Supplementary Information

Ortho-substituted Lipidated Brartemicin Derivative shows promising Mincle-mediated Adjuvant Activity

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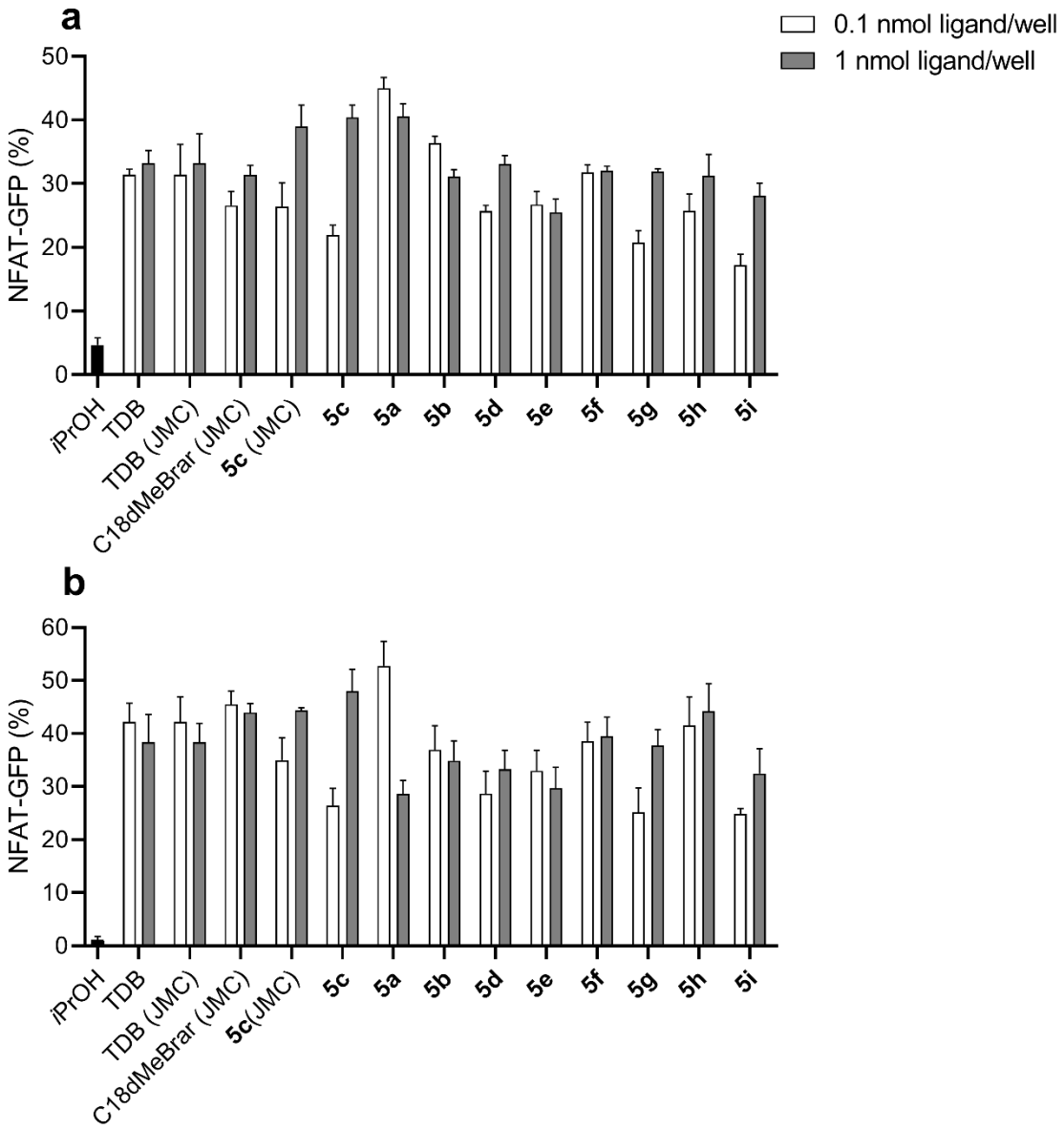
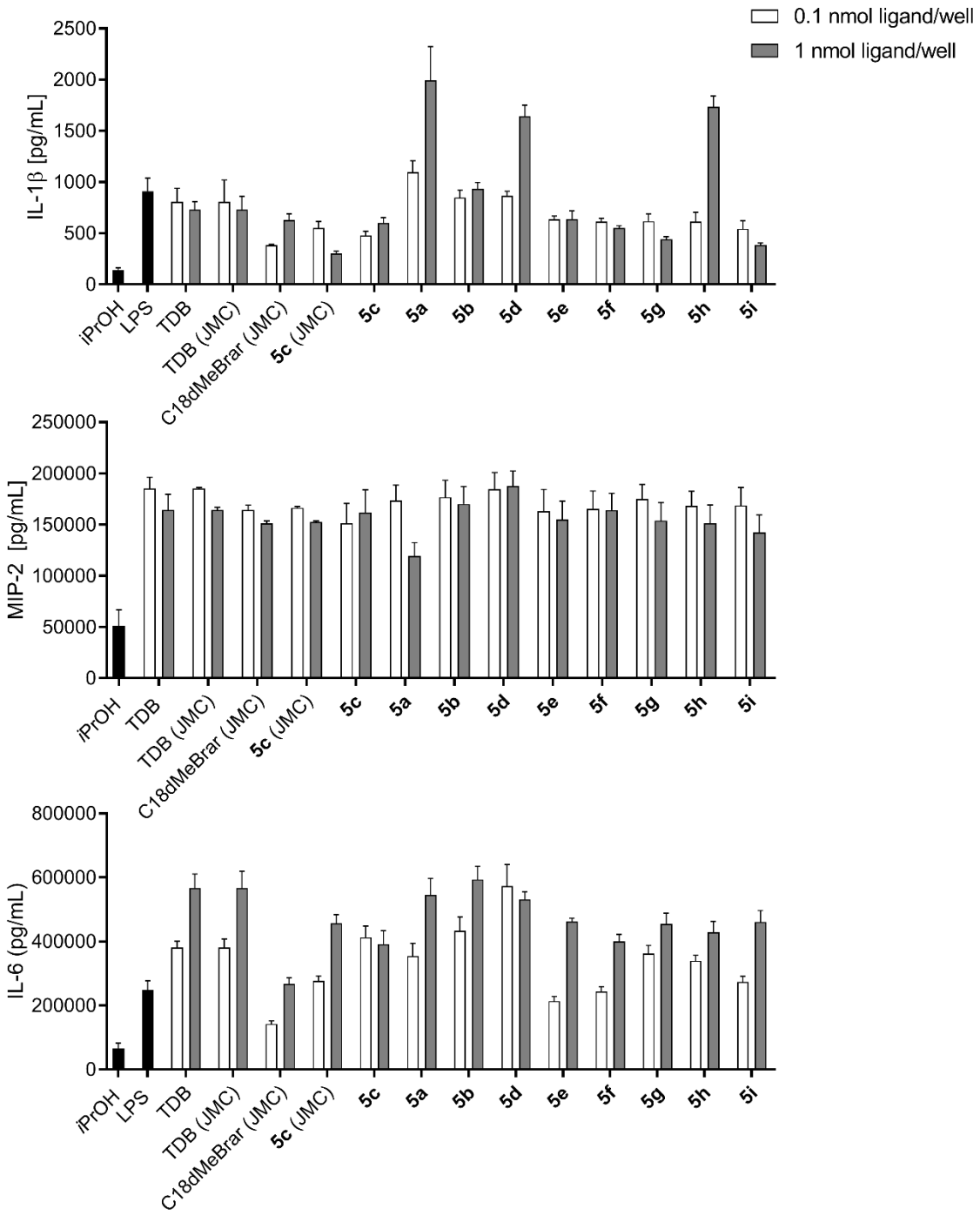
Supplementary figures



SI Figure 1. NFAT-GFP 2B4 cells expressing mMincle + FcRγ (**a**) or hMincle + FcRγ (**b**) were stimulated using ligand-coated plates (0.1 or 1 nmol ligand/well) for 20 hours. The 2B4 cells were then harvested and analysed for NFAT-GFP expression using flow cytometry. Data represent the mean of two or three independent experiments performed in duplicate (mean ± SEM). The data for the compounds bearing the JMC label were evaluated in three independent experiments performed in duplicate (mean ± SEM)[1] and were included in these data sets after scaling to an internal standard, TDB.



SI Figure 2. Harvested WT BMDMs were incubated in plates coated with Brartemicin derivatives (0.1 and 1 nmol ligand/well), iPrOH, LPS (100 ng/mL), or TDB (**2**, 0.1 or 1 nmol ligand/well). IL-1β, MIP-2, and IL-6 production was measured by ELISA of the supernatant collected after 24 hours. Data represents the mean of two (IL-6) or three (MIP-2 and IL-1β) experiments performed in duplicate (mean ± SEM). The data for the compounds bearing the JMC label are representative of three independent experiments performed in triplicate[1] and were included in these data sets after scaling to an internal standard, TDB.

Biology experimental procedures

Mice. C57BL/6 wild-type mice were bred and housed in a conventional animal facility at the Malaghan Institute of Medical Research, New Zealand. All experimental procedures were approved by the Victoria University Animal Ethics Committee.

Endotoxin testing. All synthesised glycolipids were confirmed to be endotoxin free at a sensitivity of ≤ 0.1 EU/mL by using the Pierce Limulus amebocyte lysate (LAL) chromogenic Endotoxin Quantitation kit (Thermo Scientific).

Preparation of ligand-coated plates. Brartemicin analogues, **5c** (*p*-OC_{18}),[1] and TDB[2] were dissolved in $CHCl_3$:MeOH (2:1, 1 mM), diluted in isopropanol (0.05 mM), and added to 96-well plates (20 µL/well). The solvents were evaporated within a sterile hood.

2B4-NFAT-GFP reporter cells. 2B4-NFAT-GFP reporter cells expressing mMincle + FcRγ, hMincle + FcRγ, or FcRγ only have been previously described.[1,3] NFAT-GFP 2B4 reporter cells were incubated with ligand-coated plates (0.1 or 1 nmol/well) for 18 hours. The reporter cells were harvested, stained with propidium iodide, and analysed for NFAT-GFP expression using flow cytometry (BD FACSCantoII or LSRFortessa Cell Analyser).

Murine bone-marrow derived macrophages. For the preparation of murine bone-marrow derived macrophages, bone marrow cells were collected from the tibias and femurs of C57BL/6 mice and cultured (250,000 cells/mL) in complete RPMI media [RPMI-1640 (Gibco) with 10% heat inactivated fetal bovine serum (Gibco), 100 unit/mL penicillin-streptomycin (Gibco), and 2 mM Glutamax (Gibco)] supplemented with 50 ng/mL GM-CSF (clone X63/GM-CSF murine cells). Cells were incubated at 37 °C (5% CO_2) for 8 days (cells fed by replacing half the media on days 3 and 6). On day 8, all media was removed and the cells were washed with Dulbecco's Phosphate-Buffered Saline (DPBS, Gibco) to remove any loosely-adherent cells. The BMDMs were harvested with StemPro Acutase (1 mL/well, 15 minutes at room temperature, Gibco) and seeded onto a pre-coated 96-well plate (1×10^6 cells/mL, 100 µL/well). After 24 hours, the supernatant was collected and analysed for cytokine/chemokine production by ELISA.

Human cell isolation and culture. The use of human leukocytes from healthy donors was approved by New Zealand Northern A Health and Disability Ethics Committee (approval 12/NTA/178). Human monocytes were purified from whole bloody by negative selection using RosetteSep Human Monocyte Enrichment Cocktail (StemCell) according to the manufacturer's instructions. Following isolation, the cells were adjusted to a final

concentration of 1×10^6 cells/mL in complete RPMI (10% FCS, 1% PenStrep) and seeded onto pre-coated 96-well plates (100 μL/well). After 24 hours, the supernatant was collected and analysed for IL-8 production using ELISA.

Cytokine Analysis. Murine IL-6 (BD Biosciences), murine MIP-2 (R&D), murine IL-1β (R&D), and human IL-8 (BD Biosciences) levels were determined via sandwich ELISA according to the manufacturer's protocol.

Chemistry experimental procedures

General Experimental.

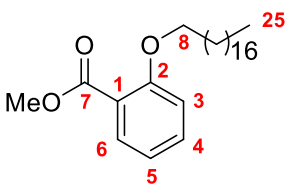
Unless otherwise stated, all reactions were performed under an atmosphere of argon. Acetone (Fisher Scientific), EtOAc (Pure Science), and petroleum ether (Pure Science) were distilled and stored over molecular sieves (4Å). 1-bromooctadecane (Aldrich), 1-bromohexadecane (Aldrich), ethyl 3-hydroxybenzoate (Homebrew), methyl 2-hydroxybenzoate (M&B), methyl 3,4-dihydroxybenzoate (Sigma), methyl 3-(4-hydroxyphenyl)propanoate (Sigma), *N*,*O*-bis(trimethylsilyl)acetamine (Acros), methyl 4-hydroxycinnamate (Sigma), triphenylphosphine (Acros), terephthalaldehyde (BDH), BuLi (Sigma), PCC (Sigma), ethyl 4-aminobenzoate (BDH), TBAI (Riedel-de Haen), methanol (Fisher Scientific), sodium hydroxide (Vickers), K_2CO_3 (Panreac) ethanol (Fisher Scientific), EDCI (Chem Impex), DMAP (Lab Supply), toluene (ROMIL), $Pd(OH)_2$ (Aldrich), CH_2Cl_2 (Fisher Scientific), 4-mercaptobenzoic acid (Sigma), pyridine (ROMIL), C_5D_5N (Apollo), $CDCl_3$ (Aldrich), CD_3OD (Cambridge Isotopes Laboratories Inc.), and H_2 (BOC) were used as received. Trehalose dibehenate,[2] 2,2′,3,3′,4,4′-hexa-*O*-benzyl-α,α′-D-trehalose,[2] 2,2′,3,3′,4,4′-hexa-*O*-trimethylsilyl-α,α′-D-trehalose,[2] and methyl 4-formylbenzoate[4] were prepared according to literature procedures. All solvents were removed by evaporation under reduced pressure. Reactions were monitored by TLC-analysis on Macherey-Nagel silica gel coated plastic sheets (0.20 mm with fluorescent indicator UV_{254}) via detection by UV-absorption (254 nm), dipping in 10% H_2SO_4 in EtOH followed by charring, dipping in $KMnO_4$ solution, or dipping in ceric ammonium molybdate solution. Column chromatography was performed using Pure Science silica gel (40-63 μm), and size exclusion chromatography was performed using lipophilic sephadex (25-100 μm, Sigma). High resolution mass spectra and MALDI mass spectra were recorded on an Agilent 6530 Q-TOF mass spectrometer utilising a JetStream™ electrospray ionisation source in positive and negative mode or an AB SCIEX TOF/TOF™ 5800,

respectively. Optical rotations were recorded on an Autopol II or IV (Rudolph Research Analytical) at 589 nm (sodium D-line). Infrared spectra were recorded as thin films using a Bruker Platinum ATR and are reported in wave numbers (cm^{-1}). Nuclear magnetic resonance spectra were recorded at 20 °C in C_5D_5N, CD_3OD, or $CDCl_3$ using a varian INOVA operating at 500 or 600 MHz or a JEOL resonance Inc. JNM-ECZS operating at either 500 or 600 MHz. Chemical shifts are given in ppm (δ) relative to residual solvent peaks. NMR peak assignments were made using COSY, HSQC, and HMBC 2D experiments.

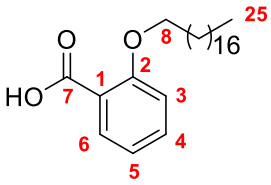
MALDI sample preparation.

The matrix solution was prepared by dissolving 2,5-dihydroxybenzoic acid (DHB) at 30 mg/mL in acetonitrile and water (7/3, *v/v*). Samples were dissolved in an appropriate solvent. The sample solutions (1 μL) and MALDI matrix solution (1 μL) were deposited using the dry droplet method on a stainless steel plate. The mass spectra were obtained operating in reflectron positive mode and mass calibration was performed externally using a peptide mixture.

Synthetic procedures.

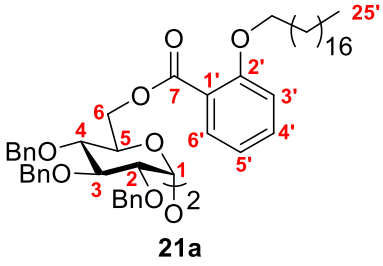


Methyl 2-(octadecyloxy)benzoate. To a solution of methyl 2-hydroxybenzoate (500 mg, 3.3 mmol), K_2CO_3 (705 mg, 5.1 mmol), and TBAI (55 mg, 0.17 mmol) in acetone (25 mL) was added 1-bromooctadecane (1.55 g, 4.6 mmol) and the resulting suspension was stirred at reflux overnight. The following morning the reaction mixture was concentrated under reduced pressure and the remaining residue was purified by silica-gel column chromatography (1:0-9:1, Pet. Ether:EtOAc, *v/v*) to give the title compound as an off-white solid (383 mg, 0.95 mmol, 29%). R_f = 0.60 (3:2; CH_2Cl_2:pet. Ether; *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (dd, $J_{6,5}$ = 7.9 Hz, $J_{6,4}$ = 1.8 Hz, 1H, H-6), 7.43 (ddd, $J_{4,5}$ = 8.4 Hz, $J_{4,3}$ = 7.4 Hz, $J_{4,6}$ = 1.9 Hz, 1H, H-4), 6.97-6.94 (m, 2H, H-3, H-5), 4.03 (t, $J_{8,9}$ = 6.6 Hz, 2H, CH_2-8), 3.88 (s, 3H, CO_2Me), 1.82 (m, 2H, CH_2-9), 1.48 (m, 2H, CH_2-10), 1.39-1.23 (m, 28H, CH_2-11—CH_2-24), 0.88 (t, $J_{24,25}$ = 6.9 Hz, 3H, CH_3-25); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.2 (C-7), 158.8 (C-2), 133.5 (C-4), 131.7 (C-6), 120.6 (C-1), 120.1, 113.3 (C-5, C-3), 69.1 (CH_2-8), 52.1 (CO_2Me), 32.1, 29.9, 29.83, 29.82, 29.77, 29.76, 29.52, 29.51, 29.3, 22.9 (C-9, C-11—C-24), 26.1 (C-10), 14.3 (C-25); IR (film) 2922, 2852, 1735, 1466, 1303, 1249 cm^{-1}; HRMS (ESI) calcd. for $[C_{26}H_{44}O_3+H]^+$: 405.33632; obsd.: 405.33722.



8a

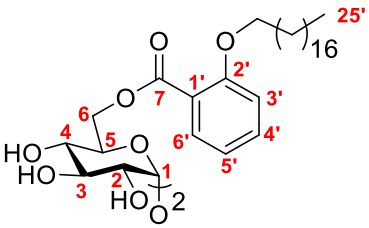
2-(Octadecyloxy)benzoic acid (8a). To a solution of methyl 2-(ocdecyloxy)benzoate (383 mg, 0.95 mmol) in MeOH (30 mL) was added NaOH (5 mL, 5 M) and the resulting mixture was refluxed overnight. The following day, the reaction mixture was diluted with water (20 mL), acidified to pH 1 with conc. HCl, and extracted with EtOAc. The organic phase was dried over $MgSO_4$, filtered, and concentrated under reduced pressure to give the title compound as an off-white amorphous solid (338, 0.87 mmol, 91%). R_f = 0.72 (2:1; pet. ether:EtOAc; *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.20 (dd, $J_{6,5}$ = 7.9 Hz, $J_{6,4}$ = 1.8 Hz, 1H, H-6), 7.55 (ddd, $J_{4,3}$ = 8.4 Hz, $J_{4,5}$ = 7.4 Hz, $J_{4,6}$ = 1.8 Hz, 1H, H-4), 7.13 (td, $J_{5,4}$ = $J_{5,6}$ = 7.6 Hz, $J_{5,3}$ = 1.0 Hz, 1H, H-5), 7.04 (d, $J_{3,4}$ = 8.4 Hz, 1H, H-3), 4.25 (t, $J_{8,9}$ = 6.6 Hz, 2H, CH_2-8), 1.92 (p, $J_{9,10}$ = 6.6 Hz, 2H, CH_2-9), 1.48 (m, 2H, CH_2-10), 1.41-1.22 (m, 28H, CH_2-11—CH_2-24), 0.88 (t, $J_{24,25}$ = 7.0 Hz, 3H, CH_3-25); ^{13}C NMR (150 MHz, $CDCl_3$) δ 165.5 (C-7), 157.5 (C-2), 135.1 (C-4), 134.0 (C-6), 122.3 (C-5), 117.9 (C-1), 112.7 (C-3), 70.5 (C-8), 32.1, 29.9, 29.83, 29.81, 29.79, 29.76, 29.67, 29.57, 29.5, 29.4, 29.1, 22.8 (C-9, C-11—C-24), 26.0 (C-10), 14.3 (C-25); IR (film): 2914, 2849, 1690, 1602, 1472, 1300, 1257 cm^{-1}; HRMS (ESI) calcd. for $[C_{25}H_{42}O_3\text{-}H]^-$: 389.30612; obsd.: 389.30569.



21a

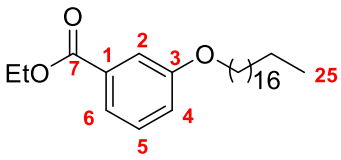
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(2-octadecyloxybenzoyl)-α,α′-D-trehalose (21a). Diol **6** (97 mg, 0.11 mmol) and acid **8a** (193 mg, 0.49 mmol) were co-evaporated with toluene (2 × 5 mL) and then dissolved in dry toluene (4 mL). To the resulting solution was added EDCI (137 mg, 0.71 mmol) and DMAP (13 mg, 0.11 mmol) and the mixture was stirred at 60 °C overnight. The following day, further portions of acid **6** (60 mg, 0.15 mmol), EDCI (60 mg, 0.31 mmol) were added and the resulting suspension was stirred for an additional 2 hours. The reaction mixture was diluted with EtOAc (50 mL), washed with H_2O (50 mL) and brine (50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. The remaining residue was purified by silica-gel column chromatography (1:0-5:1, pet. ether:EtOAc, *v/v*) to give the title compound as a clear oil (150 mg, 0.092 mmol, 84%). R_f = 0.51 (4:1; pet. ether:EtOAc); $[\alpha]_D^{21}$ = +56 (*c* = 0.1, CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, $J_{6',5'}$ = 8.0 Hz, $J_{6',4'}$ = 1.6 Hz, 2H, H-6'), 7.41 (td, $J_{4',3'}$ = $J_{4',5'}$ = 7.9 Hz, $J_{4',6'}$ = 1.8 Hz, 2H, H-4'), 7.37-7.20 (m, 30H, CH_{arom}), 6.91 (m, 4H, H-5', H-3'), 5.22 (d, $J_{1,2}$ = 3.6 Hz, 2H, H-1), 5.03 (d, $J_{a,b}$ = 11.0 Hz, 2H, CH_a 3-*O*-Bn), 4.89 (d, $J_{a,b}$ = 10.8 Hz, 2H, CH_b 3-*O*-Bn), 4.86 (d, $J_{a,b}$ = 10.4 Hz, 2H, CH_a 4-*O*-Bn), 4.67 (s, 4H, CH_2 2-*O*-Bn), 4.58 (d, $J_{a,b}$ = 10.5 Hz, 2H, CH_b

4-*O*-Bn), 4.42 (dd, $J_{6a,6b}$ = 12.3 Hz, $J_{6a,5}$ = 3.4 Hz, 2H, H-6a), 4.33 (m, 2H, H-5), 4.27 (m, 2H, H-6b), 4.08 (t, $J_{3,4}$ = $J_{2,3}$ = 9.4 Hz, 2H, H-3), 3.97 (m, 4H, CH_2-8'), 3.71 (t, $J_{3,4}$ = $J_{4,5}$ = 9.5 Hz, 2H, H-4), 3.58 (dd, $J_{2,3}$ = 9.6 Hz, $J_{1,2}$ = 3.4 Hz, 2H, H-2), 1.78 (p, $J_{8',9'}$ = 7.4 Hz, 4H, CH_2-9'), 1.37 (m, 4H, CH_2-10'), 1.31-1.20 (m, 56H, CH_2-11'—CH_2-24'), 0.88 (t, $J_{23',24'}$ = 7.1 Hz, 6H, CH_3-25'); ^{13}C NMR (150 MHz, $CDCl_3$) δ 165.8 (C-7), 158.7 (C-2'), 138.7 (C_i, 3-*O*-Bn), 137.9, 137.8 (C_i, 2-*O*-Bn, 4-*O*-Bn), 133.4 (C-4'), 131.7 (C-6'), 128.44, 128.42, 128.37, 128.2, 127.90, 127.86, 127.7, 127.6, 127.4 (CH_{arom}), 120.0 (C-1'), 119.9, 113.0 (C-3', C-5'), 94.0 (C-1), 81.7 (C-3), 79.4 (C-2), 77.7 (C-4), 75.7 (CH_2, 3-*O*-Bn), 75.3 (CH_2, 4-*O*-Bn), 72.8 (CH_2, 2-*O*-Bn), 69.3 (C-5), 68.9 (CH_2-8'), 63.0 (C-6), 31.9, 29.70, 29.68, 29.61, 29.38, 29.35, 29.2, 22.7 (CH_2-9', CH_2-11'—CH_2-24'), 25.8 (CH_2-10'), 14.1 (CH_3-25'); IR (film): 2922, 2852, 1735, 1453, 1298, 1244, 1071 cm^{-1}; HRMS calcd. for $[C_{104}H_{138}O_{15}+NH_4]^+$: 1645.0374; obsd.: 1645.0375.

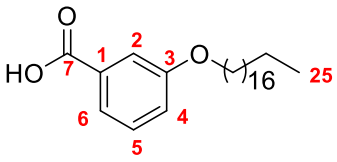


5a

6,6′-Di-*O*-(2-octadecyloxybenzoyl)-α,α′-D-trehalose (5a). To a solution of diester **21a** (146 mg, 0.090 mmol) in MeOH:CH_2Cl_2 (4 mL, 1:1, *v/v*) was added $Pd(OH)_2$/C (88 mg). H_2-gas was bubbled through the reaction mixture overnight. The following day, the reaction mixture was diluted in pyridine, filtered over celite, and concentrated *in vacuo*. The resulting residue was purified by silica-gel column chromatography (1:1-9:1, pet. ether:EtOAc-EtOAc:MeOH, *v/v*) to give the title compound as an off-white amorphous solid (56 mg, 0.051 mmol, 57%). R_f = 0.63 (9:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{20}$ = +80 (*c* = 0.1, C_5H_5N); ^{1}H NMR (600 MHz, C_5D_5N) δ 8.10 (dd, $J_{5',6'}$ = 7.6 Hz, $J_{6',4'}$ = 1.8 Hz, 2H, H-6'), 7.42 (m, 2H, H-4'), 7.27 (bs, 2H, OH), 7.01 (m, 6H, OH, H-5'), 6.86 (t, $J_{3',4'}$ = 7.6 Hz, 2H, H-3'), 5.88 (d, $J_{1,2}$ = 3.7 Hz, 2H, H-1), 5.21 (ddd, $J_{5,4}$ = 10.0 Hz, $J_{5,6b}$ = 4.7 Hz, $J_{5,6a}$ = 1.8 Hz, 2H, H-5), 5.16 (dd, $J_{6a,6b}$ = 11.9 Hz, $J_{5,6a}$ = 2.1 Hz, 2H, H-6a), 5.08 (dd, $J_{6a,6b}$ = 11.8 Hz, $J_{5,6b}$ = 5.0 Hz, 2H, H-6b), 4.77 (t, $J_{2,3}$ = $J_{3,4}$ = 9.1 Hz, 2H, H-3), 4.28 (m, 4H, H-2, H-4), 3.97 (m, 4H, CH_2-8'), 1.83 (m, 4H, CH_2-9'), 1.48 (m, 4H, CH_2-10'), 1.30-1.20 (m, 56H, CH_2-11'—CH_2-24'), 0.85 (t, $J_{24',25'}$ = 7.1 Hz, 6H, CH_3-25'); ^{13}C NMR (C_5D_5N) δ 166.7 (C-7), 159.5 (C-2'), 133.8 (C-4'), 132.3 (C-6'), 122.0 (C-1'), 120.6 (C-3'), 114.2 (C-5'), 96.4 (C-1), 75.4 (C-3), 73.8, 72.3 (C-2, C-4), 72.0 (C-5), 69.6 (CH_2-8'), 65.2 (C-6), 32.5, 30.4, 30.38, 30.36, 30.33, 30.30, 30.1, 30.0, 29.9, 23.3 (CH_2-9', CH_2-11'—CH_2-24'), 26.6 (C-10'), 14.7 (CH_3-25'); IR (film): 3253, 2918, 2850, 1734, 1449, 1238, 1081 cm^{-1}; HRMS (ESI) calcd. for $[C_{62}H_{102}O_{15}+NH_4]^+$: 1104.7562; obsd.: 1104.7533.

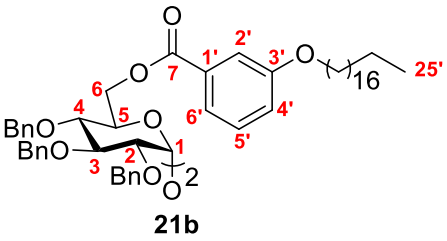


Ethyl 3-(octadecyloxy)benzoate. To a solution of ethyl 3-hydroxybenzoate (500 mg, 3.0 mmol), TBAI (100 mg, 0.31 mmol), and K_2CO_3 (622 mg, 4.5 mmol) in acetone (25 mL) was added 1-bromooctadecane (1.50 g, 4.5 mmol) and the resulting suspension was refluxed overnight. The reaction mixture was concentrated *in vacuo* and the remaining residue was purified by silica-gel column chromatography (1:0-17:3, Pet. Ether:EtOAc, *v/v*) to give the title compound as an off-white solid (1.1 g, 2.6 mmol, 86%). R_f = 0.34 (2:3, CH_2Cl_2:Pet. ether, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.62 (dt, $J_{6,5}$ = 7.6 Hz, $J_{6,2}$ = 1.2 Hz, 1H, H-6), 7.55 (dd, $J_{2,4}$ = 2.7 Hz, $J_{2,6}$ = 1.5 Hz, 1H, H-2), 7.32 (t, $J_{5,6}$ = $J_{5,4}$ = 8.0 Hz, 1H, H-5), 7.08 (ddd, $J_{4,5}$ = 8.2 Hz, $J_{4,2}$ = 2.7 Hz, $J_{4,6}$ = 1.0 Hz, 1H, H-4), 4.37 (q, J = 7.2 Hz, 2H, CH_2-OEt), 3.99 (t, $J_{8,9}$ = 6.6 Hz, 2H, CH_2-8), 1.79 (m, 2H, CH_2-9), 1.45 (m, 2H, CH_2-10), 1.39 (t, J = 7.1 Hz, 3H, CH_3-OEt), 1.37-1.23 (m, 28H, CH_2-11—CH_2-24), 0.88 (t, $J_{23,24}$ = 6.9 Hz, 3H, CH_3-25); ^{13}C NMR (125 MHz, $CDCl_3$) δ 166.7 (C-7), 159.2 (C-3), 131.9 (C-1), 129.4 (C-5), 121.9 (C-6), 119.9 (C-4), 114.8 (C-2), 68.4 (CH_2-8), 61.2 (CH2-OEt), 32.1, 29.9, 29.83, 29.82, 29.76, 29.73, 29.54, 29.52, 26.2 (C-11—C-23), 29.4 (C-9), 22.9 (C-9), 14.5 (OEt-CH_3), 14.3 (C-24); IR (film): 2917, 2850, 1720, 1467, 1277, 1100 cm^{-1}; HRMS (ESI) calcd. for $[C_{27}H_{46}O_3+H]^+$: 419.35197; obsd.: 419.35259.



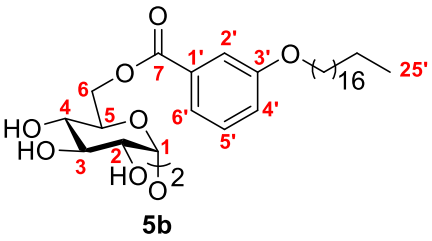
8b

3-Octadecyloxybenzoic acid (8b). To a solution of ethyl 3-(octadecyloxy)benzoate (590 mg, 1.4 mmol) in ethanol (25 mL) was added a solution of NaOH (5 M, 6 mL) and the resulting suspension was refluxed overnight. The reaction mixture was diluted with H_2O (50 mL), acidified to pH 1 with conc. HCl, and extracted with EtOAc (50 mL). The organic phase was dried with $MgSO_4$, filtered, and concentrated under reduced pressure to give the named compound as an off white solid (503 mg, 1.3 mmol, 91%). R_f = 0.44 (4:1, pet. ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.68 (dt, $J_{5,6}$ = 7.6 Hz, $J_{6,2}$ = 1.4 Hz, $J_{6,4}$ = 1.1Hz, 1H, H-6), 7.60 (dd, $J_{2,4}$ = 2.5 Hz, $J_{2,6}$ = 1.6 Hz, 1H, H-2), 7.36 (t, $J_{5,6}$ = $J_{5,4}$ = 8.1 Hz, 1H, H-5), 7.14 (ddd, $J_{4,5}$ = 8.3 Hz, $J_{4,2}$ = 2.7 Hz, $J_{4,6}$ = 1.0 Hz, 1H, H-4), 4.01 (t, $J_{8,9}$ = 6.6 Hz, 2H, CH_2-8), 1.80 (m, 2H, CH_2-9), 1.46 (m, 2H, CH_2-10), 1.39-1.21 (m, 24H, CH_2-11—CH_2-24), 0.88 (t, $J_{24,25}$ = 7.1 Hz, 3H, CH_3-25); ^{13}C NMR (150 MHz, $CDCl_3$) δ 170.3 (C-7), 159.3 (C-3), 130.4 (C-1), 129.6 (C-5), 122.6 (C-6), 121.0 (C-4), 115.2 (C-2), 68.4 (CH_2-8), 32.1, 29.9, 29.8, 29.76, 29.73, 29.5, 29.3, 22.9 (CH_2-9, CH_2-11—CH_2-24), 26.2 (CH_2-10), 14.3 (CH_3-25); IR (film): 2916, 2849, 1676, 1602, 1470, 1454, 1278, 1246 cm^{-1} (the OH stretching frequency was obscured or weak); HRMS ($C_{25}H_{42}O_3$-H]$^-$: 389.3061; obsd.: 389.3067.



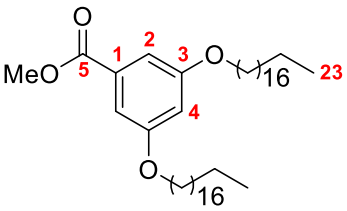
21b

2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3-octadecyloxybenzoyl)-α,α′-D-trehalose (21b). Diol **6** (107 mg, 0.12 mmol) and 3-octadecyloxybenzoic acid (212 mg, 0.54 mmol) were co-evaporated with toluene (2 × 5 mL) and then dissolved in dry toluene (7 mL). To the resulting solution was added EDCI (151 mg, 0.79 mmol) and DMAP (15 mg, 0.12 mmol) and the mixture was stirred at 55 °C overnight. The following day, further portions of 3-octadecyloxybenzoic acid (22 mg, 0.056 mmol) and EDCI (37 mg, 0.19 mmol) were added and the resulting suspension was stirred for an additional 2 hours. The reaction mixture was diluted with EtOAc (50 mL), washed with H_2O (50 mL) and brine (50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. The remaining residue was purified by silica-gel column chromatography (1:0-22:3, pet. ether:EtOAc, *v/v*) to give the title compound as a clear oil (174 mg, 0.11 mmol, 88%). R_f = 0.40 (4:1; pet. ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.52 (d, $J_{5',6'}$ = 7.7 Hz, 2H, H-6'), 7.48 (s, 2H, H-2'), 7.38-7.23 (m, 32H, H-3', CH_{arom}), 7.06 (dd, $J_{4'-5'}$ = 7.9 Hz, $J_{4',6'}$ = 2.3 Hz, 2H, H-4'), 5.22 (d, $J_{1,2}$ = 3.6 Hz, 2H, H-1), 5.02 (d, $J_{a,b}$ = 10.5 Hz, 2H, CH_a 3-*O*-Bn), 4.90 (d, $J_{a,b}$ = 10.6 Hz, 2H, CH_b 3-*O*-Bn), 4.89 (d, $J_{a,b}$ = 10.7 Hz, 2H, CH_a 4-*O*-Bn), 4.73 (d, $J_{a,b}$ = 11.9 Hz, CH_a 2-*O*-Bn), 4.69 (d, $J_{a,b}$ = 11.7 Hz, 2H, CH_b 2-*O*-Bn), 4.58 (d, $J_{a,b}$ = 10.7 Hz, 2H, CH_b 4-*O*-Bn), 4.34-4.24 (m, 6H, H-5, H-6), 4.11 (t, $J_{3,4}$ = $J_{4,5}$ = 9.7 Hz, 2H, H-3),), 3.94 (t, $J_{8',9'}$ = 6.3 Hz, 4H, CH_2-8'), 3.66 (t, $J_{3,4}$ = $J_{4,5}$ = 9.4 Hz, 2H, H-4), 3.61 (dd, $J_{2,3}$ = 9.7 Hz, $J_{1,2}$ = 3.5 Hz, 2H, H-2), 1.77 (m, 4H, CH_2-9'), 1.43 (m, 4H, CH_2-10'), 1.36-1.02 (m, 56H, CH_2-11'—CH_2-24'), 0.88 (t, $J_{24'-25'}$ = 7.0 Hz, 6H, CH_3-25'); ^{13}C NMR (150 MHz, $CDCl_3$) δ 166.3 (C-7), 159.3 (C-3'), 138.7 (C_i, 3-*O*-Bn), 138.0, 137.9 (C_i, 2-*O*-Bn, 4-*O*-Bn), 131.2 (C-1'), 129.5, 128.6, 128.3, 128.1, 127.5 (CH_{arom}, C-5'), 121.9, 115.1 (C-2', C-6'), 120.0 (C-4'), 94.1 (C-1), 81.9 (C-3), 79.7 (C-2), 77.8 (C-4), 76.0 (CH_2, 3-*O*-Bn), 75.5 (CH_2, 4-*O*-Bn), 73.2 (CH_2, 2-*O*-Bn), 69.5 (C-5), 68.4 (CH_2-8'), 63.2 (C-6), 32.1, 29.9, 29.82, 29.78, 29.74, 29.6, 29.5, 29.3, 22.9 (CH_2-9', CH_2-11—CH_2-24'), 26.2 (CH_2-10'), 14.3 (CH_3-25'); IR (film): 2918, 2851, 1723, 1454, 1275, 1097, 1071 cm^{-1}; HRMS (ESI) calcd. For $[C_{104}H_{138}O_{15}+NH_4]^+$: 1645.0374; obsd.: 1645.0399.



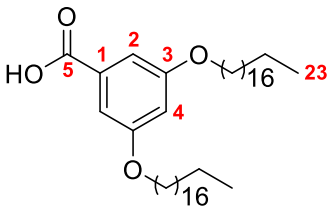
5b

6,6′-Di-*O*-(3-octadecyloxybenzoyl)-α,α′-D-trehalose (5b). To a solution of diester **21b** (110 mg, 0.067 mmol) in MeOH:CH_2Cl_2 (10 mL, 1:1, *v/v*) was added $Pd(OH)_2/C$ (74 mg). H_2-gas was bubbled through the reaction mixture overnight. The following day, the reaction mixture was diluted in pyridine and filtered over celite and concentrated *in vacuo*. The resulting residue was purified by silica-gel column chromatography (1:1-9:1, pet. ether:EtOAc-EtOAc:MeOH, *v/v*) to give the title compound as an off-white amorphous solid (49 mg, 0.045 mmol, 67%). R_f = 0.83 (4:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{21}$ = +80 (*c* = 0.1, C_5H_5N); ^{1}H NMR (500 MHz, C_5D_5N) δ 7.93 (m, 2H, H-6', H-2'), 7.47 (d, *J* = 5.6 Hz, 2H, OH), 7.30 (t, $J_{4',5'} = J_{5',6'}$ = 7.8 Hz, 2H, H-5'), 7.20 (dd, $J_{2',4'}$ = 2.6 Hz, $J_{2',6'}$ = 0.9 Hz, 2H, H-4'), 7.15 (m, 2H, OH), 5.98 (d, $J_{1,2}$ = 3.7 Hz, 2H, H-1), 5.29 (ddd, $J_{4,5}$ = 10.1 Hz, $J_{5,6b}$ = 5.6 Hz, $J_{5,6a}$ = 1.7 Hz, 2H, H-5), 5.24 (dd, $J_{6a,6b}$ = 11.7 Hz, $J_{6a,5}$ = 1.9 Hz, 2H, H-6a), 5.05 (dd, $J_{6b,6a}$ = 11.8 Hz, $J_{6b,5}$ = 5.9 Hz, 2H, H-6b), 4.81 (t, $J_{2,3} = J_{3,4}$ = 9.41 Hz, 2H, H-3), 4.36 (m, 2H, H-2), 4.25 (td, $J_{4,5}$ = 9.8 Hz, $J_{4,3}$ = 5.1 Hz, 2H, H-4), 3.94 (m, 4H, CH_2-8'), 1.73 (p, $J_{8',9'} = J_{9',10'}$ = 6.7 Hz, 4H, CH_2-9'), 1.43 (m, 4H, CH_2-10'), 1.34-1.23 (m, 56H, CH_2-11'—CH_2-24'), 0.88 (t, $J_{24',25'}$ = 7.1 Hz, 6H, CH_3-25'); ^{13}C NMR (150 MHz, C_5D_5N) δ 166.4 (C-7), 159.4 (C-3'), 132.2 (C-1'), 129.6 (C-5'), 121.9, 114.9 (C-6', C-2'), 119.9 (C-4'), 95.7 (C-1), 74.8 (C-3), 73.2 (C-2), 72.0 (C-4), 71.4 (C-5), 68.0 (CH_2-8'), 65.3 (C-6), 31.9, 29.8, 29.70, 29.67, 29.46, 29.39, 29.3, 29.1, 22.7 (CH_2-9', CH_2-11'—CH_2-24'), 26.1 (CH_2-10'), 14.1 (CH_3-25'); IR (film): 3331, 2916, 2849, 1696, 1490, 1279 cm^{-1}; HRMS (ESI) calcd. For $[C_{62}H_{102}O_{15}+NH_4]^+$: 1104.7557; obsd.: 1104.7555

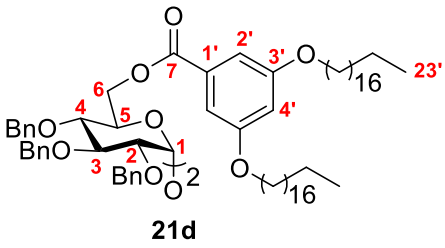


Methyl 3,5-bis(octadecyloxy)benzoate. To a solution of Methyl 3,4-dihydroxybenzoate (350 mg, 2.1 mmol) in acetone (20 mL) was added K_2CO_3 (862 mg, 6.24 mmol), 1-bromooctadecane (2.1 g, 6.2 mmol), and TBAI (74 mg, 0.23 mmol) and the resulting suspension was refluxed overnight. The reaction mixture was concentrated *in vacuo* and the resulting residue was purified by silica-gel column chromatography (1:0-4:2, CH_2Cl_2:EtOAc, *v/v*) to give the title compound as a white solid (880 mg, 1.3 mmol, 63%). R_f = 0.62 (2:3, CH_2Cl_2:pet. ether, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15 (d, $J_{2,4}$ = 2.4 Hz, 2H, H-2), 6.65 (t, $J_{2,4}$ = 2.4 Hz, 1H, H-4), 3.98 (t, $J_{6,7}$ = 6.6 Hz, 4H, CH_2-6), 3.91 (s, 3H, CO_2Me), 1.79 (p, $J_{6,7} = J_{7,8}$ = 6.6 Hz, 4H, CH_2-7), 1.46 (m, 4H, CH_2-8), 1.40-1.25 (m, 46H, CH_2-9—CH_2-22), 0.89 (t, $J_{20,21}$ = 7.1 Hz, 6H, CH_3-23); ^{13}C NMR (150 MHz, $CDCl_3$) δ 167.2 (C-5), 160.3 (C-3), 131.9 (C-1), 107.7 (C-2), 106.7 (C-4), 68.5 (CH_2-6), 52.3 (CO_2Me), 32.1, 29.9, 29.84, 29.82, 29.76,

29.73, 29.5, 29.3, 22.9 (CH_2-7, CH_2-9—CH_2-22) 26.2 (C-8), 14.3 (CH_3-23); IR (film): 2916, 2849, 1724, 1601, 1471, 1167 cm^{-1}; MALDI-TOF/TOF MS calcd. for $[C_{44}H_{80}O_4+H]^+$: 673.6135; obsd.: 673.6125.



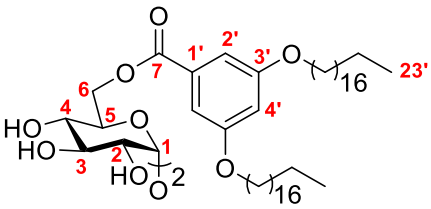
3,5-bis(octadecyloxy)benzoic acid (8c). To a solution of methyl 3,5-bis(octadecyloxy)benzoate (880 mg, 1.31 mmol) in MeOH (50 mL) was added NaOH (8 mL, 5 M) and the resulting suspension was refluxed overnight. The reaction mixture was diluted with water, acidified with conc. HCl (to pH 1), and extracted with EtOAc. The organic phase was dried over $MgSO_4$, filtered, and concentrated *in vacuo* to give the title compound as an off-white solid (606 mg, 0.92 mmol, 70%). R_f = 0.5 (4:1, pet. Ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.21 (d, $J_{2,4}$ = 2.3 Hz, 2H, H-2), 6.68 (t, $J_{2,4}$ = 2.3 Hz, 1H, H-4), 3.97 (t, $J_{6,7}$ = 6.6 Hz, 4H, CH_2-6), 1.78 (p, $J_{6,7}$ = $J_{7,8}$ = 6.7 Hz, 4H, CH_2-7), 1.45 (m, 4H, CH_2-8), 1.39-1.21 (m, 56 H, CH_2-9—CH_2-22), 0.88 (t, $J_{20,21}$ = 7.1 Hz, 6H, CH_3-23); ^{13}C NMR (150 MHz, $CDCl_3$) δ 170.5 (C-5), 160.3 (C-3), 130.8 (C-1), 108.3 (C-2), 107.5 (C-4), 68.5 (CH_2-6), 32.1, 29.86, 29.82, 29.76, 29.73, 29.5, 29.3, 22.9 (CH_2-7, CH_2-9—CH_2-22), 26.2 (CH_2-8), 14.3 (CH_3-23); IR (film): 2916, 2849, 1694, 1600, 1466, 1277, 1173 cm^{-1}; HRMS (ESI) calcd. For $[C_{43}H_{78}O_4$-H]$^-$: 657.5827; obsd.: 657.5854.



21d

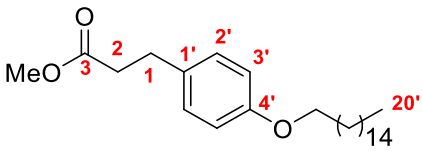
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3,5-bis(octadecyloxy)benzoate)-α,α′-D-trehalose (21d). Diol **6** (97 mg, 0.110 mmol) and acid **8c** (472 mg, 0.72 mmol) were co-evaporated with toluene (2 × 5 mL) and then dissolved in dry toluene (3 mL). To the resulting solution was added EDCI (194 mg, 1.0 mmol) and DMAP (24 mg, 0.20 mmol) and the mixture was stirred at 55 °C overnight. The following day, the reaction mixture was diluted with EtOAc (50 mL), washed with H_2O (50 mL) and brine (50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo*. The resulting residue was purified by silica-gel column chromatography (1:0-22:3, pet. ether:EtOAc, *v/v*) to give the title compound as a clear oil (146 mg, 0.067 mmol, 61%). R_f = 0.69 (4:1, pet. Ether:EtOAc, *v/v*); $[\alpha]_D^{25}$ = +58 (*c* = 0.1, CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39-7.26 (m, 30H, CH_{arom}), 7.09 (d, $J_{2',4'}$ = 2.3 Hz, 4H, H-2'), 6.61 (t, $J_{2',4'}$ = 2.3 Hz, 2H, H-4'), 5.23 (d, $J_{1,2}$ = 3.6 Hz, 2H, H-1), 5.03 (d, $J_{a,b}$ = 10.8 Hz, 2H, CH_a 3-*O*-Bn), 4.90 (d, $J_{a,b}$ = 10.7 Hz, 2H, CH_b 3-*O*-Bn), 4.89 (d, $J_{a,b}$ = 10.6 Hz, 2H, CH_a 4-*O*-Bn), 4.74 (d, $J_{a,b}$ = 11.9 Hz, 2H, CH_a 2-*O*-Bn), 4.70 (d, $J_{a,b}$ = 11.9 Hz, 2H, CH_b 2-*O*-Bn), 4.58 (d, $J_{a,b}$ = 10.6 Hz, 2H, CH_b 4-*O*-Bn), 4.30 (m, 6H, H-5, H-6), 4.10 (t, $J_{2,3}$ = $J_{3,4}$ = 9.4 Hz, 2H, H-3), 3.92 (t, $J_{6',7'}$ =

6.6 Hz, 4H, CH_2-6'), 3.65 (t, $J_{3,4} = J_{4,5} = 9.3$ Hz, 2H, H-4), 3.62 (dd, $J_{2,3} = 9.6$ Hz, $J_{1,2} = 3.6$ Hz, 2H, H-2), 1.76 (p, $J_{6',7'} = 6.7$ Hz, 8H, CH_2-7'), 1.43 (m, 8H, CH_2-8'), 1.37-1.23 (m, 112H, CH_2-9'—CH_2-22'), 0.89 (t, $J_{22',23'} = 7.1$ Hz, 12H, CH_3-23'); ^{13}C NMR (125 MHz, $CDCl_3$) δ 166.3 (C-7), 160.3 (C-3'), 138.7 (C_i, 3-*O*-Bn), 138.0 (C_i 4-*O*-Bn), 138.0 (C_i 2-*O*-Bn), 131.7 (C-1'), 128.6, 129.3, 128.2, 128.1, 127.9, 127.8, 127.6 (CH_{arom}), 108.0 (C-2'), 106.3 (C-4'), 94.1 (C-1), 81.9 (C-3), 79.7 (C-2), 77.9 (C-4), 76.0 (CH_2, 3-*O*-Bn), 75.5 (CH_2, 4-*O*-Bn), 73.2 (CH_2, 2-*O*-Bn), 69.5 (C-5), 68.5 (CH_2-6'), 63.3 (C-6), 32.1, 29.9, 29.82, 29.80, 29.75, 29.6, 29.5, 29.3, 22.9 (CH_2-7', CH_2-9'—CH_2-22'), 26.2 (CH_2-8'), 14.3 (CH_3-23'); IR (film): 2921, 2851, 1724, 1595, 1453, 1163, 1069, 998, 732 cm^{-1}; MALDI-TOF/TOF MS calcd. for $[C_{140}H_{210}O_{17}+Na]^+$: 2186.5460; obsd.: 2186.5471.

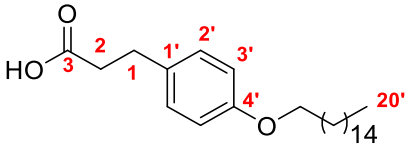


5d

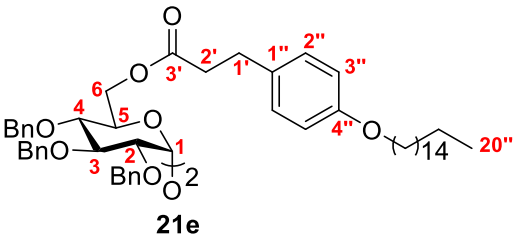
6,6′-di-*O*-(3,5-bis(octadecyloxy)benzoate)-α,α′-D-trehalose (5d). To a solution of **21d** (154 mg, 0.071 mmol) in CH_2Cl_2:MeOH (1:1, 5 mL) was added $Pd(OH)_2$/C (87 mg) and the resulting suspension was bubbled with H_2 overnight. The following day, the reaction mixture was diluted with pyridine (50 mL), filtered over celite, and concentrated under reduced pressure. The residue was purified by silica-gel column chromatography (1:0-9:1, EtOAc:MeOH, *v/v*) to give the title compound as a white solid (62 mg, 0.038 mmol, 54%). R_f = 0.60 (4:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{21}$ = +60 (*c* = 0.1, C_5H_5N);^{1}H NMR (600 MHz, C_5D_5N) δ 7.67 (d, $J_{2',4'} = 2.3$ Hz, 4H, H-2'), 7.46 (d, $J = 5.4$ Hz, 2H, OH), 7.16-7.10 (m, 4H, OH), 7.0 (t, $J_{2',4'} = 2.3$ Hz, 2H, H-4'), 6.03 (d, $J_{1,2} = 3.7$ Hz, 2H, H-1), 5.31 (m, 4H, H-5, H-6a), 5.03 (dd, $J_{6a,6b} = 12.1$ Hz, $J_{5,6b} = 6.9$ Hz, 2H, H-6b), 4.80 (t, $J_{3,4} = J_{2,3} = 9.3$ Hz, 2H, H-3), 4.35 (m, 2H, H-2), 4.21 (m, 2H, H-4), 4.01 (m, 4H, CH_2-6'), 1.78 (p, $J_{6',7'} = J_{7',8'} = 6.6$ Hz, 4H, CH_2-7'), 1.47 (m, 4H, CH_2-8'), 1.36-1.24 (m, 4H, 112H, CH_2-9'—CH_2-22'), 0.90 (t, $J_{22',23'} = 7.0$ Hz, 12H, CH_3-23'); ^{13}C NMR (150 MHz, C_5D_5N) δ 168.0 (C-7), 162.1 (C-3'), 134.1 (C-1'), 109.4 (C-2'), 108.3 (C-3'), 97.0 (C-1), 76.3 (C-3), 74.8 (C-2), 73.7 (C-4), 72.9 (C-5), 69.7 (CH_2-6'), 67.1 (C-6), 33.4, 31.3, 31.2, 31.0, 30.9, 30.8, 24.2 (CH_2-7', CH_2-9'—CH_2-22'), 27.7 (C-8'), 15.6 (CH_3-23'); IR (film): 3340, 2916, 2849, 1718, 1595, 1466, 1160, 987, 764 cm^{-1}; HRMS (ESI) calcd. For $[C_{98}H_{174}O_{17}+NH_4]^+$: 1641.3089; obsd.: 1641.3112.



Methyl 3-(4-[hexadecyloxy]phenyl)propanoate. To a solution of methyl 3-(4-hydroxyphenyl)propanoate (300 mg, 1.7 mmol) in acetone (20 mL) was added K_2CO_3 (299 mg, 2.2 mmol), TBAI (54 mg, 0.17 mmol), and 1-bromohexadecane (0.66 mL, 2.2 mmol) and the resulting suspension was refluxed overnight. The following day, additional portions of 1-bromohexadecane (0.1 mL, 0.32 mmol) and TBAI (30 mg, 0.093 mmol) were added and mixture was stirred at reflux for an additional two hours. The reaction mixture was concentrated under reduced pressure and the resulting residue was purified by silica-gel column chromatography (1:0-19:1. Pet. Ether:EtOAc, *v/v*) to give the title compound as a white solid (457 mg, 1.1 mmol, 68%). R_f = 0.69 (CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.09 (d, $J_{2',3'}$ = 8.7 Hz, 2H, H-2'), 6.81 (d, $J_{3',2'}$ = 8.7 Hz, 2H, H-3'), 3.92 (t, $J_{5',6'}$ = 6.6 Hz, 2H, CH_2-5'), 3.66 (s, 3H, CO_2Me), 2.88 (t, $J_{1,2}$ = 7.6 Hz, 2H, CH_2-1), 2.59 (t, $J_{1,2}$ = 7.6 Hz, 2H, CH_2-2), 1.76 (p, $J_{5',6'}$ = $J_{6',7'}$ = 6.7 Hz, 2H, CH_2-6'), 1.43 (m, 2H, CH_2-7'), 1.37-1.23 (m, 24H, CH_2-8'—CH_2-19'), 0.88 (t, $J_{19',20'}$ = 7.1 Hz, 3H, CH_3-20'); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.5 (C-3), 57.6 (C-4'), 132.3 (C-1'), 129.2 (C-2'), 114.5 (C-3'), 68.0 (C-5'), 51.6 (CO_2Me), 36.0 (CH_2-2), 31.9, 30.1, 29.70, 29.68, 29.67, 29.61, 29.59, 29.42, 29.37, 29.32, 22.70 (CH_2-6'—CH_2-19', CH_2-1), 14.1 (CH_3-20'); IR (film): 2916, 2849, 1740, 1514, 1272, 1165 cm^{-1}; MALDI-TOF/TOF MS calcd. for $[C_{20}H_{44}O_3+Na]^+$: 427.3188; obsd.: 427.3173.

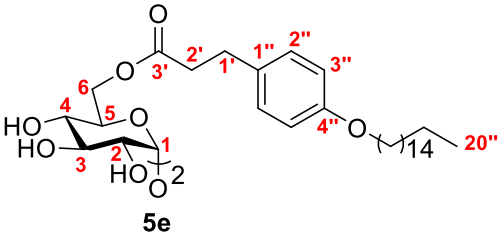


3-(4-[hexadecyloxy]phenyl)propanoic acid (9e). To a solution of Methyl 3-(4-[hexadecyloxy]phenyl)propanoate (450 mg, 1.11 mmol) in MeOH (20 mL) was added NaOH (5.6 mL, 5 M) and the resulting suspension was refluxed overnight. The reaction mixture was diluted with H_2O (50 mL), acidified with conc. HCl (pH 1), extracted with EtOAc, dried over $MgSO_4$, filtered, and concentrated *in vacuo* to give the title compound as an off-white solid (403 mg, 1.0 mmol, 93%). R_f = 0.51 (2:1; pet. ether:EtOAc; *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.11 (d, $J_{2',3'}$ = 8.7 Hz, 2H, H-2'), 6.82 (d, $J_{2',3'}$ = 8.7 Hz, 2H, H-3'), 3.92 (t, $J_{5',6'}$ = 6.6 Hz, 2H, CH_2-5'), 2.90 (t, $J_{1,2}$ = 7.6 Hz, 2H, CH_2-1), 2.64 (t, $J_{1,2}$ = 7.5 Hz, 2H, CH_2-2), 1.76 (p, $J_{5',6'}$ = $J_{6',7'}$ = 6.7 Hz, 2H, CH_2-6'), 1.43 (m, 2H, CH_2-7'), 1.37-1.23 (m, 24H, CH_2-8'—CH_2-19'), 0.88 (t, $J_{19',20'}$ = 7.1 Hz, 3H, CH_3-20'); ^{13}C NMR (125 MHz, $CDCl_3$) δ 177.9 (C-3), 157.9 (C-4'), 132.1 (C-1'), 129.3 (C-2'), 114.7 (C-3'), 68.2 (CH_2-5'), 35.8 (CH_2-2), 29.94, 29.86, 29.85, 29.83, 29.82, 29.76, 29.74, 29.57, 29.52, 29.46, 22.9 (CH_2-6', CH_2-8'—CH_2-19'), 26.2 (CH_2-7'), 14.3 (CH_3-20'); IR (film): 2917, 2850, 1694, 1473, 1277, 1026 cm^{-1}; MALDI-TOF/TOF MS calcd. for $[C_{25}H_{42}O_3+Na]^+$: 413.3032; obsd.: 413.2946.



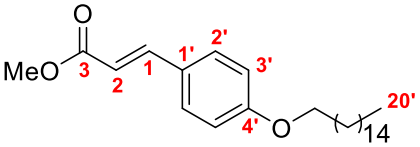
21e

2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3-[4-(hexadecyloxy)phenyl]propanoate)-α,α′-D-trehalose (21e). Diol **6** (130 mg, 0.15 mmol) and acid **9e** (258 mg, 0.66 mmol) was co-evaporated with toluene (2 × 5 mL) and then re-dissolved in dry toluene (7 mL). To the resulting solution was added EDCI (187 mg, 0.98 mmol) and DMAP (18 mg, 0.15 mmol) and the mixture was stirred at 60 °C overnight. The reaction mixture was diluted with EtOAc (50 mL), washed with water and brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The resulting residue was purified by silica-gel column chromatography (1:0-9:1, pet. ether:EtOAc, *v/v*) and lipophilic size exclusion (1:1, CH_2Cl_2:MeOH, *v/v*) to give the title compound as a clear oil (102 mg, 0.065 mmol, 44%). R_f = 0.38 (4:1, pet. ether:EtOAc, *v/v*); $[\alpha]_D^{21}$ = +56 (*c* = 1.0, CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36-7.20 (m, 30H, CH_{arom}), 7.03 (d, $J_{2'',3''}$ = 8.5 Hz, 4H, H-2''), 6.75 (d, $J_{2'',3''}$ = 8.5 Hz, 4H, H-3''), 5.15 (d, $J_{1,2}$ = 3.6 Hz, 2H, H-1), 4.99 (d, $J_{a,b}$ = 10.8 Hz, 2H, CH_2Ph, CH_a 3-*O*-Bn), 4.85 (d, $J_{a,b}$ = 10.9 Hz, 2H, CH_2Ph, CH_b 3-*O*-Bn), 4.78 (d, $J_{a,b}$ = 10.7 Hz, 2H, CH_2Ph, CH_a 4-*O*-Bn), 4.71 (d, $J_{a,b}$ = 11.9 Hz, 2H, CH_2Ph, CH_a 2-*O*-Bn), 4.66 (d, $J_{a,b}$ = 12.0 Hz, 2H, CH_2Ph, CH_b 2-*O*-Bn), 4.39 (d, $J_{a,b}$ = 10.6 Hz, 2H, CH_2Ph, CH_b 4-*O*-Bn), 4.20 (m, 2H, H-5), 4.14 (dd, $J_{6a,6b}$ = 12.3 Hz, $J_{5,6a}$ = 3.6 Hz, 2H, H-6a), 4.02 (m, 4H, H-6b, H-3), 3.83 (t, $J_{5'',6''}$ = 6.6 Hz, 4H, CH_2-5''), 3.54 (dd, $J_{2,3}$ = 9.6 Hz, $J_{1,2}$ = 3.5 Hz, 2H, H-2), 3.47 (t, $J_{3,4}$ = $J_{4,5}$ = 9.6 Hz, 2H, H-4), 2.82 (m, 4H, CH_2-1'), 2.53 (m, 4H, CH_2-2'), 1.71 (m, 4H, CH_2-6''), 1.40 (m, 4H, CH_2-7''), 1.35-1.24 (m, 48H, CH_2-8''—CH_2-19''), 0.88 (t, $J_{19'',20''}$ = 7.2 Hz, 6H, CH_3-20''); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.7 (C-3'), 157.7 (C-4''), 138.7 (C_i, 3-*O*-Bn) , 138.0 (C_i, 4-*O*-Bn), 137.9 (C_i, 2-*O*-Bn), 132.2 (C-1''), 129.2 (C-2''), 128.64, 128.60, 128.58, 128.3, 128.1, 128.0, 127.8, 127.6 (CH_{arom}), 114.6 (C-3''), 94.3 (C-1), 81.7 (C-3), 79.4 (C-2), 77.5 (C-4), 75.8 (CH_2, 3-*O*-Bn), 75.3 (CH_2, 4-*O*-Bn), 73.1 (CH_2, 2-*O*-Bn), 69.3 (C-5), 68.1 (CH_2-5''), 62.8 (C-6), 36.0 (CH_2-2'), 30.0, 29.9, 29.84, 29.83, 29.82, 29.77, 29.75, 29.6, 29.5, 29.46, 22.9 (CH_2-1', CH_2-6'', CH_2-8''—CH_2-19'') 26.2 (CH_2-7''), 14.3 (CH_3-20''); IR (film): 2923, 2853, 1735, 1512, 1245, 1106, 1096, 1071 cm^{-1}; HRMS (ESI) calcd. For $[C_{106}H_{142}O_{15}+NH_4]^+$: 1645.0380; obsd.: 1645.0407.



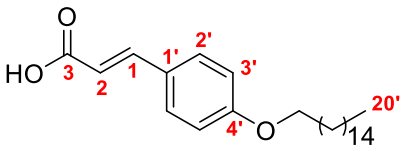
5e

6,6′-di-*O*-(3-[4-(hexadecyloxy)phenyl]propanoate)-α,α′-D-trehalose (5e). To a solution of diester **21e** (103 mg, 0.066 mmol) in MeOH:CH_2Cl_2 (3 mL, 1:1, *v/v*) was added $Pd(OH)_2/C$ (50 mg). H_2-gas was bubbled through the reaction mixture overnight. The following day, the reaction mixture was diluted in pyridine and filtered over celite and concentrated *in vacuo*. The resulting residue was purified by silica-gel column chromatography (1:0-9:1, EtOAc:MeOH, *v/v*) to give the title compound as an off-white amorphous solid (43 mg, 0.042 mmol, 64%). R_f = 0.56 (4:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{28}$ = +50.6 (*c* = 0.1, C_5H_5N); ^{1}H NMR (500 MHz, C_5D_5N) δ 7.18 (d, $J_{2'',3''}$ = 8.5 Hz, 4H, H-2''), 6.99 (d, $J_{2'',3''}$ = 8.5 Hz, 4H, H-3''), 5.92 (d, $J_{1,2}$ = 3.7 Hz, 2H, H-1), 5.13 (ddd, $J_{4,5}$ = 10.1 Hz, $J_{5,6b}$ = 5.4 Hz, $J_{5,6a}$ = 1.6 Hz, 2H, H-5), 5.02 (m, 2H, H-6a), 4.83 (dd, $J_{6a,6b}$ = 11.7 Hz, $J_{6b,5}$ = 5.6 Hz, 2H, H-6b), 4.76 (t, $J_{3,4} = J_{2,3}$ = 9.1 Hz, 2H, H-3), 4.33 (dd, $J_{2,3}$ = 9.6 Hz, $J_{2,1}$ = 3.7 Hz, 2H, H-2), 4.18 (t, $J_{3,4} = J_{4,5}$ = 9.4 Hz, 2H, H-4), 3.92 (t, $J_{5'',6''}$ = 6.5 Hz, 4H, CH_2-6''), 2.96 (t, $J_{1',2'}$ = 7.8 Hz, 4H, CH_2-1'), 2.67 (m, 4H, CH_2-2'), 1.76 (p, $J_{5'',6''} = J_{6'',7''}$ = 6.6 Hz, 4H, CH_2-6''), 1.44 (m, 4H, CH_2-7''), 1.34-1.23 (m, 48H, CH_2-8''—CH_2-19''), 0.88 (t, $J_{19'',20''}$ = 7.1 Hz, 6H, CH_3-20''); ^{13}C NMR (150 MHz, C_5D_5N) δ 173.3 (C-3'), 158.5 (C-4''), 133.4 (C-1''), 130.1 (C-2''), 115.3 (C-3''), 96.3 (C-1), 75.3 (C-3), 73.8 (C-2), 72.4 (C-4), 72.0 (C-5), 68.5 (CH_2-5''), 65.0 (C-6), 36.8 (CH_2-2'), 32.5, 30.8, 30.4, 30.3, 30.1, 30.05, 30.0, 23.3 (CH_2-1', CH_2-6'', CH_2-8''—CH_2-19''), 26.8 (CH_2-7''), 14.7 (CH_3-20''); IR (film) 3360, 2916, 2849, 1718, 1297, 990, 721 cm^{-1}; HRMS (ESI) calcd. for $[C_{62}H_{102}O_{15}+NH_4]^+$: 1104.7557; obsd.: 1104.7604.



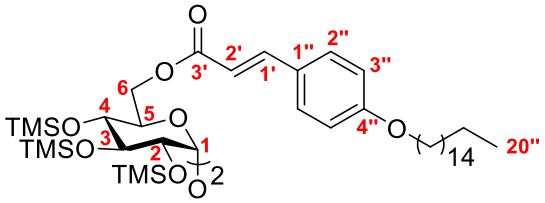
Methyl 4-hexadecyloxycinnamate. To a solution of methyl 4-hydroxycinnamate (409 mg, 2.3 mmol) in acetone (15 mL) was added K_2CO_3 (472 mg, 3.4 mmol), 1-bromohexadecane (1.05 mL, 3.5 mmol), and TBAI (74 mg, 0.23 mmol) and the resulting solution was stirred at reflux overnight. The reaction mixture was concentrated *in vacuo* and purified via silica-gel column chromatography (1:0-4:1, Pet. Ether:EtOAc, *v/v*) to give the title compound as a white solid (817 mg, 2.0 mmol, 88%). R_f = 0.70 (4:1, pet. Ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.65 (d, $J_{1,2}$ = 16.0 Hz, 1H, H-1), 7.46 (d, $J_{2',3'}$ = 8.7 Hz, 2H, H-2'), 6.89 (d, $J_{2',3'}$ = 8.7 Hz, 2H, H-3'), 6.30 (d, $J_{1,2}$ = 16.0 Hz, 1H, H-2), 3.98 (t, $J_{5',6'}$ = 6.5 Hz, 2H, CH_2-5'), 3.79 (s, 3H, CO_2Me), 1.78 (p, $J_{5',6'} = J_{6',7'}$ = 6.7 Hz, 2H, CH_2-6'), 1.44 (m, 2H, CH_2-7'), 1.38-1.22 (m, 24H, CH_2-8'—CH_2-19'), 0.88 (t, $J_{19',20'}$ = 7.0 Hz, 3H, CH_3-20'); ^{13}C NMR

(150 MHz, $CDCl_3$) δ 168.0 (C-3), 161.2 (C-4'), 144.8 (C-1), 129.9 (C-2'), 127.0 (C-1'), 115.2 (C-2), 115.0 (C-3'), 68.3 (CH_2-5'), 51.7 (CH_3-20'), 32.1, 29.9, 29.8, 29.74, 29.71, 29.5, 29.3, 22.9 (CH_2-6', CH_2-8'—CH_2-19'), 26.2 (CH_2-7'), 14.3 (CH_3-20'); IR (film): 2916, 2848, 1725, 1513, 1302, 1178 cm^{-1}; HRMS (ESI) calcd. for $[C_{26}H_{42}O_3+H]^+$: 403.32067; obsd.: 403.32093.



9f

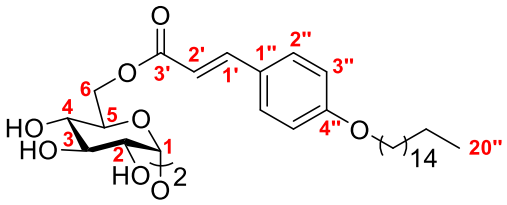
4-Hexadecyloxycinnamic acid (9f). To a solution of methyl 4-hexadecyloxycinnamate (379 mg, 0.94 mmol) in MeOH (20 mL) was added NaOH (5 mL, 5 M) and the resulting suspension was refluxed overnight. The reaction mixture was diluted with 1 M HCl (50 mL), extracted with EtOAc (50 mL), dried over $MgSO_4$, filtered, and concentrated *in vacuo* to give the title compound as an off-white solid (291 mg, 0.75 mmol, 80%). R_f = 0.47 (2:1, pet. ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.73 (d, $J_{1,2}$ = 15.9 Hz, 1H, H-1), 7.49 (d, $J_{2',3'}$ = 8.7 Hz, 2H, H-2'), 6.90 (d, $J_{2',3'}$ = 8.8 Hz, 2H, H-3'), 6.31 (d, $J_{1,2}$ = 16.0 Hz, 1H, H-2), 3.99 (t, $J_{5',6'}$ = 6.6 Hz, 2H, CH_2-5'), 1.79 (p, $J_{5',6'}$ = $J_{6',7'}$ = 6.7 Hz, 2H, CH_2-6'), 1.45 (m, 2H, CH_2-7'), 1.37-1.22 (m, 24H, CH_2-8'—CH_2-19'), 0.88 (t, $J_{19',20'}$ = 7.1 Hz, 3H, CH_3-20'); ^{13}C NMR (150 MHz, $CDCl_3$) δ 171.3 (C-3), 161.4 (C-4'), 146.8 (C-1), 130.0 (C-2'), 126.5 (C-1'), 114.9 (C-3'), 114.1 (C-2), 68.4 (CH_2-5'), 32.1, 29.9, 29.8, 29.74, 29.71, 29.5, 29.3, 22.9 (CH_2-6', CH_2-8'—CH_2-19'), 26.1 (C-7'), 14.3 (C-20'); IR (film): 2917, 2849, 1676, 1624, 1246, 1172 cm^{-1}; HRMS (ESI) calcd. for $[C_{25}H_{40}O_3-H]^-$: 387.2905; obsd.: 387.2907



22f

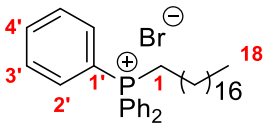
2,2′,3,3′,4,4′-Hexa-*O*-trimethylsilyl-6,6′-di-*O*-(4-hexadecyloxycinnamate)-α,α′-D-trehalose (22f). Diol **7** (150 mg, 0.19 mmol) and acid **9f** (388 mg, 0.87 mmol) were co-evaporated with toluene (2 × 5 mL) and then re-dissolved in dry toluene (6 mL). To the resulting solution was added EDCI (258 mg, 1.4 mmol) and DMAP (38 mg, 0.31 mmol) and the mixture was stirred at 50 °C overnight. The following day, additional portions of acid **9f** (43 mg, 0.11 mmol) and EDCI (42 mg, 0.22 mmol) and the mixture was left to stir for a further 2 hours. The reaction mixture was diluted with EtOAc (50 mL), washed with water and brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The resulting residue was purified by silica-gel column chromatography (1:0-3:2, pet. ether:EtOAc, *v/v*) and lipophilic size exclusion (1:1, CH_2Cl_2:MeOH, *v/v*) to give the title compound as a clear oil (117 mg, 0.077 mmol, 34%); R_f = 0.77 (4:1, pet. ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.66 (d, $J_{1',2'}$ = 15.9 Hz, 2H, H-1'), 7.47 (d, $J_{2",3"}$ = 8.8 Hz, 4H, H-2"), 6.89 (d, $J_{2",3"}$ = 8.8 Hz, 4H, H-3"), 6.35 (d, $J_{1',2'}$ = 15.9 Hz, 2H, H-2'), 4.99 (d, $J_{1,2}$ = 3.1 Hz,

2H, H-1), 4.39 (dd, $J_{6a,6b}$ = 12.1 Hz, $J_{6a,5}$ = 2.2 Hz, 2H, H-6a), 4.20 (dd, $J_{6a,6b}$ = 12.1 Hz, $J_{6b,5}$ = 4.3 Hz, 2H, H-6b), 4.08 (m, 2H, H-5), 3.96 (m, 6H, H-3, CH_2-5"), 3.57 (t, $J_{3,4}$ = $J_{4,5}$ = 9.0 Hz, 2H, H-4), 3.51 (dd, $J_{2,3}$ = 9.3 Hz, $J_{1,2}$ = 3.1 Hz, 2H, H-2), 1.78 (p, $J_{5",6"}$ = $J_{6",7"}$ = 6.6 Hz, 4H, CH_2-6"), 1.44 (m, 4H, CH_2-7"), 1.39-1.21 (m, 48H, CH_2-8"—CH_2-19"), 0.88 (t, $J_{19",20"}$ = 7.1 Hz, 6H, CH_3-20'), 0.17 (s, 18H, CH_3-TMS), 0.16 (s, 18H, CH_3-TMS), 0.14 (s, 18H, CH_3-TMS); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.5 (C-3'), 161.2 (C-4"), 145.1 (C-1'), 129.9 (C-2"), 127.0 (C-1"), 115.1 (C-2'), 115.0 (C-3"), 94.7 (C-1), 73.7 (C-3), 72.8 (C-2), 72.1 (C-4), 71.0 (C-5), 68.3 (CH_2-5"), 63.6 (C-6), 32.1, 29.9, 29.83, 29.81, 29.75, 29.72, 29.53, 29.52, 29.3, 22.9 (CH_2-6", CH_2-8"—CH_2-9"), 26.2 (C-7"), 14.3 (CH_3-20'), 1.24, 1.1, 0.4 (CH_3-TMS); IR (film): 2920, 2851, 1719, 1603, 1250, 1171, 1046 cm^{-1}; HRMS (ESI) calcd. for $[C_{80}H_{146}O_{15}Si_6+NH_4]^+$: 1532.9616; obsd.: 1532.9610.



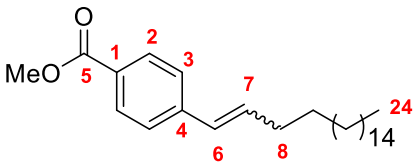
5f

6,6′-Di-*O*-(4-hexadecyloxycinnamate)-α,α′-D-trehalose (5f). To a solution of diester **22f** (116 mg, 0.076 mmol) in CH_2Cl_2:MeOH (1:1, 10 mL), was added Dowex-H$^+$ (35 mg) and the resulting suspension was left to stir at room temperature for 30 minutes. The reaction mixture was filtered, concentrated under reduced pressure, and purified by silica-gel column chromatography (1:0-4:1, EtOAc:MeOH, *v/v*) to give the title compound as a white amorphous solid (32 mg, 0.030 mmol, 40%). R_f = 0.71 (4:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{28}$ = +42.8 (*c* = 0.1, C_5H_5N); ^{1}H NMR (500 MHz, C_5D_5N) δ 7.94 (d, $J_{1',2'}$ = 15.9 Hz, 2H, H-1'), 7.49 (d, $J_{2",3"}$ = 8.7 Hz, 4H, H-2"), 7.44 (m, 1H, OH), 7.17 (m, 2H, OH), 7.00 (d, $J_{2",3"}$ = 8.8 Hz, 2H, H-3"), 6.60 (d, $J_{1',2'}$ = 15.9 Hz, 2H, H-2'), 5.99 (d, $J_{1,2}$ = 3.8 Hz, 2H, H-1), 5.23 (ddd, $J_{4,5}$ = 9.9 Hz, $J_{5,6b}$ = 4.9 Hz, $J_{5,6a}$ 1.8 Hz, 2H, H-5), 5.11 (dd, $J_{6a,6b}$ = 11.8 Hz, $J_{6a,5}$ = 1.9 Hz, 2H, H-6a), 5.02 (dd, $J_{6a,6b}$ = 11.8 Hz, $J_{6b,5}$ = 5.3 Hz, 2H, H-6b), 4.82 (t, $J_{3,4}$ = $J_{2,3}$ = 9.3 Hz, 2H, H-3), 4.38 (m, 2H, H-2), 4.27 (td, $J_{3,4}$ = $J_{4,5}$ = 9.5 Hz, J = 3.9 Hz, 2H, H-4), 3.93 (t, $J_{5",6"}$ = 6.52, 4H, CH_2-5"), 1.75 (p, $J_{5",6"}$ = $J_{6",7"}$ = 6.5 Hz, 4H, CH_2-6"), 1.43 (m, 4H, CH_2-7"), 1.31-1.23 (m, 48H, CH_2-8"—CH_2-19"), 0.87 (t, $J_{19",20"}$ = 7.1 Hz, 6H, CH_3-20"); ^{13}C NMR (150 MHz, C_5D_5N) δ 167.8 (C-3'), 161.8 (C-4"), 145.1 (C-1'), 130.7 (C-2"), 127.8 (C-1"), 116.6 (C-2'), 115.6 (C-3"), 96.5 (C-1), 75.3 (C-3), 73.8 (C-2), 72.4 (C-4), 72.1 (C-5), 68.7 (CH_2-5"), 65.0 (C-6), 32.5, 30.4, 30.34, 30.30, 30.27, 30.25, 30.03, 29.99, 29.85, 23.3 (CH_2-6", CH_2-8"—CH_2-19"), 26.7 (C-7"), 14.7 (CH_3-20"); IR (film): 3342, 2917, 2850, 1700, 1603, 1250, 1172, 1017, 825 cm^{-1}; HRMS (ESI) calcd. For $[C_{62}H_{98}O_{15}+H]^+$: 1083.6983; obsd.: 1083.6981.



16

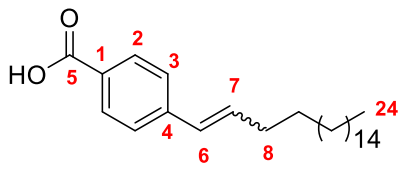
Octadecyltriphenylphosphonium bromide (16). A solution of 1-bromooctadecane (5.00 g, 0.015 mol) and PPh_3 (3.93 g, 0.015 mmol) in toluene (20 mL) was heated to 120 °C for 24 hours. The reaction mixture was cooled to room temperature and precipitated by the addition of Et_2O (50 mL). The precipitate was repeatedly washed with Et_2O to give the title compound as a pale brown solid (5.10 g, 8.6 mmol, 57%). ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.87-7.83 (m, 6H, H-2′), 7.80-7.76 (m, 3H, H-4′), 7.69 (m, 6H, H-3′), 3.82 (m, 2H, CH_2-1), 1.61 (m, 4H, CH_2-2, CH_2-3), 1.30-1.15 (m, 28H, CH_2-4—CH_2-17), 0.86 (t, $J_{17,18}$ = 7.2 Hz, 3H, CH_3-18); ^{13}C NMR (150 MHz, $CDCl_3$) δ 135.0 (d, $^4J_{C\text{-}4',P}$ = 3.0 Hz, C-4′), 133.9 (d, $^2J_{C\text{-}2',P}$ = 10.0 Hz, C-2′), 130.6 (d, $^3J_{C\text{-}3',P}$ = 12.5 Hz, C-3′), 118.6 (d, $^1J_{C\text{-}1',P}$ = 85.8 Hz, C-1′), 32.1, 30.5 (d, J = 15.5 Hz), 23.0 (d, $^1J_{C\text{-}1,P}$ = 45.3 Hz, C-1), 29.83, 29.82, 29.80, 29.78, 29.76, 29.72, 29.67, 29.5, 29.4, 29.3, 22.8 (C-2—C-17), 14.3 (CH_3-18). HRMS (ESI) calcd. for $[C_{36}H_{52}P]^+$: 515.3801; obsd.: 515.3825. Recorded NMR data were consistent with that reported in literature.[5]



17

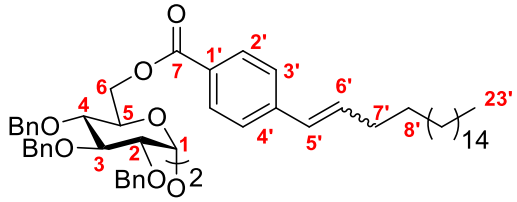
Methyl (*Z*)-4-(nonadec-1-en-1-yl)benzoate and **methyl (*E*)-4-(nonadec-1-en-1-yl)benzoate (17).** To a solution of **16** (543 mg, 0.91 mmol) in freshly distilled THF (5 mL) cooled to 0 °C was added BuLi (0.46 mL, 2 M) dropwise. The reaction mixture was warmed to room temperature and left to stir for 1 hour. To the reaction mixture was added aldehyde **14g** (150 mg, 0.91 mmol) dissolved in dry THF (2 mL) and the resulting solution was left to stir at room temperature for 12 hours. The following day, the reaction was quenched by the addition of acetone (5 mL) and concentrated under reduced pressure. The resulting residue was purified by silica-gel column chromatography (1:0-99:1, pet. ether:EtOAc, *v/v*) to give the title compound as a white solid (3:1 mixture, *Z:E*, 276 mg, 0.69 mmol, 76%). No attempts were made to separate the isomers. R_f = 0.82 (CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, $J_{2,3}$ = 8.4 Hz, *Z*-2H, *Z*-H-2), 7.96 (d, $J_{2,3}$ = 8.4 Hz, *E*-2H, *E*-H-2), 7.38 (d, $J_{2,3}$ = 8.4 Hz, *E*-2H, *E*-H-3), 7.33 (d, $J_{2,3}$ = 8.3 Hz, *Z*-2H, *Z*-H-3), 6.44-6.33 (m, *E*-2H and *Z*-1H, *E*-H-6, *E*-H-7, *Z*-H-6), 5.77 (dt, $J_{6,7}$ = 11.7 Hz, $J_{7,8}$ = 7.3 Hz, *Z*-1H, *Z*-H-7), 3.91 (s, *Z*-3H, *Z*-CO_2Me), 3.90 (s, *E*-3H, *E*-CO_2Me), 2.32 (qd, $J_{7,8}$ = $J_{8,9}$ = 7.4 Hz, $J_{6,8}$ = 1.7 Hz, *Z*-2H, *Z*-CH_2-8), 2.23 (m, *E*-2H, *E*-CH_2-8), 1.45 (m, *Z*-2H and *E*-2H, *Z*-CH_2-9, *E*-CH_2-9), 1.32-1.22 (m, *Z*-28H and *E*-28H, *Z*-CH_2-10—CH_2-23, *E*-CH_2-10—CH_2-23), 0.88 (m, *Z*-3H and *E*-3H, *Z*-CH_3-24, *E*-CH_3-24); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.0 (*Z*-C-5), 142.5 (*Z*-C-4), 135.5 (*Z*-C-7), 129.9 (*E*-C-2), 129.4 (*Z*-C-2), 128.7 (*Z*-C-3), 127.9 (*Z*-C-6, *Z*-C-1), 52.0 (*Z*-CO_2Me), 31.9, 29.8, 29.7, 29.6, 29.5, 29.4, 29.3, 22.7 (*Z*-CH_2-9—CH_2-23), 28.8 (*Z*-CH_2-8),

14.1 (*Z*-CH_3-24); IR (film): 2916, 2849, 1723, 1463, 1284, 1108, 1056 cm^{-1}; HRMS (ESI) calcd. for $[C_{27}H_{44}O_2+H]^+$: 401.3420; obsd.: 401.3411.



10g

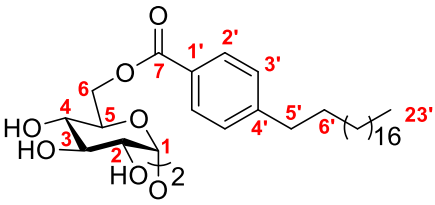
(*Z*)-4-(Nonadec-1-en-1-yl)benzoic acid and **(*E*)-4-(nonadec-1-en-1-yl)benzoic acid (10g).** To a solution of benzoates **17** (273 mg, 0.68 mmol) in MeOH (40 mL) was added NaOH (5 M, 8 mL) and the resulting suspension was refluxed overnight. The reaction mixture was acidified (pH 1) with 1 M HCl, extracted with EtOAc (50 mL), dried over $MgSO_4$, and concentrated under reduced pressure to give the title compound as an amorphous white solid (3:1 mixture, *Z:E*, 241 mg, 0.62 mmol, 91%). No attempts were made to separate the isomers. R_f = 0.63 (2:1, pet. ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.06 (d, $J_{2,3}$ = 8.3 Hz, *Z*-2H, *Z*-H-2), 8.02 (d, $J_{2,3}$ = 8.3 Hz, *E*-2H, *E*-H-2), 7.42 (d, $J_{2,3}$ = 8.4 Hz, *E*-2H, *E*-H-3), 7.36 (d, $J_{2,3}$ = 8.3 Hz, 2H, *Z*-H-3), 6.46-6.38 (m, *Z*-1H, *E*-2H, *Z*-H-6, *E*-H-6, *E*-H-7), 5.80 (dt, $J_{6,7}$ = 11.8 Hz, $J_{7,8}$ = 7.3 Hz, *Z*-1H, *Z*-H-7), 2.33 (qd, $J_{7,8}$ = $J_{8,9}$ = 7.3 Hz, $J_{6,8}$ = 1.5 Hz, *Z*-2H, *Z*-CH_2-8), 2.24 (m, *Z*-2H, *E*-CH_2-8), 1.46 (m, *Z*-2H and *E*-2H, *Z*-CH_2-9, *E*-CH_2-9), 1.34-1.20 (m, *Z*-28H and *E*-28H, *Z*-CH_2-10—CH_2-23, *E*-CH_2-10—CH_2-23), 0.88 (t, $J_{23,24}$ = 7.1 Hz, *Z*-3H and *E*-3H, *Z*-CH_3-24, *E*-CH_3-24); ^{13}C NMR (150 MHz, $CDCl_3$) δ 170.2 (*Z*-C-5), 143.5 (*Z*-C-4), 136.1 (*Z*-C-7), 135.0, 129.1 (*E*-C-6, *E*-C-7), 130.7 (*E*-C-2), 130.2 (*Z*-C-2), 128.9 (*Z*-C-3), 128.0 (*Z*-C-6), 127.0 (*Z*-C-1), 126.0 (*E*-C-3), 32.1, 30.0, 29.9, 29.84, 29.83, 29.82, 29.79, 29.76, 29.75, 29.66, 29.63, 29.52, 29.47, 29.4, 29.3, 22.9 (*Z*-CH_2-9—CH_2-23), 29.0 (*Z*-CH_2-8), 14.3 (*Z*-CH_3-24); IR (film): 2916, 2848, 1690, 1296, 1250 cm^{-1}; HRMS (ESI) calcd. for $[C_{26}H_{42}O_2-H]^-$: 385.3112; obsd.: 385.3120.



21g

2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-[(*Z*)-4-(nonadec-1-en-1-yl)benzoate]-α,α′-D-trehalose and **2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-[(*E*)-4-(nonadec-1-en-1-yl)benzoate]-α,α′-D-trehalose (70).** Diol **6** (105 mg, 0.12 mmol) and acids **10g** (207 mg, 0.54 mmol) were co-evaporated with toluene (2 × 5 mL) and then re-dissolved in dry toluene (3 mL). To the resulting solution was added EDCI (157 mg, 0.82 mmol) and DMAP (18 mg, 0.15 mmol) and the mixture was stirred at 70 °C overnight. The following day, the reaction mixture was diluted with EtOAc (50 mL), washed with water and brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The resulting residue was purified by silica-gel column chromatography (1:0-23:2, pet. ether:EtOAc, *v/v*) to give the title compound as a clear oil (5:2 mixture of isomers, 65 mg, 0.040 mmol, 34%).The major isomer

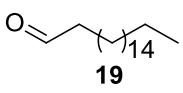
is assumed to be the *Z,Z* product and the minor visible isomer is assumed to be the *Z,E* product. R_f = 0.50 (4:1, pet. Ether:EtOAc, *v/v*); $[\alpha]_D^{21}$ = +64 (*c* = 1.0, CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (d, $J_{2',3'}$ = 8.3 Hz, 4H [major], H-2′ [major]), 7.88 (d, $J_{2',3'}$ = 8.5 Hz, 4H [minor], H-2′ [minor]), 7.39-7.21 (m, 34H [major] and 34H [minor], CH_{arom} [major], CH_{arom} [minor], H-3′ [major], H-3′ [minor]), 6.42-6.33 (m, 1H [major] and 2H [minor], H-5′ [major], H-5′ [minor], H-6′ [minor]), 5.77 (dt, $J_{5',6'}$ = 11.7 Hz, $J_{6',7'}$ = 7.3 Hz, 2H [major], H-6′ [major]), 5.23 (d, $J_{1,2}$ = 3.5 Hz, 2H [major], H-1 [major]), 5.04 (d, $J_{a,b}$ = 10.7 Hz, 2H [major], CH_a 3-*O*-Bn [major]), 4.91 (m, 4H [major], CH_b 3-*O*-Bn [major], CH_a 4-*O*-Bn [major]), 7.74 (d, $J_{a,b}$ = 11.9 Hz, 2H [major], CH_a 2-*O*-Bn [major]), 4.70 (d, $J_{a,b}$ = 11.9 Hz, 2H [major], CH_b 2-*O*-Bn [major]), 4.59 (d, $J_{a,b}$ = 10.7 Hz, 2H [major], CH_b 4-*O*-Bn [major]), 4.37-4.24 (m, 6H, H-6 [major], H-5 [major]), 4.11 (t, $J_{2,3}$ = $J_{3,4}$ = 9.3 Hz, 2H [major], H-3 [major]), 3.69 (t, $J_{3,4}$ = $J_{4,5}$ = 9.5 Hz, 2H [major], H-4 [major]), 3.63 (dd, $J_{2,3}$ = 9.7 Hz, $J_{1,2}$ = 3.5 Hz, 2H [major], H-2 [major]), 2.31 (m, 4H [major], CH_2-7′ [major]), 2.22 (m, 4H [minor], *E*-CH_2-7′ [minor]), 1.45 (m, 4H [major], CH_2-8′ [major]), 1.35-1.19 (m, 56H [major], CH_2-9′—CH_2-22′ [major]), 0.87 (t, $J_{22',23'}$ = 7.0 Hz, 6H [major], CH_3-23′ [major]); ^{13}C NMR (150 MHz, $CDCl_3$) δ 166.2 (C-7 [major]), 142.8 (C-4 [major]), 138.7 (C_i, 3-*O*-Bn [major]), 138.00, 137.95 (C_i, 2-*O*-Bn [major], 4-*O*-Bn [major]), 135.8 (C-6′ [major]), 134.6, 129.1 (C-5′ [minor], C-6′ [minor]), 130.1 (C-2′ [minor]), 129.7 (C-2 [major]), 128.8, 128.7, 128.3, 128.2, 128.1, 128.0, 127.93, 127.89, 127.82, 127.5 (CH_{arom} [major], CH_{arom} [minor] C-3′ [major], C-1′ [major], C-3′ [minor], C-1′ [minor]), 94.2 (C-1 [major]), 81.9 (C-3 [major]), 79.7 (C-2 [major]), 77.9 (C-4 [major]), 76.0 (CH_2, 3-*O*-Bn [major]), 75.5 (CH_2, 4-*O*-Bn [major]), 73.2 (CH_2, 2-*O*-Bn [major]), 69.5 (C-5 [major]), 63.1 (C-6 [major]), 32.1, 30.0, 29.9, 29.8, 29.76, 29.71, 29.5, 22.9 (CH_2-8′—CH_2-22′ [major]), 29.0 (CH_2-8′ [major]) 14.3 (CH_3-23′ [major]); IR (film): 2923, 2852, 1734, 1607, 1466, 1273, 1097, 1072 cm^{-1}; HRMS (ESI) calcd. for $[C_{106}H_{138}O_{13}+NH_4]^+$: 1637.0476; obsd.: 1637.0494.



5g

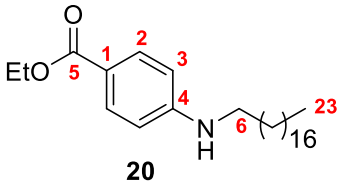
6,6′-di-*O*-4-(nonadec-1-en-1-yl)benzoate-α,α′-D-trehalose (5g). To a solution of diesters **21g** (62 mg, 0.038 mmol) in MeHO:CH_2Cl_2 (2.5 mL, 1:1, *v/v*) was added $Pd(OH)_2$/C (37 mg). H_2 gas was bubbled through the reaction mixture overnight. After 12 hours, the reaction mixture was diluted, filtered over celite, and concentrated *in vacuo*. The resulting residue was purified by silica-gel column chromatography (1:0-9:1, EtOAc:MeOH, *v/v*) to give the title compound as an off-white solid (24 mg, 0.022 mmol, 58%). R_f = 0.76 (4:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{22}$ = +60 (*c* = 0.1, C_5H_5N); ^{1}H NMR (500 MHz, C_5D_5N) δ 8.24 (d, $J_{2',3'}$ = 8.2 Hz, 4H,

H-2′), 7.49 (m, 2H, OH), 7.19 (d, $J_{2',3'}$ = 8.1 Hz, 4H, H-3′), 5.97 (d, $J_{1,2}$ = 3.7 Hz, 2H, H-1), 5.29 (ddd, $J_{4,5}$ = 10.1 Hz, $J_{6a,6b}$ = 5.5 Hz, $J_{6a,5}$ = 2.0 Hz, 2H, H-5), 5.20 (dd, $J_{5,6b}$ = 11.8 Hz, $J_{6a,6b}$ = 2.1 Hz, 2H, H-6a), 5.08 (m, 2H, H-6b), 4.83 (t, $J_{2,3}$ = $J_{3,4}$ = 9.2 Hz, 2H, H-3), 4.40 (m, 2H, H-2), 4.28 (t, $J_{3,4}$ = $J_{4,5}$ = 9.4 Hz, 2H, H-4), 2.56 (t, $J_{5',6'}$ = 7.7 Hz, 4H, CH_2-5′), 1.55 (m, 4H, CH_2-6′), 1.36-1.21 (m, 64H, CH_2-7′—CH_2-22′), 0.88 (t, $J_{23',24'}$ = 7.2 Hz, 6H, CH_3-23′);^{13}C NMR (150 MHz, C_5D_5N) δ 167.2 (C-7), 149.0 (C-4′), 130.5 (C-2′), 129.2 (C-3′), 128.9 (C-1′), 96.3 (C-1), 75.4 (C-3), 73.8 (C-2), 72.5 (C-4), 72.0 (C-5), 65.5 (C-6), 36.4 (CH_2-5′), 31.7 (CH_2-6′), 32.5, 30.37, 30.36, 30.35, 30.29, 30.27, 30.1, 30.0, 29.9, 23.3 (CH_2-7′—CH_2-22′), 14.7 (CH_3-23′); IR (film): 3357, 2917, 2850, 1716, 1467, 1415, 1283, 1102, 1077, 1046, 1019, 721 cm^{-1}; HRMS (ESI) calcd. for $[C_{64}H_{106}O_{13}+NH_4]^+$: 1100.7972; obsd.: 1100.7992.



19

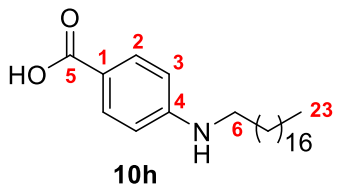
Octadecanal (19). To a solution of PCC (1.60 g, 7.4 mmol) in dry CH_2Cl_2 (20 mL) was added octadecanol (1.0 g, 3.7 mmol) and the resulting solution was left to stir at room temperature for 3 hours. The reaction mixture was filtered over silica-gel, concentrated under reduced pressure, and purified by silica-gel column chromatography (1:0-9:1, pet. ether:EtOAc, *v/v*) to give the title compound as a white solid (847 mg, 3.1 mmol, 85%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (s, 1H, H-1), 2.41 (t, $J_{2,3}$ = 7.4 Hz, 2H, CH_2-2), 1.62 (p, $J_{2,3}$ = $J_{3,4}$ = 7.1 Hz, 2H, CH_2-3), 1.37-1.16 (m, 28H, CH_2-4—CH_2-17), 0.87 (t, $J_{17,18}$ = 7.1 Hz, 3H, CH_3-18); ^{13}C NMR (125 MHz, $CDCl_3$) δ 203.1 (C-1), 44.1 (CH_2-2), 32.1, 29.9, 29.82, 29.79, 29.74, 29.6, 29.5, 29.3, 22.9 (CH_2-4—CH_2-17), 22.3 (CH_2-3), 14.3 (CH_3-18). Data obtained for this compound matched literature values.[6]



20

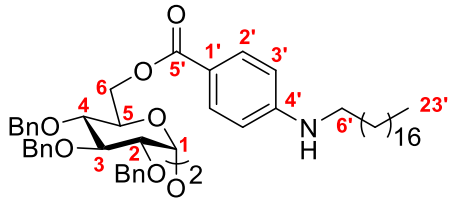
Ethyl 4-(octadecylamino)benzoate (20). Ethyl 4-aminobenzoate (200 mg, 1.2 mmol), octadecanal (650 mg, 2.4 mmol), and AcOH (0.21 mL, 3.6 mmol) were dissolved in THF (10 mL) and stirred at room temperature for 10 minutes. To the resulting solution was added $NaBH(OAc)_3$ (518 mg, 2.4 mmol) and the reaction was left to stir at room temperature overnight. The reaction mixture was concentrated *in vacuo* and the residue was purified by silica-gel column chromatography (1:0-9:1, pet. ether:EtOAc, *v/v*) to give the title compound as a white solid (469 mg, 1.1 mmol, 93%). R_f = 0.65 (CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.86 (d, $J_{2,3}$ = 8.8 Hz, 2H, H-2), 6.53 (d, $J_{2,3}$ = 8.8 Hz, 2H, H-3), 4.31 (q, J = 7.1 Hz, 2H, CH_2-OEt), 3.15 (t, $J_{6,7}$ = 7.2 Hz, 2H, CH_2-6), 1.62 (p, $J_{6,7}$ = $J_{7,8}$ = 7.3 Hz, 2H, CH_2-7), 1.42-1.36 (m, 2H, CH_2-8), 1.36 (t, J = 7.2 Hz, 3H, CH_3-OEt), 1.33-1.23 (m, 28H, CH_2-9—CH_2-22), 0.88 (t, $J_{22,23}$ = 7.1 Hz, 3H, CH_3-23); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.1 (C-5), 152.2 (C-4), 131.6 (C-2), 118.5 (C-1), 111.4 (C-3), 60.3 (CH_2-OEt), 43.6 (CH_2-6), 32.1, 29.85, 29.82, 29.74,

29.72, 29.54, 29.52, 29.48, 22.9 (CH_2-7, CH_2-9-CH_2-22), 27.2 (CH_2-8), 14.6 (CH_3-OEt), 14.3 (CH_3-23); IR (film): 3370, 2915, 2849, 1679, 1600, 1534, 1471, 1282, 1173, 1124 cm^{-1}; HRMS (ESI) calcd. for $[C_{27}H_{47}NO_2+H]^+$: 418.3680; obsd.: 418.3691.



10h

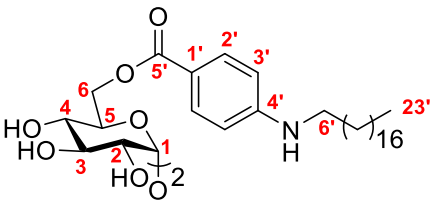
4-(Octadecylamino)benzoic acid (10h). To a solution of ethyl benzoate **20** (460 mg, 1.1 mmol) in ethanol (20 mL) was added NaOH (5.5 mL, 5 M) and the resulting suspension was refluxed overnight. The reaction mixture was diluted with water (50 mL), acidified with conc. HCl (pH 1), extracted with EtOAc, dried over $MgSO_4$, filtered, and concentrated *in vacuo* to give the title compound as a beige solid (392 mg, 1.0 mmol, 92%). R_f = 0.49 (2:1; pet. ether:EtOAc; *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 (d, $J_{2,3}$ = 8.9 Hz, 2H, H-2), 6.55 (d, $J_{2,3}$ = 8.9 Hz, 2H, H-3), 3.17 (t, $J_{6,7}$ = 7.2 Hz, 2H, CH_2-6), 1.63 (p, $J_{6,7}$ = $J_{7,8}$ = 7.1 Hz, 2H, CH_2-7), 1.39 (m, 2H, CH_2-8), 1.35-1.23 (m, 28H, CH_2-9—CH_2-22), 0.88 (t, $J_{22,23}$ = 7.1 Hz, 3H, CH_3-23); ^{13}C NMR (150 MHz, $CDCl_3$) δ 171.0 (C-5), 152.7 (C-4), 132.3 (C-2), 116.7 (C-1), 111.3 (C-3), 43.4 (CH_2-6), 29.69, 29.68, 29.66, 29.64, 29.58, 29.55, 29.36, 29.27, 22.7 (CH_2-7, CH_2-9—CH_2-22), 27.1 (CH_2-8), 14.1 (CH_3-23); IR (film): 2955, 2849, 1671, 1605, 1468, 1424, 1342, 1318, 1284, 1175 cm^{-1}; HRMS (ESI) calcd. for $[C_{25}H_{43}NO_2-H]^-$: 388.32210; obsd.: 388.32283.



21h

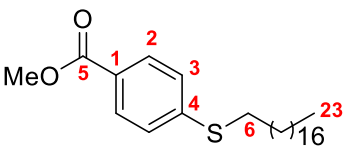
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(4-(octadecylamino)benzoate)-α,α′-D-trehalose (21h). Diol **6** (107 mg, 0.12 mmol) and acid **10h** (211 mg, 0.54 mmol) were co-evaporated with toluene (2 × 5 mL) and then re-dissolved in dry toluene (3 mL). To the resulting solution was added EDCI (151 mg, 0.79 mmol) and DMAP (15 mg, 0.12 mmol) and the mixture was stirred at 70 °C overnight. The following day, the reaction mixture was diluted with EtOAc (50 mL), washed with water and brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The resulting residue was purified by silica-gel column chromatography (1:0-3:1, pet. ether:EtOAc, *v/v*) to give the title compound as a clear oil (75 mg, 0.046 mmol, 38%). R_f = 0.46 (4:1, pet. ether:EtOAc, *v/v*); $[\alpha]_D^{23}$ = +66 (*c* = 1.0, CH_2Cl_2); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.84 (d, $J_{2',3'}$ = 8.9 Hz, 4H, H-2'), 7.42-7.27 (m, 30H, CH_{arom}), 6.53 (d, $J_{2',3'}$ = 8.8 Hz, 4H, H-3'), 5.28 (d, $J_{1,2}$ = 3.5 Hz, 2H, H-1), 5.06 (d, $J_{a,b}$ = 10.7 Hz, 2H, CH_a 3-*O*-Bn), 4.93 (d, $J_{a,b}$ = 10.8 Hz, 2H, CH_b 3-*O*-Bn), 4.91 (d, $J_{a,b}$ = 10.7 Hz, 2H, CH_a 4-*O*-Bn), 4.75 (m, 4H, CH_2 2-*O*-Bn), 4.61 (d, $J_{a,b}$ = 10.5 Hz, 2H, CH_b 4-*O*-Bn), 4.39-4.25 (m, 6H, H-5, H-6), 4.16-4.10 (m, 2H, H-3), 3.73 (t, $J_{3,4}$ = $J_{4,5}$ = 9.7 Hz, 2H, H-4), 3.66 (dd, $J_{2,3}$ = 9.6 Hz,

$J_{1,2}$ = 3.4 Hz, 2H, H-2), 3.17 (m, 4H, CH_2-6'), 1.65 (m, 4H, CH_2-7'), 1.42 (m, 4H, CH_2-8'), 1.38-1.25 (m, 28H, CH_2-9'—CH_2-22'), 0.91 (t, $J_{22',23'}$ = 7.2 Hz, 6H, CH_3-23'); ^{13}C NMR (125 MHz, $CDCl_3$) δ 166.5 (C-5'), 152.4 (C-4'), 138.7 (C_i, 3-*O*-Bn), 138.04 (C_i, 4-*O*-Bn), 137.97 (C_i, 2-*O*-Bn), 131.8 (C-2'), 128.60, 128.59, 128.3, 128.2, 128.0, 127.9, 127.8, 127.6 (CH_{arom}), 117.8 (C-1'), 111.4 (C-3'), 94.1 (C-1), 81.8 (C-3), 79.6 (C-2), 78.0 (C-4), 76.0 (CH_2, 3-*O*-Bn), 75.5 (CH_2, 4-*O*-Bn), 73.0 (CH_2, 2-*O*-Bn), 69.6 (C-5), 62.5 (C-6), 43.5 (CH_2-6'), 32.1, 29.84, 29.81, 29.80, 29.74, 29.72, 29.6, 29.50, 29.45 (CH_2-7', CH_2-9'—CH_2-22'), 27.2 (CH_2-8'), 14.3 (CH_3-23'); IR (film): 3380, 2921, 2852, 1706, 1604, 1527, 1497, 1418, 1267, 1172, 1095, 1070 cm^{-1}; HRMS (ESI) calcd. for $[C_{104}H_{140}N_2O_{13}+H]^+$: 1626.0428; obsd.: 1626.0490.



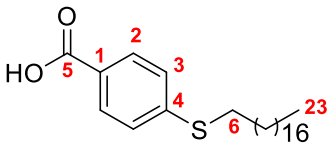
21h

6,6′-di-*O*-(4-(octadecylamino)benzoate)-α,α′-D-trehalose (5h). To a solution of diester **21h** (74 mg, 0.046 mmol) in MeHO:CH_2Cl_2 (3 mL, 1:1, *v/v*) was added $Pd(OH)_2$/C (44 mg). H_2 gas was bubbled through the reaction mixture. After 48 hours, the reaction mixture was diluted with pyridine, filtered over celite, and concentrated *in vacuo*. The resulting residue was purified by silica-gel column chromatography (1:0-4:1, EtOAc:MeOH, *v/v*) to give the title compound as an off-white solid (14 mg, 0.013 mmol, 28%). R_f = 0.71 (9:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{21}$ = + 80 (*c* = 0.025, C_5H_5N); ^{1}H NMR (600 MHz, C_5D_5N) δ 8.23 (d, $J_{2',3'}$ = 8.8 Hz, 4H, H-2′), 7.31 (m, 2H, OH), 7.08 (m, 4H, OH), 6.62 (d, $J_{2',3'}$ = 8.9 Hz, 4H, H-3′), 6.70 (m, 2H, NH), 5.99 (d, $J_{1,2}$ = 3.7 Hz, 2H, H-1), 5.27 (ddd, $J_{4,5}$ = 9.7 Hz, $J_{5,6b}$ = 5.2 Hz, $J_{5,6a}$ = 1.8 Hz, 2H, H-5), 5.19 (dd, $J_{6a,6b}$ = 11.6, $J_{5,6a}$ = 1.8 Hz, 2H, H-6a), 5.07 (dd, $J_{6a,6b}$ = 11.7 Hz, $J_{5,6b}$ = 5.3 Hz, 2H, H-6b), 4.82 (dt, $J_{3,4}$ = $J_{2,3}$ = 9.4 Hz, $J_{a,b}$ = 3.1 Hz, 2H, H-3), 4.38 (m, 2H, H-2), 4.31 (td, $J_{3,4}$ = $J_{4,5}$ = 9.4 Hz, $J_{a,b}$ = 5.3 Hz, 2H, H-4), 3.14 (q, $J_{NH,6'}$ = $J_{6',7'}$ = 6.5 Hz, 4H, CH_2-6′), 1.62 (p, $J_{6',7'}$ = $J_{7',8'}$ = 7.4 Hz, 4H, CH_2-7′), 1.39-1.17 (m, 60H, CH_2-8′—CH_2-22′), 0.88 (t, $J_{22',23'}$ = 7.2 Hz, 6H, CH_3-23′); ^{13}C NMR (150 MHz, C_5D_5N) δ 167.7 (C-5′), 154.1 (C-4′), 132.6 (C-2′), 118.2 (C-1′), 111.9 (C-3′), 96.5 (C-1), 75.5 (C-3), 74.0 (C-2), 72.6 (C-4), 72.3 (C-5), 64.9 (C-6), 43.9 (CH_2-6′), 32.6, 30.47, 30.39, 30.2, 30.1, 29.9, 28.0, 23.4 (CH_2-7′—CH_2-22′), 14.8 (CH_3-23′); IR (film): 3365, 2916, 1851, 1696, 1604, 1471, 1434, 1378, 1104 cm^{-1}; HRMS (ESI) calcd. For $[C_{62}H_{104}N_2O_{13}+H]^+$: 1085.7611; obsd.: 1085.7589.



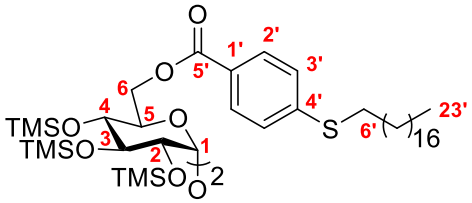
Methyl 4-(octadecylthio)benzoate. To a solution of methyl 4-mercaptobenzoate (466 mg, 2.8 mmol) in acetone (20 mL) was added K_2CO_3 (613 mg, 4.4 mmol) and 1-bromooctadecane (1.48 g, 4.4 mmol), and TBAI (143 mg, 0.44 mmol) and the resulting solution was stirred at reflux

overnight. The reaction mixture was concentrated under reduced pressure and purified by silica-gel column chromatography (1:0-3:2, pet. ether:EtOAc, *v/v*) to give the title compound as a white solid (460 mg, 1.1 mmol, 40%). R_f = 0.77 (4:1, pet. ether:EtOAc, *v/v*); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (d, $J_{2,3}$ = 8.4 Hz, 2H, H-2), 7.27 (d, $J_{2,3}$ = 8.6 Hz, 2H, H-3), 3.90 (s, 3H, CO_2Me), 2.97 (t, $J_{6,7}$ = 7.4 Hz, 2H, CH_2-6), 1.69 (p, $J_{6,7}$ = $J_{7,8}$ = 7.4 Hz, 2H, CH_2-7), 1.44 (m, 2H, CH_2-8), 1.34-1.22 (m, 28H, CH_2-9—CH_2-22), 0.88 (t, $J_{22,23}$ = 7.1 Hz, 3H, CH_3-23); ^{13}C NMR (150 MHz, $CDCl_3$) δ 167.0 (C-5), 144.7 (C-4), 133.0 (C-1), 130.0 (C-2), 126.4 (C-3), 52.2 (CO_2Me), 32.0 (CH_2-6), 31.9, 29.71, 29.68, 29.65, 29.58, 29.50, 293.38, 29.2 (CH_2-9—CH_2-22), 28.7 (CH_2-7), 28.9 (CH_2-8), 14.2 (CH_3-23); IR (film): 2916, 2848, 1723, 1596, 1435, 1288, 1113, 1013 cm^{-1}; HRMS (ESI) calcd. for $[C_{26}H_{44}O_2S+H]^+$: 421.3140; obsd.: 421.3132.



10i

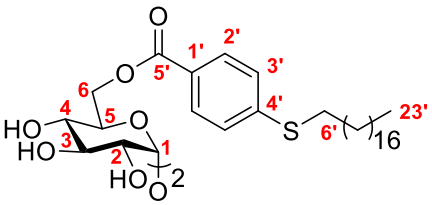
4-(Octadecylthio)benzoic acid (10i). To a solution of methyl 4-(octadecylthio)benzoate (446 mg, 1.1 mmol) in MeOH (20 mL) was added NaOH (5 mL, 5 M) and the resulting solution was refluxed overnight. The reaction mixture was diluted with 1 M HCl (50 mL), extracted with hot EtOAc, dried over $MgSO_4$, filtered, and concentrated under reduced pressure to give the title compound as a white amorphous solid (434 mg, 1.1 mmol, quant.). R_f = 0.45 (4:1, pet. ether:EtOAc, *v/v*); ^{1}H NMR (600 MHz, C_5D_5N) δ 8.41 (d, $J_{2,3}$ = 8.5 Hz, 2H, H-2), 7.54 (d, $J_{2,3}$ = 8.5 Hz, 2H, H-3), 3.04 (t, $J_{6,7}$ = 7.3 Hz, 2H, CH_2-6), 1.69 (p, $J_{6,7}$ = $J_{7,8}$ = 7.4 Hz, 2H, CH_2-7), 1.42 (m, 2H, CH_2-8), 1.32-1.22 (CH_2-9—CH_2-22), 0.88 (t, $J_{22,23}$ = 7.2 Hz, 3H, CH_3-23); ^{13}C NMR (150 MHz, C_5D_5N) δ 169.1 (C-5), 144.7 (C-4), 131.1 (C-2), 129.5 (C-1), 127.2 (C-3), 32.5, 30.36, 30.3, 30.2, 30.1, 30.0, 29.8, 29.4 23.3 (CH_2-9—CH_2-23), 32.4 (CH_2-6), 29.4 (CH_2-7, CH_2-8), 14.7 (CH_3-23); IR (film): 2954, 2849, 1686, 1473, 1431, 1280, 1133, 1014 cm^{-1}; HRMS (ESI) calcd. for $[C_{25}H_{42}O_2S-H]^-$: 405.2827; obsd.: 405.2841.



22i

2,2′,3,3′,4,4′-Hexa-*O*-trimethylsilyl-6,6′-di-*O*-(4-[octadecylthio]benzoate)-α,α′-D-trehalose (22i). Diol **7** (110 mg, 0.14 mmol) and acid **10i** (346 mg, 0.85 mmol) were co-evaporated with toluene (2 × 5 mL) and then re-dissolved in dry toluene (5 mL). To the resulting solution was added EDCI (186 mg, 0.92 mmol) and DMAP (20 mg, 0.16 mmol) and the mixture was stirred at 70 °C for 48 hours. The reaction mixture was diluted with EtOAc (50 mL), washed with water and brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The resulting residue was purified by silica-gel column chromatography (1:0-19:1, pet. ether:EtOAc, *v/v*) to give the title compound as a clear oil (170 mg, 0.11 mmol, 77%). R_f

= 0.59 (9:1, pet. ether:EtOAc, *v/v*); $[\alpha]_D^{22}$ = +30 (*c* = 1.0, CH_2Cl_2; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (d, $J_{2',3'}$ = 8.4 Hz, 4H, H-2'), 7.29 (d, $J_{2',3'}$ = 8.4 Hz, 4H, H-3'), 4.97 (d, $J_{1,2}$ = 2.9 Hz, 2H, H-1), 4.55 (dd, $J_{6a,6b}$ = 12.0 Hz, $J_{5,6a}$ = 2.1 Hz, 2H, H-6a), 4.26 (dd, $J_{6a,6b}$ = 12.1 Hz, $J_{5,6b}$ = 3.41, 2H, H-6b), 4.12 (m, 2H, H-5), 3.97 (t, $J_{2,3}$ = $J_{3,4}$ = 8.9 Hz, 2H, H-3), 3.64 (t, $J_{3,4}$ = $J_{4,5}$ = 9.0 Hz, 2H, H-4), 3.49 (dd, $J_{2,3}$ = 9.3 Hz, $J_{1,2}$ = 3.0 Hz, 2H, H-2), 2.98 (t, $J_{6',7'}$ = 7.4 Hz, 4H, CH_2-6'), 1.69 (p, $J_{6',7'}$ = $J_{7',8'}$ = 7.3 Hz, 4H, CH_2-7'), 1.44 (m, 4H, CH_2-8'), 1.33-1.22 (m, 56H, CH_2-9'—CH_2-22'), 0.88 (t, $J_{22',23'}$ = 7.1 Hz, 6H, CH_3-23'), 0.18 (s, 18H, CH_3-TMS), 0.15 (s, 18H, CH_3-TMS), 0.13 (s, 18H, CH_3-TMS); ^{13}C NMR (125 MHz, $CDCl_3$) δ 166.3 (C-5'), 144.9 (C-4'), 130.1 (C-2'), 126.4 (C-1'), 126.3 (C-3'), 94.8 (C-1), 73.8 (C-3), 72.9 (C-2), 72.1 (C-4), 71.0 (C-5), 63.7 (C-6), 32.2 (C-6'), 32.1, 29.85, 29.82, 29.81, 29.80, 29.74, 29.66, 29.52, 29.3, 29.1, 28.9 (CH_2-9'—CH_2-22'), 29.1 (CH_2-8'), 28.9 (CH_2-7'), 14.3 (CH_3-23'), 1.3, 1.1, 0.4 (CH_3-TMS); IR (film): 2922, 2852, 1718, 1593, 1457, 1401, 1263, 1148, 1099, 869, 838, 757 cm^{-1}; HRMS (ESI) calcd. for $[C_{80}H_{150}O_{13}S_2Si_6+NH_4]^+$: 1568.9472; obsd.: 1568.9496.



5i

6,6′-di-*O*-(4-[octadecylthio]benzoate)-α,α′-D-trehalose (5i). To a solution of diester **22i** (160 mg, 0.10 mmol) in CH_2Cl_2:MeOH (1:1, 5 mL) was added Dowex-H^+ (23 mg) and the resulting suspension was left to stir at room temperature for 1 hour. The reaction mixture was filtered and concentrated under reduced pressure to yield the title compound as a white solid, which was precipitated from hot EtOH (60 mg, 0.054 mmol, 52%). R_f = 0.68 (4:1, EtOAc:MeOH, *v/v*); $[\alpha]_D^{23}$ = +60 (*c* = 0.1, C_5H_5N); ^{1}H NMR (500 MHz, C_5D_5N) δ 8.19 (d, $J_{2',3'}$ = 8.5 Hz, 4H, H-2′), 7.47 (m, 2H, OH), 7.32 (d, $J_{2',3'}$ = 8.4 Hz, 4H, H-3′), 1.19 (m, 4H, OH), 5.96 (d, $J_{1,2}$ = 3.7 Hz, 2H, H-1), 5.28 (ddd, $J_{4,5}$ = 10.0 Hz, $J_{6,6a}$ = 5.5 Hz, $J_{5,6a}$ = 1.8 Hz, 2H, H-5), 5.20 (dd, $J_{6a,6b}$ = 11.7 Hz, $J_{5,6a}$ = 1.7 Hz, 2H, H-6a), 5.05 (dd, $J_{6a,6b}$ = 11.7 Hz, $J_{5,6b}$ = 5.7 Hz, 2H, H-6b), 4.81 (td, $J_{2,3}$ = $J_{3,4}$ = 9.4 Hz, $J_{a,b}$ = 2.9 Hz, H-3), 4.38 (m, 2H, H-2), 4.26 (td, $J_{4,5}$ = $J_{3,4}$ = 9.6 Hz, $J_{a,b}$ = 5.2 Hz, 2H, H-4), 2.97 (t, $J_{6',7'}$ = 7.4 Hz, 4H, CH_2-6′), 1.66 (p, $J_{6',7'}$ = $J_{7',8'}$ = 7.4 Hz, 4H, CH_2-7′), 1.41 (m, 4H, CH_2-8′), 1.36-1.19 (m, 56H, CH_2-9′—CH_2-22′), 0.88 (t, $J_{22',23'}$ = 7.1 Hz, 6H, CH_3-23′); ^{13}C NMR (150 MHz, C_5D_5N) δ 166.9 (C-5′), 145.4 (C-4′), 130.9 (C-2′), 127.8 (C-1′), 127.0 (C-3′), 96.5 (C-1), 75.5 (C-3), 73.9 (C-2), 72.6 (C-4), 72.2 (C-5), 65.7 (C-6), 32.4 (CH_2-6′), 32.6, 30.48, 30.46, 30.44, 30.40, 30.36, 30.28, 30.1, 29.9, 29.6, 29.5, 23.4 (CH_2-7′—CH_2-22′), 14.8 (CH_3-23′); IR (film): 3353, 2917, 2849, 1713, 1593, 1470, 1400, 1275, 1100, 1077, 1042, 759 cm^{-1}; HRMS (ESI) calcd. For $[C_{62}H_{102}O_{13}S_2+NH_4]^+$: 1136.7100; obsd.: 1136. 7117.

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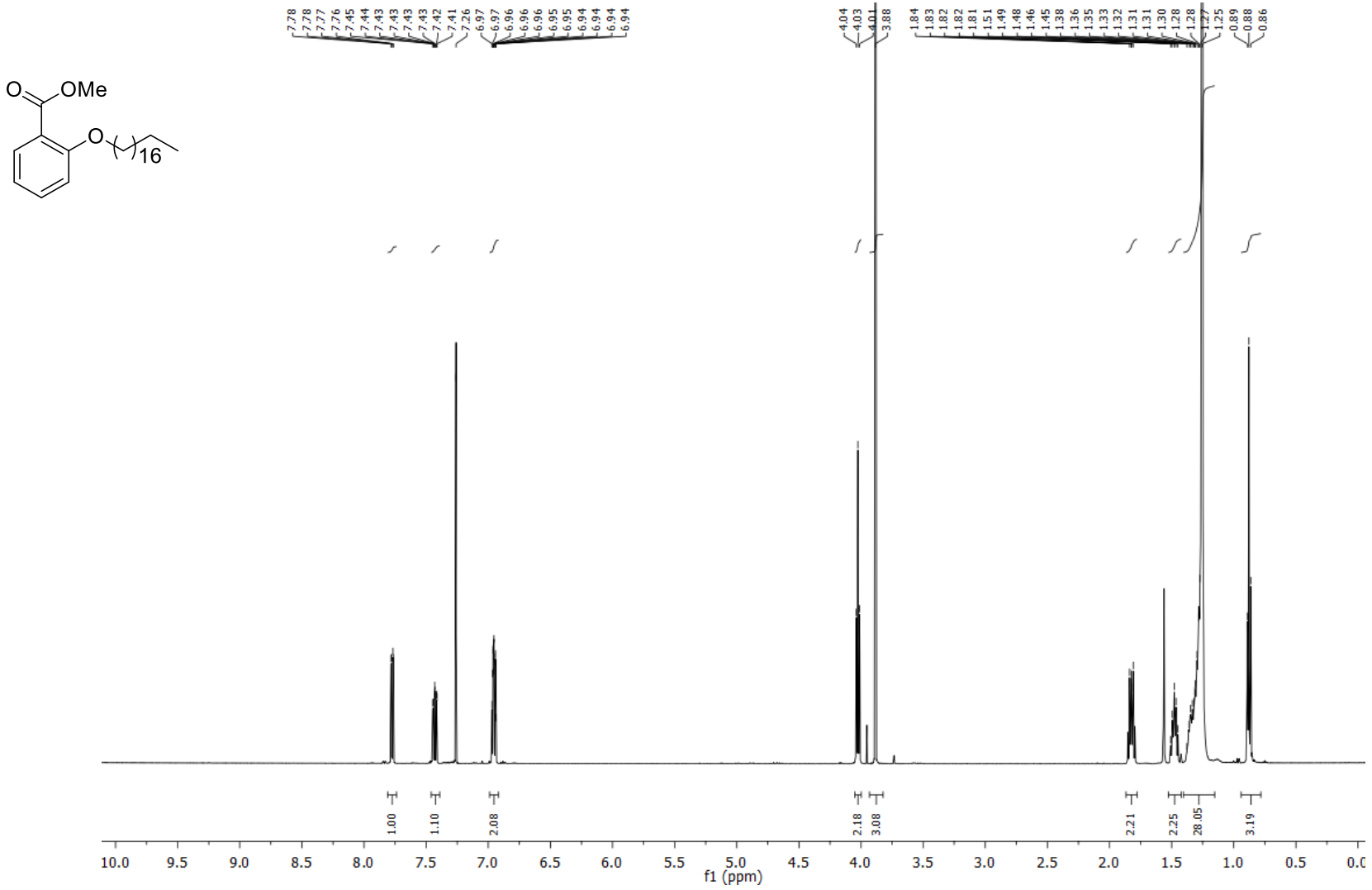
NMR Spectra

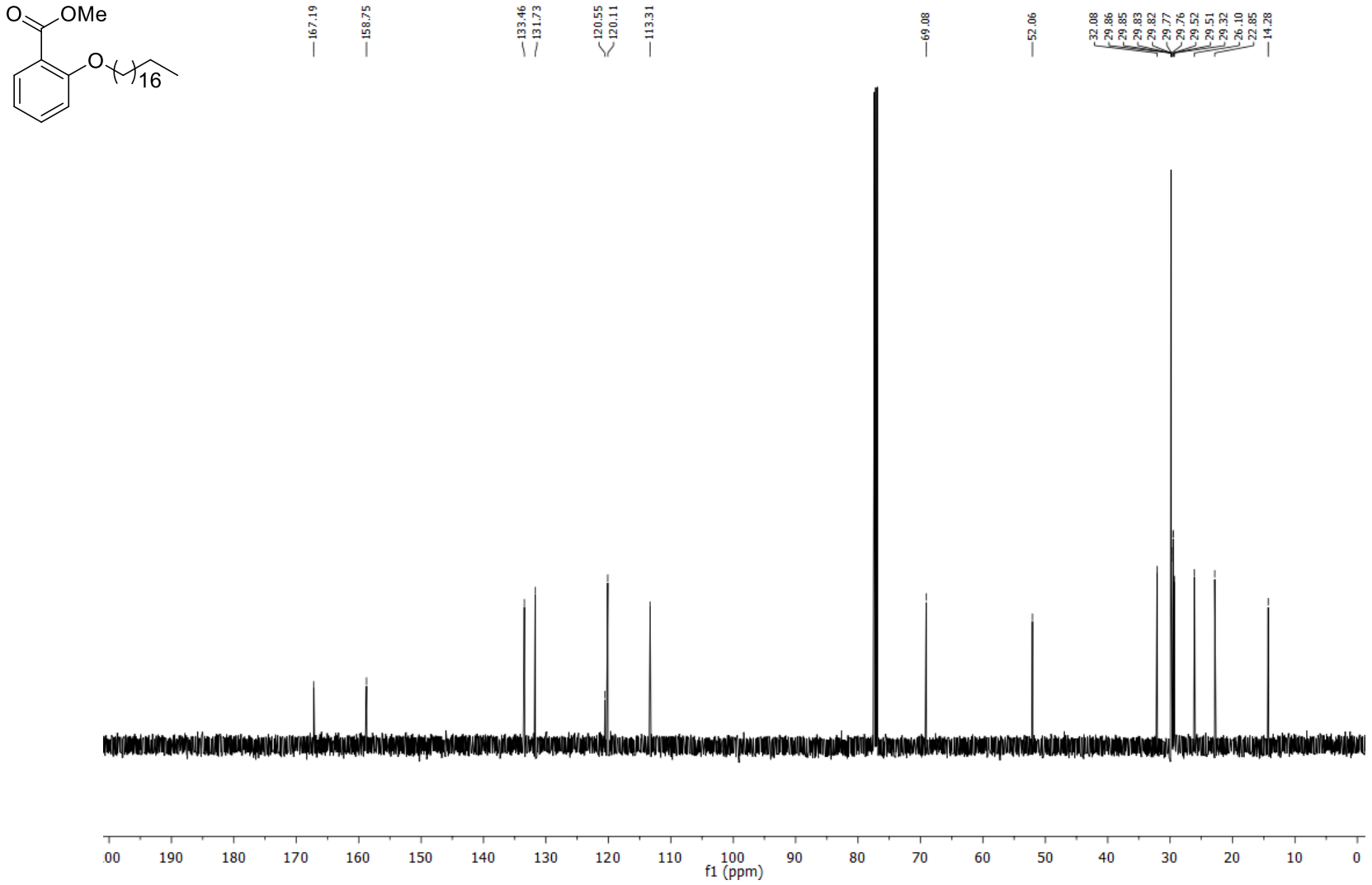
Methyl 2-(octadecyloxy)benzoate

^{1}H NMR (500 MHz, $CDCl_3$)



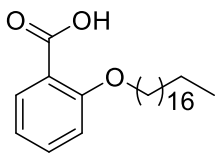
Methyl 2-(octadecyloxy)benzoate

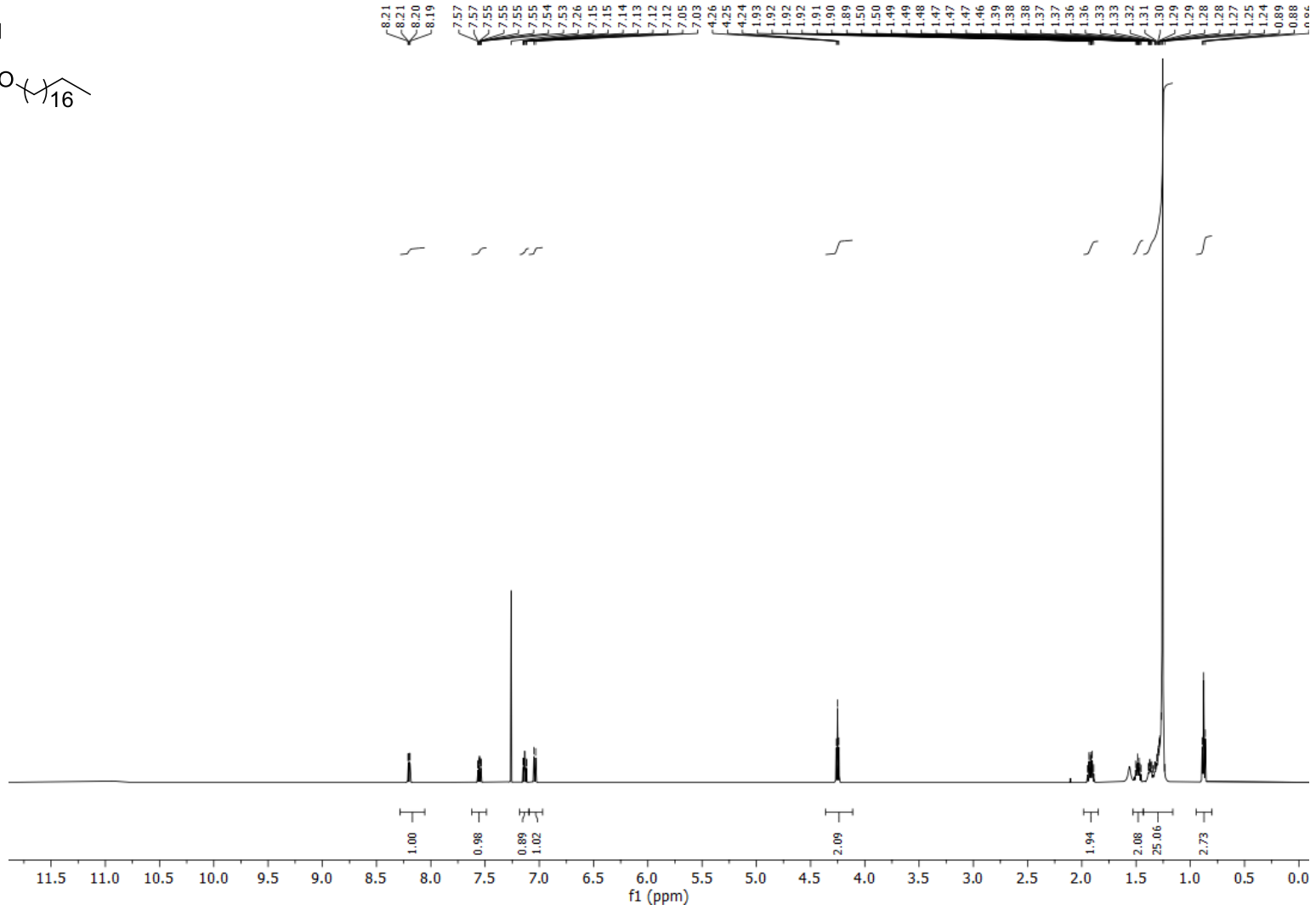
^{13}C NMR (125 MHz, $CDCl_3$)



2-(Octadecyloxy)benzoic acid (8a)

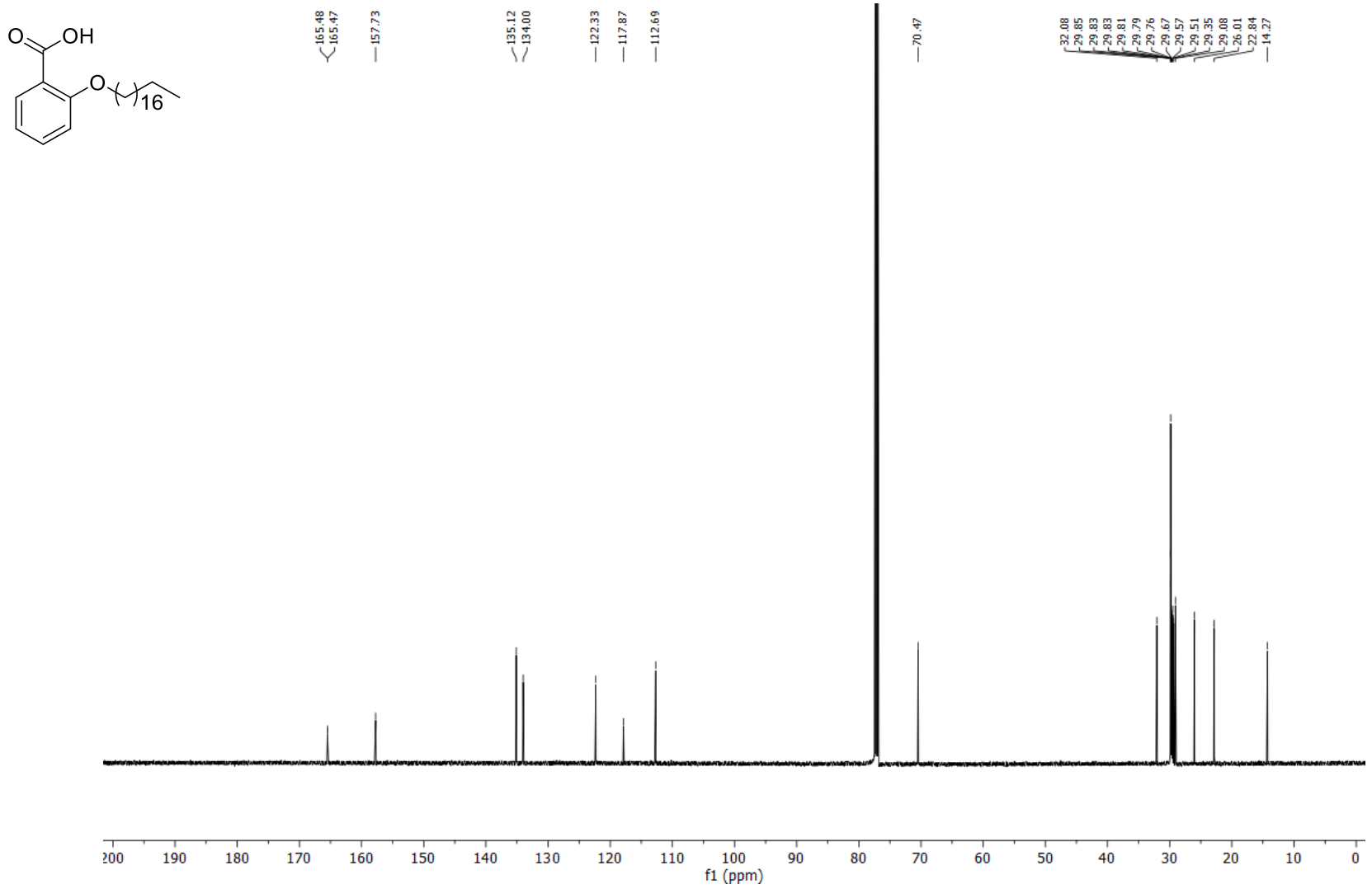
^{1}H NMR (500 MHz, $CDCl_3$)





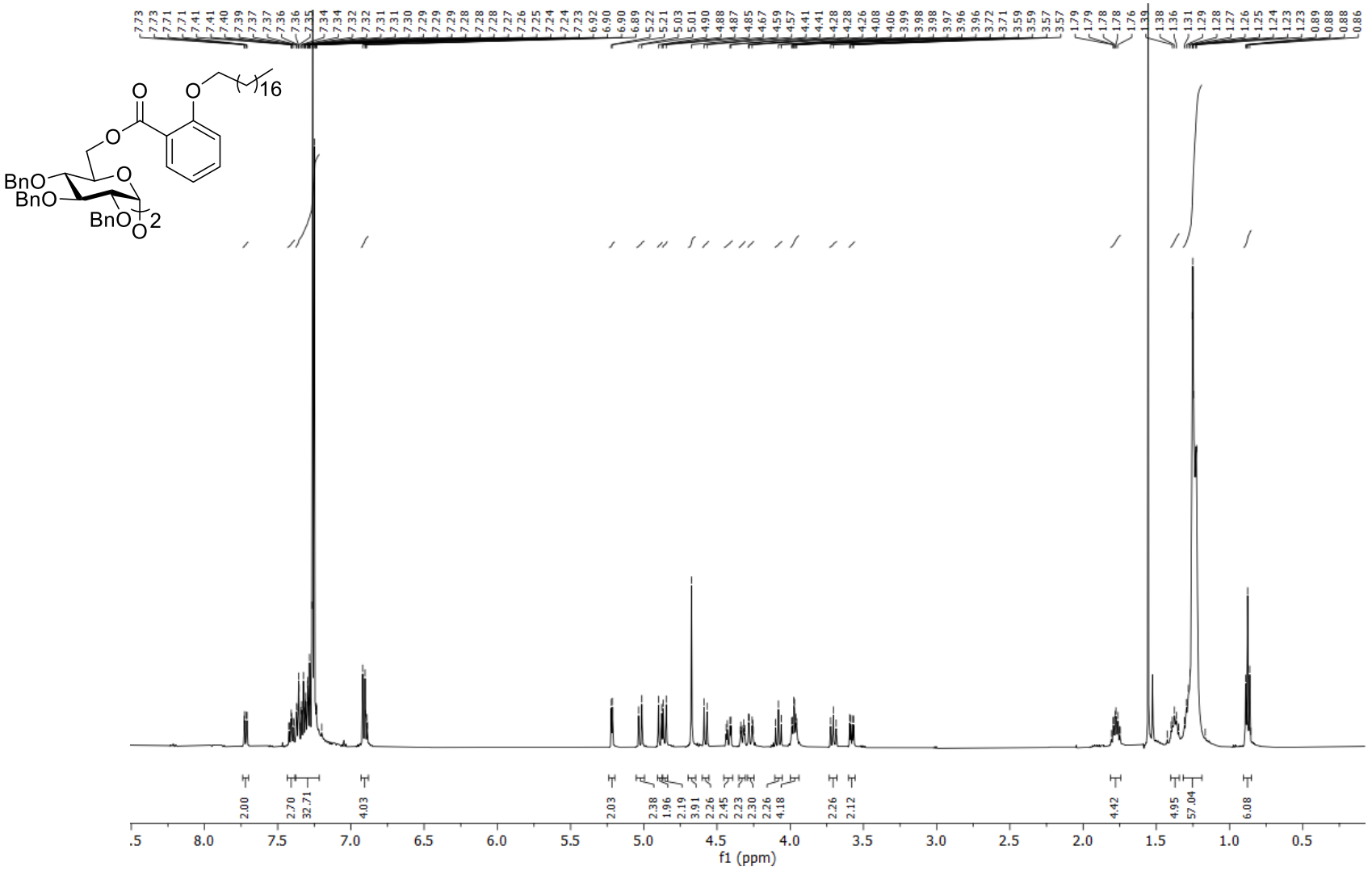
2-(Octadecyloxy)benzoic acid (8a)

^{13}C NMR (150 MHz, $CDCl_3$)



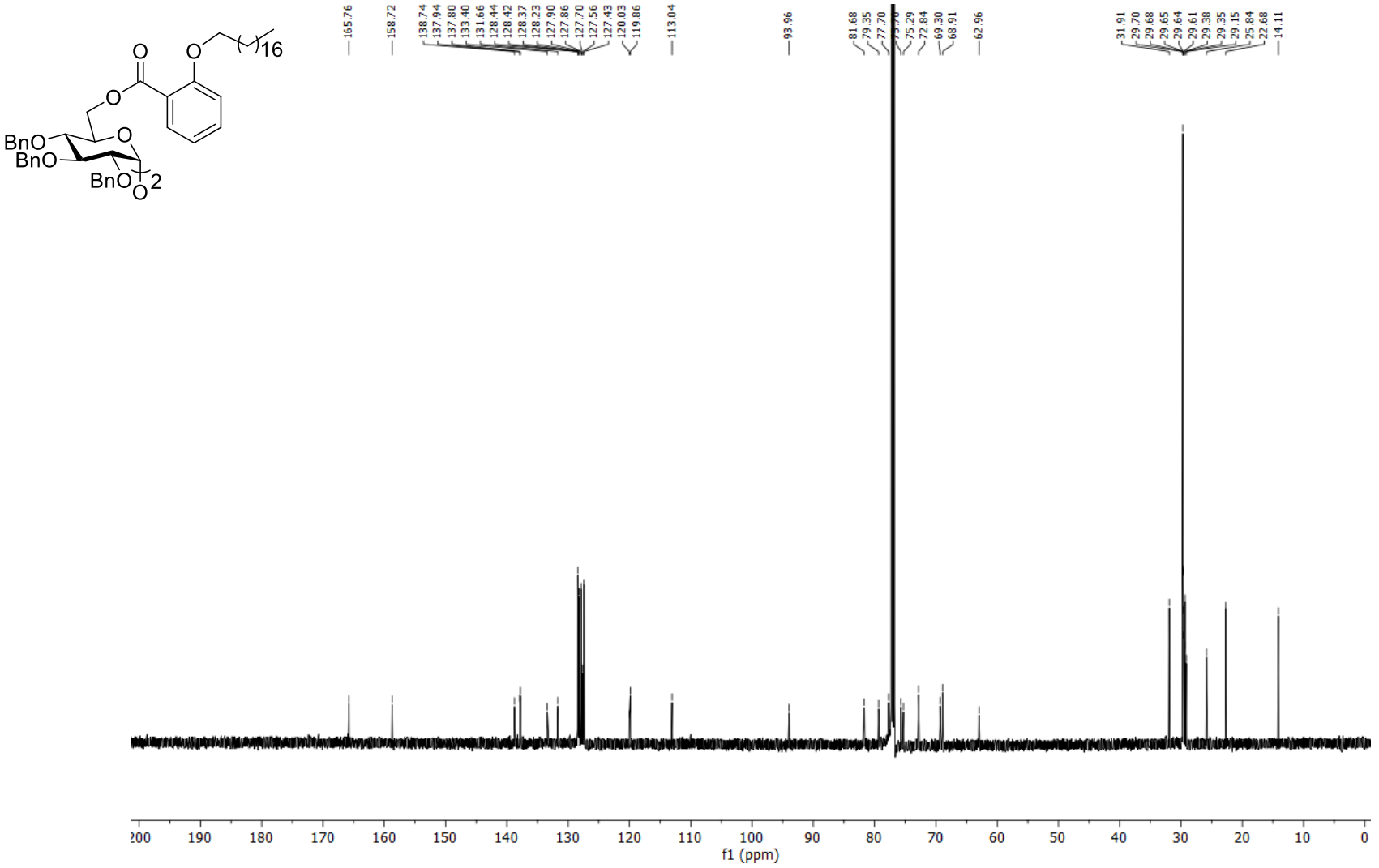
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(2-octadecyloxybenzoyl)-α,α′-D-trehalose (21a)

^{1}H NMR (500 MHz, $CDCl_3$)



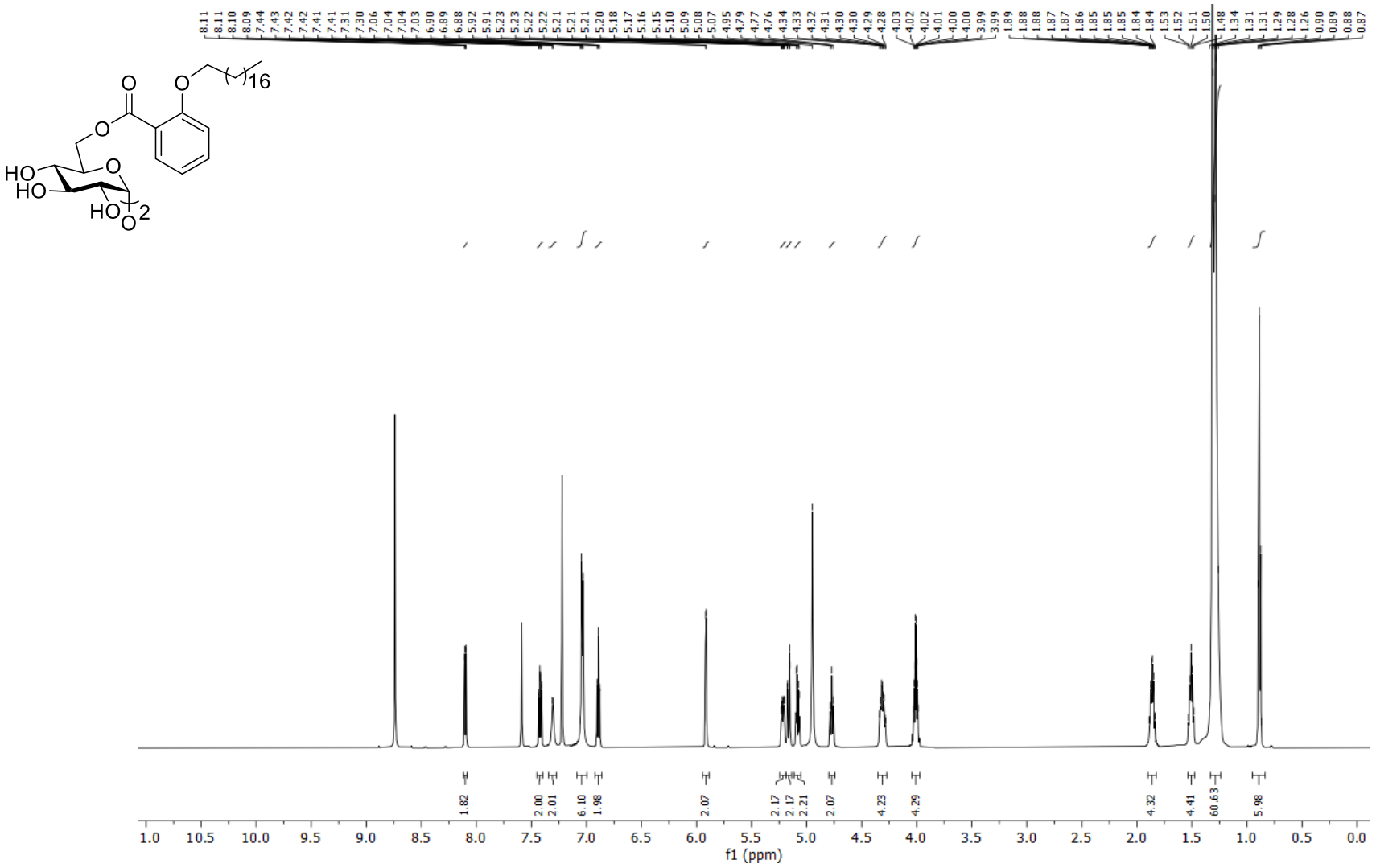
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(2-octadecyloxybenzoyl)-α,α′-D-trehalose (21a)

^{13}C NMR (150 MHz, $CDCl_3$)



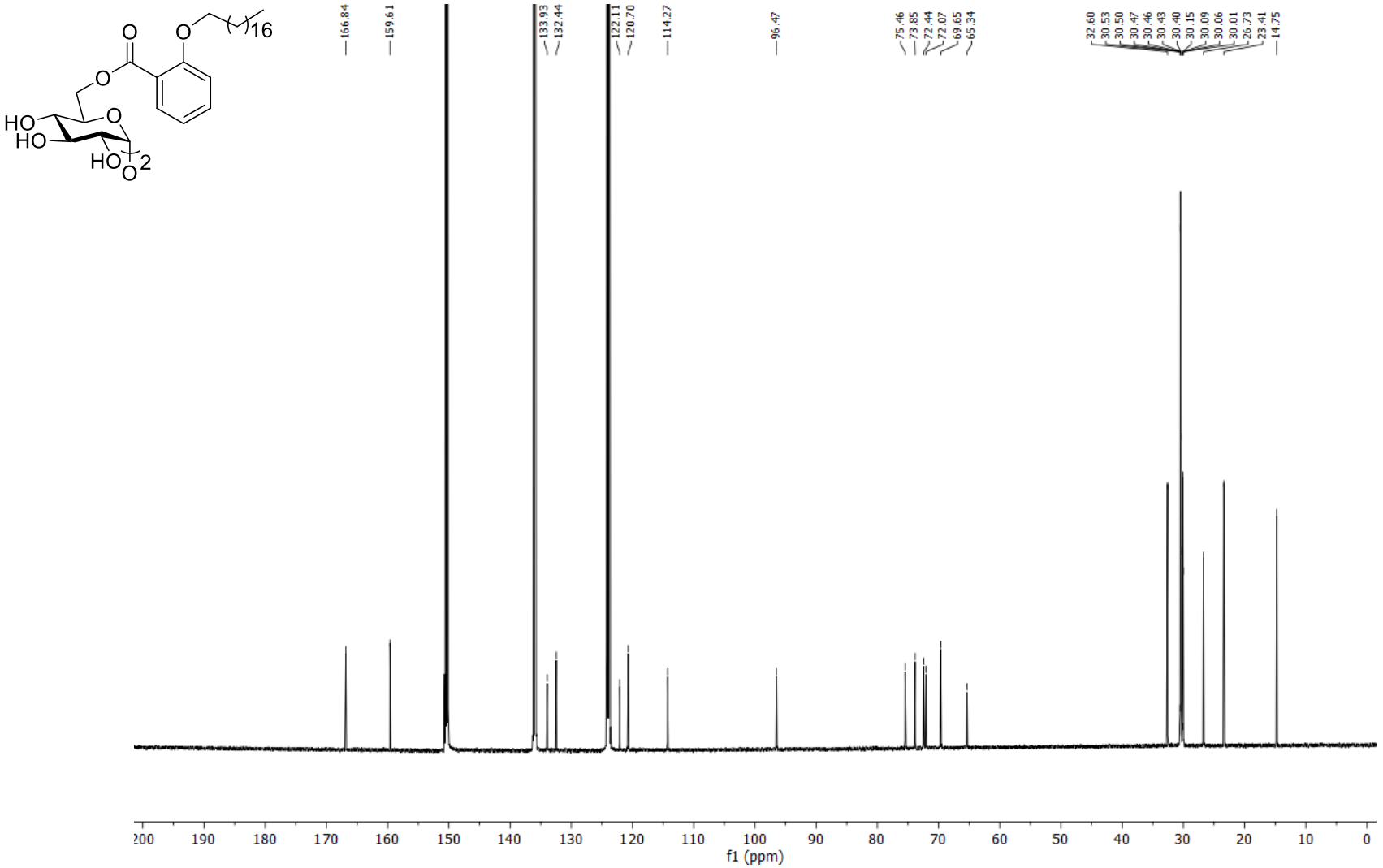
6,6′-Di-*O*-(2-octadecyloxybenzoyl)-α,α′-D-trehalose (5a)

^{1}H NMR (600 MHz, C_5D_5N)



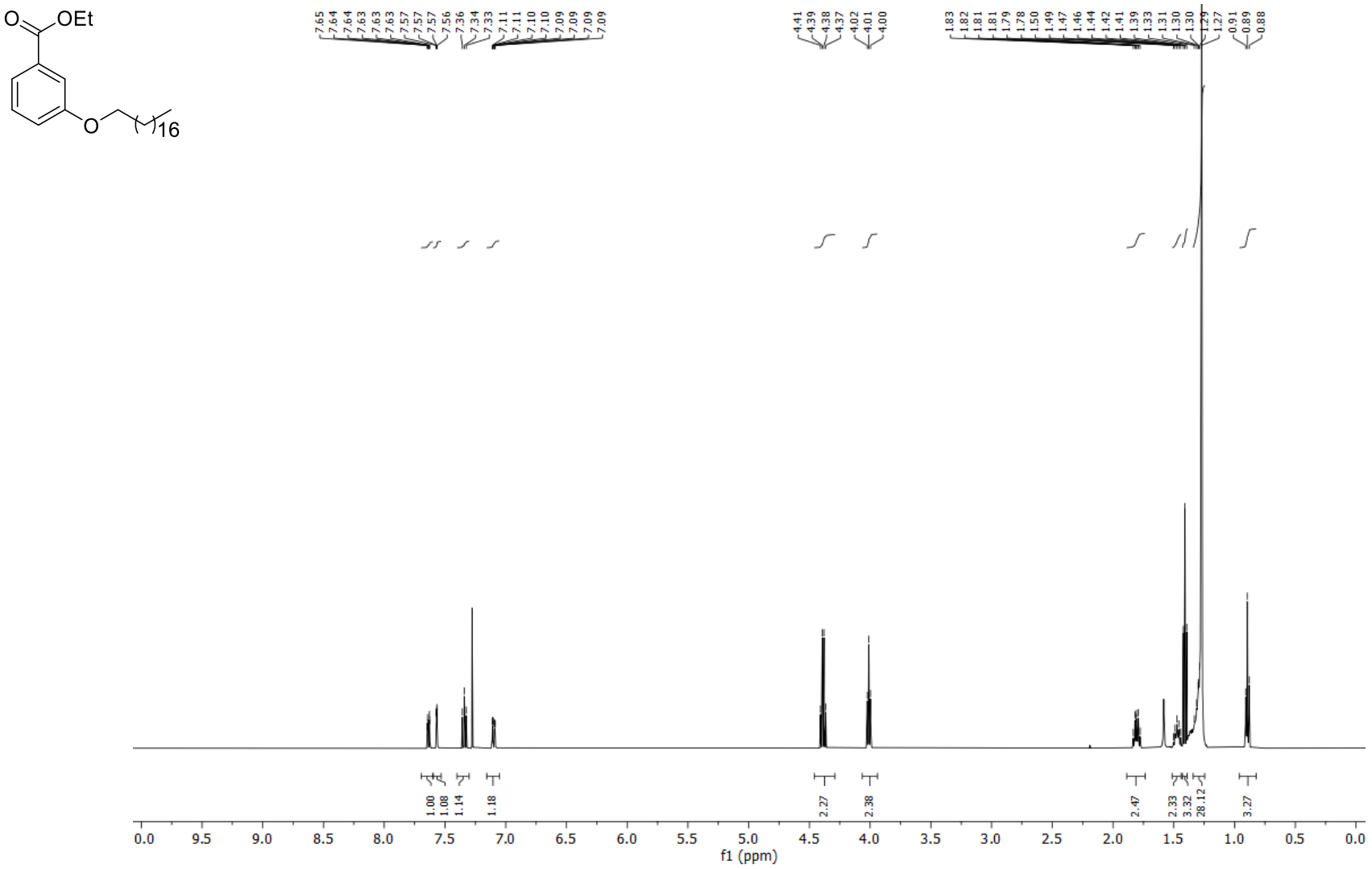
6,6′-Di-*O*-(2-octadecyloxybenzoyl)-α,α′-D-trehalose (5a)

^{13}C NMR (150 MHz, C_5D_5N)



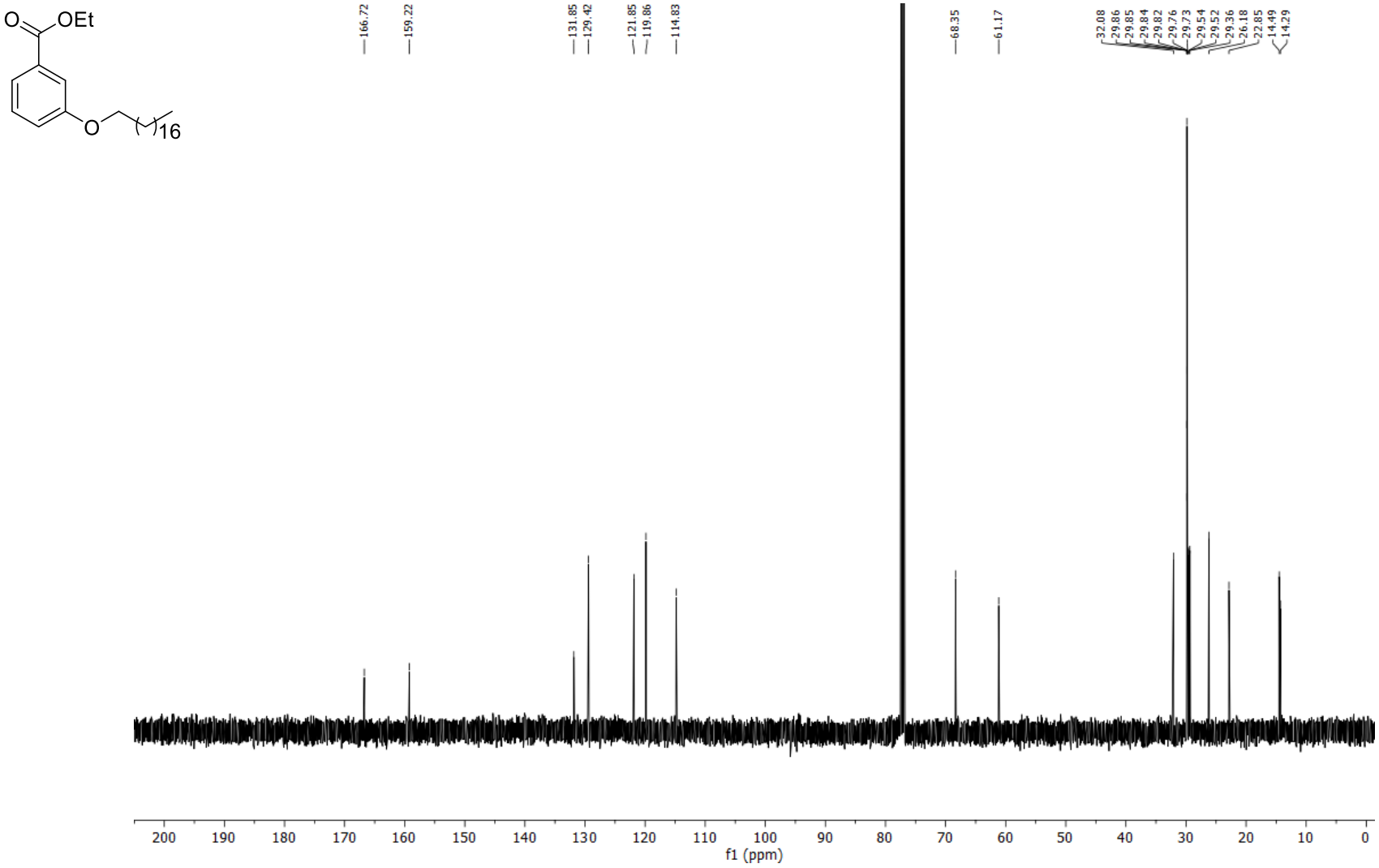
Ethyl 3-(octadecyloxy)benzoate

^{1}H NMR (500 MHz, $CDCl_3$)



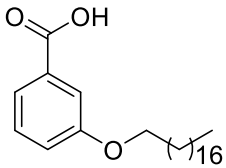
Ethyl 3-(octadecyloxy)benzoate

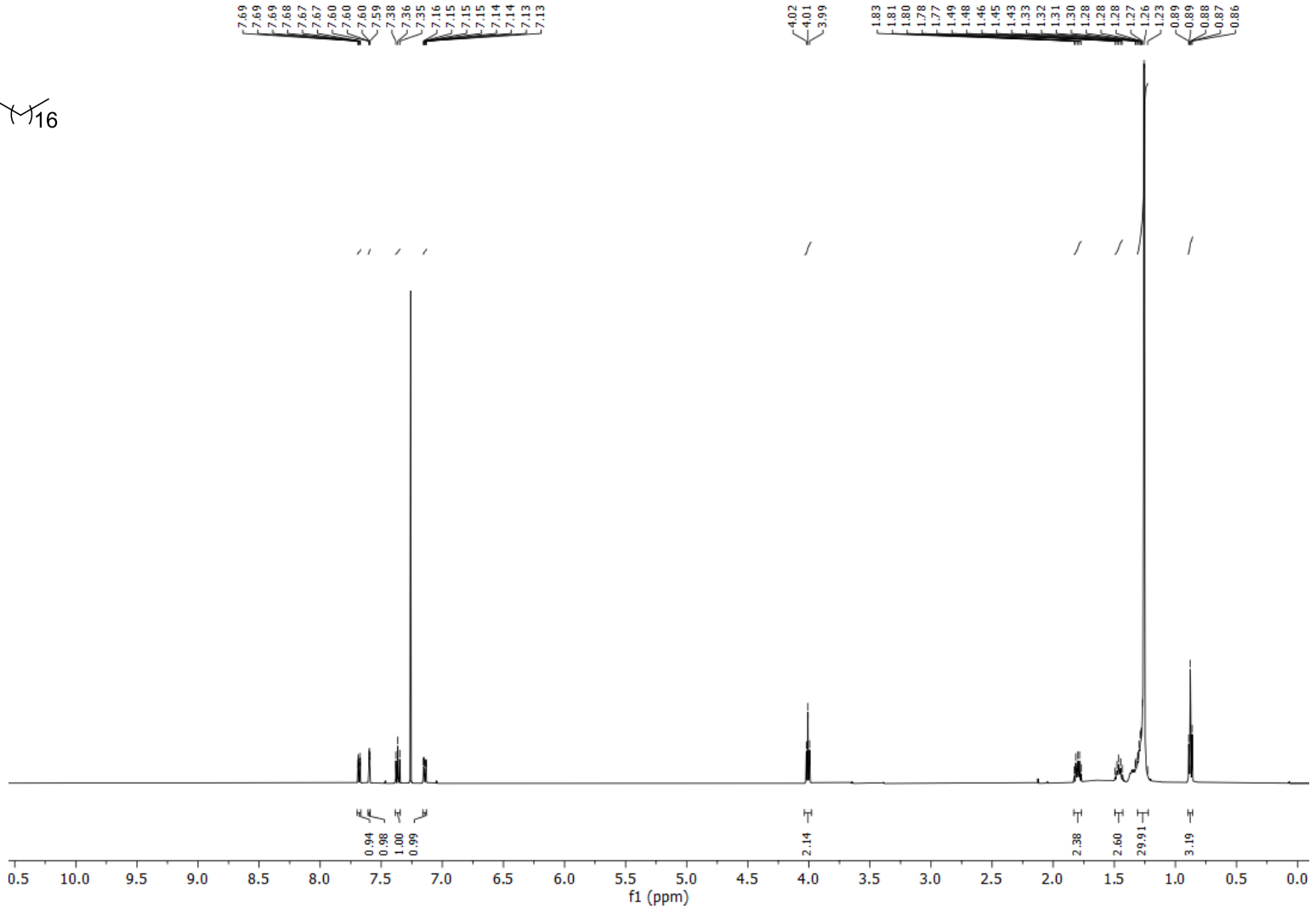
^{13}C NMR (125 MHz, $CDCl_3$)



3-Octadecyloxybenzoic acid (8b)

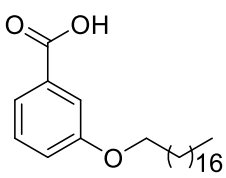
^{1}H NMR (500 MHz, $CDCl_3$)

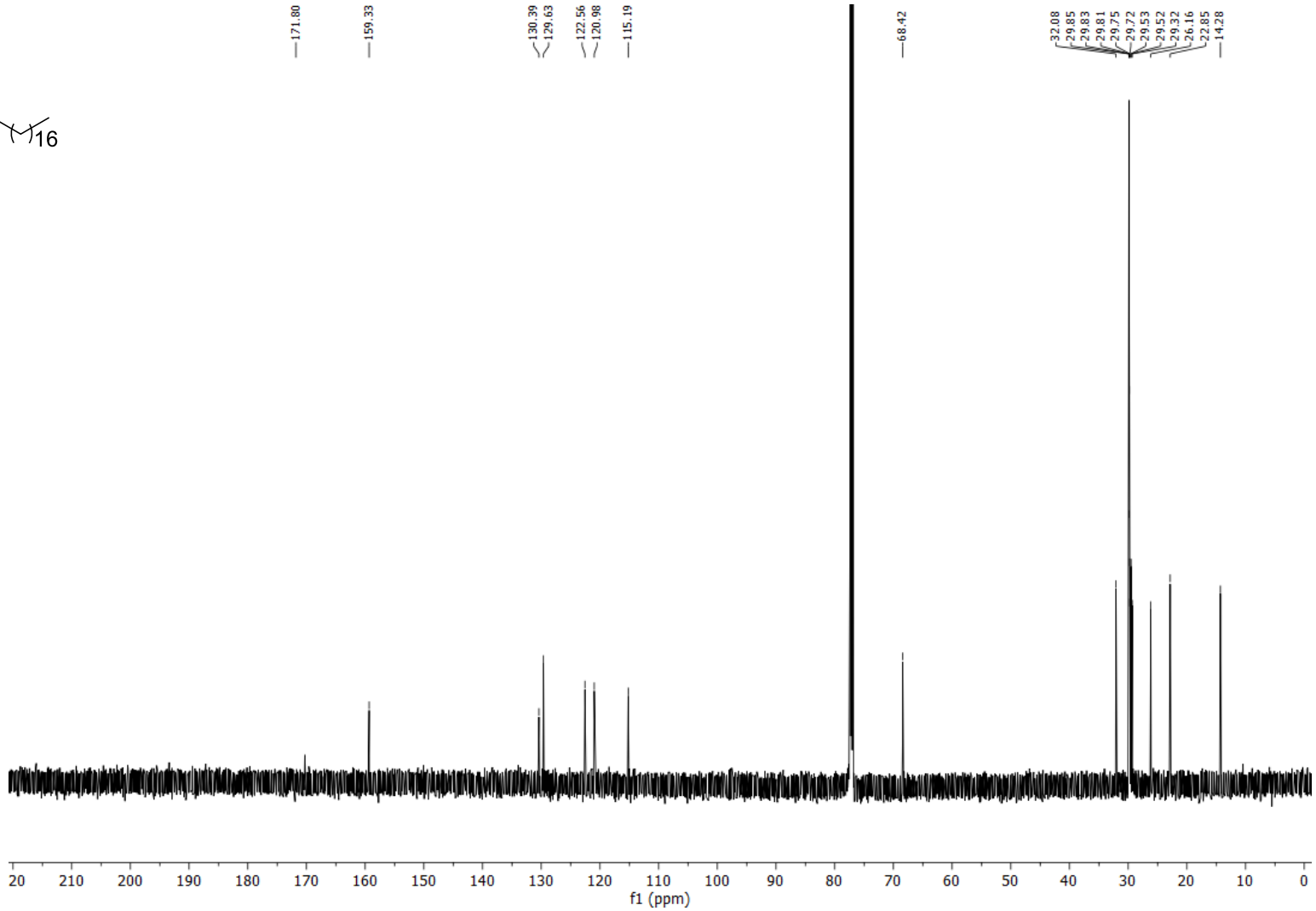




3-Octadecyloxybenzoic acid (8b)

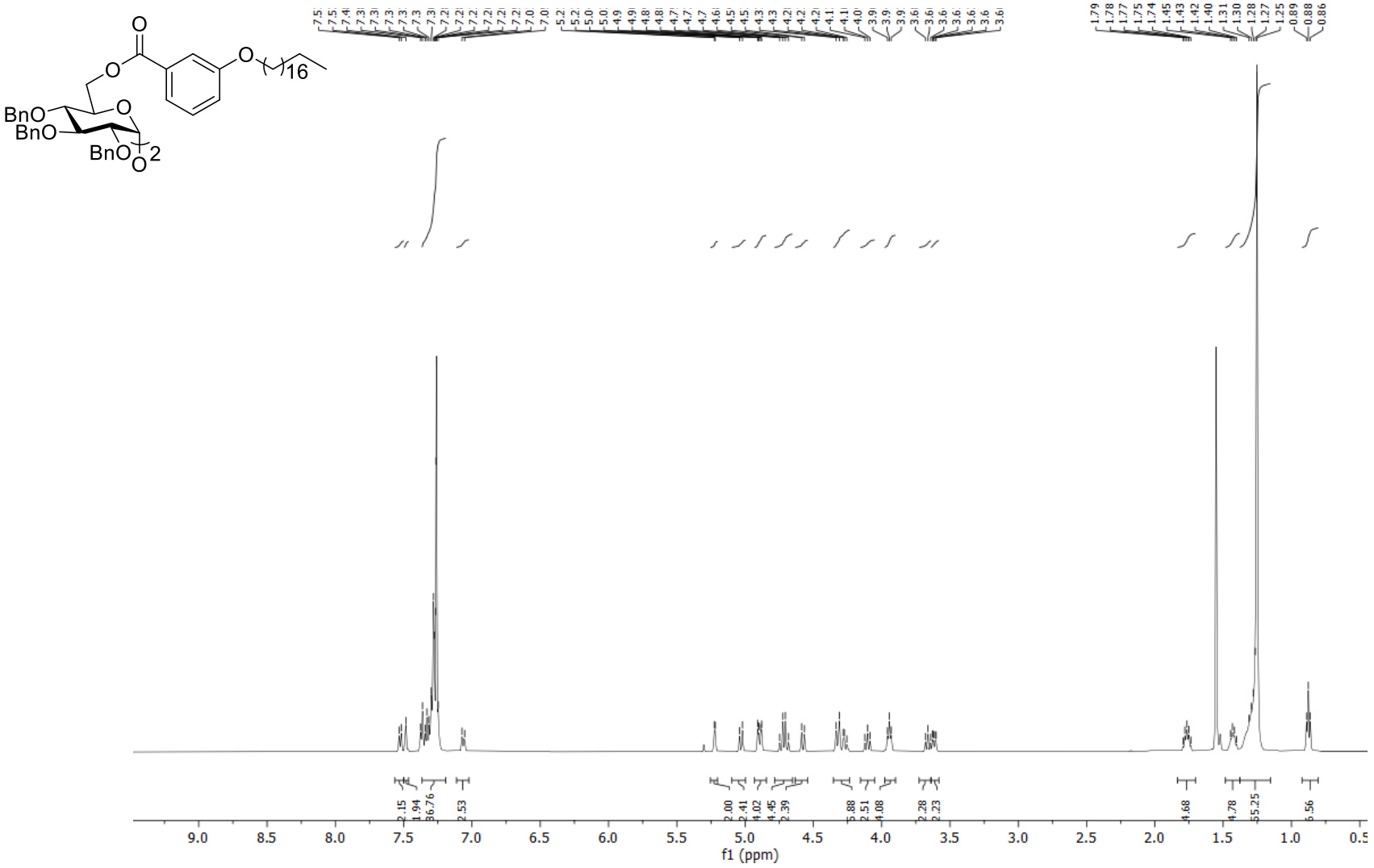
^{13}C NMR (150 MHz, $CDCl_3$)





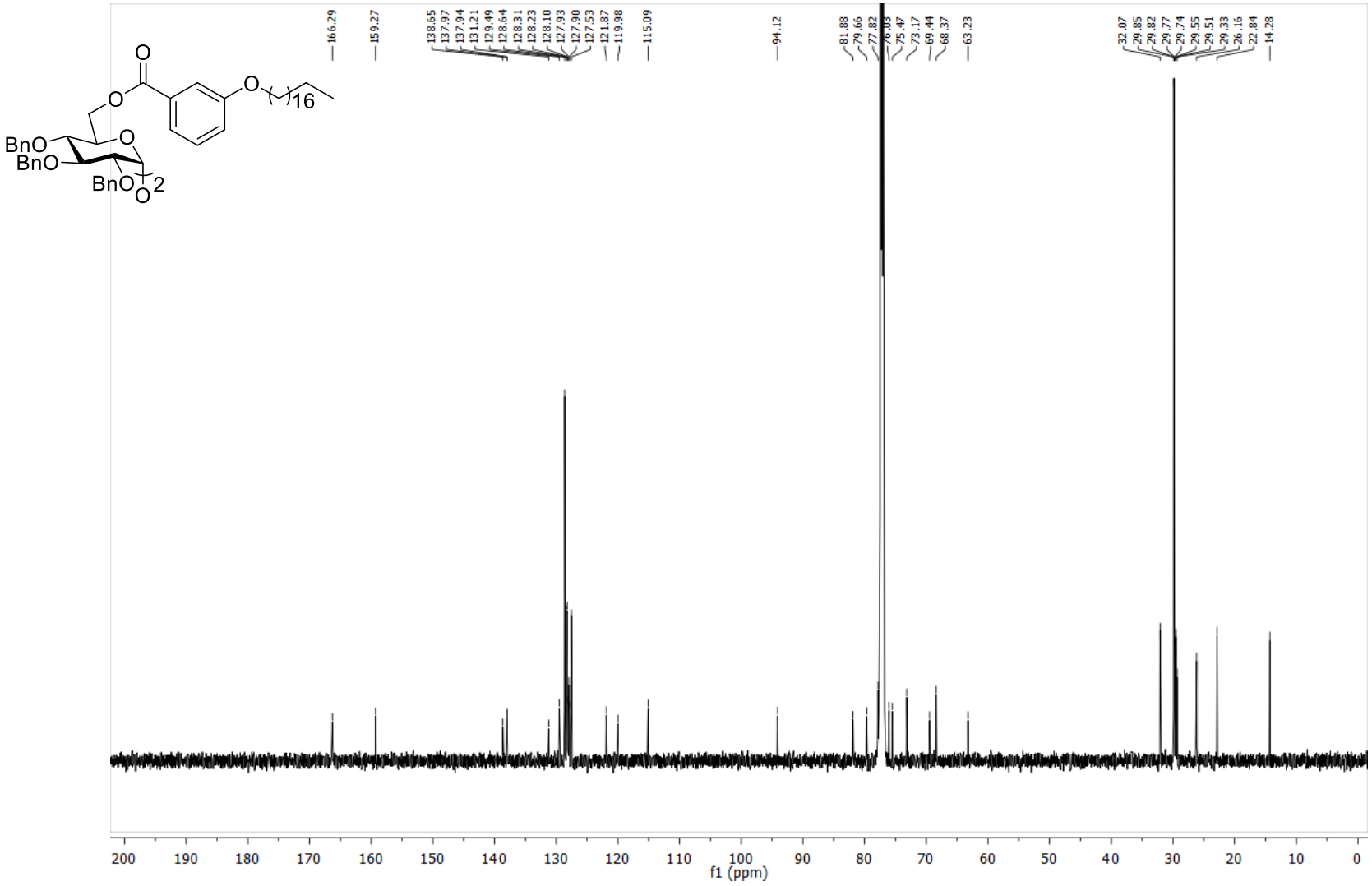
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3-octadecyloxybenzoyl)-α,α′-D-trehalose (21b)

^{1}H NMR (500 MHz, $CDCl_3$)



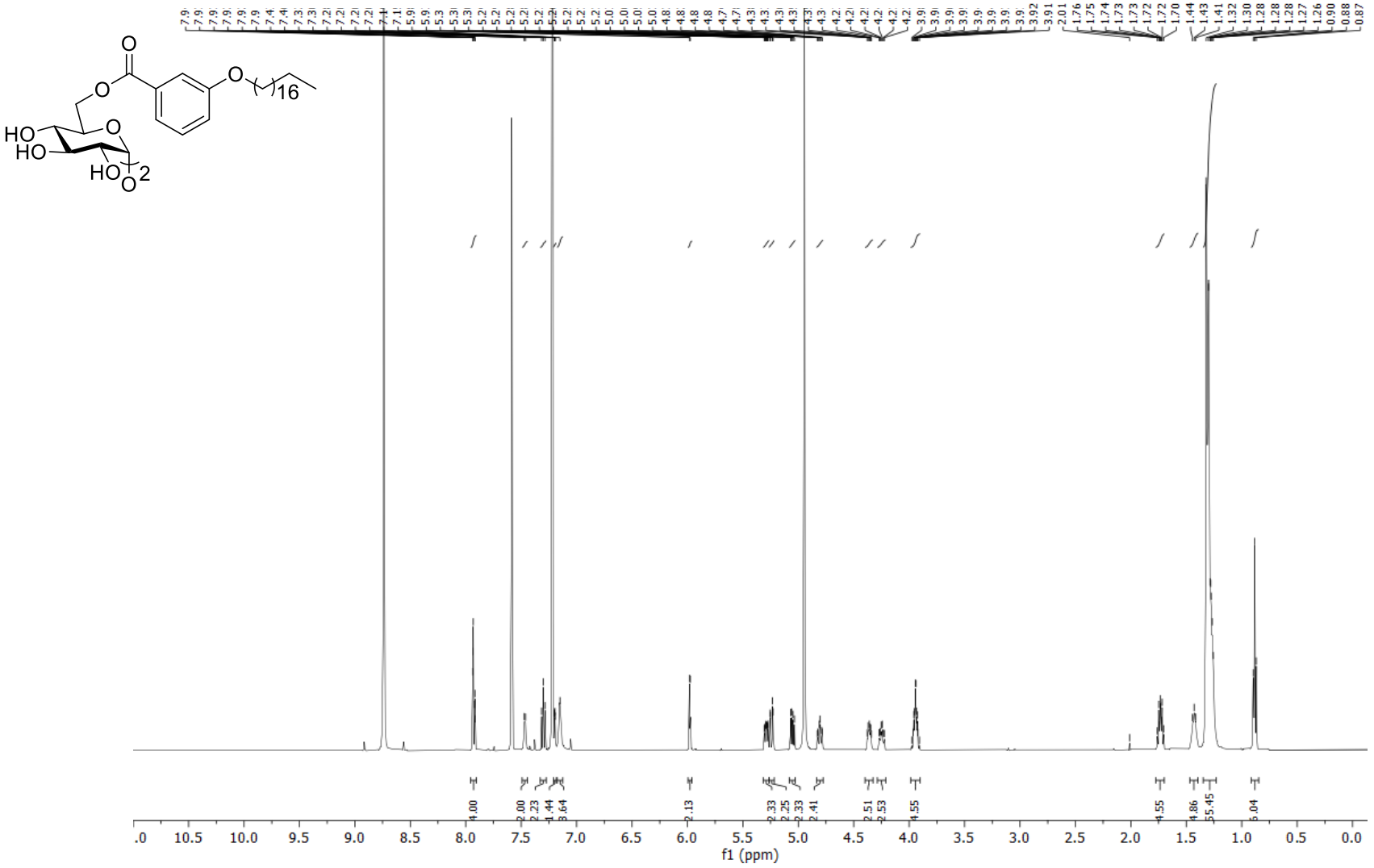
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3-octadecyloxybenzoyl)-α,α′-D-trehalose (21b)

^{13}C NMR (125 MHz, $CDCl_3$)



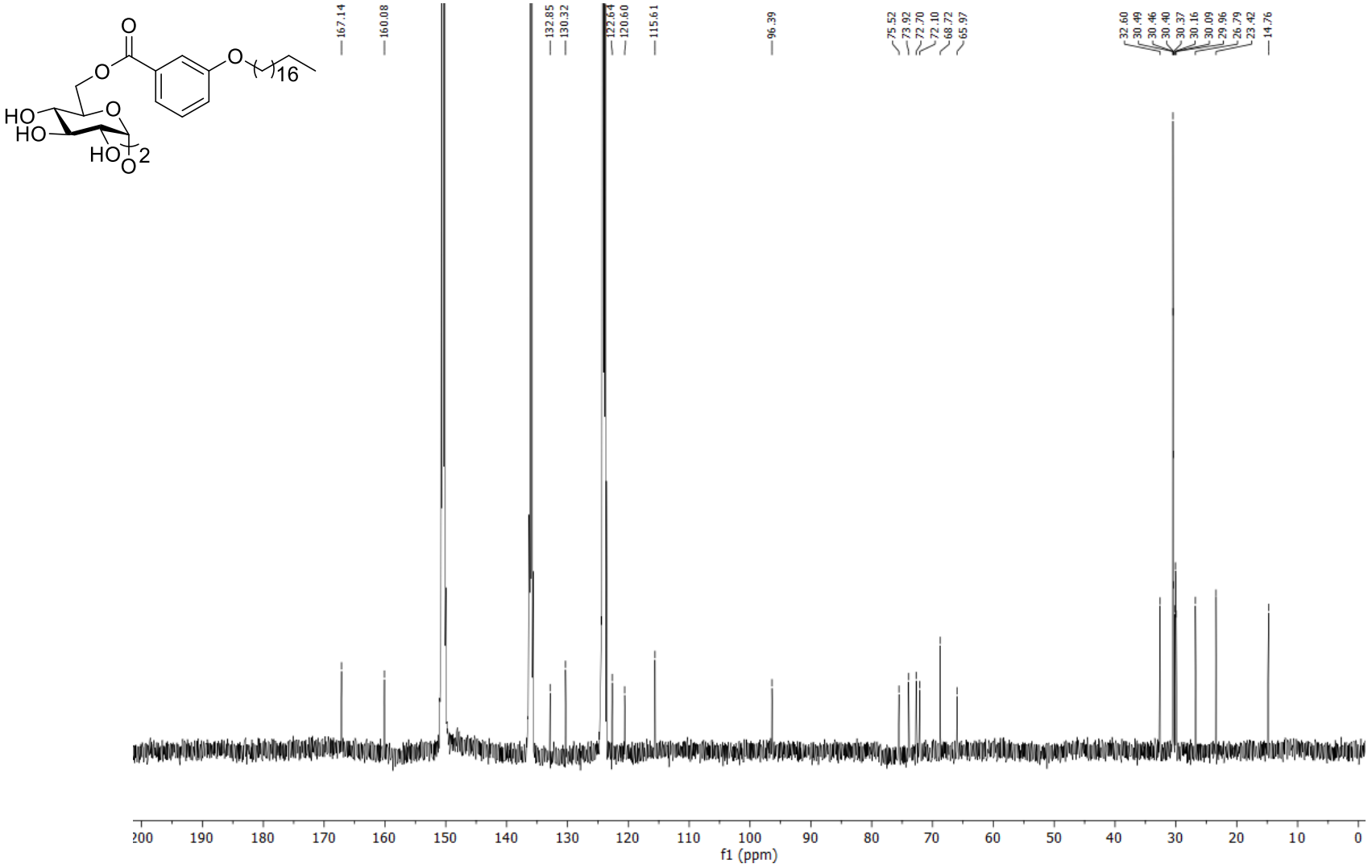
6,6′-Di-*O*-(3-octadecyloxybenzoyl)-α,α′-D-trehalose (5b)

^{1}H NMR (500 MHz, C_5D_5N)



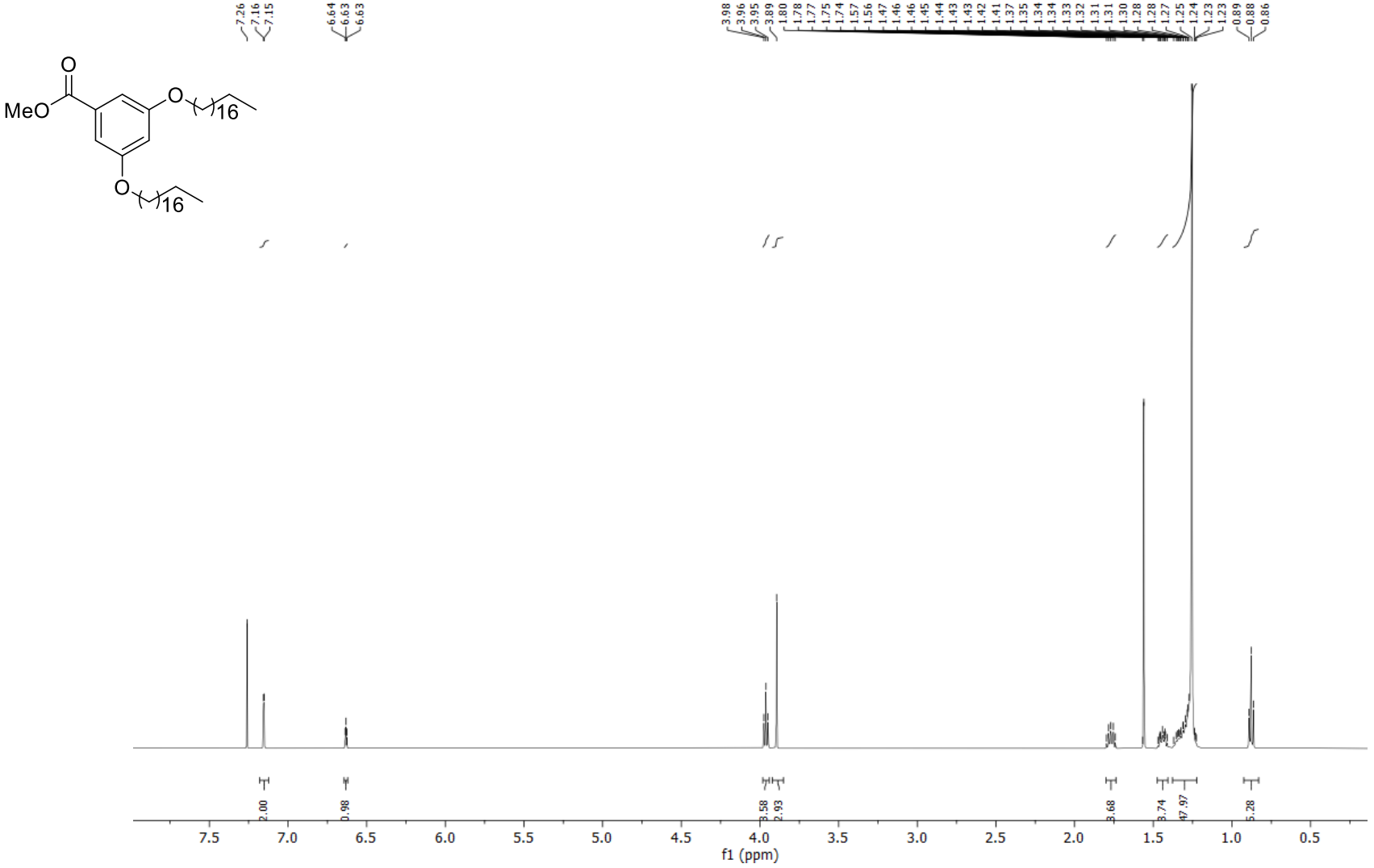
6,6′-Di-*O*-(3-octadecyloxybenzoyl)-α,α′-D-trehalose (5b)

^{13}C NMR (150 MHz, C_5D_5N)



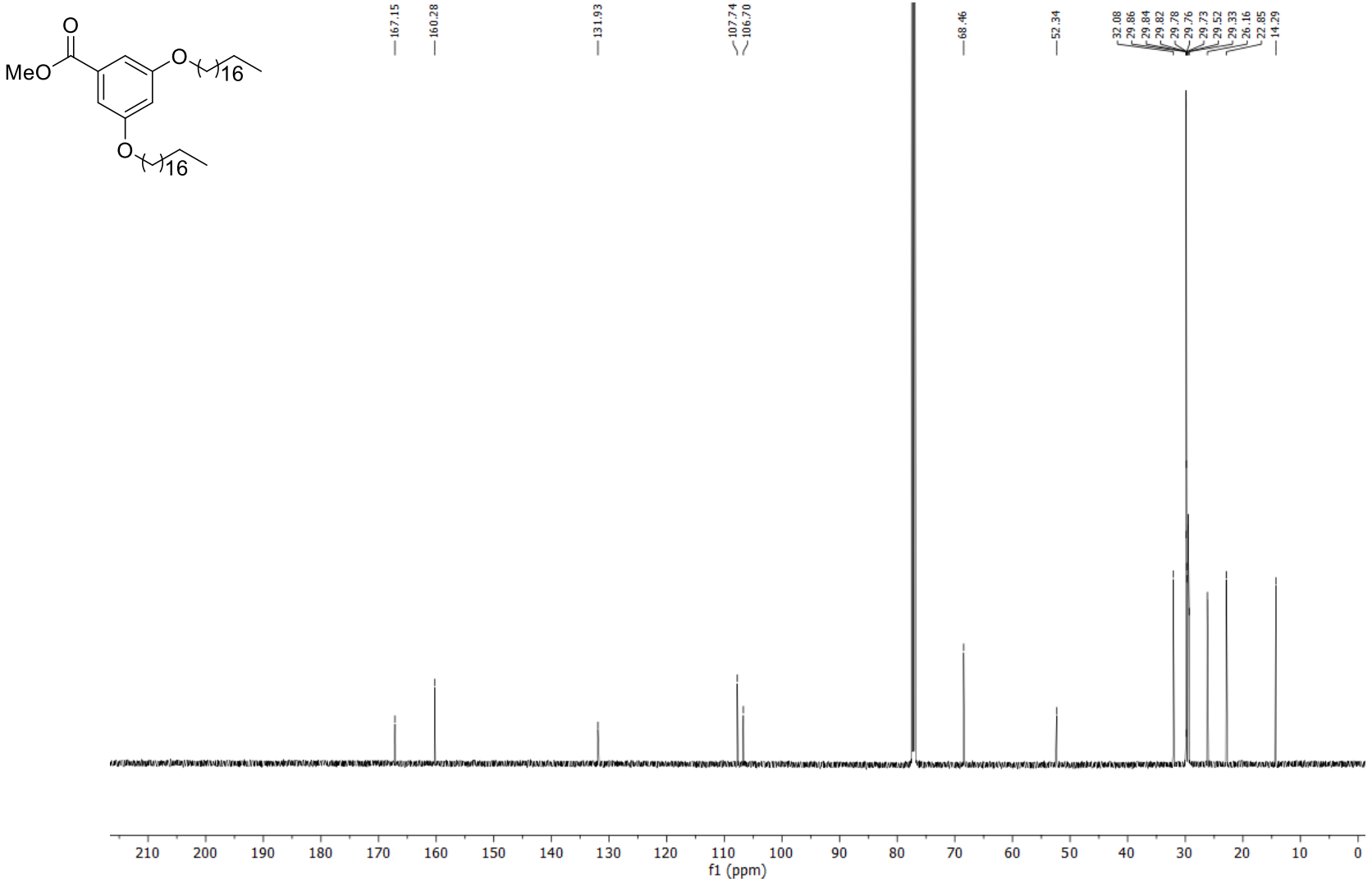
Methyl 3,5-bis(octadecyloxy)benzoate

^{1}H NMR (500 MHz, $CDCl_3$)



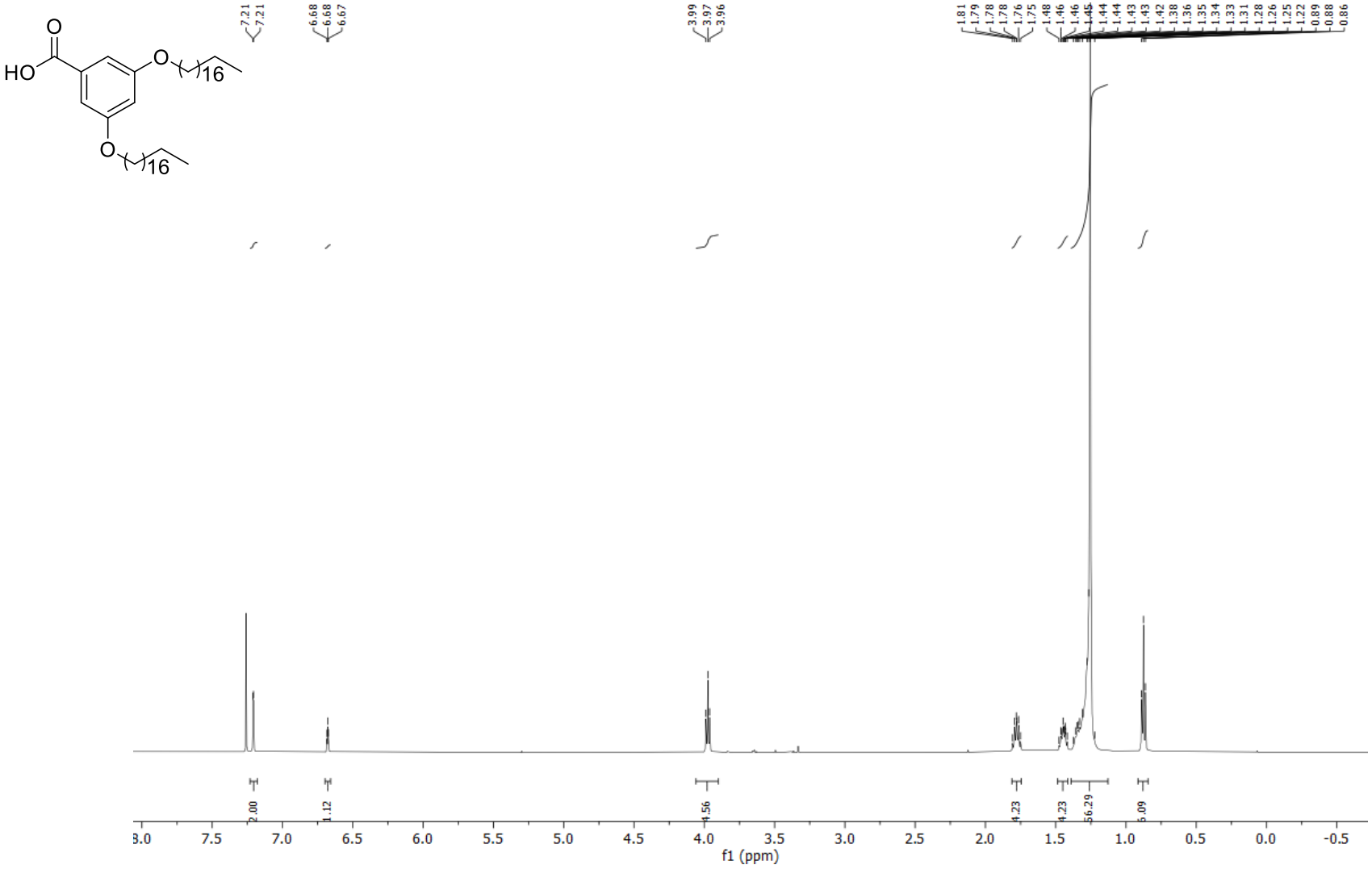
Methyl 3,5-bis(octadecyloxy)benzoate

^{13}C NMR (150 MHz, $CDCl_3$)



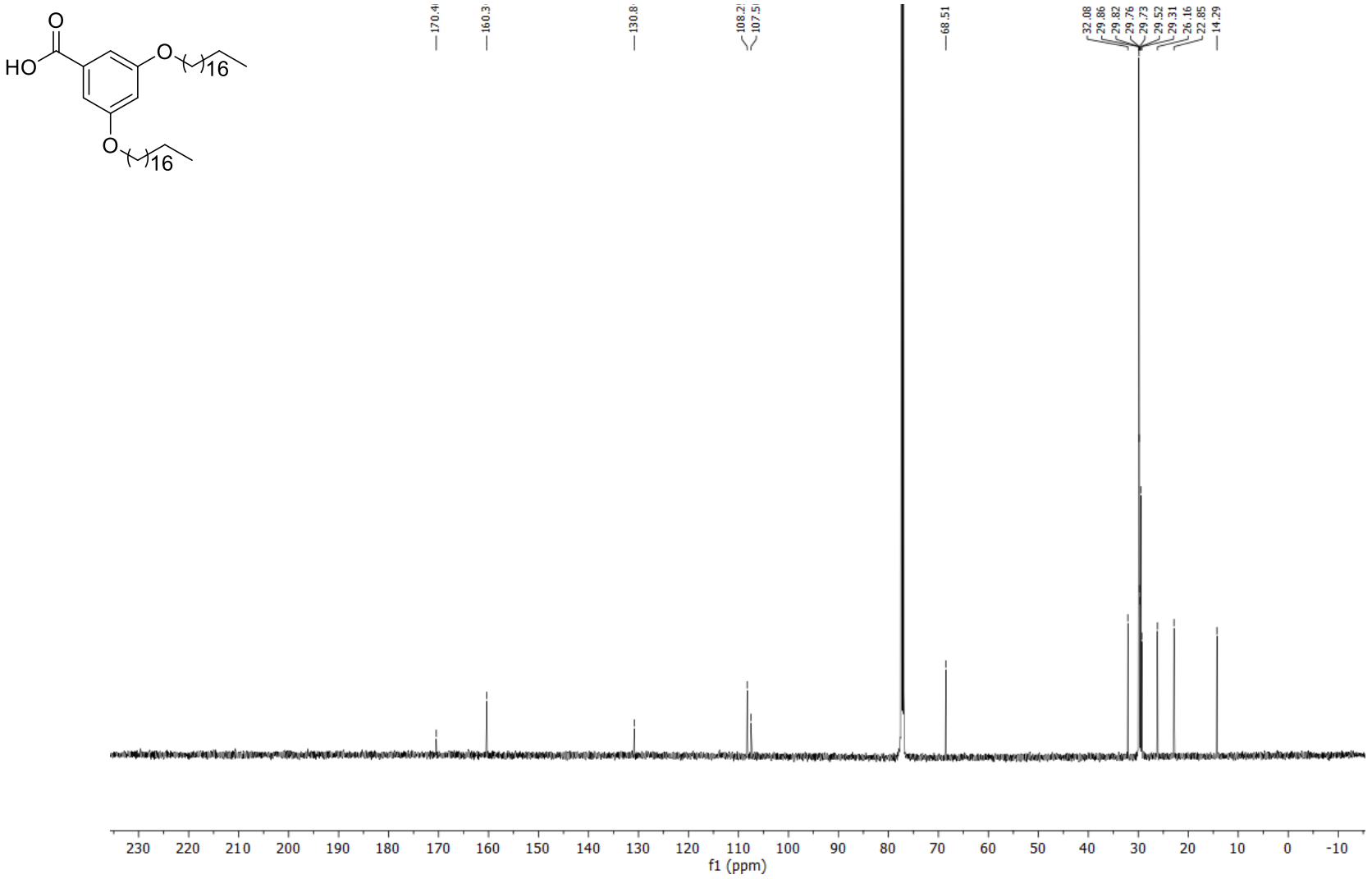
3,5-Bis(octadecyloxy)benzoic acid (8d)

^{1}H NMR (500 MHz, $CDCl_3$)



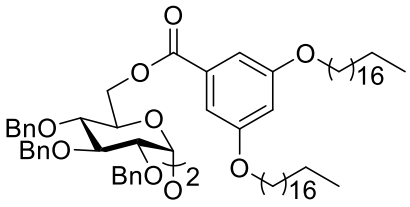
3,5-Bis(octadecyloxy)benzoic acid (8d)

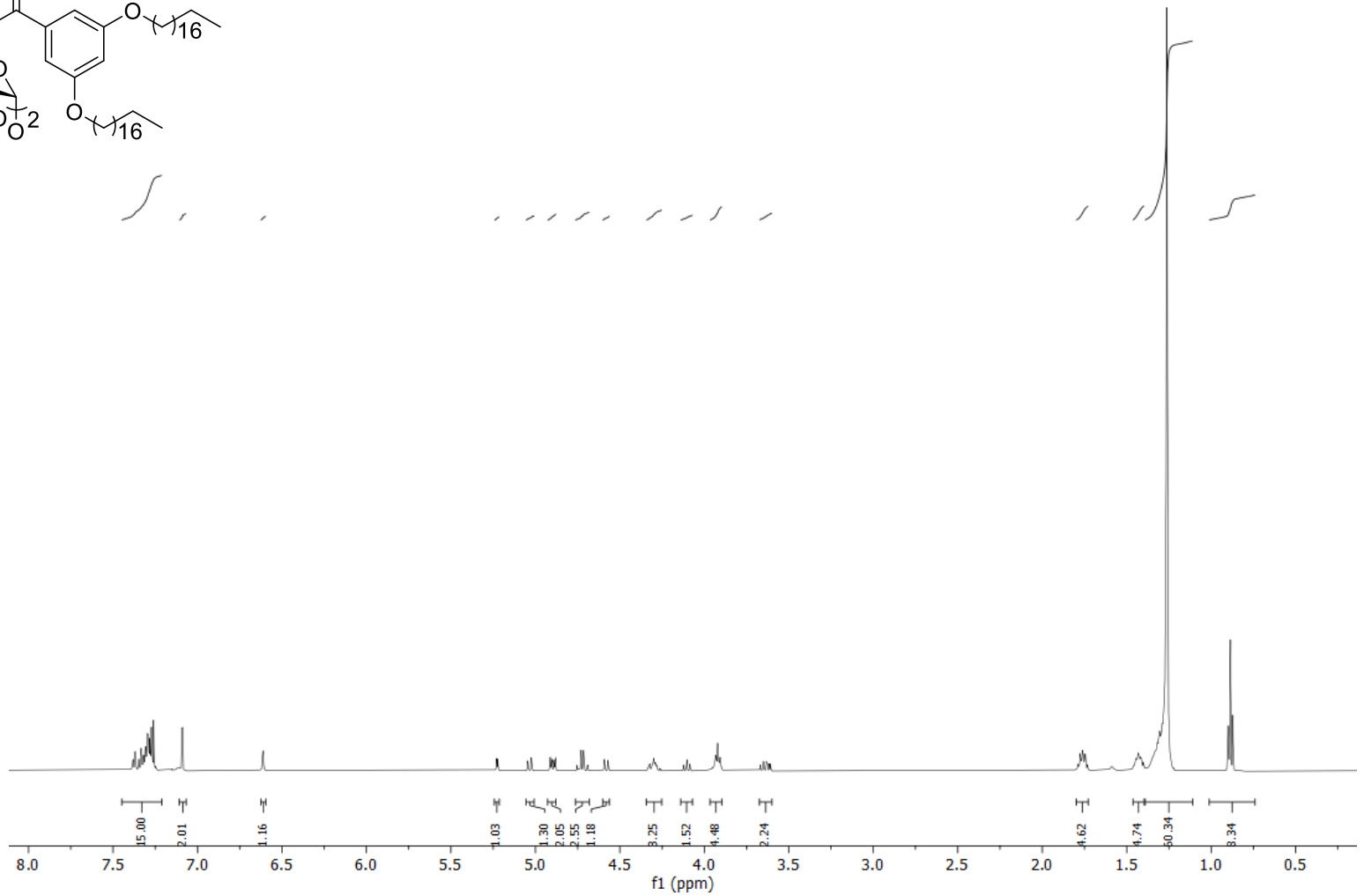
^{13}C NMR (150 MHz, $CDCl_3$)



2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3,5-bis[octadecyloxy]benzoyl)-α,α′-D-trehalose (21d)

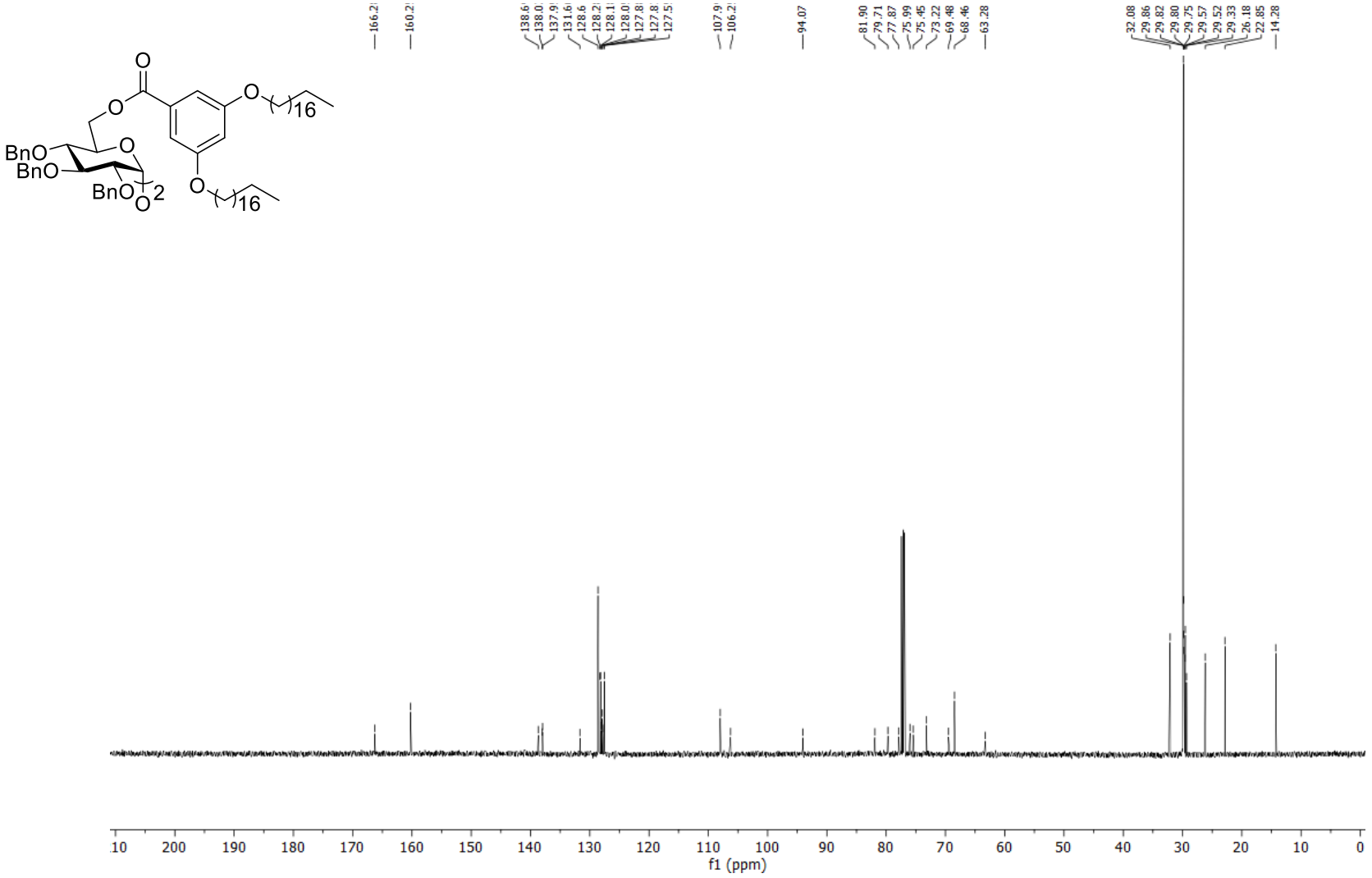
^{1}H NMR (500 MHz, $CDCl_3$)





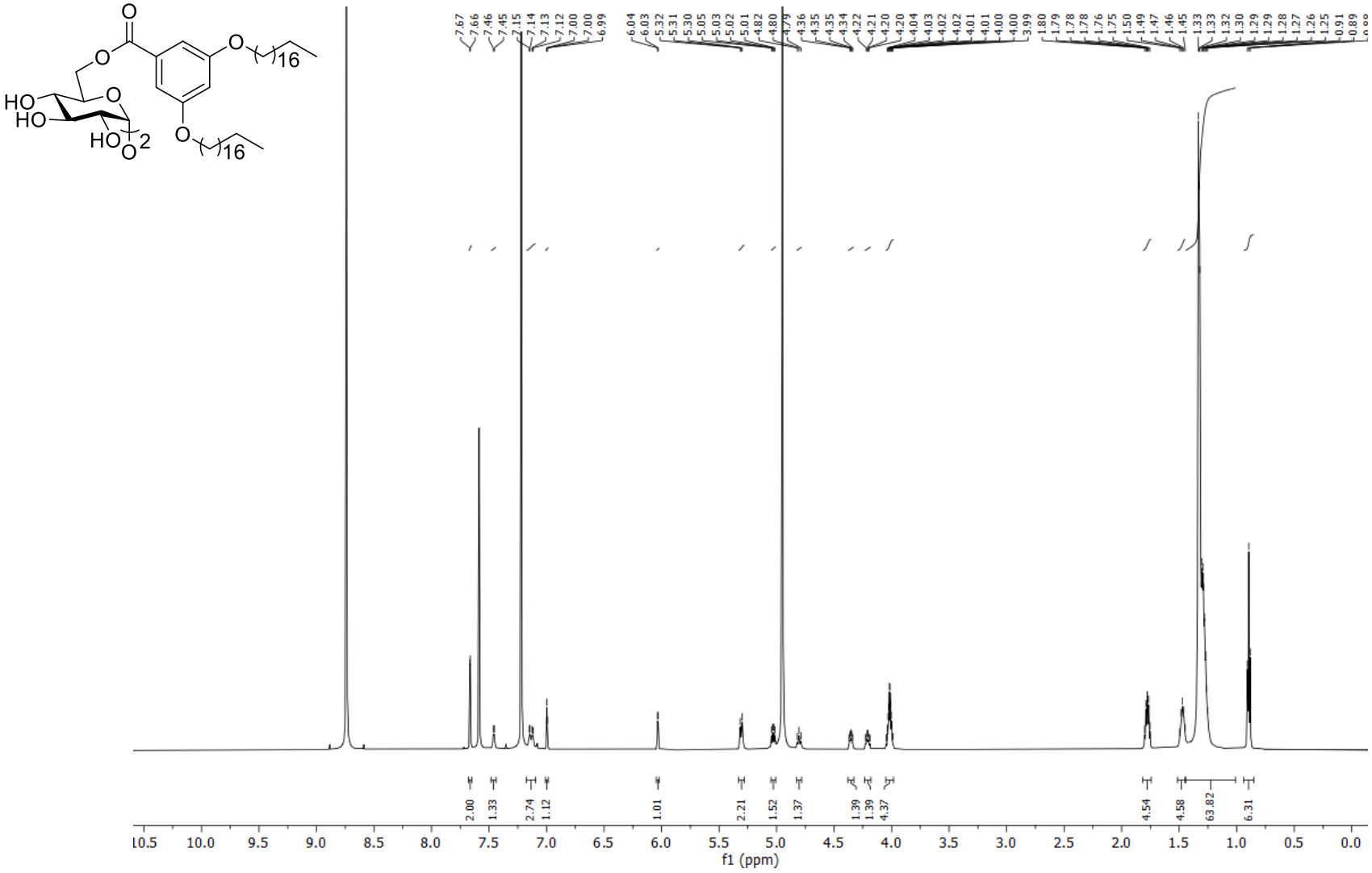
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3,5-bis[octadecyloxy]benzoyl)-α,α′-D-trehalose (21d)

^{1}H NMR (125 MHz, $CDCl_3$)



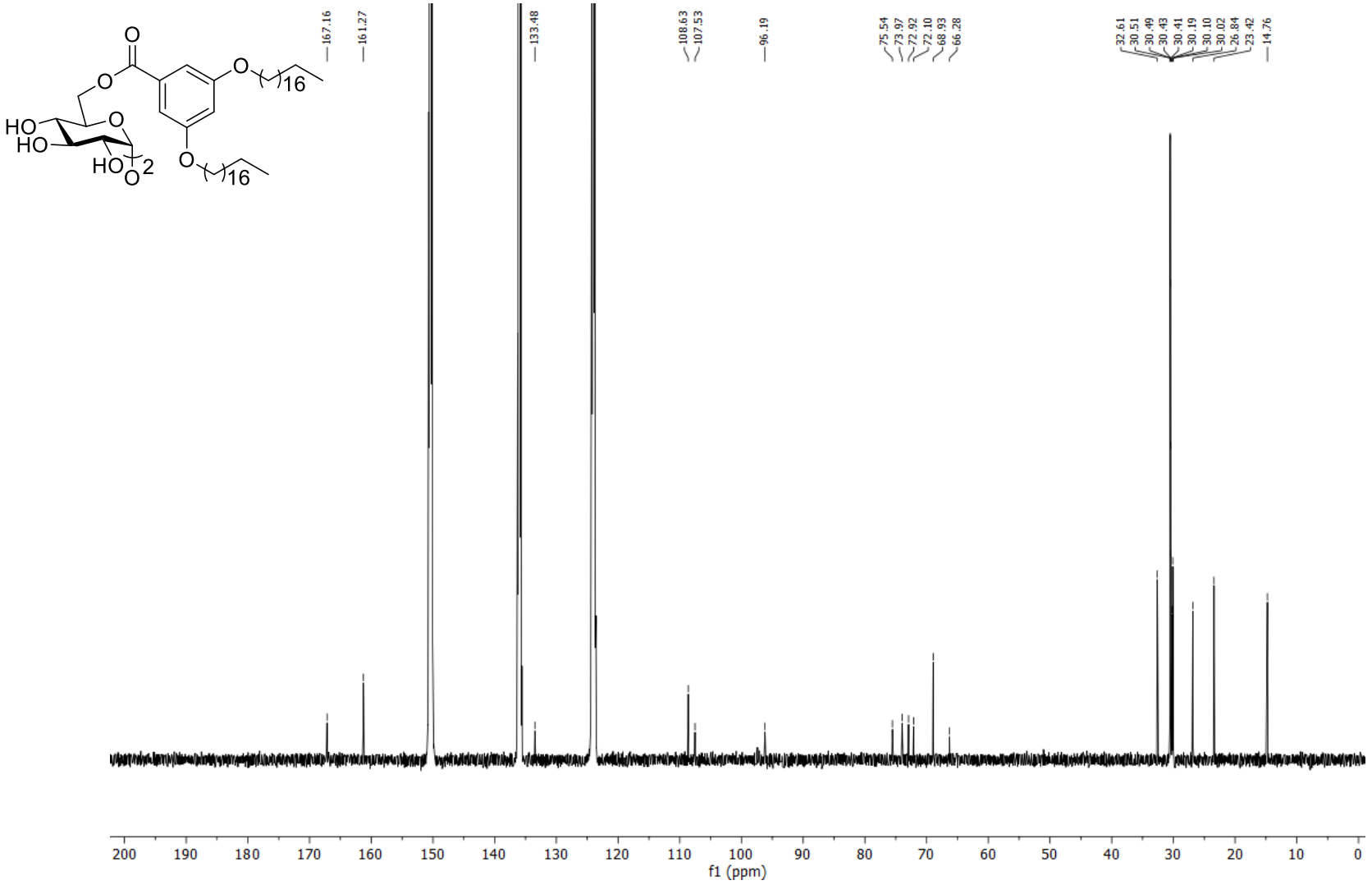
6,6′-Di-*O*-(3,5-bis[octadecyloxy]benzoyl)-α,α′-D-trehalose (5d)

^{1}H NMR (600 MHz, C_5D_5N)



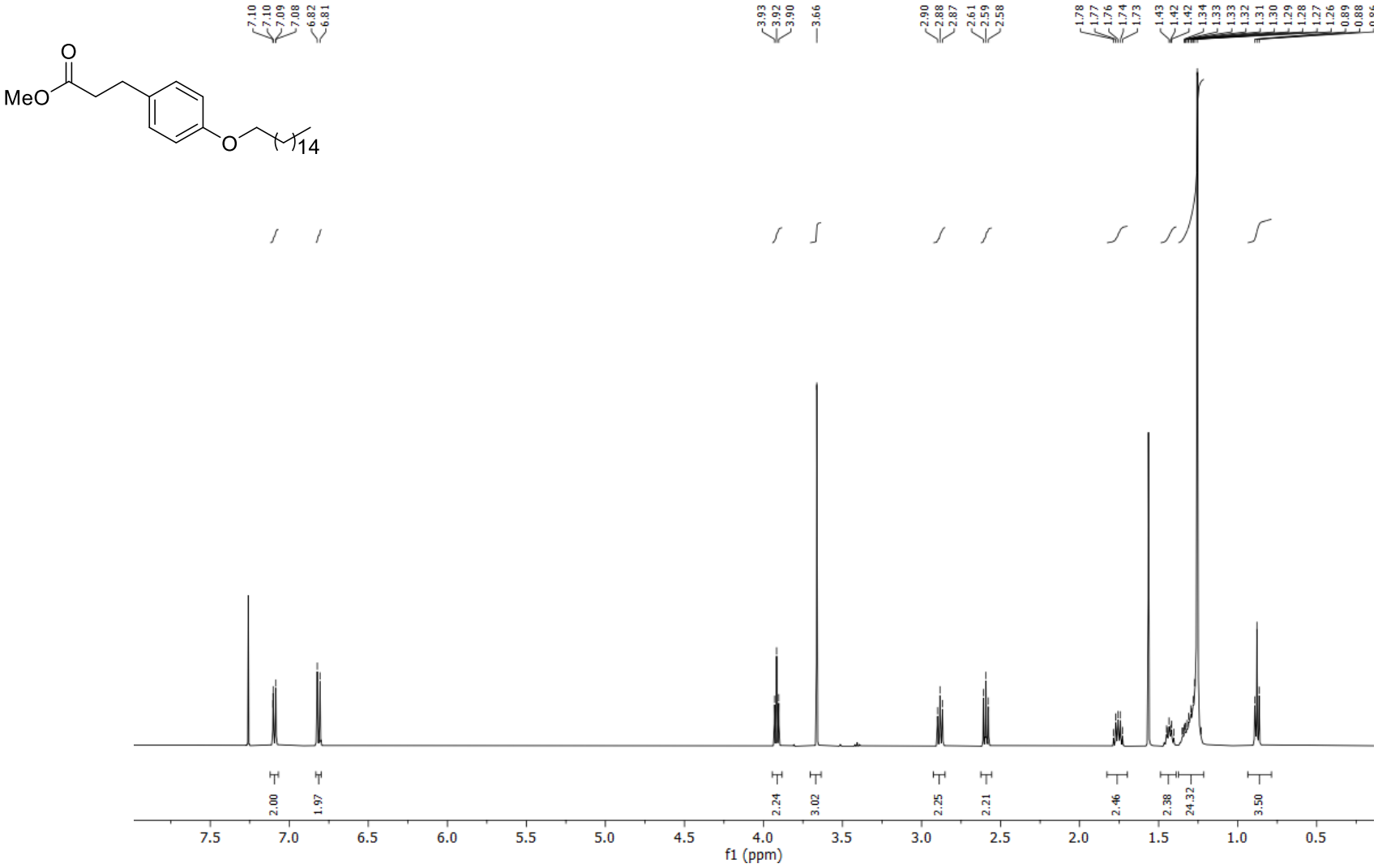
6,6′-Di-*O*-(3,5-bis[octadecyloxy]benzoyl)-α,α′-D-trehalose (5d)

^{13}C NMR (150 MHz, C_5D_5N)



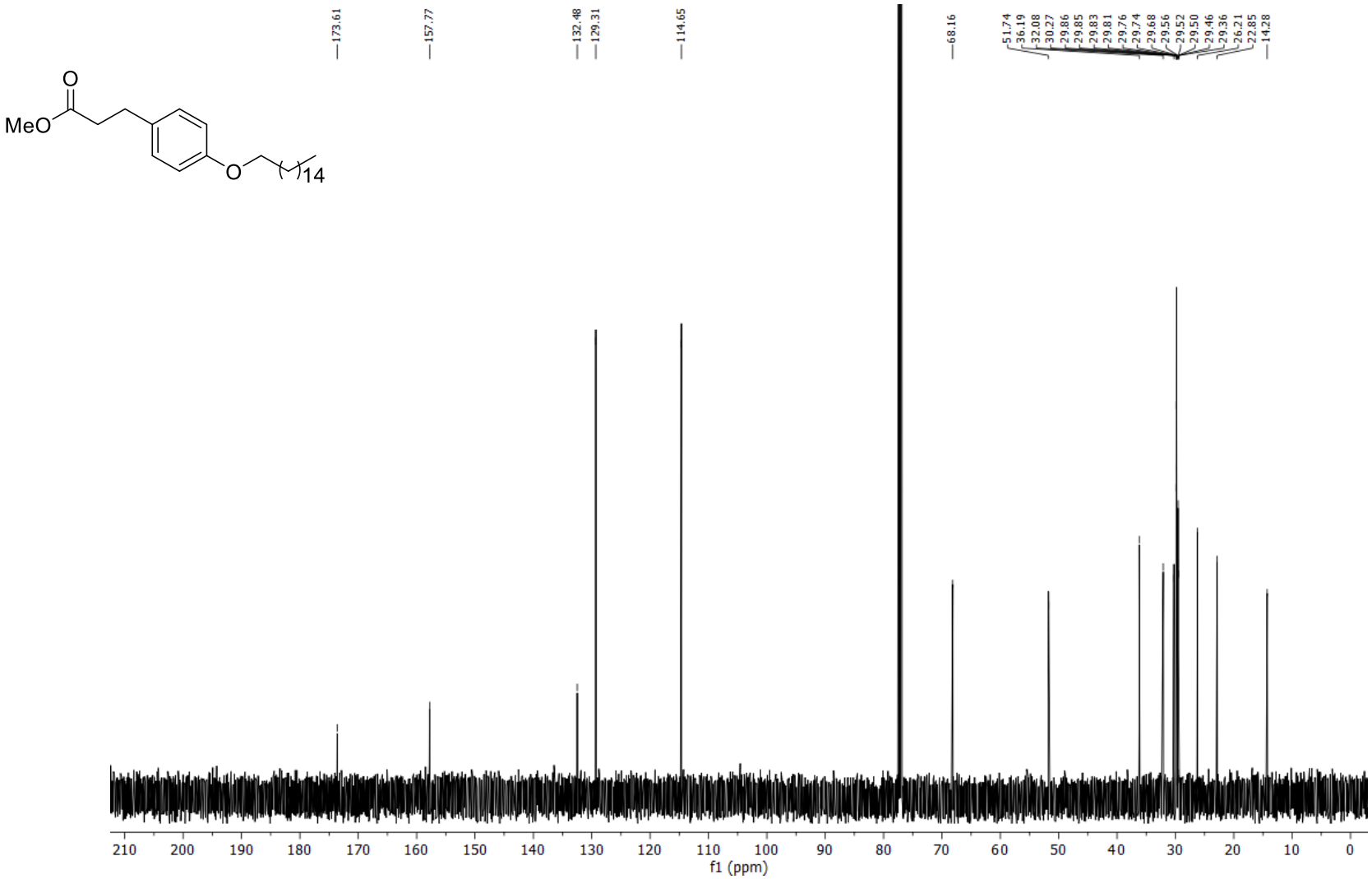
Methyl 3-(4-[hexadecyloxy]phenyl)propanoate

^{1}H NMR (500 MHz, $CDCl_3$)



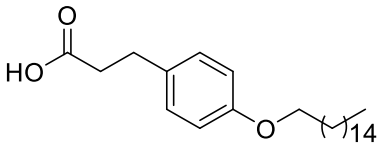
Methyl 3-(4-[hexadecyloxy]phenyl)propanoate

^{13}C NMR (125 MHz, $CDCl_3$)



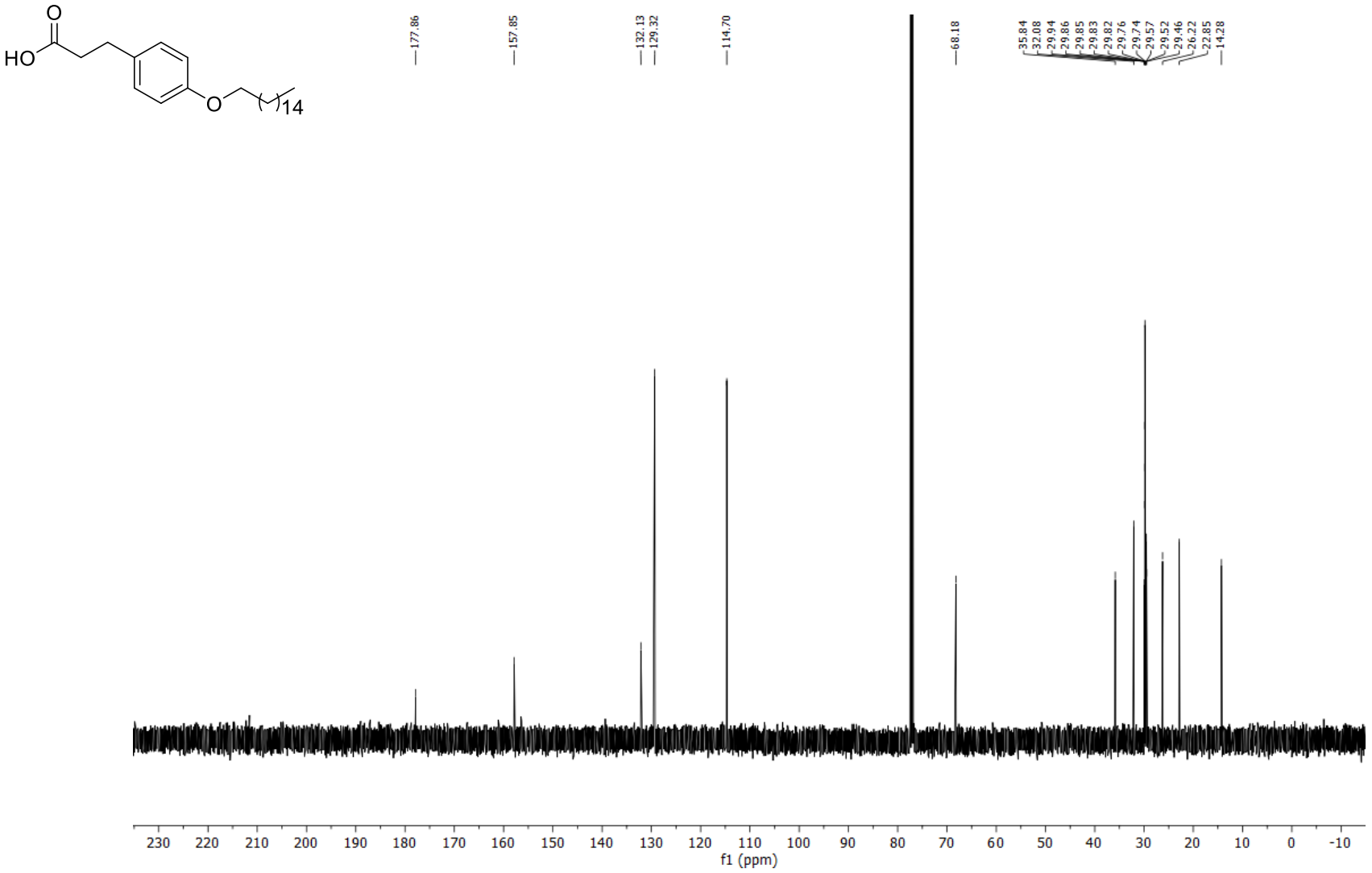
3-(4-[Hexadecyloxy]phenyl)propanoate (8e)

^{1}H NMR (500 MHz, $CDCl_3$)



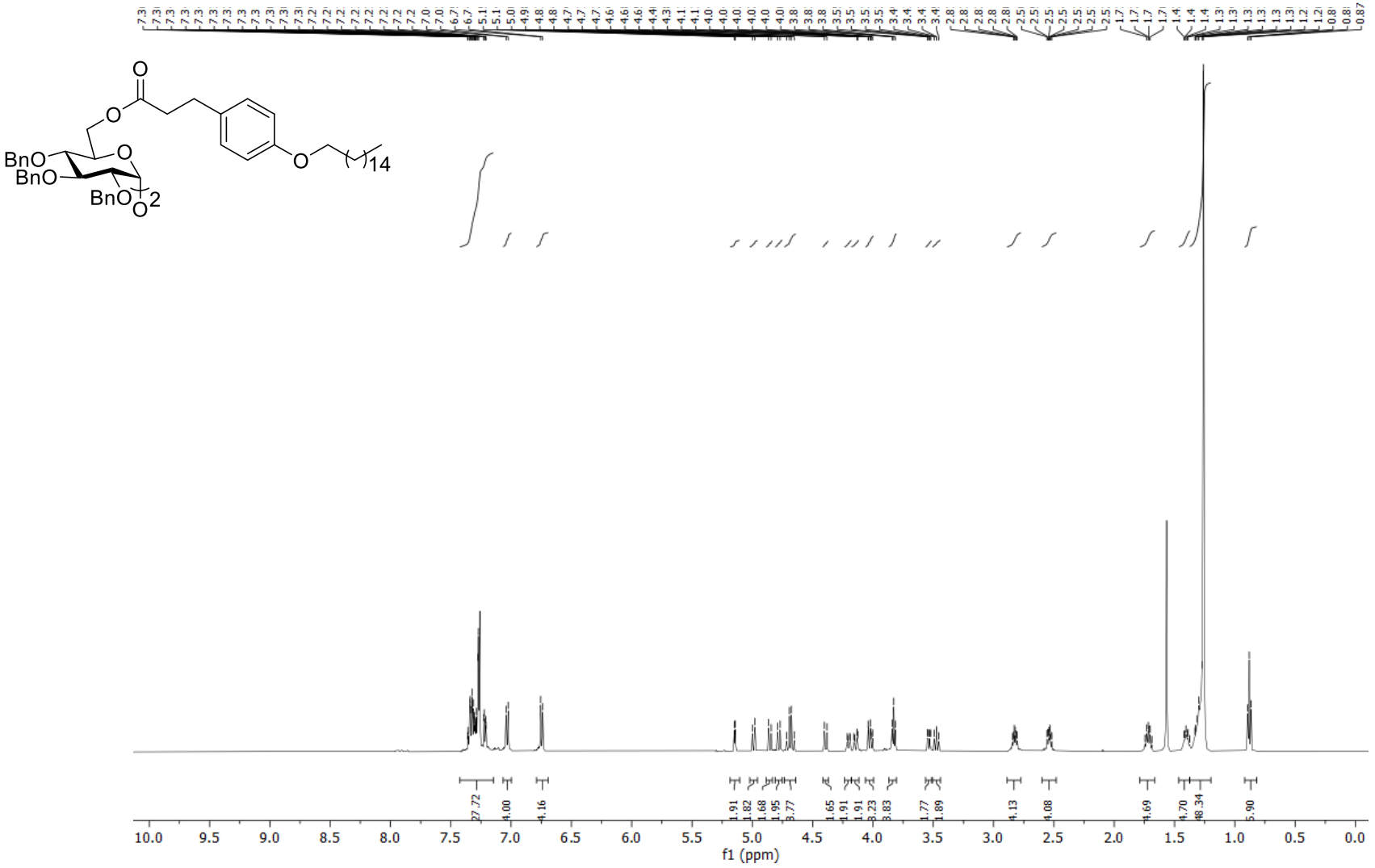
3-(4-[Hexadecyloxy]phenyl)propanoate (8e)

^{13}C NMR (125 MHz, $CDCl_3$)



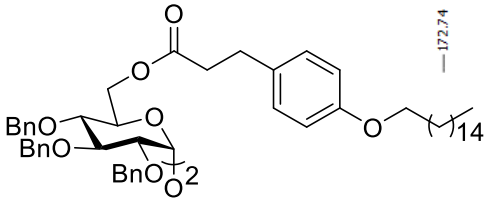
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3-[4-(hexadecyloxy)phenyl]propanoate)-α,α′-D-trehalose (21e)

^{1}H NMR (500 MHz, $CDCl_3$)



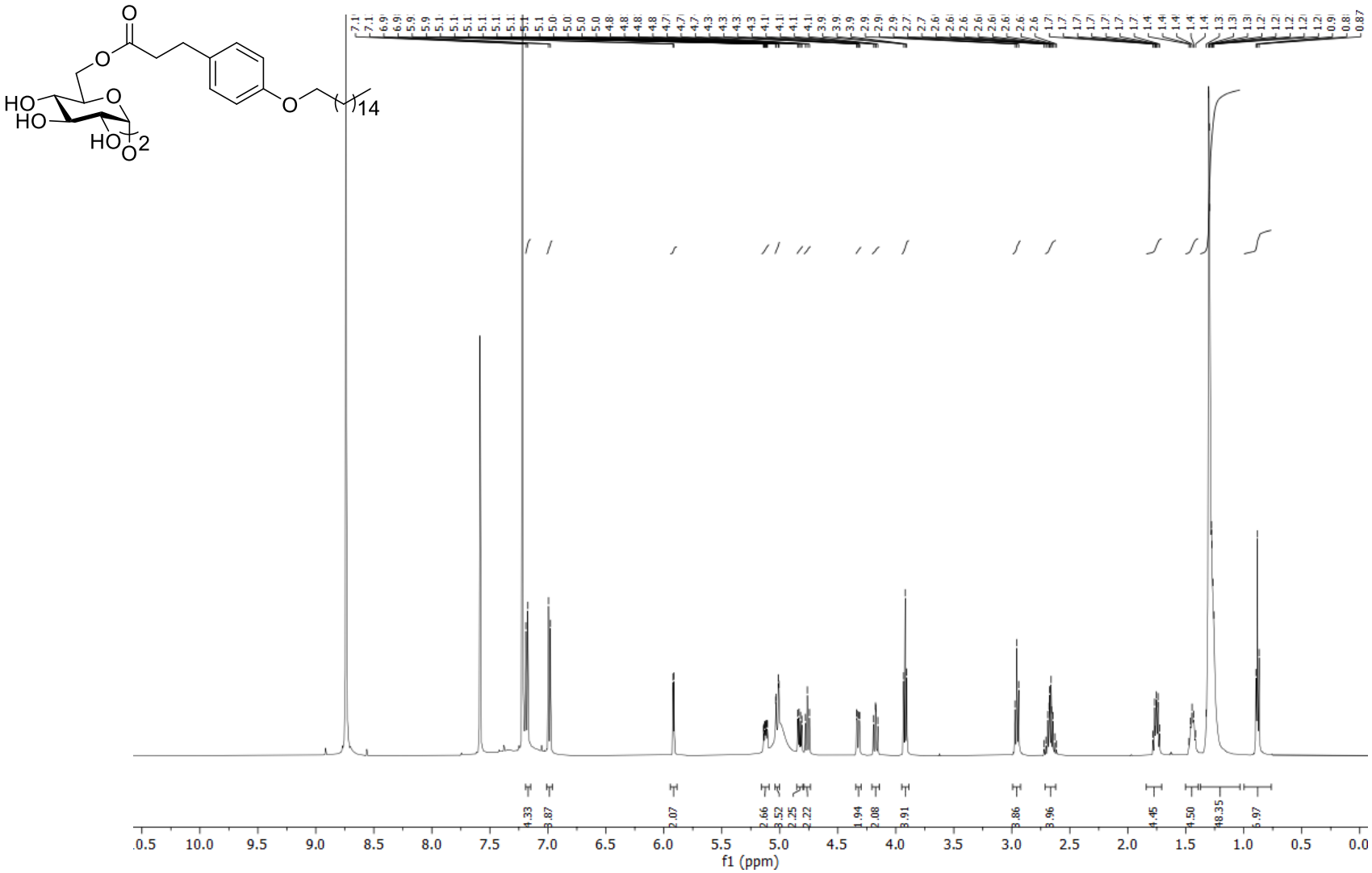
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(3-[4-(hexadecyloxy)phenyl]propanoate)-α,α′-D-trehalose (21e)

^{13}C NMR (150 MHz, $CDCl_3$)



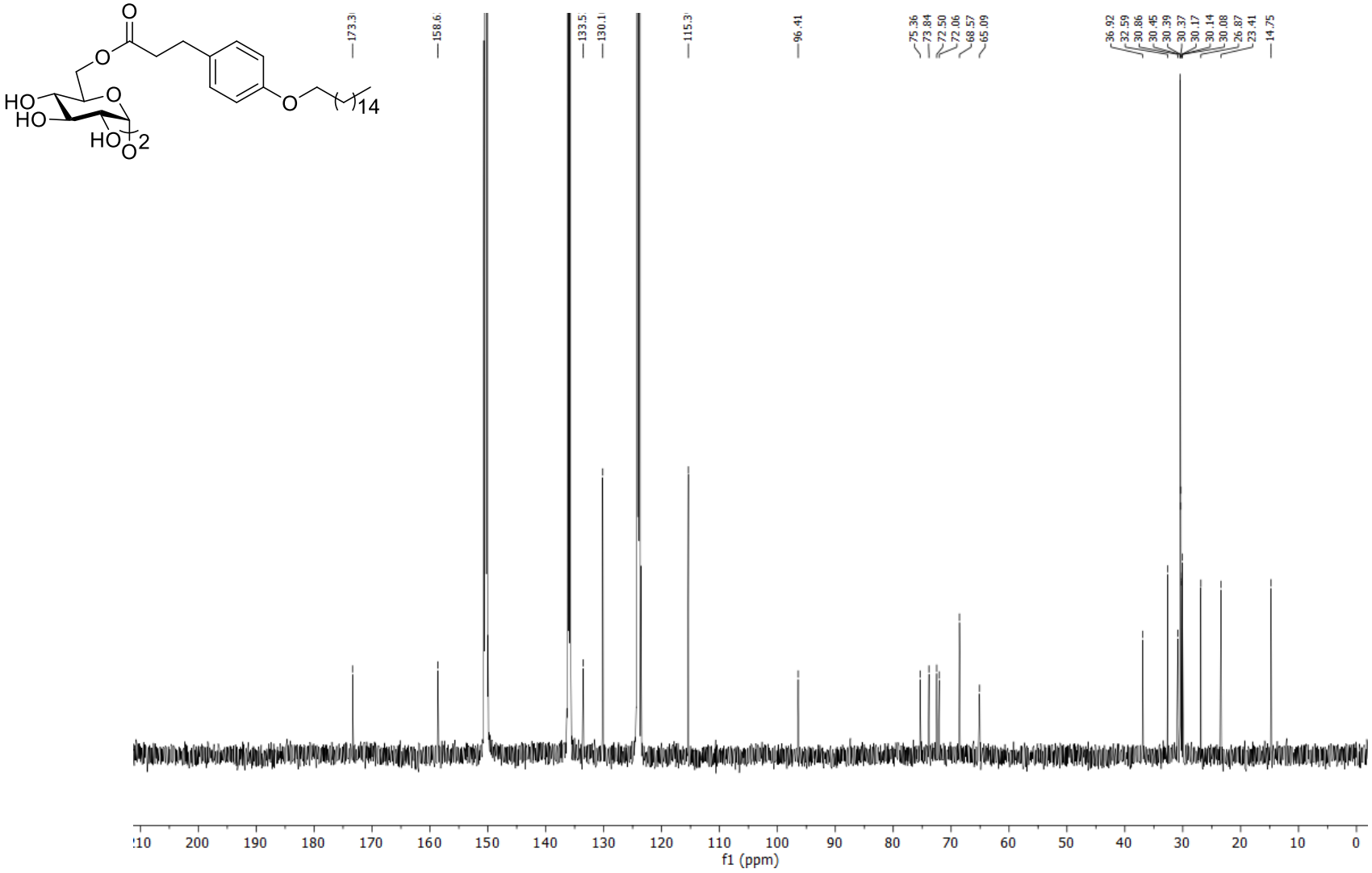
6,6′-Di-*O*-(3-[4-(hexadecyloxy)phenyl]propanoate)-α,α′-D-trehalose (5e)

^{1}H NMR (500 MHz, C_5D_5N)



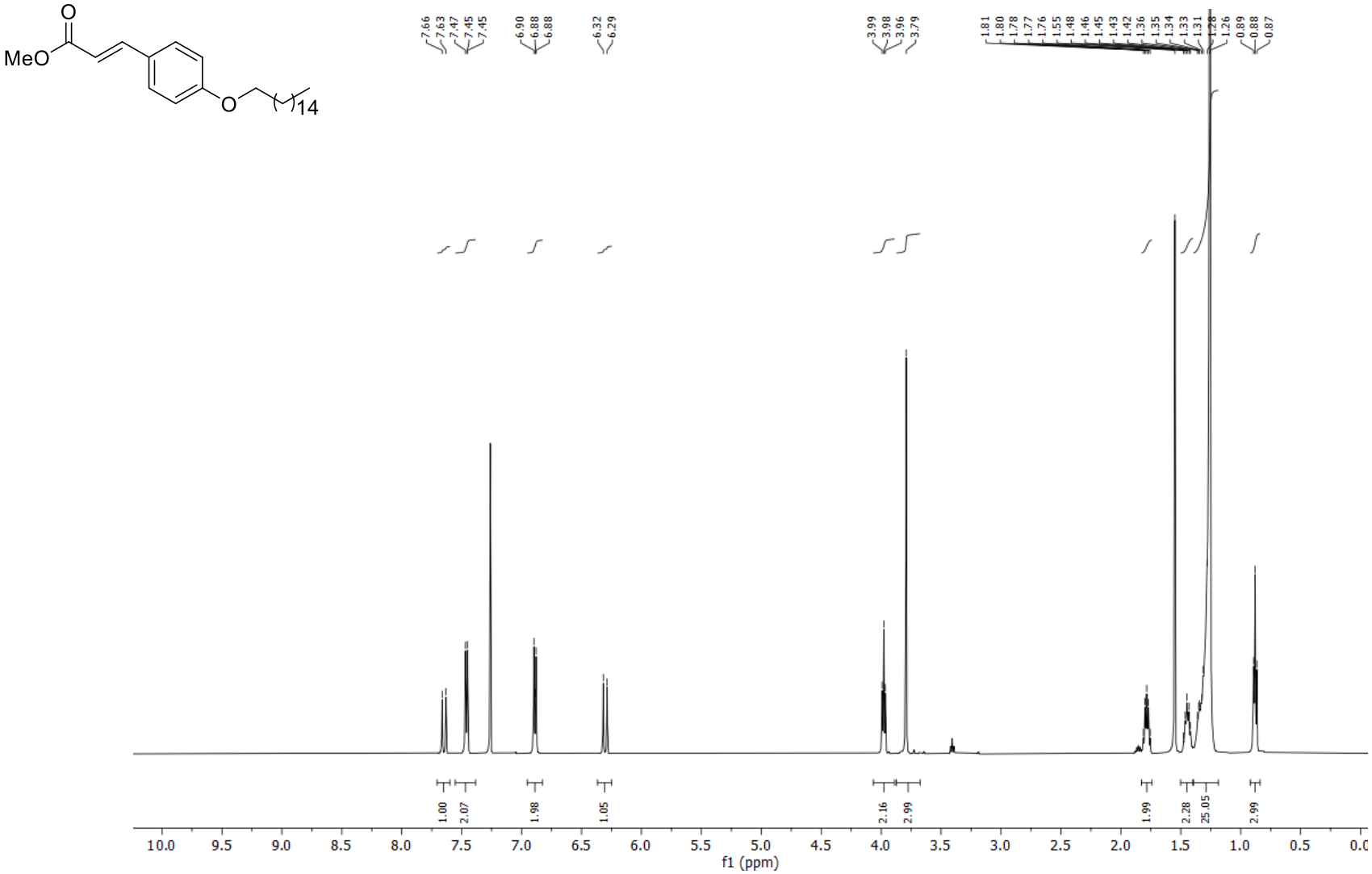
6,6′-Di-*O*-(3-[4-(hexadecyloxy)phenyl]propanoate)-α,α′-D-trehalose (5e)

^{13}C NMR (150 MHz, C_5D_5N)



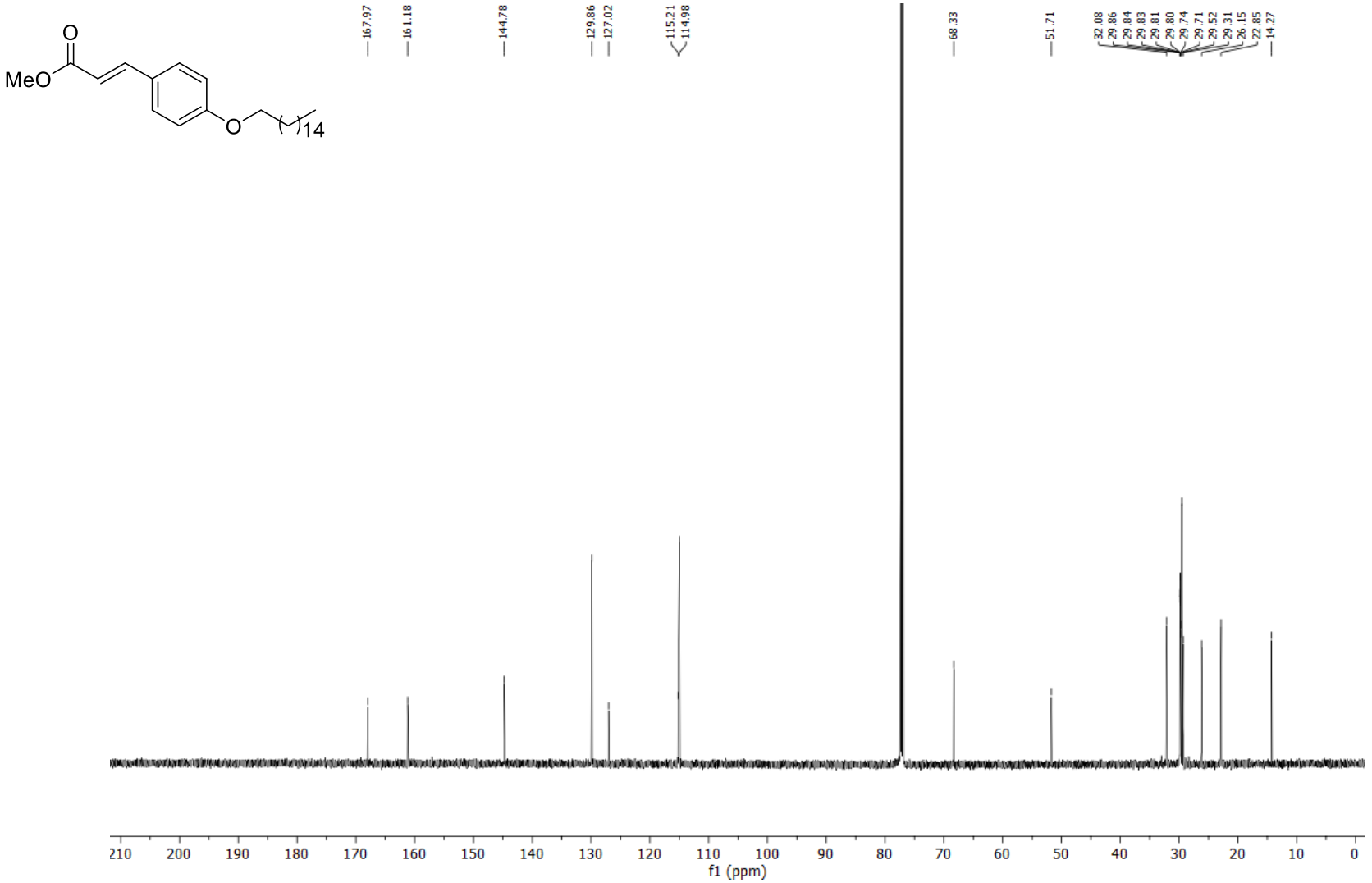
Methyl 4-hexadecyloxycinnamate

^{1}H NMR (500 MHz, $CDCl_3$)



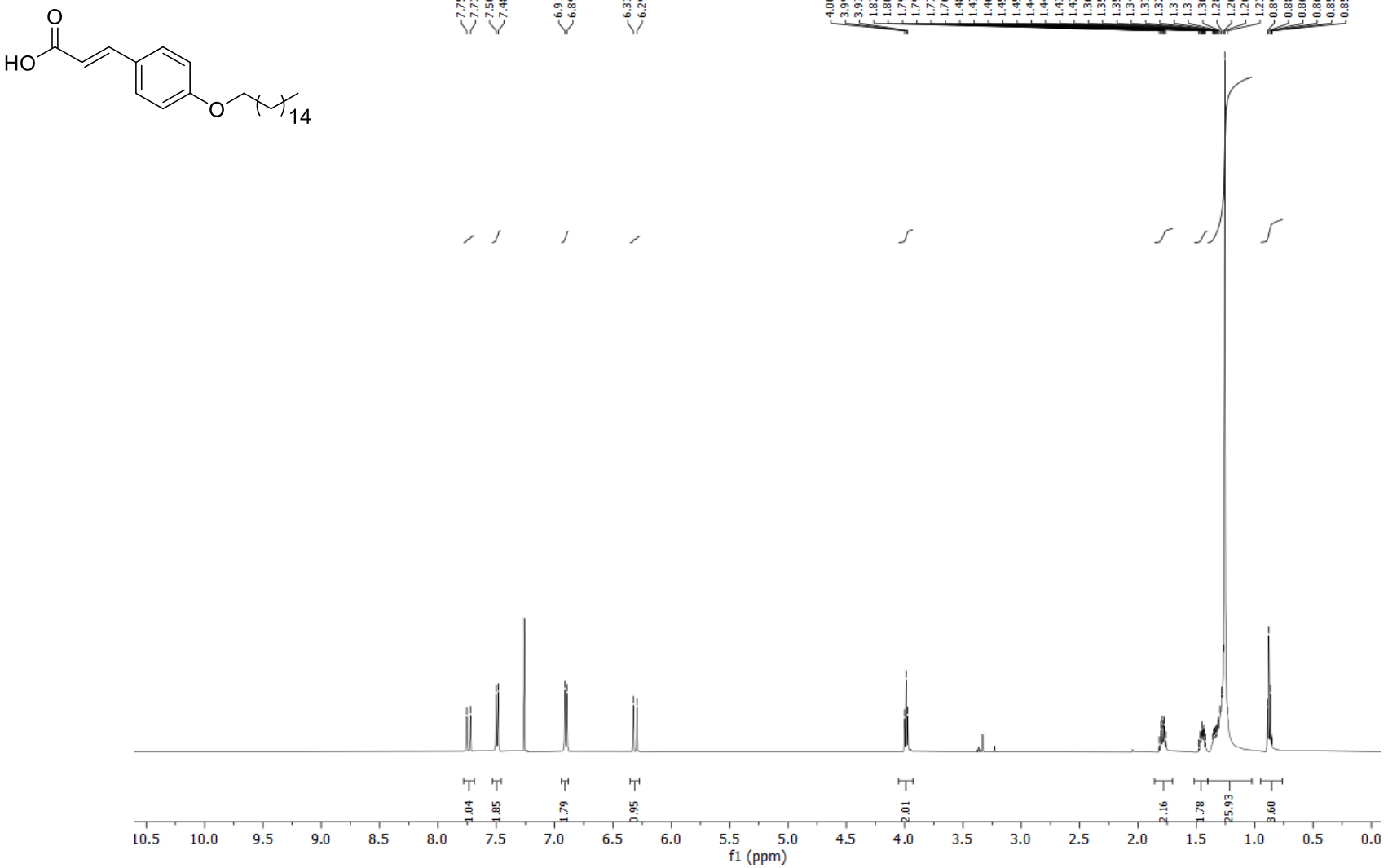
Methyl 4-hexadecyloxycinnamate

^{13}C NMR (150 MHz, $CDCl_3$)



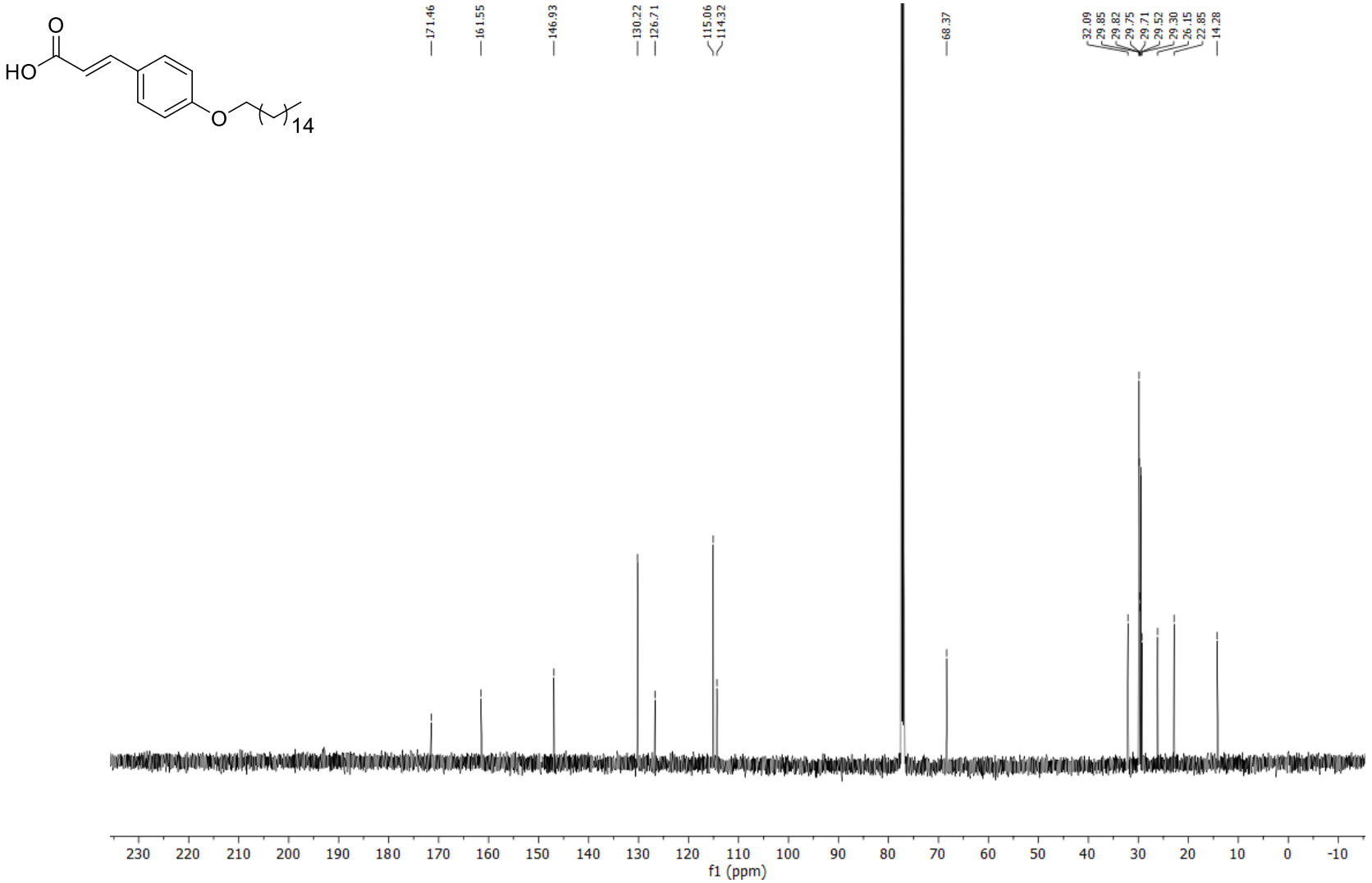
4-hexadecyloxycinnamic acid (9f)

^{1}H NMR (500 MHz, $CDCl_3$)



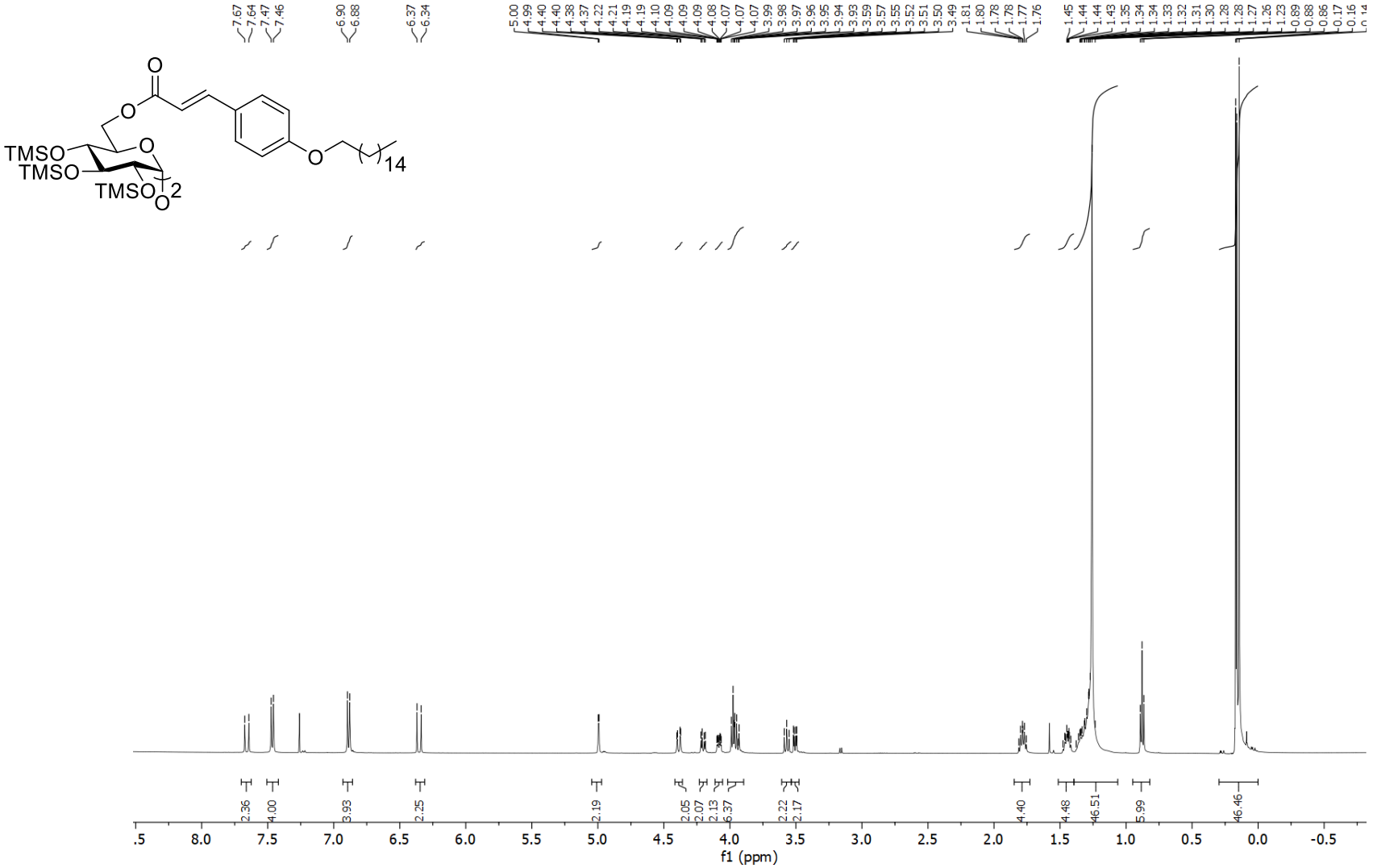
4-hexadecyloxycinnamic acid (9f)

^{13}C NMR (150 MHz, $CDCl_3$)



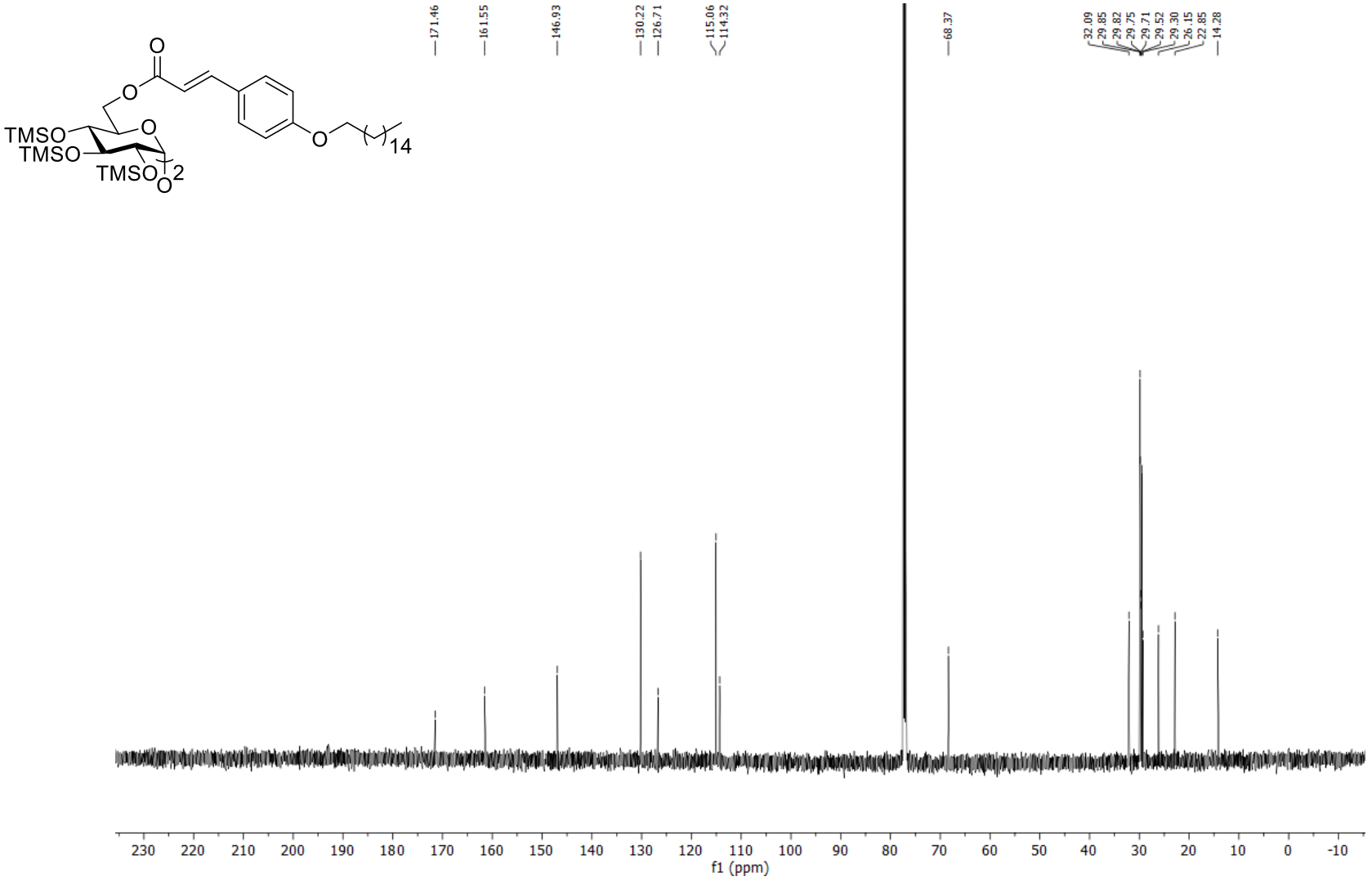
2,2′,3,3′,4,4′-Hexa-*O*-trimethylsilyl-6,6′-di-*O*-(4-hexadecyloxycinnamate)-α,α′-D-trehalose (21f)

^{1}H NMR (500 MHz, $CDCl_3$)



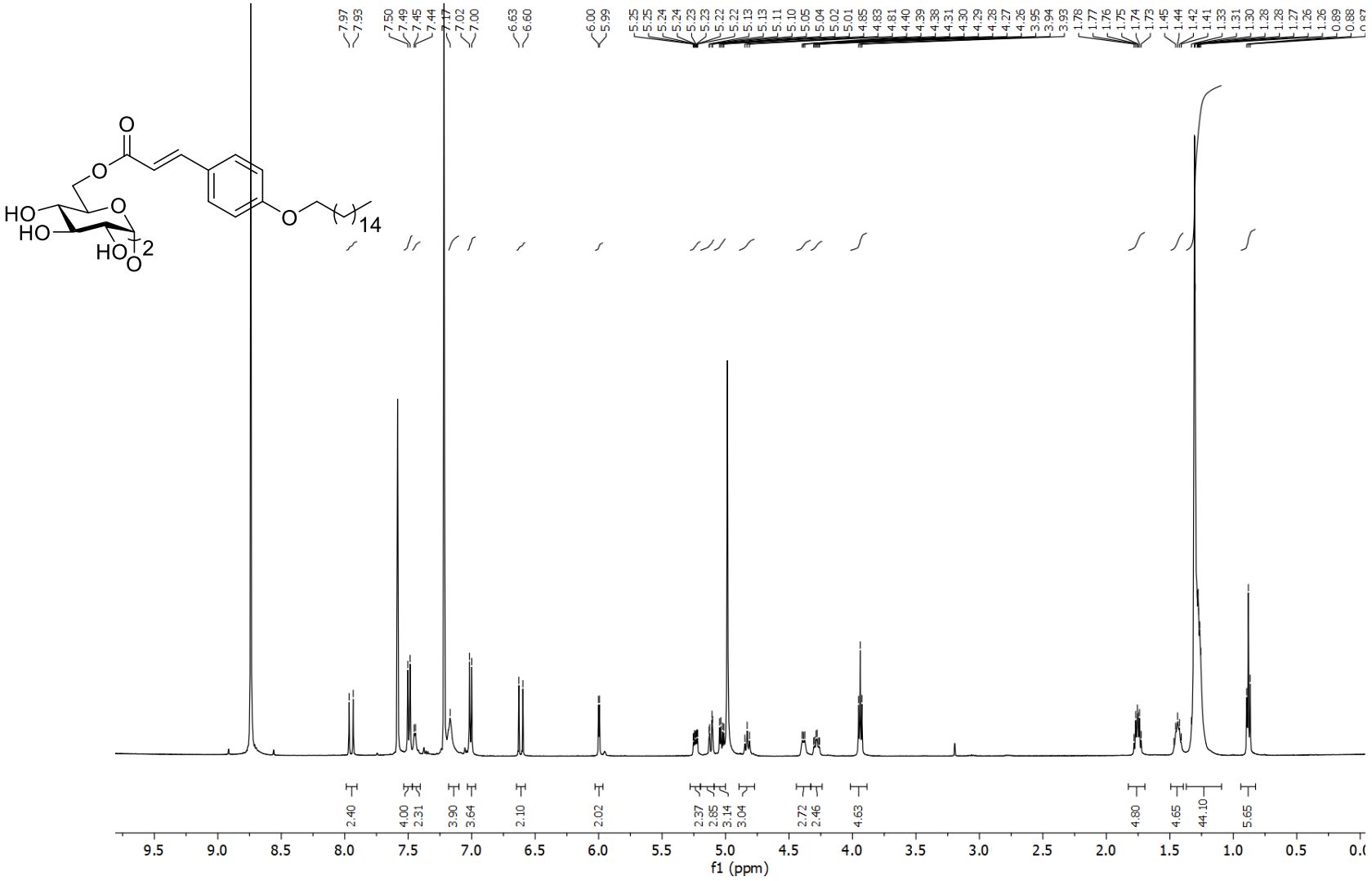
2,2′,3,3′,4,4′-Hexa-*O*-trimethylsilyl-6,6′-di-*O*-(4-hexadecyloxycinnamate)-α,α′-D-trehalose (21f)

^{13}C NMR (125 MHz, $CDCl_3$)



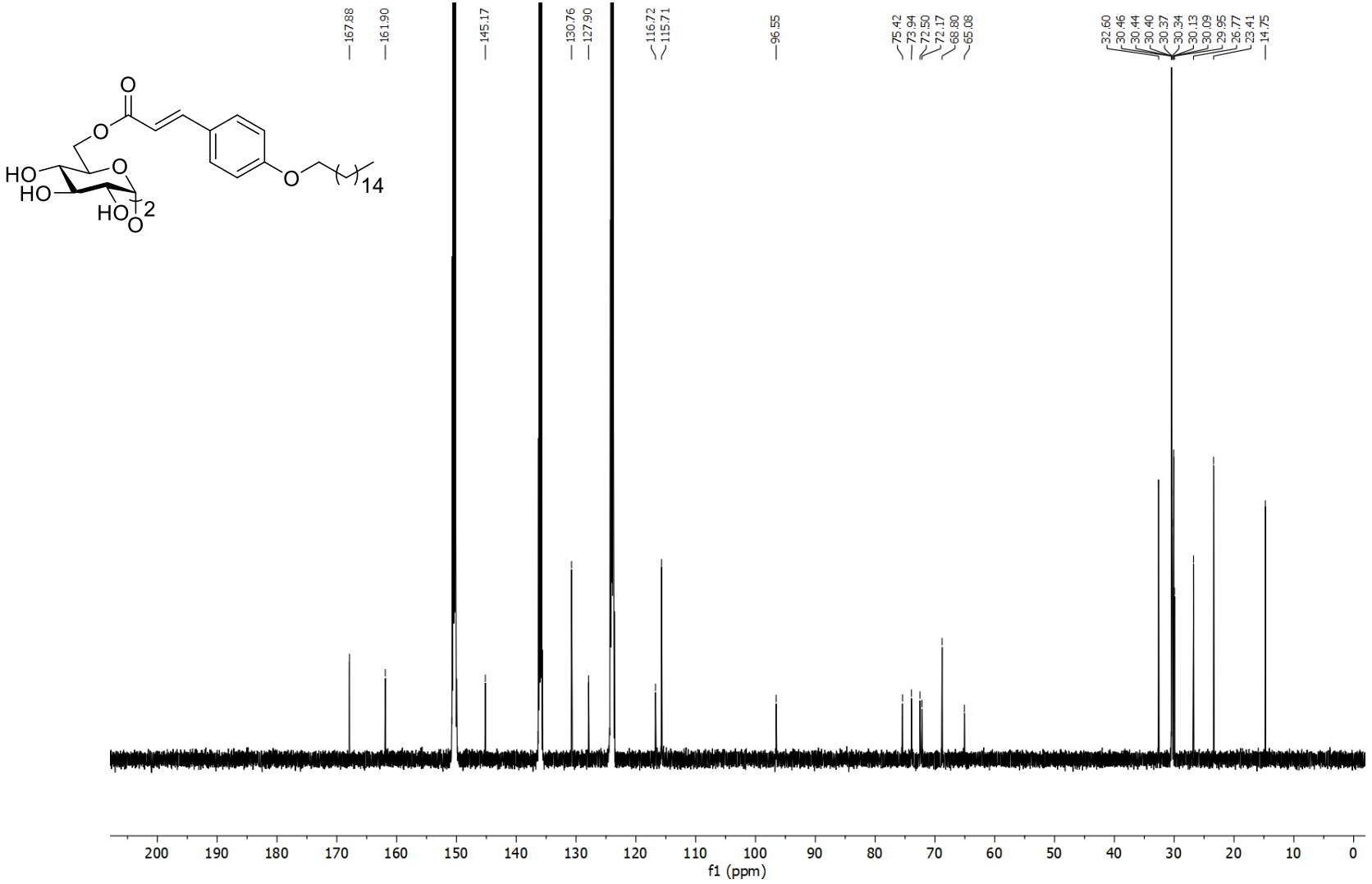
6,6′-Di-*O*-(4-hexadecyloxycinnamate)-α,α′-D-trehalose (5f)

^{1}H NMR (500 MHz, C_5D_5N)



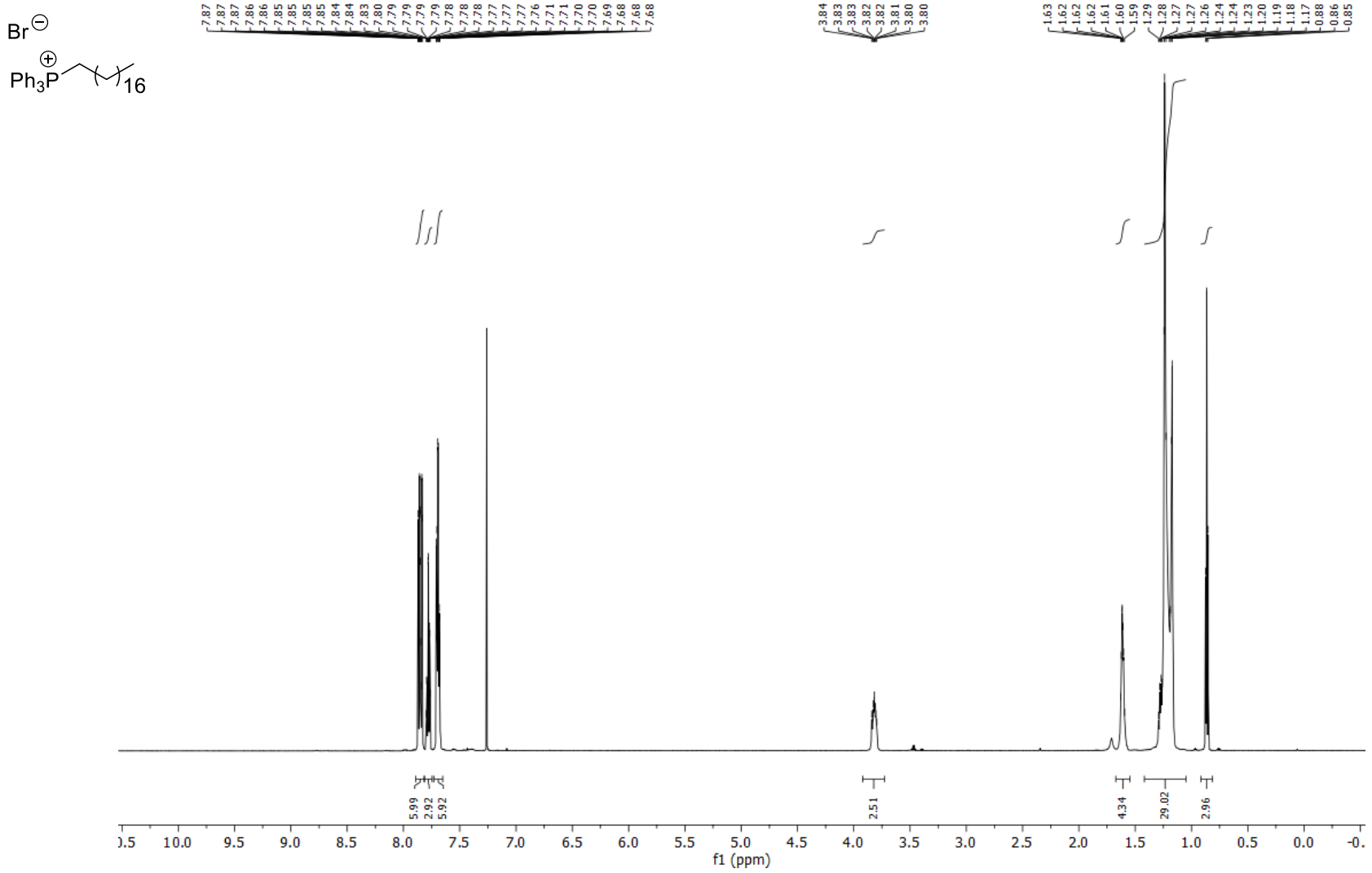
6,6′-Di-*O*-(4-hexadecyloxycinnamate)-α,α′-D-trehalose (5f)

^{13}C NMR (150 MHz, C_5D_5N)



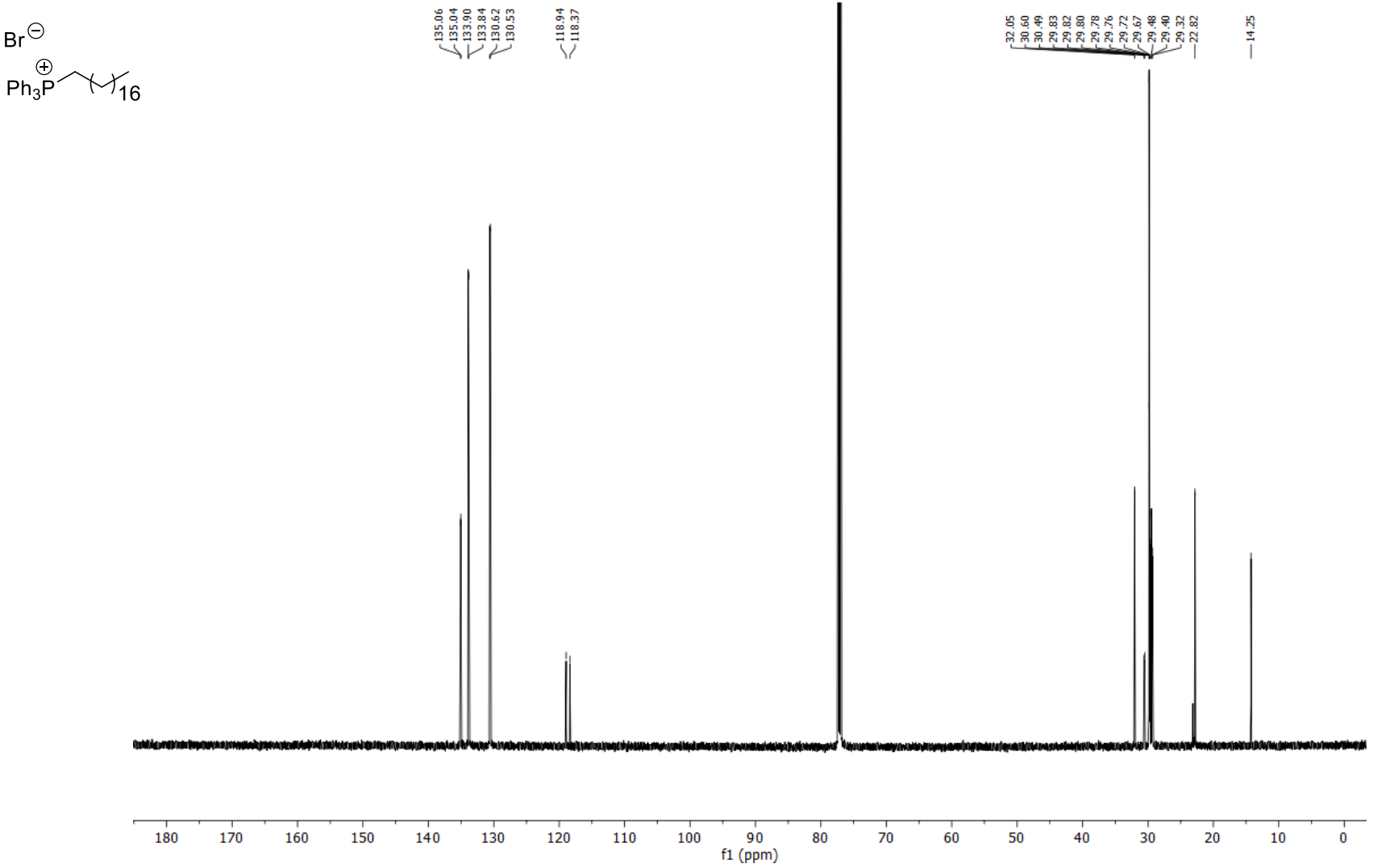
Octadecyltriphenylphosphonium bromide (16)

^{1}H NMR (600 MHz, $CDCl_3$)



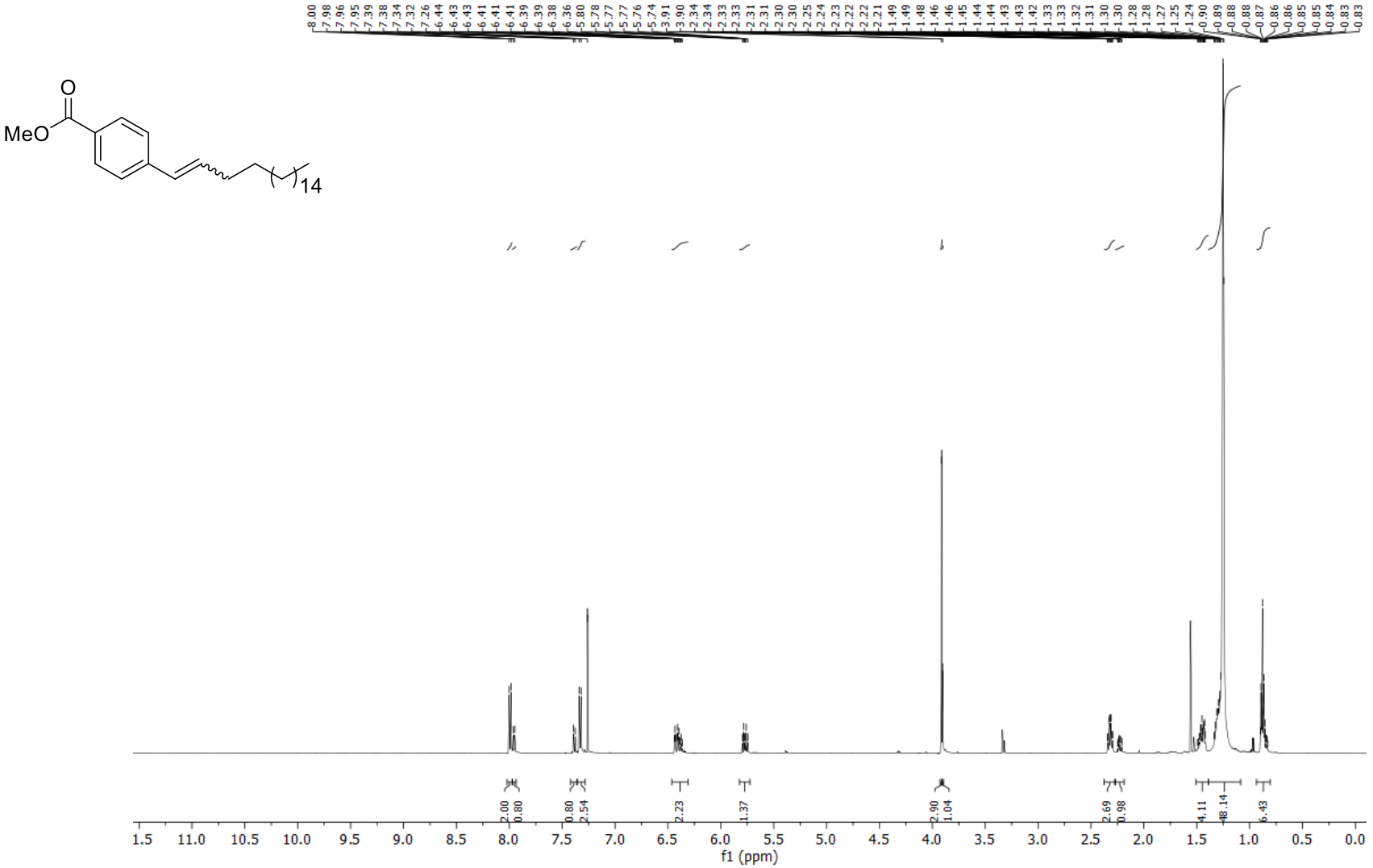
Octadecyltriphenylphosphonium bromide (16)

^{13}C NMR (150 MHz, $CDCl_3$)



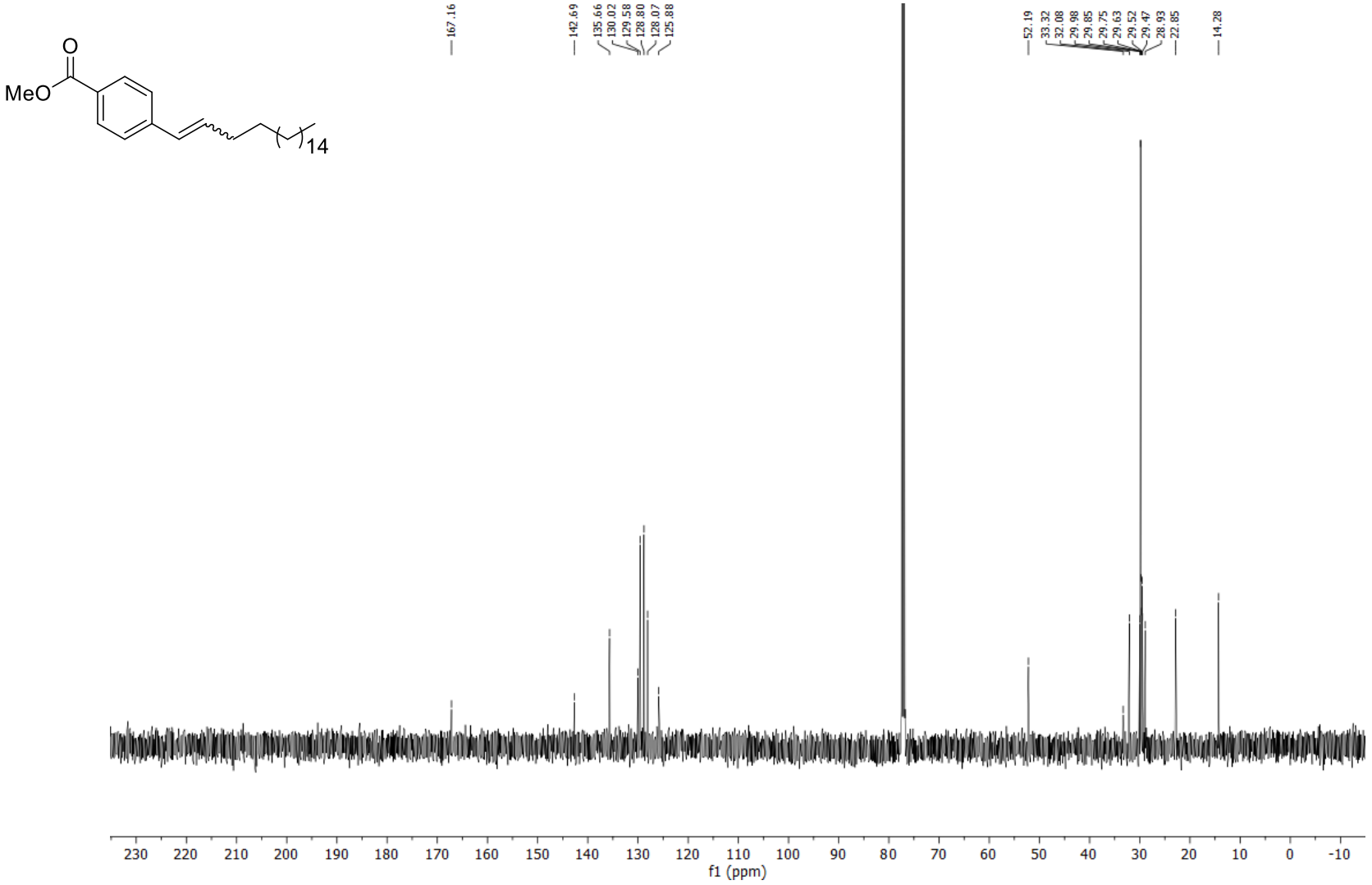
Methyl (*Z*)-4-(nonadec-1-en-1-yl)benzoate and Methyl (*E*)-4-(nonadec-1-en-1-yl)benzoate (17)

^{1}H NMR (500 MHz, $CDCl_3$)



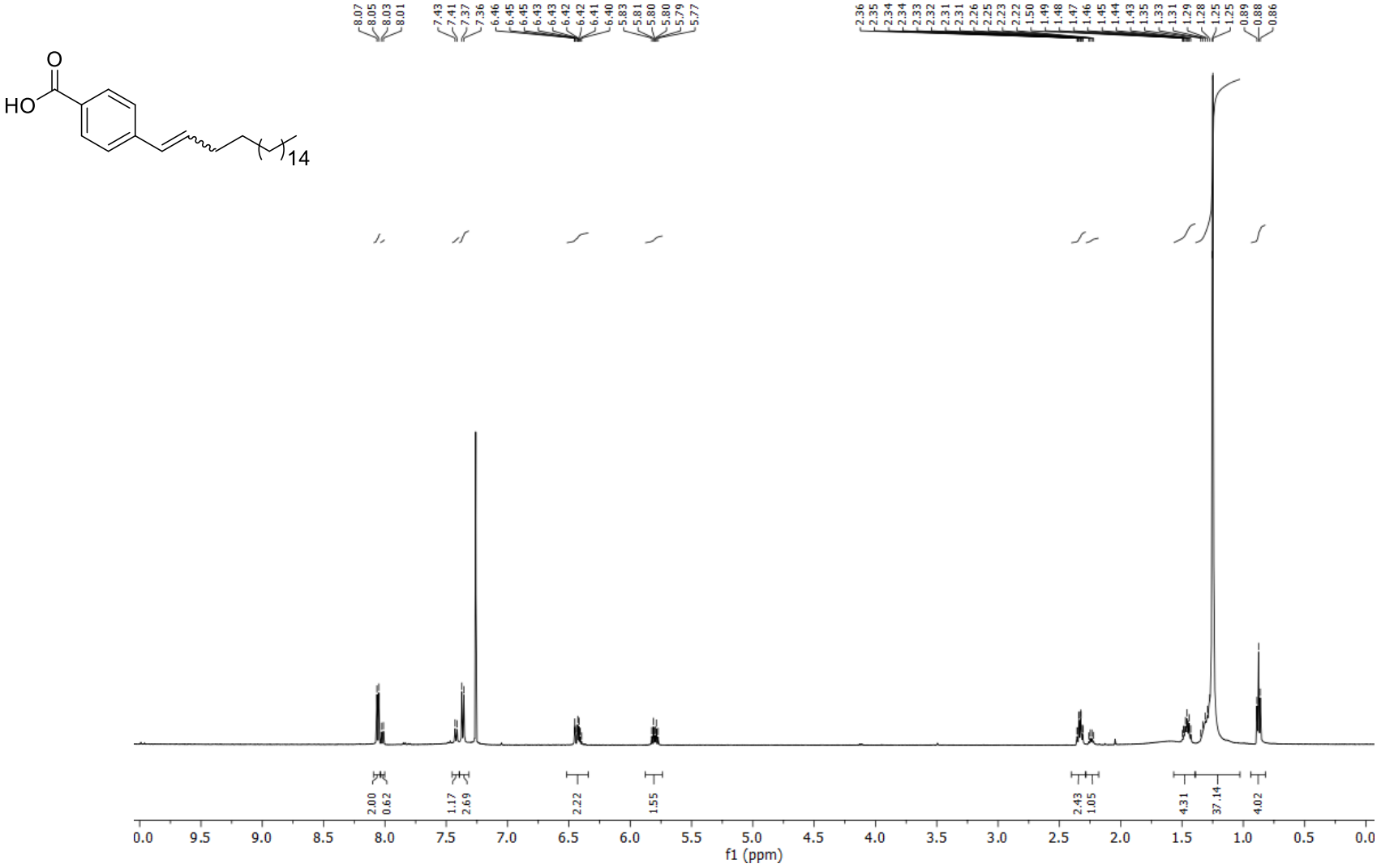
Methyl (*Z*)-4-(nonadec-1-en-1-yl)benzoate and Methyl (*E*)-4-(nonadec-1-en-1-yl)benzoate (17)

^{13}C NMR (125 MHz, $CDCl_3$)



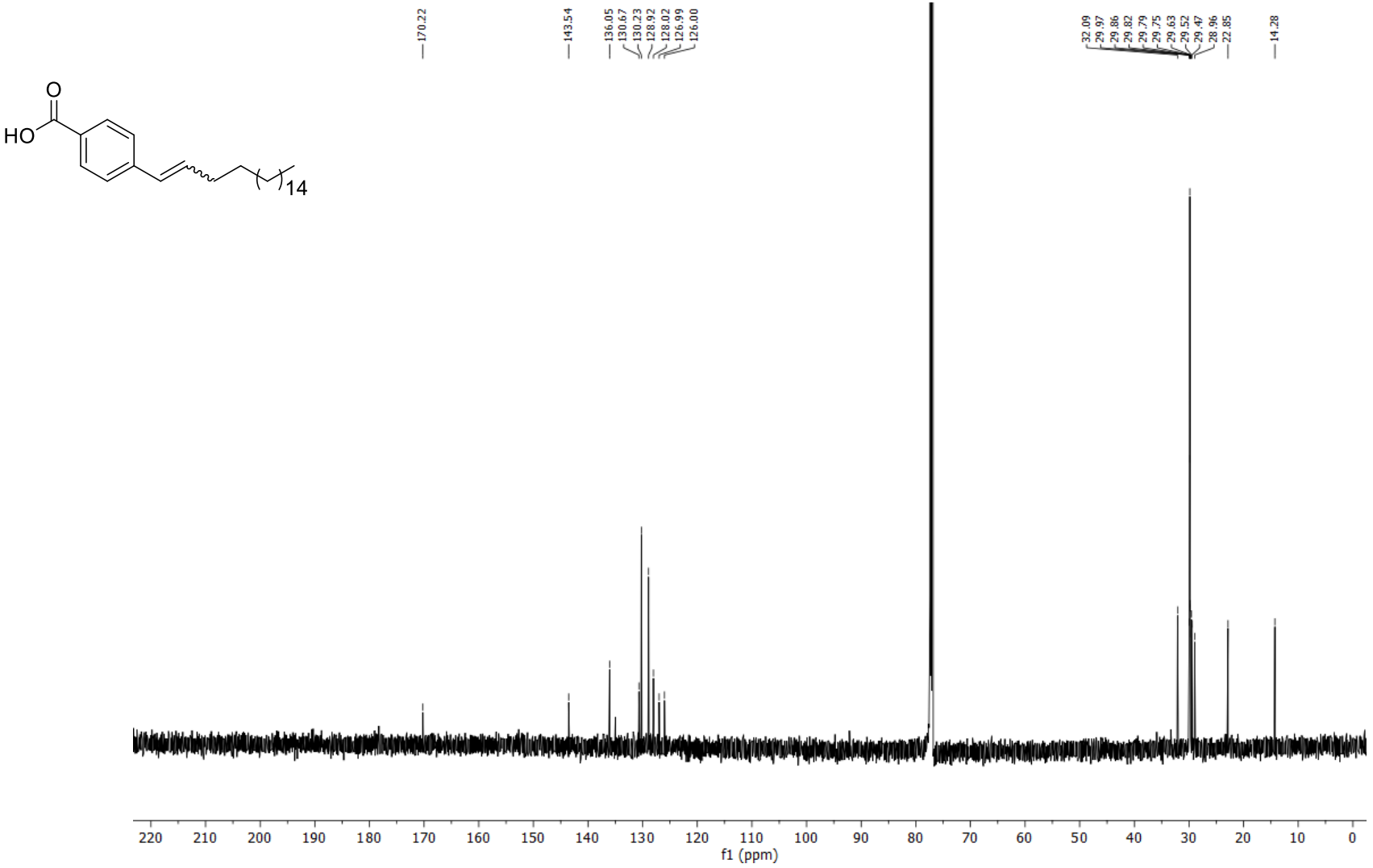
(*Z*)-4-(nonadec-1-en-1-yl)benzoic acid and (*E*)-4-(nonadec-1-en-1-yl)benzoic acid (10g)

^{1}H NMR (500 MHz, $CDCl_3$)



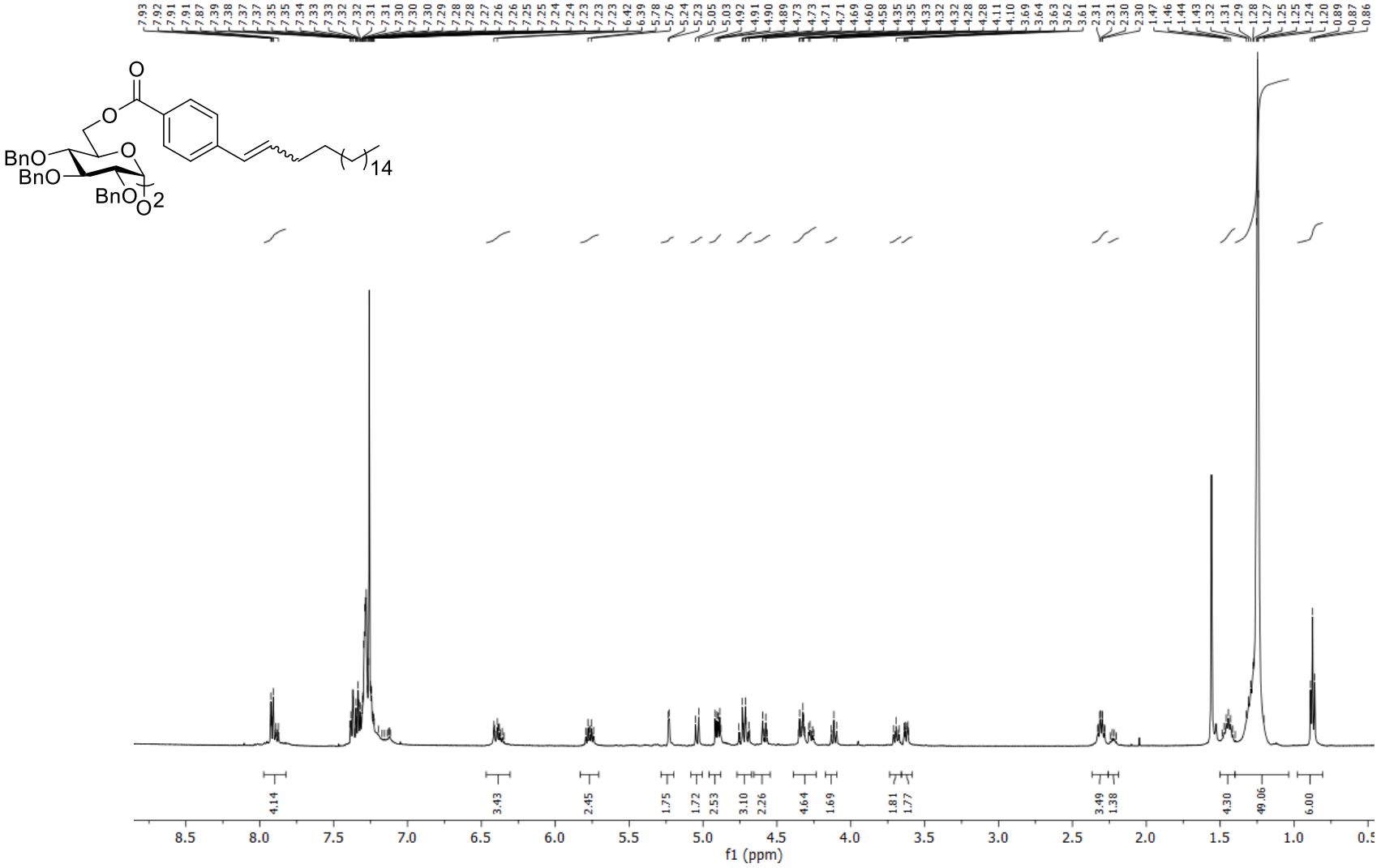
(*Z*)-4-(nonadec-1-en-1-yl)benzoic acid and (*E*)-4-(nonadec-1-en-1-yl)benzoic acid (10g)

^{13}C NMR (150 MHz, $CDCl_3$)



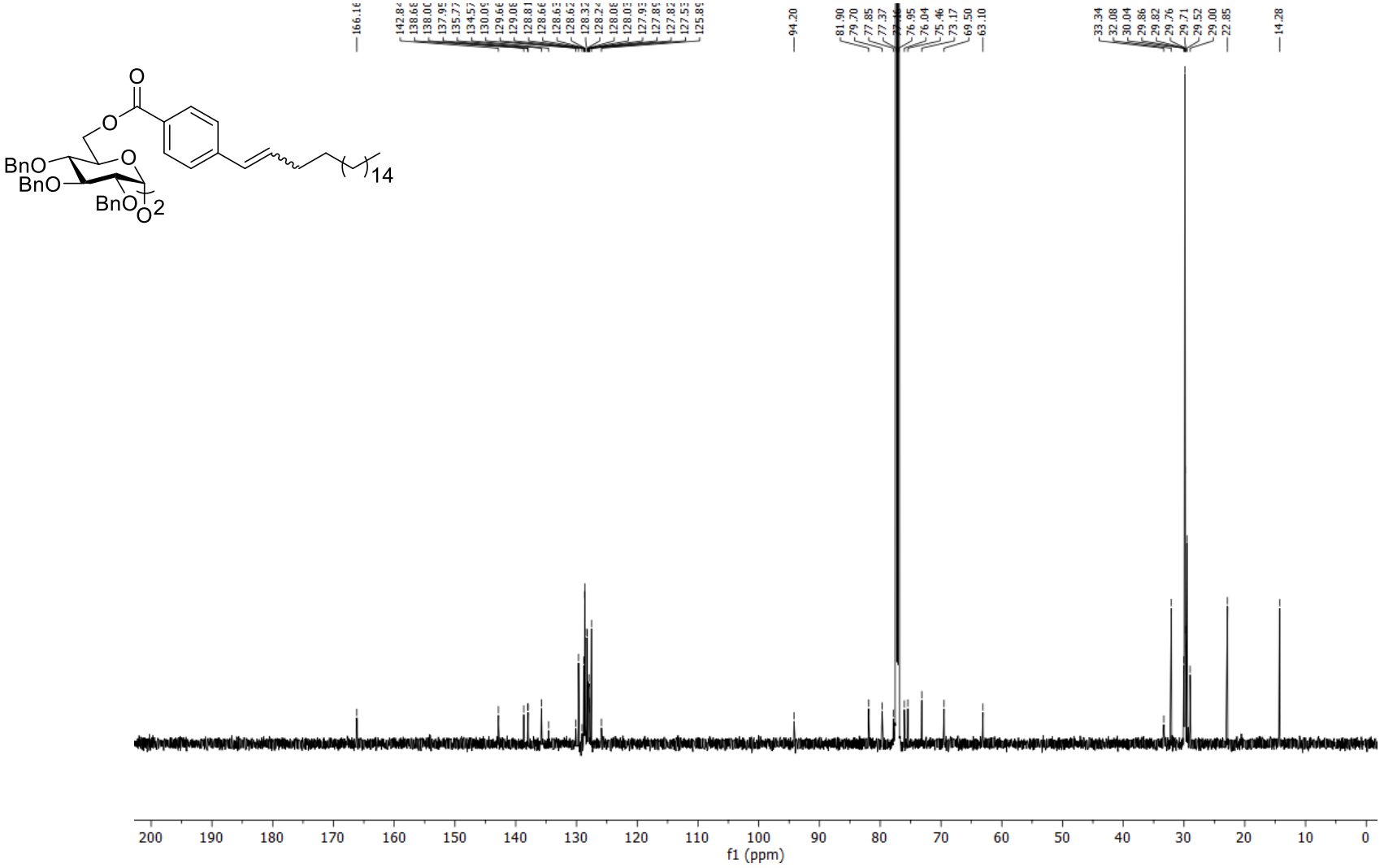
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*- ([*Z*]-4-[nonadec-1-en-1-yl]benzoate)-α,α′-D-trehalose and 2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*- ([*E*]-4-[nonadec-1-en-1-yl]benzoate)-α,α′-D-trehalose (21g)

^{1}H NMR (500 MHz, $CDCl_3$)



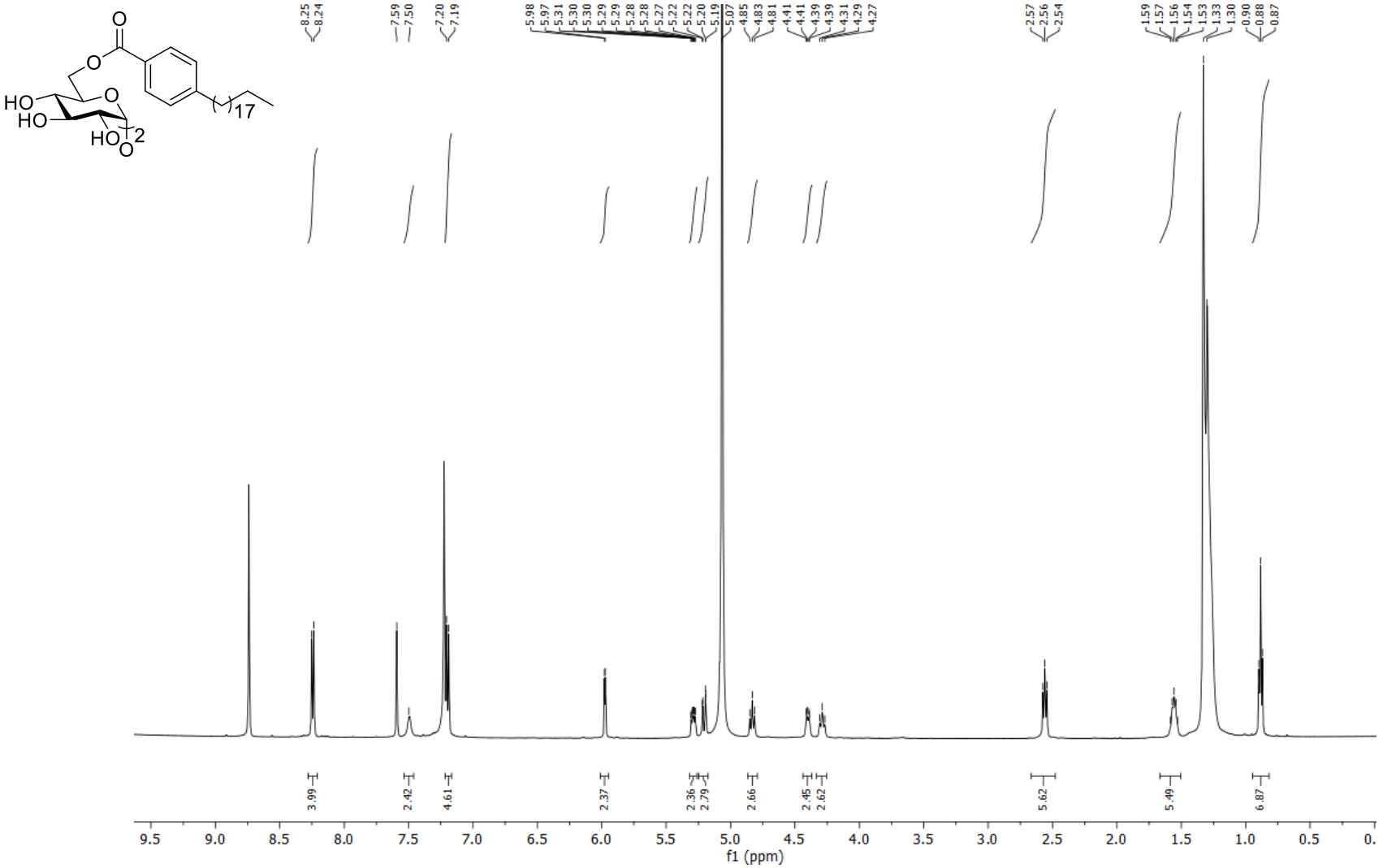
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*- ([*Z*]-4-[nonadec-1-en-1-yl]benzoate)-α,α′-D-trehalose and 2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*- ([*E*]-4-[nonadec-1-en-1-yl]benzoate)-α,α′-D-trehalose (21g)

^{13}C NMR (150 MHz, $CDCl_3$)



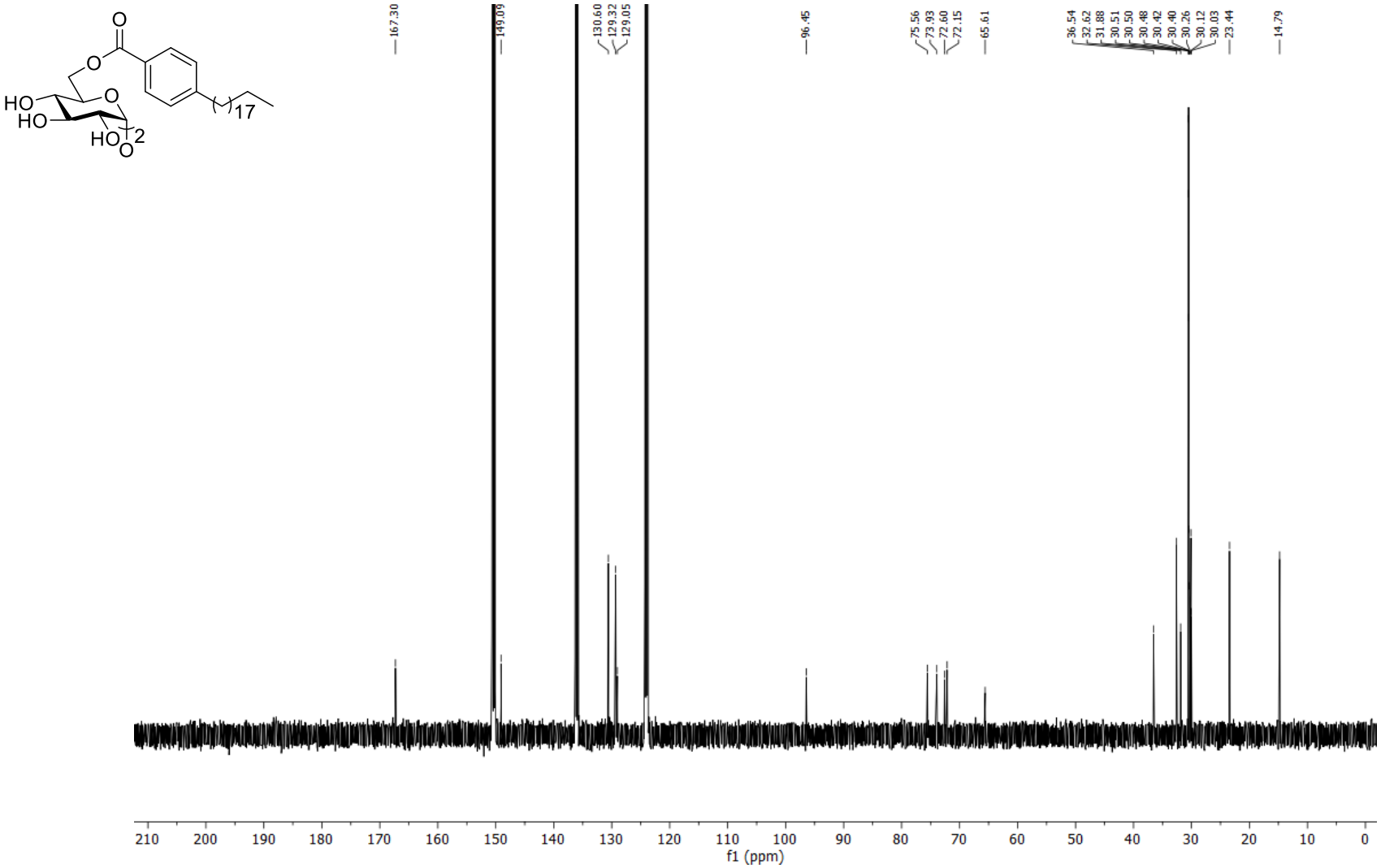
6,6′-Di-*O*-(4-nonadecylbeznoate)-α,α′-D-trehalose (5g)

^{1}H NMR (500 MHz, C_5D_5N)



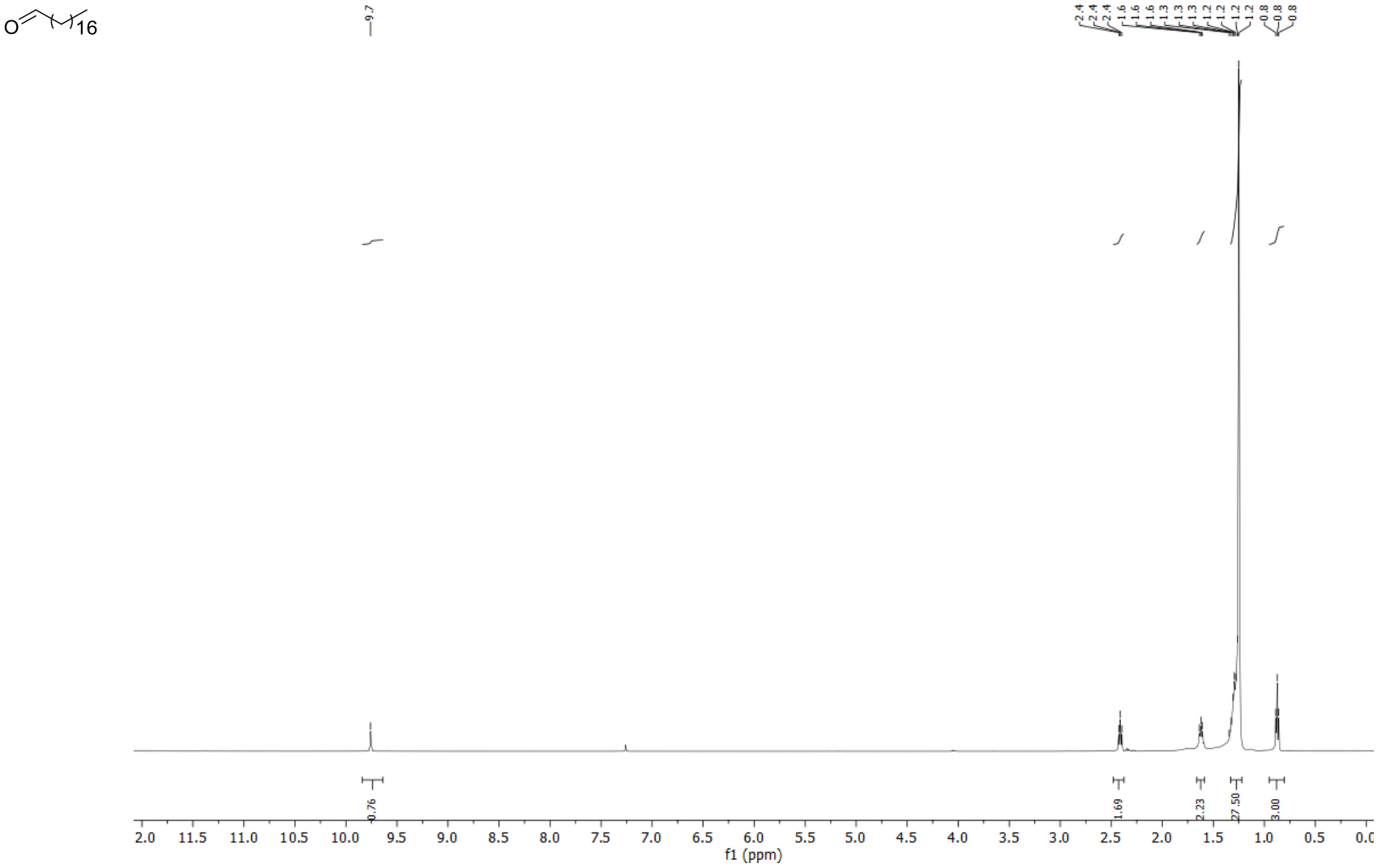
6,6′-Di-*O*-(4-nonadecylbeznoate)-α,α′-D-trehalose (5g)

^{13}C NMR (150 MHz, C_5D_5N)



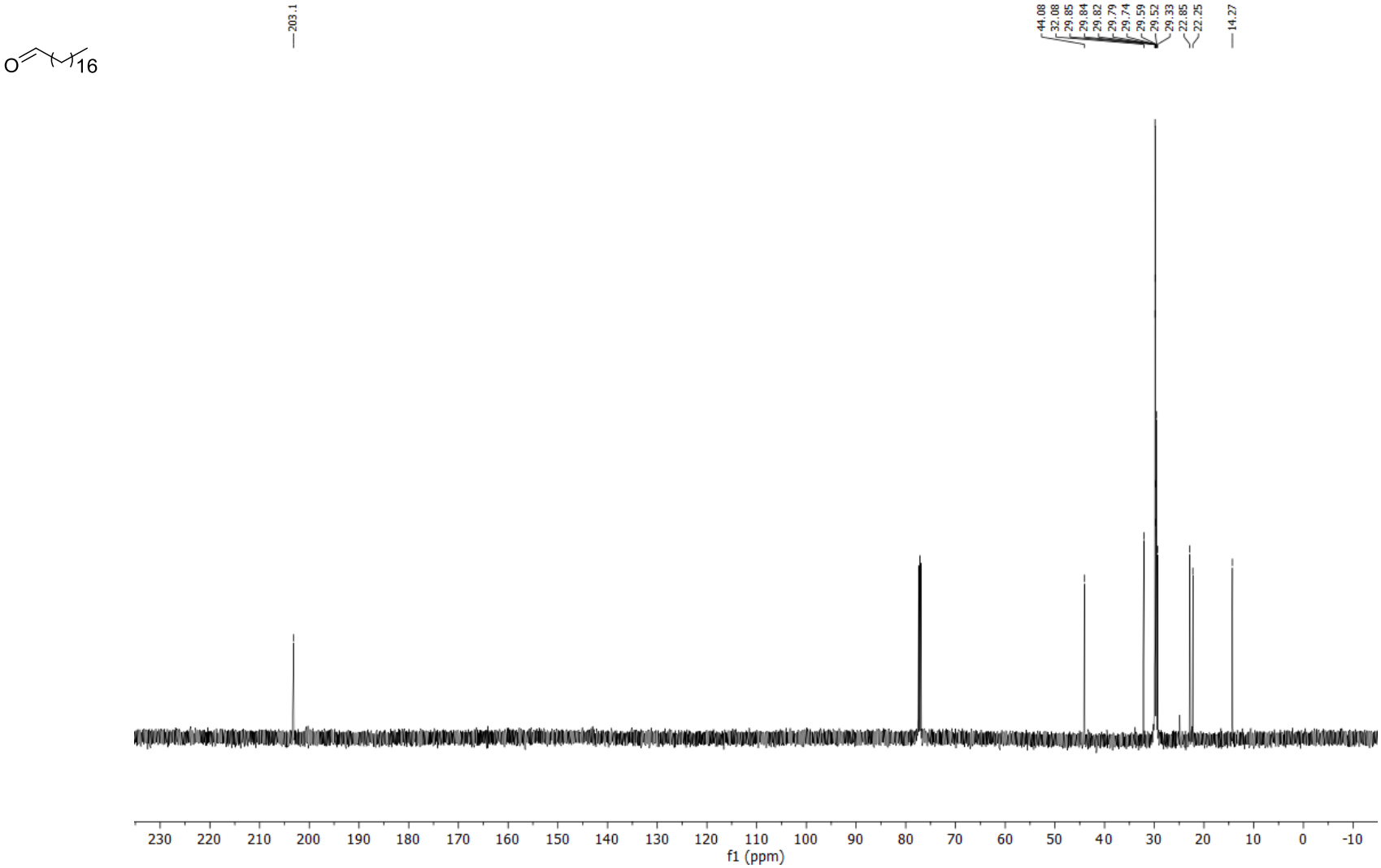
Octadecanal (19)

^{1}H NMR (500 MHz, $CDCl_3$)



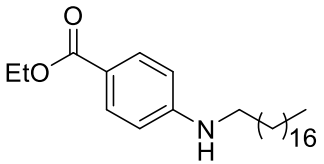
Octadecanal (19)

^{13}C NMR (125 MHz, $CDCl_3$)



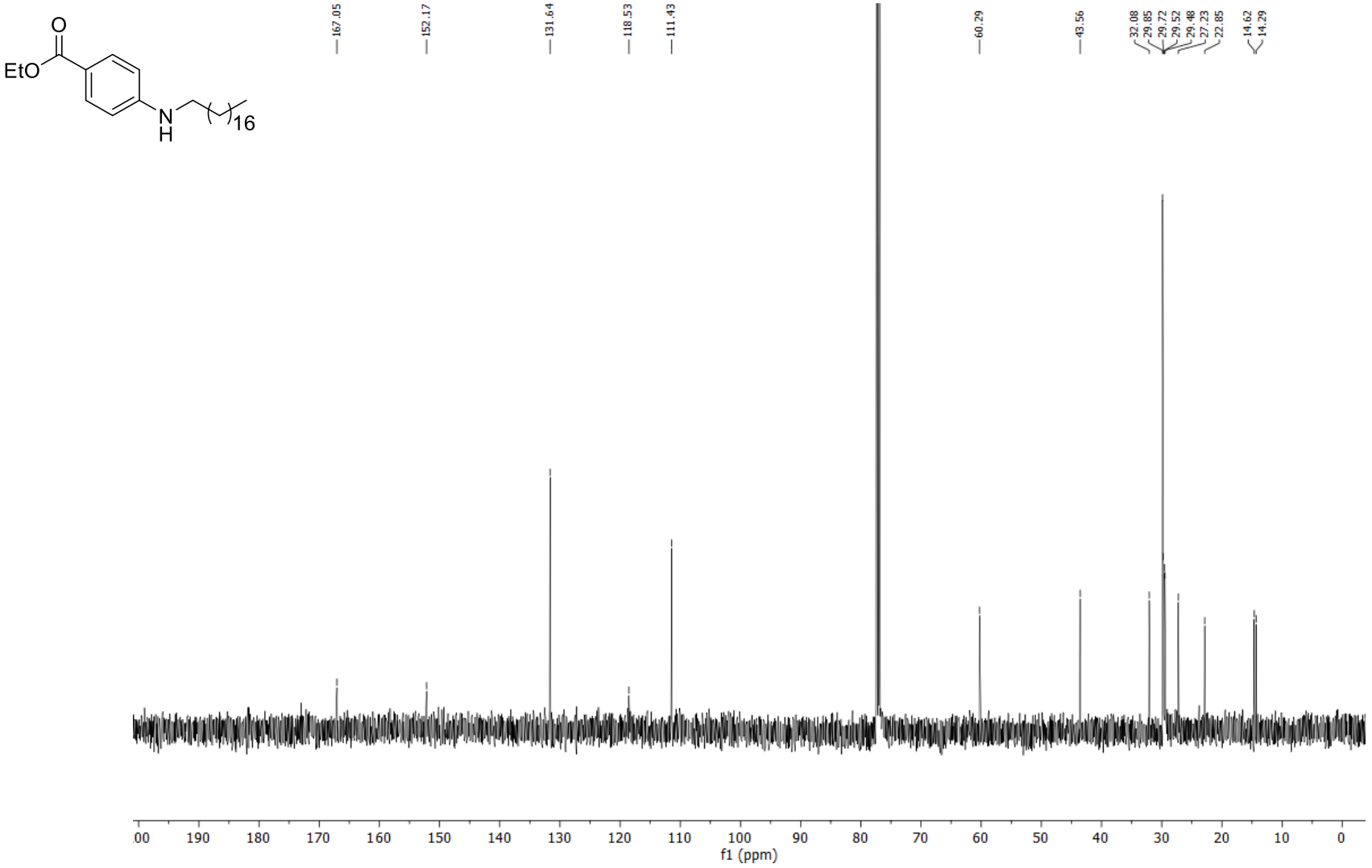
Ethyl 4-(octadecylamino)benzoate (20)

^{1}H NMR (500 MHz, $CDCl_3$)



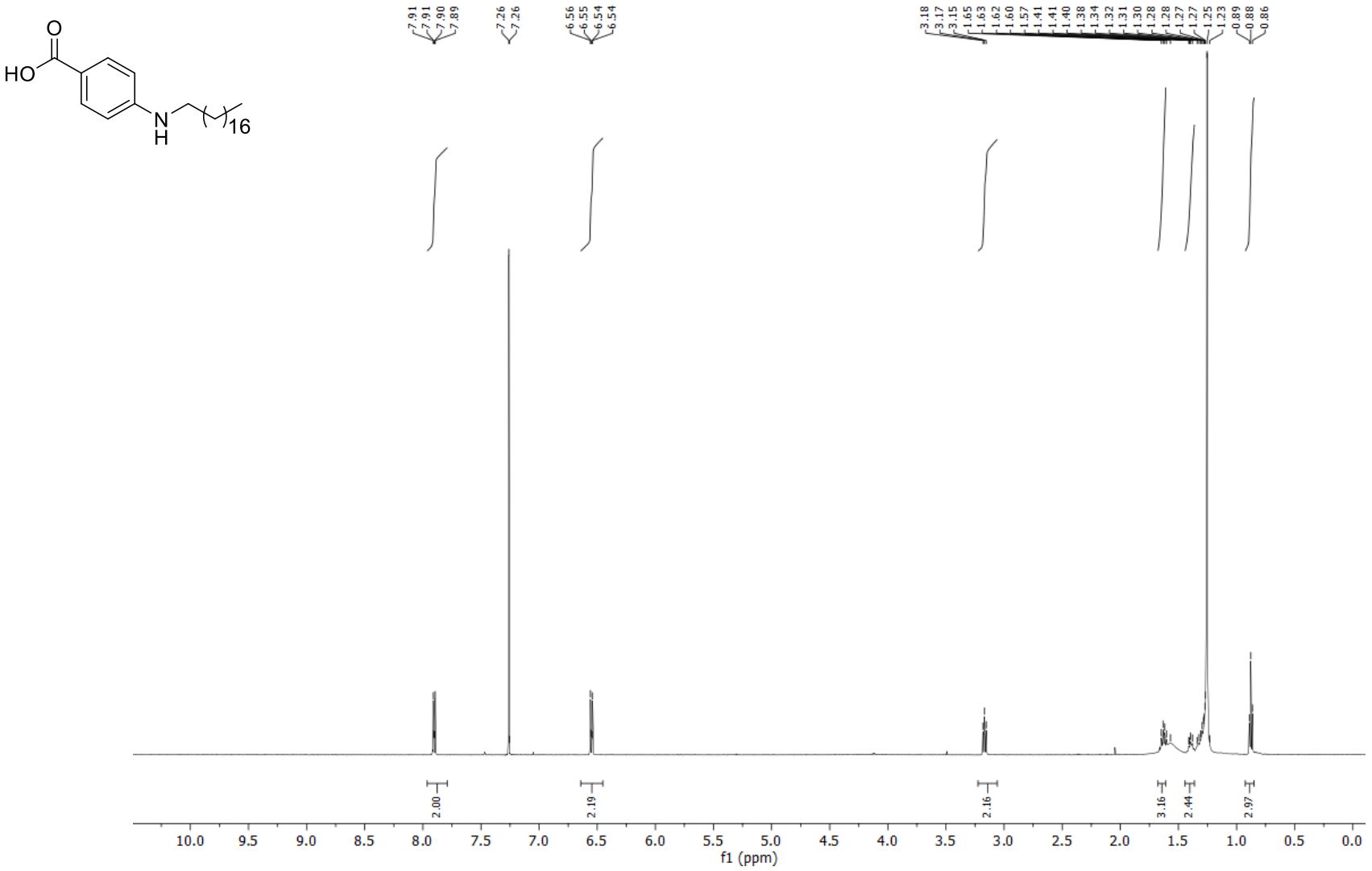
Ethyl 4-(octadecylamino)benzoate (20)

^{13}C NMR (125 MHz, $CDCl_3$)



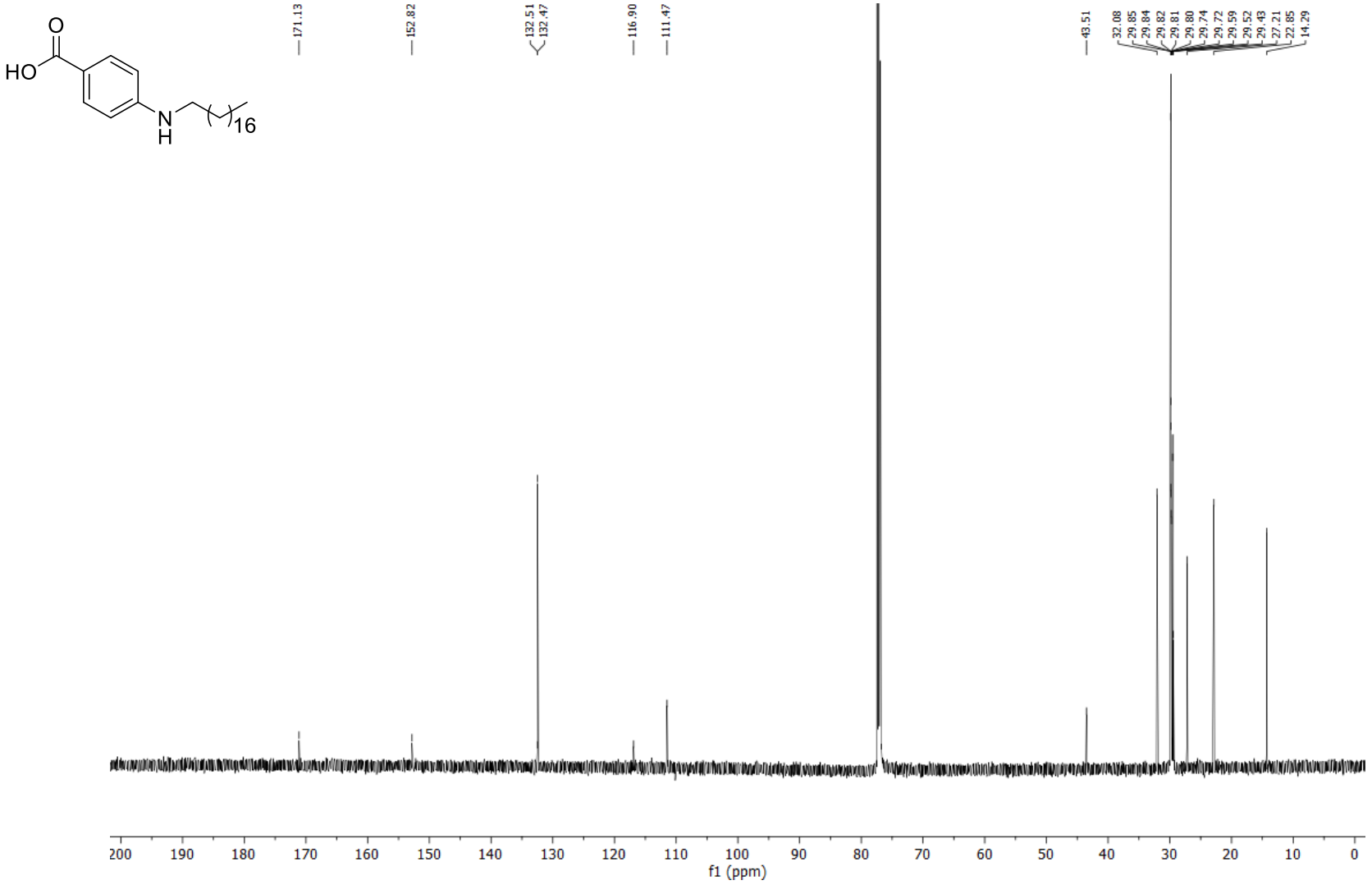
4-(octadecylamino)benzoic acid (10h)

^{1}H NMR (500 MHz, $CDCl_3$)



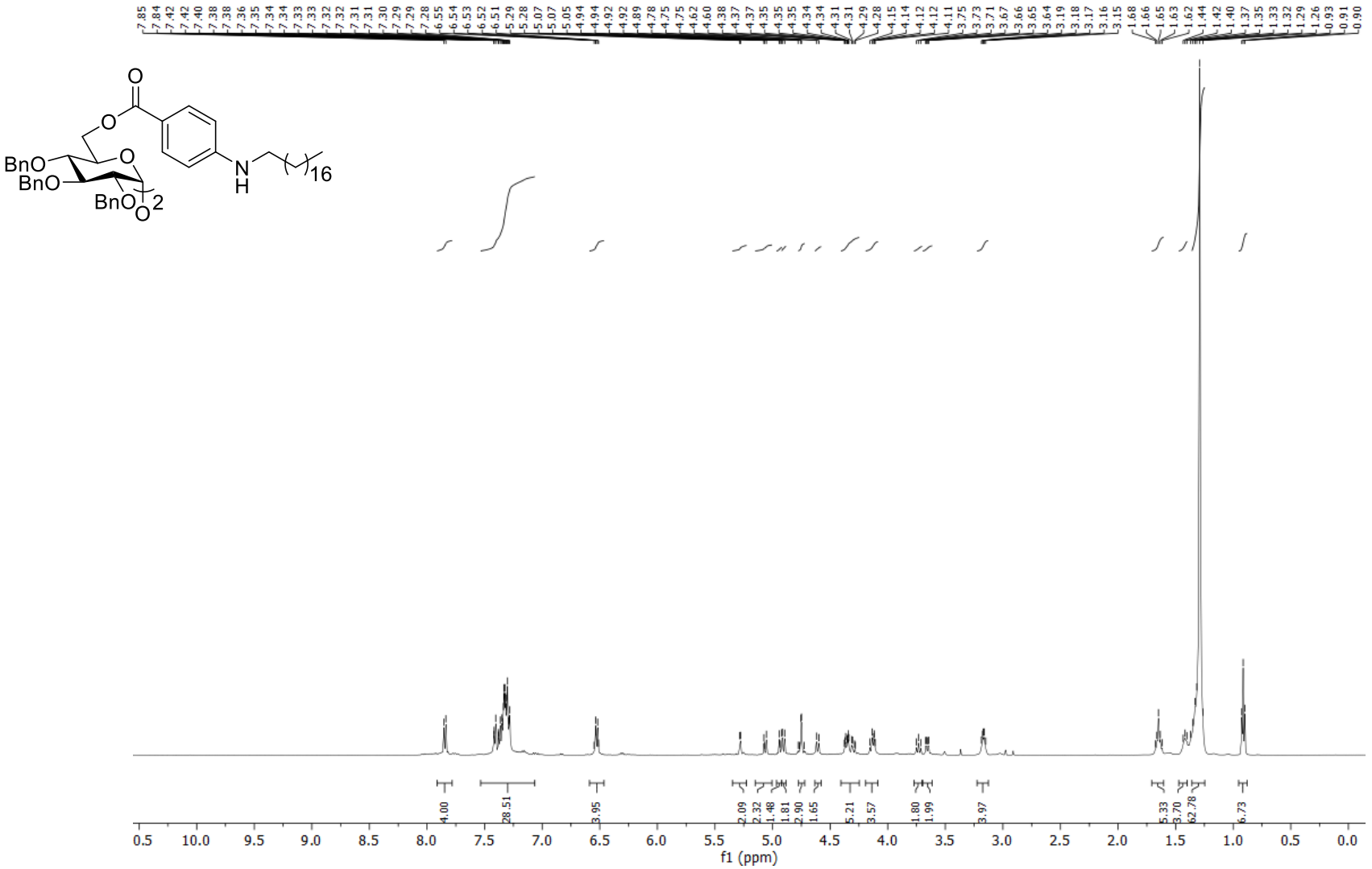
4-(octadecylamino)benzoic acid (10h)

^{13}C NMR (150 MHz, $CDCl_3$)



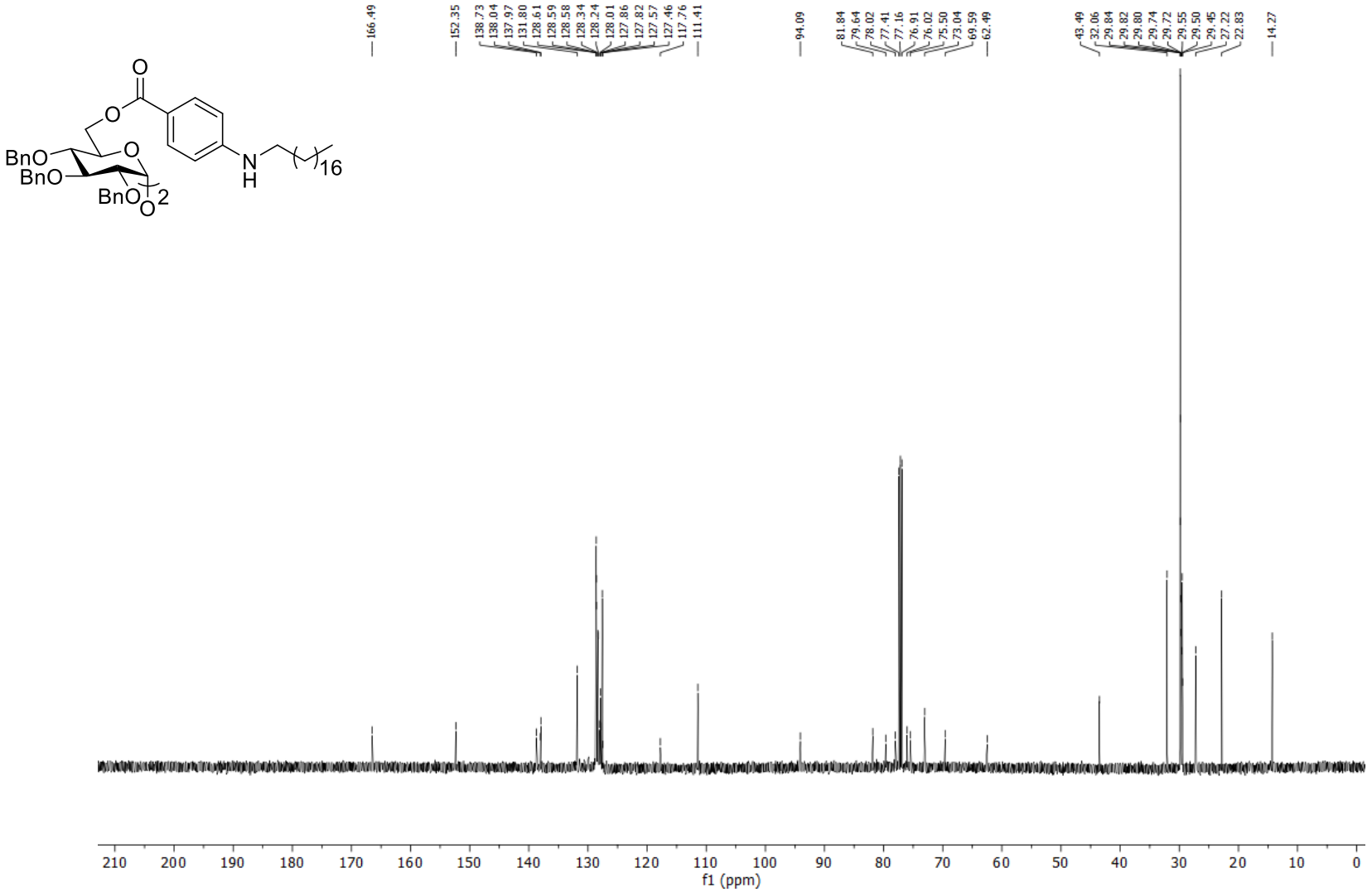
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(4-[octadecylamino]benzoate)-α,α′-D-trehalose (21h)

^{1}H NMR (500 MHz, $CDCl_3$)



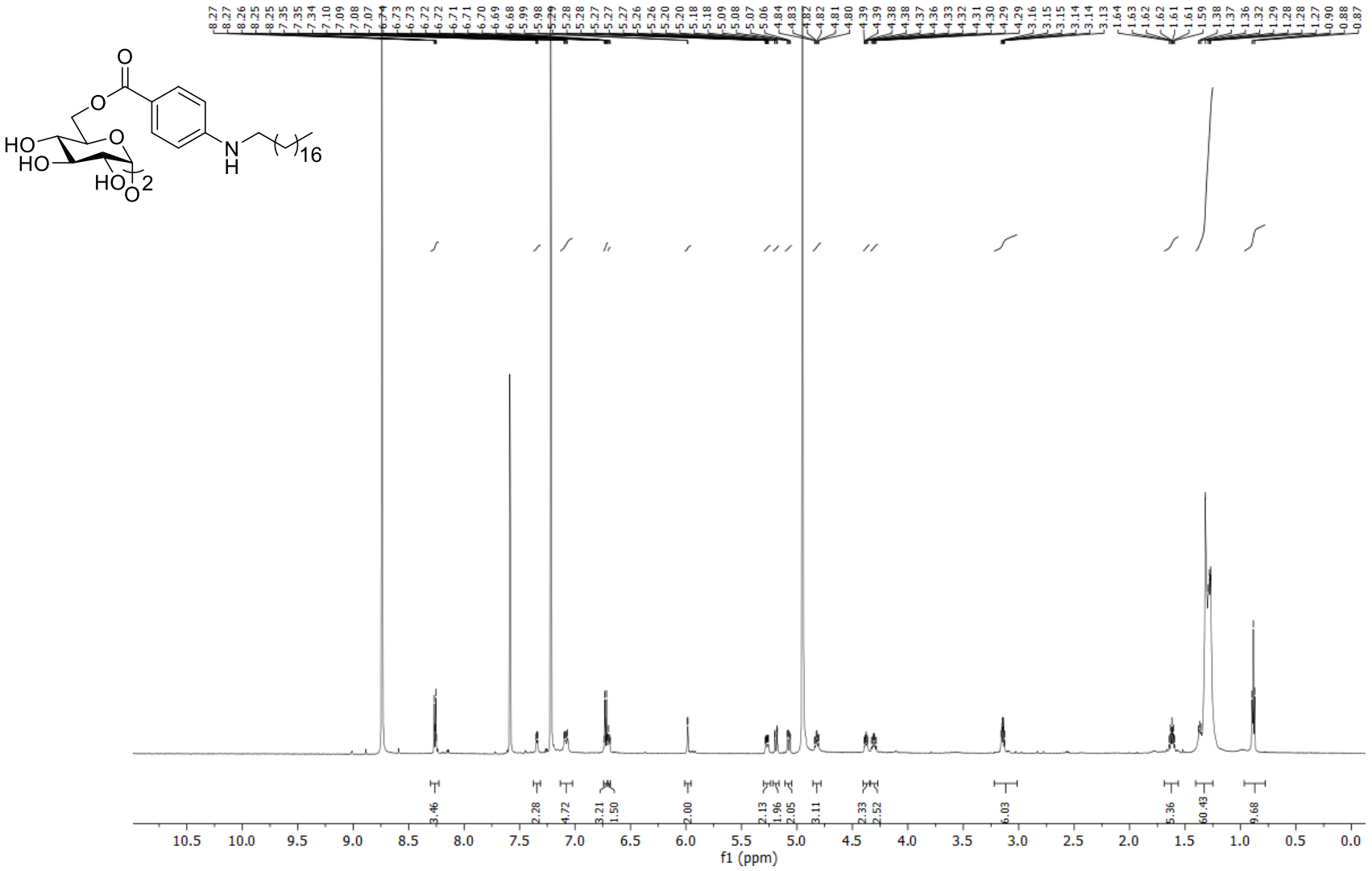
2,2′,3,3′,4,4′-Hexa-*O*-benzyl-6,6′-di-*O*-(4-[octadecylamino]benzoate)-α,α′-D-trehalose (21h)

^{13}C NMR (125 MHz, $CDCl_3$)



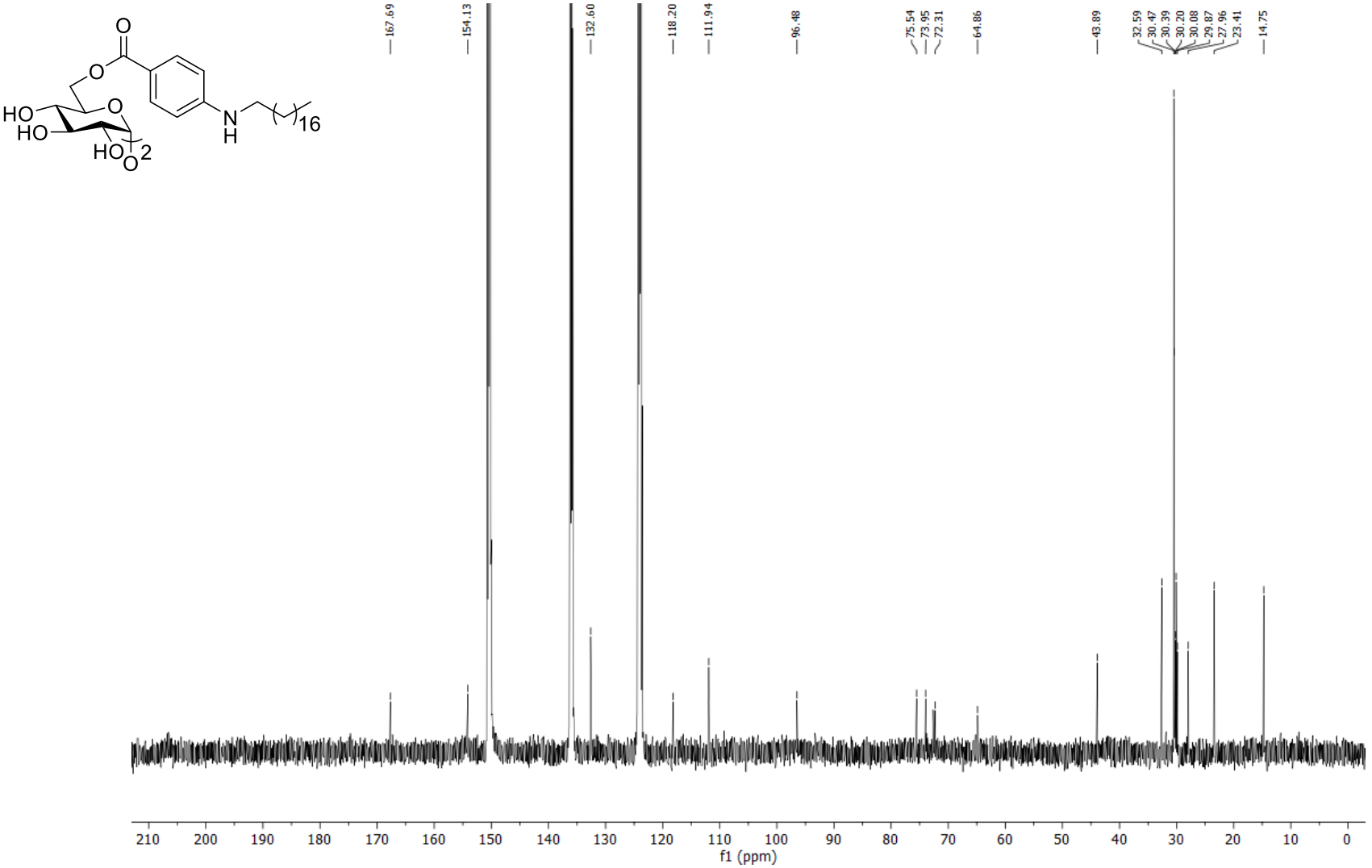
6,6′-Di-*O*-(4-[octadecylamino]benzoate)-α,α′-D-trehalose (5h)

^{1}H NMR (500 MHz, C_5D_5N)



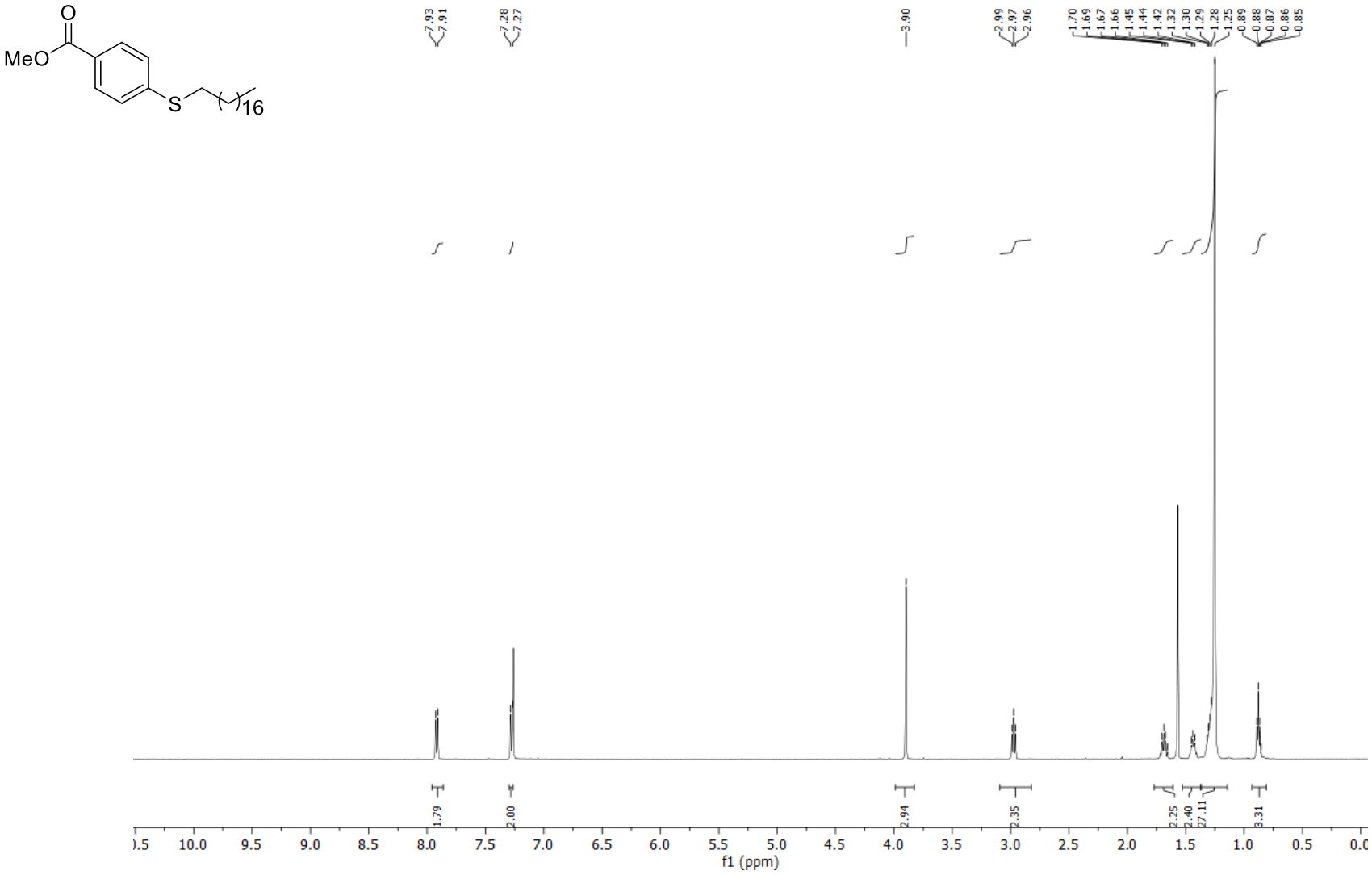
6,6′-Di-*O*-(4-[octadecylamino]benzoate)-α,α′-D-trehalose (5h)

^{13}C NMR (150 MHz, C_5D_5N)



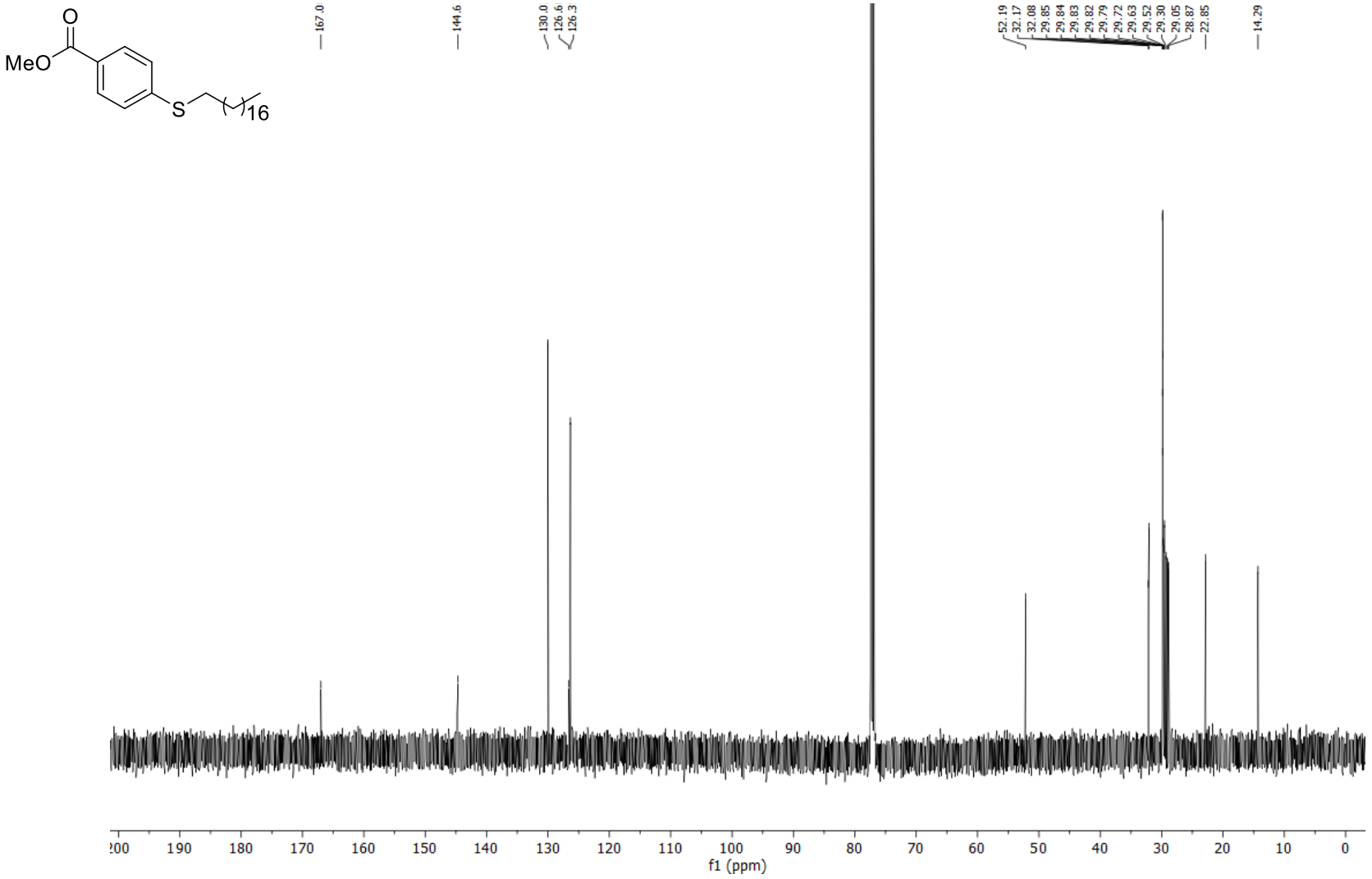
Methyl 4-(octadecylthio)benzoate

^{1}H NMR (500 MHz, $CDCl_3$)



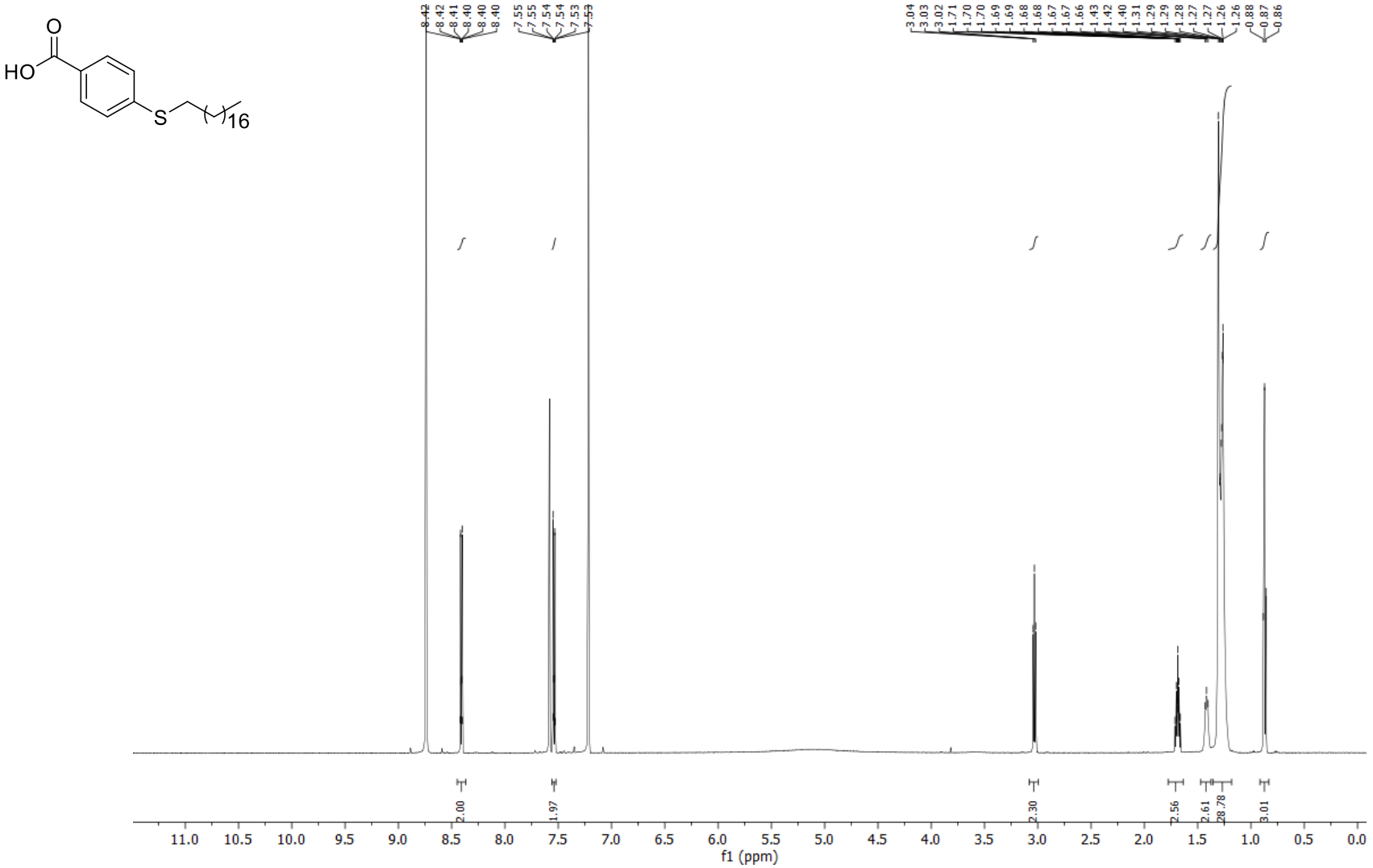
Methyl 4-(octadecylthio)benzoate

^{13}C NMR (150 MHz, $CDCl_3$)



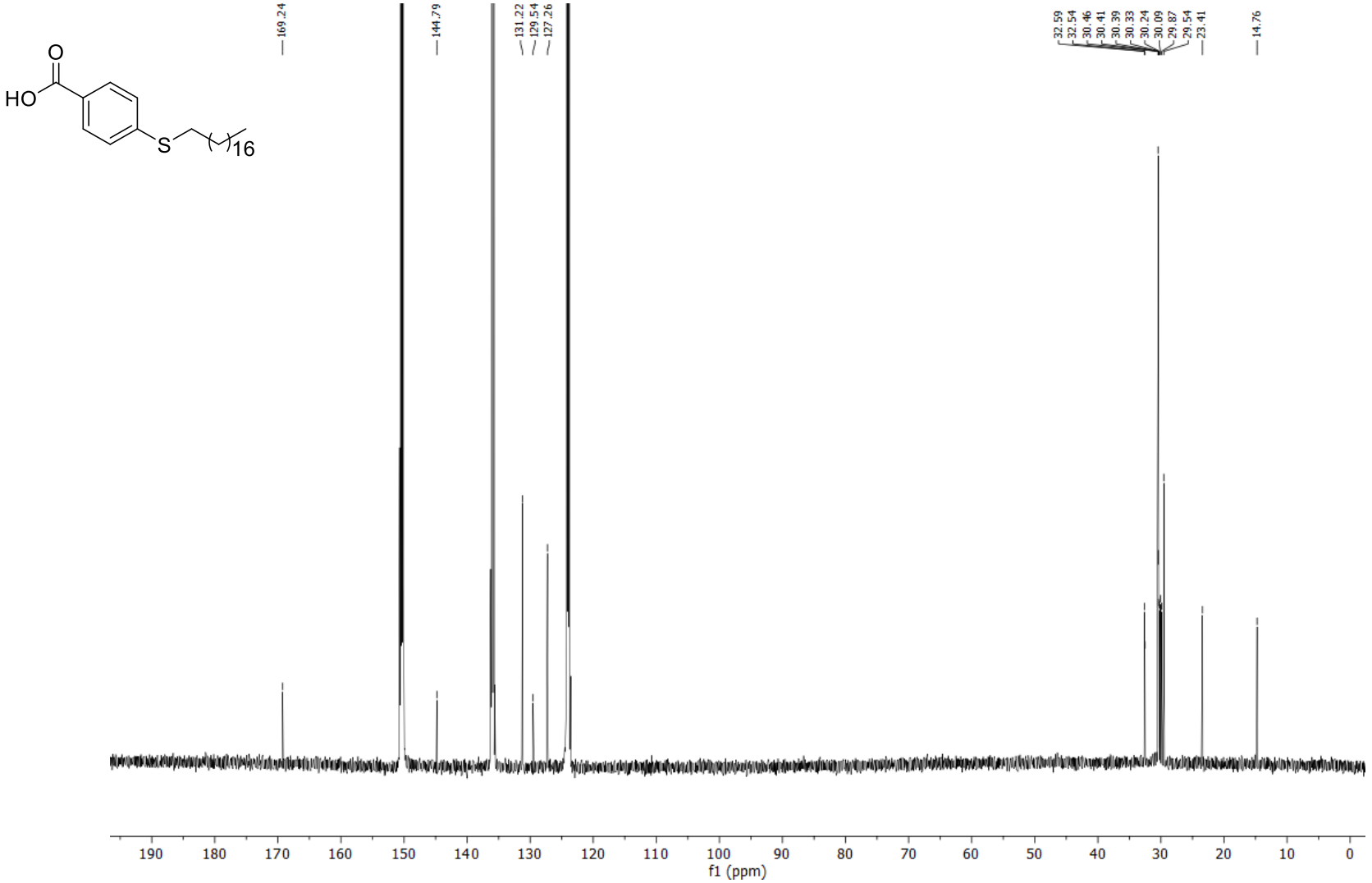
4-(Octadecylthio)benzoic acid (10i)

^{1}H NMR (600 MHz, C_5D_5N)



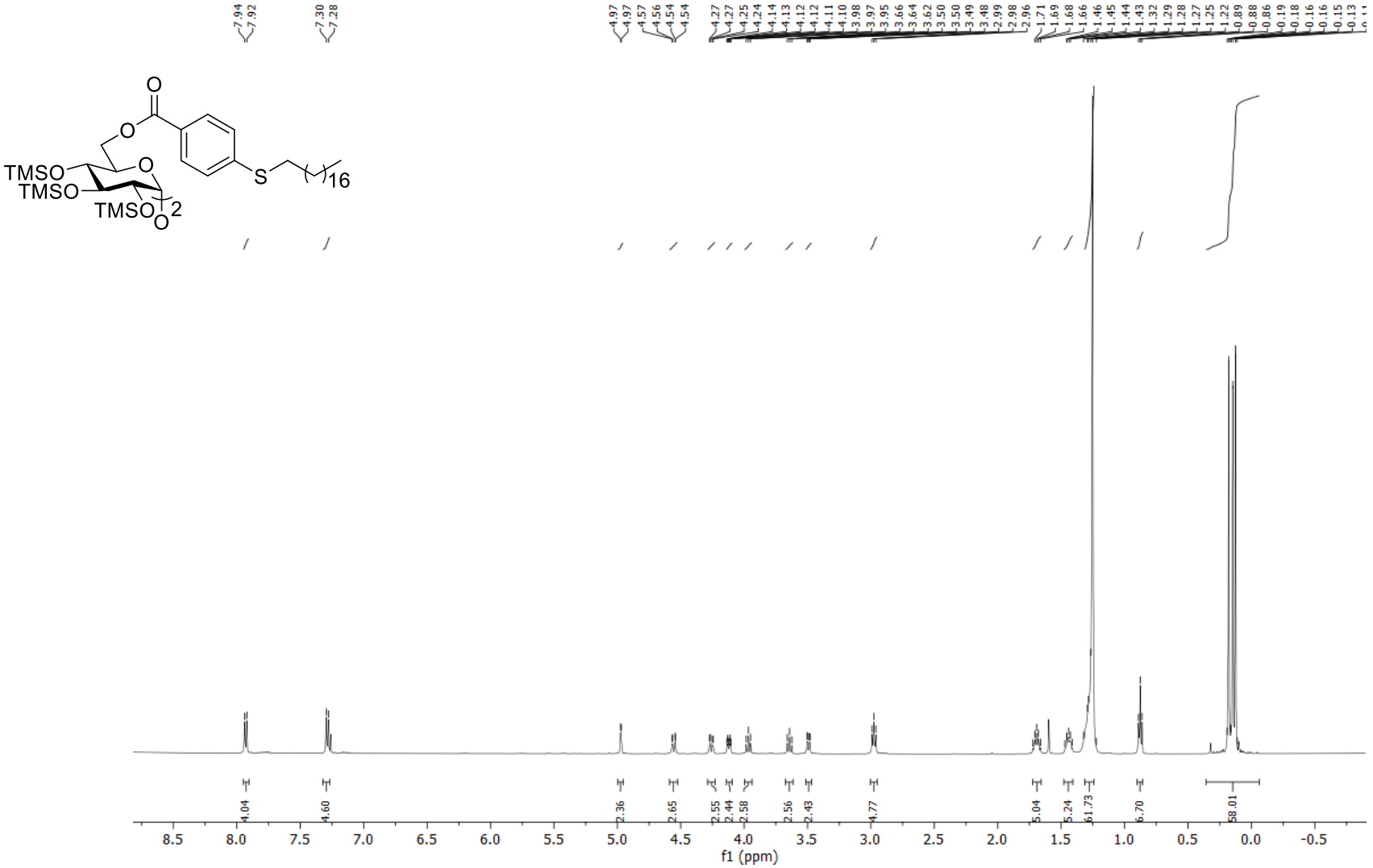
4-(Octadecylthio)benzoic acid (10i)

^{13}C NMR (150 MHz, C_5D_5N)



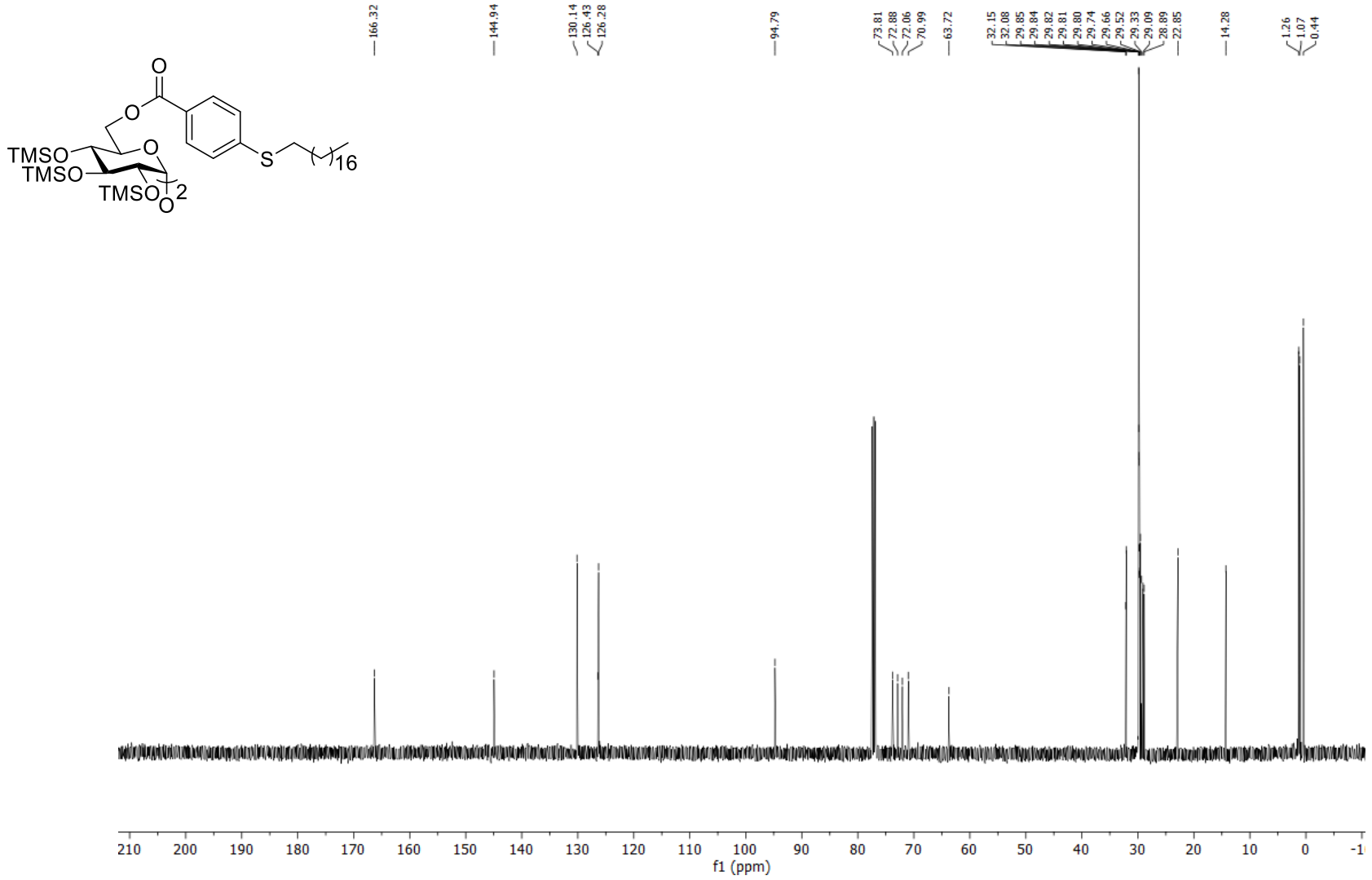
2,2′,3,3′,4,4′,-Hexa-*O*-trimethylsilyl-6,6′-di-*O*-(4-[octadecylthio]benzoate)-α,α′-D-trehalose (22i)

^{1}H NMR (500 MHz, $CDCl_3$)



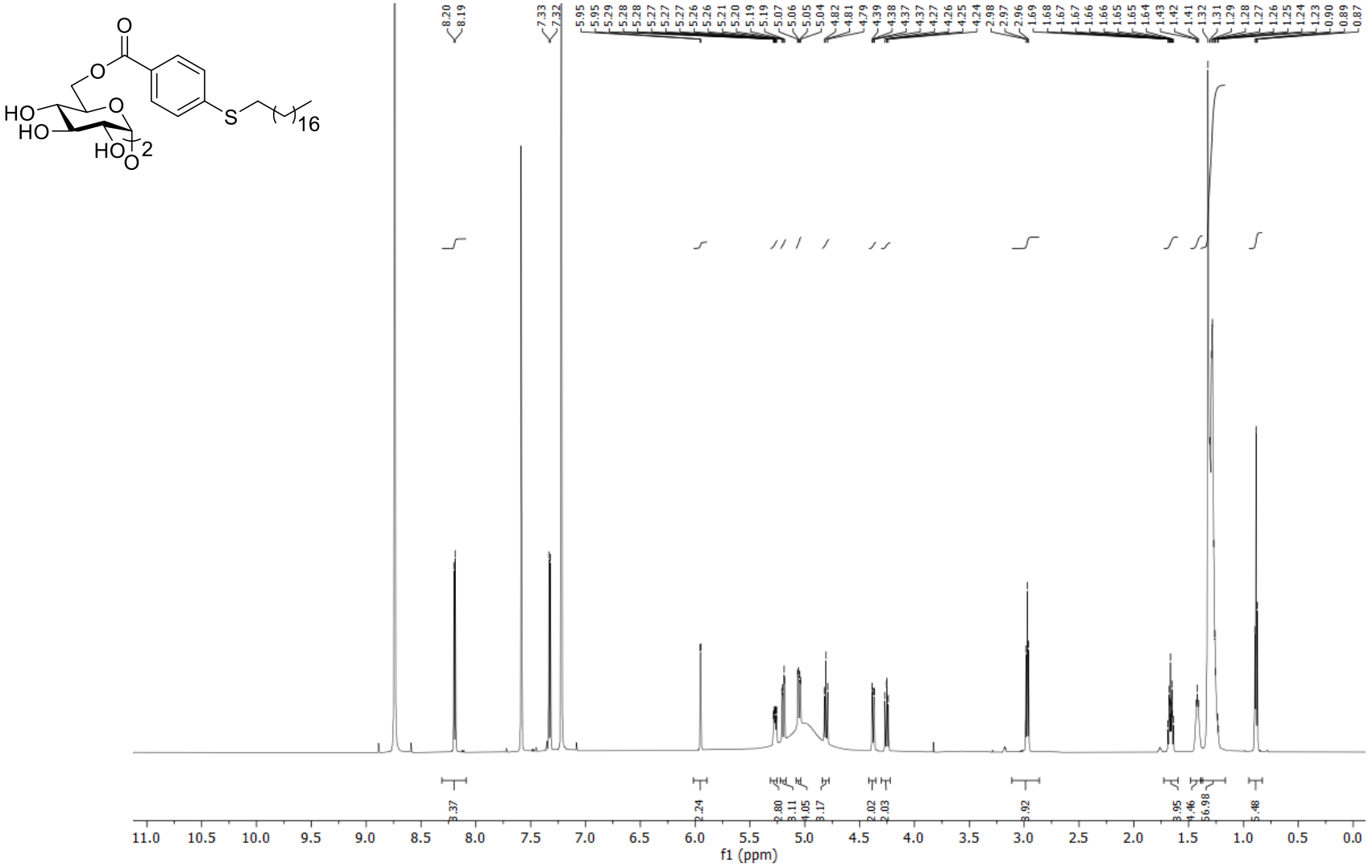
2,2′,3,3′,4,4′,-Hexa-*O*-trimethylsilyl-6,6′-di-*O*-(4-[octadecylthio]benzoate)-α,α′-D-trehalose (22i)

^{13}C NMR (125 MHz, $CDCl_3$)



6,6′-Di-*O*-(4-[octadecylthio]benzoate)-α,α′-D-trehalose (5i)

^{1}H NMR (600 MHz, C_5D_5N)



6,6′-Di-*O*-(4-[octadecylthio]benzoate)-α,α′-D-trehalose (5i)

^{1}H NMR (150 MHz, C_5D_5N)