



Supporting Information

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**Highly Selective Thiirane of 1,2-Allenlyc Sulfones with Br₂
and Na₂S₂O₃. Mechanistic Study and Asymmetric Synthesis of
Alkylidenethiiranes**

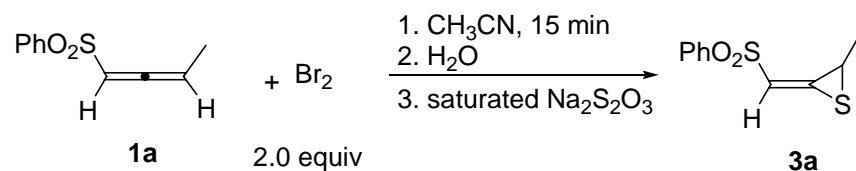
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**1. Synthesis of 1-Phenylsulfonylalkylidenethiiranes via the Electrophilic
Reactions of 1,2-Allenlyc Sulfones with Br₂**

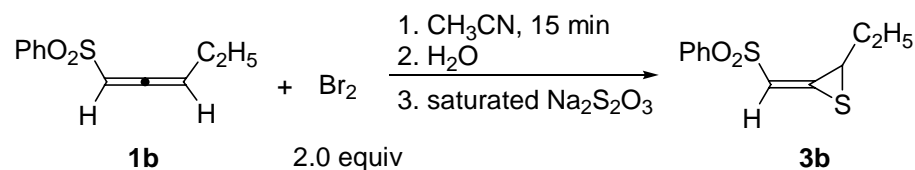
(1) *E*-2-Methyl-1-(phenylsulfonylmethylene)thiirane (3a)



Typical procedure: To a solution of **1a** (57.1 mg, 0.29 mmol) in 2.5 mL of MeCN was added dropwise with stirring 1.5 mL (0.5 M in MeCN, 0.75 mmol) of Br₂ at 23 °C. After the addition, the resulting solution was stirred for 15 min (monitored by TLC), quenched sequentially with 6 mL of water and 3.0 mL of saturated aqueous

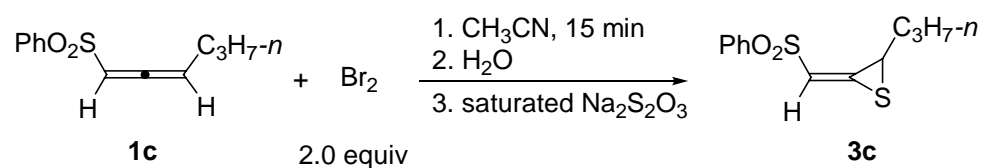
solution of Na₂S₂O₃. The mixture was then extracted with diethyl ether (50 + 25×2 mL), washed with brine, and dried over anhydrous Na₂SO₄. Evaporation and column chromatography on silica gel (petroleum ether/ethyl acetate = 10:1) afforded **3a** (46.8 mg, 70%): oil. ¹H NMR (400 MHz, CDCl₃) δ 7.88 (d, *J* = 7.8 Hz, 2H), 7.60 (t, *J* = 7.8 Hz, 1H), 7.53 (t, *J* = 7.8 Hz, 2H), 6.30 (s, 1H), 3.69 (q, *J* = 5.6 Hz, 1H), 1.85 (d, *J* = 5.6 Hz, 3H); ¹³C NMR(100 MHz, CDCl₃) δ 149.8, 141.6, 133.2, 129.2, 127.1, 114.4, 35.2, 21.6; IR (neat) ν (cm⁻¹) 3062, 1699, 1446, 1306, 1146; MS (70 eV, EI) *m/z* (%): 226 (M⁺, 57.2); 161 (100), Elemental analysis: Calcd for C₁₀H₁₀O₂S₂: C, 53.07, H, 4.45, S, 28.34; Found: C, 53.07, H, 4.48, S, 27.97.

(2) *E*-2-Ethyl-1-(phenylsulfonylmethylene)thiirane (3b)



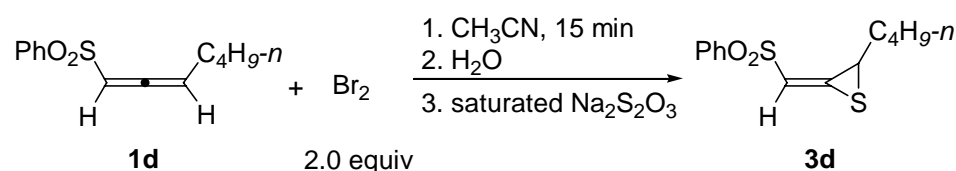
The reaction of 62.5 mg (0.3 mmol) of **1b** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br₂ afforded 50.3 mg (70%) of **3b**: oil. ¹H NMR (400 MHz, CDCl₃) δ 7.86 (d, *J* = 7.6 Hz, 2H), 7.58 (t, *J* = 7.6 Hz, 1H), 7.52 (t, *J* = 7.6 Hz, 2H), 6.30 (d, *J* = 1.2 Hz, 1H), 3.71 (ddd, *J* = 8.0, 3.2 & 1.2 Hz, 1H), 2.60-2.70 (m, 1H), 1.56-1.69 (m, 1H), 1.05 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 148.8, 141.6, 133.1, 129.2, 127.0, 114.6, 42.7, 27.5, 11.5; IR (neat) ν (cm⁻¹) 3063, 1698, 1618, 1446, 1317, 1147; MS (70 eV, EI) *m/z* (%): 240 (M⁺, 6.38), 97 (100); HRMS Calcd for C₁₁H₁₂O₂S₂Na (M⁺+Na): 263.0176, Found: 263.0173.

(3) *E*-1-(Phenylsulfonylmethylene)-2-propylthiirane (**3c**)



The reaction of 65.3 mg (0.29 mmol) of **1c** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br₂ afforded 52.0 mg (68%) of **3c**: oil, ¹H NMR (400 MHz, CDCl₃) δ 7.87 (d, *J* = 7.2 Hz, 2H), 7.60 (t, *J* = 7.2 Hz, 1H), 7.53 (t, *J* = 7.2 Hz, 2H), 6.30 (d, *J* = 1.2 Hz, 1H), 3.71 (ddd, *J* = 8.4, 3.2 & 1.2 Hz, 1H), 2.62-2.70 (m, 1H), 1.36-1.62 (m, 3H), 1.01 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 140.2, 138.5, 134.0, 133.9, 129.6, 127.5, 69.6, 39.7, 18.1, 13.9; IR (neat) ν (cm⁻¹) 3062, 1697, 1446, 1317, 1147; MS (70 eV, EI) *m/z* (%) 254 (M⁺, 10.88), 77 (100); HRMS Calcd for C₁₂H₁₄O₂S₂Na (M⁺+Na): 277.0333, Found: 277.0338.

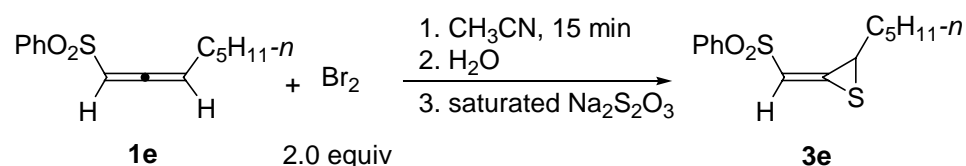
(4) *E*-2-Butyl-1-(phenylsulfonylmethylene)thiirane (**3d**)



The reaction of 72.2 mg (0.31 mmol) of **1d** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br₂ afforded 57.1 mg (71%) of **3d**: oil. ¹H NMR (400 MHz, CDCl₃) δ 7.84-7.90 (m, 2H), 7.55-7.62 (m, 1H), 7.48-7.55 (m, 2H), 6.29 (d, *J* = 1.2 Hz, 1H), 3.71 (ddd, *J* = 8.0, 3.0 & 1.2 Hz, 1H), 2.62-2.73 (m, 1H), 1.33-1.57 (m, 5H), 0.92 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 149.0, 141.7, 133.1, 129.2, 127.1, 114.5, 41.3, 34.2, 30.1, 21.8, 13.8; IR (neat) ν (cm⁻¹) 3064, 1695, 1446, 1320, 1147;

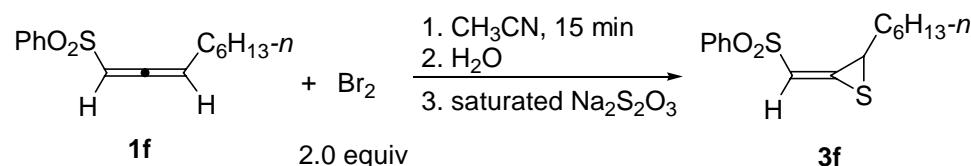
MS (70 eV, EI) m/z (%): 269 ($M^+ + 1$, 1.94), 77 (100); HRMS Calcd for $C_{13}H_{16}O_2S_2Na$ ($M^+ + Na$): 291.0489, Found: 291.0481.

(5) *E*-2-Pentyl-1-(phenylsulfonylmethylene)thiirane (3e)



The reaction of 74.2 mg (0.30 mmol) of **1e** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br_2 afforded 53.0 mg (63%) of **3e**: oil. ^1H NMR (400 MHz, CDCl_3) δ 7.84-7.89 (m, 2H), 7.56-7.62 (m, 1H), 7.48-7.55 (m, 2H), 6.29 (d, $J = 1.4$ Hz, 1H), 3.70 (ddd, $J = 8.0, 3.0$ & 1.4 Hz, 1H), 2.62-2.71 (m, 1H), 1.28-1.59 (m, 7H), 0.90 (t, $J = 7.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 149.1, 141.7, 133.1, 129.2, 127.1, 114.4, 41.3, 34.4, 30.8, 27.6, 22.4, 13.9; IR (neat) ν (cm^{-1}) 3059, 1694, 1615, 1446, 1320, 1147; MS (70 eV, EI) m/z (%): 250 ($M^+ - 32$, 3.5), 77 (100); HRMS Calcd for $C_{14}H_{18}O_2S_2Na$ ($M^+ + Na$): 305.0646, Found: 305.0625.

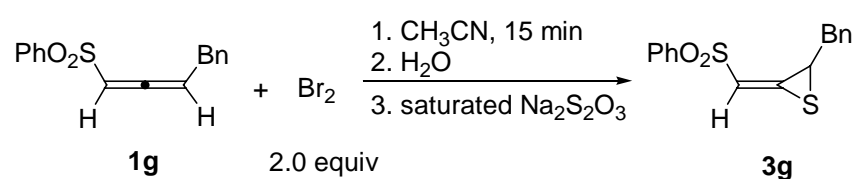
(6) *E*-2-(*n*-Hexyl)-1-(phenylsulfonylmethylene)thiirane (3f)



The reaction of 79.2 mg (0.3 mmol) of **1f** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br_2 afforded 60.7 mg (68%) of **3f**: oil. ^1H NMR (400 MHz, CDCl_3) δ 7.84-7.90 (m, 2H), 7.56-7.62 (m, 1H), 7.48-7.55 (m, 2H), 6.29 (d, $J = 1.2$ Hz, 1H), 3.70 (ddd, $J = 8.2, 3.0$ & 1.2 Hz, 1H), 2.62-2.72 (m, 1H), 1.21-1.60 (m, 9H), 0.89 (t, J

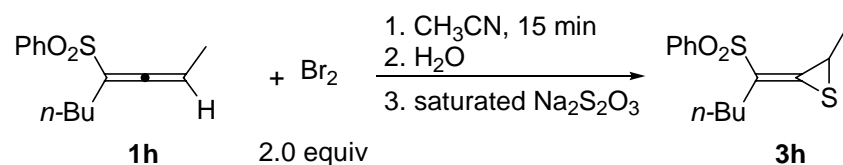
= 7.0 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 149.1, 141.7, 133.1, 129.2, 127.1, 114.5, 41.3, 34.5, 31.5, 28.4, 27.9, 22.5, 14.0; IR (neat) ν (cm^{-1}) 3059, 1696, 1619, 1446, 1321, 1148; MS (70 eV, EI) m/z (%): 295 (M^+-1 , 0.1), 264 (M^+-32 , 1.2), 77 (100); HRMS Calcd for $\text{C}_{15}\text{H}_{20}\text{O}_2\text{S}_2\text{Na}$ (M^++Na): 319.0802, Found: 319.0798.

(7) *E*-2-Benzyl-1-(phenylsulfonylmethylene)thiirane (3g)



The reaction of 53.0 mg (0.20 mmol) of **1g** and 0.8 mL (0.5 M in MeCN, 0.4 mmol) of Br_2 afforded 42.5 mg (72%) of **3g**: oil. ^1H NMR (400 MHz, CDCl_3) δ 7.92 (d, $J = 7.4$ Hz, 2H), 7.62 (t, $J = 7.4$ Hz, 1H), 7.55 (t, $J = 7.4$ Hz, 2H), 7.23-7.38 (m, 5H), 6.34 (s, 1H), 4.09 (dd, $J = 14.8$ & 2.8 Hz, 1H), 3.87 (dd, $J = 9.2$ & 2.8 Hz, 1H), 2.67 (dd, $J = 14.8$ & 9.2 Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 147.8, 141.6, 137.3, 133.3, 129.3, 128.8, 128.6, 127.2, 127.1, 115.0, 40.9, 40.8; IR (neat) ν (cm^{-1}) 3061, 1702, 1446, 1317, 1146; MS (70 eV, EI) m/z (%) 269 (M^+-33 , 0.01), 125 (100); HRMS Calcd for $\text{C}_{16}\text{H}_{14}\text{O}_2\text{S}_2\text{Na}$ (M^++Na): 325.0333, Found: 325.0315.

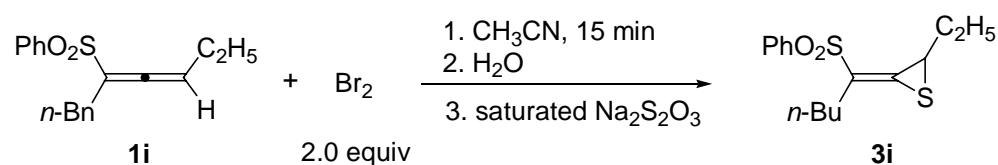
(8) *E*-2-Methyl-1-(1-(phenylsulfonyl)pentylidene)thiirane (3h)



The reaction of 49.2 mg (0.20 mmol) of **1h** and 0.8 mL (0.5 M in MeCN, 0.4 mmol) of Br_2 afforded 44.4 mg (80%) of **3h**: oil. ^1H NMR (400 MHz, CDCl_3) δ 7.83

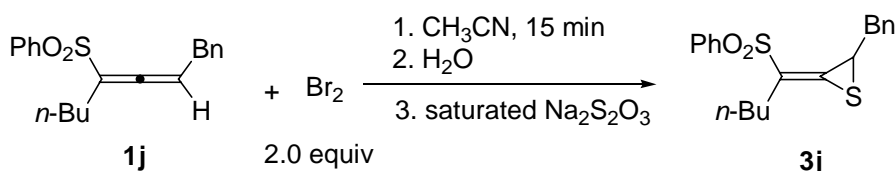
(d, $J = 7.4$ Hz, 2H), 7.60 (t, $J = 7.4$ Hz, 1H), 7.52 (t, $J = 7.4$ Hz, 2H), 3.74 (q, $J = 5.8$ Hz, 1H), 2.33 (t, $J = 7.6$ Hz, 2H), 1.88 (d, $J = 5.8$ Hz, 3H), 1.41-1.51 (m, 2H), 1.15-1.28 (m, 2H), 0.80 (t, $J = 7.6$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 145.8, 140.5, 133.1, 129.1, 127.7, 124.1, 36.2, 29.5, 29.1, 22.2, 22.1, 13.6; IR (neat) ν (cm^{-1}) 3063, 1710, 1446, 1310, 1153; MS (70 eV, EI) m/z (%) 282 (M^+ , 26.2), 140 (100); HRMS Calcd for $\text{C}_{14}\text{H}_{18}\text{O}_2\text{S}_2\text{Na}$ ($\text{M}^+\text{+Na}$): 305.0646, Found: 305.0634.

(9) *E*-2-Ethyl -1-(1-(phenylsulfonyl)pentylidene)thiirane (3i)



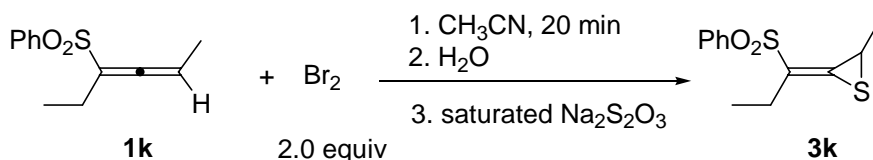
The reaction of 62.5 mg (0.24 mmol) of **1i** and 0.95 mL (0.5 M in MeCN, 0.48 mmol) of Br_2 afforded 47.1 mg (67%) of **3i**: oil; ^1H NMR (400 MHz, CDCl_3) δ 7.81-7.85 (m, 2H), 7.56-7.63 (m, 1H), 7.49-7.55 (m, 2H), 3.76 (dd, $J = 8.0$ and 3.2 Hz, 1H), 2.65-2.78 (m, 1H), 2.34 (t, $J = 8.0$ Hz, 2H), 1.54-1.68 (m, 1H), 1.37-1.54 (m, 2H), 1.13-1.29 (m, 2H), 1.10 (t, $J = 7.2$ Hz, 3H), 0.81 (t, $J = 7.2$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 144.9, 140.7, 133.1, 129.1, 127.7, 124.4, 43.9, 29.5, 29.2, 28.1, 22.2, 13.6, 11.7; IR (neat) ν (cm^{-1}) 3059, 1694, 1615, 1446, 1320, 1147; MS (70 eV, EI) m/z (%): 296 (M^+ , 8.54), 126 (100); HRMS Calcd for $\text{C}_{15}\text{H}_{20}\text{O}_2\text{S}_2\text{Na}$ ($\text{M}^+\text{+Na}$): 319.0802, Found: 319.0800.

(10) *E*-2-Benzyl-1-(1-(phenylsulfonyl)pentylidene)thiirane (3j)



The reaction of 65.1 mg (0.20 mmol) of **1j** and 0.8 mL (0.5 M in MeCN, 0.4 mmol) of Br₂ afforded 59.8 mg (84%) of **3j**: oil. ¹H NMR (400 MHz, CDCl₃) δ 7.86-7.92 (m, 2H), 7.58-7.66 (m, 1H), 7.51-7.57 (m, 2H), 7.22-7.39 (m, 5H), 4.12 (dd, *J* = 14.4 and 2.8 Hz, 1H), 3.92 (dd, *J* = 9.2 and 2.8 Hz, 1H), 2.69 (dd, *J* = 14.4 and 9.2 Hz, 1H), 2.29-2.37 (m, 2H), 1.39-1.51 (m, 2H), 1.12-1.25 (m, 2H), 0.80 (t, *J* = 7.4 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 143.8, 140.5, 137.7, 133.2, 129.2, 128.9, 128.5, 127.7, 127.0, 124.8, 42.0, 41.3, 29.5, 29.2, 22.2, 13.6; IR (neat) ν (cm⁻¹) 3063, 1708, 1446, 1305, 1151; MS (70 eV, EI) *m/z* (%): 326 (M⁺-S, 0.65), 91 (100); HRMS Calcd for C₂₀H₂₂O₂S₂Na (M⁺+Na): 381.0959, Found: 381.0941.

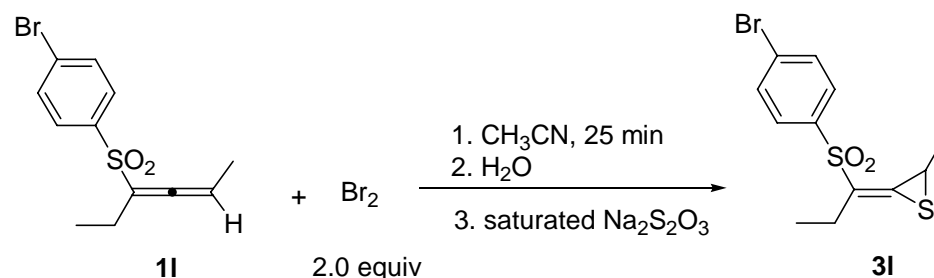
(11) *E*-2-Methyl-1-(1-(phenylsulfonyl)propylidene)thiirane (3k)



The reaction of 44.2 mg (0.2 mmol) of **1k** and 0.8 mL (0.5 M in MeCN, 0.4 mmol) of Br₂ afforded 42.6 mg (84%) of **3k**: oil. ¹H NMR (400 MHz, CDCl₃) δ 7.82-7.88 (m, 2H), 7.57-7.64 (m, 1H), 7.49-7.56 (t, *J* = 8.0 Hz, 2H), 3.72 (q, *J* = 6.0 Hz, 1H), 2.38 (q, *J* = 7.6 Hz, 2H), 1.87 (d, *J* = 6.0 Hz, 3H), 1.06 (t, *J* = 7.6 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 145.3, 140.4, 133.2, 129.1, 127.6, 125.1, 35.7, 22.9, 22.0, 12.1; IR (neat) ν (cm⁻¹) 3068, 1732, 1615, 1446, 1304, 1153; MS (70 eV, EI)

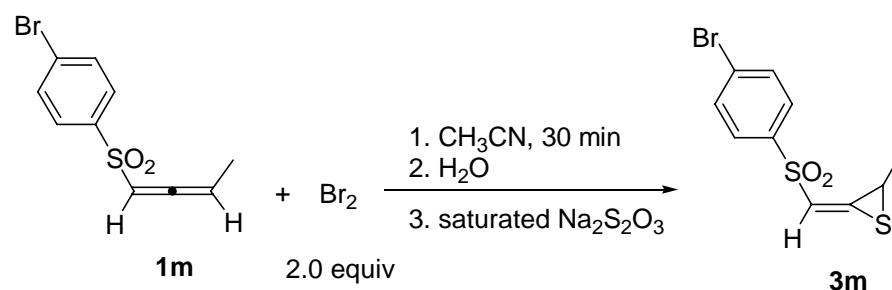
m/z (%): 254 (M^+ , 18.5), 112 (100); HRMS Calcd for $C_{12}H_{14}O_2S_2Na$ ($M^+ + Na$): 277.0327, Found: 277.0320.

(12) *E*-1-(1-(4'-Bromophenylsulfonyl)propylidene)-2-methylthiirane(3l)



The reaction of 90.4 mg (0.3 mmol) of **1l** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br_2 afforded 61.3 mg (61%) of **3l**: oil. 1H NMR (400 MHz, $CDCl_3$) δ 7.70 (d, $J = 9.0$ Hz, 2H), 7.65 (d, $J = 9.0$ Hz, 2H), 3.70 (q, $J = 5.6$ Hz, 1H), 2.37 (q, $J = 7.6$ Hz, 2H), 1.85 (d, $J = 5.6$ Hz, 3H), 1.07 (t, $J = 7.6$ Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 146.0, 139.7, 132.4, 129.2, 128.3, 124.7, 35.7, 22.9, 22.0, 12.1; IR (neat) ν (cm^{-1}) 3087, 1711, 1573, 1470, 1312, 1155; MS (70 eV, EI) m/z (%): 334 (M^+ (^{81}Br), 5.9), 332 (M^+ (^{79}Br), 5.4), 112 (100); HRMS Calcd for $C_{12}H_{13}BrO_2S_2$ (M^+): 333.9520 (^{81}Br), 331.9535 (^{79}Br), Found: 333.9516 (^{81}Br), 331.9534 (^{79}Br).

(13) *E*-1-((4'-Bromophenylsulfonyl)methylene)-2-methylthiirane (3m)

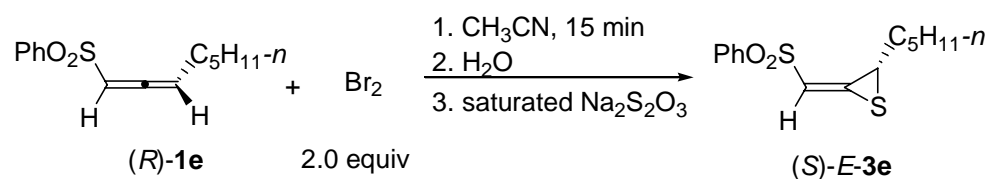


The reaction of 57.5 mg (0.21 mmol) of **1m** and 0.8 mL (0.5 M in MeCN, 0.4 mmol) of Br_2 afforded 42.0 mg (65%) of **3m**: solid, m.p. 86-87 °C (hexane and ethyl

acetate). ^1H NMR (400 MHz, CDCl_3) δ 7.73 (d, $J = 8.8$ Hz, 2H), 7.66 (d, $J = 8.8$ Hz, 2H), 6.27 (s, 1H), 3.68 (q, $J = 5.8$ Hz, 1H), 1.85 (d, $J = 5.8$ Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 150.7, 140.7, 132.6, 128.7, 128.4, 114.0, 35.2, 21.7; IR (neat) ν (cm^{-1}) 3062, 1731, 1632, 1574, 1446, 1314, 1145; MS (70 eV, EI) m/z (%): 306 ($\text{M}^+(\text{}^{81}\text{Br})$, 18.6), 304 ($\text{M}^+(\text{}^{79}\text{Br})$, 17.8), 160 (100); Elemental analysis: Calcd for $\text{C}_{10}\text{H}_9\text{BrO}_2\text{S}_2$: C, 39.35, H, 2.97; Found: C, 39.31, H, 2.92.

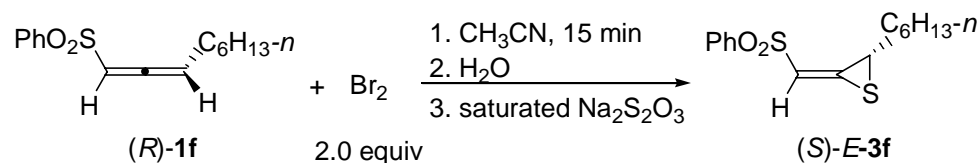
2 Synthesis of Optically Active (1-Phenylsulfonyl)alkylidenethiiranes via the Reactions of Optically Active 1,2-Allenyl Sulfones

(1) (*S*)-*E*-2-Pentyl-1-(phenylsulfonylmethylene)thiirane ((*S*)-**3e**)



The reaction of 74.9 mg (0.3 mmol, 99% *ee*) of (*R*)-(-)-**1e** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br_2 afforded 52.1 mg (62%, 99% *ee*) (HPLC conditions: Chiralcel OJ-H, hexane/*i*-PrOH = 95/5, 0.7 mL/min, $n = 254$ nm, t_r 18.6 (major), 22.2 (minor)); $[\alpha] = -137.5$ (c 1.3, CHCl_3) of (*S*)-(-)-**3e**, oil.

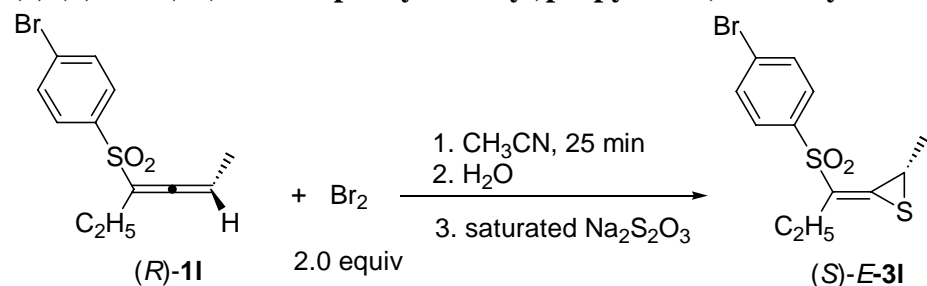
(2) (*R*)-*E*-2-Hexyl-1-(phenylsulfonylmethylene)thiirane ((*S*)-**3f**)



The reaction of 79.2 mg (0.3 mmol, >99.0% *ee*) of (*R*)-(-)-**1f** and 1.2 mL (0.5 M in MeCN, 0.6 mmol) of Br_2 afforded 51.6 mg (58%, 99% *ee*). (HPLC conditions:

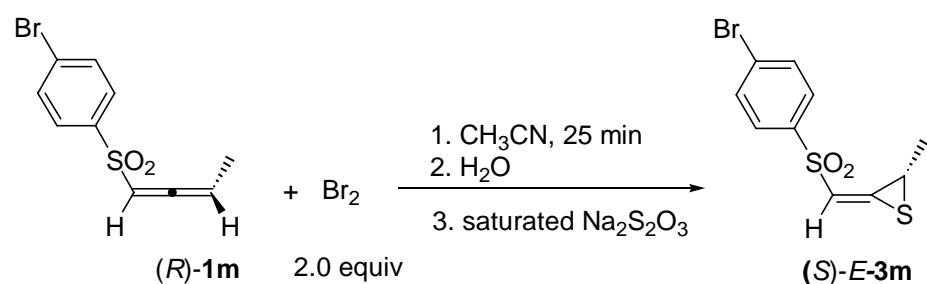
Chiralcel OJ-H, hexane/*i*-PrOH = 95/5, 0.7 mL/min, $n = 254$ nm, t_r 16.6 (major), 18.7 (minor)); $[\alpha] = -139.0$ (c 1.2, CHCl₃) of (*S*)-(-)-**3f**, oil.

(3) (*S*)-*E*-1-(1-(4-Bromophenylsulfonyl)propylidene)-2-methylthiirane(3l**)**



The reaction of 150.5 mg (0.5 mmol, 96% *ee*) of (*R*)-(-)-**11** and 2.0 mL (0.5 M in MeCN, 1.0 mmol) of Br₂ for 25 min afforded 123.1 mg (74%, 97% *ee* (HPLC conditions: Chiralcel OJ-H, hexane/*i*-PrOH = 95/5, 0.7 mL/min, $n = 254$ nm, t_r 15.9 (minor), 23.7 (major)); $[\alpha] = -43.3$ (c 1.0, CHCl₃)) of (*S*)-(-)-**3l**: oil.

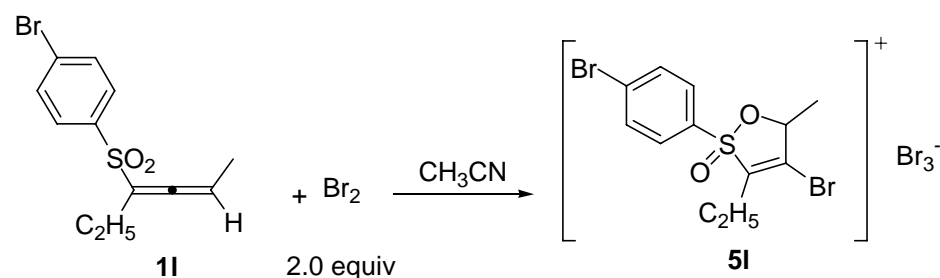
(4) (*S*)-*E*-1-((4-Bromophenylsulfonyl)methylene)-2-methylthiirane (3m**)**



The reaction of 136.5 mg (0.5 mmol, 99% *ee*) of (*R*)-(-)-**1m** and 2.0 mL (0.5 M in MeCN, 1.0 mmol) of Br₂ for 35 min afforded 86.7 mg (57%, 99% *ee* (HPLC conditions: Chiralcel OJ-H, hexane/*i*-PrOH = 95/5, 0.7 mL/min, $n = 254$ nm, t_r 37.7 (major), 40.0 (minor)); $[\alpha] = -50.1$ (c 2.6, CHCl₃)) of (*S*)-(-)-**3m**: solid, m.p., 86-87 °C (hexane/Et₂O).

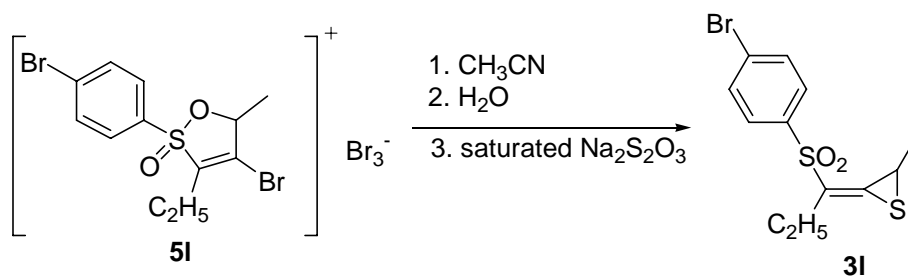
3. Isolation of Intermediate 5I and Its Reactivity Study

(1) Isolation of 5I

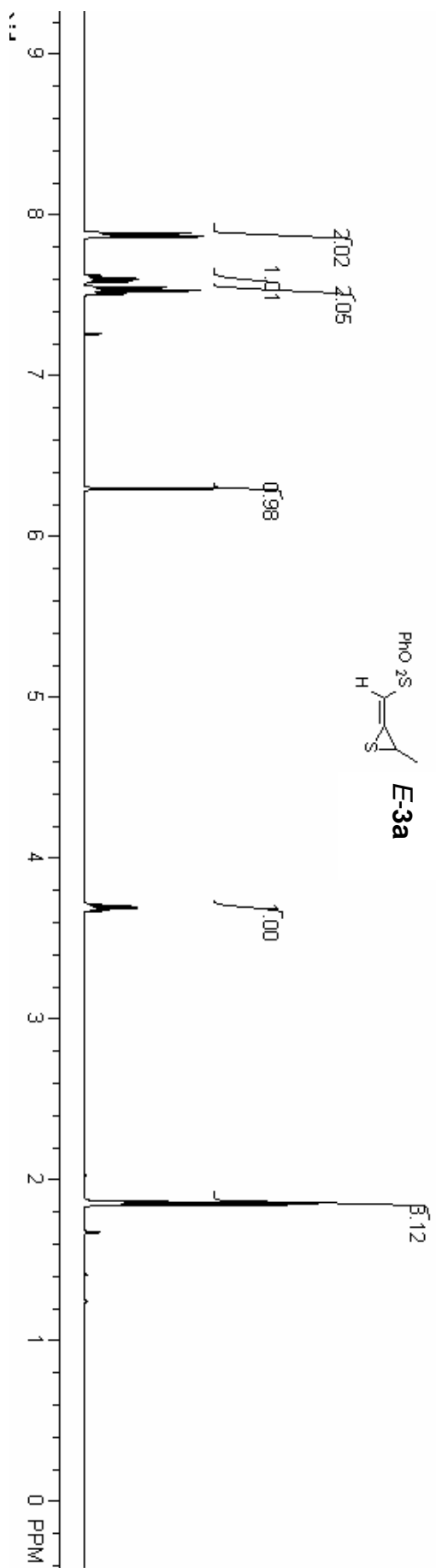


To a solution of **1o** (602.0 mg, 2.0 mmol) in 4.0 mL of anhydrous MeCN was added with stirring 8.0 mL (0.5 M in anhydrous MeCN, 4.0 mmol) of Br_2 at 19 °C. After evaporation, an orange solid was collected by filtration. It was washed with anhydrous diethyl ether (10 × 3 mL) and dried under vacuum to afford 927.9 mg of **5I** (75%, *cis/trans* isomer 1:1). This solid was dissolved in anhydrous MeCN at 40 °C and then recrystallized at 0 °C to afford pure *trans*-**5I**: solid, m.p. 92-94 °C (MeCN) (decomposition). ^1H NMR (400 MHz, CD_3CN) δ 8.09 (d, $J = 8.8$ Hz, 2H), 7.96 (d, $J = 8.8$ Hz, 2H), 6.43 (q, $J = 6.4$ Hz, 1H), 2.65-2.78 (m, 1H), 2.46-2.58 (m, 1H), 1.99 (d, $J = 7.2$ Hz, 3H) 1.08 (t, $J = 7.6$ Hz, 3H); IR (KBr) ν (cm^{-1}) 3044, 1625, 1588, 1571, 1517, 1307, 1160; MS (70eV, EI) m/z (%): 383 ($\text{M}^+(\text{}^{81}\text{Br}, \text{}^{81}\text{Br})$, 54), 381 ($\text{M}^+(\text{}^{79}\text{Br}, \text{}^{81}\text{Br})$, 100), 379 ($\text{M}^+(\text{}^{79}\text{Br}, \text{}^{79}\text{Br})$, 52); HRMS Calcd for $\text{C}_{12}\text{H}_{13}\text{}^{79}\text{Br}_2\text{O}_2\text{S}$ (M^+): 378.8998, Found: 378.9003.

(2) The reaction of **51** with H₂O and an aqueous solution of Na₂S₂O₃ affording **31**



A solution of **51** (186.7 mg, 0.3 mmol, *cis/trans* isomer 1:1) in 2.7 mL of MeCN was quenched with 4.0 mL of water followed by the addition of 3.0 mL of saturated aqueous solution of Na₂S₂O₃. Then it was extracted with diethyl ether (30 + 25×2 mL), washed with brine, and dried over anhydrous Na₂SO₄. Evaporation and column chromatography on silica gel (petroleum ether/ethyl acetate = 15:1) afforded **31** (84.0 mg, 84%).

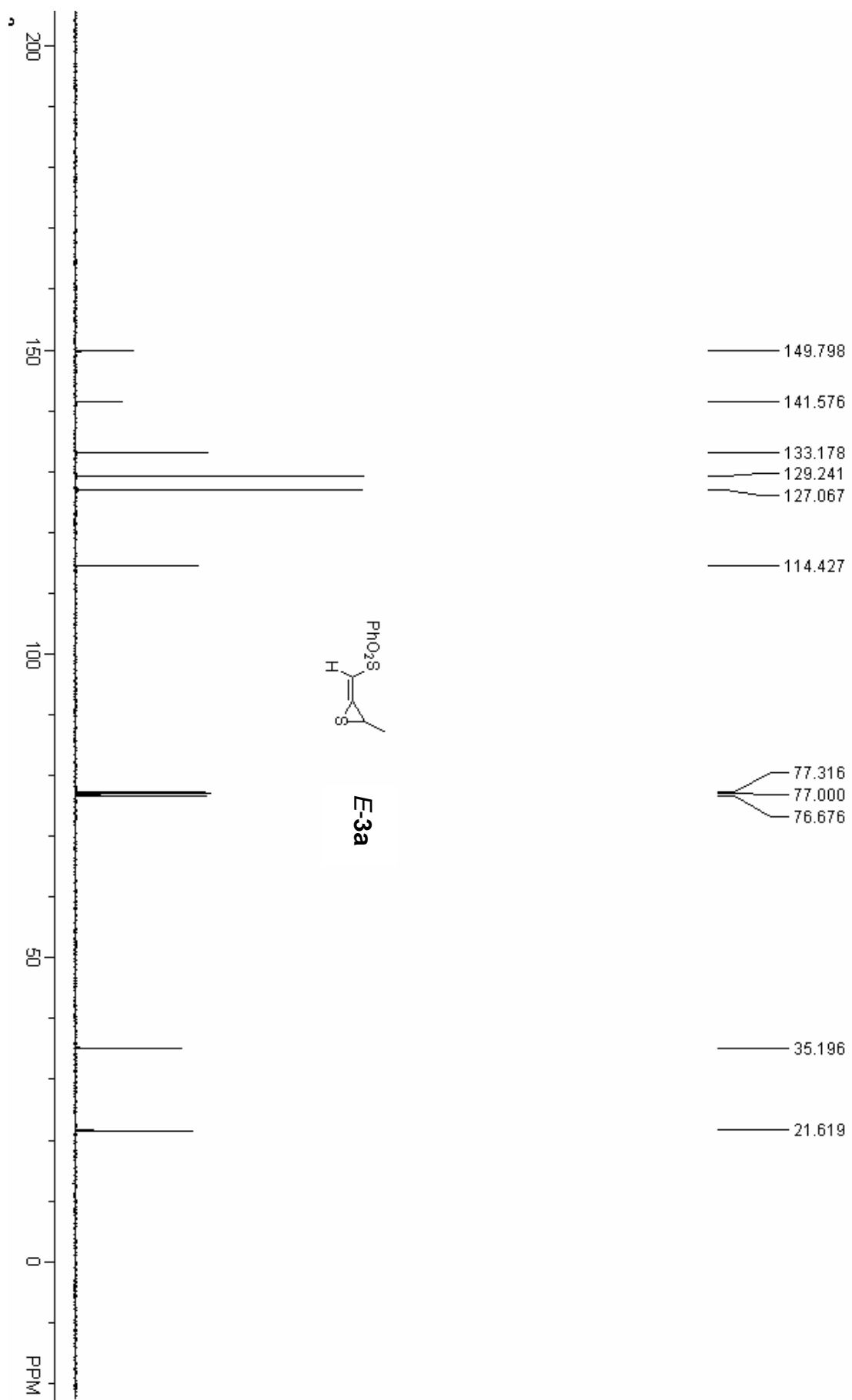


- 7.886
- 7.865
- 7.623
- 7.604
- 7.586
- 7.548
- 7.529
- 7.509
- 7.260

6.297

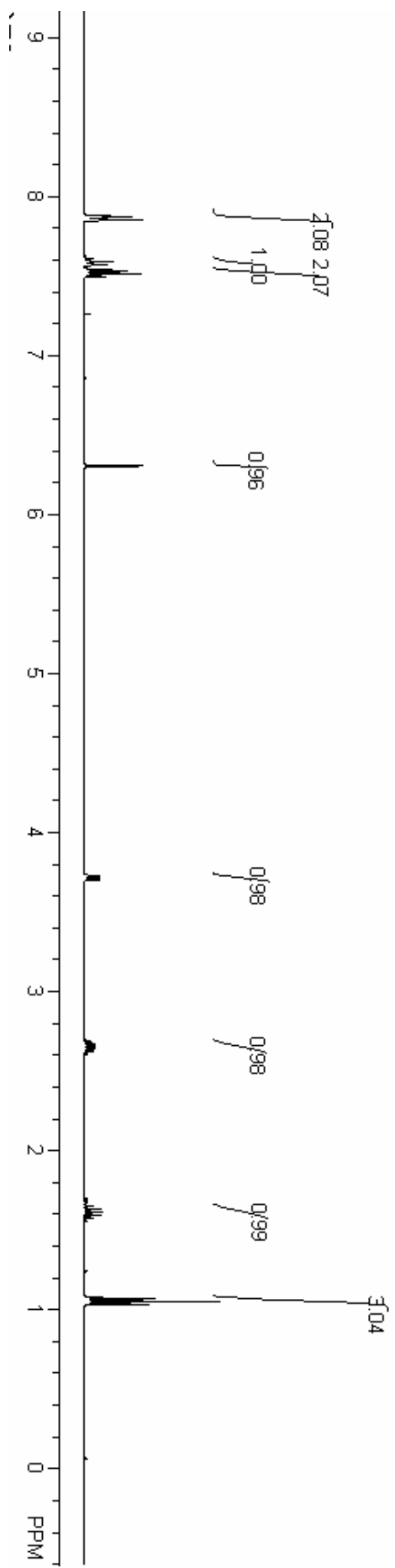
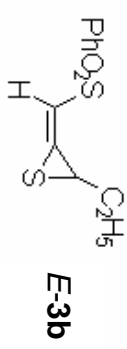
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- 3.699
- 3.685
- 3.671

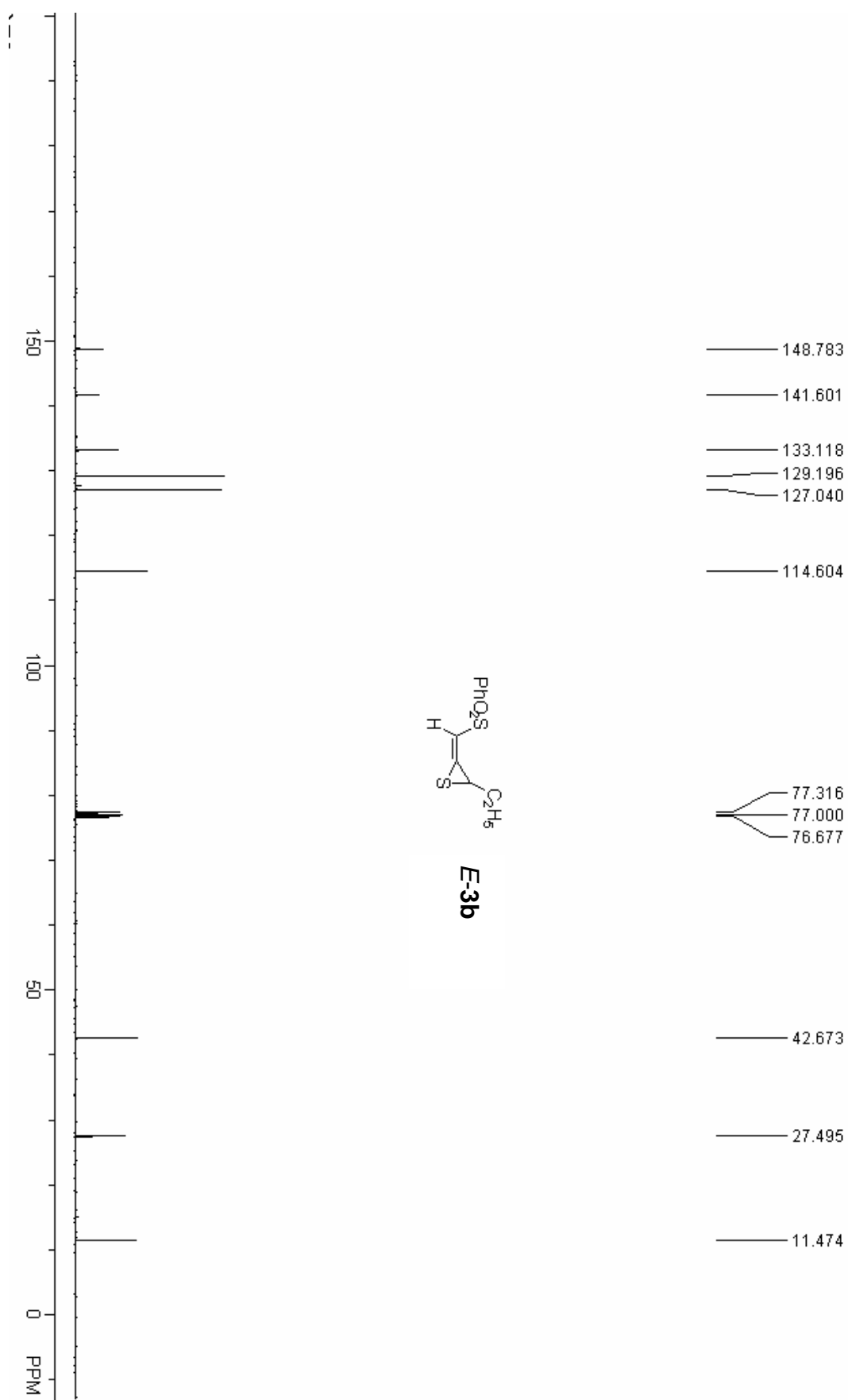
- 1.861
- 1.847

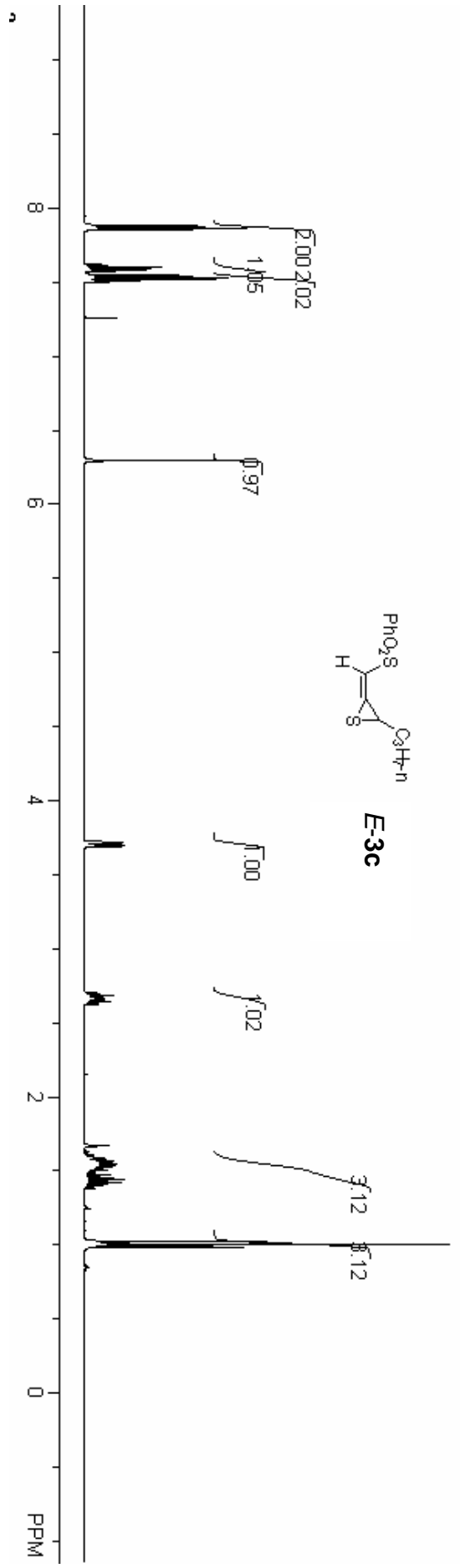
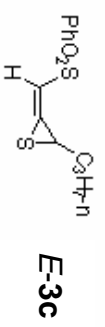
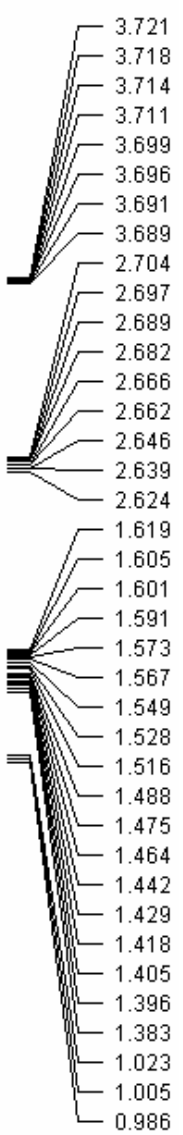
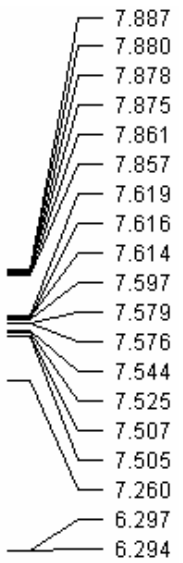


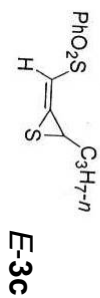
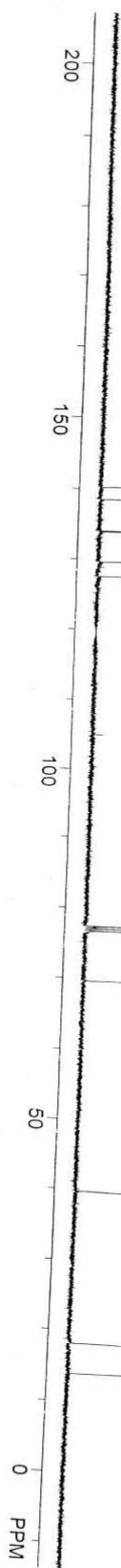
- 7.872
- 7.854
- 7.850
- 7.608
- 7.595
- 7.589
- 7.584
- 7.571
- 7.567
- 7.534
- 7.515
- 7.497
- 7.260
- 6.305
- 6.302

- 3.729
- 3.727
- 3.721
- 3.719
- 3.709
- 3.706
- 3.700
- 3.699
- 2.684
- 2.676
- 2.665
- 2.657
- 2.647
- 2.639
- 2.629
- 2.621
- 1.652
- 1.633
- 1.614
- 1.596
- 1.577
- 1.071
- 1.053
- 1.034







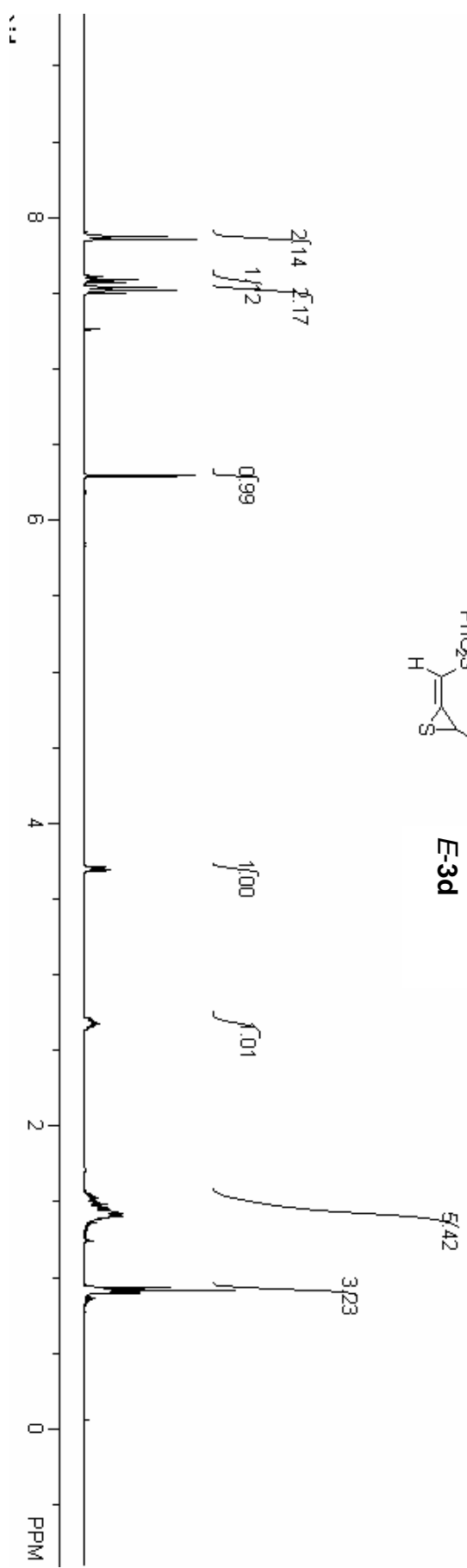
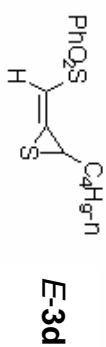
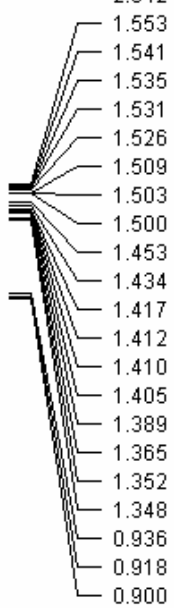
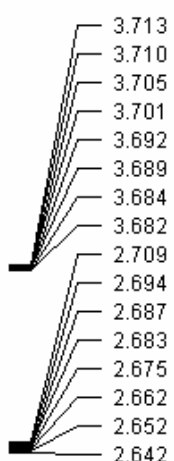
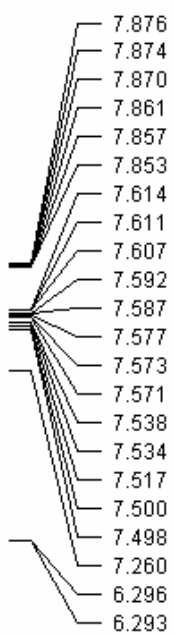


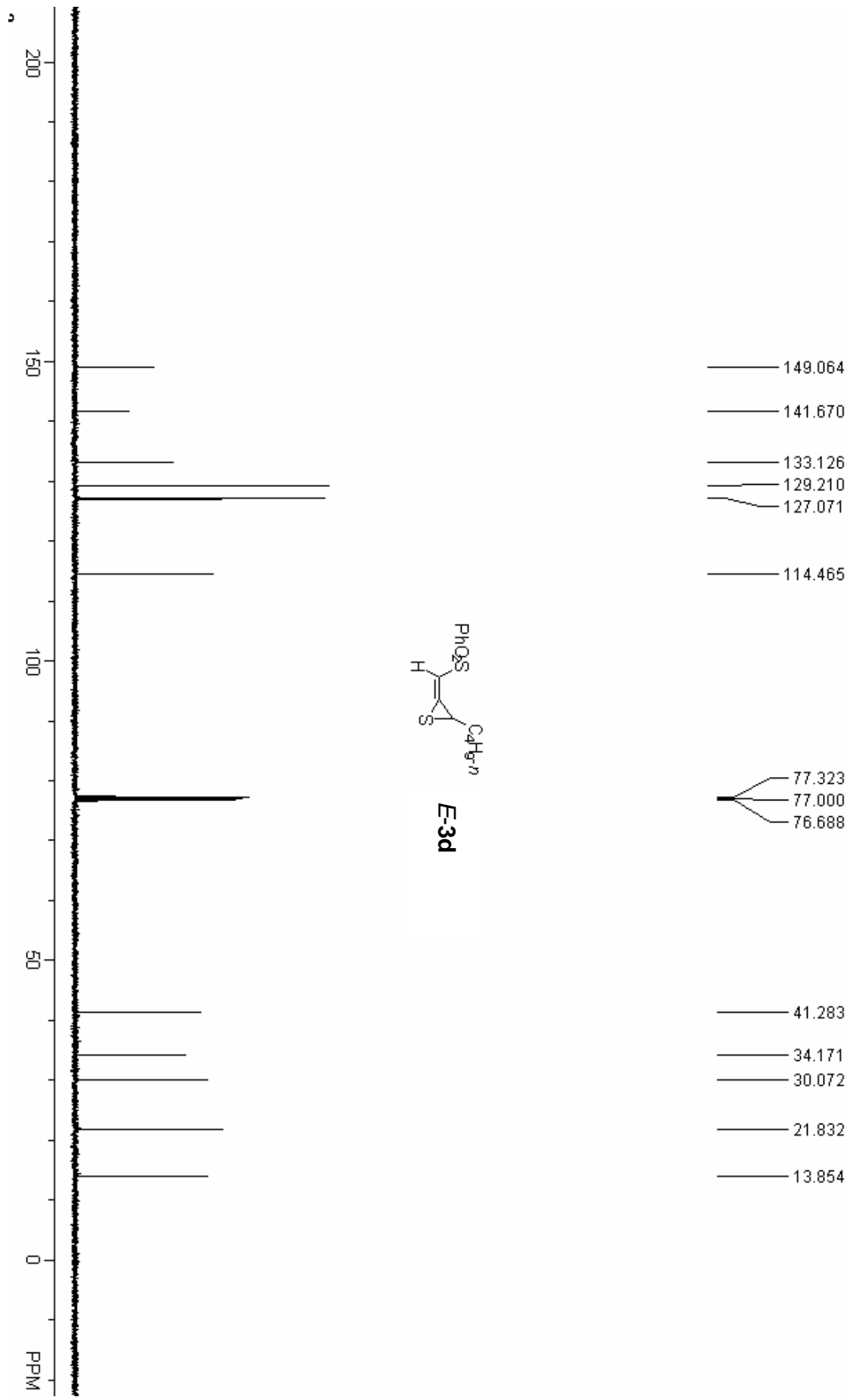
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77.307
77.000
76.684
69.604

39.652

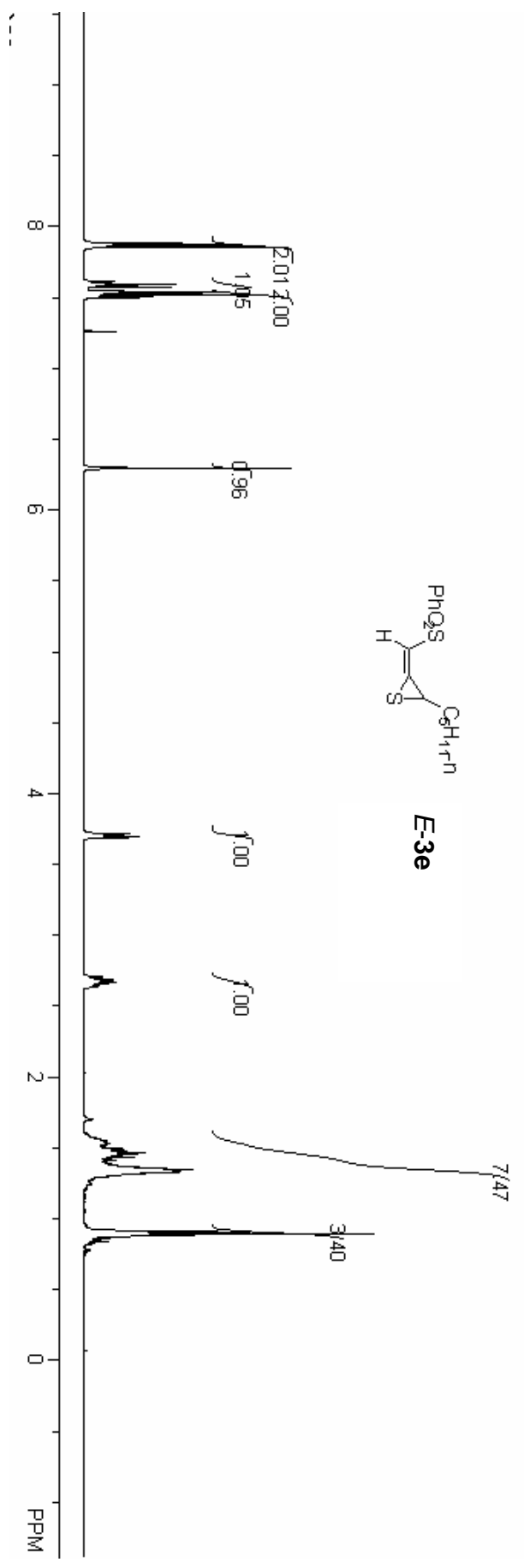
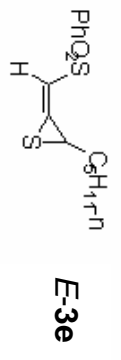
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13.855

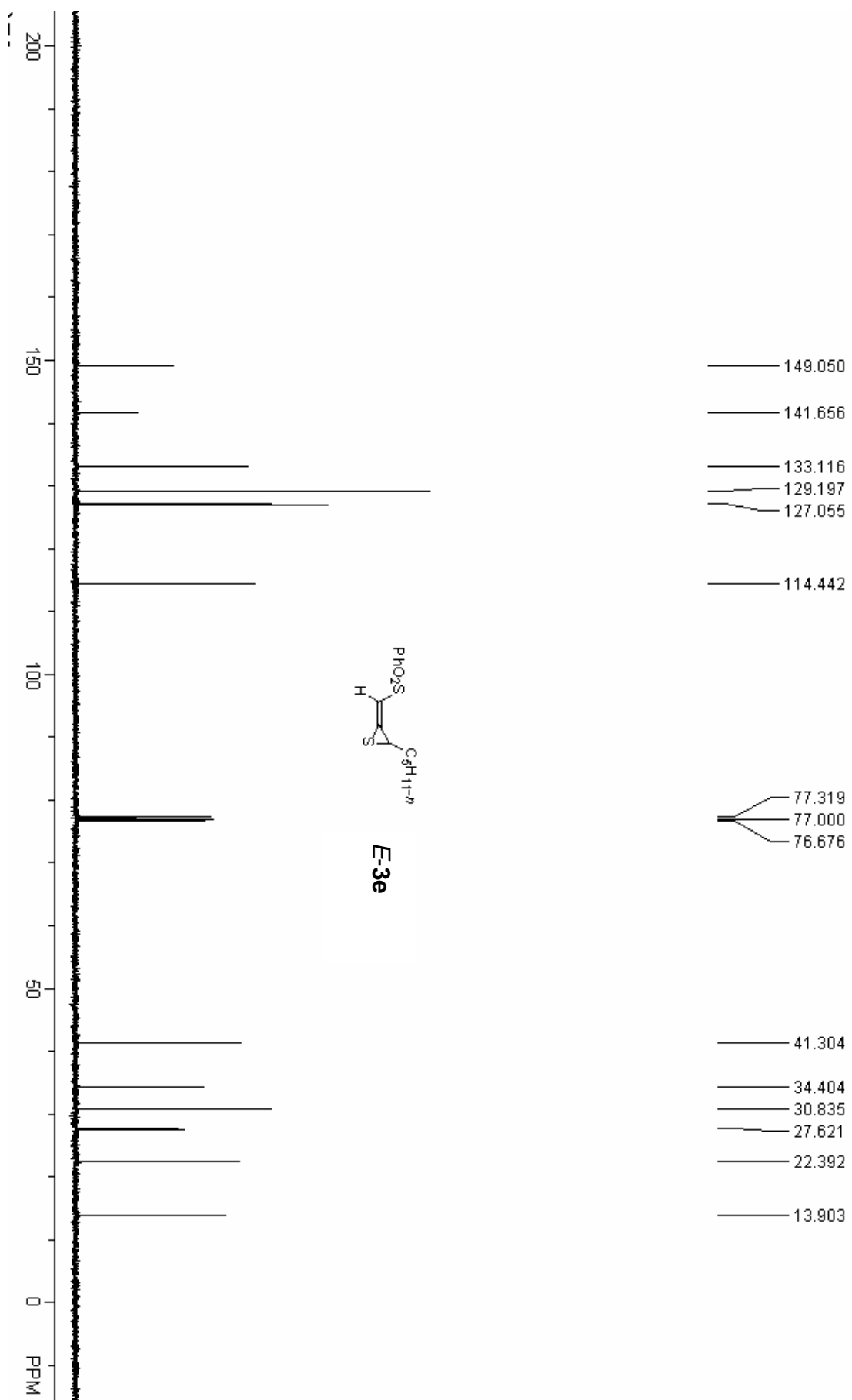


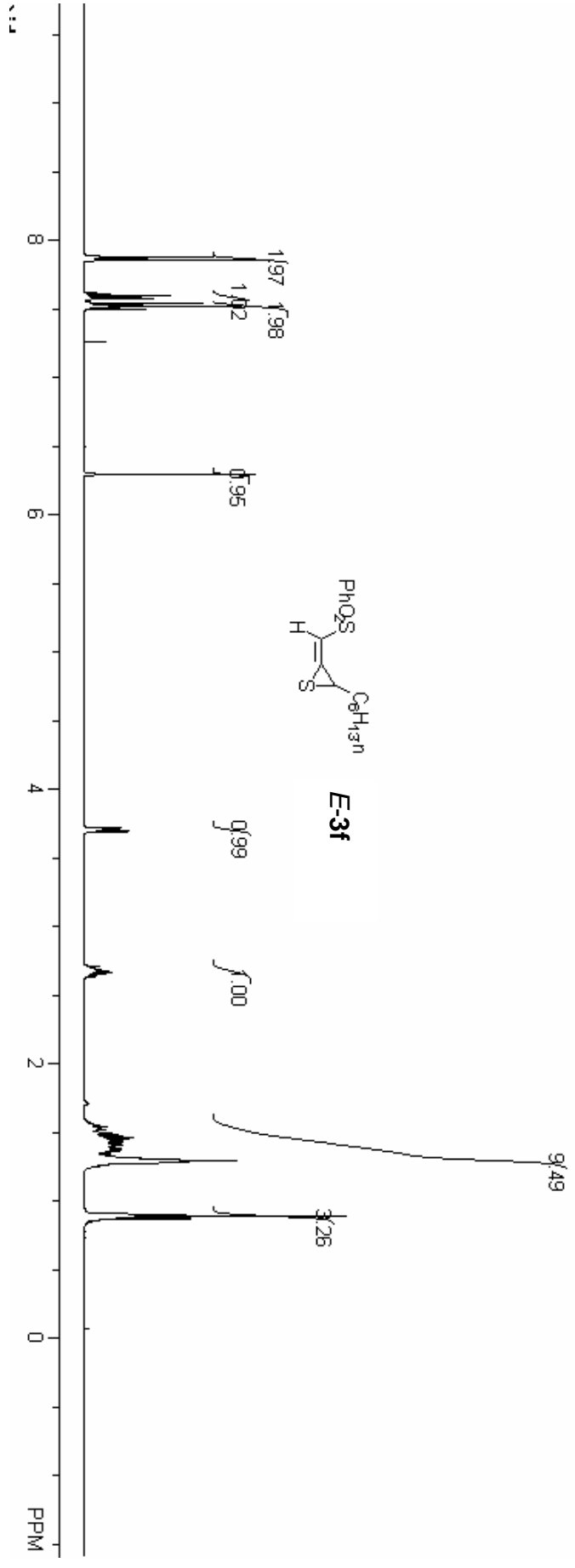
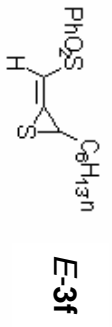
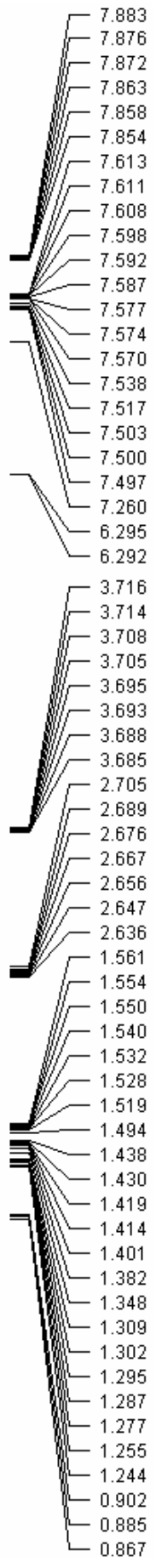


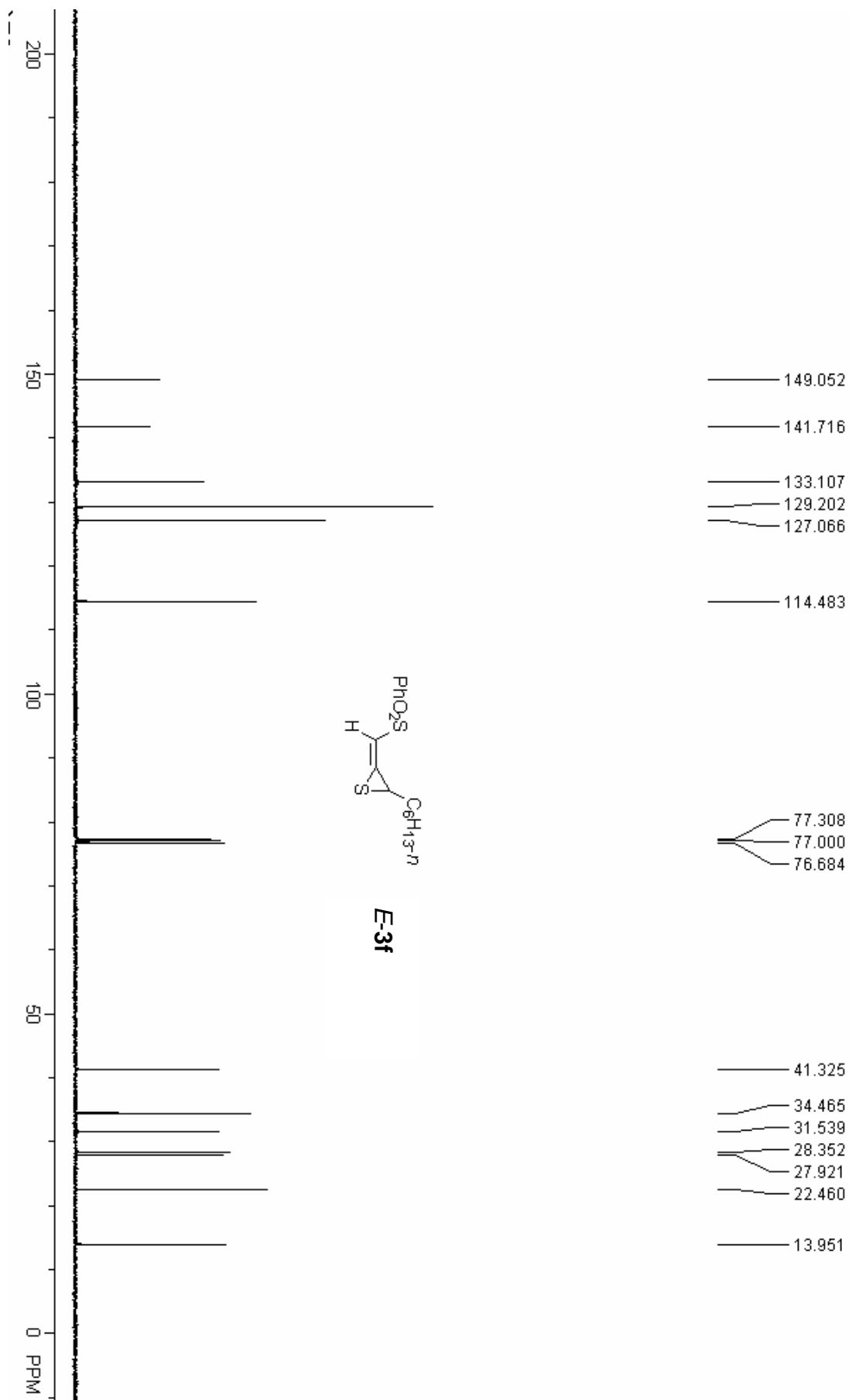
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- 7.874
- 7.870
- 7.862
- 7.857
- 7.854
- 7.611
- 7.599
- 7.592
- 7.587
- 7.578
- 7.575
- 7.570
- 7.538
- 7.522
- 7.519
- 7.500
- 7.497
- 7.260
- 6.295
- 6.291

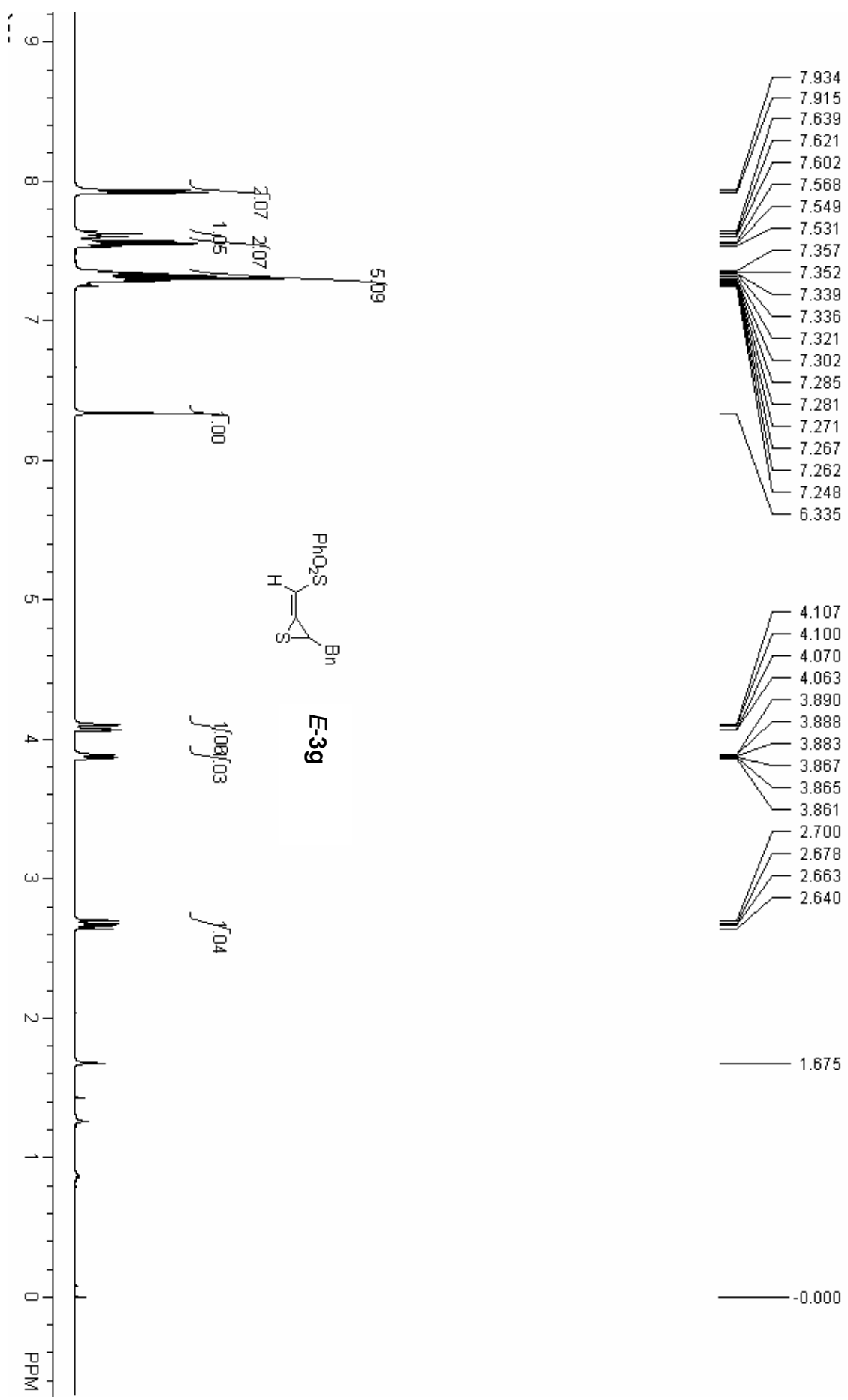
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- 3.714
- 3.708
- 3.706
- 3.696
- 3.692
- 3.689
- 3.686
- 2.704
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- 2.666
- 2.655
- 2.644
- 2.633
- 1.569
- 1.561
- 1.556
- 1.539
- 1.534
- 1.511
- 1.484
- 1.479
- 1.471
- 1.462
- 1.449
- 1.445
- 1.433
- 1.422
- 1.404
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- 1.352
- 1.335
- 1.315
- 1.295
- 0.913
- 0.896
- 0.877

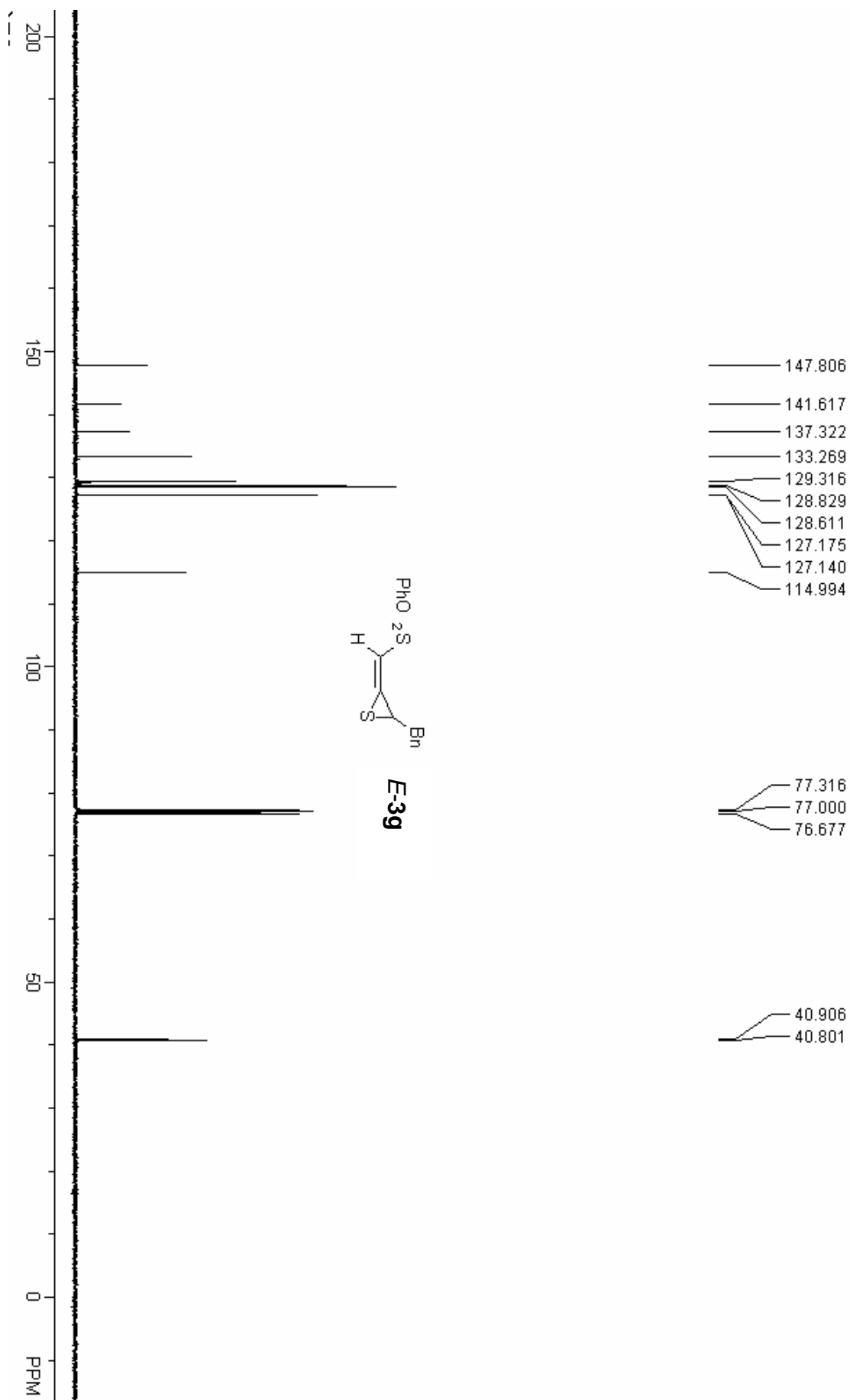








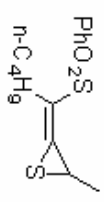




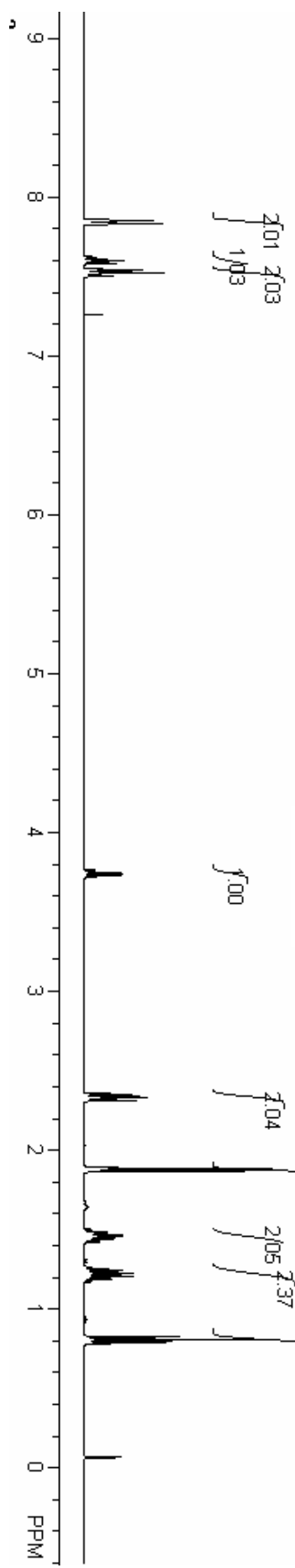
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- 7.831
- 7.620
- 7.602
- 7.584
- 7.543
- 7.524
- 7.506
- 7.260

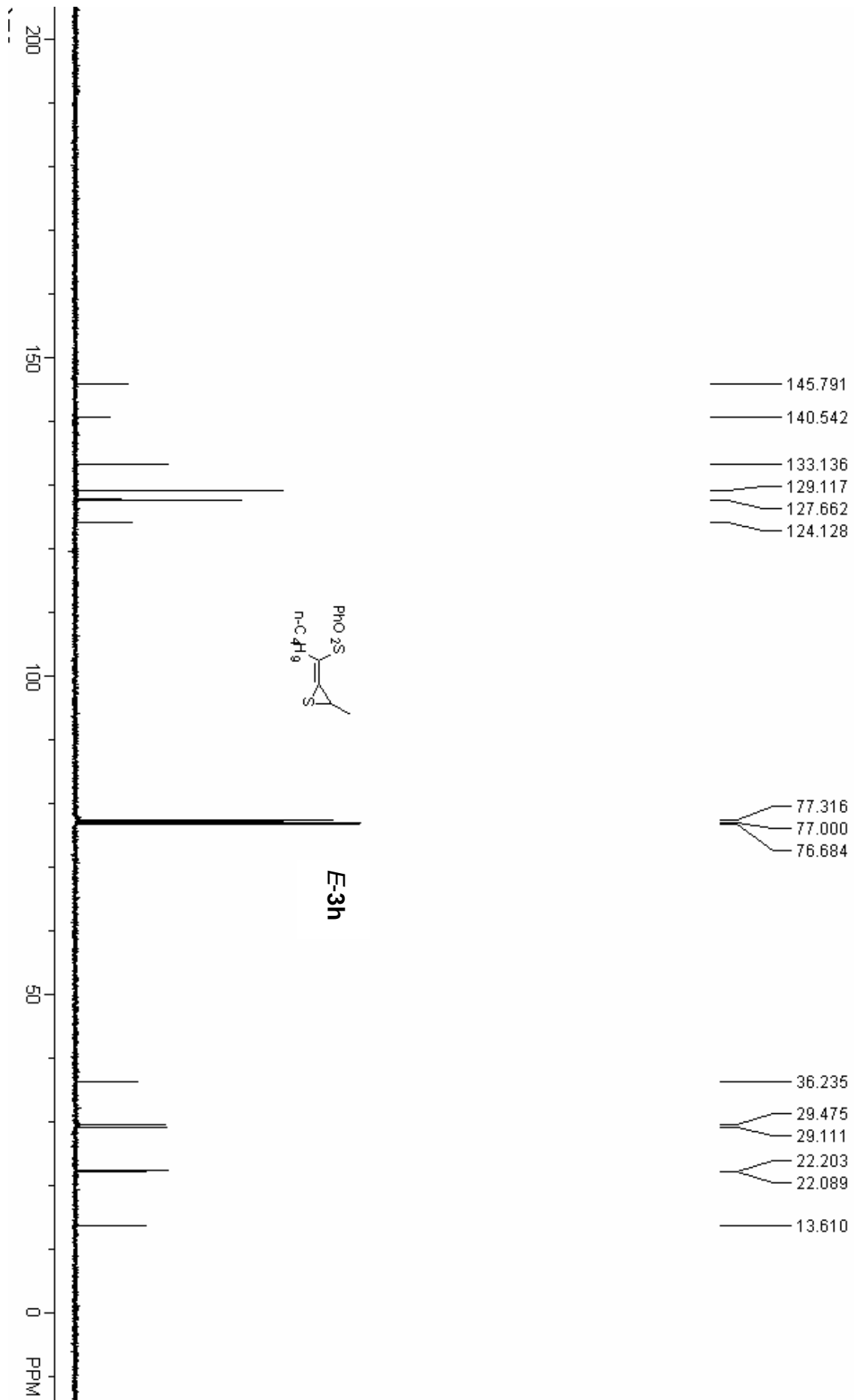
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- 3.733
- 3.718

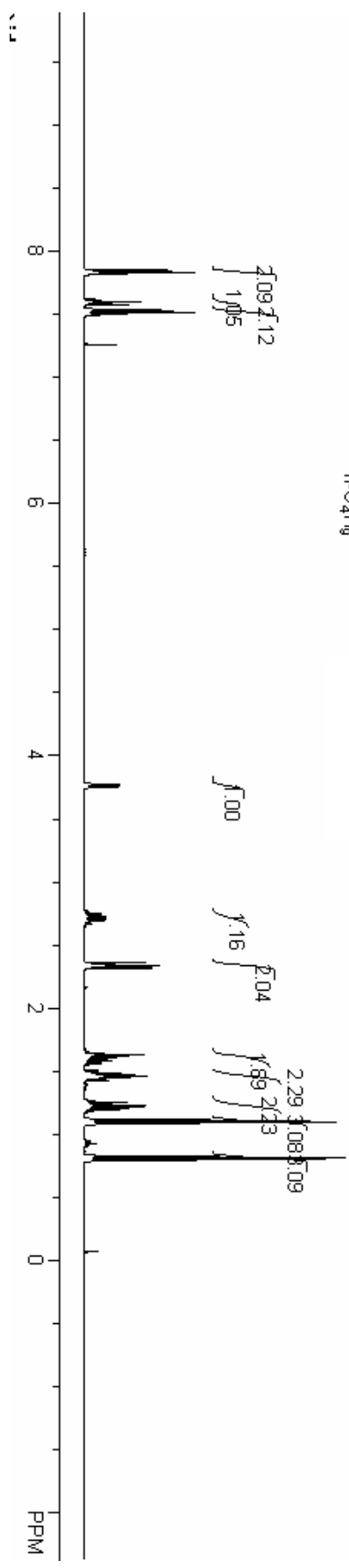
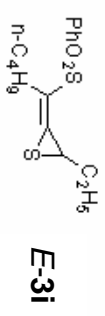
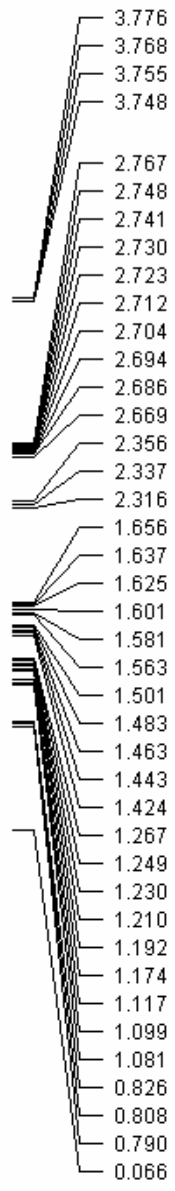
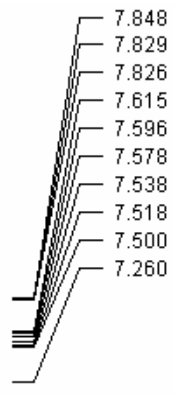
- 2.353
- 2.333
- 2.314
- 1.885
- 1.870
- 1.500
- 1.496
- 1.482
- 1.477
- 1.461
- 1.443
- 1.423
- 1.263
- 1.246
- 1.227
- 1.208
- 1.190
- 1.171
- 0.823
- 0.805
- 0.786
- 0.064

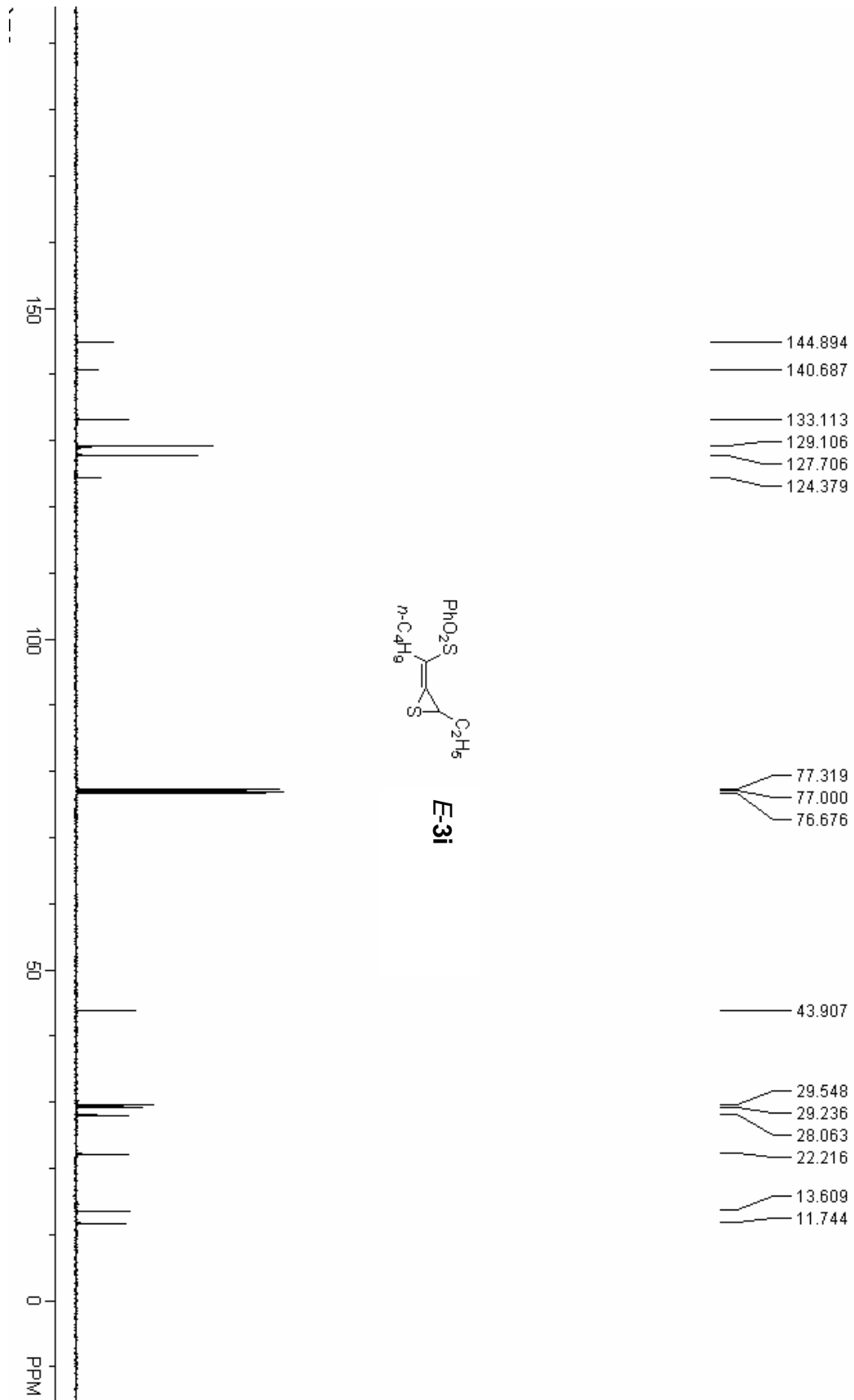


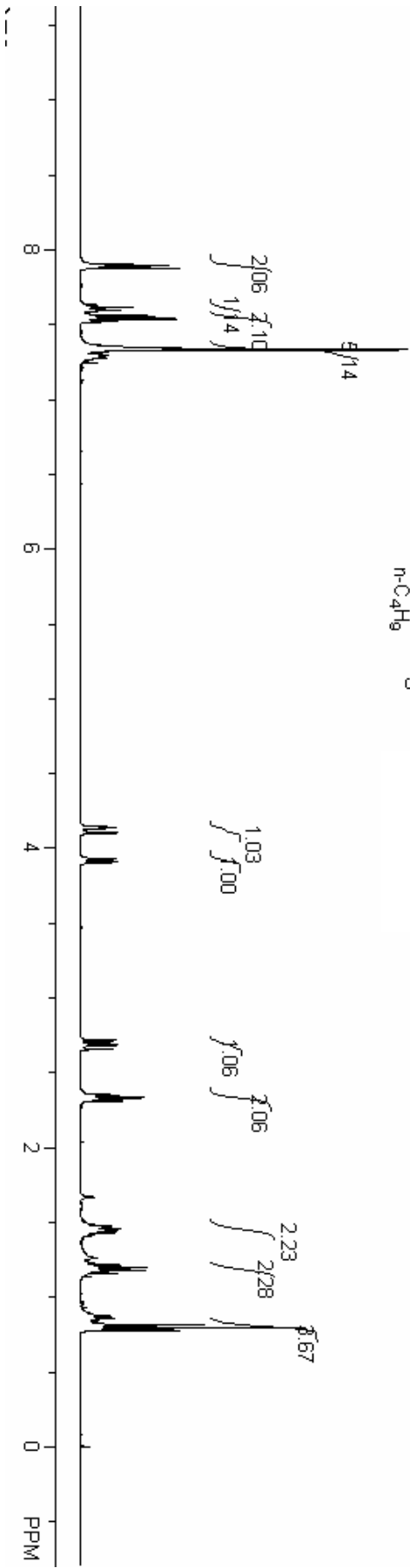
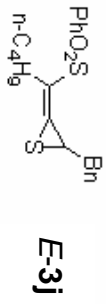
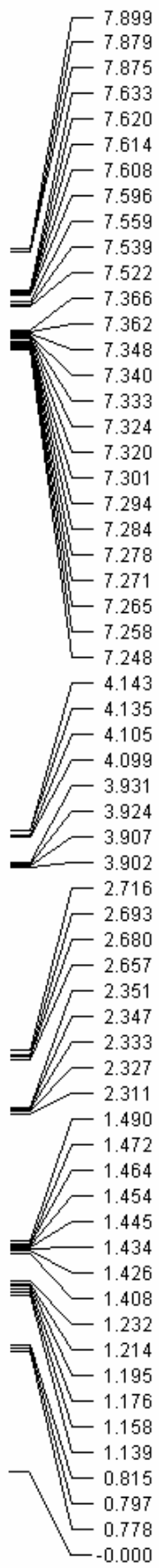
E-3h

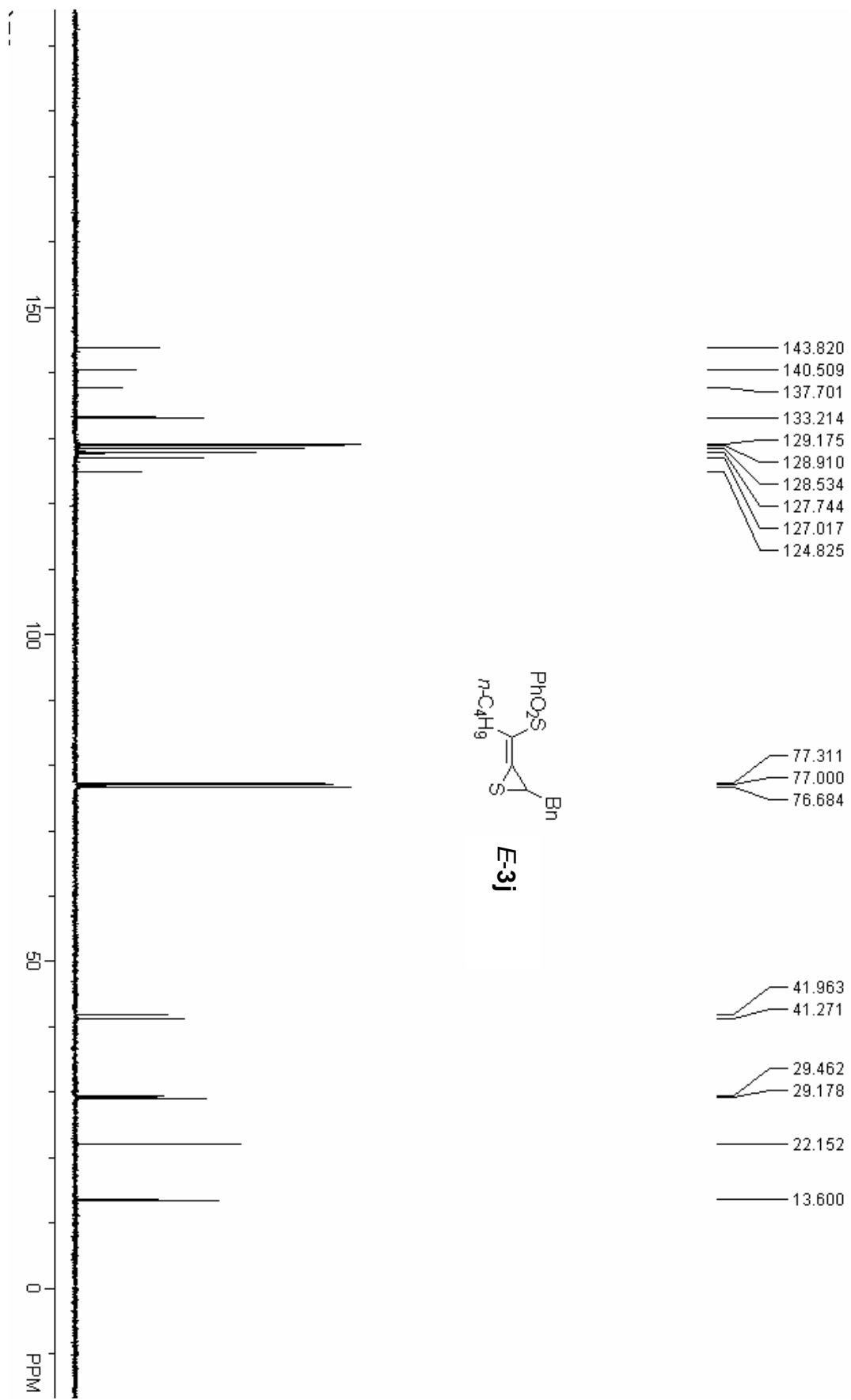


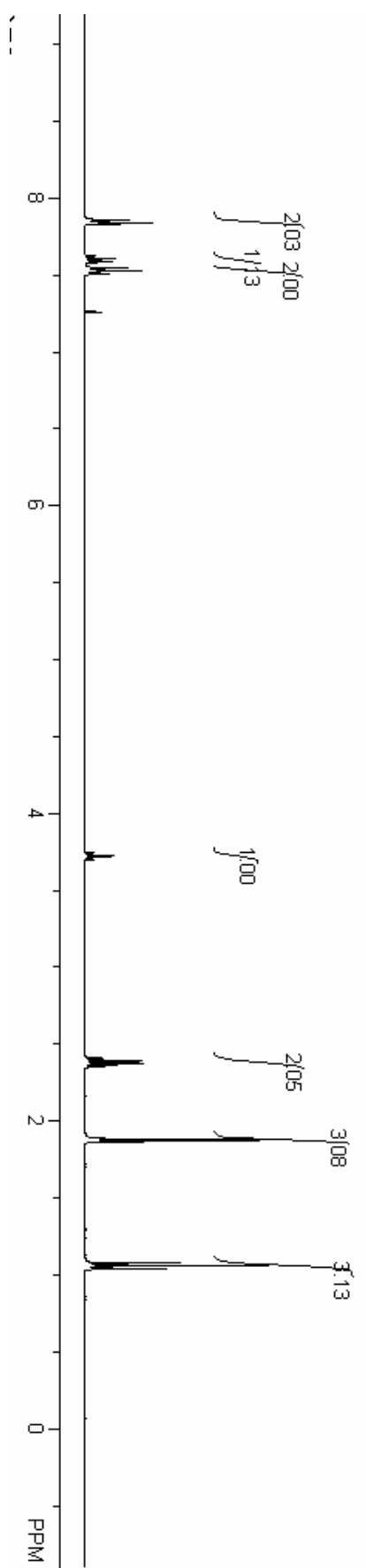
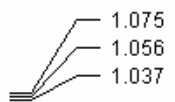
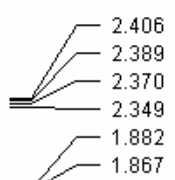
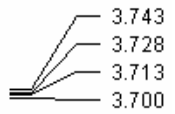
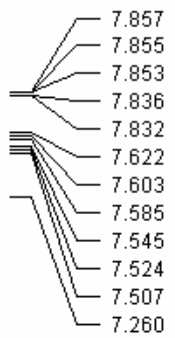


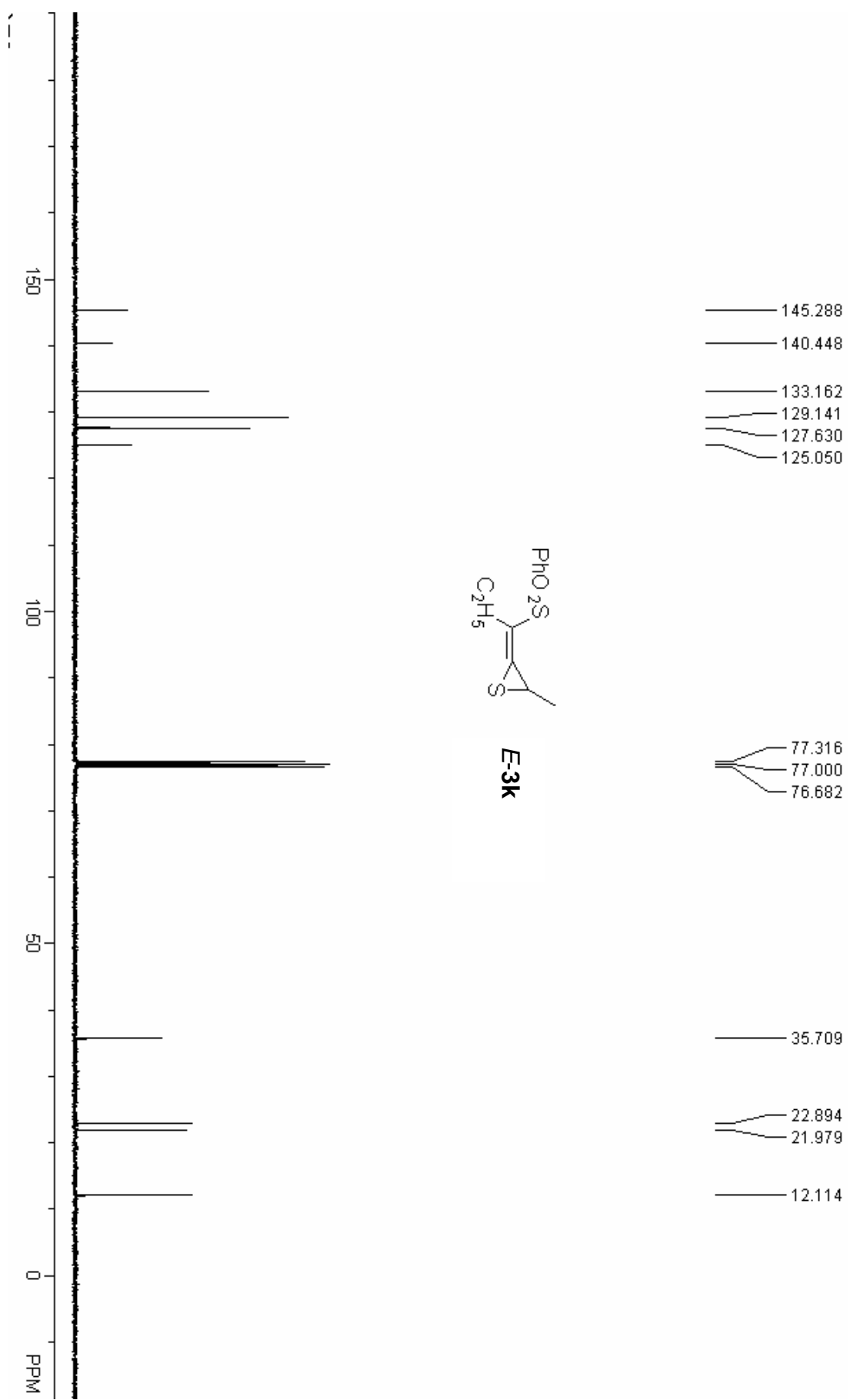


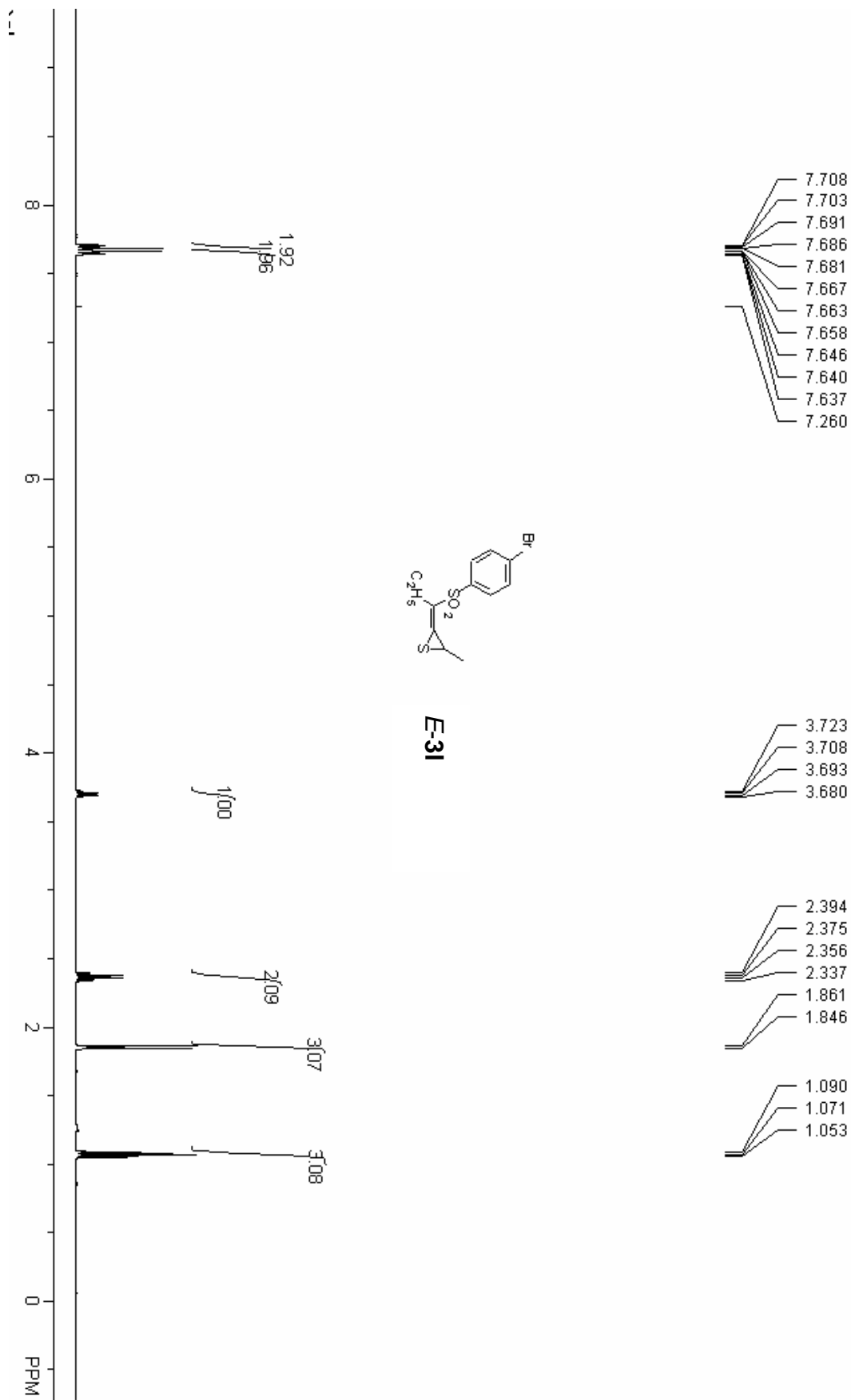


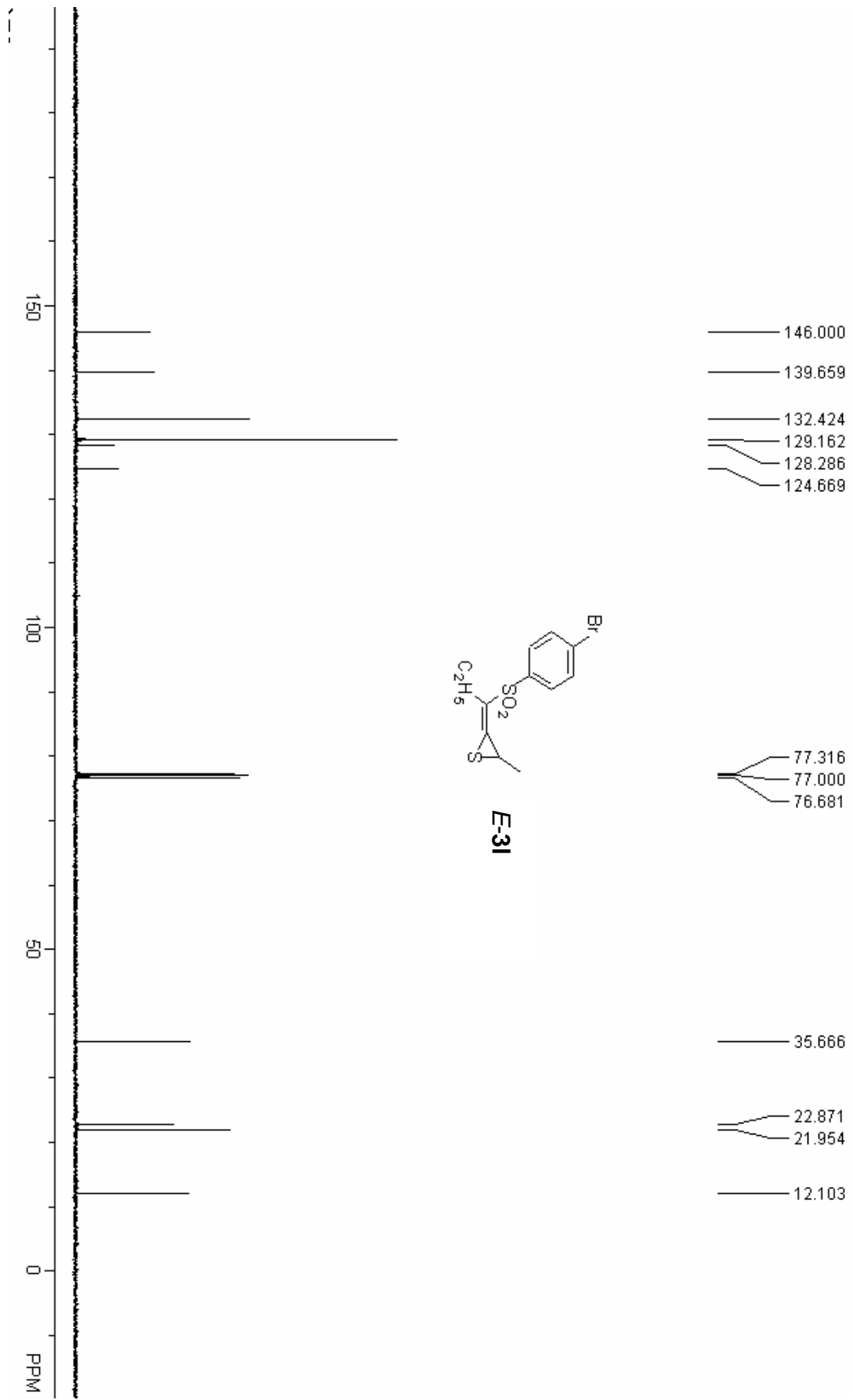


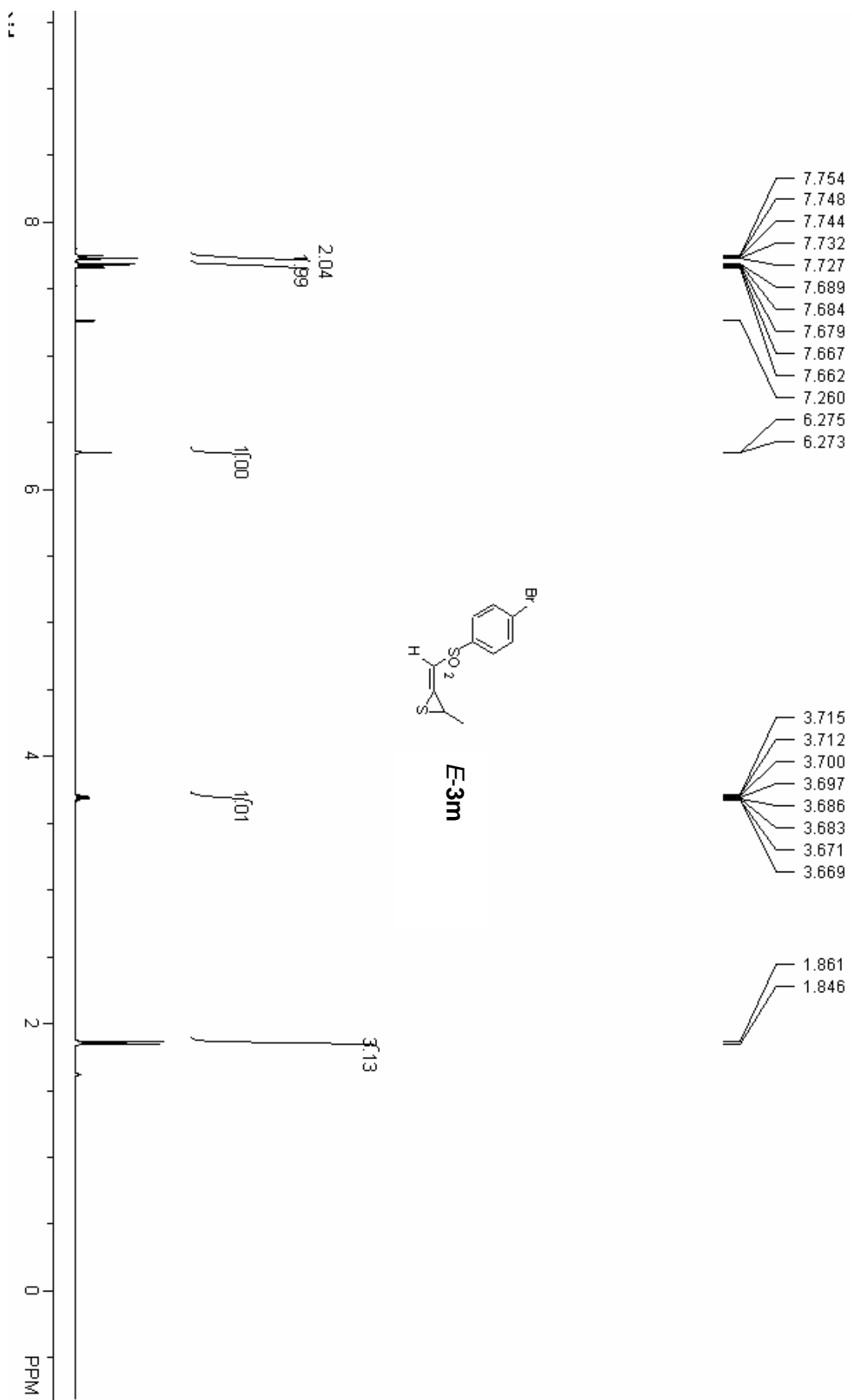


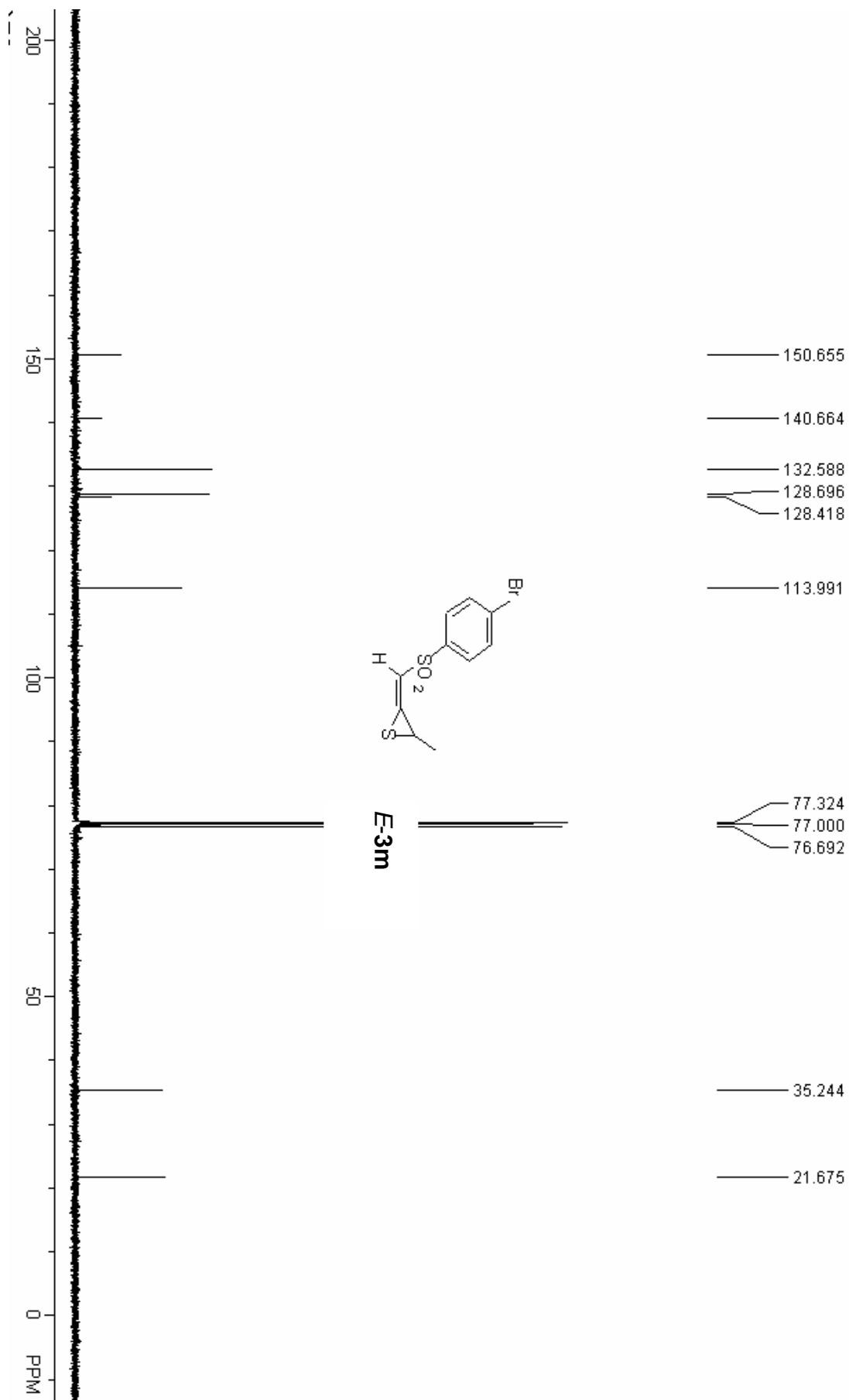








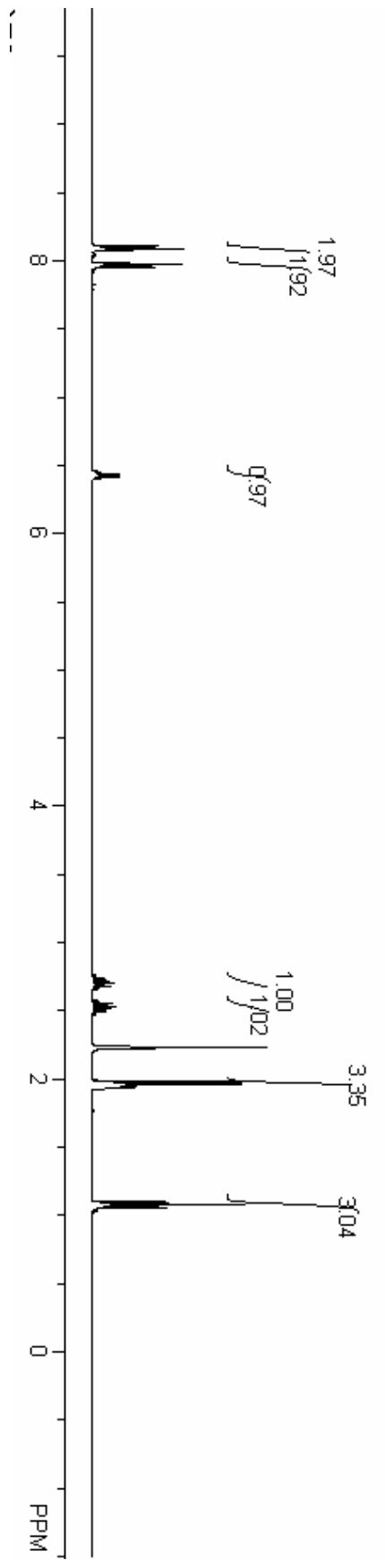
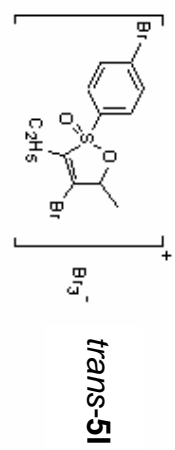


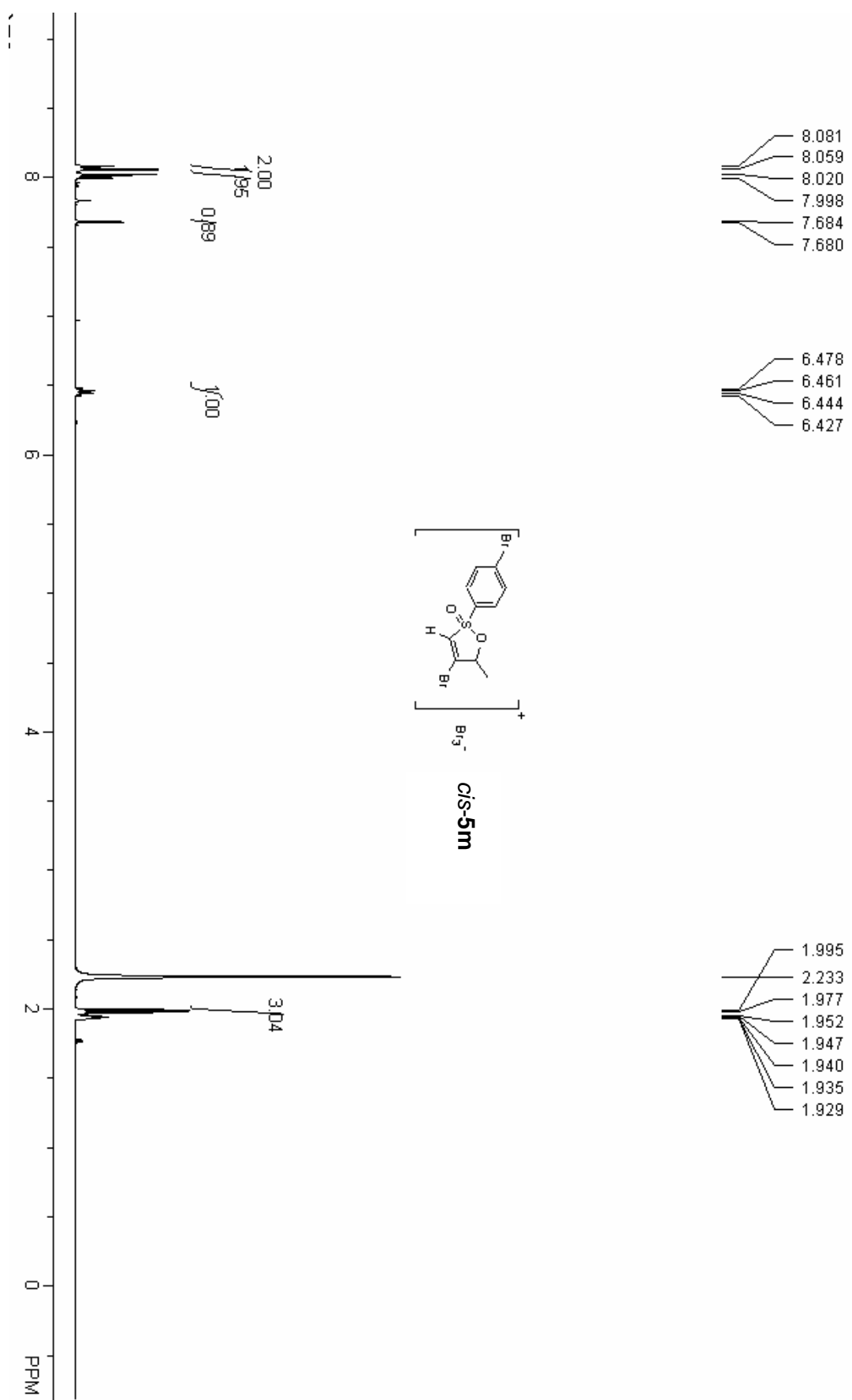


8.104
8.082
7.976
7.954

6.434
6.418

2.738
2.720
2.699
2.680
2.551
2.532
2.513
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1.096
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1.058



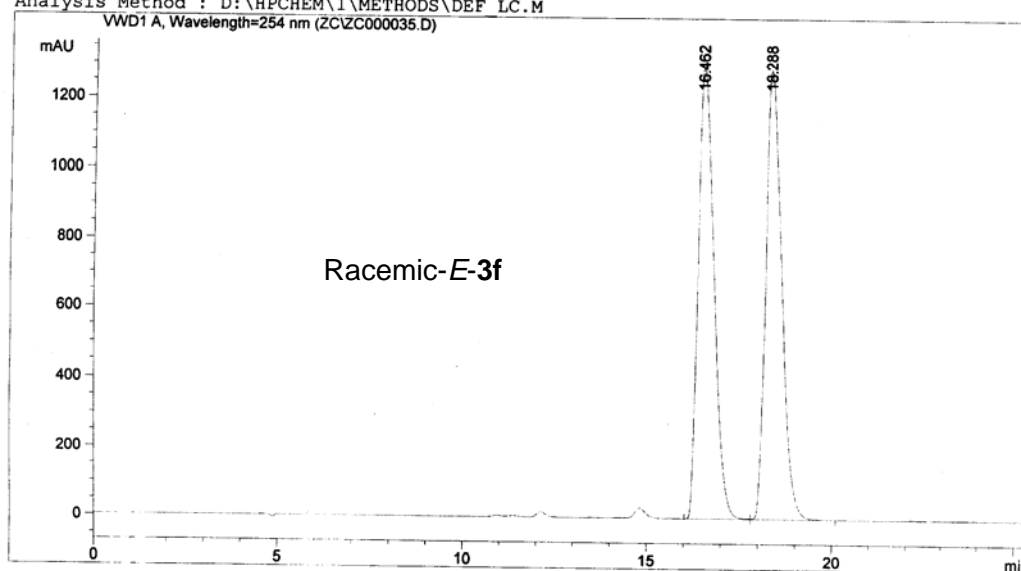


Hex:i-PrOH=95:5 0.7ml/min wavelength=254nm OJ-H

```

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Acq. Operator  : zc
Acq. Method    : D:\HPCHEM\1\METHODS\DEF_LC.M
Last changed   : 10/14/2006 9:41:32 PM by jxp
                (modified after loading)
Analysis Method: D:\HPCHEM\1\METHODS\DEF_LC.M
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=====
Area Percent Report
=====

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```

Sorted By      : Signal
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs

```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	16.462	VV	0.4487	3.81976e4	1296.01868	50.0040
2	18.288	VB	0.4585	3.81915e4	1286.30432	49.9960

```
Totals :                7.63890e4  2582.32300
```

Results obtained with enhanced integrator!

```

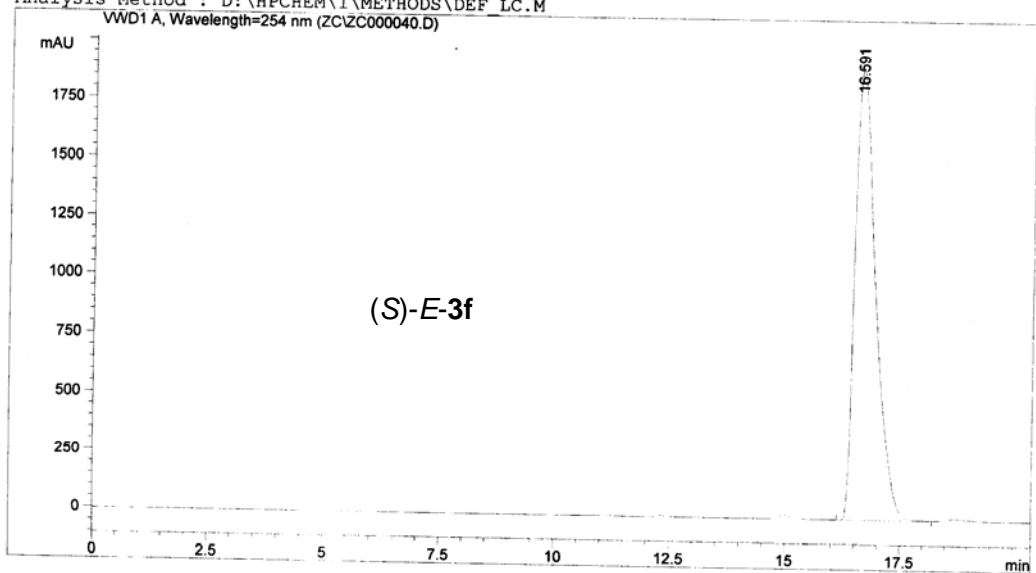
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Hex:i-PrOH=95:5 0.7ml/min wavelength=254nm OJ-H

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Last changed   : 10/15/2006 11:20:56 AM By zc
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Analysis Method : D:\HPCHEM\1\METHODS\DEF_LC.M
                VWD1 A, Wavelength=254 nm (ZC\ZC000040.D)
    
```



=====
 Area Percent Report
 =====

```

Sorted By      : Signal
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
    
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	16.591	VB	0.4844	6.06703e4	1916.26526	100.0000

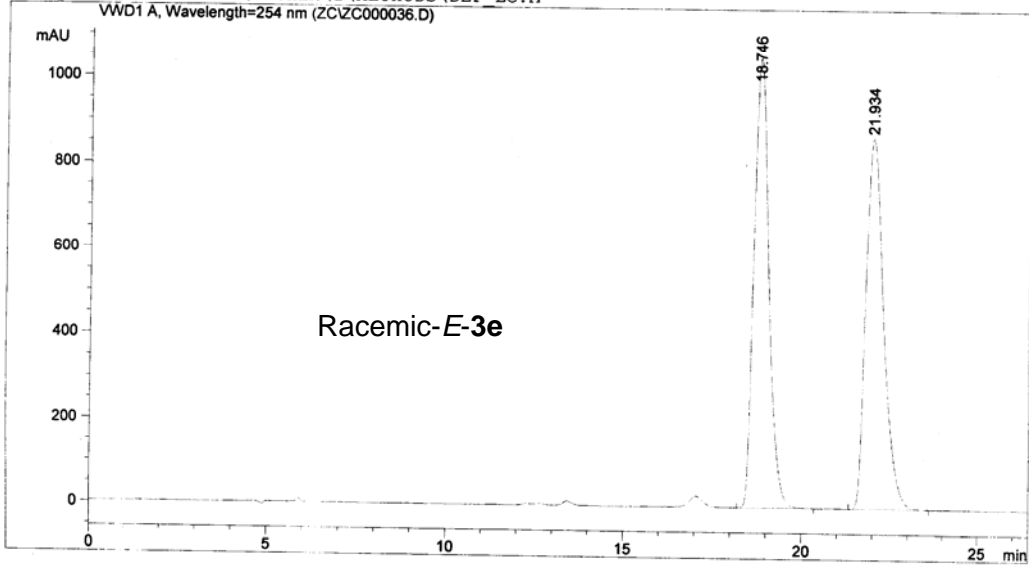
Totals : 6.06703e4 1916.26526

Results obtained with enhanced integrator!

=====
 *** End of Report ***

Hex:i-PrOH=95:5 0.7ml/min wavelength=254nm OJ-H

=====
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Acq. Operator : zc
Acq. Method : D:\HPCHEM\1\METHODS\DEF_LC.M
Last changed : 10/14/2006 9:41:32 PM by jxp
(modified after loading)
Analysis Method : D:\HPCHEM\1\METHODS\DEF_LC.M
VWD1 A, Wavelength=254 nm (ZCZC000036.D)



=====
Area Percent Report
=====

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	18.746	BB	0.4489	3.05259e4	1053.03638	50.0058
2	21.934	VB	0.5444	3.05189e4	867.36993	49.9942

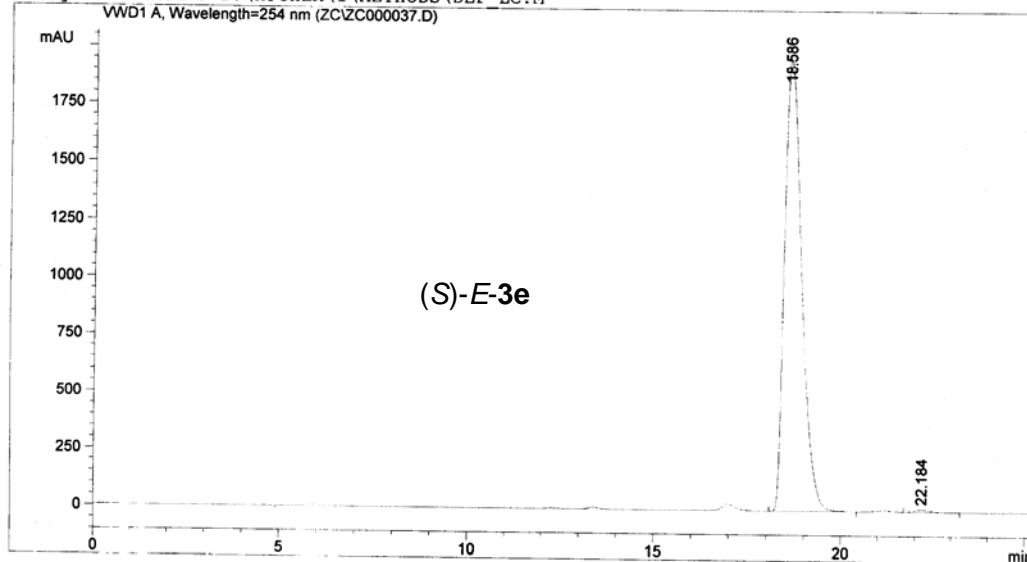
Totals : 6.10448e4 1920.40631

Results obtained with enhanced integrator!

=====
*** End of Report ***

Hex:i-PrOH=95:5 0.7ml/min wavelength=254nm OJ-H

```
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Last changed     : 10/14/2006 9:41:32 PM by jxp
                  (modified after loading)
Analysis Method  : D:\HPCHEM\1\METHODS\DEF_LC.M
VWD1 A, Wavelength=254 nm (ZC\ZC000037.D)
=====
```



```
=====
Area Percent Report
=====
```

```
Sorted By      : Signal
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	18.586	PB	0.4916	6.26299e4	1963.22168	99.4551
2	22.184	VB	0.4733	343.13336	10.95124	0.5449

```
Totals :                6.29730e4  1974.17292
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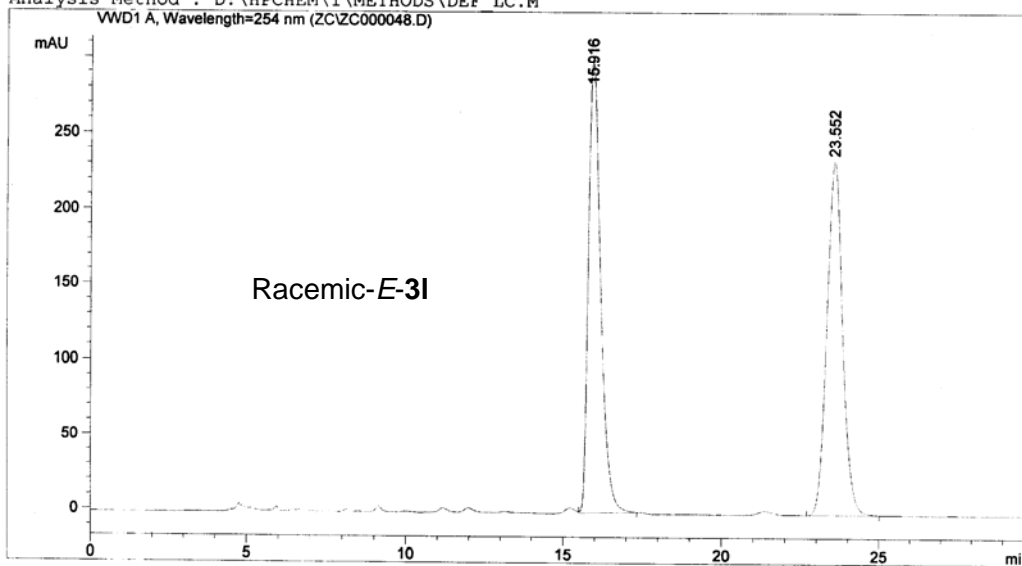
Results obtained with enhanced integrator!

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*** End of Report ***
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Acq. Operator  : zc
Acq. Method    : D:\HPCHEM\1\METHODS\DEF_LC.M
Last changed   : 10/22/2006 7:11:49 PM by zc
                 (modified after loading)
Analysis Method : D:\HPCHEM\1\METHODS\DEF_LC.M
    
```



=====
Area Percent Report
=====

```

Sorted By      : Signal
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
    
```

Signal 1: WVD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.916	VB	0.4125	8084.36035	299.45190	49.6262
2	23.552	BB	0.5328	8206.15430	234.91907	50.3738

Totals : 1.62905e4 534.37097

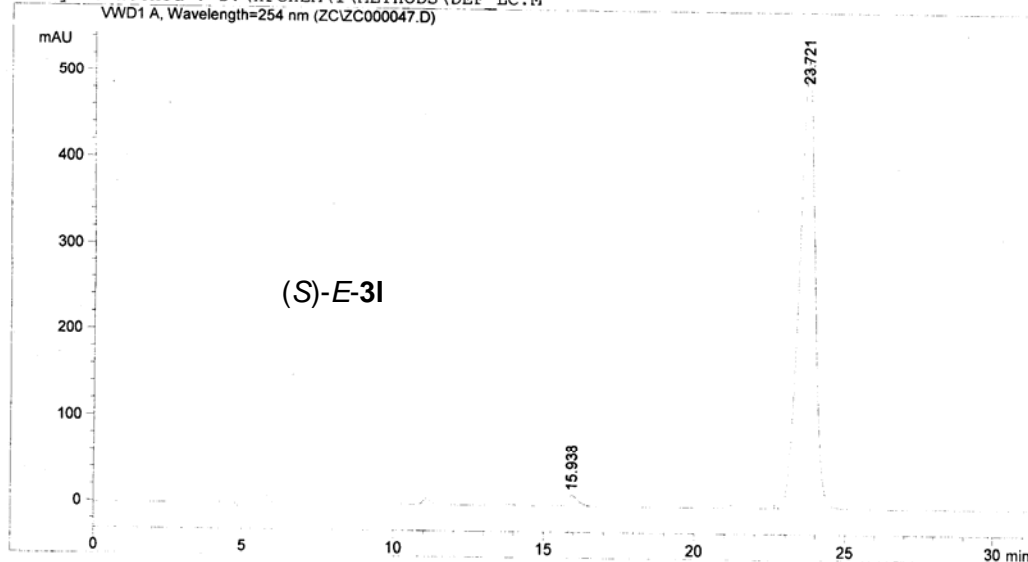
Results obtained with enhanced integrator!

=====
*** End of Report ***

Hex:i-PrOH=95:5 0.7ml/min wavelength=254nm OJ-H

```

=====
Injection Date : 10/22/2006 8:54:02 PM
Sample Name    : zc-6-97sx
Acq. Operator  : zc
Acq. Method    : D:\HPCHEM\1\METHODS\DEF_LC.M
Last changed   : 10/22/2006 7:11:49 PM by zc
                 (modified after loading)
Analysis Method : D:\HPCHEM\1\METHODS\DEF_LC.M
                 VWD1 A, Wavelength=254 nm (ZCZC000047.D)
    
```



=====
Area Percent Report
=====

```

Sorted By      :      Signal
Multiplier     :      1.0000
Dilution       :      1.0000
Use Multiplier & Dilution Factor with ISTDs
    
```

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.938	BB	0.3930	324.07156	12.60903	1.7005
2	23.721	BB	0.5474	1.87330e4	521.27808	98.2995

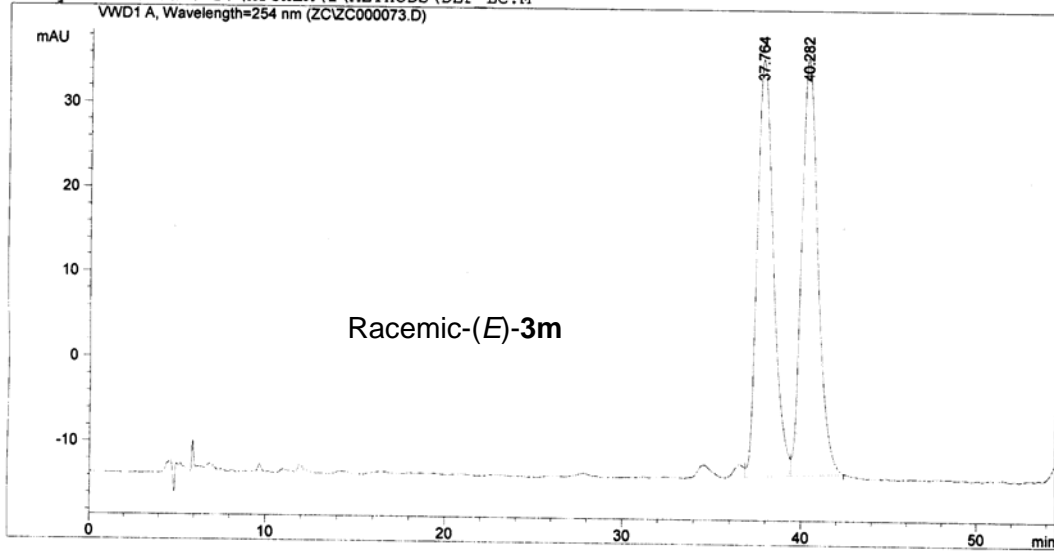
Totals : 1.90571e4 533.88711

Results obtained with enhanced integrator!

=====
*** End of Report ***

Hex:i-PrOH=95/5 0.7ml/min wavelength=254nm OJ-H colume

=====
Injection Date : 12/12/2006 8:42:07 PM
Sample Name : ZC-6-138wx Location : Vial 1
Acq. Operator : ZC
Acq. Method : D:\HPCHEM\1\METHODS\ZBC.M
Last changed : 12/12/2006 8:33:38 PM by ZC
(modified after loading)
Analysis Method : D:\HPCHEM\1\METHODS\DEF LC.M



=====
Area Percent Report
=====

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU	Height [mAU]	Area %
1	37.764	VV	0.9595	3113.41602	49.20641	49.7064
2	40.282	VB	0.9727	3150.19214	49.19544	50.2936

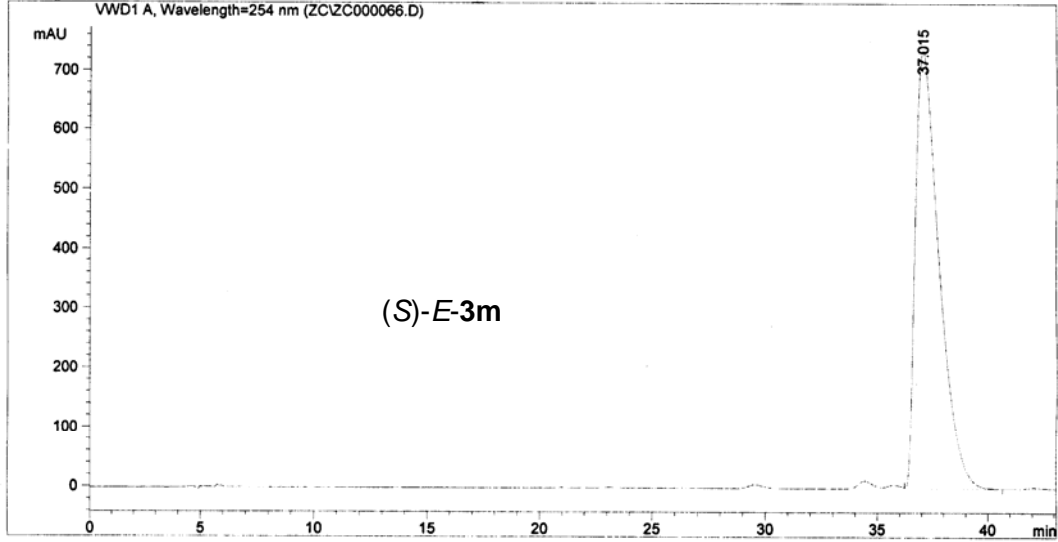
Totals : 6263.60815 98.40185

Results obtained with enhanced integrator!

=====
*** End of Report ***

Hex:i-PrOH=95:5 0.7ml/min wavelength=254nm OJ-H

=====
Injection Date : 11/2/2006 11:37:03 PM
Sample Name : zc-6-138sx Location : Vial 1
Acq. Operator : zc
Acq. Method : D:\HPCHEM\1\METHODS\DEF LC.M
Last changed : 11/2/2006 3:53:28 PM by zc
(modified after loading)
Analysis Method : D:\HPCHEM\1\METHODS\DEF LC.M



=====
Area Percent Report
=====

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU*s	Height [mAU]	Area %
1	37.015	VB	1.1344	5.52477e4	737.66974	100.0000

Totals : 5.52477e4 737.66974

Results obtained with enhanced integrator!

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*** End of Report ***