Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Preparative Scale Achmatowicz and *aza*-Achmatowicz Rearrangements Catalyzed by *Agrocybe aegerita* Unspecific Peroxygenase

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Supporting Information

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Section 1. Materials and General Methods

General Techniques and Equipment

Residual solvents were removed under high vacuum. Column chromatography was performed on silica gel (VWR International, 40-63 µM mesh particle size). Analytical thin layer chromatography (TLC) was performed on Merck silica gel 60 F_{254} coated aluminium plates and the compounds were visualized under UV (wavelength 254 nm). Preparative thin layer chromatography was performed on silica gel coated glass plates and the compounds were visualized under UV (wavelength 254 nm). A Razel A 99 syringe pump was used for the slow addition of solutions. Melting points were measured on a Gallenkamp Melting Point Measuring Apparatus in capillary tubes and data are reported uncorrected. NMR measurements were taken on Jeol ECS and Bruker AV and AM spectrometers. All spectra were acquired at room temperature, unless otherwise noted. The ^{1}H and ^{13}C chemical shifts are stated on a δ internal scale in parts per million (ppm) units. Residual solvent was used as the standard. Coupling constants are reported in Hz. MS analysis was performed on a Bruker compact® time of flight mass spectrometer (ESI and APCI), GC-MS spectra were acquired on an Agilent 5975C MSD system equipped with a 60 m DB-5™ column. For GC-FID analysis, an Agilent 7890B equipped with a 30 m DB-5MS™ column was used, *ee* values were measured on the same instrument using chiral columns, as described. UV-VIS spectra were collected on an Agilent Cary® 100 UV-VIS spectrophotometer. Infrared spectra were acquired on a Perkin Elmer Spectrum Two FT-IR Spectrometer. Optical rotation was measured on a Bellingham & Stanley ADP450 Polarimeter.

Materials

All chemicals were purchased from Sigma Aldrich (Irvine, UK), Alfa Aesar (Heysham, UK), Tokyo Chemical Industry (Oxford, UK) or Fluorochem (Hadfield, UK) and used without further purification, GPR-grade and HPLC-grade solvents were bought from VWR International (Lutterworth, UK). Anhydrous solvents were collected from a solvent tower, purchased, or dried using standard methods. Ultrapure water was produced by a Milli-Q® Integral Water Purification System.

Section 2. Production of r*Aae*UPO-PaDa-I-H

The cloning and expression of the r*Aae*UPO-PaDa-I-H and its preparation from fermentations of *Pichia pastoris* have been described previously.[1] The activity of this lyophilizate was 0.97 U mg^{-1}, as measured by the 5-nitro-1,3-benzodioxole (NBD) assay.

Section 3. Small scale screening of r*Aae*UPO-PaDa-I-H-catalysed Achmatowicz reaction

This section relates to the small scale screening results presented in **Table 1** in the manuscript. Small scale reactions were performed in 8 mL glass vials. The vials were shaken at 500 rpm at rt during the reaction time. Lyophilised r*Aae*UPO expression supernatant in 100 mM KPi (500 µL, pH = 7.00) was added to the vials, followed by ultrapure water (300 µL). Substrate was added in MeCN (100 µL, 100 mM stock concentration, 10 mM final concentration, 1.00 eq.) and the reaction was started by the addition of H_2O_2 solution (33.3 µL, 100 mM stock concentration, 3.33 mM final concentration, 0.333 eq.). In the case of the 10 mM screens, this was followed by the subsequent addition of two additional portions of H_2O_2 solution (2 x 33.3 µL, 100 mM concentration, 2 x 0.333 eq.) at 10 min intervals. After an additional 30 min of shaking, the reaction media were extracted with EtOAc (2 x 1.00 mL). The extract was dried over $MgSO_4$, filtered, and analysed by GC-FID.

Section 4. Inhibition studies for alkene containing substrates

Alkene containing substrates **9r** and **9s** exhibited similar levels of inhibition and shut down the oxidation of **9e** at 20 mM concentration almost completely.

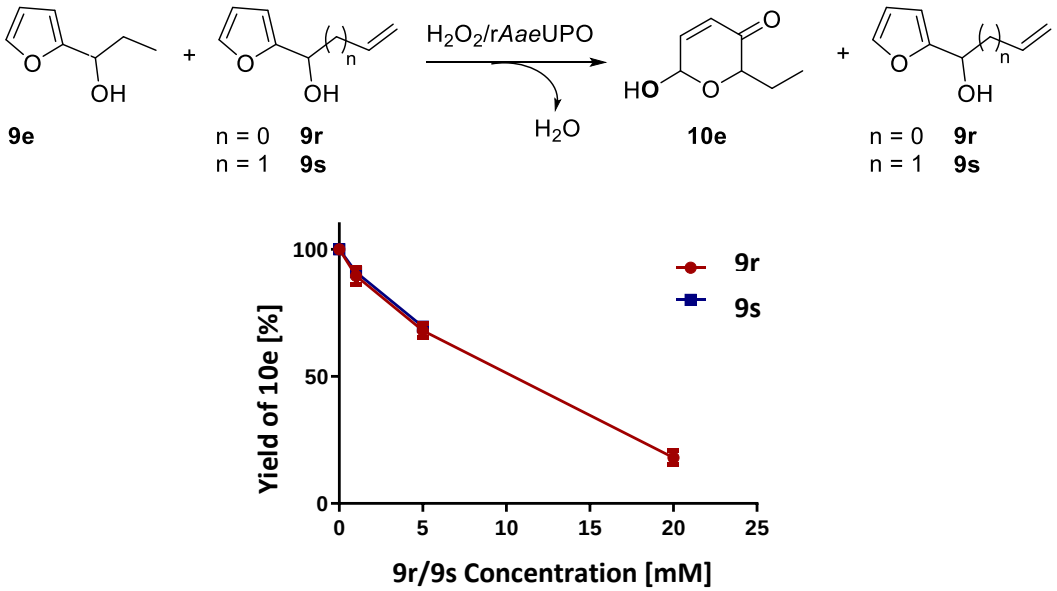


Figure S1. Titration with **9r** and **9s** resulted in the decreasing yield of the product **10e**. Yields were determined by ^{1}H NMR spectroscopy of the isolated crude material (corrected for the mass of the material).

Section 5. Synthetic procedures and Spectroscopic Characterization

General Method A - Synthesis of Furyl-Carbinols

Furan (1.43 mL, 1.33 g, 19.6 mmol, 1.50 eq.) was dissolved in dry THF (123 mL) and the mixture was cooled to –78 °C. *n*-BuLi solution (2.50 M in hexanes, 5.24 mL, 13.1 mmol, 1.00 eq.) was added dropwise to the solution at this temperature over the course of 15 min, followed by stirring of the reaction medium at 0 °C for 4 h. The solution was cooled to –78 °C again and the aldehyde/ketone solution (4.00 M in dry THF, 13.1 mmol, 1.00 eq.) was added to the reaction dropwise over the course of 15 min. The solution was stirred at rt for another hour and quenched by the addition of saturated NH_4Cl solution, washed with brine, dried over $MgSO_4$, filtered, and concentrated *in vacuo*.

General Method B - Synthesis of Furyl-Carbinols

Freshly distilled furfural (0.86 mL, 1.00 g, 10.4 mmol, 1.00 eq.) was dissolved in dry THF (1.00 M, 10.4 mL) in a flame-dried round-bottom flask and the Grignard reagent (12.5 mmol, 1.20 eq.) was added in ethereal solvent at 0 °C over 20 min. The reaction was stirred at rt for 2 h and the reaction was quenched by the addition of saturated aqueous $NaHCO_3$ solution (20.0 mL). The layers were separated and the aqueous phase was further extracted with EtOAc (3 x 10 mL). The unified organic phase was washed with brine (10.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material. The crude material was purified as described for the individual experiments.

General Method C – Synthesis of 6-Hydroxy-2H-Pyran-3(6H)-ones

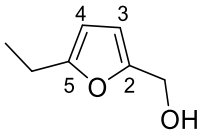
The furyl-carbinol (3.57 mmol, 1.00 eq.) was dissolved in in a 2:1 mixture of THF and H_2O (0.170 M mixture), followed by the addition of solid $NaHCO_3$ (2.00 eq.) and NaOAc (1.0 eq.). The reaction medium was cooled to 0 °C and NBS (1.00 eq.) was added in three portions every 5 min. The reaction was stirred at this temperature for 1 h, after which it was quenched by the addition of saturated aq. $NaHCO_3$ at rt (3-fold dilution). The aqueous phase was extracted with Et_2O three times, the unified organic phase was dried over $MgSO_4$, filtered, and evaporated under reduced pressure. The crude product was purified by column chromatography.

General Method D – Enzymatic Synthesis of 6-Hydroxy-2H-Pyran-3(6H)-ones

Furyl-carbinol (1.00 mmol, 1.00 eq.) was dissolved in *t*-BuOH (10.0 mL), unless otherwise noted. The solution was added to lyophilised r*Aae*UPO-PaDa-I-H expression supernatant (454 mg, 409 U) in sodium citrate buffer (50.0 mL, pH = 5.50, 50 mM). The mixture was diluted with deionised water (39.0 mL), followed by the dropwise addition of 30% aqueous H_2O_2 solution (102 µL, 34.0 mg,

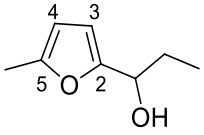
1.00 mmol, 1.00 eq.) in deionised water (1.00 mL) over 2 h using a syringe pump, unless otherwise noted. The reaction was extracted with EtOAc (3 x 60 mL), unless noted otherwise. The layers were separated, and the organic phase was washed with brine, dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude product. Further purification (when needed) is described for each individual experiment.

5-Ethylfuryl alcohol **9b**



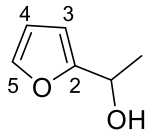
5-Ethylfurfural (600 mg, 4.83 mmol, 1.00 eq.) was dissolved in MeOH (5.00 mL) and $NaBH_4$ (200 mg, 5.32 mmol, 1.10 eq.) was added in one portion to the solution. The reaction was stirred at rt overnight and it then poured onto saturated aqueous $NaHCO_3$ solution (50.0 mL). The aqueous phase was extracted with EtOAc (3 x 40 mL), the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude product as a light-flowing orange oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **9b** as a yellow oil. R_f = 0.58 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ stain). Yield: 206 mg (34%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.18 (d, *J* = 3.0 Hz, 1H, 3-H_{Ar}), 5.92 (d, *J* = 3.0 Hz, 1H, 4-H_{Ar}), 4.55 (s, 2H, -C*H*$_2$-OH), 2.64 (q, *J* = 7.4 Hz, 2H, -C*H*$_2$-CH_3), 1.72 (s, 1H, -O*H*), 1.23 (t, *J* = 7.4 Hz, 3H, -C*H*$_3$). ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.3 (2-C_{Ar}), 152.2 (5-C_{Ar}), 108.7 (3-C_{Ar}), 104.8 (4-C_{Ar}), 66.0 (-*C*H$_2$-OH), 21.5 (-*C*H$_2$-CH_3), 15.4 (-CH_2-*C*H_3). HRMS (APCI, m/z) m/z calculated for $C_7H_{10}O_2$ [M+H$^+$] 125.0603, found 125.0604. The data match those previously reported.[2]

(5-Methylfuran-2-yl)propanol **9c**



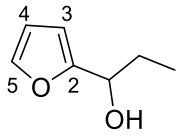
Synthesised according to General Method A. Scale 6.09 mmol (1.00 eq.). The crude material (784 mg) which was purified by column chromatography (eluent: *n*-Hex:Et_2O = 7:3) to yield the product as a thick, transparent oil. R_f = 0.49 (eluent: *n*-Hex:Et_2O = 7:3). Yield: 380 mg (45%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 6.10 (d, *J* = 2.9 Hz, 1H, 3-H_{Ar}), 5.95 - 5.80 (m, 1H, 4-H_{Ar}), 4.53 (t, *J* = 6.8 Hz, 1H, Ar-C*H*(OH)), 1.86 (qd, *J* = 7.4, 6.8 Hz, 2H, -C*H*$_2$-CH_3), 0.96 (t, *J* = 7.4 Hz, 3H, CH_2-C*H*$_3$). ^{13}C NMR (101 MHz, $CDCl_3$) δ 123.4 (2-C_{Ar}), 120.0 (5-C_{Ar}), 107.1 (3-C_{Ar}), 106.1 (4-C_{Ar}), 69.4 (-*C*H-OH), 28.6 (Ar-*C*H_3), 18.3 (-*C*H_2-), 13.8 (-CH_2-*C*H_3). HRMS (APCI, m/z) m/z calculated for $C_8H_{12}O_2$ [M+H$^+$] 141.0916, found 141.0920.

1-(Furan-2-yl)ethanol **9d**



2-Acetylfuran (450 µL, 500 mg, 4.54 mmol, 1.00 eq.) was dissolved in MeOH (5.00 mL) and $NaBH_4$ (190 mg, 5.04 mmol, 1.10 eq.) was added in 3 portions over 15 min at 0 °C. The reaction was stirred at rt overnight. The reaction medium was poured onto saturated aqueous $NaHCO_3$ solution (50.0 mL) and extracted with Et_2O (3 x 40 mL). The unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to afford the title compound **9d** (484 mg, 95%) as a pale yellow oil. R_f = 0.47 (eluent: *n*-Hex:EtOAc = 1:1); ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.41–7.39 (m, 1H, 5-H_{Ar}), 6.34–6.29 (m, 1H, 4-H_{Ar}), 6.25–6.20 (m, 1H, 3-H_{Ar}), 4.77 (q, *J* = 6.6 Hz, 1H, -C*H*-), 1.46 (d, *J* = 6.6 Hz, 3H, -C*H*$_3$); ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.4 (2-C_{Ar}), 142.9 (5-C_{Ar}), 111.0 (3-C_{Ar}), 105.9 (4-C_{Ar}), 64.1 (-*C*H-), 21.8 (-*C*H_3). The data match those previously reported.[3]

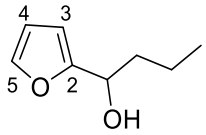
1-(Furan-2-yl)propan-1-ol **9e**



Furan (2.14 mL, 2.00 g, 29.4 mmol, 1.50 eq.) was dissolved in dry THF (180 mL) in a flame-dried round-bottom flask. *n*-BuLi solution (2.50 M in hexanes, 7.84 mL, 19.6 mmol, 1.00 eq.) was added to the reaction at –78 °C and the reaction was stirred at 0 °C for 2 h. Propionaldehyde (1.41 mL, 1.14 g, 19.6 mmol, 1.00 eq.) was added to the reaction mixture in dry THF (10.0 mL) over 20 min at –78 °C. The reaction was stirred at rt for 1 h and it was quenched by the dropwise addition of saturated NH_4Cl solution (100 mL) at 0 °C. The layers were separated, and the organic phase was washed with brine (50.0 mL). The organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude product is a brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 8:2) to yield the title compound **9e** (945 mg, 38%) as light brown oil. R_f = 0.61 (eluent: *n*-Hex:EtOAc = 8:2, $KMnO_4$ stain); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 (dd, *J* = 1.8, 0.7 Hz, 1H, 5-H_{Ar}), 6.33 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.23 (dd, *J* = 3.2, 0.7 Hz, 1H, 3-H_{Ar}), 4.60 (t, *J* = 6.8 Hz, 1H, Ar-C*H*(OH)-), 2.00 (s, 1H, -O*H*), 1.95 - 1.79 (m, 2H, -C*H*$_2$-CH_3), 0.95 (t, *J* = 7.4 Hz, 3H, -CH_2-C*H*$_3$); ^{13}C NMR (101 MHz, $CDCl_3$) δ 156.8 (5-C_{Ar}), 142.0 (2-C_{Ar}), 110.2 (3-C_{Ar}), 106.0 (4-C_{Ar}), 69.3 (-*C*(OH)-), 28.7 (-*C*H_2-CH_3), 10.0 (-

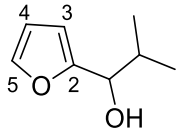
CH_2-CH_3). HRMS (APCI, m/z) m/z calculated for $C_7H_{10}O_2$ $[M-H]^+$ 125.0603, found 125.0591. The data match those previously reported.[4]

1-(Furan-2-yl)butan-1-ol **9f**



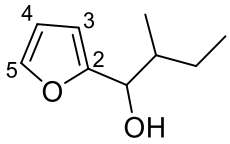
The compound was synthesized in an identical method to that described for the preparation of 1-(furan-2-yl)propan-1-ol **9e**, but replacing propionaldehyde with butyraldehyde (1.74 mL, 1.41 g, 19.6 mmol, 1.00 eq.). Scale: 19.6 mmol (1.00 eq). The crude product was obtained as a light brown oil (423 mg, 29%) and used without further purification R_f = 0.49 (eluent: *n*-Hex:EtOAc = 8:2, $KMnO_4$ staining); ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.37 (dd, *J* = 1.8, 0.7 Hz, 1H, 5-H_{Ar}), 6.32 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.22 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.68 (t, *J* = 6.9 Hz, 1H, -C*H*(OH)-), 1.92 (s, 1H, -O*H*), 1.83 (td, *J* = 7.5, 7.4 Hz, 2H, -CH(OH)-CH_2-), 1.50–1.30 (m, 2H, -CH_2-CH_2-), 0.94 (t, *J* = 7.3 Hz, 3H, -CH_3); ^{13}C NMR (101 MHz, MeOH-d_4) δ 157.0 (2-C_{Ar}), 142.0 (5-C_{Ar}), 110.2 (3-C_{Ar}), 105.9 (4-C_{Ar}), 67.7 (-*C*H(OH)-), 37.8 (CH(OH)-*C*H_2-), 18.9 (-*C*H_2-CH_3), 14.0 (-*C*H_3). The data match those previously reported.[5]

1-(Furan-2-yl)-2-methylpropan-1-ol **9g**



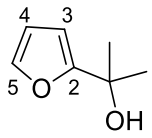
The compound was synthesised using an identical method to that described for the preparation of 1-(furan-2-yl)propan-1-ol **9e**, but replacing propionaldehyde with isobutyraldehyde (1.79 mL, 1.41 g, 19.6 mmol, 1.00 eq.). Scale: 19.6 mmol (1.00 eq.). The crude material was obtained as a yellow oil (2.23 g, 81%) which was used without further purification. R_f = 0.74 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.40 (dd, *J* = 1.7, 0.7 Hz, 1H, 5-H_{Ar}), 6.32 (dd, *J* = 3.0, 1.7 Hz, 1H, 4-H_{Ar}), 6.21 (d, *J* = 3.0 Hz, 1H, 3-H_{Ar}), 4.25 (d, *J* = 7.3 Hz, 1H, -C*H*(OH)-), 2.06–2.02 (m, 1H, -C*H*$(CH_3)_2$), 0.98 (d, *J* = 6.8 Hz, 3H, -C*H*'$_3$), 0.79 (d, *J* = 6.8 Hz, 3H, -C*H*''$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 156.7 (2-C_{Ar}), 141.3 (5-C_{Ar}), 109.6 (3-C_{Ar}), 106.0 (4-C_{Ar}), 72.8 (-C*H*(OH)-), 33.1 (-C*H*$(CH_3)_2$). HRMS (EI, m/z) m/z calculated for $C_8H_{12}O_2$ $[M^+]$ 140.0832, found 140.0830. The data match those previously reported.[6]

1-(Furan-2-yl)-2-methylbutan-1-ol **9h**



The compound was synthesized using an identical method to that described for the preparation of 1-(furan-2-yl)propan-1-ol **9e**, but replacing propionaldehyde with 2-methylbutanal (2.10 mL, 1.69 g, 19.6 mmol, 1.00 eq.). Scale: 19.6 mmol (1.00 eq.). The crude product was obtained as a yellow oil (2.58 g, 85%) and used without further purification. The alcohol was formed as a 6:4 mixture of diastereoisomers. R_f = 0.79 (*n*-Hex:EtOAc = 7:3); ^{1}H NMR (400 MHz, $CDCl_3$) δ Major diastereoisomer: 7.48 - 7.29 (dd, *J* = 1.9, 0.9 Hz, 1H, 5-H_{Ar}), 6.37 - 6.29 (dd, *J* = 3.2, 1.9 Hz, 1H, 4-H_{Ar}), 6.22 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.51 (d, *J* = 6.8 Hz, 1H, -C*H*(OH)-), 1.95 - 1.81 (m, 1H, -CH(OH)-C*H*-), 1.72 - 1.61 (m, 2H, -CH-CH_2-), 1.46 - 1.36 (m, 1H, -CH-*H*CH-), 1.25 - 1.05 (m, 1H, -CH-HC*H*-), 0.97 (d, *J* = 6.8 Hz, 3H, -CH-CH_3), 0.89 (t, *J* = 7.5 Hz, 3H, -CH_2-CH_3). Minor diastereoisomer: 7.48 - 7.29 (dd, *J* = 1.9, 0.9 Hz, 1H, 5-H_{Ar}), 6.37 - 6.29 (dd, *J* = 3.2, 1.9 Hz, 1H, 4-H_{Ar}), 6.22 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.46 (d, *J* = 6.8 Hz, 1H, -C*H*(OH)-), 1.95 - 1.81 (m, 1H, -CH(OH)-C*H*-), 1.46 - 1.36 (m, 1H, -CH-*H*CH-), 1.25 - 1.05 (m, 1H, -CH-HC*H*-), 0.94 (t, *J* = 7.3 Hz, 3H, -CH_2-CH_3), 0.81 (d, *J* = 6.8 Hz, 3H, -CH-CH_3). ^{13}C NMR (101 MHz, $CDCl_3$) δ Major diastereoisomer: 156.5 (2-C_{Ar}), 141.8 (5-C_{Ar}), 110.2 (3-C_{Ar}), 106.7 (4-C_{Ar}), 72.4 (-*C*H(OH)-), 39.9 (-*C*H-), 25.8 (-*C*H_2), 15.1 (-CH-*C*H_3), 11.7 (-CH_2-*C*H_3). Minor diastereoisomer: 156.3 (2-C_{Ar}), 141.8 (5-C_{Ar}), 110.2 (3-C_{Ar}), 106.4 (4-C_{Ar}), 72.2 (-*C*H(OH)-), 25.1 (-*C*H_2), 14.5 (-CH-*C*H_3), 11.3 (-CH_2-*C*H_3). HRMS (APCI, m/z) m/z calculated for $C_9H_{14}O_2$ $[M-H]^+$ 153.0916, found 153.0912.

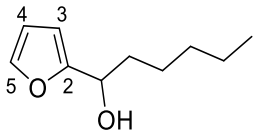
2-Furan-2-yl-propan-2-ol **9i**



Furan (2.14 mL, 2.00 g, 29.4 mmol, 1.00 eq.) was dissolved in dry Et_2O (35.0 mL) in a flame-dried round-bottom flask and *n*-BuLi solution (11.0 mL, 2.50 M in hexanes, 27.5 mmol, 0.94 eq.) was added to the reaction dropwise at –20 °C over 30 min. The reaction was stirred at 0 °C for 4 h during which time brown precipitate formed. Dry acetone was added to the suspension dropwise at –20 °C over 20 min. The suspension was refluxed for 11 h and quenched by the addition of saturated NH_4Cl solution (141 mL). Water was added until the precipitate dissolved, and the layers were separated. The aqueous layer was extracted with Et_2O (3 x 50 mL), the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the title compound **9i** as a thick, yellow

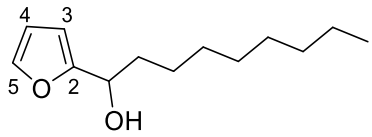
oil. R_f = 0.53 (eluent: *n*-Hex:EtOAc = 0.47, $KMnO_4$ staining). Yield: 3.40 g (92%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.38 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 6.30 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.20 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 1.52 (s, 6H, CH(C*H*$_3$)$_2$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 141.2 (2-C_{Ar}), 133.0 (5-C_{Ar}), 109.6 (3-C_{Ar}), 108.2 (4-C_{Ar}), 27.7 (-*C*H$_3$). The data match those previously reported.[7]

1-(Furan-2-yl)hexan-1-ol **9j**



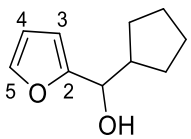
Mg turnings (760 mg, 31.2 mmol, 3.00 eq) were suspended in dry THF (15.0 mL) in a flame-dried flask and the surface of the Mg was activated with iodine. 1-Bromopentane (1.93 mL, 2.36 g, 15.6 mmol 1.50 eq) was added to the mixture dropwise over the course of 20 min. After an additional hour stirring at room temperature, the solution of the Grignard reagent was added to a solution of freshly-distilled furfural (860 µL, 1.00 g, 10.4 mmol, 1.00 eq.) in dry THF (10.4 mL, in a flame-dried flask) over the course of 20 min at 0 °C. The reaction medium was stirred for 12 h at rt. Deionised water (5.00 mL) was then added at 0 °C to quench the reaction. This was followed by the addition of concentrated aqueous $NaHCO_3$ solution (20.0 mL). The precipitated bicarbonate was filtered, the phases were separated and the aqueous phase was further extracted with Et_2O (3 x 20 mL). The unified organic phase was washed with brine (20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude product as a deep yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 6:4) to yield the title compound **9j** as a pale yellow oil. R_f = 0.51 (eluent: *n*-Hex:EtOAc = 6:4, $KMnO_4$ staining). Yield: 1.49 g (85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 6.33 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.23 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.67 (t, *J* = 6.9 Hz, 1H, -C*H*(OH)-), 1.90 - 1.79 (m, 3H, -CH(OH)-*H*CH-C*H*$_2$-), 1.49 - 1.36 (m, 1H, -CH(OH)-HC*H*-), 1.34 - 1.29 (m, 4H, -C*H*$_2$-C*H*$_2$-CH$_3$), 0.88 (t, *J* = 7.6 Hz, 3H, -C*H*$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 157.0 (2-C_{Ar}), 142.0 (5-C_{Ar}), 110.2 (3/4-C_{Ar}), 105.9 (3/4-C_{Ar}), 68.0 (-*C*H(OH)-), 35.6 (-CH(OH)-*C*H$_2$-), 31.7 (-CH$_2$-), 25.4 (-*C*H$_2$-), 22.7 (-*C*H$_2$-CH$_3$), 14.2 (-*C*H$_3$). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{16}O_2$ [M+Na$^+$] 191.1048, found 191.1044. The data match those previously reported.[8]

1-(Furan-2-yl)nonan-1-ol **9k**



Freshly distilled furfural (1.72 mL, 2.00 g, 20.8 mmol, 1.00 eq) was dissolved in dry THF (21.0 mL) in a flame-dried round-bottom flask. In a separate flame-dried round-bottom flask, Mg turnings (1.52 g, 62.5 mol, 3.00 eq) were added to dry THF (25.0 mL). The Mg was activated with I_2, followed by the dropwise addition of octyl bromide (5.38 mL, 31.2 mmol, 1.50 eq) over 20 min under rigorous stirring at rt. The freshly prepared Grignard reagent solution was added to the furfural solution dropwise over 20 min at 0 °C. The reaction was stirred at rt for 14 h, after which deionised water (10.0 mL) was added to the reaction at 0 °C. This was followed by the addition of saturated aqueous $NaHCO_3$ solution (40 mL). The formed white precipitate was filtered, the phases were separated and the aqueous phase was further extracted with Et_2O (3 x 30 mL). The unified organic phase was washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3), to afford the title compound **9k** as a pale yellow oil. R_f = 0.70 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 4.06 g (93%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.39 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 6.31 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.21 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.55 (t, *J* = 7.1 Hz, 1H, -C*H*(OH)-), 1.84 - 1.70 (m, 2H, -CH(OH)-CH_2-), 1.42 - 1.17 (m, 12H, -(CH_2)$_6$-), 0.87 (t, *J* = 7.3 Hz, 3H, -CH_3). ^{13}C NMR (101 MHz, MeOH-d_4) δ 158.6 (2-C_{Ar}), 142.8 (5-C_{Ar}), 111.1 (3/4-C_{Ar}), 106.6 (3/4-C_{Ar}), 68.4 (-*C*H(OH)-), 36.7 (-*C*H_2-), 33.0 (-*C*H_2-), 30.7 (-*C*H_2-), 30.6 (-*C*H_2-), 30.4 (-*C*H_2-), 26.7 (-*C*H_2-), 23.7 (-*C*H_2-), 14.4 (-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_{13}H_{22}O_2$ [M+Na^+] 233.1518, found 233.1516. The data match those previously reported.[9]

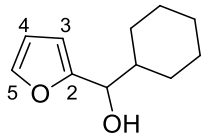
Cyclopentyl(furan-2-yl)methanol **9l**



Compound was prepared according to General Method B. Scale: 10.4 mmol (1.00 eq) of freshly-distilled furfural. The reaction was quenched by the addition of saturated aqueous $NaHCO_3$ solution (20.0 mL). The aqueous phase was extracted with EtOAc (3 x 50 mL). The unified organic phase was washed with $NaHCO_3$ (30 mL), brine (30 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo*. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 8:2) to

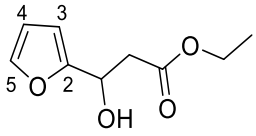
afford the title compound **9l** as a yellow oil. R_f = 0.46 (eluent: *n*-Hex:EtOAc = 8:2, $KMnO_4$ staining). Yield: 328 mg (21%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.40 (d, *J* = 1.9 Hz, 1H, 5-H_{Ar}), 6.38 - 6.29 (m, 1H, 4-H_{Ar}), 6.22 (d, *J* = 2.9 Hz, 1H, 3-H_{Ar}), 4.31 (d, *J* = 8.0 Hz, 1H, -C*H*(OH)-), 2.37 (app. q, *J* = 8.0 Hz, 1H, -CH(OH)-C*H*-), 1.90 - 1.81 (m, 1H, -HC*H*-CH-), 1.65 - 1.47 (m, 7H, -$H_{Cyclopentyl}$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 158.6 (2-C_{Ar}), 142.7 (5-C_{Ar}), 111.0 (3-C_{Ar}), 107.1 (4-C_{Ar}), 72.6 (-C*H*(OH)-), 49.9 (-CH(OH)-CH-), 30.6 (-CH-*C*H_2-), 30.1 (-CH-*C*'H_2-), 26.6 (-CH_2-*C*'H_2-), 26.6 (-CH_2-*C*H_2-). HRMS (APCI, m/z) m/z calculated for $C_9H_{12}O_2$ [M-H$^-$] 165.0916, found 165.0925. The data match those previously reported.[10]

Cyclohexyl(furan-2-yl)methanol **9m**



The compound was synthesized using General Method A. Scale: 2.00 mmol (1.00 eq) of freshly-distilled cyclohexanecarbaldehyde. The reaction was quenched by the addition of saturated aq. $NaHCO_3$ solution (10.0 mL). The aqueous phase was extracted with EtOAc (3 x 10 mL). The unified organic phase was washed with sat. aq. $NaHCO_3$ (10 mL), brine (10 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as yellow oil. The crude was purified by column chromatography (eluent: *n*-Hex:Et_2O = 4:1) to yield pure **9m** as a pale yellow oil. R_f = 0.27 (eluent: *n*-Hex:Et_2O = 4:1, $KMnO_4$ staining). Yield: 326 mg (57%); ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.41 - 7.39 (m, 1H, 5-H_{Ar}), 6.36 - 6.28 (m, 1H, 3-H_{Ar}), 6.20 (d, *J* = 3.1 Hz, 1H, 4-H_{Ar}), 4.27 (d, *J* = 7.7 Hz, 1H, -C*H*(OH)-CH-), 1.98 (m, 1H, -CH(OH)-C*H*-), 1.80 - 1.62 (m, 4H, 4 x $H_{Cyclohexyl}$), 1.47 - 1.13 (m, 5H, 4 x $H_{Cyclohexyl}$), 1.07 - 0.87 (m, 2H, 2 x $H_{Cyclohexyl}$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 157.9 (2-C_{Ar}), 142.7 (5-C_{Ar}), 110.9 (3-C_{Ar}), 107.5 (4-C_{Ar}), 73.3 (-*C*H(OH)-), 44.1 (-CH(OH)-*C*H-), 30.3 (-CH-*C*H_2-), 30.2 (CH-*C*'H_2), 27.6 (-CH-CH_2-*C*H_2-), 27.2 (-CH-CH_2-*C*'H_2-), 27.1 (-CH-CH_2-CH_2-*C*H_2-). HRMS (APCI, m/z) m/z calculated for $C_{11}H_{16}O_2$ [M+Na$^+$] 203.1048, found 203.1051. The data match those previously reported.[10]

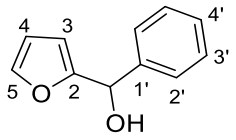
Ethyl 3-(2-furyl)-3-hydroxypropanoate **9n**



Zn dust (1.09 g, 16.7 mmol, 1.64 eq.) and 0.26 mL TMSCl (220 mg, 2.04 mmol, 0.200 eq) were added to dry Et_2O (20.0 mL) in a flame-dried round-bottom flask equipped with a reflux condenser. After 15 min stirring at rt, ethyl bromoacetate (2.26 mL, 3.41 g, 20.4 mmol, 2.00 eq) was added to the mixture dropwise at 0 °C. The suspension attained a white colour and the heat formation was

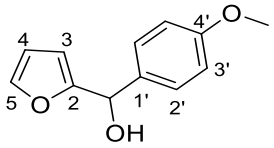
intensive. After cooling, the solution of freshly distilled furfural (860 µL, 1.00 g, 10.4 mmol, 1.00 eq) in dry Et_2O (5.00 ml) was added to the reaction medium dropwise at 0 °C to avoid the overheating of the mixture. The reaction medium was then refluxed for 3 h, followed by the addition of 3.00 M aq. HCl solution (15 mL, 45 mmol, 4.3 eq). The layers were separated and the aqueous phase was extracted with EtOAc (3 x 20 mL). The unified organic phase was washed with saturated aq. $NaHCO_3$ solution (2 x 20 mL), and deionised water (20 mL). The organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **9n** as a yellow oil. R_f = 0.48 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 1.16 g (61%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.43 (d, *J* = 1.8 Hz, 1H, 5-H_{Ar}), 6.34 (dd, *J* = 3.3, 1.8 Hz, 1H, 4-H_{Ar}), 6.28 (d, *J* = 3.3 Hz, 1H, 3-H_{Ar}), 5.06 (t, *J* = 7.2 Hz, 1H, -C*H*(OH)-), 4.12 (q, *J* = 7.4 Hz, 2H, -OC*H*$_2$-CH_3), 2.79 (d, *J* = 7.2 Hz, -CH(OH)-C*H*$_2$-), 1.22 (t, *J* = 7.4 Hz, 3H, -OCH_2-C*H*$_3$). ^{13}C NMR (101 MHz, $CDCl_3$) δ 172.4 (-*C*OO-), 157.2 (2-H_{Ar}), 143.3 (5-H_{Ar}), 111.2 (4-H_{Ar}), 107.0 (3-H_{Ar}), 65.0 (-C*H*(OH)-), 61.7 (-O*C*H_2CH_3), 41.9 (-CH(OH)-*C*H_2-), 14.5 (-CH_3). HRMS (ESI, m/z) m/z calculated for $C_9H_{12}O_4$ [M+Na^+] 207.0628, 207.0623. The data match those previously reported.[11]

2-Furyl(phenyl)methanol **9o**



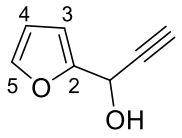
Furan (1.07 mL, 1.00 g, 16.1 mmol, 1.50 eq.) was dissolved in dry THF (75.0 mL) and *n*-BuLi solution (2.50 M in hexanes, 4.30 mL, 10.7 mmol, 1.00 eq.) was added to the mixture at –78 °C over 20 min. The lithiation was left to be completed at 0 °C for 3 h and then, freshly-distilled benzaldehyde (collected at 104 °C at 35 mbar, 1.03 mL, 1.08 g, 10.2 mmol, 0.950 eq.) was added in dry THF (10.0 mL) over 20 min at –78 °C. The reaction was stirred at rt for 1 h and the reaction was quenched by the dropwise addition of saturated NH_4Cl solution (53.0 mL) at rt. The phases were separated and the organic layer was washed with brine (30 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude product as a yellow oil, which was used without further purification. R_f = 0.78 (*n*-Hex:EtOAc = 7:3). Yield: 1.95 g (70%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.43-7.38 (m, 3H, 2 x 2'-H_{Ar}, 5-H_{Ar}), 7.32 (t, *J* = 7.0 Hz, 2H, 2 x 3'-H_{Ar}), 7.26 (t, *J* = 7.0 Hz, 1H, 4'-H_{Ar}), 6.31 (m, 1H, 4-H_{Ar}), 6.08 (d, *J* = 3.3 Hz, 1H, 3-H_{Ar}), 5.72 (s, 1H, -C*H*(OH)-). ^{13}C NMR (101 MHz, MeOH-d_4) δ 158.1 (5-C_{Ar}), 143.4 (1'-C_{Ar}), 143.1 (2-C_{Ar}), 129.2 (2 x 3'-C_{Ar}), 128.7 (4'-C_{Ph}), 127.8 (2 x 2'-C_{Ar}), 111.1 (3-C_{Ar}), 108.0 (4-C_{Ar}), 70.8 (*C*H(OH)-). HRMS (ESI, m/z) m/z calculated for $C_{11}H_{10}O_2$ [M+Na^+] 197.0573, found 197.0575. The data match those previously reported.[9]

(Furan-2-yl)-(4-methoxyphenyl)-methanol **9p**



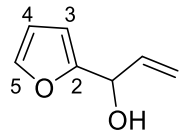
Furan (2.14 mL, 2.00 g, 29.4 mmol, 1.50 eq.) was dissolved in dry THF (150 mL) and *n*-BuLi solution (2.50 M in hexanes, 7.83 mL, 19.6 mmol, 1.00 eq.) was added dropwise at –78 °C over 20 min. The reaction was stirred at 0 °C for 3.5 h, followed by the dropwise addition of freshly-distilled *p*-anisaldehyde (b.p.: 146 °C at 28 mbar, 2.38 mL, 2.67 g, 19.6 mmol, 1.00 eq.) in dry THF (10.0 mL) over 20 min at –78 °C. The reaction was stirred at rt for an additional hour and then it was quenched by the addition of saturated NH_4Cl solution (100 mL). The separated organic phase was washed with brine (2 x 50 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a brown oil, that was used without further purification. R_f = 0.47 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 3.87 g (97%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.41 (dd, *J* = 1.9, 1.1 Hz, 1H, 5-H_{Ar}), 7.30 (d, *J* = 8.7 Hz, 2H, 2 x 2'-H_{Ar}), 6.87 (d, *J* = 8.7 Hz, 2H, 2 x 3'-H_{Ph}), 6.30 (dd, *J* = 2.6, 1.9 Hz, 1H, 4-H_{Ar}), 6.07 (dt, *J* = 2.6, 1.1 Hz, 1H, 3-H_{Ar}), 5.66 (s, 1H, -C*H*(OH)-), 3.76 (s, 3H, -OC*H*$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 160.8 (4'-C_{Ar}), 158.3 (2-C_{Ar}), 143.3 (5-C_{Ar}), 135.2 (1'-C_{Ar}), 129.1 (2 x 2'-C_{Ar}), 114.6 (2 x 3'-C_{Ph}), 111.1 (4-C_{Ar}), 107.8 (3-C_{Ar}), 70.5 (-*C*H(OH)-), 55.7 (-O*C*H$_3$). The data match those previously reported.[12]

1-(Furan-2-yl)prop-2-yn-1-ol **9q**



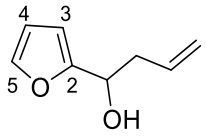
The compound was synthesized according to General Method B. Scale: 5.21 mmol (1.00 eq.) of freshly distilled furfural. The aqueous phase was extracted with Et_2O (3 x 30 mL). The unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3). R_f = 0.24 (eluent: *n*-Hex:EtOAc = 8:2, $KMnO_4$ staining) to afford the title compound **9q** as a thick yellow oil. Yield: 482 mg (76%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.44 (dd, *J* = 1.7, 0.8 Hz, 1H, 5-H_{Ar}), 6.41 (d, *J* = 3.3 Hz, 1H, 3-H_{Ar}), 6.35 (dd, *J* = 3.3, 1.7 Hz, 1H, 4-H_{Ar}), 5.36 (d, *J* = 2.1 Hz, 1H, -C*H*(OH)-), 2.95 (d, *J* = 2.1 Hz, 1H, -C*H*). ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.9 (2-C_{Ar}), 144.0 (5-C_{Ar}), 111.3 (3-C_{Ar}), 108.3 (4-C_{Ar}), 82.7 (-C-), 74.6 (-CH), 58.3 (-CH(OH)-). HRMS (APCI, m/z) m/z calculated for $C_7H_6O_2$ [M+H$^+$] 123.0446, found 123.0440. The data match those previously reported.[13]

1-(Furan-2-yl)-2-propen-1-ol **9r**



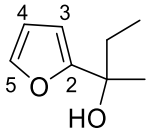
The compound was synthesized according to General Method B. Scale: 10.4 mmol (1.00 eq) of freshly distilled furfural. The aqueous phase was extracted with EtOAc (3 x 30 mL), the unified organic phase was washed with brine, dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a pale yellow oil, which was used without further purification. R_f = 0.22 (eluent: *n*-Hex:EtOAc = 9:1, $KMnO_4$ staining). Yield: 1.12 g (87%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.45 - 7.40 (m, 1H, 5-H_{Ar}), 6.36 - 6.31 (m, 1H, 4-H_{Ar}), 6.27 - 6.19 (m, 1H, 3-H_{Ar}), 6.16 - 5.98 (m, 1H, -C*H*=CH_2), 5.33 (ddt, *J* = 17.0, 3.1, 1.6 Hz, 1H, -CH=HC*H*), 5.19 (ddt, *J* = 9.0, 3.1, 1.6 Hz, 1H, -CH=*H*CH), 5.11 (dd, *J* = 5.7, 1.6 Hz, 1H, -C*H*(OH)-). ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.1 (2-C_{Ar}), 143.4 (5-C_{Ar}), 138.9 (-*C*H=CH_2), 116.1 (-CH=*C*H_2), 111.2 (3-C_{Ar}), 107.3 (4-C_{Ar}), 69.4 (-*C*H(OH)-). HRMS (ESI, m/z) m/z calculated for $C_7H_8O_2$ [M+Na^+] 147.0417, found 147.0423. The data match those previously reported.[14]

1-(Furan-2-yl)but-3-en-1-ol **9s**



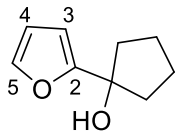
The compound was synthesised according General Method B. Scale: 10.4 mmol (1.00 eq) of freshly-distilled furfural. The aq. phase was extracted with EtOAc (3 x 30 mL), the unified organic phase was washed with brine (30 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo*, affording the title compound **9s** as a pale yellow oil, which was used without further purification. R_f = 0.43 (eluent: *n*-Hex:EtOAc = 9:1, $KMnO_4$ staining) Yield: 1.52 g (99%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.42 (dd, *J* = 1.8, 0.9 Hz, 1H, 5-H_{Ar}), 6.33 (dd, *J* = 3.0, 1.8 Hz, 1H, 4-H_{Ar}), 6.24 (d, *J* = 3.0 Hz, 1H, 3-H_{Ar}), 5.86 - 5.69 (m, 1H, -C*H*=CH_2), 5.08 (d, *J* = 16.4 Hz, 1H, -CH=HC*H*), 5.01 (d, *J* = 8.9 Hz, 1H -CH=*H*CH), 4.63 (t, *J* = 6.9 Hz, 1H, -C*H*(OH)-), 2.68 – 2.48 (m, 2H, -CH(OH)-CH_2-). ^{13}C NMR (101 MHz, $CDCl_3$) δ =158.0 (2-C_{Ar}), 143.0 (5-C_{Ar}), 135.6 (-*C*H=CH_2), 117.6 (-CH=*C*H_2), 111.0 (4-C_{Ar}), 107.0 (3-C_{Ar}), 68.1 (-C*H*(OH)-), 41.2 (-CH(OH)-*C*H_2-). HRMS (ESI, m/z) m/z calculated for $C_8H_{10}O_2$ [2M+Na^+] 299.1254, found 299.1255. The data match those previously reported.[15]

2-(Furan-2-yl)butan-2-ol **9t**



Furan (1.07 mL, 1.00 g, 14.7 mmol, 1.00 eq) was dissolved in dry Et_2O (20.0 mL) in a flame-dried round-bottom flask equipped with a reflux condenser. *n*-BuLi solution (5.52 mL, 13.8 mmol, 0.92 eq) was added to the solution dropwise over 20 min at –78 °C. The reaction was then stirred for 2 h at 0 °C, during which time a white precipitation formed in the reaction medium. Freshly distilled methyl-ethyl-ketone (1.47 mL, 1.19 g, 16.5 mmol, 1.12 eq) was added dropwise in dry Et_2O (5.00 mL) over 20 min at –78 °C. The suspension attained a yellow colour, which was refluxed overnight, the precipitate dissolved upon heating. The reaction was quenched by the addition of saturated aq. NH_4Cl solution (20.0 mL). The layers were separated and the aqueous phase was extracted with Et_2O (3 x 25 mL). The unified organic phase was washed with brine (20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow oil. Column chromatography (eluent: *n*-Hex:EtOAc = 8:2) afforded pure **9t** as a pale yellow oil. R_f = 0.47 (eluent: *n*-Hex:EtOAc = 0.47, $KMnO_4$ staining). Yield: 1.27 g (62%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.38 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 6.30 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.19 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 1.90 - 1.73 (m, 2H, -C*H*$_2$-CH$_3$), 1.45 (s, 3H, -C*H*$_3$), 0.79 (t, *J* = 7.6 Hz, 2H, -CH$_2$-C*H*$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 159.7 (2-C_{Ar}), 141.1 (5-C_{Ar}), 109.6 (4-C_{Ar}), 104.4 (3-C_{Ar}), 71.2 (-C(OH)-), 33.9 (-*C*H$_2$-CH$_3$), 24.9 (-C(OH)-*C*H$_3$), 7.5 (-CH$_2$-*C*H$_3$). HRMS (ESI, m/z) m/z calculated for $C_8H_{12}O_2$ [M+Na$^+$] 163.0730, found 163.0733. The data match those previously reported.[16]

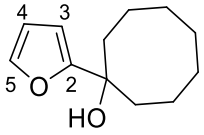
1-(Furan-2-yl)cyclopentan-1-ol **9u**



Furan (1.07 mL, 1.00 g, 14.7 mmol, 1.00 eq) was dissolved in dry Et_2O (20.0 mL) in a flame-dried round-bottom flask and *n*-BuLi solution (5.52 mL, 2.50 M in hexanes, 13.8 mmol, 0.94 eq) was added to the solution dropwise over 30 min at –78 °C. The resulting solution was stirred at 0 °C for 2 h, followed by the dropwise addition of freshly distilled (122 °C at ambient pressure) cyclopentanone (1.46 mL, 1.38 g, 16.5 mmol, 1.12 eq.) in dry Et_2O (5.00 mL) over the course of 20 min. The reaction mixture became a yellow suspension during the addition. The reaction was left to warm to rt and then it was refluxed for 14 h. Upon reaching the reflux temperature, the reaction turned to a pink suspension.

Saturated NH_4Cl solution (20.0 mL) was added to the suspension and the biphasic mixture was stirred until dissolution of the precipitate occurred. After this, the phases were separated and the aqueous phase was further extracted with Et_2O (3 x 25 mL). The unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 9:1) to yield the title compound **9u** as a yellow oil. R_f = 0.13 (eluent: *n*-Hex:EtOAc = 9:1, $KMnO_4$ staining). Yield: 1.75 g (78%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.37 (dd, *J* = 1.8, 0.9 Hz, 1H, 5-H_{Ar}), 6.29 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.20 (dd, *J* = 3.3, 0.9 Hz, 1H, 3-H_{Ar}), 2.07 - 1.93 (m, 2H, 2 x $H_{Cyclopentyl}$), 1.93 - 1.83 (m, 4H, 4 x $H_{Cyclopentyl}$), 1.77 - 1.65 (m, 2H, 2 x $H_{Cyclopentyl}$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 160.9 (2-C_{Ar}), 142.5 (5-C_{Ar}), 111.0 (4-C_{Ar}), 105.3 (3-C_{Ar}), 80.2 (-*C*-OH), 40.2 (2 x -C-*C*H_2-), 24.4 (2 x -*C*H_2). HRMS (APCI, m/z) m/z calculated for $C_9H_{12}O_2$ [M+H^+] 153.0910, found 153.0902. The data match those previously reported.[17]

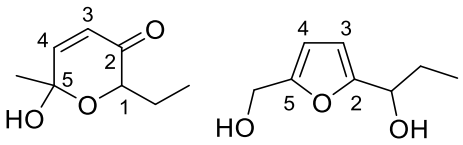
1-(Furan-2-yl)cyclooctan-1-ol **9v**



Furan (1.07 mL, 1.00 g, 14.7 mmol, 1.00 eq) was dissolved in dry Et_2O (20.0 mL) in a flame-dried round-bottom flask equipped with a reflux condenser. *n*-BuLi solution (5.52 mL, 2.50 M in hexanes, 13.8 mmol, 0.82 eq) was added to the reaction mixture dropwise over the course of 20 min at –78 °C. The lithiation was allowed to complete at 0 °C for 2 h. Cyclooctanone (1.24 mL, 1.19 g, 16.5 mmol, 1.12 eq) was dissolved in dry Et_2O (5.00 mL) and added to the reaction mixture dropwise at –78 °C. A suspension was formed, and the reaction was refluxed overnight. The reaction was quenched by the addition of saturated aq. NH_4Cl solution (25.0 mL) and the phases were separated. The aqueous phase was extracted with Et_2O (3 x 30 mL), the unified organic phase was washed with brine (15 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 8:2) to yield the title compound **9v** as a pale yellow oil. R_f = 0.47 (eluent: *n*-Hex:EtOAc = 8:2, $KMnO_4$ staining). Yield: 1.46 g (54%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (dd, *J* = 1.7, 0.9 Hz, 1H, 5-H_{Ar}), 6.30 (ddd, *J* = 3.3, 1.7, 0.6 Hz, 1H, 4-H_{Ar}), 6.20 (dt, *J* = 3.3, 0.7 Hz, 1H, 3-H_{Ar}), 2.46 - 2.37 (m, 1H), 2.12 - 2.01 (m, 2H), 1.90 - 1.83 (m, 1H), 1.81 - 1.77 (m, 1H), 1.75 - 1.60 (m, 5H), 1.57 - 1.42 (m, 5H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.1 (2-C_{Ar}), 141.7 (5-C_{Ar}), 110.1 (4-C_{Ar}), 105.0 (3-C_{Ar}), 73.9 (-C-OH), 42.1 (-C(OH)-*C*H-), 35.0, 28.3, 28.3, 27.3, 25.8, 24.8, 22.0 (7 x CH_2). HRMS (ESI, m/z) m/z calculated according to $C_{12}H_{18}O_2$ 217.1199, found 217.1203. The data match those previously reported.[7]

2-Ethyl-6-hydroxy-6-methyl-2H-pyran-3(6H)-one **10c**

and *1-(5-(hydroxymethyl)furan-2-yl)propan-1-ol*



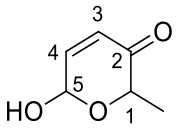
10c

1-(5-Methylfuran-2-yl)propan-1-ol **9c** (30.0 mg, 214 µmol, 1.00 eq.) was dissolved in *t*BuOH (2.10 mL) and added to the solution lyophilised r*Aae*UPO-PaDa-I-H expression supernatant (97.0 mg, 87.3 U) in sodium citrate buffer (18.3 mL, pH = 5.50, 50 mM). KBr (250 mg, 2.10 mmol, 10.0 eq.) was added to the reaction. 30 m/m % H_2O_2 solution (21.9 µL, 7.30 mg, 214 µmol, 1.00 eq.) was diluted with deionised water (1.00 mL) and it was added to the reaction mixture dropwise over 1 h at rt. The reaction was extracted with EtOAc (3 x 20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 6:4) to yield **10c** [transparent oil, R_f = 0.28 (eluent: *n*-Hex:EtOAc = 6:4, $KMnO_4$ staining) Yield: 6.0 mg (18%)] and 1-(5-(hydroxymethyl)furan-2-yl)propan-1-ol [transparent oil, R_f = 0.08 (eluent: *n*-Hex:EtOAc = 6:4, $KMnO_4$ staining) Yield: 9.0 mg (27%)]. **10c** was obtained as a 2:1 mixture of diastereoisomers.

Data for **10c**: ^{1}H NMR (300 MHz, $CDCl_3$) δ <u>Major isomer:</u> 6.81 (d, *J* = 10.1 Hz, 1H, 4-H), 6.01 (d, *J* = 10.1 Hz, 1H, 3-H), 4.46 (dd, *J* = 7.3, 4.0 Hz, 1H, 1-H), 2.02 - 1.79 (m, 2H, -*H*CH-), 1.76 - 1.61 (m, 1H, -HC*H*-), 1.64 (s, 3H, -C-CH_3), 0.96 (t, *J* = 7.5 Hz, 3H, -CH_2-C*H*$_3$). <u>Minor isomer:</u> 7.01 (d, *J* = 10.1), 6.03 (d, *J* = 10.1 Hz, 1H, 3-H), 4.36 (dd, *J* = 7.3, 5.1 Hz, 1H, 1-H), 2.02 - 1.79 (m, 1H, -*H*CH-), 1.76 - 1.61 (m, 1H, -HC*H*-), 1.61 (s, 3H, -C-CH_3), 1.02 (t, *J* = 6.7 Hz, 3H, -CH_2-C*H*$_3$). ^{13}C NMR (75 MHz, $CDCl_3$) δ 196.9 (2-C), 147.9 (4-C), 126.8 (3-C), 92.9 (1-C), 75.4 (5-C), 29.1 (-C-*C*H_3), 23.1 (-*C*H_2-CH_3), 9.4 (-CH_2-*C*H_3). Due to the small amount of the minor isomer, ^{13}C NMR signals of the major isomer only are reported. HRMS (APCI, m/z) m/z calculated for $C_8H_{12}O_3$ [M+H$^+$] 157.0859, found 157.0860.

Data for 1-(5-(hydroxymethyl)furan-2-yl)propan-1-ol: ^{1}H NMR (300 MHz, $CDCl_3$) δ 6.23 (d, *J* = 3.2 Hz, 1H, 3/4-H_{Ar}), 6.18 (d, *J* = 3.2 Hz, 1H, 3/4-H_{Ar}), 4.58 (s, 3H, -C*H*$_2$-OH, -CH(OH)-), 1.93 - 1.81 (m, 2H, -C*H*$_2$-CH_3), 0.96 (t, *J* = 7.4 Hz, 1H, -C*H*$_3$). ^{13}C NMR (75 MHz, $CDCl_3$) δ 156.9 (2/5-C_{Ar}), 153.5 (2/5-C_{Ar}), 108.6 (3/4-C_{Ar}), 108.5 (3/4-C_{Ar}), 69.4 (-C*H*(OH)-), 57.7 (-*C*H_2OH), 28.6 (-*C*H_2-CH_3), 10.1 (-CH_2-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_8H_{12}O_3$ [M+H$^+$] 157.0859, found 157.0859.

2-Methyl-6-hydroxy-2H-pyran-3(6H)-one **10d**



Method used for the preparation of the synthetic standard:

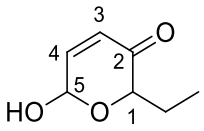
The compound was prepared according to General Method C. Scale: 1-(Furan-2-yl)ethan-1-ol **9d** (500 mg, 3.96 mmol, 1.00 eq.). The crude material was obtained as a pale brown oil and it was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the product as a yellow oil. R_f = 0.43 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 421 mg (83%). The title compound **10d** was yielded as a mixture of diastereoisomers in a 2:1 ratio (determined based on its ^{13}C spectrum due to the signal overlap in the ^{1}H spectrum).

Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)propan-1-ol **9d** (30.0 mg, 234 µmol, 1.00 eq.). The reaction was extracted with EtOAc (3 x 30 mL), washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo*. The title compound **10d** was obtained as a pale-yellow oil, which was chromatographically pure without the need for additional purification. R_f = 0.35 (eluent: *n*-Hex:EtOAc = 7:3. $KMnO_4$ staining). Yield: 29.0 mg (85%). Compound **10d** was obtained as a mixture of diastereoisomers in a 2:1 ratio (determined based on its ^{13}C spectrum due to the signal overlap in the ^{1}H spectrum).

Data for **10d**: ^{1}H NMR (400 MHz, MeOH-d_4) δ 6.82 - 6.67 (m, 1H, 4-H), 6.25 (d, *J* = 10.3 Hz, 1H, 3-H), 5.68 (dd, *J* = 3.8, 1.6 Hz, 1H, 5-H), 4.65 (q, *J* = 7.1 Hz, 1H, 1-H), 1.35 (d, *J* = 7.1 Hz, 3H, -CH_3). ^{13}C NMR (101 MHz, MeOH-d_4) δ Major diastereoisomer: 197.2 (2-C), 148.1 (4-C), 128.3 (3-C), 90.5 (5-C), 74.8 (1-C), 16.4 (-CH_3). Minor diastereoisomer: 196.8 (2-C), 144.3 (4-C), 127.5 (3-C), 88.3 (5-C), 70.8 (1-C), 15.0 (-CH_3). No molecular ion could be detected under either ESI, or APCI conditions. The NMR data match those previously reported.[6]

2-Ethyl-6-hydroxy-2H-pyran-3(6H)-one **10e**



Method used for the preparation of the synthetic standard:

The compound was prepared according to General Method C. Scale: 1-(furan-2-yl)propan-1-ol **9e** (500 mg, 3.96 mmol, 1.00 eq.). The crude material was yielded as brown oil (575 mg). The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **10e** as a light-brown oil. R_f = 0.50 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 502 mg (89%). The product was yielded as a mixture of diastereoisomers in a 2:1 ratio.

Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)propan-1-ol **9e** (30.3 mg, 240 µmol, 1.00 eq.). The reaction was extracted with EtOAc (3 x 30 mL), washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo*. The title compound **10e** was obtained as a pale yellow oil, without the need for additional purification. R_f = 0.35 (eluent: *n*-Hex:EtOAc = 7:3. $KMnO_4$ staining). Yield: 28.0 mg (83%). Compound **10e** was yielded as a mixture of diastereoisomers in a 2:1 ratio.

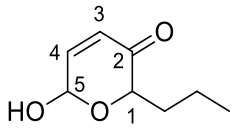
Biocatalytic method on 1 g scale:

1-(Furan-2-yl)propan-1-ol **9e** (1.00 g, 7.92 mmol, 1.00 eq.) was dissolved in acetone (3.96 mL) and added to the solution of lyophilised r*Aae*UPO-PaDa-I-H expression supernatant (450 mg, 405 U) in a mixture of sodium citrate buffer (9.90 mL, pH = 5.50, 50 mM) and deionised water (2.94 mL). 30 % H_2O_2 solution (890 µL, 300 mg, 8.71 mmol, 1.10 eq.) was diluted with deionised water (3.00 mL) and added to the heterogenous reaction mixture dropwise over 4 h at rt. The reaction media was diluted with deionised water (20.0 mL) and extracted with EtOAc (4 x 50 mL). The unified organic phase was washed with saturated aq. sodium sulfite solution (2 x 20 mL) and brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as pale brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield **10e** as pale yellow oil. R_f = 0.27 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 921 mg (82%).

Data for **10e**: ^{1}H NMR (400 MHz, MeOH-d_4) δ Major diastereoisomer: 6.99 (dd, *J* = 10.4, 3.5 Hz, 1H, 4-H), 6.01 (d, *J* = 10.4 Hz, 1H, 3-H), 5.53 (d, *J* = 3.5 Hz, 1H, 5-H), 4.45 (dd, *J* = 7.5, 4.0 Hz, 1H, 1-H), 1.96 - 1.84 (m, 1H, -*H*CH-CH_3), 1.78 - 1.63 (m, 1H, -HC*H*-CH_3), 0.96 (t, *J* = 7.4 Hz, 1H, -CH_3). Minor diastereoisomer: 6.99 (dd, *J* = 10.2, 1.8 Hz, 1H, 4-H), 6.07 (dd, *J* = 10.2, 1.7 Hz, 1H, 3-H), 5.59 (d,

J = 1.6 Hz, 1H, 5-H), 4.04 (app. ddd, *J* = 7.8, 3.9, 1.3 Hz, 1H, 1-H), 1.96 - 1.84 (m, 1H, -*H*CH-CH_3), 1.78 - 1.63 (m, 1H, -HC*H*-CH_3), 1.00 (t, *J* = 7.6 Hz, 1H, -CH_3). ^{13}C NMR (101 MHz, $CDCl_3$) δ Major diastereoisomer: 198.9 (2-C), 148.0 (4-C), 127.6 (3-C), 88.6 (1-C), 75.9 (5-C), 24.0 (-CH_2-), 9.7 (-CH_3). Minor diastereoisomer: 198.5 (2-C), 151.5 (4-C), 129.2 (3-C), 92.1 (1-C), 80.8 (5-C), 24.7 (-CH_2-), 9.9 (-CH_3). HRMS (APCI, m/z) m/z calculated for $C_7H_{10}O_3$ [M+H^+] 143.0708, found 143.0708. The data match those previously reported.[18]

2-Propyl-6-hydroxy-2H-pyran-3(6H)-one **10f**



Method used for the preparation of the synthetic standard:

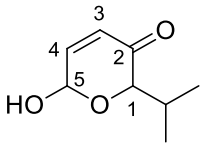
The compound was prepared according to General Method C. Scale: 1-(furan-2-yl)butan-1-ol **9f** (500 mg, 3.57 mmol, 1.00 eq.). The crude material (596 mg) was formed as a brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining) to yield pure **10f** as a yellow oil. R_f = 0.27 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 49.0 mg (8.8%). The product was yielded as a mixture of diastereoisomers in a 2:1 ratio.

Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)butan-1-ol **9f** (26.6 mg, 190 µmol, 1.00 eq.). The aq. phase was extracted with EtOAc (3 x 20 mL), washed with brine (20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure. The title compound **10f** was obtained as an orange oil, that did not require additional purification. R_f = 0.33 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 26 mg (0.17 mmol, 90%). Compound **10f** was yielded as a mixture of diastereoisomers in a 2:1 ratio.

Data for **10f**: ^{1}H NMR (400 MHz, MeOH-d_4) δ Major isomer: 6.98 (dd, *J* = 10.3, 3.5 Hz, 1H, 4-H), 6.01 (d, *J* = 10.3 Hz, 1H, 3-H), 5.51 (d, *J* = 3.5 Hz, 1H, 5-H), 4.51 (dd, *J* = 8.2, 3.5 Hz, 1H, 1-H), 1.90 - 1.79 (m, 1H, -*H*CH-CH_2-), 1.66-1.40 (m, 1H, -HC*H*-CH_2-), 0.96 (t, *J* = 7.6 Hz, 3H, -CH_3). Minor isomer: 6.98 (dd, *J* = 10.1, 1.8 Hz, 1H, 4-H), 6.07 (dd, *J* = 10.1, 1.7 Hz, 1H, 3-H), 5.58 (dd, *J* = 1.7 Hz, 1H, 5-H), 4.10 (dd, *J* = 6.8, 3.1 Hz, 1H, 2-H), 1.90 - 1.79 (m, 1H, -*H*CH-CH_2-), 1.66 - 1.40 (m, 3H, -HC*H*-CH_2-), 0.95 (t, *J* = 7.1 Hz, 3H, -CH_3). ^{13}C NMR (101 MHz, MeOH-d_4) δ Major isomer: 199.1 (2-C), 147.9 (4-C), 127.5 (3-C), 88.5 (1-C), 74.6 (5-C), 32.8 (-*C*H_2-CH_2-), 19.2 (-CH_2-*C*H_2-), 14.2 (-*C*H_3). Minor isomer: 198.8 (2-C), 151.4 (4-C), 129.1 (3-C), 92.1 (1-C), 79.4 (5-C), 33.6 (-*C*H_2-CH_2-), 19.3 (-CH_2-*C*H_2-), 14.2 (-*C*H_3). The data match those previously reported.[18]

6-Hydroxy-2-isopropyl-2H-pyran-3(6H)-one **10g**



Method used for the preparation of the synthetic standard:

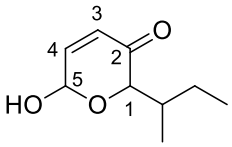
The compound was synthesised according to General Method C. Scale: 1-(furan-2-yl)-2-methylpropan-1-ol **9g** (450 mg, 3.24 mmol, 1.00 eq.). The crude material (529 mg) was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining) to yield the product **10g** as a pale yellow oil. R_f = 0.35 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 386 mg (76%). The compound was yielded as a mixture of diastereoisomers in a 7:3 ratio.

Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)-2-methylpropan-1-ol **9g** (26.6 mg, 190 µmol, 1.00 eq.). The aq. phase was extracted with EtOAc (3 x 20 mL), washed with brine (20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure. The title compound **10g** was obtained as an orange oil and did not require additional purification. R_f = 0.38 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 22.5 mg (76%). The compound was yielded as a mixture of diastereoisomers in a 2:1 ratio.

Data for **10g**: ^{1}H NMR (400 MHz, $CDCl_3$) δ Major diastereoisomer: 6.91 (dd, *J* = 10.4, 3.7 Hz, 1H, 4-H), 6.08 (dd, *J* = 10.4, 1.3 Hz, 1H, 3-H), 5.68 (d, *J* = 3.7 Hz, 1H, 5-H), 4.37 (d, *J* = 3.1 Hz, 1H, 1-H), 2.52 – 2.41 (m, 1H, -C*H*$(CH_3)_2$), 1.02 (d, *J* = 7.0 Hz, 3H, -C*H*'$_3$), 0.88 (d, *J* = 6.8 Hz, 3H, -C*H*''$_3$). Minor diastereoisomer: 6.93 (dd, *J* = 10.5, 3.3 Hz, 1H, 4-H), 6.12 (dd, *J* = 10.5, 1.6 Hz, 1H, 3-H), 5.68 (br. s, 1H, 1-H), 3.88 (dd, *J* = 3.3, 1.6 Hz, 1H, 5-H), 2.51 – 2.38 (m, 1H, -C*H*$(CH_3)_2$), 1.07 (d, *J* = 7.0 Hz, 3H, -C*H*'$_3$), 0.92 (d, *J* = 6.5 Hz, 3H, -C*H*''$_3$). ^{13}C NMR (101 MHz, $CDCl_3$) δ Major diastereoisomer: 196.5 (2-C), 144.2 (3-C), 128.1 (4-C), 87.5 (5-C), 78.3 (1-C), 28.9 (-C*H*$(CH_3)_2$), 19.0 (-*C*'H_3), 16.2 (-C''H_3). Minor diastereoisomer: 196.6 (2-C), 148.1 (3-C), 129.4 (4-C), 91.2 (5-C), 83.1 (1-C), 29.2 (-C*H*$(CH_3)_2$), 19.1 (-*C*'H_3), 16.3 (-*C*''H_3). The NMR data match those previously reported.[18]

2-(sec-Butyl)-6-hydroxy-2H-pyran-3(6H)-one **10h**



Method used for the preparation of the synthetic standard:

The compound was synthesised according to General Method C. Scale: 1-(furan-2-yl)-2-methylbutan-1-ol **9h** (500 mg, 3.24 mmol, 1.00 eq.). The crude material (609 mg) was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining) to yield the product **10h** as a pale yellow oil. R_f = 0.38 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 430 mg (78%). The product was isolated as a mixture of four diastereoisomers in 7:5:1.3:1 ratio. The isomers are listed according to their relative abundance.

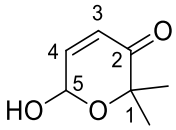
Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)2-methylbutan-1-ol **9h** (40.0 mg, 260 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (3x20 mL), washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure. The title compound **10h** was obtained as an orange oil and did not require additional purification. R_f = 0.40 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 44.1 mg (99%). The compound was yielded as a mixture of 4 diastereoisomers in 6:4:3:2 ratio that are listed in order of their relative amounts.

^{1}H NMR (300 MHz, MeOH-d_4) δ Isomer 1: 7.06-6.92 (m, 1H, 4-H), 6.02 (d, *J* = 10.2 Hz, 1H, 3-H), 5.52 (d, *J* = 3.6 Hz, 1H, 5-H), 4.52 (d, *J* = 2.7 Hz, 1H, 1-H), 2.18 - 2.07 (m, 1H, -O-CH-C*H*-), 1.56 - 1.19 (m, 2H, -CH_2-), 0.80 (d, *J* = 6.8 Hz, 3H, -CH-CH_3), 0.93 (t, *J* = 7.5 Hz, 3H, -CH_2-CH_3). Isomer 2: 7.06-6.92 (m, 1H, 4-H), 6.01 (d, *J* = 10.2 Hz, 1H, 3-H), 5.52 (d, *J* = 3.6 Hz, 1H, 5-H), 4.39 (d, *J* = 2.9 Hz, 1H, 1-H), 2.18 - 2.07 (m, 1H, -O-CH-C*H*-), 1.56 - 1.19 (m, 2H, -CH_2-), 1.00 (d, *J* = 7.0 Hz, 3H, -CH-CH_3), 0.83 (t, *J* = 7.3 Hz, 3H, -CH_2-CH_3). Isomer 3: 7.06-6.92 (m, 1H, 4-H), 6.07 (dd, *J* = 10.3, 1.7 Hz, 1H, 3-H), 5.55 (d, *J* = 8.2 Hz, 1H, 6-H), 4.08 (dd, *J* = 4.5, 2.3 Hz, 1H, 1-H), 2.18 - 2.07 (m, 1H, -O-CH-C*H*-), 1.56 - 1.19 (m, 2H, -CH_2-), 0.86 (d, *J* = 7.2 Hz, 3H, -CH-CH_3), 0.93 (t, *J* = 7.7 Hz, 3H, -CH_2-CH_3). Isomer 4: 7.06-6.92 (m, 1H, 4-H), 6.06 (dd, *J* = 10.4, 1.2 Hz, 1H, 3-H), 5.55 (d, *J* = 8.2 Hz, 1H, 5-H), 3.96 (dd, *J* = 3.3, 1.5 Hz, 1H, 1-H), 2.18 - 2.07 (m, 1H, -O-CH-C*H*-), 1.56 - 1.19 (m, 2H, -CH_2-), 1.02 (d, *J* = 6.6 Hz, 3H, -CH-CH_3), 0.85 (t, *J* = 7.6 Hz, -CH_2-CH_3). ^{13}C NMR (75 MHz, MeOH-d_4) δ Isomer 1: 199.7 (2-C), 147.8 (4-C), 128.1 (3-C), 88.5 (1-C), 76.7 (5-C), 36.4 (-O-CH-*C*H-), 26.9 (-CH_2-), 14.4 (-CH-*C*H_3), 12.1 (-CH_2-*C*H_3). Isomer 2: 199.2 (2-C), 147.7 (4-C), 128.1 (3-C), 88.5 (1-C), 79.2 (5-C), 36.8 (-O-CH-*C*H-), 25.3 (-*C*H_2-), 16.4 (-CH-CH_3)12.6 (-CH_2-*C*H_3). Isomer 3: 199.0 (2-C), 151.9 (4-C), 130.0 (3-C), 92.5 (1-C), 81.9 (5-C), 36.4 (-O-CH-*C*H-), 27.0 (-CH-*C*H_2-), 14.3 (-

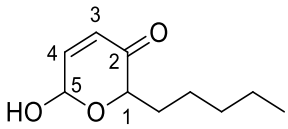
CH-*C*H$_3$), 12.5 (-CH$_2$-*C*H$_3$). Isomer 4: 198.7 (2-C), 151.5 (4-C), 129.9 (3-C), 92.4 (1-C), 83.9 (5-C), 36.8 (-O-CH-*C*H), 25.2 (-*C*H$_2$-), 16.4 (-CH-*C*H$_3$), 12.5 (-CH$_2$-*C*H$_3$). HRMS (ESI, m/z) m/z calculated for $C_9H_{14}O_3$ [M-H$^+$] 169.0870, found 169.0867.

6-Hydroxy-2,2-dimethyl-2H-pyran-3(6H)-one **10i**



The compound was synthesised according General Method D. Scale: 2-(furan-2-yl)propan-2-ol **9i** (24.6 mg, 195 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (3 x 30 mL), washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo*. The title compound **10i** was obtained as a pale-yellow oil, and did not require additional purification. R_f = 0.29 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 21.0 mg (76%). ^{1}H NMR (400 MHz, MeOH-d$_4$) δ 6.97 (dd, *J* = 10.2, 2.2 Hz, 1H, 4-H), 6.02 (dd, *J* = 10.2, 1.3 Hz, 1H, 3-H), 5.63 (dd, *J* = 2.2, 1.3 Hz, 5-H), 1.43 (s, 3H, -C*H*'$_3$), 1.35 (s, 3H, -C*H*''$_3$). ^{13}C NMR (101 MHz, MeOH-d$_4$) δ 199.9 (2-C), 148.2 (4-C'), 147.9 (4-C''), 125.4 (3-C'), 125.2 (3-C''), 87.4 (5-C'), 87.3 (5-C''), 78.7 (1-C), 25.7 (-CH$_3$), 25.5 (-CH$_3$), 22.9 (-CH$_3$), 22.8(-CH$_3$).

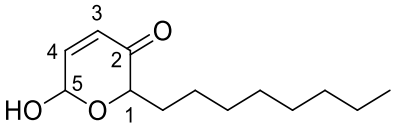
6-Hydroxy-2-pentyl-2H-pyran-3(6H)-one **10j**



The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)hexan-1-ol **9j** (20.0 mg, 128 µmol, 1.00 eq.). *The reaction medium was heterogenous at first, but became homogeneous after ≈30 min.* The reaction was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the title compound **10j** as a yellow oil, which did not require additional purification. R_f = 0.42 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 20 mg (0.11 mmol, 85%). The product was a 7:3 mixture of diastereoisomers. ^{1}H NMR (300 MHz, MeOH-d$_4$) δ Major diastereoisomer: 6.96 (dd, *J* = 10.5, 3.5 Hz, 4-H), 5.99 (dd, *J* = 10.5 Hz, 1H, 3-H), 5.50 (d, *J* = 3.5 Hz, 1H, 5-H), 4.48 (dd, *J* = 8.0, 3.9 Hz, 1H, 1-H), 1.90-1.79 (m, 1H, -O-CH-*H*CH-), 1.70-1.53 (m, 1H, -O-CH-HC*H*-), 1.48-1.35 (m, -CH-CH$_2$-C*H*$_2$-), 1.36-1.22 (m, 4H, -C*H*$_2$-C*H*$_2$-CH$_3$), 0.92-0.83 (m, 3H, -C*H*$_3$). Minor diastereoisomer: 6.97 (dd, *J* = 10.3, 2.5 Hz, 1H, 4-H), 6.05 (dd, *J* = 10.3 Hz, 1H, 3-H), 5.58 - 5.55 (m, 1H, 5-H), 4.11 - 4.04 (m, 1H, 1-H), 1.90 - 1.79 (m, 1H, -O-CH-*H*CH-), 1.70 - 1.53 (m, 1H, -O-CH-HC*H*-), 1.48 - 1.35 (m, -CH-CH$_2$-C*H*$_2$-), 1.36 - 1.22 (m, 4H, -C*H*$_2$-C*H*$_2$-CH$_3$), 0.92 - 0.83 (m, 3H, -C*H*$_3$). ^{13}C NMR (75 MHz, MeOH-d$_4$) δ Major diastereoisomer: 199.1 (2-C), 147.9 (4-C), 127.5 (3-C), 88.5 (1-C), 74.8 (5-C),

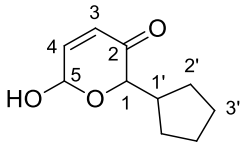
32.7, 30.7, 25.7, 23.6 (4 x CH_2), 14.4 (-CH_3). Minor diastereoisomer: 198.7 (2-C), 151.4 (4-C), 129.1 (3-C), 92.1 (1-C), 79.7 (5-C), 32.7, 31.4, 25.8, 23.6 (4 x CH_2), 14.4 (-CH_3). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{16}O_3$ [M-H^+] 183.1027, found 183.1025. The data match those previously reported.[19]

6-Hydroxy-2-octyl-2H-pyran-3(6H)-one **10k**



The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)nonan-1-ol **9k** (40.0 mg, 190 µmol, 1.00 eq.). *The reaction was performed using 20 v/v % MeCN as co-solvent to increase solubility of the substrate*. The aqueous phase was extracted with Et_2O (3 x 20 mL), the unified organic phase was washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a thick, yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **10k** as a white solid. R_f = 0.42 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 16.0 mg (49%). The poor solubility of the starting material likely influenced the comparatively low yield of the reaction. The product was yielded as a 7:3 mixture of diastereoisomers. ^{1}H NMR (300 MHz, MeOH-d_4) δ Major diastereoisomer: 7.03 (dd, *J* = 10.3, 3.3 Hz, 1H, 4-H), 6.06 (d, *J* = 10.3 Hz, 1H, 3-H), 5.56 (d, *J* = 3.3 Hz, 1H, -C*H*(OH)-), 4.55 (dd, *J* = 8.0, 3.9 Hz, 1H, 1-H) 2.00 – 1.84 (m, 1H, -O-CH-*H*CH-), 1.81 - 1.61 (m, 1H, -O-CH-HC*H*-), 1.58-1.22 (m, 12H, 6 x CH_2), 0.94 (t, *J* = 7.2 Hz, 3H, -CH_3). Minor diastereoisomer: 7.03 (d, *J* = 10.3 Hz, 1H, 4-H), 6.12 (dd, *J* = 10.3, 1.7 Hz, 1H, 3-H), 5.63 (d, *J* = 1.7 Hz, 1H, 5-H), 4.14 (ddd, *J* = 8.2, 3.9, 1.4 Hz, 1H, 1-H), 2.00 – 1.84 (m, 1H, -O-CH-*H*CH-), 1.81 – 1.61 (m, 1H, -O-CH-HC*H*-), 1.58-1.22 (m, 12H, 6 x CH_2), 0.94 (t, *J* = 7.2 Hz, 3H, -CH_3). ^{13}C NMR (75 MHz, MeOH-d_4) δ Major diastereoisomer: 199.1 (2-C), 147.9 (4-C), 127.5 (3-C), 88.6 (1-C), 74.9 (5-C), 33.03, 30.8, 30.6, 30.5, 30.4, 26.0 (6 x CH_2), 23.7 (-*C*H_2-CH_3), 14.4 (-CH_2-*C*H_3). Minor diastereoisomer: 198.7 (2-C), 151.4 (4-C), 129.1 (3-C), 92.1 (1-C), 79.7 (5-C), 31.5, 30.8, 30.6, 30.5, 30.4, 26.1 (6 x CH_2), 23.7 (-*C*H_2-CH_3), 14.4 (-CH_2-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_{13}H_{22}O_3$ [M-H^+] 225.1496, found 225.1499. The data match those previously reported.[20]

2-Cyclopentyl-6-hydroxy-2H-pyran-3(6H)-one **10l**



Method used for the preparation of the synthetic standard:

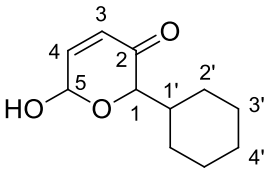
The compound was synthesised according to General Method C. Scale: cyclopentyl(furan-2-yl)methanol **9l** (160 mg, 0.963 mmol, 1.00 eq.). The crude material did not require additional purification. Yield: 173 mg (99%). The product **10l** was yielded as a mixture of diastereoisomers in a 2:1 ratio.

Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: cyclopentyl(furan-2-yl)methanol **9l** (71.8 mg, 432 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (3 x 30 mL), washed with brine, dried over $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a brown oil. The crude material contained 23% starting material and 77% product based on analysis of the ^{1}H NMR data of the unpurified product. The crude material was purified by column chromatography (*n*-Hex:EtOAc = 8:2). Rf = 0.45 (*n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 24.2 mg (31%). The product was yielded as a mixture of diastereoisomers in 2:1 ratio.

Data for **10l**: ^{1}H NMR (400 MHz, MeOH-d_4) δ Major diastereoisomer: 6.97 (dd, *J* = 10.1, 3.3 Hz, 1H, 4-H), 6.00 (d, *J* = 10.1 Hz, 1H, 3-H), 5.54 (d, *J* = 3.3 Hz, 1H, 5-H), 4.46 (d, *J* = 4.7 Hz, 1H, 1-H), 2.58 - 2.46 (m, 1H, 1'-H), 1.82 - 1.40 (m, 8H, 2 x 2'-H, 2 x 3'-H). Minor diastereoisomer: 6.96 (dd, *J* = 10.3, 1.5 Hz, 1H, 4-H), 6.05 (dd, *J* = 10.3 Hz, 1H, 3-H), 5.59 - 5.56 (m, 1H, 5-H), 4.03 (dd, *J* = 5.0, 1.5 Hz, 1H, 1-H), 2.58 - 2.46 (m, 1H, 1'-H), 1.82 - 1.40 (m, 8H, 2 x 2'-H, 2 x 3'-H). ^{13}C NMR (100 MHz, MeOH-d_4) δ Major diastereoisomer: 199.2 (2-C), 147.8 (4-C), 127.9 (3-C), 88.7 (5-C), 77.3 (1-C), 40.6 (1'-C), 30.6 (2'/3'-C), 29.6 (2'/3'-C), 27.8 (2'/3'-C), 26.8 (2'/3'-C). Minor diastereoisomer: 198.8 (2-C), 151.2 (4-C), 129.6 (3-C), 92.3 (5-C), 82.2 (2-C), 41.2 (1'-C), 30.6 (2'/3'-C), 29.8 (2'/3'-C), 28.2 (2'/3'-C), 26.9 (2'/3'-C). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{14}O_3$ [M-H$^+$] 181.0870, found 181.0875.

2-Cyclohexyl-6-hydroxy-2H-pyran-3(6H)-one **10m**



Method used for the preparation of the synthetic standard:

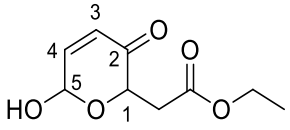
The compound was synthesised according to General Method C. Scale: cyclohexyl(furan-2-yl)methanol **9m** (150 mg, 0.832 mmol, 1.00 eq). The crude material was formed as a yellow residue, and did not require additional purification. Yield: 162 mg (99%). The title compound **10m** was yielded as a mixture of diastereoisomers in a 7:3 ratio.

Biocatalytic method on preparative scale:

The compound was synthesised according to General Method D. Scale: cyclohexyl(furan-2-yl)methanol **9m** (54.0 mg, 281 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (3 x 20 mL), the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as yellow oil. The crude material (44 mg) was purified by column chromatography (*n*-Hex:EtOAc = 7:3) to yield the title compound **10m** as a yellow oil. R_f = 0.39 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 24.8 mg (45%). The product was yielded as a ≈1:1 mixture of diastereoisomers.

Bio cat data ^{1}H NMR (400 MHz, MeOH-d_4) δ 6.91 (dd, *J* = 10.1, 2.7 Hz, 1H, 4-H), 5.91 (d, *J* = 10.1 Hz, 1H, 3-H), 4.89 - 4.87 (m, 1H, 5-H), 4.29 (d, *J* = 2.7 Hz, 1H, 1-H), 2.37 - 2.28 (m, 1H, 1'-H), 1.54 – 1.47 (m, 1H, 2H, 2'-H_α, 3'-H_α), 1.04 - 0.95 (m, 2H, 4'-H_α, 2'-H_β), 0.84 - 0.75 (m, 2H, 4'-H_β, 3'-H_β). ^{13}C NMR (101 MHz, MeOH-d_4) δ diastereoisomer 1: 199.3 (2-C), 151.4 (4-C), 137.2 (3-C) 93.3 (5-C), 79.2 (1-C), 30.0 (1'-C), 28.4 (2'-C), 19.5 (3'-C), 16.4 (4'-C). diastereoisomer 2: 199.3 (2-C), 151.2 (4-C), 137.2 (3-C), 93.3 (5-C), 79.2 (1-C), 29.7 (1'-C), 28.2 (2'-C), 19.5 (3'-C), 16.4 (4'-C). Due to signal overlap in the 1H spectrum, the signals of the two diastereoisomers were not well resolved. HRMS (ESI, m/z) m/z calculated for [M-H$^+$] 195.1027, found 195.1026. The data match those previously reported.[21]

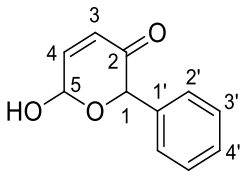
Ethyl 2-(6-hydroxy-3-oxo-3,6-dihydro-2H-pyran-2-yl)acetate **10n**



The compound was prepared according to General Method D. Scale: ethyl 3-(furan-2-yl)-3-hydroxypropanoate **9n** (40.0 mg, 217 µmol, 1.00 eq.). The diluted H_2O_2 solution was added to the

reaction over 1 h at rt. The reaction was extracted with EtOAc (3 x 30 mL), the unified organic phase was washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a pale brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **10n** as a transparent oil. R_f = 0.19 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 30.0 mg (70%). The product was obtained as a mixture of diastereoisomers in a 2:1 ratio. ^{1}H NMR (300 MHz, MeOH-d_4) δ Major diastereoisomer: 7.00 (dd, *J* = 10.3, 3.6 Hz, 1H, 4-H), 6.07 (d, *J* = 10.3 Hz, 1H, 3-H), 5.51 (d, *J* = 3.6 Hz, 1H, 6-H), 4.94 (dd, *J* = 6.8, 4.6 Hz, 1H, 1-H), 4.13 (q, *J* = 7.1 Hz, 2H, -C*H*$_2$-CH$_3$), 2.86 (dd, *J* = 16.4, 4.6 Hz, 1H, -CH-*H*CH-), 2.72 (dd, *J* = 16.4, 6.8 Hz, 1H, -CH-HC*H*-), 1.24 (t, *J* = 7.1 Hz, 3H, -CH$_3$). Minor diastereoisomer: 7.00 (dd, *J* = 10.1, 1.8 Hz, 1H, 4-H), 6.13 (dd, *J* = 10.1, 1.7 Hz, 1H, 3-H), 5.64 (d, *J* = 1.8 Hz, 1H, 5-H), 4.59 (app. ddd, *J* = 7.6, 4.4, 1.4 Hz, 1H, 1-H), 4.10 (q, *J* = 7.2 Hz, 2H, -C*H*$_2$-CH$_3$), 2.93 (dd, *J* = 16.4, 4.4 Hz, 1H, -CH-*H*CH-), 2.71 (dd, *J* = 16.4, 7.6 Hz, 1H, -CH-HC*H*-), 1.25 (t, *J* = 7.2 Hz, 3H, -CH$_3$). ^{13}C NMR (75 MHz, MeOH-d_4) δ Major diastereoisomer: 197.2 (2-C), 172.2 (-*C*OO-), 147.7 (4-C), 127.2 (3-C), 88.7 (1-C), 71.9 (5-C), 61.8 (-*C*H$_2$-CH$_3$), 36.5 (-*C*H$_2$-C(O)-), 14.4 (-CH$_3$). Minor diastereoisomer: 196.7 (2-C), 172.2 (-*C*OO-), 151.7 (4-C), 128.9 (3-C), 92.4 (1-C), 76.5 (5-C), 61.9 (-*C*H$_2$-CH$_3$), 36.8 (-*C*H$_2$-C(O)-), 14.4 (-*C*H$_3$). HRMS (ESI, m/z) m/z calculated for $C_9H_{12}O_5$ [M+Na$^+$] 223.0577, found 223.0575. The data match those previously reported.[22]

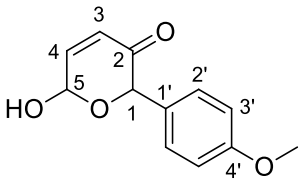
6-Hydroxy-2-phenyl-2H-pyran-3(6H)-one **10o**



The compound was prepared according to General Method D. Scale: furan-2-yl(phenyl)methanol **9o** (40.0 mg, 196 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (4 x 20 mL), the unified organic phase was washed with brine, dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a brown oil (39 mg). The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 1:1) to yield the product **10o** as a white solid. R_f = 0.63 (eluent: *n*-Hex:EtOAc = 1:1). Yield: 15.7 mg (42%). The product was yielded as a 5:2 mixture of diastereoisomers. ^{1}H NMR (400 MHz, MeOH-d_4) δ Major diastereoisomer: 7.35 - 7.21 (m, 5H, 2 2'-H$_{Ar,}$ 2 x 3'-H$_{Ar}$, 4'-H$_{Ar}$), 7.09 (dd, *J* = 10.3, 3.3 Hz, 1H, 4-H$_{Ar}$), 6.11 (d, *J* = 10.3 Hz, 1H, 3-H$_{Ar}$), 5.64 (d, *J* = 3.3 Hz, 1H, 5-H), 5.53 (s, 1H, 1-H). Minor diastereoisomer: 7.35 - 7.21 (m, 5H, 2 x 2'-H$_{Ar,}$ 2 x 3'-H$_{Ar}$, 4'-H$_{Ar}$), 7.11 – 7.07 (m, 1H, 4-H$_{Ar}$), 6.18 (dd, *J* = 10.1, 2.2 Hz, 1H, 3-H$_{Ar}$), 5.78 (d, *J* = 2.2 Hz, 1H, 5-H), 5.18 (s, 1H, 1-H). ^{13}C NMR (101 MHz, $CDCl_3$) δ Major diastereoisomer: 194.6 (-*C*O-), 144.8 (4-C), 135.3 (1'-C$_{Ar}$), 129.5 (4'-C$_{Ar}$), 128.6 (2 x 2'/3'-C$_{Ar}$), 128.1 (2 x 2'/3'-C$_{Ar}$), 128.0 (3-C), 88.2 (5-C), 77.3 (1-C). Minor

diastereoisomer: 194.2 (2-C), 148.2 (4-C), 135.5 (1'-C), 130.2 (4'-C), 129.4 (3-C), 128.7 (2 x 2'/3'-C_{Ar}), 128.6 (2 x 2'/3'-C_{Ar}), 91.6 (5-C), 81.2 (1-C). HRMS (ESI, m/z) m/z calculated for $C_{11}H_{10}O_3$ [M+Na^+] 213.0527, found 213.0524. The data match those previously reported.[23]

6-Hydroxy-2-(4-methoxyphenyl)-2H-pyran-3(6H)-one **10p**



Method used for the preparation of the synthetic standard:

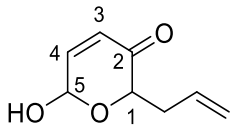
The compound was synthesised according to General Method C. Scale: furan-2-yl(4-methoxyphenyl)methanol **9p** (250 mg, 1.22 mmol, 1.00 eq.). The crude material purified by column chromatography (*n*-Hex:EtOAc = 6:4) to yield the title compound **10p** as a yellow oil. R_f = 0.34 (*n*-Hex:EtOAc = 6:4). Yield: 177 mg (0.80 mmol, 66%). The product was yielded as a mixture of diastereoisomers in a 3:1 ratio.

Biocatalytic method on preparative scale:

The compound was prepared according to General Method D. Scale: furan-2-yl(4-methoxyphenyl)methanol **9p** (40.8 mg, 200 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (4 x 20 mL), washed with brine (15.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a brown oil, that was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3). R_f = 0.13 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 20.2 mg (46 %). The product was obtained as a mixture of diastereoisomers in a 2:1 ratio.

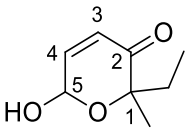
Data for **9p**: ^{1}H NMR (400 MHz, MeOH-d_4) Major diastereoisomer: 7.40 - 7.21 (m, 2H, 2 x 2'-H_{Ar}), 6.95 - 6.79 (m, 2H, 2 x 3'-H_{Ar}), 6.10 - 6.02 (m, 1H, 4-H), 5.94 - 5.90 (m, 1H, 3-H), 5.49 - 5.42 (m, 1H, 5-H), 4.70 (s, 1H, 1-H), 3.76 (s, 3H, -OCH_3). Minor diastereoisomer: 7.40 - 7.21 (m, 2H, 2 x 2'-H_{Ar}), 6.95 - 6.79 (m, 2H, 2 x 3'-H_{Ar}), 6.18 - 6.12 (m, 1H, 4-H), 5.81 - 5.79 (m, 1H, 3-H), 4.98 - 4.91 (m, 1H, 5-H), 4.77 (s, 1H, 1-H), 3.76 (s, 3H, -OCH_3). ^{13}C NMR (101 MHz, MeOH-d_4) Major diastereoisomer: 197.0 (2-C), 160.3 (4'-C_{Ar}), 149.5 (4-C), 133.5 (2 x 2'-C_{Ar}), 133.0 (1'-C_{Ar}), 131.7 (3-C), 113.6 (2 x 3'-C_{Ar}), 108.6 (5-C), 78.2 (1-C), 55.6 (-OCH_3). Minor diastereoisomer: 197.4 (2-C), 160.9 (4'-C_{Ar}), 148.4 (4-C), 133.7 (2 x 2'-C_{Ar}), 132.5 (3-C), 131.4 (1'-C_{Ar}), 116.3 (2 x 3'-C_{Ar}), 109.8 (5-C), 77.9 (1-C), 55.6 (-OCH_3). HRMS (ESI, m/z) m/z calculated for $C_{12}H_{12}O_4$ [M+H^+] 243.0628, found 243.0626. The data match those previously reported.[6]

2-Allyl-6-hydroxy-2H-pyran-3(6H)-one **10s**



1-(Furan-2-yl)but-3-en-1-ol **9s** (560 mg, 4.04 mmol, 1.00 eq.) was dissolved in a mixture of THF (24.0 mL and deionised water (6.00 mL), followed by the addition of KBr (20.0 mg, 0.200 mmol, 5.00 mol%) and $NaHCO_3$ (170 mg, 2.02 mmol, 0.500 eq.). The heterogenous mixture was cooled to 0 °C. 0.74 g Oxone (740 mg, 4.84 mmol, 1.20 eq.) was added in 3 portions to the solution at this temperature. After stirring for an additional 30 min at this temperature, the reaction was quenched by the addition of saturated aqueous $NaHCO_3$ solution (80 mL) and extracted with EtOAc (3x50 mL). The extract was washed with brine (50 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo*. The crude material was a thick, transparent oil. oil. The crude material was chromatographically pure (GC-FID) and was used without further purification. R_f = 0.28 (*n*-Hex: = 7:3, $KMnO_4$ staining). Yield: 515 mg (83%). The product was yielded as a mixture of diastereoisomers in 2:1 ratio. ^{1}H NMR (400 MHz, MeOH-d_4) δ Major diastereoisomer: 6.99 (dd, *J* = 10.2, 3.5 Hz, 1H, 4-H), 6.01 (d, *J* = 10.2 Hz, 1H, 3-H), 5.95 - 5.76 (m, 1H, -C*H*=CH_2), 5.51 (d, *J* = 3.5 Hz, 1H, 5-H), 5.11 (dd, *J* = 16.9, 1.5 Hz, 1H, -CH-HC*H*), 5.03 (dd, *J* = 10.3, 1.5 Hz, 1H, -CH=*H*CH), 4.59 (dd, *J* = 7.7, 4.0 Hz, 1H, 1-H), 2.70 - 2.59 (m, 1H, *H*CH-CH=), 2.49 - 2.35 (m, 1H, -HC*H*-CH=); Minor diastereoisomer: 6.99 (d, *J* = 10.5 Hz, 1H, 3-H), 6.08 (dd, *J* = 10.5, 1.4 Hz, 1H, 4-H), 5.95 - 5.76 (m, 1H, -C*H*=CH_2), 5.59 (d, *J* = 1.4 Hz, 1H, 5-H), 5.12 (dd, *J* = 17.1, 1.5 Hz, -CH=HC*H*), 5.04 (dd, *J* = 10.7, 1.5 Hz, 1H, -CH=*H*CH), 4.17 (dd, *J* = 7.6, 3.7 Hz, 1H, 1-H), 2.70 - 2.59 (m, 1H, *H*CH-CH=), 2.49 - 2.35 (m, 1H, HC*H*-CH=). ^{13}C NMR (100 MHz, MeOH-d_4) δ Major diastereoisomer: 198.1 (2-C), 148.0 (4-C), 135.3 (3-C), 127.4 (-*C*H=CH_2), 117.7 (-CH=*C*H_2), 88.6 (1-C), 74.6 (5-C), 35.2 (-*C*H_2-CH=); Minor diastereoisomer: 197.7 (2-C) 151.6 (4-C), 92.2 (1-C), 74.7 (5-C). Some of the ^{13}C signals of the minor isomer were not detected due to the diluteness of the sample. No molecular ion could be detected under either ESI, or APCI conditions. The data match those previously reported.[6]

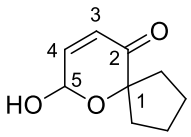
2-Ethyl-6-hydroxy-2-methyl-2H-pyran-3(6H)-one **10t**



The compound was synthesised according to General Method D. Scale: 2-(furan-2-yl)butan-2-ol **9t** (50.0 mg, 357 µmol, 1.00 eq.). The reaction media was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (15.0 mL), dried over anhydrous $MgSO_4$, filtered, and

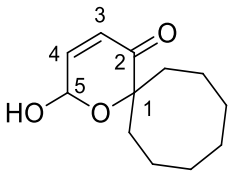
evaporated *in vacuo* to yield the crude material as a brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 6:4) to yield the title compound **10t** as a yellow oil. R_f = 0.57 (eluent: *n*-Hex:EtOAc = 6:4, $KMnO_4$ staining). Yield: 50.0 mg (90%). The product was obtained as a mixture of diastereoisomers in a 1:1 ratio. ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.02–6.90 (m, 1H, 4-H), 6.01 (dd, *J* = 10.1, 1.3 Hz, 1H, 3-H), 5.63 (ddd, *J* = 7.8, 2.1, 1.3 Hz, 1H, -C*H*(OH)-), 1.99 - 1.82 (m, 1H, -HC*H*-), 1.67-1.50 (m, 1H, -*H*CH-), 1.39 (s, 3H, -C-CH_3), 1.29 (s, 3H, -C-CH'$_3$), 0.92 (t, *J* = 7.2 Hz, 3H, -CH_2-CH_3), 0.90 (t, *J* = 7.2 Hz, 3H, -CH_2-C*H*'$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ Diastereoisomer 1: 201.6 (2-C), 149.6 (4-C), 127.3 (3-C), 88.6 (1-C), 82.7 (-*C*H(OH)-), 32.7 (-CH_2-), 24.9 (-C-CH_3), 8.1 (-CH_2-*C*H_3). Diastereoisomer 2: 201.4 (2-C), 149.0 (4-C), 126.9 (3-C), 88.5 (1-C), 82.6 (-*C*H(OH)-), 31.1 (-CH_2-), 21.6 (-C-CH_3), 7.8 (-CH_2-*C*H_3). HRMS (ESI, m/z) m/z calculated according to $C_8H_{12}O_3$ [M+Na^+] 179.0679, found 179.0676.

7-Hydroxy-6-oxaspiro[4.5]dec-8-en-10-one **10u**



The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)cyclopentanol **9u** (60.0 mg, 394 µmol, 1.00 eq.). The diluted H_2O_2 was added to the reaction mixture over 1 h at rt. The reaction was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (15.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a brown oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the product as a pale brown oil. R_f = 0.31 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 50.0 mg (81%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 6.95 (dd, *J* = 10.2, 2.3 Hz, 1H, 4-H), 6.06 (dd, *J* = 10.2, 1.4 Hz, 1H, 3-H), 5.59 (dd, *J* = 2.3, 1.4 Hz, 1H, 5-H), 2.10 – 2.01 (m, 2H), 1.99 - 1.89 (m, 1H), 1.88 – 1.77 (m, 3H), 1.76 - 1.65 (m, 2H). ^{13}C NMR (101 MHz, MeOH-d_4) δ 201.1 (-*C*(O)-), 149.2 (4-C), 127.8 (3-C), 90.3 (1-C), 88.9 (5-C), 39.7, 36.7, 25.6, 25.5 (4 x CH_2). HRMS (ESI, m/z) m/z calculated according to $C_8H_{12}O_3$ [M-H^+] 167.0708, found 167.0715. The data match those previously reported.[24]

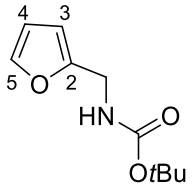
2-Hydroxy-1-oxaspiro[5.7]tridec-3-en-5-one **10v**



The compound was synthesised according to General Method D. Scale: 1-(furan-2-yl)cyclooctanol **9v** (40.0 mg, 206 µmol, 1.00 eq.). The diluted H_2O_2 solution was added to the reaction mixture over 3 h

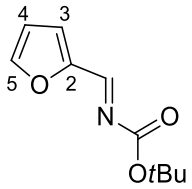
at rt. The reaction mixture was heterogenous at the outset of the reaction and gradually became homogeneous during the reaction. The reaction was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (15.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **9v** as a pale yellow oil. R_f = 0.42 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 20.0 mg (46%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 6.90 (ddd, *J* = 10.4, 3.3, 2.3 Hz, 1H, 4-H), 5.94 (ddd, *J* = 10.4, 3.1, 1.2 Hz, 1H, 3-H), 5.63 - 5.55 (m, 1H, -C*H*(OH)-), 2.10 – 2.01 (m, 1H), 1.95 – 1.70 (m, 5H), 1.65 – 1.45 (m, 8H). ^{13}C NMR (101 MHz, MeOH-d_4) δ 201.7 (3-C), 148.9 (4-C), 126.8 (3-C), 88.4 (-*C*H(OH)-), 83.7 (1-C), 34.2 (-CH_2-), 30.9 (-CH_2-), 29.3 (-CH_2-), 28.8 (-CH_2-), 25.4 (-CH_2-), 22.1 (-CH_2-), 22.0 (-CH_2-). HRMS (ESI, m/z) m/z calculated for $C_{12}H_{18}O_3$ [M+Na^+] 233.1148, found 233.1150. The NMR spectra are in agreement with those published.[7]

Furan-2-ylmethylcarbamic acid tert-butyl ester **11a**



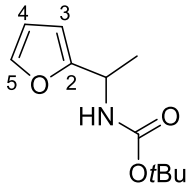
To a solution of furfurylamine (0.910 mL, 1.00 g, 10.3 mmol, 1.00 eq) and TEA (2.09 g, 20.6 mmol, 2.00 eq) in dry DCM was added Boc_2O (3.37 g, 15.4 mmol, 1.50 mmol) in one portion at rt. The reaction medium was stirred at this temperature for 4 h the reaction was washed with brine (3 x 30 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a brown oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 17:3) to yield the title compound **11a** as yellow oil. R_f = 0.31 (eluent: *n*-Hex:EtOAc = 17:3, $KMnO_4$ staining). Yield: 1.90 g (93%). This compound is acid sensitive. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.34 (dd, *J* = 1.9, 0.9 Hz, 1H, 5-H_{Ar}), 6.30 (dd, *J* = 3.2, 1.9 Hz, 1H, 4-H_{Ar}), 6.20 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.84 (br. s, 1H, -N*H*-), 4.29 (d, *J* = 5.3 Hz, 2H, -CH_2-NH-), 1.45 (s, 9H, -C(CH_3)$_3$). ^{13}C NMR (75 MHz, MeOH-d_4) δ 155.7 (-C(O)-), 152.8 (2-C_{Ar}), 142.2 (5-C_{Ar}), 110.5 (C_{Ar}), 107.0 (C_{Ar}), 79.8 (-*C*(CH_3)$_3$), 37.9 (-CH_2-), 28.5 (-C(*C*H_3)$_3$). The data match those previously reported.[25]

(1-Furan-2-ylmethylidene)carbamic acid tert-butyl ester



To a flame-dried round-bottom flask equipped with a reflux condenser was added anhydrous K_2CO_3 (12.2 g, 88.8 mmol, 6.00 eq), anhydrous Na_2SO_4 (13.0 g, 91.5 mmol, 6.18 eq) and *tert*-butyl (furan-2-yl(phenylsulphonyl)methyl)carbamate (5.00 g, 14.8 mmol, 1.00 eq) under N_2 atmosphere, followed by the addition of dry THF (121.0 mL). The suspension was refluxed for 15 h, the solids were filtered, and the filtrate was concentrated *in vacuo* to yield the crude material as a red oil. R_f = 0.64 (eluent:*n*-Hex:EtOAc = 4:1). Yield: 2.36 g (82%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.46 (d, *J* = 1.9 Hz, 1H, 5-H_{Ar}), 6.38 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 6.37 (dd, *J* = 3.2, 1.9 Hz, 1H, 4-H_{Ar}), 5.78 (s, 1H, -C*H*=NBoc), 1.47 (s, 9H, -C(C*H*$_3$)$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 152.9 (2-C_{Ar}), 143.8 (5-C_{Ar}), 111.2 (3-C_{Ar}), 108.3 (4-C_{Ar}), 81.0 (-*C*(CH$_3$)$_3$), 79.4 (-*C*H=NBoc), 28.6 (-C(*C*H$_3$)$_3$). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{13}NO_3$ [M+H$^+$] 196.0968, found 196.0964. The data match those previously reported.[26]

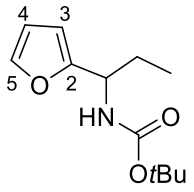
N-[1-(furan-2-yl)ethyl]carbamic acid tert-butyl ester **11b**



(1-Furan-2-ylmethylidene)carbamic acid *tert*-butyl ester (500 mg, 2.56 mmol, 1.00 eq.) was dissolved in dry THF (15.0 mL) in a flame-dried round-bottom flask and methylmagnesium bromide solution (3.00 M in Et_2O, 1.02 mL, 3.07 mmol, 1.20 eq) was added to the solution dropwise over 20 min at 0 °C. After 1 h stirring at rt, the starting material was still not consumed according to TLC analysis, but side products started to form, thus saturated NH_4Cl solution (15.0 mL) was added to the reaction medium dropwise at 0 °C. After 10 min stirring at this temperature, the layers were separated and the aqueous phase was further extracted with EtOAc (3 x 15 mL). The unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a yellow oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 10:1) to yield the title compound **11b** as a pale yellow oil. R_f = 0.38 (eluent: *n*-Hex:EtOAc = 10:1, $KMnO_4$ staining). Yield: 214 mg (40%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.36 (dd, *J* = 1.7, 0.8 Hz, 1H, 5-H_{Ar}), 6.29 (dd, *J* = 3.4, 1.7 Hz, 1H, 4-H_{Ar}), 6.13 (dd, *J* = 3.3, 0.8 Hz, 1H, 3-H_{Ar}), 4.72 (d, *J* = 7.2 Hz, 1H, -C*H*-NHBoc), 1.41 (s, 9H, -

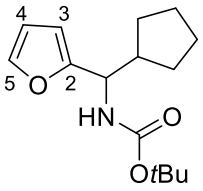
$C(CH_3)_3$), 1.39 (d, *J* = 7.2 Hz, 3H, CH-C*H*$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 156.9 (2-C_{Ar}), 142.8 (5-C_{Ar}), 111.1 (3/4-C_{Ar}), 105.7 (3/4-C_{Ar}), 45.4 (-*C*H-CH$_3$), 28.7 (-C(*C*H$_3$)$_3$), 20.0 (-CH-*C*H$_3$). %). HRMS (ESI, m/z) m/z calculated for $C_{11}H_{17}NO_3$ [M+H$^+$] 212.1281, found 212.1281. The data match those previously reported.[27]

N-[1-(Furan-2-yl)-n-propyl]carbamic acid tert-butyl ester **11c**



(1-Furan-2-ylmethylidene)carbamic acid *tert*-butyl ester (500 mg, 2.56 mmol, 1.00 eq.) was dissolved in dry THF (15.0 mL) in a flame-dried round-bottom flask and ethylmagnesium bromide solution (1.02 mL, 3.00 M in Et_2O, 3.07 mmol, 1.20 eq.) was added to the solution dropwise over 20 min at 0 °C. After an additional 30 min stirring at this temperature, the starting material was consumed according to TLC analysis and saturated NH_4Cl solution (15.0 mL) was added to the reaction mixture dropwise. After 10 min stirring, the layers were separated, and the aqueous phase was further extracted with EtOAc (3 x 15 mL). The unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 20:1) to yield the title compound **11c** as a pale yellow oil. Yield: 170 mg (30%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.33 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 6.29 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.15 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.87 - 4.73 (br. s, 1H, -N*H*-), 4.66 (dd, *J* = 7.3, 6.8 Hz, 1H, -C*H*-CH$_2$-), 1.91 - 1.70 (m, 2H, -C*H*$_2$-), 1.44 (s, 9H, -C(C*H*$_3$)$_3$), 0.90 (t, *J* = 7.4 Hz, 3H, -C*H*$_3$). ^{13}C NMR (75 MHz, MeOH-d_4) δ 142.7 (5-C_{Ar}), 111.0 (4-C_{Ar}), 106.4 (3-C_{Ar}), 80.2 (-*C*(CH$_3$)$_3$), 51.5 (-*C*H-NHBoc), 28.7 (-C(*C*H$_3$)$_3$), 28.1 (-*C*H$_2$-), 10.9 (-CH$_2$-*C*H$_3$). The quaternary carbon signals could not be detected due to signal broadening caused by the N–CO bond rotation. HRMS (ESI, m/z) m/z calculated for $C_{12}H_{19}NO_3$ [M+H$^+$] 248.1257, found 248.1256. The data match those previously reported.[28]

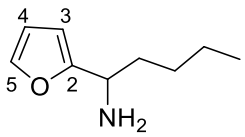
N-[1-(Furan-2-yl)-1-cyclopentylmethyl]carbamic acid tert-butyl ester **11d**



(1-Furan-2-ylmethylidene)carbamic acid *tert*-butyl ester (500 mg, 2.56 mmol, 1.00 eq.) was dissolved in dry THF (15.0 mL) in a flame-dried round-bottom flask and cyclopentylmagnesium bromide solution

(1.54 mL, 2.00 M in Et_2O, 3.07 mmol, 1.20 eq.) was added to the solution dropwise over 20 minat 0 °C. After 2 h stirring at this temperature, the reaction was quenched by the dropwise addition of saturated NH_4Cl solution (15.0 mL) at 0 °C. After 10 min stirring, the layers were separated and the aqueous phase was further extracted with EtOAc (3 x 15 mL). The unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 20:1) to yield the title compound **11d** as pale yellow oil. R_f = 0.38 (eluent: *n*-Hex:EtOAc = 20:1, $KMnO_4$ staining). Yield: 78.0 mg (12%). ^{1}H NMR (300 MHz, MeOH-d_4) δ 7.35 (d, *J* = 2.1 Hz, 1H, 5-H_{Ar}), 6.28 (dd, *J* = 3.3, 2.1 Hz, 1H, 4-H_{Ar}), 6.13 (d, *J* = 3.3 Hz, 1H, 3-H_{Ar}), 4.40 (d, *J* = 8.9 Hz, 1H, -C*H*-NHBoc), 2.32 (m, 1H, -CH(NHBoc)-C*H*-), 1.83 - 1.71 (m, 1H, 1 x $H_{Cyclopentyl}$), 1.66 - 1.43 (m, 7H, 7 x $H_{Cyclopentyl}$), 1.40 (s, 9H, -C(CH_3)$_3$). ^{13}C NMR (75 MHz, MeOH-d_4) δ 158.0 (-*C*O-), 157.1 (2-C_{Ar}), 142.5 (5-C_{Ar}), 111.0 (4-C_{Ar}), 106.7 (3-C_{Ar}), 80.1 (-*C*(CH_3)$_3$), 54.2 (-*C*H(NHBoc)-), 44.9 (-CH(NHBoc)-*C*H-), 30.9 (-CH_2-), 30.6 (-CH_2-), 28.8 (-CH_2-), 26.4 (-CH_2-), 26.2 (-C(*C*H_3)$_3$). HRMS (ESI, m/z) m/z calculated for $C_{15}H_{23}NO_3$ [M+Na^+] 288.1576, found 288.1570.

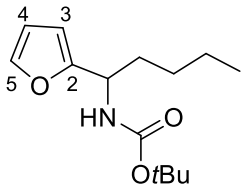
1-(Furan-2-yl)pentan-1-amine



2-Furonitrile (175 µL, 186 mg, 2.00 mmol, 1.00 eq.) was added to dry THF (3.00 mL) in a dry microwave vial equipped with a magnetic stirrer, after which the vessel was flushed with Ar and sealed immediately. *n*-Butylmagnesium chloride solution (3.00 mL, 2.00 M in THF, 6.00 mmol, 3.00 eq.) was added dropwise to the stirred solution at room temperature. The vial was then heated under microwave conditions at 100 °C for 15 min. The deep brown reaction mixture was left to cool to rt and it was carefully added to the solution of $NaBH_4$ (150 mg, 4.03 mmol, 2.00 eq.) in MeOH (10.0 mL) at 0 °C. The vigorous reaction was practically finished at this temperature after 5 min. The volatiles were partially evaporated, and the suspension was filtered through a Celite pad. The pad was washed with copious amounts of EtOAc, the filtrate was evaporated. The amine was unstable to silica and decomposes after a few days at rt as well. The crude material (a brown oil) was taken to the next step without further purification. R_f = 0.48 (eluent: DCM:MeOH = 9:1). Yield: 302 mg (99%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.39-7.36 (m, 1H, 5-H_{Ar}), 6.32-6.28 (m, 1H, 4-H_{Ar}), 6.16 (d, *J* = 3.0 Hz, 1H, 3-H_{Ar}), 3.85 (t, *J* = 7.1 Hz, 1H, -C*H*(NH_2)-), 1.84 - 1.62 (m, 2H, -CH(NH_2)-CH_2-), 1.38 - 1.15 (m, 4H, -(CH_2)$_2$-CH_3), 0.87 (t, *J* = 7.2 Hz, 3H, -CH_3). ^{13}C NMR (100 MHz, MeOH-d_4) δ 159.0 (2-C_{Ar}), 142.7 (5-C_{Ar}), 111.1 (4-C_{Ar}), 106.1 (3-C_{Ar}), 50.6 (-*C*H(NH_2)-), 36.8 (-CH(NH_2)-*C*H_2-), 29.3 (-*C*H_2-CH_2-CH_3), 23.6 (-CH_2-*C*H_2-CH_3), 14.3 (-CH_2-

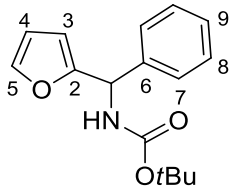
CH_2-*C*H_3). HRMS (APCI, m/z) m/z calculated for $C_9H_{15}NO$ [M+H^+] 154.1226, found 154.1225. The data match those previously reported.[29]

N-[1-(furan-2-yl)-n-pentyl]carbamic acid tert-butyl ester **11e**



1-(Furan-2-yl)pentan-1-amine (200 mg, 1.31 mmol, 1.00 eq.) was dissolved in DCM (10.0 mL), followed by the addition of 4-DMAP (16.0 mg, 0.130 mmol, 0.100 eq) and Boc_2O (330 µL, 310 mg, 1.44 mmol, 1.10 eq.). The solution was stirred at rt for 24 h, after which the volatiles were removed *in vacuo*. The residue was redissolved in EtOAc (30.0 mL) and was washed with brine (20 mL). The separated aqueous phase was extracted with EtOAc (2 x 20 mL) and the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a brown oil, that was used without further purification. R_f = 0.54 (eluent: *n*-Hex:EtOAc = 7:3). Yield: 246 mg (74%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.33 (d, *J* = 1.8 Hz, 1H, 5-H_{Ar}), 6.29 (dd, *J* = 3.2, 1.8 Hz, 1H, 4-H_{Ar}), 6.14 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.73 (s, 1H, -C*H*(NHBoc)-CH_2-), 1.87 - 1.67 (m, 2H, -CH(NHBoc)-C*H*$_2$-), 1.44 (s, 9H, -COOC(C*H*$_3$)$_3$), 1.35 - 1.19 (m, 4H, -CH_2-(C*H*$_2$)$_2$-), 0.88 (t, *J* = 6.9 Hz, 3H, -C*H*$_3$). ^{13}C NMR (100 MHz, MeOH-d_4) δ 148.7 (2-C_{Ar}), 142.7 (5-C_{Ar}), 111.0 (3-C_{Ar}), 106.2 (4-C_{Ar}), 49.3 (-*C*H(NHBoc), 34.7 (-CH(NHBoc)-*C*H_2-), 29.3 (-*C*H_2-CH_2-), 28.8 (-C(*C*H_3)$_3$), 23.4 (-*C*H_2-CH_3), 14.4 (CH_2-*C*H_3). Due to amide bond rotation, signal broadening was experienced both for ^{1}H and ^{13}C signals and some carbon signals could not be detected. HRMS (ESI, m/z) m/z calculated for $C_{14}H_{23}NO_3$ [M+H^+] 253.1678, found 253.1680. The data match those previously reported.[7]

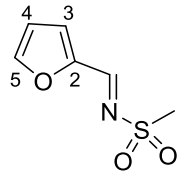
tert-Butyl (furan-2-yl(phenyl)methyl)carbamate **11f**



(1-Furan-2-ylmethylidene)carbamic acid *tert*-butyl ester (500 mg, 2.56 mmol, 1.00 eq.) was dissolved In dry THF (15.0 mL) and under N2 atmosphere and phenylmagnesium bromide solution (3.0 M in Et_2O, 1.00 mL, 3.1 mmol, 1.2 eq.) was added to the solution dropwise over 20 min at –78 °C. The resulting solution was stirred at this temperature for 1 h and it was quenched by the addition of saturated NH_4Cl solution (15.0 mL) at 0 °C. The layers were separated, and the aqueous phase was

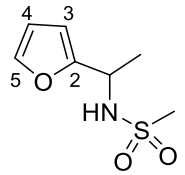
extracted with EtOAc (3 x 15.0 mL). The unified organic phase was washed with brine (15.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a pale-yellow oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 20:1 to 9:1) to yield the product as a white solid. R_f = 0.29 (eluent: *n*-Hex:EtOAc = 20:1). Yield: 302 mg (43%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.41 (d, *J* = 2.0 Hz, 1H, 9-H_{Ar}), 7.33 - 7.20 (m, 5H, 2 x 7-H_{Ar}, 2 x 8-H_{Ar}, 9-H_{Ar}), 6.31 (dd, *J* = 3.1, 2.0 Hz, 1H, 4-H_{Ar}), 6.06 (d, *J* = 3.4 Hz, 1H, 3-H_{Ar}), 5.83 (s, 1H, -C*H*(NHBoc)-), 1.43 (s, 9H, -C(CH_3)$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 156.1 (2-C_{Ar}), 143.5 (5-C_{Ar}), 129.4 (2 x 7-C_{Ar}), 128.6 (9-C_{Ar}), 128.2 (2 x 8-C_{Ar}), 111.2 (4/7-C_{Ar}), 111.1 (4/7-C_{Ar}), 108.1 (3-C_{Ar}), 80.6 (-O-*C*(CH$_3$)$_3$), 54.0 (-C*H*(NHBoc)-), 28.7 (-C(*C*H$_3$)). HRMS (ESI, m/z) m/z calculated for $C_{16}H_{19}NO_3$ [M+Na$^+$] 296.1247, found 296.1257. The data match those previously reported.[30]

N-(Furan-2-ylmethylene)methansulfonamide



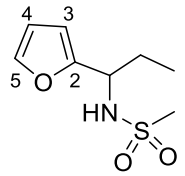
Methansulfonamide (2.97 g, 31.2 mmol, 1.00 eq.) was dissolved in dry DCM (50.0 mL) in a flame-dried round-bottom flask under N_2 atmosphere, followed by the addition of freshly distilled furfural (2.59 mL, 3.00 g, 1.00 eq.) and dry TEA (13.0 mL, 9.48 g, 93.7 mmol, 3.00 eq.). $TiCl_4$ (1.71 mL, 2.96 g, 15.6 mmol, 0.500 eq) was added to the reaction mixture dropwise over 20 min at 0 °C. The reaction was stirred at this temperature for a further hour and the reaction mixture was filtered through a Celite pad. The cake was washed with copious amounts of DCM, the filtrate was concentrated under reduced pressure. The brown residue was taken up in toluene and the precipitate (TEA·HCl) was removed by filtration. The filtrate was evaporated *in vacuo* and the crude material was recrystallised from DCM/*n*-hexane (the crude was dissolved in minimal amount of DCM under reflux conditions and *n*-Hex was added, until precipitate formed). The product crystallised as yellow needles. Yield: 2.50 g (46%). ^{1}H NMR (400 MHz, $CDCl_3$) δ δ 8.78 (s, 1H, -C*H*=N-), 7.79 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 7.38 (d, *J* = 3.6 Hz, 1H, 3-H_{Ar}), 6.69 (dd, *J* = 3.6, 1.8 Hz, 1H, 4-H_{Ar}), 3.13 (s, 3H, -SO_2C*H*$_3$). ^{13}C NMR (100 MHz, $CDCl_3$) δ 156.9 (-*C*H=N-), 150.1 (5-C_{Ar}), 150.0 (2-C_{Ar}), 125.5 (3-C_{Ar}), 114.0 (4-C_{Ar}), 40.6 (-SO_2-*C*H$_3$). HRMS (ESI, m/z) m/z calculated according to $C_6H_7NO_3S$ [M+Na$^+$] 196.0044, found 196.0039. The data match those previously reported.[31]

N-[1-(Furan-2-yl)ethyl]methanesulfonamide **11g**



(*E*)-*N*-(Furan-2-ylmethylene)methansulfonamide (300 mg, 1.73 mmol, 1.00 eq.) was dissolved in dry THF (5.00 mL) and methylmagnesium bromide solution (670 µL, 3.00 M in Et_2O, 2.08 mmol, 1.20 eq.) was added to the reaction dropwise over 20 min at –78 °C. The solution became a white suspension, as a result. The starting material was not consumed after 1 h at this temperature, thus further methylmagnesium bromide (340 µL, 3.00 M in Et_2O, 1.04 mmol, 0.600 eq.) solution was added to the reaction mixture dropwise. After an additional 30 min stirring at this temperature, the reaction was left to warm to rt and saturated NH_4Cl solution (10.0 mL) was added to the reaction, followed by the addition of deionised water (10.0 mL). The layers were separated and the aqueous phase was extracted with EtOAc (3 x 20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a thick, yellow oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **11g** as a pale yellow oil. R_f = 0.33 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 217 mg (66%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (dd, *J* = 1.7, 0.8 Hz, 1H, 5-H_{Ar}), 6.34 (dd, *J* = 3.2, 1.7 Hz, 1H, 4-H_{Ar}), 6.26 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.70 (p, *J* = 7.5 Hz, 1H, -C*H*(NHMs)-CH_3), 4.66 (d, *J* = 7.5 Hz, 1H, -N*H*-) 2.79 (s, 3H, -SO_2CH_3), 1.57 (d, *J* = 7.5 Hz, 3H, -CH(NHMs)-C*H*$_3$). ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.3 (2-C_{Ar}), 142.5 5-C_{Ar}), 110.5 (4-C_{Ar}), 106.8 (3-C_{Ar}), 47.5 (-C*H*(NHMs)-), 41.5 (-SO_2CH_3), 21.1 (-CH(NHMs)-C*H*$_3$). HRMS (ESI, m/z) m/z calculated for $C_7H_{11}NO_3S$ [M+Na^+] 212.0352, found 212.0352.

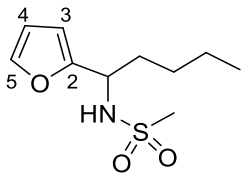
N-[1-(Ffuran-2-yl)-n-propyl]methansulfonamide **11h**



(*E*)-*N*-(Furan-2-ylmethylene)methansulfonamide (400 mg, 2.30 mmol, 1.00 eq.) was dissolved in dry THF (20.0 mL) in a flame-dried round-bottom flask and ethylmagnesium bromide solution (1.38 mL, 2.00 M in Et_2O, 2.78 mmol, 1.20 eq.) was added to the reaction medium dropwise over 20 min at –78 °C. After an additional hour at this temperature, the reaction was completed and left to warm up to rt. Saturated NH_4Cl solution (20.0 mL) was added to the reaction dropwise and the phases were separated. The aqueous phase was further extracted with EtOAc (3 x 30 mL), the unified organic phase

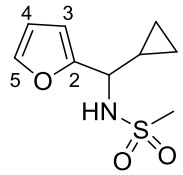
was washed with brine (20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a yellow oil, which was used without further purification. R_f = 0.27 (*n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 0.43 g (92%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (d, *J* = 1.9 Hz, 1H, 5-H_{Ar}), 6.34 (dd, *J* = 3.2, 1.9 Hz, 1H, 4-H_{Ar}), 6.27 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.70 (d, *J* = 8.7 Hz, 1H, -N*H*-), 4.43 (dt, *J* = 8.7, 7.4 Hz, 1H, -C*H*(NHMs)-CH_2-), 2.72 (s, 3H, -SO_2CH_3), 1.88 (p, *J* = 7.3 Hz, 2H, -CH-CH_2-), 0.94 (t, *J* = 7.3 Hz, 3H, -CH_2-CH_3). ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.4 (2-C_{Ar}), 142.5 (5-C_{Ar}), 110.5 (4-C_{Ar}), 107.6 (3-C_{Ar}), 53.4 (-*C*H(NHMs)-), 41.4 (-SO_2CH_3), 28.2 (-*C*H_2-CH_3), 10.5 (-CH_2-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_8H_{13}NO_3S$ [M+Na^+] 226.0514, found 226.0512.

N-[1-(Furan-2-yl)-n-pentyl]methansulfonamide **11i**



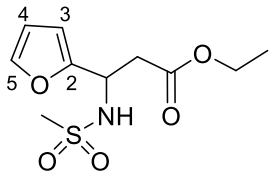
(*E*)-*N*-(Furan-2-ylmethylene)methansulfonamide (300 mg, 1.73 mmol, 1.00 eq.) was dissolved in dry THF (5.00 mL) and *n*-butylmagnesium bromide solution (1.04 mL, 2.00 M in THF, 2.08 mmol, 1.20 eq.) was added to the solution dropwise over 20 min at –78 °C. White precipitate formed, which gradually dissolved by the end of the addition. After 30 min, the reaction was left to warm to 0 °C and saturated NH_4Cl solution (10.0 mL) was added to the solution dropwise. The layers were separated and the aqueous phase was extracted with EtOAc (3 x 15 mL). The unified organic phase was washed with brine (20 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a pale-yellow oil, that was used without further purification. R_f = 0.31 (*n*-Hex:EtOAc = 1:1, $KMnO_4$ staining). Yield: 388 mg (97%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (d, *J* = 1.7 Hz, 1H, 5-H_{Ar}), 6.34 (m, 1H, 4-H_{Ar}), 6.27 (d, *J* = 3.2 Hz, 1H, 3-H_{Ar}), 4.66 (d, *J* = 8.2 Hz, 1H, -N*H*-), 4.50 (q, *J* = 7.8 Hz, 1H, -C*H*(NHMs)-), 2.70 (s, 3H, -SO_2CH_3), 1.84 (m, 2H, -C*H*(NHMs)-CH_2-), 1.41 - 1.22 (m, 4H, -CH_2-CH_2-CH_3), 0.88 (t, *J* = 6.9 Hz, 3H, -CH_2-CH_3). ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.6 (2-C_{Ar}), 142.5 (5-C_{Ar}), 110.5 (4-C_{Ar}), 107.5 (3-C_{Ar}), 51.9 (-*C*H(NHMs)-), 41.4 (-SO_2CH_3), 34.6 (-CH(NHMs)-*C*H_2-), 28.0 (-*C*H_2-CH_2-CH_3), 22.3 (-*C*H_2-CH_3), 14.0 (-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{17}NO_3S$ [M+Na^+] 254.0820, found 254.0818.

N-[1-(Furan-2-yl)cyclopropylmethyl]methansulfonamide **11j**



Cyclopropyl bromide (201 µL, 300 mg, 2.51 mmol, 2.00 eq.) was added to a suspension of Mg turnings (76.0 mg, 3.14 mmol, 2.50 eq.) in dry THF (1.00 mL) in a flame-dried flask dropwise at rt under an Ar atmosphere. The intensive heat formation indicated the formation of cyclopropyl magnesium bromide. The Grignard reagent solution was left to cool under an argon atmosphere (balloon) and it was added dropwise to the solution of *N*-(furan-2-ylmethylene)methansulfonamide (200 mg, 1.26 mmol, 1.00 eq.) in dry THF (5.00 mL) at –78 °C under an Ar atmosphere. The reaction was left to warm to 0 °C after 30 min and saturated NH_4Cl solution (10.0 mL) was added to the mixture dropwise over 20 min and the reaction was stirred at rt for 2 h. The layers were separated, and the aqueous phase was extracted with Et_2O (2 x 20 mL). The unified organic phase was washed with brine (10.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated *in vacuo* to yield the crude material as a thick, yellow oil, that was used without further purification. R_f = 0.35 (eluent: *n*-Hex:EtOAc = 1:1). Yield: 240 mg (88%). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.48 (dd, *J* = 1.8, 0.8 Hz, 1H, 5-H_{Ar}), 6.38 (dd, *J* = 3.3, 1.8 Hz, 1H, 4-H_{Ar}), 6.34 (dt, *J* = 3.3, 0.8 Hz, 1H, 3-H_{Ar}), 3.91 (d, *J* = 8.4 Hz, 1H, -C*H*-NHMs), 2.76 (s, 3H, -SO_2-CH_3), 1.38 - 1.21 (m, 1H, -C*H*-CH_2-), 0.66 - 0.51 (m, 2H, -HC*H*-HC*H*-), 0.48 - 0.37 (m, 2H, -*H*CH-*H*CH-). ^{13}C NMR (100 MHz, MeOH-d_4) δ 154.3 (2-C_{Ar}), 142.1 (5-C_{Ar}), 110.0 (4-C_{Ar}), 106.6 (3-C_{Ar}), 55.5 (-*C*H-NHMs), 40.2 (-SO_2-*C*H_3), 15.1 (-*C*H-CH_2-), 3.1 (-*C*H_2-CH_2-), 2.8 (-CH_2-*C*H_2-). HRMS (ESI, m/z) m/z calculated for $C_9H_{13}NO_3S$ [M+Na^+] 238.0508, found 238.0509.

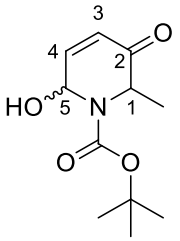
Ethyl 3-(methylsulphonylamino)-3-(furan-2-yl)propanoate **11k**



Zn powder (180 mg, 2.77 mmol, 1.60 eq.) was suspended in dry THF (5.00 mL) in a flame-dried round-bottom flask and TMSCl (44.0 µL, 37.6 mg, 0.346 mmol, 0.200 eq.) was added to the suspension at rt. After 15 min stirring at this temperature, ethyl bromoacetate (380 µL, 580 mg, 3.46 mmol, 2.00 eq.) was added to the reaction mixture, followed by the addition of (1-furan-2-ylmethylidene)carbamic acid *tert*-butyl ester (300 mg, 1.73 mmol, 1.00 eq.) in dry THF (3.00 mL). The reaction was heated to 50 °C for 48 h, during which time the reaction medium became a green suspension. The reaction was quenched by the addition of saturated NH_4Cl solution (20 mL), the layers were separated, and the

aqueous phase was extracted with EtOAc (3x20 mL). The unified organic phase was washed with brine (30 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material was a brown oil. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **11k** as a yellow oil. R_f = 0.18 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 177 mg (39%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 - 7.37 (m, 1H, 5-H_{Ar}), 6.35 – 6.32 (m, 1H, 4-H_{Ar}), 6.32 – 6.30 (m, 1H, 3-H_{Ar}), 5.43 (d, *J* = 9.1 Hz, 1H, -N*H*-), 4.97 (dt, *J* = 9.1, 6.1 Hz, 1H, -C*H*(NHMs)-CH_2-), 4.15 (q, *J* = 7.4 Hz, 2H, -OC*H*$_2$-CH_3), 2.92 (d, *J* = 6.1, 1.4 Hz, 2H, -CH(NHMs)-C*H*$_2$-), 2.82 (s, 3H, SO_2CH_3), 1.25 (t, *J* = 7.4 Hz, 3H, -CH_2-C*H*$_3$). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.6 (-*C*OO-), 152.3 (2-C_{Ar}), 142.7 (5-C_{Ar}), 110.8 (4-C_{Ar}), 107.7 (3-C_{Ar}), 61.3 (-OC*H*$_2$-), 48.5 (-*C*H(NHMs)-), 41.6 (-SO_2*C*H_3), 39.2 (-CH(NHMs)-*C*H_2-), 14.2 (-CH_2-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{15}NO_5S$ [M+Na^+] 284.0563, found 284.0560.

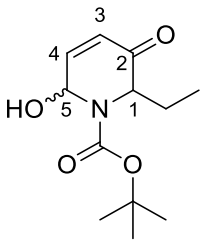
tert-Butyl 2-hydroxy-6-methyl-5-oxo-5,6-dihydropyridine-1(2H)-carboxylate **12b**



The compound was synthesised according to General Method D. Scale: *tert*-butyl (1-(furan-2-yl)ethyl)carbamate **11b** (38.0 mg, 178 µmol, 1.00 eq.). The starting material failed to dissolve in the reaction medium completely. The diluted H_2O_2 solution was added to the reaction over 2 h at rt. The reaction media was extracted with Et_2O (2 x 20 mL) and EtOAc (2 x 20 mL), the unified organic phase was washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a transparent oil. The crude material was separated by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **12b** as a transparent oil. R_f = 0.28 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 20.0 mg (49%). The NMR peaks are very broad at room temperature, thus NMR data was recorded at 240 K. Based on the reported NMR data of the *trans*-diastereoisomer,[36] the compound exists as a 1:1 mixture of *cis* and *trans* diastereoisomers, with both diastereoisomers existing in two rotameric forms at lower temperatures, hence NMR signals for 4 isomers were observed. ^{1}H NMR (500 MHz, 240 K, MeOH-d_4) δ <u>Diastereoisomer 1:</u> 7.11 (dd, *J* = 10.2, 5.0 Hz, 1H, 4-H), 6.09 (dd, *J* = 10.2, 0.9 Hz, 1H, 3-H), 5.80 (dd, *J* = 5.0, 0.9 Hz, 1H, 5-H), 5.06 (s, 1H, -OH), 4.61 (q, *J* = 7.3 Hz, 1H, 1-H), 1.53 - 1.52 (m, 9H, -C(CH_3)$_3$), 1.41 (d, *J* = 7.3 Hz, 3H, -C*H*$_3$). <u>Diastereoisomer 2:</u> 7.11 (dd, *J* = 10.2, 5.0 Hz, 1H, 4-H), 6.09 (dd, *J* = 10.2, 0.9 Hz, 1H, 3-H), 5.80 (dd, *J* = 5.0, 0.9 Hz, 1H, 5-H), 5.06 (s, 1H, -OH), 4.54 (q, *J* = 7.3 Hz, 1H, 1-H), 1.53 - 1.52 (m, 9H, -C(CH_3)$_3$), 1.45 d, *J* = 7.3 Hz, 3H, -C*H*$_3$). <u>Diastereoisomer 3:</u> 7.16 (dd,

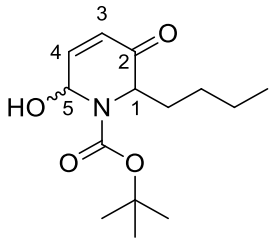
J = 10.2, 5.0 Hz, 1H, 4-H), 6.10 (d, *J* = 10.2, 0.8 Hz, 1H, 3-H), 5.87 (dd, *J* = 5.0, 0.8 Hz, 1H, 5-H), 5.06 (s, 1H, -OH), 4.31 (q, *J* = 7.2 Hz, 1H, 1-H), 1.53 - 1.52 (m, 9H, -C(CH_3)$_3$), 1.34 (d, *J* = 7.2 Hz, 3H, -C*H*$_3$). Diastereoisomer 4: 7.16 (dd, *J* = 10.2, 5.0 Hz, 1H, 4-H), 6.10 (dd, *J* = 10.2, 0.8 Hz, 1H, 3-H), 5.87 (dd, *J* = 5.0, 0.8 Hz, 1H, 5-H), 5.06 (s, 1H, -OH), 4.25 (q, *J* = 7.2 Hz, 1H, 1-H), 1.53 - 1.52 (m, 9H, -C(CH_3)$_3$), 1.37 (d, *J* = 7.2 Hz, 3H, -C*H*$_3$). ^{13}C NMR (125 MHz, 240 K, MeOH-d_4) δ 208.2 (2-C), 208.2 (2-C'), 198.8 (2-C''), 198.6 (2-C'''), 156.6 (-COO-), 156.1 (-*C*'OO-), 155.9 (-C''OO-), 155.2 (-*C*'''OO-), 82.9 (-*C*(CH_3)$_3$), 82.6 (-*C*'(CH_3)$_3$), 82.5 (-*C*''(CH_3)$_3$), 82.4 ((-*C*'''(CH_3)$_3$), 79.9 (1-C, 1-C'), 78.7 (1-C'', 1-C'''), 59.9 (5-C'''), 59.0 (5-C''), 57.9 (5-C'), 56.6 (5-C), 28.5 (-C(*C*H_3)$_3$), 28.4 (-C(C'H_3)$_3$), 28.4 (-C(C''H_3)$_3$), 28.4 (-C(C'''H_3)$_3$), 20.7 (-C'H_3), 20.2 (-CH_3), 20.1 (-C''H_3), 19.4 (-C'''H_3).

tert-Butyl 6-ethyl-2-hydroxy-5-oxo-5,6-dihydropyridine-1(2H)-carboxylate **12c**



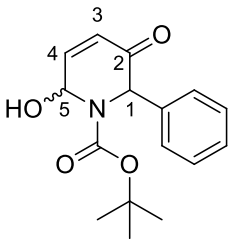
The compound was synthesised according to General Method D. Scale: *tert*-butyl (1-(furan-2-yl)propyl)carbamate **11c** (40.0 mg, 178 µmol, 1.00 eq). The starting material failed to dissolve in the reaction medium completely. H_2O_2 was added over the course of 2 h at rt. The reaction was extracted with Et_2O (4 x 20 mL), the unified organic phase was washed with brine (20.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a white amorphous material. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **12c** as a white solid. R_f = 0.30 (*n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). M.p.: 97.0–98.5 °C. Yield: 15.0 mg (35%). The compound was obtained as a single diastereoisomer, but as a mixture of 2 rotameric forms. The NMR peaks were very broad at room temperature, thus the NMR data were recorded at 240 K. ^{1}H NMR (500 MHz, 240 K, MeOH-d_4) δ Major rotamer: 6.62 (dd, *J* = 10.3, 4.7 Hz, 1H, 4-H), 5.64 (d, *J* = 10.3 Hz, 1H, 3-H), 5.61 (d, *J* = 4.7 Hz, 1H, 5-H) 3.98 – 3.95 (m, 1H, 1-H), 1.49 - 1.38 (m, 1H, -HC*H*-CH_3), 1.36 - 1.27 (m, 1H, -*H*CH-CH_3), 1.08 (s, 9H, -C(CH_3)$_3$), 0.60 (t, *J* = 7.4 Hz, 3H, -CH_3) Minor rotamer: 6.58 (dd, *J* = 10.0, 4.9 Hz, 1H, 4-H), 5.64 (d, *J* = 10.0 Hz, 1H, 3-H), 5.61 (d, *J* = 4.9 Hz, 1H, 5-H) 4.03 – 4.02 (m, 1H, 1-H), 1.49 - 1.38 (m, 1H, -HC*H*-CH_3), 1.36 – 1.27 (m, 1H, -*H*CH-CH_3), 1.10 (s, 9H, -C(CH_3)$_3$), 0.55 (t, *J* = 7.4 Hz, 3H, -CH_3). ^{13}C NMR (125 MHz, 240 K, MeOH-d_4) δ Major rotamer: 198.1 (2-C), 155.8 (-*C*OO-), 147.6 (4-C), 126.7 (3-C), 82.3 (-*C*(CH_3)$_3$), 71.7 (5-C), 63.0 (1-C), 29.9 (-CH_2-), 28.4 (-C(*C*H_3)$_3$), 11.3 (-CH_2-*C*H_3). Minor rotamer: 198.3 (2-C), 155.7 (-*C*OO-), 147.4 (4-C), 126.5 (3-C), 82.5 (-*C*(CH_3)$_3$), 72.5 (1-C), 61.6 (5-C), 29.7 (-CH_2-), 28.4 (-C(*C*H_3)$_3$), 11.0 (-CH_2-*C*H_3).

tert-Butyl 6-butyl-2-hydroxy-5-oxo-5,6-dihydropyridine-1(2H)-carboxylate **12e**



Carbamate **11e** (30.0 mg, 120 µmol, 1.00 eq.) was dissolved in *t*BuOH (1.18 mL) and added to a solution of lyophilised r*Aae*UPO expression supernatant (58.2 mg, 52.4 U) in sodium citrate buffer (9.62 mL, pH = 4.00, 50 mM). KBr (140 mg, 1.18 mmol, 10.0 eq.) was added to the reaction. 30 m/m % H_2O_2 (18.1 µL, 6.00 mg, 180 µmol, 1.50 eq.) solution was diluted in deionised water (1.00 mL) and the solution was added to the reaction medium dropwise over the course of 1 h at rt. By the end of the addition, the starting material was consumed based on TLC analysis. The reaction media was extracted with EtOAc (3 x 15 mL), the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the title compound **12e** as a yellow oil. R_f = 0.57 (*n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 23.0 mg (72 %). The compound was yielded as a single diastereoisomer. ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.09 - 6.90 (m, 1H, 4-H), 6.00 (d, *J* = 9.9 Hz, 1H, 3-H), 5.87 - 5.68 (m, 1H, 5-H), 4.64 - 4.36 (m, 1H, 1-H), 1.91 - 1.74 (m, 1H, -O-CH-*H*CH-), 1.69 - 1.61 (m, 1H, -O-CH-HC*H*-), 1.48 (s, 9H, -C(CH_3)$_3$), 1.45 - 1.27 (m, 4H, -CH_2-CH_2-CH_3), 0.95 - 0.84 (m, 3H, -CH_3). HRMS (APCI, m/z) m/z calculated for $C_{14}H_{23}NO_4$ [M+Na^+] 292.1519, found 292.1522. The data match those previously reported.[7]

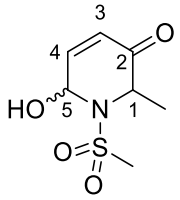
tert-Butyl 2-hydroxy-5-oxo-6-phenyl-5,6-dihydropyridine-1(2H)-carboxylate **12f**



Carbamate **11f** (40.0 mg, 146 µmol, 1.00 eq.) was dissolved in *t*BuOH (1.46 mL) and it was added to a solution of lyophilised r*Aae*UPO expression supernatant (66.4 mg, 59.8 U) in a mixture of sodium citrate buffer (7.35 mL, pH = 4.00, 50 mM) and deionised water (4.89 mL). KBr (174 mg, 1.46 mmol, 10.0 eq.) was added to the reaction. 30 m/m % H_2O_2 (14.9 µL, 5.00 mg, 146 µmol, 1.00 eq.) solution was diluted in deionised water (1.00 mL) and the solution was added to the reaction medium dropwise over the course of 1 h at rt. The reaction media was extracted with EtOAc (3 x 15 mL), the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to

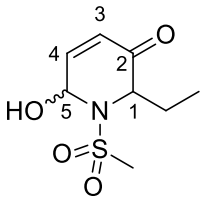
yield the crude material (34 mg), that was purified by column chromatography to afford the title compound **12f** as a yellow oil (eluent: *n*-Hex:EtOAc = 8:2). R_f = 0.57 (*n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 8.0 mg (19%). The diastereoisomeric ratio could not be determined from the ^{1}H NMR data due to signal overlap. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 - 7.69 (m, 1H, H_{Ar}), 7.58 - 7.46 (m, 2H, 2 x H_{Ar}), 7.35 - 7.24 (m, 2H, 2 x H_{Ar}), 7.22 – 7.14 (m, 1H, 5-H), 7.01 - 6.88 (m, 1H, 4-H), 6.23 (dd, *J* = 10.5, 1.6 Hz, 1H, 3-H), 6.07 (s, 1H, -OH), 5.43 (s, 1H, 1-H), 1.29 (s, 9H, -C(CH_3)$_3$). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.2 (4-C), 129.3 (C_{Ar}), 129.1 (C_{Ar}), 128.8 (C_{Ar}), 128.7 (C_{Ar}), 128.6 (C_{Ar}), 127.9 (3-C), 127.4 (C_{Ar}), 82.4 (-*C*(CH_3)$_3$), 72.3 (5-C), 66.4 (1-C), 28.1 (-C(*C*H_3)$_3$). Signal broadening and the small sample size hindered the detection of the carbonyl carbon in the ^{13}C spectrum. HRMS (ESI, m/z) m/z calculated for $C_{16}H_{19}NO_4$ [M+Na^+] 312.1206, found 312.1214.

6-Methyl-1-(methylsulfonyl)-1,2-dihydropyridine-2,5-diol **12g**



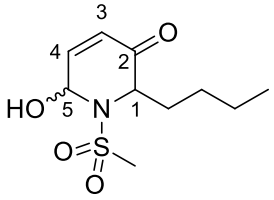
The compound was synthesised according to General Method D. Scale: *N*-(1-(furan-2-yl)ethyl)methanesulfonamide (30.0 mg, 159 µmol, 1.00 eq). H_2O_2 was added over 2 h at rt. The reaction mixture was extracted with EtOAc (3 x 20 mL), the unified organic phase was dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow amorphous material. The crude was purified by column chromatography (eluent: *n*-Hex:EtOAc = 1:1) to yield the title compound **12g** as a transparent amorphous material. R_f = 0.32 (eluent: *n*-Hex:EtOAc = 1:1, $KMnO_4$ staining). Yield: 14.5 mg (45%). The product was isolated as a single diastereoisomer. ^{1}H NMR (400 MHz MeOH-d_4) δ 7.08 (dd, *J* = 10.3, 4.8 Hz, 1H, 4-H), 6.07 (d, *J* = 10.3 Hz, 1H, 3-H), 5.89 (d, *J* = 4.8 Hz, 1H, 5-H), 4.41 (q, *J* = 7.3 Hz, 1H, 1-H), 3.05 (s, 3H, -SO_2CH_3), 1.57 (d, *J* = 7.3 Hz, 3H, -CH-C*H*$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 196.2 (2-C), 146.2 (4-C), 124.8 (3-C), 72.6 (5-C), 56.8 (1-C), 40.9 (-SO_2CH_3), 20.0 (-CH-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_7H_{11}NO_4S$ [M+Na^+] 228.0301, found 228.0309. IR (film) ν_{max}/cm^{-1} 3441 (O-H), 2930 (=C-H), 1685 (C=O), 1322 (C-N), 1157, 1004, 962, 761.

2-Ethyl-6-hydroxy-1-(methylsulfonyl)-1,6-dihydropyridin-3(2H)-one **12h**



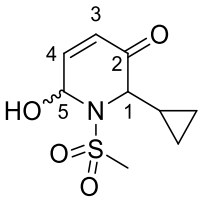
The compound was synthesised according to General Method D. Scale: *N*-(1-(furan-2-yl)propyl)methanesulfonamide (30.0 mg, 148 µmol, 1.00 eq.). 10 v/v % MeCN was used instead of *t*BuOH as co-solvent. H_2O_2 was added dropwise over 2 h at rt. The reaction was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (10.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 1:1) to yield the title compound **12h** as a transparent oil. R_f = 0.27 (eluent: *n*-Hex:EtOAc = 6:4, $KMnO_4$ staining). Yield: 7.0 mg (21 %). **12h** was yielded as a 3:2 mixture of diastereoisomers. The minor diastereoisomer exists as a mixture of keto-enol tautomers. ^{1}H NMR (400 MHz, MeOH-d_4) δ Major diastereoisomer: 7.03 (dd, *J* = 10.3, 4.6 Hz, 1H, 4-H), 6.05 (dd, *J* = 10.3, 1.3 Hz 1H, 3-H), 5.90 (dd, *J* = 4.6, 1.3 Hz, 1H, 5-H), 4.15 (t, *J* = 7.7 Hz, 1H, 1-H), 2.95 (s, 3H, -SO2C*H*$_3$), 2.07 – 1.78 (m, 2H, -C*H*$_2$-), 1.02 (t, *J* = 7.6 Hz, 3H, -CH$_2$-C*H*$_3$). Minor diastereoisomer (enol form): 8.43 (dd, *J* = 4.9, 1.5 Hz, 1H, 5-H), 7.80 (dd, *J* = 8.3, 1.5 Hz, 1H, 3-H), 7.35 (dd, *J* = 8.3, 4.9 Hz, 1H, 4-H), 4.08 (t, *J* =7.5 Hz, 1H, 1-H), 3.39 (s, 3H, -SO$_2$C*H*$_3$), 2.95 – 2.88 (m, 2H, -C*H*$_2$-CH$_3$), 1.29 (t, *J* = 7.6 Hz, 3H, -CH$_2$-C*H*$_3$). Minor diastereoisomer (keto form): 7.88 (dd, *J* = 4.9, 1.6 Hz, 1H, 5-H), 7.17 (dd, *J* = 8.2, 1.6 Hz, 1H, 3-H), 7.09 (dd, *J* = 8.2, 4.9 Hz, 1H, 4-H), 3.39 (s, 3H, -SO$_2$C*H*$_3$), 2.80 (q, *J* = 7.6 Hz, 2H, -C*H*$_2$-), 1.21 (t, *J* = 7.6 Hz, 3H, -CH$_2$-C*H*$_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ Major isomer: 195.6 (2-C), 145.8 (4-C), 125.1 (3-C), 72.9 (5-C), 62.5 (1-C), 39.7 (-SO$_2$CH$_3$), 27.9 (-*C*H$_2$-), 9.8 (-CH$_2$-*C*H$_3$). Minor isomer (enol form): 198.9 (2-C), 147.0 (5-C), 130.7 (3-C), 122.6 (4-C), 62.5 (1-C),37.4 (-SO$_2$CH$_3$), 24.9 (-*C*H$_2$), 11.8 (-*C*H$_3$). Minor isomer (keto form): 138.2 (5-C), 122.3 (3-C), 122.4 (4-C), 37.4 (-SO$_2$CH$_3$), 25.2 (-*C*H$_2$-), 11.8 (-CH$_2$-*C*H$_3$). Certain ^{13}C signals of the keto form could not be detected due to their low abundance. HRMS (ESI, m/z) m/z calculated for $C_8H_{13}NO_4S$ [M+Na$^+$] 242.0457, found 242.0457. IR (film) ν_{max}/cm^{-1} 3345 (O-H), 2932 (C-H), 1687 (C=O), 1330 (C-N), 1159, 1017, 801, 763.

6-Butyl-1-(methylsulfonyl)-1,2-dihydropyridine-2,5-diol **12i**



The compound was synthesised according to General Method D. Scale: *N*-(1-(furan-2-yl)pentyl)methanesulfonamide (30.0 mg, 148 µmol, 1.00 eq). 10 v/v % MeCN was used instead of *t*BuOH as co-solvent. The H_2O_2 was added over 13 h at rt. The reaction was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (10.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow oil. The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **12i** as a yellow oil. R_f = 0.24 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 13.0 mg (40 %). ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.02 (dd, *J* = 10.5, 4.6 Hz, 1H, 4-H), 6.04 (d, *J* = 10.5 Hz, 1H, 3-H), 5.89 (d, *J* = 4.6 Hz, 1H, 5-H), 4.21 (t, *J* = 7.8 Hz, 1H, 1-H), 2.93 (s, 3H, -SO_2CH_3), 2.09 - 1.91 (m, 1H, -CH-*H*CH-), 1.87 - 1.74 (m, 1H, -CH-HC*H*-), 1.57 - 1.44 (m, 1H, -HC*H*-), 1.42 - 1.30 (m, 3H, -*H*CH, -CH_2-), 0.91 (t, *J* = 7.2 Hz, 3H, -CH_2-CH_3). ^{13}C NMR (101 MHz, MeOH-d_4) δ 197.1 (2-C), 147.1 (4-C), 126.5 (3-C), 74.3 (1-C), 62.4 (5-C), 41.0 (-SO_2CH_3), 35.7 (-CH-*C*H_2-), 29.2 (-*C*H_2-CH_2-CH_3), 23.2 (-*C*H_2-CH_3), 14.2 (-*C*H_3). HRMS (ESI, m/z) m/z calculated for $C_{10}H_{17}NO_4S$ [M+Na^+] 270.0770, found 270.0778.

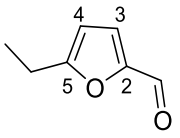
2-Cyclopropyl-6-hydroxy-1-(methylsulfonyl)-1,6-dihydropyridin-3(2H)-one **12j**



The compound was synthesised according to General Method D. Scale: *N*-(1-(furan-2-yl)cyclopropyl)methanesulfonamide (30.0 mg, 148 µmol, 1.00 eq). The H_2O_2 was added over 3 h at rt. The reaction was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (10.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude material as a yellow oil (39 mg). The crude material was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **12j** as a yellow oil. R_f = 0.15 (eluent: *n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield: 22.0 mg (68%). The product was isolated as a single diastereoisomer. ^{1}H NMR (400 MHz, MeOH-d_4) δ 7.06 (dd, *J* = 10.3, 4.6 Hz, 1H, 4-H), 6.11 (d, *J* = 10.3 Hz, 1H, 3-H), 5.90 (d, *J* = 4.6 Hz, 1H, 5-H), 3.57 - 3.38 (m, 1H, 1-H), 0.74 – 0.49 (m, 4H, -CH_2-CH_2-).^{13}C

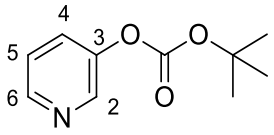
NMR (101 MHz, MeOH-d_4) δ 193.8 (2-C), 145.9 (4-C), 125.3 (3-C), 72.9 (5-C), 65.6 (1-C), 41.8 (-SO_2-*C*H_3), 15.3 (-*C*H-), 5.6 (-CH_2-), 2.7 (-CH_2). HRMS (ESI, m/z) m/z calculated for $C_9H_{13}NO_4S$ [M+Na^+] 254.0457, found 254.0461.

5-Ethylfurfural **13**



DMF (490 µL, 460 mg, 6.34 mmol, 1.20 eq.) was dissolved in dry DCM (4.00 mL) and $POCl_3$ (580 µL, 960 mg, 6.24 mmol, 1.20 eq.) was added dropwise at 0 °C. The reaction mixture was stirred at this temperature for 30 min, followed by the dropwise addition of 2-ethylfuran (550 µL, 500 mg, 5.20 mmol, 1.00 eq.) in dry DCM (4.00 mL) over 30 min. After this, the reaction mixture was stirred at rt for 3 h. The reaction was quenched by the addition of saturated Na_2CO_3 solution (9.00 mL). The layers were separated, and the aqueous phase was extracted with DCM (3 x 10 mL), the unified organic phase was washed with deionised water (3 x 10 mL), brine (10 mL) and dried over anhydrous $MgSO_4$. The drying agent was filtered off and the filtrate was evaporated *in vacuo*. The crude product is a pale brown oil, which was purified by column chromatography (eluent: *n*-pentane:Et_2O = 8:2) to yield the product as a pale brown oil. R_f = 0.40 (eluent: *n*-pentane:Et_2O = 8:2). Yield: 361 mg (56%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.51 (s, 1H, -C*H*O), 7.17 (dt, *J* = 3.5, 0.6 Hz, 1H, 2-H_{Ar}), 6.23 (dt, *J* = 3.5, 0.6 Hz, 1H, 3-H_{Ar}), 2.75 (q, *J* = 7.5 Hz, 2H, -CH_2-), 1.29 (t, *J* = 7.5 Hz, 3H, -CH_3). ^{13}C NMR (101 MHz, $CDCl_3$) δ 177.1 (-CHO), 163.4 (2-C_{Ar}), 151.9 (5-C_{Ar}), 108.1 (3-C_{Ar}, 4-C_{Ar}), 21.9 (-*C*H_2-), 11.7 (-*C*H_3). HRMS (APCI, m/z) m/z calculated for $C_7H_8O_2$ [M+Na^+] 147.0417, found 147.0421. The data match those previously reported.[32]

tert-Butyl pyridin-3-yl carbonate **14**

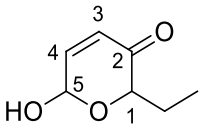


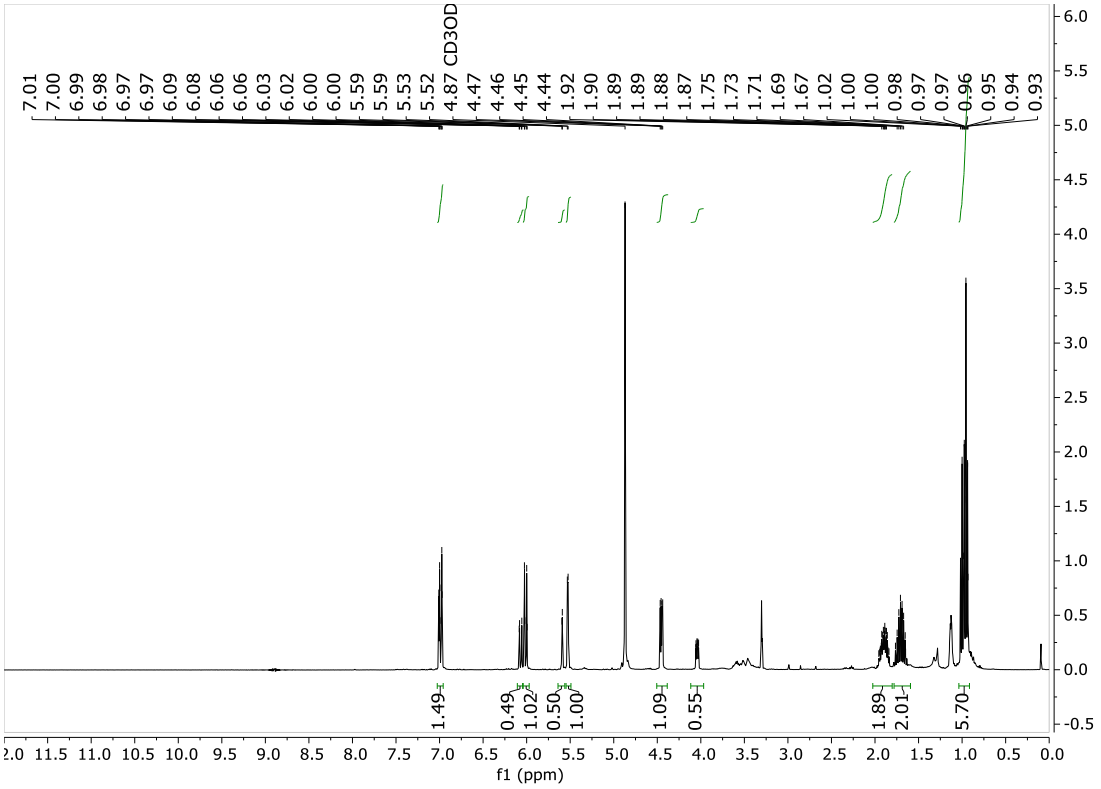
Method 1 (direct oxidation): The compound was synthesised according to General Method D. Scale: *tert*-butyl (furan-2-ylmethyl)carbamate **11a** (30.0 mg, 153 µmol, 1.00 eq.). The diluted H_2O_2 was added dropwise over 1 h at rt. The reaction media was extracted with EtOAc (3 x 20 mL), the unified organic phase was washed with brine (15.0 mL), dried over anhydrous $MgSO_4$, filtered, and evaporated under reduced pressure to yield the crude product as yellow oil. The compound was purified by column chromatography (eluent: *n*-Hex:EtOAc = 7:3) to yield the title compound **14** as a transparent oil. R_f = 0.41 (*n*-Hex:EtOAc = 7:3, $KMnO_4$ staining). Yield:20.0 mg (0.094 mmol, 60%). ^{1}H

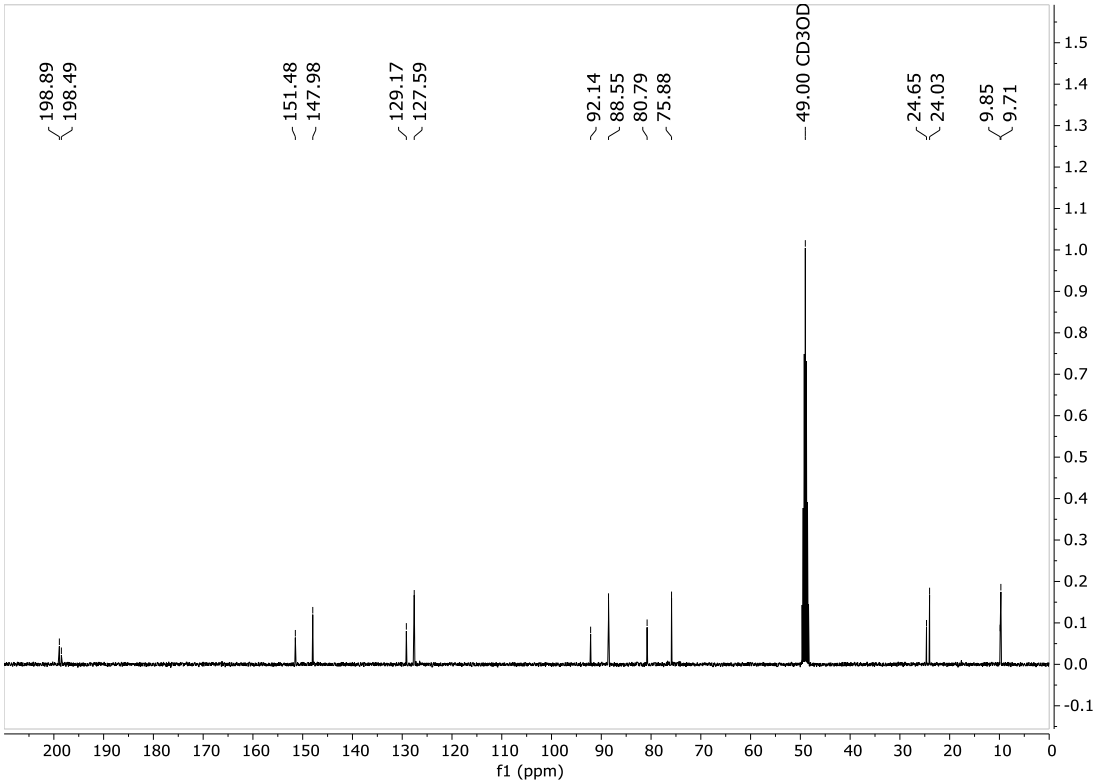
NMR (400 MHz, MeOH-d_4) δ 8.41 (dd, *J* = 3.3, 1.2 Hz, 1H, 6-H_{Ar}), 8.40 (s, 1H, 2-H_{Ar}), 7.68 (ddd, *J* = 8.5, 2.7, 1.3 Hz, 1H, 5-H_{Ar}), 7.47 (dd, *J* = 8.4, 4.8 Hz, 1H, 4-H_{Ar}), 1.52 (s, 9H, -$C(CH_3)_3$). ^{13}C NMR (101 MHz, MeOH-d_4) δ 147.4 (6-C_{Ar}), 143.9 (2-C_{Ar}), 131.2 (5-C_{Ar}), 125.8 (4-C_{Ar}), 85.3 (-*C*$(CH_3)_3$), 27.8 (-C(*C*$H_3)_3$). HRMS (ESI, m/z) calculated for $C_{10}H_{13}NO_3$ [M+H^+] 196.0968, found 196.0970.

Section 6: ^{1}H and ^{13}C NMR Spectra

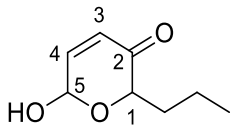
2-Ethyl-6-hydroxy-2H-pyran-3(6H)-one **10e**

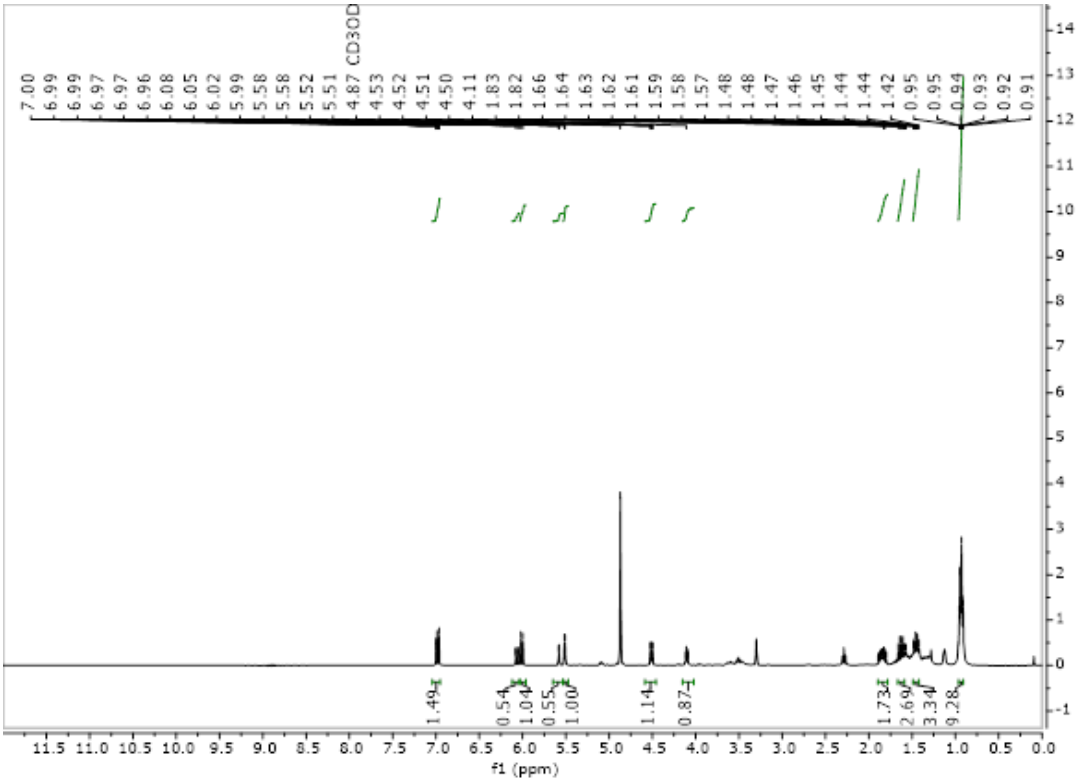


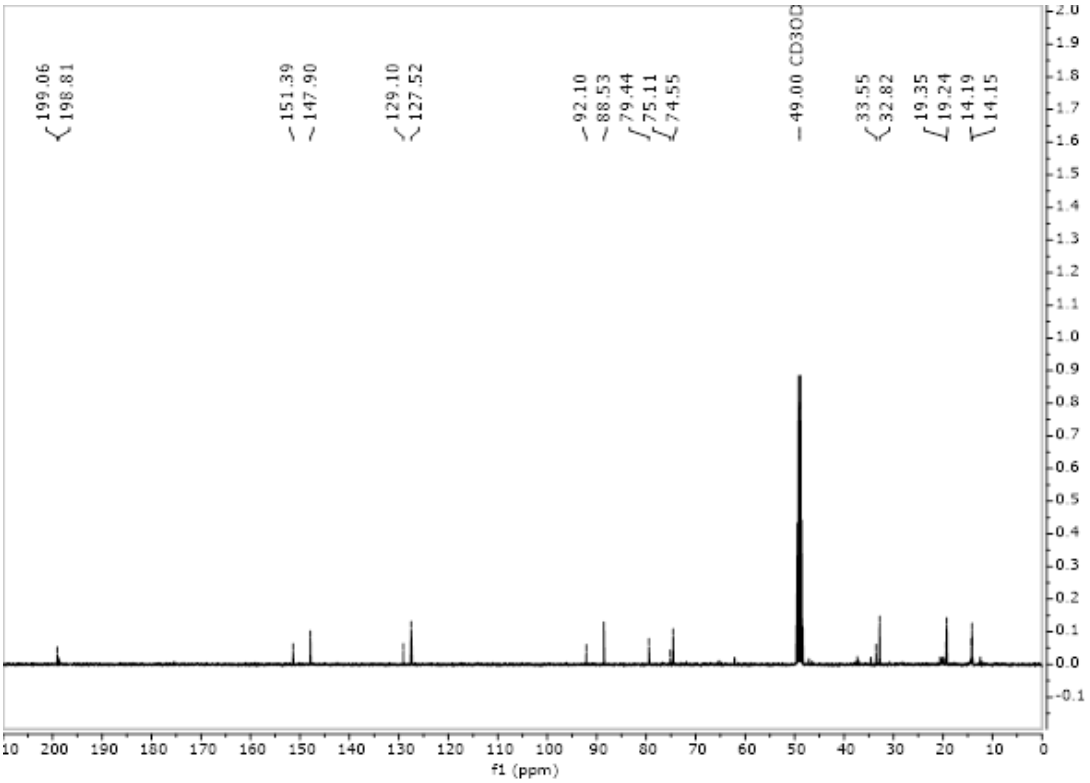




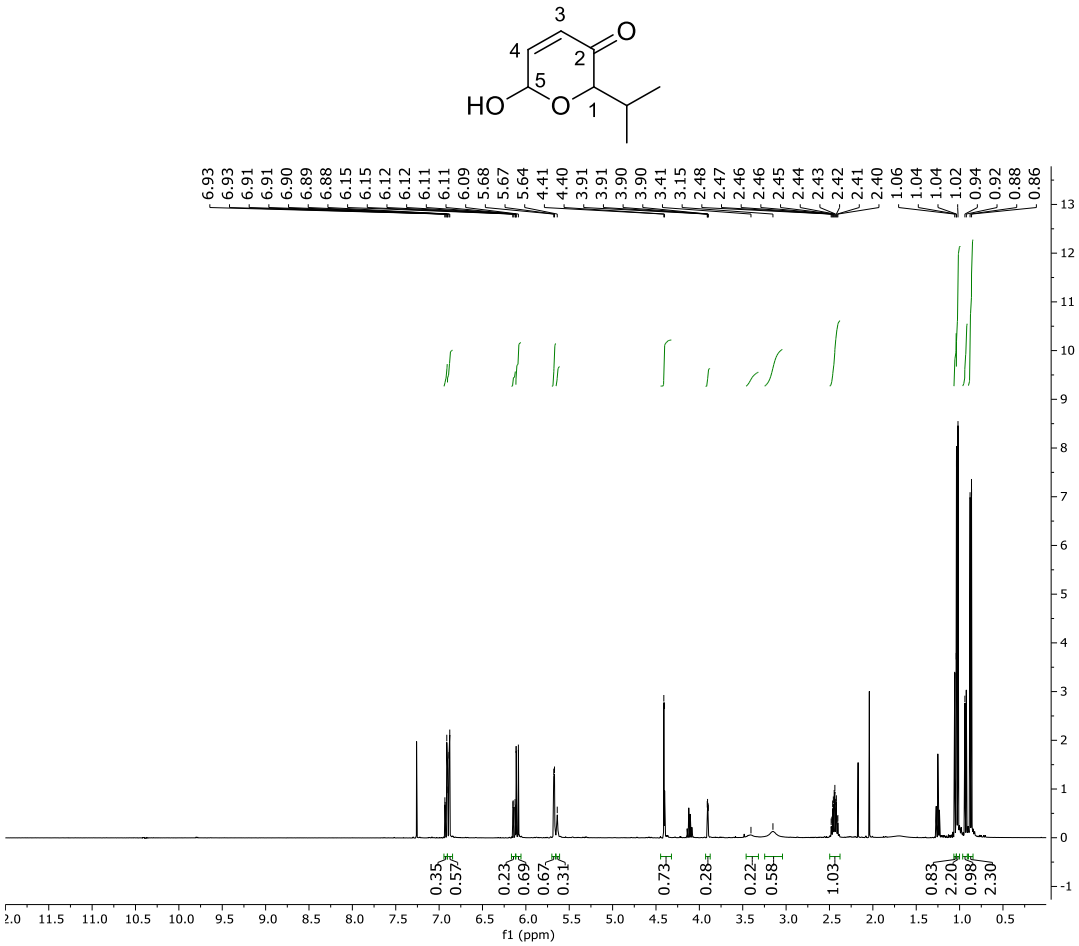
2-Propyl-6-hydroxy-2H-pyran-3(6H)-one **10f**

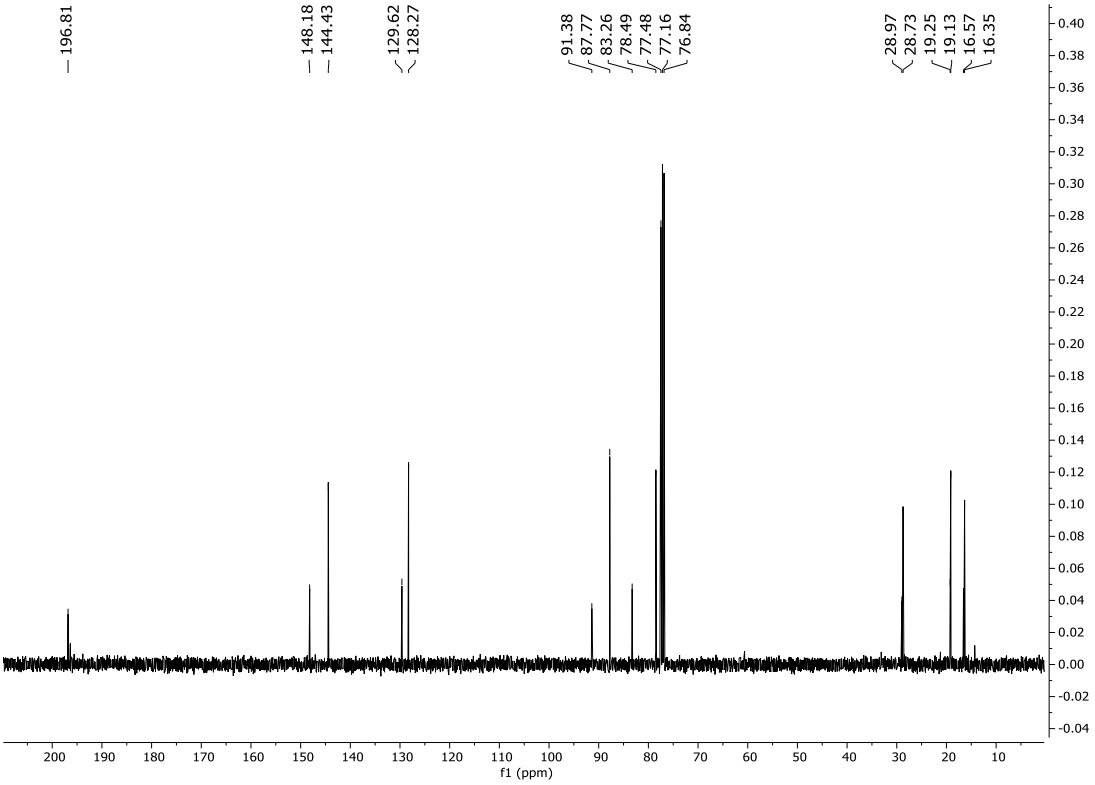




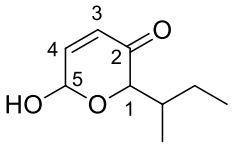


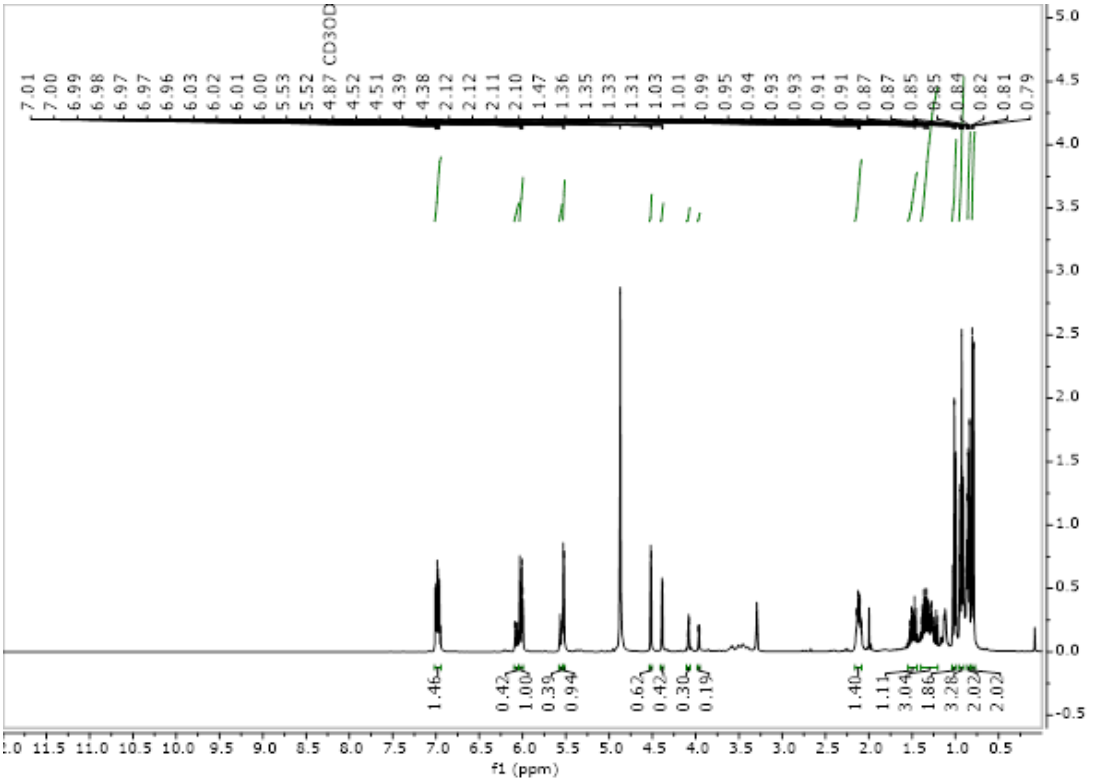
6-Hydroxy-2-isopropyl-2H-pyran-3(6H)-one **10g**

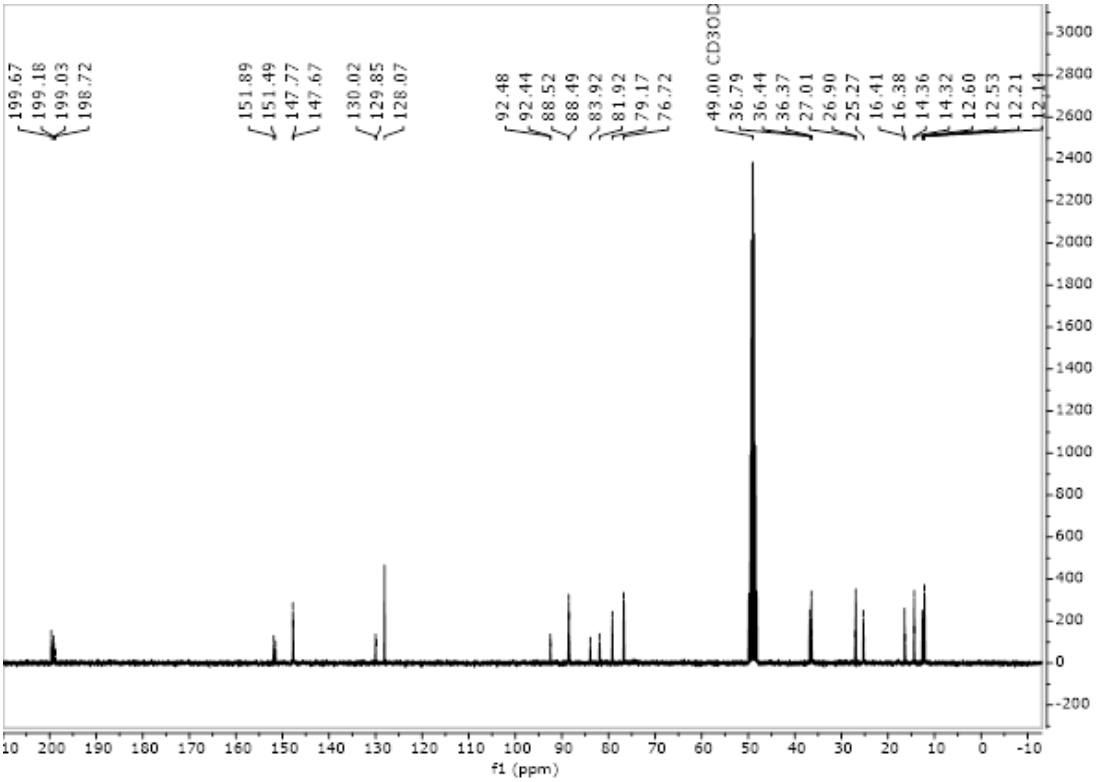




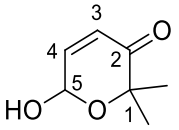
2-(sec-Butyl)-6-hydroxy-2H-pyran-3(6H)-one **10h**

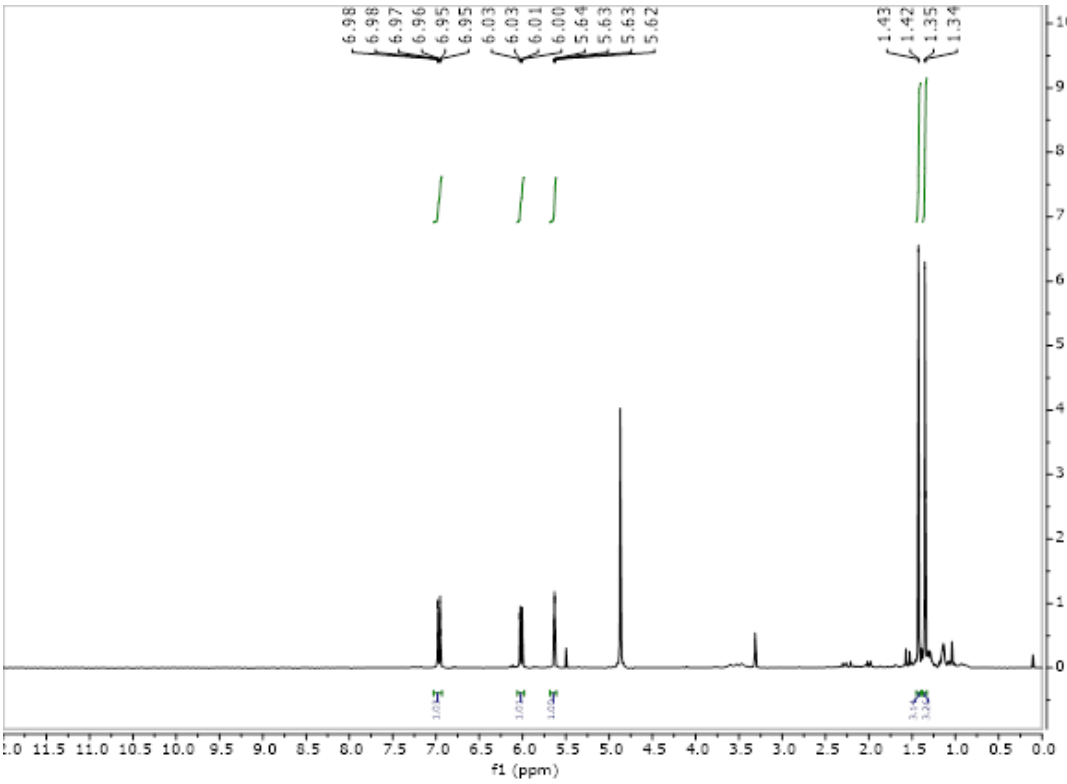


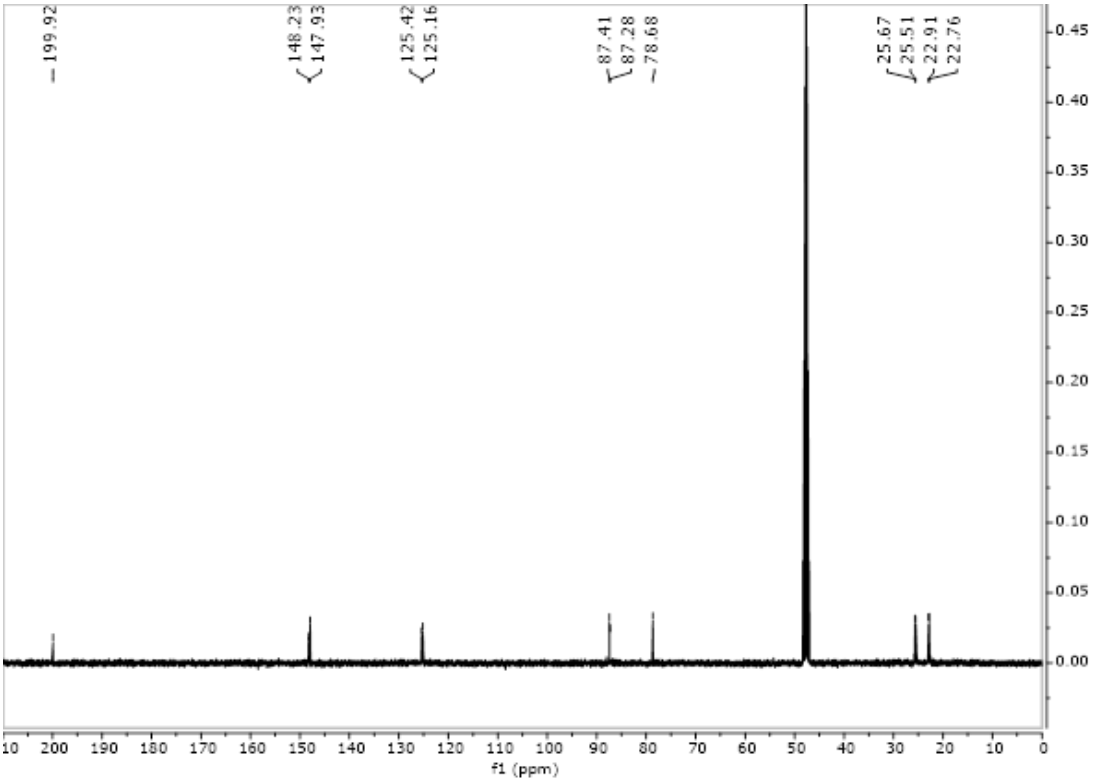




6-Hydroxy-2,2-dimethyl-2H-pyran-3(6H)-one **10i**



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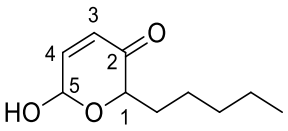
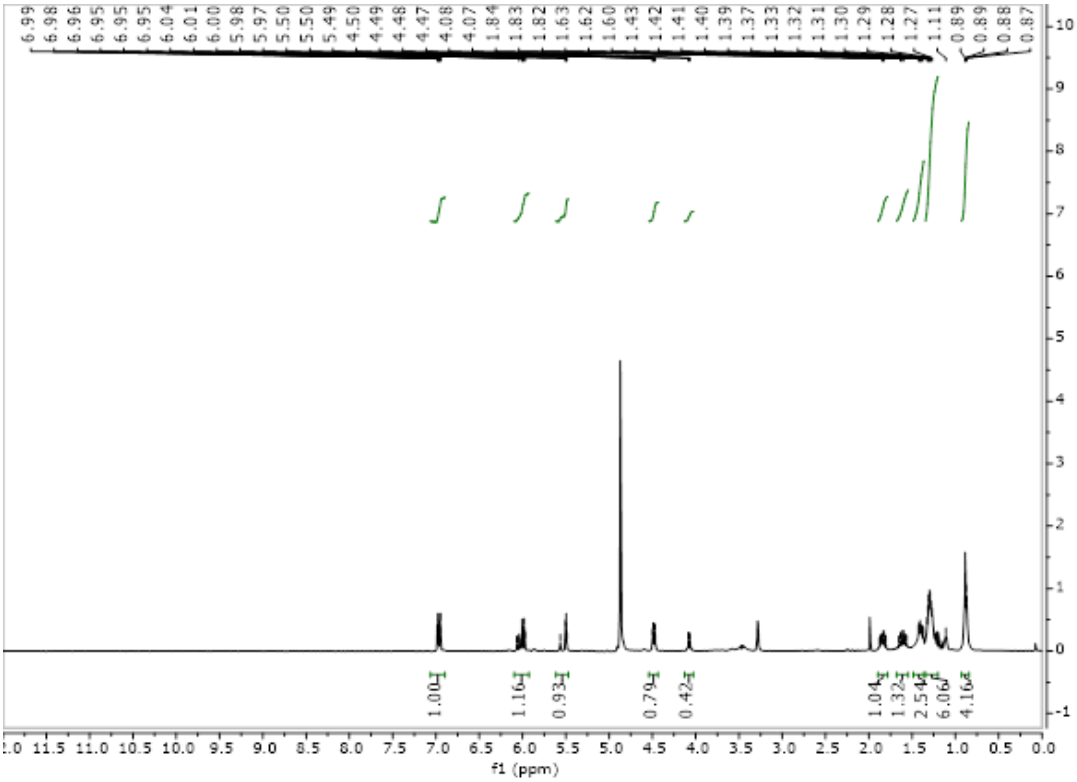
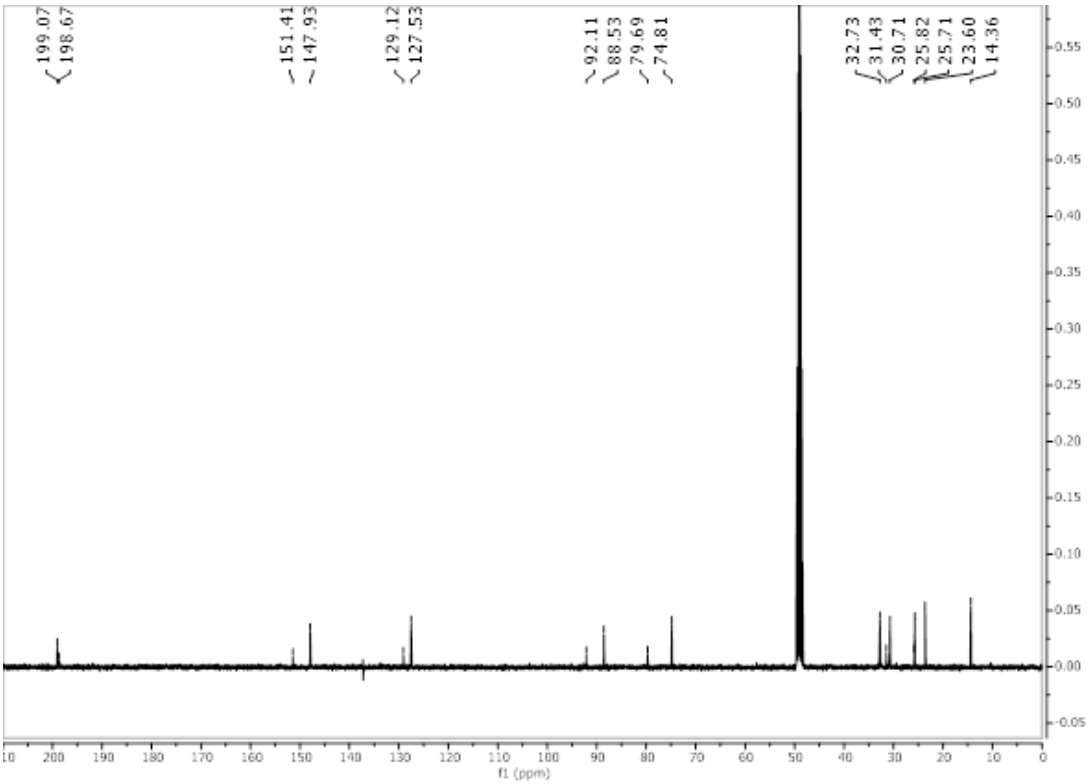
148.23
147.93
125.42
125.16
87.41
87.28
78.68
25.67
25.51
22.91
22.76
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
10 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

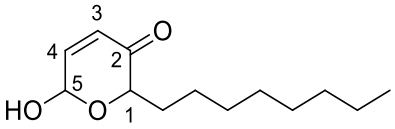
6-Hydroxy-2-pentyl-2H-pyran-3(6H)-one **10j**

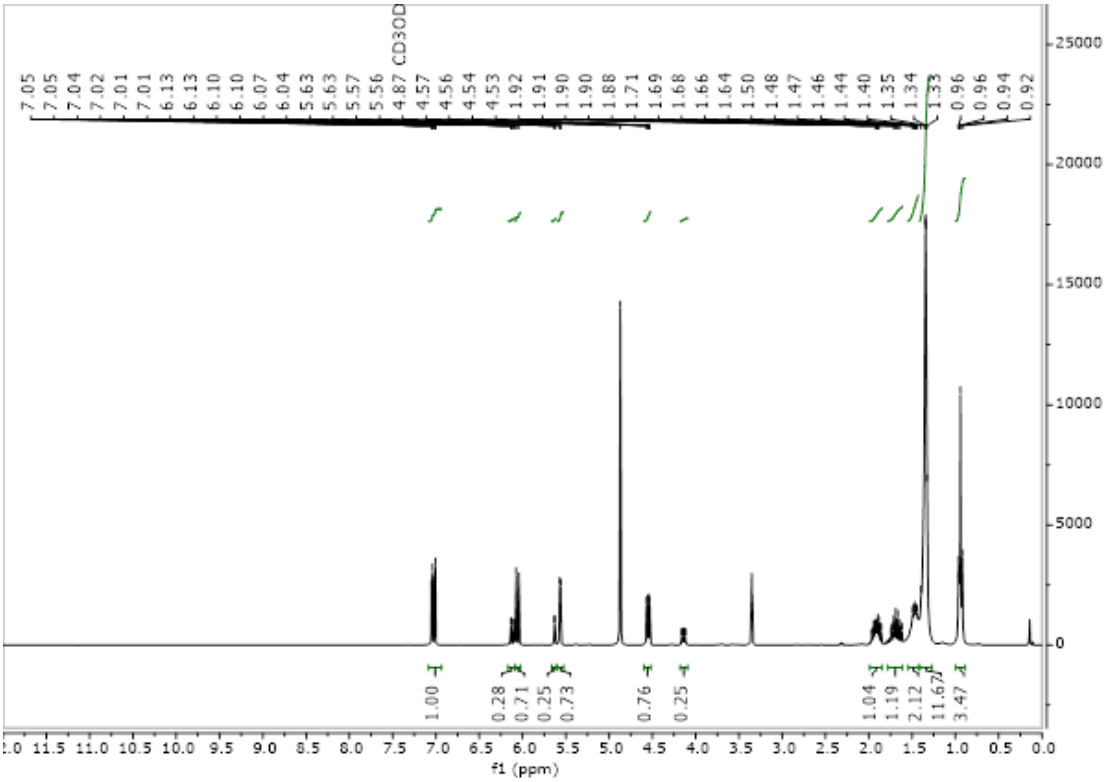


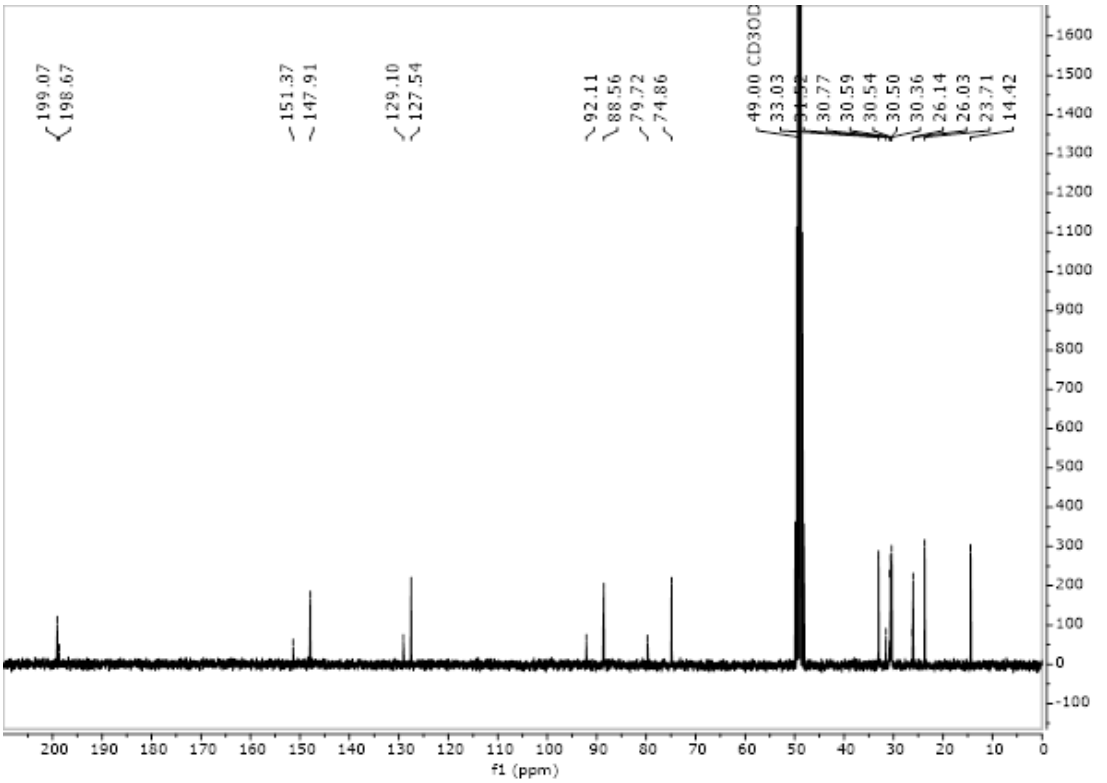




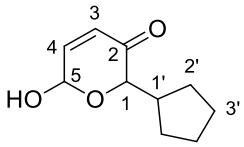
6-Hydroxy-2-octyl-2H-pyran-3(6H)-one **10k**

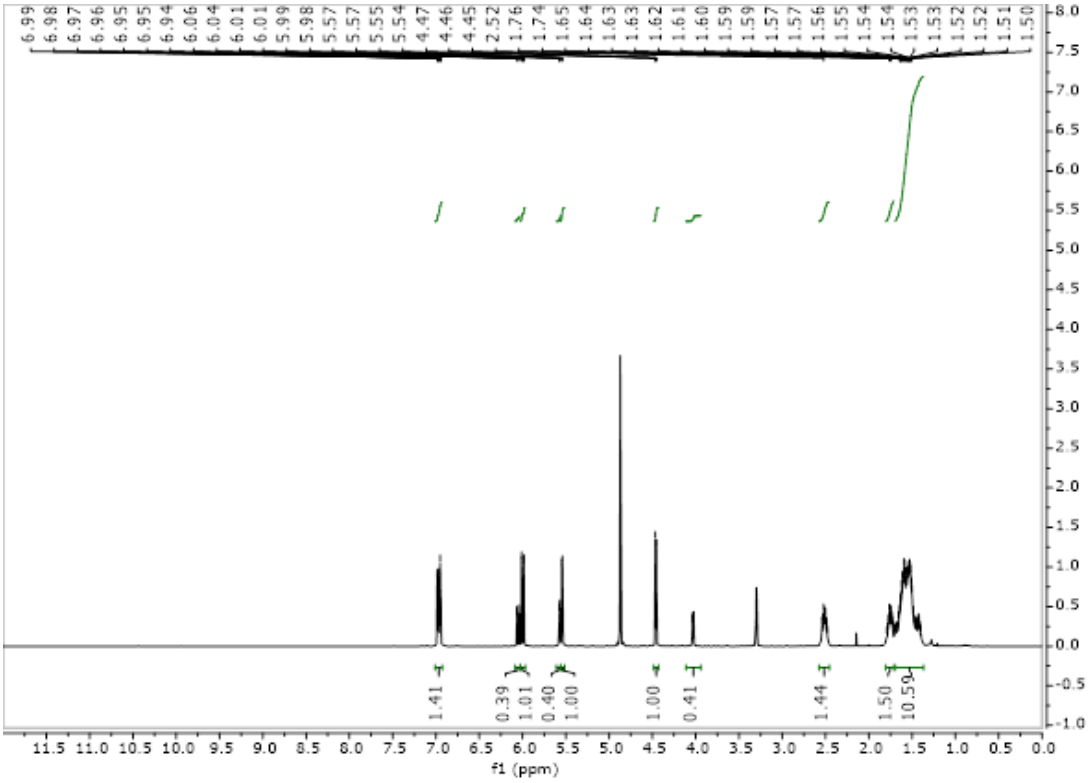


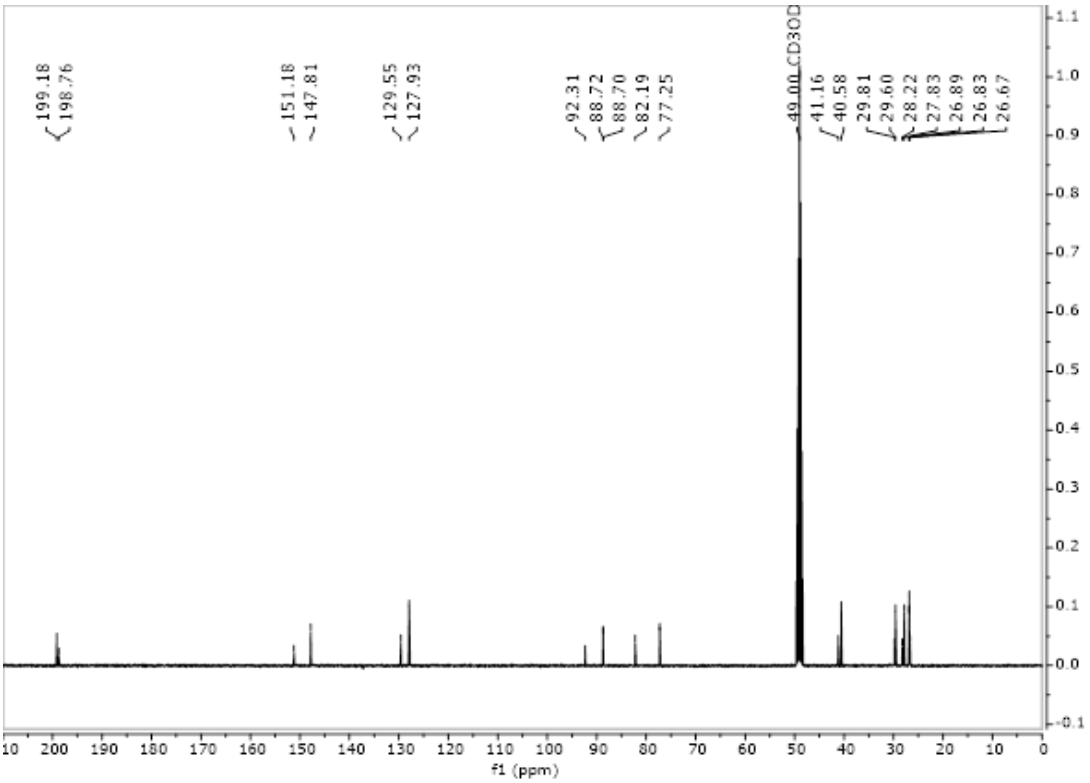




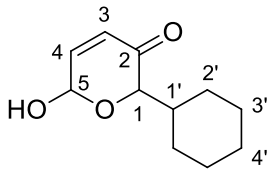
2-Cyclopentyl-6-hydroxy-2H-pyran-3(6H)-one **10l**

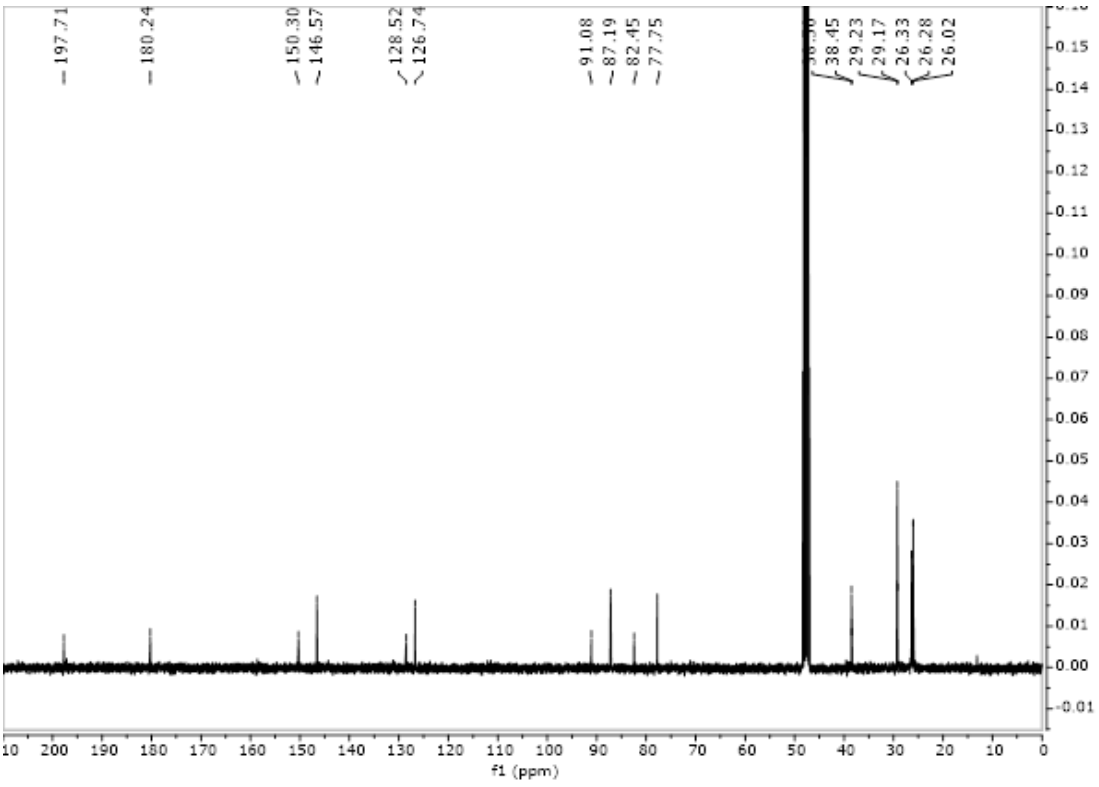




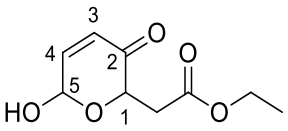


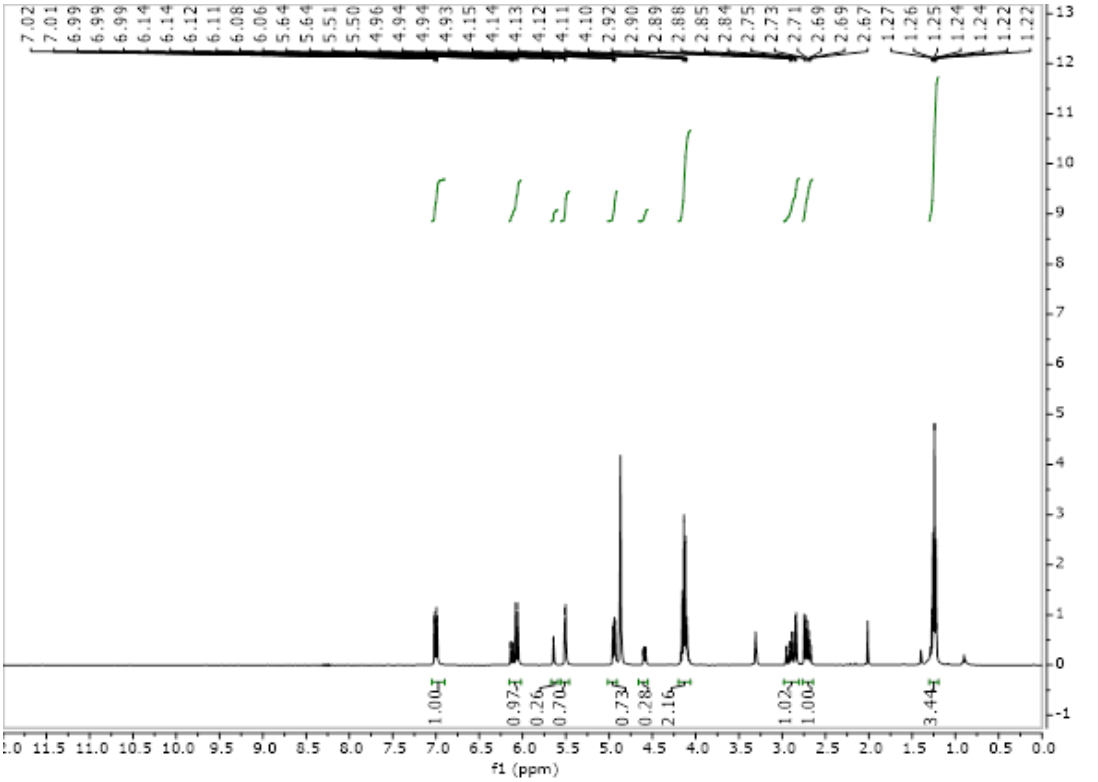
2-Cyclohexyl-6-hydroxy-2H-pyran-3(6H)-one **10m**

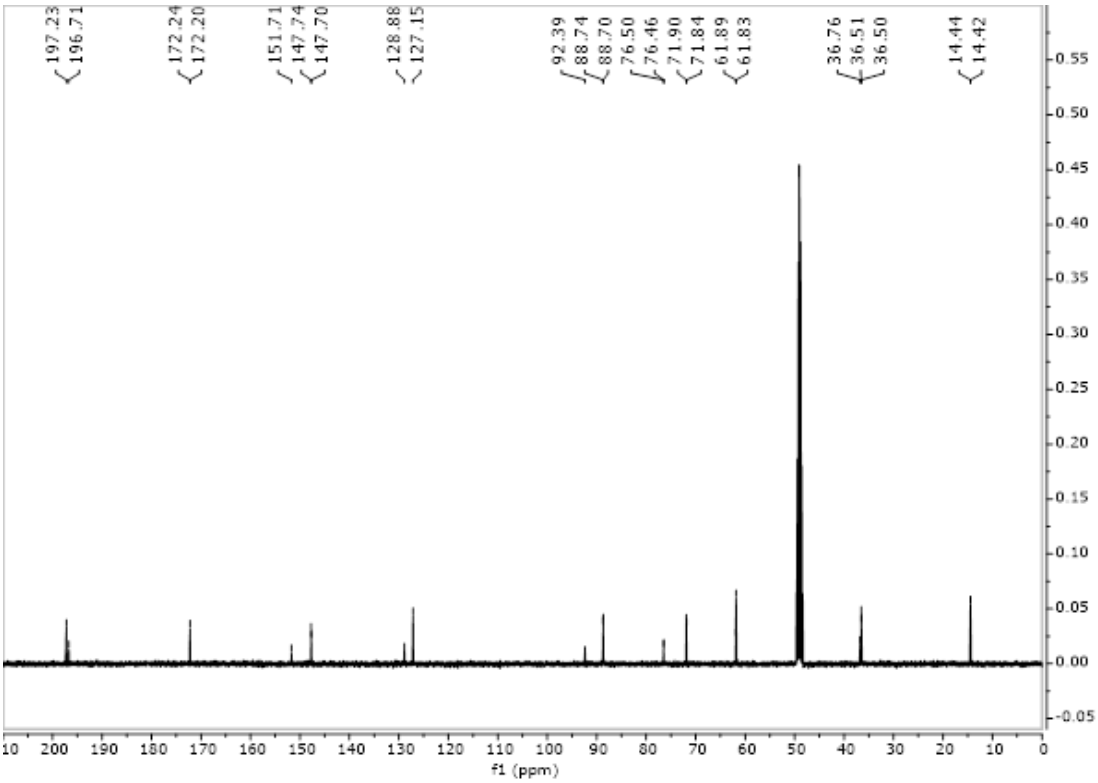




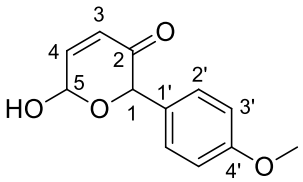
Ethyl 2-(6-hydroxy-3-oxo-3,6-dihydro-2H-pyran-2-yl)acetate **10n**

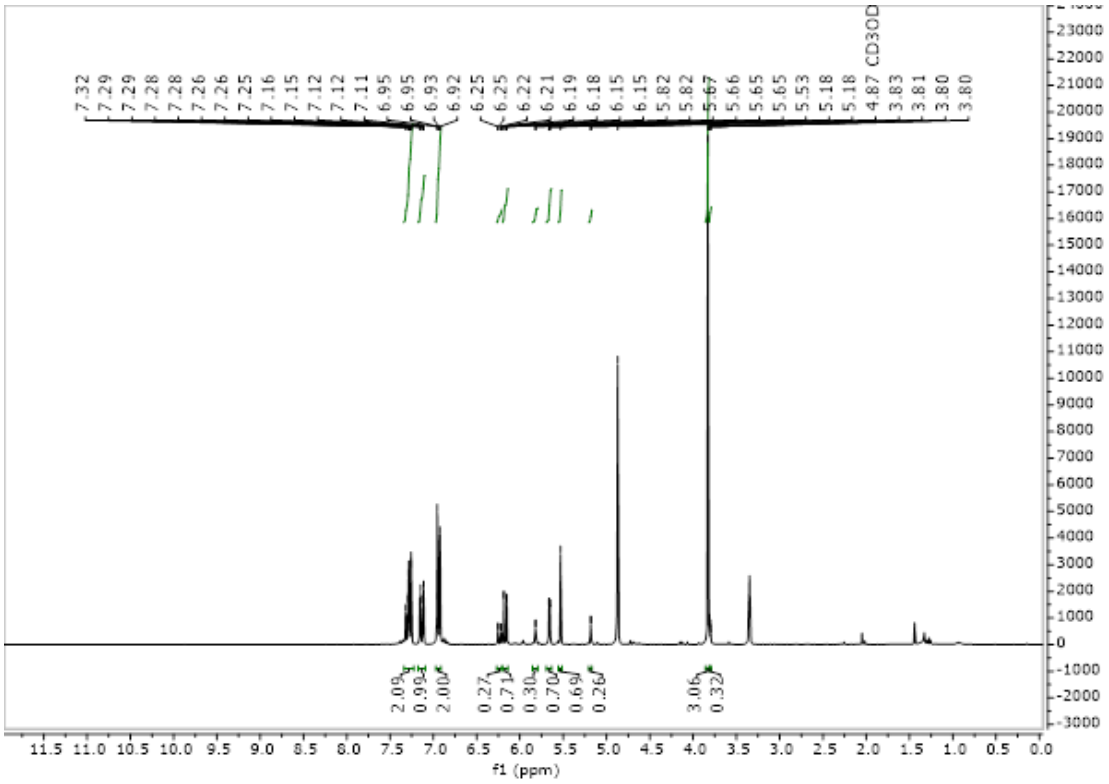


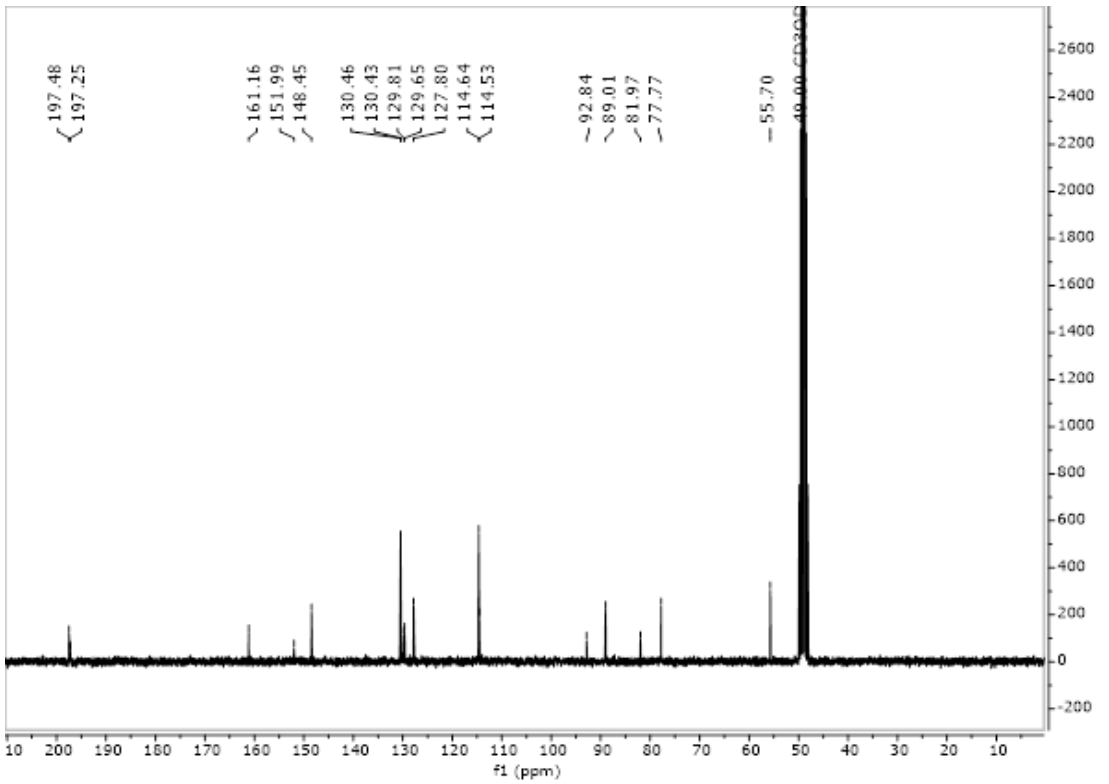




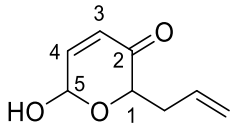
6-Hydroxy-2-(4-methoxyphenyl)-2H-pyran-3(6H)-one **10p**

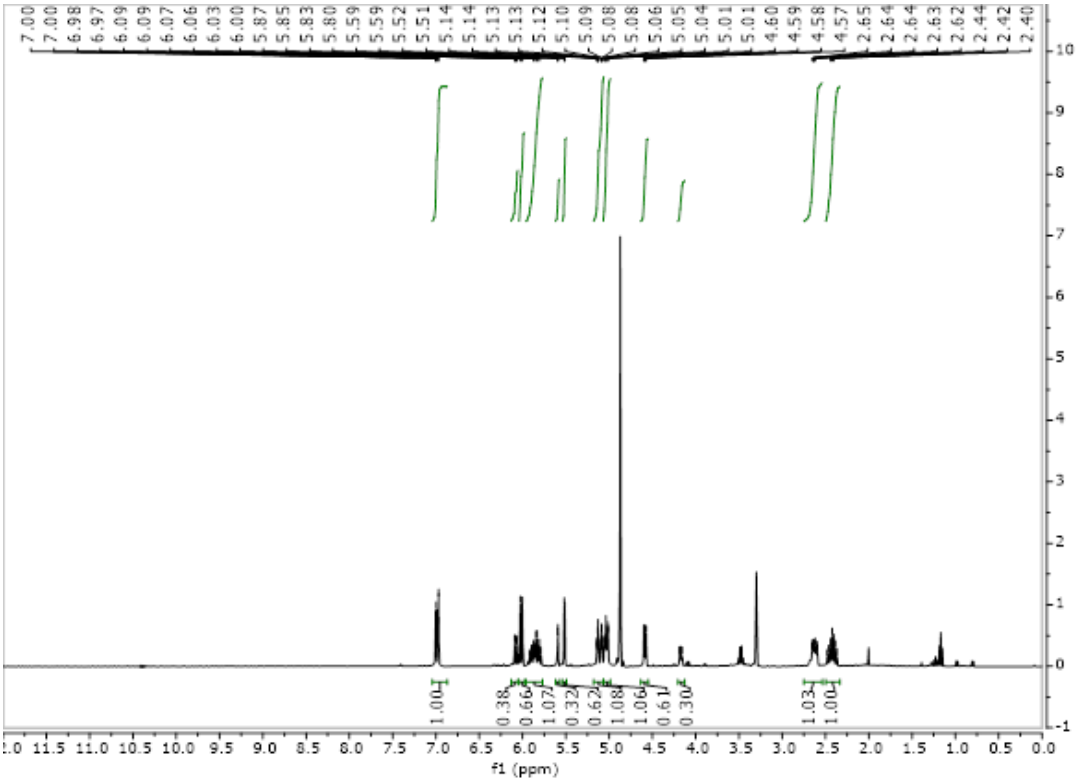


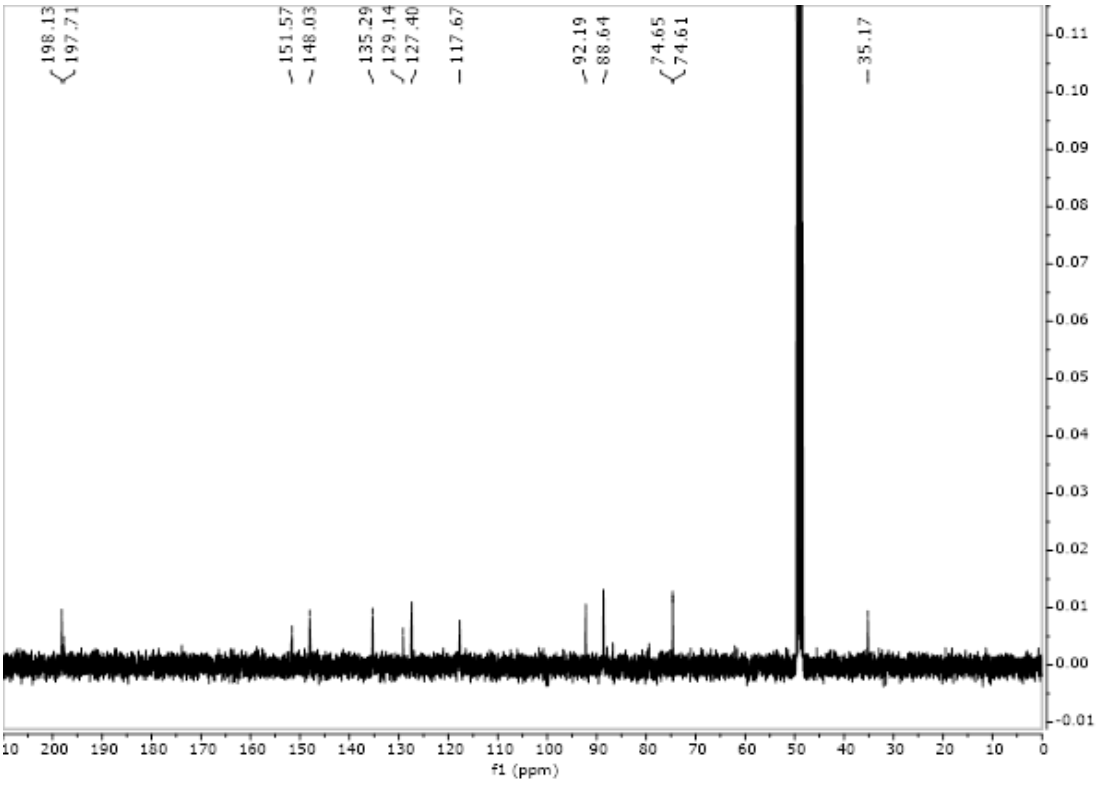




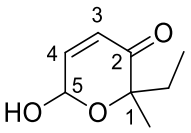
2-Allyl-6-hydroxy-2H-pyran-3(6H)-one **10s**

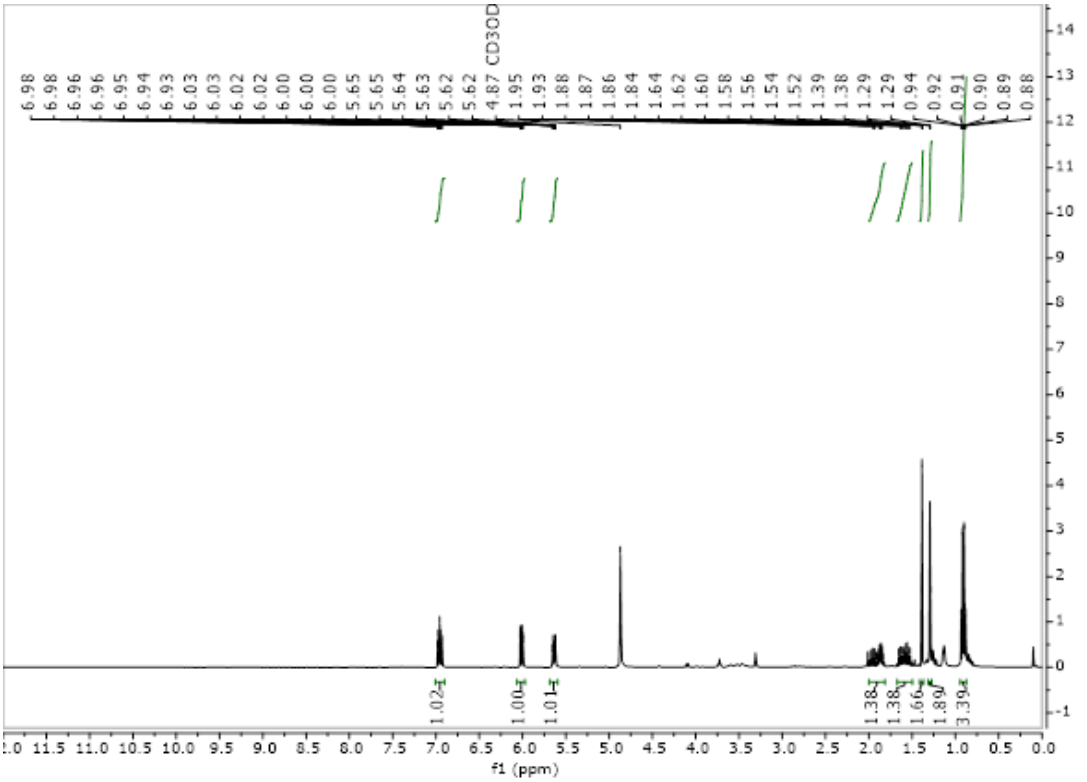


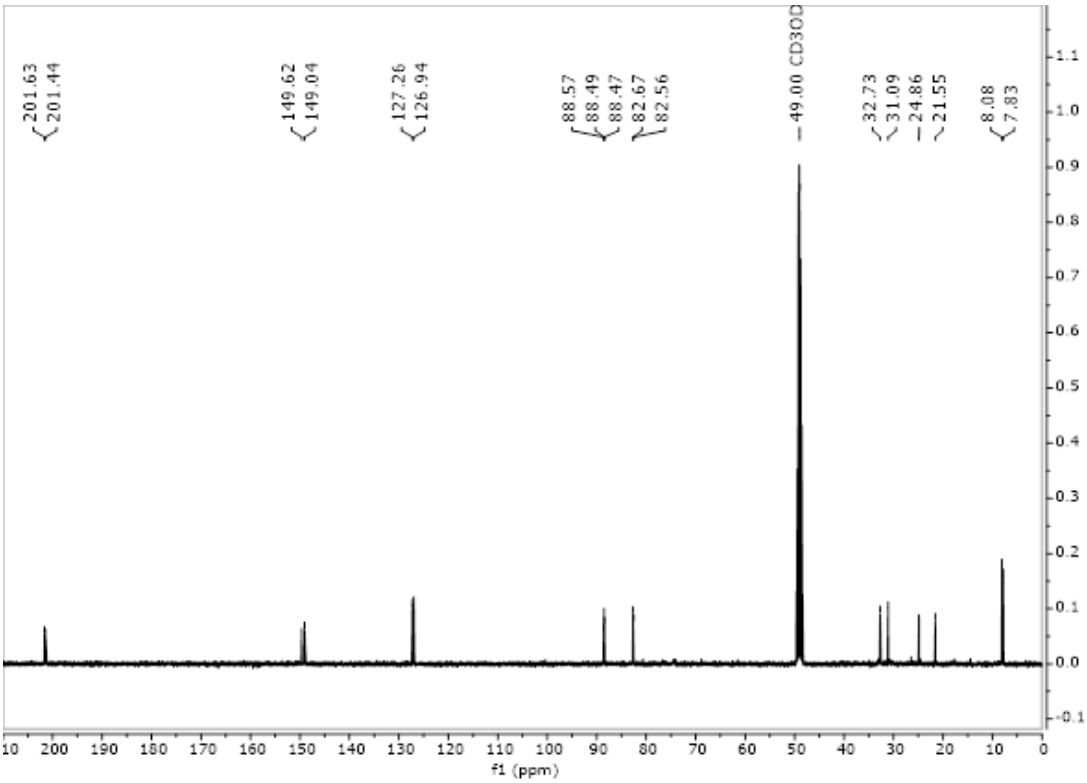




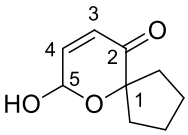
2-Ethyl-6-hydroxy-2-methyl-2H-pyran-3(6H)-one **10t**

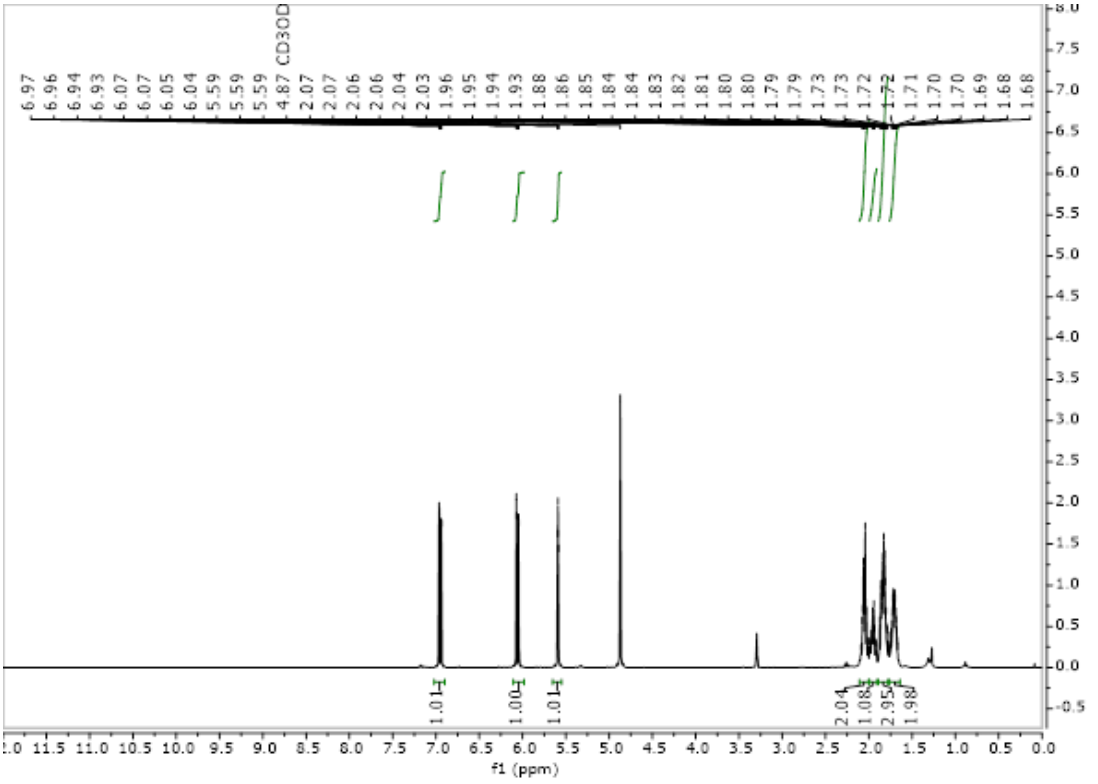


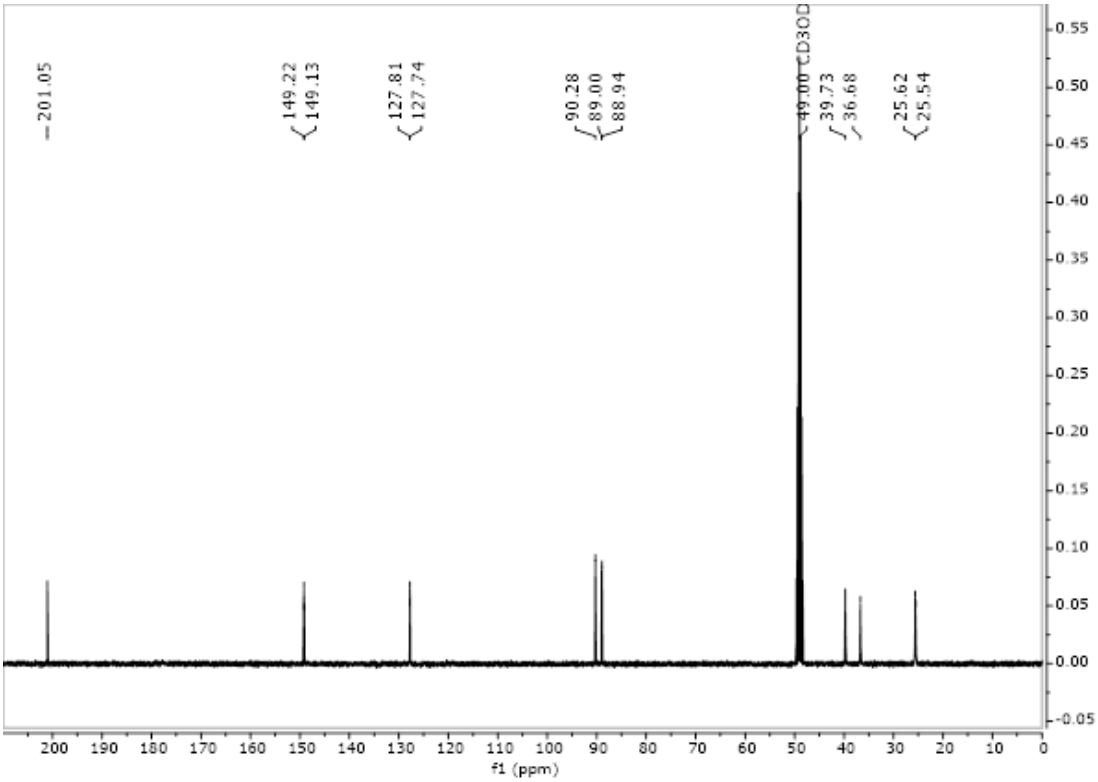




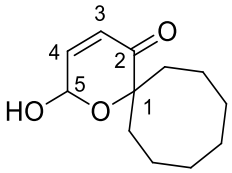
7-Hydroxy-6-oxaspiro[4.5]dec-8-en-10-one **10u**

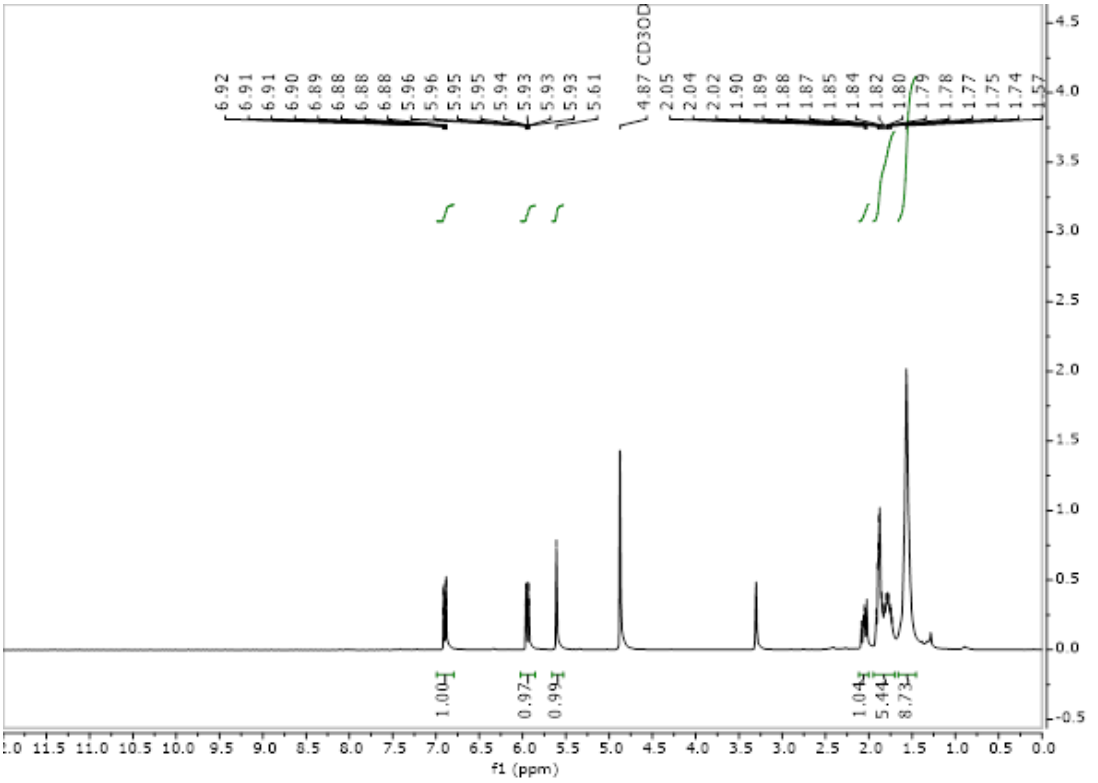


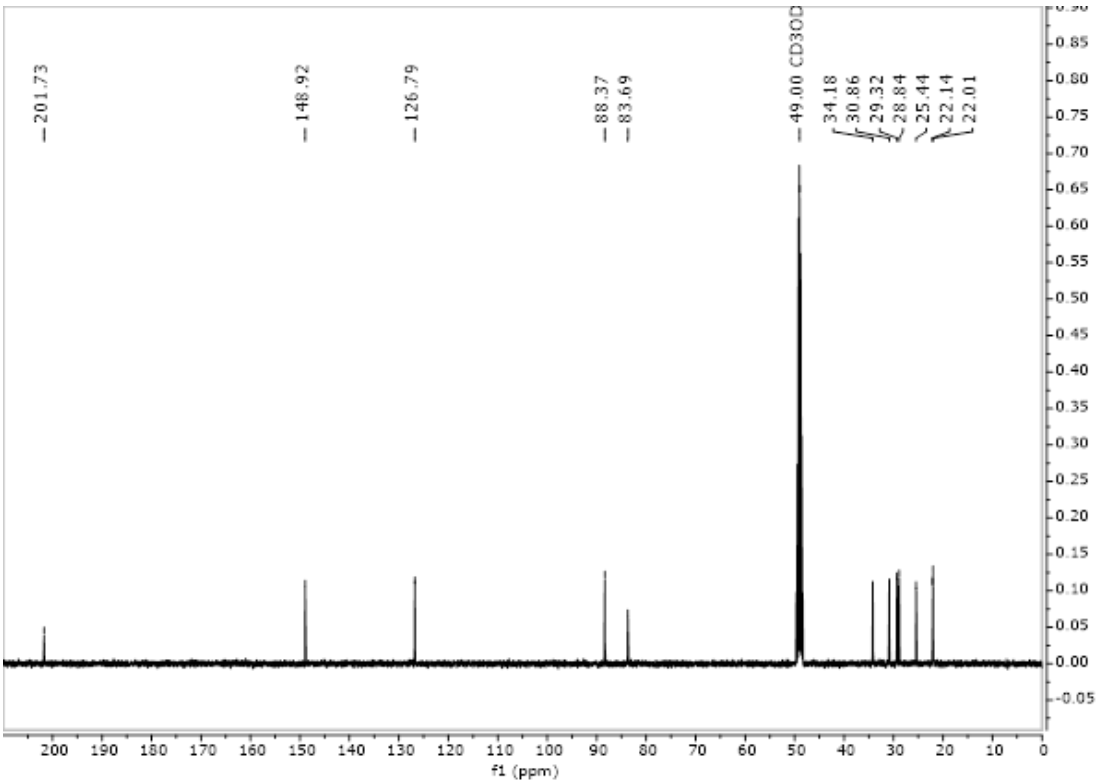




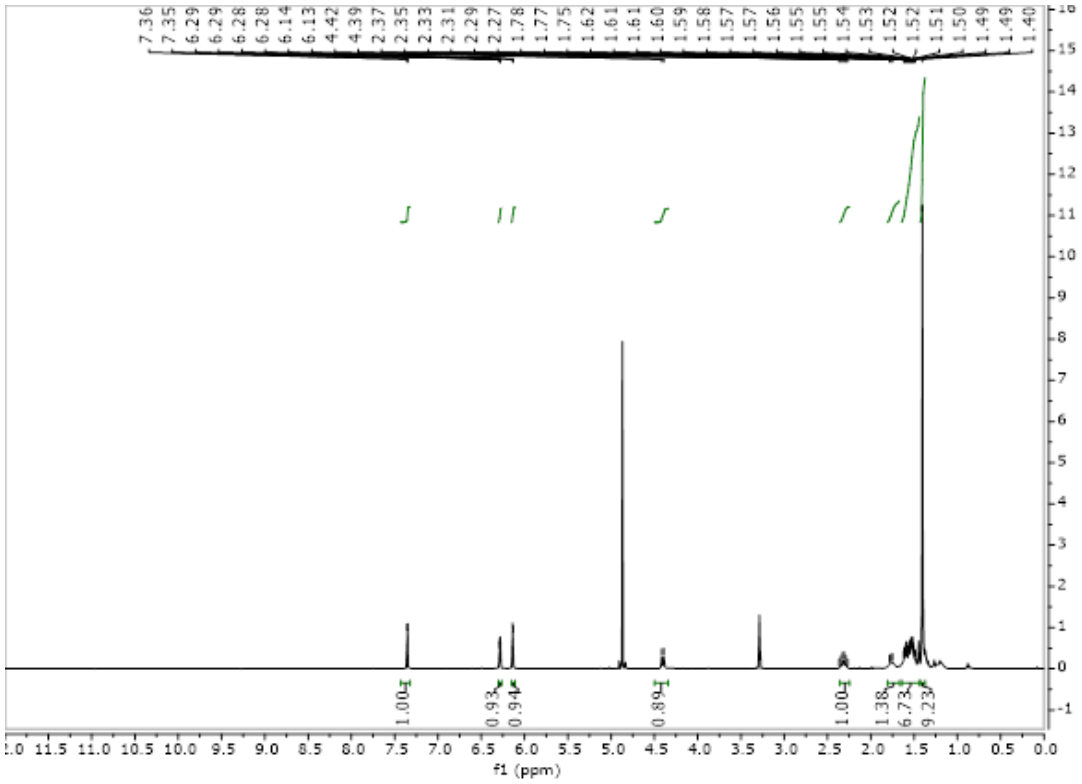
2-Hydroxy-1-oxaspiro[5.7]tridec-3-en-5-one **10v**

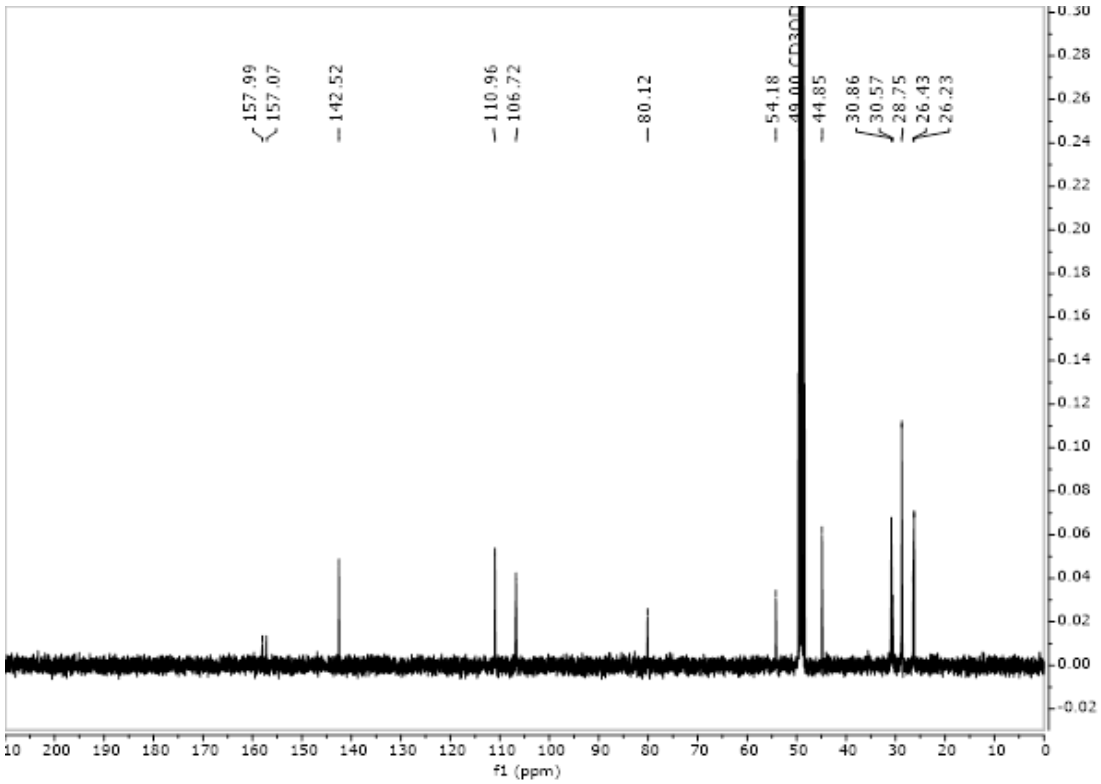




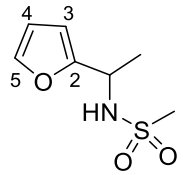


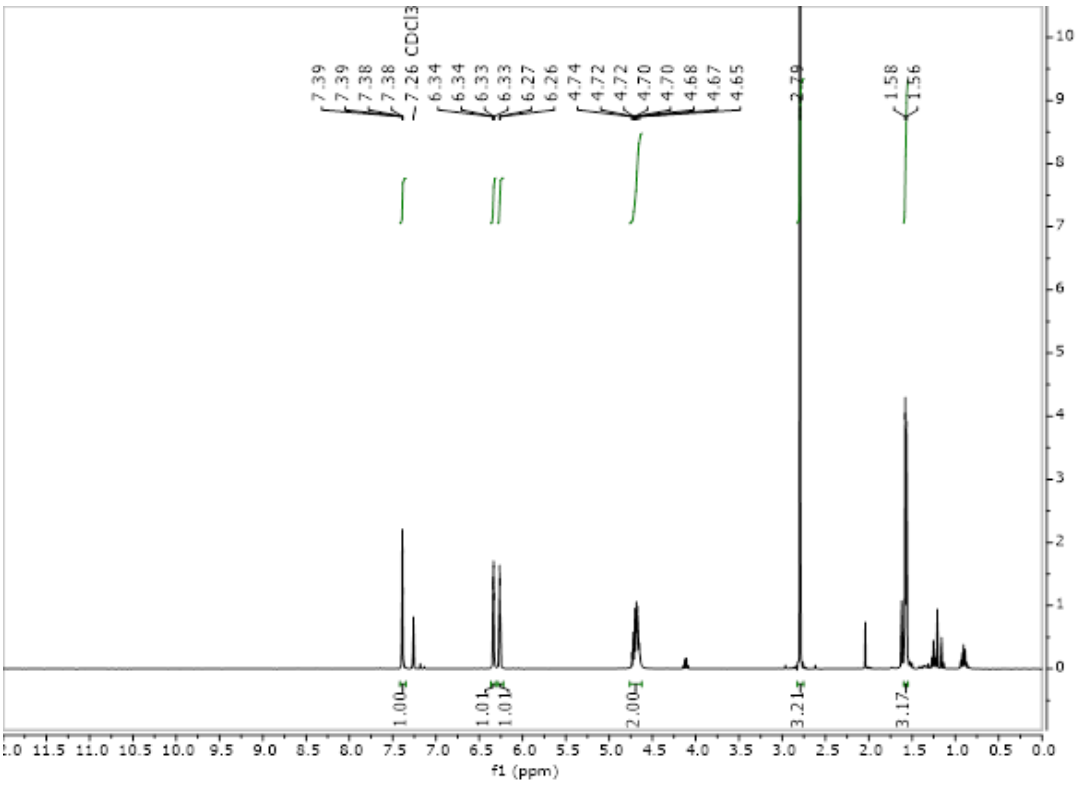
N-[1-(Furan-2-yl)-1-cyclopentylmethyl]carbamic acid tert-butyl ester **11d**

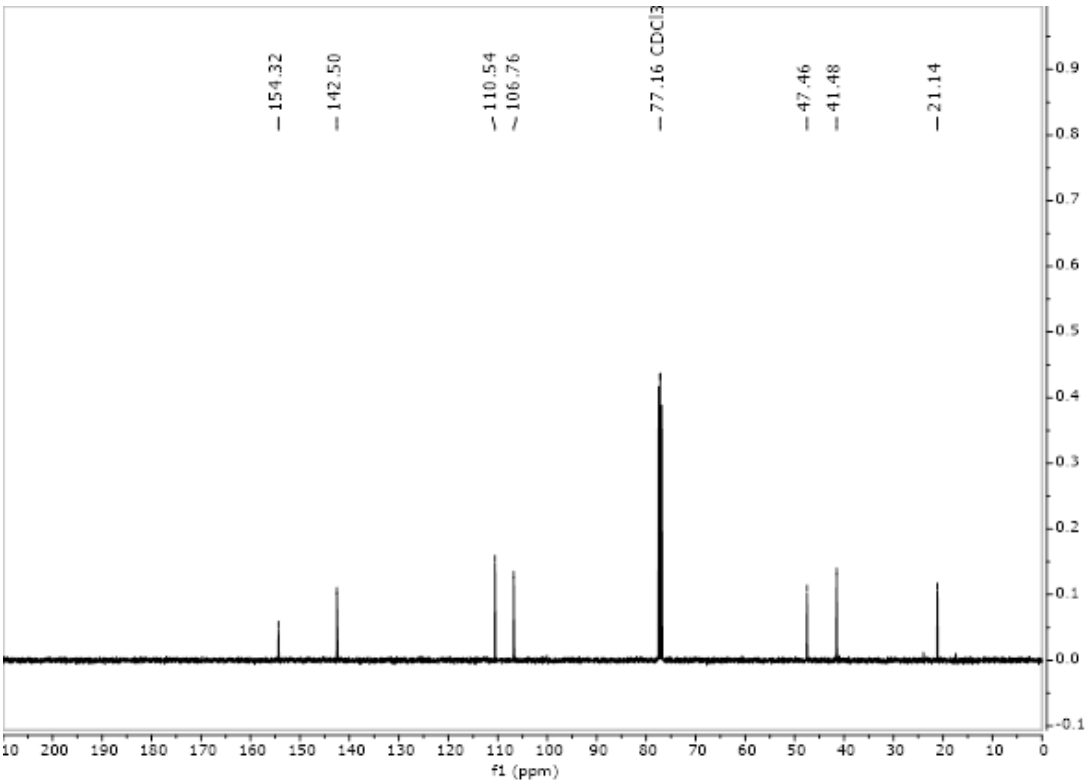




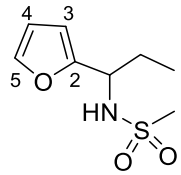
N-[1-(furan-2-yl)ethyl]methanesulfonamide **11g**

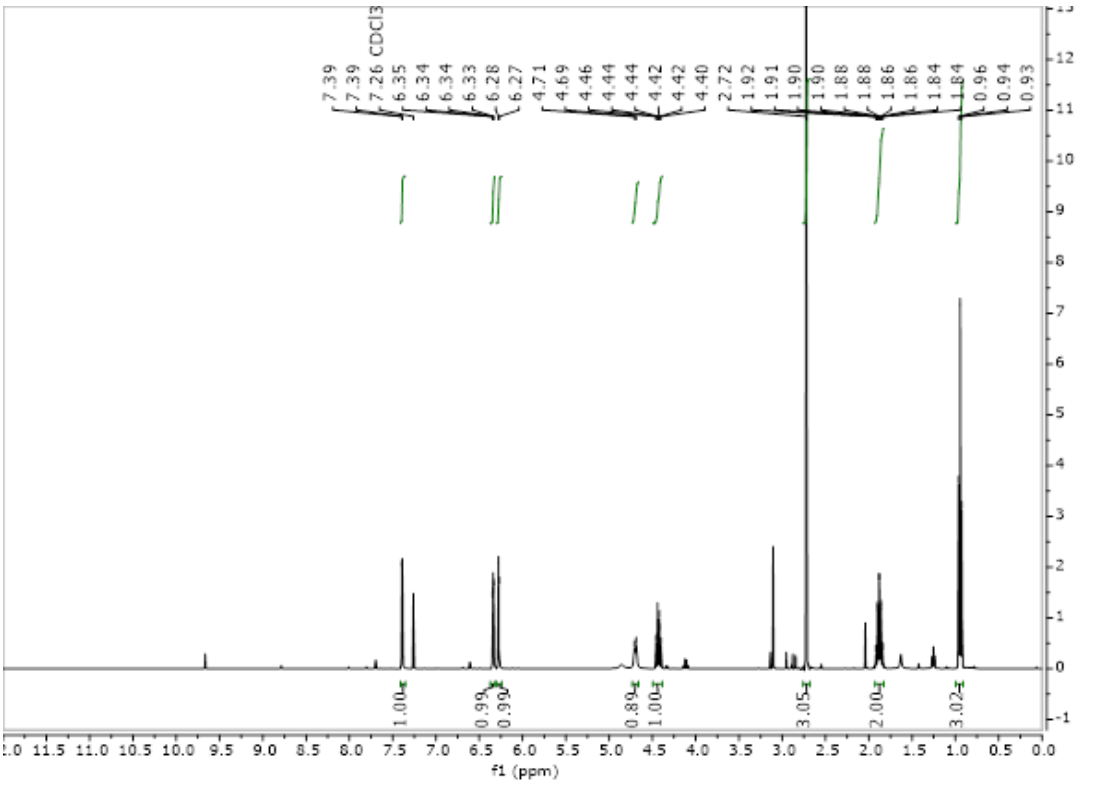


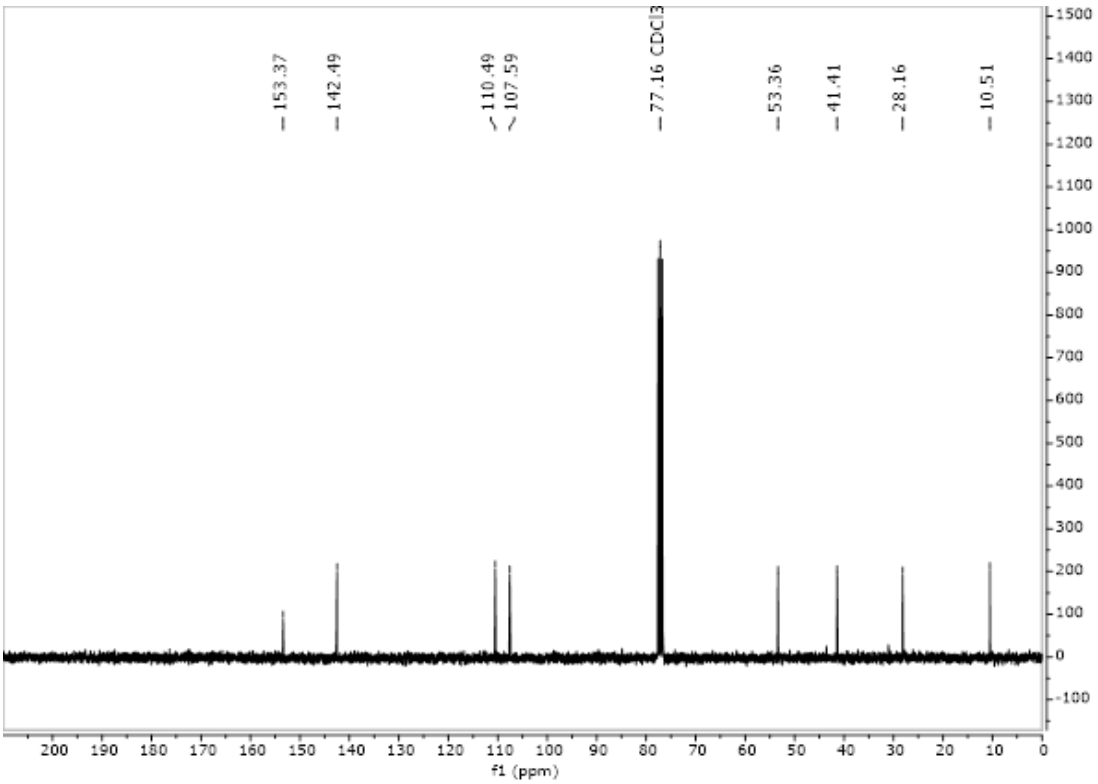




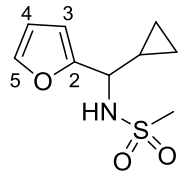
N-[1-(furan-2-yl)-n-propyl]methansulfonamide **11h**

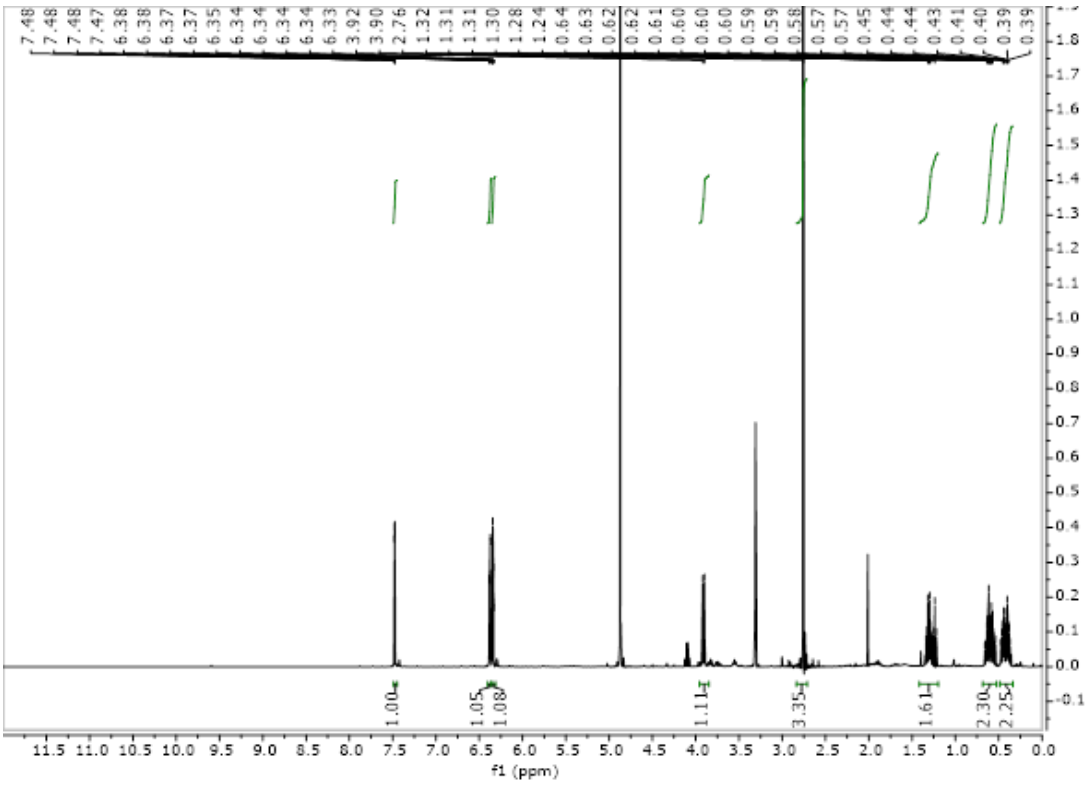


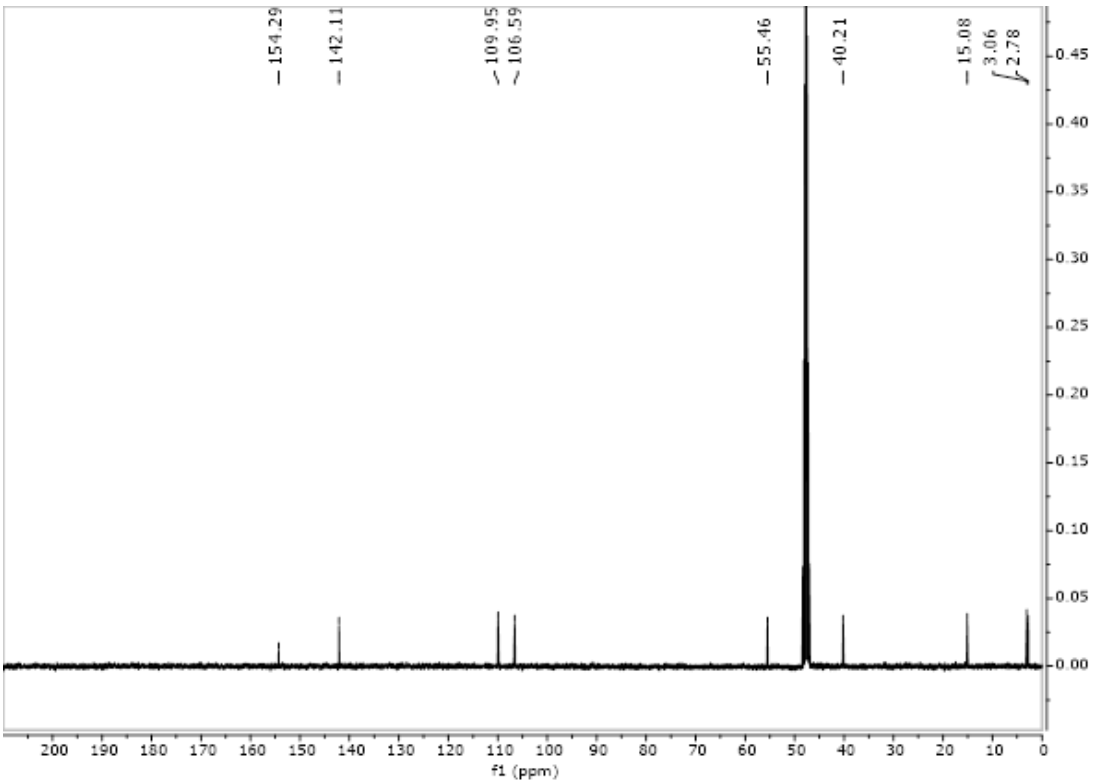




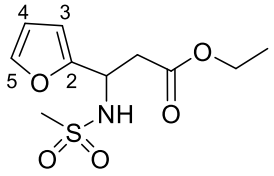
N-[1-(furan-2-yl)cyclopropylmethyl]methansulfonamide **11j**

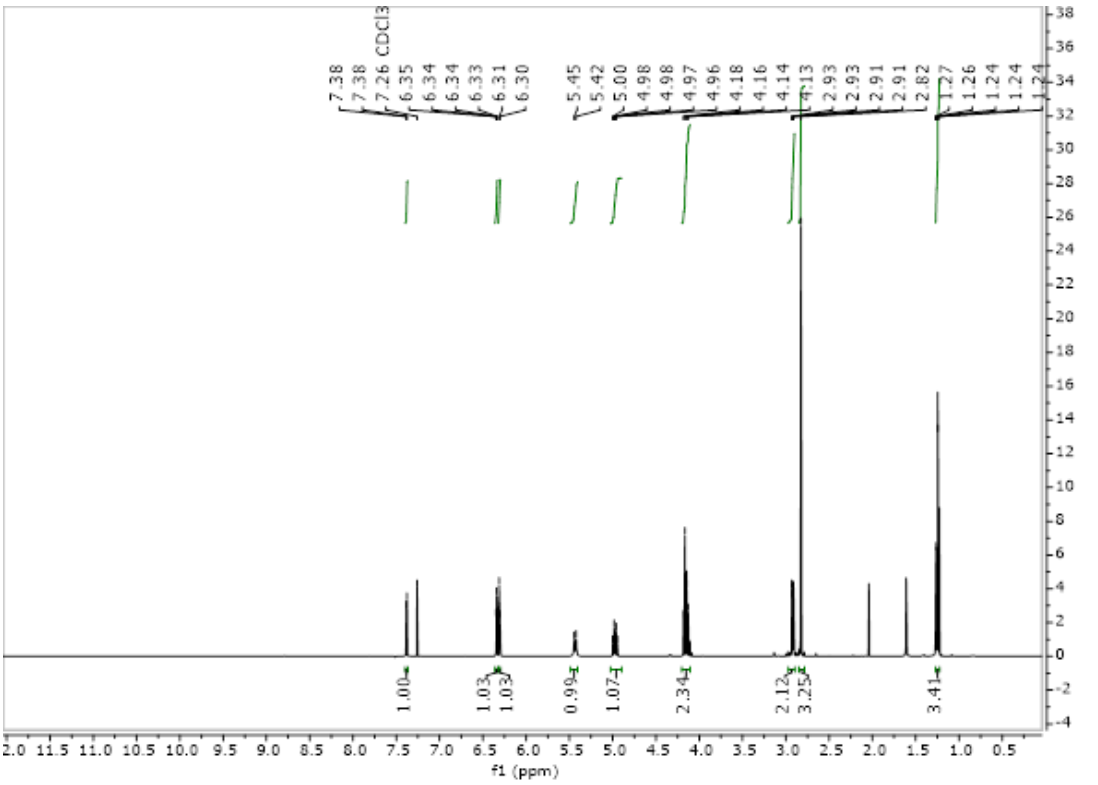


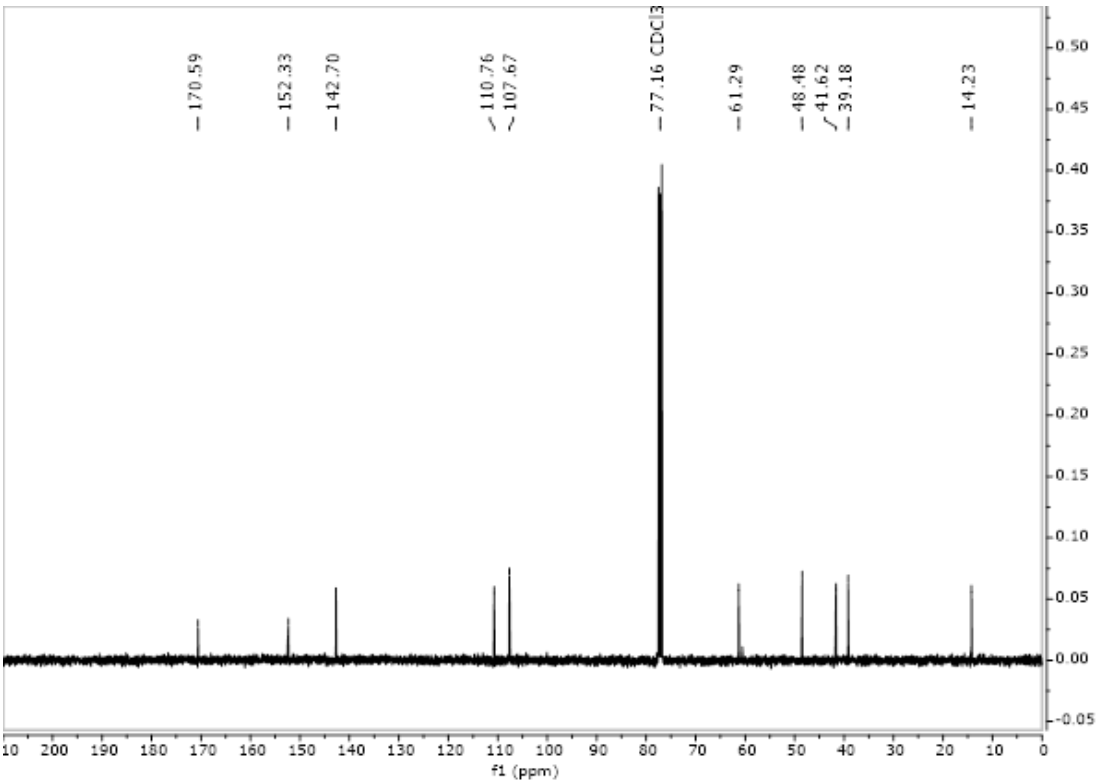




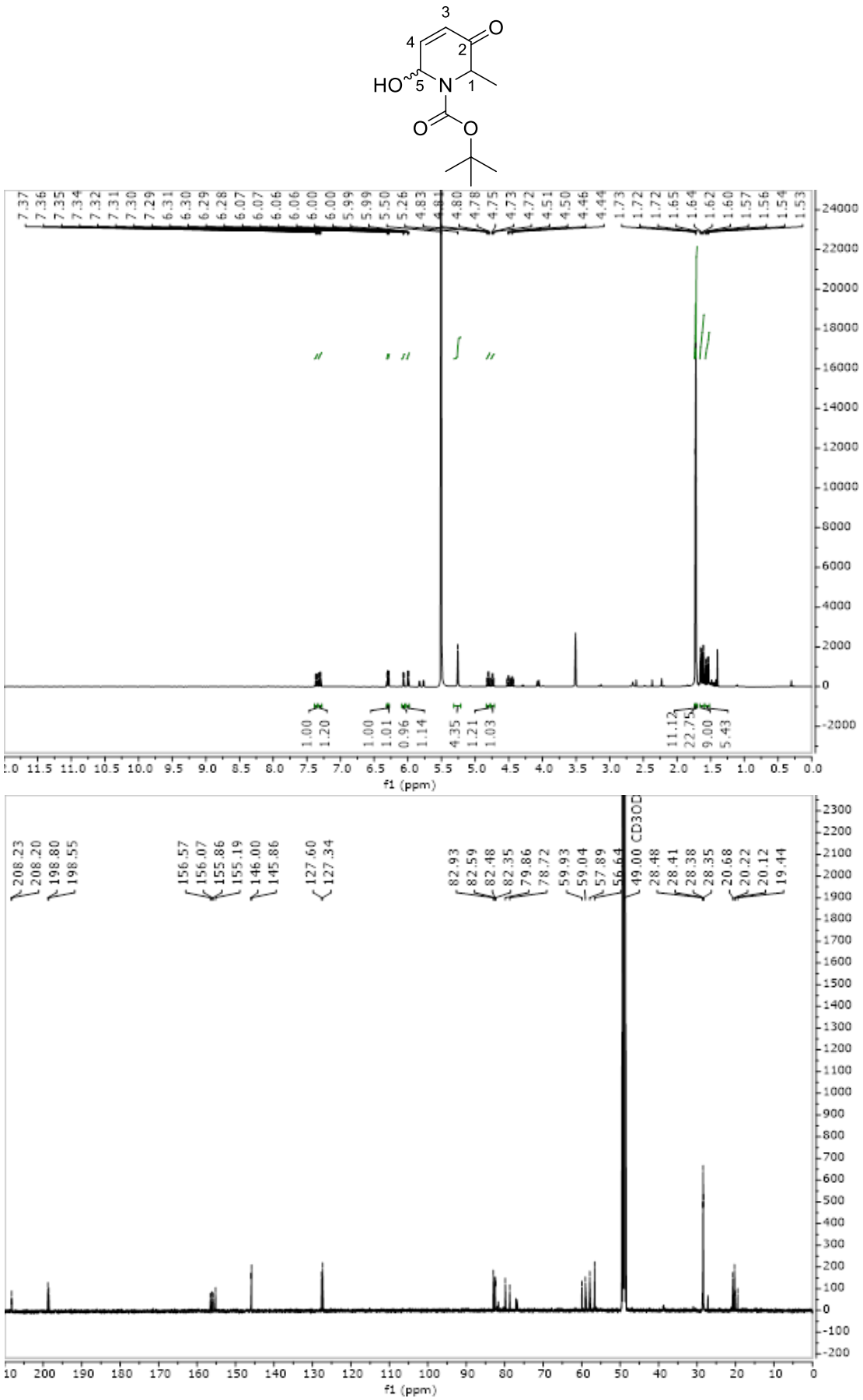
Ethyl 3-(methylsulphonylamino)-3-(furan-2-yl)propanoate **11k**



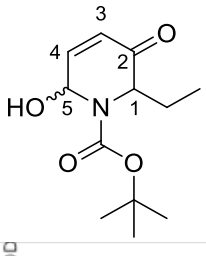


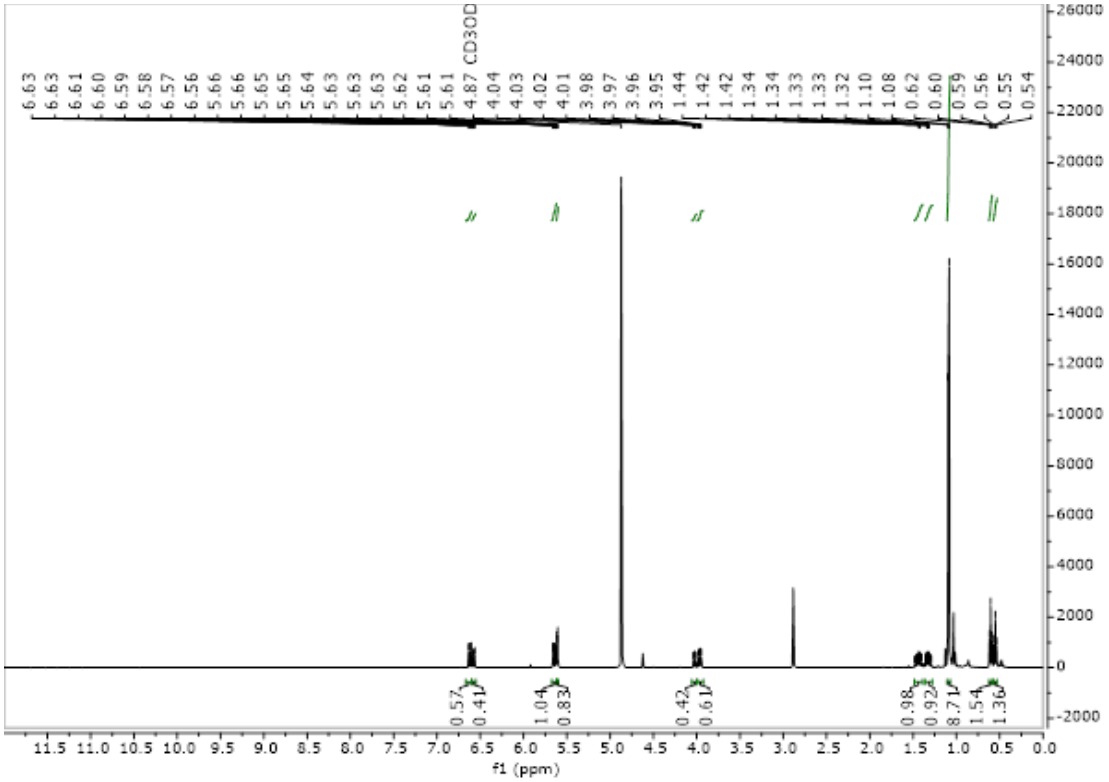


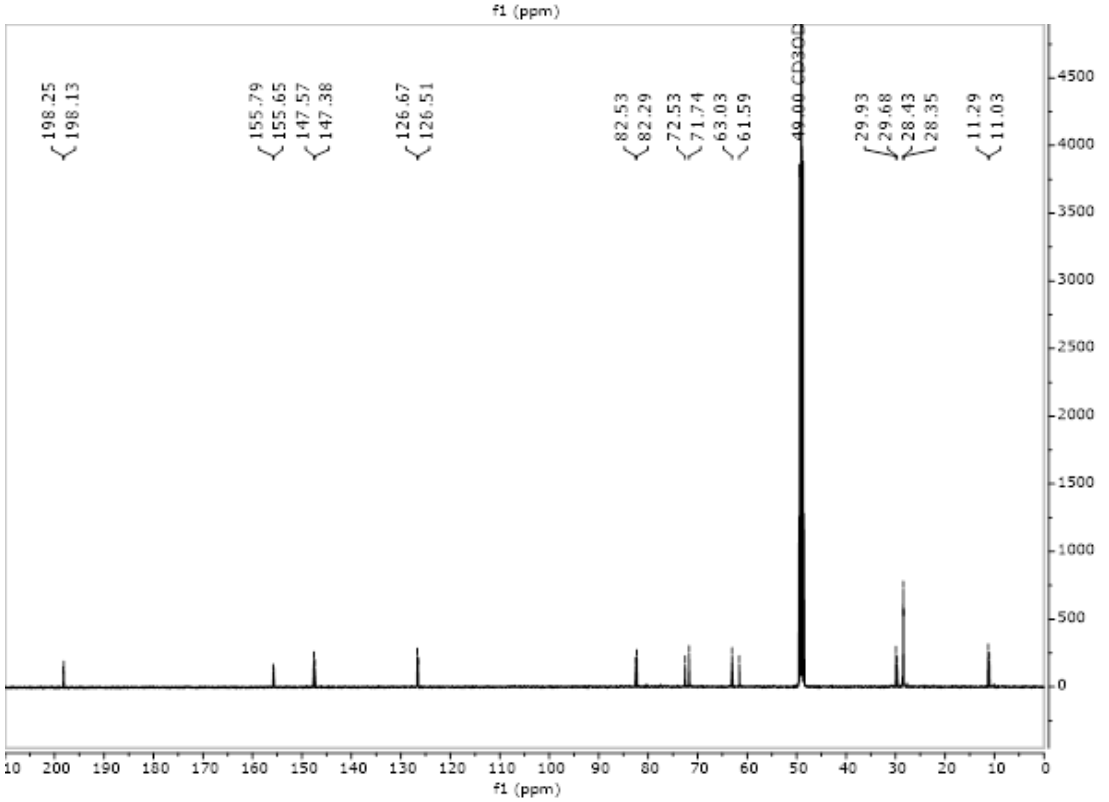
tert-Butyl 2-hydroxy-6-methyl-5-oxo-5,6-dihydropyridine-1(2H)-carboxylate **12b**



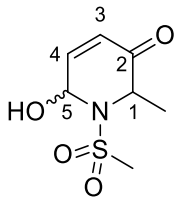
tert-Butyl 6-ethyl-2-hydroxy-5-oxo-5,6-dihydropyridine-1(2H)-carboxylate **12c**

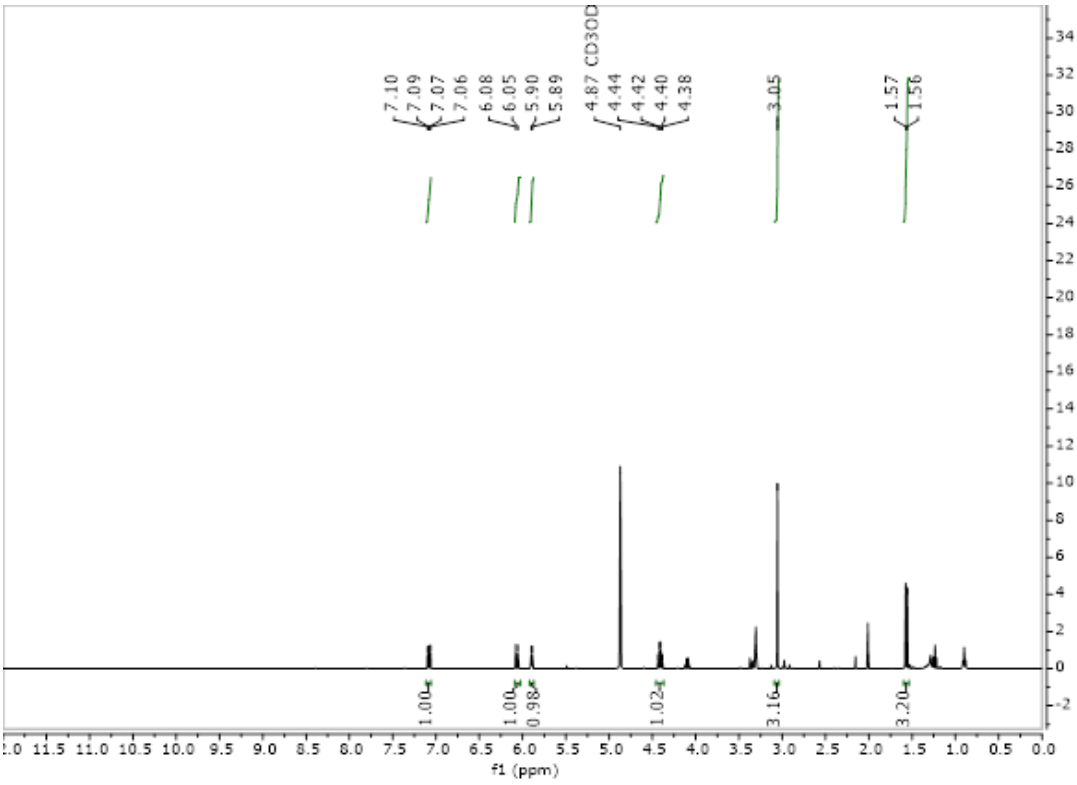


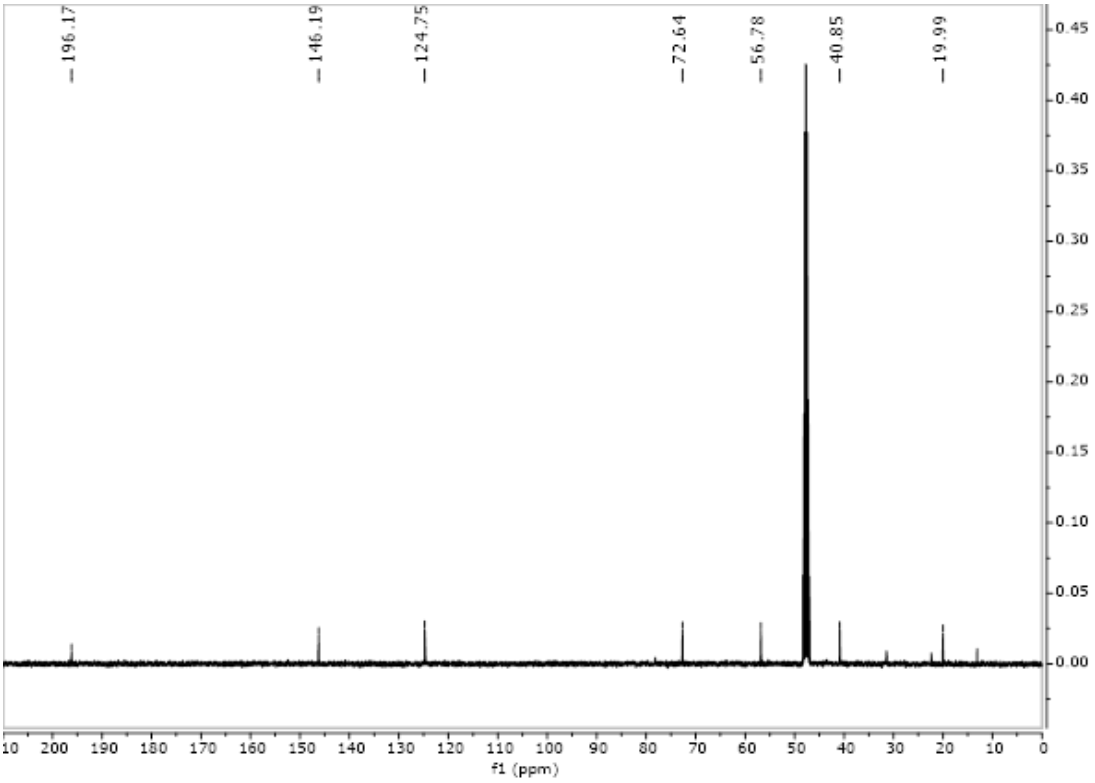




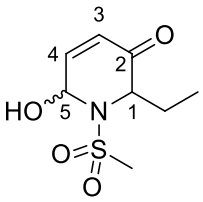
6-Methyl-1-(methylsulfonyl)-1,2-dihydropyridine-2,5-diol **12g**

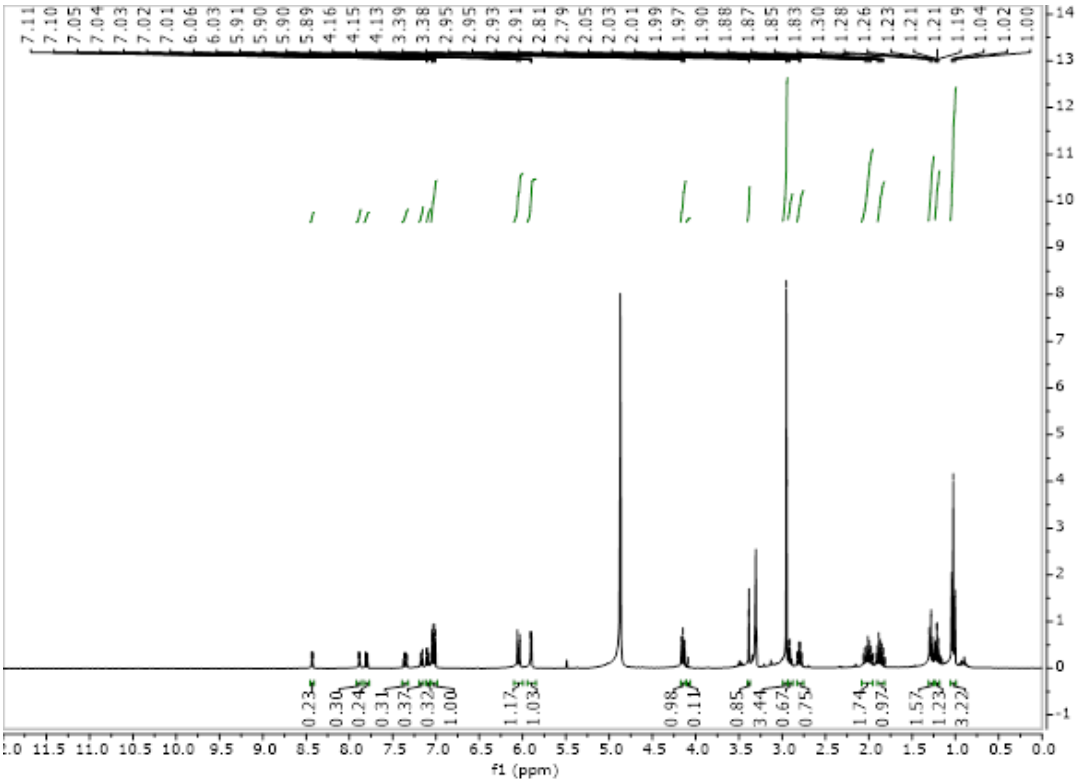


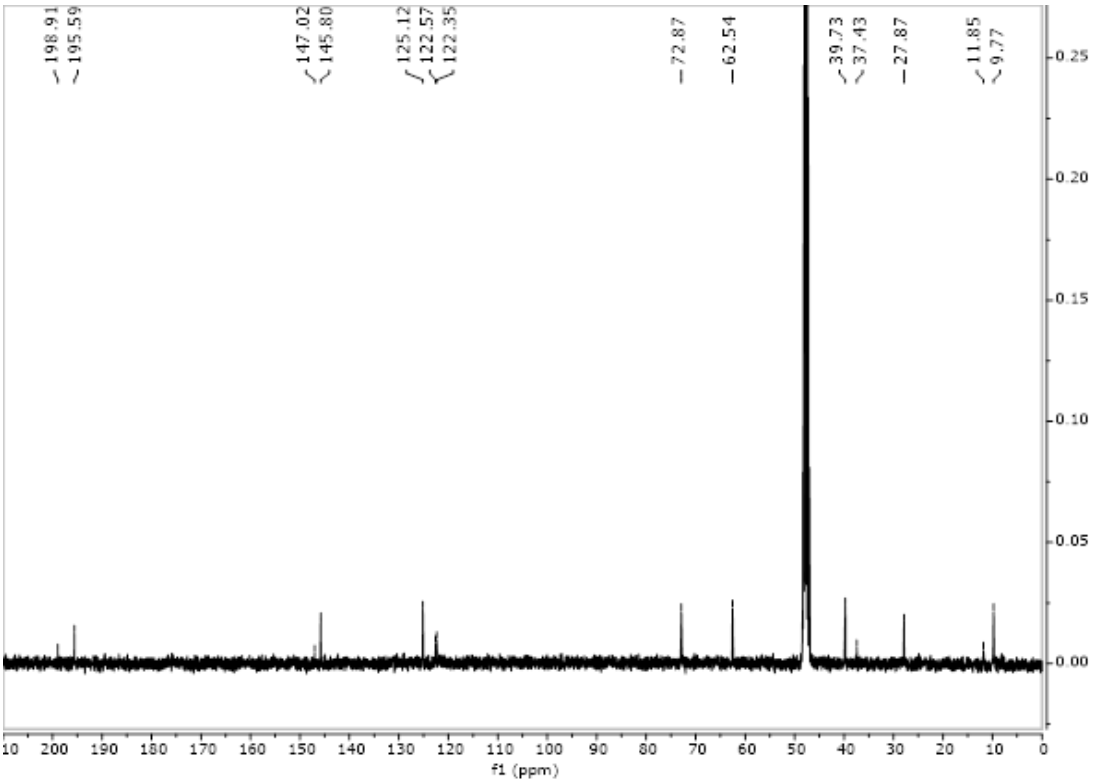




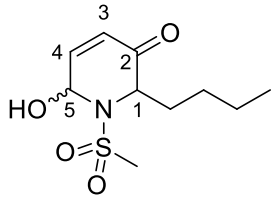
2-Ethyl-6-hydroxy-1-(methylsulfonyl)-1,6-dihydropyridin-3(2H)-one **12h**

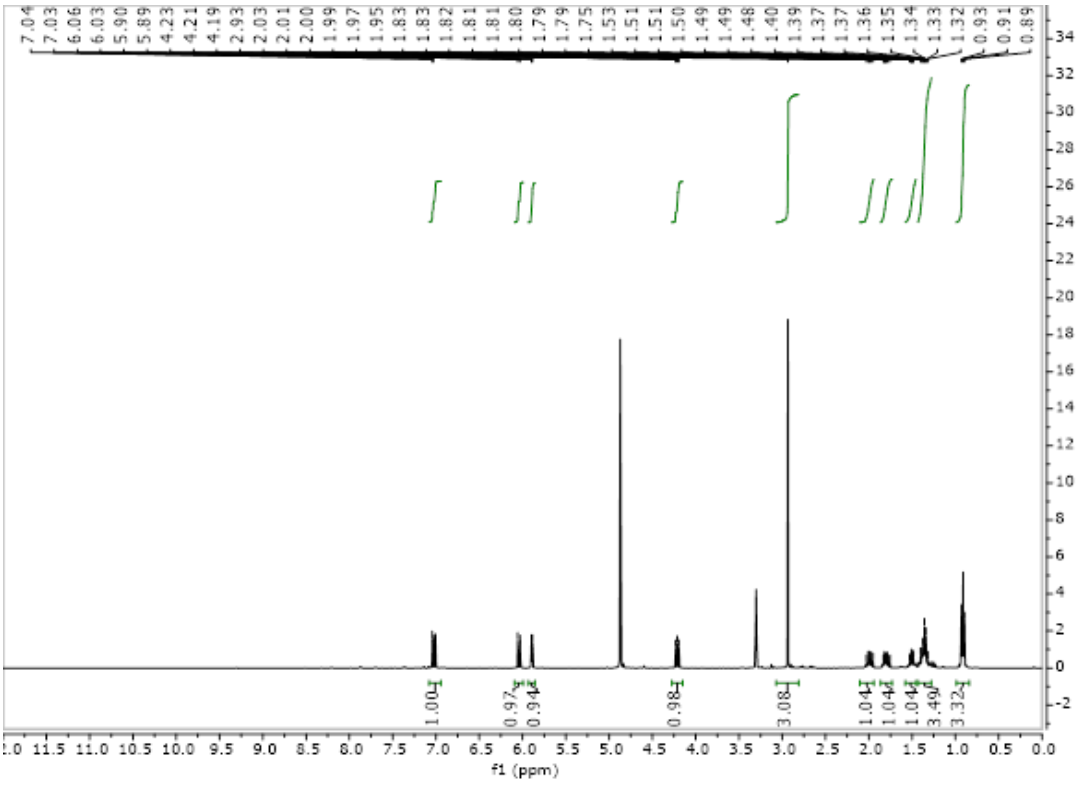


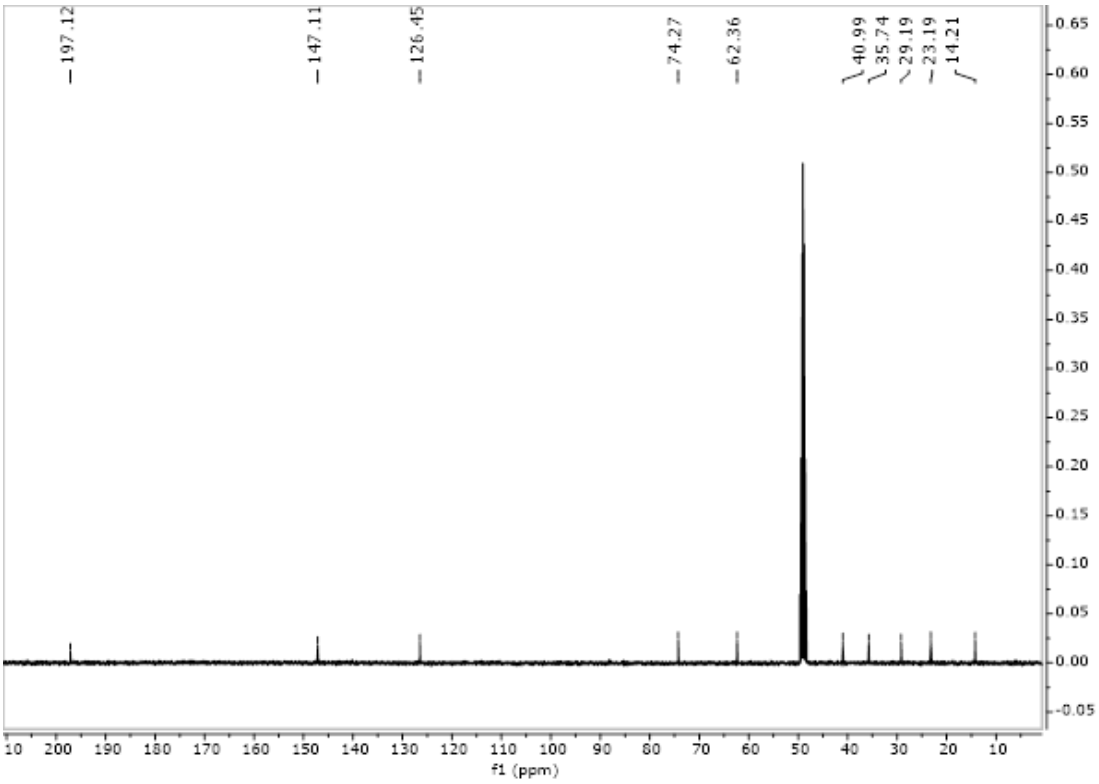




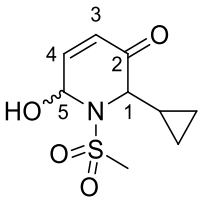
6-Butyl-1-(methylsulfonyl)-1,2-dihydropyridine-2,5-diol **12i**

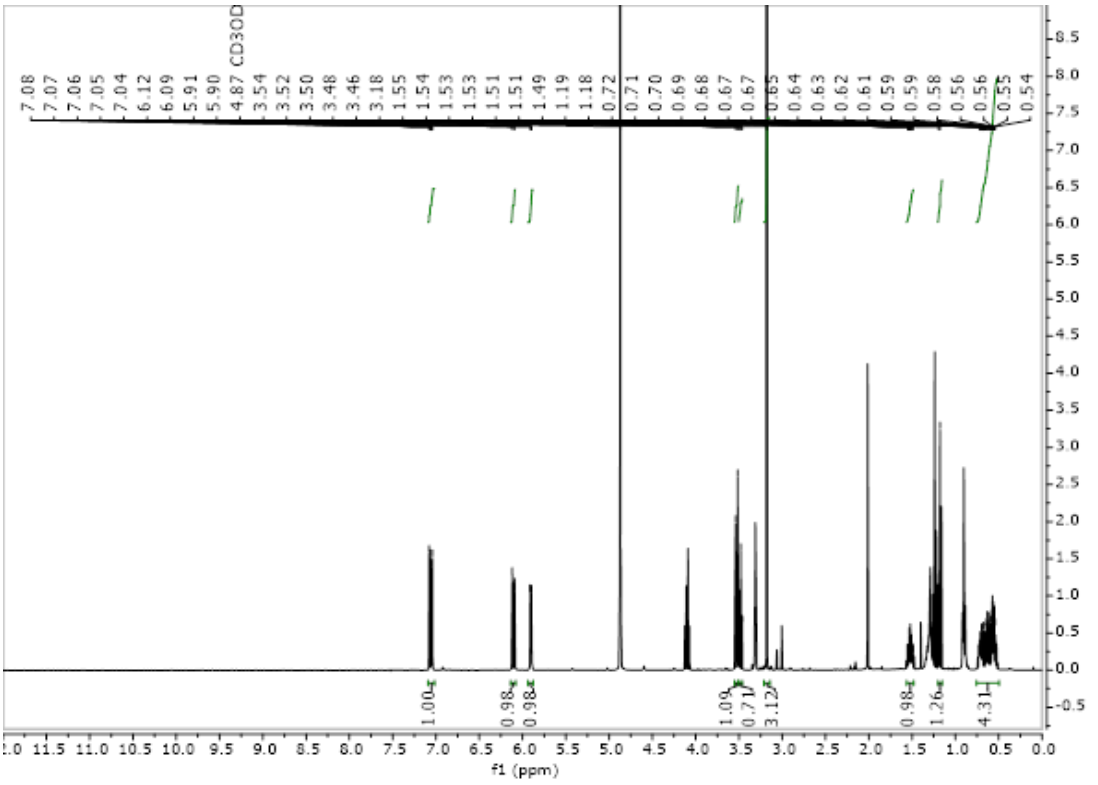


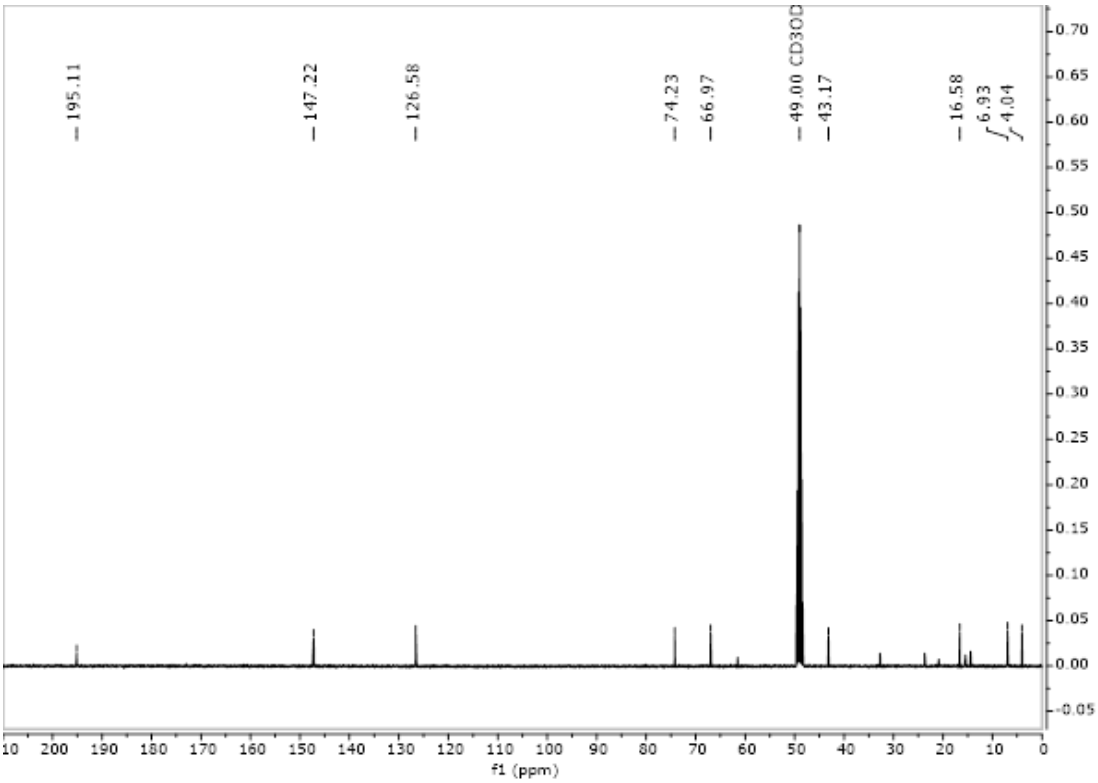




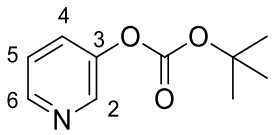
2-Cyclopropyl-6-hydroxy-1-(methylsulfonyl)-1,6-dihydropyridin-3(2H)-one **12j**

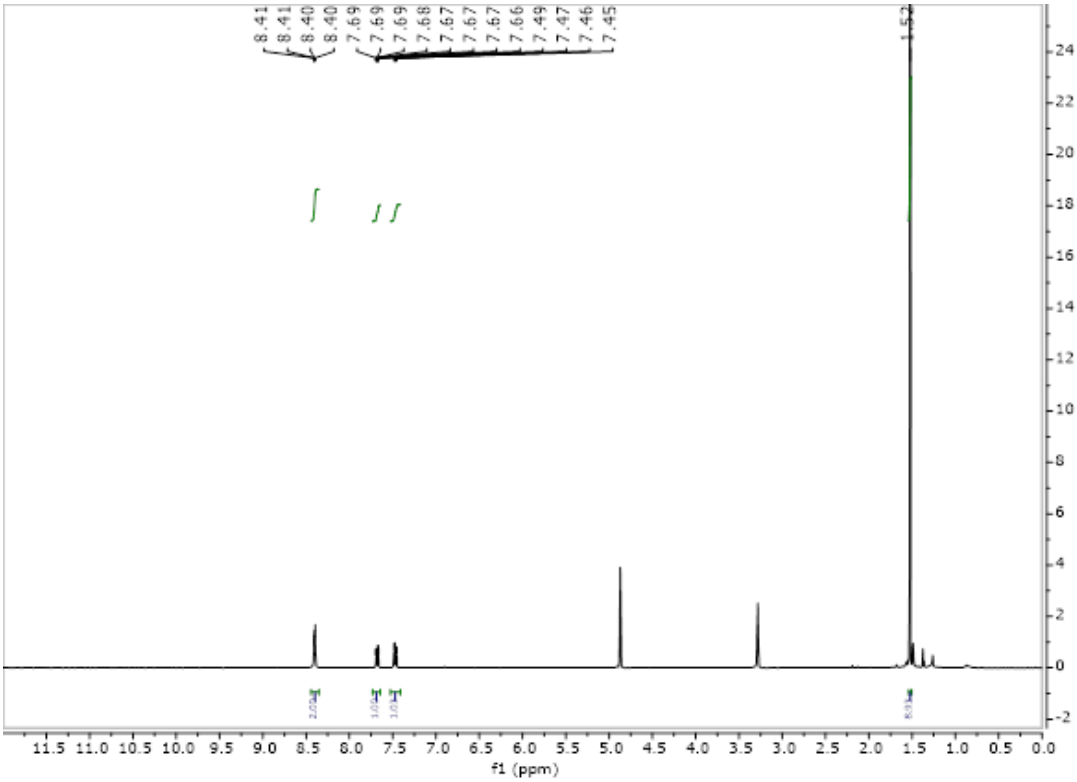


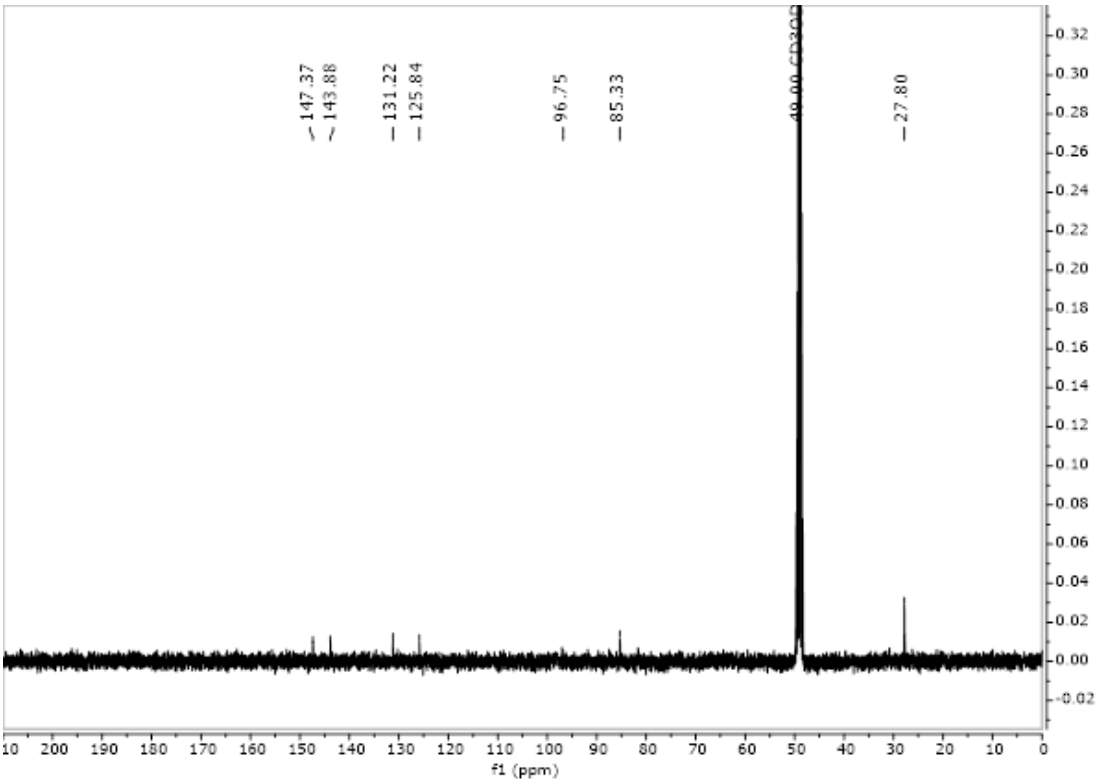




tert-Butyl pyridin-3-yl carbonate **14**







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