# Electronic Supplementary Information

## Chiral Ionic Polymer for Direct Visual Enantioselective Recognition of α-Amino acid Anion

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## Contents:



## ESI 1. Instrumentation and Materials.

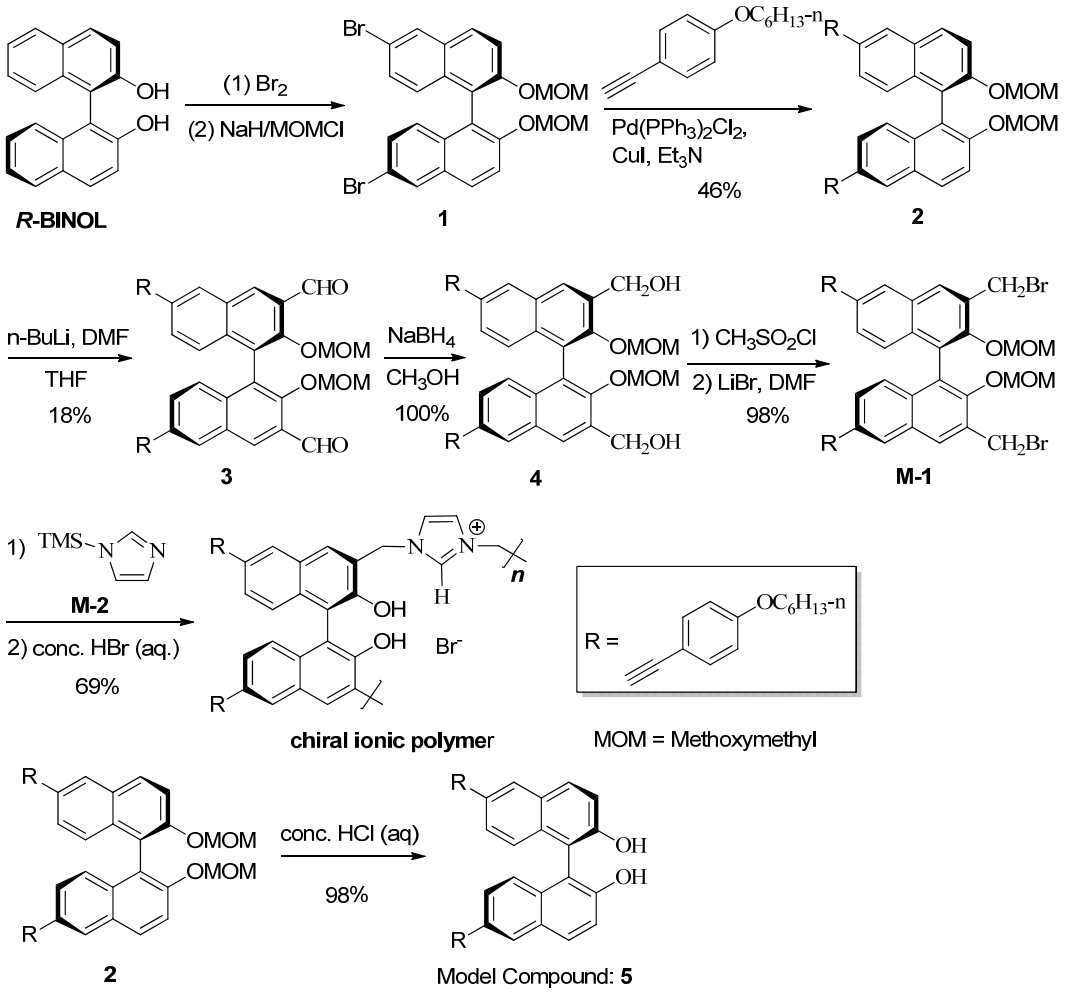
**Measurements and Materials:**

All solvents and reagents were commercially available and analytical-reagent-grade. THF and $Et_3N$ were purified by distillation from sodium in the presence of benzophenone. NMR spectra were obtained using a 300-Bruker for $^1H$ NMR and 75 MHz for $^{13}C$ NMR and reported as parts per million (ppm) from the internal standard TMS. Electrospray ionization mass spectra (ESI-MS) were measured on a Thermo Finnigan LCQ Fleet system. FT-IR spectra were taken on a Nexus 870 FT-IR spectrometer. Fluorescence spectra were obtained from an RF-5301PC spectrometer. Ultraviolet-visible (UV-vis) spectra were obtained using a Perkin-Elmer Lambda 35 spectrophotometer. Specific rotation was determined with a Ruololph Research Analyfical Autopol I. C, H and N of elemental analyses were performed on an Elementar Vario MICRO analyzer. CD spectra were recorded with JASCO J-810 CD spectrometers. Molecular weight was determined by GPC with Waters-244 HPLC pump and THF was used as solvent and relative to polystyrene standards. Thermogravimetric analysis (TGA) was performed on a Perkin-Elmer Pyris-1 instrument under $N_2$ atmosphere.

**Fluorescence measurements:**

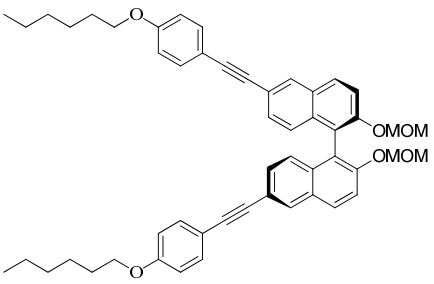
Stock solutions ($1.0\times10^{-2}$ mol/L or 0.1 mol/L) of the tetrabutylammonium salts of $Ala^-$, $PG^-$, $Phe^-$ and N-Boc-$Ala^-$ in THF were prepared. Stock solution ($1.0\times10^{-2}$ mol/L or 0.1 mol/L) of the tetrabutylammonium salts of $Val^-$ in a mixture solution of THF/DME (1% v/v) was prepared. Stock solution ($1.0\times10^{-2}$ mol/L or 0.1 mol/L) of the tetrabutylammonium salts of $Pro^-$ in a mixture solution of THF/DME (10% v/v) was prepared. Stock solution ($1.0\times10^{-2}$ mol/L or 0.1 mol/L) of the tetrabutylammonium salts of $Trp^-$ in a mixture solution of THF/DME (3% v/v) was prepared. Each experiment was started with a 4.0 mL polymer in THF solution or a mixture solution of THF/DME with a known concentration ($5.0\times10^{-5}$ mol/L). The adding amount of each experiment example of amino acid salts is shown on the figure and the graphical interpretation. All the fluorescence measurements were taken at λex=385 nm (slit 3/5).

## ESI 2. Synthesis procedures of the chiral ionic polymer and model compound.



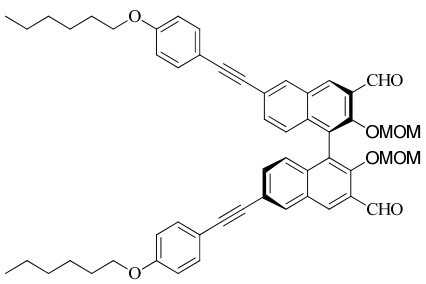

**Scheme S1.** Synthesis procedures of the chiral ionic polymer and model compound.

**(*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene (2)**:




A mixture of (*R*)-6,6'-dibromo-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene (7.17 g, 13.5 mmol), $Pd(PPh_3)_2Cl_2$ (94 mg, 0.13 mmol), CuI (25 mg, 0.13 mmol) and 1-ethynyl-4-(hexyloxy)benzene (6.0 g, 29.7 mmol) was dissolved in 80 mL $Et_3N$. The reaction mixture was stirred at 80 °C for 36 h under a $N_2$ atmosphere. The solution was cooled to room temperature, and then the solvent was removed under reduced pressure. The residue was purified by flash chromatography on silica gel (petroleum ether/ethyl acetate, 10:1, *v/v*) to give a yellow oil identified as (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene (4.85g, 46.4%). $[\alpha]_D^{25}$ = -205.00 (*c* 0.20, THF); $^1$H NMR (300 MHz, $CDCl_3$): δ 8.12 (s, 2H), 7.96 (d, *J* = 9.0 Hz, 2H), 7.64 (d, *J* = 9.0 Hz, 2H), 7.52 (d, *J* = 8.7 Hz, 4H), 7.38 (dd, *J* = 8.7 Hz, 1.2 Hz, 2H), 7.18 (d, *J* = 9.0 Hz, 2H), 6.90 (d, *J* = 8.7 Hz, 4H), 5.15 (d, *J* = 6.9 Hz, 2H), 5.03 (d, *J* = 6.9 Hz, 2H), 4.00 (t, *J* = 6.5 Hz, 4H), 3.20 (s, 6H), 1.87-1.78 (m, 4H), 1.52-1.46 (m, 4H), 1.41-1.36 (m, 8H), 0.96 (t, *J* = 6.6 Hz, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 159.1, 153.2, 133.18, 133.00, 131.1, 129.39, 129.32, 128.90, 125.4, 120.8, 119.1, 117.4, 115.1, 114.5, 94.9, 89.5, 88.4, 68.0, 55.9, 31.5, 29.1, 25.7, 22.6, 14.0. MS (ESI, m/z): 797.42 ($M^+$+Na). FT-IR (KBr, $cm^{-1}$): 2927, 2858, 2201, 1594, 1506, 1469, 1243, 1159, 1074, 1016, 924, 823, 619. Anal. calcd for $C_{52}H_{54}O_6$: C, 80.59; H, 7.02. Found: C, 80.54; H, 7.02.

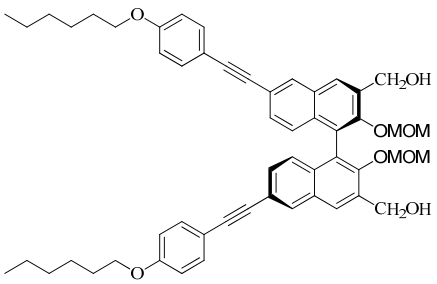
**(*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-(1,1'-binaphthalene)-3,3'-dicarbaldehyde(3):**




(*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'- binaphthalene (4.80 g,

6.2 mmol) was dissolved in anhydrous THF (80 mL), *n*-BuLi (5.0 mL, 2.5 M in hexanes, 12.5 mmol) was added by syringe injection at room temperature under a $N_2$ atmosphere. The mixture was first stirred for 15 min at 0°C. And then 0.96 mL of DMF (12.5 mmol) was added to the above solution. The reaction mixture was gradually warmed to room temperature and continued to stir for 8 h. After 60 mL of $H_2O$ was added to the above solution, the solution was stirred at room temperature for 20 min. After the removal of solvent under reduced pressure, the residue was extracted with $CH_2Cl_2$ (3×50 mL). The combined extract was washed with 100 mL of saturated brine twice and then dried over anhydrous $Na_2SO_4$. After removal of solvent under reduced pressure, the crude product was purified by column chromatography (petroleum ether/ethyl acetate) (10:1 v/v) to afford (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene-3,3'-dicarbaldehyde as a yellow powder in 18.4% (0.94 g). $[\alpha]_D^{25}$ = -167.0 (*c* 0.2, THF). Mp: 39.0 °C. $^1$H NMR (300 MHz, $CDCl_3$) δ: 10.54 (s, 2H), 8.59 (s, 2H), 8.24 (s, 2H), 7.54-7.49 (m, 6H), 7.22 (d, *J* = 8.7 Hz, 2H), 6.90 (dd, *J* = 8.7 Hz, 1.8 Hz, 2H), 4.79 (d, *J* = 6.0 Hz, 2H), 4.73 (d, *J* = 6.3 Hz, 2H), 3.99 (t, *J* = 6.3 Hz, 4H), 2.88 (s, 6H), 1.85-1.76 (m, 4H), 1.50-1.36 (m, 14H), 0.93 (t, *J* = 4.8 Hz, 6H); $^{13}$C NMR (75 MHz, $CDCl_3$) δ: 190.3, 159.5, 154.5, 135.5, 133.1, 132.8, 132.093, 132.039, 129.8, 129.3, 126.0, 126.8, 121.8, 114.5, 114.4, 100.7, 91.4, 87.2, 68.0, 57.0, 31.5, 29.1, 25.6, 22.5, 14.0. FT-IR (KBr, $cm^{-1}$): 2935, 1622, 1508, 1386, 1244, 1149, 1069, 826, 622. MS (ESI) m/z = 853.33 ($M^+$+Na). Anal. calcd for $C_{54}H_{54}O_8$: C, 78.05; H, 6.55. Found: C, 78.06; H, 6.55.

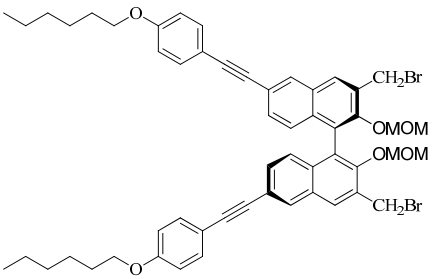
**(*R*)-(6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene-3,3'-diyl)dimethanol (4):**




At 0 °C, 200 mg $NaBH_4$ was portionwisely added into a stirred solution of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene-3,3'-dicarbaldehyde of two mixed solvents composed of 20 mL THF and 20 mL $CH_3OH$, and then adjusted

the solution to PH 7.0 or so with saturated $NaHCO_3$. After removal of the organic solvents under reduced pressure, the aqueous phase was extracted with ethyl acetate three times. The ethyl acetate layers were combined, washed with little brine, dried with anhydrous $Na_2SO_4$, concentrated in vacuo to afford (*R*)-(6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaph thalene-3,3'-diyl-dimethanol as a colorless solid. It needn't be purified and directly used for the next step in 100% yield. $[\alpha]_D^{25}$ = -81.0 (*c* 0.2, THF). Mp: 50.5 °C. $^1$H NMR (300 MHz, $CDCl_3$) δ: 8.11 (s, 2H), 8.02 (s, 2H), 7.50 (d, *J* = 6.3 Hz, 4H), 7.40 (d, *J* = 7.8 Hz, 2H), 7.14 (d, *J* = 6.6 Hz, 2H), 6.90 (d, *J* = 6.9 Hz, 2H), 5.00 (d, *J* = 10.8 Hz, 2H), 4.87 (d, *J* = 12.6 Hz, 2H), 4.49 (s, *J* = 12.6 Hz, 4H), 4.00 (t, *J* = 6.0 Hz, 4H), 3.22 (s, 6H), 1.83-1.76 (m, 4H), 1.48-1.37 (m, 14H), 0.93 (t, *J* = 6.6 Hz, 6H); $^{13}$C NMR (75 MHz, $CDCl_3$) δ: 159.3, 153.6, 135.3, 133.0, 132.8, 131.2, 130.6, 129.49, 129.46, 125.7, 125.0, 120.8, 114.8, 114.5, 99.3, 90.4, 87.8, 68.0, 61.7, 57.1, 31.5, 29.1, 25.6, 22.5, 14.0. FT-IR (KBr, $cm^{-1}$): 3420, 2933, 2862, 2204, 1600, 1508, 1384, 1243, 1157, 1071, 1013, 827. MS (ESI) m/z = 857.42 ($M^+$+Na). Anal. calcd for $C_{54}H_{54}O_8$: C, 77.67; H, 7.00. Found: C, 77.67; H, 7.01.

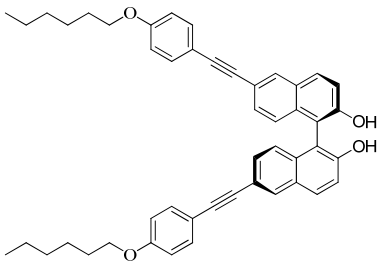
**(*R*)-3,3'-bis(bromomethyl)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1 ,1'-binaphthalene (M-1):**




To an ice-cooled solution of crude (*R*)-(6,6'-bis((4- (hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxym ethoxy)-1,1'-binaphthalene-3,3'-diyl)dimethanol (1.25 g, 1.50 mmol) in toluene (30 mL) were successingly added $Et_3N$ (5 mL, 36 mmol), and MsCl (0.50 mL, 6.43 mmol), The mixture was stirred at 0 °C for 90 min. The resulting suspension was filtered to remove solid salt $Et_3NH^+Cl^-$ and the solid was washed with toluene (10 mL). The combined filtrate and washings were cooled to 0 °C, and then LiBr (2.61g, 30 mmol) in 25 mL of DMF was added. The mixture was stirred at room temperature for 30 min. It was then diluted with ether (100 mL) and washed with water (3×50 mL), and then dried over anhydrous $Na_2SO_4$. After removal of solvent under reduced

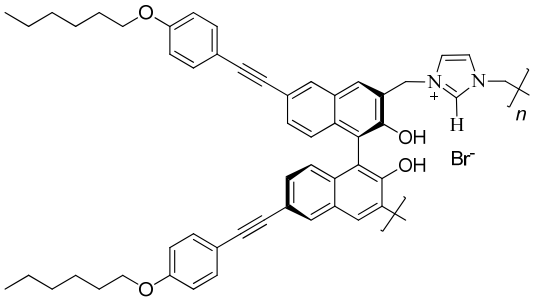
pressure, the crude product was rotary evaporated to afford a yellow powder in 98.0 % (1.41 g, 1.47 mmol). $[\alpha]_D^{25}$ = -113.0 (*c* 0.2, THF). Mp: 46.0 °C. $^1$H NMR (300 MHz, $CDCl_3$) δ: 8.10 (s, 4H), 7.51 (d, *J* = 8.4 Hz, 4H), 7.42 (dd, *J* = 9.0 Hz, 0.6 Hz, 2H), 7.17 (d, *J* = 8.7 Hz, 2H), 6.90 (d, *J* = 8.4 Hz, 4H), 4.97 (d, *J* = 5.4 Hz, 4H), 4.66 (d, *J* = 5.7 Hz, 2H), 4.58 (d, *J* = 5.7 Hz, 2H), 4.00 (t, *J* = 6.6 Hz, 4H), 3.00 (s, 6H), 1.86-1.77 (m, 4H), 1.51-1.36 (m, 14H), 0.94 (t, *J* = 6.9 Hz, 6H); $^{13}$C NMR (75 MHz, $CDCl_3$) δ: 159.3, 152.7, 133.1, 133.0, 131.9, 131.0, 130.7, 130.3, 129.8, 125.9, 125.3, 120.9, 114.8, 114.5, 99.5, 90.5, 87.8, 68.0, 56.8, 42.1, 31.5, 29.1, 25.6, 22.5, 14.0. FT-IR (KBr, $cm^{-1}$): 2929, 2861, 1607, 1510, 1468, 1385, 1243, 1156, 827, 614. MS (ESI) m/z = 959.08 ($M^+$+1). Anal. calcd for $C_{54}H_{56}Br_2O_6$: C, 67.50; H, 5.87. Found: C, 67.55; H, 5.88.

**(*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-[1,1'-binaphthalene]-2,2'-diol (Model Compound 5):**




1.0 g (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene was dissolved in 20 mL THF, and 10 mL conc. HCl (12.0 mol/L) was added. The mixture was stirred at room temperature for 12 h. It was diluted with ethyl acetate (100 mL) and washed with water (3×50 mL), and then dried over anhydrous $Na_2SO_4$. After removal of solvent under reduced pressure, the crude product was rotary evaporated to afford a brown powder in 98.0% (0.87 g, 1.28 mmol). $[\alpha]_D^{25}$ = -339.0 (*c* 0.2, THF). Mp: 40.0 °C. $^1$H NMR (300 MHz, $CDCl_3$) δ: 8.09 (s, 2H), 7.95 (d, *J* = 9.3 Hz, 2H), 7.50 (d, *J* = 8.7 Hz, 4H), 7.44-7.39 (m, 4H), 7.12 (d, *J* = 9.0 Hz, 2H), 6.89 (d, *J* = 8.7 Hz, 4H), 5.18 (s, 2H), 3.99 (t, *J* = 3.6 Hz, 4H), 1.86-1.76 (m, 4H), 1.51-1.29 (m, 12H), 0.94 (m, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 159.2, 153.2, 133.0, 132.6, 131.5, 131.2, 130.1, 129.1, 124.2, 119.3, 118.4, 115.0, 114.5, 110.8, 89.7, 88.0, 77.4, 77.0, 76.5, 68.0, 31.5, 29.1, 25.6, 22.5, 14.0. MS (ESI, m/z): 685.25 ($M^-$-1). FT-IR (KBr, $cm^{-1}$): 3310, 2859, 2208, 1600, 1478, 1241, 1158, 1016, 938, 829. Anal. calcd for $C_{48}H_{46}O_4$: C, 83.93; H, 6.75. Found: C, 83.89; H, 6.52.

**Chiral ionic polymer sensor:**




A mixture of (trimethylsilyl)imidazole (145 mg, 1.03 mmol) and (*R*)-3,3'-bis(bromomethyl)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene (900 mg, 0.94 mmol) was refluxed at 60 °C for 24 h in a mixture anhydrous solution of 10 mL THF and 10 mL DMF under a $N_2$ atmosphere. After the solution was cooled to room temperature, 20 mL of HBr (8.6 mol/L) was added to the solution, and the mixture was stirred at room temperature for 8 h under a $N_2$ atmosphere. After removal of the solvent under reduced pressure, the residue was extracted with $CH_2Cl_2$ (3×20 mL) and the organic phase was dried over $MgSO_4$ anhydrous. The solvent was reduced to 1 mL and the residue was precipitated from *n*-hexane (3 times). The polymer was isolated as a pale yellow solid (580 mg, 69%). $[\alpha]_D^{25}$ = -130.0 (*c* 0.2, THF); $M_w$ = 14560, $M_n$ = 8530, PDI = 1.68; $^1$H NMR (300 MHz, $CDCl_3$) δ: 9.46 (s), 8.79 (s), 7.93 (br), 7.43-6.65 (m), 5.27 (br), 3.92 (s), 3.10 (br), 1.75-0.95 (m). FT-IR (KBr, $cm^{-1}$): 3417, 2926, 2854, 2610, 1600, 1505, 1384, 1245, 1152, 1061, 942, 829, 753. Anal. calcd for $C_{53}H_{51}BrN_2O_4$: C, 74.03; H, 5.98; N, 3.26. Found: C, 74.09; H, 5.88; N, 3.22.

## ESI 3. Thermogravimetric analyses

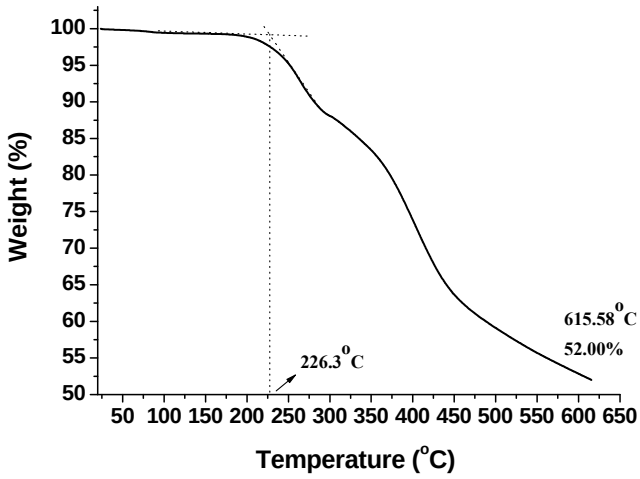



**Figure S1.** TGA curve of the chiral polymer

## ESI 4. UV-vis absorption and fluorescence spectra of the chiral polymer.

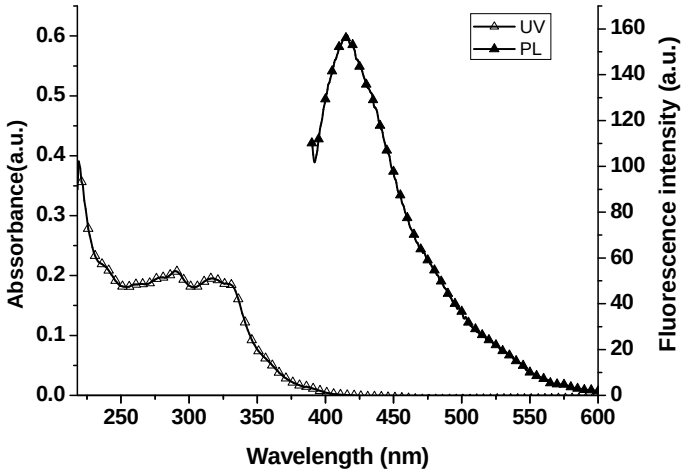



**Figure S2.** UV-vis absorption ($1.0\times10^{-5}$ mol/L) and fluorescence ($5.0\times10^{-5}$ mol/L) spectra of the chiral ionic polymer in THF. $\lambda_{ex}$ = 385 nm.

## ESI 5. Fluorescence analysis for enantioselective recognition

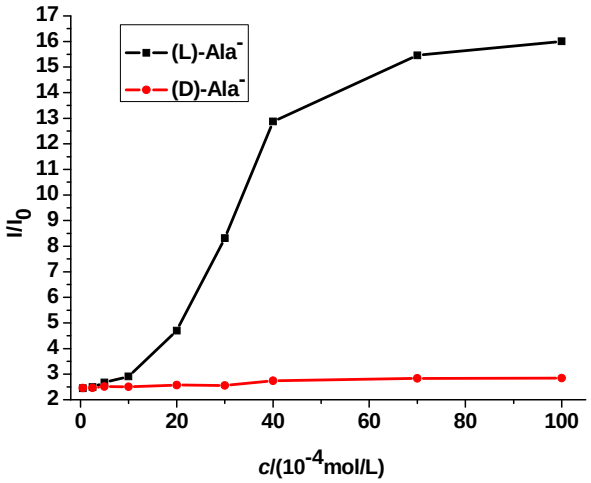



**Figure S3.** Fluorescence enhancement of chiral polymer ($5.0 \times 10^{-5}$ mol/L) with (D)- and (L)-$Ala^-$ ($\lambda$em = 500 nm; $\lambda$ex = 385 nm).

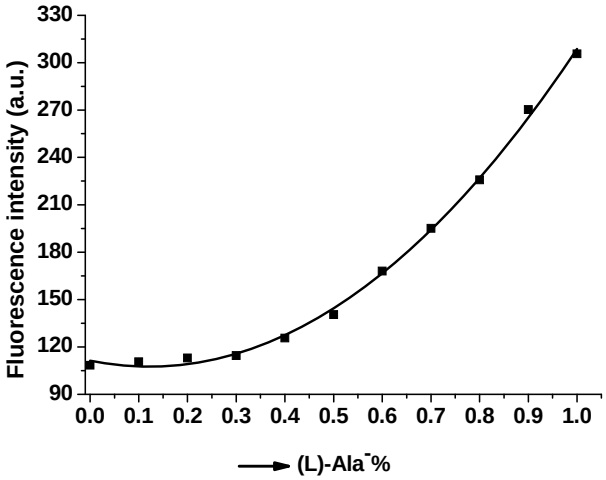



**Figure S4.** Fluorescence intensity of chiral ionic polymer with enantiomeric content of (L)-Ala$^-$ for enantiomers of Ala$^-$. [chiral ionic polymer] = ([(L)-Ala$^-$]+[(D)-Ala$^-$])/60 = 5.0 ×10$^{-5}$ mol/L in THF.

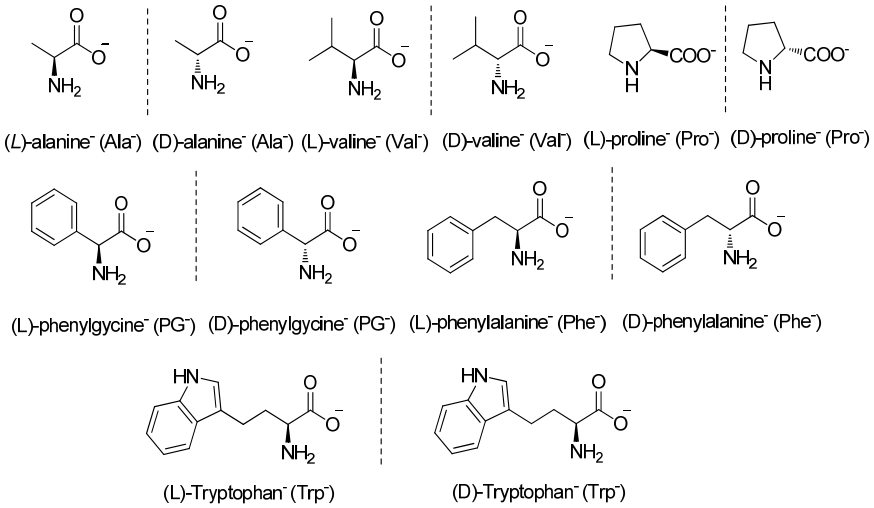
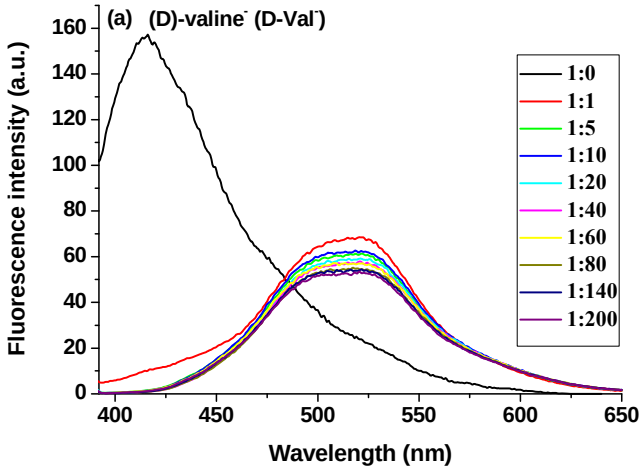



**Figure S5.** Chiral guests used in the enantioselective recognitions of the chiral ionic polymer.



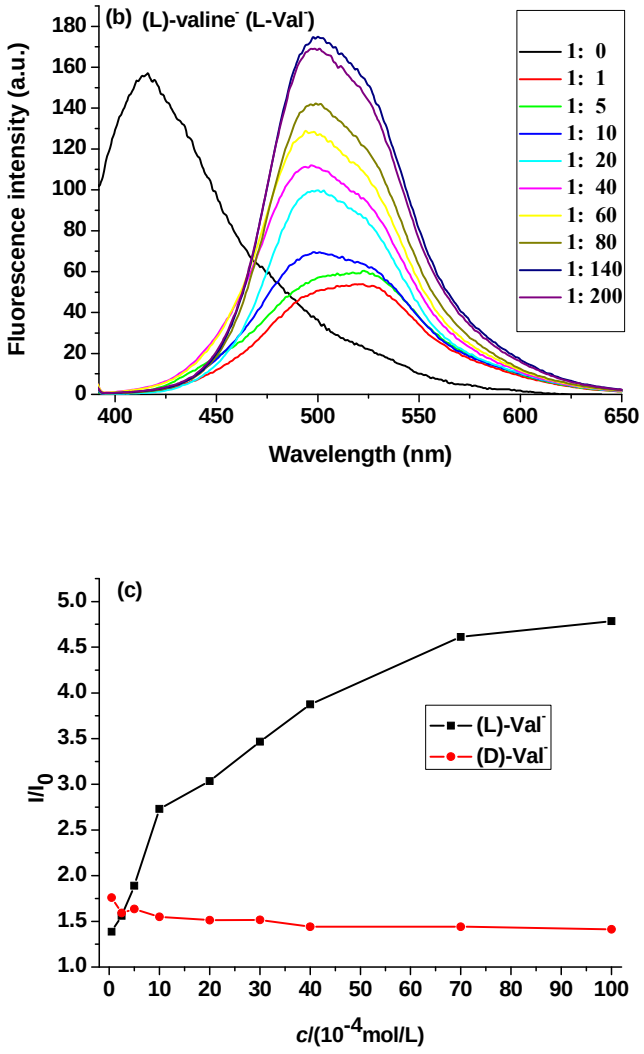
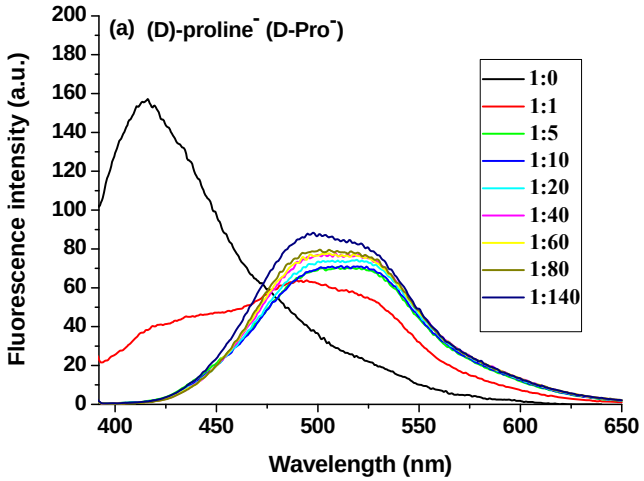



**Figure S6.** Fluorescence spectra of chiral ionic polymer ($5.0 \times 10^{-5}$ mol/L in THF/DME, 1% v/v) with increasing amounts of (D)-Val-TBA (a) and (L)-Val-TBA (b) (0.5, 2.5, 5, 10, 20, 30, 40, 70, 100 $\times 10^{-4}$ mol/L, 1.0 $\times 10^{-1}$ mol/L in THF/DME, 1% v/v). (c) Fluorescence enhancement of chiral polymer ($5.0 \times 10^{-5}$ mol/L) with (D)- and (L)-Val⁻ (λem = 498 nm; λex = 385 nm).



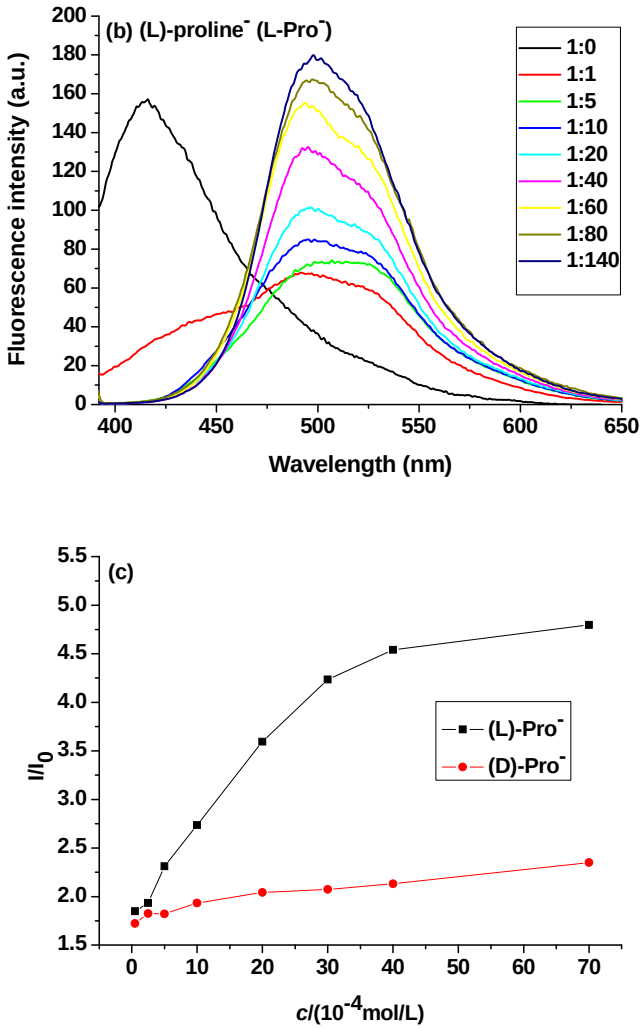



**Figure S7.** Fluorescence spectra of chiral ionic polymer ($5.0 \times 10^{-5}$ mol/L in THF/DME, 10% v/v) with increasing amounts of (D)-Pro-TBA (a) and (L)-Pro-TBA (b) (0.5, 2.5, 5, 10, 20, 30, 40, 70 $\times 10^{-4}$ mol/L, 1.0 $\times 10^{-1}$ mol/L in THF/DME, 10% v/v). (c) Fluorescence enhancement of chiral polymer ($5.0 \times 10^{-5}$ mol/L) with (D)- and (L)-Pro$^-$ ($\lambda$em = 494 nm; $\lambda$ex = 385 nm).

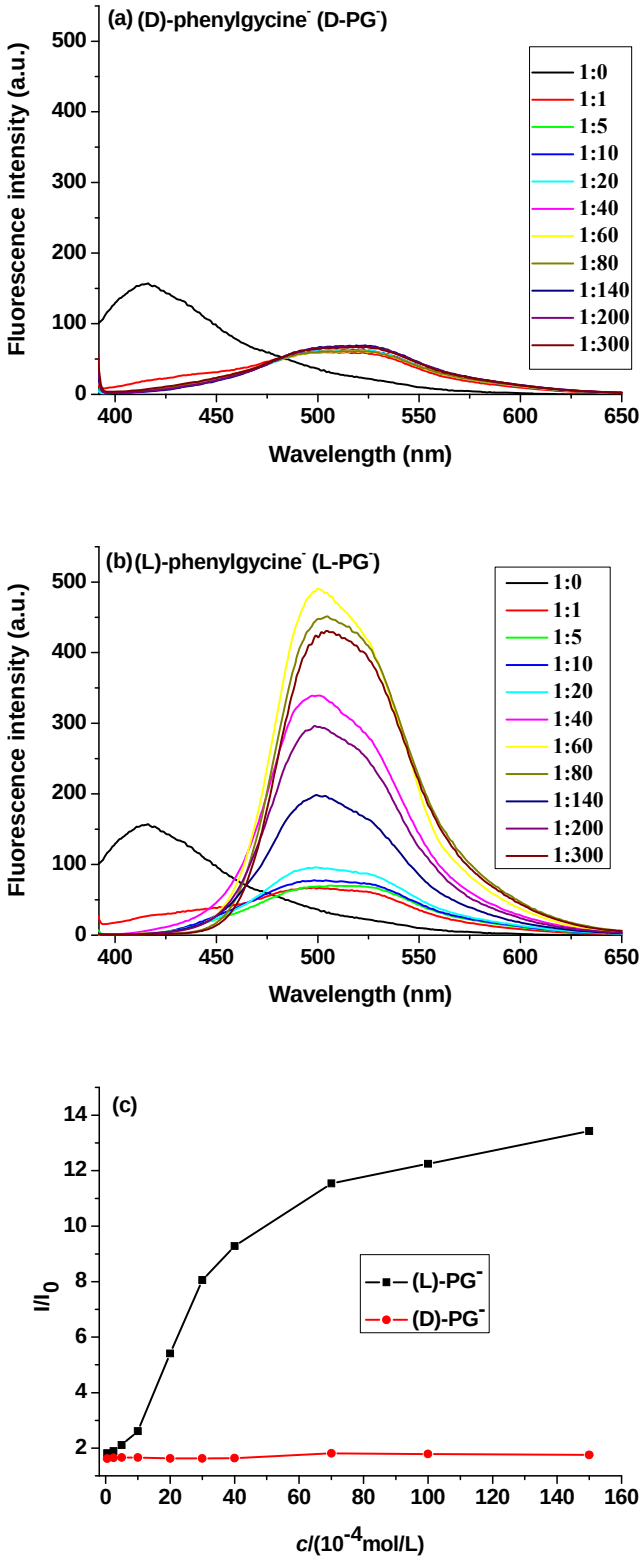



**Figure S8.** Fluorescence spectra of chiral ionic polymer ($5.0 \times 10^{-5}$ mol/L in THF) with increasing amounts of (D)-PG-TBA (a) and (L)-PG-TBA (b) (0.5, 2.5, 5, 10, 20, 30, 40, 70, 100, 150 $\times 10^{-4}$ mol/L, 1.0 $\times 10^{-1}$ mol/L in THF). (c) Fluorescence enhancement of chiral polymer ($5.0 \times 10^{-5}$ mol/L) with (D)- and (L)-$PG^-$ ($\lambda$em = 501 nm; $\lambda$ex = 385 nm).

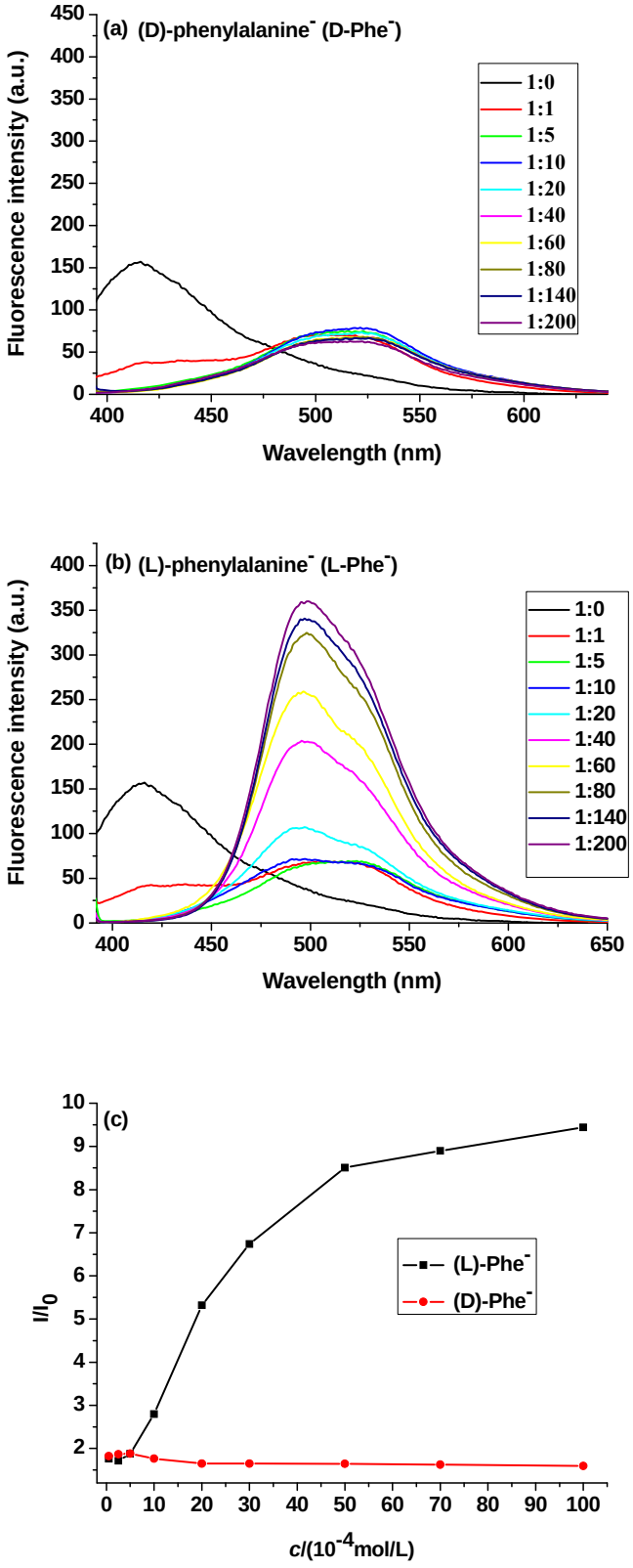



**Figure S9.** Fluorescence spectra of chiral ionic polymer ($5.0 \times 10^{-5}$ mol/L in THF) with increasing amounts of (D)-Phe-TBA (a) and (L)-Phe-TBA (b) (0.5, 2.5, 5, 10, 20, 30, 40, 70, 100, 150 $\times 10^{-4}$ mol/L, 1.0 $\times 10^{-1}$ mol/L in THF). (c) Fluorescence enhancement of chiral polymer ($5.0 \times 10^{-5}$ mol/L) with (D)- and (L)-Phe$^-$ ($\lambda$em = 496 nm; $\lambda$ex = 385 nm).

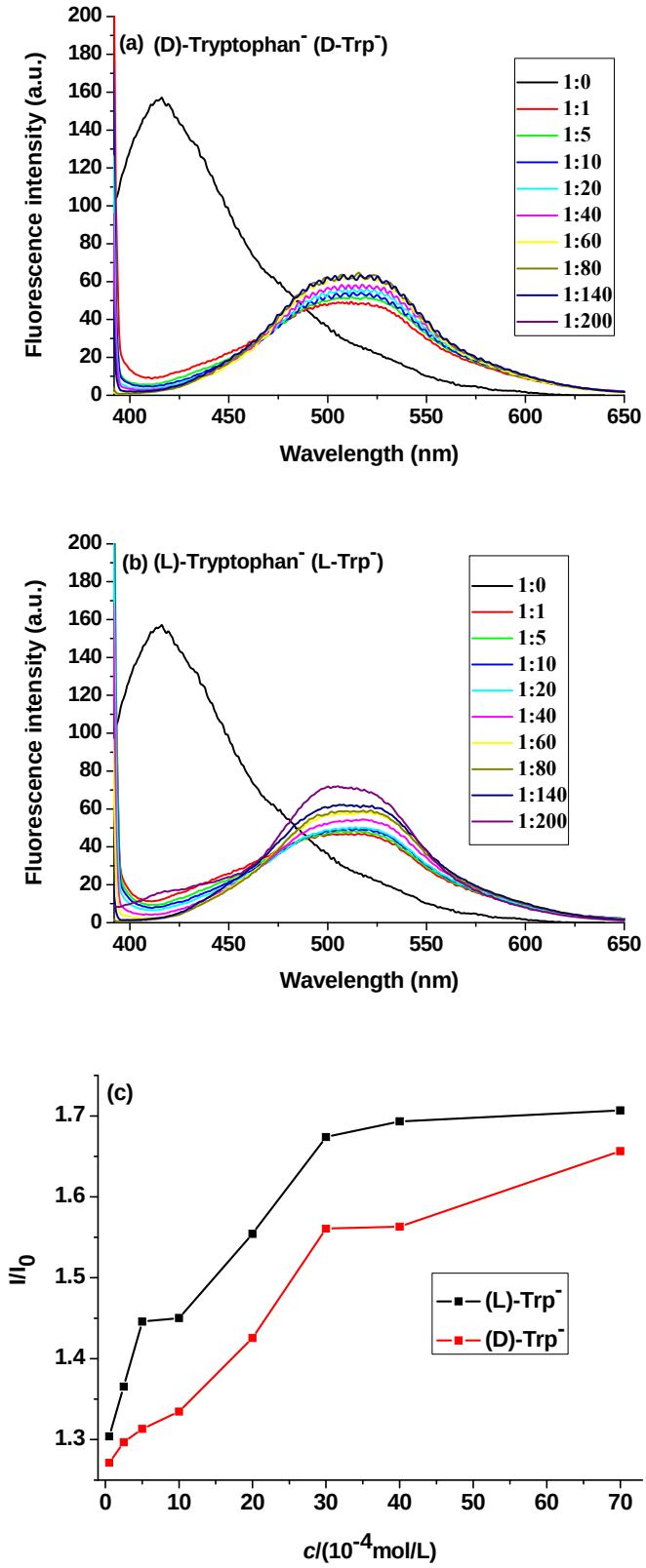



**Figure S10.** Fluorescence spectra of chiral ionic polymer ($5.0 \times 10^{-5}$ mol/L in THF/DME, 3% v/v) with increasing amounts of (D)-Trp-TBA (a) and (L)-Trp-TBA (b) (0.5, 2.5, 5, 10, 20, 30, 40, 70, 100, 150 $\times 10^{-4}$ mol/L, 1.0 $\times 10^{-1}$ mol/L in THF/DME, 3% v/v). (c) Fluorescence enhancement of chiral polymer ($5.0 \times 10^{-5}$ mol/L) with (D)- and (L)-Trp⁻ (λem = 505 nm; λex = 385 nm).

## ESI 6. Fluorescence image of polymer solution plus amino acid enantiomers

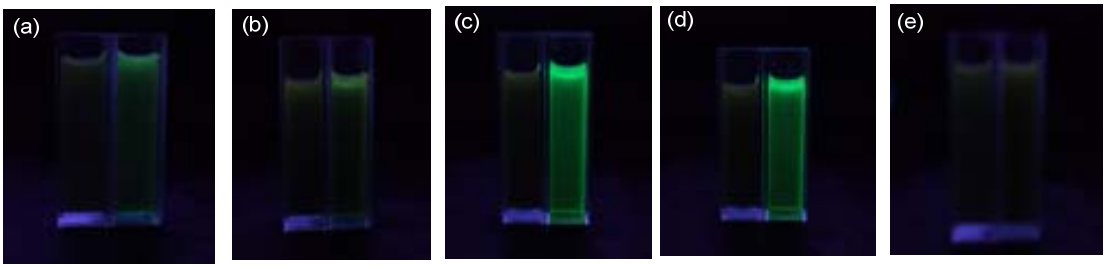



**Figure S11.** The fluorescence image of polymer solution ($5 \times 10^{-5}$mol/L) plus other amino acid enantiomers were excited by a commercially available UV lamp (λ = 365 nm).(a) Val-TBA, 140.0 equiv. ef = 6.21 (b) Pro-TBA, 80.0 equiv. ef = 3.11 (c) PG-TBA, 200.0 equiv. ef = 14.03 (d) Phe-TBA, 100.0 equiv. ef = 12.37 (e) Ser-TBA. 40.0 equiv. ef = 1.11. (left: D- amino acid anion, right: L- amino acid anion).

## ESI 7. NMR spectra

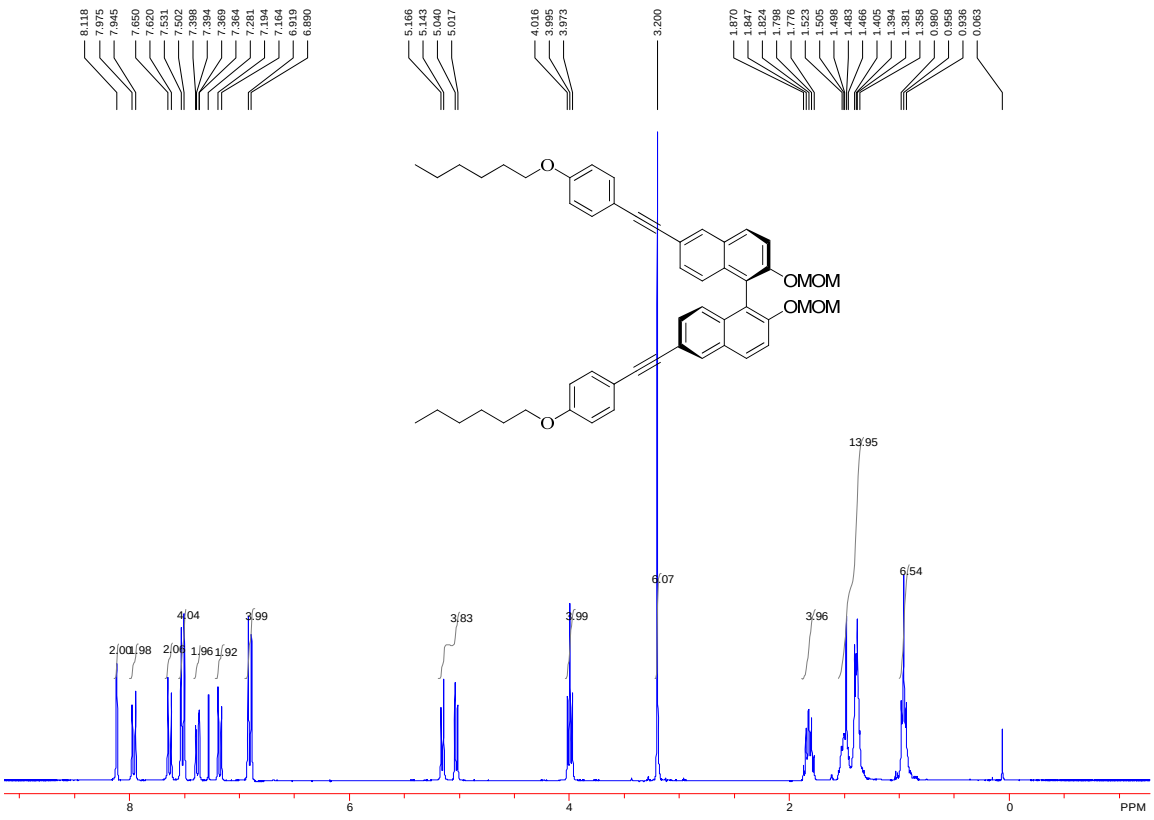



**Figure S12**. $^{1}$H NMR of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene in $CDCl_3$

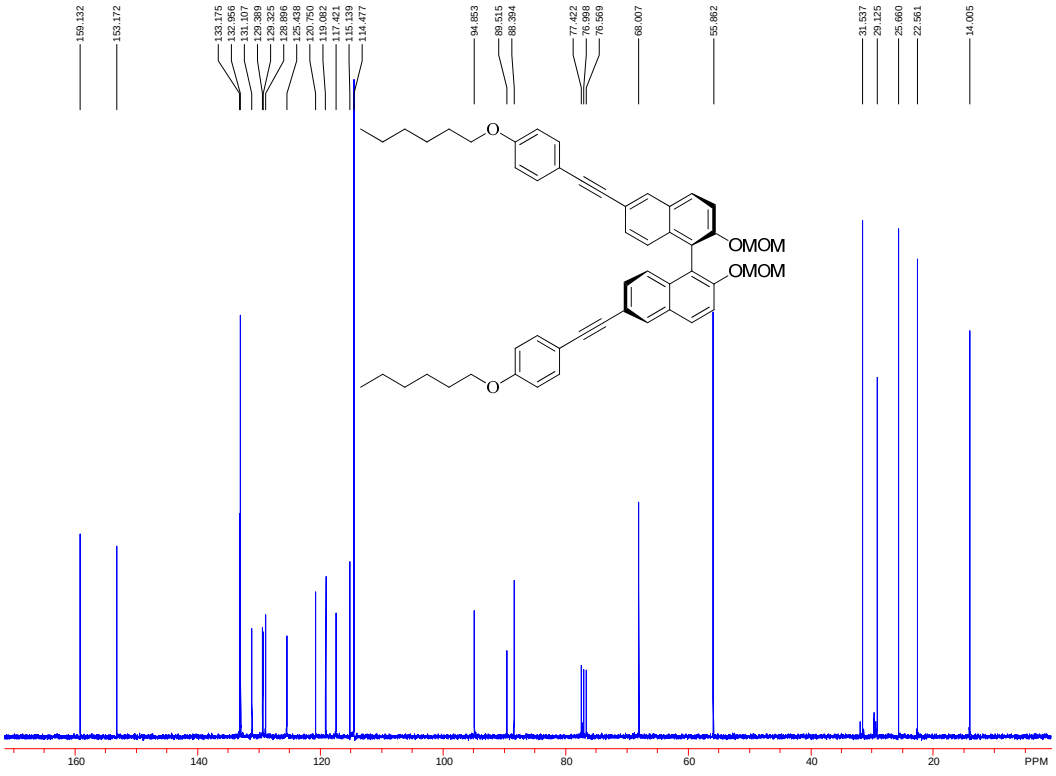



**Figure S13**.[13]C NMR of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene in $CDCl_3$

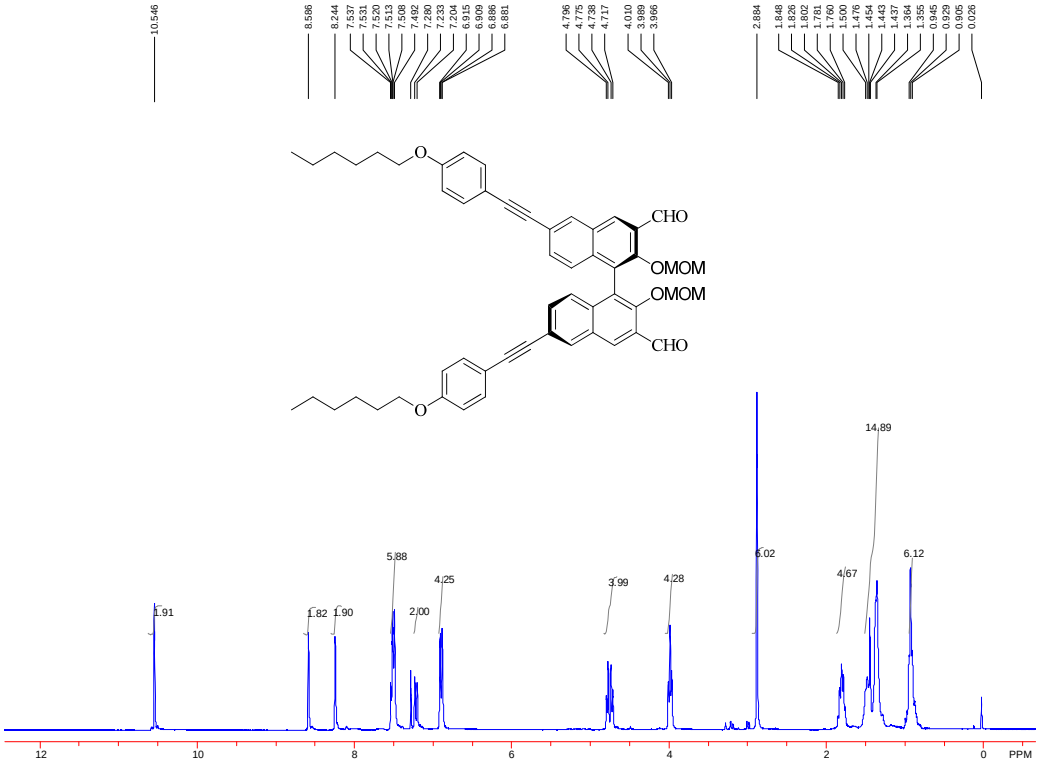



**Figure S14**.[1]H NMR of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-(1,1'-binaphthalene)-3,3'-dicarbaldehyde in $CDCl_3$

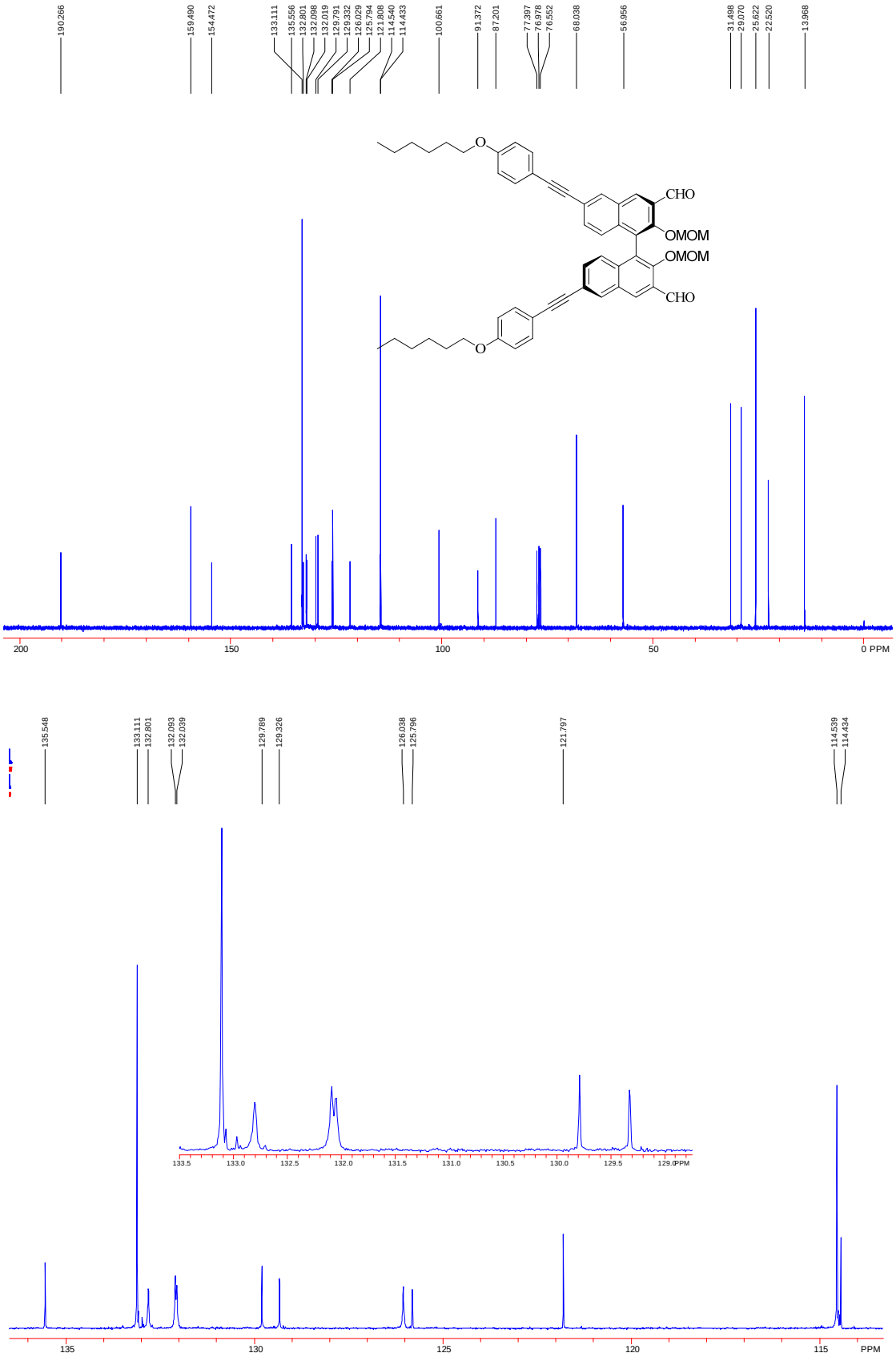



**Figure S15**.$^{13}$C NMR of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-(1,1'-binaphthalene)-3,3'-dicarbaldehyde in $CDCl_3$

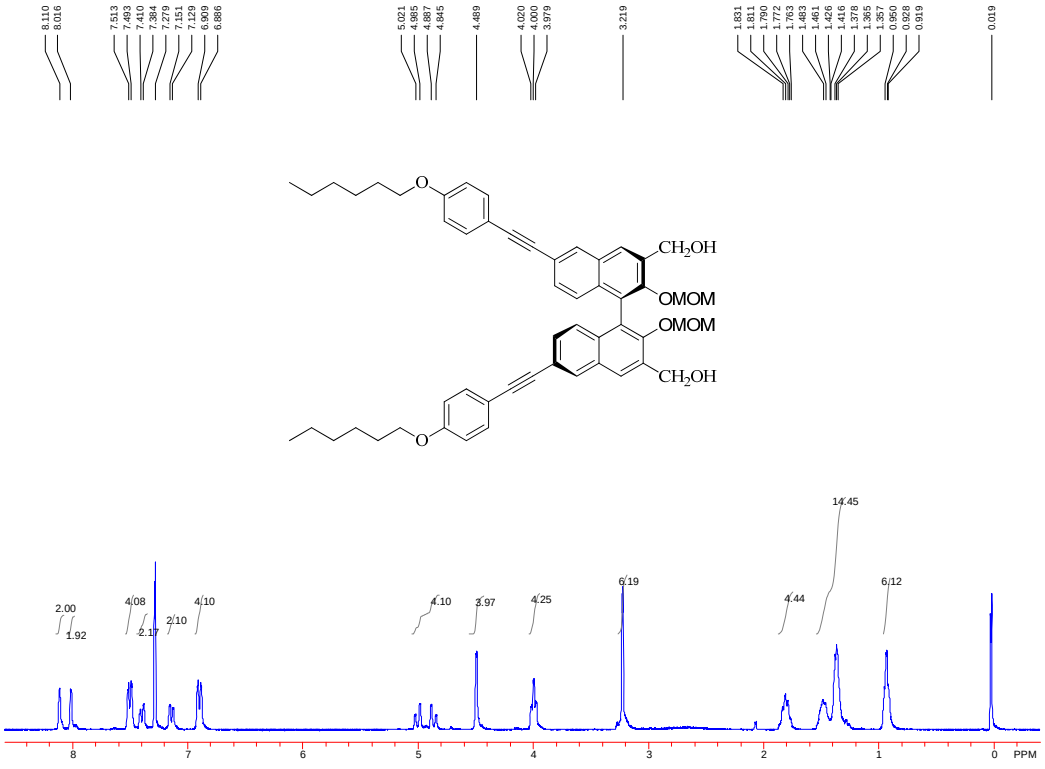
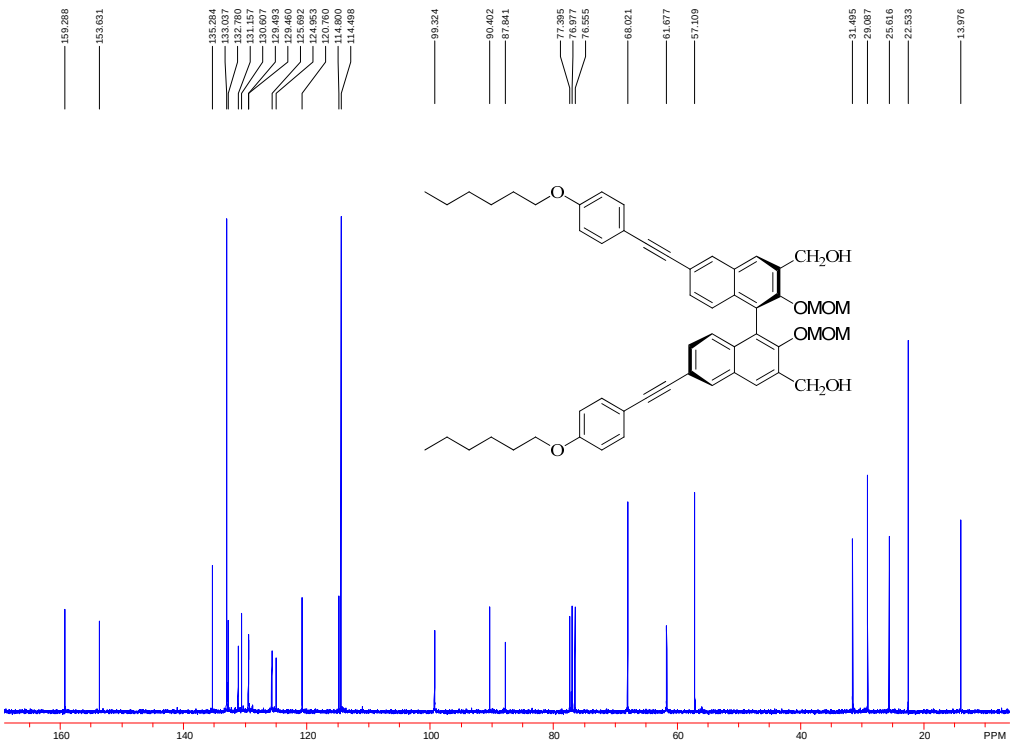



**Figure S16**.[1]H NMR of (*R*)-(6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-(1,1'-binaphthalene)-3,3'-diyl)dimethanol in $CDCl_3$



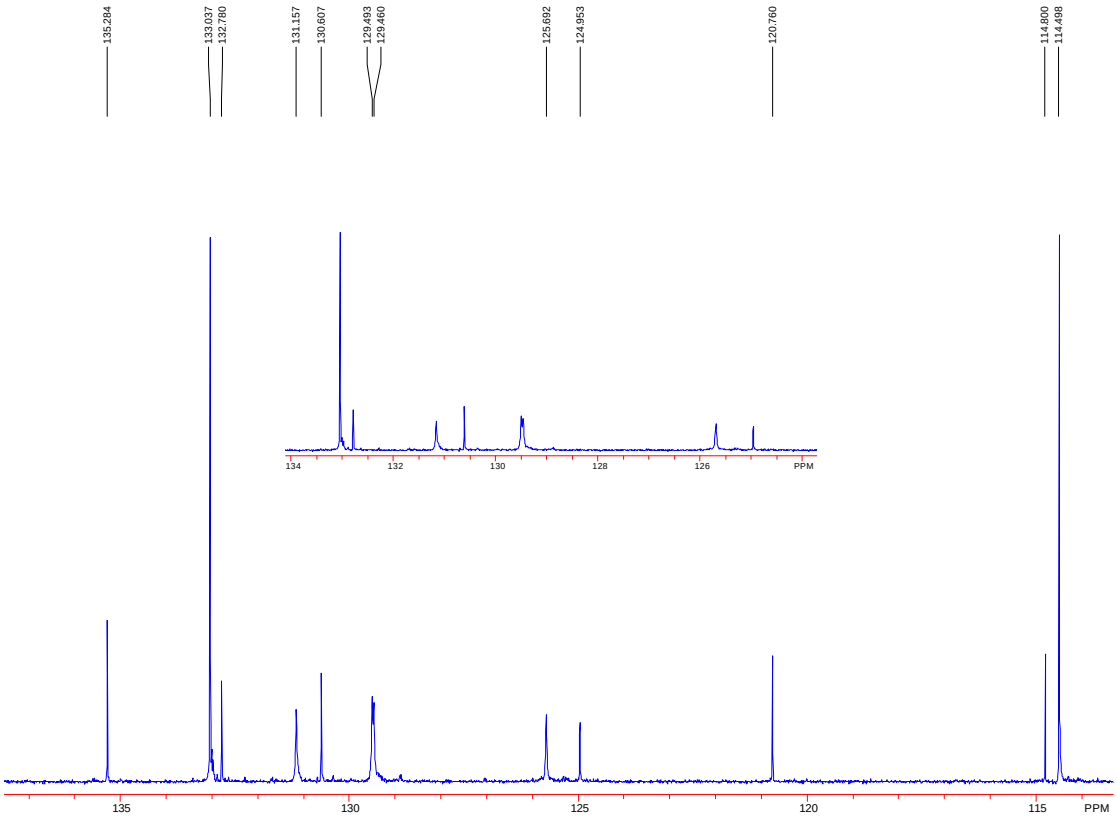



**Figure S17**.[13]C NMR of (*R*)-(6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-(1,1'-binaphthalene)-3,3'-diyl)dimethanol in $CDCl_3$

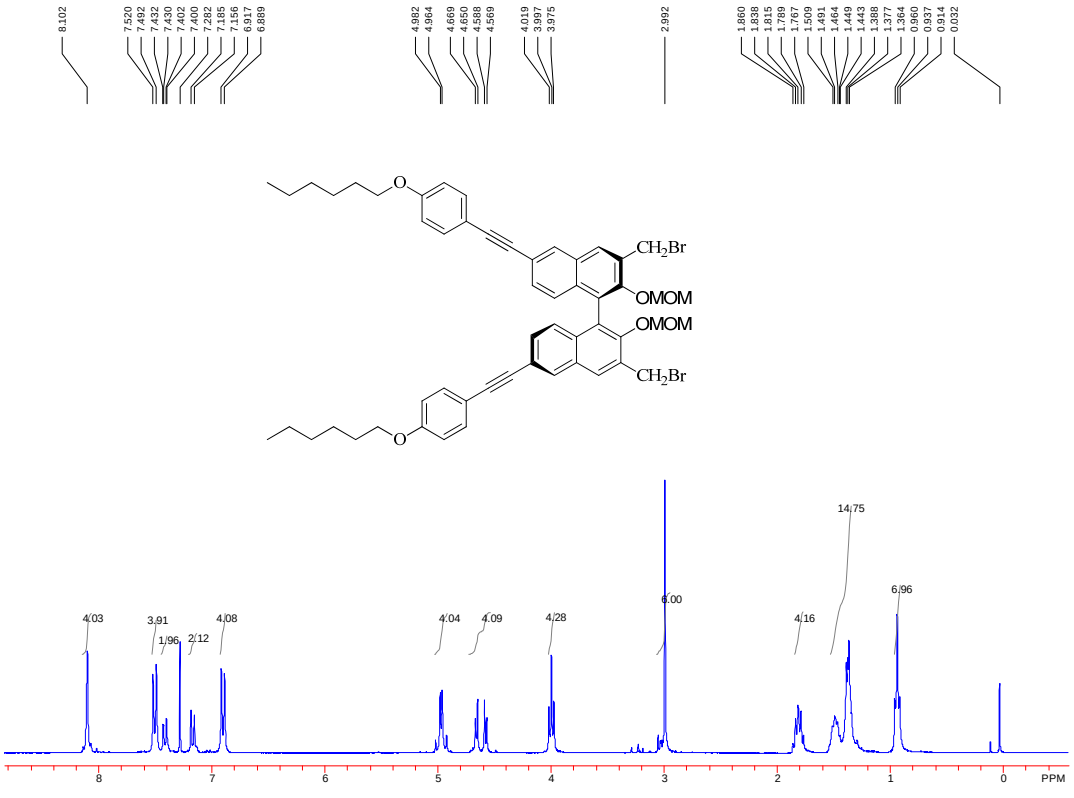


**Figure S18.** $^{1}$H NMR of (*R*)-3,3'-bis(bromomethyl)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene in $CDCl_3$

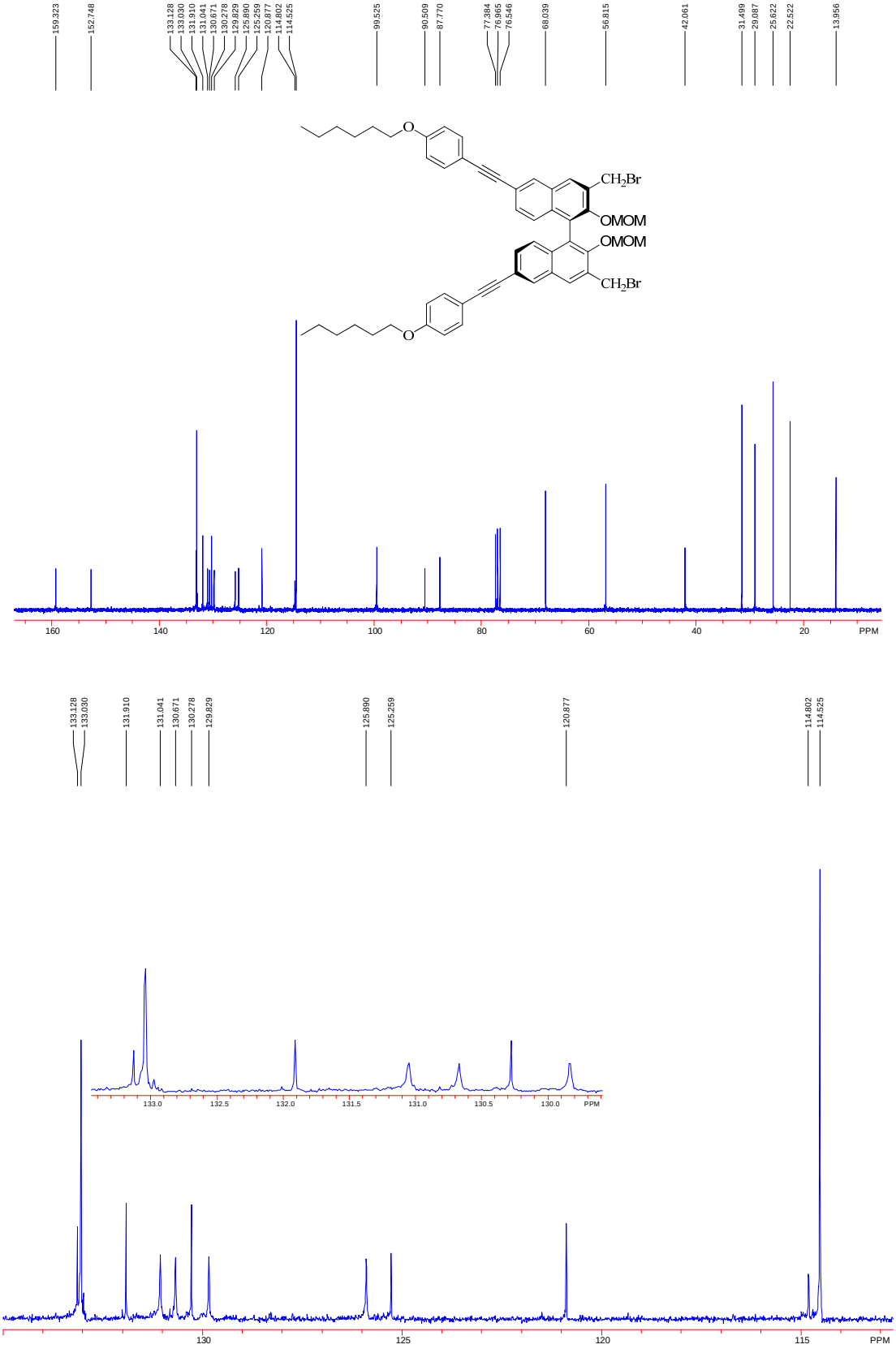


**Figure S19.** $^{13}$C NMR of (*R*)-3,3'-bis(bromomethyl)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-2,2'-bis(methoxymethoxy)-1,1'-binaphthalene in $CDCl_3$

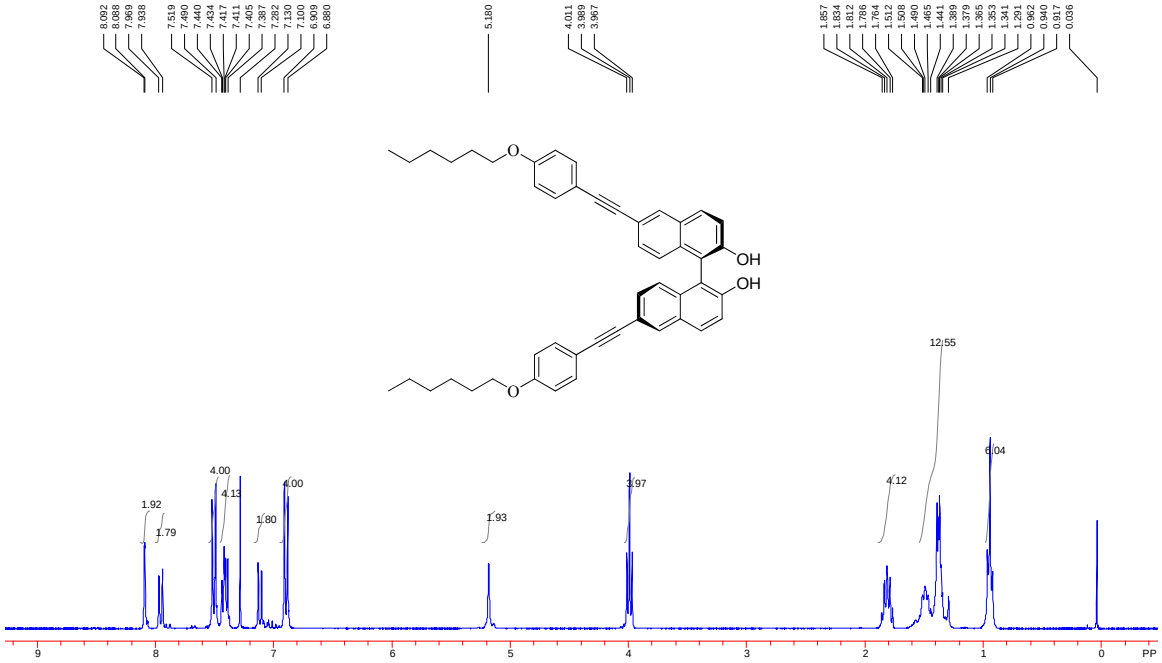
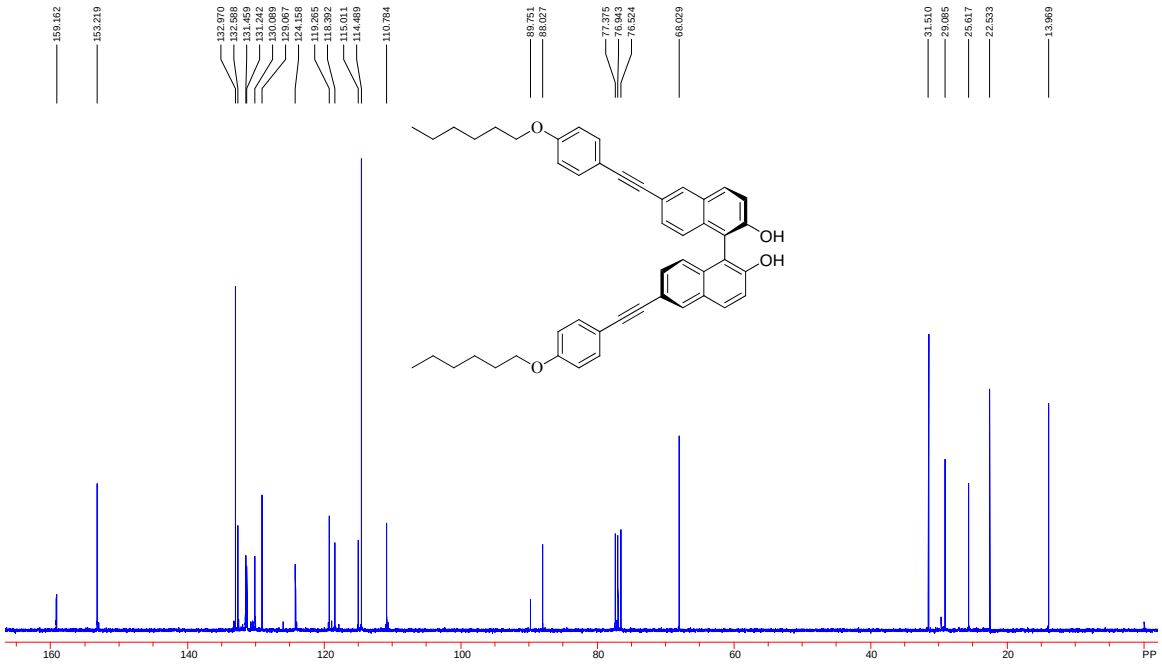



**Figure S20.** $^{1}$H NMR of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-(1,1'-binaphthalene)-2,2'-diol in $CDCl_3$



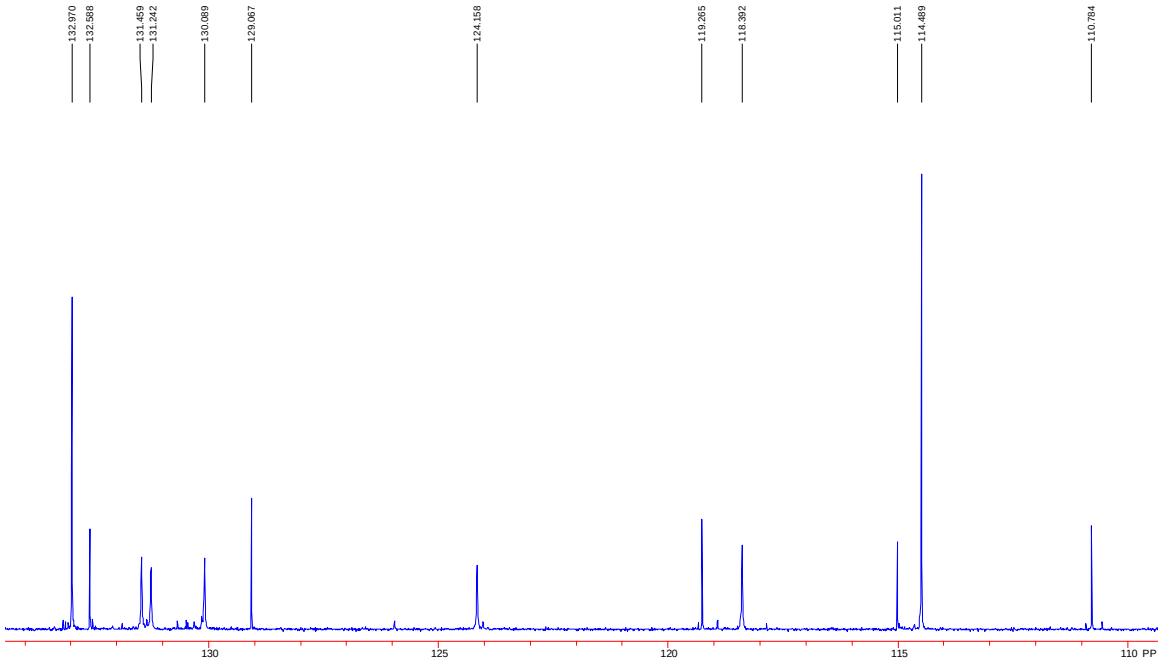
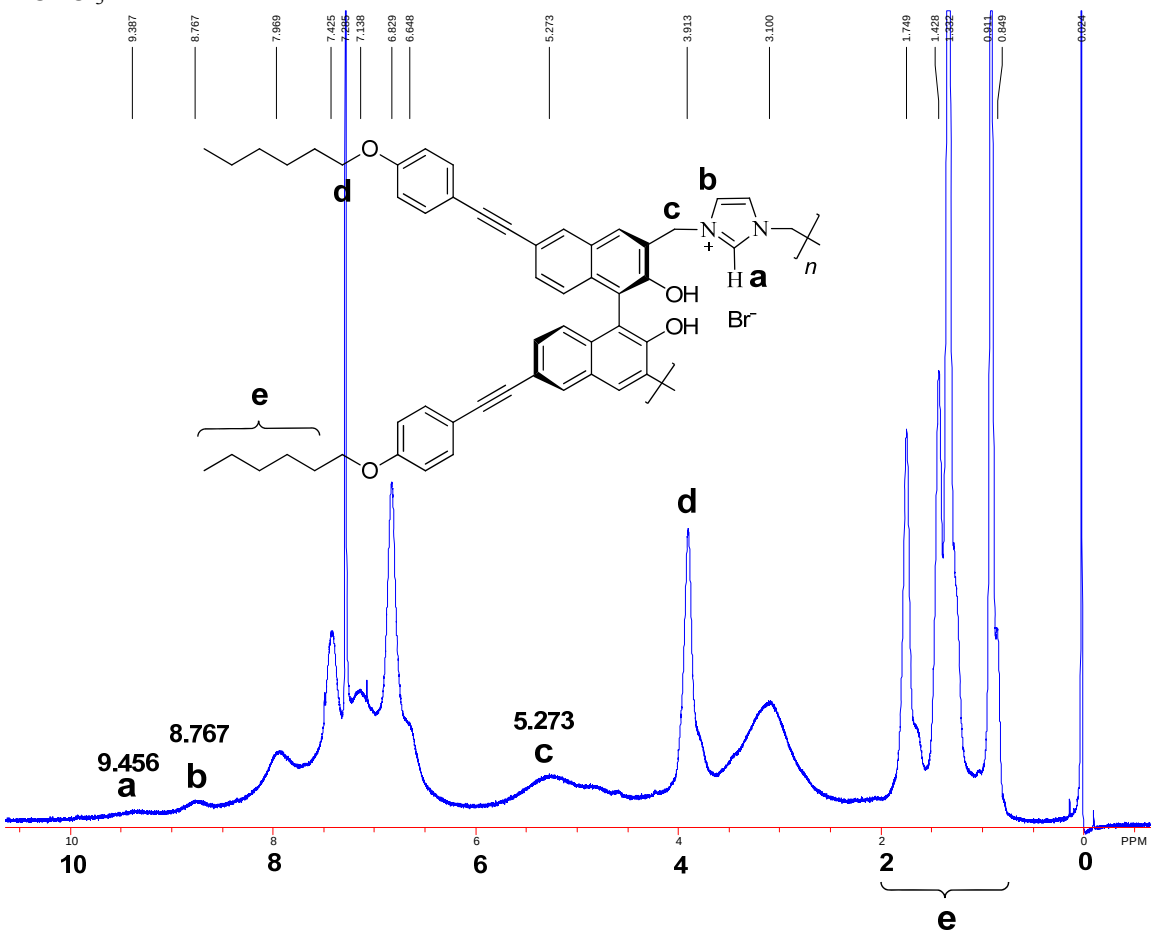



**Figure S21.** $^{13}$C NMR of (*R*)-6,6'-bis((4-(hexyloxy)phenyl)ethynyl)-(1,1'-binaphthalene)-2,2'-diol in $CDCl_3$



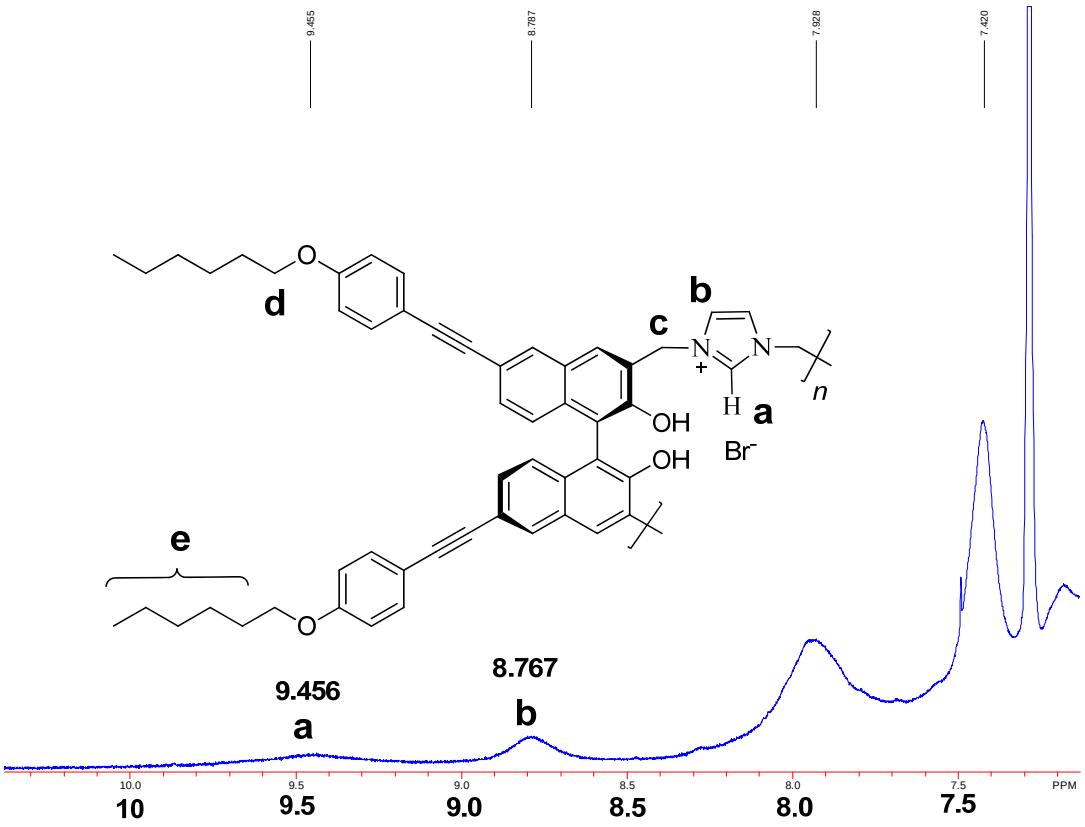
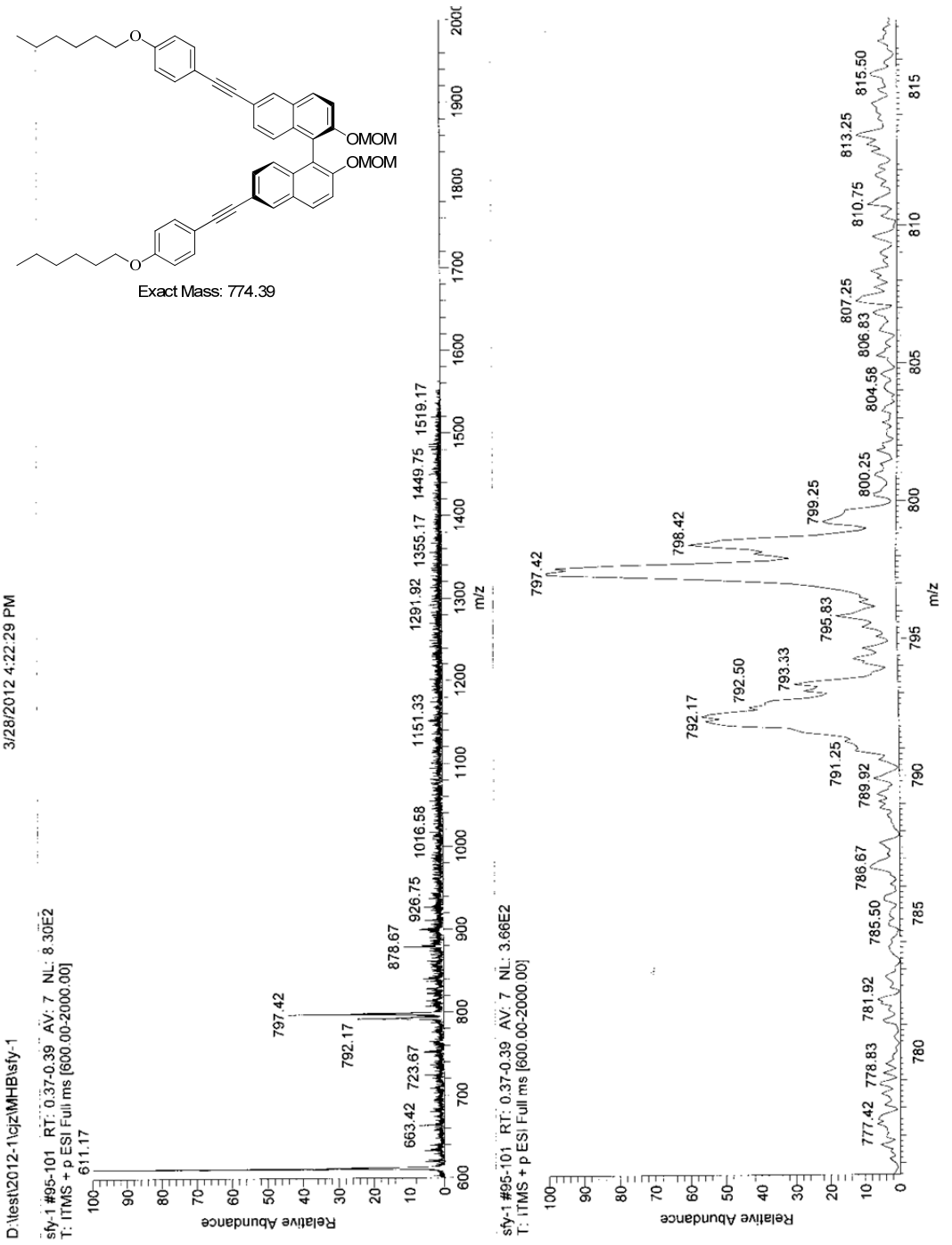
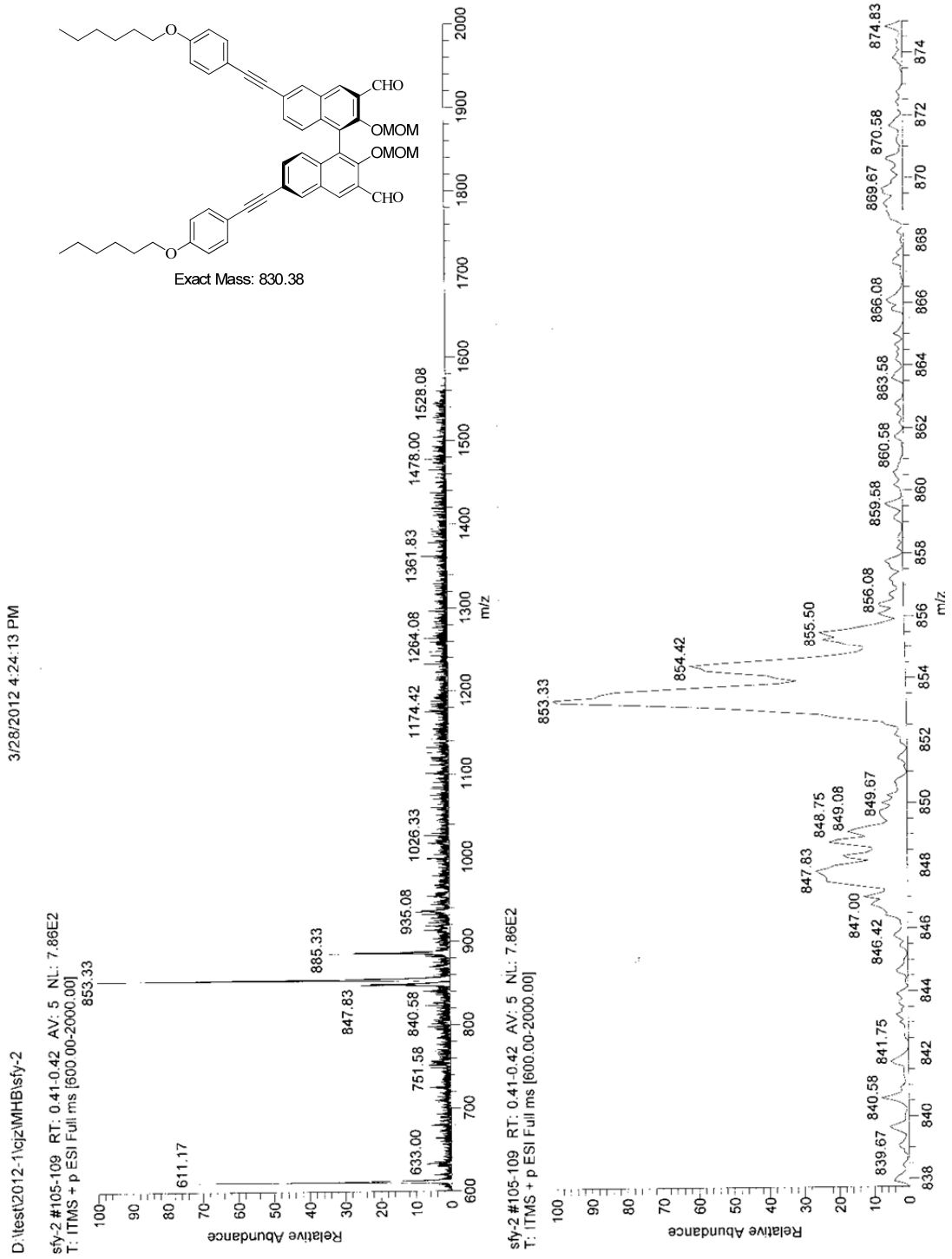



**Figure S22.** $^{1}$H NMR of chiral ionic polymer in $CDCl_3$

## ESI 8. MS (ESI) Spetra.

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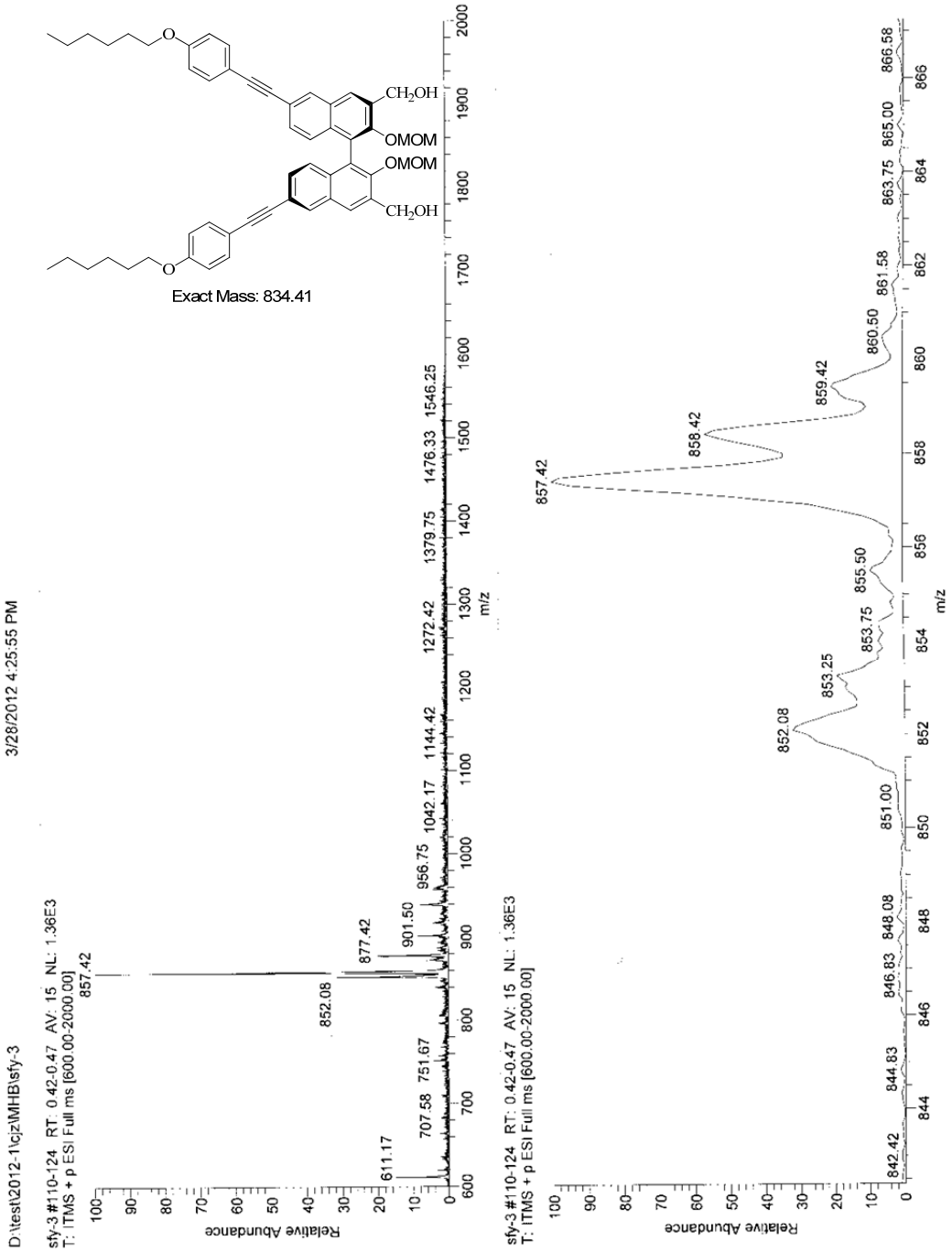

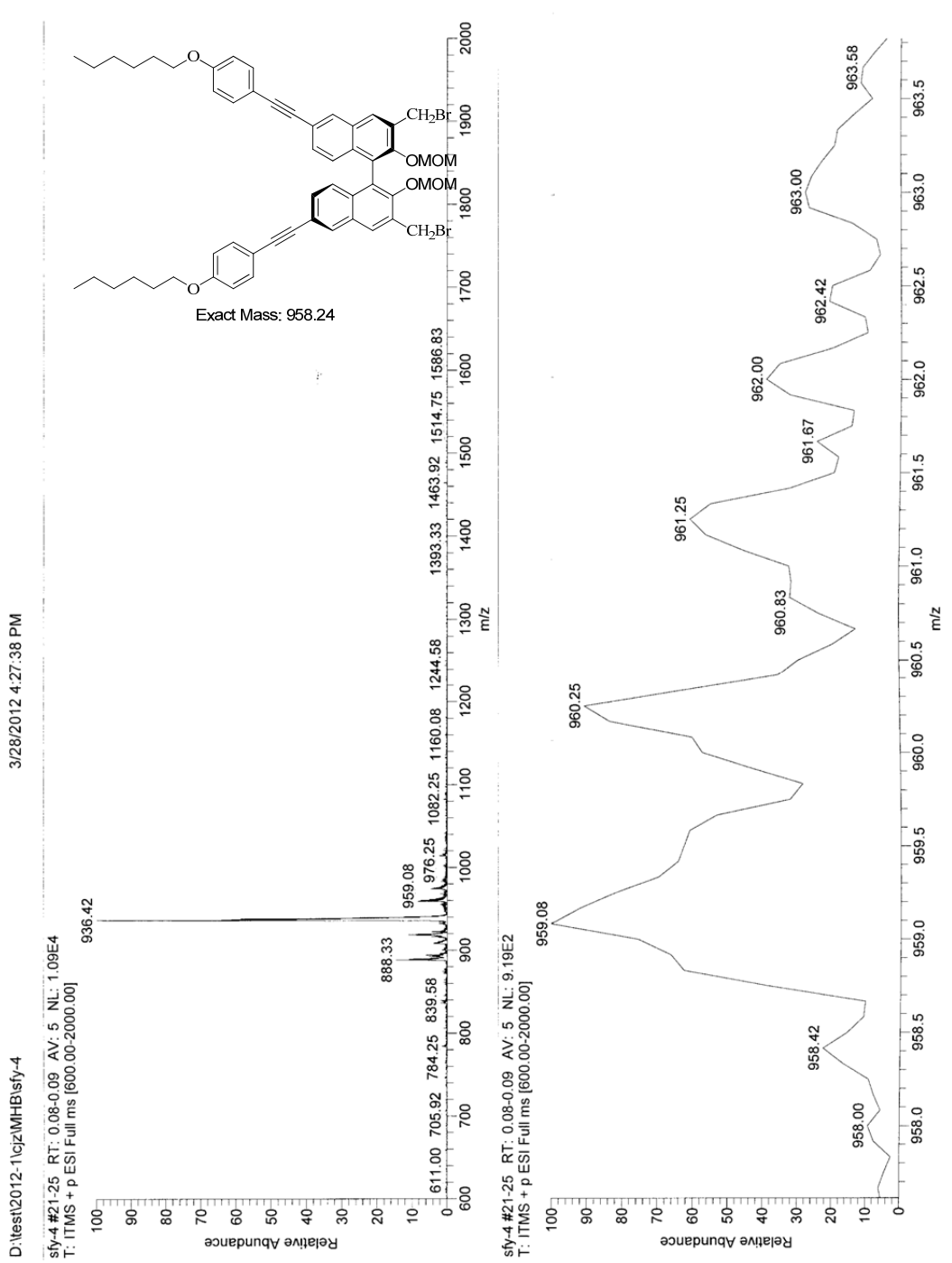
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