

Supporting Information for

**A Facile Assembly of Bifunctional, Magnetically Retrievable Mesoporous Silica for Enantioselective Cascade Reactions**

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## Experimental

**1. General:** All experiments, which are sensitive to moisture or air, were carried out under an Ar atmosphere using the standard Schlenk techniques. Tetraethoxysilane (TEOS), 1,4-bis(triethoxysilyl)ethane, cetyltrimethylammonium bromide (CTAB), fluorocarbon surfactant (FC-4:  $[\text{C}_3\text{F}_7\text{O}(\text{CF}(\text{CF}_3)\text{CF}_2\text{O})_2\text{CF}(\text{CF}_3)\text{CONH}(\text{CH}_2)_3\text{N}^+(\text{C}_2\text{H}_5)_2\text{CH}_3]\text{I}^-$ ), 4-(2-(trimethoxysilyl)ethyl)benzene-1-sulfonyl chloride, 4-(methylphenylsulfonyl)-1,2-diphenylethylenediamine [(S,S)-TsDPEN], PdCl<sub>2</sub>, (MesityleneRuCl<sub>2</sub>)<sub>2</sub> were purchased from Sigma-Aldrich Company Ltd and used as received. Compound of (S,S)-4-(trimethoxysilyl)ethylphenylsulfonyl-1,2-diphenylethylenediamine [*J. Mater. Chem.* **2010**, *20*, 1970–1975.] were synthesized according to the reported literature.

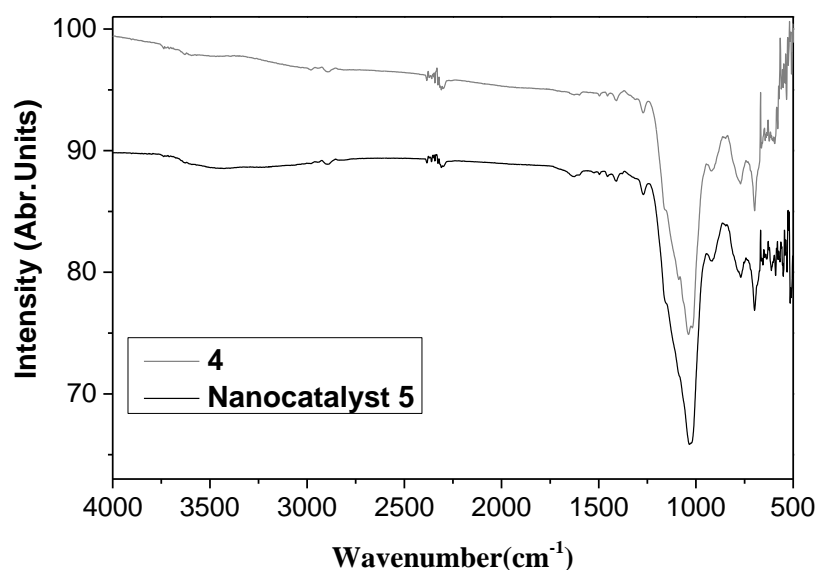
**2. Characterization:** Ru and Pd loading amounts in the catalyst were analyzed using an inductively coupled plasma optical emission spectrometer (ICP, Varian VISTA-MPX). Fourier transform infrared (FT-IR) spectra were collected on a Nicolet Magna 550 spectrometer using KBr method. Scanning electron microscopy (SEM) images were obtained using a JEOL JSM-6380LV microscope operating at 20 kV. Transmission electron microscopy (TEM) images were performed on a JEOL JEM2010 electron microscope at an acceleration voltage of 220 kV. Nitrogen adsorption isotherms were measured at 77 K with a Quantachrome Nova 4000 analyzer. The samples were measured after being outgassed at 423 K overnight. Pore size distributions were calculated by using the BJH model. The specific surface areas ( $S_{\text{BET}}$ ) of samples were determined from the linear parts of BET plots ( $p/p_0 = 0.05-1.00$ ). Solid state NMR experiments were explored on a Bruker AVANCE spectrometer at a magnetic field strength of 9.4 T with <sup>1</sup>H frequency of 400.1 MHz, <sup>13</sup>C frequency of 100.5 MHz and <sup>29</sup>Si frequency of 79.4 MHz with 4 mm rotor at two spinning frequency of 5.5 kHz and 8.0 kHz, TPPM decoupling is applied in the during acquisition period. <sup>1</sup>H cross polarization in all solid state NMR experiments was employed using a contact time of 2 ms and the pulse lengths of 4μs.

**3. General procedure for the preparation of catalyst 5.** In a typical synthesis, (*First step for the preparation of 3*) the obtained solids **1** (0.20 g) were suspended in an alkaline solution (0.35 mL of NaOH (2.0 M) in mixed 125.0 mL of water and 50.0 mL of ethanol with ultrasonication for 20 minutes. After that, an aqueous solution (0.04 g, 0.044 mmol) of FC-4 (FC-4:  $[\text{C}_3\text{F}_7\text{O}(\text{CF}(\text{CF}_3)\text{CF}_2\text{O})_2\text{CF}(\text{CF}_3)\text{CONH}(\text{CH}_2)_3\text{N}^+(\text{C}_2\text{H}_5)_2\text{CH}_3]\text{I}^-$ ), 0.08 g (0.22 mmol) of cetyltrimethylammonium bromide (CTAB) and 0.20 mL (25 wt%) of NH<sub>3</sub> H<sub>2</sub>O in 3.0 mL of water) was added, and the mixture was stirred at 38 °C for another 30 minutes. Next, 0.89 g (2.50 mmol) of 1,2-bis(triethoxysilyl)ethane and 0.15 g (0.30 mmol) of (S,S)-ArDpen-siloxane (**2**) in 2.0 mL of ethanol (2 minutes later) were added at room temperature, and the mixture was stirred under vigorous stirring for further 1.5 h. Finally, the temperature was raised to 80 °C and the mixture was stirred at 80 °C for another 3 h. After cooling the above mixture down to room temperature, the solid was collected by filtration to afford the ArDpen@SiO<sub>2</sub>@Pd/C@Fe<sub>3</sub>O<sub>4</sub> (**3**) as a black powder. (*Second step for the selective etching*) To remove the surfactant, the collected **3** were dispersed in 120 mL of solution (80 mg (1.0 mmol) of ammonium nitrate in 120 mL (95%) of ethanol), and the mixture was stirred at 60 °C for 10 h. After cooling the above mixture down to room temperature, the solids were filtered and washed with excess water and ethanol, and dried at 60 °C under vacuum overnight to afford the ArDpen@Pd/C@Fe<sub>3</sub>O<sub>4</sub> (**4**) as a dark-gray powder. (*Third step for the coordination*) 50.0 mg of (MesRuCl<sub>2</sub>)<sub>2</sub> (0.086 mmol) was added to a suspension of **4** (0.50 g) in 20.0 mL of dry CH<sub>2</sub>Cl<sub>2</sub> at room temperature, and the resulting mixture was stirred at 25 °C for 12 h. The solids were filtered and rinsed with excess dry CH<sub>2</sub>Cl<sub>2</sub>. After Soxhlet extraction for 4.0 h in CH<sub>2</sub>Cl<sub>2</sub>, the solids were collected and dried at 60 °C under vacuum overnight to

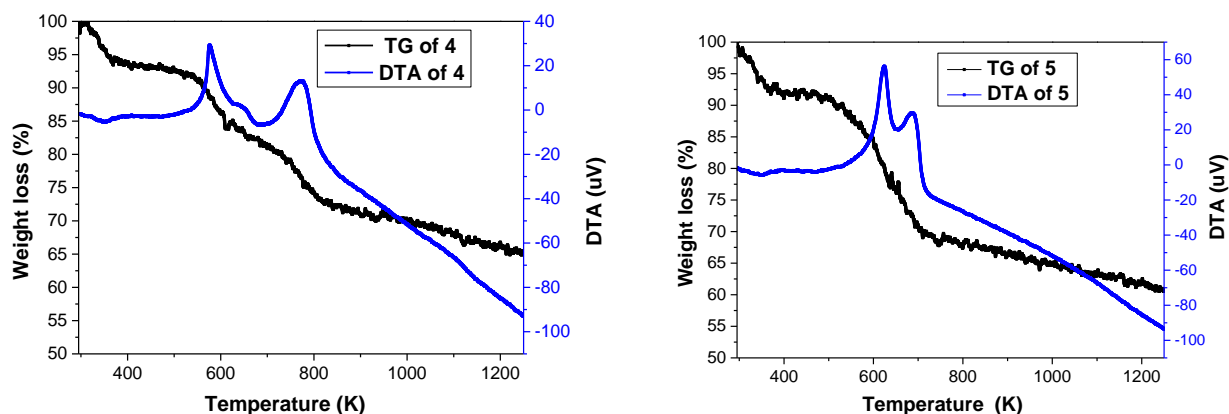
afford the magnetic catalyst **5** as a light-gray powder. An inductively coupled plasma optical emission spectrometer (ICP-OES) analysis showed that the Pd and Ru loadings were 41.63 mg (0.39 mmol of Pd) and 9.27 mg (0.091 mmol of Ru) per gram of catalyst, respectively.  $^{13}\text{C}$  CP/MAS NMR (161.9 MHz): 161.5–121.1 ( $\underline{\text{C}}$  of Ph and Ar groups), 109.7, 106.2 ( $\underline{\text{C}}$  of mesitylene), 78.2–72.9 ( $\underline{\text{C}}\text{H}$  of  $-\text{NCHPh}$ ), 67.8–64.2 ( $\underline{\text{C}}$  of  $-\text{NCH}_2$  and  $-\text{NCH}_3$  in CTAB molecule), 38.4–28.7 ( $\underline{\text{C}}\text{H}_2$  of  $-\text{CH}_2\text{Ar}$  and  $\underline{\text{C}}$  of  $\text{CH}_3\text{CH}_2-$  in CTAB molecule), 24.4 ( $\underline{\text{C}}\text{H}_3$  of mesitylene), 15.0–0.9 ( $\underline{\text{C}}\text{H}_2$  of  $-\text{CH}_2\text{Si}$ ) ppm.  $^{29}\text{Si}$  MAS/NMR (79.4 MHz):  $\text{T}^2$  ( $\delta = -57.7$  ppm),  $\text{T}^3$  ( $\delta = -65.9$  ppm),  $\text{Q}^3$  ( $\delta = -102.6$  ppm),  $\text{Q}^4$  ( $\delta = -112.7$  ppm).

**4. General procedure for the enantioselective cascade reactions.** A typical procedure was as follows. (For successive reduction/ATH enantioselective cascade reductions of styryl-substituted aromatic ketones) Catalyst **5** (21.98 mg, 2.0  $\mu\text{mol}$  of Ru, 8.57  $\mu\text{mol}$  of Pd, based on ICP analysis),  $\text{HCO}_2\text{Na}$  (1.0 mmol), ketones (0.10 mmol), and 4.0 mL of the mixed solvents ( $^i\text{PrOH}/\text{H}_2\text{O}$  v/v = 3/1) were added sequentially to a 10.0 mL round-bottom flask. The mixture was then stirred at 50  $^\circ\text{C}$  for 6–12 h. (For successive reduction/ATH enantioselective cascade reductions of styryl-substituted aromatic ketones: catalyst **5** (21.98 mg, 2.0  $\mu\text{mol}$  of Ru, 8.57  $\mu\text{mol}$  of Pd, based on ICP analysis),  $\text{HCO}_2\text{Na}$  (1.0 mmol), iodoacetophenones (0.10 mmol) and boronic acids (0.12 mmol), and 4.0 mL of the mixed solvents ( $^i\text{PrOH}/\text{H}_2\text{O}$  v/v = 3/1) were added sequentially to a 10.0 mL round-bottom flask. The mixture was then stirred at 60  $^\circ\text{C}$  for 12–16 h). During this period, the reaction was monitored constantly by TLC. After completion of the reaction, the catalyst was separated by centrifugation (10,000 rpm) for the recycling experiment. The aqueous solution was extracted with ethyl ether (3  $\times$  3.0 mL). The combined ethyl ether extracts were washed with aqueous  $\text{Na}_2\text{CO}_3$  and brine, and then dehydrated with  $\text{Na}_2\text{SO}_4$ . After evaporation of ethyl ether, the residue was purified by silica gel flash column chromatography to afford the desired product. The *ee* values were determined using an HPLC analysis with a UV-Vis detector and a Daicel chiralcel column ( $\Phi$  0.46  $\times$  25 cm).

**Figure S1.** FT-IR spectra of **4** and catalyst **5**.



**Figure S2.** TG/DTA curves of **4** and catalyst **5**.

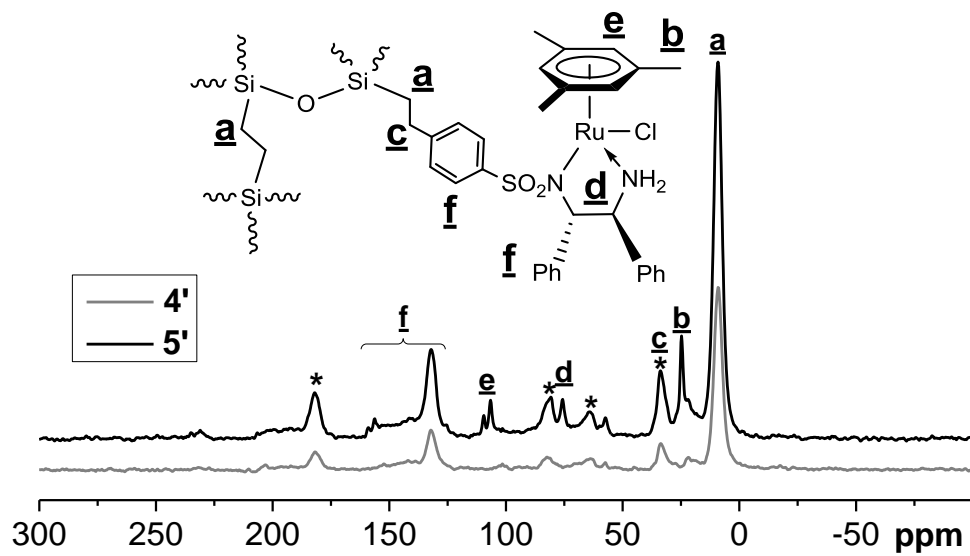


**Explanation:** The TG/DTA curves of ArDpen@Pd/C@Fe<sub>3</sub>O<sub>4</sub> (**4**) and catalyst **5** was treated in the air as shown above. For the ArDpen@Pd/C@Fe<sub>3</sub>O<sub>4</sub> (**4**), an endothermic peak around 351 K with weight loss of (100-93.1) 6.9% could be attributed to the release of physical adsorption water. In addition, the weight loss of (93.1-66.2) 28.9% between 440K and 1200K could be assigned to the oxidation of the organic moieties (including alkyl-linked ArDPEN moiety, alkyl fragments and part of the residual surfactants). Because the totally weight loss of organic moieties was 28.9% per 93.1% the extracted catalyst when eliminated the part of water, meaning the whole weight loss 31.1% of the oxidation of the organic molecules per 100% materials.

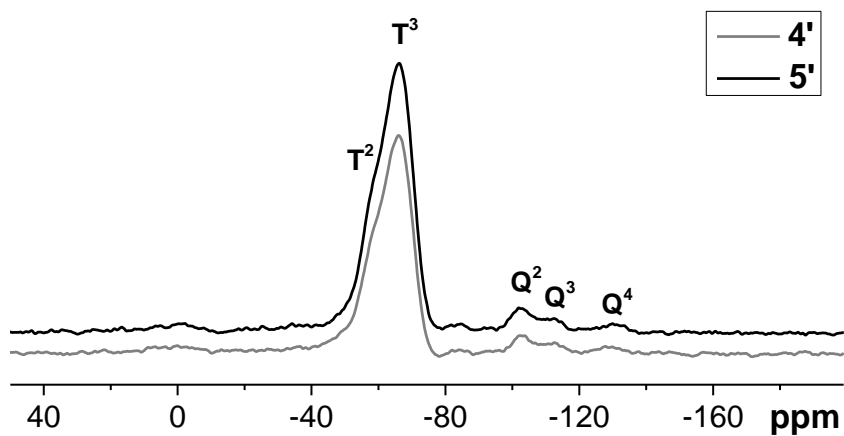
For catalyst **5**, it was found easily that a similar endothermic peak around 349 K with weight loss of (100-91.9) 8.1% were strongly similar to that of parent **4** due to the release of physical adsorption water. It was worth mentioning that the all exothermic peaks were combined into one complicated exothermic peak between 400K and 1200K with weight loss of (91.9-62.0) 29.9% could be assigned to the oxidation of organic molecules (including alkyl-linked MesityleneRuArDPEN complexes, alkyl fragments and part of the residual surfactants). Because the totally weight loss of organic moieties was 29.9% per 91.9% the extracted catalyst when eliminated the part of water, meaning the whole weight loss 32.5% of the oxidation of the organic molecules per 100% materials.

As compared the weight loss of **5** with **4**, the weight loss of the MesityleneCl moieties was 1.4% (32.5-31.1) per 100% materials. This finding means that the mole amounts of [MesityleneCl] in **5** is 0.009003 mol% (Mr = 155.5), demonstrating the 9.1741 mg (0.09003 mmol of Ru) of the Ru loading per gram of **5**.

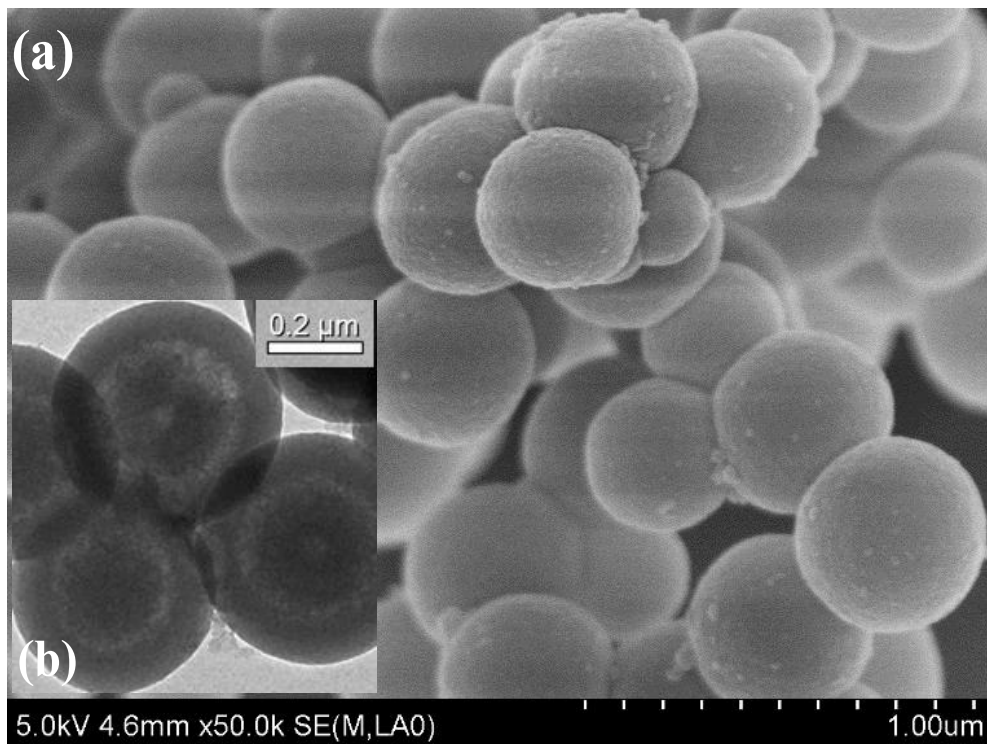
**Figure S3.** Solid-state  $^{13}\text{C}$  CP/MAS NMR spectra of **4'** and catalyst **5'**.



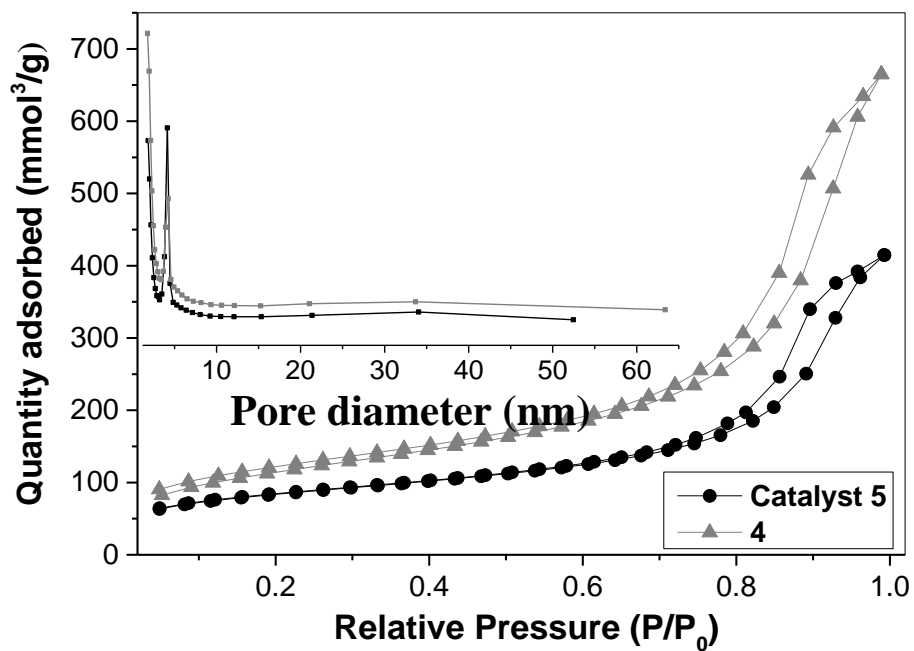
**Figure S4.** Solid-state  $^{29}\text{Si}$  MAS NMR spectra of **4'** and catalyst **5'**.



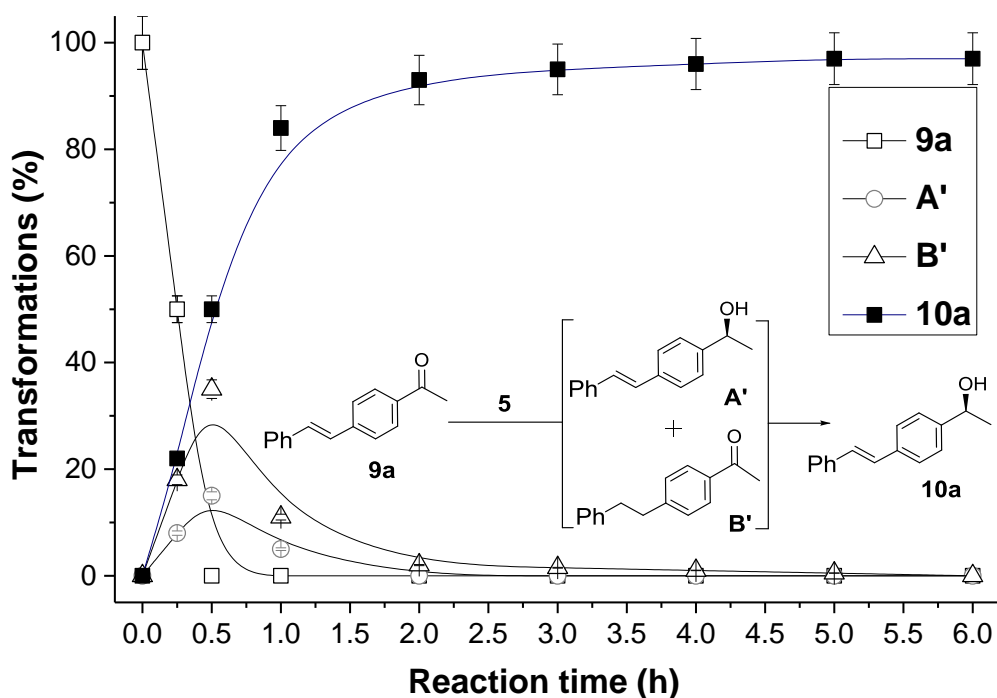
**Figure S5.** (a) SEM and TEM (b) images of catalyst 5.



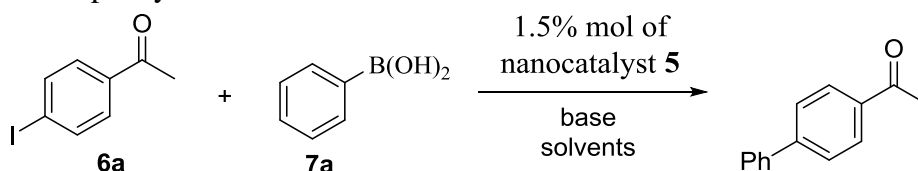
**Figure S6.** Nitrogen adsorption–desorption isotherms of 4 and catalyst 5.



**Figure S7.** Time course for the cascade reaction of (*E*)-1-(4-styrylphenyl)ethanone catalyzed by **5** (the reaction was performed with 2.0 mmol% Ru and 8.57 mmol% Pd of catalyst **5**, 1 equivalent of (*E*)-1-(4-styrylphenyl)ethan-1-one, and 10.0 equivalent of HCOONa at 50 °C)



**Table S1.** Optimizing reaction conditions for the Suzuki cross-coupling/ATH cascade reaction of 4-iodoacetophenone and phenylboronic acid.

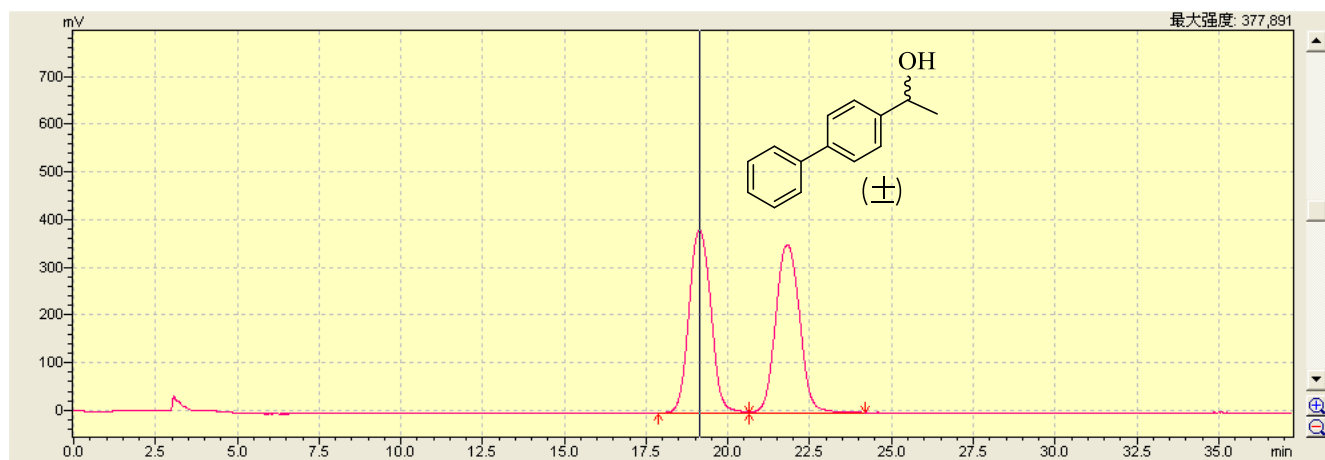


Entry	Solvent	base (H-resource)	°C	Time (h)	Yield (%)
1	<i>i</i> PrOH	K <sub>2</sub> CO <sub>3</sub> (1.0 equiv.)	70	6	99
2	<i>i</i> PrOH	K <sub>2</sub> CO <sub>3</sub> (1.0 equiv.)	60	3	99
3	<i>i</i> PrOH	HCOONa (10.0 equiv.)	60	3	98
4	H <sub>2</sub> O	HCOONa (10.0 equiv.)	60	3	68
5	<i>i</i> PrOH	HCOONa (10.0 equiv.)	50	3	90
6	<i>i</i> PrOH/ H <sub>2</sub> O (2/1)	HCOONa (10.0 equiv.)	60	3	93
7	<i>i</i> PrOH/ H <sub>2</sub> O (3/1)	HCOONa (10.0 equiv.)	60	3	99
8	<i>i</i> PrOH/ H <sub>2</sub> O (4/1)	HCOONa (10.0 equiv.)	60	3	99

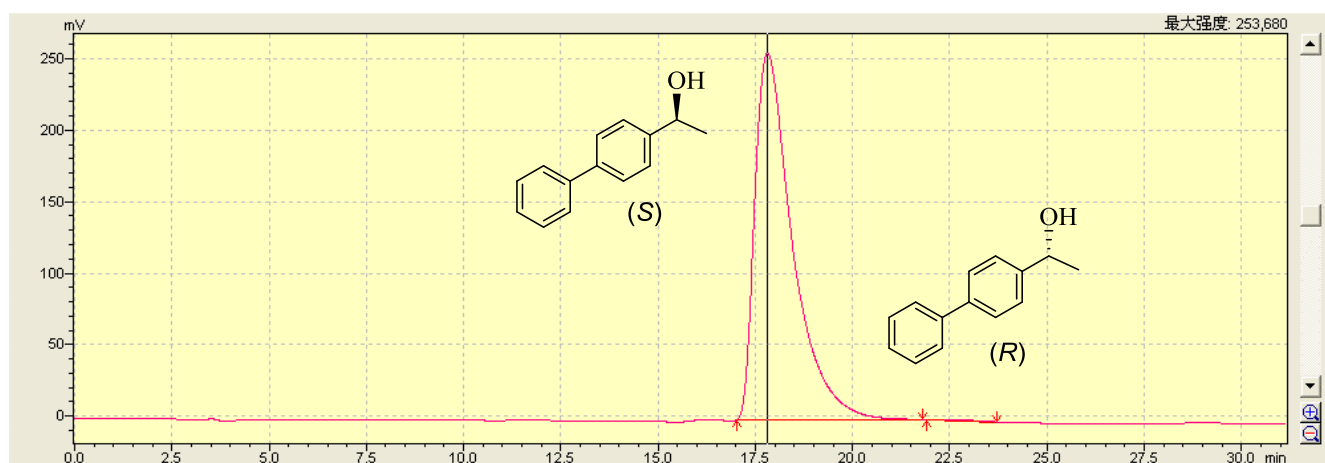
Reaction conditions: Catalyst **5** (38.50 mg, 3.50 μmol of Ru, 15.0 μmol of Pd, based on ICP analysis), iodoacetophenones (1.0 mmol), boronic acids (1.20 mmol), and 10.0 mL of co-solvents were added sequentially to a 10.0 mL round-bottom flask. Yields were determined by <sup>1</sup>H-NMR analysis.

**Figure S8.** HPLC analyses for chiral products.

**(S)-1-([1,1'-biphenyl]-4-yl)ethan-1-ol (8a):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 19.1$  min (major),  $t_2 = 21.8$  min).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT19.119	19.119	1	17891701	363554	49.9033
2	RT21.802	21.802	2	17961064	352585	50.0967



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT17.811	17.811	1	17436965	256593	99.6354
2	RT22.525	22.525	2	63810	1135	0.3646

Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471



**(S)-1-(4'-fluoro-[1,1'-biphenyl]-4-yl)ethanol (8b):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 20.0$  min (major),  $t_2 = 23.1$  min).

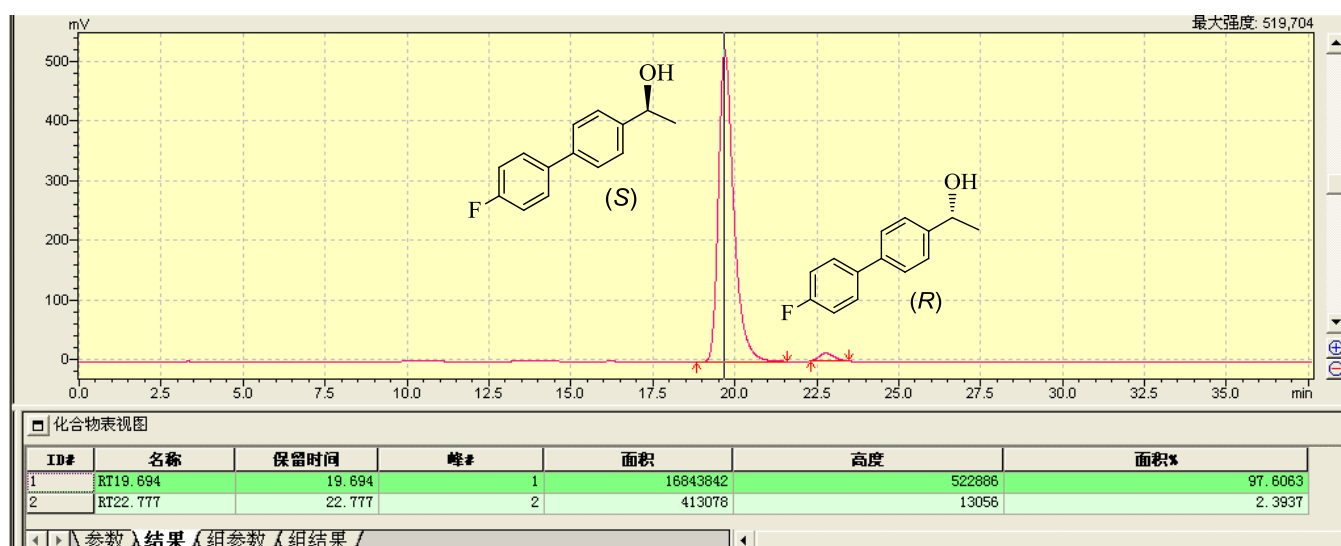
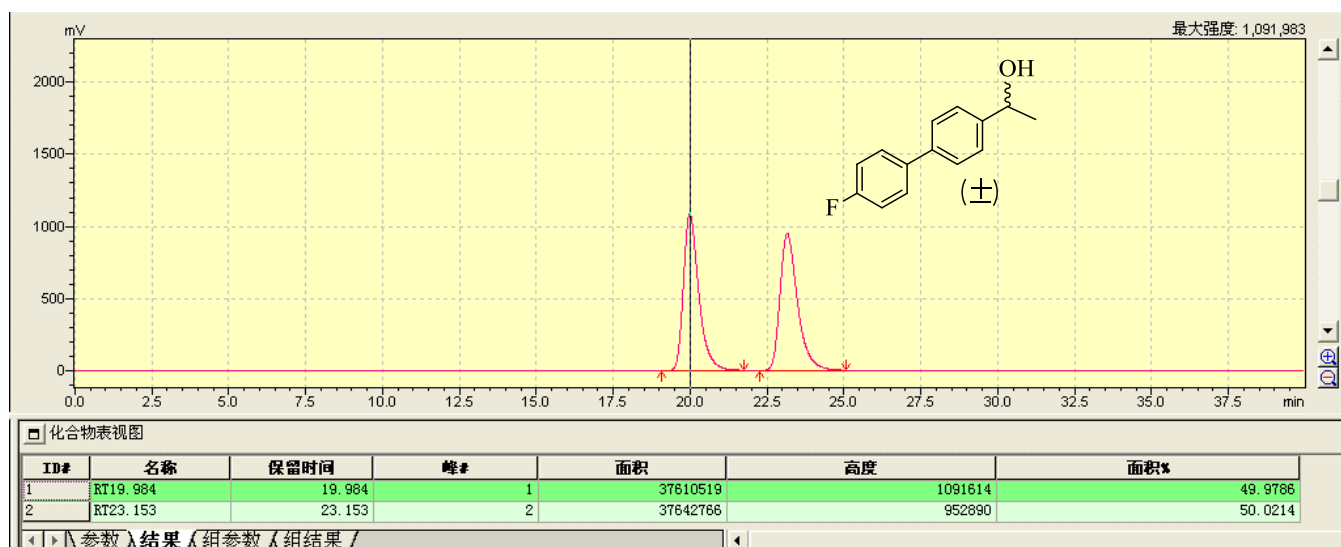


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ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4'-chloro-[1,1'-biphenyl]-4-yl)ethanol (8c):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 20.0$  min (major),  $t_2 = 26.2$  min.

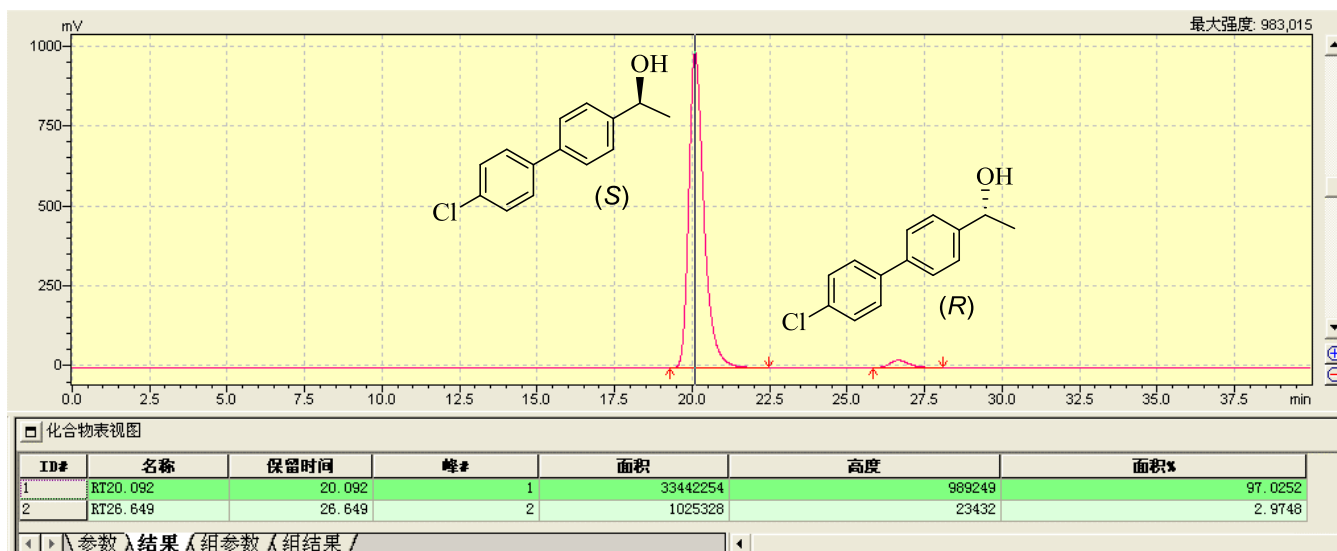
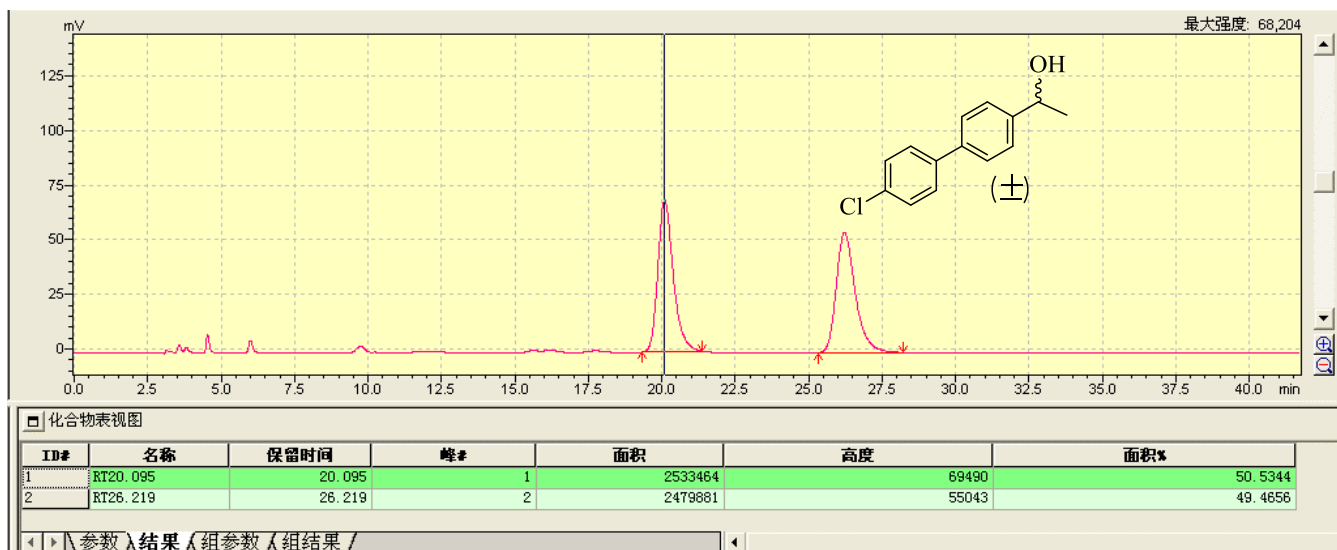


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3'-chloro-[1,1'-biphenyl]-4-yl)ethanol (8d):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 17.6$  min (major),  $t_2 = 19.9$  min.)

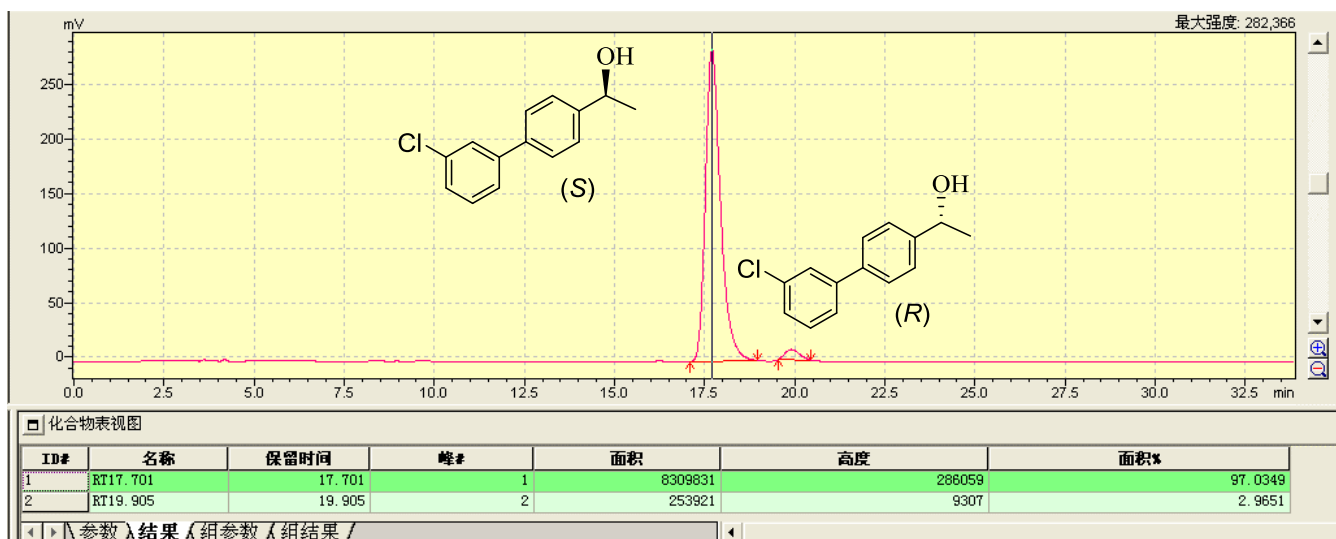
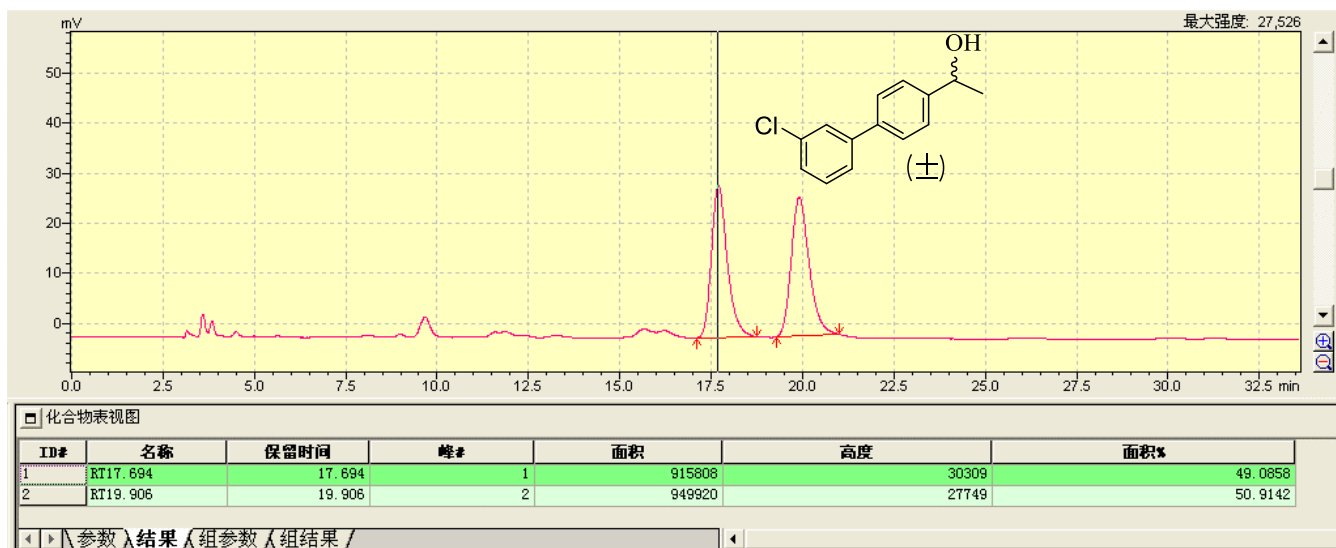


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

(S)-1-(4'-(trifluoromethyl)-[1,1'-biphenyl]-4-yl)ethanol (8e) : (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1$  = 14.3min (major),  $t_2$  = 19.8 min).

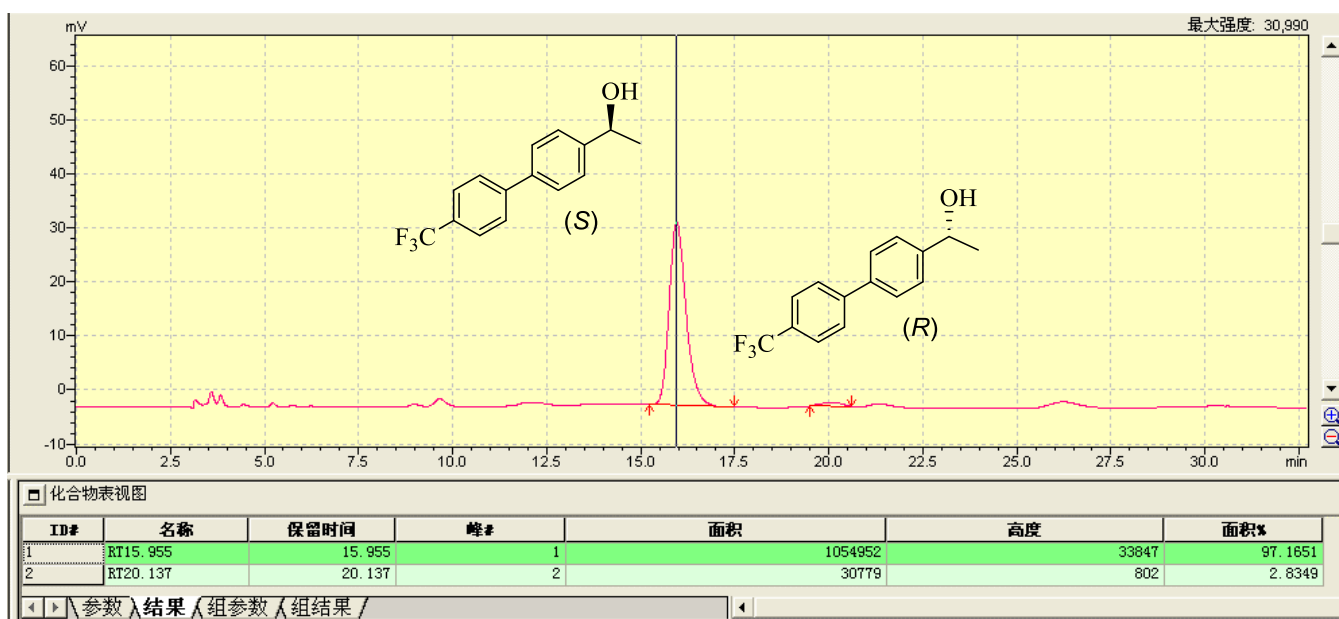
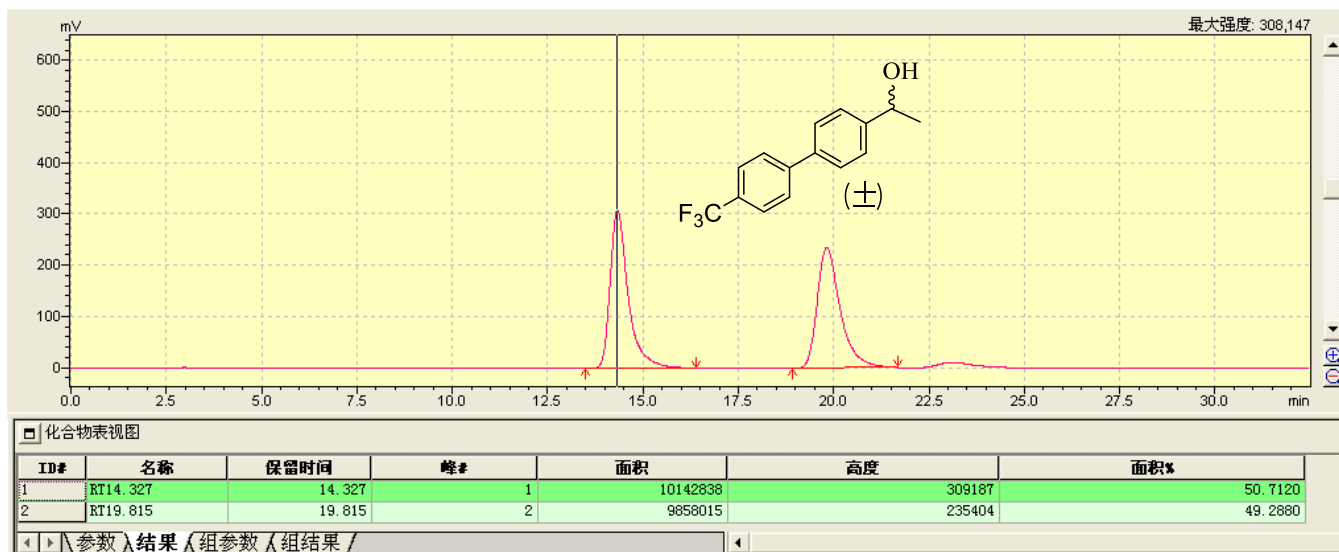


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

化合物表视图

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3'-(trifluoromethyl)-[1,1'-biphenyl]-3-yl)ethan-1-ol (8f):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1$  = 13.9 min (major),  $t_2$  = 15.1 min.)

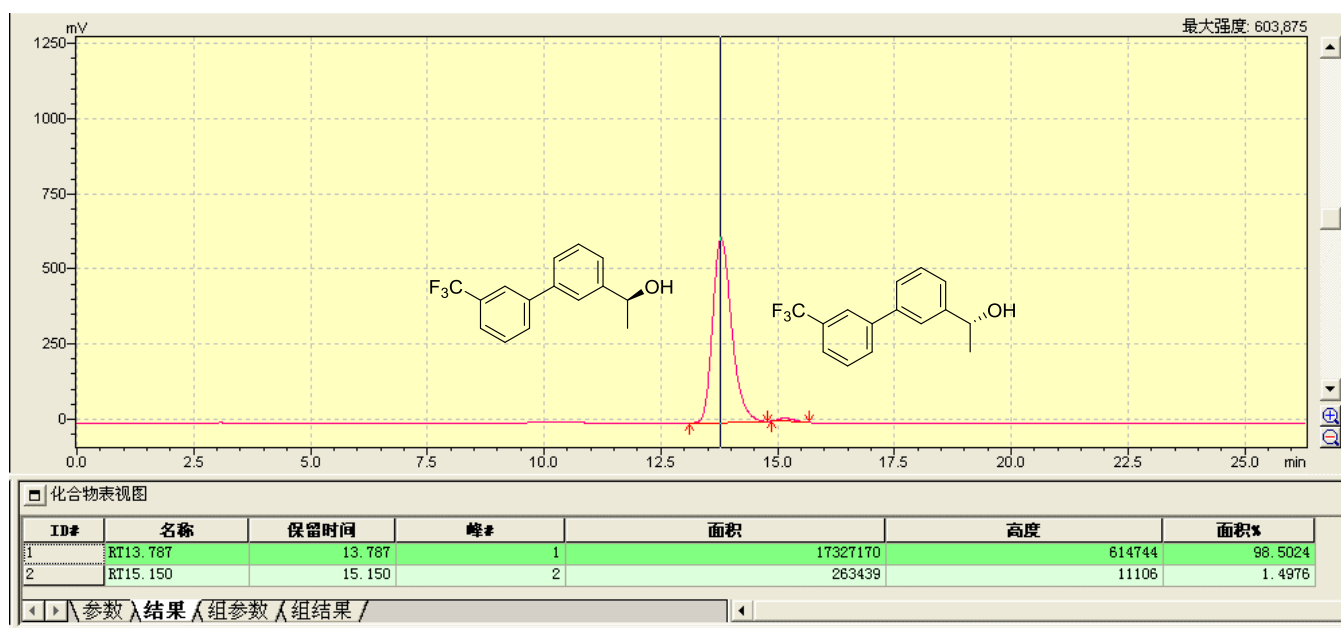
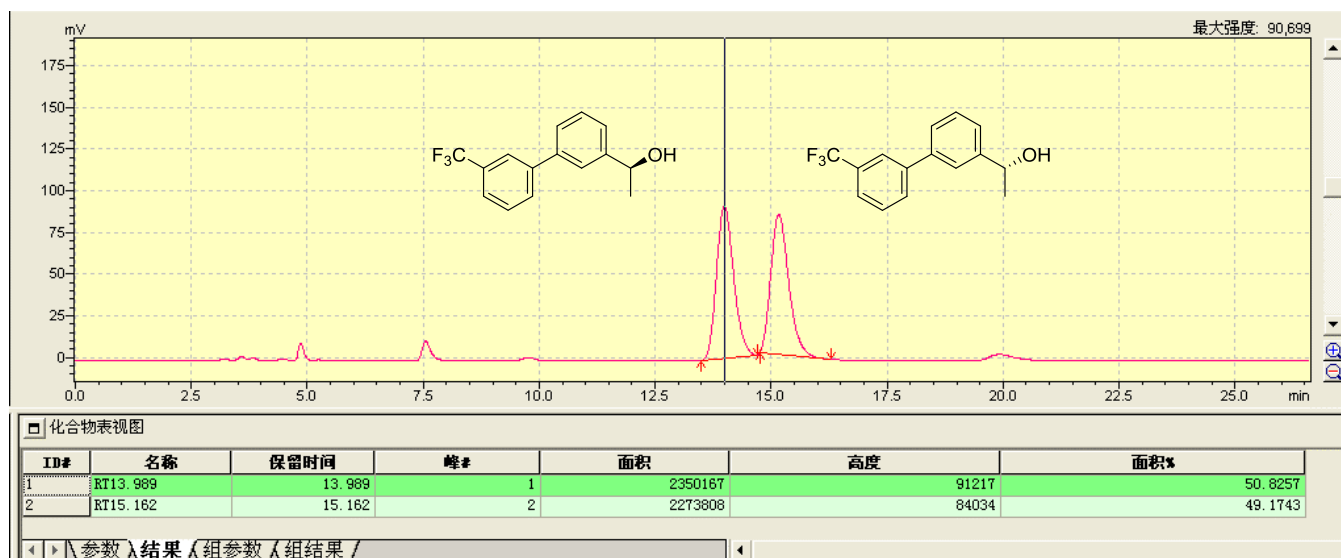


Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4'-methyl-[1,1'-biphenyl]-4-yl)ethanol (8g):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 15.5$  min (major),  $t_2 = 20.8$  min.)

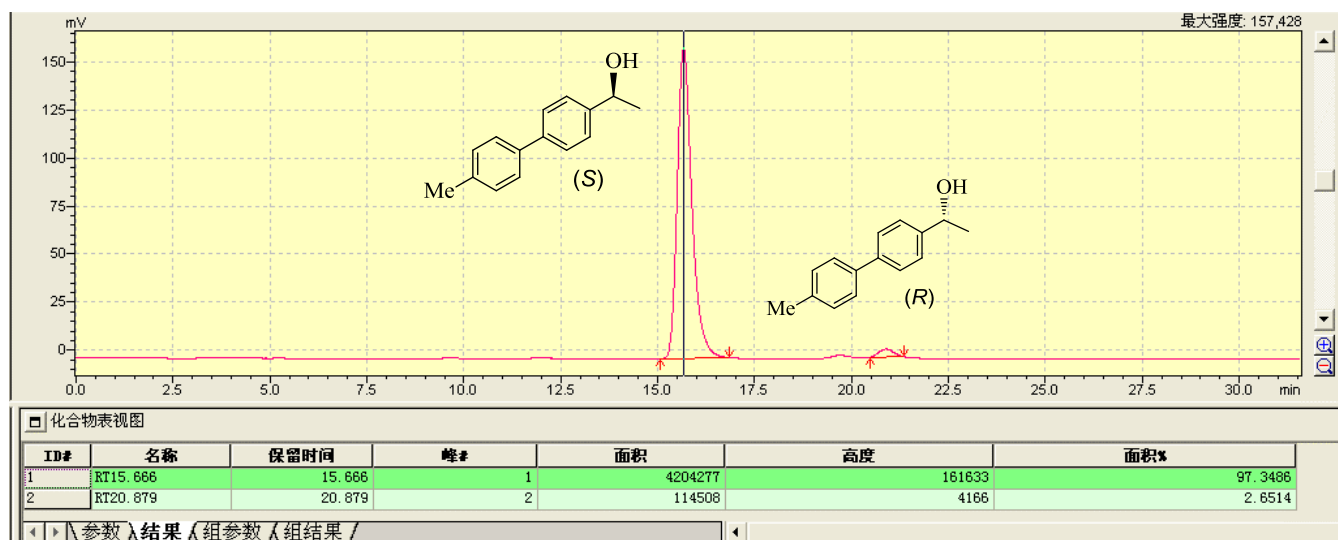
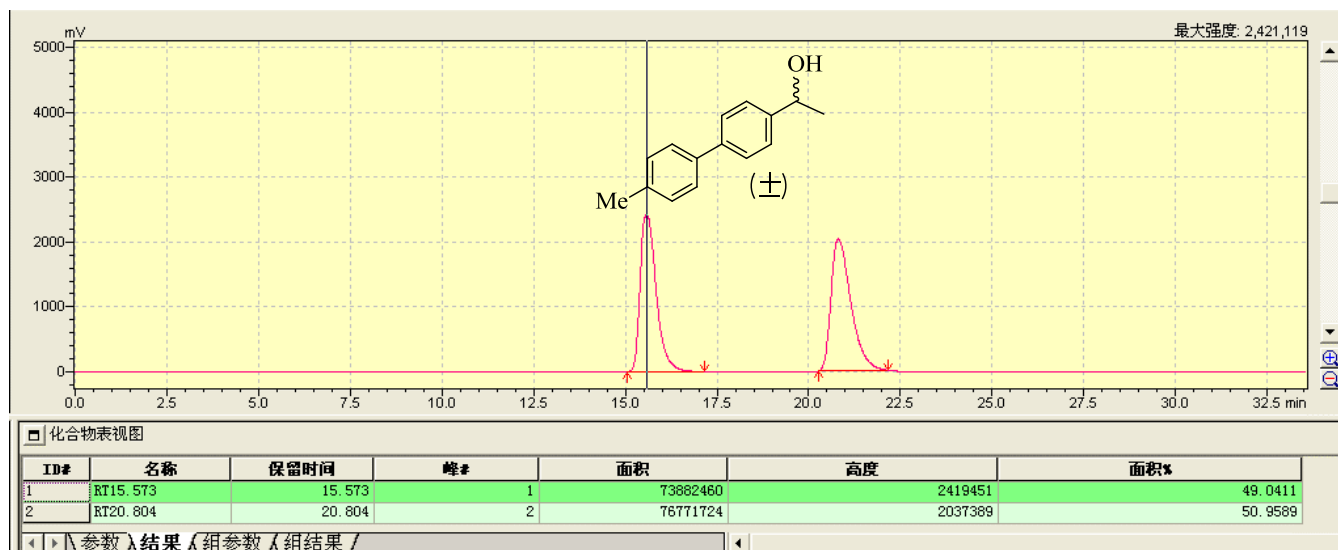


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3'-methyl-[1,1'-biphenyl]-4-yl)ethanol (8h):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 34.6$  min (major),  $t_2 = 38.3$  min.)

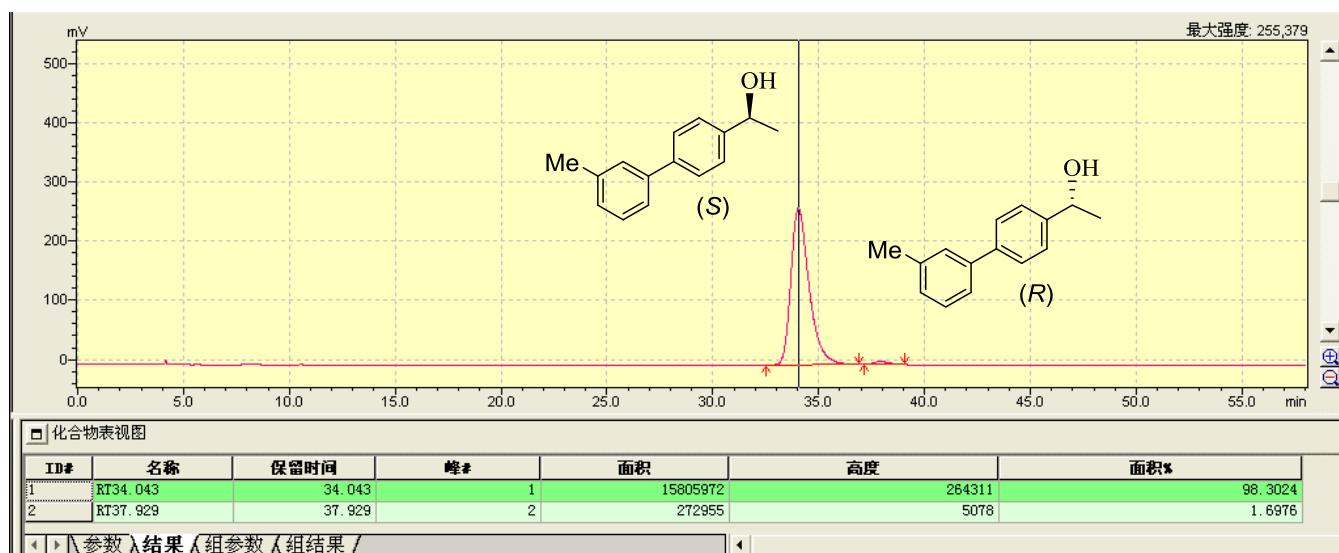
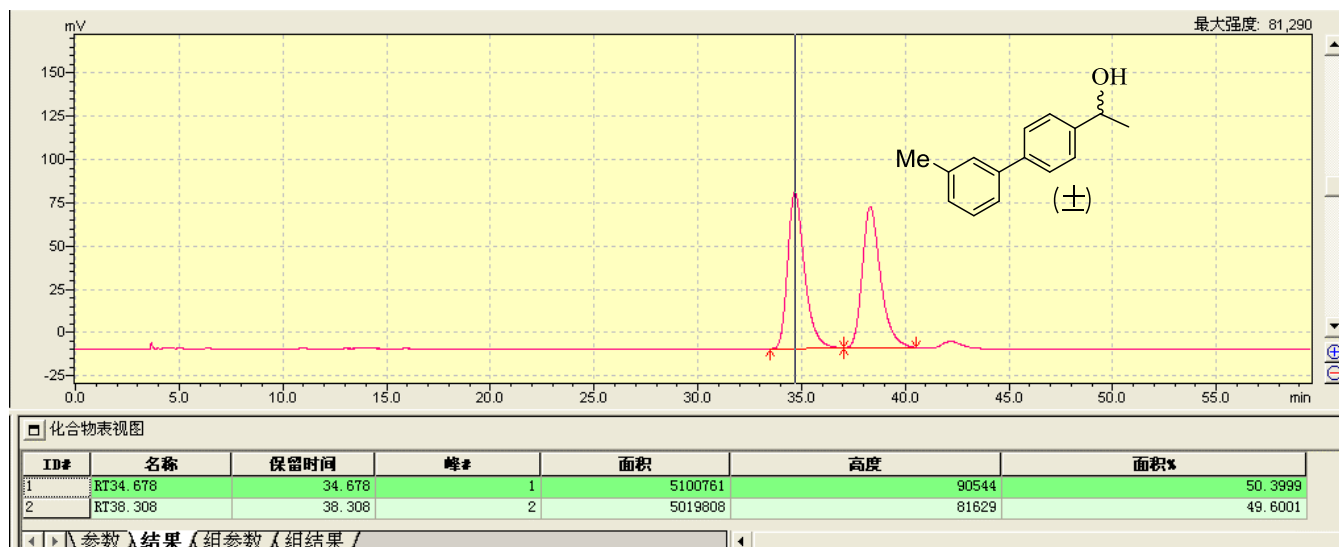


Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4'-methoxy-[1,1'-biphenyl]-4-yl)ethanol (8i):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 31.2$ min (major),  $t_2 = 36.0$  min.)

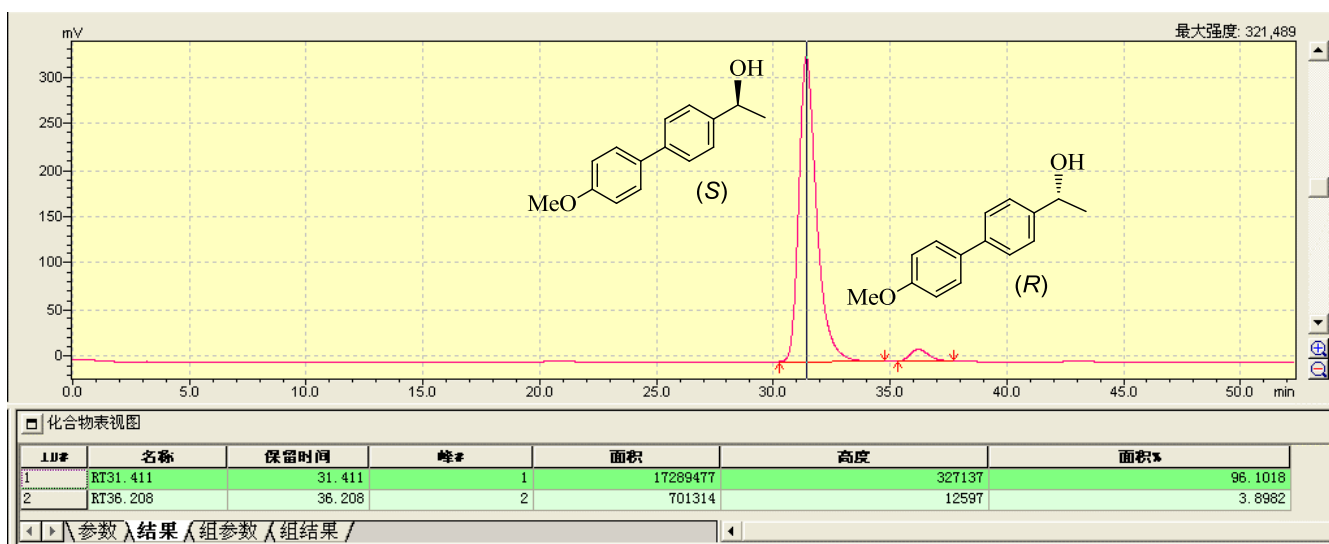
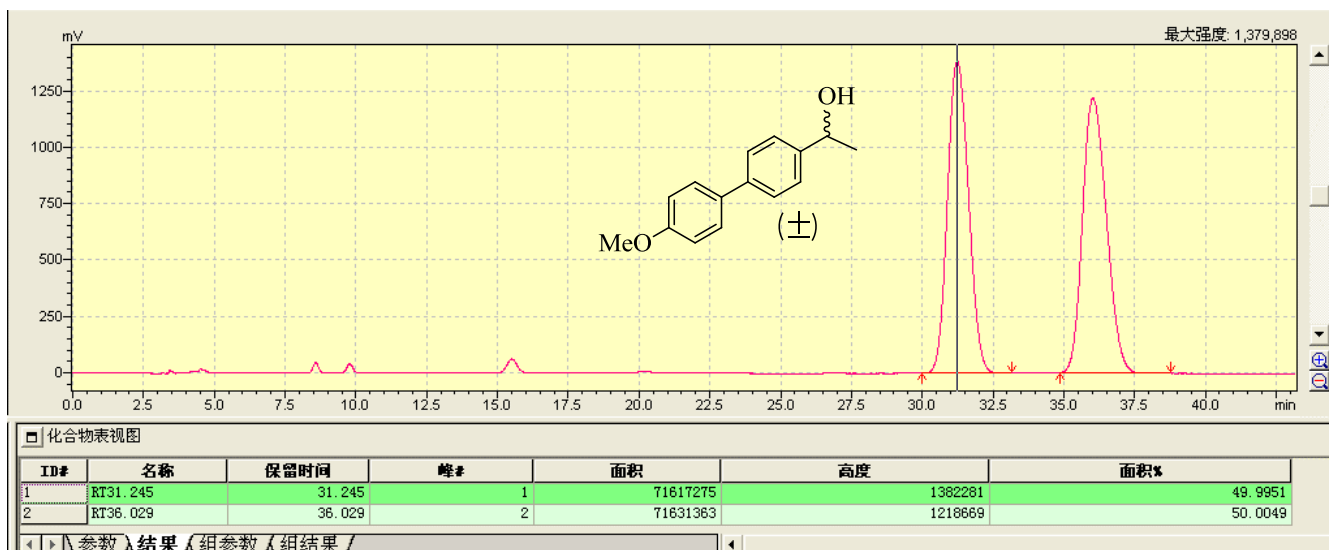


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

化合物表视图

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471



**(S)-1-(4-(thiophen-3-yl)phenyl)ethan-1-ol (8j):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 28.4$  min,  $t_2 = 33.5$  min (major)).

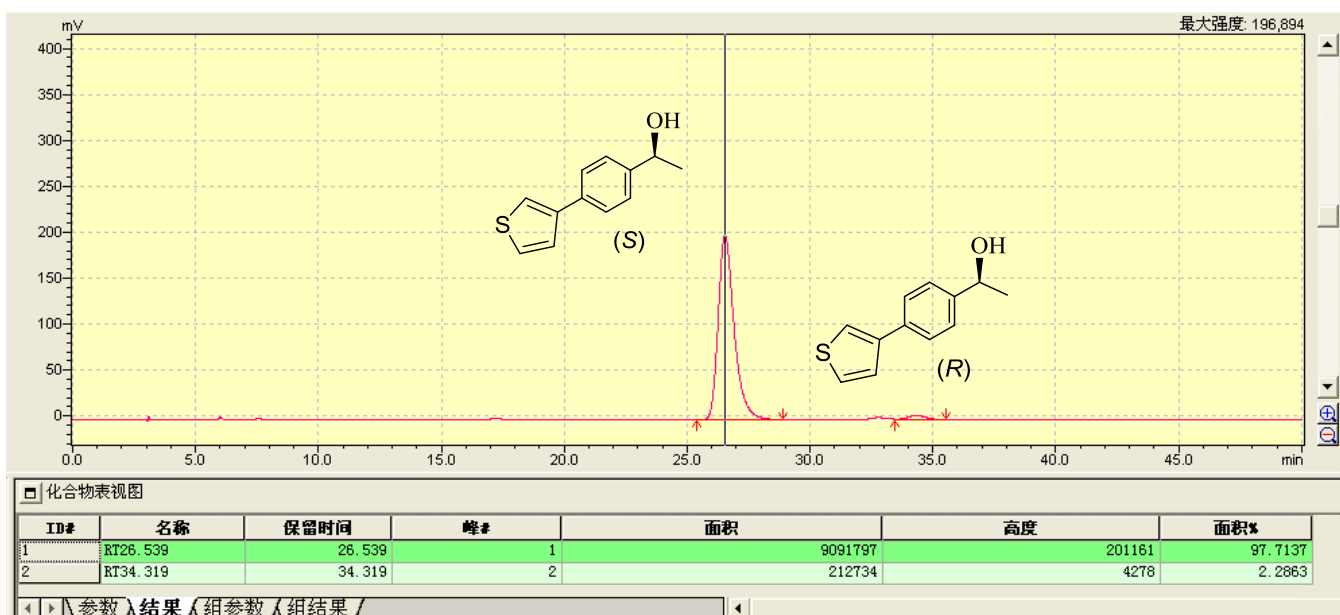
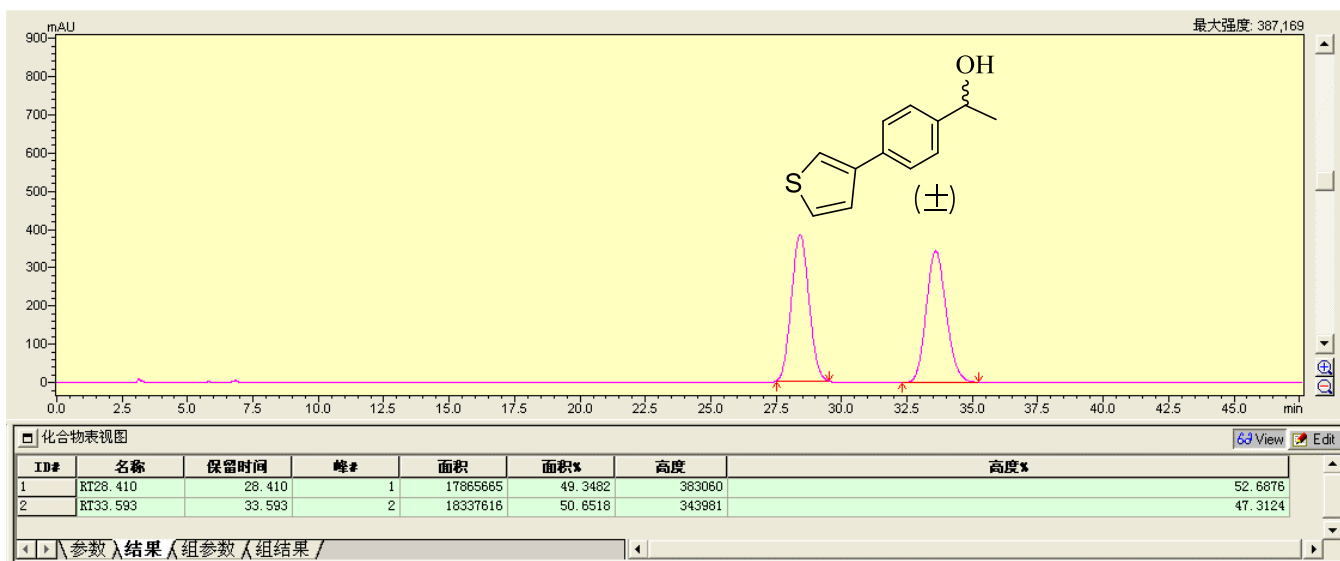
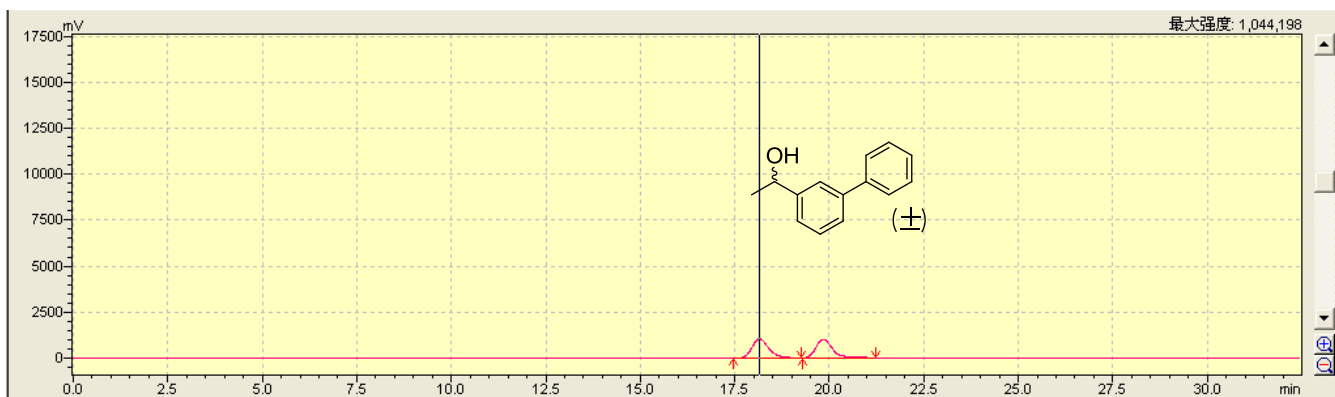


Table view of compound

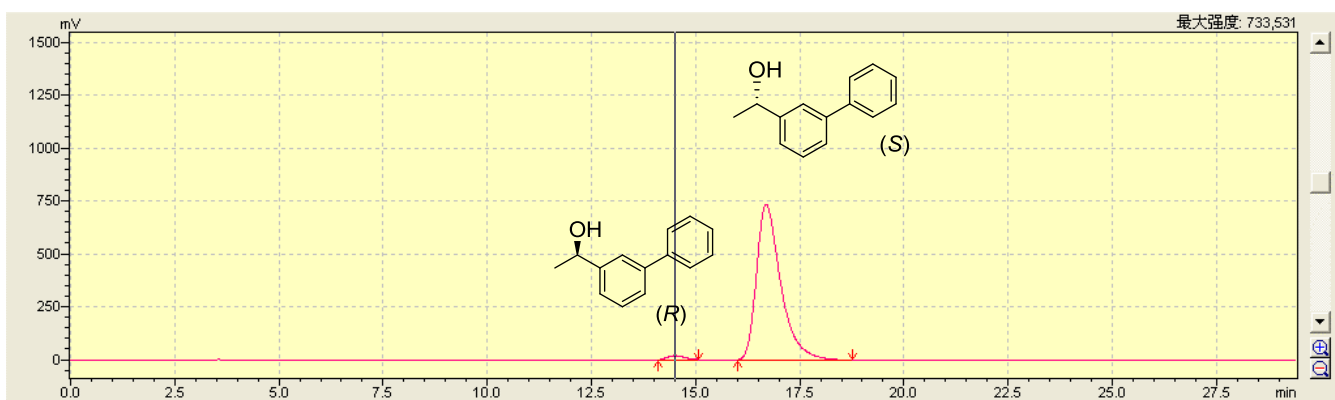
↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT18.273	18.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-([1,1'-biphenyl]-3-yl)ethanol (8k):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 18.1$  min,  $t_2 = 19.8$  min (major)).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT18.149	18.149	1	31921797	1040576	50.5851
2	RT19.830	19.830	2	31183337	1000961	49.4149



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT14.504	14.504	1	613736	20490	2.0126
2	RT16.692	16.692	2	29880374	735648	97.9874

Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4'-fluoro-[1,1'-biphenyl]-3-yl)ethanol (8l):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 21.1$  min,  $t_2 = 23.4$  min(major)).

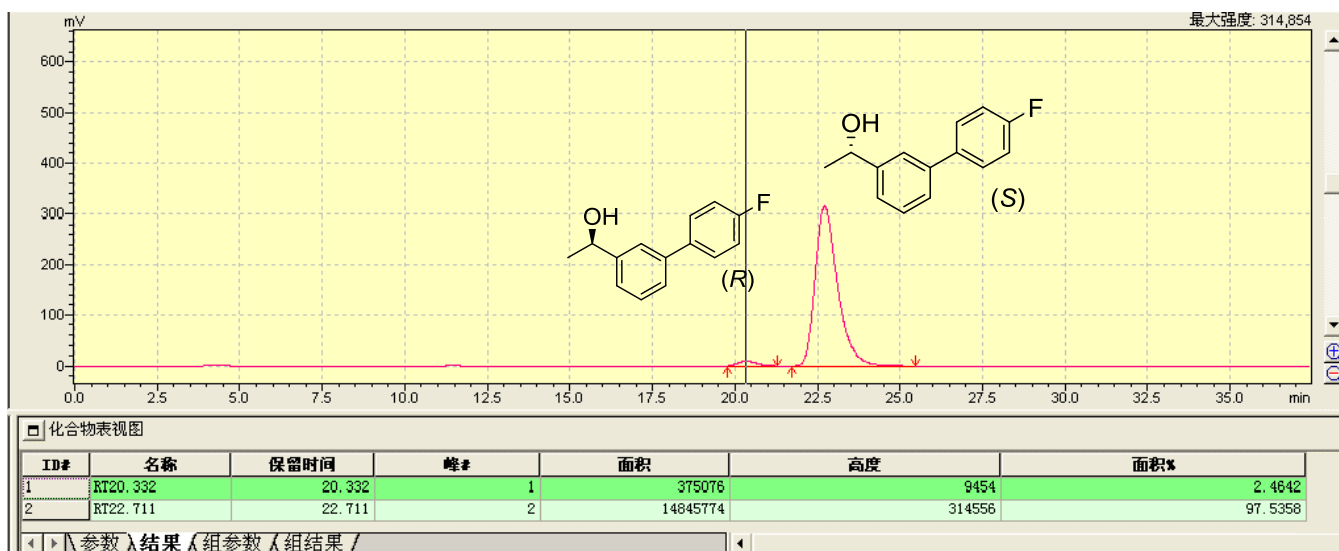
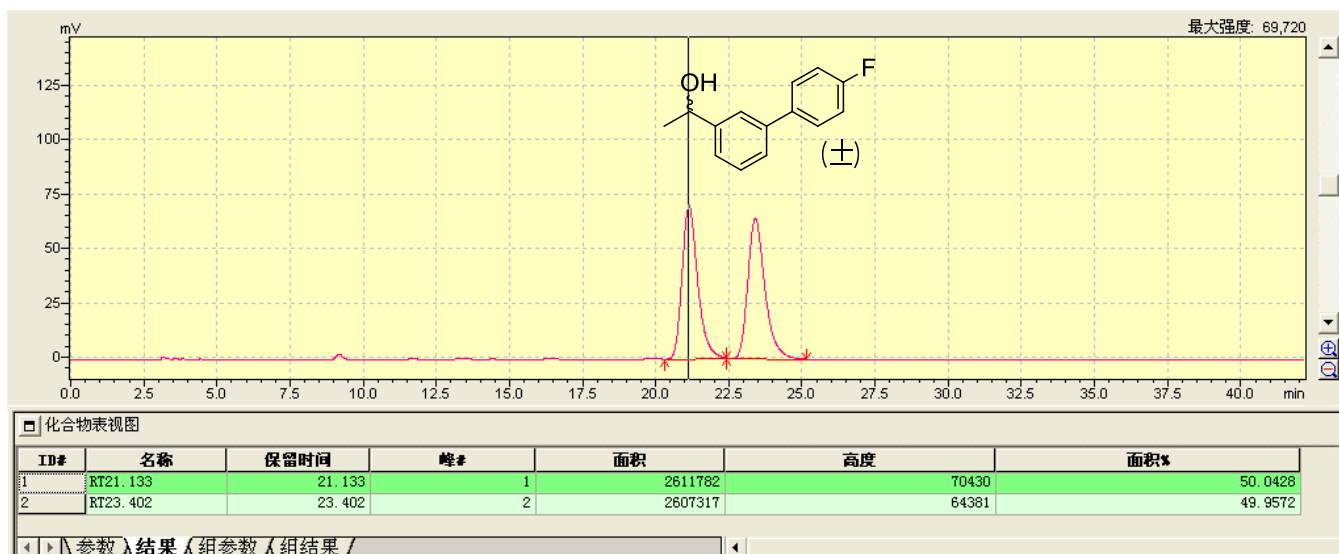


Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

化合物表视图

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4'-chloro-[1,1'-biphenyl]-3-yl)ethanol (8m):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 22.2$  min,  $t_2 = 25.4$  min (major))

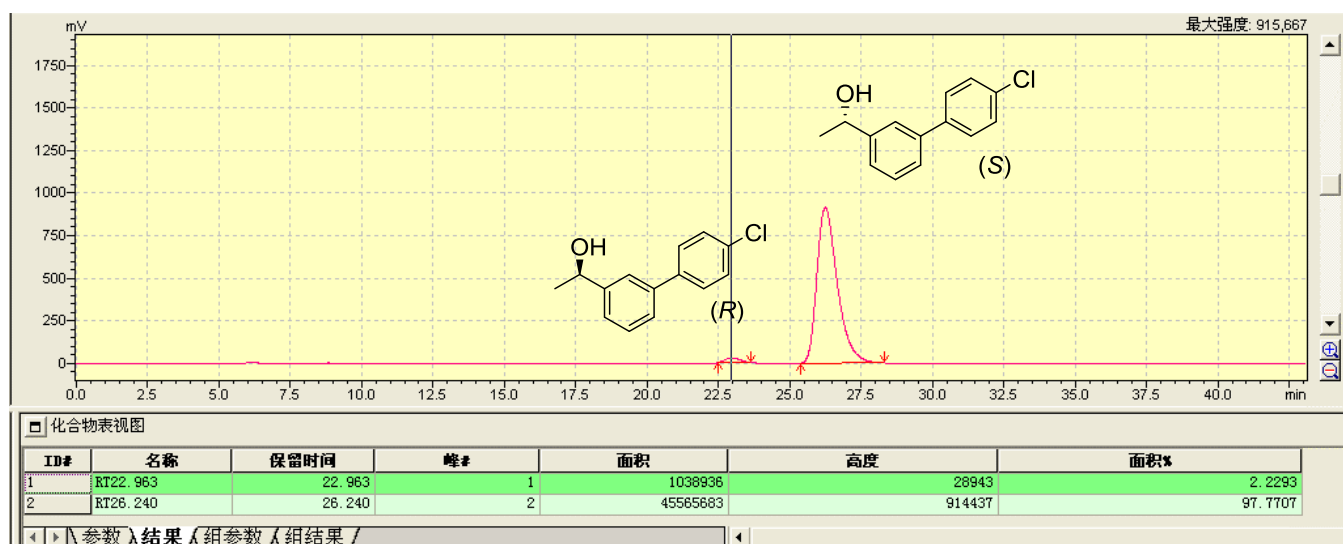
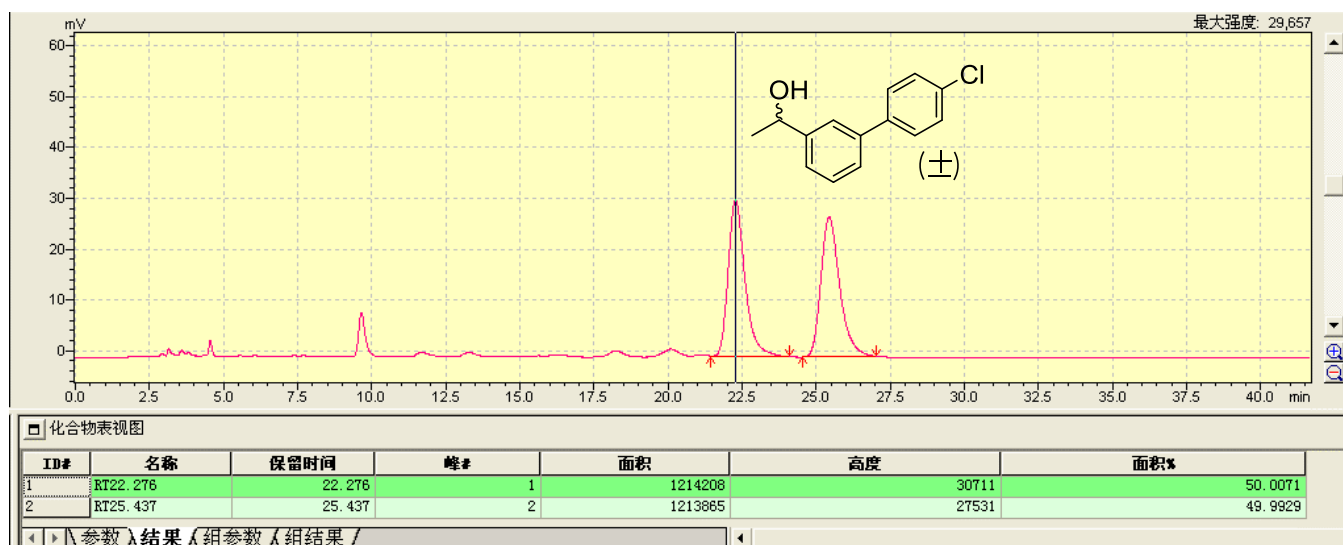


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3'-chloro-[1,1'-biphenyl]-3-yl)ethanol (8n):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 16.4$  min,  $t_2 = 19.6$  min(major)).

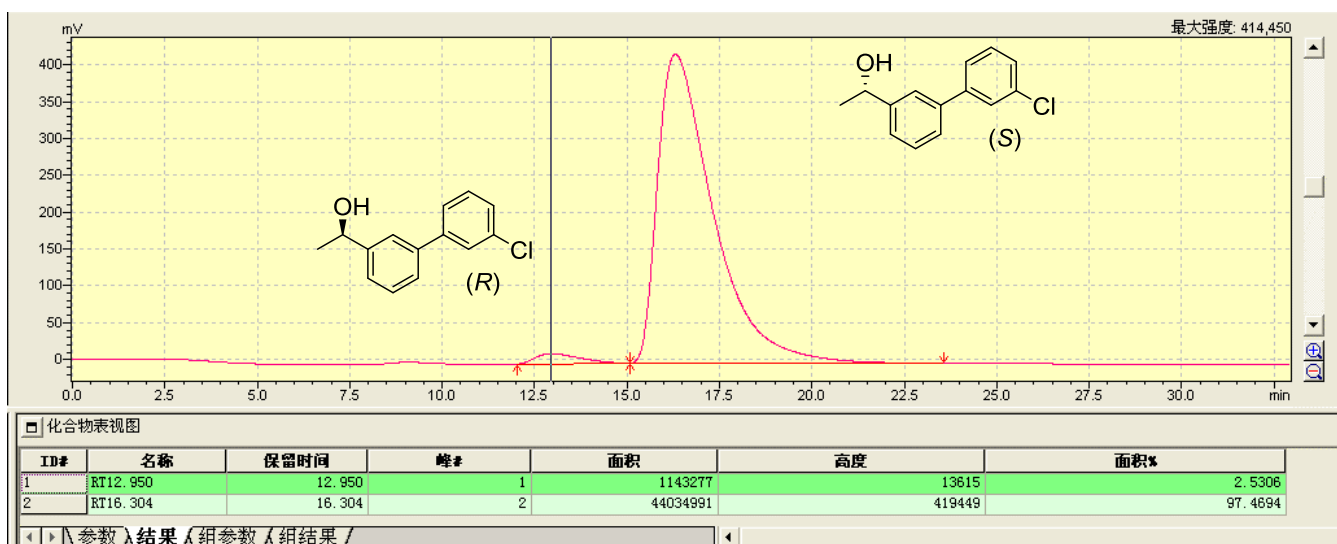
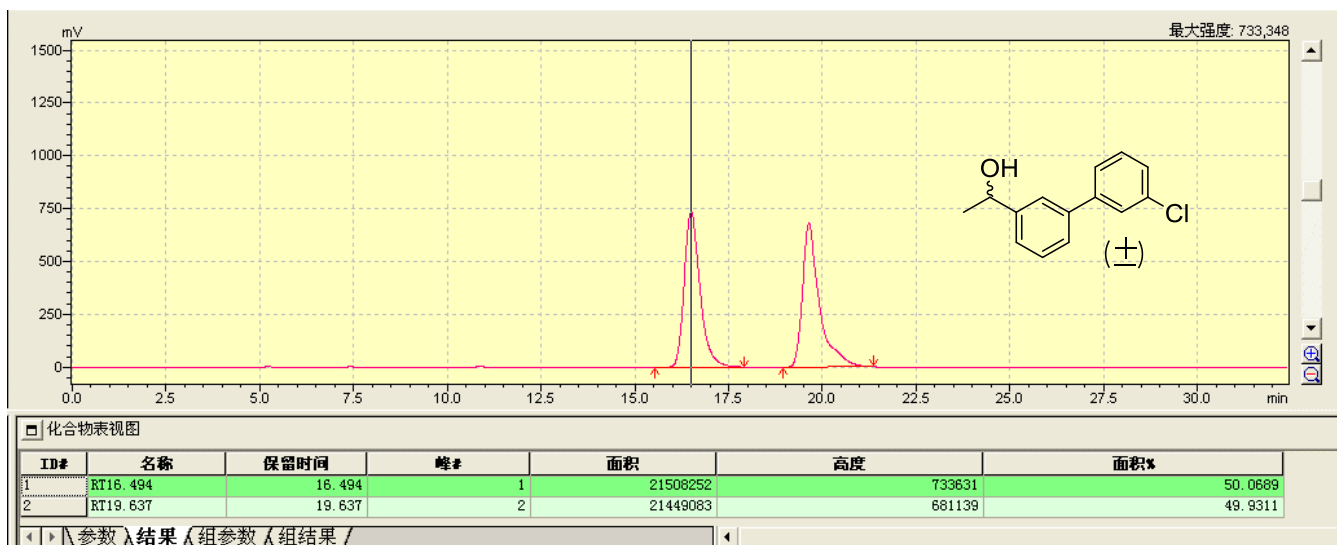


Table view of compound

↑ Name    RetTime [min]    Peak    Area    Height    Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4'-(trifluoromethyl)-[1,1'-biphenyl]-3-yl)ethanol (8o):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 17.8\text{min}$  (major),  $t_2 = 20.1\text{min}$ ).

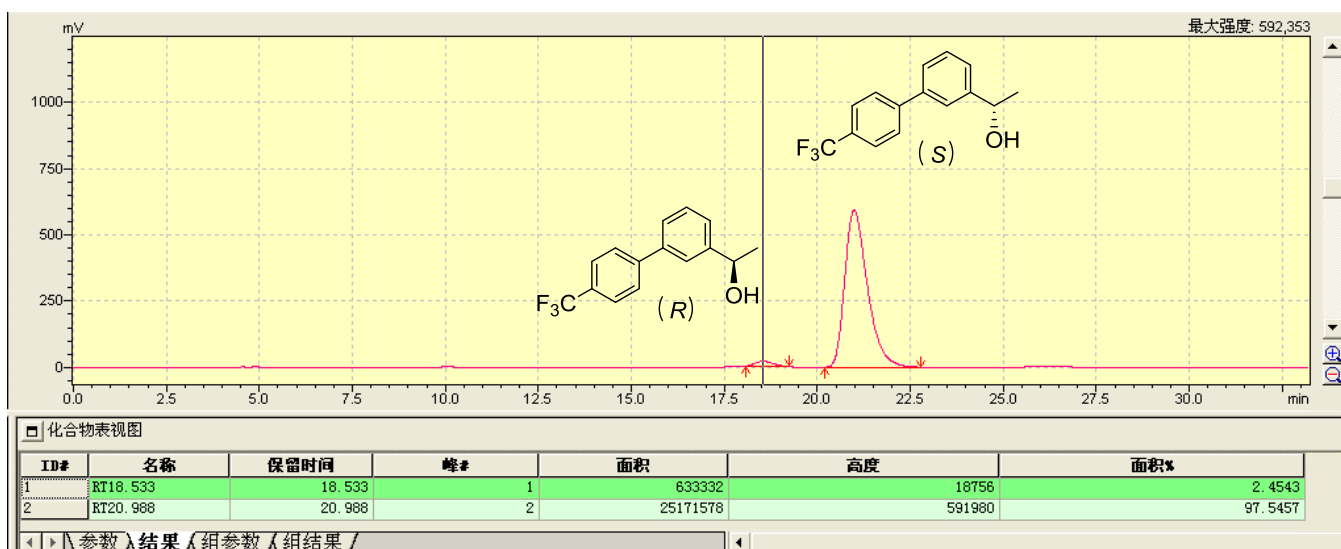
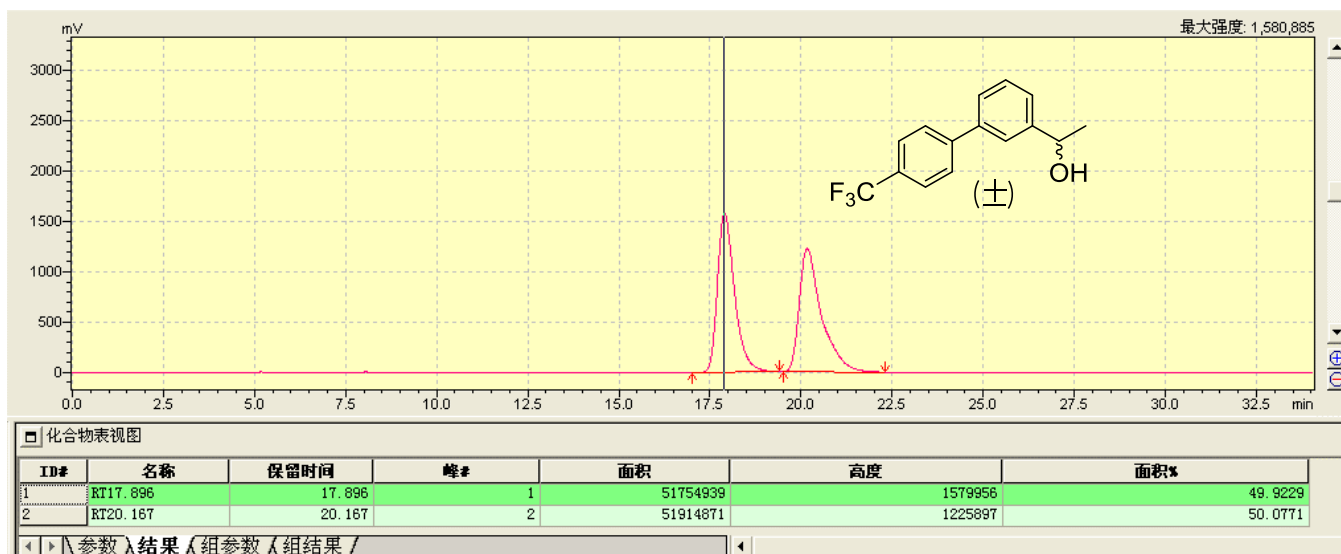


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-((4'-methyl-[1,1'-biphenyl]-3-yl)ethanol (8p):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: nhexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 18.4$  min,  $t_2 = 22.0$  min (major)).

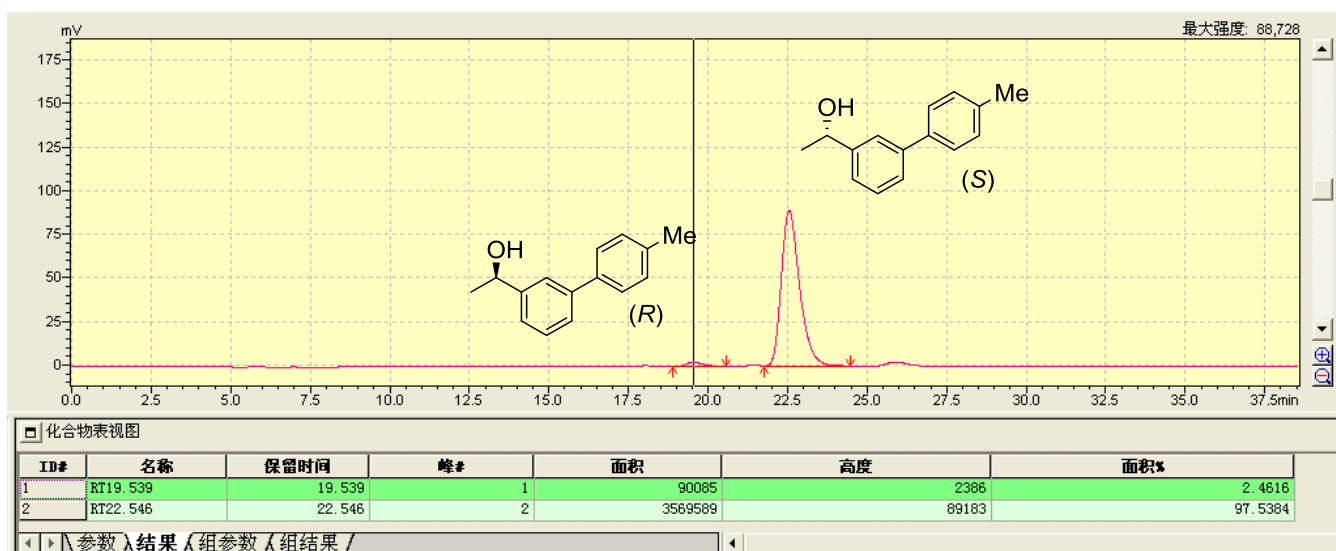
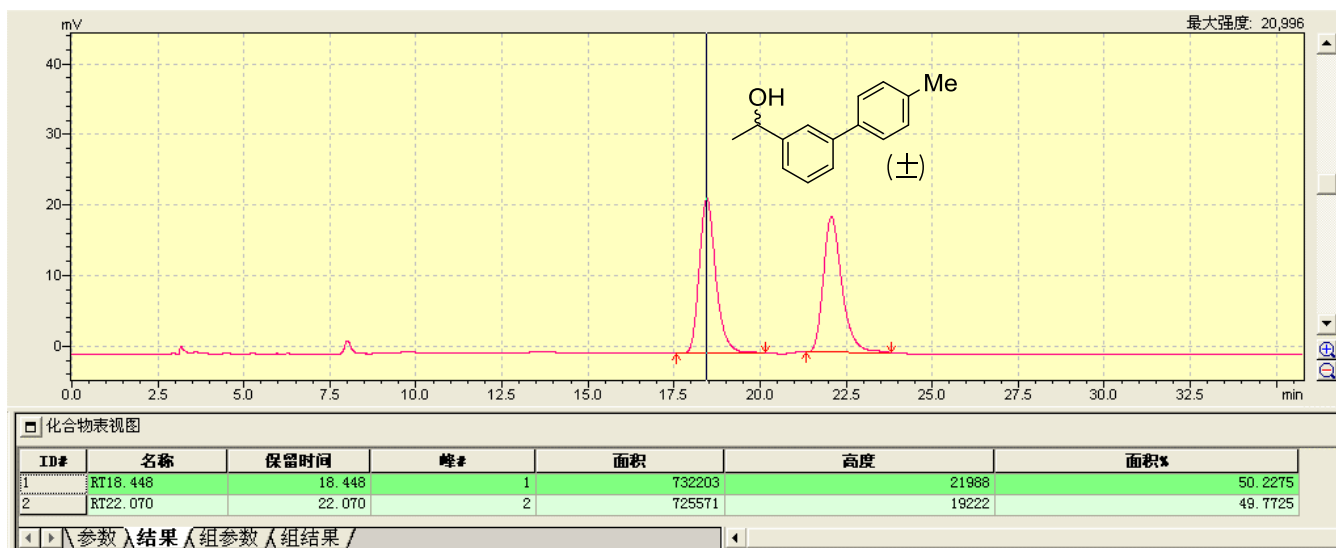


Table view of compound

↑ Name    RetTime [min]    Peak    Area    Height    Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT18.273	18.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-((3'-methyl-[1,1'-biphenyl]-3-yl)ethanol (8q):**(HPLC: Chiracel AD-H, detected at 254 nm, eluent: nhexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 14.6$  min,  $t_2 = 17.2$  min (major))

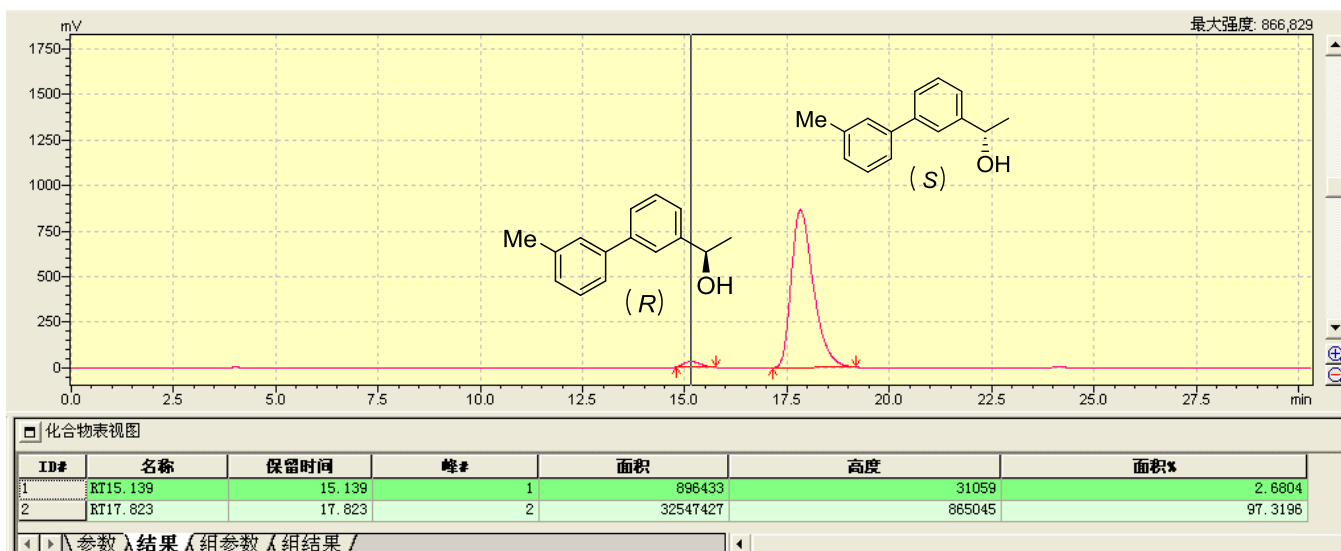
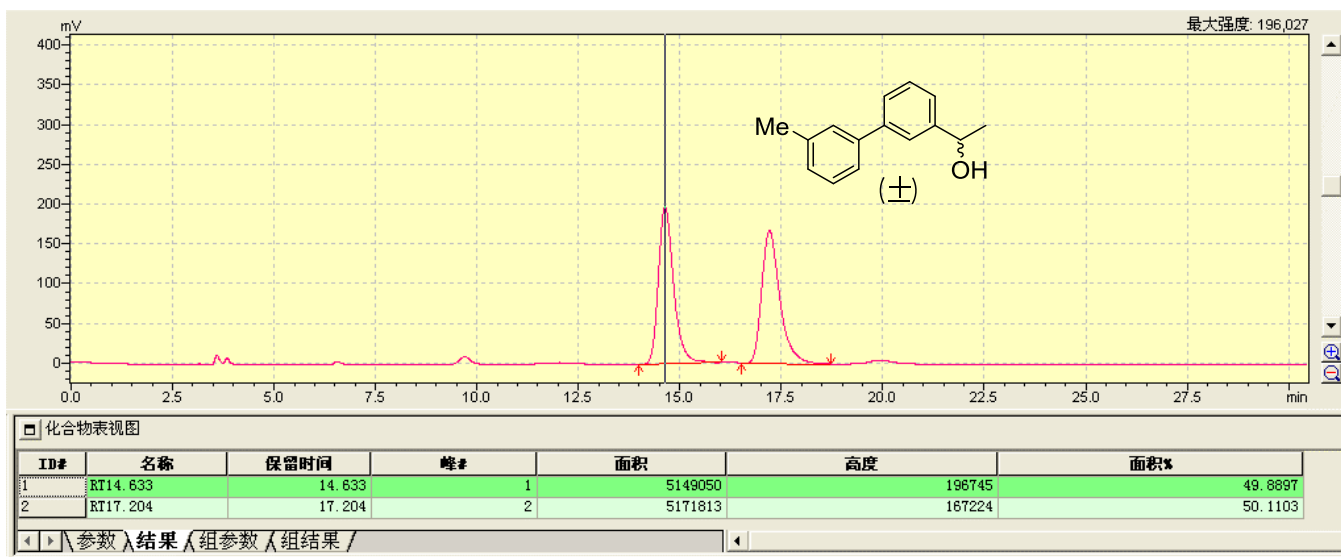


Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471



**(S)-1-((4'-methoxy-[1,1'-biphenyl]-3-yl)ethanol (8r):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 36.0$  min,  $t_2 = 41.8$  min (major)).

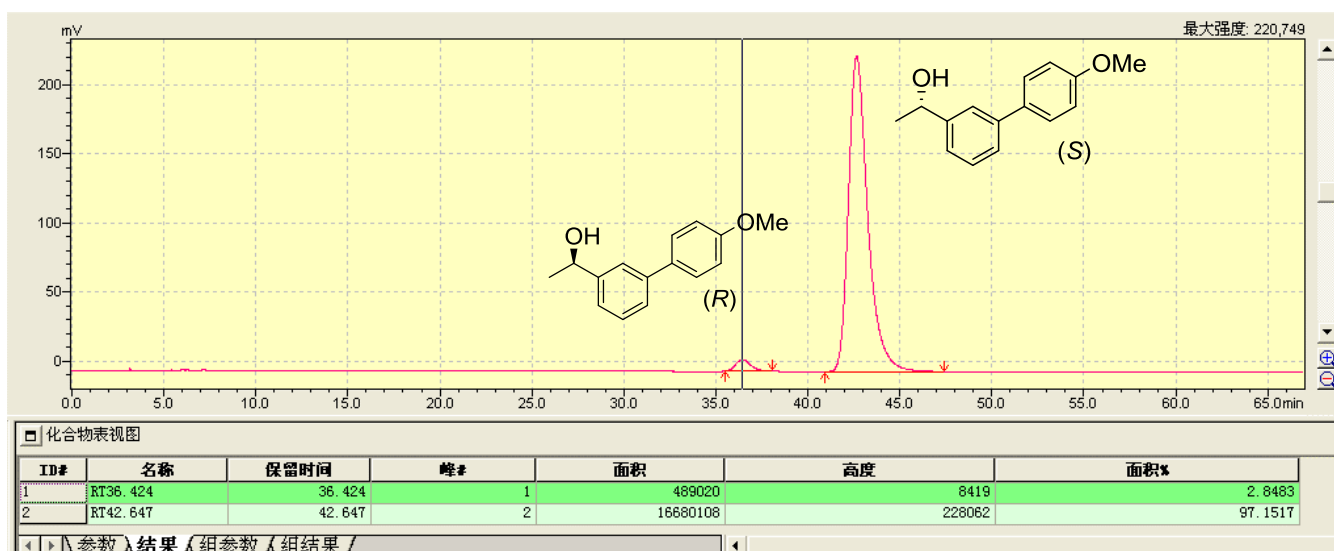
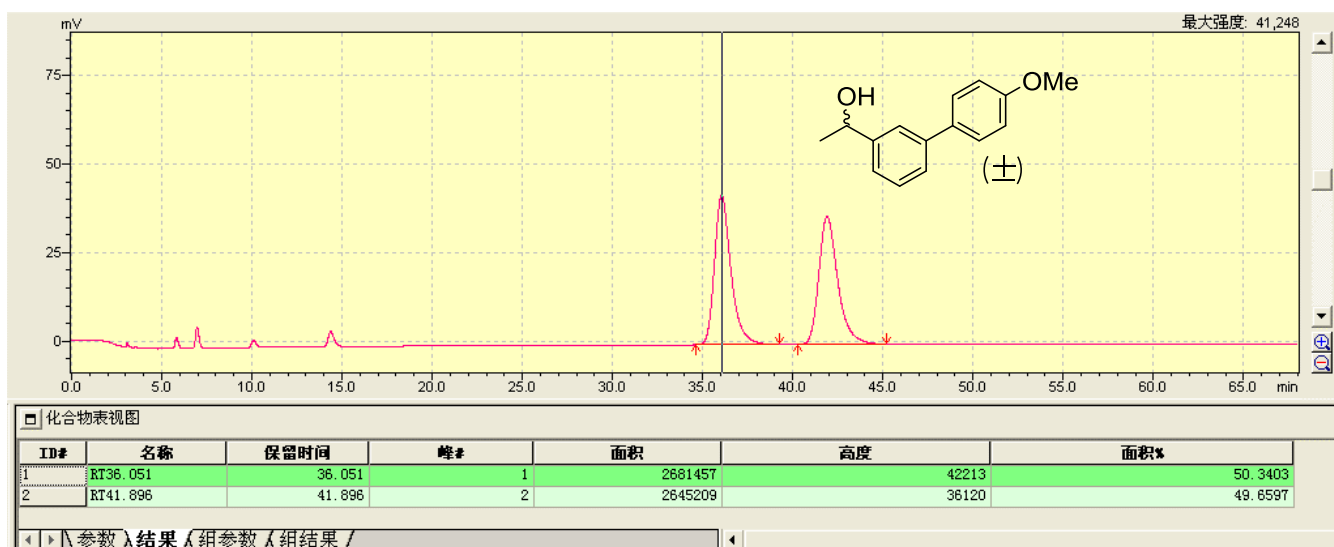


Table view of compound

↑ Name    RetTime [min]    Peak    Area    Height    Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-(thiophen-3-yl)phenyl)ethan-1-ol (8s):** (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 97/3, flow rate = 1.0 mL/min, 25 °C,  $t_1 = 28.4$  min,  $t_2 = 30.8$  min (major)).

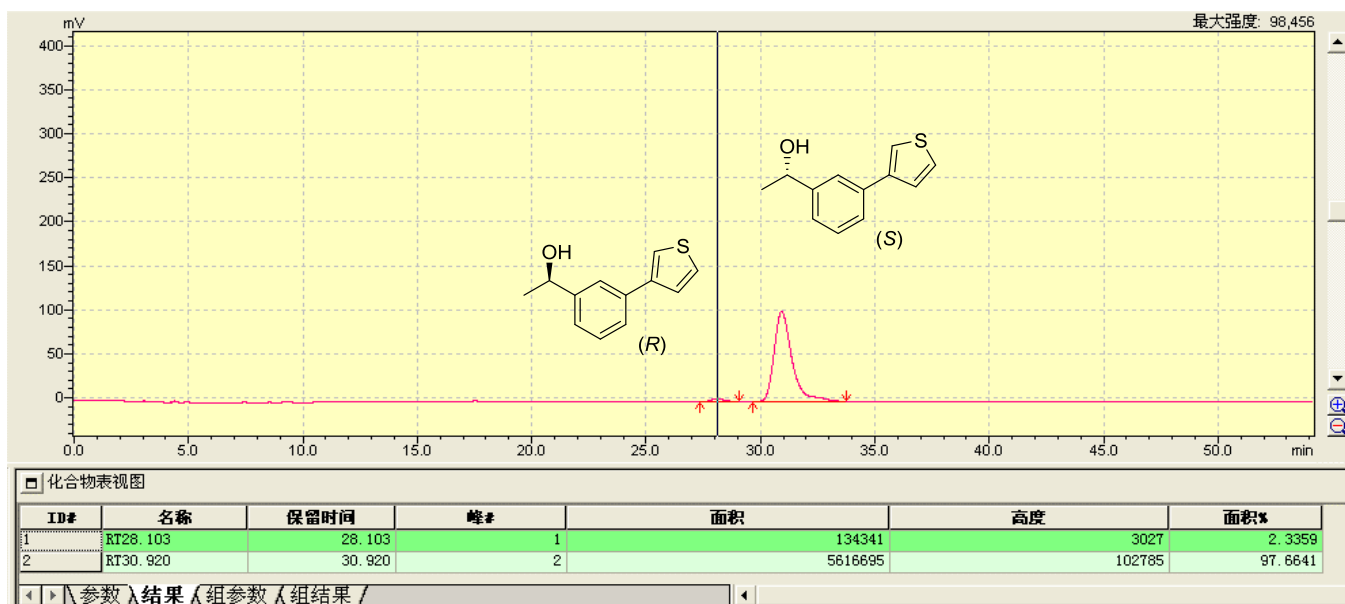
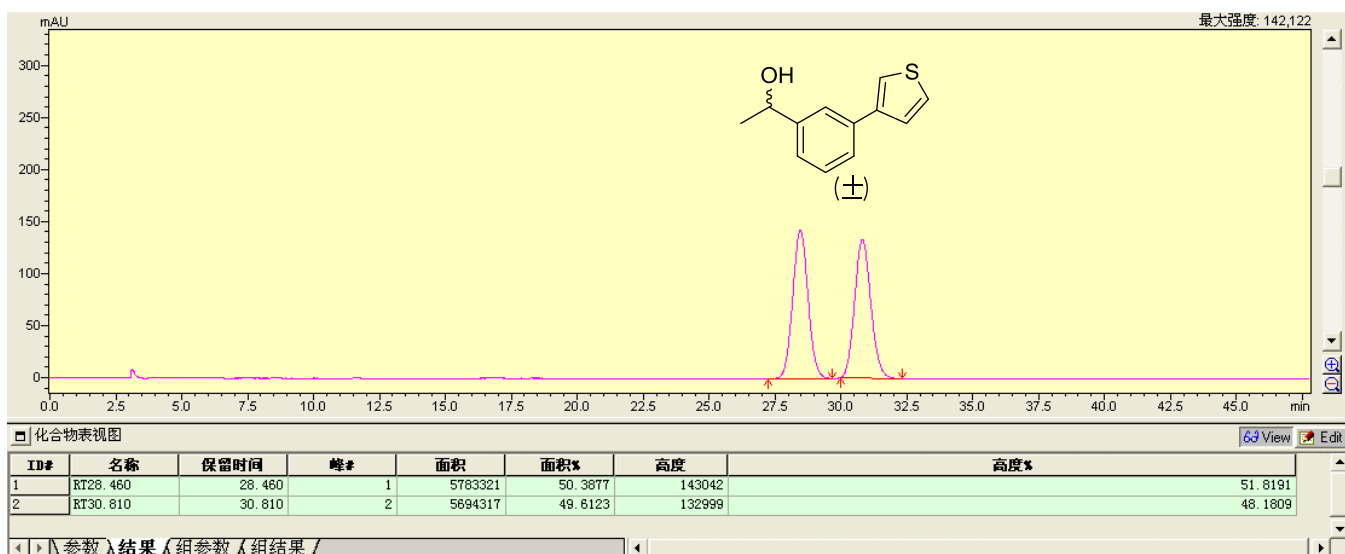


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

(*S,S*)-1,1'-([1,1'-biphenyl]-4,4'-diyl)diethanol (**8t**): (HPLC: Chiracel AD-H, detected at 254 nm, eluent: n-hexane/2-propanol = 92.5/7.5, flow rate = 1.0 mL/min, 25 °C).

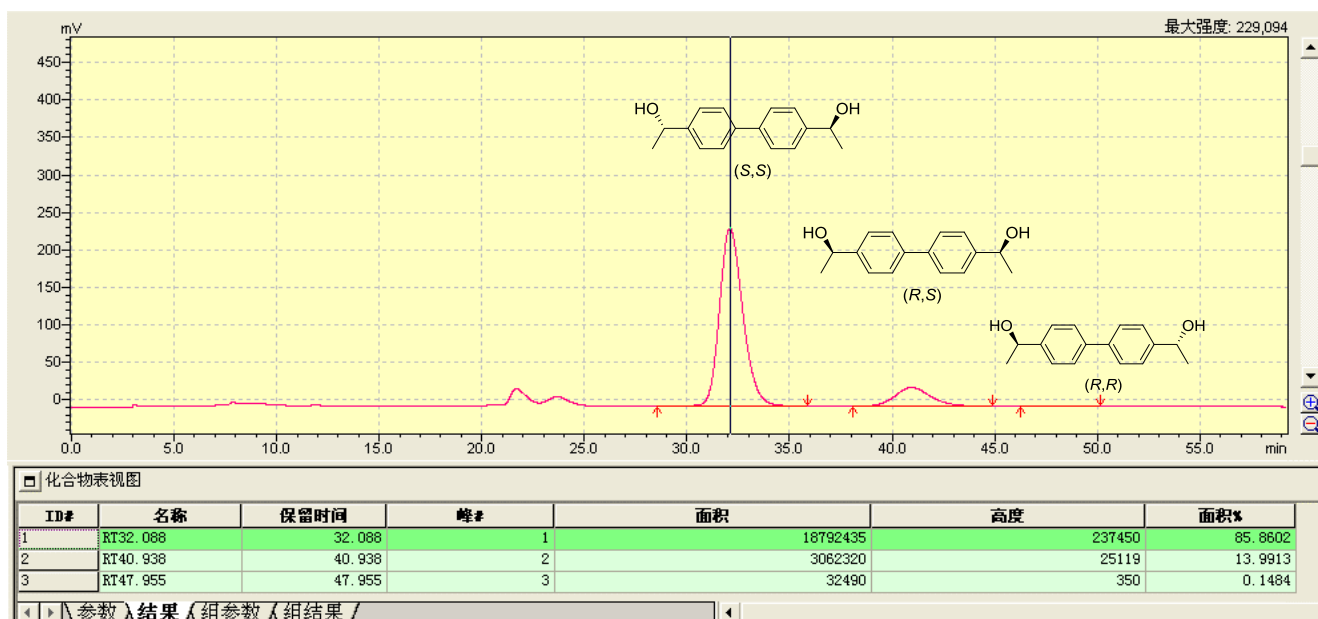
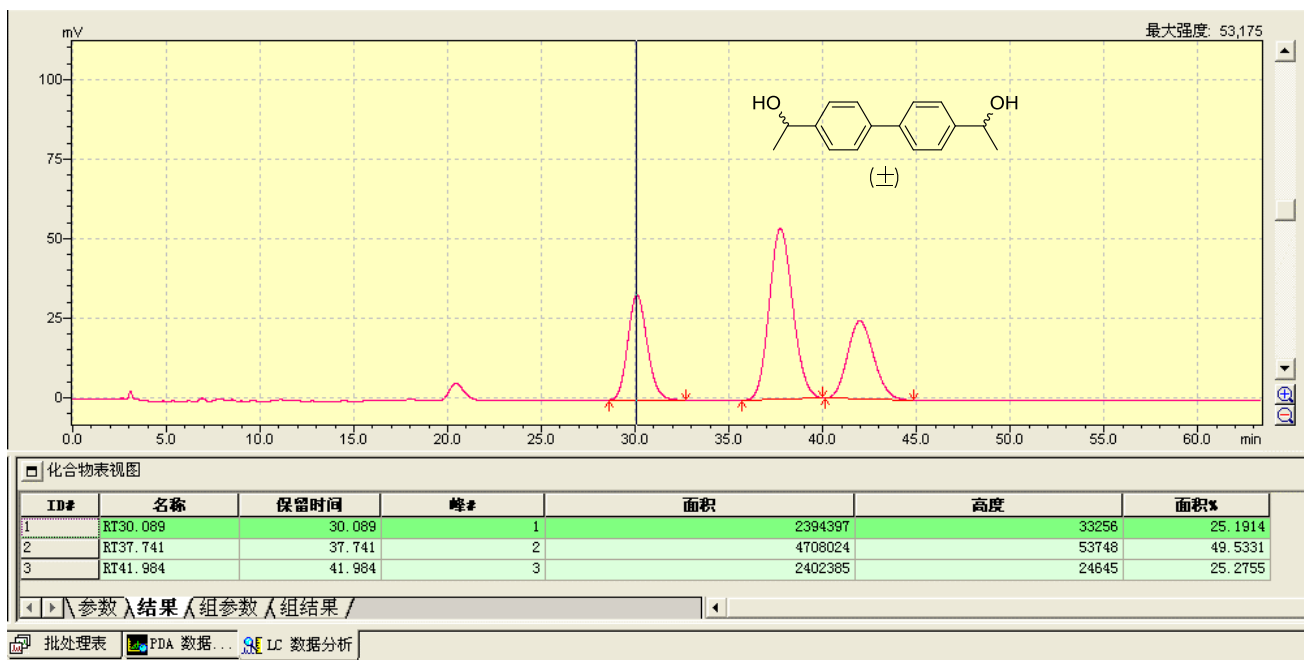


Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4-phenethylphenyl)ethan-1-ol: (10a)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 99/1, flow rate = 0.8mL/min, 25 °C).

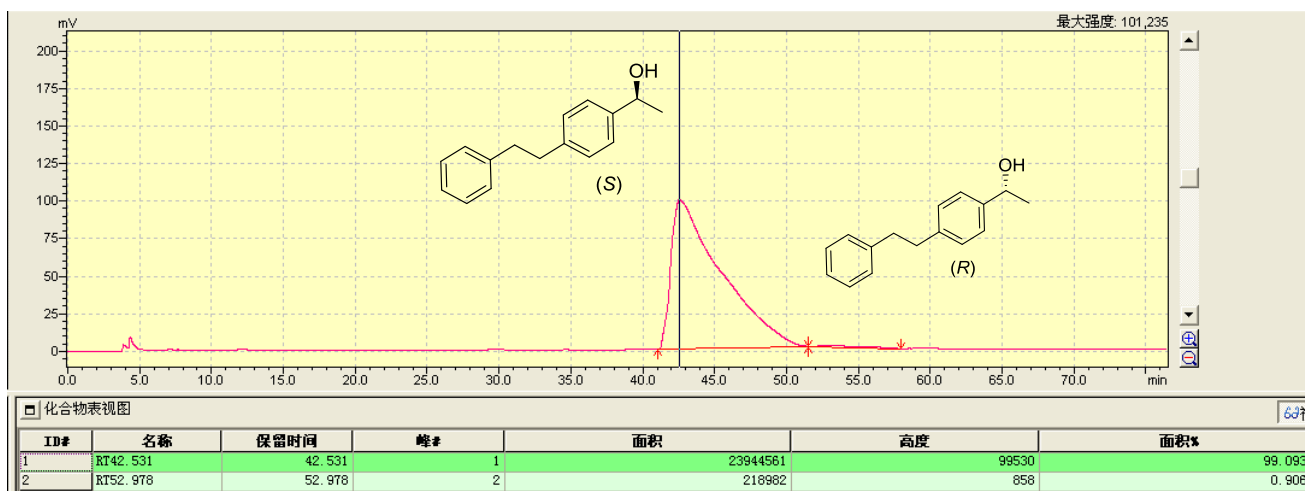
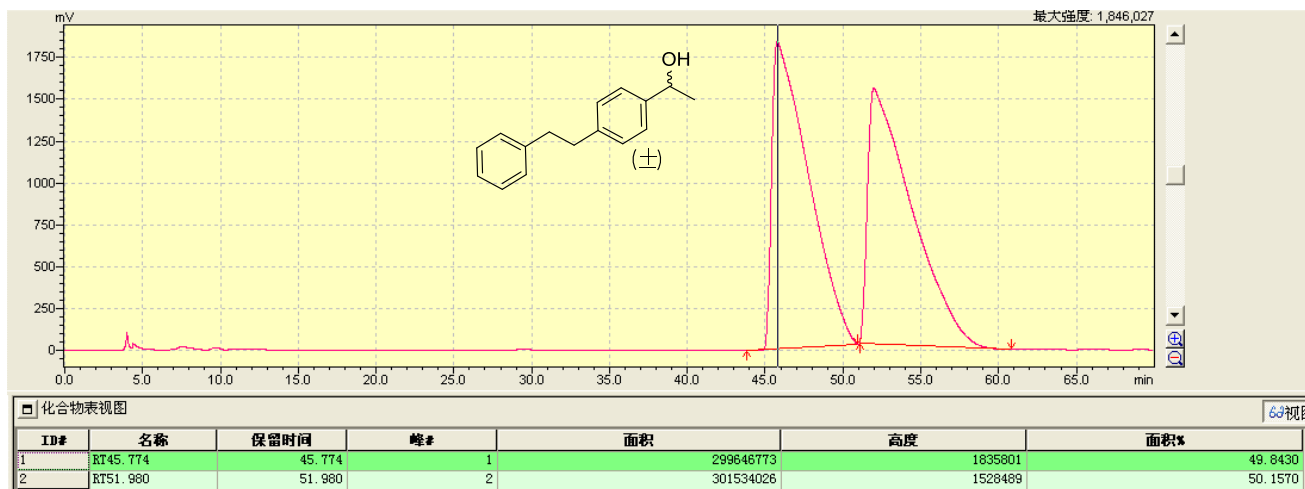
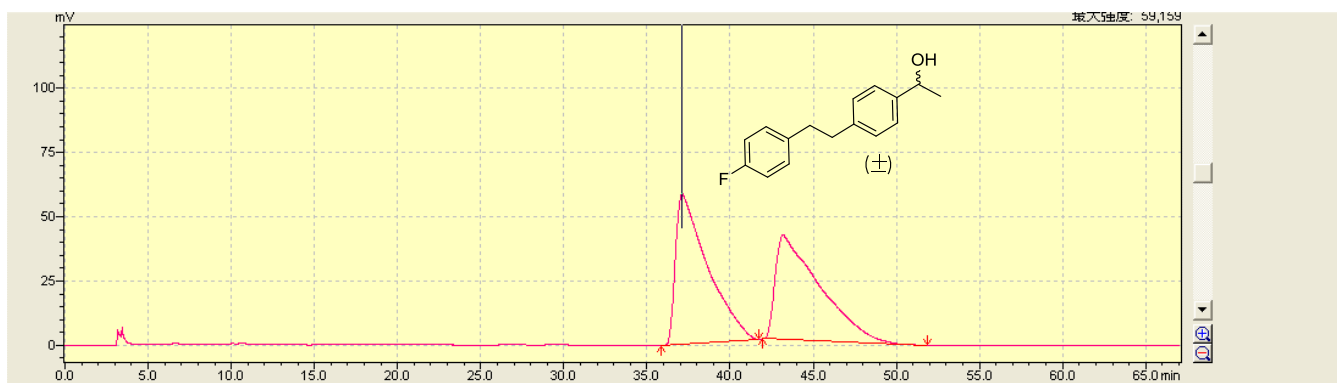


Table view of compound

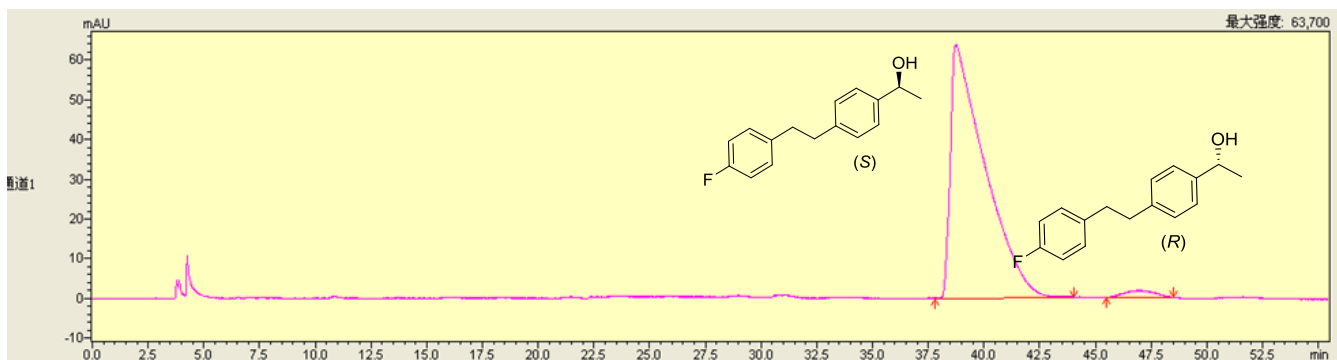
↑ Name    RetTime [min]    Peak    Area    Height    Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4-(4-fluorophenethyl)phenyl)ethan-1-ol: (10b)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 99/1, flow rate = 0.8mL/min, 25 °C).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT37.103	37.103	1	7777028	59847	50.8190
2	RT43.171	43.171	2	7526352	40681	49.1810



ID#	名称	保留时间	峰#	面积	面积%	高度	高度%
1	RT38.736	38.736	1	6816084	97.5303	63550	97.2841
2	RT47.014	47.014	2	172602	2.4697	1774	2.7159

Table view of compound

Name

RetTime [min]

Peak

Area

Height

Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4-(3-fluorophenethyl)phenyl)ethan-1-ol: (10c)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 99/1, flow rate = 0.8mL/min, 25 °C).

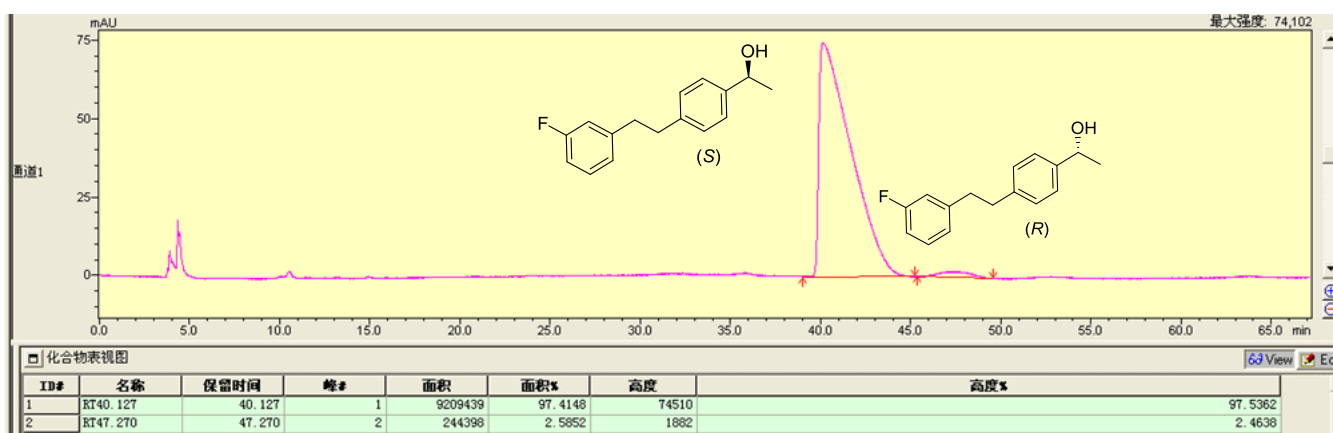
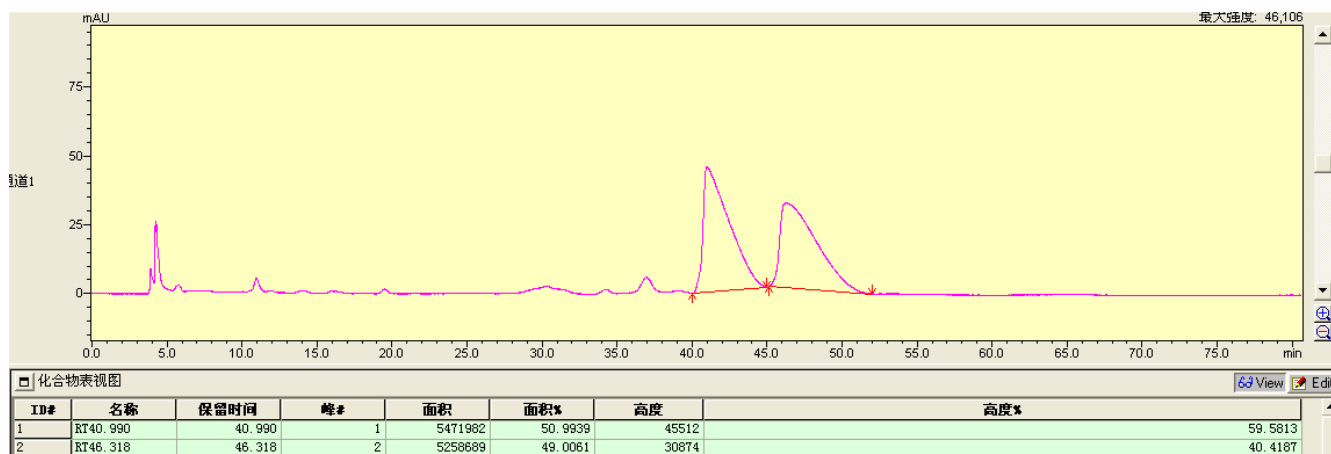


Table view of compound

Name

RetTime [min]

Peak

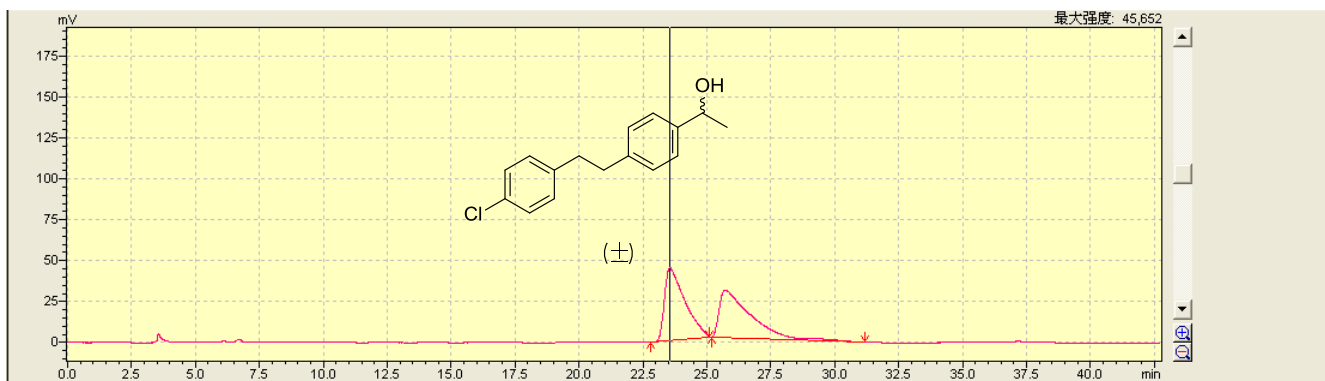
Area

Height

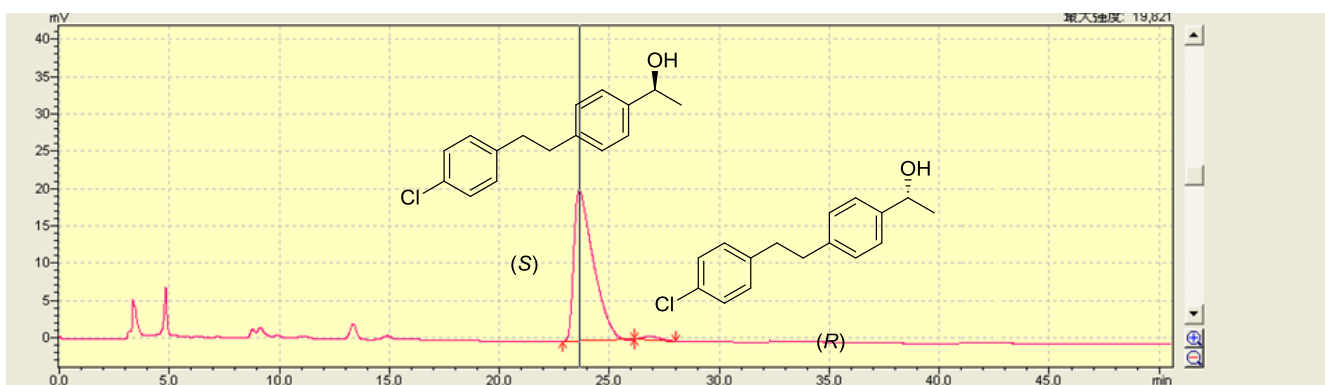
Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4-(4-chlorophenethyl)phenyl)ethan-1-ol: (10d)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 98/2, flow rate = 1 mL/min, 25 °C).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT23.544	23.544	1	2437527	44449	49.2946
2	RT25.716	25.716	2	2507291	29104	50.7054



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT23.630	23.630	1	1244371	20246	97.9636
2	RT26.809	26.809	2	25867	458	2.0364

Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4-(4-methylphenethyl)phenyl)ethan-1-ol: (10e)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 98/2, flow rate = 0.8 mL/min, 25 °C).

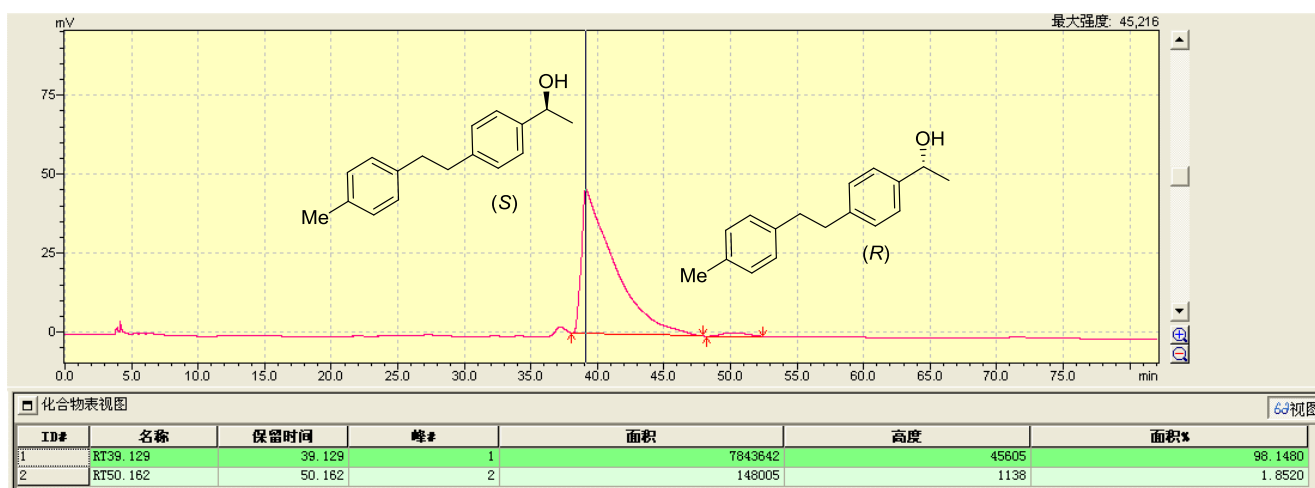
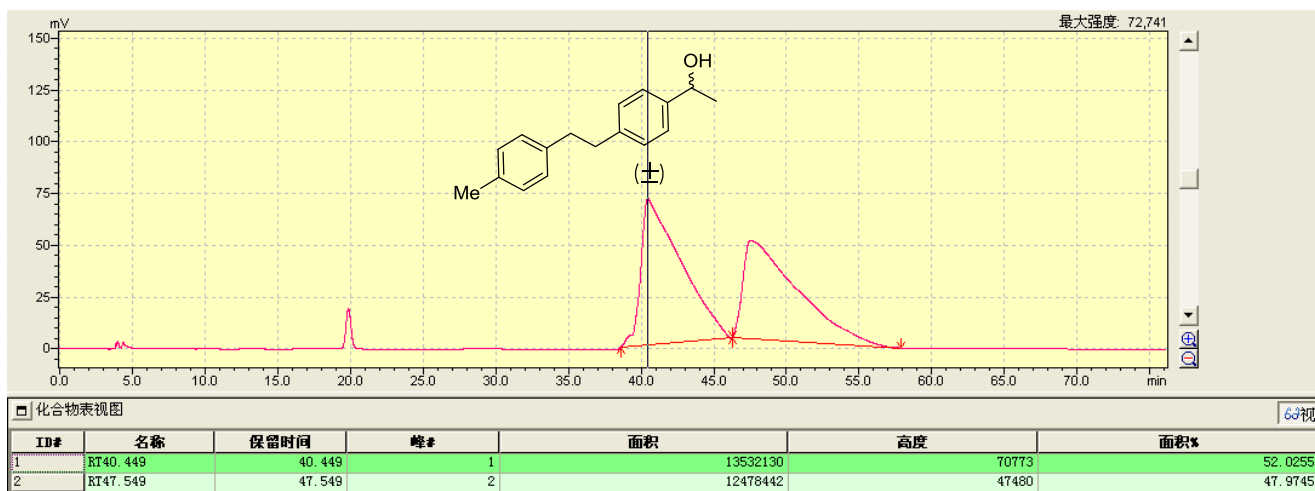


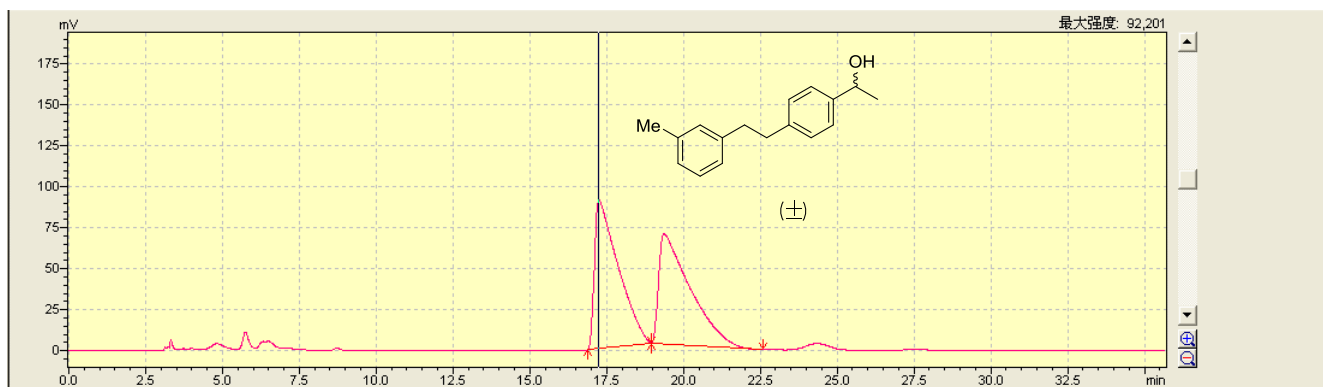
Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

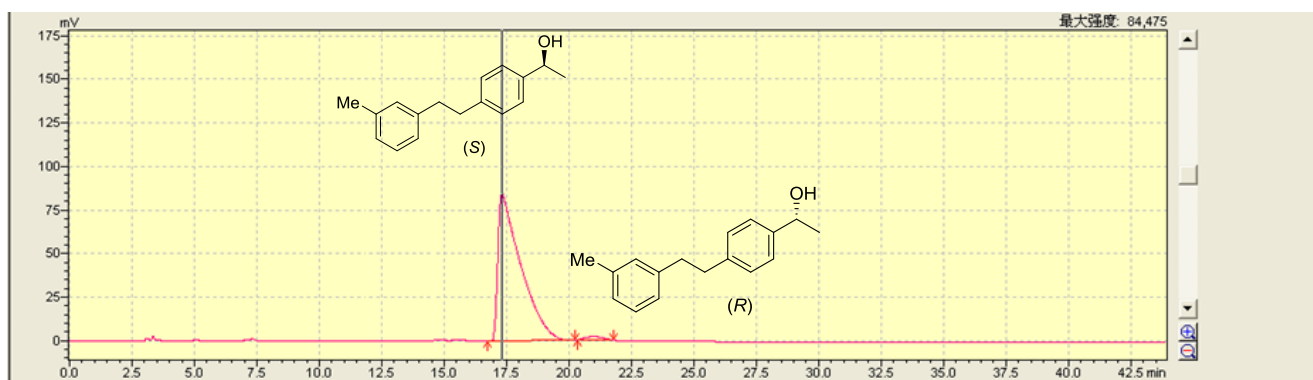
ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471



**(S)-1-(4-(3-methylphenethyl)phenyl)ethan-1-ol: (10f)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 98/2, flow rate = 1 mL/min, 25 °C).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT17.249	17.249	1	4896645	91093	50.5328
2	RT19.369	19.369	2	4793395	67371	49.4672



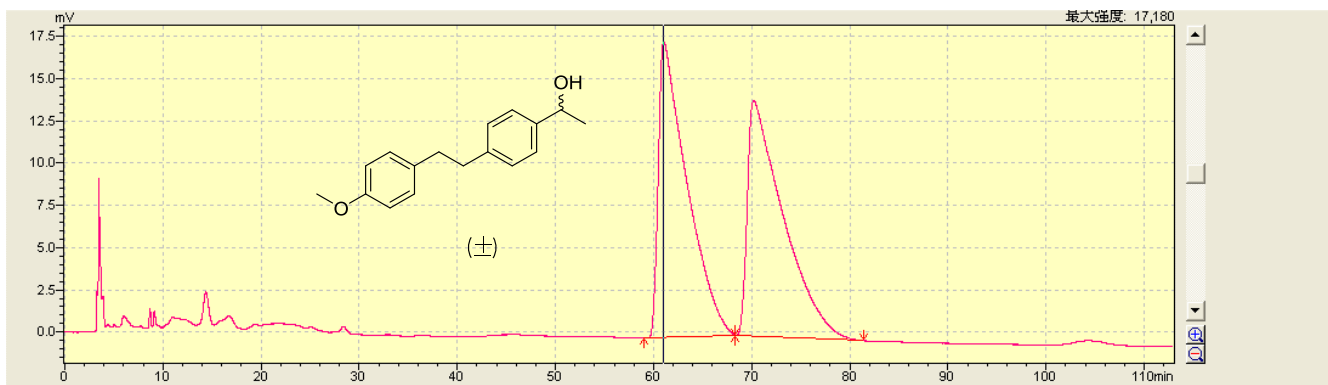
ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT17.307	17.307	1	5356581	84623	98.2415
2	RT20.976	20.976	2	95881	1923	1.7585

Table view of compound

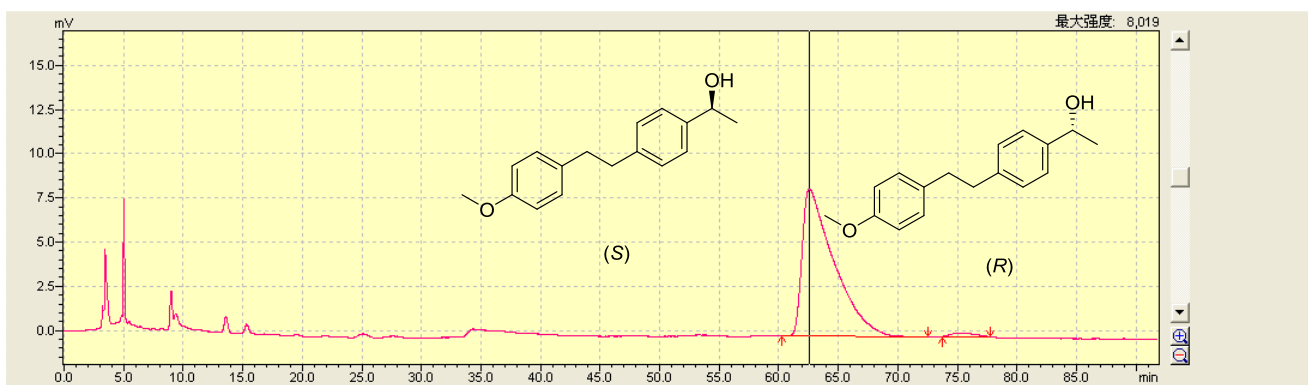
↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(4-(4-methoxyphenethyl)phenyl)ethan-1-ol: (10g)** (HPLC: Chiracel OB-H, detected at 254 nm, eluent: n-hexane/2-propanol = 98/2, flow rate = 1 mL/min, 25 °C).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT61.042	61.042	1	3530745	17491	49.9978
2	RT70.196	70.196	2	3531055	13901	50.0022



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT62.580	62.580	1	1553469	8338	98.1006
2	RT75.562	75.562	2	30078	220	1.8994

Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-phenethylphenyl)ethan-1-ol: (10h)** (HPLC: Chiracel OJ-H, detected at 254 nm, eluent: n-hexane/2-propanol =98/2, flow rate = 1 mL/min, 25 °C).

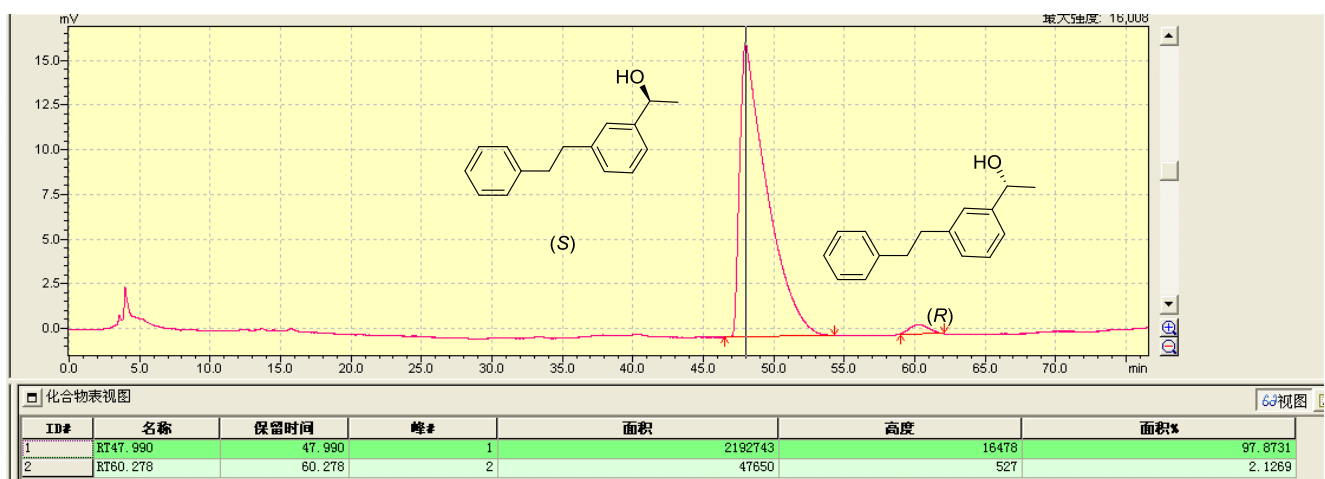
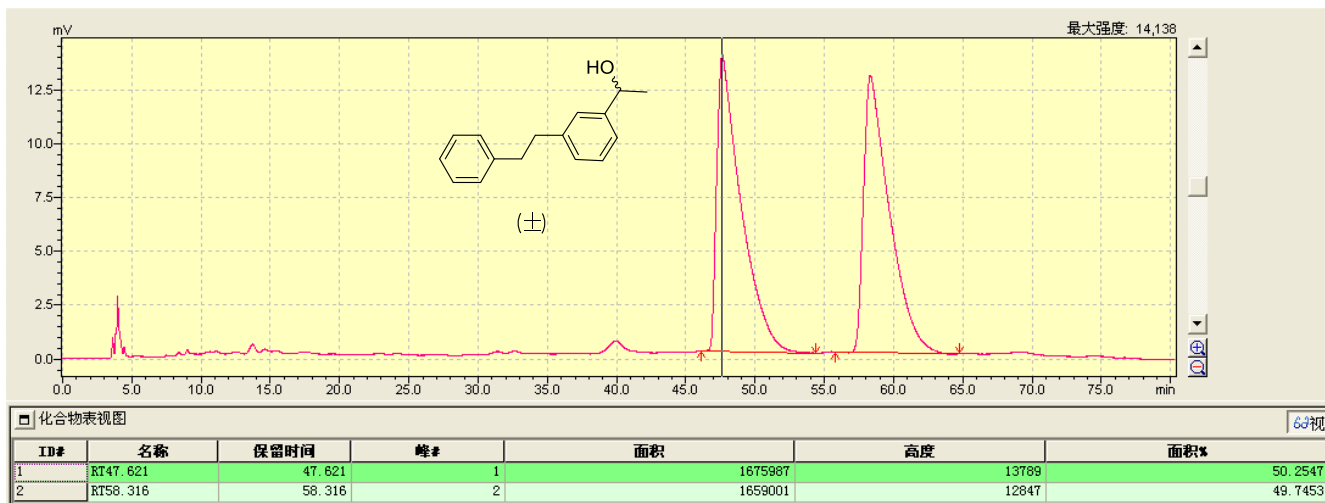


Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-(4-fluorophenethyl)phenyl)ethan-1-ol: (10i)** (HPLC: Chiracel OJ-H, detected at 254 nm, eluent: n-hexane/2-propanol =97/3, flow rate = 1 mL/min, 25 °C).

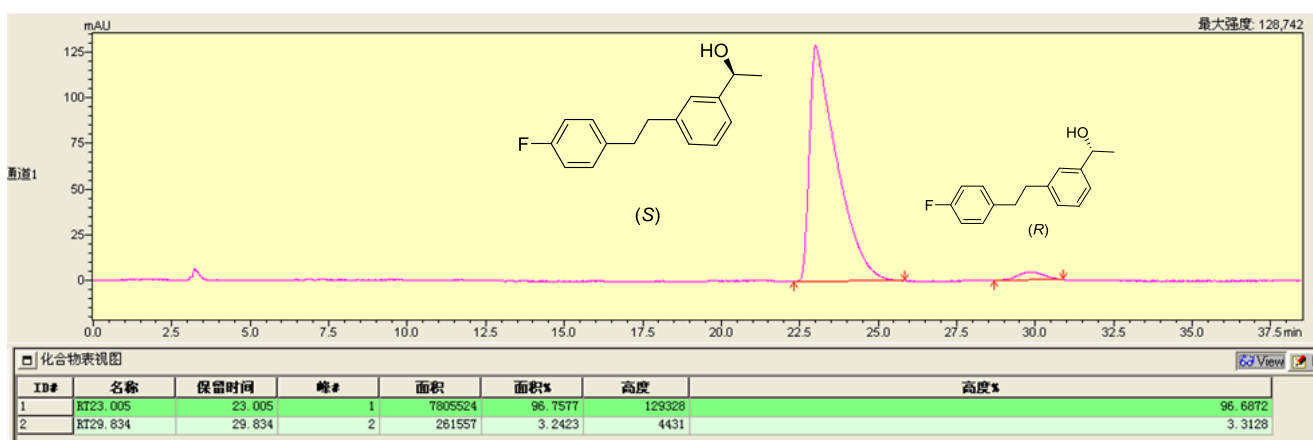
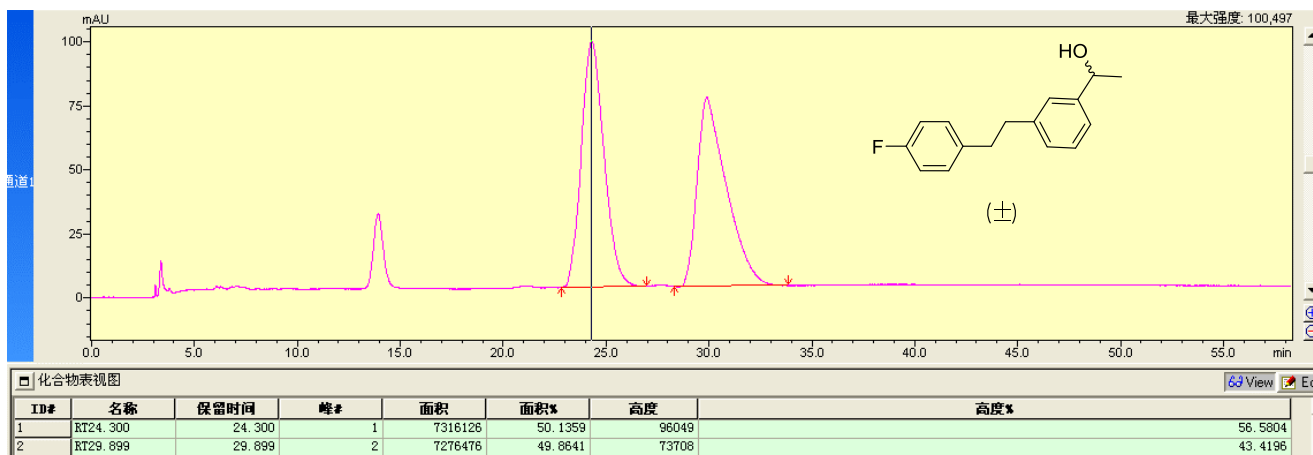


Table view of compound

Name

RetTime [min]

Peak

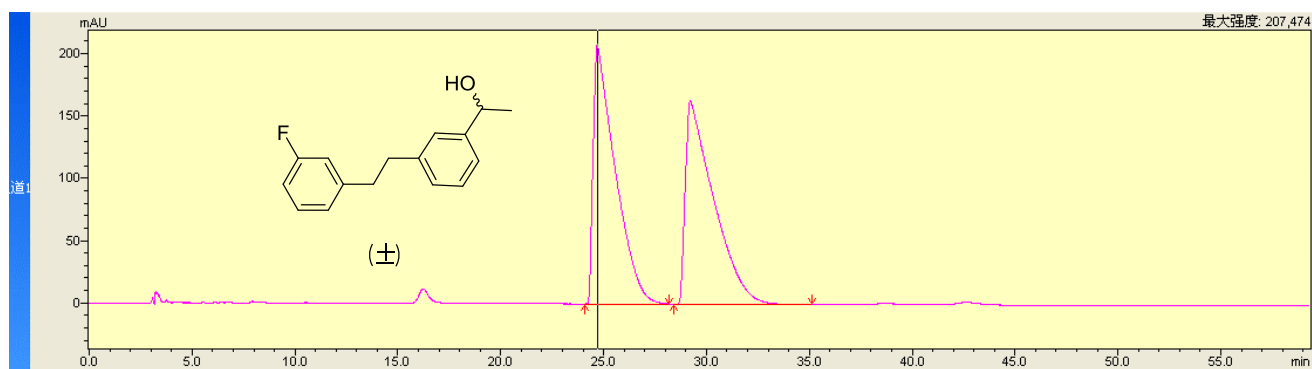
Area

Height

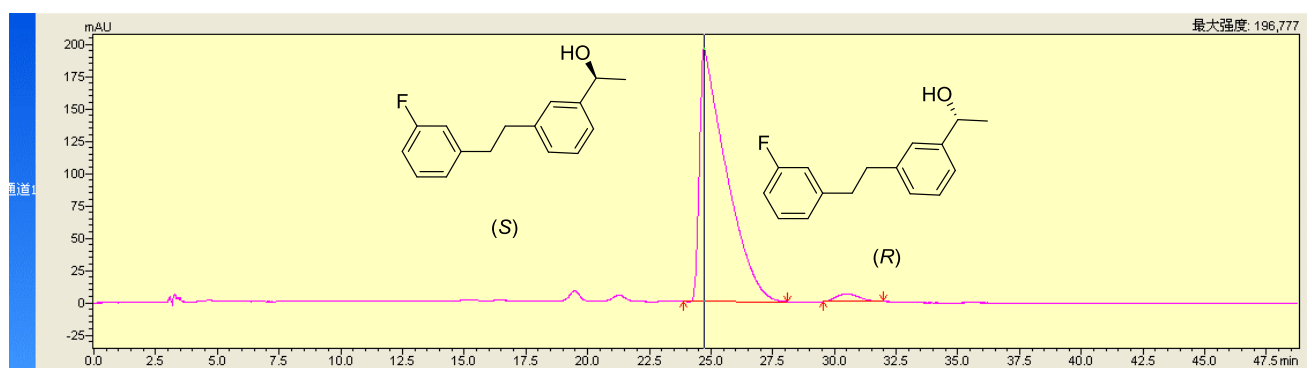
Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-(3-fluorophenethyl)phenyl)ethan-1-ol: (10j)** (HPLC: Chiracel OJ-H, detected at 254 nm, eluent: n-hexane/2-propanol =97/3, flow rate = 1 mL/min, 25 °C).



ID#	名称	保留时间	峰#	面积	面积%	高度	高度%
1	RT24.689	24.689	1	15429895	49.8151	208253	56.0804
2	RT29.205	29.205	2	15544408	50.1849	163094	43.9196



ID#	名称	保留时间	峰#	面积	面积%	高度	高度%
1	RT24.709	24.709	1	14744066	97.4506	195826	97.0981
2	RT30.540	30.540	2	385720	2.5494	5853	2.9019

Table view of compound

↑ Name    ↑ RetTime [min]    ↑ Peak    ↑ Area    ↑ Height    ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-(4-chlorophenyl)phenyl)ethan-1-ol: (10k)** (HPLC: Chiracel OJ-H, detected at 254 nm, eluent: n-hexane/2-propanol =97/3, flow rate = 1 mL/min, 25 °C).

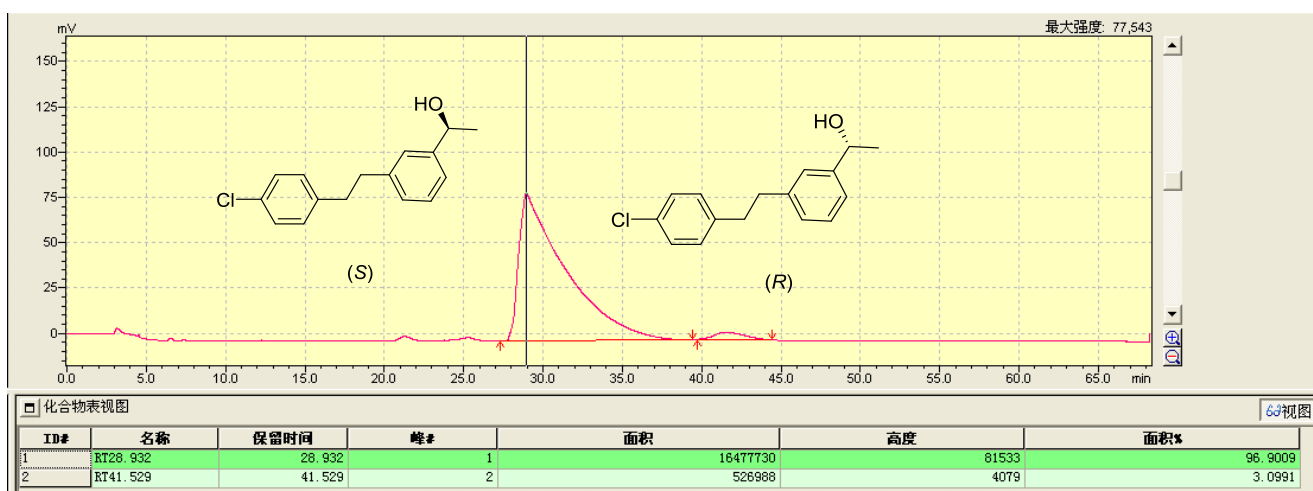
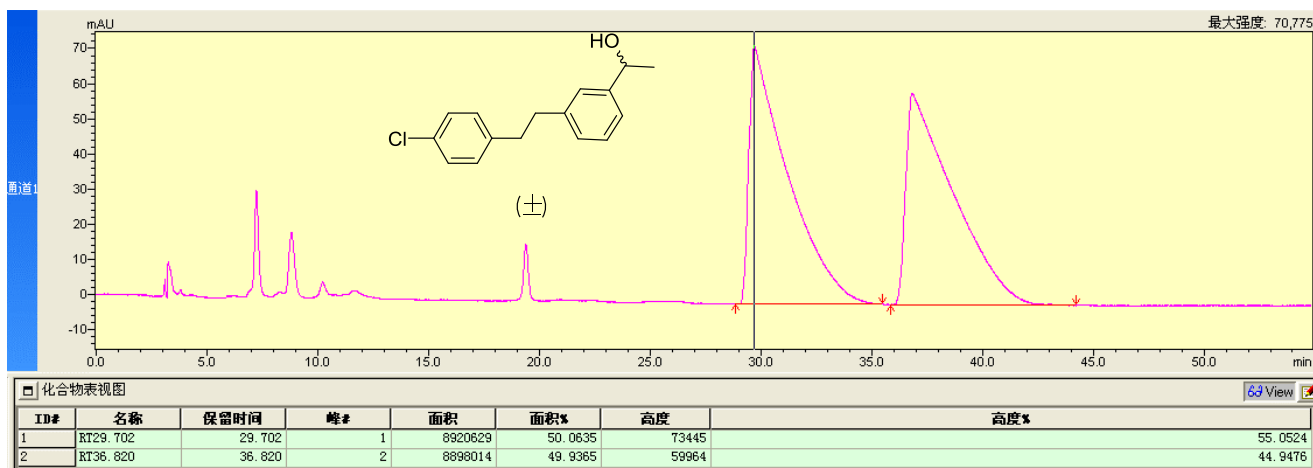
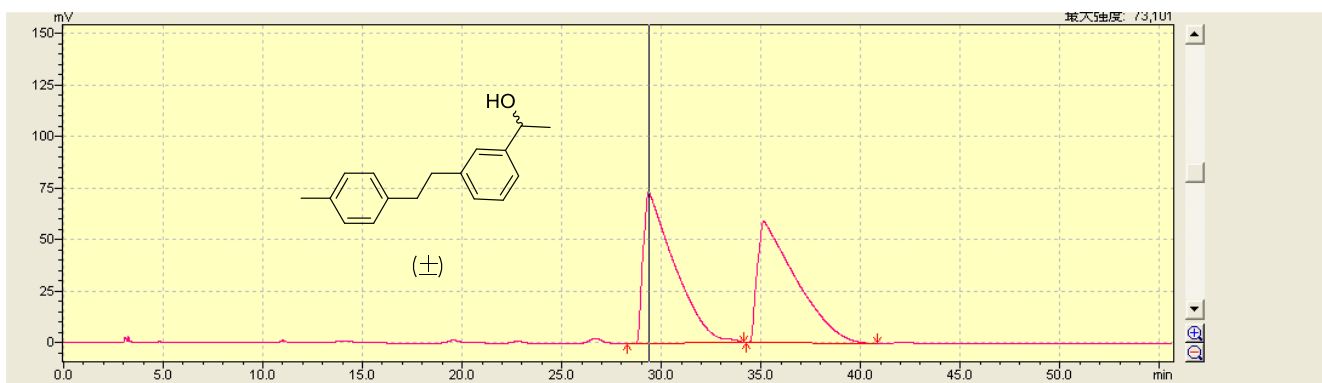


Table view of compound

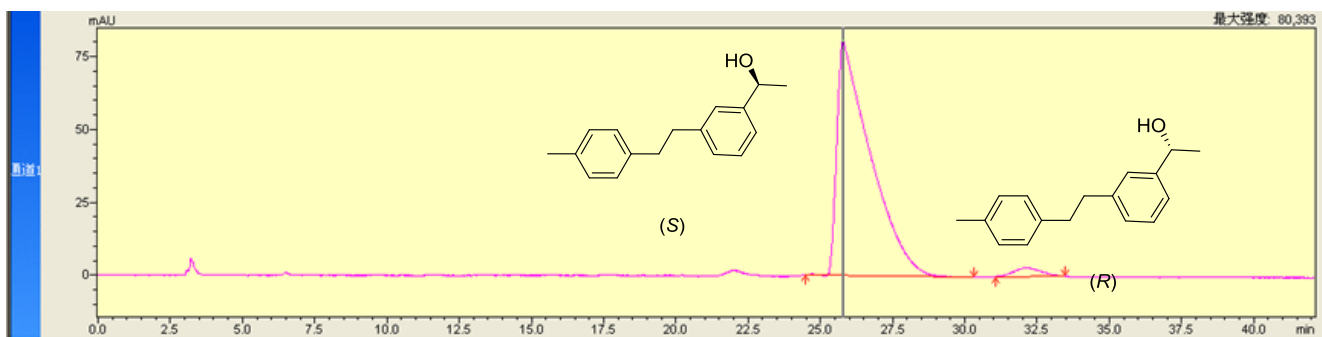
↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-(4-methylphenethyl)phenyl)ethan-1-ol: (10l)** (HPLC: Chiracel OJ-H, detected at 254 nm, eluent: n-hexane/2-propanol =97/3, flow rate = 1 mL/min, 25 °C).



ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT29.352	29.352	1	8014559	73323	50.2240
2	RT35.130	35.130	2	7943059	58859	49.7760



ID#	名称	保留时间	峰#	面积	面积%	高度	高度%
1	RT25.771	25.771	1	8469994	97.0870	80456	96.4296
2	RT32.082	32.082	2	194123	2.9130	2979	3.5704

Table view of compound

Name      RetTime [min]      Peak      Area      Height      Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

**(S)-1-(3-(3-methylphenethyl)phenyl)ethan-1-ol: (10m)** (HPLC: Chiracel OJ-H, detected at 254 nm, eluent: n-hexane/2-propanol =97/3, flow rate = 1 mL/min, 25 °C).

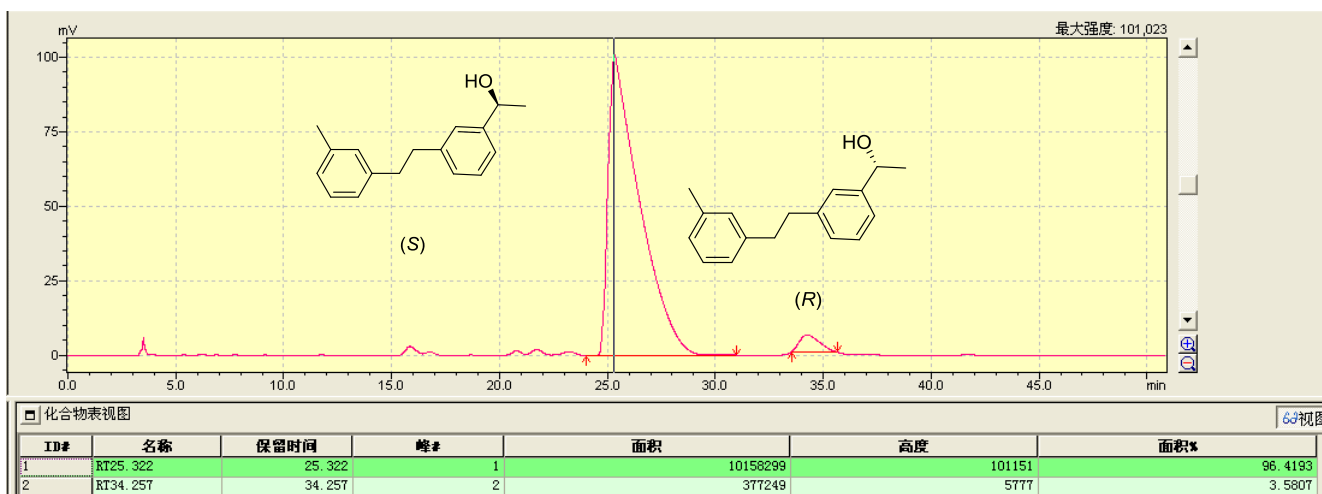
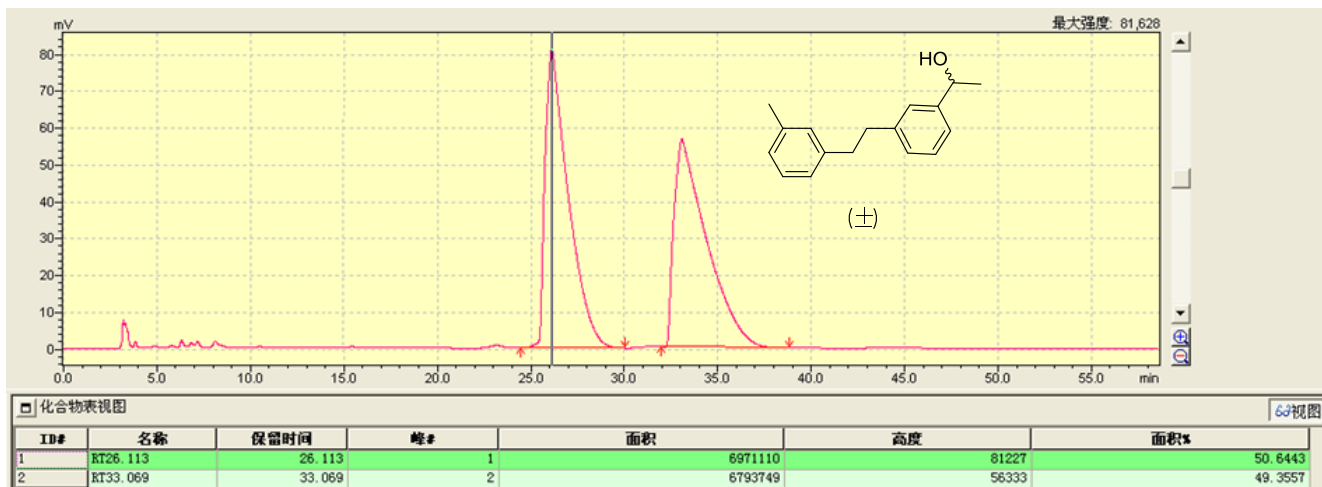


Table view of compound

↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471



**(S)-1-(3-(4-methoxyphenyl)phenyl)ethan-1-ol: (10n)** (HPLC: Chiracel AS-H, detected at 254 nm, eluent: n-hexane/2-propanol =96/4, flow rate = 1 mL/min, 25 °C).

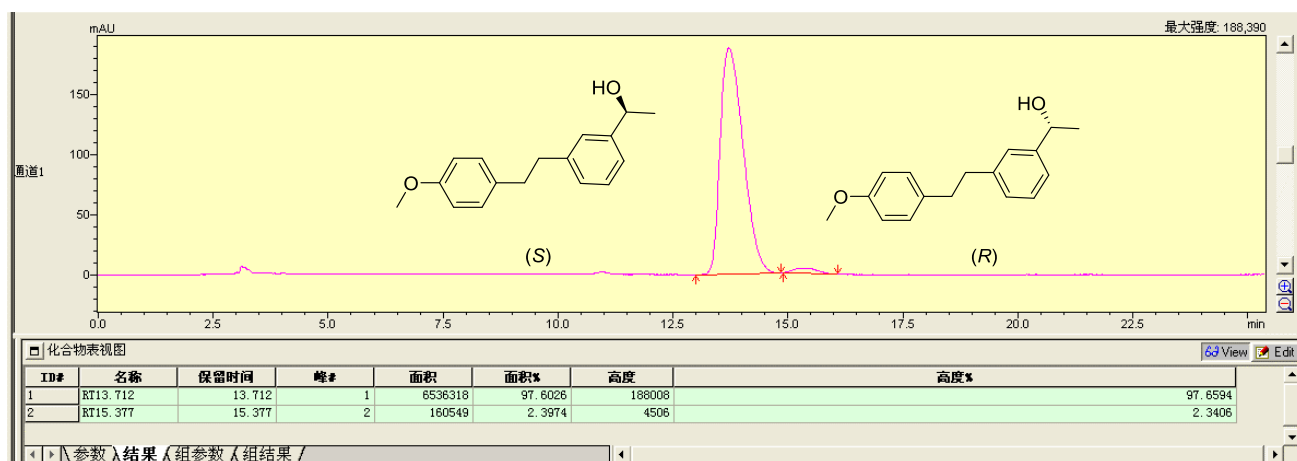
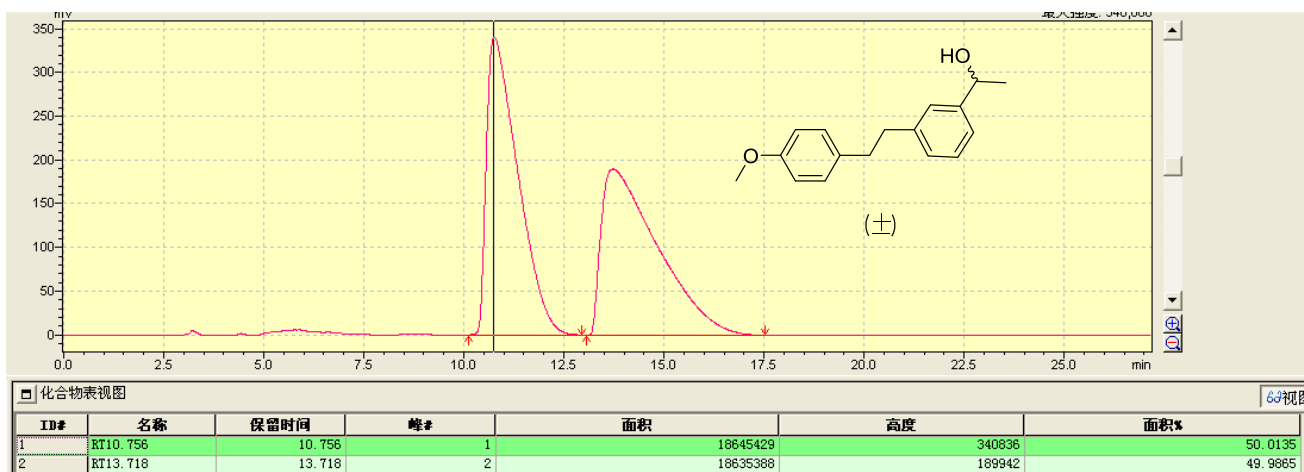


Table view of compound

Name	RetTime [min]	Peak	Area	Area%	Height	Height%
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ID#	名称	保留时间	峰#	面积	面积%	高度	高度%
1	RT13.712	13.712	1	6536318	97.6026	188008	97.6594
2	RT15.377	15.377	2	160549	2.3974	4506	2.3406

**Table S2.** Reusability of catalyst **5** in the Suzuki cross-coupling/ATH cascade reaction of 4-iodoacetophenone and phenylboronic acid.<sup>[a]</sup>

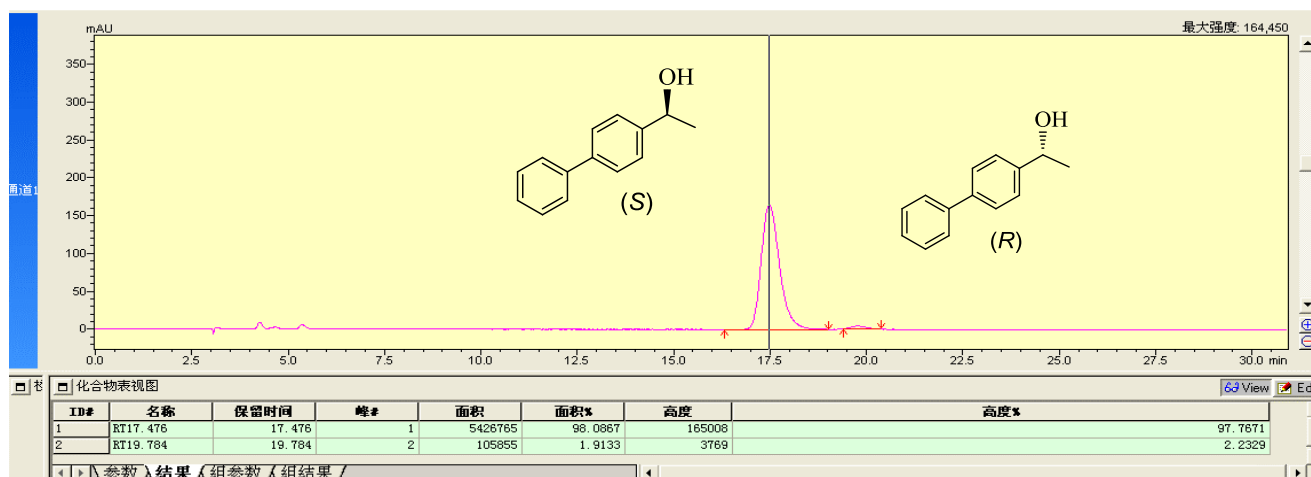
Entry	1	2	3	4	5	6	7	8	9	10
Yield [%]	96	96	96	95	94	94	94	93	91	82
ee [%]	96	96	95	95	95	95	93	93	93	90

<sup>a</sup> Reaction conditions: catalyst **5** (219.80 mg, 20.0  $\mu$ mol of Ru, 85.70  $\mu$ mol of Pd, based on ICP analysis), HCO<sub>2</sub>Na (10.0 mmol), iodoacetophenones (1.0 mmol) and boronic acids (1.2 mmol), and 40.0 mL of (<sup>i</sup>PrOH/H<sub>2</sub>O v/v = 3/1) were added sequentially to a 100.0 mL round-bottom flask. The mixture was then stirred at 60 °C for 12 h. Yields were determined by <sup>1</sup>H-NMR analysis and *ee* values were determined by chiral HPLC analysis.

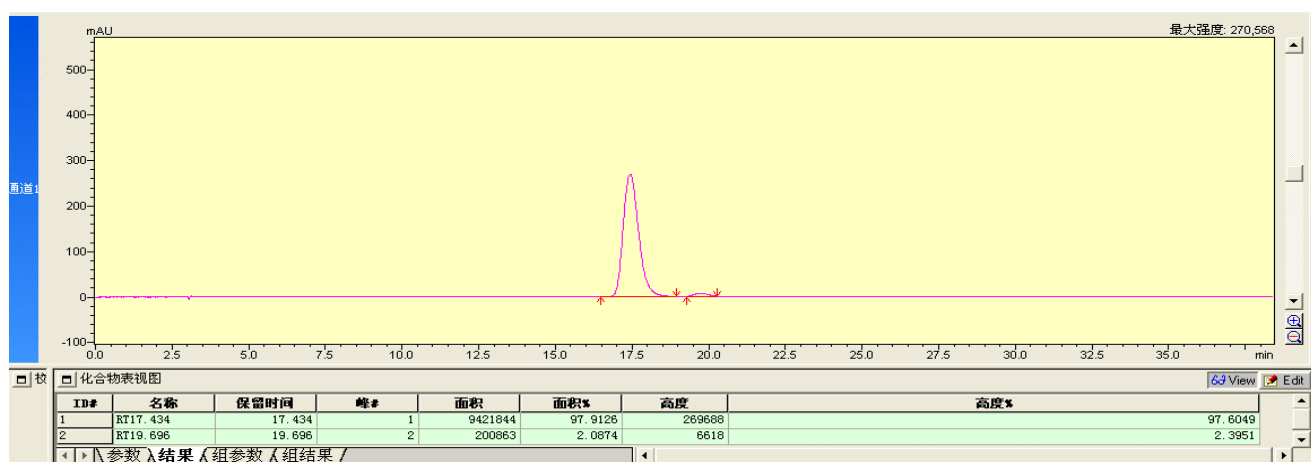
**Figure S9.** HPLC analyses for the **5**-catalyzed Suzuki cross-coupling/ATH cascade reaction of 4-iodoacetophenone and phenylboronic acid.

### Recycling experiment part:

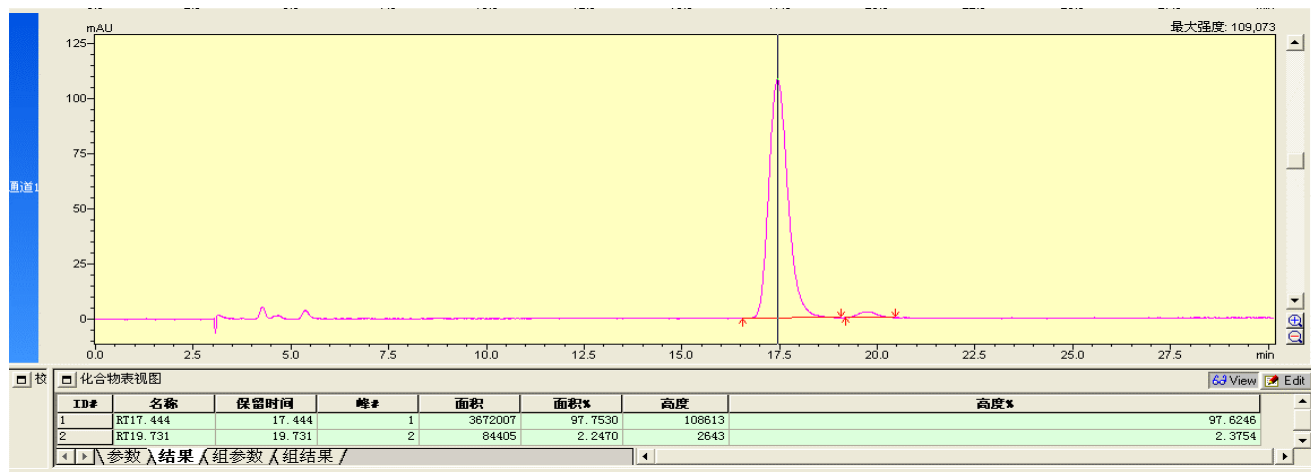
#### Recycle 1.



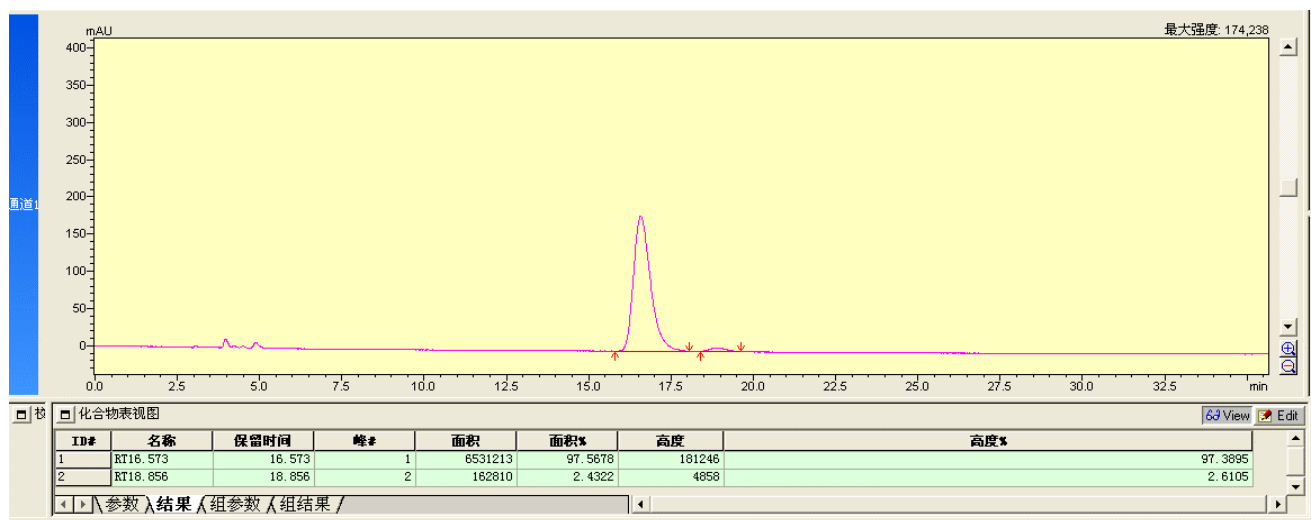
#### Recycle 2.



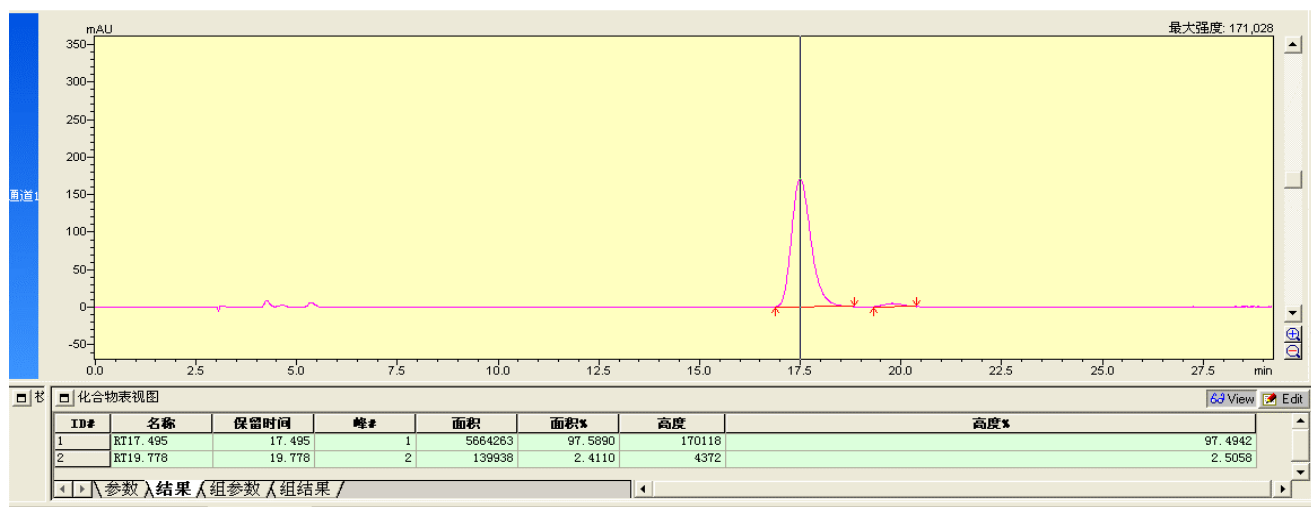
### Recycle 3.



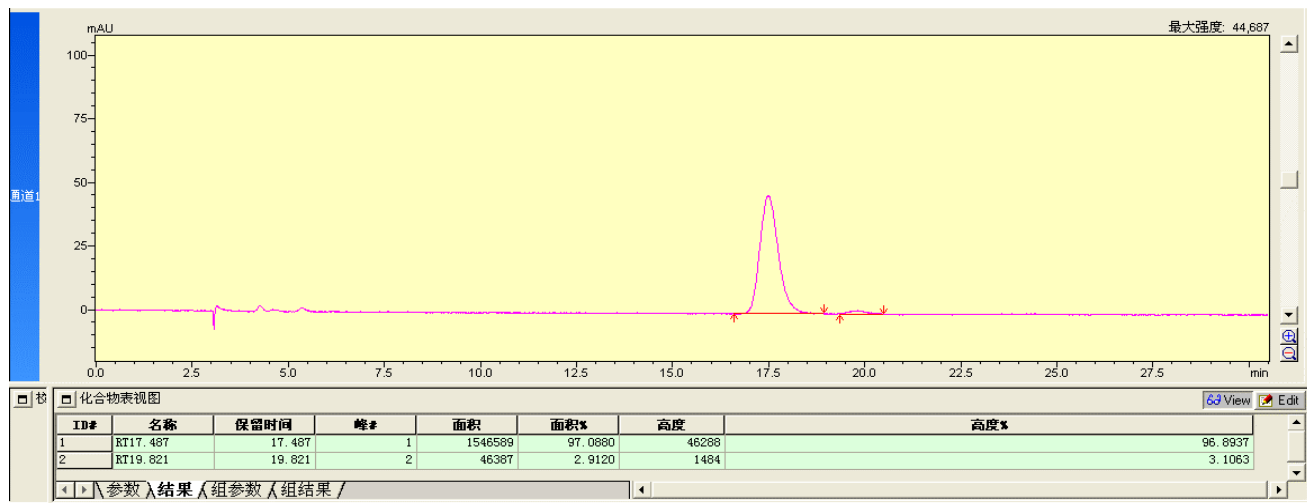
### Recycle 4.



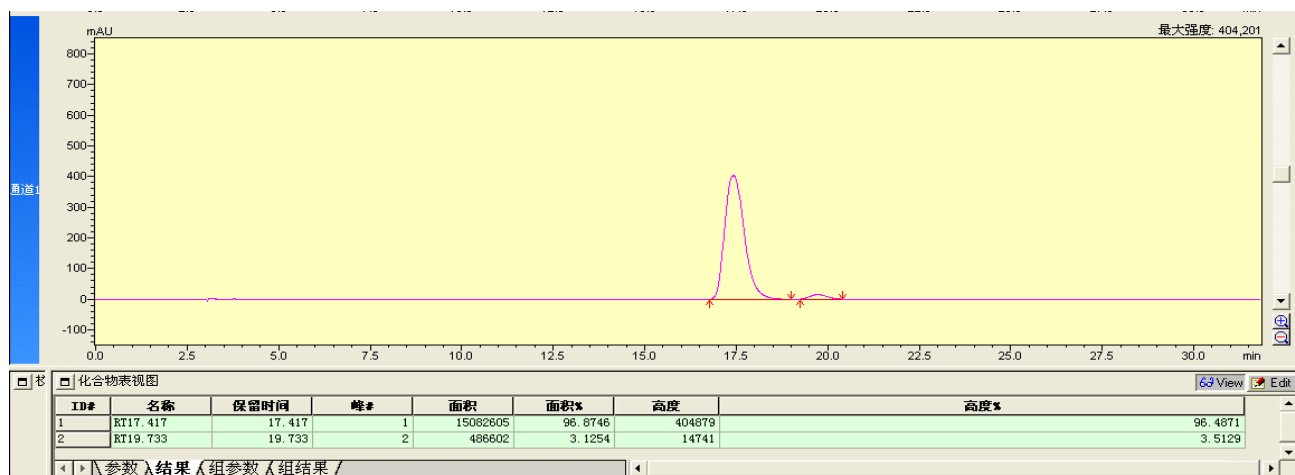
### Recycle 5.



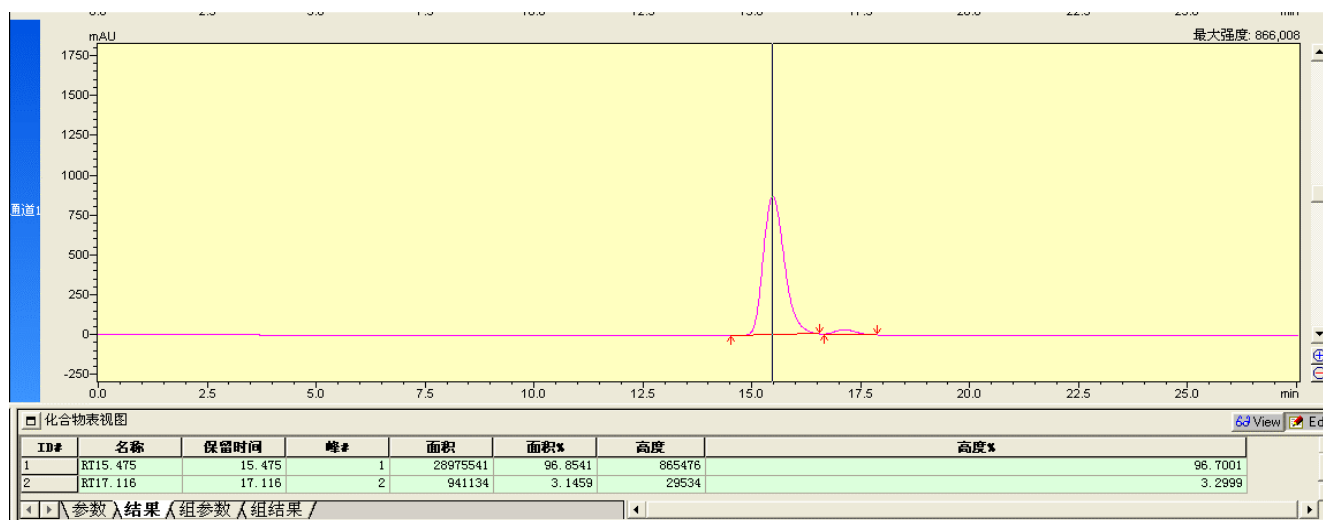
### Recycle 6.



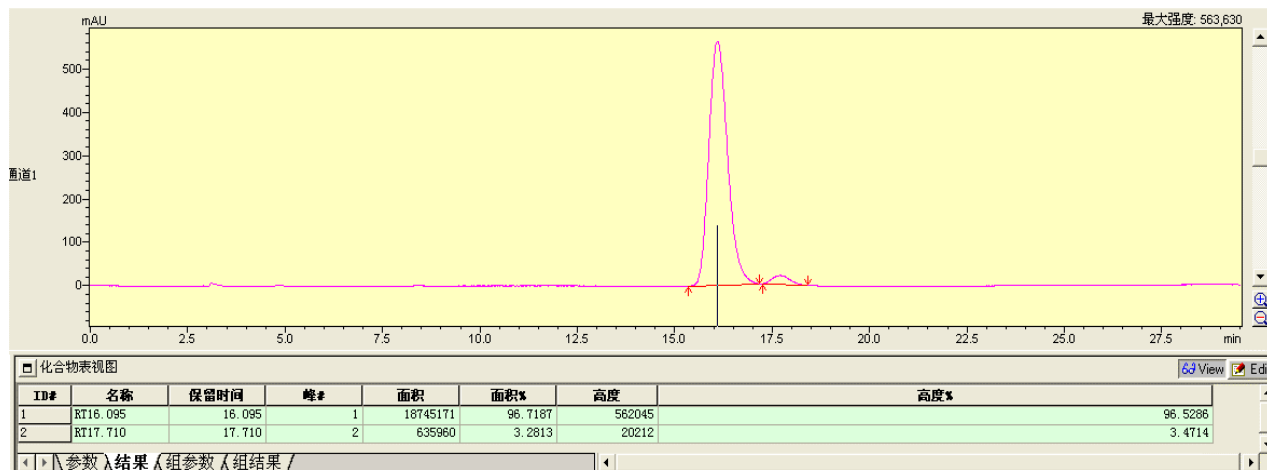
### Recycle 7.



### Recycle 8.



## Recycle 9.



## Recycle 10.

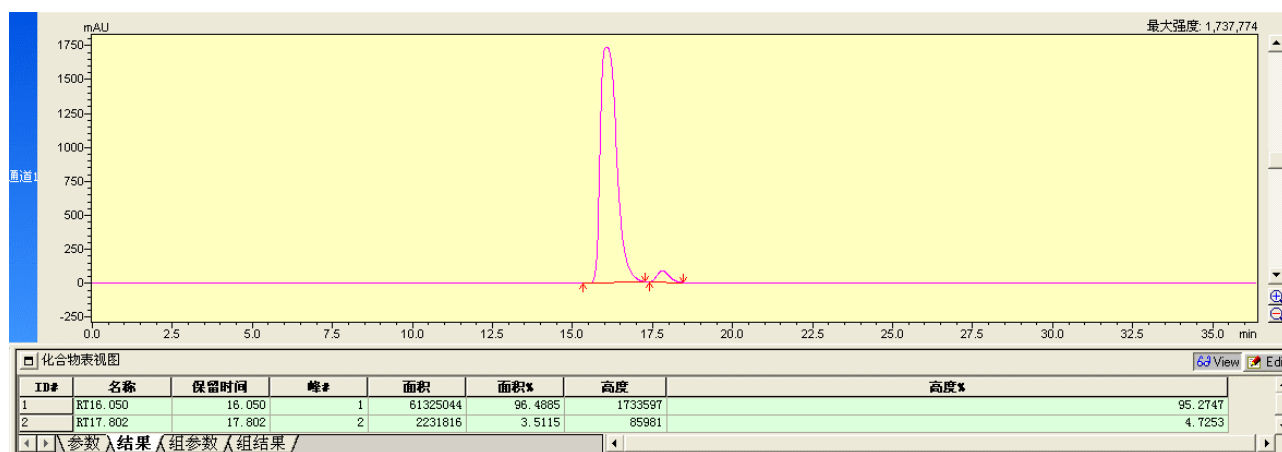
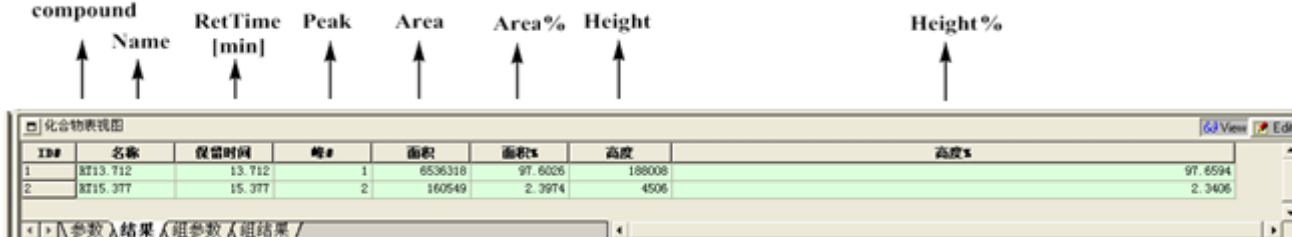


Table view of compound



**Table S3.** Reusability of catalyst **5** in the successive reduction/ATH of (*E*)-1-(4-styrylphenyl)than-1-one.<sup>[a]</sup>

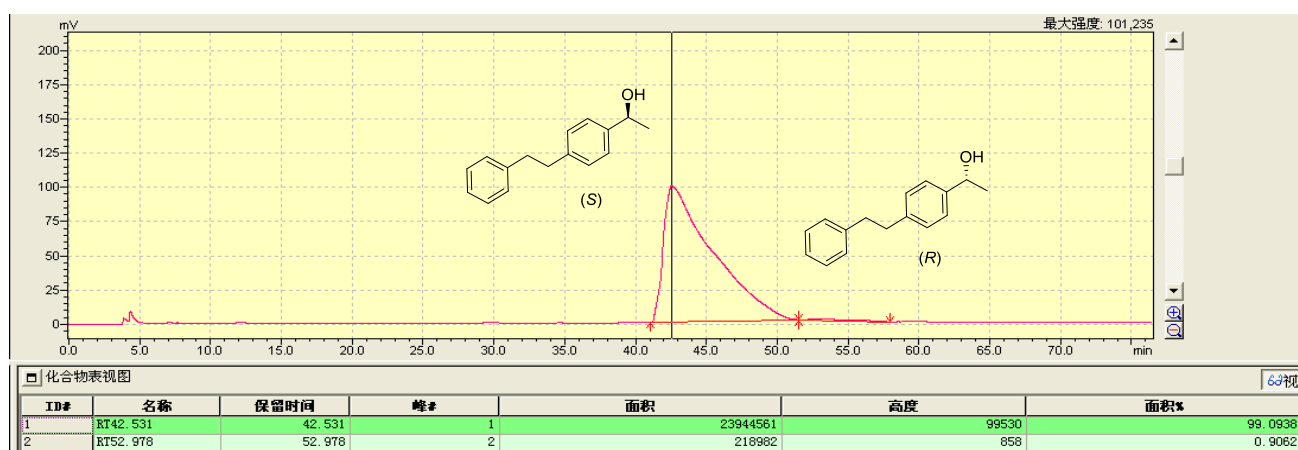
Entry	1	2	3	4	5	6	7	8	9	10
Yield [%]	97	97	95	96	94	94	93	92	91	83
ee [%]	98	98	97	97	96	95	95	95	95	95

<sup>a</sup> Reaction conditions: Catalyst **5** (219.80 mg, 20.0  $\mu$ mol of Ru, 85.70  $\mu$ mol of Pd, based on ICP analysis), HCO<sub>2</sub>Na (10.0 mmol), (*E*)-1-(4-styrylphenyl)than-1-one (1.0 mmol), and 40.0 mL of co-solvents (<sup>t</sup>PrOH/H<sub>2</sub>O v/v = 3/1) were added sequentially to a 100.0 mL round-bottom flask. The mixture was then stirred at 50 °C for 6 h. Yields were determined by <sup>1</sup>H-NMR analysis and *ee* values were determined by chiral HPLC analysis.

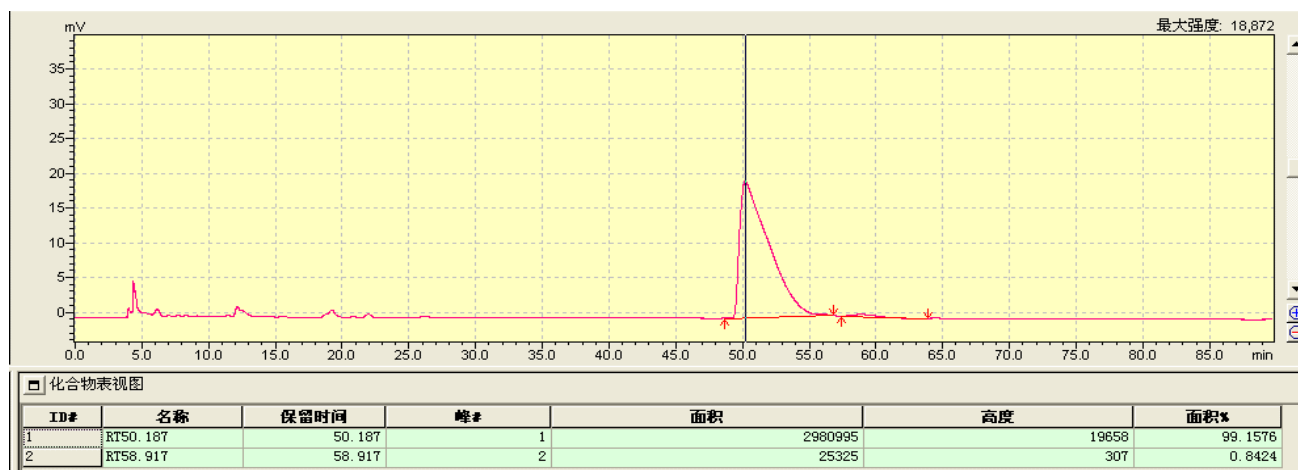
**Figure S10.** HPLC analyses for the **5**-catalyzed reduction/ATH of (*E*)-1-(4-styrylphenyl)than-1-one.

### Recycling experiment part:

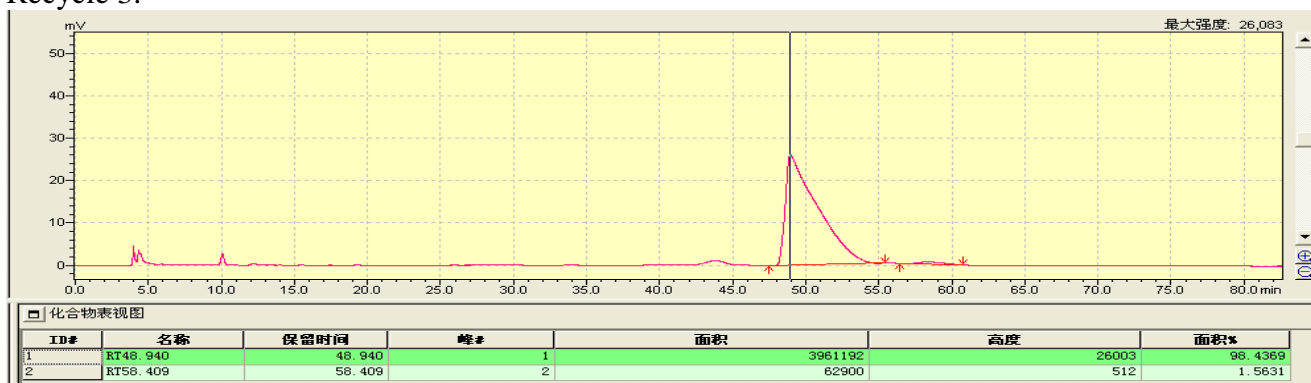
#### Recycle 1.



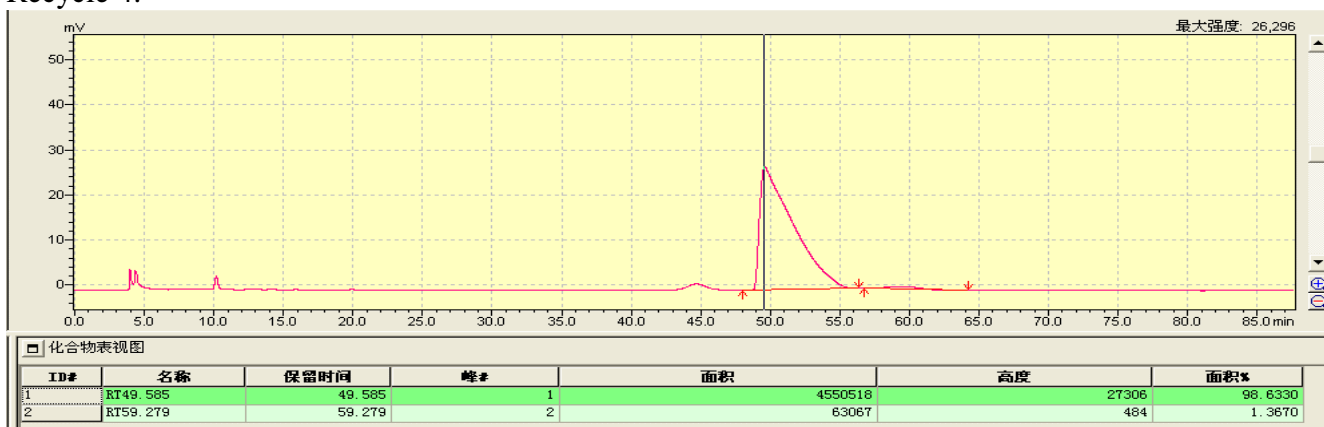
#### Recycle 2.



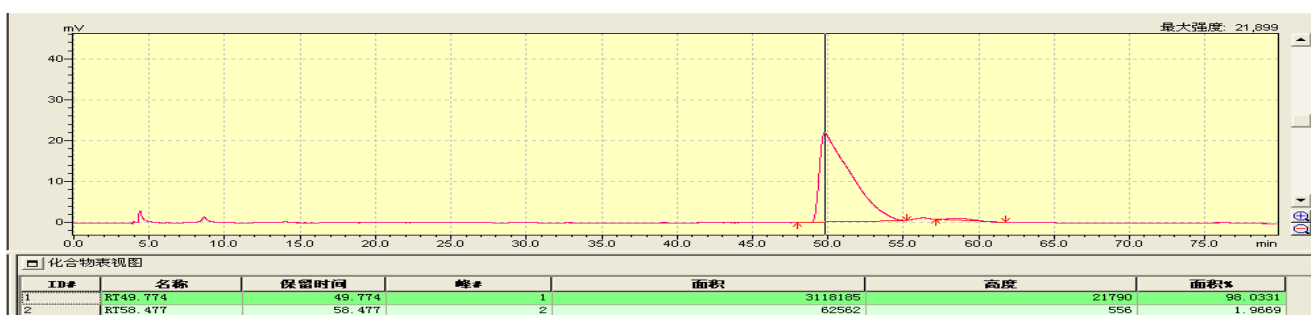
### Recycle 3.



### Recycle 4.



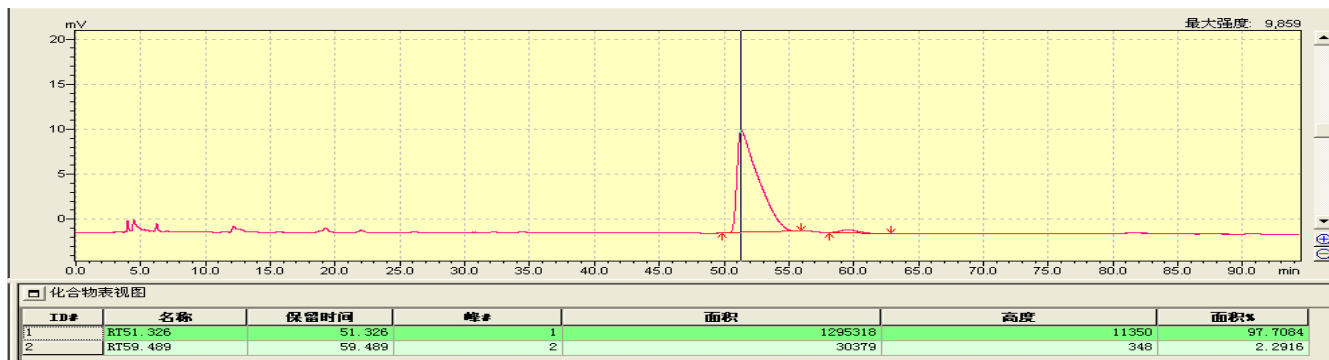
### Recycle 5.



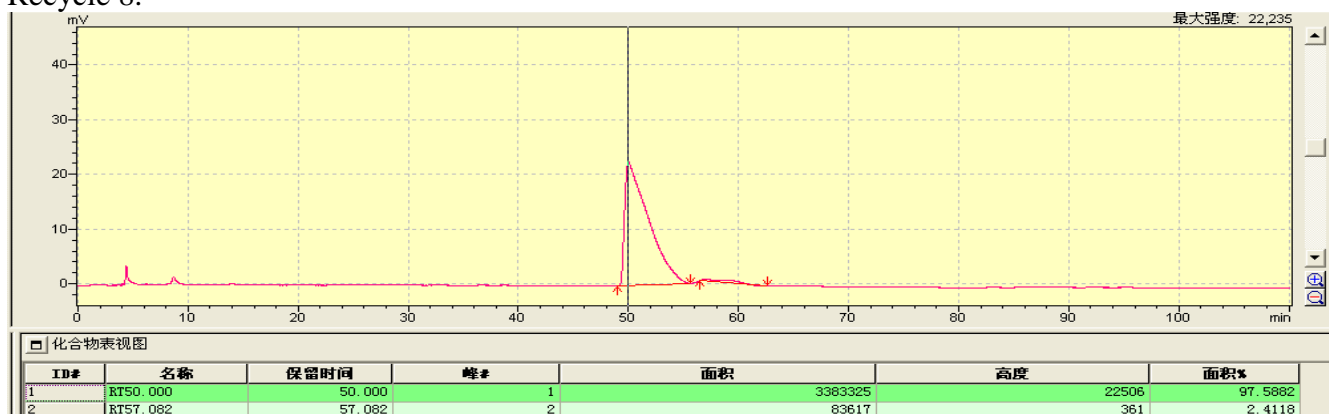
### Recycle 6.



### Recycle 7.



### Recycle 8.



### Recycle 9.

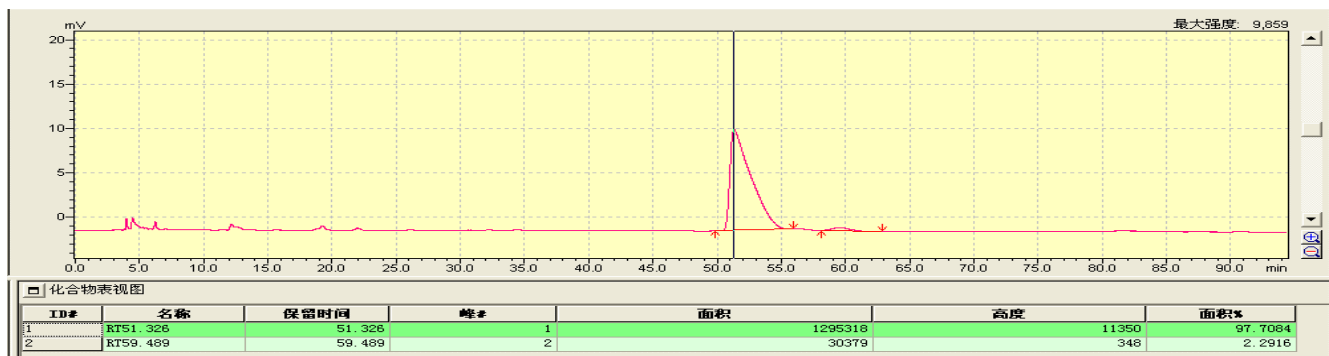


Table view of compound

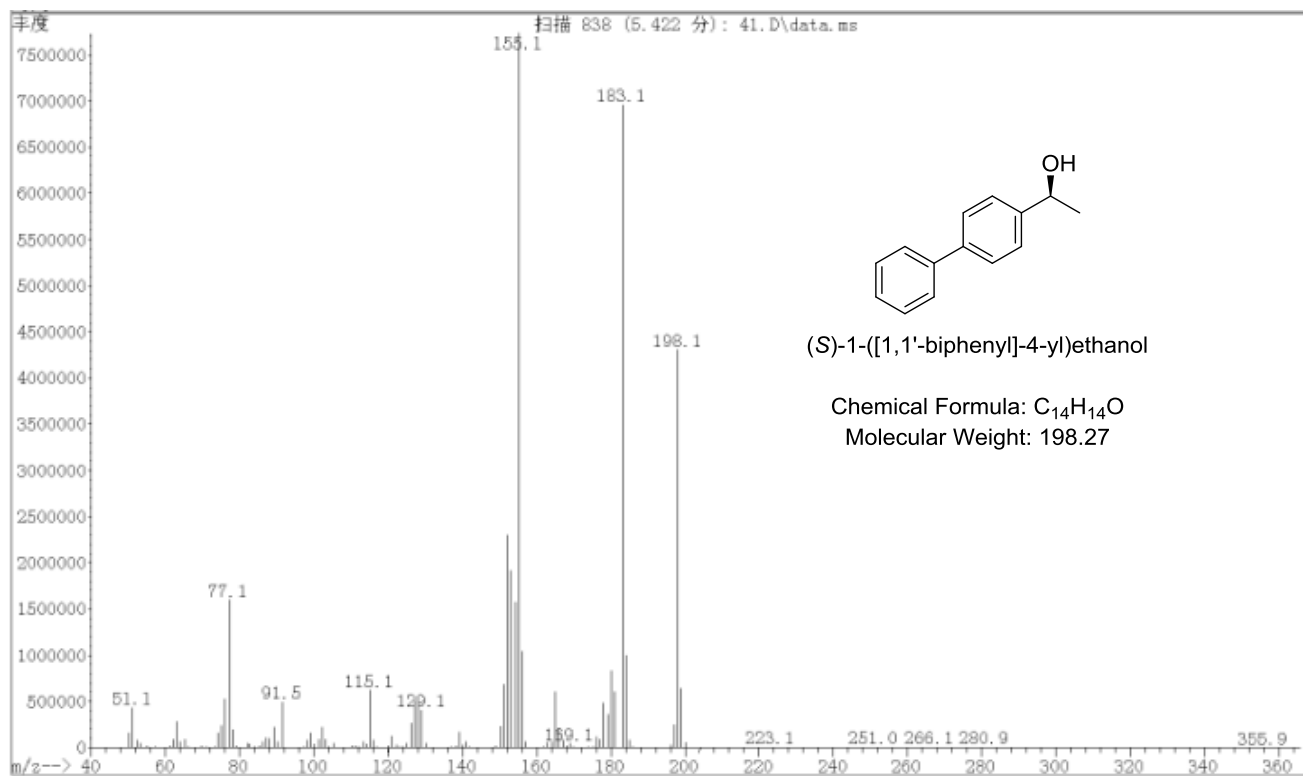
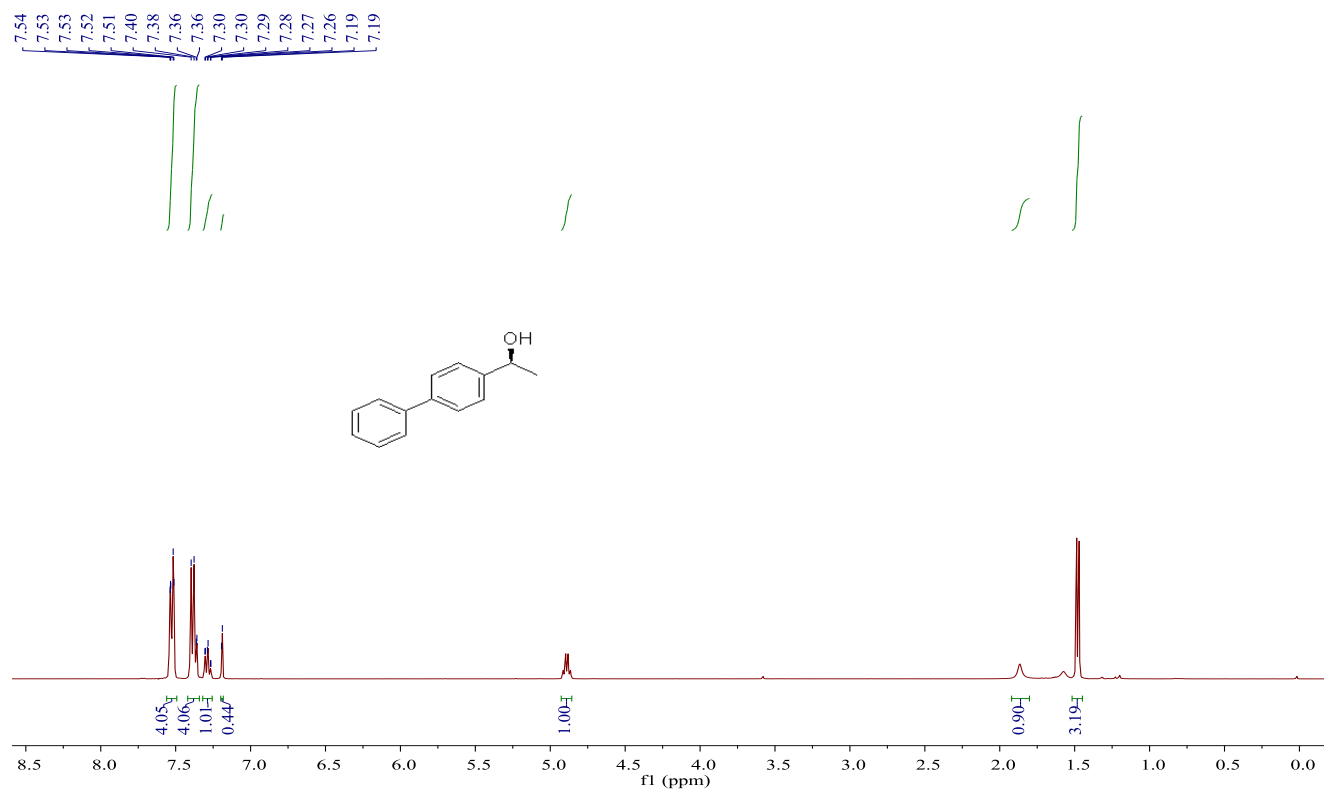
↑ Name      ↑ RetTime [min]      ↑ Peak      ↑ Area      ↑ Height      ↑ Area%

ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT16.273	16.273	1	29062298	1157381	98.0529
2	RT18.111	18.111	2	577094	24437	1.9471

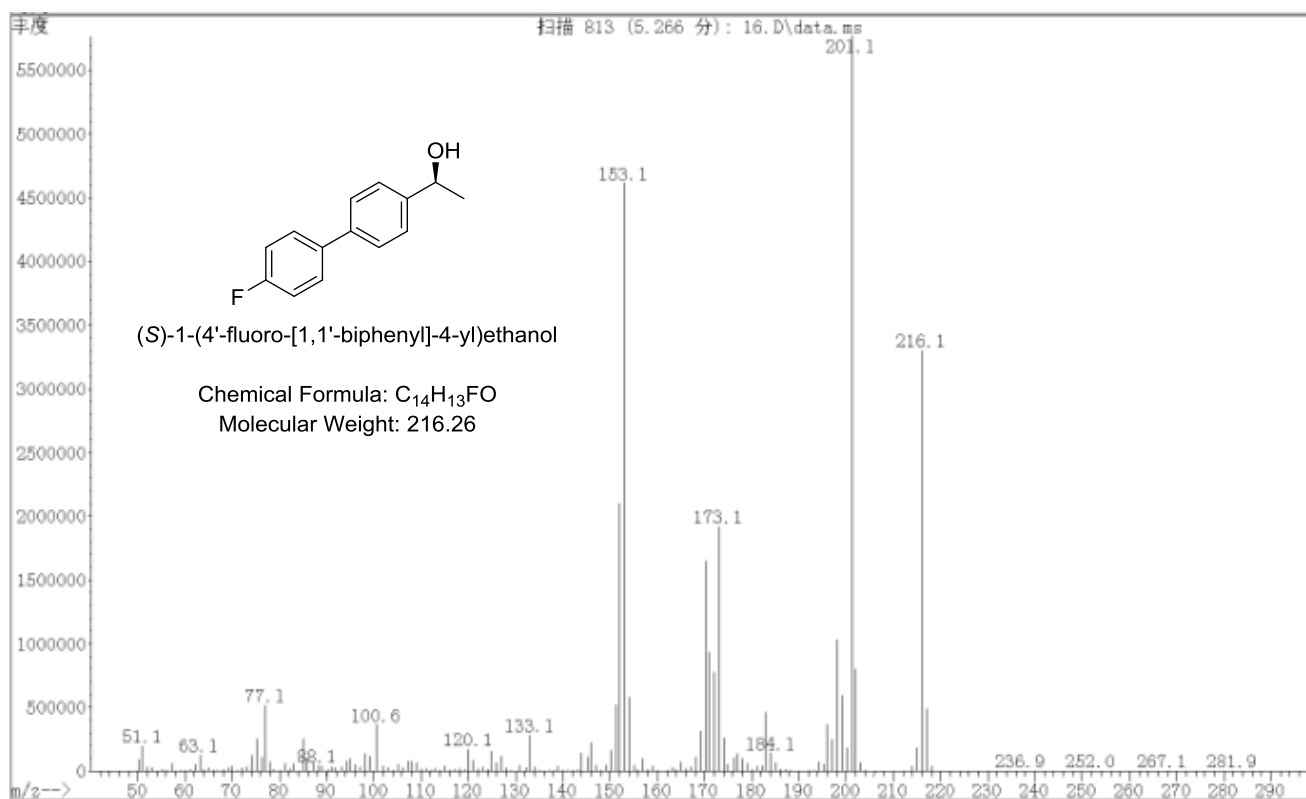
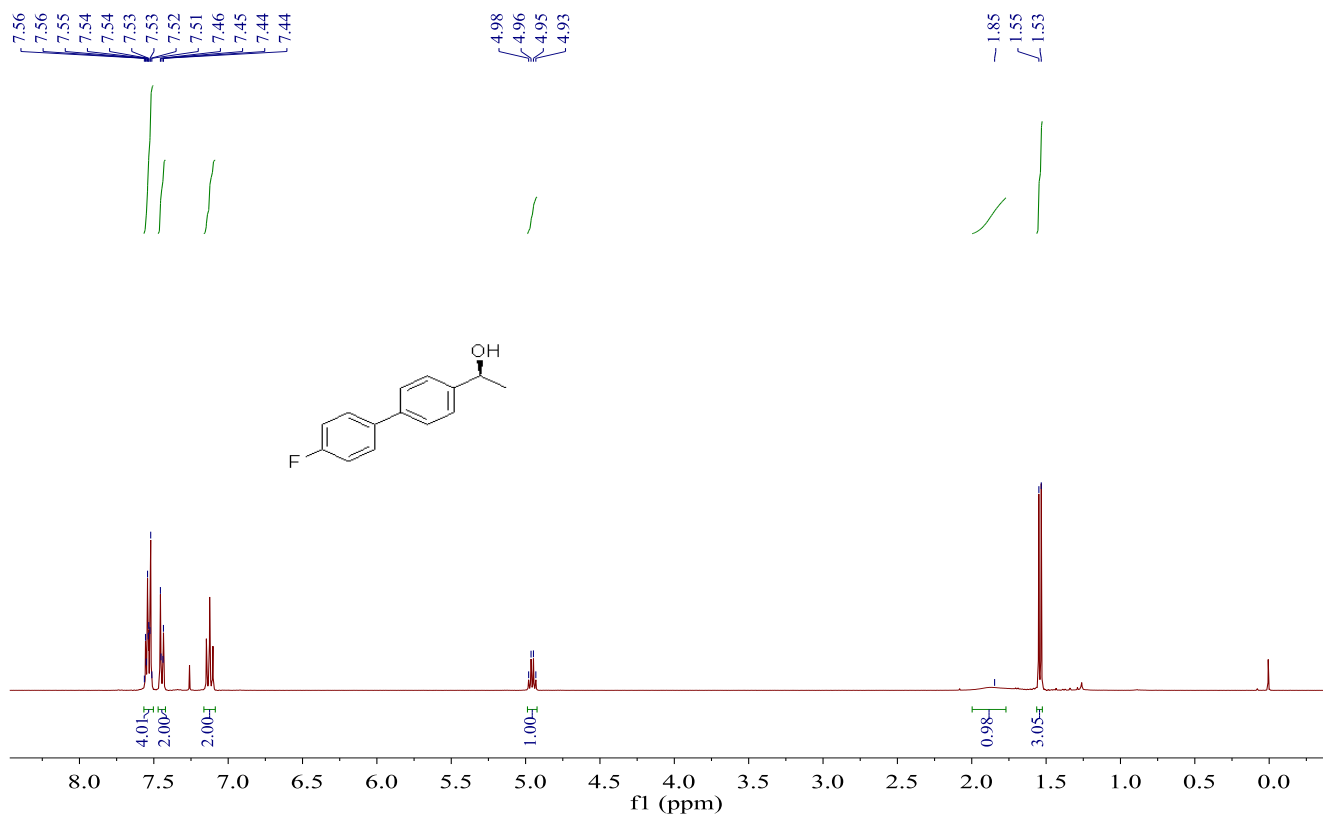


**Figure S11.** The characterizations of chiral products (The  $^1\text{H}$  NMR and GC-MS spectra of all chiral products).

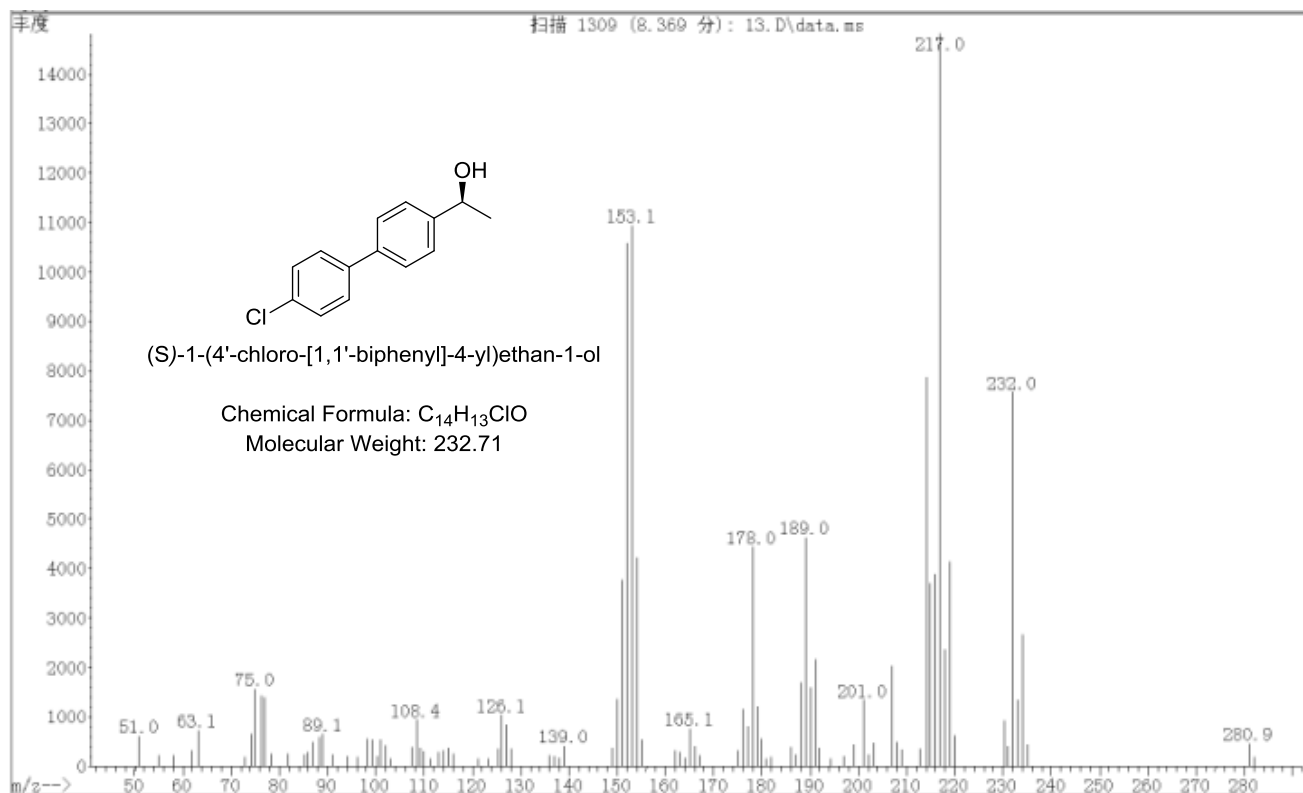
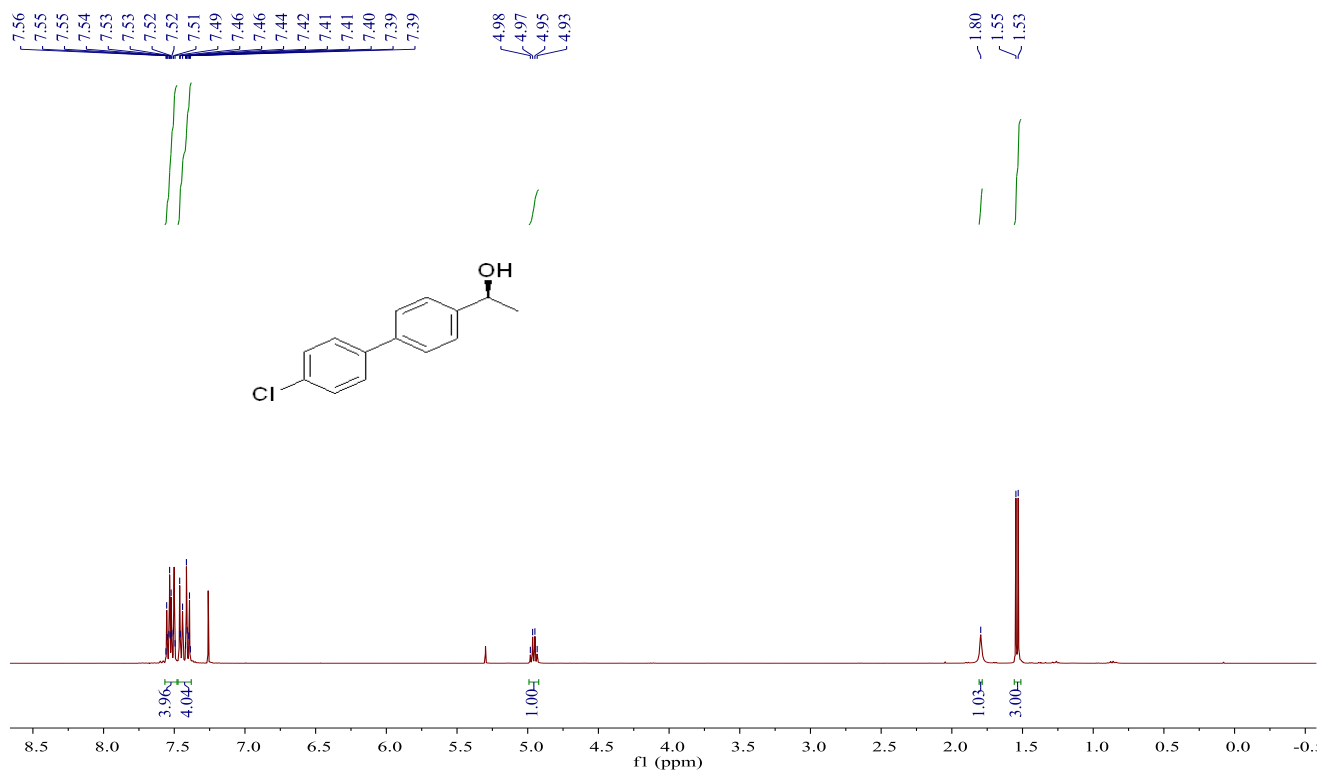
**(S)-1-([1,1'-biphenyl]-4-yl)ethan-1-ol (8a).**



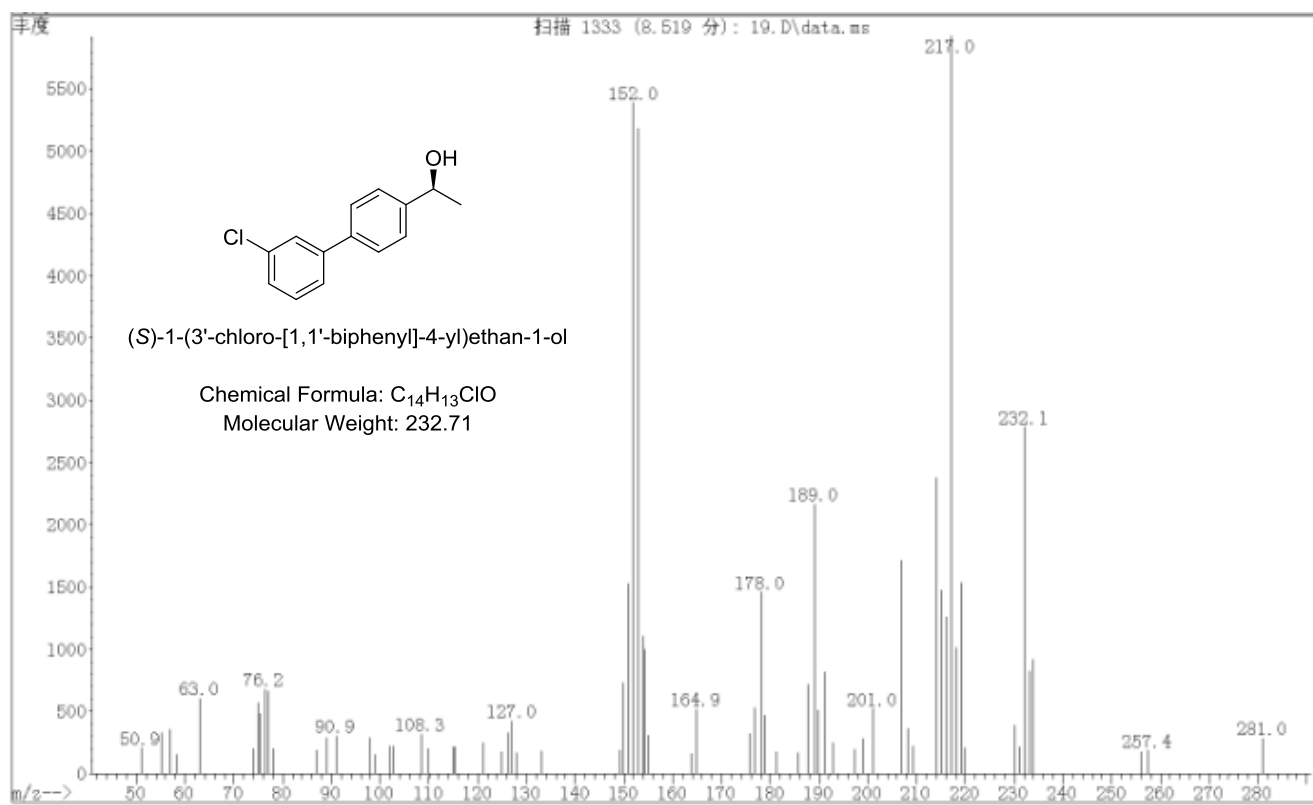
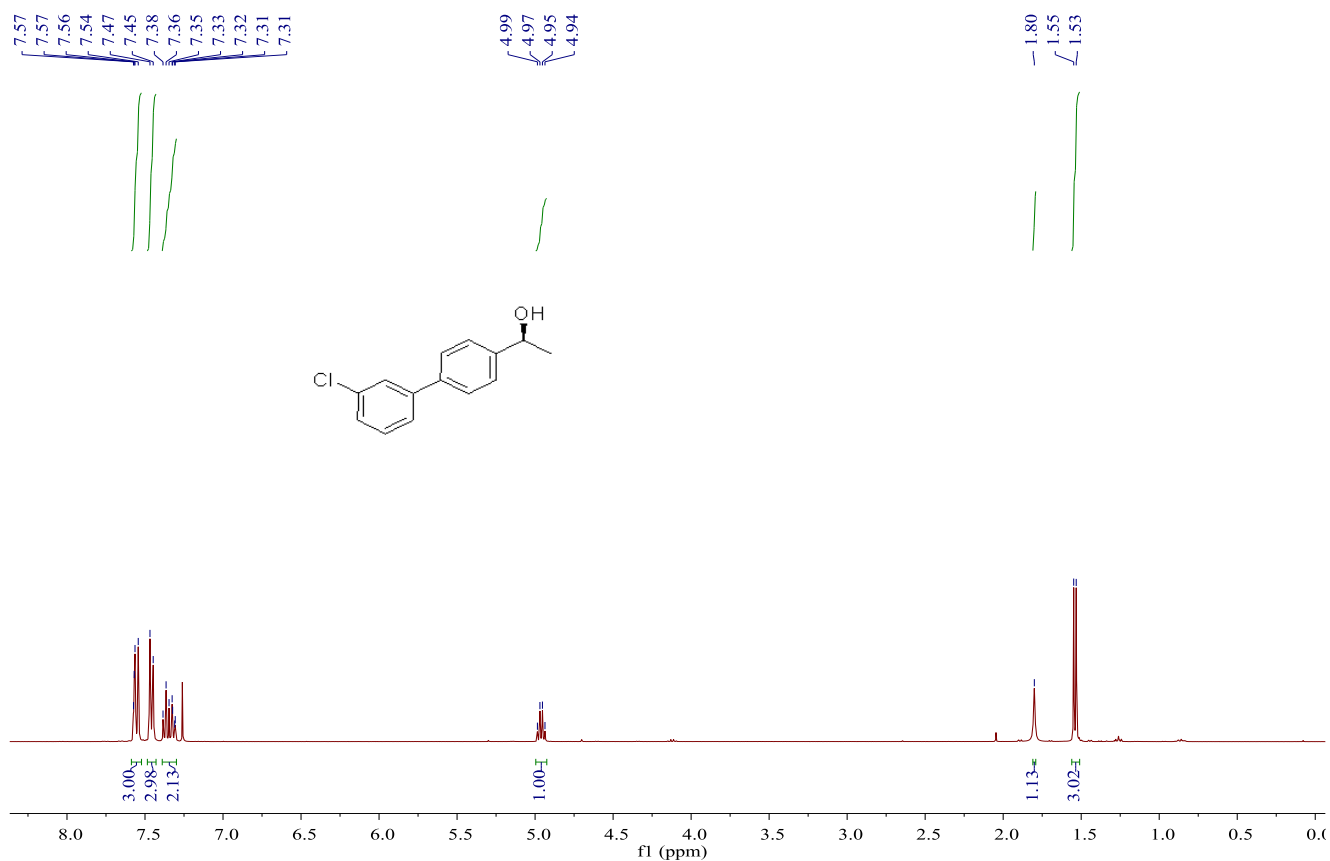
**(S)-1-(4'-fluoro-[1,1'-biphenyl]-4-yl)ethan-1-ol (8b).**



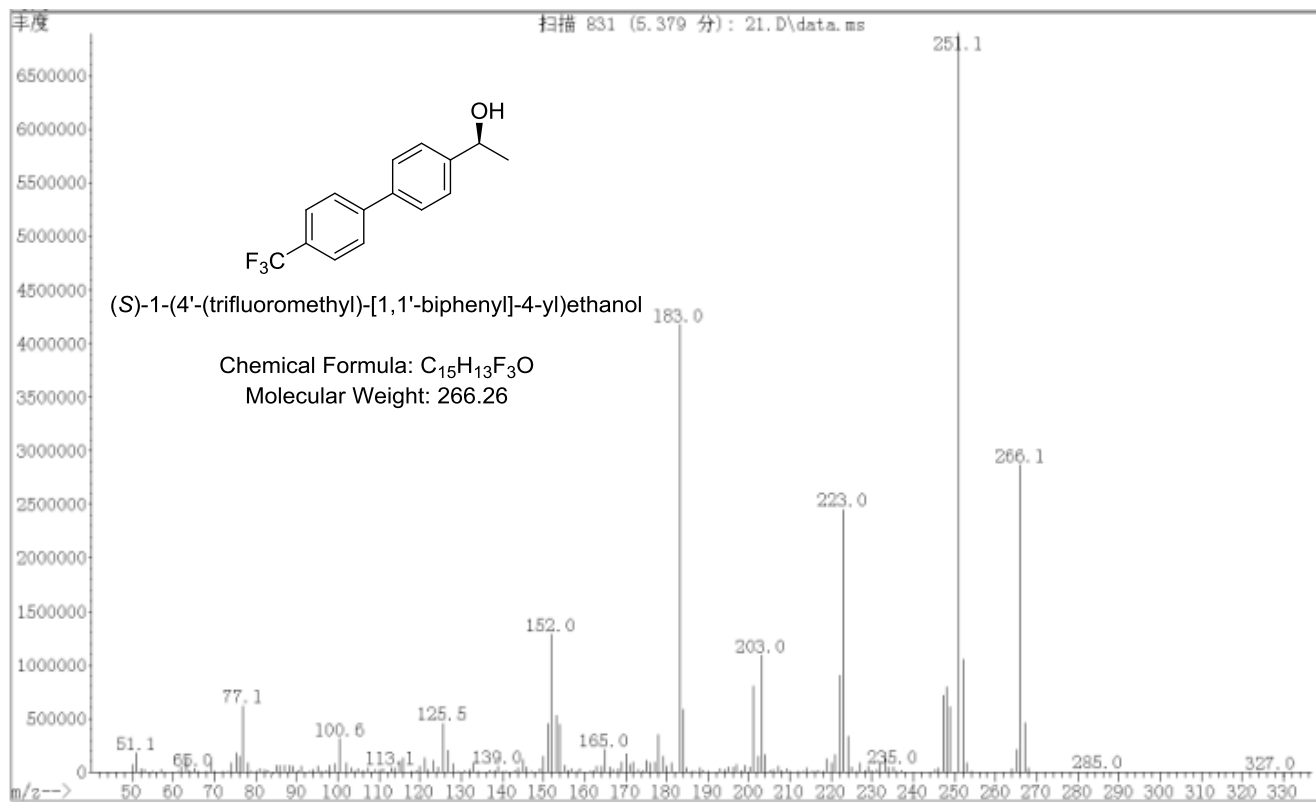
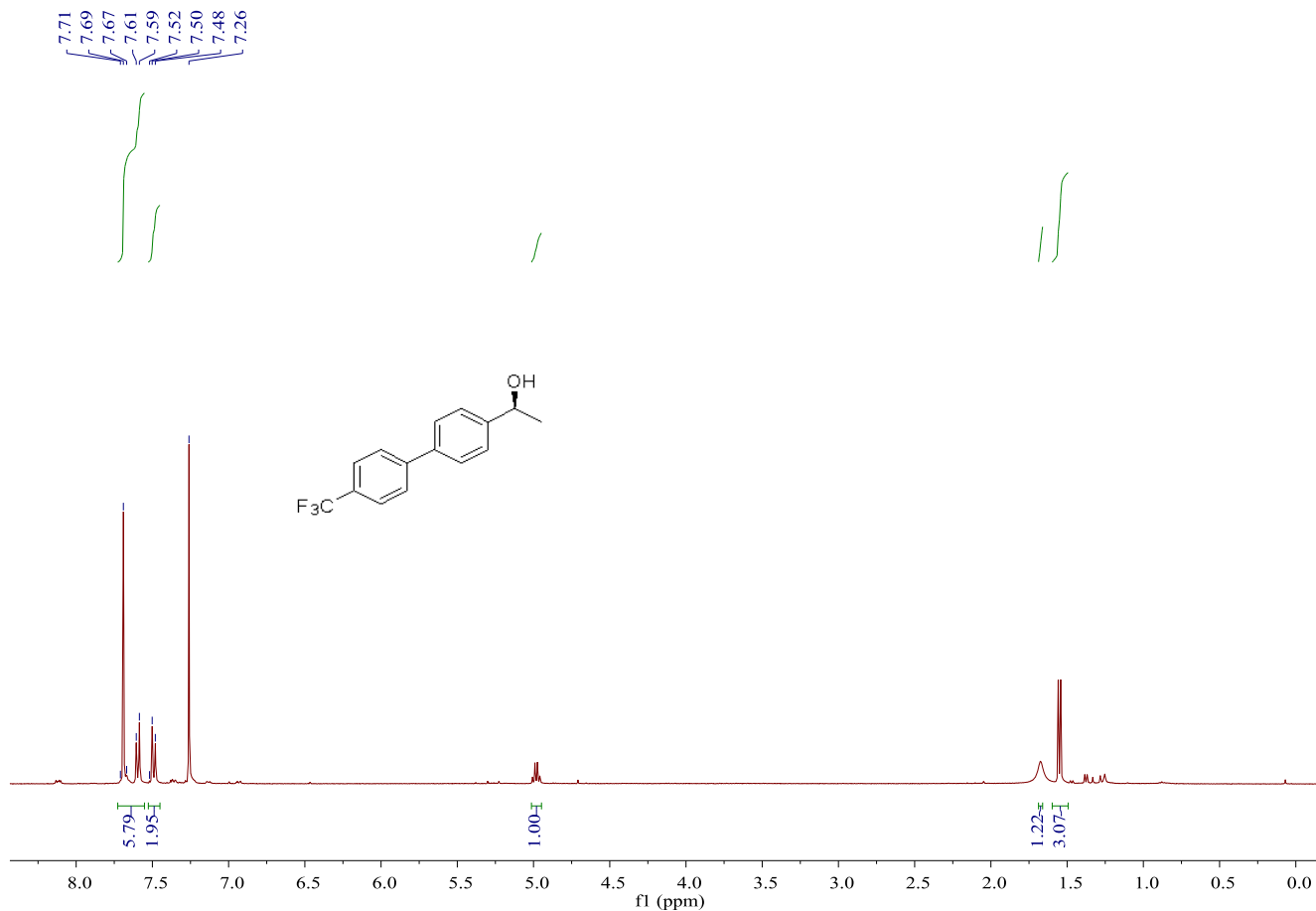
**(S)-1-(4'-chloro-[1,1'-biphenyl]-4-yl)ethan-1-ol (8c).**



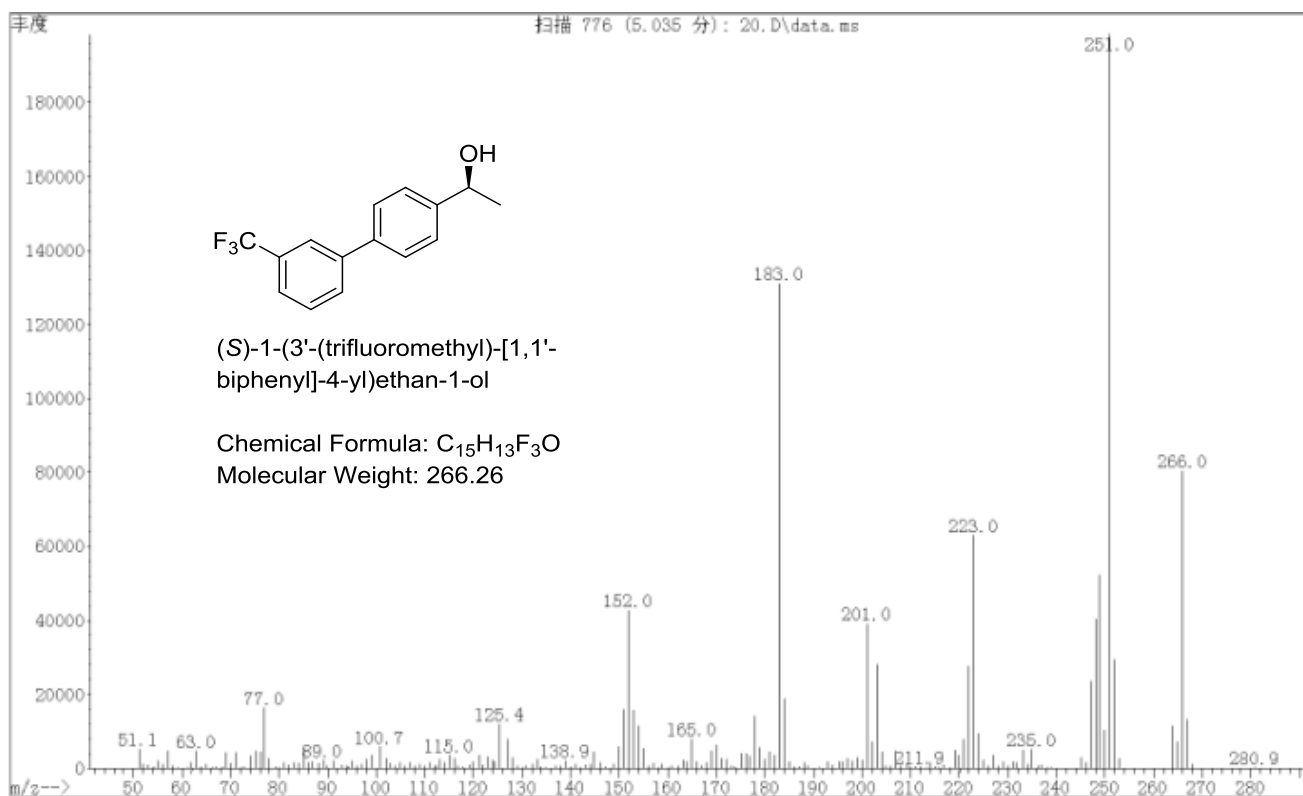
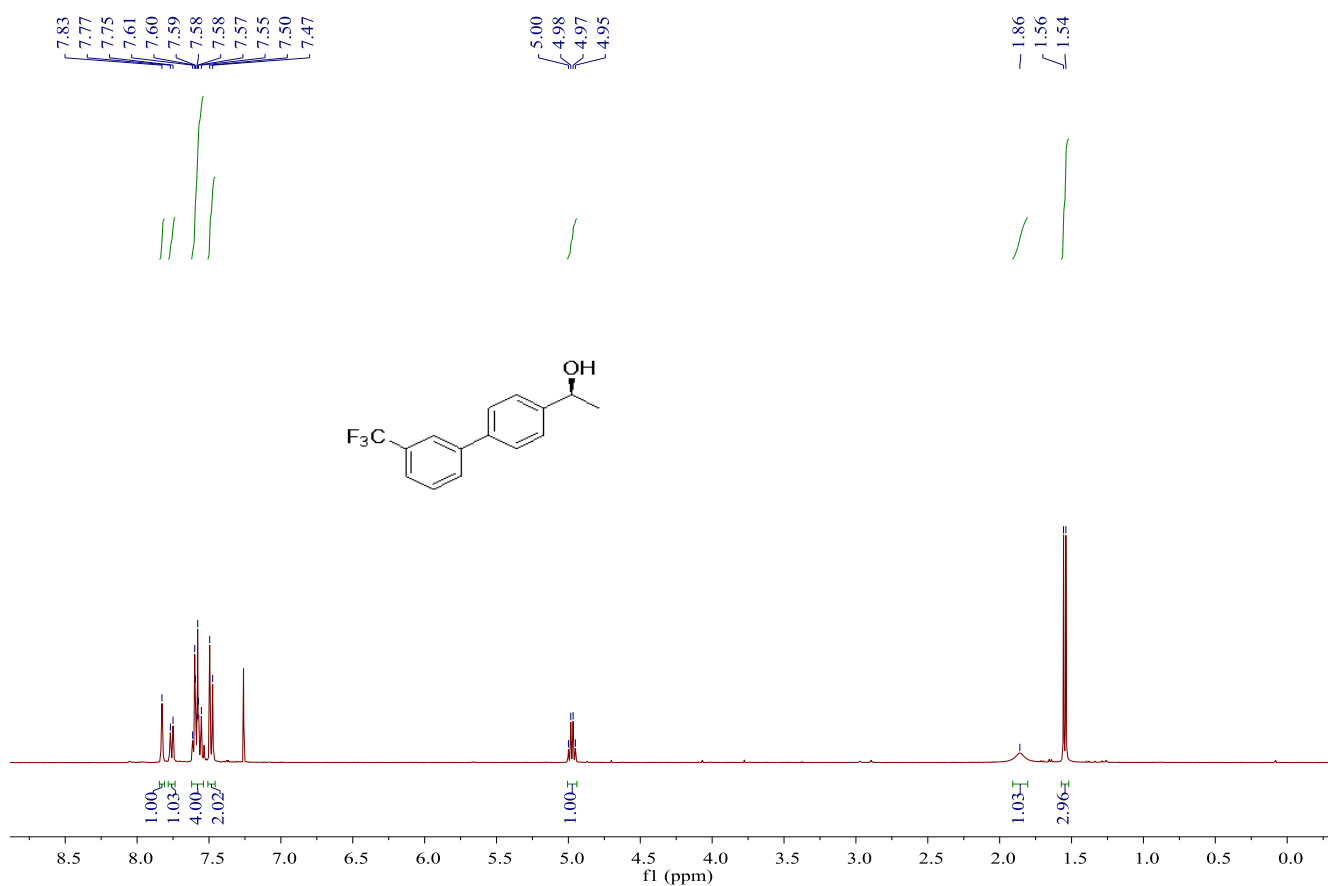
**(S)-1-(3'-chloro-[1,1'-biphenyl]-4-yl)ethan-1-ol (8d)**



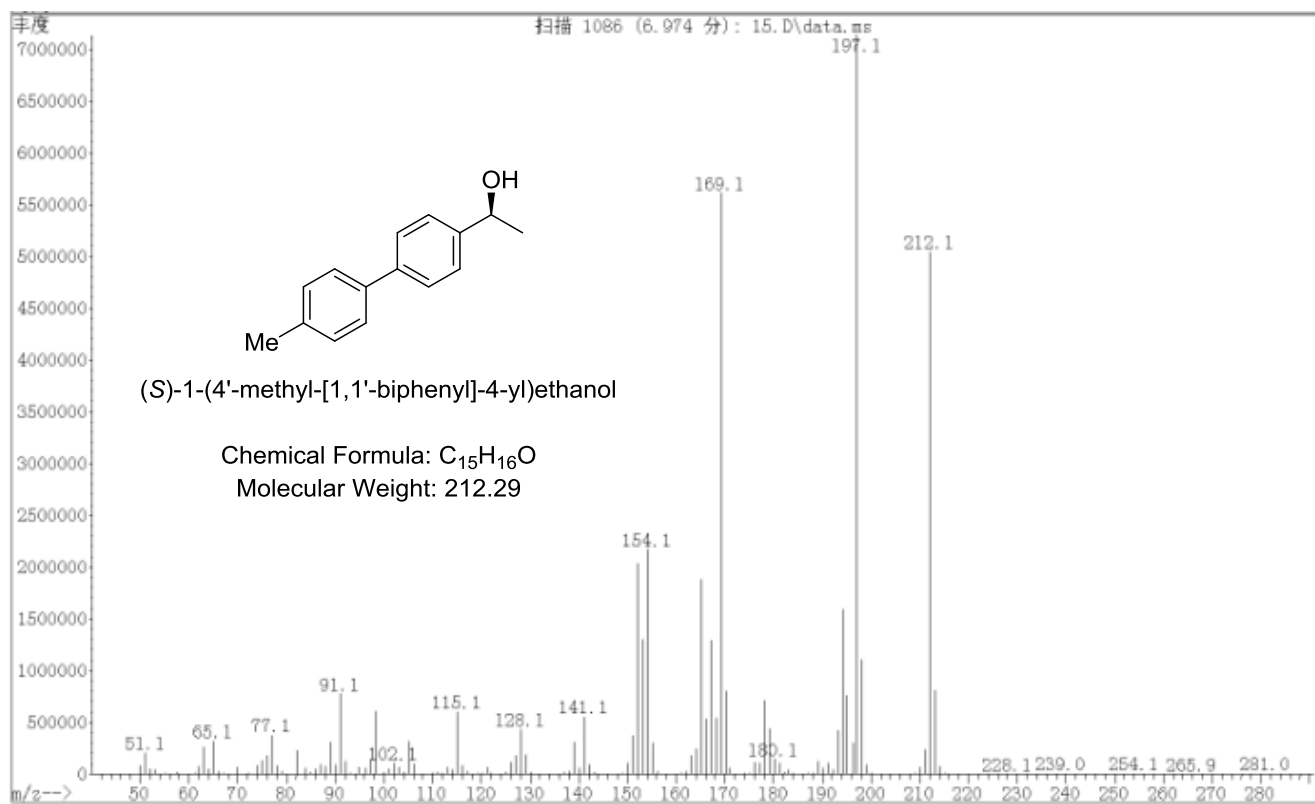
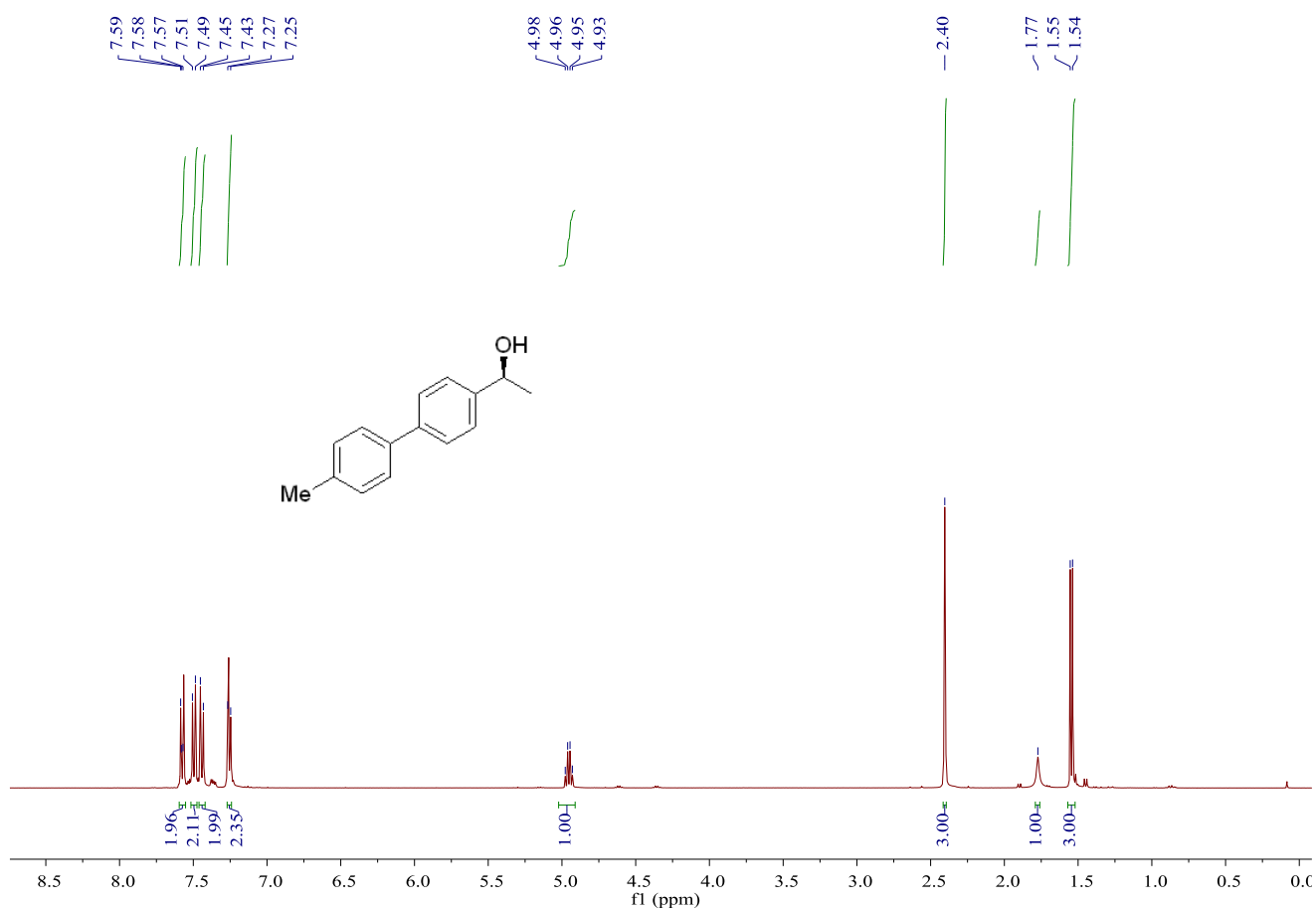
**(S)-1-(4'-(trifluoromethyl)-[1,1'-biphenyl]-4-yl)ethan-1-ol (8e)**



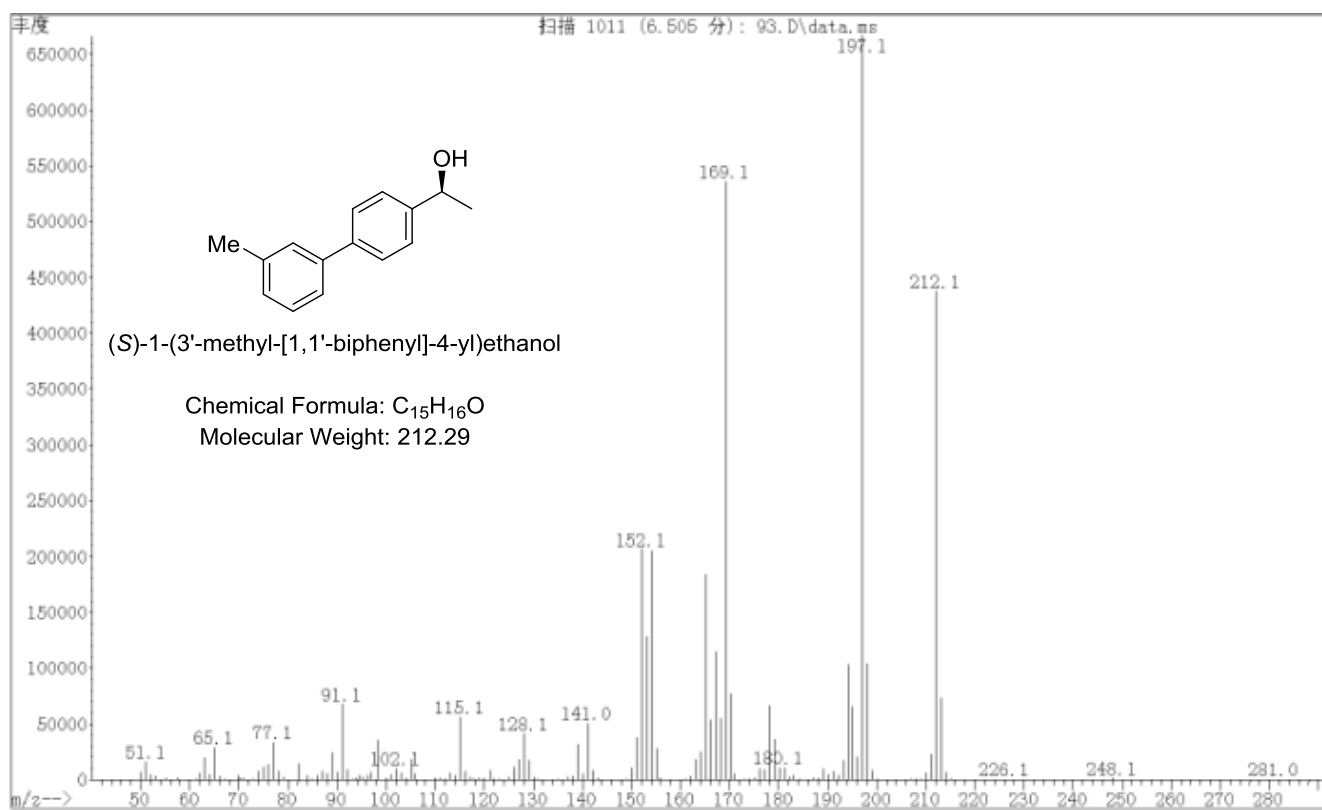
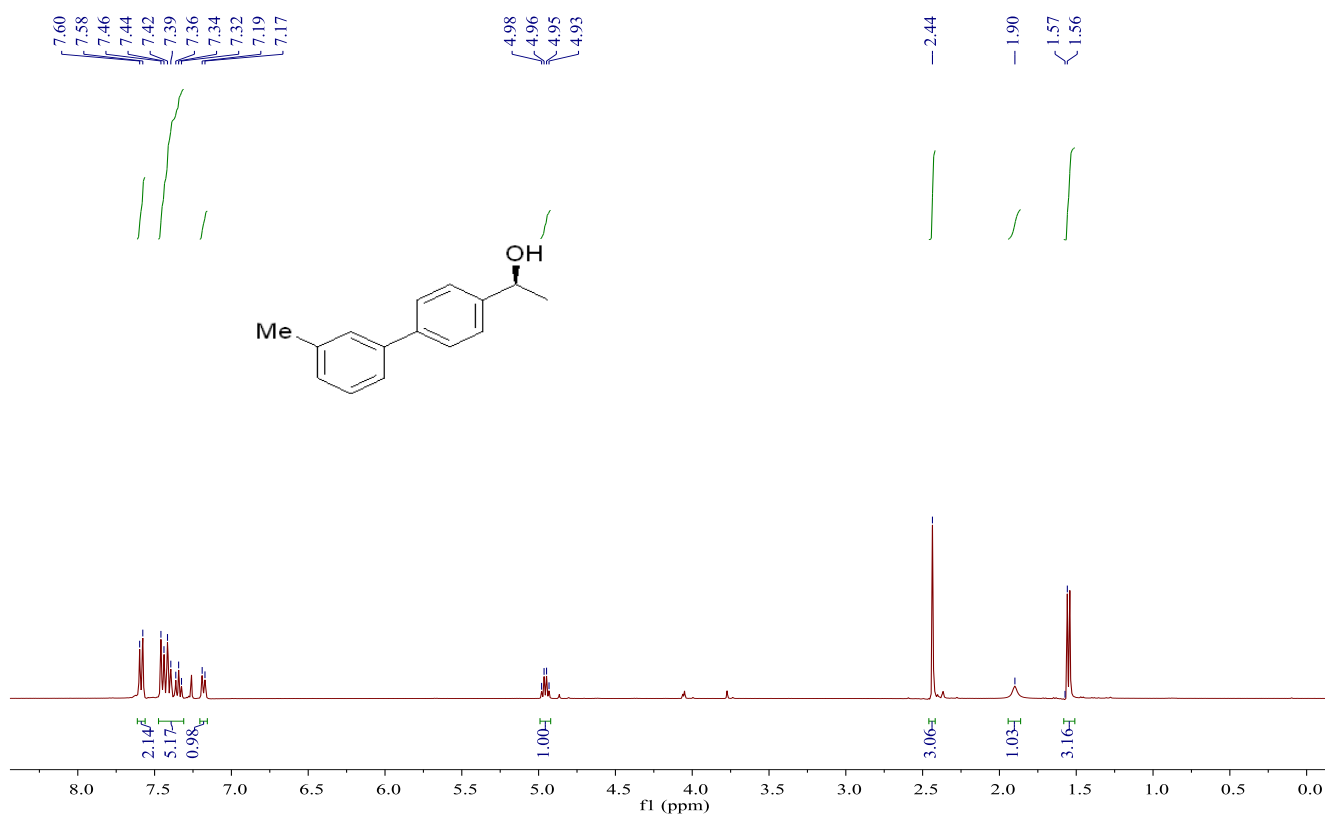
**(S)-1-(3'-(trifluoromethyl)-[1,1'-biphenyl]-4-yl)ethan-1-ol (8f)**



**(S)-1-(4'-methyl-[1,1'-biphenyl]-4-yl)ethan-1-ol (8g)**

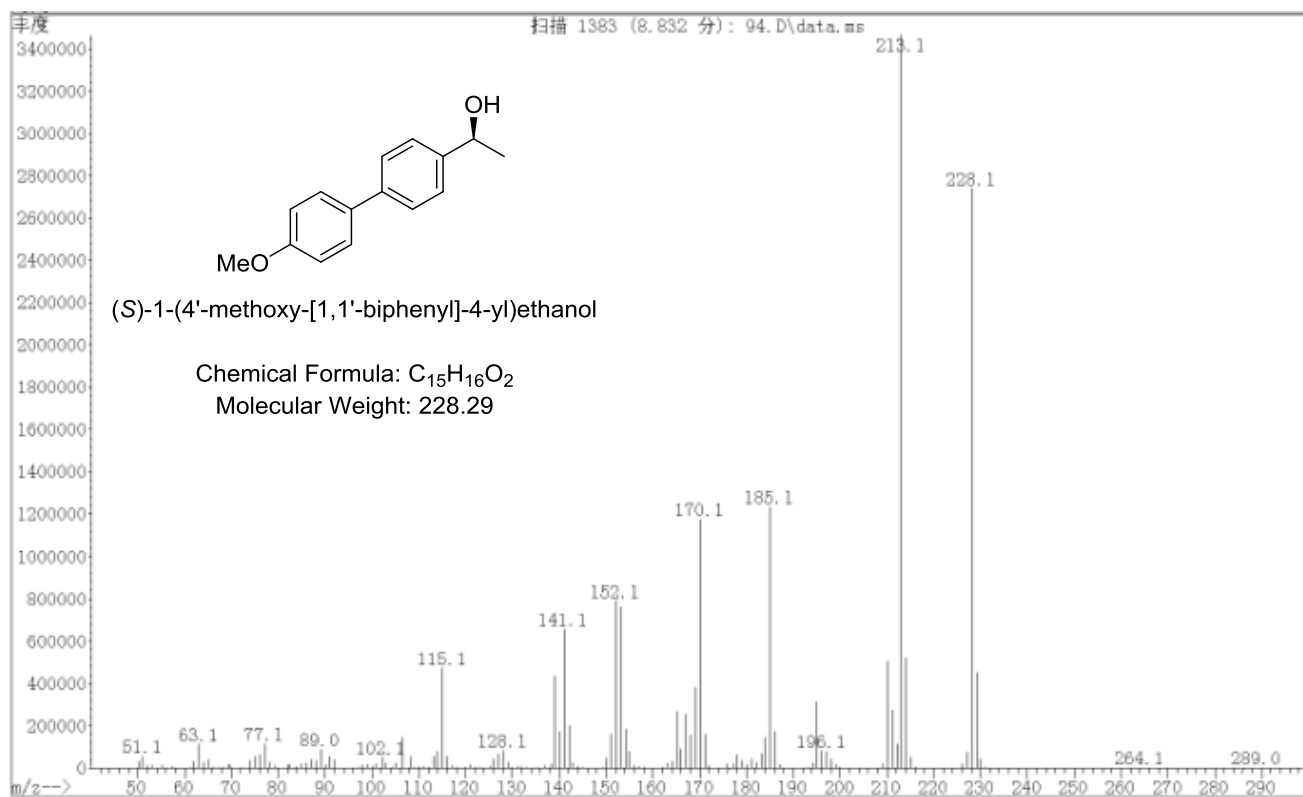
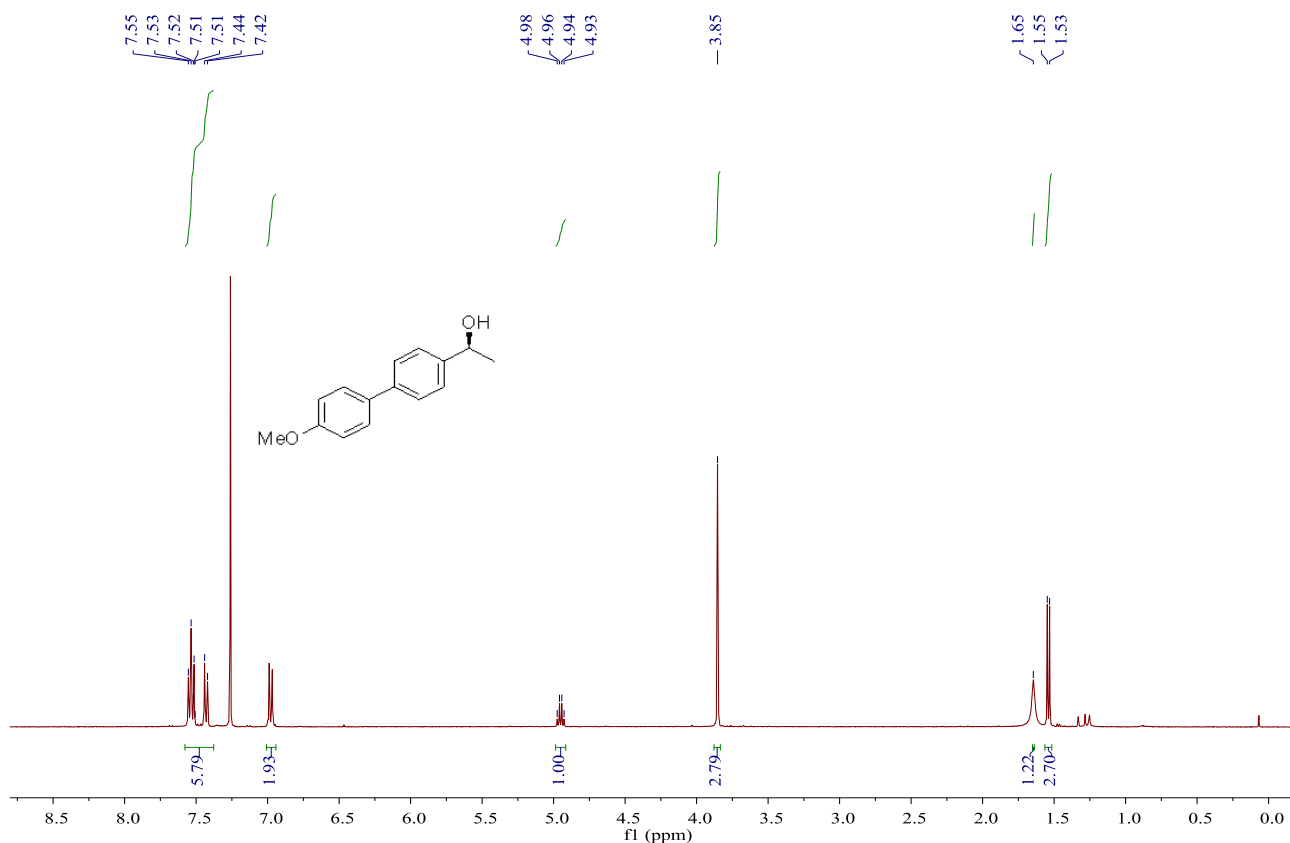


**(S)-1-(3'-methyl-[1,1'-biphenyl]-4-yl)ethan-1-ol (8h).**

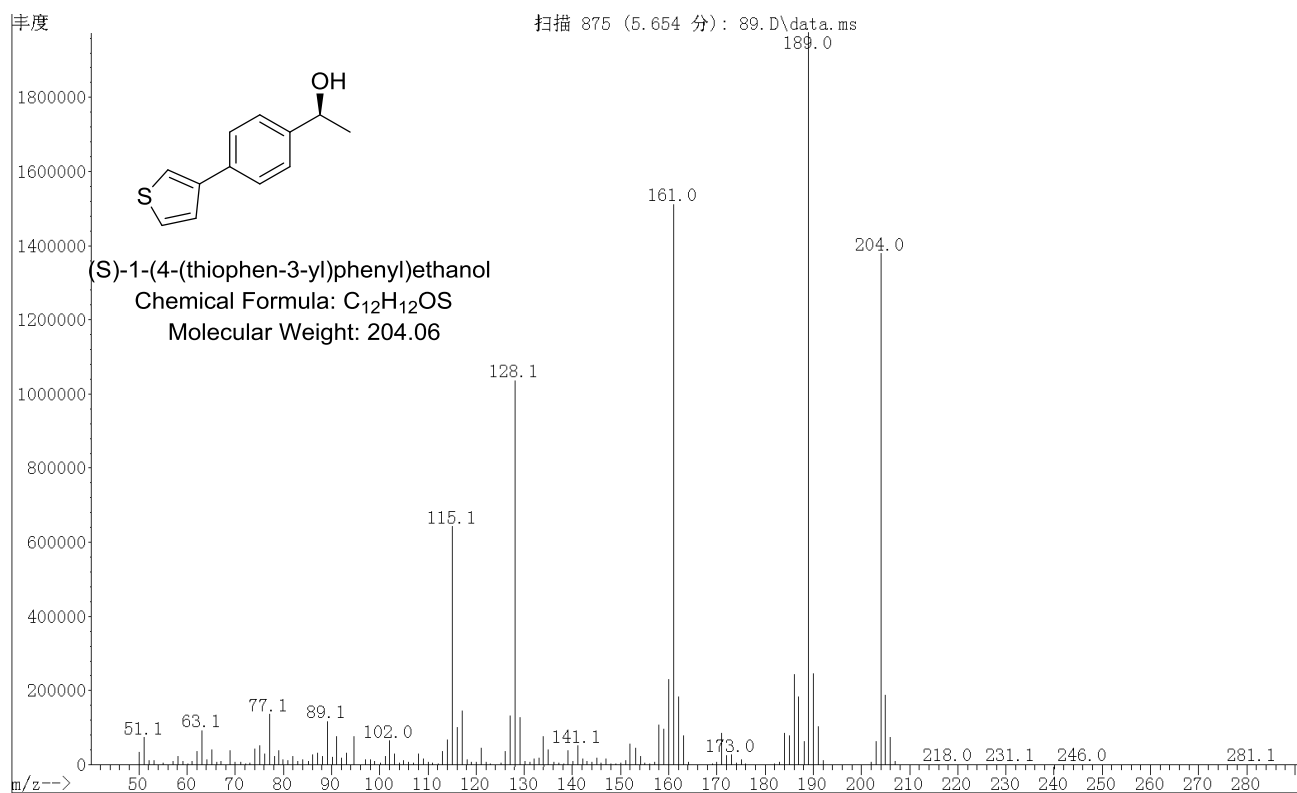
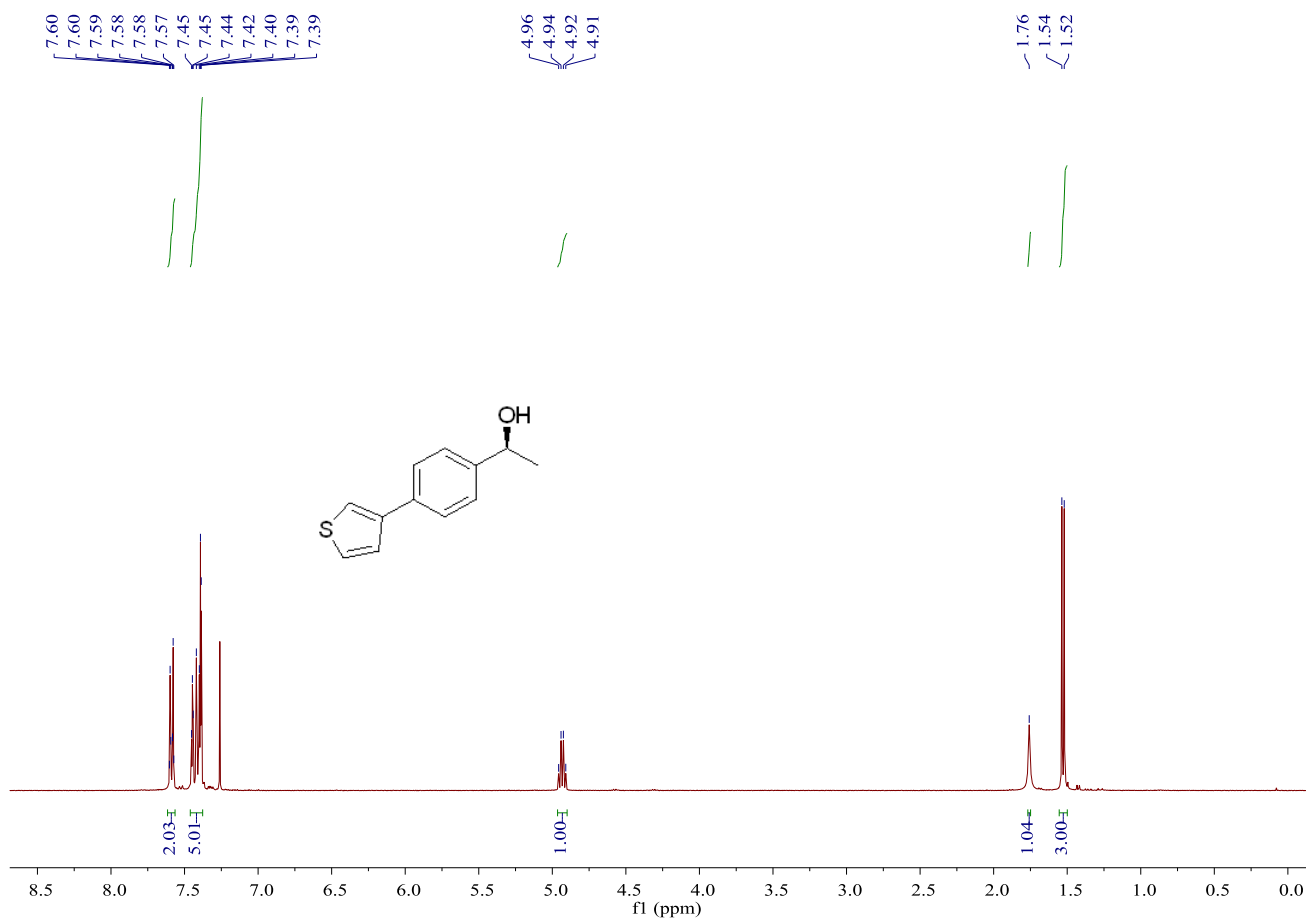




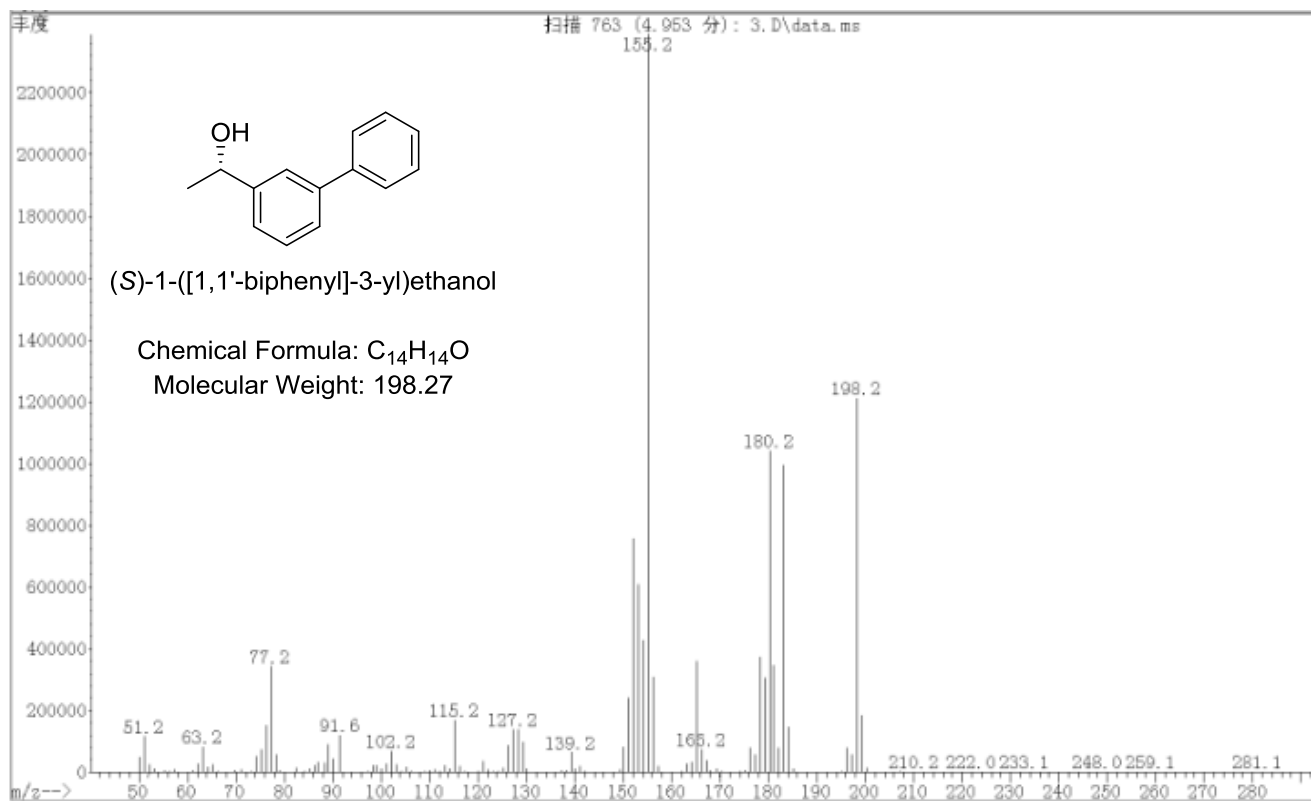
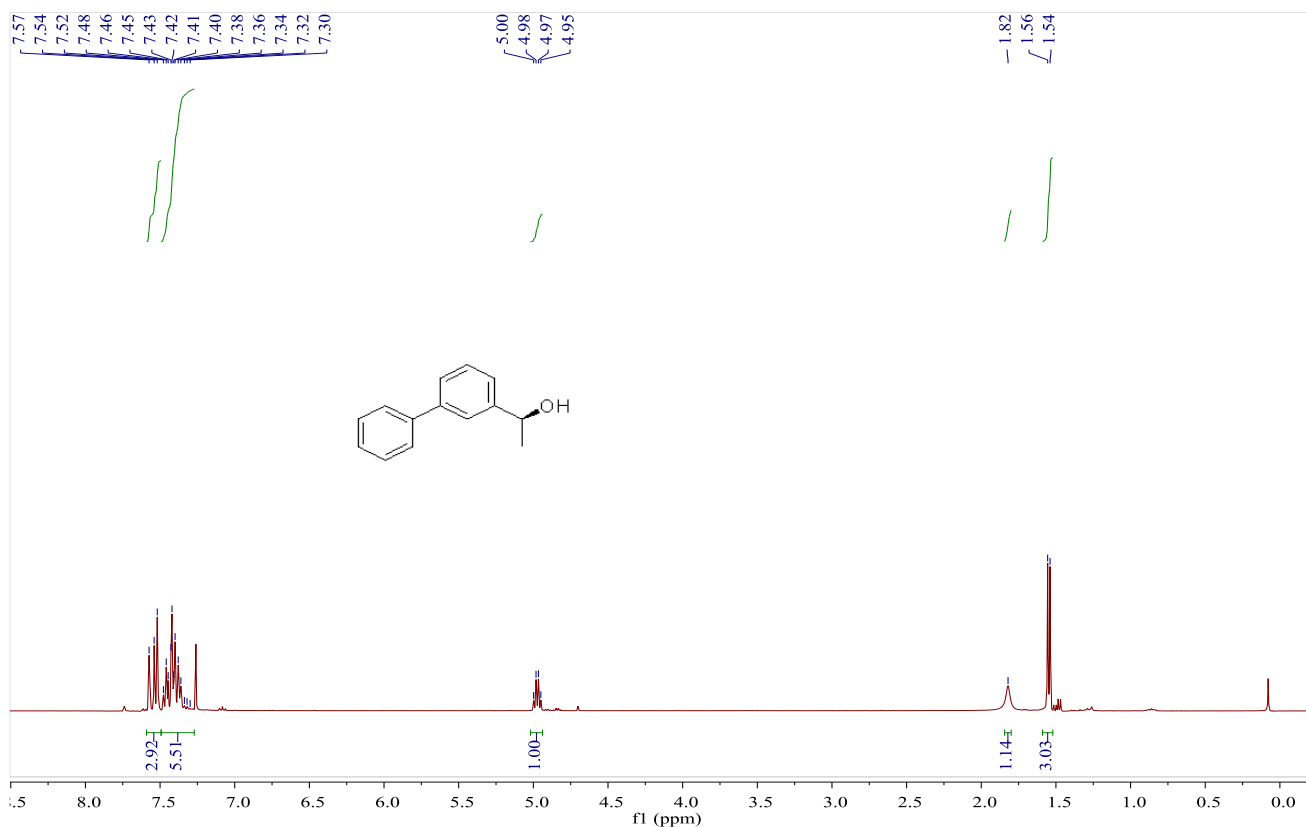
**(S)-1-(4'-methoxy-[1,1'-biphenyl]-4-yl)ethan-1-ol (8i).**



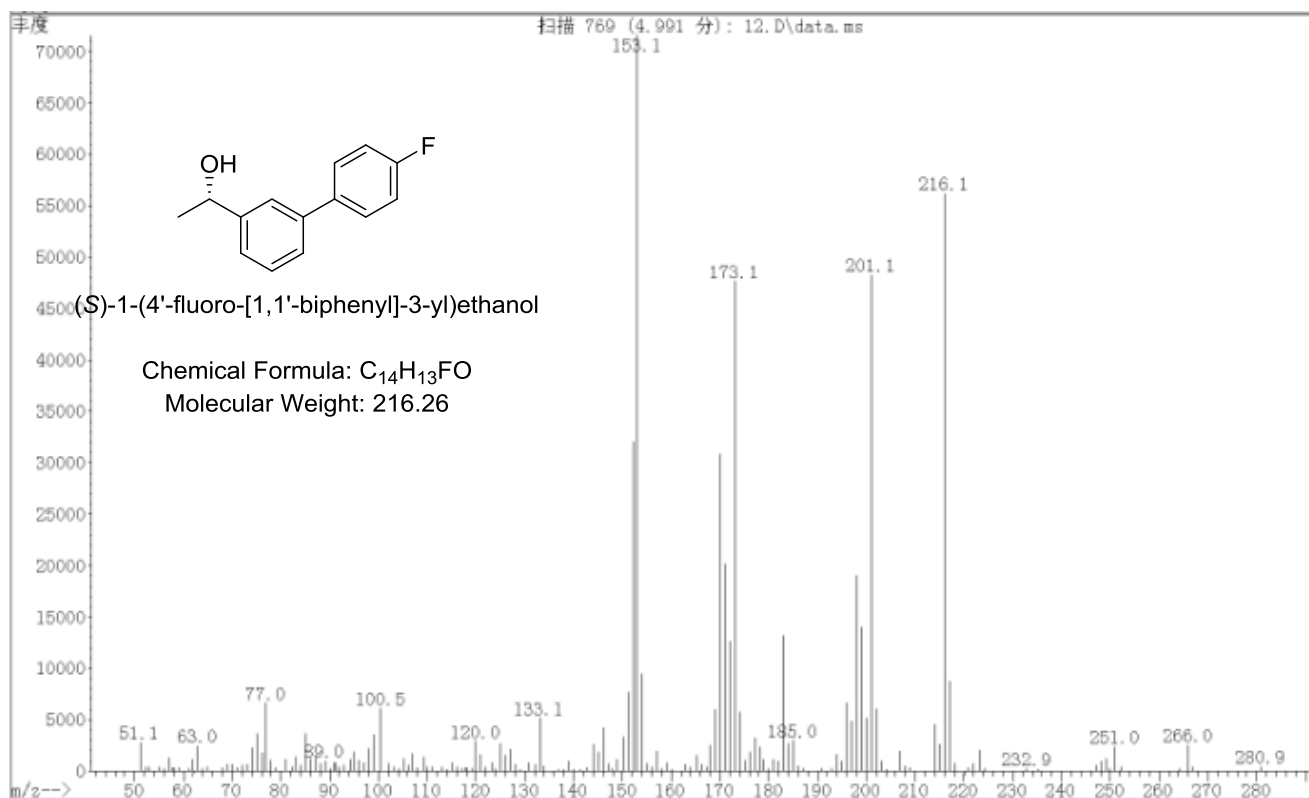
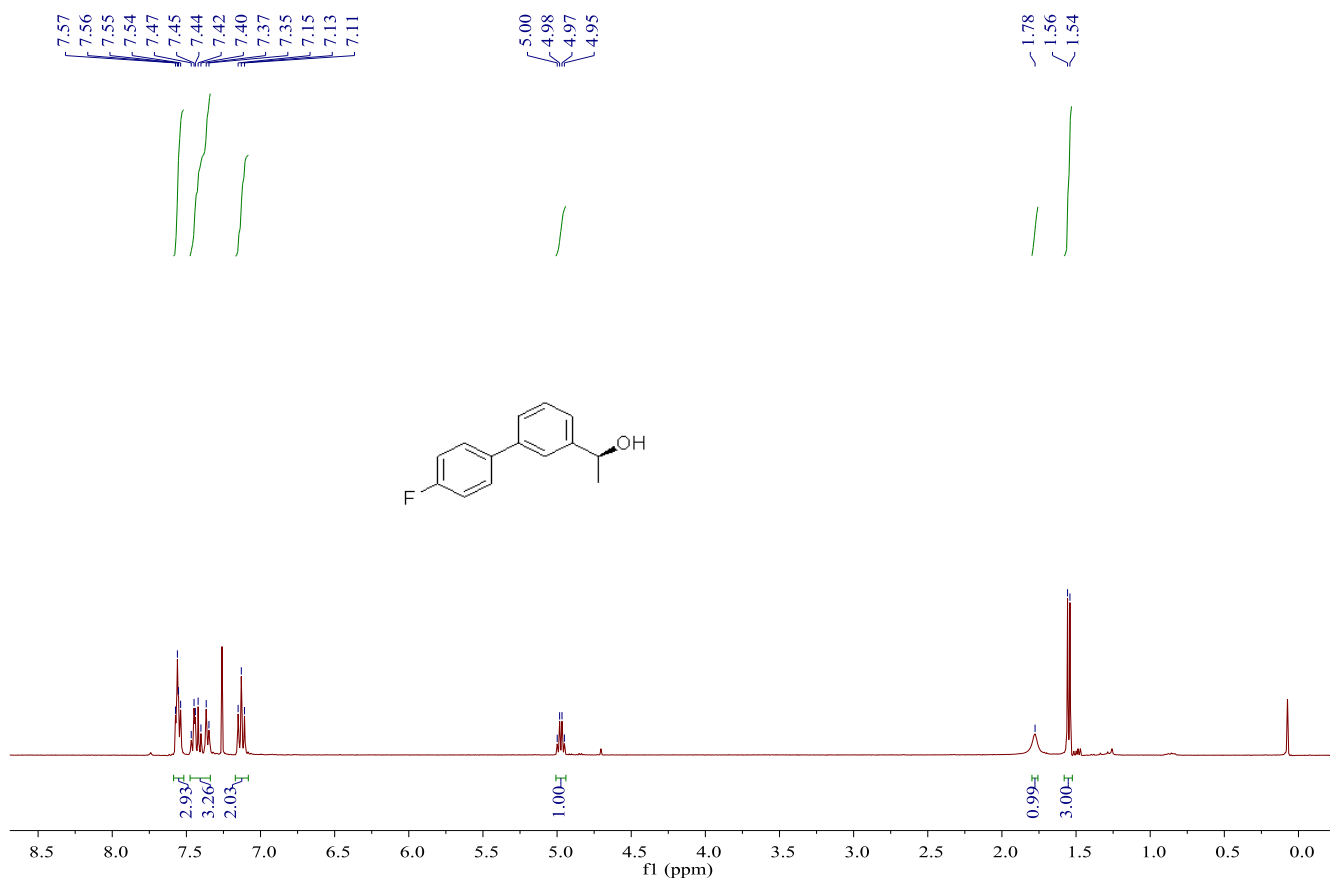
**(S)-1-(4-(thiophen-3-yl)phenyl)ethan-1-ol (8j).**



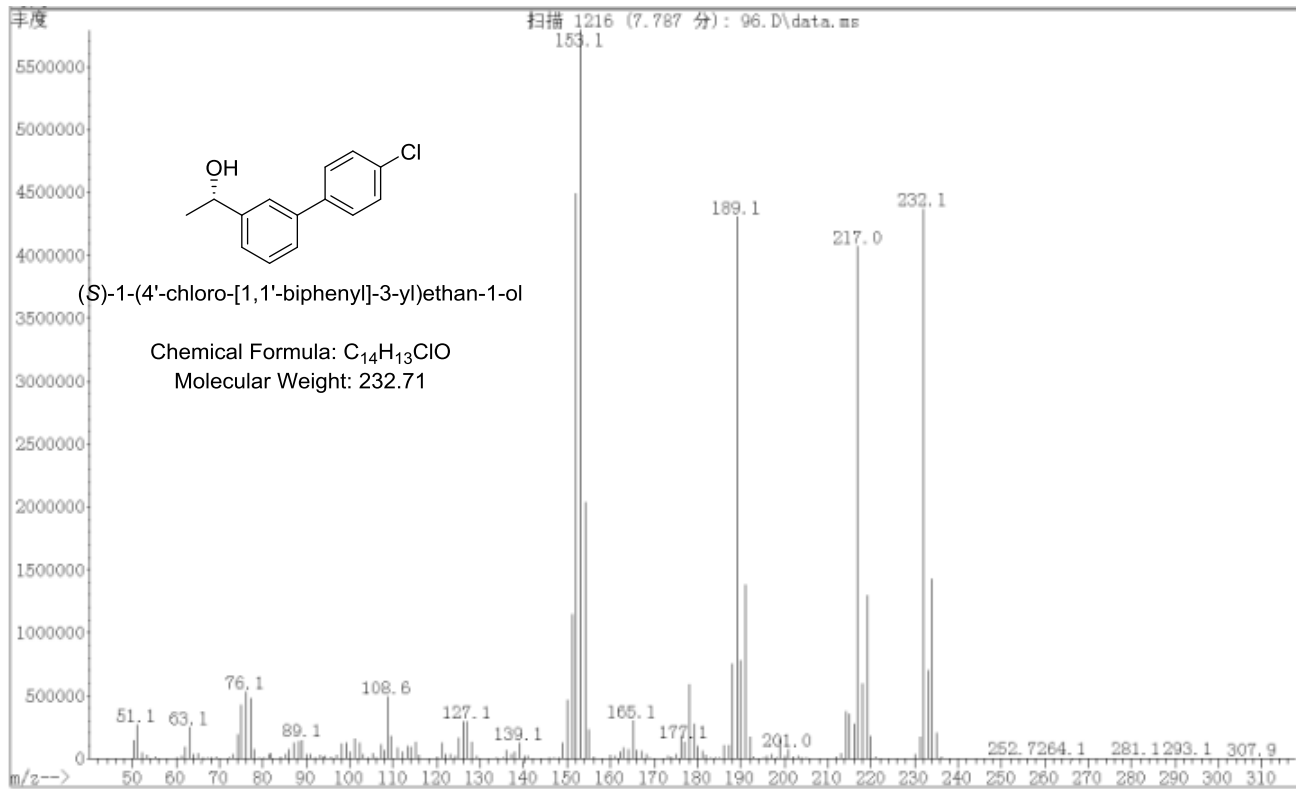
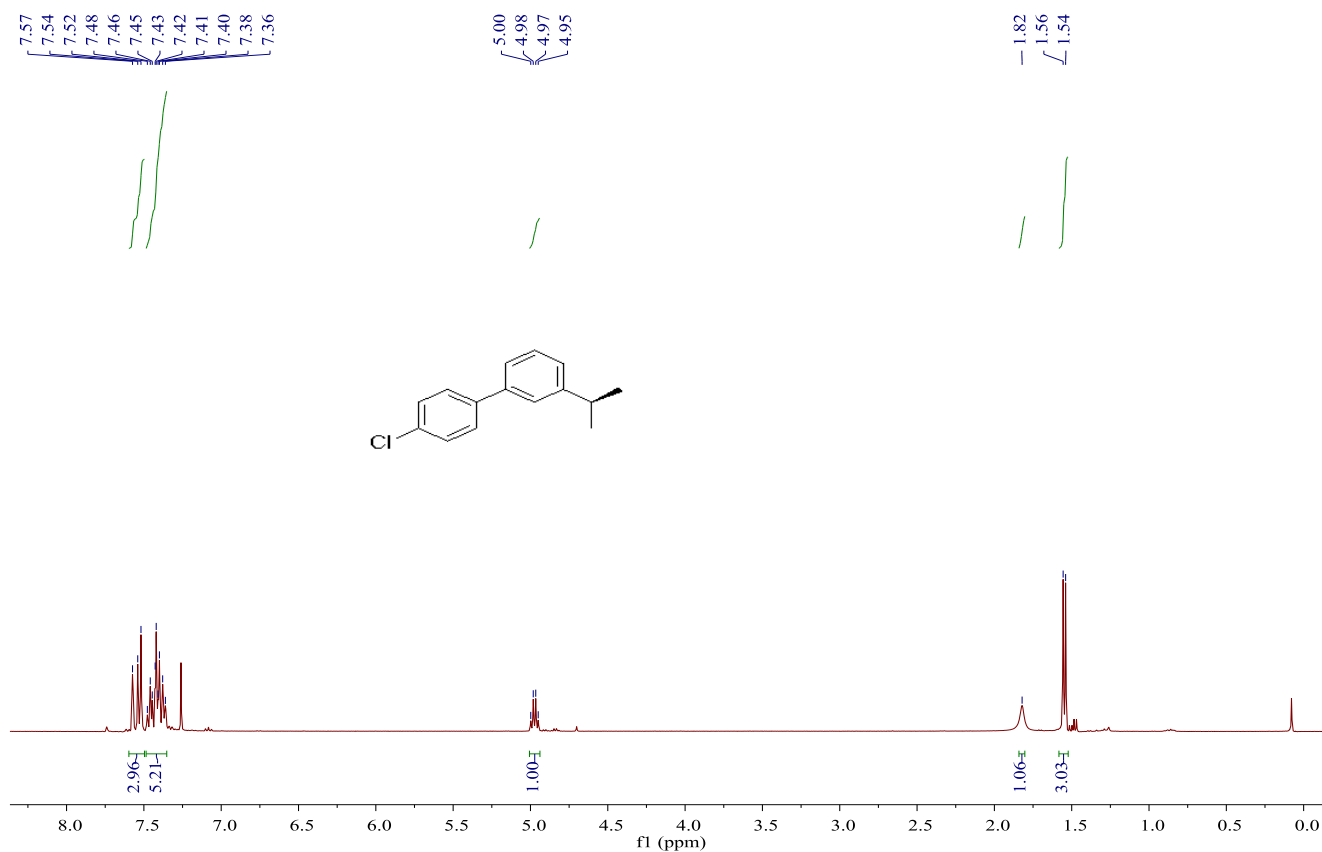
**(S)-1-([1,1'-biphenyl]-3-yl)ethan-1-ol (8k).**



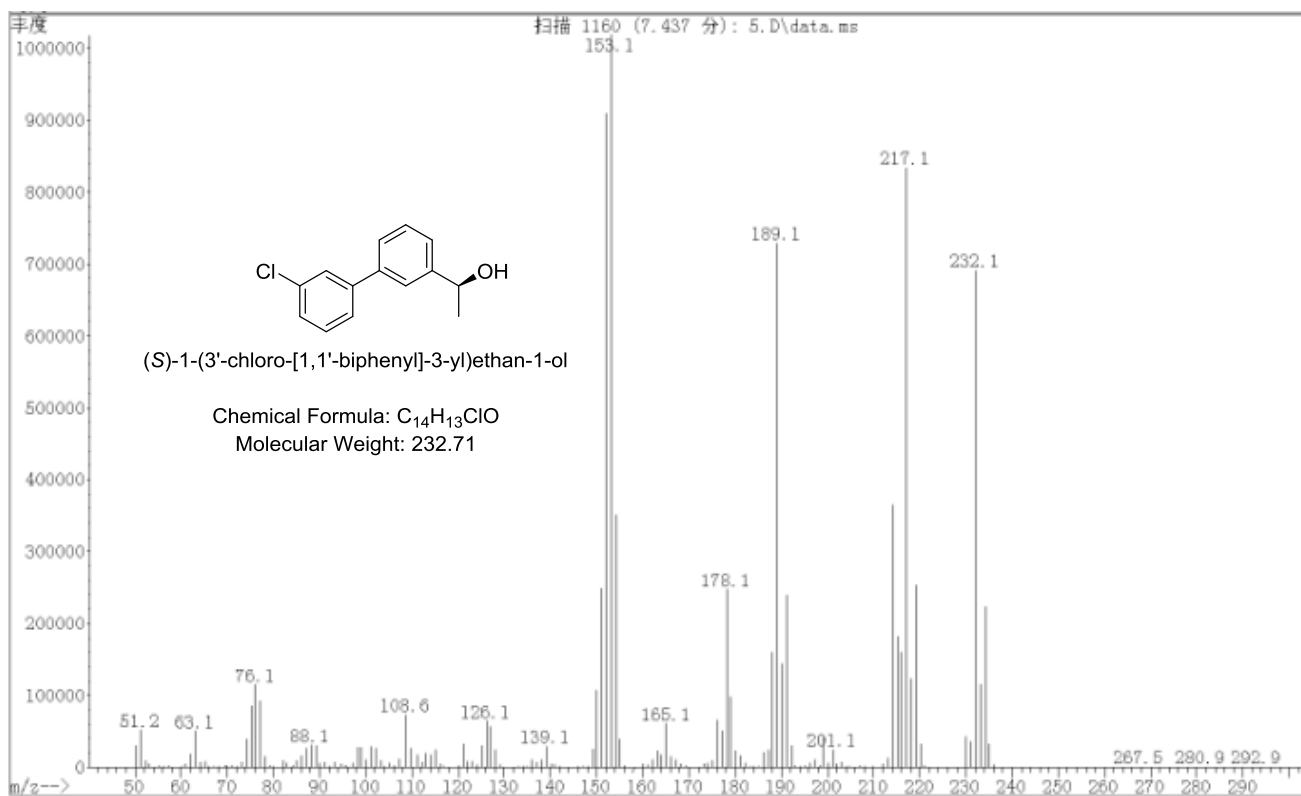
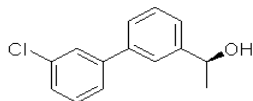
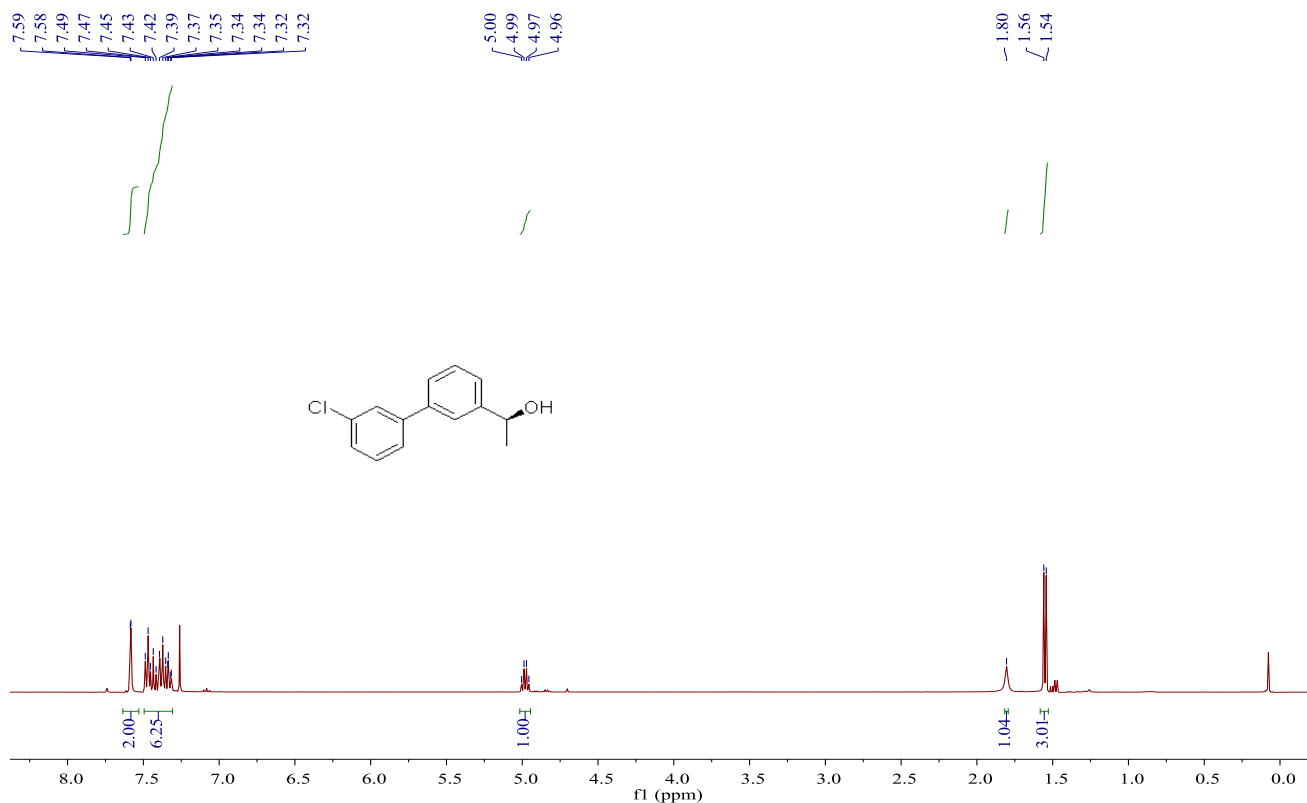
**(S)-1-(4'-fluoro-[1,1'-biphenyl]-3-yl)ethan-1-ol (8l).**



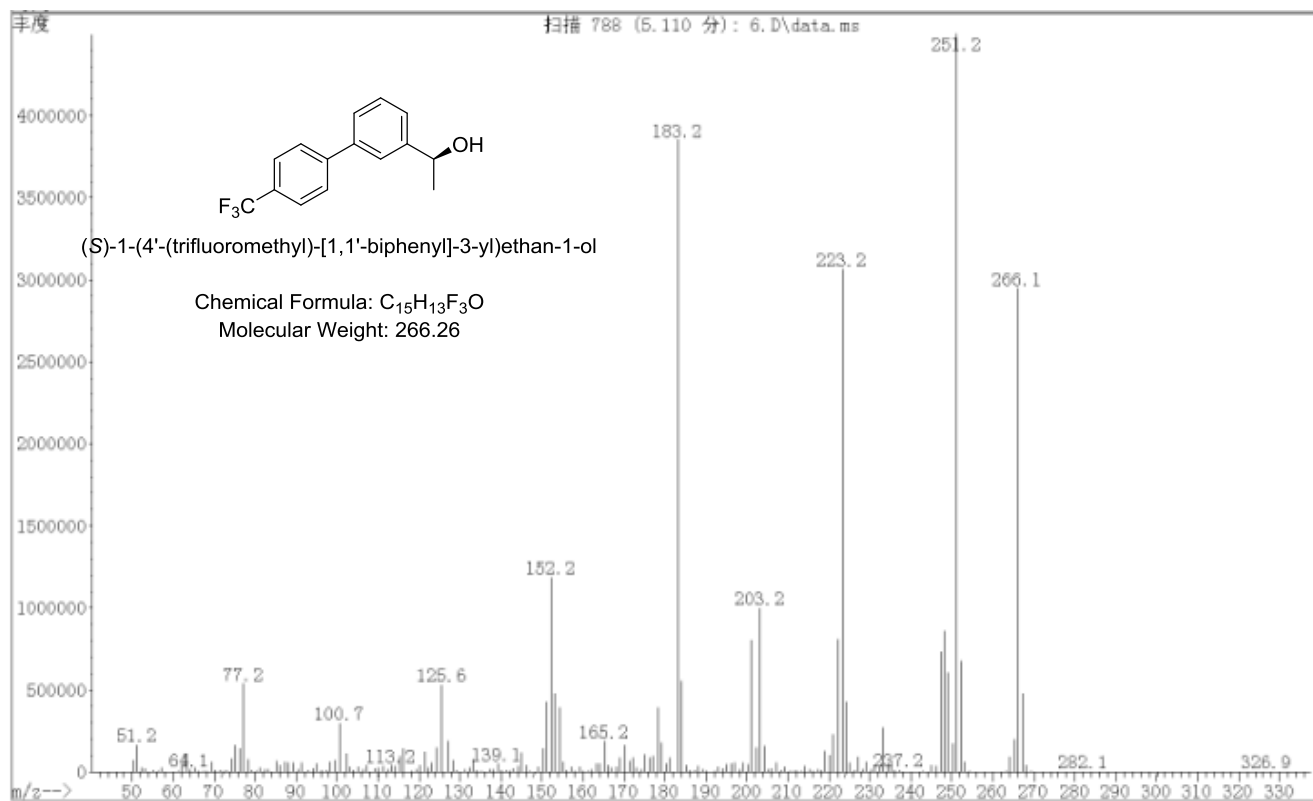
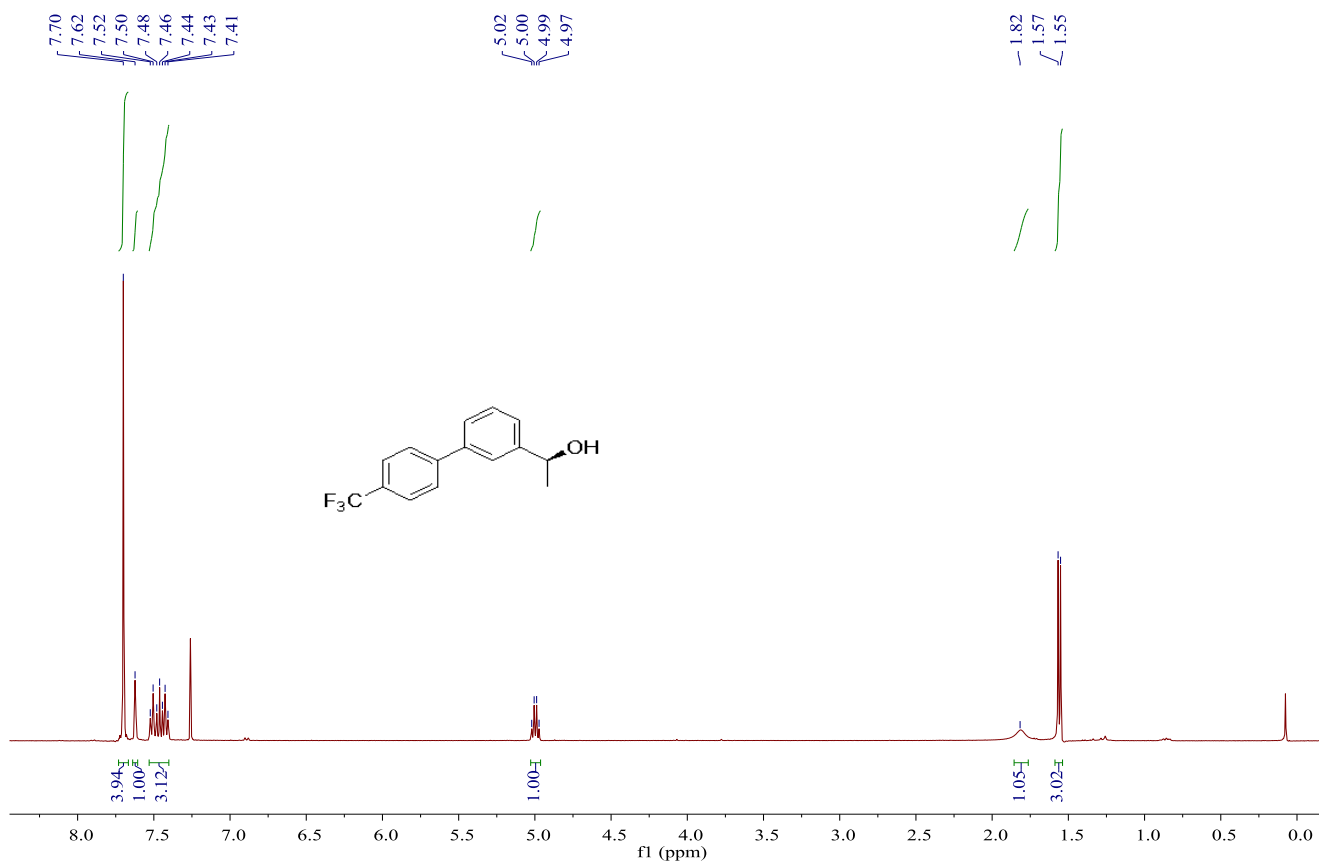
**(S)-1-(4'-chloro-[1,1'-biphenyl]-3-yl)ethan-1-ol (8m).**



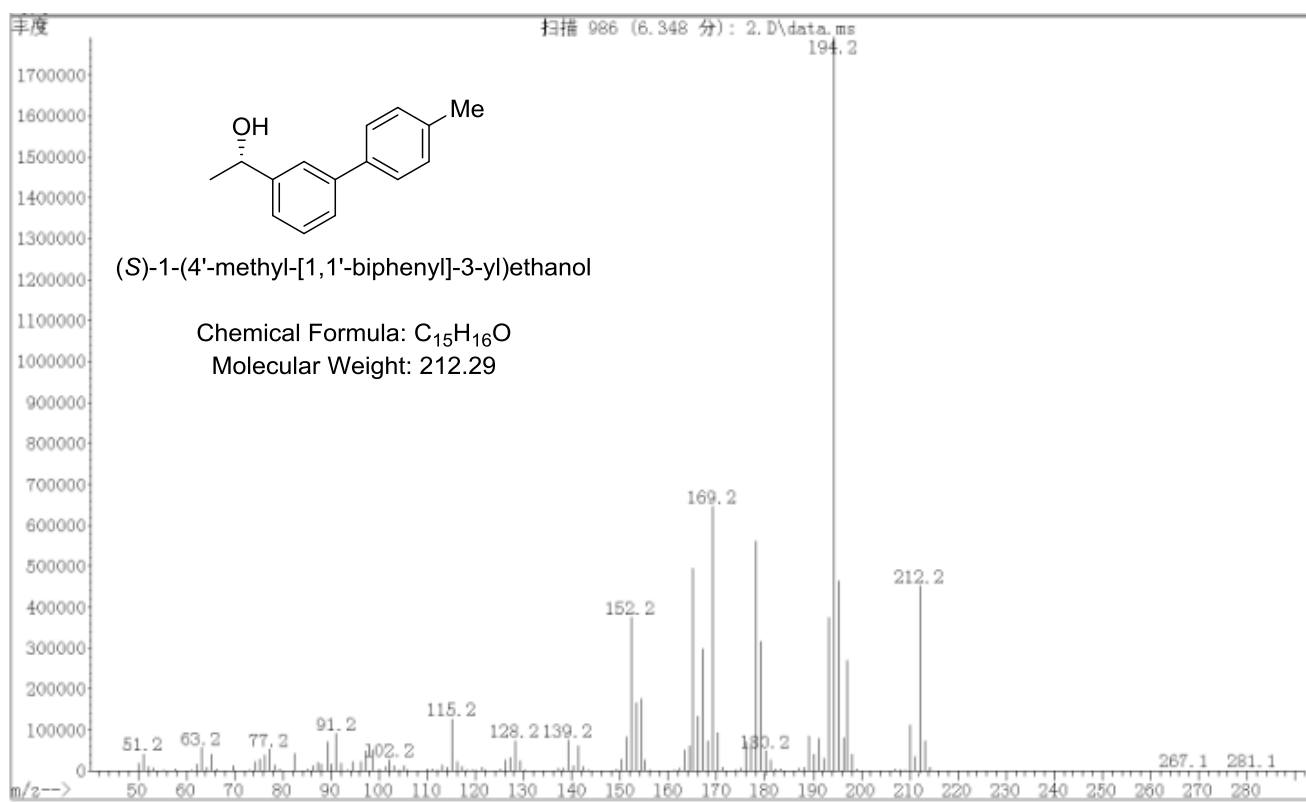
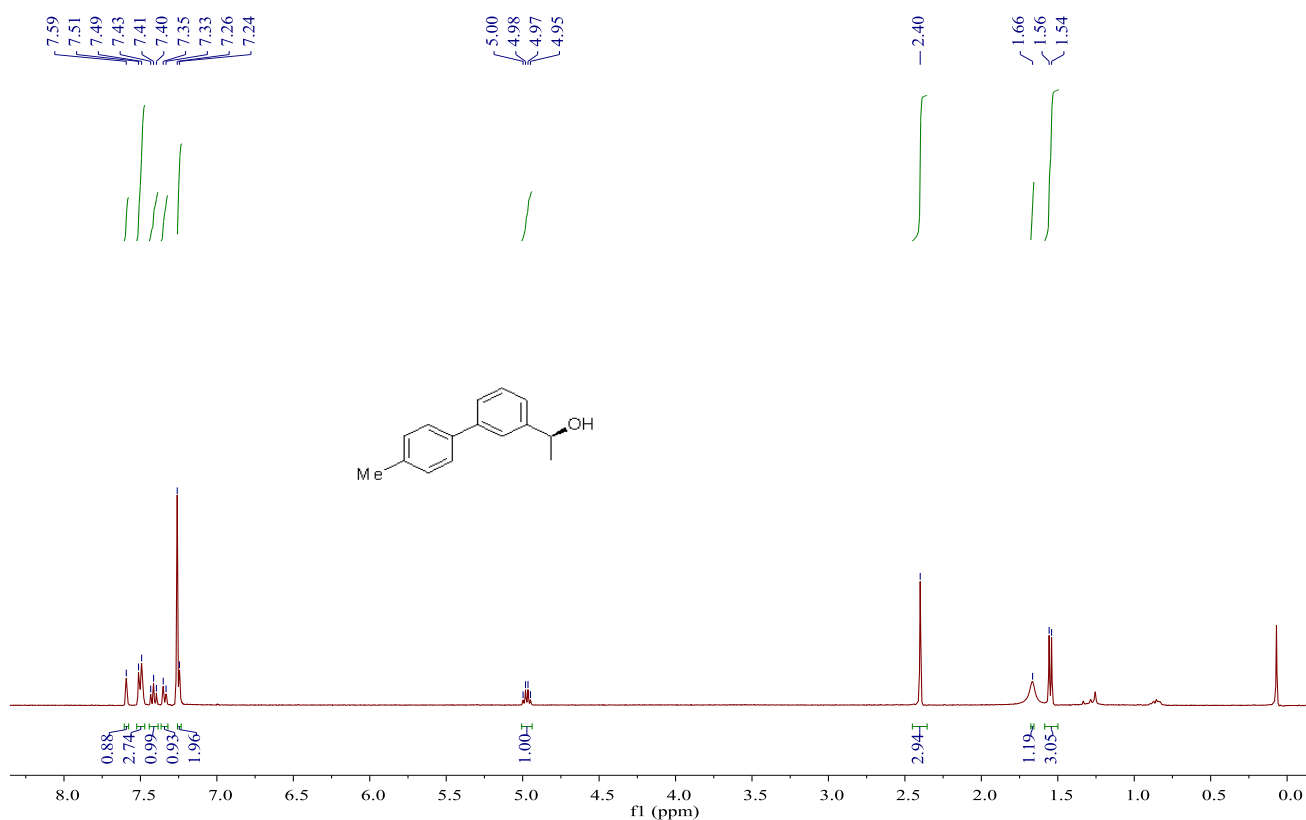
**(S)-1-(3'-chloro-[1,1'-biphenyl]-3-yl)ethan-1-ol (8n).**



**(S)-1-(4'-(trifluoromethyl)-[1,1'-biphenyl]-3-yl)ethan-1-ol (8o).**

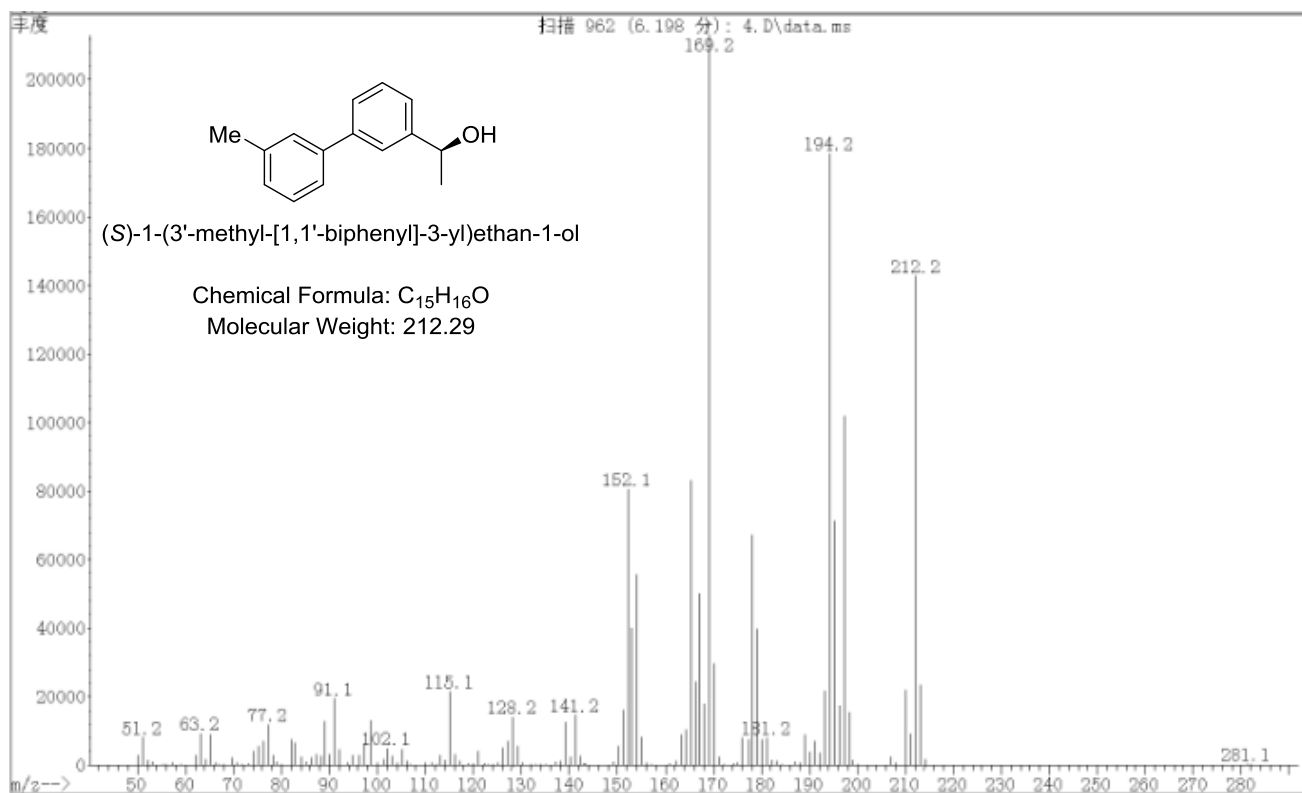
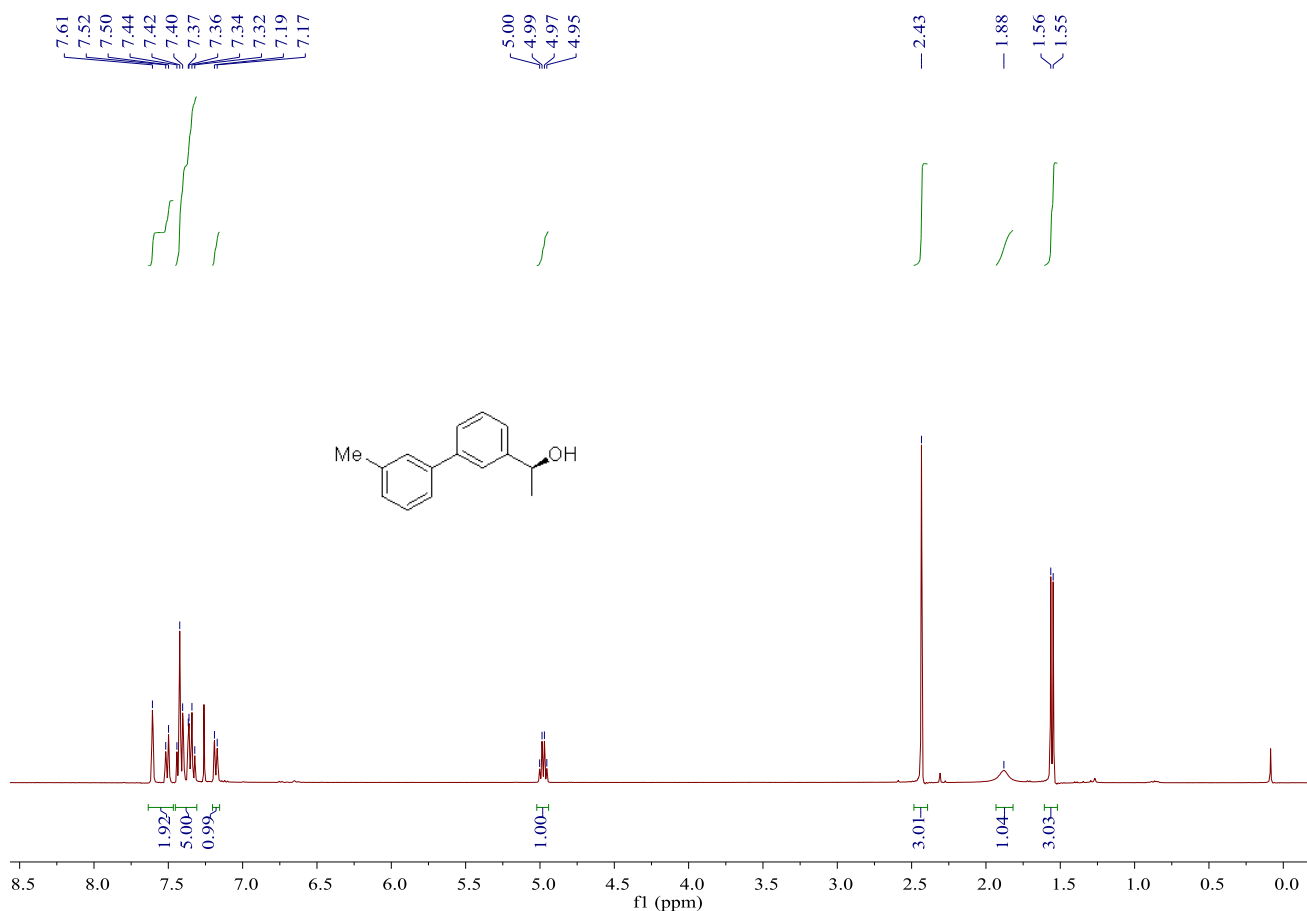


**(S)-1-(4'-methyl-[1,1'-biphenyl]-3-yl)ethan-1-ol (8p).**

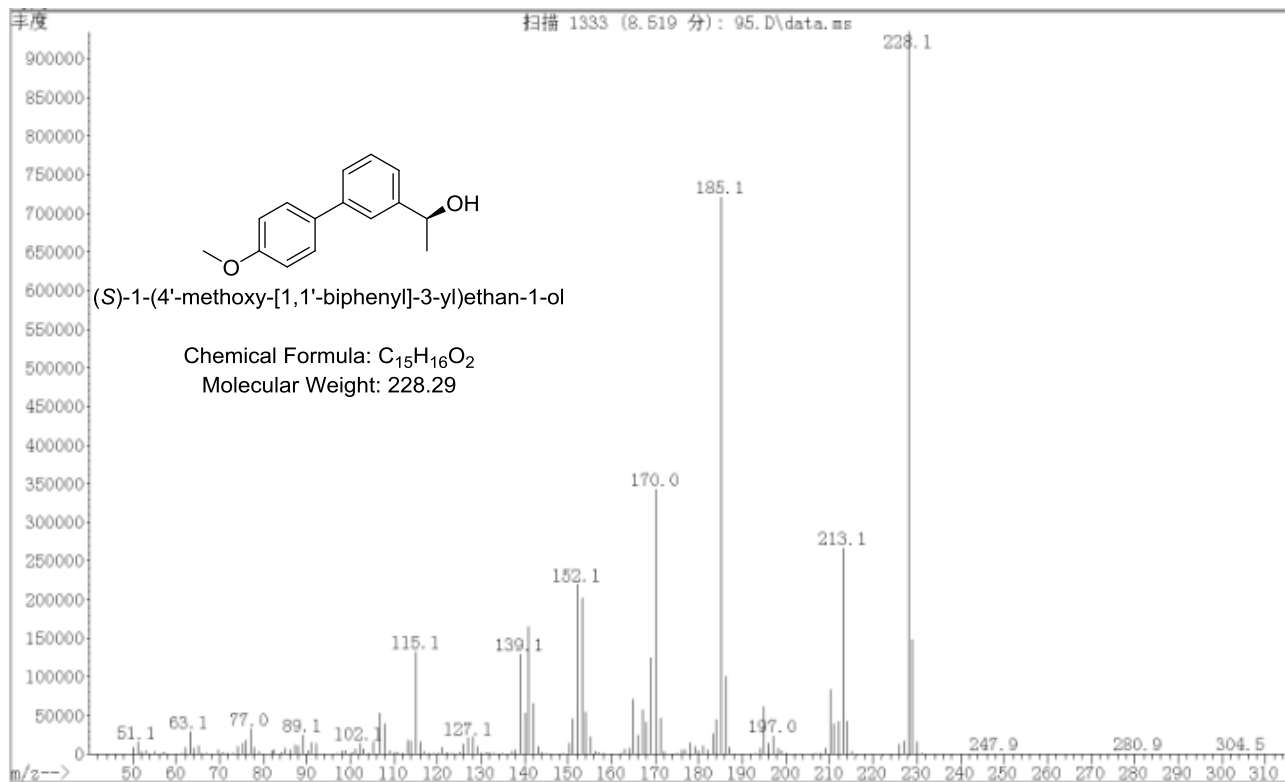
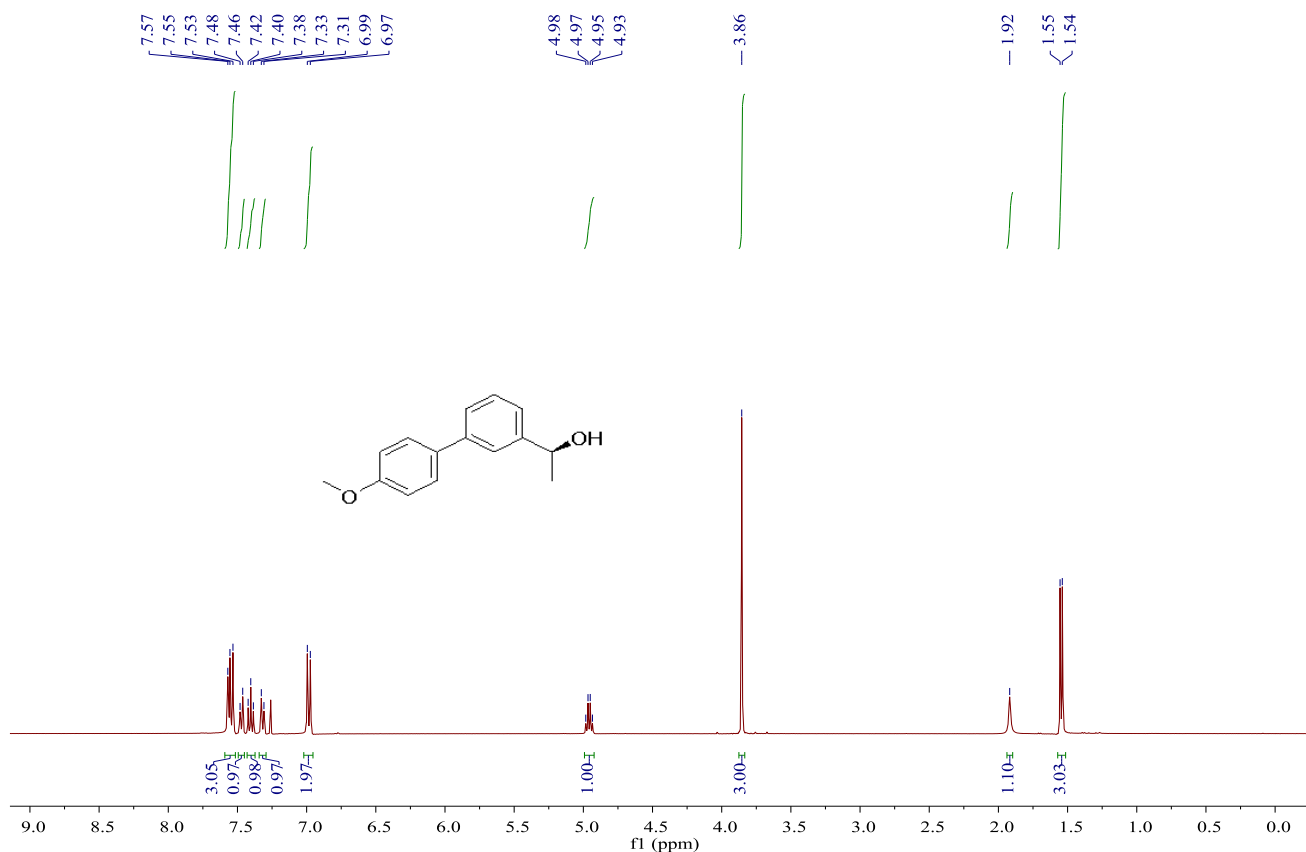




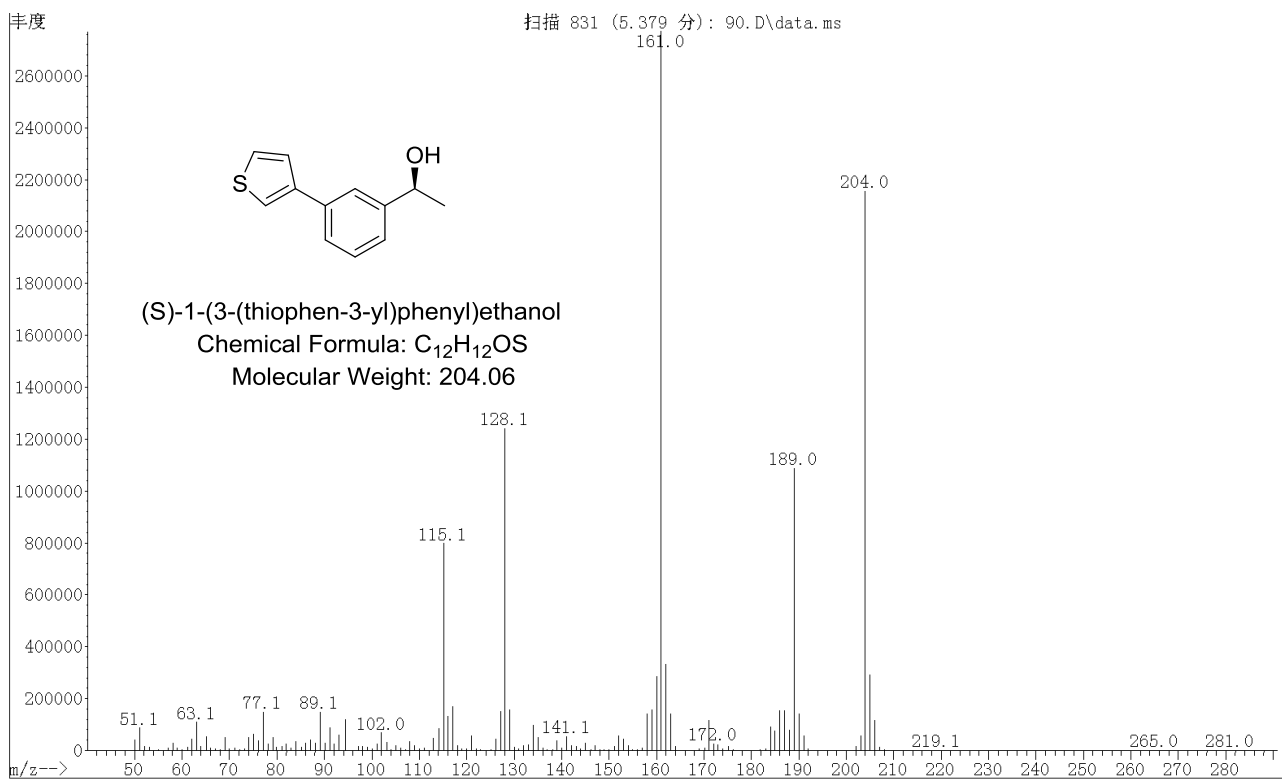
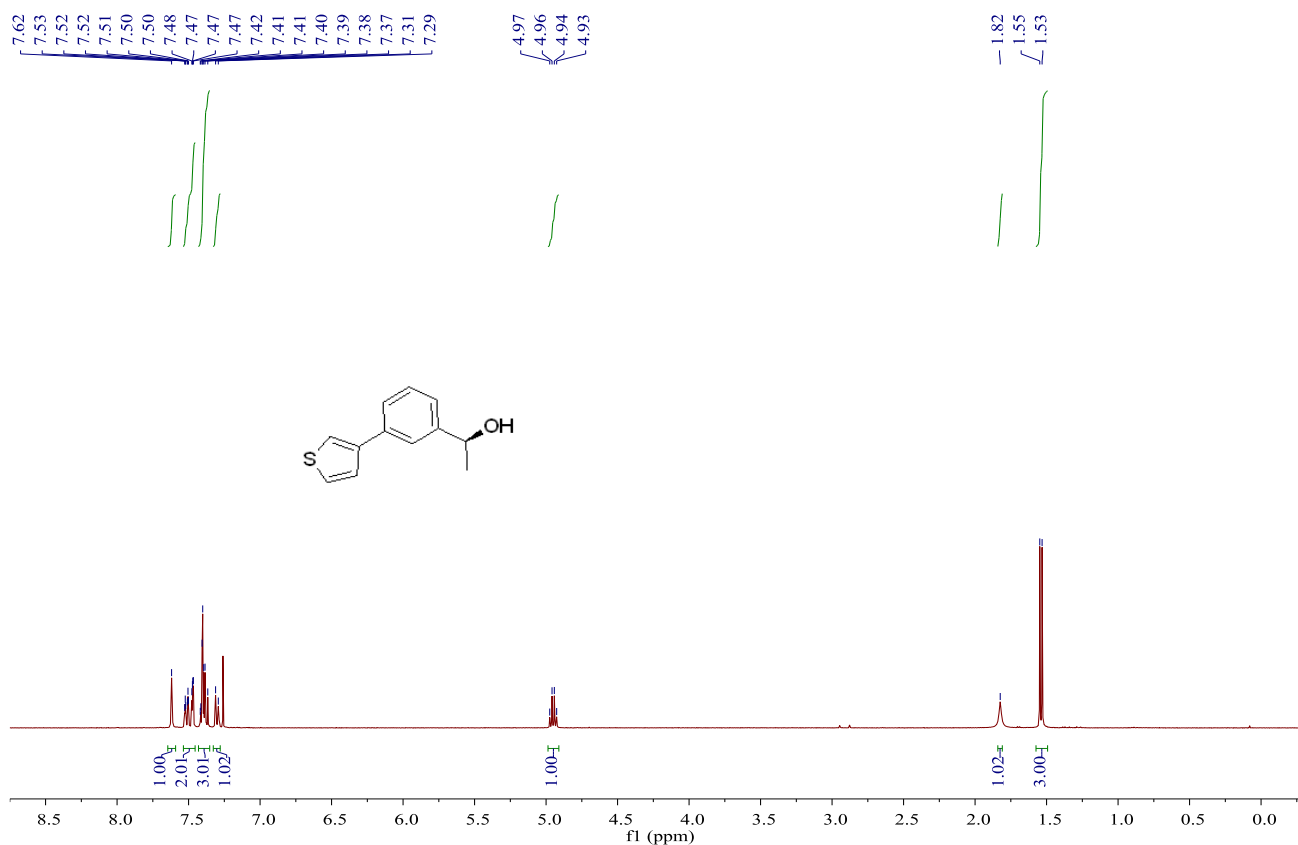
**(S)-1-(3'-methyl-[1,1'-biphenyl]-3-yl)ethan-1-ol (8q).**



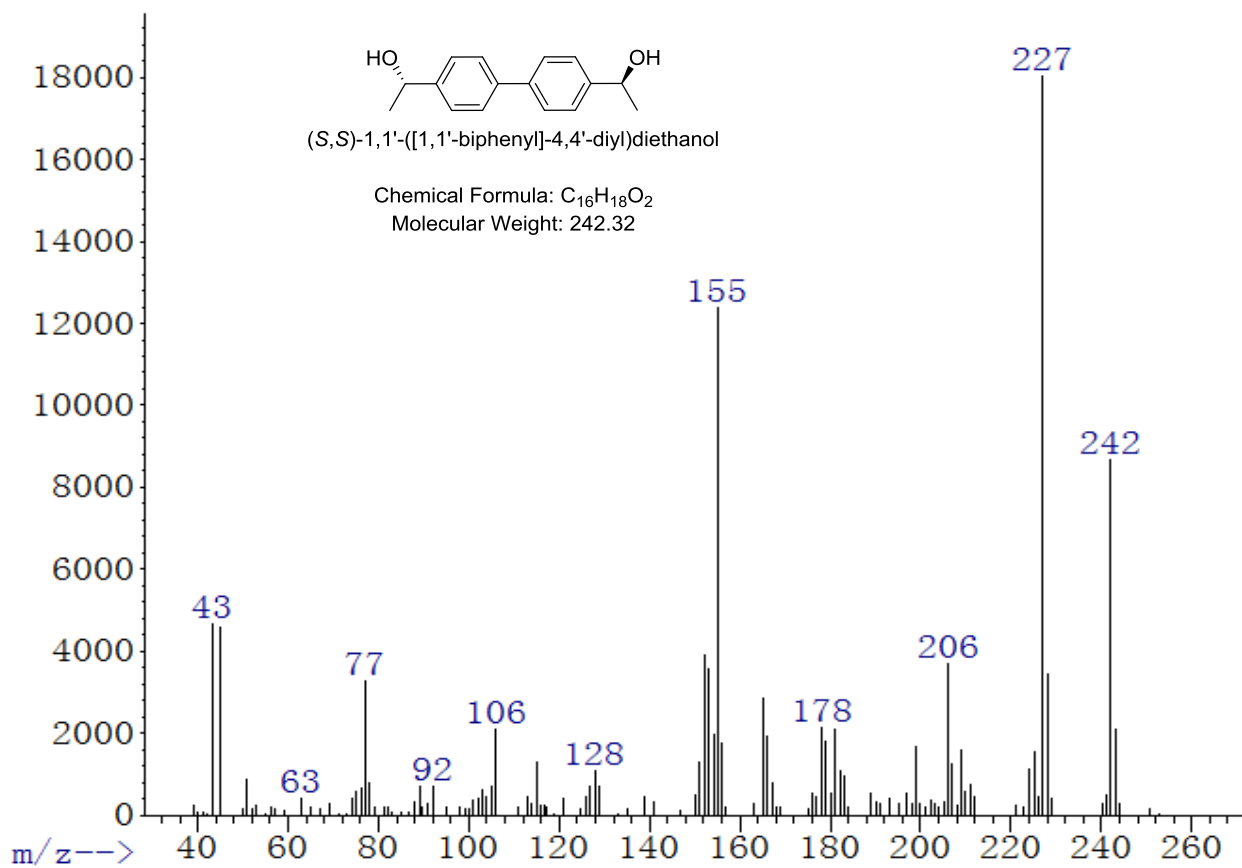
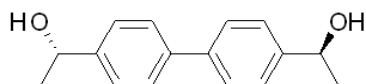
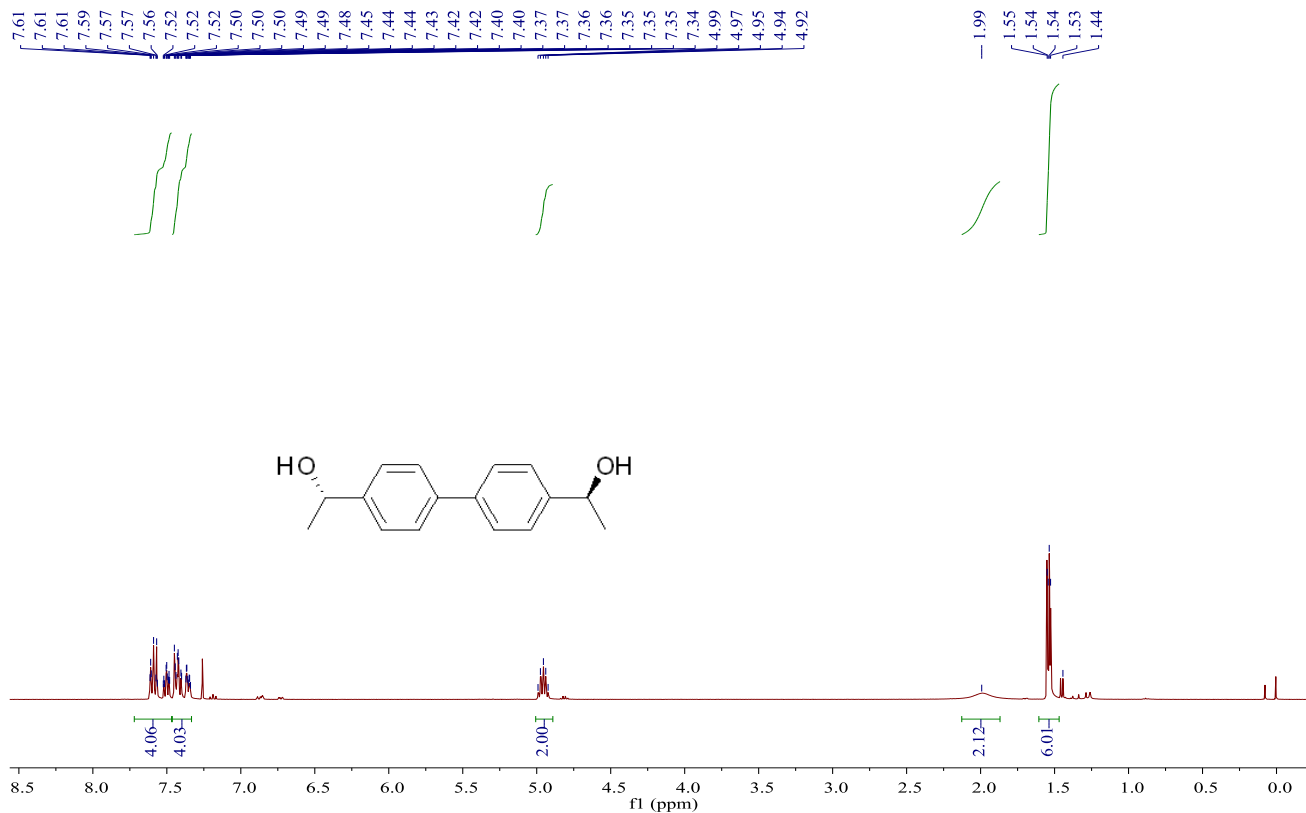
**(S)-1-(4'-methoxy-[1,1'-biphenyl]-3-yl)ethan-1-ol (8r).**



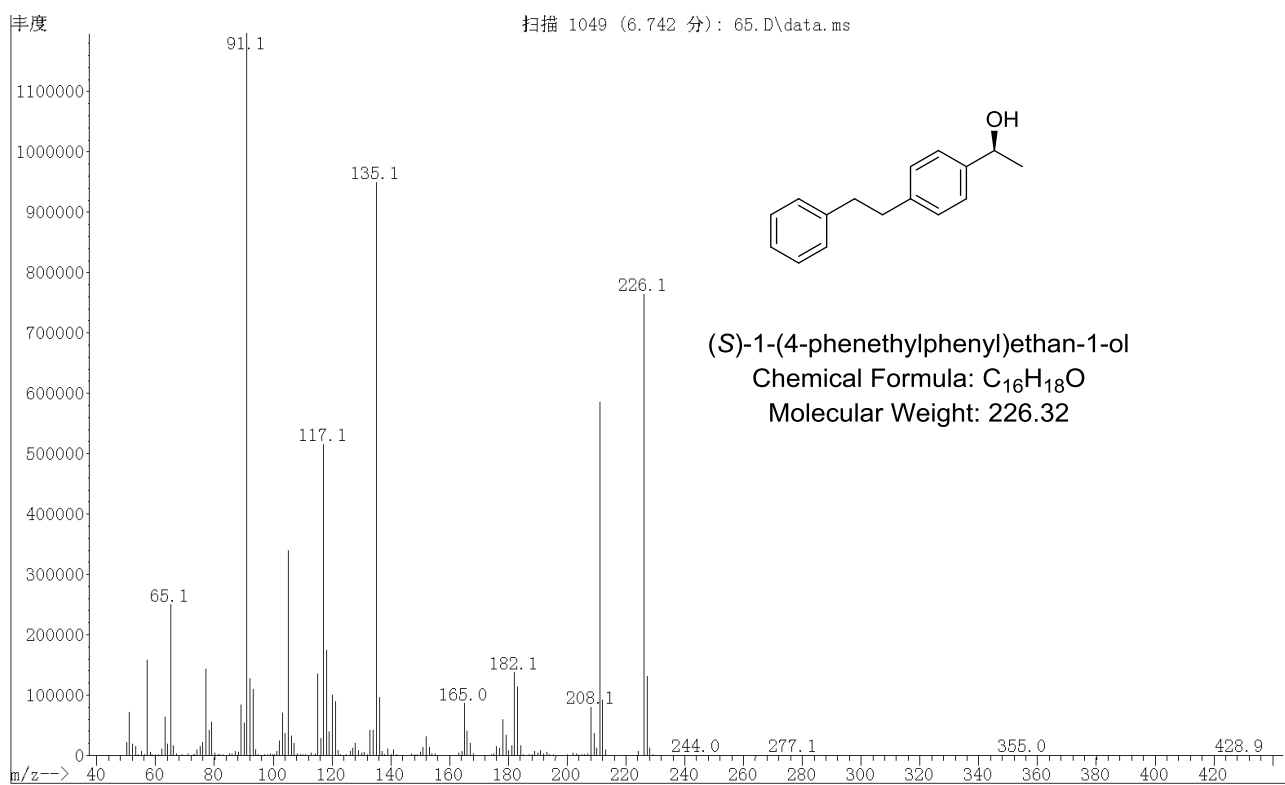
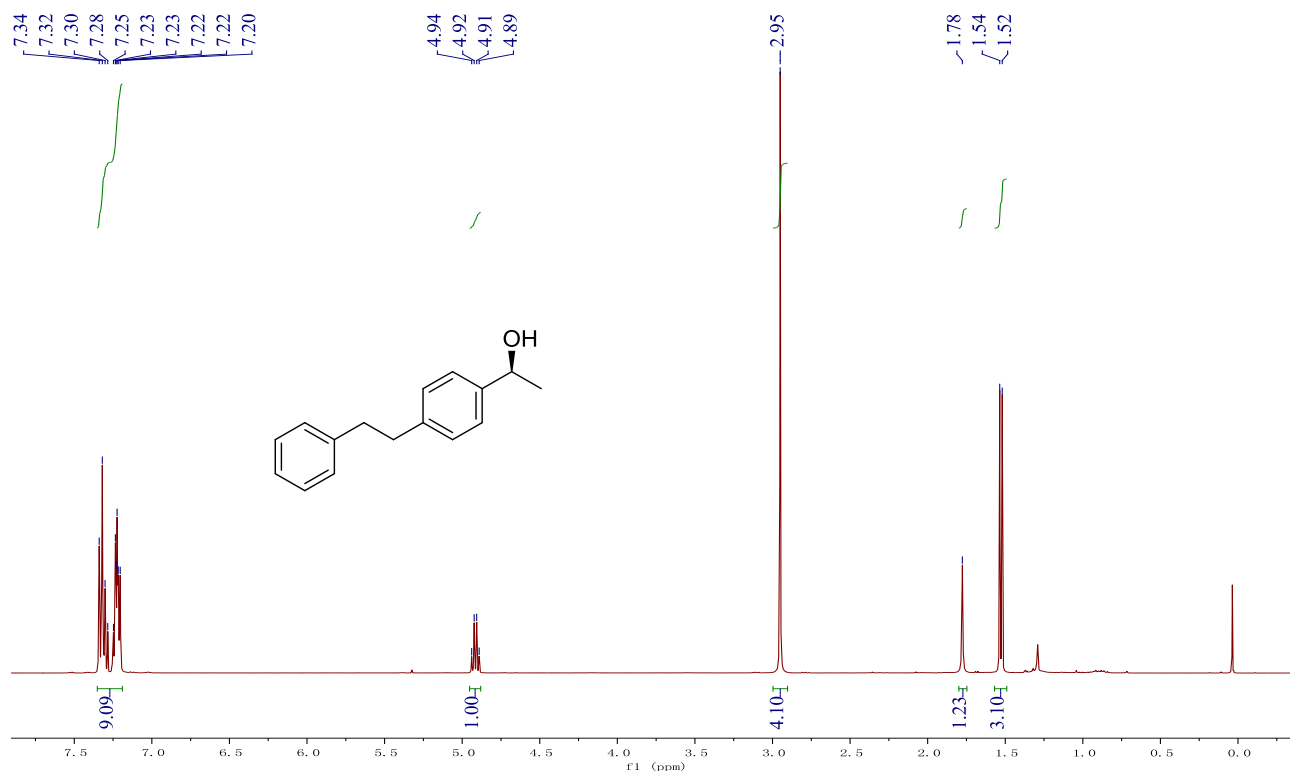
**(S)-1-(3-(thiophen-3-yl)phenyl)ethan-1-ol (8s).**



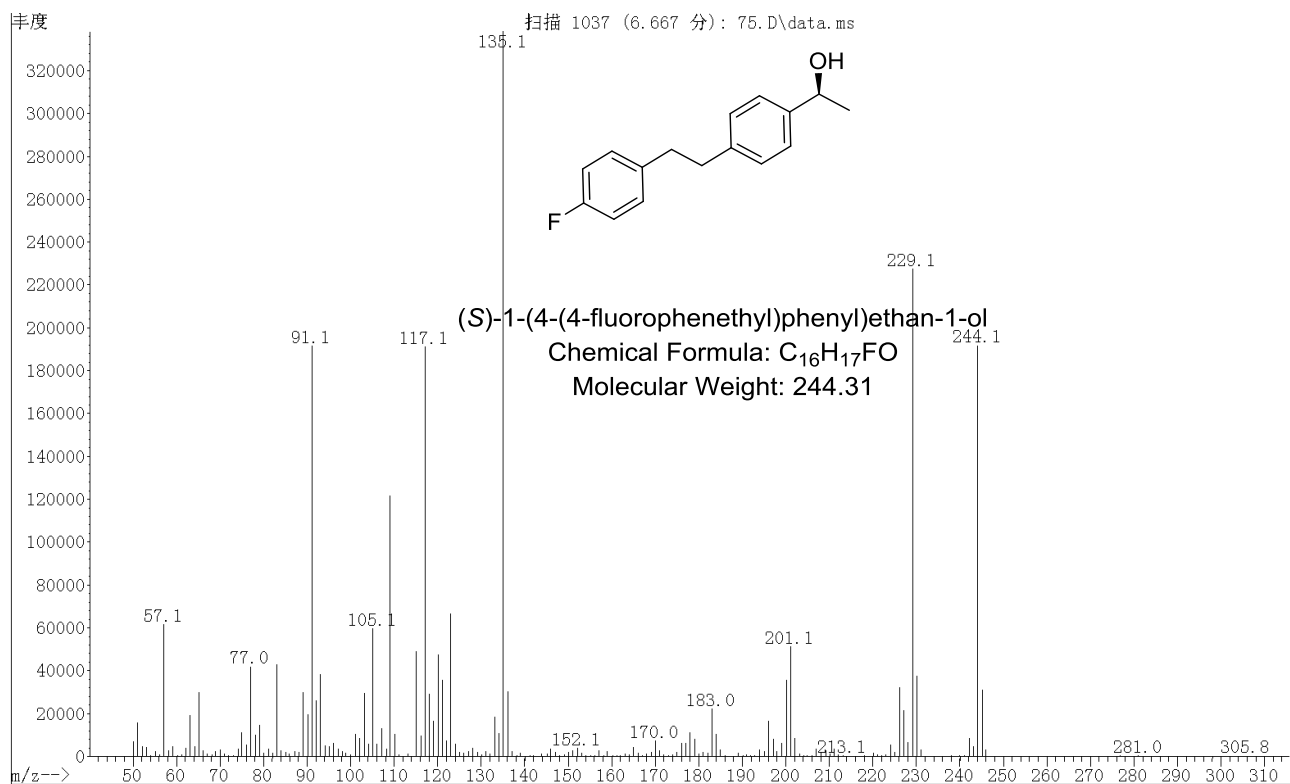
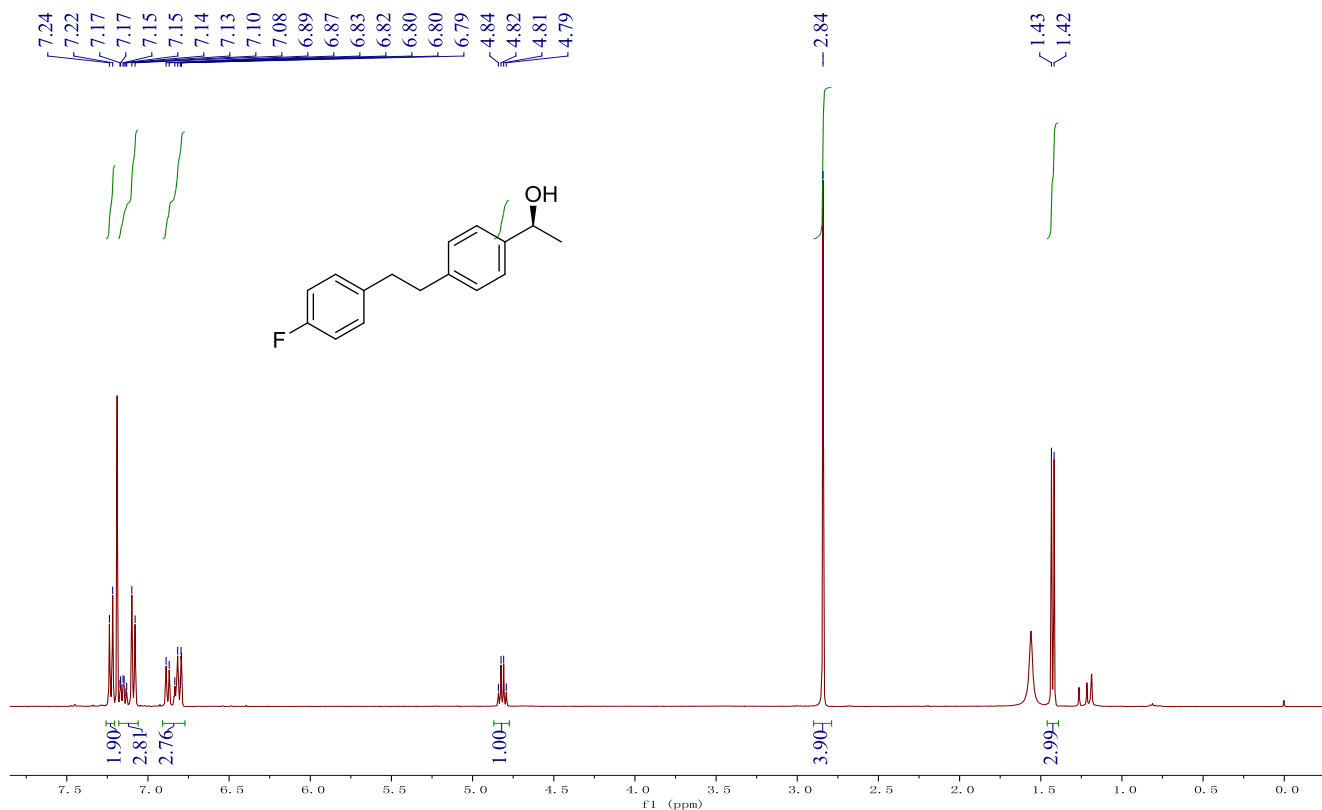
**(S,S)-1,1'-([1,1'-biphenyl]-4,4'-diyl)diethanol (8t).**



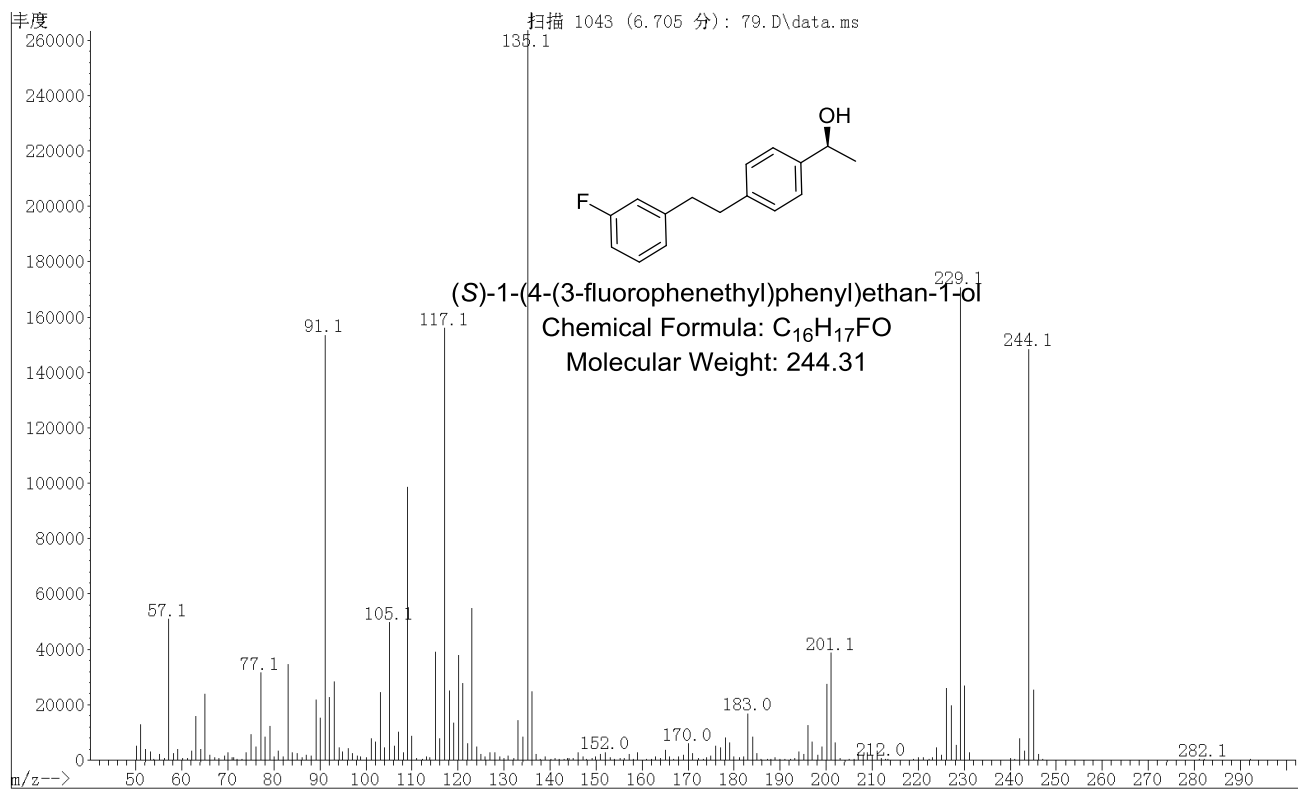
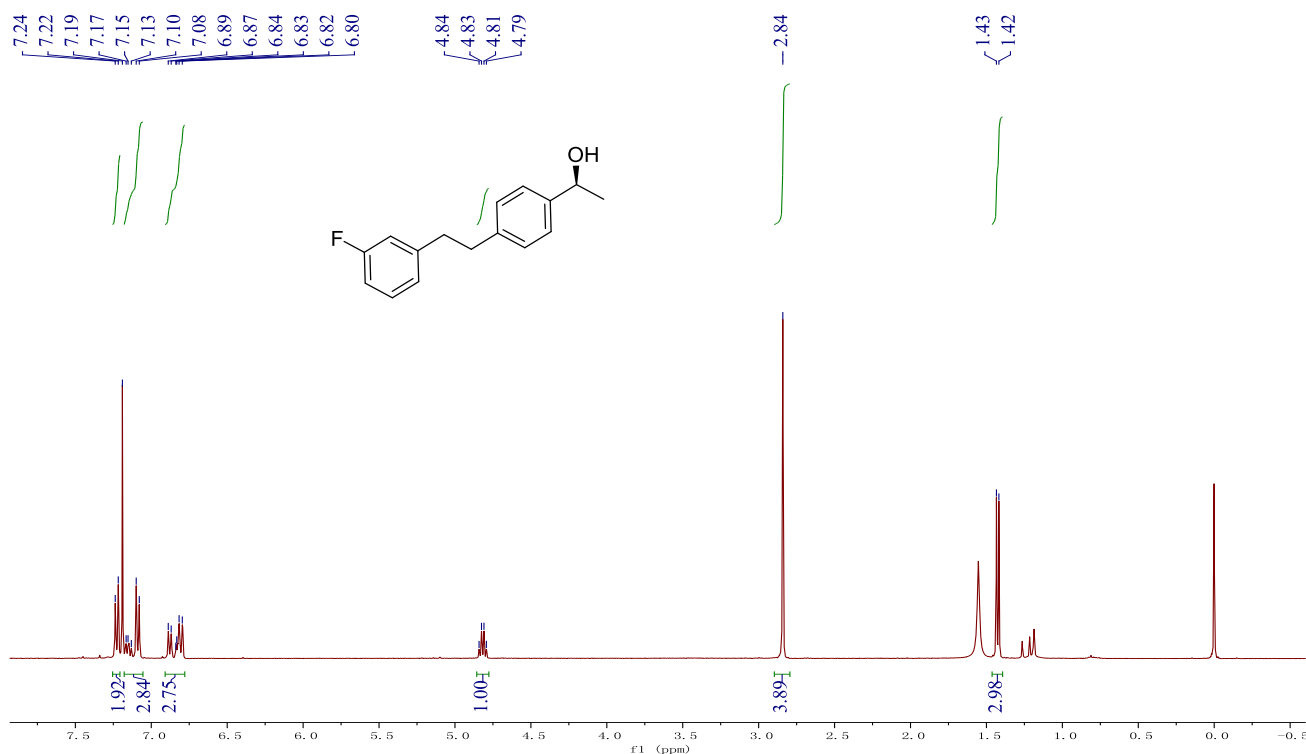
**(S)-1-(4-phenethylphenyl)ethan-1-ol (10a).**



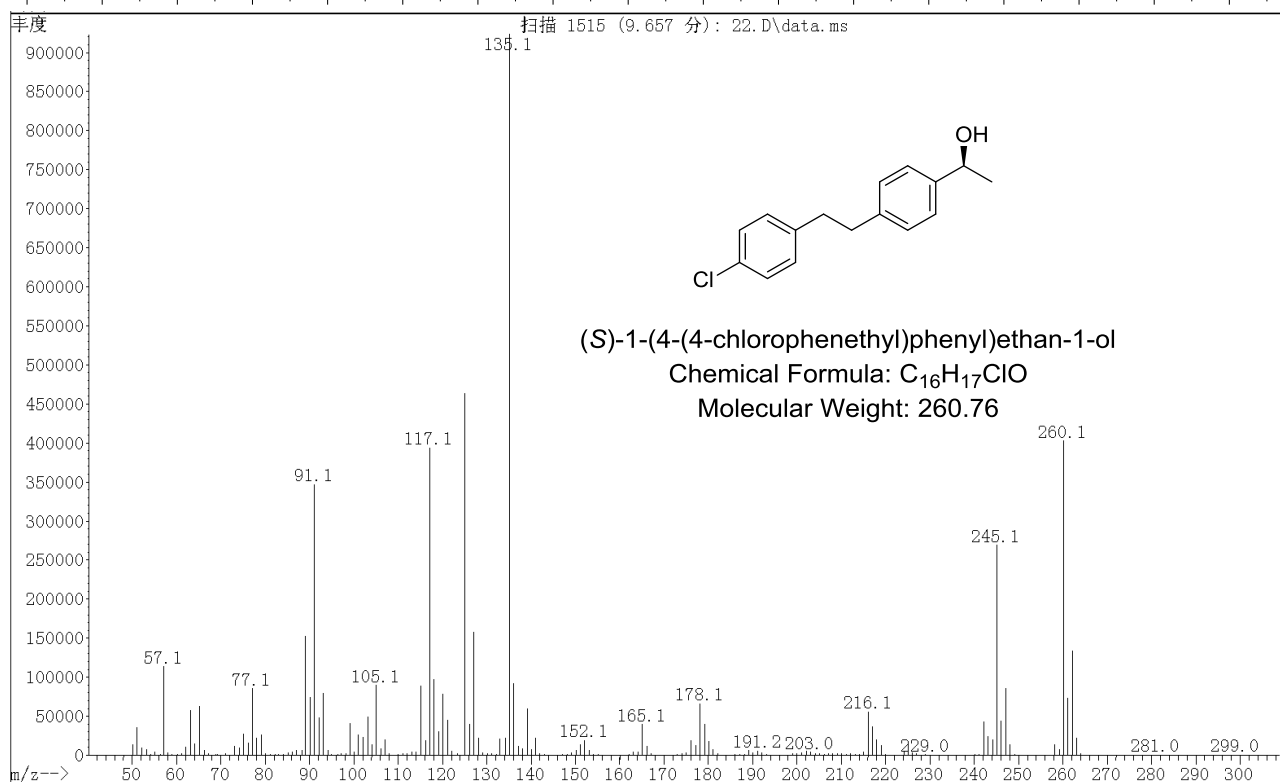
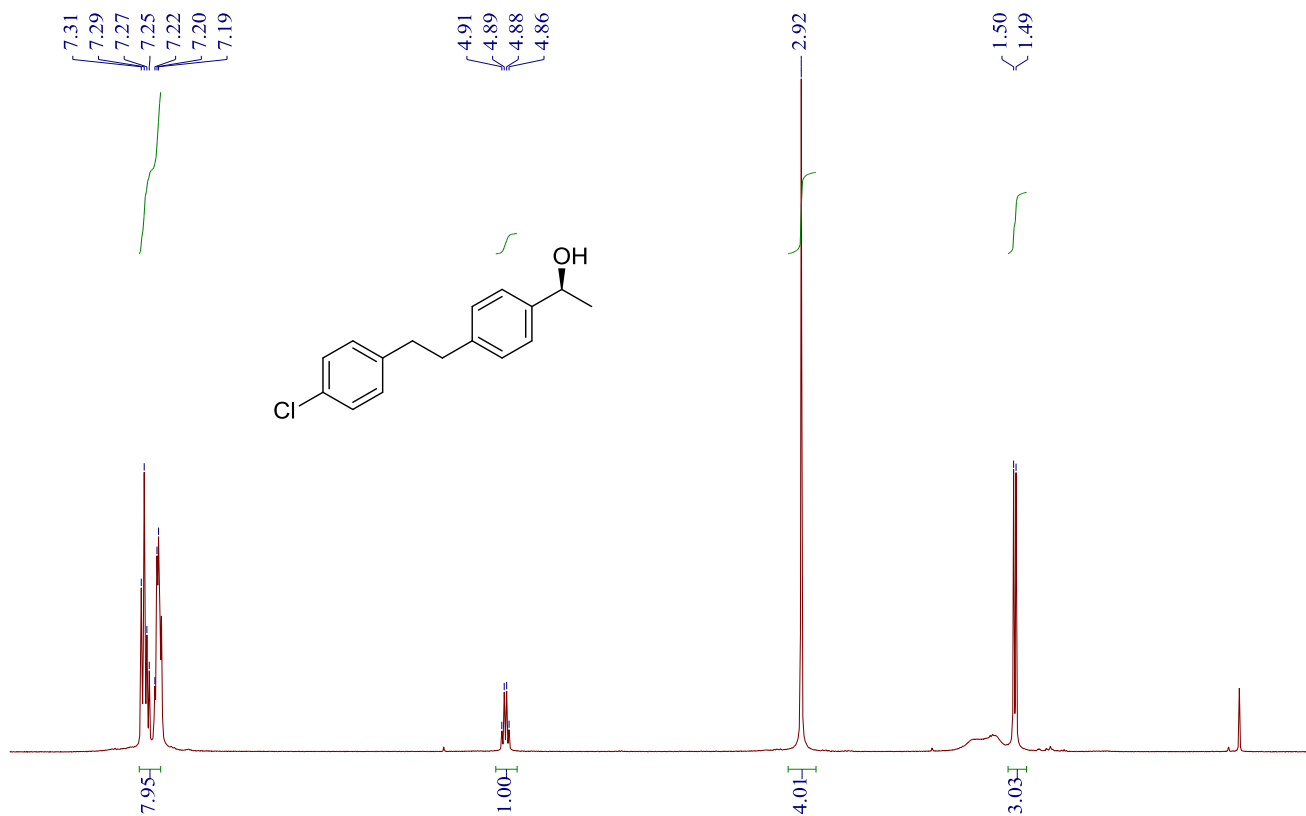
**(S)-1-(4-(4-fluorophenethyl)phenyl)ethan-1-ol (10b).**



**(S)-1-(4-(3-fluorophenethyl)phenyl)ethan-1-ol (10c).**

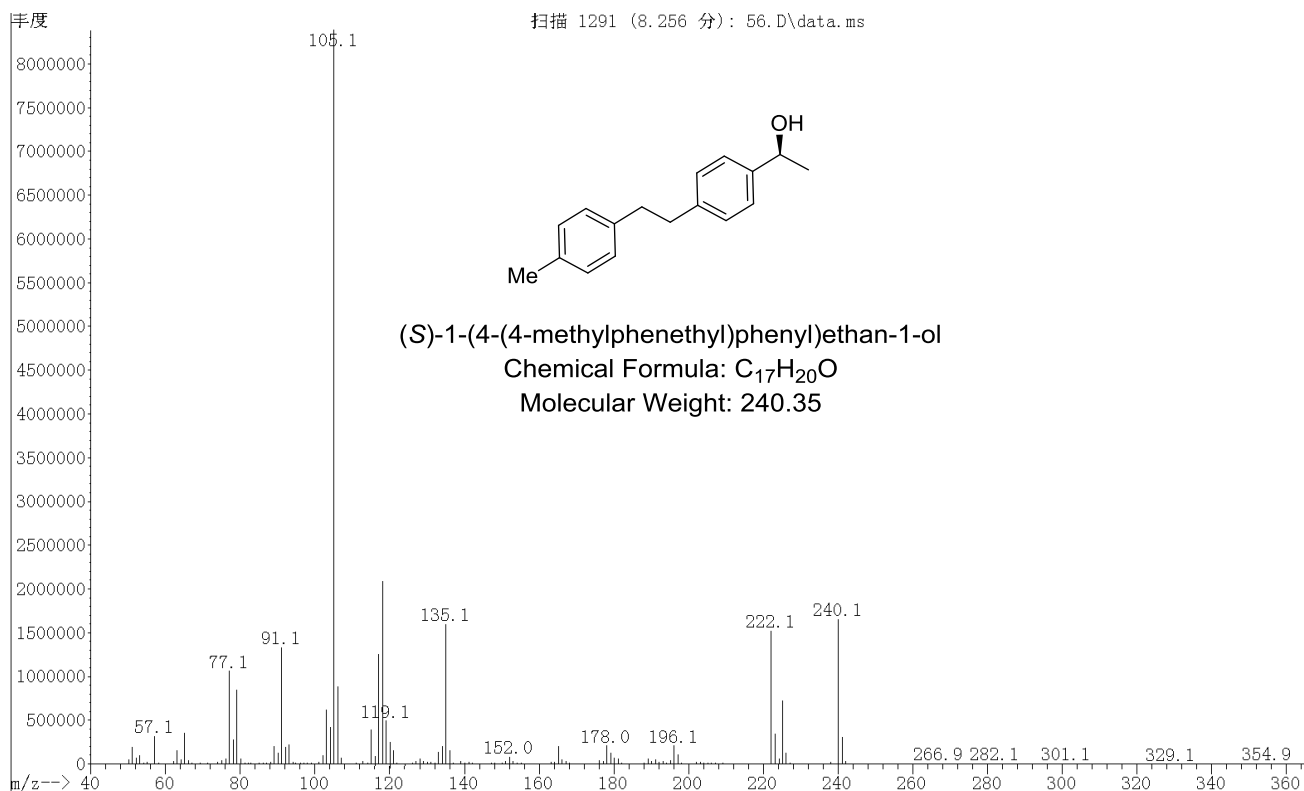
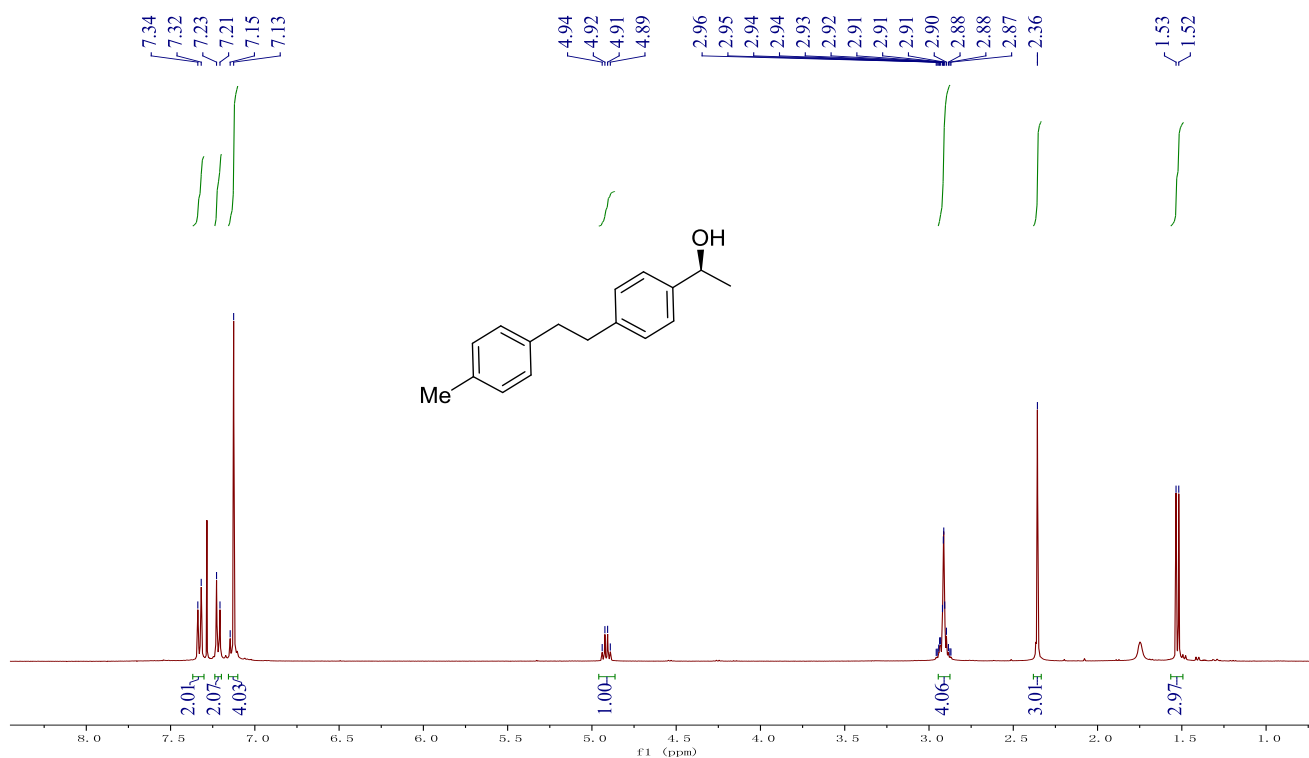


**(S)-1-(4-(4-chlorophenethyl)phenyl)ethan-1-ol (10d).**

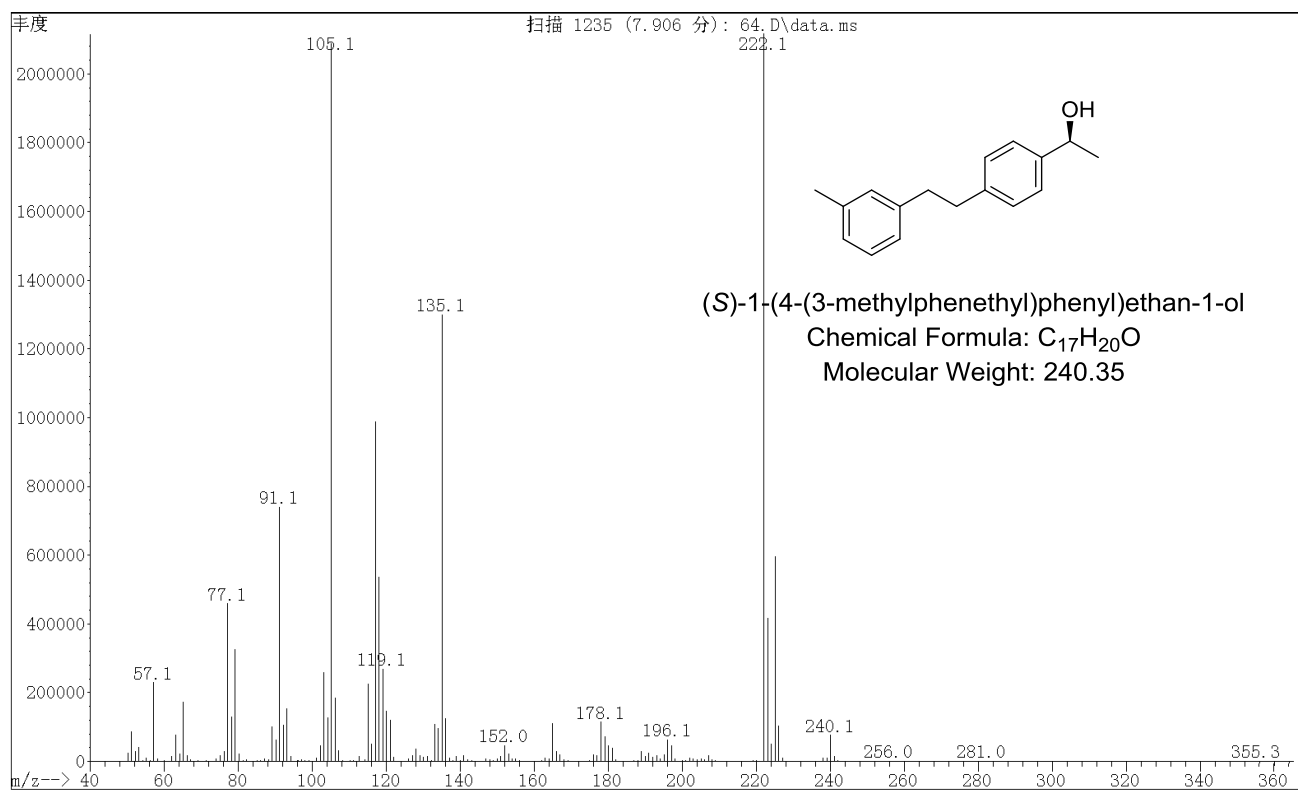
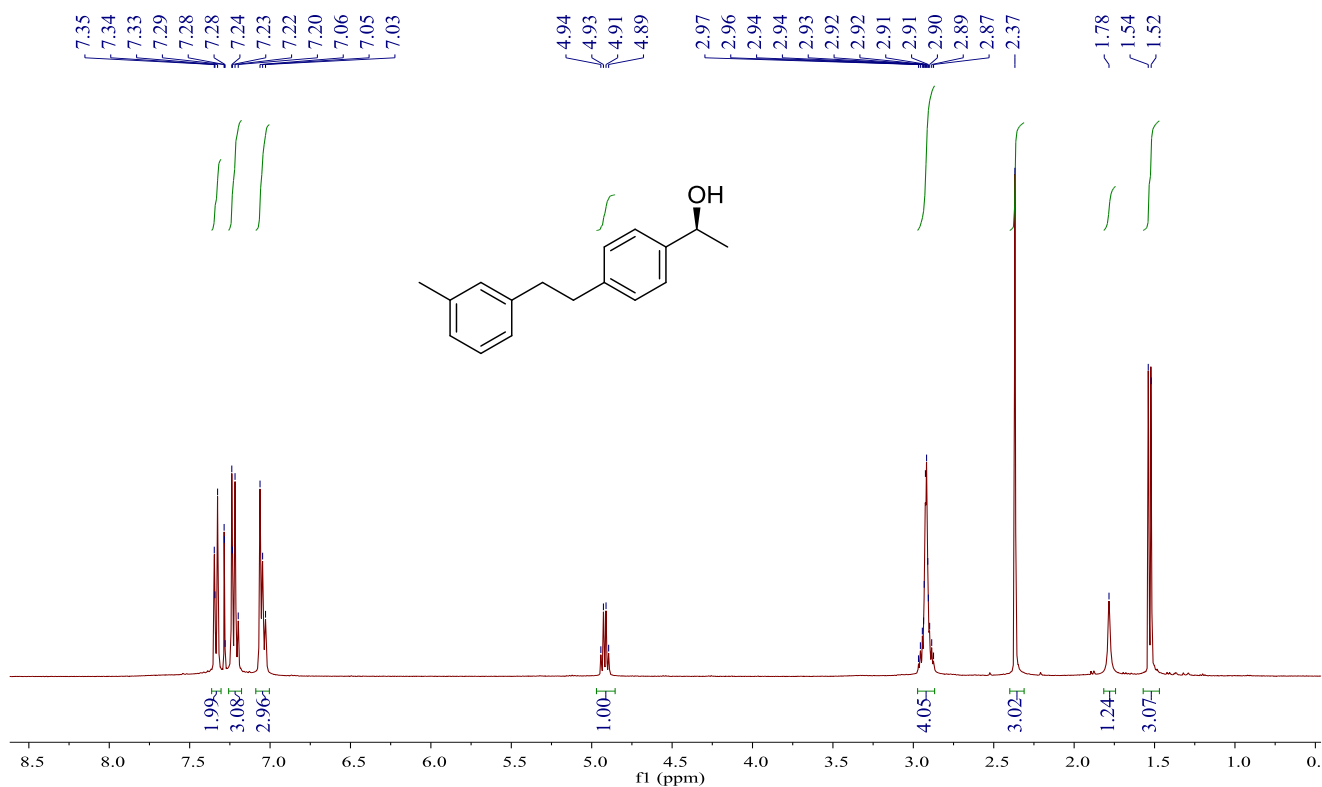




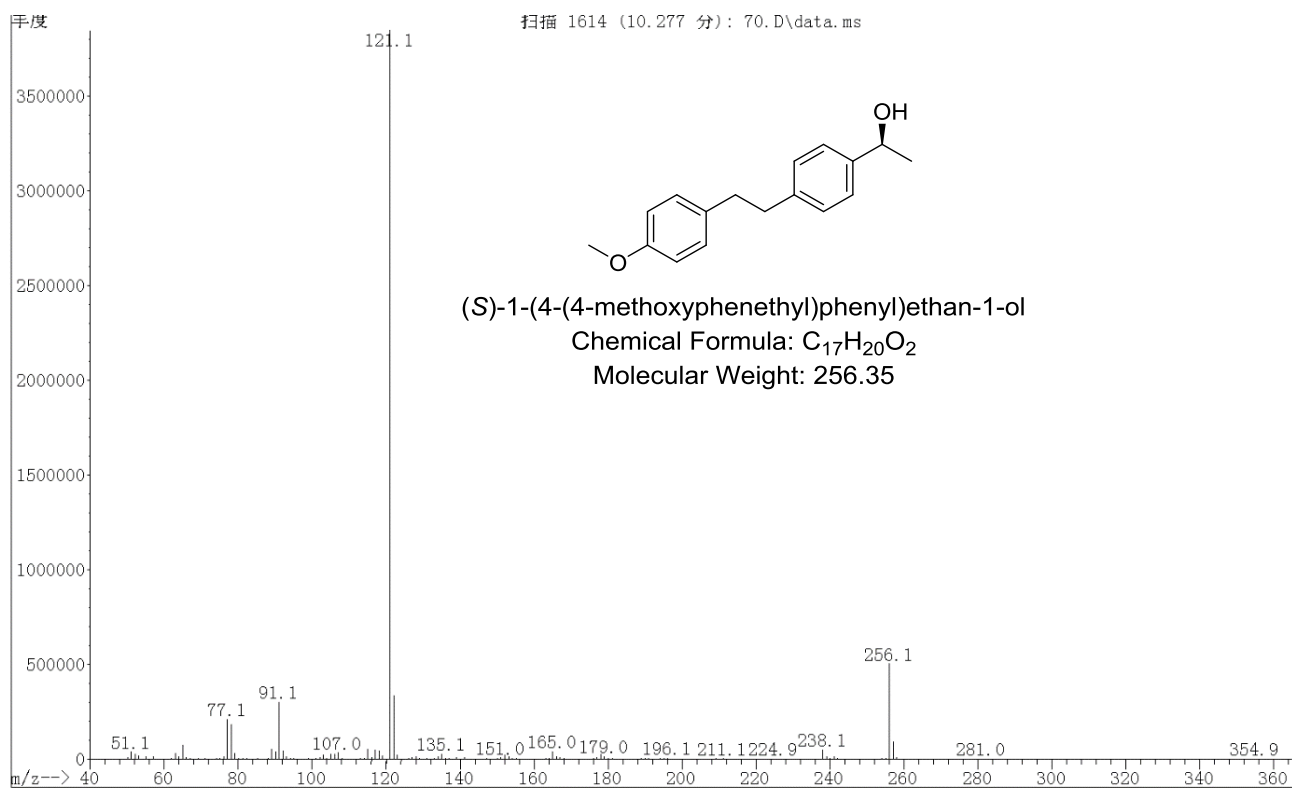
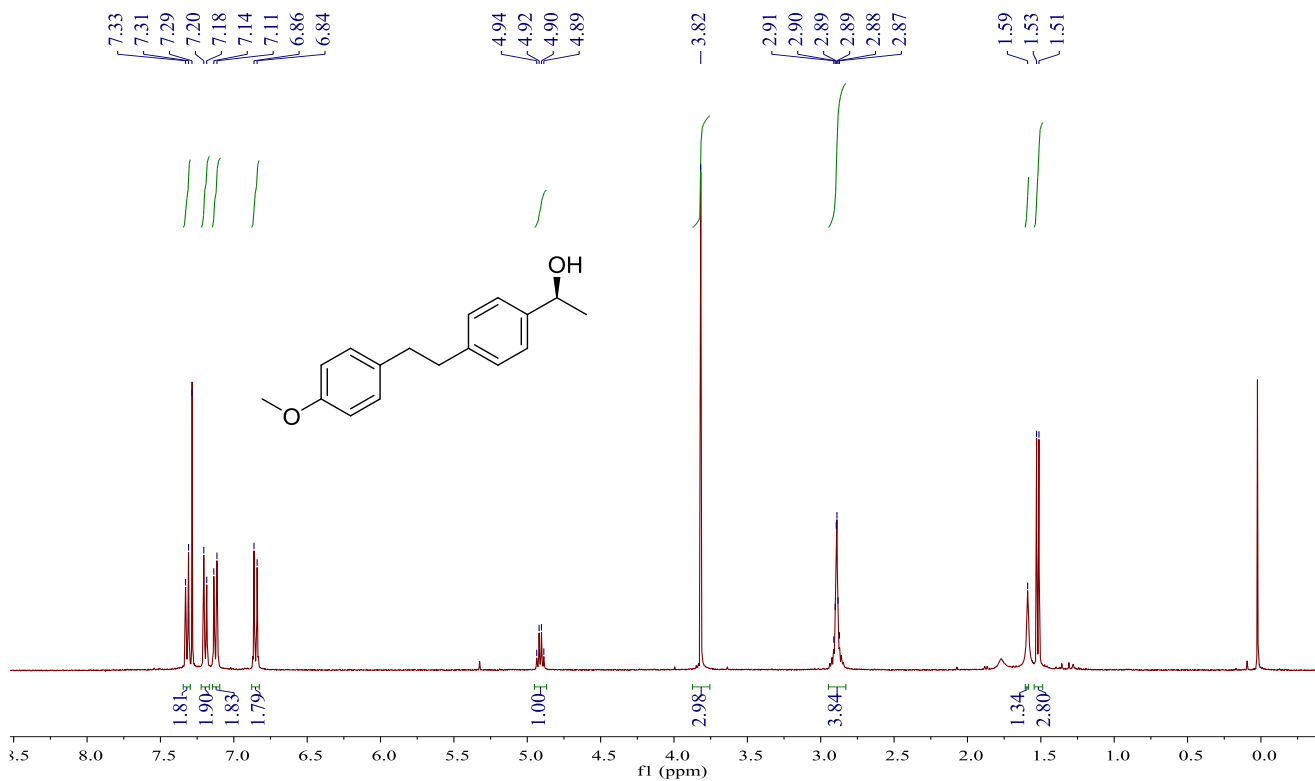
**(S)-1-(4-(4-methylphenethyl)phenyl)ethan-1-ol (10e).**



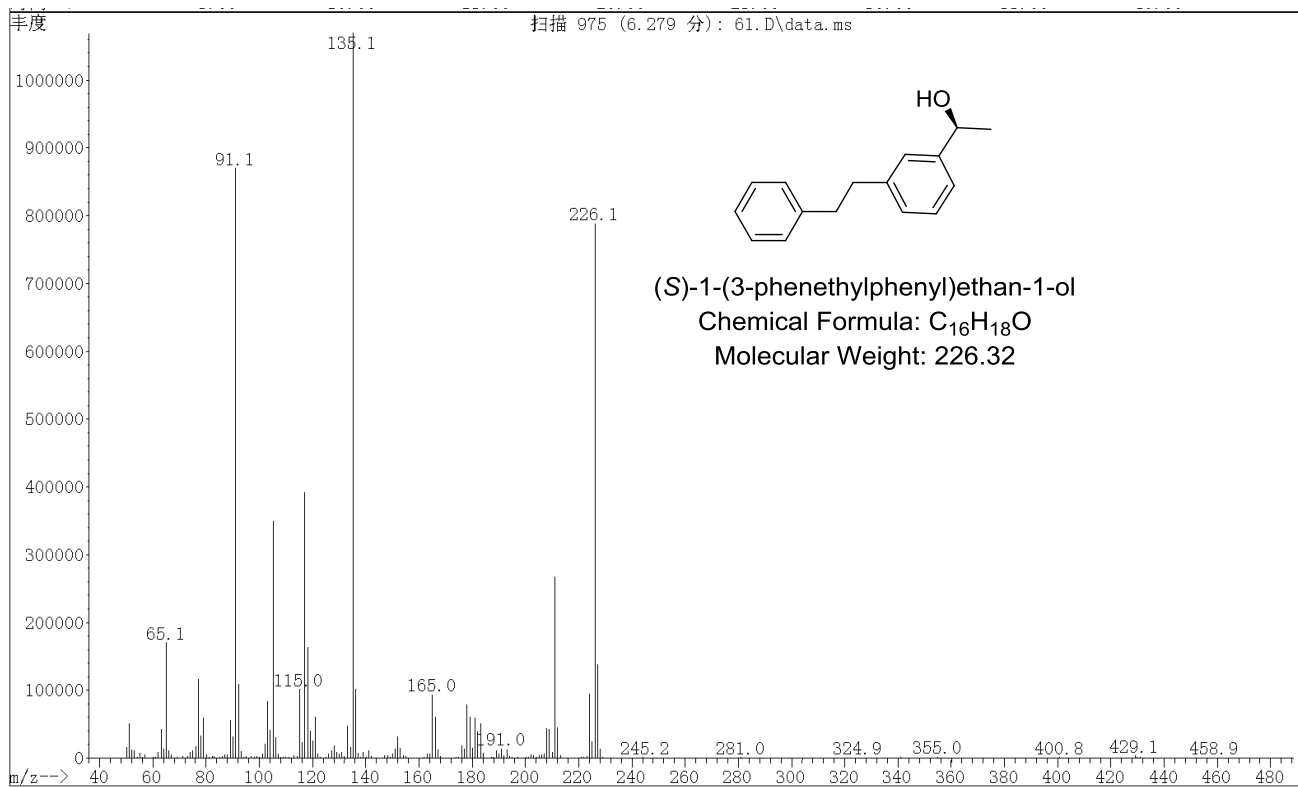
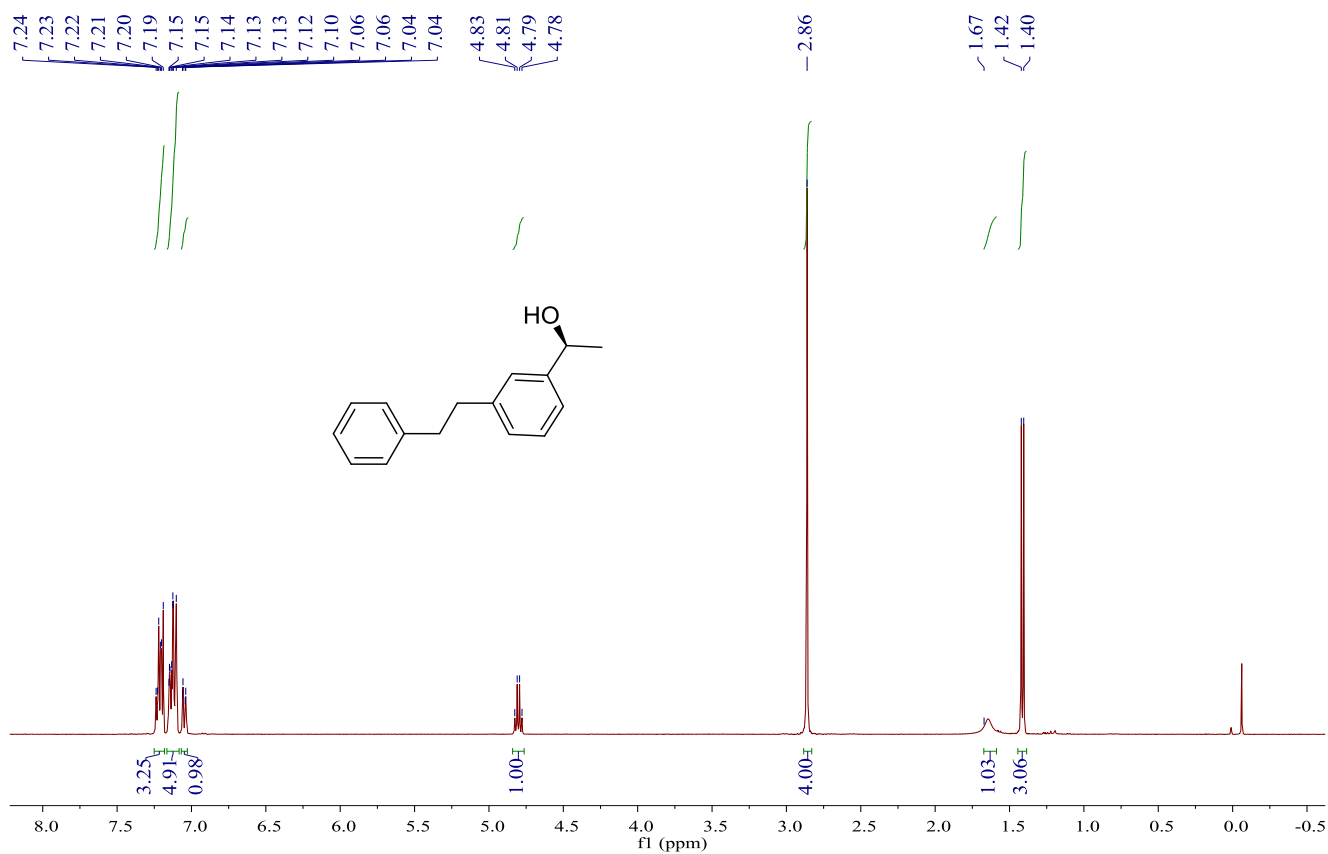
**(S)-1-(4-(3-methylphenethyl)phenyl)ethan-1-ol (10f).**



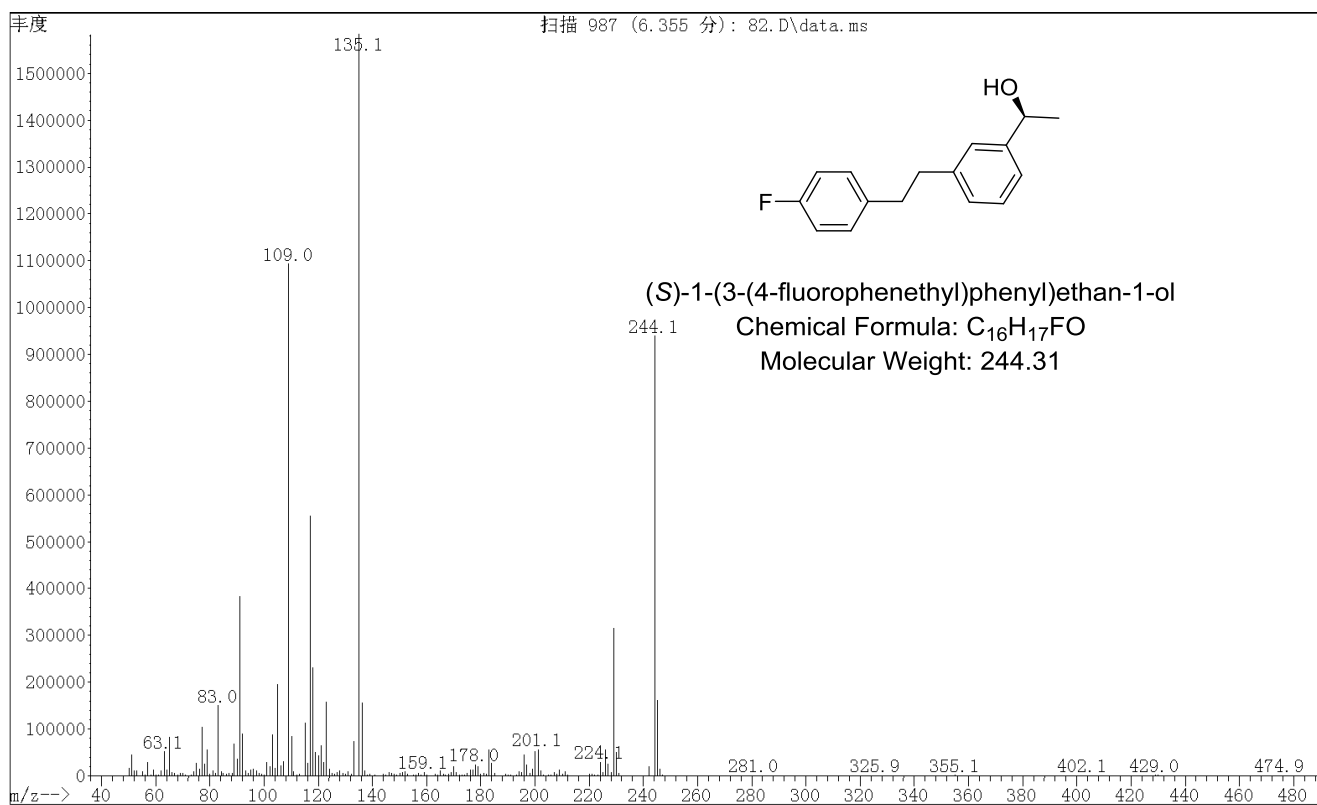
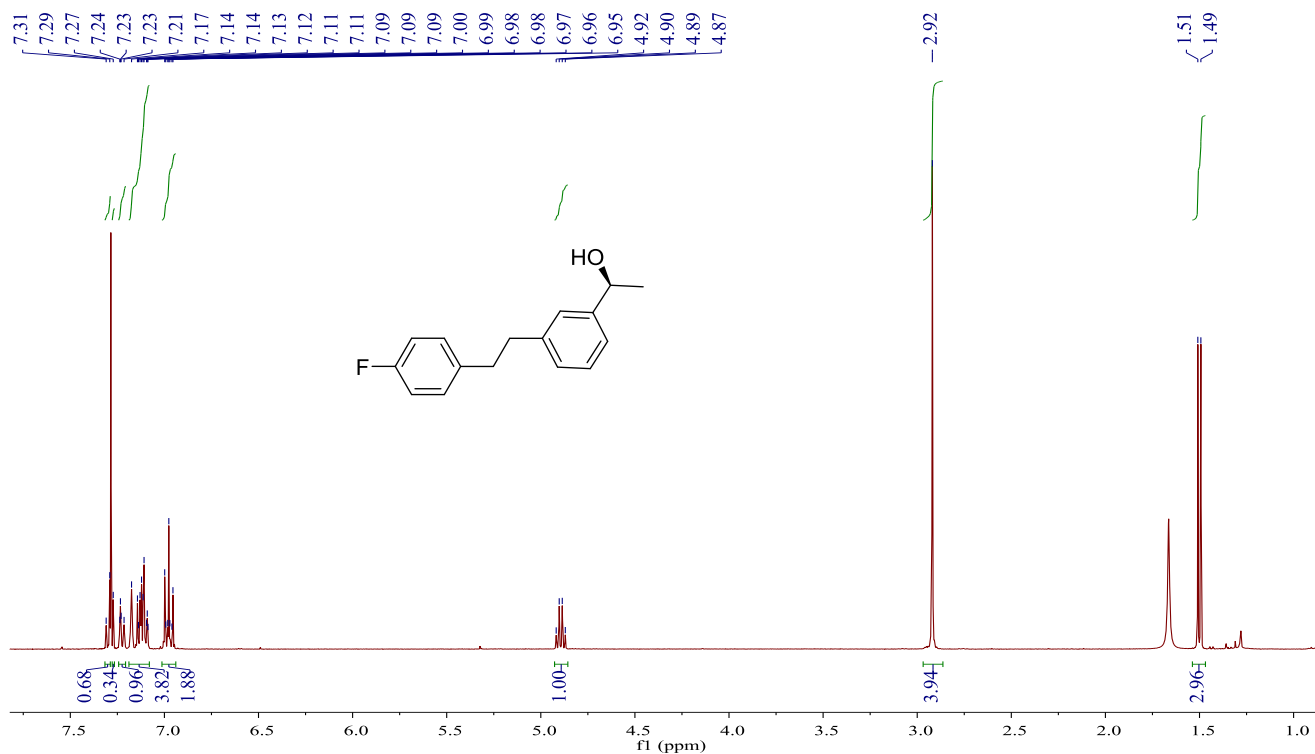
**(S)-1-(4-(4-methoxyphenethyl)phenyl)ethan-1-ol (10g).**



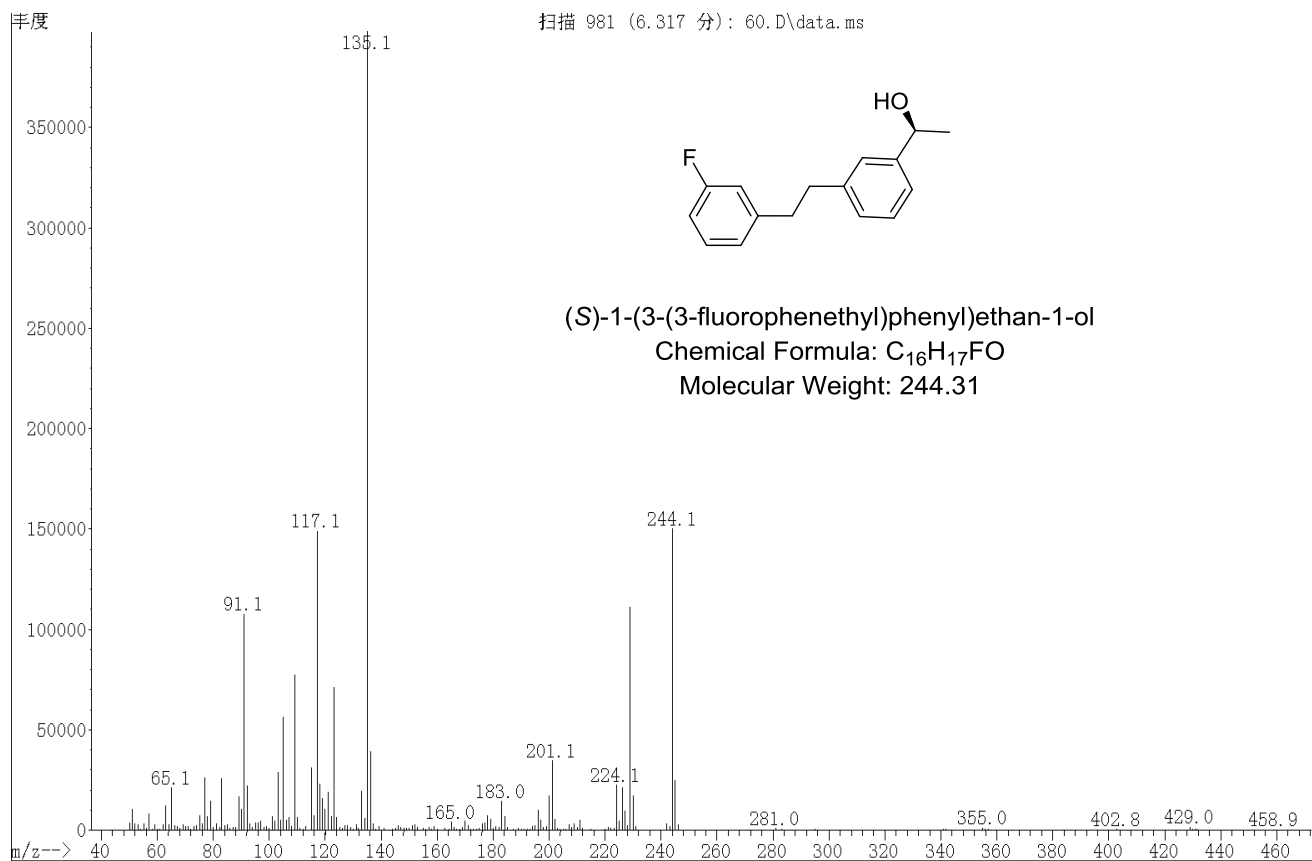
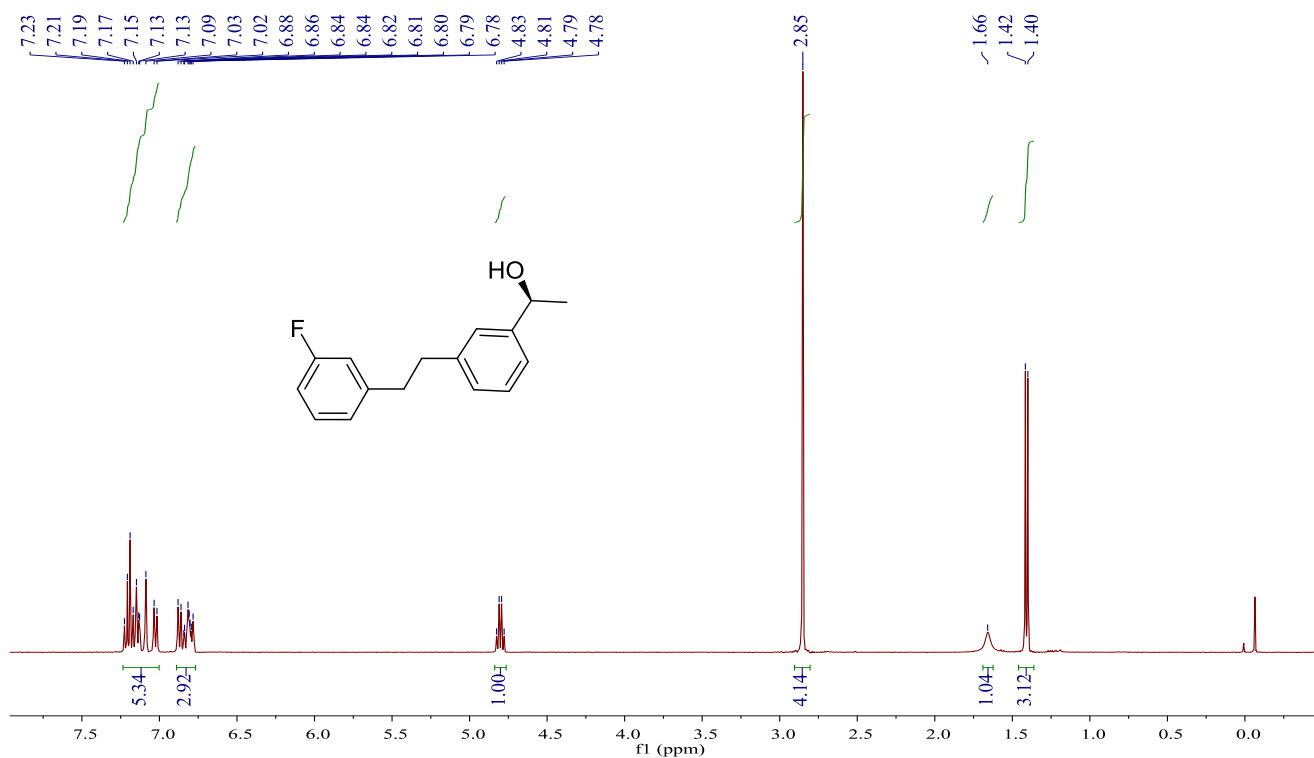
**(S)-1-(3-phenethylphenyl)ethan-1-ol (10h).**



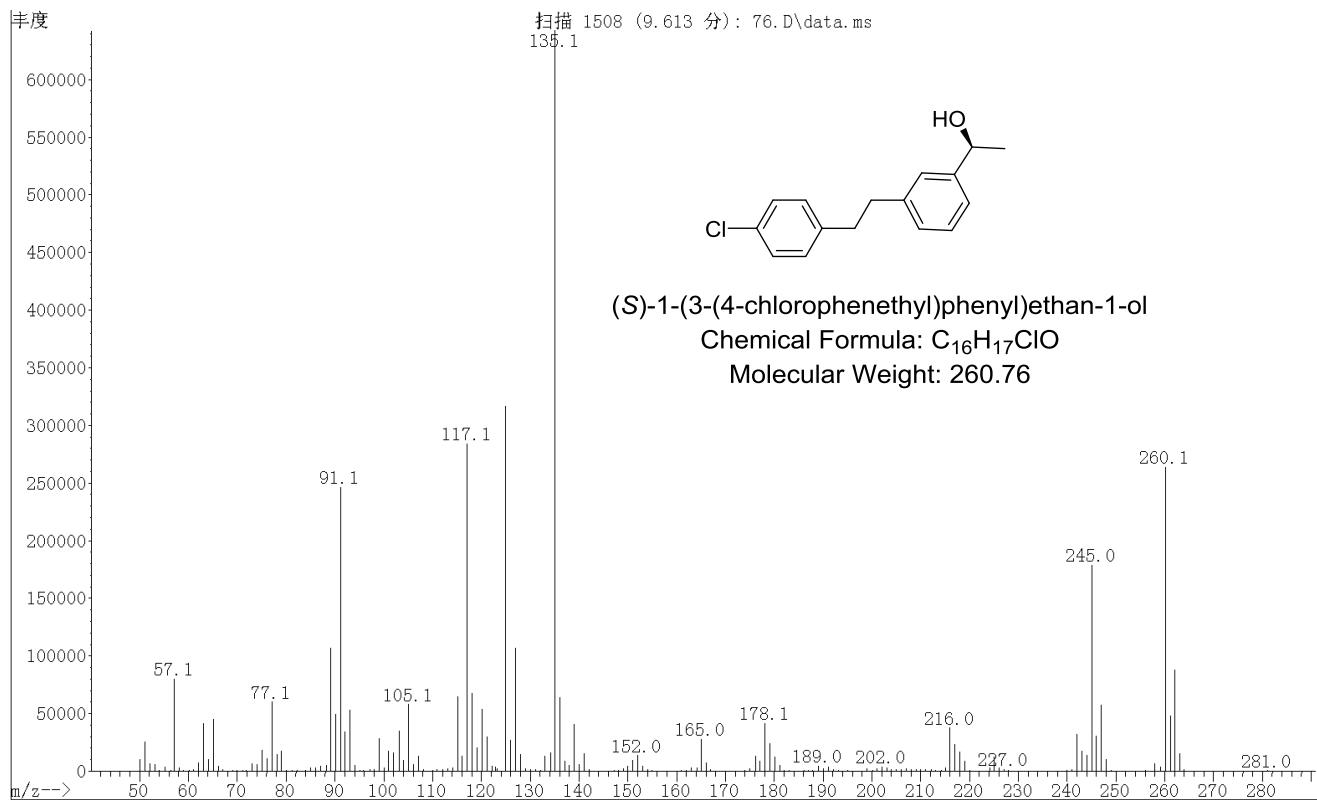
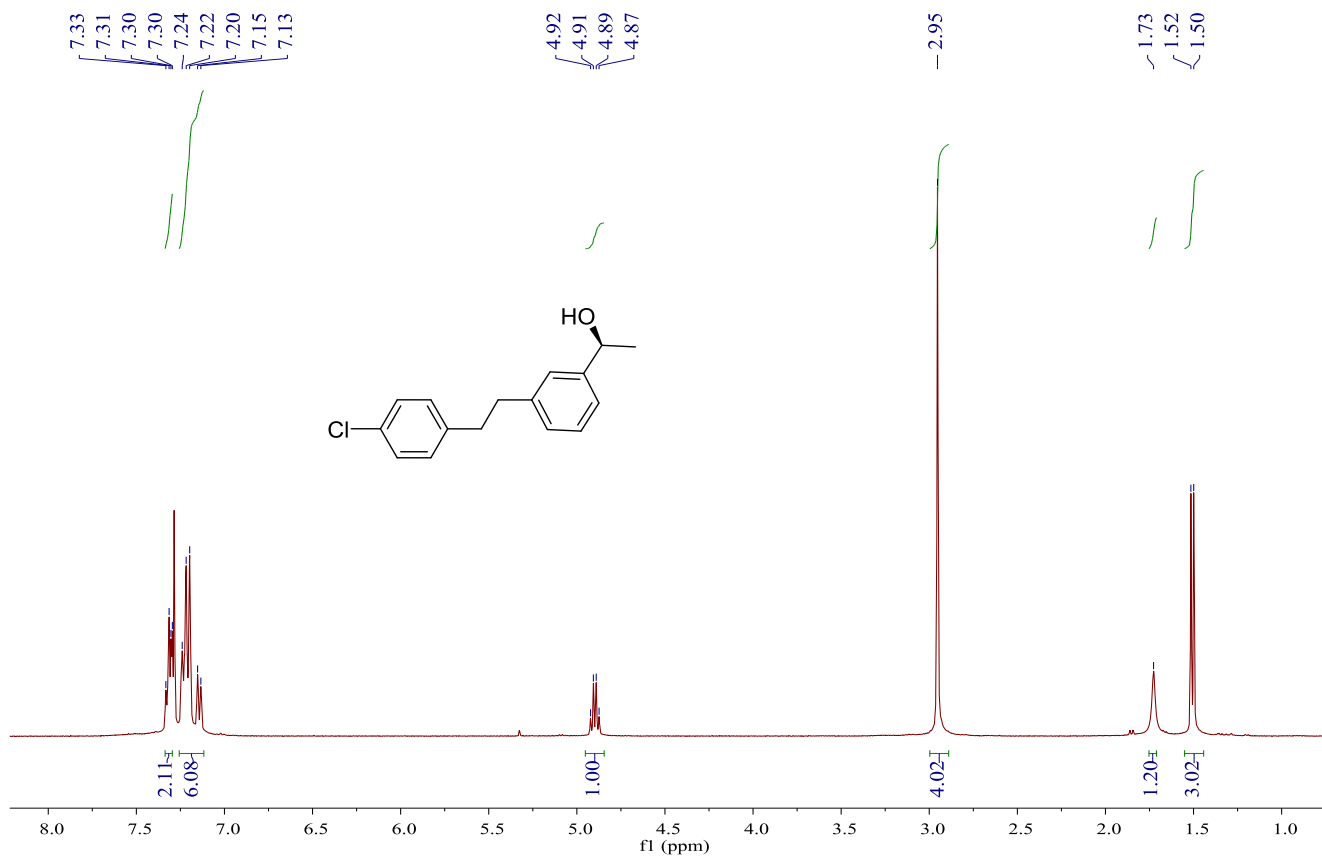
**(S)-1-(3-(4-fluorophenethyl)phenyl)ethan-1-ol (10i).**



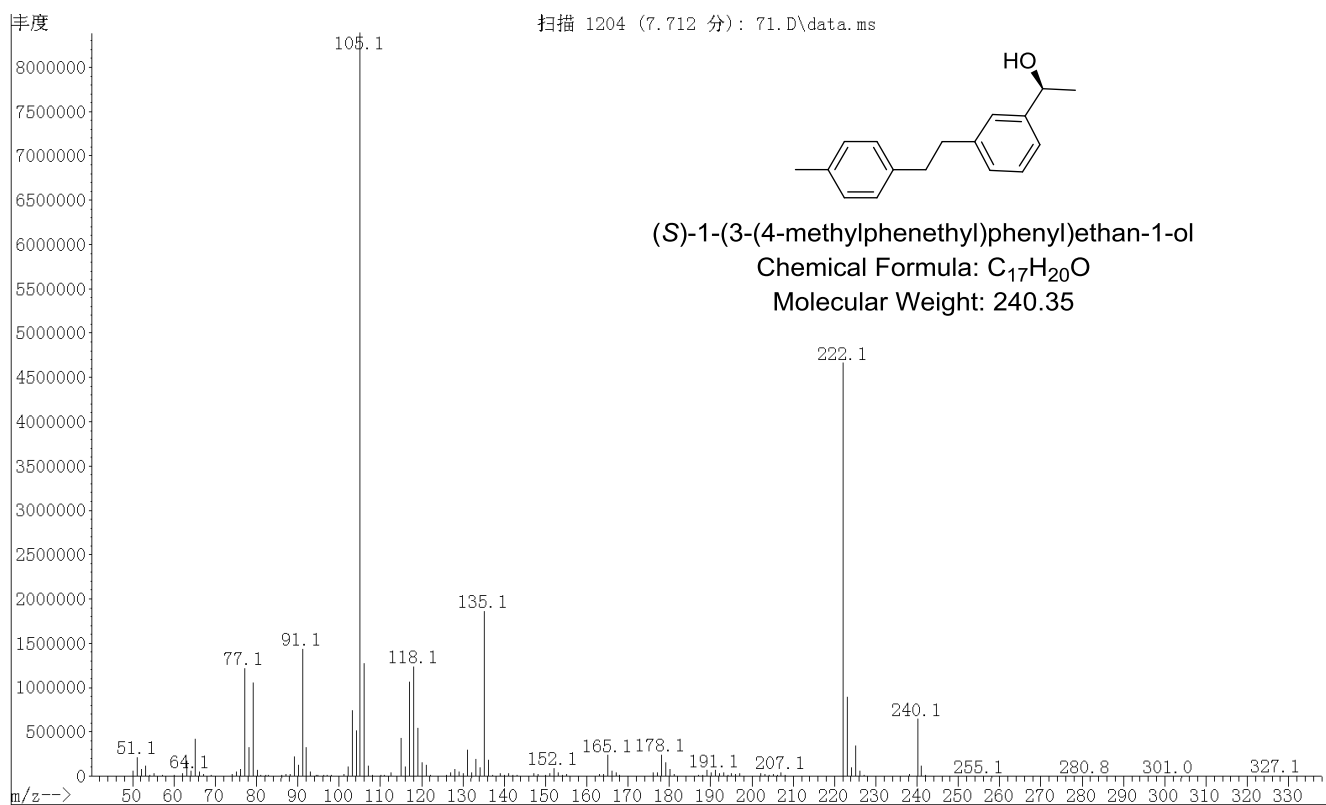
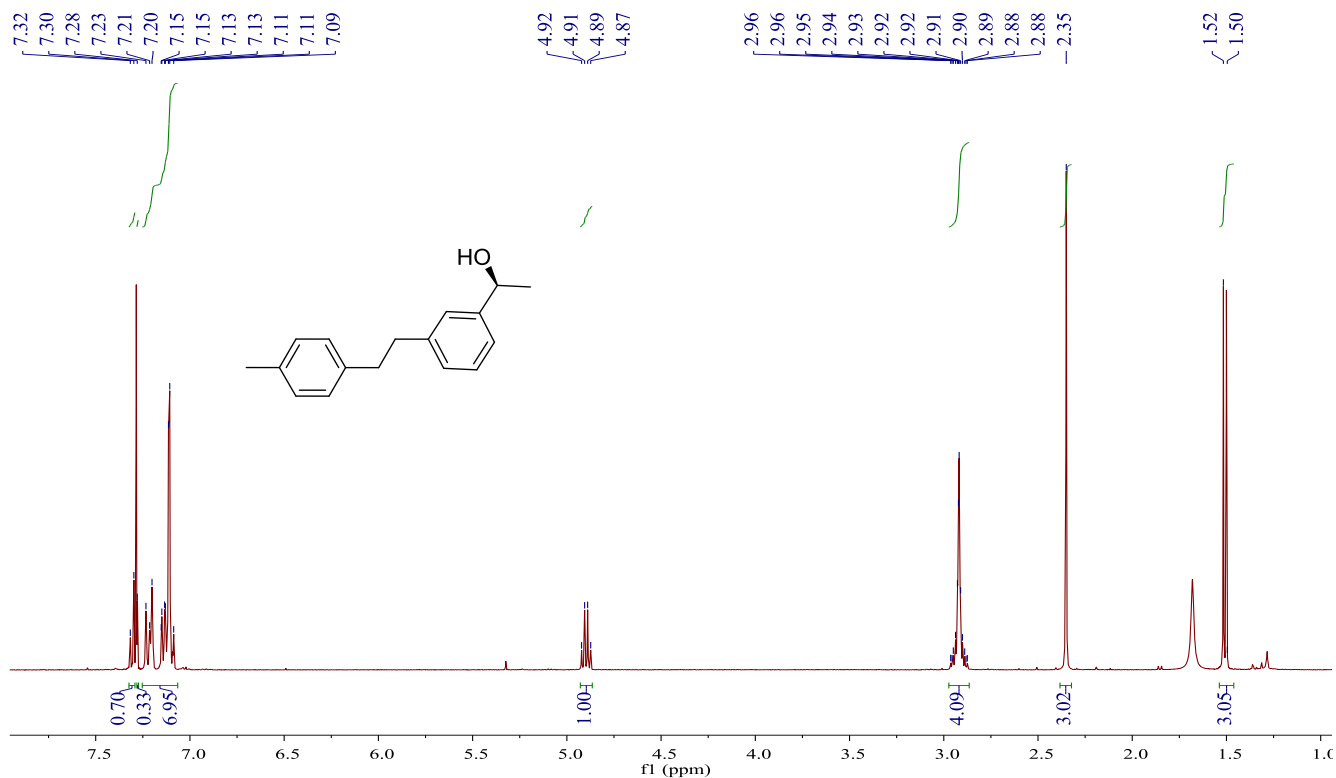
**(S)-1-(3-(3-fluorophenethyl)phenyl)ethan-1-ol (10j).**



**(S)-1-(3-(4-chlorophenethyl)phenyl)ethan-1-ol (10k).**

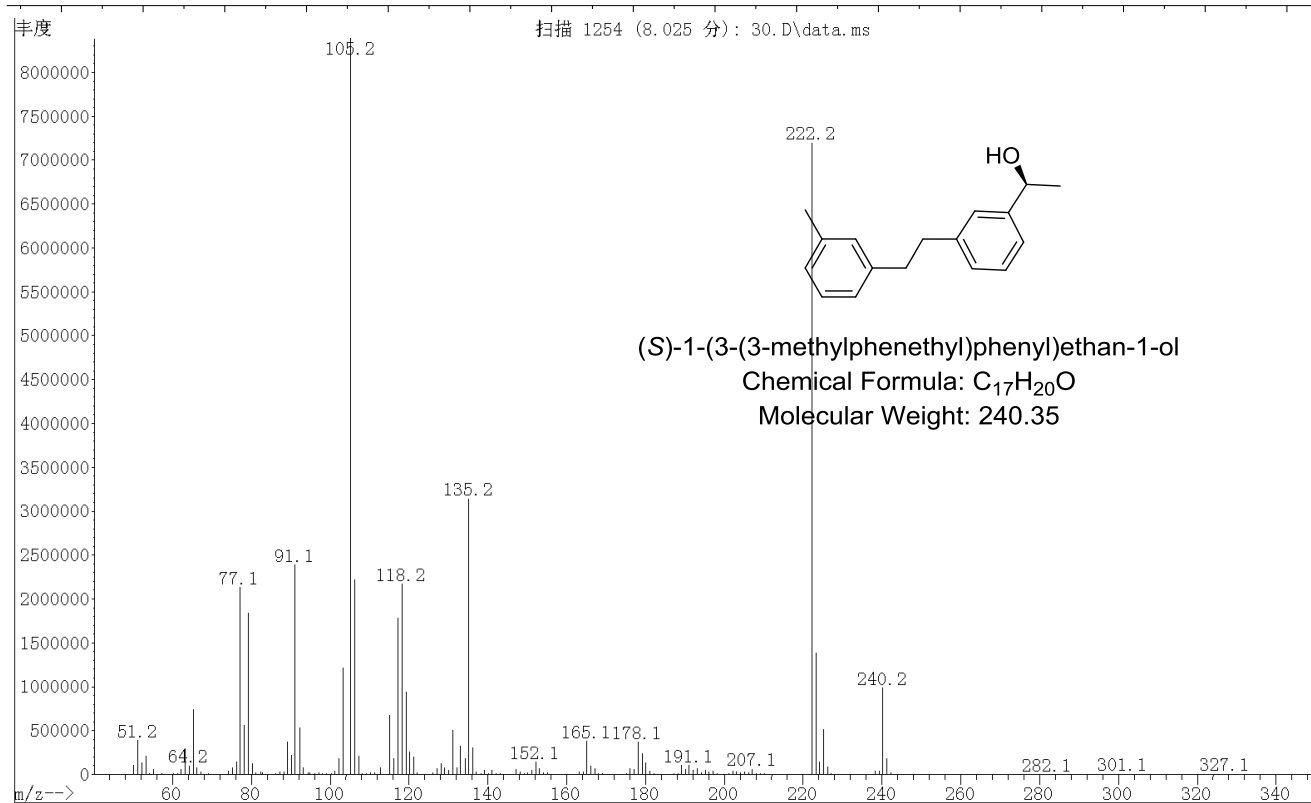
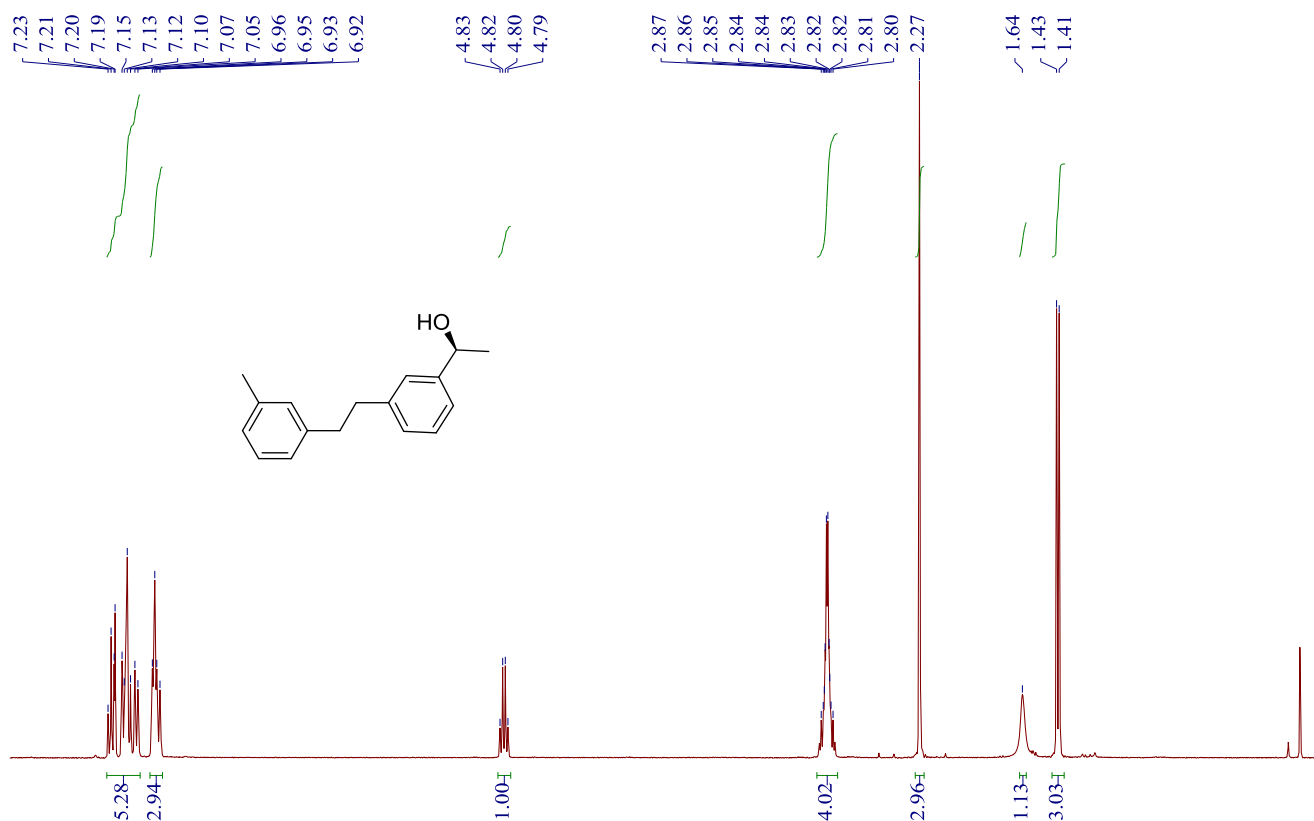


**(S)-1-(3-(4-methylphenethyl)phenyl)ethan-1-ol (10l).**





**(S)-1-(3-(3-methylphenethyl)phenyl)ethan-1-ol (10m).**



**(S)-1-(3-(4-methoxyphenethyl)phenyl)ethan-1-ol (10n).**

