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Supporting information

For

An extremely efficient and green method for the acylation of secondary alcohols, phenols and naphthols with deep eutectic solvent as catalyst

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Section S1. Chemicals, supplies and instruments

Chemicals and supplies.

(2-Hydroxyethyl)trimethylammonium (Choline chloride, extra pure ≥ 99.0%) was obtained from HiMedia Laboratories Pvt. Ltd. (India). Zinc chloride (reagent great ≥ 98%) was obtained from Sigma-Aldrich. Propionic anhydride (purum ≥ 96.0% (NT)), acetic anhydride (reagent Plus®, ≥ 99%), butyric anhydride (purum ≥ 97% (NT)), benzoic anhydride (purity ≥ 95%), isopropanol (ACS reagent, ≥ 99.5%), 2-butanol (assay 99%), 2-pentanol (98%), (+/-)-2-hexanol (99%), 2-heptanol (assay, 98%), cyclohexanol (reagent Plus®, ≥ 99%), isoborneol (assay, 98%), 1-phenylethanol (98%), diphenylmethanol (assay, 99%), 2-phenyl-2-propanol (GC > 97%), 1,1-diphenylethanol (assay, 98%), 1-hydroxybiphenyl (assay, 99%), 2-naphthol (assay, 99%), 4-methoxyphenol (reagent Plus®, 99%), *myo*-inositol (assay, 99%) were obtained from Sigma-Adrich. L-(-)-Menthol (99%) were obtained from Capot Janssen Chimica. Silica gel 230 – 400 mesh, for flash chromatography) was obtained from HiMedia Laboratories Pvt. Ltd. (India). TLC (silica gel 60 F_{254}) was obtained from Merck. Ethyl acetate (purity ≥ 99.5%), hexane (≥ 95%), chloroform (purity ≥ 99%) were obtained from Xilong Chemical Co., Ltd (China). Chloroform-d, 99.8 Atom %D, stab. with Ag was obtained from Armar (Switzerland).

All starting materials, reagent and solvents were used without further purification.

Analytical techniques.

The ^{1}H and ^{13}C NMR spectra were recorded on a Bruker Advance 500 instruments using $CDCl_3$ as solvent and solvent peaks or TMS as internal standards. HRMS (ESI) data were recorded on Bruker micrOTOF-QII MS at 80 eV. Infrared (IR) spectra were recorded on a Bruker Alpha FTIR spectrometer.

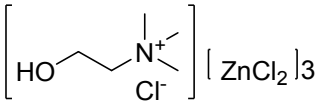
GC–MS analyses were performed on an Agilent GC System 7890 equipped with a mass selective detector Agilent 5973N and a capillary DB–5MS column (30 m x 250 μm x 0.25 μm).

Section S2. General procedure

1-Phenylethanol (122 mg, 1.0 mmol) was treated with propionic anhydride (136 mg, 1.05 mmol) in the presence of [CholineCl][$ZnCl_2$]$_3$ (191 mg, 0.35 mmol) for 30 min at room temperature under solvent-free magnetic stirring. The mixture was diluted with diethyl ether (10 x 5 mL). The ether solution was decanted, washed with H_2O (10 mL), aqueous $NaHCO_3$ (2 x 20 mL), and brine (10 mL), and dried over $MgSO_4$. The solvent was removed on a rotary evaporator to afford the desired product (432 mg, 96%). The purity and identity of the product were confirmed by ^{1}H and ^{13}C NMR, and MS. The recovered catalyst was activated by heating under reduced vacuum at 80 ^{o}C for 6 hours and reused for consecutive cycles.

Section S3. Spectral data

[CholineCl][$ZnCl_2$]$_3$[1-3]



IR ν_{max} 3543, 1619, 1475 cm^{-1}.

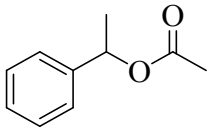
HRMS (ESI): [Choline + H]$^+$ 105.0504

[$ZnCl_3$]$^-$ 170.8356, [Zn_2Cl_5]$^-$ 306.6968, [Zn_3Cl_7]$^-$ 444.5604

^{1}H-NMR (500 MHz, DMSO-*d6*): δ 5.23 (s, 1H), 3.80 (m, 2H), 3.33 (m, 2H), 3.04 (s, 9H).

^{13}C-NMR (125 MHz, DMSO-*d6*): δ 67.8, 55.9, 54.2, 54.1, 54.0.

1-Phenylethyl acetate[4-6]

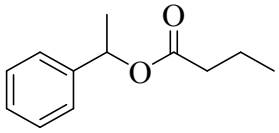


^{1}H-NMR (500 MHz, $CDCl_3$) δ 7.35–7.34 (m, 4H), 7.30–7.27 (m, 1H), 5.90–5.86 (q, J = 6.5 Hz, 1H), 2.07 (s, 3H), 1.54 (d, J = 6.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 170.2, 141.7, 128.5, 127.8, 126.1, 72.3, 22.2, 21.3.

GC-MS (EI, 70 eV) *m/z*: 164, 122, 104, 77, 51, 43.

1-Phenylethyl butyrate[4,7]

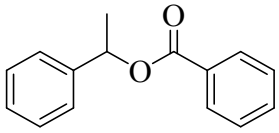


^{1}H-NMR (500 MHz, $CDCl_3$) δ 7.35 (m, 4H), 7.30–7.27 (m, 1H), 5.92–5.88 (q, J = 6.5 Hz, 1H), 2.32–2.29 (m, 2H), 1.68–1.62 (q, J = 7.5 Hz, 2H), 1.54–1.53 (d, J = 6.5 Hz, 3H), 0.95–0.92 (t, J = 7.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 172.9, 141.9, 128.5, 127.8, 126.0, 72.0, 37.1, 22.3, 18.5, 13.4.

GC-MS (EI, 70 eV) *m/z*: 192, 122, 105, 77, 71, 51, 43.

1-Phenylethyl benzoate[4,5,8]

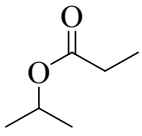


^{1}H-NMR (500 MHz, $CDCl_3$) δ = 8.09 (d, J = 7 Hz, 2H), 7.57–7.54 (t, J = 7.5 Hz, 1H), 7.46–7.43 (t, J = 7.5 Hz, 4H), 7.39–7.36 (t, J = 7.5 Hz, 2H), 7.32–7.29 (t, J = 7 Hz, 1H), 6.16–6.12 (q, J = 6.5 Hz, 1H), 1.68 (d, J = 6.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 165.8, 141.8, 132.9, 130.6, 129.7, 128.6, 128.3, 127.9, 126.1, 72.9, 22.4.

GC-MS (EI, 70 eV) *m/z*: 226, 105, 77, 51.

Isopropyl propionate[9,10]

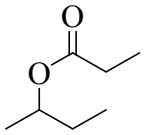


^{1}H-NMR (500 MHz, $CDCl_3$) δ 5.00–4.95 (m, 1H), 2.27–2.23 (q, J = 7 Hz, 2H), 1.20–1.19 (d, J = 7 Hz, 6H), 1.10–1.08 (t, J = 7 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.0, 67.3, 27.9, 21.8, 9.1

GC-MS (EI, 70 eV) *m/z*: 101, 75, 57, 43.

***sec*-Butyl propionate[11,12]**

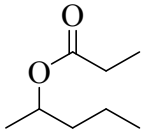


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.85–4.79 (m, 1H), 2.30–2.25 (q, J = 7.5 Hz, 2H), 1.60–1.48 (m, 2H), 1.18–1.17 (d, J = 6.5 Hz, 2H), 1.13–1.10 (t, J = 7.5 Hz, 3H), 0.88–0.86 (t, J = 7.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.2, 71.9, 28.8, 27.9, 19.4, 9.6, 9.2

GC-MS (EI, 70 eV) *m/z*: 101, 75, 57, 41.

2-Pentyl propionate[13,14]

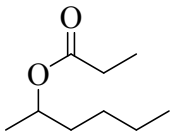


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.93–4.87 (m, 1H), 2.30–2.25 (q, J = 8.0 Hz, 2H), 1.60–1.52 (m, 1H), 1.47–1.40 (m, 1H), 1.38–1.28 (m, 2H), 1.19–1.18 (d, J = 6.5 Hz, 3H), 1.13–1.10 (t, J = 8.0 Hz, 3H), 0.91–0.88 (t, J = 7.0 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.2, 70.5, 38.1, 27.9, 20.0, 18.6, 13.9, 9.2.

GC-MS (EI, 70 eV) *m/z*: 101, 75, 70, 57, 43.

2-Hexyl propionate[15]

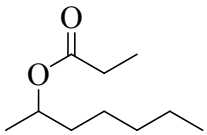


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.92–4.86 (m, 1H), 2.31–2.26 (q, J = 7.5 Hz, 2H), 1.60–1.54 (m, 1H), 1.50–1.44 (m, 1H), 1.32–1.26 (m, 4H), 1.19–1.18 (d, J = 6.5 Hz, 3H), 1.14–1.11 (t, J = 8 Hz, 3H), 0.90 – 0.87 (t, J = 7 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.2, 70.8, 35.6, 28.7, 27.9, 27.6, 22.5, 20.0, 9.2, 8.4.

GC-MS (EI, 70 eV) *m/z*: 101, 84, 57, 43.

2-Heptyl propionate[13]

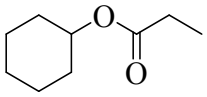


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.91–4.85 (m, 1H), 2.49–2.45 (q, J = 7.5 Hz, 2H), 2.30–2.25 (q, J = 7.5 Hz, 2H). 1.58–1.52 (m, 1H), 1.47–1.40 (m, 1H), 1.28–1.25 (m, 4H), 1.17 (d, J = 2 Hz, 3H), 1.13–1.10 (t, J = 7.5 Hz, 3H), 0.87–0.85 (t, J = 6.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.3, 70.9, 36.0, 31.7, 28.8, 28.1, 25.2, 22.6, 20.1, 9.3, 8.5.

GC-MS (EI, 70 eV) *m/z*: 101, 75, 70, 57, 41.

Cyclohexyl propionate[16,17]

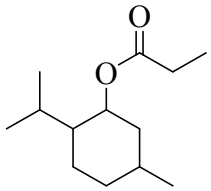


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.74–4.69 (m, 1H), 2.47–2.42 (q, J = 7.5 Hz, 2H), 2.28–2.23 (m, 2H), 1.83–1.79 (m, 2H), 1.70–1.66 (m, 2H), 1.38–1.30 (m, 4H), 1.16–1.13 (t, J = 7.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 173.9, 72.3, 31.6, 28.7, 27.9, 25.4, 23.7, 9.2, 8.3.

GC-MS (EI, 70 eV) *m/z*: 82, 75, 67, 57, 41.

2-Isopropyl-5-methylcyclohexyl propionate[18,19]

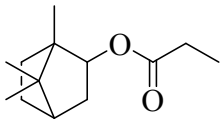


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.69–4.64 (m, 1H), 2.49–2.45 (q, J = 7.0 Hz, 1H), 2.31–2.26 (m, 2H), 1.98–1.95 (d, J = 12.0 Hz, 1H), 1.88–1.82 (m, 1H), 1.67–1.63 (m, 2H), 1.51–1.44 (m, 1H), 1.38–1.32 (m, 1H), 1.13–1.10 (t, J = 7.5 Hz, 3H), 1.08–1.00 (m, 1H), 0.97–0.93 (t, J = 11.5 Hz, 1H), 0.89–0.87 (m, 6H), 0.75–0.74 (d, J = 7.0 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.2, 74.1, 47.2, 41.1, 34.4, 31.5, 28.8, 28.1, 26.4, 23.6, 22.1, 20.9, 16.5, 9.4, 8.5.

GC-MS (EI, 70 eV) *m/z*: 138, 123, 109, 95, 81, 69, 57, 41.

1,7,7-Trimethylbicyclo[2.2.1]heptan-2-yl propionate[20]

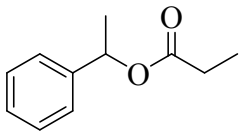


^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.67–4.65 (t, J = 3.5 Hz, 1H), 2.31–2.27 (q, J = 7.5 Hz, 2H), 1.81–1.77 (m, 1H), 1.74–1.71 (m, 2H), 1.68–1.65 (m, 1H), 1.56–1.51 (m, 1H), 1.16–1.07 (m, 5H), 0.97 (s, 3H), 0.83 (s, 6H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 173.9, 80.7, 48.6, 46.9, 45.0, 38.8, 33.7, 28.1, 27.0, 20.1, 19.9, 11.3, 9.2.

GC-MS (EI, 70 eV) *m/z*: 154, 136, 121, 108, 95, 81, 69, 57, 41.

1-Phenylethyl propionate[4,21]

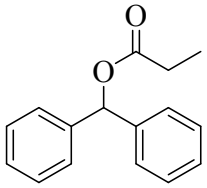


^{1}H-NMR (500 MHz, $CDCl_3$) δ 7.37–7.36 (d, J = 7.0 Hz, 2H), 7.36–7.35 (d, J = 6.5 Hz, 2H), 7.31–7.29 (m, 1H), 5.93–5.89 (q, J = 7.0 Hz, 1H), 2.39–2.33 (m, 2H), 1.55–1.53 (d, J = 7.0 Hz, 3H), 1.16–1.13 (t, J = 7.5 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 173.7, 141.9, 128.5, 128.2, 127.8, 126.3, 126.0, 72.1, 27.9, 22.3, 9.1.

GC-MS (EI, 70 eV) *m/z*: 178, 122, 105, 77, 57, 51, 43.

Benzhydryl propionate[20,22]

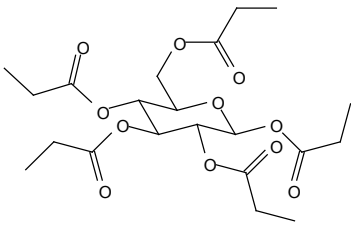


^{1}H-NMR (500 MHz, $CDCl_3$) δ 7.35–7.34 (m, 8H), 7.30–7.27 (m, 2H), 6.90 (s, 1H), 2.48–2.43 (t, J = 8.0 Hz, 2H), 1.20–1.17 (m, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 173.4, 140.4, 130.0, 128.5, 127.8, 127.1, 27.9, 9.1.

GC-MS (EI, 70 eV) *m/z*: 240, 184, 166, 152, 105, 77, 57.

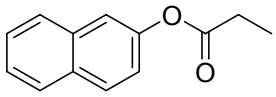
α-*D*-glucopyranose pentapropanoate[23]



^{1}H-NMR (500 MHz, $CDCl_3$) δ 6.32 (d, J = 3.7 Hz, 1H), 5.48 – 5.44 (t, J = 9.7 Hz, 1H), 5.15 – 5.11 (m, 1H), 5.10 – 5.07 (m, 1H), 4.25 – 4.22 (dd, J = 13.0 Hz, 4.7 Hz, 1H), 4.10 – 4.06 (m, 2H), 2.44 – 2.40 (q, J = 15.2 Hz, 2H), 2.37 – 2.31 (m, 2H), 2.30 – 2.20 (m, 6H), 1.18 – 1.15 (t, J = 7.6 Hz, 3H), 1.12 – 1.09 (t, J = 7.6 Hz, 3H), 1.07 – 1.03 (m, 9H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 174.0, 173.6, 173.0, 173.0, 172.2, 89.0, 70.0, 69.7, 69.2, 67.6, 61.4, 27.5, 27.4, 27.3, 27.2, 9.1, 9.0, 8.9, 8.9, 8.8.

Naphthalen-2-yl propionate[22]

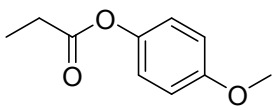


^{1}H NMR (500 MHz, $CDCl_3$) δ 7.85 (m, 2H), 7.81 (d, J = 7.8 Hz, 1H), 7.57 (d, J = 2.2 Hz, 1H), 7.48 (m, 2H), 7.24 (dd, J = 8.8 Hz, 2.2 Hz, 1H), 2.66 (q, J = 7.6 Hz, 2H), 1.32 (t, J = 7.6 Hz, 3H).

^{13}C NMR (125 MHz, $CDCl_3$) δ 173.1, 148.5, 133.8, 131.5, 129.4, 127.78, 127.7, 126.5, 125.7, 121.2, 118.5, 27.9, 9.1.

GC-MS (EI, 70 eV) *m/z*: 200, 144, 115, 89, 57.

4-Methoxyphenyl propionate[24]

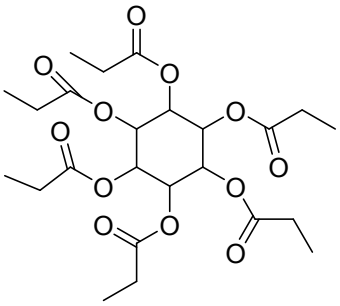


^{1}H-NMR (500 MHz, $CDCl_3$) δ 7.02 – 6.98 (m, 2H), 6.90 – 6.86 (m, 2H), 3.79 (s, 3H), 2.57 (q, J = 7.6 Hz, 2H), 1.26 (t, J = 7.6 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 173.3, 157.2, 144.3, 122.3, 114.4, 55.6, 27.7, 9.1.

GC-MS (EI, 70 eV) *m/z*: 180, 124, 109, 81, 57.

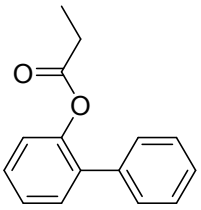
Cyclohexane-1,2,3,4,5,6-hexayl hexapropionate[25]



^{1}H-NMR (500 MHz, $CDCl_3$) δ 5.60 – 5.59 (t, J = 2.8 Hz, 1H), 5.54 – 5.50 (t, J = 10.2 Hz, 2H), 5.24 – 5.20 (t, J = 9.9 Hz, 1H), 5.14 – 5.12 (m, 2H), 2.27 – 2.20 (m, 12H), 1.08 – 1.04 (m, 18H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 173.3, 173.1, 173.1, 172.8, 70.6, 69.4, 68.5, 68.2, 27.5, 27.4, 27.3, 27.2, 9.4, 9.1, 9.1, 8.8.

[1,1'-Biphenyl]-2-yl propionate[26]



^{1}H-NMR (500 MHz, $CDCl_3$) δ 7.47 – 7.41 (m, 5H), 7.41 – 7.39 (m, 1H), 7.37 (ddd, J = 5.4, 3.1, 1.6 Hz, 1H), 7.33 (dd, J = 7.5, 1.4 Hz, 1H), 7.16 (dd, J = 8.0, 1.3 Hz, 1H), 2.39 (q, J = 7.6 Hz, 2H), 1.08 (t, J = 7.6 Hz, 3H).

^{13}C-NMR (125 MHz, $CDCl_3$) δ 172.8, 147.9, 137.7, 135.0, 130.9, 129.0, 128.5, 128.2, 127.4, 126.3, 122.9, 27.7, 9.0.

GC-MS (EI, 70 eV) *m/z*: 226, 170, 141, 115, 57.

References

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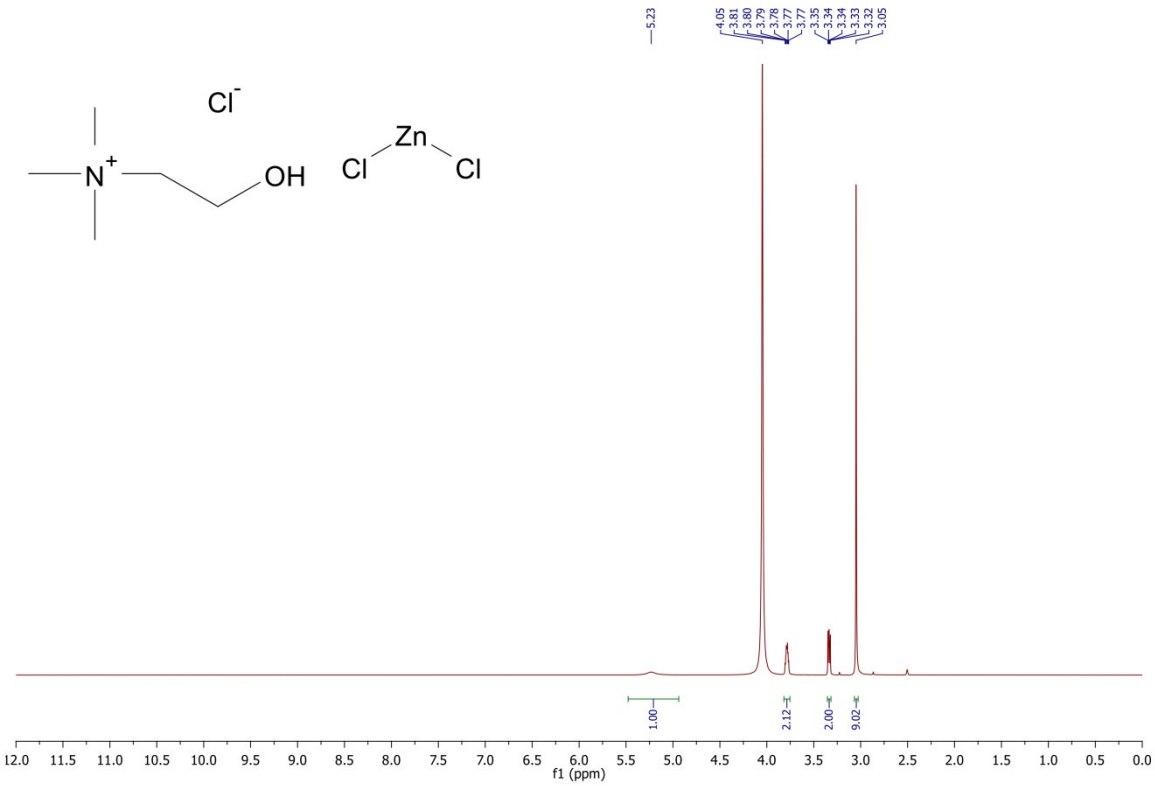
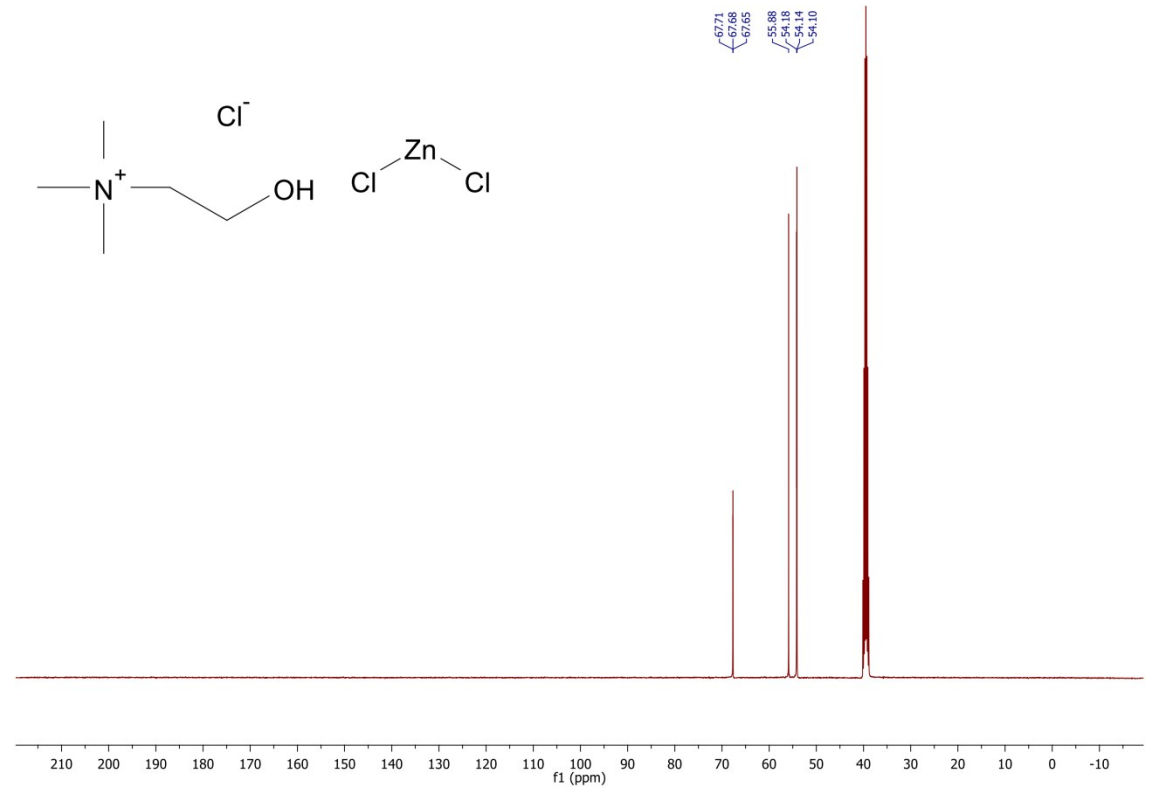
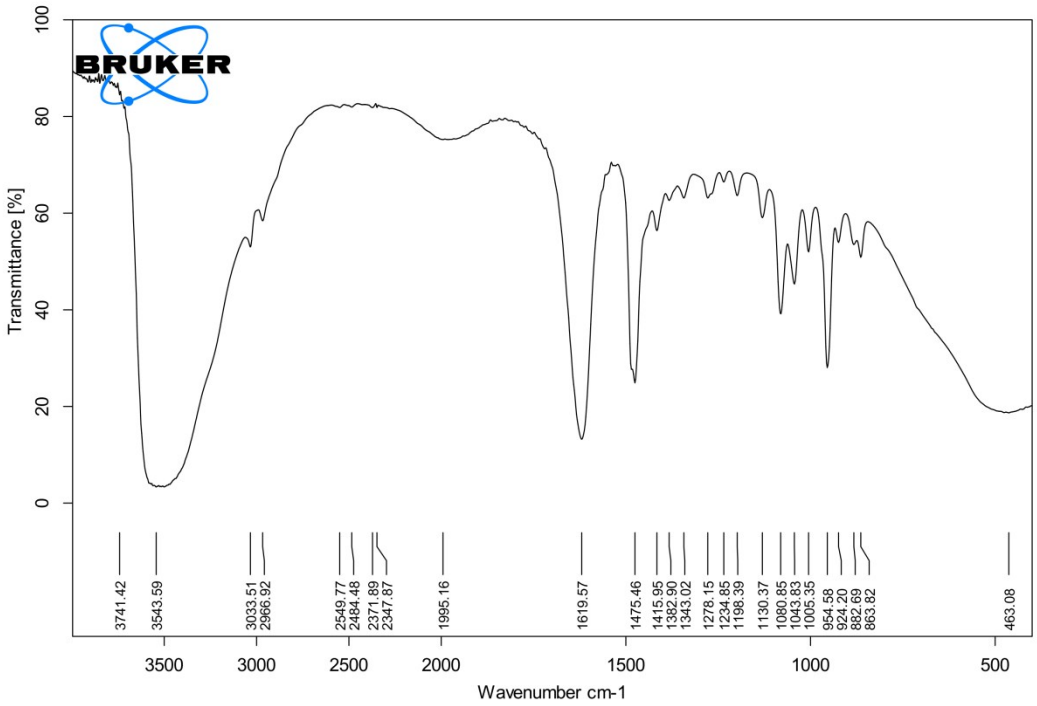
^{1}H-NMR, ^{13}C-NMR, IR and HR-MS of [CholineCl][$ZnCl_2$]$_3$



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1080.85
1043.83
1005.35
954.58
924.20
882.69
863.82
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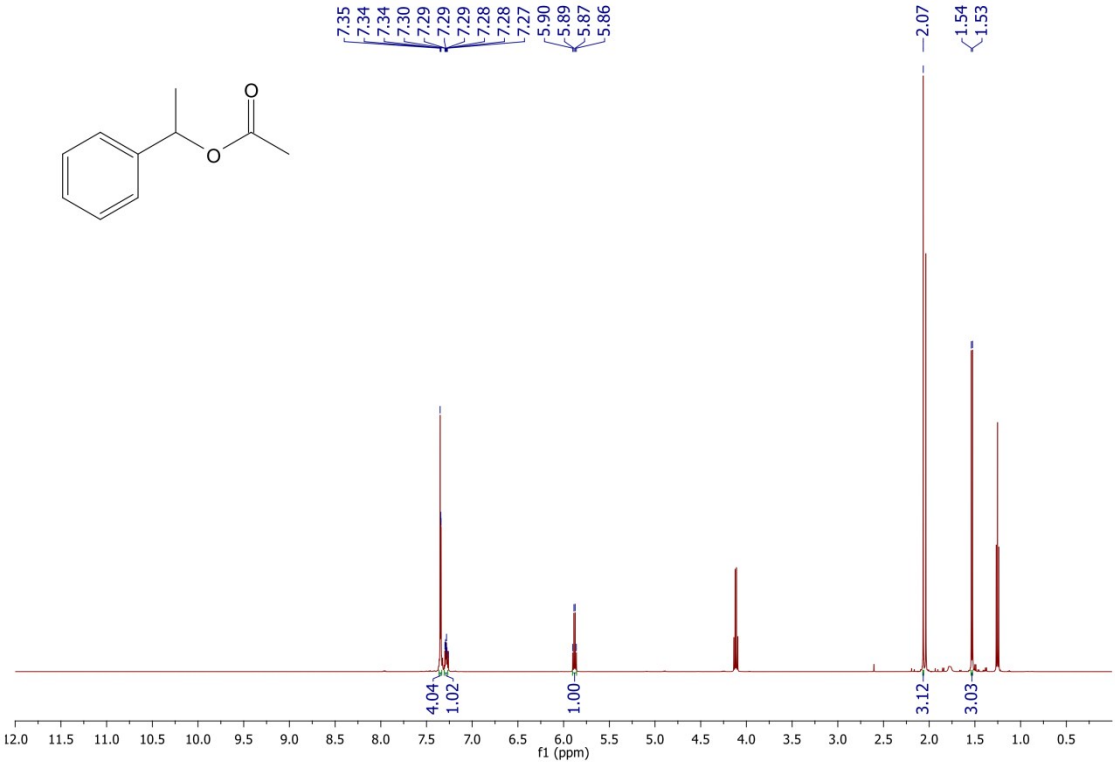
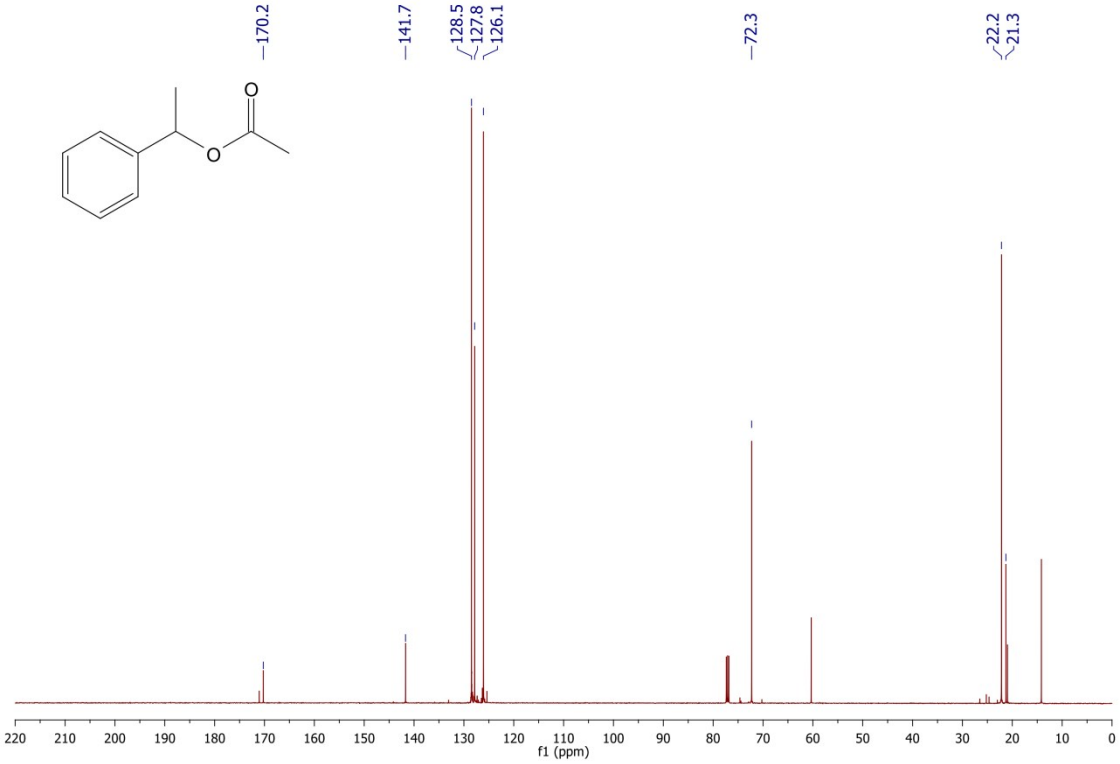
Wavenumber cm-1

^{1}H-NMR, ^{13}C-NMR and GC-MS of 1-phenylethyl acetate





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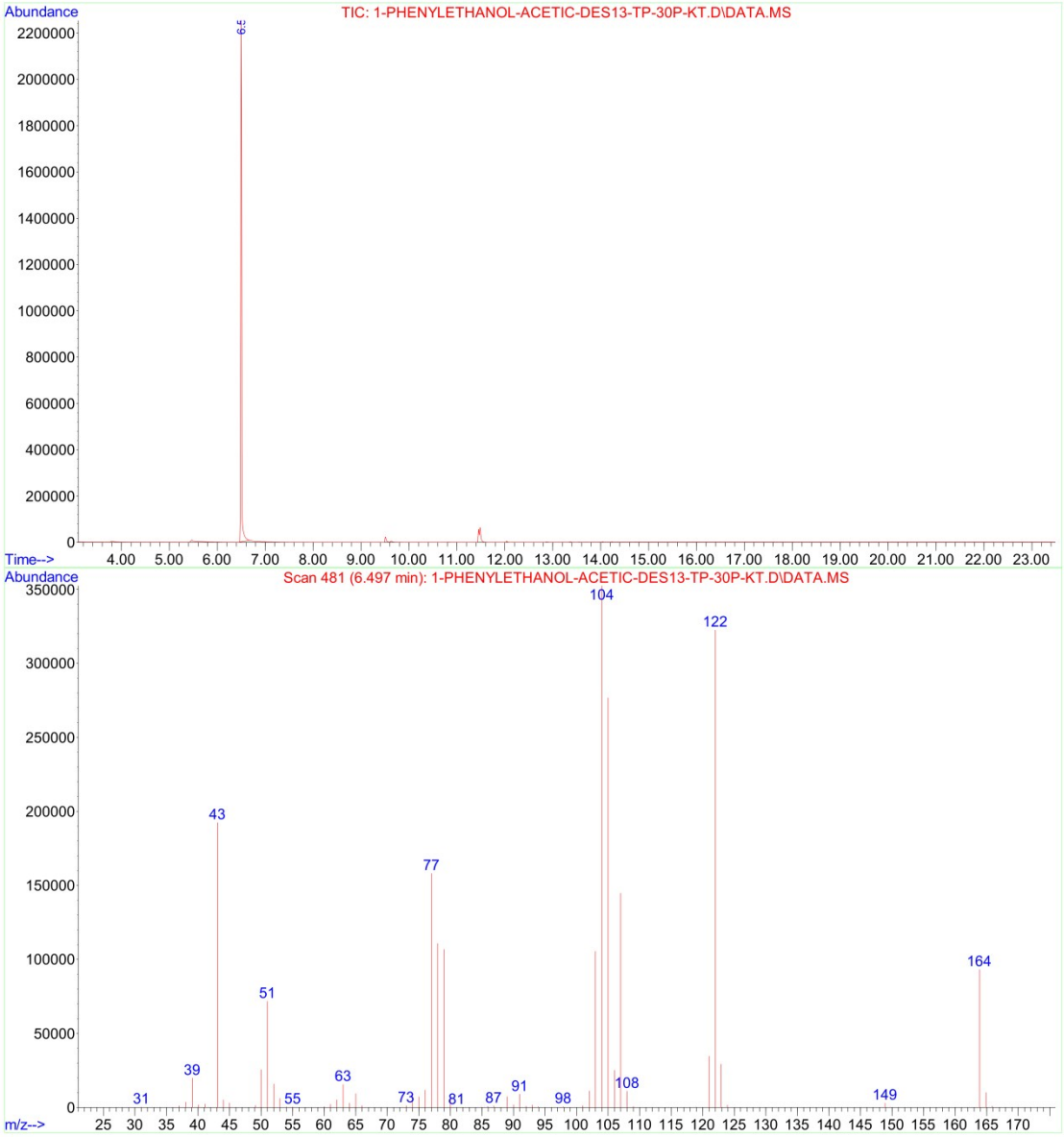
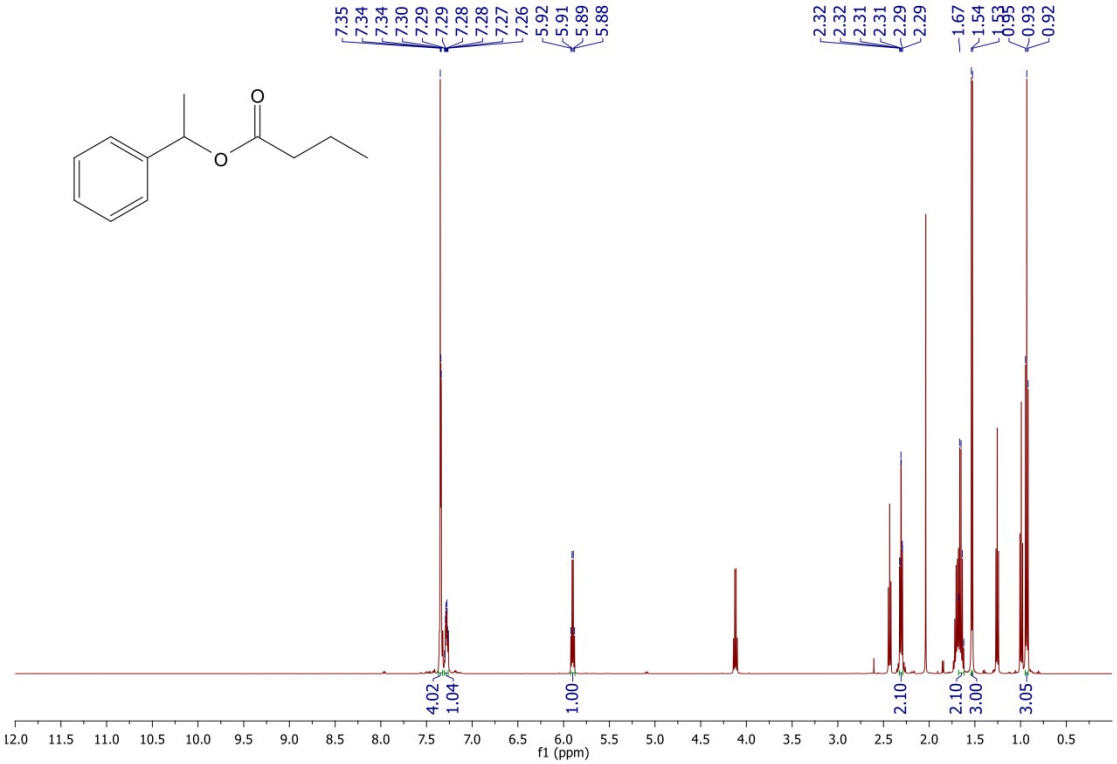
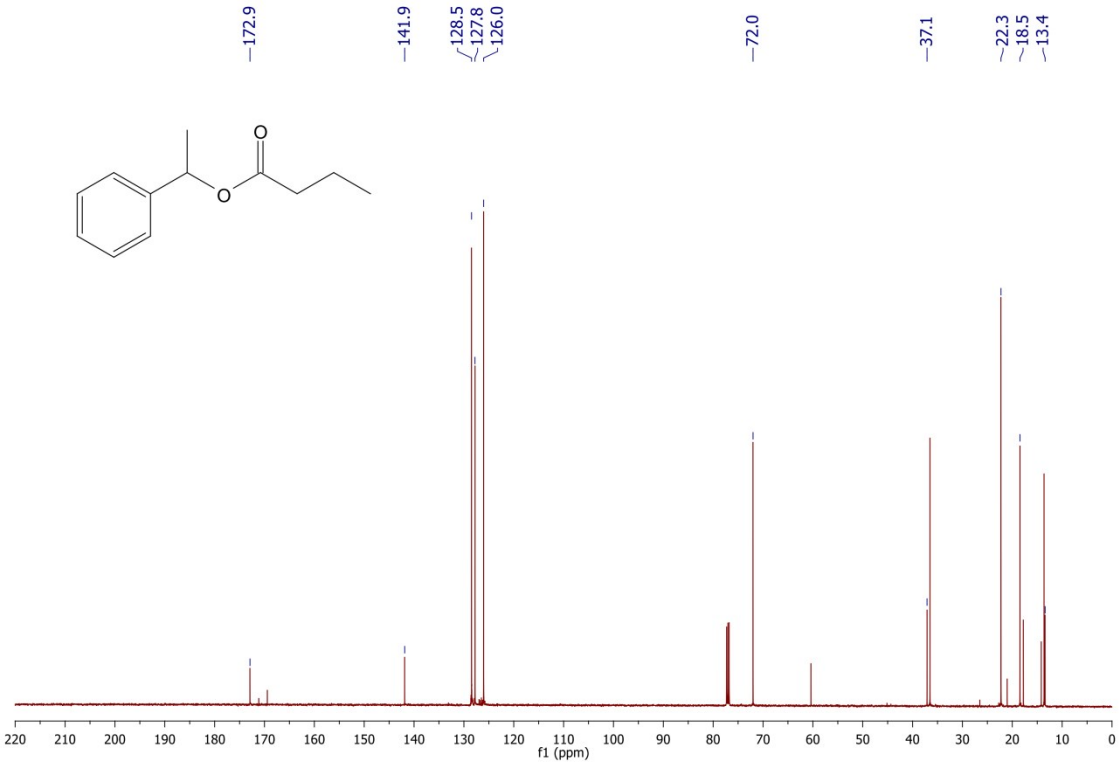


^{1}H-NMR, ^{13}C-NMR and GC-MS of 1-phenylethyl butyrate





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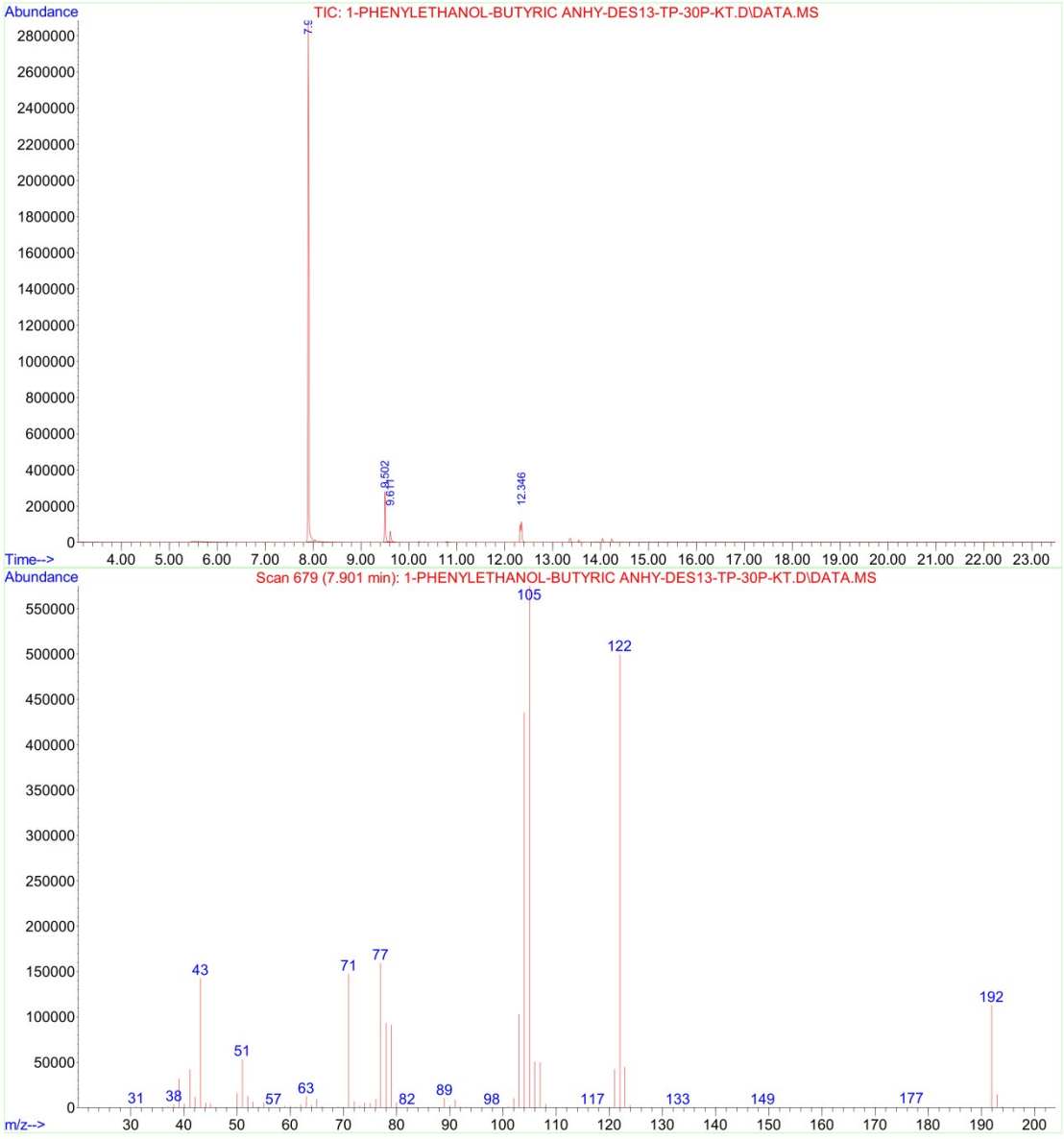
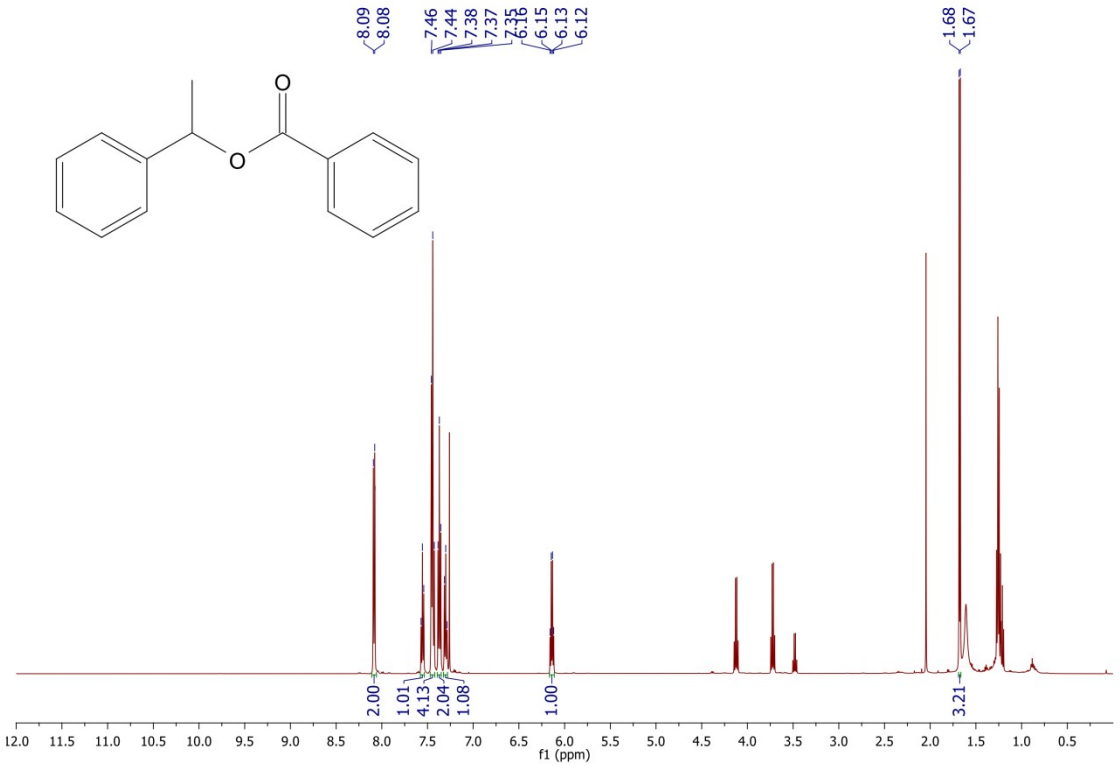
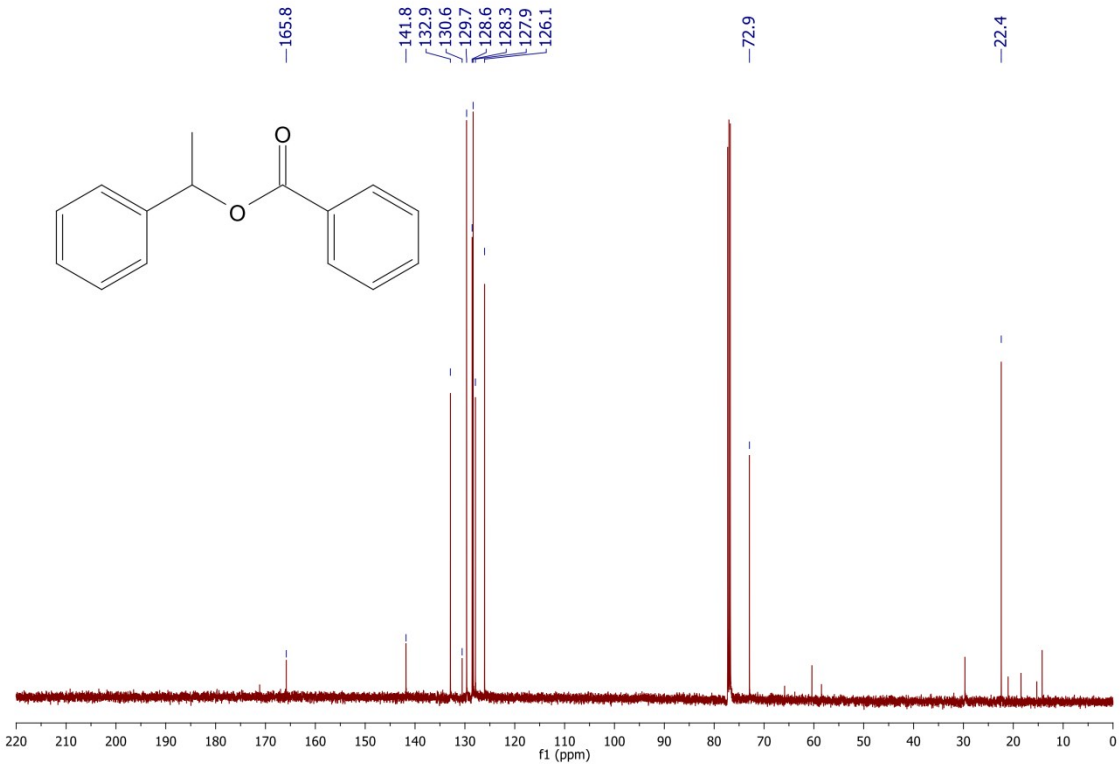


^{1}H-NMR, ^{13}C-NMR and GC-MS of 1-phenylethyl benzoate





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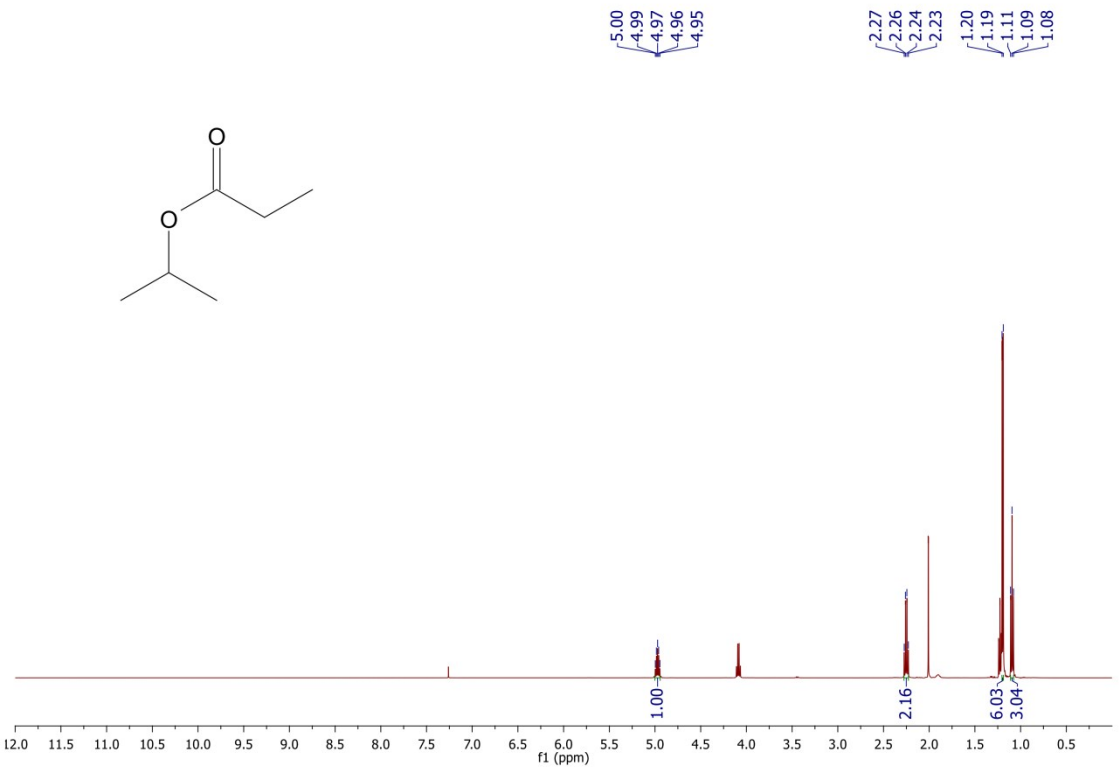

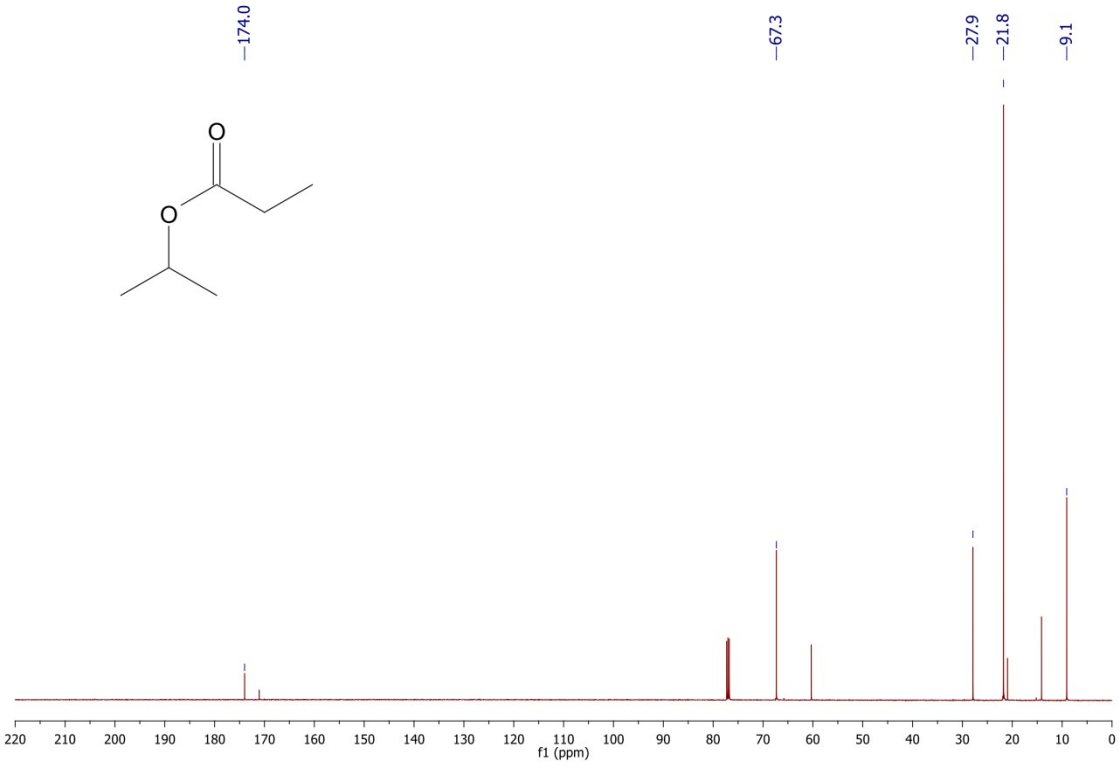

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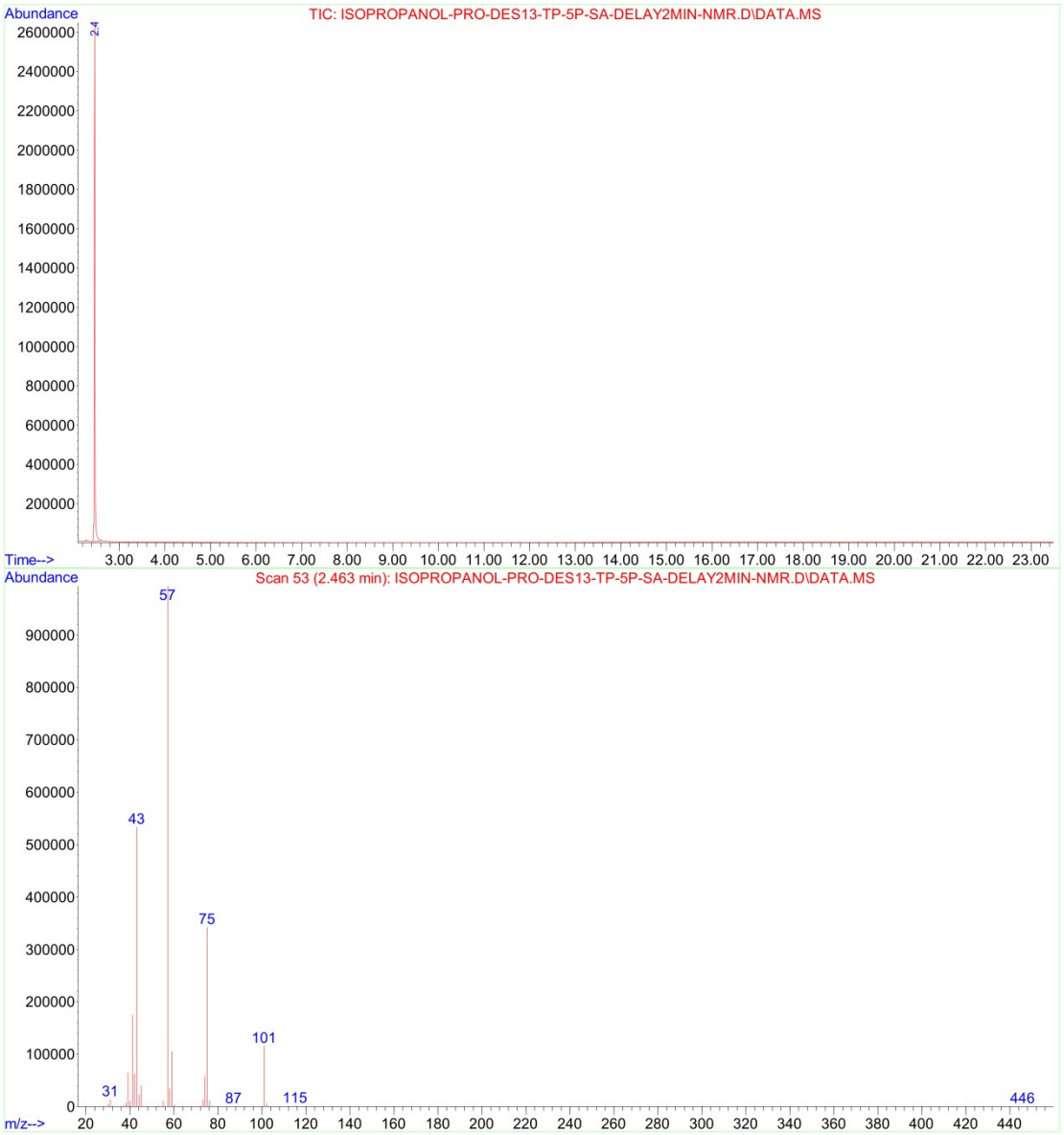

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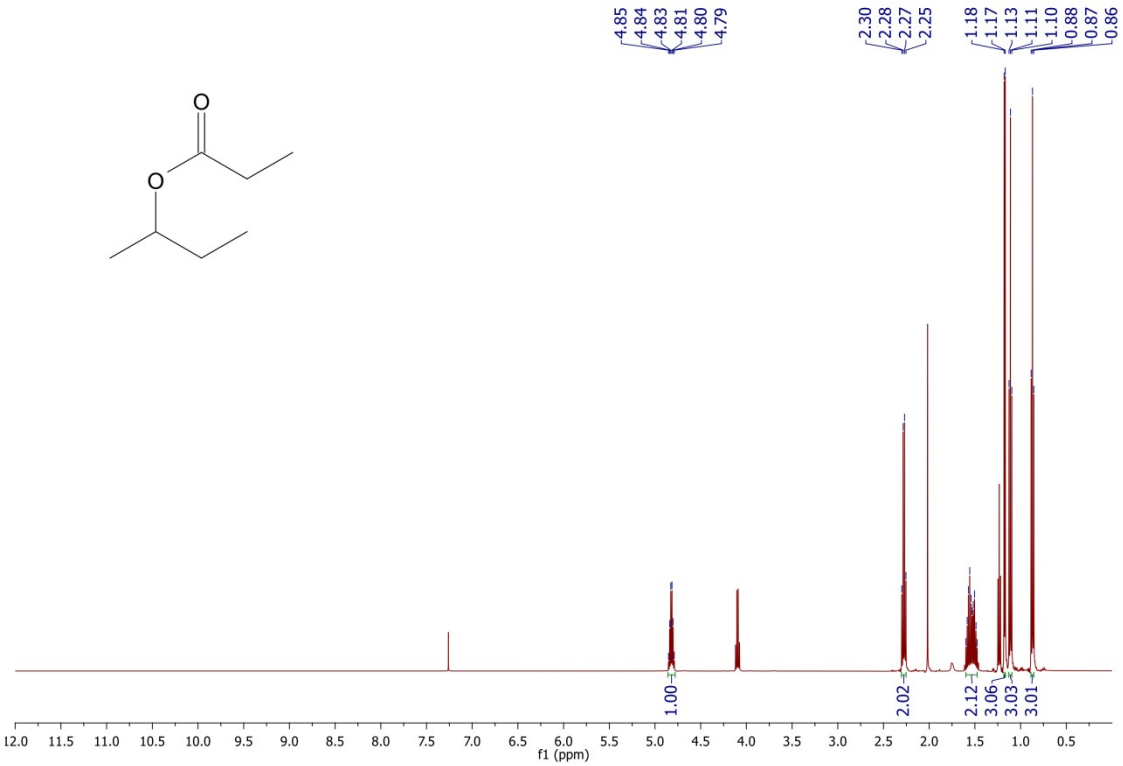

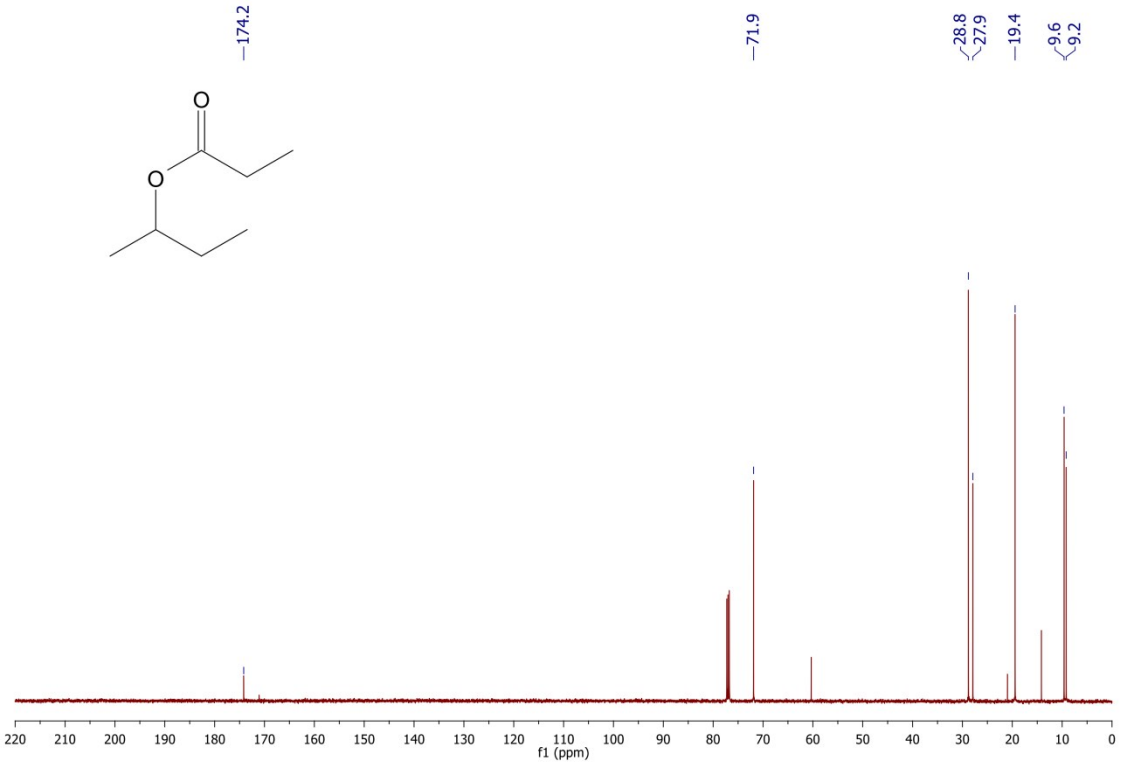

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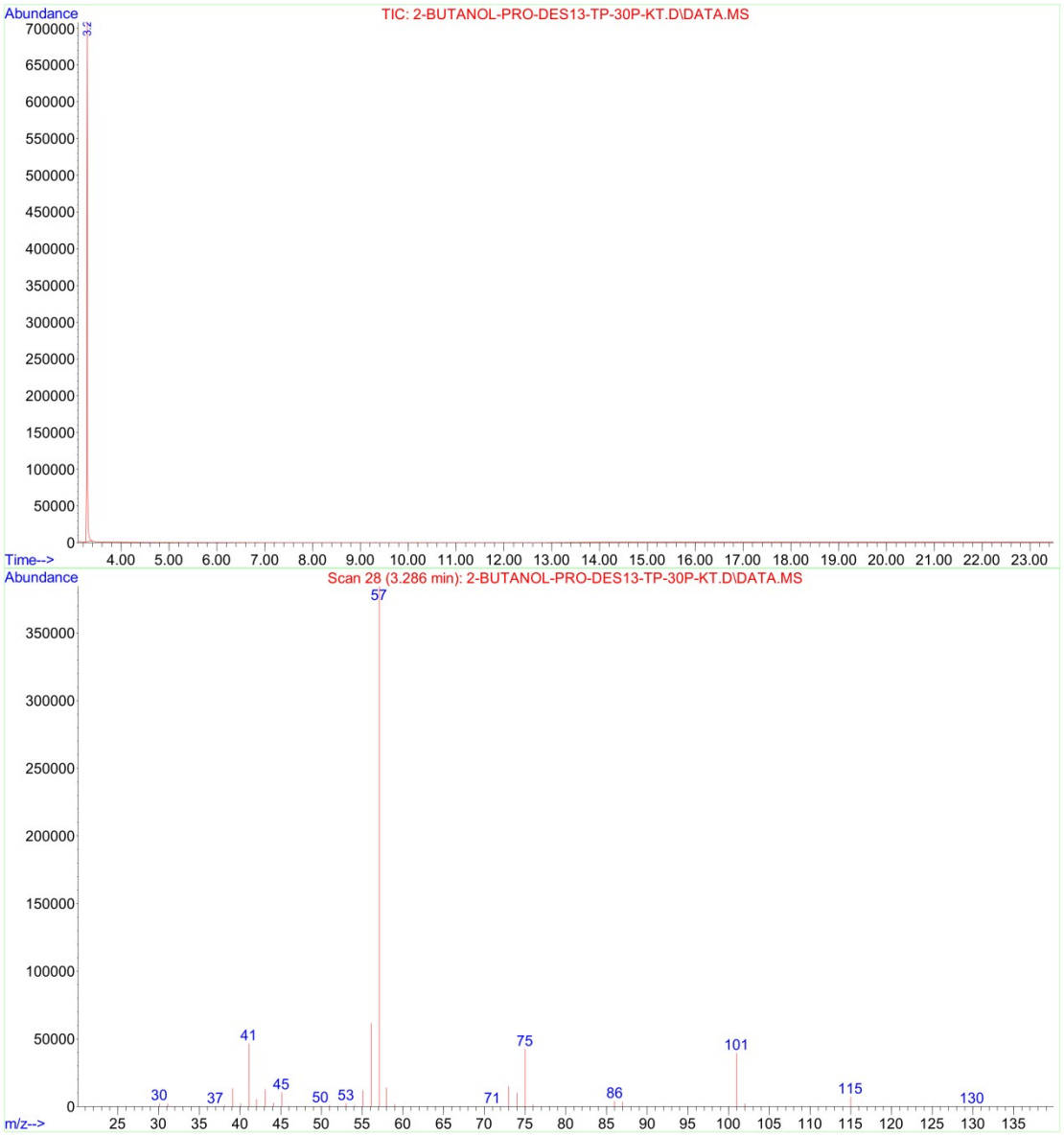
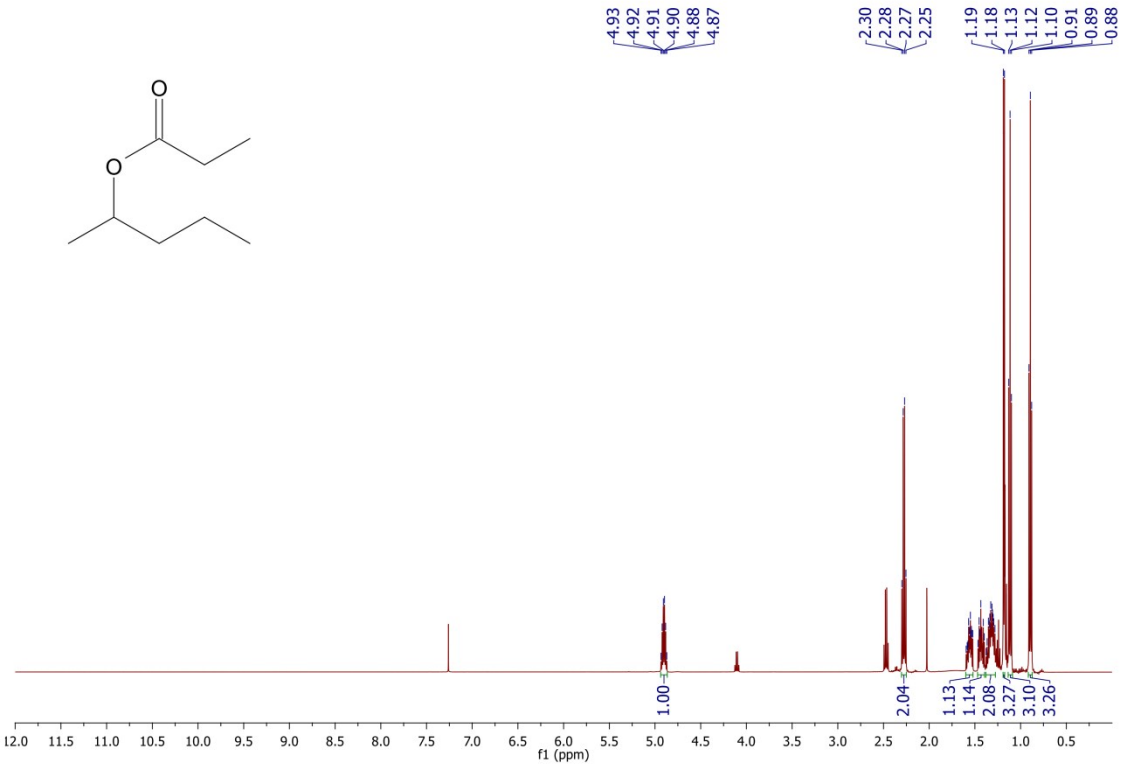
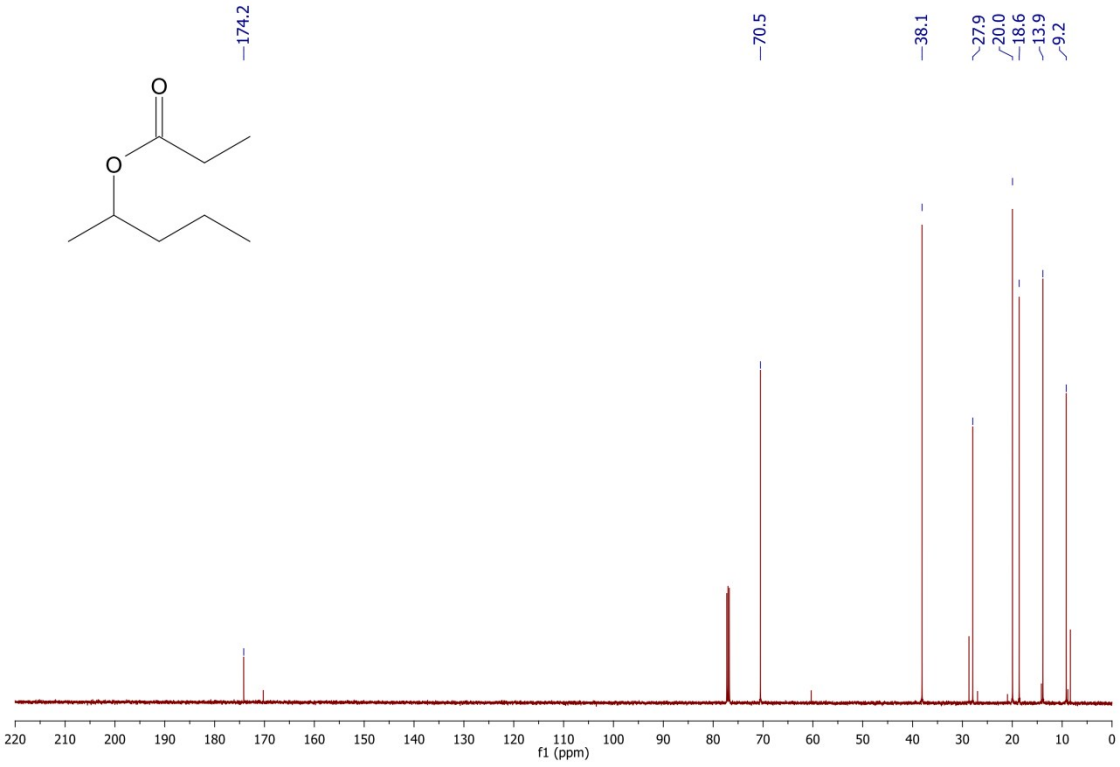


^{1}H-NMR, ^{13}C-NMR and GC-MS of 2-pentyl propionate





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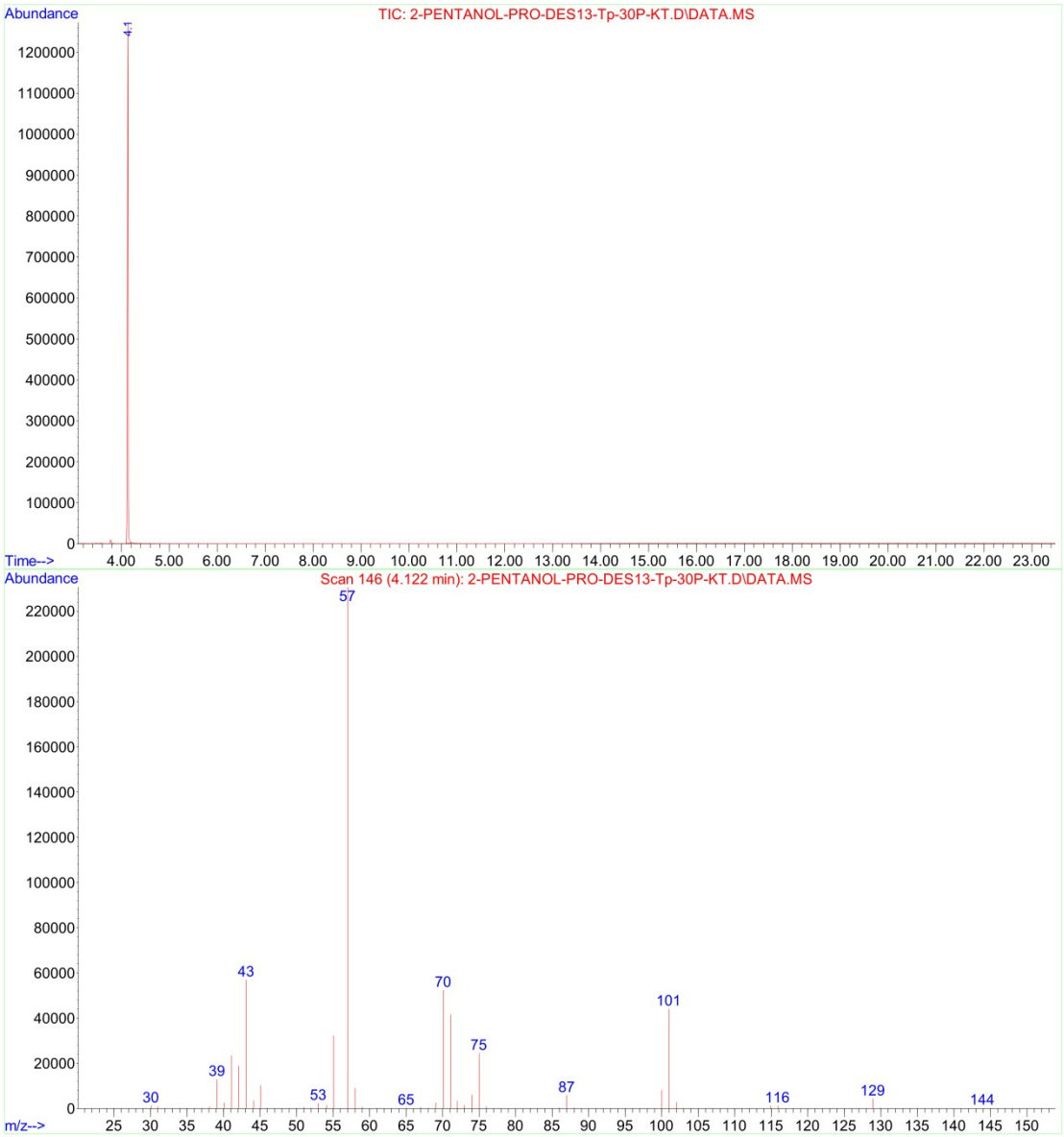
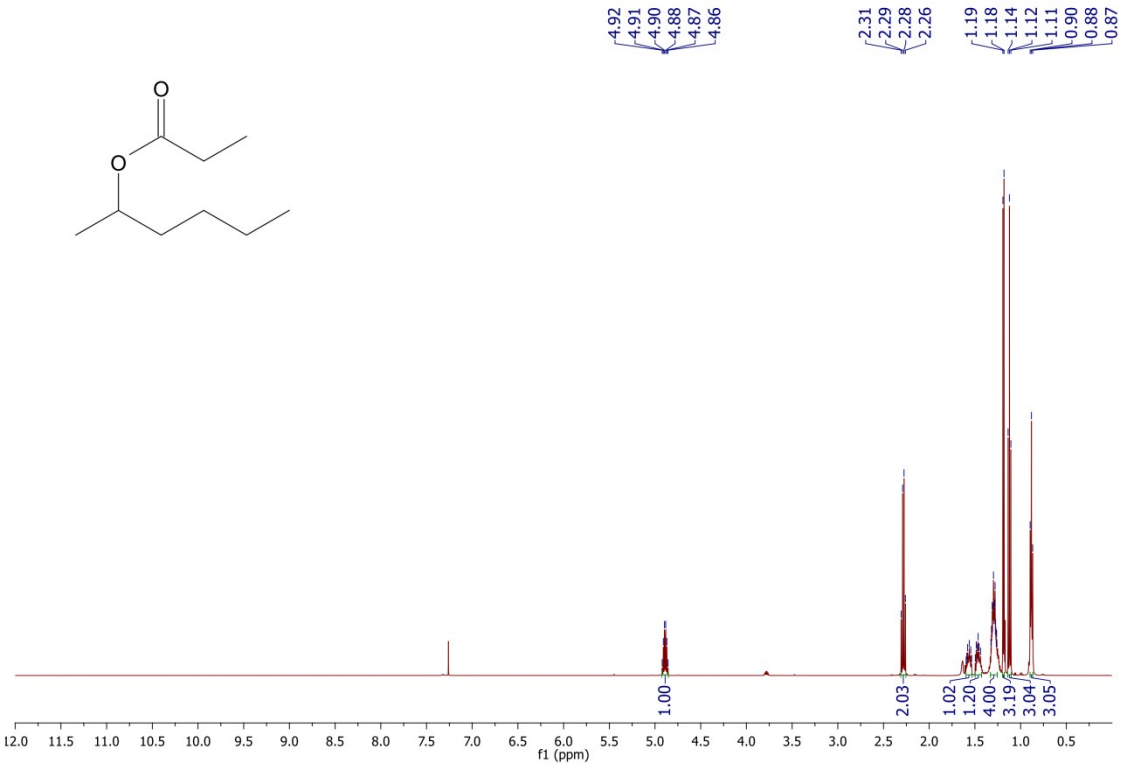
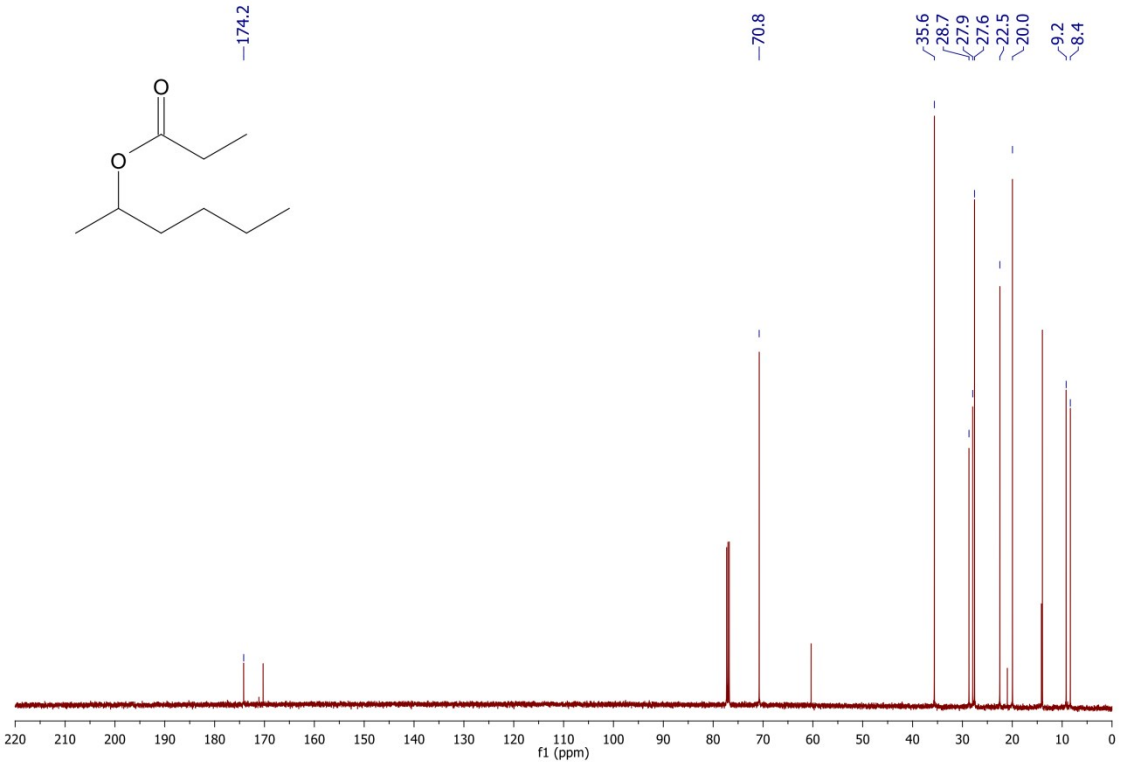


^{1}H-NMR, ^{13}C-NMR and GC-MS of 2-hexyl propionate





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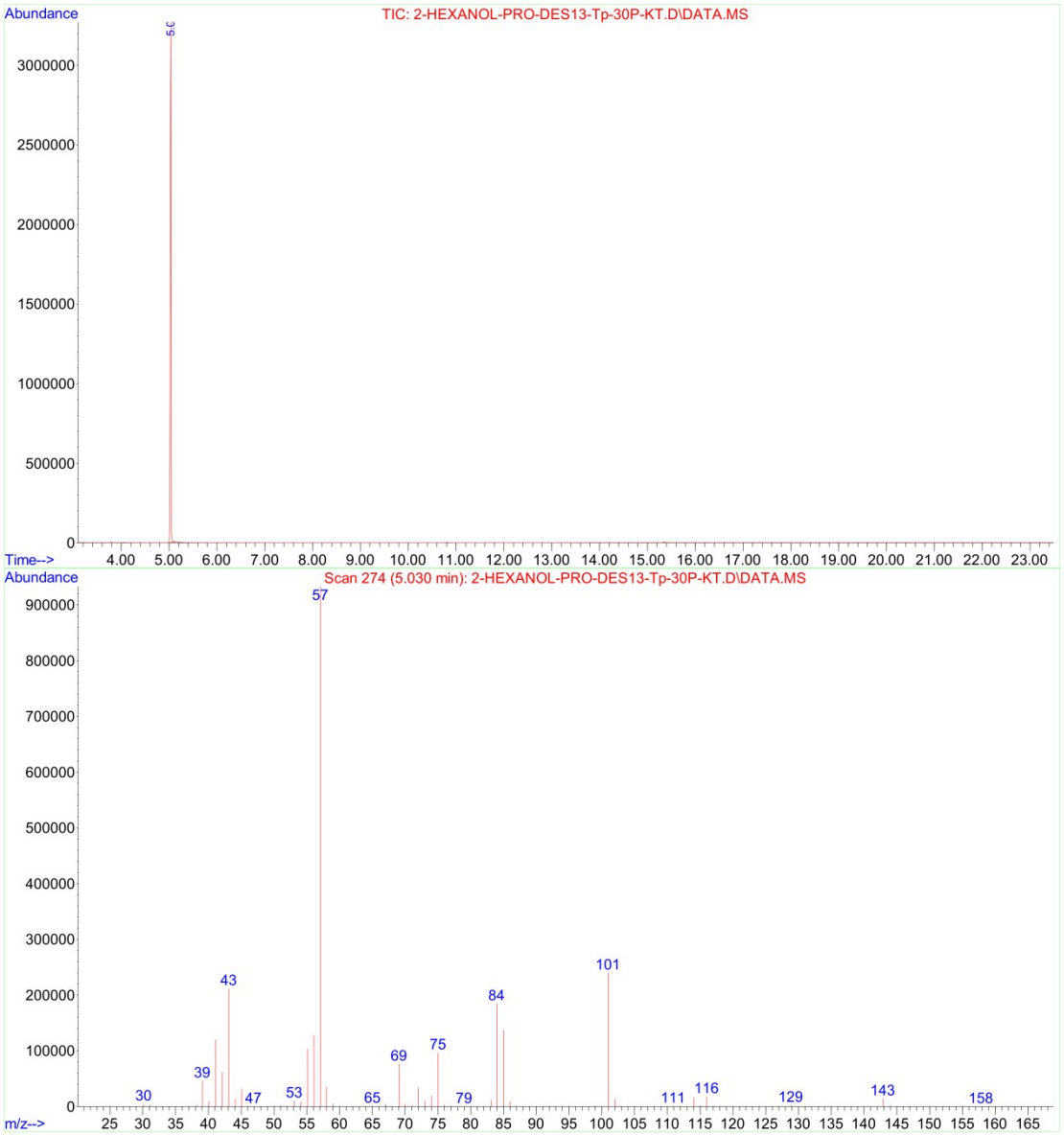
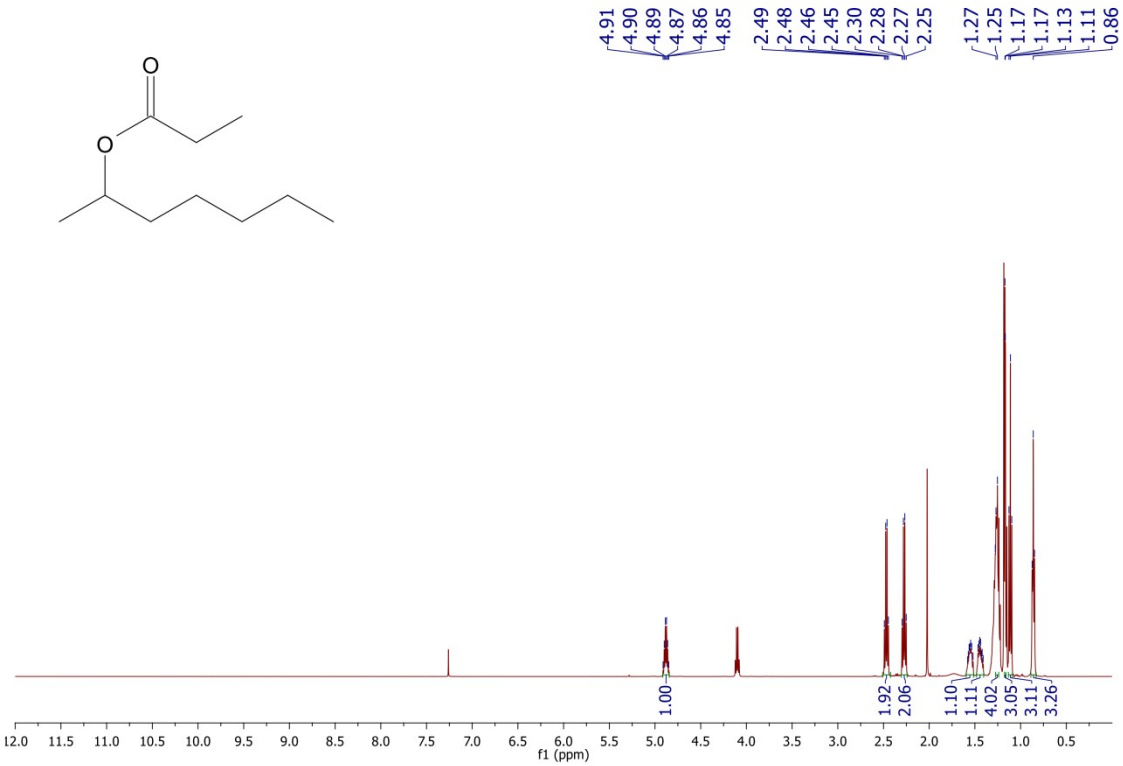
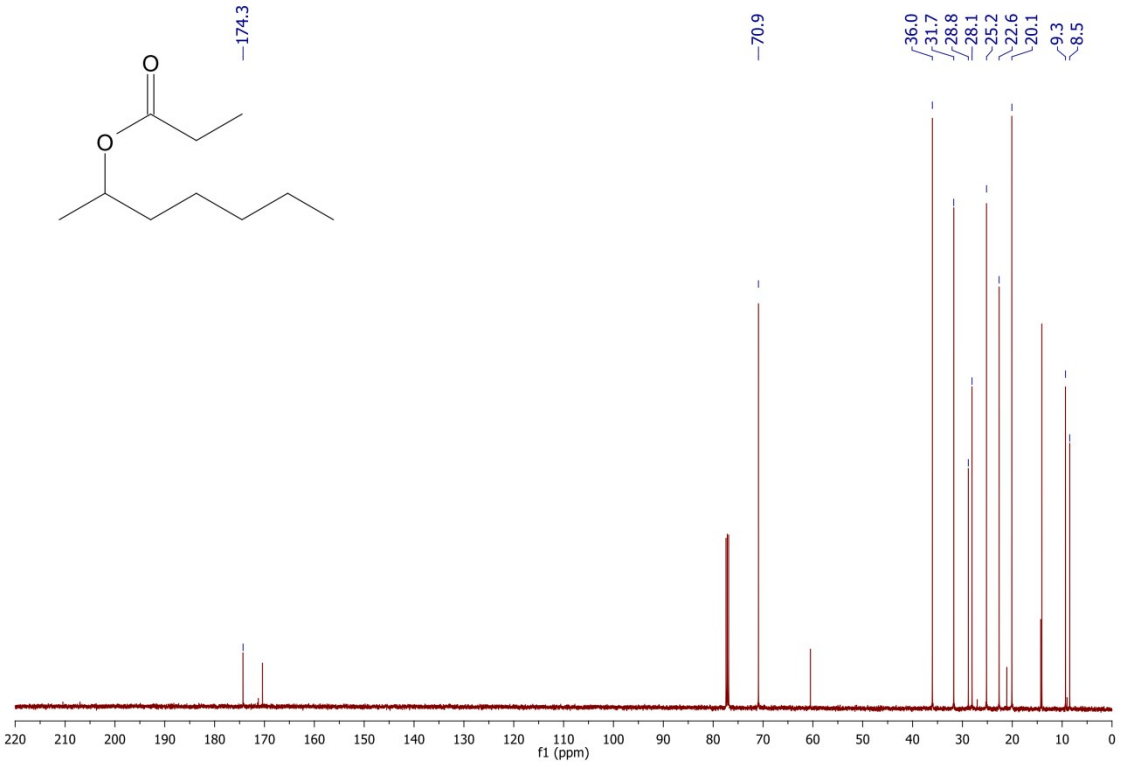


^{1}H-NMR, ^{13}C-NMR and GC-MS of 2-heptyl propionate





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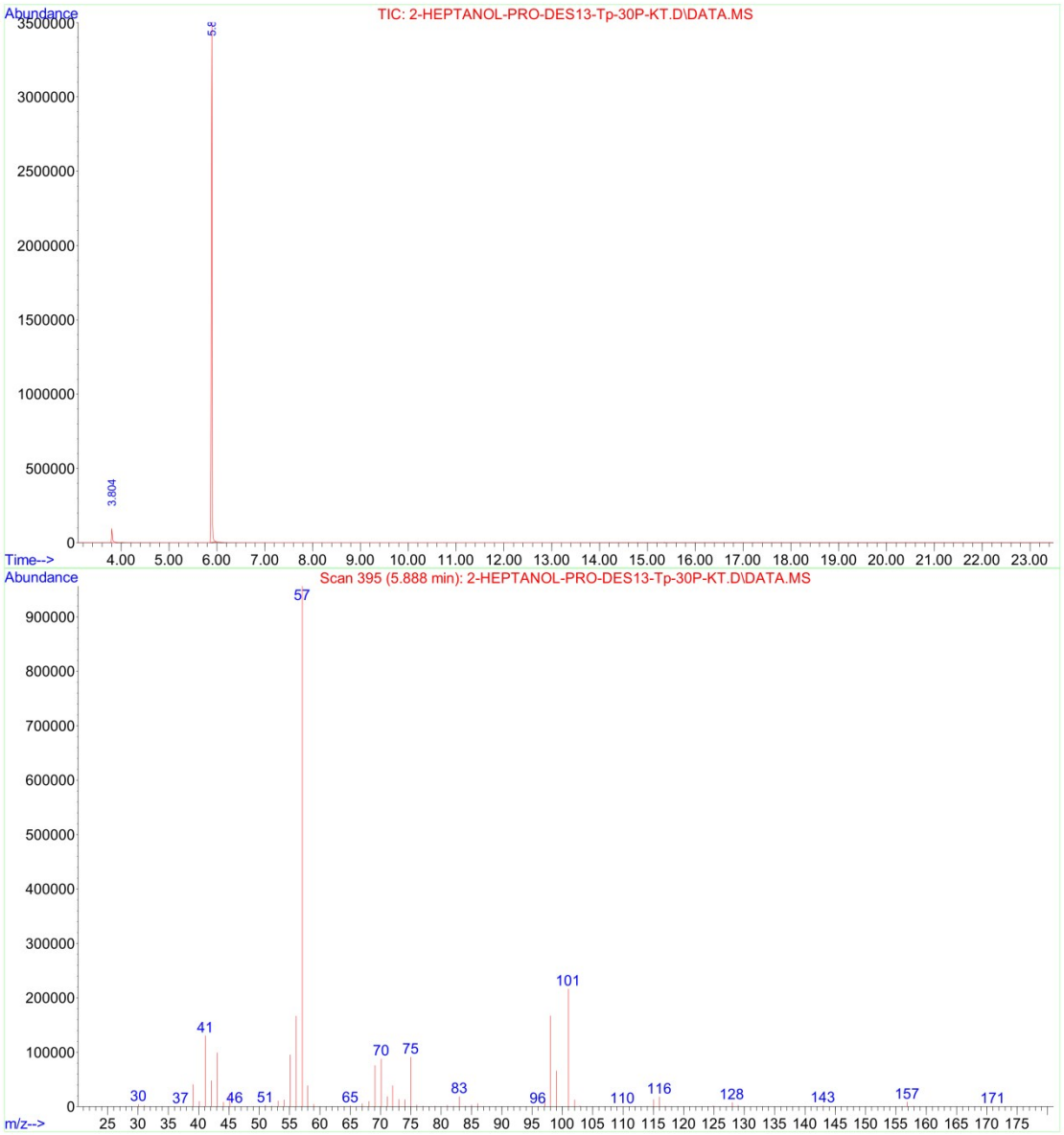
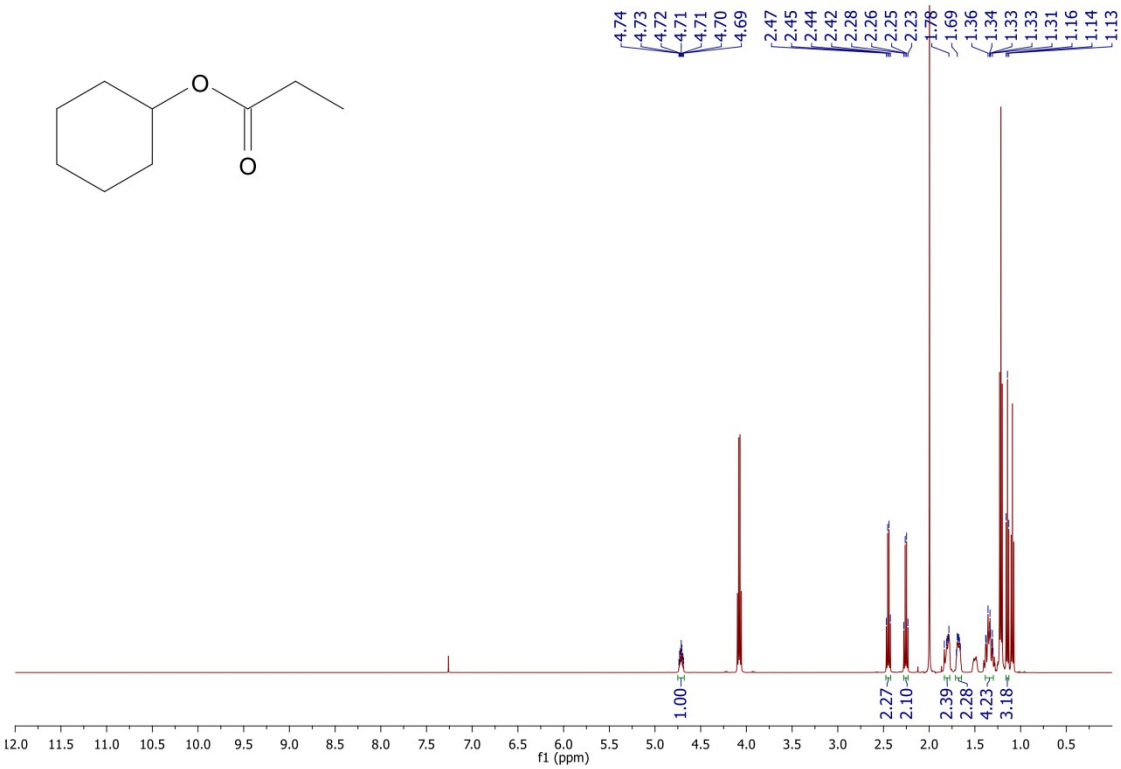
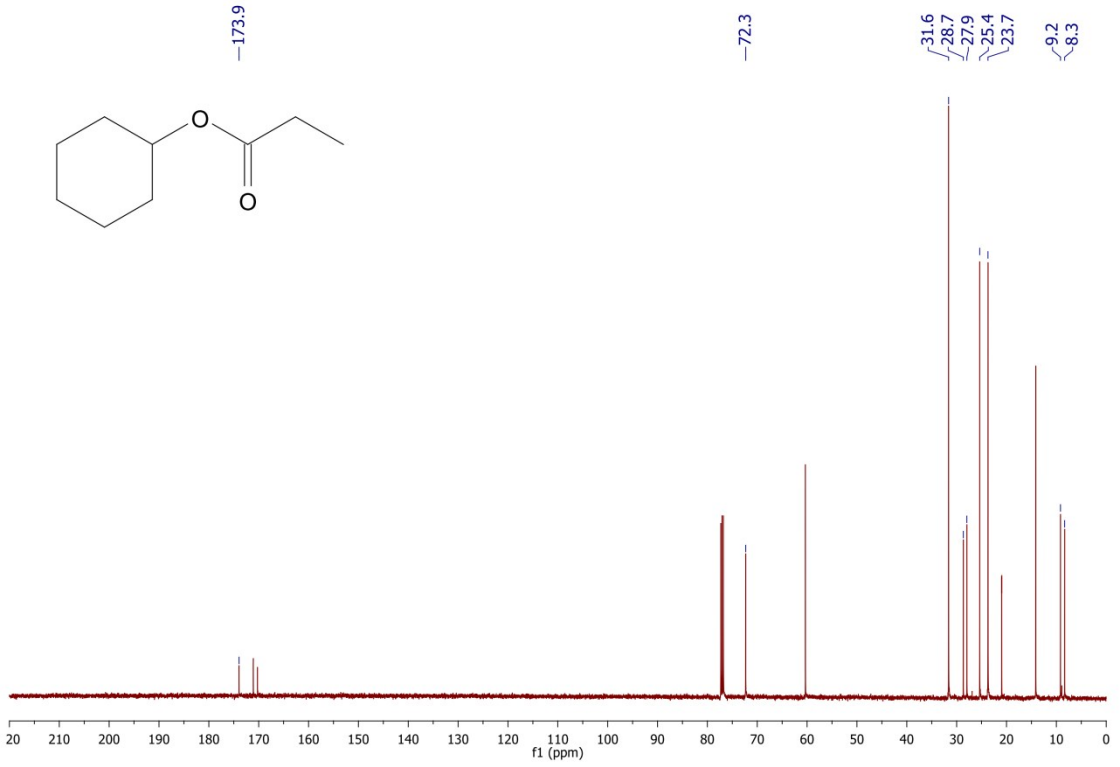


^{1}H-NMR, ^{13}C-NMR and GC-MS of cyclohexyl propionate





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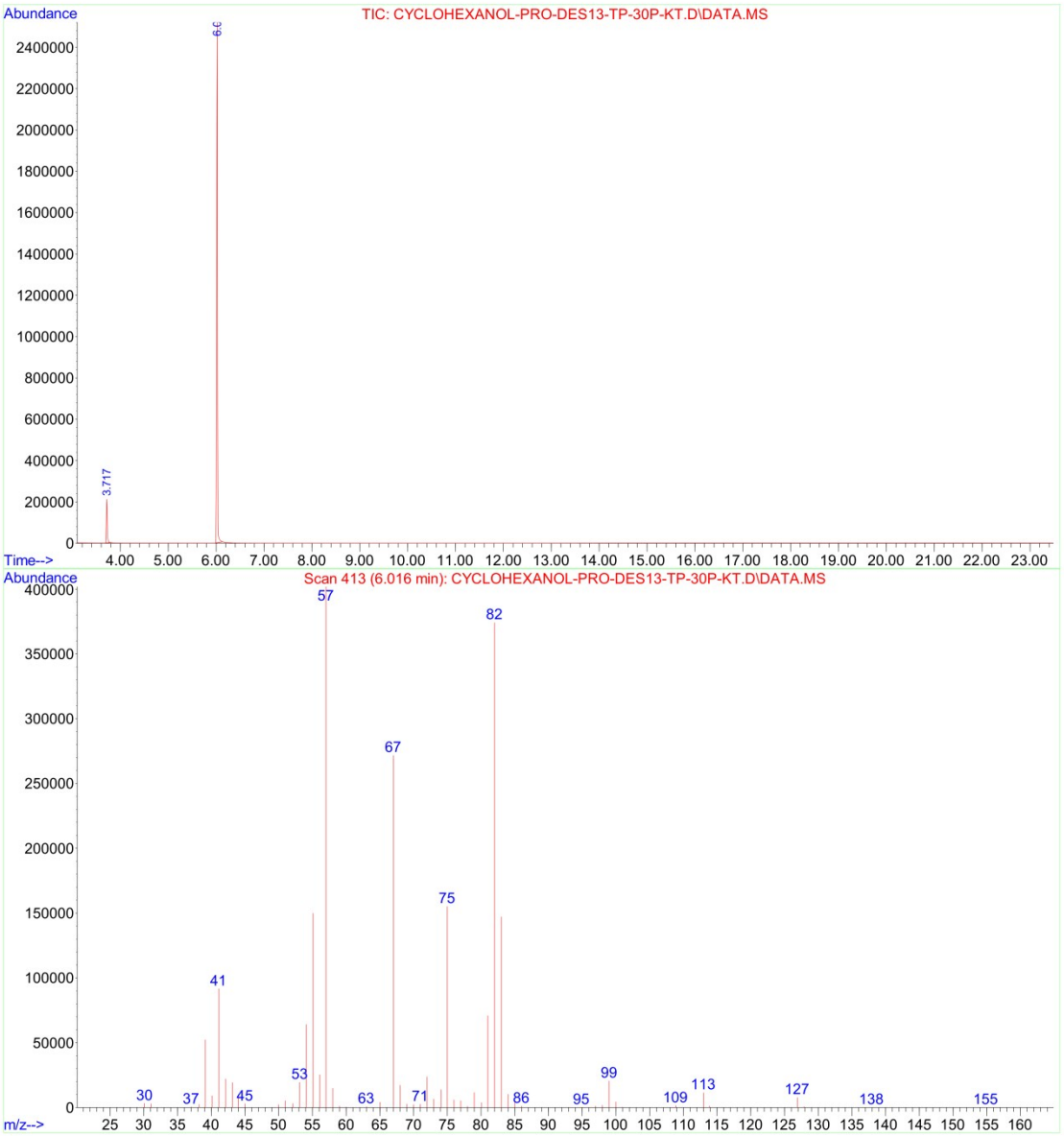
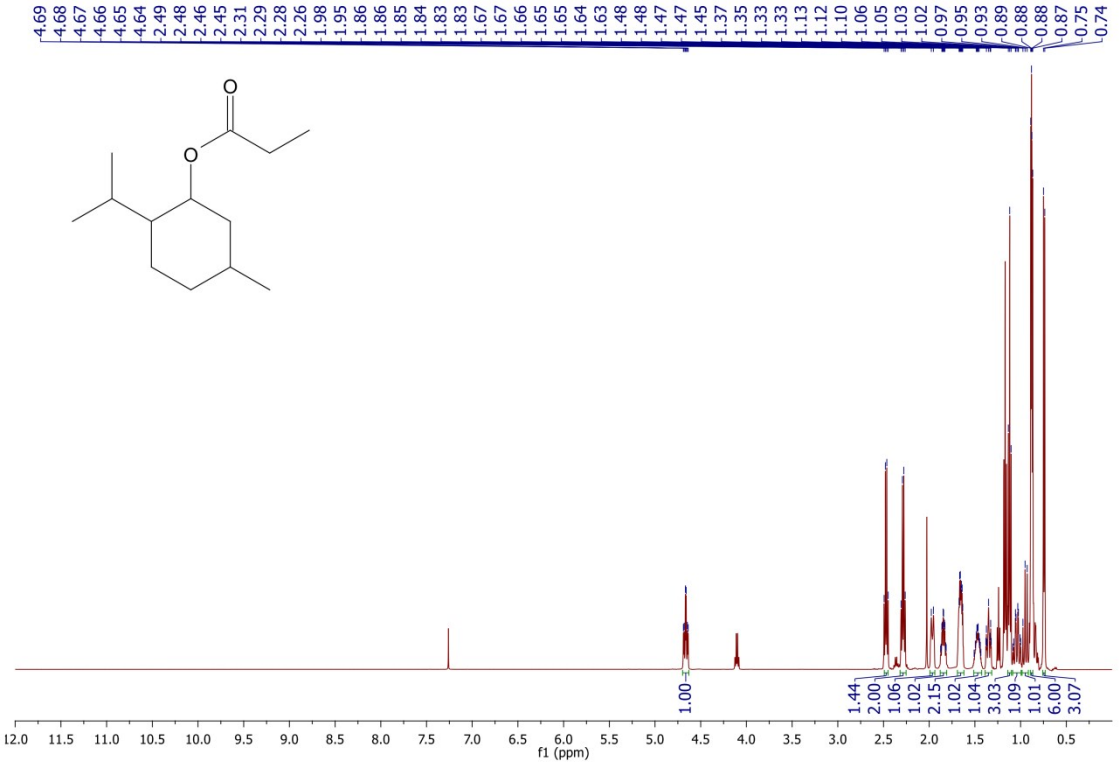
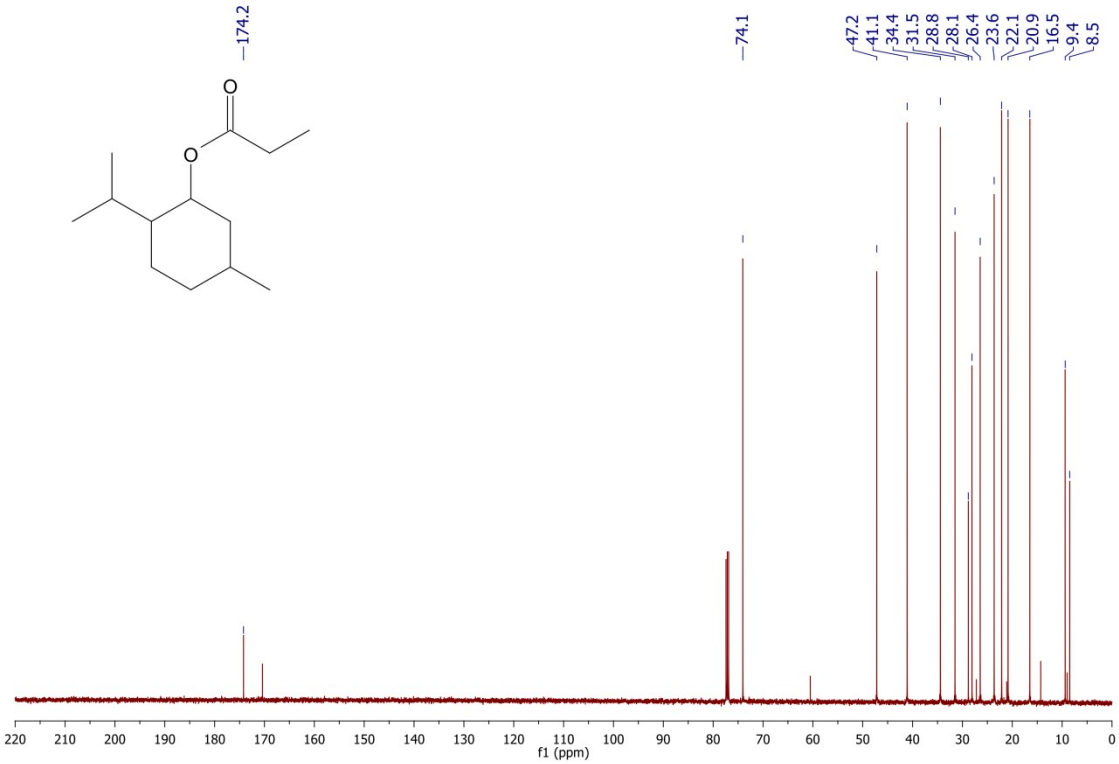


[1]H-NMR, [13]C-NMR and GC-MS of **2-isopropyl-5-methylcyclohexyl propionate**





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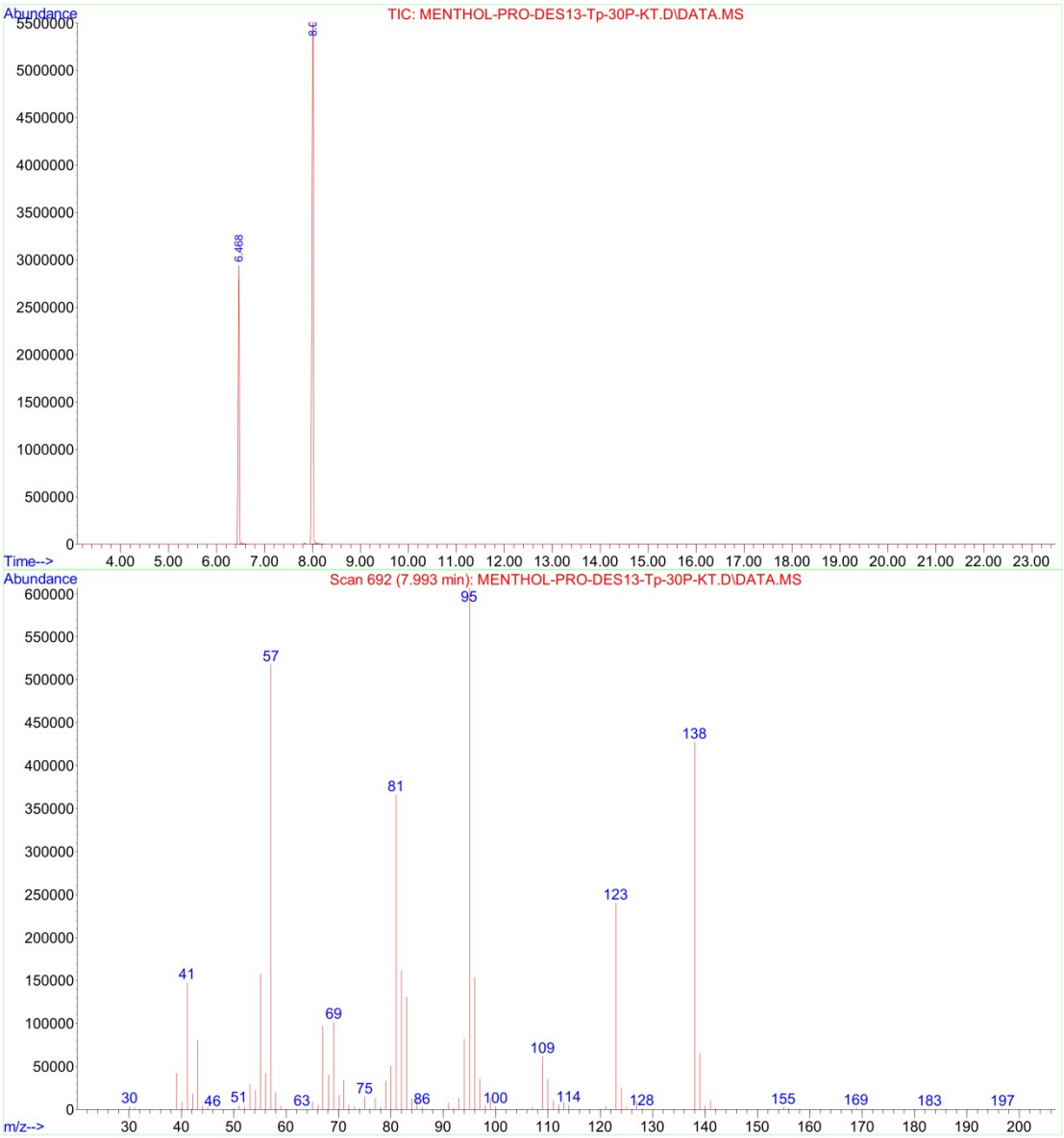
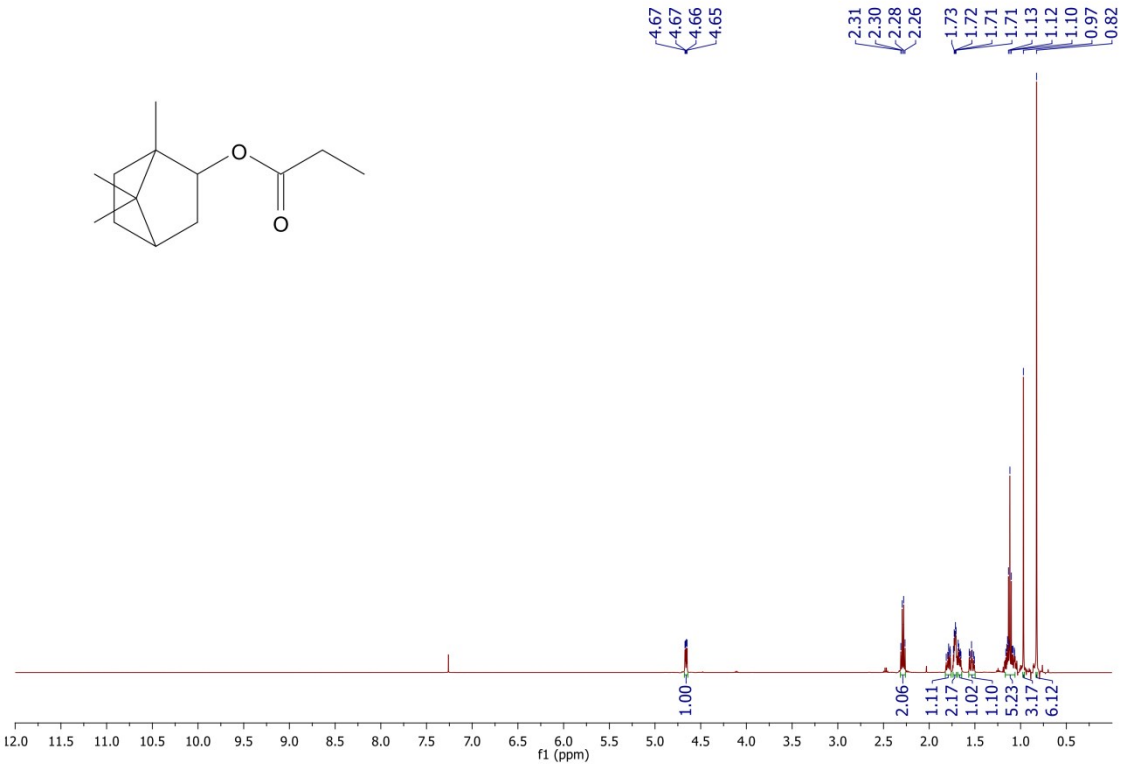
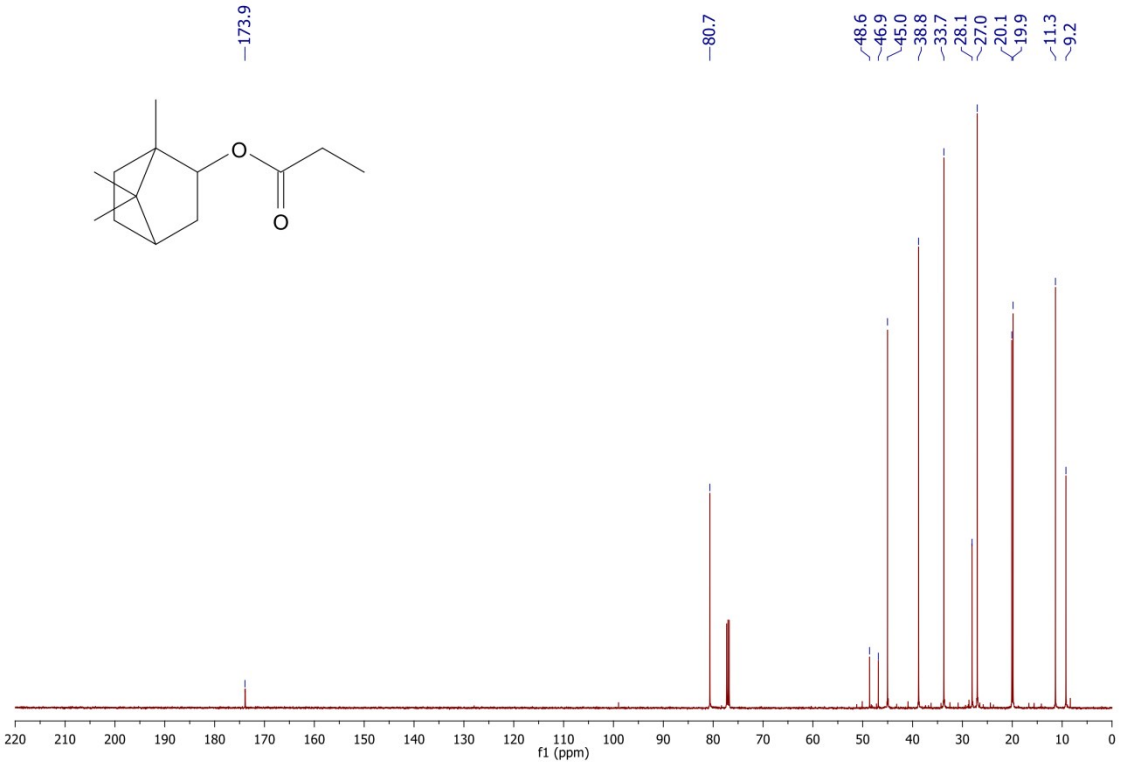
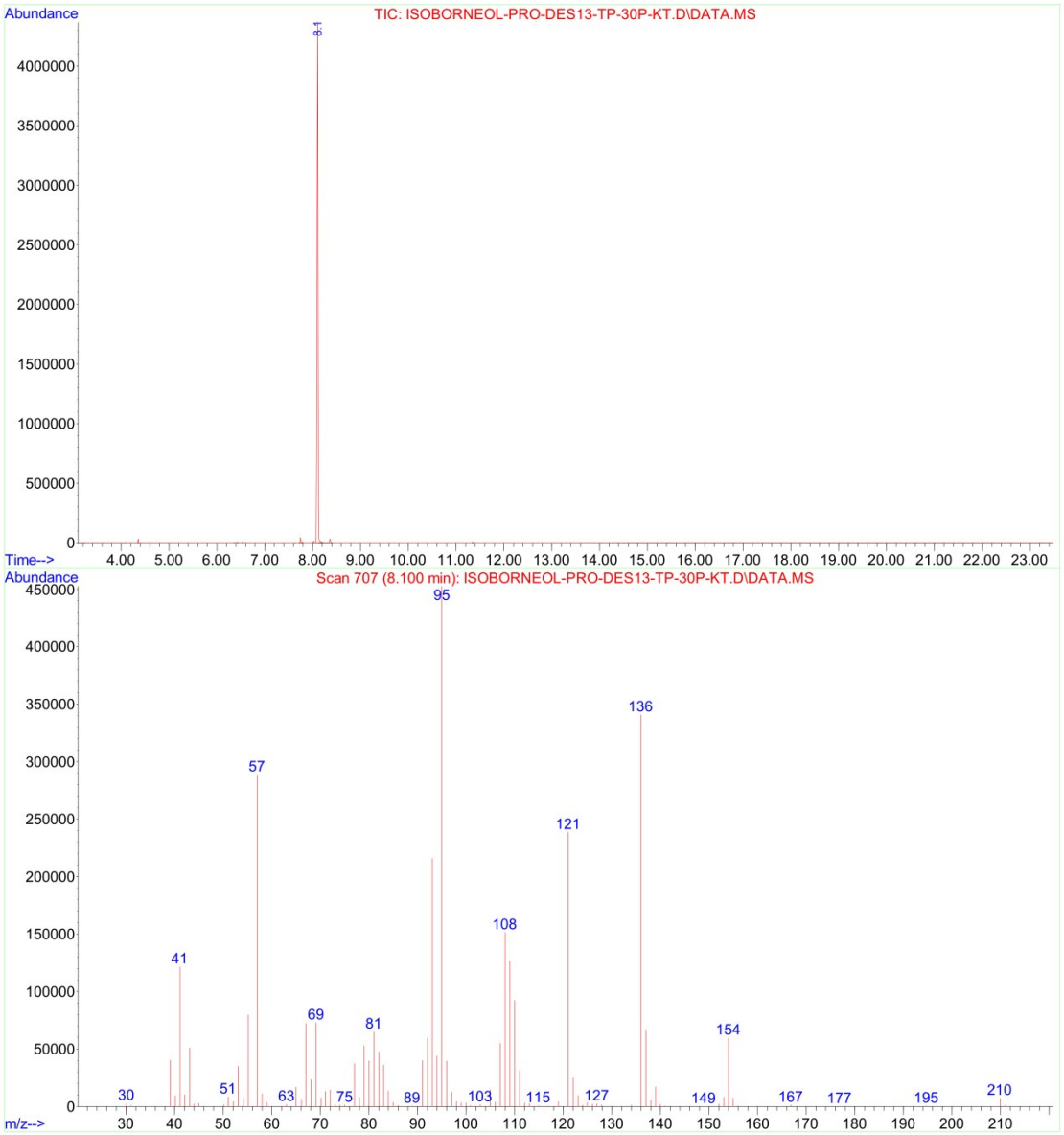


^{1}H-NMR and ^{13}C-NMR of 1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl propionate

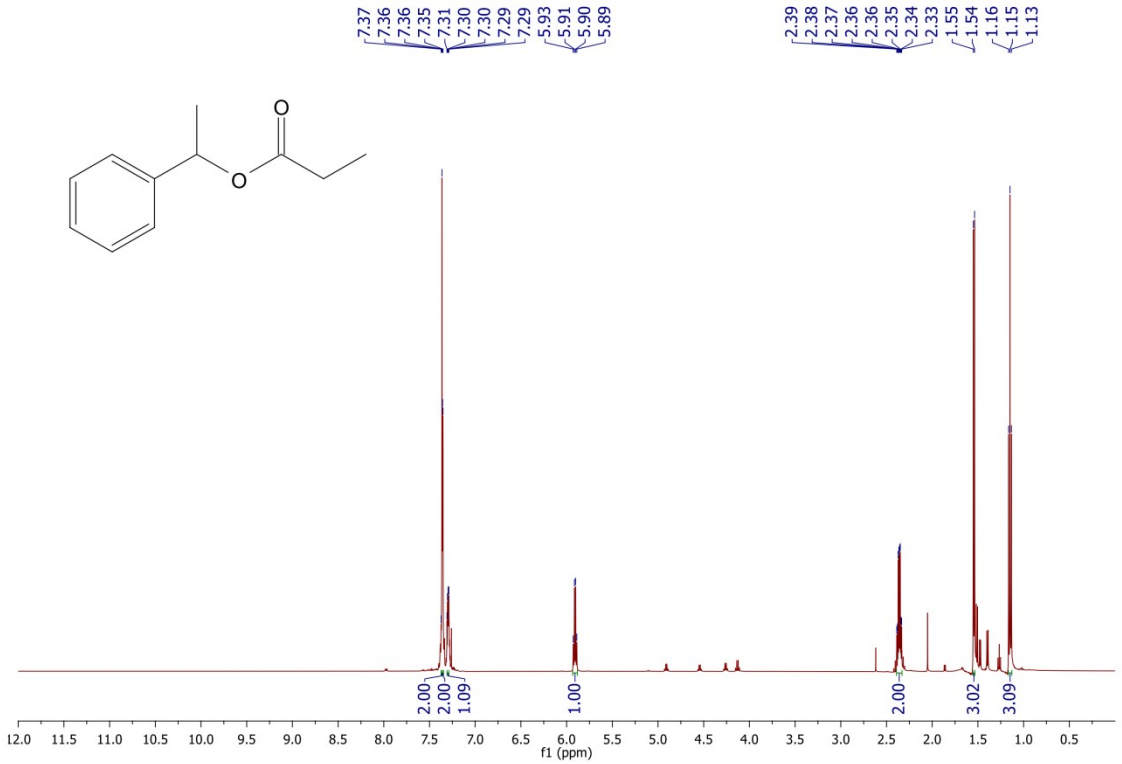


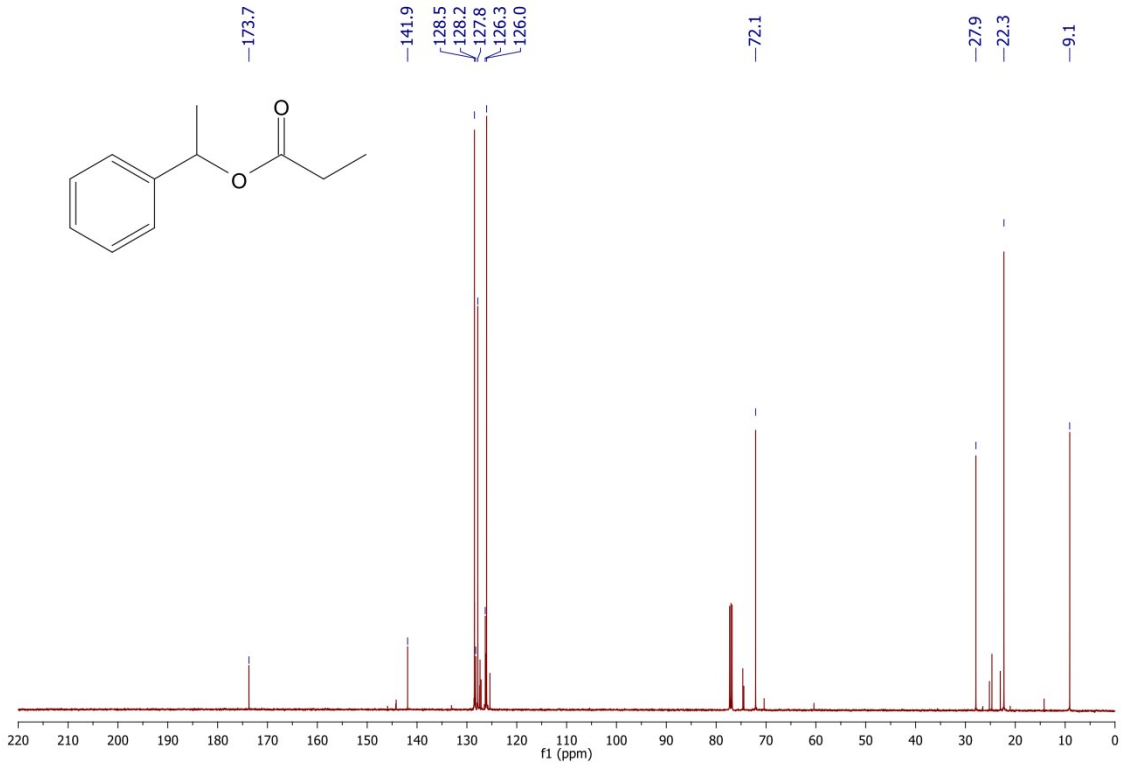


File :D:\phuong\NCS\2011-HAI\CHOLINE CLORIDE - ZnCl2\GRADUATION\ES
... TER\KHUAY TU\ISOBORNEOL-PRO-DES13-TP-30P-KT.D
Operator : TRUONG HAI
Instrument : GCMSD
Acquired : 13 Nov 2015 22:18 using AcqMethod ACYLATION-SHORT.M
Sample Name: ISOBORNEOL-PRO-DES13-TP-30P-KT
Misc Info :

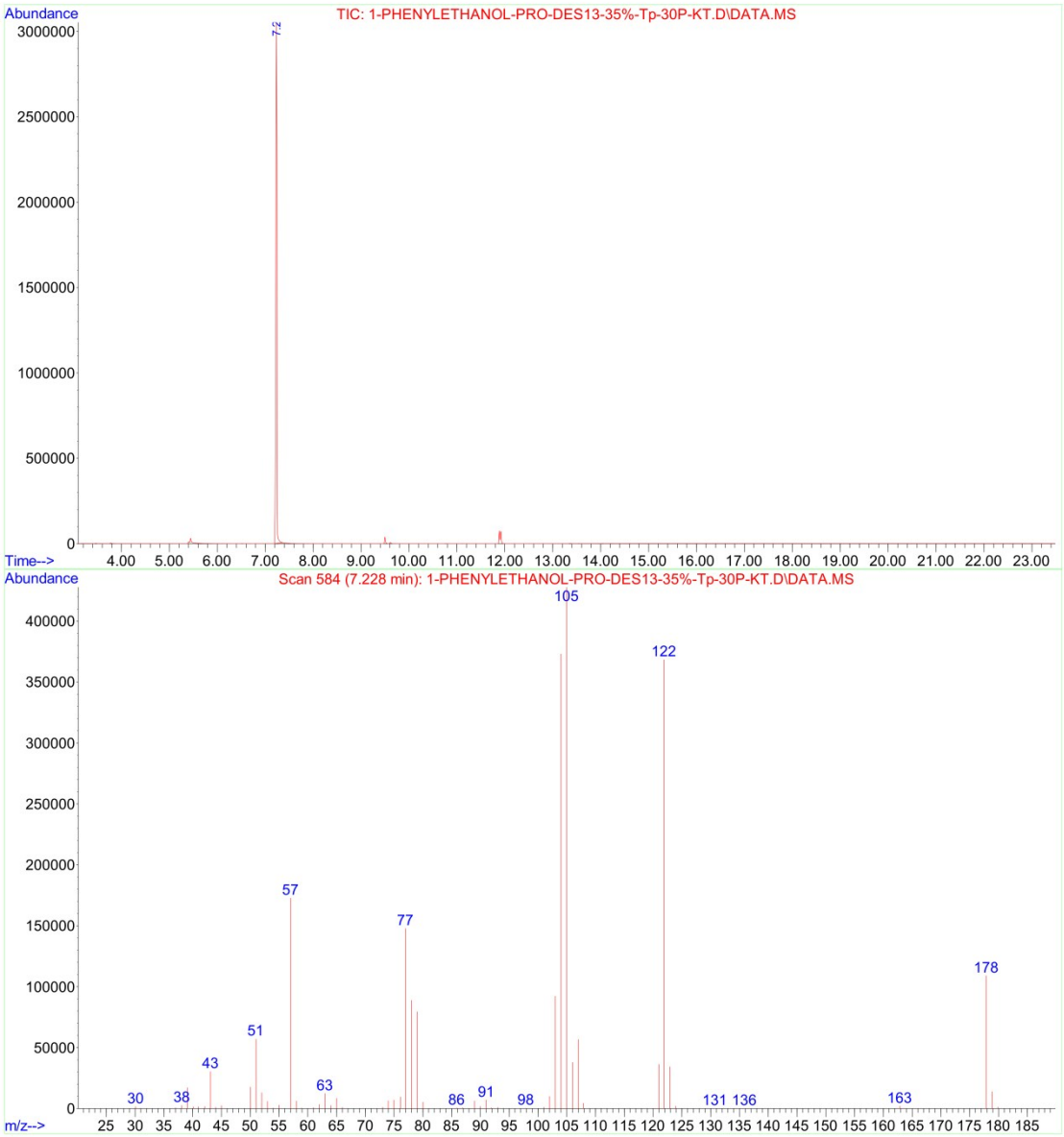


^{1}H-NMR, ^{13}C-NMR and GC-MS of 1-phenylethyl propionate

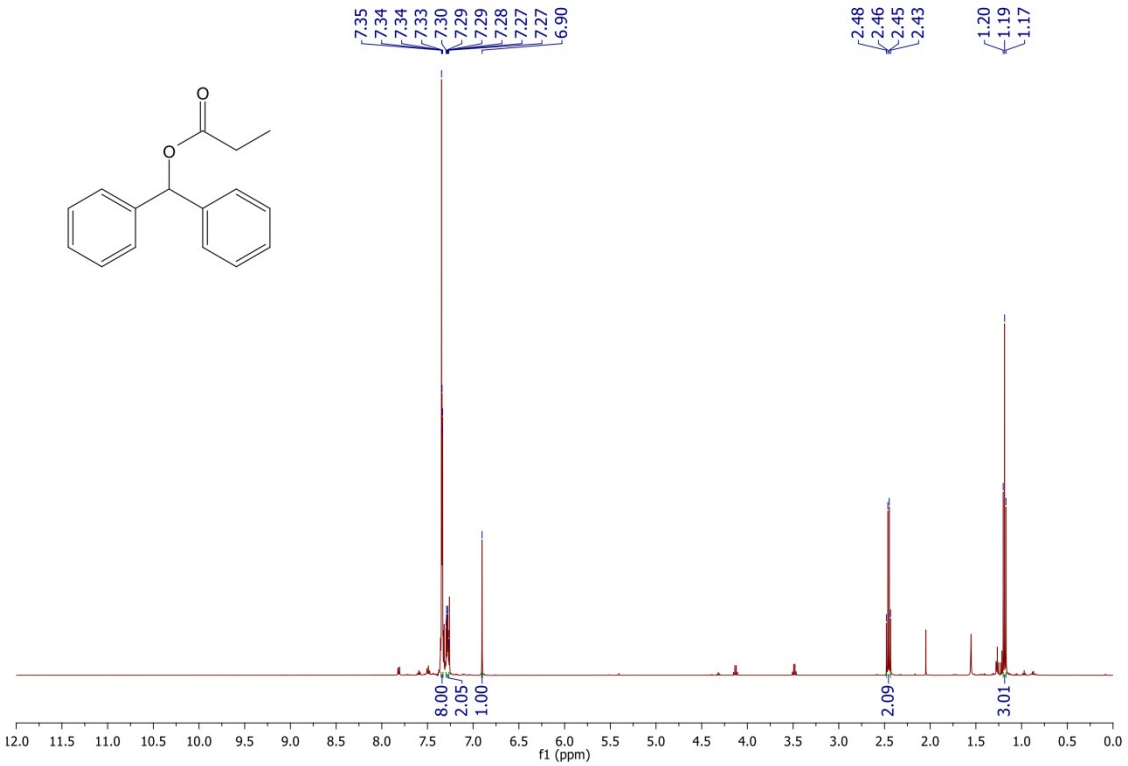


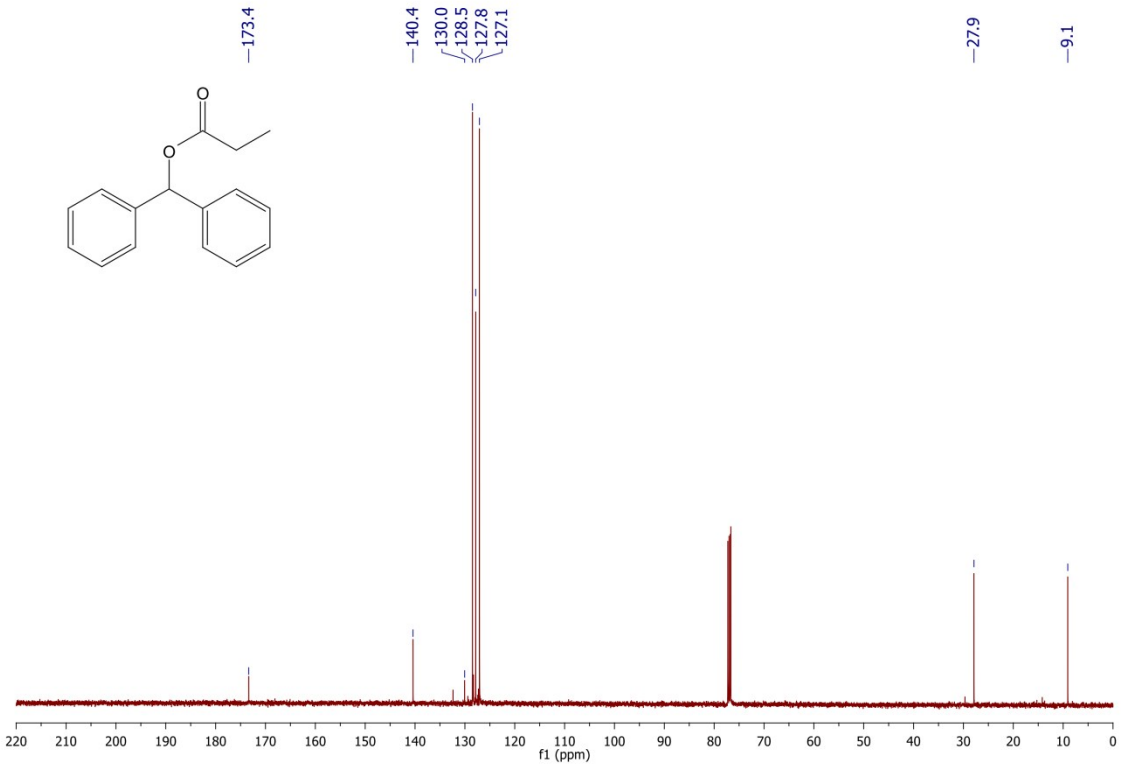


File :D:\phuong\NCS\2011-HAI\CHOLINE CLORIDE - ZnCl2\GRADUATION\ES
... TER\KHUAY TU\1-PHENYLETHANOL-PRO-DES13-35%-Tp-30P-KT.D
Operator : TRUONG HAI
Instrument : GCMSD
Acquired : 3 Nov 2015 18:59 using AcqMethod ACYLATION-SHORT.M
Sample Name: 1-PHENYLETHANOL-PRO-DES13-Tp-30P-KT
Misc Info :

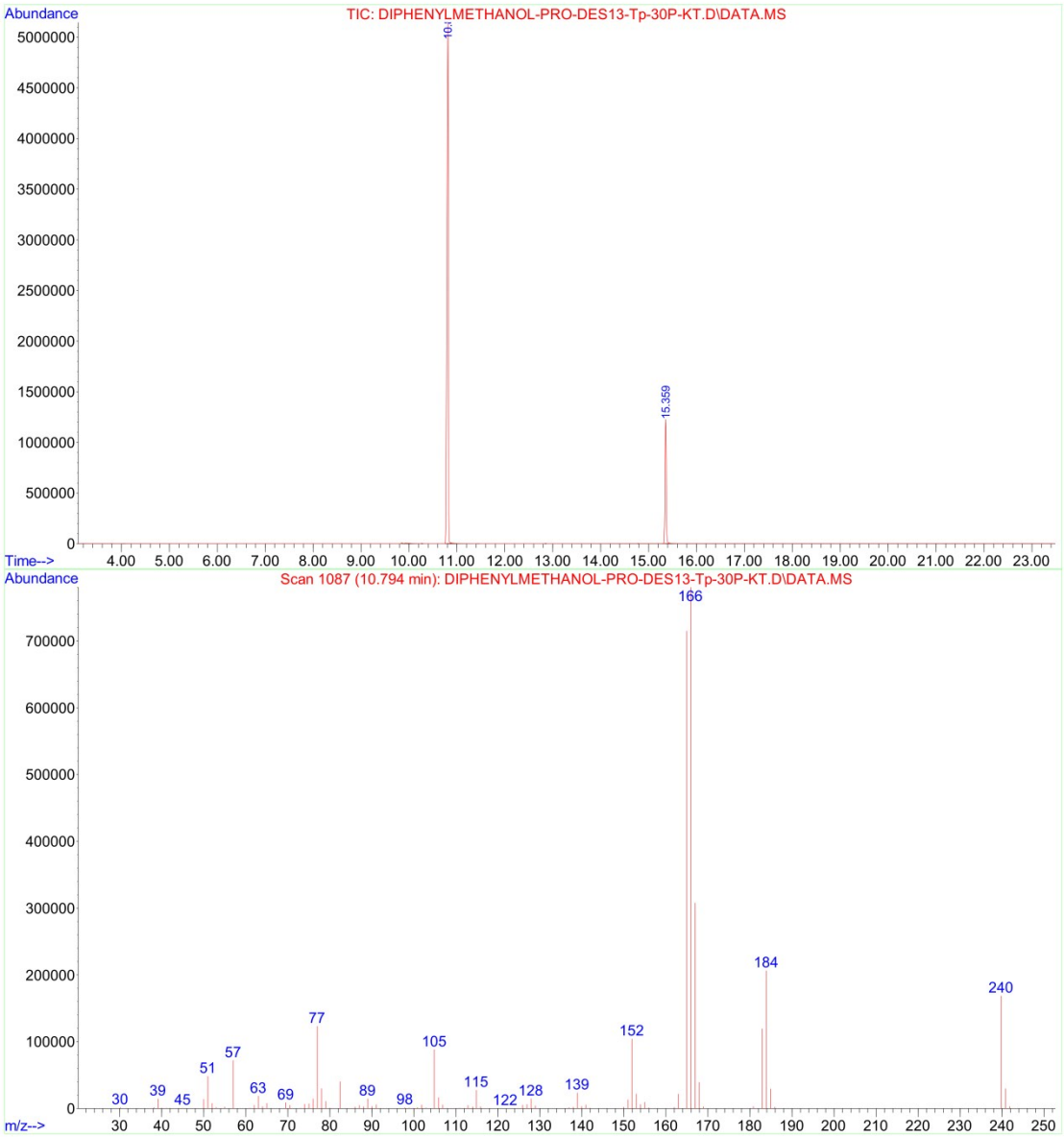


^{1}H-NMR, ^{13}C-NMR and GC-MS of benzhydryl propionate

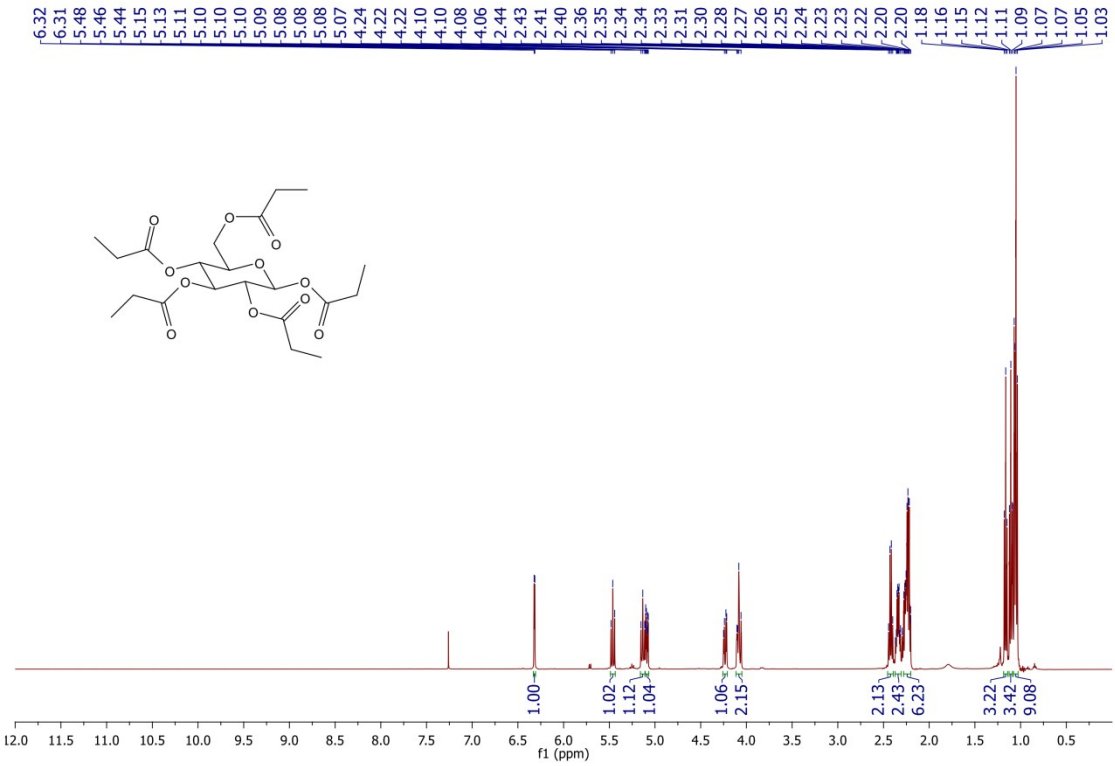


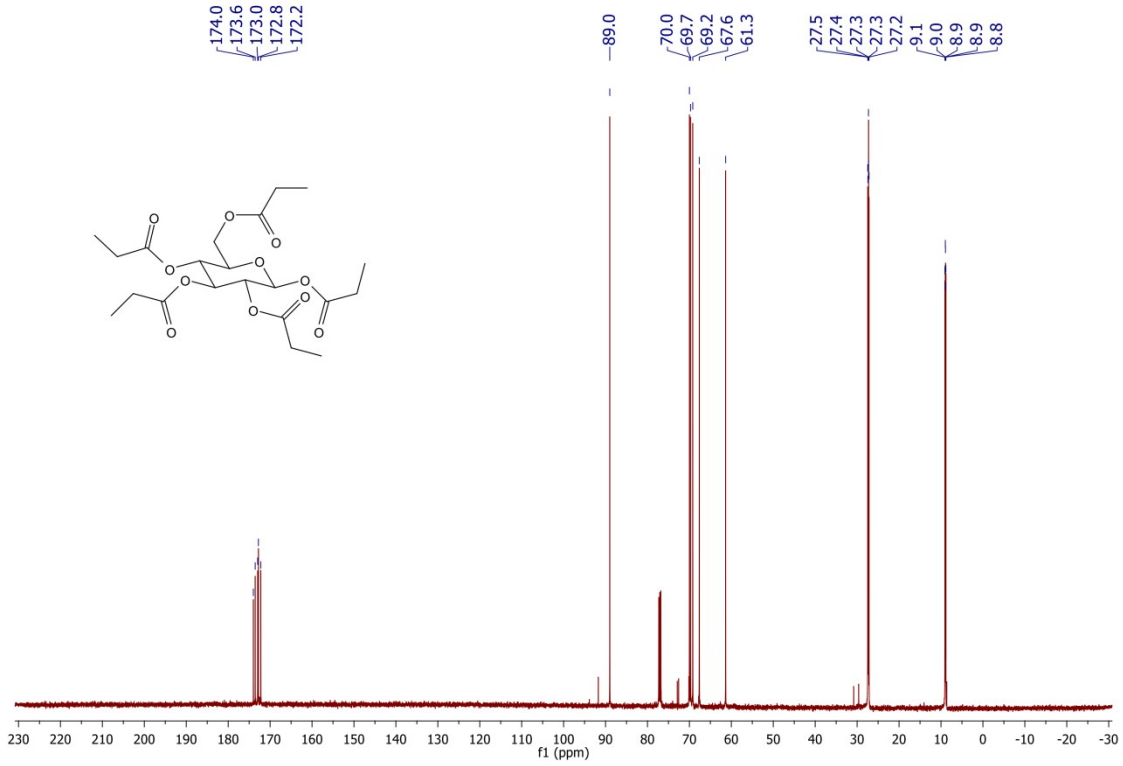


File :D:\phuong\NCS\2011-HAI\CHOLINE CLORIDE - ZnCl2\GRADUATION\ES
... TER\KHUAY TU\DIPHENYLMETHANOL-PRO-DES13-Tp-30P-KT.D
Operator : TRUONG HAI
Instrument : GCMSD
Acquired : 5 Nov 2015 18:22 using AcqMethod ACYLATION-SHORT.M
Sample Name: DIPHENYLMETHANOL-PRO-DES13-Tp-30P-KT
Misc Info :

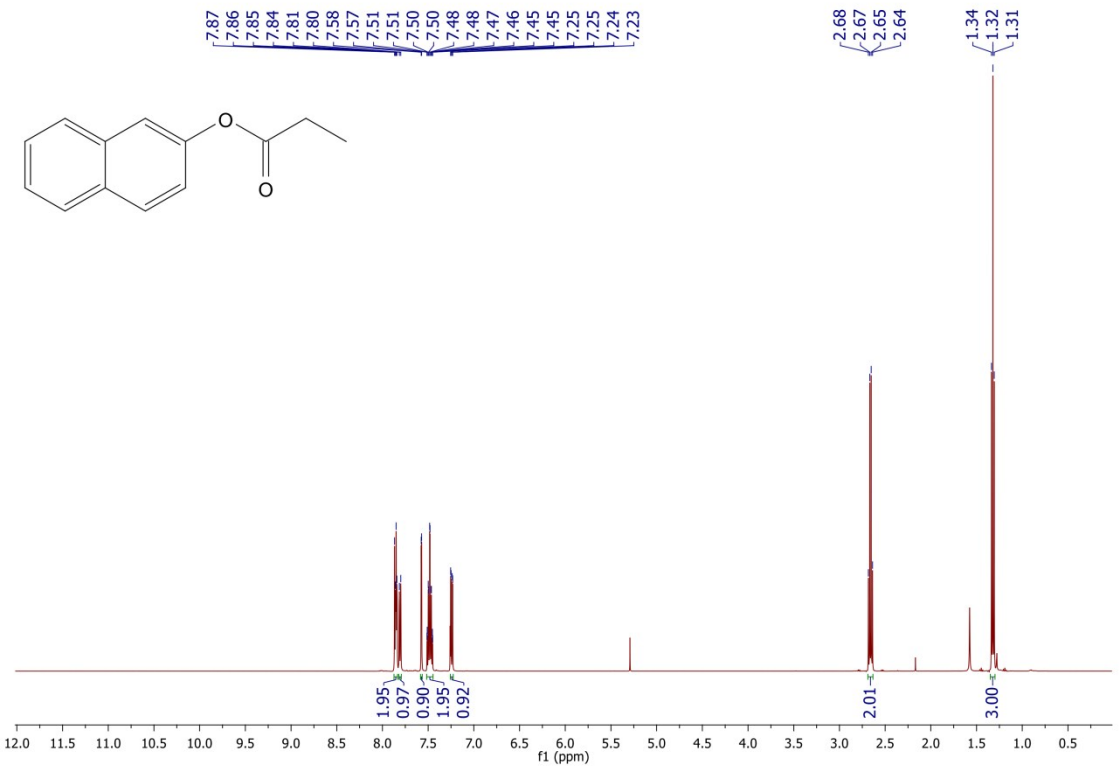


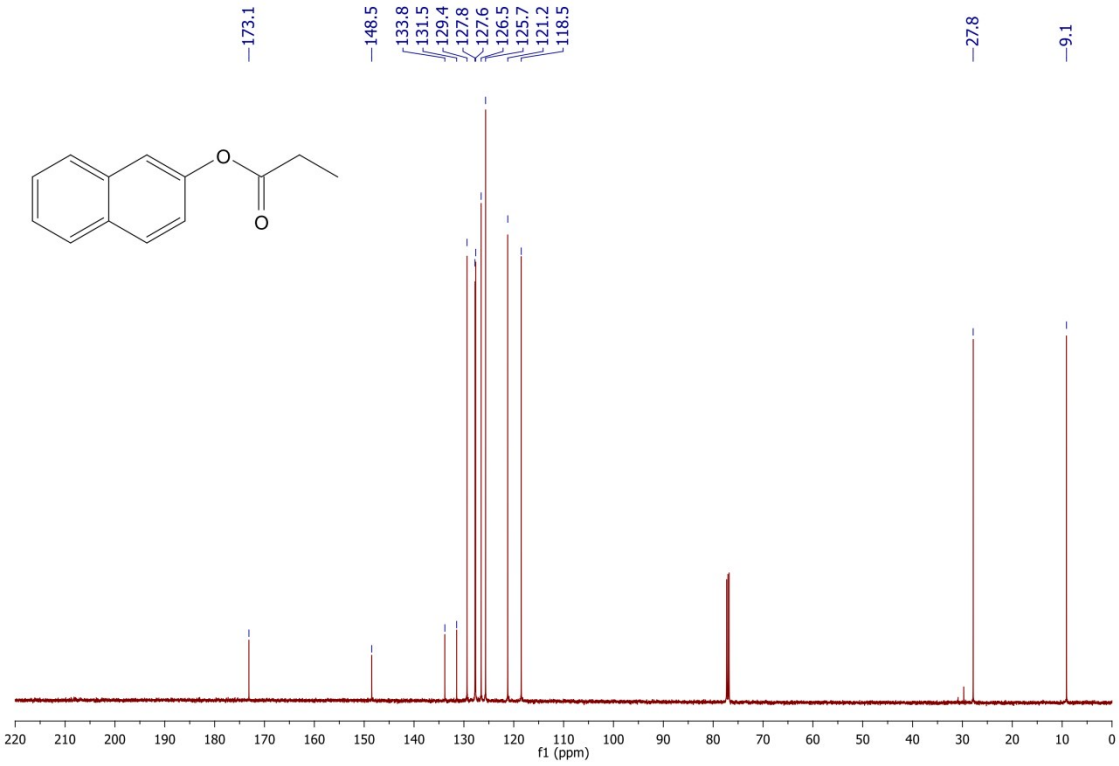
^{1}H-NMR and ^{13}C-NMR of α-*D*-glucopyranose pentapropanonate



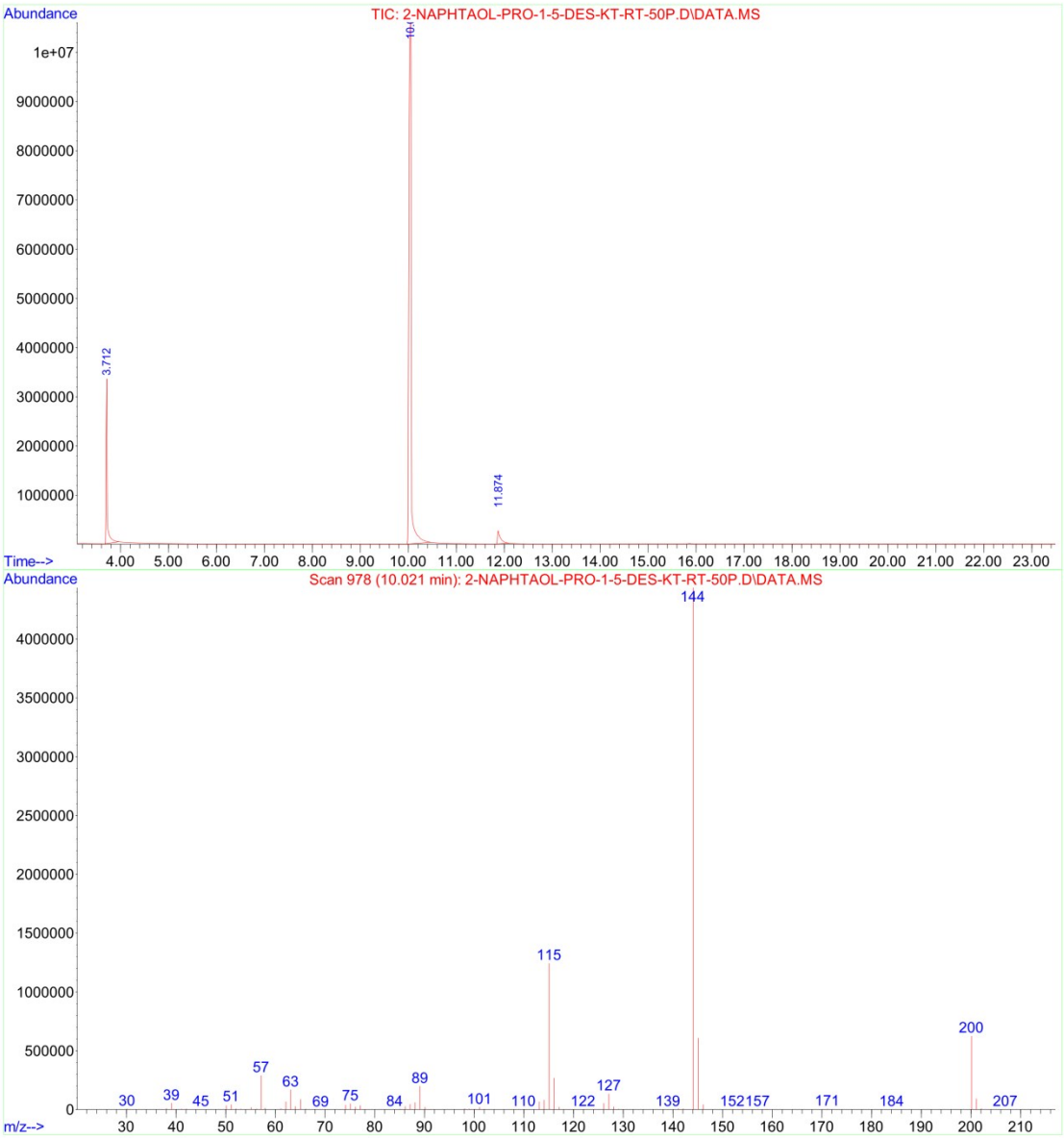


^{1}H-NMR, ^{13}C-NMR and GC-MS of naphthalene-2-yl propionate

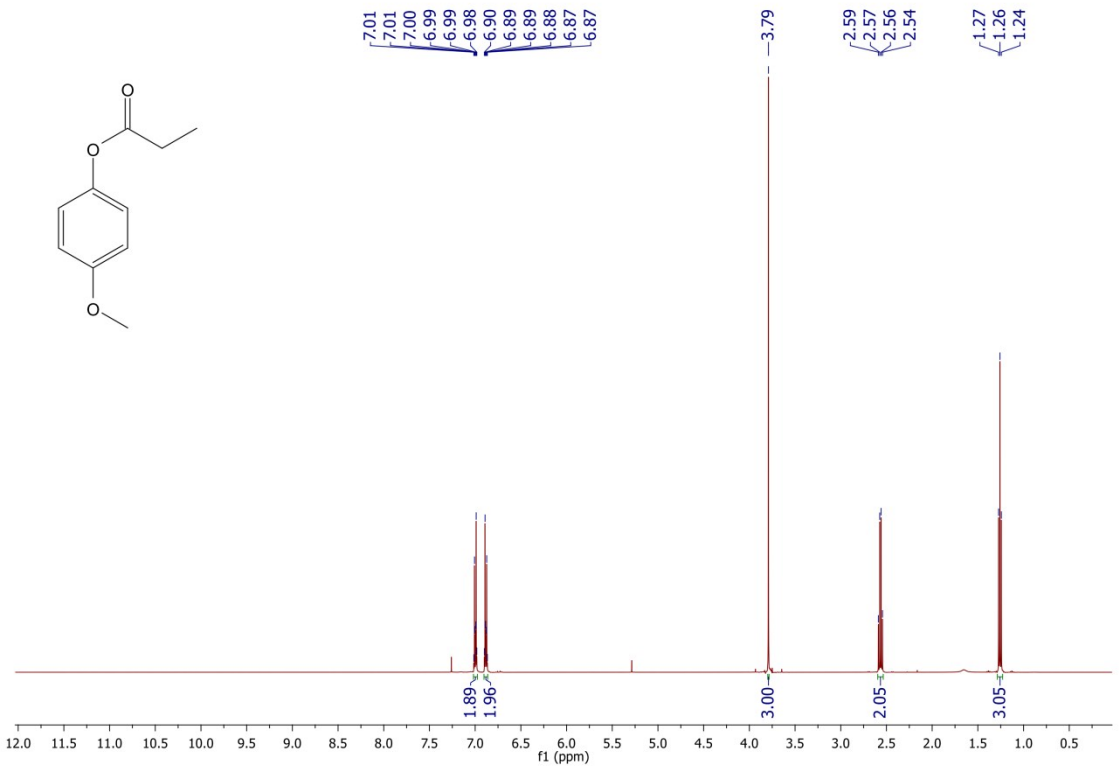


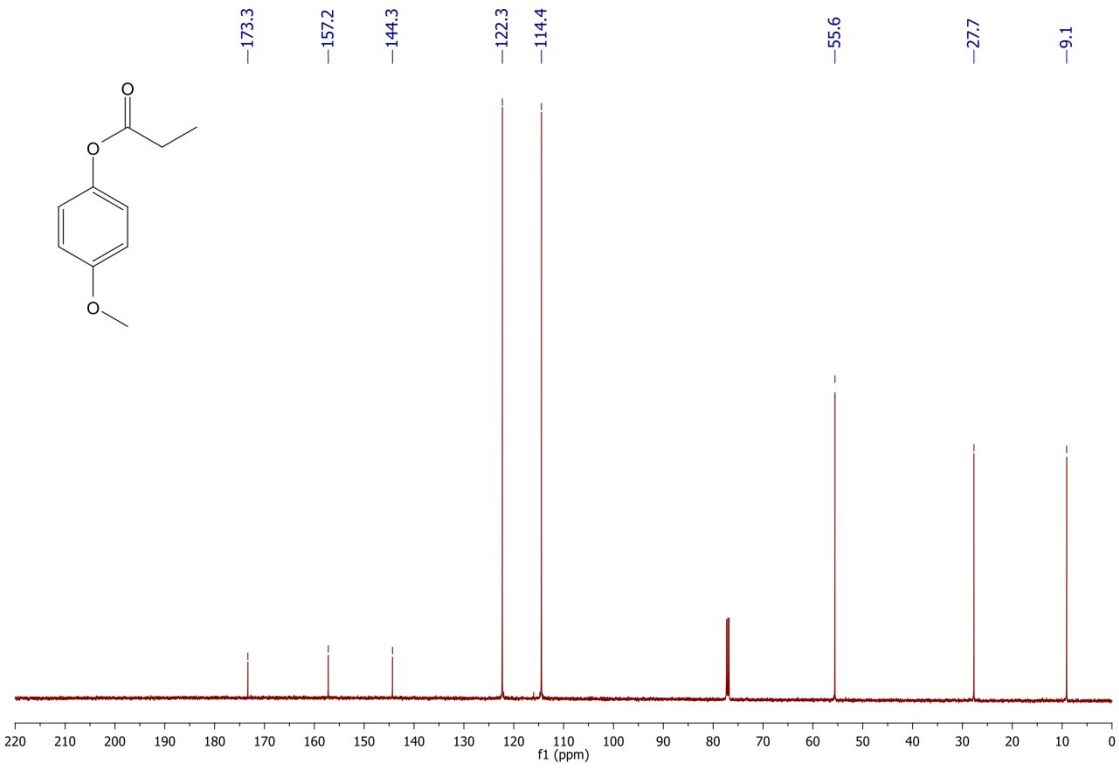


File :C:\GC-MS\2016\07.27.2016\2-NAPHTAOL-PRO-1-5-DES-KT-RT-50P.D
Operator : TRUONG HAI
Acquired : 27 Jul 2016 17:18 using AcqMethod ACYLATION-SHORT-DELAY-3MIN.M
Instrument : GCMSD
Sample Name: 2-NAPHTAOL-PRO-1-5-DES-KT-RT-50P
Misc Info :
Vial Number: 8

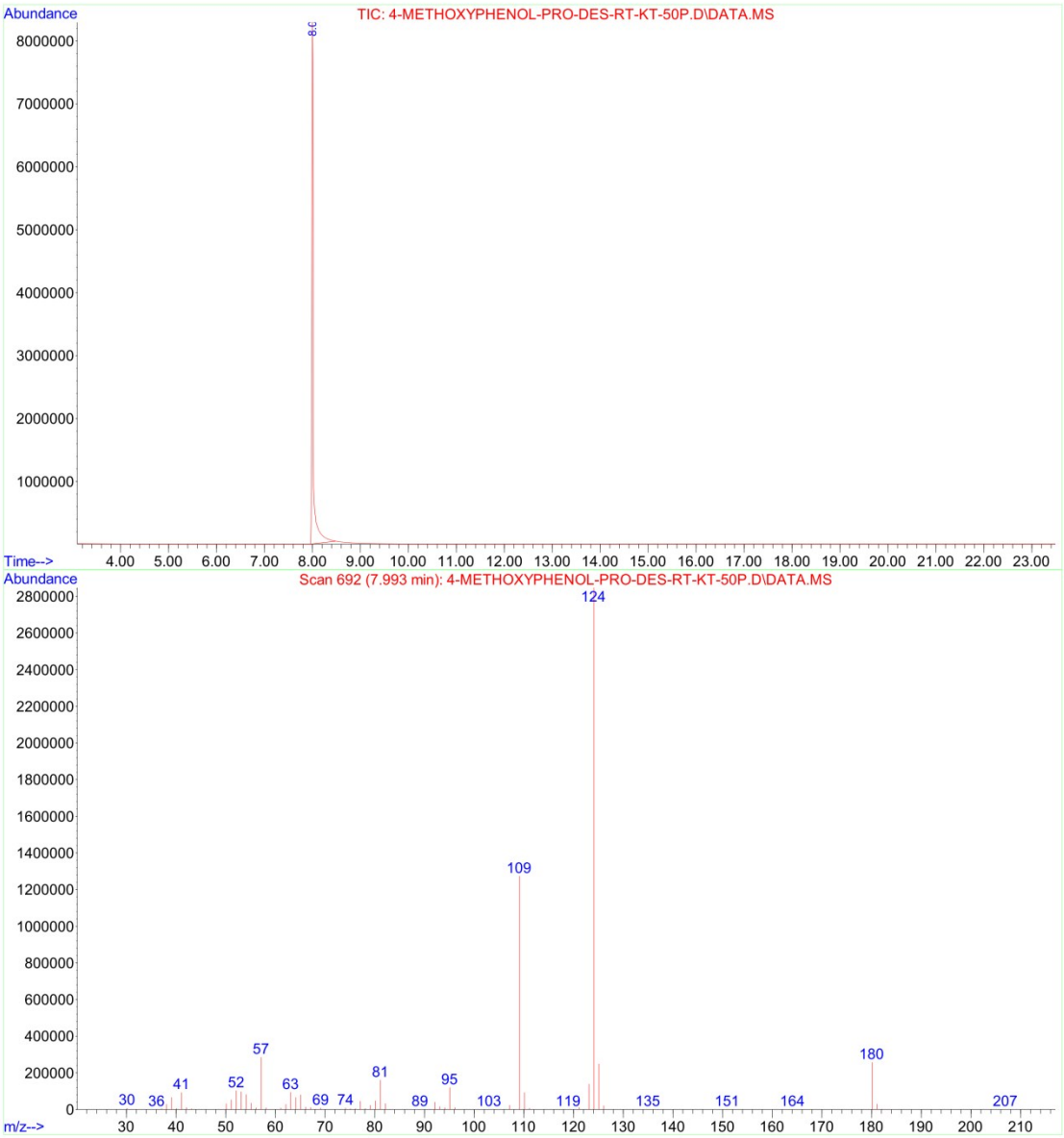


^{1}H-NMR, ^{13}C-NMR and GC-MS of 4-methoxyphenyl propionate

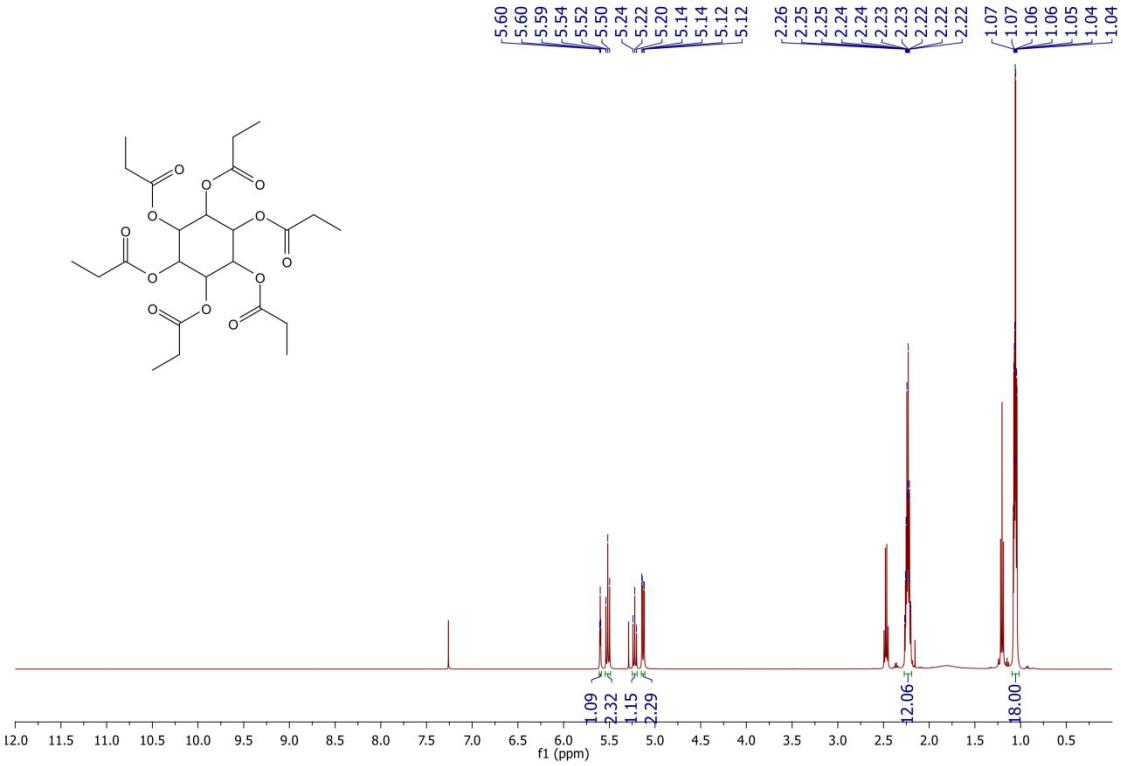


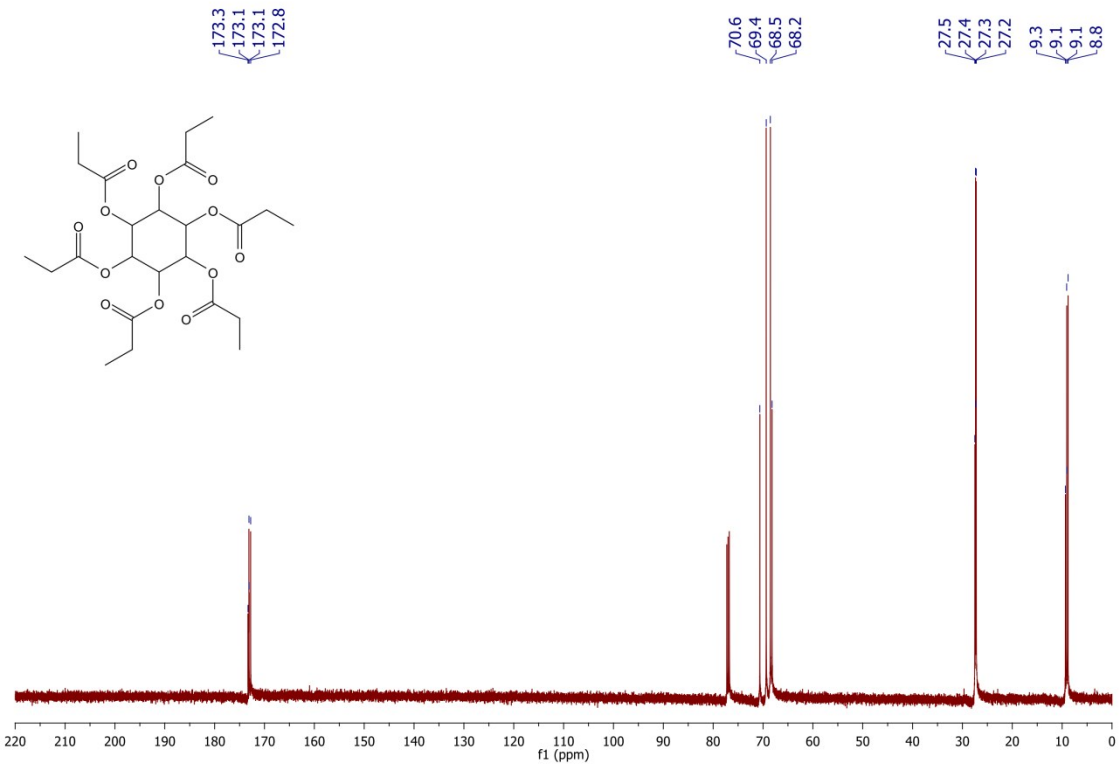


File :C:\GC-MS\2016\07.31.2016\4-METHOXYPHENOL-PRO-DES-RT-KT-50P.D
Operator : TRUONG HAI
Acquired : 31 Jul 2016 16:02 using AcqMethod ACYLATION-SHORT-DELAY-3MIN.M
Instrument : GCMSD
Sample Name: 4-METHOXYPHENOL-PRO-DES-RT-KT-50P
Misc Info :
Vial Number: 3

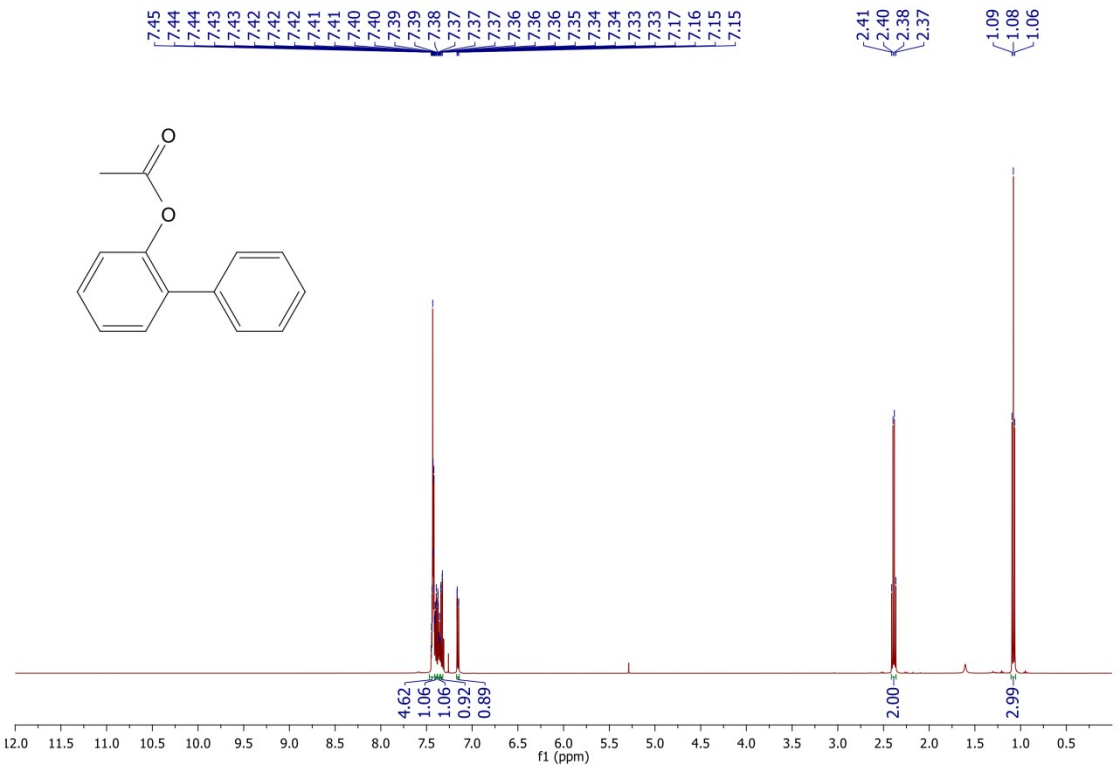


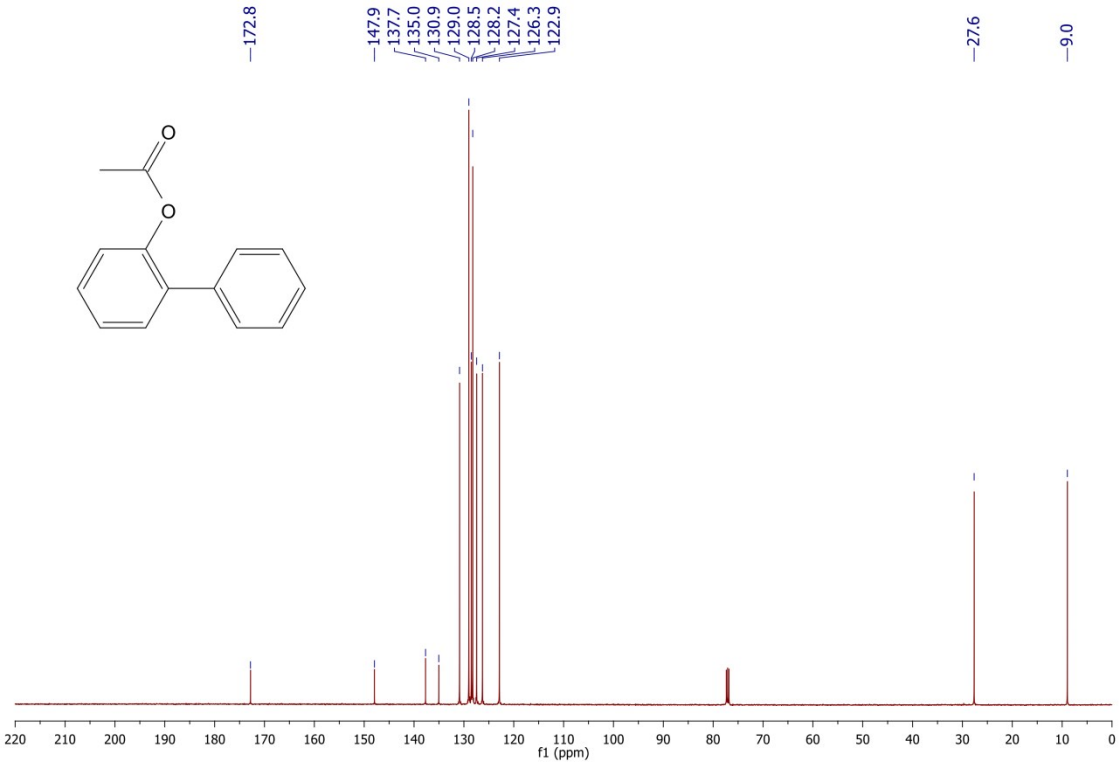
^{1}H-NMR and ^{13}C-NMR of (1R,2r,3S,4R,5s,6S)-cyclohexane-1,2,3,4,5,6-hexayl hexapropionate





^{1}H-NMR, ^{13}C-NMR and GC-MS of [1,1'-biphenyl]-2-yl propionate





File :C:\GC-MS\2016\07.28.2016\1-HYDROXYBIPHENYL-PRO-1-5-DES-KT-RT
... -50P.D
Operator : TRUONG HAI
Instrument : GCMSD
Acquired : 28 Jul 2016 13:27 using AcqMethod ACYLATION-SHORT-DELAY-3MIN.M
Sample Name: 1-HYDROXYBIPHENYL-PRO-1-5-DES-KT-RT-50P
Misc Info :