Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry

Benzaldehyde Lyase-catalyzed diastereoselective C-C bond formation by simultaneous carboligation and kinetic resolution

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SUPPORTING INFORMATION

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Preparation of the potassium phosphate buffer (pH 8) & Chemicals

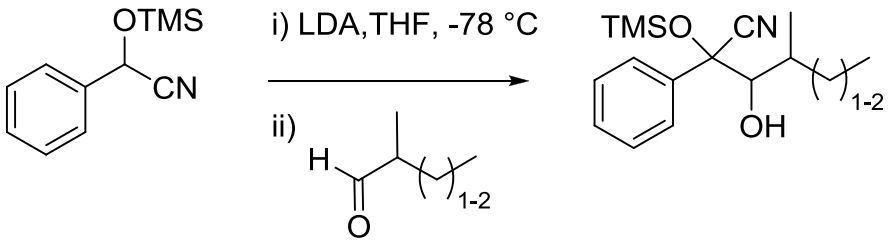
K_2HPO_4 (7.4937 g, 43.0 mmol) and KH_2PO_4 (0.9495 g, 7.0 mmol) and $MgSO_4$ (300 mg, 2.5 mmol) were dissolved in 1 L water. The pH was adjusted to 8.00 with phosphoric acid or 2.0 M KOH solution.

Chemicals. All chemicals were supplied by Sigma-Aldrich and, unless otherwise stated, were used without further purifications.

Method A: Procedure for the biocatalysis with BAL

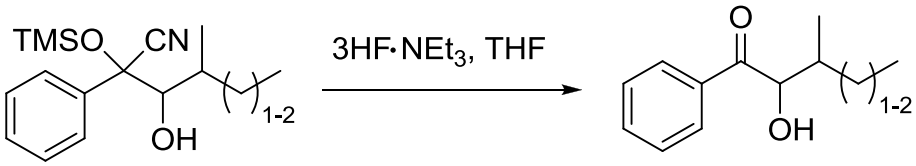
To a mixture of 80 mL potassium phosphate buffer buffer (pH 8), BAL (from *Pseudomonas fluorescens*, cloned and overexpressed in *E. coli*, 100 mg) and ThDP (2.5 mg, 5.4 x 10^{-3} mmol), a solution of 20 mL DMSO, benzaldehyde (152.4 µL, 159.1 mg, 1.50 mmol) and 2-mehtyl substituted aldehyde (7.50 mmol) was added. The solution was stirred for 24 h at 23 °C and afterwards quenched by the addition of ethyl acetate (100 mL). After extraction of the aqueous phase with ethyl acetate (3 x 100 mL), the combined organic layers were washed with brine (50 mL). The organic solution was concentrated under vacuum supported distillation after drying over anhydrous Na_2SO_4 and filtration. Purification by flash chromatography over silica gel (ethyl acetate / petroleum ether) yielded the products. BAL was cloned and overexpressed in *E. coli* cells, and produced by fermentation. After fermentation, BAL was lyophilized and stored at -20 °C until use

Method B.1: Procedure for the regioselective formation of *rac*-α-hydroxyketone starting from 2-phenyl-2-(trimethylsilyloxy)acetonitrile



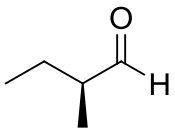
LDA was *in situ* formed in a flask under argon atmosphere by adding diisopropylamine (2.20 mL, 15.7 mmol, 1.1 equiv.) and a 2.0 M solution of *n*-butyl lithium in hexane (8.20 mL, 16.4 mmol, 1.15 equiv.) in 100 mL dry THF at -78 °C. 2-phenyl-2-(trimethylsilyloxy)acetonitrile (3.00 mL, 2.934 g, 14.3 mmol) was added dropwise and the reaction mixture was allowed to reach room temperature within 25 minutes to form an orange solution of the metalated species. After cooling down again to -78 °C the 2-methyl substituted aldehyde (15.0 mmol, 1.05 equiv.) was added dropwise over 30 minutes, and the reaction was stirred further 60 minutes at this temperature. For completion of the reaction the solution was heated up to room temperature and stirred for an additional hour. The quenching was accomplished by the addition of aqueous saturated ammonium chloride solution (100 mL). After neutralization of the mixture with 10% HCl solution the aqueous phase was extracted with ethyl acetate (3 x 100 mL). The combined organic layers were washed with brine (100 mL) and after separation dried over anhydrous Na_2SO_4. Filtration and vacuum supported distillation of the solvent resulted the product which could be purified by flash chromatography over silica gel (ethyl acetate / petroleum ether) to afford colorless oil. ^{1}H- and ^{13}C-NMR showed the presence of the instable diastereomers of the trimethylsilyloxy nitrile species.

Method B.2: Transformation of the trimethylsilyloxy nitrile species to the corresponding α-hydroxyketones



The trimethylsilyloxy nitrile species were dissolved in 10 mL dry THF and triethylamine trihydrofluoride (1.2 equiv.) was added. The solution was stirred for 2 h at room temperature and quenched afterwards by the addition of saturated $NaHCO_3$ solution until neutral pH. The aqueous phase was extracted with diethyl ether (3 x 10 mL) and the combined organic layers were washed with brine and after separation dried over Na_2SO_4. Filtration and removal of the solvent *via* vacuum supported distillation resulted the crude product. Both diastereoisomers could be purified with flash chromatography over silica gel in order to yield colorless oil.

Synthesis of (*S*)-2-methylbutanal



(*S*)-2-Methylbutanol (4.00 mL, 3.28 g, 37.2 mmol) were dissolved with TEMPO (59 mg, 0.37 mmol, 0.01 equiv.) in 12 mL DCM. A solution of KBr (443 mg, 3.72 mmol, 0.10 equiv.) in 2 mL water was added and the solution was cooled down to -7 °C. After 5 min. a sodium hypochlorite solution (50 mL, 5.0 – 7.5%, 40 – 60 mmol, 1.1 – 1.6 equiv.) was added dropwise within 30 minutes. After 1 h stirring at 0 °C and 1 h at room temperature, the aqueous phase was extracted with DCM (1 x 25 mL). The

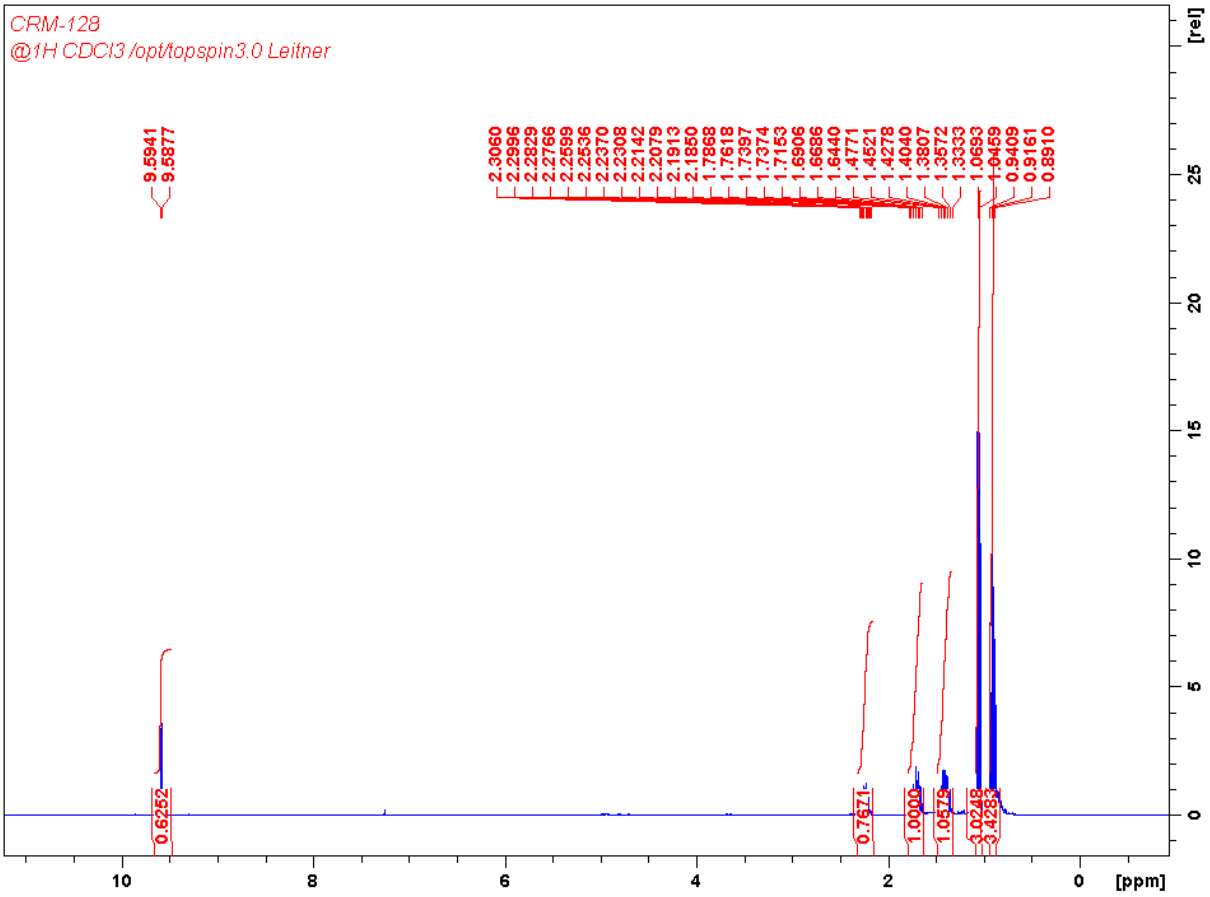
organic layer was washed with 10% HCl solution (10 mL) containing KI (100 mg) and subsequently with a 20% $Na_2S_2O_3$ solution (10 mL). After drying over sodium sulfate the product (2.532 g, 29.4 mmol, 79% yield) was obtained after filtration and vacuum supported distillation as colorless liquid.

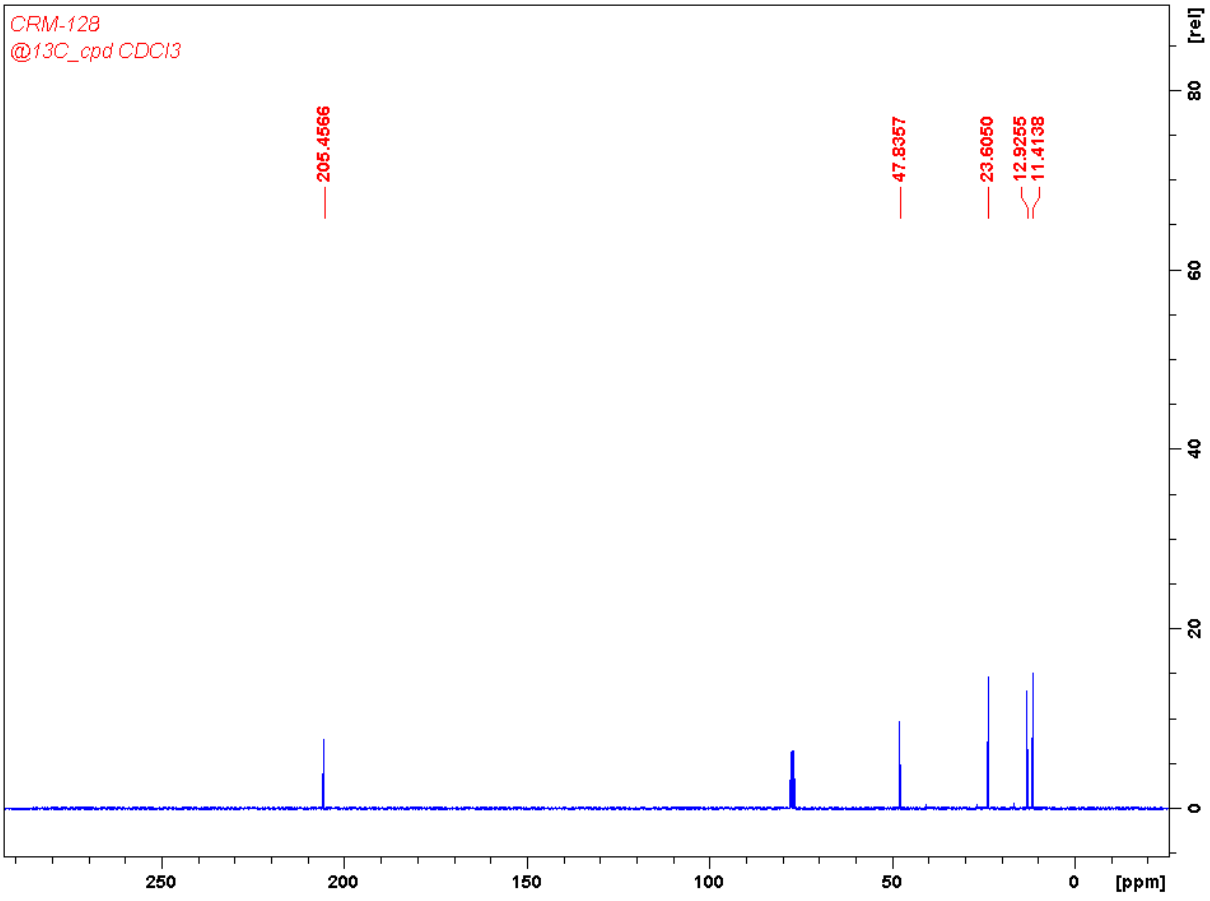
^{1}H-NMR (300 MHz, $CDCl_3$): δ = 9.59 (d, *J* = 1.9 Hz, 1H), 2.31 – 2.19 (m, 1H), 1.79 – 1.64 (m, 1H), 1.48 – 1.33 (m, 1H), 1.06 (d, *J* = 7.0 Hz, 3H), 0.92 (d, *J* = 7.5 Hz, 3H);

^{13}C-NMR (75 MHz, $CDCl_3$): δ = 205.5, 47.8, 23.6, 12.9, 11.4.

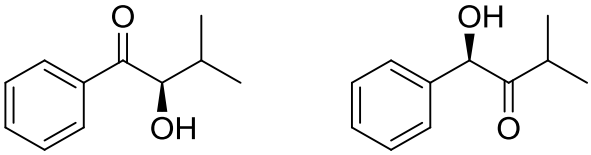
Analytical data are according to literature.[1]

[1] J. R. Davies, P. D. Kane, C. J. Moody, A. M. Z. Slawin, *J. Org. Chem.*, **2005**, *70*, 5840–5851.





Synthesis of 2-hydroxy-3-methyl-1-phenylbutan-2-one and 1-hydroxy-3-methyl-1-phenylbutan-1-one



BAL-catalyzed synthesis

Following Method A, *iso*-butyraldehyde (685 µL, 541 mg, 7.50 mmol, 5.00 equiv.) was employed and the reaction time was prolonged to 72 h. (*R*)-2-hydroxy-3-methyl-1-phenylbutan-2-one was purified with flash chromatography over silica gel (45 mg, 0.63 mmol, 42% yield, >99% *ee*) as a colorless oil. The fraction with (*R*)-1-hydroxy-3-methyl-1-phenylbutan-1-one (30 mg, 0.16 mmol, 11% yield, 93% *ee*) contained the other regioisomer (~25%) as well.

Synthesis of *rac*-2-hydroxy-3-methyl-1-phenylbutan-1-one and *rac*-1-hydroxy-3-methyl-1-phenylbutan-2-one.

Benzaldehyde (630 µL, 6.2 mmol), triethylamine (512 µL, 3.7 mmol, 0.60 equiv.), 3-ethyl-5-(2-hydroxyethyl)-4-methylthiazolium bromide (156 mg, 0.62 mmol, 0.10 equiv.) and *iso*-butyraldehyde (2.00 mL, 1.58 g, 18.7 mmol, 3.02 equiv.) were dissolved in ethanol (2.0 mL) and stirred for 12 h at 85 °C in a closed reaction vessel. The reaction was quenched by the addition of saturated ammonium chloride solution until neutral pH. The aqueous phase was extracted with ethyl acetate (3 x 15 mL) and the combined organic layers were dried over sodium sulfate. Filtration and vacuum supported distillation afforded the crude product. *Rac*-2-Hydroxy-3-methyl-1-

phenylbutan-1-one was purified with flash chromatography over silica gel (199 mg, 1.12 mmol, 18% yield) as colorless oil. The fraction with *rac*-1-hydroxy-3-methyl-1-phenylbutan-2-one (331 mg, 1.86 mmol, 30% yield) contained the other regioisomer (~25%) as well.

(*R*)-2-hydroxy-3-methyl-1-phenylbutan-1-one (separated from racemic mixture)

R_f = 0.34 (1:8 ethyl acetate / petroleum ether)

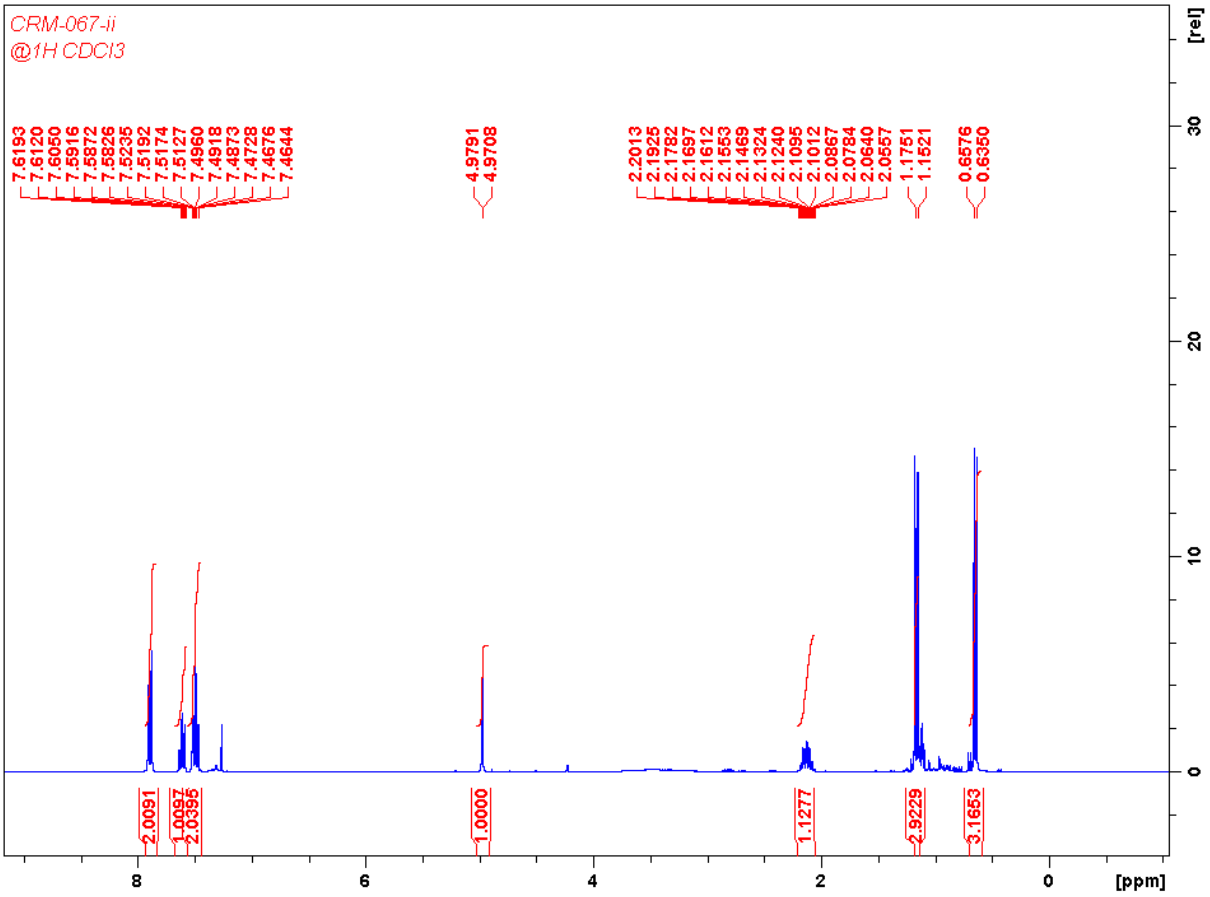
^{1}H-NMR (300 MHz, $CDCl_3$): δ = 7.91 – 7.88 (m, 2H), 7.64 (m, 1H), 7.52 – 7.46 (m, 2H), 4.98 (d, *J* = 2.5 Hz, 1H), 2.14 (dhept, *J* = 6.8, 2.5 Hz, 1H), 1.16 (d, *J* = 6.8 Hz, 3H), 0.65 (d, *J* = 6.8 Hz, 3H);

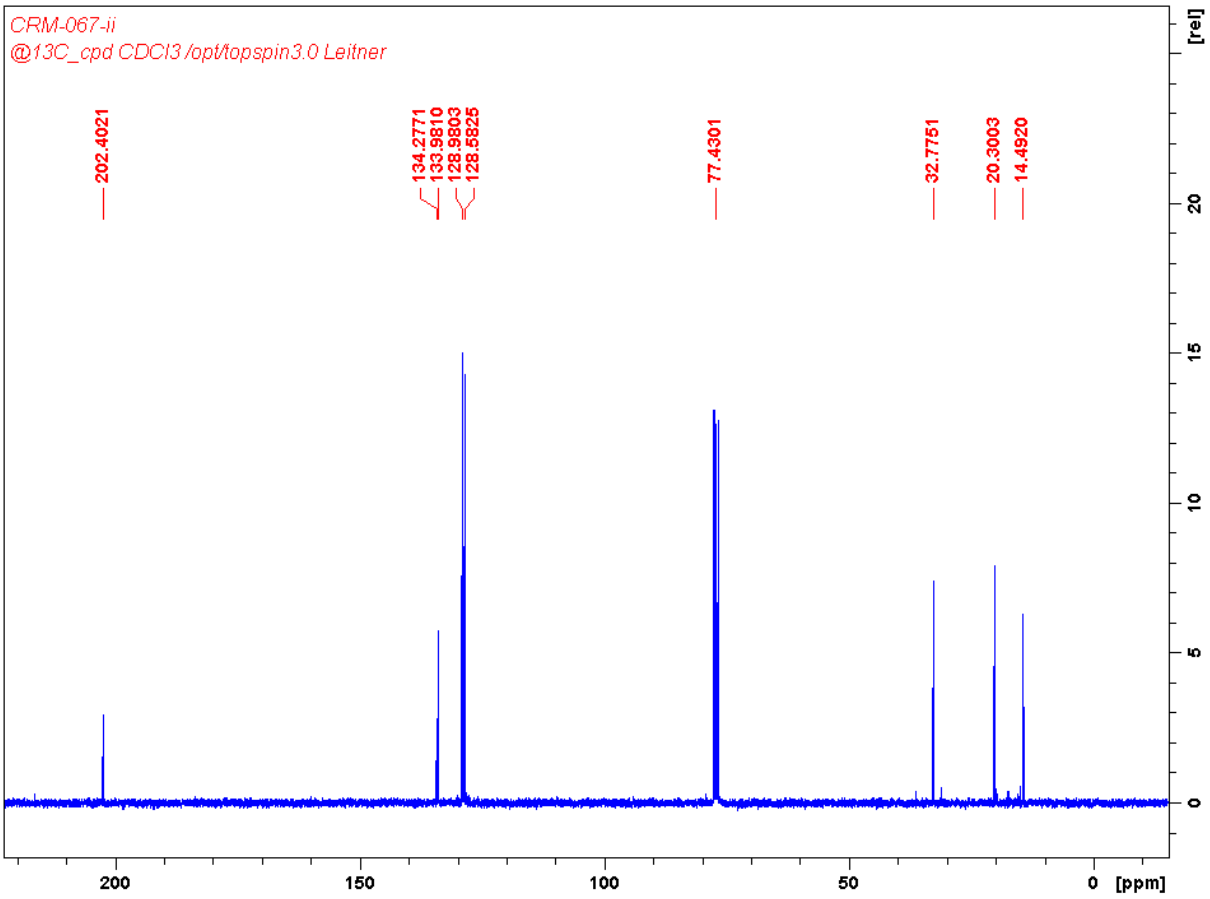
^{13}C-NMR (75 MHz, $CDCl_3$): δ = 202.4, 134.2, 134.0, 129.0, 128.6, 77.4, 32.8, 20.3, 14.5;

Enantiometric excess was determined by HPLC with a Chiralcel OD-H column (*n*-heptane : *iso*-propanol = 99 : 1, λ = 210 nm), 0.5 mL / min; major enantiomer t_{2R} = 25.8 min, minor enantiomer t_{2S} = 18.3 min.

Analytical data are according to literature.[2]

[2] S. E. O'Toole, C. A. Rose†, S. Gundala, K. Zeitler,S. J. Connon, *J. Org. Chem.*, **2011**, *76*, 347–357.





(*R*)-1-hydroxy-3-methyl-1-phenylbutan-2-one (separated from racemic mixture)

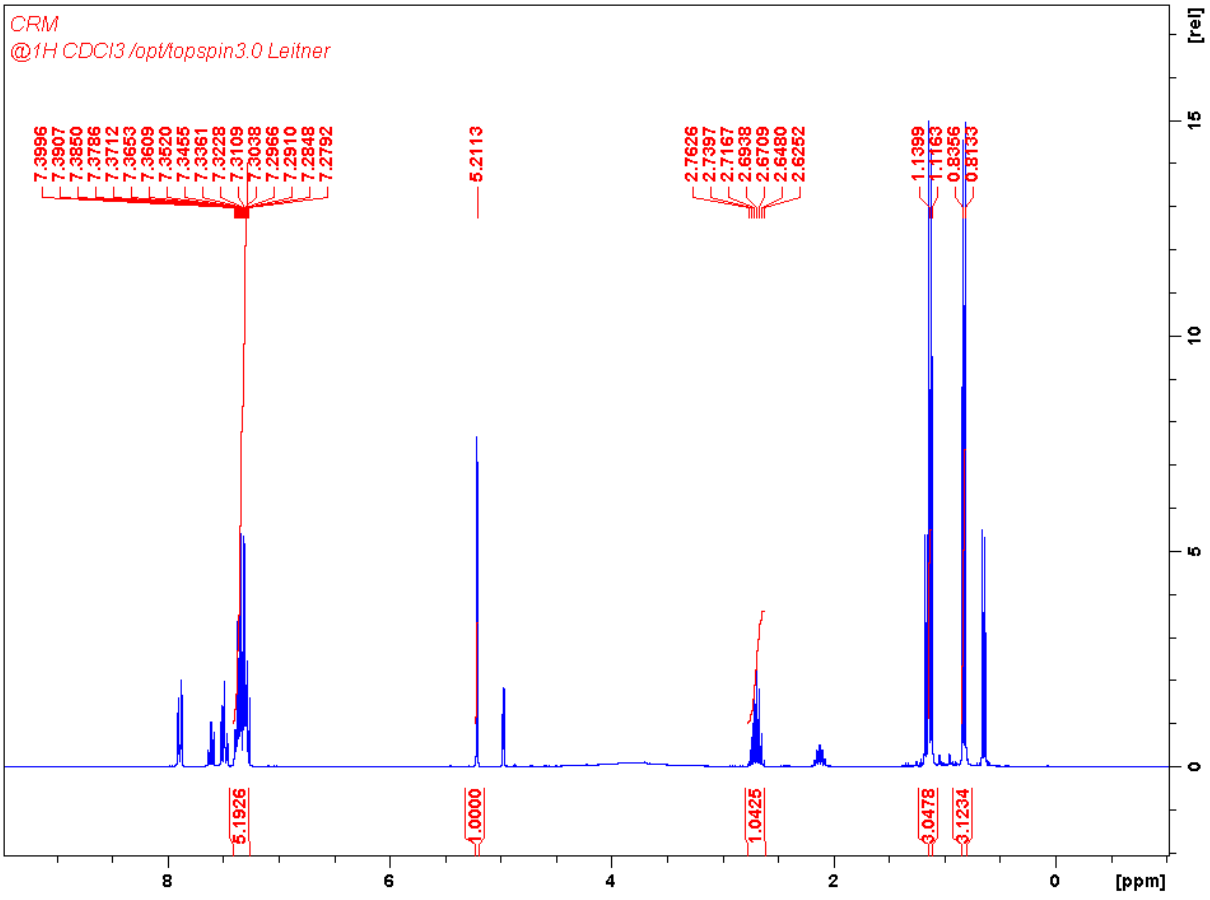
R_f = 0.28 (1:8 ethyl acetate / petroleum ether)

^{1}H-NMR (300 MHz, $CDCl_3$): δ = 7.37 – 7.28 (m, 5H), 5.21 (s, 1H), 2.69 (sept, *J* = 6.9, 1H), 1.13 (d, *J* = 7.1 Hz, 3H), 0.82 (d, *J* = 6.7 Hz, 3H);

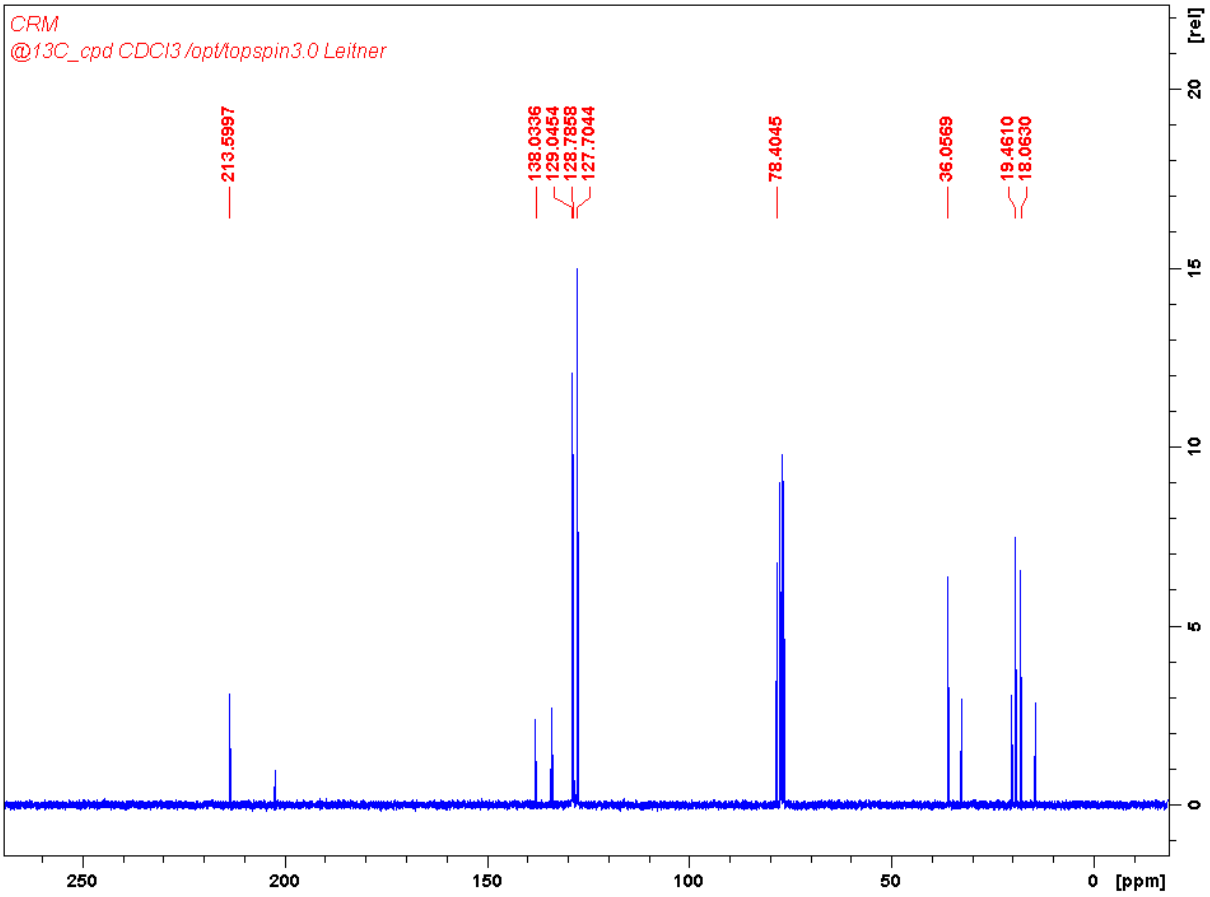
^{13}C-NMR (75 MHz, $CDCl_3$): δ = 213.6, 138.0, 129.0, 128.8, 127.7, 78.4, 36.1, 19.5, 18.1;

Enantiometric excess was determined by HPLC with a Chiralcel OD-H column (*n*-heptane : *iso*-propanol = 99 : 1, λ = 210 nm), 0.5 mL / min; major enantiomer t_{1R} = 41.9 min, minor enantiomer t_{1S} = 30.7 min.

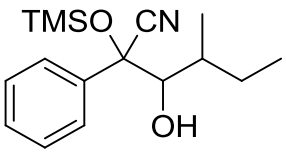
Analytical data are according to literature[3]



[3] S. E. O'Toole, C. A. Rose†, S. Gundala, K. Zeitler,S. J. Connon, *J. Org. Chem.*, **2011**, *76*, 347–357.



Synthesis of 3-hydroxy-4-methyl-2-phenyl-2-(trimethylsilyloxy)-hexanenitrile



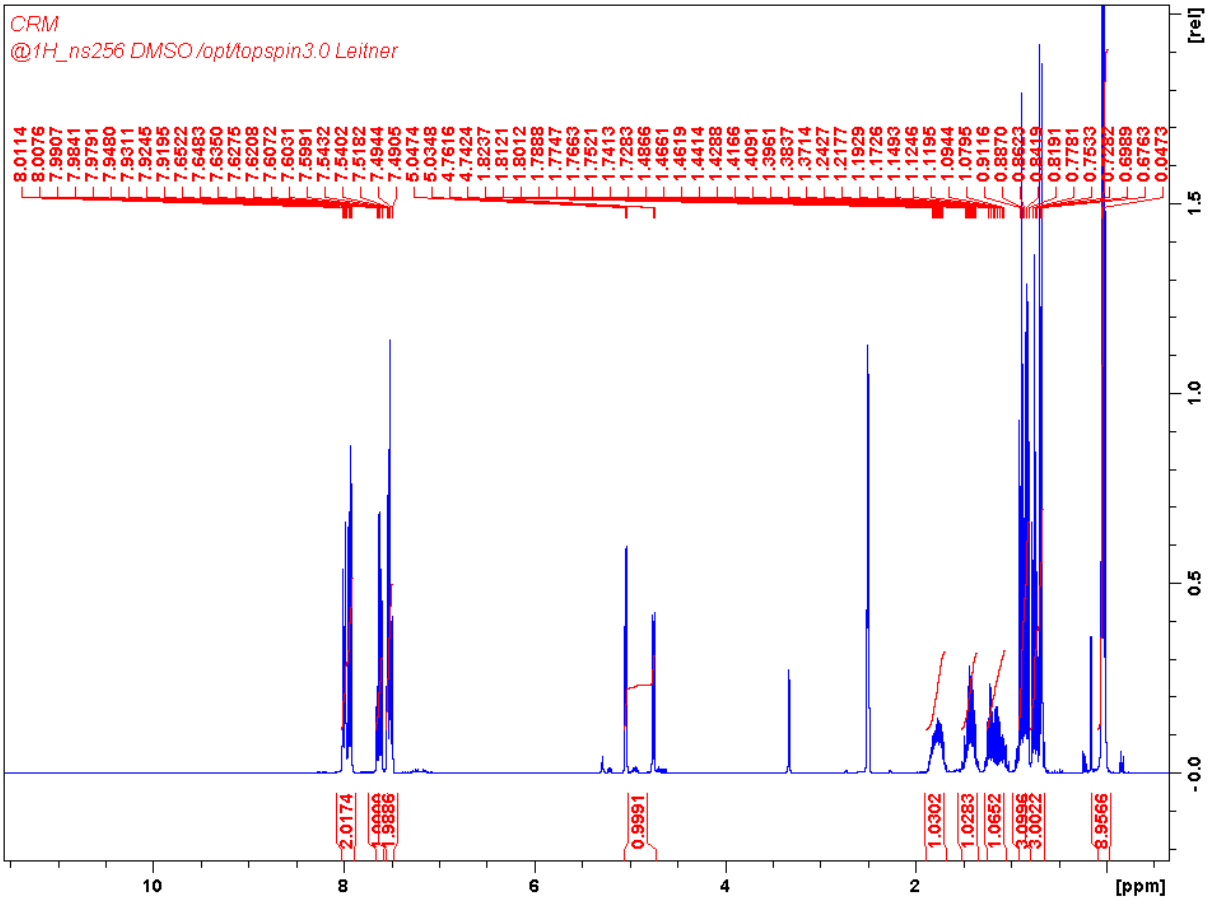
Following Method B.1, 2-methylbutyraldehyde (1.60 mL, 1.29 g, 15.0 mmol, 1.05 equiv.) was employed. The instable product (3.407 g, 11.7 mmol, 82% yield) was only available for NMR analysis.

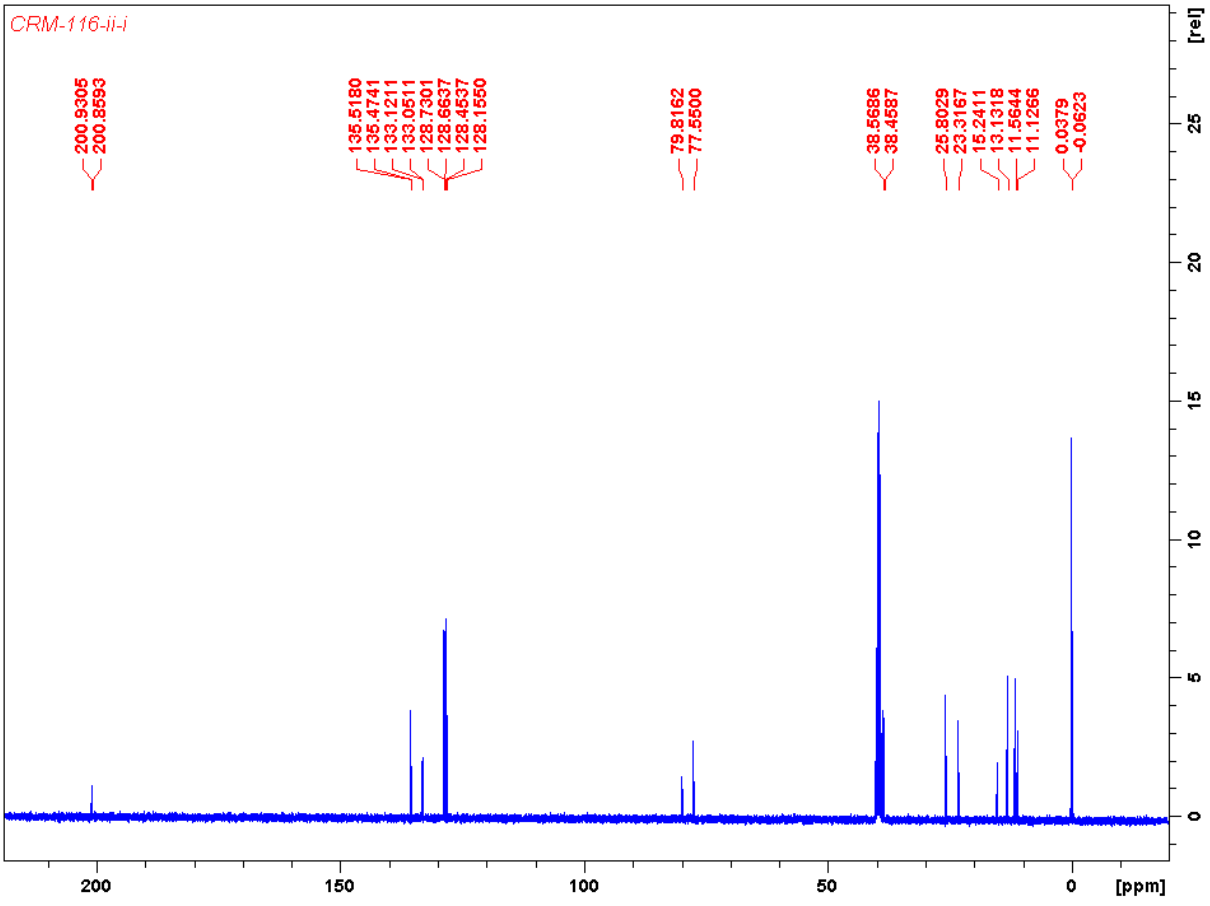
R_f = 0.28 (1:50 ethyl acetate / petroleum ether)

^{1}H-NMR (300 MHz, DMSO-d_6): δ = 8.01 – 7.92 (m, 2H), 7.65 (m, 1H), 7.54 – 7.49 (m, 2H), 5.04 (d, *J* = 3.6 Hz, 0.57H*), 4.75 (d, *J* = 5.7 Hz, 0.43H*), 1.86 – 1.68 (m,

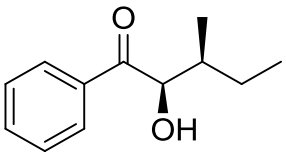
1H), 1.51 – 1.35 (m, 1H), 1.24 – 1.05 (m, 1H), 0.91 – 0.82 (m, 3H), 0.78 – 0.68 (m, 3H), 0.05 – 0.02 (m, 9H);

^{13}C-NMR (101 MHz, DMSO-d $_6$):δ = 200.9 (2C), 135.5 (2C), 133.1 (2C), 128.7 (2C), 128.5, 128.2, 79.8, 77.6, 38.6, 38.5, 25.8, 23.3, 15.2, 13.1, 11.6, 11.1, 0.0, -0.1.





Synthesis of *syn*-2-hydroxy-3-methyl-1-phenylpentan-1-one



BAL-catalyzed synthesis.

Following Method A, 2-methylbutyraldehyde (804 μL, 646 mg, 7.50 mmol, 5.00 equiv.) was employed. The product (77 mg, 0.40 mmol, >99% *ee*) was a colorless oil.

Synthesis of *rac*-*syn*-2-hydroxy-3-methyl-1-phenylpentan-1-one.

Following Method B.2, 3-hydroxy-4-methyl-2-phenyl-2-(trimethylsilyloxy)-hexanenitrile (415 mg, 1.42 mg) and triethylamine trihydrofluoride (278 μL, 1.70 mmol, 1.2 equiv.) were employed. The product (148 mg, 0.75 mmol, 53% yield) was a colorless oil.

R_f = 0.22 (1:20 ethyl acetate / petroleum ether)

^{1}H-NMR (600 MHz, DMSO-d_6): δ = 7.94 – 7.92 (m, 2H), 7.65 – 7.62 (m, 1H), 7.54 – 7.52 (m, 2H), 4.96 (dd, J = 6.4, 3.6 Hz, 1H), 4.93 (d, J = 6.4 Hz, 1H), 1.76 – 1.70 (m, 1H), 1.53 – 1.46 (m, 1H), 1.27 – 1.20 (m, 1H), 0.92 (t, J = 7.5 Hz, 3H), 0.66 (d, J = 6.8 Hz, 3H);

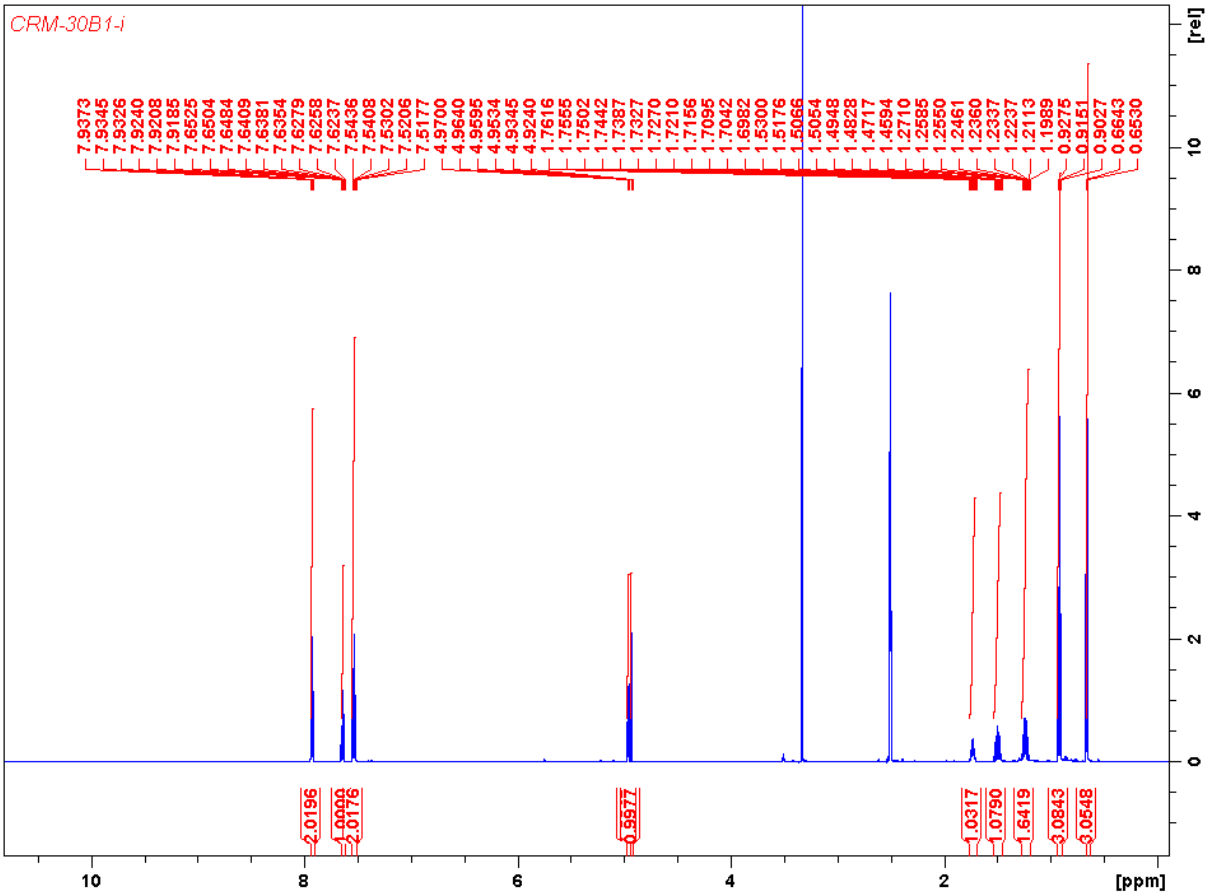
^{13}C-NMR (101 MHz, DMSO-d_6): δ = 202.3, 135.3, 133.1, 128.7, 128.2, 75.2, 38.1, 26.1, 13.0, 11.7;

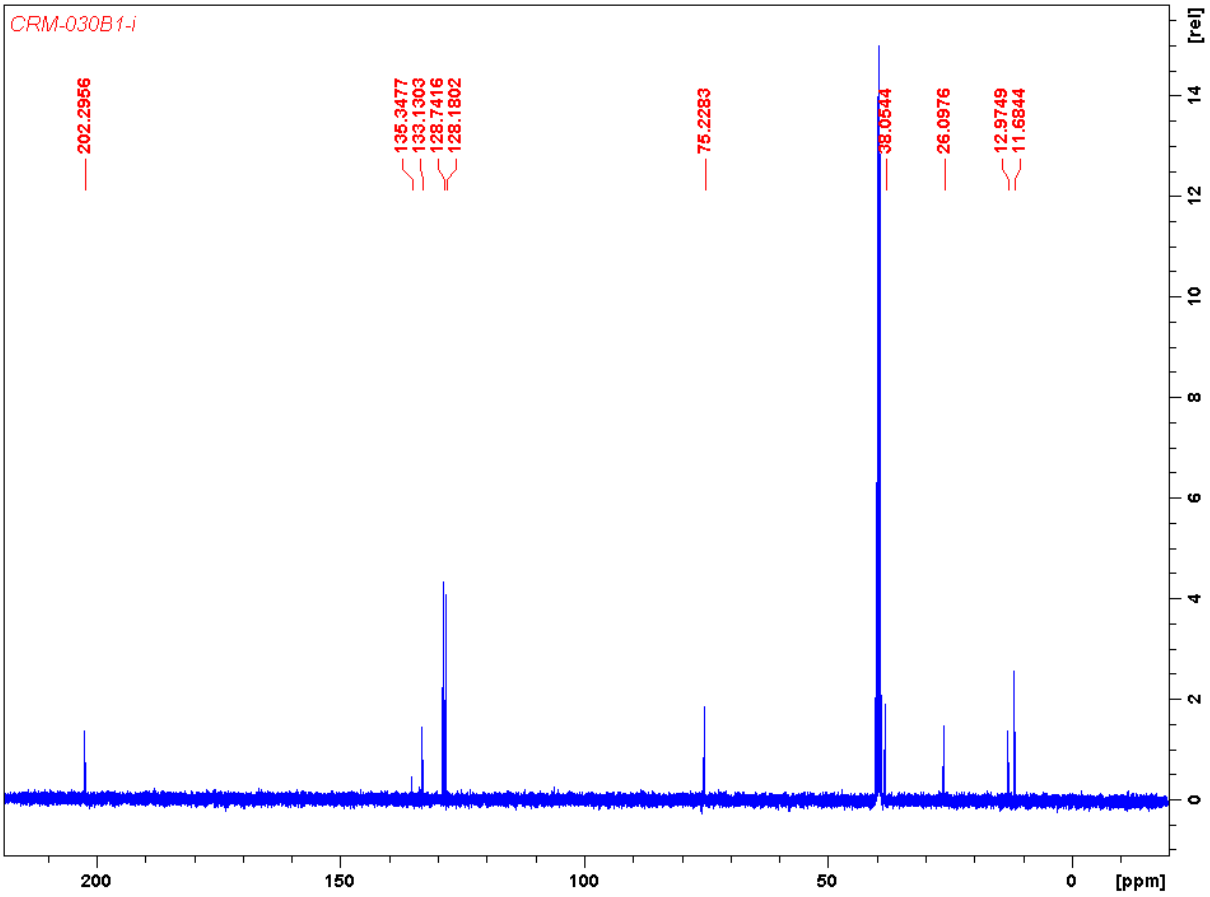
IR ($CHCl_3$): ν = 3478 (s), 3064 (w), 2964 (vs), 2930 (vs), 2877 (s), 1679 (vs), 1597 (m), 1456 (s), 1382 (m), 1305 (s), 1268 (vs), 1137 (vs), 1048 (m), 1009 (vw), 976 (s), 902 (vw), 851 (vw), 792 (vw), 757 (m), 694 (vs), 607 (w) cm^{-1};

MS (EI, 100 eV): *m/z* (%) = 193 ($[M+H]^+$, 3), 136 (23), 107 (47), 106 (28), 105 ($[C_7H_5O]^+$, 100), 87 (34), 77 (50), 71 (24), 69 (15), 51 (17);

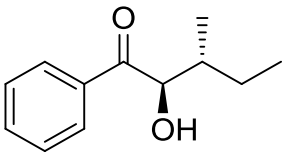
HRMS (ESI): $[M]^+$ calculated for $[C_{12}H_{16}O_2]^+$: 192.1145, found: 192.1148;

Enantiometric excess was determined by HPLC with a Chiralcel OD-H column (*n*-heptane : *iso*-propanol = 99 : 1, λ = 210 nm), 0.5 mL / min; major enantiomer $t_{2R,3S}$ = 25.5 min, minor enantiomer $t_{2R,3S}$ = 15.5 min.





Synthesis of *anti*-2-hydroxy-3-methyl-1-phenylpentan-1-one



Following protocol reported in Method B.2, 3-hydroxy-4-methyl-2-phenyl-2-(trimethylsilyloxy)hexanenitrile (415 mg, 1.42 mg) and triethylamine trihydrofluoride (278 μL, 1.70 mmol, 1.2 equiv.) were employed. The product (112 mg, 0.58 mmol, 41% yield) was a colorless oil.

R_f = 0.18 (1:20 ethyl acetate / petroleum ether)

^{1}H-NMR (600 MHz, DMSO-d_6): δ = 7.98 – 7.97 (m, 2H), 7.65 – 7.61 (m, 1H), 7.53 – 7.51 (m, 2H), 5.21 (d, *J* = 5.2 Hz, 1H), 4.69 (d, *J* = 5.2 Hz, 1H), 1.82 – 1.75 (m, 1H), 1.41 – 1.34 (m, 1H), 1.14 – 1.07 (m, 1H), 0.87 (d, *J* = 6.8 Hz, 3H), 0.76 (t, *J* = 7.5 Hz, 3H);

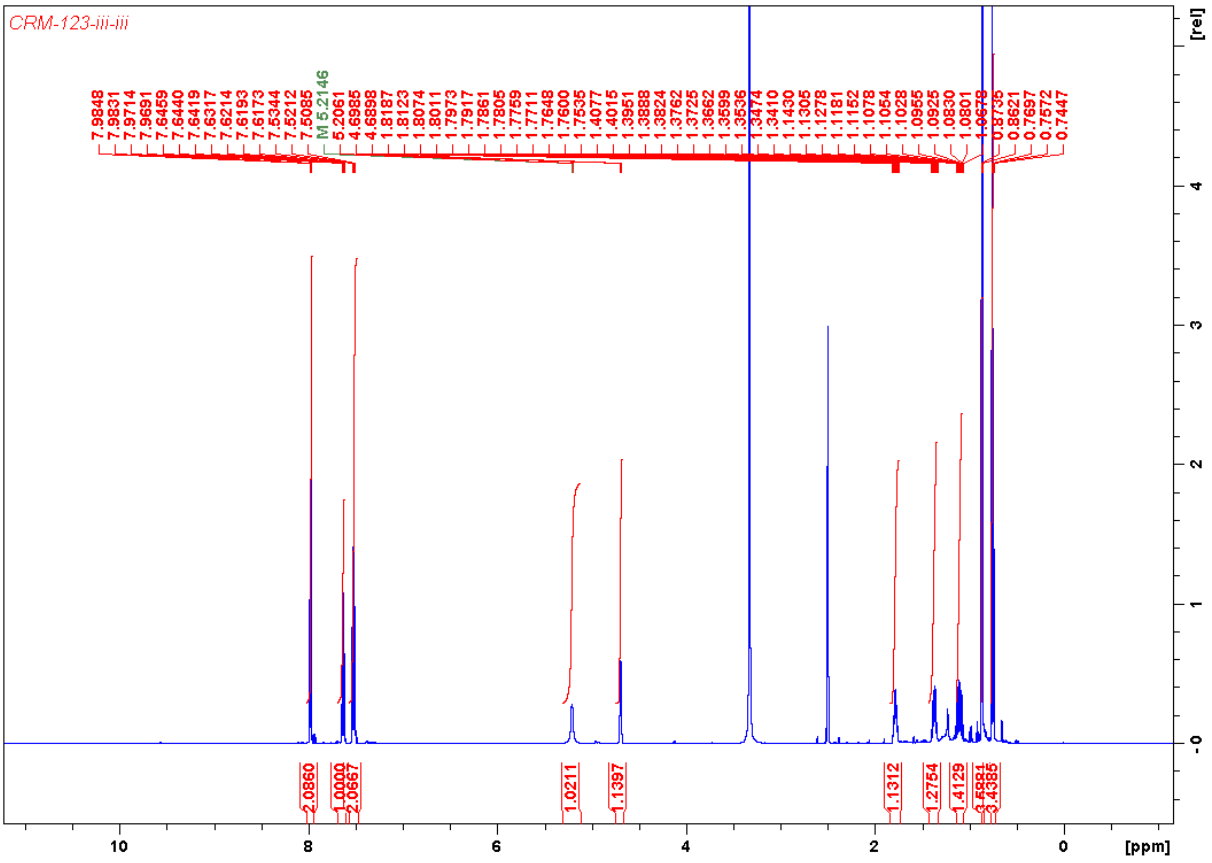
^{13}C-NMR (151 MHz, DMSO-d_6): δ = 201.9, 135.7, 133.1, 128.6, 128.4, 77.2, 38.1, 23.1, 15.7, 11.2;

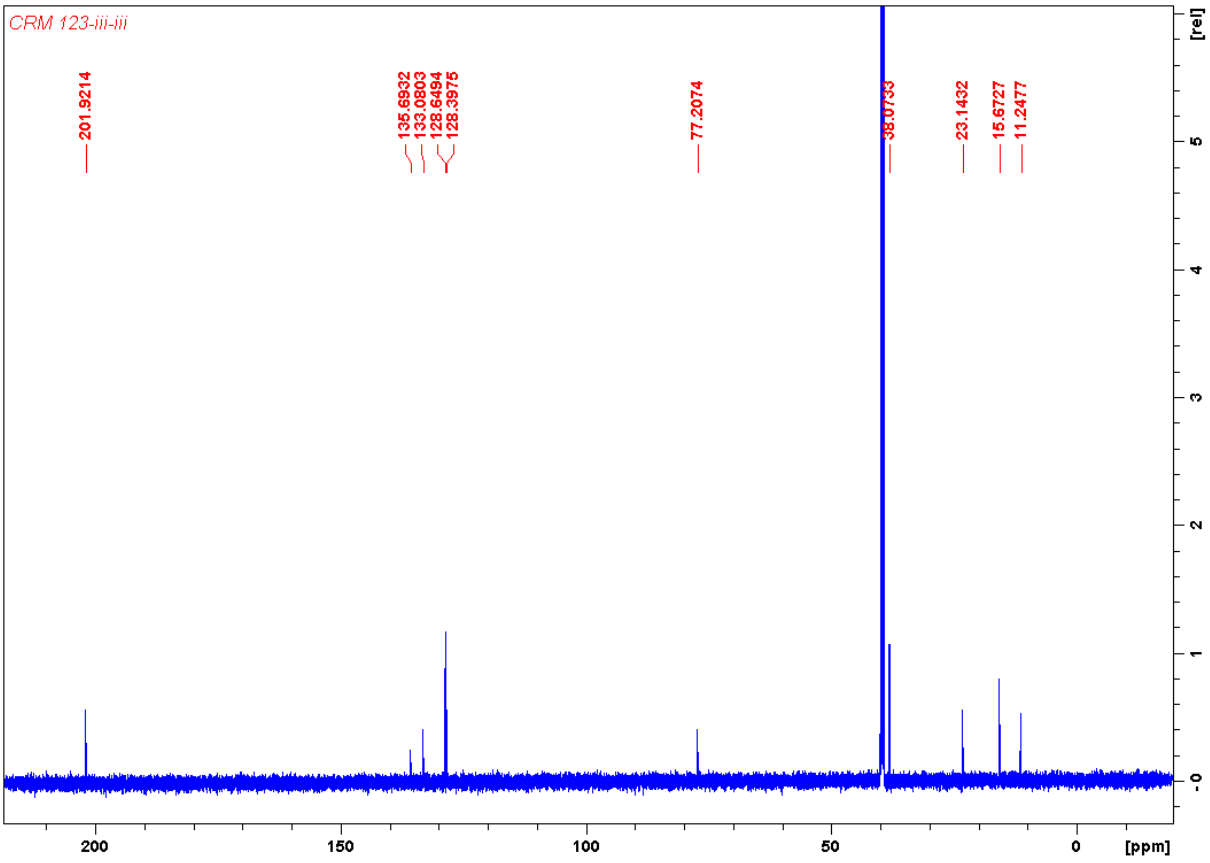
IR ($CHCl_3$): ν = 3476 (m), 3067 (vw), 2963 (vs), 2930 (vs), 1805 (vw), 1682 (vs), 1596 (m), 1455 (s), 1401 (w), 1270 (vs), 1132 (s), 1046 (w), 995 (s), 926 (w), 756 (w), 700 (s), 609 (vw), 496 (w) cm^{-1};

MS (EI, 100 eV): *m/z* (%) = 192 ($[M]^+$, 1), 136 (17), 107 (37), 106 (21), 105 ($[C_7H_5O]^+$, 100), 87 (16), 77 (47);

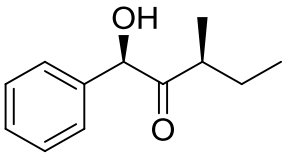
HRMS (ESI): $[M]^+$ calculated for $[C_{12}H_{16}O_2]^+$: 192.1145, found: 192.1147;

Enantiometric excess was determined by HPLC with a Chiralcel OD-H column (*n*-heptane : *iso*-propanol = 99 : 1, λ = 210 nm), 0.5 mL / min; major enantiomer $t_{2R,3R}$ = 27.5 min, minor enantiomer $t_{2S,3S}$ = 18.2 min.





Synthesis of (1*R*,3*S*)-1-hydroxy-3-methyl-1-phenylpentan-2-one



Following Method A, (*S*)-2-methylbutyraldehyde (804 µL, 646 mg, 7.50 mmol, 5.00 equiv.) was employed. The product (72 mg, 0.37 mmol, 25% yield) was a colorless oil.

R_f = 0.18 (1:20 ethyl acetate / petroleum ether)

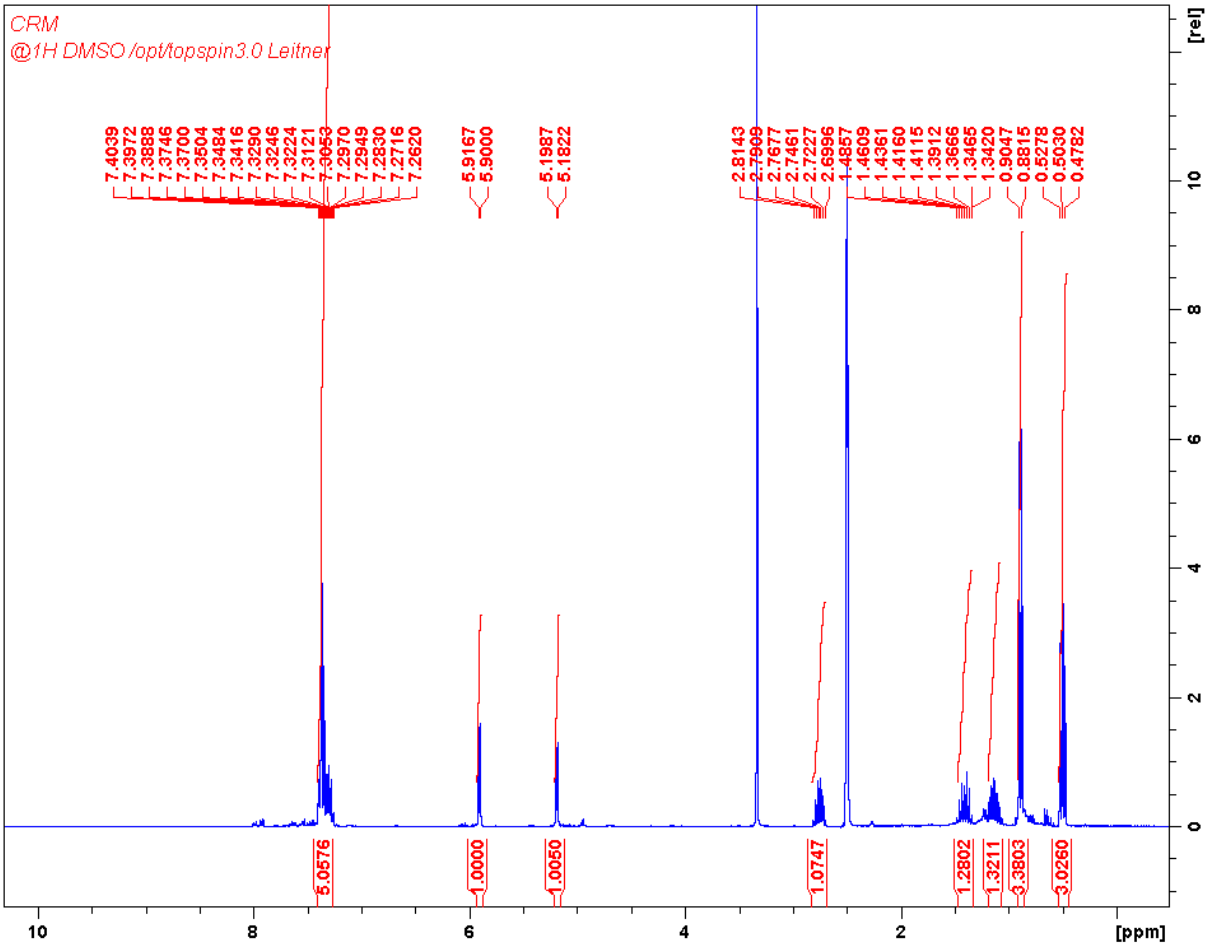
^{1}H-NMR (300 MHz, DMSO-d_6): δ = 7.40 – 7.26 (m, 5H), 5.91 (d, *J* = 5.0 Hz, 1H), 5.19 (d, *J* = 5.0 Hz, 1H), 2.81 – 2.70 (m, 1H), 1.49 – 1.34 (m, 1H), 1.21 – 1.07 (m, 1H), 0.89 (d, *J* = 6.9 Hz, 3H), 0.50 (t, *J* = 7.6 Hz, 3H);

^{13}C-NMR (151 MHz, DMSO-d_6):δ = 213.1, 139.1, 128.2, 127.8, 127.1, 78.1, 41.7, 25.2, 16.9, 11.2;

IR ($CHCl_3$): ν = 3462 (s), 3063 (w), 3031 (w), 2963 (vs), 2928 (vs), 2874 (s), 1711 (vs), 1598 (w), 1491 (w), 1457 (vs), 1378 (m), 1265 (m), 1191 (w), 1112 (m), 1069 (w), 1027 (s), 997 (s), 868 (vw), 757 (m), 700 (s), 593 (vw), 514 (vw) cm^{-1};

MS (EI, 100 eV): m/z (%) = 192 ($[M]^+$, 4), 149 (2), 108 (7), 107 ($[C_7H_7O]^+$, 100), 105 (14), 85 (13);

HRMS (ESI): $[M]^+$ calculated for $[C_{12}H_{16}O_2]^+$: 192.1145, found: 192.1143.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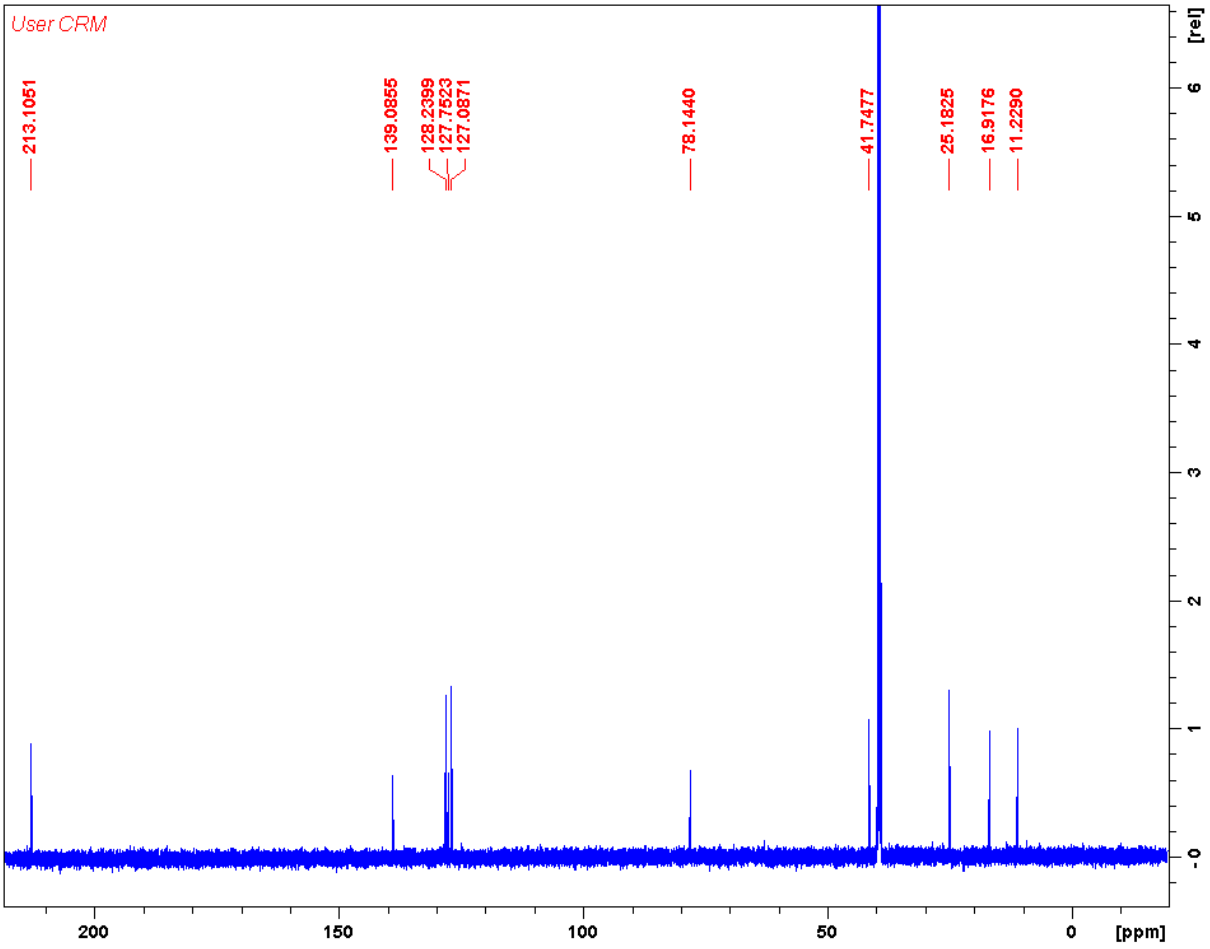
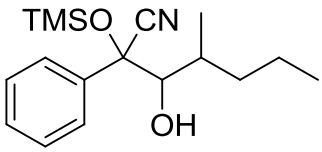
1.4361
1.4160
1.4115
1.3912
1.3666
1.3465
1.3420
0.9047
0.8815
0.5278
0.5030
0.4782
6.0576
1.0000
1.0050
1.0747
1.2802
1.3211
3.3803
3.0260
10
8
6
4
2
[ppm]
[rel]



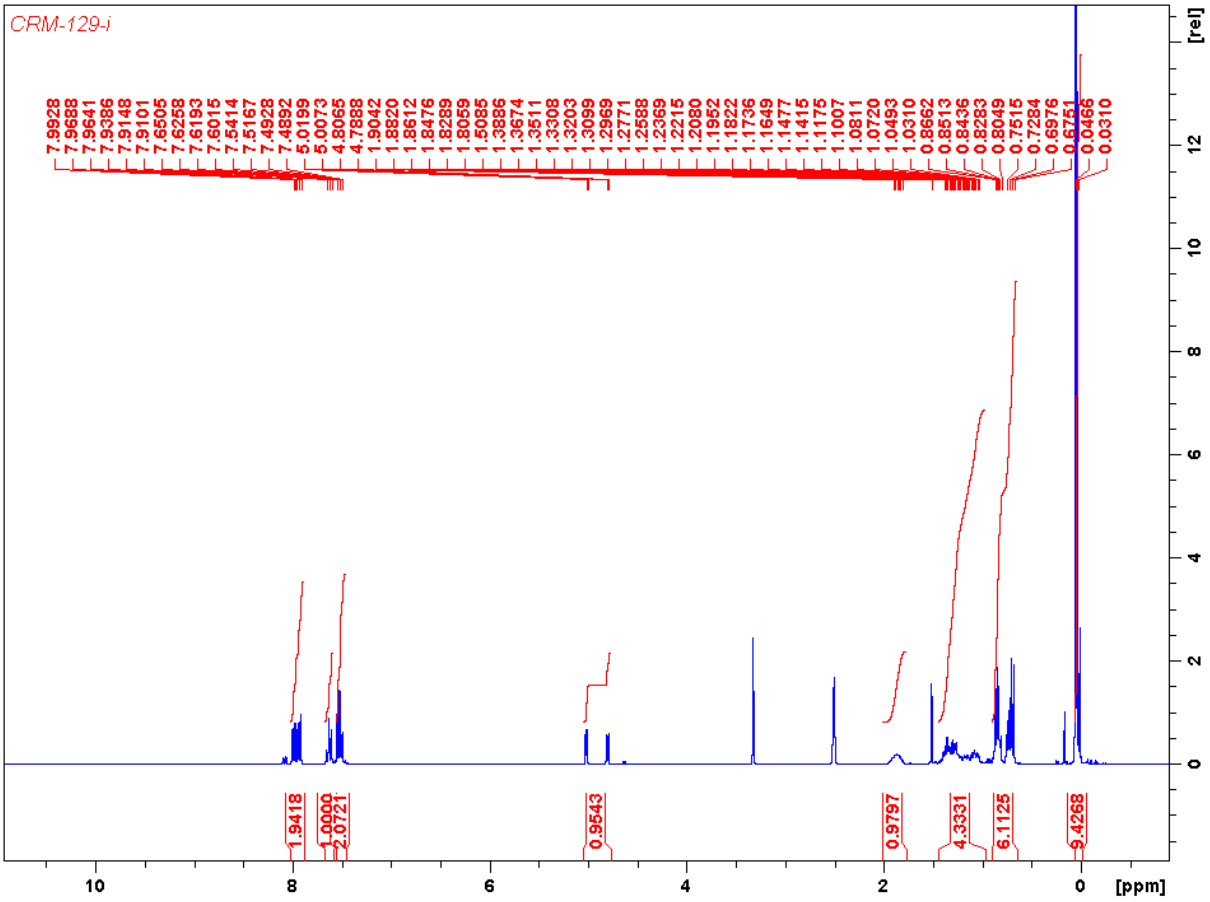
Synthesis of 3-hydroxy-4-methyl-2-phenyl-2-(trimethylsilyloxy)hexanenitrile

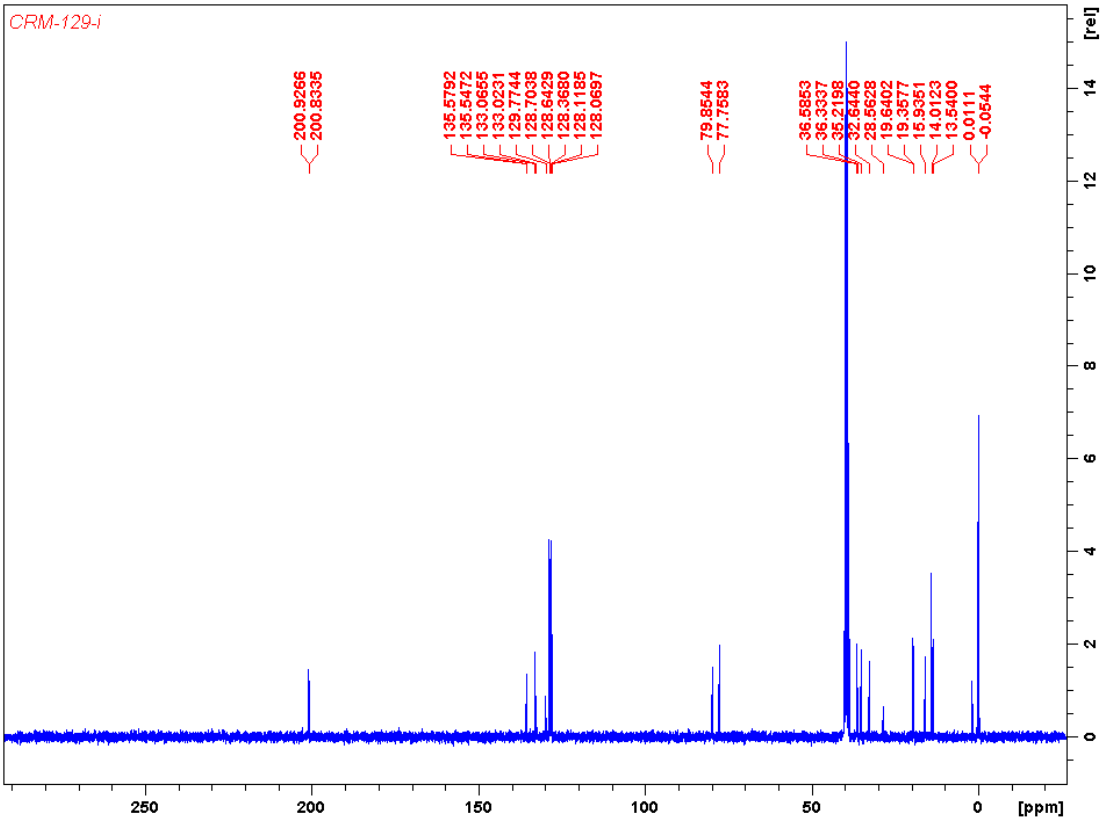


Following Method B.1, 2-methylpentanal (1.86 mL, 1.50 g, 15.0 mmol, 1.05 equiv.) was employed. The instable product (2.929 g, 9.6 mmol, 67% yield) was only available for NMR analysis.

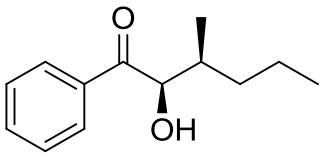
^{1}H-NMR (300 MHz, DMSO-d_6): δ = 7.99 – 7.91 (m, 2H), 7.65 – 7.60 (m, 1H), 7.54 – 7.49 (m, 2H), 5.01 (d, *J* = 3.8 Hz, 0.54H*), 4.80 (d, *J* = 5.2 Hz, 0.47H), 1.90 – 1.81 (m, 1H), 1.39 – 1.03 (m, 4H), 0.87 – 0.68 (m, 6H), 0.71 (m, 3H), 0.05 – 0.03 (m, 9H);

^{13}C-NMR (101 MHz, DMSO-d_6):δ = 200.9, 200.8, 135.6, 135.5, 133.1, 133.0, 129.8, 128.7, 128.6, 128.4, 128.1 (2C), 79.9, 77.8, 36.6, 36.3, 35.2, 32.6, 28.6, 19.6, 19.4, 15.9, 14.0, 13.5





Synthesis of *syn*-2-hydroxy-3-methyl-1-phenylhexan-1-one



(2*R*,3*S*)- 2-hydroxy-3-methyl-1-phenylhexan-1-one.

Following Method A (BAL-catalyzed), 2-methylbutyraldehyde (804 μL, 646 mg, 7.50 mmol, 5.00 equiv.) was employed. The product (142 mg, 0.69 mmol, 46% yield) was a colorless oil.

***rac-syn*-2-hydroxy-3-methyl-1-phenylhexan-1-one.**

Following protocol reported in Method B.2, 3-hydroxy-4-methyl-2-phenyl-2-(trimethylsilyloxy)heptanenitrile (1.000 g, 3.27 mmol) and triethylamine trihydrofluoride (640 μL, 3.93 mmol, 1.20 equiv.) were employed. The product (391 mg, 1.90 mmol, 58% yield, >99% ee) was a colorless oil.

R_f = 0.36 (1:20 ethyl acetate / *n*-pentane)

^{1}H-NMR (300 MHz, DMSO-d_6): δ = 7.93 – 7.90 (m, 2H), 7.66 – 7.61 (m, 1H), 7.55 – 7.50 (m, 2H), 4.93 – 4.92 (m, 2H), 1.88 – 1.77 (m, 1H), 1.51 – 1.13 (m, 4H) 0.85 (t, J = 7.1 Hz, 3H), 0.66 (d, J = 6.8 Hz, 3H);

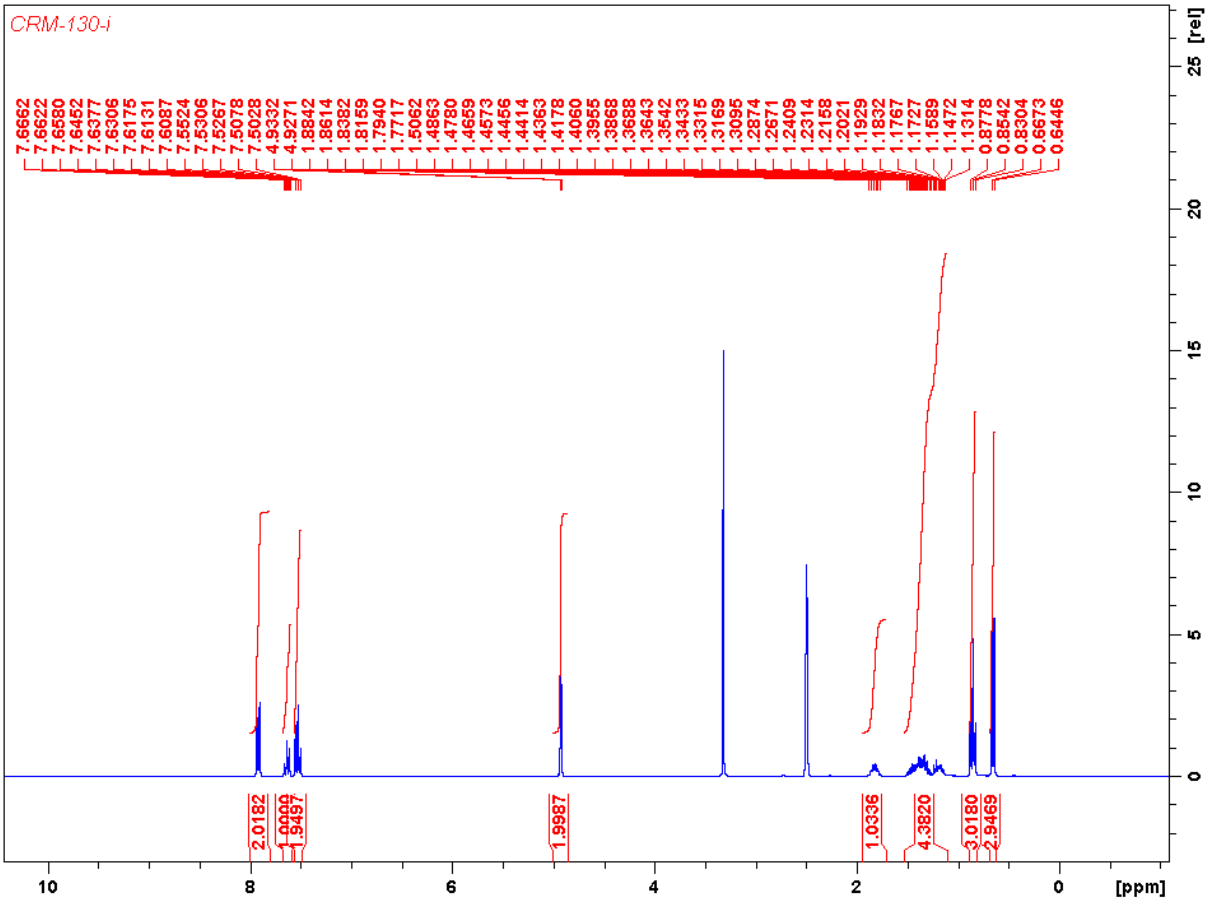
^{13}C-NMR (101 MHz, DMSO-d_6): δ = 202.3, 135.4, 133.1, 128.8, 128.2, 75.5, 36.0, 35.6, 19.8, 14.1, 13.3;

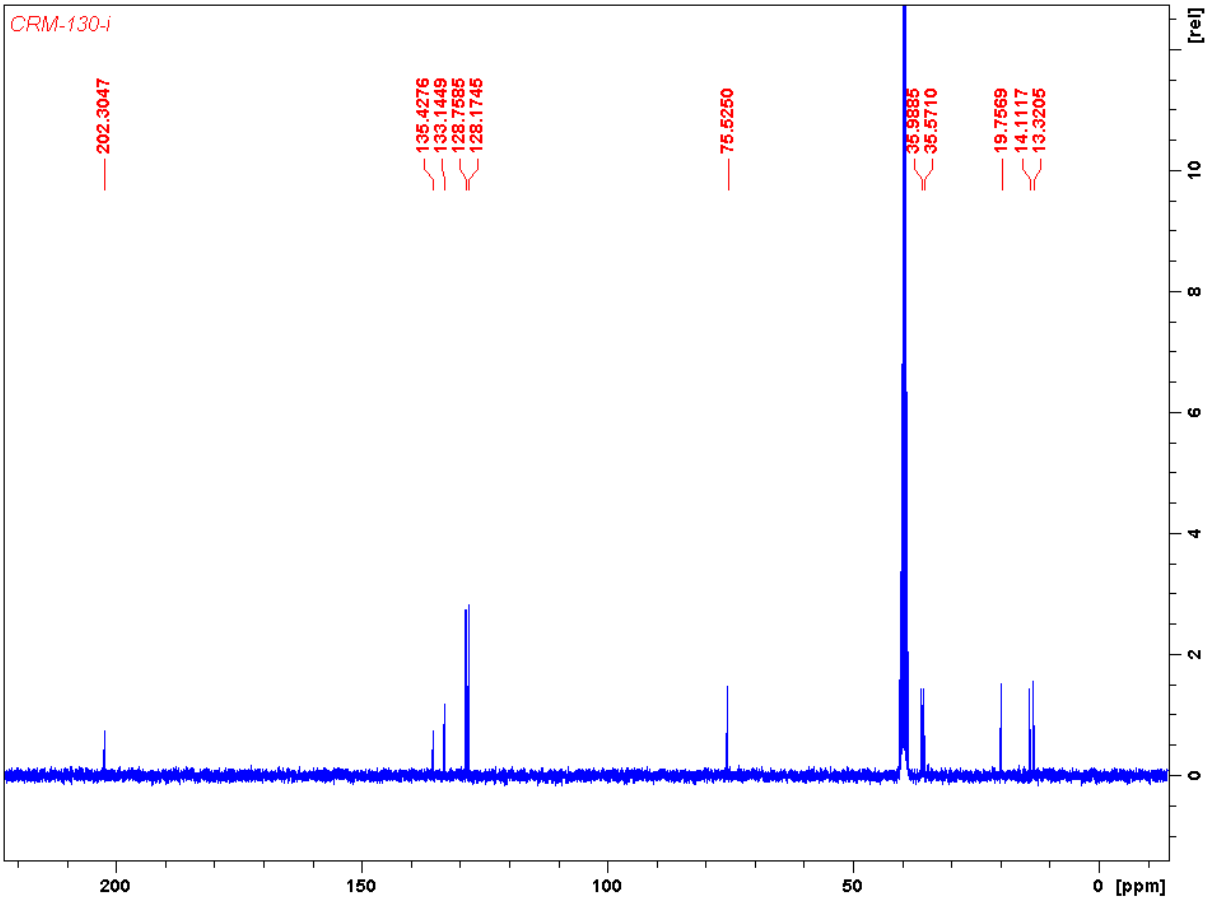
IR ($CHCl_3$): ν = 3476 (s), 3064 (vw), 2962 (vs), 2930 (vs), 2873 (s), 1680 (vs), 1598 (m), 1454 (m), 1381 (m), 1267 (vs), 1137 (s), 1059 (w), 980 (vs), 947 (m), 765 (m), 695 (vs), 606 (w), 497 (m) cm^{-1};

MS (EI, 100 eV): *m/z* (%) = 207 ($[M+H]^+$, 1), 136 (26), 107 (38), 106 (33), 105 (83), 101 (21), 83 (72), 79 (24), 77 ($[C_6H_5]^+$, 100), 59 (33), 58 (23), 57 (24), 55 (60), 51 (34);

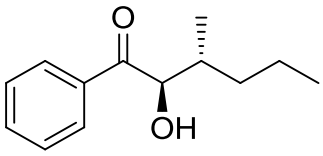
HRMS (ESI): $[M]^+$ calculated for $[C_{13}H_{18}O_2]^+$: 206.1301, found: 206.1301;

Enantiometric excess was determined by HPLC with a Chiralcel OD-H column (*n*-heptane : *iso*-propanol = 99 : 1, λ = 210 nm), 0.5 mL / min; major enantiomer $t_{2R,3S}$ = 23.1 min, minor enantiomer $t_{2R,3S}$ = 14.6 min.





Synthesis of *anti*-2-hydroxy-3-methyl-1-phenylhexan-1-one



***rac-anti*-2-hydroxy-3-methyl-1-phenylhexan-1-one:**

Following protocol reported in Method B.2, 3-hydroxy-4-methyl-2-phenyl-2-(trimethylsilyloxy)heptanenitrile (1.000 g, 3.27 mmol) and triethylamine trihydrofluoride (640 μL, 3.93 mmol, 1.20 equiv.) were employed. The product (202 mg, 0.98 mmol, 30% yield) was a colorless oil.

R_f = 0.30 (1:20 ethyl acetate / *n*-pentane)

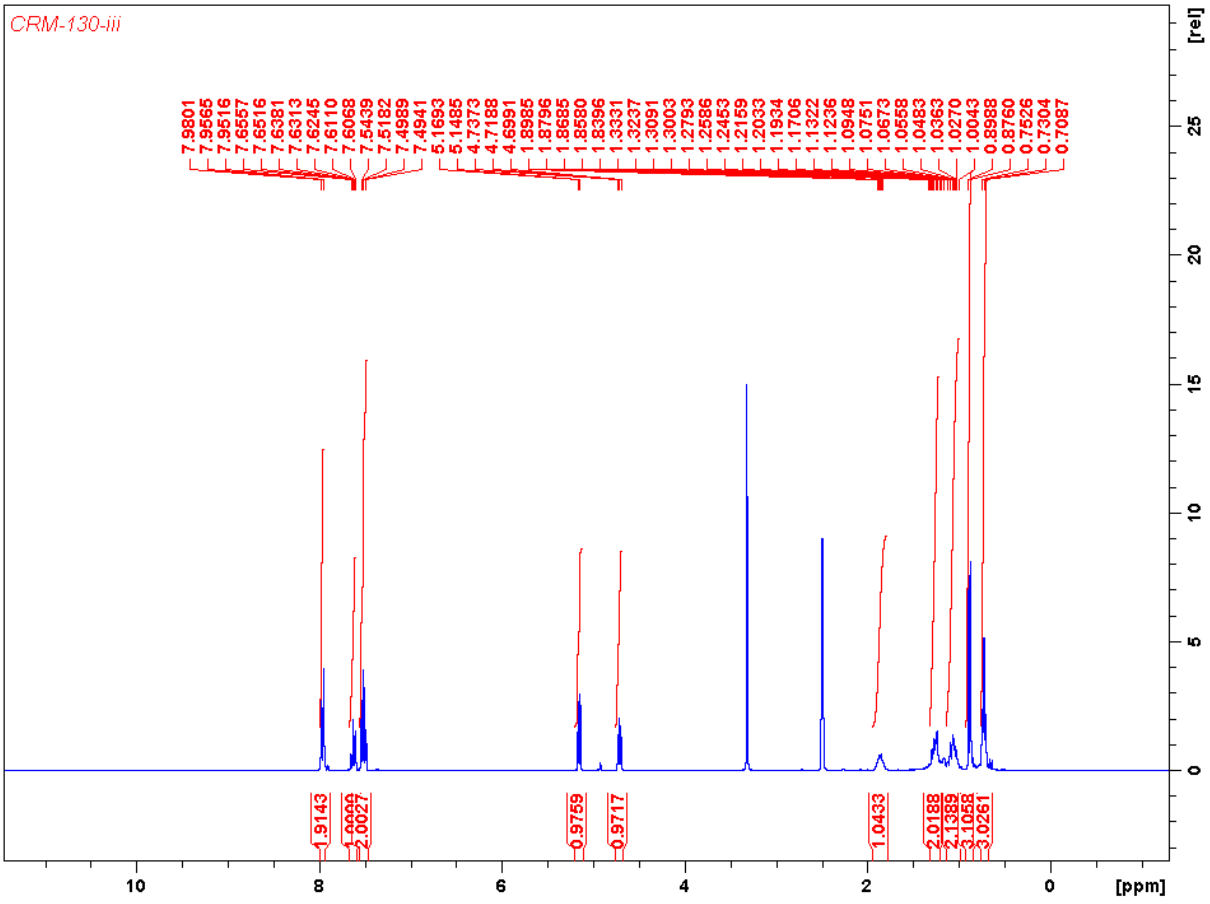
^{1}H-NMR (300 MHz, DMSO-d_6):δ = 7.98 – 7.95 (m, 2H), 7.66 – 7.61 (m, 1H), 7.54 – 7.49 m, 2H), 5.16 (d, *J* = 6.5 Hz, 1H), 4.74 – 4.70 (m, 1H), 1.90 – 1.84 (m, 1H), 1.33 – 1.19 (m, 2H), 1.13 – 1.00 (m, 2H), 0.89 (d, *J* = 6.8 Hz, 3H), 0.73 (t, *J* = 6.7 Hz, 3H);

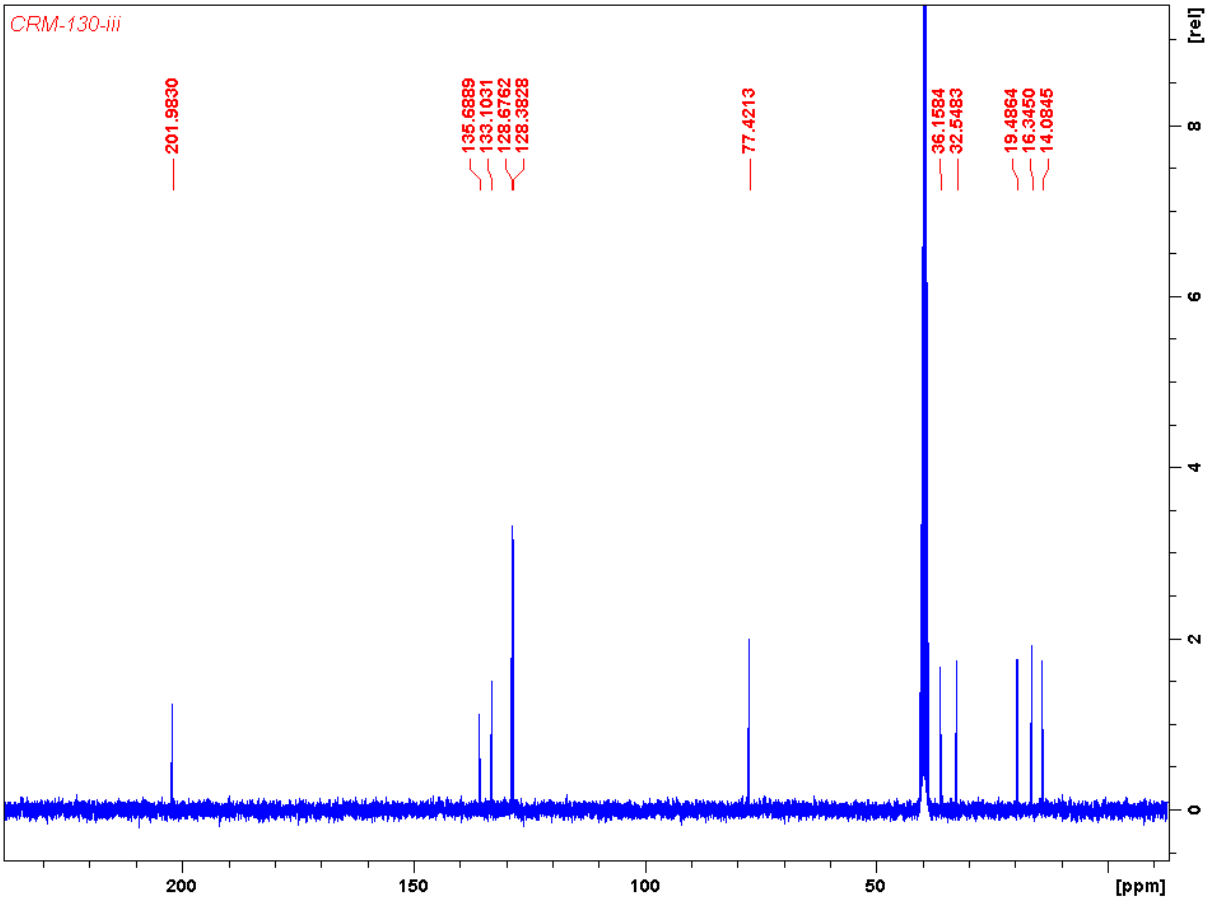
^{13}C-NMR (101 MHz, DMSO-d $_6$):δ = 202.0, 135.7, 133.1, 128.7, 128.4, 77.4, 36.2, 32.5, 19.5, 16.3, 14.1;

MS (EI, 100 eV):m/z (%) = 206 ($[M]^+$, 1), 136 (58), 107 (63), 106 (51), 105 ($[C_7H_5O]^+$, 100), 101 (32), 100 (17), 99 (20), 83 (54), 79 (17), 78 (12), 77 (77) 59 (20), 57 (16), 55 (33), 51 (20);

IR ($CHCl_3$): ν = 3478 (s), 3063 (vw), 2960 (vs), 2930 (vs), 2872 (s), 1679 (vs), 1597 (m), 1454 (s), 1403 (w), 1380 (w), 1269 (vs), 1134 (s), 1070 (m), 987 (vs), 936 (w), 848 (vw), 765 (m), 697 (vs), 608 (w), 466 (vw) cm^{-1}.

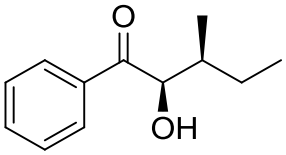
HRMS (ESI): $[M]^+$ calculated for $[C_{13}H_{18}O_2]^+$: 206.1302, found: 206.1301;

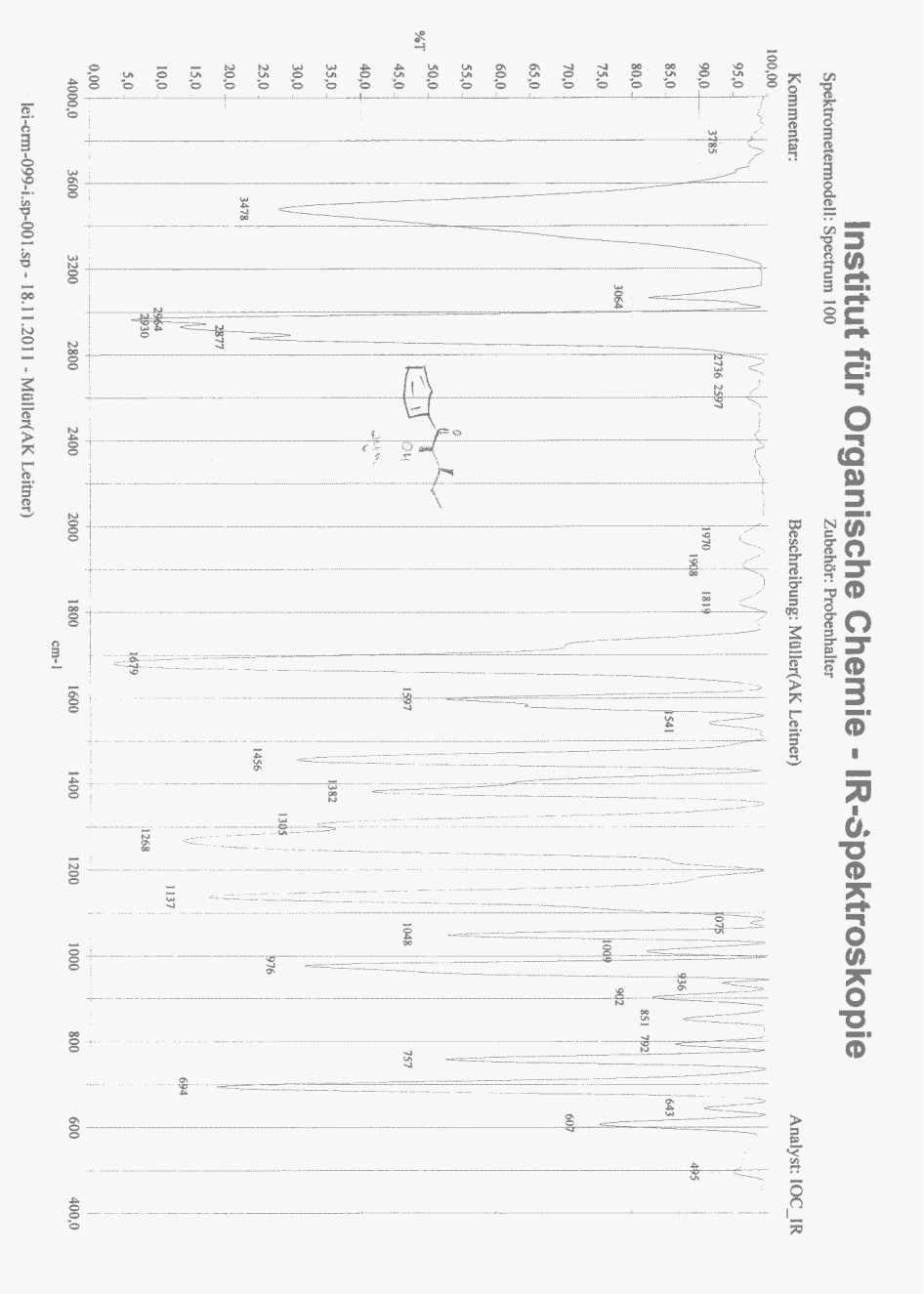


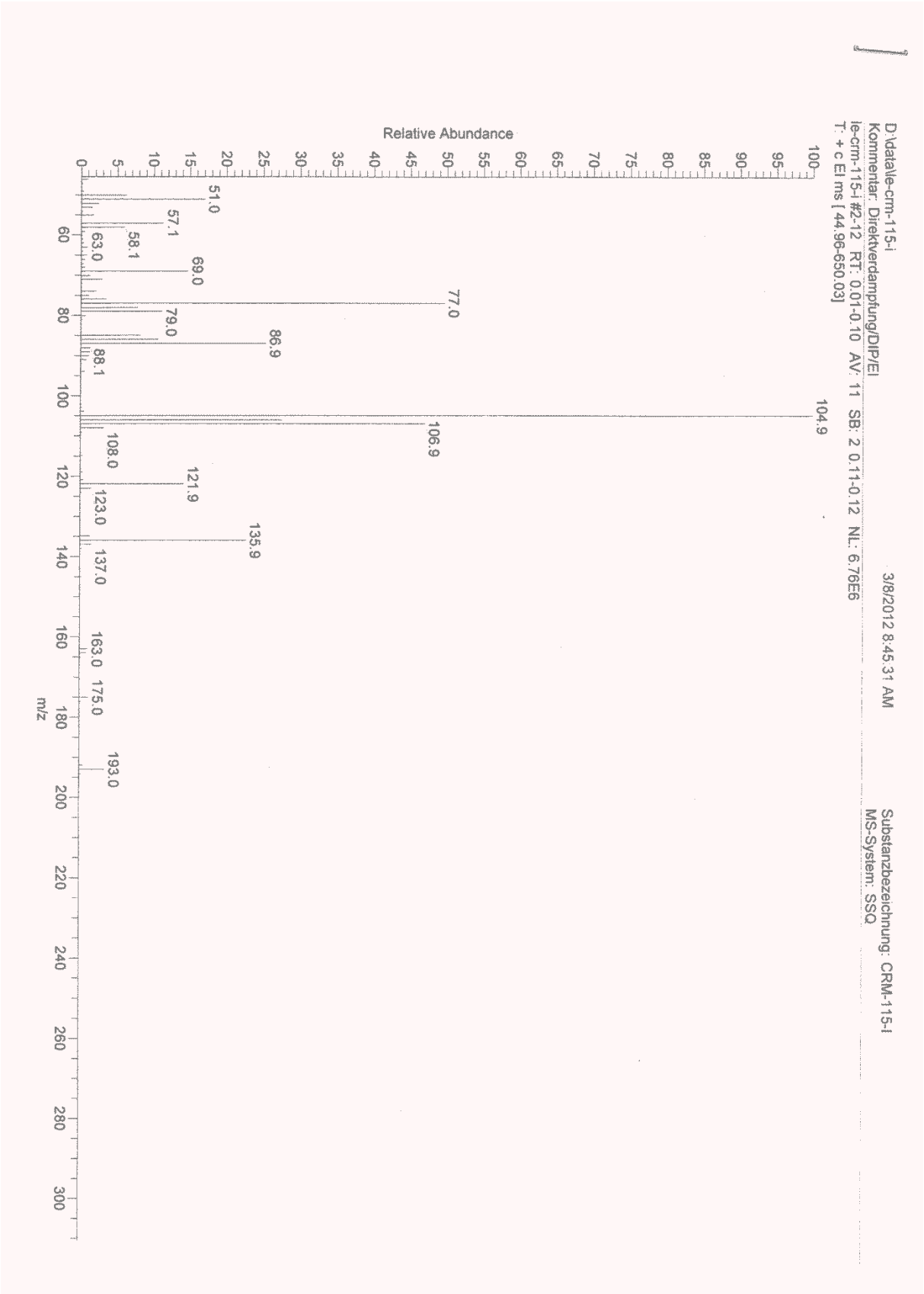


IR/MS Spectra

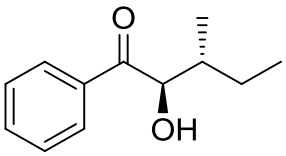
(2*R*,3*S*)- 2-hydroxy-3-methyl-1-phenylpentan-1-one.

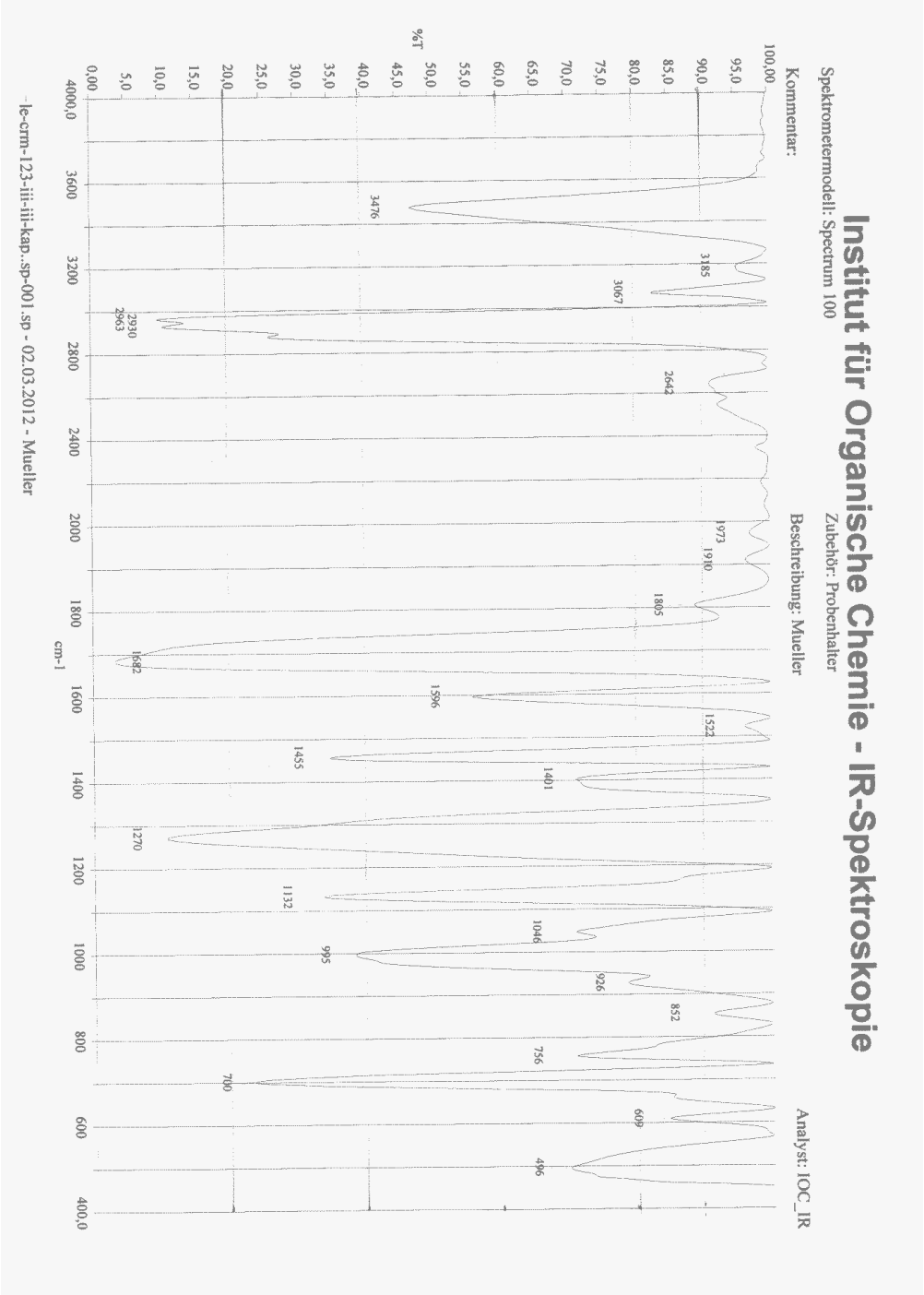


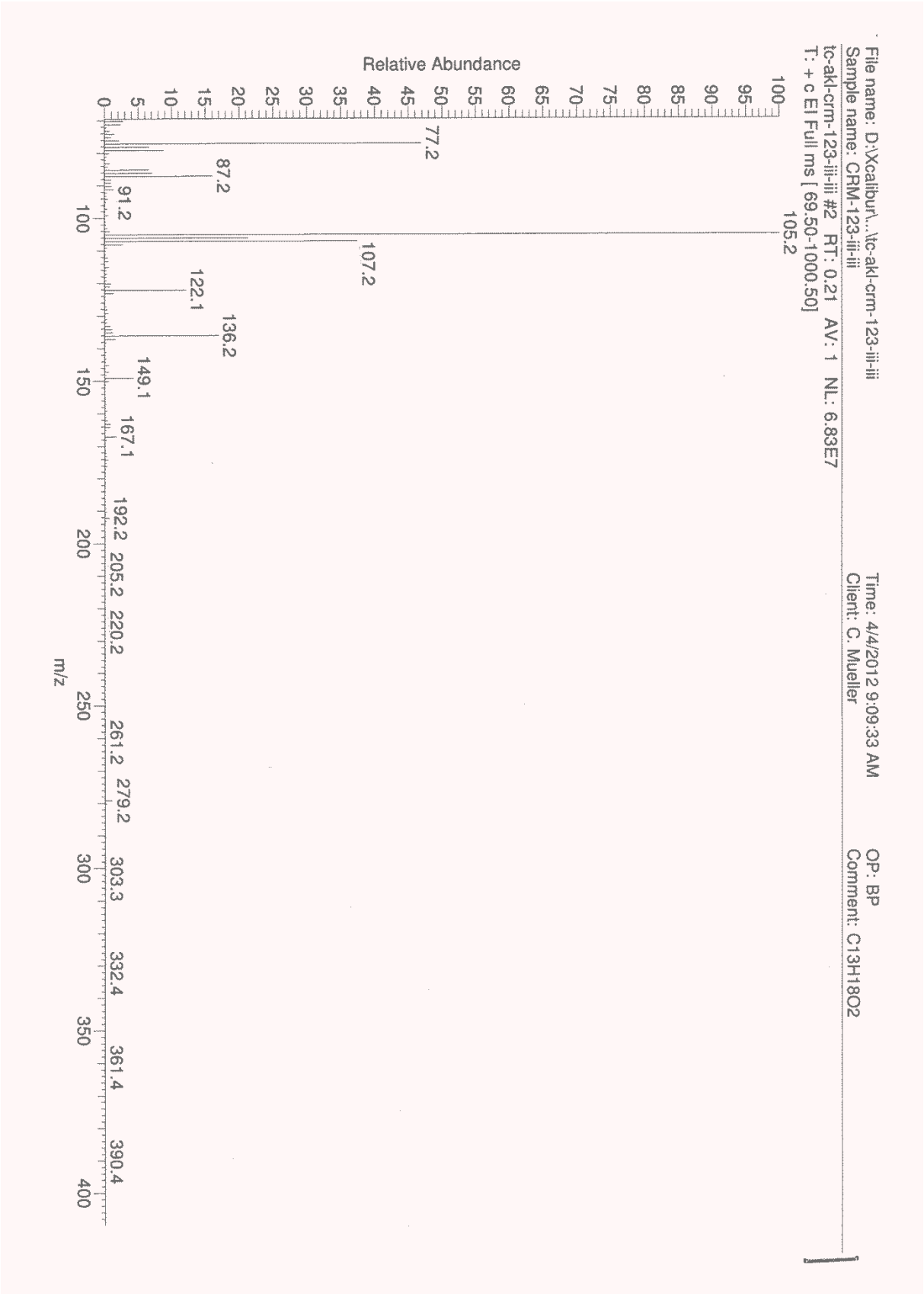



D:\data\le-crm-115-i
Kommentar: Direktverdampfung/DIP/EI
le-crm-115-i #2-12 RT: 0.01-0.10 AV: 11 SB: 2 0.11-0.12 NL: 6.76E6
T: + c EI ms [44.96-650.03]
3/8/2012 8:45:31 AM
Substanzbezeichnung: CRM-115-I
MS-System: SSQ
Relative Abundance
m/z
51.0
57.1
58.1
63.0
69.0
77.0
79.0
86.9
88.1
104.9
106.9
108.0
121.9
123.0
135.9
137.0
163.0
175.0
193.0

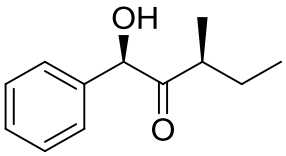
(2*R*,3*R*)-2-hydroxy-3-methyl-1-phenylpentan-1-one.

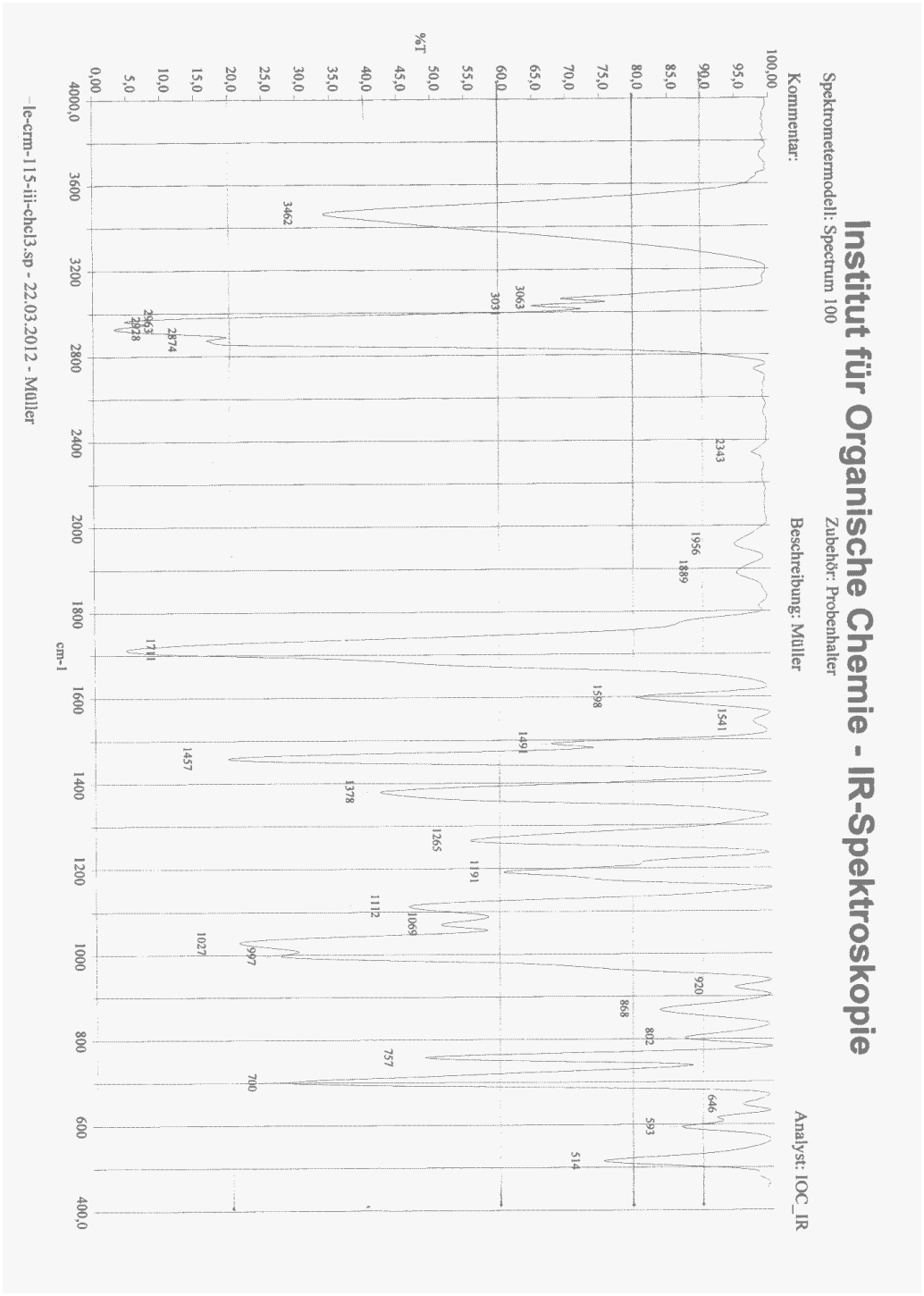


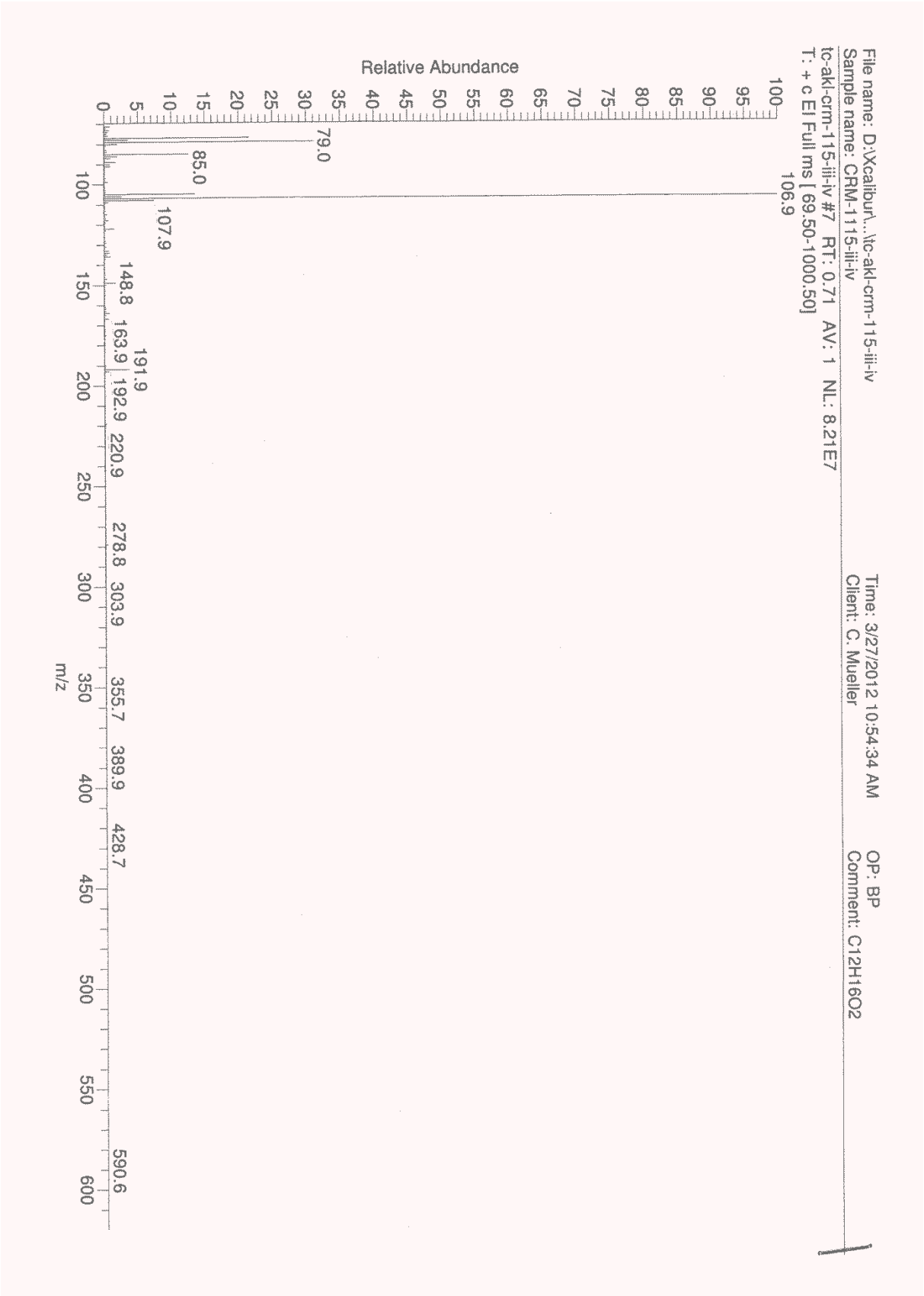



File name: D:\Xcalibur\...\tc-akl-crm-123-iii-iii
Sample name: CRM-123-iii-iii
tc-akl-crm-123-iii-iii #2 RT: 0.21 AV: 1 NL: 6.83E7
T: + c EI Full ms [69.50-1000.50]
Time: 4/4/2012 9:09:33 AM
Client: C. Mueller
OP: BP
Comment: C13H18O2
Relative Abundance
m/z
105.2
77.2
87.2
91.2
107.2
122.1
136.2
149.1
167.1
192.2
205.2
220.2
261.2
279.2
303.3
332.4
361.4
390.4

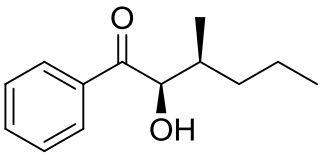
(1*R*,3*S*)-1-hydroxy-3-methyl-1-phenylpentan-2-one:

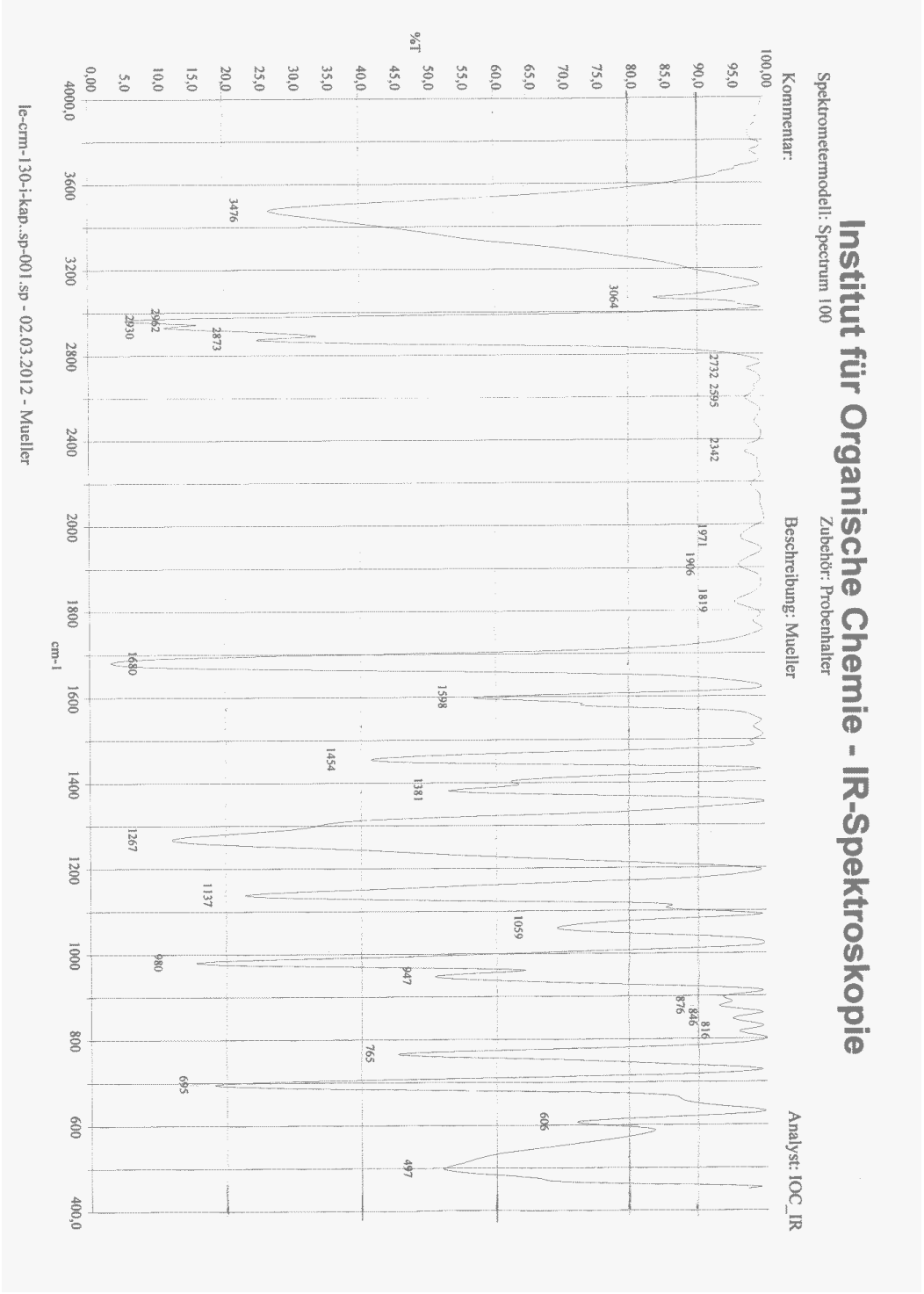


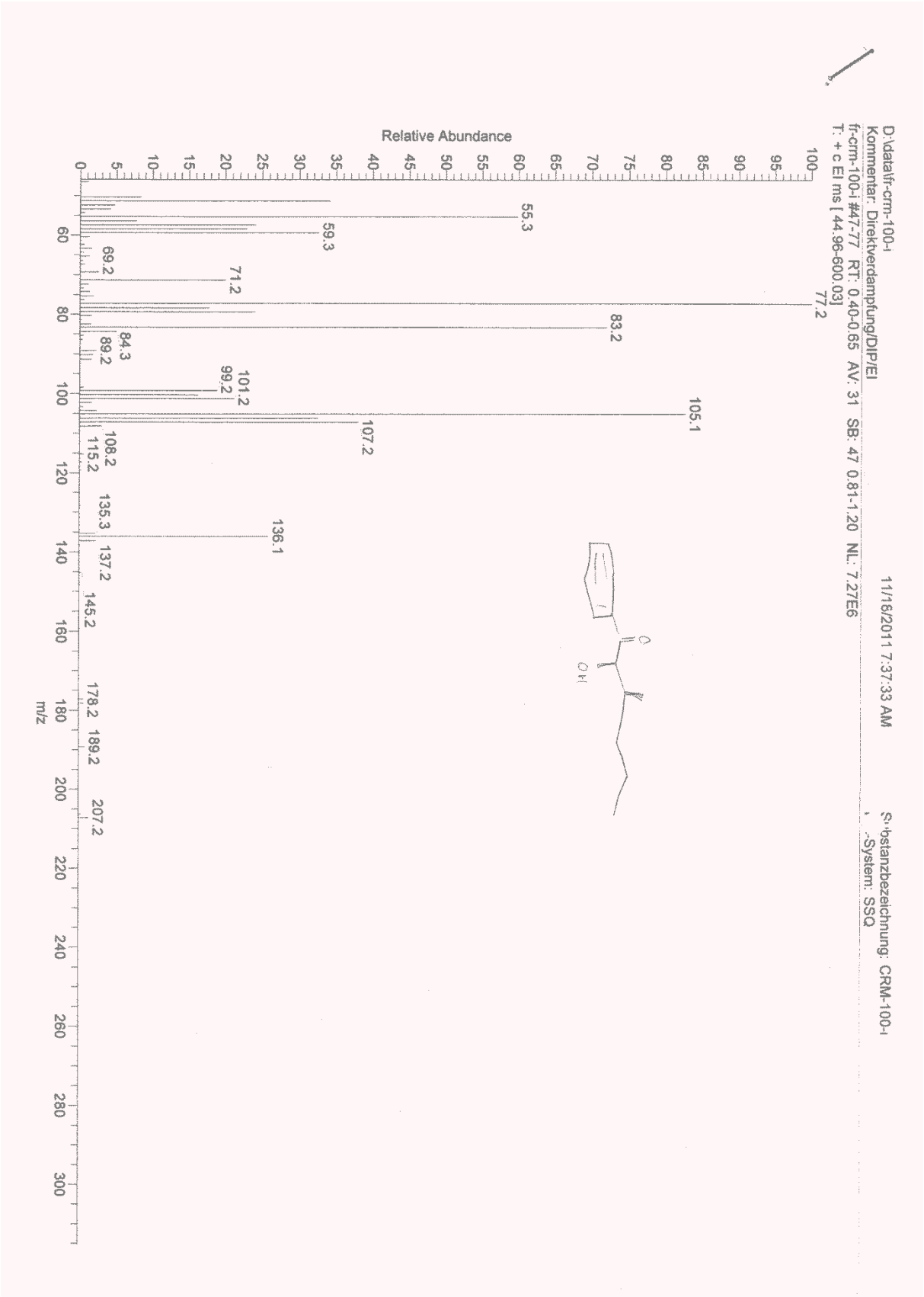



File name: D:\Xcalibur\...\tc-akl-crm-115-iii-iv
Sample name: CRM-1115-iii-iv
tc-akl-crm-115-iii-iv #7 RT: 0.71 AV: 1 NL: 8.21E7
T: + c EI Full ms [69.50-1000.50]
Time: 3/27/2012 10:54:34 AM
Client: C. Mueller
OP: BP
Comment: C12H16O2
Relative Abundance
m/z
106.9
79.0
85.0
107.9
148.8
163.9
191.9
192.9
220.9
278.8
303.9
355.7
389.9
428.7
590.6

(2*R*,3*S*)-2-hydroxy-3-methyl-1-phenylhexan-1-one.



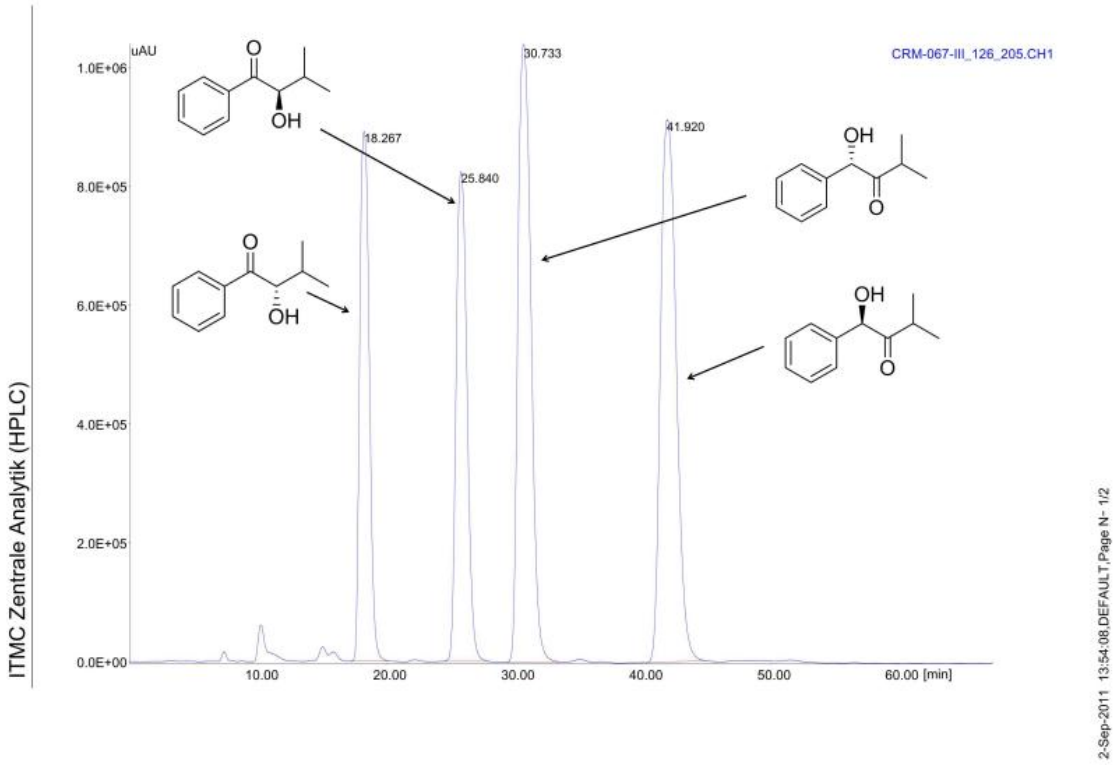



D:\data\fr-crm-100-I
11/16/2011 7:37:33 AM
Kommentar: Direktverdampfung/DIP/EI
Substanzbezeichnung: CRM-100-I
fr-crm-100-I #47-77 RT: 0.40-0.65 AV: 31 SB: 47 0.81-1.20 NL: 7.27E6
System: SSQ
T: + c EI ms [44.96-600.03]
Relative Abundance
m/z
77.2
55.3
59.3
69.2
71.2
83.2
84.3
89.2
99.2
101.2
105.1
107.2
108.2
115.2
135.3
136.1
137.2
145.2
178.2
189.2
207.2

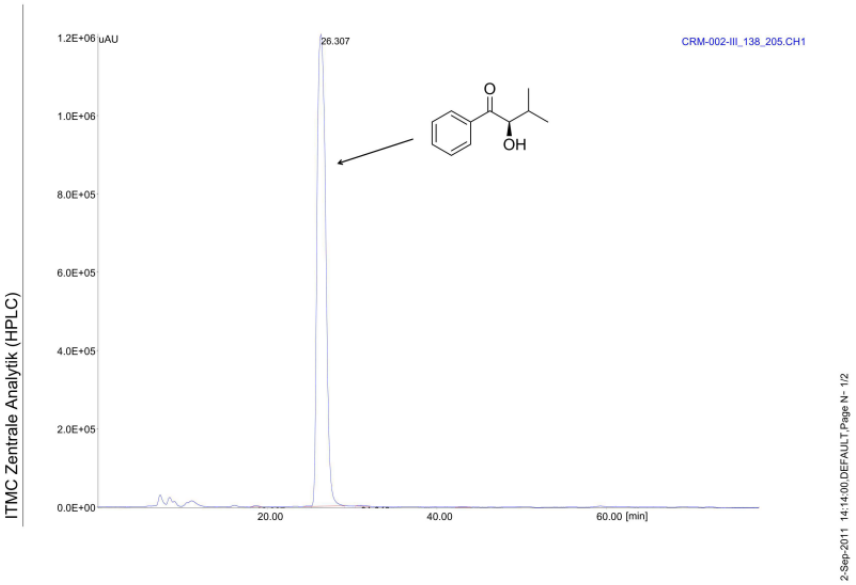
HPLC Chromatograms

1-hydroxy-3-methyl-1-phenylbutan-2-one and 2-hydroxy-3-methyl-1-phenylbutan-1-one

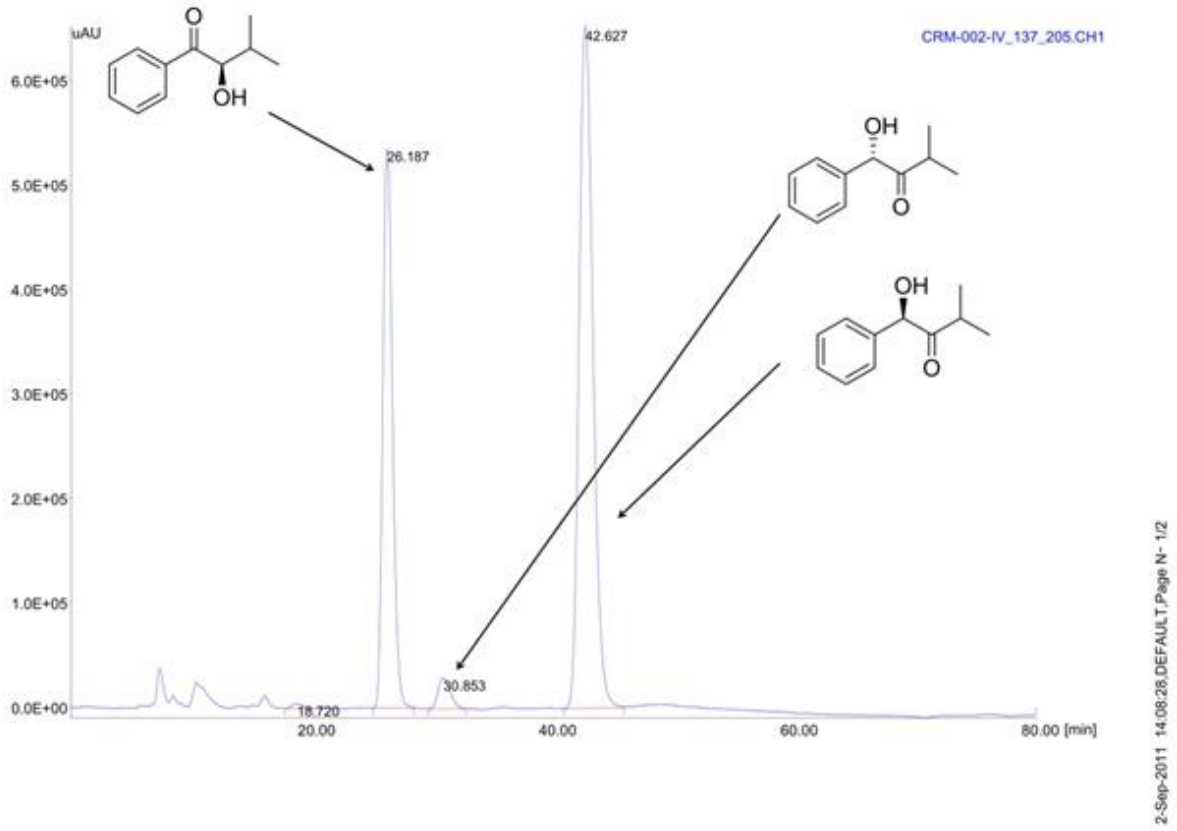
HPLC of the synthetized standard:



HPLC of the BAL-catalyzed purified product (benzaldehyde as donor):

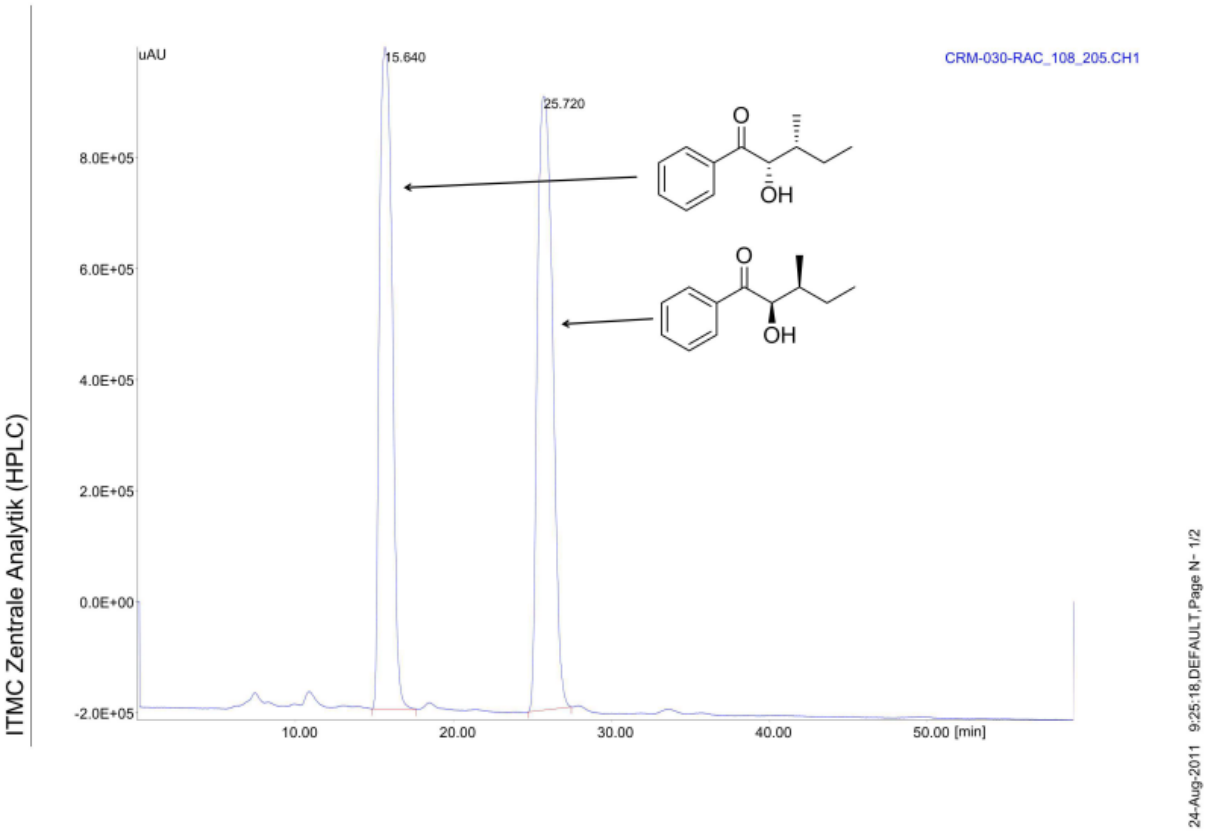


HPLC of the BAL-catalyzed crude mixture:

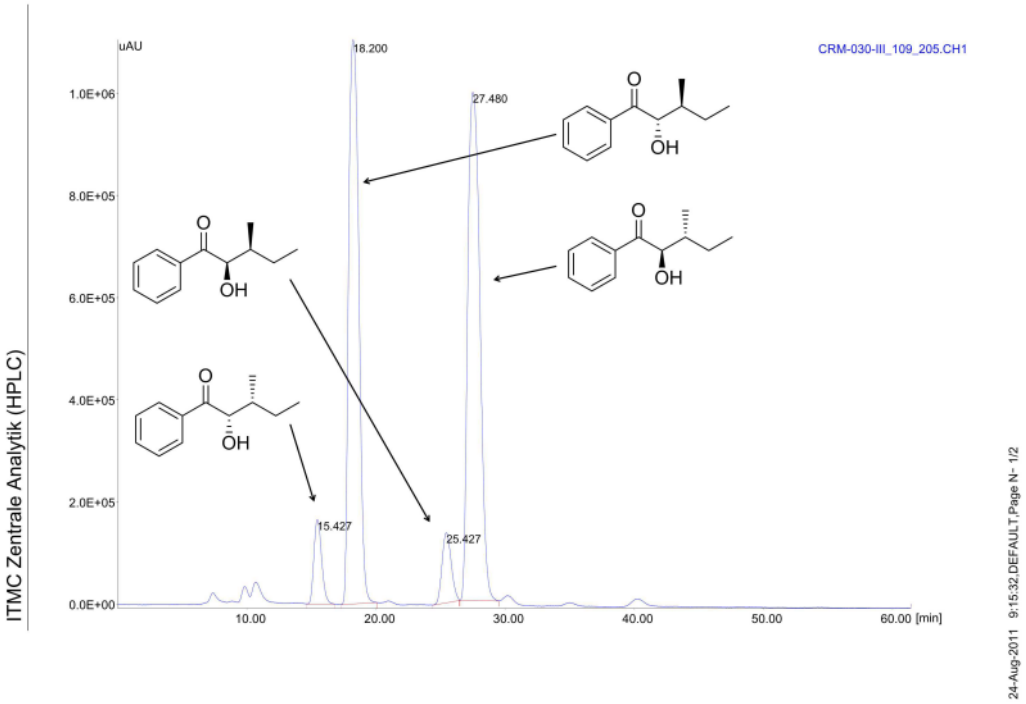


(2*R*,3*S*)- 2-hydroxy-3-methyl-1-phenylpentan-1-one and (2*R*,3*R*)- 2-hydroxy-3-methyl-1-phenylpentan-1-one

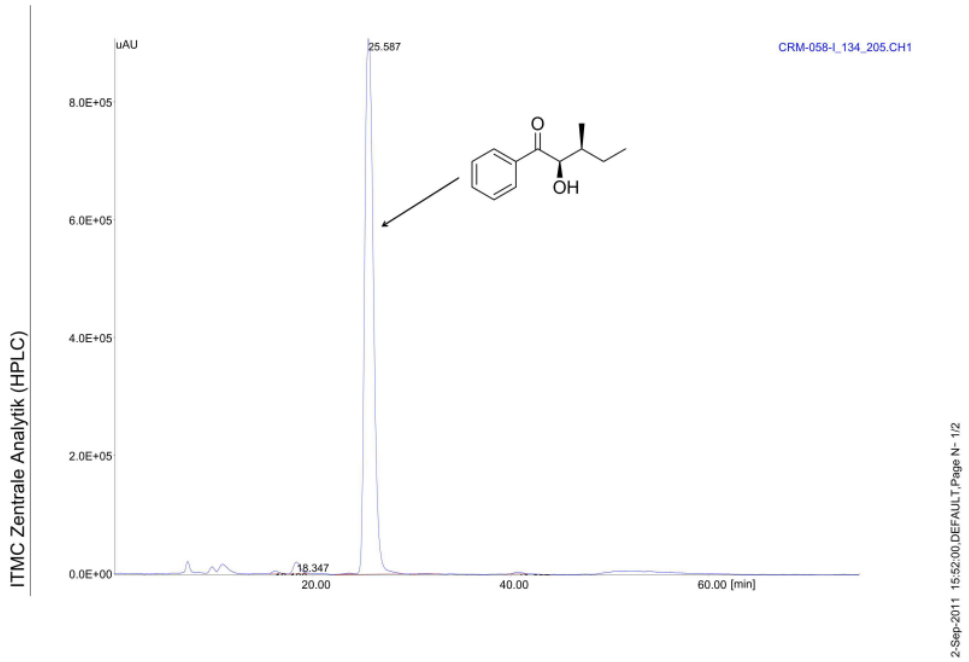
HPLC of the synthetized mixture:



HPLC of the BAL-catalyzed crude mixture:

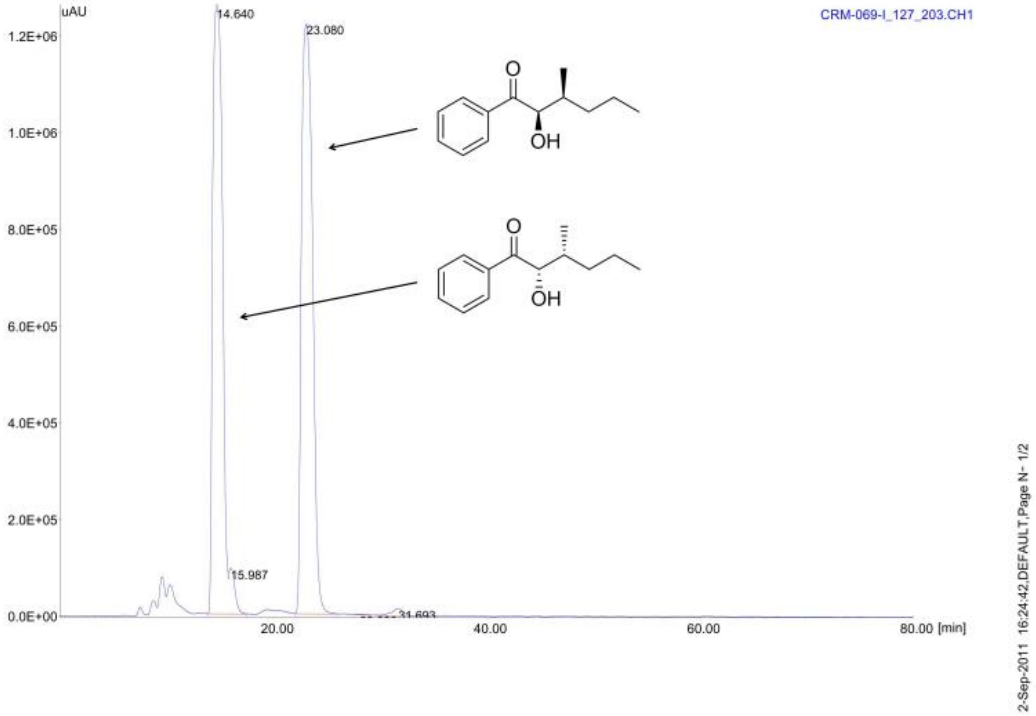


HPLC of the BAL-catalyzed purified mixture using (*S*)-methyl-butanal:



(2*R*,3*S*)- 2-hydroxy-3-methyl-1-phenylhexan-1-one

HPLC of chemically synthetized mixture:



HPLC of BAL-catalyzed purified product: