Supporting Information for

Highly Enantioselective Zn(BINOL)-Catalyzed Alkynylation of α-Ketoimine Ester: A New Entry to Optically Active Quaternary α-CF_3 α-Amino Acids

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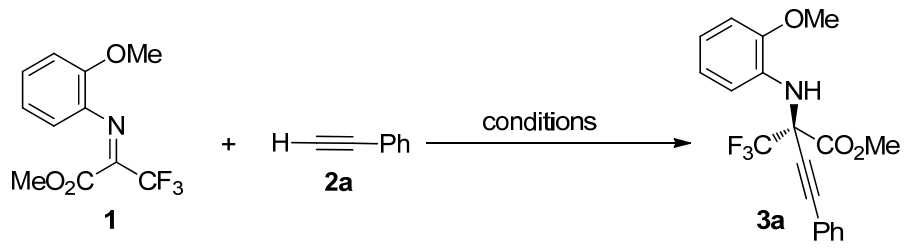
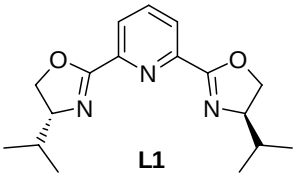
General information: ^{1}H NMR and ^{13}C NMR spectra were recorded on a Bruker AM300 and AM400 spectrometer. ^{19}F NMR was recorded on a Bruker AM300 spectrometer ($CFCl_3$ as outside standard and low field is positive). Chemical shifts (δ) are reported in ppm, and coupling constants (*J*) are in Hertz (Hz). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. NMR yield was determined by ^{19}F NMR using trifluorobenzene as an internal standard before working up the reaction.

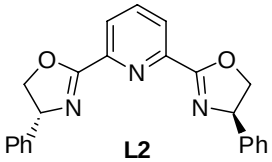
Materials: Me_2Zn (1.2 M in toluene) was purchased from Acros, all alkynes were from Aldrich, and methyl trifluoropyruvate was from Intechem, China. All reagents were weighed and handled in air, and refilled with an inert atmosphere of N_2 at room temperature. Toluene and hexane were distilled from sodium and benzophenone immediately before use. CH_2Cl_2 and $CHCl_3$ were distilled from CaH_2. The BINOL type ligands **4a**,[1] **4c-g**,[1] **4h-j**[2] were prepared according to literatures.

Table S1. Screens for Addition of Phenylacetylene **2a** to α-Ketoimine Ester **1** with Different Transition Metal Catalysts. [a]



Entry	Catalyst	Ligand	Yield[b]
1	$CuPF_6.CH_3CN$	**L1**	0
2	$CuPF_6.CH_3CN$	**L2**	0
3	$CuOTf.0.5C_6H_6$	**L1**	0
4	$CuOTf.0.5C_6H_6$	**L2**	0
5	$Sc(OTf)_3$	**L2**	0
6	$Zn(OTf)_2$	----	0

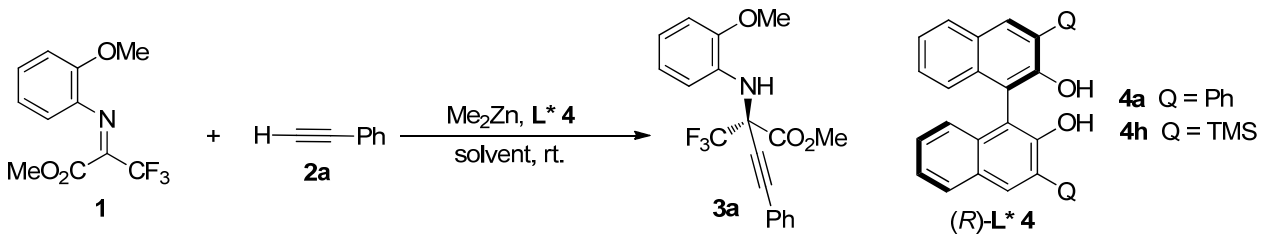




[a]Reaction conditions: **1** (0.3 mmol), **2a** (0.6 mmol), catalyst (10 mol%), **L** (10 mol%) PMP-NH_2 (0.1 equiv) in CH_2Cl_2 at room temperature. [b]Part of **1** was decomposed and some uncertain products were observed. N.R., no reaction.

General Procedure for Addition of Phenylacetylene 2a to α-Ketoimine Ester 1 with Zinc/BINOL Catalytic System (Table S2). To a solution of Phenylacetylene **2a** (1.7-3.3 equiv) in anhydrous solvent (1.2 mL) was added Me_2Zn (1.2-1.5 equiv, 1.2 M in toluene) under Ar at room temperature. After stirring for 1h, BINOL type ligand **4** (5-10 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-CF_3 ketoimine ester **1** (0.3 mmol) was then added as an oil by a microliter syringe. The reaction mixture was stirred at the same temperature until the starting material was totally consumed, as confirmed by means of TLC. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extract was dried over anhydrous sodium sulfate, filtered, and concentrated. The residue was purified using chromatography on silica gel (Petroleum ether /Ethyl acetate = 100:1) to give product **3a.**

Table S2. Addition of Phenylacetylene **2a** to α-Ketoimine Ester **1** with Zn/BINOL Catalytic System[a]



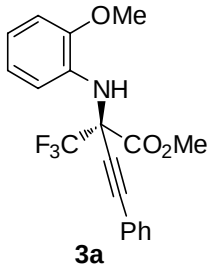
Entry	Me_2Zn (equiv)	**2a** (equiv)	**L* 4** (x mol%)	Solvent	Time (h)	Yield (%)[b]	ee (%)[c]
1	1.5	2.4	**4a**, 10	toluene	8	78	87
2	1.5	2.7	**4a**, 10	toluene	8	80	88
3	1.5	3.3	**4a**, 10	toluene	8	77	87
4	1.3	2.1	**4a**, 10	toluene	8	89	88
5	1.2	2.0	**4a**, 10	toluene	8	90	85
6	1.2	2.0	**4a**, 10	CH_2Cl_2	8	76	87
7	1.2	2.0	**4a**, 10	$CHCl_3$	12	84	62
8	1.2	2.0	**4a**, 10	Hexane	8	76	82
9	1.2	2.0	**4h**, 10	toluene	8	91	97
10	**1.2**	**1.7**	**4h, 5**	**toluene**	**24**	**90**	**97.3**

[a]Recation conditions: **1** (0.3 mmol) in solvent (1.2 mL); [b]Isolated yield; [c] Determined by chiral HPLC analysis.

General Procedure for Self-Disproportionation of Enantiomers (SDE) Test of Compounds 3a and 3h. After the enantioselective addition of alkyne **2a** or **2h** to α-Ketoimine ester **1**, the reaction mixture was worked up as mentioned in general procedure. The crude product **3a** or **3h** was run on silica gel chromatography to give 7 fractions that include all of the product. The 7 fractions were subsequently determined ee values by chiral HPLC analysis separately as shown in Table S3 and S4.

The SDE tests of **3a** and **3h** showed that **3a** has slight SDE effect, but no such effect for **3h**. However, the ee values obtained before and after column chromatography are similar, suggesting that the ee values obtained after purification are not influenced by the SDE effect of **3**.

Table S3. Self-disproportionation of enantiomers (SDE) test of compound **3a.**[a]

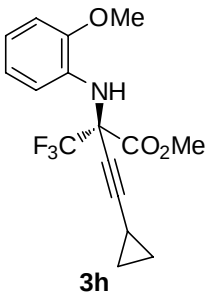


3a

Fraction	Mass / mg	Mass%	% ee[b]
A1	12.8	8.8	99.8
B2	18.9	13.1	97.2
C3	21.0	14.5	97.6
D4	23.7	16.4	97.7
E5	20.4	14.1	97.7
F6	15.0	10.4	97.9
G7	32.9	22.7	97.9
SUM (A1-G7)	144.7	100	97.9[c]

[a]Silica gel chromatography eluent: petroleum ether/ethyl acetate = 100/1. [b]Determined by chiral HPLC analysis after column chromatography (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.783 min (major) and t_R = 10.077 min (minor)). 98.3% ee was obtained before column chromatography for compound **3a**. [c] average ee value based on calculation.

Table S4. Self-disproportionation of enantiomers (SDE) test of compound **3h.**[a]

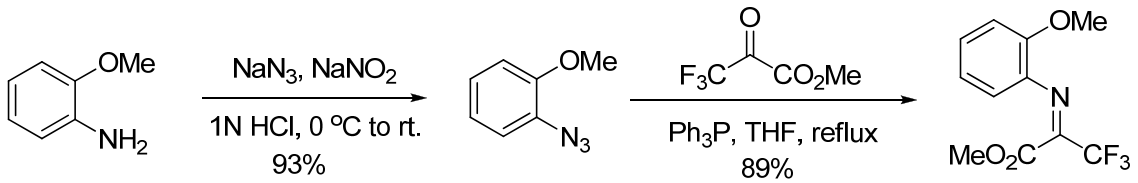


3h

Fraction	Mass / mg	Mass%	% ee[b]
A1	2.0	2.2	98.71
B2	6.7	7.2	98.29
C3	7.7	8.3	98.09
D4	17.1	18.4	98.04
E5	25.1	27.1	98.40
F6	16.8	18.1	98.98
G7	17.3	18.7	98.42
SUM (A1-G7)	92.7	100	98.4[c]

[a]Silica gel chromatography eluent: petroleum ether/ethyl acetate = 200/1. [b]Determined by chiral HPLC analysis after column chromatography (PC-1, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.485 min (major) and t_R = 8.052 min (minor)). 98.5% ee was obtained before column chromatography for compound **3h**. [c]Average ee value based on calculation.

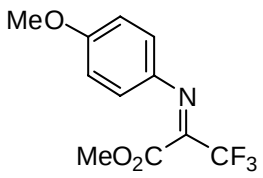
Preparation of α-Ketoimine Ester 1.



1

Methyl 3,3,3-trifluoro-2-(2-methoxyphenylimino)propanoate (1).[3, 4] To a solution of 2-methoxyaniline (3.3 mL, 30 mmol) in 1N HCl (30 mL) was added $NaNO_2$ (2.08 g, 30 mmol) at 0 ^oC. After stirring for 2 h at same temperature, the reaction mixture was warmed to room temperature. NaN_3 (2.34 g, 36 mmol) was added. The reaction mixture stirred until the starting

material was consumed. The reaction mixture was diluted with ethyl acetate, washed with brine. The organic layer was dried over Na_2SO_4, filtered, and concentrated to give 1-azido-2-methoxybenzene 4.185 g (93% yield) as a brown oil, which was used for next step. To a solution of 1-azido-2-methoxybenzene (4.18 g, 28 mmol) in THF was added dropwise of a solution of Ph_3P (7.31 g, 28 mmol) in THF (100 mL) at room temperature. The resulting mixture was then heated to reflux and stirred for 2 h. The reaction mixture was cooled to room temperature. Methyl trifluoropyruvate (1.87 mL, 16.7 mmol) was added. The reaction mixture was then heated to reflux and stirred until the starting material was consumed. The reaction was then cooled to room temperature and concentrated. The residue was extracted with petroleum ether several times. The combined organic layers were concentrated. The residue was purified with silica gel by flash chromatography (Petroleum ether /Ethyl Acetate = 80:1) to give **1** (3.90 g, 89% yield) as a brown oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.17 (td, J = 8.7, 2.4, 1H), 6.99-6.94 (m, 2H), 6.92-6.87 (m, 2H), 3.71 (s, 3H), 3.67 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -69.6 (s, 3F). IR (thin film): ν_{max} 2858, 1747, 1593 cm^{-1}. MS (EI): *m/z* (%) 261 (M^+), 202 (100), 133, 77. HRMS: Calculated for $C_{11}H_{10}NO_3F_3$ (M^+): 261.0613; Found: 261.0612.



Methyl 3,3,3-trifluoro-2-(4-methoxyphenylimino)propanoate (1').[5] The preparation of **1'** is same with **1**. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.01 (d, *J* = 6.9, 2H), 6.90 (d, *J* = 6.9, 2H), 3.82 (s, 3H), 3.78 (s, 3H); ^{19}F NMR (282 MHz, $CDCl_3$) δ -69.5 (s, 3F).

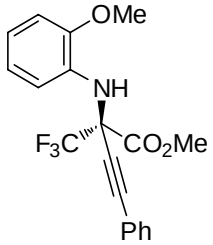
General Procedure for Enantioselective Addition of Terminal Alkynes to α-Ketoimine Esters 1. To a solution of terminal alkyne **2** (1.7 equiv) in anhydrous toluene (1.2 mL) was added Me_2Zn (300 μL, 1.2 M in toluene) under Ar at room temperature. After stirring for 1h, BINOL type ligand **4h** (6.5 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Fluoroalkyl ketoimine ester **1** (0.3 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at the same temperature until the starting material was totally consumed, as confirmed by means of TLC. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extract was dried over anhydrous sodium sulfate, and the solvent was removed in

vacuo. The residue was purified using chromatography on silica gel to give product **3**.

Note: For α-CF_3 α-amino acids **3**, two ee values were provided for each compound, which were determined before and after silica gel column chromatography.

General Procedure for Synthesis of Racemic 3.

To a solution of terminal alkyne **2** (1.7 equiv) in anhydrous toluene (1.2 mL) was added Me_2Zn (300 μL, 1.2 M in toluene) under Ar at room temperature. After stirring for 1h, racemic BINOL **4h** (6.5 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-CF_3 ketoimine ester **1** (0.3 mmol) was then added as an oil by a microliter syringe. The reaction mixture was stirred at the same temperature until the starting material was totally consumed, as confirmed by means of TLC. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extract was dried over anhydrous sodium sulfate, and the solvent was removed in vacuo. The residue was purified using chromatography on silica gel to give products **3**.

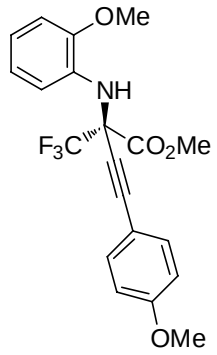


(*R*)-Methyl 2-(2-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)but-3-ynoate (3a). The product (98 mg, 90% yield) as a colorless oil was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.41-7.32 (m, 5 H), 7.20 (m, 1H), 6.86 (m, 3H), 3.96 (s, 3H), 3.89 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.9, 148.6, 132.7, 131.9 (2), 129.3, 128.3 (2), 123.0 (q, J = 288.1), 121.0, 120.3, 120.2, 116.0 (q, J = 2.2), 109.8, 89.6, 78.6, 63.4 (q, J = 32.1), 55.6, 54.7; ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.8 (s, 3F). IR (thin film): ν_{max} 3373, 2238, 1758, 1602 cm^{-1}. LRMS (EI): *m/z* (%) 363 (M^+), 304 (100), 77. HRMS (EI) Calcd for $C_{19}H_{16}F_3NO_3$: 363.1082. Found: 363.1083. $[\alpha]^{25}_D$ = -7.8 (*c* 3.2, $CHCl_3$) for a 97.3% ee sample Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.727 min (major) and t_R = 9.977 min (minor)): 98.3% ee (before silica gel column chromatography), 97.3% ee (after silica gel column chromatography).

(*R*)-Methyl 2-(4-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)but-3-ynoate (3a'). 2.0 equiv of phenylacetylene was used. The product (98 mg, 90% yield) as a colorless oil was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.39 – 7.23 (m, 5H), 7.06 (d, *J* = 9.0, 2H), 6.80 (d, *J* = 9.0, 2H), 3.94 (s, 3H), 3.77 (s, 3H). ^{13}C NMR (75.4 MHz, $CDCl_3$) δ = 166.4, 155.5, 136.1, 131.9(2), 129.3, 128.3(2), 122.9(2), 122.8 (q, *J* = 287.1), 121.0, 113.9(2), 90.3, 78.6, 65.3 (q, *J* = 30.9), 55.4, 54.7. ^{19}F NMR (282 MHz, $CDCl_3$) δ -75.3 (s, 3F). IR (thin film): ν_{max} 3354, 2241, 1755, 1574 cm^{-1}. LRMS (EI): *m/z* (%) 363 (M^+), 304 (100), 234, 122. HRMS (EI) Calcd for $C_{19}H_{16}F_3NO_3$: 363.1082. Found: 363.1081. $[\alpha]^{27}_D$ = -21 (*c* 0.55, $CHCl_3$) for a 95.7% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane:i-PrOH=95:5, 214nm, t_R = 11.627 min (major) and t_R = 11.727 min (minor)): 96.1% ee (before silica gel column chromatography), 95.7% ee (after silica gel column chromatography).

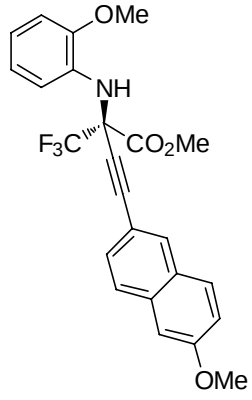
(*R*)-Methyl 2-(2-methoxyphenylamino)-4-(4-propylphenyl)-2-(trifluoromethyl)but-3-ynoate (3b). The product (112 mg, 92% yield) as a colorless oil was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.2, 2H), 7.20 (t, *J* = 3.8, 1H), 7.11 (d, *J* = 8.2, 2H), 6.83 – 6.87 (m, 3H), 3.95 (s, 3H), 3.89 (s, 3H), 2.56 (t, *J* = 7.2, 2H), 1.61 (m, 2H), 0.91 (t, *J* = 7.3, 3H); ^{13}C NMR (75.4 MHz, $CDCl_3$) δ 166.0, 148.4, 144.4, 132.7, 131.8(2), 128.4(2), 123.0 (q, *J* = 288.2), 120.3, 120.0, 118.1, 115.9 (q, *J* = 2.0), 109.7, 89.9, 77.9, 63.3 (q, *J* = 32.2), 55.6, 54.7, 37.9, 24.3, 13.6; ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.9 (s, 3F). IR (thin film): ν_{max} 3372, 2237, 1759, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 405 (M^+), 346 (100), 336. HRMS (EI) Calcd for $C_{22}H_{22}F_3NO_3$: 405.1552. Found: 405.1549. $[\alpha]^{24}_D$ = -1.8 (*c* 1.5, $CHCl_3$) for a 97.5% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 95:5, 214 nm, t_R = 6.73 min (major) and t_R = 9.23 min(minor)).

(*R*)-Methyl 4-(4-methoxyphenyl)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate

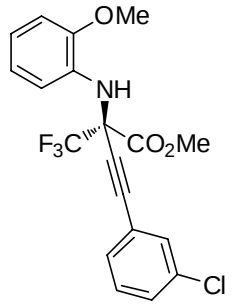


(3c). The product (102 mg, 87% yield) as a white solid was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). M.P. 68-71 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.9, 2H), 7.20 (m, 1H), 6.80 – 6.87 (m, 5H), 3.95 (s, 3H), 3.89 (s, 3H), 3.80 (s, 3H). ^{13}C NMR (75.4 MHz, $CDCl_3$) δ 166.1, 160.3, 148.5, 133.5(2), 132.8, 123.1 (q, *J* = 288.1), 120.2, 120.0, 116.0 (q, *J* = 2.2), 113.9(2), 113.0, 109.8, 89.7, 77.3, 63.4 (q, *J* = 32.3), 55.6, 55.3, 54.7. ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.9 (s, 3F). IR (thin film): ν_{max} 3369, 2235, 1758, 1605, 1511 cm^{-1}. LRMS (EI): *m/z* (%) 393 (M^+), 334 (100), 324. HRMS (EI) Calcd for $C_{20}H_{18}F_3NO_4$: 393.1188. Found: 393.1190. $[\alpha]^{20}_D$ = 0.6 (*c* 1.5, $CHCl_3$) for a 95.9% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 11.477 min (major) and t_R = 18.827 min (minor)): 98.5% ee (before silica gel column chromatography), 95.9% ee (after silica gel column chromatography).

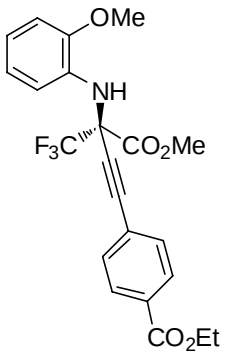
(*R*)-Methyl 4-(6-methoxynaphthalen-2-yl)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3d).



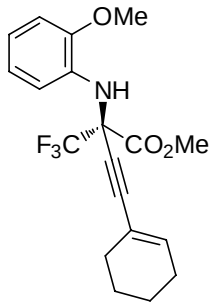
The product (120 mg, 91% yield) as a white solid was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 50:1). M.P. 83-86 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.85 (s, 1H), 7.65 (t, *J* = 8.3, 2H), 7.37 (dd, *J* = 8.5, 1.3, 1H), 7.25 (m, 1H), 7.15 (dd, *J* = 9.0, 2.4, 1H), 7.08 (d, *J* = 1.9, 1H), 6.88 (m, 3H), 5.78 (br, 1H), 3.97 (s, 3H), 3.91 (s, 3H), 3.90 (s, 3H). ^{13}C NMR (75.4 MHz, CDCl3) δ 166.0, 158.6, 148.5, 134.6, 132.7, 132.2, 129.4, 128.6, 128.0, 126.8, 123.1 (q, *J* = 288.4), 120.3, 120.1, 119.6, 116.0, 115.7, 110.0, 105.6, 90.2, 78.1, 63.4 (q, *J* = 32.0), 55.6, 55.3, 54.8. ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.8 (s, 3F). IR (thin film): ν_{max} 3387, 2231, 1763, 1627, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 443 (M^+), 384 (100), 338. HRMS (EI) Calcd for $C_{24}H_{20}F_3NO_4$: 443.1344. Found: 443.1347. $[\alpha]^{24}_D$ = 13.2 (*c* 2.20, $CHCl_3$) for a 95.8% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7 mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 15.177 min (major) and t_R = 22. 727min (minor)): 96.0% ee (before silica gel chromatography), 95.8% ee (after silica gel column chromatography).

(*R*)-Methyl 4-(3-chlorophenyl)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3e). 

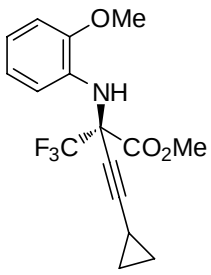
The product (108 mg, 90% yield) as a white solid was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). M.P. 27-29 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.37-7.32 (m, 2H), 7.28-7.22 (m, 2H), 7.14 (m, 1H), 6.89 – 6.84 (m, 3H), 3.96 (s, 3H), 3.89 (s, 3H). ^{13}C NMR (75.4 MHz, $CDCl_3$) δ 165.6, 148.5, 134.1, 132.5, 131.7, 130.1, 129.7, 129.6, 122.9 (q, *J* = 288.1), 122.6, 120.4, 120.2, 115.9 (q, *J* = 1.9), 109.8, 88.1, 79.8, 63.4 (q, *J* = 31.7), 55.6, 54.8; ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.8 (s, 3F). IR (thin film): ν_{max} 3360, 2240, 1759, 1602 cm^{-1}. LRMS (EI): *m/z* (%) 399 (M^+), 397 (M^+), 338 (100), 202. HRMS (EI) Calcd for $C_{19}H_{15}ClF_3NO_3$: 397.0693. Found: 397.0696. $[\alpha]^{24}_{D}$ = -3.3 (*c* 3.0, $CHCl_3$) for a 93.9% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.127 min (major) and t_R = 7.877 min (minor)): 94.6% ee (before silica gel column chromatography), 93.9% ee (after silica gel column chromatography).

(*R*)-Ethyl 4-(4,4,4-trifluoro-3-(methoxycarbonyl)-3-(2-methoxyphenylamino)but-1-ynyl)benzoate (3f). 

The product (121 mg, 93% yield) as a colorless oil was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.3, 2H), 7.44 (d, *J* = 8.3, 2H), 7.15 (m, 1H), 6.89 – 6.84 (m, 3H), 5.76 (br, 1H), 4.37 (q, *J* = 7.1, 2H), 3.97 (s, 3H), 3.89 (s, 3H), 1.39 (t, *J* = 7.1, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.7, 165.6, 148.6, 132.5, 131.8, 130.9, 129.3, 125.4, 122.9 (q, *J* = 288.0), 120.4, 120.2, 116.0 (q, *J* = 2.0), 109.9, 88.7, 81.3, 63.5 (q, *J* = 32.2), 61.2, 55.6, 54.8, 14.2. ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.7 (s, 3F). IR (thin film): ν_{max} 3370, 2240, 1759, 1721, 1604 cm^{-1}. LRMS (EI): *m/z* (%) 435 (M^+), 376 (100), 202. HRMS(EI) Calcd for $C_{20}H_{20}F_3NO_5$: 435.1294. Found: 435.1296. $[\alpha]^{25}_{D}$ = 7.1 (*c* 2.9, $CHCl_3$) for a 91.9% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 13.627 min (major) and t_R = 20.617 min (minor)): 91.9% ee (before silica gel column chromatography), 91.9% ee (after silica gel column chromatography).

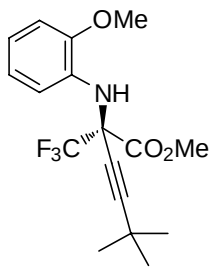


(*R*)-Methyl 4-cyclohexenyl-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3g). 2.5 equiv of 1-ethynylcyclohex-1-ene and 1.2 equiv of Me_2Zn were used. The product (101 mg, 91% yield) as a colorless oil was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 200:1). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.12 (m, 1H), 6.86 – 6.83 (m, 3H), 6.16 (m, 1H), 5.70 (br, 1H), 3.92 (s, 3H), 3.87 (s, 3H), 2.06 (m, 4H), 1.58 (m, 4H). ^{13}C NMR (75.4 MHz, $CDCl_3$) δ166.1, 148.3, 137.8, 132.7, 123.0 (q, J = 288.2), 120.2, 119.8, 119.1, 115.9, 110.0, 91.4, 75.8, 63.2 (q, J = 32.0), 55.6, 54.6, 28.2, 25.6, 21.9, 21.2. ^{19}F NMR (282 MHz, $CDCl_3$) δ -75.0 (s, 3F). IR (thin film): ν_{max} 3373, 2226, 1757, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 367 (M^+), 308 (100), 298. HRMS (EI) Calcd for $C_{19}H_{20}F_3NO_3$: 367.1395. Found: 367.1390. $[\alpha]^{24}_D$ = -12.4 (*c* 1.10, $CHCl_3$) for a 99.6% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (OD-H, flow 0.4mL/min, Hexane/i-PrOH = 100:1, 254 nm, t_R = 13.113 min (major) and t_R = 14.627 min (minor)): 99.5% ee (before silica gel column chromatography), 99.6% ee (after silica gel column chromatography).



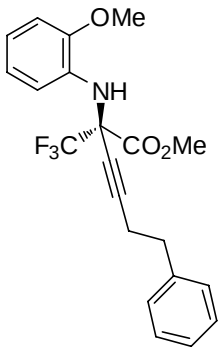
(*R*)-Methyl 4-cyclopropyl-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3h). The product (89 mg, 91% yield) as a white solid was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 200:1). M.P. 55-57 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.06 (t, J = 3.6 Hz, 1H), 6.85 – 6.81 (m, 3H), 5.61 (s, 1H), 3.90 (s, 3H), 3.86 (s, 3H), 1.26 (m, 1H), 0.83 – 0.73 (m, 2H), 0.72 – 0.58 (m, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.2, 148.4, 132.8, 123.0 (q, J = 288.0), 120.1, 119.9, 116.0 (q, J = 1.9), 109.7, 94.1, 64.7, 62.8 (q, J = 32.2), 55.6, 54.6, 8.2(2), -0.6. ^{19}F NMR (282 MHz, $CDCl_3$) δ -75.2 (s, 3F). IR (thin film): ν_{max} 3367, 2247, 1756, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 327 (M^+), 268 (100), 258. HRMS (EI) Calcd for $C_{16}H_{16}F_3NO_3$: 327.1082. Found: 327.1087. $[\alpha]^{24}_D$ = -7.4 (*c* 1.3, $CHCl_3$) for a 98.2% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (PC-1, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.727 min (major) and t_R = 8.477 min (minor)): 98.5% ee (before silica gel column chromatography), 98.2% ee (after silica gel column chromatography).

(*R*)-Methyl 2-(2-methoxyphenylamino)-5,5-dimethyl-2-(trifluoromethyl)hex-3-ynoate (3i). To a



solution of 3,3-dimethylbut-1-yne (5.0 equiv) in anhydrous toluene (1.2 mL) in a sealed tube was added Me_2Zn (300 μL, 1.2 M in toluene) under Ar at room temperature. After stirring for 12h, BINOL type ligand **4h** (6.5 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Trifluoromethyl ketoimine ester **1a** (0.3 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at the same temperature for 70h. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extracts were dried over anhydrous sodium sulfate, and the solvent was removed in vacuo. The residue was purified using chromatography (Petroleum ether/Ethyl acetate = 200:1) on silica gel to give product **3i** 94 mg (91% yield) as a white solid. M.P. 51-52 ^oC; ^1H NMR (300 MHz, $CDCl_3$) δ 7.14 (m, 1H), 6.87 – 6.76 (m, 3H), 3.91 (s, 3H), 3.87 (s, 3H), 1.17 (s, 9H). ^{13}C NMR (75.4 MHz, $CDCl_3$) δ 166.4, 148.5, 132.8, 123.0 (q, J = 287.8), 120.0, 119.9, 116.4 (q, J = 2.0), 109.6, 99.0, 68.5, 62.8 (q, J = 32.3), 60.4, 55.6, 54.5, 30.1(3), 27.5. ^{19}F NMR (282 MHz, $CDCl_3$) δ -75.4 (s, 3F). IR (thin film): ν_{max} 3377, 2248, 1758, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 343 (M^+), 284 (100), 274. HRMS (EI) Calcd for $C_{17}H_{20}F_3NO_3$: 343.1395. Found: 343.1399. $[\alpha]^{24}_D$ = -20 (*c* 0.91, $CHCl_3$) for a 97.6% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (IC, flow 0.7mL/min, Hexane/i-PrOH = 100:1, 214 nm, t_R = 8.660 min (minor) and t_R = 10.177 min (major)): 97.5% ee (before silica gel column chromatography), 97.6% ee (after silica gel column chromatography).

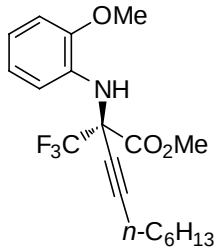
(*R*)-Methyl 2-(2-methoxyphenylamino)-6-phenyl-2-(trifluoromethyl)hex-3-ynoate (3j). 2.5



equiv of but-3-ynylbenzene and 1.2 equiv of Me_2Zn were used. The product (101 mg, 86% yield) as a colorless oil was purified with silica gel chromatography (Petroleum ether/Ethyl acetate = 100:1). ^1H NMR (300 MHz, $CDCl_3$) δ 7.30 – 7.20 (m, 3H), 7.14 (d, J = 7.8, 2H), 6.98 (d, J = 7.5, 1H), 6.86 – 6.76 (m, 3H), 3.87 (s, 3H), 3.86 (s, 3H), 2.78 (m, 2H), 2.50 (td, J = 7.2, 3.0, 2H). ^{13}C NMR (75.4 MHz, $CDCl_3$) δ 166.1, 148.3, 140.0, 132.7, 128.4(2), 128.3(2), 126.3, 123.0 (q, J = 288.0), 120.21, 119.8, 115.7 (q, J = 1.7), 109.7, 90.3, 70.7, 62.8 (q, J = 32.3), 55.6, 54.5, 34.0, 20.9. ^{19}F NMR (282 MHz, $CDCl_3$) δ -75.0 (s, 3F). IR (thin film): ν_{max}

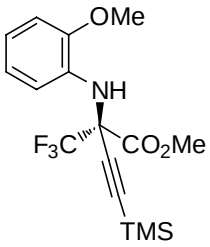
3374, 2250, 1756, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 391 (M^+), 332 (100), 91. HRMS (EI) Calcd for $C_{21}H_{20}F_3NO_3$: 391.1395. Found: 391.1398. $[\alpha]^{24}_D$ = -6.3 (*c* 4.0, $CHCl_3$) for a 95.6% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (PC-1, flow 0.7 mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 11.577 min (minor) and t_R = 12.777 min (major)): 95.1% ee (before silica gel column chromatography), 95.6% ee (after silica gel column chromatography).

(*R*)-Methyl 2-(2-methoxyphenylamino)-2-(trifluoromethyl)dec-3-ynoate (3k). To a solution of



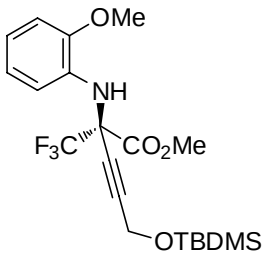
oct-1-yne (2.5 equiv) in anhydrous toluene (1.2 mL) was added Me_2Zn (300 μL, 1.2 M in toluene) under Ar at room temperature. The reaction mixture was heated to 100 °C for 2h and cooled to room temperature. BINOL type ligand **4h** (6.5 mg, 5 mol%) was then added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Trifluoromethyl ketoimine ester **1a** (0.3 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at the same temperature for 48h. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extracts were dried over anhydrous sodium sulfate, and the solvent was removed in vacuo. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 200:1) to give product **3k** 106 mg (95% yield) as a white solid. M.P. 22-23 °C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.10 (m, 1H), 6.83-6.81 (m, 3H), 3.90 (s, 3H), 3.87 (s, 3H), 2.22 (t, *J* = 6.9, 2H), 1.47 (m, 2H), 1.32–1.21 (m, 6H), 0.87 (t, *J* = 6.7, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 166.3, 148.3, 132.8, 123.1 (q, *J* = 287.9), 120.2, 119.8, 115.8 (q, *J* = 2.2), 109.7, 91.3, 69.9, 62.8 (q, *J* = 32.0), 55.6, 54.5, 31.2, 28.3, 27.7, 22.5, 18.7, 14.0. ^{19}F NMR (282 MHz, $CDCl_3$) δ -75.2 (s, 3F). IR (thin film): ν_{max} 3376, 2249, 1758, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 371 (M^+), 312(100), 302. HRMS (EI) Calcd for $C_{19}H_{24}F_3NO_3$: 371.1708. Found: 371.1703. $[\alpha]^{24}_D$ = -4.7 (*c* 2.3, $CHCl_3$) for a 95.9% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (Sino-OJ, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.447 min (minor) and t_R = 8.877 min (major)): 96.2% ee (before silica gel column chromatography), 95.9% ee (after silica gel column chromatography).

(*R*)-Methyl 2-(2-methoxyphenylamino)-2-(trifluoromethyl)-4-(trimethylsilyl)but-3-ynoate (3l).



To a solution of ethynyltrimethylsilane (5.0 equiv) in anhydrous toluene (1.2 mL) in a sealed tube was added Me_2Zn (300 μL, 1.2 M in toluene) under Ar at room temperature. After stirring for 12h, BINOL type ligand **4h** (6.5 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Trifluoromethyl ketoimine ester **1a** (0.3 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at the same temperature for 48h. The reaction mixture was diluted with EtOAc (100mL) and washed quickly with 20mL 0.1wt% H_2SO_4. The aqueous layer was extracted with EtOAc. The combined organic extracts were dried over anhydrous sodium sulfate, and the solvent was removed in vacuo. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 200:1) to give product **3l** 91 mg (84% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.11 (m, 1H), 6.84 – 6.81 (m, 3H), 3.92 (s, 3H), 3.87 (s, 3H), 0.14 (s, 9H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 165.7, 148.4, 132.6, 122.8 (q, J = 288.0), 120.1(2), 116.3 (q, J = 1.7), 109.7, 96.5, 93.5, 63.2 (q, J = 32.2), 55.6, 54.7, -0.8 (3). ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.9 (s, 3F). IR (thin film): ν_{max} 3376, 2178, 1760, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 359 (M^+), 300 (100), 73. HRMS (EI) Calcd for $C_{16}H_{20}F_3NO_3Si$: 359.1165. Found: 359.1166. $[\alpha]^{27}_D$ = -25.0 (*c* 2.05, $CHCl_3$) for a 97.7% ee sample. Enantiomeric purity was determined by chiral HPLC Enantiomeric purity was determined by chiral HPLC analysis (Sino-OJ, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 6.437 min (minor) and t_R = 7.777 min (major)).

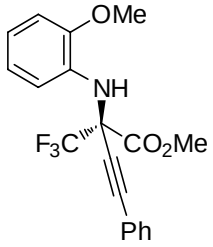
(*R*)-Methyl 5-(tert-butyldimethylsilyloxy)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)pent-3-ynoate (3m).



To a solution of tert-butyldimethyl(prop-2-ynyloxy)silane (2.5 equiv) in anhydrous toluene (1.2 mL) was added Me_2Zn (300 μL, 1.2 M in toluene) under Ar at room temperature. The reaction mixture was heated to 100 ^{o}C for 2h and cooled to room temperature. Then BINOL type ligand **4h** (6.5 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Trifluoromethyl ketoimine ester **1a** (0.3 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at the same temperature for 48h.The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The

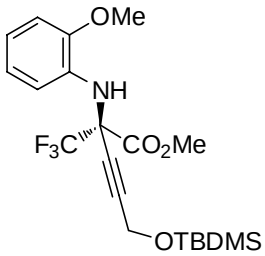
aqueous layer was extracted with EtOAc. The combined organic extracts were dried over anhydrous sodium sulfate, and the solvent was removed in vacuo. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 100:1) to give product **3m** 121 mg, (93% yield) as a white solid. M.P. 86-89 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.05 (m, 1H), 6.83 (m, 3H), 4.34 (s, 2H), 3.90 (s, 3H), 3.87 (s, 3H), 0.88 (s, 9H), 0.07 (s, 6H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 165.7, 148.2, 132.6, 122.8 (q, J = 288.1), 120.3, 120.0, 115.4 (q, J = 2.1), 109.8, 88.4, 74.3, 62.8 (q, J = 32.0), 55.6, 54.6, 51.5, 25.6(3), 18.1, -5.45(2). ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.8 (s, 3F). IR (thin film): ν_{max} 3376, 2180, 1760, 1604 cm^{-1}. LRMS (EI): *m/z* (%) 431 (M^+), 372 (100), 218, 73. HRMS (EI) Calcd for $C_{20}H_{28}F_3NO_4Si$: 431.1740. Found: 431.1744. $[\alpha]^{24}_D$ = -8.5 (*c* 1.8, $CHCl_3$) for a 94.7% ee sample. Enantiomeric purity was determined by chiral HPLC analysis (Sino-OJ, flow 0.7 mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 6.018 min (minor) and t_R = 8.318 min (major)).

Gram-scale catalytic asymmetric synthesis of 3a and 3m



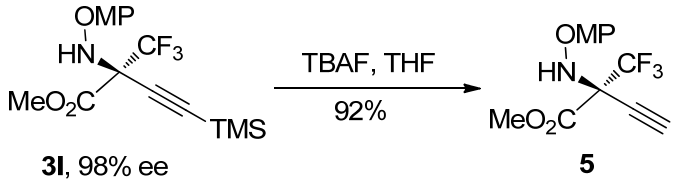
(*R*)-Methyl 2-(2-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)but-3-ynoate (3a). To a solution of phenylacetylene (0.84 mL, 7.65 mmol, 1.7 equiv) in anhydrous toluene (18 mL) was added Me_2Zn (4.5 mL, 5.4 mmol, 1.2 M in toluene) under Ar at room temperature. After stirring for 1h, BINOL type ligand **4h** (97.5 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Trifluoromethyl ketoimine ester **1a** (1.18 g, 4.5 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at room temperature for 48h. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extract was dried over anhydrous sodium sulfate, and the solvent was removed in *vacuo*. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 100:1) to give product **3**a (1.50g, 92% yield, 97% ee) as a colorless oil. Enantiomeric purity was determined by chiral HPLC analysis (AD-H, flow 0.7mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 7.127 min (major) and t_R = 8.877 min (minor)): 97% ee (after silica gel chromatography).

(*R*)-Ethyl 5-(*tert*-butyldimethylsilyloxy)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)pent-3-ynoate (3m).



To a solution of tert-butyldimethyl(prop-2-ynyloxy)silane (2.0 mL, 9.575 mmol, 2.5 equiv) in anhydrous toluene (15 mL) was added Me_2Zn (3.83 mL, 4.6 mmol, 1.2 M in toluene) under Ar at room temperature. The reaction mixture was heated to 100 ^oC for 2 h and cooled to room temperature. Then BINOL type ligand **4h** (83 mg, 5 mol%) was added as a solid in one portion. The reaction mixture was stirred for 2.5 h at room temperature. α-Trifluoromethyl ketoimine ester **1a** (1.0 g, 3.83 mmol) was then added as an oil with a microliter syringe. The reaction mixture was stirred at the same temperature for 48h. The reaction mixture was quenched with saturated NH_4Cl, and diluted with EtOAc. The aqueous layer was extracted with EtOAc. The combined organic extract was dried over anhydrous sodium sulfate, and the solvent was removed in *vacuo*. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 100:1) to give product **3m** (1.54 g, 93% yield, 96% ee) as a colorless oil. Enantiomeric purity was determined by chiral HPLC analysis (Sino-OJ, flow 0.7 mL/min, Hexane/i-PrOH = 98:2, 214 nm, t_R = 6.52 min (minor) and t_R = 9.76 min (major)): 96% ee (after silica gel chromatography).

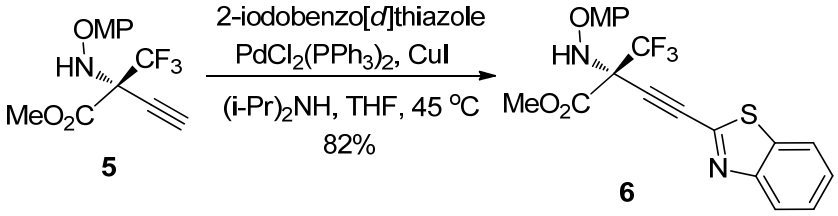
Synthesis of compound 6.



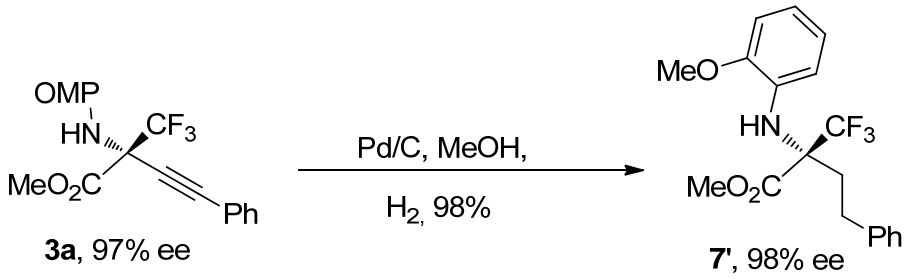
3l, 98% ee **5**

(*R*)-methyl 2-((2-methoxyphenyl)amino)-2-(trifluoromethyl)but-3-ynoate (5). To a solution of **3l** (650 mg, 1.8 mmol) in THF was added TBAF (1.0 M in THF, 2.2 mL, 2.2 mmol) immediately at 0 ^oC. After stirring for 1 min, the reaction mixture was quenched with saturated aqueous NH_4Cl. The reaction mixture was extracted with ethyl acetate, washed with brine, dried over anhydrous sodium sulfate, and the solvent was removed in vacuo. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 100:1) to give alkyne **5** in 92% yield (475 mg) as an oil. ^1H NMR (300 MHz, $CDCl_3$) δ 7.06 (m, 1H), 6.85 (m, 3H), 5.62 (s, 1H), 3.93 (s, 3H), 3.88 (s, 3H), 2.69 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.3, 148.4, 132.4, 122.7 (q, *J* =

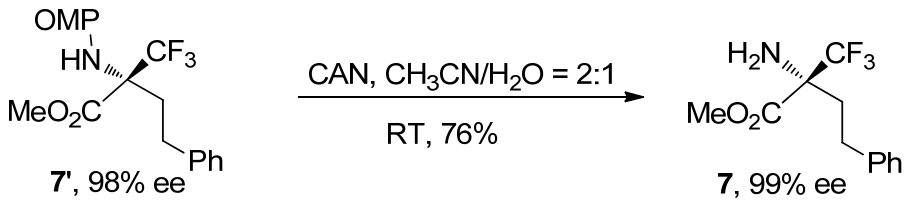
286.3), 120.3, 115.5, 109.9, 78.3, 73.4, 62.8 (q, J = 25.9), 55.6, 54.8. ^{19}F NMR (282 MHz, $CDCl_3$) δ -74.2 (s, 3F). IR (thin film): ν_{max} 3382, 3283, 2127, 1760 cm^{-1}. LRMS (EI): *m/z* (%) 287 (M^+), 228 (100), 144. HRMS (EI) Calcd for $C_{13}H_{12}F_3NO_3$: 287.0769. Found: 287.0770. $[\alpha]^{25}_D$ = -9.1 (*c* 3.2, $CHCl_3$).



(*R*)-methyl 4-(benzo[*d*]thiazol-2-yl)-2-((2-methoxyphenyl)amino)-2-(trifluoromethyl)but-3 -ynoate (6). To a mixture of **5** (178 mg, 0.62 mmol) and 2-iodobenzo[*d*]thiazole (162 mg, 0.62 mmol) in THF (2 mL) was added (i-Pr)$_2$NH (2 mL), followed by $PdCl_2(PPh_3)_2$ (19 mg, 0.03 mmol) and CuI (2.4 mg, 0.012 mmol) at room temperature under N_2. The reaction mixture was heated to 45 °C and stirred for 5 h. The reaction mixture was cooled to room temperature and water was added. The reaction mixture was extracted with EtOAc, dried over Na_2SO_4, and concentrated. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 30:1) to give alkyne **6** in 82% yield (214 mg) as a yellow solid. The solid was recrystallized with Petroleum ether/Ethyl acetate to give a white solid. M.P. 77-79 °C; ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.08 (d, J = 7.8 Hz, 1H), 7.86 (d, J = 8.1 Hz, 1H), 7.50 (m, 2H), 7.14 (m, 1H), 6.88 (m, 3H), 5.79 (br, 1H), 4.00 (s, 3H), 3.90 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.8, 152.5, 148.6, 146.3, 135.3, 132.2, 126.9, 126.8, 123.9, 122.6 (q, J = 289.3), 121.3, 120.7, 120.5, 115.8 (q, J = 2.0), 109.9, 85.3, 82.5, 63.6 (q, J = 31.9), 55.6, 55.1.^{19}F NMR (282 MHz, $CDCl_3$) δ -74.1 (s, 3F). IR (thin film): ν_{max} 3356, 1764, 1601 cm^{-1}. LRMS (EI): *m/z* (%) 420 (M^+), 361 (100), 362, 77. HRMS (EI) Calcd for $C_{20}H_{15}F_3N_2O_3S$: 420.0755. Found: 420.0758. $[\alpha]^{26}_D$ = 18 (*c* 2.0, $CHCl_3$).



(*R*)-Methyl 2-(2-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)butanoate (7'). To a solution of **3a** (210 mg, 0.578 mmol) in MeOH (30 mL) was added Pd/C 10% (40 mg). The reaction mixture was stirred under H_2 (1 atm) for 24 h. The reaction mixture was filtered through a silica gel pad, washed with CH_2Cl_2, and filtrate was concentrated. The residue was purified using chromatography on silica gel (Petroleum ether/Ethyl acetate = 100:1) to give hydrogenated product (209 mg, 98%) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.25 – 7.12 (m, 3H), 6.92 – 6.84 (m, 6H), 3.91 (s, 3H), 3.85 (s, 3H), 2.75 – 2.64 (m, 1H), 2.55 – 2.23 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ169.0, 148.6, 140.1, 133.2, 128.4, 128.3, 126.2, 124.8 (q, J = 289.3), 120.7, 119.7, 115.3 (q, J = 3.7), 110.1, 67.5 (q, J = 28.0), 55.8, 53.7, 31.1, 29.3. ^{19}F NMR (282 MHz, $CDCl_3$) δ -73.3 (s, 3F). IR (thin film): ν_{max} 3371, 1750, 1603 cm^{-1}. LRMS (EI): *m/z* (%) 367 (M^+), 91 (100), 308. HRMS (EI) Calcd for $C_{19}H_{20}F_3NO_3$: 367.1395. Found: 367.1392. $[\alpha]^{29}_D$ = 62 (*c* 0.50, $CHCl_3$) for a 98% ee sample. Enantiomeric purity was determinded by chiral HPLC analysis (Sino-AD, flow 0.5 mL/min, Hexane/*i*PrOH = 98:2, 214 nm, t_R = 9.127 min (minor) and t_R = 10.477 min (major)).



(*R*)-Methyl 2-amino-4-phenyl-2-(trifluoromethyl)butanoate (7). To a solution of Cerium(IV) Ammonium Nitrate (CAN, 396mg, 5.0 eqiv) in MeCN / H_2O (6 mL, 1:1) at 0 ^{o}C was added a solution of **5'** (53 mg, 0.144 mmol, 1equiv, 98% ee) in MeCN (3 mL). The reaction mixture was stirred at 0 ^{o}C for 1h and quenched with saturated aqueous $NaHSO_3$ (1 mL). The reaction mixture was extracted with EtOAc. The combined organic extract was washed with brine, dried over anhydrous sodium sulfate, and the solvent was removed in *vacuo*. The residue was purified using chromatography on Al_2O_3 (100% CH_2Cl_2) to give product **7** (29 mg, 76% yield) as a brown oil. ^{1}H

NMR (300 MHz, $CDCl_3$) δ 7.33 – 7.26 (m, 2H), 7.24 – 7.16 (m, 3H), 3.80 (s, 3H), 2.85 – 2.79 (m, 1H), 2.57 – 2.34 (m, 2H), 1.99 (m, 1H), 1.90 (br, 2H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 168.9, 140.2, 128.4 (2), 128.3 (2), 126.2, 124.8 (q, J = 284.9), 64.6 (q, J = 27.1), 53.3, 34.4, 29.4. ^{19}F NMR (282 MHz, $CDCl_3$) δ -78.3 (s, 3F). IR (thin film): ν_{max} 3420, 3344, 1748, 1604 cm^{-1}. LRMS (EI): *m/z* (%) 261 (M^+), 91 (100), 202. HRMS (EI) Calcd for $C_{12}H_{14}F_3NO_2$: 261.0977. Found: 261.0978. $[\alpha]^{29}_D$ = -26.5 (*c* 0.493, $CHCl_3$). Enantiomeric purity was determinded by chiral HPLC analysis (PC-2, flow 0.7 mL/min, Hexane/*i*PrOH = 50:50, 214 nm, t_R = 5.402 min (minor) and t_R = 6.238 min (major)).

References

1) Wu, T. R.; Shen, L.; Chong, J. M. *Org. Lett.* **2004**, *6*, 2701-2704.

2) Maruoka, K.; Yamamoto, H. *Bull. Chem. Soc. Jpn.* **1988**, *61*, 2975-2976.

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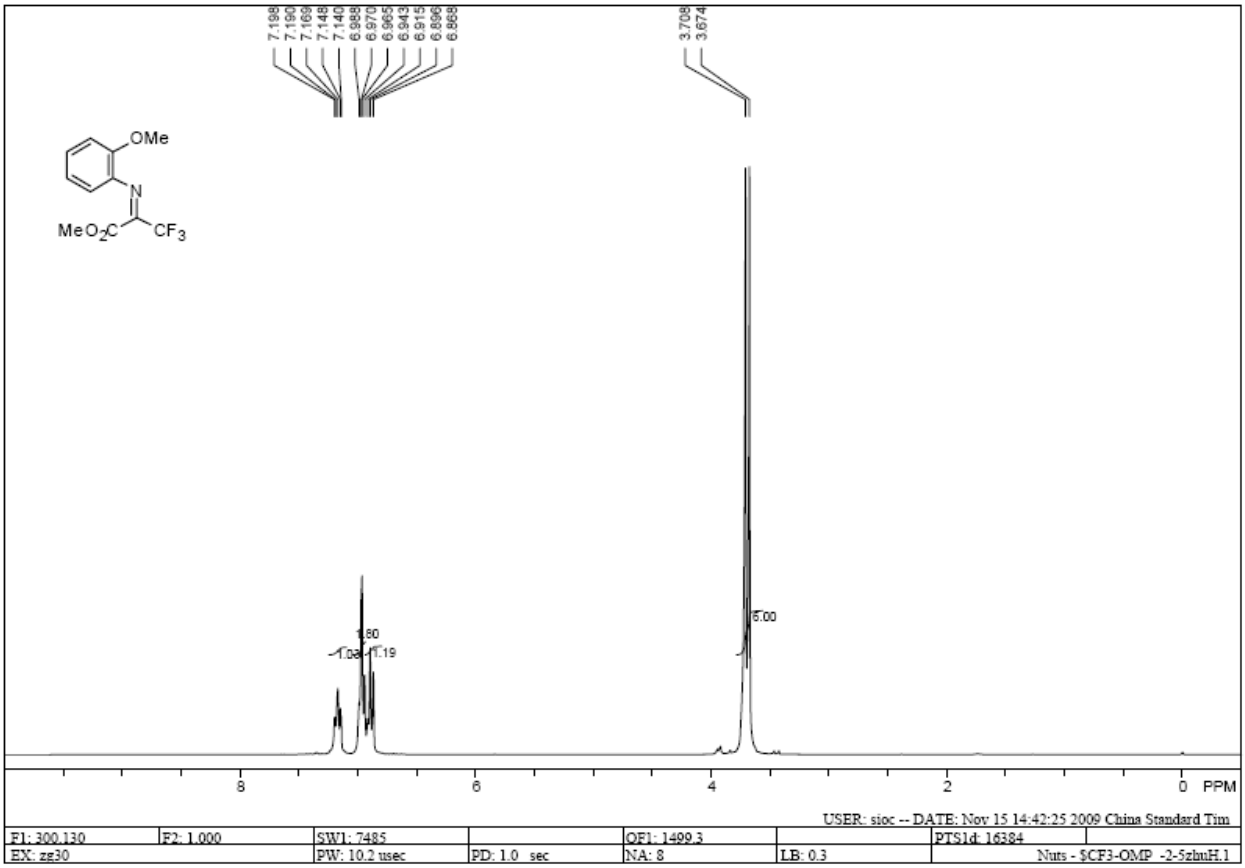
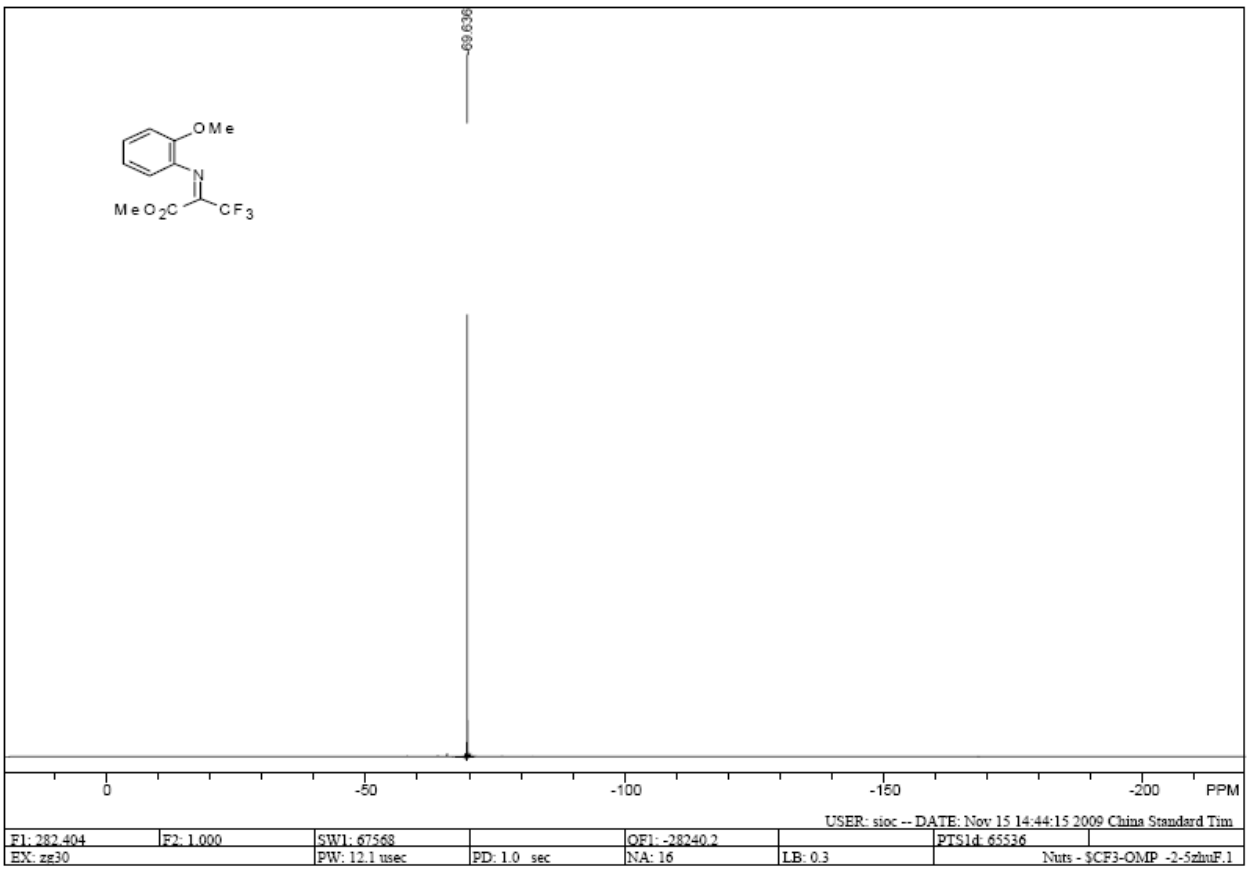
4) Hemming, K.; Bevan, M. J.; Loukou, C.; Patel, S. D.; Renaudeau, D. *Synlett* **2000**, 1565-1568

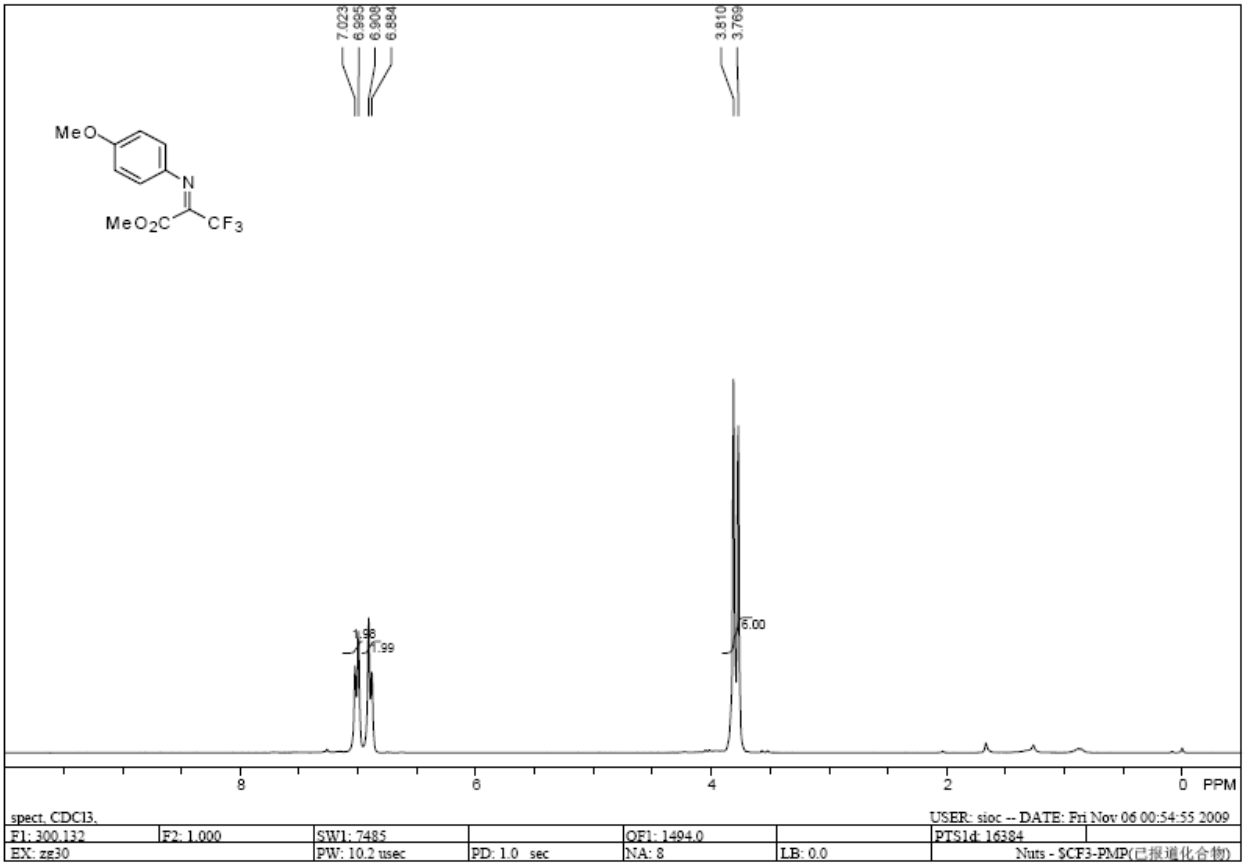
5) a) Watanabe, H.; Hashizume, Y.; Uneyama, K. *Tetrahedron Lett.* **1992**, *33*, 4333-4336; b) Abe, H.; Amii, H.; Uneyama, K. *Org. Lett.* **2001**, *3*, 313-315.

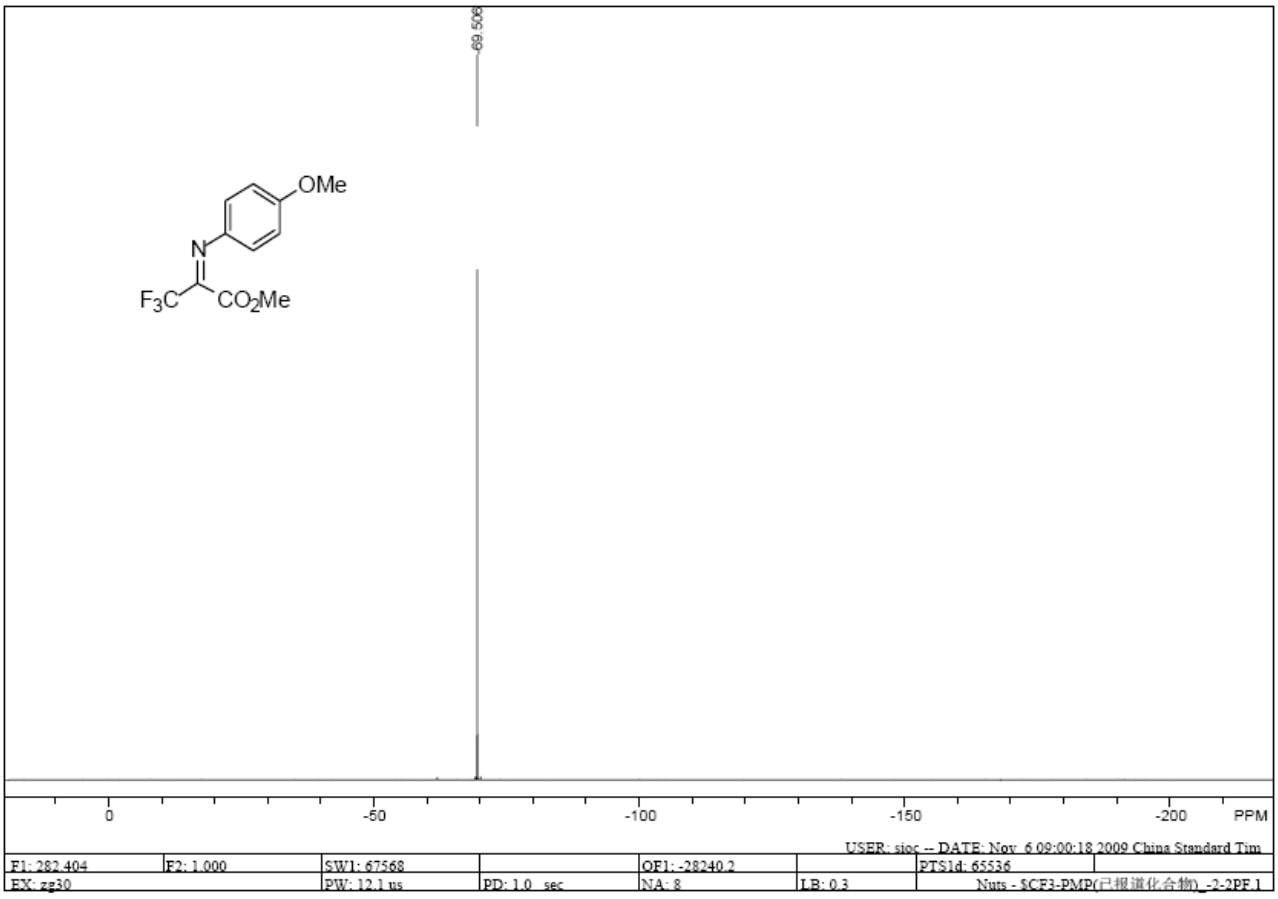
Methyl 3,3,3-trifluoro-2-(2-methoxyphenylimino)propanoate (1).



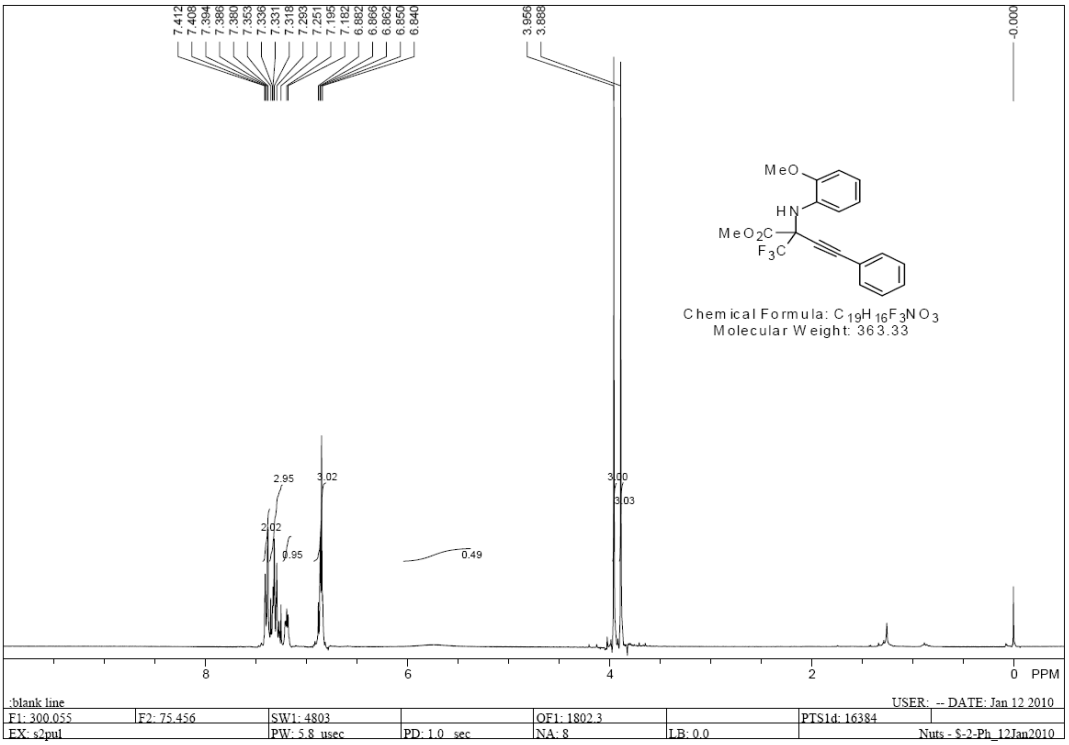


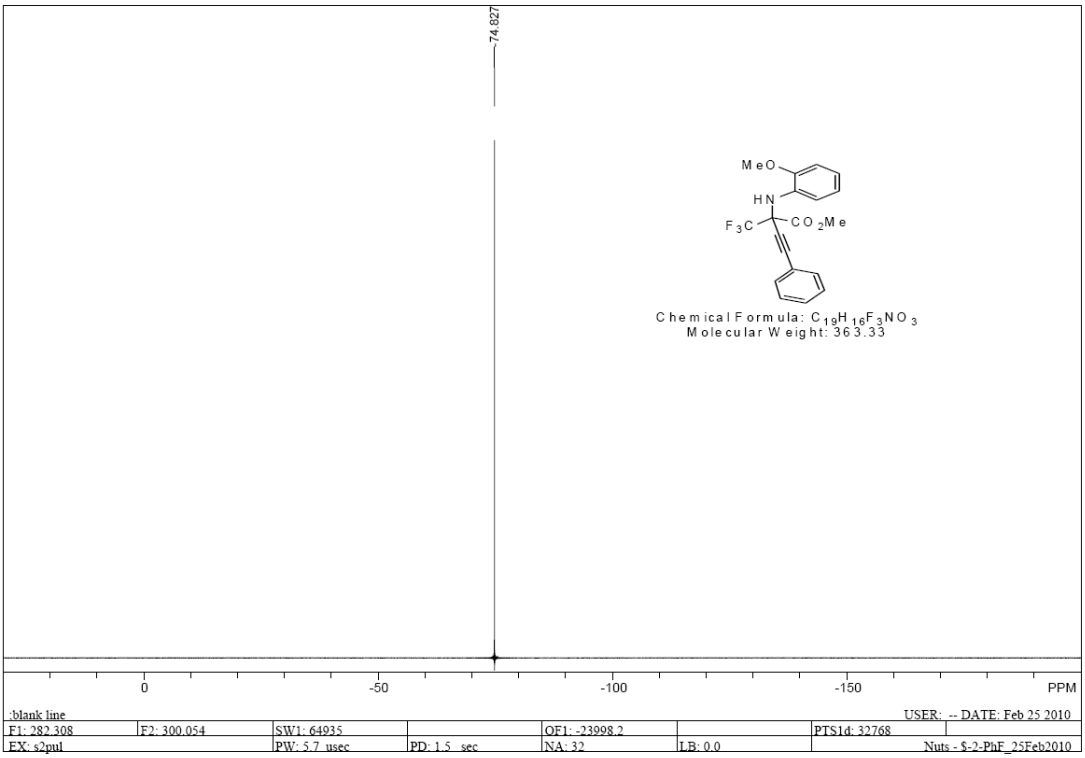
Methyl 3,3,3-trifluoro-2-(4-methoxyphenylimino)propanoate (1')

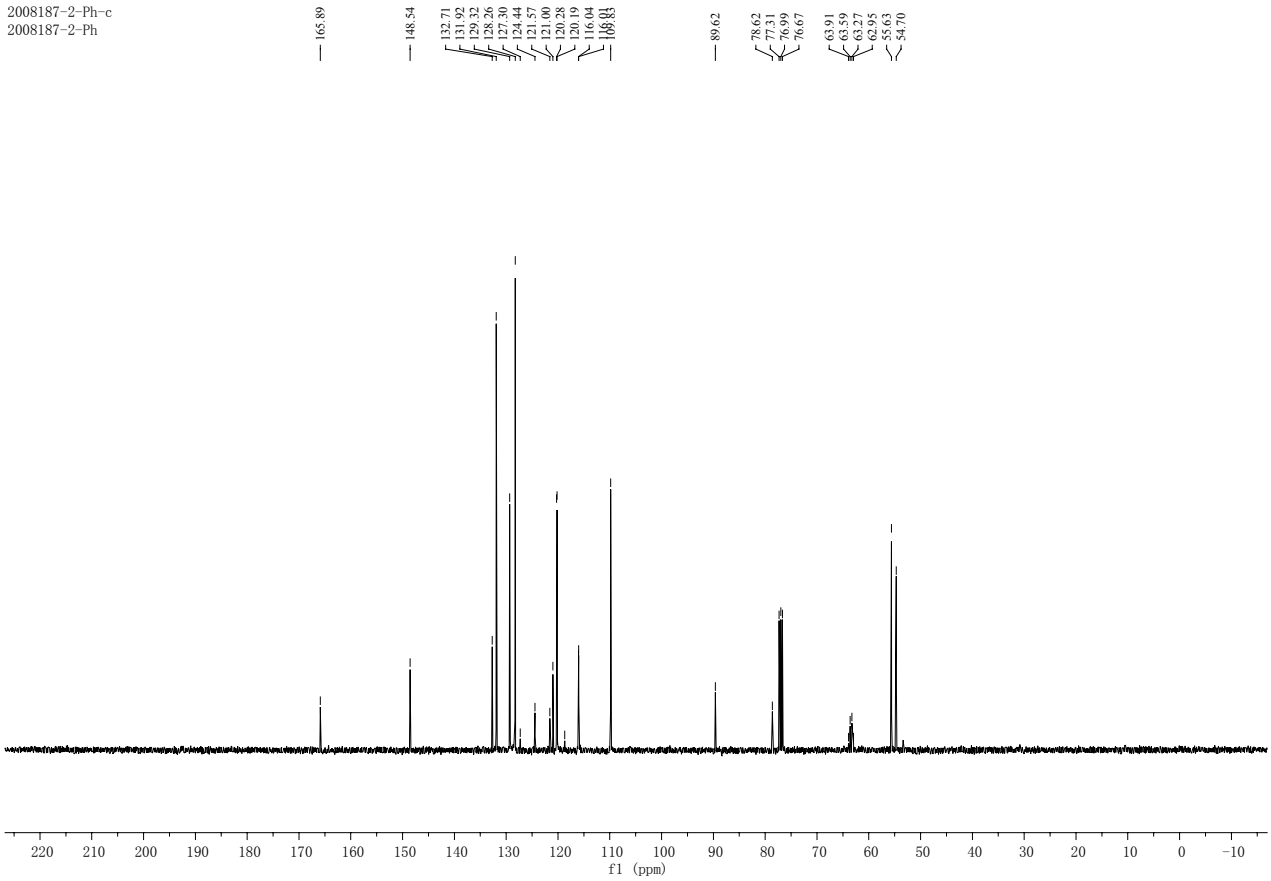




(*R*)-Methyl 2-(2-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)but-3-ynoate (3a).







Chiral HPLC Analysis of 3a

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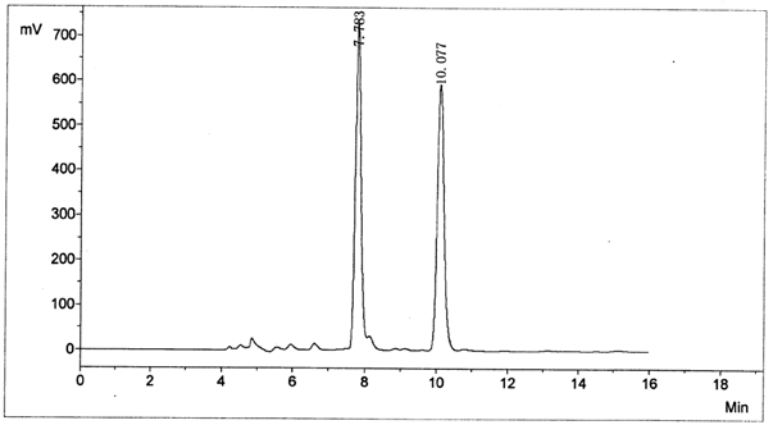
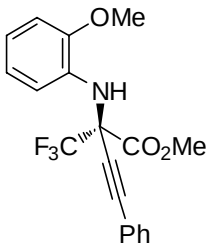
Date:2010-12-13





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HPLC Report

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Operator:
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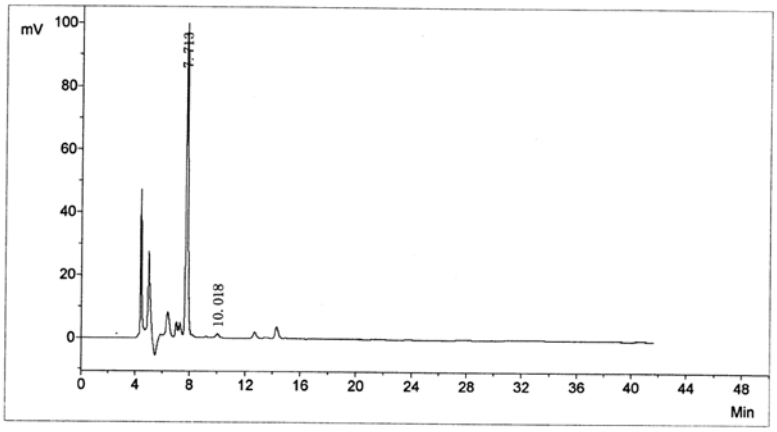
Date:2010-12-13



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before column chramatography

HPLC Report

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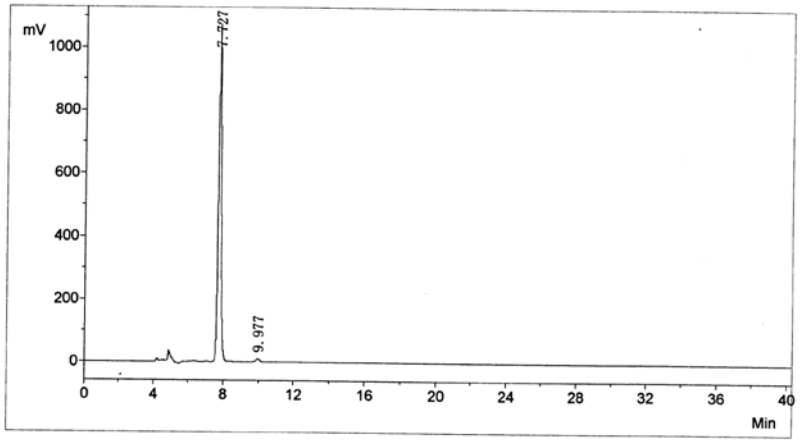

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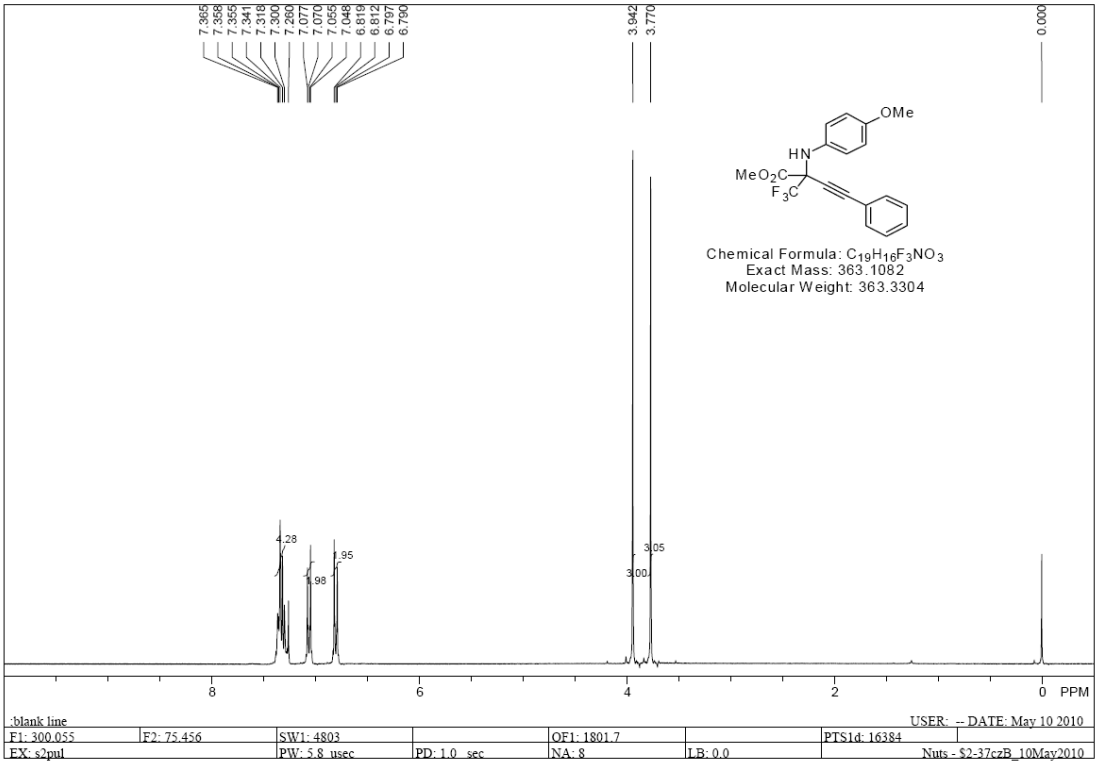
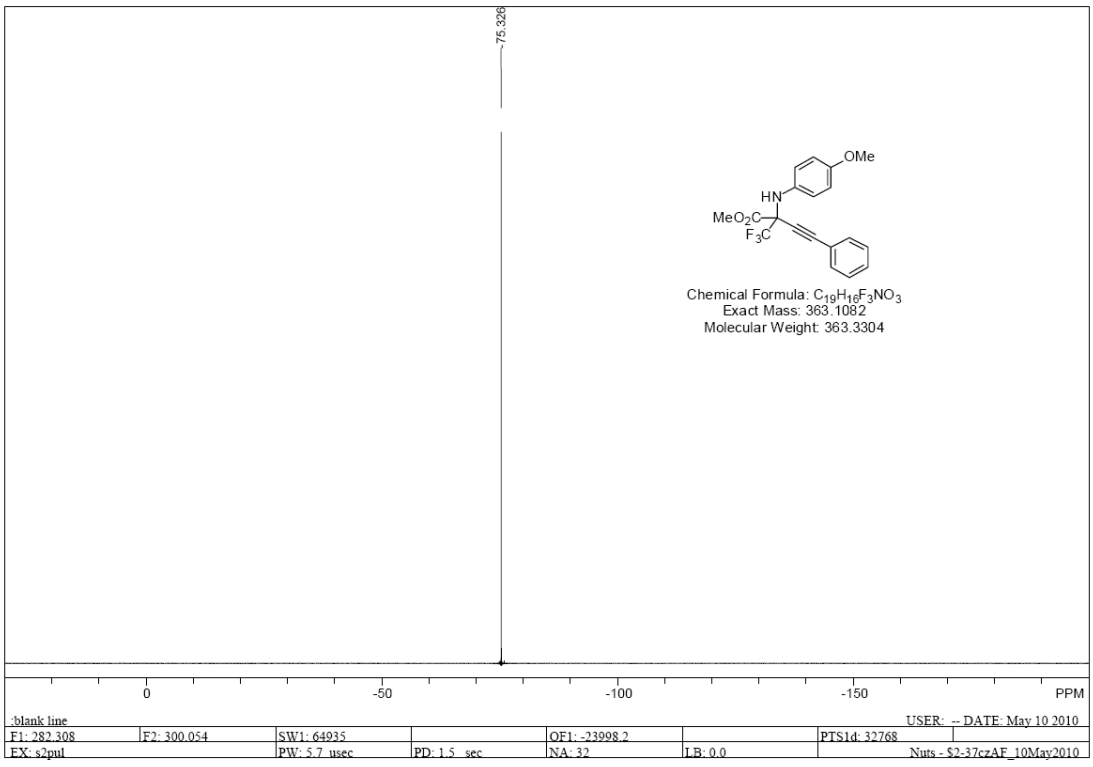
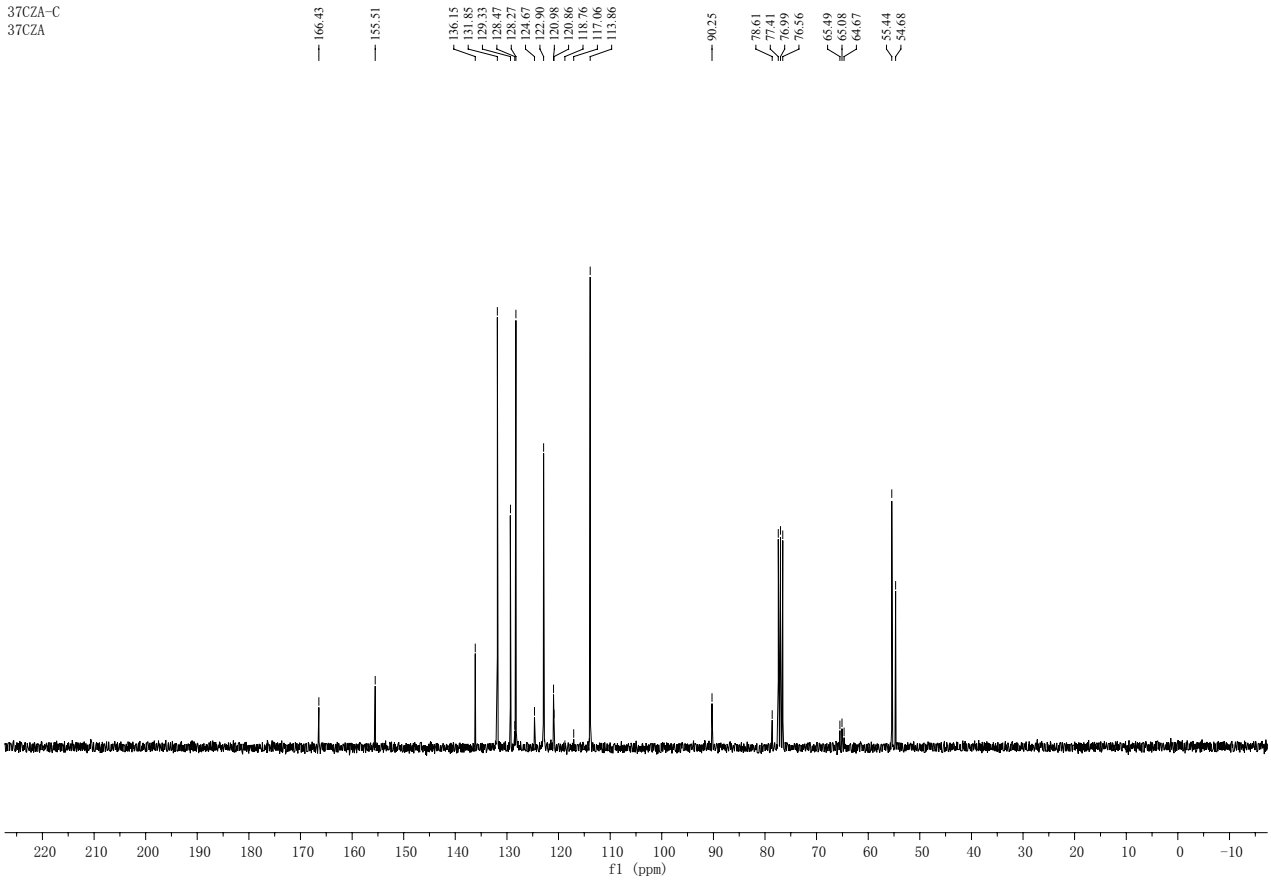
Total				1082424.1	12498570.5	100.0000

after column chramatography

(*R*)-Methyl 2-(4-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)but-3-ynoate (3a').







Chiral HPLC Analysis of 3a'

HPLC Report

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Operator:
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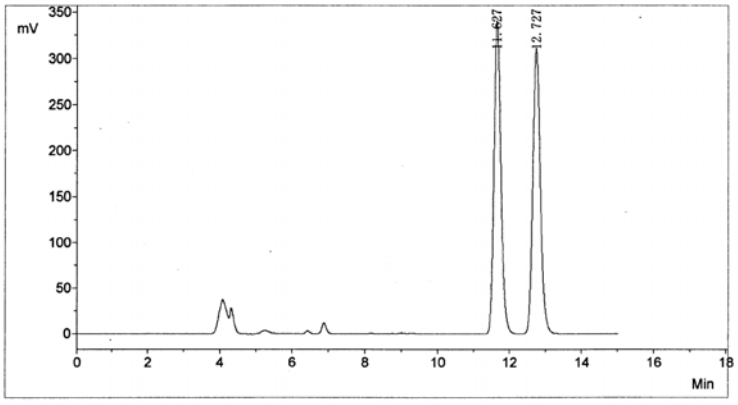

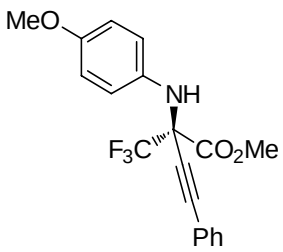

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HPLC Report

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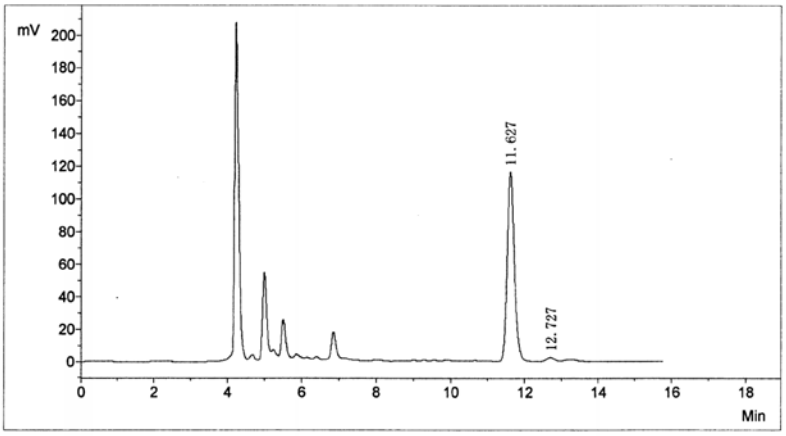
Date:2010-12-21



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Total				118423.4	1595092.3	100.0000

before column chramatography

HPLC Report

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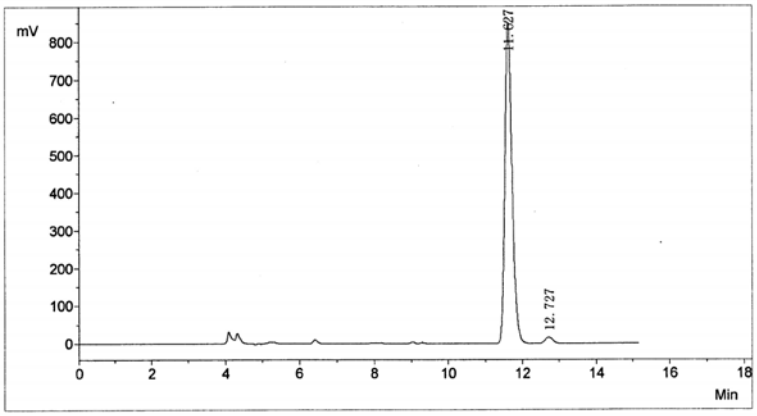
Date:2010-12-21



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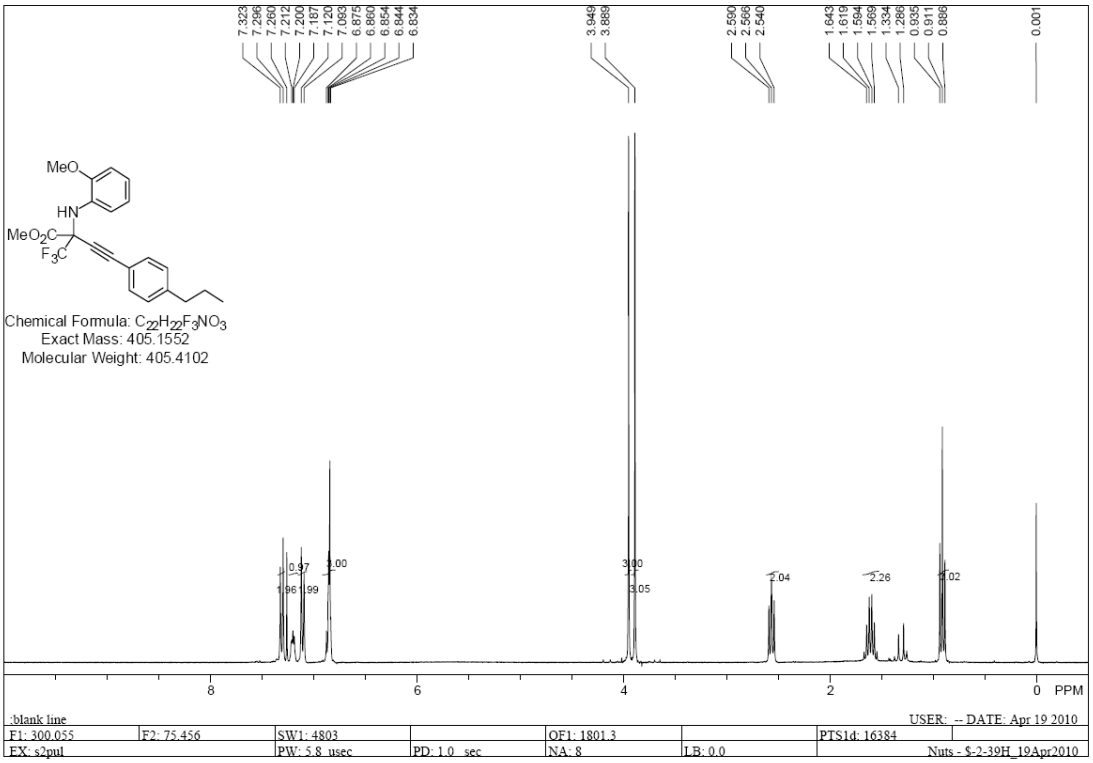
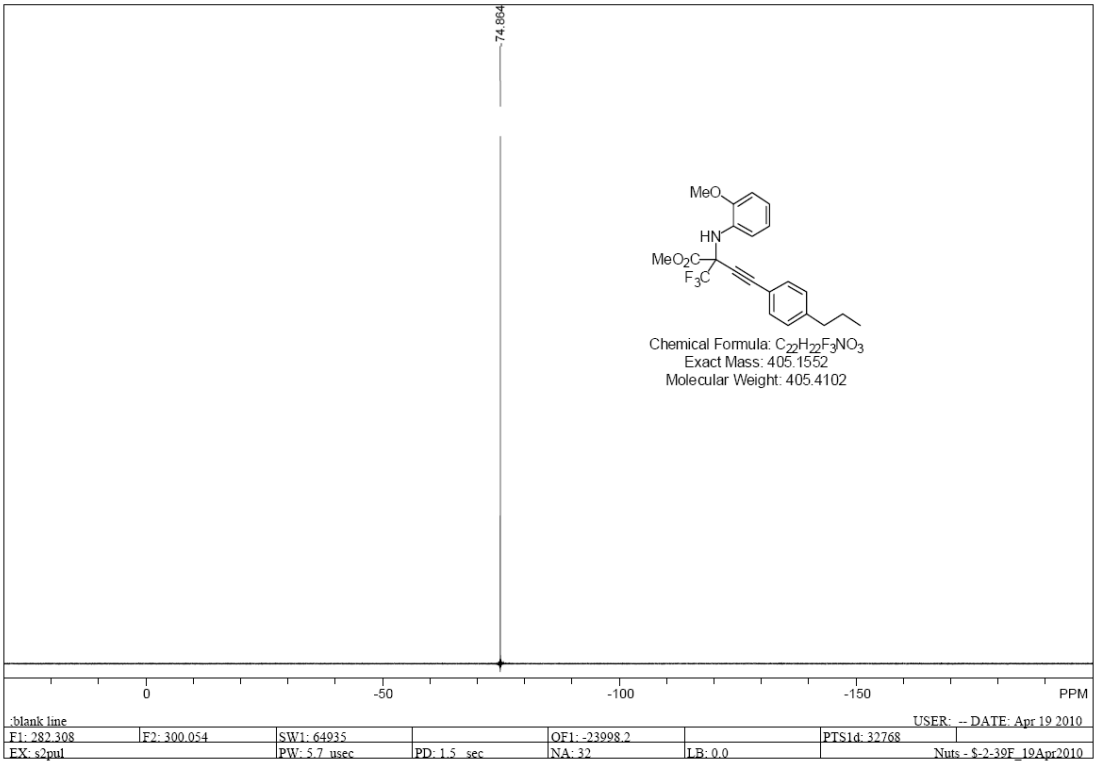
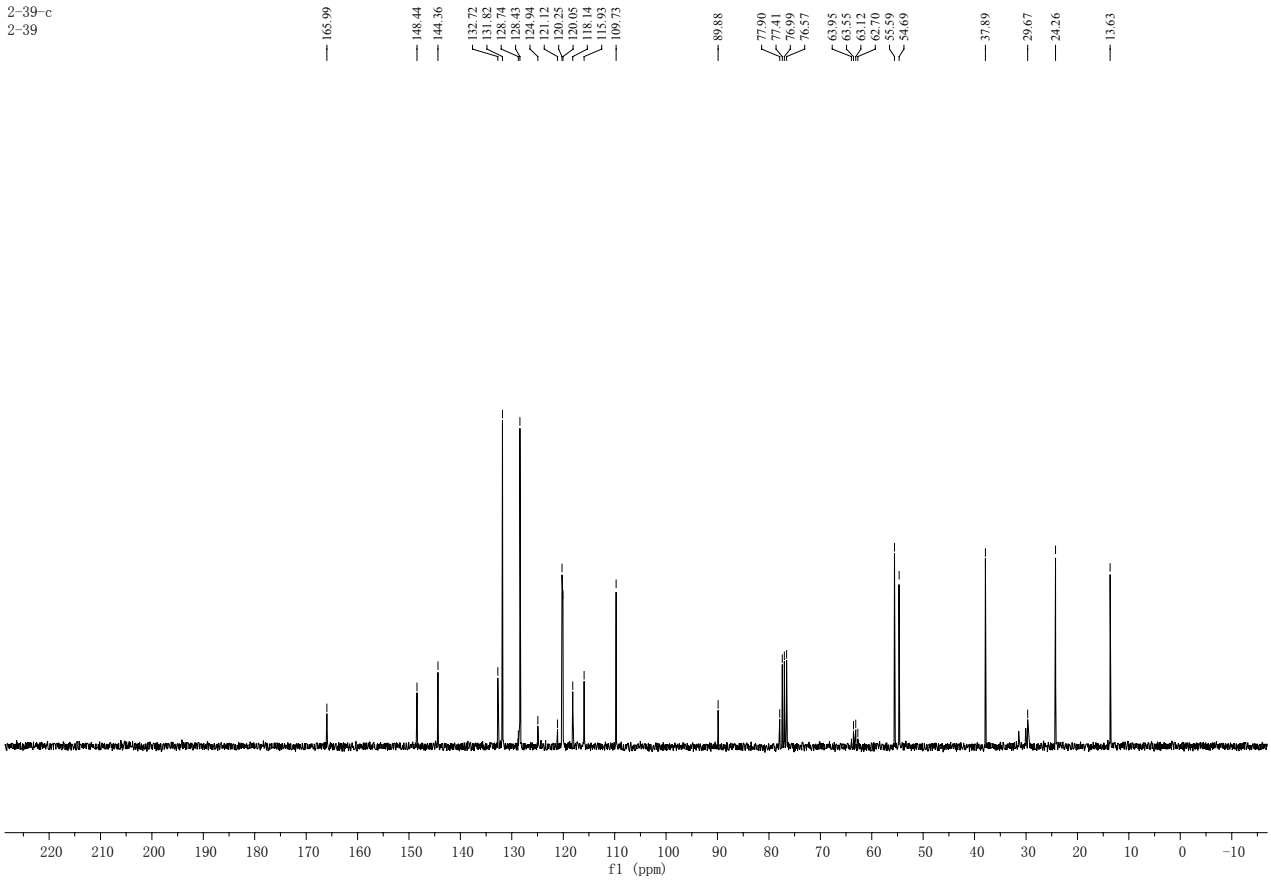
after column chramatography

(*R*)-Methyl 2-(2-methoxyphenylamino)-4-(4-propylphenyl)-2-(trifluoromethyl)but-3-ynoate (3b).



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109.73
89.88
77.90
77.41
76.99
76.57
63.95
63.55
63.12
62.70
55.59
54.69
37.89
29.67
24.26
13.63
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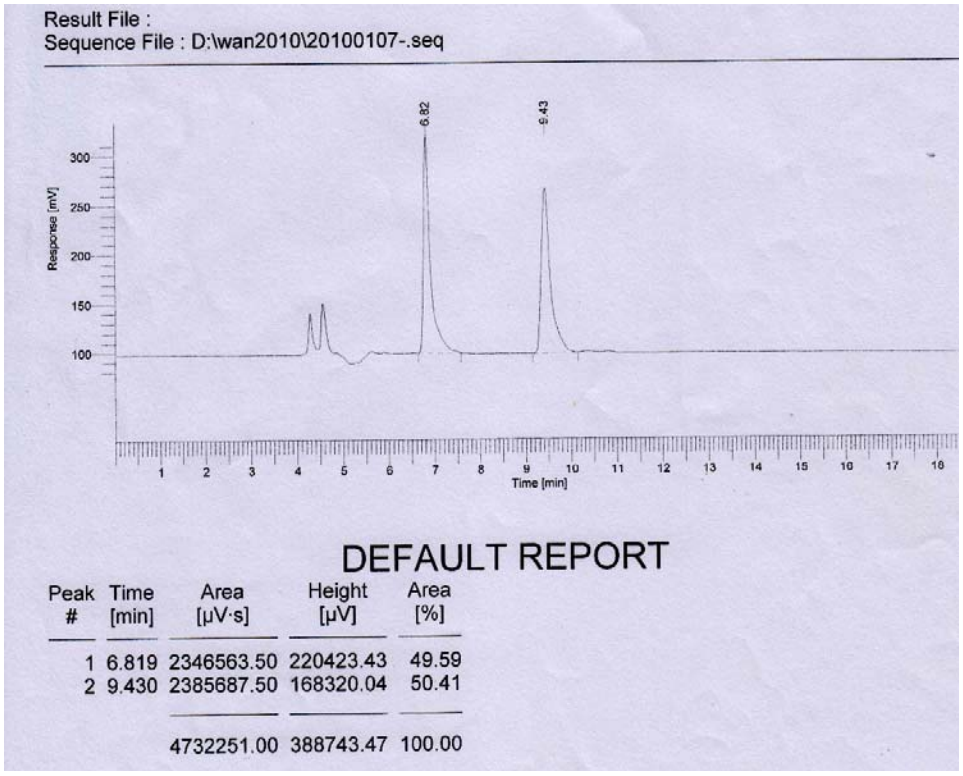
f1 (ppm)

Chiral HPLC Analysis of 3b



DEFAULT REPORT

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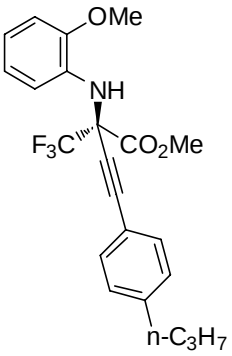
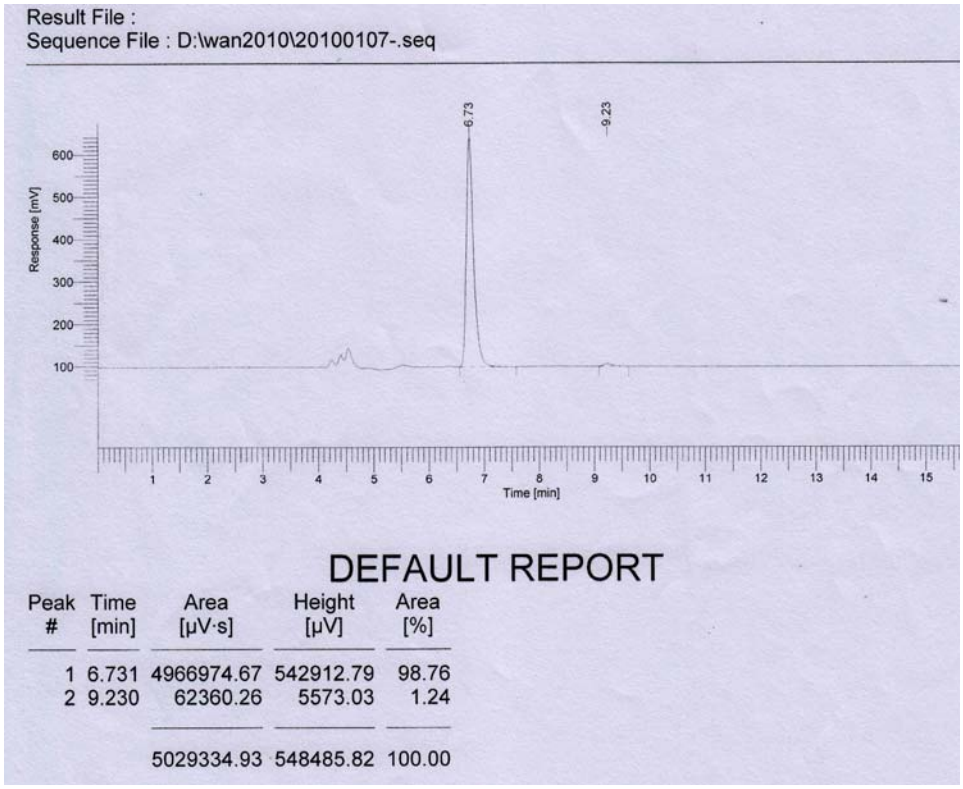


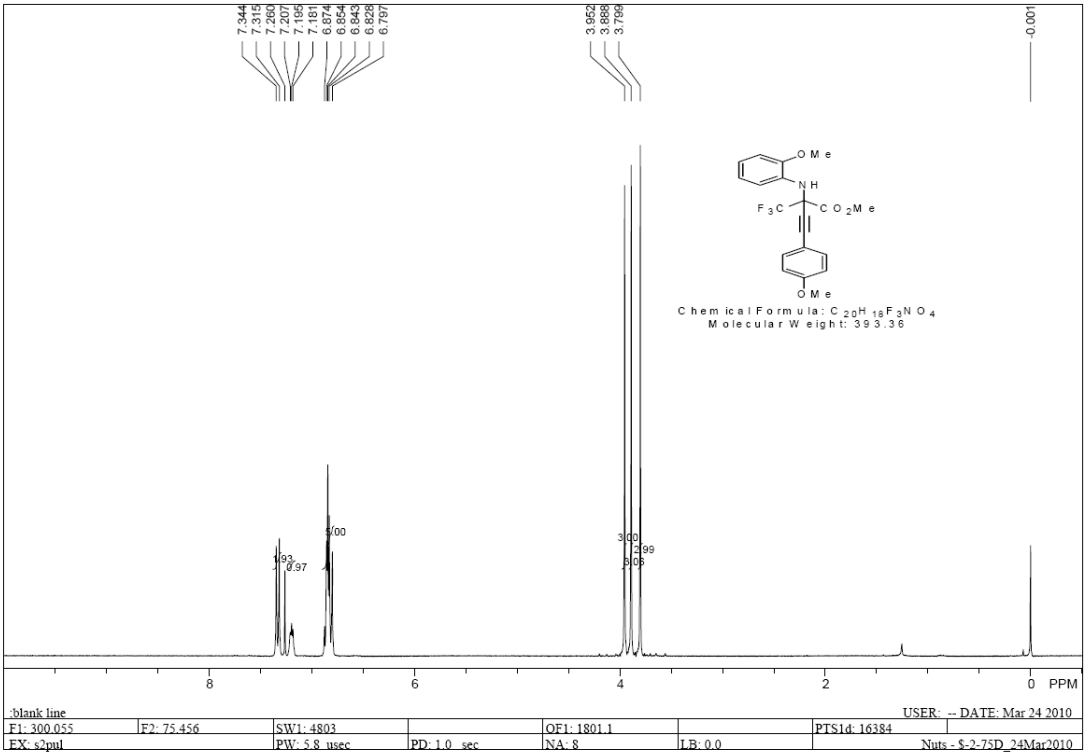


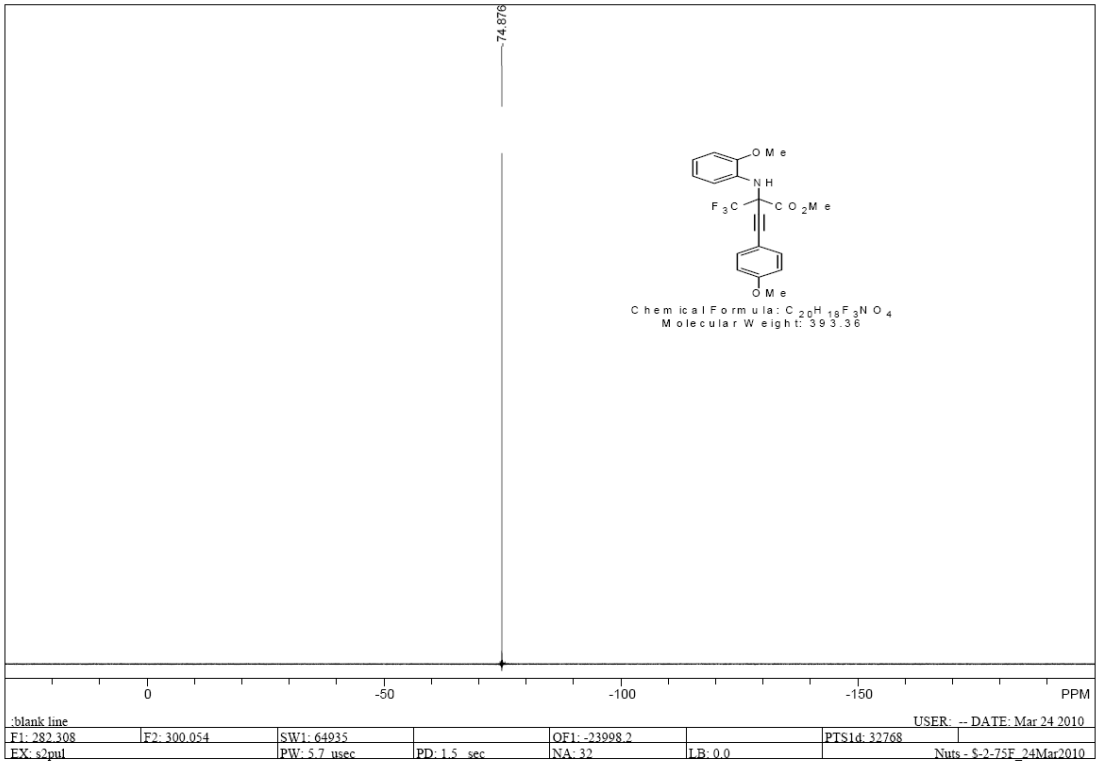
DEFAULT REPORT

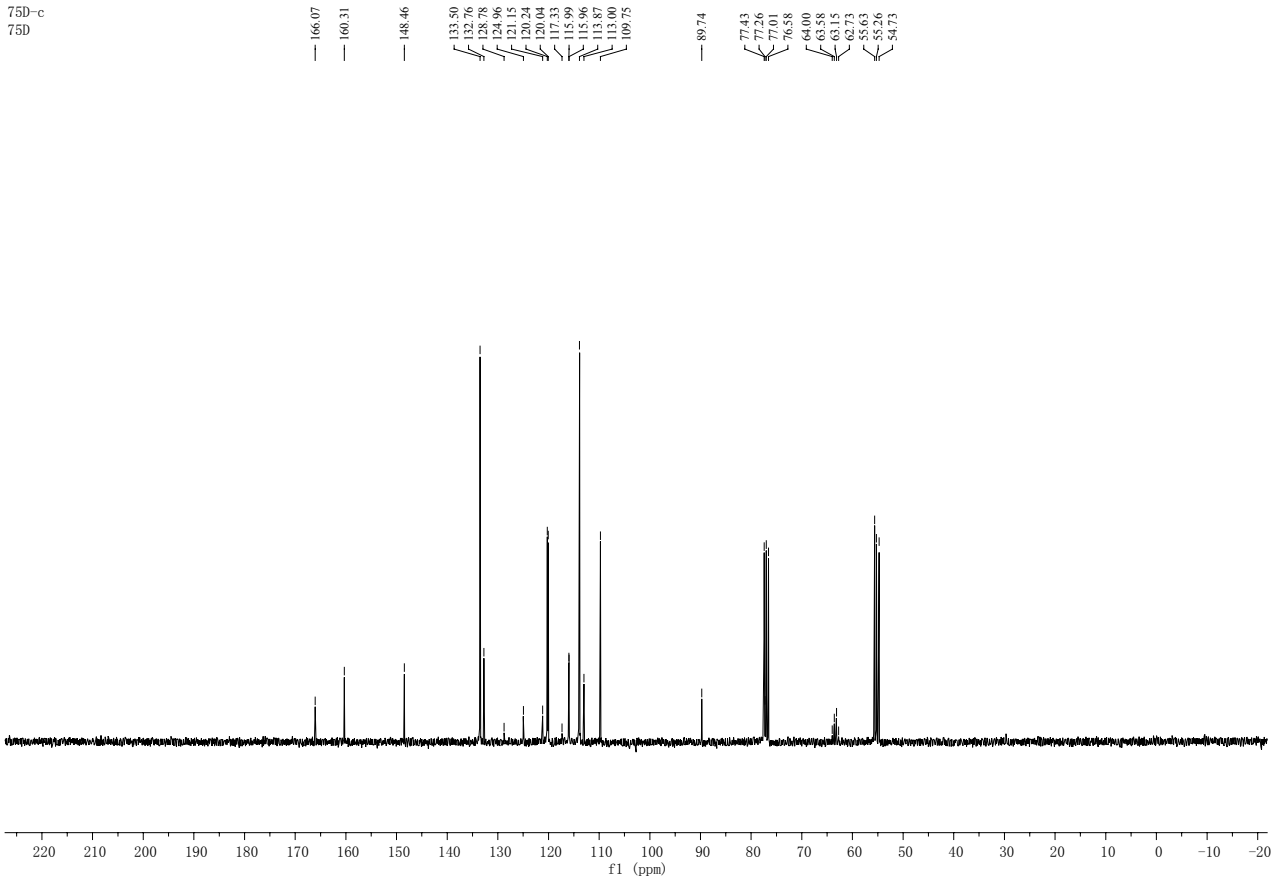
Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]
1	6.731	4966974.67	542912.79	98.76
2	9.230	62360.26	5573.03	1.24
		5029334.93	548485.82	100.00

after column chramatography

(*R*)-Methyl 4-(4-methoxyphenyl)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3c).





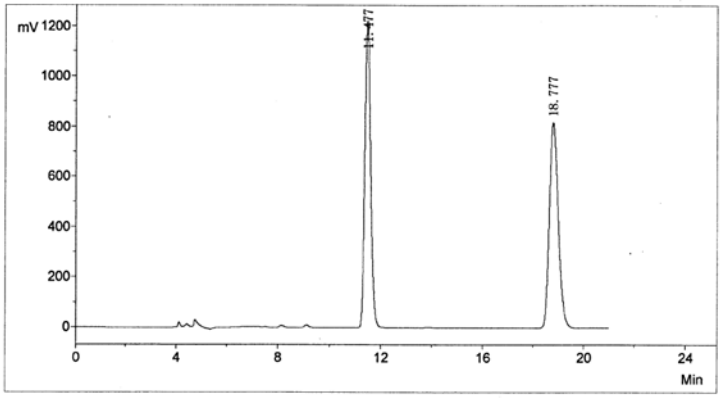


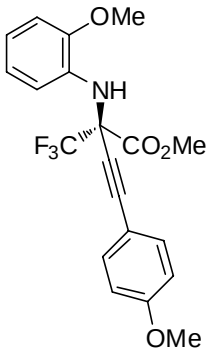
Chiral HPLC Analysis of 3c

HPLC Report

Sample Name:
Operator:
Time:14:11

Data File:HGC-2-46+-.che
Date:2010-12-20



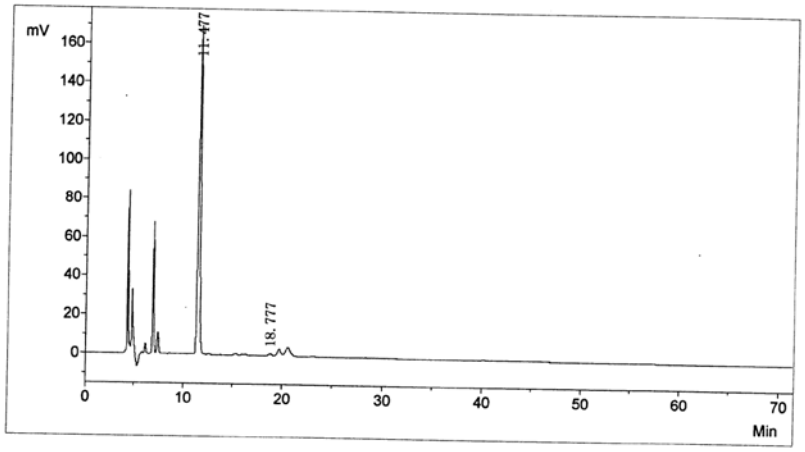


No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		11.477	1221342.7	19313416.8	49.1120
2	2		18.777	817490.0	20011867.6	50.8880
Total				2038832.7	39325284.4	100.0000

HPLC Report

Sample Name:
Operator:
Time:14:55

Data File:HGC-4-60Q.che
Date:2010-12-20



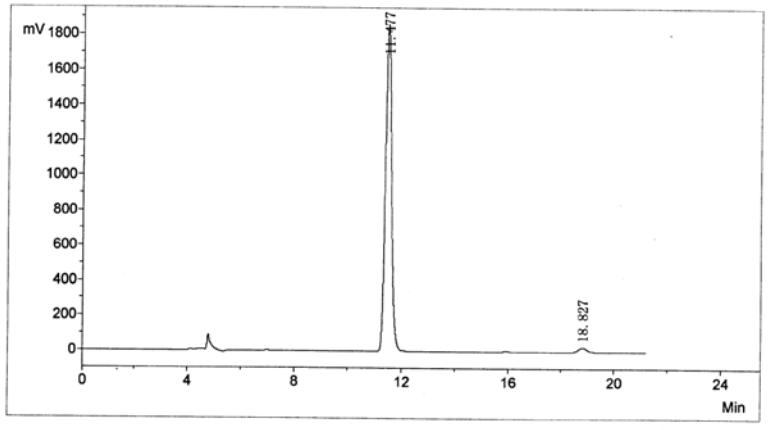
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		11.477	169505.4	2512961.3	99.2637
2	2		18.777	903.9	18640.0	0.7363
Total				170409.3	2531601.3	100.0000

before column chramatography

HPLC Report

Sample Name:
Operator:
Time:14:33

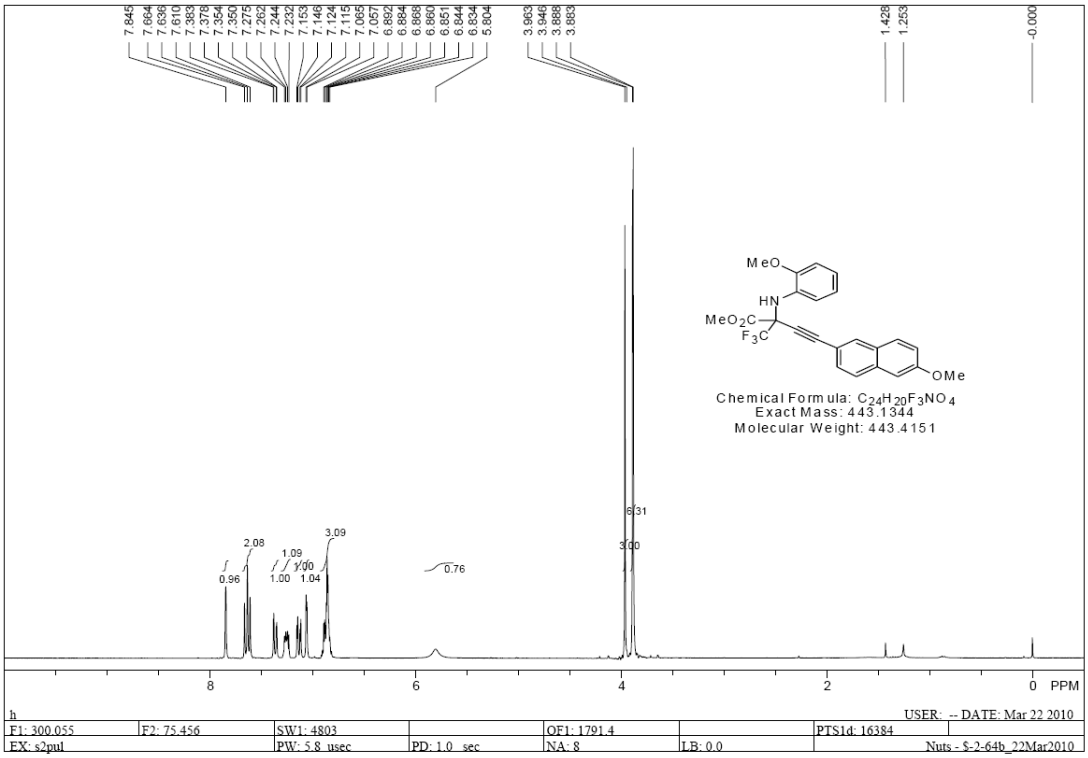
Data File:HGC-4-60T.che
Date:2010-12-20

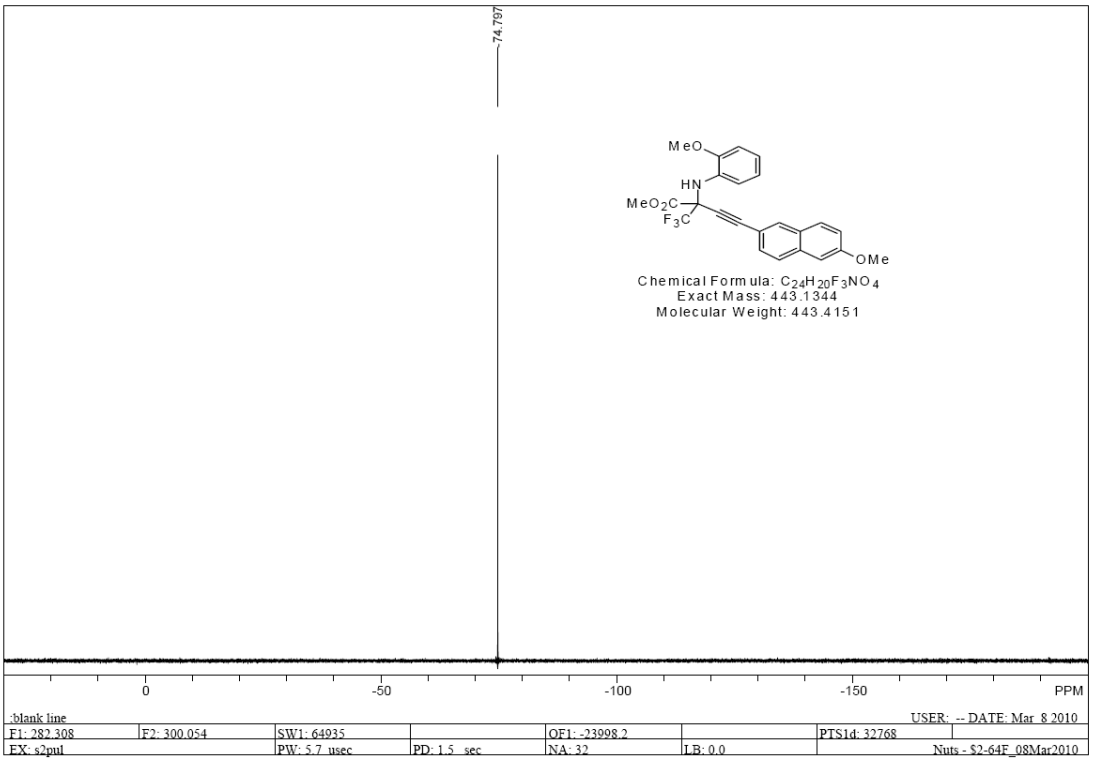


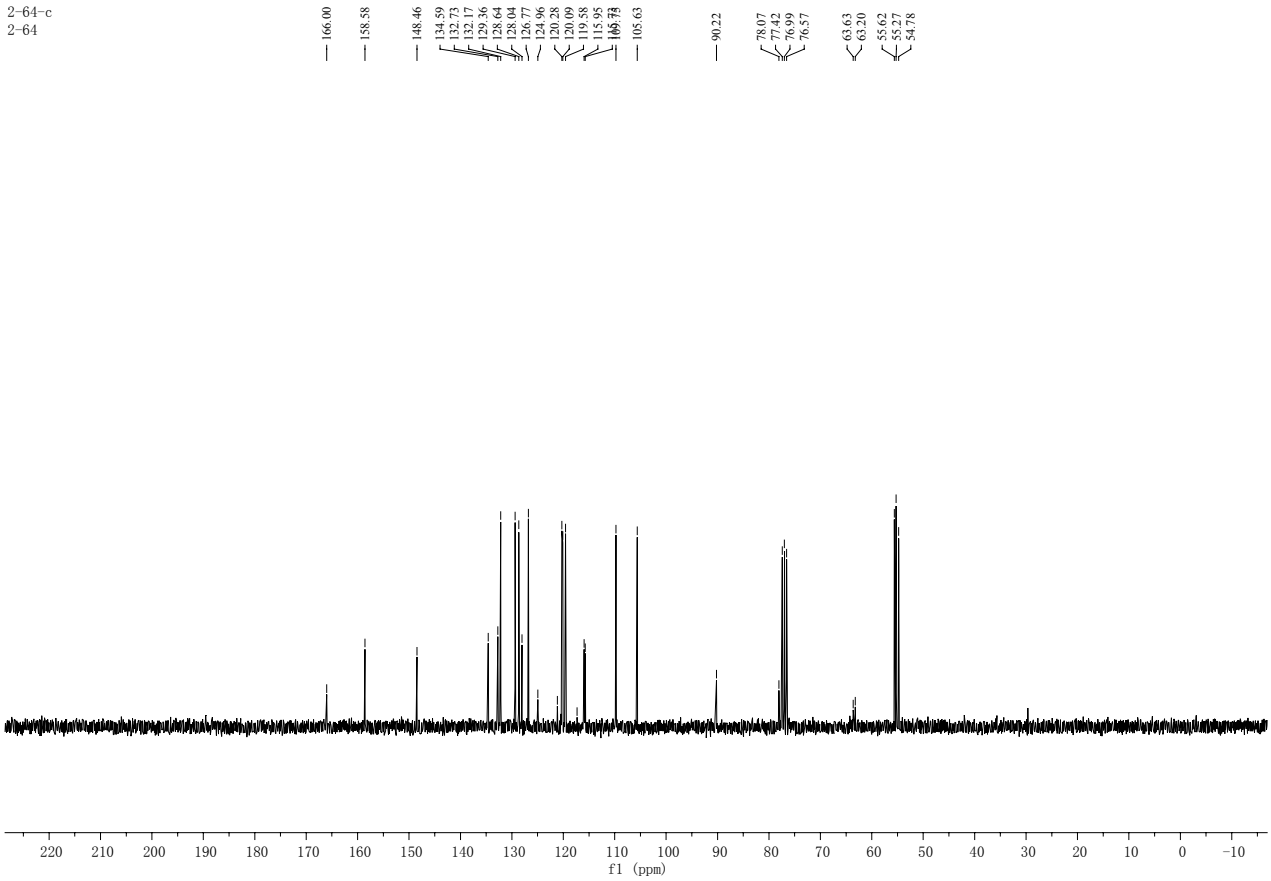
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		11.477	1847562.1	29685239.7	97.9500
2	2		18.827	26661.9	621286.0	2.0500
Total				1874224.0	30306525.7	100.0000

after column chramatography

(*R*)-Methyl 4-(6-methoxynaphthalen-2-yl)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3d).







Chiral HPLC Analysis of 3d

HPLC Report

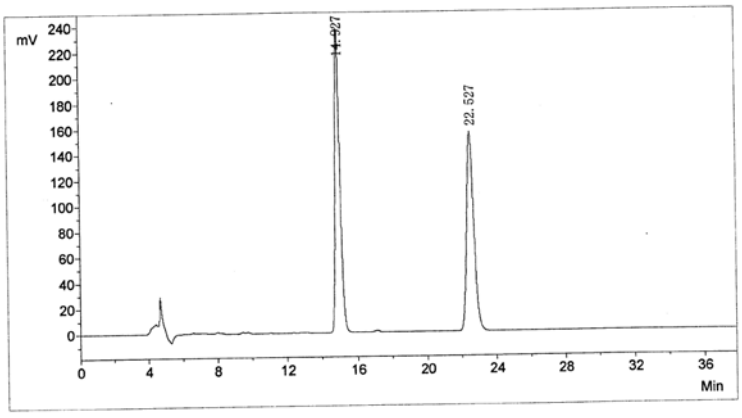
Sample Name:

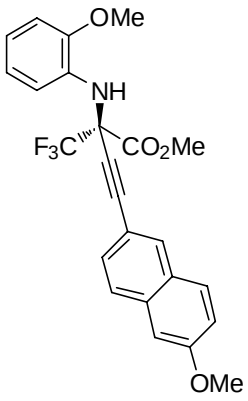
Operator:

Time:14:51

Data File:HGC-2-53+- AD-H 982 214 0.7.che

Date:2010-12-21



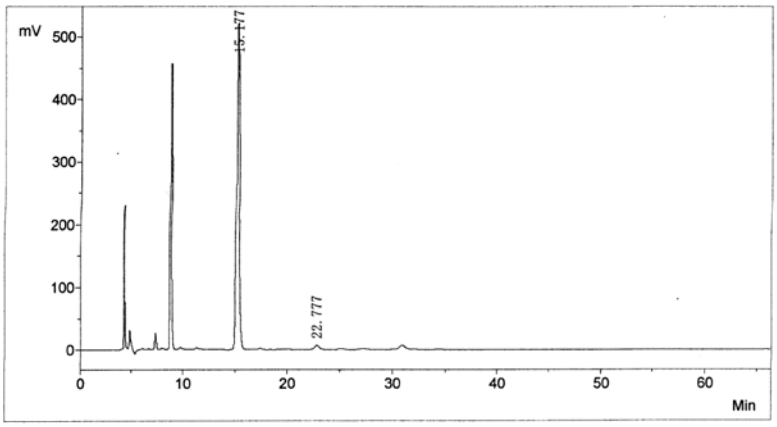


No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		14.927	237659.7	4570249.3	50.6358
2	2		22.527	155344.4	4455475.5	49.3642
Total				393004.1	9025724.8	100.0000

HPLC Report

Sample Name:
Operator:
Time:16:28

Data File:HGC-4-61Q.che
Date:2010-12-21



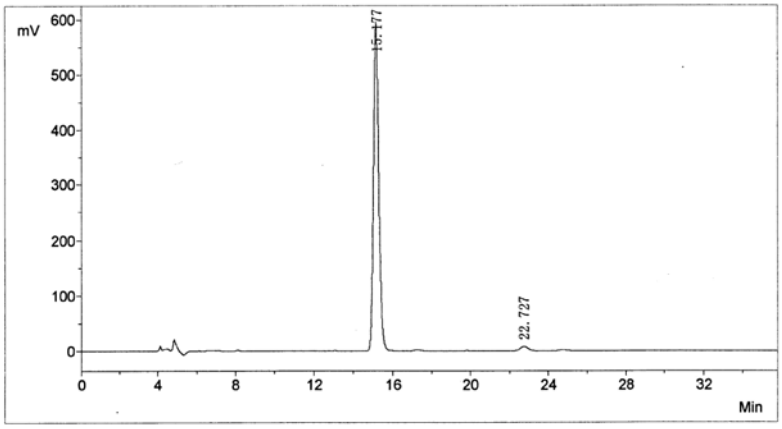
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		15.177	521123.2	9702739.9	97.9889
2	2		22.777	6955.2	199135.6	2.0111
Total				528078.5	9901875.5	100.0000

before column chramatography

HPLC Report

Sample Name:
Operator:
Time:15:36

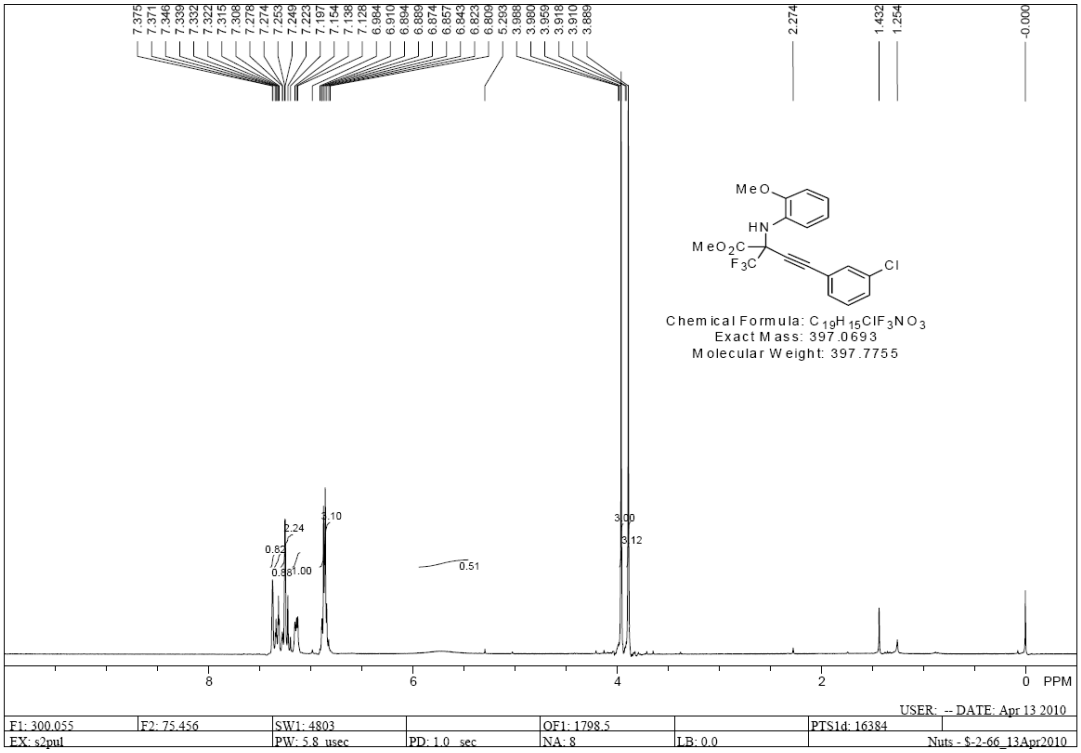
Data File:HGC-4-61T.che
Date:2010-12-21

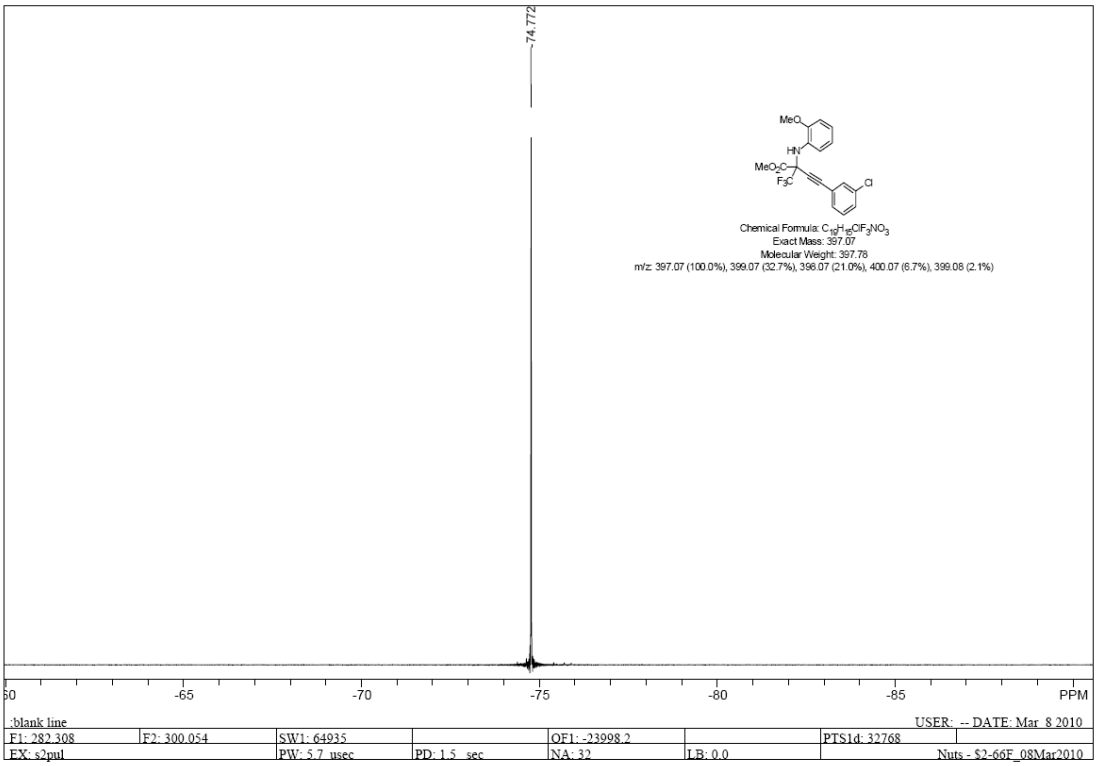


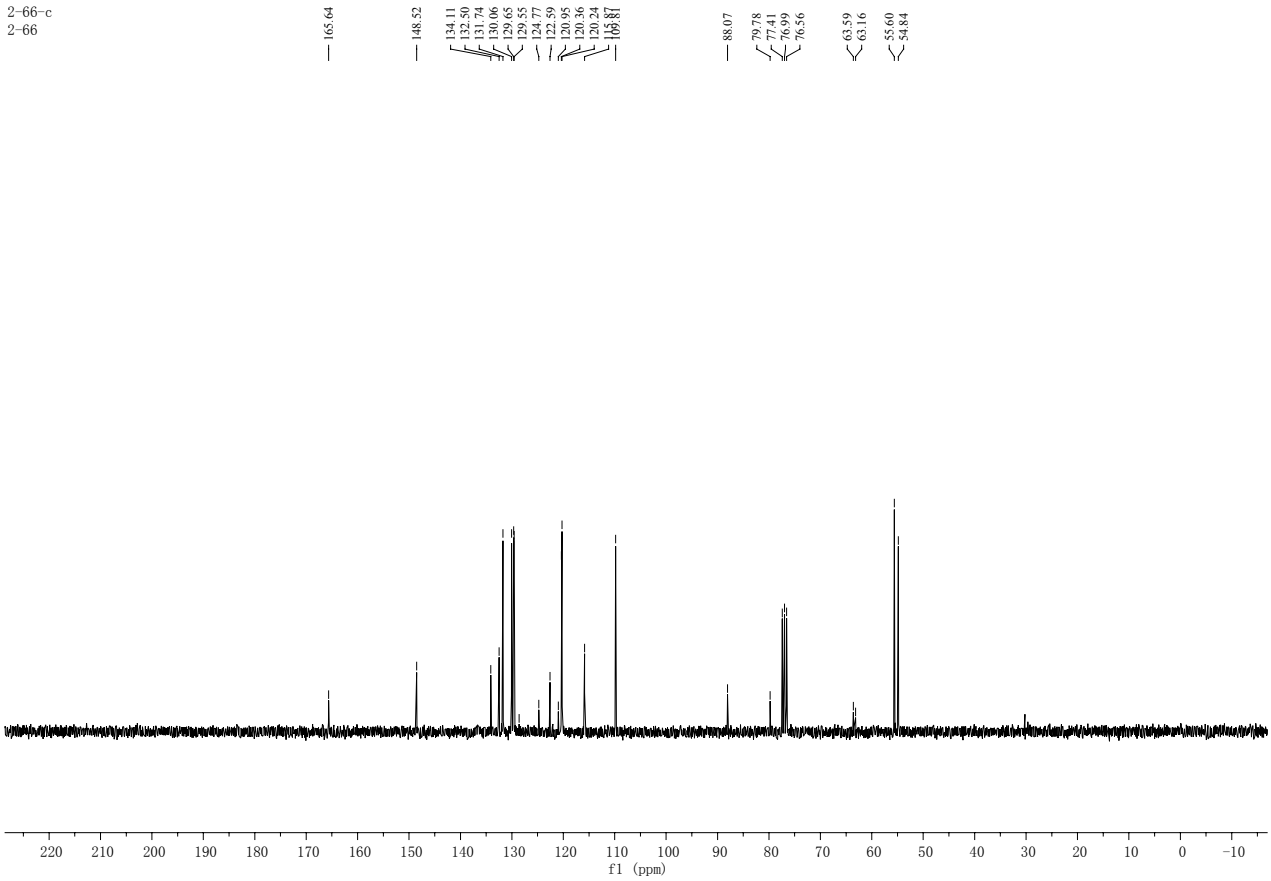
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		15.177	586368.6	11126921.8	97.9114
2	2		22.727	8401.4	237349.0	2.0886
Total				594770.0	11364270.8	100.0000

after column chramatography

(*R*)-Methyl 4-(3-chlorophenyl)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate （3e）.





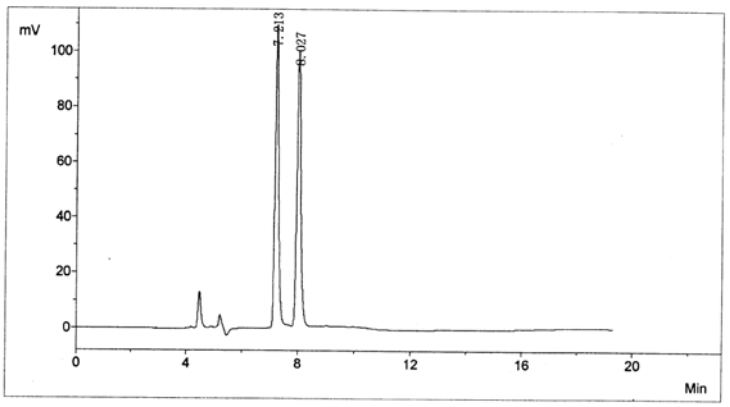


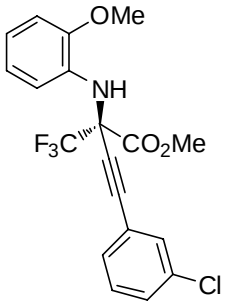
Chiral HPLC Analysis of 3e

HPLC Report

Sample Name:
Operator:
Time:07:29

Data File:HGC-2-44+-...che
Date:2010-12-28



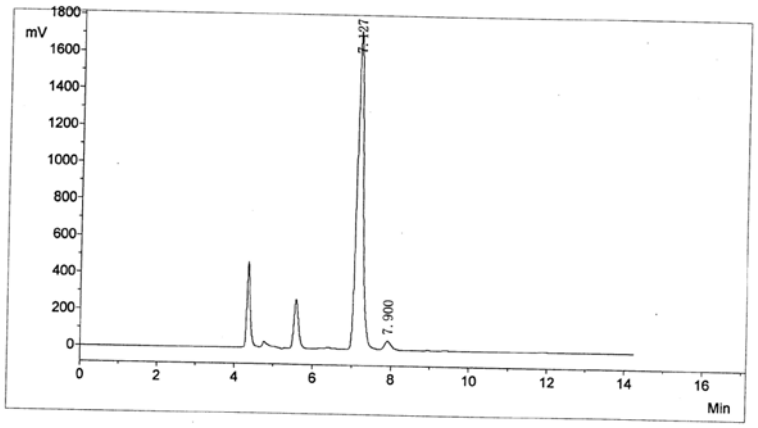


No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.213	108698.4	940799.7	49.6798
2	2		8.027	91980.2	952928.3	50.3202
Total				200678.6	1893727.9	100.0000

HPLC Report

Sample Name:
Operator:
Time:08:28

Data File:HGC-4-69CZQ.che
Date:2010-12-28



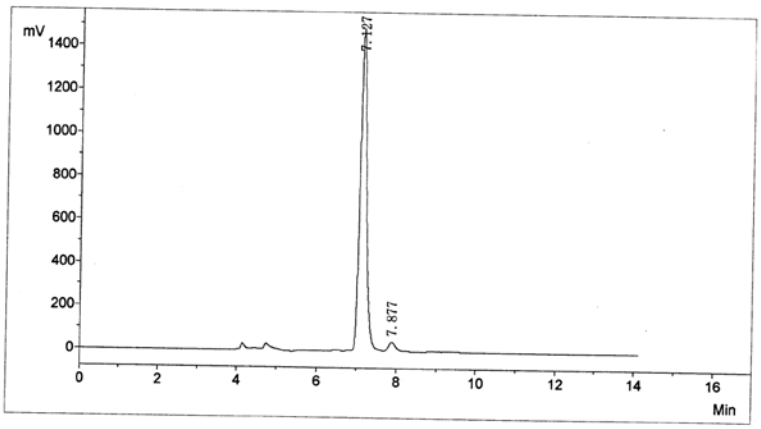
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.127	1711607.7	19317804.1	97.3195
2	2		7.900	46587.7	532074.5	2.6805
Total				1758195.4	19849878.6	100.0000

before column chramatography

HPLC Report

Sample Name:
Operator:
Time:08:11

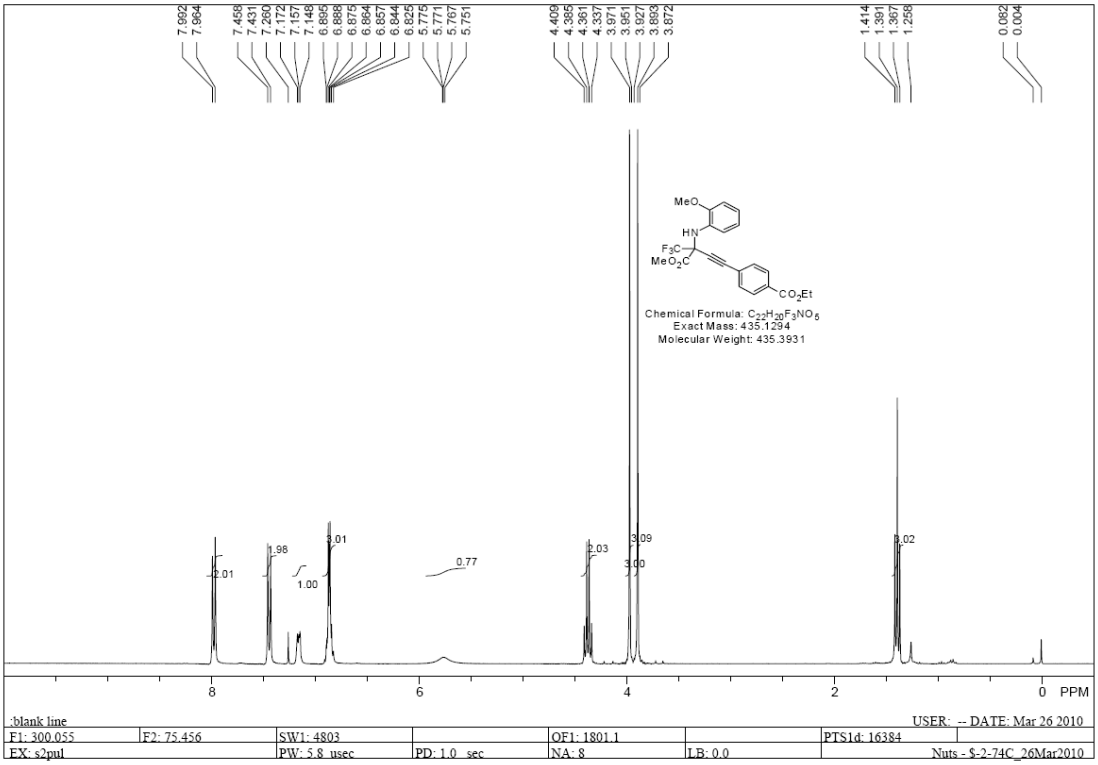
Data File:HGC-4-69CZT...che
Date:2010-12-28

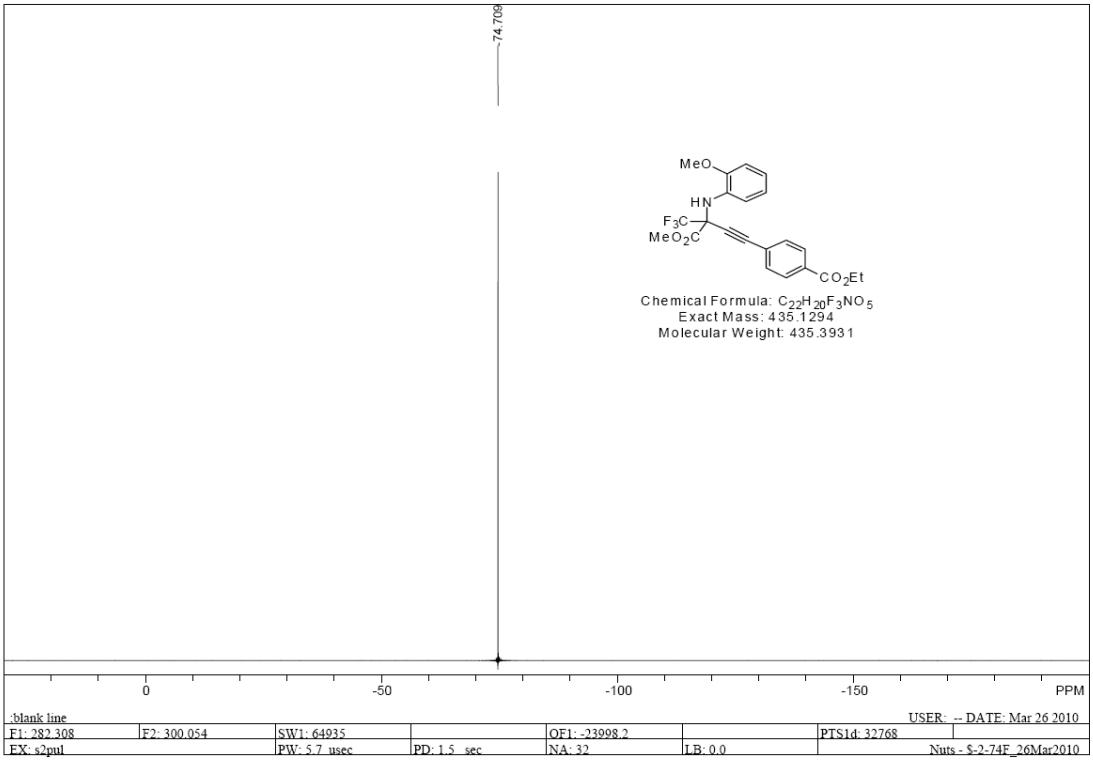


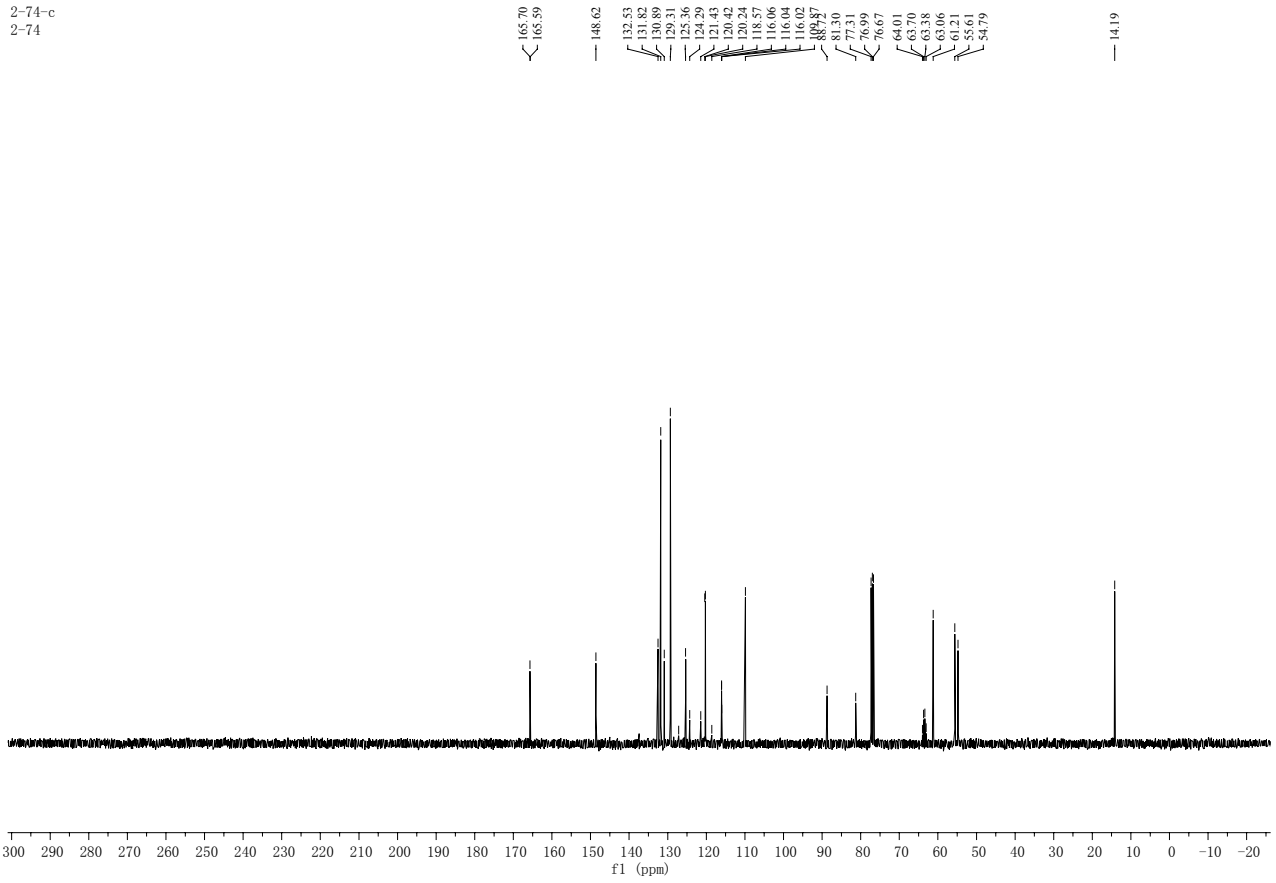
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.127	1458045.9	16957288.1	96.9474
2	2		7.877	41963.7	533935.3	3.0526
Total				1500009.7	17491223.3	100.0000

after column chramatography

(*R*)-Ethyl 4-(4,4,4-trifluoro-3-(methoxycarbonyl)-3-(2-methoxyphenylamino)but-1-ynyl)benzoate (3f).





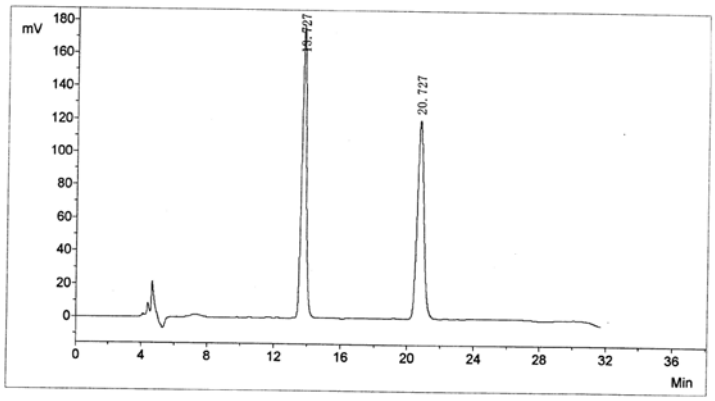


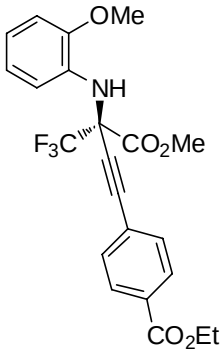
Chiral HPLC Analysis of 3f

HPLC Report

Sample Name:
Operator:
Time:08:03

Data File:HGC-2-88+-...che
Date:2010-12-27



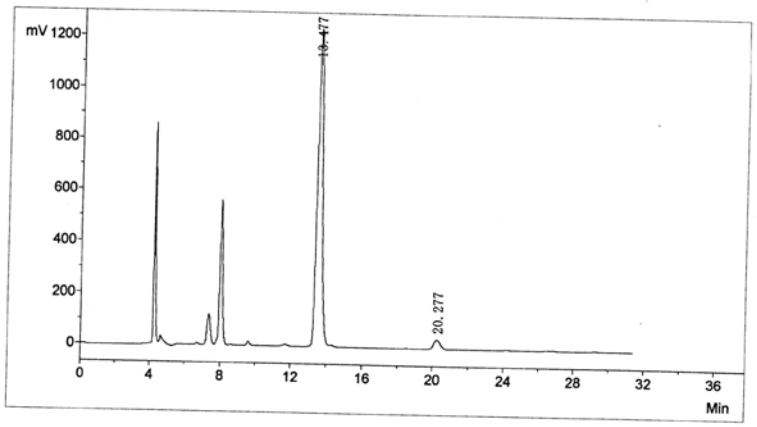


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		13.727	175173.3	3370476.7	50.4665
2	2		20.727	119999.2	3308170.4	49.5335
Total				295172.4	6678647.1	100.0000

HPLC Report

Sample Name:
Operator:
Time:09:58

Data File:HGC-4-672Q.che
Date:2010-12-27



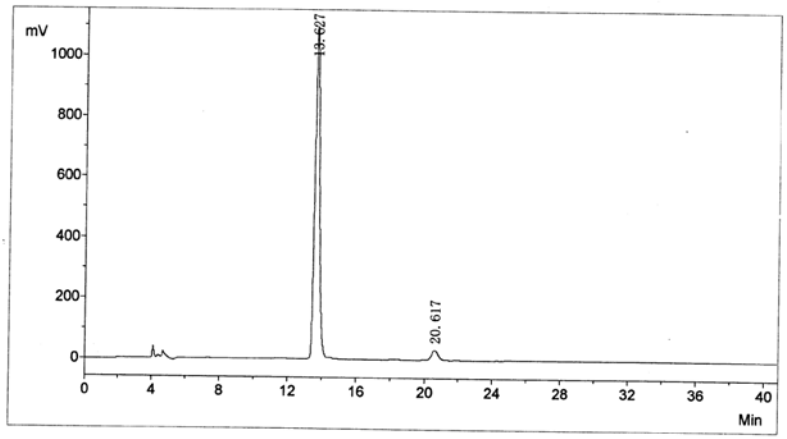
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		13.477	1233370.2	24535852.6	95.9312
2	2		20.277	37327.2	1040656.7	4.0688
Total				1270697.4	25576509.4	100.0000

before column chramatography

HPLC Report

Sample Name:
Operator:
Time:08:37

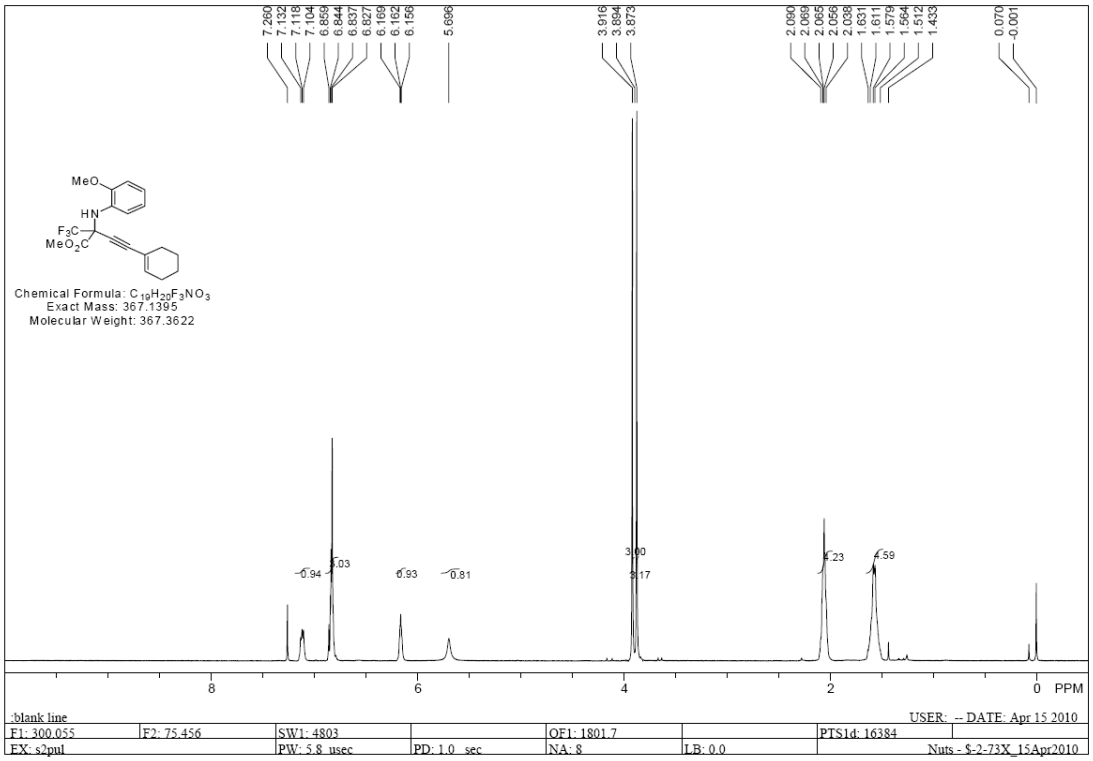
Data File:HGC-4-672T.che
Date:2010-12-27

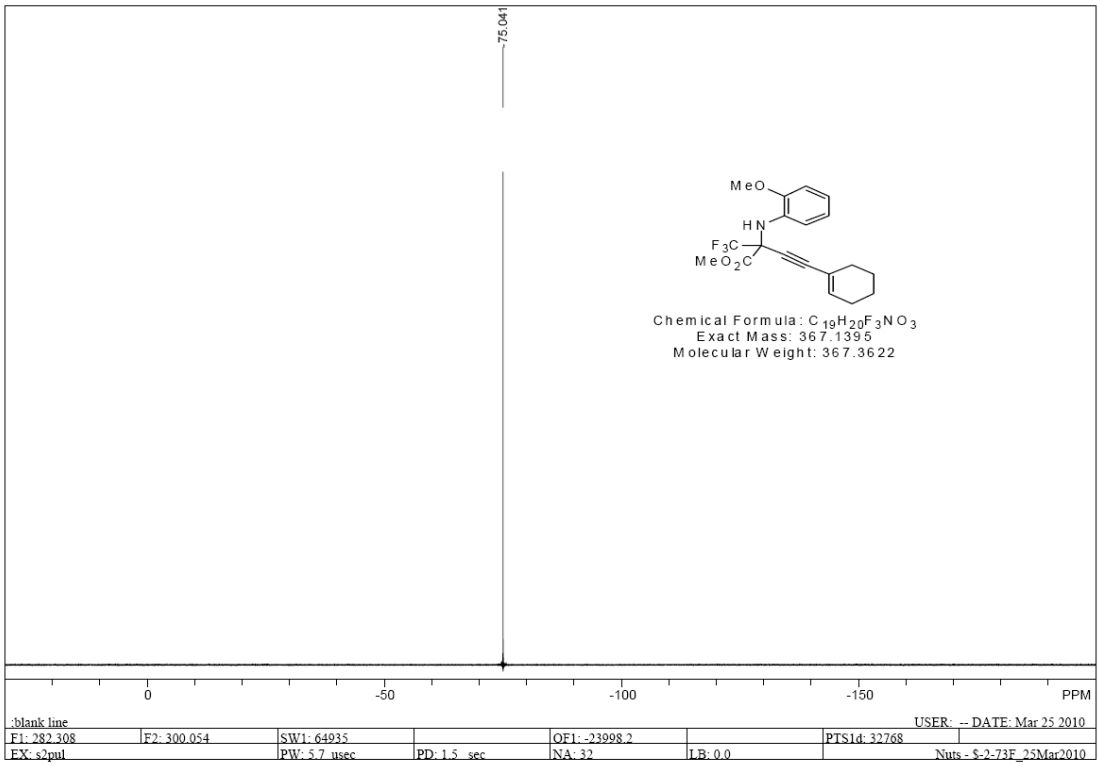


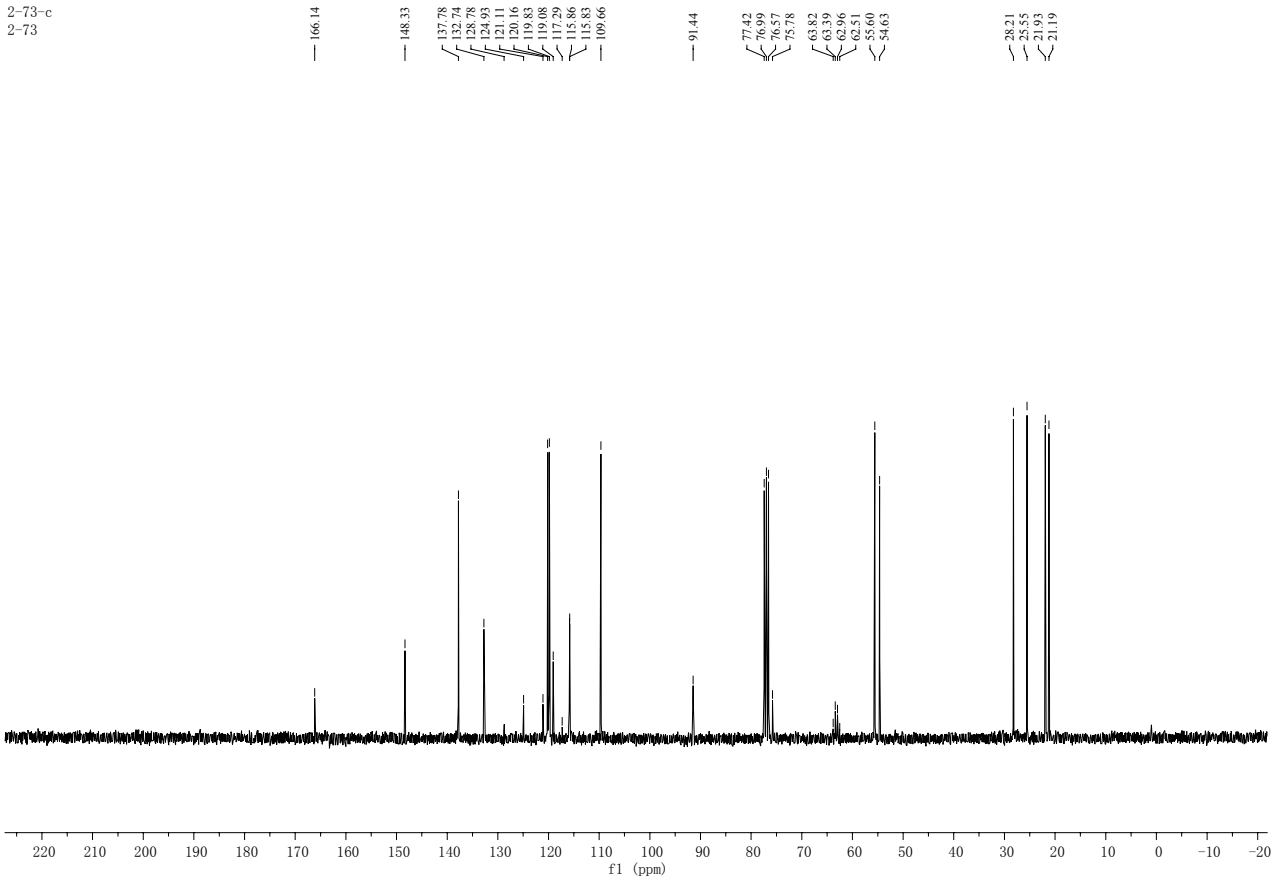
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		13.627	1089395.0	21087603.4	95.9291
2	2		20.617	33398.6	894878.5	4.0709
Total				1122793.6	21982481.9	100.0000

after column chramatography

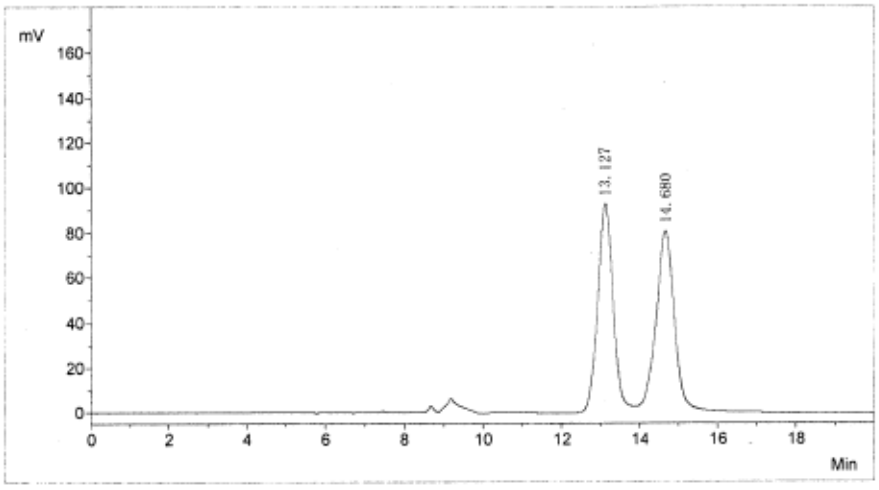
(*R*)-Methyl 4-cyclohexenyl-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3g).

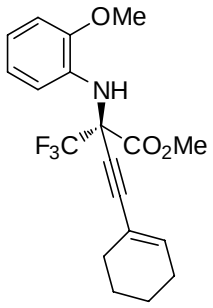




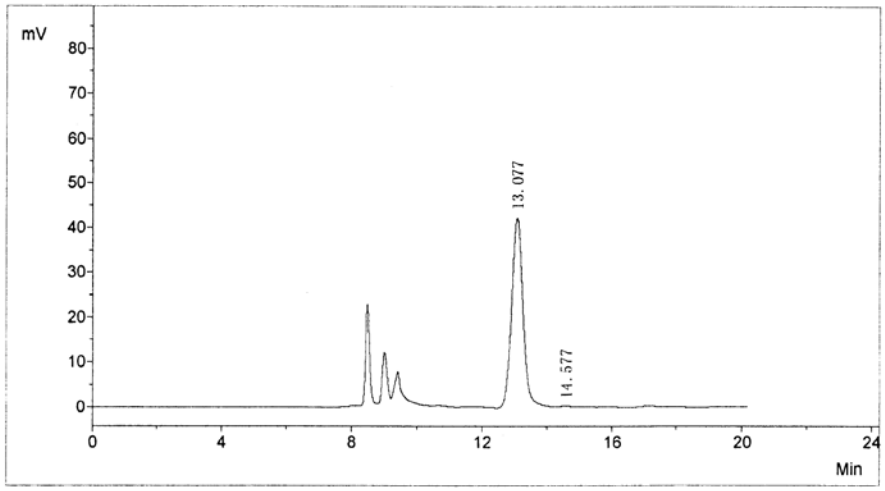


Chiral HPLC Analysis of 3g



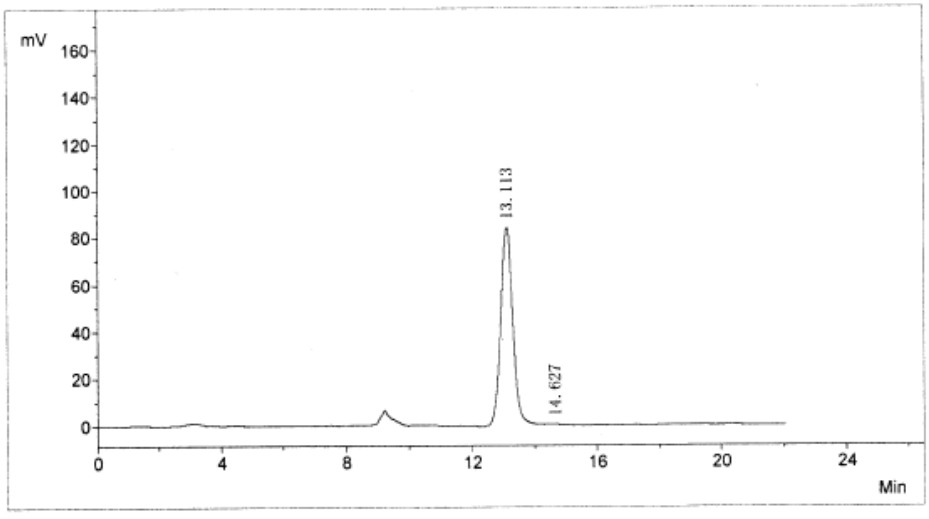


No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	13.127	91116.6	2415291.8	49.6979
2	2	14.680	78558.0	2444656.2	50.3021
Total			169674.7	4859947.9	100.0000



No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	13.077	42466.9	1031002.0	99.7685
2	2	14.577	111.1	2391.9	0.2315
Total			42578.0	1033393.9	100.0000

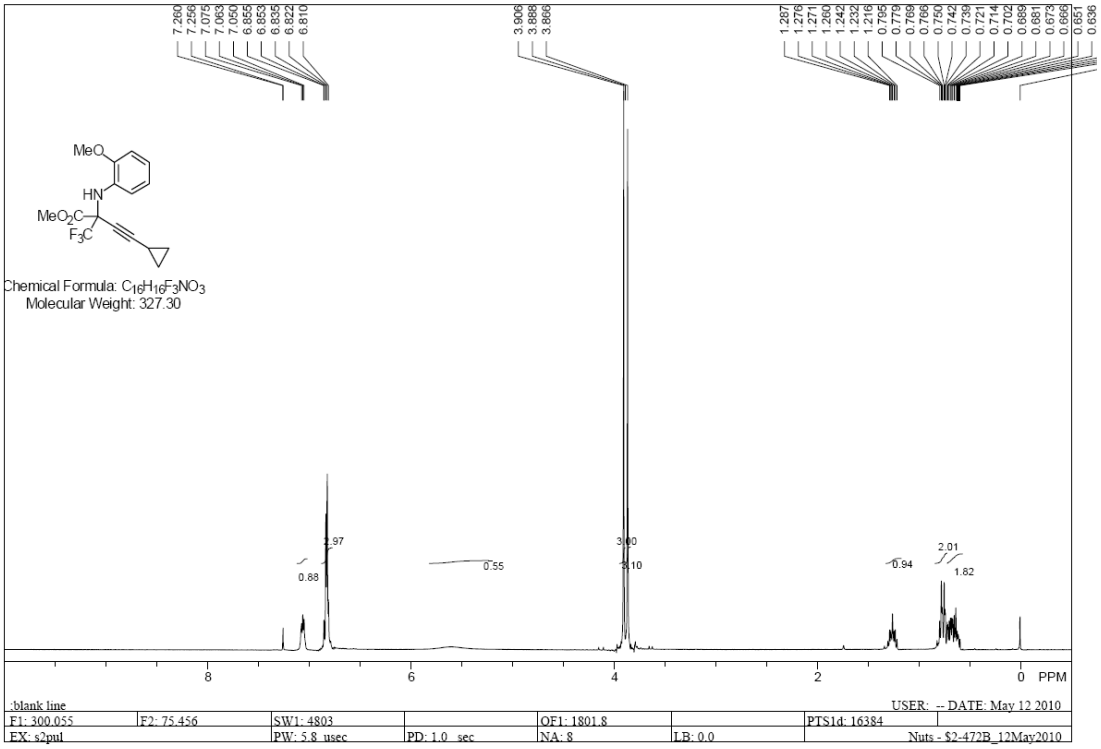
before column chromatography

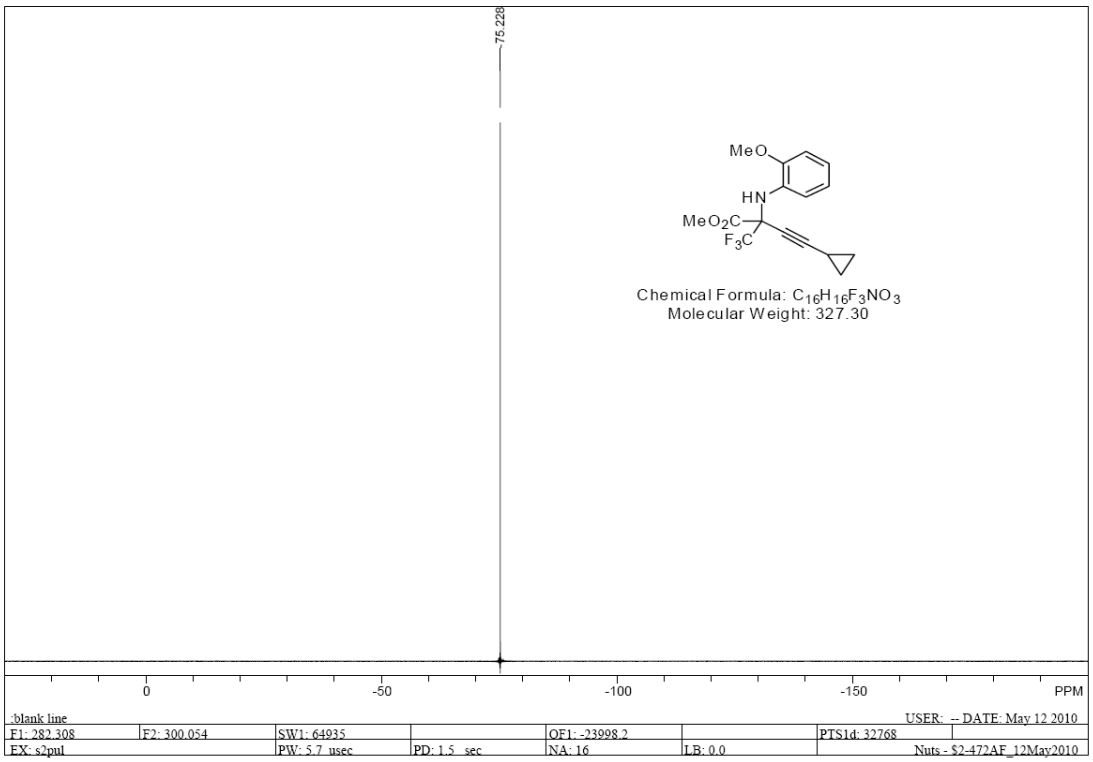


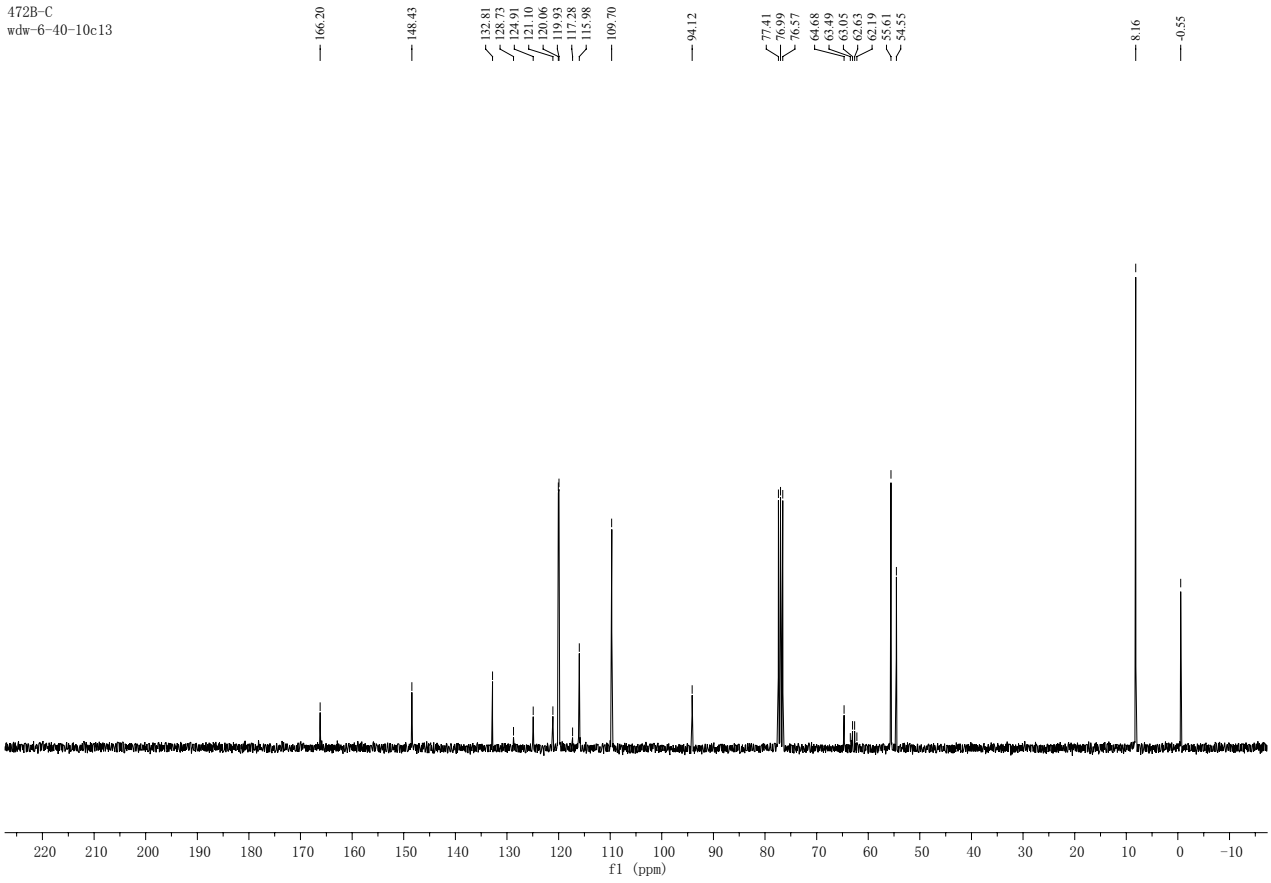
No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	13.113	84195.9	2235363.3	99.7858
2	2	14.627	235.0	4798.2	0.2142
Total			84430.9	2240161.5	100.0000

after column chromatography

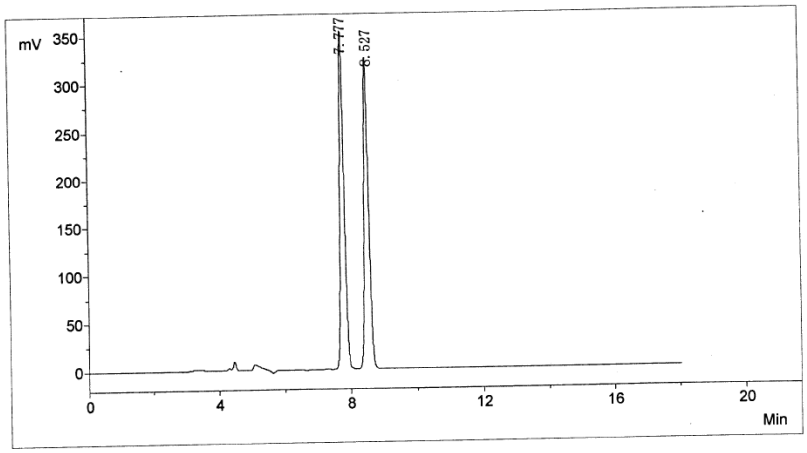
(*R*)-Methyl 4-cyclopropyl-2-(2-methoxyphenylamino)-2-(trifluoromethyl)but-3-ynoate (3h).

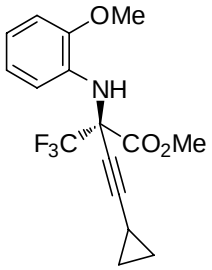




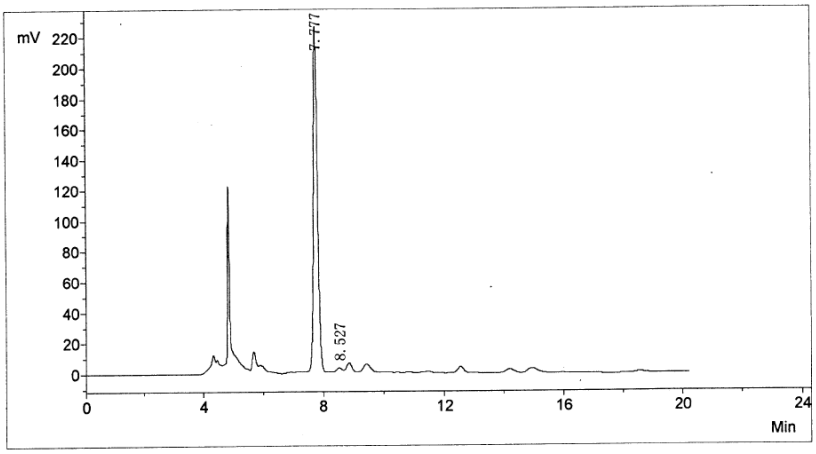


Chiral HPLC Analysis of 3h



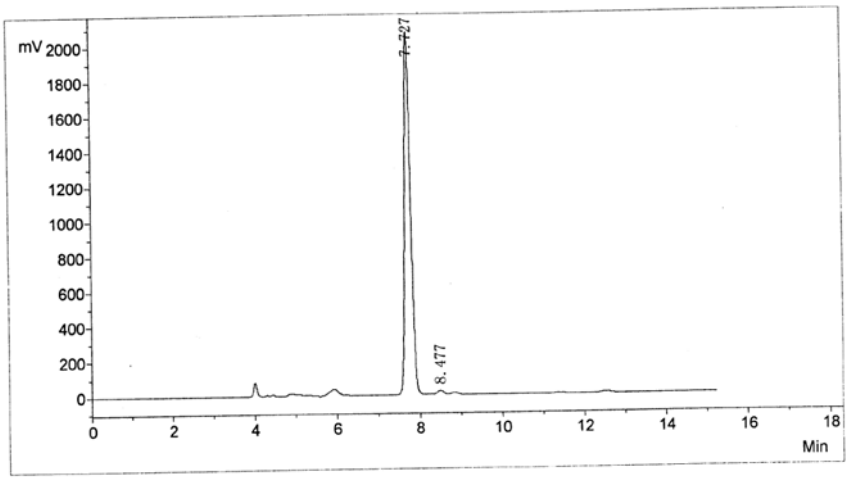


No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.777	353140.5	3165398.1	49.8019
2	2		8.527	308758.6	3190581.7	50.1981
Total				661899.2	6355979.8	100.0000



No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.777	216594.8	2147230.1	99.2313
2	2		8.527	1888.5	16632.8	0.7687
Total				218483.3	2163862.8	100.0000

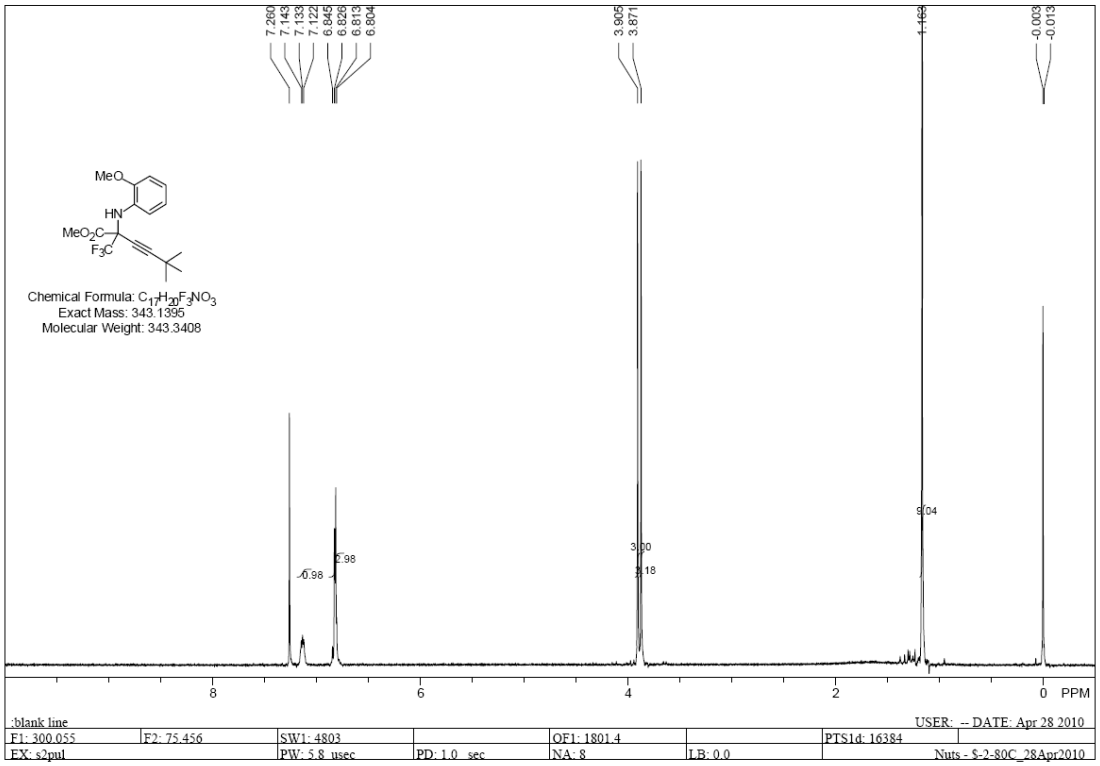
before column chramatography

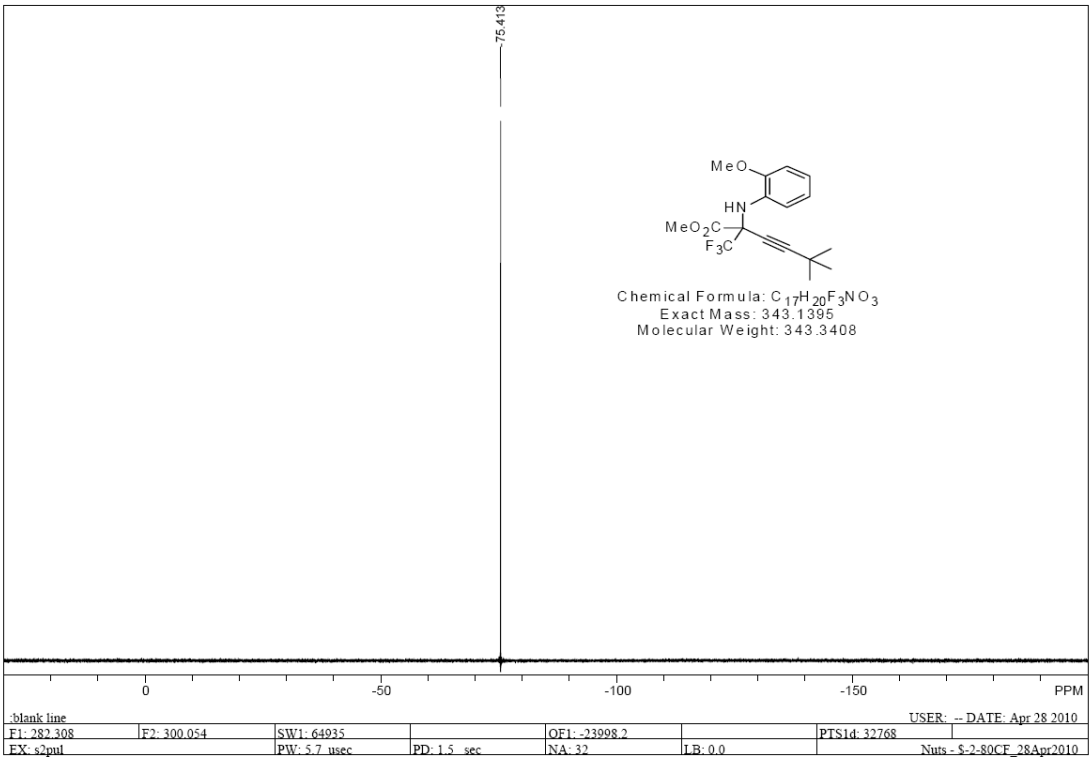


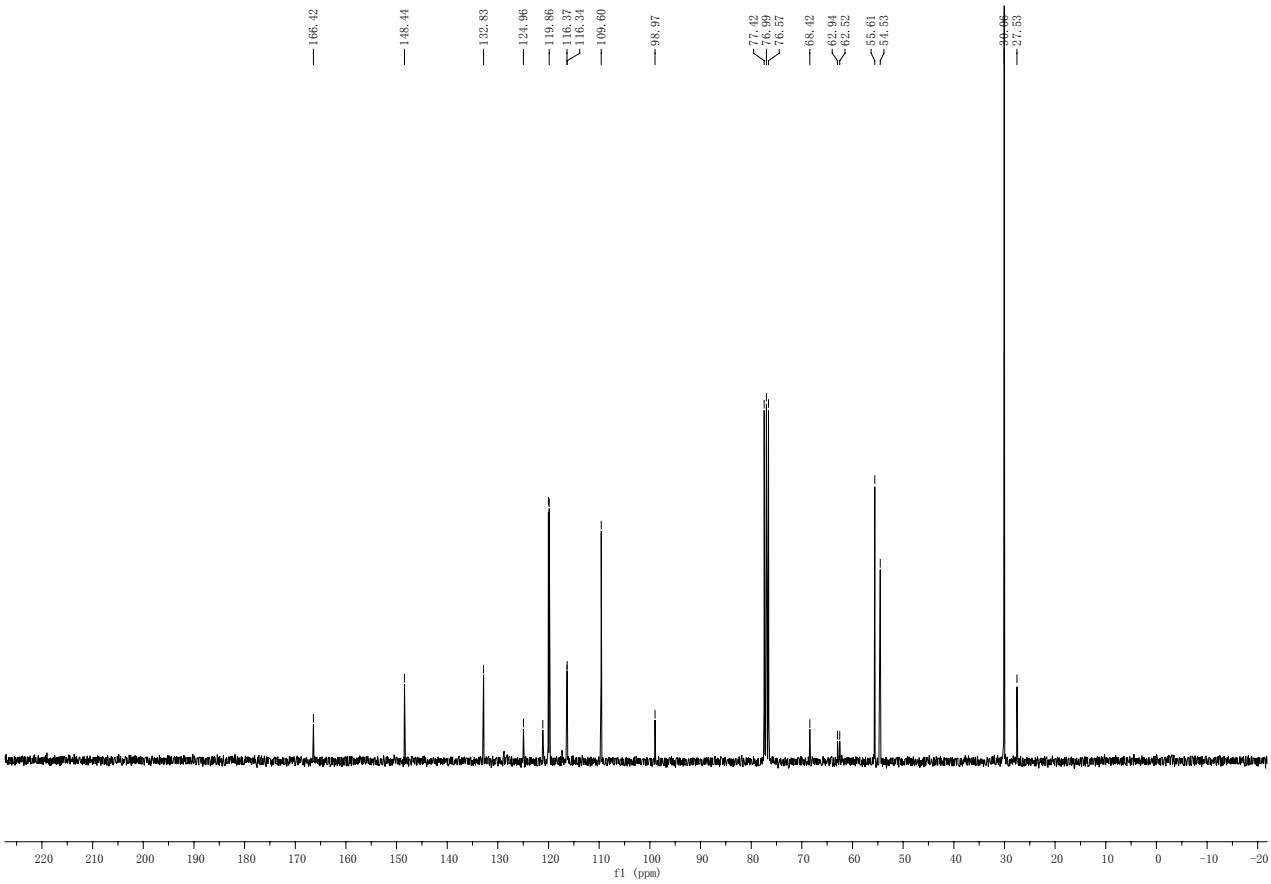
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.727	2009651.4	21004026.3	99.1001
2	2		8.477	19180.2	190726.3	0.8999
Total				2028831.6	21194752.5	100.0000

after column chramatography

(*R*)-Methyl 2-(2-methoxyphenylamino)-5,5-dimethyl-2-(trifluoromethyl)hex-3-ynoate (3i).





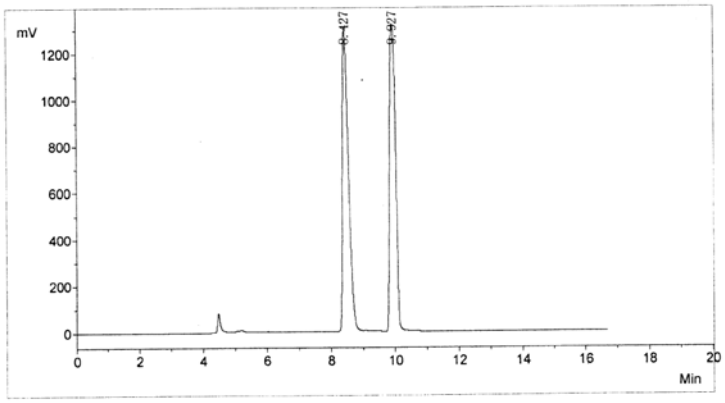


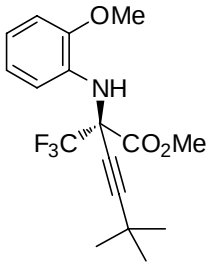
Chiral HPLC Analysis of 3i

HPLC Report

Sample Name:
Operator:
Time:10:51

Data File:HGC-2-21+-.che
Date:2010-12-29



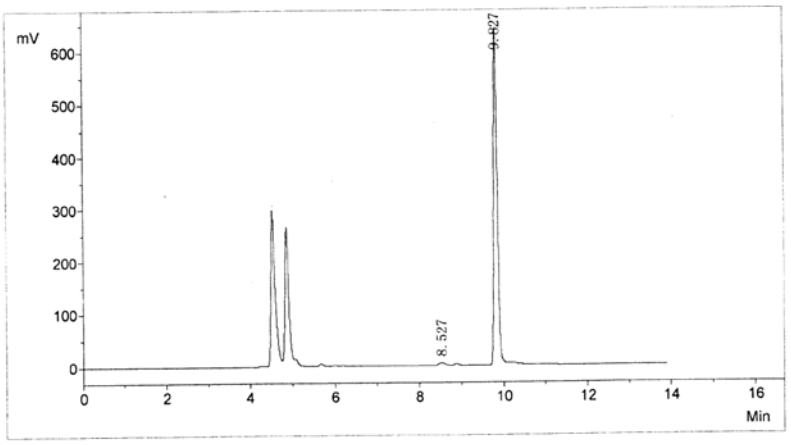


No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	8.427	1304768.9	17223561.3	49.9477
2	2	9.927	1322731.0	17259646.5	50.0523
Total			2627499.9	34483207.8	100.0000

HPLC Report

Sample Name:
Operator:
Time:11:26

Data File:HGC-4-66Q.che
Date:2010-12-29



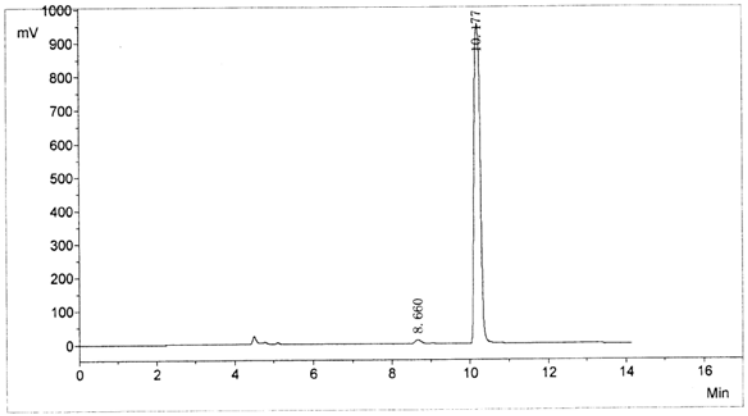
No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	8.527	5175.4	54167.3	1.2686
2	2	9.827	638301.4	4215721.2	98.7314
Total			643476.8	4269888.5	100.0000

before column chramatography

HPLC Report

Sample Name:
Operator:
Time:11:09

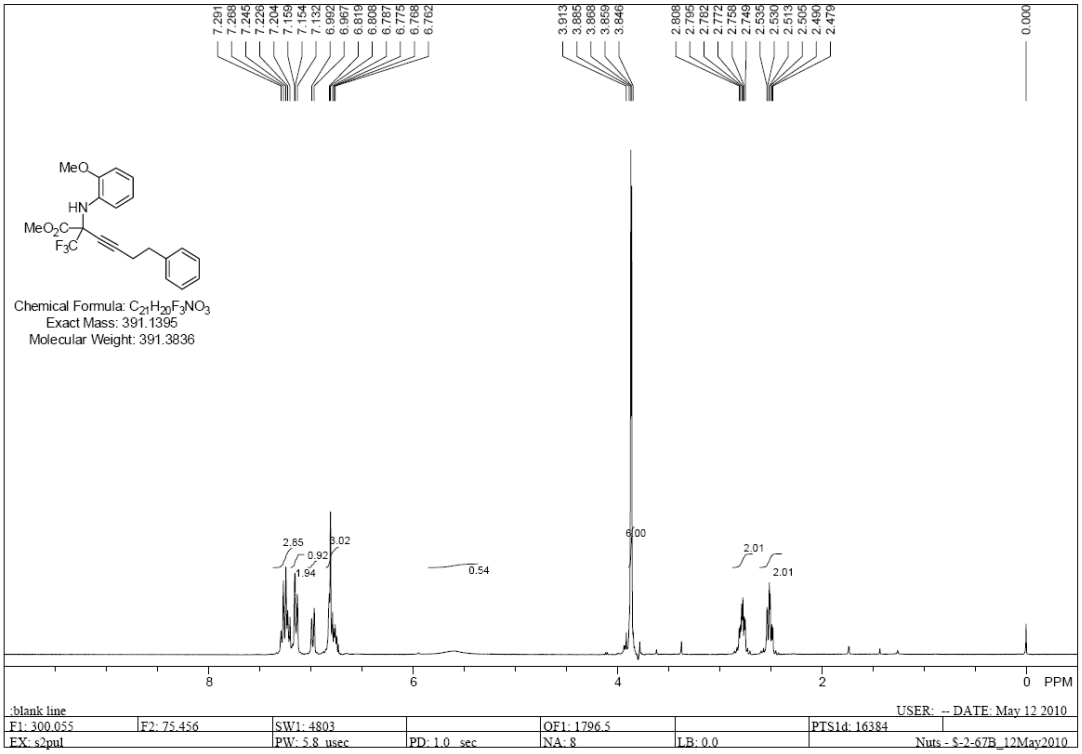
Data File:HGC-4-66T.che
Date:2010-12-29

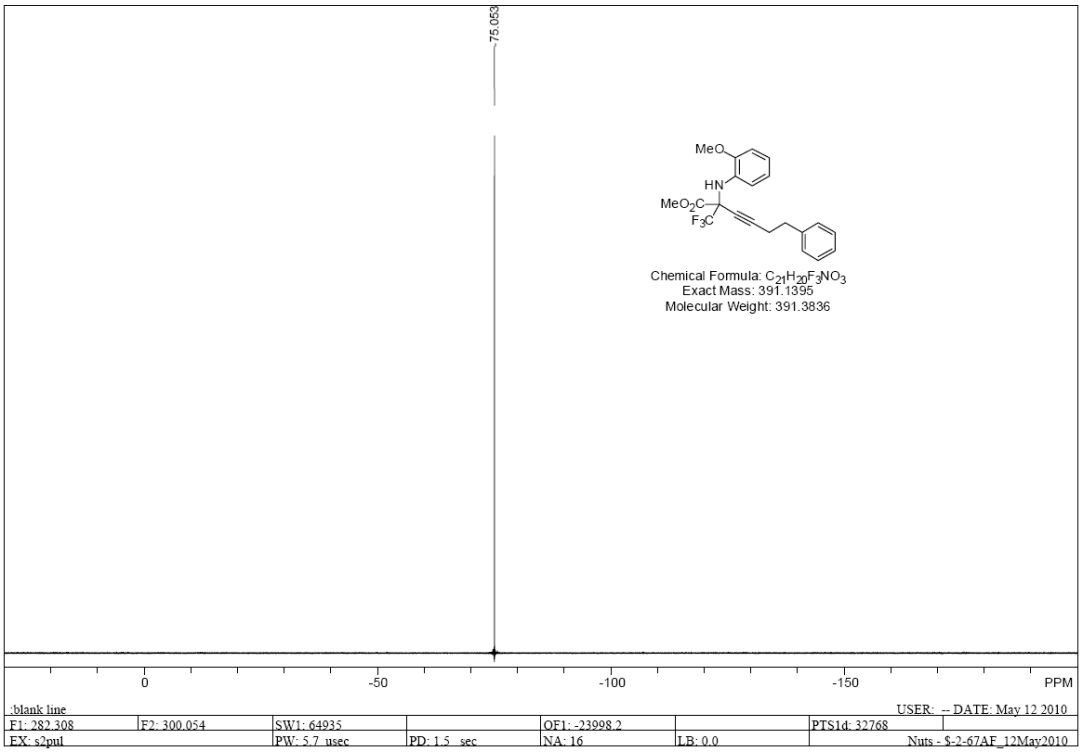


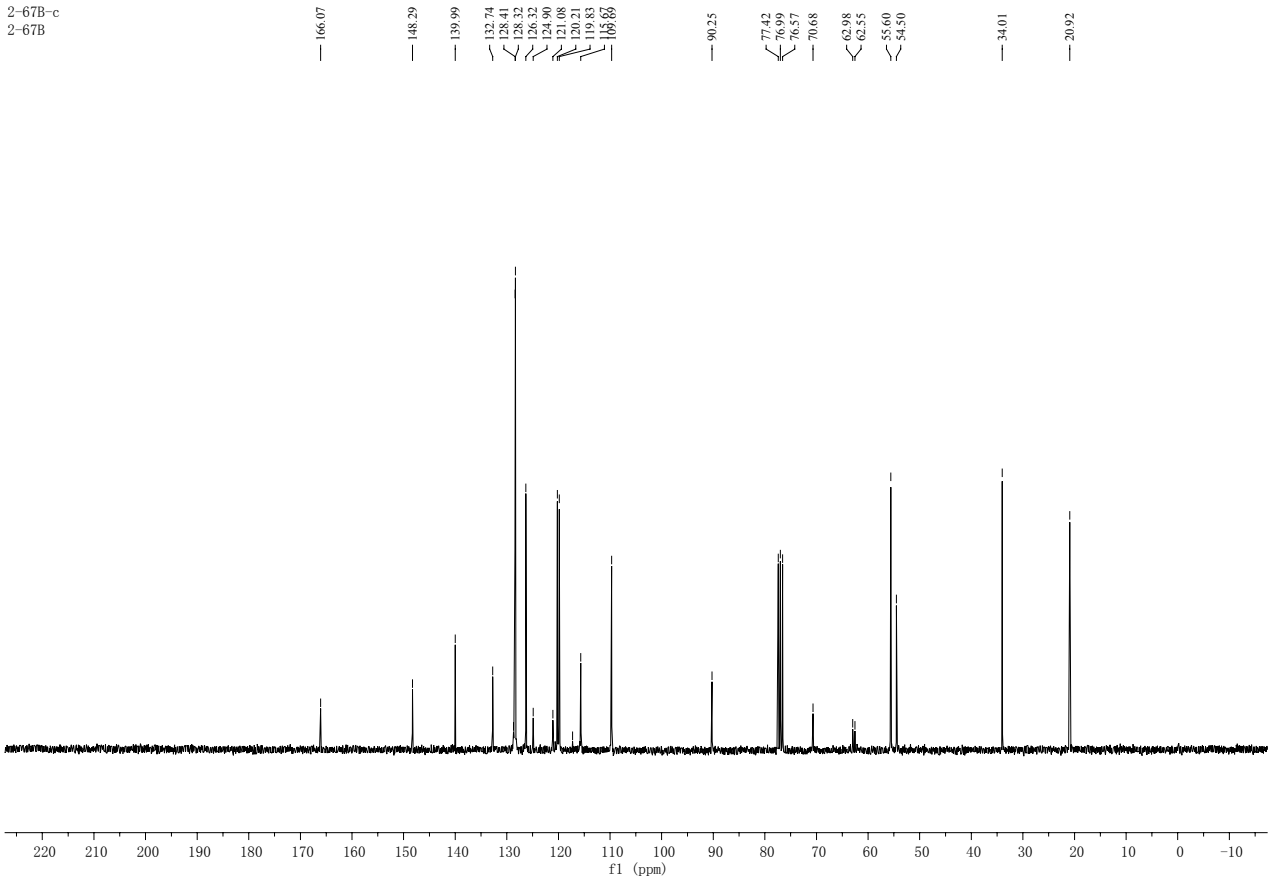
No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	8.660	11765.5	124800.2	1.1751
2	2	10.177	943712.7	10496015.8	98.8249
Total			955478.2	10620816.0	100.0000

after column chramatography

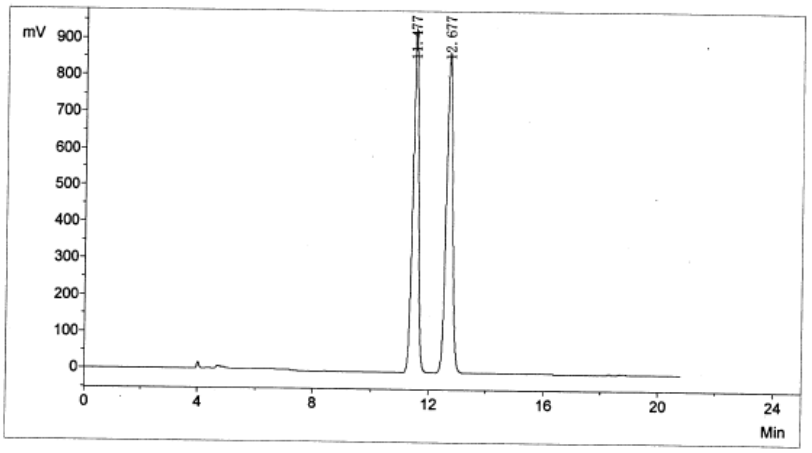
(*R*)-Methyl 2-(2-methoxyphenylamino)-6-phenyl-2-(trifluoromethyl)hex-3-ynoate (3j).

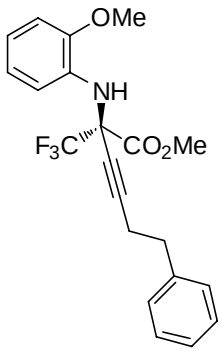




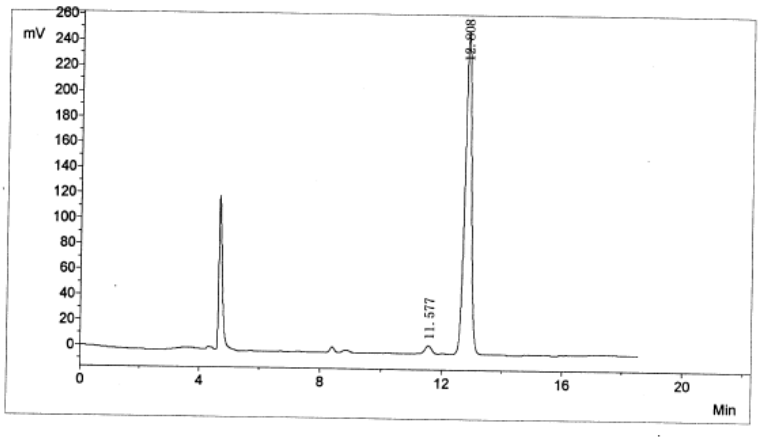


Chiral HPLC Analysis of 3j



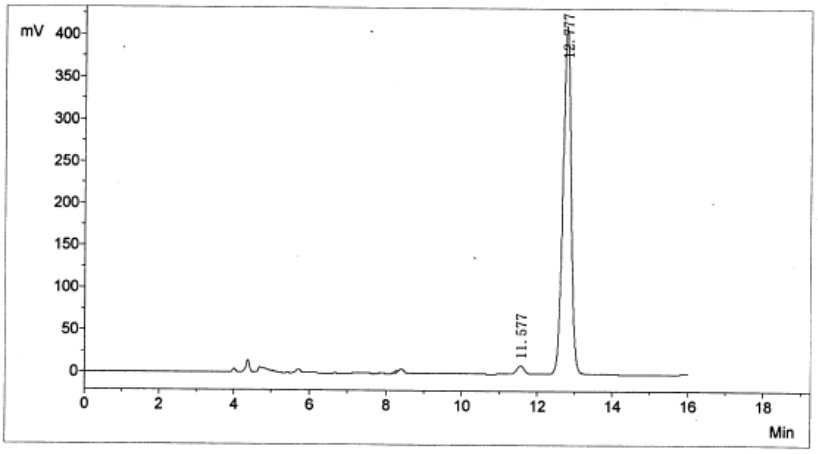


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		11.477	924158.5	12936033.2	49.0785
2	2		12.677	872668.6	13421786.7	50.9215
Total				1796827.0	26357819.9	100.0000



No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		11.577	6225.8	96006.2	2.4682
2	2		12.808	251919.7	3793692.4	97.5318
Total				258145.5	3889698.6	100.0000

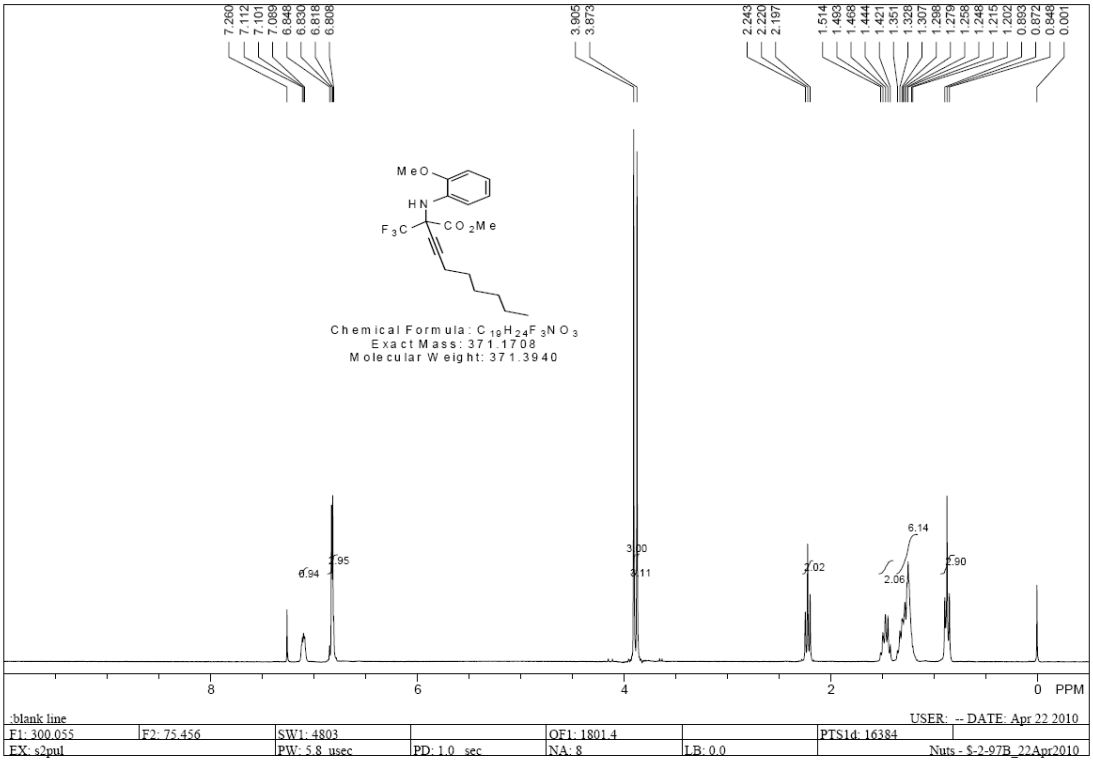
before column chramatography

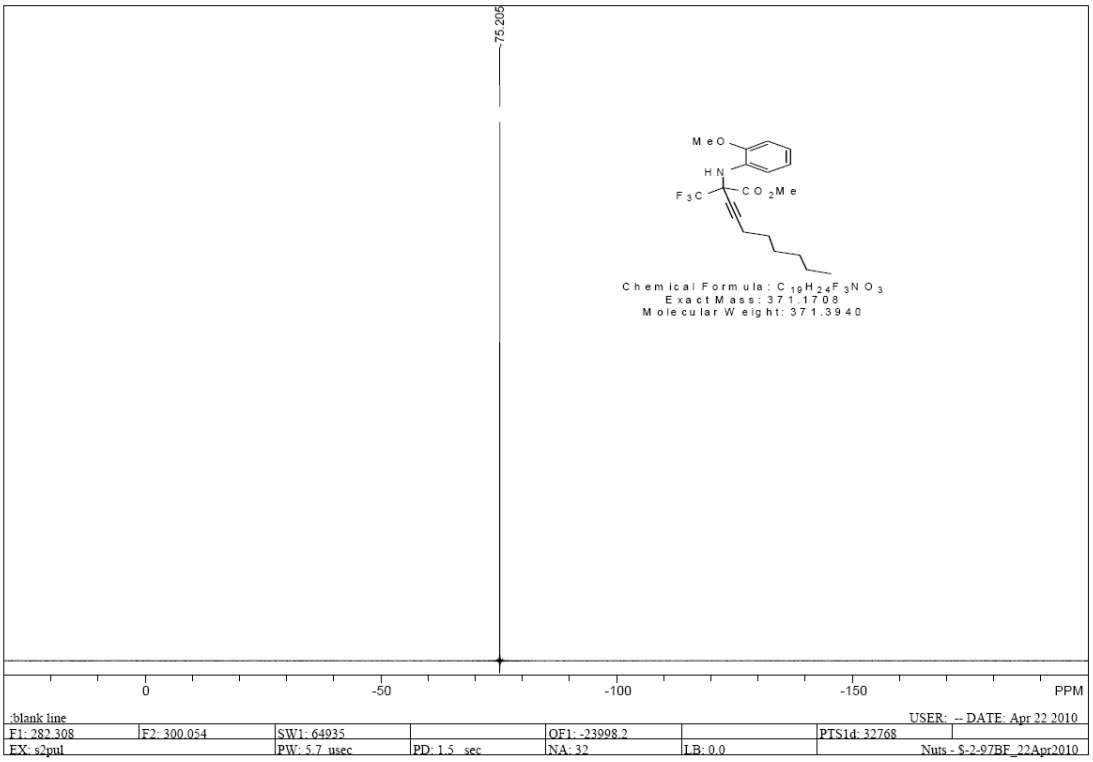


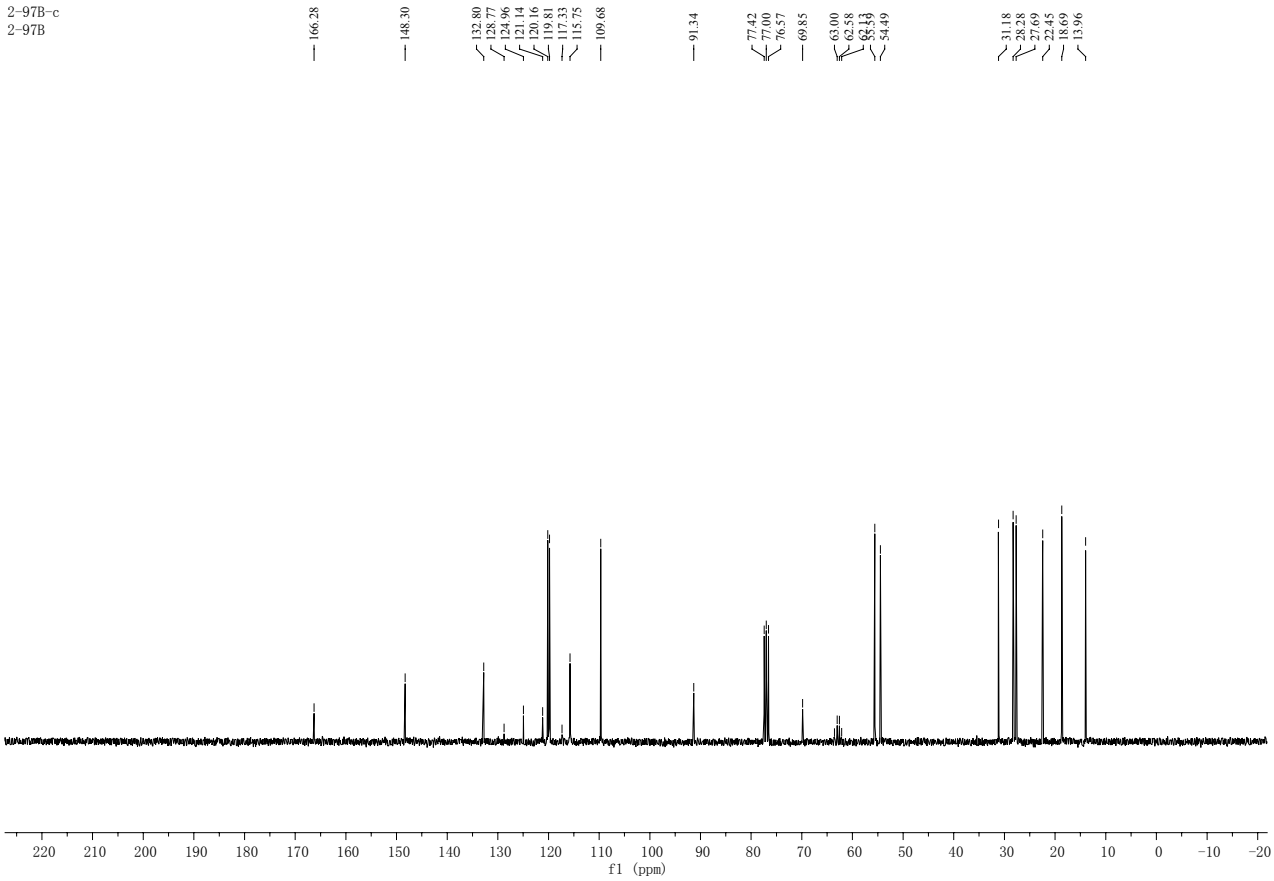
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		11.577	9758.2	141981.6	2.2206
2	2		12.777	405925.6	6251899.5	97.7794
Total				415683.9	6393881.0	100.0000

after column chramatography

(*R*)-Methyl 2-(2-methoxyphenylamino)-2-(trifluoromethyl)dec-3-ynoate (3k).





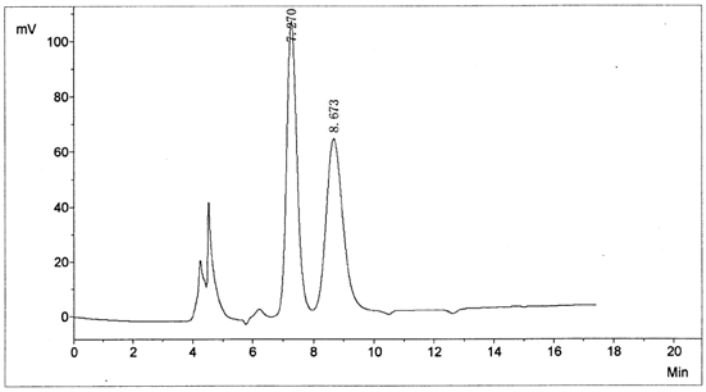


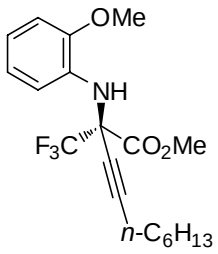
Chiral HPLC Analysis of 3k

HPLC Report

Sample Name:
Operator:
Time:12:38

Data File:HGC-2-90A+-.che
Date:2010-12-28



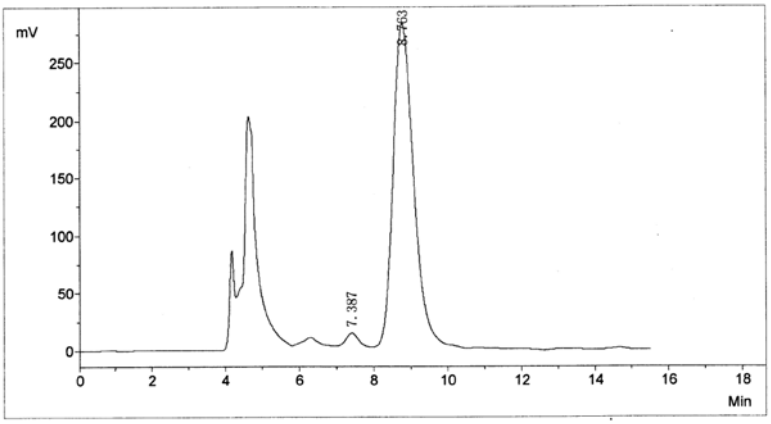


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		7.270	105646.2	2471514.5	51.1821
2	2		8.673	62258.4	2357351.8	48.8179
Total				167904.6	4828866.2	100.0000

HPLC Report

Sample Name:
Operator:
Time:13:20

Data File:HGC-4-74Q.che
Date:2010-12-28



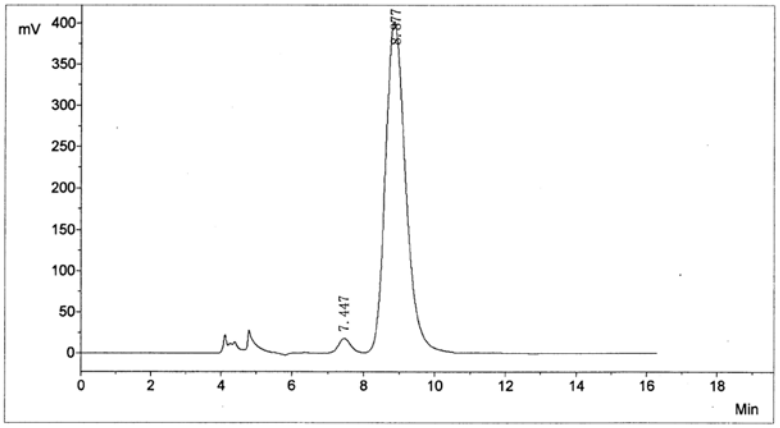
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.387	10106.6	195413.8	1.8831
2	2		8.763	276291.7	10181971.4	98.1169
Total				286398.3	10377385.2	100.0000

before column chramatography

HPLC Report

Sample Name:
Operator:
Time:12:59

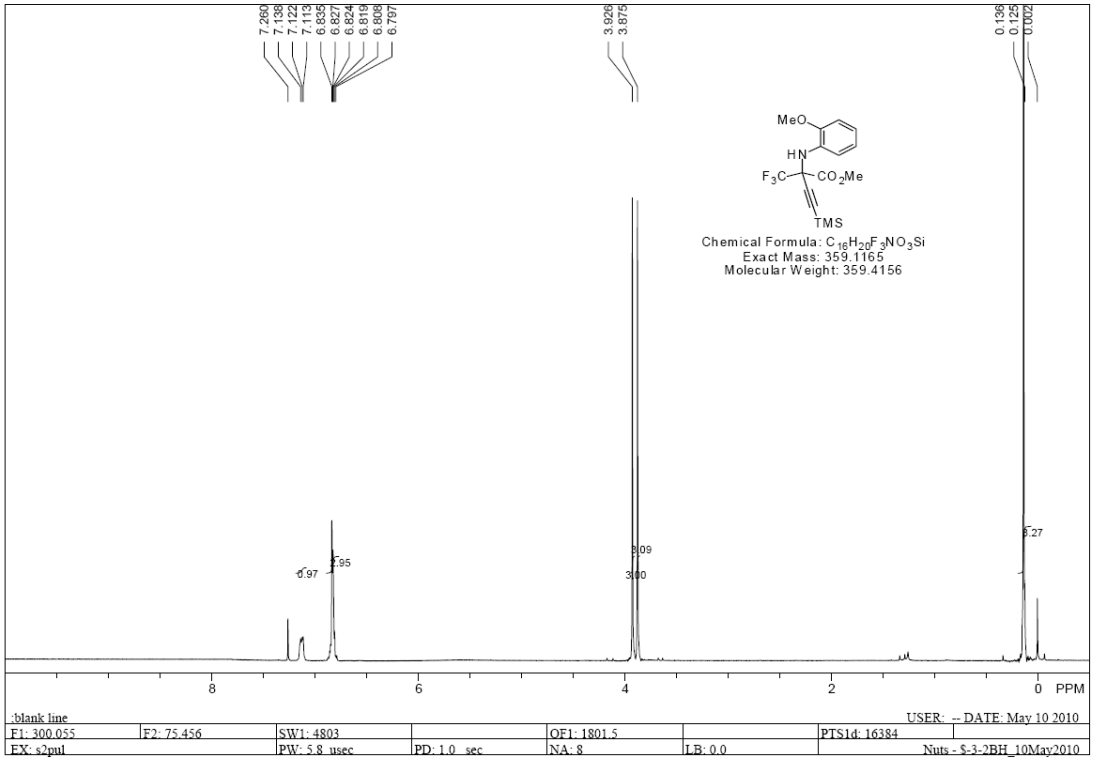
Data File:HGC-4-74T.che
Date:2010-12-28

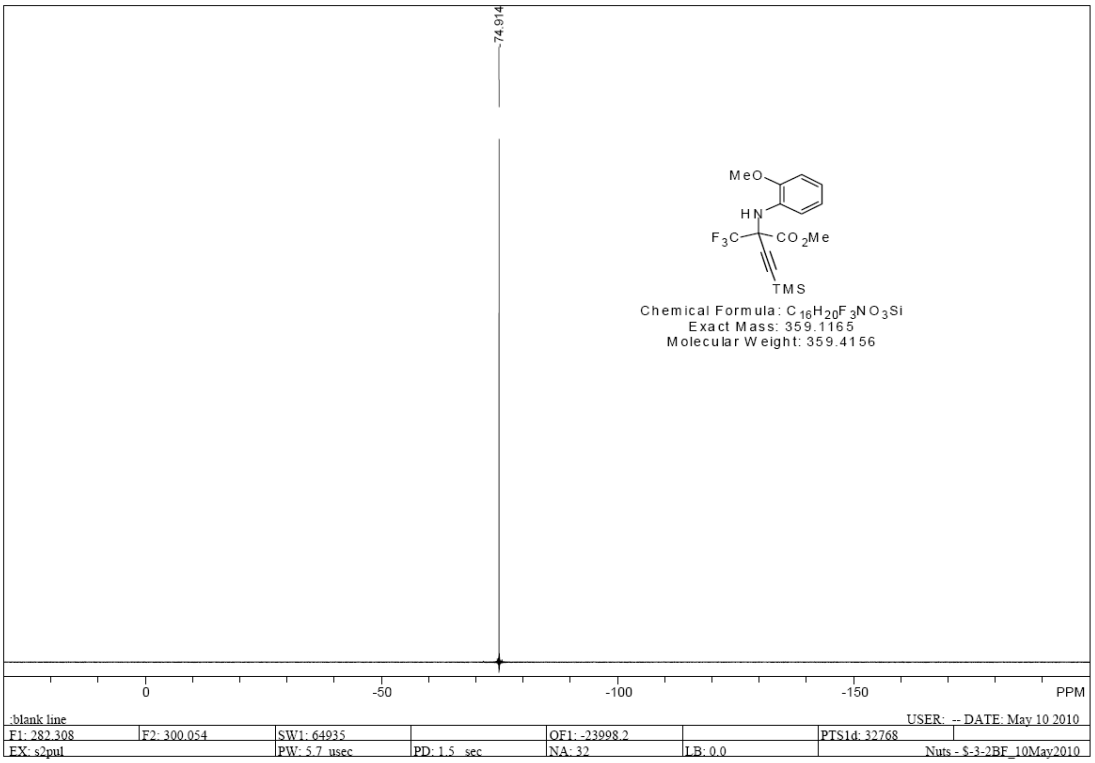


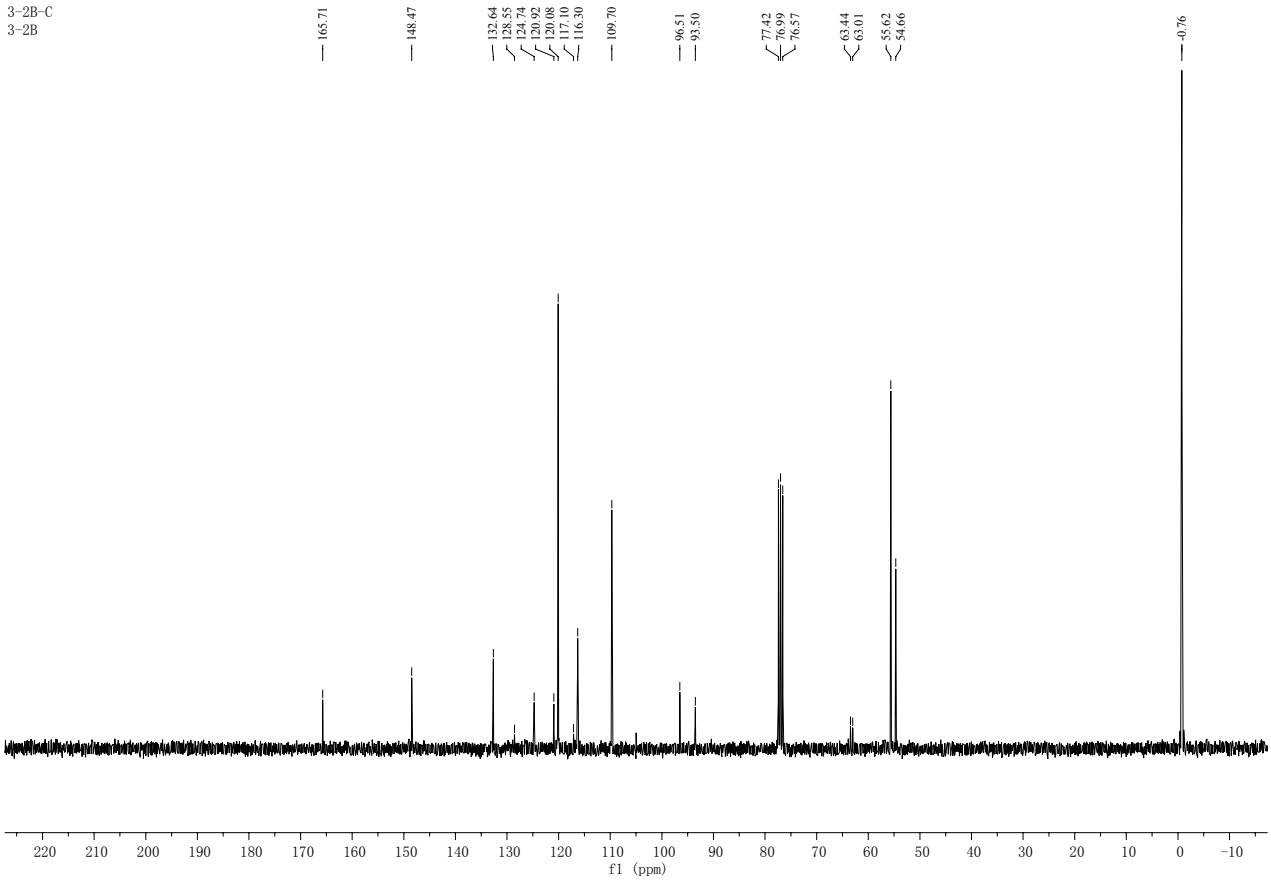
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		7.447	16028.6	331337.4	2.0607
2	2		8.877	397929.4	15747339.6	97.9393
Total				413958.0	16078677.0	100.0000

after column chramatography

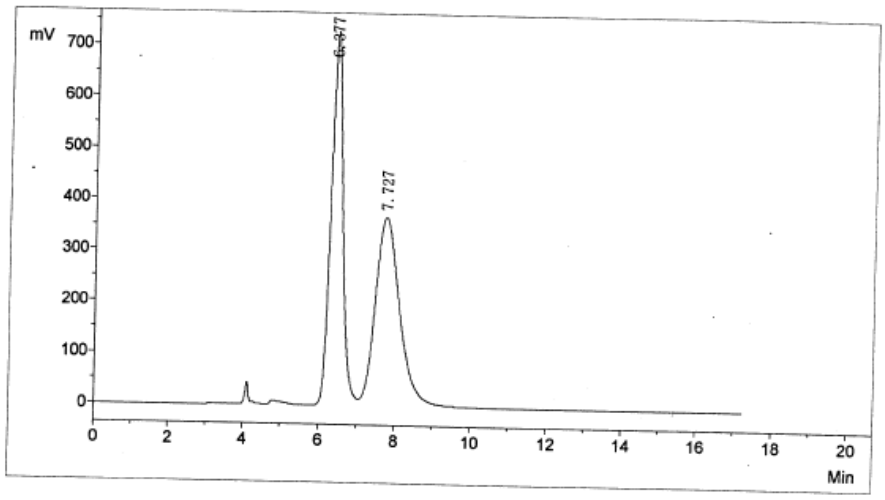
(*S*)-Methyl 2-(2-methoxyphenylamino)-2-(trifluoromethyl)-4-(trimethylsilyl)but-3-ynoate (3l).

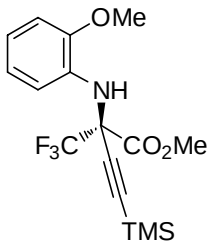




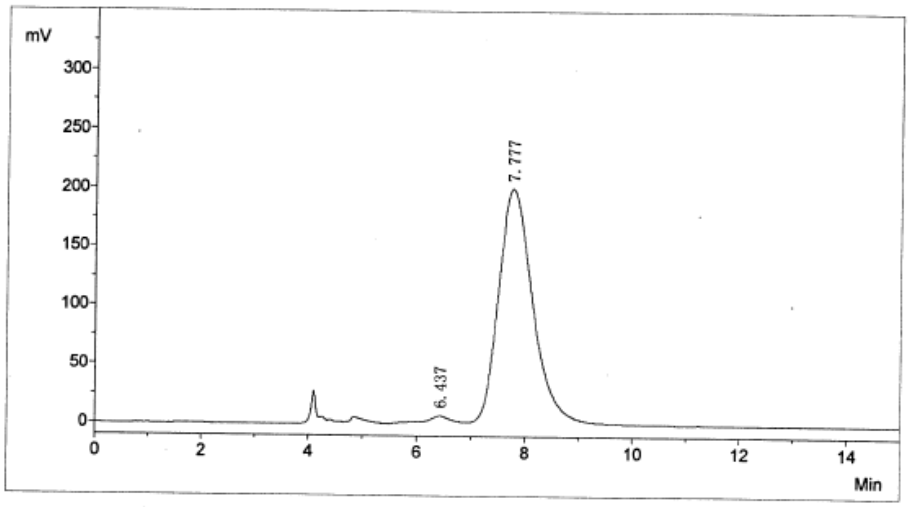

3-2B-C
3-2B
165.71
148.47
132.64
128.55
124.74
120.92
120.08
117.10
116.30
109.70
96.51
93.50
77.42
76.99
76.57
63.44
63.01
55.62
54.66
-0.76
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

Chiral HPLC Analysis of 3l





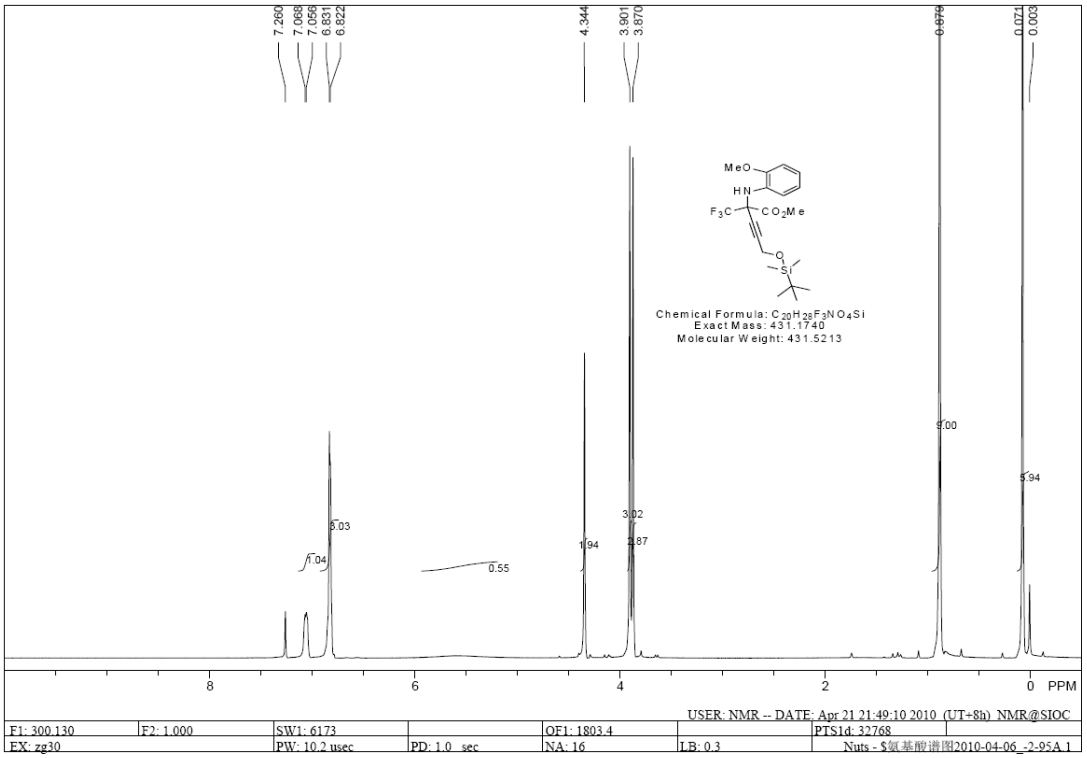
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		6.377	716992.7	15971217.7	49.1193
2	2		7.727	367667.3	16543929.5	50.8807
Total				1084660.0	32515147.3	100.0000

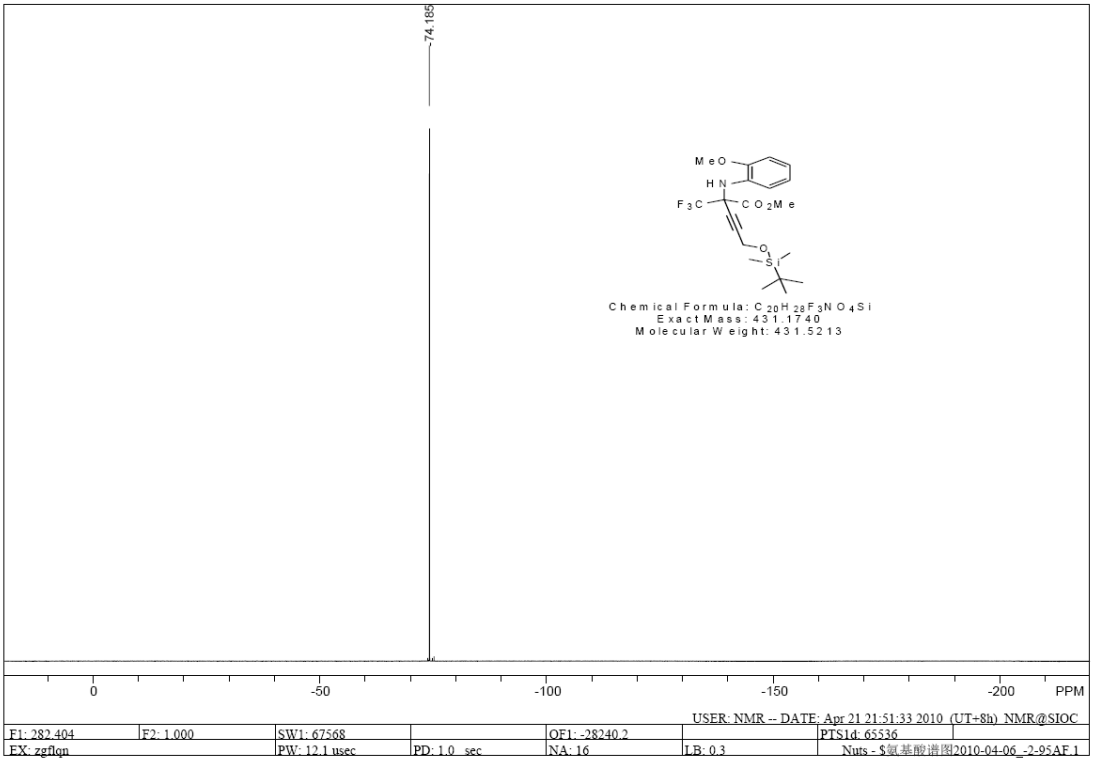


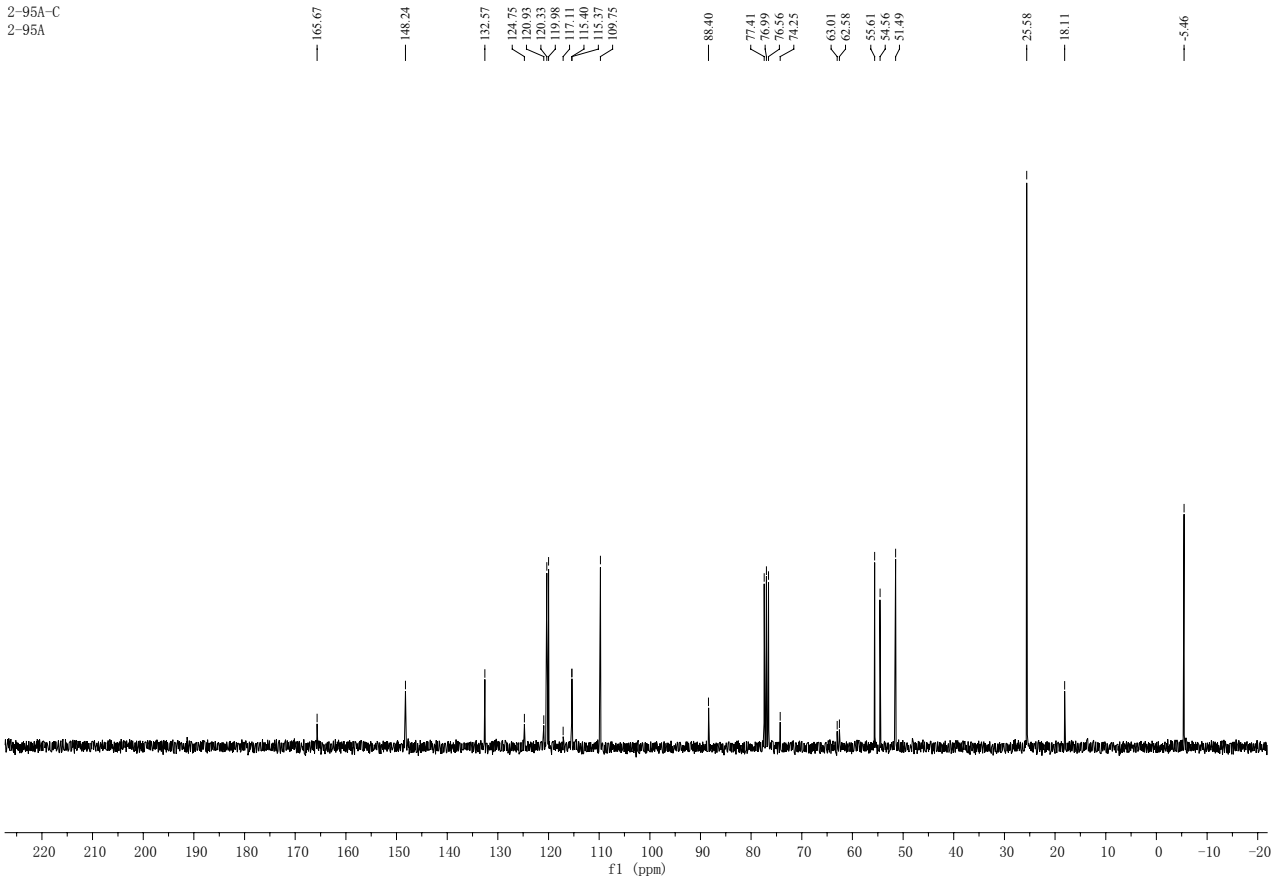
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		6.437	4913.4	101610.2	1.1534
2	2		7.777	198488.0	8708159.6	98.8466
Total				203401.4	8809769.8	100.0000

after column chramatography

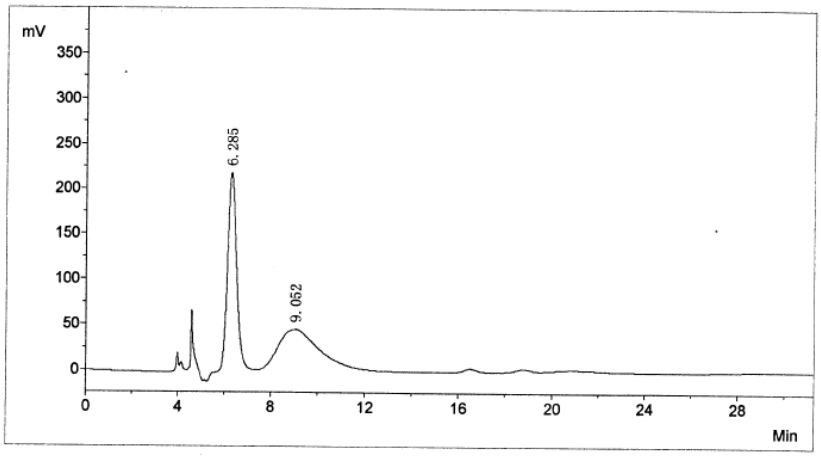
(*R*)-Methyl 5-(tert-butyldimethylsilyloxy)-2-(2-methoxyphenylamino)-2-(trifluoromethyl)pent-3-ynoate (3m).

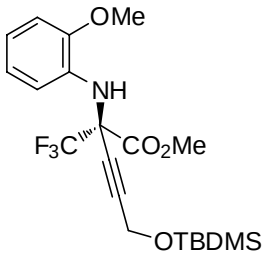




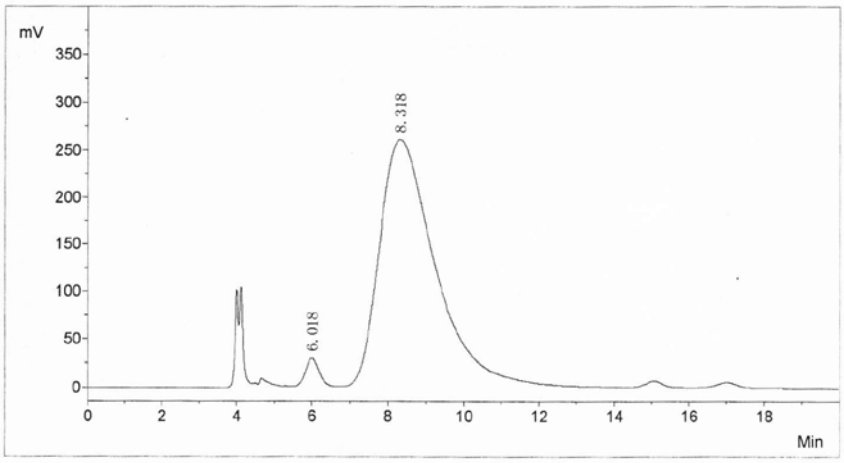

2-95A-C
2-95A
165.67
148.24
132.57
124.75
120.93
120.33
119.98
117.11
115.40
115.37
109.75
88.40
77.41
76.99
76.56
74.25
63.01
62.58
55.61
54.56
51.49
25.58
18.11
-5.46
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

Chiral HPLC Analysis of 3m





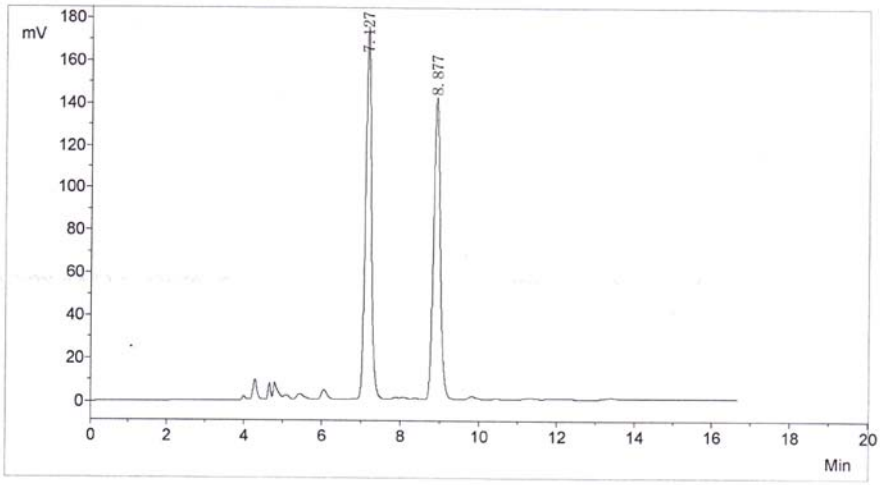
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		6.285	220558.2	6066888.6	50.2469
2	2		9.052	46869.1	6007278.3	49.7531
Total				267427.4	12074166.8	100.0000



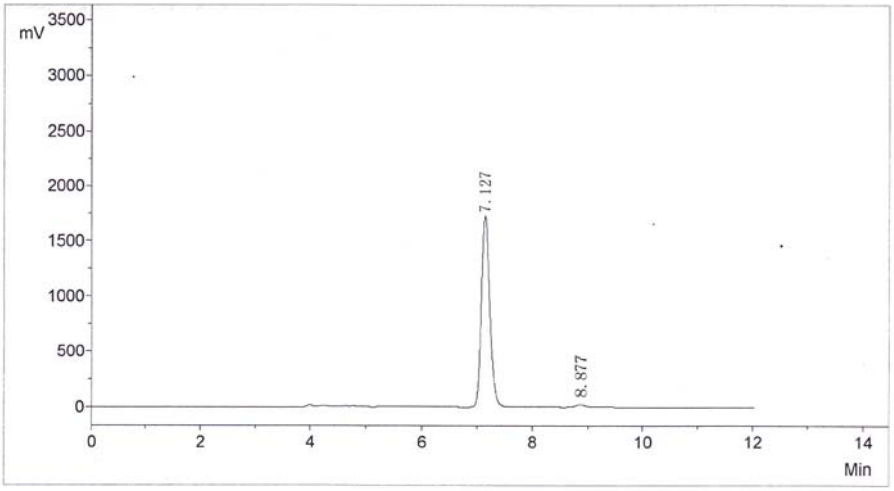
No.	PeakNo	ID.Name	R.Time	PeakHeight	PeakArea	PerCent
1	1		6.018	28887.4	719545.4	2.6446
2	2		8.318	260364.9	26488698.9	97.3554
Total				289252.3	27208244.3	100.0000

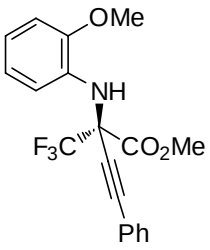
after column chramatography

Gram-scale catalytic asymmetric synthesis of 3a



No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		7.127	163672.7	1836024.8	52.3244
2	2		8.877	139045.0	1672900.3	47.6756
Total				302717.8	3508925.1	100.0000

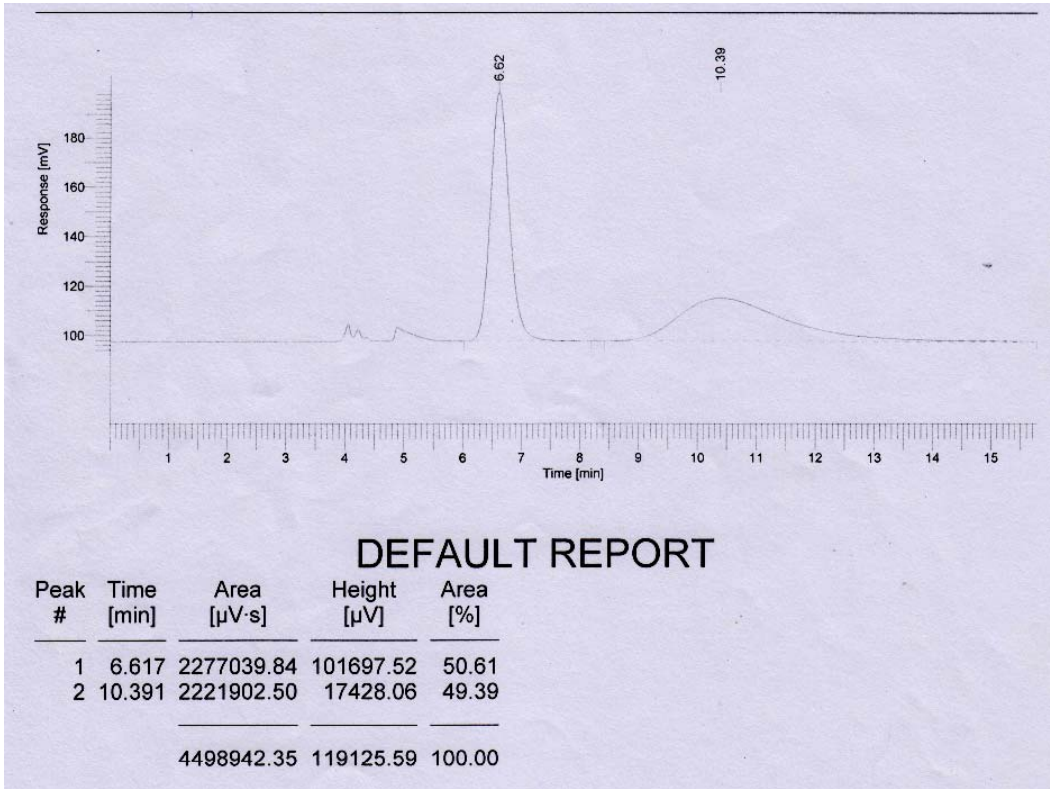




No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		7.127	1691706.6	18376725.7	98.3921
2	2		8.877	22916.8	300313.9	1.6079
Total				1714623.4	18677039.6	100.0000

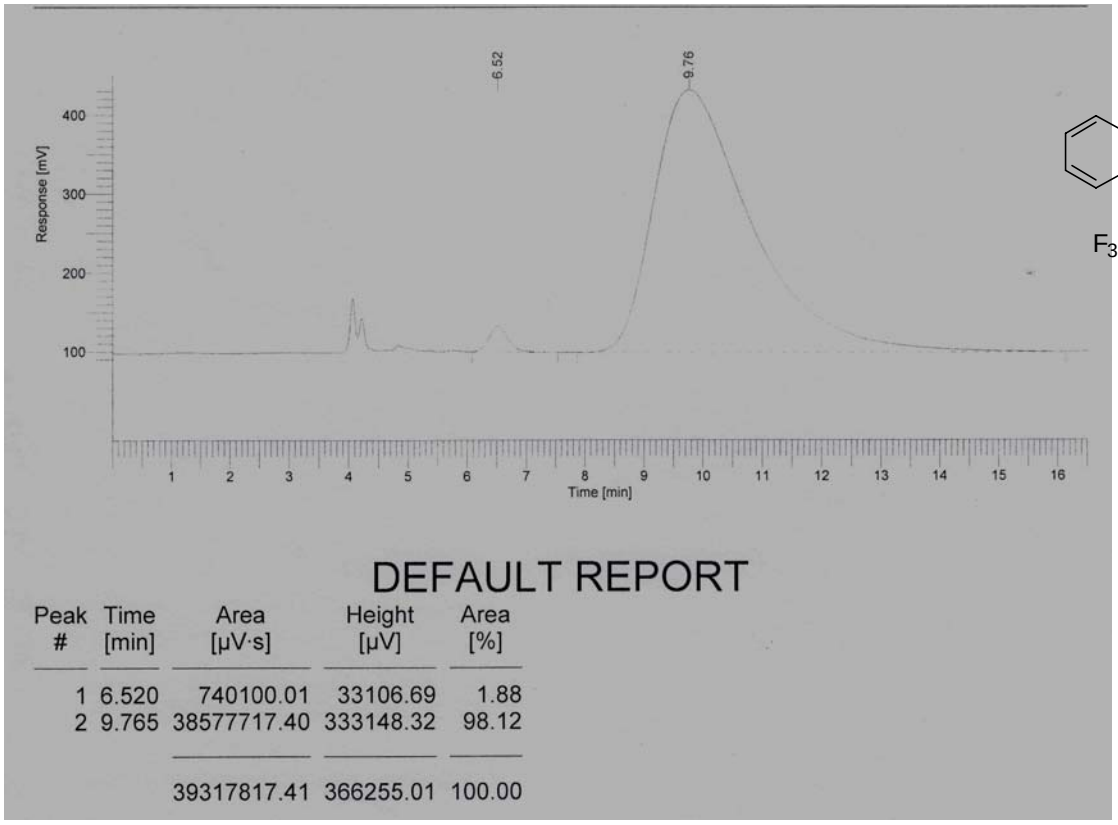
after column chramatography

Gram-scale catalytic asymmetric synthesis of 3m



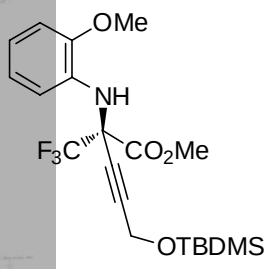
DEFAULT REPORT

Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]
1	6.617	2277039.84	101697.52	50.61
2	10.391	2221902.50	17428.06	49.39
		4498942.35	119125.59	100.00



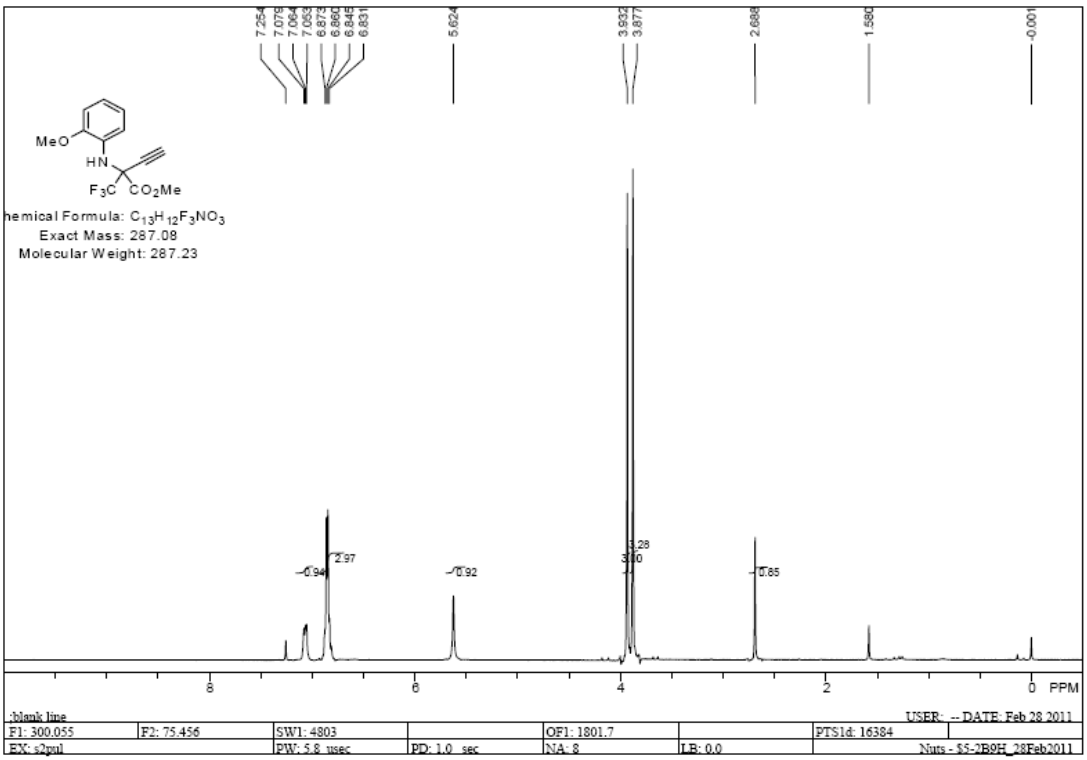
DEFAULT REPORT

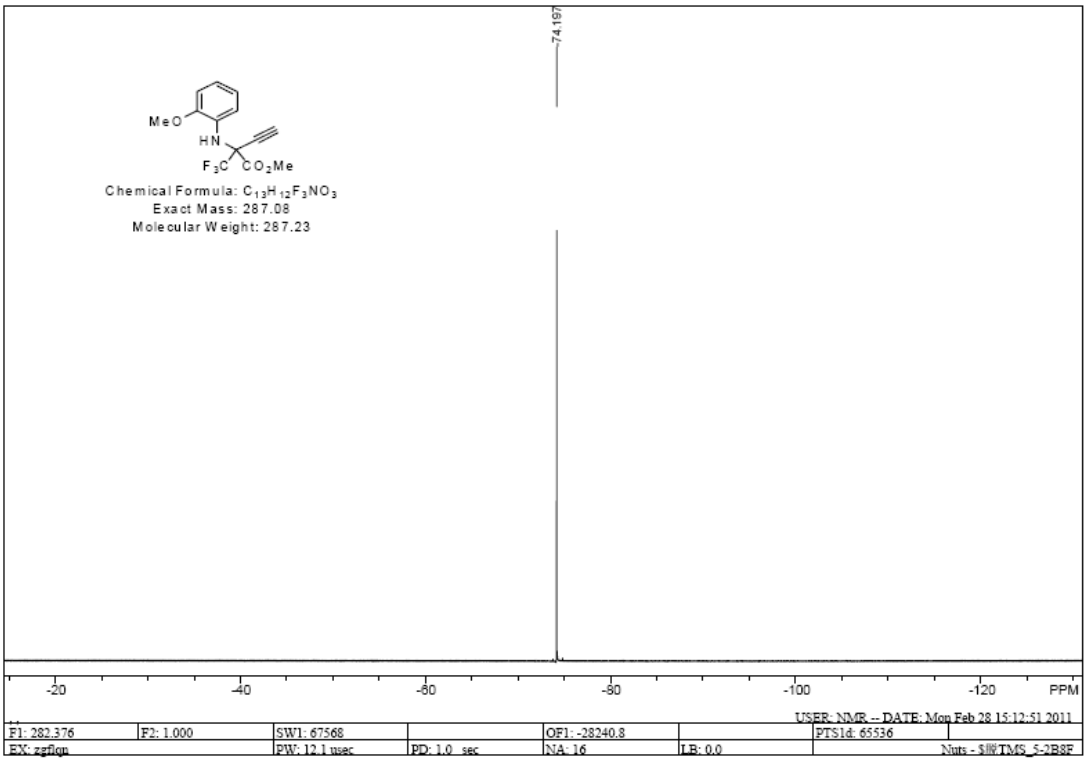
Peak #	Time [min]	Area [μV·s]	Height [μV]	Area [%]
1	6.520	740100.01	33106.69	1.88
2	9.765	38577717.40	333148.32	98.12
		39317817.41	366255.01	100.00

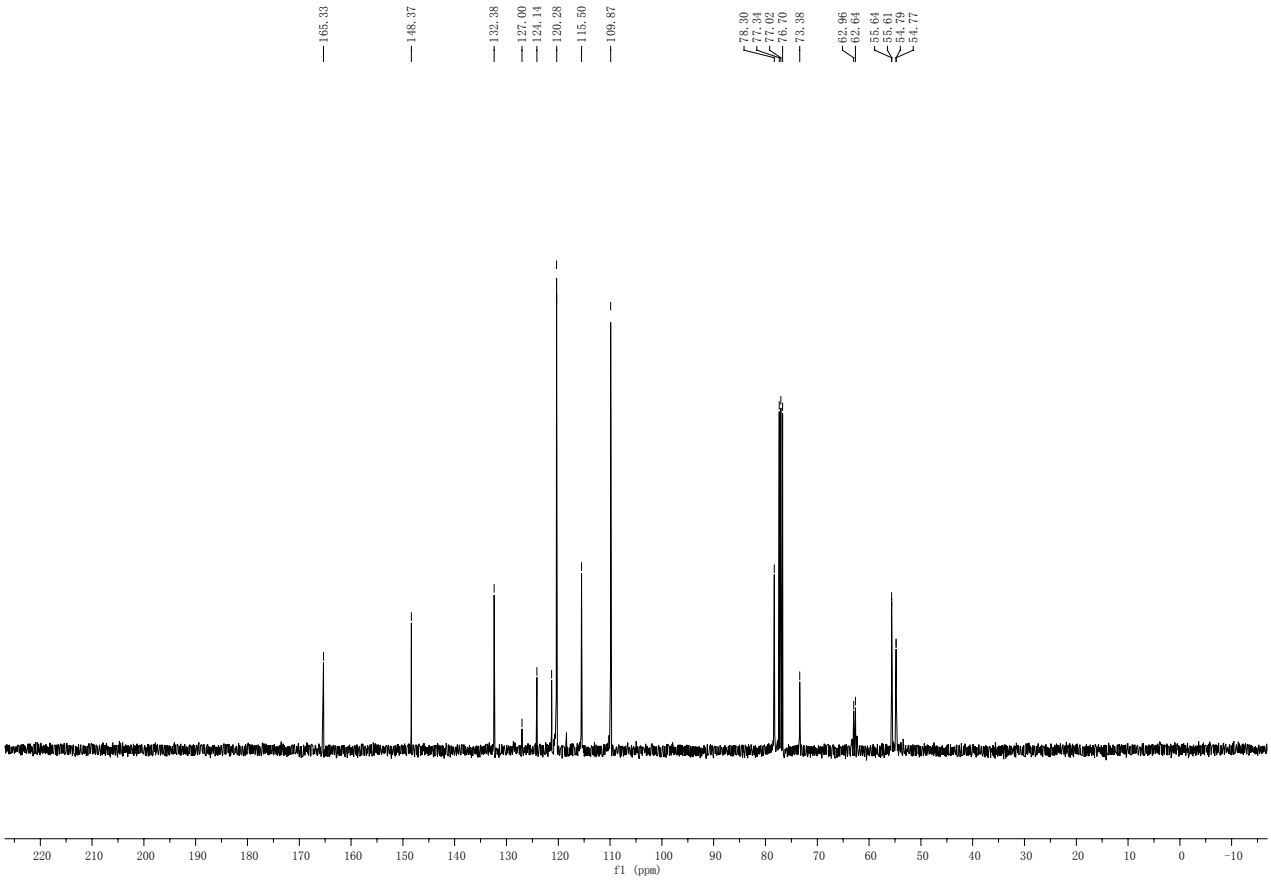


after column chramatography

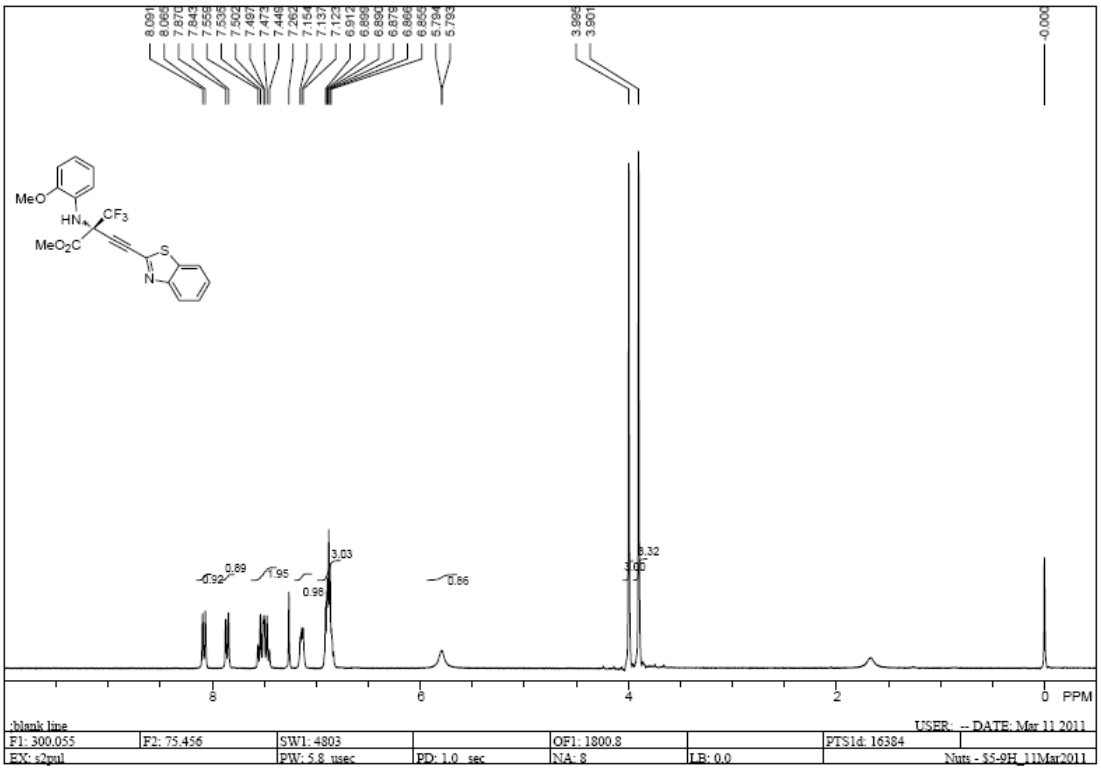
(*R*)-methyl 2-((2-methoxyphenyl)amino)-2-(trifluoromethyl)but-3-ynoate (5).

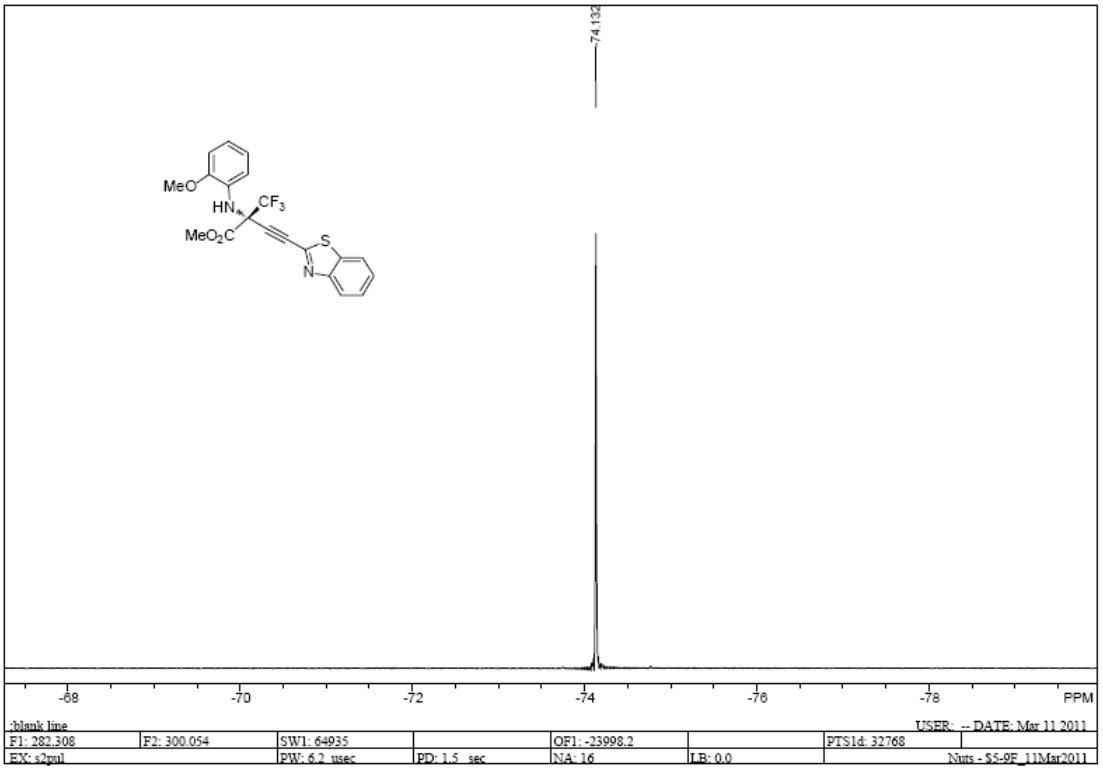


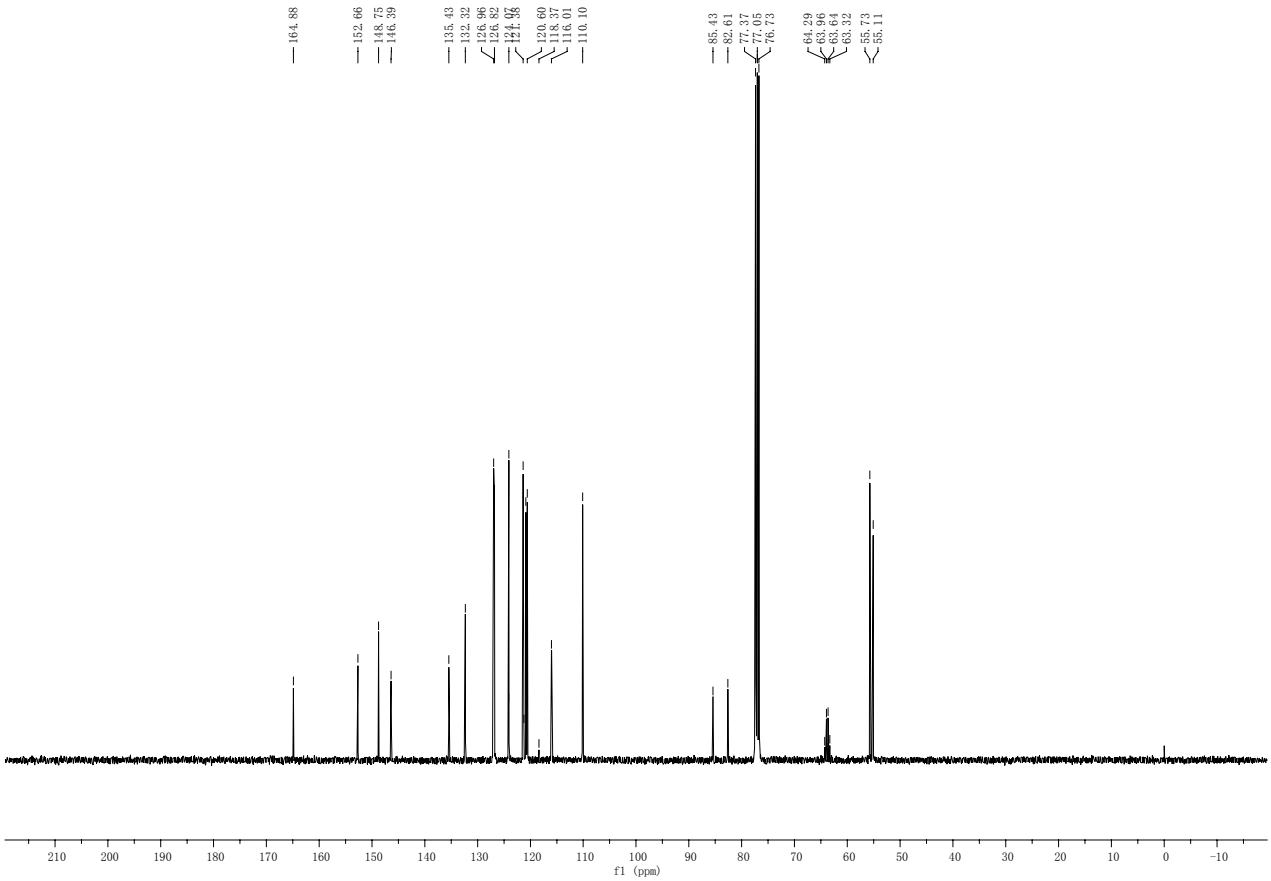




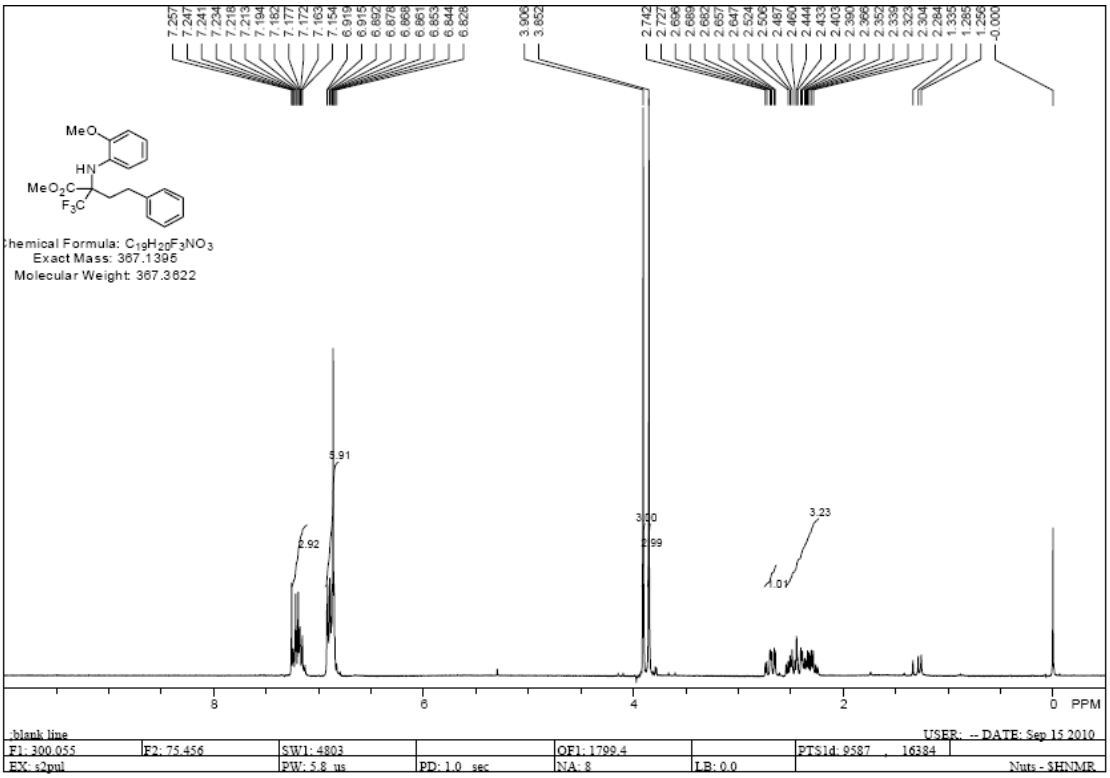
(*R*)-methyl 4-(benzo[*d*]thiazol-2-yl)-2-((2-methoxyphenyl)amino)-2-(trifluoromethyl)but-3-ynoate (6).

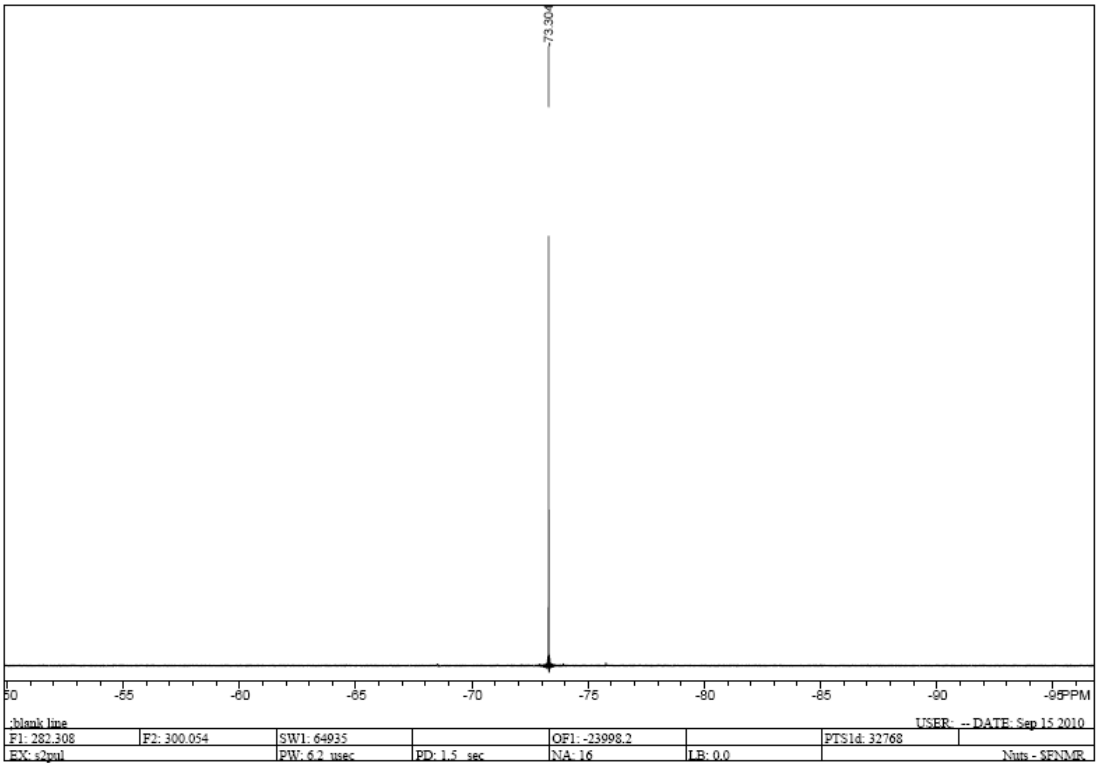


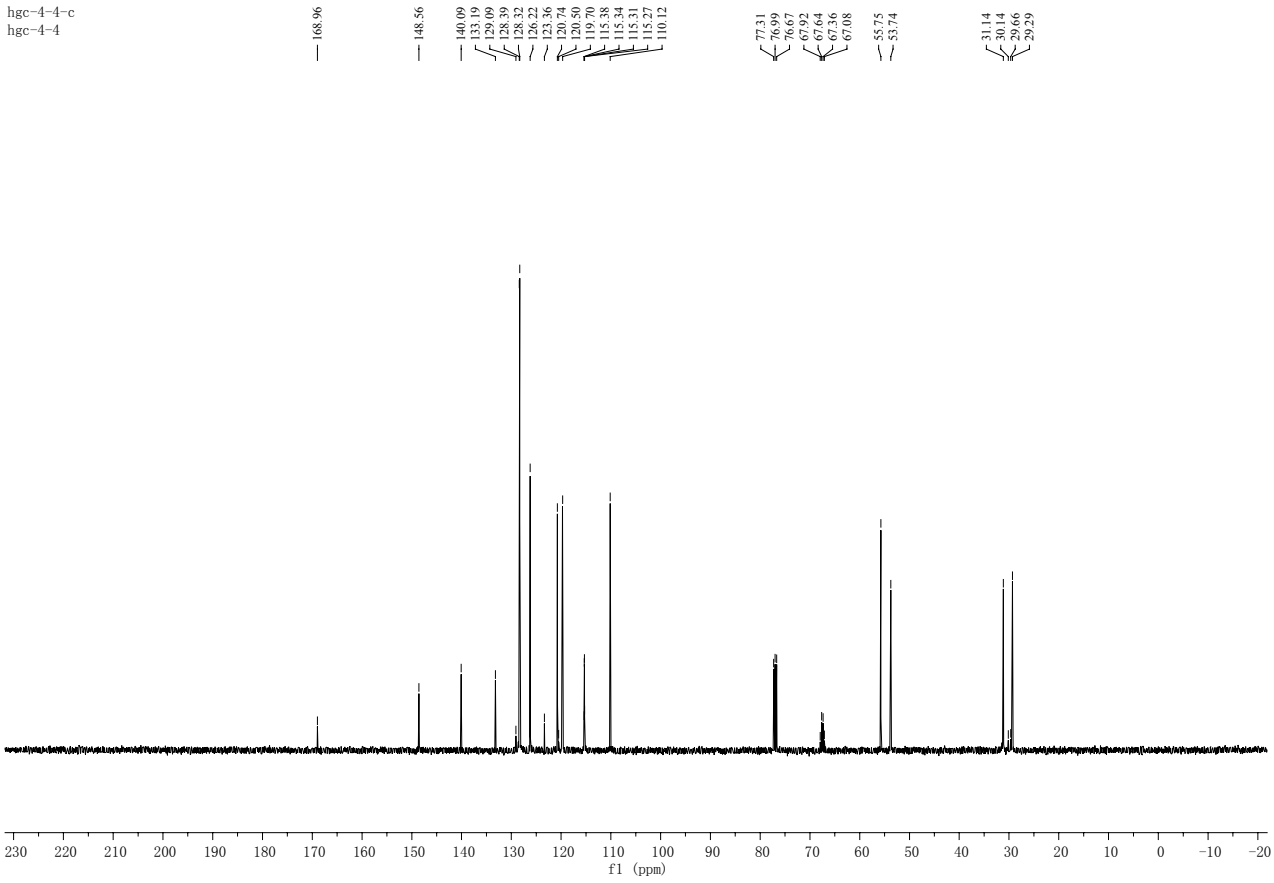

-74.132
MeO
HN
CF3
MeO2C
S
N
-68
-70
-72
-74
-76
-78
PPM
:blank line
USER: -- DATE: Mar 11 2011
F1: 282.308
F2: 300.054
SW1: 64935
OF1: -23998.2
PTS1d: 32768
EX: s2pul
PW: 6.2 usec
PD: 1.5 sec
NA: 16
LB: 0.0
Nuts - S5-9F_11Mar2011


164.88
152.66
148.75
146.39
135.43
132.32
126.96
126.82
124.07
121.38
120.60
118.37
116.01
110.10
85.43
82.61
77.37
77.05
76.73
64.29
63.96
63.64
63.32
55.73
55.11
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

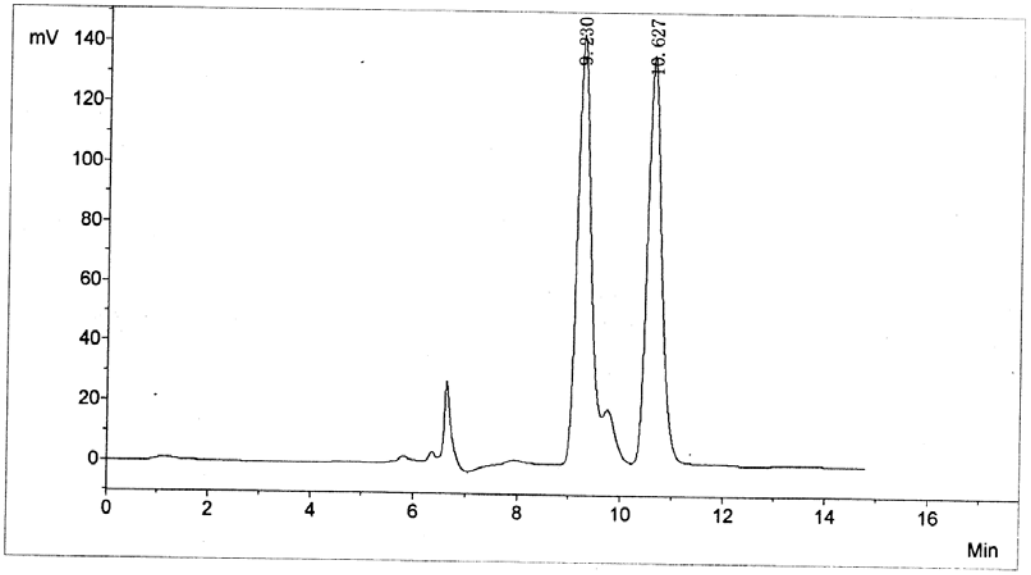
(*R*)-Methyl 2-(2-methoxyphenylamino)-4-phenyl-2-(trifluoromethyl)butanoate (7').



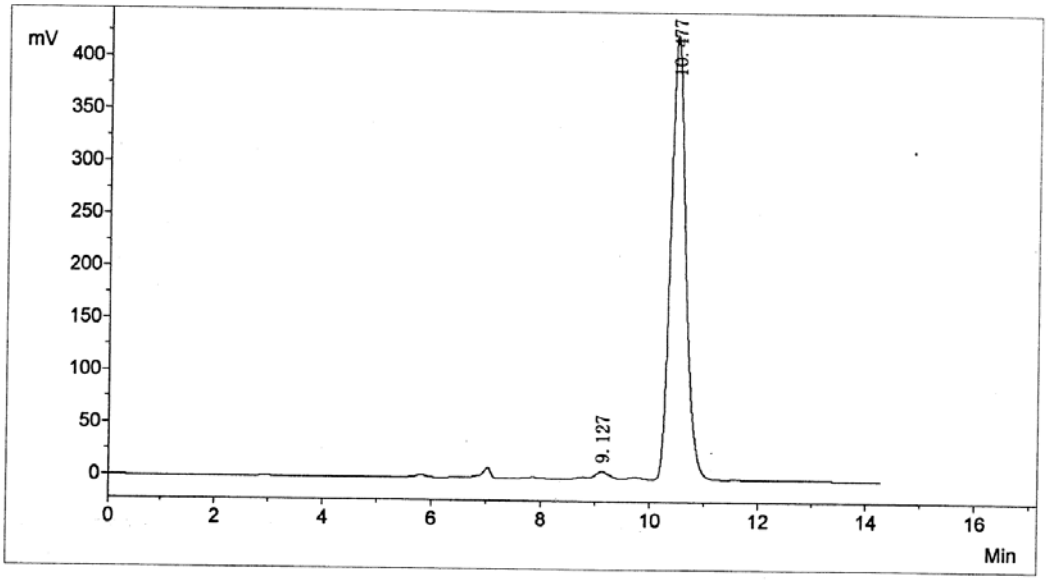



hgc-4-4-c
hgc-4-4
168.96
148.56
140.09
133.19
129.09
128.39
128.32
126.22
123.36
120.74
120.50
119.70
115.38
115.34
115.31
115.27
110.12
77.31
76.99
76.67
67.92
67.64
67.36
67.08
55.75
53.74
31.14
30.14
29.66
29.29
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

Chiral HPLC Analysis of 7'

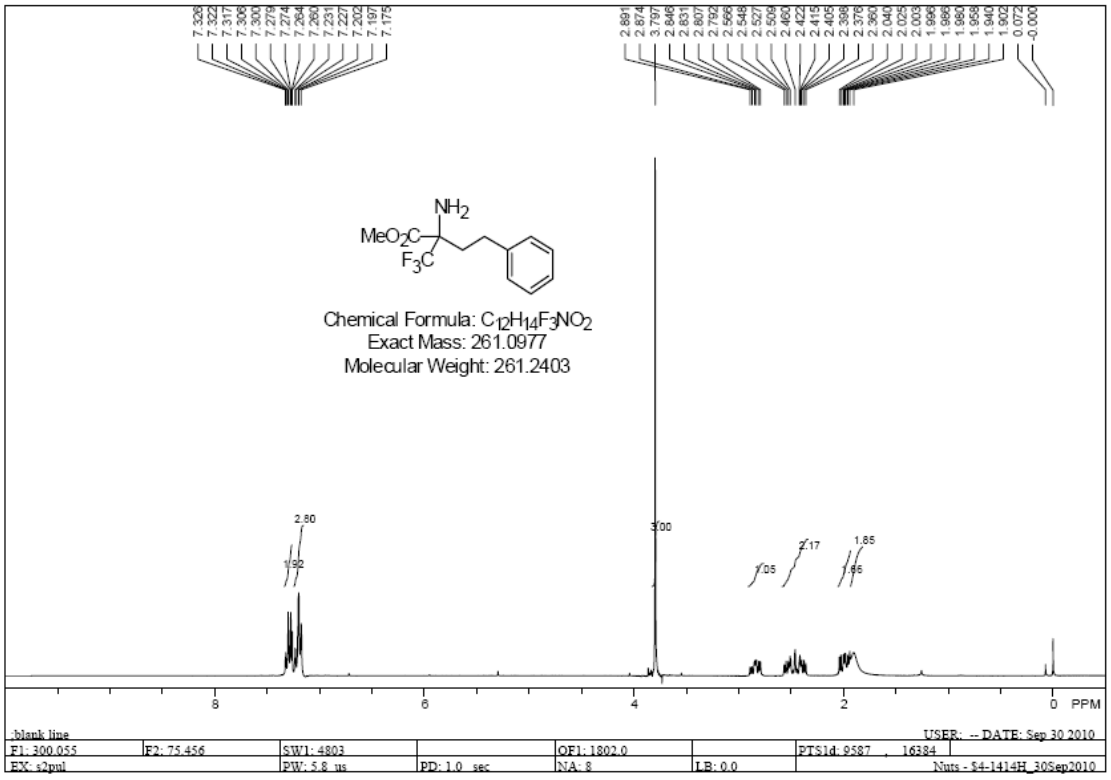


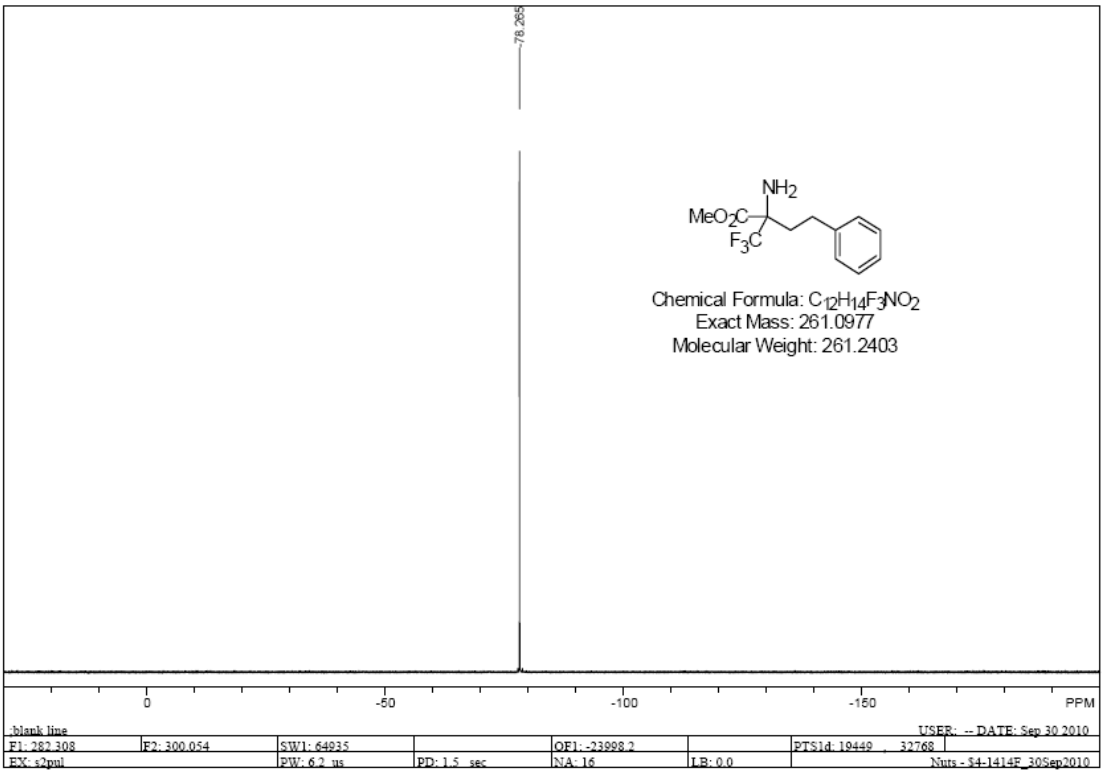
No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		9.230	135165.2	2255122.4	46.5269
2	2		10.627	133249.8	2591797.2	53.4731
Total				268415.0	4846919.6	100.0000

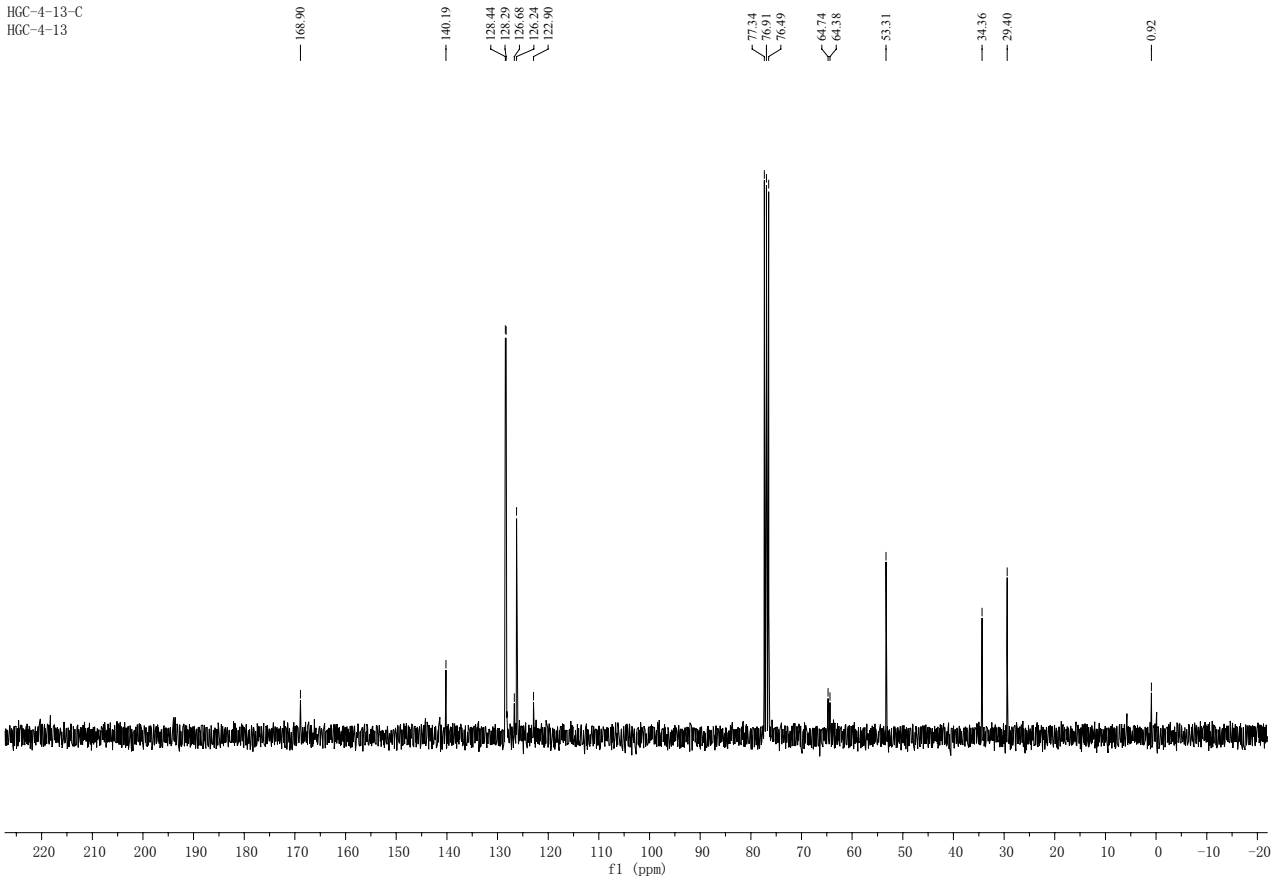


No.	PeakNo	ID. Name	R. Time	PeakHeight	PeakArea	PerCent
1	1		9.127	6028.2	94128.8	1.1344
2	2		10.477	417956.6	8203551.9	98.8656
Total				423984.8	8297680.7	100.0000

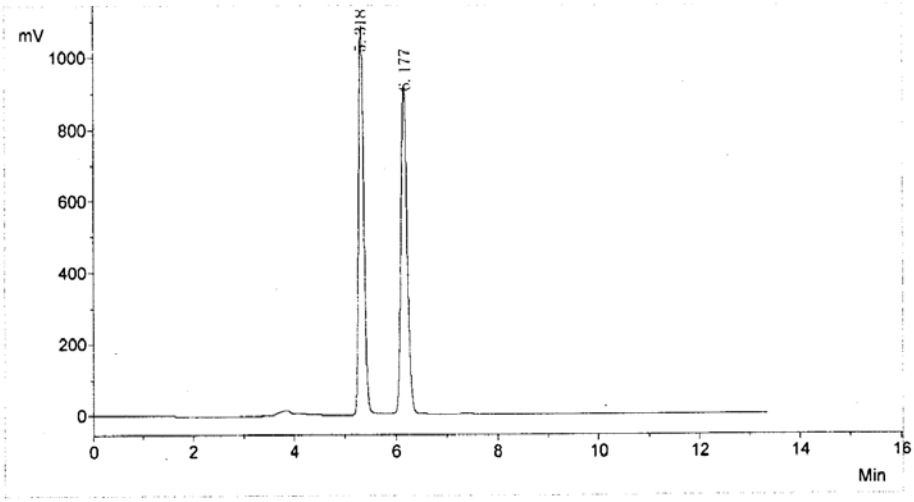
(*R*)-Methyl 2-amino-4-phenyl-2-(trifluoromethyl)butanoate (7).



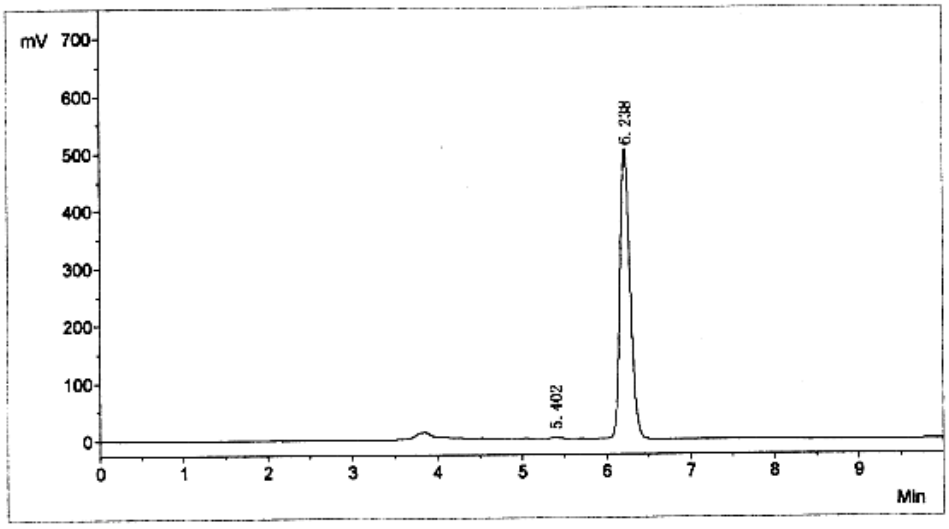



HGC-4-13-C
HGC-4-13
168.90
140.19
128.44
128.29
126.68
126.24
122.90
77.34
76.91
76.49
64.74
64.38
53.31
34.36
29.40
0.92
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20
f1 (ppm)

Chiral HPLC Analysis of 7



No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	5.318	1074946.8	7519959.4	49.2720
2	2	6.177	879287.2	7742186.9	50.7280
Total			1954234.0	15262146.3	100.0000



No.	PeakNo	R.Time	PeakHeight	PeakArea	PerCent
1	1	5.402	2971.9	18229.2	0.4348
2	2	6.238	495937.7	4174408.7	99.5652
Total			498909.5	4192637.9	100.0000