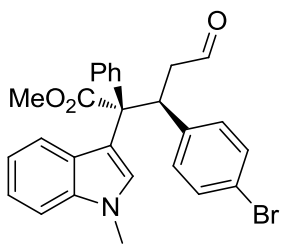
(*2R,3S*)-*syn*-**5a**

(*2R,3S*)-*syn*-**5a**: 97%**ee**.^{1}H NMR (400 MHz, $CDCl_3$) δ 9.55 (s, 1H), 7.34 – 7.26 (m, 3H), 7.22 (d, J = 7.1 Hz, 2H), 7.18 – 7.07 (m, 6H), 6.95 – 6.82 (m, 4H), 5.02 (d, J = 10.9 Hz, 1H), 3.81 (s, 3H), 3.47 (s, 3H), 3.22 (m, 1H), 2.70 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.91, 173.06, 138.77, 137.27, 137.11, 131.45, 131.29, 128.86, 127.40, 127.25, 127.20, 126.72, 126.69, 122.35, 121.70, 119.20, 114.71, 109.21, 60.99, 51.91, 46.19, 43.86, 33.10. HRMS(ESI) : Calcd. for C_{27} H_{26} NO_3 $[M+H]^+$: 412.1913, Found: 412.1918.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =0.8 mL/min), t_{major} = 16.63 min, t_{minor} = 13.81 min.

(*2S,3S*)-methyl3-(4-bromophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenylpentanoate (5b)



(*2S,3S*)-*anti*-**5b**

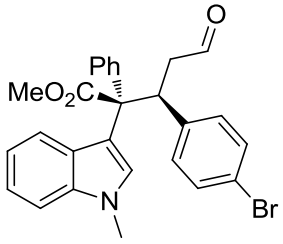
(*2S,3S*)-*anti*-**5b**: 96%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.49 (s, 1H), 7.60 – 7.27 (m, 5H), 7.24 – 7.11 (m, 3H), 6.93 (s, 1H), 6.86 (t, *J* = 7.5 Hz, 1H), 6.69 – 6.49 (m, 2H), 5.23 – 4.74 (m, 1H), 3.79 (s, 2H), 3.56 (s, 2H), 3.26 – 2.88 (m, 1H), 2.81 – 2.40 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 200.91, 173.52, 139.63, 138.30, 136.68, 132.41, 132.36, 130.41, 129.18, 128.26, 127.50, 127.47, 122.33, 121.28, 121.17, 119.04, 110.45, 109.45, 60.90, 52.25, 46.45, 43.91, 32.96.

HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3NaBr$ $[M+Na]^+$: 512.0837 , Found: 512.0858.

HPLC (Chiral AD-H, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 17.82 min, t_{minor} = 15.47 min.

(*2R,3S*)-methyl3-(4-bromophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenylpentanoate (5b)



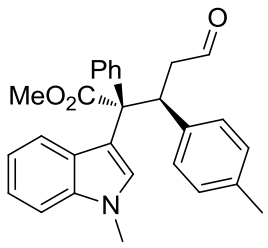
(*2R,3S*)-*syn*-**5b**

(*2R,3S*)-*syn*-**5b**: 95%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.56 (s, 1H), 7.40 – 7.29 (m, 2H), 7.29 – 7.25 (m, 3H), 7.23 (s, 1H), 7.22 – 7.13 (m, 2H), 7.08 (d, *J* = 7.6 Hz, 2H), 6.99 – 6.85 (m, 2H), 6.72 (d, *J* = 8.4 Hz, 2H), 5.01 (d, *J* = 10.9 Hz, 1H), 3.81 (s, 3H), 3.48 (s, 3H), 3.24 (d, *J* = 17.6 Hz, 1H), 2.74 – 2.57 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 201.17, 173.03, 138.00, 137.30, 136.91, 133.01, 131.26, 130.42, 128.87, 127.42, 126.88, 126.57, 122.29, 121.78, 121.24, 119.29, 114.31, 109.25, 77.34, 77.02, 76.71, 60.91, 51.97, 46.23, 43.18, 33.09.

HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3NaBr$ $[M+Na]^+$: 512.0837 , Found: 512.0812.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 11.16 min, t_{minor} = 10.34 min.

(*2S,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenyl-3-(p-tolyl)pentanoate (5c)



(2S,3S)-*anti*-**5c**

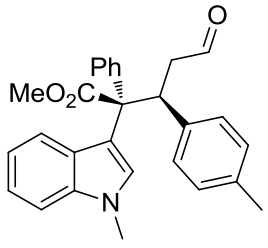
(*2S,3S*)-*anti*-**5c**: 96%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.47 (dd, *J* = 2.2, 1.0 Hz, 1H), 7.49 – 7.41 (m, 2H), 7.37 – 7.27 (m, 3H), 7.17 – 7.09 (m, 1H), 7.01 (s, 1H), 6.93 (dd, *J* = 11.1, 4.4 Hz, 2H), 6.86 – 6.78 (m, 1H), 6.68 – 6.61 (m, 2H), 6.54 (d, *J* = 8.2 Hz, 1H), 4.99 (dd, *J* = 12.3, 2.5 Hz, 1H), 3.79 (s, 2H), 3.56 (s, 2H), 3.13 (ddd, *J* = 17.3, 2.4, 1.0 Hz, 1H), 2.68 (ddd, *J* = 17.3, 12.3, 2.4 Hz, 1H), 2.26 (s, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.74, 173.72, 140.08, 136.81, 136.60, 135.82, 132.75, 130.46, 129.29, 128.14, 127.69, 127.30, 122.39, 120.89, 118.84, 110.59, 109.27, 61.06, 52.11, 46.45, 44.24, 32.91, 21.02.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_3Na$ $[M+ Na]^+$: 448.1889 , Found: 448.0600.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 10/1, Flow rate =1.0 mL/min), t_{major} = 11.53 min, t_{minor} = 9.79 min.

(*2R,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenyl-3-(p-tolyl)pentanoate (5c)



(2R,3S)-*syn*-**5c**

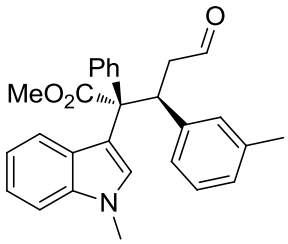
(*2R,3S*)-*syn*-**5c**: 82%**ee** .^{1}H NMR (400 MHz, $CDCl_3$) δ 9.55 (d, *J* = 1.0 Hz, 1H), 7.37 – 7.27 (m, 2H), 7.25 – 7.20 (m, 3H), 7.17 – 7.13 (m, 1H), 7.11 – 7.07 (m, 2H), 6.94 (d, *J* = 8.0 Hz, 2H), 6.92 – 6.83 (m, 2H), 6.75 (d, *J* = 8.0 Hz, 2H), 4.96 (dd, *J* = 12.2, 2.1 Hz, 1H), 3.82 (s, 3H), 3.48 (s, 3H), 3.19 (dd, *J* = 17.4, 1.2 Hz, 1H), 2.78 – 2.49 (m, 1H), 2.28 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 202.08, 173.06, 137.26, 137.12, 136.75, 135.57, 131.49, 131.09, 128.78, 128.14, 127.14, 126.72, 126.63, 122.37, 121.66, 119.14, 114.83, 109.14, 60.97, 51.83, 46.16, 43.57, 33.07, 21.02.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_3Na$ $[M+ Na]^+$: 448.1889 , Found: 448.1871.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 10/1, Flow rate =1.0 mL/min), t_{major} = 11.16 min, t_{minor} = 9.00 min.

(*2S,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenyl-3-(m-tolyl)pentanoate (5d)



(*2S,3S*)-*anti*-**5d**

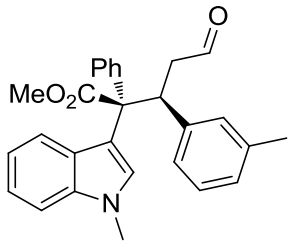
(*2S,3S*)-*anti*-**5d**: 98%**ee** .^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.46 (d, *J* = 3.9 Hz, 2H), 7.35 – 7.27 (m, 4H), 7.13 (t, *J* = 7.6 Hz, 1H), 7.05 – 6.94 (m, 3H), 6.83 (t, *J* = 7.6 Hz, 1H), 6.66 (d, *J* = 7.4 Hz, 1H), 6.53 (d, *J* = 8.2 Hz, 1H), 6.45 (s, 1H), 4.99 (d, *J* = 12.9 Hz, 1H), 3.78 (s, 3H), 3.55 (s, 3H), 3.13 (d, *J* = 17.2 Hz, 1H), 2.70 (dd, *J* = 17.2, 12.9 Hz, 1H), 2.16 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.71, 173.64, 140.13, 138.82, 136.65, 136.59, 132.80, 131.34, 129.31, 128.17, 127.96, 127.83, 127.76, 127.33, 127.24, 122.41, 120.93, 118.87, 110.62, 109.28, 61.09, 52.08, 46.34, 44.57, 32.86, 21.37.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_3Na$ $[M+Na]^+$: 448.1889 , Found: 448.1875.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 16.08 min, t_{minor} = 11.96 min.

(*2R,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenyl-3-(m-tolyl)pentanoate (5d)



(*2R,3S*)-*syn*-**5d**

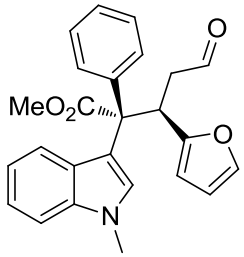
(*2R,3S*)-*syn*-**5d**: 98%**ee** .^{1}H NMR (400 MHz, $CDCl_3$) δ 9.56 (s, 1H), 7.33 – 7.27 (m, 2H), 7.22 (d, *J* = 9.1 Hz, 2H), 7.18 – 6.95 (m, 6H), 6.92 – 6.83 (m, 2H), 6.75 (d, *J* = 7.3 Hz, 1H), 6.55 (s, 1H), 4.97 (d, *J* = 11.8 Hz, 1H), 3.82 (s, 3H), 3.48 (s, 3H), 3.19 (d, *J* = 16.8 Hz, 1H), 2.68 (dd, *J* = 16.8, 11.8Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 202.04, 172.99, 138.53, 137.25, 137.18, 136.66, 131.94, 131.50, 128.85, 128.38, 127.84, 127.22, 127.17, 126.73, 126.56, 122.34, 121.67, 119.16, 114.76, 109.14, 60.99, 51.81, 46.10, 43.87, 33.07, 21.36.

HRMS(ESI) :Calcd. for $C_{28}H_{28}NO_3$ $[M+H]^+$: 426.2069 , Found: 426.2072.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 13.64 min, t_{minor} = 11.57 min.

(*2S,3R*)-methyl3-(furan-2-yl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenylpentanoate(5e)



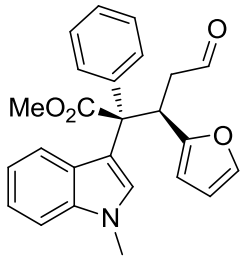
(2*S*,3*R*)-*anti*-**5e**

(*2S,3R*)-*anti*-**5e**: 90%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.60 (s, 1H), 7.49 – 7.28 (m, 6H), 7.18 – 7.10 (m, 2H), 7.03 (s, 1H), 6.91 – 6.79 (m, 1H), 6.70 – 6.60 (m, 1H), 6.18 (s, 1H), 5.72 (s, 1H), 5.11 (d, J = 11.2 Hz, 1H), 3.76 (s, 3H), 3.65 (s, 3H), 2.98 (d, J = 16.7 Hz, 1H), 2.78 – 2.59 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 200.89, 173.89, 153.48, 140.97, 138.78, 130.76, 129.47, 127.82, 127.79, 127.36, 127.20, 127.14, 122.00, 121.05, 118.91, 112.05, 110.34, 109.13, 60.41, 52.37, 44.95, 38.97, 32.89.

HRMS(ESI) :Calcd. for $C_{25}H_{23}NO_4Na$ $[M+Na]^+$: 424.1525 , Found: 424.1522.

HPLC (Chiral IC, λ= 254 nm, hexane/2-propanol = 6/1, Flow rate =0.8 mL/min), t_{major} = 16.44 min, t_{minor} =11.86 min.

(*2R,3R*)-methyl3-(furan-2-yl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-2-phenylpentano ate(5e)



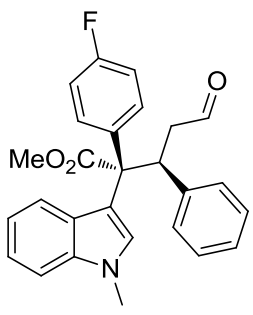
(2*R*,3*R*)-*syn*-**5e**

(*2R,3R*)-*syn*-**5e**: 94%ee. ^{1}H NMR (300 MHz, $CDCl_3$) δ 9.69 (s, 1H), 7.36 – 7.27 (m, 3H), 7.21 – 7.13 (m, 4H), 7.00 – 6.94 (m, 2H), 6.90 – 6.87 (m, 2H), 6.27 (dd, J = 3.2, 1.9 Hz, 1H), 6.04 (d, J = 3.3 Hz, 1H), 5.13 – 5.01 (m, 1H), 3.82 (s, 3H), 3.61 (s, 3H), 3.04 (dd, J = 17.9, 1.7 Hz, 1H), 2.77 – 2.61 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 201.25, 173.30, 153.05, 141.20, 137.54, 137.20, 130.11, 128.56, 127.08, 126.95, 122.32, 121.71, 119.20, 113.41, 110.52, 110.15, 109.67, 109.16, 60.72, 52.17, 43.69, 38.67, 33.07.

HRMS(ESI) :Calcd. for $C_{25}H_{23}NO_4Na$ $[M+Na]^+$: 424.1525 , Found: 424.1522.

HPLC (Chiral IC, λ= 254 nm, hexane/2-propanol = 6/1, Flow rate =0.8 mL/min), t_{major} = 13.86 min, t_{minor} =10.95 min.

(*2S,3S*)-methyl2-(4-fluorophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpent anoate (5f)



(2*S*,3*S*)-*anti*-**5f**

(*2S,3S*)-*anti*-**5f**: 97%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.40 – 7.31 (m, 3H), 7.18 – 7.10 (m, 4H), 6.99 – 6.94 (m, 3H), 6.87 (t, J = 7.6 Hz, 1H), 6.76 (d, J = 7.1 Hz, 2H), 6.63 (d, J

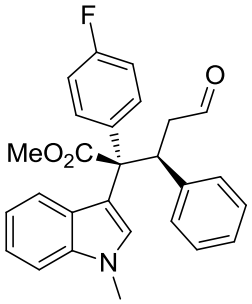
= 8.1 Hz, 1H), 4.95 (dd, *J* = 12.1, 2.2 Hz, 1H), 3.77 (s, 3H), 3.58 (s, 3H), 3.13 (d, *J* = 16.8 Hz , 1H), 2.85 – 2.73 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.37, 173.52, 161.93 (d, *J* = 247.2 Hz), 138.94, 136.72, 135.77 (d, *J* = 3.3 Hz), 132.35, 131.11 (d, *J* = 8.0 Hz), 130.57, 127.48, 127.40, 127.35, 122.19, 121.16, 119.08, 114.93 (d, *J* = 21.2 Hz), 110.66, 109.45, 60.54, 52.22, 46.53, 44.97, 32.93.

HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3FNa$ $[M+Na]^+$: 452.1638 , Found: 452.1616.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 16.24 min, t_{minor} =12.30 min.

(*2R,3S*)-methyl2-(4-fluorophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpent anoate (5f)



(*2R,3S*)-*syn*-**5f**

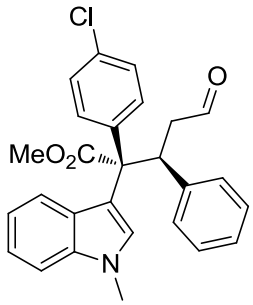
(*2R,3S*)-*syn*-**5f**: 97%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.58 (s, 1H), 7.30 (d, *J* = 8.3 Hz, 1H), 7.24 – 7.12 (m, 5H), 7.09 – 7.02 (m, 2H), 6.99 – 6.80 (m, 6H), 4.99 (d, *J* = 11.8 Hz, 1H), 3.83 (s, 3H), 3.47 (s, 3H), 3.21 (d, *J* = 17.2 Hz, 1H), 2.73 – 2.56 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.58, 172.74, 161.99 (d, J = 246.7 Hz), 138.45, 137.30, 133.23 (d, J = 7.8 Hz), 132.72 (d, J = 3.2 Hz), 131.10, 128.61, 127.55, 127.39, 126.50, 122.19, 121.83, 119.31, 114.65, 113.46 (d, J = 21.1 Hz), 109.24, 60.38, 51.93, 45.90, 43.74, 33.10.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3F$ $[M+H]^+$: 430.1818 , Found: 430.1818.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 13.72 min, t_{minor} =11.63 min.

(*2S,3S*)-methyl2-(4-chlorophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpent anoate (5g)



(*2S,3S*)-*anti*-**5g**

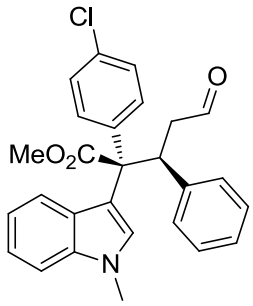
(*2S,3S*)-*anti*-**5g**: 94%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.34 (t, *J* = 7.2 Hz, 3H), 7.27 – 7.24 (m, 2H), 7.20 – 7.07

(m, 4H), 6.97 (s, 1H), 6.88 (t, *J* = 7.5 Hz, 1H), 6.76 (d, *J* = 7.2 Hz, 2H), 6.64 (d, *J* = 8.1 Hz, 1H), 4.94 (d, *J* = 10.3 Hz, 1H), 3.78 (s, 3H), 3.58 (s, 3H), 3.11 (d, *J* = 16.3 Hz, 1H), 2.87 – 2.73 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.24, 173.29, 138.83, 138.58, 136.70, 133.29, 132.36, 130.83, 130.54, 128.22, 127.49, 127.38, 127.31, 122.15, 121.18, 119.13, 110.38, 109.46, 60.68, 52.27, 46.51, 44.85, 32.94. HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3NaCl$ $[M+Na]^+$: 468.1342 , Found: 468.1323.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 16.85 min, t_{minor} =12.54 min.

(*2R,3S*)-methyl2-(4-chlorophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpen tanoate (5g)



(*2R,3S*)-*syn*-**5g**

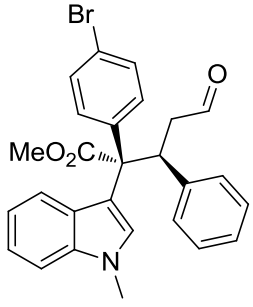
(*2R,3S*)-*syn*-**5g**: 99%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.58 (s, 1H), 7.30 (d, *J* = 8.3 Hz, 1H), 7.24 – 7.11 (m, 7H), 7.03 (d, *J* = 8.7 Hz, 2H), 6.95 – 6.79 (m, 4H), 4.99 (dd, *J* = 12.1, 2.0 Hz, 1H), 3.83 (s, 3H), 3.47 (s, 3H), 3.25 – 3.14 (m, 1H), 2.73 – 2.59 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.47, 172.51, 138.32, 137.29, 135.51, 133.22, 133.01, 131.10, 128.58, 127.60, 127.45, 126.78, 126.42, 122.15, 121.87, 119.36, 114.38, 109.26, 60.46, 51.96, 45.85, 43.60, 33.12.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3Cl$ $[M+H]^+$: 446.1523 , Found: 446.1524.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 13.08 min, t_{minor} =11.23 min.

(*2S,3S*)-methyl2-(4-bromophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpen tanoate (5h)



(*2S,3S*)-*anti*-**5h**

(*2S,3S*)-*anti*-**5h**: 94%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.41 (d, *J* = 8.6 Hz, 2H), 7.34 – 7.27 (m, 3H), 7.18 – 7.09 (m, 4H), 6.97 (s, 1H), 6.89 (t, *J* = 7.4 Hz, 1H), 6.76 (d, *J* = 7.1

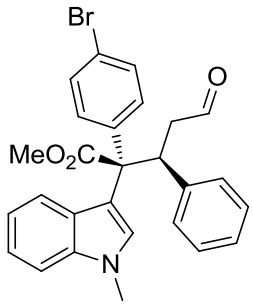
Hz, 2H), 6.65 (d, *J* = 8.2 Hz, 1H), 4.94 (m, 1H), 3.78 (s, 3H), 3.58 (s, 3H), 3.11 (m, 1H), 2.86 – 2.73 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.22, 173.21, 139.12, 138.81, 136.70, 132.37, 131.18, 130.53, 127.50, 127.38, 127.29, 122.15, 121.54, 121.19, 119.14, 110.30, 109.46, 60.76, 52.28, 46.50, 44.78, 32.94.

HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3NaBr$ $[M+Na]^+$: 512.0837, Found: 512.0812

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 18.43 min, t_{minor} = 13.44 min.

(*2R,3S*)-methyl2-(4-bromophenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpentanoate (5h)



(*2R,3S*)-*syn*-**5h**

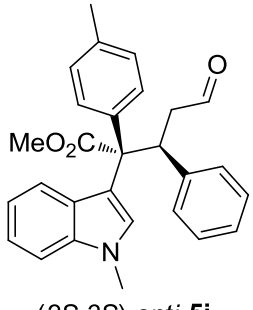
(*2R,3S*)-*syn*-**5h**: 97%ee.^{1}H NMR (400 MHz, $CDCl_3$) δ 9.58 (s, 1H), 7.36 (d, *J* = 8.5 Hz, 2H), 7.30 (d, *J* = 8.2 Hz, 1H), 7.25 – 7.09 (m, 5H), 7.08 – 6.36 (m, 6H), 4.99 (d, *J* = 11.3 Hz, 1H), 3.83 (s, 3H), 3.47 (s, 3H), 3.19 (d, *J* = 17.4 Hz, 1H), 2.74 – 2.51 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.44, 172.44, 138.29, 137.29, 136.04, 133.37, 131.09, 129.74, 128.58, 127.61, 127.46, 126.40, 122.14, 121.88, 121.51, 119.37, 114.31, 109.26, 60.52, 51.97, 45.84, 43.53, 33.12.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3Br$ $[M+H]^+$: 490.1018, Found: 490.1013

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), tmajor = 13.69 min, tminor = 11.89 min.

(*2S,3S*)-methyl 2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenyl-2-(p-tolyl)pentanoate (5i)



(*2S,3S*)-*anti*-**5i**

(*2S,3S*)-*anti*-**5i**: 96%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.38 – 7.30 (m, 3H), 7.18 – 7.06 (m, 6H), 6.92 (s, 1H), 6.85 (t, *J* = 7.6 Hz, 1H), 6.75 (d, *J* = 7.2 Hz, 2H), 6.65 – 6.58 (m, 1H),

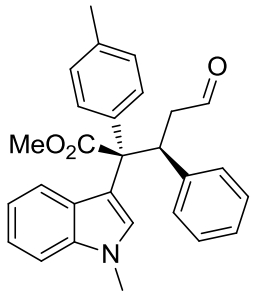
5.03 (d, *J* = 12.2 Hz, 1H), 3.77 (s, 3H), 3.56 (s, 3H), 3.15 (d, *J* = 17.4 Hz, 1H), 2.77 – 2.63 (m, 1H), 2.36 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.70, 173.83, 139.11, 137.04, 136.88, 136.58, 132.69, 130.66, 129.14, 128.92, 127.70, 127.32, 127.18, 122.49, 120.89, 118.81, 110.58, 109.29, 60.76, 52.13, 46.36, 44.57, 32.89, 21.06.

HRMS(ESI) :Calcd. for $C_{28}H_{28}NO_3$ $[M+H]^+$: 426.2069, Found: 426.2079.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 14.30 min, t_{minor} = 10.69 min.

(*2R,3S*)-methyl2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenyl-2-(p-tolyl)pentanoate(5i)



(*2R,3S*)-*syn*-**5i**

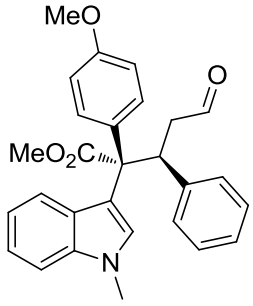
(*2R,3S*)-*syn*-**5i**: 98%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.56 (s, 1H), 7.43 – 7.26 (m, 2H), 7.24 – 7.08 (m, 5H), 7.07 – 6.81 (m, 7H), 4.97 (d, *J* = 11.8 Hz, 1H), 3.82 (s, 3H), 3.47 (s, 3H), 3.20 (d, *J* = 17.3 Hz, 1H), 2.79 – 2.63 (m, 1H), 2.38 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 202.00, 173.18, 138.86, 137.23, 136.80, 134.03, 131.31, 131.28, 128.78, 127.41, 127.35, 127.12, 126.75, 122.39, 121.62, 119.10, 114.90, 109.12, 60.64, 51.84, 46.28, 43.96, 33.07, 21.10.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_3Na$ $[M+Na]^+$: 448.1889, Found: 448.1909.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =0.8 mL/min), t_{major} = 14.50 min, t_{minor} = 12.73 min.

(*2S,3S*)-methyl2-(4-methoxyphenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpe ntanoate (5j)



(*2S,3S*)-*anti*-**5j**

(*2S,3S*)-*anti*-**5j**: 94%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.44 – 7.29 (m, 3H), 7.22 – 7.04 (m, 4H), 7.00 – 6.81 (m, 4H), 6.75 (d, *J* = 7.4 Hz, 2H), 6.68 – 6.51 (m, 1H), 5.22 – 4.72 (m, 1H), 3.82 (s, 3H), 3.77 (s, 2H), 3.56 (s, 2H), 3.19 – 3.02 (m, 1H), 2.83 – 2.61 (m, 1H).

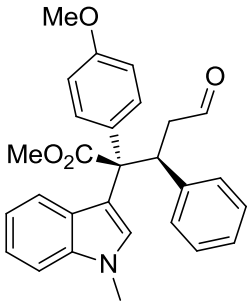
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.67, 173.87, 158.69, 139.14,

136.63, 132.59, 131.91, 130.65, 130.47, 127.67, 127.34, 127.19, 122.50, 120.94, 118.88, 113.47, 110.72, 109.31, 60.42, 55.24, 52.10, 46.39, 44.75, 32.88.

HRMS(ESI) :Calcd. for $C_{28}H_{28}NO_4$ $[M+H]^+$: 442.2018 , Found: 442.2018.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 33.41 min, t_{minor} = 23.44 min.

(*2R,3S*)-methyl2-(4-methoxyphenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpentanoate (5j)



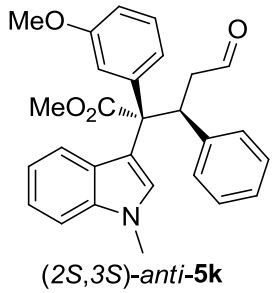
(*2R,3S*)-*syn*-**5j**

(*2R,3S*)-*syn*-**5j**: 99%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.56 (s, 1H), 7.29 (d, *J* = 8.2 Hz, 1H), 7.22 – 7.12 (m, 5H), 7.01 (d, *J* = 8.8 Hz, 2H), 6.94 – 6.84 (m, 4H), 6.77 (d, *J* = 8.8 Hz, 2H), 4.96 (d, *J* = 11.0 Hz, 1H), 3.83 (d, *J* = 4.7 Hz, 6H), 3.47 (s, 3H), 3.20 (d, *J* = 17.3 Hz, 1H), 2.75 – 2.62 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 201.95, 173.16, 158.61, 138.84, 137.27, 132.58, 131.26, 129.16, 128.70, 127.40, 127.16, 126.74, 122.40, 121.66, 119.15, 115.02, 111.98, 109.12, 60.30, 55.21, 51.82, 46.20, 44.07, 33.06.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_4Na$ $[M+Na]^+$: 464.1838 , Found: 464.1839.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 24.84 min, t_{minor} = 22.35 min.

(*2S,3S*)-methyl2-(3-methoxyphenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpentanoate (5k)



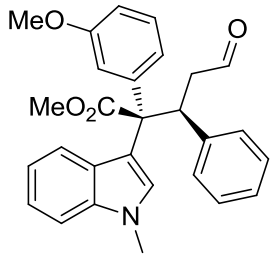
(*2S,3S*)-*anti*-**5k**

(*2S,3S*)-*anti*-**5k**: 98%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.48 (s, 1H), 7.31 (d, *J* = 8.0 Hz, 1H), 7.25 – 7.21 (m, 1H), 7.16 – 7.00 (m, 6H), 6.95 (s, 1H), 6.89 – 6.82 (m, 2H), 6.77 (d, *J* = 6.9 Hz, 2H), 6.65 (d, *J* = 7.9 Hz, 1H), 4.99 (d, *J* = 11.7 Hz, 1H), 3.77 (s, 3H), 3.66 (s, 3H), 3.57 (s, 3H), 3.19 (d, *J* = 17.3 Hz, 1H), 2.81 – 2.65 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 201.52, 173.56, 159.35, 141.66, 139.09, 136.61, 132.56, 130.65, 129.03, 127.69, 127.36, 127.25, 122.38, 121.70, 120.97, 118.94, 115.40, 112.78, 110.52, 109.29, 61.08, 55.25, 52.16, 46.49, 44.79, 32.90.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_4Na$ $[M+Na]^+$: 464.1838 , Found: 464.1845.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =0.8 mL/min), t_{major} = 30.76 min, t_{minor} = 27.30 min.

(*2R,3S*)-methyl2-(3-methoxyphenyl)-2-(1-methyl-1H-indol-3-yl)-5-oxo-3-phenylpentanoate (5k)



(*2R,3S*)-*syn*-**5k**

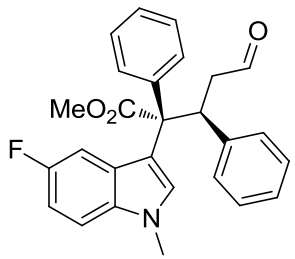
(*2R,3S*)-*syn*-**5k**: 99%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.55 (s, 1H), 7.28 (s, 1H), 7.22 – 7.09 (m, 6H), 6.98 – 6.83 (m, 5H), 6.71 (d, *J* = 7.6 Hz, 1H), 6.65 (s, 1H), 5.00 (d, *J* = 11.6 Hz, 1H), 3.80 (s, 3H), 3.65 (s, 3H), 3.48 (s, 3H), 3.21 (d, *J* = 17.5 Hz, 1H), 2.86 – 2.64 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.82, 172.99, 158.09, 138.84, 138.78, 137.24, 131.23, 128.85, 127.57, 127.38, 127.21, 126.73, 123.82, 122.28, 121.67, 119.21, 117.62, 114.62, 112.75, 109.16, 61.07, 55.16, 51.89, 46.22, 44.01, 33.06.

HRMS(ESI) :Calcd. for $C_{28}H_{27}NO_4Na$ $[M+Na]^+$: 464.1838 , Found: 464.1833.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =0.8 mL/min), t_{major} = 32.66 min, t_{minor} = 29.69 min.

(*2S,3S*)-methyl2-(5-fluoro-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5l)



(*2S,3S*)-*anti*-**5l**

(*2S,3S*)-*anti*-**5l**: 97%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.50 (d, *J* = 1.3 Hz, 1H), 7.50 – 7.40 (m, 2H), 7.37 – 7.26 (m, 3H), 7.25 – 7.07 (m, 4H), 7.01 (s, 1H), 6.88 (m, 1H), 6.77 (d, *J* = 7.1 Hz, 2H), 6.15 (dd, *J* = 10.8, 2.3 Hz, 1H), 5.01 (dd, *J* = 12.2, 2.2 Hz, 1H), 3.77 (s, 3H), 3.56 (s, 3H), 3.13 (dd, *J* = 17.4, 1.8 Hz, 1H), 2.81 – 2.59 (m, 1H).

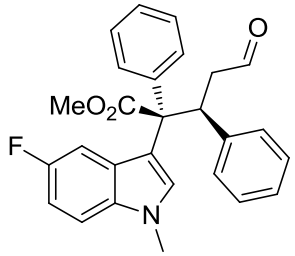
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.29, 173.48, 157.17 (d, J = 233.6 Hz), 139.53, 138.85, 134.19, 133.23, 130.56, 129.17, 128.33, 127.98 (d, J = 10.1 Hz), 127.56, 127.45, 127.35, 110.68 (d, J = 4.7 Hz), 109.89 (d, J = 10.0 Hz), 109.49 (d, J = 26.5 Hz), 107.13 (d, J = 24.7 Hz), 60.89, 52.19, 46.28, 44.42, 33.19.

^{19}F NMR (376 MHz, $CDCl_3$) δ -124.62.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3F$ $[M+H]^+$: 430.1818, Found: 430.1832.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =0.8 mL/min), t_{major} = 18.17 min, t_{minor} = 13.72 min.

(*2R,3S*)-methyl2-(5-fluoro-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5l)



(*2R,3S*)-*syn*-**5l**

(*2R,3S*)-*syn*-**5l**: 98%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.56 (s, 1H), 7.36 – 7.29 (m, 1H), 7.27 – 7.22 (m, 3H), 7.20 – 7.10 (m, 4H), 7.08 – 7.04 (m, 2H), 6.95 – 6.80 (m, 3H), 6.46 (d, *J* = 10.5 Hz, 1H), 4.93 (d, *J* = 10.5 Hz, 1H), 3.80 (s, 3H), 3.51 (s, 3H), 3.18 (d, *J* = 17.0 Hz, 1H), 2.80 – 2.67 (m, 1H).

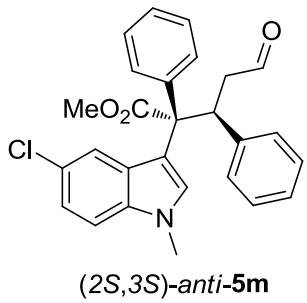
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.74, 172.96, 157.26 (d, *J* = 234.2 Hz), 138.67, 136.78, 133.87, 131.24, 131.20, 130.26, 127.41, 127.24, 127.11 (d, *J* = 10.3 Hz), 126.88, 114.80 (d, *J* = 4.8 Hz), 110.25 (d, *J* = 26.7 Hz), 109.76 (d, *J* = 9.9 Hz), 107.26 (d, *J* = 24.6 Hz), 60.86, 51.92, 46.22, 43.95, 33.35.

^{19}F NMR (376 MHz, $CDCl_3$) δ -124.34.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3F$ $[M+H]^+$: 430.1818, Found: 430.1814.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =0.8 mL/min), t_{major} = 16.55 min, t_{minor} = 14.83 min.

(*2S,3S*)-methyl2-(5-chloro-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5m)



(*2S,3S*)-*anti*-**5m**

(*2S,3S*)-*anti*-**5m**: 98%ee.^{1}H NMR (400 MHz, $CDCl_3$) δ 9.51 (s, 1H), 7.49 – 7.39 (m, 2H), 7.38 – 7.28 (m, 3H), 7.22 (d, *J* = 8.7 Hz, 1H), 7.19 – 7.04 (m, 4H), 6.98 (s, 1H), 6.77 (d, *J* = 7.3 Hz, 2H), 6.43 (s, 1H), 5.01 (d, *J* = 10.8 Hz, 1H), 3.76 (s, 3H), 3.57 (s, 3H), 3.13 (d, *J* = 16.6 Hz, 1H), 2.78 – 2.62 (m, 1H).

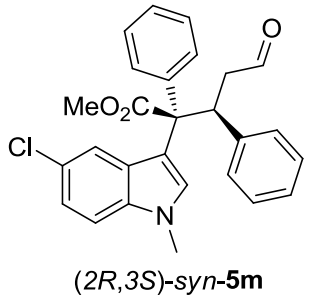
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.25, 173.43, 139.56, 138.78, 134.98, 133.86,

130.55, 129.14, 128.70, 128.35, 127.62, 127.46, 127.39, 124.86, 121.49, 121.41, 110.54, 110.34, 60.88, 52.22, 46.19, 44.33, 33.11.

HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3NaCl$ $[M+Na]^+$: 468.1342 , Found: 468.1362.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 14.23 min, t_{minor} = 10.90 min.

(*2R,3S*)-methyl2-(5-chloro-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5m)



(*2R,3S*)-*syn*-**5m**

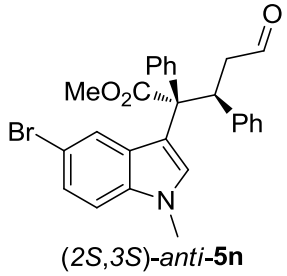
(*2R,3S*)-*syn*-**5m**: 99%ee.^{1}H NMR (400 MHz, $CDCl_3$) δ 9.55 (s, 1H), 7.37 – 7.31 (m, 1H), 7.27 (d, *J* = 8.2 Hz, 2H), 7.24 – 6.99 (m, 8H), 6.87 (d, *J* = 7.3 Hz, 2H), 6.73 (s, 1H), 4.91 (d, *J* = 11.8 Hz, 1H), 3.79 (s, 3H), 3.52 (s, 3H), 3.16 (d, *J* = 17.5 Hz, 1H), 2.85 – 2.67 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.70, 172.97, 138.64, 136.95, 135.62, 131.20, 131.03, 130.09, 127.73, 127.47, 127.44, 127.30, 126.99, 125.07, 122.12, 121.57, 114.69, 110.18, 60.85, 51.98, 46.28, 44.14, 33.25.

HRMS(ESI) :Calcd. for $C_{27}H_{24}NO_3NaCl$ $[M+Na]^+$: 468.1342 , Found: 468.1342.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 12.64 min, t_{minor} = 11.43 min.

(*2S,3S*)-methyl2-(5-bromo-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5n)



(*2S,3S*)-*anti*-**5n**

(*2S,3S*)-*anti*-**5n**: 95%**ee** .^{1}H NMR (400 MHz, $CDCl_3$) δ 9.51 (s, 1H), 7.42 (d, *J* = 3.0 Hz, 2H), 7.39 – 7.30 (m, 3H), 7.24 – 7.14 (m, 3H), 7.11 (t, *J* = 7.4 Hz, 2H), 6.96 (s, 1H), 6.77 (d, *J* = 7.4 Hz, 2H), 6.57 (s, 1H), 5.01 (d, *J* = 10.5 Hz, 1H), 3.76 (s, 3H), 3.57 (s, 3H), 3.12 (d, *J* = 16.0 Hz, 1H), 2.76 – 2.61 (m, 1H).

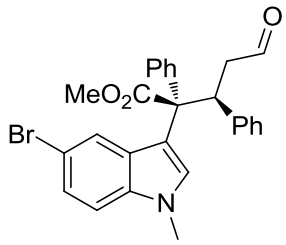
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.24, 173.41, 139.57, 138.75, 135.22, 133.68,

130.54, 129.38, 129.12, 128.35, 127.62, 127.46, 127.40, 124.56, 123.96, 112.54, 110.79, 110.52, 60.88, 52.22, 46.15, 44.29, 33.09.

HRMS(ESI) :Calcd. for C_{27} H_{25} NO_3 Br $[M+H]^+$: 490.1018 , Found: 490.0997.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 14.28 min, t_{minor} = 11.06 min.

(*2R,3S*)-methyl2-(5-bromo-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate (5n)



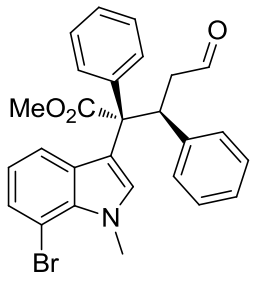
(*2R,3S*)-*syn*-**5n**

(*2R,3S*)-*syn*-**5n**: 73%**ee** .^{1}H NMR (400 MHz, $CDCl_3$) δ 9.55 (s, 1H), 7.36 – 7.31 (m, 1H), 7.27 (d, *J* = 10.0 Hz, 2H), 7.23 – 7.03 (m, 8H), 6.88 (s, 3H), 4.90 (d, *J* = 11.1 Hz, 1H), 3.78 (s, 3H), 3.53 (s, 3H), 3.15 (d, *J* = 17.3 Hz, 1H), 2.84 – 2.69 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.67, 172.98, 138.64, 137.02, 135.85, 131.18, 130.95, 129.98, 128.37, 127.49, 127.45, 127.32, 127.02, 124.66, 124.64, 114.67, 112.74, 110.62, 60.86, 51.99, 46.32, 44.21, 33.22.

HRMS(ESI) :Calcd. for C_{27} H_{25} NO_3 Br $[M+H]^+$: 490.1018 , Found: 490.1020.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 15/1, Flow rate =1.0 mL/min), t_{major} = 12.58 min, t_{minor} = 11.55 min.



(*2S,3S*)-*anti*-**5o**

(*2S,3S*)-methyl2-(7-bromo-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate(5o)

(*2S,3S*)-*anti*-**5o**: 98%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.49 (s, 1H), 7.44 – 7.39 (m, 2H), 7.34 – 7.29 (m, 3H), 7.20 – 7.07 (m, 3H), 6.94 (s, 1H), 6.77 (d, *J* = 7.1 Hz, 2H), 6.61 (t, *J* = 7.8 Hz, 1H), 6.45 (d, *J* = 8.1 Hz, 1H), 5.01 (d, *J* = 10.6 Hz, 1H), 4.15 (s, 3H), 3.56 (s, 3H), 3.12 (d, *J* = 16.6 Hz, 1H), 2.83 – 2.56 (m, 1H).

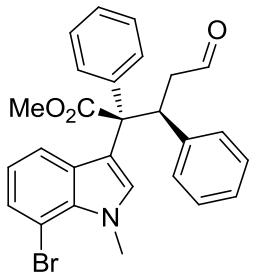
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.28, 173.36, 139.63, 138.75, 135.82, 133.00, 130.75, 130.57, 129.18, 128.26, 127.49, 127.40, 126.18, 121.73, 119.97, 110.61, 103.99, 60.84, 52.23, 46.29, 44.43, 37.21.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3Br$ $[M+H]^+$: 490.1018, Found: 490.1023.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min),

t_{major} = 14.73 min, t_{minor} = 11.15 min.

(*2R,3S*)-methyl2-(7-bromo-1-methyl-1H-indol-3-yl)-5-oxo-2,3-diphenylpentanoate(5o)



*(2R,3S)-syn-***5o**

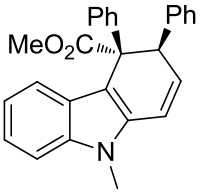
(*2R,3S*)-*syn*-**5o**: 94%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.56 (s, 1H), 7.40 – 7.29 (m, 1H), 7.27 – 7.20 (m, 3H), 7.19 – 7.11 (m, 4H), 7.07 (d, *J* = 7.8 Hz, 2H), 6.88 (d, *J* = 7.1 Hz, 2H), 6.76 (d, *J* = 8.1 Hz, 1H), 6.62 (t, *J* = 7.8 Hz, 1H), 4.93 (d, *J* = 11.5 Hz, 1H), 4.20 (s, 3H), 3.49 (s, 3H), 3.16 (d, *J* = 17.4 Hz, 1H), 2.81 – 2.49 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 201.62, 172.65, 138.54, 136.76, 133.64, 131.72, 131.34, 131.16, 129.79, 127.49, 127.34, 126.85, 126.80, 121.74, 120.28, 114.79, 103.68, 60.59, 51.94, 46.15, 43.93, 37.36.

HRMS(ESI) :Calcd. for $C_{27}H_{25}NO_3Br$ $[M+H]^+$: 490.1018, Found: 490.1016.

HPLC (Chiral IC, λ= 220 nm, hexane/2-propanol = 30/1, Flow rate =1.0 mL/min), t_{major} = 11.83 min, t_{minor} = 10.75 min.

(*3R,4S*)-methyl9-methyl-3,4-diphenyl-4,9-dihydro-3H-carbazole-4-carboxylate(6)



*(2S,3S)-anti-***6**

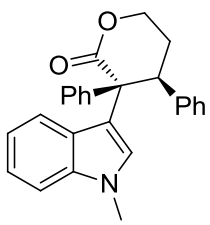
(*2S,3S*)-*anti*-**6**: 96%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 8.3 Hz, 1H), 7.26 – 7.03 (m, 12H), 7.00-6.90 (m, 1H), 6.70 (dd, *J* = 9.9, 2.3 Hz, 1H), 6.33 (dd, *J* = 9.9, 4.0 Hz, 1H), 4.35 (dd, *J* = 4.0, 2.3 Hz, 1H), 3.79 (s, 3H), 3.32 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 172.54, 143.04, 138.97, 137.95, 135.56, 132.22, 130.66, 128.51, 127.49, 126.99, 126.88, 126.05, 121.70, 121.34, 119.71, 115.53, 109.70, 109.08, 59.76, 54.85, 51.30, 29.40.

HRMS(ESI) :Calcd. for $C_{27}H_{23}NO_2Na$ $[M+ Na]^+$: 416.1626, Found: 416.1619.

HPLC (Chiral IC, λ= 254 nm, hexane/2-propanol = 10/1, Flow rate =1.0 mL/min), t_{major} = 6.48 min, t_{minor} = 17.74 min.

(*3S,4S*)-3-(1-methyl-1H-indol-3-yl)-3,4-diphenyltetrahydro-2H-pyran-2-one (7)



*(2S,3S)-anti-***7**

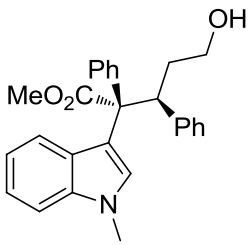
(*2S,3S*)-*anti*-**7**: 96%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* =

8.1 Hz, 1H), 7.33 (d, *J* = 8.2 Hz, 1H), 7.23 (d, *J* = 7.3 Hz, 1H), 7.17 – 7.11 (m, 1H), 7.09 – 7.01 (m, 2H), 6.88 – 6.79 (m, 1H), 6.68 (d, *J* = 7.3 Hz, 1H), 4.70 – 4.55 (m, 1H), 4.43 – 4.29 (m, 1H), 3.77 (s, 1H), 2.52 – 2.34 (m, 1H), 2.31 – 2.10 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.08, 140.97, 138.39, 137.77, 130.14, 129.48, 129.12, 127.66, 126.85, 126.82, 126.80, 126.38, 121.97, 121.20, 119.62, 115.09, 109.61, 68.18, 58.97, 46.49, 33.02, 26.79.

HRMS(ESI) :Calcd. for $C_{26}H_{24}NO_2$ $[M+H]^+$: 382.1807, Found:382.1815.

HPLC (Chiral IA, λ= 254 nm, hexane/2-propanol = 4/1, Flow rate =1.0 mL/min), t_{major} = 10.23 min, t_{minor} = 14.64 min.

(*2S,3S*)-methyl 5-hydroxy-2-(1-methyl-1H-indol-3-yl)-2,3-diphenylpentanoate (8)



*(2S,3S)-anti-***8**

(*2S,3S*)-*anti*-**6**: 96%ee. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 – 7.49 (m, 1H), 7.42 – 7.27 (m, 2H), 7.21 – 7.00 (m, 3H), 6.87 – 6.70 (m, 1H), 6.56 (d, *J* = 8.1 Hz, 1H), 5.34 (s, 1H), 4.59 (d, *J* = 12.1 Hz, 1H), 3.78 (s, 1H), 3.53 (s, 1H), 3.44 – 3.37 (m, 1H), 3.31 – 3.17 (m, 1H), 2.56 – 2.38 (m, 1H), 2.09 – 1.92 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.16, 140.65, 139.71, 136.50, 132.62, 130.84, 129.61, 128.04, 127.91, 127.26, 126.98, 126.94, 122.82, 120.70, 118.53, 111.21, 109.02, 61.23, 61.09, 51.99, 46.89, 34.55, 32.88.

HRMS(ESI) :Calcd. for $C_{27}H_{27}NO_3Na$ $[M+Na]^+$: 436.1889, Found: 436.1900.

HPLC (Chiral IA, λ= 254 nm, hexane/2-propanol = 10/1, Flow rate =1.0 mL/min), t_{major} = 13.54 min, t_{minor} = 11.05 min.

methyl 2-(1-methyl-1H-indol-3-yl)-2-phenylacetate (9)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.32 (m, 3H), 7.22 – 7.09 (m, 5H), 6.98 – 6.94 (m, 2H), 5.17 (s, 1H), 3.63 (s, 3H), 3.60 (s, 3H).

References

[1]. a) G. Battistuzzi, S. Cacchi, G. Fabrizi, *Org. Lett*. **2003**, 5, 777; b) C. A. Müller, A. Pfaltz, *Angew. Chem. Int. Ed.* **2008**, 47, 3363.

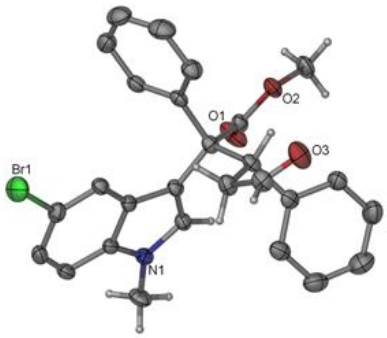
[2]. Y. Hayashi, H. Gotoh, T. Hayashi, M. Shoji, *Angew. Chem. Int. Ed.* **2005**, 44,

4212.

[3]. J. M. Fraile, K. L. Jeune, J. A. Mayoral, N. Ravasiob, F. Zaccheriab, *Org. Biomol. Chem.* **2013**, 11, 4327.

4. X-ray Diffraction Parameters and Data

Single Crystal X-ray Diffraction Data of *anti*-5m (CCDC NO.: 1030110)



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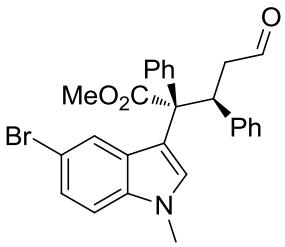
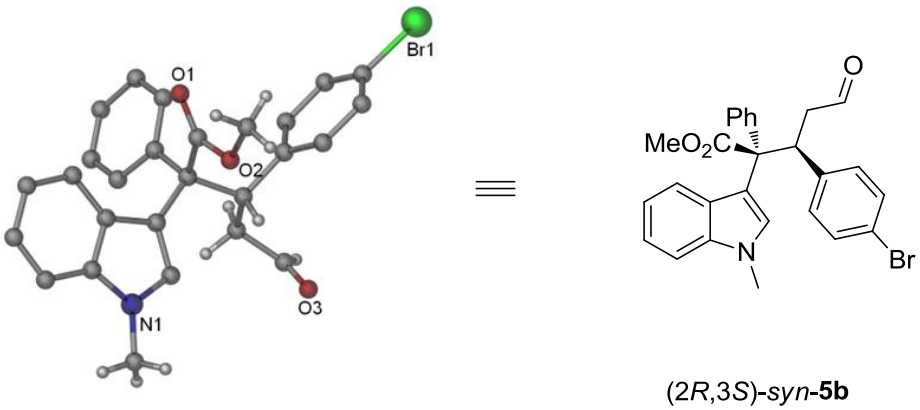


(2*S*,3*S*)-*anti*-**5m**

Datablock: z

```
Bond precision:       C-C = 0.0037 A                Wavelength=0.71073
Cell:        a=7.5980(3)      b=10.0968(4)     c=30.0491(11)
             alpha=90         beta=90          gamma=90
Temperature: 173 K
                     Calculated                        Reported
Volume               2305.23(15)                       2305.23(15)
Space group          P 21 21 21                        P2(1)2(1)2(
Hall group           P 2ac 2ab                         ?
Moiety formula       C27 H24 Br N O3                   ?
Sum formula          C27 H24 Br N O3                   C27 H24 Br N O3
Mr                   490.37                            490.38
Dx,g cm-3            1.413                             1.413
Z                    4                                 4
Mu (mm-1)            1.812                             1.812
F000                 1008.0                            1008.0
F000'                1007.25
h,k,lmax             9,12,35                           9,12,35
Nref                 4036[ 2339]                       4028
Tmin,Tmax            0.626,0.735                       0.595,0.748
Tmin'                0.554
Correction method= MULTI-SCAN
Data completeness= 1.72/1.00      Theta(max)= 25.010
R(reflections)= 0.0283( 3590)         wR2(reflections)= 0.0638( 4028)
S = 1.027              Npar= Npar = 289
```

Single Crystal X-ray Diffraction Data of *syn*-5b (CDCC NO.: 1030118)

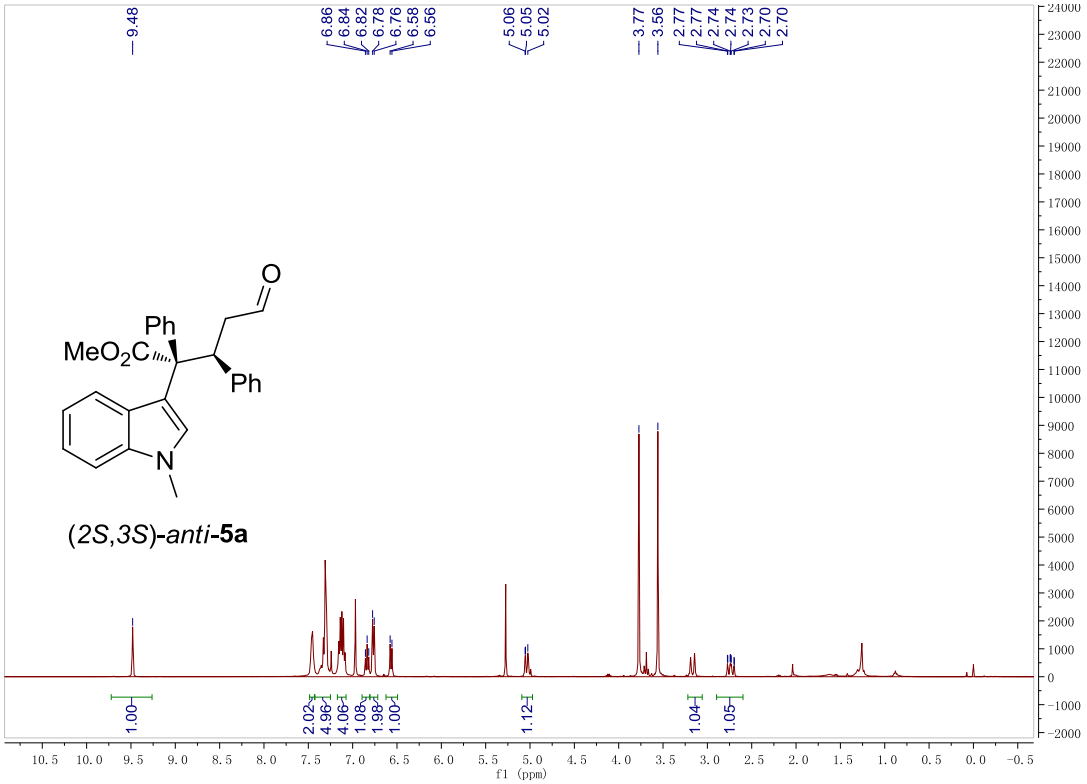


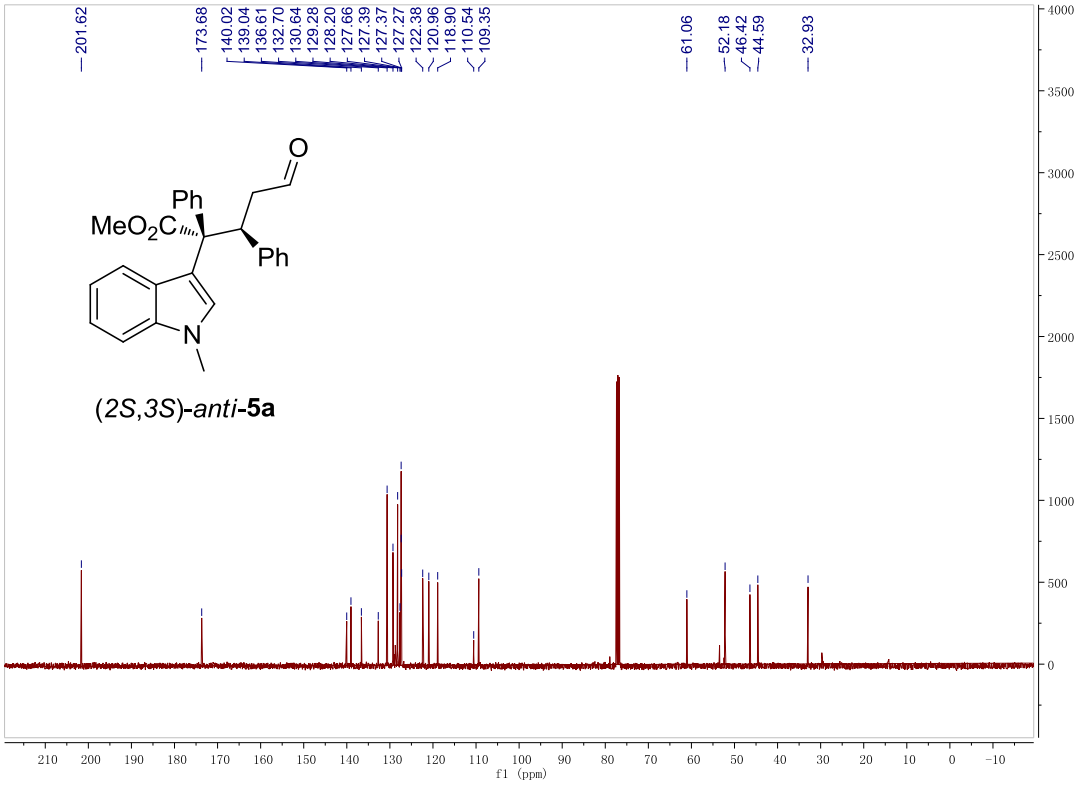
(2*R*,3*S*)-*syn*-**5b**

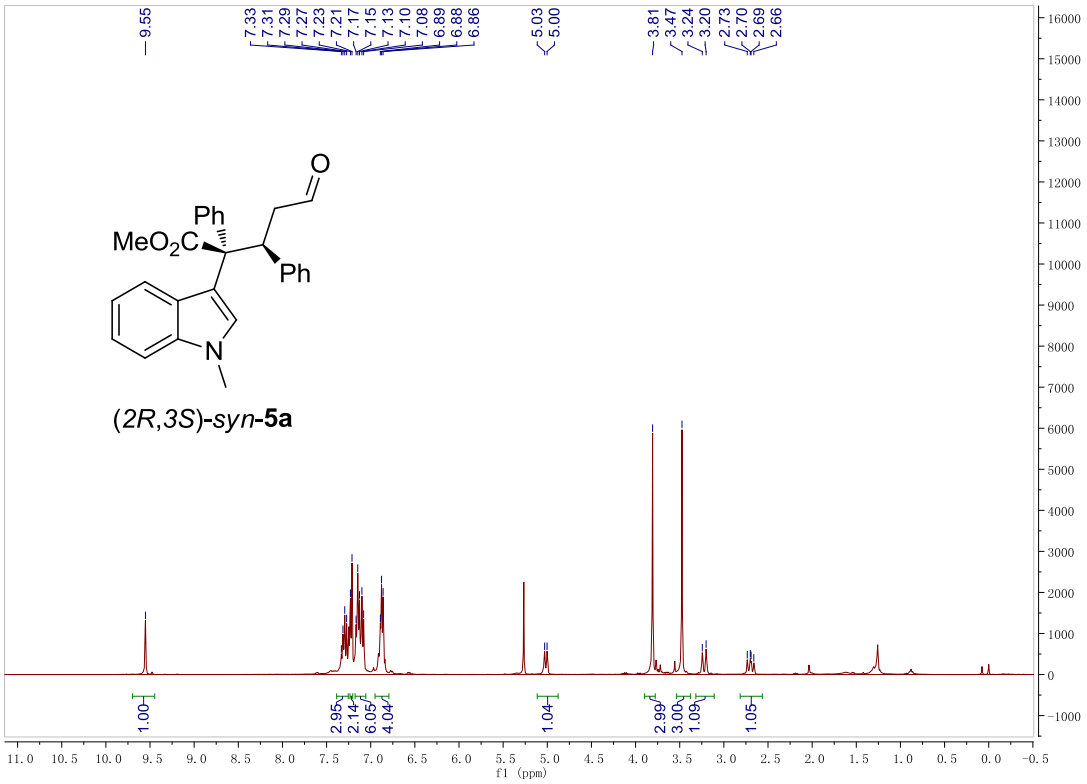
Datablock: z

```
Bond precision:  C-C = 0.0062 A          Wavelength=0.71073

Cell:             a=8.8669(5)     b=14.7074(7)     c=17.9059(9)
                  alpha=90        beta=90          gamma=90
Temperature:      296 K

                 Calculated                Reported
Volume           2335.1(2)                 2335.1(2)
Space group      P 21 21 21                P2(1)2(1)2(
Hall group       P 2ac 2ab                 ?
Moiety formula   C27 H24 Br N O3           ?
Sum formula      C27 H24 Br N O3           C27 H24 Br N O3
Mr               490.37                    490.38
Dx,g cm-3        1.395                     1.395
Z                4                         4
Mu (mm-1)        1.789                     1.789
F000             1008.0                    1008.0
F000'            1007.25
h,k,lmax         10,17,21                  10,17,21
Nref             4132[ 2361]               4130
Tmin,Tmax        0.566,0.792               0.581,0.801
Tmin'            0.539

Correction method= # Reported T Limits: Tmin=0.581 Tmax=0.801
AbsCorr = MULTI-SCAN

Data completeness= 1.75/1.00      Theta(max)= 25.010

R(reflections)= 0.0397( 2821)     wR2(reflections)= 0.0949( 4130)

S = 1.012                 Npar= 284
```

5. NMR Spectra of Compounds



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7.33
7.31
7.29
7.27
7.23
7.21
7.17
7.15
7.13
7.10
7.08
6.89
6.88
6.86
5.03
5.00
3.81
3.47
3.24
3.20
2.73
2.70
2.69
2.66
O
Ph
MeO2C
Ph
N
(2R,3S)-syn-5a
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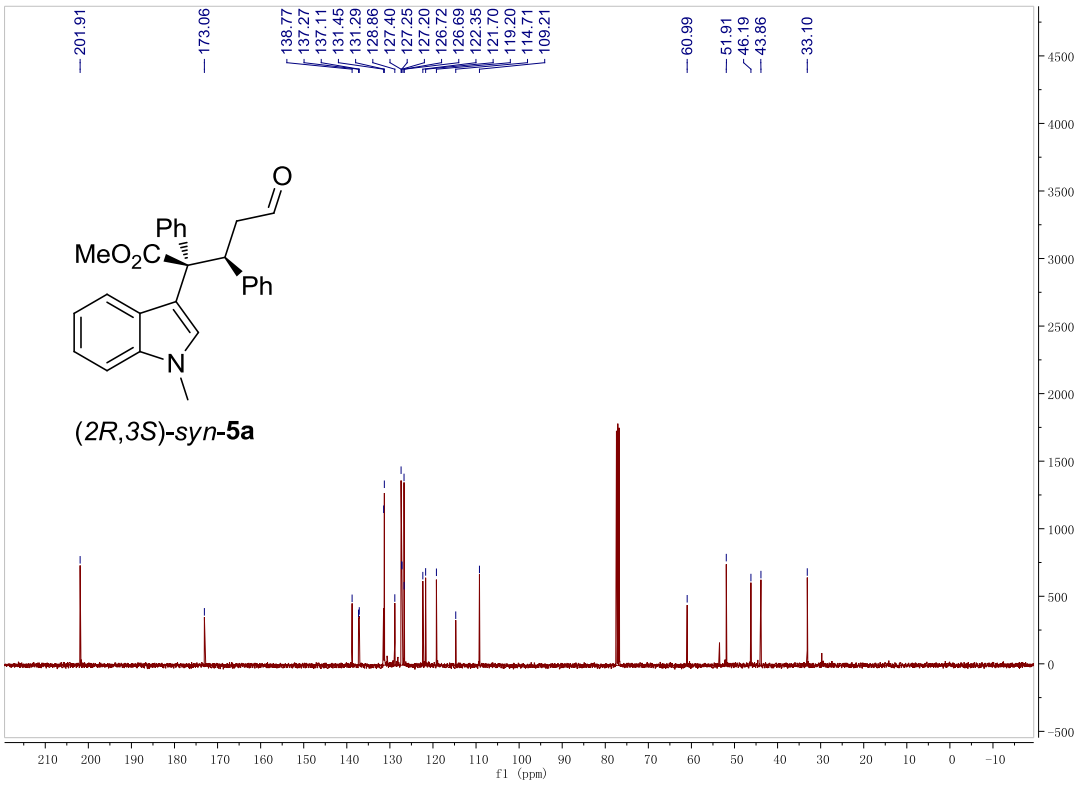
2.95
2.14
6.05
4.04
1.04
2.99
3.00
1.09
1.05
f1 (ppm)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138.77
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137.11
131.45
131.29
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127.25
127.20
126.72
126.69
122.35
121.70
119.20
114.71
109.21
60.99
51.91
46.19
43.86
33.10
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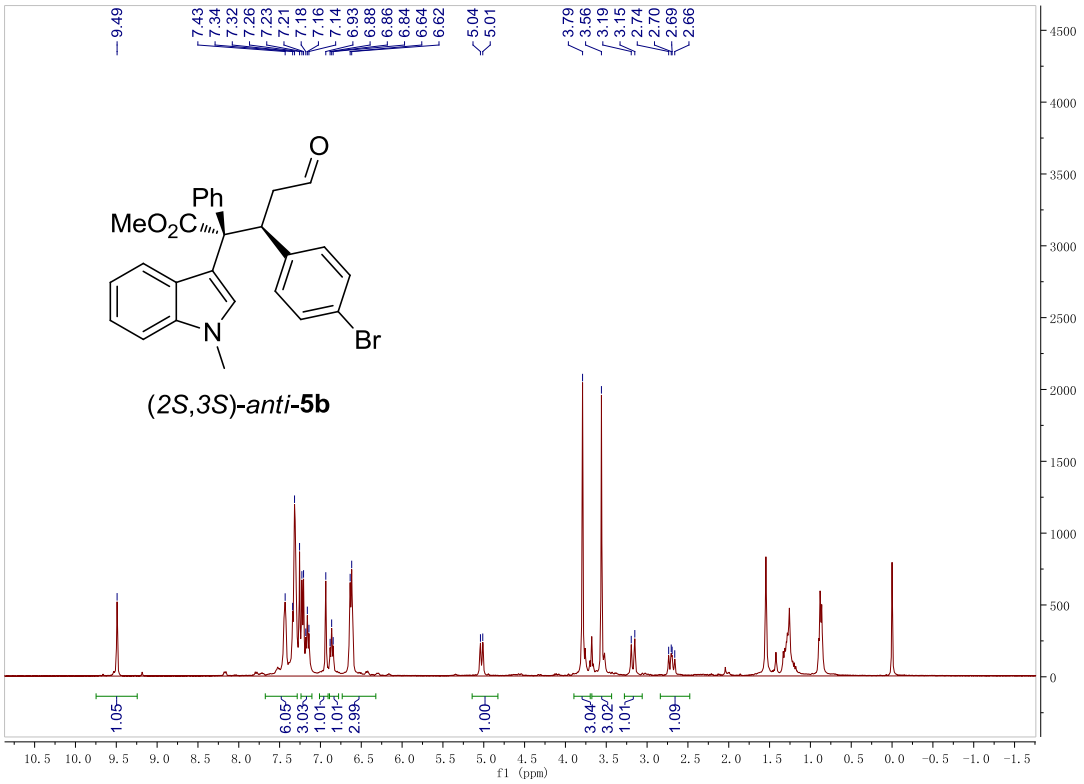
Ph
MeO2C
Ph
N
(2R,3S)-syn-5a
f1 (ppm)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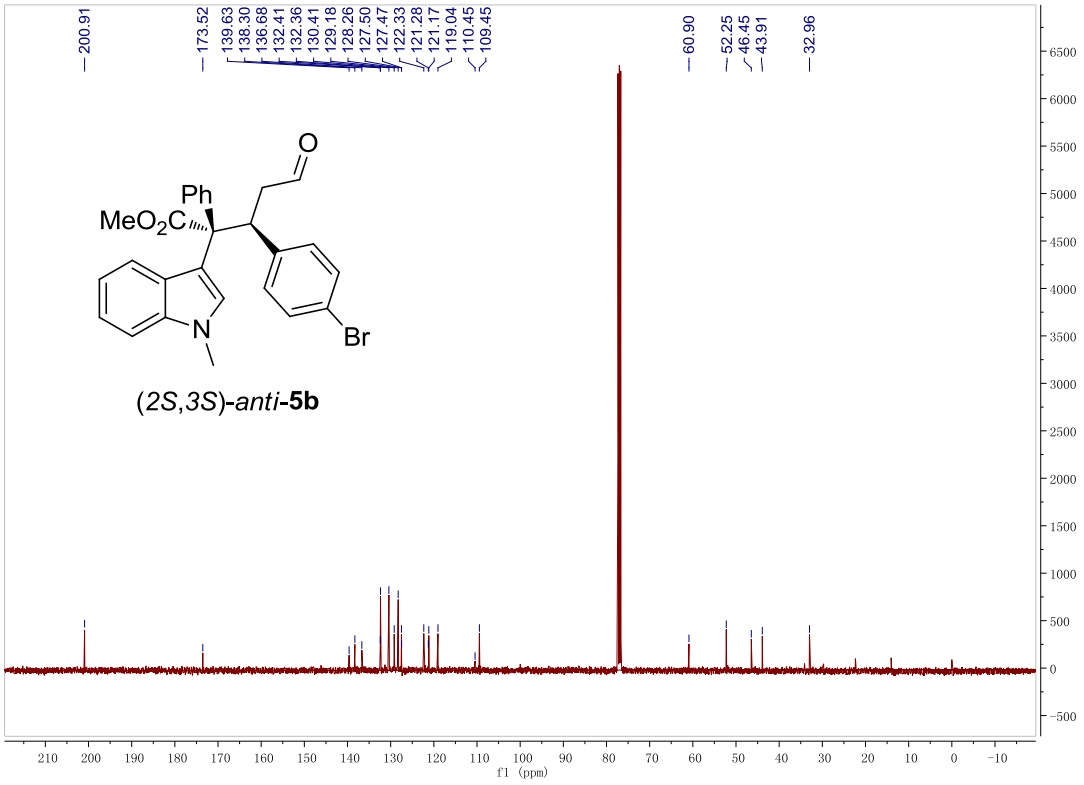
7.26
7.23
7.21
7.18
7.16
7.14
6.93
6.88
6.86
6.84
6.64
6.62
5.04
5.01
3.79
3.56
3.19
3.15
2.74
2.70
2.69
2.66
O
Ph
MeO2C
N
Br
(2S,3S)-anti-5b
1.05
6.05
3.03
1.01
1.01
2.99
1.00
3.04
3.02
1.01
1.09
f1 (ppm)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132.36
130.41
129.18
128.26
127.50
127.47
122.33
121.28
121.17
119.04
110.45
109.45
60.90
52.25
46.45
43.91
32.96
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Ph
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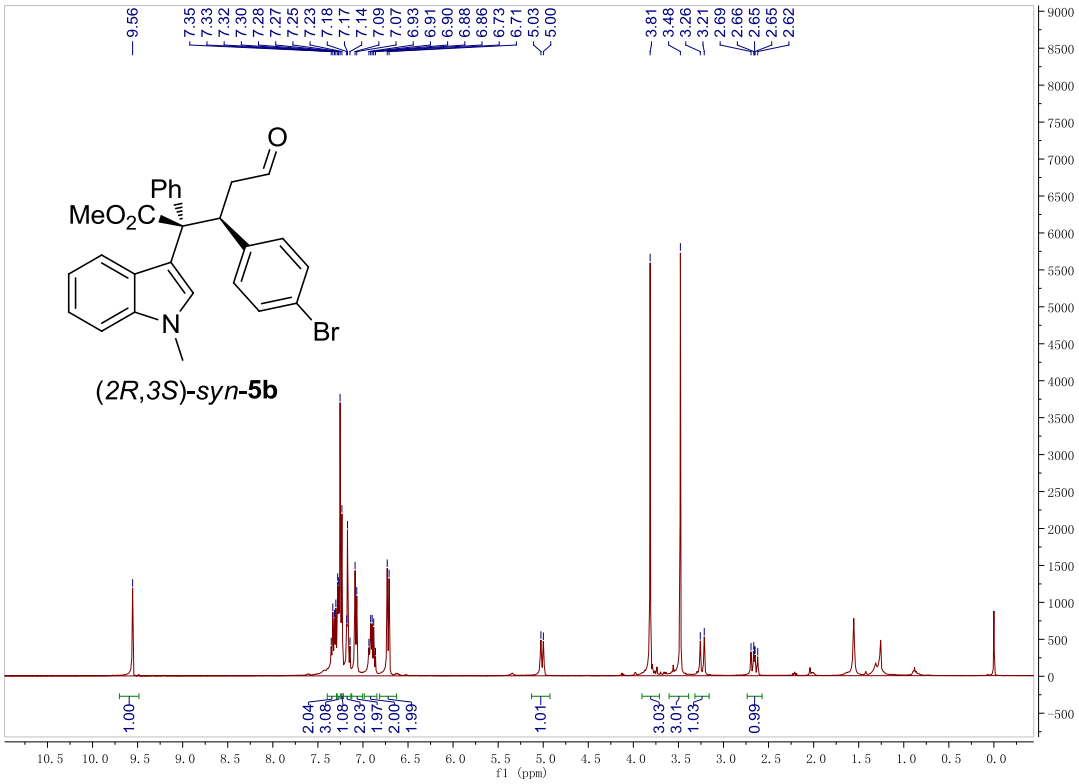
N
Br
(2S,3S)-anti-5b
f1 (ppm)


9.56
7.35
7.33
7.32
7.30
7.28
7.27
7.25
7.23
7.18
7.17
7.14
7.09
7.07
6.93
6.91
6.90
6.88
6.86
6.73
6.71
5.03
5.00
3.81
3.48
3.26
3.21
2.69
2.66
2.65
2.65
2.62
O
Ph
MeO2C
N
Br
(2R,3S)-syn-5b
1.00
2.04
3.08
1.08
2.03
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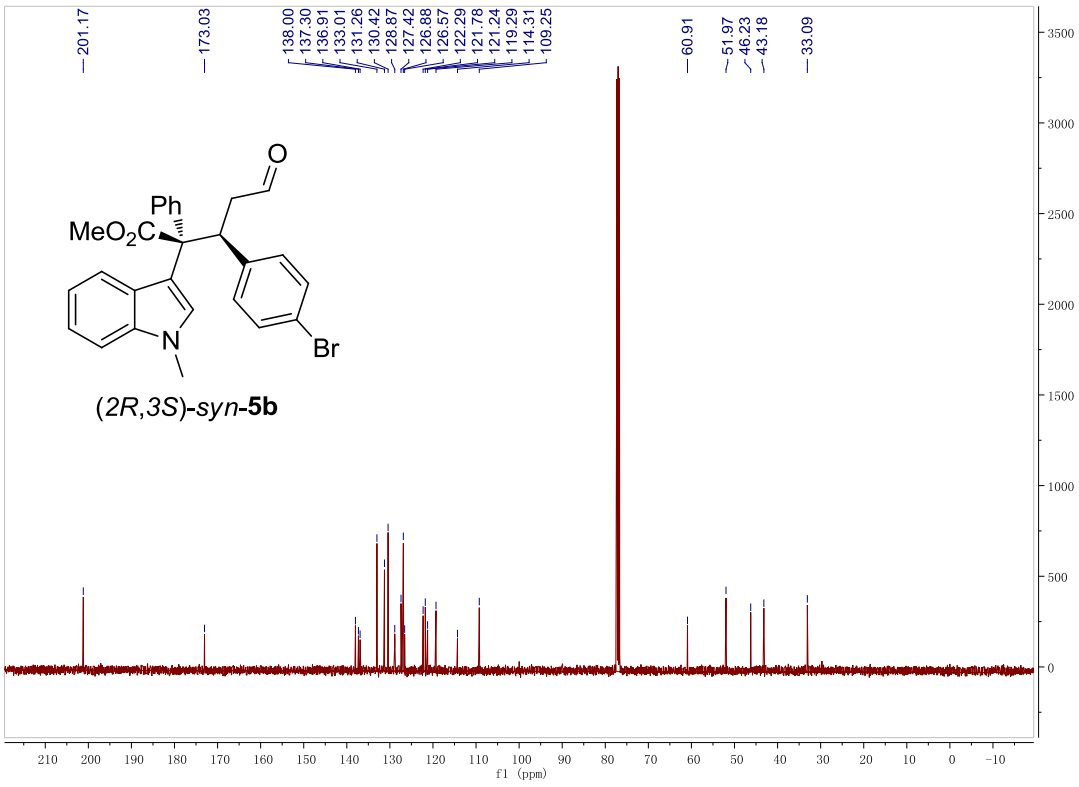
2.00
1.99
1.01
3.03
3.01
1.03
0.99
f1 (ppm)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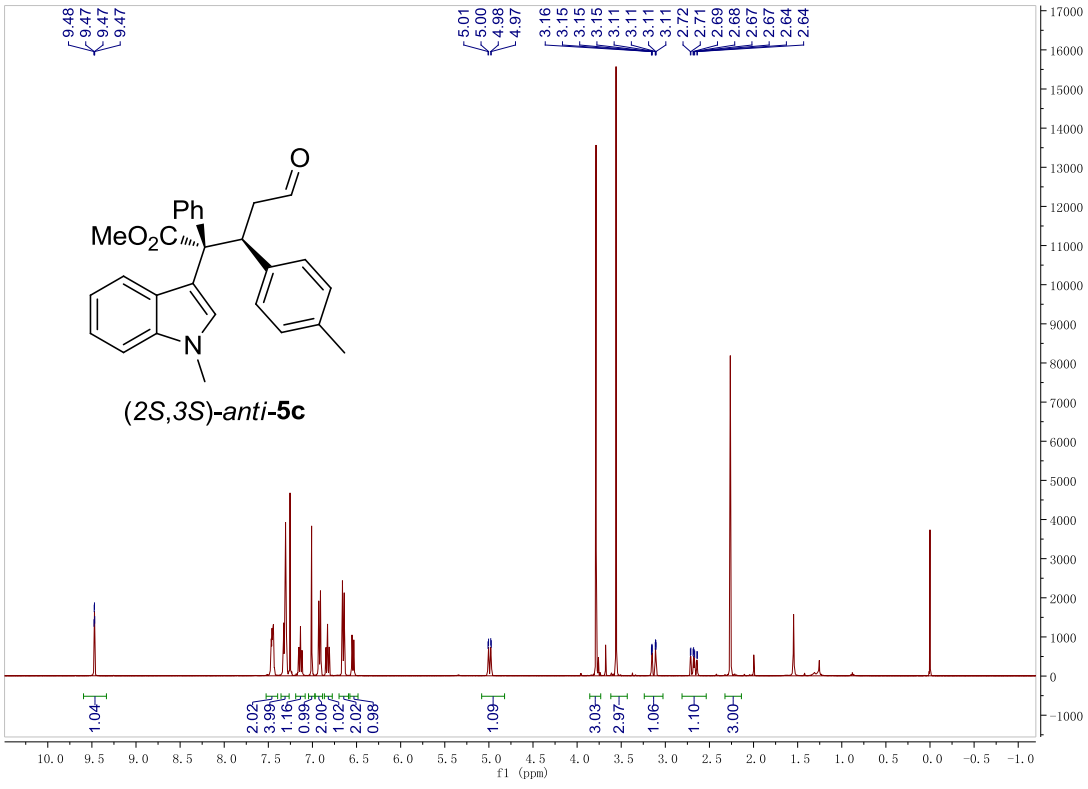
122.29
121.78
121.24
119.29
114.31
109.25
60.91
51.97
46.23
43.18
33.09
O
Ph
MeO2C
N
Br
(2R,3S)-syn-5b
f1 (ppm)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9.47
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5.00
4.98
4.97
3.16
3.15
3.15
3.15
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3.11
3.11
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2.71
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2.68
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2.67
2.64
2.64
O
Ph
MeO2C
N
(2S,3S)-anti-5c
1.04
2.02
3.99
1.16
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0.98
1.09
3.03
2.97
1.06
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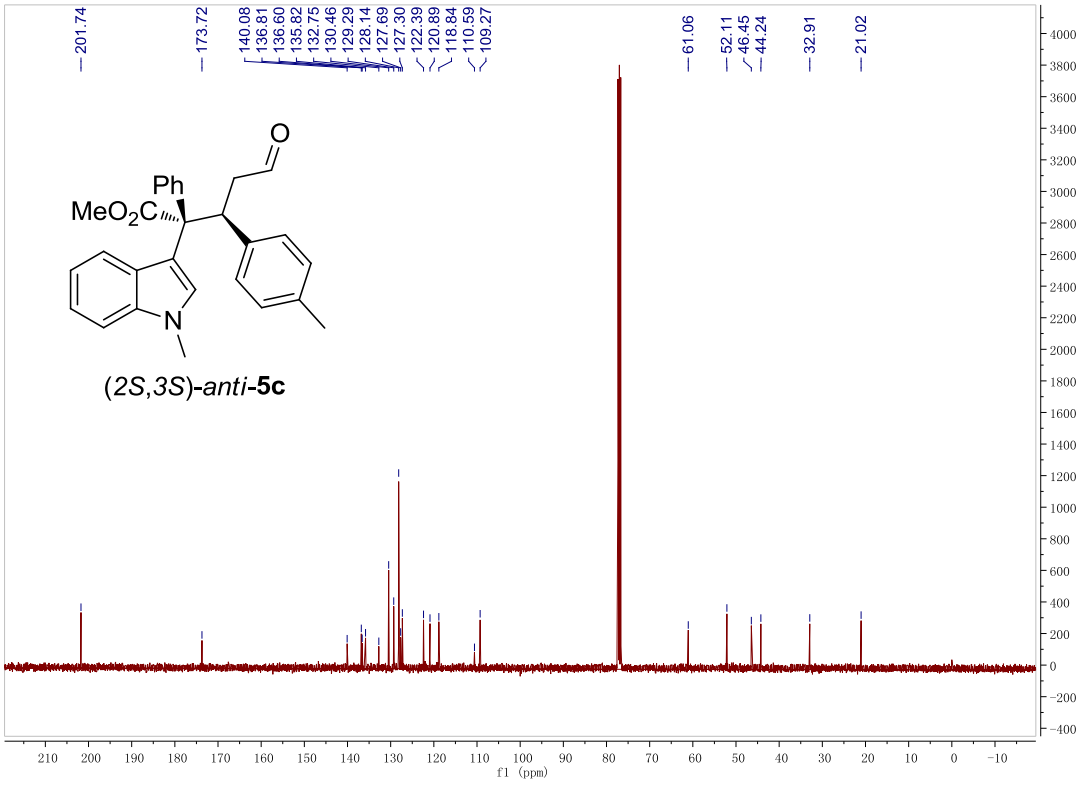
3.00
f1 (ppm)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128.14
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127.30
122.39
120.89
118.84
110.59
109.27
61.06
52.11
46.45
44.24
32.91
21.02
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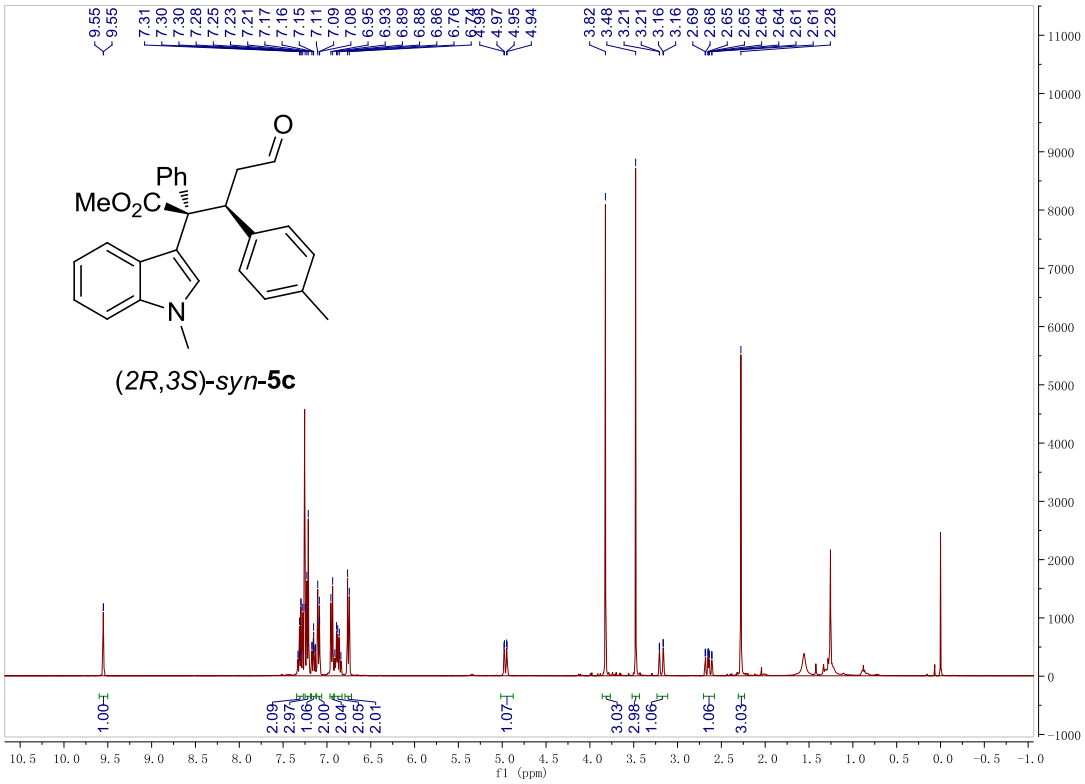
Ph
MeO2C
N
(2S,3S)-anti-5c
f1 (ppm)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7.23
7.21
7.17
7.16
7.15
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3.21
3.16
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2.65
2.65
2.64
2.64
2.61
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2.28
O
Ph
MeO2C
N
(2R,3S)-syn-5c
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2.97
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2.00
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2.05
2.01
1.07
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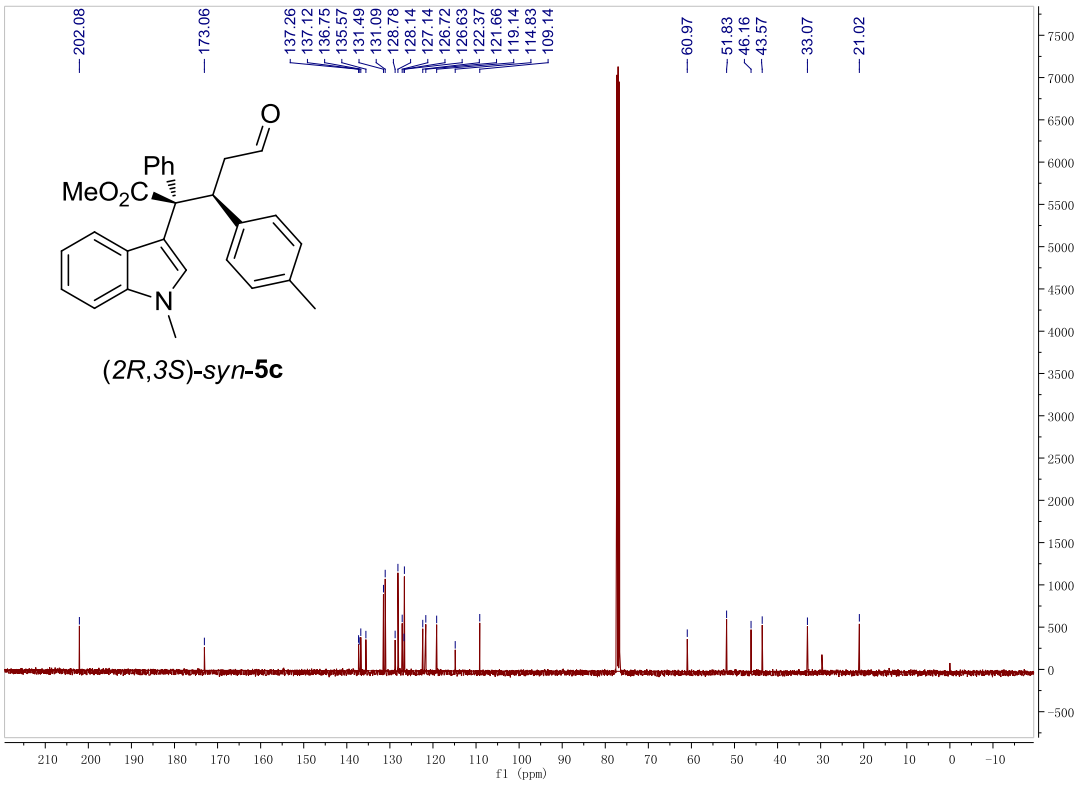
1.06
3.03
f1 (ppm)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127.14
126.72
126.63
122.37
121.66
119.14
114.83
109.14
60.97
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33.07
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Ph
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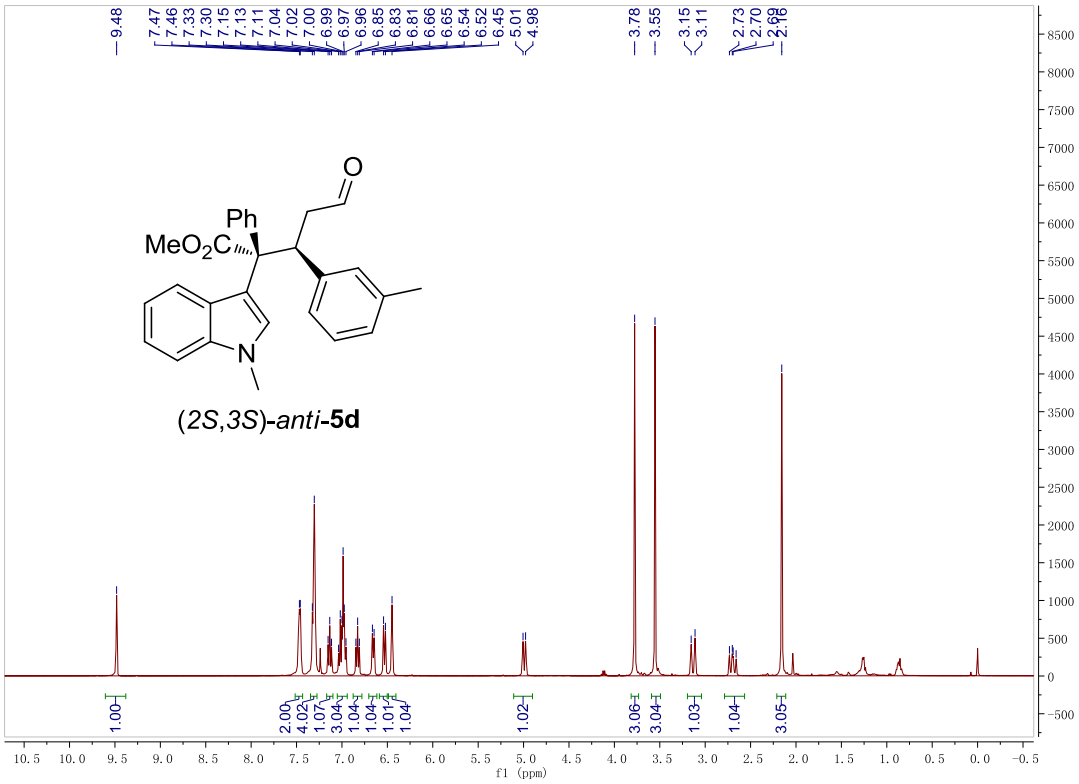
N
(2R,3S)-syn-5c
f1 (ppm)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7.02
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6.54
6.52
6.45
5.01
4.98
3.78
3.55
3.15
3.11
2.73
2.70
2.68
2.16
Ph
MeO2C
O
N
(2S,3S)-anti-5d
1.00
2.00
4.02
1.07
3.04
1.04
1.04
1.01
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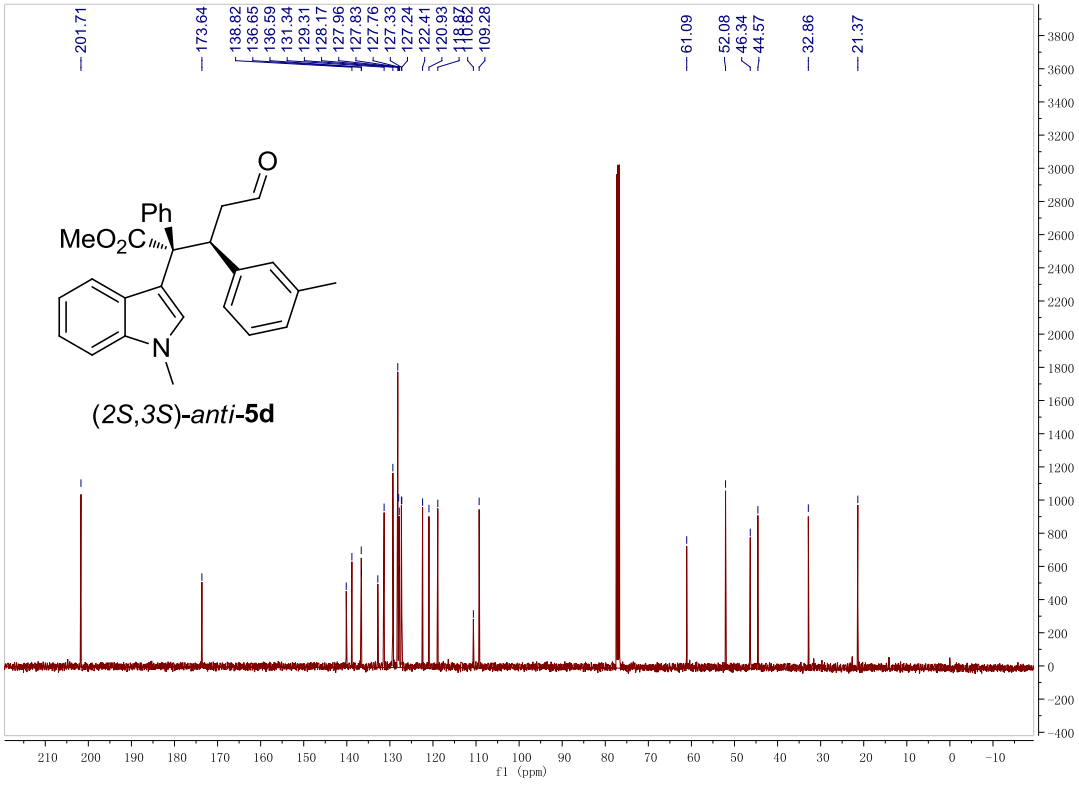
3.04
1.03
1.04
3.05
f1 (ppm)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127.24
122.41
120.93
118.87
110.82
109.28
61.09
52.08
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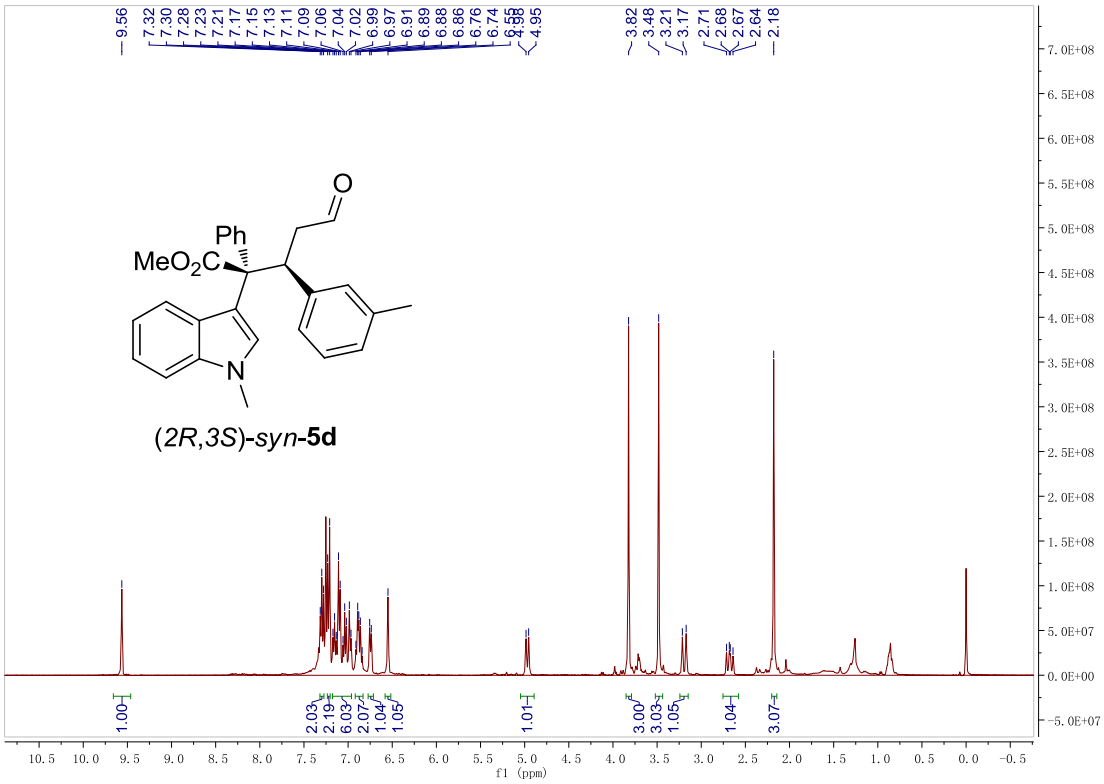
Ph
MeO2C
O
N
(2S,3S)-anti-5d
f1 (ppm)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7.13
7.11
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7.06
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7.02
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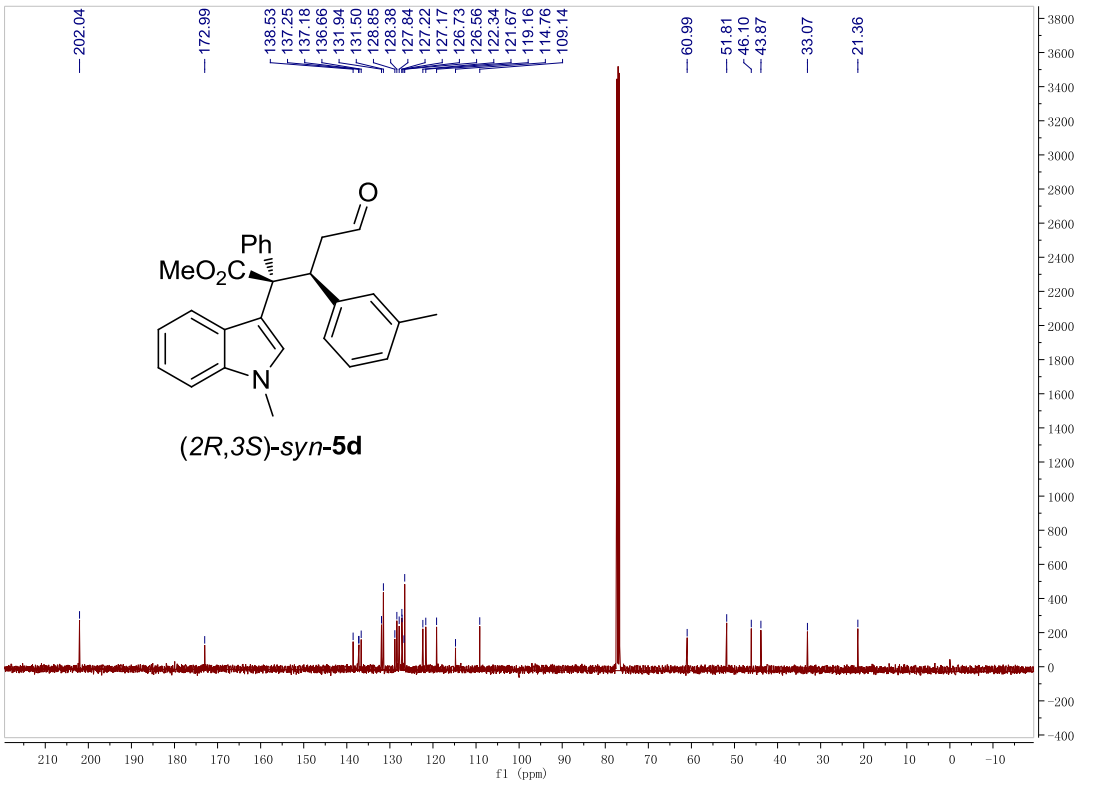
6.86
6.76
6.74
4.95
3.82
3.48
3.21
3.17
2.71
2.68
2.67
2.64
2.18
Ph
MeO2C
O
N
(2R,3S)-syn-5d
1.00
2.03
2.19
6.03
2.07
1.04
1.05
1.01
3.00
3.03
1.05
1.04
3.07
f1 (ppm)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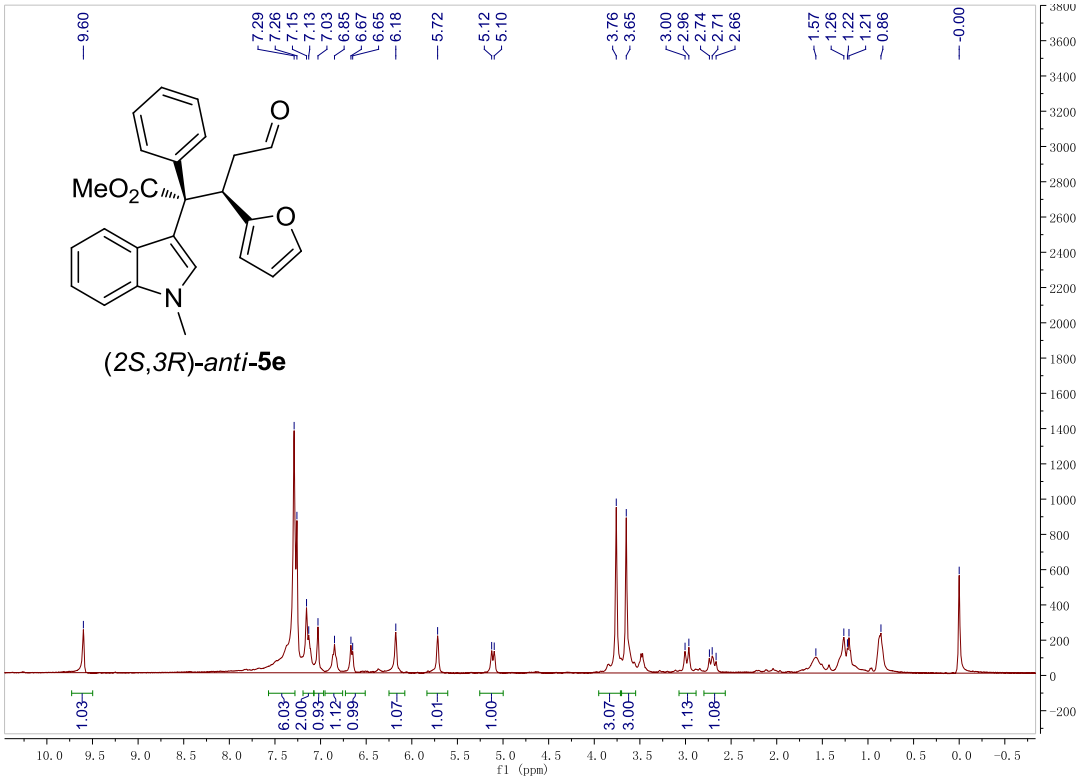
131.50
128.85
128.38
127.84
127.22
127.17
126.73
126.56
122.34
121.67
119.16
114.76
109.14
60.99
51.81
46.10
43.87
33.07
21.36
Ph
MeO2C
O
N
(2R,3S)-syn-5d
f1 (ppm)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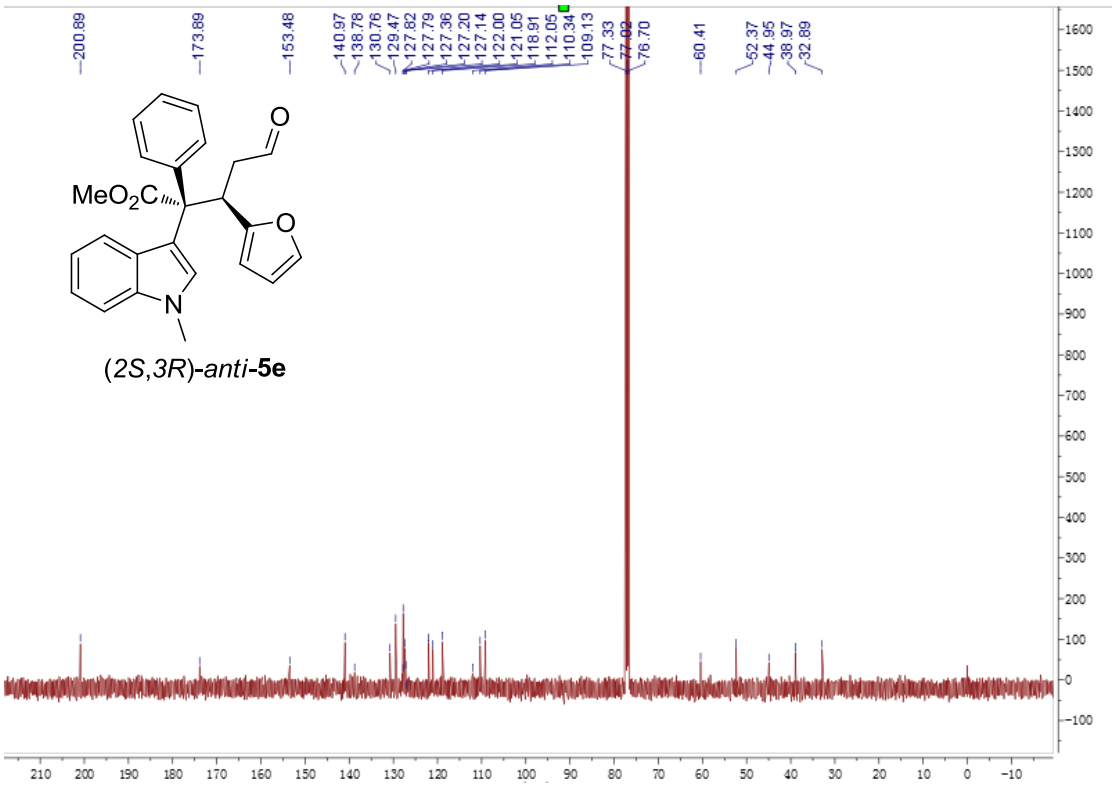
7.03
6.85
6.67
6.65
6.18
5.72
5.12
5.10
3.76
3.65
3.00
2.96
2.74
2.71
2.66
1.57
1.26
1.22
1.21
0.86
-0.00
MeO2C
O
O
N
(2S,3R)-anti-5e
1.03
6.03
2.00
0.93
1.12
0.99
1.07
1.01
1.00
3.07
3.00
1.13
1.08
f1 (ppm)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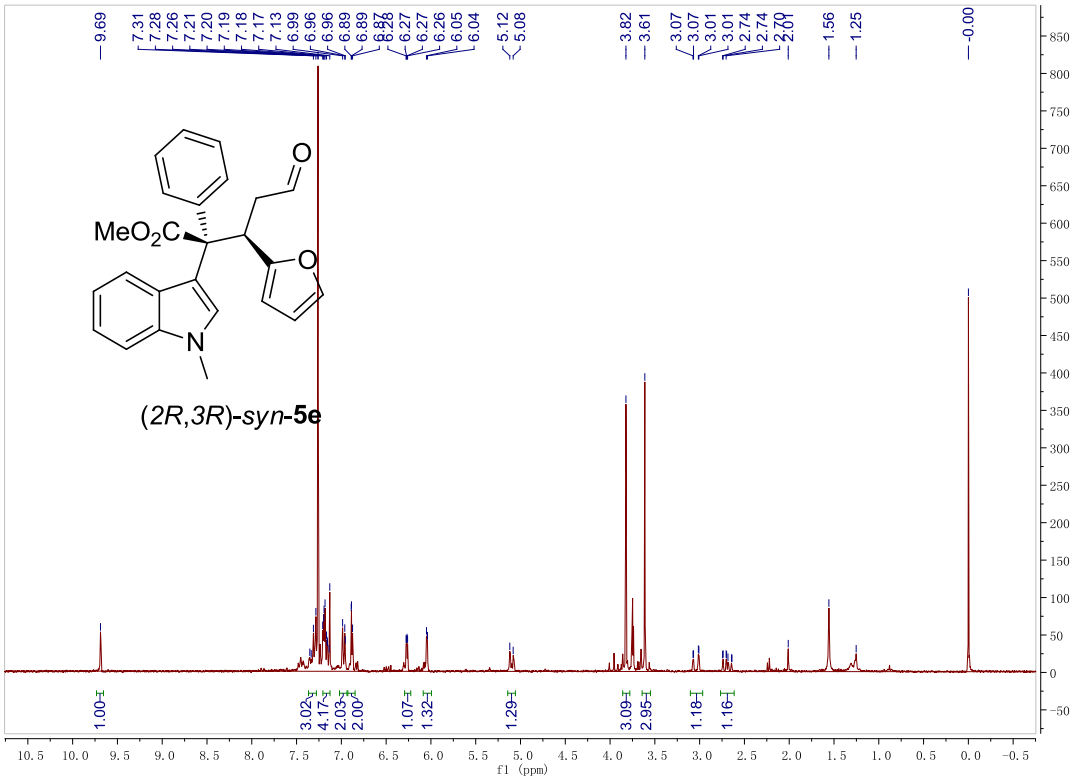
122.00
121.05
118.91
112.05
110.34
109.13
77.33
77.02
76.70
60.41
52.37
44.95
38.97
32.89
MeO2C
O
O
N
(2S,3R)-anti-5e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7.18
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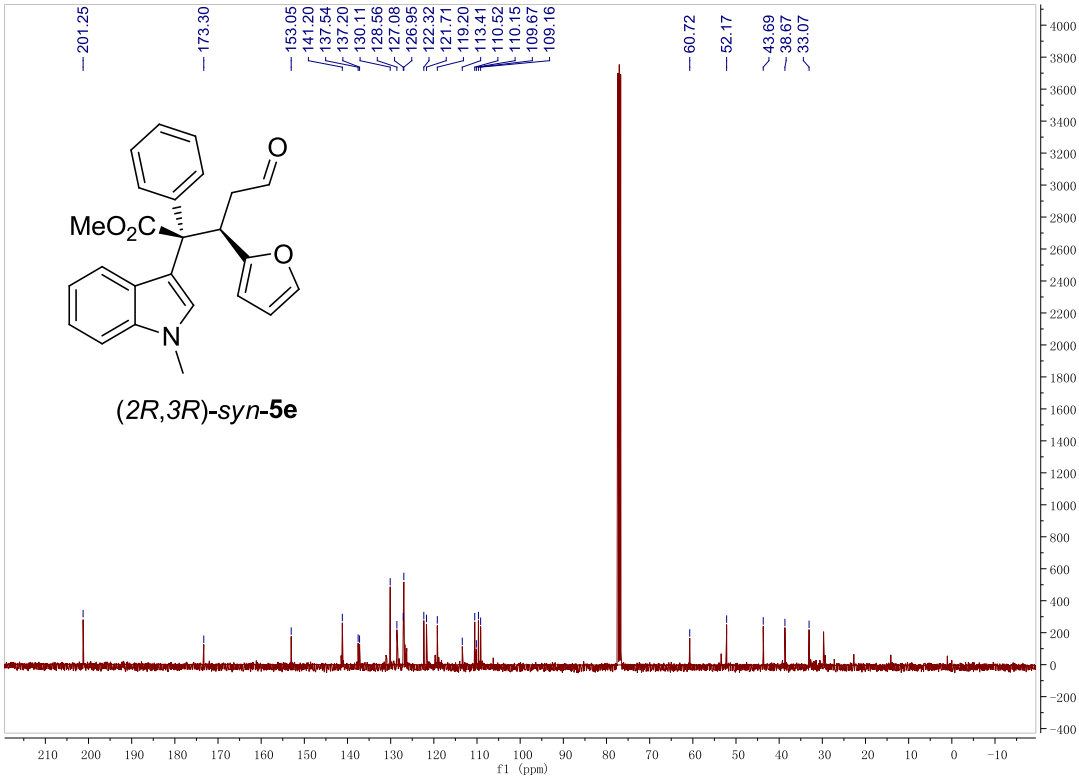
7.13
6.99
6.96
6.96
6.89
6.89
6.27
6.27
6.26
6.05
6.04
5.12
5.08
3.82
3.61
3.07
3.07
3.01
3.01
2.74
2.74
2.70
2.01
1.56
1.25
0.00
MeO2C
O
O
N
(2R,3R)-syn-5e
1.00
3.02
4.17
2.03
2.00
1.07
1.32
1.29
3.09
2.95
1.18
1.16
f1 (ppm)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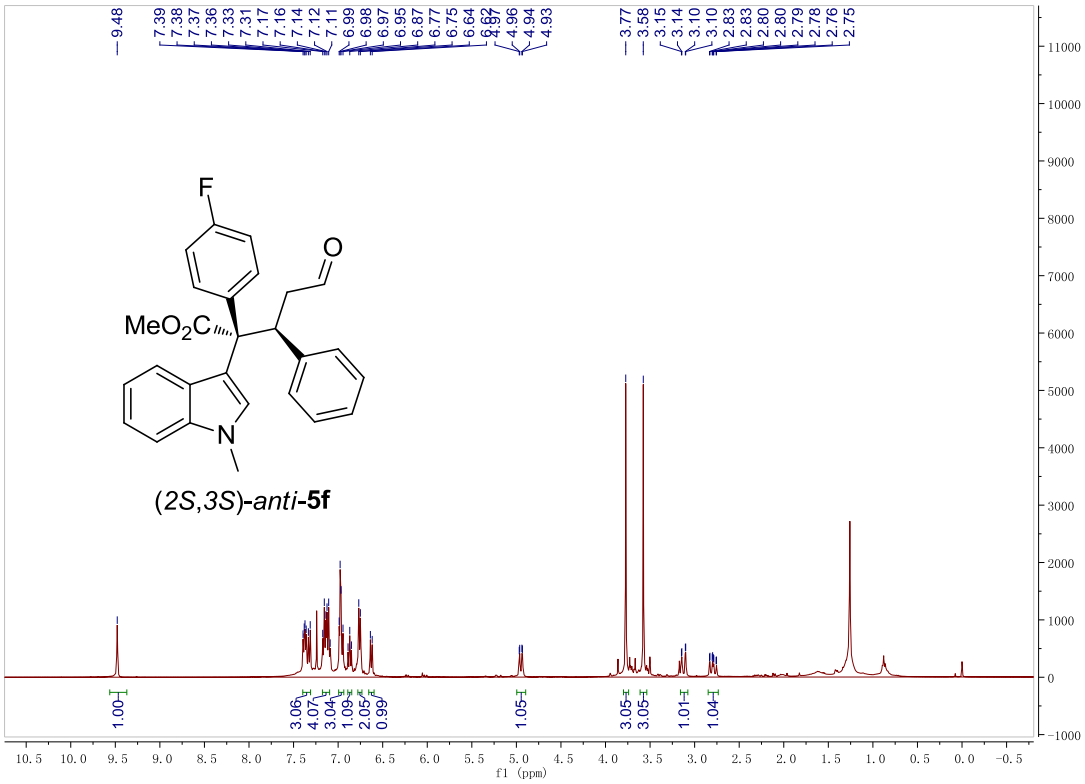
128.56
127.08
126.95
122.32
121.71
119.20
113.41
110.52
110.15
109.67
109.16
60.72
52.17
43.69
38.67
33.07
MeO2C
O
O
N
(2R,3R)-syn-5e
f1 (ppm)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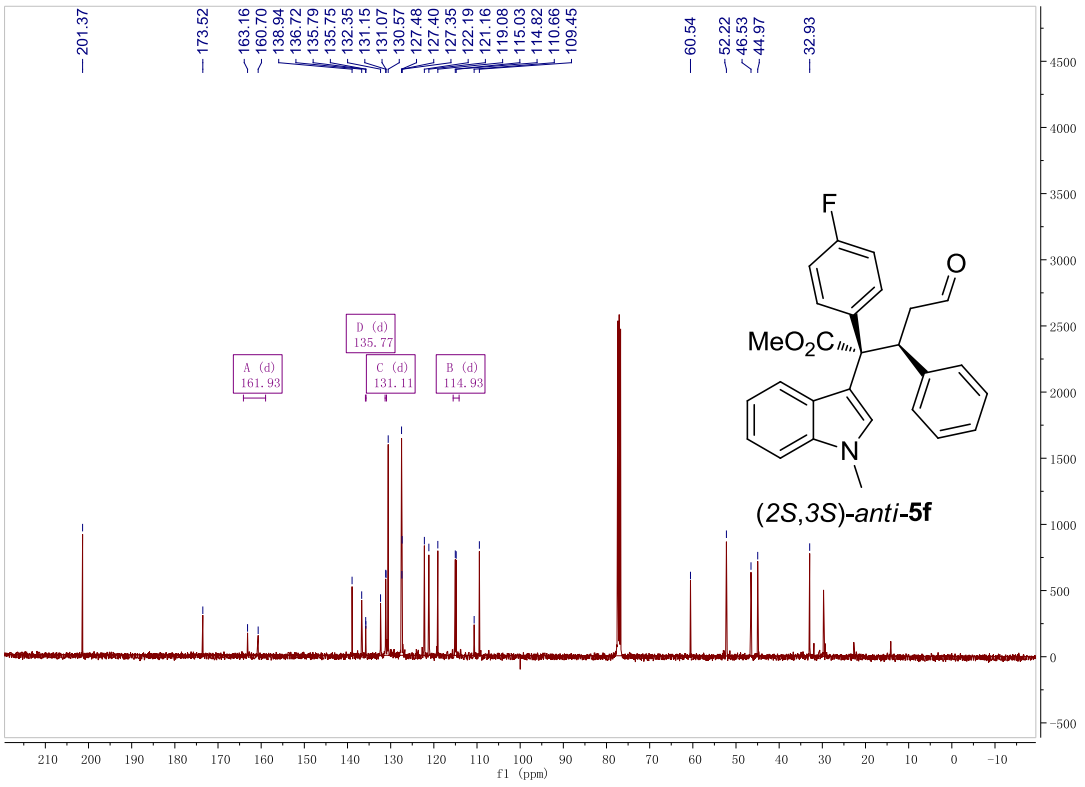
7.31
7.17
7.16
7.14
7.12
7.11
6.99
6.98
6.97
6.95
6.87
6.77
6.75
6.64
4.96
4.94
4.93
3.77
3.58
3.15
3.14
3.10
3.10
2.83
2.83
2.80
2.80
2.79
2.78
2.76
2.75
F
O
MeO2C
N
(2S,3S)-anti-5f
1.00
3.06
4.07
3.04
1.09
2.05
0.99
1.05
3.05
3.05
1.01
1.04
f1 (ppm)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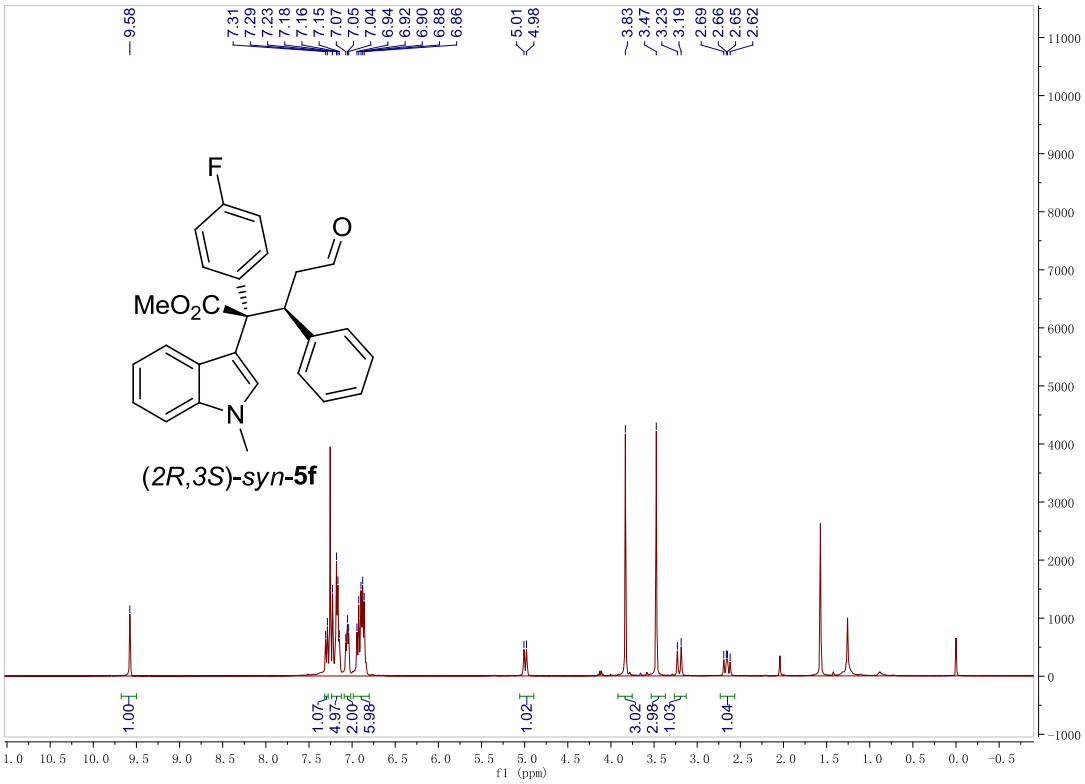
136.72
135.79
135.75
132.35
131.15
131.07
130.57
127.48
127.40
127.35
122.19
121.16
119.08
115.03
114.82
110.66
109.45
60.54
52.22
46.53
44.97
32.93
A (d)
161.93
D (d)
135.77
C (d)
131.11
B (d)
114.93
F
O
MeO2C
N
(2S,3S)-anti-5f
f1 (ppm)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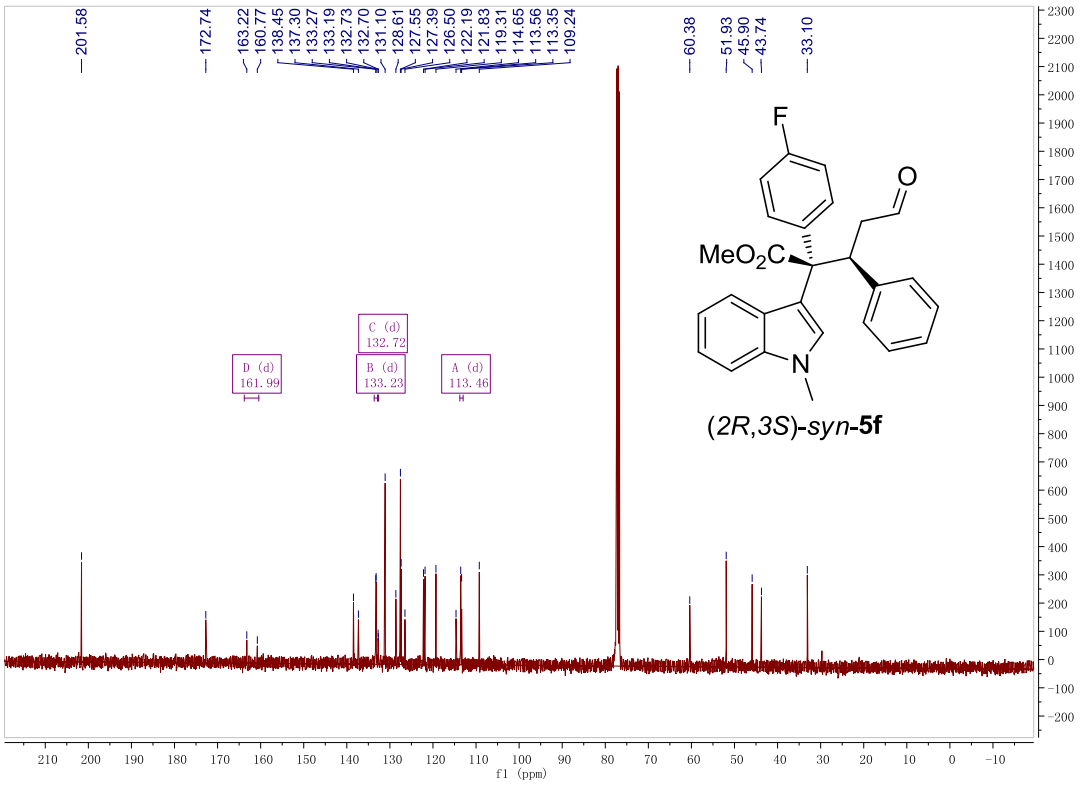
7.16
7.15
7.07
7.05
7.04
6.94
6.92
6.90
6.88
6.86
5.01
4.98
3.83
3.47
3.23
3.19
2.69
2.66
2.65
2.62
F
O
MeO2C
N
(2R,3S)-syn-5f
1.00
1.07
4.97
2.00
5.98
1.02
3.02
2.98
1.03
1.04
f1 (ppm)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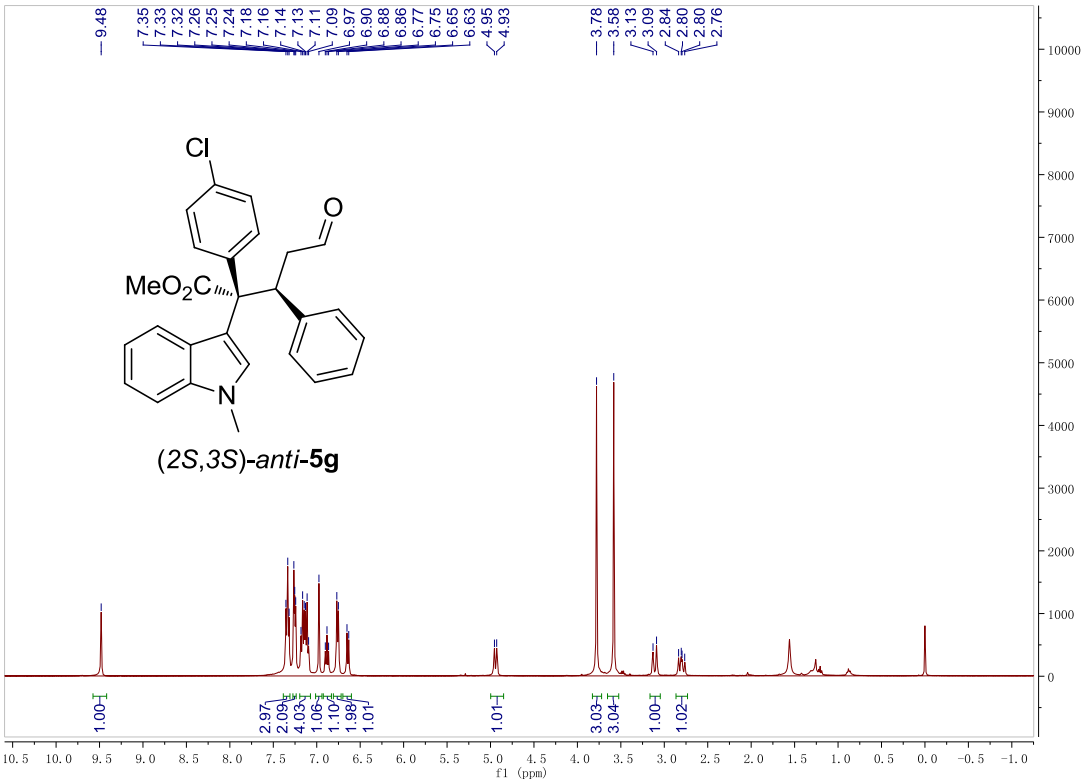
137.30
133.27
133.19
132.73
132.70
131.10
128.61
127.55
127.39
126.50
122.19
121.83
119.31
114.65
113.56
113.35
109.24
60.38
51.93
45.90
43.74
33.10
C (d)
132.72
D (d)
161.99
B (d)
133.23
A (d)
113.46
F
O
MeO2C
N
(2R,3S)-syn-5f
f1 (ppm)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7.35
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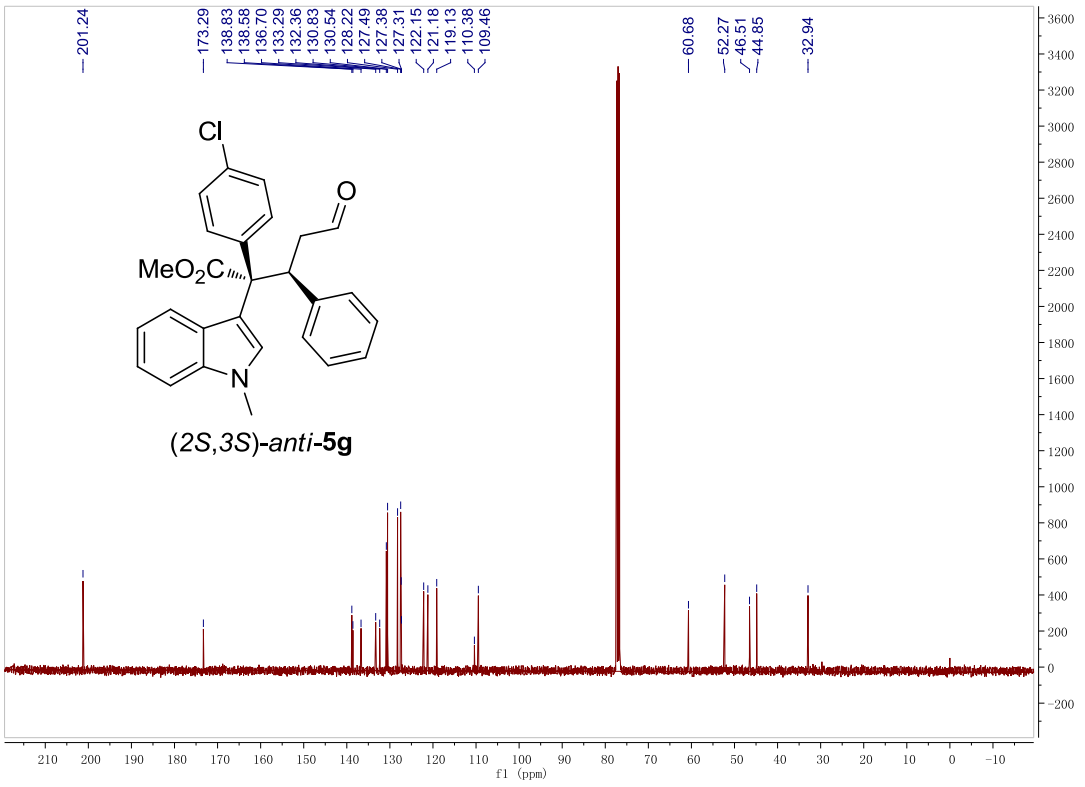
7.32
7.26
7.25
7.24
7.18
7.16
7.14
7.13
7.11
7.09
6.97
6.90
6.88
6.86
6.77
6.75
6.65
6.63
4.95
4.93
3.78
3.58
3.13
3.09
2.84
2.80
2.80
2.76
Cl
O
MeO2C
N
(2S,3S)-anti-5g
1.00
2.97
2.09
4.03
1.06
1.10
1.98
1.01
1.01
3.03
3.04
1.00
1.02
f1 (ppm)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138.58
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133.29
132.36
130.83
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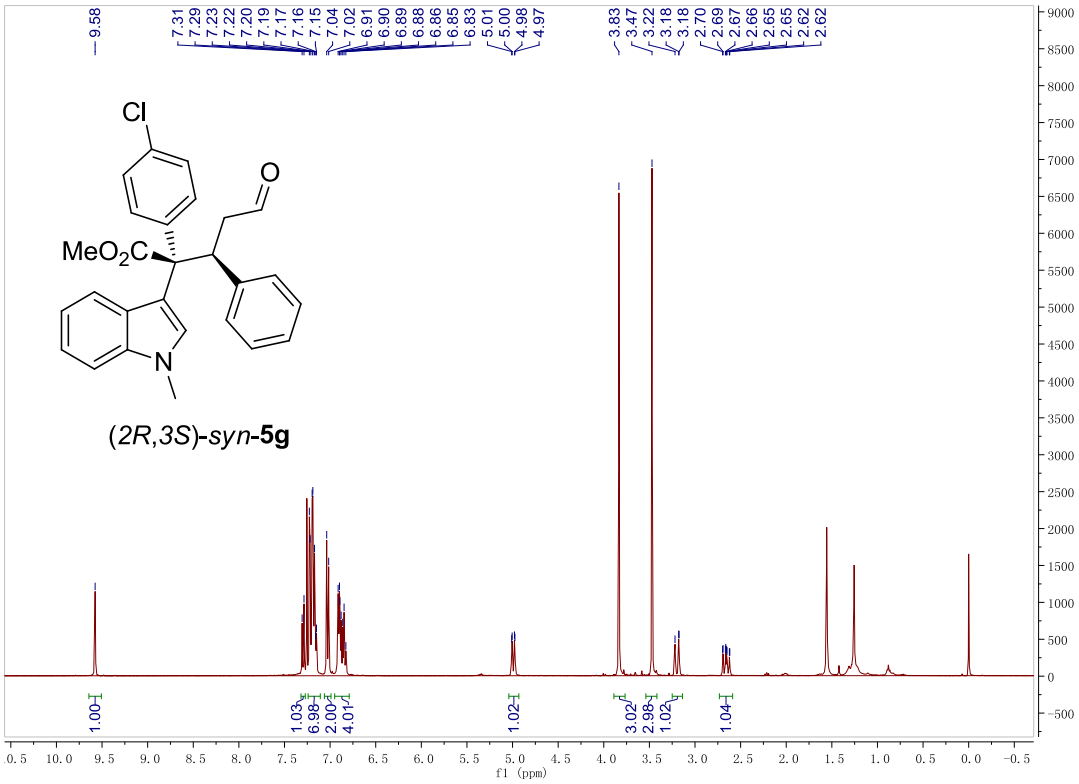
127.49
127.38
127.31
122.15
121.18
119.13
110.38
109.46
60.68
52.27
46.51
44.85
32.94
Cl
O
MeO2C
N
(2S,3S)-anti-5g
f1 (ppm)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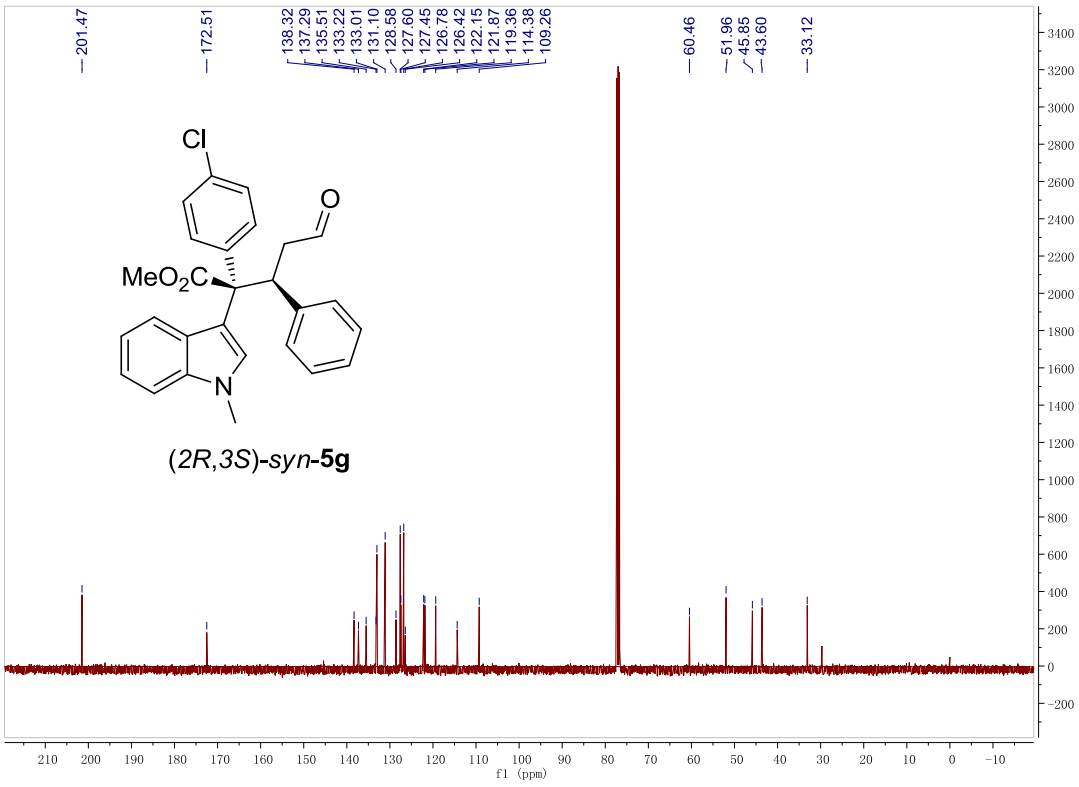
7.31
7.29
7.23
7.22
7.20
7.19
7.17
7.16
7.15
7.04
7.02
6.91
6.90
6.89
6.88
6.86
6.85
6.83
5.01
5.00
4.98
4.97
3.83
3.47
3.22
3.18
3.18
2.70
2.69
2.67
2.66
2.65
2.65
2.62
2.62
Cl
O
MeO2C
N
(2R,3S)-syn-5g
1.00
1.03
6.98
2.00
4.01
1.02
3.02
2.98
1.02
1.04
f1 (ppm)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133.01
131.10
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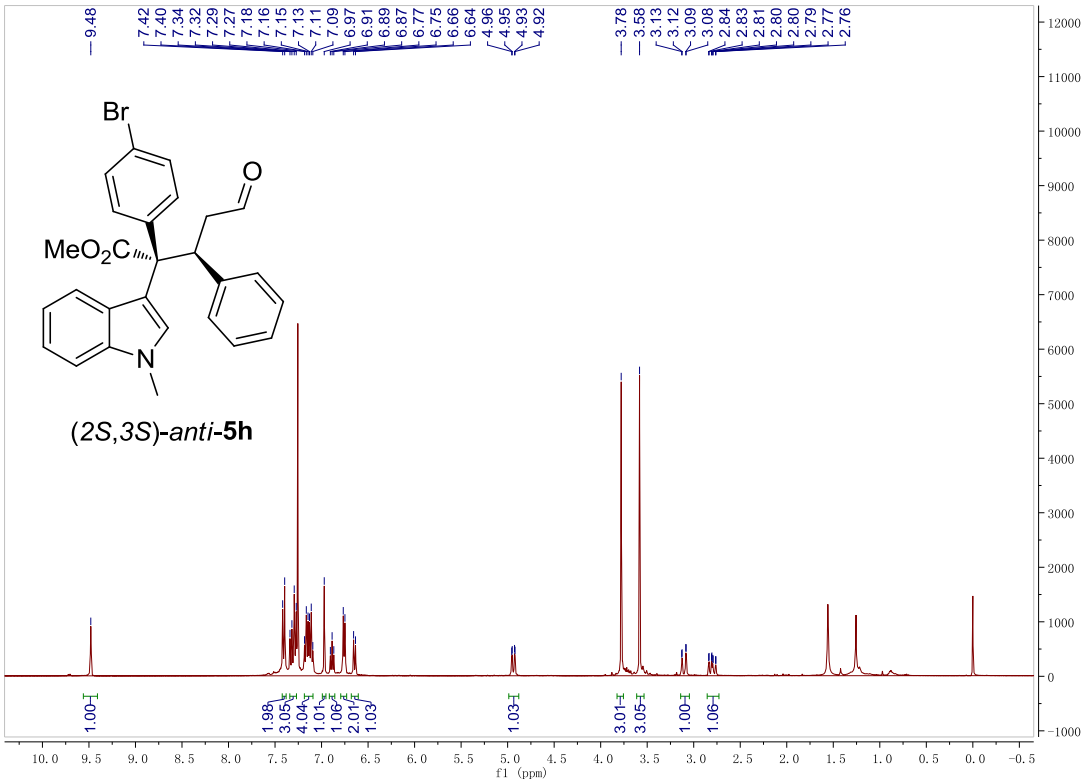
127.60
127.45
126.78
126.42
122.15
121.87
119.36
114.38
109.26
60.46
51.96
45.85
43.60
33.12
Cl
O
MeO2C
N
(2R,3S)-syn-5g
f1 (ppm)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7.27
7.18
7.16
7.15
7.13
7.11
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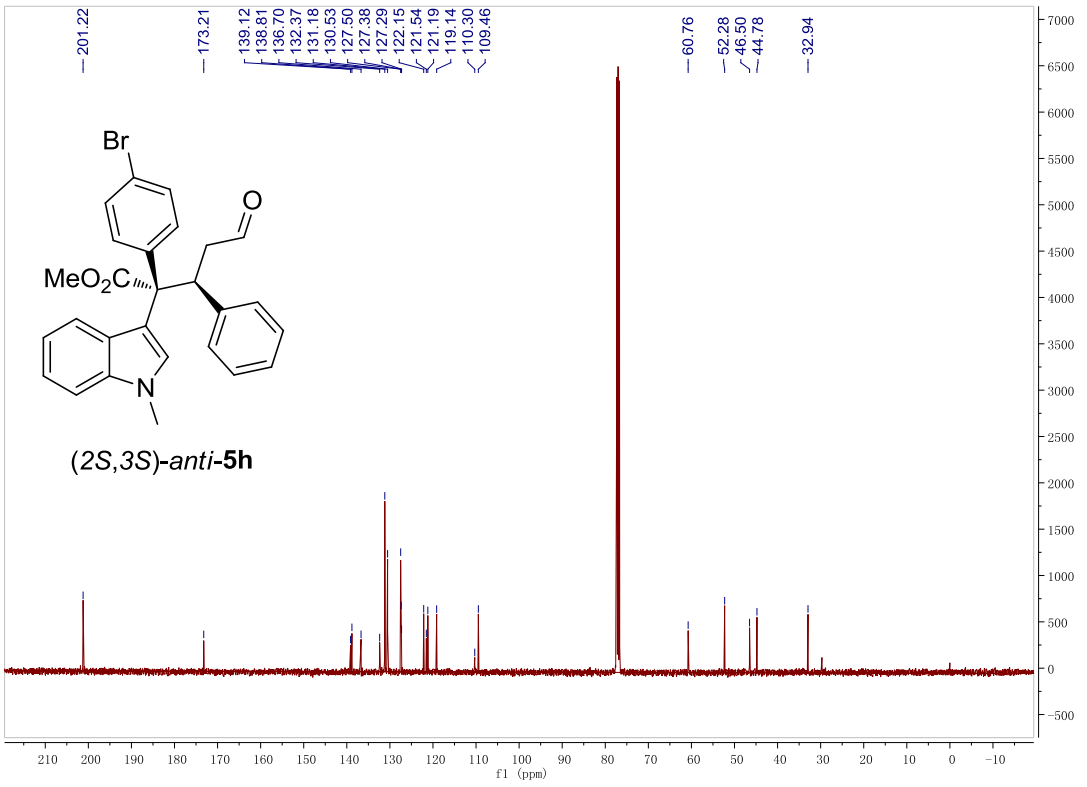
6.97
6.91
6.89
6.87
6.77
6.75
6.66
6.64
4.96
4.95
4.93
4.92
3.78
3.58
3.13
3.12
3.09
3.08
2.84
2.83
2.81
2.80
2.80
2.79
2.77
2.76
Br
O
MeO2C
N
(2S,3S)-anti-5h
1.00
1.98
3.05
4.04
1.01
1.06
2.01
1.03
1.03
3.01
3.05
1.00
1.06
f1 (ppm)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132.37
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127.38
127.29
122.15
121.54
121.19
119.14
110.30
109.46
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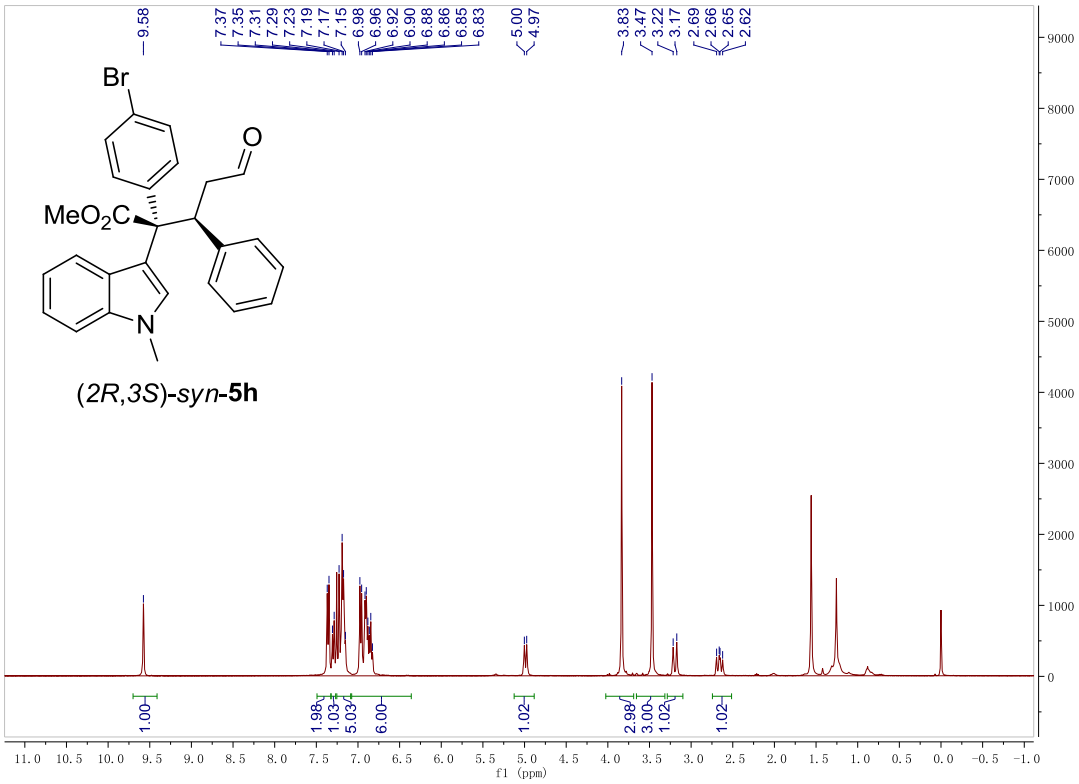
52.28
46.50
44.78
32.94
Br
O
MeO2C
N
(2S,3S)-anti-5h
f1 (ppm)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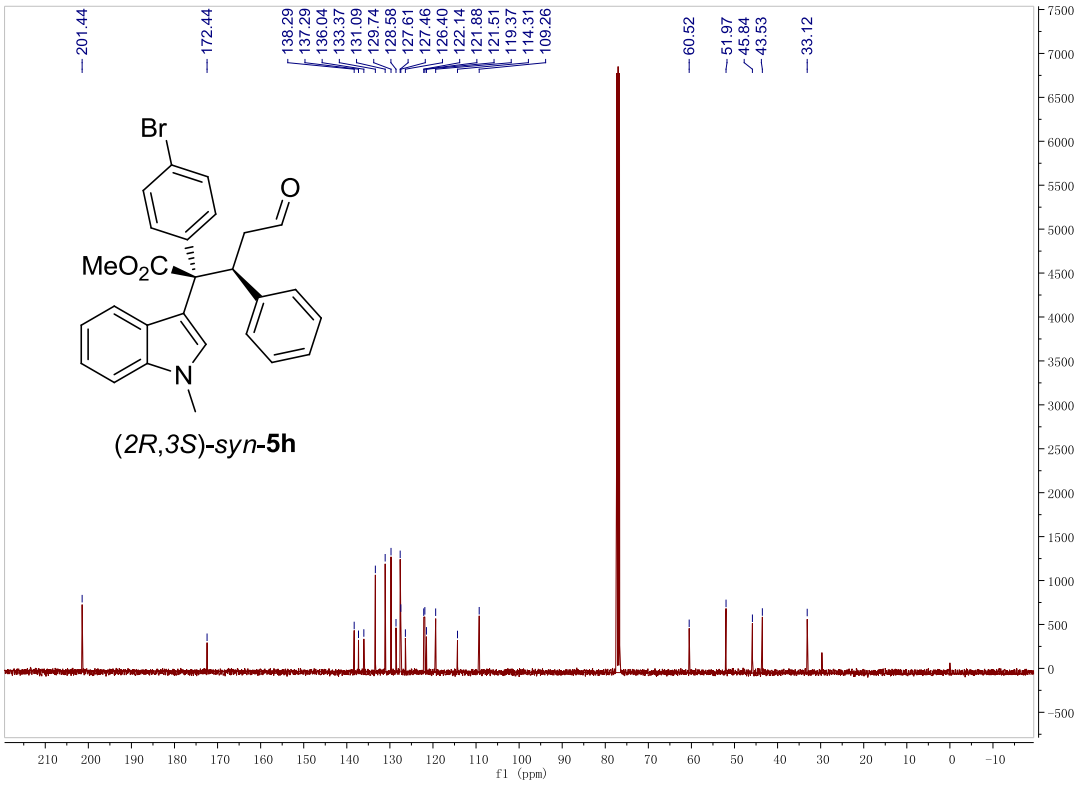
7.23
7.19
7.17
7.15
6.98
6.96
6.92
6.90
6.88
6.86
6.85
6.83
5.00
4.97
3.83
3.47
3.22
3.17
2.69
2.66
2.65
2.62
Br
O
MeO2C
N
(2R,3S)-syn-5h
1.00
1.98
1.03
5.03
6.00
1.02
2.98
3.00
1.02
1.02
f1 (ppm)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127.46
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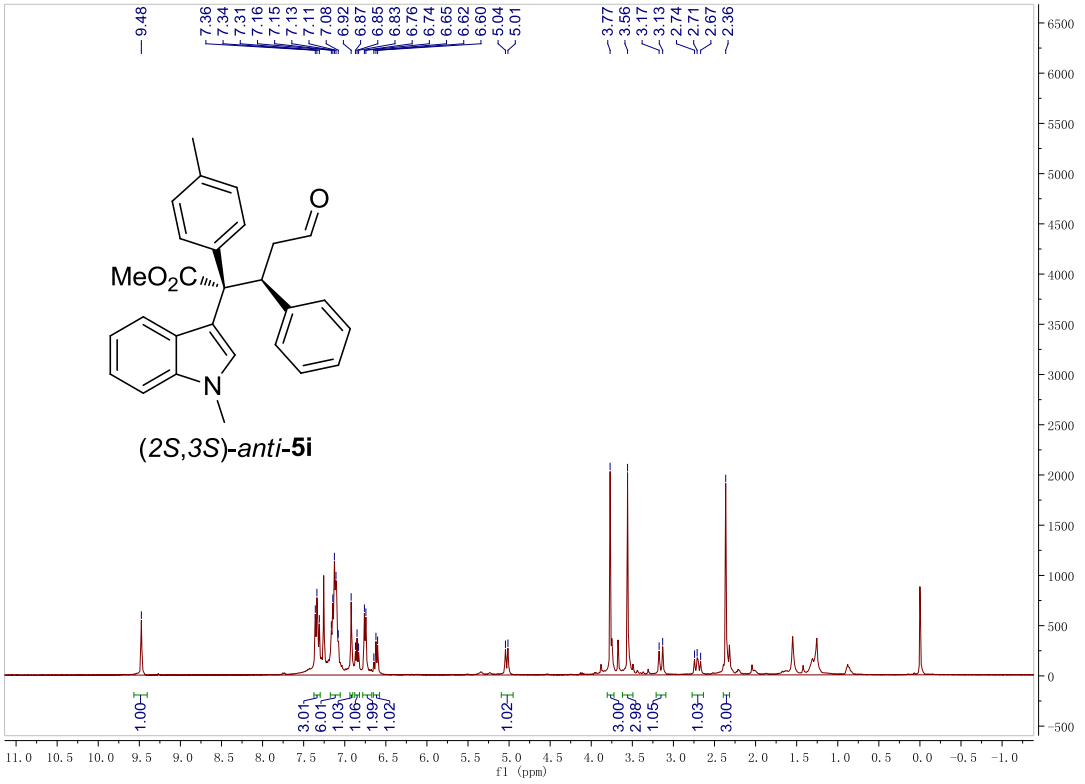
122.14
121.88
121.51
119.37
114.31
109.26
60.52
51.97
45.84
43.53
33.12
Br
O
MeO2C
N
(2R,3S)-syn-5h
f1 (ppm)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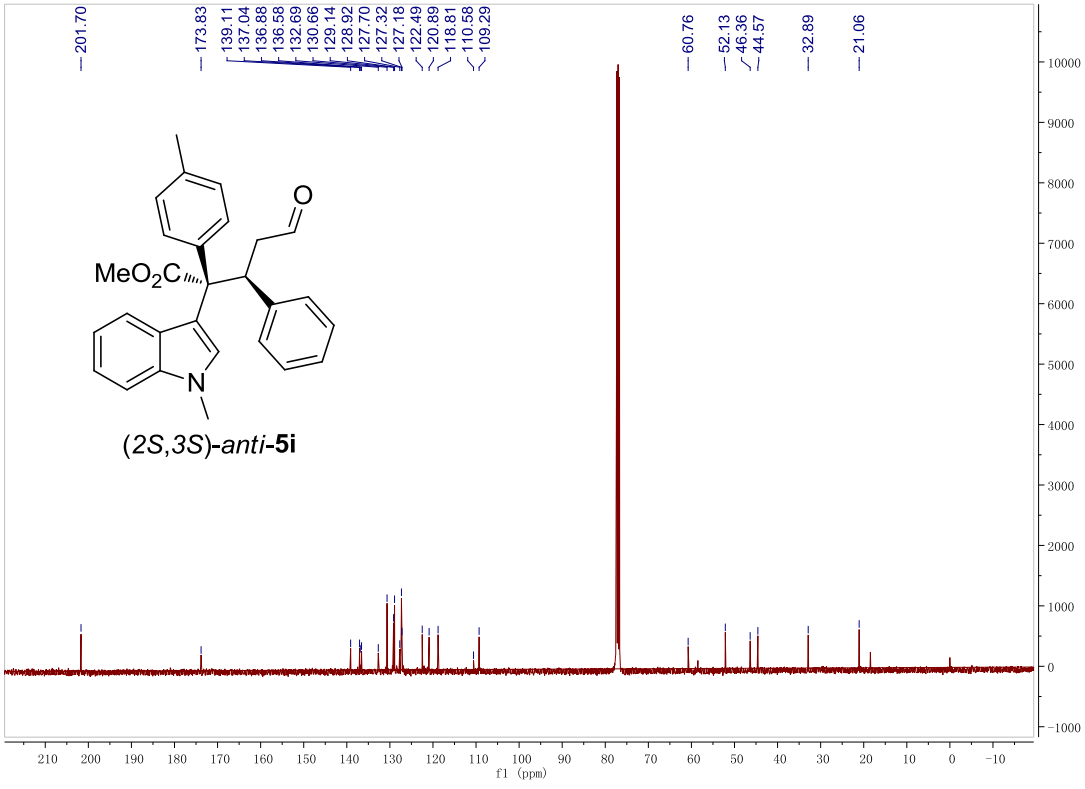
7.31
7.16
7.15
7.13
7.11
7.08
6.92
6.87
6.85
6.83
6.76
6.74
6.65
6.62
6.60
5.04
5.01
3.77
3.56
3.17
3.13
2.74
2.71
2.67
2.36
O
MeO2C
N
(2S,3S)-anti-5i
1.00
3.01
6.01
1.03
1.06
1.99
1.02
1.02
3.00
2.98
1.05
1.03
3.00
f1 (ppm)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130.66
129.14
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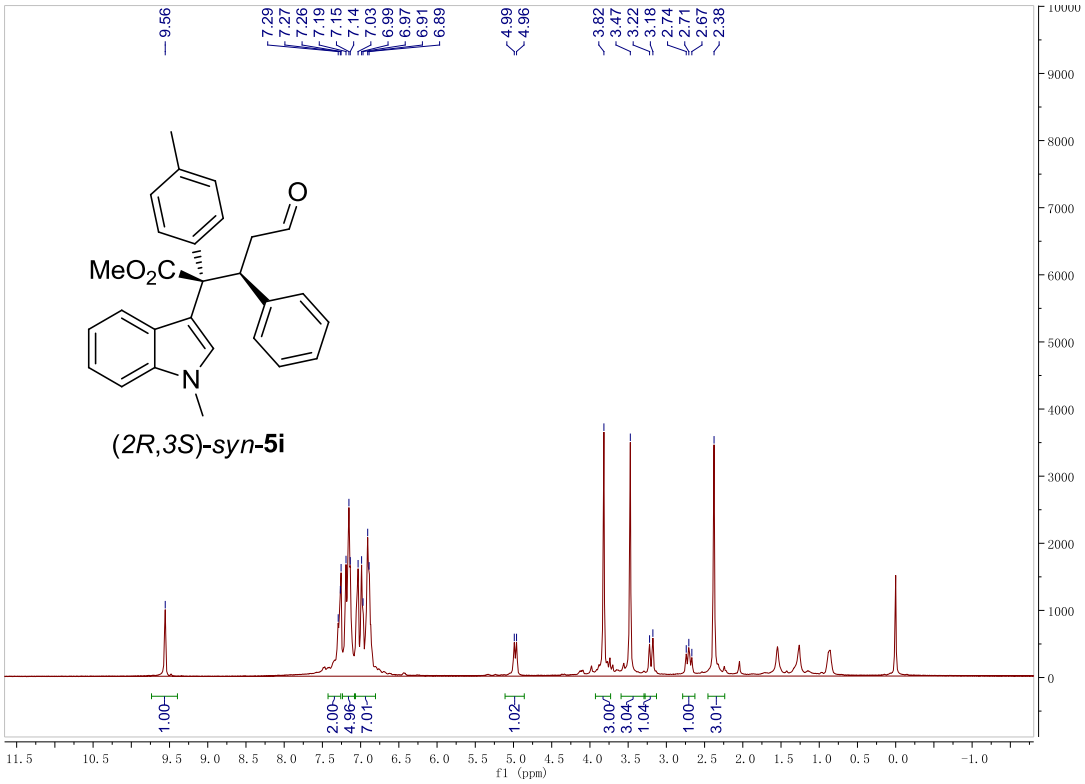
127.70
127.32
127.18
122.49
120.89
118.81
110.58
109.29
60.76
52.13
46.36
44.57
32.89
21.06
O
MeO2C
N
(2S,3S)-anti-5i
f1 (ppm)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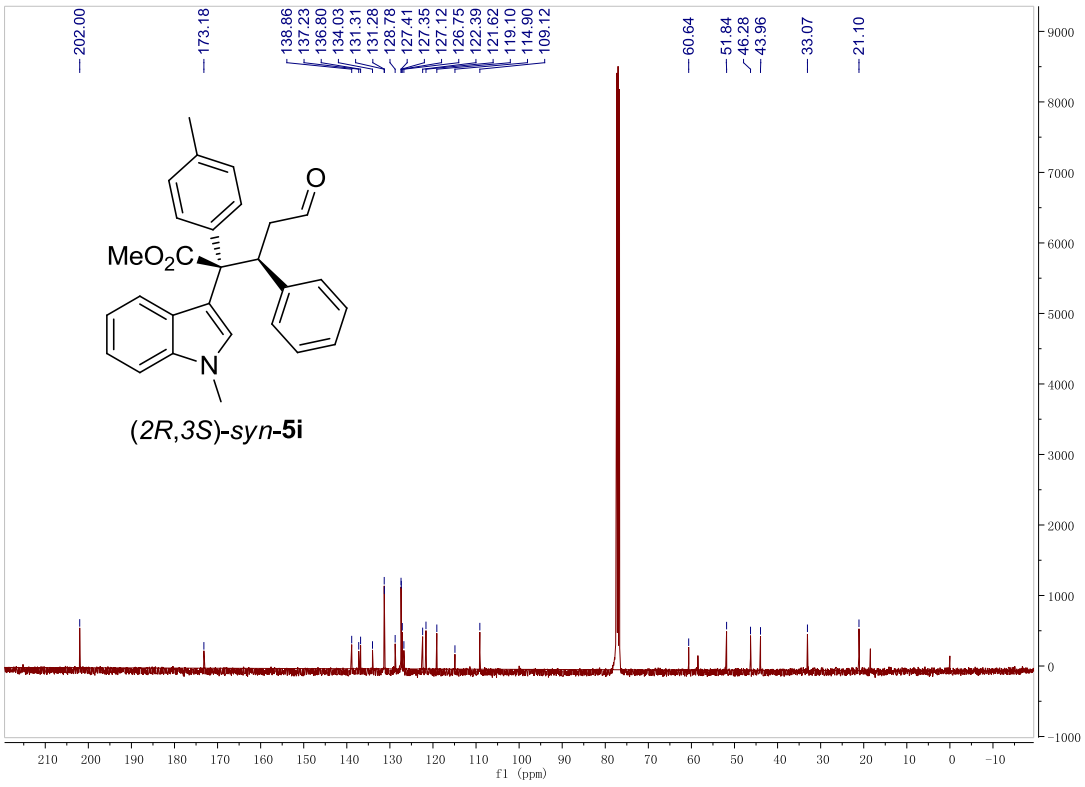
7.03
6.99
6.97
6.91
6.89
4.99
4.96
3.82
3.47
3.22
3.18
2.74
2.71
2.67
2.38
O
MeO2C
N
(2R,3S)-syn-5i
1.00
2.00
4.96
7.01
1.02
3.00
3.04
1.04
1.00
3.01
f1 (ppm)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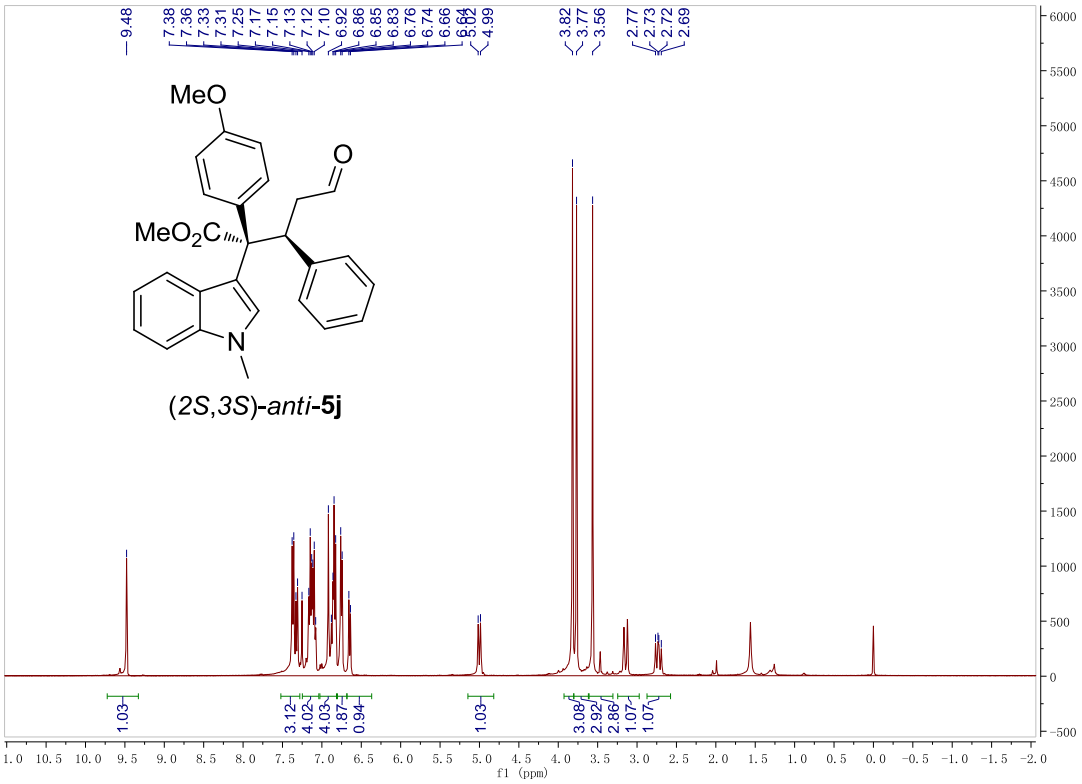
127.12
126.75
122.39
121.62
119.10
114.90
109.12
60.64
51.84
46.28
43.96
33.07
21.10
O
MeO2C
N
(2R,3S)-syn-5i
f1 (ppm)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7.38
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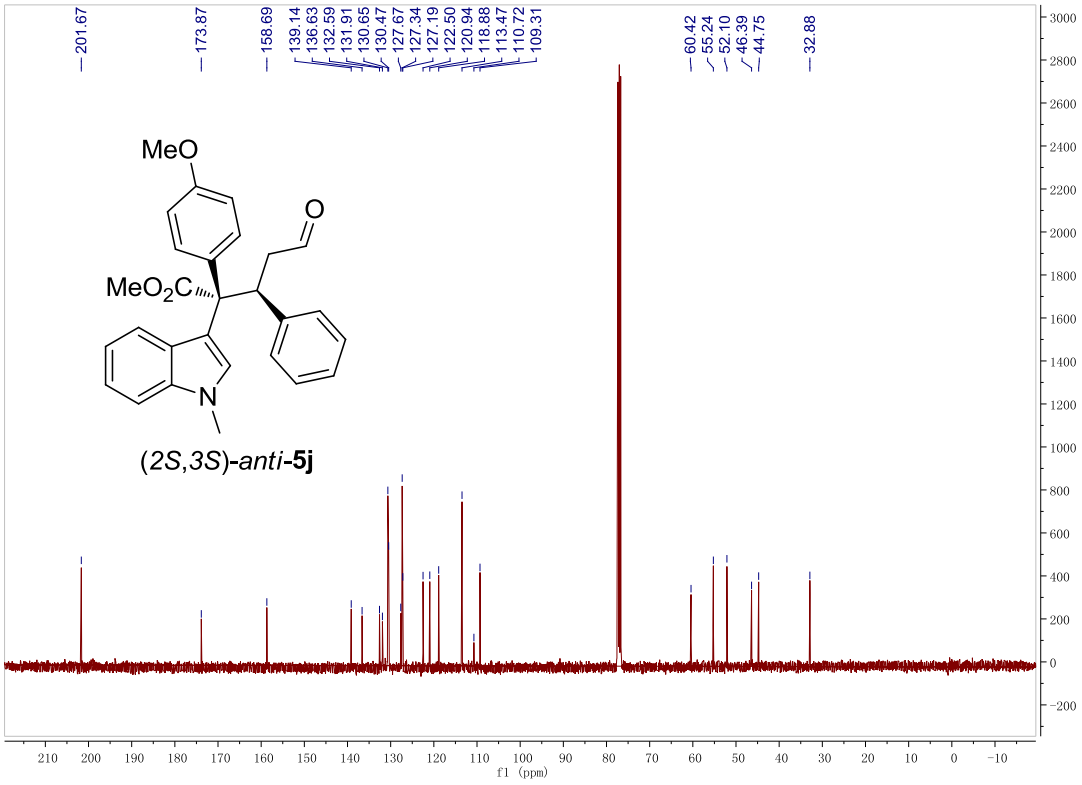
7.33
7.31
7.25
7.17
7.15
7.13
7.12
7.10
6.92
6.86
6.85
6.83
6.76
6.74
6.66
6.64
5.02
4.99
3.82
3.77
3.56
2.77
2.73
2.72
2.69
MeO
O
MeO2C
N
(2S,3S)-anti-5j
1.03
3.12
4.02
4.03
1.87
0.94
1.03
3.08
2.92
2.86
1.07
1.07
f1 (ppm)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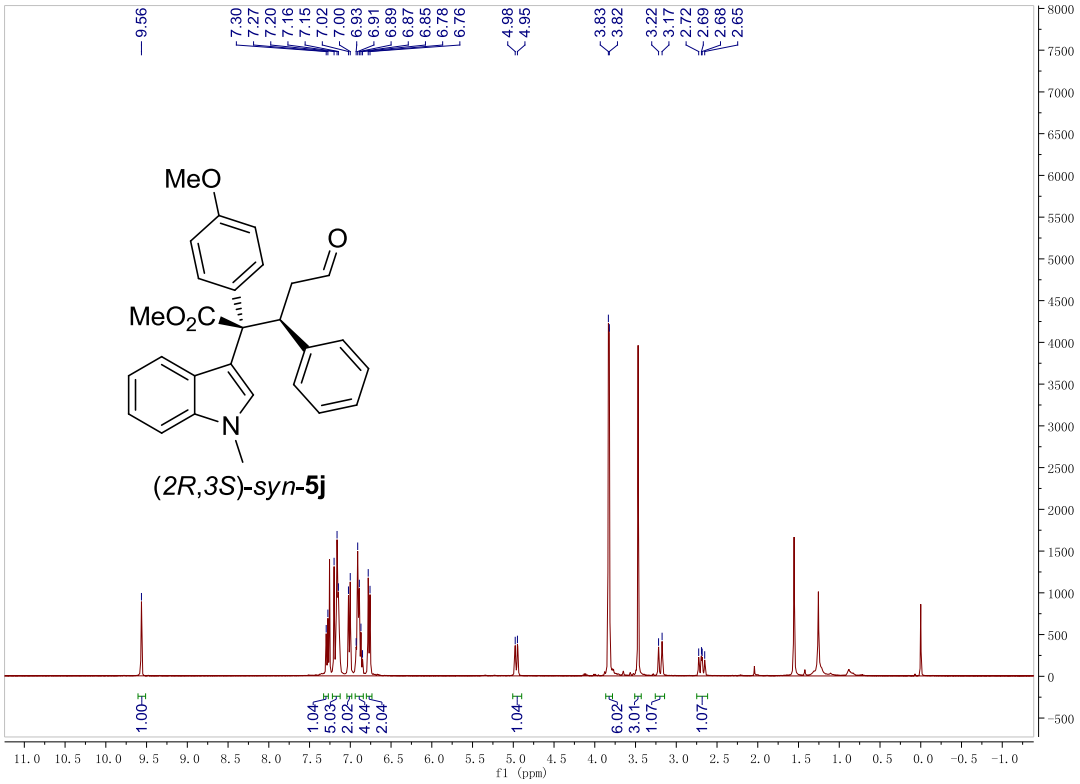
127.67
127.34
127.19
122.50
120.94
118.88
113.47
110.72
109.31
60.42
55.24
52.10
46.39
44.75
32.88
MeO
O
MeO2C
N
(2S,3S)-anti-5j
f1 (ppm)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7.20
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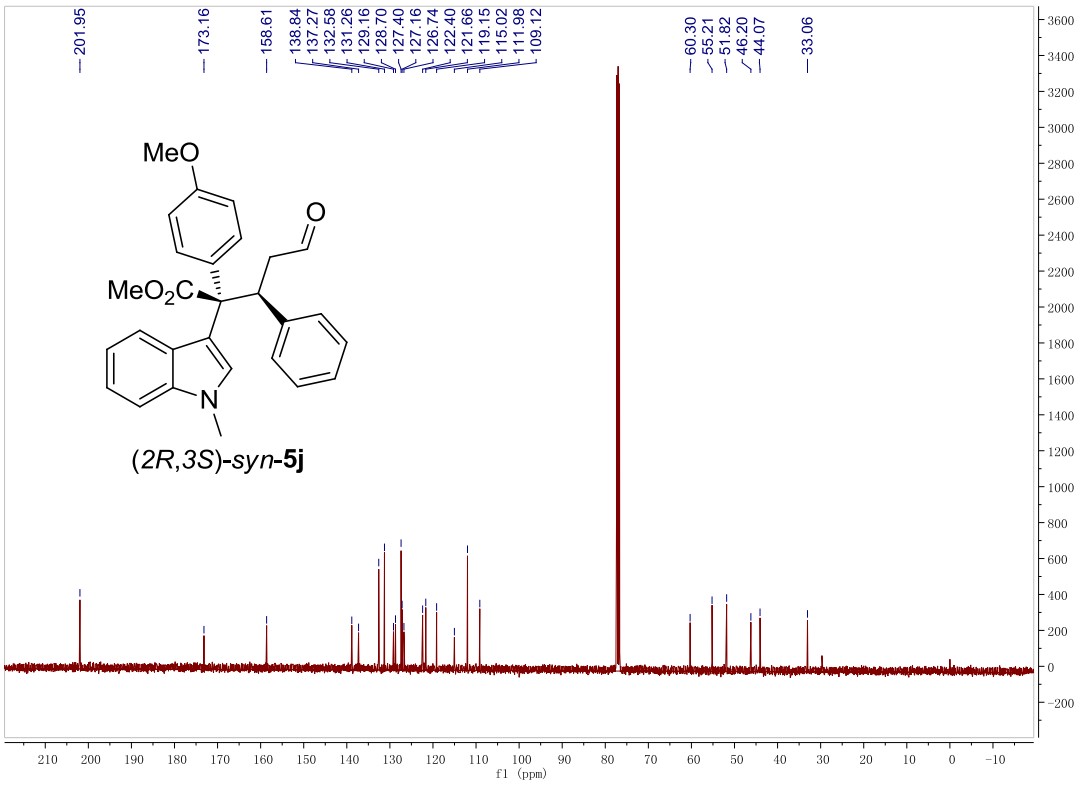
7.15
7.02
7.00
6.93
6.91
6.89
6.87
6.85
6.78
6.76
4.98
4.95
3.83
3.82
3.22
3.17
2.72
2.69
2.68
2.65
MeO
O
MeO2C
N
(2R,3S)-syn-5j
1.00
1.04
5.03
2.02
4.04
2.04
1.04
6.02
3.01
1.07
1.07
f1 (ppm)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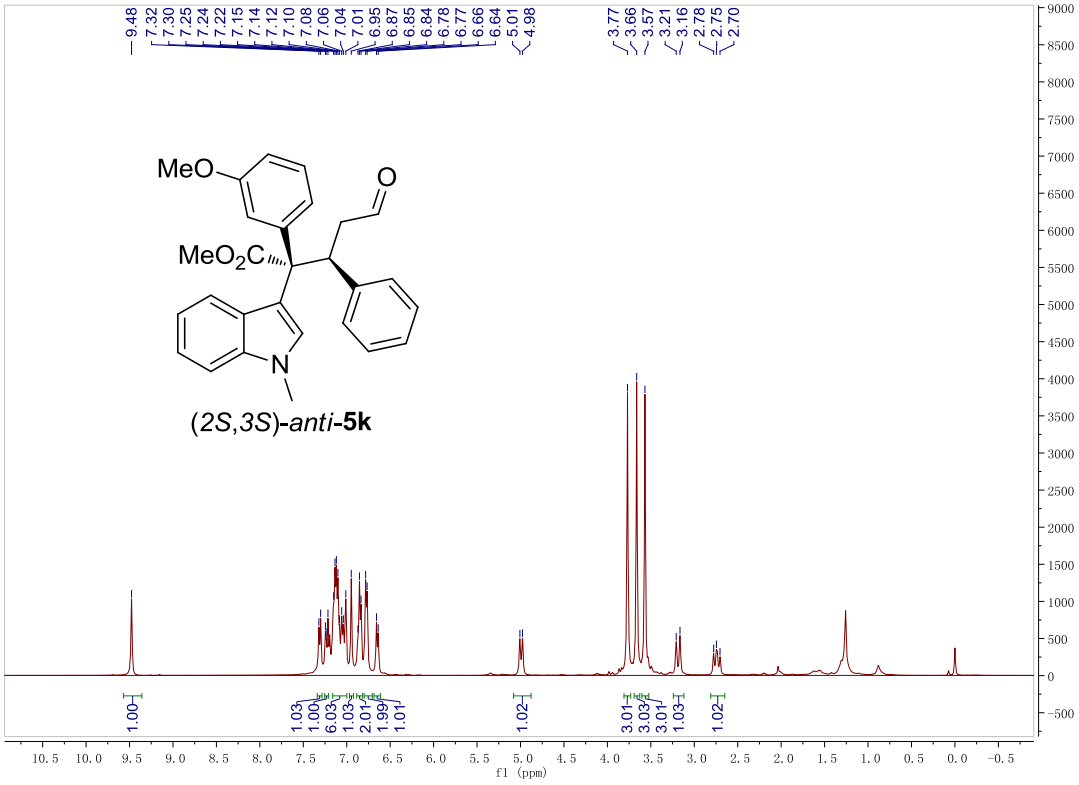
122.40
121.66
119.15
115.02
111.98
109.12
60.30
55.21
51.82
46.20
44.07
33.06
MeO
O
MeO2C
N
(2R,3S)-syn-5j
f1 (ppm)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7.32
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7.22
7.15
7.14
7.12
7.10
7.08
7.06
7.04
7.01
6.95
6.87
6.85
6.84
6.78
6.77
6.66
6.64
5.01
4.98
3.77
3.66
3.57
3.21
3.16
2.78
2.75
2.70
MeO
O
MeO2C
N
(2S,3S)-anti-5k
1.00
1.03
1.00
6.03
1.03
2.01
1.99
1.01
1.02
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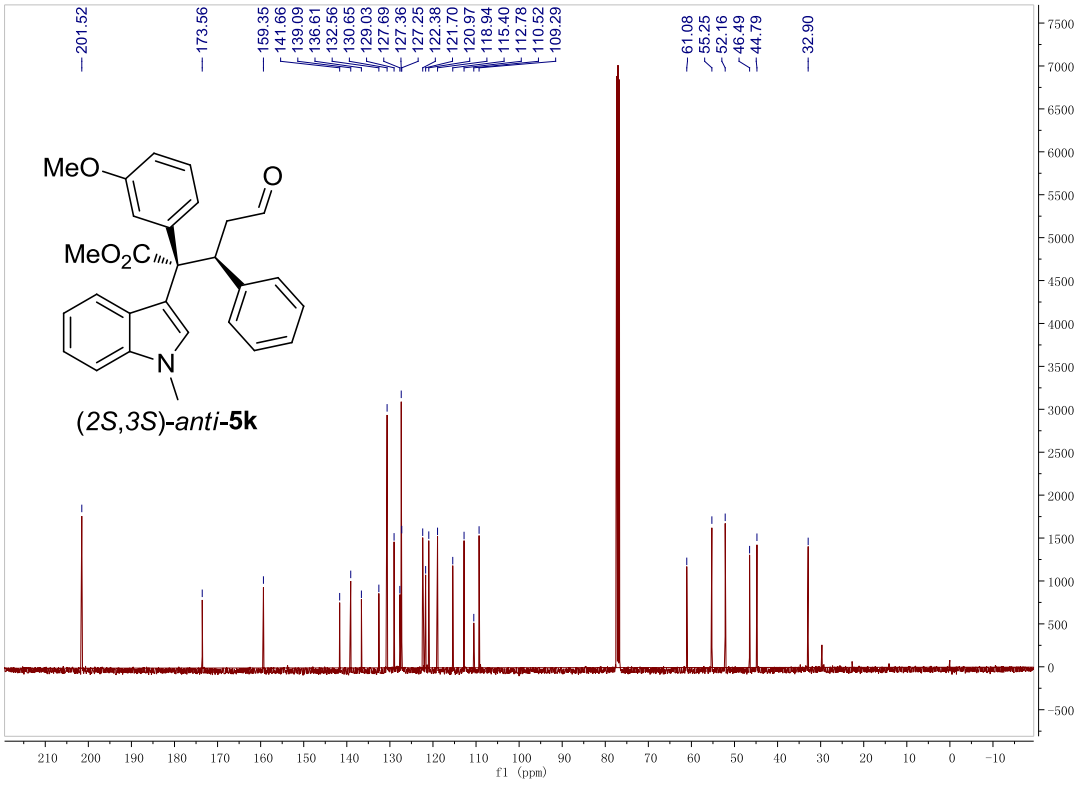
3.03
3.01
1.03
1.02
f1 (ppm)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159.35
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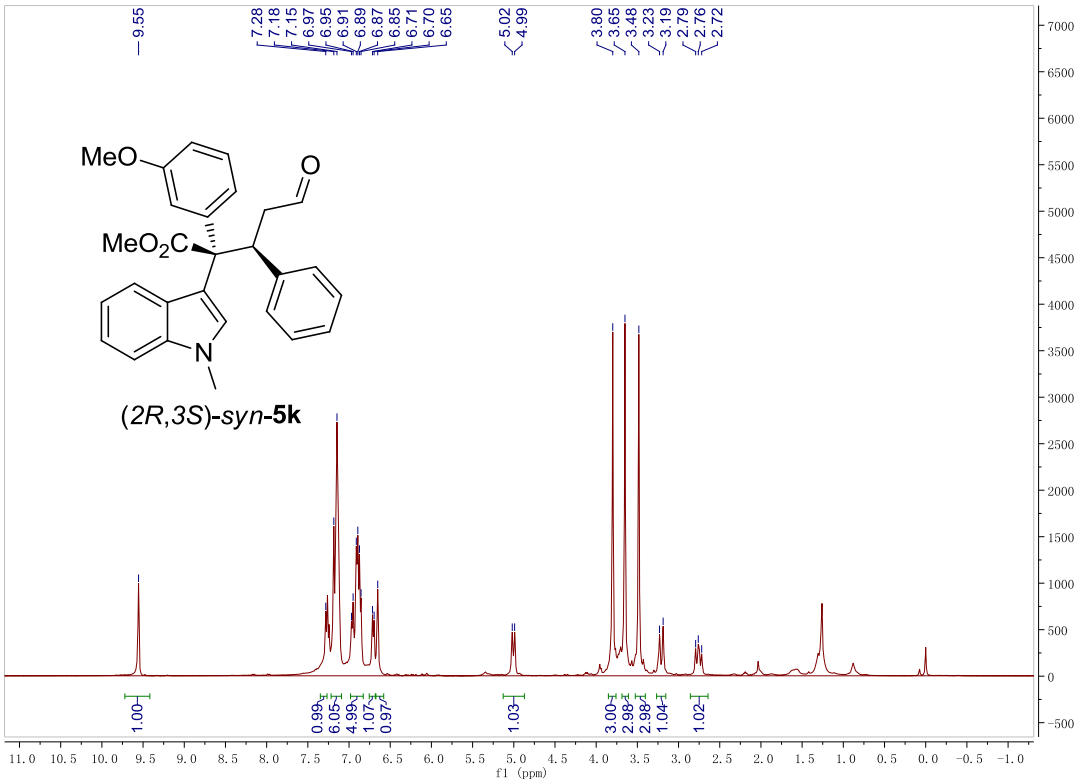
136.61
132.56
130.65
129.03
127.69
127.36
127.25
122.38
121.70
120.97
118.94
115.40
112.78
110.52
109.29
61.08
55.25
52.16
46.49
44.79
32.90
MeO
O
MeO2C
N
(2S,3S)-anti-5k
f1 (ppm)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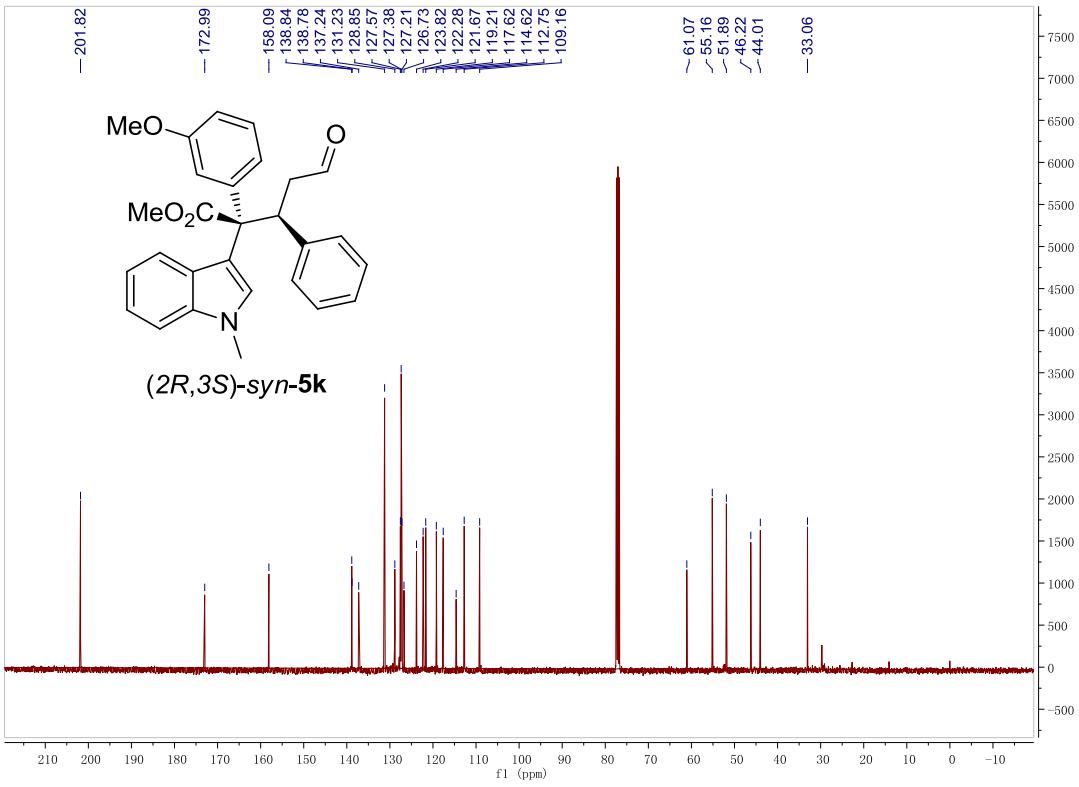
7.28
7.18
7.15
6.97
6.95
6.91
6.89
6.87
6.85
6.71
6.70
6.65
5.02
4.99
3.80
3.65
3.48
3.23
3.19
2.79
2.76
2.72
MeO
O
MeO2C
N
(2R,3S)-syn-5k
1.00
0.99
6.05
4.99
1.07
0.97
1.03
3.00
2.98
2.98
1.04
1.02
f1 (ppm)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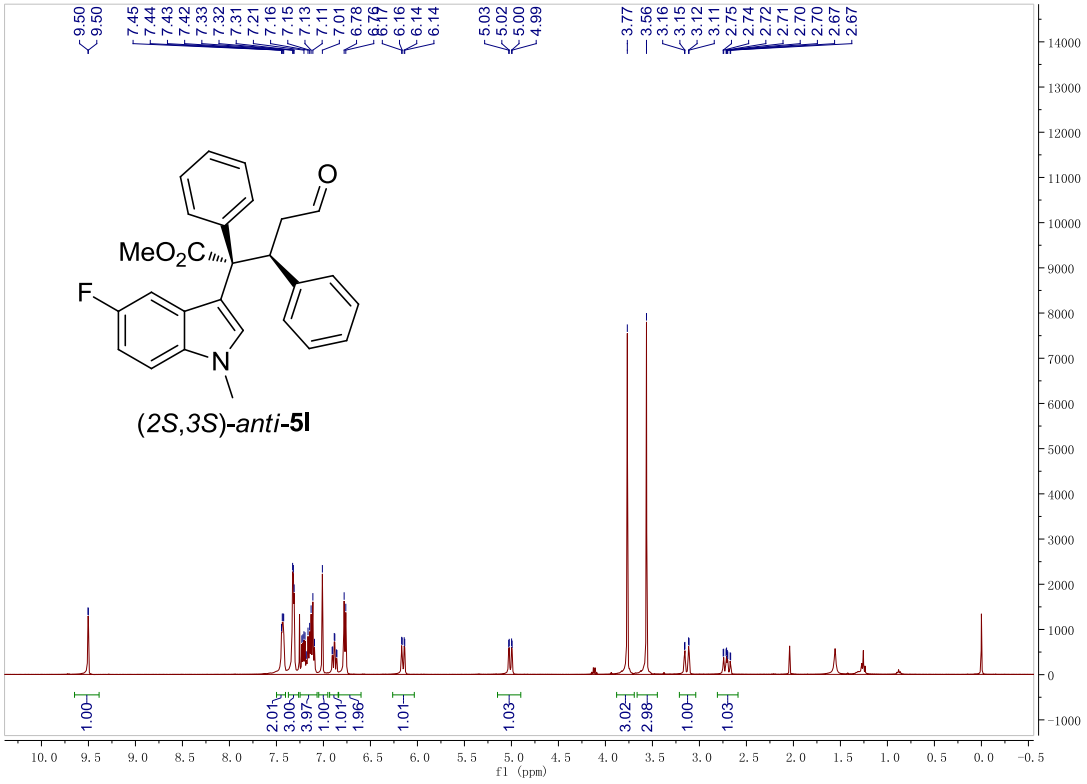
131.23
128.85
127.57
127.38
127.21
126.73
123.82
122.28
121.67
119.21
117.62
114.62
112.75
109.16
61.07
55.16
51.89
46.22
44.01
33.06
MeO
O
MeO2C
N
(2R,3S)-syn-5k
f1 (ppm)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7.43
7.42
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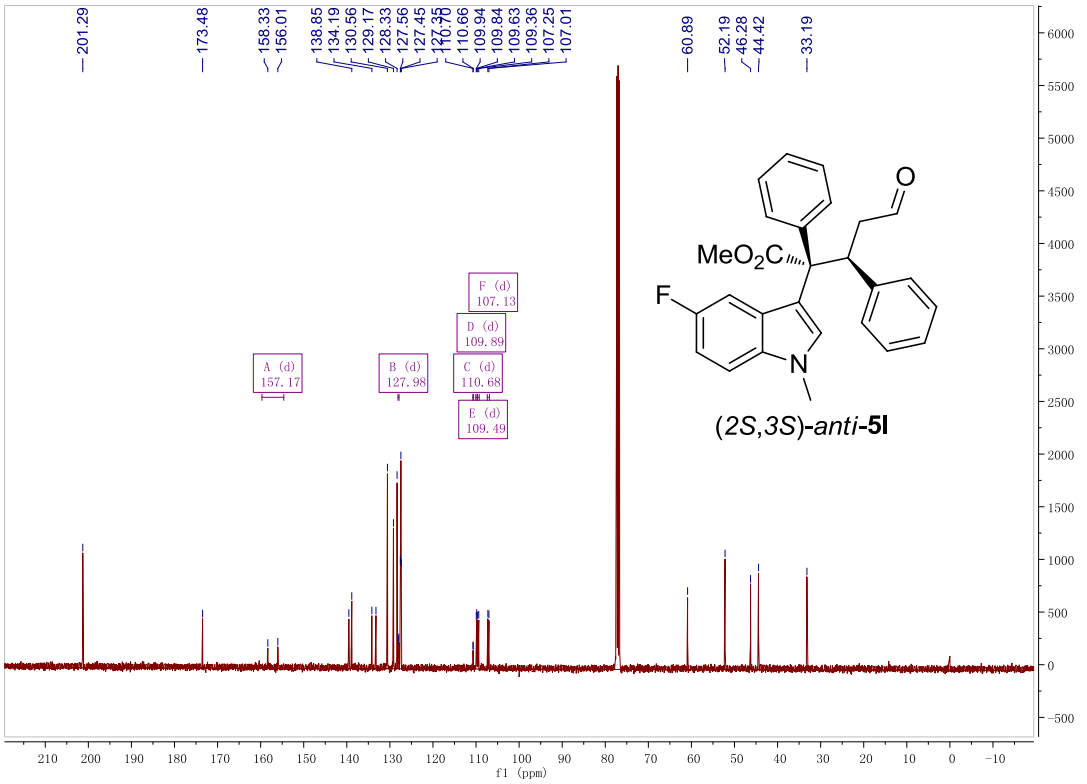
7.32
7.31
7.21
7.16
7.15
7.13
7.11
7.01
6.78
6.77
6.16
6.14
6.14
5.03
5.02
5.00
4.99
3.77
3.56
3.16
3.15
3.12
3.11
2.75
2.74
2.72
2.71
2.70
2.70
2.67
2.67
MeO2C
F
N
O
(2S,3S)-anti-5l
1.00
2.01
3.00
3.97
1.00
1.01
1.96
1.01
1.03
3.02
2.98
1.00
1.03
f1 (ppm)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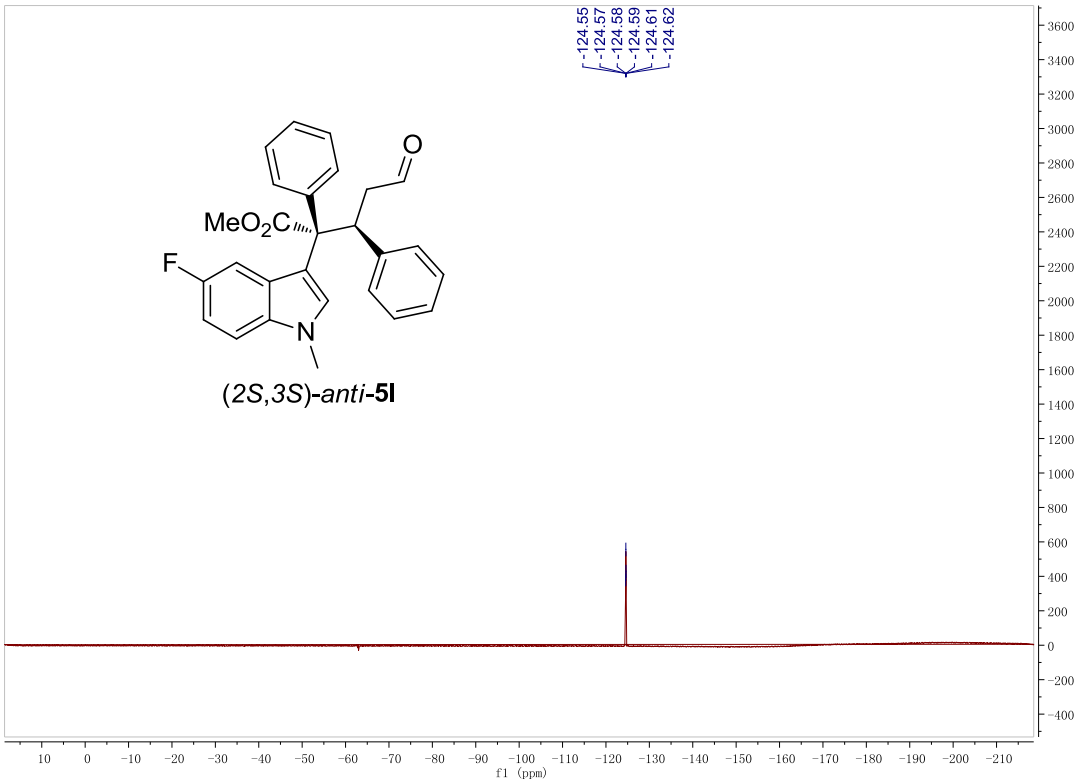
134.19
130.56
129.17
128.33
127.56
127.45
110.66
109.94
109.84
109.63
109.36
107.25
107.01
60.89
52.19
46.28
44.42
33.19
A (d)
157.17
B (d)
127.98
C (d)
110.68
D (d)
109.89
E (d)
109.49
F (d)
107.13
MeO2C
F
N
O
(2S,3S)-anti-5l
f1 (ppm)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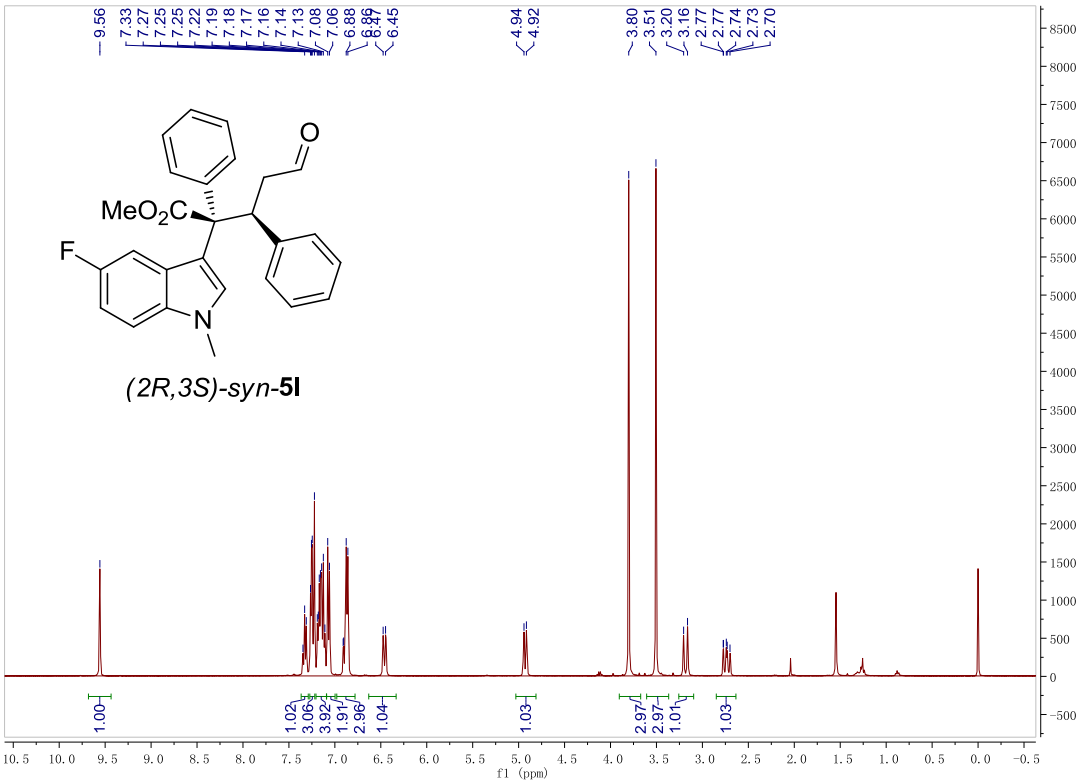
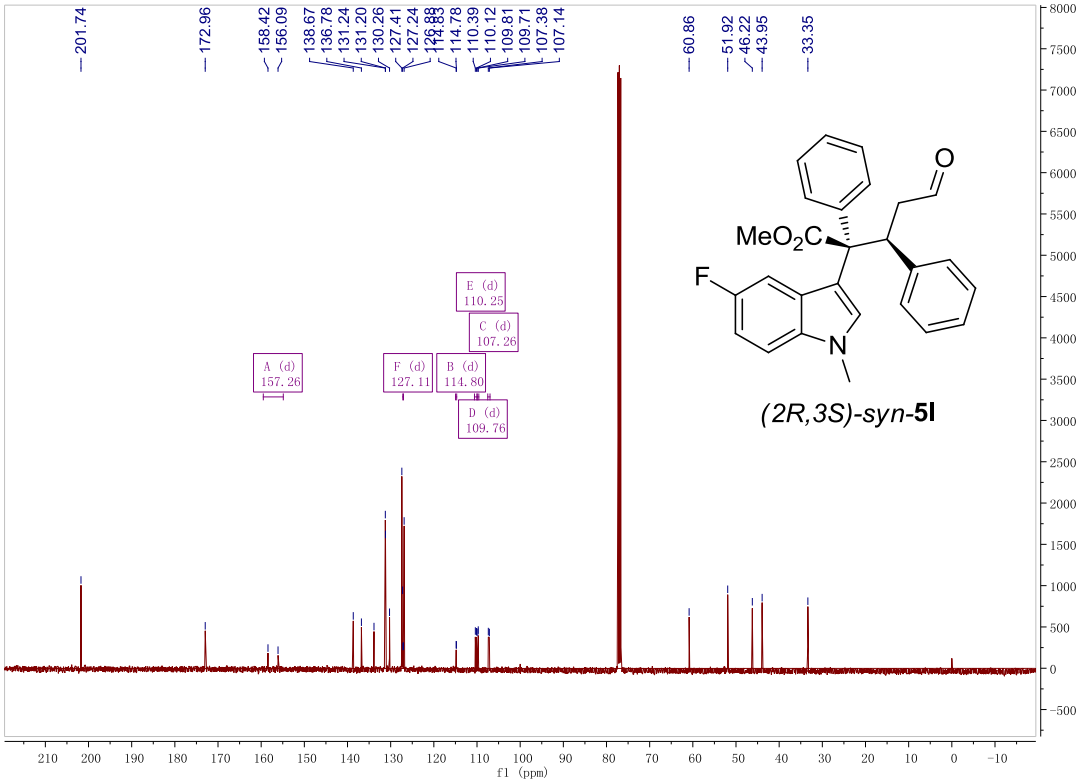
-124.57
-124.58
-124.59
-124.61
-124.62
O
MeO2C
F
N
(2S,3S)-anti-5l
f1 (ppm)


9.56
7.33
7.27
7.25
7.25
7.22
7.19
7.18
7.17
7.16
7.14
7.13
7.08
7.06
6.88
6.45
4.94
4.92
3.80
3.51
3.20
3.16
2.77
2.77
2.74
2.73
2.70
MeO2C
F
O
N
(2R,3S)-syn-5l
1.00
1.02
3.06
3.92
1.91
2.96
1.04
1.03
2.97
2.97
1.01
1.03
f1 (ppm)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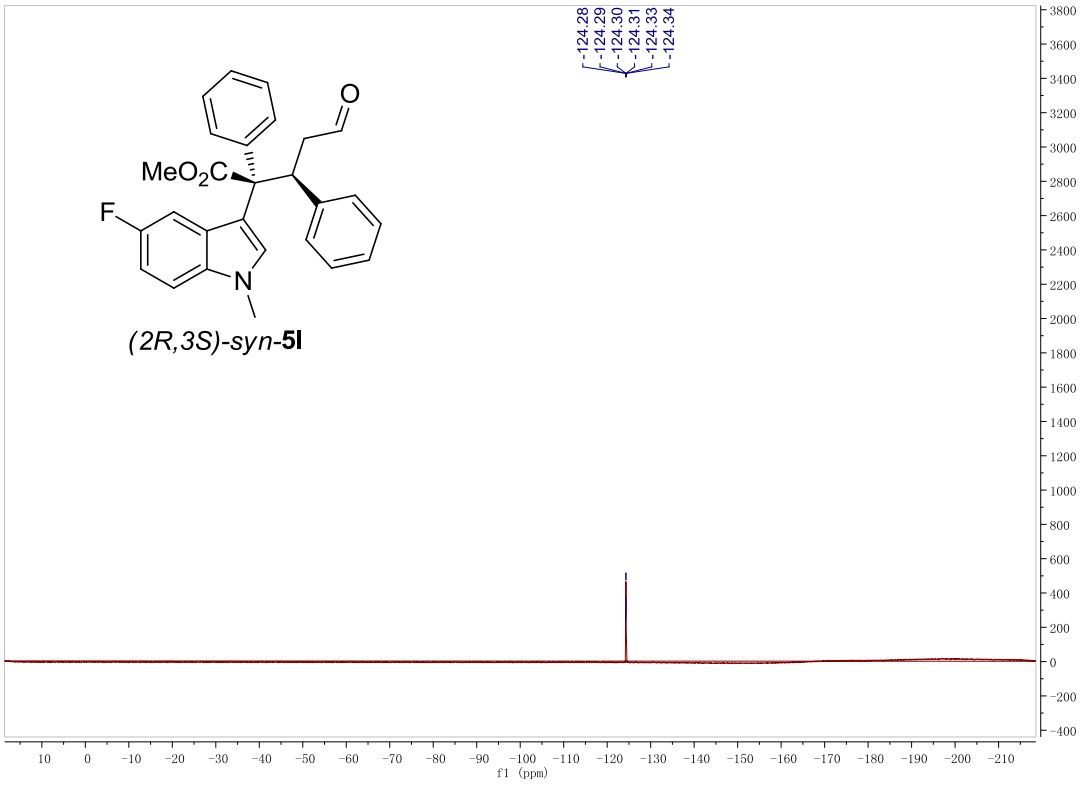
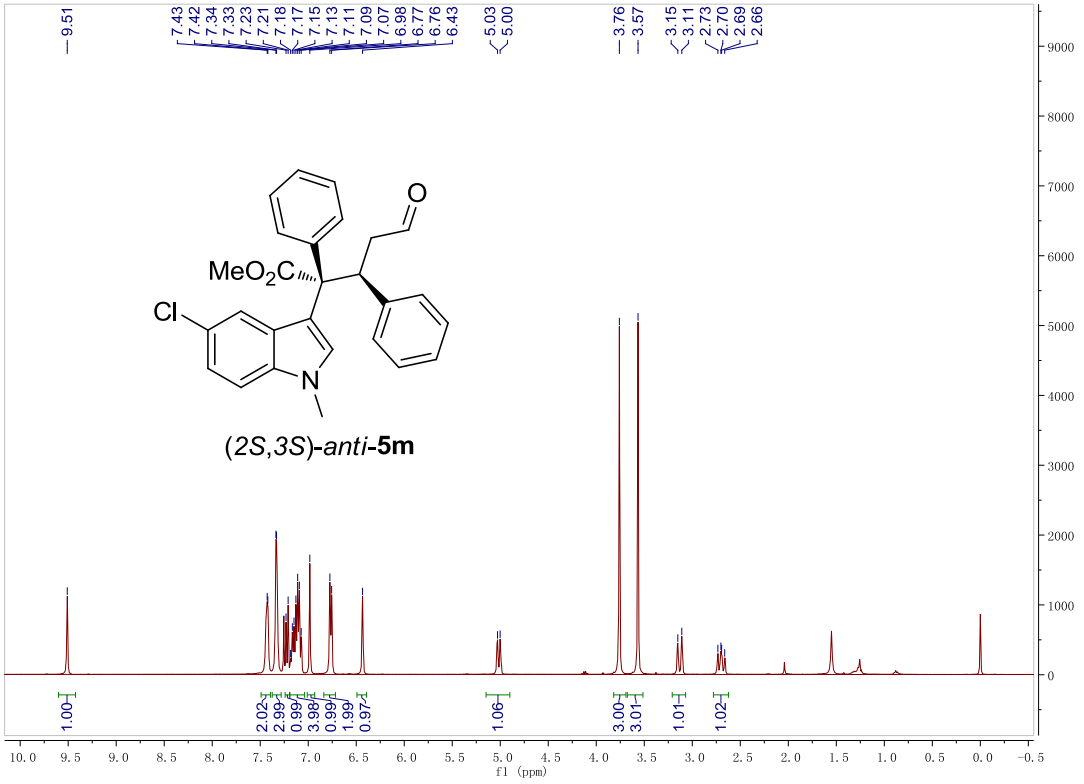
136.78
131.24
131.20
130.26
127.41
127.24
114.78
110.39
110.12
109.81
109.71
107.38
107.14
60.86
51.92
46.22
43.95
33.35
A (d)
157.26
F (d)
127.11
B (d)
114.80
D (d)
109.76
C (d)
107.26
E (d)
110.25
MeO2C
F
O
N
(2R,3S)-syn-5l
f1 (ppm)


-124.28
-124.29
-124.30
-124.31
-124.33
-124.34
O
MeO2C
F
N
(2R,3S)-syn-5l
f1 (ppm)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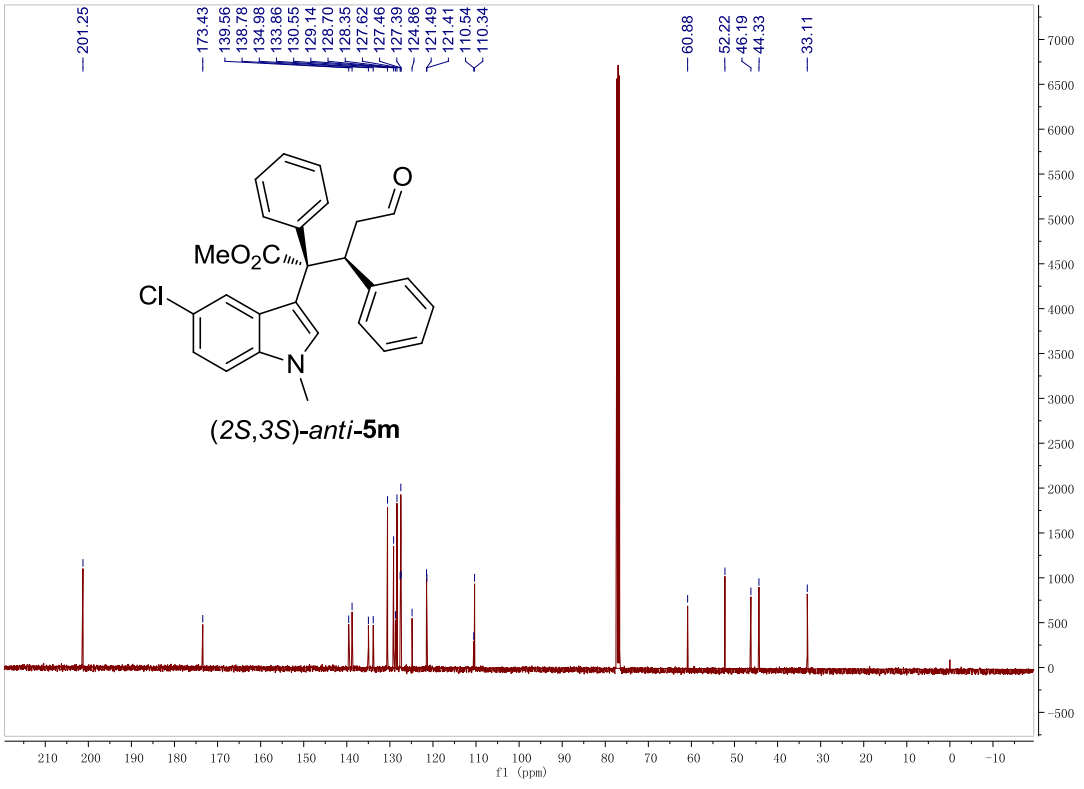
7.23
7.21
7.18
7.17
7.15
7.13
7.11
7.09
7.07
6.98
6.77
6.76
6.43
5.03
5.00
3.76
3.57
3.15
3.11
2.73
2.70
2.69
2.66
MeO2C
Cl
N
O
(2S,3S)-anti-5m
1.00
2.02
2.99
0.99
3.98
0.99
1.99
0.97
1.06
3.00
3.01
1.01
1.02
f1 (ppm)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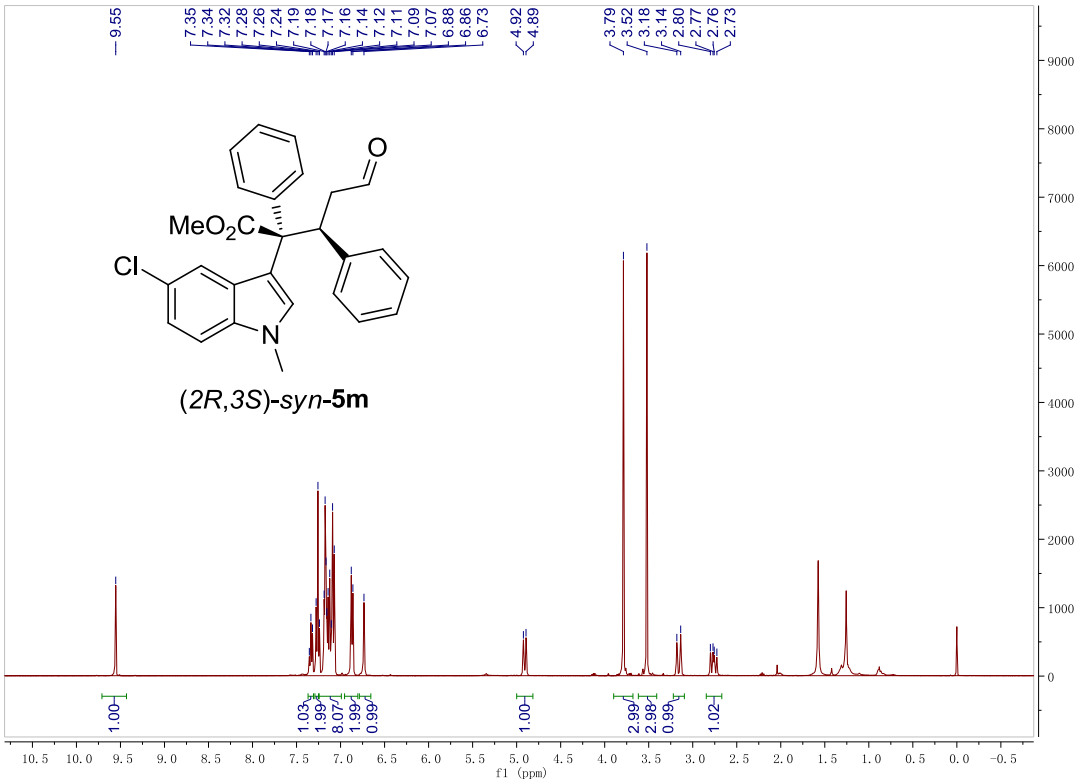
134.98
133.86
130.55
129.14
128.70
128.35
127.62
127.46
127.39
124.86
121.49
121.41
110.54
110.34
60.88
52.22
46.19
44.33
33.11
MeO2C
Cl
N
O
(2S,3S)-anti-5m
f1 (ppm)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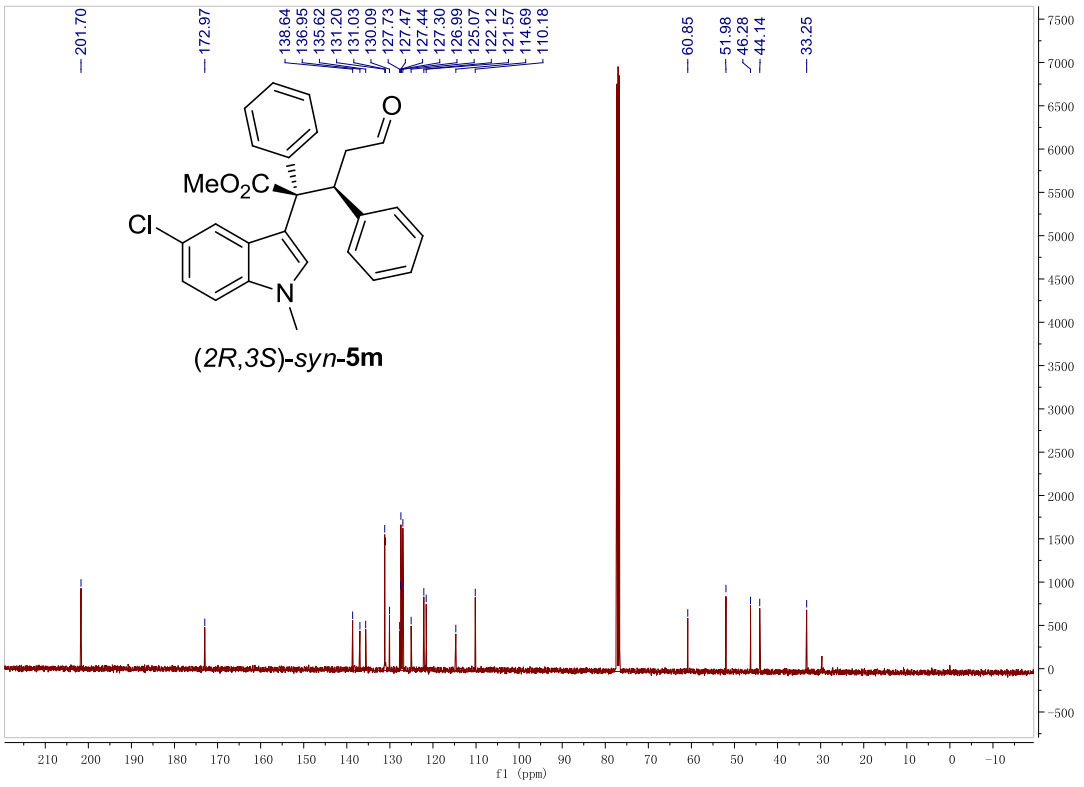
7.35
7.34
7.32
7.28
7.26
7.24
7.19
7.18
7.17
7.16
7.14
7.12
7.11
7.09
7.07
6.88
6.86
6.73
4.92
4.89
3.79
3.52
3.18
3.14
2.80
2.77
2.76
2.73
MeO2C
Cl
N
O
(2R,3S)-syn-5m
1.00
1.03
1.99
8.07
1.99
0.99
1.00
2.99
2.98
0.99
1.02
f1 (ppm)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136.95
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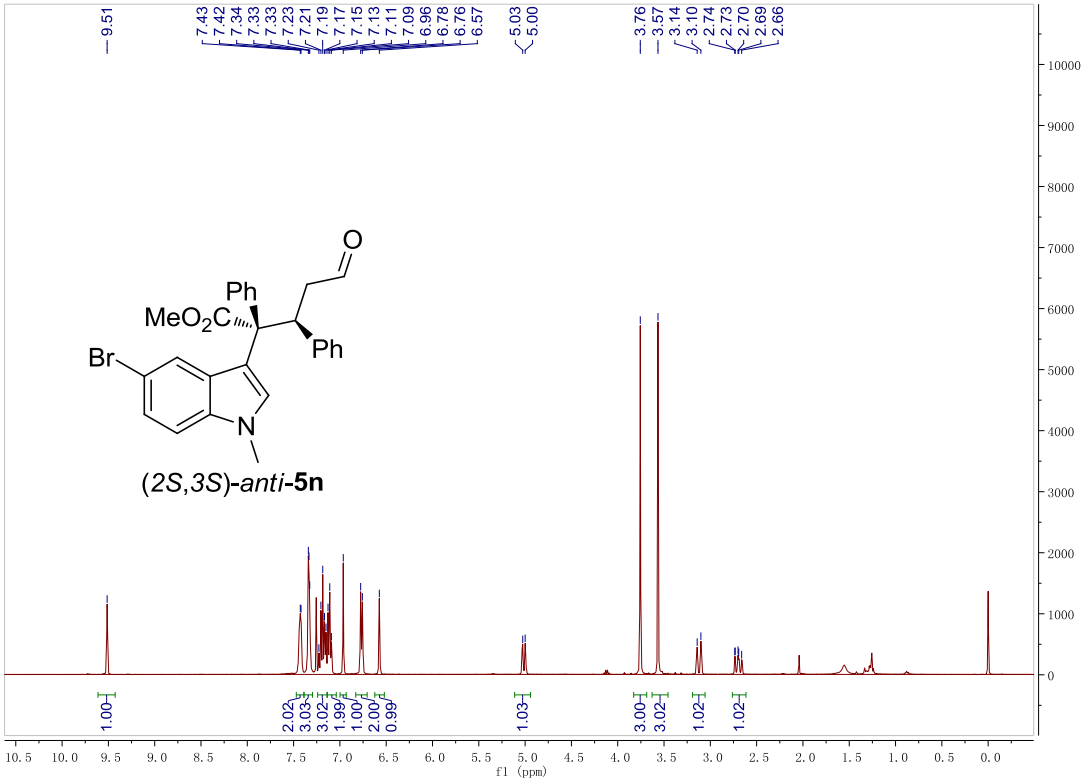
130.09
127.73
127.47
127.44
127.30
126.99
125.07
122.12
121.57
114.69
110.18
60.85
51.98
46.28
44.14
33.25
MeO2C
Cl
N
O
(2R,3S)-syn-5m
f1 (ppm)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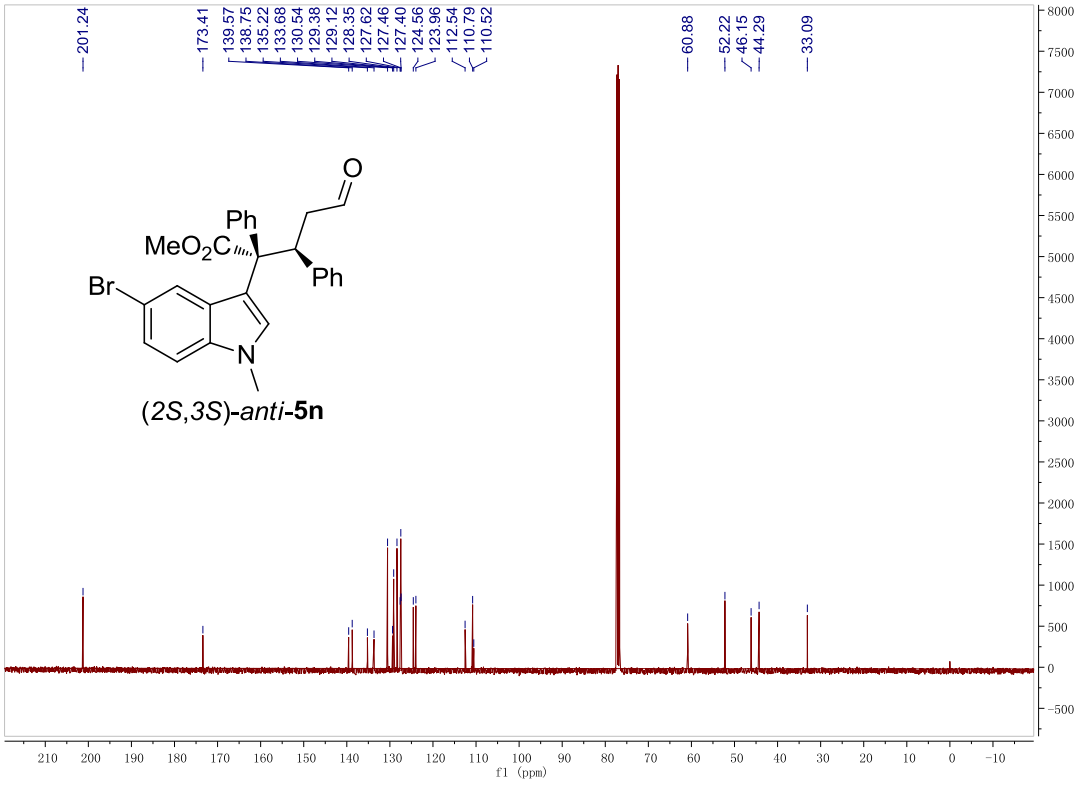
7.42
7.34
7.33
7.23
7.21
7.19
7.17
7.15
7.13
7.11
7.09
6.96
6.78
6.76
6.57
5.03
5.00
3.76
3.57
3.14
3.10
2.74
2.73
2.70
2.69
2.66
O
Ph
MeO2C
Ph
Br
N
(2S,3S)-anti-5n
f1 (ppm)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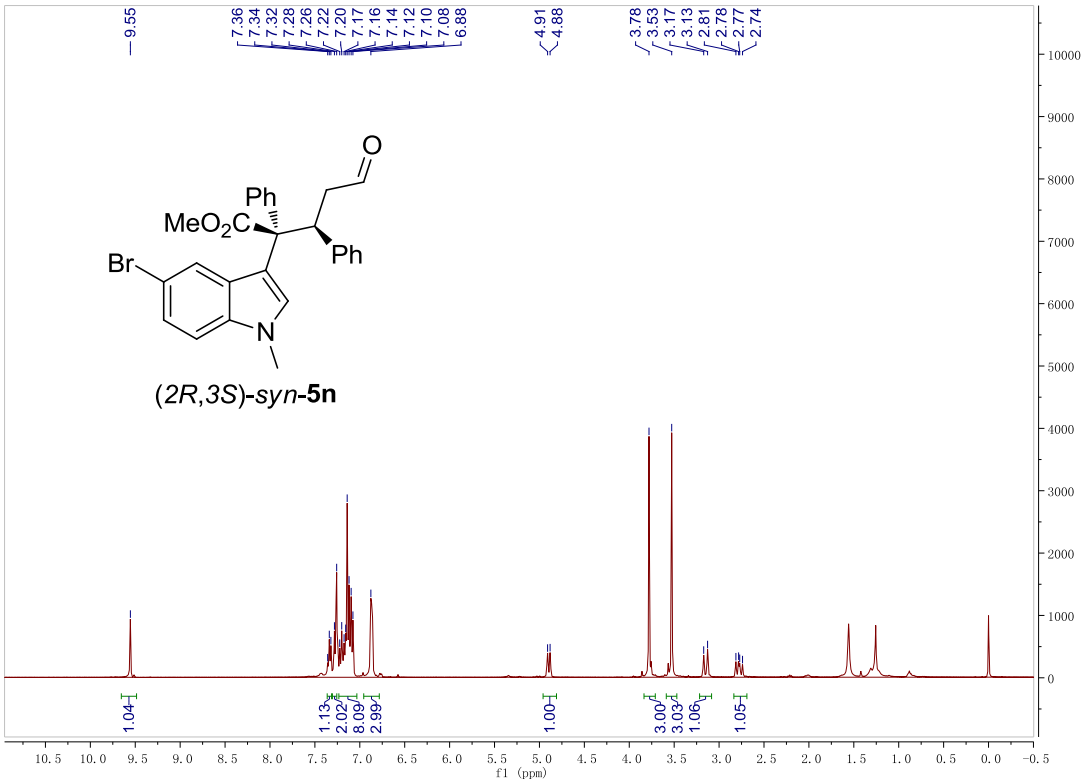
129.38
129.12
128.35
127.62
127.46
127.40
124.56
123.96
112.54
110.79
110.52
60.88
52.22
46.15
44.29
33.09
O
Ph
MeO2C
Ph
Br
N
(2S,3S)-anti-5n
f1 (ppm)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7.32
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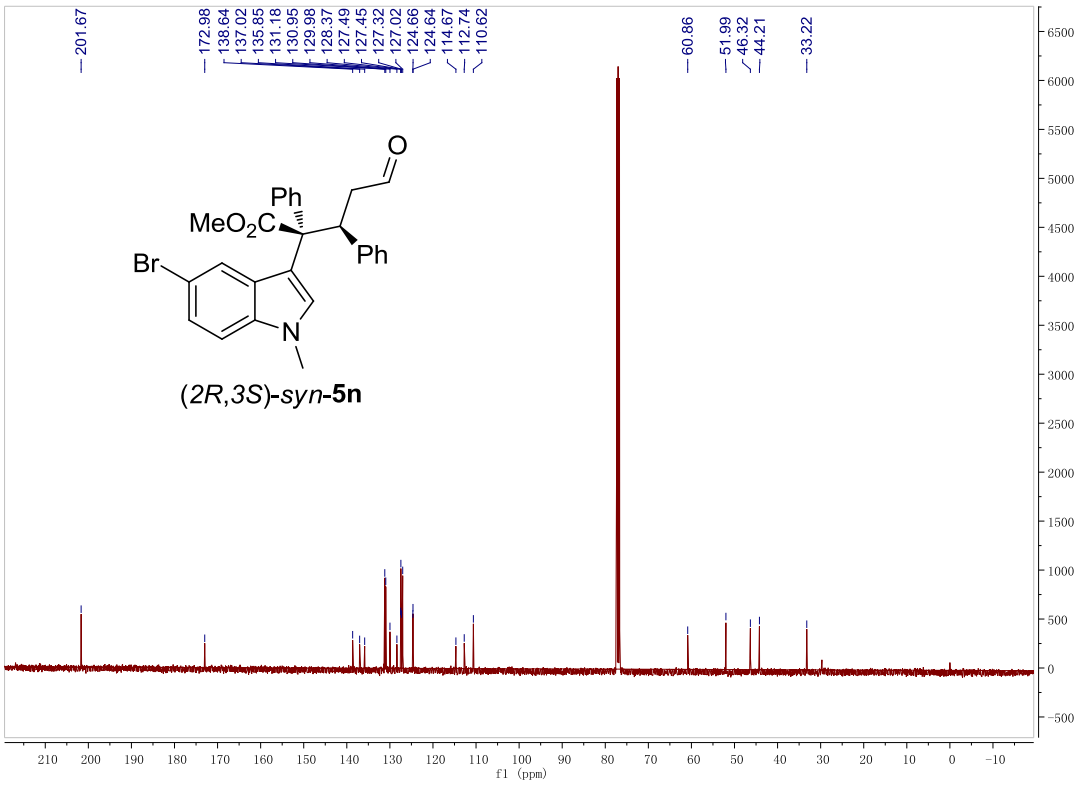
7.22
7.20
7.17
7.16
7.14
7.12
7.10
7.08
6.88
4.91
4.88
3.78
3.53
3.17
3.13
2.81
2.78
2.77
2.74
O
Ph
MeO2C
Ph
Br
N
(2R,3S)-syn-5n
1.04
1.13
2.02
8.09
2.99
1.00
3.00
3.03
1.06
1.05
f1 (ppm)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127.49
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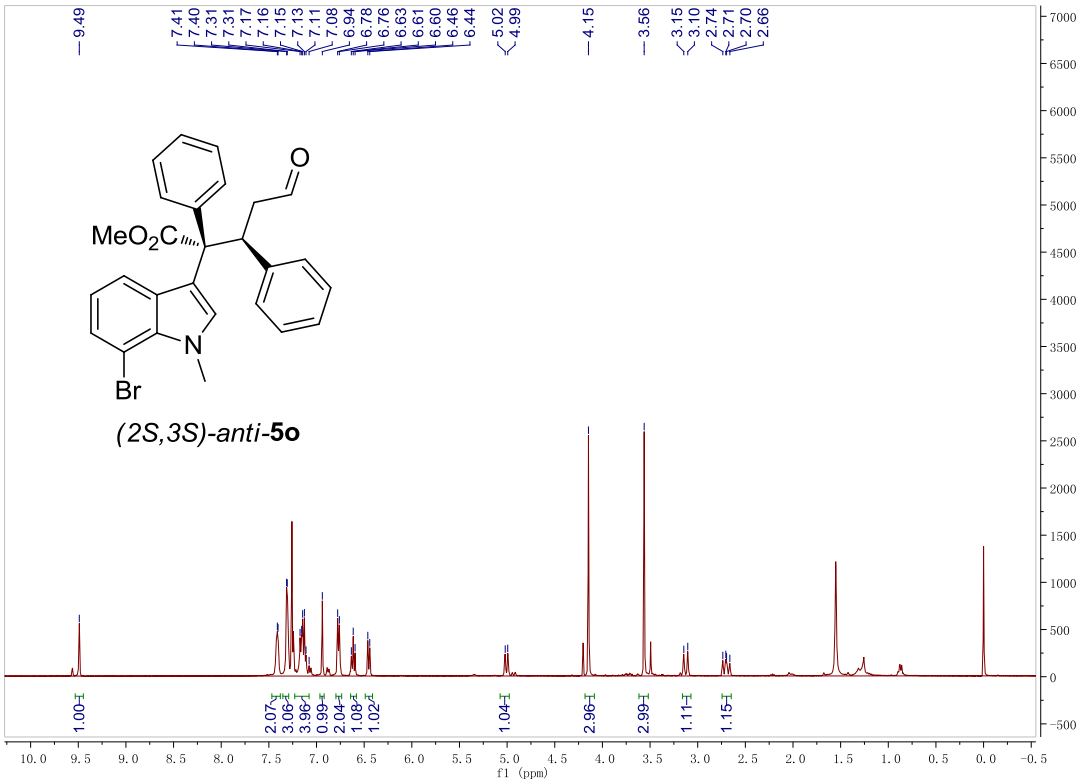
127.32
127.02
124.66
124.64
114.67
112.74
110.62
60.86
51.99
46.32
44.21
33.22
O
Ph
MeO2C
Ph
Br
N
(2R,3S)-syn-5n
f1 (ppm)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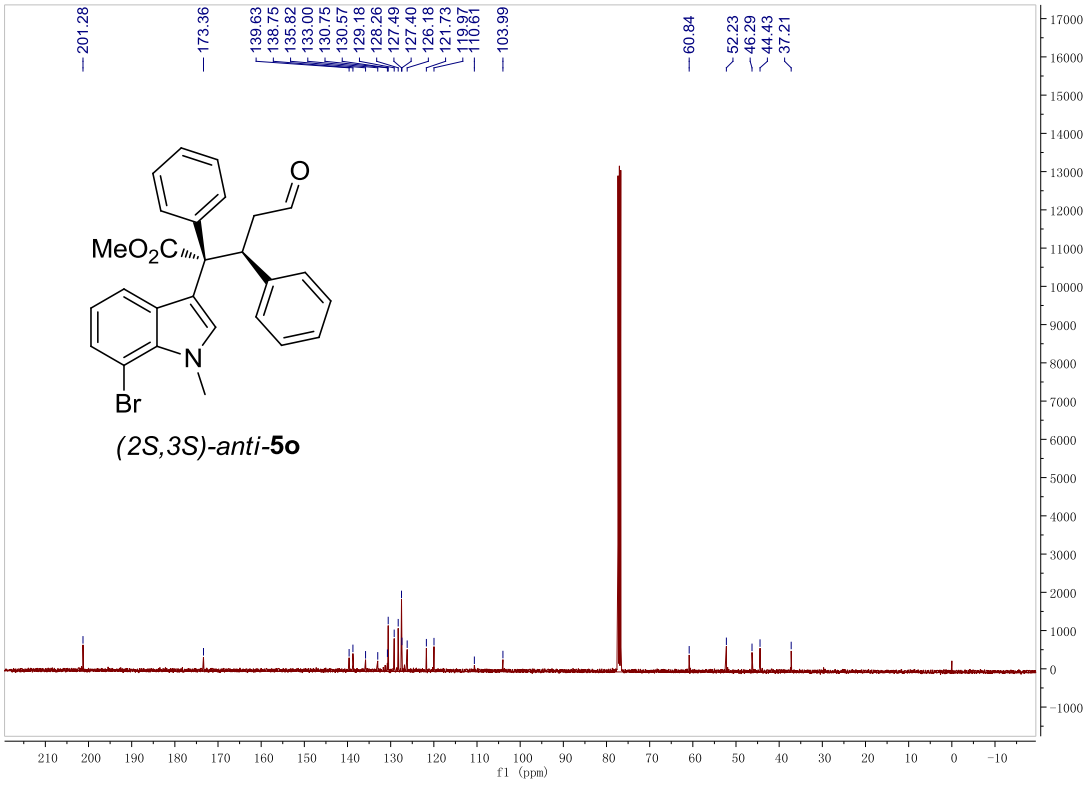
7.31
7.17
7.16
7.15
7.13
7.11
7.08
6.94
6.78
6.76
6.63
6.61
6.60
6.46
6.44
5.02
4.99
4.15
3.56
3.15
3.10
2.74
2.71
2.70
2.66
O
MeO2C
N
Br
(2S,3S)-anti-5o
1.00
2.07
3.06
3.96
0.99
2.04
1.08
1.02
1.04
2.96
2.99
1.11
1.15
f1 (ppm)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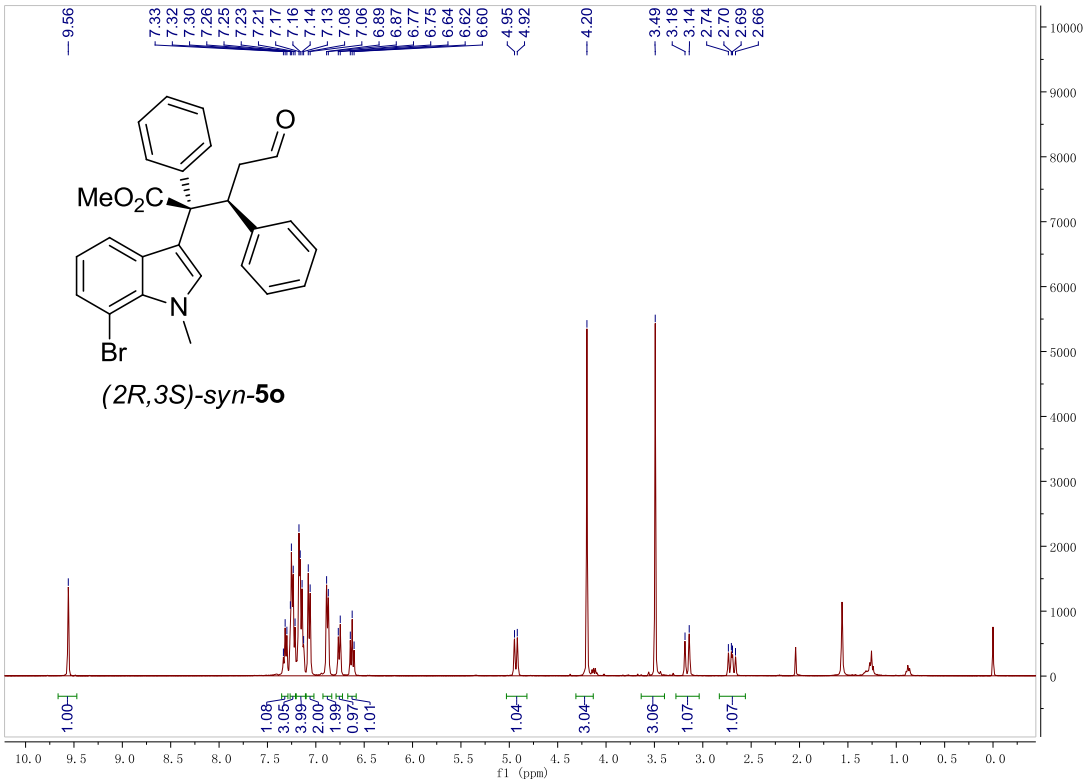
135.82
133.00
130.75
130.57
129.18
128.26
127.49
127.40
126.18
121.73
119.97
110.61
103.99
60.84
52.23
46.29
44.43
37.21
O
MeO2C
N
Br
(2S,3S)-anti-5o
f1 (ppm)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7.32
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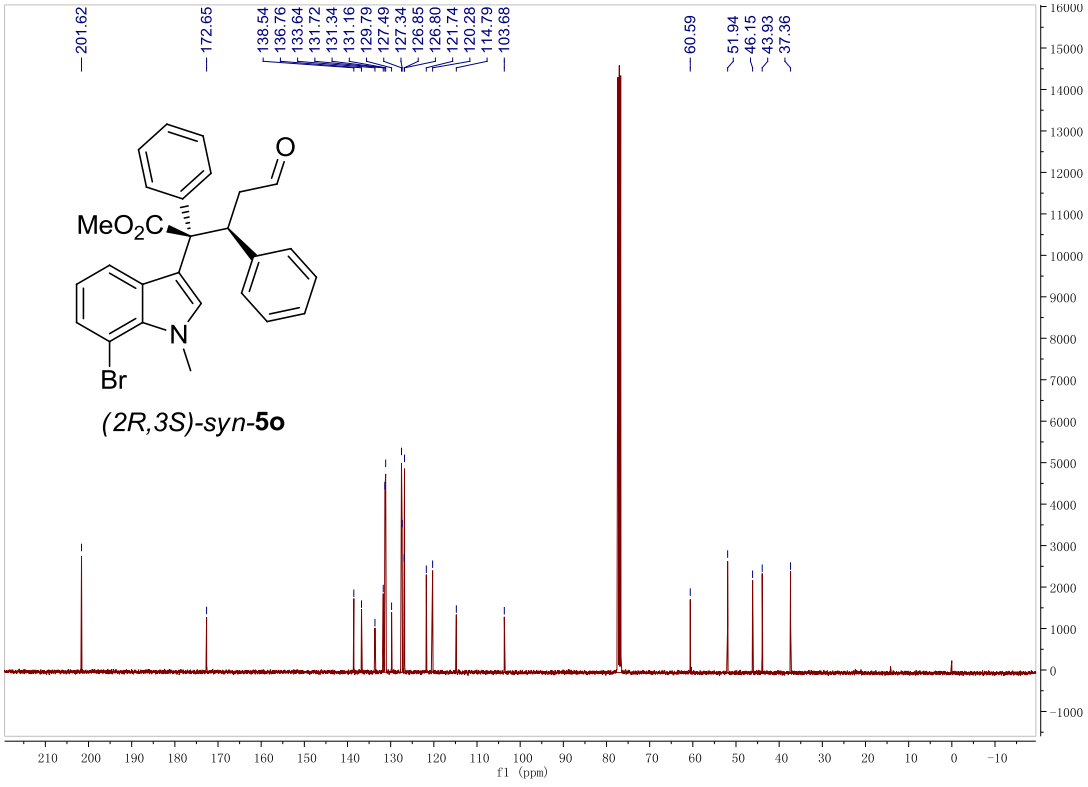
7.25
7.23
7.21
7.17
7.16
7.14
7.13
7.08
7.06
6.89
6.87
6.77
6.75
6.64
6.62
6.60
4.95
4.92
4.20
3.49
3.18
3.14
2.74
2.70
2.69
2.66
MeO2C
O
N
Br
(2R,3S)-syn-5o
1.00
1.08
3.05
3.99
2.00
1.99
0.97
1.01
1.04
3.04
3.06
1.07
1.07
f1 (ppm)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131.72
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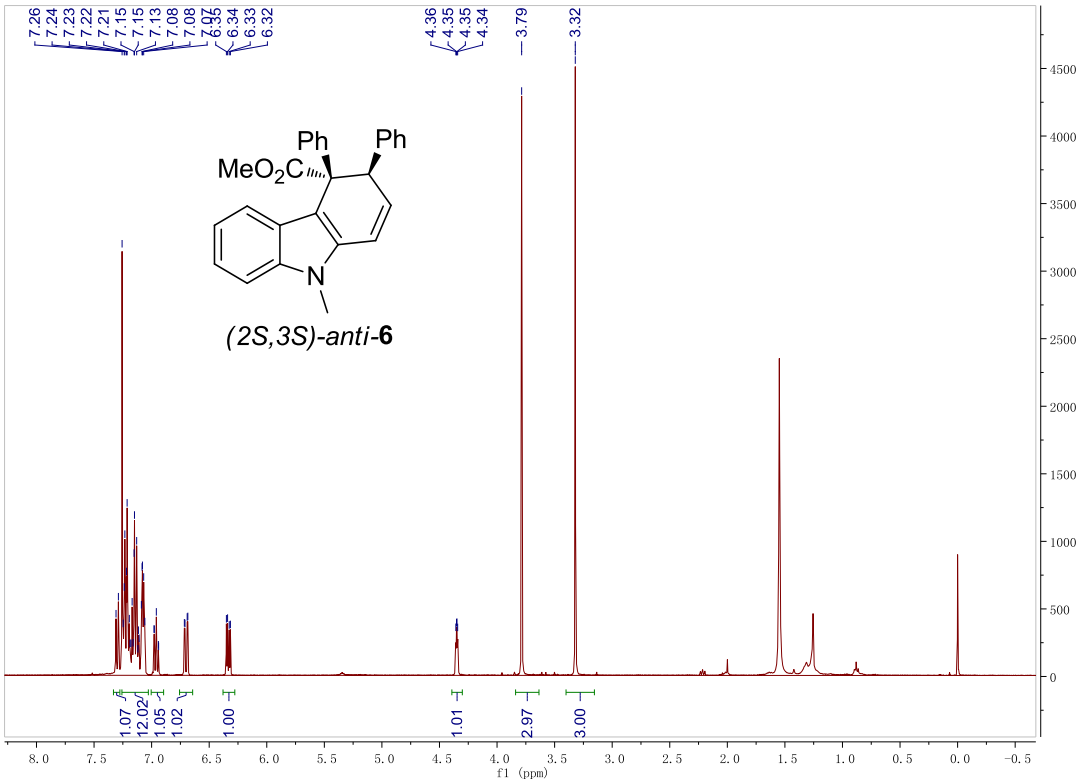
131.16
129.79
127.49
127.34
126.85
126.80
121.74
120.28
114.79
103.68
60.59
51.94
46.15
43.93
37.36
MeO2C
O
N
Br
(2R,3S)-syn-5o
f1 (ppm)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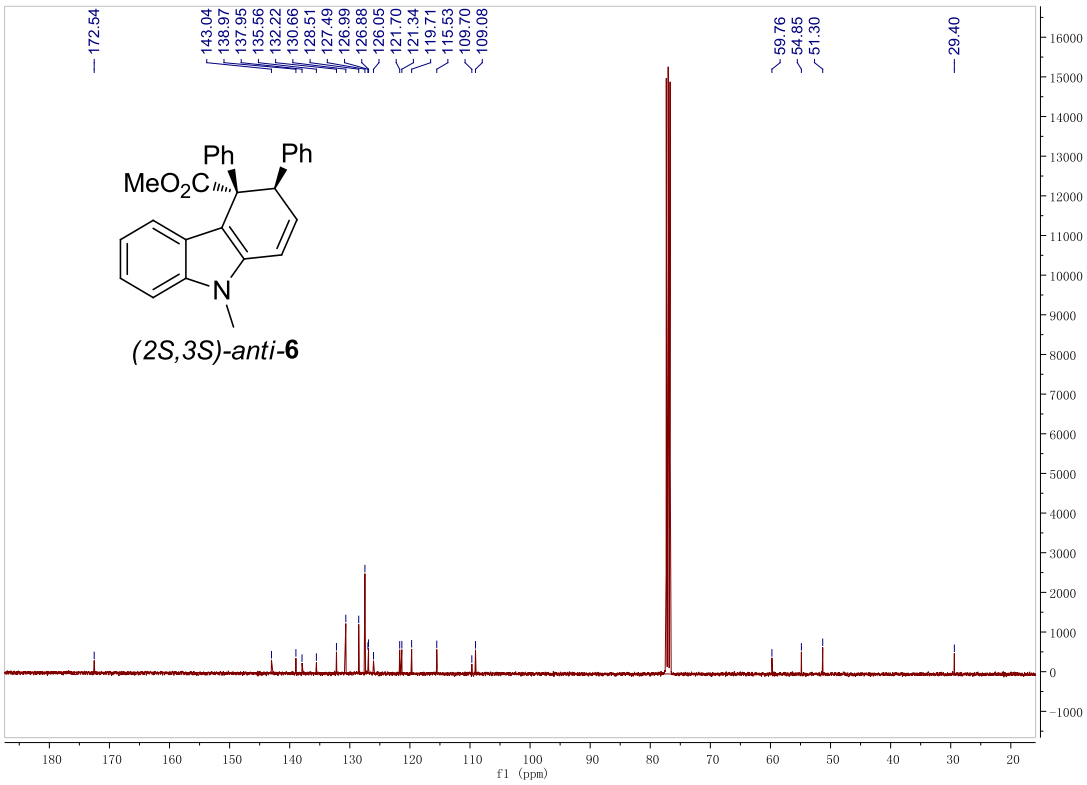
7.24
7.23
7.22
7.21
7.15
7.15
7.13
7.08
7.07
6.35
6.34
6.33
6.32
4.36
4.35
4.35
4.34
3.79
3.32
Ph
Ph
MeO2C
N
(2S,3S)-anti-6
1.07
12.02
1.05
1.02
1.00
1.01
2.97
3.00
f1 (ppm)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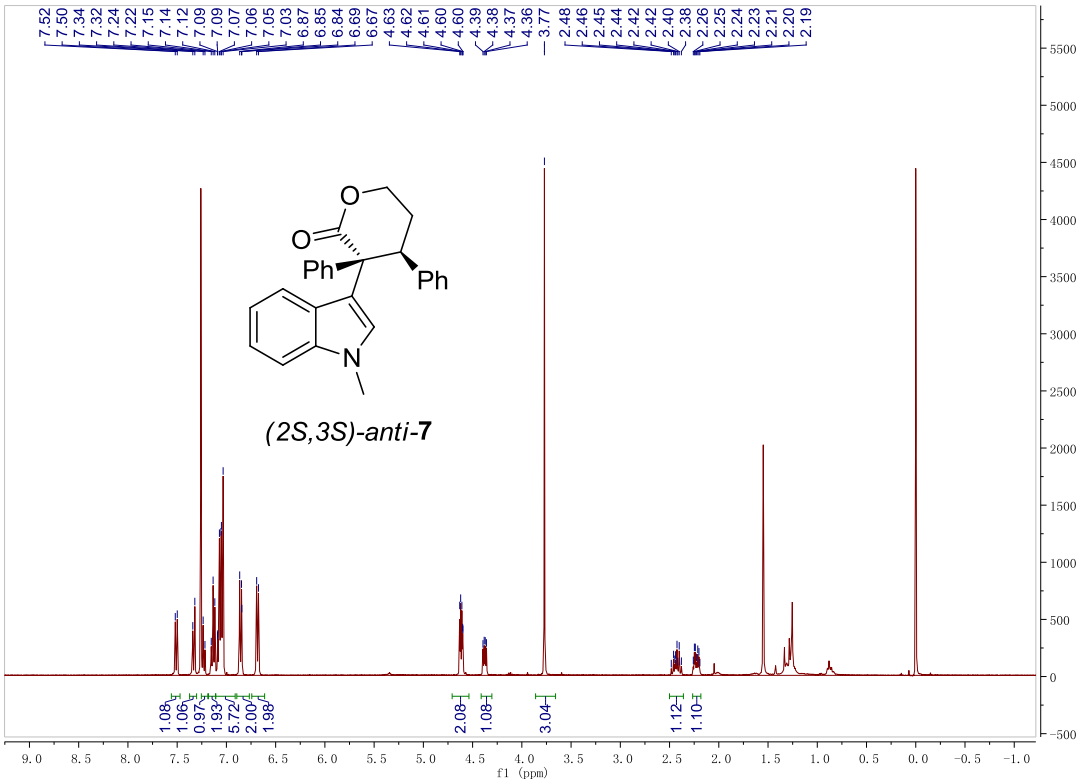
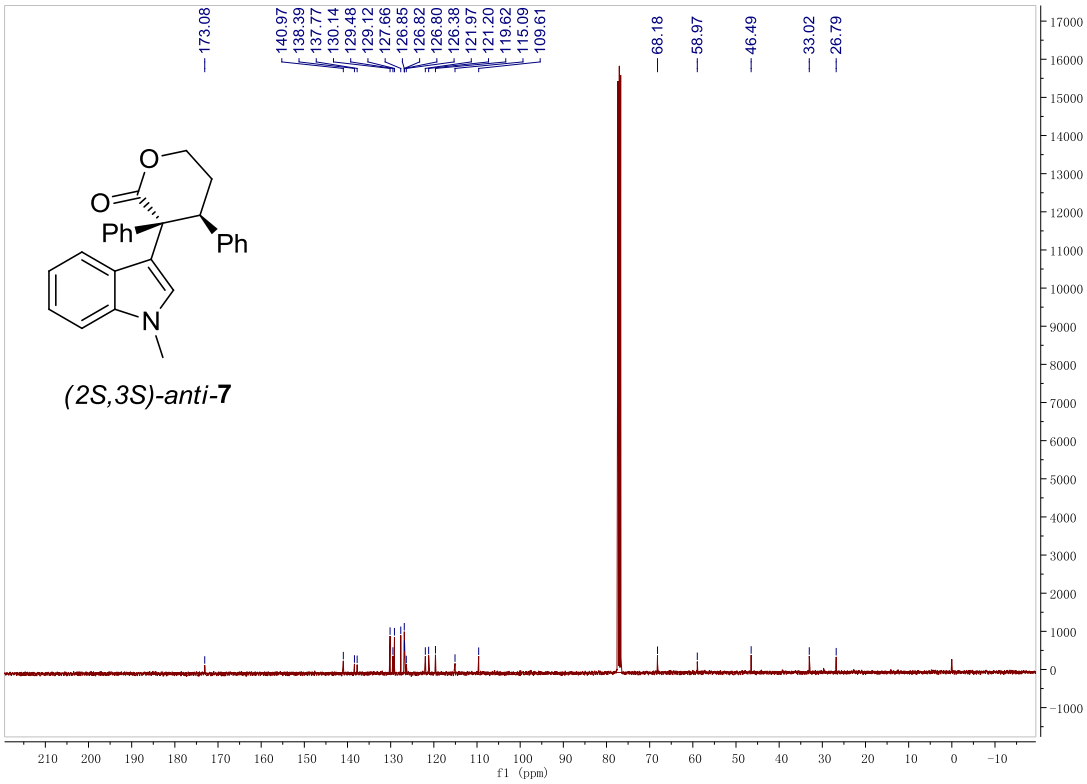
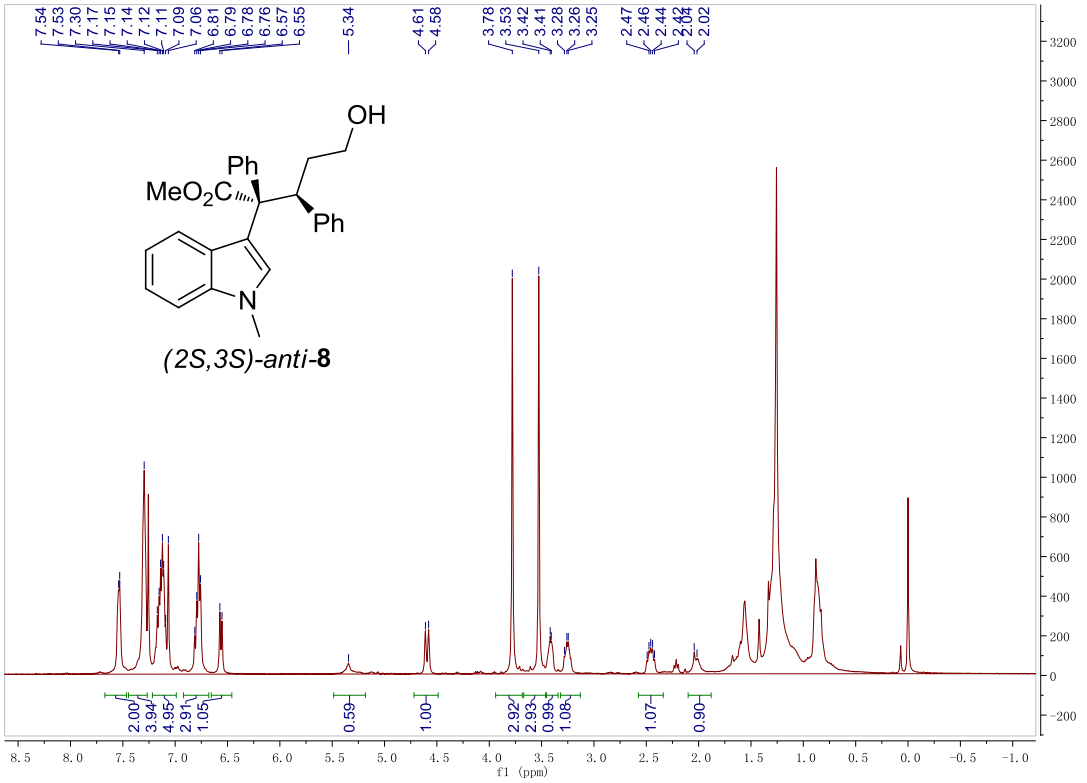
137.95
135.56
132.22
130.66
128.51
127.49
126.99
126.88
126.05
121.70
121.34
119.71
115.53
109.70
109.08
59.76
54.85
51.30
29.40
Ph
Ph
MeO2C
N
(2S,3S)-anti-6
f1 (ppm)



(2S,3S)-anti-**7**



(2S,3S)-anti-**7**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7.17
7.15
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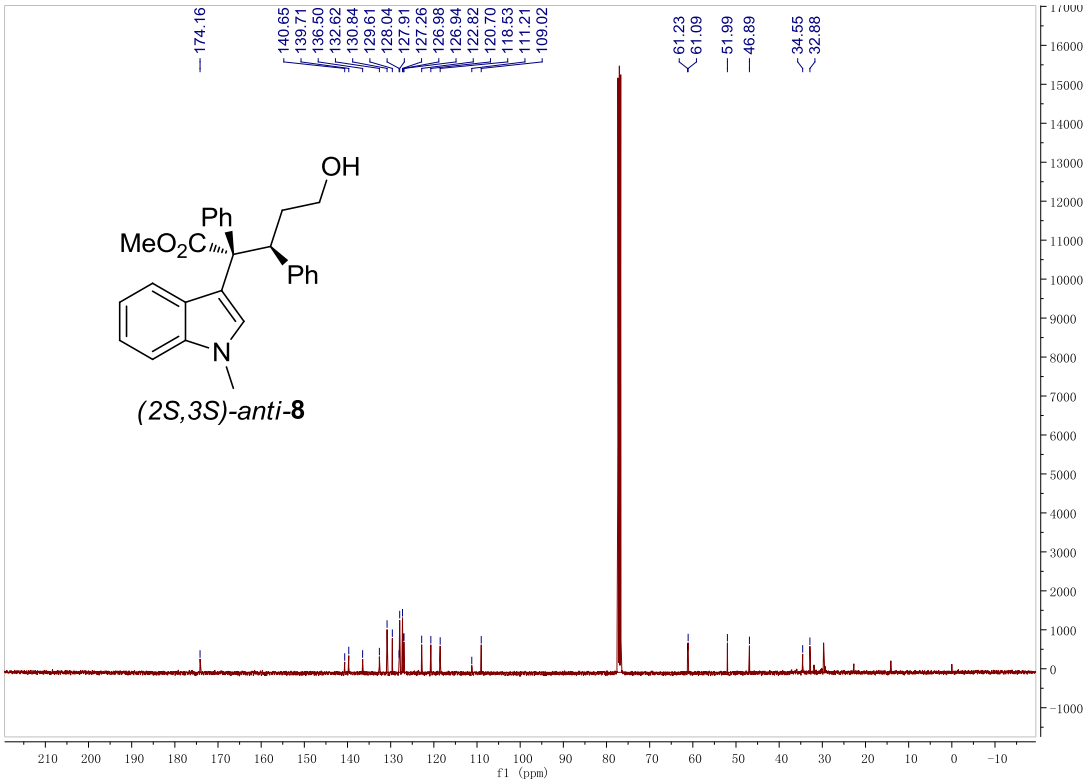
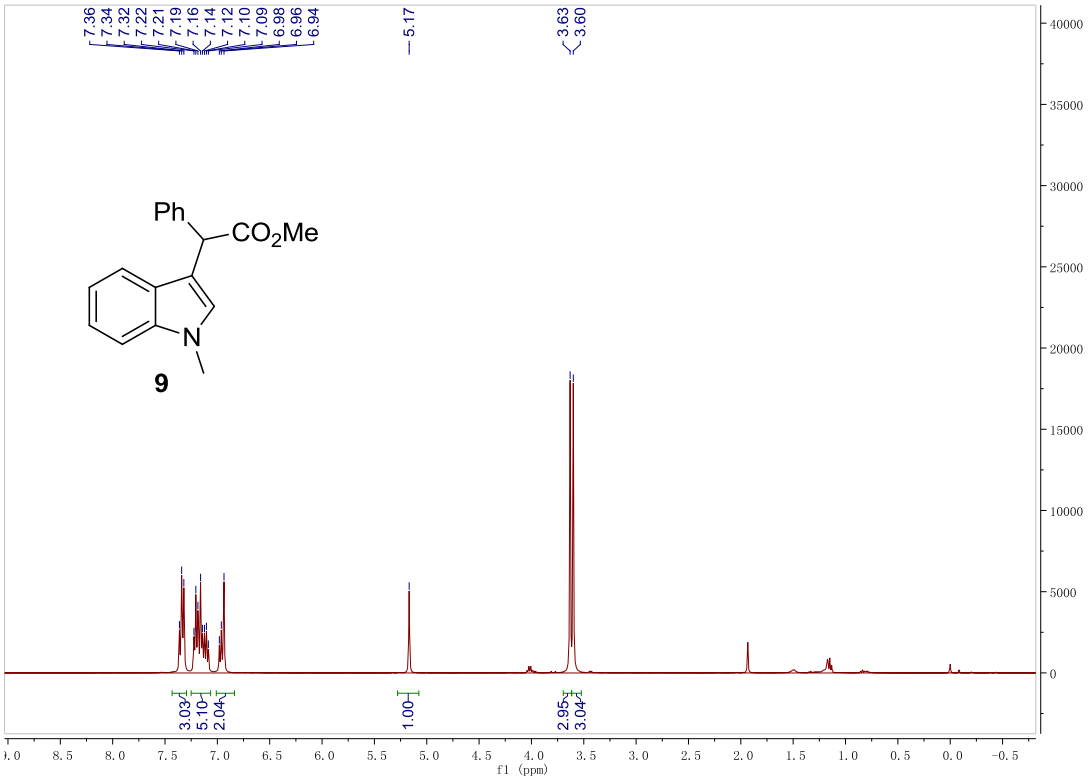
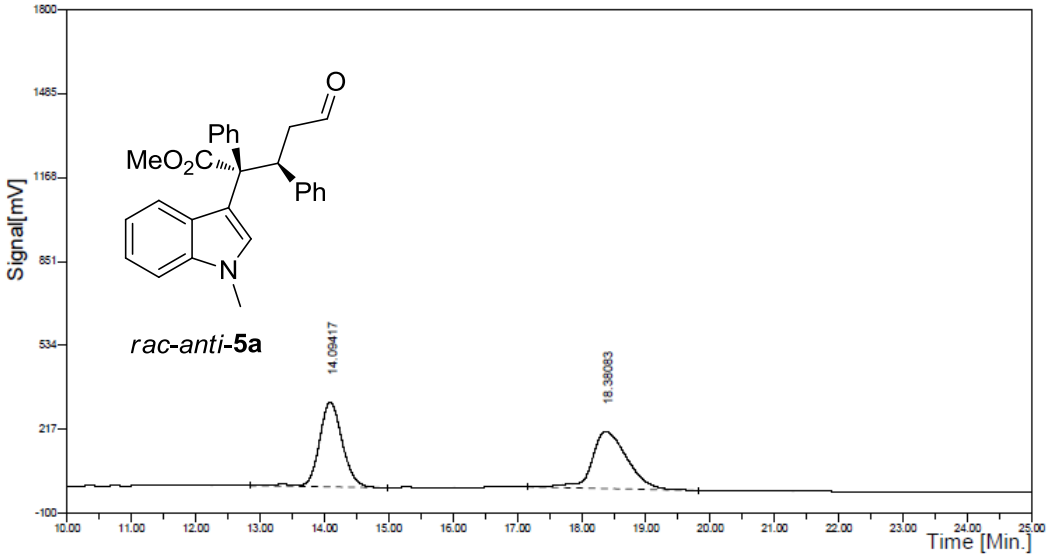
7.12
7.11
7.09
7.06
6.81
6.79
6.78
6.76
6.57
6.55
5.34
4.61
4.58
3.78
3.53
3.42
3.41
3.28
3.26
3.25
2.47
2.46
2.44
2.02
OH
Ph
MeO2C
Ph
N
(2S,3S)-anti-8
2.00
3.94
4.95
2.91
1.05
0.59
1.00
2.92
2.93
0.99
1.08
1.07
0.90
f1 (ppm)


174.16
140.65
139.71
136.50
132.62
130.84
129.61
128.04
127.91
127.26
126.98
126.94
122.82
120.70
118.53
111.21
109.02
61.23
61.09
51.99
46.89
34.55
32.88
OH
Ph
MeO2C
Ph
N
(2S,3S)-anti-8
f1 (ppm)


7.36
7.34
7.32
7.22
7.21
7.19
7.16
7.14
7.12
7.10
7.09
6.98
6.96
6.94
5.17
3.63
3.60
Ph
CO2Me
N
9
3.03
5.10
2.04
1.00
2.95
3.04
f1 (ppm)

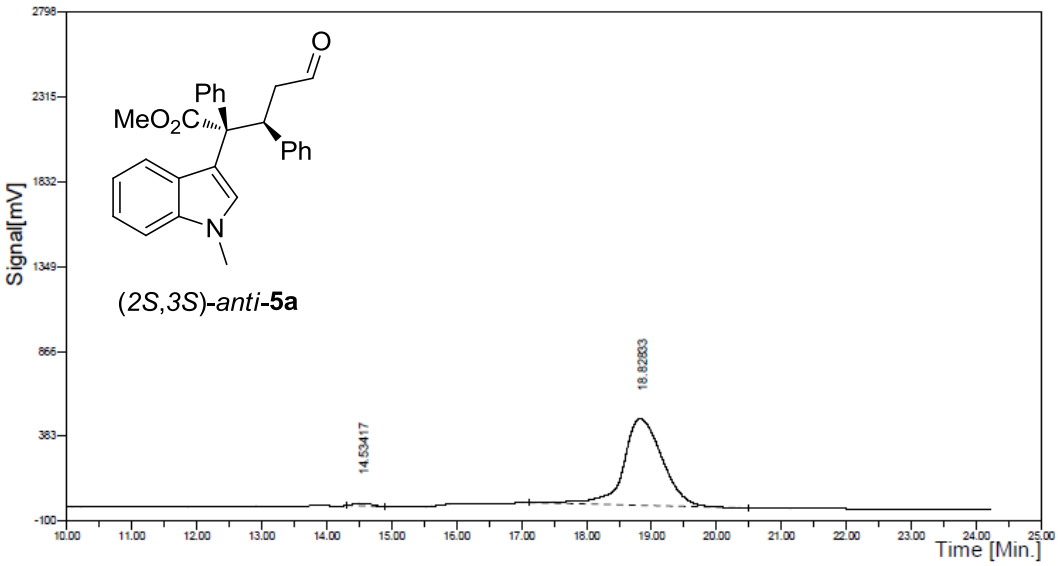
6. HPLC spectra of compounds

Condition: hexane/2-propanol = 15/1
Flow rate = 0.8 mL/min
λ= 220 nm
Chiral IC



组分表

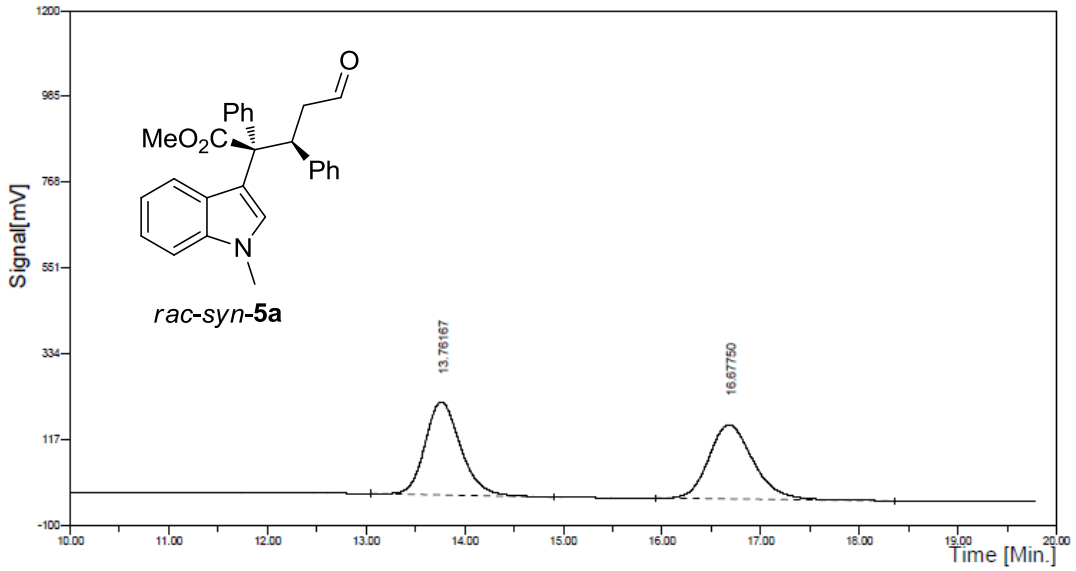
#	保留时间(min)	峰面积(mV.sec)	面积百分比(%)
1	14.09417	7954.27	49.5388
2	18.38083	8102.39	50.4612
合计		16056.66	100



组分表

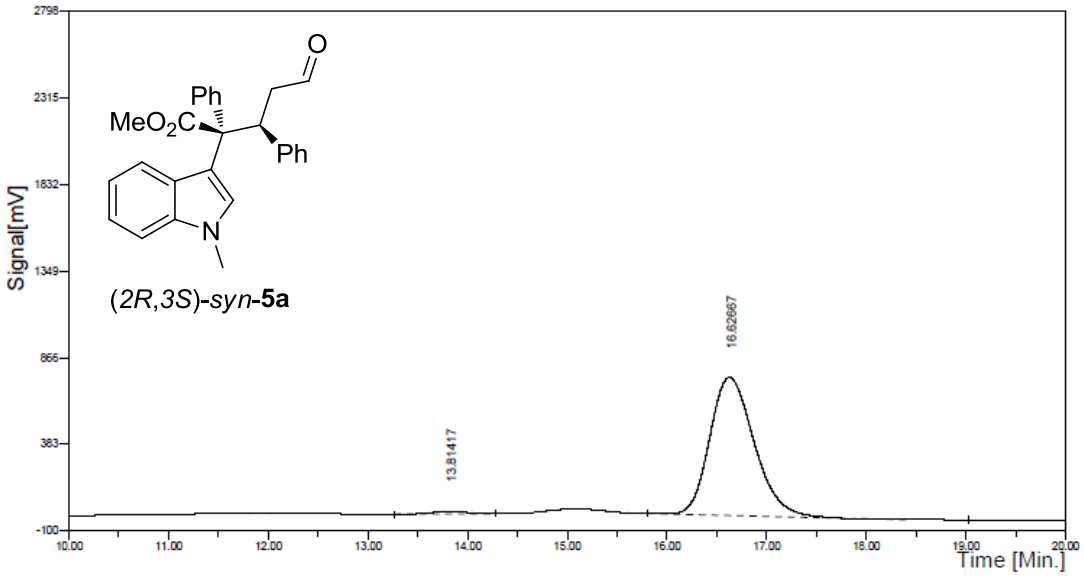
#	保留时间(min)	峰面积(mV.sec)	面积百分比(%)
1	14.53417	314.12	1.5132
2	18.82833	20445.33	98.4868
合计		20759.45	100

Condition: hexane/2-propanol = 15/1
Flow rate = 0.8 mL/min
λ= 220 nm
Chiral IC



组分表

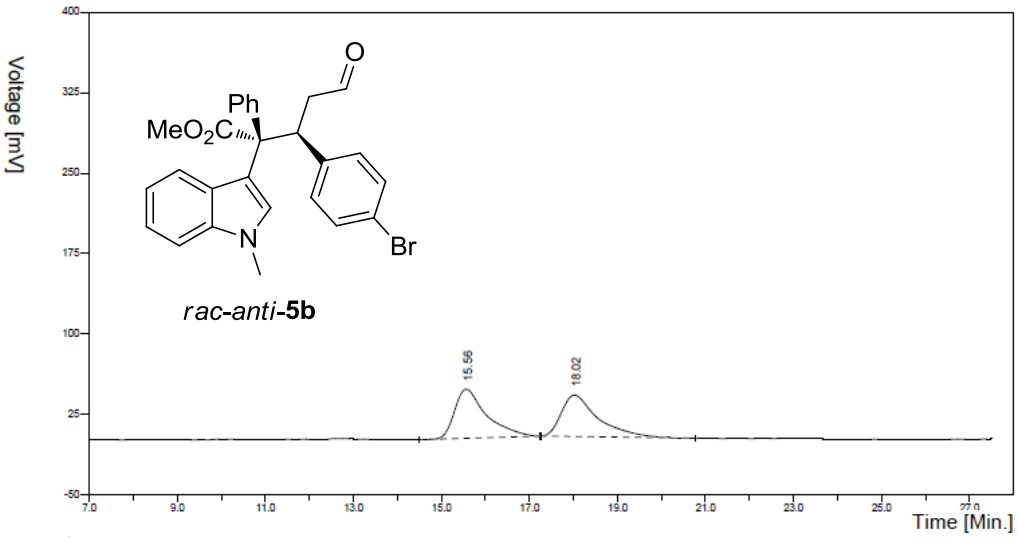
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	13. 76167	5901. 25	50. 2730
2	16. 67750	5837. 16	49. 7270
合计		11738. 41	100



组分表

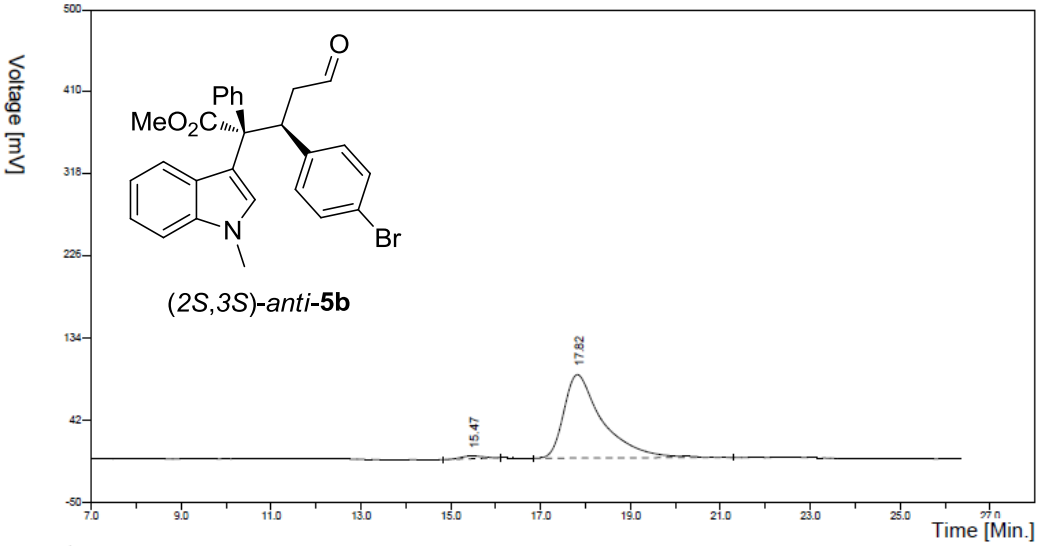
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	13. 81417	356. 36	1. 4959
2	16. 62667	23466. 39	98. 5041
合计		23822. 75	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ= 220 nm
Chiral AD-H



组分表

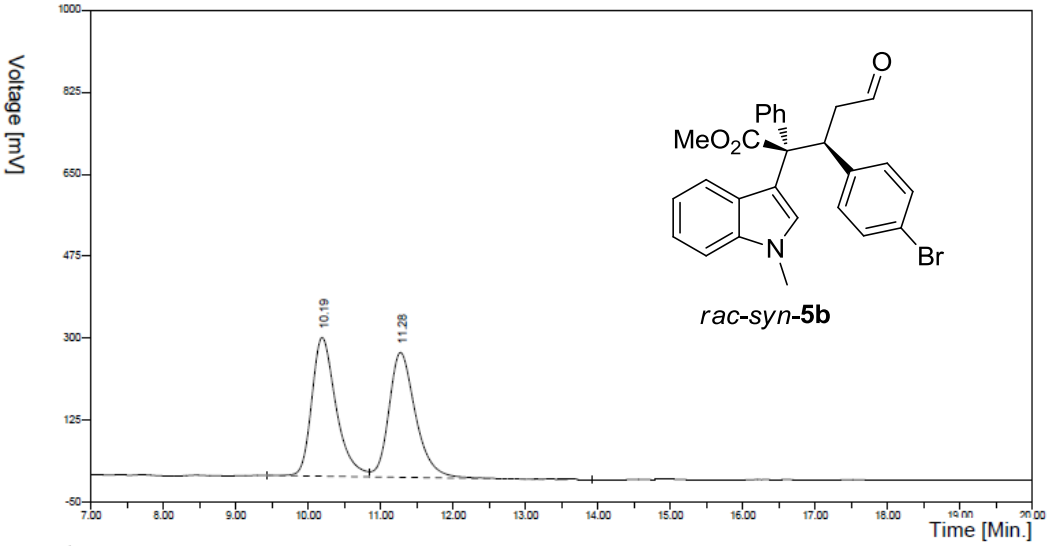
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	15.56	2291.90	50.6332
2	18.02	2234.58	49.3668
合计		4526.48	100



组分表

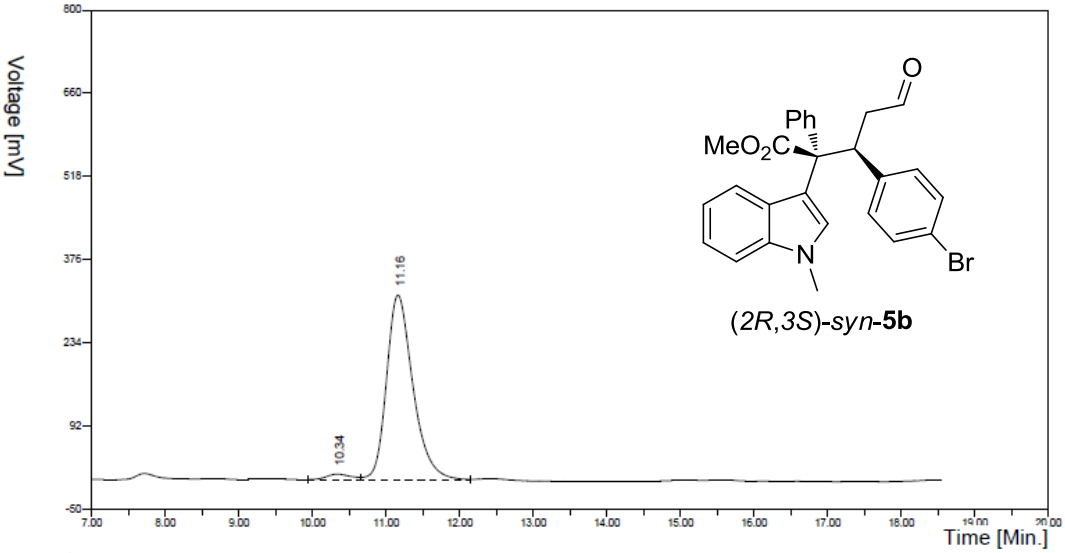
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	15.47	102.39	1.8027
2	17.82	5577.28	98.1973
合计		5679.67	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



组分表

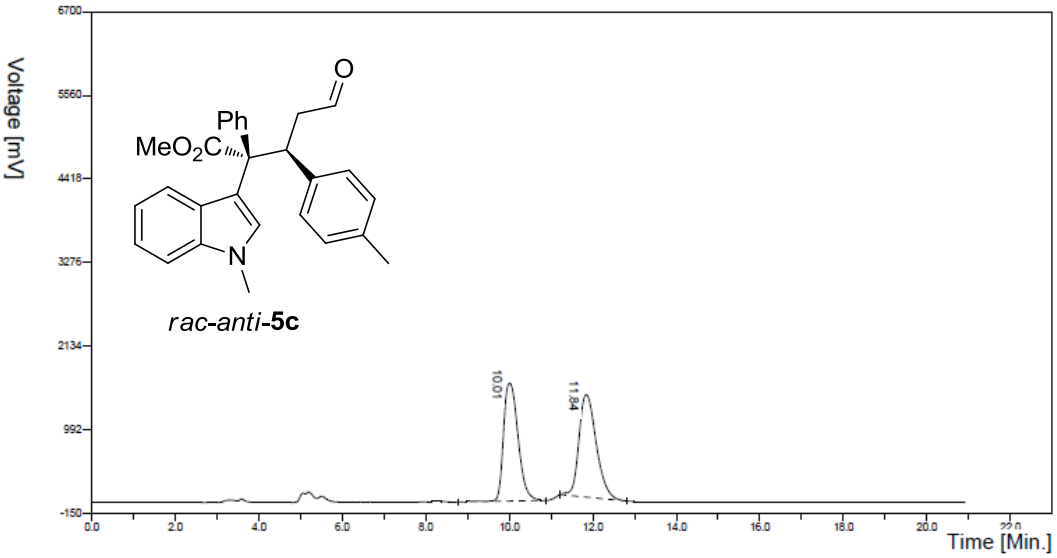
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.19	6912.45	50.6249
2	11.28	6741.80	49.3751
合计		13654.25	100



组分表

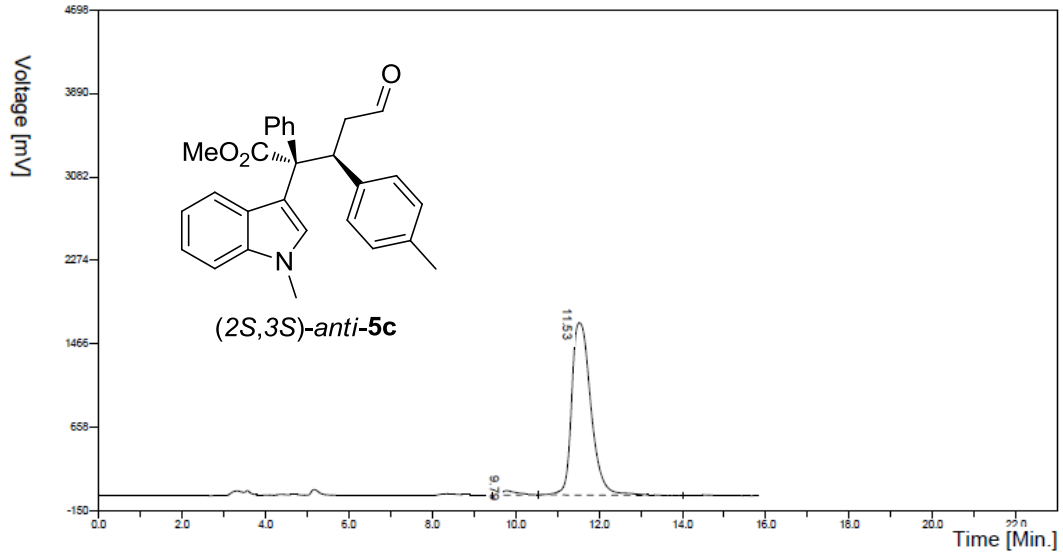
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.34	203.37	2.5365
2	11.16	7814.36	97.4635
合计		8017.73	100

Condition: hexane/2-propanol = 10/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

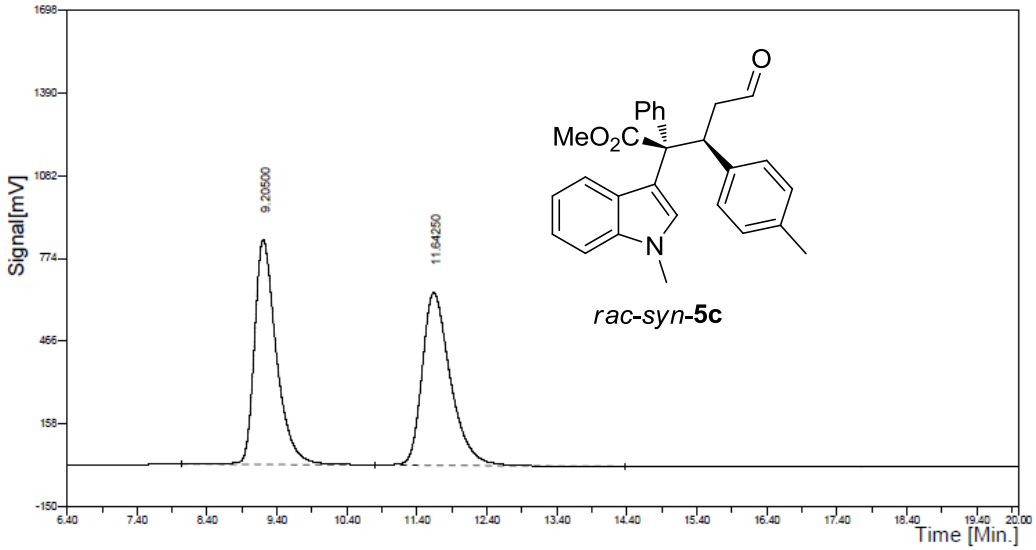
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.01	39097.36	49.0714
2	11.84	40577.05	50.9286
合计		79674.42	100



积分结果

#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	9.79	1086.31	1.9901
2	11.53	53498.30	98.0099
合计		54584.61	100

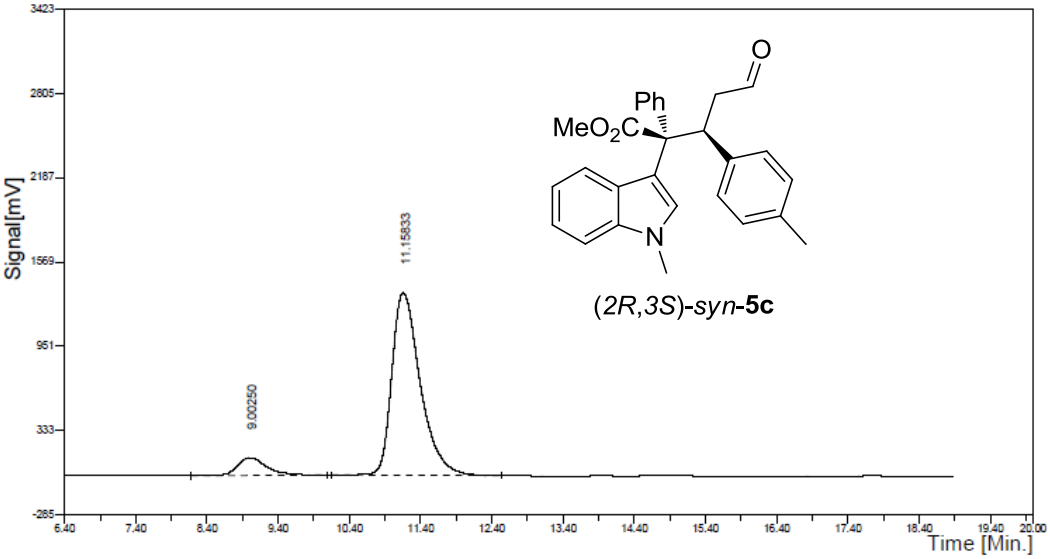
Condition: hexane/2-propanol = 10/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



rac-syn-**5c**

组分表

#	保留时间(min)	峰面积(mV.sec)	面积百分比(%)
1	9.20500	18276.51	50.1917
2	11.64250	18136.90	49.8083
合计		36413.40	100

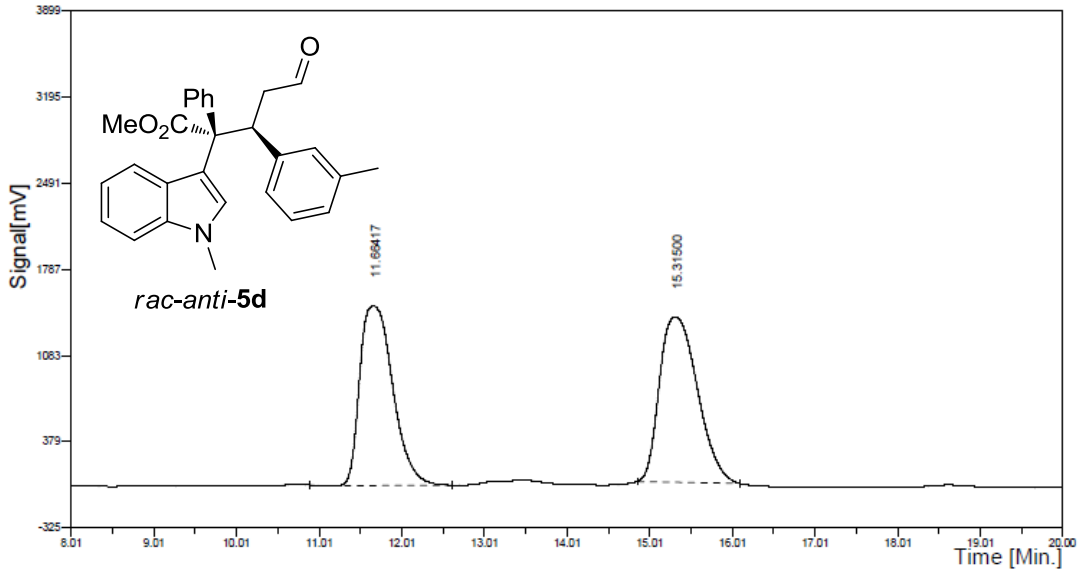


(*2R*,*3S*)-*syn*-**5c**

组分表

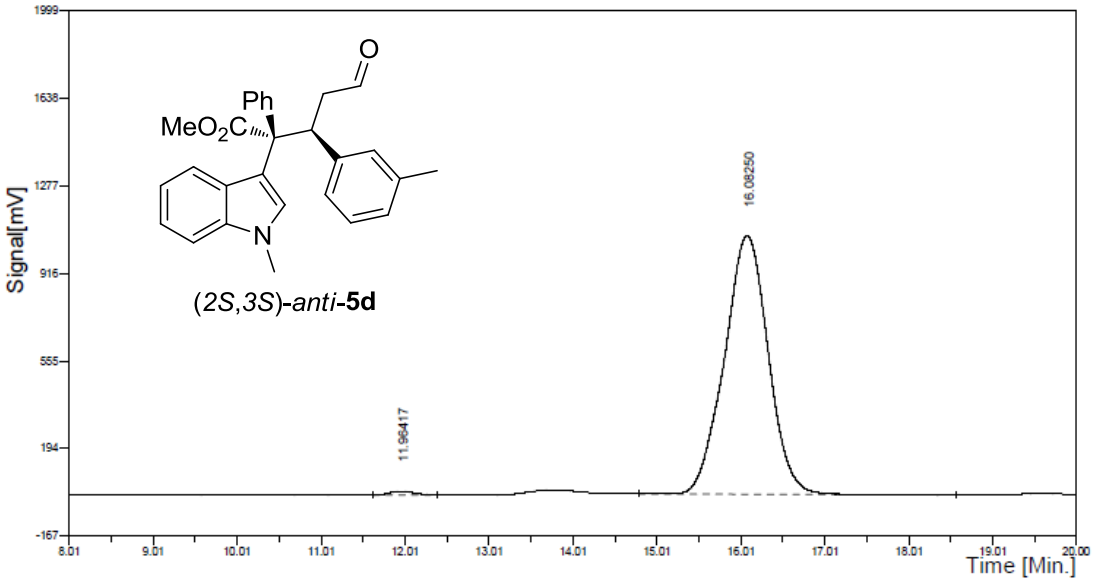
#	保留时间(min)	峰面积(mV.sec)	面积百分比(%)
1	9.00250	3737.90	9.1524
2	11.15833	37102.95	90.8476
合计		40840.85	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



组分表

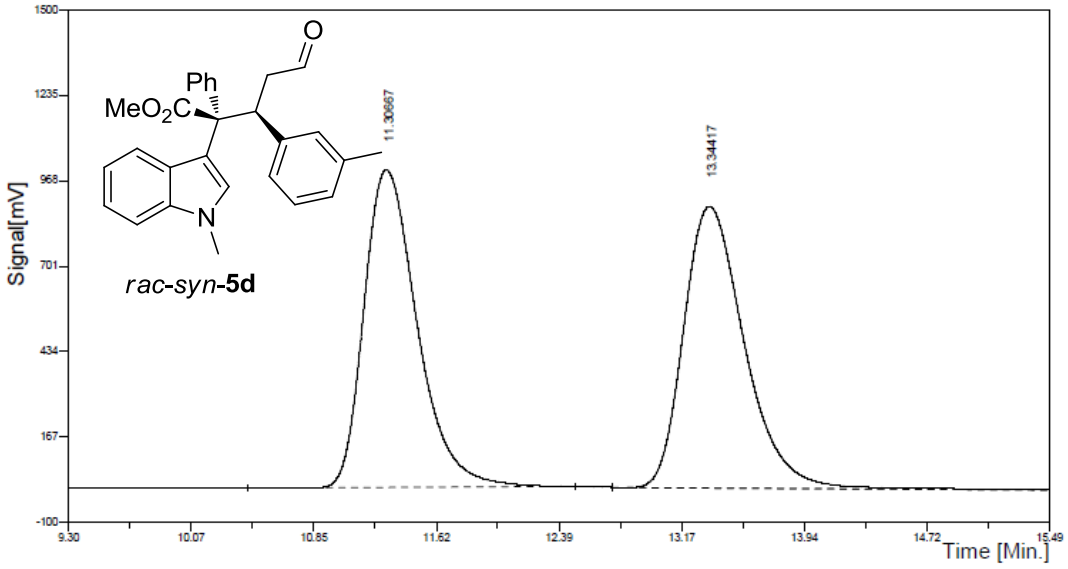
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	11. 66417	40515. 34	48. 4592
2	15. 31500	43091. 71	51. 5408
合计		83607. 05	100



组分表

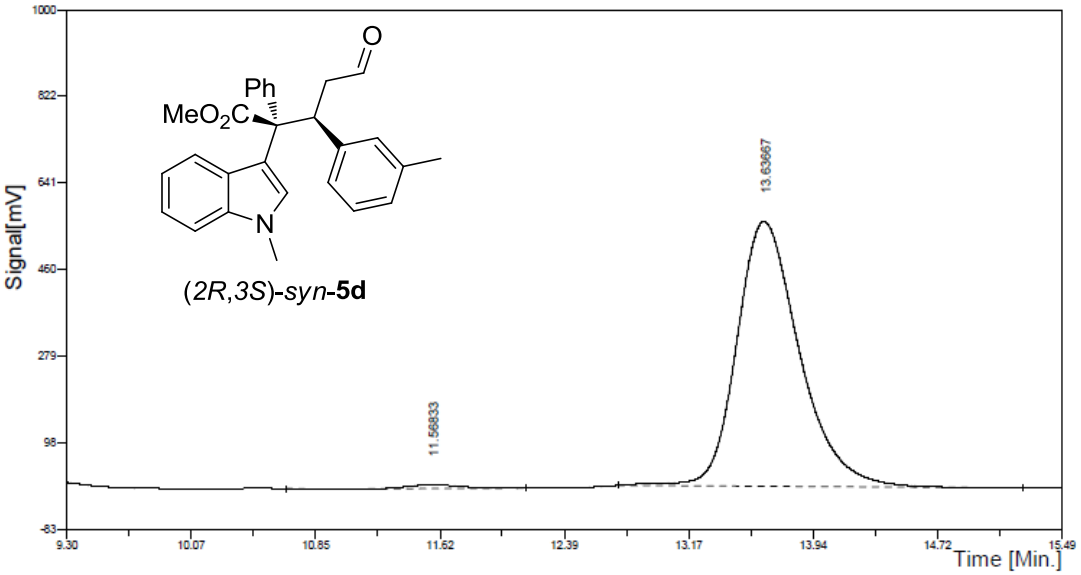
组分名	保留时间(min)	面积百分比(%)	浓 度
Unknown	11. 96417	0. 8314	0. 0000
Unknown	16. 08250	99. 1686	0. 0000
		100	

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



组分表

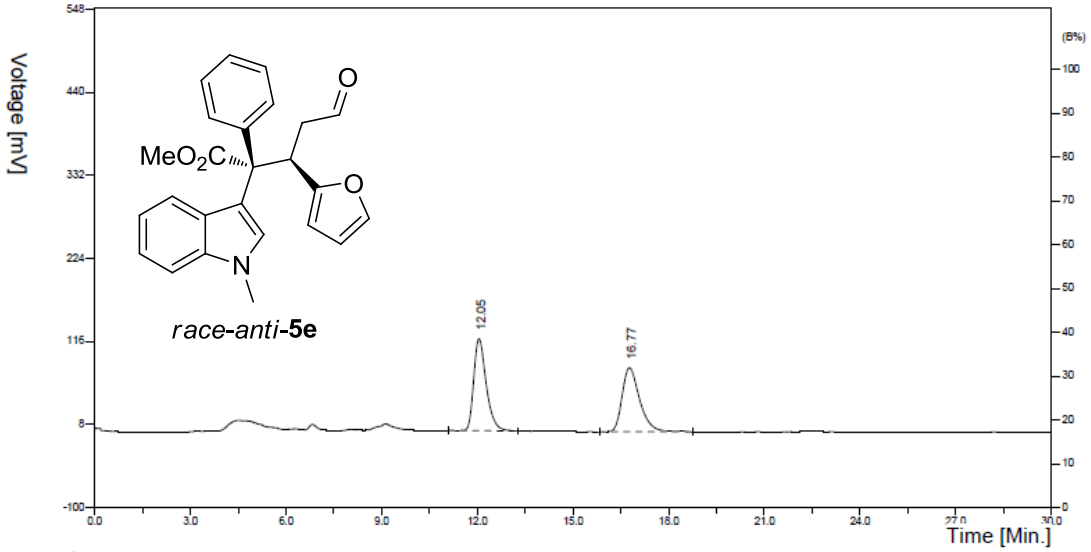
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	11. 30667	23102. 96	49. 6736
2	13. 34417	23406. 61	50. 3264
合计		46509. 57	100



组分表

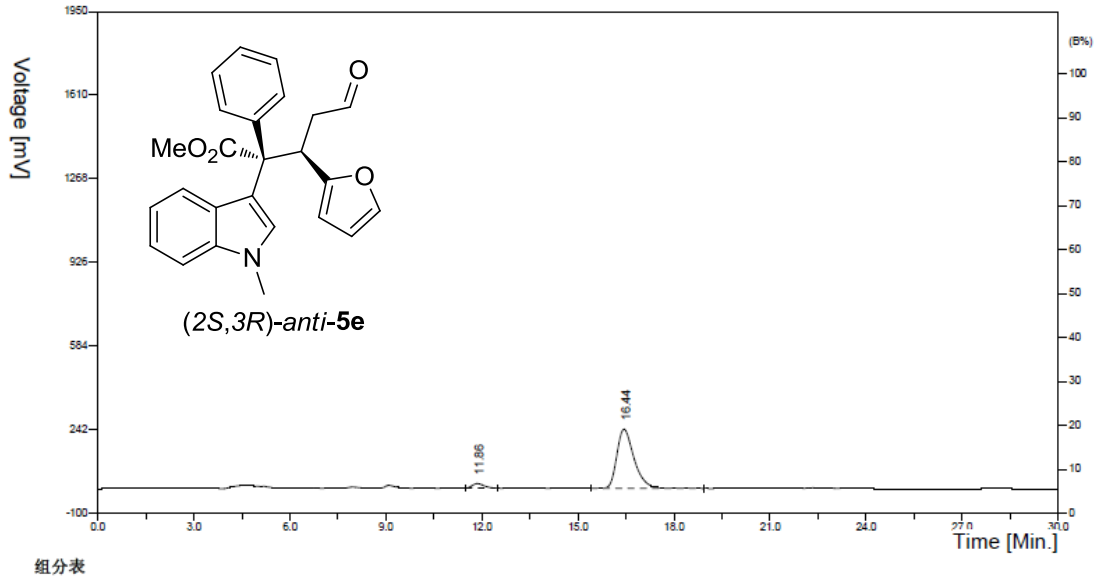
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	11. 56833	116. 29	0. 7720
2	13. 63667	14948. 69	99. 2280
合计		15064. 99	100

Condition: hexane/2-propanol = 6/1
Flow rate = 0.8 mL/min
λ = 254 nm
Chiral IC



组分表

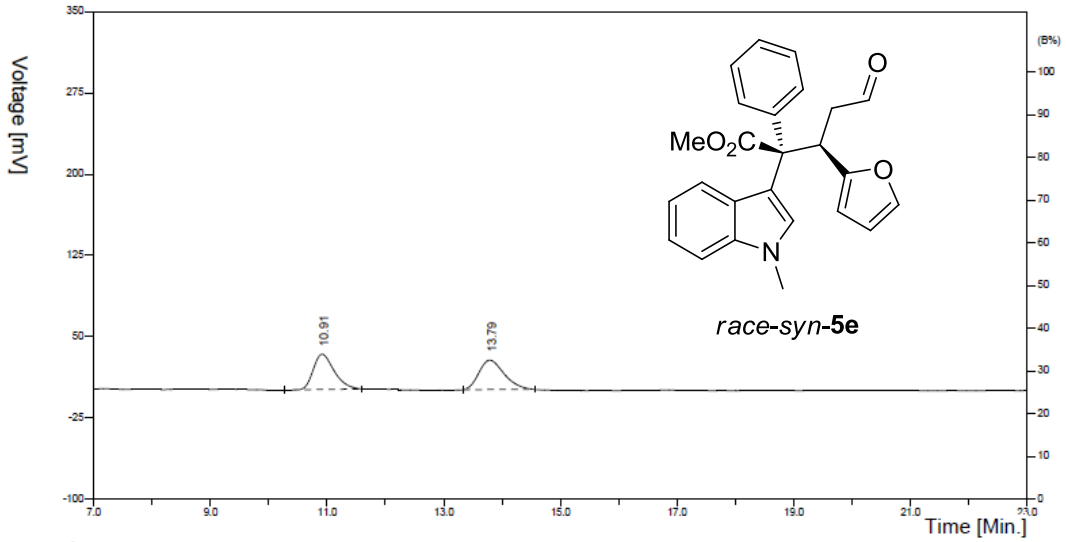
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	12.05	3250.27	50.6142
2	16.77	3171.38	49.3858
合计		6421.64	100



组分表

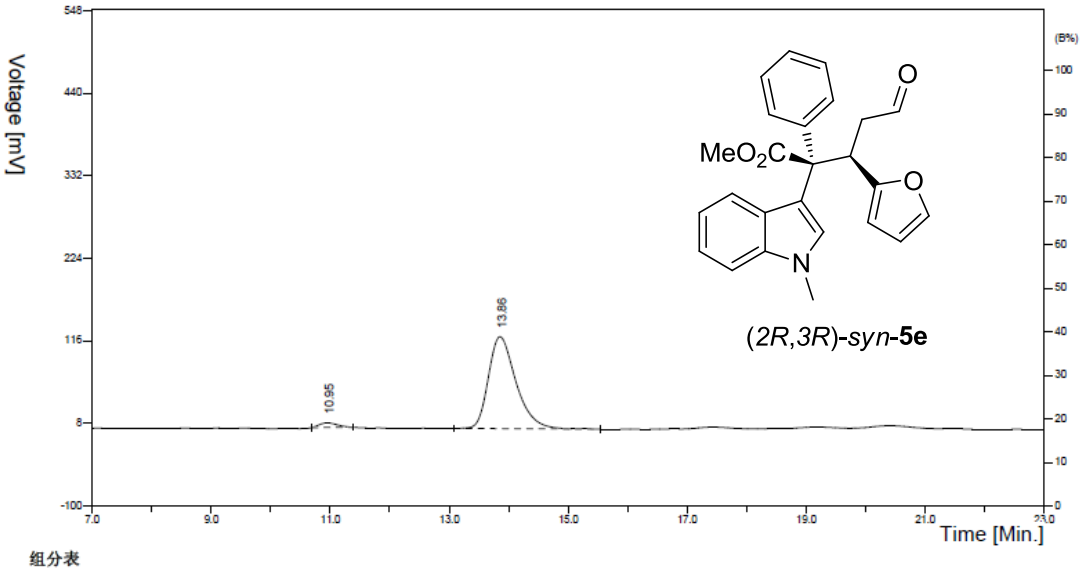
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.86	463.60	4.8163
2	16.44	9162.18	95.1837
合计		9625.78	100

Condition: hexane/2-propanol = 6/1
Flow rate = 0.8 mL/min
λ = 254 nm
Chiral IC



组分表

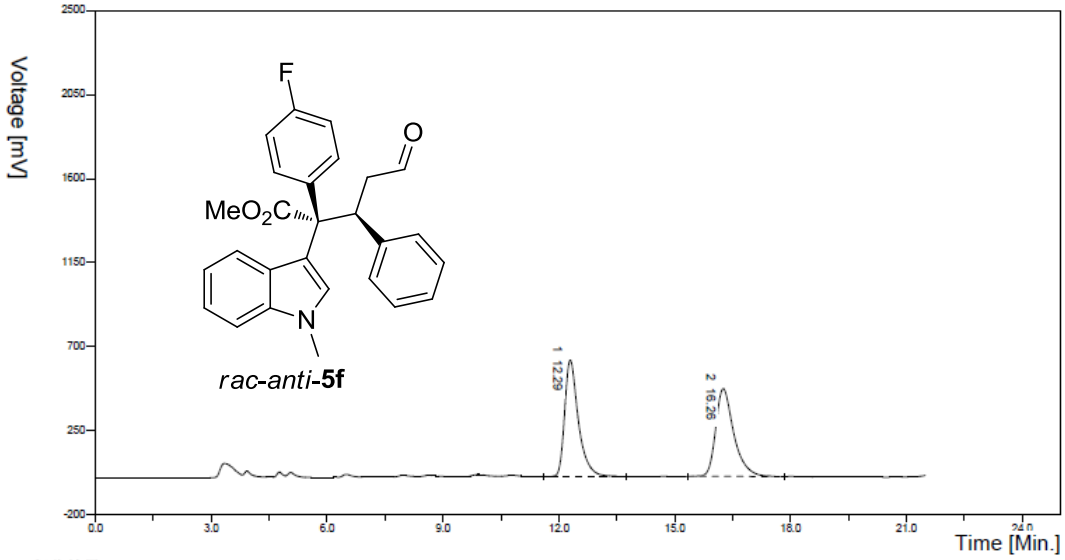
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.91	802.85	49.5783
2	13.79	816.50	50.4217
合计		1619.35	100



组分表

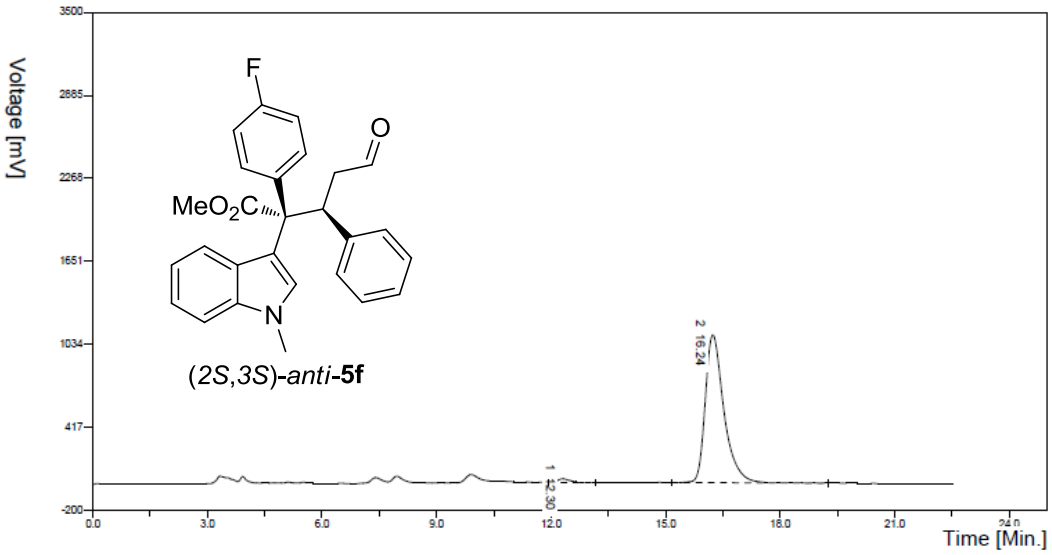
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.95	126.58	3.1709
2	13.86	3865.33	96.8291
合计		3991.91	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

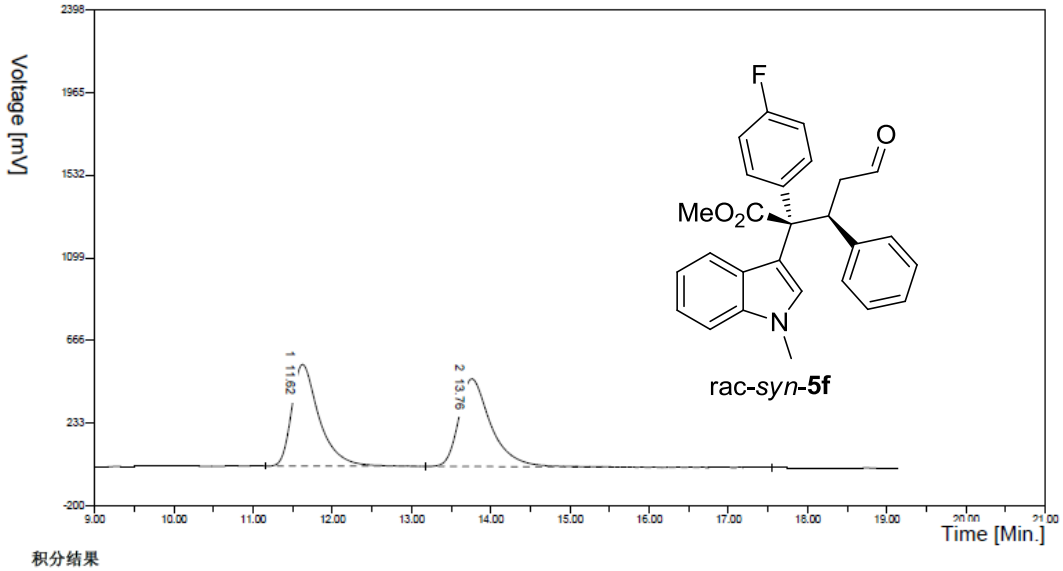
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	12.29	15257.81	49.8311
2	16.26	15361.27	50.1689
合计		30619.08	100



积分结果

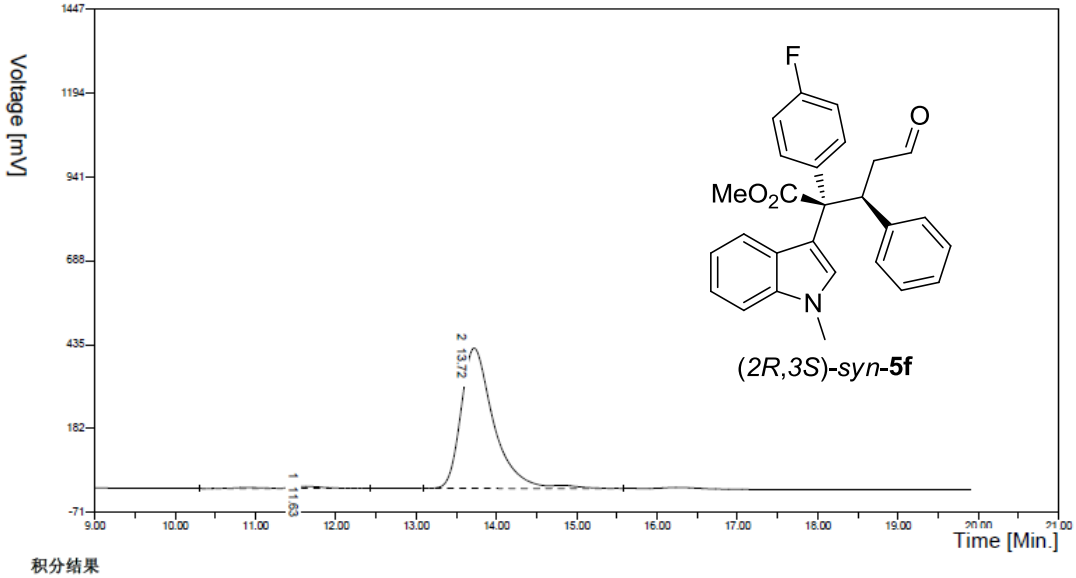
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	12.30	647.58	1.7046
2	16.24	37342.85	98.2954
合计		37990.43	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

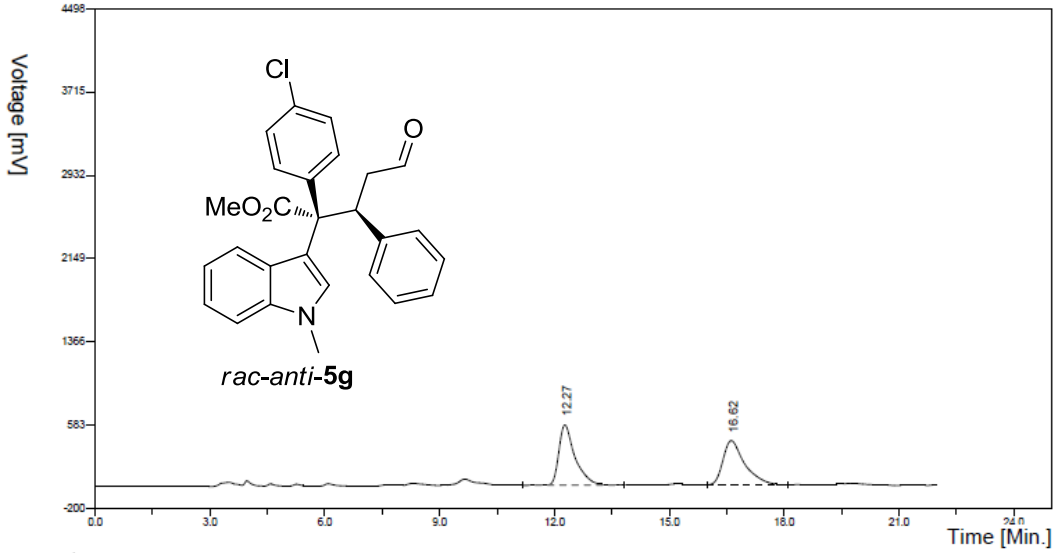
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.62	12851.87	49.9006
2	13.76	12903.05	50.0994
合计		25754.91	100



积分结果

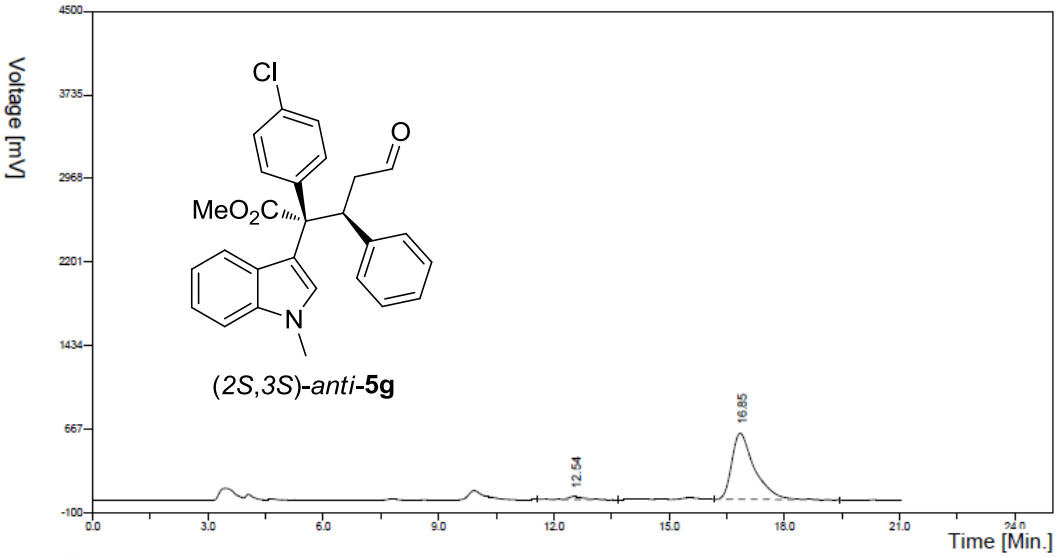
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.63	204.56	1.6688
2	13.72	12052.87	98.3312
合计		12257.43	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



组分表

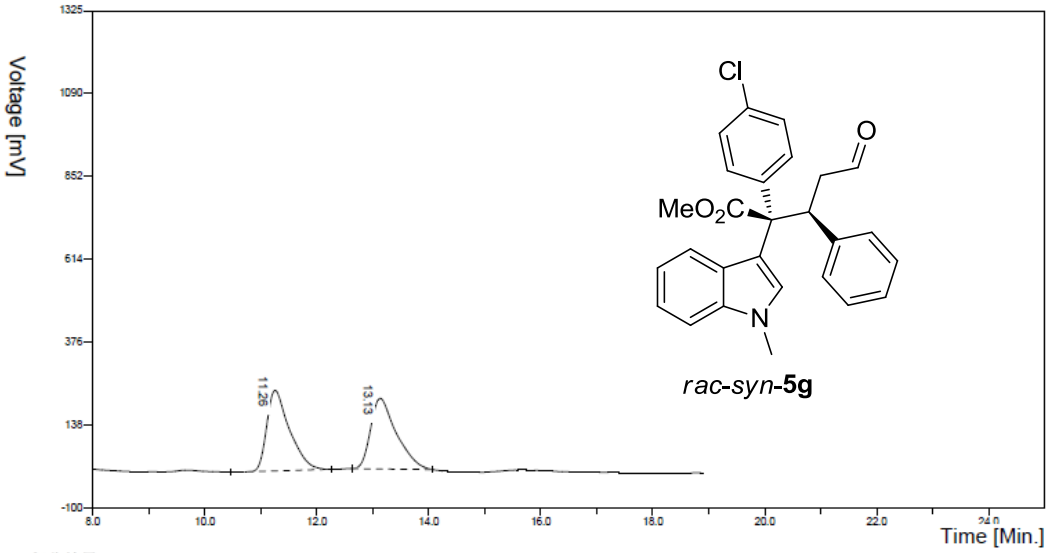
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	12.27	16627.59	50.4556
2	16.62	16327.27	49.5444
合计		32954.86	100



组分表

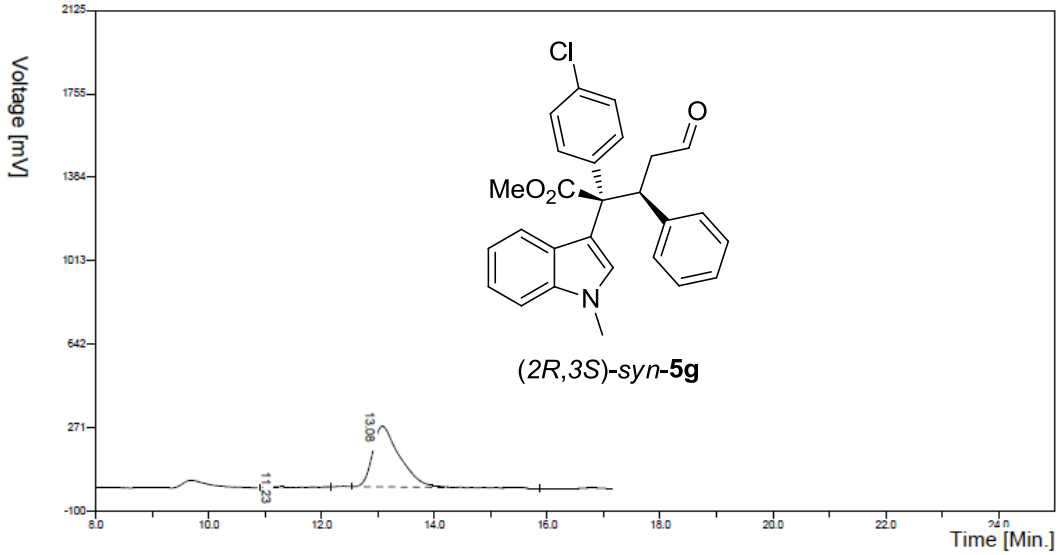
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	12.54	777.10	3.0383
2	16.85	24799.44	96.9617
合计		25576.54	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

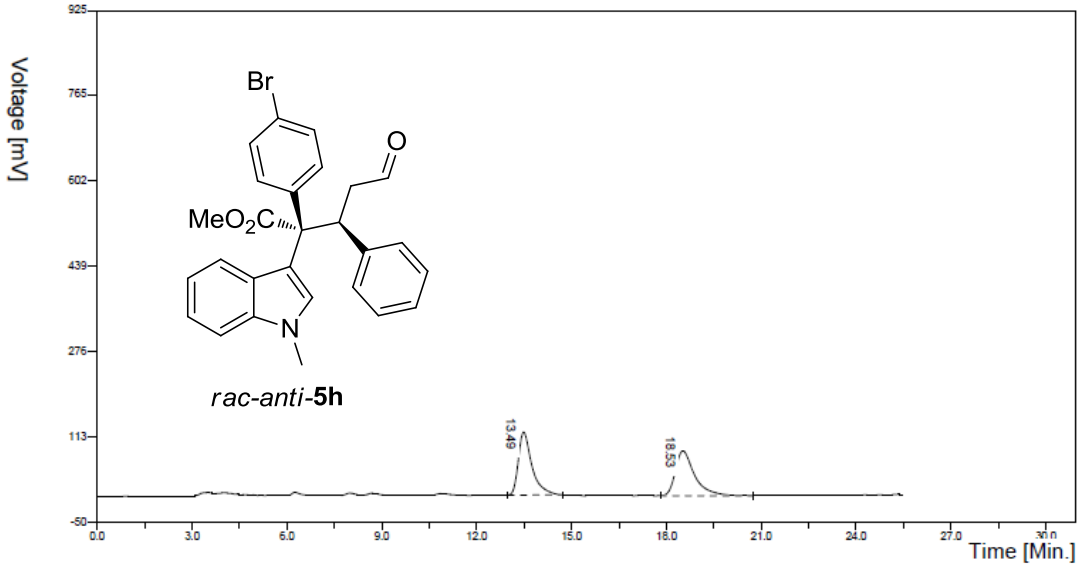
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.26	6462.40	49.9972
2	13.13	6463.11	50.0028
合计		12925.51	100



积分结果

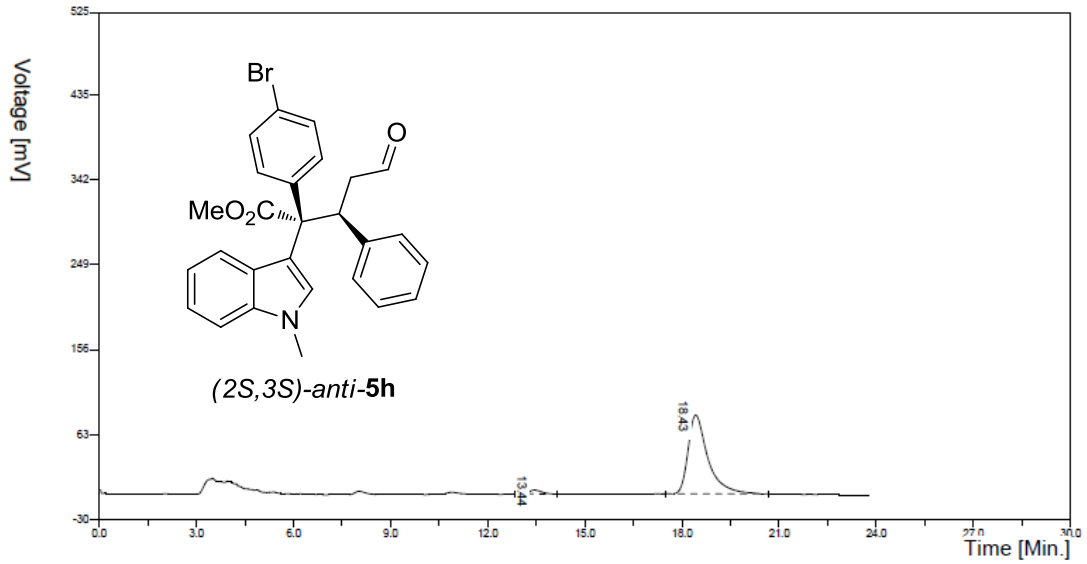
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.23	64.05	0.7146
2	13.08	8899.45	99.2854
合计		8963.50	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

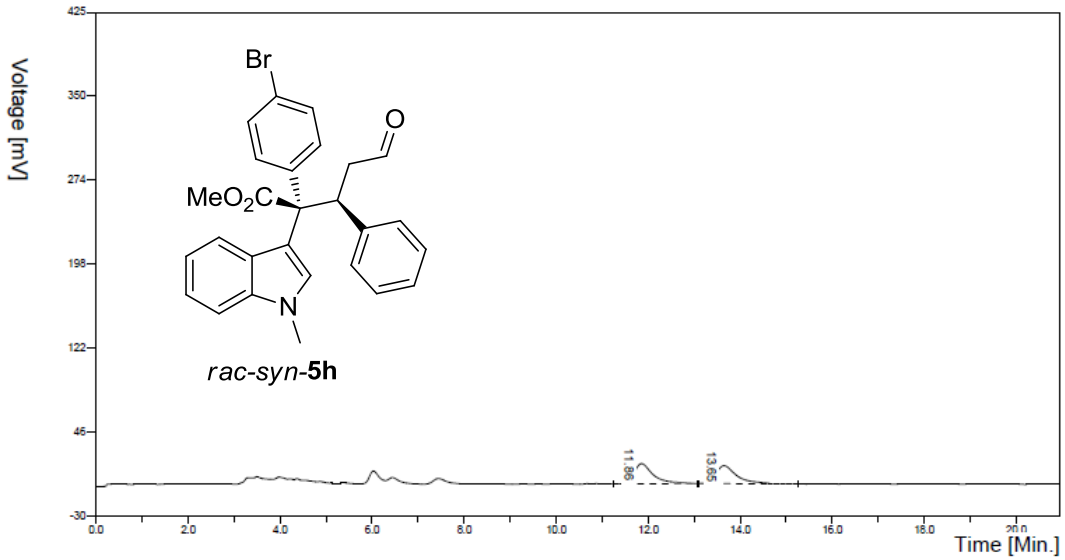
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	13.49	3599.50	49.8931
2	18.53	3614.93	50.1069
合计		7214.43	100



积分结果

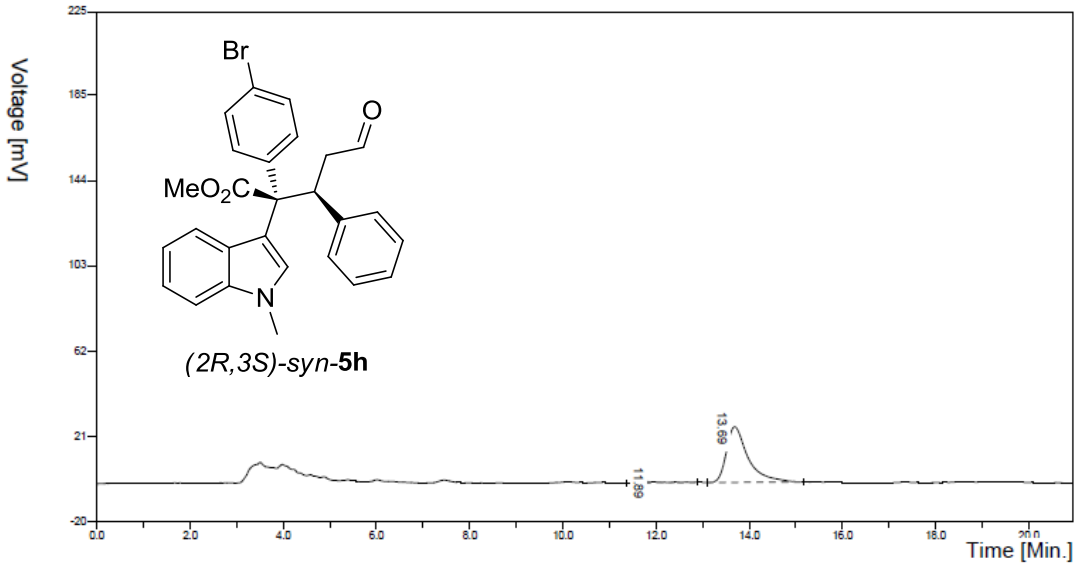
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	13.44	122.20	3.2133
2	18.43	3680.66	96.7867
合计		3802.86	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

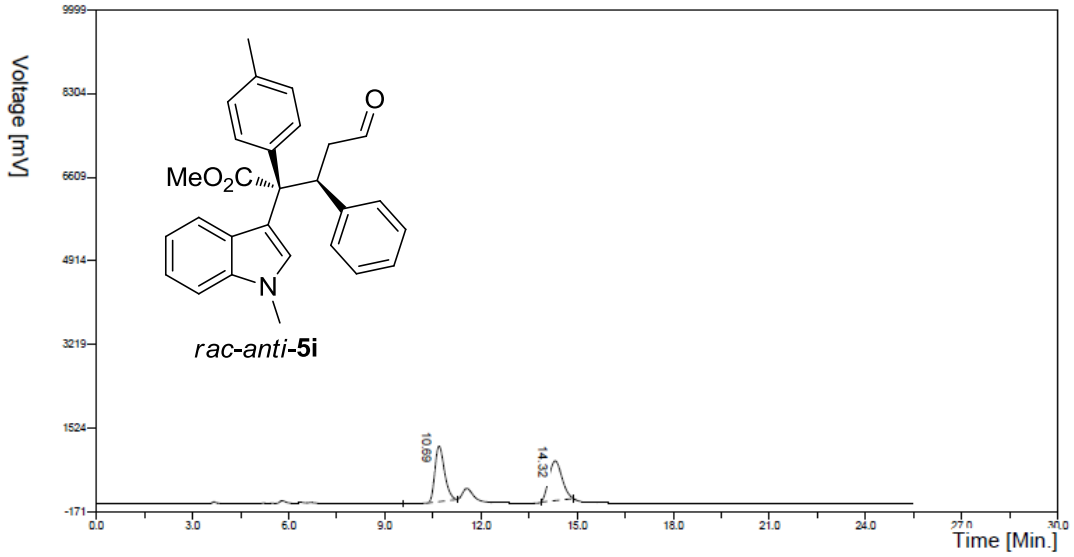
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.86	523.58	50.3718
2	13.65	515.85	49.6282
合计		1039.43	100



积分结果

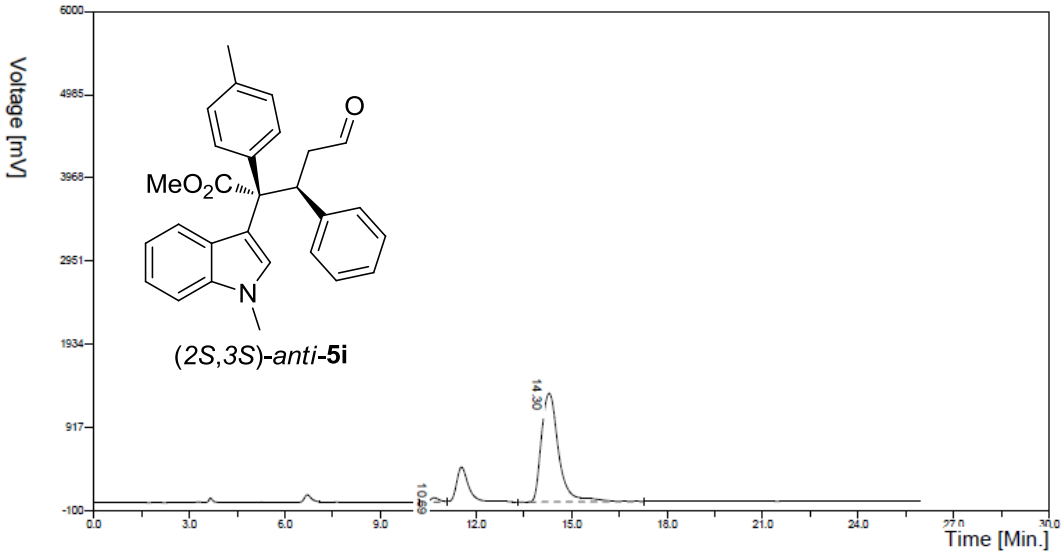
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.89	14.94	1.7025
2	13.69	862.34	98.2975
合计		877.28	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

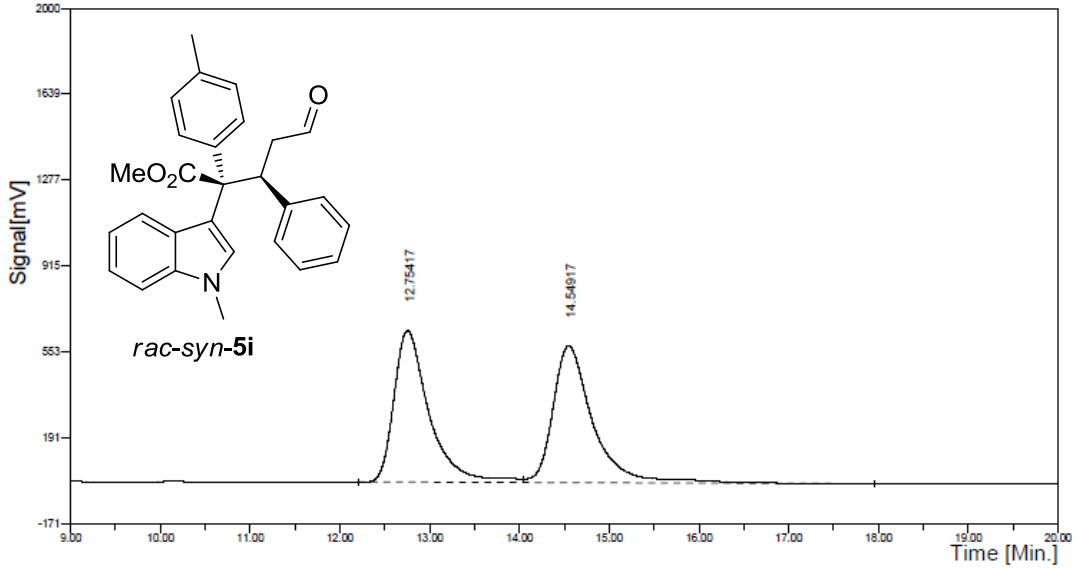
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.69	22003.70	48.9205
2	14.32	22974.76	51.0795
合计		44978.45	100



积分结果

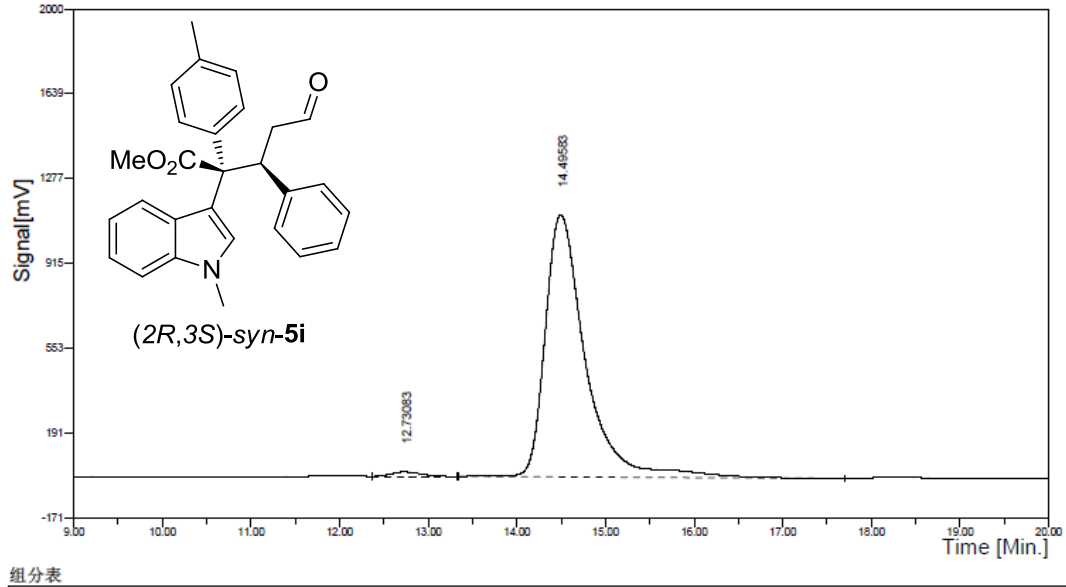
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.69	960.74	1.8800
2	14.30	50143.51	98.1200
合计		51104.26	100

Condition: hexane/2-propanol = 15/1
Flow rate = 0.8 mL/min
λ = 220 nm
Chiral IC



组分表

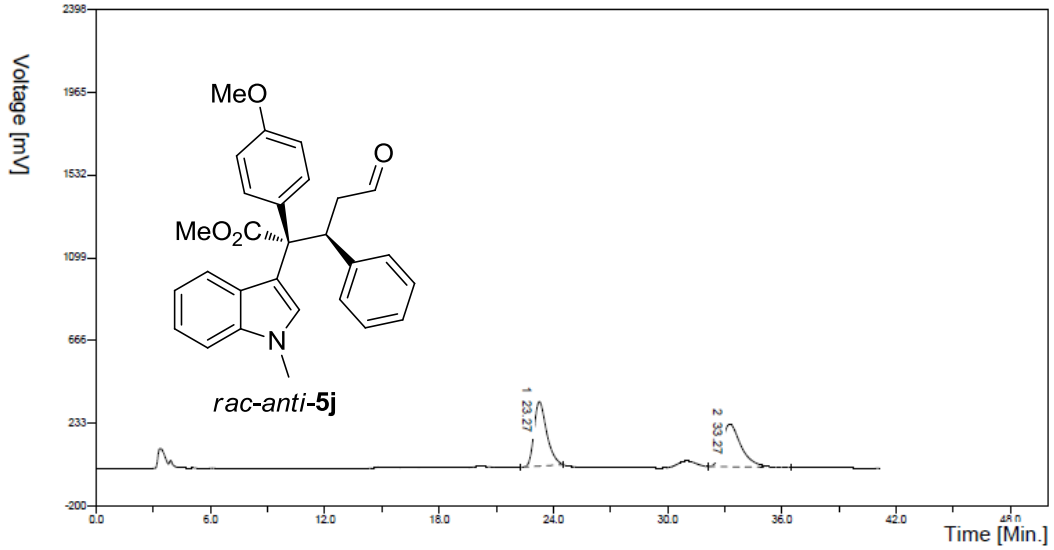
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	12. 75417	17379. 11	49. 2859
2	14. 54917	17882. 70	50. 7141
合计		35261. 81	100



组分表

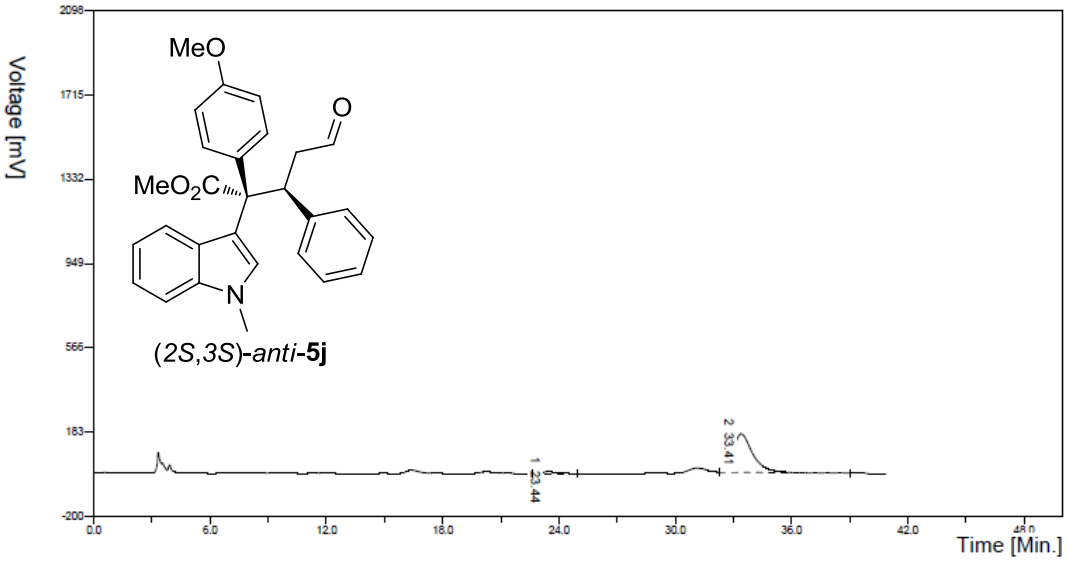
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	12. 73083	409. 75	1. 1447
2	14. 49583	35386. 26	98. 8553
合计		35796. 01	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

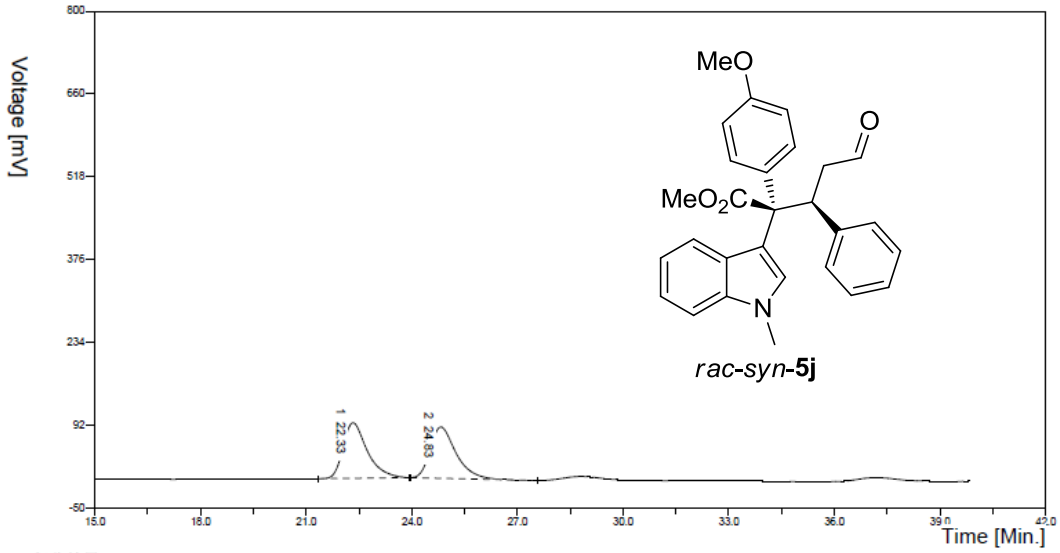
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	23.27	15591.36	50.1956
2	33.27	15469.87	49.8044
合计		31061.23	100



积分结果

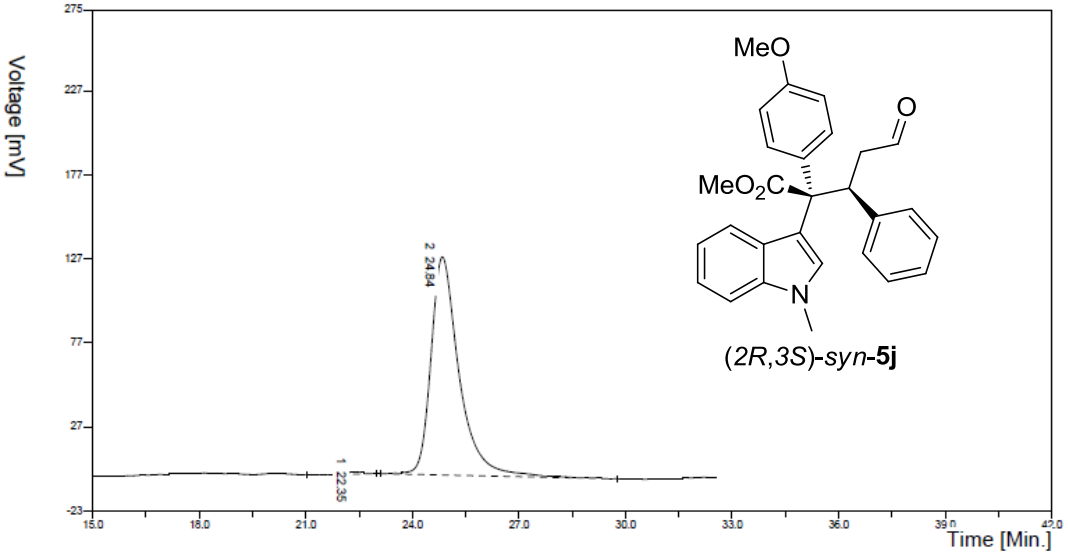
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	23.44	381.66	3.0073
2	33.41	12309.26	96.9927
合计		12690.92	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

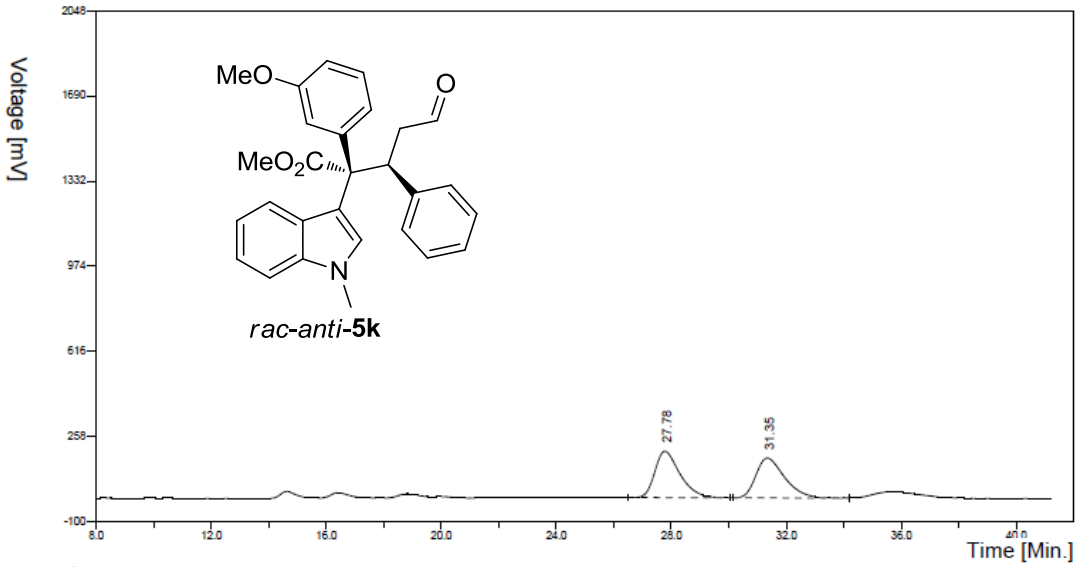
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	22.33	4523.82	50.2325
2	24.83	4481.96	49.7675
合计		9005.78	100



积分结果

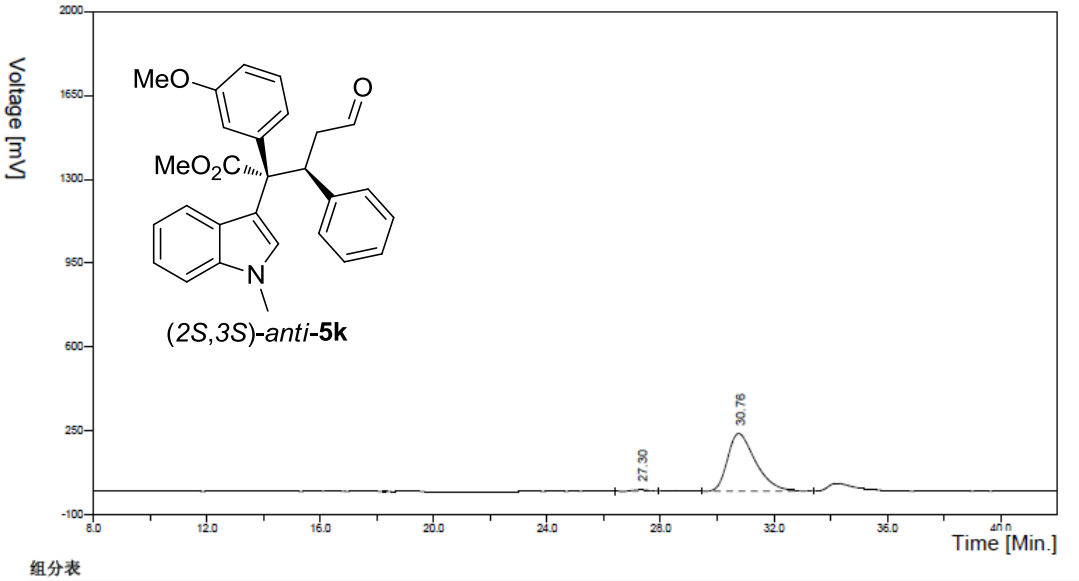
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	22.35	34.11	0.4732
2	24.84	7174.38	99.5268
合计		7208.49	100

Condition: hexane/2-propanol = 30/1
Flow rate = 0.8 mL/min
λ = 220 nm
Chiral IC



组分表

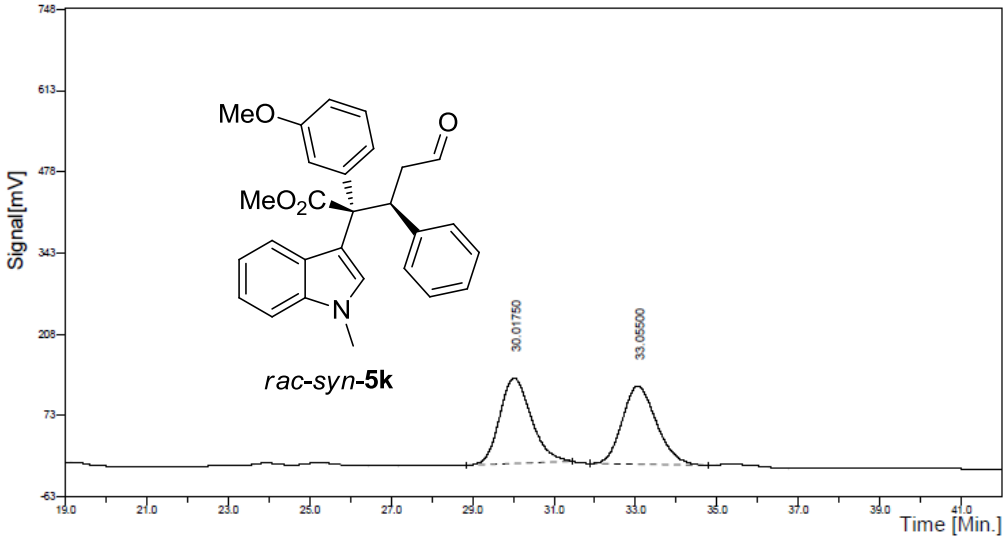
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	27.78	11853.08	50.3497
2	31.35	11688.45	49.6503
合计		23541.54	100



组分表

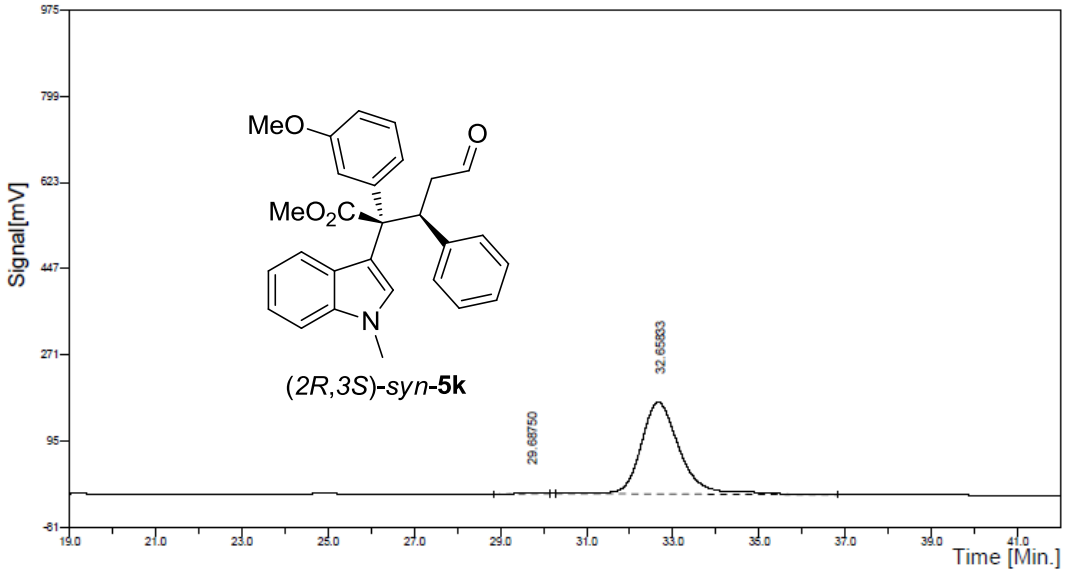
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	27.30	165.36	0.9946
2	30.76	16459.42	99.0054
合计		16624.77	100

Condition: hexane/2-propanol = 30/1
Flow rate = 0.8 mL/min
λ = 220 nm
Chiral IC



组分表

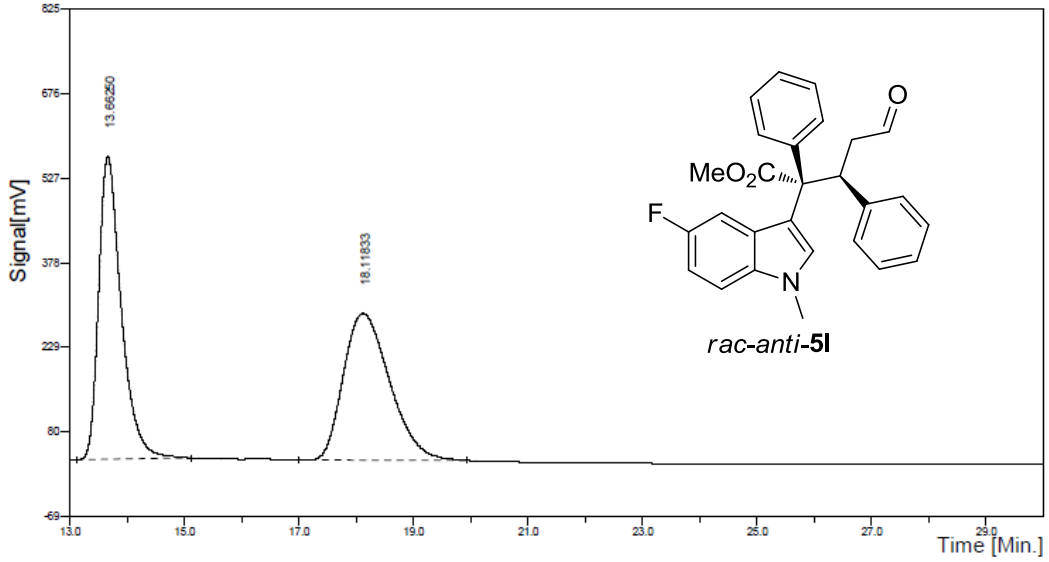
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	30. 01750	7664. 77	50. 3568
2	33. 05500	7556. 15	49. 6432
合计		15220. 93	100



组分表

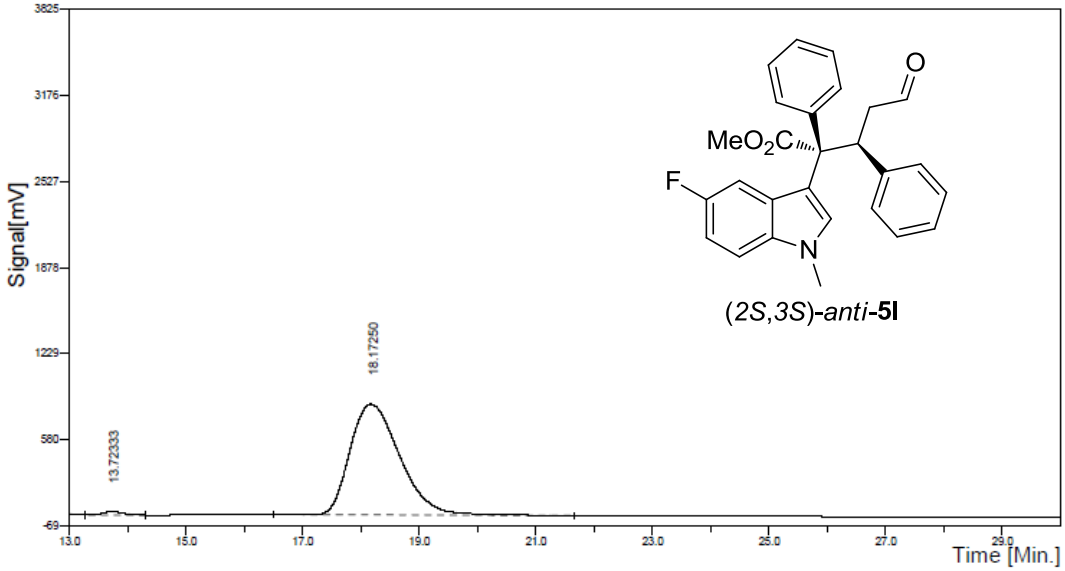
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	29. 68750	60. 20	0. 5145
2	32. 65833	11640. 37	99. 4855
合计		11700. 57	100

Condition: hexane/2-propanol = 15/1
Flow rate = 0.8 mL/min
λ = 220 nm
Chiral IC



组分表

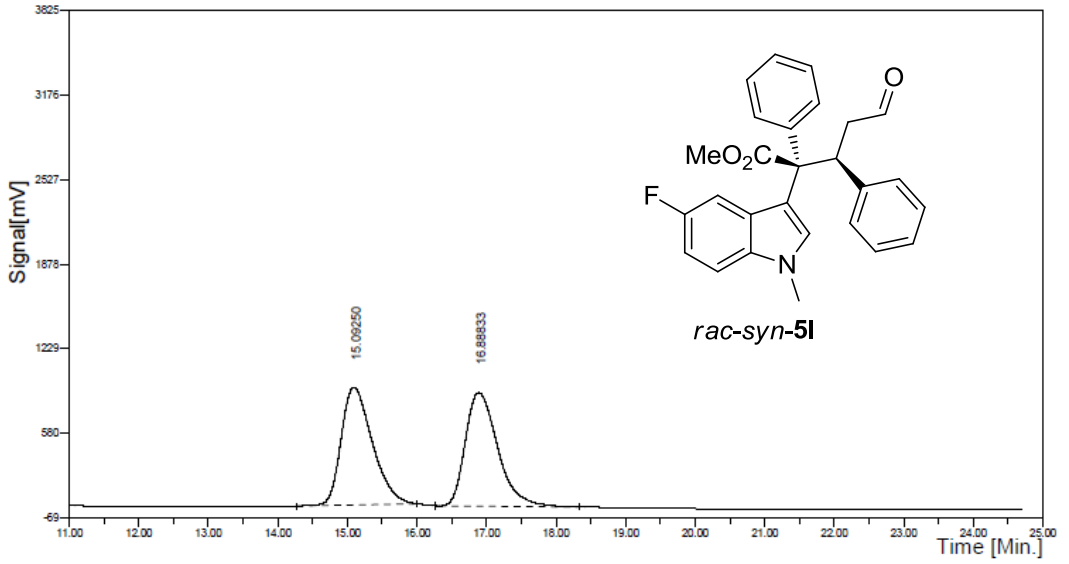
#	保留时间(min)	峰面积(mV.sec)	面积百分比(%)
1	13.66250	14593.08	50.3122
2	18.11833	14411.98	49.6878
合计		29005.05	100



组分表

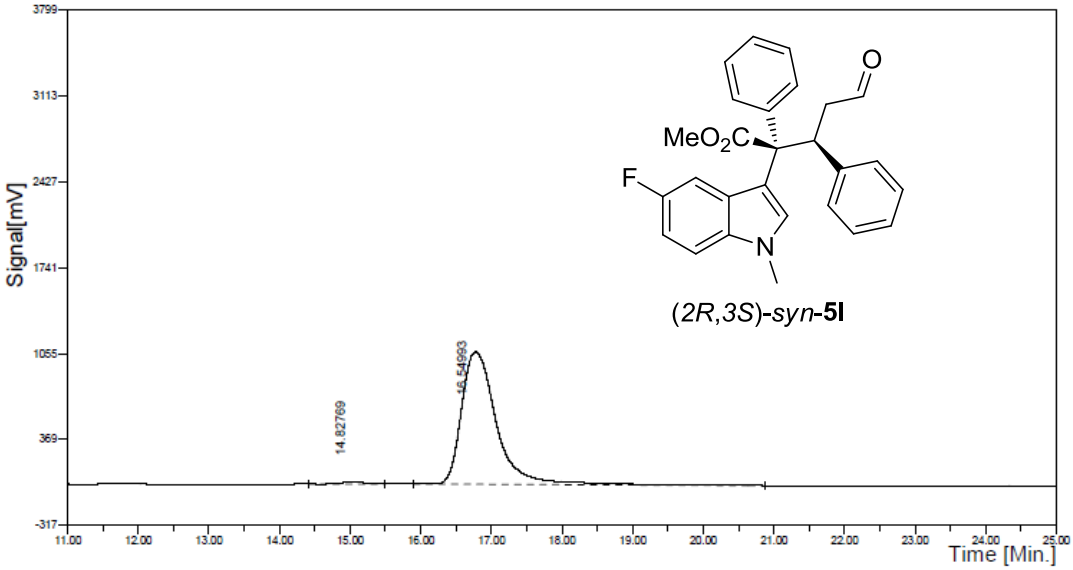
#	保留时间(min)	峰面积(mV.sec)	面积百分比(%)
1	13.72333	626.38	1.2551
2	18.17250	49280.18	98.7449
合计		49906.56	100

Condition: hexane/2-propanol = 15/1
Flow rate = 0.8 mL/min
λ = 220 nm
Chiral IC



组分表

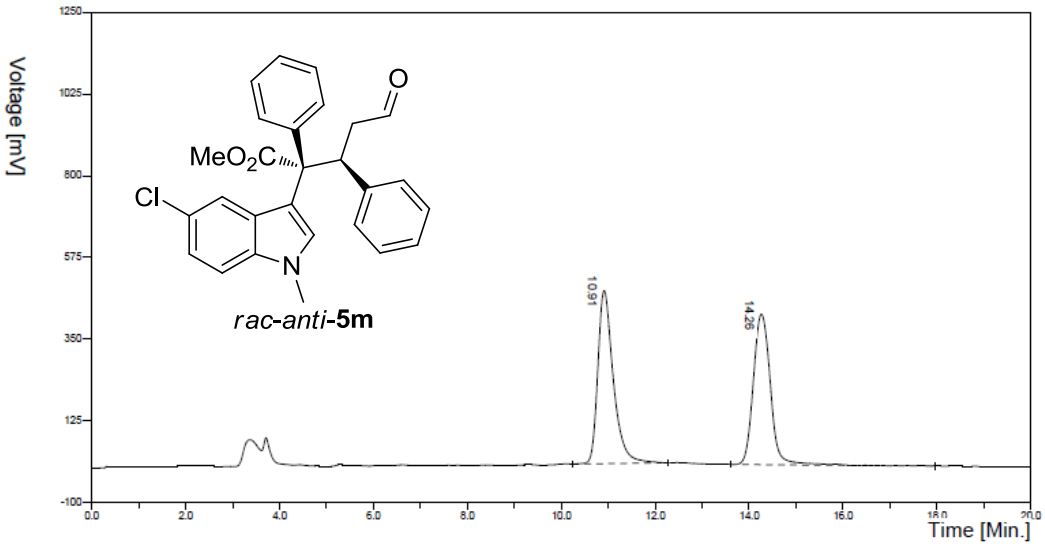
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	15. 09250	28053. 50	49. 8558
2	16. 88833	28215. 81	50. 1442
合计		56269. 31	100



组分表

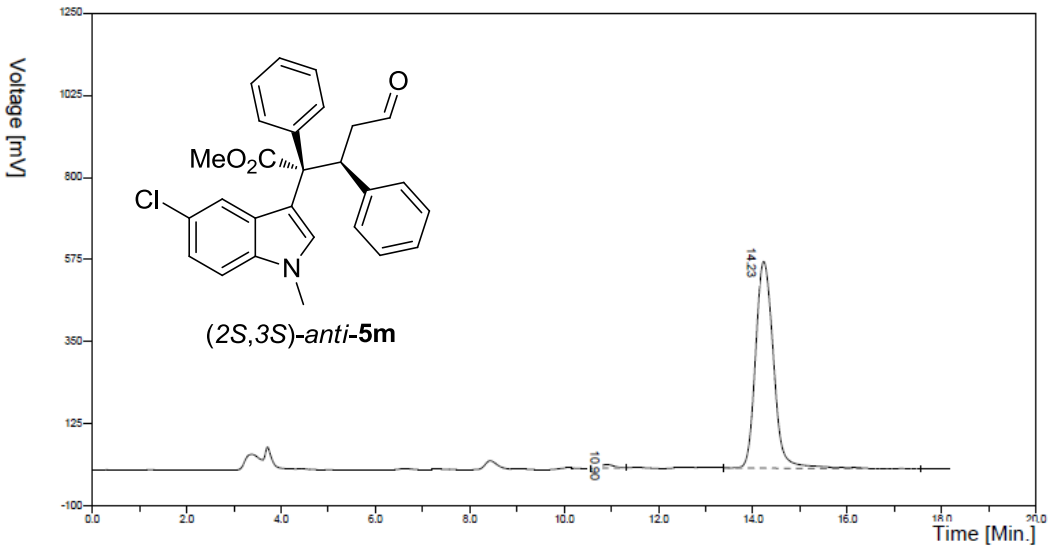
#	保留时间(min)	峰面积(mV. sec)	面积百分比(%)
1	14. 82769	365. 38	1. 0062
2	16. 54993	35946. 78	98. 9938
合计		36312. 16	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

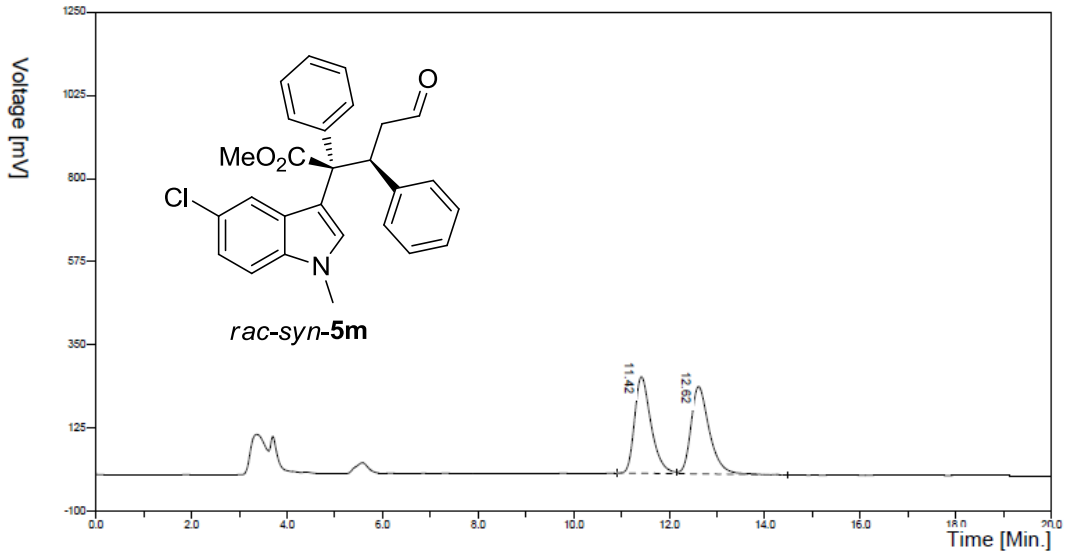
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.91	10949.18	51.0287
2	14.26	10507.72	48.9713
合计		21456.90	100



积分结果

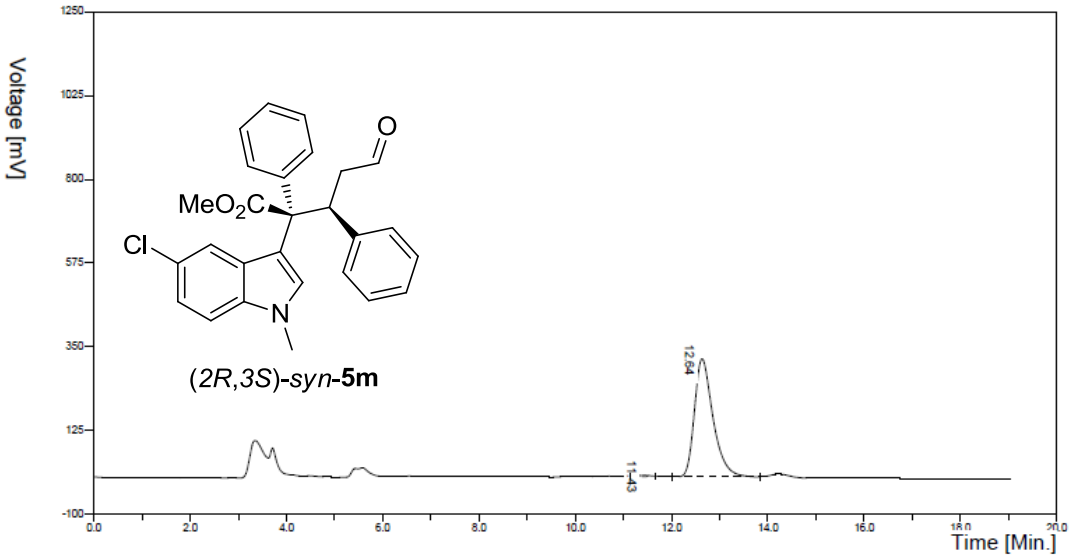
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.90	187.25	1.2310
2	14.23	15024.59	98.7690
合计		15211.84	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

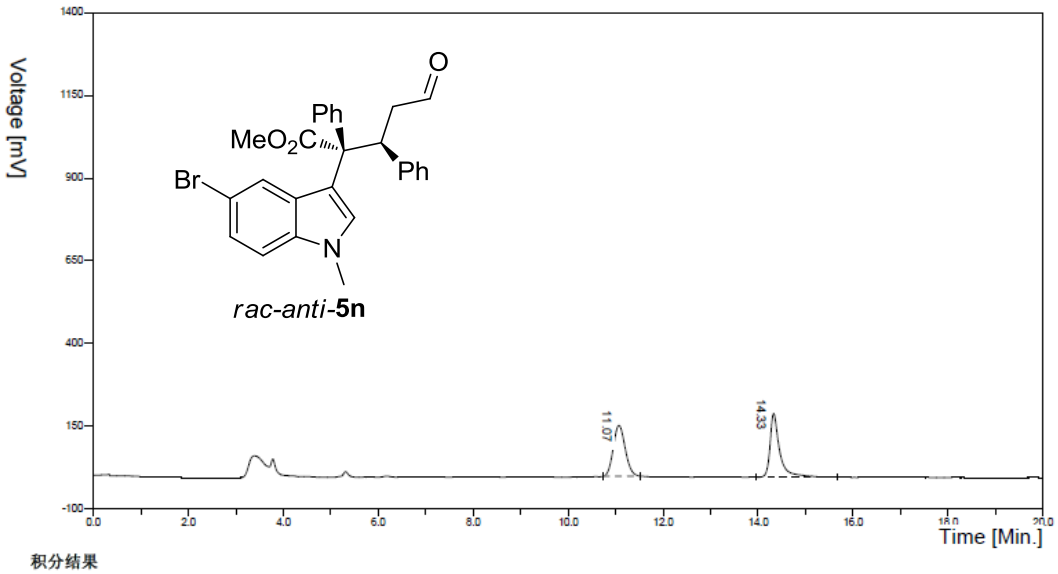
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.42	6297.25	49.8251
2	12.62	6341.45	50.1749
合计		12638.70	100



积分结果

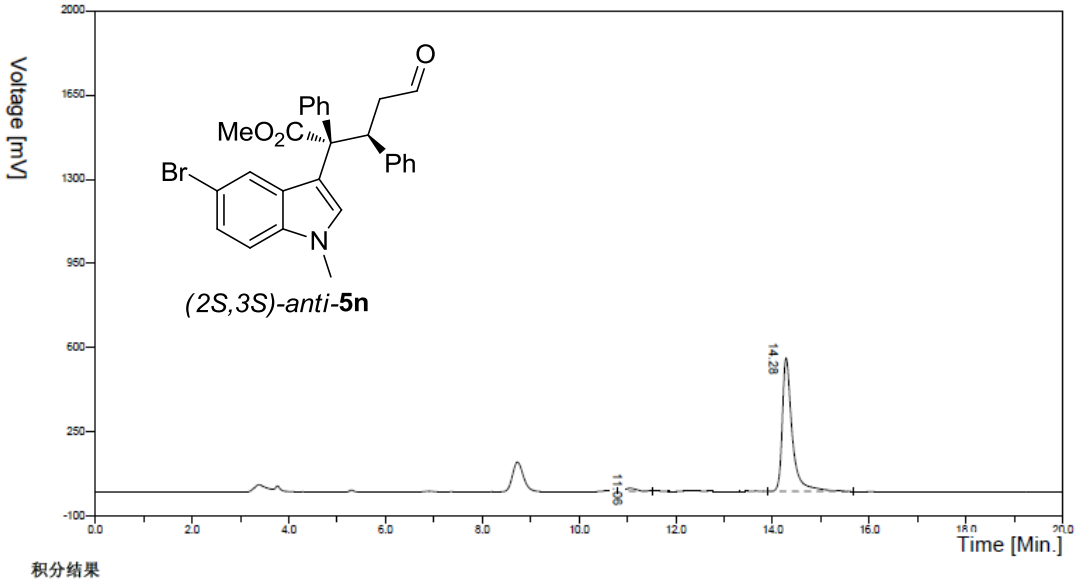
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.43	51.53	0.5995
2	12.64	8544.32	99.4005
合计		8595.85	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

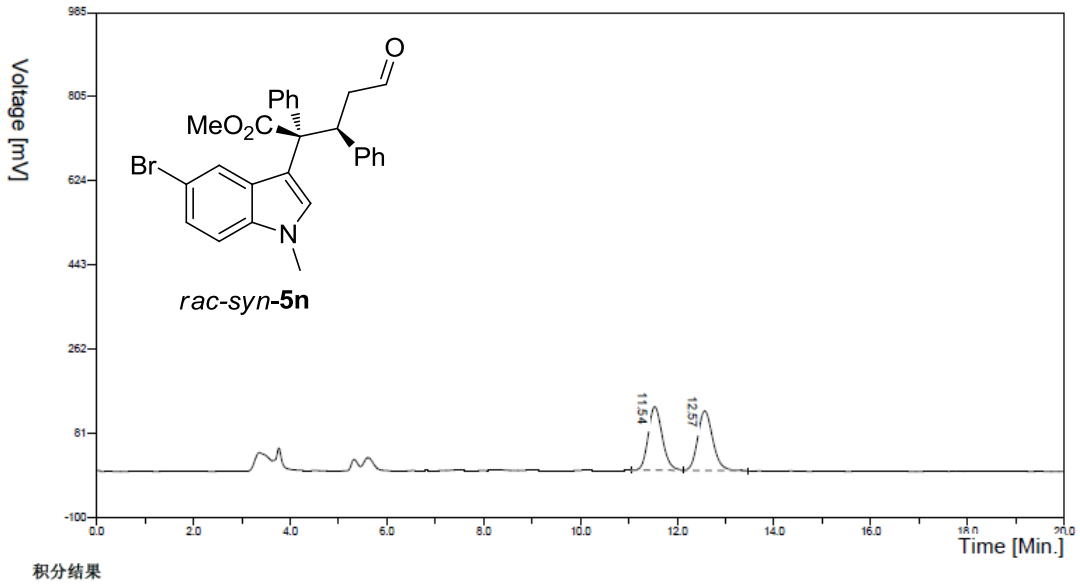
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.07	2692.48	49.5290
2	14.33	2743.69	50.4710
合计		5436.17	100



积分结果

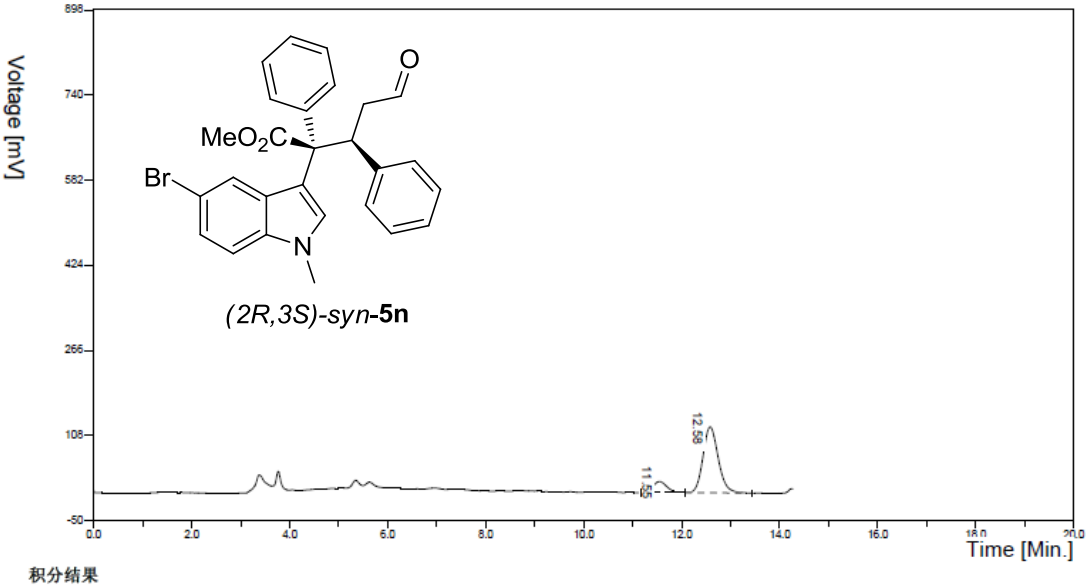
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.06	198.71	2.4483
2	14.28	7917.39	97.5517
合计		8116.10	100

Condition: hexane/2-propanol = 15/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

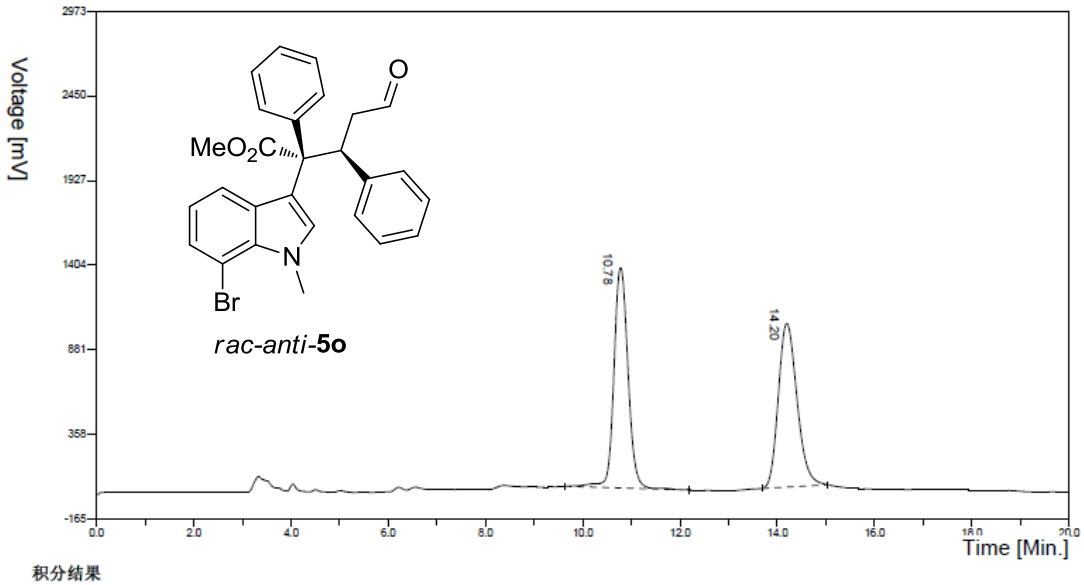
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.54	2763.83	49.9505
2	12.57	2769.31	50.0495
合计		5533.14	100



积分结果

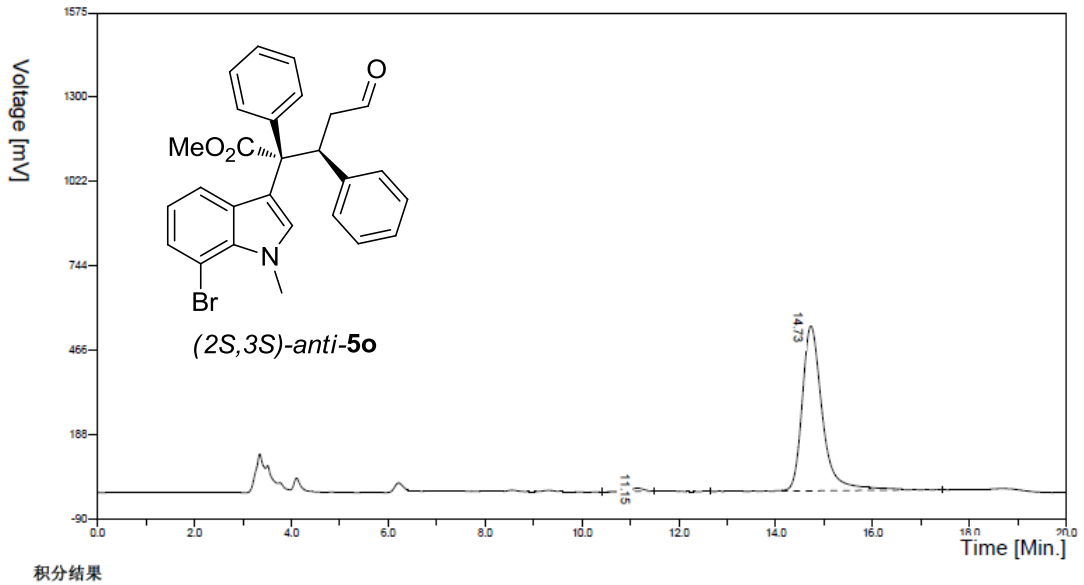
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.55	409.57	13.3920
2	12.58	2648.76	86.6080
合计		3058.33	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

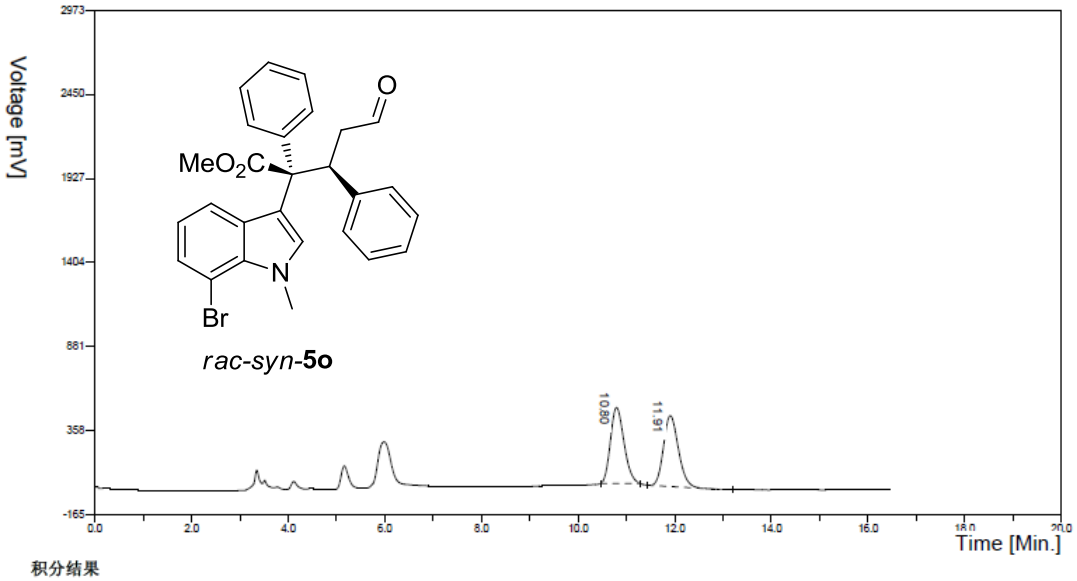
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.78	27555.32	50.4578
2	14.20	27055.29	49.5422
合计		54610.61	100



积分结果

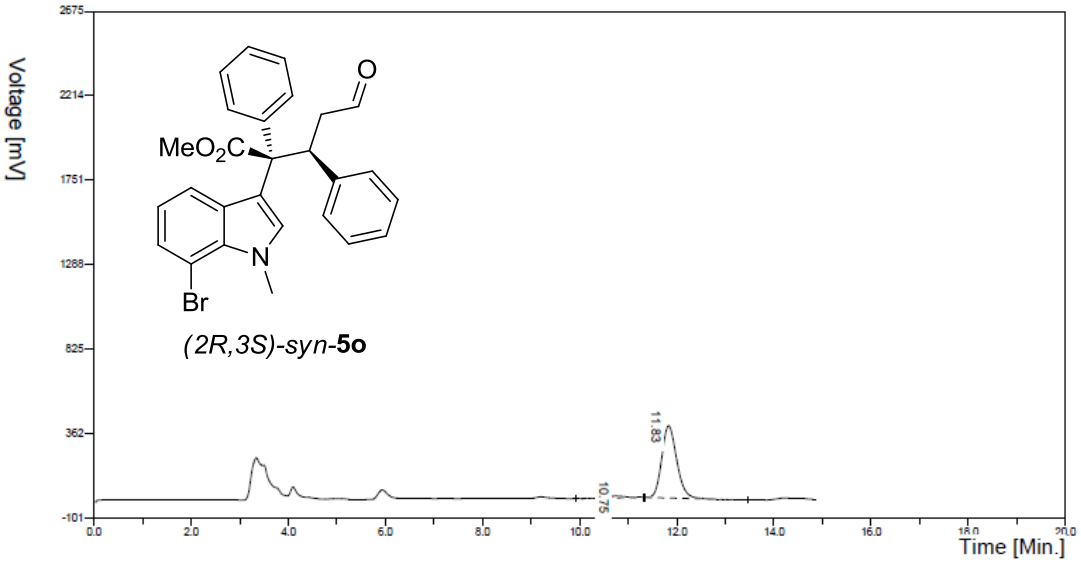
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.15	180.18	1.1311
2	14.73	15749.96	98.8689
合计		15930.14	100

Condition: hexane/2-propanol = 30/1
Flow rate = 1.0 mL/min
λ = 220 nm
Chiral IC



积分结果

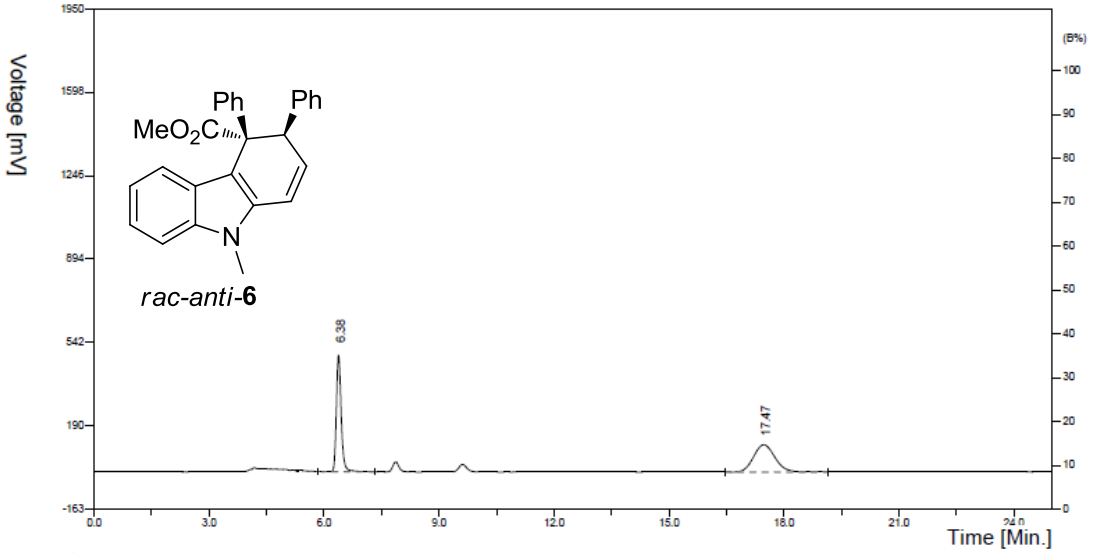
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.80	9242.73	49.8410
2	11.91	9301.70	50.1590
合计		18544.42	100



积分结果

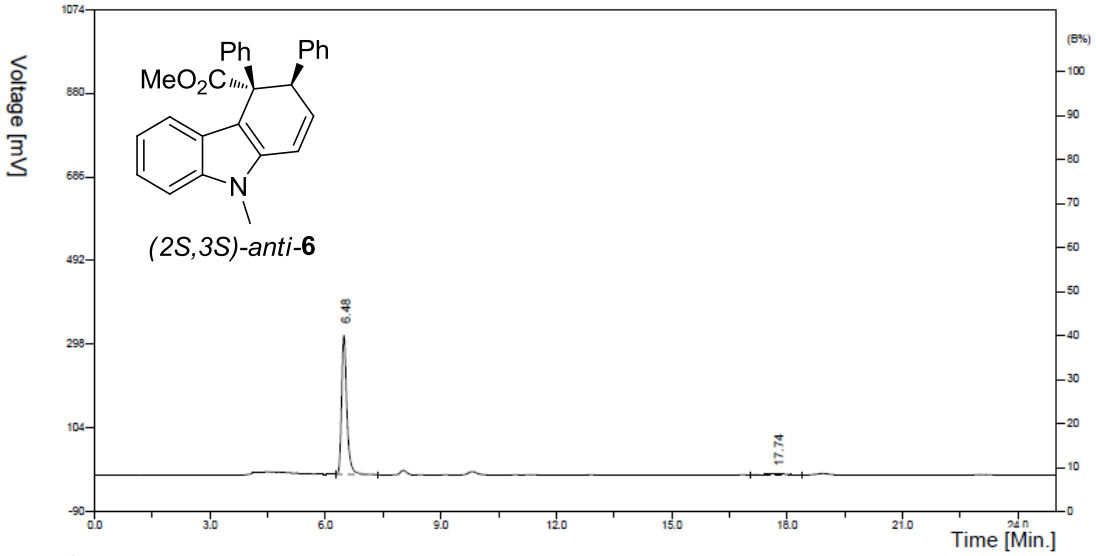
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.75	269.23	3.0804
2	11.83	8470.92	96.9196
合计		8740.16	100

Condition: hexane/2-propanol = 10/1
Flow rate = 1.0 mL/min
λ = 254 nm
Chiral IC



组分表

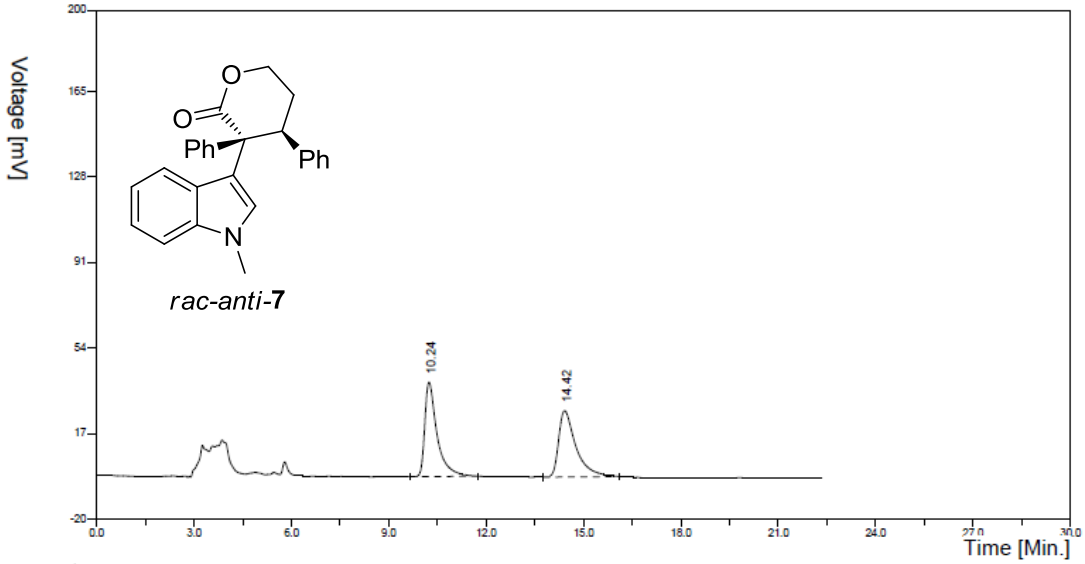
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	6.38	4351.19	49.2084
2	17.47	4491.18	50.7916
合计		8842.37	100



组分表

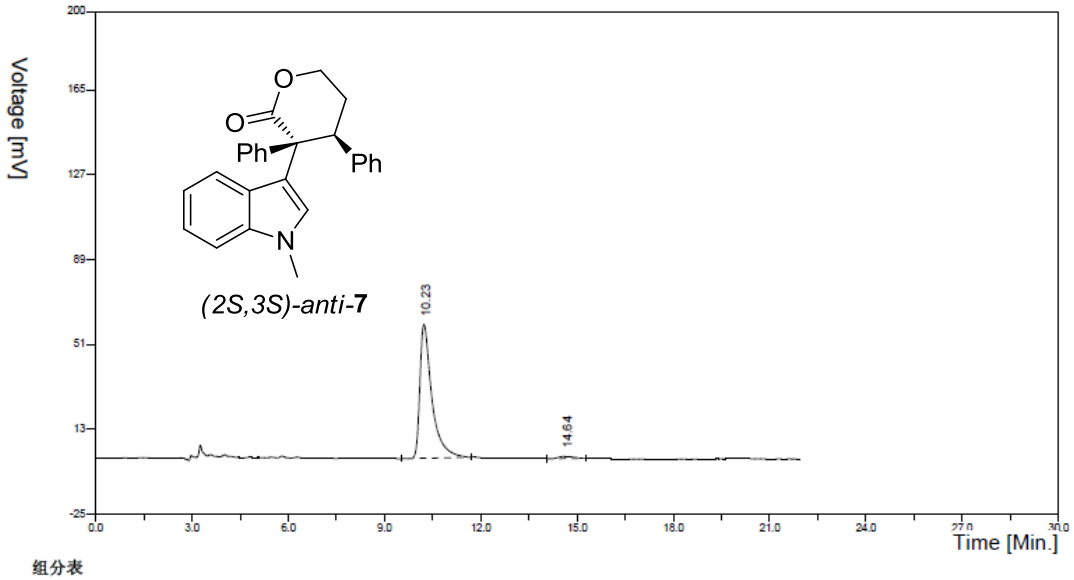
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	6.48	3064.16	98.0112
2	17.74	62.18	1.9888
合计		3126.34	100

Condition: hexane/2-propanol = 4/1
Flow rate = 1.0 mL/min
λ = 254 nm
Chiral IA



组分表

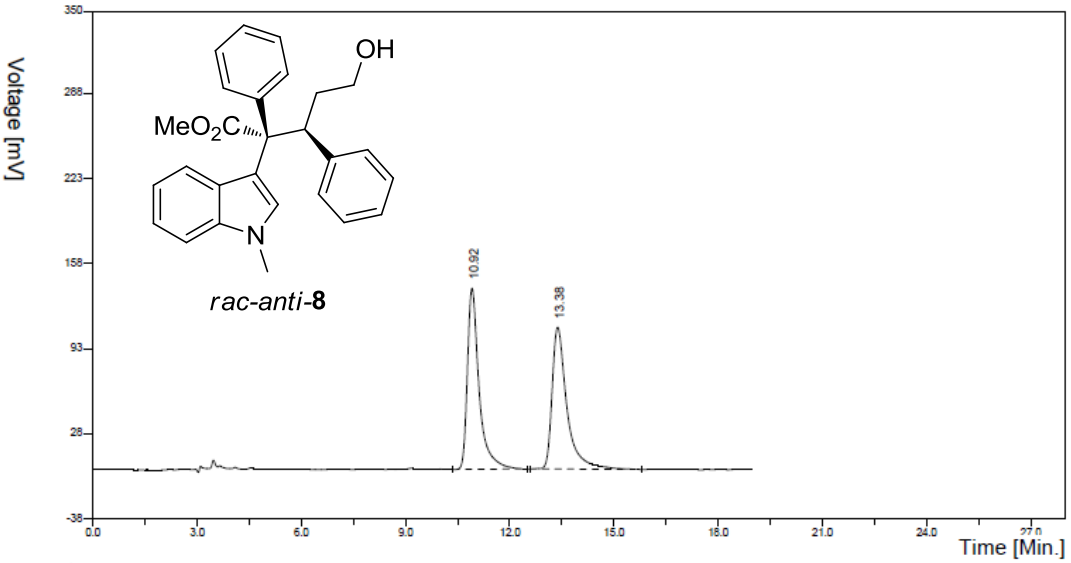
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.24	1074.31	50.2668
2	14.42	1062.90	49.7332
合计		2137.21	100



组分表

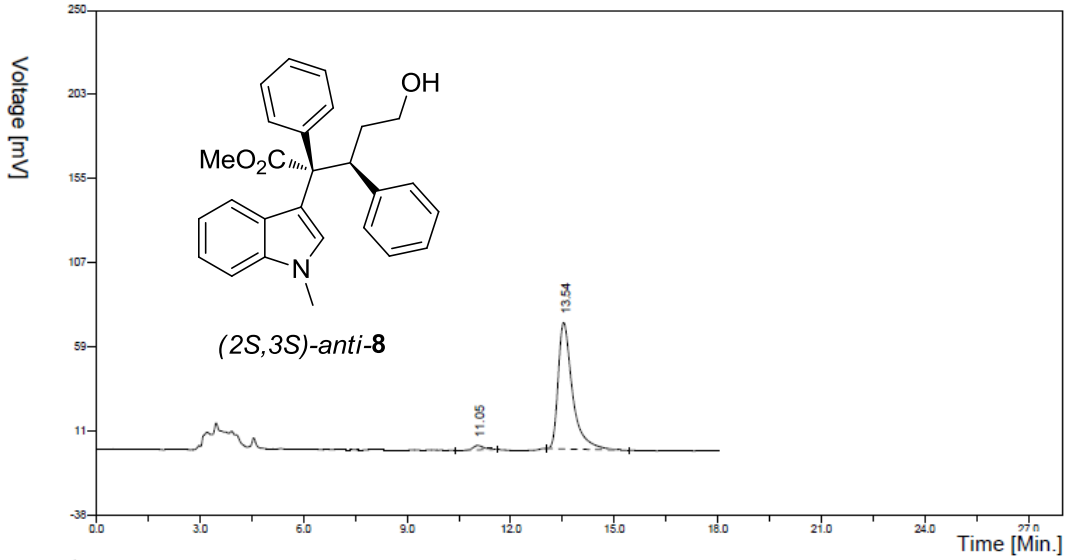
#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.23	1560.31	97.8878
2	14.64	33.67	2.1122
合计		1593.98	100

Condition: hexane/2-propanol = 10/1
Flow rate = 1.0 mL/min
λ = 254 nm
Chiral IA



组分表

#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	10.92	3233.02	50.2068
2	13.38	3206.38	49.7932
合计		6439.40	100



组分表

#	保留时间(min)	峰面积(mv.sec)	面积百分比(%)
1	11.05	50.87	2.3931
2	13.54	2074.73	97.6069
合计		2125.60	100