Supplementary Information

Direct Transformation of Benzyl Esters to Esters, Amides, and Anhydrides using Catalytic Ferric(III) Chloride under Mild Conditions

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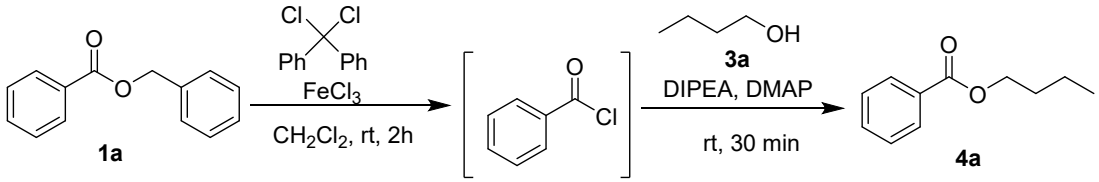
General Information

All the reagents and solvents used in this study are purchased from Sigma-Aldrich (St. Louis, MO, USA), Tokyo Chemical Industry Co., Ltd (Tokyo, Japan), and Alfa Aesar (Ward Hill, MA, USA), and used without any purification. Reaction progress was analyzed by thin-layer chromatography (TLC) using silica gel 60 F254 pre-coated aluminum plate from Merck and TLC spots were observed under UV light (254nm) exposure. Flash chromatography was carried out using 230–400 mesh silica gel and analytical grade solvents. Stuart SMP10 Melting Point Apparatus was used to record melting points of products. Structure elucidation by NMR (^{1}H and ^{13}C NMR) was performed on Bruker Avance 400 MHz spectrometer. The chemical shifts were reported in δ units (ppm) relative to the residual protonated solvent resonance, the coupling constants (J) quoted in Hz, and multiplicity of signals was abbreviated as follows: singlet (s); doublet (d); doublet of doublet (dd); triplet (t); multiplet (m).

Table S1. Screening of amounts of reagents for esterification[a]

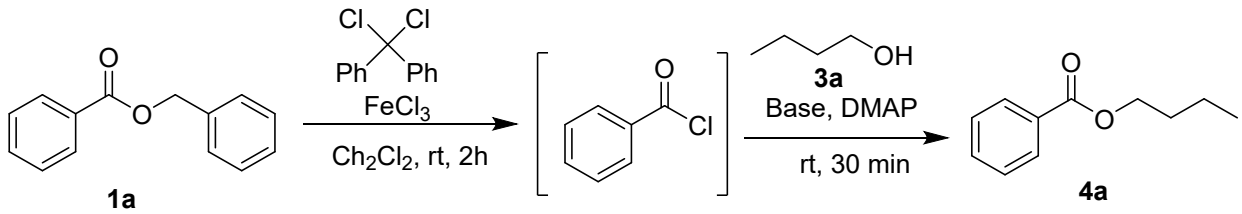


Entry	dichlorodiphenylmethane (equiv.)	$FeCl_3$ (mol%)	Base	Yield[b] (%)
1	1.2	0.5	DIPEA	46
2	1.2	1.0	DIPEA	57
3	1.2	2.0	DIPEA	82
4	1.2	5.0	DIPEA	93
5	1.2	10.0	DIPEA	93
6	1.2	20.0	DIPEA	93
7	2.0	5.0	DIPEA	93
8	1.5	5.0	DIPEA	93
9	1.2	5.0	DIPEA	93
10	1.0	5.0	DIPEA	90

[a] Reaction conditions: compound **1a** (1.0 mmol), α,α-dichlorodiphenylmethane (1.2 mmol), $FeCl_3$ (5 mol%), CH_2Cl_2 (2 mL), r.t., 2 h, n-butyl alcohol **2a** (1.2 mmol), base (1.5 mmol), DMAP (0.2 mmol).

[b] Isolated yield after purification of flash column chromatography.

Table S2. Screening of reaction conditions of for esterification[a]



Entry	dichlorodiphenylmethane (equiv.)	$FeCl_3$ (mol %)	Base	Yield[b] (%)
10	1.2	5.0	Pyridine	71
11	1.2	5.0	$NaHCO_3$	73
12	1.2	5.0	K_2CO_3	68
13	1.2	5.0	Cs_2CO_3	64
14	1.2	5.0	DIPEA	93

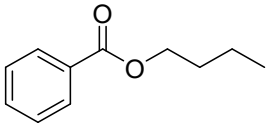
[a] Reaction conditions: compound **1a** (1.0 mmol), α,α-dichlorodiphenylmethane (1.2 mmol), $FeCl_3$ (5 mol%), CH_2Cl_2 (2 mL), r.t., 2 h, n-butyl alcohol **3a** (1.2 mmol), base (1.5 mmol), DMAP (0.2 mmol).

[b] Isolated yield after purification of flash column chromatography.

General procedure for the synthesis of esters 4a – 4i and 5a – 5r

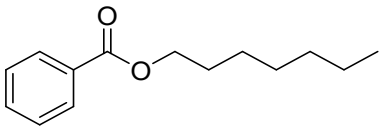
Dichlorodiphenylmethane (0.283 g, 1.20 mmol) and $FeCl_3$ (0.0081 g, 5.0 mol%) were added to benzyl benzoate (1a) (0.212 g, 1.00 mmol) in CH2Cl2 (2 mL). The mixture was stirred at room temperature for 2 h. Butyl alcohol (2a) (0.088 g, 1.20 mmol), DIPEA (0.217 g, 1.50 mmol), and DMAP (0.024 g, 0.20 mmol) were added to the reaction mixture and stirred for 30 min at room temperature. The mixture was then neutralize with HCl 1N (30mL) to remove the amines DMAP and DIPEA, and extracted with CH_2Cl_2 (2 × 30 mL). The organic layer was dried over sodium sulfate and concentrated under reduced pressure. The resulting residue was purified by flash column chromatography on silica gel with hexane-EtOAc as an eluent to afford the desired product (4a) (0.165 g, 93%).

Butyl benzoate (4a)



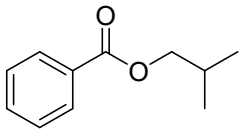
4a was obtained in 93% yield (165.5 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (dd, J = 3.2 Hz, J = 4.8 Hz, 2H), 7.55 (m, 1H), 7.44 (m, 2H), 4.33 (t, J = 6.4 Hz, 2H), 1.79-1.72 (m, 2H), 1.53-1.44 (m, 2H), 0.98 (t, J = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.7, 132.8, 130.5, 129.5 (2C), 128.3 (2C), 64.8, 30.8, 19.3, 13.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{15}O_2$ = 179.1072; found 179.1075.

Heptyl benzoate (4b)



4b was obtained in 91% yield (200.2 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, J = 8.4 Hz, 2H), 7.55 (m, 1H), 7.44 (m, 2H), 4.32 (t, J = 6.8 Hz, 2H), 1.81-1.74 (m, 2H), 1.47-1.29 (m, 8H), 0.89 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.7, 132.8, 130.6, 129.5 (2C), 128.3 (2C), 65.2, 31.8, 28.9, 28.7, 26.0, 22.6, 14.1; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{21}O_2$ = 221.1542; found 221.1543.

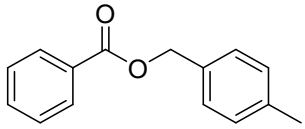
Isobutyl benzoate (4c)



4c was obtained in 95% yield (169.1 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07-8.05 (m, 2H), 7.55 (m, 1H), 7.44 (m, 2H), 4.12 (d, J = 6.4 Hz, 2H), 2.09 (m, 1H), 1.04 (d, J = 6.4 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.6, 132.8, 130.6, 129.5 (2C), 128.3 (2C),

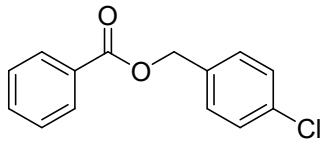
71.0, 27.9, 19.2 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{15}O_2$ = 179.1072; found 179.1075.

4-methylbenzyl benzoate (4d)



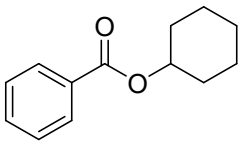
4d was obtained in 89% yield (201.1 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (d, J = 8.4 Hz, 2H), 7.56 (m, 1H), 7.43 (m, 2H), 7.35 (t, J = 7.6 Hz, 2H), 7.22 (d, J = 7.6 Hz, 2H), 5.34 (s, 2H), 2.37 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.5, 138.1, 133.1, 133.0, 130.3, 129.7 (2C), 129.3 (2C), 128.4 (2C), 128.3 (2C), 66.7, 21.3; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{15}O_2$ = 227.1072; found 227.1076.

4-chlorobenzyl benzoate (4e)



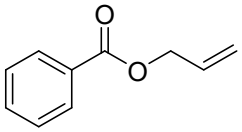
4e was obtained in 90% yield (221.4 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08-8.06 (m, 2H), 7.59-7.55 (m, 1H), 7.46-7.43 (m, 2H), 7.40-7.35 (m, 4H), 5.33 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.3, 134.6, 134.2, 133.2, 129.9, 129.7 (2C), 129.6 (2C), 128.8 (2C), 128.4 (2C), 65.9; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{12}ClO_2$ = 247.0526; found 247.0522.

Cyclohexyl benzoate (4f)



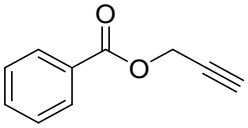
4f was obtained in 86% yield (175.7 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07-8.04 (dd, J = 8.4, 1.6 Hz, 2H), 7.54 (m, 1H), 7.43 (m, 2H), 5.04 (qu, J = 4.8 Hz, 1H), 1.97-1.93 (m, 2H), 1.81-1.75 (m, 2H), 1.62-1.56 (m, 3H), 1.50-1.41 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.0, 132.7, 131.1, 129.5 (2C), 128.3 (2C), 73.0, 31.7 (2C), 25.5, 23.7 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{17}O_2$ = 205.1223; found 205.1226.

Allyl benzoate (4g)



4g was obtained in 88% yield (142.5 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, J = 7.2 Hz, 2H), 7.56 (m, 1H), 7.44 (m, 2H), 6.08-6.01 (m, 1H), 5.44 (d, J = 17.6 Hz, 1H), 5.31 (d, J = 10.4 Hz, 1H), 4.84 (dd, J = 5.6, 2.4 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.3, 132.9, 132.3, 130.2, 129.7 (2C), 128.4 (2C), 118.2, 65.5; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{10}H_{11}O_2$ = 163.0754; found 163.0760.

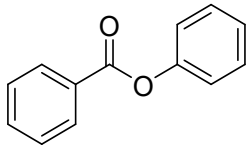
Prop-2-yn-1-yl benzoate (4h)



4h was obtained in 85% yield (136.1 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, J = 7.2 Hz, 2H), 7.58 (m, 1H), 7.45 (m, 2H), 4.93 (d, J = 2.4 Hz, 2H), 2.51 (t, J = 4.8, 1H);

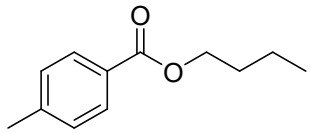
^{13}C NMR (100 MHz, $CDCl_3$) δ 165.8, 133.3, 129.8 (2C), 129.4, 128.4 (2C), 74.9, 52.5; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{10}H_9O_2$ = 161.0603; found 161.0605.

Phenyl benzoate (4i)



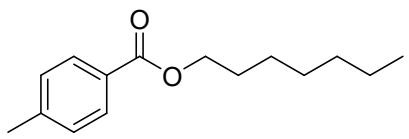
4i was obtained in 90% yield (178.2 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (d, J = 7.2 Hz, 2H), 7.65 (m, 1H), 7.53 (m, 2H), 7.45 (m, 2H), 7.31-7.23 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.2, 151.0, 133.6, 130.2 (2C), 129.6 (2C), 129.5, 128.6 (2C), 125.9, 121.8 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{11}O_2$ = 199.0759; found 199.0757.

Butyl 4-methylbenzoate (5a)



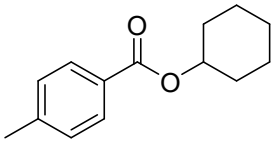
5a was obtained in 90% yield (172.9 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, J = 8.0 Hz, 2H), 7.24 (t, J = 8.0 Hz, 2H), 4.31 (t, J = 6.4 Hz, 2H), 4.41 (s, 3H), 1.78-1.71 (m, 2H), 1.51-1.43 (m, 2H), 0.98 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.8, 143.4, 129.6 (2C), 129.0 (2C), 127.8, 64.7, 30.8, 21.7, 19.3, 13.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{12}H_{17}O_2$ = 193.1229; found 193.1227.

Heptyl 4-methylbenzoate (5b)



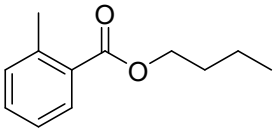
5b was obtained in 87% yield (203.7 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, J = 8.4 Hz, 2H), 7.24 (d, J = 8.4 Hz, 2H), 4.30 (t, J = 6.8 Hz, 2H), 2.41 (s, 3H), 1.76-1.74 (m, 2H), 1.32-1.29 (m, 8H), 0.89 (t, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.8, 143.4, 129.6 (2C), 129.0 (2C), 127.8, 64.9, 31.8, 28.9, 28.8, 26.0, 22.6, 21.6, 14.1; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{23}O_2$ = 235.1693; found 235.1694.

Cyclohexyl 4-methylbenzoate (5c)



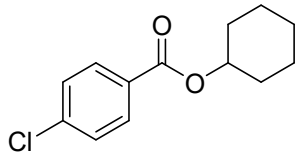
5c was obtained in 86% yield (187.6 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, J = 8.4 Hz, 2H), 7.24 (d, J = 8.4 Hz, 2H), 5.04-5.00 (m, 1H), 2.41 (s, 3H), 1.96-1.92 (m, 2H), 1.78-1.77 (m, 2H), 1.59-1.54 (m, 3H), 1.46-1.43 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.1, 143.3, 129.6 (2C), 129.0 (2C), 128.3, 72.8, 31.7 (2C), 25.6, 23.7 (2C), 21.7; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{19}O_2$ = 219.1385; found 219.1388.

Butyl 2-methylbenzoate (5d)



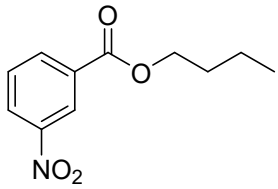
5d was obtained in 88% yield (169.0 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (d, J = 8.0 Hz, 1H), 7.39 (m, 1H), 7.25-7.22 (m, 2H), 4.31 (t, J = 6.8 Hz, 2H), 2.60 (s, 3H), 1.77-1.73 (m, 2H), 1.51-1.48 (m, 2H), 0.99 (t, J = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.8, 140.0, 131.8, 131.6, 130.5, 130.0, 125.7, 64.6, 30.8, 21.7, 19.4, 13.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{12}H_{17}O_2$ = 193.1229; found 193.1225.

Cyclohexyl 4-chlorobenzoate (5e)



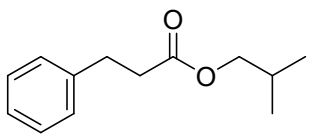
5e was obtained in 87% yield (207.0 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (d, J = 8.4 Hz, 2H), 7.41 (d, J = 8.4 Hz, 2H), 5.04-4.98 (m, 1H), 1.96-1.92 (m, 2H), 1.81-1.77 (m, 2H), 1.62-1.53 (m, 3H), 1.47-1.32 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.1, 139.1, 130.9 (2C), 129.5, 128.6 (2C), 73.4, 31.6 (2C), 25.4, 23.7 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{19}ClO_2$ = 239.0838; found 239.0839.

Butyl 3-nitrobenzoate (5f)



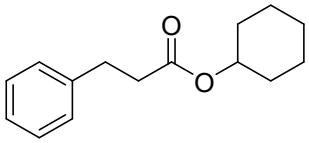
5f was obtained in 84% yield (187.3 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.85 (m, 1H), 8.42 (d, J = 8.4 Hz, 1H), 8.38 (d, J = 8.0 Hz, 2H), 7.65 (m, 1H), 4.39 (t, J = 6.8 Hz, 2H), 1.82-1.75 (m, 2H), 1.52-1.46 (m, 2H), 0.99 (t, J = 7.6 Hz, 3H) ; ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.5, 148.3, 135.3, 132.3, 129.6, 127.3, 124.5, 65.8, 30.7, 19.2, 13.7; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{14}NO_4$ = 224.0923; found 224.0920.

Isobutyl 3-phenylpropanoate (5g)



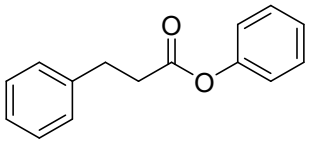
5g was obtained in 84% yield (173.1 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31-7.27 (m, 2H), 7.22-7.18 (m, 3H), 3.87 (d, J = 6.4 Hz, 2H), 2.97 (t, J = 7.6 Hz, 2H), 2.65 (t, J = 7.6 Hz, 2H), 1.94-1.87 (m, 1H), 0.91 (d, J = 6.8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.0, 140.6, 128.5 (2C), 128.3 (2C), 126.2, 70.6, 35.9, 31.0, 27.7, 19.1 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{19}O_2$ = 207.1385; found 207.1386.

Cyclohexyl 3-phenylpropanoate (5h)



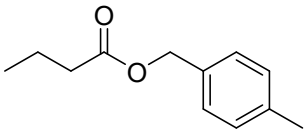
5h was obtained in 83% yield (192.6 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.26 (m, 2H), 7.22-7.18 (m, 3H), 4.79-4.73 (m, 1H), 2.95 (t, J = 7.6 Hz, 2H), 2.61 (t, J = 7.6 Hz, 2H), 1.83-1.79(m, 2H), 1.71-1.68 (m, 2H), 1.54-1.52 (m, 1H), 1.39-1.26 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.4, 140.7, 128.4 (2C), 128.3 (2C), 126.2, 72.7, 36.3, 31.6 (2C), 31.1, 25.4, 23.8 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{21}O_2$ = 233.1542; found 233.1544.

Phenyl 3-phenylpropanoate (5i)



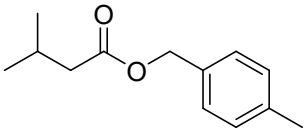
5i was obtained in 81% yield (183.1 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39-7.32 (m, 4H), 7.29-7.21 (m, 4H), 7.04 (d, J = 8.4 Hz, 2H), 3.09 (t, J = 7.6 Hz, 2H), 2.90 (t, J = 7.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.4, 150.7, 140.2, 129.4 (2C), 128.6 (2C), 128.4 (2C), 126.5, 125.8, 121.6 (2C), 36.0, 31.0; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{15}O_2$ = 227.1072; found 227.1075.

4-methylbenzyl butyrate (5j)



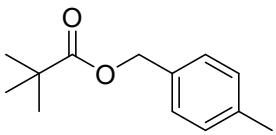
5j was obtained in 90% yield (172.9 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (d, J = 8.0 Hz, 2H), 7.18 (m, 2H), 5.08 (s, 2H), 2.35 (s, 3H), 2.33 (t, J = 7.2 Hz, 2H), 1.70-1.65 (m, 2H), 0.95 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.5, 138.0, 133.2, 129.2 (2C), 128.3 (2C), 66.0, 36.3, 21.2, 18.5, 13.7; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{12}H_{17}O_2$ = 193.1229; found 193.1226.

4-methylbenzyl 3-methylbutanoate (5k)



5k was obtained in 89% yield (183.4 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (d, J = 8.0 Hz, 2H), 7.18 (d, J = 8.0 Hz, 2H), 5.08 (s, 2H), 2.35 (s, 3H), 2.34 (d, J = 6.8 Hz, 2H), 2.17-2.09 (m, 1H), 0.96 (d, J = 6.8 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.5, 138.0, 133.2, 129.2 (2C), 128.3 (2C), 65.9, 43.5, 25.7, 22.4 (2C), 21.2; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{19}O_2$ = 207.1385; found 207.1387.

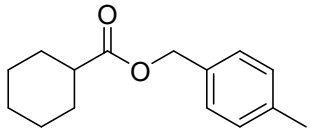
4-methylbenzyl pivalate (5l)



5l was obtained in 84% yield (173.1 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (d, J = 8.0 Hz, 2H), 7.18 (m, 2H), 5.07 (s, 2H), 2.36 (s, 3H), 1.22 (s, 9H); ^{13}C NMR (100

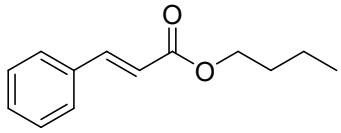
MHz, $CDCl_3$) δ 178.4, 137.7, 133.5, 129.2 (2C), 127.9 (2C), 66.0, 38.8, 27.2 (3C), 21.2; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{19}O_2$ = 207.1385; found 207.1383.

4-methylbenzyl cyclohexanecarboxylate (5m)



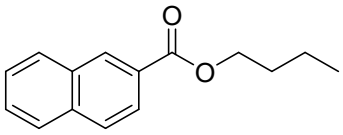
5m was obtained in 83% yield (192.7 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (d, J = 8.0 Hz, 2H), 7.18 (m, 2H), 5.07 (s, 2H), 2.35 (s, 3H), 1.94-1.91 (m, 2H), 1.77-1.74 (m, 2H), 1.65-1.62 (m, 1H), 1.48-1.44 (m, 2H), 1.29-1.23 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.9, 137.9, 133.3, 129.2 (2C), 128.1 (2C), 65.9, 43.3, 29.0 (2C), 25.8, 25.5 (2C), 21.2; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{21}O_2$ = 233.1542; found 233.1546.

Butyl cinnamate (5n)



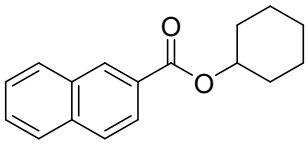
5n was obtained in 90% yield (183.6 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, J = 16.0 Hz, 1H), 7.54-7.52 (m, 2H), 7.39-7.36 (m, 3H), 6.46 (s, 3H), 1.94-1.91 (d, J = 16.0 Hz, 1H), 4.22 (t, J = 6.8 Hz, 2H), 1.73-1.66 (m, 2H), 1.49-1.42 (m, 2H), 0.97 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.1, 144.5, 134.5, 130.2, 128.9 (2C), 128.0 (2C), 118.3, 64.4, 30.8, 19.2, 13.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{17}O_2$ = 205.1229; found 205.1228.

Butyl cinnamate (5o)



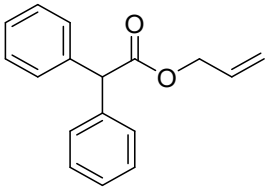
5o was obtained in 91% yield (207.5 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.60 (s, 1H), 8.07-8.05 (m, 1H), 7.96 (d, J = 8.0 Hz, 1H), 7.88 (d, J = 8.8 Hz, 2H), 7.58-7.53 (m, 2H), 4.39 (t, J = 6.8 Hz, 2H), 1.82-1.77 (m, 2H), 1.57-1.53 (m, 2H), 0.93 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.9, 135.5, 132.5, 130.9, 129.3, 128.2, 128.2 (2C), 127.8, 126.6, 125.3, 65.0, 30.9, 19.3, 13.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{17}O_2$ = 229.1229; found 229.1225.

Cyclohexyl 2-naphthoate (5p)



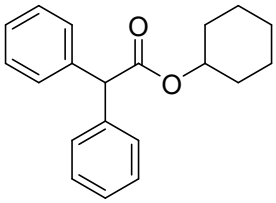
5p was obtained in 87% yield (221.0 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.61 (s, 1H), 8.09-8.08 (m, 1H), 7.98 (d, J = 8.0 Hz, 1H), 7.89 (d, J = 8.8 Hz, 2H), 7.60-7.52 (m, 2H), 5.14-5.07 (m, 1H), 2.04-1.99 (m, 2H), 1.86-1.83 (m, 2H), 1.70-1.59 (m, 3H); 1.51-1.39 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.2, 135.5, 132.5, 130.9, 129.3, 128.3, 128.1, 128.0, 127.8, 126.6, 125.4, 73.3, 31.8 (2C), 25.5, 23.8 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{19}O_2$ = 255.1385; found 255.1386.

Allyl 2,2-diphenylacetate (5q)



5q was obtained in 88% yield (221.7 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.27 (m, 8H), 7.24-7.19 (m, 2H), 5.89-5.80 (m, 1H), 5.23-5.14 (m, 2H), 5.01 (s, 1H), 4.62-4.60 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.1, 138.6, 131.9, 128.6 (8C), , 127.3, 118.5, 65.7, 57.1; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{17}H_{17}O_2$ = 253.1229; found 253.1226.

Cyclohexyl 2,2-diphenylacetate (5r)

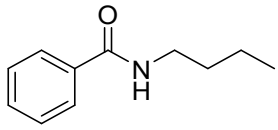


5r was obtained in 86% yield (252.8 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32-7.22 (m, 10H), 4.99 (s, 1H), 4.88-4.82 (m, 1H), 1.94-1.62 (m, 10H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.9, 138.9 (2C), 128.6 (4C), 128.5 (4C), 127.1 (2C), 73.4, 57.4, 31.4 (2C), 25.4, 23.6 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{20}H_{23}O_2$ = 295.1698; found 295.1694.

General procedure for the synthesis of amides 7a – 7l

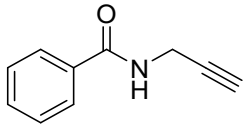
Dichlorodiphenylmethane (0.283 g, 1.20 mmol) and $FeCl_3$ (0.0081 g, 0.05 mmol) were added to benzyl benzoate (**1a**) (0.212 g, 1.00 mmol) in CH_2Cl_2 (2 mL). The mixture was stirred at room temperature for 2 h. *N*-Butylamine (**6a**) (0.088 g, 1.20 mmol) and DIPEA (0.0.217 g, 1.50 mmol) were added to the reaction mixture and stirred for 30 min at room temperature. The mixture was then neutralize with HCl 1N (30mL) to remove the amines and DIPEA, and extracted with CH_2Cl_2 (2 × 30 mL). The organic layer was dried over sodium sulfate and concentrated under reduced pressure. The resulting residue was purified by flash column chromatography on silica gel with hexane-EtOAc as an eluent to afford the desired product (**7a)** (0.163 g, 92%).

N-butylbenzamide (7a)



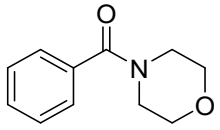
7a was obtained in 92% yield (162.8 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, J = 6.8 Hz, 2H), 7.48 (m, 1H), 7.42 (m, 2H), 6.16 (br s, 1H), 3.48-3.43 (m, 2H), 1.62-1.57 (m, 2H), 1.44-1.39 (m, 2H), 0.96 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.5, 134.9, 131.3, 128.5 (2C), 126.8 (2C), 39.8, 31.8, 20.2, 13.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{16}NO$ = 178.1232; found 178.1235.

***N*-(Prop-2-yn-1-yl)benzamide (7b)**



7b was obtained in 91% yield (144.7 mg), colourless oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, J = 7.2 Hz, 2H), 7.52 (m, 1H), 7.44 (m, 2H), 6.33 (br s, 1H), 4.26 (q, J = 2.8 Hz, 2H), 2.28 (t, J = 2.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.1, 133.8, 131.8, 128.7 (2C), 127.0 (2C), 79.5, 71.9, 29.82; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{10}H_{10}NO$ = 160.0762; found 160.0764.

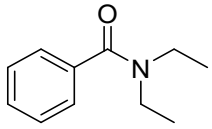
Morpholino(phenyl)methanone (7c)



7c was obtained in 89% yield (170.0 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42-7.37 (m, 5H), 3.692 (m, 8H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.5, 135.3, 129.9, 128.6 (2C),

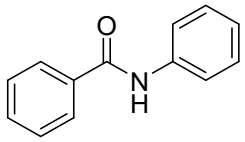
127.1 (2C), 66.9 (2C), 48.1, 42.6; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{14}NO_2$ = 192.1025; found 192.1027.

N,N-diethylbenzamide (7d)



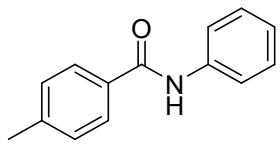
7d was obtained in 90% yield (159.3 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42-7.37 (m, 5H), 3.48-3.34 (m, 4H), 1.19 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.3, 137.2, 129.1, 128.4 (2C), 126.3 (2C), 43.2, 39.3, 14.2, 13.2; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{16}NO$ = 178.1232; found 178.1235.

N-phenylbenzamide (7e)



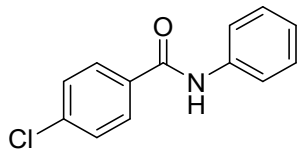
7e was obtained in 90% yield (177.3 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, J = 7.2 Hz, 2H), 7.80 (br s, 1H), 7.66 (d, J = 8.4 Hz, 2H), 7.56 (m, 1H), 7.50 (m, 2H), 7.38 (m, 2H), 7.16 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.7, 137.9, 135.1, 131.9, 129.1 (2C), 128.8 (2C), 127.0 (1C), 124.6 (2C), 120.2 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{12}NO$ = 198.0919; found 198.0917

4-methyl-N-phenylbenzamide (7f)



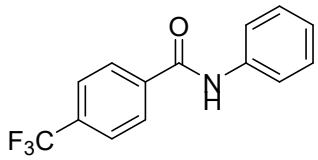
7f was obtained in 85% yield (179.4 mg); colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, J = 8.4 Hz, 3H), 7.65 (d, J = 7.6 Hz, 2H), 7.37 (m, 2H), 7.28 (m, 2H), 7.15 (m, 1H), 2.43 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.6, 142.4, 138.0, 132.2, 129.5 (2C), 129.1 (2C), 127.0, 124.5 (2C), 120.1 (2C), 21.5; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{14}NO$ = 212.1075; found 212.1078.

4-Chloro-*N*-phenylbenzamide (7g)



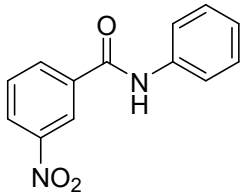
7g was obtained in 84% yield (194.0 mg), white solid, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83-7.81 (m, 2H), 7.75 (br s, 1H), 7.63 (d, J = 7.6 Hz, 2H), 7.48-7.46 (dd, J = 6.8, 2 Hz, 2H), 7.38 (m, 2H), 7.17 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.6, 138.2, 137.7, 133.4, 129.2 (2C), 129.1 (2C), 128.5 (2C), 124.8, 120.3 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{11}ClNO$ = 232.0529; found 232.0527.

N-phenyl-4-(trifluoromethyl)benzamide (7h)



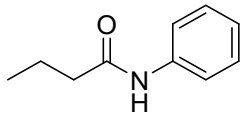
7h was obtained in 82% yield (217.3 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 10.47 (s, 1H), 8.17 (d, J = 8.0 Hz, 2H), 7.94 (d, J = 8.4 Hz, 2H), 7.80 (d, J = 8.4 Hz, 2H), 7.38 (t, J = 7.2 Hz,, 2H), 7.14 (t, J = 7.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.8, 139.3, 139.2, 131.7, 129.2 (2C), 129.1 (2C), 125.9, 125.8, 124.5, 120.9 (2C), 120.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{11}F_3NO$ = 266.0793; found 266.0796.

3-nitro-N-phenylbenzamide (7i)



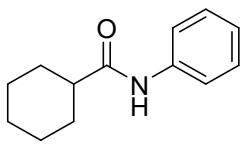
7i was obtained in 80% yield (193.5 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.70 (s, 1H), 8.42 (d, J = 8.4 Hz, 1H), 8.27 (d, J = 7.6 Hz, 1H), 7.92 (s, 1H), 7.71 (m, 1H), 7.66 (d, J = 7.6 Hz, 2H), 7.41 (m, 2H), 7.21 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.2, 148.3, 137.2, 136.6, 133.3, 130.2, 129.3 (2C), 126.4, 125.3, 121.8, 120.5 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{11}N_2O_3$ = 243.0764; found 243.0767.

N-phenylbutyramide (7j)



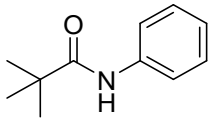
7j was obtained in 88% yield (143.4 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, J = 8.0 Hz, 2H), 7.31 (m, 2H), 7.19 (s, 1H), 7.10 (m, 1H), 2.34 (t, J = 7.2 Hz, 2H), 1.80-1.74 (m, 2H), 1.01 (t, J = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.2, 137.9, 129.0 (2C), 124.2, 119.8 (2C), 39.7, 19.1, 13.8;); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{10}H_{14}NO$ = 164.1070; found 164.1073.

N-phenylcyclohexanecarboxamide (7k)



7k was obtained in 90% yield (182.7 mg); yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, J = 8.0 Hz, 2H), 7.31 (m, 2H), 7.17 (br s, 1H), 7.09 (m, 1H), 2.22 (t, J = 3.2 Hz, 1H), 1.98 (d, J = 13.6 Hz, 2H), 1.86-1.83 (m, 2H), 1.72-1.69 (m, 1H), 1.57-1.53 (m, 2H), 1.33-1.27 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.3, 138.1, 128.9 (2C), 124.1, 119.7 (2C), 46.6, 29.7 (2C), 25.7 (3C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{13}H_{18}NO$ = 204.1383; found 204.1385.

N-phenylpivalamide (7l)

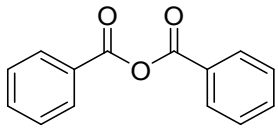


7l was obtained in 89% yield (157.6 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, J = 7.6 Hz, 2H), 7.32 (m, 2H), 7.10 (m, 1H), 1.32 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.5, 138.0, 128.9 (2C), 124.2, 119.9 (2C), 39.6, 27.7 (3C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{11}H_{16}NO$ = 178.1232; found 178.1230.

General procedure for the synthesis of anhydrides 9a – 9k

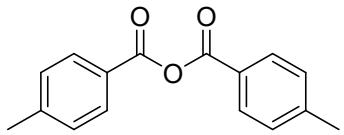
Dichlorodiphenylmethane (0.283 g, 1.20 mmol) and $FeCl_3$ (0.0081 g, 0.05 mmol) were added to benzyl benzoate (**1a**) (0.212 g, 1.00 mmol) in CH_2Cl_2 (2 mL). The mixture was stirred at room temperature for 2 h. Benzoic acid (**8a**) (0.146 g, 1.20 mmol) and DIPEA (0.0.217 g, 1.50 mmol) were added to the reaction mixture and stirred for 30 min at room temperature. The mixture was then neutralize with HCl 1N (30mL) to remove the DIPEA, and extracted with CH_2Cl_2 (2 × 30 mL). The organic layer was dried over sodium sulfate and concentrated under reduced pressure. The resulting residue was purified by flash column chromatography on silica gel with hexane-EtOAc as an eluent to afford the desired product (**9a**) (0.192 g, 85%).

Benzoic anhydride (9a)



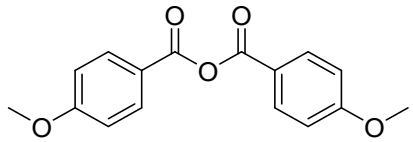
9a was obtained in 85% yield (192.1 mg), white solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (d, J = 8.4 Hz, 4H), 7.68 (m, 2H), 7.53 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.4 (2C), 134.5 (2C), 130.6 (4C), 128.9 (6C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{11}O_3$ = 227.0708; found 227.0705

4-Methylbenzoic anhydride (9b)



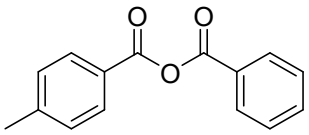
9b was obtained in 92% yield (233.7 mg), white solid, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (m, 4H), 7.35 (m, 4H), 2.48 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.6 (2C), 145.6 (2C), 130.6 (4C), 129.6 (4C), 126.3 (2C), 21.9 (2C). HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{16}H_{15}O_3$ = 255.1021; found 255.1020.

4-Methoxybenzoic anhydride (9c)



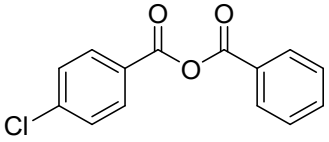
9c was obtained in 89% yield (254.5 mg), white solid, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.13 (m, 4H), 7.02 (m, 4H), 3.92 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.6 (2C), 162.3 (2C), 132.8 (4C), 121.32 (2C), 114.15 (4C), 55.61 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{16}H_{15}O_5$ = 287.0919; found 278.1016.

Benzoic 4-methylbenzoic anhydride (9d)



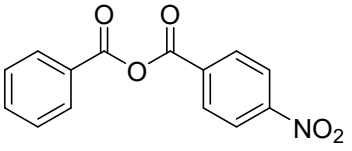
9d was obtained in 81% yield (194.4 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.17 (m, 2H), 8.06-8.03 (m, 2H), 7.67 (m, 1H), 7.53 (t, J = 8.0 Hz, 2H), 7.33-7.31 (m, 2H), 2.46 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.5, 162.4, 145.7, 134.4, 130.7 (2C), 130.6 (2C), 129.6 (2C), 128.8 (2C), 126.1 (2C), 21.9; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{15}H_{13}O_3$ = 241.0865; found 241.0861.

Benzoic 4-chlorobenzoic anhydride (9e)



9e was obtained in 76% yield (197.6 mg), yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (m, 2H), 8.09 (m, 2H), 7.69 (m, 1H), 7.56-7.50 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.1, 161.6, 141.2, 134.7, 131.9 (2C), 130.6 (2C), 129.3 (2C), 128.9 (2C), 128.7, 127.3; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{10}ClO_3$ = 261.0318; found 261.0315.

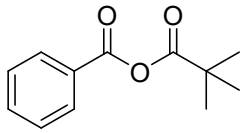
Benzoic 4-nitrobenzoic anhydride (9f)



9f was obtained in 74% yield (200.5 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40-8.33 (m, 4H), 8.18-8.14 (m, 2H), 7.72-7.58 (m, 1H), 7.56-7.54 (m, 2H); ^{13}C NMR (100 MHz,

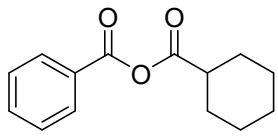
$CDCl_3$) δ 161.6, 160.6, 151.3, 135.1, 134.2, 131.6 (2C), 130.7 (2C), 129.6, 129.1 (2C), 124.0 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{10}NO_5$ = 272.0559; found 272.0557.

Benzoic pivalic anhydride (9g)



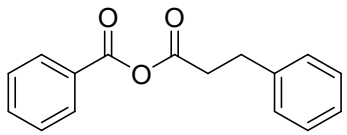
9g was obtained in 86% yield (177.2 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, J = 7.2 Hz, 2H), 7.64 (m, 1H), 7.49 (m, 2H), 1.37 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.8, 162.5, 134.3, 130.4 (2C), 129.0 (2C), 128.8, 40.37, 26.6 (3C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{12}H_{15}O_3$ = 207.1021; found 207.1023.

Benzoic cyclohexanecarboxylic anhydride (9h)



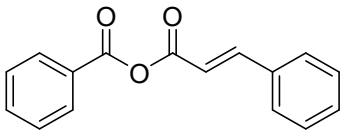
9h was obtained in 84% yield (194.9 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (d, J = 7.2 Hz, 2H), 7.92 (m, 1H), 7.77 (m, 2H), 2.91-2.84 (m, 1H), 2.36 (t, J = 8.4 Hz, 2H), 2.12-2.09 (m, 2H), 1.98-1.87 (m, 3H), 1.65-1.55 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.5, 162.6, 134.3, 130.4 (2C), 128.9 (2C), 128.8, 44.2, 28.5 (2C), 25.6, 25.2 (2C); HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{14}H_{17}O_3$ = 233.1178; found 233.1175.

Benzoic 3-phenylpropanoic anhydride (9i)



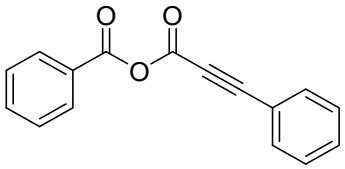
9i was obtained in 80% yield (203.2 mg), colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, J = 8.8 Hz, 2H), 7.56 (m, 1H), 7.49 (m, 2H), 7.37-7.27 (m, 5H), 3.11 (t, J = 7.6 Hz, 2H), 2.99 (t, J = 7.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.7, 162.3, 139.6, 134.4, 130.5 (2C), 128.9 (2C), 128.8 (2C), 128.7, 128.4 (2C), 126.6, 37.2, 30.4; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{16}H_{15}O_3$ = 255.1021; found 255.1020.

(*E*)-Benzoic cinnamic anhydride (9j)



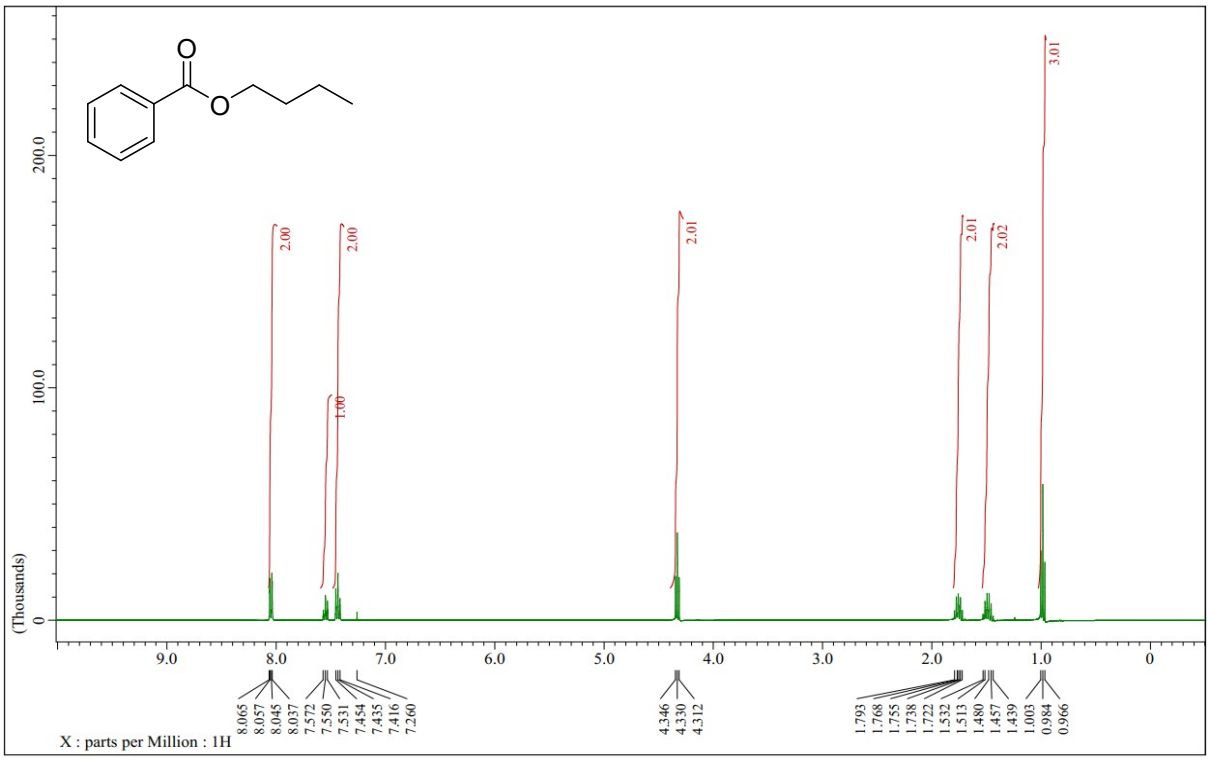
9j was obtained in 88% yield (221.8 mg), yellow oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (d, J = 7.2 Hz, 2H), 7.91 (d, J = 16 Hz, 1H), 7.65 (m, 1H), 7.60 (d, J = 7.6 Hz, 2H), 7.54-7.50 (m, 2H), 7.44-7.42 (m, 3H), 6.61 (d, J = 16 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.5, 162.4, 148.94, 134.4, 131.4, 130.5 (2C), 129.1 (2C), 128.8 (2C), 128.7 (2C), 116.8; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{16}H_{13}O_3$ = 253.0865; found 253.0863.

Benzoic 3-phenylpropiolic anhydride (9k)

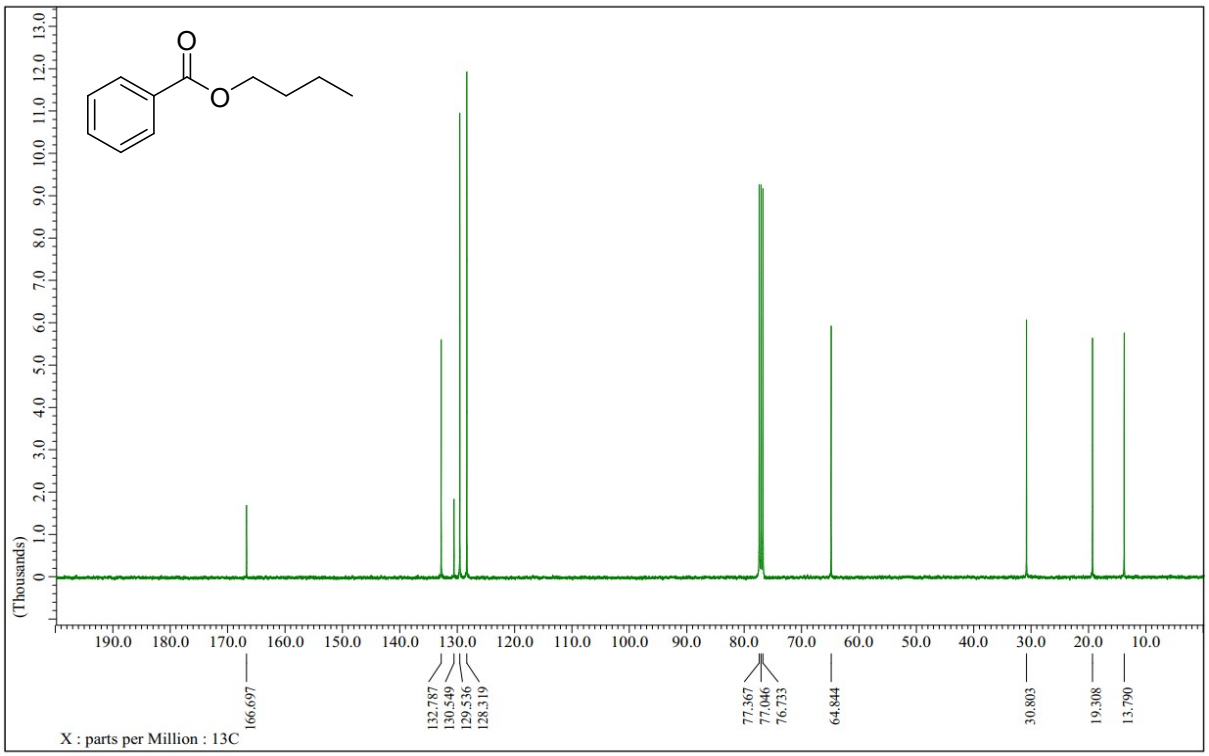


9k was obtained in 89% yield (222.5 mg), yellow oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18-8.12 (m, 2H), 7.70-7.64 (m, 3H), 7.55-7.51 (m, 3H), 7.44-7.42 (2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.4, 148.4, 134.8, 133.5 (2C), 131.5, 130.8 (2C), 130.6, 128.9 (2C), 128.8 (2C), 118.8, 90.8, 80.0; HRMS (ESI) m/z $(M+H)^+$ calcd for $C_{16}H_{11}O_3$ = 251.0708; found 251.0705.

Butyl benzoate (4a)

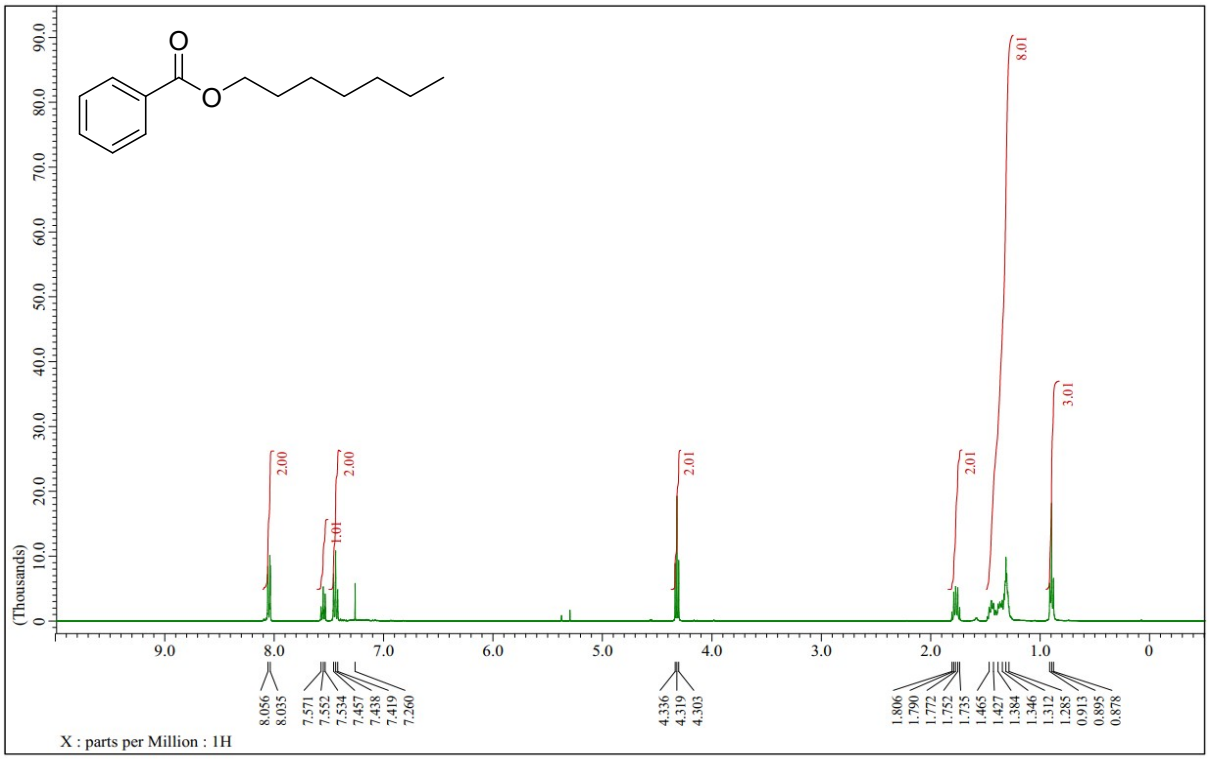


^{1}H NMR spectrum of butyl benzoate

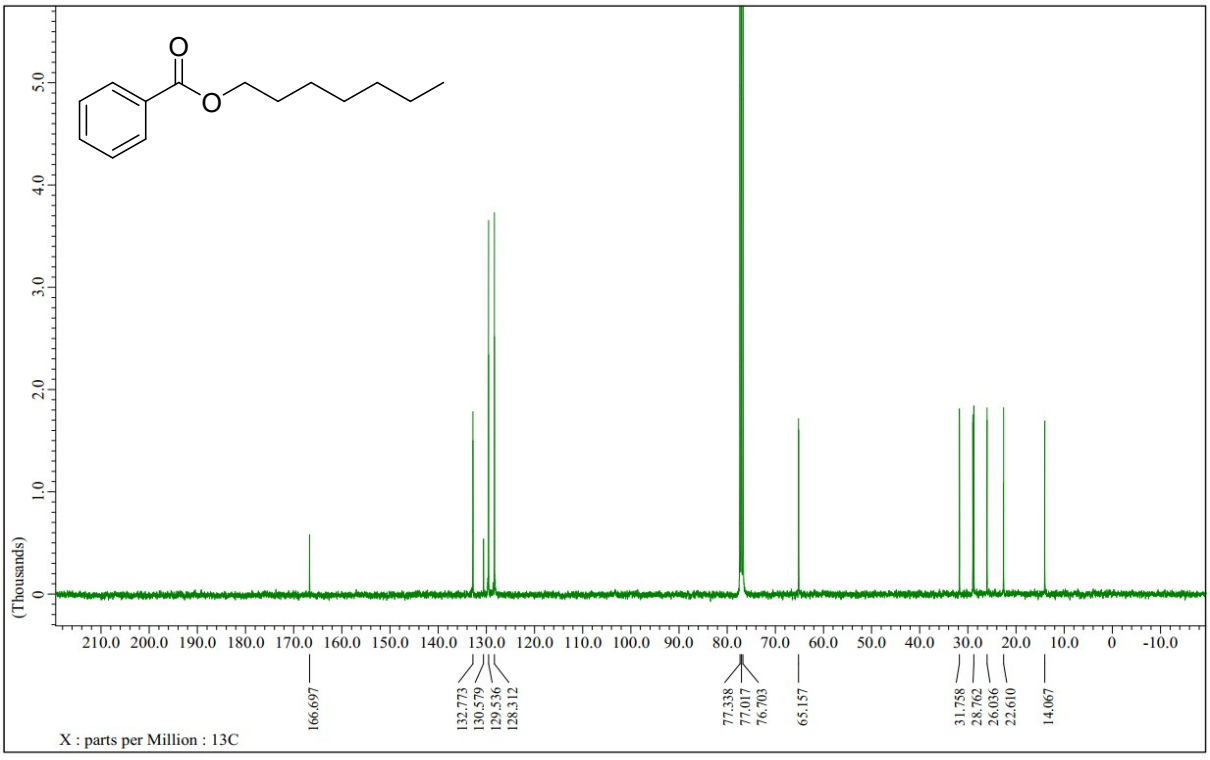


^{13}C NMR spectrum of butyl benzoate

Heptyl benzoate (4b)

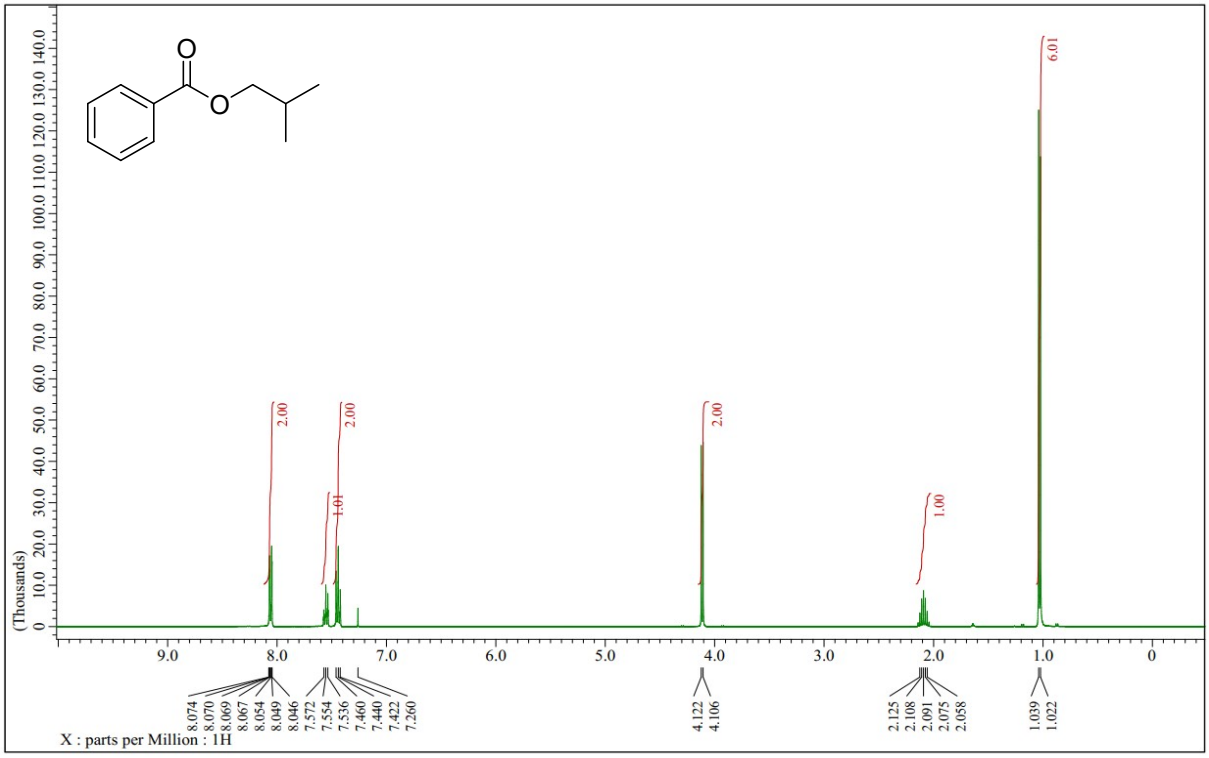


^{1}H NMR spectrum of heptyl benzoate

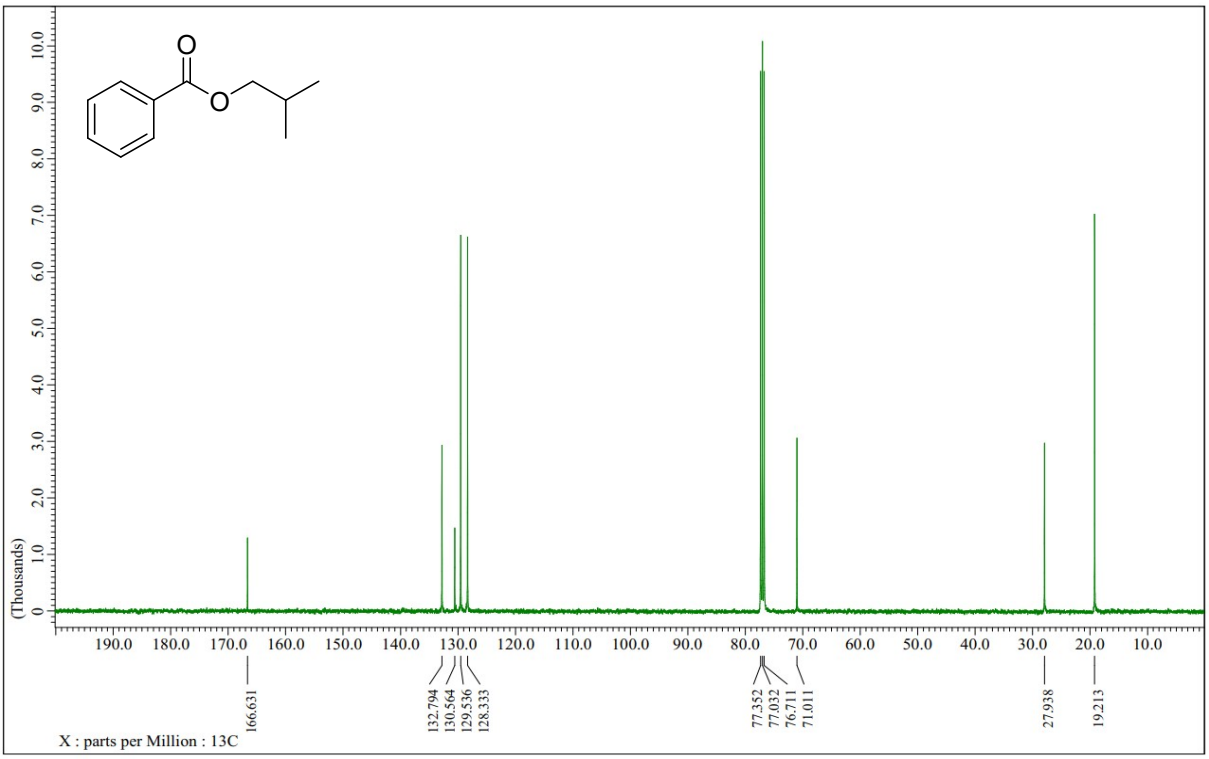


^{13}C NMR spectrum of heptyl benzoate

Isobutyl benzoate (4c)

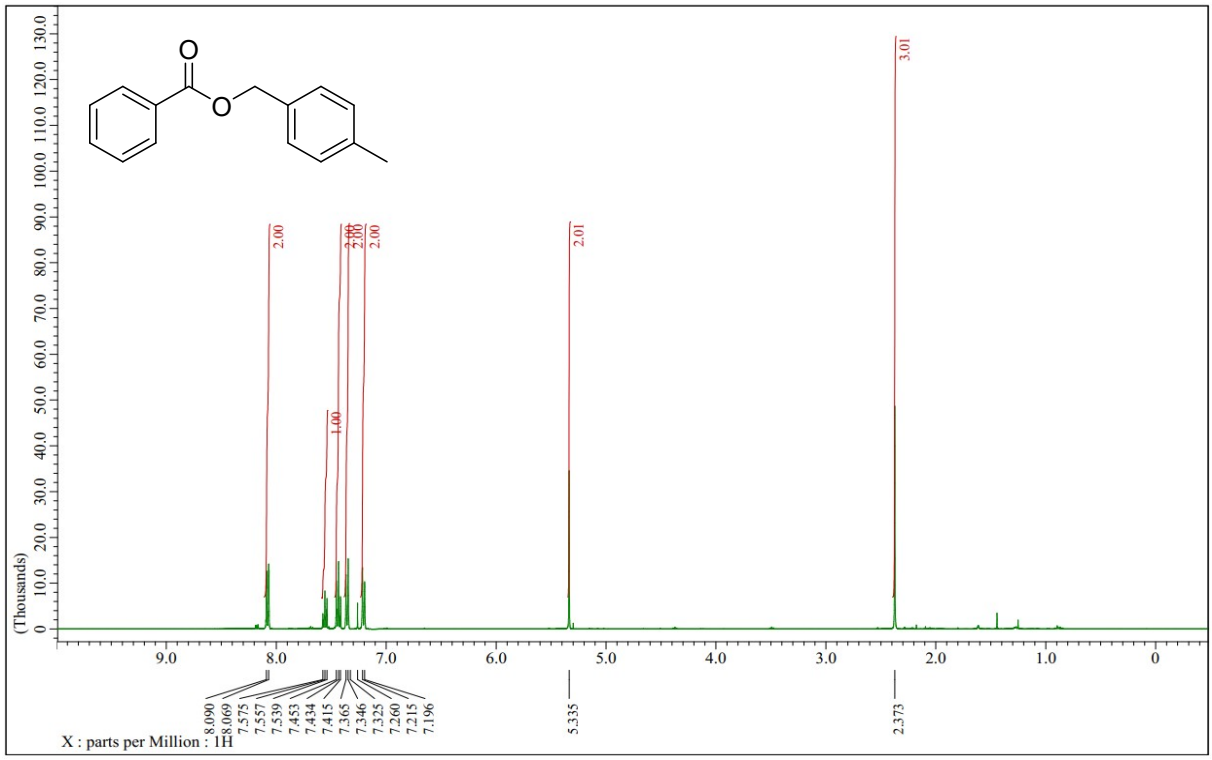


^{1}H NMR spectrum of isobutyl benzoate

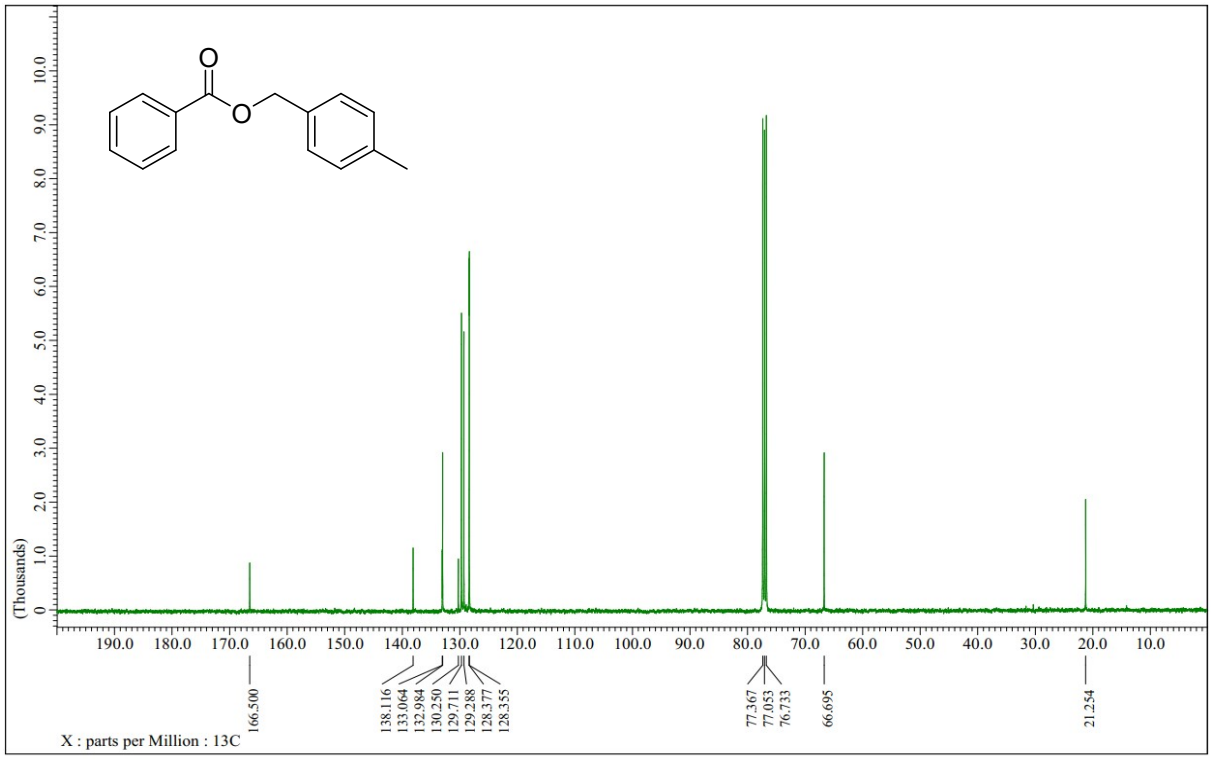


^{13}C NMR spectrum of isobutyl benzoate

4-methylbenzyl benzoate (4d)

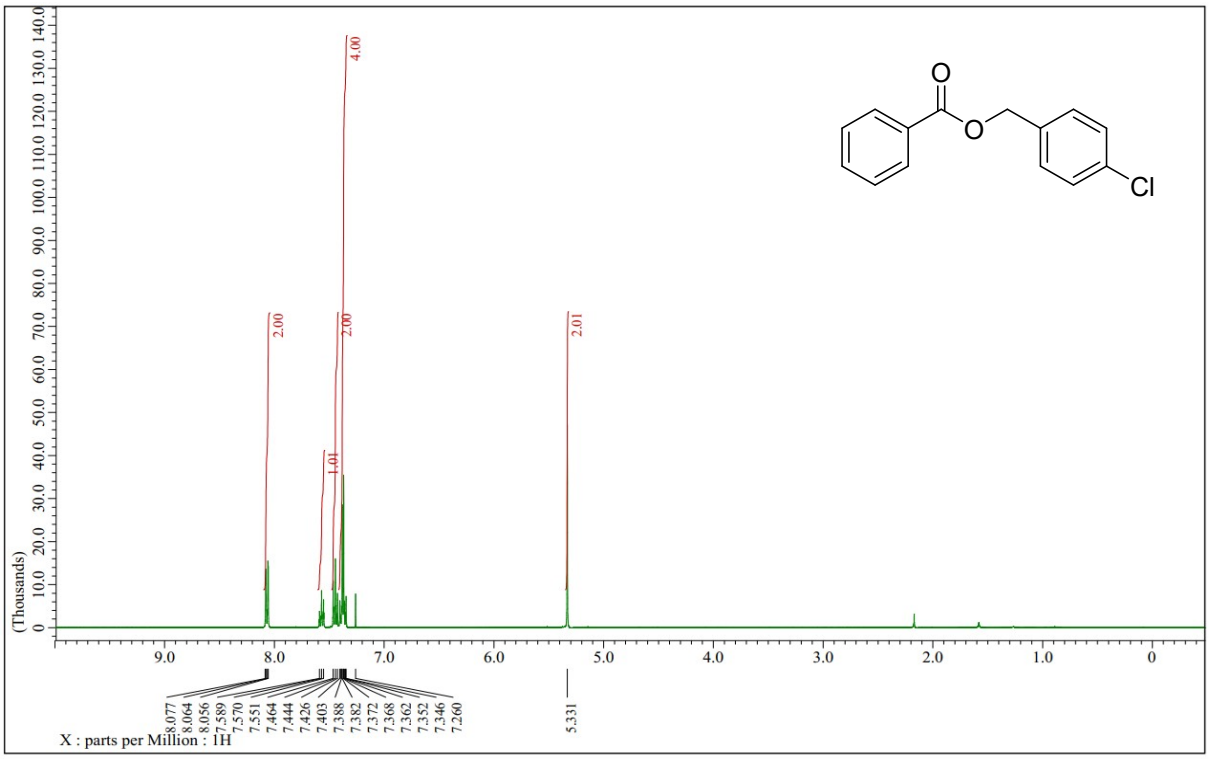


^{1}H NMR spectrum of 4-methylbenzyl benzoate

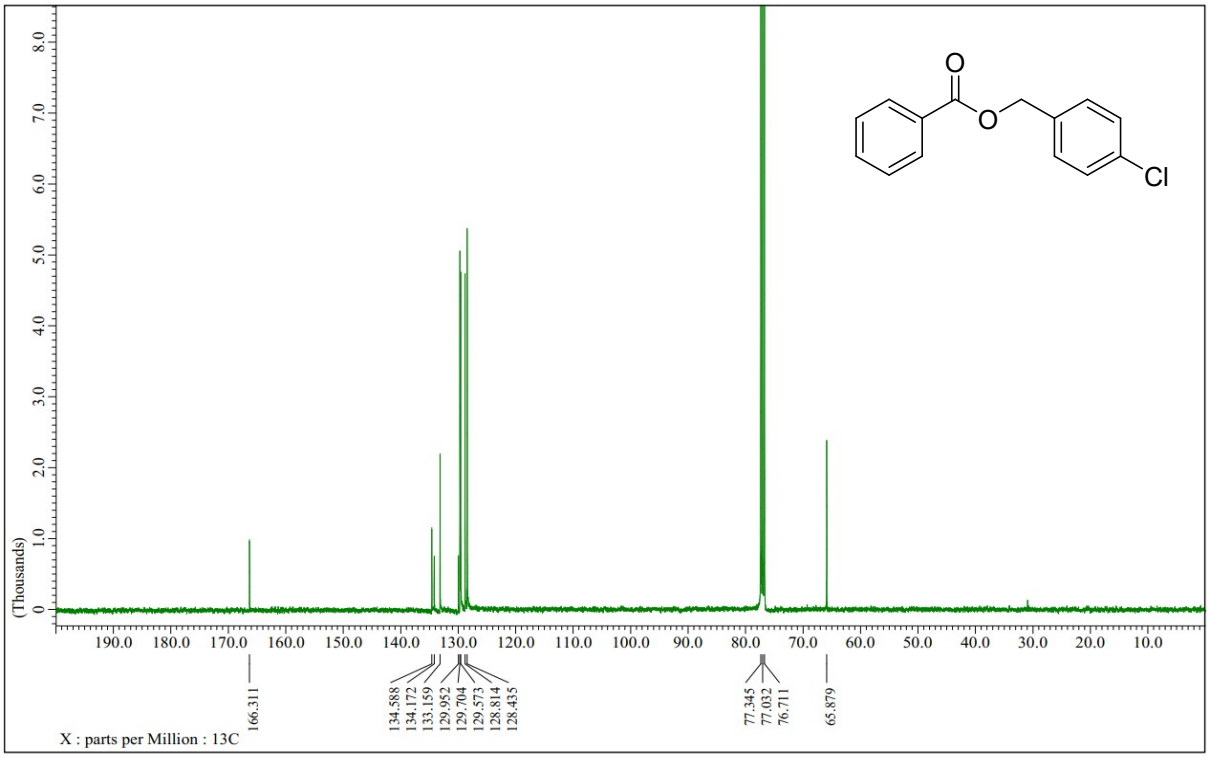


^{13}C NMR spectrum of 4-methylbenzyl benzoate

4-chlorobenzyl benzoate (4e)

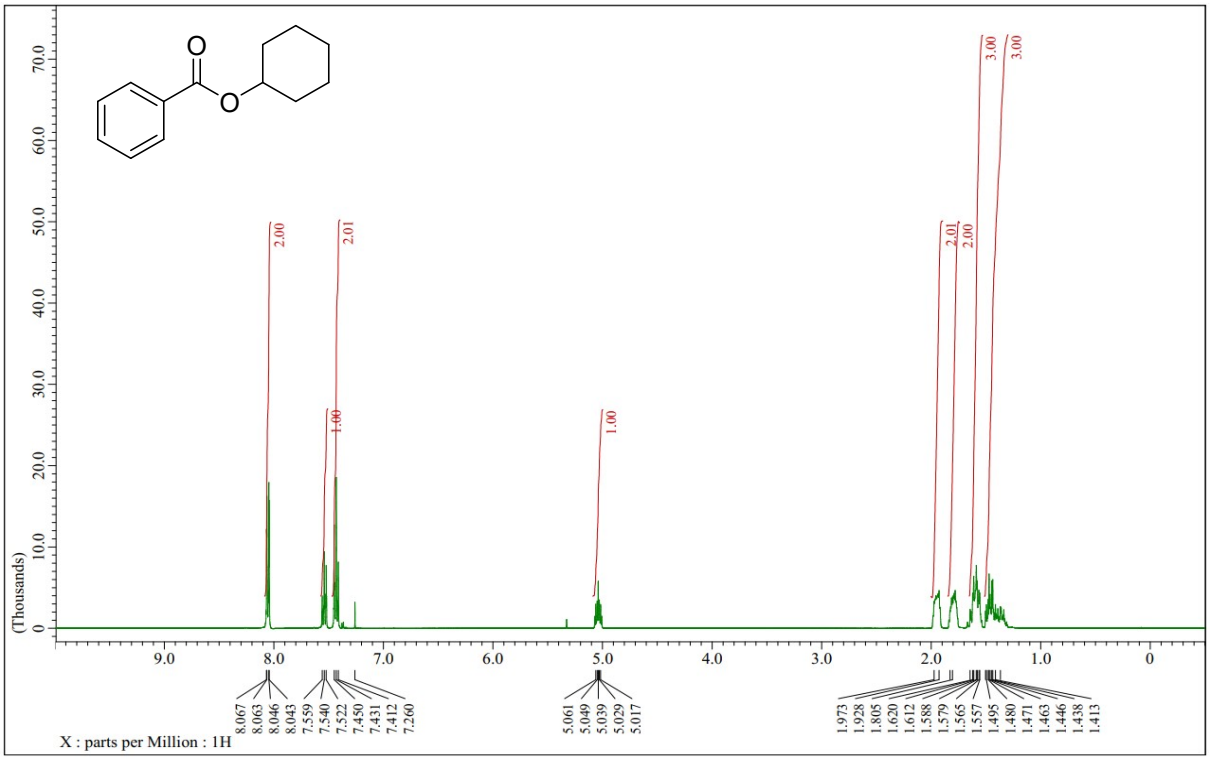


^{1}H NMR spectrum of 4-chlorobenzyl benzoate

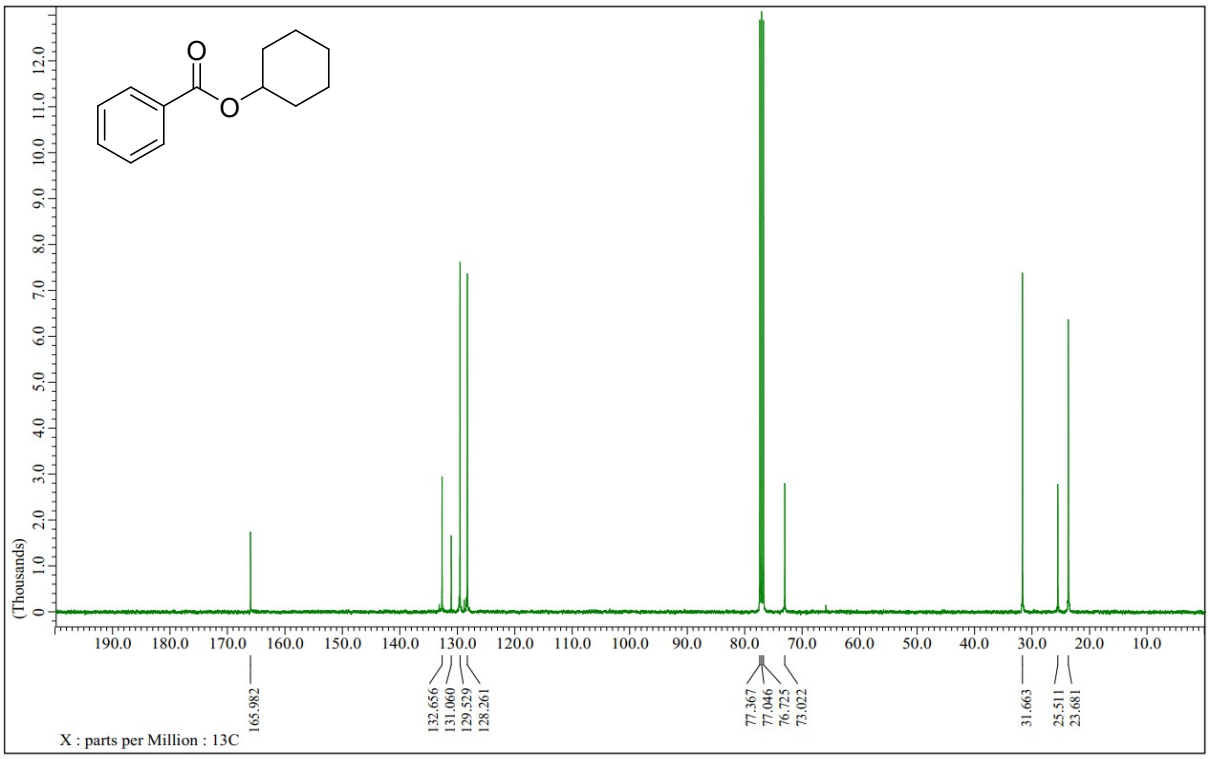


^{13}C NMR spectrum of 4-chlorobenzyl benzoate

Cyclohexyl benzoate (4f)

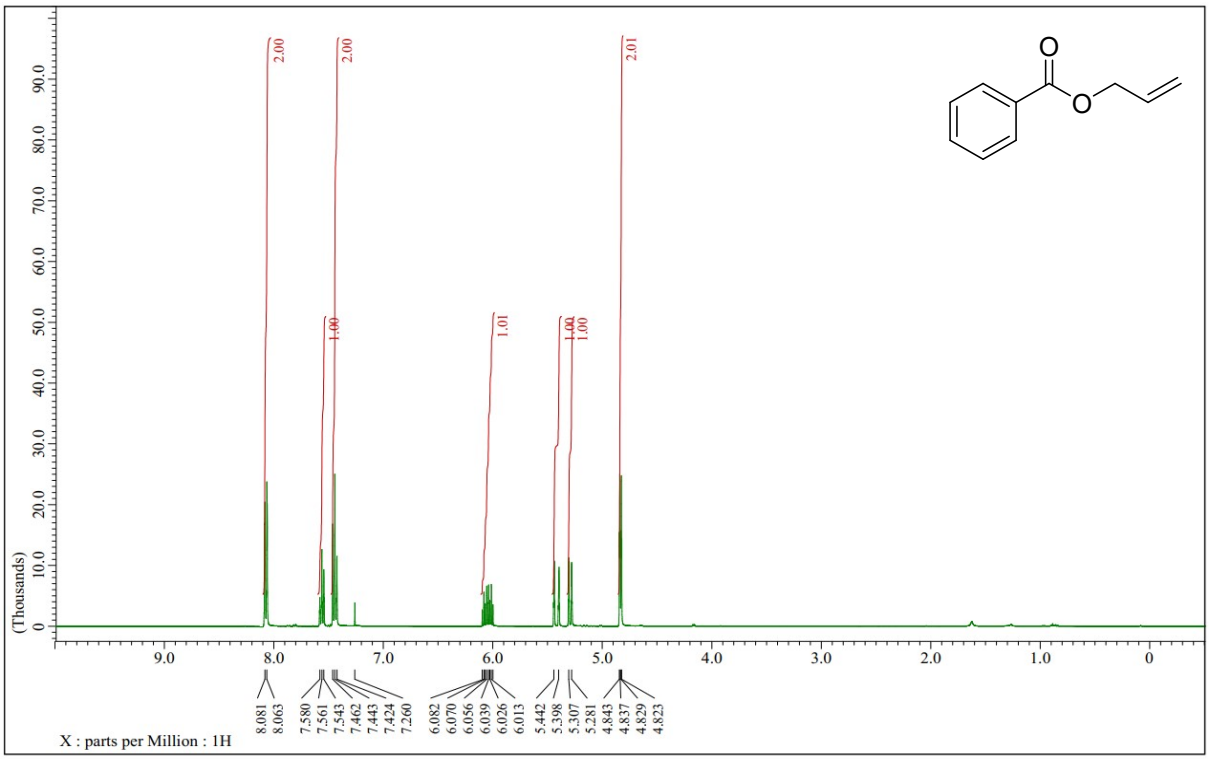


^{1}H NMR spectrum of cyclohexyl benzoate

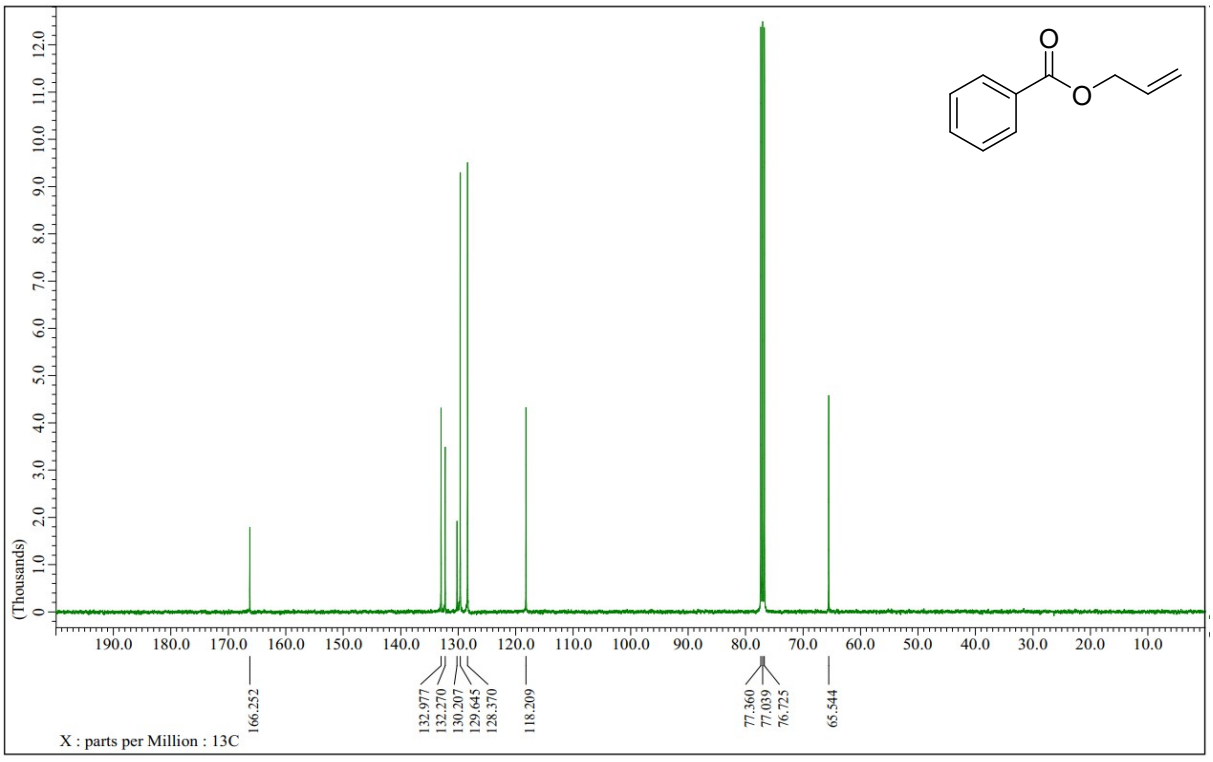


^{13}C NMR spectrum of cyclohexyl benzoate

Allyl benzoate (4g)

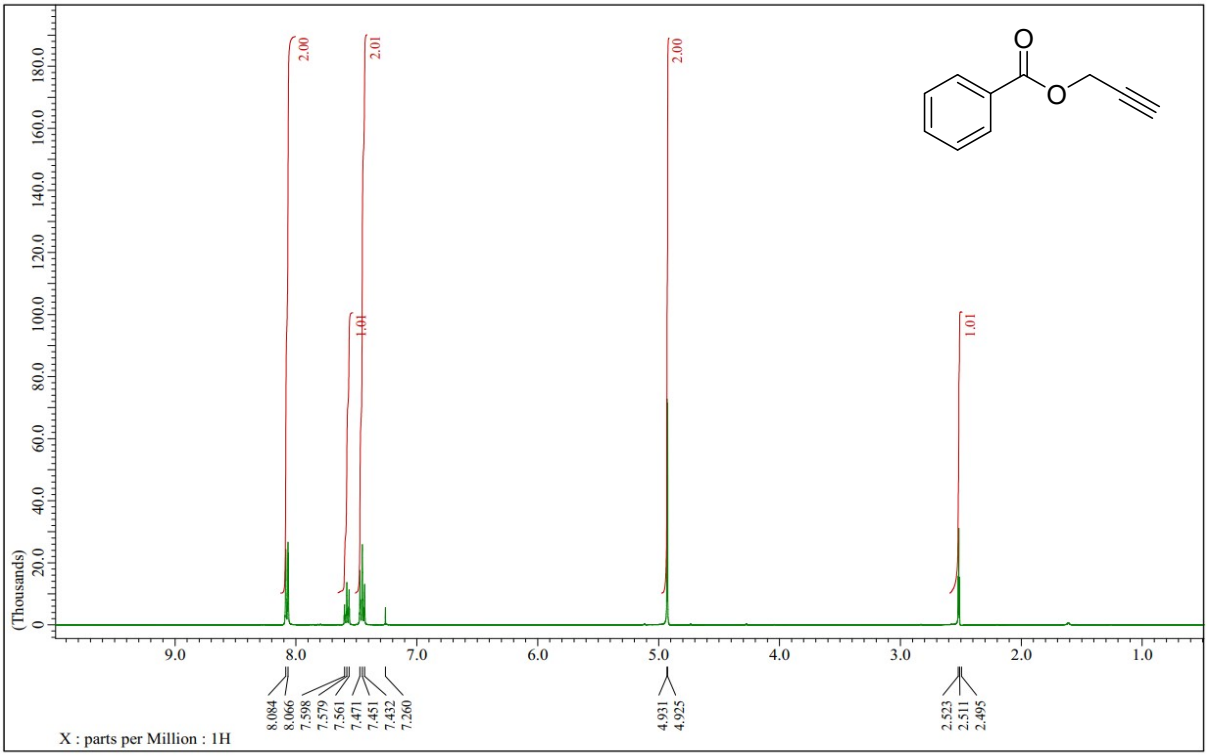


^{1}H NMR spectrum of allyl benzoate

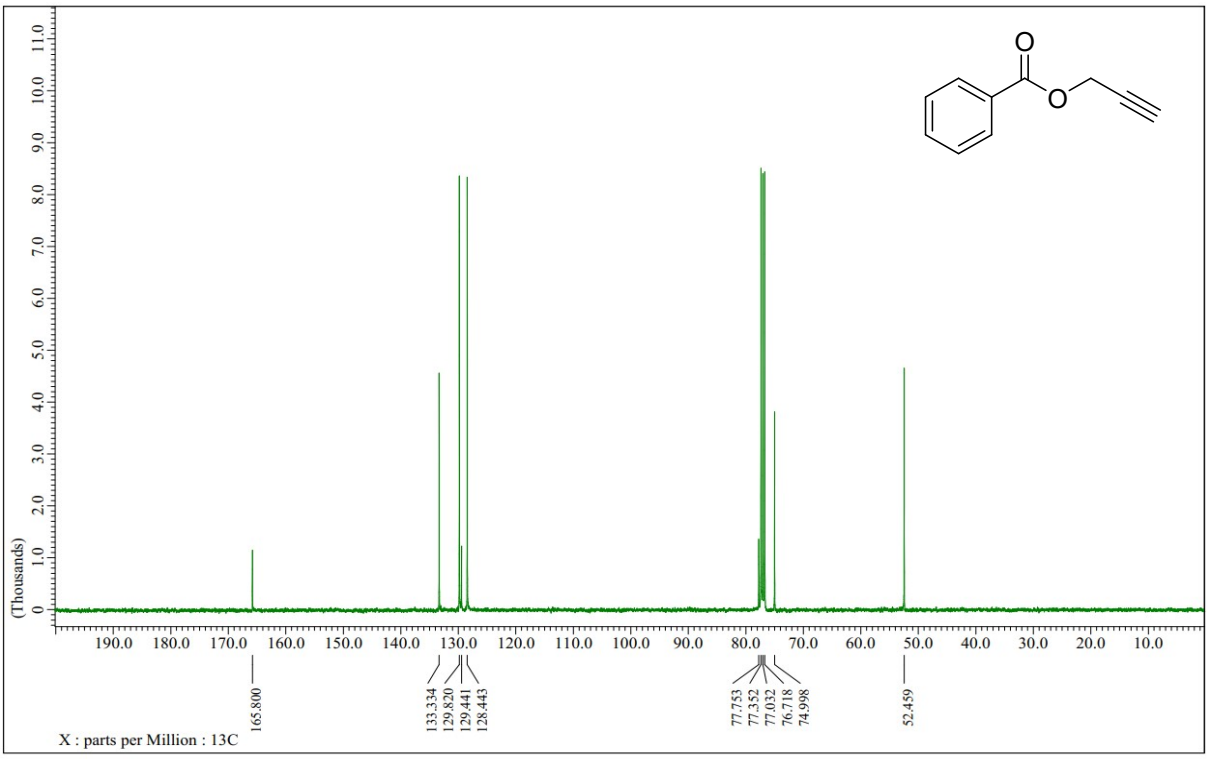


^{13}C NMR spectrum of allyl benzoate

Prop-2-yn-1-yl benzoate (4h)

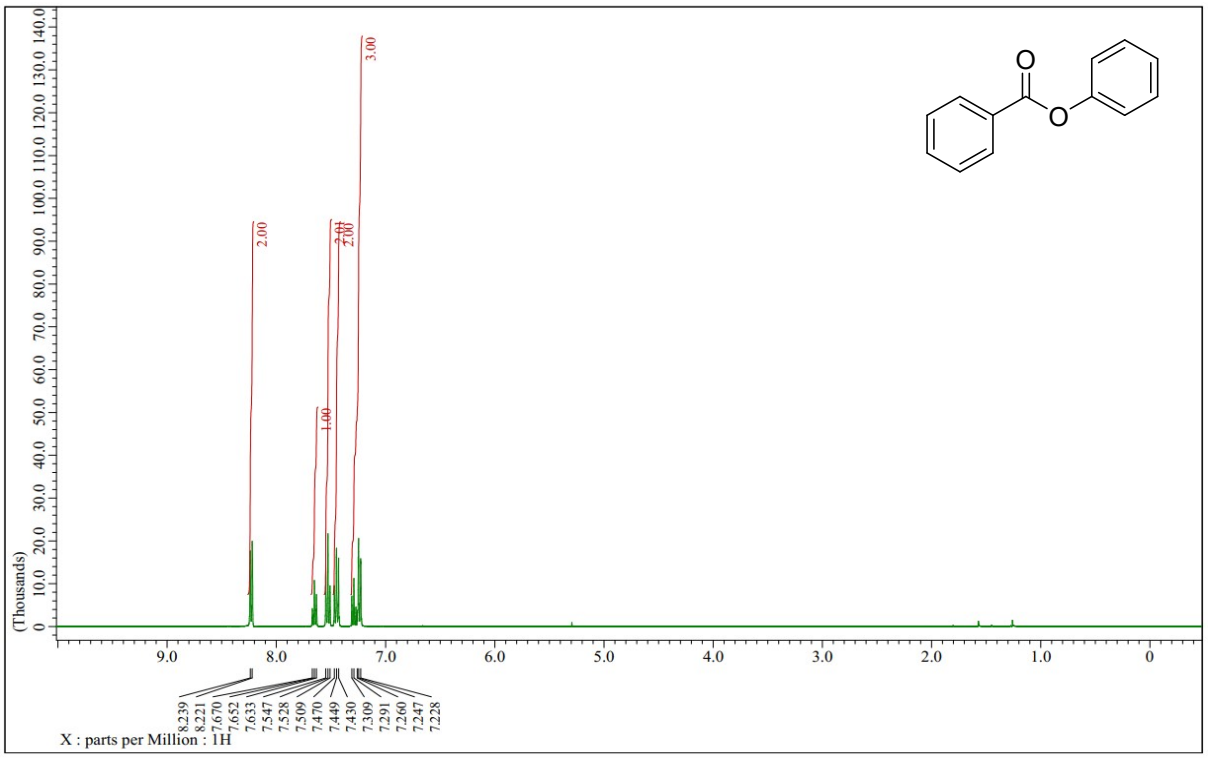


^{1}H NMR spectrum of prop-2-yn-1-yl benzoate

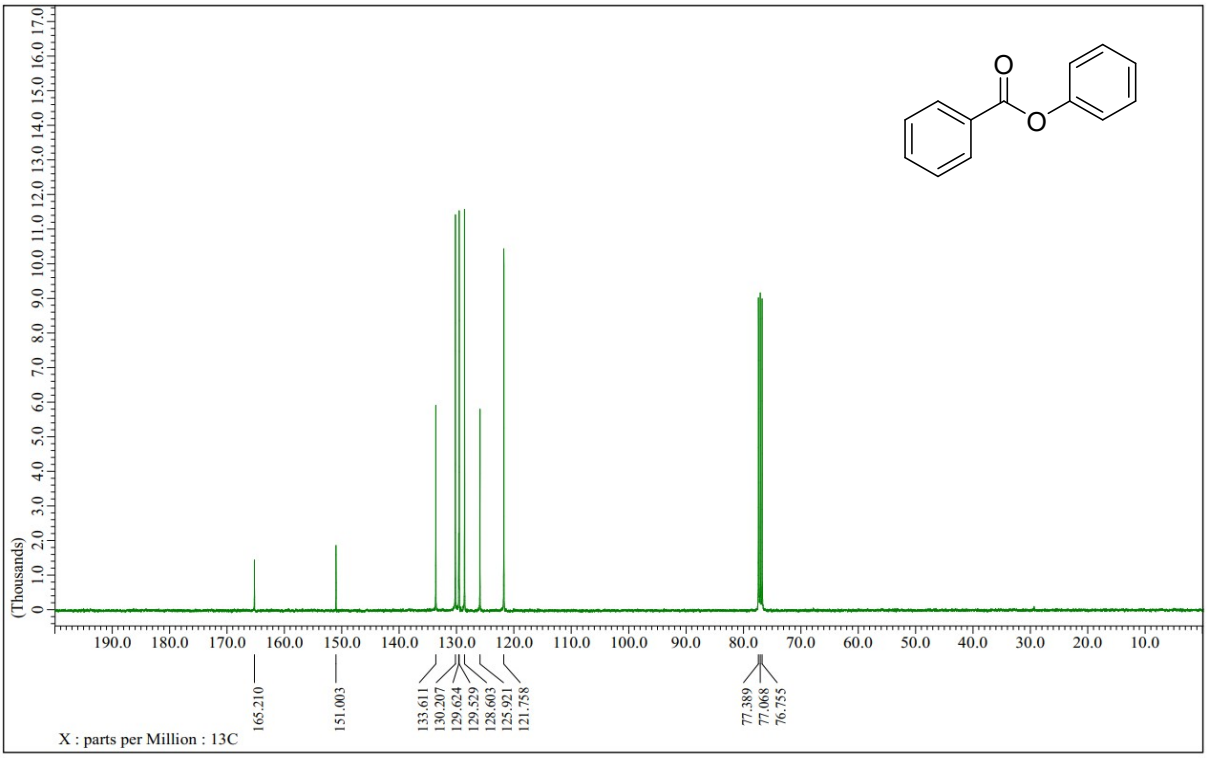


^{13}C NMR spectrum of prop-2-yn-1-yl benzoate

Phenyl benzoate (4i)

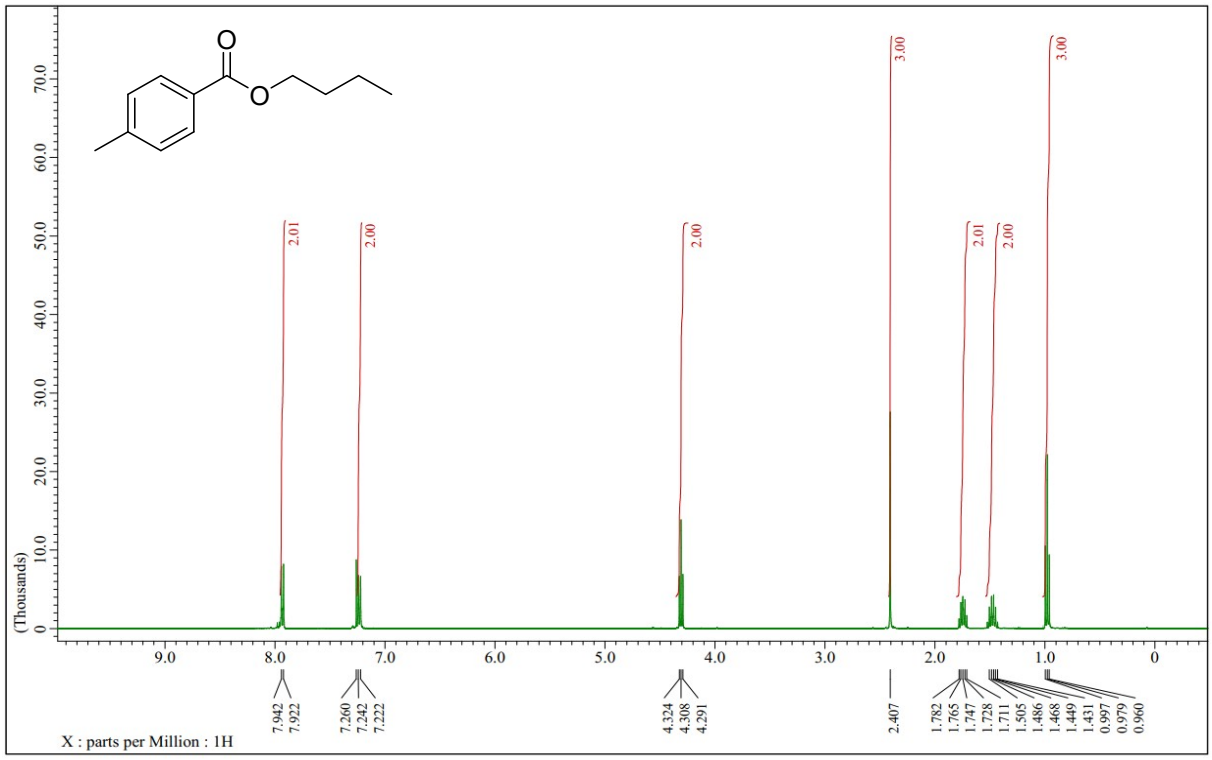


^{1}H NMR spectrum of phenyl benzoate

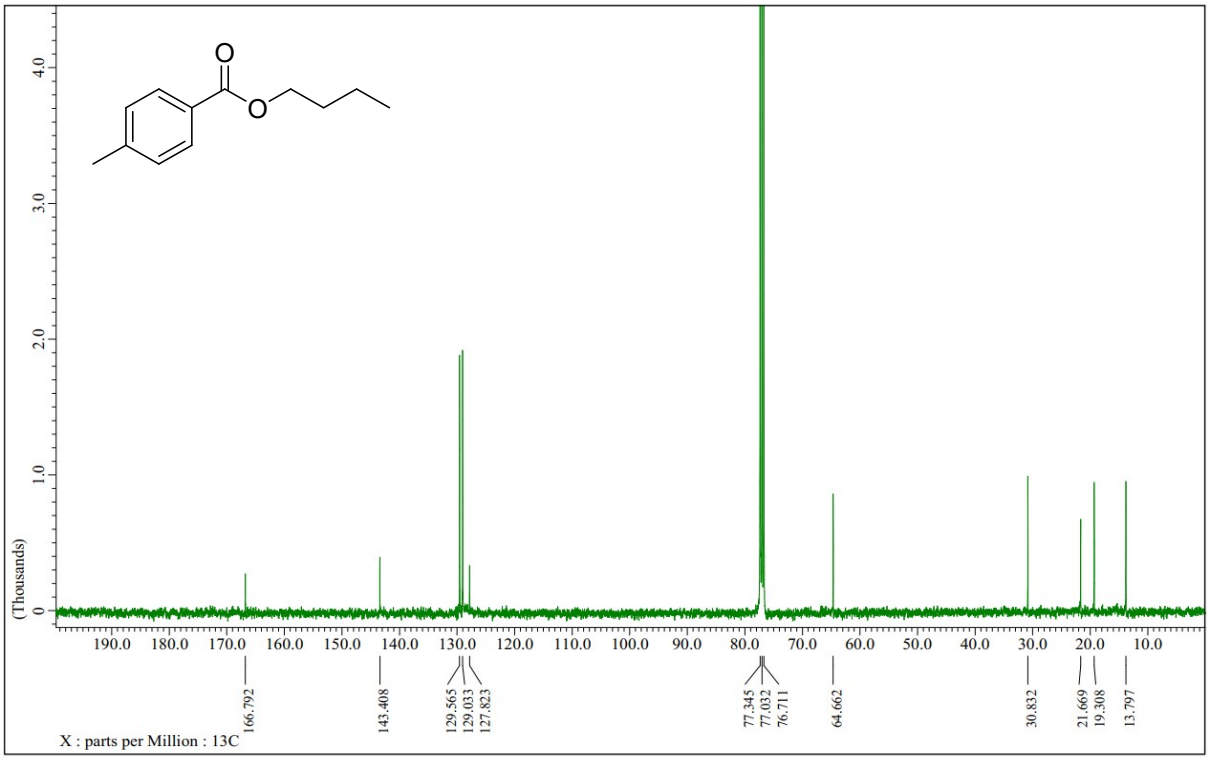


^{13}C NMR spectrum of phenyl benzoate

Butyl 4-methylbenzoate (5a)

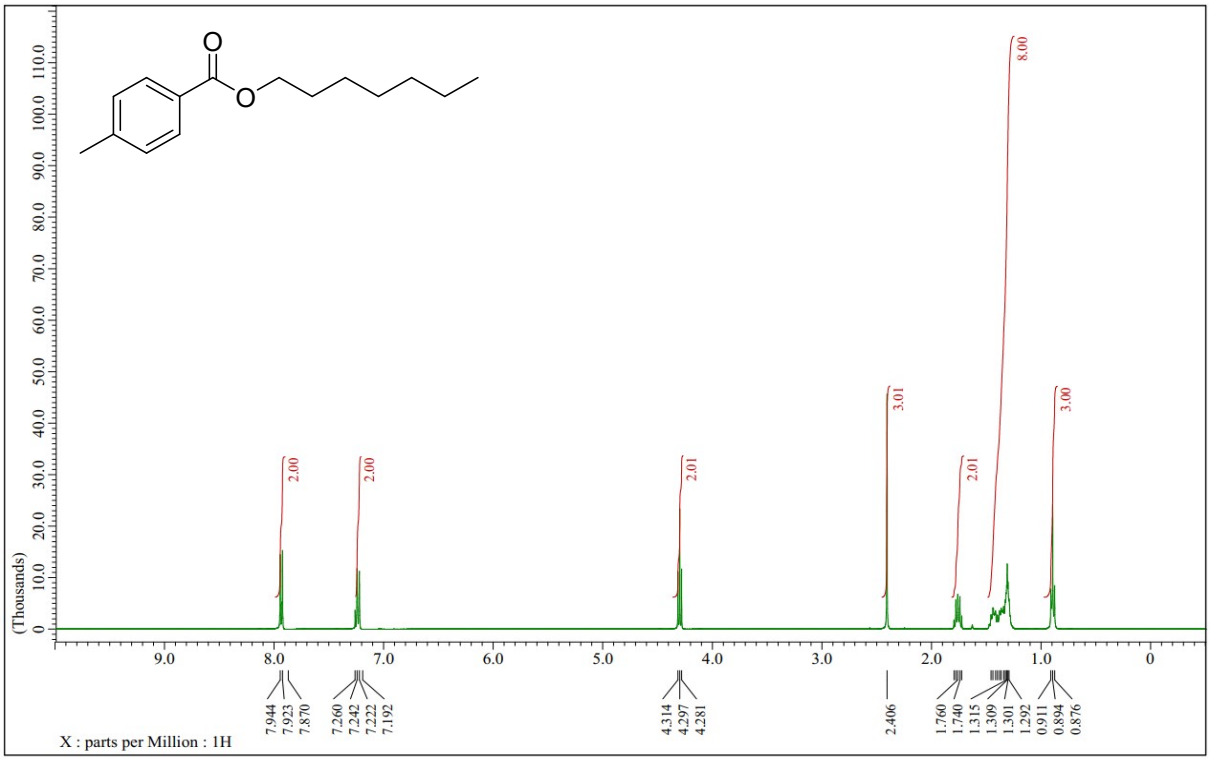


^{1}H NMR spectrum of butyl 4-methylbenzoate

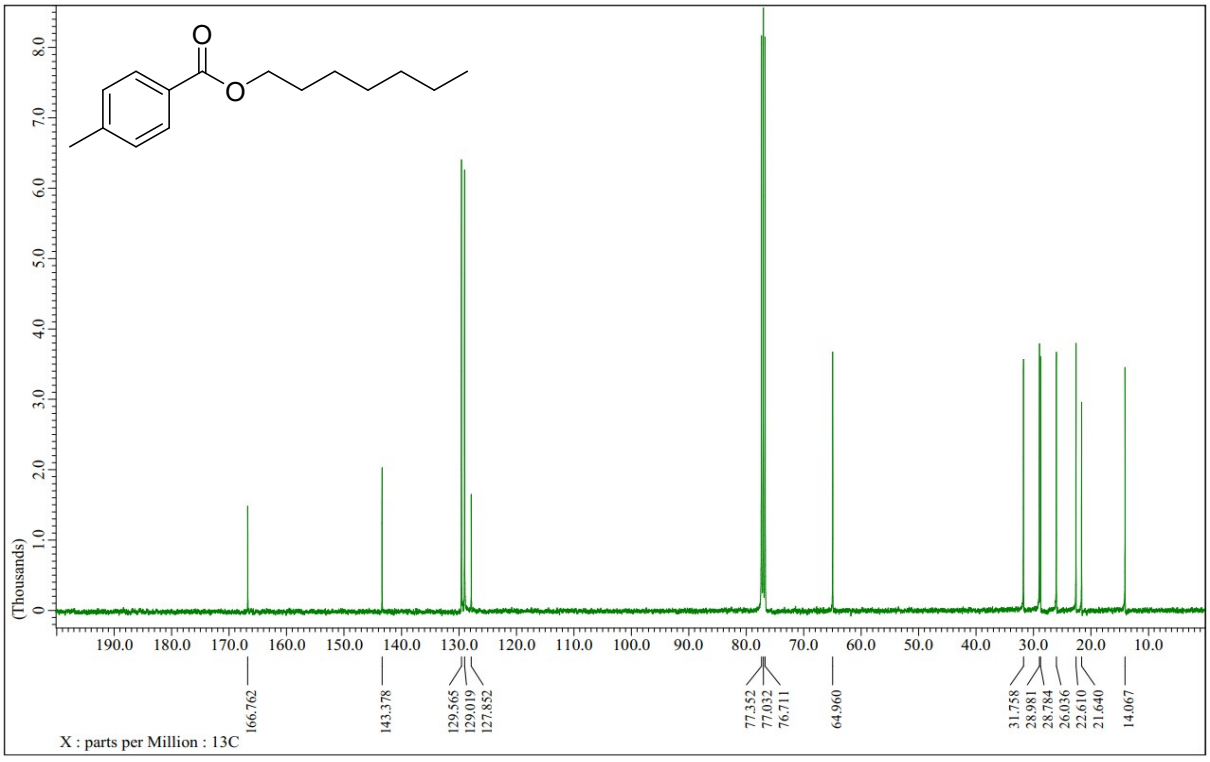


^{13}C NMR spectrum of butyl 4-methylbenzoate

Heptyl 4-methylbenzoate (5b)

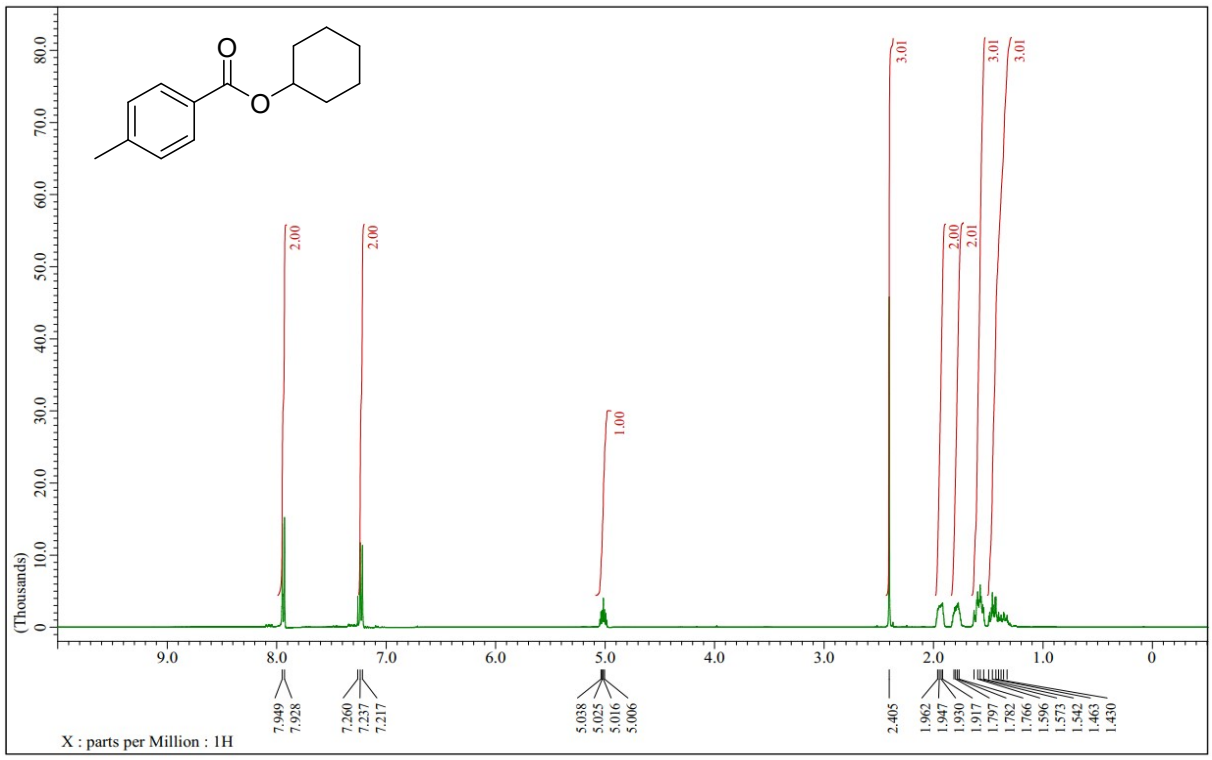


^{1}H NMR spectrum of heptyl 4-methylbenzoate

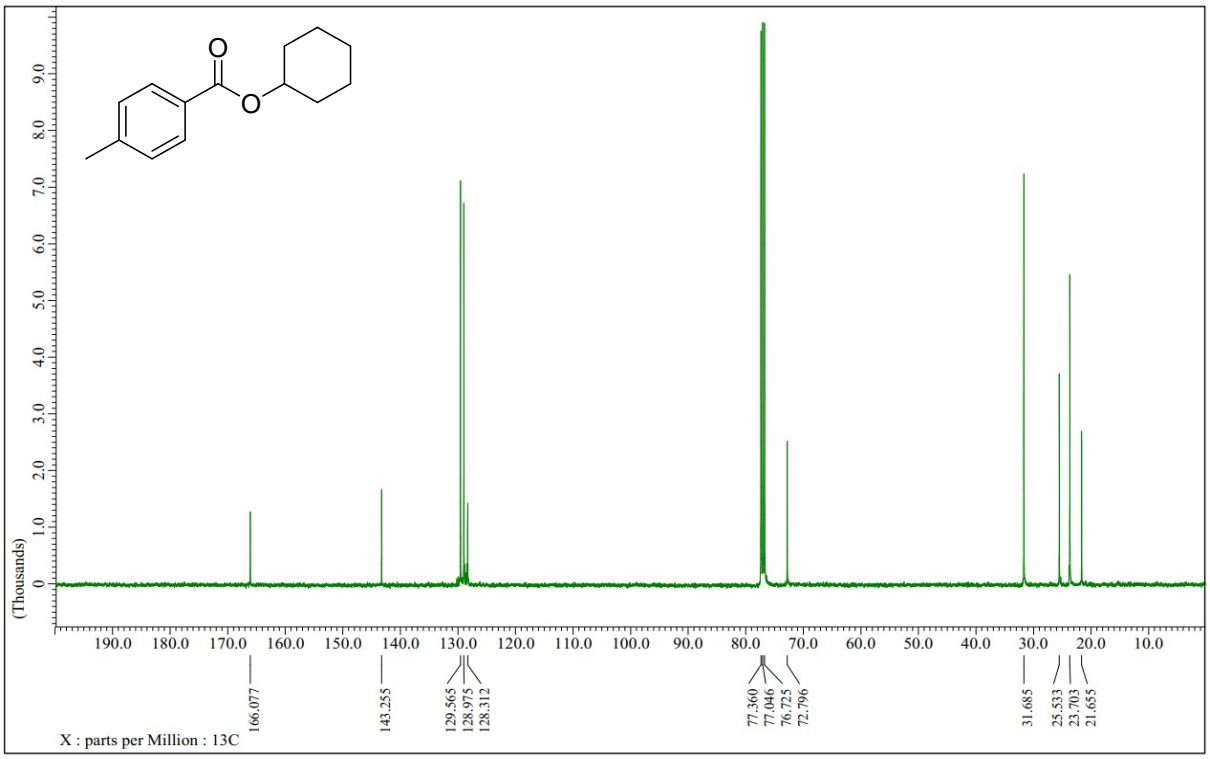


^{13}C NMR spectrum of heptyl 4-methylbenzoate

Cyclohexyl 4-methylbenzoate (5c)

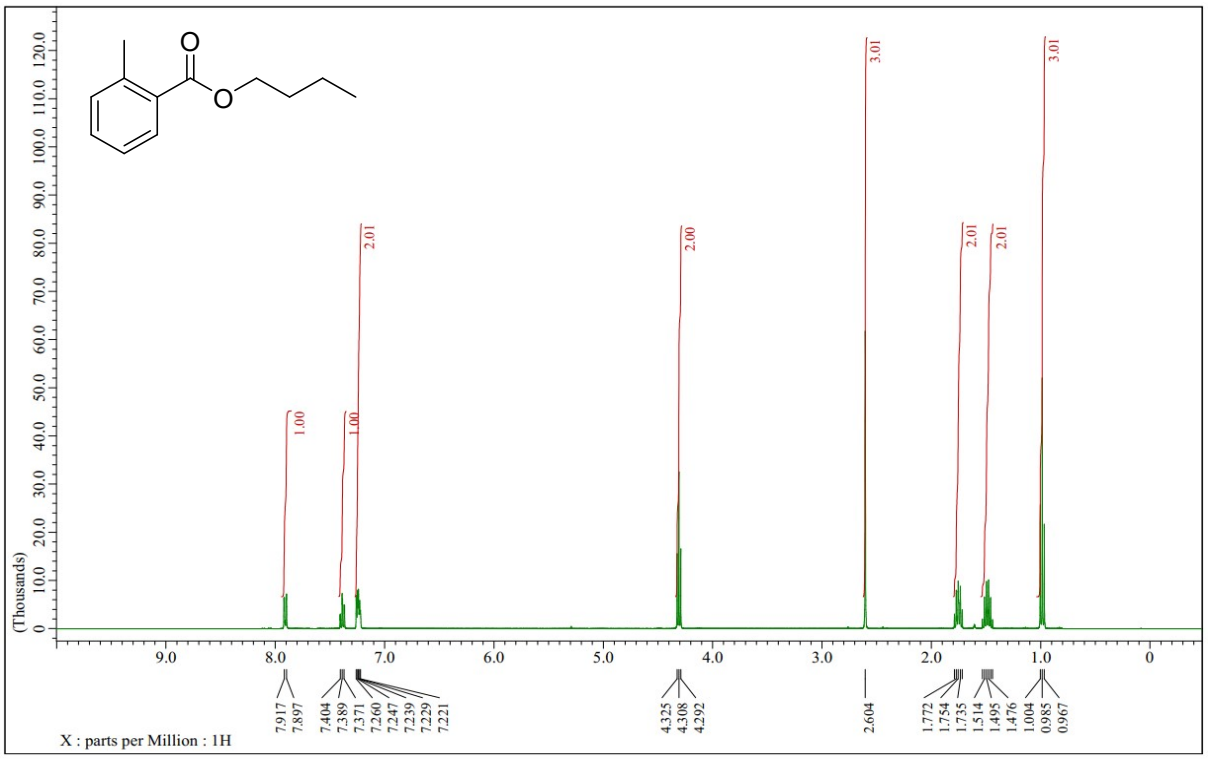


^{1}H NMR spectrum of cyclohexyl 4-methylbenzoate

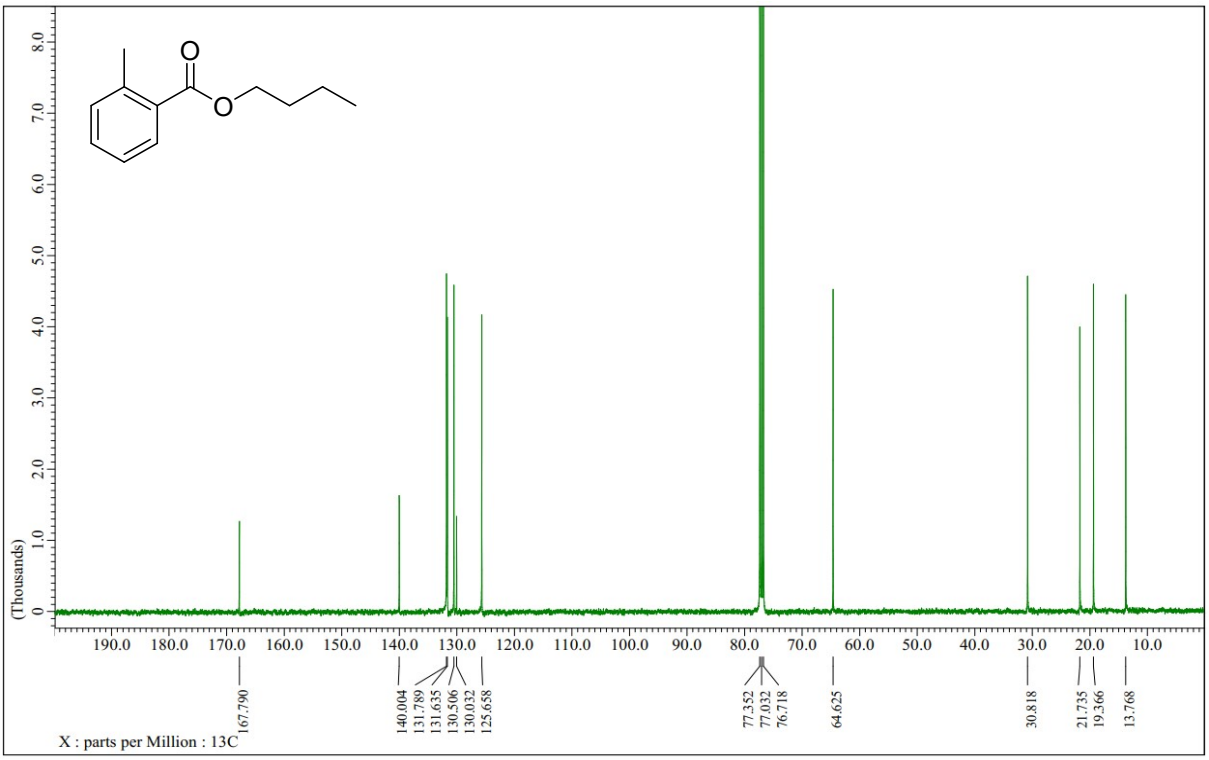


^{13}C NMR spectrum of cyclohexyl 4-methylbenzoate

Butyl 2-methylbenzoate (5d)

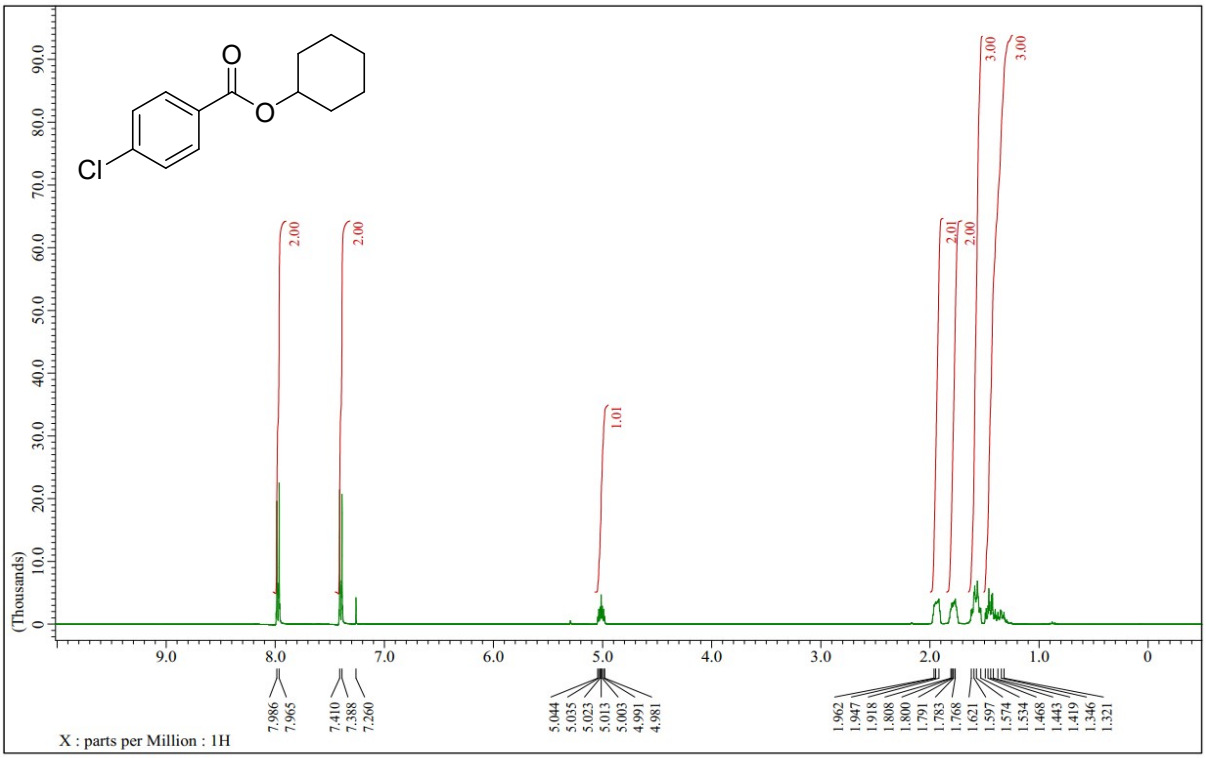


^{1}H NMR spectrum of butyl 2-methylbenzoate

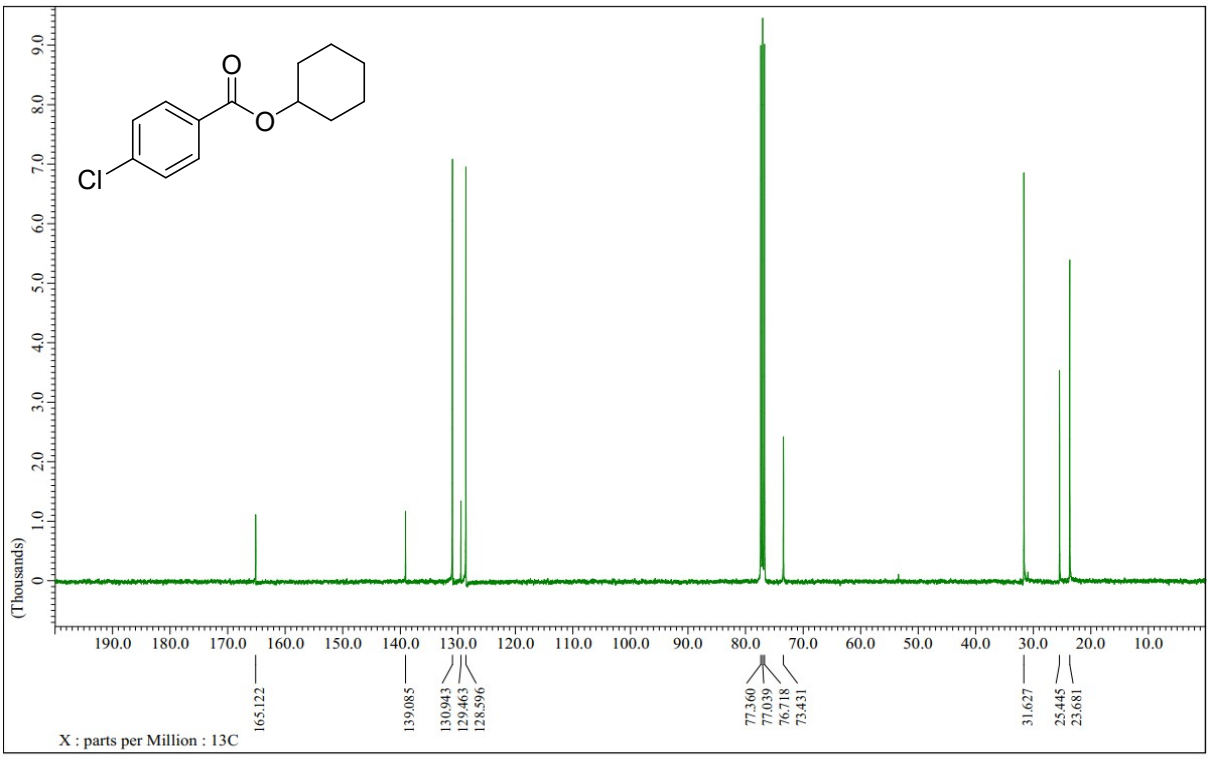


^{13}C NMR spectrum of butyl 2-methylbenzoate

Cyclohexyl 4-chlorobenzoate (5e)

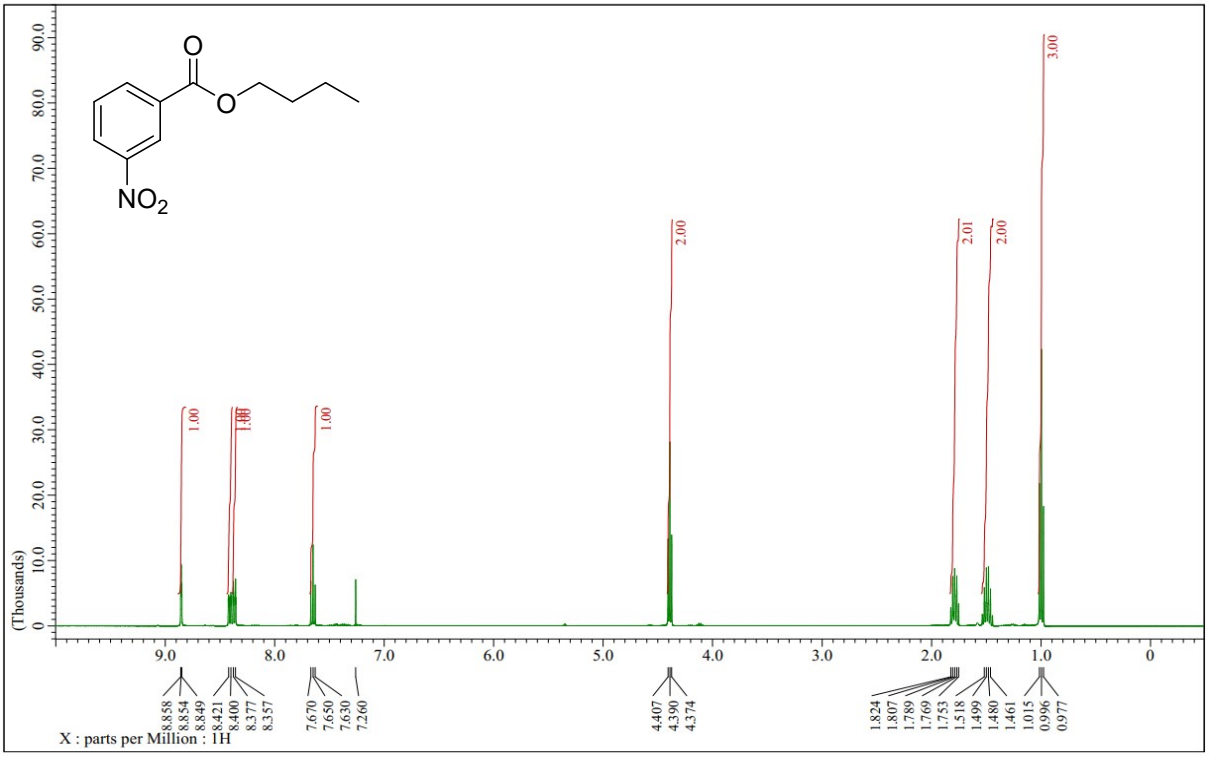


^{1}H NMR spectrum of cyclohexyl 4-chlorobenzoate

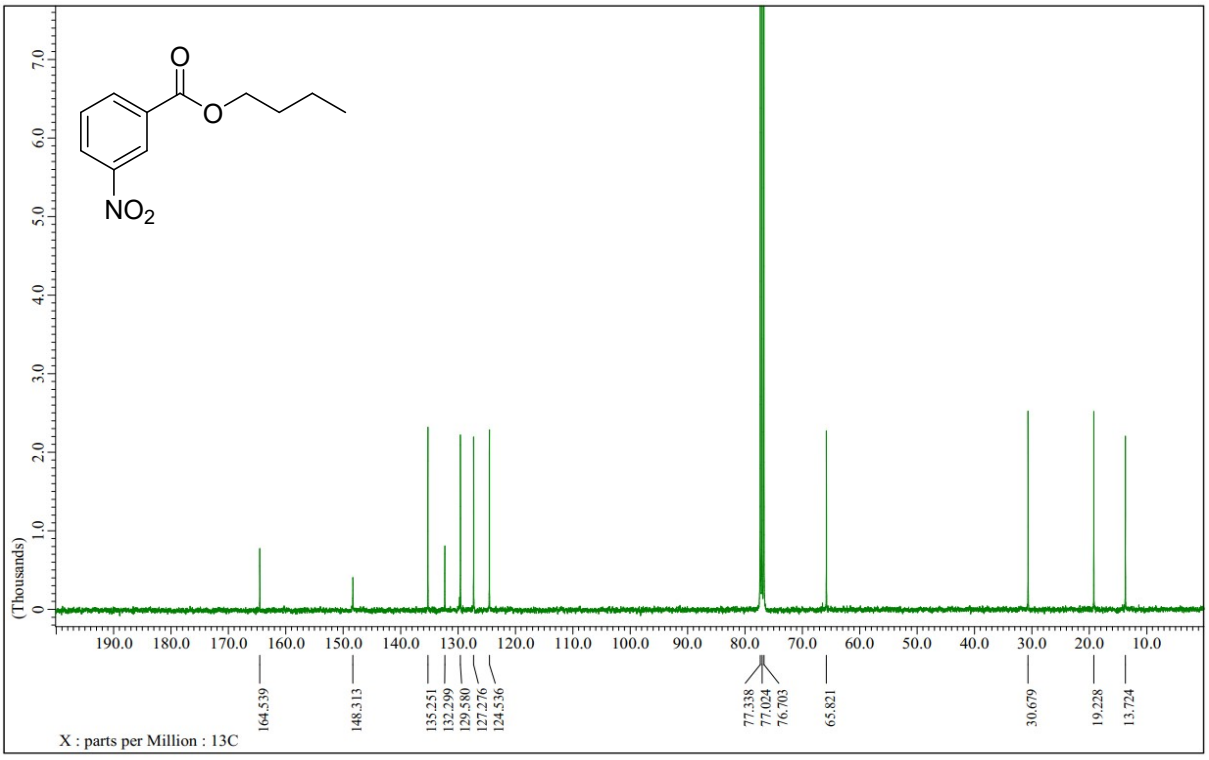


^{13}C NMR spectrum of cyclohexyl 4-chlorobenzoate

Butyl 3-nitrobenzoate (5f)

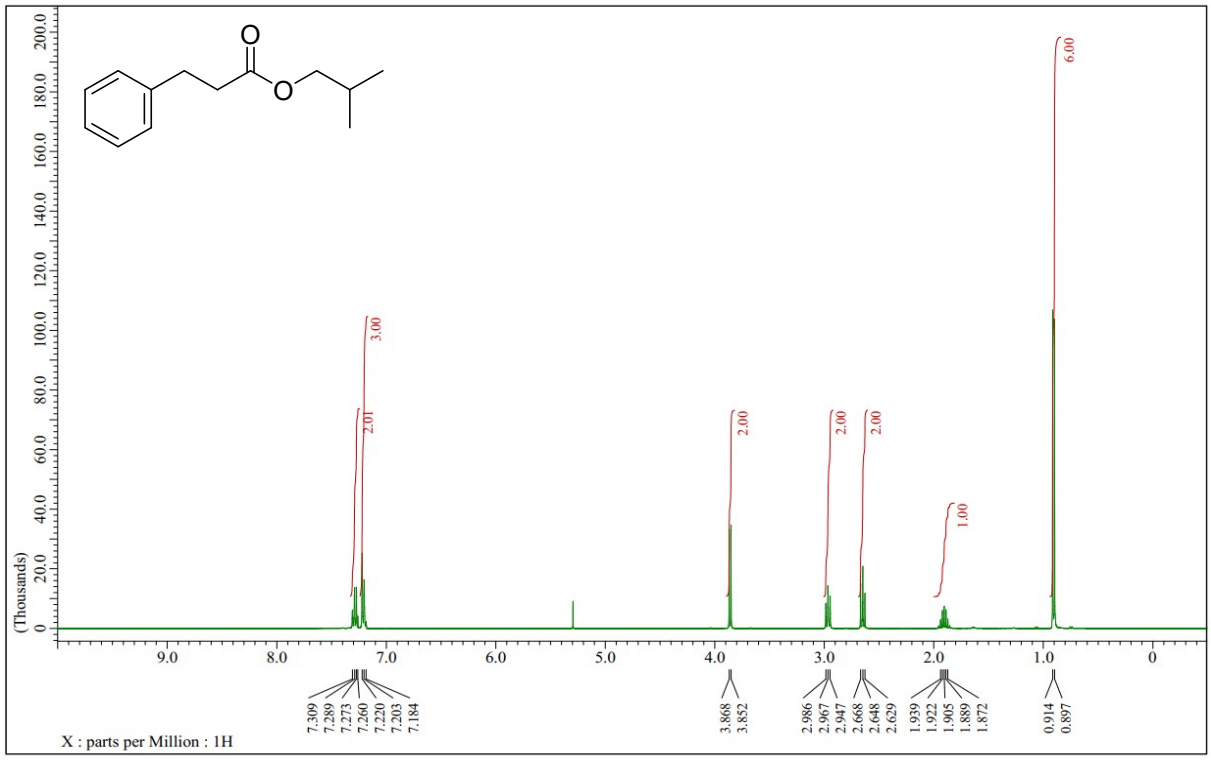


^{1}H NMR spectrum of butyl 3-nitrobenzoate

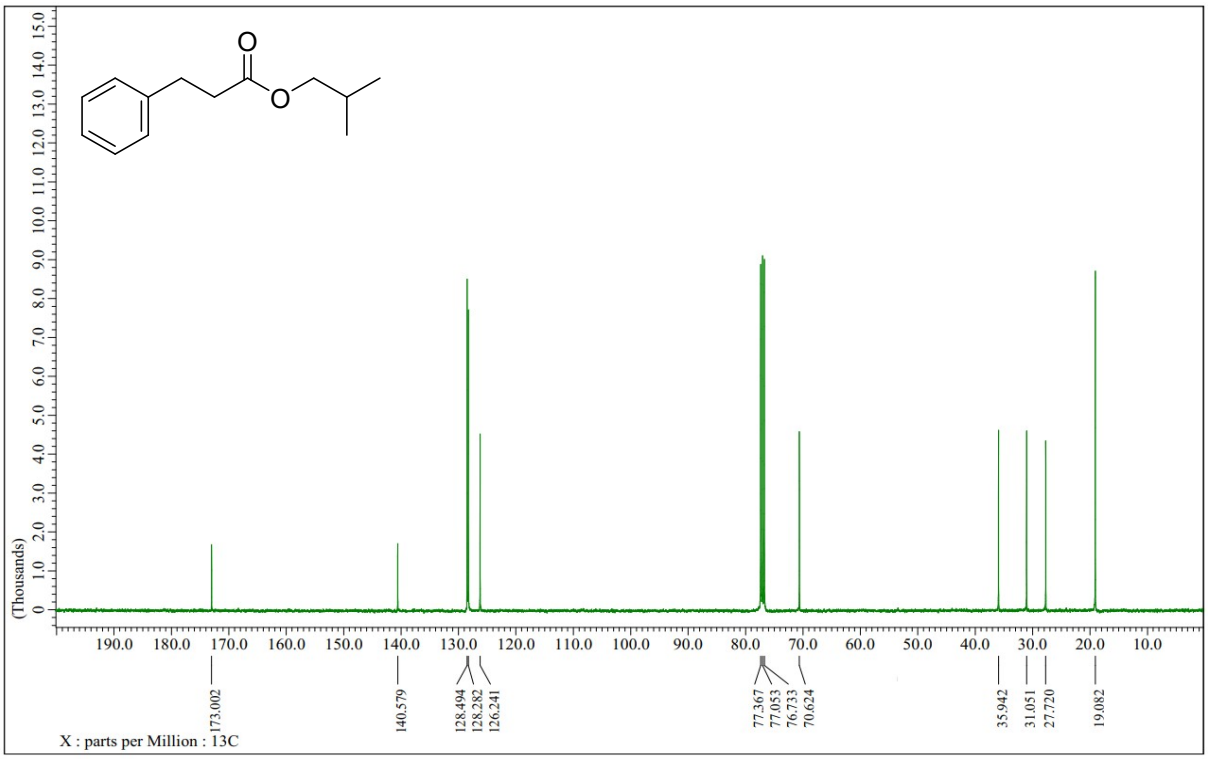


^{13}C NMR spectrum of butyl 3-nitrobenzoate

Isobutyl 3-phenylpropanoate (5g)

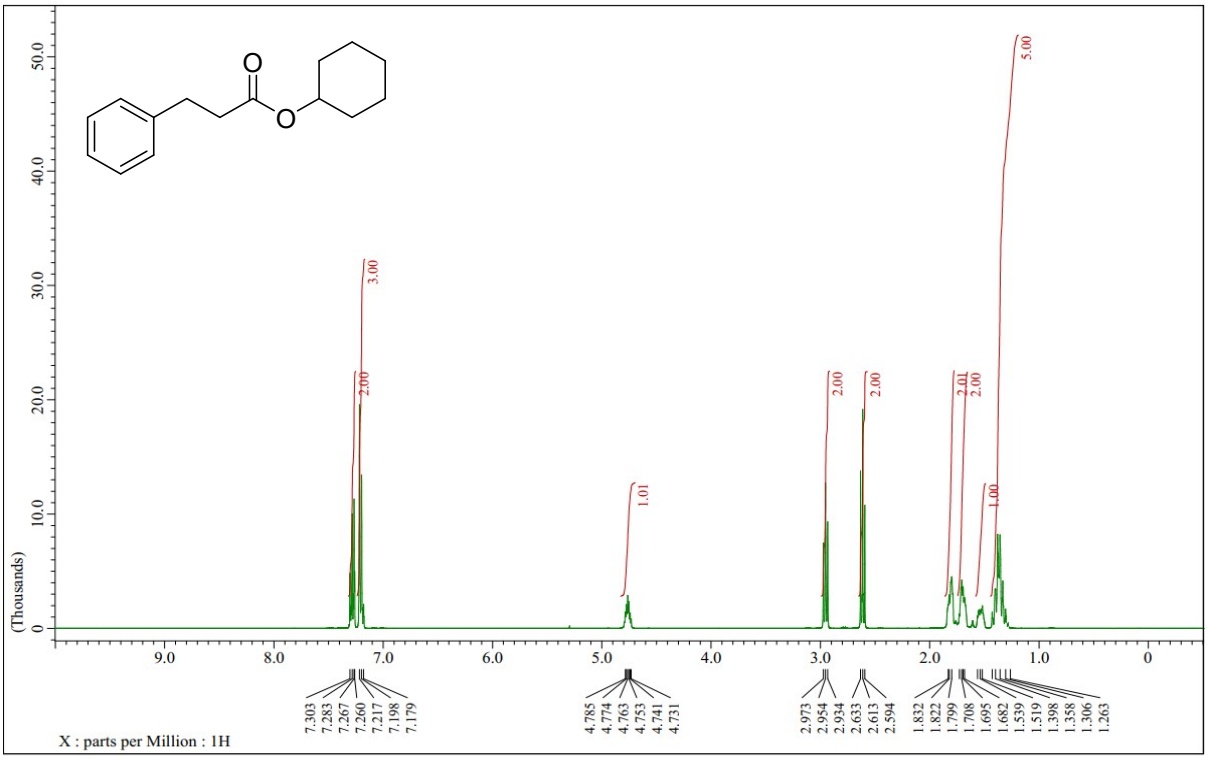


^{1}H NMR spectrum of isobutyl 3-phenylpropanoate

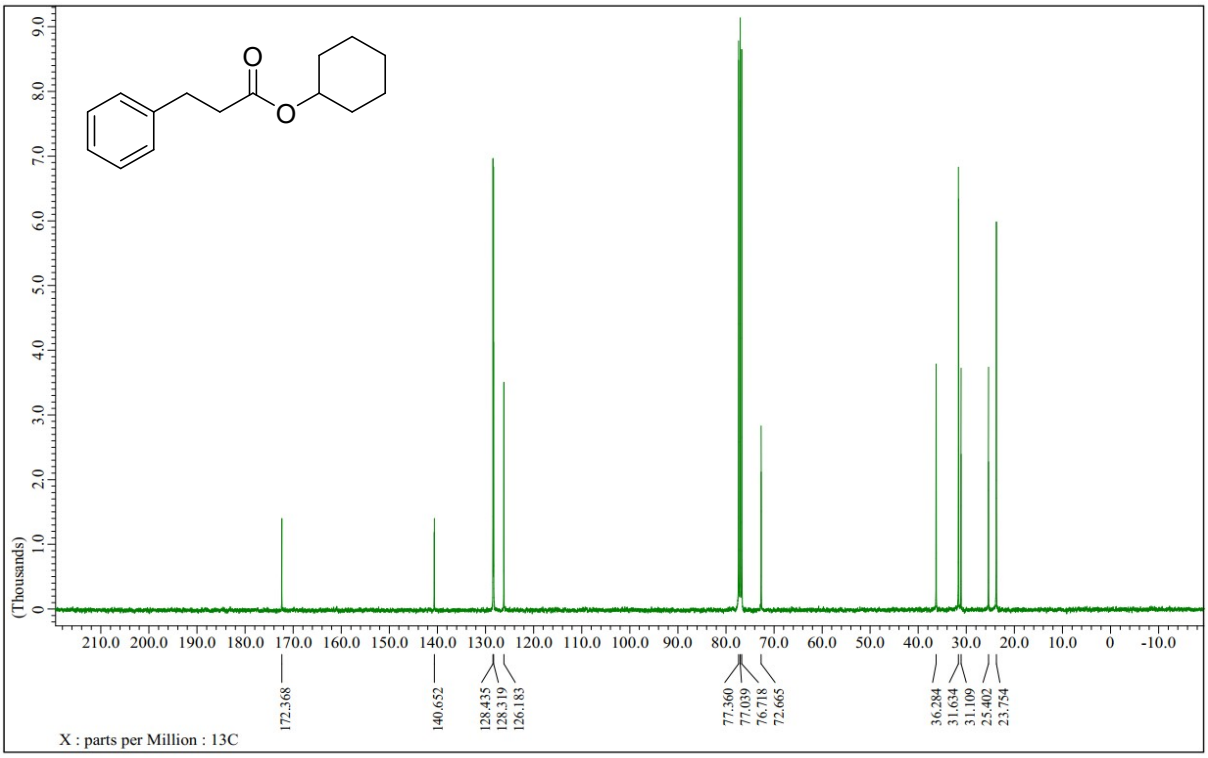


^{13}C NMR spectrum of isobutyl 3-phenylpropanoate

Cyclohexyl 3-phenylpropanoate (5h)

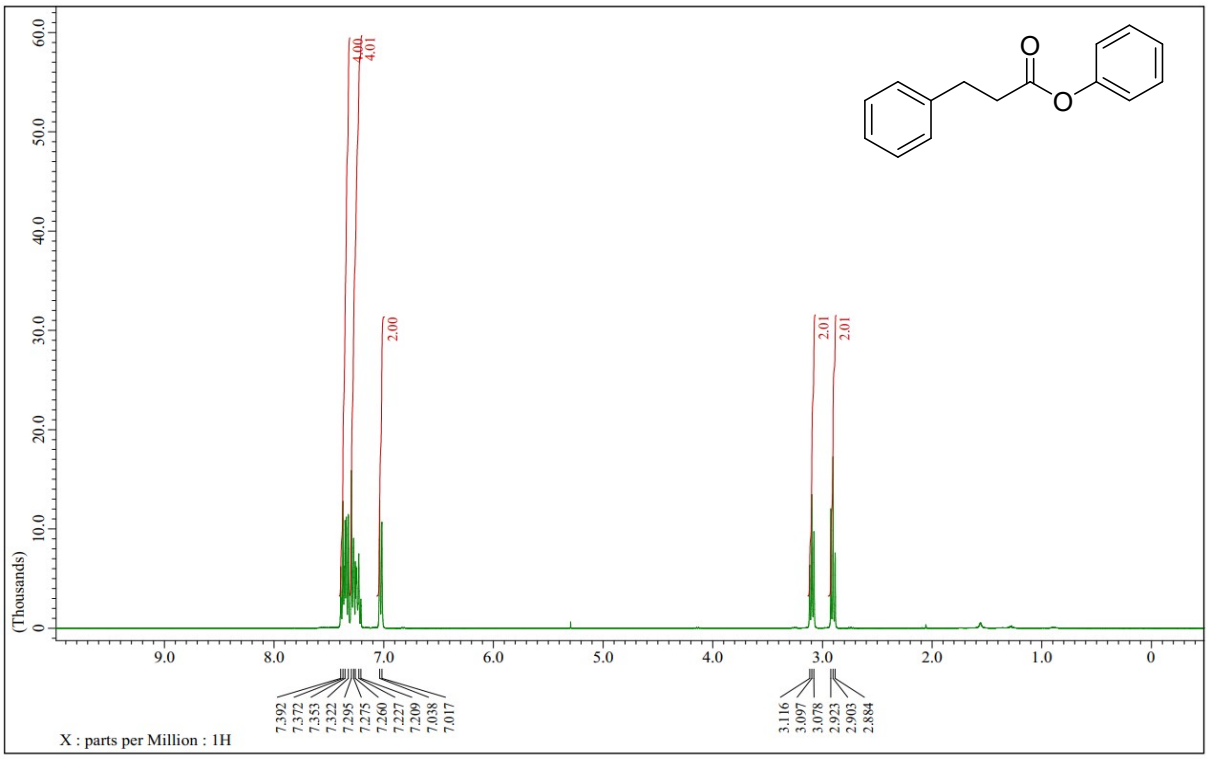


^{1}H NMR spectrum of cyclohexyl 3-phenylpropanoate

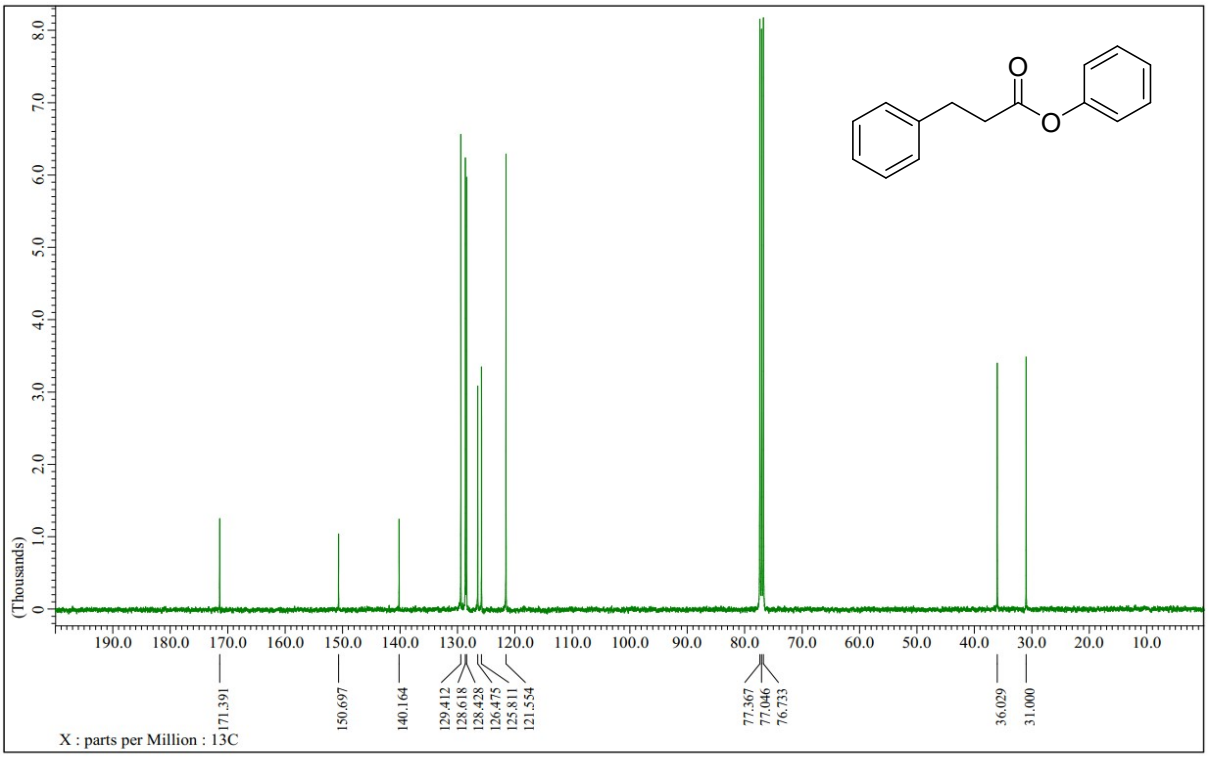


^{13}C NMR spectrum of cyclohexyl 3-phenylpropanoate

Phenyl 3-phenylpropanoate (5i)

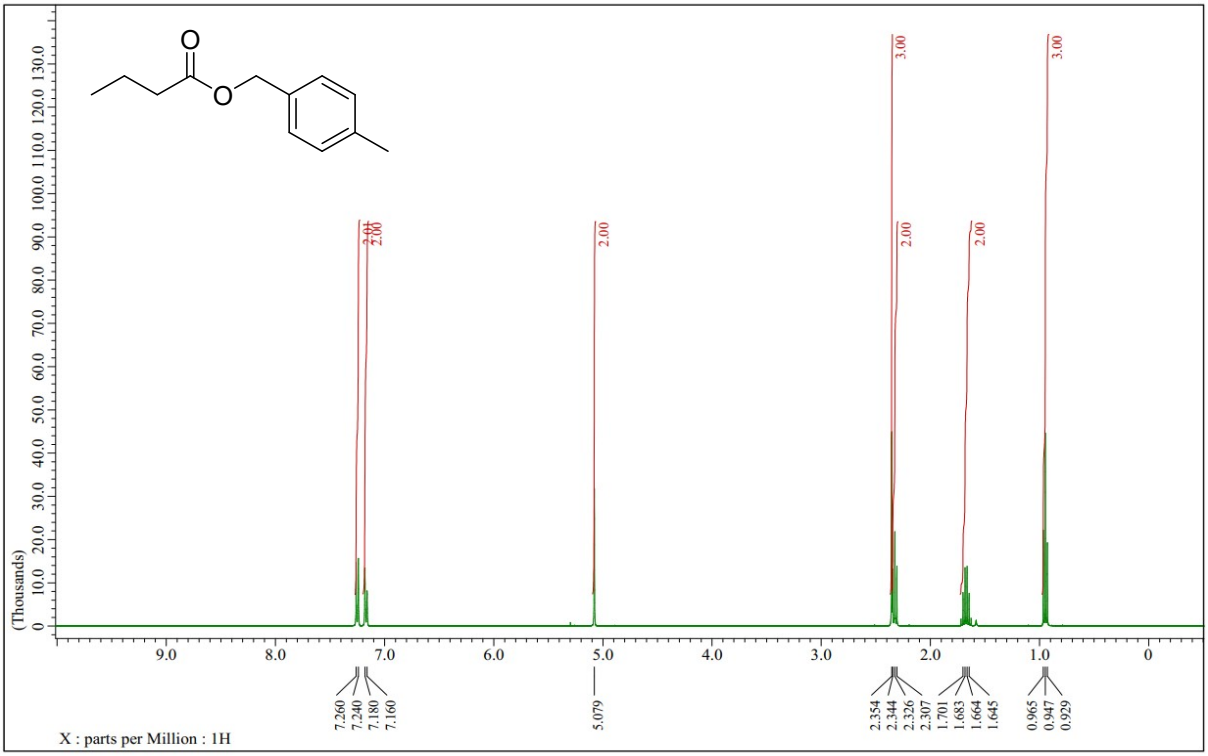


^{1}H NMR spectrum of phenyl 3-phenylpropanoate

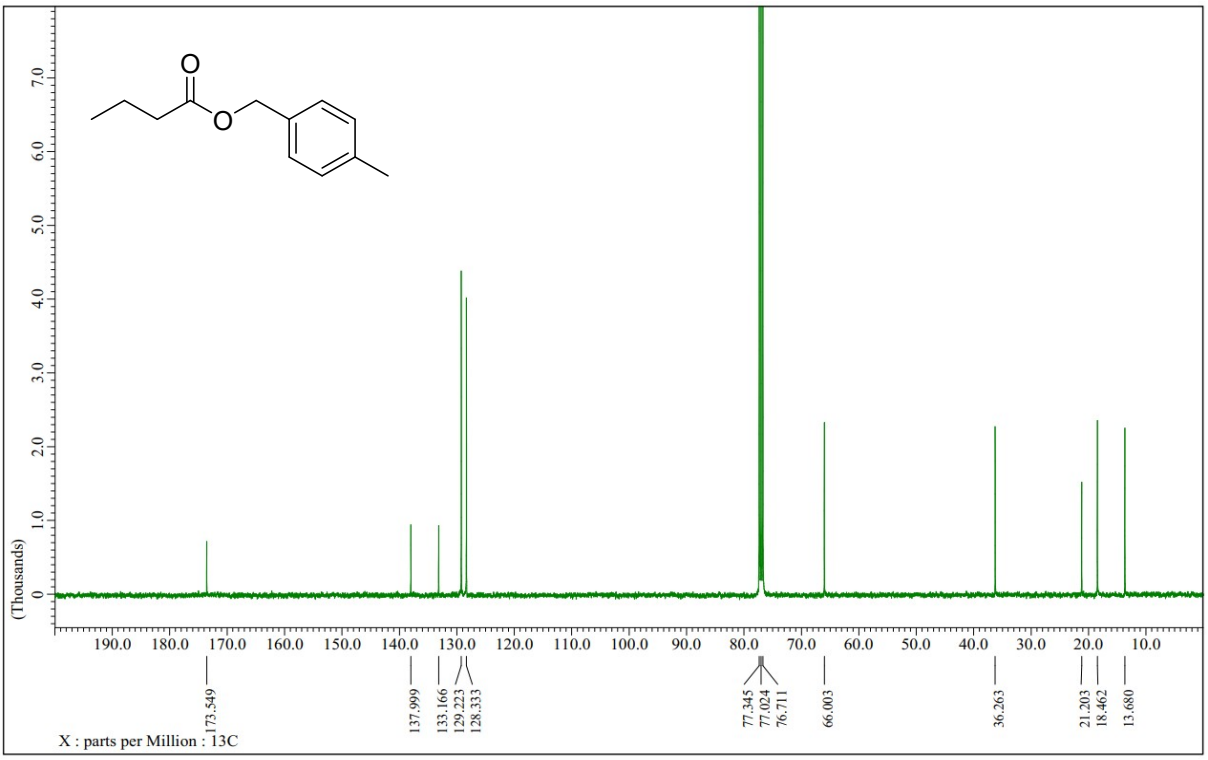


^{13}C NMR spectrum of phenyl 3-phenylpropanoate

4-methylbenzyl butyrate (5j)

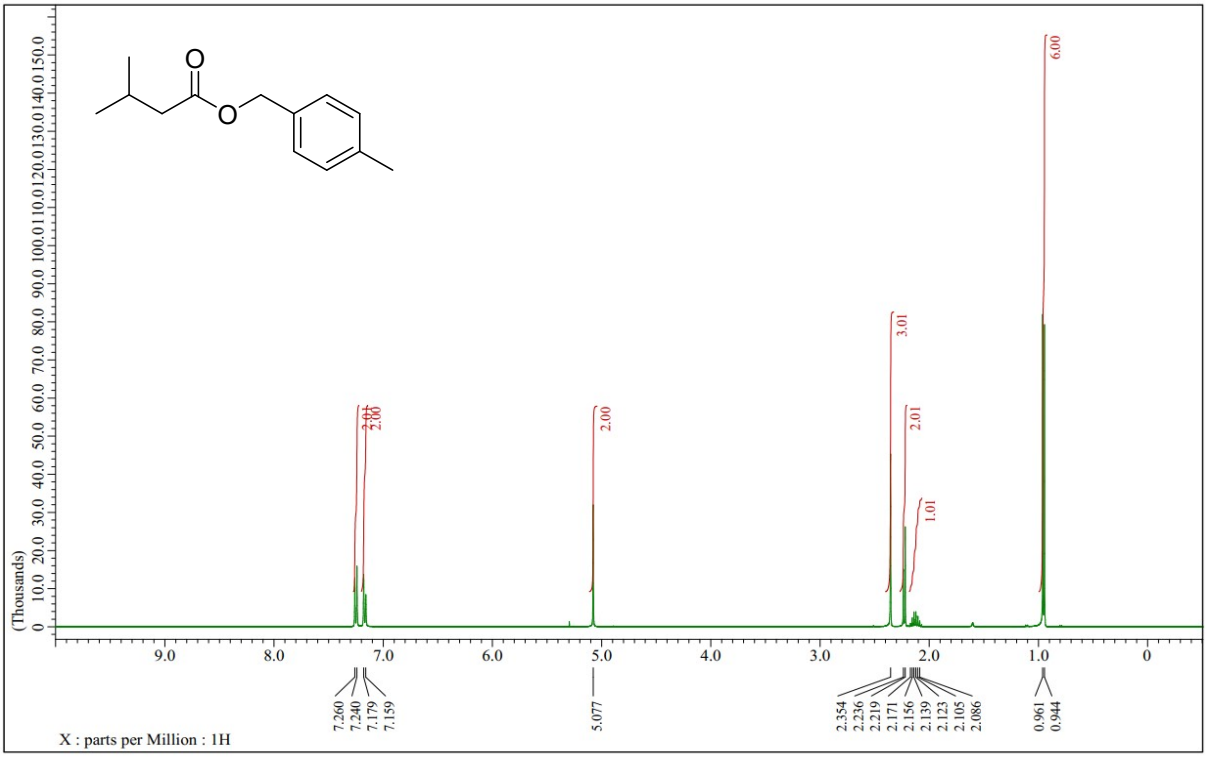


^{1}H NMR spectrum of 4-methylbenzyl butyrate

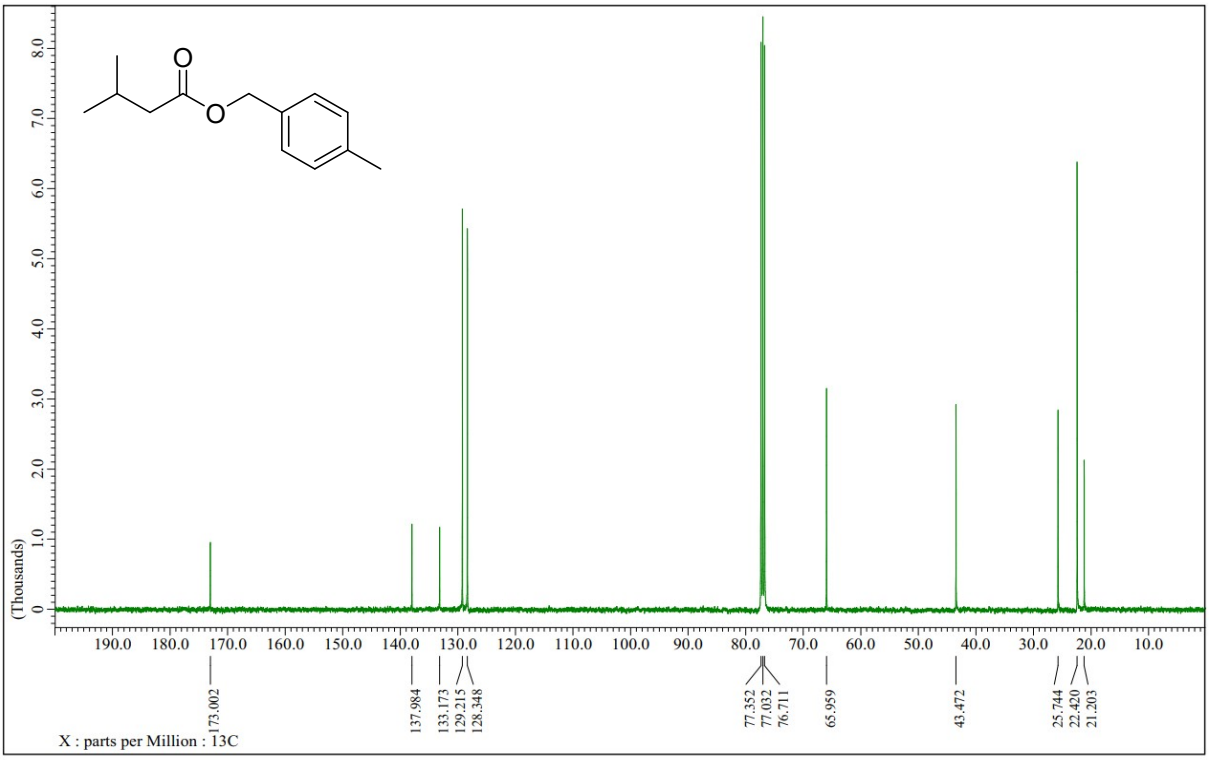


^{13}C NMR spectrum of 4-methylbenzyl butyrate

4-methylbenzyl 3-methylbutanoate (5k)

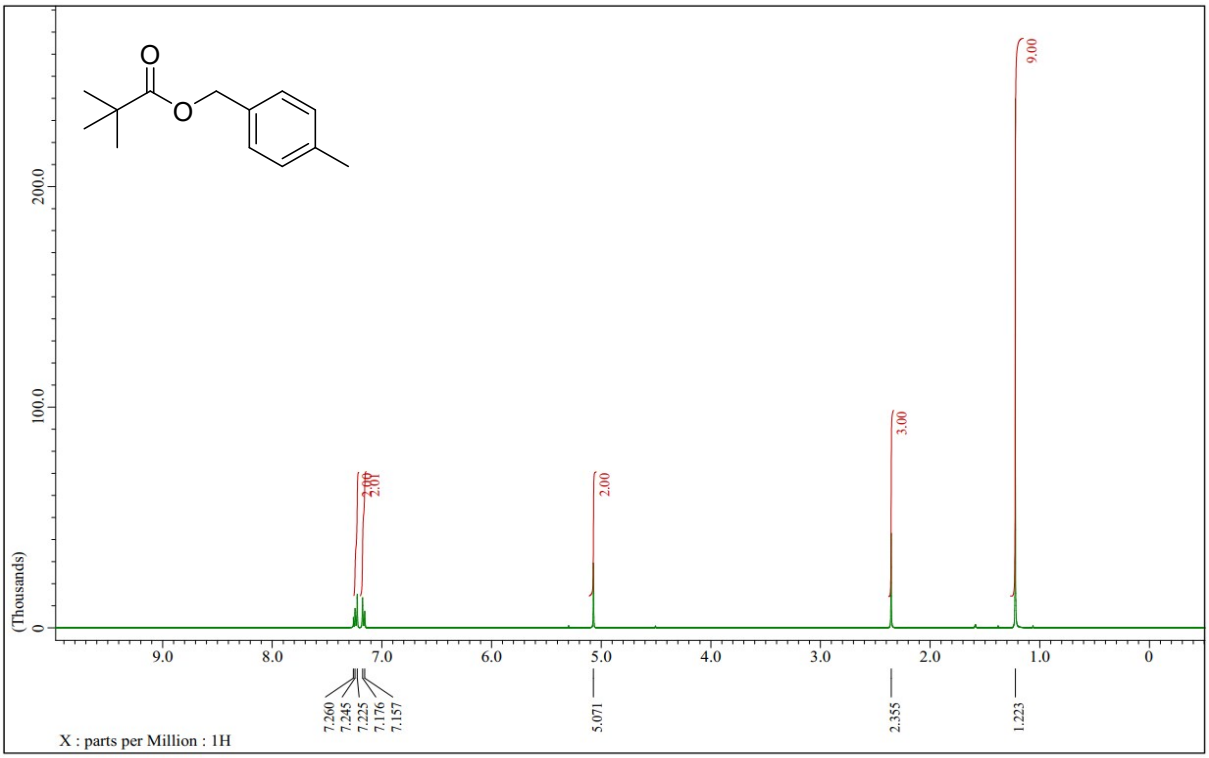


^{1}H NMR spectrum of 4-methylbenzyl 3-methylbutanoate

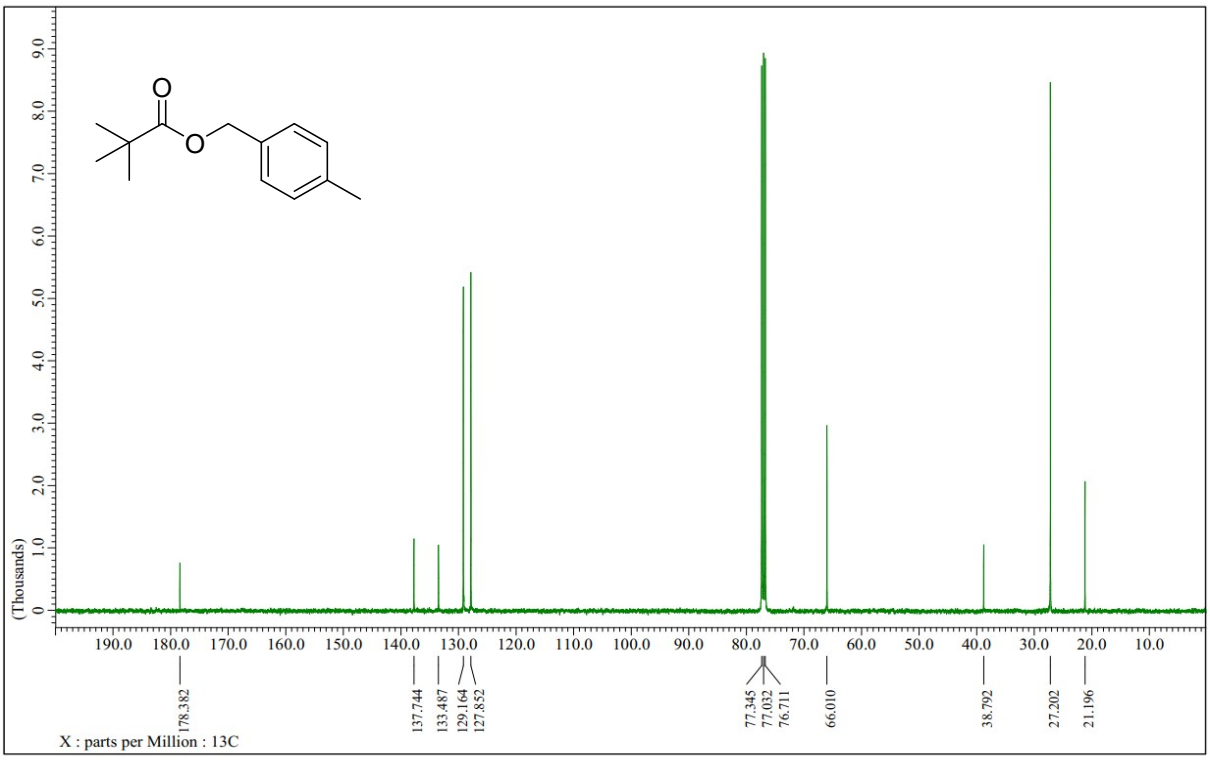


^{13}C NMR spectrum of 4-methylbenzyl 3-methylbutanoate

4-methylbenzyl pivalate (5l)

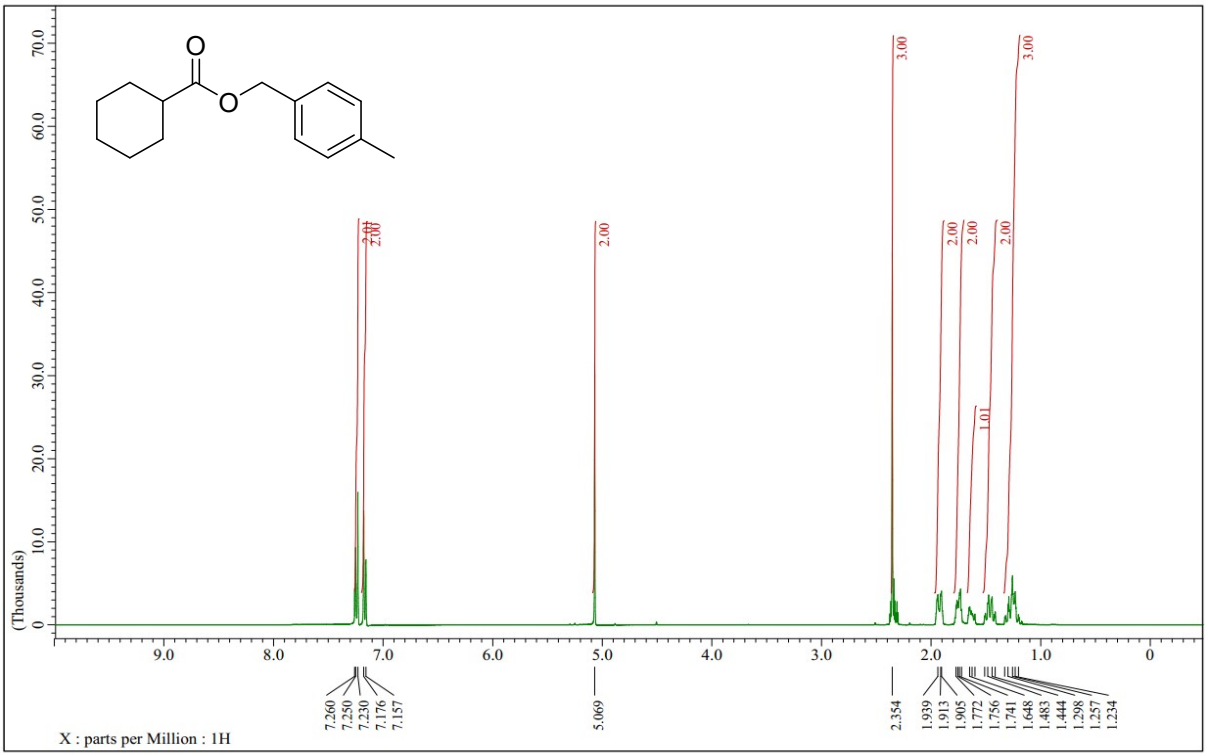


^{1}H NMR spectrum of 4-methylbenzyl pivalate

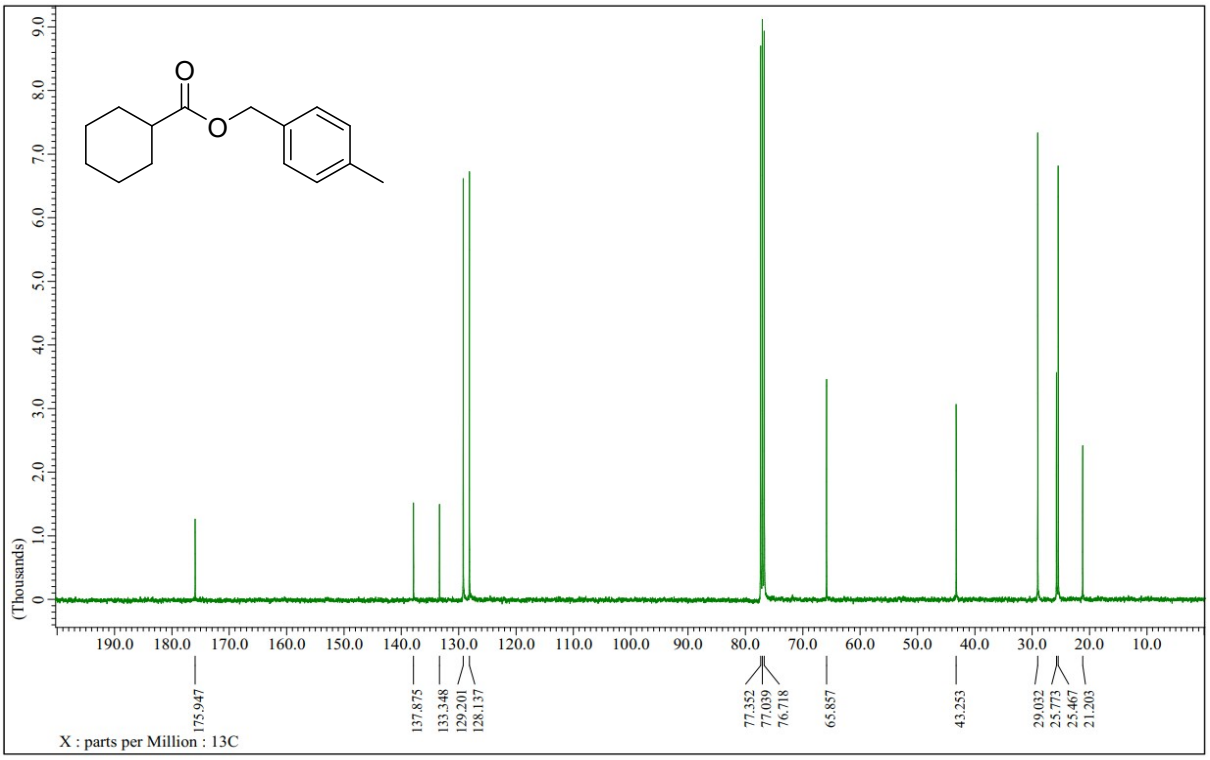


^{13}C NMR spectrum of 4-methylbenzyl pivalate

4-methylbenzyl cyclohexanecarboxylate (5m)

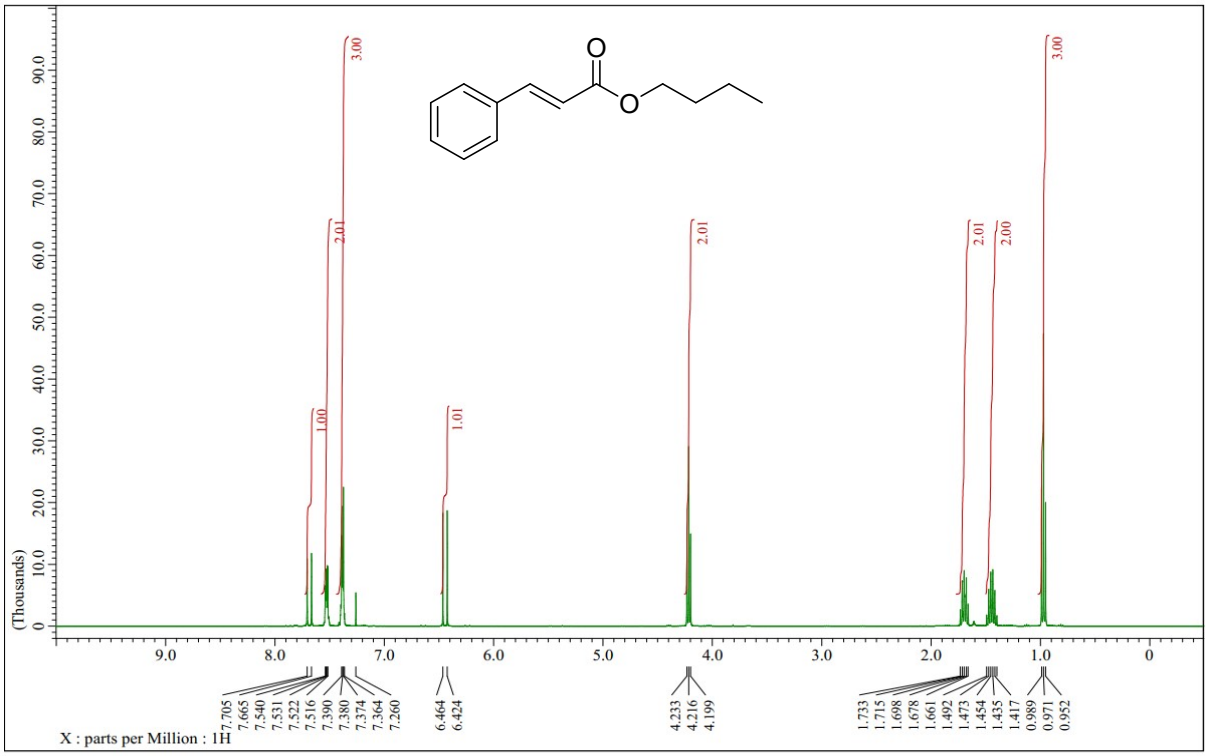


^{1}H NMR spectrum of 4-methylbenzyl cyclohexanecarboxylate

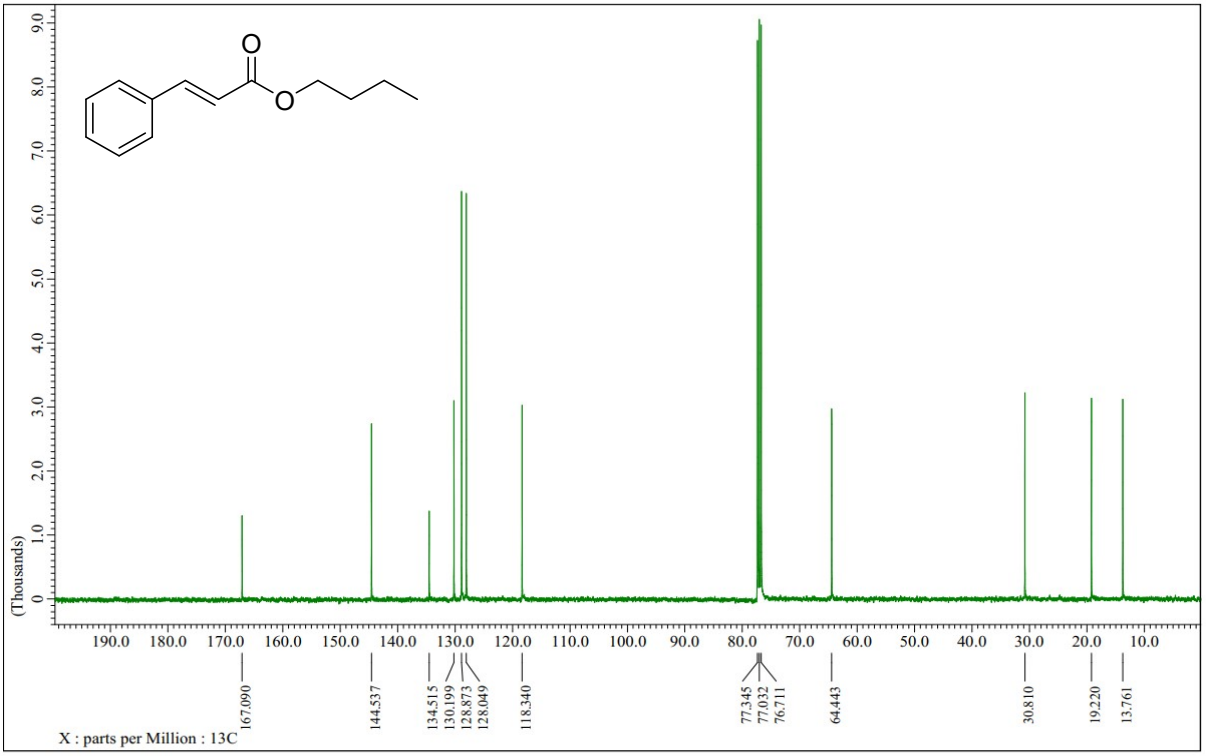


^{13}C NMR spectrum of 4-methylbenzyl cyclohexanecarboxylate

Butyl cinnamate (5n)

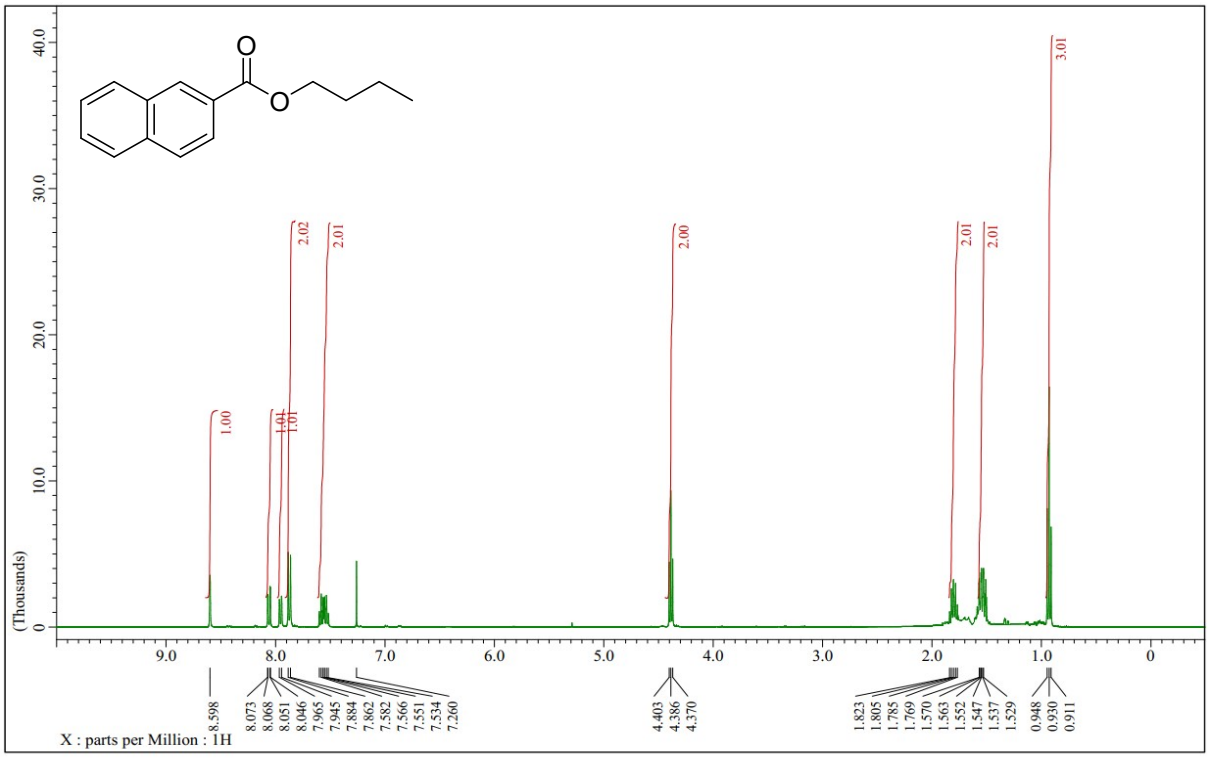


^{1}H NMR spectrum of butyl cinnamate

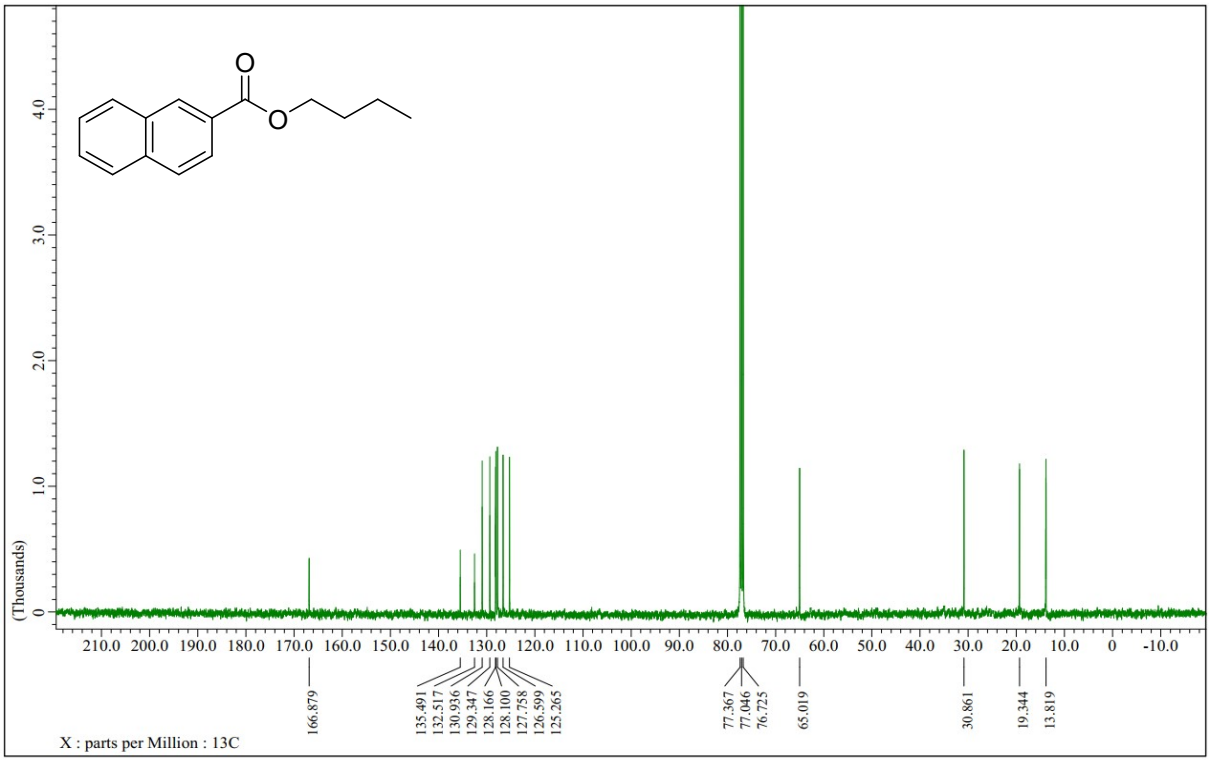


^{13}C NMR spectrum of butyl cinnamate

butyl 2-naphthoate (5o)

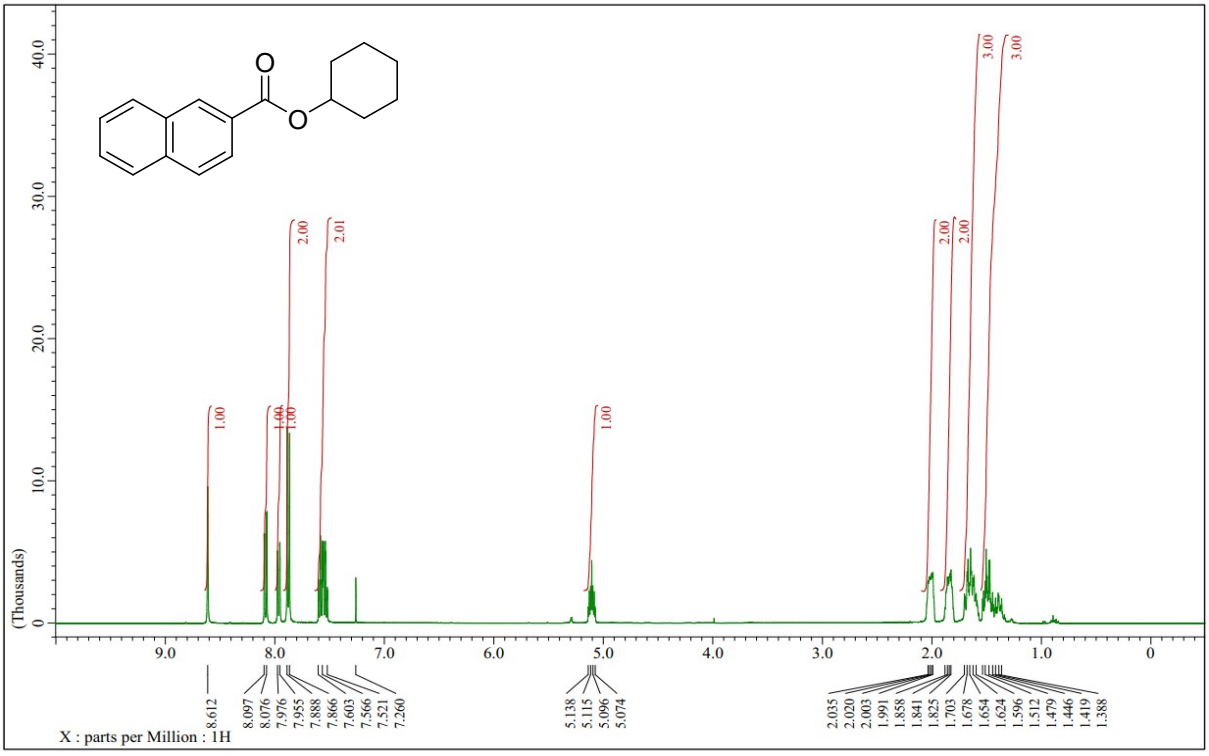


^{1}H NMR spectrum of butyl 2-naphthoate

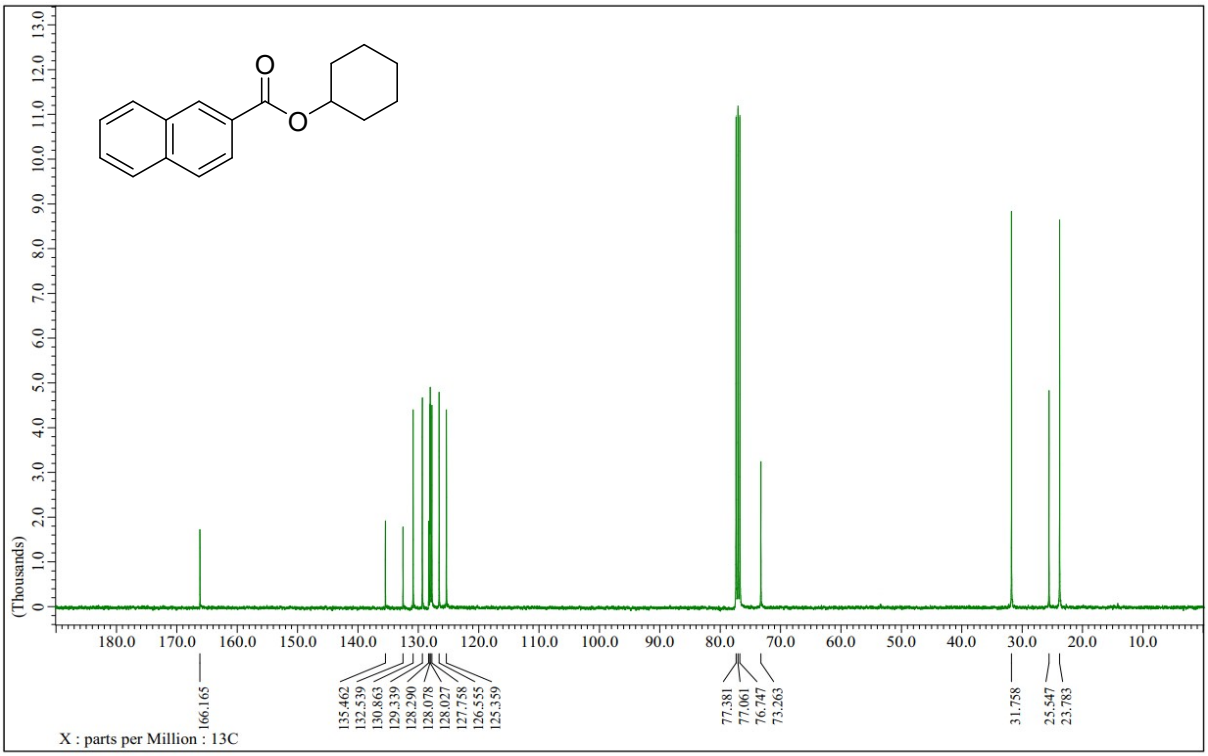


^{13}C NMR spectrum of butyl 2-naphthoate

Cyclohexyl 2-naphthoate (5p)

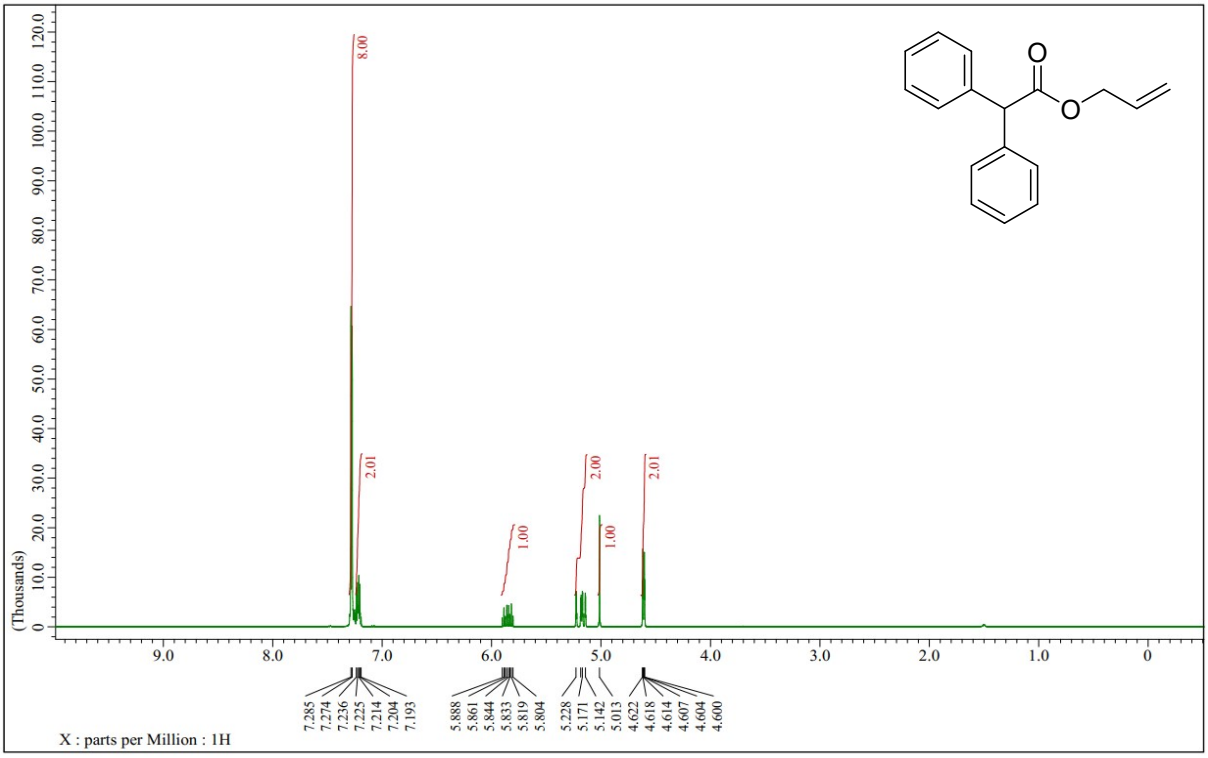


^{1}H NMR spectrum isobutyl 3-phenylpropanoate

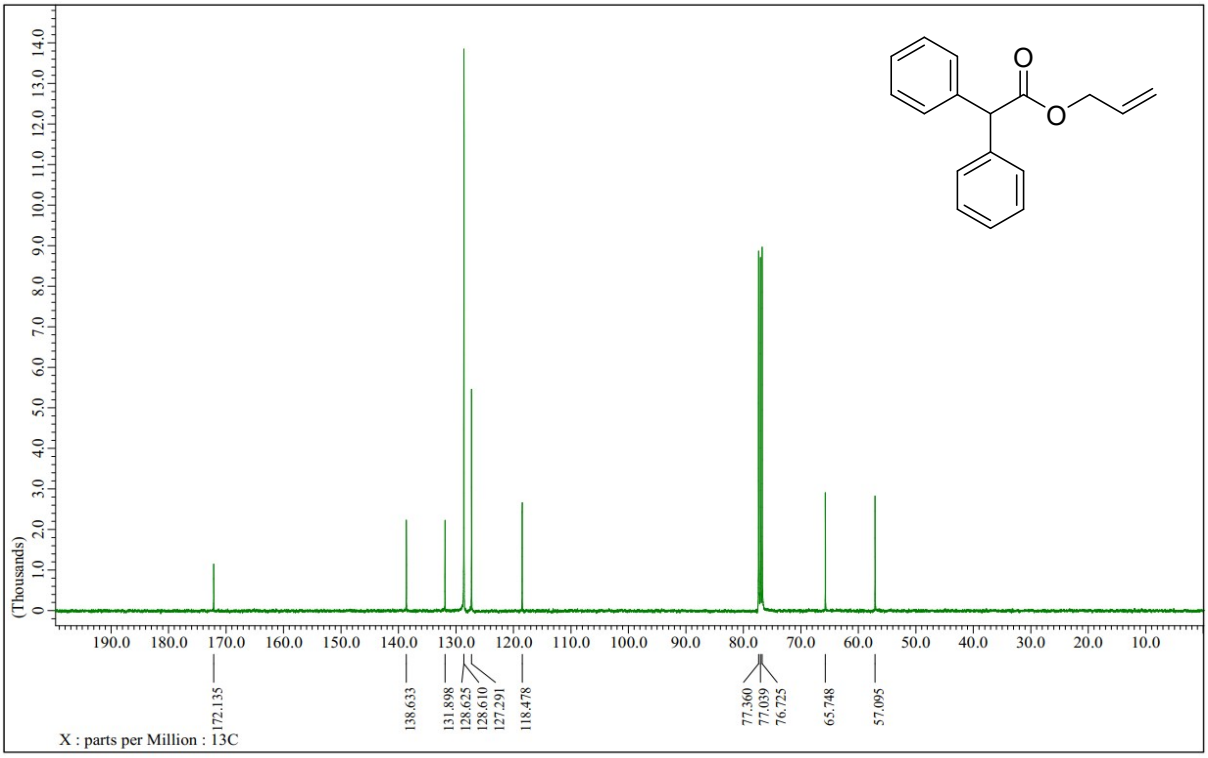


^{13}C NMR spectrum of isobutyl 3-phenylpropanoate

Allyl 2,2-diphenylacetate (5q)

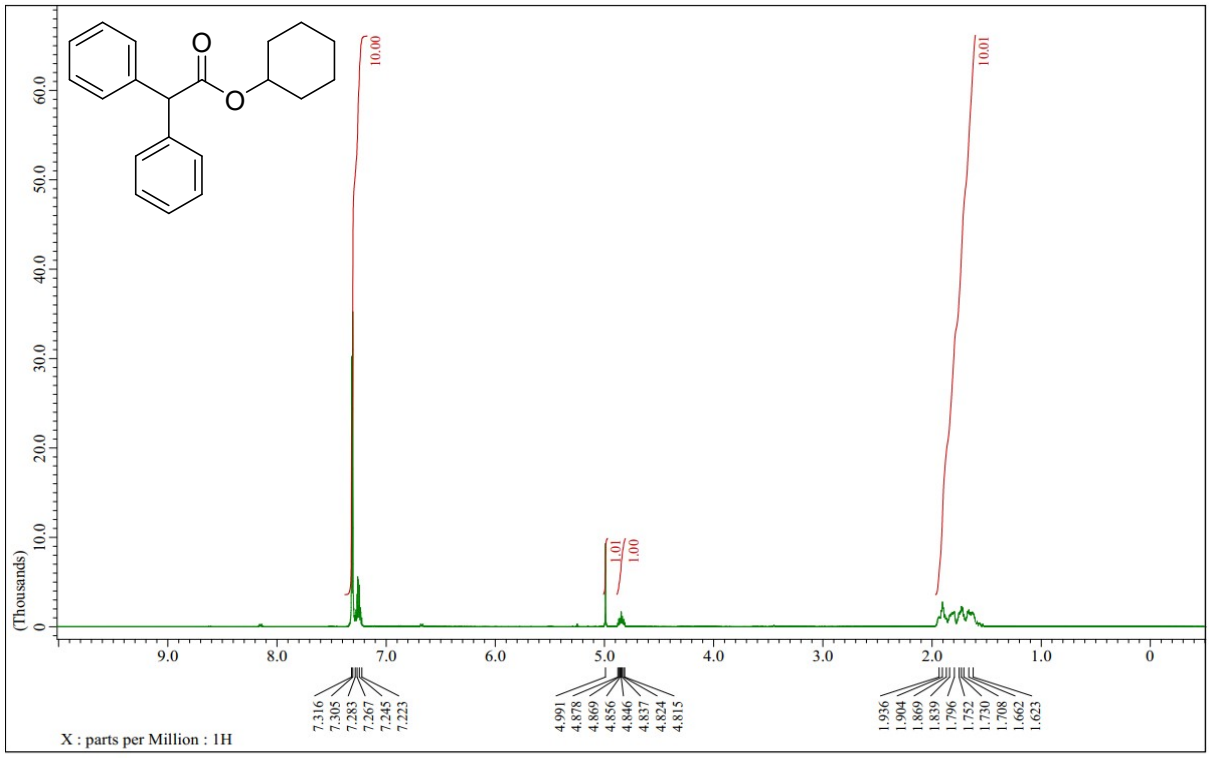


^{1}H NMR spectrum of allyl 2,2-diphenylacetate

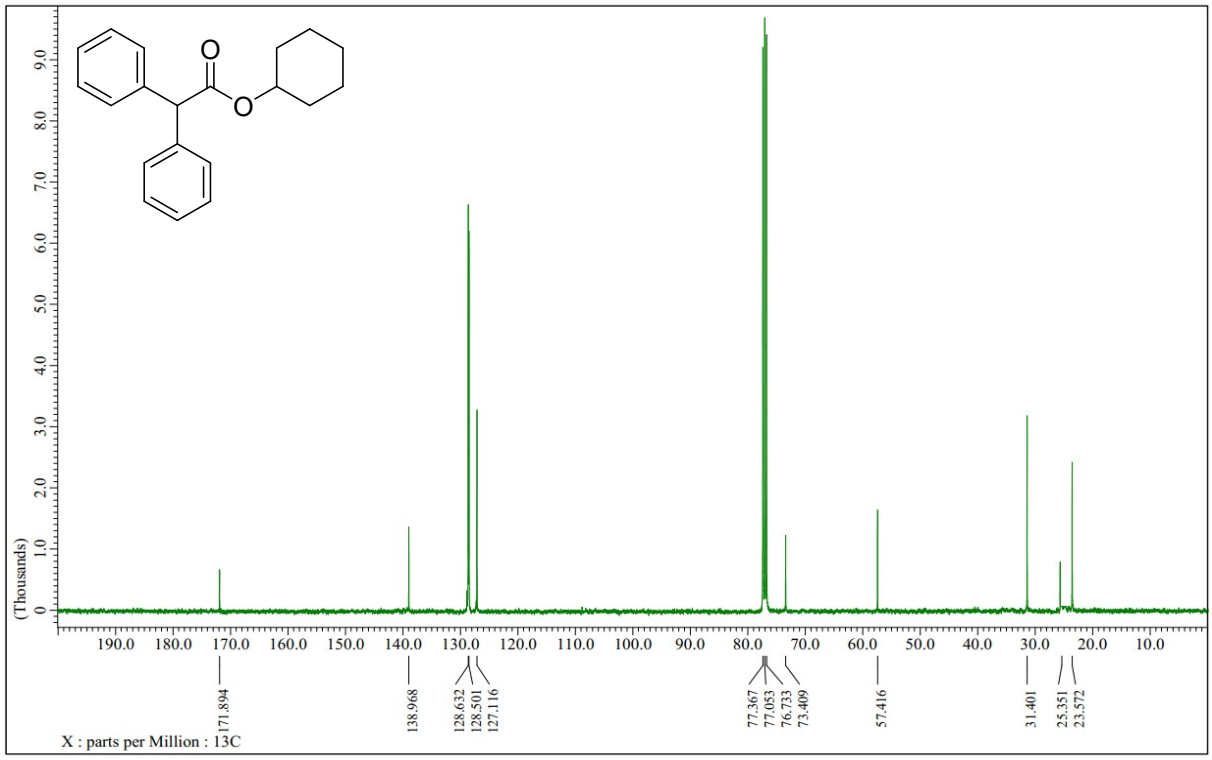


^{13}C NMR spectrum of allyl 2,2-diphenylacetate

Cyclohexyl 2,2-diphenylacetate (5r)

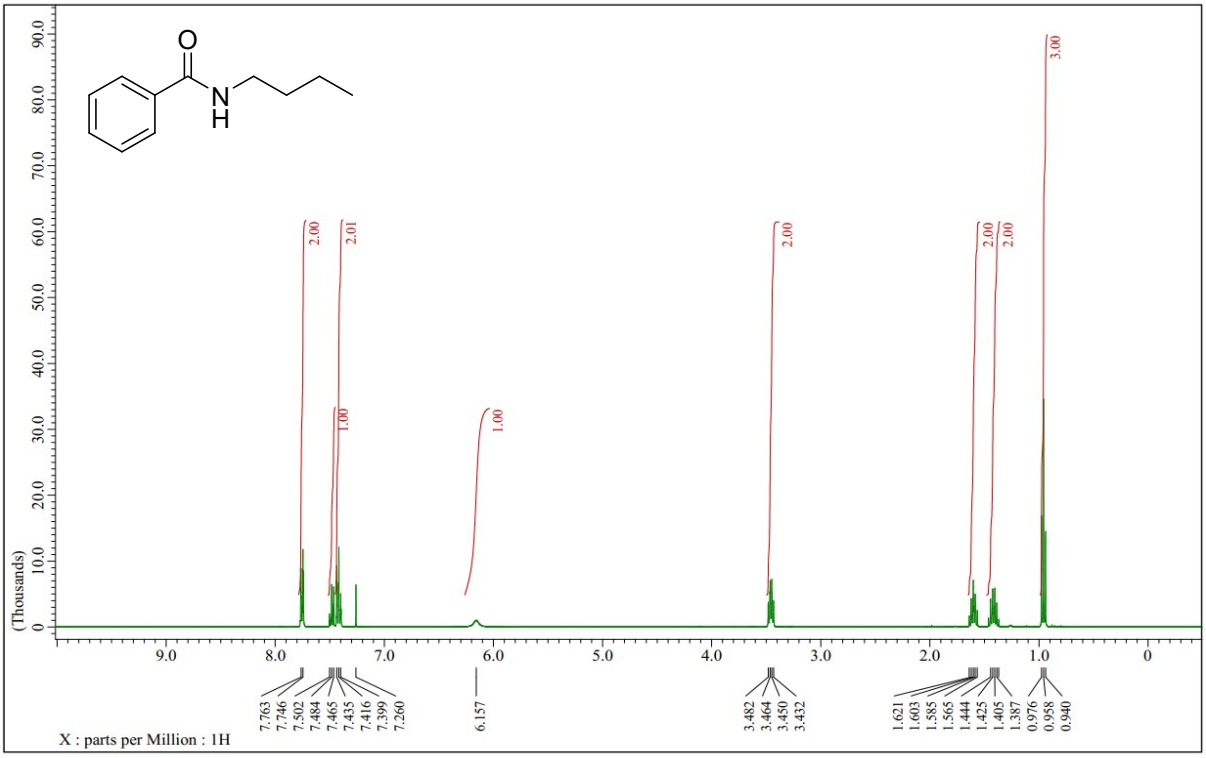


^{1}H NMR spectrum of cyclohexyl 2,2-diphenylacetate

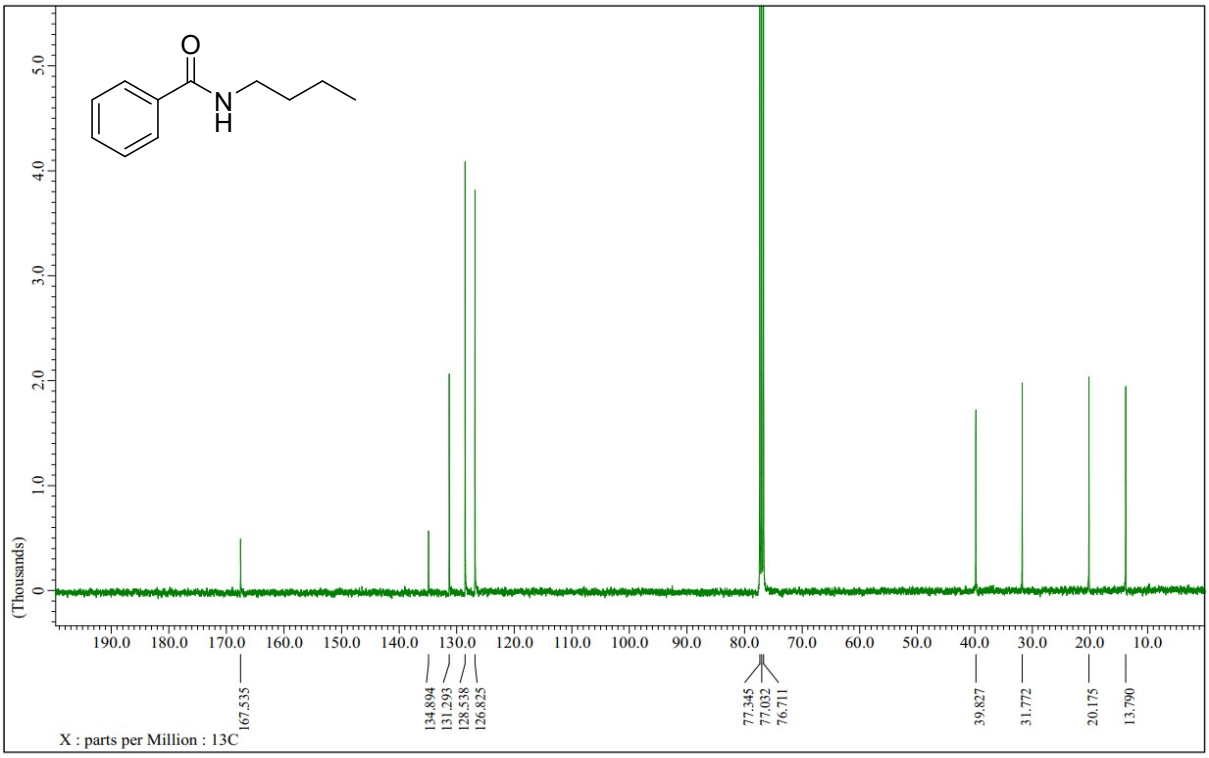


^{13}C NMR spectrum of cyclohexyl 2,2-diphenylacetate

N-butylbenzamide (7a)

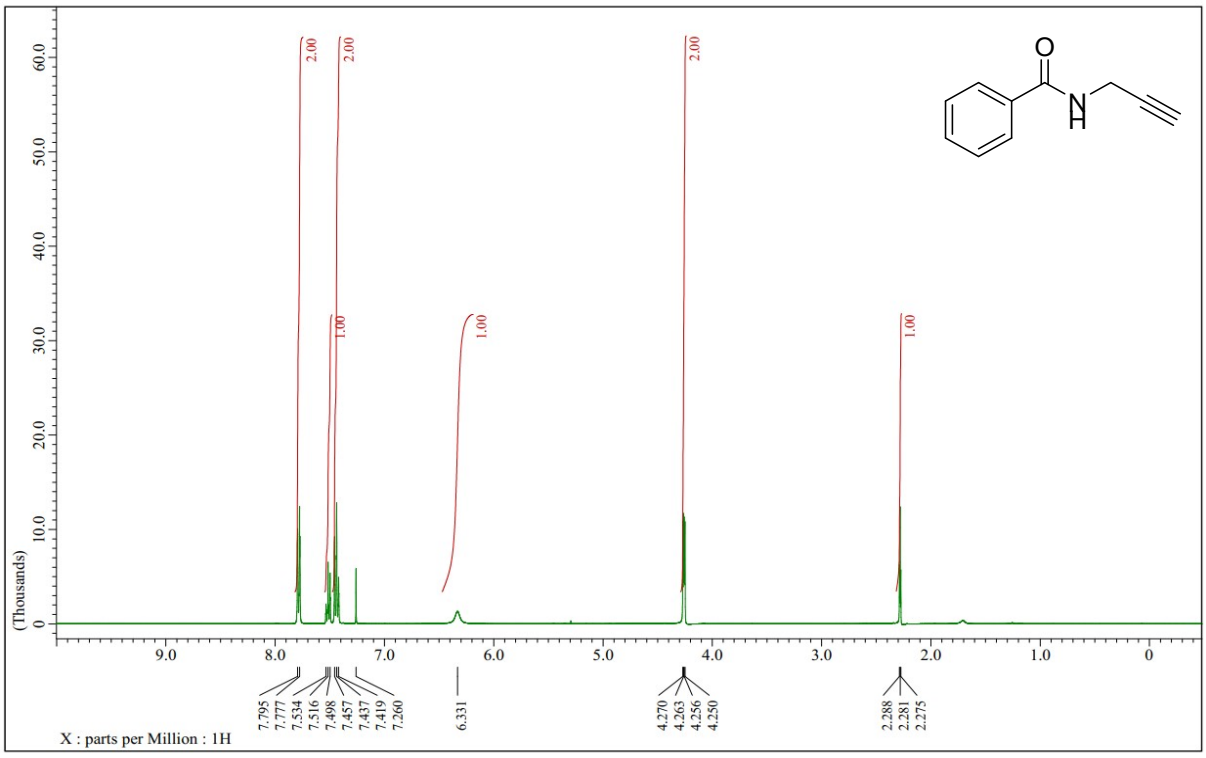


^{1}H NMR spectrum of N-butylbenzamide

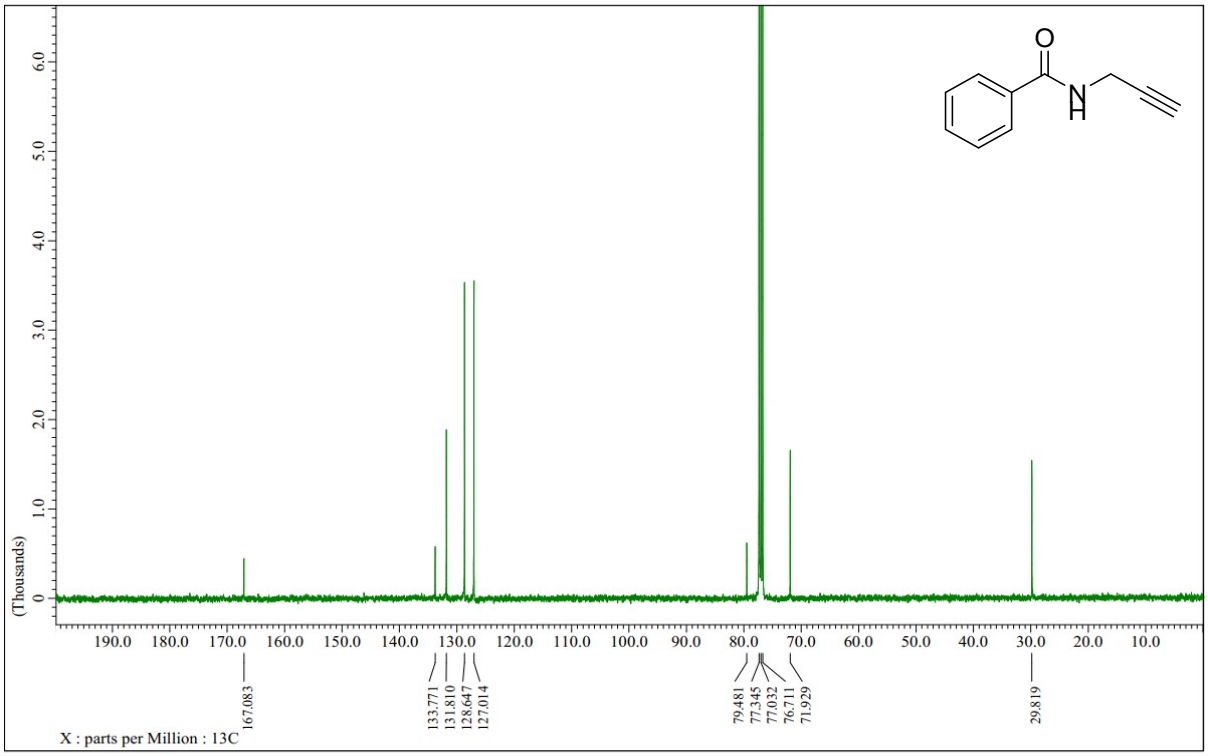


^{13}C NMR spectrum of N-butylbenzamide

***N*-(Prop-2-yn-1-yl)benzamide (7b)**

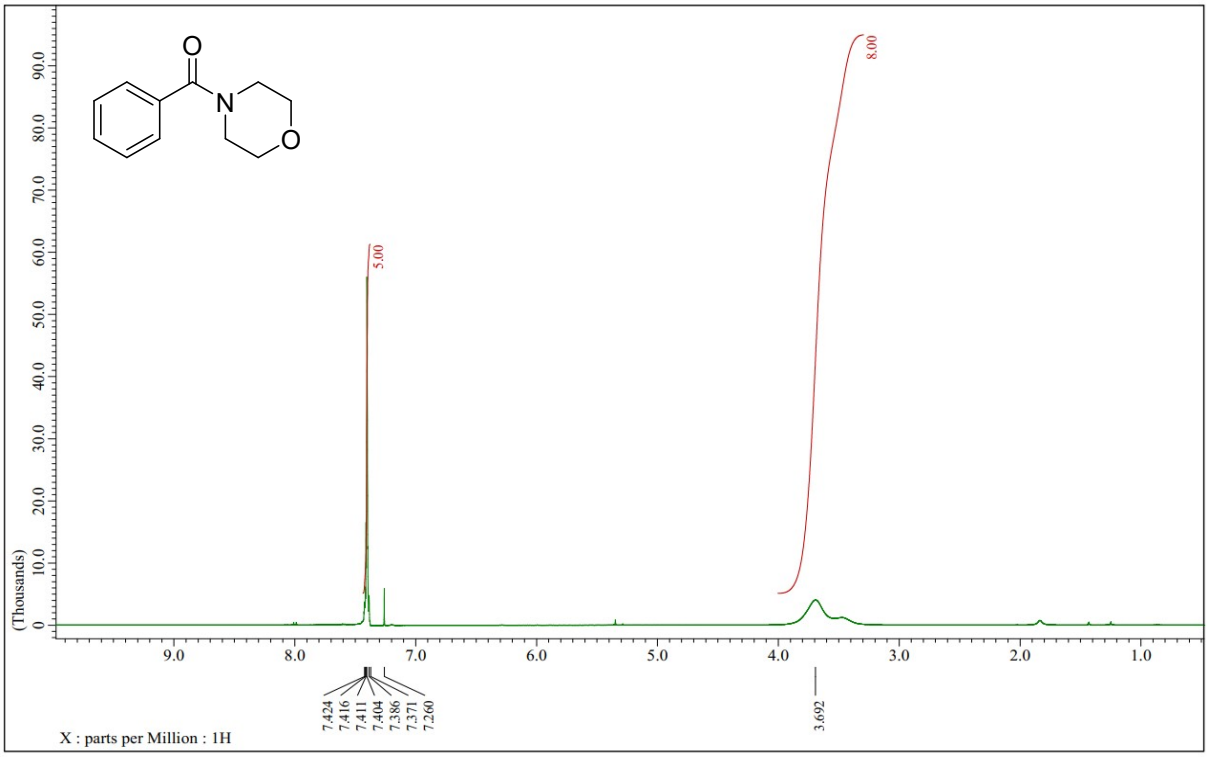


^{1}H NMR spectrum of N-(Prop-2-yn-1-yl)benzamide

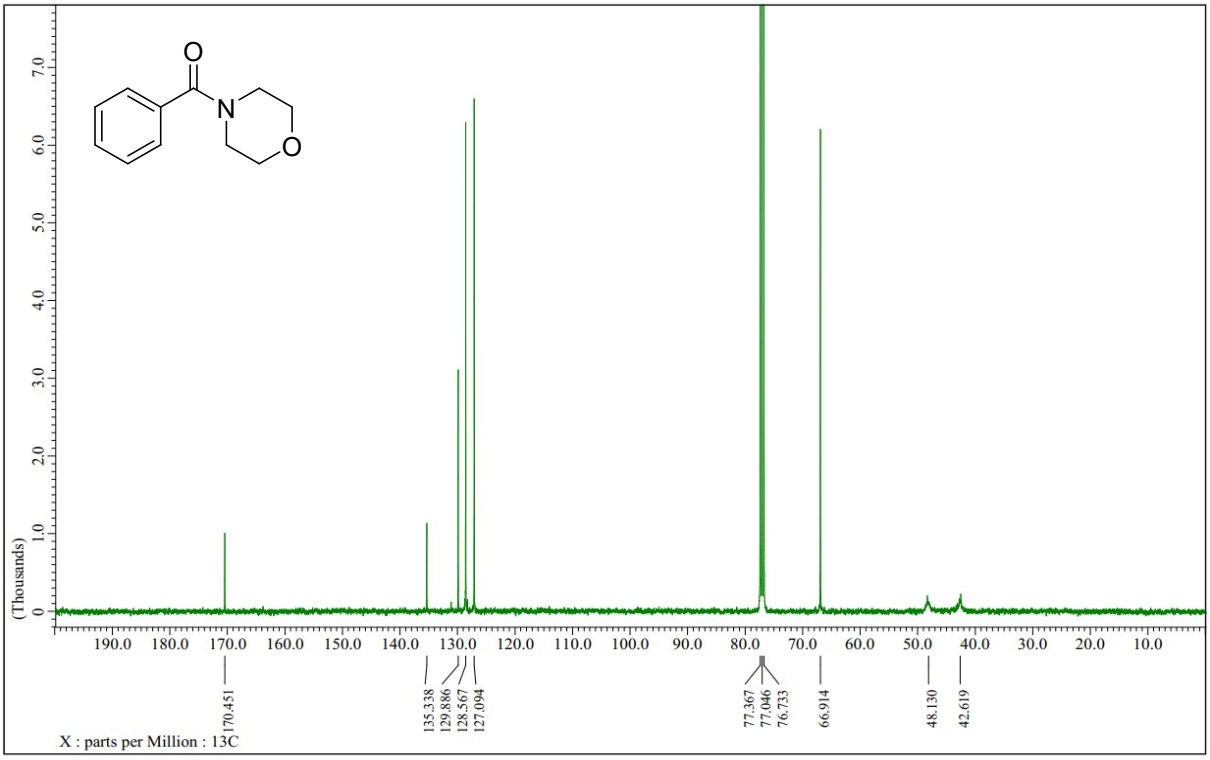


^{13}C NMR spectrum of N-(Prop-2-yn-1-yl)benzamide

Morpholino(phenyl)methanone (7c)

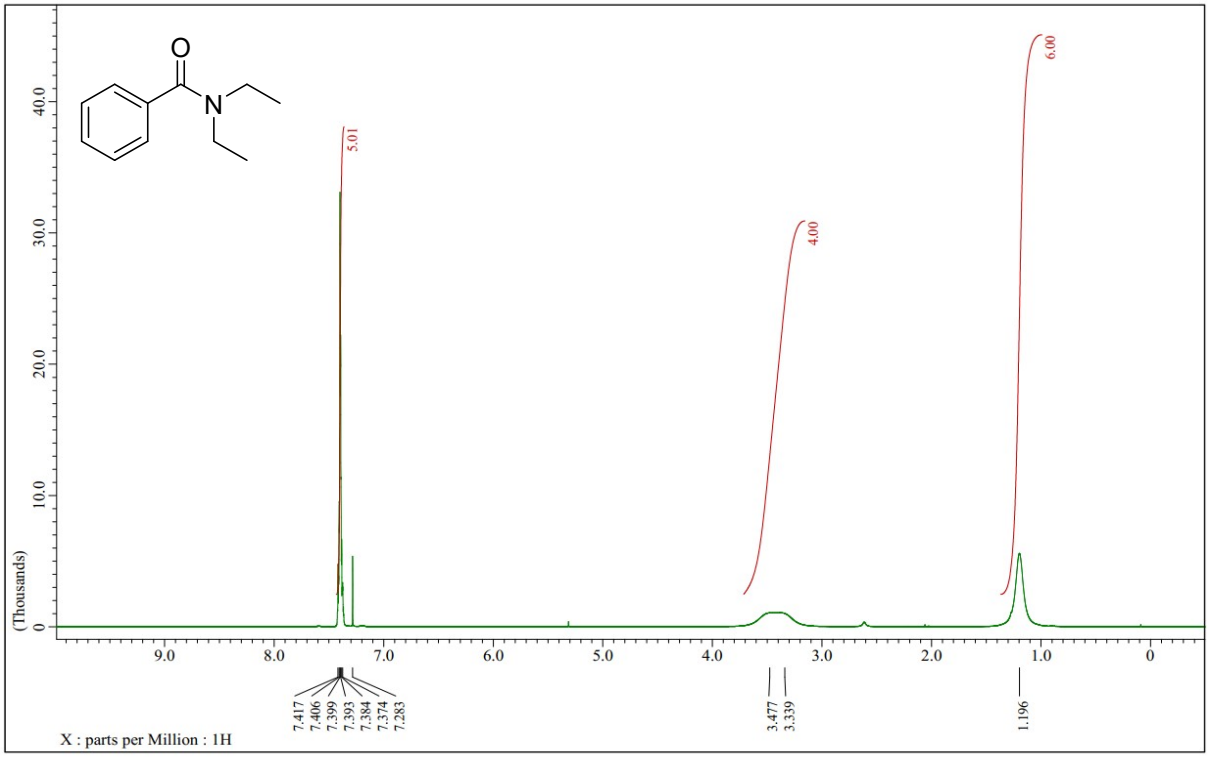


^{1}H NMR spectrum of morpholino(phenyl)methanone

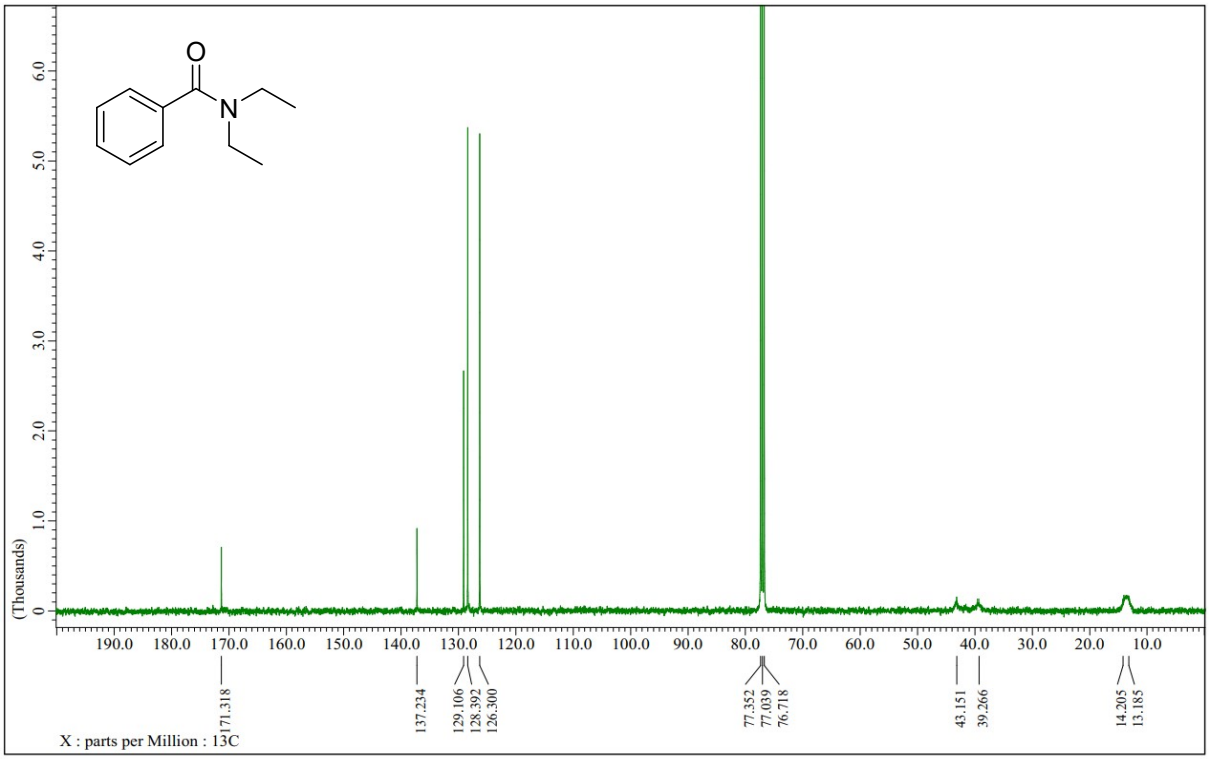


^{13}C NMR spectrum of morpholino(phenyl)methanone

N,N-diethylbenzamide (7d)

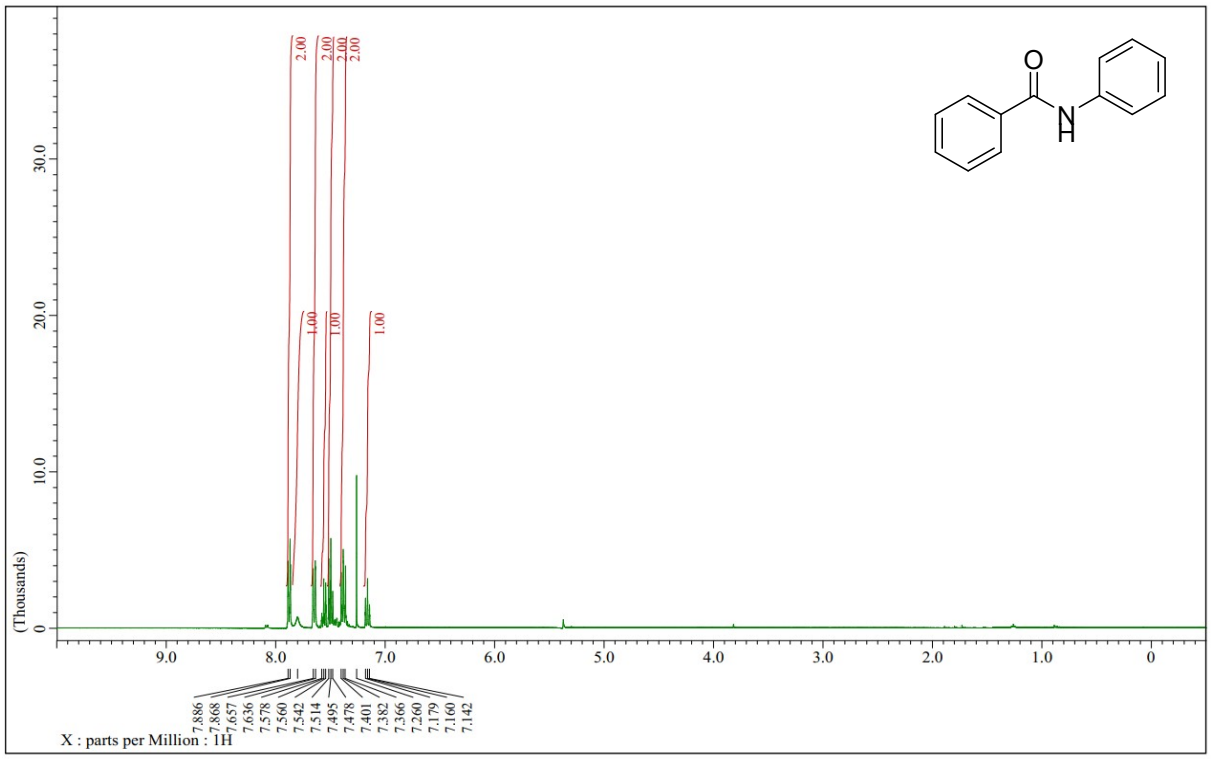


^{1}H NMR spectrum of N,N-diethylbenzamide

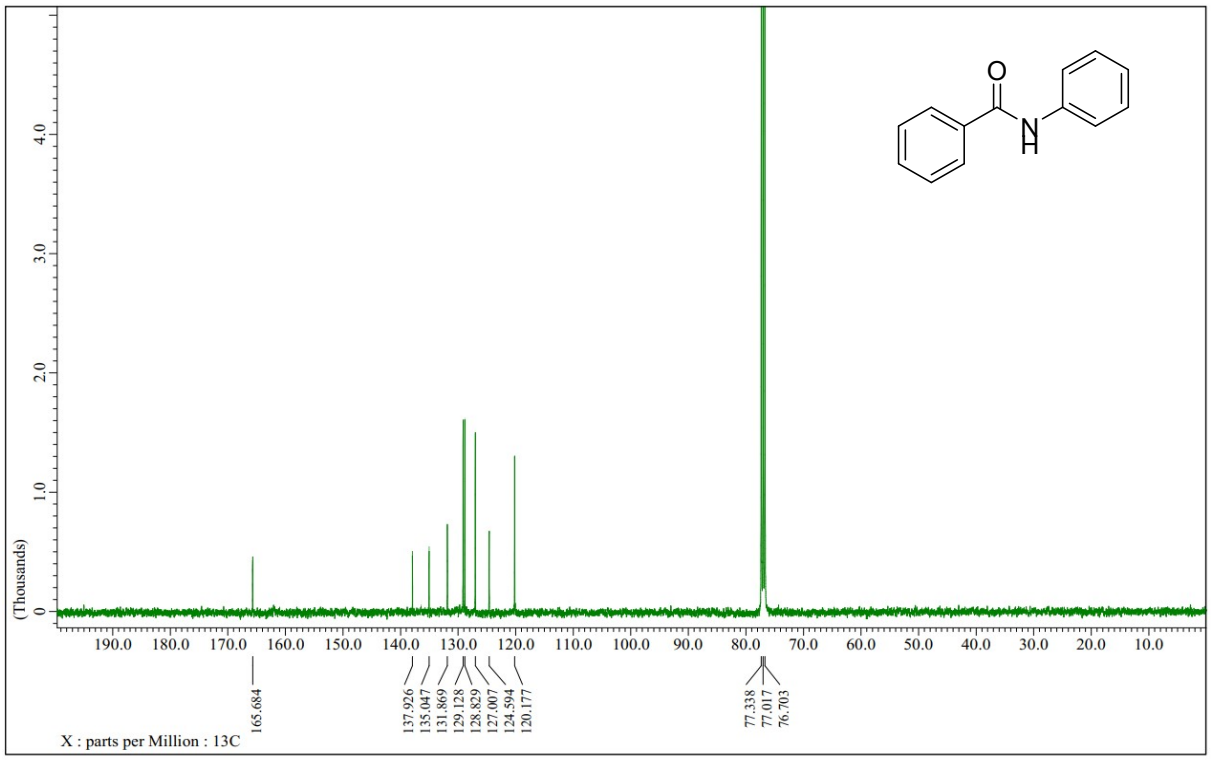


^{13}C NMR spectrum of N,N-diethylbenzamide

N-phenylbenzamide (7e)

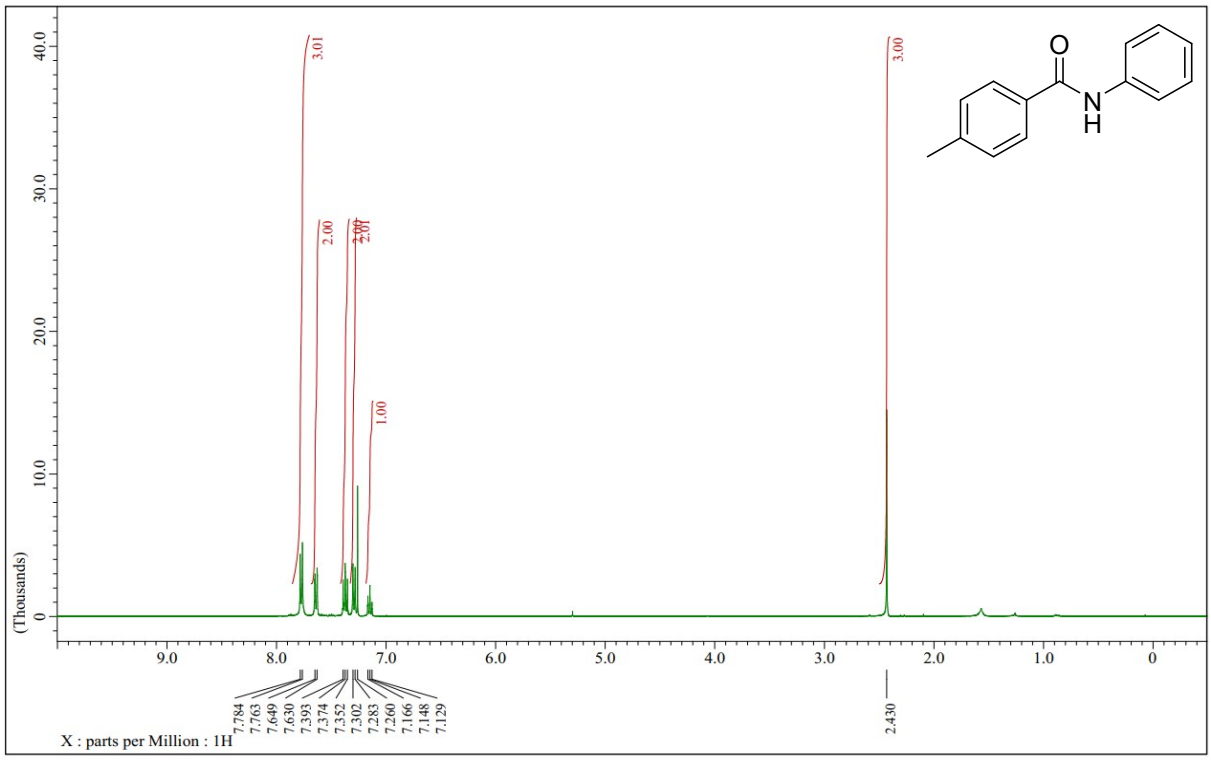


^{1}H NMR spectrum of N-phenylbenzamide

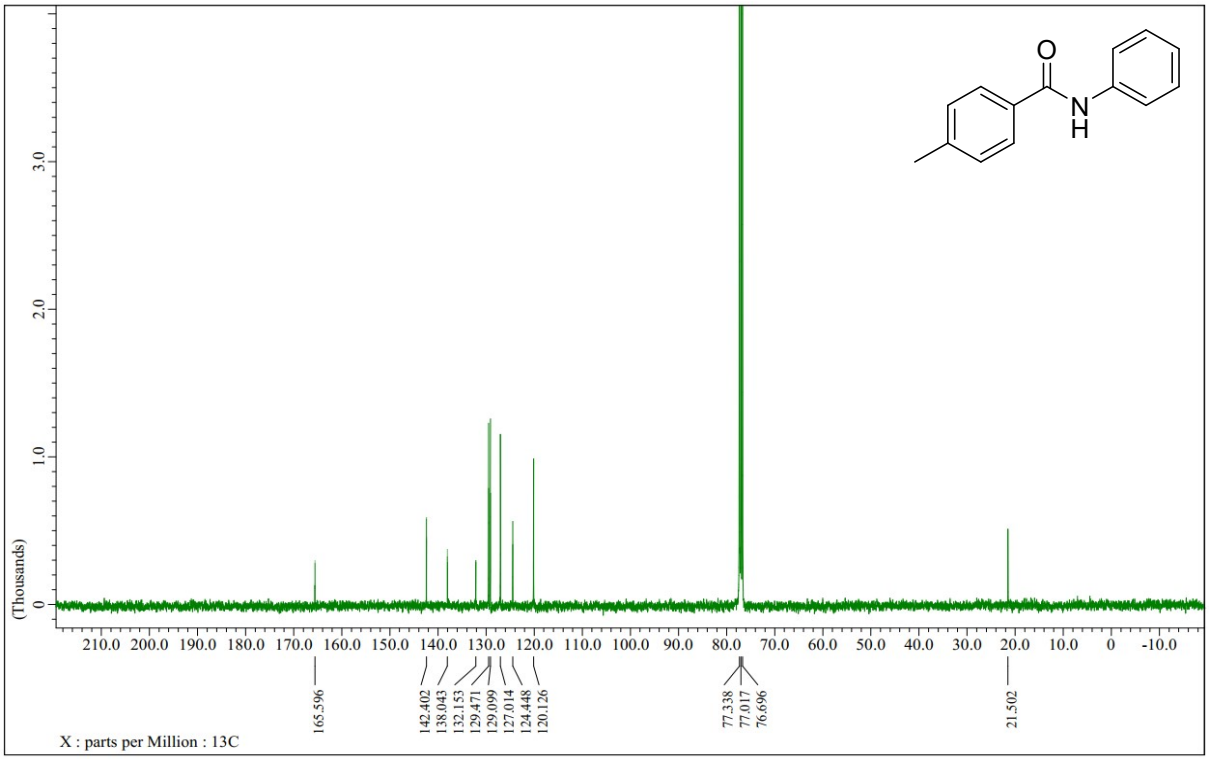


^{13}C NMR spectrum of N-phenylbenzamide

4-methyl-N-phenylbenzamide (7f)

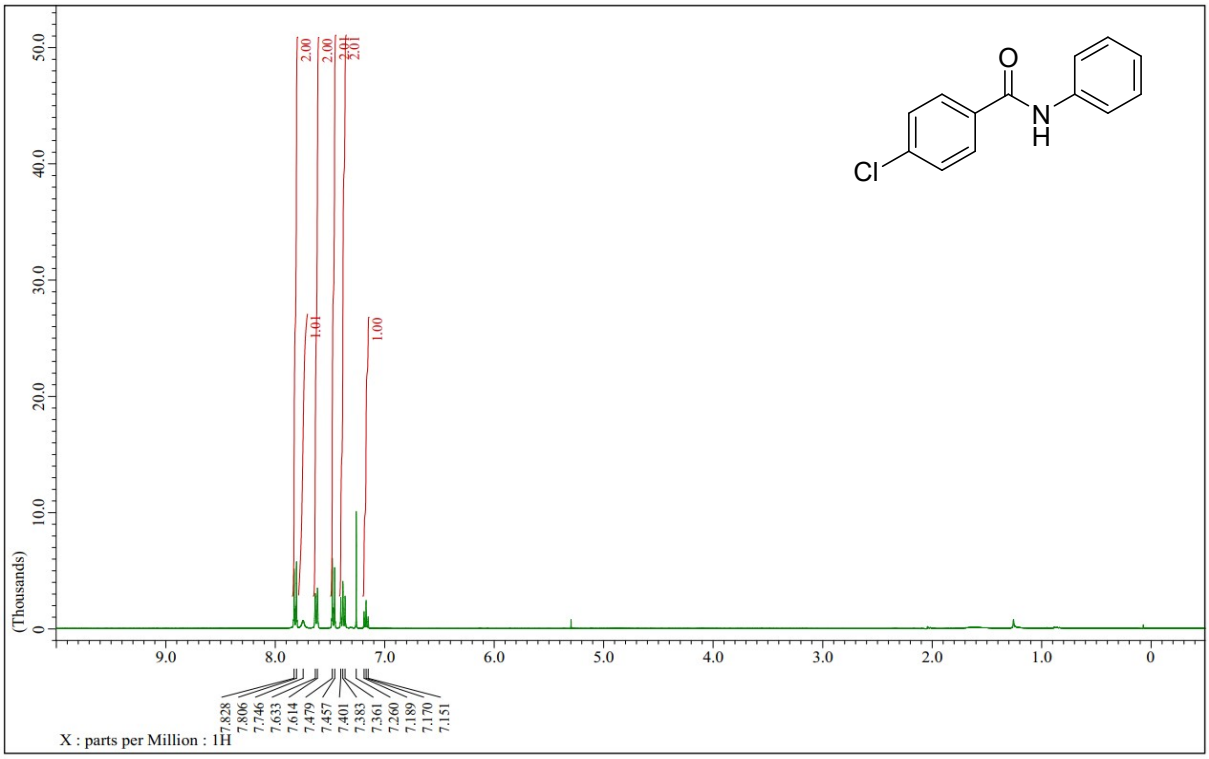


^{1}H NMR spectrum of 4-methyl-N-phenylbenzamide

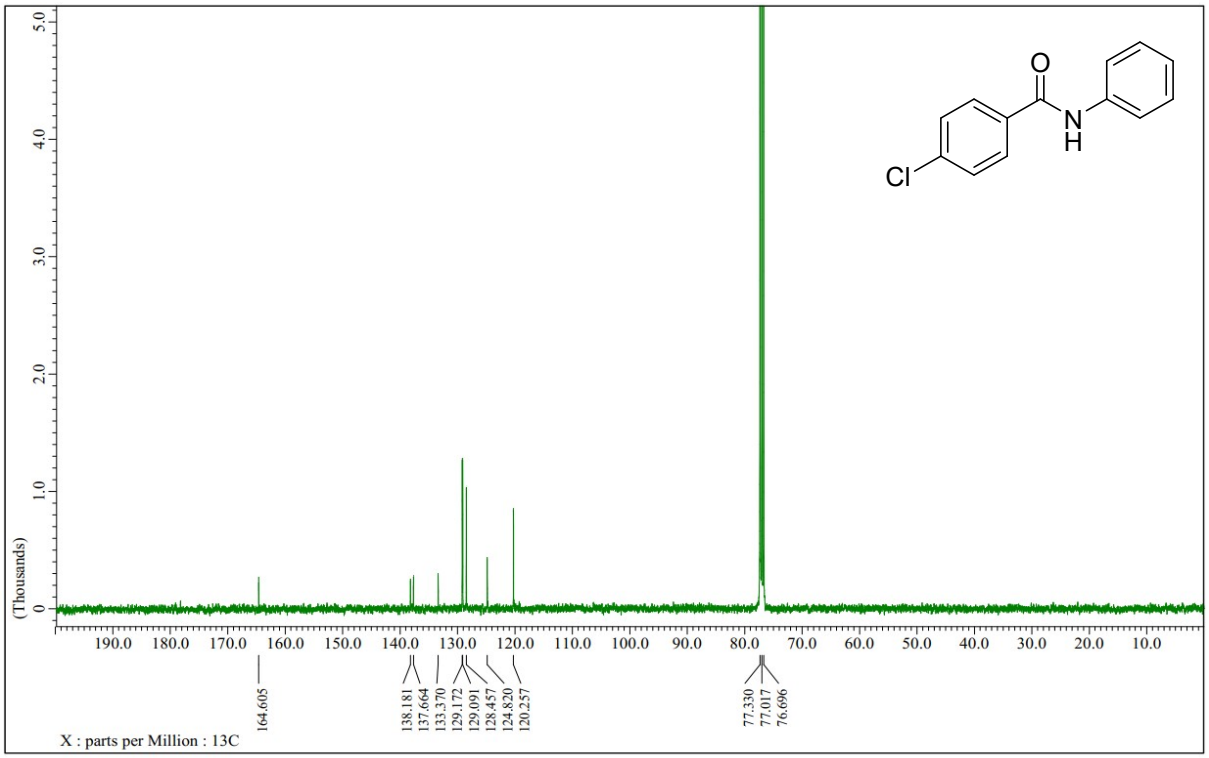


^{13}C NMR spectrum of 4-methyl-N-phenylbenzamide

4-Chloro-*N*-phenylbenzamide (7g)

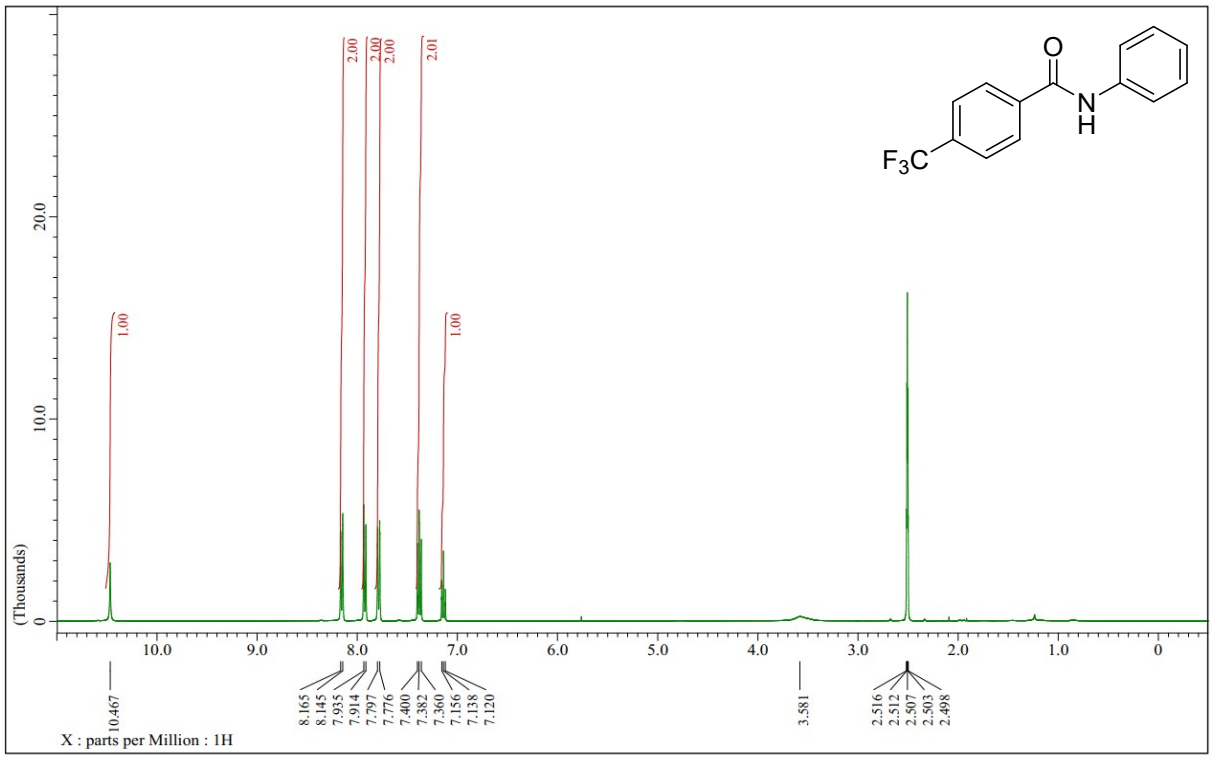


^{1}H NMR spectrum of 4-chloro-N-phenylbenzamide

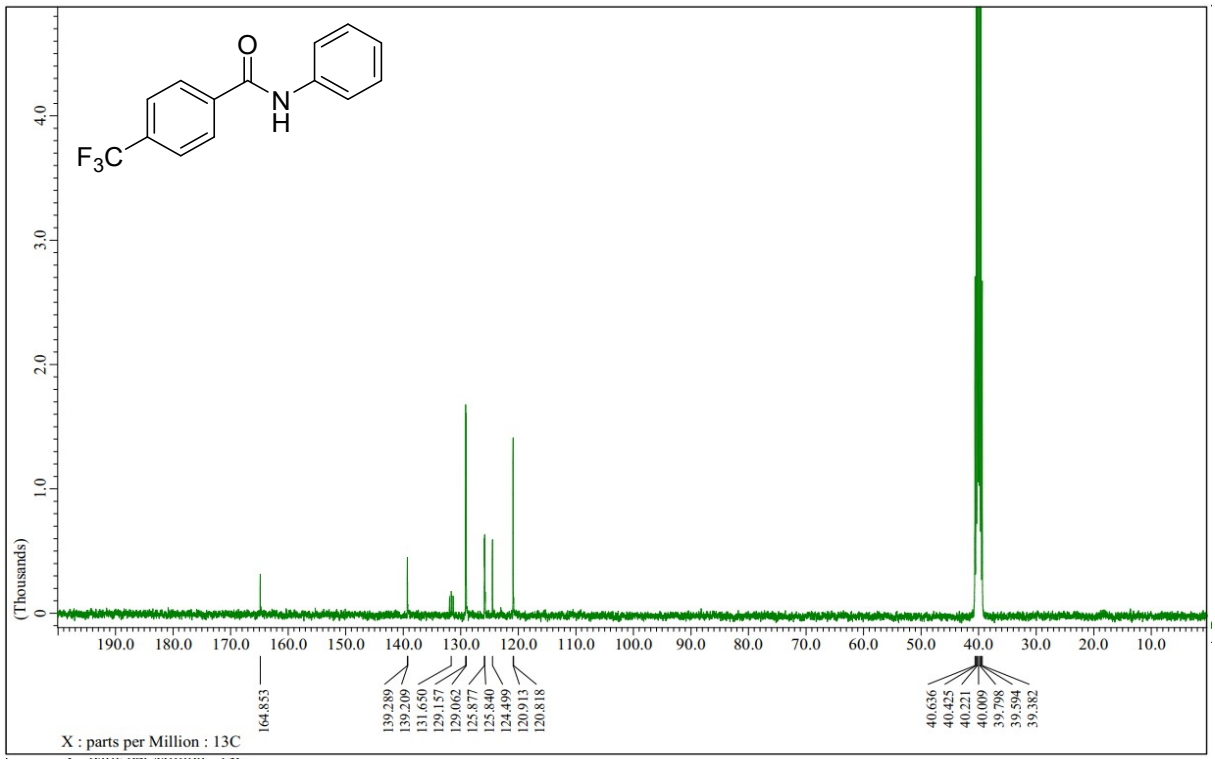


^{13}C NMR spectrum of 4-chloro-N-phenylbenzamide

N-phenyl-4-(trifluoromethyl)benzamide (7h)

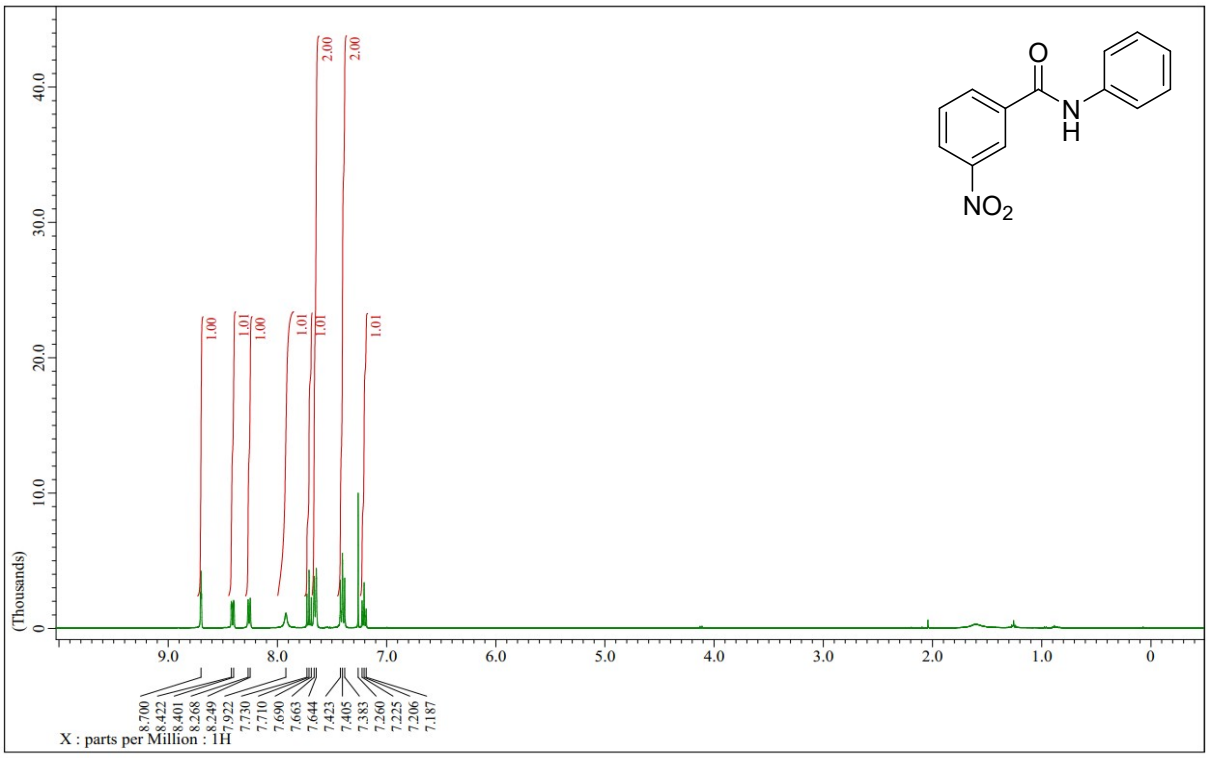


^{1}H NMR spectrum of N,N-diethylbenzamide

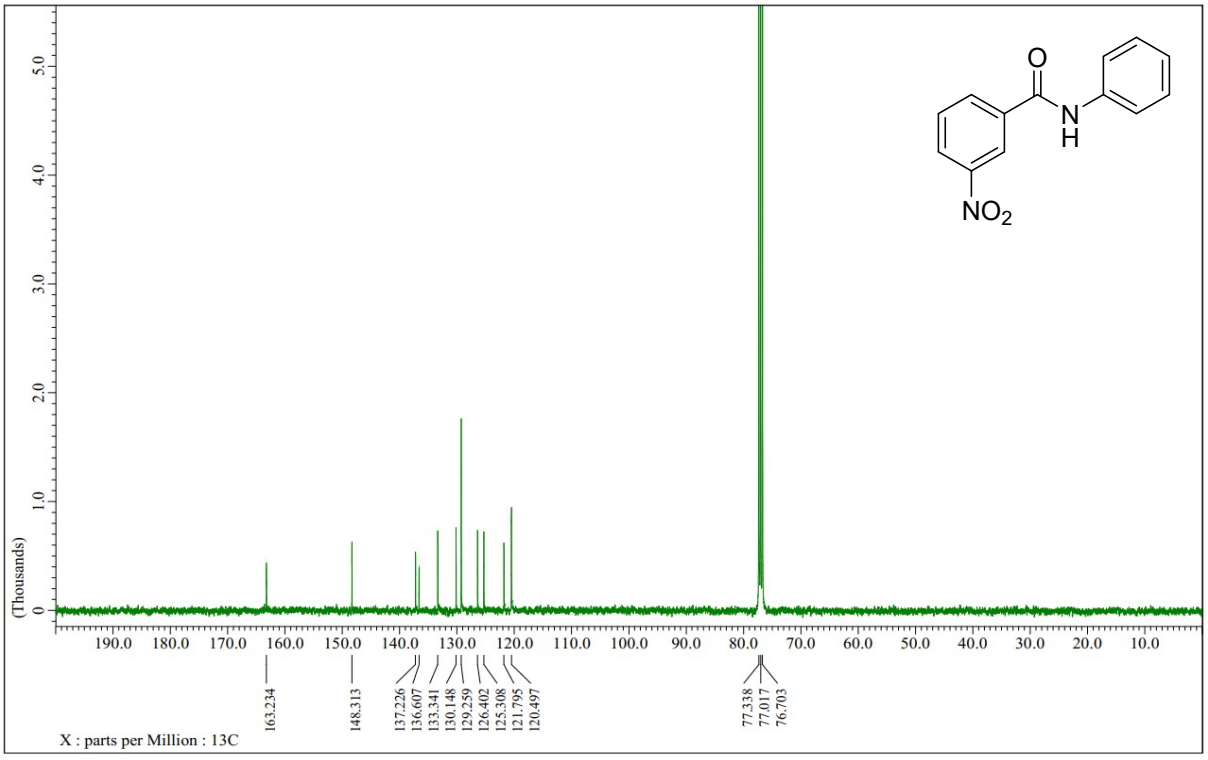


^{13}C NMR spectrum of N,N-diethylbenzamide

3-nitro-N-phenylbenzamide (7i)

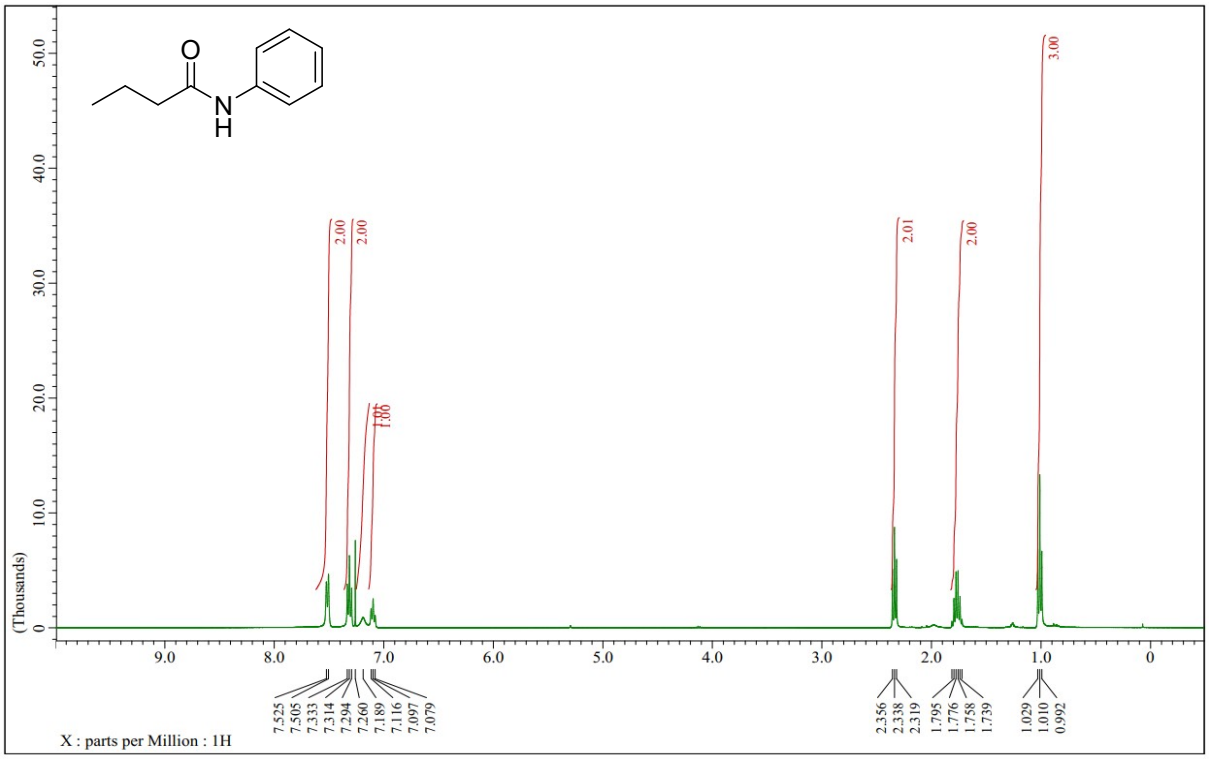


^{1}H NMR spectrum of 3-nitro-N-phenylbenzamide

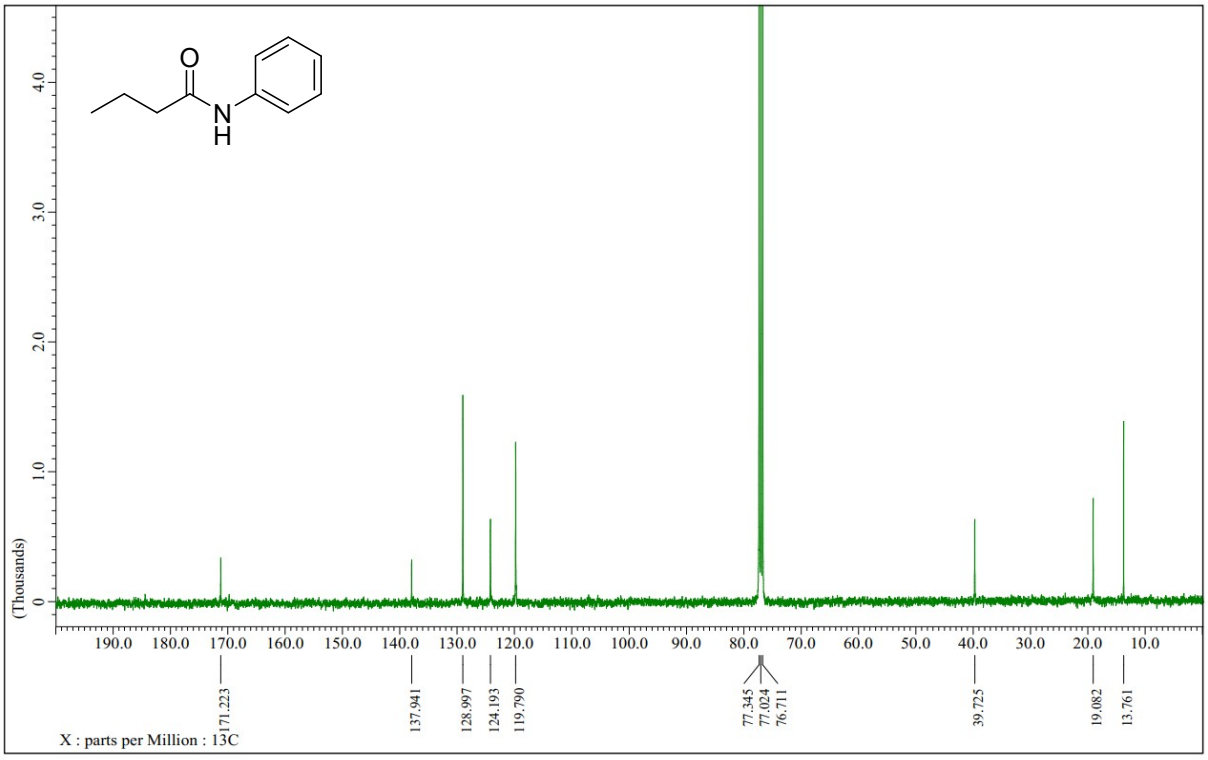


^{13}C NMR spectrum of 3-nitro-N-phenylbenzamide

N-phenylbutyramide (7j)

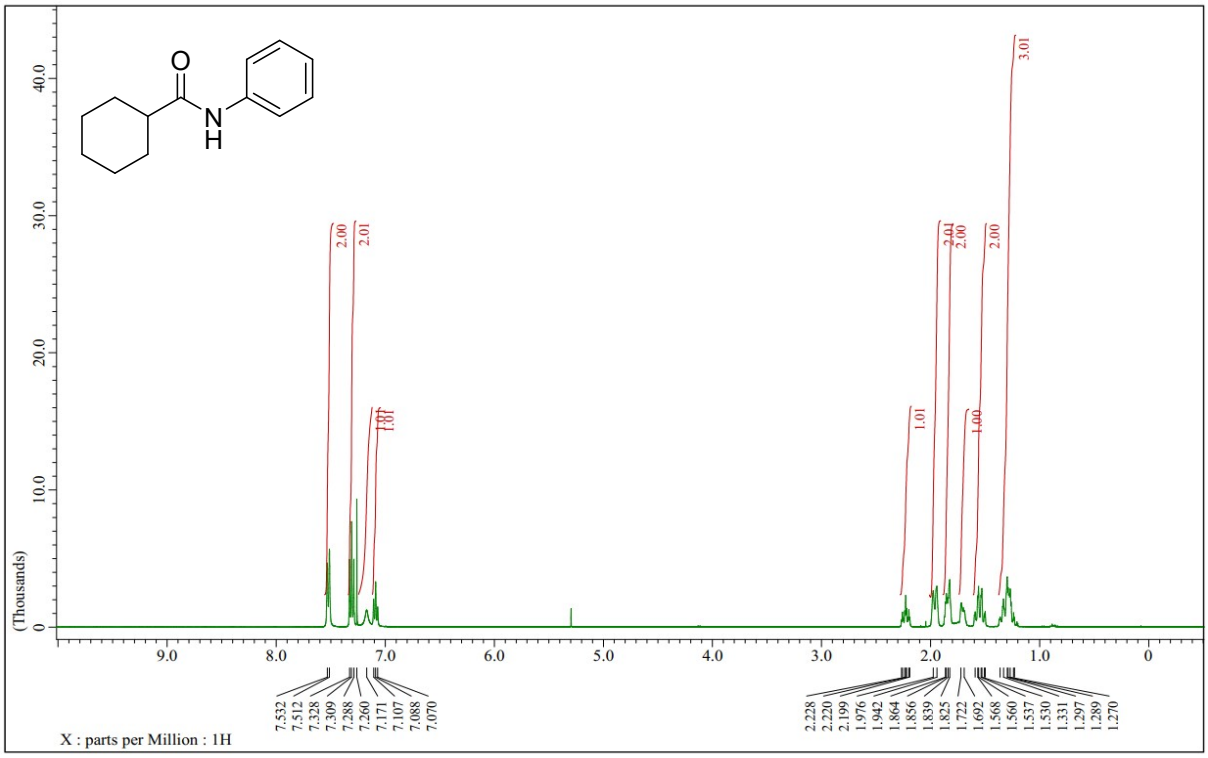


^{1}H NMR spectrum of N-phenylbutyramide

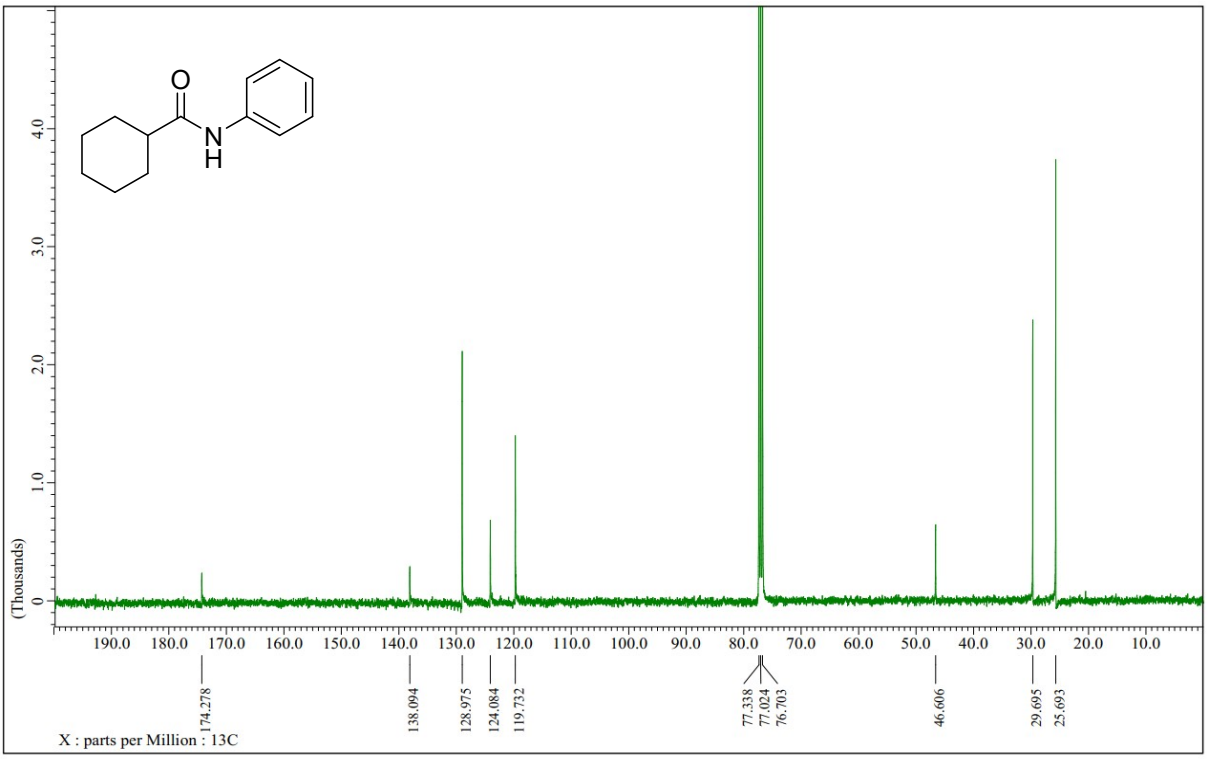


^{13}C NMR spectrum of N-phenylbutyramide

N-phenylcyclohexanecarboxamide (7k)

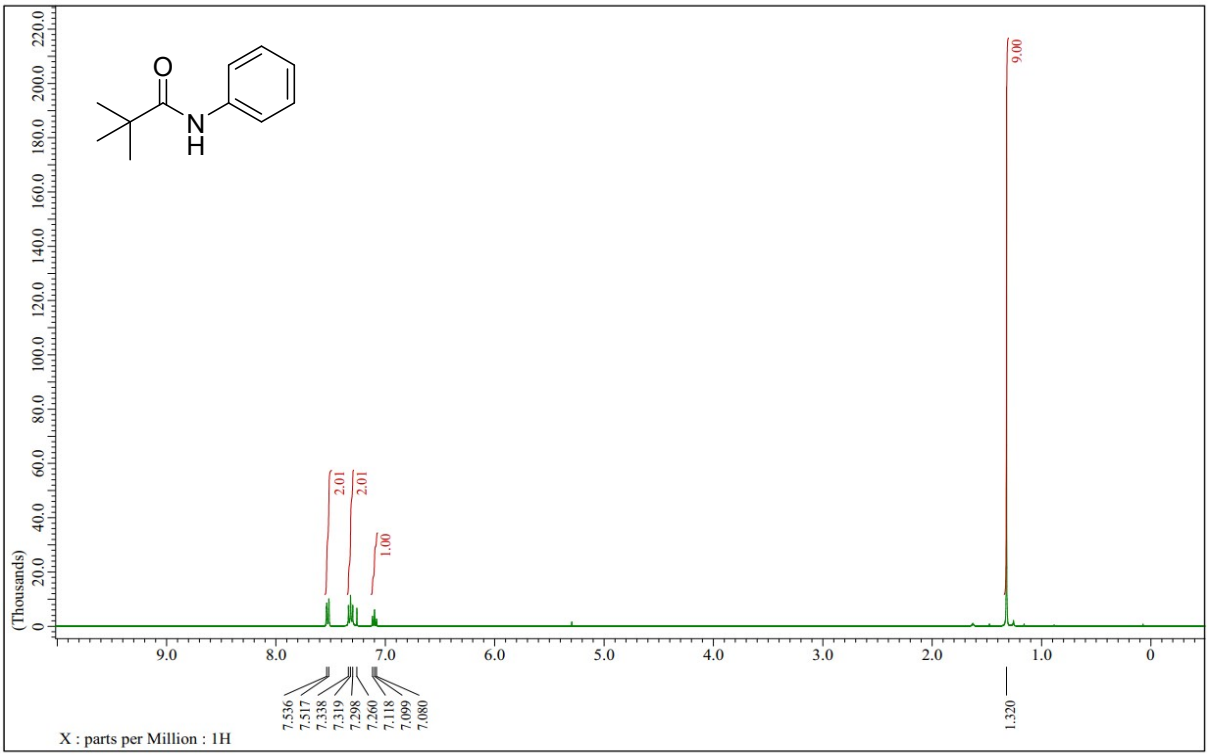


^{1}H NMR spectrum of N-phenylcyclohexanecarboxamide

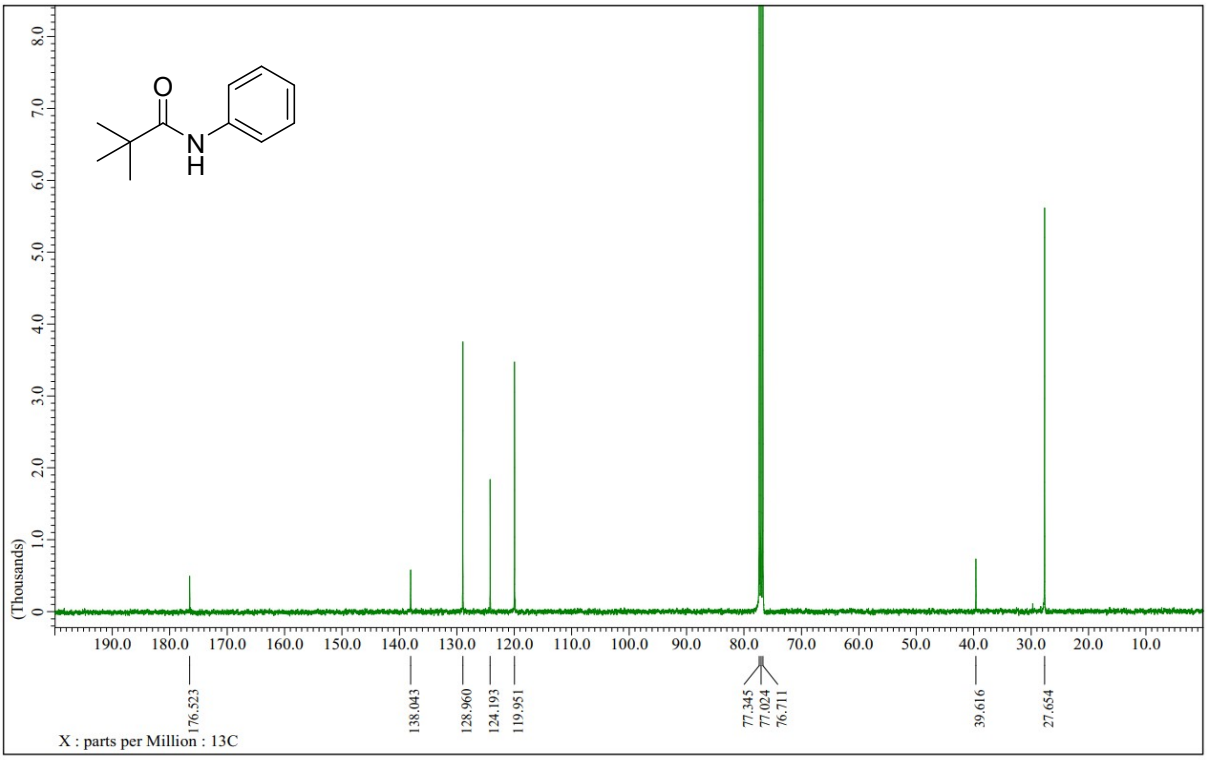


^{13}C NMR spectrum of N-phenylcyclohexanecarboxamide

N-phenylpivalamide (7l)

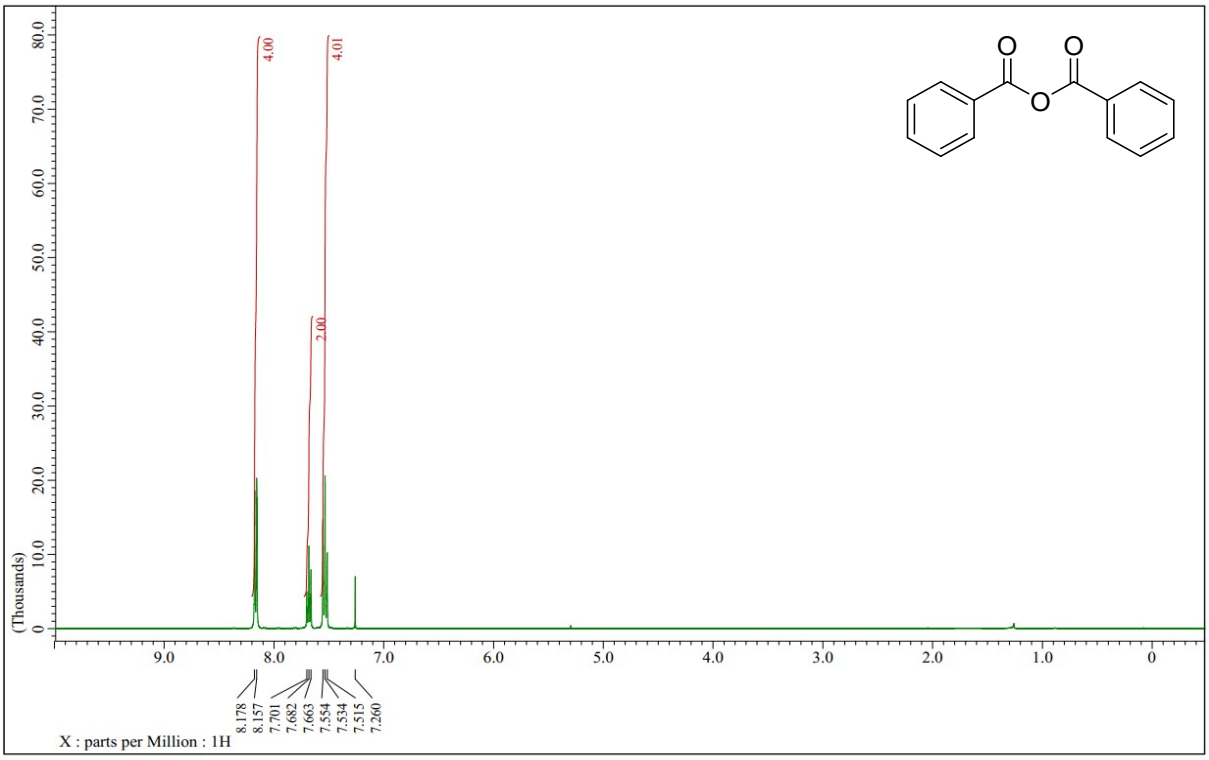


^{1}H NMR spectrum of N-phenylpivalamide

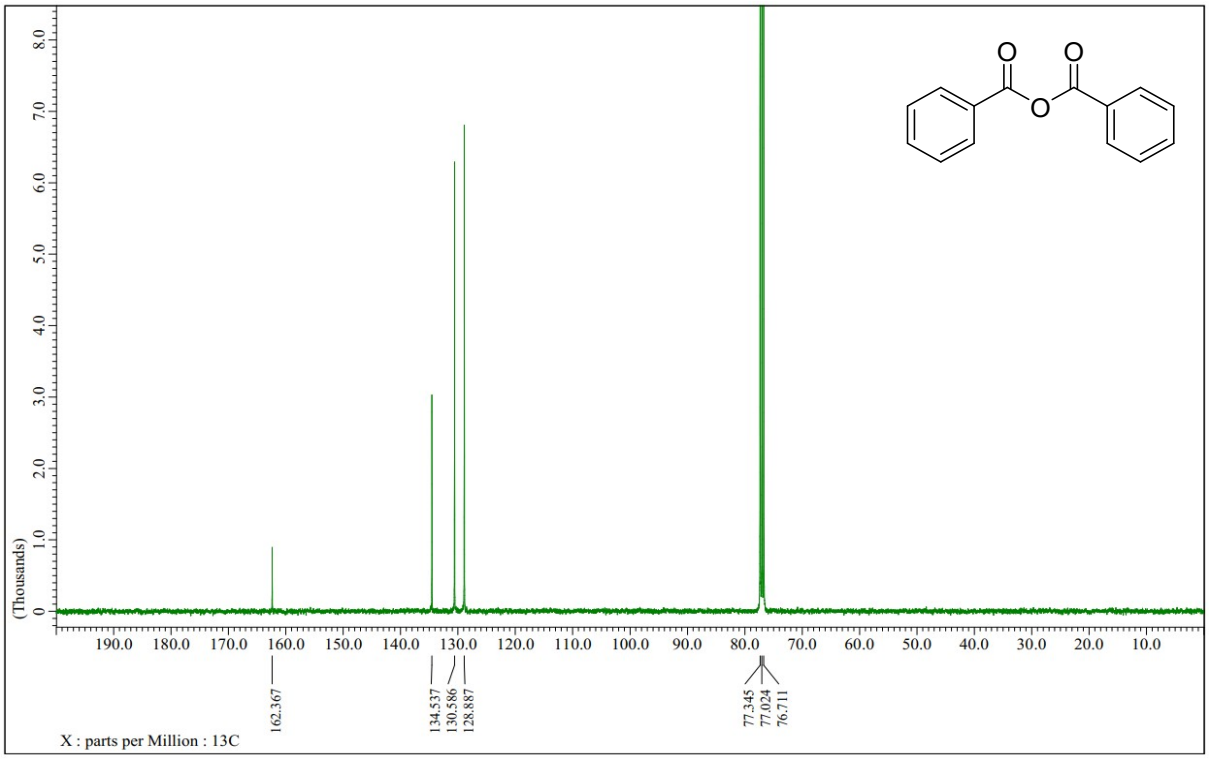


^{13}C NMR spectrum of N-phenylpivalamide

Benzoic anhydride (9a)

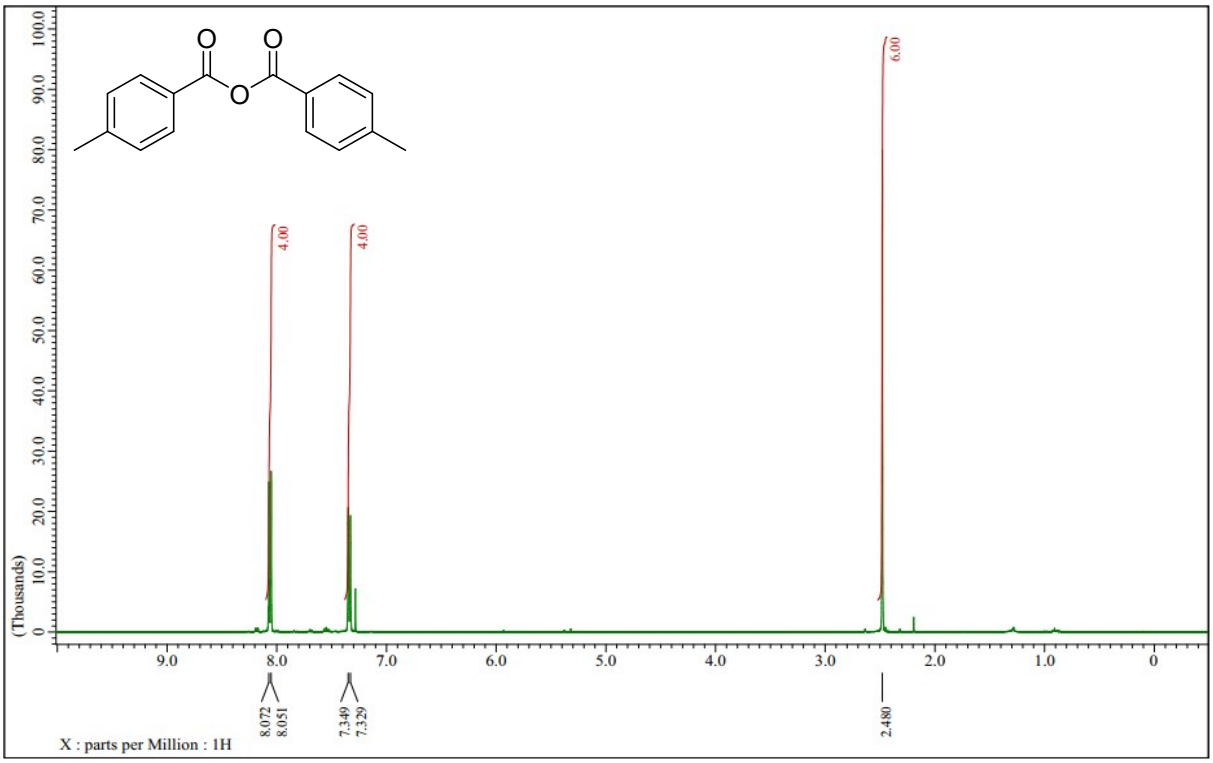


^{1}H NMR spectrum of benzoic anhydride

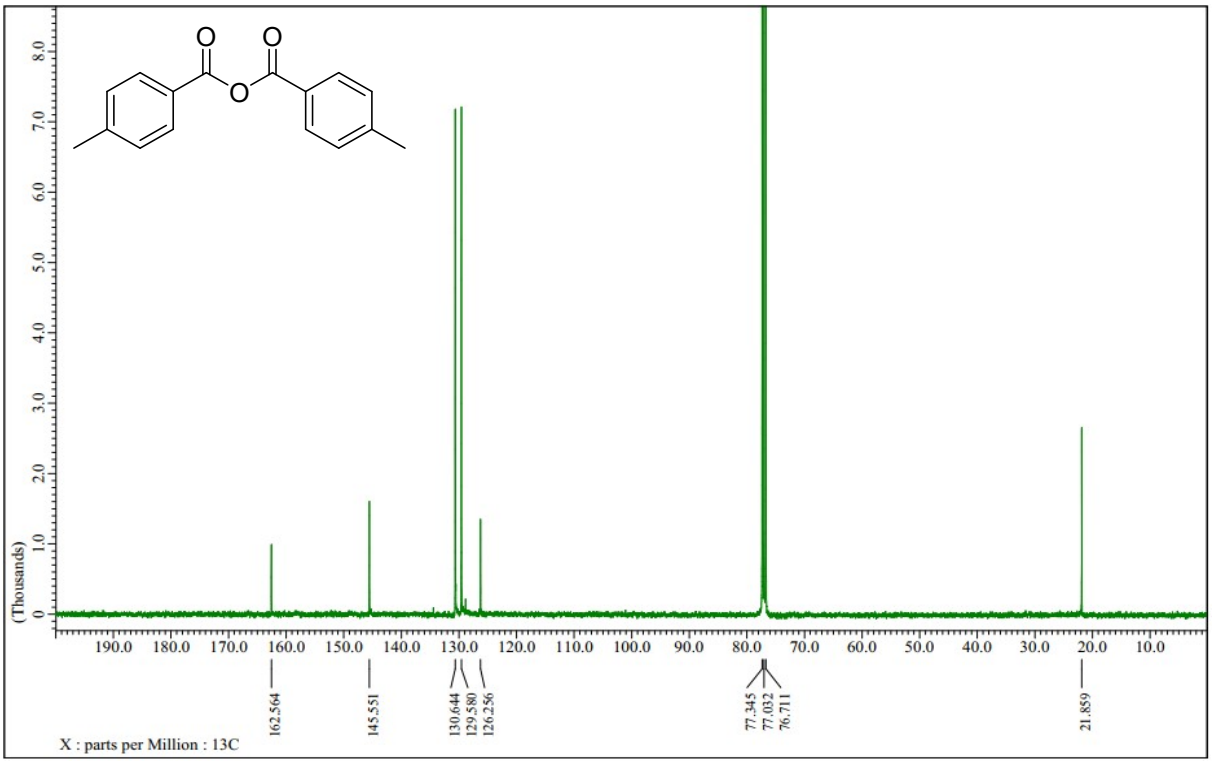


^{13}C NMR spectrum of benzoic anhydride

4-Methylbenzoic anhydride (9b)

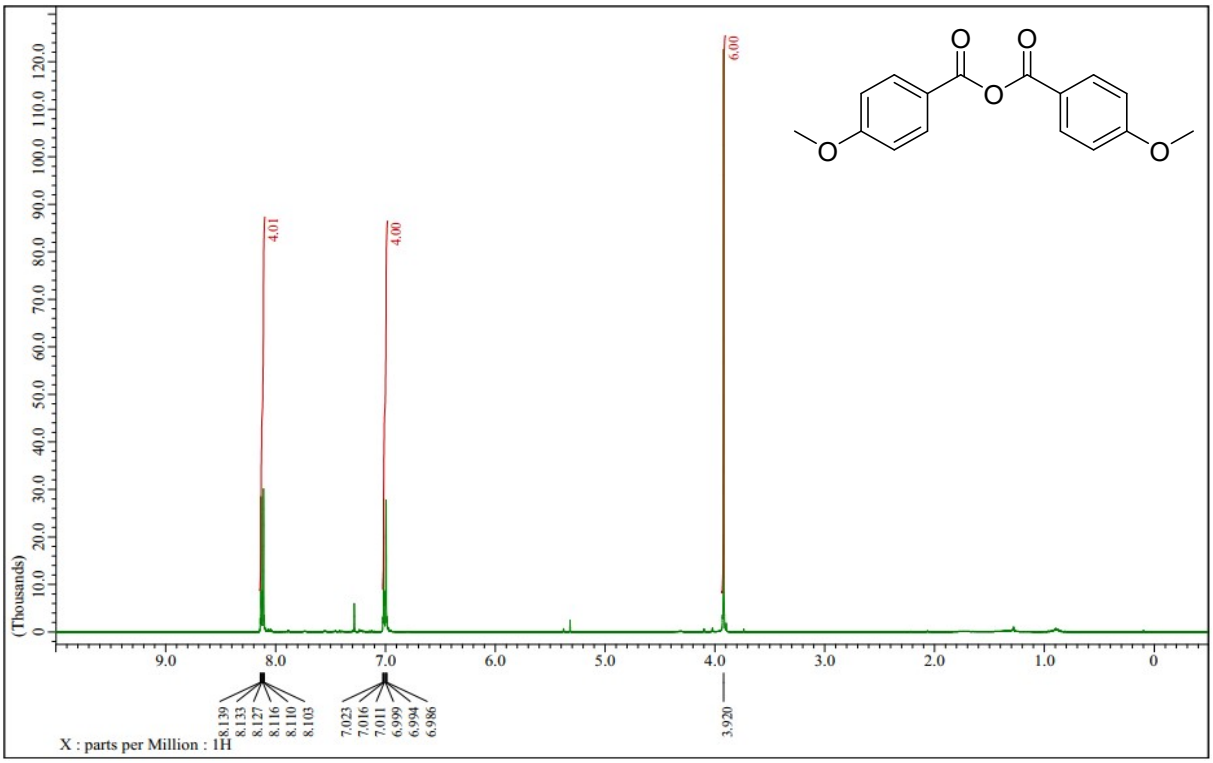


^{1}H NMR spectrum of 4-methylbenzoic anhydride

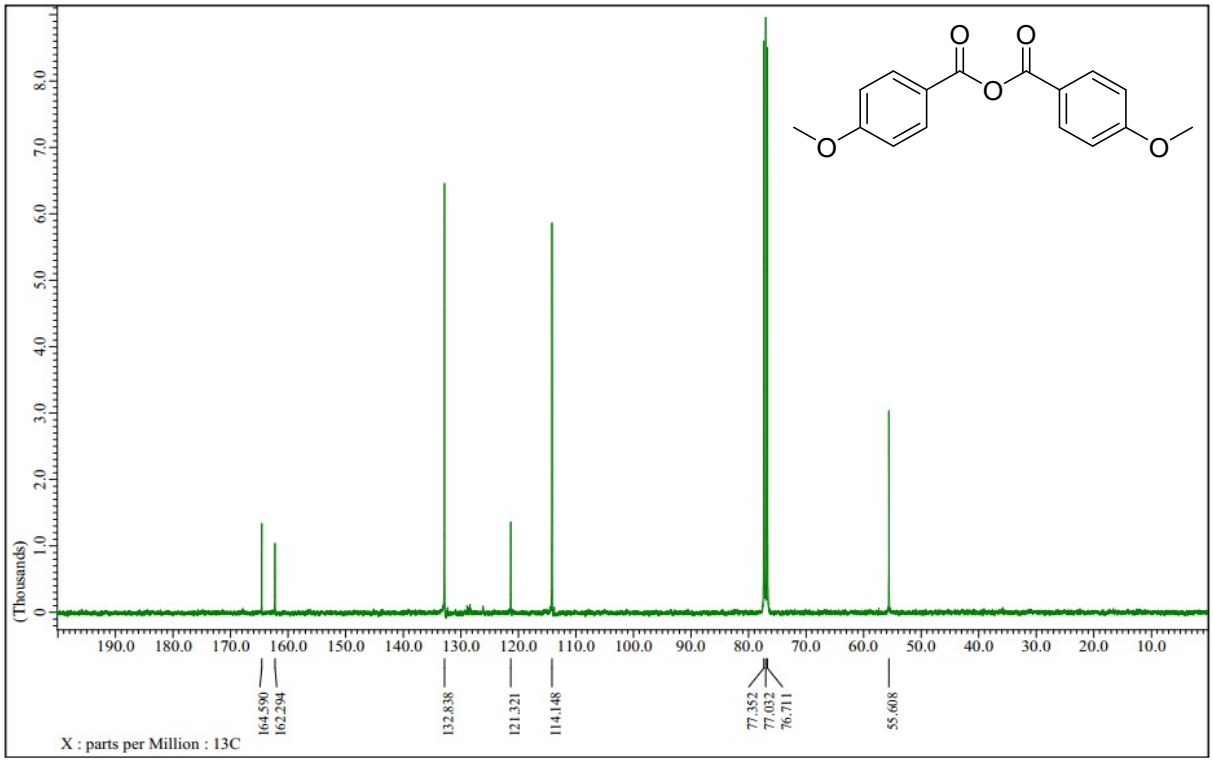


^{13}C NMR spectrum of 4-methylbenzoic anhydride

4-Methoxybenzoic anhydride (9c)

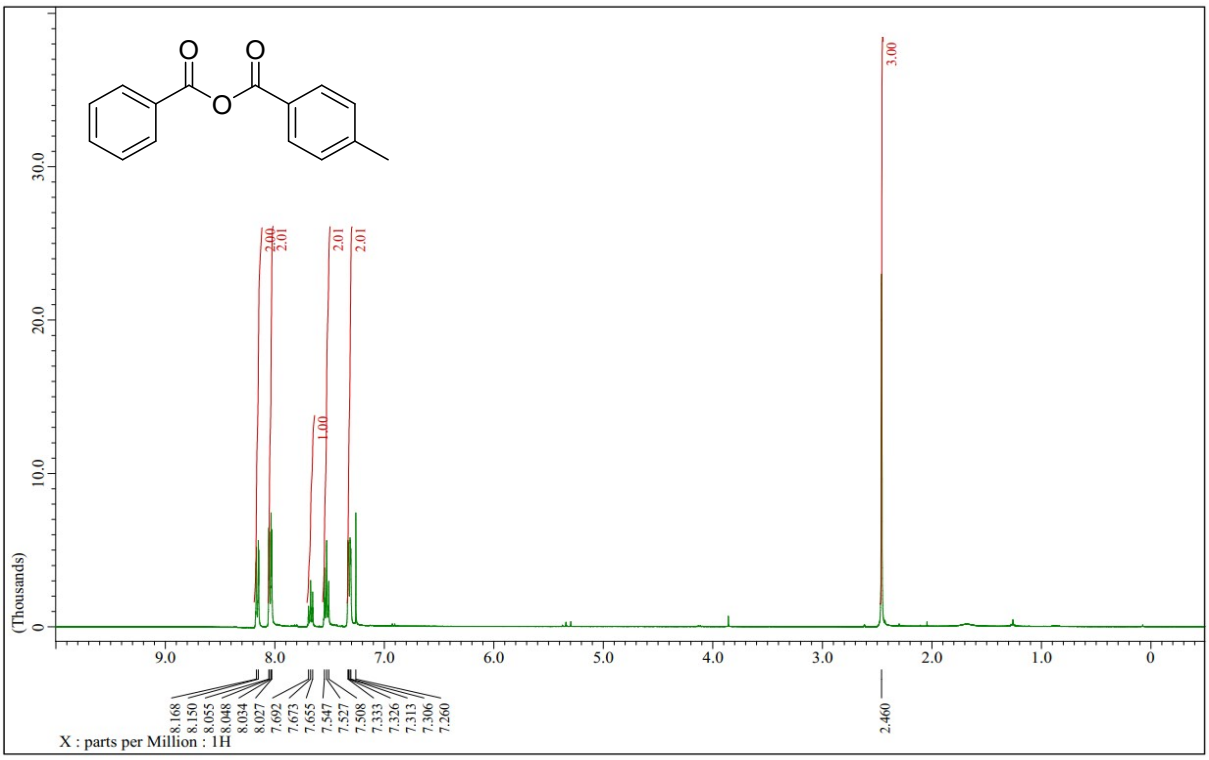


^{1}H NMR spectrum of 4-methoxybenzoic anhydride

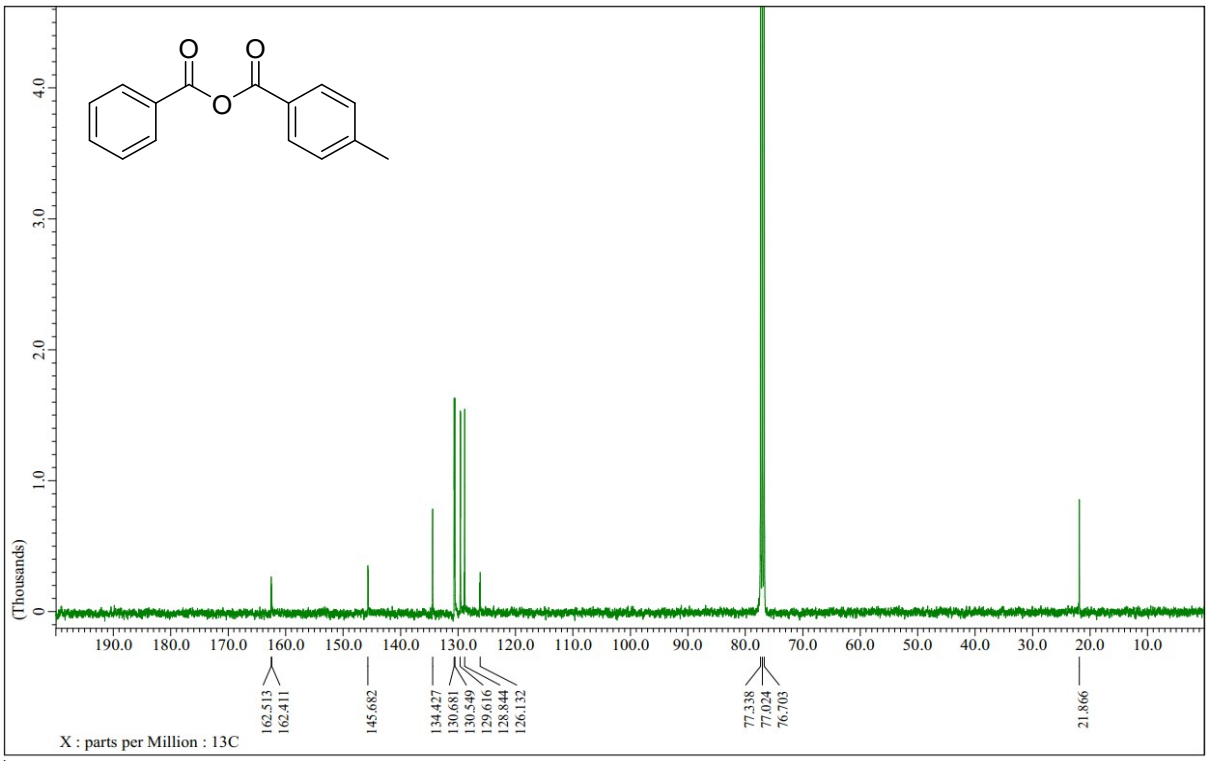


^{13}C NMR spectrum of 4-methoxybenzoic anhydride

Benzoic 4-methylbenzoic anhydride (9d)

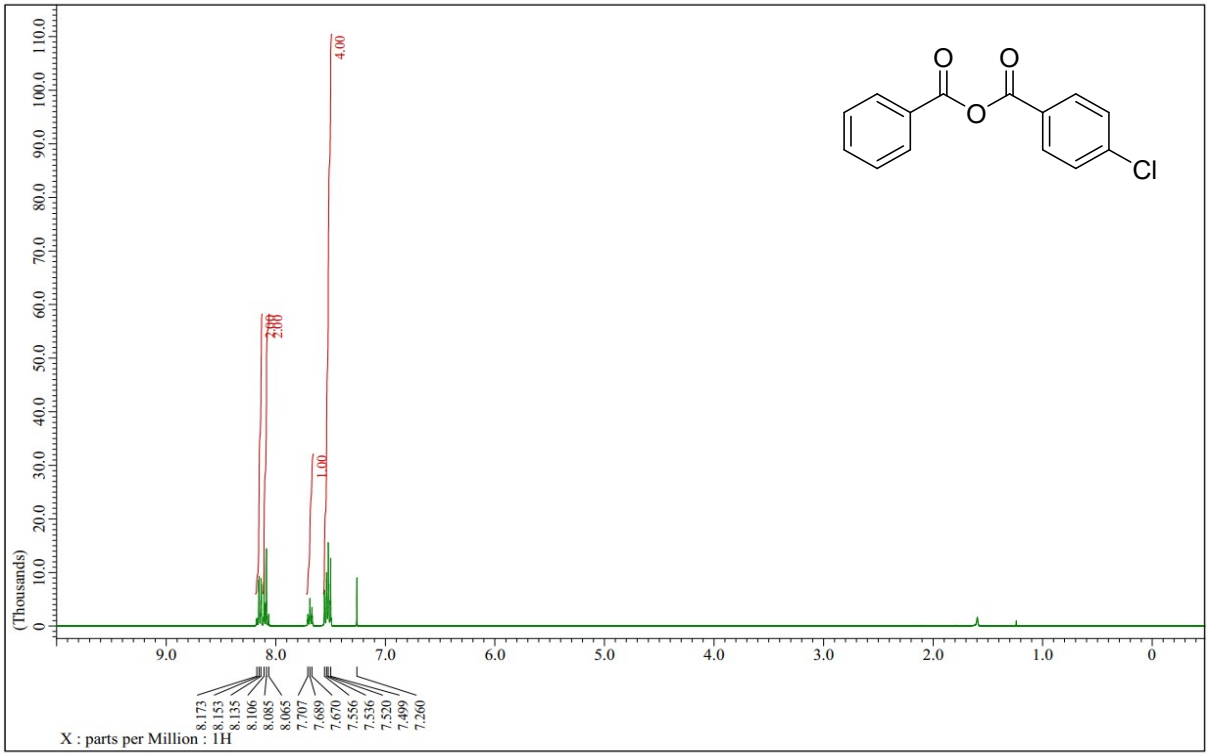


^{1}H NMR spectrum of benzoic 4-methylbenzoic anhydride

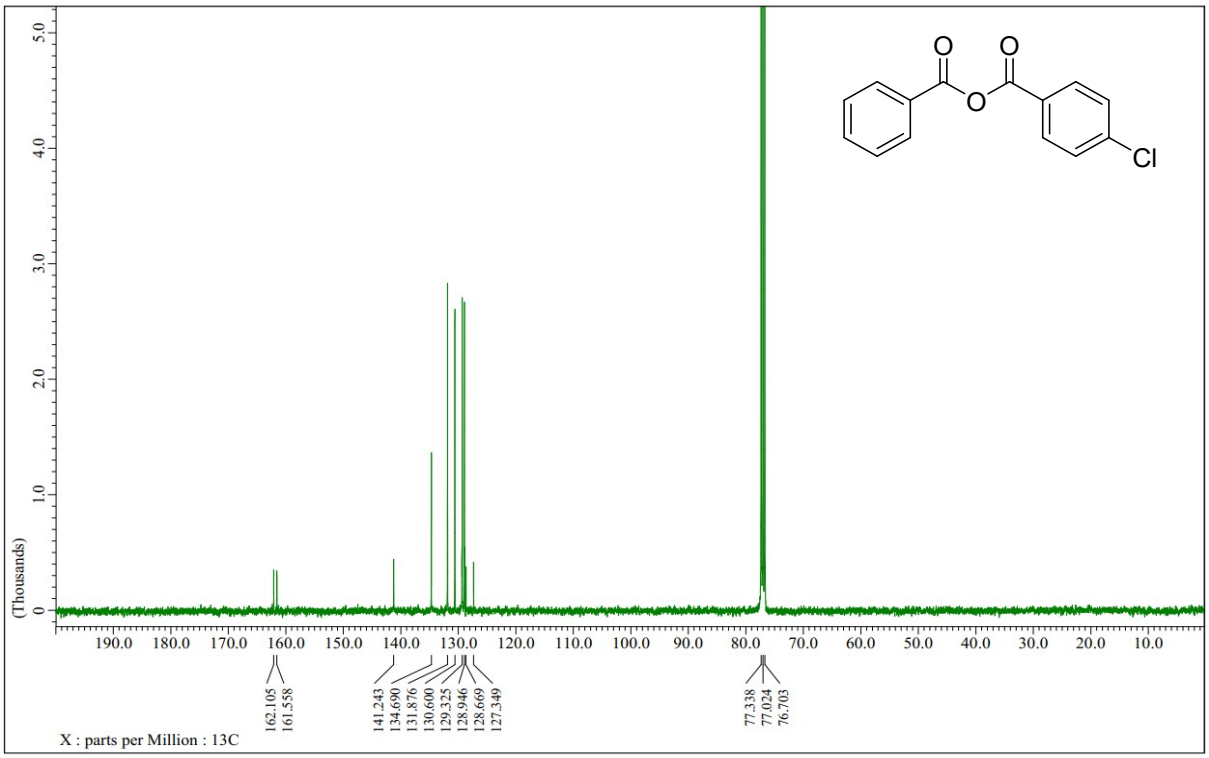


^{13}C NMR spectrum of benzoic 4-methylbenzoic anhydride

Benzoic 4-chlorobenzoic anhydride (9e)

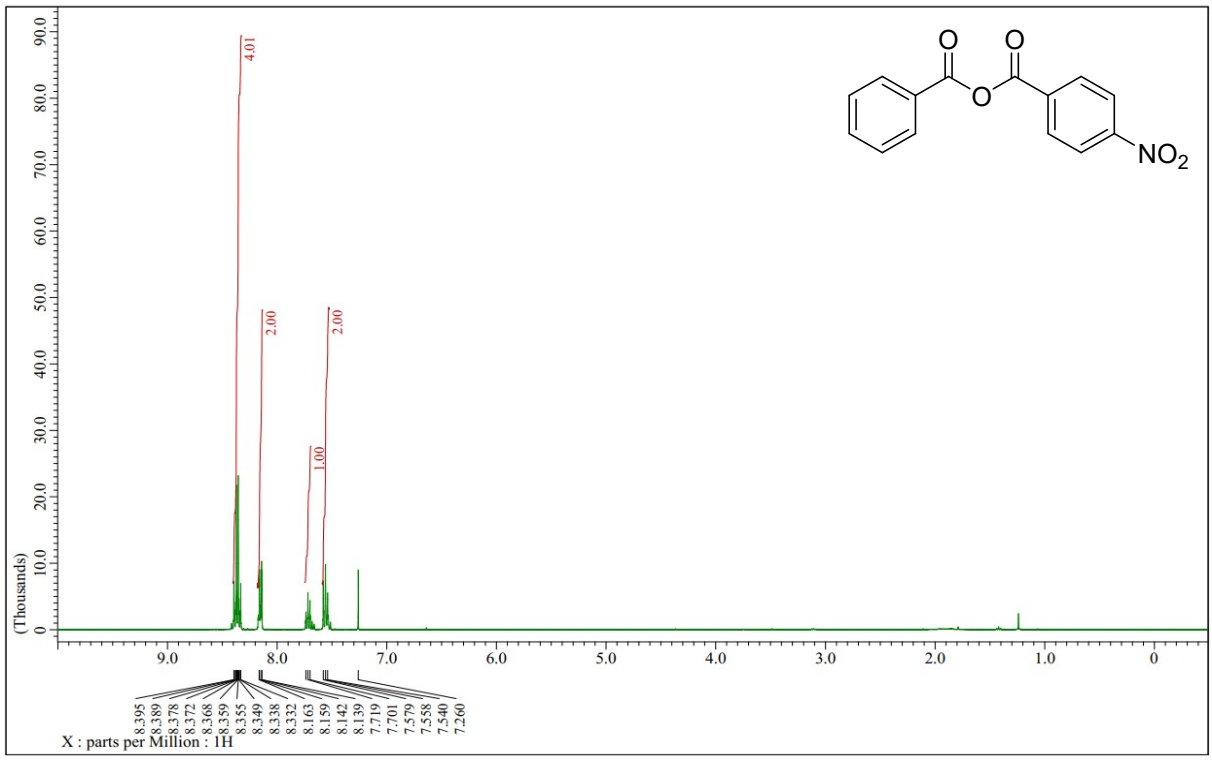


^{1}H NMR spectrum of benzoic 4-chlorobenzoic anhydride

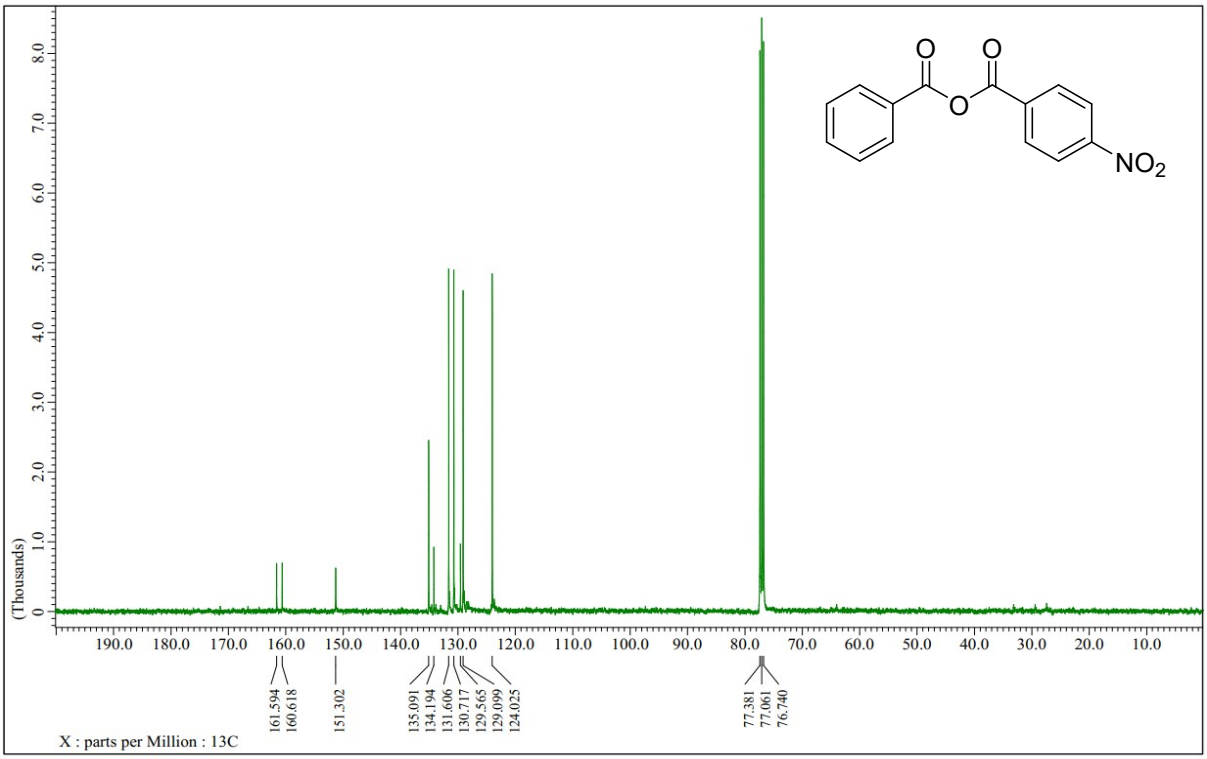


^{13}C NMR spectrum of benzoic 4-chlorobenzoic anhydride

Benzoic 4-nitrobenzoic anhydride (9f)

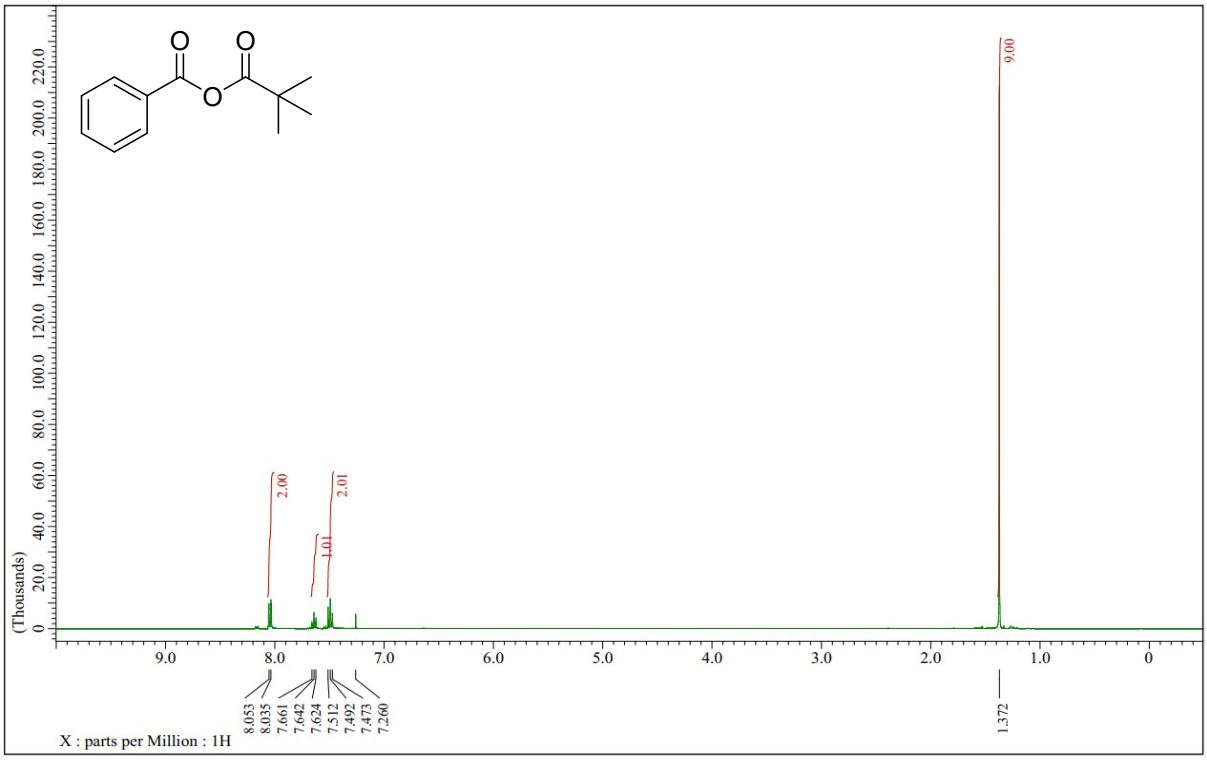


^{1}H NMR spectrum of benzoic 4-nitrobenzoic anhydride

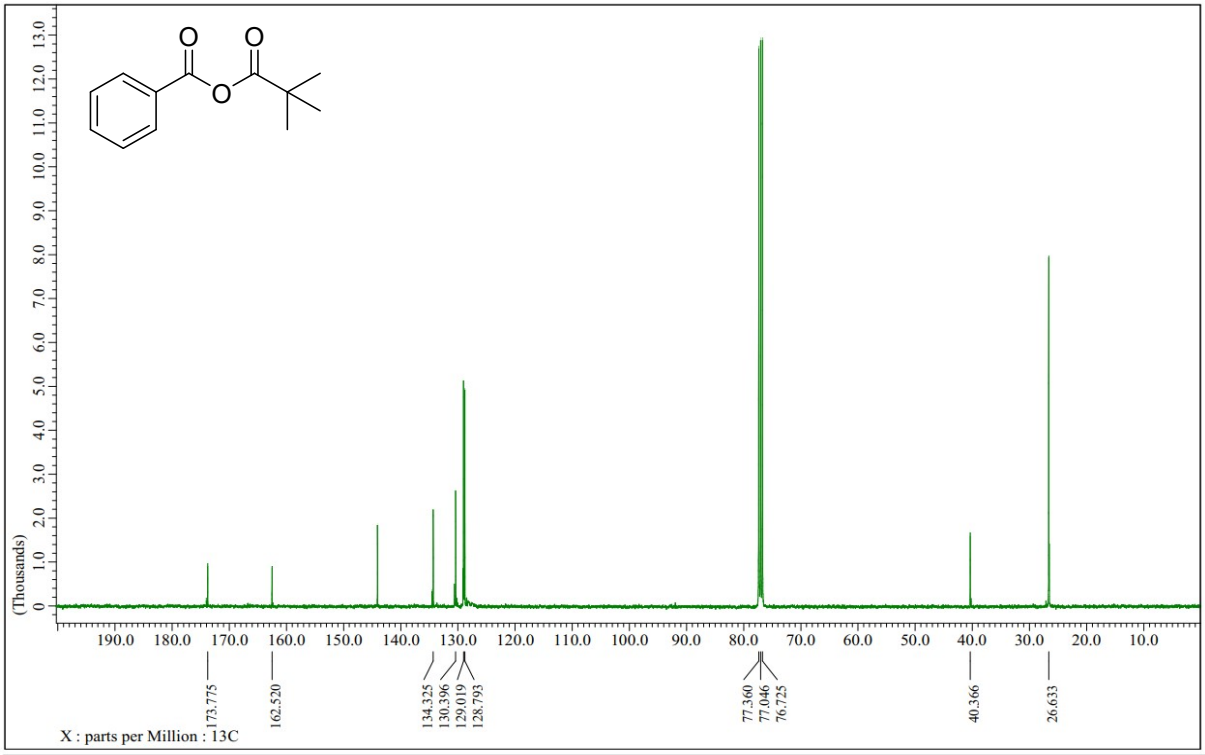


^{13}C NMR spectrum of benzoic 4-nitrobenzoic anhydride

Benzoic pivalic anhydride (9g)

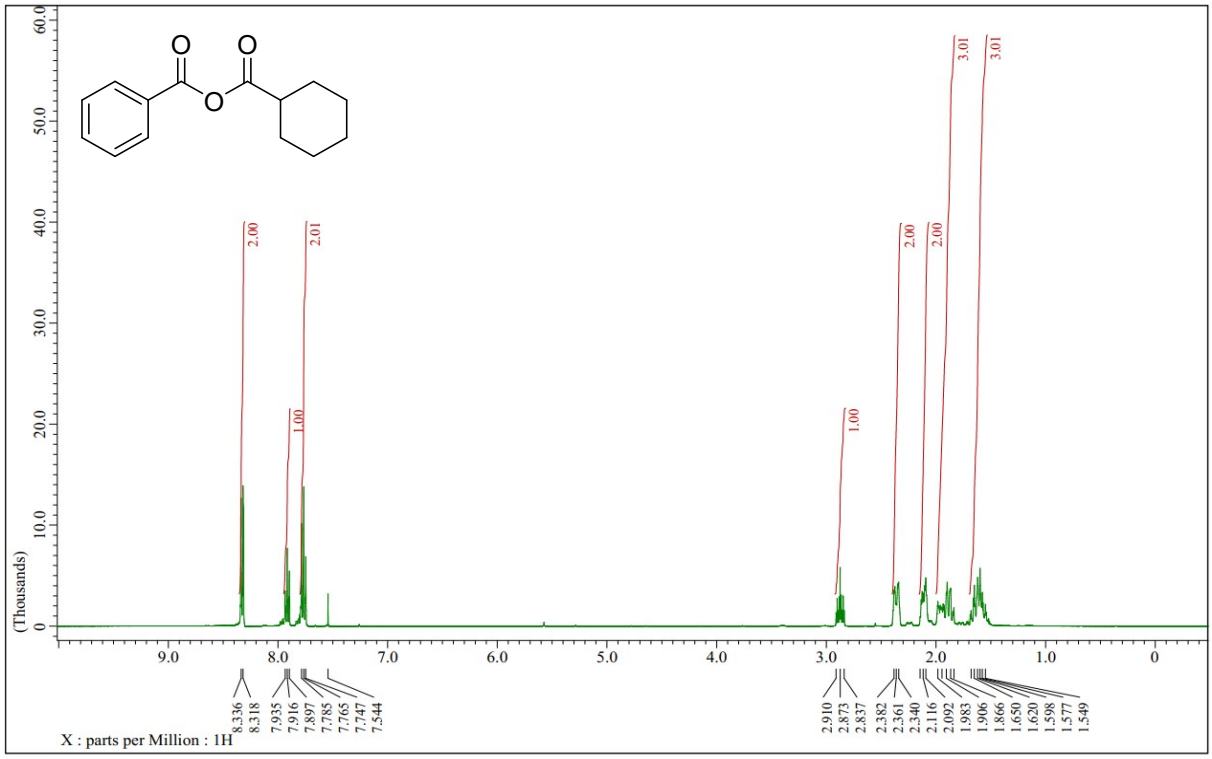


^{1}H NMR spectrum of benzoic pivalic anhydride

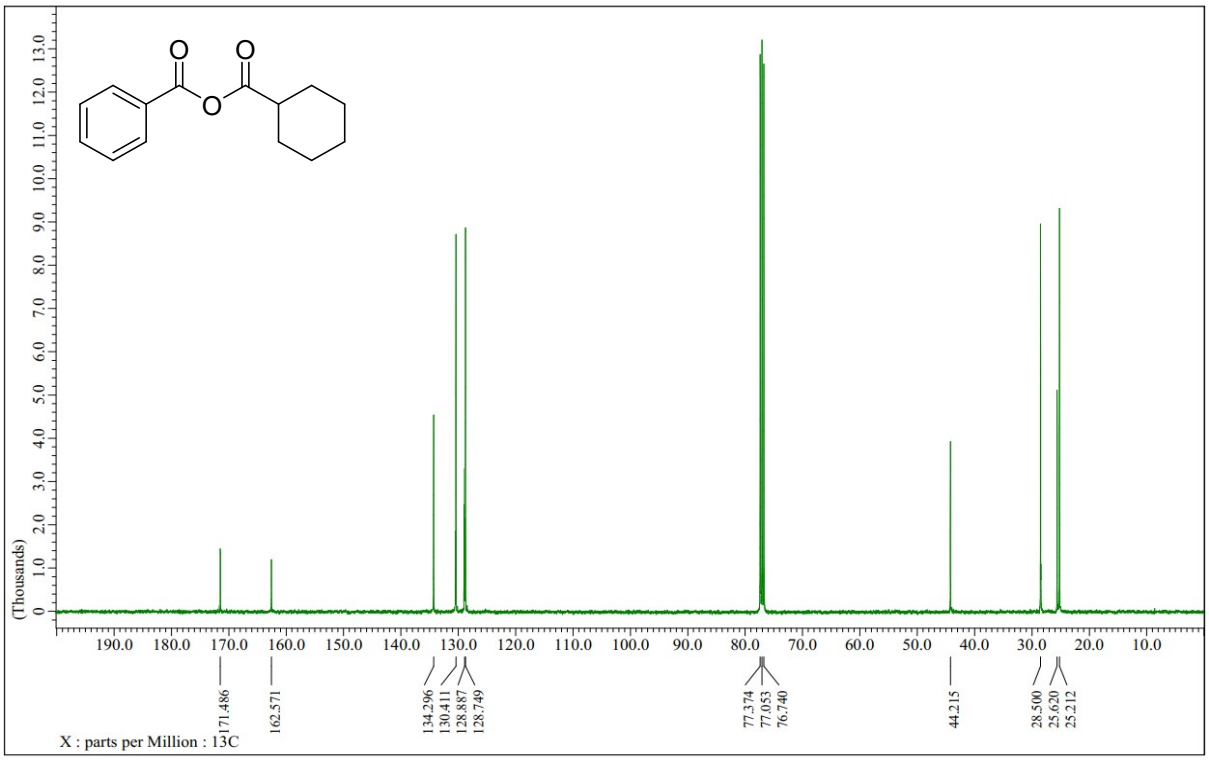


^{13}C NMR spectrum of benzoic pivalic anhydride

Benzoic cyclohexanecarboxylic anhydride (9h)

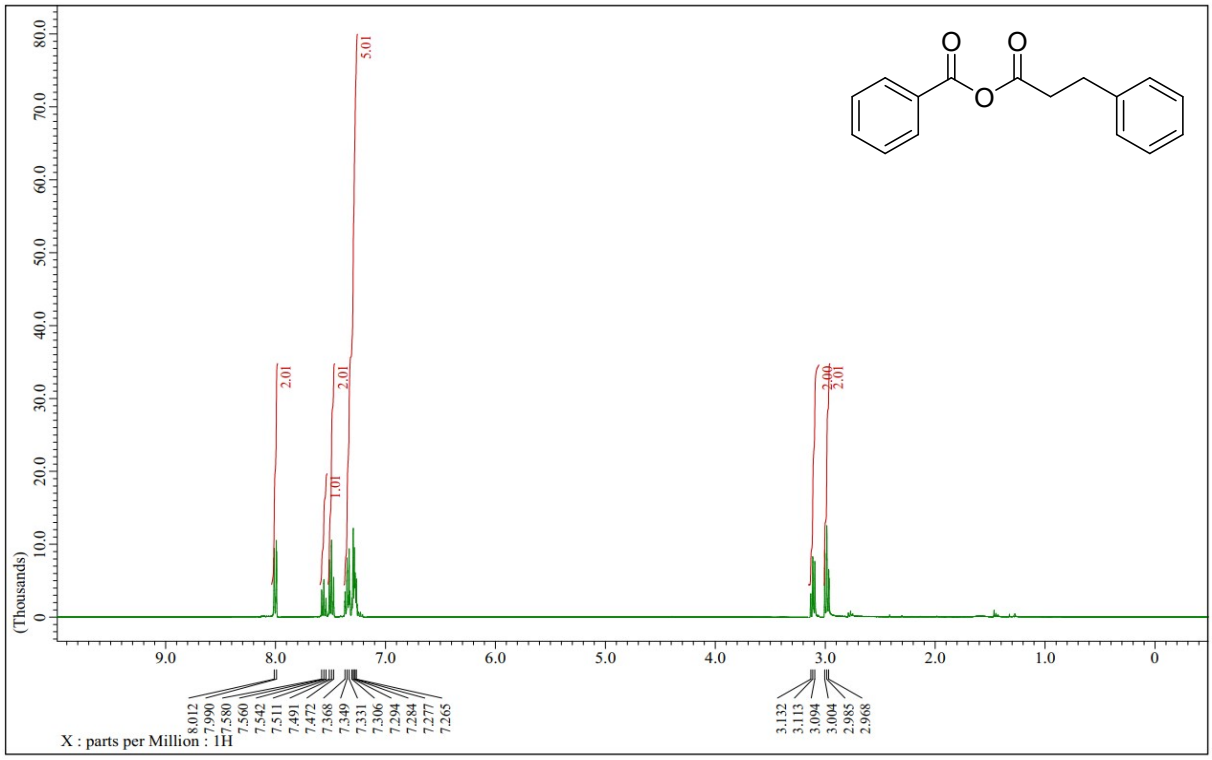


^{1}H NMR spectrum of benzoic cyclohexanecarboxylic anhydride

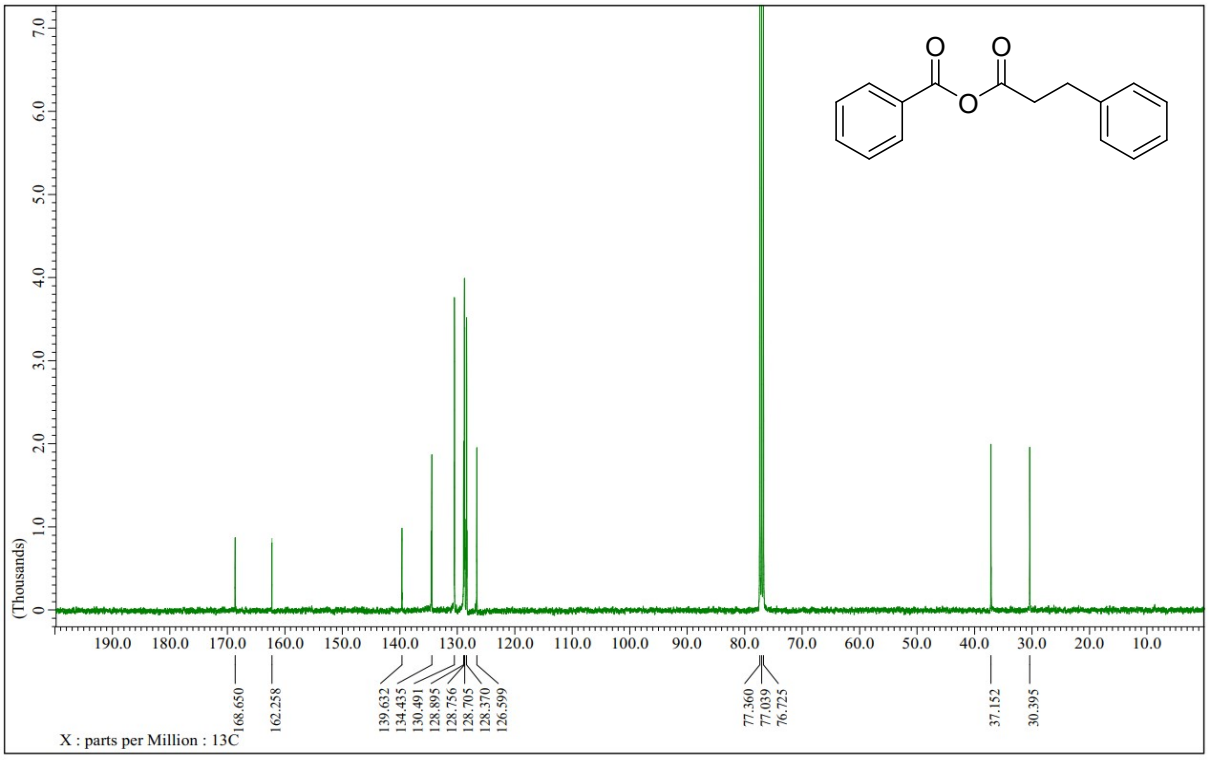


^{13}C NMR spectrum of benzoic cyclohexanecarboxylic anhydride

Benzoic 3-phenylpropanoic anhydride (9i)

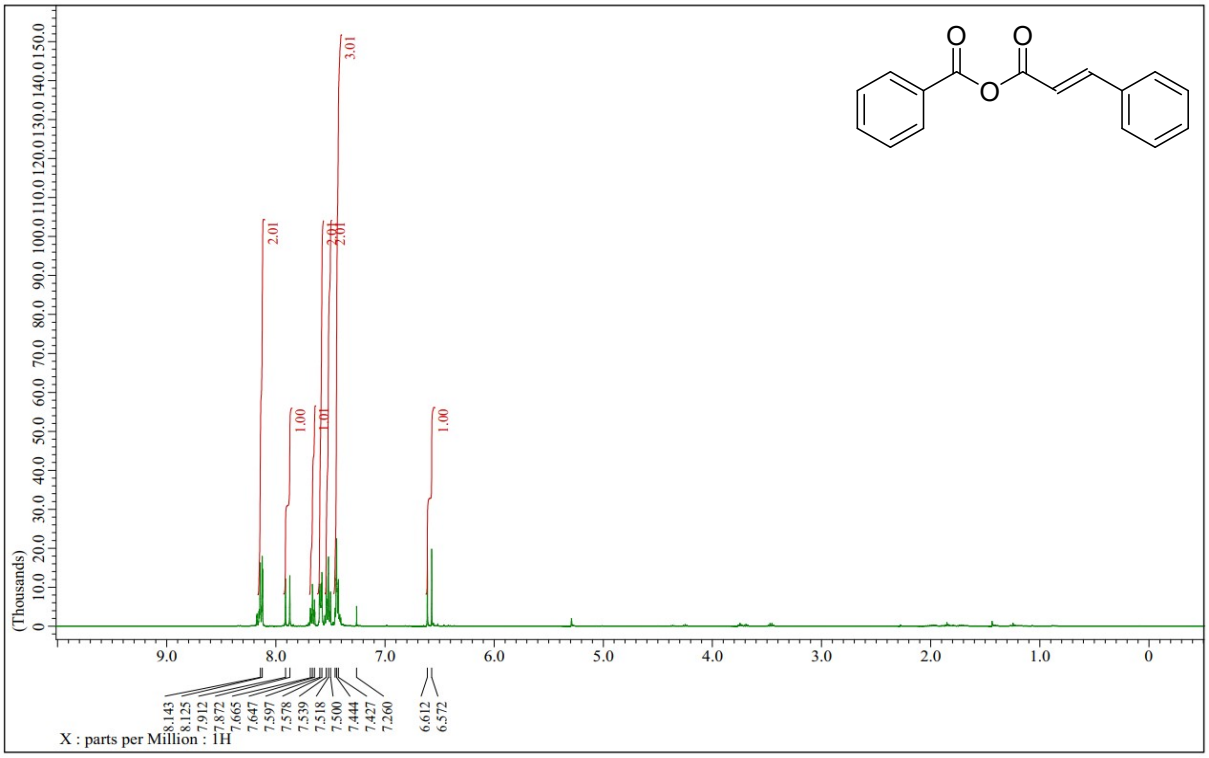


^{1}H NMR spectrum of benzoic 3-phenylpropanoic anhydride

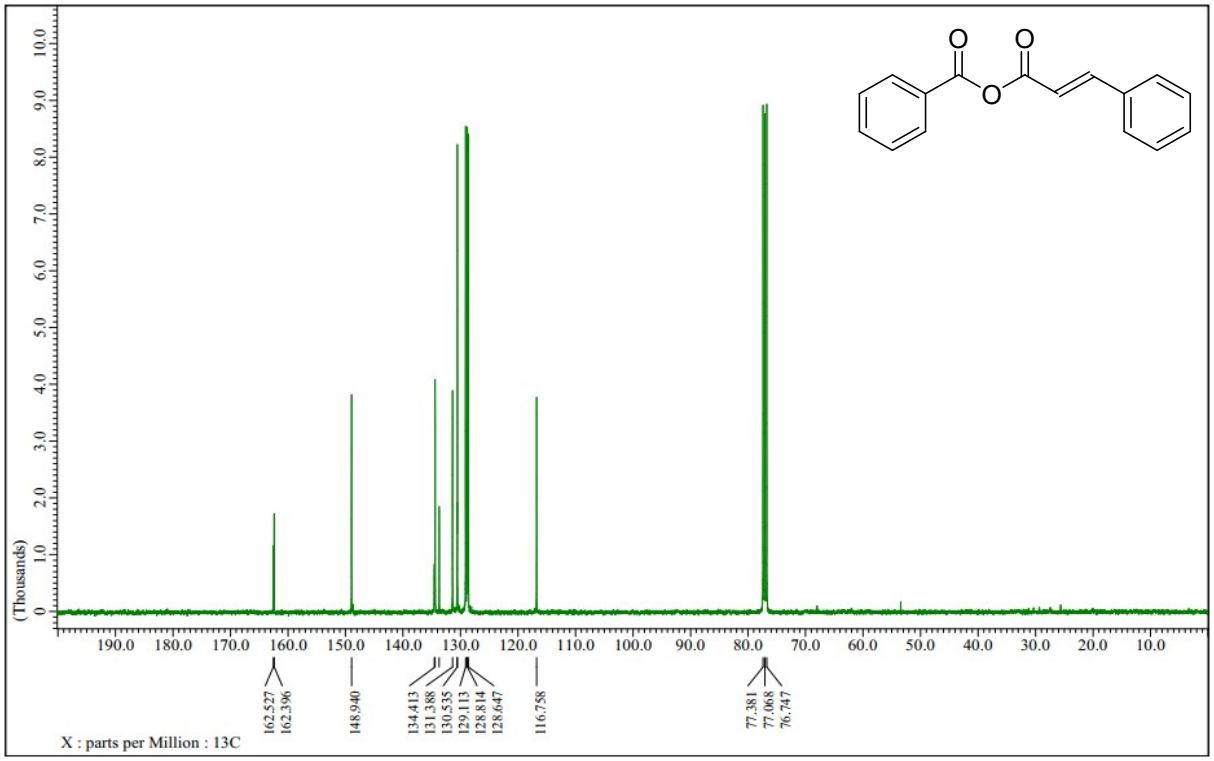


^{13}C NMR spectrum of benzoic 3-phenylpropanoic anhydride

(*E*)-Benzoic cinnamic anhydride (9j)

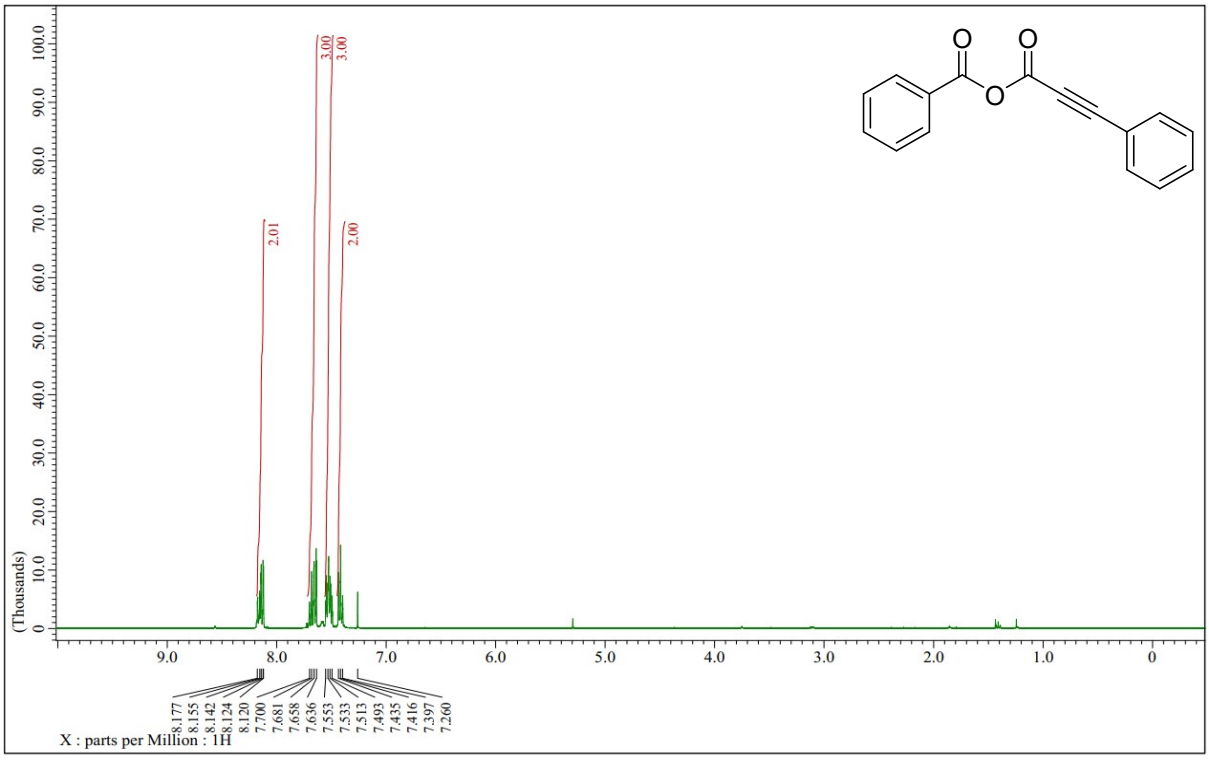


^{1}H NMR spectrum of (E)-benzoic cinnamic anhydride

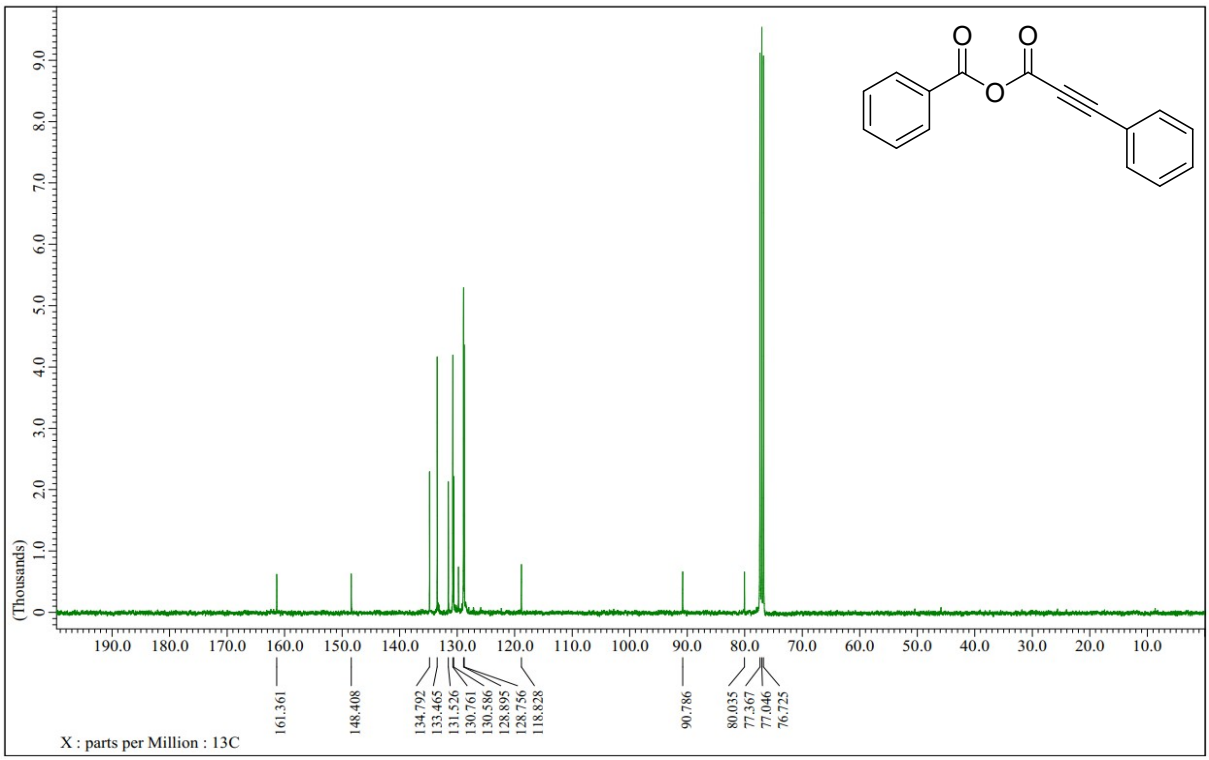


^{13}C NMR spectrum of (E)-benzoic cinnamic anhydride

Benzoic 3-phenylpropiolic anhydride (9k)

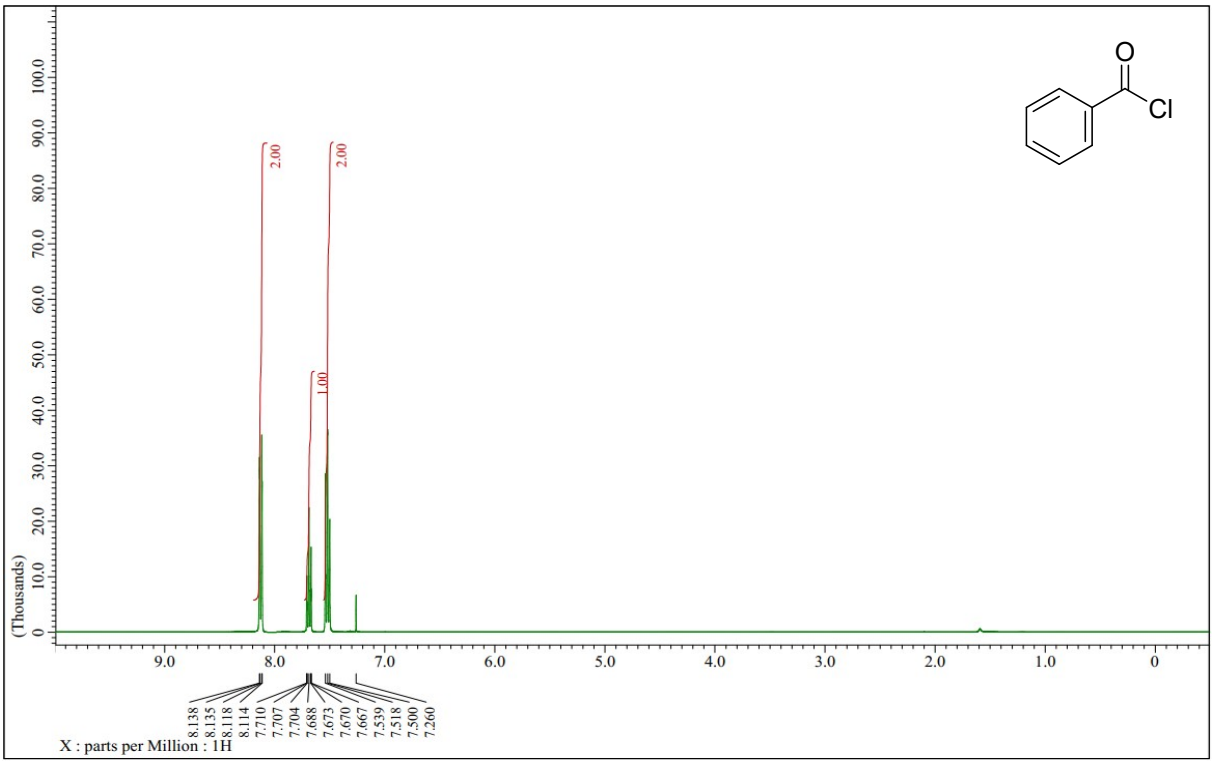


^{1}H NMR spectrum of benzoic 3-phenylpropiolic anhydride

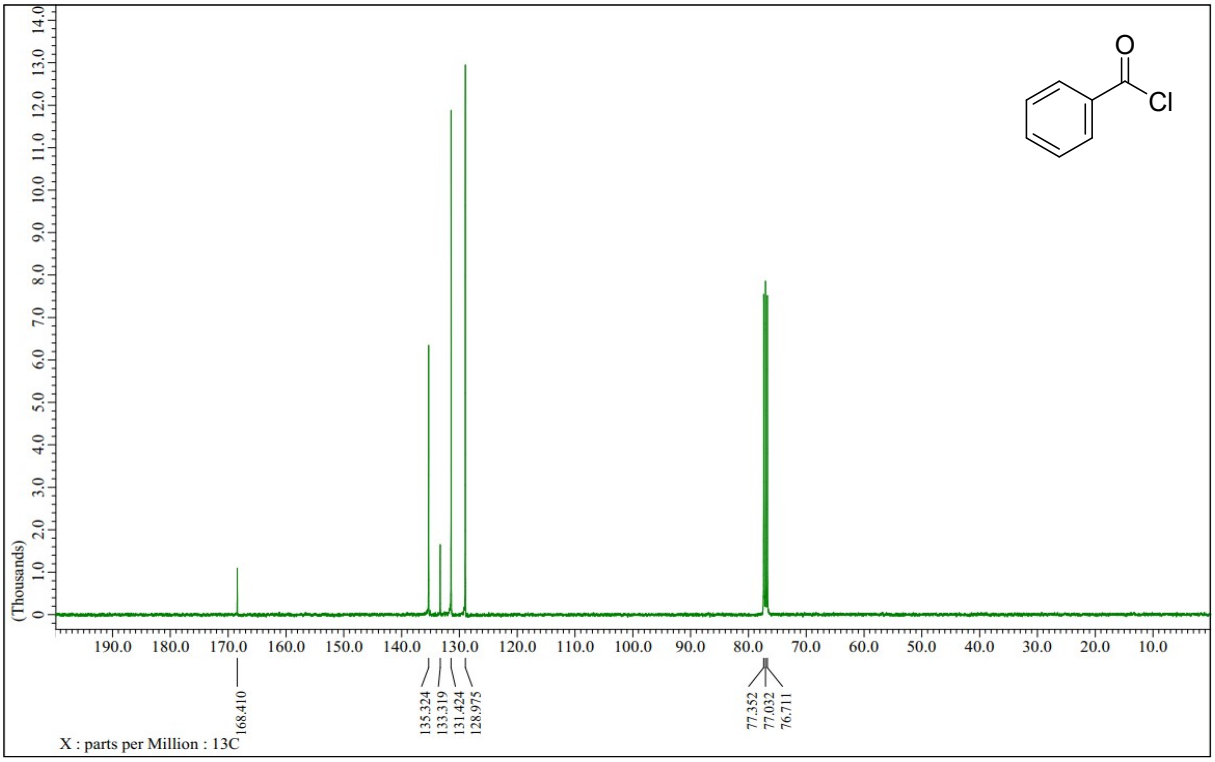


^{13}C NMR spectrum of benzoic 3-phenylpropiolic anhydride

Benzoyl chloride (2a)

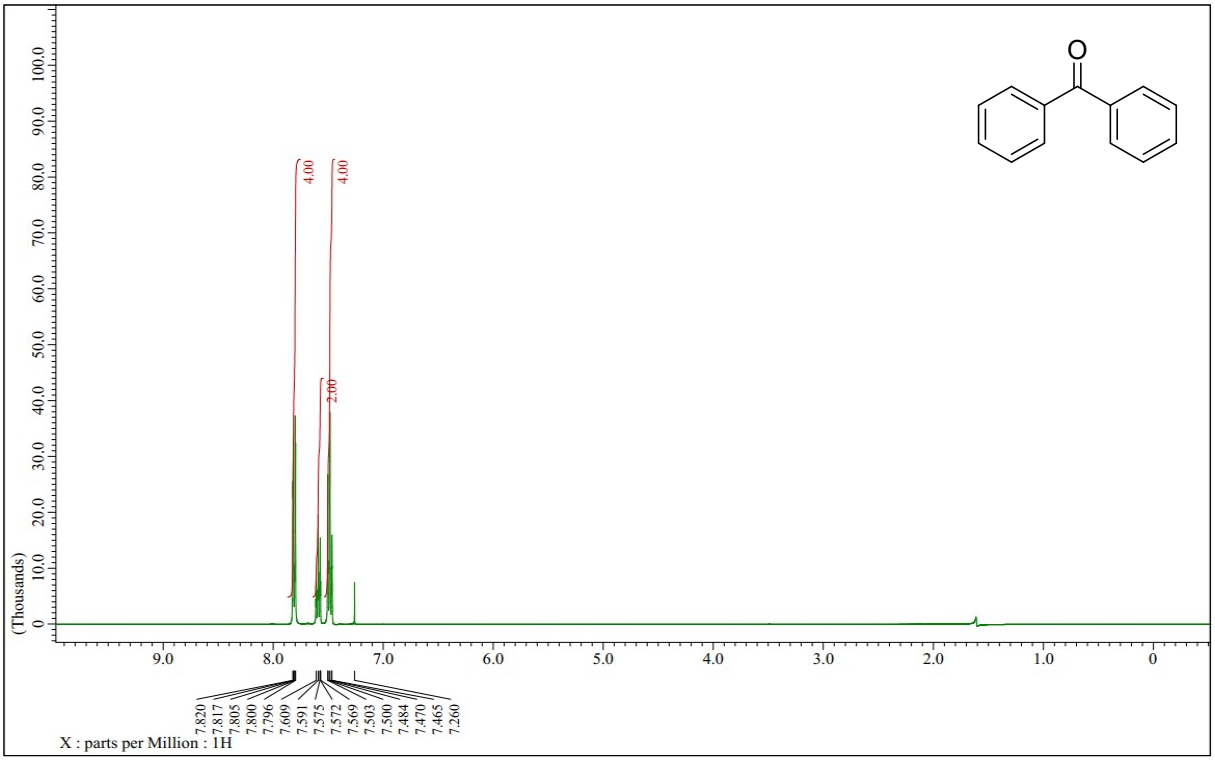


^{1}H NMR spectrum of benzoyl chloride

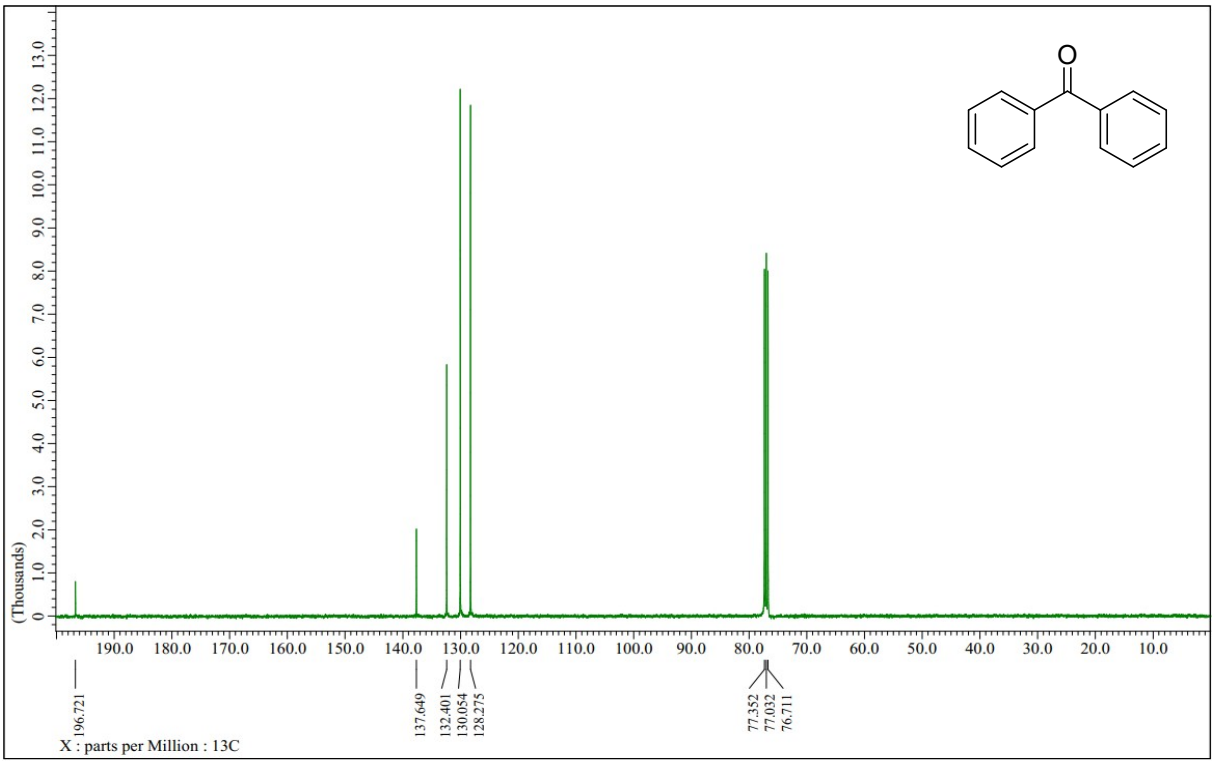


^{13}C NMR spectrum of benzoyl chloride

Benzophenone (15)

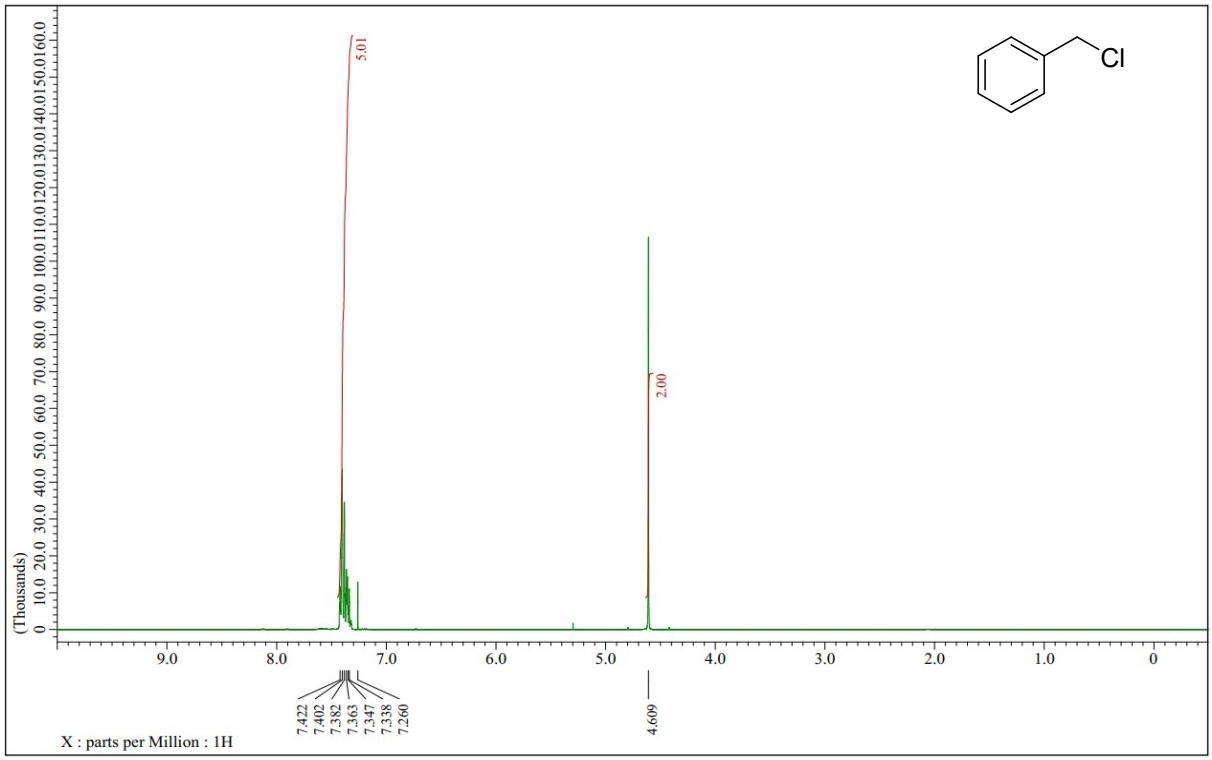


^{1}H NMR spectrum of benzophenone

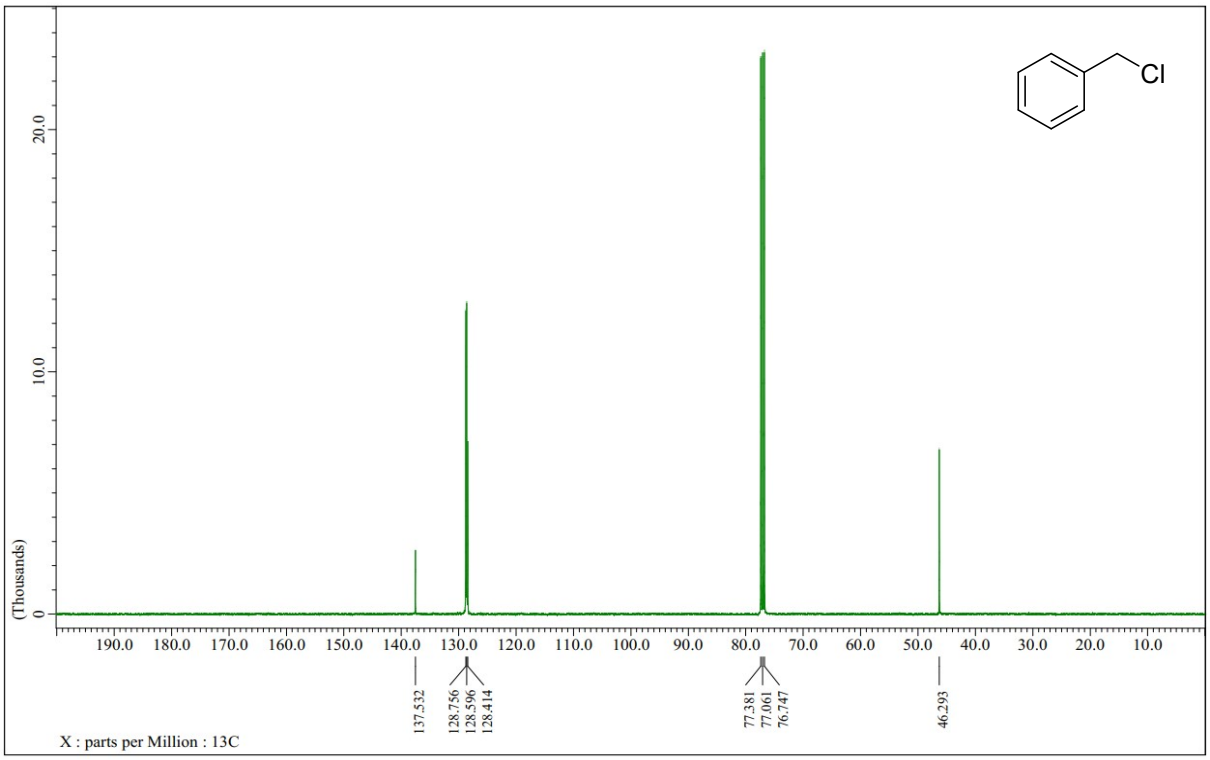


^{13}C NMR spectrum of benzophenone

Benzyl chloride



^{1}H NMR spectrum of benzyl chloride



^{13}C NMR spectrum of benzyl chloride