Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

Photoinduced Copper-Catalyzed Alkoxycarbonylation of Alkyl Fluorides

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Contents

1. General information

Reagents and solvents: Unless otherwise noted, reagents were ordered from *Sigma-Aldrich*, *TCI*, *ABCR*, *Alfa Aesar* or *BLD pharm*, and used without purification. Pure solvents was available from *Thermo Fisher*, and degassed (3 times) under argon atmosphere, then store under standard Schlenk technique (anhydrous and under inert atmosphere).

Purification: Analytical thin layer chromatography was performed using *MACHEREY-NAGEL Gmbn & Co. KG* silica gel plates (Silica gel 60 UV_{254}). Visualization was by ultraviolet fluorescence (λ = 254 nm) and/or staining with potassium permanganate ($KMnO_4$). The products were isolated from the reaction mixture by column chromatography on silica gel 60, 0.063-0.2 mm, 70-230 mesh (Merck). Gradient flash chromatography was conducted eluting with PE/EA, PE refers to pentane and EA refers to ethyl acetate, they were listed as volume/volume ratios.

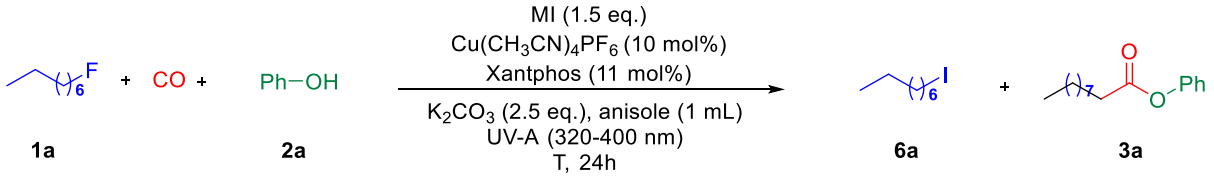
Irradiation: The light source was placed ca. 23 cm from the reaction vial on top of a manufactured autoclave (see Figure S1). In every reaction the strong light source Portable Lumatec SUPERLITE S 04[1] was used with different set filters: UV-A (λ= 320 - 400 nm) at maximum intensity (100% power). Figures S2, S3 illustrate relevant photophysical properties of the lamps.

Data collection: GC analysis was performed on an Agilent HP-7890A instrument with FID detector and HP-5 capillary column (polydimethylsiloxane with 5% phenyl groups, 30 m, 0.32 mm i.d., 0.25 µm film thickness) using argon as carrier gas. Electron impact (EI) mass spectra were recorded on AMD 402 mass spectrometer (70 eV). The data are given as mass units per charge (m/z). NMR spectra were recorded on Bruker Avance 300 and Bruker ARX 400 spectrometers. Multiplets were assigned as s(singlet), d (doublet), t (triplet), q (quartet), dd (doublet of doublet), m (multiplet) and br. s (broad singlet). Chemical shifts (ppm) are given relative to solvent: references for $CDCl_3$ were 7.26 ppm (^{1}H NMR) and 77.00 ppm (^{13}C NMR). All measurements were carried out at room temperature unless otherwise stated.

NOTE: Because of the high toxicity of carbon monoxide, all the reactions should be performed in an autoclave. The laboratory should be well-equipped with a CO detector and alarm system.

2. Additional Optimization Information

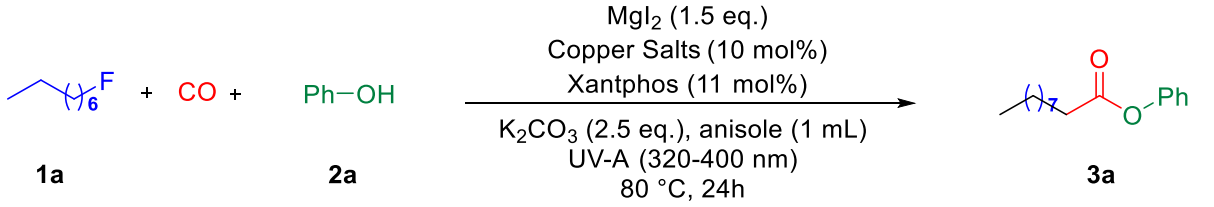
Table S1. Optimization of metal iodides.



Entry	Metal iodide	T (℃)	Conv. **6a** (%)	Yield **3a** (%)
1	MgI_2	25	0	0
2	MgI_2	60	61	42
3	MgI_2	80	89	95
4	LiI (3 eq.)	80	75	0
5	NaI (3 eq.)	80	trace	0
6	KI (3 eq.)	80	trace	0
7	AgI (3 eq.)	80	60	0
8	CaI_2	80	71	0

Reaction conditions: 1a (0.2 mmol), 2a (0.1 mmol), **Metal iodide** (1.5 eq.), $Cu(CH_3CN)_4PF_6$ (10 mol%), Xantphos (11 mol%), K_2CO_3 (2.5 eq.), CO (40 atm), anisole (1 mL), stirred at 80 ºC for 24 h under UV-A (320-400 nm). Determined by GC with hexadecane as internal standard.

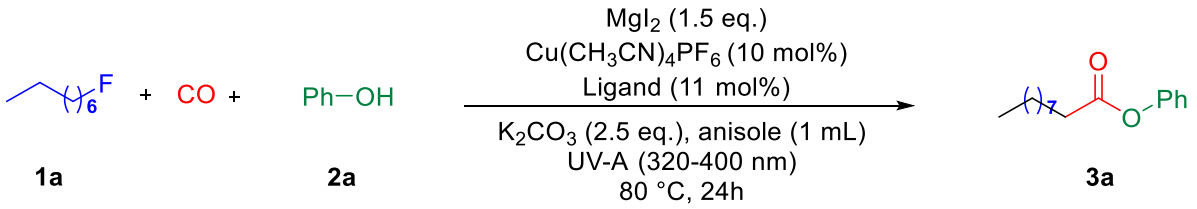
Table S2. Optimization of copper salts.



Entry	Copper Salts	Yield (%)
1	$Cu(CH_3CN)_4PF_6$	95
2	CuBr	5
3	CuI	15
4	CuCN	trace
5	$Cu(OAc)_2$	0
6	$CuCl_2$	0
7	$Cu(OTf)_2$	0
8	IMesCuCl	8
9	$CuBr(Me_2S)$	trace

Reaction conditions: 1a (0.2 mmol), 2a (0.1 mmol), MgI_2 (1.5 eq.), **Copper salts** (10 mol%), Xantphos (11 mol%), K_2CO_3 (2.5 eq.), CO (40 atm), anisole (1 mL), stirred at 80 ºC for 24 h under UV-A (320-400 nm). NMR yield.

Table S3. Optimization of ligands.

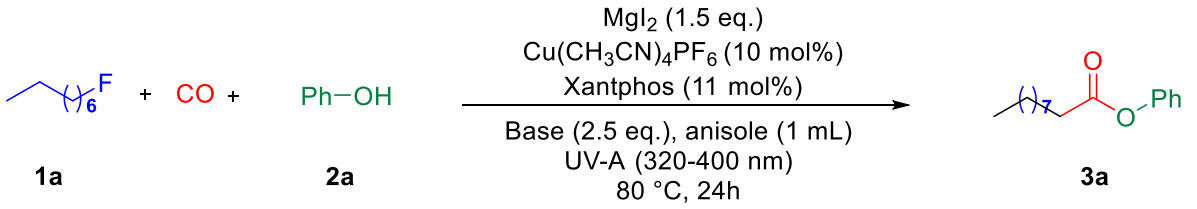


1a **2a** **3a**

Entry	Ligand	Yield (%)
1	Xantphos	95
2	Nixantphos	16
3	Sixantphos	20
4	BNIAP	<5
5	DPEphos	0
6	DPPBz	0
7	DPPE	0
8	DPPP	0
9	DCyPE	0
10	$BuPAd_2$	0
11	Pyridine	0
12	Bipyridine	0
13	1,10-phen	0

Reaction conditions: 1a (0.2 mmol), 2a (0.1 mmol), MgI_2 (1.5 eq.), $Cu(CH_3CN)_4PF_6$ (10 mol%), **Ligand** (11 mol%), K_2CO_3 (2.5 eq.), CO (40 atm), anisole (1 mL), stirred at 80 ºC for 24 h under UV-A (320-400 nm). NMR yield.

Table S4. Optimization of ligands.

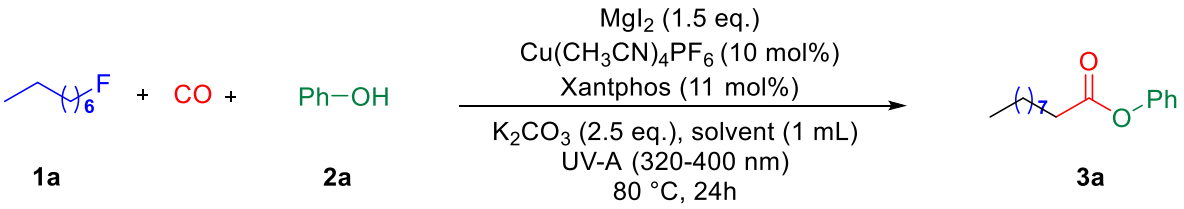


1a **2a** **3a**

Entry	Base	Yield (%)
1	K_2CO_3	95
2	Li_2CO_3	0
3	Na_2CO_3	<5
4	Rb_2CO_3	62
5	Cs_2CO_3	33
6	$KHCO_3$	0
7	KOH	0
8	KO^tBu	0
9	DBU	0
10	DABCO	0

Reaction conditions: 1a (0.2 mmol), 2a (0.1 mmol), MgI_2 (1.5 eq.), $Cu(CH_3CN)_4PF_6$ (10 mol%), Xantphos (11 mol%), **Base** (2.5 eq.), CO (40 atm), anisole (1 mL), stirred at 80 ºC for 24 h under UV-A (320-400 nm). NMR yield.

Table S5. Optimization of solvent.



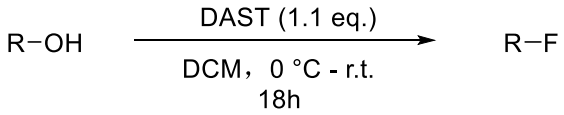
1a **2a** **3a**

Entry	Solvent	Yield (%)
1	Anisole	95
2	4-Methylanisole	80
3	Toluene	40
4	Fluorobenzene	26
5	Chlorobenzene	17
6	Benzotrifluoride	trace
7	*p*-Xylene	trace
8	Cumene	trace
9	DCE	0
10	CH_3CN	0
11	THF	0
12	1,4-Dioxane	0
13	DME	0
14	DMF	0
15	DMSO	0
16	EtOH	0
17	HFIP	0

Reaction conditions: 1a (0.2 mmol), 2a (0.1 mmol), MgI_2 (1.5 eq.), $Cu(CH_3CN)_4PF_6$ (10 mol%), Xantphos (11 mol%), K_2CO_3 (2.5 eq.), CO (40 atm), **solvent** (1 mL), stirred at 80 ºC for 24 h under UV-A (320-400 nm). NMR yield.

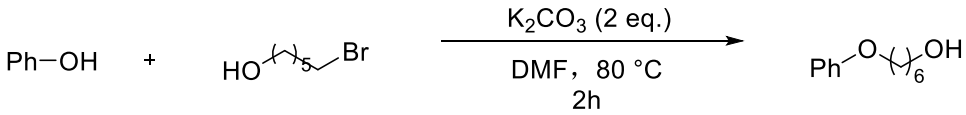
3. Preparation of Substrates

General Procedure A[2]:



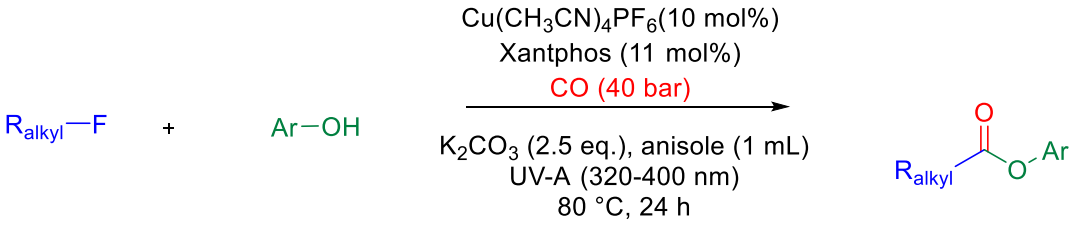
A round-bottom flask containing a stirring bar was charged DAST (1.1 eq.) and DCM (4 mL), a solution of alcohol (3 mmol) in DCM (4 mL) was slowly added at 0 °C followed by stirring at the temperature for 18 h. The reaction mixture was quenched by addition of mixture of ice and water and extracted with DCM (15 mL×3). Combined organic layer was dried over MgSO4, concentrated, and purified by flash column chromatography on silica gel to obtain corresponding fluorides.

General Procedure [3]:



A round-bottom flask containing a stirring bar was charged with the phenol (8.0 eq.), 6-bromo-1-hexanol (5 mmol), and DMF (10 mL). Then K_2CO_3 (2.0 eq.) was added. The reaction mixture was stirred at 80 ℃ for 2 h. After the reaction was completed, the reaction mixture was diluted with AcOEt and washed with water and brine. Combined organic layer was dried over MgSO4, concentrated, and purified by flash column chromatography on silica gel to obtain corresponding fluorides.

4. General procedure



A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), MgI_2 (41.7 mg, 1.5 eq.), K_2CO_3 (34.5 mg, 2.5 eq.), and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and alkyl fluoride (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at 80 ℃ under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then the reaction was extracted with EA (3 x 3 mL). The Combined organic layer was dried over $MgSO_4$, concentrated, and purified by flash column chromatography on silica gel to obtain the corresponding product.

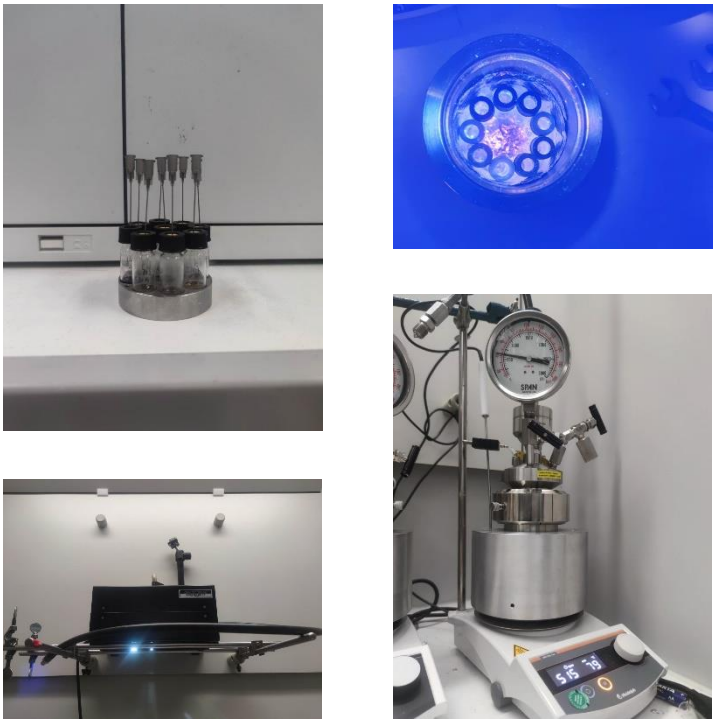


Figure S1. Photoautoclave and photoreactor used in this research.

Note: All photos in this material were taken by the first author Peng Yang.

SPEKTRUM

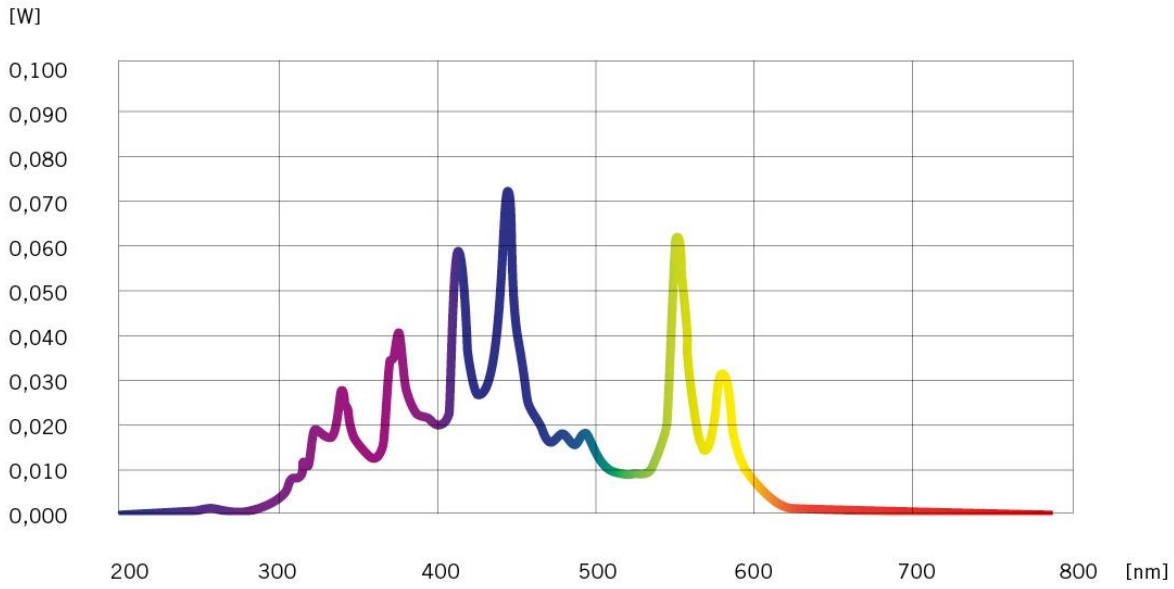


Figure S2. Emission spectrums of the Portable Lumatec SUPERLITE S 04.

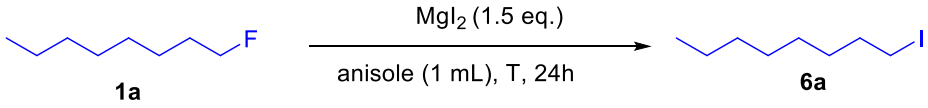
OPTISCHE LEISTUNG

Spektrum		Leistung	Intensität
UVA	320–400 nm	2.100 mW	10.500 mW/cm²
UVA + Blau	320–500 nm	6.900 mW	34.500 mW/cm²
Blau	400–500 nm	4.800 mW	24.000 mW/cm²
Weiß	400–700 nm	9.700 mW	48.500 mW/cm²
Violett	415 nm	2.000 mW	10.000 mW/cm²
Blau 440	440 nm	2.300 mW	11.500 mW/cm²
Blau 460	460 nm	2.000 mW	10.000 mW/cm²
Türkis	490 nm	1.200 mW	6.000 mW/cm²
Grün	550 nm	1.400 mW	7.000 mW/cm²
Gelb	570 nm	1.800 mW	9.000 mW/cm²

Figure S3. Technical specifications of the Portable Lumatec SUPERLITE S 04

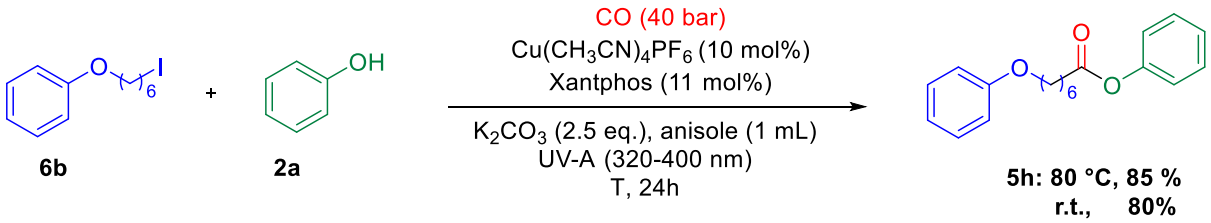
5. Mechanism studies.

5.1 Control experiments



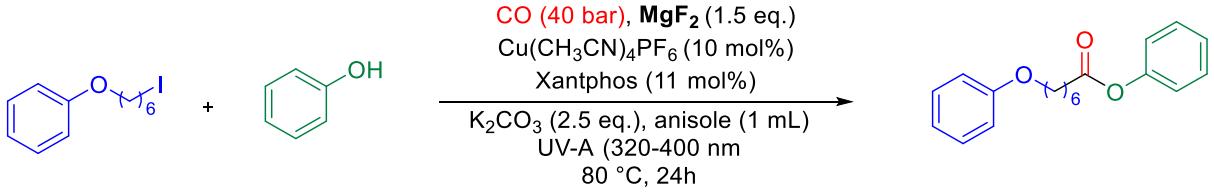
T	yield
25 °C	trace
60 °C	61 %
80 °C	89 %

In a flame-dried 10 mL Schlenk tube equipped with oven-dried stir added MgI_2 (41.7 mg, 1.5 eq.), and 1-fluorooctane (0.2 mmol), followed by the addition of DCM (4.0 mL). Then the mixture was stirred at established temperature for 24 h. After the reaction was complete, 10 µL of hexadecane was added to the tube. And a proper amount of solvent was taken for GC analysis. The result is shown above.



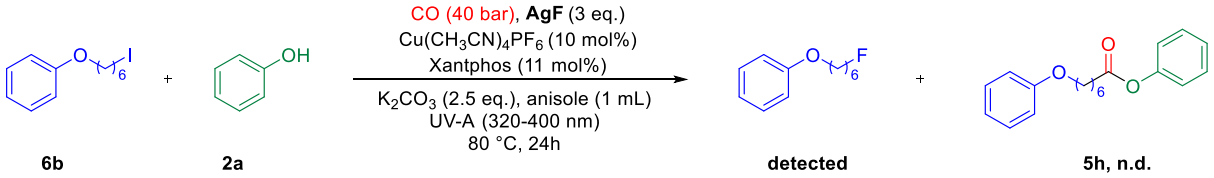
5h: 80 °C, 85 %
r.t., 80%

A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), K_2CO_3 (34.5 mg, 2.5 eq.), and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and **6b** (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at established temperature under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then, 8.4 mg 1,3,5-trimethoxybenzene was added to the vials. A proper amount of solvent was dried under high vacuum and dissolved in $CDCl_3$ taken for NMR analysis.



6b **2a** **5h, 80 %**

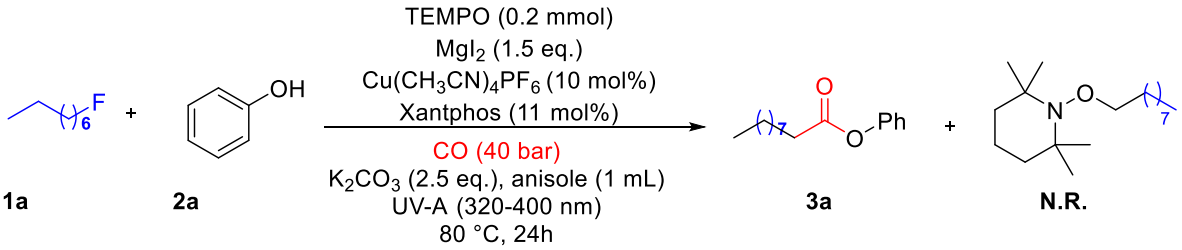
A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), MgF_2 (9.4 mg, 1.5 eq.), K_2CO_3 (34.5 mg, 2.5 eq.), and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and **6b** (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at 80 ℃ under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then, 8.4 mg 1,3,5-trimethoxybenzene was added to the vials. A proper amount of solvent was dried under high vacuum and dissolved in $CDCl_3$ taken for NMR analysis.

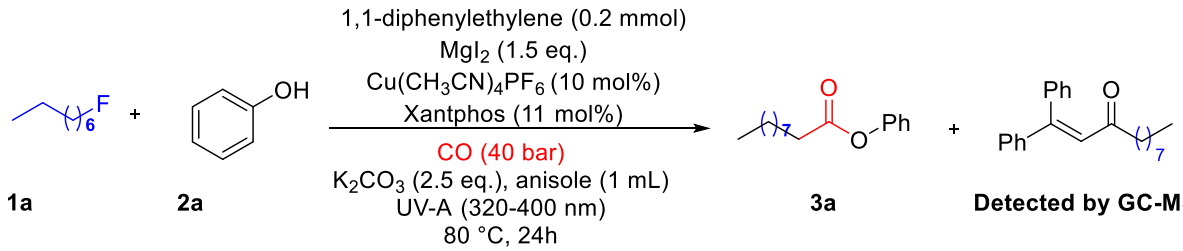


6b **2a** **detected** **5h, n.d.**

A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), AgF_2 (38.1 mg, 3 eq.), K_2CO_3 (34.5 mg, 2.5 eq.), and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and **6b** (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at 80 ℃ under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then, a proper amount of solvent was taken for GC-MS analysis.

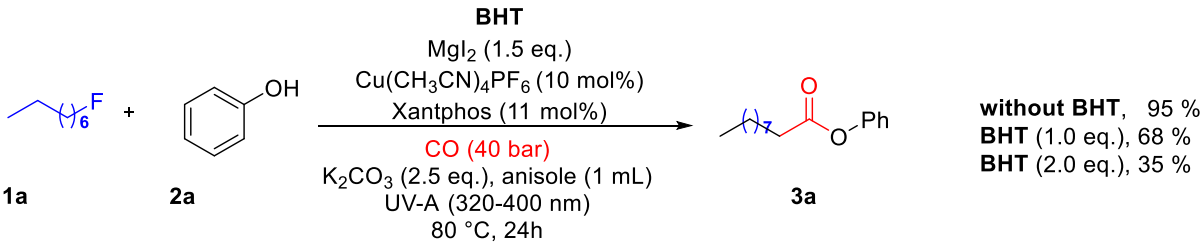
5.2 Radical capture experiments





A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), MgI_2 (41.7 mg, 1.5 eq.), K_2CO_3 (34.5 mg, 2.5 eq.), radical scavenger (1.5 eq.), and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and 1-fluorooctane (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at 80 ℃ under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then, a proper amount of solvent was taken for GC-MS analysis. The result is shown in Figure S2.

5.2 Radical inhibition experiments



A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), MgI_2 (41.7 mg, 1.5 eq.), K_2CO_3 (34.5 mg, 2.5 eq.), 2,6-di-tert-butyl4-methylphenol (0-2 eq) and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and 1-fluorooctane (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at 80 ℃ under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then, 8.4 mg 1,3,5-trimethoxybenzene was added to the vials. A proper amount of solvent was dried under high vacuum and dissolved in $CDCl_3$ taken for NMR analysis.

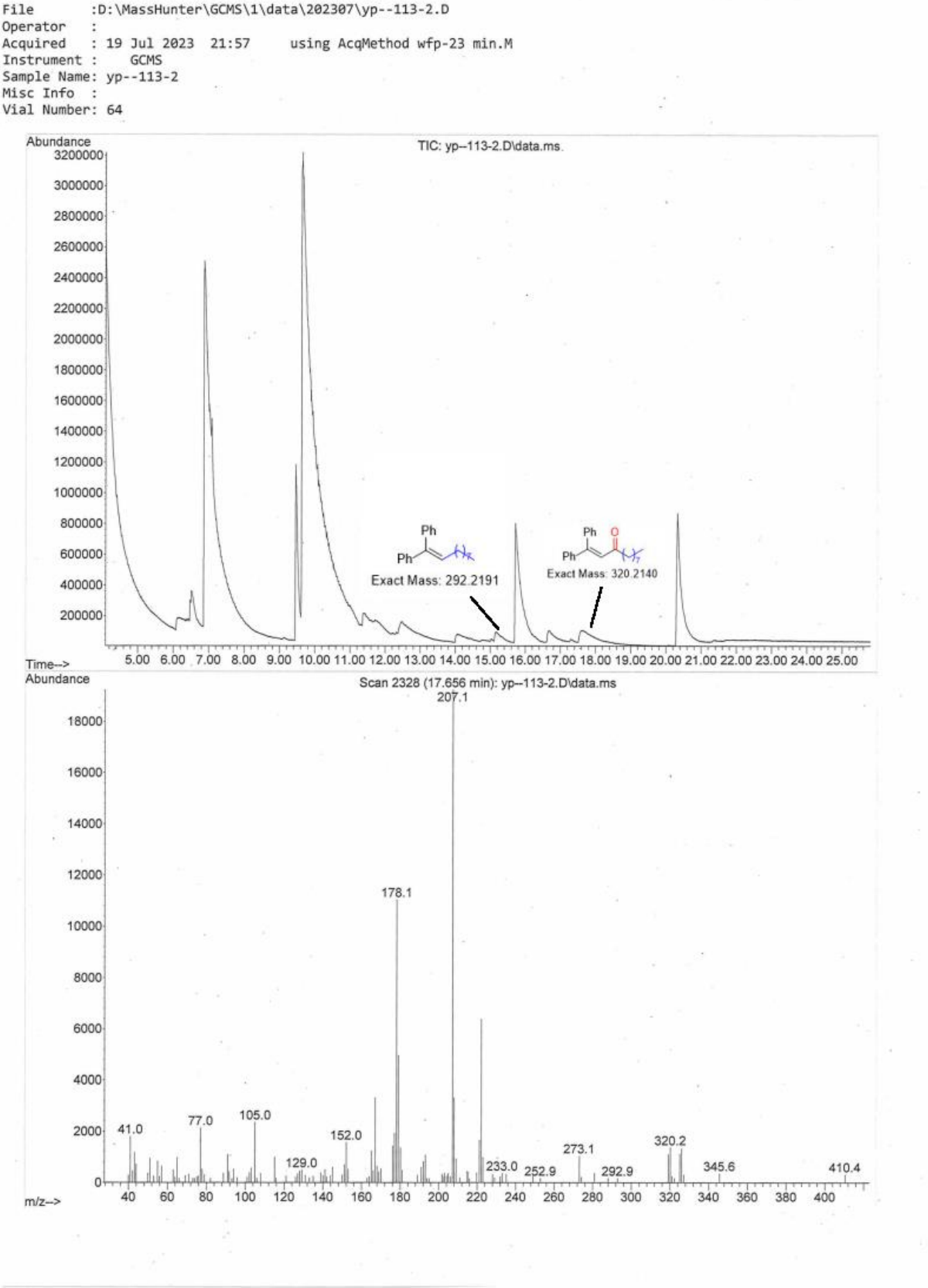
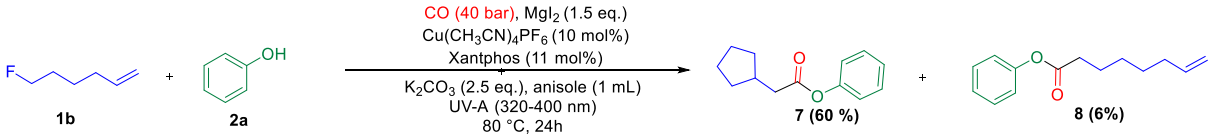
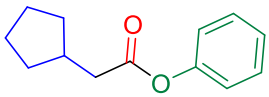


Figure S2 GC-MS of the reaction solvent

5.2 Radical clock experiments



A 4 mL screw-cap vial was charged with Phenol (9.4 mg, 1 mmol), $Cu(CH_3CN)_4PF_6$ (3.7 mg, 10 mol%), Xantphos (6.4 mg, 11 mol%), MgI_2 (41.7 mg, 1.5 eq.), K_2CO_3 (34.5 mg, 2.5 eq.), and an oven-dried stir bar. The vial was closed with a Teflon septum and cap and connected to the atmosphere via a needle. After anisole (1.0 mL), and 6-fluorohex-1-ene (0.2 mmol) were added with a syringe under argon atmosphere, the vial was moved to a cannula and transferred into a 300 mL photoautoclave, manufactured by Parr instrument company®, under an argon atmosphere. At room temperature, the autoclave was flushed with CO three times and charged with 40 bar of CO. The autoclave was placed on a heating plate equipped with a magnetic stirrer and an aluminum block. The reaction mixture was reacted at 80 ℃ under UV-A (320-400 nm). for 24h. After the reaction was complete, the pressure of the autoclave was released carefully. Then, a proper amount of solvent was taken for GC-MS analysis. And the crude residue was purified by silica gel chromatography (pentane/EA = 200:1) to afford a mixture of 7 and 8.



Phenyl 2-cyclopentylacetate (7) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA =100:1) to afford the title compound as a colorless oil (12.3 mg, 60% yield)

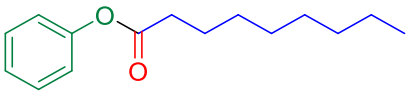
^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.25 – 7.19 (m, 1H), 7.10 – 7.06 (m, 2H), 2.57 (d, *J* = 7.59 Hz, 2H), 2.45 – 2.29 (m, 1H), 1.97 – 1.88 (m, 2H), 1.78 – 1.59 (m, 4H), 1.31 – 1.24 (m, 2H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.88, 150.78, 129.40, 125.71, 121.62, 40.46, 36.62, 32.47, 25.05.

6. References

1. http://www.lumatec.de/de/produkte/uv-lichtquelle-superlite-s04/
2. T. Iwasaki, R. Shimizu, R. Imanishi, H. Kuniyasu, N. Kambe, *Angew. Chem. Int. Ed.* **2015**, *54*, 9347-9350.
3. T. Suzuki, Y. Nagano, A. Kouketsu, A. Matsuura, S. Maruyama, M. Kurotaki, H. Nakagawa, N. Miyata, *J. Med. Chem.* **2005**, *48*, 1019-1032.
4. P. Wang, Y. Wang, H. Neumann, M. Beller, *Chem. Sci*. **2022**, *13*, 13459-13465.
5. H.-J. Ai, C.-L. Li, H. Wang, X.-F. Wu, *ACS Catal.* **2020**, *10*, 5147-5152.

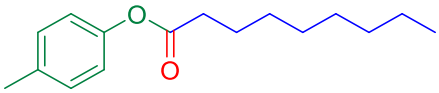
7. Spectroscopic data of products



Phenyl nonanoate (3a) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (21.5 mg, 92% yield)[4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.35 (m, 2H), 7.26 – 7.20 (m, 1H), 7.11 – 7.06 (m, 2H), 2.56 (t, *J* = 7.35 Hz, 2H), 1.81 – 1.71 (m, 2H), 1.49 – 1.27 (m, 10H), 0.92 – 0.85 (m, 3H).

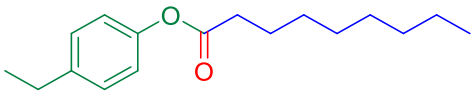
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.35, 150.80, 129.40, 125.71, 121.61, 34.44, 31.83, 29.25, 29.15, 29.14, 24.98, 22.67.



***p*-Tolyl nonanoate (3b)** Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (21.3 mg, 86% yield)[4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.18 – 7.15 (m, 2H), 6.97 – 6.93 (m, 2H), 2.54 (t, *J* = 7.32 Hz, 2H), 2.34 (s, 3H), 1.80 – 1.70 (m, 2H), 1.44 – 1.28 (m, 10H), 0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.54, 148.55, 135.31, 129.90, 121.25, 34.43, 31.81, 29.23, 29.13, 25.00, 22.65, 20.86, 14.10.

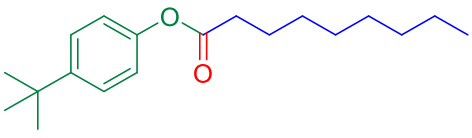


4-Ethylphenyl nonanoate (3c) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (21.5 mg, 82% yield)

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.22 – 7.17 (m, 2H), 7.00 – 6.96 (m, 2H), 2.65 (q, *J* = 7.59 Hz, 2H), 2.55 (t, *J* = 7.41 Hz, 2H), 1.80 – 1.71 (m, 2H), 1.43 – 1.27 (m, 10H), 1.24 (t, *J* = 7.59 Hz, 3H), 0.92 – 0.88 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.55, 148.69, 141.63, 128.72, 121.29, 34.44, 31.83, 29.25, 29.15, 28.30, 25.01, 22.67, 15.58, 14.11.

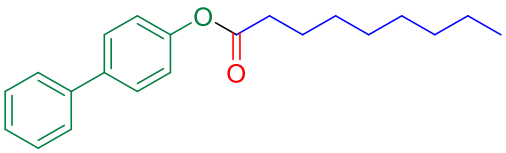
HRMS-EI(m/z): calcd for $C_{17}H_{26}O_2$+ [M+] 262.19273, found 262.19315.



4-(*tert*-Butyl)phenyl nonanoate (3d) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (23.2 mg, 80% yield) [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.40 – 7.35 (m, 2H), 7.02 – 6.97 (m, 2H), 2.54 (t, *J* = 7.32 Hz, 2H), 1.80 – 1.70 (m, 2H), 1.43 – 1.27 (m, 19H),0.92 – 0.87 (m, 3H).

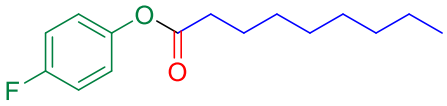
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.56, 148.49, 148,41 126.29, 120.88, 34.46, 31.83, 31.43, 29.25, 29.15, 29.14, 25.01, 22.66, 14.12.



[1,1'-Biphenyl]-4-yl nonanoate (3e) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (25.1 mg, 81% yield) [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.61 – 7.54 (m, 4H), 7.47 – 7.41 (m, 2H), 7.38 – 7.32 (m, 1H), 7.18 – 7.13 (m, 2H), 2.58 (t, *J* = 7.32 Hz, 2H), 1.83 – 1.73 (m, 2H), 1.46 – 1.26 (m, 10H),0.92 – 0.88 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.44, 150.20, 140.44, 138.89, 128.80, 128.16, 127.33, 127.14, 121.87, 34.47, 31.83, 29.25, 29.15, 24.99, 22.67, 14.12.



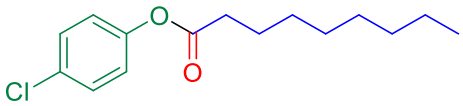
4-Fluorophenyl nonanoate (3f) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 400:1) to afford the title compound as a colorless oil (23.2 mg, 92% yield)

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.15– 7.03 (m, 4H), 2.54 (t, *J* = 7.32 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.37 – 1.26 (m, 10H), 0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.38, 160.17(d, *J* = 242.51 Hz), 146.59 (d, *J* = 3.01 Hz), 122.96 (d, *J* = 8.36 Hz), 116.03 (d, *J* = 23.42 Hz), 34.31, 31.81, 29.22, 29.13, 29.11, 24.92, 22.66, 14.11.

^{19}F NMR (300 MHz, $CDCl_3$): δ -117.25 (p, *J* = 6.5 Hz),

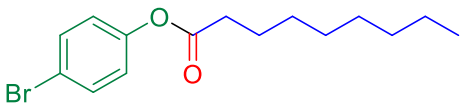
HRMS-EI(m/z): calcd for $C_{15}H_{21}O_2F_1$+ [M+] 252.15201, found 252.15273.



4-Chlorophenyl nonanoate (3g) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (26.2 mg, 98% yield) [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.36 – 7.31 (m, 2H), 7.05 – 7.00 (m, 2H), 2.54 (t, *J* = 7.32 Hz, 2H), 1.79 – 1.70 (m, 2H), 1.43 – 1.28 (m, 10H),0.92 – 0.87 (m, 2H).

^{13}C NMR (75 MHz, $CDCl_3$): δ172.06, 149.26, 131.06, 129.44, 122.96, 34.33, 31.81, 29.21, 29.10, 24.89, 22.65, 14.10.

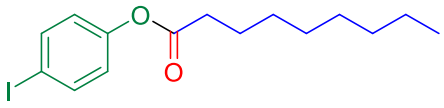


4-Bromophenyl nonanoate (3h) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (28.5 mg, 91% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.51 – 7.46 (m, 2H), 7.00 – 6.95 (m, 2H), 2.54 (t, *J* = 7.32 Hz, 2H), 1.80 – 1.69 (m, 2H), 1.43 – 1.26 (m, 10H),0.92 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.98, 149.80, 132.43, 123.41, 1148.76, 34.34, 31.82, 29.22, 29.13, 29.10, 24.89, 22.66, 14.12.

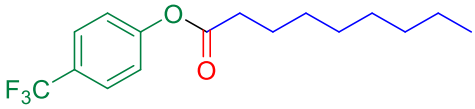
HRMS-EI(m/z): calcd. for $C_{15}H_{21}BrO_2$+ [M+] 312.07194, found 312.07260.



4-Iodophenyl nonanoate (3i) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (25.2 mg, 70% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.70– 7.65 (m, 2H), 6.87 – 6.82 (m, 2H), 2.54 (t, *J* = 7.35 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.42 – 1.25 (m, 10H), 0.91 – 0.86 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.98, 150.61, 138.44, 123.82, 89.69, 34.36, 31.81, 29.21, 29.12, 29.10, 24.88, 22.66, 14.12.



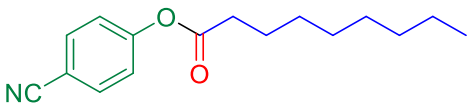
4-(Trifluoromethyl)phenyl nonanoate (3j) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (19.3 mg, 64% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.67– 7.62 (m, 2H), 7.23 – 7.18 (m, 2H), 2.58 (t, *J* = 7.35 Hz, 2H), 1.81 – 1.71 (m, 2H), 1.44 – 1.26 (m, 22H), 0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.80, 153.26, 127.99 (q, *J* = 32.44Hz), 126.76(q, *J* = 3.67 Hz), 124.02(q, *J* = 315.01 Hz), 122.10, 34.36, 31.80, 29.21, 29.12, 29.09, 24.84, 22.65, 14.10.

^{19}F NMR (300 MHz, $CDCl_3$): δ -62.23

HRMS-EI(m/z): calcd for $C_{16}H_{21}F_3O_2$+ [M+] 302.14882, found 302.14927

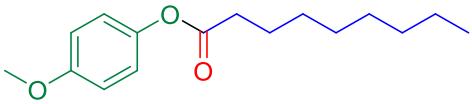


4-Cyanophenyl nonanoate (3k) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (12.4 mg, 48% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.71 – 7.66 (m, 2H), 7.24 – 7.20 (m, 2H), 2.58 (t, *J* = 7.35 Hz, 2H), 1.80 – 1.70 (m, 2H), 1.43 – 1.25 (m, 10H),0.91 – 0.86 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.43, 154.07, 133.65, 122.75, 118,28, 109.63, 34.34, 31.79, 29.18, 29.10, 29.06, 24.77, 22.64, 14.09.

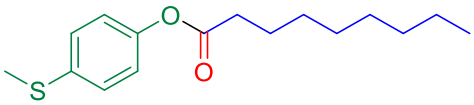
HRMS-EI(m/z): calcd for $C_{16}H_{21}NO_2$+ [M+] 259.15668, found 259.15631.



4-Methoxyphenyl nonanoate (3l) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (14.5 mg, 55% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.02 – 6.96 (m, 2H), 6.91 – 6.85 (m, 2H), 3.80 (s, 3H), 2.53 (t, *J* = 7.32 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.43 – 1.26 (m, 10H),0.91 – 0.86 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.73, 157.17, 144.29, 122.32, 114.44, 55.60, 34.37, 31.81, 29.23, 29.13, 24.99, 22.65, 14.10.

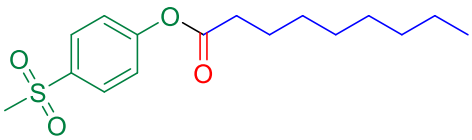


4-(Methylthio)phenyl nonanoate (3m) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a yellow oil (19.8 mg, 71% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.29 – 7.25 (m, 2H), 7.03 – 6.99 (m, 2H), 2.54 (t, *J* = 7.32 Hz, 2H), 2.48 (s, 3H), 1.79 – 1.69 (m, 2H), 1.43 – 1.26 (m, 10H),0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.37, 148.52, 135.49, 128.06, 122.08, 34.39, 31.82, 29.23, 29.13, 29.12, 24.94, 22.66, 16.56, 14.11.

HRMS-EI(m/z): calcd for $C_{16}H_{24}O_3$+ [M+] 280.14915, found 280.14924.

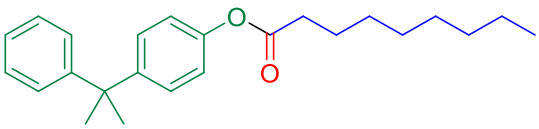


4-(Methylsulfonyl)phenyl nonanoate (3n) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 5:1) to afford the title compound as a yellow oil (16.2 mg, 52% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.99 – 7.95 (m, 2H), 7.32 – 7.27 (m, 2H), 3.06 (s, 3H), 2.59 (t, *J* = 7.41 Hz, 2H), 1.81 – 1.71 (m, 2H), 1.37 – 1.25 (m, 10H), 0.91 – 0.86 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.59, 154.85, 137.70, 129.19, 122.71, 44.68, 34.36, 31.79, 29.70, 29.19, 29.10, 29.06, 24.79, 22.64, 14.10.

HRMS-EI(m/z): calcd for $C_{16}H_{24}O_4S$+ [M+] 312.13898, found 312.13893.

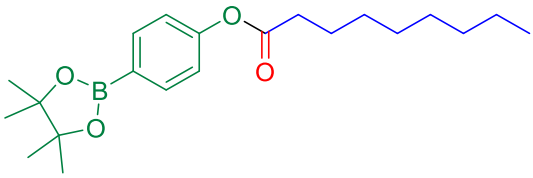


4-(2-Phenylpropan-2-yl)phenyl nonanoate (3o) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (31.0 mg, 88% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.30 – 7.27 (m, 1H), 7.25 – 7.15 (m, 6H), 6.99 – 6.94 (m, 2H), 2.54 (t, *J* = 7.32 Hz, 2H), 1.79 – 1.72 (m, 2H), 1.68 (m, 6H) 1.43 – 1.27 (m, 10H), 0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.47, 150.38, 148.57, 148.07, 128.05, 127.81, 126.79, 125.72, 120.88, 42.72, 34.45, 31.82, 30.84, 29.24, 29.15, 29.12, 24.99, 22.66, 14.11.

HRMS-EI(m/z): calcd for $C_{24}H_{32}O_2$+ [M+] 352.23968, found 352.23959.



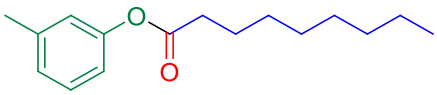
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl nonanoate (3p) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (28.4 mg, 79% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.85– 7.80 (m, 2H), 7.10 – 7.05 (m, 2H), 2.55 (t, *J* = 7.32 Hz, 2H), 1.80 – 1.70 (m, 2H), 1.38 – 1.27 (m, 22H), 0.91 – 0.86 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.10, 153.31, 136.17, 120.97, 83.89, 34.47, 31.82, 29.72, 29.23, 29.13, 24.93, 24.86, 22.66, 14.11.

^{11}B NMR (300 MHz, $CDCl_3$): δ 29.60.

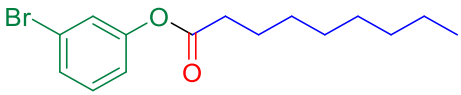
HRMS-EI(m/z): calcd for $C_{21}H_{33}BO_4$+ [M+] 360.24664, found 360.24675.



***m*-Tolyl nonanoate (3q)** Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (18.9 mg, 76% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.27 – 7.22 (m, 1H), 7.05 – 7.01 (m, 1H), 6.89 – 6.85 (m, 2H), 2.54 (t, *J* = 7.41 Hz, 2H), 2.36 (s, 3H), 1.80 – 1.70 (m, 2H), 1.41 – 1.26 (m, 10H), 0.91 – 0.87 (m, 3H).

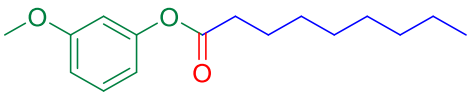
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.49, 150.72, 139.58, 129.12, 126.53, 122.20, 118.53, 34.45, 31.83, 29.24, 29.14, 25.00, 22.66, 21.32, 14.11.



3-Bromophenyl nonanoate (3r) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (24.4 mg, 78% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.38 – 7.34 (m, 1H), 7.28 – 7.21 (m, 2H), 7.05 – 7.02 (m, 1H), 2.54 (t, *J* = 7.41 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.41 – 1.26 (m, 10H), 0.91 – 0.87 (m, 3H).

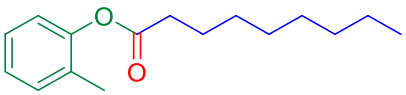
^{13}C NMR (75 MHz, $CDCl_3$): δ 171.89, 151.30, 130.43, 128.90, 125.14, 122.35, 120.50, 34.31, 31.81, 29.20, 29.11, 29.09, 24.87, 22.65, 14.10.



3-Methoxyphenyl nonanoate (3s) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (23.8 mg, 90% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.27 (t, *J* = 8.15 Hz, 1H), 6.79 – 6.76 (m, 1H), 6.70 – 6.66 (m, 1H), 6.63 (t, *J* = 2.31 Hz, 1H), 3.80 (s, 3H), 2.54 (t, *J* = 7.41 Hz, 2H), 1.80 – 1.70 (m, 2H), 1.41 – 1.26 (m, 10H), 0.91 – 0.87 (m, 3H).

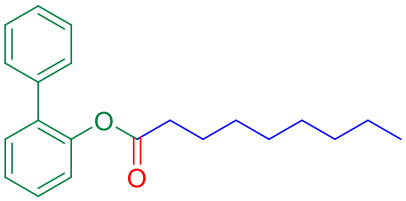
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.24, 160.49, 151.76, 129.78, 113.83, 111.56, 107.63, 55.40, 34.44, 31.82, 29.23, 29.13, 24.96, 22.66, 14.10.



***o*-Tolyl nonanoate (3t)** Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (17.4 mg, 70% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.25 – 7.11 (m, 3H), 7.01 – 6.98 (m, 1H), 2.58 (t, *J* = 7.32 Hz, 2H), 2.18 (s, 3H), 1.83 – 1.73 (m, 2H), 1.43 – 1.26 (m, 10H), 0.92 – 0.87 (m, 3H).

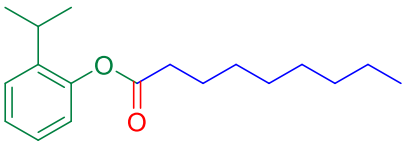
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.08, 149.40, 131.11, 130.11, 126.90, 125.93, 121.91, 34.30, 31.82, 29.24, 29.21, 29.15, 25.11, 22.66, 16.22, 14.11.



[1,1'-Biphenyl]-2-yl nonanoate (3u) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (27.3 mg, 88% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.44 – 7.29 (m, 8H), 7.15 – 7.12 (m, 1H), 2.35 (t, *J* = 7.32 Hz, 2H), 1.58 – 1.48 (m, 2H), 1.36 – 1.24 (m, 10H), 0.93 – 0.88 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.20, 147.90, 137.69, 135.08, 130.88, 129.02, 128.49, 128.21, 127.42, 126.24, 122.88, 34.24, 31.82, 29.19, 29.08, 28.97, 24.71, 22.68, 14.13.

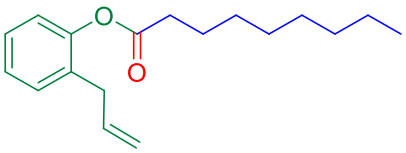


2-Isopropylphenyl nonanoate (3v) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (17.9 mg, 65% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.33 – 7.29 (m, 1H), 7.21 – 7.16 (m, 2H), 7.00 – 6.96 (m, 1H), 3.07 – 2.98 (m, 1H), 2.58 (t, *J* = 7.32 Hz, 2H), 1.83 – 1.73 (m, 2H), 1.43 – 1.26 (m, 10H), 1.21 (d, *J* = 6.96 Hz, 6H), 0.92 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.50, 148.14, 140.15, 126.62, 126.60, 126.20, 122.29, 34.42, 31.82, 29.25, 29.21, 29.16, 27.33, 25.06, 22.96, 22.67, 14.12.

HRMS-EI(m/z): calcd for $C_{18}H_{28}O_2$+ [M+] 276.20838, found 276.20793.

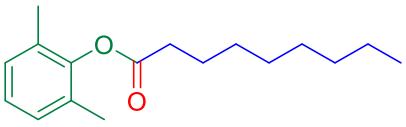


2-Allylphenyl nonanoate (3w) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (14.0 mg, 65% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.25 – 7.15 (m, 3H), 7.04 – 7.01 (m, 1H), 5.97– 5.84 (m, 1H), 5.09– 5.02 (m, 2H), 3.31 – 3.28 (m, 2H), 2.56 (t, *J* = 7.35 Hz, 2H), 1.81 – 1.71 (m, 2H), 1.39 – 1.26 (m, 10H), 0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.19, 148.99, 135.93, 131.91, 130.34, 127.38, 126.05, 122.38, 116.20, 34.56, 34.34, 31.82, 29.24, 29.20, 29.14, 24.99, 22.66, 14.10.

HRMS-EI(m/z): calcd for $C_{18}H_{26}O_2$+ [M+] 274.19273, found 274.19272.

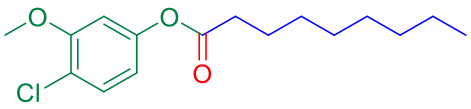


2,6-Dimethylphenyl nonanoate (3x) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (14.7 mg, 56% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.09 – 7.04 (m, 3H), 2.60 (t, *J* = 7.35 Hz, 2H), 2.14 (s, 6H), 1.85 – 1.75 (m, 2H), 1.37 – 1.26 (m, 10H), 0.92 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.55, 148.24, 130.12, 128.55, 125.73, 34.10, 31.45, 29.30, 29.24, 29.15, 25.17, 22.65, 16.37, 14.10.

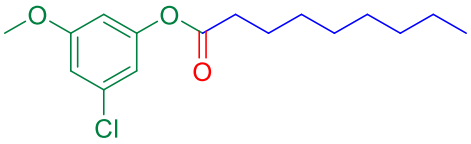
HRMS-EI(m/z): calcd for $C_{17}H_{26}O_2$+ [M+] 262.19273, found 262.19332.



4-Chloro-3-methoxyphenyl nonanoate (3y) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (27.4 mg, 92% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.34 (d, *J* = 8.52 Hz, 1H), 6.69 – 6.63 (m, 2H), 3.88 (s, 3H), 2.55 (t, *J* = 7.32 Hz, 2H), 1.80 – 1.70 (m, 2H), 1.44 – 1.25 (m, 10H), 0.91 – 0.86 (m, 3H).

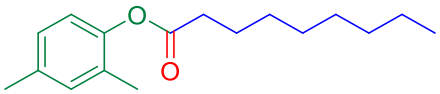
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.10, 155.47, 150.16, 130.20, 119.43, 114.21, 106.30, 56.24, 34.36, 31.81, 29.22, 29.12, 24.87, 22.66, 14.11.



3-Chloro-5-methoxyphenyl nonanoate (3z) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (27.4 mg, 92% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 6.78 – 6.76 (m, 1H), 6.72 (t, *J* = 1.92 Hz, 1H), 6.54 (t, *J* = 2.22 Hz, 1H), 3.78 (s, 3H), 2.53 (t, *J* = 7.32 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.41 – 1.29 (m, 10H), 0.91 – 0.87 (m, 3H).

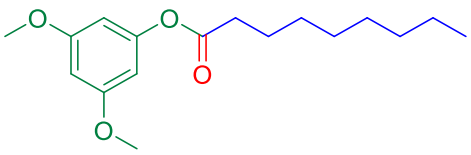
^{13}C NMR (75 MHz, $CDCl_3$): δ 171.80, 160.75, 151.89, 135.02, 114.64, 112.03, 106.60, 55.68, 34.32, 31.81, 29.20, 29.12, 29.08, 24.86, 22.65, 14.09.



2,4-Dimethylphenyl nonanoate (4a) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (21.2 mg, 81% yield).[4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.04 – 6.98 (m, 2H), 6.87 (d, *J* = 8.07 Hz, 1H), 2.56 (t, *J* = 7.32 Hz, 2H), 2.31 (s, 3H), 2.14 (s, 3H), 1.82 – 1.72 (m, 2H), 1.45 – 1.27 (m, 10H), 0.92 – 0.87 (m, 3H).

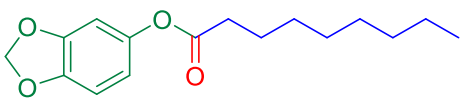
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.27, 147.16, 135.46, 131.74, 129.64, 127.43, 121.55, 34.31, 31.82, 29.24, 29.22, 29.15, 25.13, 22.66, 20.81, 16.14, 14.10.



3,5-Dimethoxyphenyl nonanoate (4b) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (27.6 mg, 94% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 6.33 (t, *J* = 2.28 Hz, 1H), 6.25 (t, *J* = 2.9 Hz, 1H), 3.77 (s, 6H), 2.53 (t, *J* = 7.32 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.41 – 1.27 (m, 10H), 0.91 – 0.87 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.13, 161.13, 152.34, 100.23, 98.17, 55.46, 34.43, 31.82, 29.22, 29.13, 24.93, 22.65, 14.09.

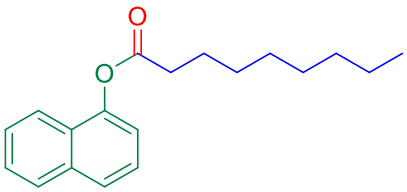


Benzo[*d*][1,3]dioxol-5-yl nonanoate (4c) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (17.2 mg, 62% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 6.76 (d, *J* = 8.07 Hz, 1H), 6.59 – 6.49 (m, 2H), 5.97 (s, 2H), 2.52 (t, *J* = 7.32 Hz, 2H), 1.78 – 1.68 (m, 2H), 1.38 – 1.25 (m, 10H), 0.91 – 0.86 (m, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.67, 147.98, 145.08, 113.92, 107.97, 103.78, 101.68, 34.32, 31.82, 29.22, 29.14, 29.13, 24.96, 22.66, 14.1. HRMS-ESI(m/z): calcd for $C_{16}H_{23}O_4^+$ $[M+H]^+$ 279.1591, found

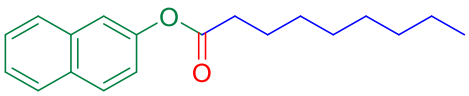
HRMS-EI(m/z): calcd for $C_{16}H_{22}O_4$+ [M+] 278.15126, found 278.15149.



Naphthalen-2-yl nonanoate (4d) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (13.7 mg, 48% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.91 – 7.86 (m, 2H), 7.75 (d, *J* = 8.25 Hz, 2H), 7.56 – 7.45 (m, 3H),), 7.29 – 7.23 (m, 1H), 2.75 (t, *J* = 732 Hz, 2H), 1.91 – 1.84 (m, 2H), 1.46 – 1.28 (m, 10H), 0.94 – 0.90 (m, 3H).

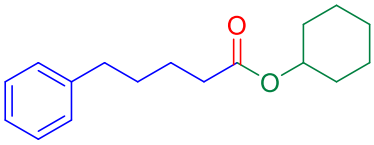
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.33, 146.68, 134.68, 128.05, 126.91, 126.40, 125.90, 125.43, 121.17, 118.10, 34.47, 31.84, 29.28, 29.26, 29.18, 25.15, 22.68, 14.12.



Naphthalen-2-yl nonanoate (4e) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (19.9 mg, 70% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.87 – 7.79 (m, 3H), 7.57– 7.43 (m, 3H), 7.26 – 7.21 (m, 1H), 2.62 (t, *J* = 7.44 Hz, 2H), 1.86 – 1.76 (m, 2H), 1.47 – 1.30 (m, 10H), 0.94 – 0.89 (m, 3H).

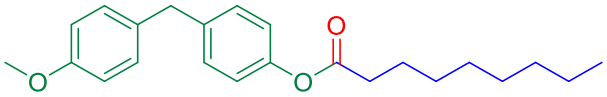
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.53, 148.45, 133.81, 131.44, 129.37, 127.78, 127.64, 126.54, 125.65, 121.24, 118.52, 34.51, 31.85, 29.27, 29.17, 25.02, 22.69, 14.13.



Cyclohexyl 5-phenylpentanoate (4f) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (5.8 mg, 22% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.31– 7.25 (m, 2H), 7.20 – 7.14 (m, 3H), 4.80 – 4.71 (m, 1H), 2.65 – 2.61 (m, 2H), 2.33 – 2.29 (m, 2H), 1.86 – 1.80 (m, 2H), 1.72 – 1.62 (m, 6H), 1.42 – 1.26 (m, 3H).

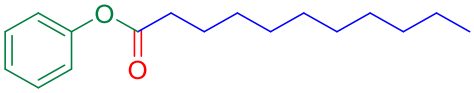
^{13}C NMR (75 MHz, $CDCl_3$): δ 173.14, 142.24, 128.40, 128.32, 125.76, 72.42, 35.62, 34.60, 31.67, 30.92, 25.41, 24.75, 23.77.



4-(4-Methoxybenzyl)phenyl nonanoate (4g) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (28.3 mg, 80% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.18 – 7.07 (m, 4H), 7.00 – 6.95 (m, 2H), 6.86 – 6.81 (m, 2H), 3.91 (s, 2H), 3.79 (s, 3H), 2.53 (t, *J* = 7.35 Hz, 2H), 1.79 – 1.69 (m, 2H), 1.42 – 1.26 (m, 10H), 0.91 – 0.86 (m, 3H).

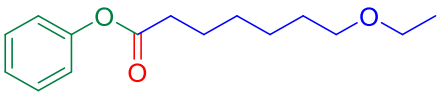
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.49, 158.05, 148.98, 139.02, 132.93, 129.91, 129.68, 121.45, 113.92, 55.28, 40.38, 34.43, 31.82, 29.23, 29.14, 24.98, 22.66, 14.11.



Phenyl undecanoate (5a) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (23.3 mg, 89% yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41– 7.34 (m, 2H), 7.25 – 7.19 (m, 1H), 7.10 – 7.05 (m, 2H), 2.56 (t, *J* = 7.35 Hz, 2H), 1.81 – 1.71 (m, 2H), 1.41 – 1.28 (m, 12H), 0.91 – 0.87 (m, 3H).

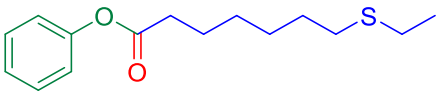
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.35, 150.80, 129.39, 125.71, 121.60, 34.44, 31.92, 29.57, 29.49, 29.33, 29.28, 29.13, 24.98, 22.70, 14.13.



Phenyl 7-ethoxyheptanoate (5b) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 200:1) to afford the title compound as a colorless oil (20.7 mg, 83% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41– 7.34 (m, 2H), 7.24 – 7.19 (m, 1H), 7.09 – 7.05 (m, 2H), 3.51 – 3.40 (m, 2H), 2.56 (t, *J* = 7.35 Hz, 2H), 1.82 – 1.72 (m, 2H), 1.66 – 1.56 (m, 2H), 1.46 – 1.41 (m, 4H), 1.20 (t, *J* = 6.96 Hz, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.25, 150.77, 129.39, 125.72, 121.58, 70.57, 66.12, 34.34, 29.65, 28.97, 25.93, 24.91, 15.25.

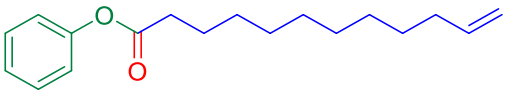


Phenyl 7-(ethylthio)heptanoate (5c) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a yellow oil (21.5 mg, 81% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.25 – 7.19 (m, 1H), 7.09 – 7.05 (m, 2H), 2.59 – 2.54 (m, 6H), 1.82 – 1.72 (m, 2H), 1.65 – 1.58 (m, 2H), 1.65 – 1.58 (m, 4H), 1.26 (t, *J* = 7.44 Hz, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.23, 150.74, 129.42, 125.75, 121.58, 34.31, 31.45, 29.48, 28.72, 28.55, 25.92, 24.82, 14.85.

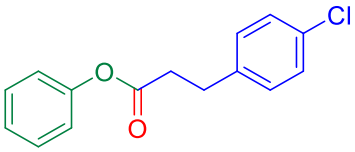
HRMS-EI(m/z): calcd for $C_{15}H_{22}O_4S_1$+ [M+] 266.13350, found 266.13306.



Phenyl dodec-11-enoate (5d) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 400:1) to afford the title compound as a colorless oil (12.9 mg, 47% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.25 – 7.19 (m, 1H), 7.09 – 7.05 (m, 2H), 5.88 – 7.75 (m, 1H), 5.03 – 4.91 (m, 2H), 2.55 (t, *J* = 7.35 Hz, 2H), 2.01 – 2.00 (m, 2H), 1.82 – 1.70 (m, 2H), 1.40 – 1.25 (m, 12H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.33, 150.80, 139.22, 129.39, 125.71, 121.60, 121.56, 114.15, 34.43, 33.82, 29.43, 29.41, 29.25, 29.12, 28.94, 24.97.

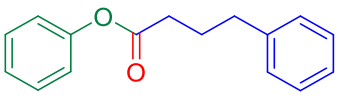


phenyl 3-(4-chlorophenyl)propanoate (5e) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (19.3 mg, 74% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.40 – 7.33 (m, 2H), 7.32 – 7.19 (m, 5H), 7.03 – 6.99 (m, 2H), 3.05 (t, *J* = 7.41 Hz, 2H), 2.30 – 2.84 (m, 2H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.13, 150.58, 138.59, 132.28, 129.82, 129.45, 128.72, 125.89, 121.48, 35.81, 30.27.

HRMS-EI(m/z): calcd for $C_{15}H_{13}O_2Cl_1$+ [M+] 260.05986, found 260.05836.

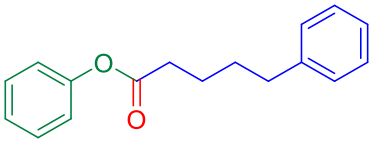


Phenyl 4-phenylbutanoate (5f) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (18.1 mg, 75% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.29 (m, 4H), 7.26 – 7.19 (m, 4H), 7.10 – 7.05 (m, 2H), 2.76 (t, *J* = 7.23 Hz, 2H), 2.59 (t, *J* = 7.41 Hz, 2H), 2.14 – 2.05 (m, 2H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.01, 150.74, 141.24, 129.44, 128.57, 128.51, 126.14, 125.80, 121.59, 35.11, 33.69, 26.53.

HRMS-EI(m/z): calcd for $C_{16}H_{16}O_2$+ [M+] 240.11448, found 240.11612.

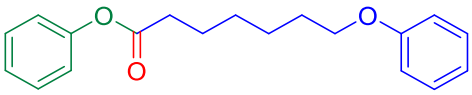


Phenyl 5-phenylpentanoate (5g) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (18.3 mg, 72% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.17 (m, 8H), 7.09 – 7.04 (m, 2H), 2.69 (t, *J* = 7.32 Hz, 2H), 2.59 (t, *J* = 7.05 Hz, 2H), 1.87 – 1.72 (m, 4H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.12, 150.73, 142.04, 129.42, 128.43, 128.39, 125.87, 125.77, 121.59, 35.59, 34.26, 30.88, 24.57.

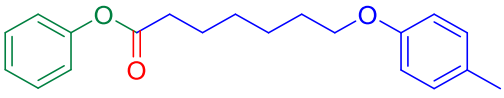
HRMS-EI(m/z): calcd for $C_{17}H_{18}O_2$+ [M+] 254.13013, found 254.13047.



Phenyl 7-phenoxyheptanoate (5h) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (24.1 mg, 81% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.40 – 7.19 (m, 5H), 7.10 – 7.05 (m, 2H), 6.96 – 6.88 (m, 3H), 3.97 (t, *J* = 6.42 Hz, 2H), 2.58 (t, *J* = 7.38 Hz, 2H), 1.87 – 1.75 (m, 4H), 1.60 – 1.44 (m, 4H).

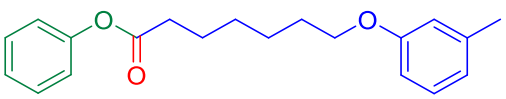
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.22, 159.08, 150.76, 129.44, 129.42, 125.75, 121.59, 120.55, 114.51, 67.66, 34.32, 29.14, 28.86, 25.81, 24.87.



Phenyl 7-(*p*-tolyloxy)heptanoate (5i) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (25.2 mg, 81% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.25 – 7.19 (m, 1H), 7.09 – 7.05 (m, 4H), 6.82 – 6.77 (m, 2H), 3.95 (t, *J* = 6.39 Hz, 2H), 2.58 (t, *J* = 7.51 Hz, 2H), 2.29 (s, 3H), 1.85 – 1.75 (m, 4H), 1.52 – 1.50 (m, 4H).

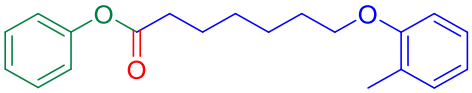
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.21, 156.96, 150.76, 129.87, 129.74, 129.41, 125.73, 121.58, 114.38, 67.85, 34.32, 29.17, 28.86, 25.79, 24.87, 20.46.



Phenyl 7-(*m*-tolyloxy)heptanoate (5j) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (25.3 mg, 81% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.25 – 7.16 (m, 2H), 7.10 – 7.06 (m, 2H), 6.77 – 6.69 (m, 3H), 3.96 (t, *J* = 6.39 Hz, 2H), 2.58 (t, *J* = 7.38 Hz, 2H), 2.33 (s, 3H), 1.87 – 1.76 (m, 4H), 1.56 – 1.50 (m, 4H).

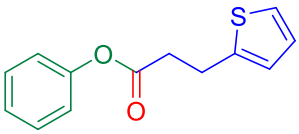
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.22, 159.11, 150.77, 139.45, 129.41, 129.18, 125.74, 121.59, 121.39, 115.40, 111.37, 67.62, 34.32, 29.17, 28.86, 25.81, 24.88, 21.54.



Phenyl 7-(o-tolyloxy)heptanoate (5k) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (25.9 mg, 83% yield).[5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.26 – 7.06 (m, 5H), 6.88 – 6.80 (m, 2H), 3.98 (t, *J* = 6.24 Hz, 2H), 2.59 (t, *J* = 7.38 Hz, 2H), 2.24 (s, 3H), 1.90 – 1.77 (m, 4H), 1.63 – 1.46 (m, 4H).

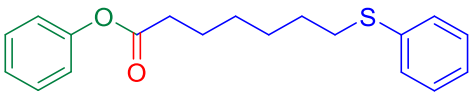
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.22, 157.20, 150.77, 130.60, 129.41, 126.84, 126.73, 125.74, 121.58, 120.14, 110.93, 67.67, 34.33, 29.22, 28.86, 25.90, 24.90, 16.25.



Phenyl 3-(thiophen-2-yl)propanoate (5l) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a colorless oil (14.0 mg, 60% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.20 (m, 4H), 7.08 – 7.00 (m, 4H), 3.11 (t, *J* = 7.77 Hz, 2H), 2.92 – 2.87 (m, 2H).

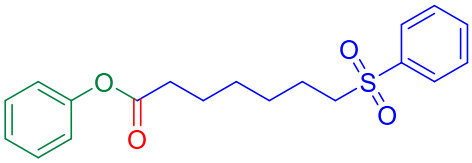
^{13}C NMR (75 MHz, $CDCl_3$): δ 171.41, 150.67, 140.44, 129.44, 128.03, 125.85, 125.81, 121.54, 120.96, 35.30, 25.51.



Phenyl 7-(phenylthio)heptanoate (5m) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a yellow oil (26.7 mg, 85% yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.14 (m, 8H), 7.09 – 7.05 (m, 2H), 2.94 (t, *J* = 7.14 Hz, 2H), 2.55 (t, *J* = 7.44 Hz, 2H), 1.81 – 1.64 (m, 4H), 1.53 – 1.38 (m, 4H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 172.17, 150.74, 136.84, 129.42, 129.02, 128.87, 125.77, 125.75, 121.57, 34.28, 33.55, 28.94, 28.62, 28.41, 24.78.

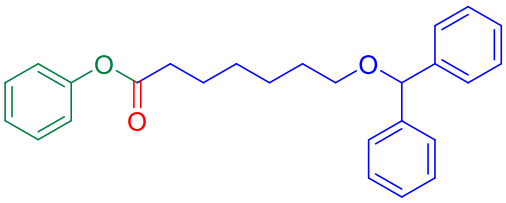


Phenyl 7-(phenylsulfonyl)heptanoate (5n) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 5:1) to afford the title compound as a yellow oil (24.9 mg, 72% yield).

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.93 – 7.89 (m, 2H), 7.68 – 7.54 (m, 3H), 7.40 – 7.33 (m, 2H), 7.24 – 7.18 (m, 1H), 7.07– 7.03 (m, 2H), 3.12 – 3.07 (m, 2H), 2.53 (t, *J* = 7.35 Hz, 2H), 1.80 – 1.66 (m, 4H), 1.49 – 1.37 (m, 4H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 171.97, 150.67, 139.18, 133.69, 129.43, 129.31, 128.05, 125.80, 121.53, 56.17, 34.11, 28.48, 27.96, 24.48, 22.52.

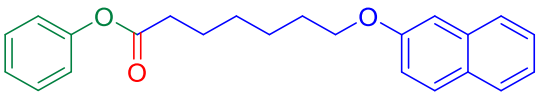
HRMS-EI(m/z): calcd for $C_{19}H_{22}O_4S_1$+ [M+] 346.12333, found 346.12433.



Phenyl 7-(benzhydryloxy)heptanoate (5o) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (15.5 mg, 40 % yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.42 – 7.20 (m, 13H), 7.10 – 7.06 (m, 2H), 5.35 (s, 1H), 3.48 (t, *J* = 6.42 Hz, 2H), 2.56 (t, *J* = 7.32 Hz, 2H), 1.83 – 1.65 (m, 4H), 1.53 – 1.42 (m, 4H).

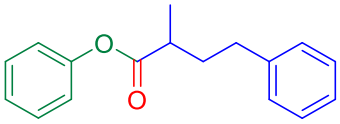
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.27, 150.77, 142.61, 129.41, 128.36, 127.36, 126.97, 125.73, 121.60, 83.66, 69.04, 34.36, 29.72, 28.95, 25.97, 24.91.



Phenyl 7-(naphthalen-2-yloxy)heptanoate (5p) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (13.8 mg, 42 % yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.78 – 7.71 (m, 3H), 7.46 – 7.30 (m, 4H), 7.25 – 7.05 (m, 5H), 4.10 (t, *J* = 6.42 Hz, 2H), 2.60 (t, *J* = 7.38 Hz, 2H), 1.94 – 1.78 (m, 4H), 1.63 – 1.53 (m, 4H).

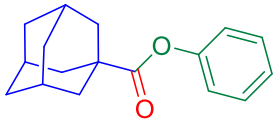
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.21, 157.06, 150.76, 134.63, 129.41, 129.35, 128.93, 127.65, 126.71, 126.31, 125.74, 123.51, 121.58, 119.01, 106.60, 67.80, 34.33, 29.09, 28.87, 25.85, 24.88.



Phenyl 2-methyl-4-phenylbutanoate (5q) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (13.8 mg, 42 % yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.17 (m, 8H), 7.09 – 7.05 (m, 2H), 2.77 – 2.69 (m, 3H), 2.23 – 2.11(m, 1H), 1.92 – 1.80 (m, 1H), 1.35 (d, *J* = 6.96 Hz, 3H).

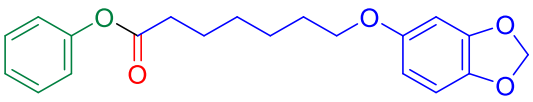
^{13}C NMR (75 MHz, $CDCl_3$): δ 175.04, 150.82, 141.52, 129.45, 128.51, 126.07, 125.78, 121.56, 39.17, 35.45, 33.53, 17.16.



Phenyl (3r,5r,7r)-adamantane-1-carboxylate (5r) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 400:1) to afford the title compound as a colorless oil (22.8 mg, 89 % yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.40 – 7.34 (m, 2H), 7.24 – 7.18 (m, 1H), 7.07 – 7.03 (m, 2H), 2.09 – 2.07 (m, 9H), 1.82 – 1.78 (m, 6H).

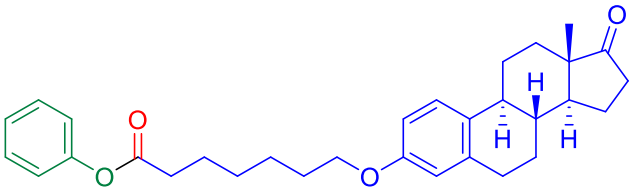
^{13}C NMR (75 MHz, $CDCl_3$): δ 175.04, 150.82, 141.52, 129.45, 128.51, 126.07, 125.78, 121.56, 39.17, 35.45, 33.53, 17.16.



Phenyl 7-(benzo[d][1,3]dioxol-5-yloxy)heptanoate (5s) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 100:1) to afford the title compound as a white oil (27.5 mg, 85 % yield). [4]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.25 – 7.19 (m, 1H), 7.10 – 7.06 (m, 2H), 6.70 (d, *J* = 8.43 Hz, 1H), 6.50 (d, *J* = 2.46 Hz, 1H), 6.32 (dd, *J* = 8.43, 2.46 Hz, 1H), 5.91 (s, 2H), 3.89 (t, *J* = 6.42 Hz, 2H), 2.58 (t, *J* = 7.35 Hz, 2H), 1.84 – 1.74 (m, 4H), 1.54 – 1.47 (m, 4H).

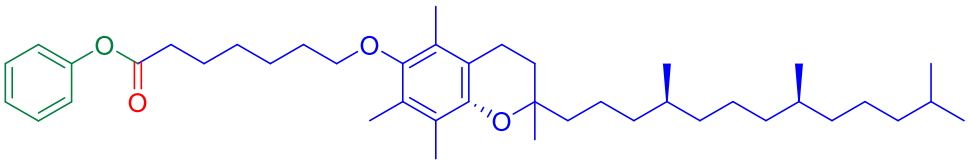
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.21, 154.63, 150.76, 148.24, 141.51, 129.42, 125.75, 121.59, 107.95, 105.68, 101.09, 98.07, 68.74, 34.31, 29.14, 28.84, 25.77, 24.86.



Phenyl 7-(((8R,9S,13S,14S)-13-methyl-17-oxo-7,8,9,11,12,13,14,15,16,17-decahydro-6*H*-cyclopenta[*a*]phenanthren-3-yl)oxy)heptanoate (5t) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (37.9 mg, 80 % yield). [5]

^{1}H NMR (300 MHz, $CDCl_3$): δ 7.41 – 7.34 (m, 2H), 7.26 – 7.18 (m, 2H), 7.10 – 7.06 (m, 2H), 6.74 – 6.65 (m, 2H), 3.95 (t, *J* = 6.42 Hz, 2H), 2.93 – 2.88 (m, 2H), 2.58 (t, *J* =7.32 Hz, 2H), 2.53 – 1.27 (m, 21H), 0.92 (s, 3H).

^{13}C NMR (75 MHz, $CDCl_3$): δ 220.96, 172.21, 157.13, 150.77, 137.73, 131.93, 129.42, 126.33, 125.75, 121.60, 114.59, 112.15, 67.71, 50.44, 48.04, 44.02, 38.42, 35.90, 34.32, 31.63, 29.69, 29.18, 28.85, 26.60, 25.96, 25.81, 24.88, 21.62, 13.89.



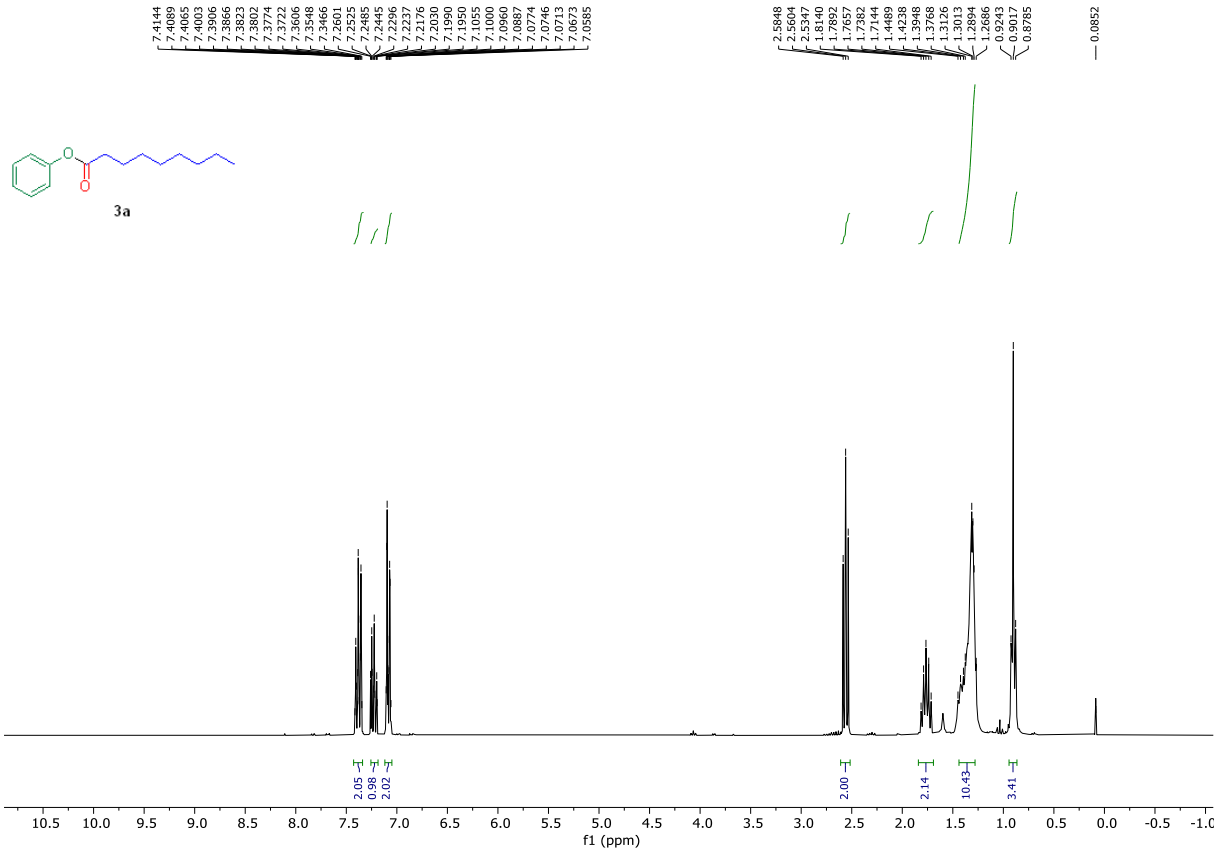
Phenyl 7-((2,5,7,8-tetramethyl-2-((4S,8S)-4,8,12-trimethyltridecyl)chroman-6-yl)oxy)heptanoate (5u) Prepared according to the general procedure. The crude product was purified by silica gel chromatography (PE/EA = 50:1) to afford the title compound as a colorless oil (38.1 mg, 60% yield).

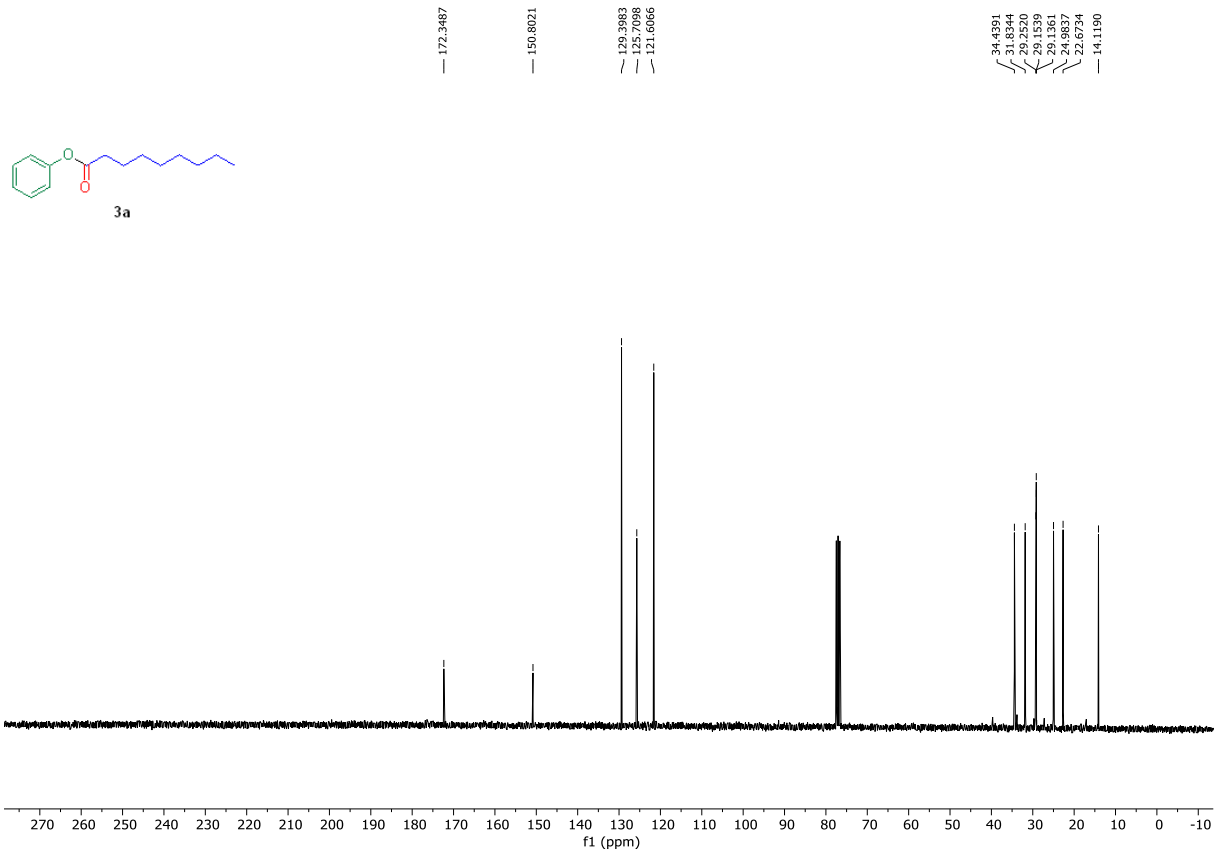
^{1}H NMR (300 MHz, $CDCl_3$): δ 7.42 – 7.36 (m, 2H), 7.26 – 7.21 (m, 1H), 7.12 – 7.07 (m, 2H), 3.67 (t, *J* = 6.51 Hz, 2H), 2.63 – 2.56 (m, 4H), 2.19 (s, 3H), 2.14 (s, 3H), 2.10 (s, 3H), 1.88 – 1.76 (m, 4H), 1.64 – 1.09 (m, 28H), 0.90 – 0.85 (m, 12H).

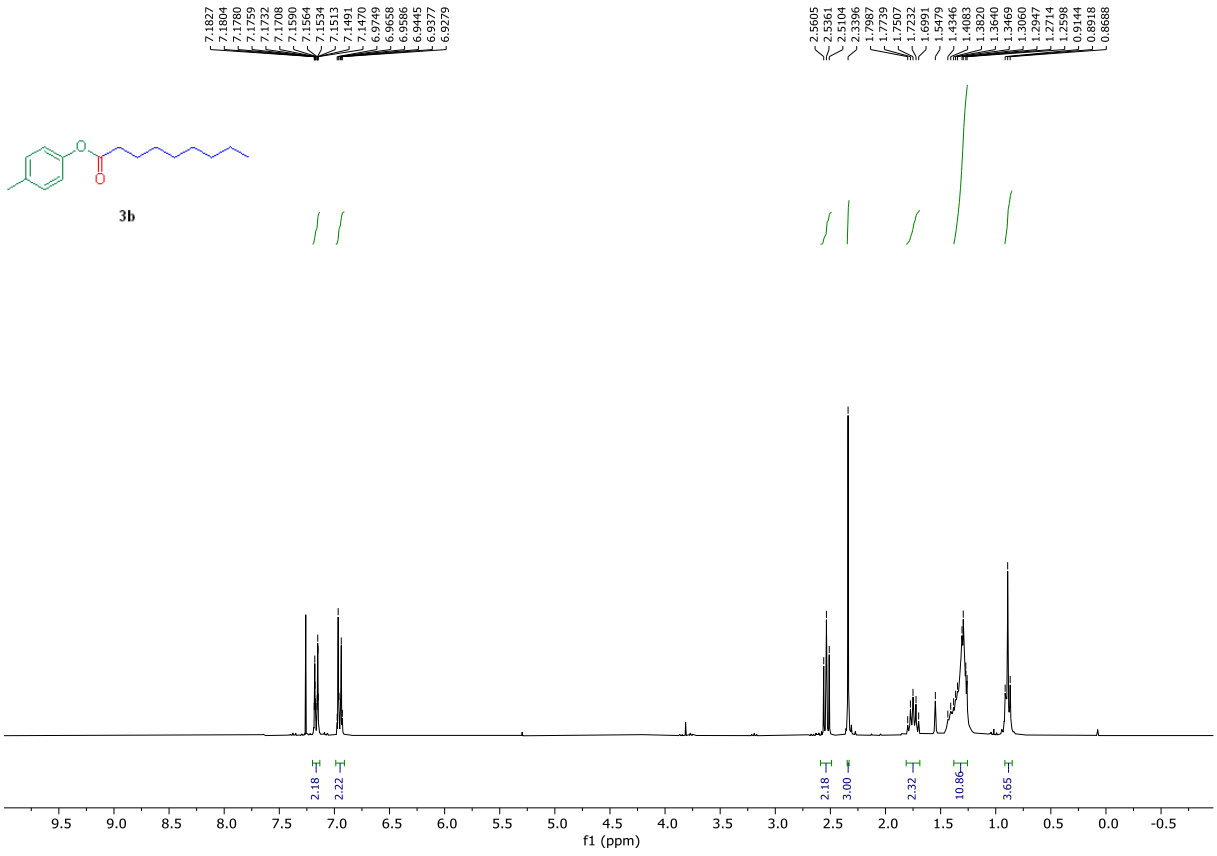
^{13}C NMR (75 MHz, $CDCl_3$): δ 172.26, 150.78, 148.35, 147.69, 129.42, 127.84, 125.82, 125.75, 122.80, 121.62, 117.50, 74.77, 72.90, 40.13, 39.41, 37.61, 37.50, 37.43, 37.32, 34.39, 32.83, 32.81, 32.74, 32.71, 31.34, 31.29, 30.22, 29.14, 28.02, 26.01, 24.96, 24.85, 24.48, 23.93, 22.77, 22.67, 21.09, 20.70, 19.80, 19.73, 19.67, 19.64, 12.79, 11.92, 11.84.

HRMS-EI(m/z): calcd for $C_{42}H_{66}O_4$+ [M+] 634.49556, found 634.49454.

8. NMR spectra of the products



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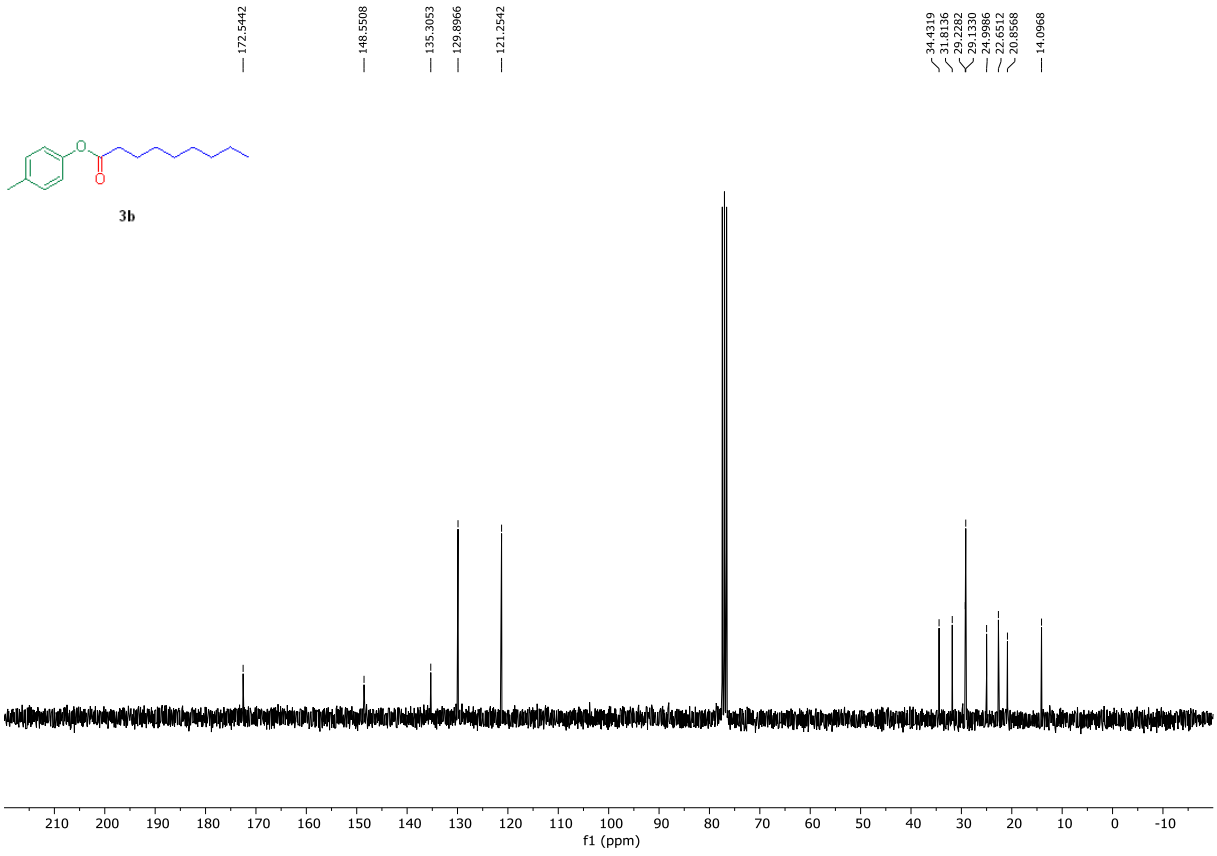
3.65
f1 (ppm)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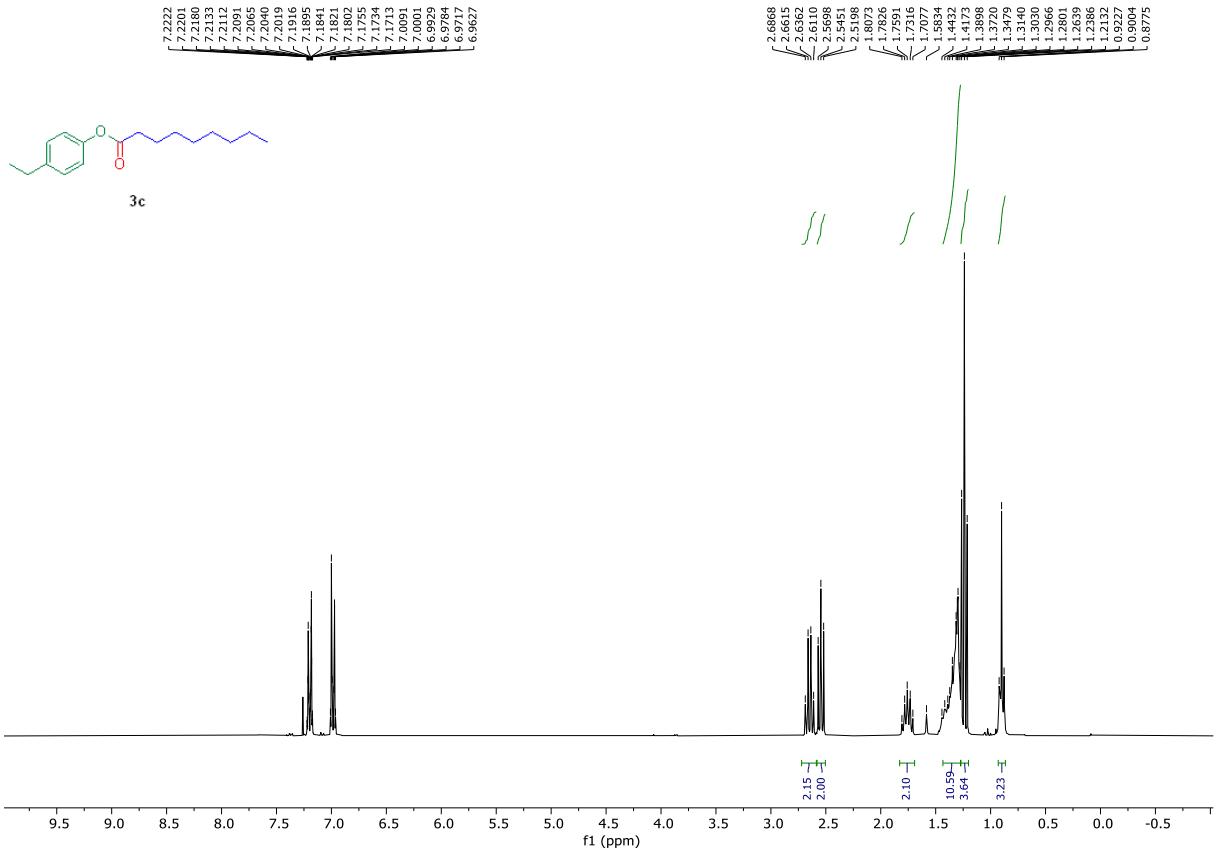
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2.6110
2.5698
2.5451
2.5198
1.8073
1.7826
1.7591
1.7316
1.7077
1.5834
1.4432
1.4173
1.3898
1.3720
1.3479
1.3140
1.3030
1.2966
1.2801
1.2639
1.2386
1.2132
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2.15
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2.10
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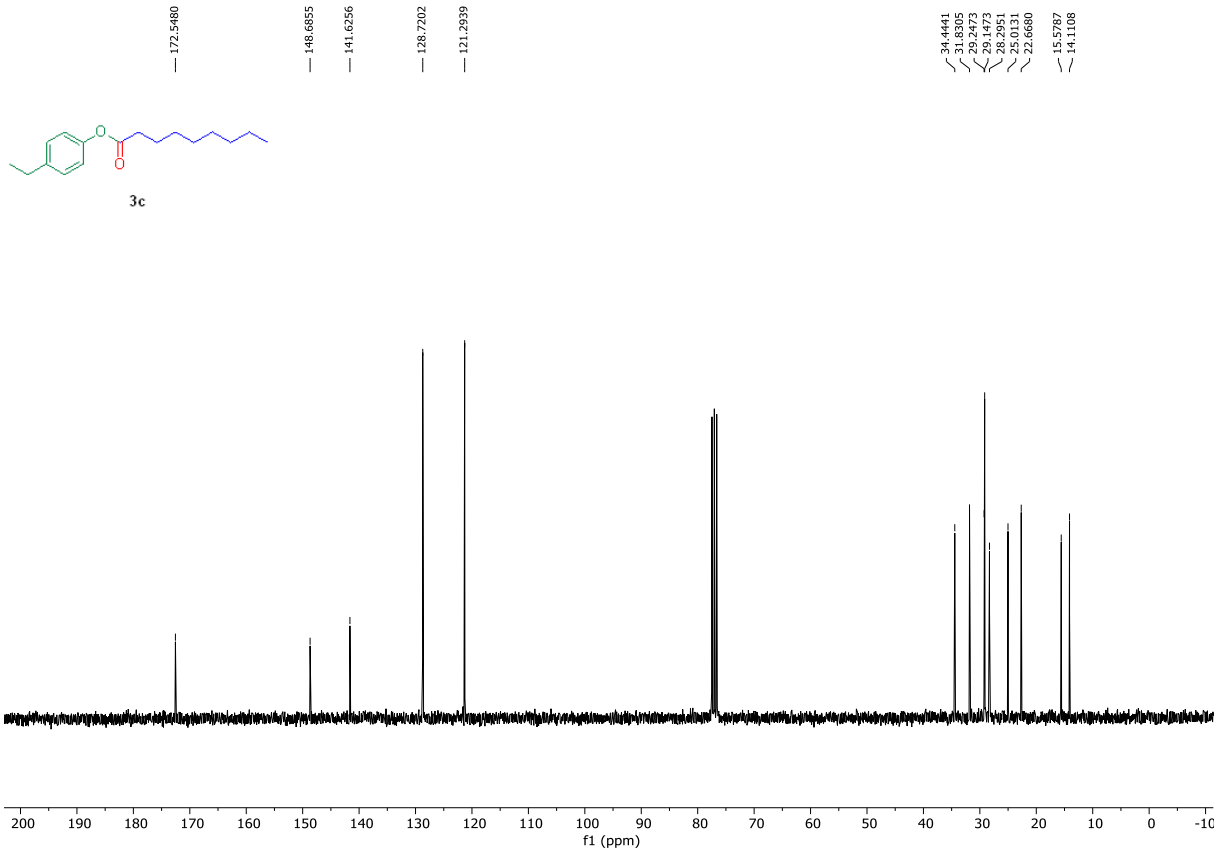
3.23
f1 (ppm)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121.2939
34.4441
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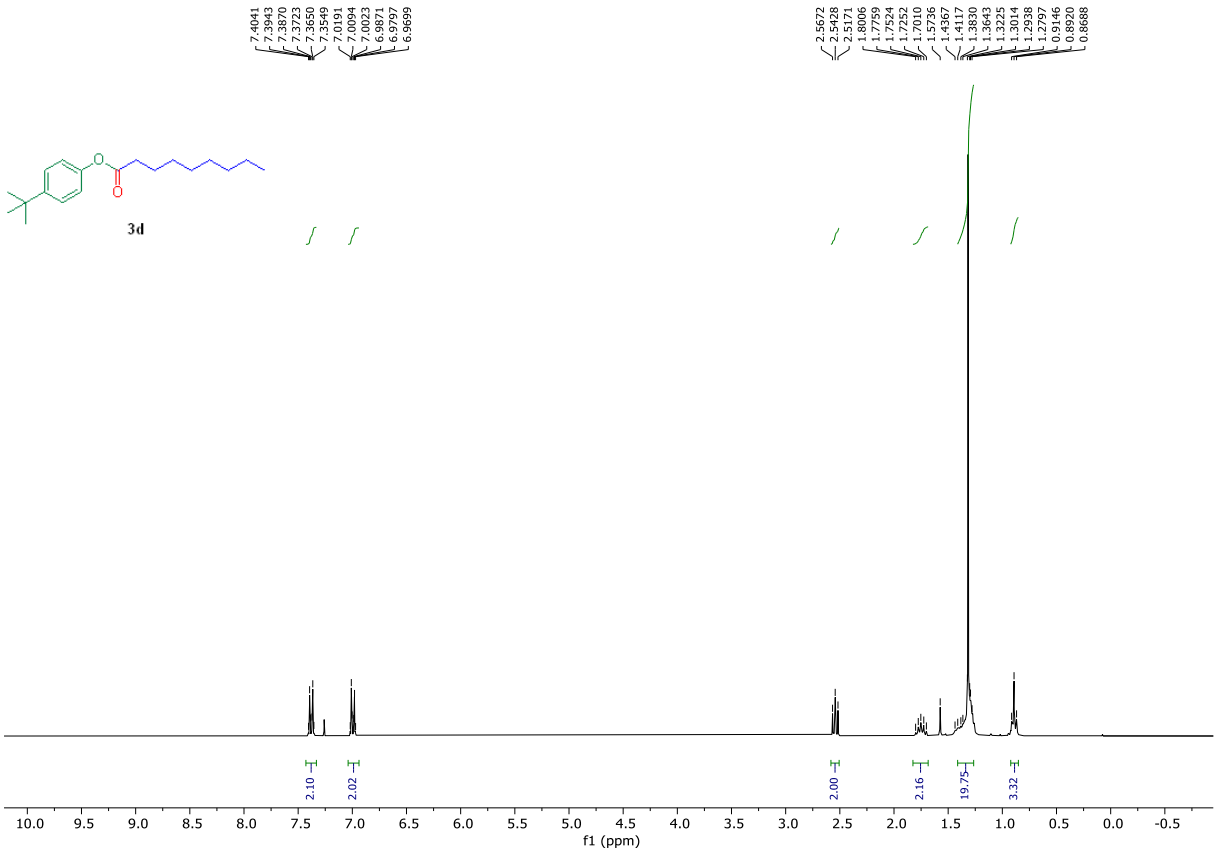
25.0131
22.6680
15.5787
14.1108
3c
f1 (ppm)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6.9699
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2.5428
2.5171
1.8006
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1.7524
1.7252
1.7010
1.5736
1.4367
1.4117
1.3830
1.3643
1.3225
1.3014
1.2938
1.2797
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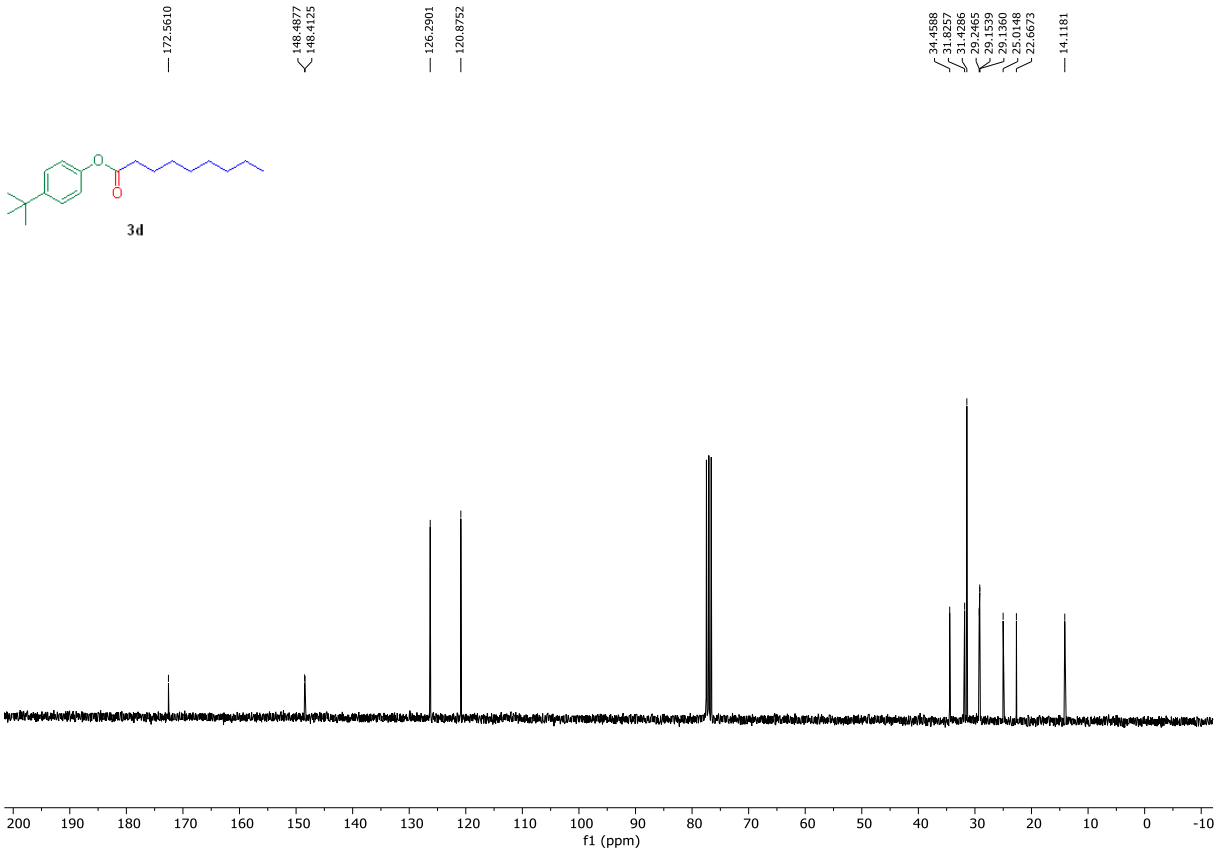
3d
2.10
2.02
2.00
2.16
19.75
3.32
f1 (ppm)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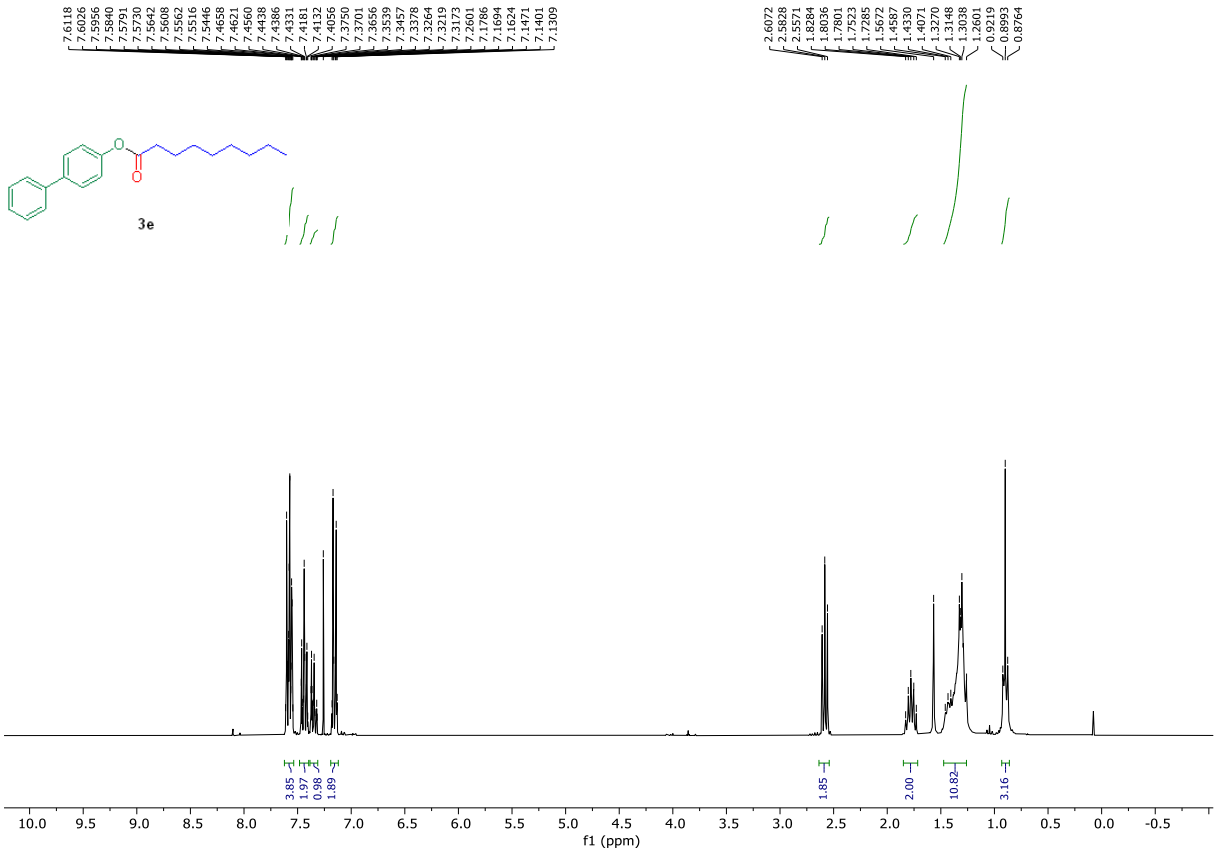
3d
f1 (ppm)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7.4132
7.4056
7.3750
7.3701
7.3656
7.3539
7.3457
7.3378
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7.1786
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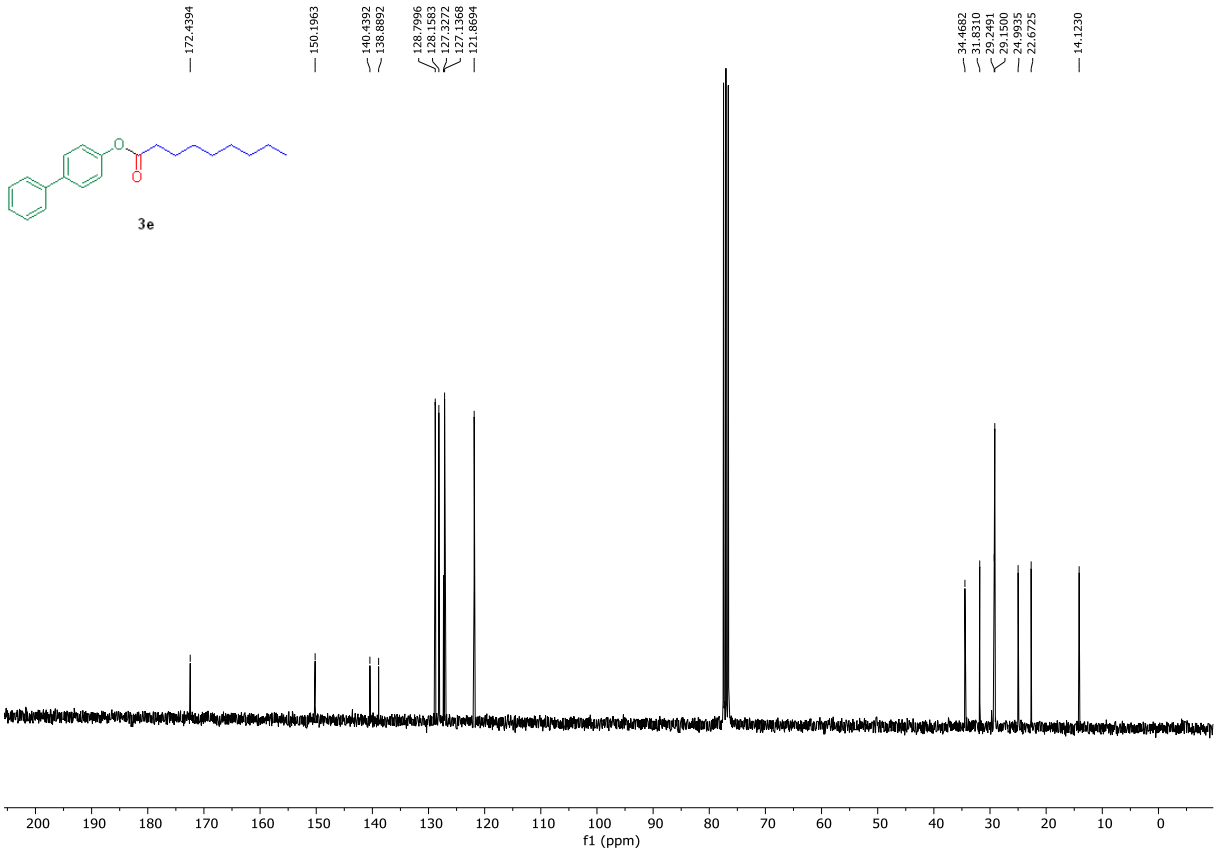
O
O
3e
3.85
1.97
0.98
1.89
1.85
2.00
10.82
3.16
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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29.2491
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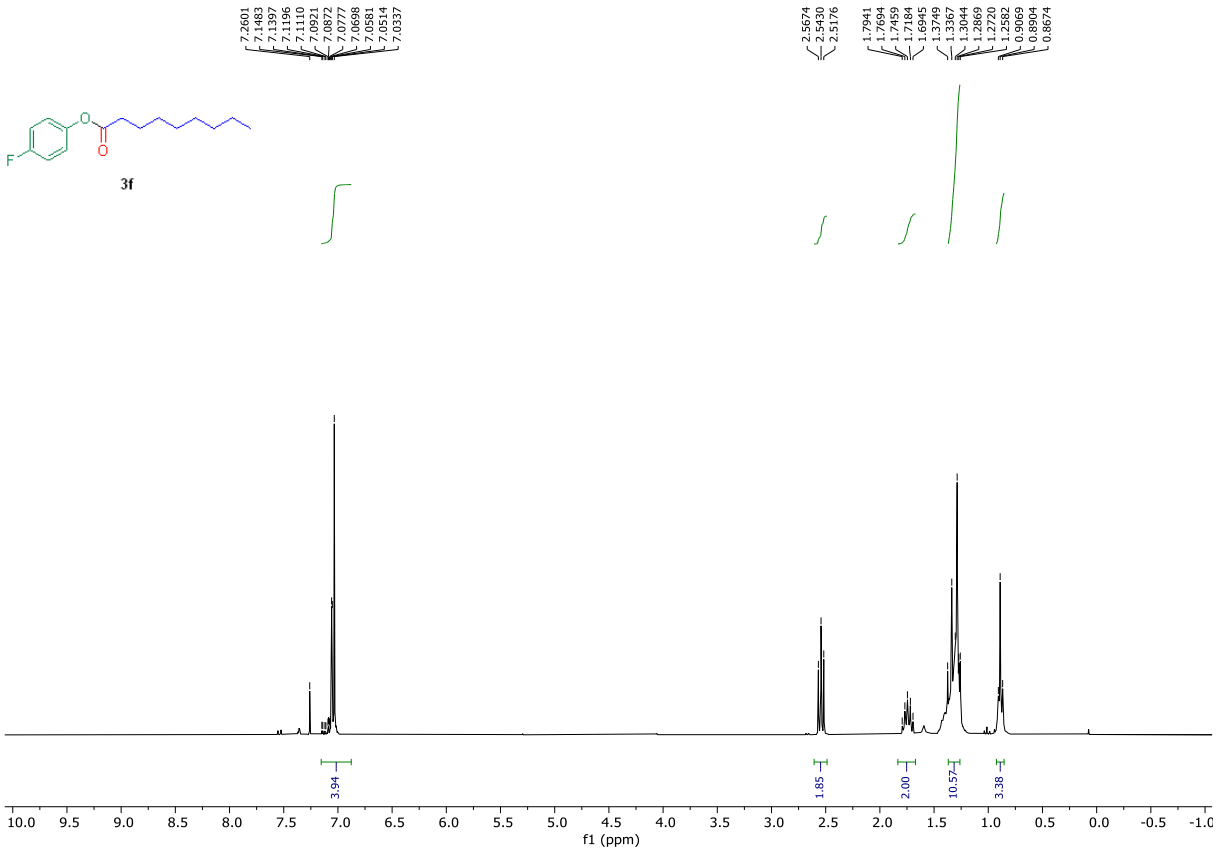
O
O
3e
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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7.0698
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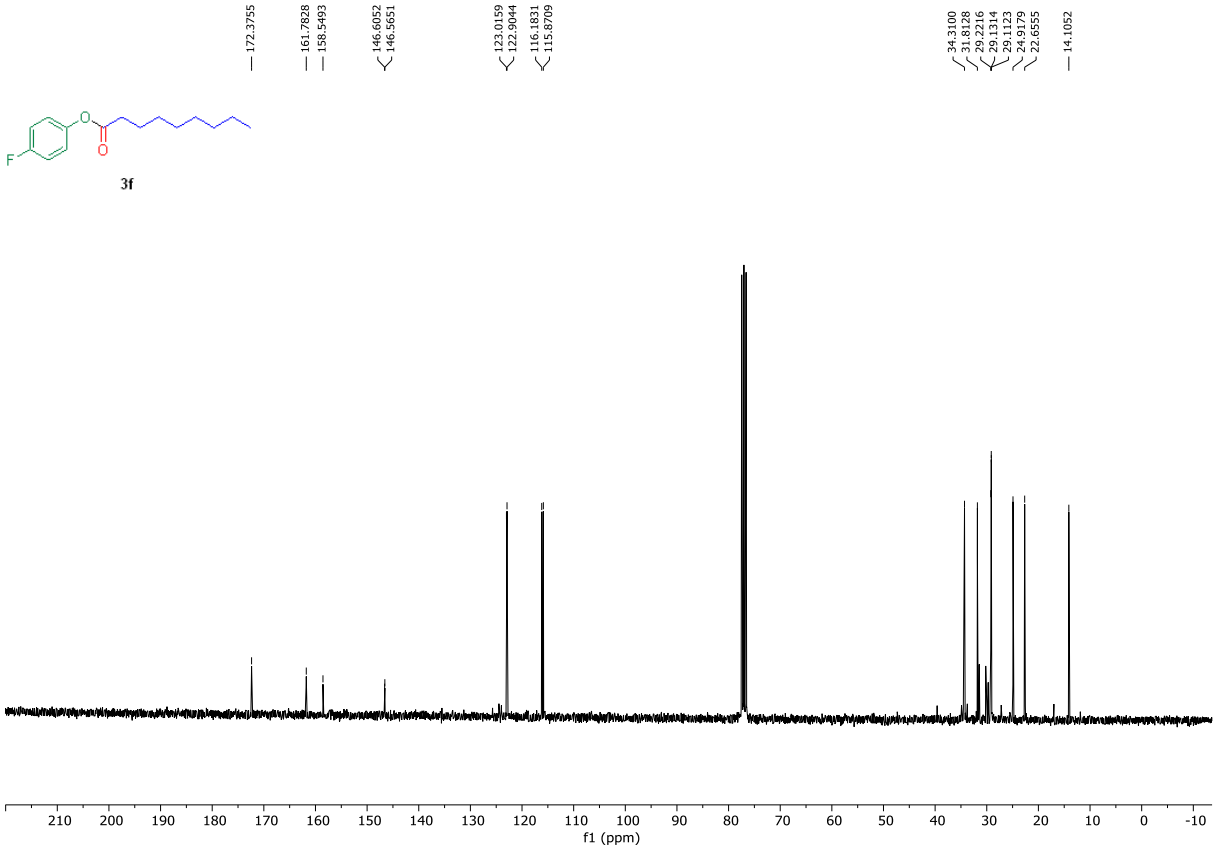
7.0514
7.0337
2.5674
2.5430
2.5176
1.7941
1.7694
1.7459
1.7184
1.6945
1.3749
1.3367
1.3044
1.2669
1.2720
1.2582
0.8669
0.8994
0.8674
F
O
O
3f
3.94
1.85
2.00
10.57
3.38
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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161.7828
158.5493
146.6052
146.5651
123.0159
122.9044
116.1831
115.8709
34.3100
31.8128
29.2216
29.1314
29.1123
24.9179
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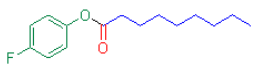
F
O
O
3f
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


O
O
F

3f

-117.2043
-117.2286
-117.2502
-117.2719
-117.2935
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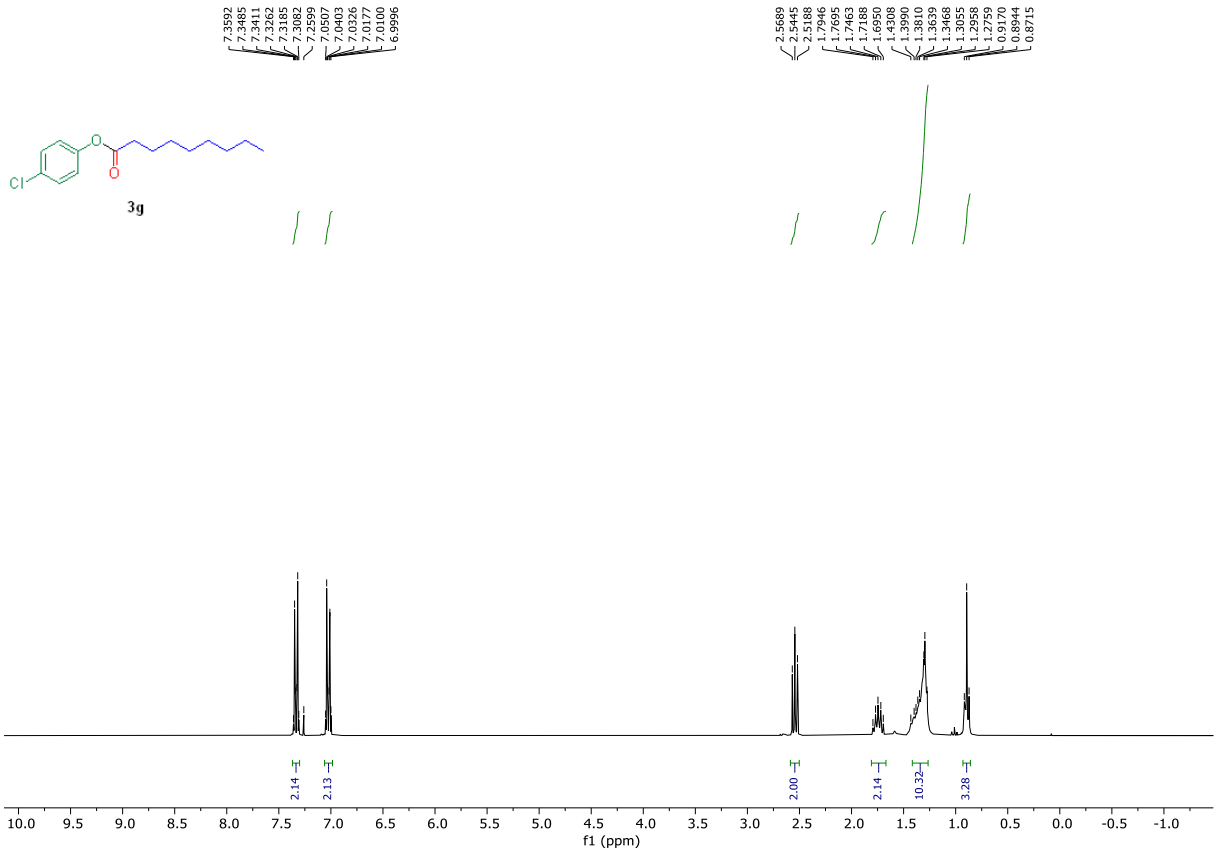
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
f1 (ppm)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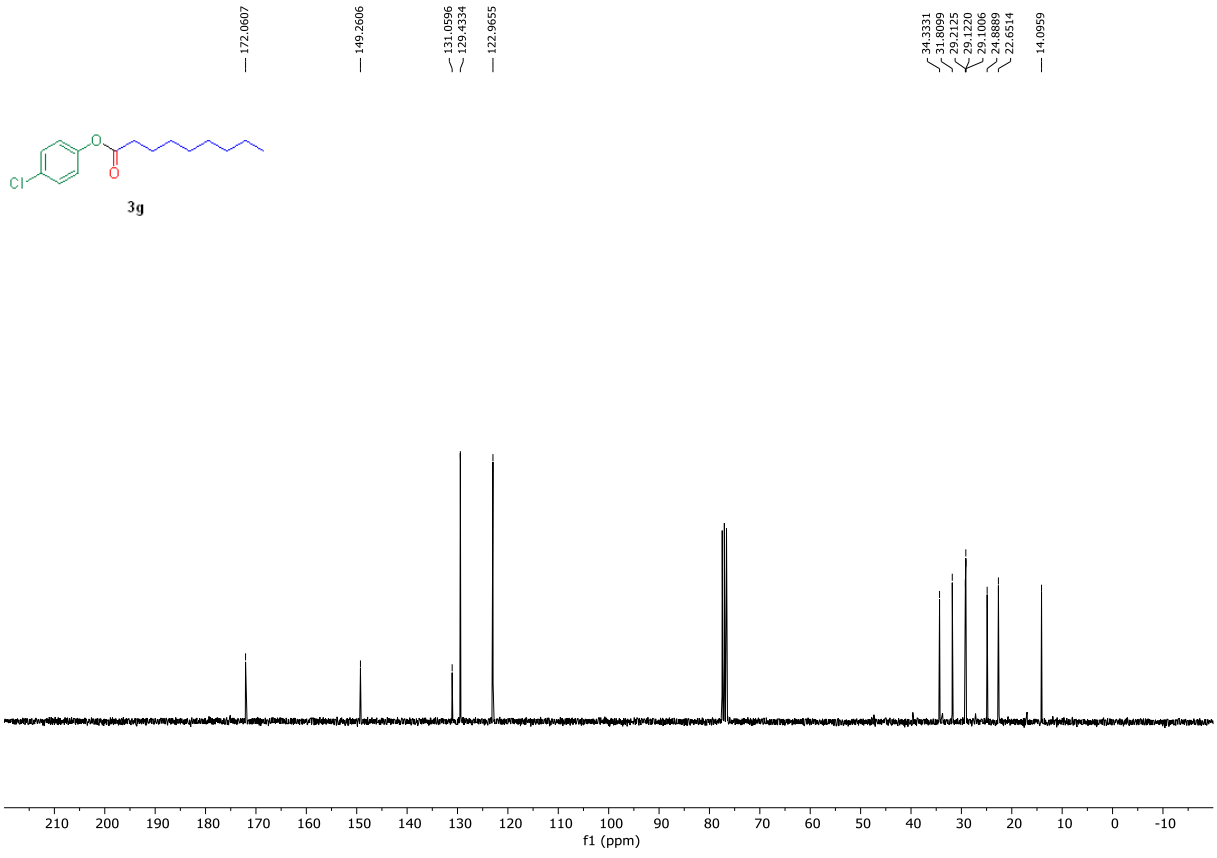
7.0177
7.0100
6.9996
2.5689
2.5445
2.5188
1.7946
1.7695
1.7463
1.7188
1.6950
1.4308
1.3990
1.3810
1.3639
1.3468
1.3055
1.2958
1.2759
1.9170
0.8944
0.8715
Cl
O
O
3g
2.14
2.13
2.00
2.14
10.32
3.28
f1 (ppm)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122.9655
34.3331
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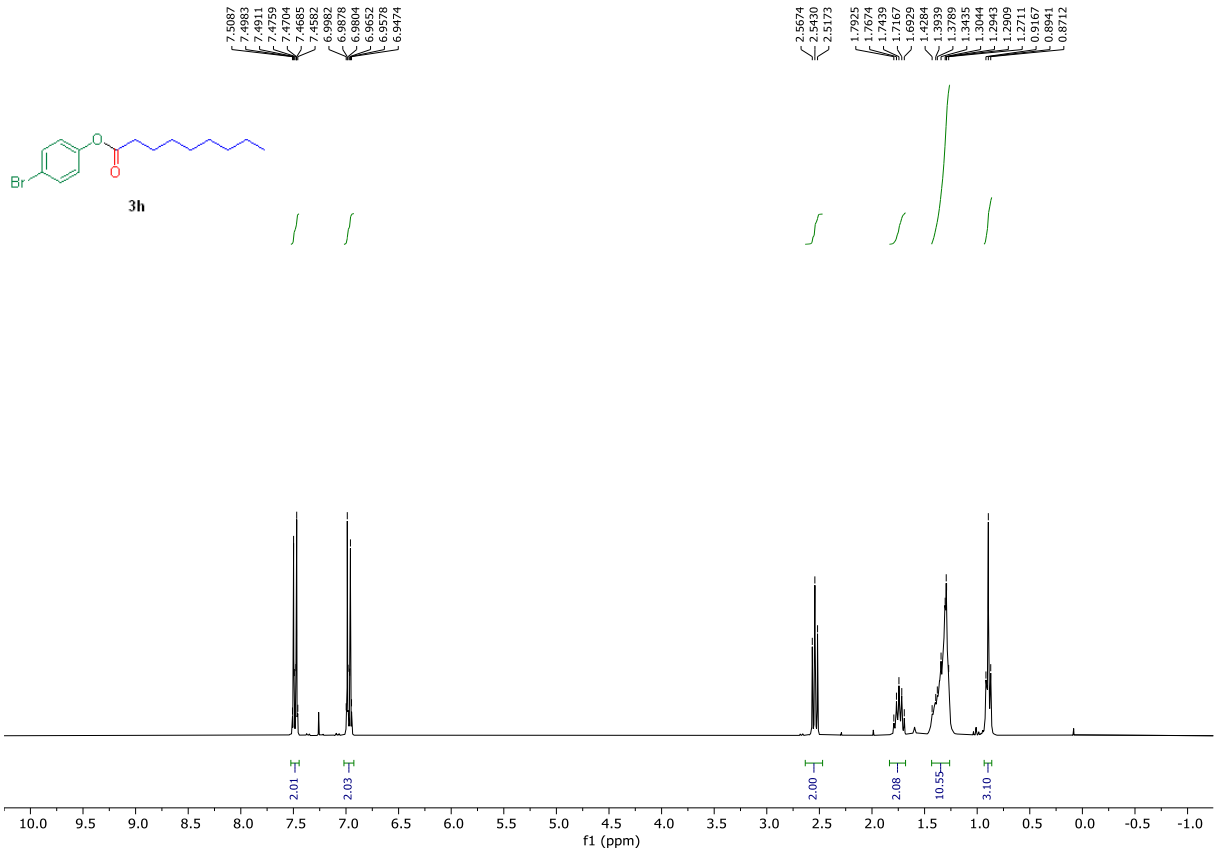
29.1006
24.8889
22.6514
14.0959
Cl
O
O
3g
f1 (ppm)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6.9578
6.9474
2.5674
2.5430
2.5173
1.7925
1.7674
1.7439
1.7167
1.6929
1.4284
1.3939
1.3789
1.3435
1.3044
1.2943
1.2909
1.2711
0.9167
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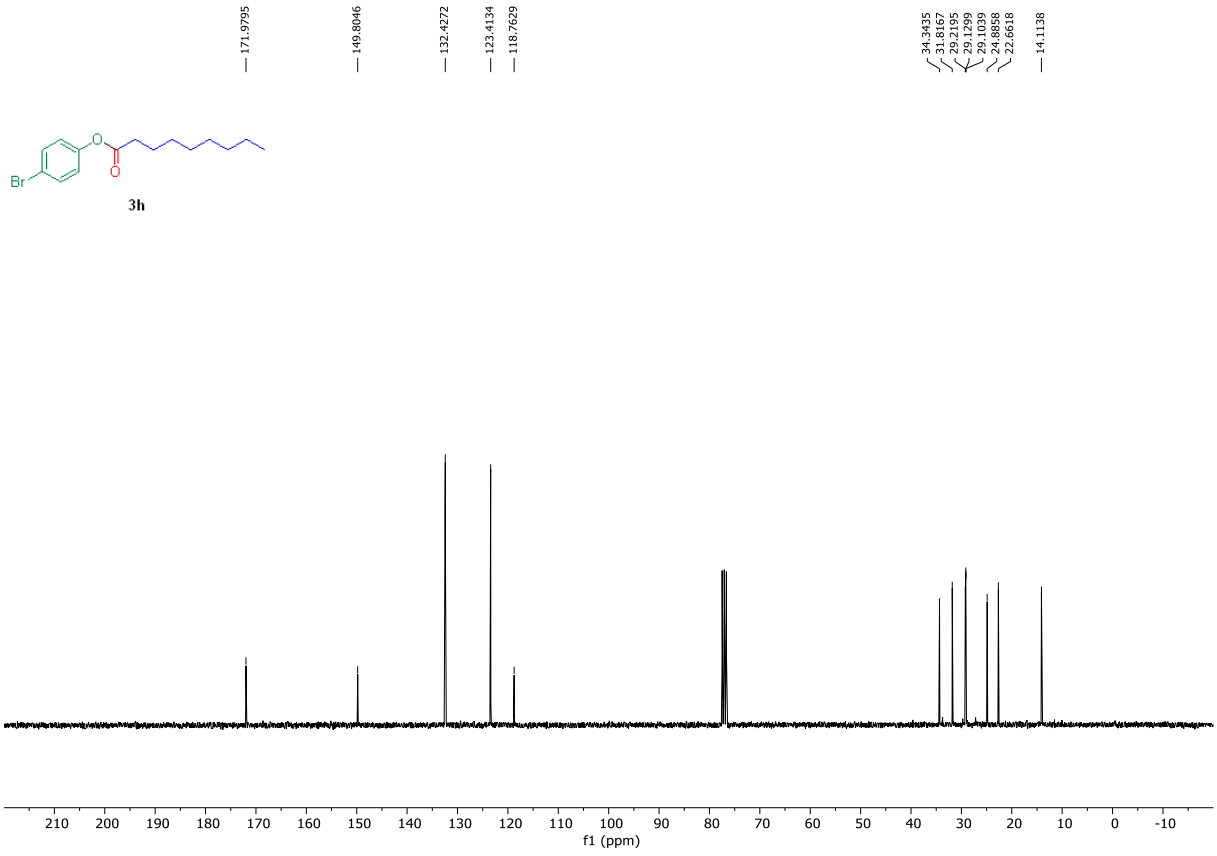
0.8712
Br
O
O
3h
2.01
2.03
2.00
2.08
10.55
3.10
f1 (ppm)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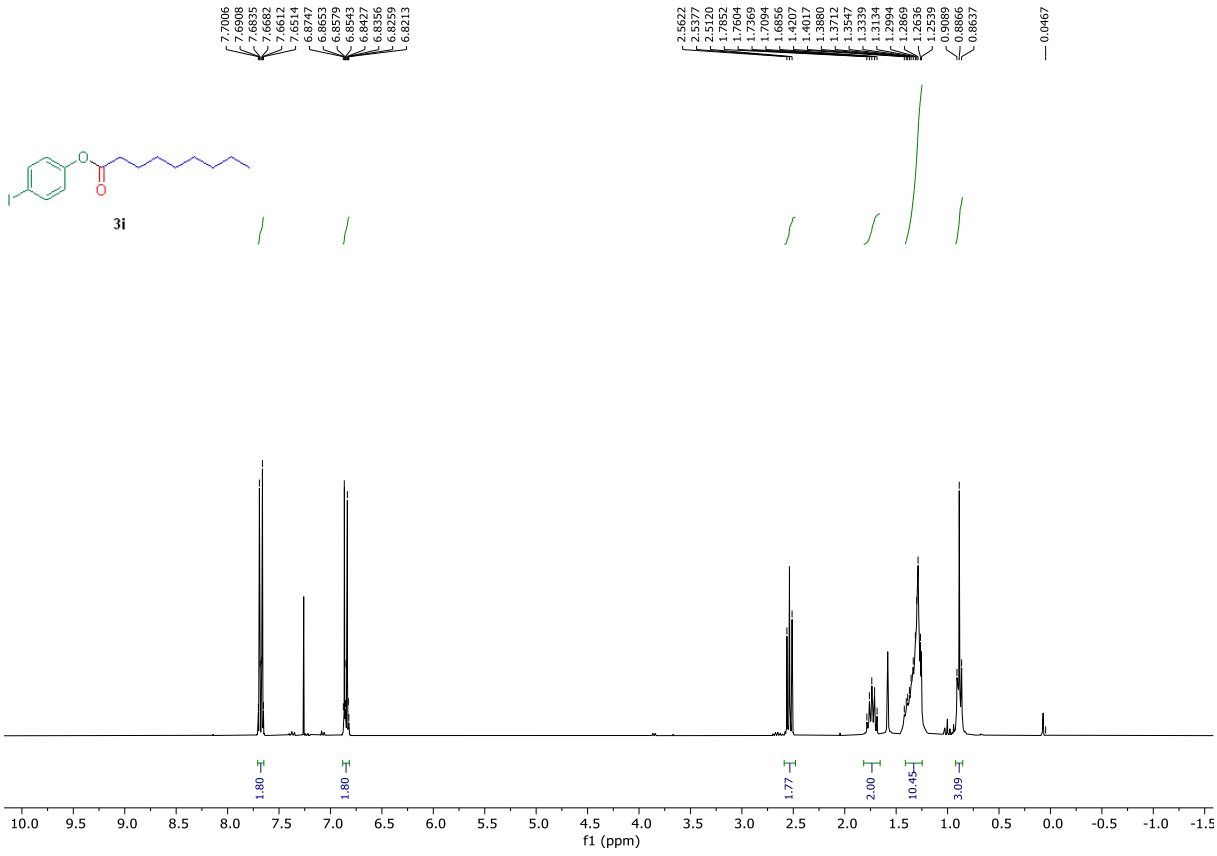
14.1138
Br
O
O
3h
f1 (ppm)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6.8356
6.8259
6.8213
2.5622
2.5377
2.5120
1.7852
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1.7369
1.7094
1.6856
1.4207
1.4017
1.3880
1.3712
1.3547
1.3339
1.3134
1.2994
1.2869
1.2636
1.2539
0.9089
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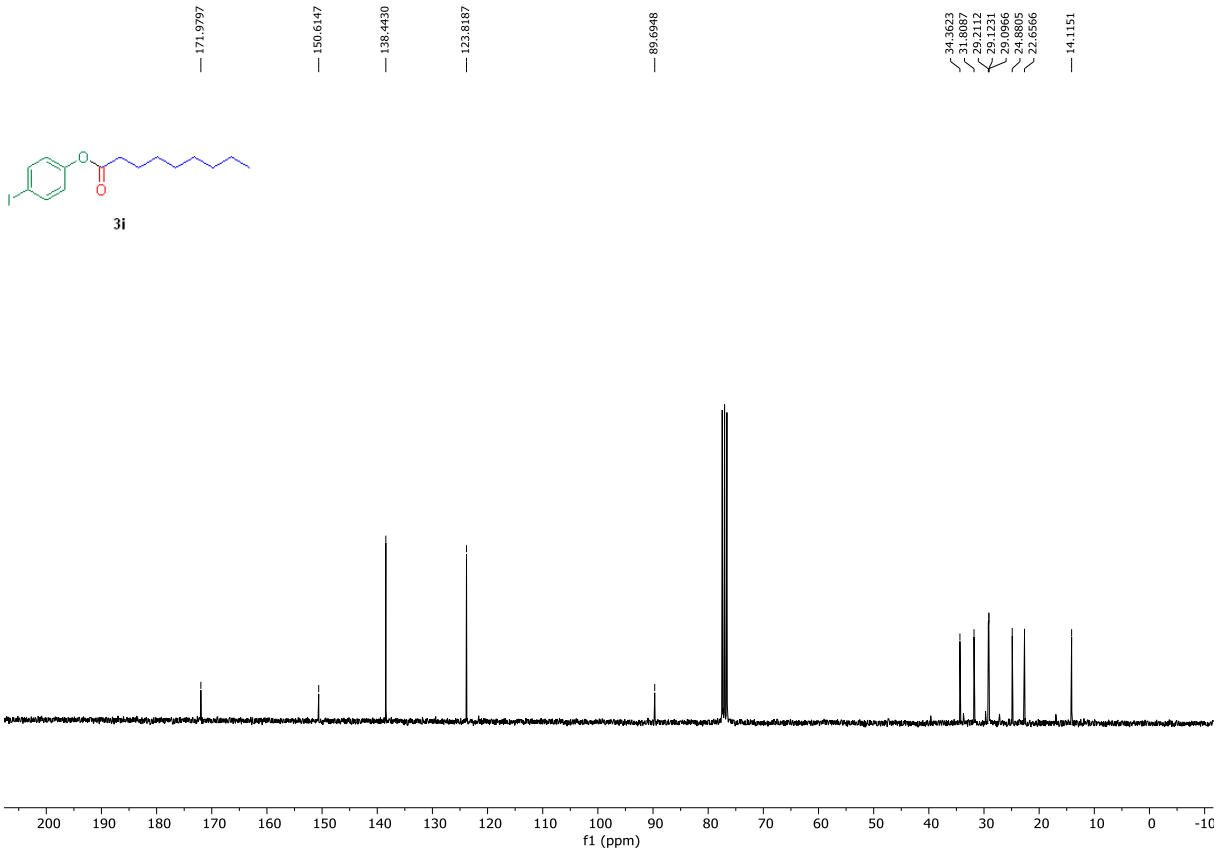
0.0467
1.80
1.80
1.77
2.00
10.45
3.09
f1 (ppm)

3i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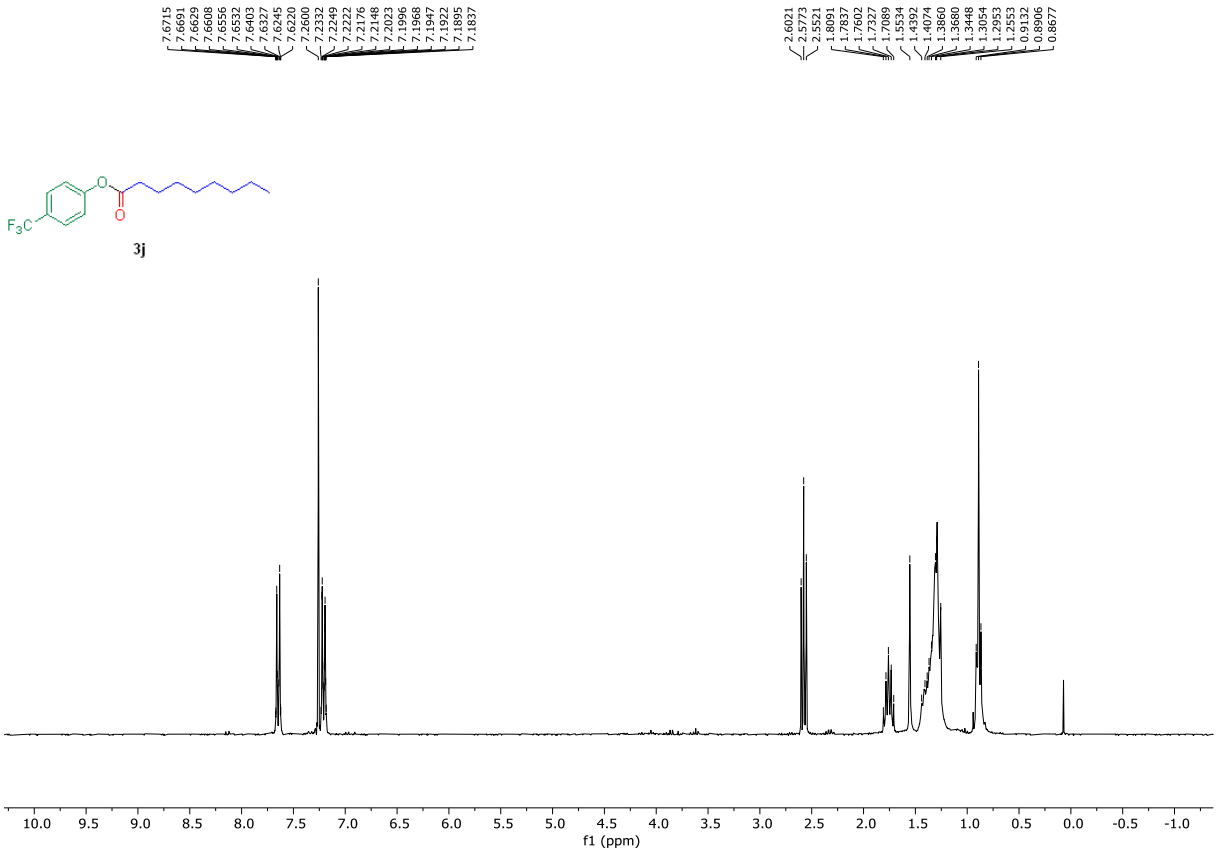
29.1231
29.0866
24.8865
22.6566
14.1151
f1 (ppm)

3i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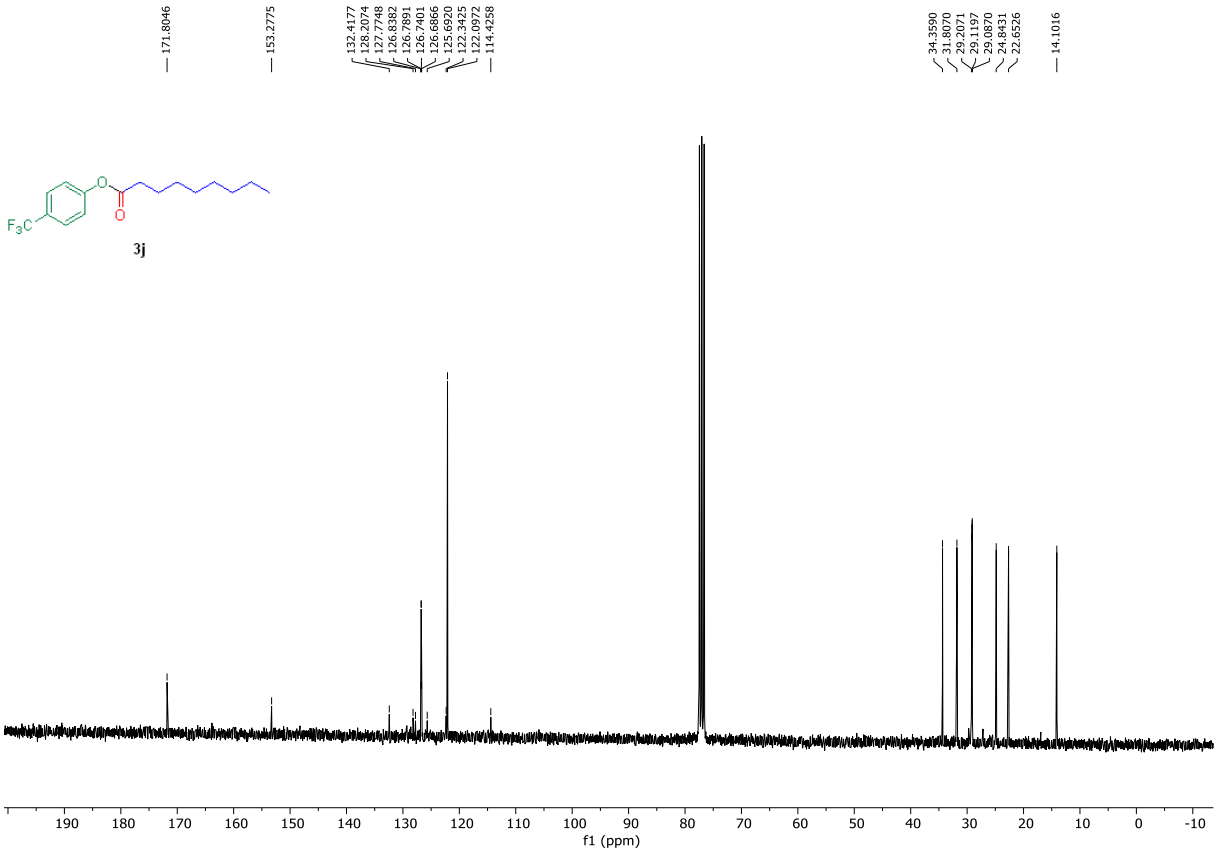
7.2600
7.2332
7.2259
7.2222
7.2176
7.2148
7.2023
7.1996
7.1968
7.1947
7.1922
7.1895
7.1837
2.6021
2.5773
2.5521
1.8091
1.7837
1.7602
1.7327
1.7089
1.5534
1.4392
1.4074
1.3860
1.3680
1.3448
1.3054
1.2953
1.2553
0.9132
0.8906
0.8677
F3C
O
O
3j
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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122.0972
114.4258
34.3590
31.8070
29.2071
29.1197
29.0870
24.8431
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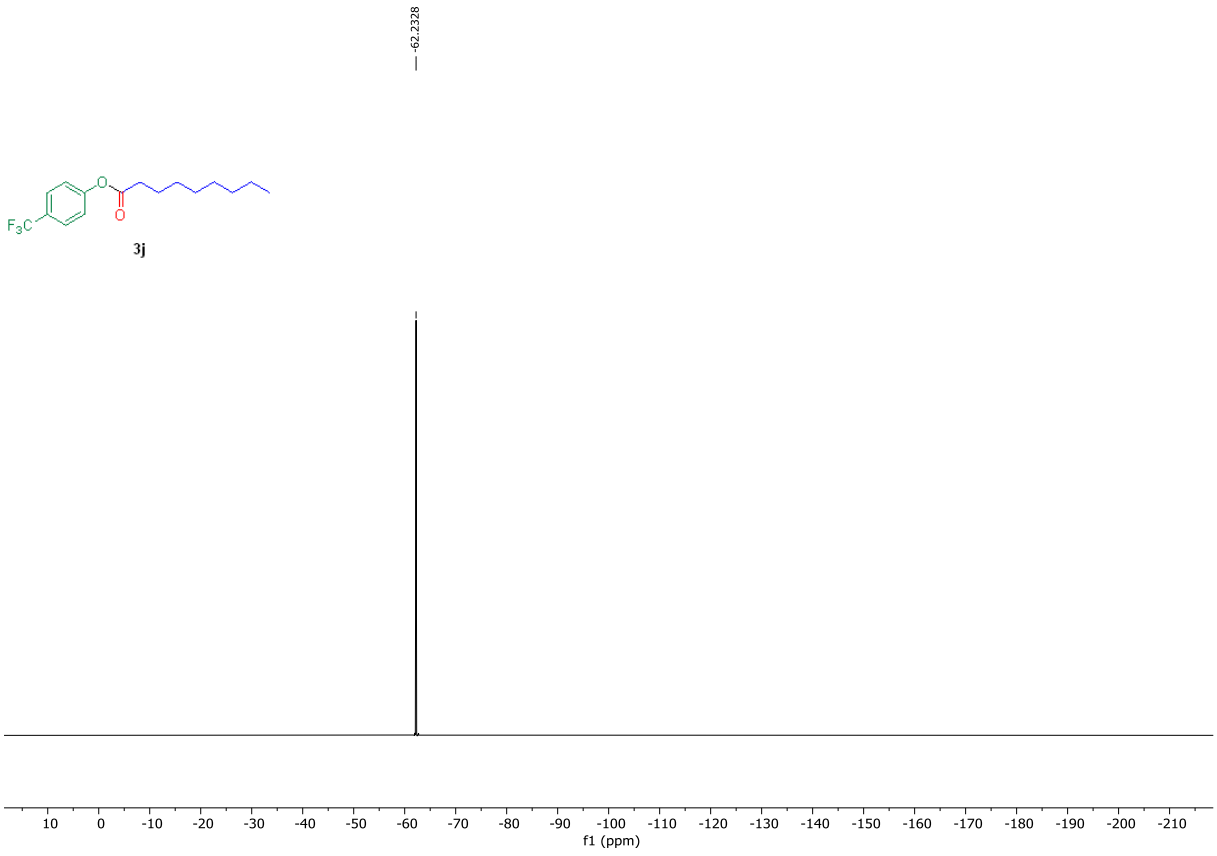
14.1016
F3C
O
O
3j
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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O
O
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3j
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0
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-30
-40
-50
-60
-70
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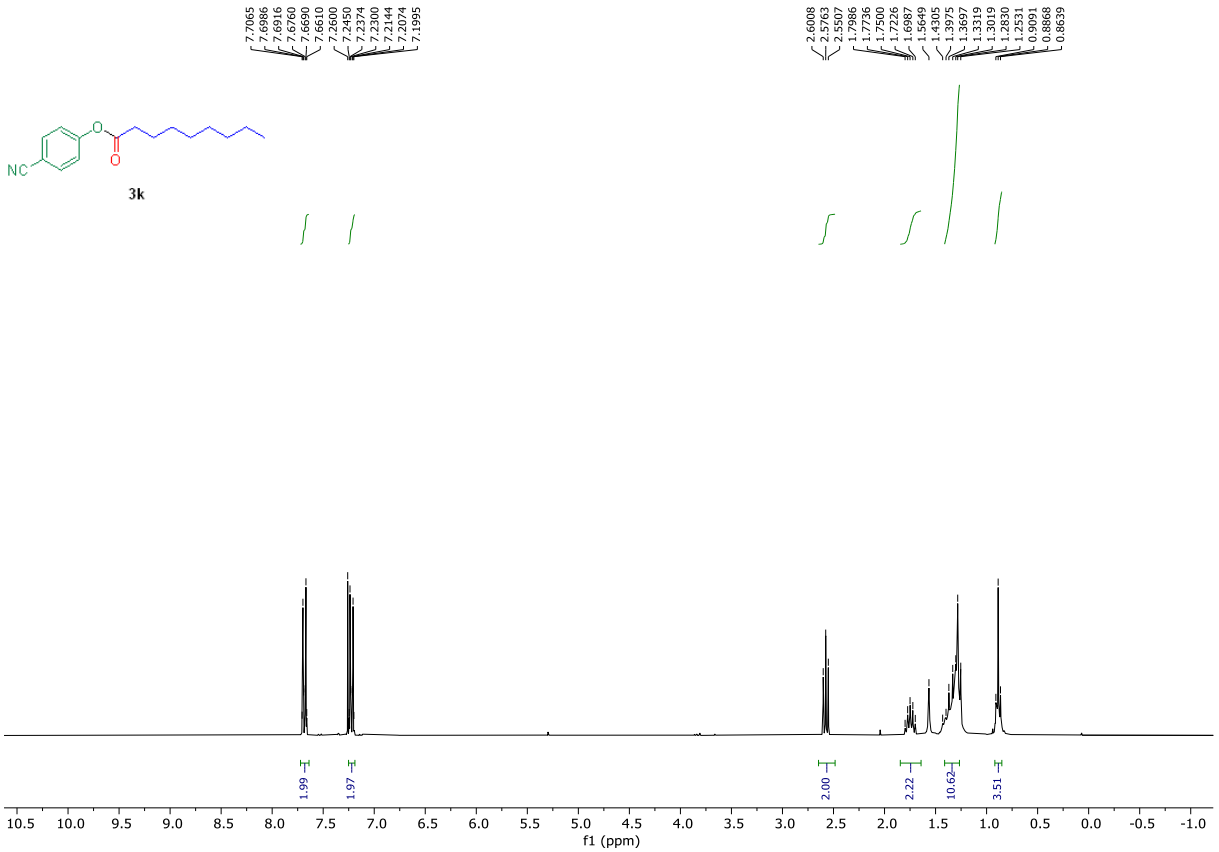
-170
-180
-190
-200
-210
f1 (ppm)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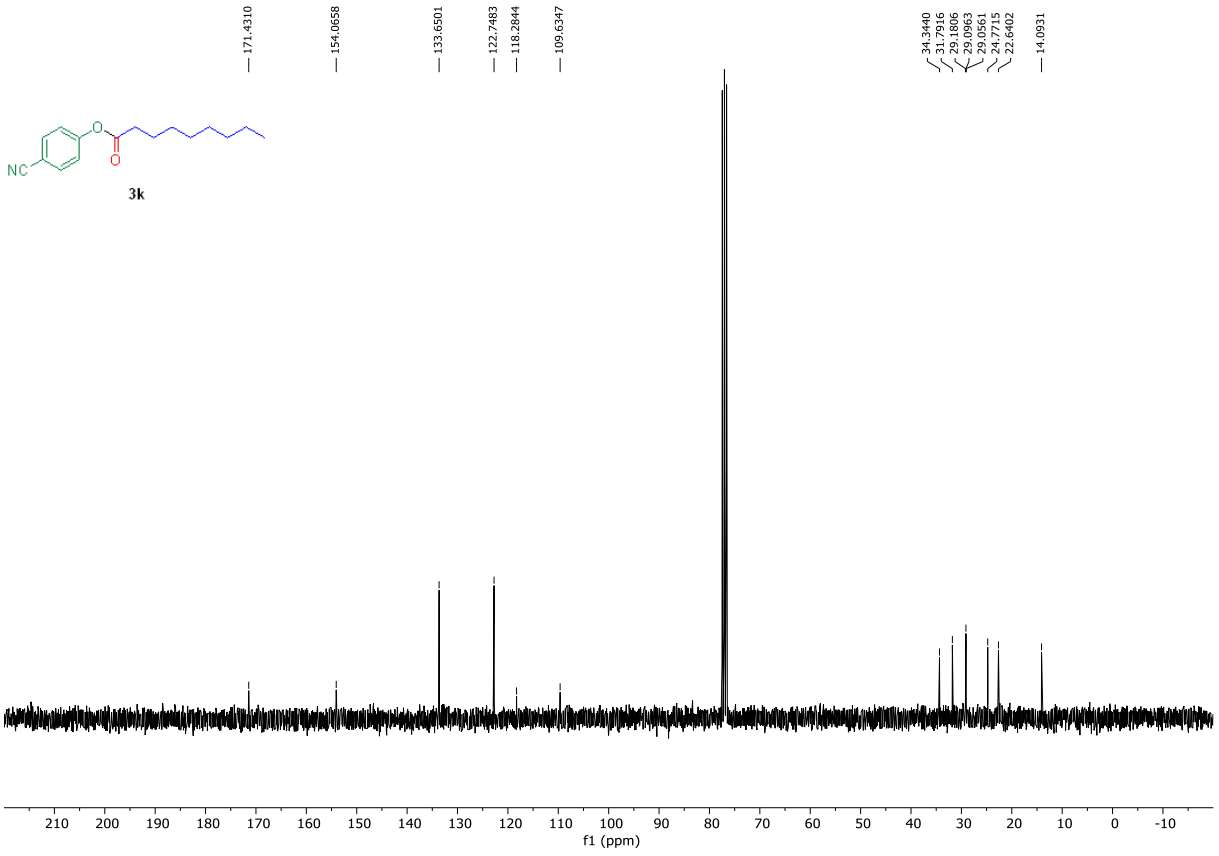
7.2144
7.2074
7.1995
2.6008
2.5763
2.5507
1.7986
1.7736
1.7500
1.7226
1.6987
1.5649
1.4305
1.3975
1.3697
1.3319
1.3019
1.2830
1.2531
1.0091
0.8868
0.8639
NC
O
O
3k
1.99
1.97
2.00
2.22
10.62
3.51
f1 (ppm)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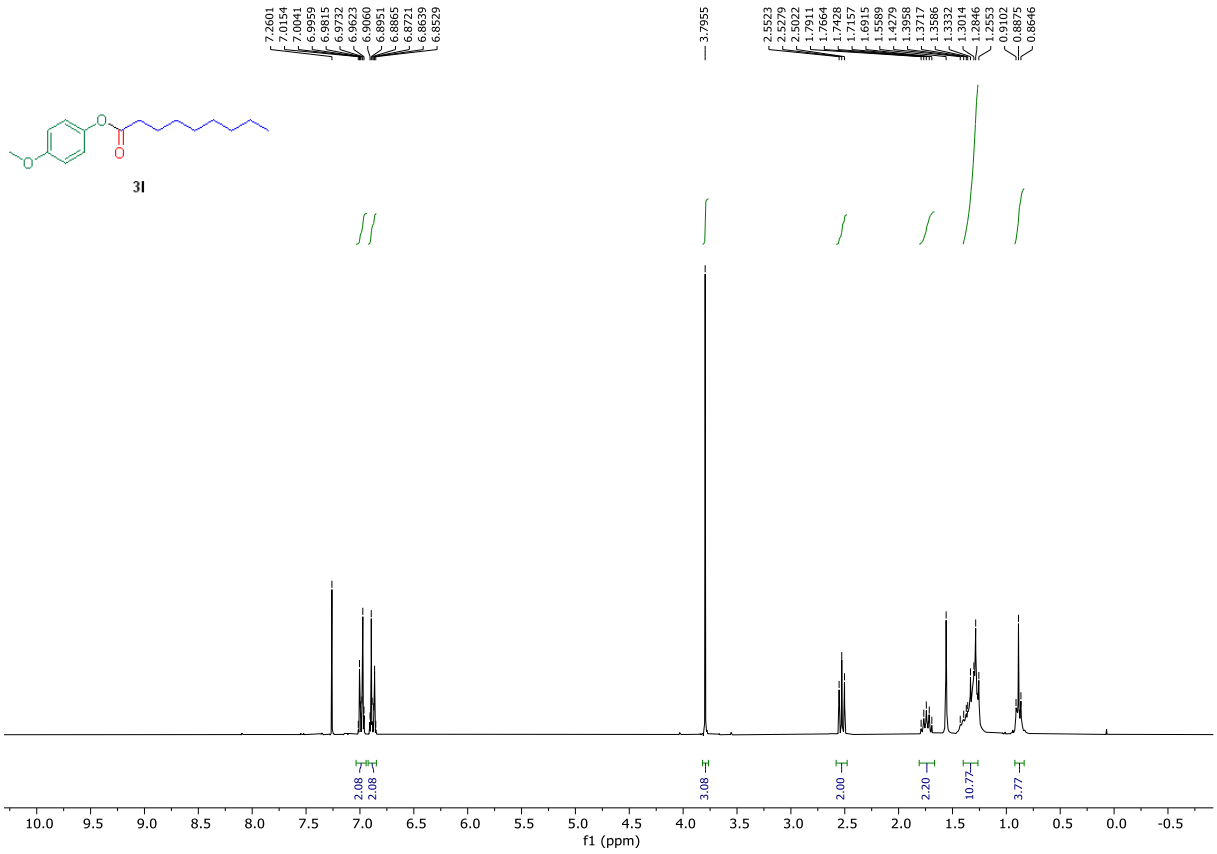
14.0931
NC
O
O
3k
f1 (ppm)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1.7911
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1.3717
1.3586
1.3332
1.3014
1.2846
1.2553
0.9102
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2.08
3.08
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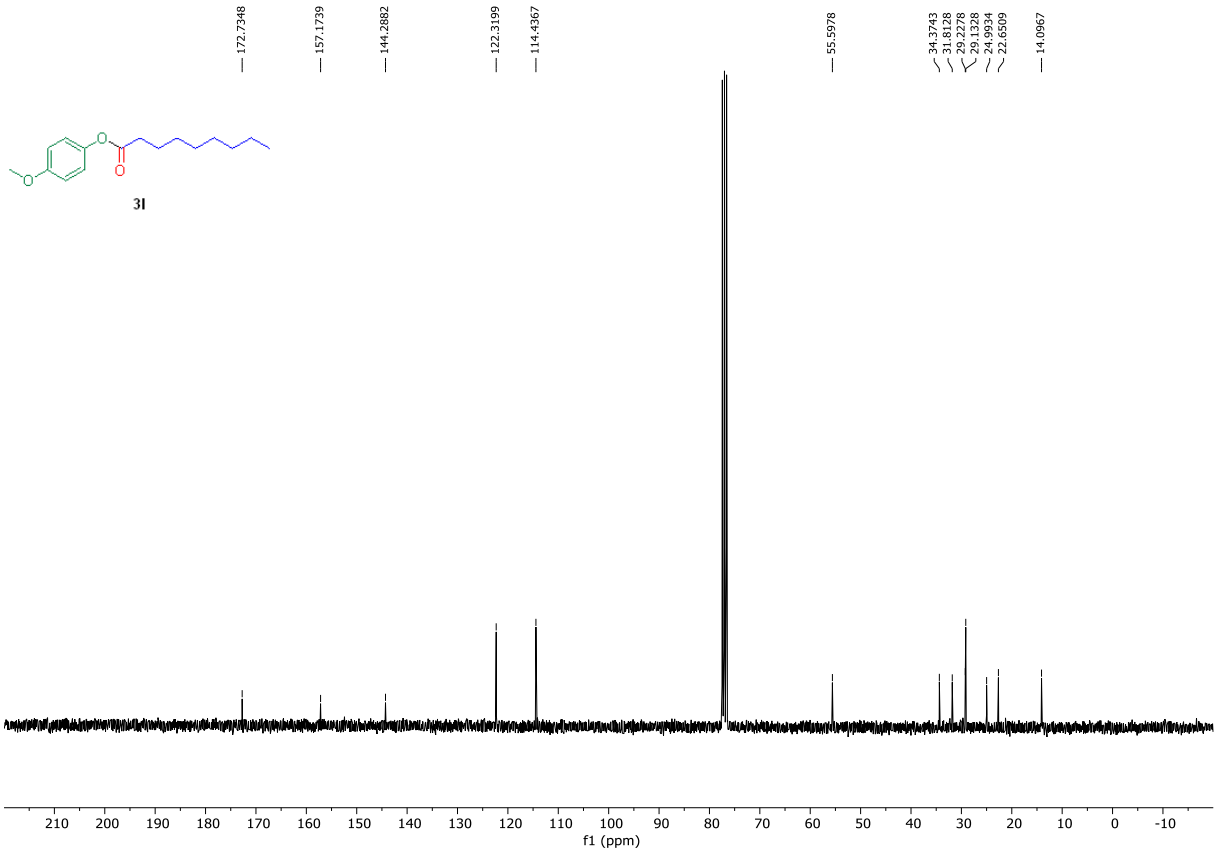
f1 (ppm)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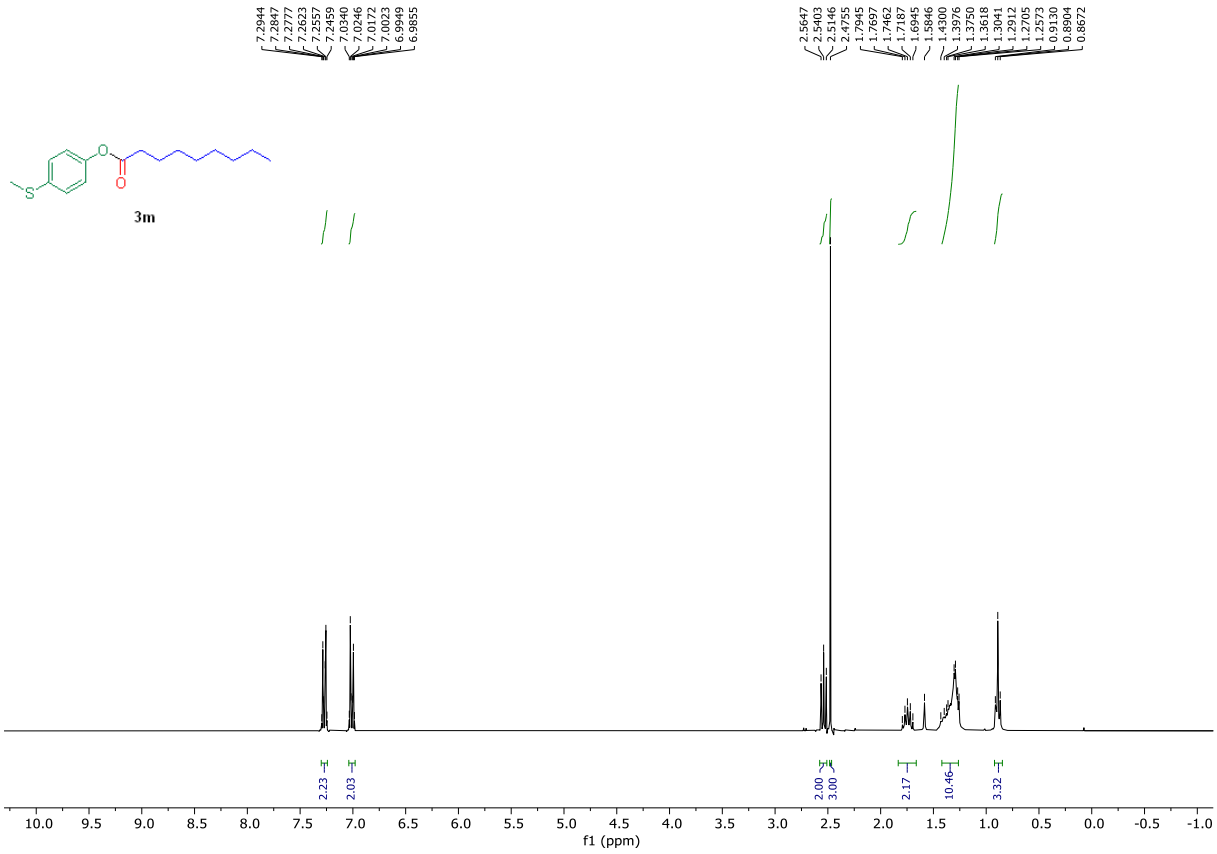
3l
f1 (ppm)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1.3750
1.3618
1.3041
1.2912
1.2705
1.2573
0.9130
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3m
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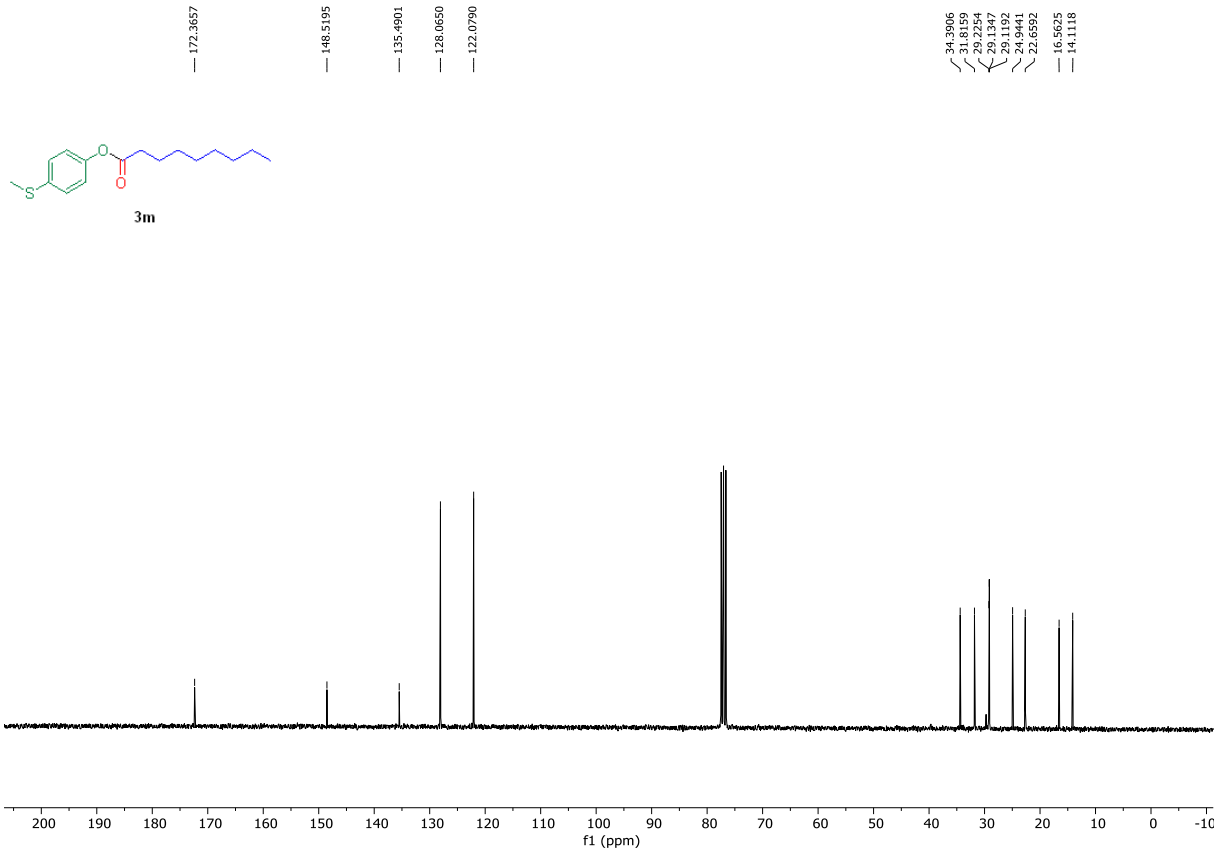
f1 (ppm)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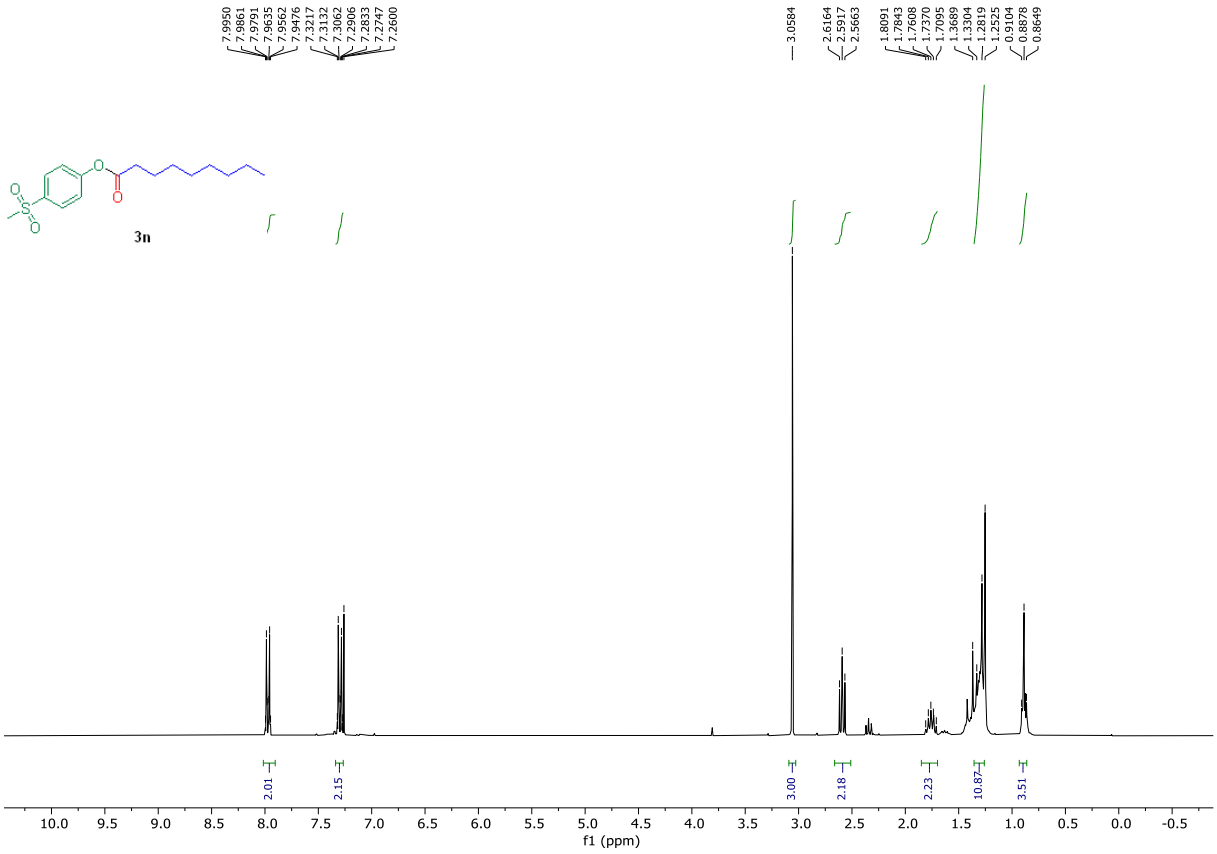
14.1118
3m
f1 (ppm)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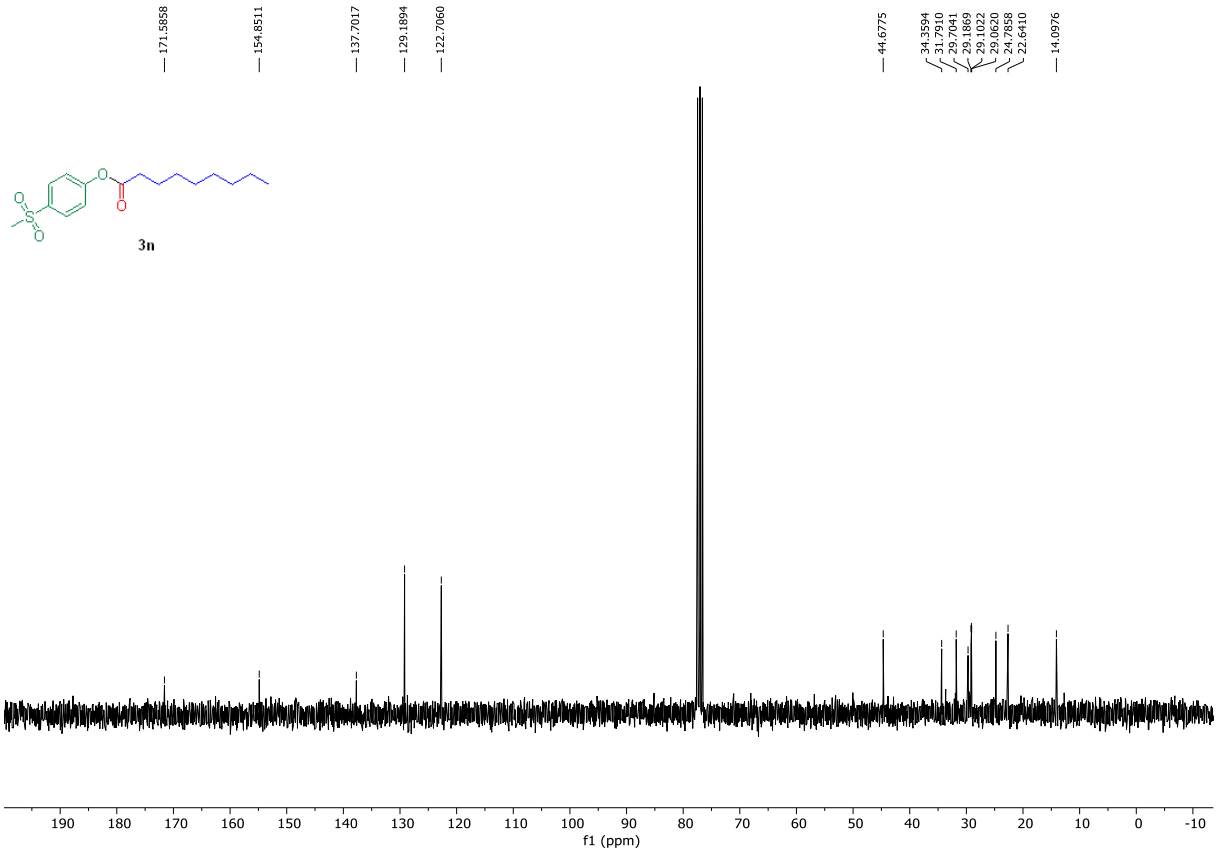
2.18
2.23
10.87
3.51
f1 (ppm)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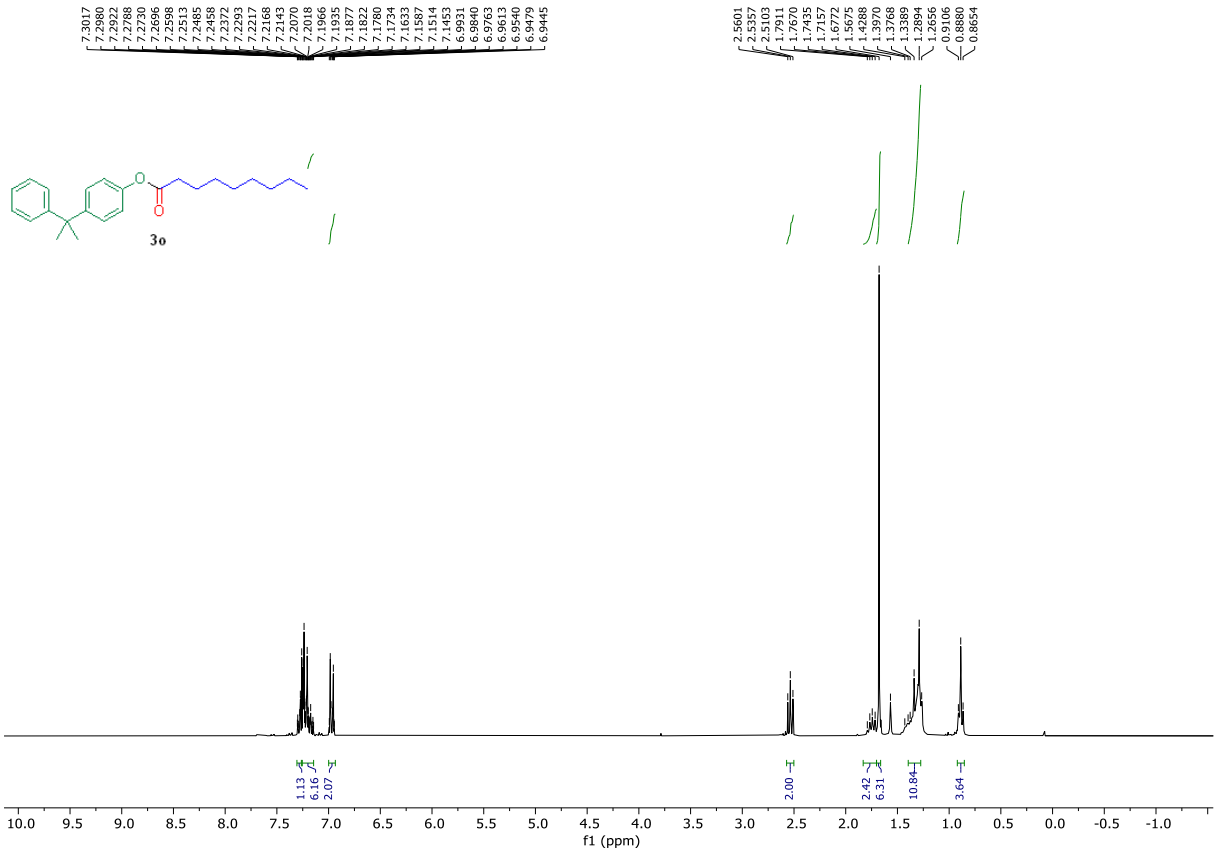
24.7858
22.6410
14.0976
3n
f1 (ppm)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7.2598
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7.2485
7.2458
7.2372
7.2293
7.2217
7.2168
7.2143
7.2070
7.2018
7.1966
7.1935
7.1877
7.1822
7.1780
7.1734
7.1633
7.1587
7.1514
7.1453
6.9931
6.9840
6.9763
6.9613
6.9540
6.9479
6.9445
2.5601
2.5357
2.5103
1.7911
1.7670
1.7435
1.7157
1.6772
1.5675
1.4288
1.3970
1.3768
1.3389
1.2894
1.2656
0.9106
0.8880
0.8654
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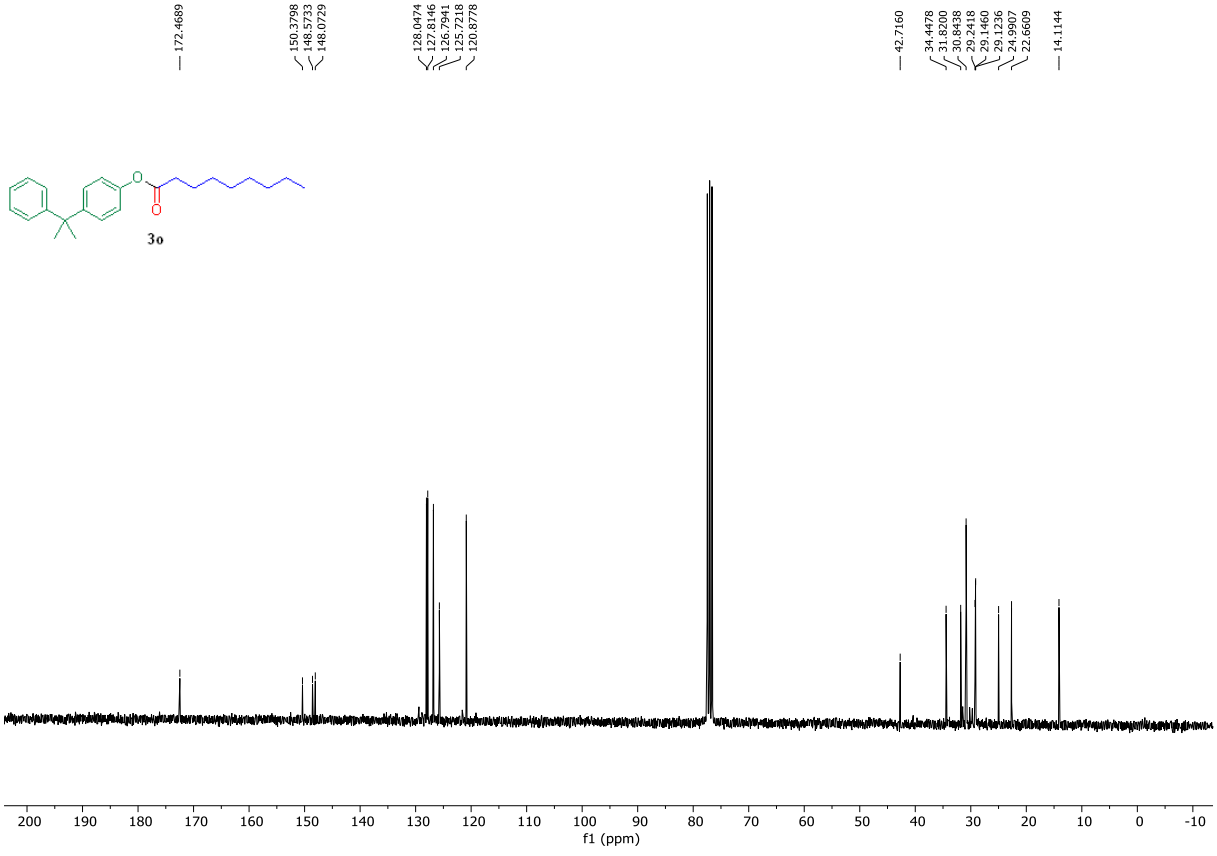
6.16
2.07
2.00
2.42
6.31
10.84
3.64
f1 (ppm)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34.4478
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29.1460
29.1236
24.9907
22.6609
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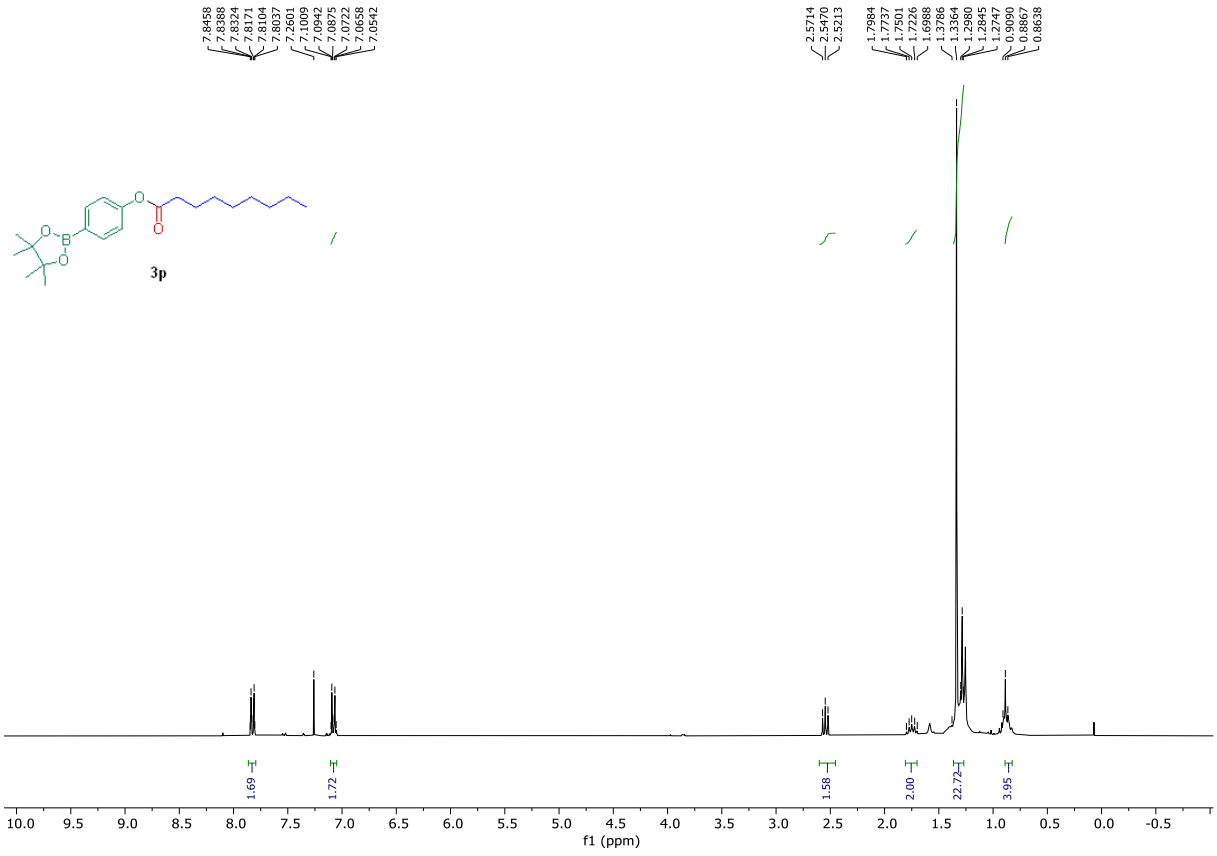
3o
f1 (ppm)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7.0722
7.0658
7.0542
2.5714
2.5470
2.5213
1.7984
1.7737
1.7501
1.7226
1.6988
1.3786
1.3364
1.2980
1.2845
1.2747
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0.8638
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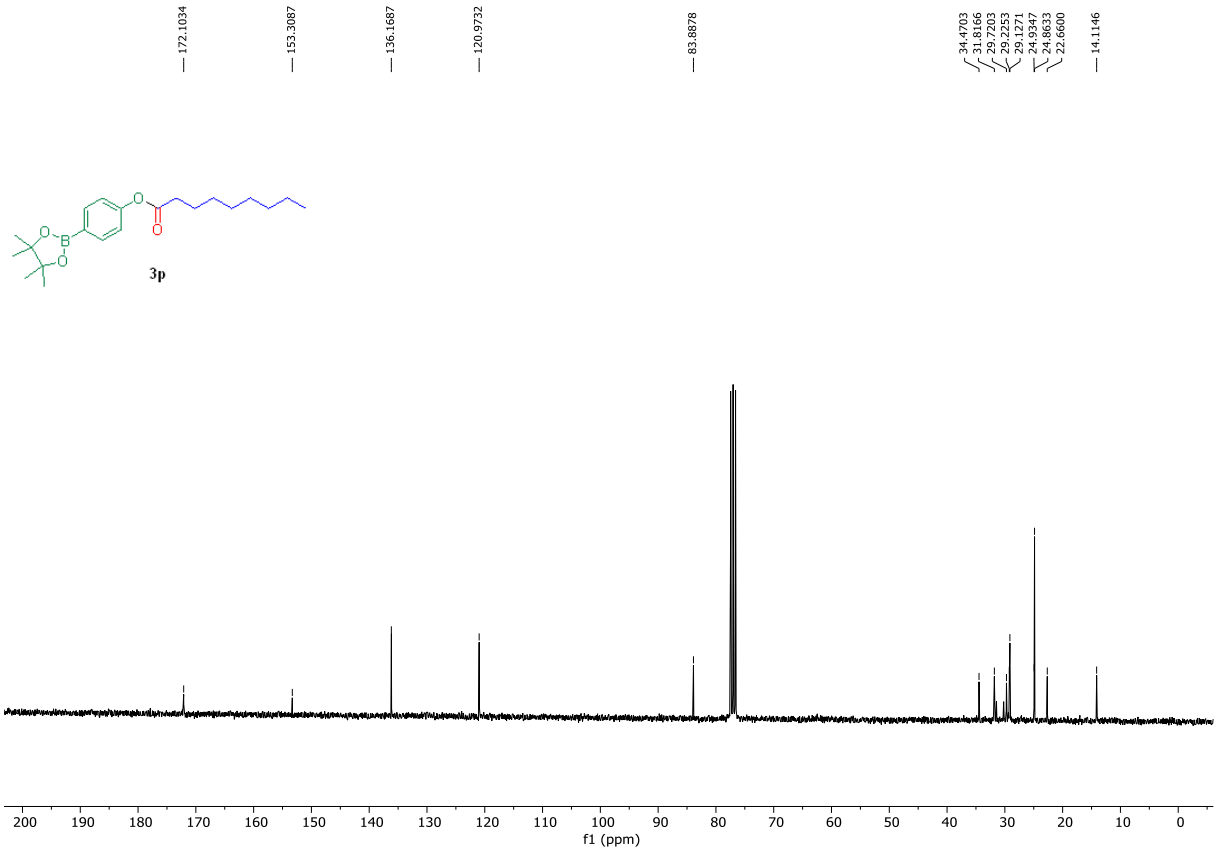
1.72
1.58
2.00
22.72
3.95
f1 (ppm)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136.1687
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34.4703
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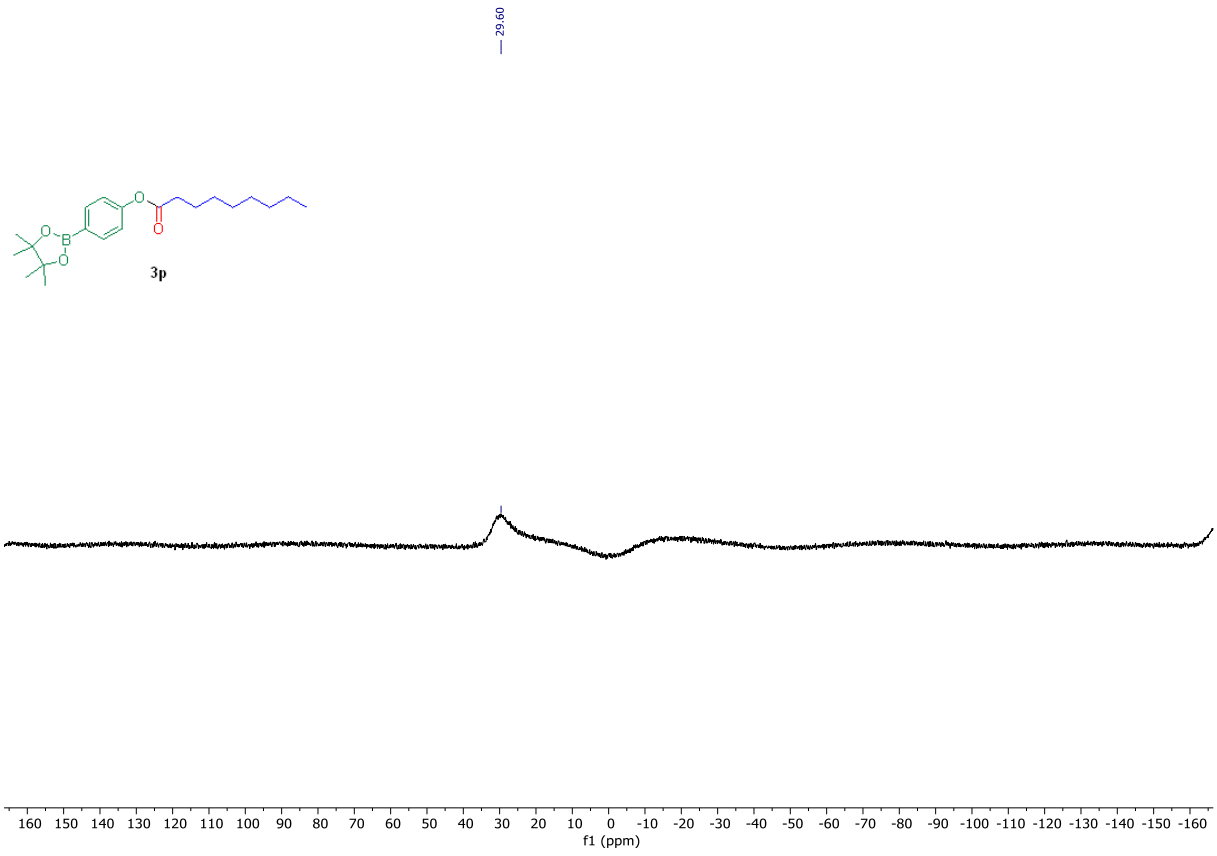
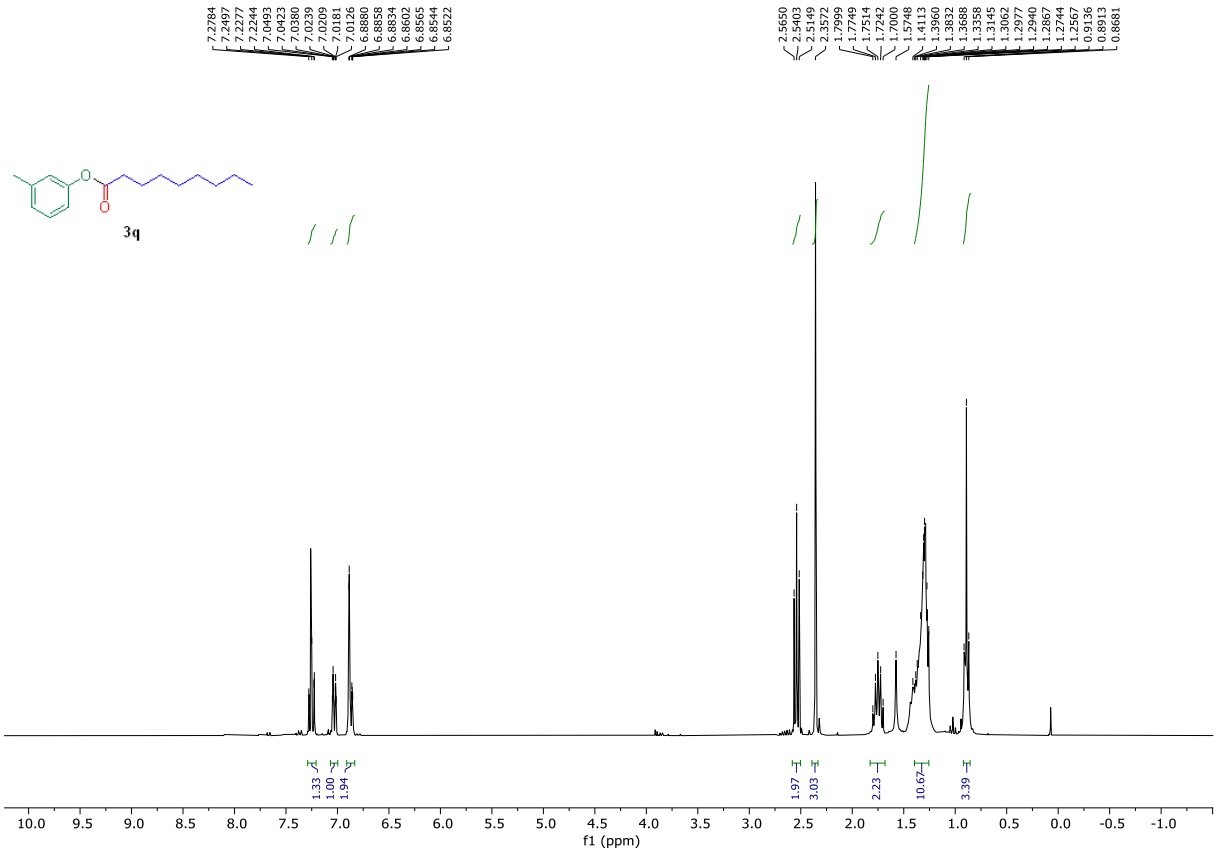
24.8633
22.6600
14.1146
3p
f1 (ppm)


29.60
3p
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160
f1 (ppm)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7.0126
6.8880
6.8858
6.8834
6.8602
6.8565
6.8544
6.8522
2.5650
2.5403
2.5149
2.3572
1.7999
1.7749
1.7514
1.7242
1.7000
1.5748
1.4113
1.3960
1.3632
1.3588
1.3358
1.3145
1.3062
1.2977
1.2940
1.2867
1.2744
1.2567
0.9136
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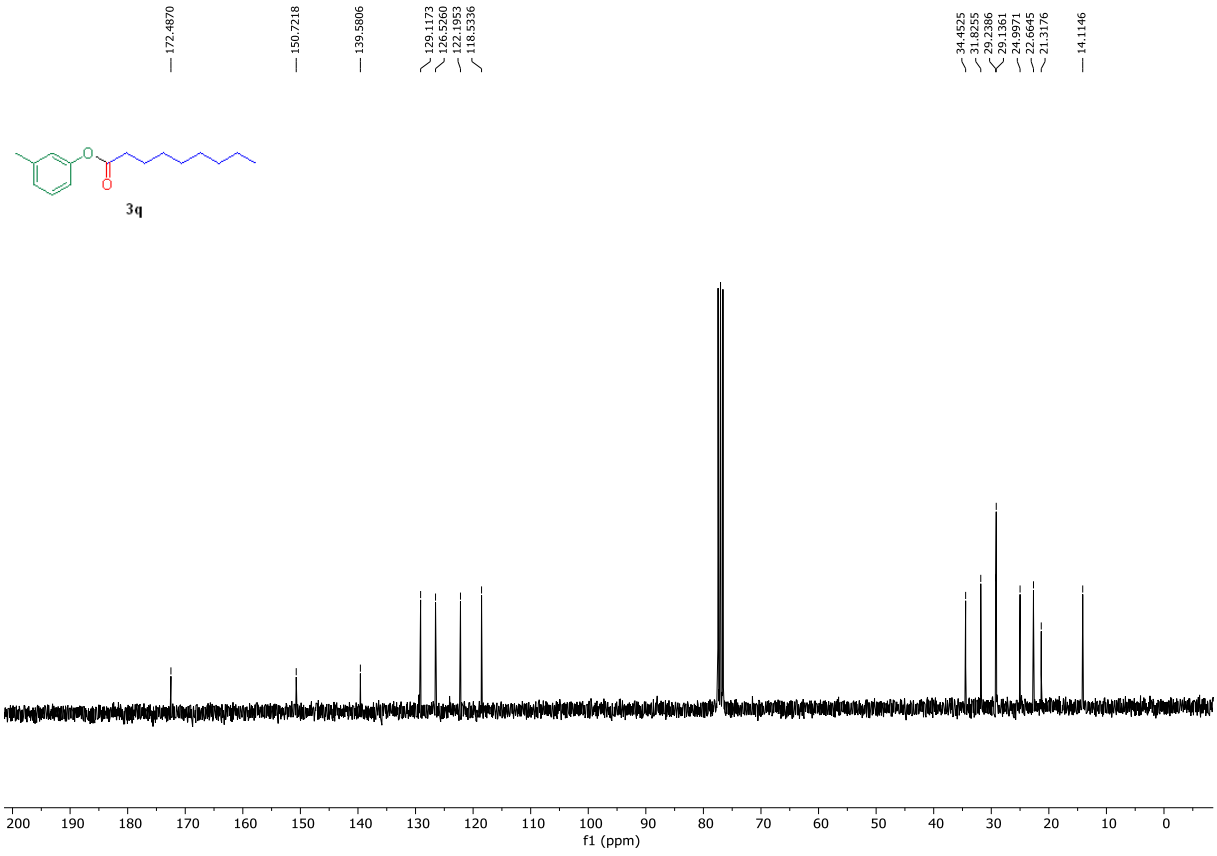
1.33
1.00
1.94
1.97
3.03
2.23
10.67
3.39
f1 (ppm)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126.5260
122.1953
118.5336
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29.2386
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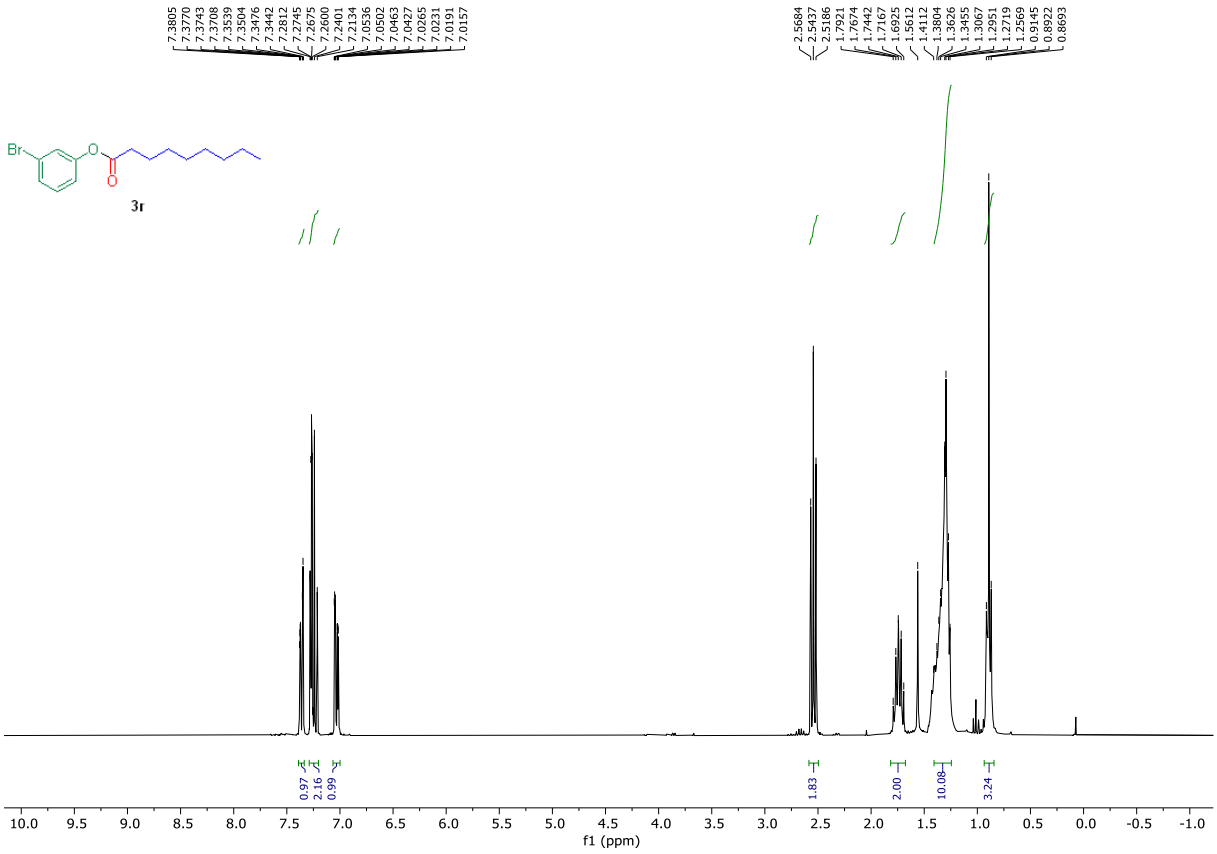
24.9971
22.6645
21.3176
14.1146
3q
f1 (ppm)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7.3708
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7.3504
7.3476
7.3442
7.2812
7.2745
7.2675
7.2600
7.2401
7.2134
7.0536
7.0502
7.0463
7.0427
7.0265
7.0231
7.0191
7.0157
2.5684
2.5437
2.5186
1.7921
1.7674
1.7442
1.7167
1.6925
1.5612
1.4112
1.3804
1.3626
1.3455
1.3067
1.2951
1.2719
1.2569
0.9145
0.8922
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Br
O
O
3r
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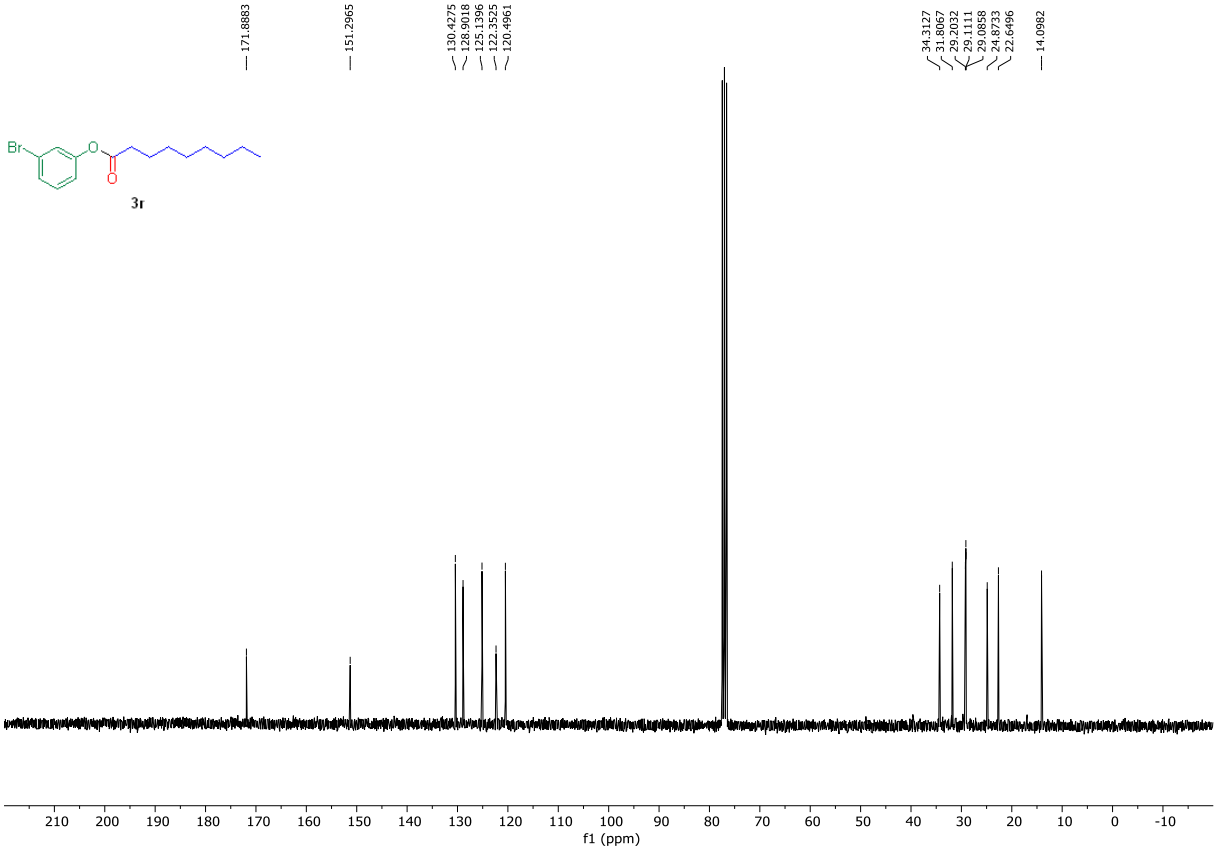
2.16
0.99
1.83
2.00
10.08
3.24
f1 (ppm)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128.9018
125.1396
122.3525
120.4961
34.3127
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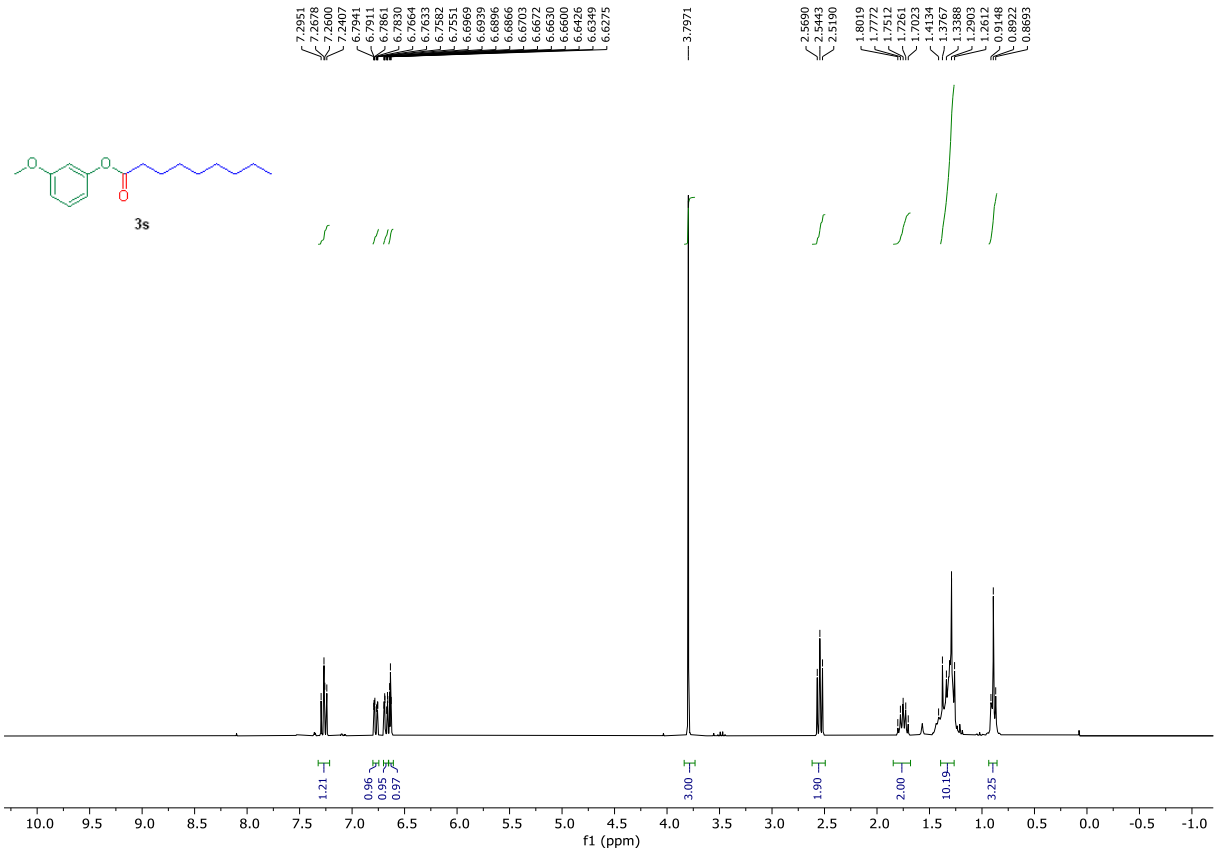
29.2032
29.1111
29.0858
24.8733
22.6496
14.0982
Br
O
O
3r
f1 (ppm)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7.2600
7.2407
6.7941
6.7911
6.7861
6.7830
6.7664
6.7633
6.7582
6.7551
6.6969
6.6939
6.6896
6.6866
6.6703
6.6672
6.6630
6.6600
6.6426
6.6349
6.6275
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2.5443
2.5190
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1.7772
1.7512
1.7261
1.7023
1.4134
1.3767
1.3388
1.2903
1.2612
0.9148
0.8922
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3s
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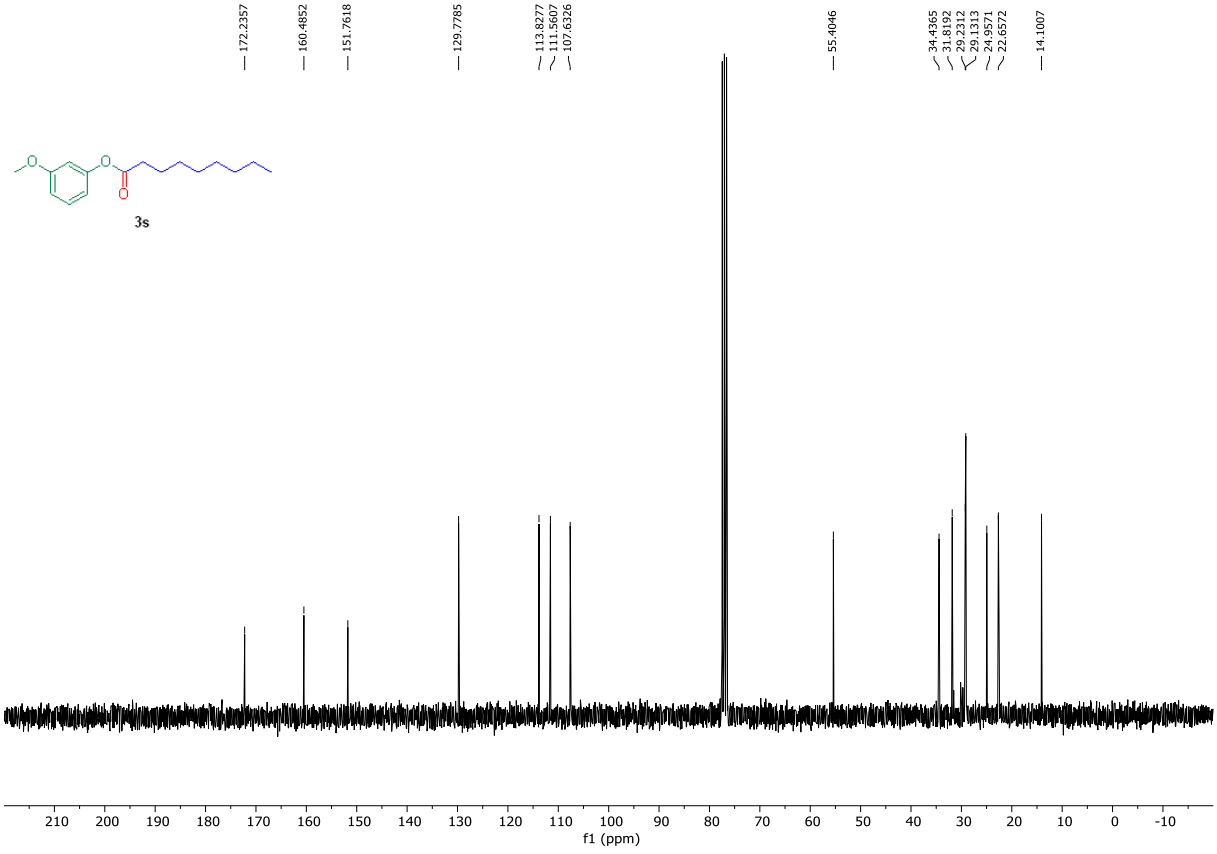
0.96
0.95
0.97
3.00
1.90
2.00
10.19
3.25
f1 (ppm)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111.5607
107.6326
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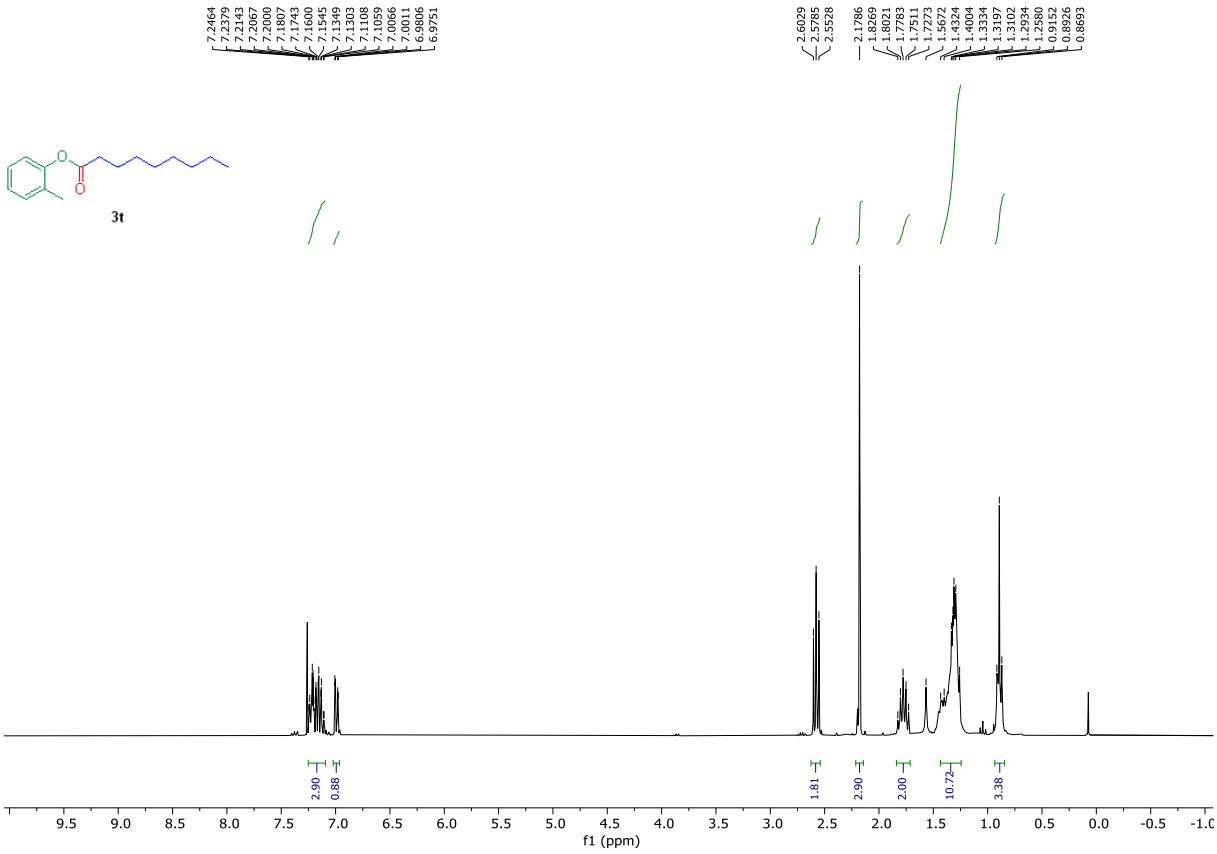
29.1313
24.9571
22.6572
14.1007
3s
f1 (ppm)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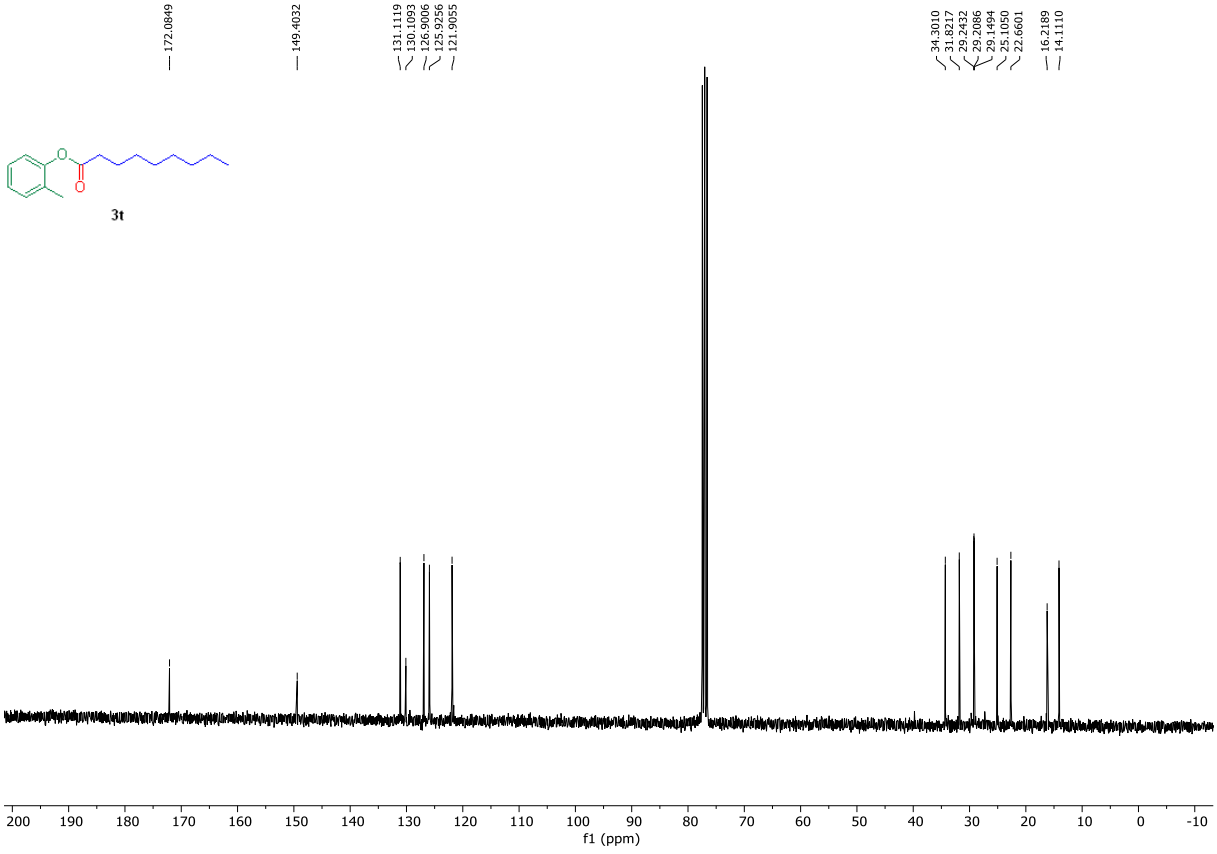
7.2000
7.1807
7.1743
7.1600
7.1545
7.1349
7.1303
7.1108
7.1059
7.0066
7.0011
6.9806
6.9751
2.6029
2.5785
2.5528
2.1786
1.8269
1.8021
1.7783
1.7511
1.7273
1.5672
1.4324
1.4004
1.3334
1.3197
1.3102
1.2934
1.2580
0.9152
0.8926
0.8693
3t
2.90
0.88
1.81
2.90
2.00
10.72
3.38
f1 (ppm)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126.9006
125.9256
121.9055
34.3010
31.8217
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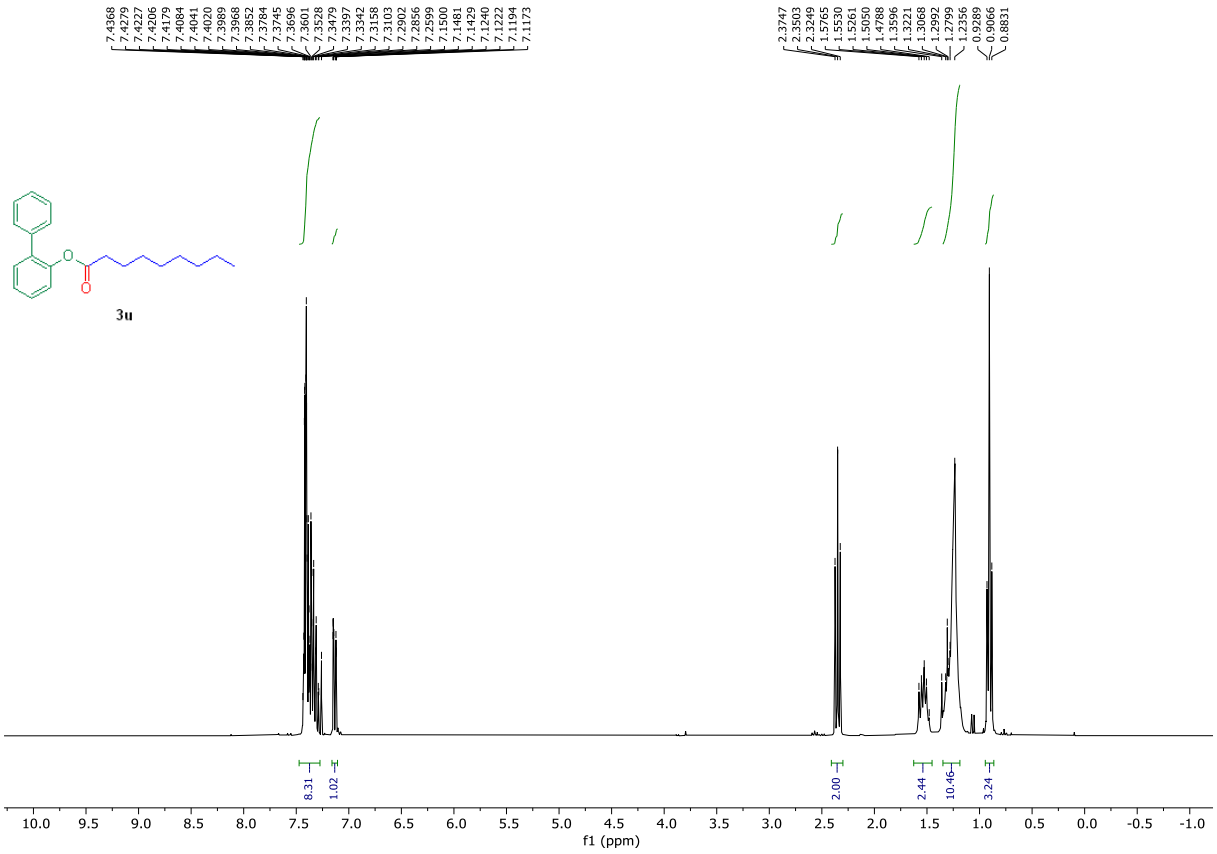
29.2096
29.1494
25.1050
22.6601
16.2189
14.1110
3t
f1 (ppm)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7.3852
7.3794
7.3745
7.3696
7.3601
7.3528
7.3479
7.3397
7.3342
7.3158
7.3102
7.2902
7.2856
7.2599
7.1500
7.1481
7.1429
7.1240
7.1222
7.1194
7.1173
2.3747
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2.3249
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1.5530
1.5261
1.5050
1.4788
1.3596
1.3221
1.3068
1.2992
1.2799
1.2356
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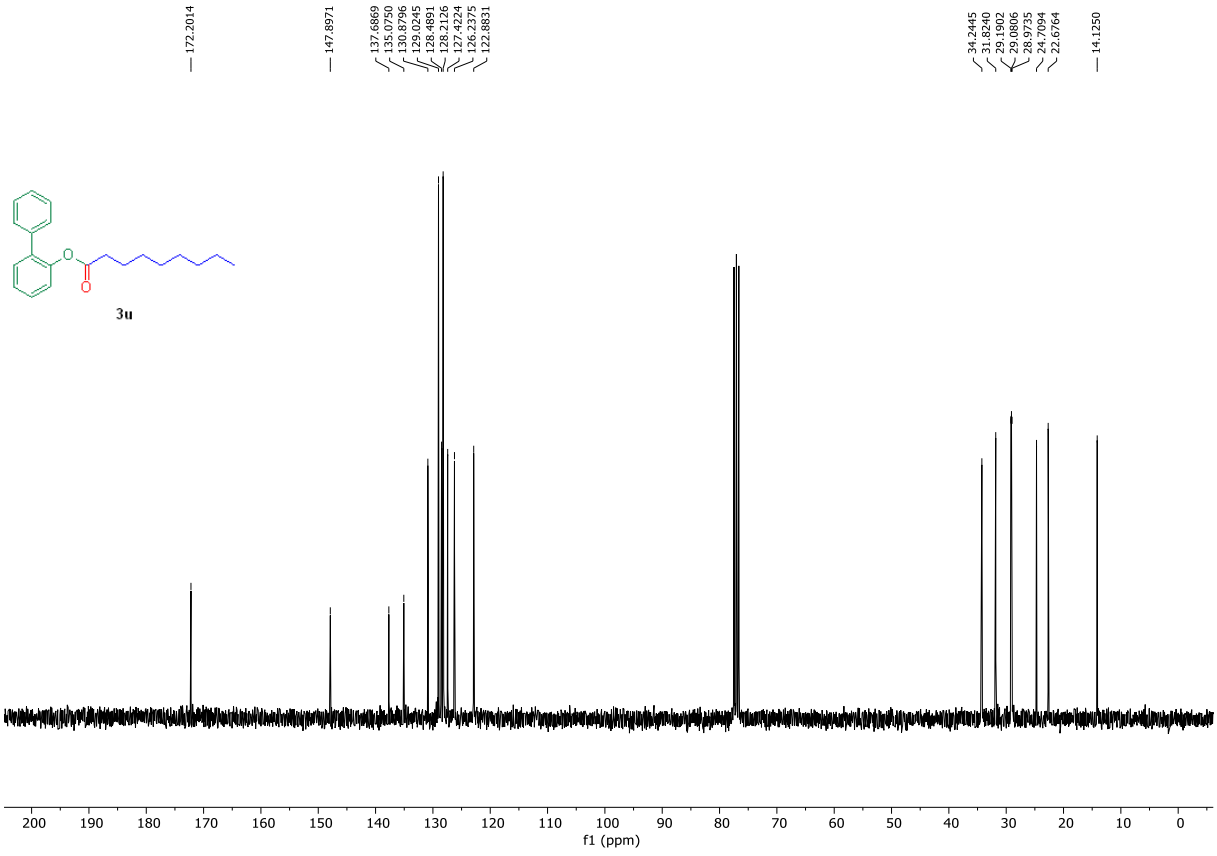
10.46
3.24
f1 (ppm)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22.6764
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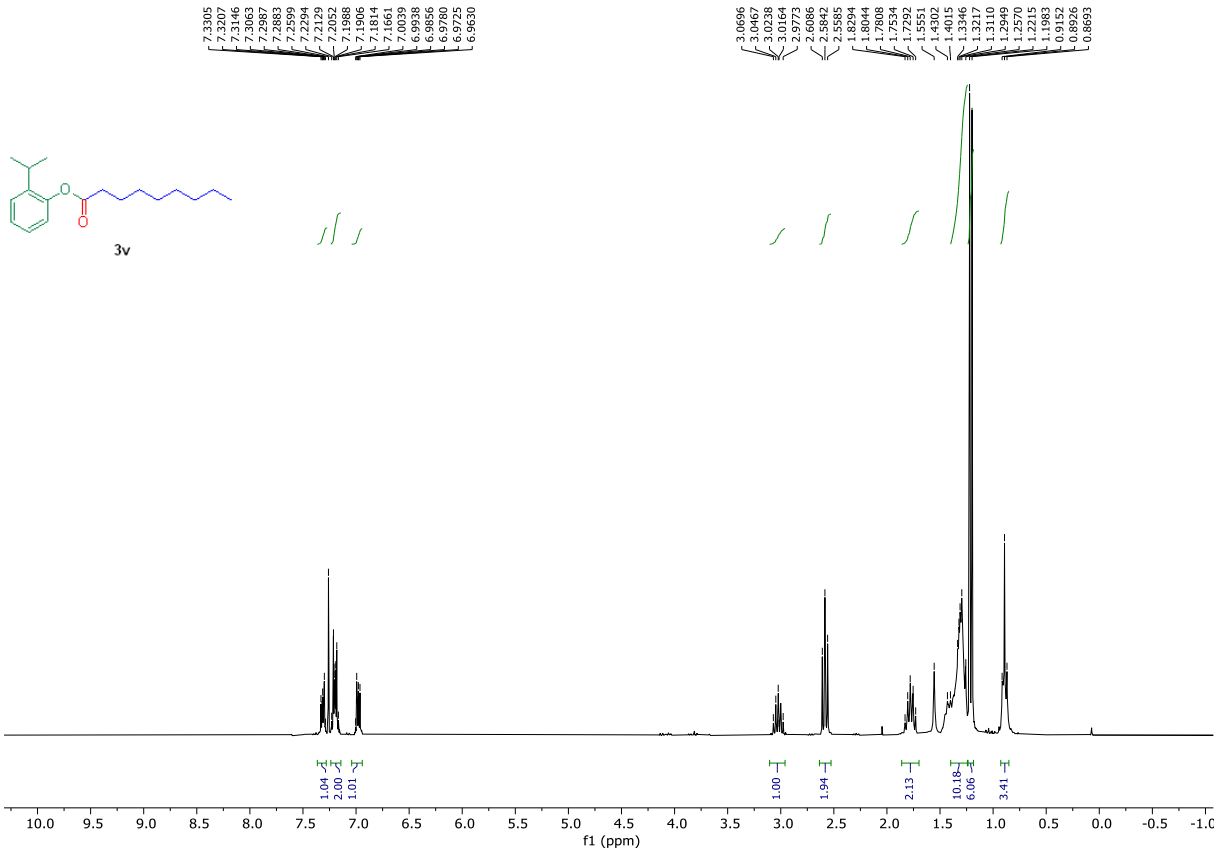
3u
f1 (ppm)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7.2129
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7.1986
7.1906
7.1814
7.1661
7.0039
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6.9856
6.9780
6.9725
6.9630
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3.0467
3.0238
3.0164
2.9773
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2.5585
1.8294
1.8044
1.7808
1.7554
1.7232
1.5551
1.4302
1.4015
1.3346
1.3217
1.3110
1.2949
1.2570
1.2215
1.1983
0.9152
0.8926
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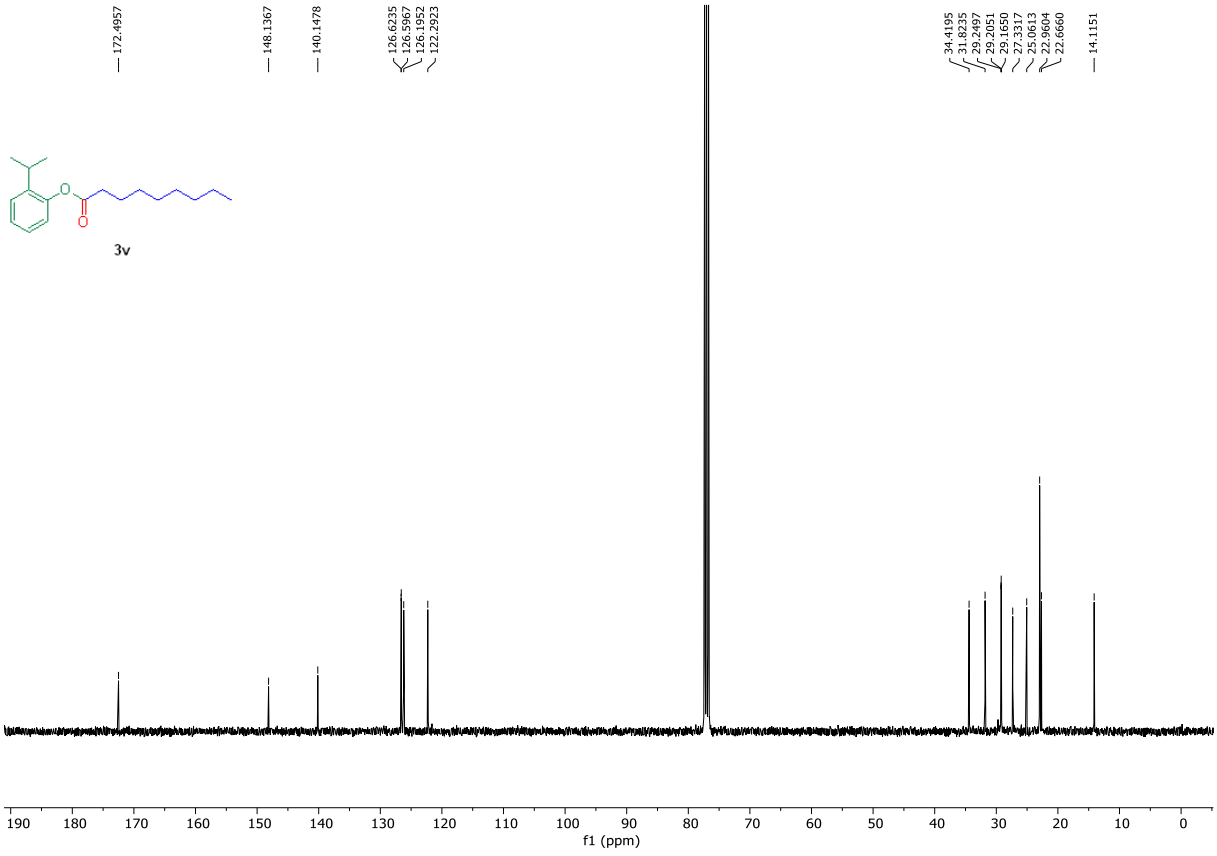
1.01
1.00
1.94
2.13
10.18
6.06
3.41
f1 (ppm)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25.0613
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22.6660
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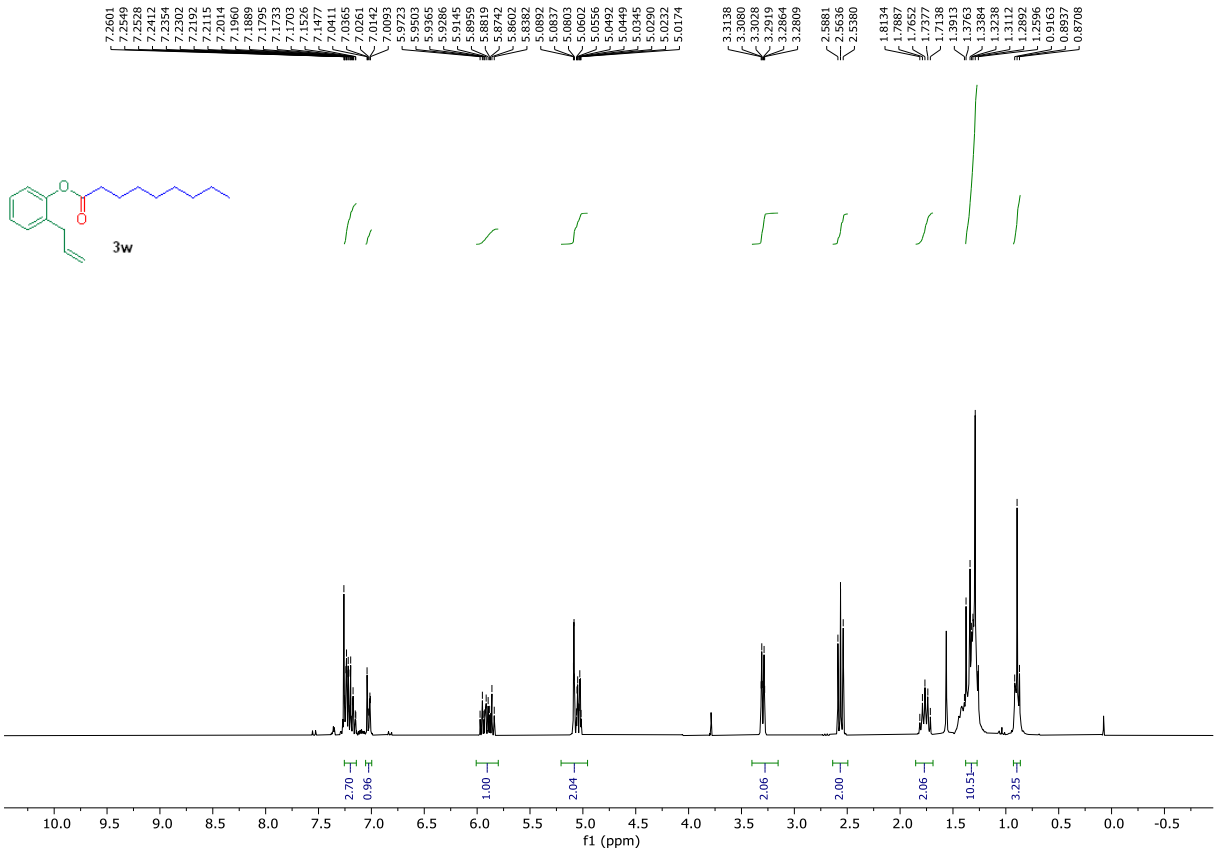
3v
f1 (ppm)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7.1733
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1.3238
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0.8937
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2.06
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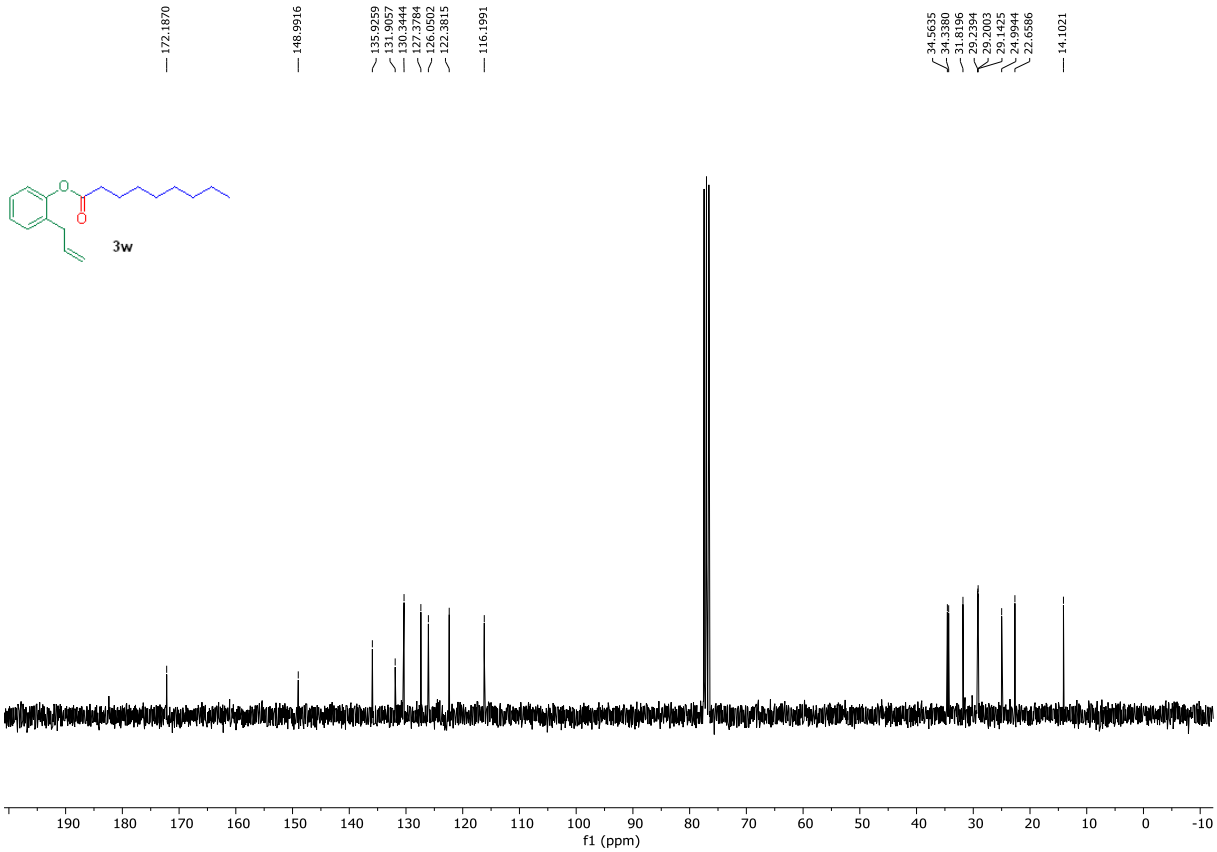
3.25
f1 (ppm)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116.1991
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29.2003
29.1425
24.9944
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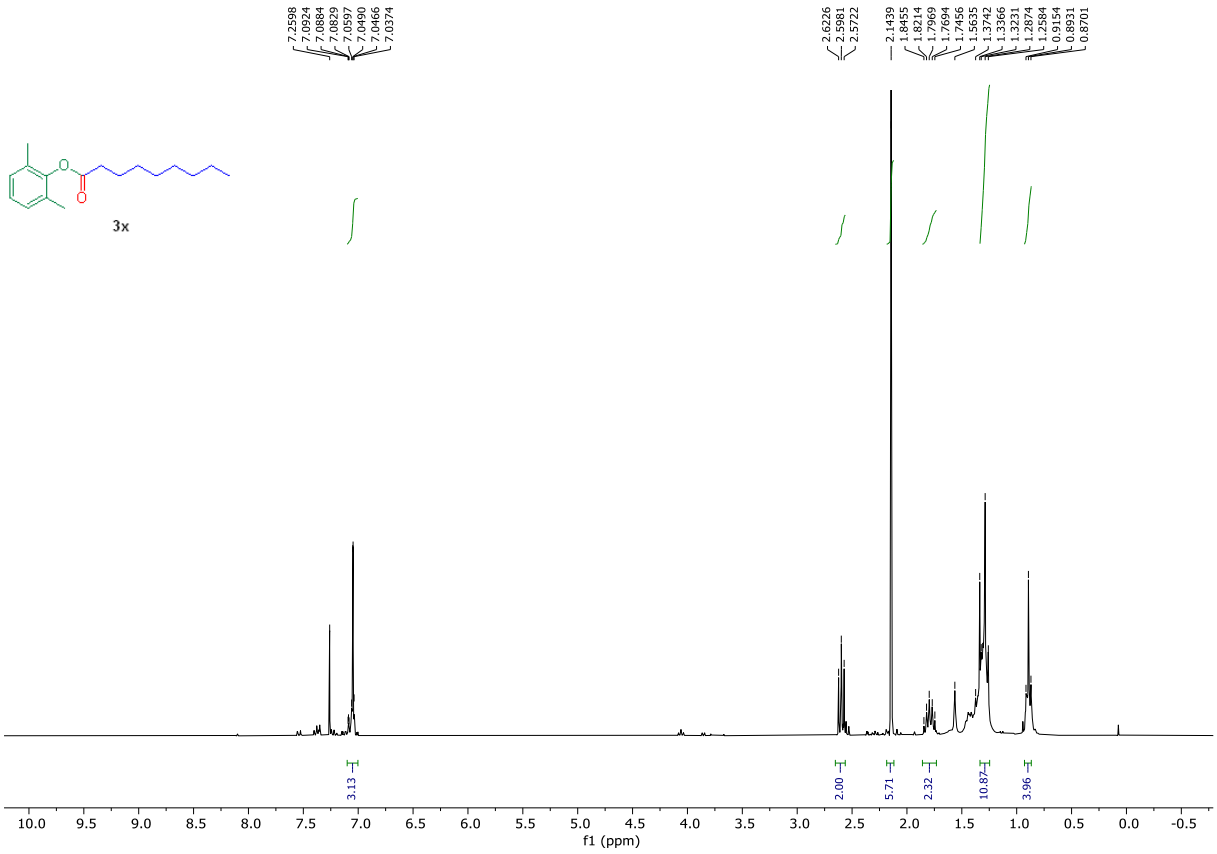
14.1021
3w
f1 (ppm)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1.7456
1.5635
1.3742
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1.3231
1.2874
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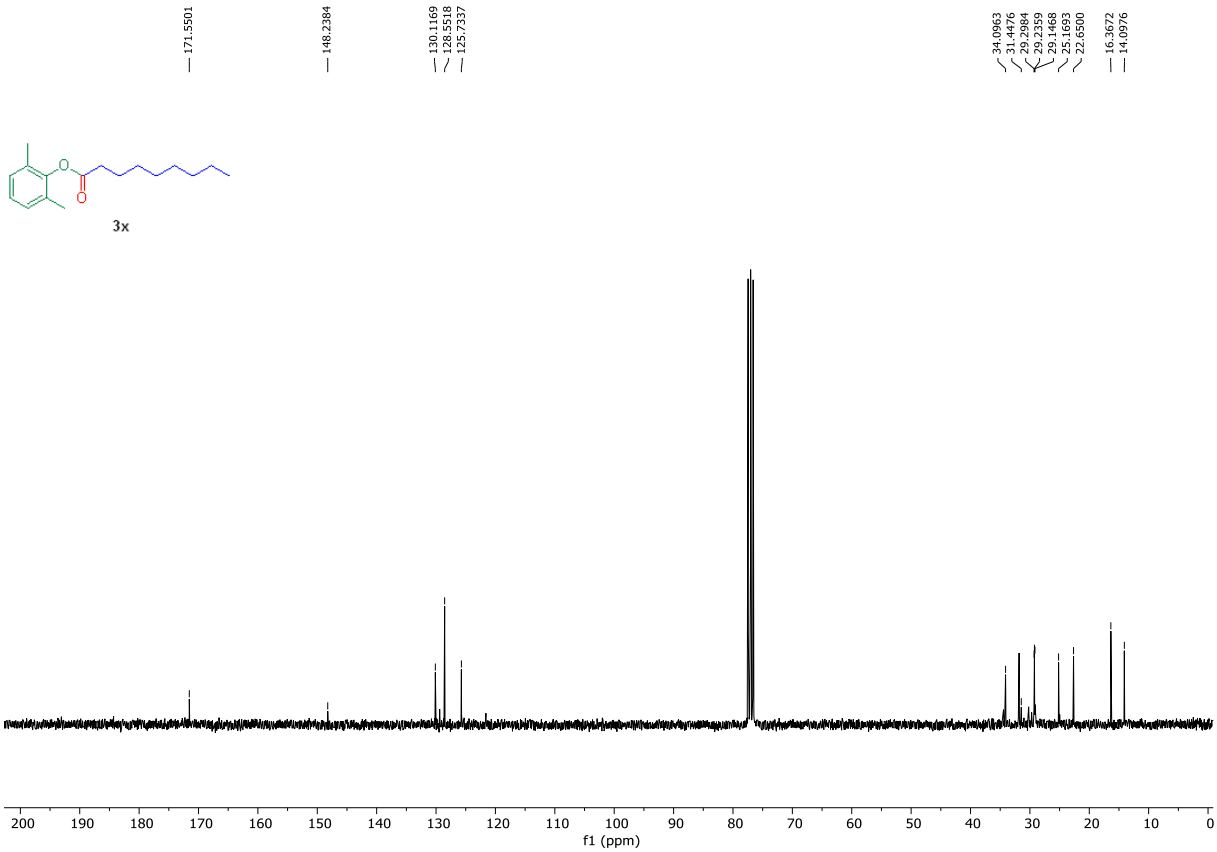
3.96
f1 (ppm)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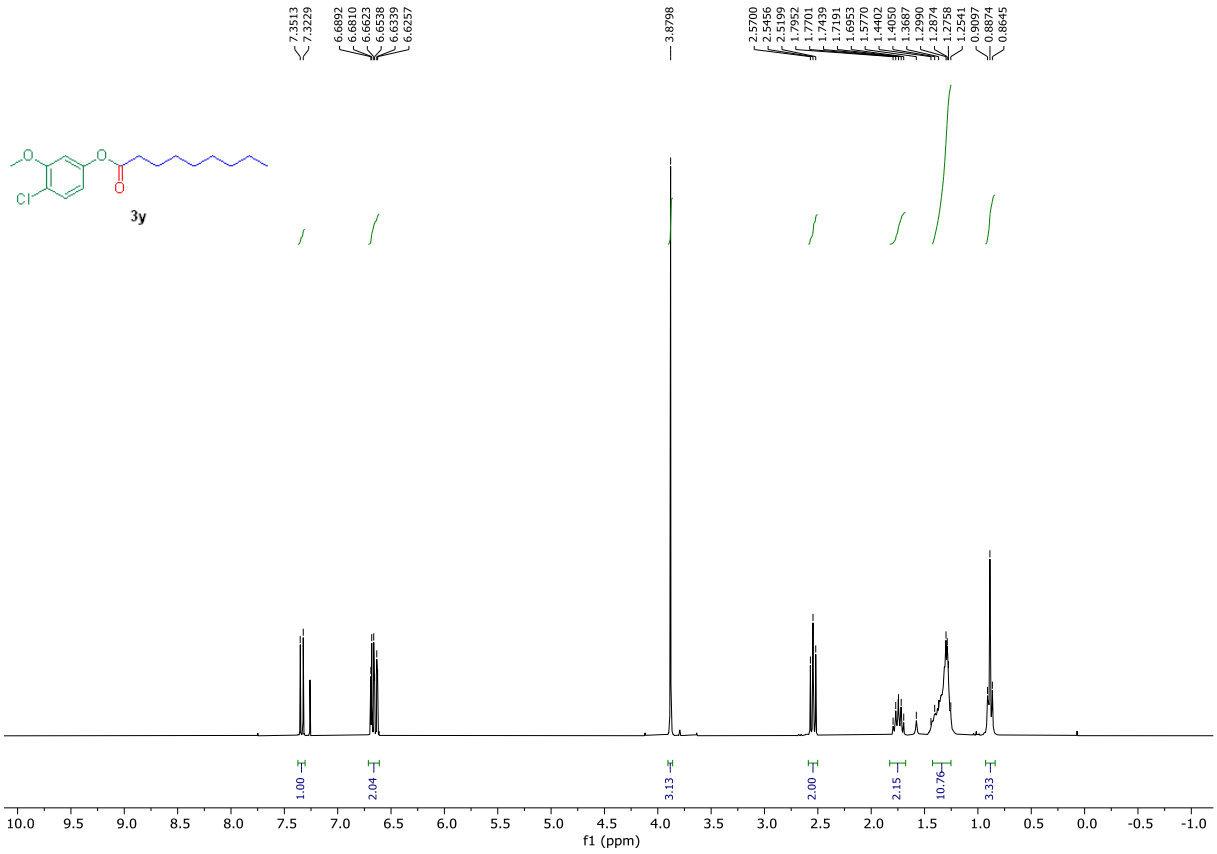
14.0976
3x
f1 (ppm)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2.5456
2.5199
2.1952
1.7701
1.7439
1.7191
1.6951
1.5770
1.4402
1.4050
1.3687
1.2990
1.2874
1.2758
1.2541
0.9097
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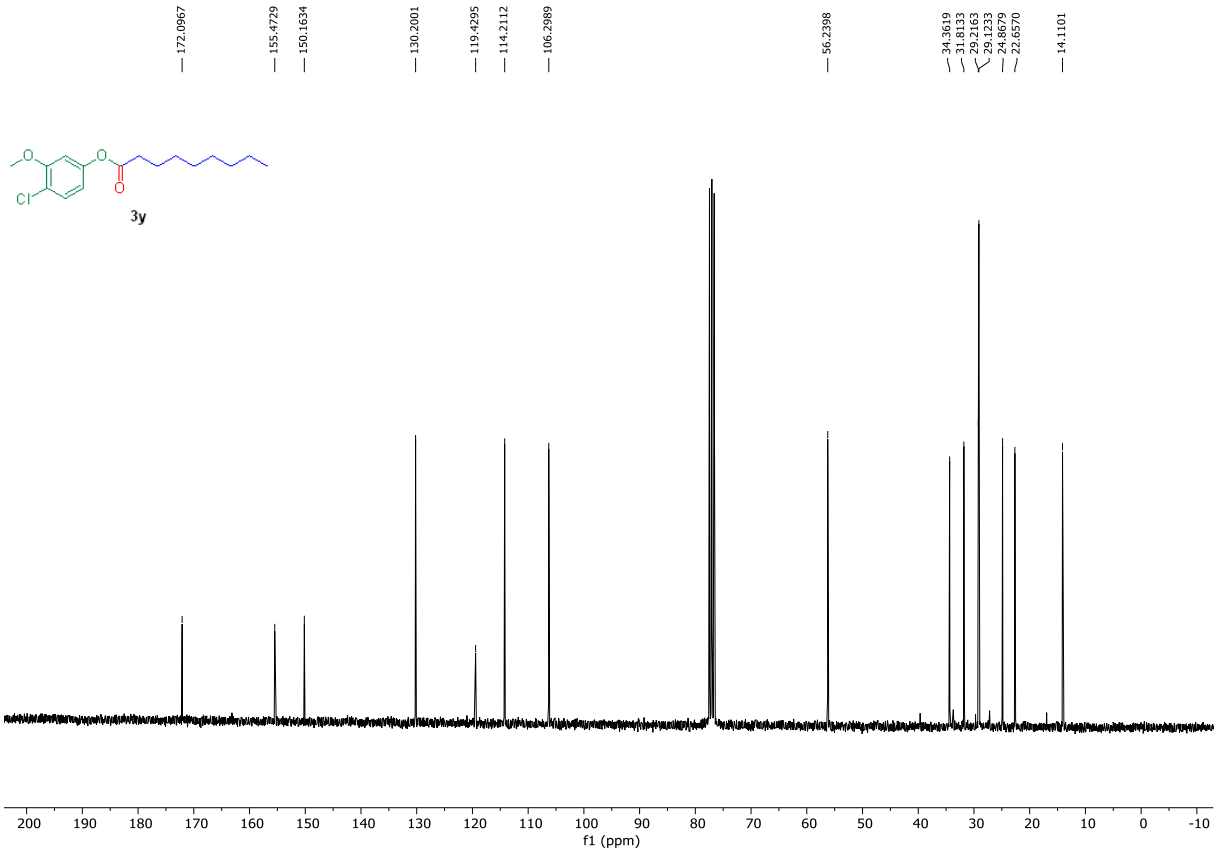
3.33
f1 (ppm)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14.1101
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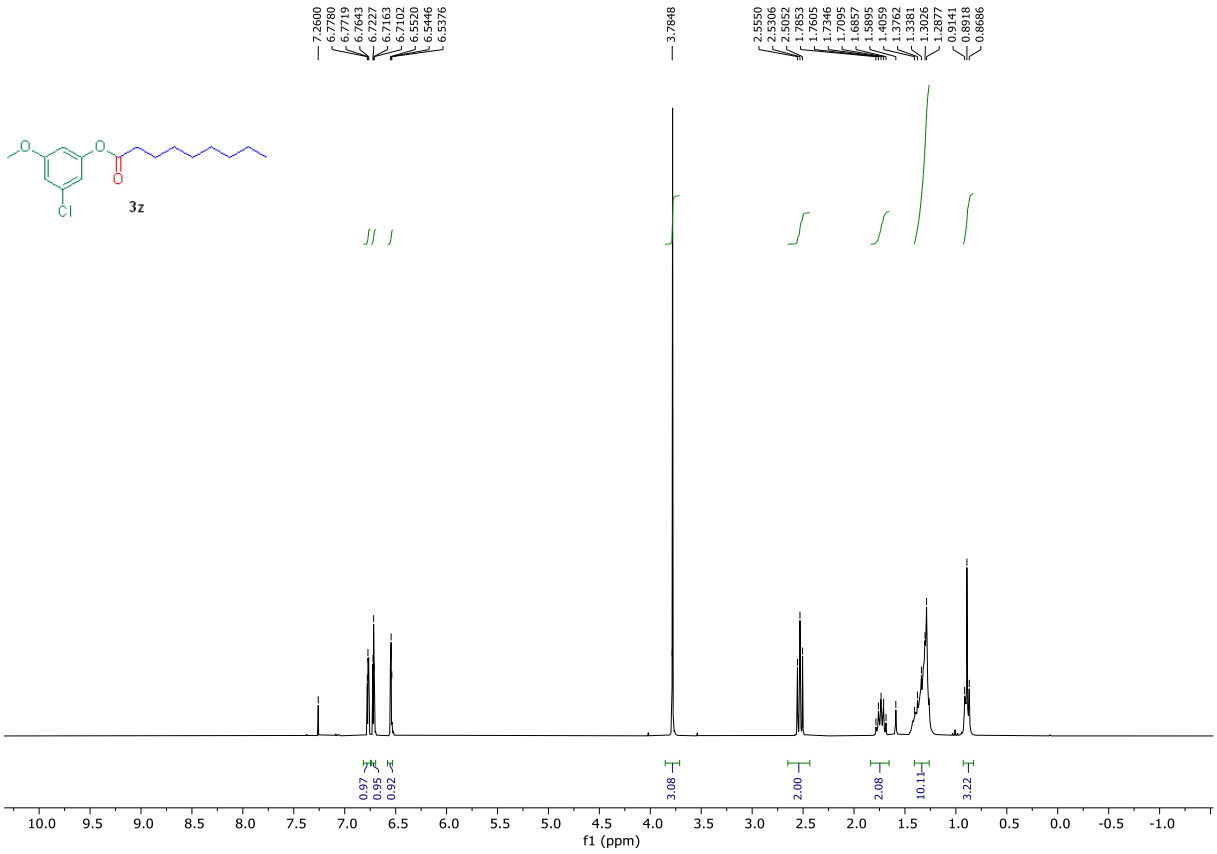
f1 (ppm)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3.7848
2.5550
2.5306
2.5052
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1.7605
1.7346
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1.6857
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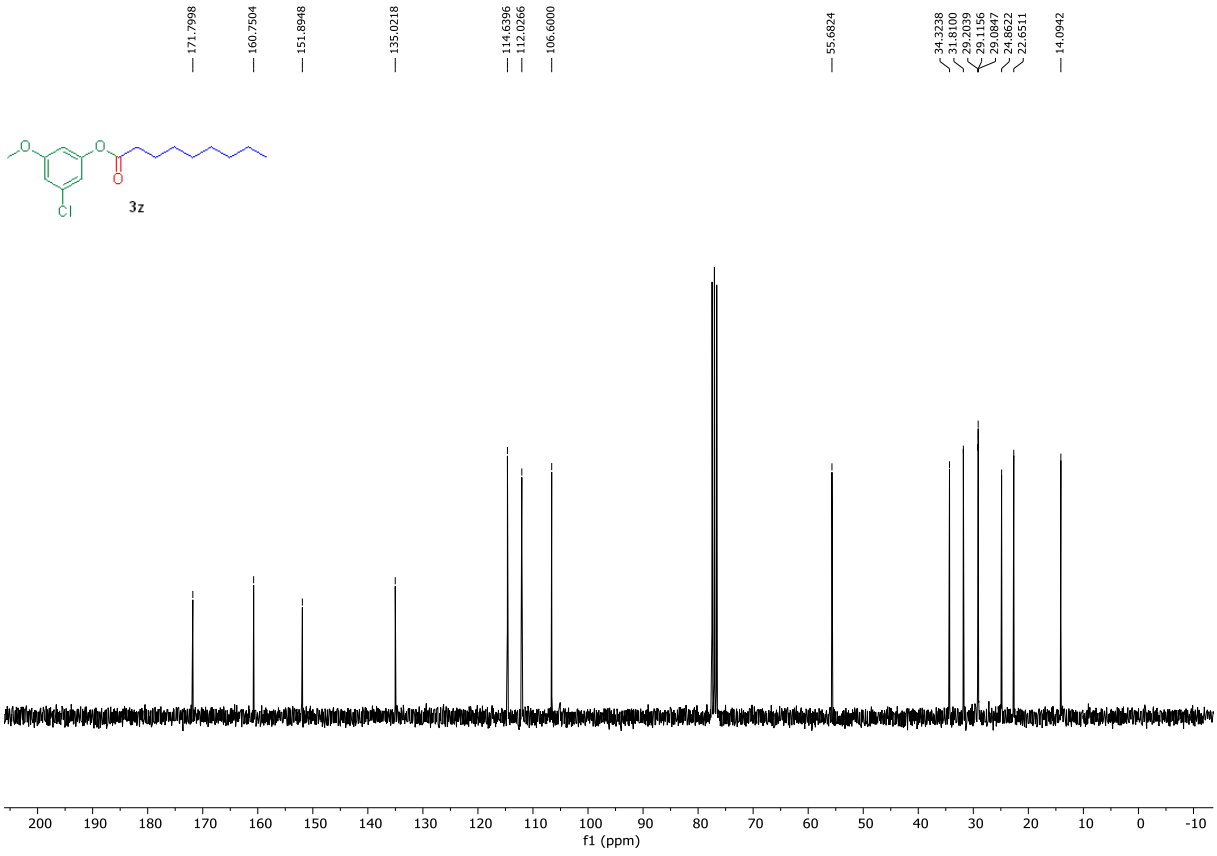
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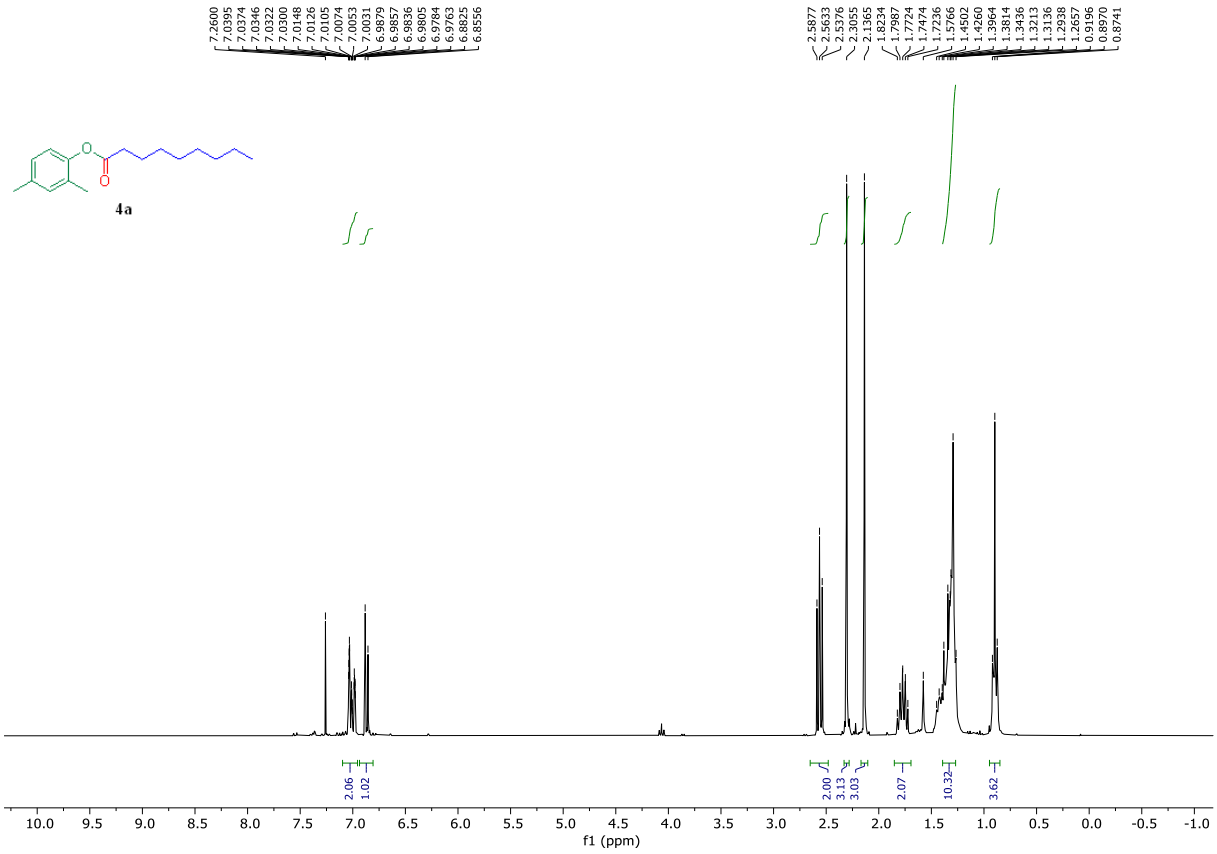
29.1156
29.0847
24.8622
22.6511
14.0942
3z
f1 (ppm)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7.0031
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6.9836
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6.8825
6.8556
2.5877
2.5633
2.5376
2.3055
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1.7724
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1.7236
1.5766
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1.4260
1.3964
1.3814
1.3436
1.3213
1.3136
1.2938
1.2657
0.9156
0.8970
0.8741
4a
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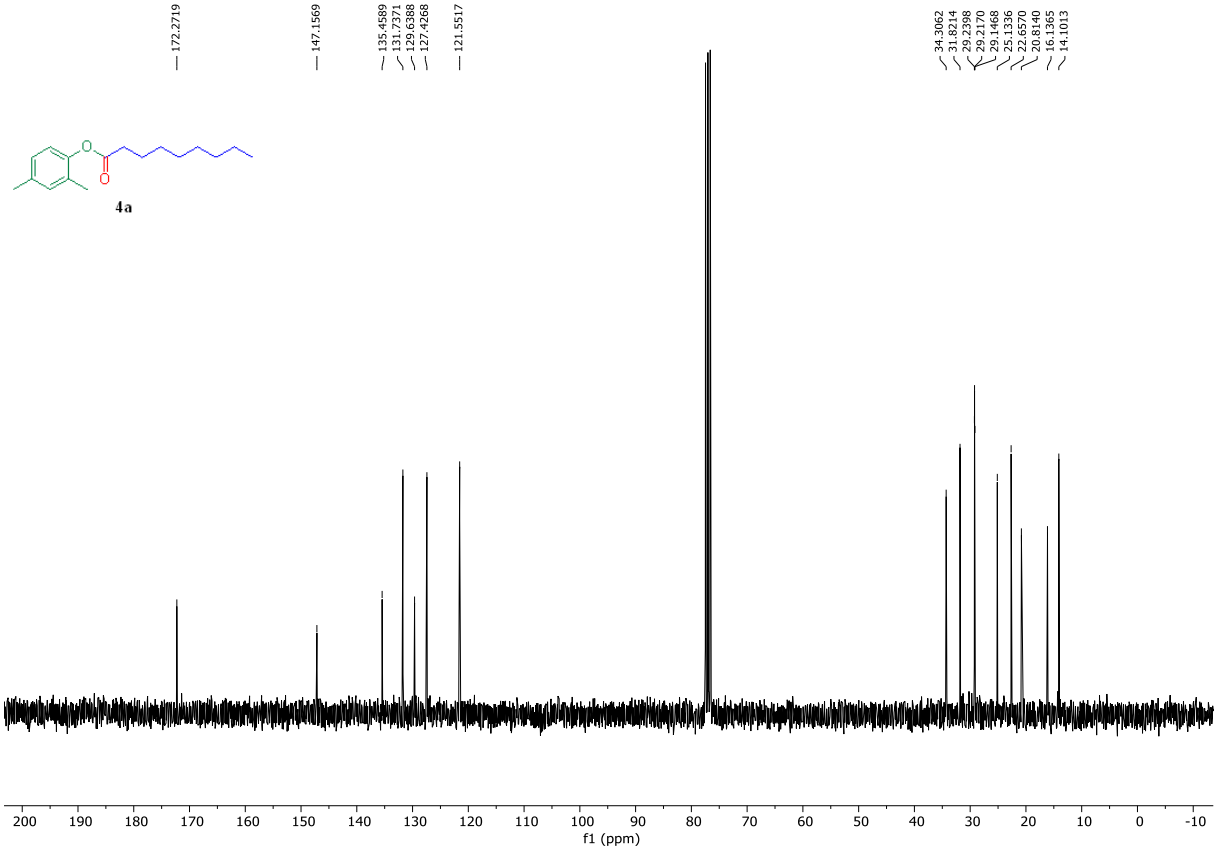
1.02
2.00
3.13
3.03
2.07
10.32
3.62
f1 (ppm)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121.5517
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31.8214
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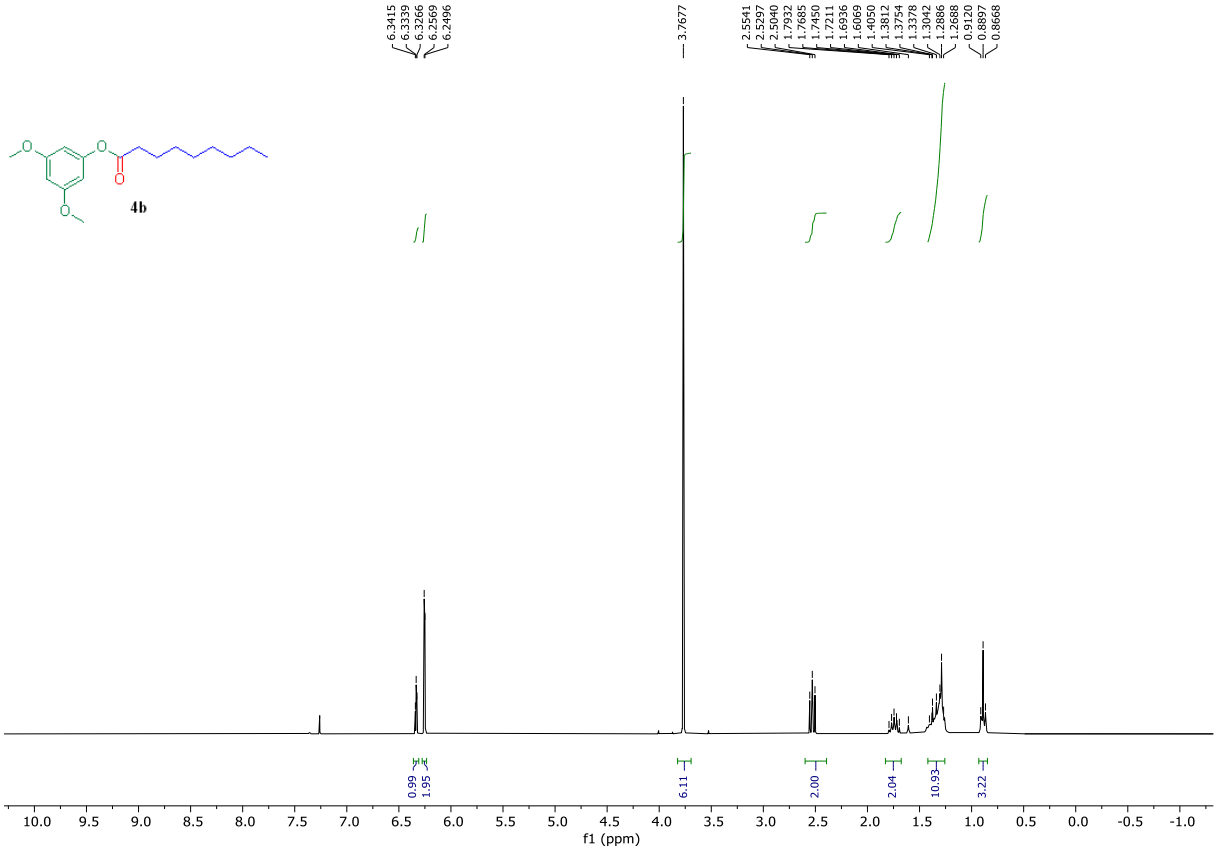
29.1468
25.1336
22.6570
20.8140
16.1365
14.1013
4a
f1 (ppm)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2.5541
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2.5040
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1.7685
1.7450
1.7211
1.6936
1.6069
1.4050
1.3812
1.3754
1.3378
1.3042
1.2886
1.2688
0.9120
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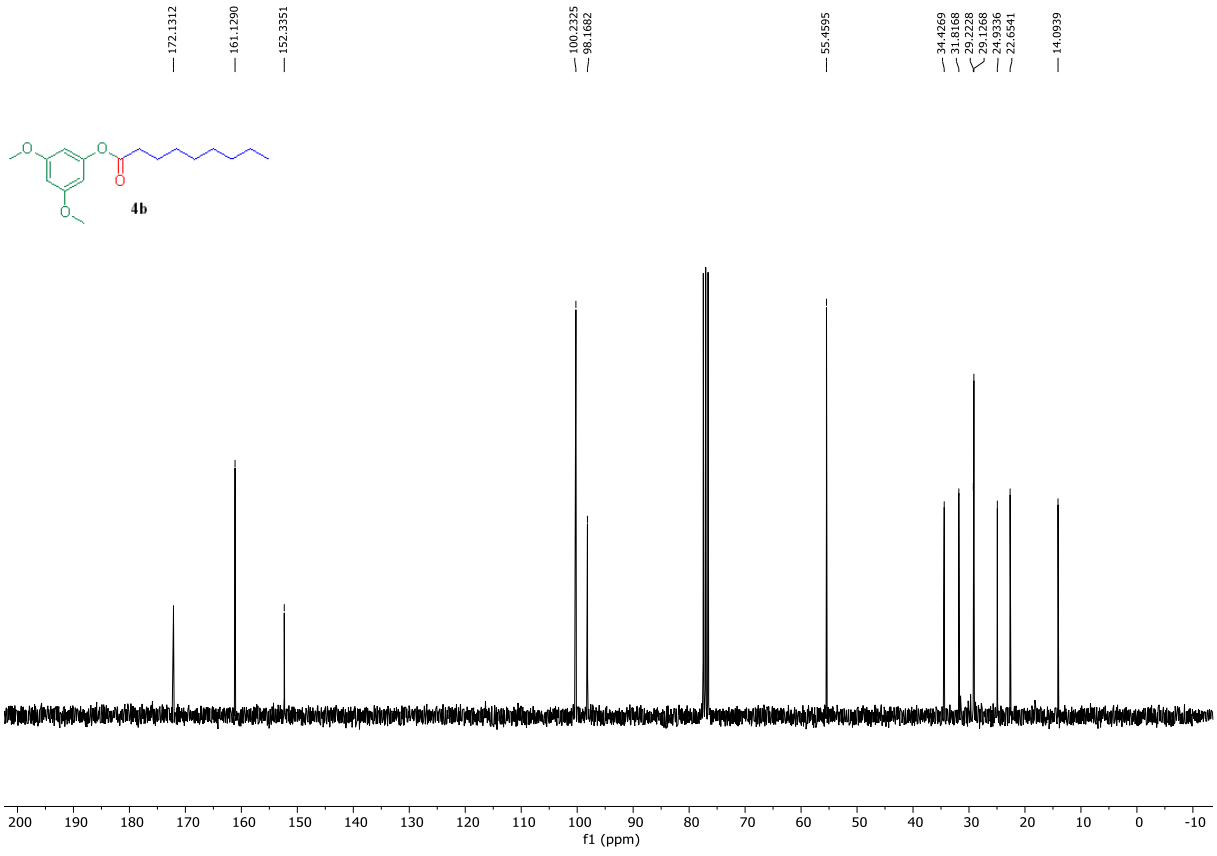
4b
0.99
1.95
6.11
2.00
2.04
10.93
3.22
f1 (ppm)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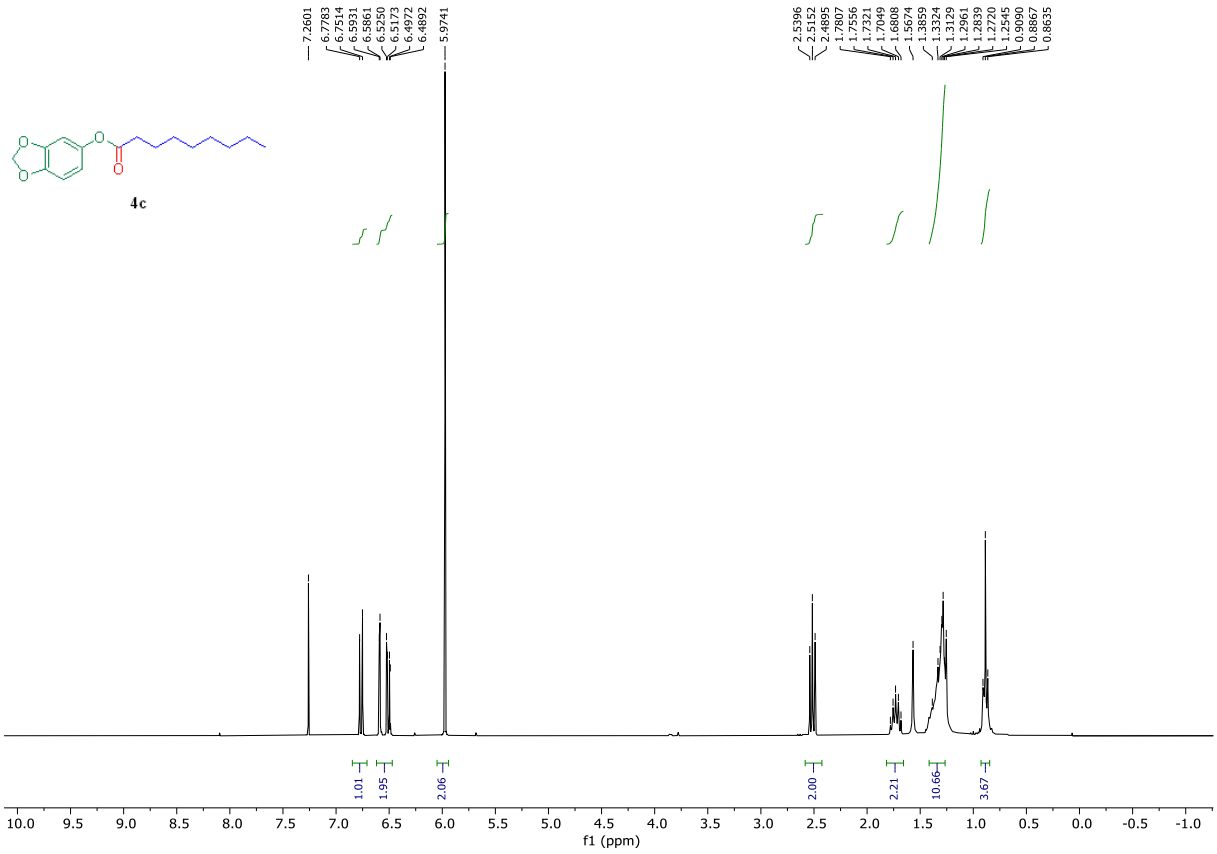
4b
f1 (ppm)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6.5861
6.5250
6.5173
6.4972
6.4892
5.9741
2.5396
2.5152
2.4895
1.7807
1.7556
1.7321
1.7049
1.6808
1.5674
1.3859
1.3324
1.3129
1.2961
1.2839
1.2720
1.2545
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0.8867
0.8635
1.01
1.95
2.06
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2.21
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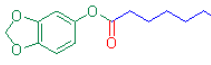
f1 (ppm)



4c

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107.9660
103.7841
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29.2247
29.1261
24.9589
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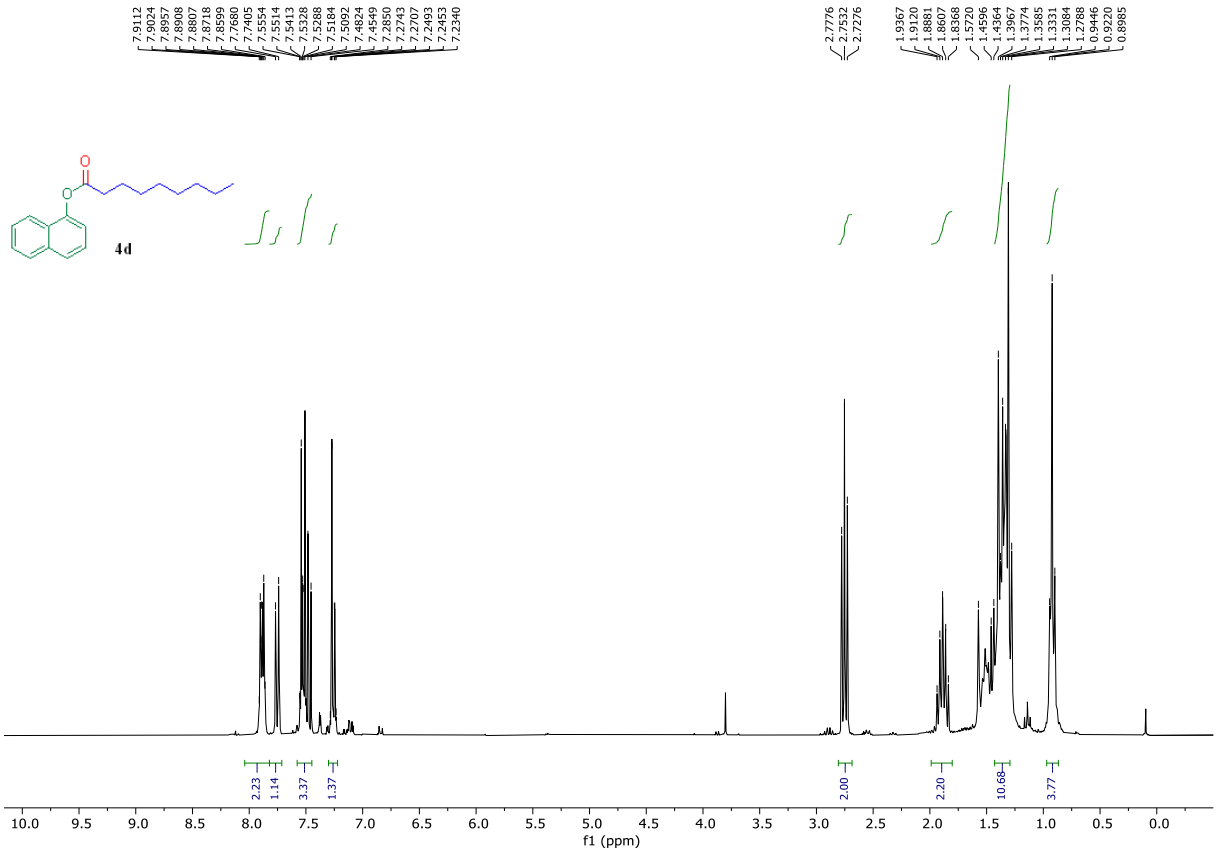
f1 (ppm)

4c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7.5514
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7.5328
7.5288
7.5184
7.5092
7.4824
7.4549
7.2850
7.2743
7.2707
7.2493
7.2453
7.2340
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2.7532
2.7276
1.9367
1.9120
1.8881
1.8607
1.8368
1.5720
1.4596
1.4364
1.3967
1.3774
1.3585
1.3331
1.3084
1.2788
0.9446
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3.37
1.37
2.00
2.20
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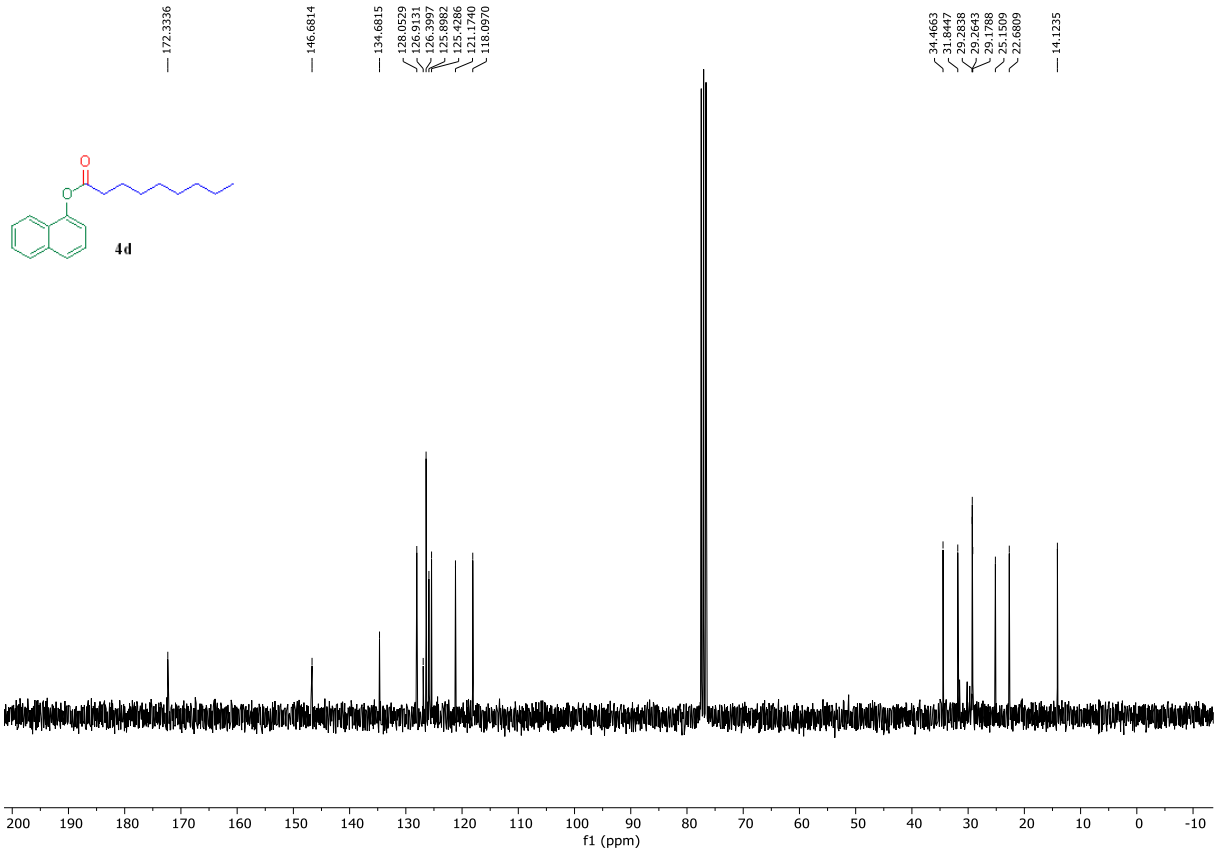
3.77
f1 (ppm)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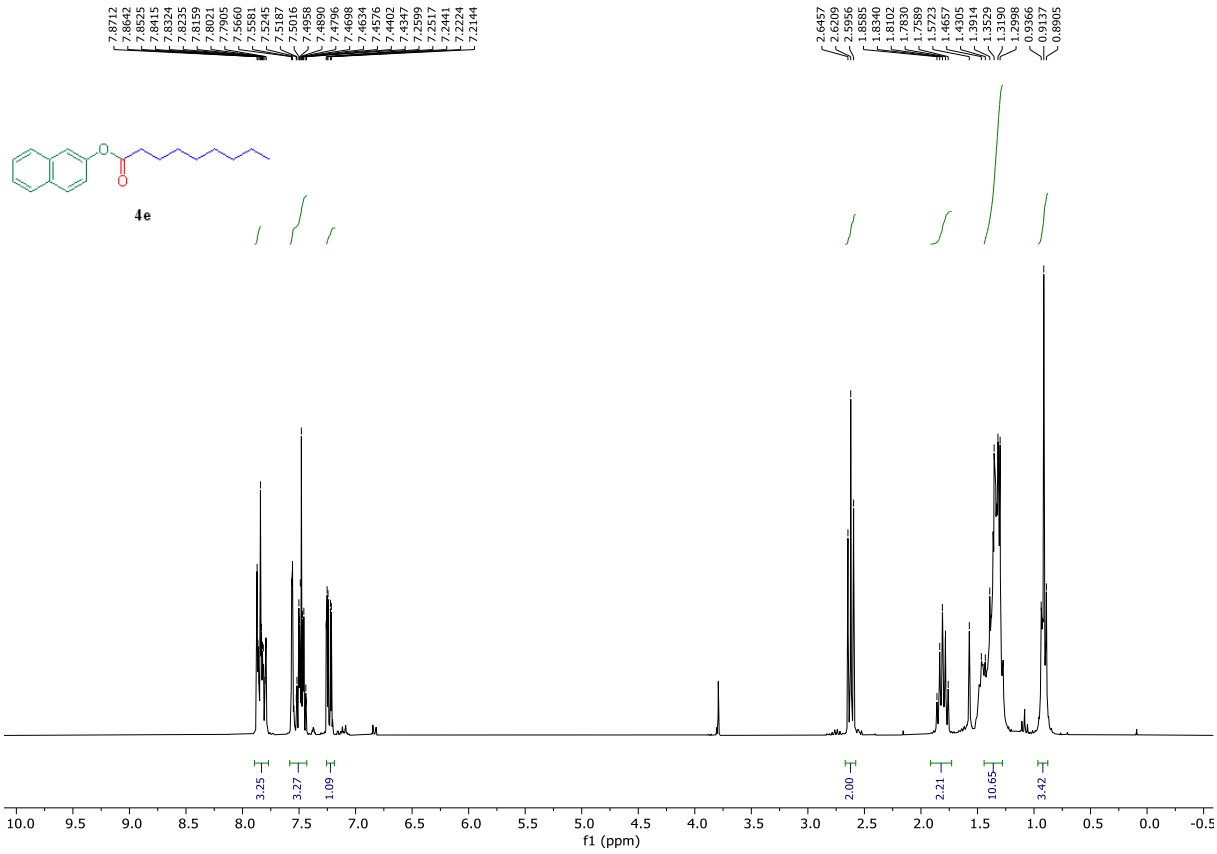
4d
f1 (ppm)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7.4576
7.4402
7.4347
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7.2517
7.2441
7.2224
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2.5956
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1.8102
1.7830
1.7589
1.5723
1.4657
1.4305
1.3914
1.3529
1.3190
1.2998
0.9366
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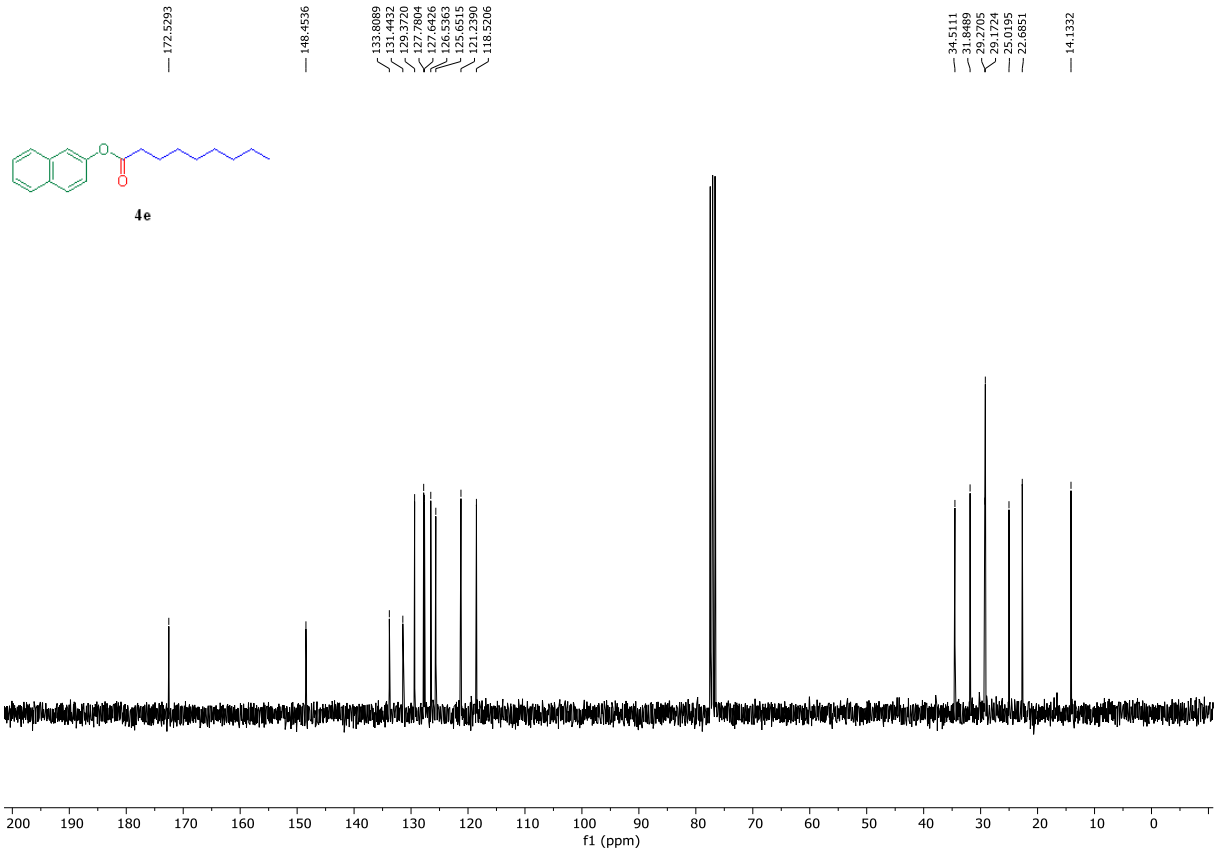
3.27
1.09
2.00
2.21
10.65
3.42
f1 (ppm)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129.3720
127.7804
127.6426
126.5363
125.6515
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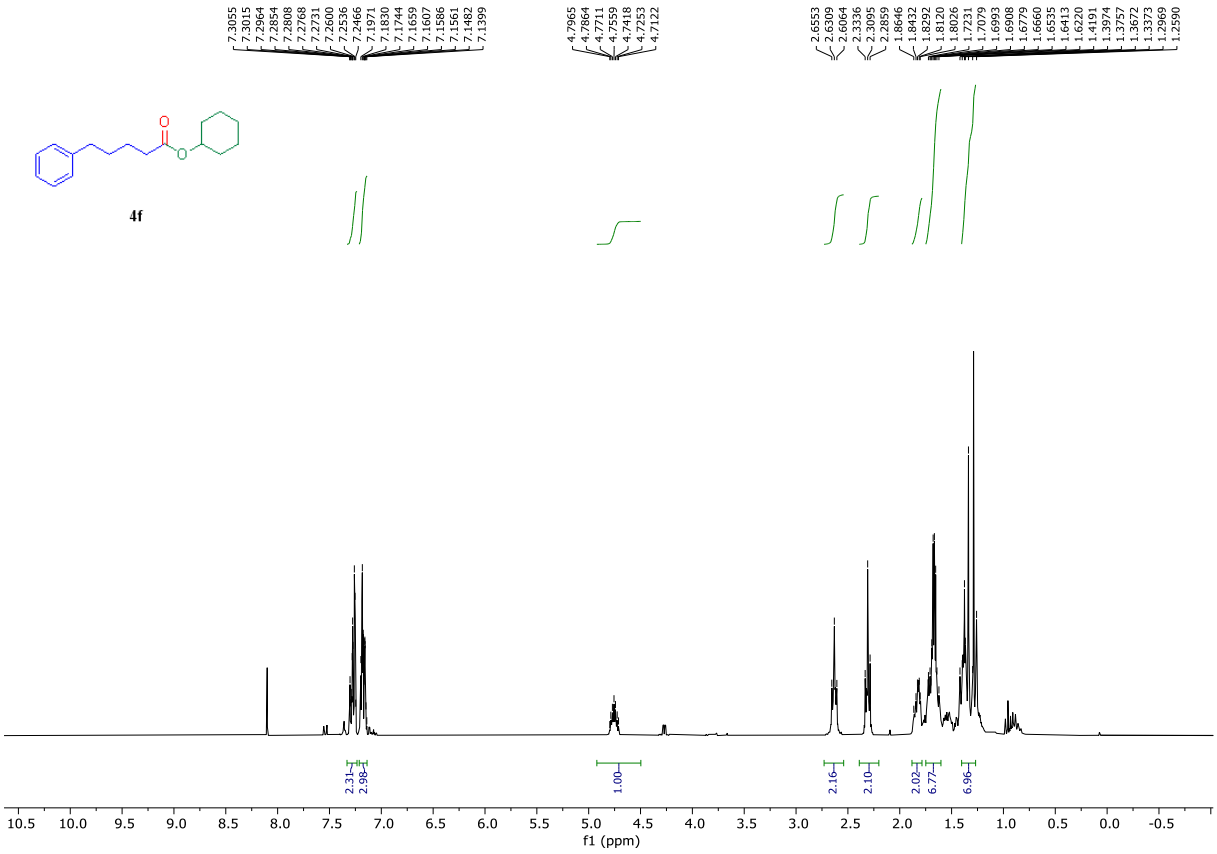
25.0195
22.6851
14.1332
4e
f1 (ppm)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7.1607
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1.7079
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1.6535
1.6413
1.6220
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1.3974
1.3757
1.3672
1.3373
1.2969
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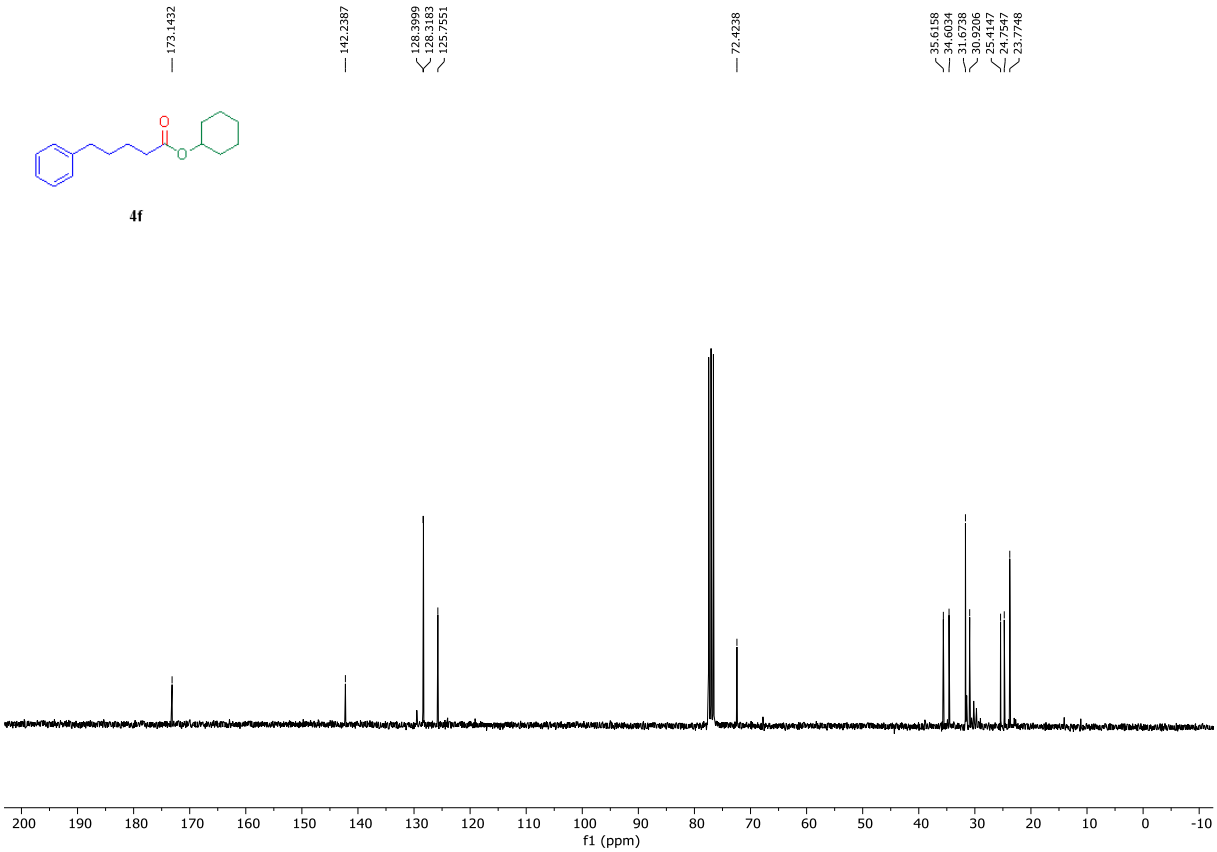
2.10
2.02
6.77
6.96
f1 (ppm)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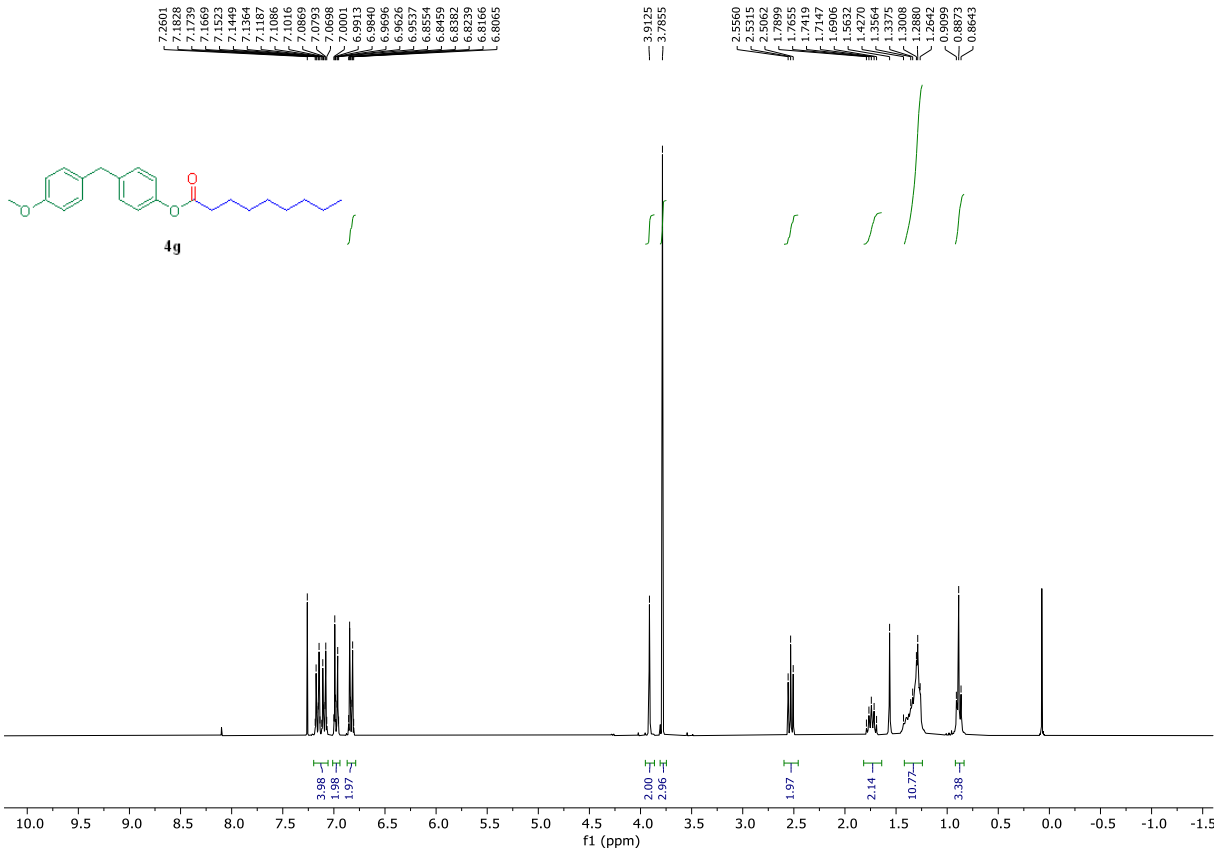
O
O
4f
f1 (ppm)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7.1086
7.1016
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7.0793
7.0698
7.0001
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6.9696
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6.8065
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1.7899
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1.7419
1.7147
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1.4270
1.3564
1.3375
1.3008
1.2880
1.2642
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0.8873
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1.97
2.00
2.96
1.97
2.14
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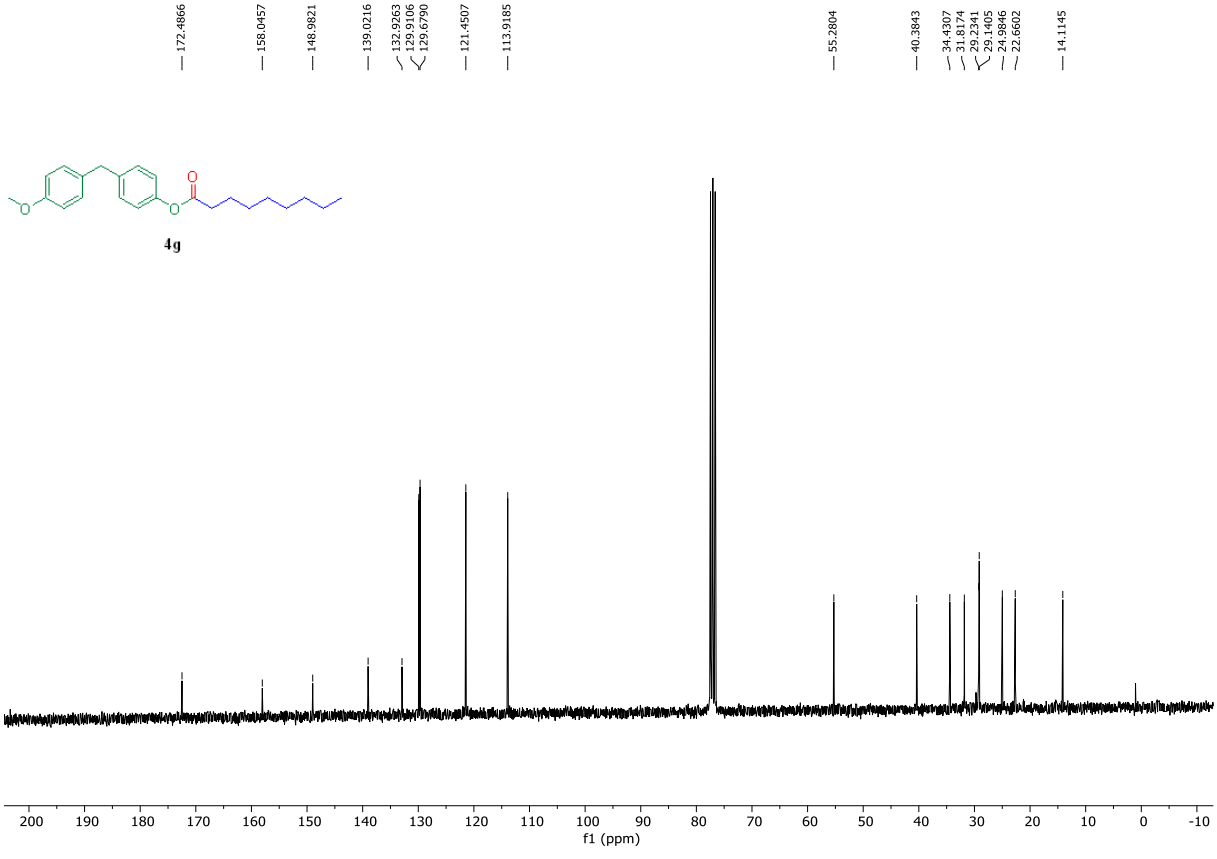
3.38
f1 (ppm)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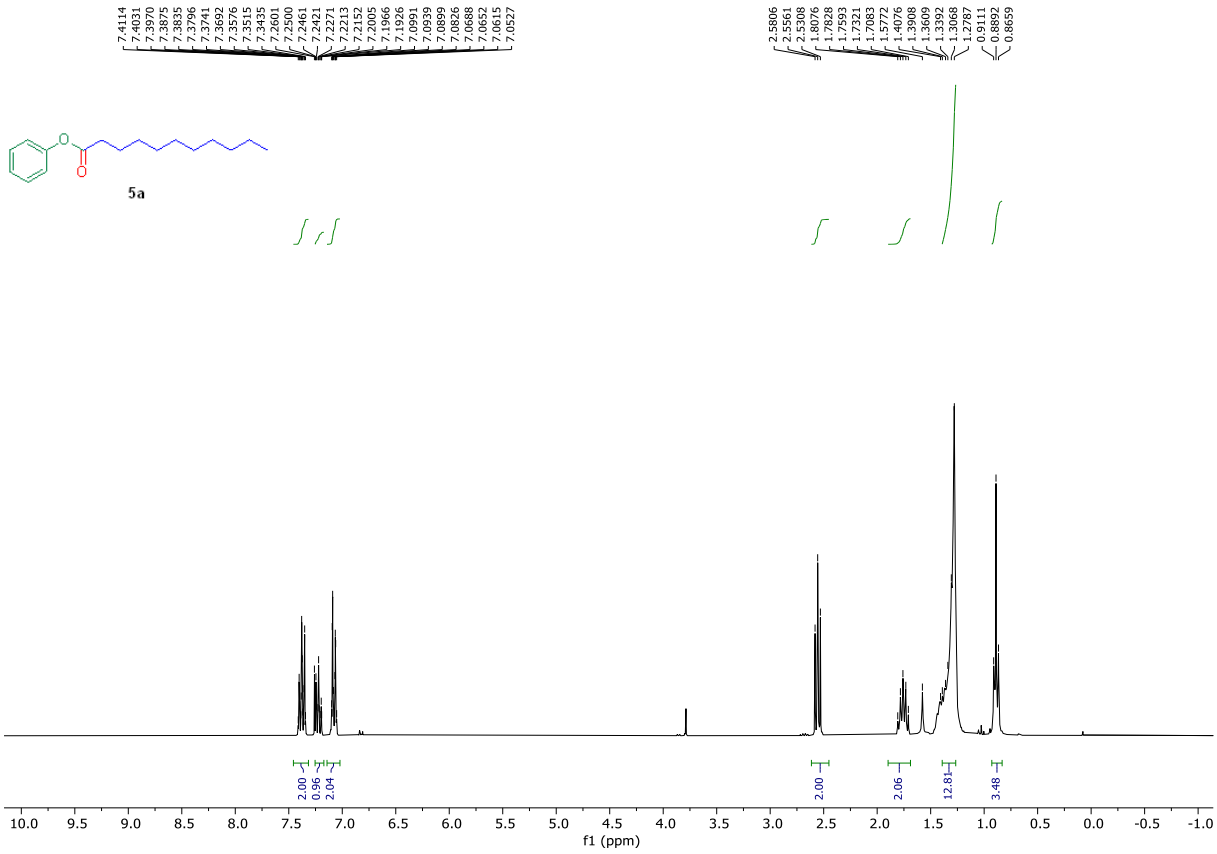
4g
f1 (ppm)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7.2500
7.2461
7.2421
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7.2152
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7.0899
7.0826
7.0688
7.0652
7.0615
7.0527
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2.5561
2.5308
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1.7321
1.7083
1.5772
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1.3392
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1.2787
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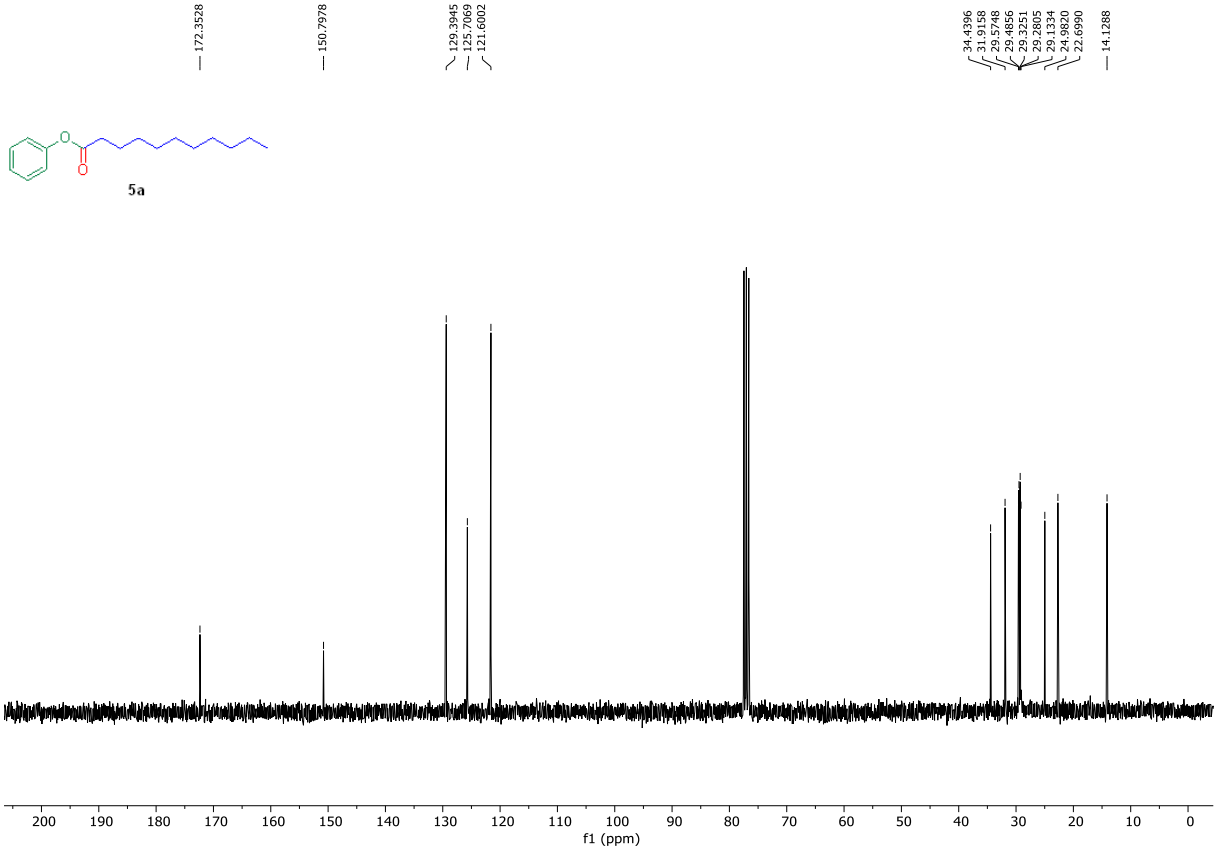
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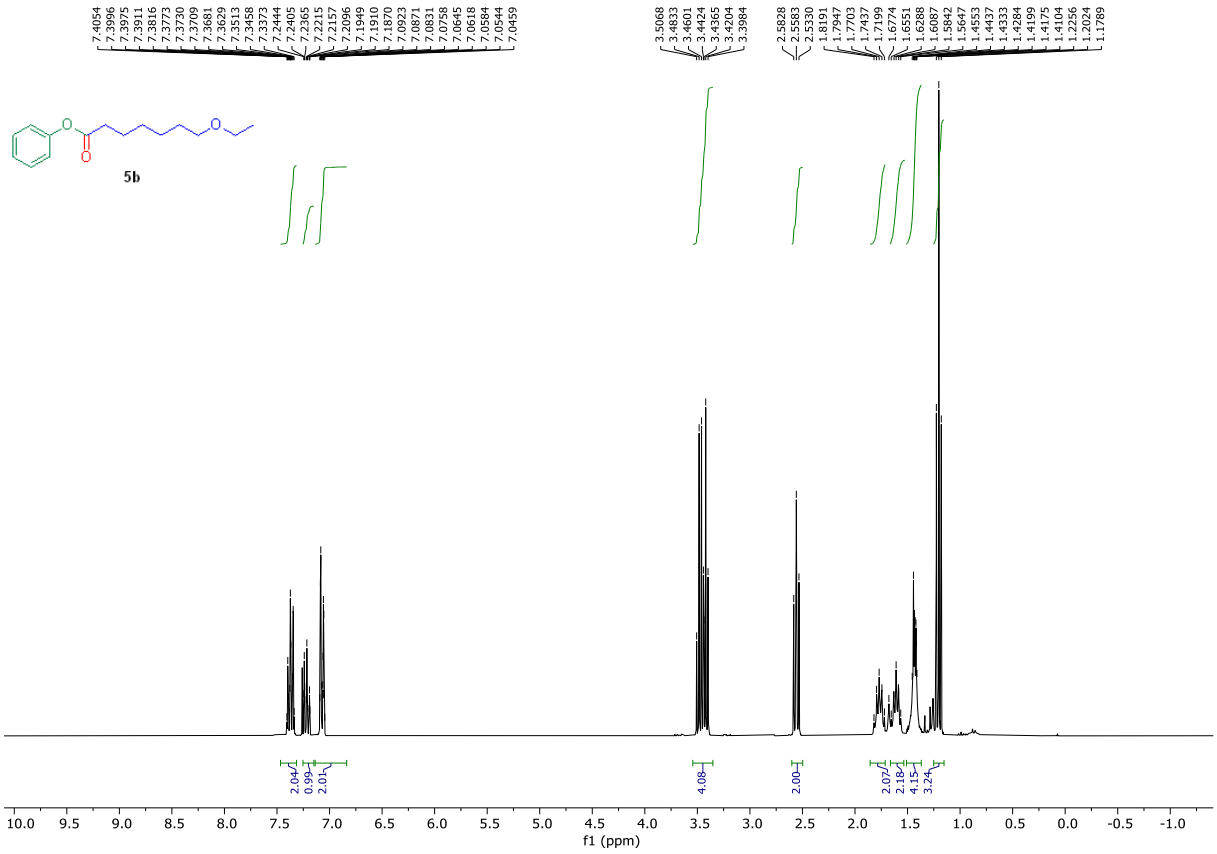
5a
f1 (ppm)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7.3458
7.3373
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7.2405
7.2365
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4.08
2.00
2.07
2.18
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3.24
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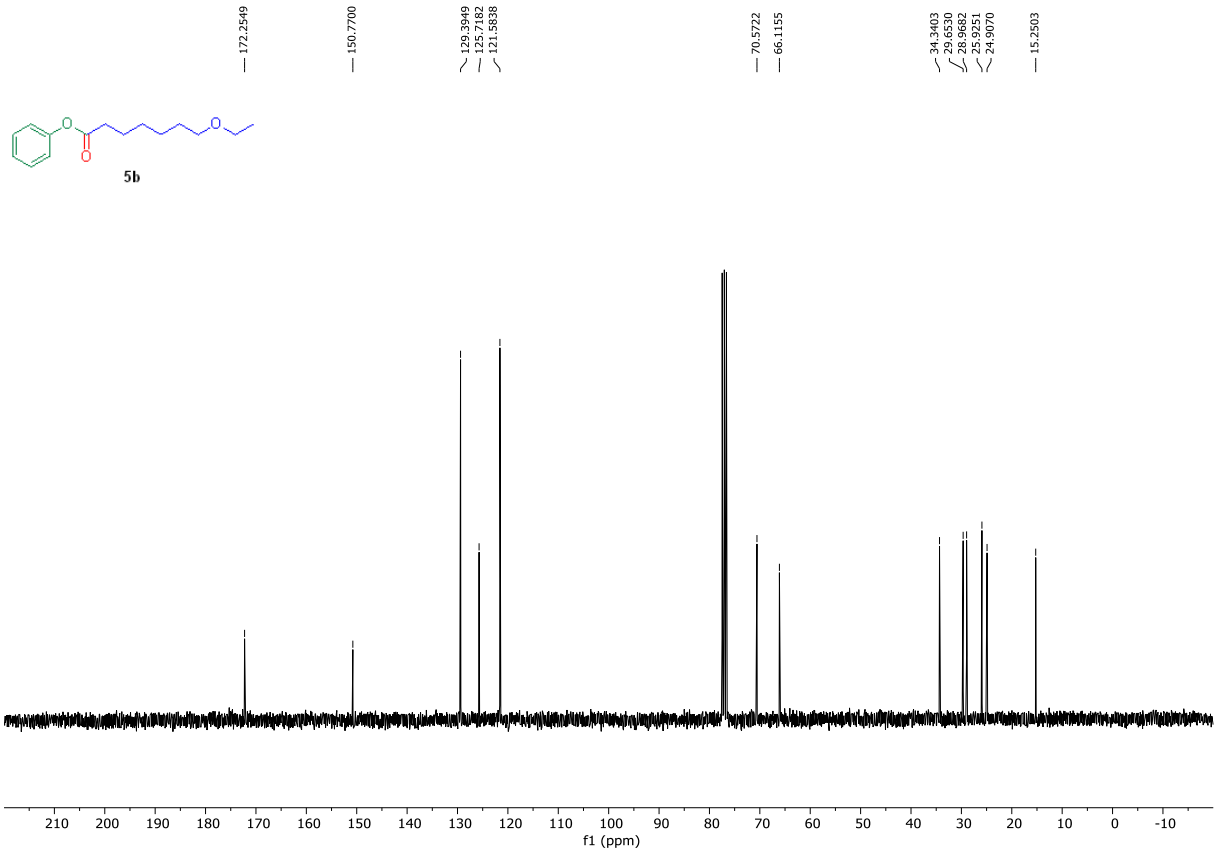
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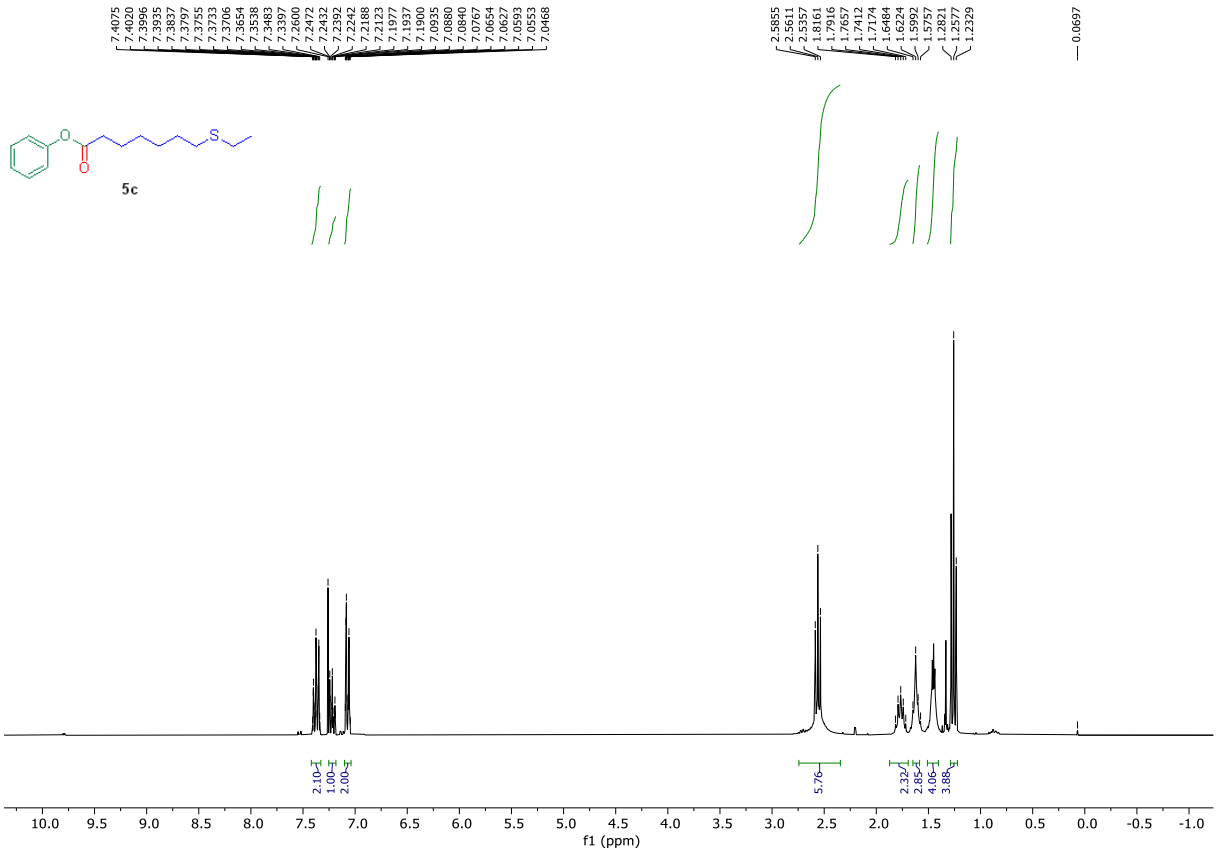
5b
f1 (ppm)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7.3397
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7.2432
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0.0697
O
O
S
5c
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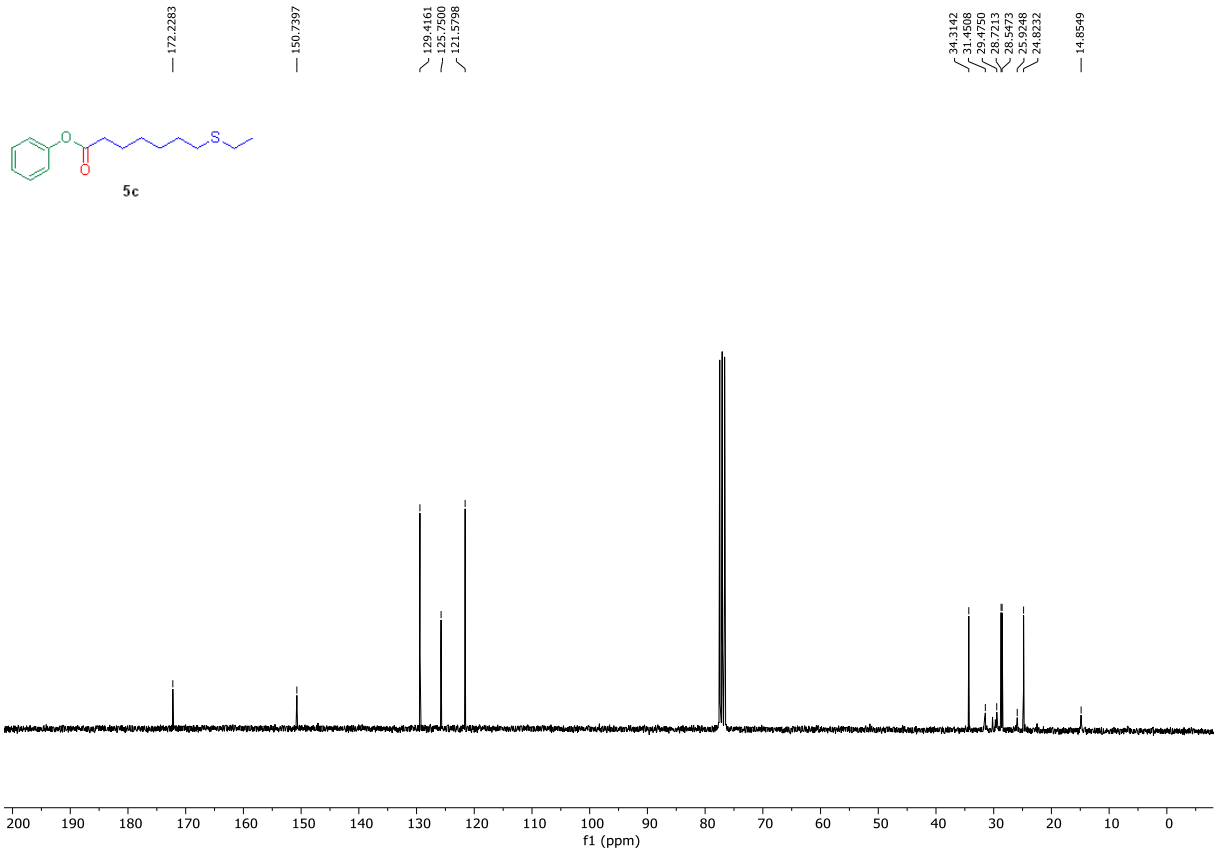
1.00
2.00
5.76
2.32
2.85
4.06
3.88
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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14.8549
O
O
S
5c
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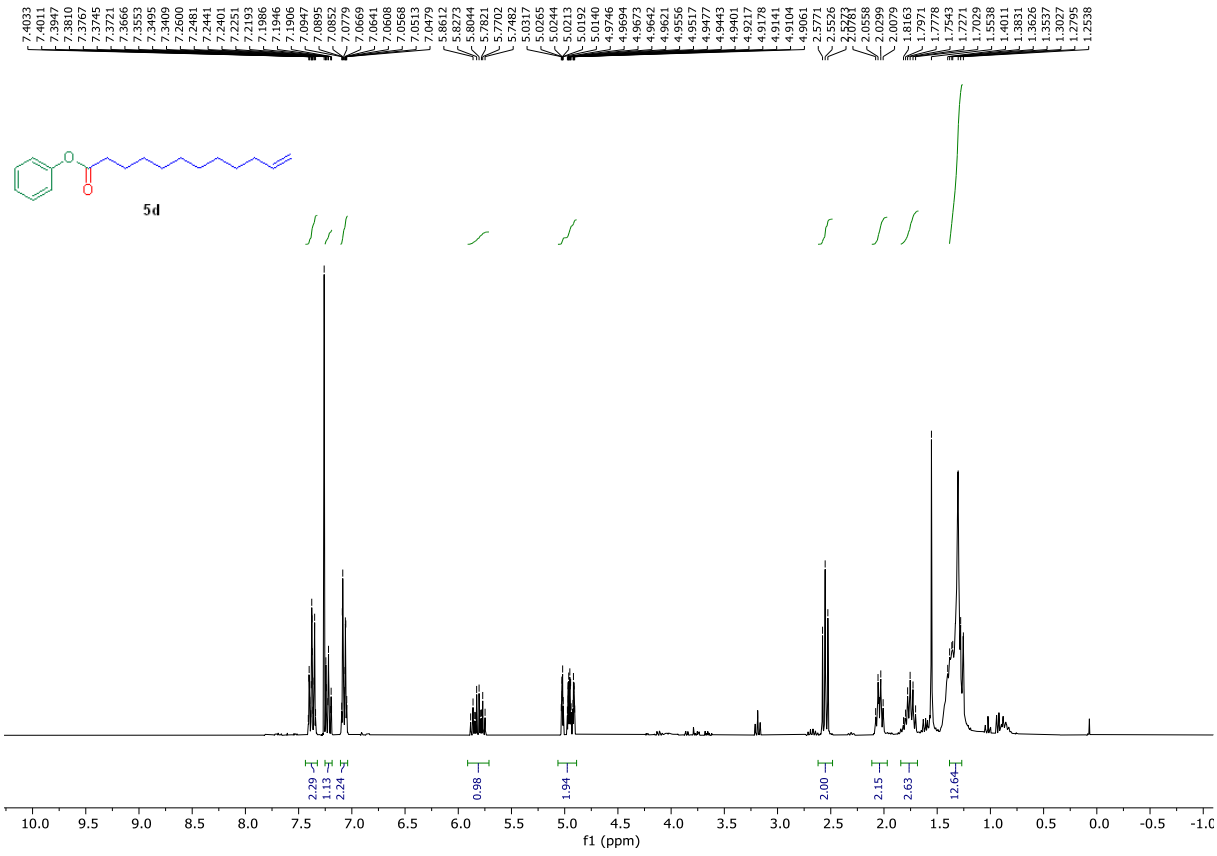
f1 (ppm)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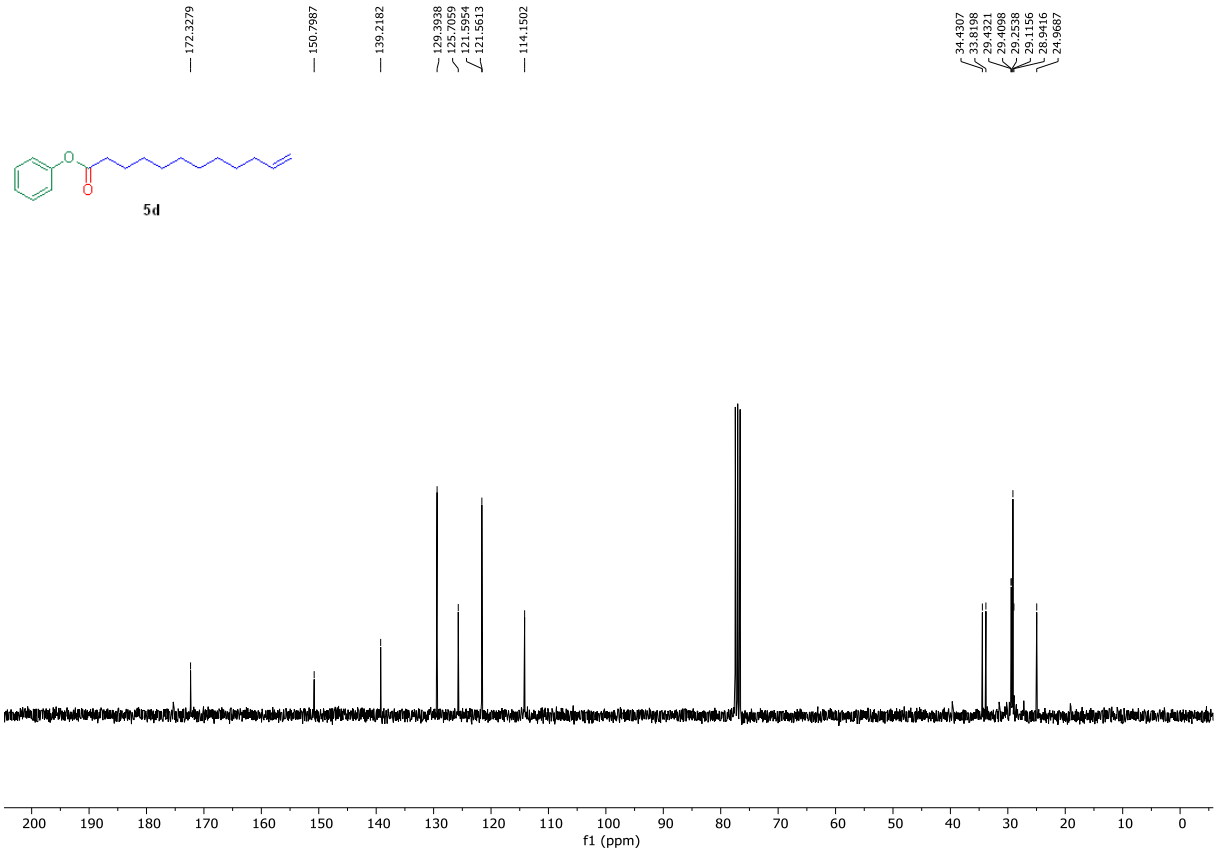
12.64
f1 (ppm)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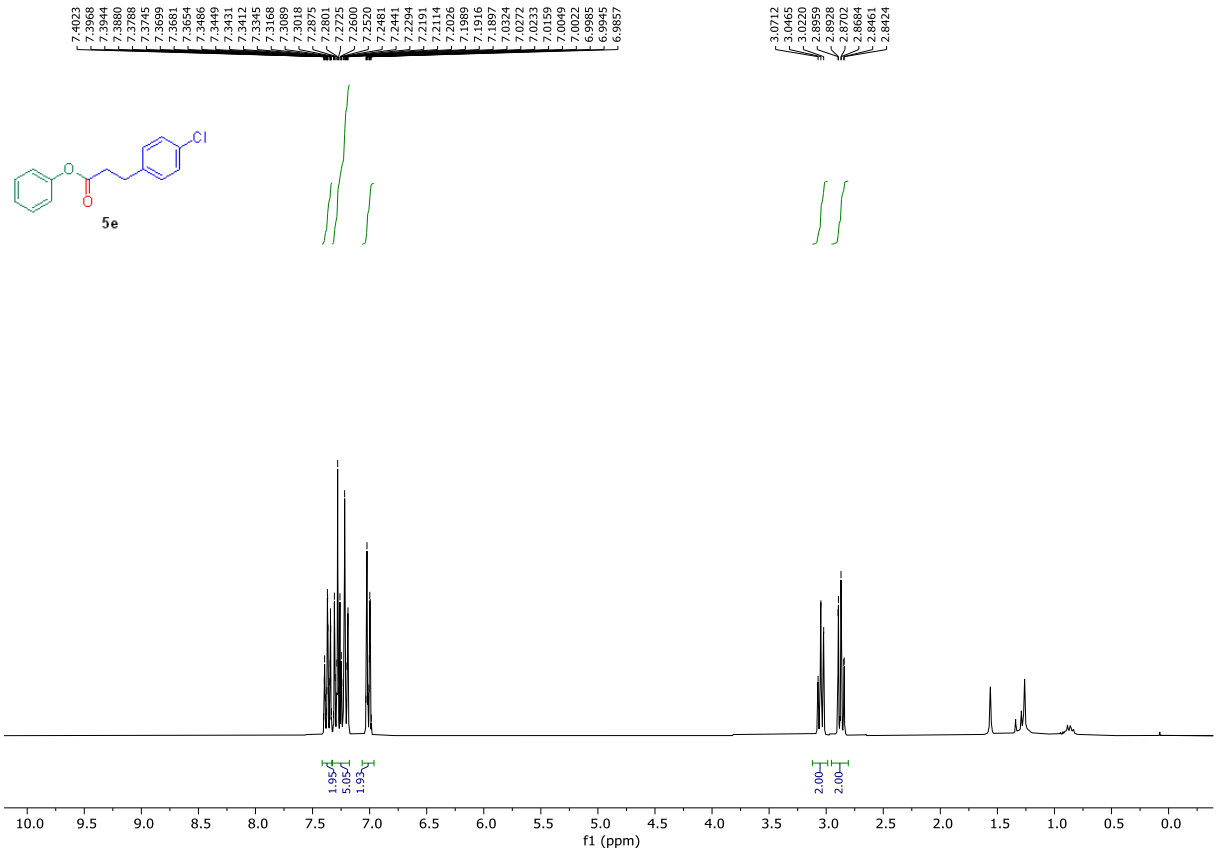
f1 (ppm)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6.9857
3.0712
3.0465
3.0220
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2.8928
2.8702
2.8684
2.8461
2.8424
Cl
O
O
5e
1.95
5.05
1.93
2.00
2.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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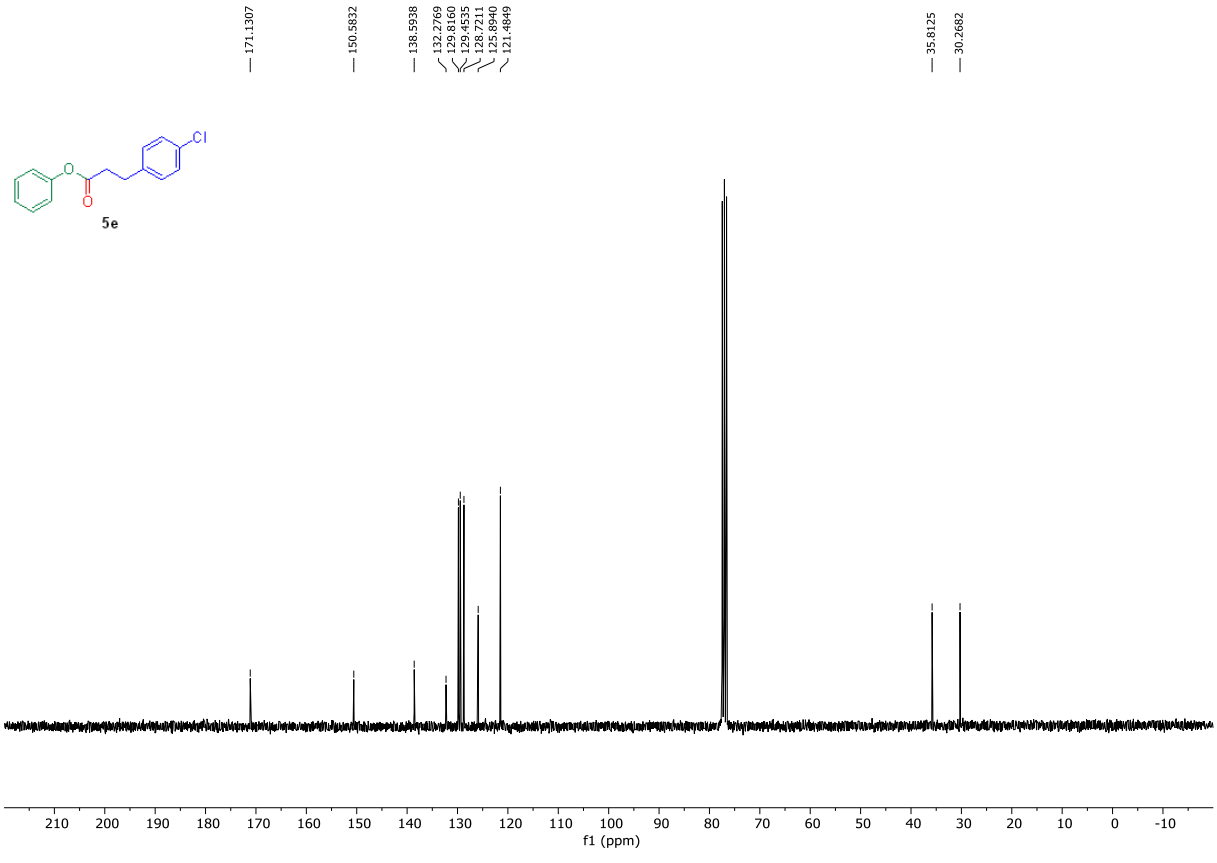
f1 (ppm)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Cl
O
O
5e
210
200
190
180
170
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120
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100
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80
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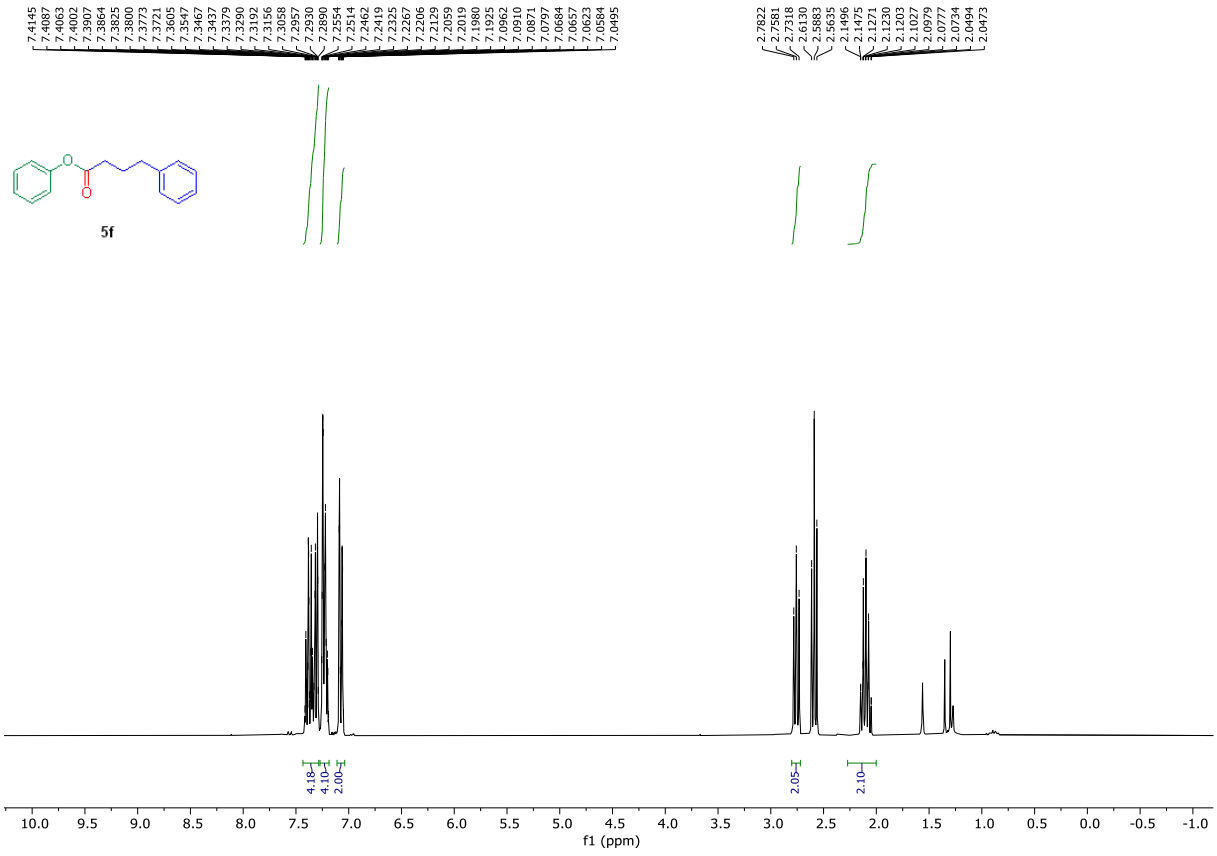
-10
f1 (ppm)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7.3437
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7.2930
7.2890
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7.2514
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7.2419
7.2325
7.2267
7.2206
7.2129
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7.2019
7.1980
7.1925
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7.0910
7.0871
7.0797
7.0684
7.0657
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7.0495
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2.7581
2.7318
2.6130
2.5883
2.5635
2.1496
2.1475
2.1271
2.1230
2.1203
2.1027
2.0979
2.0777
2.0734
2.0494
2.0473
5f
4.18
4.10
2.00
2.05
2.10
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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2.0
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0.0
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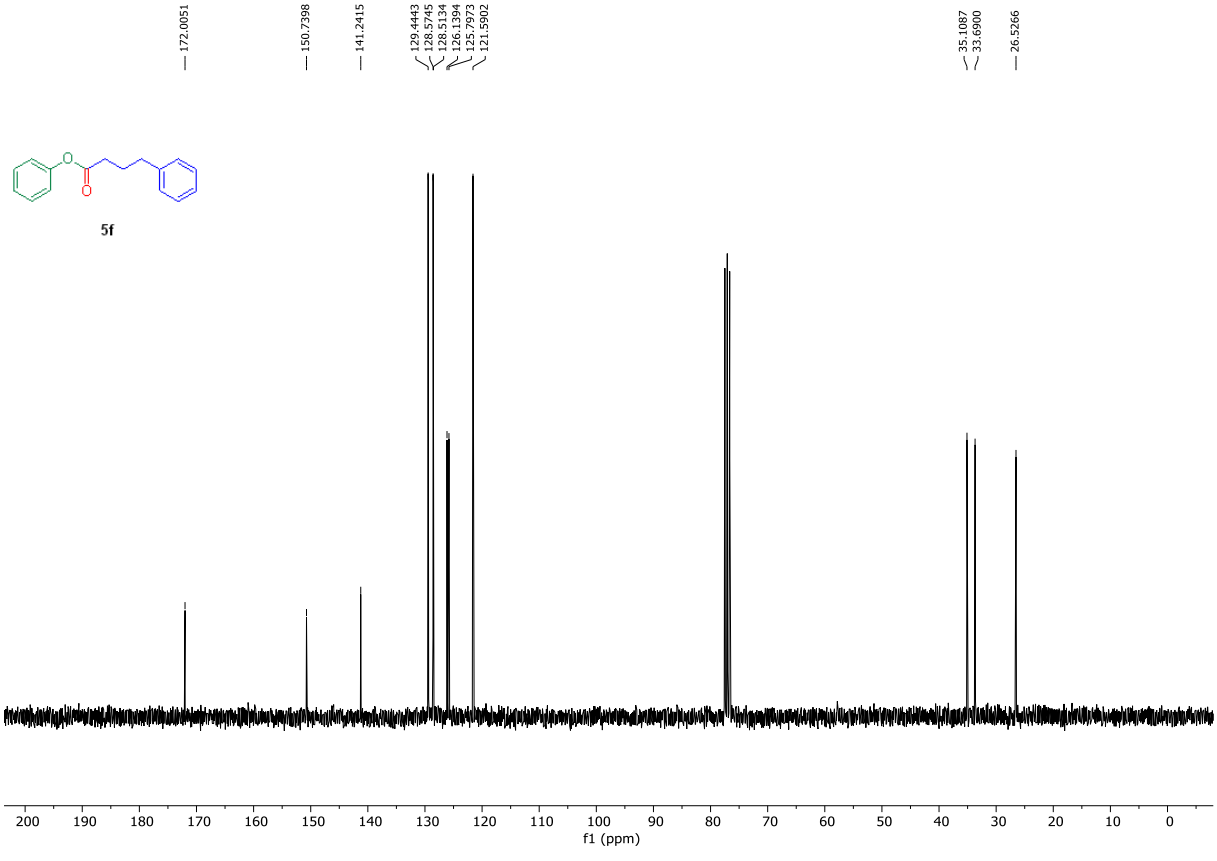
-1.0
f1 (ppm)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26.5266
5f
200
190
180
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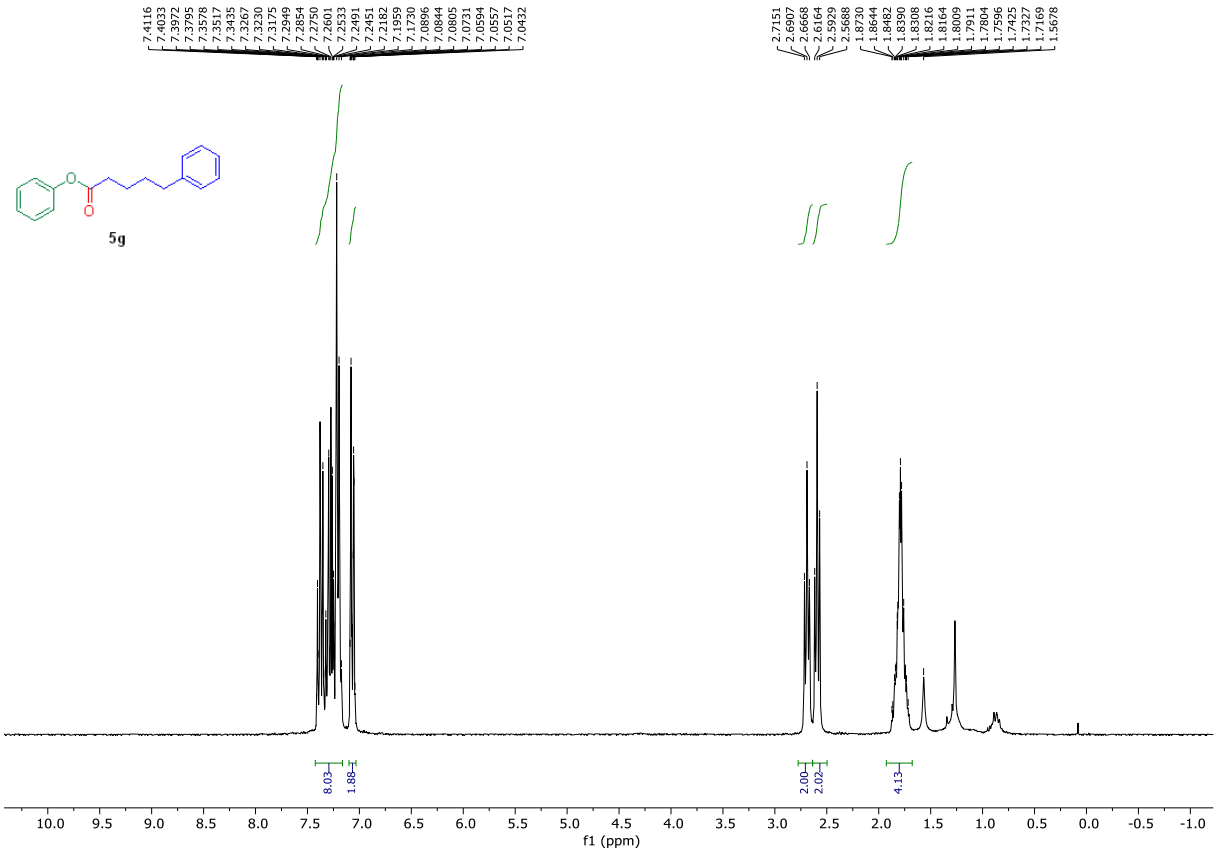
f1 (ppm)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7.2854
7.2750
7.2601
7.2533
7.2491
7.2451
7.2182
7.1959
7.1730
7.0896
7.0844
7.0805
7.0731
7.0594
7.0557
7.0517
7.0432
2.7151
2.6907
2.6668
2.6164
2.5929
2.5688
1.8730
1.8644
1.8482
1.8390
1.8308
1.8216
1.8164
1.8009
1.7911
1.7804
1.7596
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1.7169
1.5678
5g
8.03
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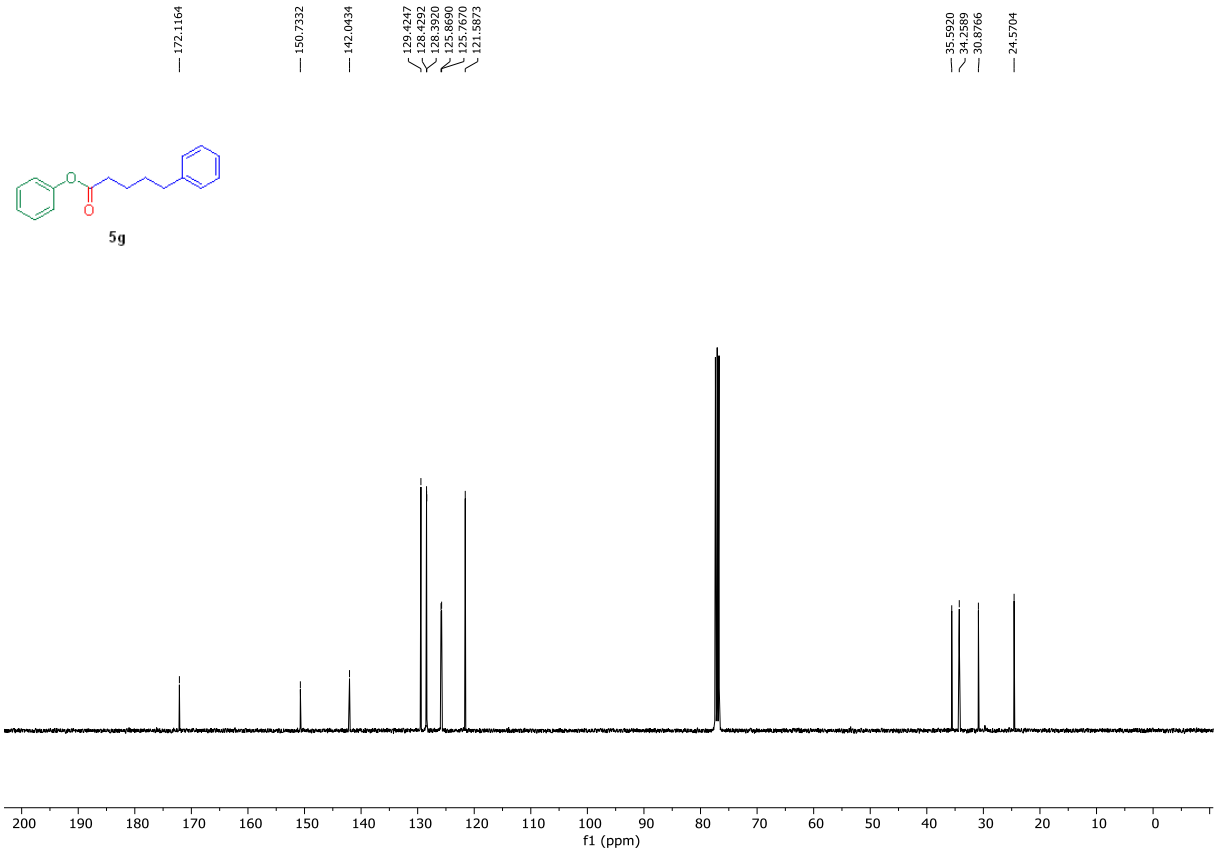
2.00
2.02
4.13
f1 (ppm)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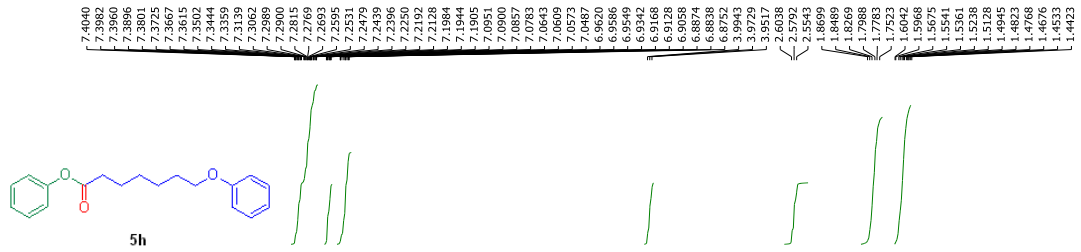
24.5704
5g
f1 (ppm)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7.3359
7.3139
7.3062
7.2989
7.2900
7.2815
7.2769
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7.2595
7.2531
7.2479
7.2439
7.2396
7.2250
7.2192
7.2128
7.1984
7.1944
7.1905
7.0951
7.0900
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7.0783
7.0643
7.0609
7.0573
7.0487
6.9600
6.9586
6.9549
6.9342
6.9168
6.9128
6.9058
6.8874
6.8838
6.8752
3.9943
3.9729
3.9517
2.6038
2.5792
2.5543
1.8699
1.8489
1.8269
1.7988
1.7783
1.7523
1.6042
1.5968
1.5675
1.5541
1.5361
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1.4768
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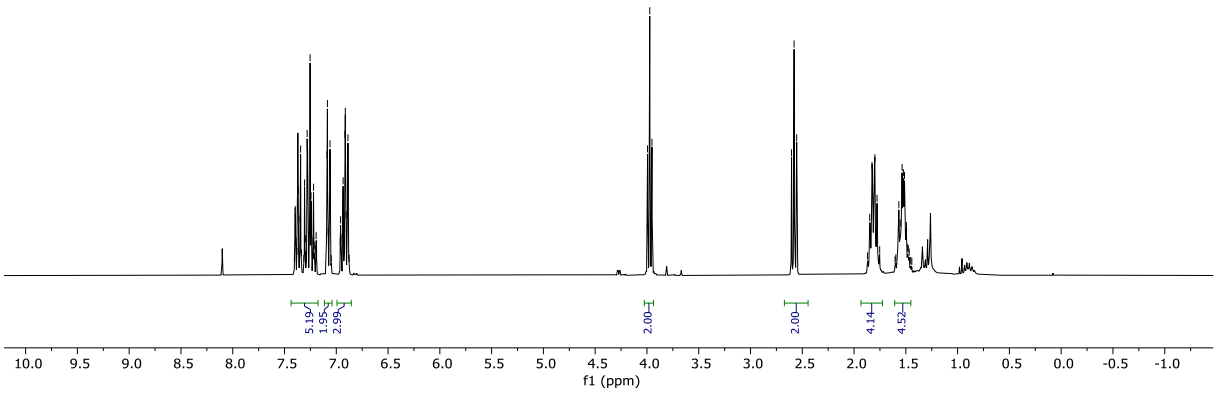
1.4423

O
O
O

5h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1.95
2.99
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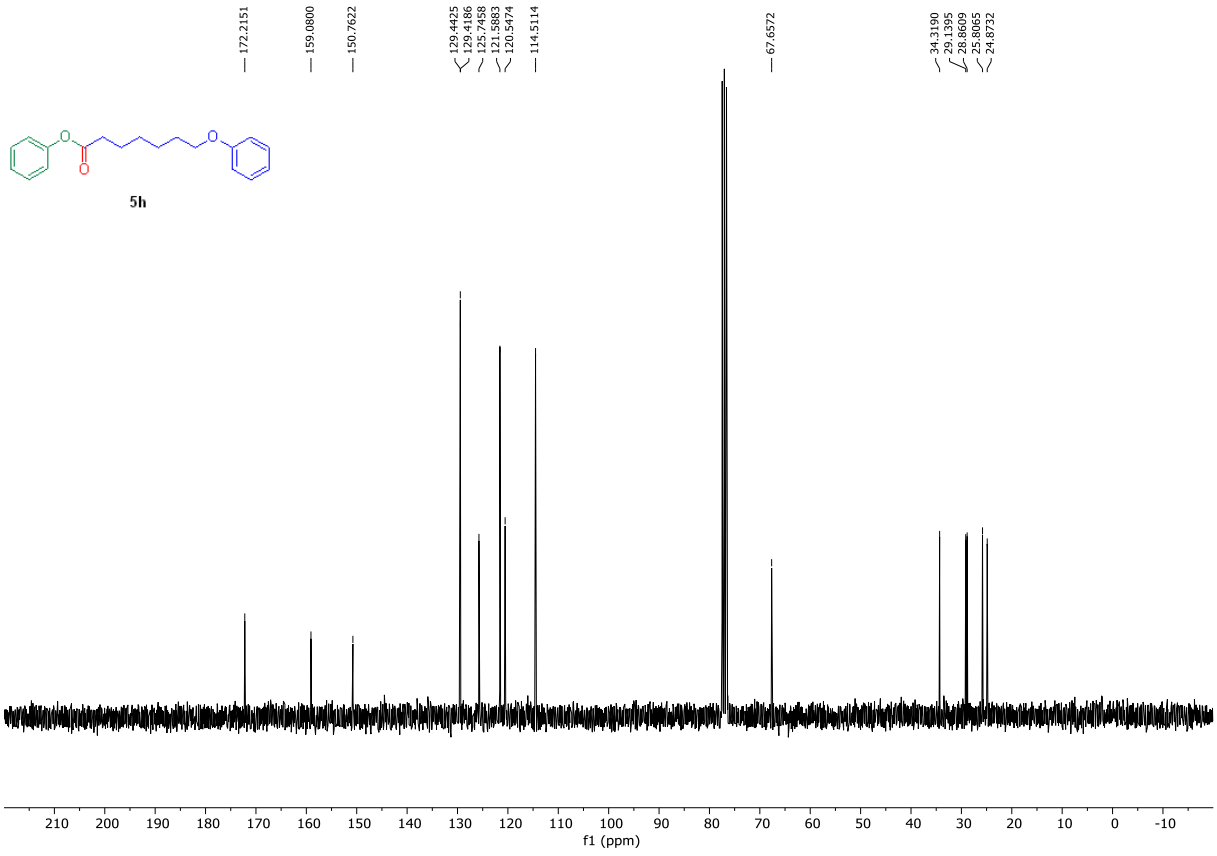
2.00
4.14
4.52
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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114.5114
67.6572
34.3190
29.1395
28.8609
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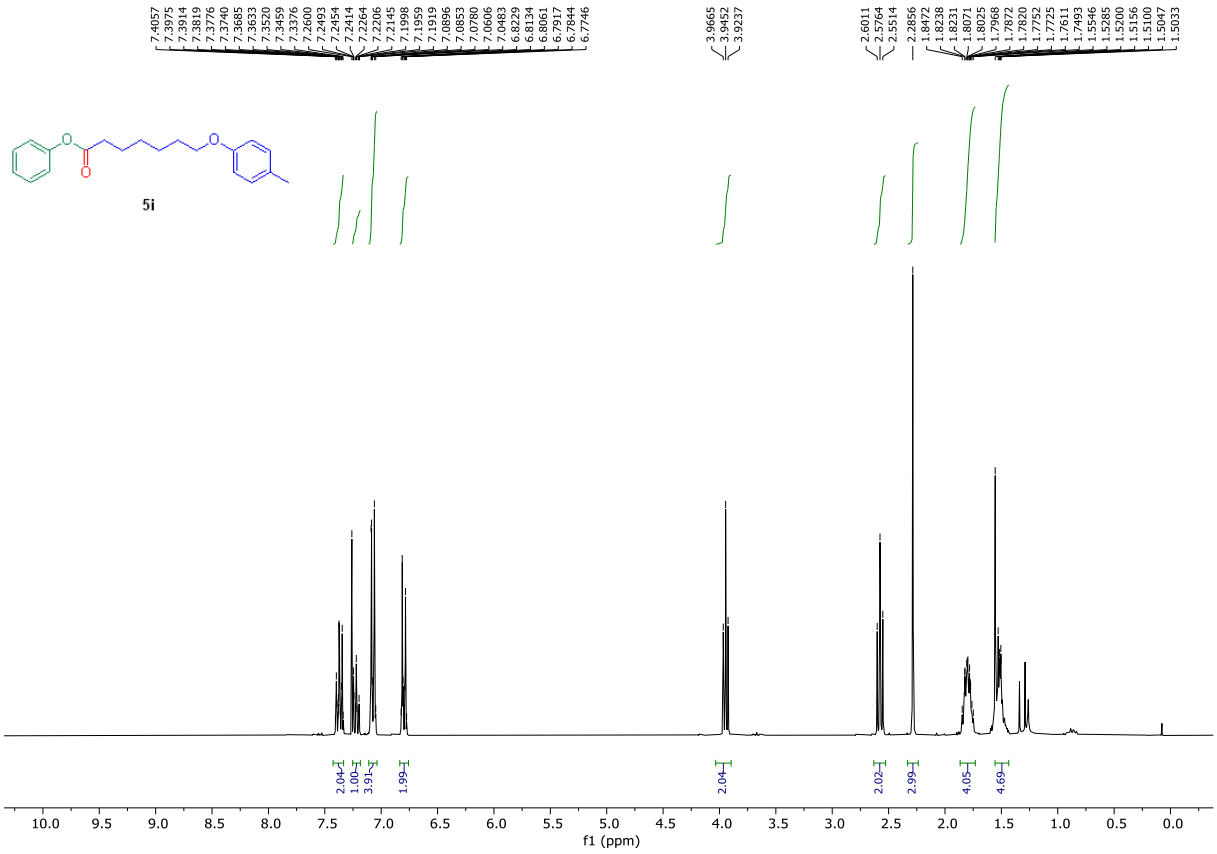
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

O
O
O

5h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7.2454
7.2414
7.2264
7.2206
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7.1998
7.1959
7.1919
7.0896
7.0853
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6.8134
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6.7917
6.7844
6.7746
3.9665
3.9452
3.9237
2.6011
2.5764
2.5514
2.2856
1.8472
1.8238
1.8231
1.8071
1.8025
1.7968
1.7872
1.7820
1.7752
1.7725
1.7611
1.7493
1.5546
1.5285
1.5200
1.5156
1.5100
1.5047
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5i
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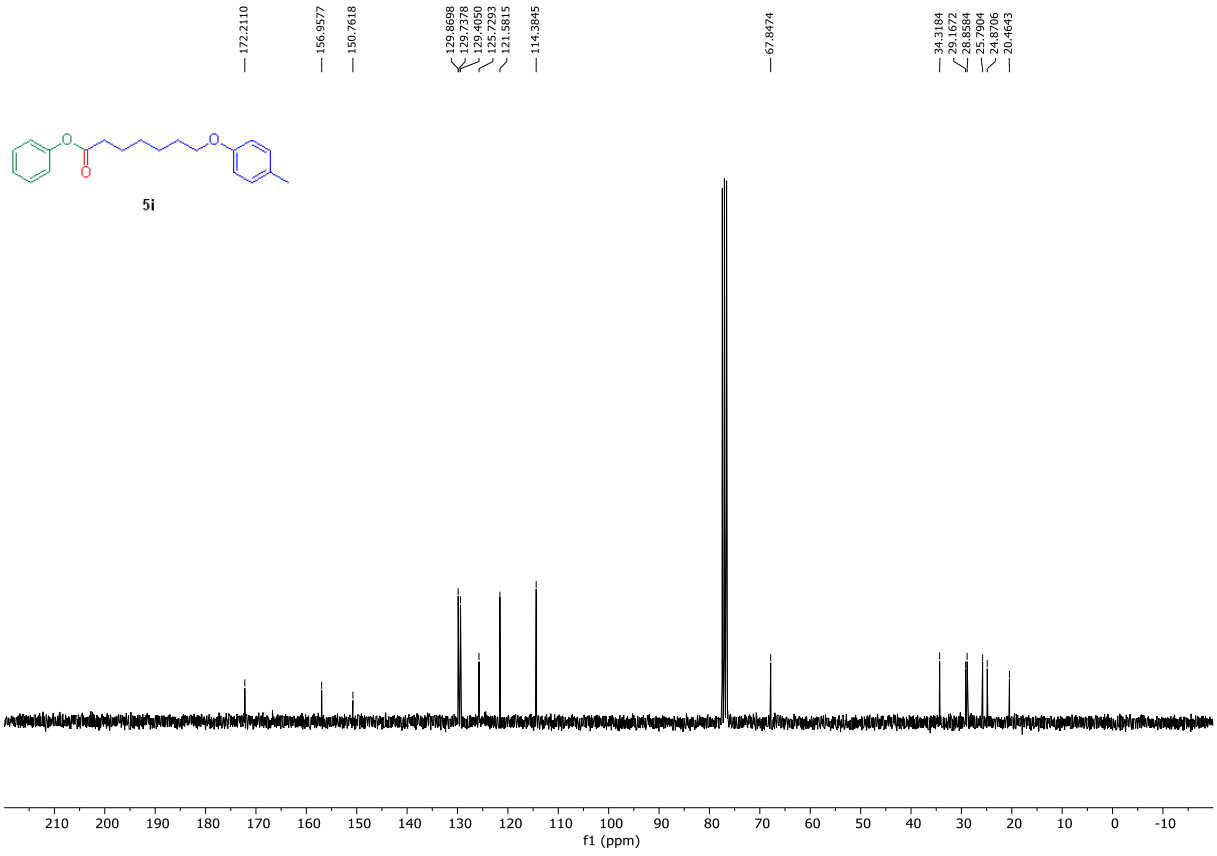
1.00
3.91
1.99
2.04
2.02
2.99
4.05
4.69
f1 (ppm)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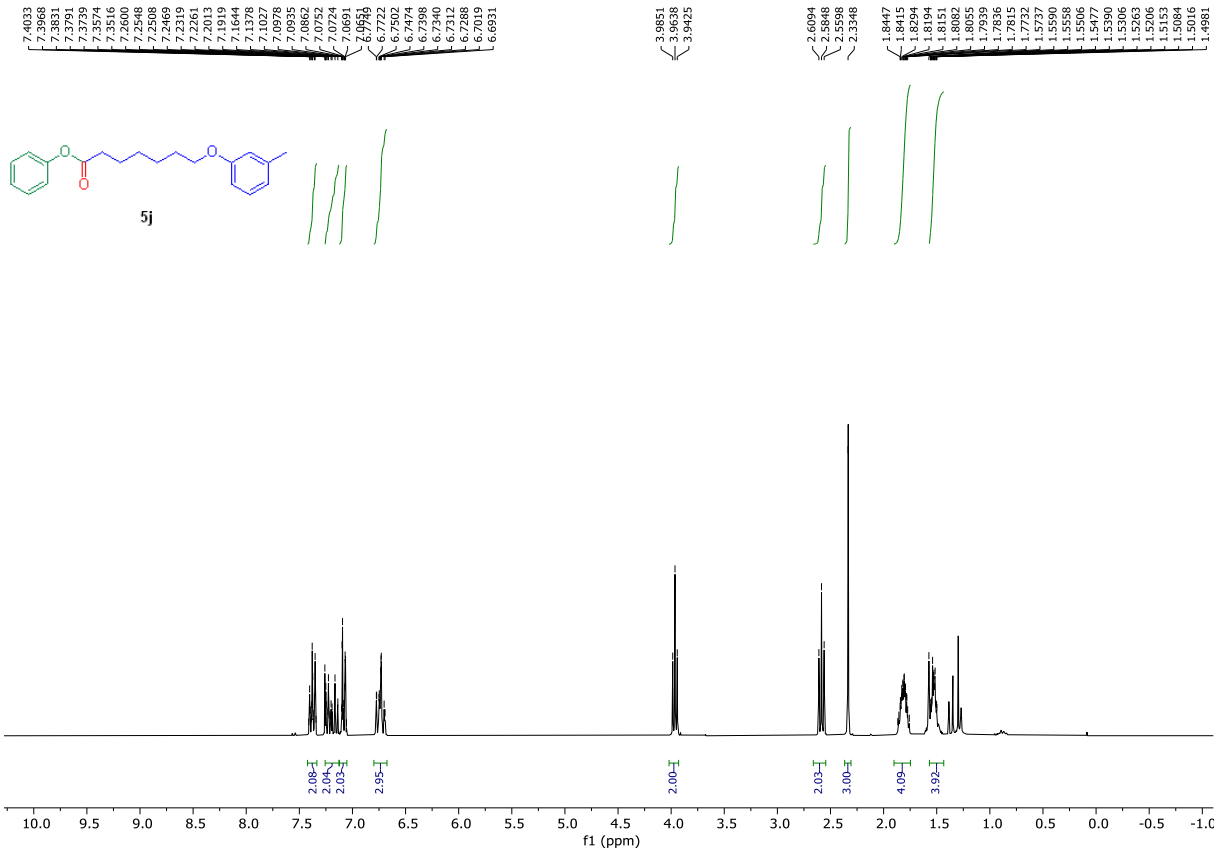
5i
f1 (ppm)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7.1919
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O
O
O
5j
2.08
2.04
2.03
2.95
2.00
2.03
3.00
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7.0
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5.0
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3.0
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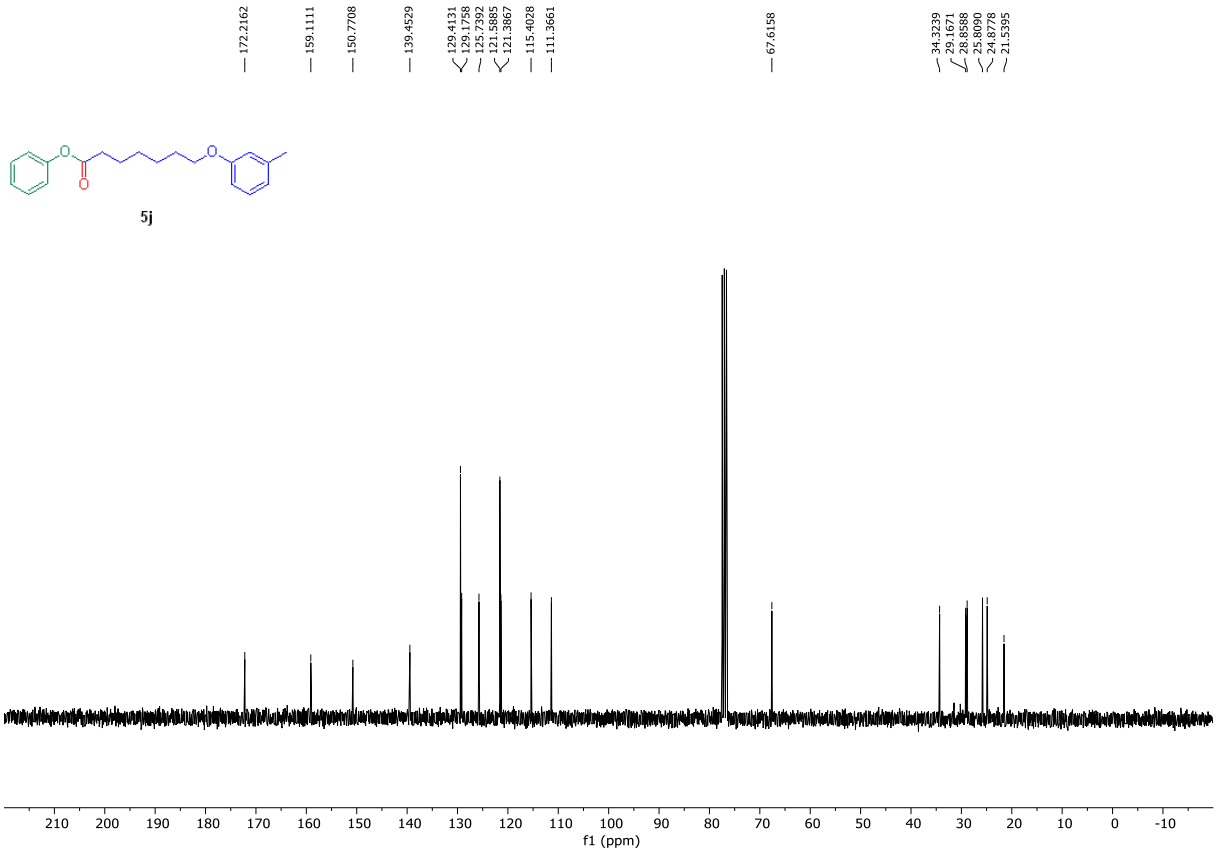
0.5
0.0
-0.5
f1 (ppm)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21.5395
O
O
O
5j
210
200
190
180
170
160
150
140
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120
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100
90
80
70
60
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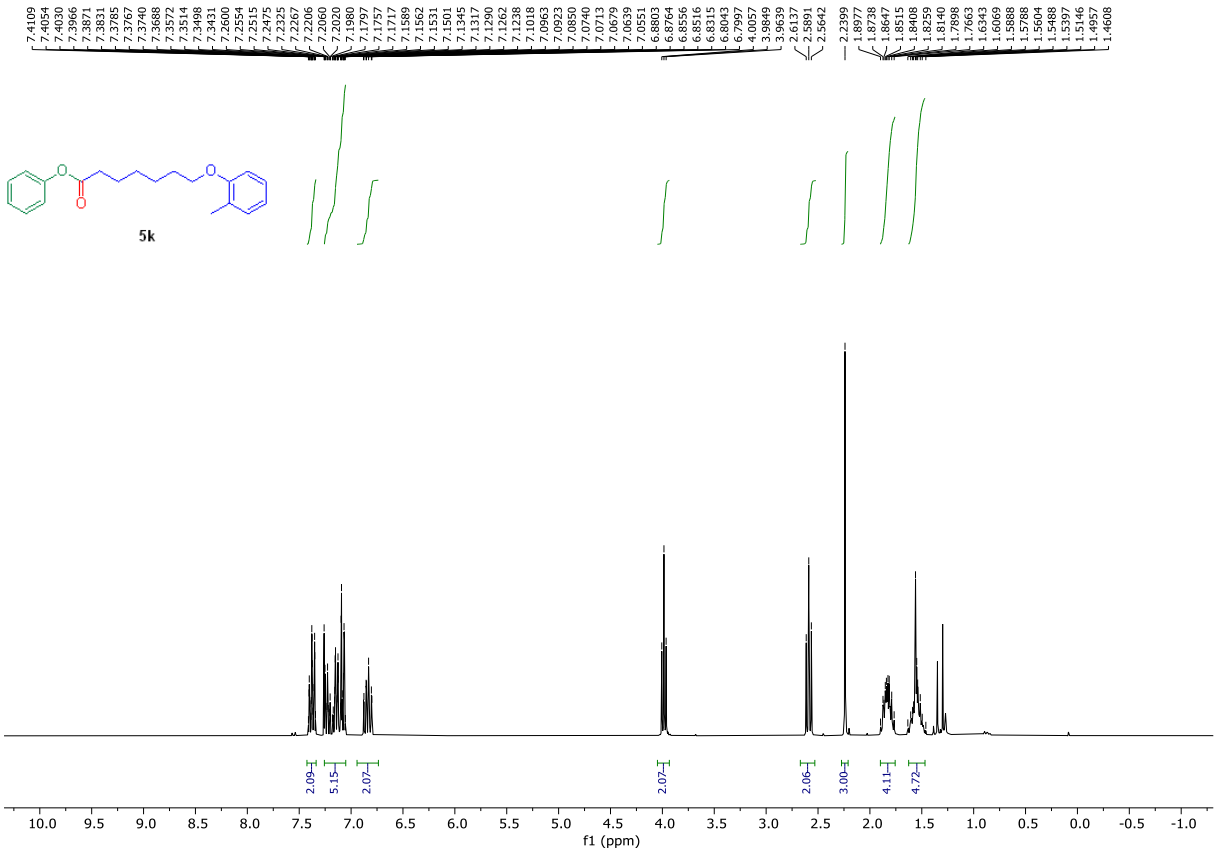
40
30
20
10
0
-10
f1 (ppm)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7.2554
7.2515
7.2475
7.2325
7.2267
7.2206
7.2060
7.2020
7.1980
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7.1531
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7.1345
7.1317
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7.0963
7.0923
7.0850
7.0740
7.0713
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1.5488
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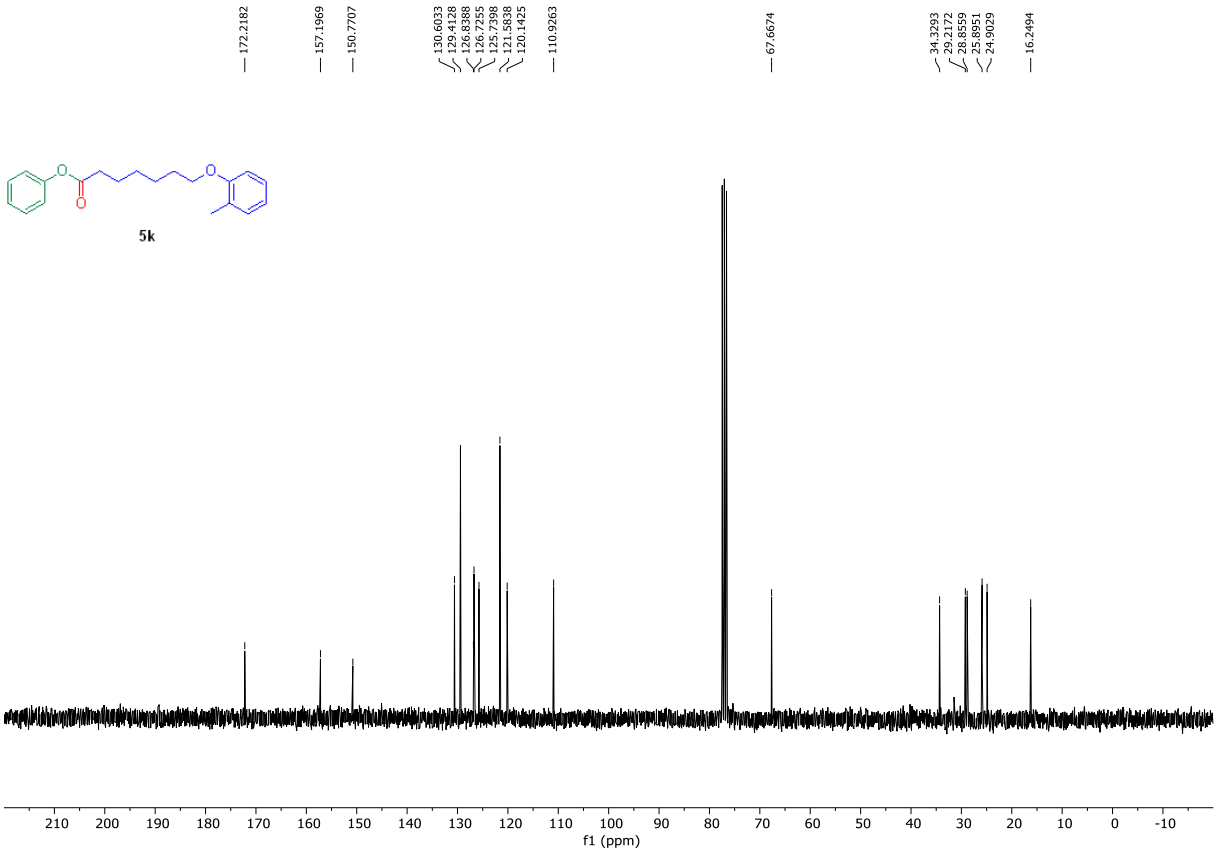
1.4608
5k
2.09
5.15
2.07
2.07
2.06
3.00
4.11
4.72
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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34.3293
29.2172
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24.9029
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5k
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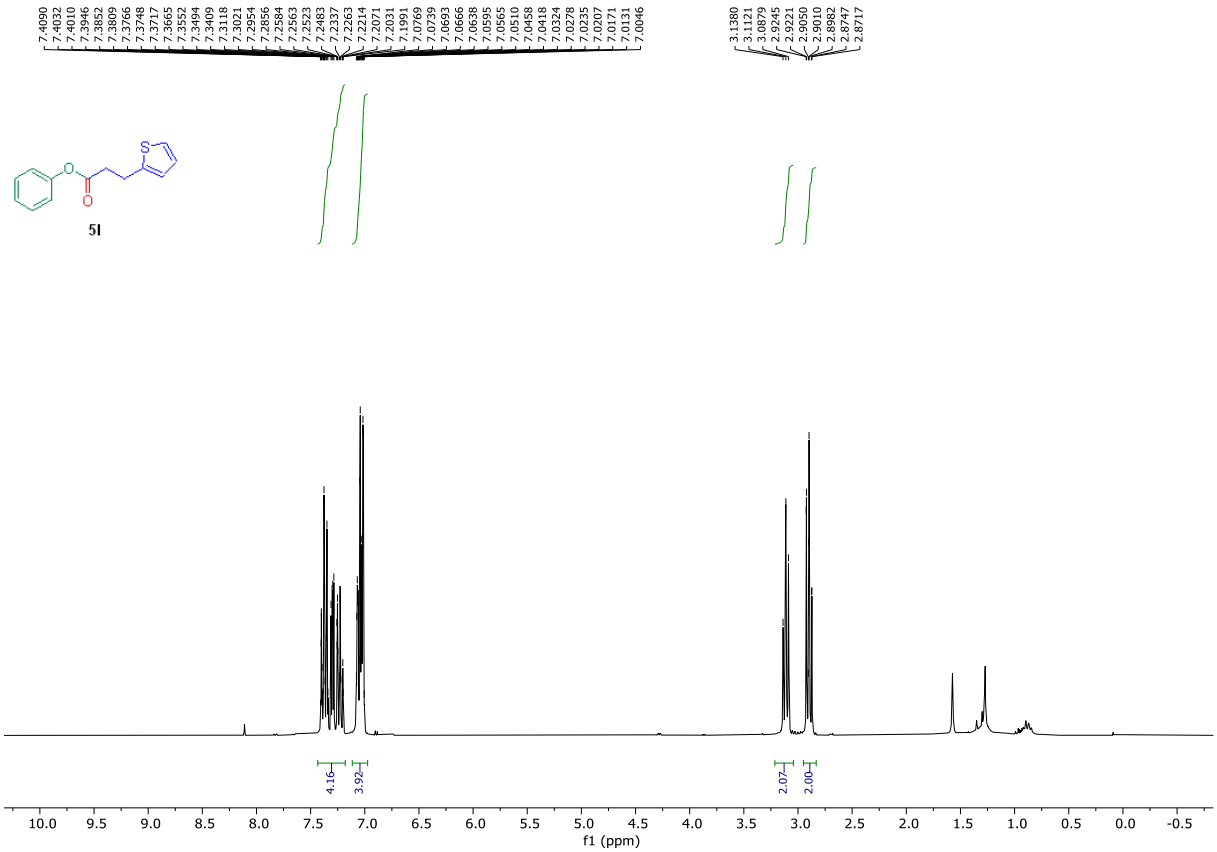
f1 (ppm)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3.0879
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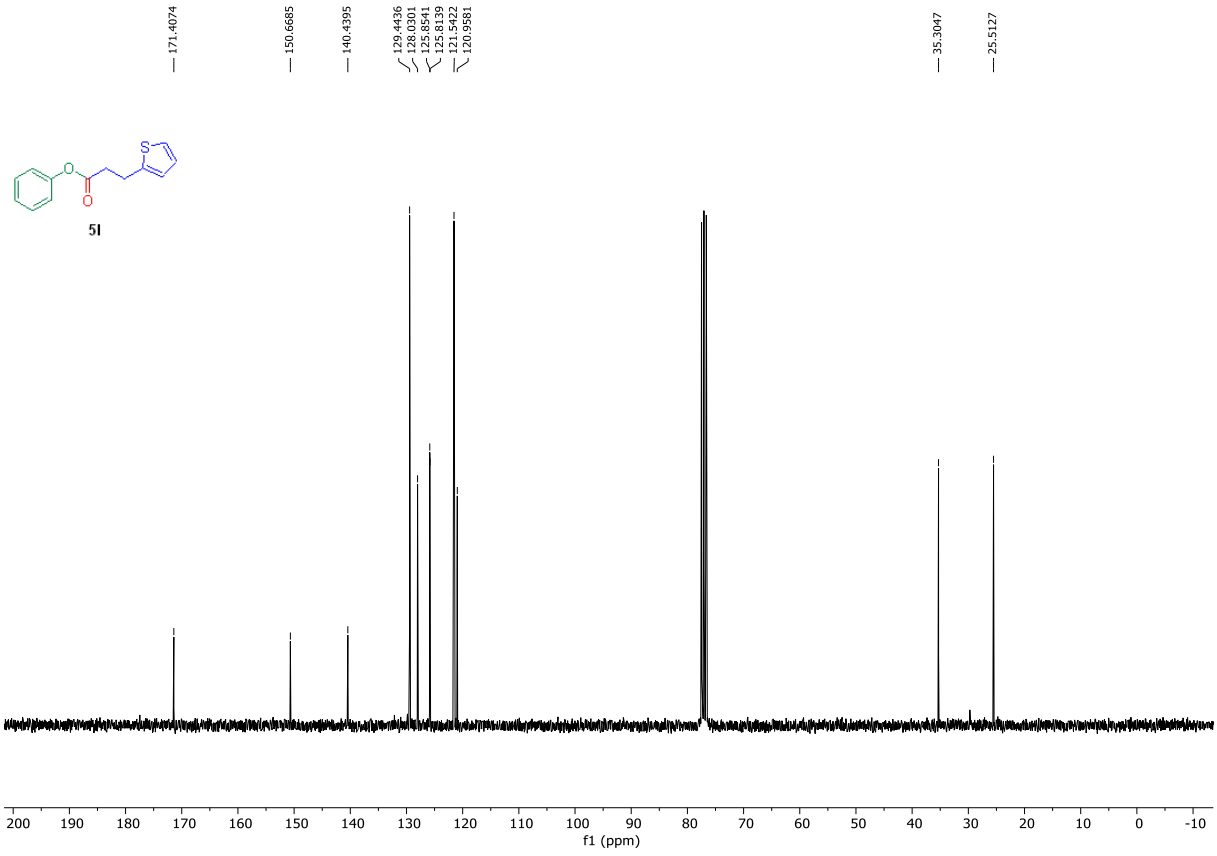
2.9221
2.9050
2.9010
2.8982
2.8747
2.8717
O
O
S
5l
4.16
3.92
2.07
2.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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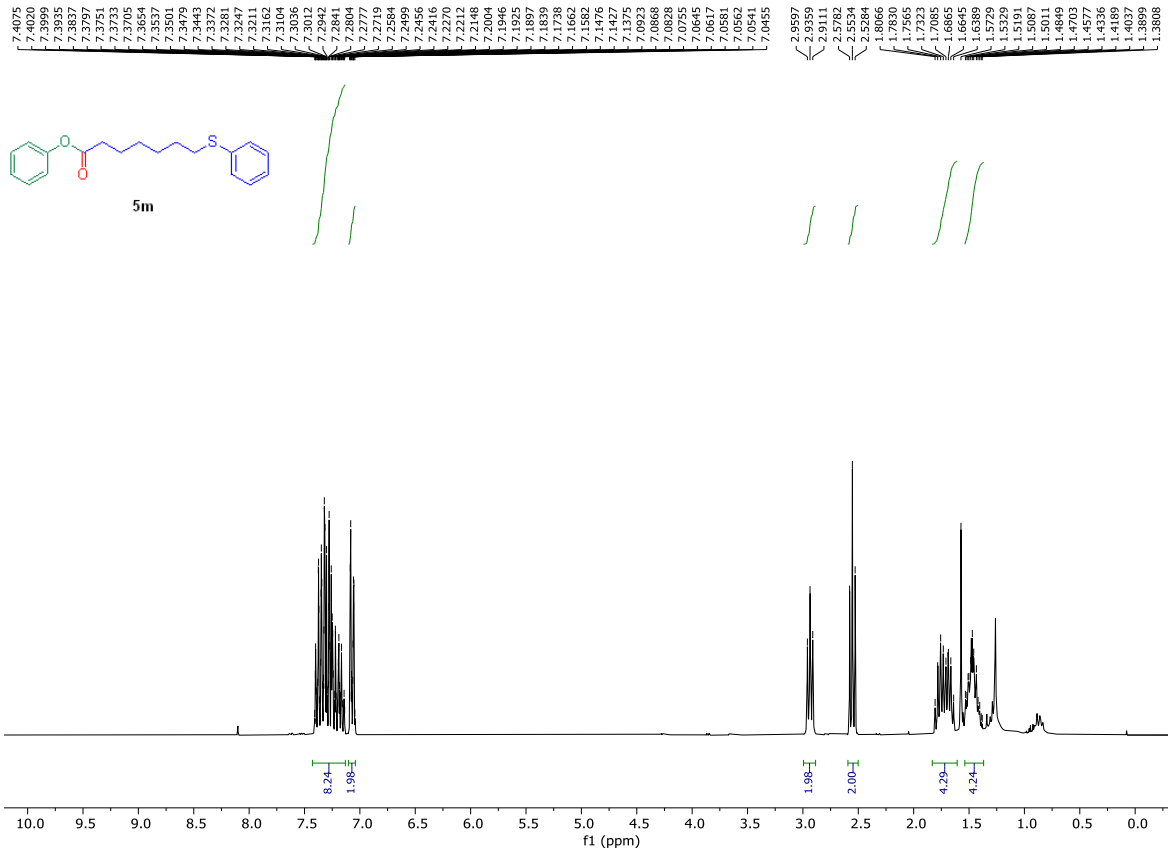
O
O
S
5l
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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1.98
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4.24
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9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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3.0
2.5
2.0
1.5
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0.5
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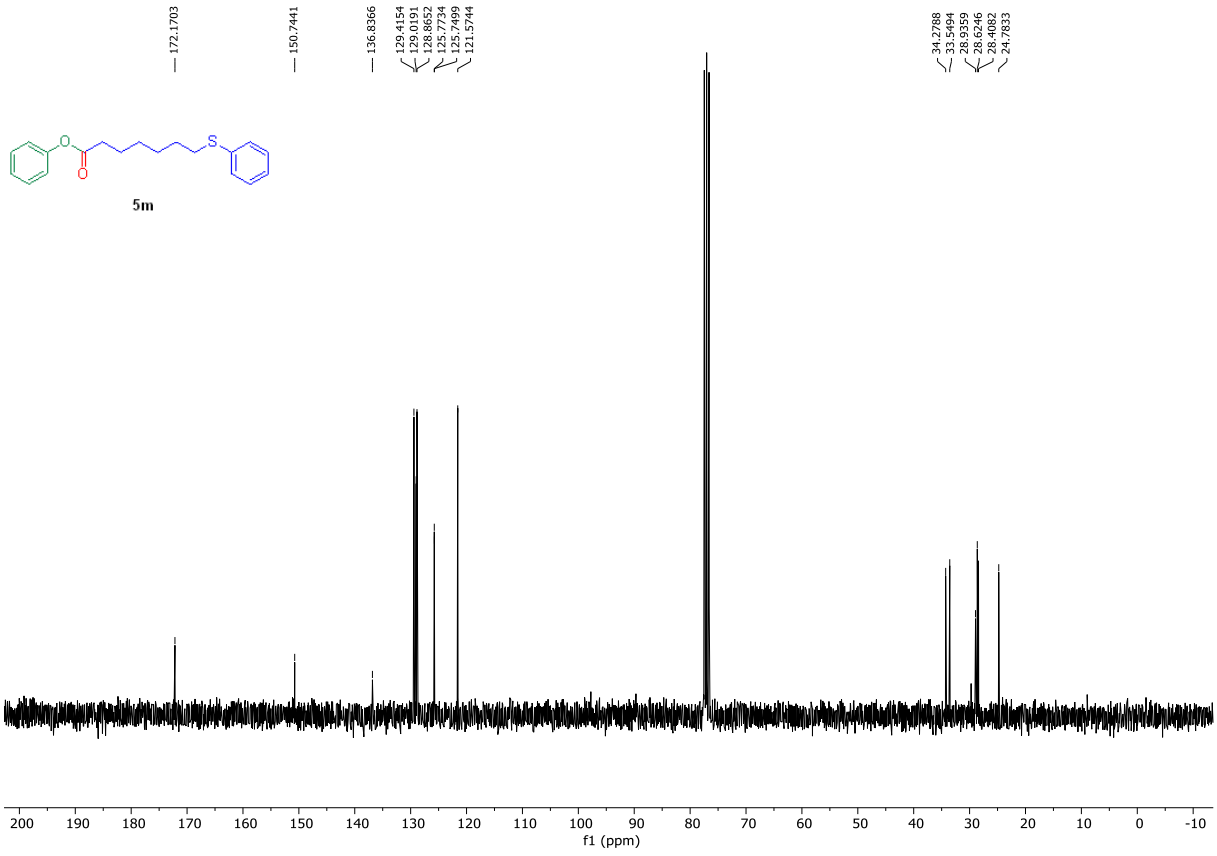
-0.5
f1 (ppm)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24.7833
5m
200
190
180
170
160
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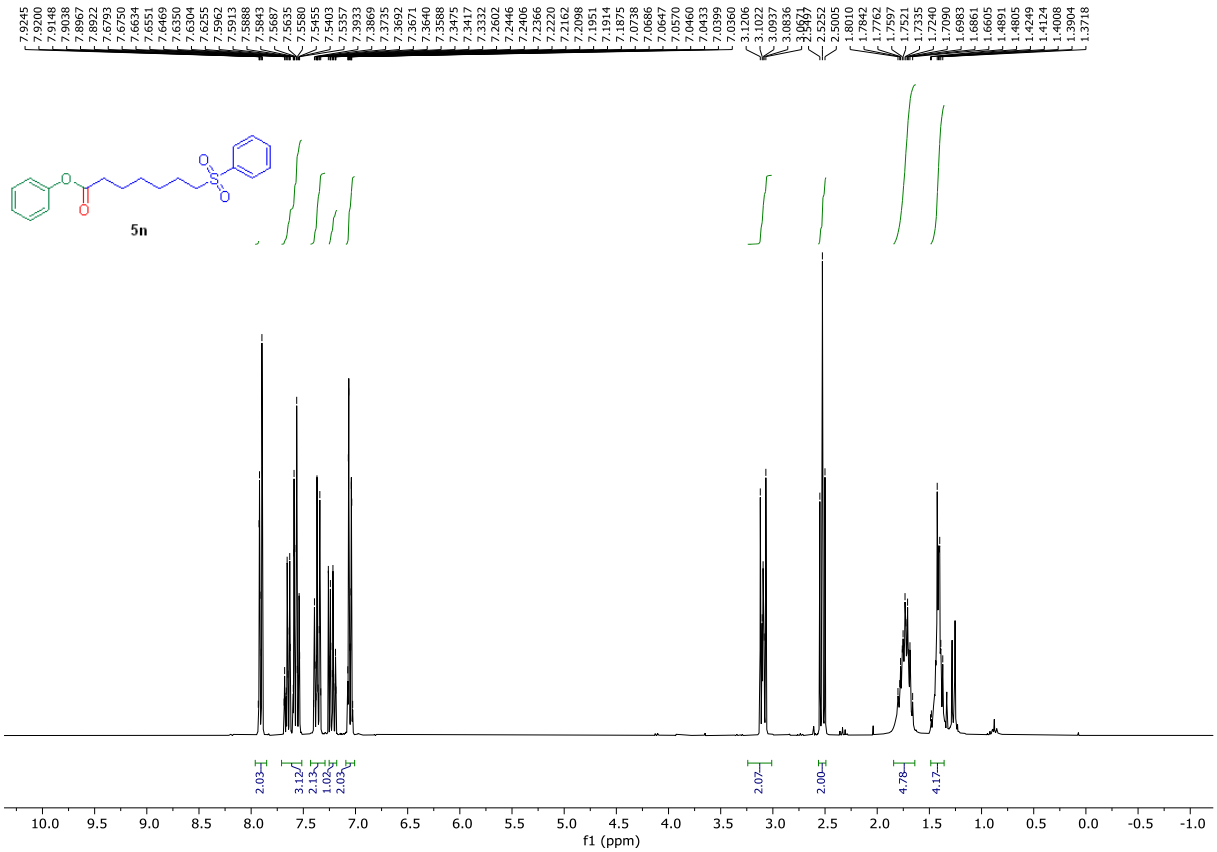
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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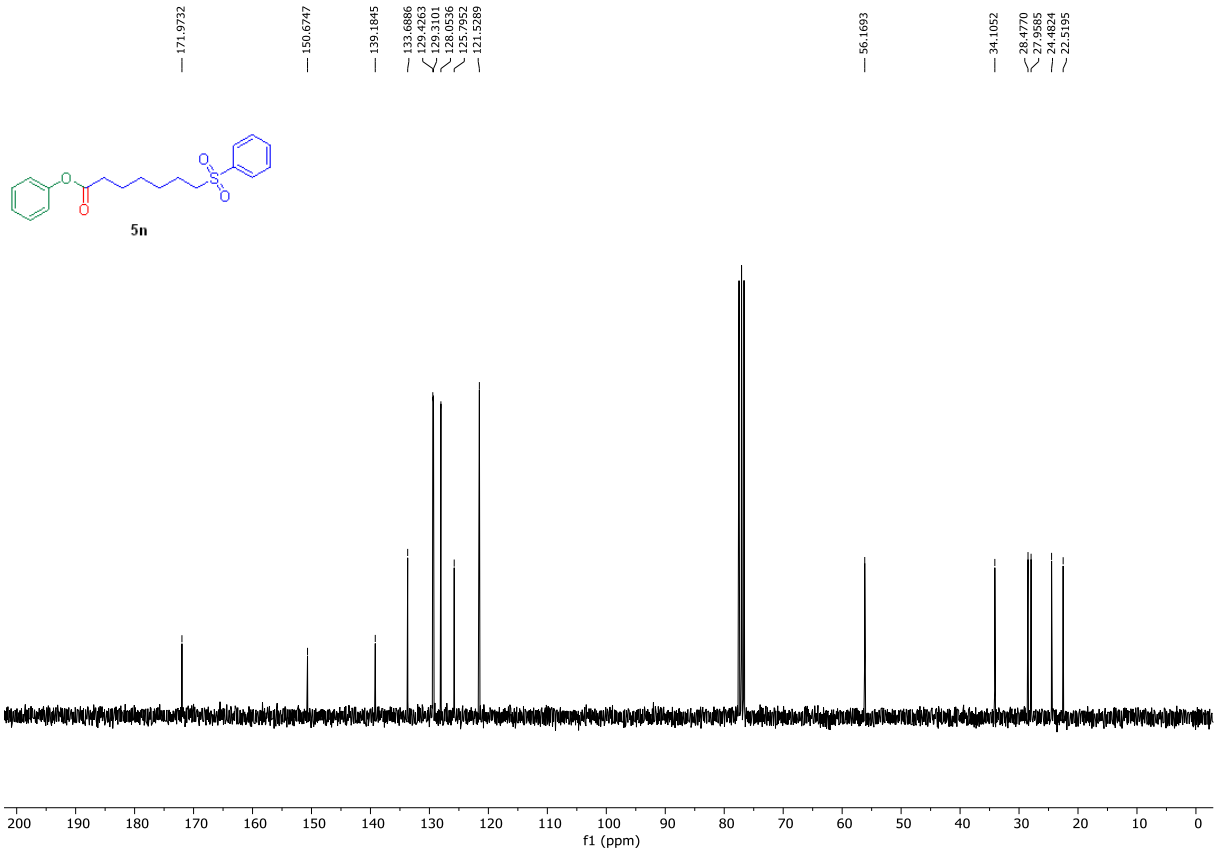
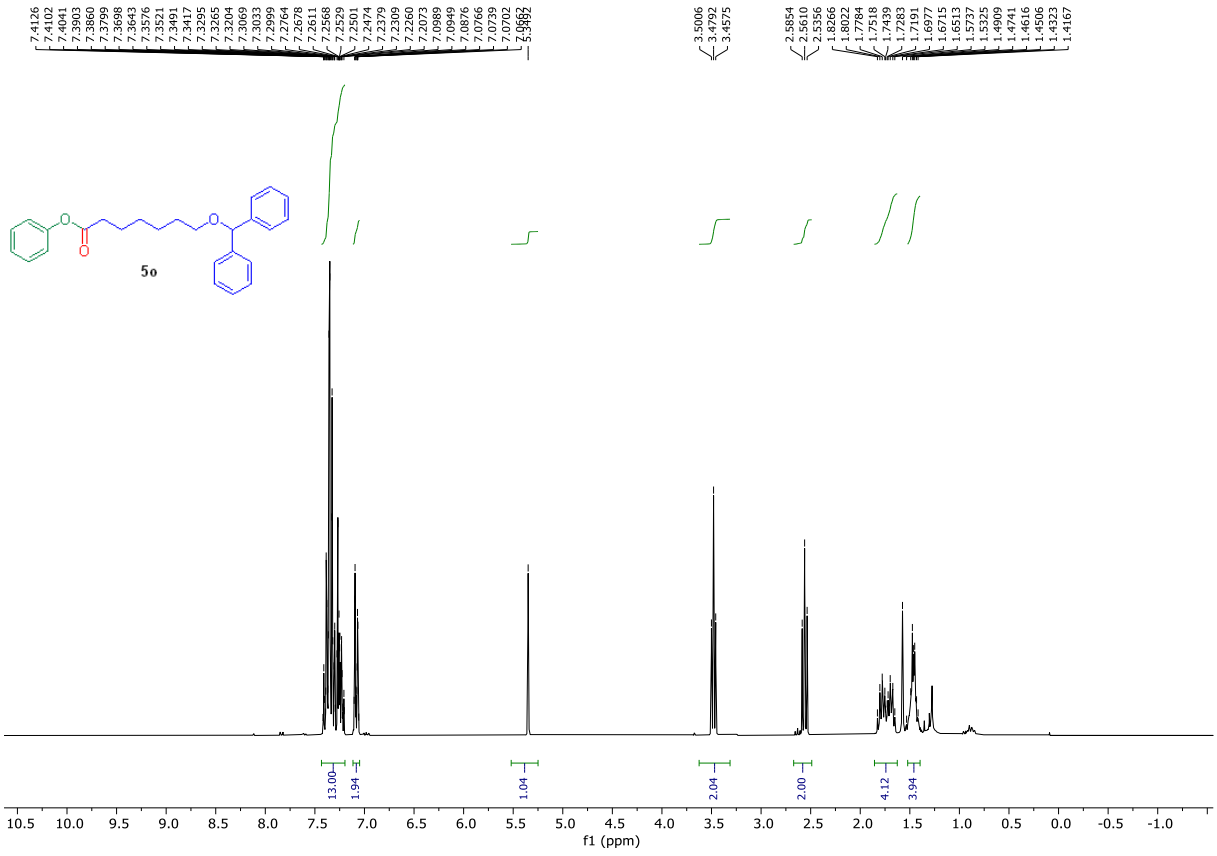

5n
f1 (ppm)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7.3033
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7.2611
7.2568
7.2529
7.2501
7.2474
7.2379
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7.2260
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7.0739
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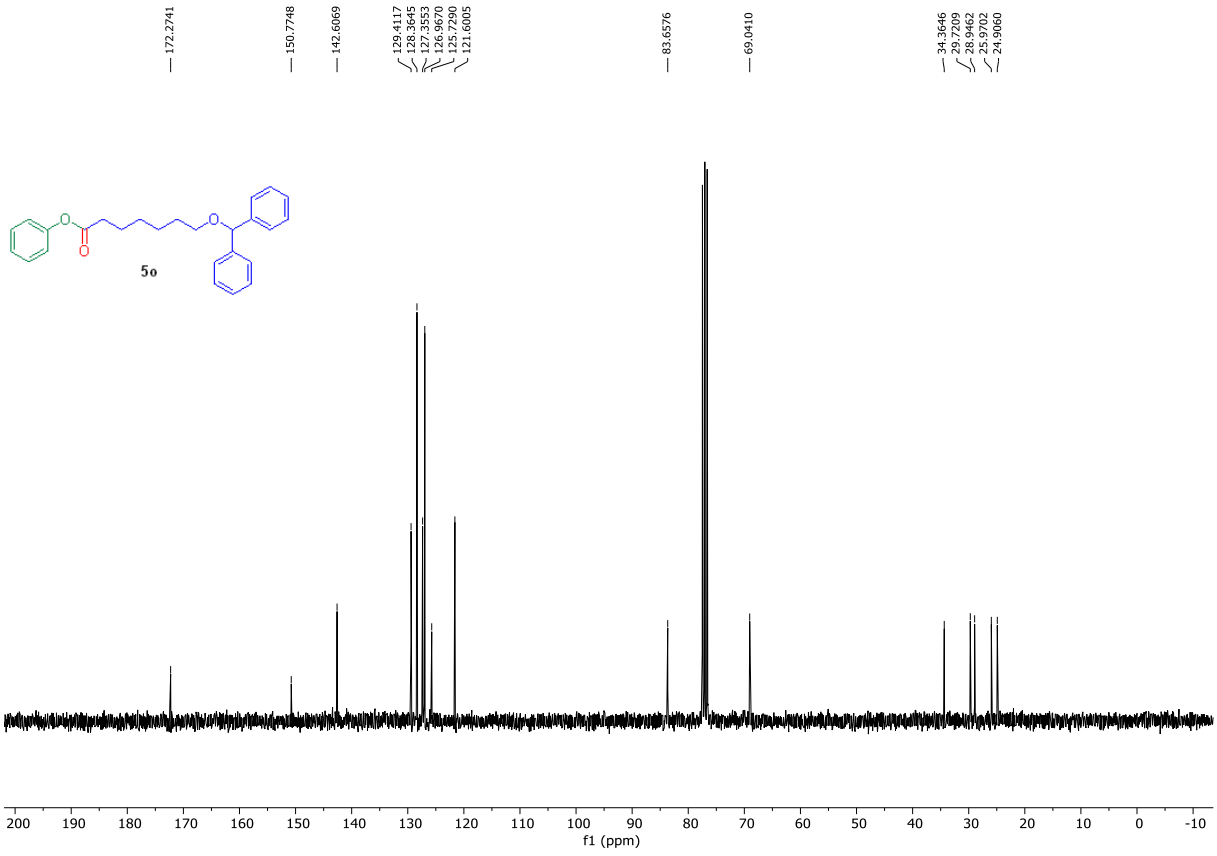
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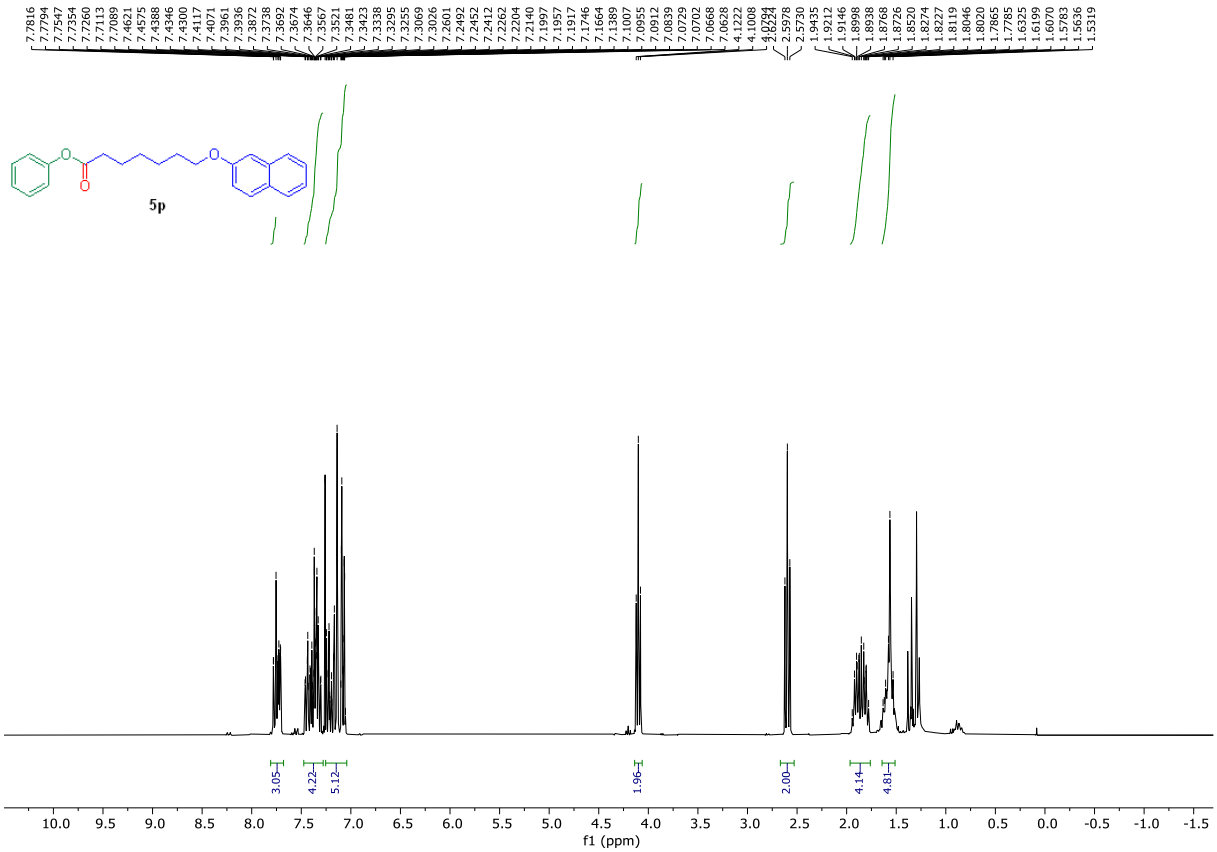
f1 (ppm)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1.6070
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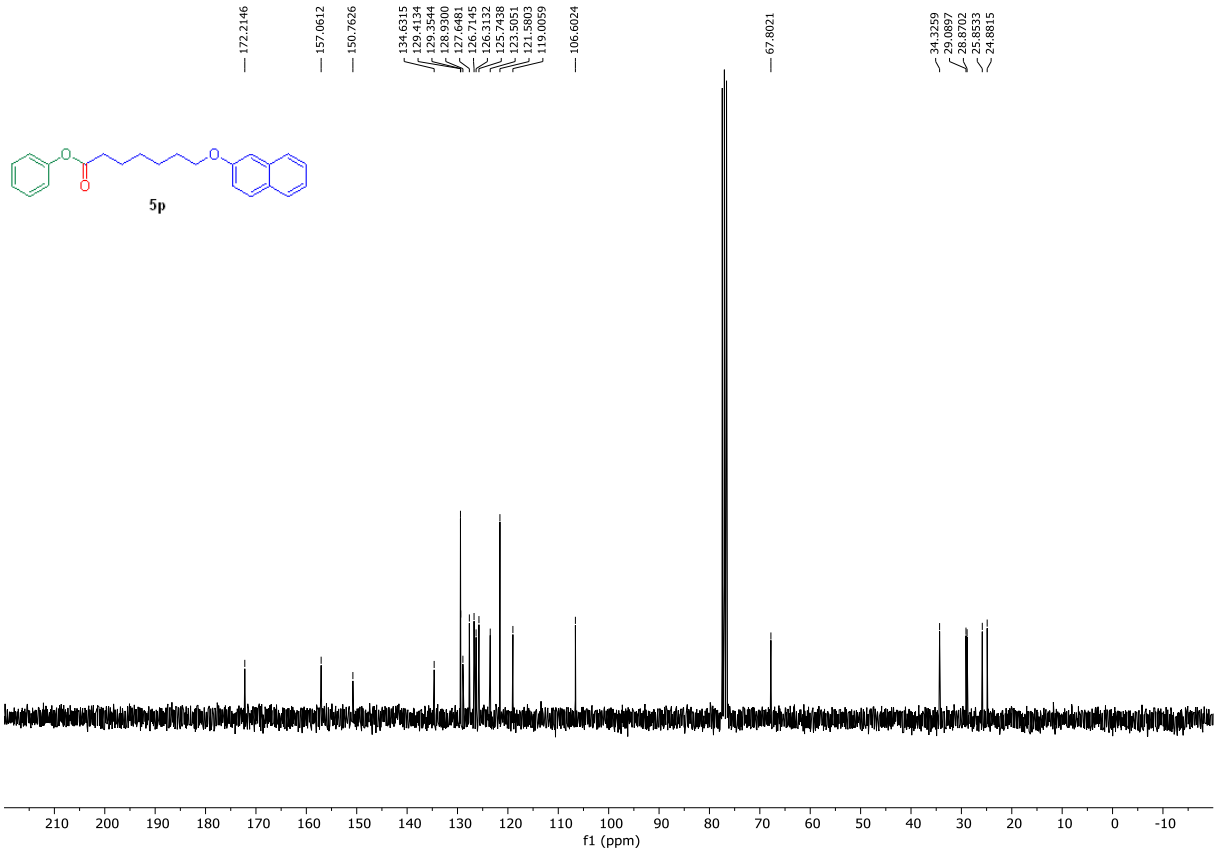
1.5636
1.5319
5p
3.05
4.22
5.12
1.96
2.00
4.14
4.81
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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123.5051
121.5803
119.0059
106.6024
67.8021
34.3259
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24.8815
5p
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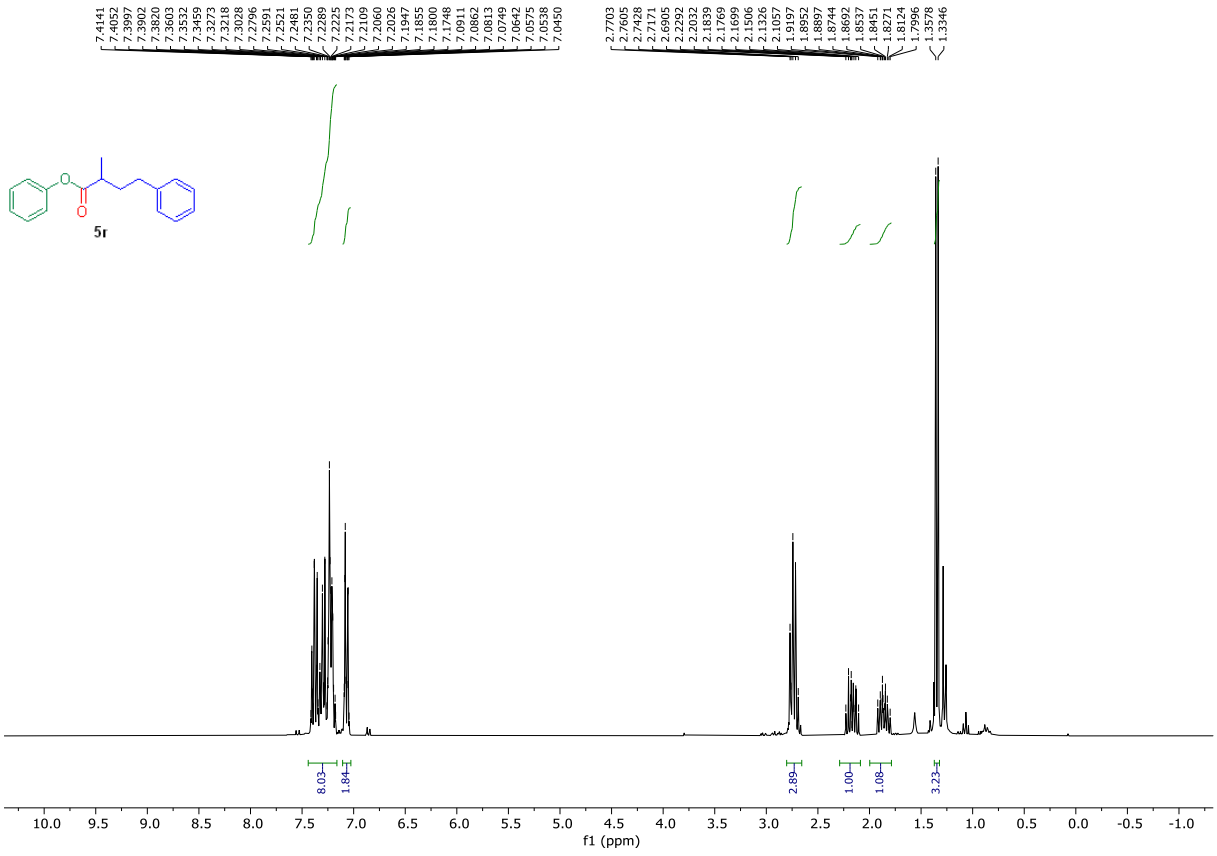
f1 (ppm)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7.2521
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7.2289
7.2225
7.2173
7.2109
7.2060
7.2026
7.1947
7.1855
7.1800
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7.0911
7.0862
7.0813
7.0749
7.0642
7.0575
7.0538
7.0450
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2.7428
2.7171
2.6905
2.2292
2.2032
2.1839
2.1769
2.1699
2.1506
2.1326
2.1057
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1.8897
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1.8692
1.8537
1.8451
1.8271
1.8124
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8.03
1.84
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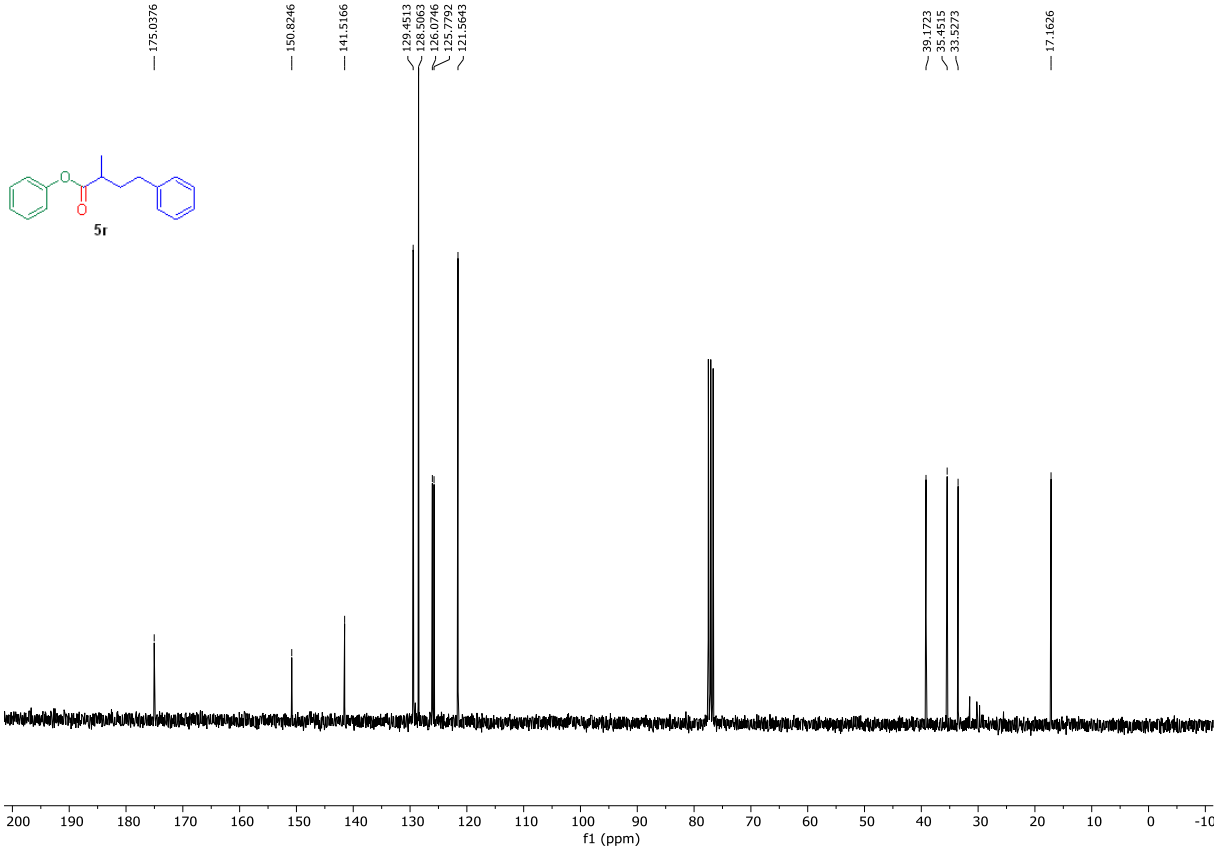
1.00
1.08
3.23
f1 (ppm)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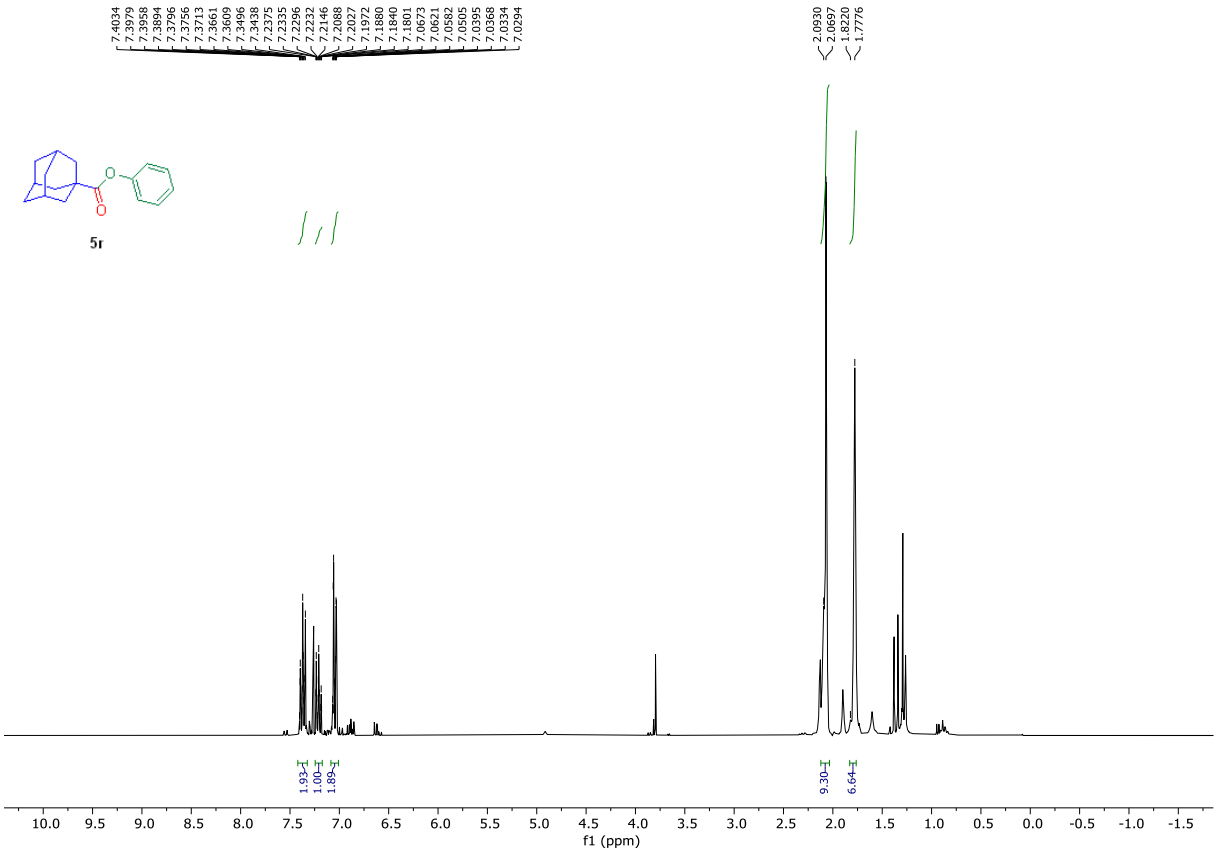
f1 (ppm)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7.2335
7.2296
7.2232
7.2146
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7.1880
7.1840
7.1801
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7.0621
7.0582
7.0505
7.0395
7.0368
7.0334
7.0294
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5r
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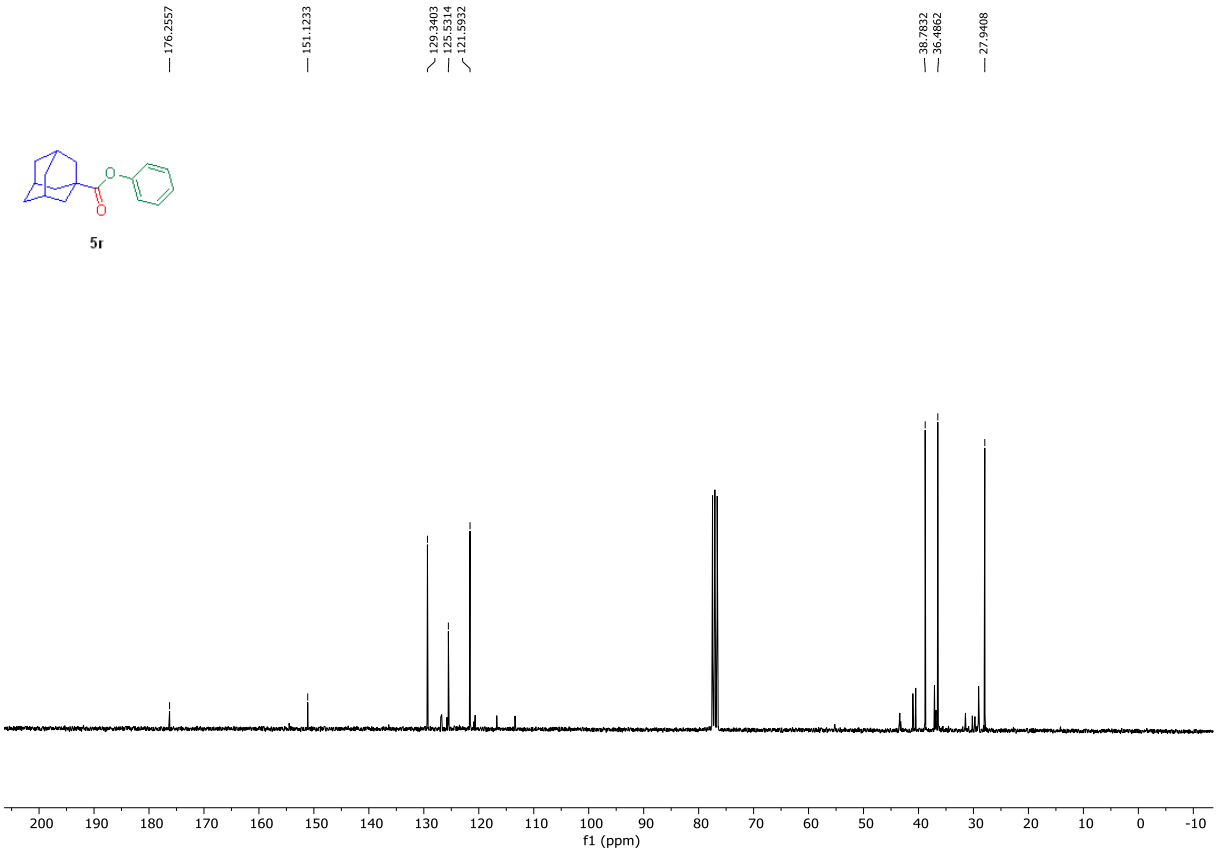
6.64
f1 (ppm)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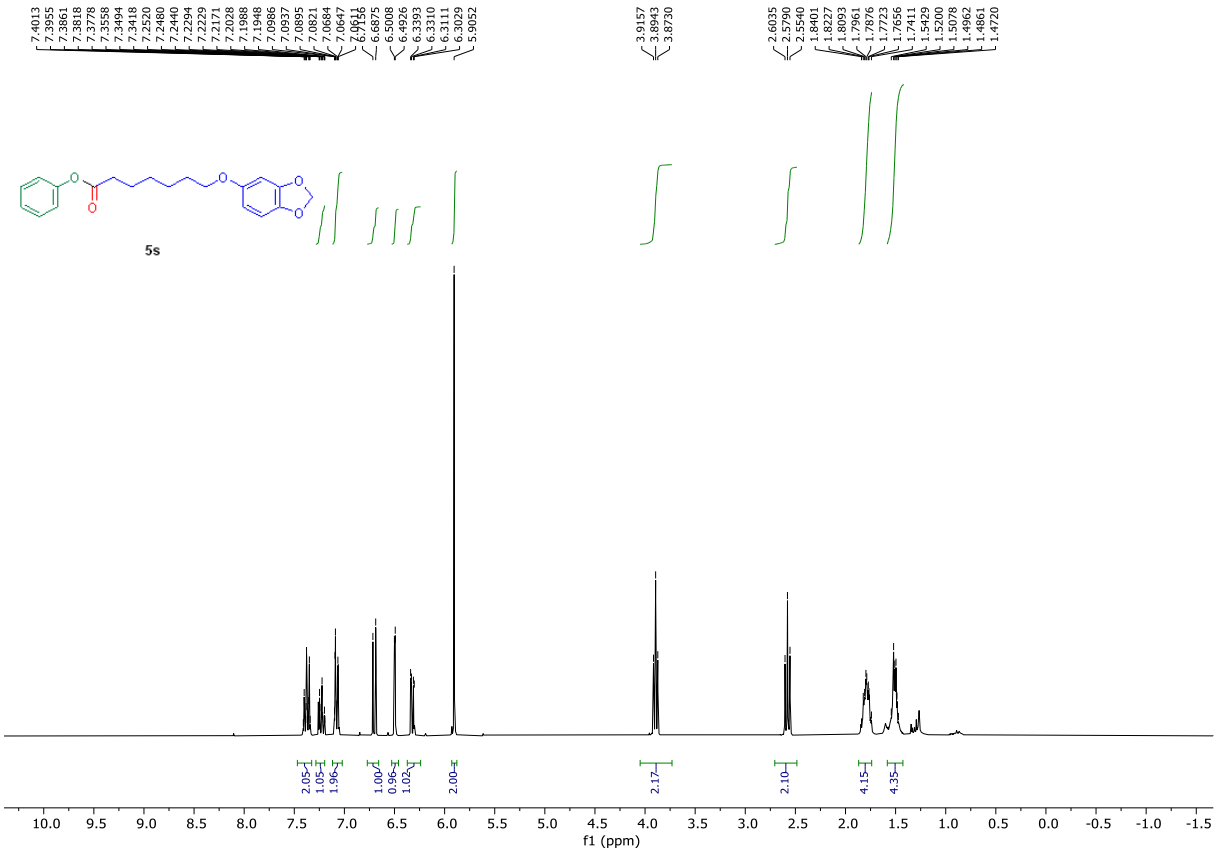
f1 (ppm)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7.2440
7.2294
7.2229
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7.1948
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7.0937
7.0895
7.0821
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7.0647
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6.3029
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2.5540
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1.8227
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1.7723
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1.7411
1.5429
1.5200
1.5078
1.4962
1.4861
1.4720
5s
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1.02
2.00
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2.10
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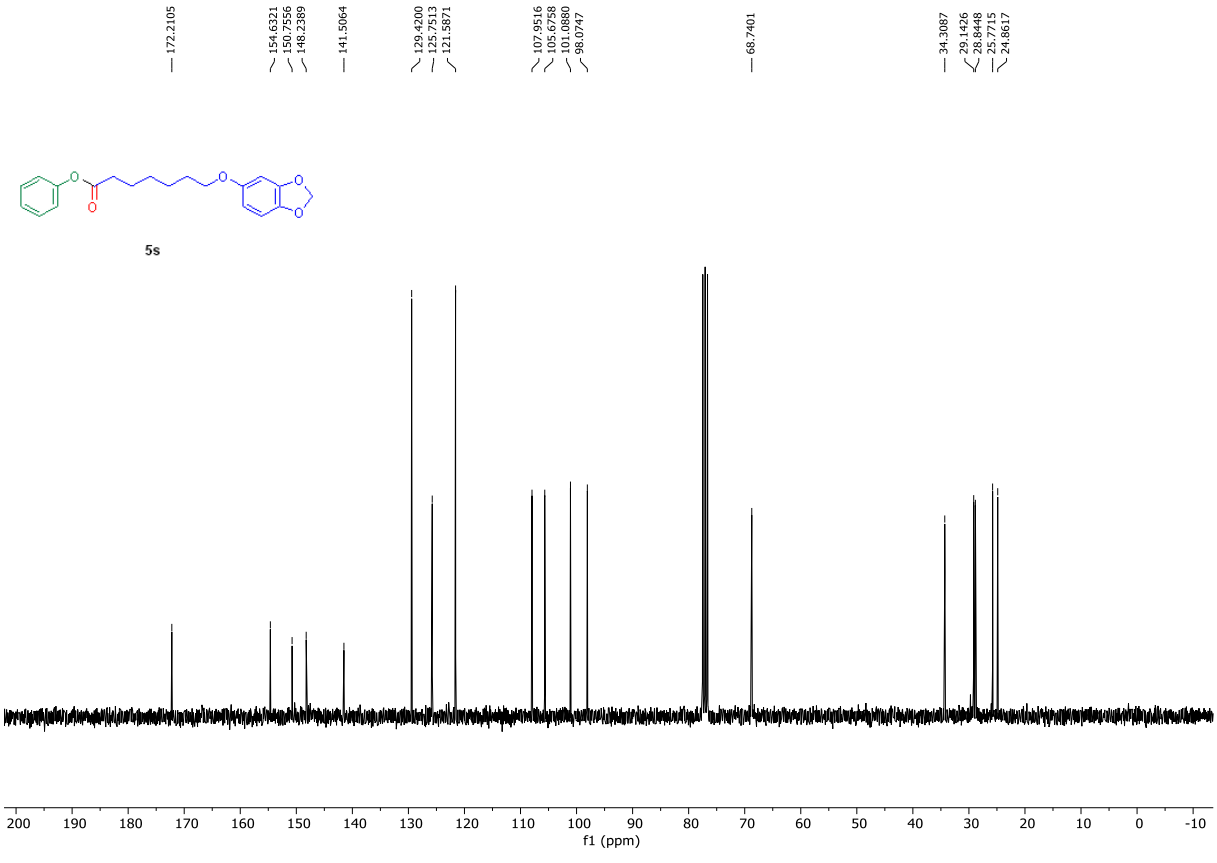
4.35
f1 (ppm)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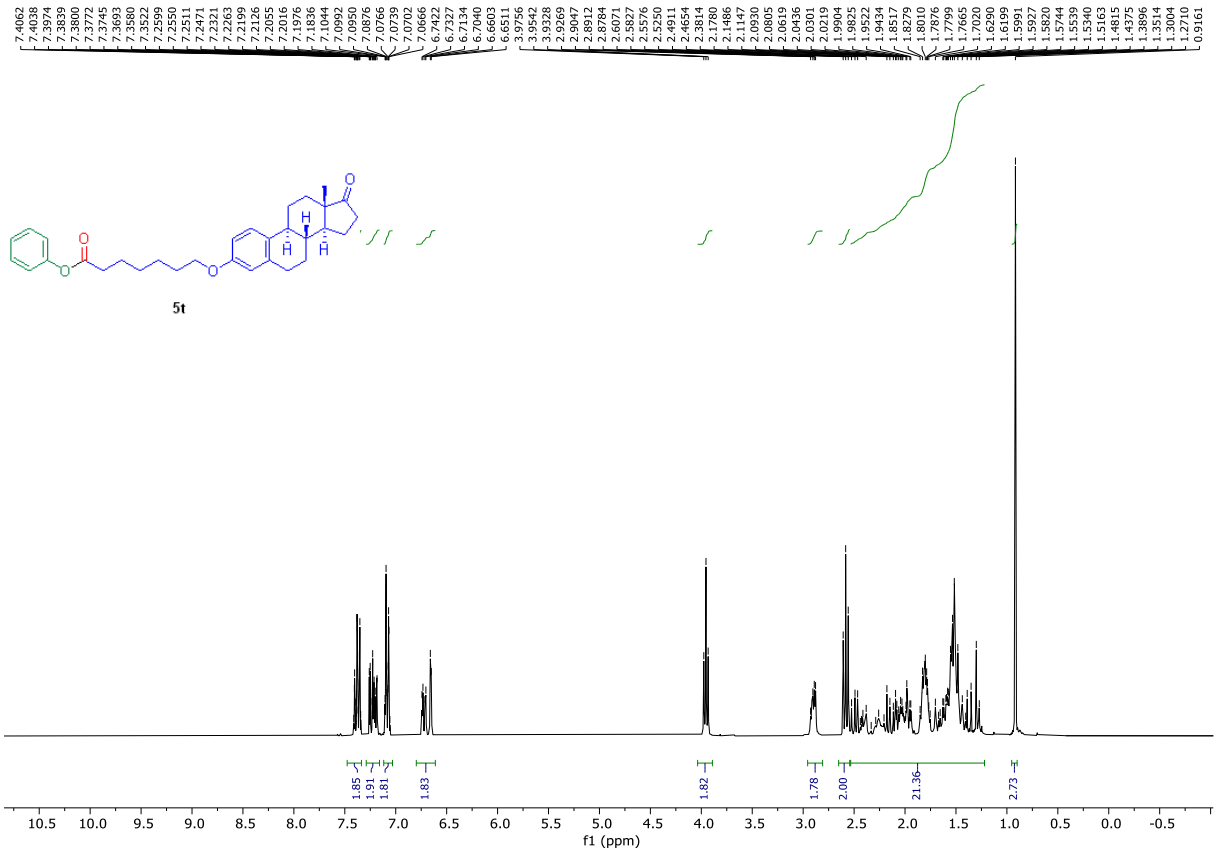
f1 (ppm)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7.2511
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7.2126
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7.1044
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7.0950
7.0876
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2.1486
2.1147
2.0930
2.0805
2.0619
2.0436
2.0301
2.0219
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1.4375
1.3896
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1.3004
1.2710
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2.00
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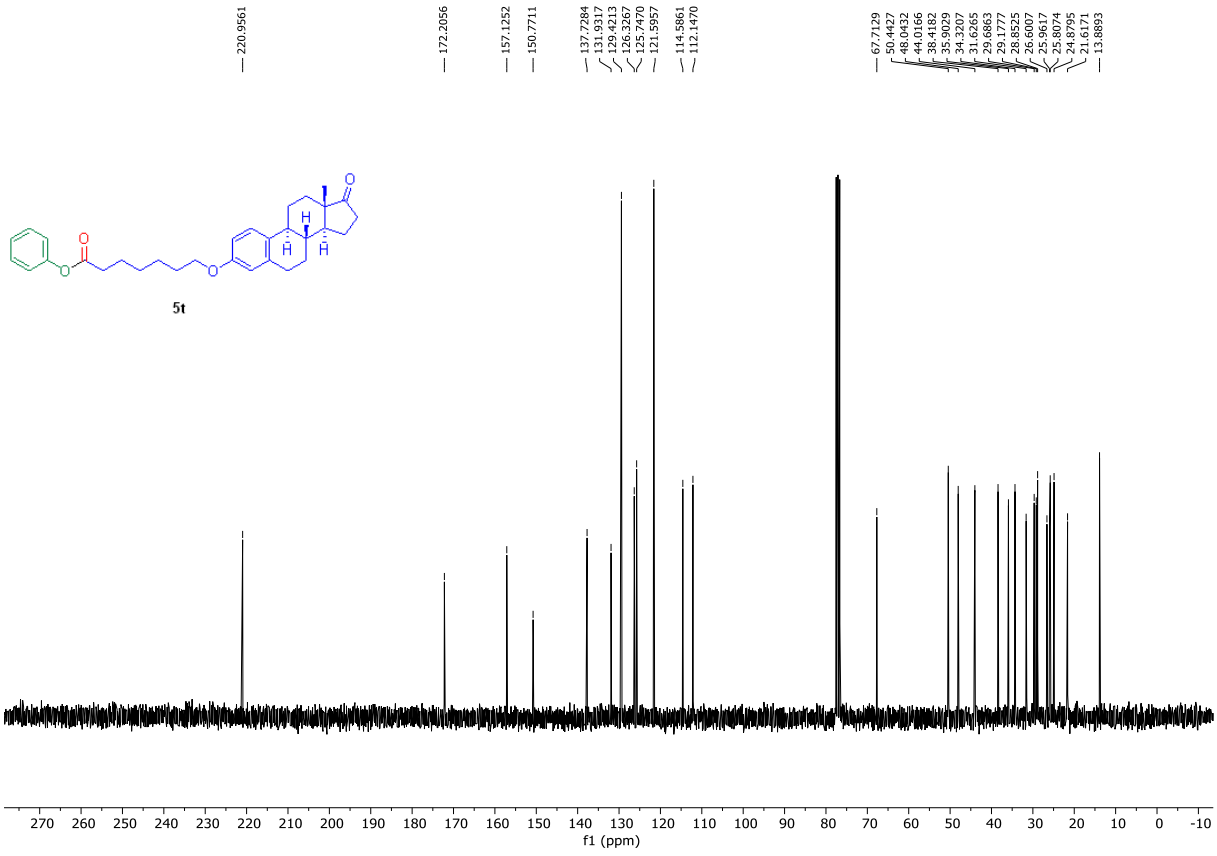
2.73
f1 (ppm)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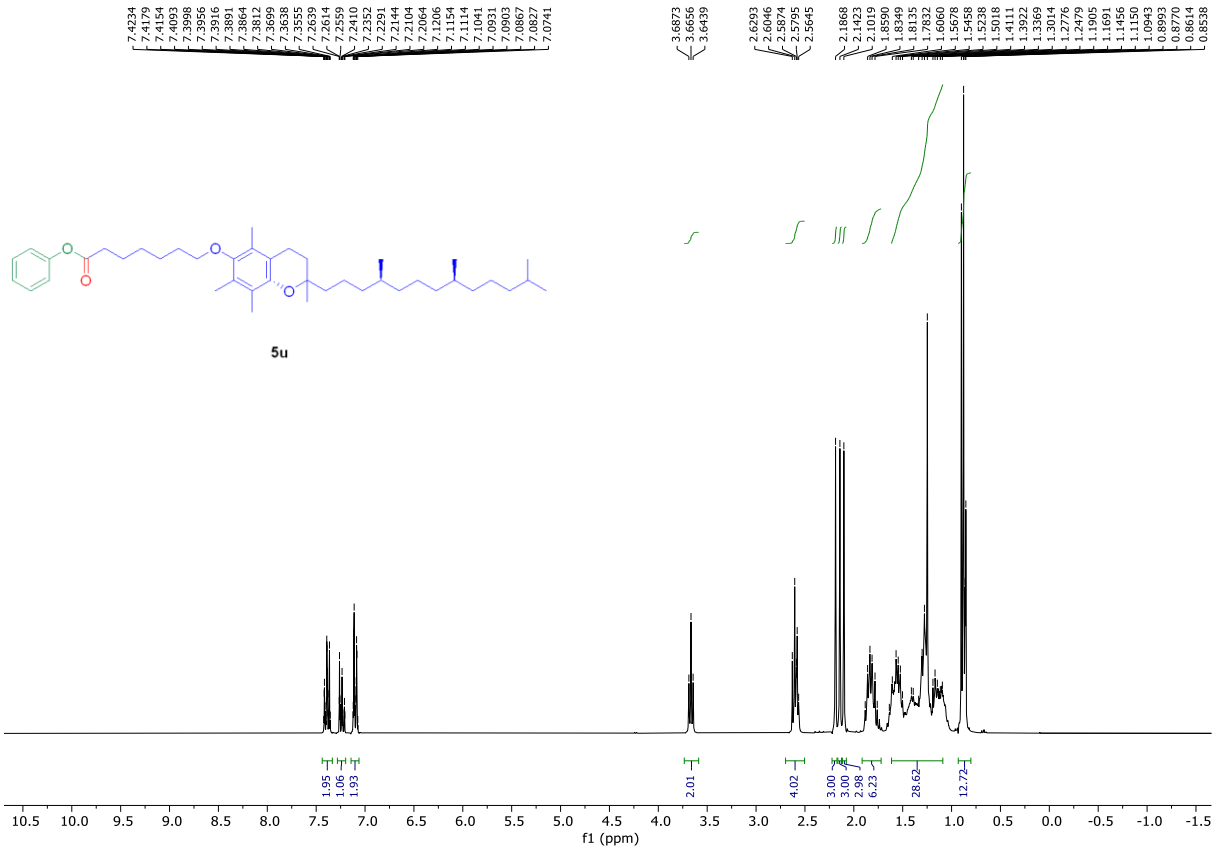
f1 (ppm)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7.2614
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12.72
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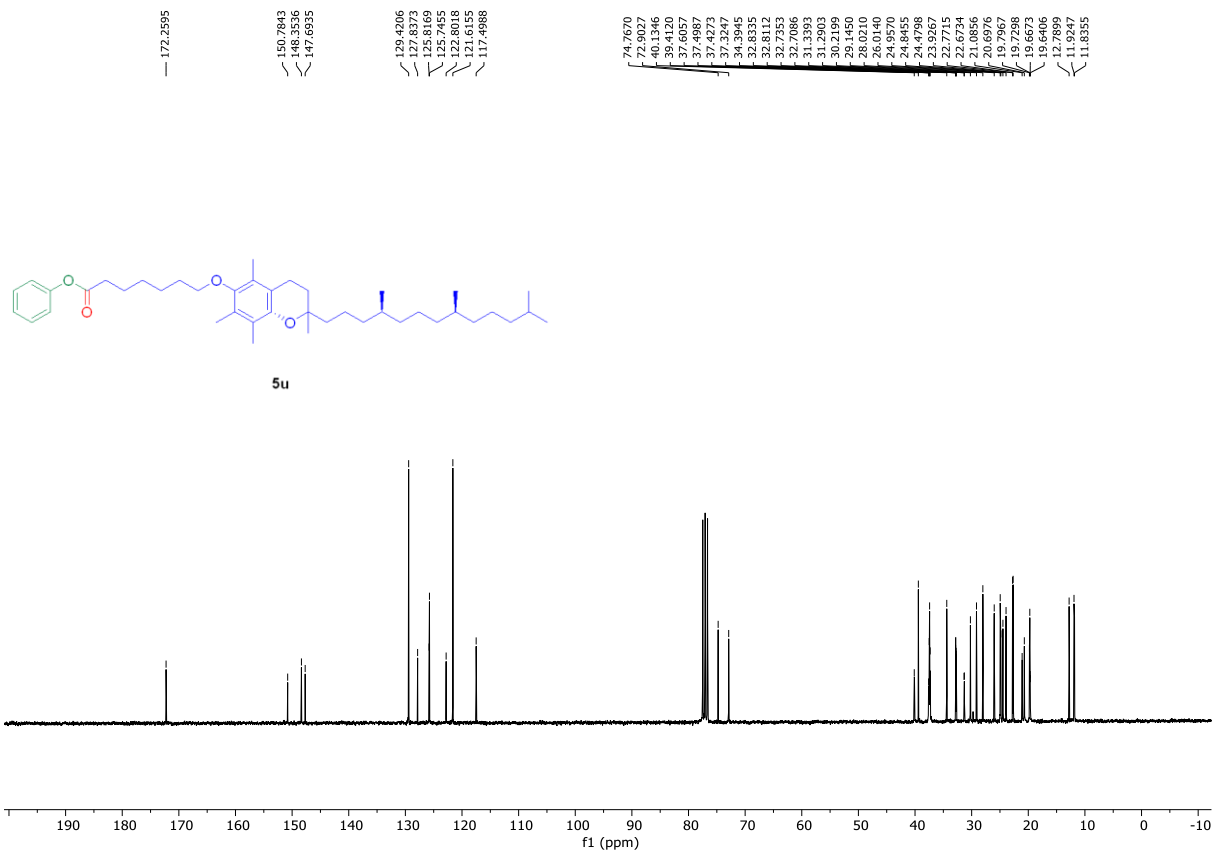
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74.7670
72.9027
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39.4120
37.4987
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32.8335
32.8112
32.7353
32.7086
31.3393
31.2903
30.2199
29.1450
28.0210
26.0140
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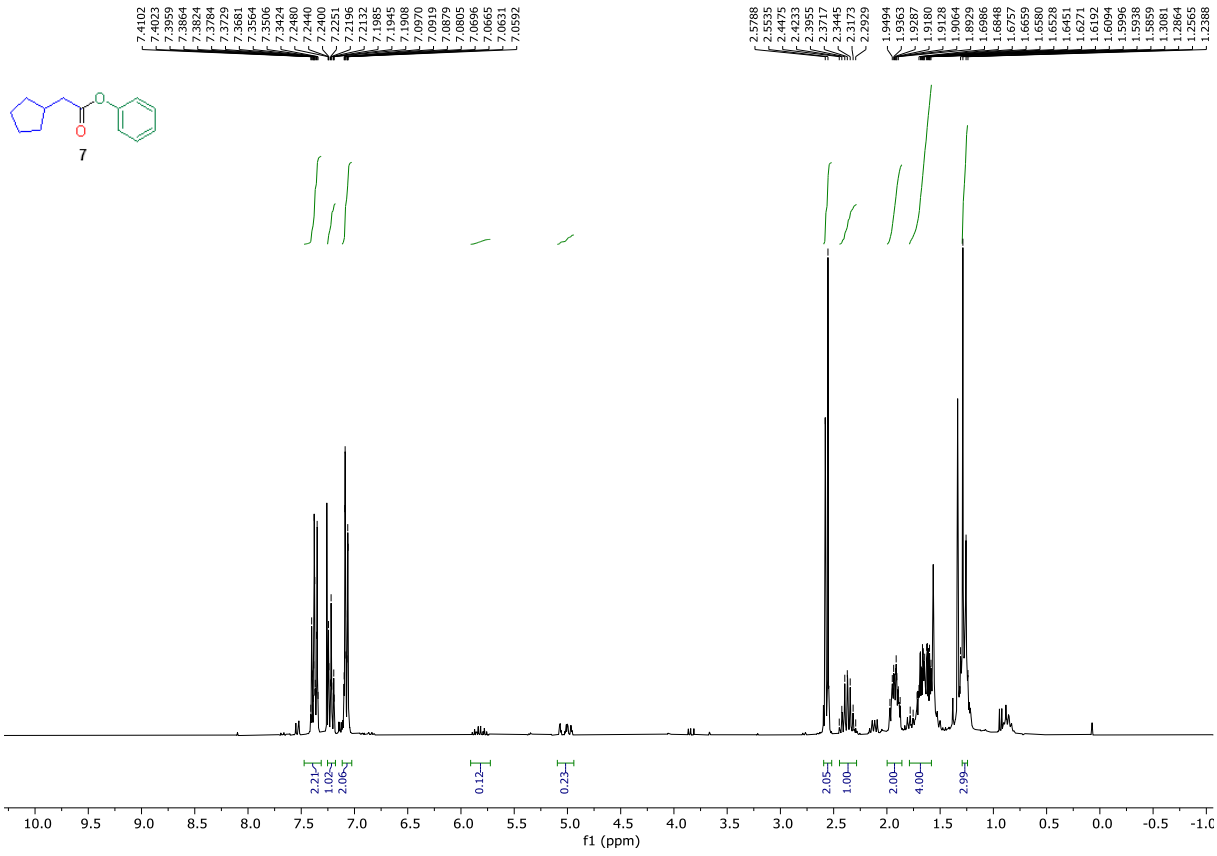
f1 (ppm)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O
O
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1.02
2.06
0.12
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2.05
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2.00
4.00
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9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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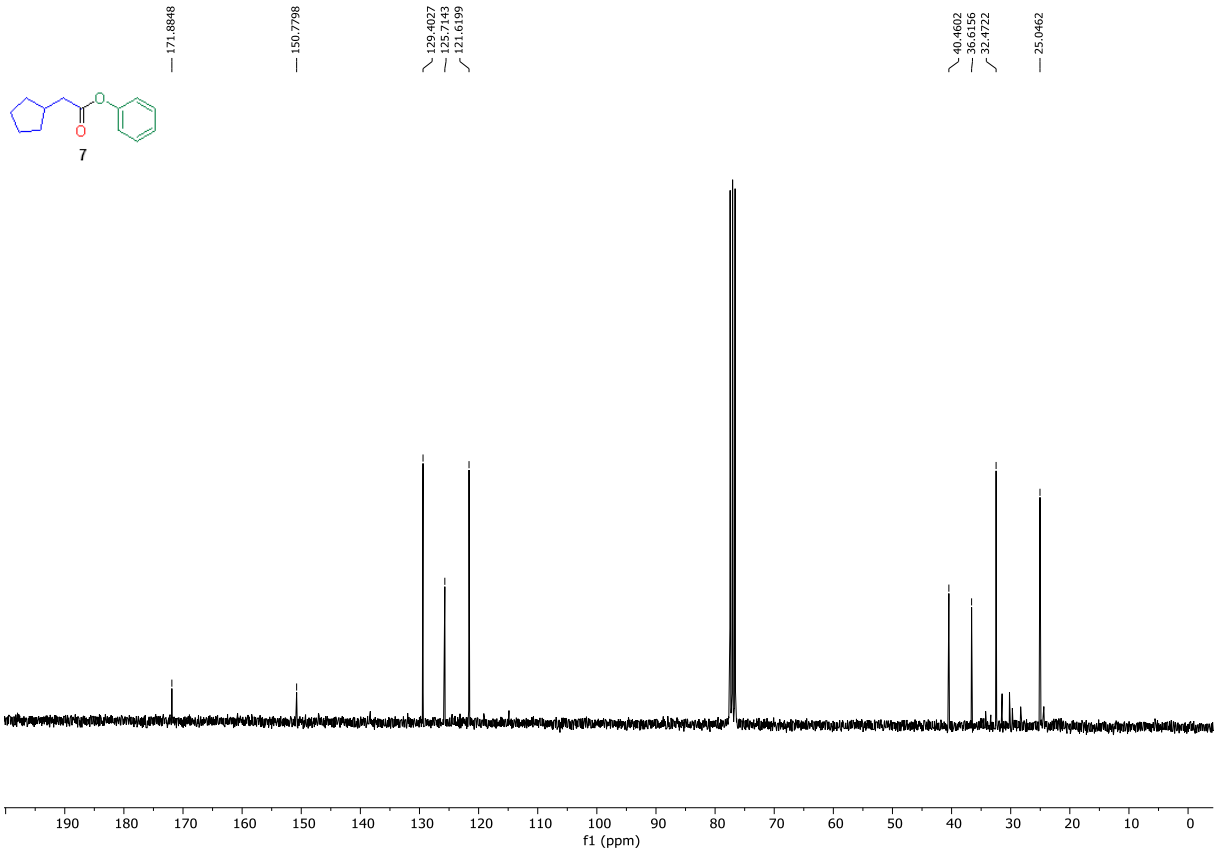
f1 (ppm)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25.0462
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190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)