*SUPPORTING INFORMATION*

# Tandem olefin metathesis/α-ketohydroxylation revisited

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## General Remarks

All reactions requiring exclusion of oxygen and moisture were carried out in oven-dried glassware with dry solvents (purified using *MBraun* SPS) under a dry and oxygen-free atmosphere using Schlenk technique. The addition of dry solvents or reagents was carried out using argon flushed stainless steel cannulas and plastic syringes.

**Nuclear Magnetic Resonance (NMR):** $^{1}H$ and $^{13}C$ NMR spectra were recorded on *Agilent* Mercury 400 MHz spectrometer, at ambient temperature with $CDCl_3$ used as a solvent. Chemical shifts (δ) are given in parts per million (ppm) downfield from tetramethylsilane with a residual protio solvent signal used as a reference: $CDCl_3$ ($\delta_H$ = 7.26 ppm, $\delta_C$ = 77.16 ppm) $CD_3OD$ ($\delta_H$ = 3.31 ppm, $\delta_C$ = 47.6 ppm). Coupling constants (*J*) are reported in hertz (Hz) and refer to *H*,*H*-couplings. The following abbreviations are used in order to indicate the signal multiplicity: s (singlet), d (doublet), t (triplet), q (quartet), quin (quintet), sext (sextet), hept (heptet), dd (doublet of doublet), dt (doublet of triplet), ddd (doublet of doublet of doublet) etc., bs (broad signal), m (multiplet). The obtained data was processed using MestReNova.

**High-Resolution Mass Spectrometry (HRMS):** HRMS were provided by the analytical laboratory at the Institute of Organic Chemistry, Polish Academy of Sciences (PAS).

**IR spectra** were recorded on a Perkin-Elmer Spectrum One FTIR spectrometer or JASCO FT/IR-6200. Substances were applied as a film, solid or in solution. The obtained data was processed with the software Omni32. Wavenumbers are given in $cm^{-1}$.

**Gas Chromatography (GC):** GC measurements were carried out using *PerkinElmer Clarus 580* with FID detector employing InertCap 5MS-Sil Capillary Column (inner diameter 0.25 mm, length 30 m, df 0.50 μm) and helium as a carrier gas.

**Column Chromatography (CC):** CC was performed using *Merck* Millipore silica gel (60, particle size 0.043 – 0.063 nm) with EtOAc/*n*-hexane system as an eluent, unless otherwise stated.

**Thin Layer Chromatography (TLC):** TLC was performed using Merck Silica Gel 60 F254

precoated aluminium sheets (0.25 mm thickness). Substances were visualised using UV-light (254 or 365 nm) or by stains: $KMnO_4/K_2CO_3$/NaOH (aqueous solution) or anisaldehyde/$H_2SO_4$ (ethanolic solution).

**Solvents**

Analytical grade ethyl acetate (EtOAc) used for metathesis reactions was dried over 4Å molecular sieves (dried overnight in the oven at 300 °C prior to use) for 7 days, distilled, and stored under argon.

Analytical grade ethyl acetate (EtOAc) and acetonitrile (ACN) used in oxidation reaction were used without any purification together with distilled water.

**Reagents**

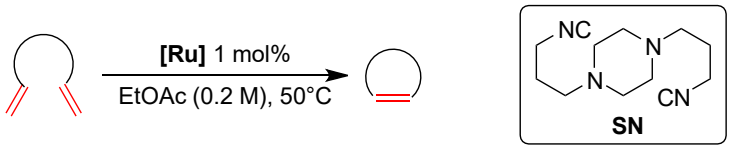
All common laboratory reagents ($MgSO_4$, $NaHCO_3$, Oxone™) were purchased from Avantor Performance Materials Poland S.A. and used as received.

Substrate **1**, **5**, and **9**-**15** were purchased from Sigma-Aldrich. Substrates **2**,[1] **3**,[2] **4**,[3] **6**,[4] **7**,[5] **8**[6] **16**,[7] **17**,[8] were prepared according to literature procedures. All substrates had been freeze/pump/thaw degassed and stored under Ar over activated 4 Å molecular sieves for at least 12 h prior to use.

SnatchCat Metal Scavenger (1,4-bis(2-isocyanopropyl)piperazine) was prepared according to literature procedure[9] and used as a solution in EtOAc (C = 10 mg/mL) in order to quench metathesis reactions.

## Protocols

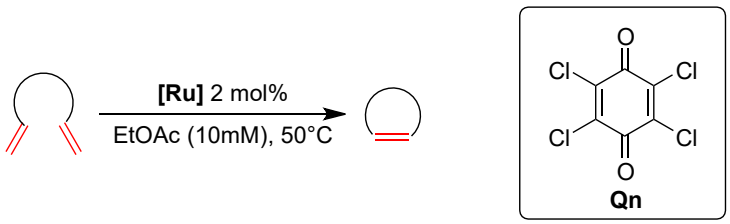
### General procedure for RCM reactions




**Scheme S1.** General scheme of RCM reaction (first step in tandem metathesis/α-ketohydroxylation).

To a stirred solution of diene in EtOAc (approx. 0.2 M) 1 mol% of catalyst was added and the mixture was stirred at 50 °C until the full conversion was reached (it was monitored *via* TLC plate) but no longer than 4 h. Next, the mixture was cooled to room temperature and used directly in the oxidation step. In some cases, after metathesis reaction 4.4 mol% of SnatchCat (**SN**) was added and the mixture was stirred for 30 min. before oxidation step.

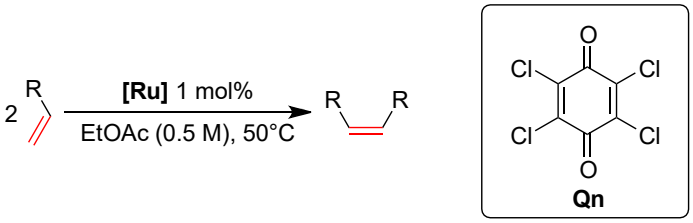
### General procedure for macroRCM reactions




**Scheme S2.** General scheme of macroRCM reaction (first step in tandem metathesis/α-ketohydroxylation).

To a stirred solution of diene in EtOAc (10 mM) 2 mol% of catalyst and 2,3,4,5-tetrachloro-1,4-benzoquinone (**Qn**, 8 mol%) was added, and the mixture was stirred at 50 °C until the full conversion was reached (it was monitored *via* TLC plate) but no longer than 24 h. Next, the mixture was cooled to room temperature, some of the solvent was evaporated to achieved 0.2 M diene concentration, and the residue was used directly in the oxidation step.

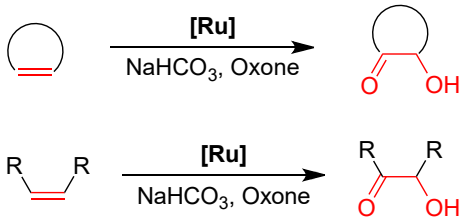
## General procedure for selfCM reactions




**Scheme S3.** General scheme of selfCM reaction (first step in tandem metathesis/α-ketohydroxylation).

To a stirred solution of olefin in EtOAc (0.5 M) 1 mol% of catalyst and 2,3,4,5-tetrachloro-1,4-benzoquinone (**Qn**, 8 mol%) were added, and the mixture was stirred at 50 °C until the full conversion was reached (it was monitored *via* TLC plate) but no longer than 4 h. Next, the mixture was cooled to room temperature and used directly in the oxidation step. In some cases, after metathesis reaction 4.4 mol% of SnatchCat (**SN**) was added and the mixture was stirred for 30 min. before oxidation step.

## General procedure for oxidation reactions

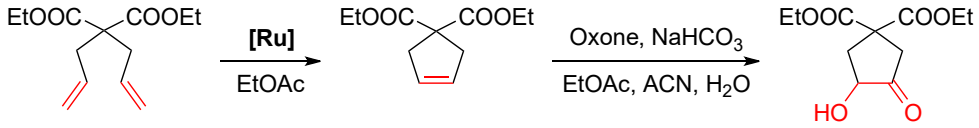



**Scheme S4.** General scheme of oxidation reaction (second step in tandem metathesis/α-ketohydroxylation).

To the previously prepared solution of metathesis product, acetonitrile and water were added to obtain EtOAc:ACN:$H_2O$, 6:6:1 *v:v:v* mixture with final concentration of the olefin around 0.08 M. Next, $NaHCO_3$ (2.5 equiv.) and Oxone (5 equiv.) were added and the mixture was vigorously stirred at room temperature. After a while colourless solution become yellow or brown. When the full conversion was reached (it was monitored *via* TLC plate), the resulting mixture was diluted with EtOAc and filtered. The filtrate was washed with saturated solution of $Na_2SO_3$, followed by water and brine. The organic layer was dried over $Na_2SO_4$, filtered, the solvent was evaporated, and the residue was purified by column chromatography with EtOAc/*n*-hexane as eluent.

## Results

### Influence of various conditions on tandem metathesis/α-ketohydroxylation of diethyl diallylmalonate (DEDAM, S1)




**Scheme S5.** Tandem metathesis/α-ketohydroxylation of DEDAM (**S1**).

**Table S1.** Influence of time on the oxidation step in tandem metathesis/α-ketohydroxylation of DEDAM (**S1**) in the presence of 1 mol% of catalyst.

| Entry | Catalyst | Time of oxidation step (min) | GC Yield (%) |
|---|---|---|---|
| 1 | **Ru1** | 15 | 54 |
| 2 | | 30 | 51 |
| 3 | | 45 | 53 |
| 4 | | 60 | 52 |
| 5 | **Ru2** | 15 | 46 |
| 6 | | 30 | 45 |
| 7 | | 45 | 49 |
| 8 | | 60 | 52 |
| 9 | **Ru3** | 15 | 43 |
| 10 | | 30 | 51 |
| 11 | | 45 | 53 |
| 12 | | 60 | 57 |
| 13 | **Ru4** | 15 | 39 |
| 14 | | 30 | 46 |
| 15 | | 45 | 51 |
| 16 | | 60 | 51 |
| 17 | **Ru5** | 15 | 38 |
| 18 | | 30 | 49 |
| 19 | | 45 | 53 |
| 20 | | 60 | 54 |

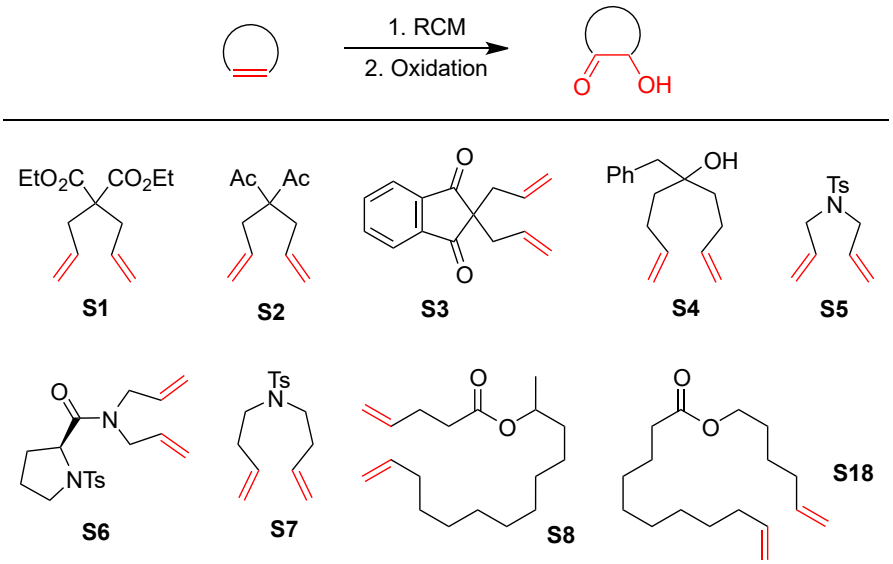
**Conditions:** Metathesis step: Ru-catalyst (1 mol%), 50 °C. 0.2 M in EtOAc, the reaction was performed until full conversion was reached. Oxidation Step: $NaHCO_3$ (2.5 equiv.), then Oxone™ (5 equiv.), RT, 1 h, 0.08 M in EtOAc/MeCN/$H_2O$ (6/6/1 *v/v/v*).

**Table S2.** Influence of time on the oxidation step in tandem metathesis/α-ketohydroxylation of DEDAM (**S1**) in the presence of 0.1 mol% of catalyst.

| Entry | Catalyst | Time of oxidation step (min) | GC Yield (%) |
|---|---|---|---|
| 1 | **Ru1** | 75 | 37 |
| 2 | | 90 | 39 |
| 3 | | 105 | 40 |
| 4 | | 120 | 32 |
| 5 | **Ru2** | 75 | 33 |
| 6 | | 90 | 32 |
| 7 | | 105 | 31 |
| 8 | | 120 | 22 |
| 9 | **Ru3** | 75 | 52 |
| 10 | | 90 | 49 |
| 11 | | 105 | 52 |
| 12 | | 120 | 50 |
| 13 | **Ru4** | 75 | 46 |
| 14 | | 90 | 43 |
| 15 | | 105 | 44 |
| 16 | | 120 | 43 |
| 17 | **Ru5** | 75 | 42 |
| 18 | | 90 | 43 |
| 19 | | 105 | 46 |
| 20 | | 120 | 45 |

**Conditions:** Metathesis step: Ru-catalyst (0.1 mol%), 50 °C. 0.2 M in EtOAc, the reaction was performed until full conversion was reached. Oxidation Step: $NaHCO_3$ (2.5 equiv.), then Oxone™ (5 equiv.), RT, 1 h, 0.08 M in EtOAc/MeCN/$H_2O$ (6/6/1 *v/v/v*).

### RCM and macroRCM reactions



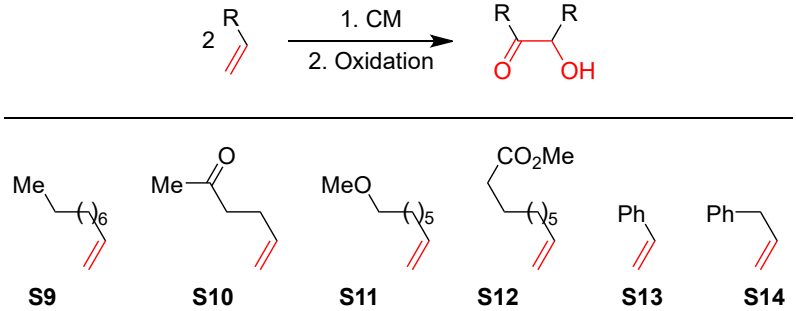

**Scheme S6.** Tandem metathesis/α-ketohydroxylation of dienes.

**Table S3.** Results of tandem RCM/α-ketohydroxylation reactions.

| Entry | Catalyst | Substrate | RCM yield[a] (%) | Product yield (%) |
|---|---|---|---|---|
| 1 | **Ru2** | **S2** | 99 | 46 |
| 2 | | **S4** | 99 | 32 |
| 3 | **Ru3** | **S1** | 99 | 51 |
| 4[b] | | **S1** | 99 | traces |
| 5 | | **S4** | 89 | 26 |
| 6[b] | | **S4** | 89 | 31 |
| 7 | | **S7** | 93 | 61 |
| 8[b] | | **S7** | 92 | 55 |
| 9 | **Ru5** | **S1** | 99 | 54 |
| 10[b] | | **S1** | 99 | 90 |
| 11 | | **S2** | nd | 26 |
| 12 | | **S3** | nd | 40 |
| 13 | | **S4** | 99 | 28 |
| 14[b] | | **S4** | 99 | 35 |
| 15 | | **S5** | 99 | traces |
| 16[b] | | **S5** | 99 | traces |
| 17 | | **S6** | 99 | traces |
| 18 | | **S6** | 99 | traces |
| 19 | | **S7** | 99 | 43 |
| 20[b] | | **S7** | 99 | 30 |
| 21[c] | | **S8** | nd | 30 |
| 22[c] | | **S18** | 92 | 30 |
| 23[b,c] | | **S18** | 92 | 21 |

**Conditions:** Metathesis step: Ru-catalyst (1 mol%), 50 °C. 0.2 M in EtOAc, the reaction was performed until full conversion was reached. Oxidation step: $NaHCO_3$ (2.5 equiv.), then Oxone™ (5 equiv.), RT, 0.08 M in EtOAc/MeCN/$H_2O$ (6/6/1 *v/v/v*). [a] Calculated based on GC measurements. [b] After metathesis step 4.4 mol% of SnatchCat (**SN**) was added. [c] Metathesis step: Ru-catalyst (2 mol%), quinone (**Qn**, 8 mol%), 50 °C. 0.01 M in EtOAc, before oxidation step the solution was concentrated to 0.2 M.

## selfCM reactions




**Scheme S7.** Tandem metathesis/α-ketohydroxylation of olefins.

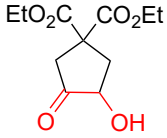
**Table S4.** Results of tandem selfCM/α-ketohydroxylation reactions.

| Entry | Catalyst | Substrate | CM yield[a] (%) | Product yield (%) |
|---|---|---|---|---|
| 1 | | **S9** | nd | 45 |
| 2 | **Ru2** | **S10** | nd | 40 |
| 3 | | **S11** | nd | 44 |
| 4 | | **S9** | nd | 55 |
| 5 | | **S10** | nd | 20 |
| 6 | | **S11** | nd | 44 |
| 7 | **Ru5** | **S13** | 84 | 44 |
| 8 | | **S14** | 78 | 40 |
| 9 | | **S15** | 44 | 40 |
| 10 | | **S12** | nd | 45 |

**Conditions:** Metathesis step: Ru-catalyst (1 mol%), quinone (**Qn**, 4 mol%), 50 °C, 0.5 M in EtOAc, the reaction was performed until full conversion was reached. Oxidation step: $NaHCO_3$ (2.5 equiv.), then Oxone™ (5 equiv.), RT, 0.08 M in EtOAc/MeCN/$H_2O$ (6/6/1 *v/v/v*). [a] Calculated based on GC measurements.

## Analytical Data

### Diethyl 3-hydroxy-4-oxocyclopentane-1,1-dicarboxylate (P1b)[10]

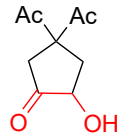



$^{1}$H NMR (400 MHz, $CDCl_3$) δ 4.32 – 4.14 (m, 6H), 3.06 – 2.96 (m, 2H), 2.89 (d, *J* = 9.2 Hz, 2H), 2.15 (dd, *J* = 13.2, 11.3 Hz, 1H), 1.26 (td, *J* = 7.1, 2.5 Hz, 8H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 213.2, 170.8, 170.1, 73.7, 62.5, 62.4, 62.3, 61.9, 61.8, 57.4, 54.3, 52.2, 41.4, 37.1, 13.9.

HRMS TOF MS ES$^-$ (ESI): *m/z* calcd. for $C_{11}H_{15}O_6$: 243.0869, found 243.0872.

### 1,1'-(3-hydroxy-4-oxocyclopentane-1,1-diyl)bis(ethan-1-one) (P2b)



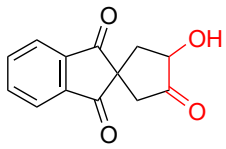

$^{1}$H NMR (400 MHz, $CDCl_3$) δ 4.07 (t, *J* = 4.5 Hz, 1H), 2.40 – 2.27 (m, 4H), 2.21 – 2.13 (m, 3H), 2.08 (s, 2H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 213.4, 110.0, 73.1, 71.7, 35.8, 26.5, 26.2.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_9H_{11}O_4Na$: [M+Na$^+$] 183.0657, found 183.0656.

IR ATR: ν = 3054, 3004, 2987, 1698, 1422, 1359, 1264, 1103, 895, 733, 703 cm$^{-1}$.

### 3-hydroxyspiro[cyclopentane-1,2'-indene]-1',3',4-trione (P3b)



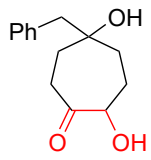

$^{1}$H NMR (400 MHz, $CDCl_3$) δ 8.03 (m, 2H), 7.97 – 7.88 (m, 2H), 4.74 (ddd, *J* = 10.6, 8.5, 1.6 Hz, 1H), 2.98 (s, 1H), 2.65 (s, 1H), 2.62 – 2.56 (m, 1H), 2.56 – 2.46 (m, 1H), 2.20 – 2.09 (m, 2H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 213.0, 202.1, 200.9, 141.3, 140.7, 136.6, 136.5, 124.1, 124.0, 73.8, 52.1, 39.0, 37.2, 31.0.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{13}H_{10}O_4Na$: [M+Na$^+$] 253.0477, found 253.0473.

IR ATR: ν = 3054, 2986, 1757, 1708, 1598, 1421, 1264, 1096, 895, 731, 703 cm$^{-1}$.

### 5-benzyl-2,5-dihydroxycycloheptan-1-one (P4b)



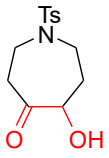

$^{1}$H NMR (400 MHz, $CDCl_3$) δ 7.23 (m, 5H), 3.65 (dd, *J* = 10.5, 5.9 Hz, 1H), 2.92 (s, 2H), 2.33 (dtd, *J* = 11.2, 8.5, 4.1 Hz, 1H), 1.96 (td, *J* = 10.3, 6.1 Hz, 2H), 1.65 – 1.55 (m, 2H), 1.43 (dt, *J* = 14.9, 5.5 Hz, 2H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 137.2, 130.3, 128.2, 128.1, 126.5, 126.4, 105.6, 104.2, 83.8, 83.28, 71.7, 70.2, 46.4, 45.8, 34.7, 32.6, 32.4, 31.4, 30.6, 29.4, 26.7, 26.1.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{14}H_{18}O_3Na$: [M+Na$^+$] 257.1154, found 257.1165.

IR ATR: ν = 3367, 3185, 3058, 3026, 2945, 2913, 2848, 1767, 1681, 1603, 1496, 1471, 1452, 1362, 1329, 1266, 1229, 1180, 1156, 1137, 1103, 1076, 1053, 1027, 996, 981, 950, 916, 884, 868, 844, 807, 763, 734, 699, 632, 562, 488 cm$^{-1}$.

**5-hydroxy-1-tosylazepan-4-one (P7b)**[10]

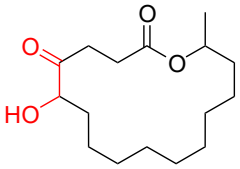



$^1$H NMR (400 MHz, $CDCl_3$) (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 4.32 (dt, *J* = 11.0, 3.9 Hz, 1H), 3.85 (dt, *J* = 13.0, 4.0 Hz, 2H), 3.78 (d, *J* = 4.2 Hz, 1H), 3.08 – 3.00 (m, 1H), 3.00 – 2.95 (m, 1H), 2.91 (ddd, *J* = 18.2, 10.9, 3.7 Hz, 1H), 2.73 (ddd, *J* = 18.1, 5.1, 2.5 Hz, 1H), 2.44 (s, 3H), 2.19 – 2.10 (m, 2H), 1.84 (dtd, *J* = 14.7, 11.4, 3.5 Hz, 1H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 210.0, 143.9, 135.5, 130.0, 127.0, 47.6, 43.5, 41.2, 34.2, 21.5.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{13}H_{17}NO_4NaS$: [M+Na$^+$] 306.0776, found 306.0768.

**6-hydroxy-16-methyloxacyclohexadecane-2,5-dione (P8b)**



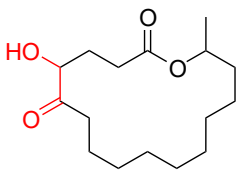

$^1$H NMR (400 MHz, $CD_3OD$) δ 4.95 (s, 1H), 4.29 – 4.14 (m, 1H), 4.07 (dd, *J* = 7.1, 4.8 Hz, 1H), 3.14 (ddd, *J* = 18.8, 10.1, 4.5 Hz, 1H), 3.00 (ddd, *J* = 18.7, 8.3, 5.3 Hz, 1H), 2.82 – 2.53 (m, 2H), 2.44 (ddq, *J* = 15.3, 10.9, 5.1 Hz, 2H), 1.75 (qt, *J* = 9.1, 5.6 Hz, 2H), 1.59 (ddt, *J* = 17.4, 8.7, 5.5 Hz, 2H), 1.49 – 1.34 (m, 9H), 1.34 – 1.24 (m, 10H), 1.20 (d, *J* = 6.3 Hz, 6H).

$^{13}$C NMR (101 MHz, $CD_3OD$) δ 212.7, 211.1, 173.0, 172.8, 48.2, 48.0, 47.8, 47.6, 47.4, 47.2, 47.0, 35.5, 35.1, 34.8, 33.6, 32.8, 32.8, 32.4, 28.9, 28.1, 27.4, 26.9, 26.7, 26.5, 26.4, 26.4, 26.3, 26.1, 26.0, 25.4, 25.1, 25.0, 24.8, 23.3, 23.1, 21.6, 21.4, 19.0, 18.9.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{16}H_{28}O_4Na$: [M+Na$^+$] 307.1885, found 307.1882.

IR ATR: ν = 3054, 2984, 2930, 2856, 1720, 1264, 732, 703 cm$^{-1}$.

**5-hydroxy-16-methyloxacyclohexadecane-2,6-dione (P8b')**



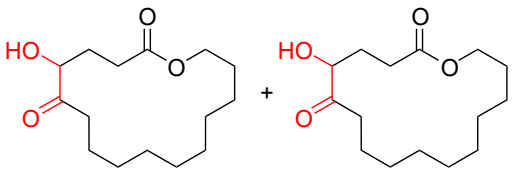

$^1$H NMR (400 MHz, $CD_3OD$) δ 5.02 – 4.90 (m, 1H), 4.21 (dd, *J* = 7.2, 4.5 Hz, 1H), 4.07 (dd, *J* = 8.8, 3.9 Hz, 1H), 2.65 – 2.26 (m, 3H), 2.25 – 2.02 (m, 1H), 2.00 – 1.86 (m, 1H), 1.75 – 1.66 (m, 1H), 1.66 – 1.50 (m, 2H), 1.50 – 1.33 (m, 4H), 1.33 – 1.29 (m, 3H), 1.29 – 1.17 (m, 3H).

$^{13}$C NMR (101 MHz, $CD_3OD$) δ 213.3, 212.6, 173.0, 173.0, 48.2, 48.0, 47.8, 47.6, 47.4, 47.2, 47.0, 36.0, 35.7, 35.3, 34.8, 30.9, 29.8, 29.4, 29.1, 28.6, 27.0, 27.0, 26.9, 26.9, 26.8, 26.8, 26.3, 26.3, 26.0, 25.8, 23.6, 23.2, 22.3, 21.7, 19.2, 18.9.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{16}H_{28}O_4Na$: [M+Na$^+$] 307.1885, found 307.1882.

IR ATR: ν = 3054, 2984, 2930, 2856, 1720, 1264, 732, 703 cm$^{-1}$.

**11-hydroxyoxacyclohexadecane-2,12-dione and 12-hydroxyoxacyclohexadecane-2,11-dione (P18b/P18b')**



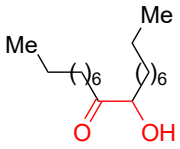
$^{1}$H NMR (400 MHz, $CDCl_3$) δ 4.27 (ddq, *J* = 20.9, 7.6, 4.2 Hz, 2H), 4.11 – 3.86 (m, 1H), 2.75 – 2.58 (m, 1H), 2.52 – 2.32 (m, 1H), 2.28 (dt, *J* = 10.4, 6.2 Hz, 2H), 2.12 – 1.85 (m, 1H), 1.85 – 1.78 (m, 1H), 1.75 (t, *J* = 4.6 Hz, 1H), 1.74 – 1.65 (m, 2H), 1.65 – 1.60 (m, 2H), 1.60 – 1.44 (m, 2H), 1.28 (dh, *J* = 21.2, 8.2, 7.5 Hz, 9H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 212.3, 212.2, 174.0, 173.9, 114.8, 114.1, 77.4, 64.1, 63.3, 36.9, 36.7, 34.3, 34.1, 33.8, 33.6, 33.4, 32.9, 29.0, 28.1, 27.8, 27.5, 27.3, 27.2, 27.1, 27.1, 27.0, 26.8, 26.6, 25.2, 24.9, 24.5, 21.6, 21.5, 20.3, 20.11.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{15}H_{26}O_4Na$: [M+Na$^+$] 293.1729, found 293.1718.

IR ATR: ν = 3481, 3057, 2928, 1725, 1459, 1357, 1265, 1170, 1106, 734, 702 cm$^{-1}$.

**10-hydroxyoctadecan-9-one (P9b)[11]**

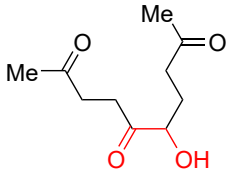


$^{1}$H NMR (400 MHz, $CDCl_3$) δ 4.16 (dt, *J* = 7.8, 4.2 Hz, 1H), 3.50 (d, *J* = 4.9 Hz, 1H), 2.43 (tt, *J* = 16.8, 8.3 Hz, 2H), 1.81 (ddt, *J* = 13.9, 9.2, 4.5 Hz, 1H), 1.62 (dd, *J* = 12.7, 5.8 Hz, 2H), 1.59 – 1.47 (m, 2H), 1.47 – 1.40 (m, 1H), 1.36 – 1.23 (m, 20H), 0.87 (t, *J* = 6.6 Hz, 6H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 212.6, 59.0, 37.8, 36.1, 33.9, 32.1, 31.8, 31.8, 31.6, 29.5, 29.4, 29.3, 29.2, 29.1, 29.1, 29.0, 26.1, 24.8, 23.6, 23.0, 22.7, 22.6, 14.1.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{18}H_{36}O_2Na$: [M+Na$^+$] 307.2613, found 307.2603.

**6-hydroxydecane-2,5,9-trione (P10b)**



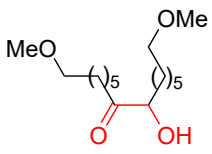
$^{1}$H NMR (400 MHz, $CDCl_3$) δ 4.25 (dd, *J* = 8.1, 4.1 Hz, 1H), 3.49 (d, *J* = 4.7 Hz, 1H), 2.87 – 2.77 (m, 3H), 2.75 – 2.58 (m, 4H), 2.18 (d, *J* = 9.9 Hz, 8H), 1.80 (d, *J* = 7.2 Hz, 1H), 1.25 (s, 1H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 211.0, 38.4, 37.0, 31.5, 30.1, 29.8, 27.3.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{10}H_{16}O_4Na$: [M+Na$^+$] 223.0946, found 223.0938.

IR ATR: ν = 3399, 3057, 2956, 2923, 2853, 1710, 1635, 1603, 1401, 1359, 1266, 1164, 1084, 732, 701 cm$^{-1}$.

**7-hydroxy-1,12-dimethoxydodecan-6-one (P11b)**



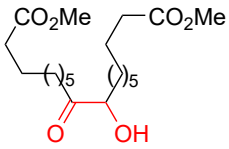
$^{1}$H NMR (400 MHz, $CDCl_3$) δ 4.14 (dt, *J* = 7.8, 4.0 Hz, 1H), 3.33 (d, *J* = 14.1 Hz, 8H), 2.44 (q, *J* = 7.6 Hz, 2H), 1.86 – 1.74 (m, 1H), 1.62 (d, *J* = 7.3 Hz, 2H), 1.57 – 1.39 (m, 5H), 1.33 (ddt, *J* = 13.1, 9.4, 5.3 Hz, 8H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 212.4, 72.8, 72.7, 58.6, 58.6, 37.7, 33.7, 29.5, 29.4, 29.3, 29.0, 26.0, 25.9, 25.8, 24.8, 23.5.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{16}H_{32}O_4Na$: [M+Na$^+$] 311.2198, found 311.2210.

IR ATR: ν = 3054, 3025, 2934, 2860, 1708, 1462, 1264, 1114, 895, 732, 703 cm$^{-1}$.

**dimethyl 2,19-dihydroxy-10-methyl-11-oxoicosanedioate (P12b)**



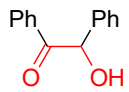
$^1$H NMR (400 MHz, $CDCl_3$) δ 4.14 (dd, *J* = 7.5, 3.6 Hz, 1H), 3.65 (s, 6H), 2.52 – 2.28 (m, 6H), 2.26 (s, 2H), 1.60 (q, *J* = 7.0 Hz, 8H), 1.50 - 1.41 (m, 3H), 1.34 – 1.19 (m, 15H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 212.4, 174.3, 174.3, 51.5, 37.8, 34.0, 34.0, 33.7, 29.2, 29.1, 29.0, 29.0, 28.9, 24.8, 24.8, 24.8, 23.5.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{20}H_{36}O_6Na$: [M+Na$^+$] 395.2410, found 395.2428.

IR ATR: ν = 3055, 2987, 2934, 2857, 1731, 1437, 1362, 1264, 1199, 1173, 895, 732, 703 cm$^{-1}$.

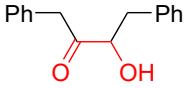
**2-hydroxy-1,2-diphenylethan-1-one (P13b)[12]**



$^1$H NMR (400 MHz, $CDCl_3$) δ 7.95 – 7.88 (m, 1H), 7.52 (t, *J* = 7.4 Hz, 1H), 7.40 (t, *J* = 7.7 Hz, 2H), 7.36 – 7.31 (m, 3H), 7.29 (dd, *J* = 7.4, 4.4 Hz, 3H), 5.95 (d, *J* = 6.0 Hz, 1H), 4.55 (d, *J* = 6.1 Hz, 1H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 198.9, 139.0, 133.9, 133.4, 129.2, 129.1, 128.7, 128.6, 127.8.

**3-hydroxy-1,4-diphenylbutan-2-one (P14b)[13]**

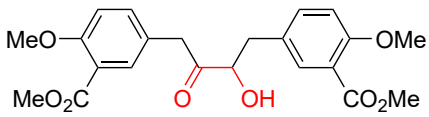


$^1$H NMR (400 MHz, $CDCl_3$) δ 8.0 – 7.9 (m, 2H), 7.7 – 7.6 (m, 1H), 7.5 (ddd, J = 8.4, 7.1, 0.5 Hz, 1H), 7.3 – 7.2 (m, 4H), 7.1 – 7.1 (m, 1H), 5.3 (td, J = 6.9, 4.1 Hz, 1H), 3.7 (dd, J = 6.8, 0.4 Hz, 1H), 3.2 – 2.9 (m, 3H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 201.0, 134.1, 129.4, 129.0, 128.6, 128.3, 126.8, 73.7, 41.9.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{14}H_{12}O_2Na$: [M+Na$^+$] 235.0735, found 235.0733.

**dimethyl 5,5'-(2-hydroxy-3-oxobutane-1,4-diyl)bis(2-methoxybenzoate) (P15b)**



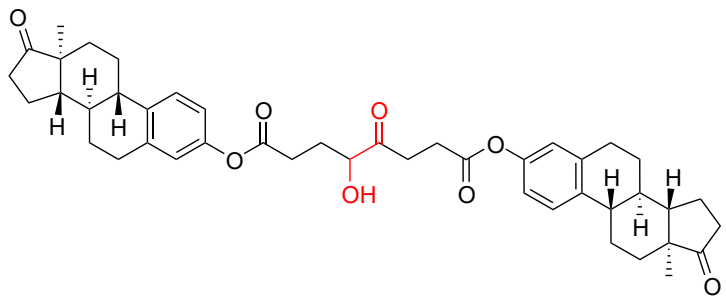
$^1$H NMR (400 MHz, $CDCl_3$) δ 7.0 – 6.9 (m, 2H), 6.8 – 6.7 (m, 4H), 4.3 (s, 1H), 3.8 – 3.7 (m, 6H), 3.7 (s, 1H), 3.1 (dd, J = 14.2, 4.6 Hz, 1H), 3.0 (s, 1H), 2.9 (dp, J = 15.6, 7.7 Hz, 1H), 2.3 (d, J = 2.5 Hz, 6H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 208.8, 207.0, 169.1, 169.0, 151.3, 151.2, 151.1, 139.1, 139.0, 138.7, 135.4, 131.7, 131.5, 123.1, 122.9, 122.8, 121.7, 121.5, 121.4, 113.6, 113.5, 113.3, 67.7, 55.9, 55.9, 55.9, 45.4, 45.3, 40.0, 20.7, 20.6.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{22}H_{24}O_8Na$: [M+Na$^+$] 439.1369, found 439.1360.

IR ATR: ν = 3491, 3062, 3009, 2962, 2939, 2845, 1759, 1720, 1604, 1508, 1464, 1419, 1369, 1268, 1217, 1196, 1150, 1122, 1032, 1011, 903, 827, 732, 700, 647, 602 cm$^{-1}$.

**bis((9*R*,13*R*,14*R*)-13-methyl-17-oxo-7,8,9,11,12,13,14,15,16,17-decahydro-6*H*-cyclopenta[*a*]phenanthren-3-yl) 3-hydroxy-4-oxohexanedioate (P16b)**



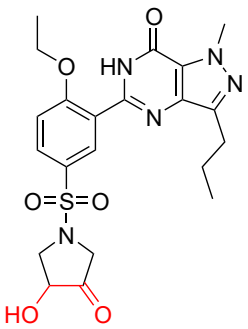
$^{1}$H NMR (400 MHz, $CDCl_3$) δ 7.27 (d, *J* = 8.4 Hz, 3H), 6.89 – 6.77 (m, 5H), 4.41 – 4.32 (m, 1H), 2.90 (dtt, *J* = 14.7, 10.2, 4.6 Hz, 10H), 2.83 – 2.76 (m, 2H), 2.50 (dd, *J* = 18.9, 8.7 Hz, 3H), 2.38 (dd, *J* = 9.7, 4.9 Hz, 3H), 2.30 – 2.24 (m, 2H), 2.11 (dd, *J* = 16.7, 8.0 Hz, 3H), 2.02 – 1.89 (m, 6H), 1.55 (dddd, *J* = 36.1, 24.6, 14.8, 8.4 Hz, 15H), 0.90 (s, 8H).

$^{13}$C NMR (101 MHz, $CDCl_3$) δ 221.0, 210.1, 207.2, 171.4, 148.4, 138.1, 138.0, 137.5, 126.5, 126.4, 121.5, 121.5, 121.4, 121.4, 118.7, 118.6, 75.4, 68.2, 60.4, 50.4, 47.9, 44.1, 37.9, 35.9, 31.5, 31.0, 29.4, 28.7, 26.3, 25.7, 21.6, 13.8.

HRMS TOF MS ES$^+$ (ESI): *m/z* calcd. for $C_{44}H_{52}O_8Na$: [M+Na$^+$] 731.3560, found 731.3537.

IR ATR: ν = 3057, 2930, 2862, 1732, 1607, 1493, 1454, 1405, 1373, 1264, 1222, 1208, 1152, 1083, 1008, 904, 820, 732, 701 cm$^{-1}$.

**5-(2-ethoxy-5-((3-hydroxy-4-oxopyrrolidin-1-yl)sulfonyl)phenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (P17b)**



$^{1}$H NMR (400 MHz, $CDCl_3$) δ 10.9 – 10.8 (m, 1H), 8.9 – 8.6 (m, 1H), 8.0 – 7.8 (m, 1H), 7.1 (dd, *J* = 22.0, 8.9 Hz, 1H), 4.4 (ddt, *J* = 20.9, 14.0, 7.7 Hz, 3H), 4.2 (d, *J* = 6.4 Hz, 4H), 4.2 (s, 1H), 3.5 (d, *J* = 6.5 Hz, 1H), 3.3 – 3.2 (m, 1H), 2.9 (d, *J* = 7.1 Hz, 2H), 1.9 – 1.8 (m, 2H), 1.6 (d, *J* = 6.3 Hz, 3H), 1.0 (t, *J* = 7.1 Hz, 3H).

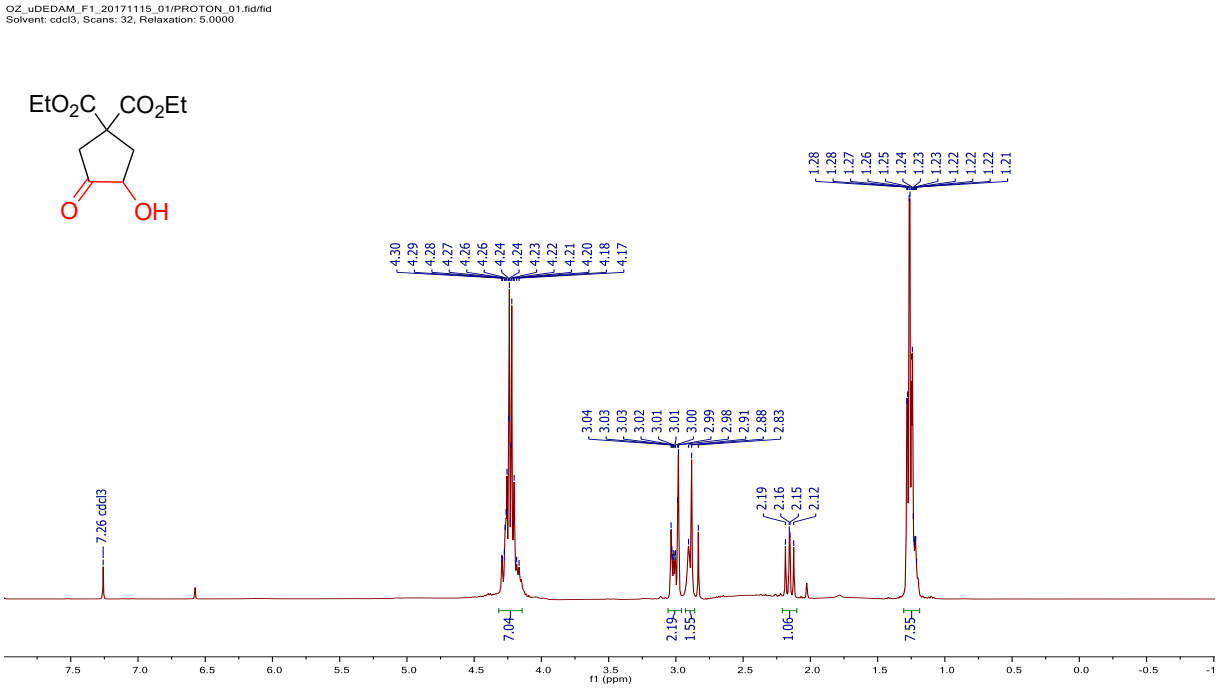
$^{13}$C NMR (101 MHz, $CDCl_3$) δ 202.2, 159.4, 153.7, 146.9, 138.3, 130.7, 113.0, 77.3, 77.3, 77.0, 76.7, 70.7, 66.0, 52.2, 38.2, 27.6, 22.3, 14.5, 14.5, 14.0.

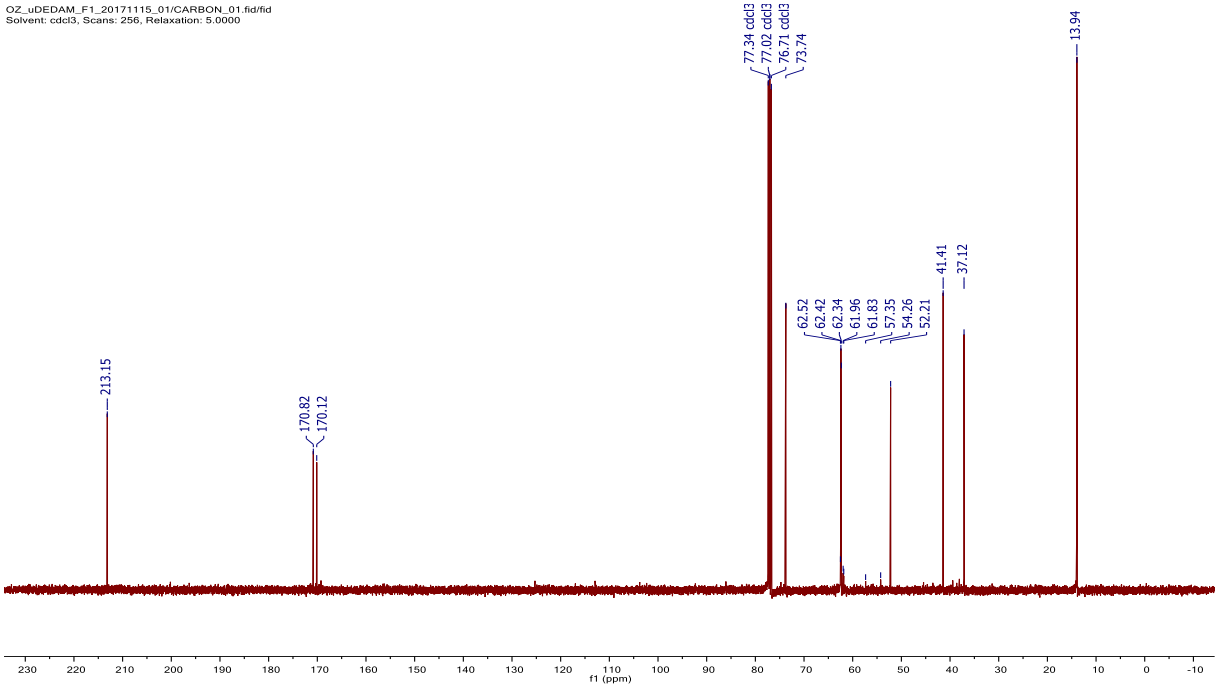
HRMS TOF MS ESI$^-$ (ESI): *m/z* calcd. for $C_{21}H_{24}N_5O_6S$: [M-H$^-$] 474.1447, found 474.1438.

IR ATR: ν = 3322, 3054, 2986, 2963, 2937, 2873, 1697, 1599, 1584, 1563, 1489, 1470, 1394, 1347, 1264, 1164, 1029, 732, 702, 653, 586 cm$^{-1}$.

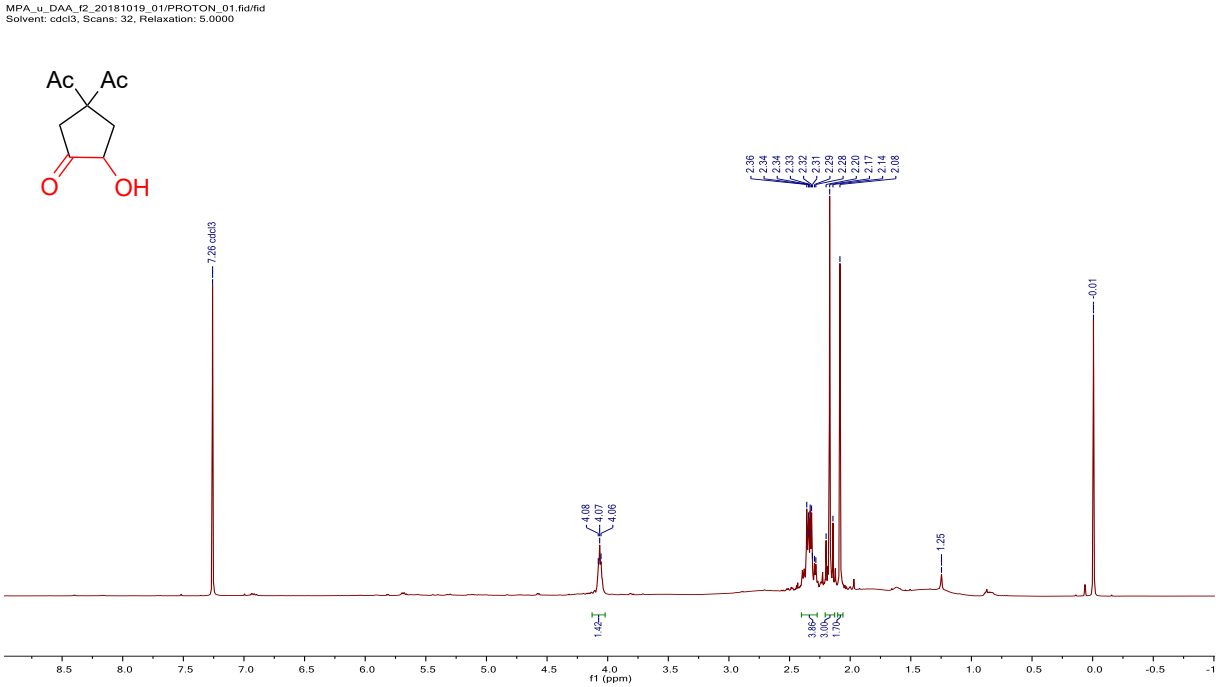
# $^{1}H$ and $^{13}C$ NMR Spectra

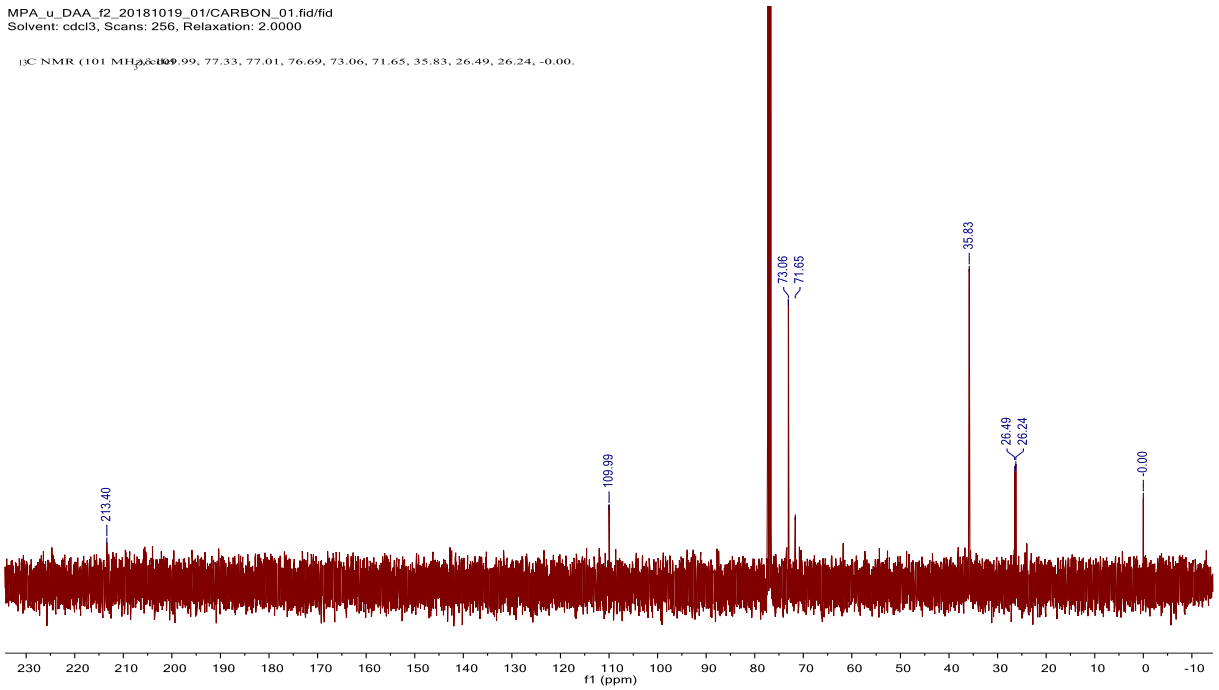
## Diethyl 3-hydroxy-4-oxocyclopentane-1,1-dicarboxylate



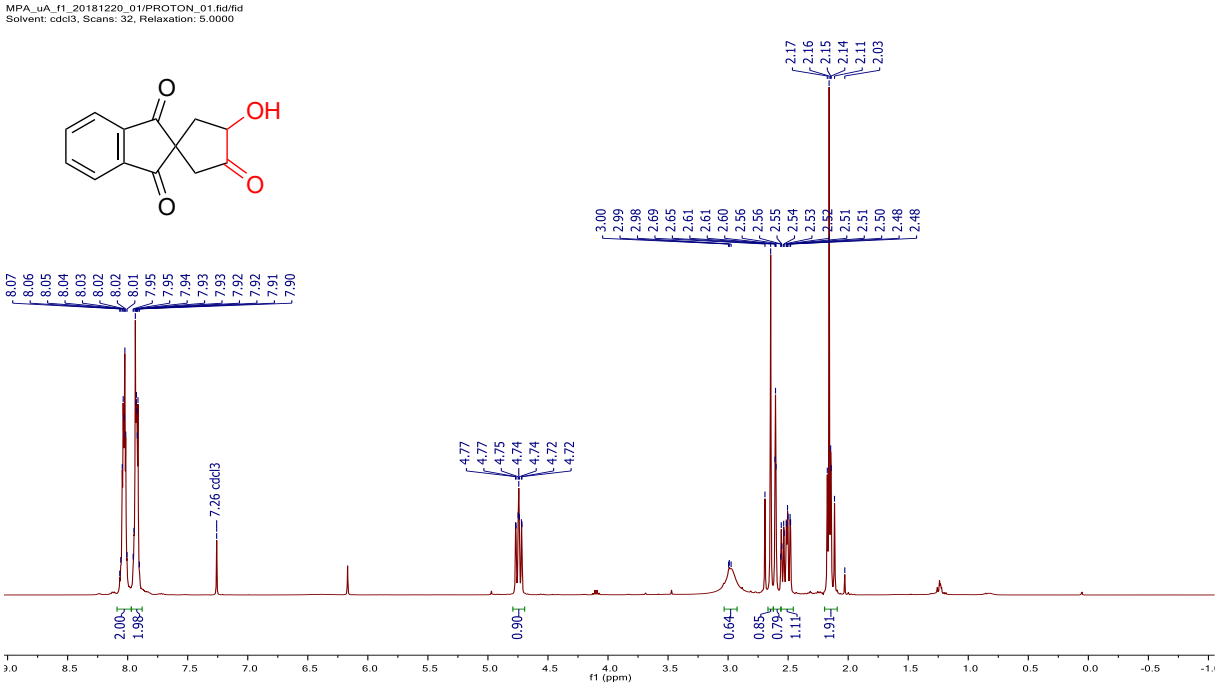



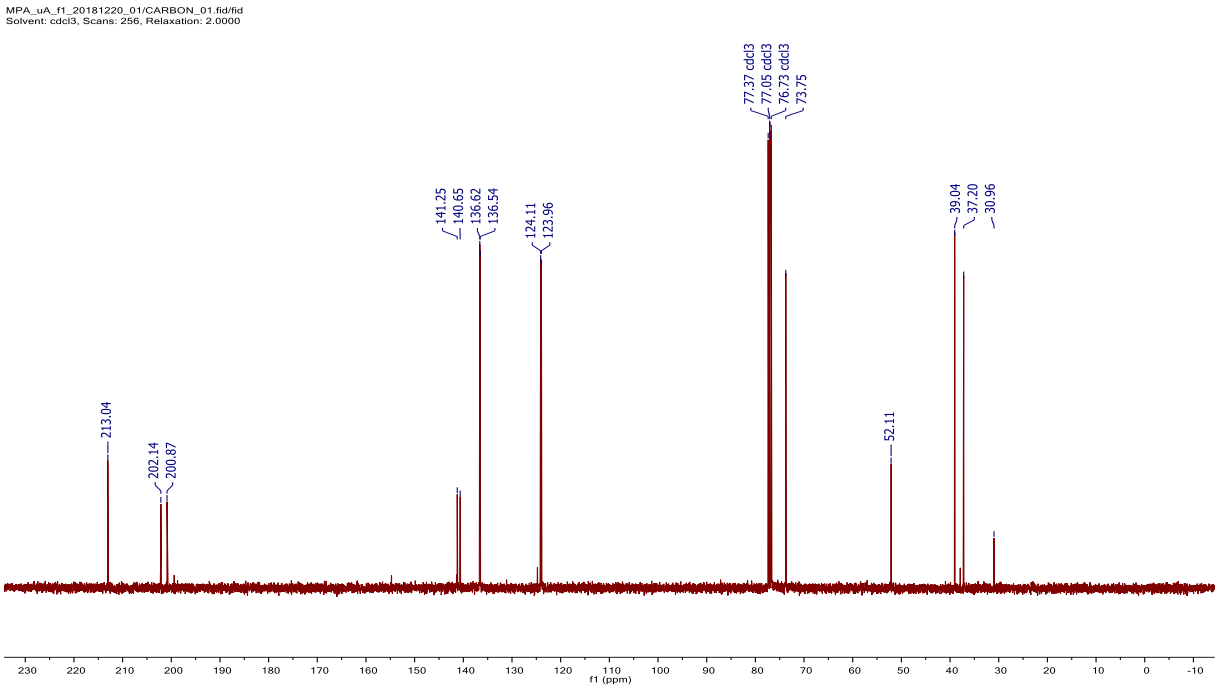
# 1,1'-(3-hydroxy-4-oxocyclopentane-1,1-diyl)bis(ethan-1-one)



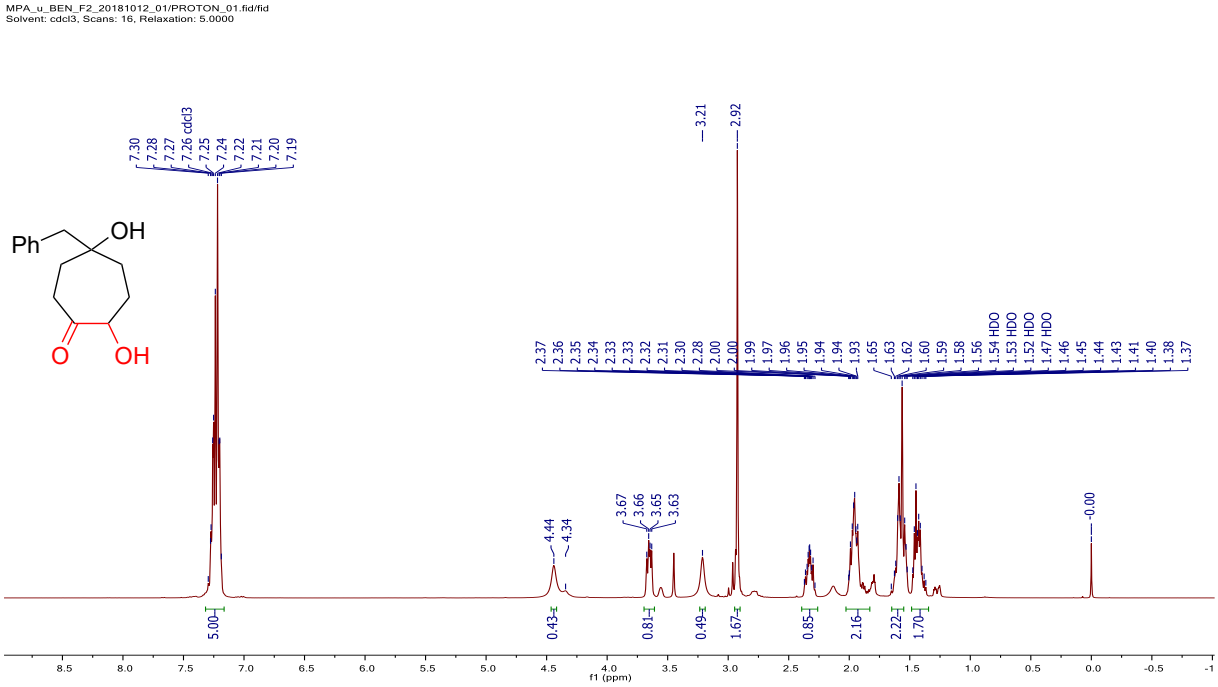



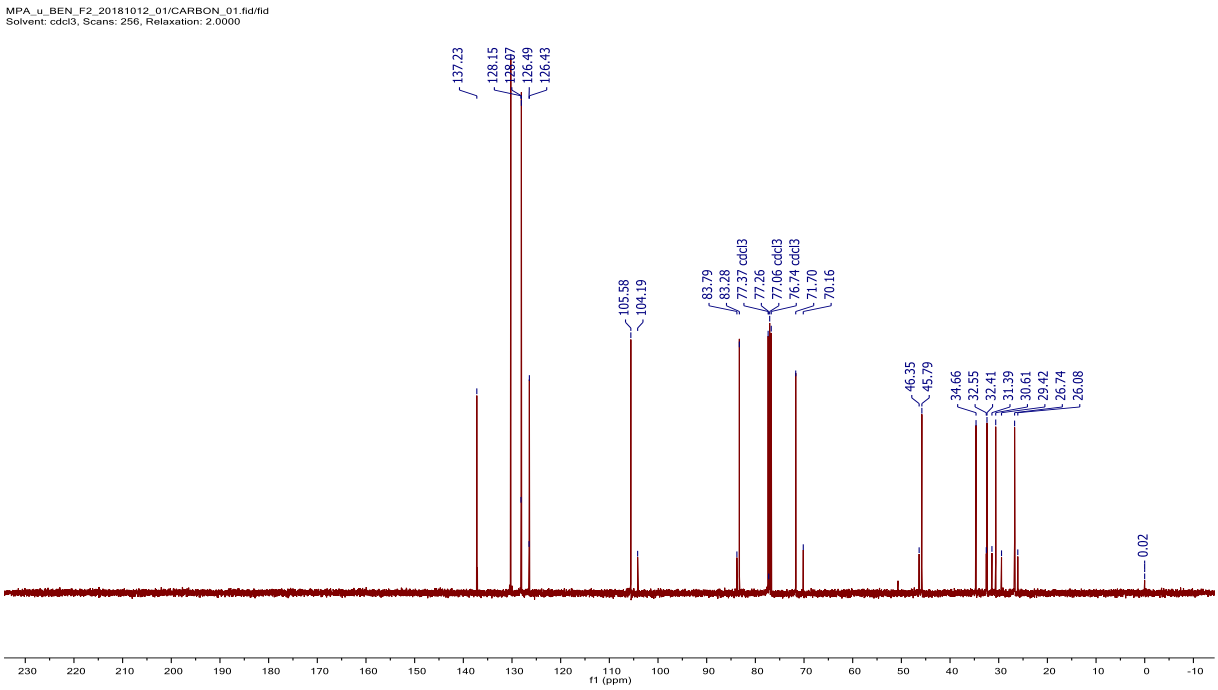
## 3-hydroxyspiro[cyclopentane-1,2'-indene]-1',3',4-trione



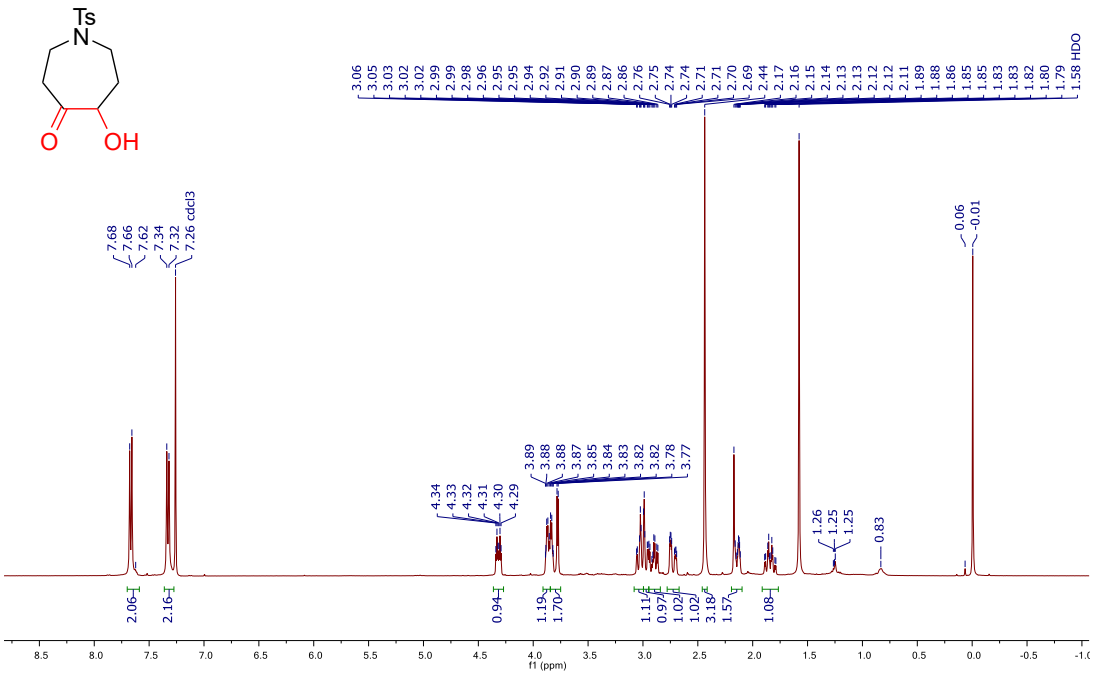
# 5-benzyl-2,5-dihydroxycycloheptan-1-one



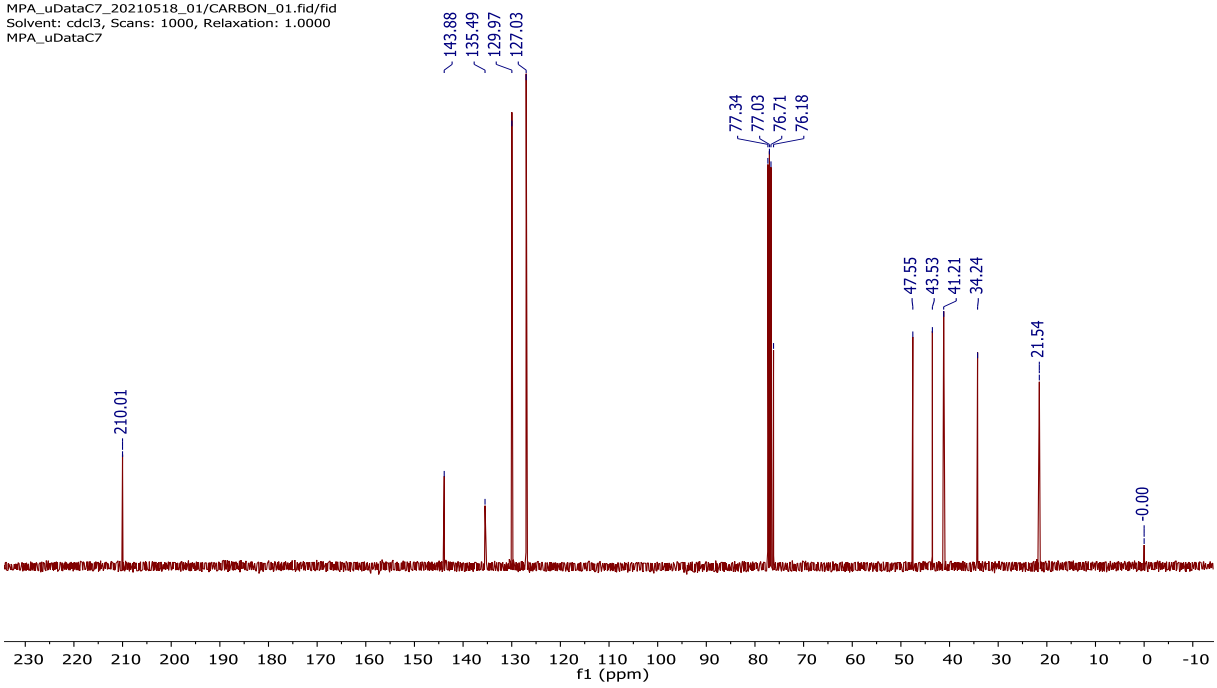



# 5-hydroxy-1-tosylazepan-4-one

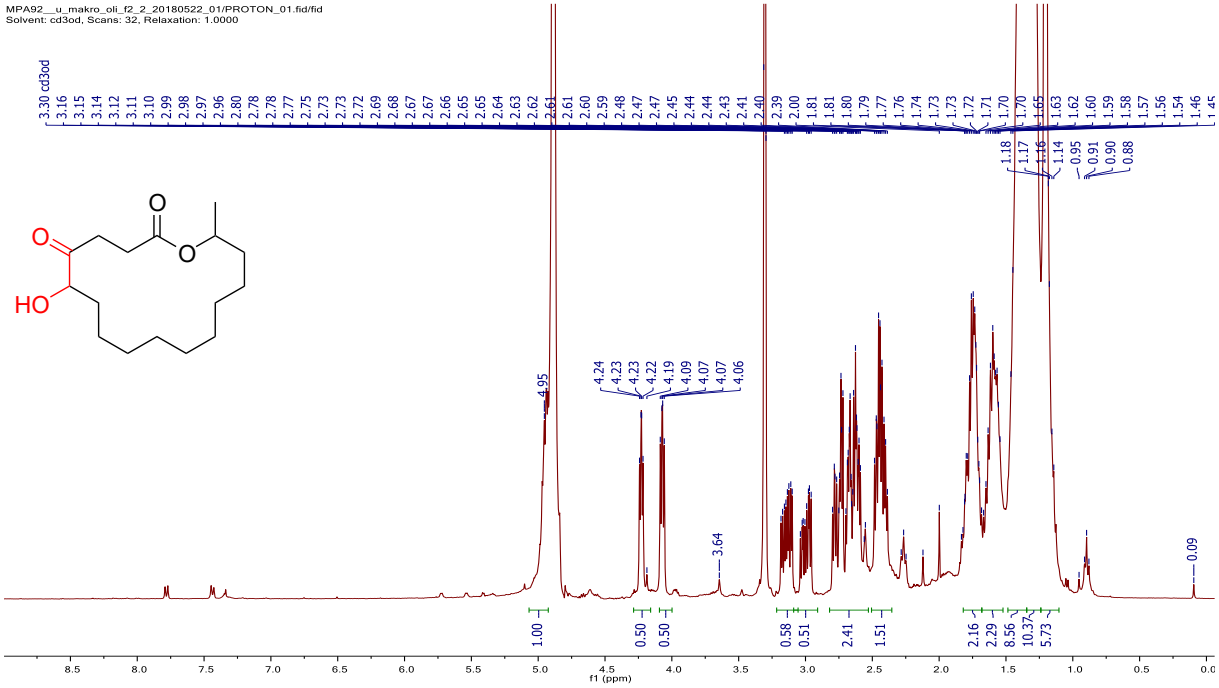
MPA_uDATA7_AquaMet_bezSC_20181009_01/PROTON_01.fid/fid
Solvent: cdcl3, Scans: 32, Relaxation: 2.0000

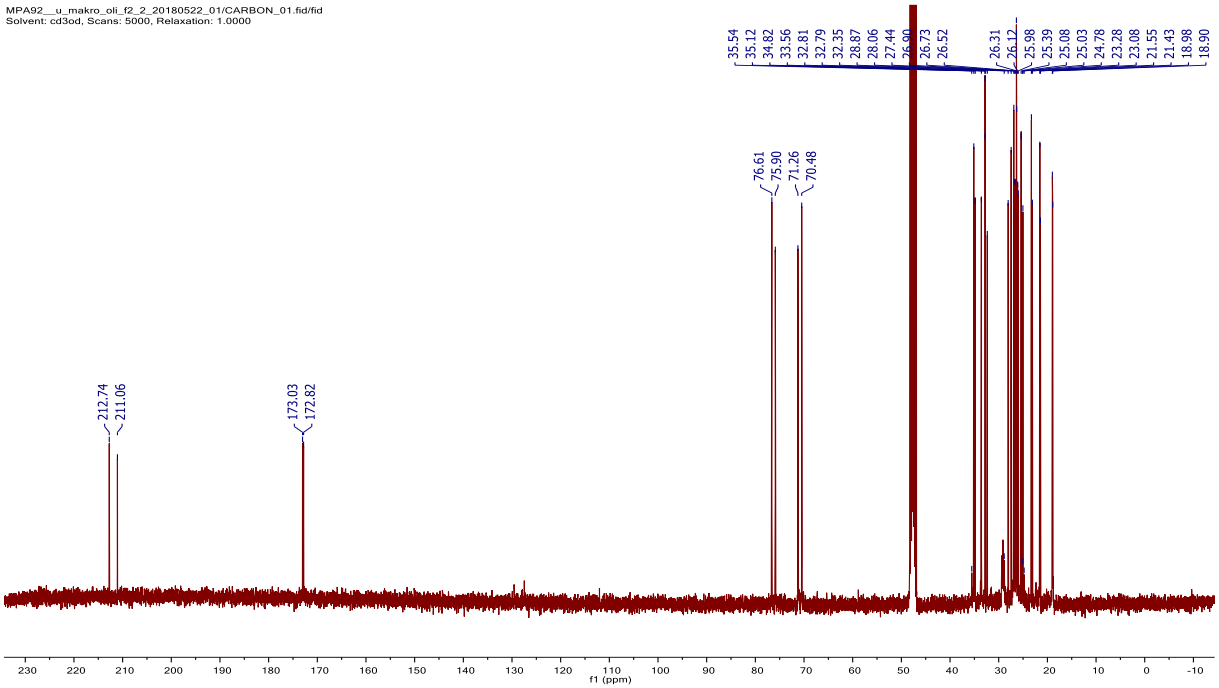



MPA_uDataC7_20210518_01/CARBON_01.fid/fid
Solvent: cdcl3, Scans: 1000, Relaxation: 1.0000
MPA_uDataC7



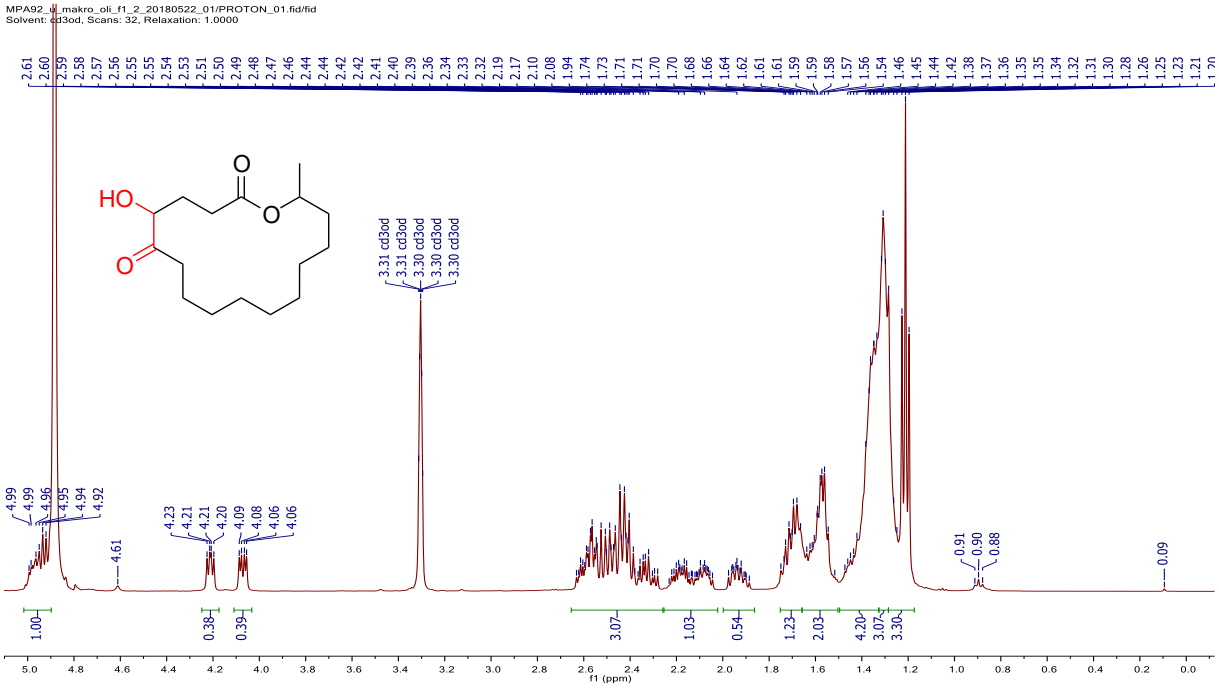
## 6-hydroxy-16-methyloxacyclohexadecane-2,5-dione

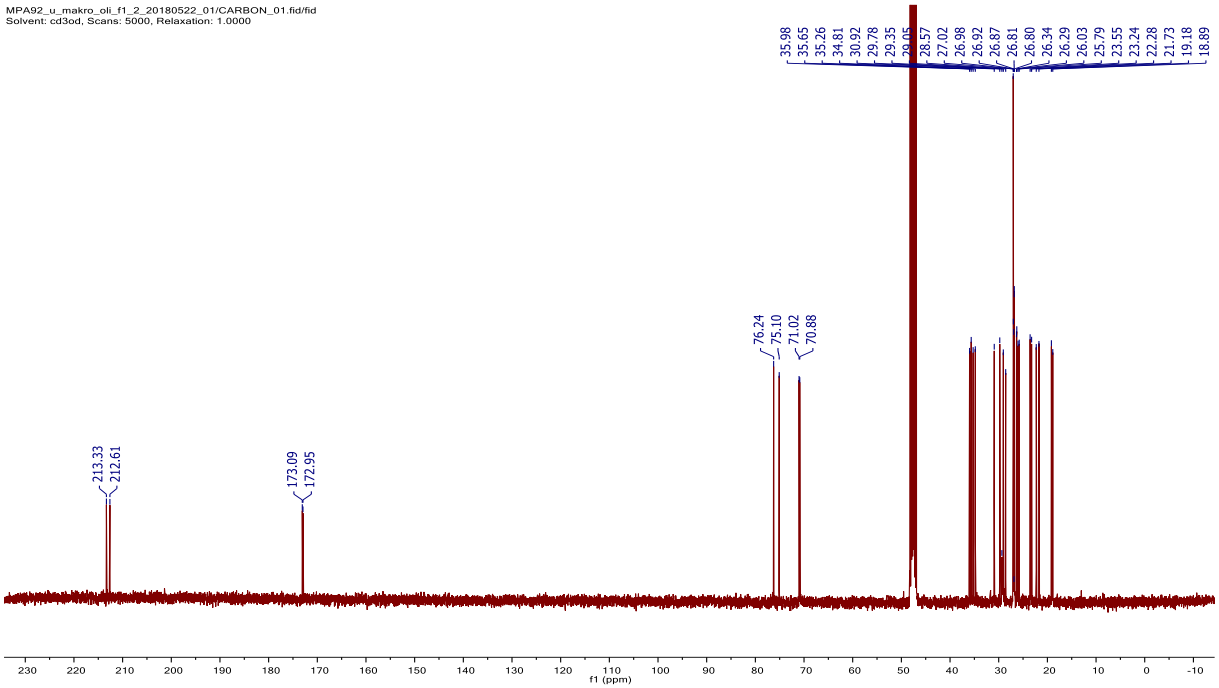



MPA92__u_makro_oli_f2_2_20180522_01/gCOSY_01.fid/fid
Solvent: cd3od, Scans: 1, Relaxation: 1.0000
f2 (ppm)
f1 (ppm)

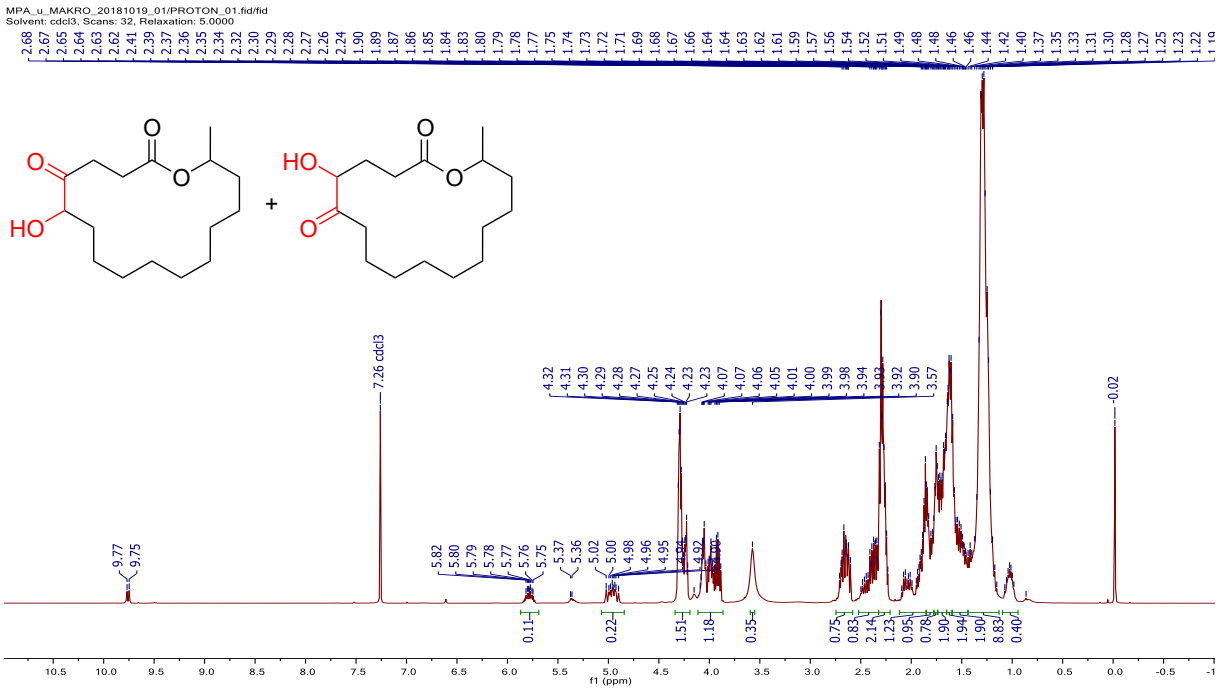
## 5-hydroxy-16-methyloxacyclohexadecane-2,6-dione

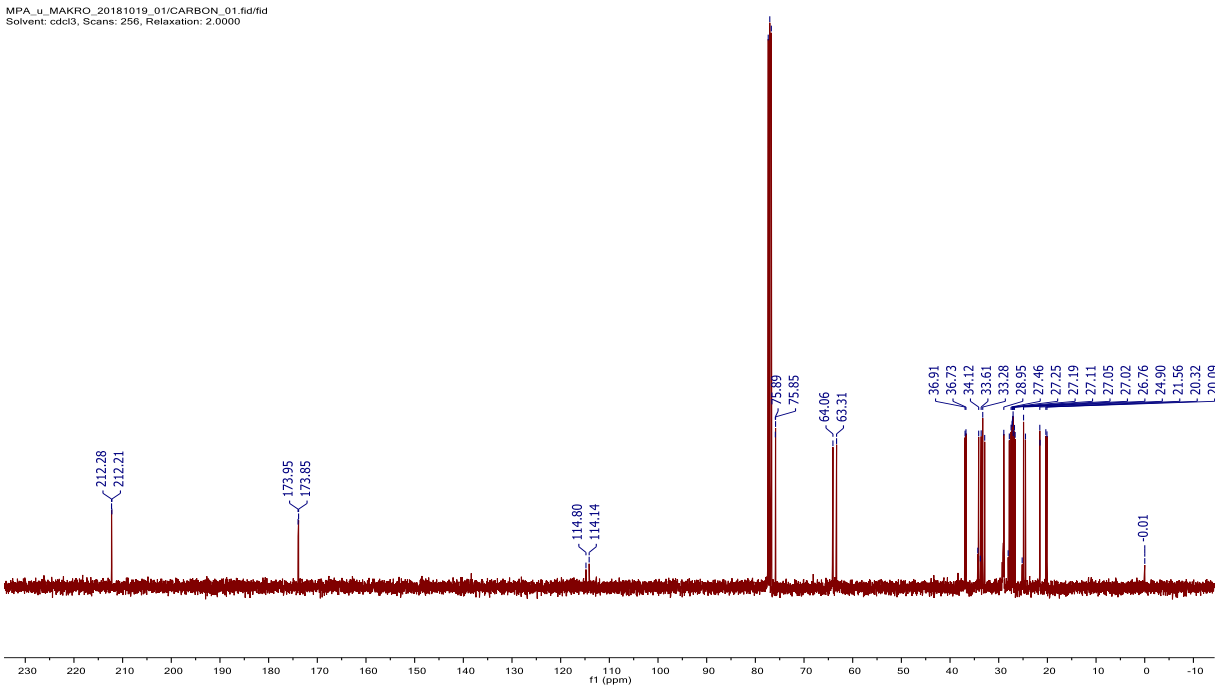


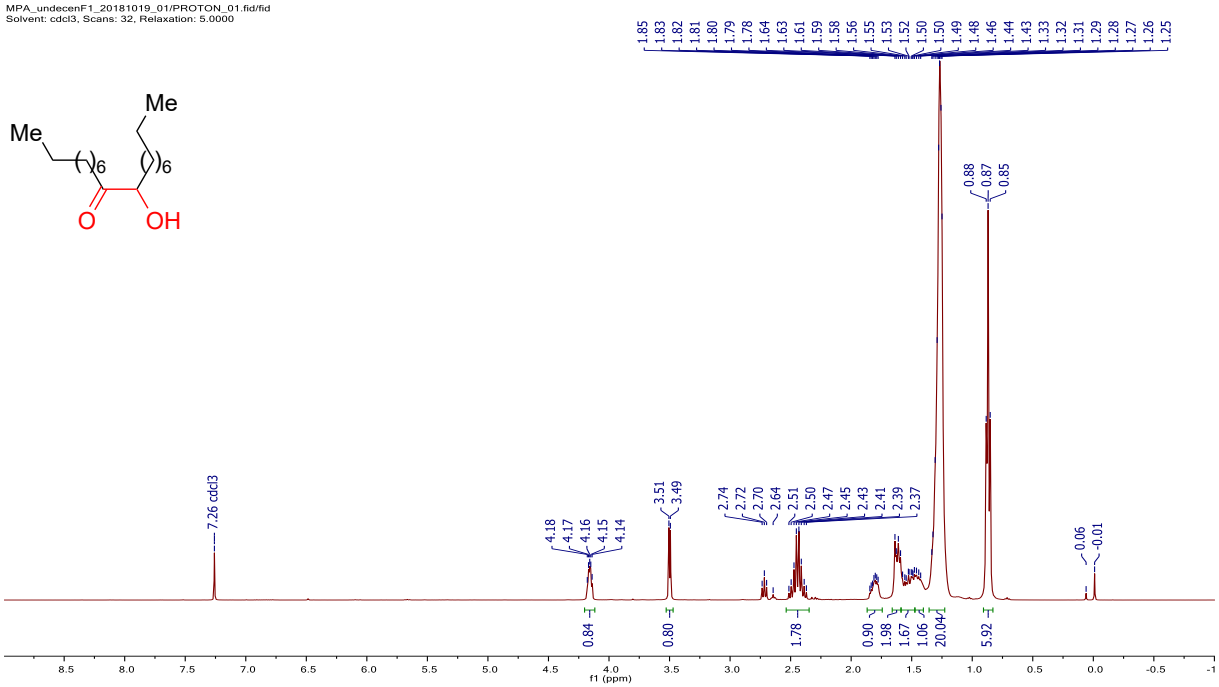

MPA92_u_makro_oli_f1_2_20180522_01/gCOSY_01.fid/fid
Solvent: cd3od, Scans: 1, Relaxation: 1.0000
f2 (ppm)
f1 (ppm)

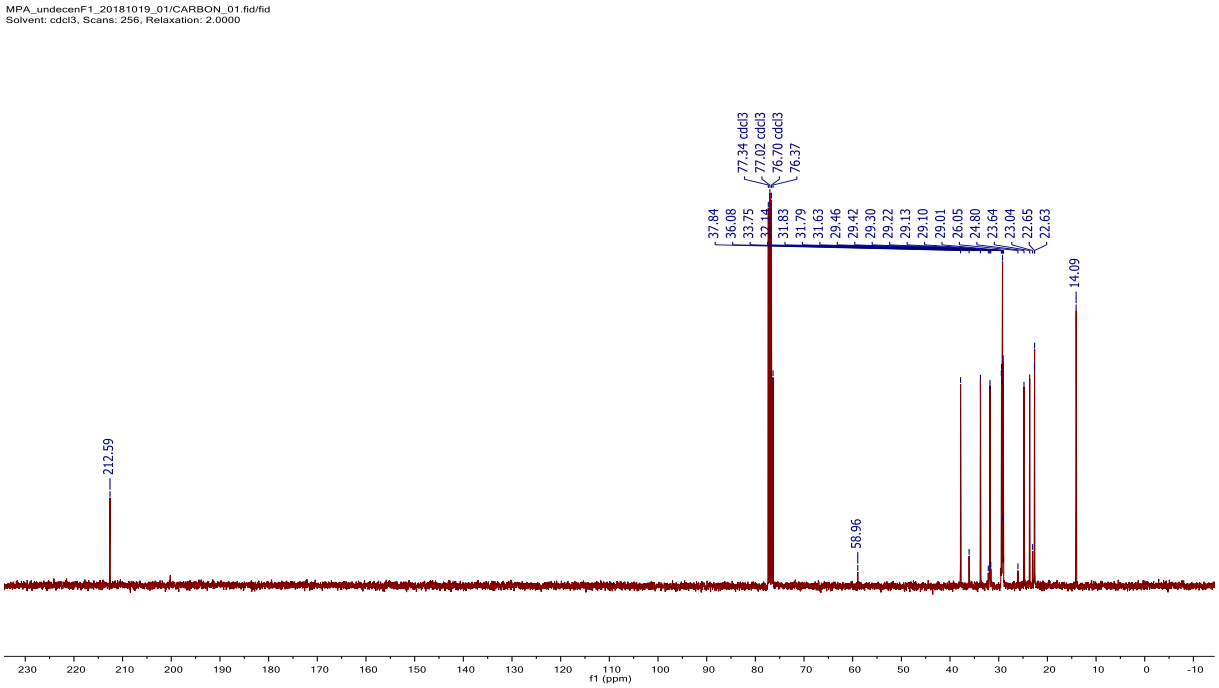
## 11-hydroxyoxacyclohexadecane-2,12-dione and 12-hydroxyoxacyclohexadecane-2,11-dione



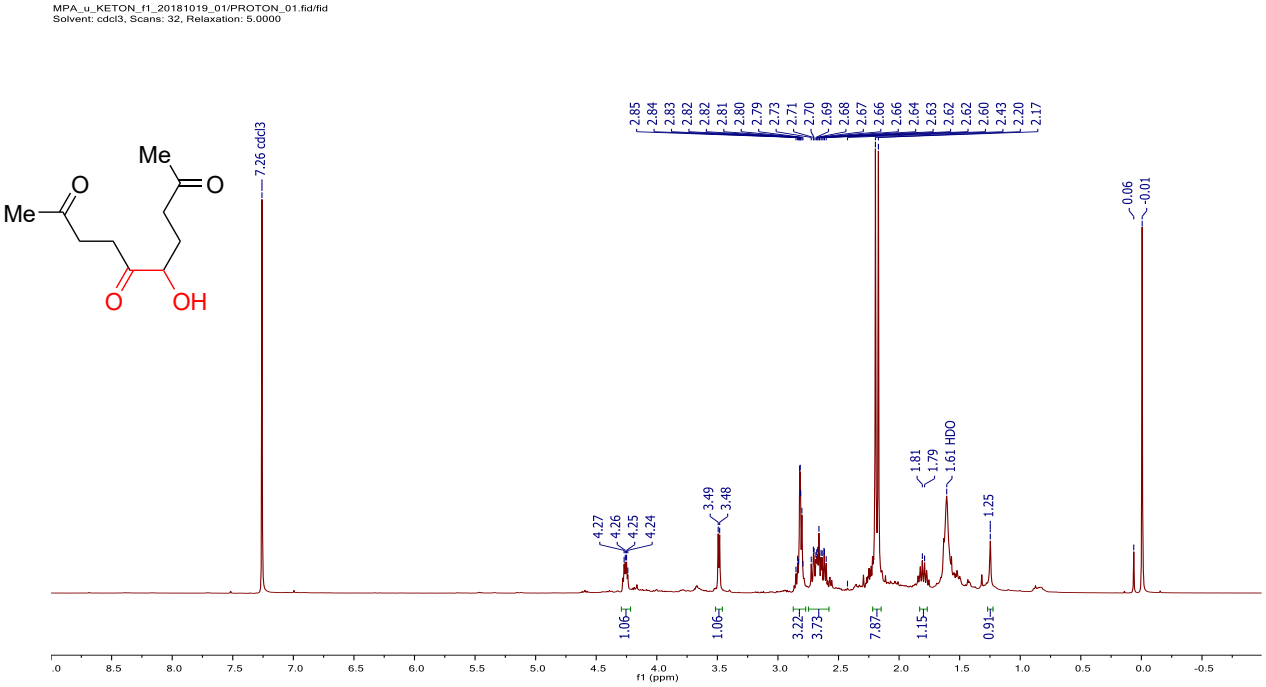



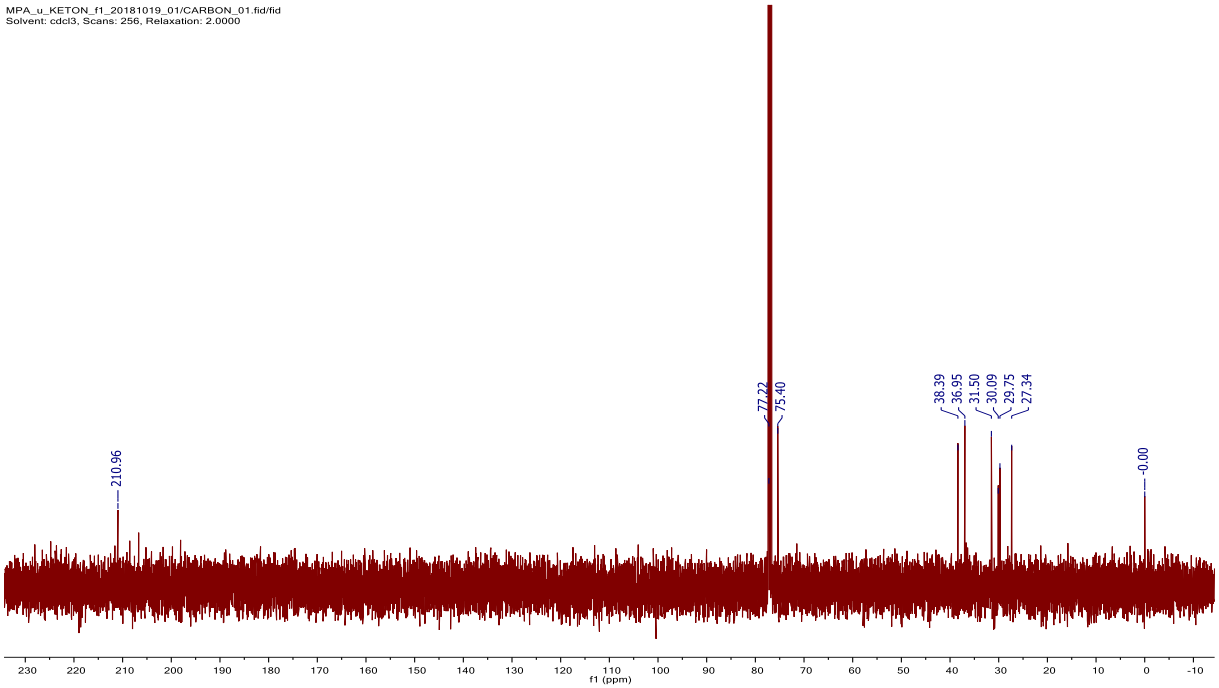
## 10-hydroxyoctadecan-9-one



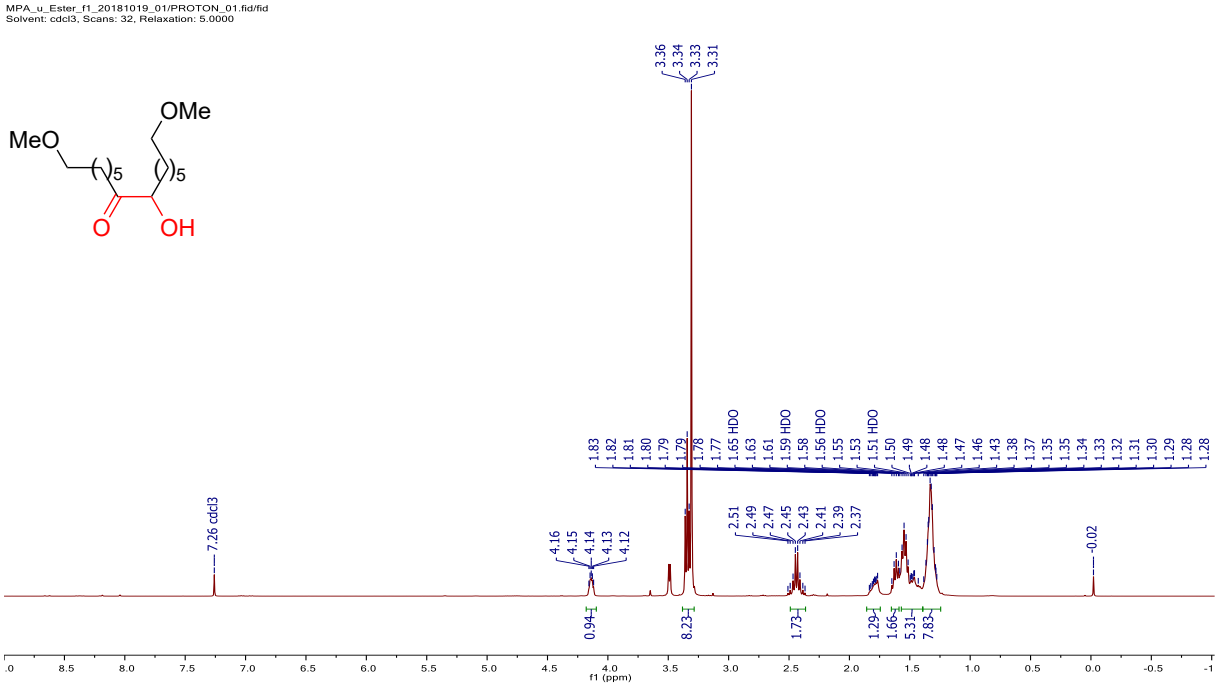



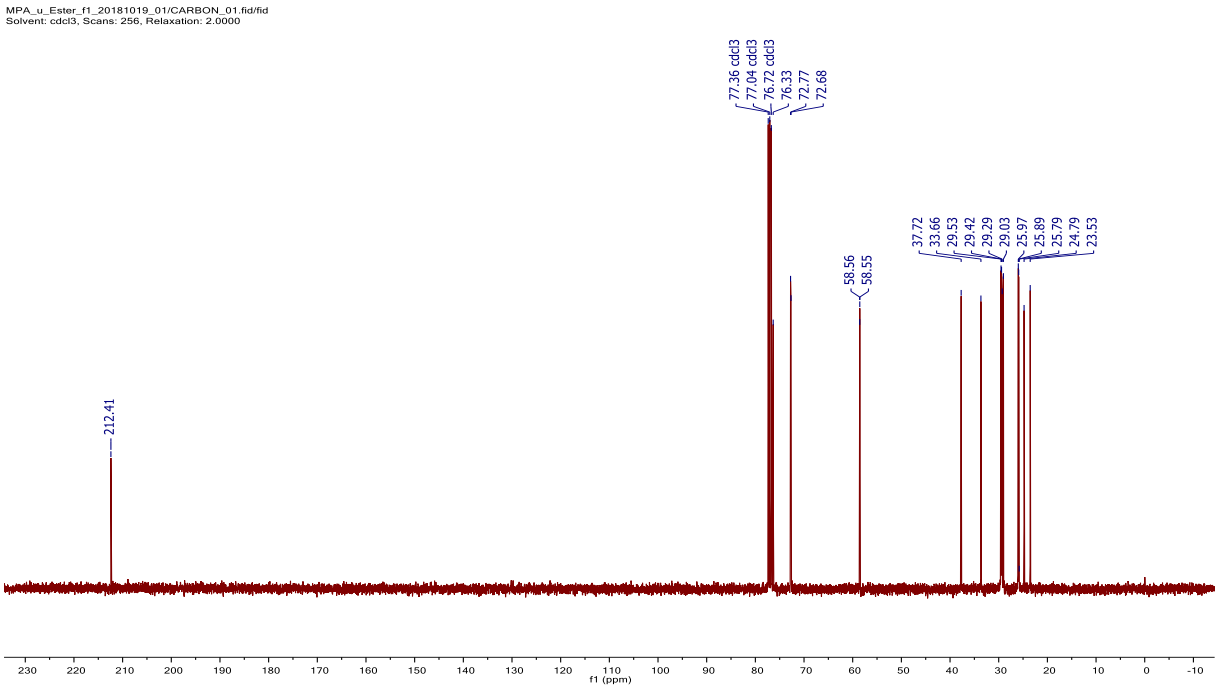
# 6-hydroxydecane-2,5,9-trione



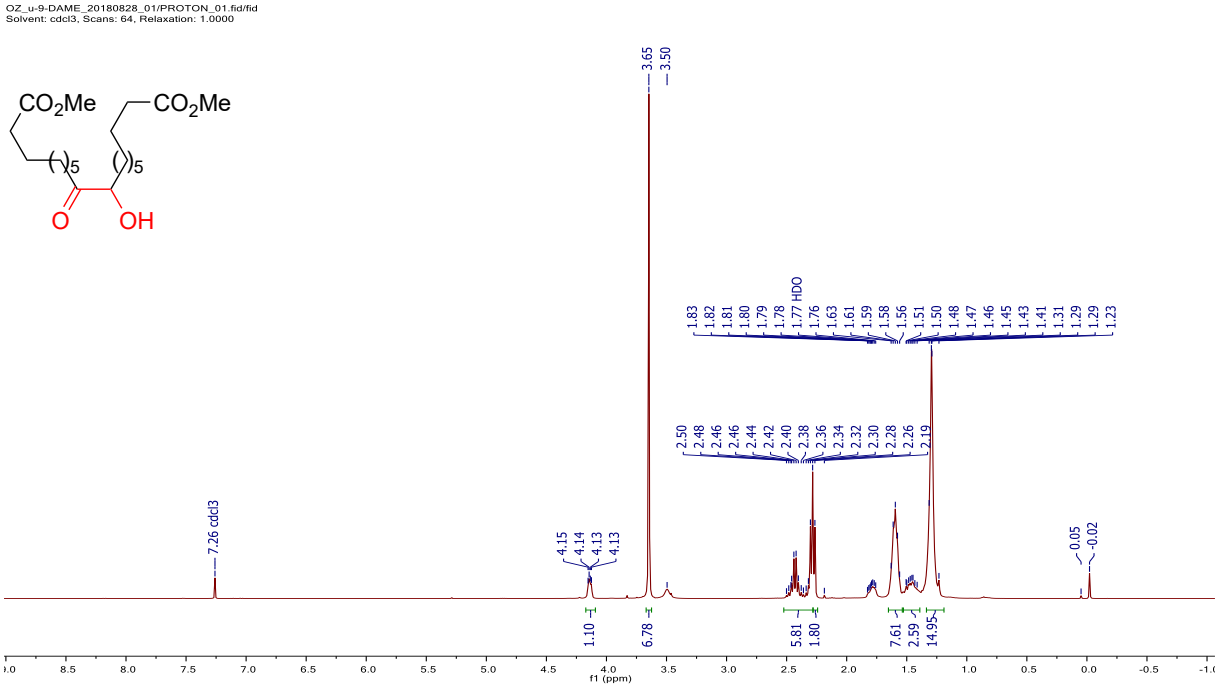



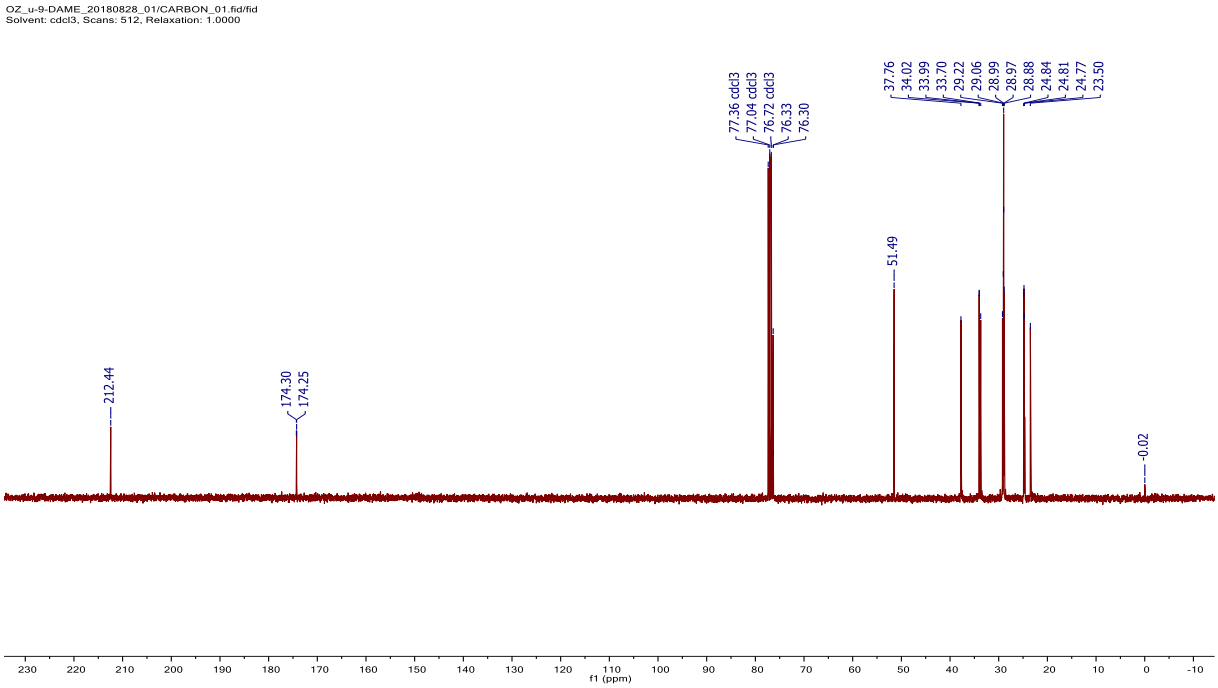
# 7-hydroxy-1,12-dimethoxydodecan-6-one



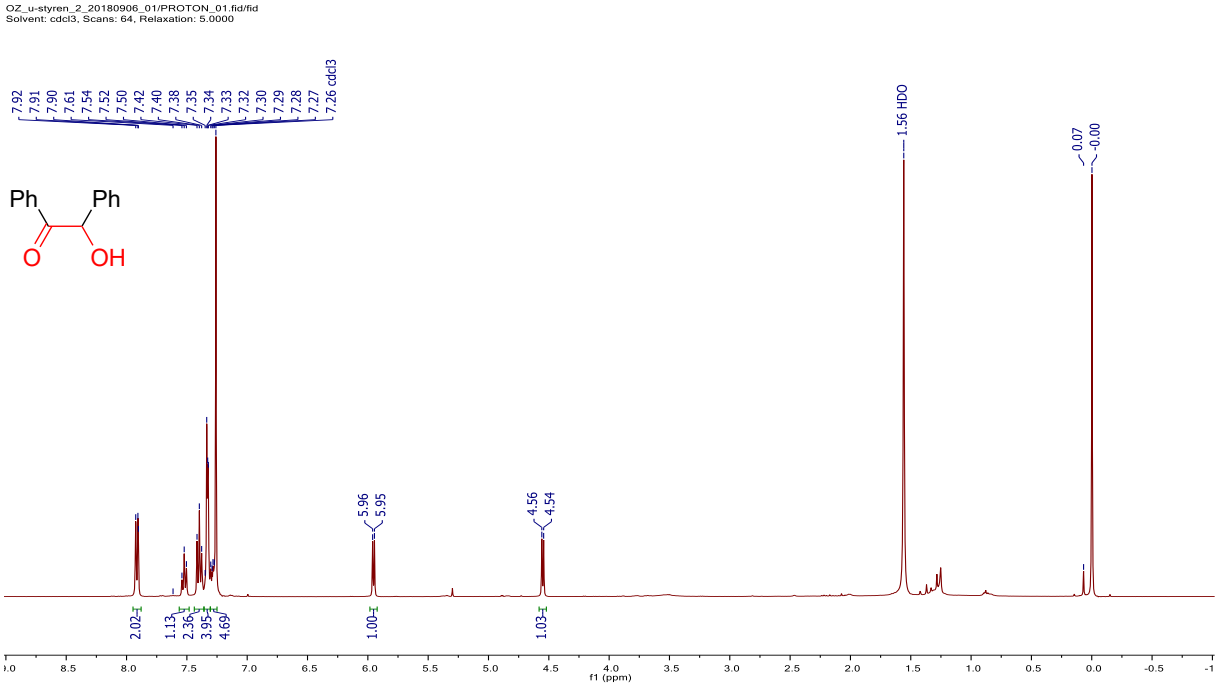



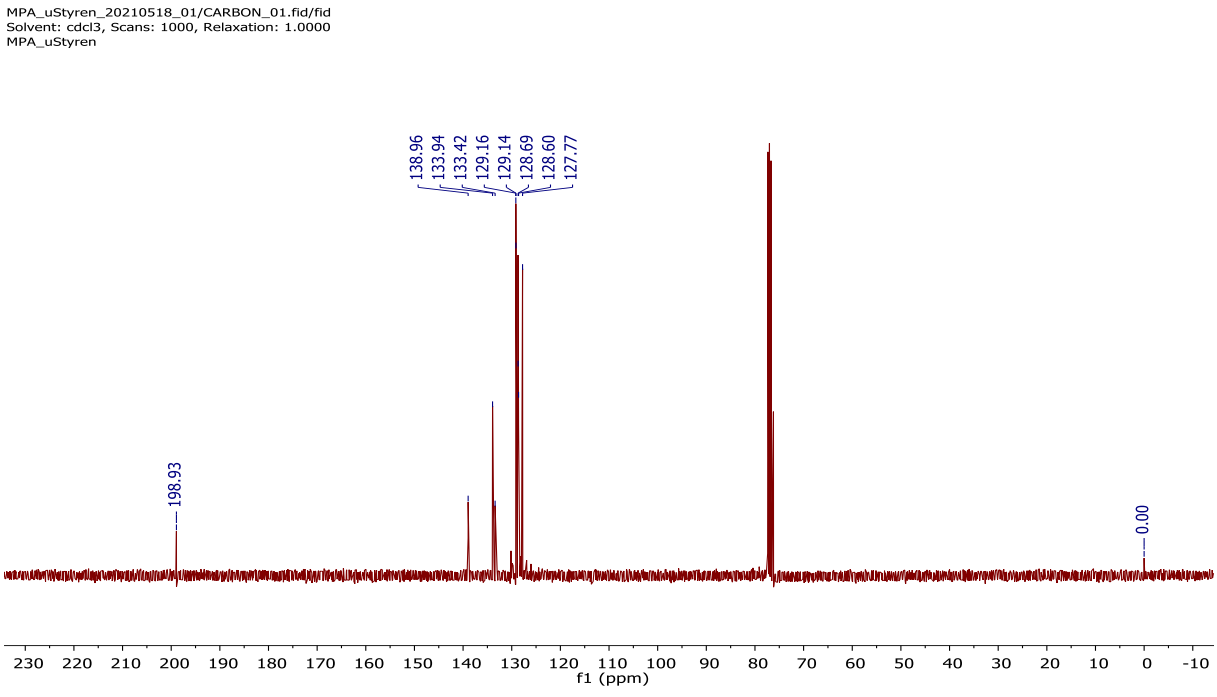
## Dimethyl 2,19-dihydroxy-10-methyl-11-oxoicosanedioate



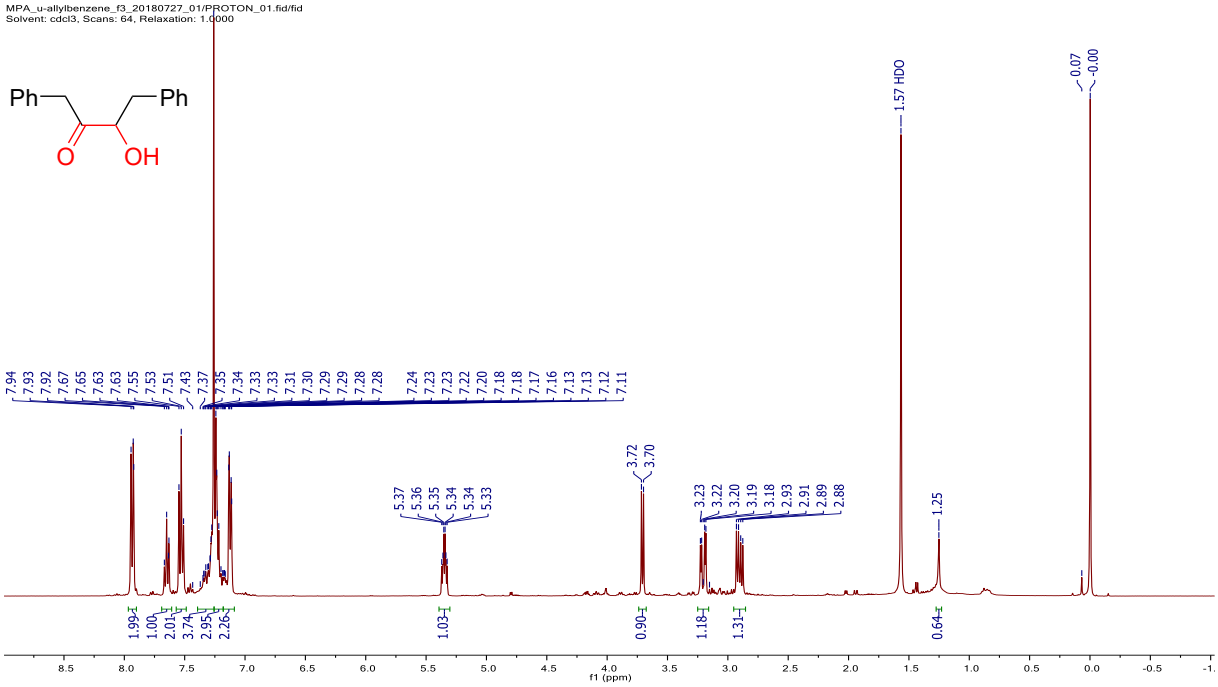



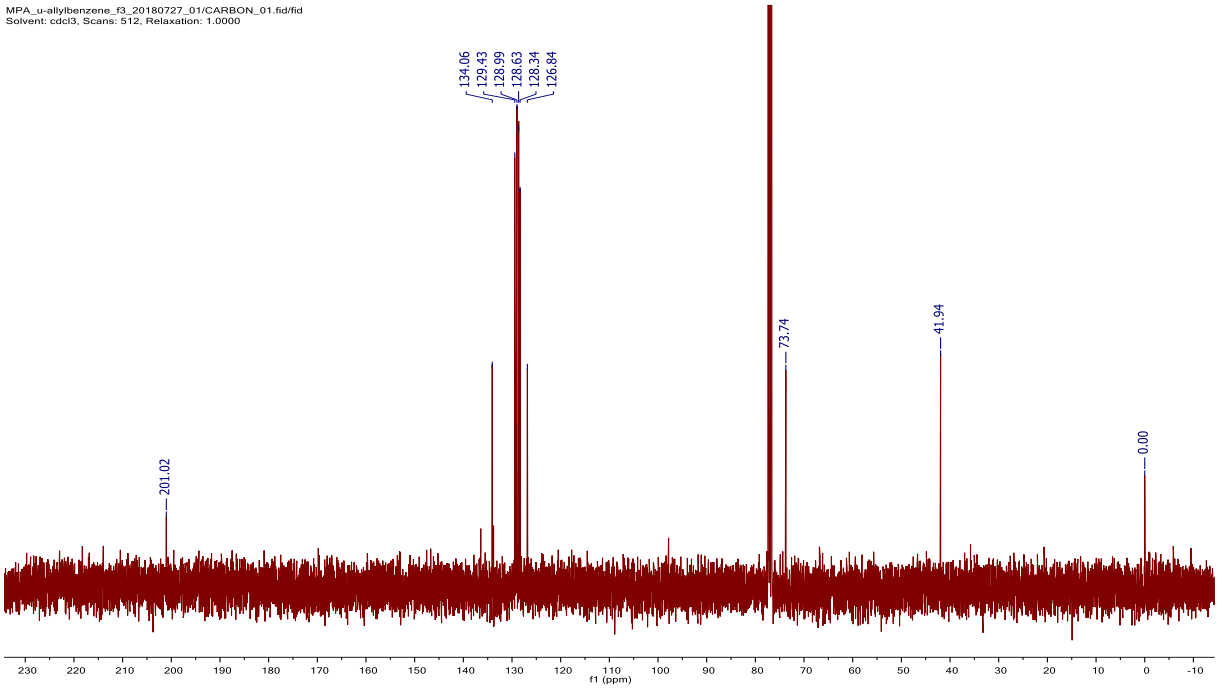
## 2-hydroxy-1,2-diphenylethan-1-one



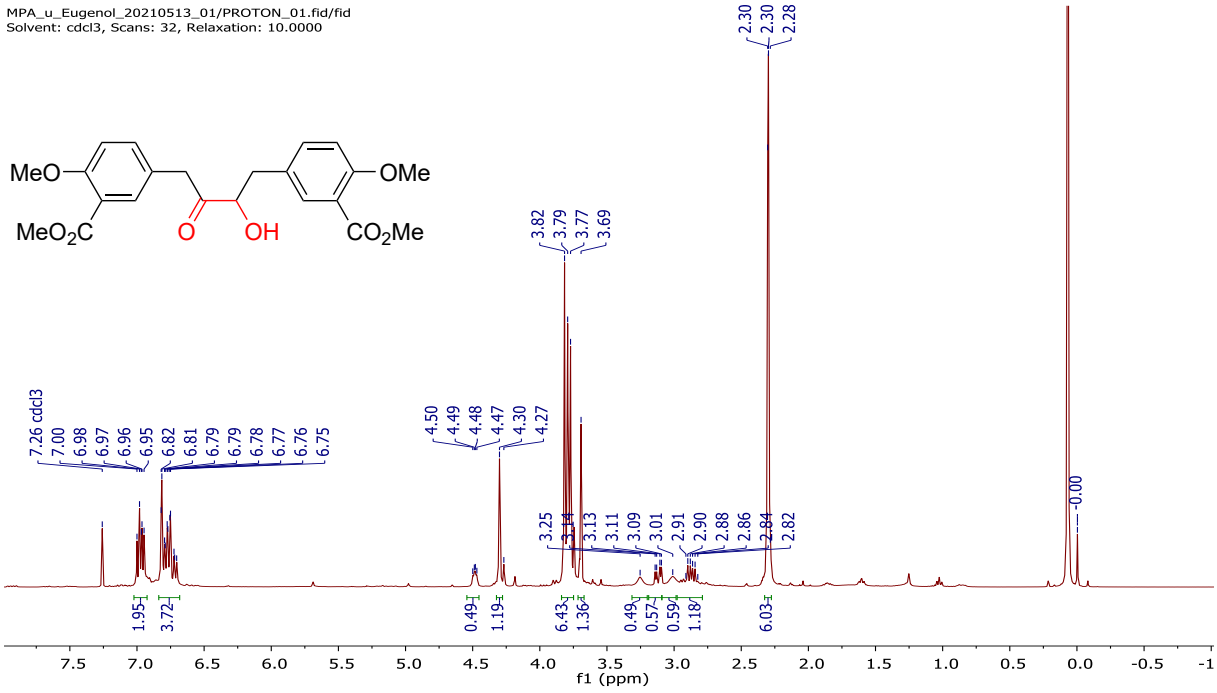



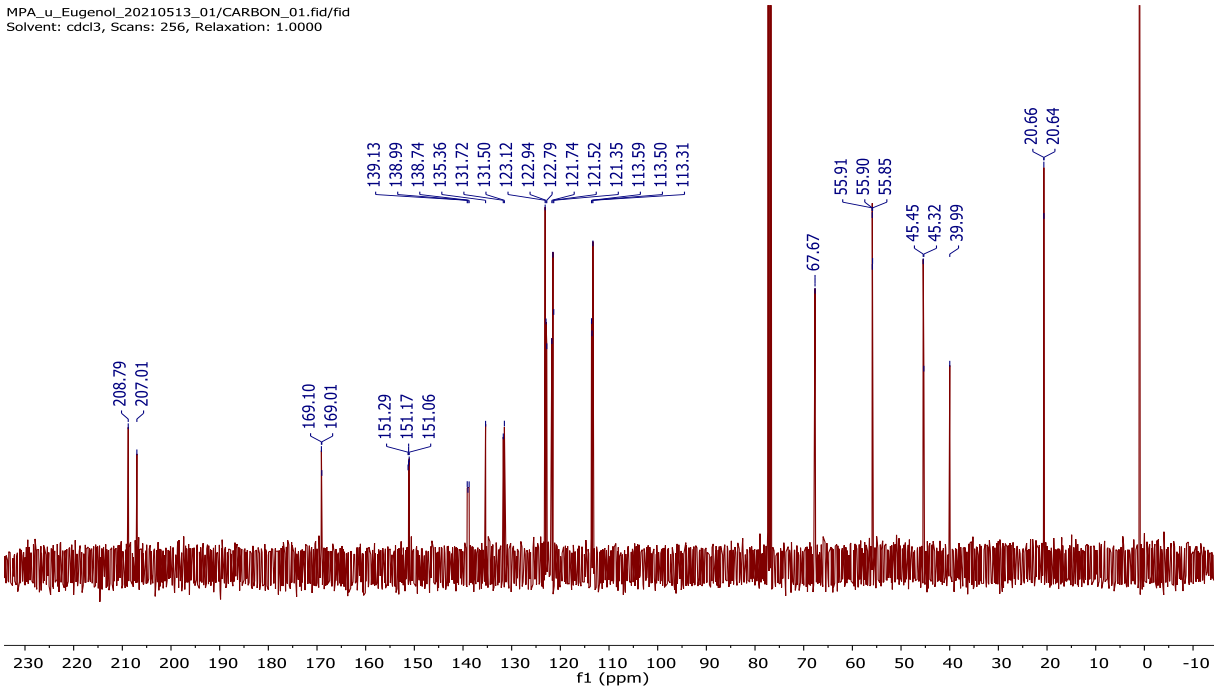
## 3-hydroxy-1,4-diphenylbutan-2-one



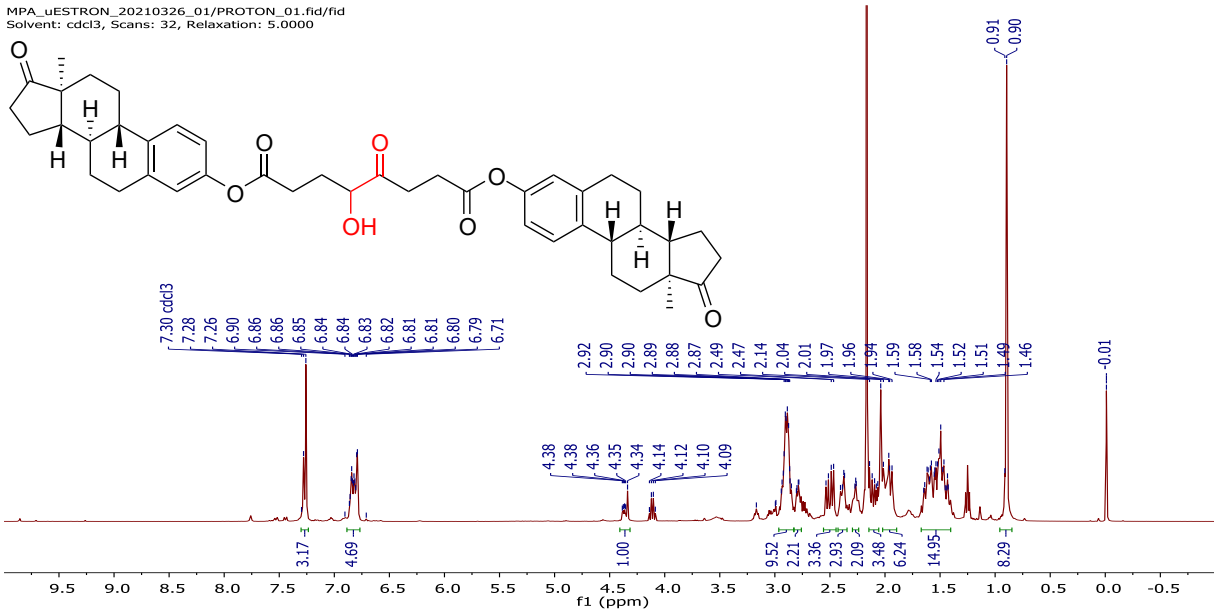



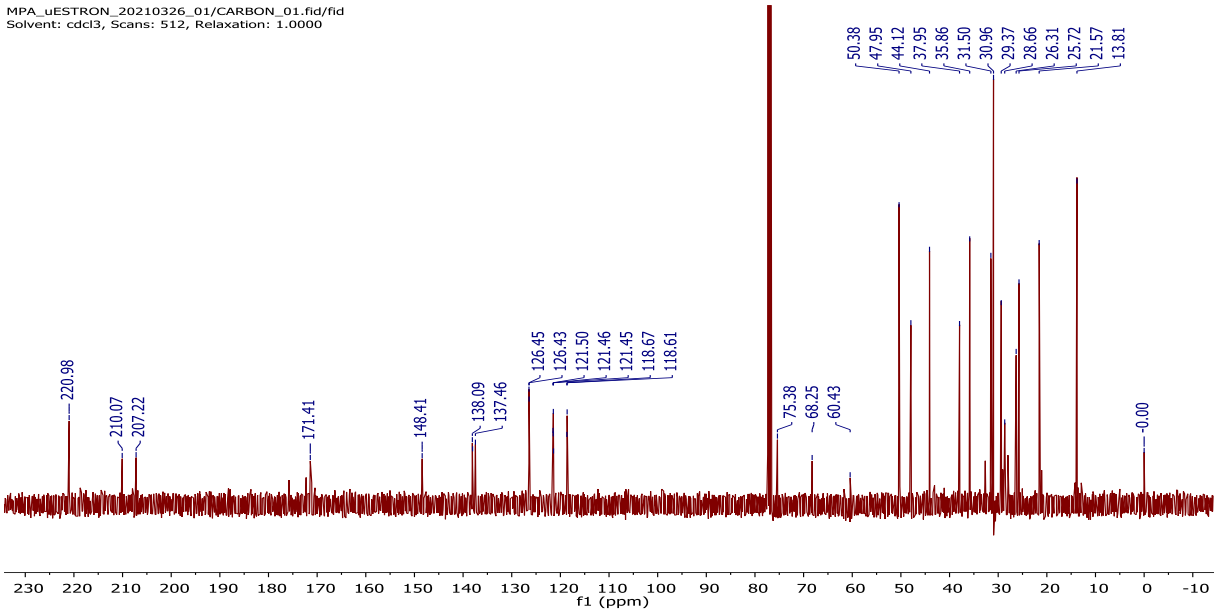
## Dimethyl 5,5'-(2-hydroxy-3-oxobutane-1,4-diyl)bis(2-methoxybenzoate)



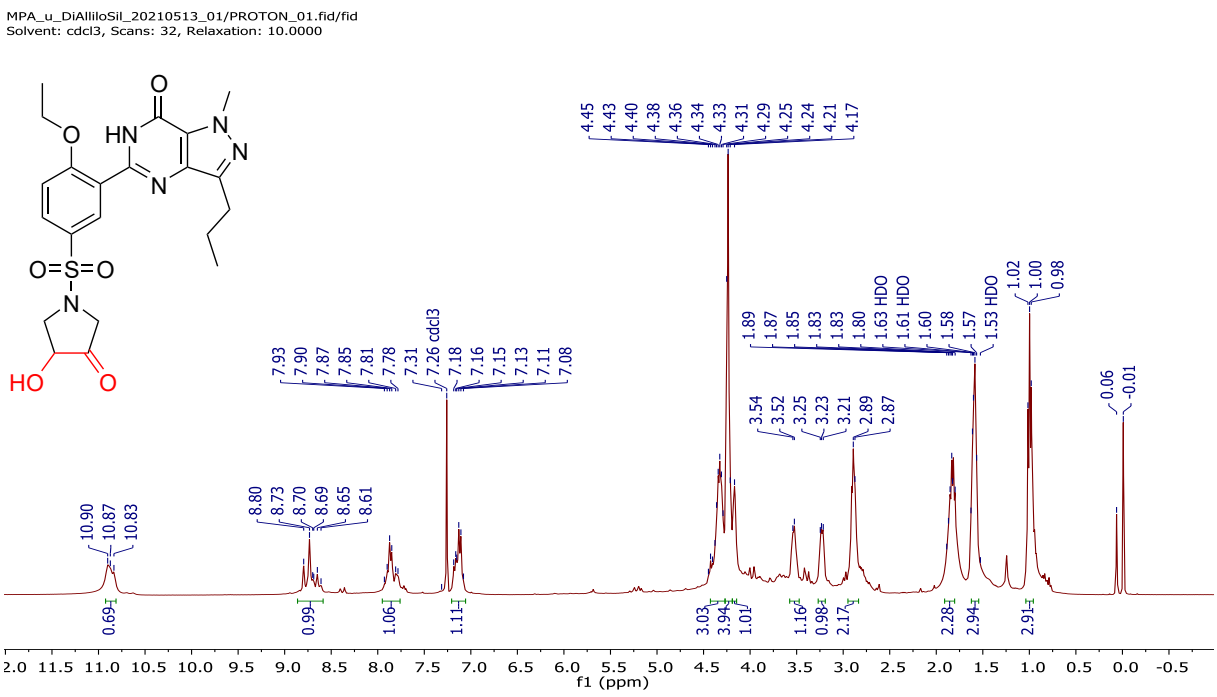



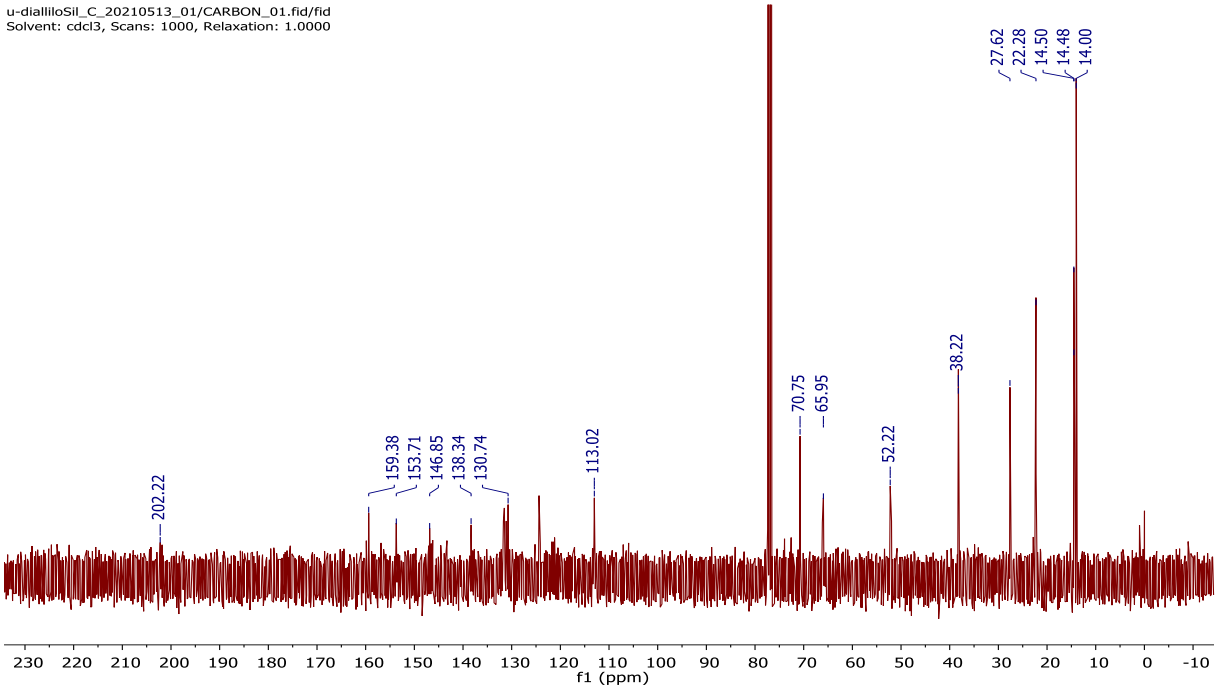
**Bis((9*R*,13*R*,14*R*)-13-methyl-17-oxo-7,8,9,11,12,13,14,15,16,17-decahydro-6*H*-cyclopenta[*a*]phenanthren-3-yl) 3-hydroxy-4-oxohexanedioate**



**5-(2-ethoxy-5-((3-hydroxy-4-oxopyrrolidin-1-yl)sulfonyl)phenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one**



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