Supporting Information

for

Desymmetrization of Cyclic Anhydrides Using Dihydroxy Compounds: Selective Synthesis of Macrocyclic Tetralactones

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General Procedure

General: All reactions were carried out in oven-dried glassware under an atmosphere of argon. All solvents were freshly purified by distillation. All the materials used are purchased from Aldrich. IR spectra were recorded using KBr pellets or CH₂Cl₂ on a Perkin-Elmer Spectrum GX FT-IR spectrophotometer. ¹H NMR and ¹³C NMR spectra were recorded (200 and 50.3 MHz, respectively) on a Bruker Avance DPX 200 using CDCl₃. Chemical shifts for proton and carbon resonances are reported in ppm (δ) relative to tetramethylsilane (δ 0.00) and chloroform (δ 77), respectively. Multiplicities are indicated by singlet (s), doublet (d), triplet (t), quartet (q), multiplet (m). Coupling constants (*J*) were reported in Hertz (Hz). Carbon types were determined from ¹³C NMR and DEPT experiments. High resolution mass analyses were performed using electrospray ionization (ESI) technique on a Waters QToF-micro mass spectrometer. Elemental analyses were performed on a Perkin-Elmer model 2400 analyzer. Single-crystal X-ray crystallographic analyses were carried out on a Bruker Smart Apex CCD diffractometer. Melting points were determined on a capillary melting point apparatus and are uncorrected. Analytical thin layer chromatography (TLC) was performed on silica and components were visualized by observation under iodine, UV-light or sulfuric acid charring. Column chromatography was performed on a silica gel (100-200 mesh) column.

General procedure for the synthesis of dicarboxylic acids 3, Method A: An oven-dried round bottomed flask under argon was charged with anhydride (10.0 mmol) and diol (5.0 mmol) in anhydrous benzene (100 ml) or anhydrous dichloromethane. The stirred reaction mixture was cooled to 0 °C and 15.0 mmol of triethylamine or quinine added. The reaction was continued for 4 hrs at 0 °C and further at room temperature for 5 hrs. Reaction was monitored by TLC. After all the anhydride was reacted, the solvent was evaporated. The residue was cooled to 0 °C and added 200 mL of saturated sodium bicarbonate solution and extracted with ether. The aqueous layer was cooled to 0 °C and acidified with dilute hydrochloric acid followed by the extraction with diethyl ether or dichloromethane (4 x 100 mL). The entire organic layers were combined and evaporated

under reduced pressure to provide the corresponding pure dicarboxylic acid **3** in quantitative yield.

General procedure for the synthesis of macrocyclic tetralactones 5, Method B: To an oven-dried flask dicarboxylic acid **3** (2.5 mmol) in dry DCM (150 mL) was charged under inert atmosphere. To the above solution, diol (2.5 mmol) was added and the reaction mixture cooled to 0 °C. To this cooled reaction mixture, DCC (7.5 mmol) and a catalytic amount of DMAP were added. The reaction mixture was stirred at 0 °C for 6 hrs. Initially the reaction mixture was homogeneous. The white solid separates out from the reaction mixture after 2 hrs duration. Progress of the reaction was monitored by TLC. Finally, the white solid obtained in the reaction was filtered and the filtrate concentrated. To the residue, 20 mL of EtOAc:MeOH (10:1) was added and kept at 0°C for overnight. The solid obtained was filtered and the filtrate was evaporated. The final residue was subjected to 100-200 mesh silica column chromatography (Hexane/EtOAc or EtOAc/MeOH) to furnish the corresponding macrocyclic tetralactone **5**.

Experimental details, characterization data for all new compounds

Compound 3a: Anhydride **1a** (1.48 g, 10.0 mmol), tetra(ethylene glycol) (0.97 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3a** (2.20 g, 90%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 8.59 (broad s, 2H, OH), 7.78-7.67 (m, 4H, Arom-*H*), 7.56-7.47 (m, 4H, Arom-*H*), 4.45 (t, 4H, OCH_2), 3.77 (t, 4H, OCH_2), 3.72 (s, 8H, OCH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 169.9 ($\text{C}=\text{O}$), 167.7 ($\text{C}=\text{O}$), 131.8 (*quat*-C), 131.7 (*quat*-C), 131.1 ($=\text{CH}$), 131.0 ($=\text{CH}$), 128.9 ($=\text{CH}$), 128.8 ($=\text{CH}$), 70.5 (OCH_2), 69.8 (OCH_2), 68.6 (OCH_2), 64.6 (OCH_2).

ν_{max} (neat)/ cm^{-1} 3478, 3030, 2920, 1729, 1713, 1697, 1440, 1348, 1296, 1098, 1042.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{26}\text{O}_{11}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 513.1373, Found 513.1370.

Compound 3b: Anhydride **1a** (1.48 g, 10.0 mmol), tri(ethylene glycol) (0.75 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3b** (2.05 g, 92%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 8.68 (broad s, 2H, OH), 7.77-7.66 (m, 4H, Arom-*H*), 7.53-7.33 (m, 4H, Arom-*H*), 4.47 (t, 4H, OCH_2), 3.81 (t, 4H, OCH_2), 3.70 (s, 4H, OCH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 170.1 ($\text{C}=\text{O}$), 167.6 ($\text{C}=\text{O}$), 131.7 (*quat*-C), 131.4 (*quat*-C), 131.1 ($=\text{CH}$), 130.9 ($=\text{CH}$), 128.8 ($=\text{CH}$), 128.6 ($=\text{CH}$), 69.9 (OCH_2), 68.4 (OCH_2), 64.2 (OCH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3442, 3030, 2952, 1730, 1714, 1695, 1442, 1392, 1301, 1230, 1040, 946.

HRMS (ESI+) calcd for $\text{C}_{22}\text{H}_{22}\text{O}_{10}\text{Na}$ ($\text{M}+\text{Na}$) $^{+}$: 469.1111, Found 469.1109.

Compound 3c: Anhydride **1a** (1.48 g, 10.0 mmol), 1,2-benzenedimethanol (0.69 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3c** (1.90 g, 88%) as a White solid; mp: 136-138 °C.

^1H NMR (CDCl_3 , 200 MHz) δ 9.18 (s, 2H, COOH), 7.80-7.27 (m, 12H, Arom-*H*), 5.46 (s, 4H, OCH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 171.4 ($\text{C}=\text{O}$), 168.1 ($\text{C}=\text{O}$), 134.0 (*quat-C*), 132.8 (*quat-C*), 131.9 ($=\text{CH}$), 130.8 ($=\text{CH}$), 130.2 ($=\text{CH}$), 129.5 ($=\text{CH}$), 128.9 ($=\text{CH}$), 128.7 ($=\text{CH}$), 127.9 (*quat-C*), 65.3 (OCH_2).

$\nu_{\text{max}}(\text{KBr})/\text{cm}^{-1}$ 3240, 3073, 2925, 1731, 1699, 1421, 1305, 1267, 1128, 1068, 756.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{18}\text{O}_8\text{Na}$ ($\text{M}+\text{Na}$) $^{+}$: 457.0899, Found 457.0893.

Compound 3d: Anhydride **1b** (1.54 g, 10.0 mmol), *cis*-2-butene-1,4-diol (0.44 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3d** (1.90 g, 96%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 11.26 (broad s, 2H, OH), 5.80-5.73 (m, 2H, =CH), 4.77-4.59 (m, 4H, OCH_2), 3.03-2.74 (m, 4H, CH), 2.17-1.46 (m, 16H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 180.6 (C=O), 180.5 (C=O), 172.9 (C=O), 127.9(=CH), 59.4 (OCH_2), 42.7 (CH), 42.4 (CH), 42.3 (CH), 26.7 (CH_2), 26.5 (CH_2), 25.7 (CH_2), 25.4 (CH_2), 23.9 (CH_2), 23.8 (CH_2), 23.3 (CH_2), 23.1 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3433, 3021, 2936, 2857, 1727, 1696, 1451, 1311, 1210, 1176.

HRMS (ESI+) calcd for $\text{C}_{20}\text{H}_{28}\text{O}_8\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 419.1682, Found 419.1682.

Compound 3e: Anhydride **1b** (1.54 g, 10.0 mmol), tri(ethylene glycol) (0.75 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3e** (2.15 g, 94%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 10.33 (broad s, 2H, OH), 4.39-4.05 (m, 4H, OCH_2), 3.71-3.59 (m, 8H, OCH_2), 3.21-2.65 (m, 4H, CH), 2.04-1.44 (m, 16H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 179.7 (C=O), 179.3 (C=O), 173.4 (C=O), 173.3(C=O), 70.2 (OCH_2), 70.1 (OCH_2), 69.0 (OCH_2), 63.3 (OCH_2), 42.3 (CH), 26.5 (CH_2), 26.2 (CH_2), 26.1 (CH_2), 25.6 (CH_2), 23.8 (CH_2), 23.7 (CH_2), 23.5(CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3426, 3021, 2942, 2863, 1729, 1710, 1452, 1248, 1217, 758.

HRMS (ESI+) calcd for $C_{22}H_{34}O_{10}Na$ ($M+Na$)⁺: 481.2050, Found 481.2040

Compound 3f: Anhydride **1b** (1.54 g, 10.0 mmol), tetra(ethylene glycol) (0.97 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3f** (2.51g, 98%) as a colorless thick oil.

1H NMR ($CDCl_3$, 200 MHz) δ 10.42 (broad s, 2H, OH), 4.32-4.16 (t, 4H, OCH_2), 3.66 (m, 12H, OCH_2), 2.87 (m, 4H, CH), 2.17-1.45 (m, 16H, CH_2).

^{13}C NMR ($CDCl_3$, 50.3 MHz) δ 178.3 ($C=O$), 173.3 ($C=O$), 70.5 (OCH_2), 70.1(OCH_2), 68.8 (OCH_2), 63.3 (OCH_2), 42.3 (CH), 26.1 (CH_2), 25.9 (CH_2), 23.6 (CH_2), 23.4 (CH_2).

$\nu_{max}(\text{neat})/\text{cm}^{-1}$ 3442, 3016, 2949, 2864, 1728, 1697, 1452, 1337, 1219, 1098.

HRMS (ESI+) calcd for $C_{24}H_{38}O_{11}Na$ ($M+Na$)⁺: 525.2312, Found 525.2310.

Compound 3g: Anhydride **1c** (1.68 g, 10.0 mmol), tri(ethylene glycol) (0.75 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3g** as a mixture of regioisomers (2.30 g, 96%) in the ratio of 52:48 as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 8.99 (broad s, 2H, OH), 4.40-4.08 (m, 4H, OCH_2), 3.70-3.56 (m, 8H, OCH_2), 3.33-3.28 (m, 4H, CH), 2.48-0.89 (m, 20H, CH and CH_2).

Selected signal for isomer 1:

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 178.7 (C=O), 173.6 (C=O), 70.1 (OCH_2), 68.9 (OCH_2), 63.3 (OCH_2), 43.2 (CH), 42.8 (CH), 41.7 (CH), 40.9 (CH), 36.2 (CH_2), 33.7 (CH_2), 32.2 (CH_2), 31.9 (CH), 30.5 (CH_2), 28.0 (CH_2), 23.8 (CH_2), 22.1 (CH_3).

Selected signal for isomer 2:

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 178.9 (C=O), 173.4 (C=O), 70.1 (OCH_2), 68.9 (OCH_2), 63.3 (OCH_2), 43.2 (CH), 42.7 (CH), 42.4 (CH), 41.6 (CH), 40.8 (CH), 36.0 (CH_2), 33.6 (CH_2), 32.1 (CH_2), 31.9 (CH), 30.7 (CH_2), 27.9 (CH_2), 23.7 (CH_2), 21.8 (CH_3), 21.7 (CH_3).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3442, 3057, 2953, 2872, 1730, 1712, 1454, 1267, 1111, 1063, 740.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{38}\text{O}_{10}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 509.2363, Found 509.2383.

Compound 3h: Anhydride **1d** (0.98 g, 10.0 mmol), tetra(ethylene glycol) (0.97 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3h** (1.40 g, 72%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 10.35 (broad s, 2H, OH), 6.31 (d, 2H, =CH, J = 12 Hz), 6.22 (d, 2H, =CH, J = 12 Hz), 4.28 (t, 4H, OCH_2), 3.62 (s, 12H, OCH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 166.5 (C=O), 165.5 (C=O), 131.9 (=CH), 128.7 (=CH), 70.1 (OCH_2), 69.7 (OCH_2), 68.1 (OCH_2), 64.3 (OCH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3441, 2926, 1713, 1647, 1454, 1255, 1036, 821.

HRMS (ESI+) calcd for $C_{16}H_{22}O_{11}Na$ ($M+Na$)⁺: 413.1060, Found 413.1053.

Compound 3i: Anhydride **1e** (1.52 g, 10.0 mmol), butyne-1,4-diol (0.43 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3i** (1.87 g, 96%) as a colorless thick oil.

¹H NMR (CDCl₃, 200 MHz) δ 11.61 (broad s, 2H, OH), 5.68 (s, 4H, =CH), 4.72 (s, 4H, OCH₂), 3.25-3.02 (m, 4H, CH), 2.61-2.30 (m, 8H, CH₂).

¹³C NMR (CDCl₃, 50.3 MHz) δ 178.9 (C=O), 171.9 (C=O), 124.7 (=CH), 80.0 (quat-C), 52.2 (OCH₂), 39.6 (CH), 39.5 (CH), 39.3 (CH), 25.8 (CH₂), 25.7 (CH₂), 24.9 (CH₂), 24.7 (CH₂).

$\nu_{\max}$ (neat)/cm⁻¹ 3426, 3032, 2932, 1747, 1706, 1432, 1351, 1291, 1267, 1171, 1154.

HRMS (ESI+) calcd for $C_{20}H_{22}O_8 Na$ ($M+Na$)⁺: 413.1212, Found 413.1212.

Compound 3j: Anhydride **1e** (1.52 g, 10.0 mmol), cis-2-butene-1,4-diol (0.44 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3j** (1.92 g, 98%) as a white solid; mp:108-110 °C.

¹H NMR (CDCl₃, 200 MHz) δ 11.45 (broad s, 2H, OH), 5.74-5.69 (m, 6H, =CH), 4.65 (d, 4H, OCH₂), 3.16-2.99 (m, 4H, CH), 2.67-2.31 (m, 8H, CH₂).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 180.0 (C=O), 172.7 (C=O), 128.0 (=CH), 125.1 (=CH), 125.0 (=CH), 59.7 (OCH_2), 39.7 (CH), 26.0 (CH_2), 25.0 (CH_2).

$\nu_{\text{max}}(\text{KBr})/\text{cm}^{-1}$ 3450, 3035, 2975, 2892, 1735, 1694, 1414, 1299, 1264, 1182, 1151, 949.

HRMS (ESI+) calcd for $\text{C}_{20}\text{H}_{24}\text{O}_8\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 415.1369, Found 415.1372.

Compound 3k: Anhydride **1e** (1.52 g, 10.0 mmol), di(ethylene glycol) (0.53 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3k** (1.92 g, 94%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 11.72 (broad s, 2H, OH), 5.68 (s, 4H, =CH), 4.33-4.14 (m, 4H, OCH_2), 3.74-3.57 (m, 4H, OCH_2), 3.26-3.19 (m, 2H, CH), 3.07-2.94 (m, 2H, CH), 2.69-2.30 (m, 8H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 180.4 (C=O), 180.0 (C=O), 172.9 (C=O), 172.8 (C=O), 125.3 (=CH), 125.2 (=CH), 124.8 (=CH), 69.2 (OCH_2), 69.1 (OCH_2), 64.4 (OCH_2), 64.3 (OCH_2), 39.9 (CH), 39.6 (CH), 26.4 (CH_2), 26.1 (CH_2), 24.9 (CH_2), 24.6 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3476, 3032, 2919, 1745, 1713, 1441, 1345, 1257, 1038, 947.

HRMS (ESI+) calcd for $\text{C}_{20}\text{H}_{26}\text{O}_9\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 433.1475, Found 433.1460.

Compound 3l: Anhydride **1e** (1.52 g, 10.0 mmol), tri(ethylene glycol) (0.75 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3l** (2.20 g, 97%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 10.11 (broad s, 2H, OH), 5.67 (s, 4H, =CH), 4.26-4.24 (m, 4H, OCH_2), 3.71-3.67 (m, 4H, OCH_2), 3.64 (s, 4H, OCH_2), 3.09 (m, 4H, CH), 2.61-2.30 (m, 8H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 177.9 (C=O), 172.7 (C=O), 124.6 (=CH), 69.8 (OCH_2), 68.5 (OCH_2), 63.2 (OCH_2), 39.0 (CH), 25.2 (CH_2), 25.0 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3478, 3030, 2920, 1729, 1713, 1697, 1440, 1348, 1296, 1098, 1042.

MS (ES+, 4.53 eV): m/z (%) 472 ($\text{M}^+ + \text{Na}$, 100), 455 (18), 437(14), 303 (6), 285 (24).

HRMS (ESI+) calcd for $\text{C}_{22}\text{H}_{30}\text{O}_{10}\text{Na}$ ($\text{M} + \text{Na}$) $^+$: 477.1737, Found 477.1737.

Compound 3m: Anhydride **1e** (1.52 g, 10.0 mmol), tetra(ethylene glycol) (0.97 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3m** (2.49 g, 99%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 9.62 (broad s, 2H, OH), 5.61 (s, 4H, =CH), 4.22-4.16 (t, 4H, OCH_2), 3.63 (m, 12H, OCH_2), 3.02 (m, 4H, CH), 2.56-2.23 (m, 8H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 177.4 (C=O), 172.8 (C=O), 124.9 (=CH), 70.3 (OCH_2), 70.0 (OCH_2), 68.6 (OCH_2), 63.5 (OCH_2), 39.3 (CH), 25.6 (CH_2), 25.3 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3442, 3030, 2952, 1730, 1714, 1695, 1442, 1392, 1301, 1230, 1040, 946.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{34}\text{O}_{11}\text{Na}$ ($\text{M} + \text{Na}$) $^+$: 521.1999, Found 521.1999.

Compound 3n: Anhydride **1f** (1.64 g, 10.0 mmol), tetra(ethylene glycol) (0.97 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3n** (2.34 g, 90%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 7.03 (broad s, 2H, COOH), 6.40-6.33 (m, 2H, =CH), 6.25-6.17 (m, 2H, =CH), 4.34-4.20 (m, 2H, OCH_2), 4.11-4.04 (m, 2H, OCH_2), 3.69-3.64 (m, 12H, OCH_2), 3.33 (s, 4H, CH_2), 3.17 (s, 4H, CH), 1.48 (d, 2H, CH, $J = 8$ Hz), 1.34 (d, 2H, CH, $J = 8$ Hz).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 176.1 ($\text{C}=\text{O}$), 172.4 ($\text{C}=\text{O}$), 135.5 (=CH), 134.2 (=CH), 70.6 (OCH_2), 69.8 (OCH_2), 68.8 (OCH_2), 63.3 (OCH_2), 48.8 (CH_2), 47.9 (CH), 46.5 (CH), 45.9 (CH).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3428, 3057, 2984, 2948, 2877, 1737, 1704, 1421, 1341, 1265, 1188.

HRMS (ESI+) calcd for $\text{C}_{26}\text{H}_{34}\text{O}_{11}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 545.1999, Found 545.2002.

Compound 3o: Anhydride **1g** (1.66 g, 10.0 mmol), di(ethylene glycol) (0.53 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3o** (1.92 g, 88%) as a white solid; mp: 128-130 °C.

^1H NMR (CDCl_3 , 200 MHz) δ 11.13 (broad s, 2H, OH), 6.49 (s, 4H, =CH), 5.49 (s, 2H, OCH), 5.14 (s, 2H, OCH), 4.17-4.13 (m, 4H, OCH_2), 3.72-3.54 (m, 4H, OCH_2), 2.94 (d, 2H, CH, $J = 8$ Hz), 2.79 (d, 2H, CH, $J = 8$ Hz).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 179.3 (C=O), 170.9 (C=O), 136.6 (=CH), 136.5 (=CH), 81.4 (OCH), 79.3 (OCH), 68.2 (OCH_2), 64.7 (OCH_2), 47.2 (CH), 46.3 (CH).

$\nu_{\text{max}}(\text{KBr})/\text{cm}^{-1}$ 3454, 3098, 3015, 2951, 1736, 1693, 1427, 1340, 1210, 1190, 1051.

HRMS (ESI+) calcd for $\text{C}_{20}\text{H}_{22}\text{O}_{11}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 461.1060, Found 461.1053.

Compound 3p: Anhydride **1g** (1.66 g, 10.0 mmol), tetra(ethylene glycol) (0.97 g, 5.0 mmol) and triethylamine (2.1 mL, 15.0 mmol) were allowed to react in dry DCM or benzene according to method A to afford the dicarboxylic acid **3p** (2.23 g, 85%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 7.36 (broad s, 2H, OH), 6.39 (s, 4H, =CH), 5.22 (s, 2H, OCH), 5.15 (s, 2H, OCH), 4.32-4.05 (m, 4H, OCH_2), 3.65-3.53 (m, 12H, OCH_2), 2.77 (s, 4H, CH).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 173.9 (C=O), 171.3 (C=O), 136.5 (=CH), 136.2 (=CH), 80.4 (OCH), 79.8 (OCH), 70.4 (OCH_2), 69.4 (OCH_2), 68.5 (OCH_2), 63.8 (OCH_2), 46.9 (CH), 46.5 (CH).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3455, 2885, 1741, 1641, 1344, 1306, 1247, 1191, 1051.

HRMS (ESI+) calcd for $C_{24}H_{30}O_{13}Na$ ($M+Na$)⁺: 549.1584, Found 549.1596.

Tetralactone 5a: Dicarboxylic acid **3a** (1.22 g, 2.5 mmol), tetra(ethylene glycol) (0.48 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5a** (0.98 g, 61%) as a colorless thick oil.

1H NMR ($CDCl_3$, 200 MHz) δ 7.77-7.70 (m, 4H, Arom-*H*), 7.51-7.49 (m, 4H, Arom-*H*), 4.44 (t, 8H, OCH_2), 3.87 (t, 8H, OCH_2), 3.70 (s, 16H, OCH_2).

^{13}C NMR ($CDCl_3$, 50.3 MHz) δ 167.8 ($C=O$), 131.8 (*quat-C*), 131.0 ($=CH$), 128.9 ($=CH$), 70.2 (OCH_2), 69.8 (OCH_2), 68.7 (OCH_2), 61.2 (OCH_2).

$\nu_{max}(\text{neat})/cm^{-1}$ 3023, 2933, 1734, 1655, 1442, 1376, 1298, 1218, 1046.

HRMS (ESI+) calcd for $C_{32}H_{40}O_{14}Na$ ($M+Na$)⁺: 671.2316, Found 671.2322.

Tetralactone 5b: Dicarboxylic acid **3b** (1.11 g, 2.5 mmol), tri(ethylene glycol) (0.37 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5b** (0.75 g, 54%) as a colorless thick oil. (Small amount of side product dicyclohexyl urea was observed in the 1H and ^{13}C NMR and indicated as X in the spectra)

^1H NMR (CDCl_3 , 200 MHz) δ 7.71-7.70 (m, 4H, Arom-*H*), 7.53-7.50 (m, 4H, Arom-*H*), 4.43 (t, 8H, OCH_2), 3.77 (t, 8H, OCH_2), 3.65 (s, 8H, OCH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 167.1 ($\text{C}=\text{O}$), 131.6 (*quat-C*), 130.9 ($=\text{CH}$), 128.6 ($=\text{CH}$), 70.2 (OCH_2), 68.6 (OCH_2), 64.4 (OCH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 2875, 1728, 1652, 1486, 1450, 1375, 1289, 1116, 1075.

HRMS (ESI+) calcd for $\text{C}_{28}\text{H}_{32}\text{O}_{12}\text{Na}$ ($\text{M}+\text{Na}$) $^{+}$: 583.1791, Found 583.1798.

Tetralactone 5c: Dicarboxylic acid **3a** (1.22 g, 2.5 mmol), tri(ethylene glycol) (0.37 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5c** (0.82 g, 55%) as a colorless thick oil. (Small amount of side product dicyclohexyl urea was observed in the ^1H and ^{13}C NMR and indicated as X in the spectra)

^1H NMR (CDCl_3 , 200 MHz) δ 7.72 (m, 4H, Arom-*H*), 7.53-7.52 (m, 4H, Arom-*H*), 4.44 (t, 8H, OCH_2), 3.78 (t, 8H, OCH_2), 3.63 (s, 12H, OCH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 167.2 ($\text{C}=\text{O}$), 131.7 (*quat-C*), 130.9 ($=\text{CH}$), 128.7 ($=\text{CH}$), 70.3 (OCH_2), 68.7 (OCH_2), 64.5 (OCH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 2876, 1731, 1651, 1450, 1369, 1296, 1120, 1075.

HRMS (ESI+) calcd for $\text{C}_{30}\text{H}_{36}\text{O}_{13}\text{Na}$ ($\text{M}+\text{Na}$)⁺: 627.2054, Found 627.2069.

Tetralactone 5d: Dicarboxylic acid **3c** (1.0 g, 2.5 mmol), hexane-1,6-diol (0.29 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (Hexane:EtOAc) to afford the tetralactone **5d** (0.72 g, 61%) as a white solid; mp: 130-132 °C.

^1H NMR (CDCl_3 , 200 MHz) δ 7.73-7.26 (m, 12H, Arom-*H*), 5.49 (s, 4H, OCH_2), 4.29 (t, 4H, OCH_2), 1.69 (m, 4H, CH_2), 1.44 (m, 4H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 167.8 ($\text{C}=\text{O}$), 166.9 ($\text{C}=\text{O}$), 134.0 (*quat-C*), 132.6 (*quat-C*), 131.2 ($=\text{CH}$), 130.8 ($=\text{CH}$), 129.3 ($=\text{CH}$), 128.9 ($=\text{CH}$), 128.7 ($=\text{CH}$), 65.6 (OCH_2), 64.3 (OCH_2), 27.9 (CH_2), 25.1 (CH_2).

$\nu_{\text{max}}(\text{KBr})/\text{cm}^{-1}$ 2938, 1727, 1599, 1451, 1375, 1272, 1123, 1074, 748.

HRMS (ESI+) calcd for $C_{30}H_{28}O_8Na$ ($M+Na$)⁺: 539.1682, Found 539.1671.

Tetralactone 5e: Dicarboxylic acid **3e** (1.14 g, 2.5 mmol), cis-2-butene-1,4-diol (0.22 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5e** (0.81 g, 64%) as a colorless thick oil.

¹H NMR (CDCl₃, 200 MHz) δ 5.87-5.85 (m, 2H, =CH), 4.72-4.50 (m, 4H, OCH₂), 4.38-4.09 (m, 4H, OCH₂), 3.66 (t, 4H, OCH₂), 3.61 (s, 4H, OCH₂), 2.88 (m, 4H, CH), 1.97-1.26 (m, 16H, CH₂).

¹³C NMR (CDCl₃, 50.3 MHz) δ 173.3 (C=O), 173.0 (C=O), 127.8 (=CH), 70.4 (OCH₂), 69.0 (OCH₂), 63.8 (OCH₂), 63.5 (OCH₂), 42.6 (CH), 42.4 (CH), 26.1 (CH₂), 23.6 (CH₂), 23.4 (CH₂).

$\nu_{\max}$ (neat)/cm⁻¹ 2942, 2862, 1730, 1451, 1338, 1302, 1191, 1034, 973, 736.

HRMS (ESI+) calcd for $C_{26}H_{38}O_{10}Na$ ($M+Na$)⁺: 533.2363, Found 533.2346.

Tetralactone 5f: Dicarboxylic acid **3e** (1.14 g, 2.5 mmol), tri(ethylene glycol) (0.37 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5f** (0.96 g, 68%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 4.26-4.10 (m, 8H, OCH_2), 3.69-3.65 (t, 8H, OCH_2), 3.63 (s, 8H, OCH_2), 2.89-2.85 (t, 4H, CH), 2.04-1.20 (m, 16H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 173.4 (C=O), 70.4 (OCH_2), 69.0 (OCH_2), 63.3 (OCH_2), 42.4 (CH), 26.1 (CH_2), 23.6 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3056, 2931, 2859, 1727, 1657, 1451, 1349, 1193, 1045, 735.

HRMS (ESI+) calcd for $\text{C}_{28}\text{H}_{44}\text{O}_{12}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 595.2730, Found 595.2718.

Tetralactone 5g: Dicarboxylic acid **3e** (1.14 g, 2.5 mmol), tetra(ethylene glycol) (0.48 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5g** (0.89 g, 58%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 4.29-4.19 (m, 8H, OCH_2), 3.70-3.60 (m, 20H, OCH_2), 2.88-2.86 (m, 4H, CH), 2.04-1.26 (m, 16H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 173.3 ($\text{C}=\text{O}$), 70.3 (OCH_2), 68.9 (OCH_2), 63.3 (OCH_2), 63.2 (OCH_2), 42.3 (CH), 25.9 (CH_2), 23.4 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 2939, 2854, 1730, 1452, 1386, 1195, 1128, 1045.

HRMS (ESI+) calcd for $\text{C}_{30}\text{H}_{48}\text{O}_{13}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 639.2993, Found 639.2990.

Tetralactone 5h: Dicarboxylic acid **3i** (1.0 g, 2.5 mmol), cis-2-butene-1,4-diol (0.22 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (Hexane:EtOAc) to afford the tetralactone **5h** (0.68 g, 60%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 5.89-5.80 (m, 2H, $=\text{CH}$), 5.69 (s, 4H, $=\text{CH}$), 4.86-4.63 (m, 4H, OCH_2), 4.58 (s, 4H, OCH_2), 3.17-3.12 (m, 4H, CH), 2.58-2.31 (m, 8H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 172.5 ($\text{C}=\text{O}$), 172.2 ($\text{C}=\text{O}$), 127.5 ($=\text{CH}$), 125.0 ($=\text{CH}$), 80.7 ($\equiv\text{C}$), 64.0 (OCH_2), 52.2 (OCH_2), 39.8 (CH), 25.6 (CH_2), 25.5 (CH_2), 25.4 (CH_2), 25.3 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3033, 2932, 1730, 1439, 1377, 1185, 1032, 736.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{26}\text{O}_8\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 465.1525, Found 465.1535.

Tetralactone 5i: Dicarboxylic acid **3j** (1.0 g, 2.5 mmol), tri(ethylene glycol) (0.37 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5i** (0.77 g, 60%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 5.71 (m, 2H, =CH), 5.66 (s, 4H, =CH), 4.69-4.67 (m, 4H, OCH_2), 4.23 (t, 4H, OCH_2), 3.66 (t, 4H, OCH_2), 3.62 (s, 4H, OCH_2), 3.06 (m, 4H, CH), 2.60-2.29 (m, 8H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 172.5 (C=O), 172.2 (C=O), 127.7 (=CH), 127.5 (=CH), 124.9 (=CH), 124.6 (=CH), 70.0 (OCH_2), 69.8 (OCH_2), 68.5 (OCH_2), 63.4 (OCH_2), 63.1 (OCH_2), 59.7 (OCH_2), 39.1 (CH), 25.6 (CH_2), 25.2 (CH_2), 24.9 (CH_2).

$\nu_{\text{max}}(\text{KBr})/\text{cm}^{-1}$ 3055, 2986, 2936, 1733, 1438, 1265, 1194, 948, 736.

HRMS (ESI+) calcd for $\text{C}_{26}\text{H}_{34}\text{O}_{10}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 529.2050, Found 529.2035.

Tetralactone 5j: Dicarboxylic acid **3j** (0.98 g, 2.5 mmol), tetra(ethylene glycol) (0.48 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5j** (0.89 g, 65%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 5.86 (m, 2H, =CH), 5.68 (s, 4H, =CH), 4.73-4.63 (m, 4H, OCH_2), 4.23-4.14 (m, 4H, OCH_2), 3.67-3.63 (m, 12H, OCH_2), 3.09 (m, 4H, CH), 2.49-2.20 (m, 8H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 172.8 (C=O), 172.5 (C=O), 127.8 (=CH), 124.9 (=CH), 124.8 (=CH), 70.5 (OCH_2), 70.3 (OCH_2), 68.8 (OCH_2), 63.9 (OCH_2), 63.6 (OCH_2), 39.7 (CH), 39.6 (CH), 25.6 (CH_2), 25.4 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3031, 2896, 1733, 1440, 1350, 1295, 1192, 1248, 950, 734.

HRMS (ESI+) calcd for $\text{C}_{28}\text{H}_{38}\text{O}_{11}\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 573.2312, Found 573. 2301.

Tetralactone 5k: Dicarboxylic acid **3j** (1.0 g, 2.5 mmol), butane-1,4-diol (0.23 g, 5.0 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (Hexane:EtOAc) to afford the tetralactone **5k** (0.75 g, 66%) as a white solid; mp: 159-161 $^{\circ}\text{C}$.

^1H NMR (CDCl_3 , 200 MHz) δ 5.78-5.74 (m, 2H, =CH), 5.68 (s, 4H, =CH), 4.78-4.59 (m, 4H, OCH_2), 4.19-3.98 (m, 4H, OCH_2), 3.11-3.07 (m, 4H, CH), 2.57-2.28 (m, 8H, CH_2), 1.65 (t, 4H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 172.9 (C=O), 172.7 (C=O), 128.1 (=CH), 125.1 (=CH), 124.9 (=CH), 64.4 (OCH_2), 60.0 (OCH_2), 39.9 (CH), 25.8 (CH_2), 25.6 (CH_2), 25.2 (CH_2), 25.1 (CH_2).

$\nu_{\text{max}}(\text{KBr})/\text{cm}^{-1}$ 3441, 3035, 2970, 2923, 2899, 1730, 1350, 1299, 1254, 1198, 1156, 1035, 958.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{30}\text{O}_8\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 469.1838, Found 469.1830.

Tetralactone 5l: Dicarboxylic acid **3j** (1.0 g, 2.5 mmol), 1,2-benzenedimethanol (0.35 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (Hexane:EtOAc) to afford the tetralactone **5l** (0.73 g, 58%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 7.31 (s, 4H, Arom-*H*), 5.68 (s, 6H, =*CH*), 5.19 (s, 4H, *OCH*₂), 4.67-4.50 (m, 4H, *OCH*₂), 3.16-3.04 (m, 4H, *CH*), 2.62-2.27 (m, 8H, *CH*₂).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 172.9 (*C=O*), 172.5 (*C=O*), 134.3 (*quat-C*), 129.4 (=CH), 128.5 (=CH), 128.0 (=CH), 125.0 (=CH), 124.8 (=CH), 63.9 (*OCH*₂), 59.6 (*OCH*₂), 39.9 (*CH*), 25.8 (*CH*₂), 25.2 (*CH*₂).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 3055, 3034, 2932, 2853, 1734, 1439, 1376, 1266, 1189, 1034, 740.

HRMS (ESI+) calcd for $\text{C}_{28}\text{H}_{30}\text{O}_8\text{Na}$ (*M*+*Na*)⁺: 517.1838, Found 517.1835.

Tetralactone 5m: Dicarboxylic acid **3l** (1.13 g, 2.5 mmol), tri(ethylene glycol) (0.37 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5m** (0.79 g, 56%) as a colorless thick oil.

^1H NMR ($\text{DMSO}-d_6$, 200 MHz) δ 5.61 (s, 4H, =*CH*), 4.20-4.01 (m, 8H, *OCH*₂), 3.60-3.52 (m, 16H, *OCH*₂), 3.05 (m, 4H, *CH*), 2.60-2.31 (m, 8H, *CH*₂).

^{13}C NMR (DMSO- d_6 , 50.3 MHz) δ 172.5 (C=O), 125.0 (=CH), 69.8 (OCH₂), 68.3 (OCH₂), 63.4 (OCH₂), 38.9 (CH), 25.3 (CH₂).

ν_{max} (neat)/cm⁻¹ 3021, 2930, 1731, 1656, 1441, 1376, 1296, 1218, 1046.

HRMS (ESI+) calcd for C₂₈H₄₀O₁₂Na (M+Na)⁺: 591.2417, Found 591.2417.

Tetralactone 5n: Dicarboxylic acid **3l** (1.13 g, 2.5 mmol), cis-2-butene-1,4-diol (0.22 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5n** (0.90 g, 72%) as a colorless thick oil.

^1H NMR (CDCl₃, 200 MHz) δ 5.72 (s, 2H, =CH), 5.66 (s, 4H, =CH), 4.69 (m, 4H, OCH₂), 4.23 (m, 4H, OCH₂), 3.66-3.62 (m, 8H, OCH₂), 3.06 (m, 4H, CH), 2.60-2.31 (m, 8H, CH₂).

^{13}C NMR (CDCl₃, 50.3 MHz) δ 172.5 (C=O), 172.2 (C=O), 127.7 (=CH), 127.5 (=CH), 124.9 (=CH), 124.6 (=CH), 70.0 (OCH₂), 69.8 (OCH₂), 68.5 (OCH₂), 63.4 (OCH₂), 63.1 (OCH₂), 59.7 (OCH₂), 39.1 (CH), 25.6 (CH₂), 25.2 (CH₂), 24.9 (CH₂).

ν_{max} (neat)/cm⁻¹ 3055, 2986, 2936, 1733, 1438, 1265, 1194, 948, 736.

HRMS (ESI+) calcd for C₂₆H₃₄O₁₀Na (M+Na)⁺: 529.2050, Found 529.2045.

Tetralactone 5o: Dicarboxylic acid **3n** (1.3 g, 2.5 mmol), tetra(ethylene glycol) (0.48 g, 2.5 mmol), DCC (1.57 g, 7.5 mmol) and a catalytic amount of DMAP were allowed to react in dry DCM according to method B followed by silica gel (100-200 mesh) column purification (EtOAc:MeOH) to afford the tetralactone **5o** (0.94 g, 56%) as a colorless thick oil.

¹H NMR (CDCl₃, 200 MHz) δ 6.24 (s, 4H, =CH), 4.25-4.05 (m, 8H, OCH₂), 3.64 (s, 24H, OCH₂), 3.32 (s, 4H, CH₂), 3.17 (s, 4H, CH), 3.01 (s, 4H, CH).

¹³C NMR (CDCl₃, 50.3 MHz) δ 172.0 (C=O), 134.5 (=CH), 70.2 (OCH₂), 68.7 (OCH₂), 63.1 (OCH₂), 48.2 (CH₂), 47.7 (CH), 46.0 (OCH).

ν_{max} (neat)/cm⁻¹ 3023, 2933, 1734, 1655, 1442, 1376, 1298, 1218, 1046.

HRMS (ESI+) calcd for C₃₄H₄₈O₁₄Na (M+Na)⁺: 703.2942, Found 703.2975.

Tetralactone 6: Tetralactone **5j** (0.25 g, 0.44 mmol) and 5% Pd-C (10 mg) are allowed to stir in methanol-EtOAc (15:5 mL) under hydrogen atmosphere at room temperature for 8 hrs. The reaction mixture was filtered through celite bed, washed with ethyl acetate and the solvent evaporated under reduced pressure to afford the pure (No column chromatographic purification required) tetralactone **6** (247 mg, 98%) as a colorless thick oil.

¹H NMR (CDCl₃, 200 MHz) δ 4.26-3.93 (m, 8H, OCH₂), 3.63-3.56 (m, 12H, OCH₂), 2.78 (m, 4H, CH), 2.11-1.19 (m, 20H, CH₂).

¹³C NMR (CDCl₃, 50.3 MHz) δ 173.4 (C=O), 70.6 (OCH₂), 70.5 (OCH₂), 69.0 (OCH₂), 63.8 (OCH₂), 63.6 (OCH₂), 42.6 (CH), 42.4 (CH), 26.2 (CH₂), 25.2 (CH₂), 23.6 (CH₂).

ν_{max} (neat)/cm⁻¹ 2927, 1730, 1451, 1350, 1303, 1046, 945.

HRMS (ESI+) calcd for C₂₈H₄₄O₁₁Na (M+Na)⁺: 579.2781, Found 579.2761.

Tetralactone 7: Tetralactone **5h** (0.25 g, 0.56 mmol) and 5% Pd-C (10 mg) are allowed to stir in methanol-EtOAc (15:5 mL) under hydrogen atmosphere at room temperature for overnight. The reaction mixture was filtered through celite bed, washed with ethyl acetate and the solvent evaporated under reduced pressure to afford the pure (No column chromatographic purification required) tetralactone **7** (253 mg, 99%) as a colorless thick oil.

^1H NMR (CDCl_3 , 200 MHz) δ 4.14-4.02 (m, 8H, OCH_2), 2.84 (m, 4H, CH), 1.96-1.44 (m, 16H, CH_2).

^{13}C NMR (CDCl_3 , 50.3 MHz) δ 173.5 ($\text{C}=\text{O}$), 64.0 (OCH_2), 42.6 (CH), 26.3 (CH_2), 25.2 (CH_2), 23.6 (CH_2).

$\nu_{\text{max}}(\text{neat})/\text{cm}^{-1}$ 2931, 1725, 1450, 1181, 1035, 733.

HRMS (ESI+) calcd for $\text{C}_{24}\text{H}_{36}\text{O}_8\text{Na}$ ($\text{M}+\text{Na}$) $^+$: 475.2308, Found 475.2324.

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X-ray data for the tetralactone **5k**

Table S1. Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for tetralactone (**5k**). $U(\text{eq})$ is defined as one third of the trace of the orthogonalized U_{ij} tensor.

Atom	x	y	z	U(eq)
O(1)	9997(4)	7564(6)	10364(4)	37(2)
O(2)	8990(4)	9238(6)	10695(3)	36(2)
O(3)	6024(4)	9037(5)	9405(3)	33(1)
O(4)	5018(4)	7476(6)	9878(4)	36(2)
O(5)	6670(10)	5371(14)	7746(9)	50(4)
O(5A)	6636(10)	5732(15)	7388(10)	44(4)
O(6)	6392(11)	5996(15)	9015(10)	47(4)
O(6A)	6549(11)	6070(15)	8713(13)	43(4)
O(7)	8340(5)	6561(6)	11357(4)	46(2)
O(8)	8333(5)	5990(7)	12662(4)	51(2)
C(1)	9138(7)	8052(8)	12297(5)	38(2)
C(2)	9536(8)	8180(9)	13203(6)	53(3)
C(3)	10482(7)	7376(9)	13371(6)	47(2)
C(4)	11035(7)	6940(9)	12820(6)	43(2)
C(5)	10812(7)	7198(9)	11947(5)	40(2)
C(6)	10002(6)	8229(8)	11759(5)	32(2)
C(7)	9667(6)	8267(8)	10866(5)	29(2)
C(8)	8598(7)	9324(10)	9842(6)	47(3)
C(9)	7934(7)	10542(11)	9788(7)	58(3)
C(10)	7038(7)	10570(10)	10173(6)	51(3)
C(11)	6434(6)	9330(9)	10220(5)	37(2)
C(12)	5335(5)	8036(8)	9317(5)	28(2)
C(13)	4990(6)	7854(8)	8436(5)	28(2)
C(14)	4194(6)	6795(9)	8308(5)	33(2)
C(15)	3956(7)	6459(9)	7427(6)	38(2)
C(16)	4482(8)	6861(9)	6864(6)	47(3)
C(17)	5593(16)	7580(2)	7036(12)	37(6)
C(17A)	5272(16)	7830(2)	6953(12)	28(5)
C(18)	5853(7)	7603(9)	7882(6)	40(2)
C(19)	6357(13)	6450(2)	7912(14)	25(6)
C(19A)	6379(12)	6163(18)	8178(16)	25(5)
C(20)	6699(14)	4717(18)	9344(12)	44(4)
C(20A)	7130(17)	4810(2)	8868(14)	54(6)
C(21)	7832(12)	4756(17)	9555(10)	56(4)
C(21A)	7110(2)	4590(3)	9780(2)	51(7)
C(22)	8287(13)	4963(18)	10271(11)	62(4)
C(22A)	7760(3)	5670(4)	10160(2)	69(9)
C(23)	7821(8)	5339(11)	11086(7)	57(3)
C(24)	8571(6)	6742(9)	12146(6)	39(2)

Table S2. Bond lengths [$\text{\AA}$] and angles [$^\circ$] for tetralactone (**5k**).

O(1)-C(7)	1.198(10)	C(16)-H(16)	1.08(13)
O(2)-C(7)	1.338(9)	C(17)-C(18)	1.41(2)
O(2)-C(8)	1.466(11)	C(18)-C(19)	1.33(2)
O(3)-C(12)	1.357(9)	C(20)-C(21)	1.52(3)
O(3)-C(11)	1.440(10)	C(20A)-C(21)	1.41(3)
O(4)-C(12)	1.190(9)	C(20A)-C(21A)	1.53(4)
O(5)-C(19A)	1.15(2)	C(21)-C(22)	1.30(2)
O(5)-C(19)	1.20(2)	C(21)-C(22A)	1.36(4)
O(5A)-C(19)	1.21(2)	C(21A)-C(22A)	1.48(5)
O(5A)-C(19A)	1.44(3)	C(22)-C(23)	1.58(2)
O(6)-C(19A)	1.39(3)	C(22A)-C(23)	1.57(4)
O(6)-C(20)	1.43(2)	C(7)-O(2)-C(8)	115.2(7)
O(6)-C(20A)	1.57(3)	C(12)-O(3)-C(11)	116.8(6)
O(6A)-C(19)	1.38(3)	C(19)-O(5)-O(6A)	51.4(14)
O(6A)-C(20A)	1.49(3)	C(19A)-O(6)-C(20)	117.5(15)
O(7)-C(24)	1.327(11)	C(19A)-O(6)-C(20A)	83.8(14)
O(7)-C(23)	1.455(12)	C(20)-O(6)-C(19)	124.6(14)
O(8)-C(24)	1.200(10)	C(20A)-O(6)-C(19)	89.9(13)
C(1)-C(24)	1.521(13)	C(19A)-O(6A)-C(20A)	110(2)
C(1)-C(6)	1.522(12)	C(19)-O(6A)-C(20A)	116.8(18)
C(1)-C(2)	1.553(13)	C(19A)-O(6A)-C(20)	134(2)
C(1)-H(1)	0.9800	C(19)-O(6A)-C(20)	143.8(16)
C(2)-C(3)	1.502(14)	C(20A)-O(6A)-O(5)	74.7(12)
C(2)-H(2A)	0.9700	C(20)-O(6A)-O(5)	103.0(11)
C(2)-H(2B)	0.9700	C(24)-O(7)-C(23)	118.8(7)
C(3)-C(4)	1.295(13)	C(24)-C(1)-C(6)	113.2(7)
C(3)-H(3)	0.9300	C(24)-C(1)-C(2)	110.8(7)
C(4)-C(5)	1.472(13)	C(6)-C(1)-C(2)	109.8(8)
C(4)-H(4)	0.9300	C(24)-C(1)-H(1)	107.6
C(5)-C(6)	1.506(12)	C(6)-C(1)-H(1)	107.6
C(5)-H(5A)	0.9700	C(2)-C(1)-H(1)	107.6
C(5)-H(5B)	0.9700	C(3)-C(2)-C(1)	110.5(8)
C(6)-C(7)	1.508(12)	C(3)-C(2)-H(2A)	109.6
C(6)-H(6)	0.9800	C(1)-C(2)-H(2A)	109.6
C(8)-C(9)	1.503(13)	C(3)-C(2)-H(2B)	109.6
C(8)-H(8A)	0.9700	C(1)-C(2)-H(2B)	109.6
C(8)-H(8B)	0.9700	H(2A)-C(2)-H(2B)	108.1
C(9)-C(10)	1.400(14)	C(4)-C(3)-C(2)	124.6(9)
C(9)-H(9)	0.9300	C(4)-C(3)-H(3)	117.7
C(10)-C(11)	1.483(13)	C(2)-C(3)-H(3)	117.7
C(10)-H(10)	0.9300	C(3)-C(4)-C(5)	123.5(9)
C(11)-H(11A)	0.9700	C(3)-C(4)-H(4)	118.3
C(11)-H(11B)	0.9700	C(5)-C(4)-H(4)	118.3
C(12)-C(13)	1.502(11)	C(4)-C(5)-C(6)	113.8(8)
C(13)-C(14)	1.501(11)	C(4)-C(5)-H(5A)	108.8
C(13)-C(18)	1.551(12)	C(6)-C(5)-H(5A)	108.8
C(13)-H(13)	0.9800	C(4)-C(5)-H(5B)	108.8
C(14)-C(15)	1.506(12)	C(6)-C(5)-H(5B)	108.8
C(14)-H(14A)	0.9700	H(5A)-C(5)-H(5B)	107.7
C(14)-H(14B)	0.9700	C(5)-C(6)-C(7)	111.6(7)
C(15)-C(16)	1.277(13)	C(5)-C(6)-C(1)	111.5(7)
C(15)-H(15)	0.9300	C(7)-C(6)-C(1)	113.4(7)
C(16)-C(17A)	1.43(2)	C(5)-C(6)-H(6)	106.6

C(7)-C(6)-H(6)	106.6	C(17)-C(18)-C(19A)	110.0(13)
C(1)-C(6)-H(6)	106.6	C(13)-C(18)-C(19A)	106.4(10)
O(1)-C(7)-O(2)	124.0(8)	C(19)-C(18)-C(17A)	110.3(13)
O(1)-C(7)-C(6)	124.5(7)	C(13)-C(18)-C(17A)	102.1(9)
O(2)-C(7)-C(6)	111.4(7)	C(19A)-C(18)-C(17A)	122.8(12)
O(2)-C(8)-C(9)	105.4(8)	O(5)-C(19)-C(18)	163(2)
O(2)-C(8)-H(8A)	110.7	O(5A)-C(19)-C(18)	132(2)
C(9)-C(8)-H(8A)	110.7	O(5)-C(19)-O(6A)	86.0(18)
O(2)-C(8)-H(8B)	110.7	O(5A)-C(19)-O(6A)	119(2)
C(9)-C(8)-H(8B)	110.7	C(18)-C(19)-O(6A)	109.1(15)
H(8A)-C(8)-H(8B)	108.8	O(5)-C(19)-O(6)	91.3(17)
C(10)-C(9)-C(8)	120.7(8)	O(5A)-C(19)-O(6)	124.7(19)
C(10)-C(9)-H(9)	119.6	C(18)-C(19)-O(6)	102.6(13)
C(8)-C(9)-H(9)	119.6	O(5)-C(19)-C(17)	119.8(17)
C(9)-C(10)-C(11)	119.7(8)	O(5A)-C(19)-C(17)	89.0(16)
C(9)-C(10)-H(10)	120.1	C(18)-C(19)-C(17)	43.6(10)
C(11)-C(10)-H(10)	120.1	O(6A)-C(19)-C(17)	151.1(15)
O(3)-C(11)-C(10)	106.6(7)	O(6)-C(19)-C(17)	142.6(13)
O(3)-C(11)-H(11A)	110.4	O(6A)-C(19A)-O(5)	118(3)
C(10)-C(11)-H(11A)	110.4	O(5)-C(19A)-O(6)	124(2)
O(3)-C(11)-H(11B)	110.4	O(6A)-C(19A)-O(5A)	143(2)
C(10)-C(11)-H(11B)	110.4	O(6)-C(19A)-O(5A)	151.6(18)
H(11A)-C(11)-H(11B)	108.6	O(6A)-C(19A)-C(18)	116.5(19)
O(4)-C(12)-O(3)	122.9(8)	O(5)-C(19A)-C(18)	125(2)
O(4)-C(12)-C(13)	126.8(7)	O(6)-C(19A)-C(18)	111.6(12)
O(3)-C(12)-C(13)	110.1(7)	O(5A)-C(19A)-C(18)	96.7(17)
C(14)-C(13)-C(12)	112.2(7)	O(5)-C(19A)-C(20A)	73.1(15)
C(14)-C(13)-C(18)	110.8(6)	O(6)-C(19A)-C(20A)	52.0(12)
C(12)-C(13)-C(18)	114.2(7)	O(5A)-C(19A)-C(20A)	99.9(13)
C(14)-C(13)-H(13)	106.3	C(18)-C(19A)-C(20A)	160.4(15)
C(12)-C(13)-H(13)	106.3	C(21A)-C(20)-C(20A)	107(3)
C(18)-C(13)-H(13)	106.3	C(21A)-C(20)-O(6)	125(3)
C(13)-C(14)-C(15)	112.5(7)	O(6)-C(20)-C(21)	108.1(14)
C(13)-C(14)-H(14A)	109.1	C(21A)-C(20)-O(6A)	130(3)
C(15)-C(14)-H(14A)	109.1	C(21)-C(20)-O(6A)	100.6(13)
C(13)-C(14)-H(14B)	109.1	C(21)-C(20A)-O(6A)	118.1(19)
C(15)-C(14)-H(14B)	109.1	O(6A)-C(20A)-C(21A)	104(2)
H(14A)-C(14)-H(14B)	107.8	C(21)-C(20A)-O(6)	106.6(17)
C(16)-C(15)-C(14)	123.6(8)	C(21A)-C(20A)-O(6)	83.7(18)
C(16)-C(15)-H(15)	118.2	C(21)-C(20A)-C(19A)	139.2(18)
C(14)-C(15)-H(15)	118.2	C(21A)-C(20A)-C(19A)	127.9(19)
C(15)-C(16)-C(17A)	125.6(11)	C(22A)-C(21)-C(20A)	119(2)
C(15)-C(16)-C(17)	123.4(11)	C(22)-C(21)-C(20)	126.2(16)
C(15)-C(16)-H(16)	122(7)	C(22A)-C(21)-C(20)	93.3(19)
C(17A)-C(16)-H(16)	112(7)	C(20)-C(21A)-C(21)	102(3)
C(17)-C(16)-H(16)	114(7)	C(20)-C(21A)-C(22A)	123(4)
C(17A)-C(17)-C(18)	113(4)	C(22A)-C(21A)-C(20A)	105(2)
C(17A)-C(17)-C(16)	56(3)	C(20)-C(21A)-C(22)	146(3)
C(18)-C(17)-C(16)	108.8(13)	C(20A)-C(21A)-C(22)	110(2)
C(17A)-C(17)-C(19)	146(4)	C(21)-C(22)-C(23)	129.0(15)
C(18)-C(17)-C(19)	40.4(9)	C(23)-C(22)-C(21A)	92.4(14)
C(16)-C(17)-C(19)	105.8(12)	C(21)-C(22A)-C(23)	125(3)
C(16)-C(17A)-C(18)	106.4(12)	C(21A)-C(22A)-C(23)	104(3)
C(19)-C(18)-C(17)	96.0(14)	O(7)-C(23)-C(22A)	96.2(15))
C(19)-C(18)-C(13)	121.0(12)	O(7)-C(23)-C(22)	104.6(9)
C(17)-C(18)-C(13)	117.0(11)	O(8)-C(24)-O(7)	124.1(9)

O(8)-C(24)-C(1)	125.3(9)	O(7)-C(24)-C(1)	110.5(7)
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