Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

Enantioselective Construction of Tetrasubstituted Stereocenter in Isoindolinones *via* Organocatalyzed Reaction Between Ketones and 3-Hydroxyisoindolinones

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§ 1. General Information

Unless otherwise indicated, solvents were used as supplied (analytical or HPLC grade) without further purification. Reagents were used directly as supplied by major chemical suppliers. Flash column chromatography was carried out using silica gel (Merck, 40−63 μm particle size). Analytical thin-layer chromatography was carried out on Merck Kieselgel 60 F254 0.25 mm precoated aluminium plates. Visualization was carried out under ultra-violet irradiation (254 nm) and by appropriate heating with ammonium molybdate solution and *p*-anisaldehyde solution. Ammonium molybdate solution was prepared by dissolving ammonium molybdate (5 g) and ceric sulfate (200 mg) in 5% aqueous sulfuric acid (100 mL). *p*-anisaldehyde solution was prepared by addition of concentrated sulfuric acid (5 mL), glacial acetic acid (1.5 mL) and p-anisaldehyde (3.7 mL) in absolute ethanol (135 mL).

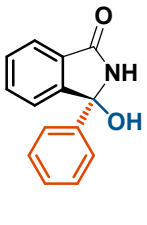
All NMR spectra were acquired on Bruker Avance 600 MHz and 300 MHz spectrometers. ^{1}H NMR chemical shifts were recorded relative to $SiMe_4$ (δ = 0.00 ppm) or residual protiated solvents (DMSO: δ = 2.50 ppm, $(CD_3)_2CO$: δ = 2.05 ppm, $CDCl_3$: δ = 7.26 ppm, CD_3CN: δ = 1.94). Multiplicities were given as: *s* (singlet), *d* (doublet), *dd* (doublet of doublets), *td* (triplet of doublets), *qd* (quartet of doublets), *t* (triplet), *dt* (doublet of triplets), *q* (quartet) and *m* (multiplet). Coupling constants were reported as a *J* value in Hz. ^{13}C NMR chemical shifts were recorded relative to solvent resonance (DMSO: δ = 39.52 ± 0.06 ppm, $(CD_3)_2CO$: δ = 29.84 ± 0.01 ppm, 206.26 ± 0.13 ppm, $CDCl_3$: δ = 77.16 ± 0.06 ppm, 206.26 ± 0.13 ppm, CD_3CN: δ = 1.32 ± 0.02 ppm, 118.26 ± 0.02 ppm).

Infrared spectra were recorded on a Bruker Tensor 27 FTIR spectrometer equipped with an attenuated total reflectance attachment with internal calibration. Absorbtion maxima (ν_{max}) are reported in wavenumbers (cm^{-1}). High resolution mass spectrometry (HRMS) was performed on a 6530 LC/Q-TOF Agilent Technologies Analyzer. Melting points of enantioenriched products were determined using an Electrothermal 9100 apparatus in open capillaries and are uncorrected. Optical rotations were measured on an Autopol IV instrument (Rudolf Research Analytical, Flanders, USA).

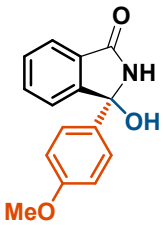
Where given, systematic compound names are those generated by ChemBioDraw Ultra 12.0 following IUPAC conventions. The starting isoindolinone alcohols **(SI-1 – SI-13**) and chiral phosphoric acids (**BA1 – BA8**) have been synthesized according to the known procedures. Racemic standards were obtained by employing *p*-toluenesulfonic or phenylphosphonic acid

(20 mol%) instead of chiral catalyst. Enantiomeric ratios were determined using a normal phase chiral high performance liquid chromatography with PDA detector. Diasteromers **20/20'**, **21/21'** and **22/22'** are obtained as pure compouds, however, their respective *syn/anti* configuration cannot be assigned based on their NMR shifts.

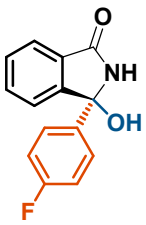
§ 2. List of 3-aryl 3-hydroxyisoindolinones



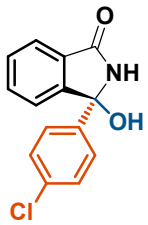
SI-1



SI-2



SI-3



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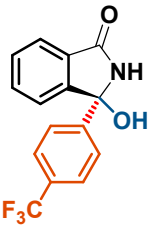
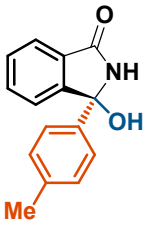
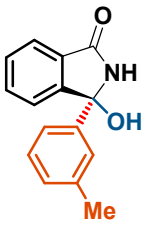


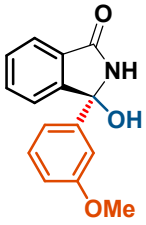
SI-5



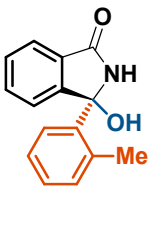
SI-6



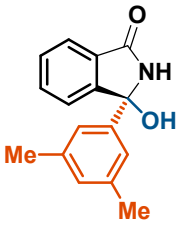
SI-7



SI-8



SI-9



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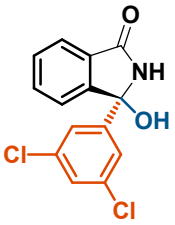
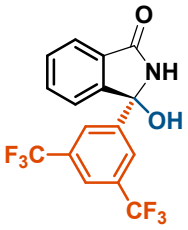
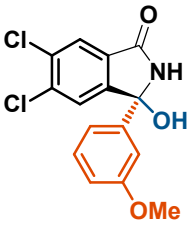


SI-11



SI-12



SI-13

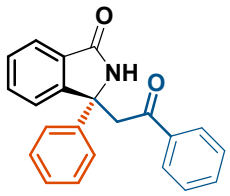
§ 3. Experimental Procedures and Analytical Data

3.1. General procedure for synthesis of 3-alkylaryl isoindolinone derivatives 1-15, 17-18 and 20-23

In a 10 mL Schlenk tube equipped with a magnetic stir bar, 3-aryl 3-hydroxyisoindolinones (0.1 mmol) and chiral phosphoric acid **BA3** (7.5 mg, 0.01 mmol, 10 mol %) were dissolved or suspended in acetonitrile (1 mL) after stirring for 5 min at 80 °C under an argon atmosphere. Ketone (0.5 mmol) was added and resulting reaction mixure was stirred at 80 °C until full consumption of starting material (monitored by TLC), unless stated otherwise.The reaction mixture was concentrated under reduced pressure to give the residue, which was purified by column chromatography on silica gel to afford the corresponding product(s).

*3.1.1. Characterization data for 3-alkylaryl isoindolinone derivatives **1-15**, **17-18** and **20-23***

(*R*)-3-(2-oxo-2-phenylethyl)-3-phenylisoindolin-1-one (1)



Isoindolinone alcohol **SI-1** (22.5 mg, 0.1 mmol) afforded product **1** (31.1 mg, 95% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 4/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 15.2 min (minor), t_{R2} = 19.2 min (major); 95:5 e.r.).

$[\alpha]_D^{20}$ = +139 ° (c 0.56, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 8.92 (s, 1H), 7.95 (d, *J* = 7.4 Hz, 2H), 7.71 (d, *J* = 7.7 Hz, 1H), 7.66 – 7.61 (m, 2H), 7.59 (d, *J* = 7.6 Hz, 2H), 7.54 (t, *J* = 7.5 Hz, 1H), 7.50 (t, *J* = 7.8 Hz, 2H), 7.43 (t, *J* = 7.4 Hz, 1H), 7.32 (t, *J* = 7.8 Hz, 2H), 7.22 (t, *J* = 7.3 Hz, 1H), 4.63 (d, *J* = 17.7 Hz, 1H), 3.84 (d, *J* = 17.7 Hz, 1H).

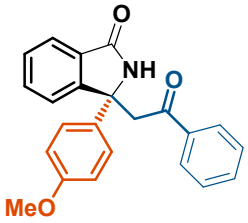
^{13}C NMR (151 MHz, DMSO) δ 196.8, 169.1, 151.3, 142.9, 136.8, 133.4, 131.9, 130.70, 128.7, 128.6, 128.1, 128.1, 127.1, 125.0, 123.2, 123.0, 64.4, 46.0.

HRMS (ESI): m/z $[M+H]^+$ for $C_{22}H_{17}NO_2$ (calcd 328.1293); found 328.1331

IR: *v* = 3430, 1693, 1479, 1378, 1281, 1225, 1001, 830, 585 cm^{-1}

m.p. 114.5–116.2 °C

(R)-3-(4-methoxyphenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (2)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **2** (34.7 mg, 97% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 19h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 14.2 min (major), t_{R2} = 18.4 min (minor); 95:5 e.r.)

$[\alpha]_D^{20}$ = +324 ° (c 0.96, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO)) δ 8.80 (s, 1H), 7.93 (d, *J* = 7.3 Hz, 2H), 7.67 (d, *J* = 7.7 Hz, 1H), 7.65 – 7.59 (m, 2H), 7.54 – 7.44 (m, 5H), 7.41 (t, *J* = 7.4 Hz, 1H), 6.86 (d, *J* = 8.7 Hz, 2H), 4.53 (d, *J* = 17.5 Hz, 1H), 3.80 (d, *J* = 17.5 Hz, 1H), 3.70 (s, 3H).

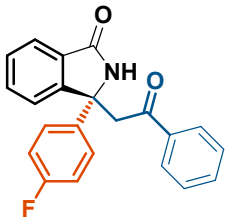
^{13}C NMR (151 MHz, DMSO) δ 197.3, 169.6, 158.7, 151.9, 137.2, 134.9, 133.8, 132.4, 130.9, 129.1, 128.5, 128.4, 126.6, 123.5, 123.4, 114.3, 64.5, 55.5, 46.2.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_3$ (calcd 358.1398); found 358.1429

IR: *v* = 3433, 1692, 1523, 1379, 1266, 1227, 1000, 907, 863, 750, 570 cm^{-1}

m.p. 214.2-216.8 °C

(R)-3-(4-fluorophenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (3)



Isoindolinone alcohol **SI-3** (24.3 mg, 0.1 mmol) afforded product **3** (33.5 mg, 96% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 14.3 min (major), t_{R2} = 19.1 min (minor); 93:7 e.r.).

^{1}H NMR (600 MHz, Acetone) δ 8.04 (d, *J* = 7.6 Hz, 2H), 7.90 (s, 1H), 7.74 (d, *J* = 7.5 Hz, 1H), 7.69 – 7.61 (m, 4H), 7.58 (t, *J* = 7.5 Hz, 1H), 7.52 (t, *J* = 7.8 Hz, 2H), 7.48 (t, *J* = 7.4 Hz, 1H), 7.11 – 7.05 (m, 2H), 4.99 (d, *J* = 18.2 Hz, 1H), 3.60 (d, *J* = 18.2 Hz, 1H).

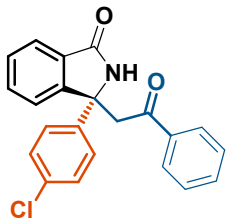
^{13}C NMR (75 MHz, Acetone) δ 198.2, 169.6, 162.8 (d, $^1J_{C\text{-}F}$ = 242.5 Hz), 152.6, 139.6 (d, $^4J_{C\text{-}F}$ = 3.2 Hz), 137.9, 134.3, 133.1, 131.4, 129.5, 129.2, 129.0, 127.9 (d, $^3J_{C\text{-}F}$ = 8.1 Hz), 124.4, 123.8, 116.2 (d, $^2J_{C\text{-}F}$ = 21.4 Hz), 65.0, 47.4.

HRMS (ESI): m/z $[M+H]^+$ for $C_{22}H_{16}FNO_2$ (calcd 346.1199); found 346.1231

IR: *v* = 3232, 1682, 1523, 1355, 1281, 1215, 911, 857, 833, 749, 589, 438 cm^{-1}

m.p. 224.5-226.1 °C

(R)-3-(4-chlorophenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (4)



Isoindolinone alcohol **SI-4** (26.0 mg, 0.1 mmol) afforded product **4** (24.6 mg, 68% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 20/1. Reaction time: 19h.

Enantiomeric ratio determined by chiral (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 8.2 min (major), t_{R2} = 11.7 min (minor); 97:3 e.r.).

$[\alpha]_D^{20}$ = +291 ° (c 0.80, $CHCl_3$)

^{1}H NMR (300 MHz, DMSO) δ 8.95 (s, 1H), 7.94 (d, *J* = 7.8 Hz, 2H), 7.75 – 7.58 (m, 5H), 7.58 – 7.32 (m, 6H), 4.64 (d, *J* = 18.0 Hz, 1H), 3.84 (d, *J* = 17.9 Hz, 1H).

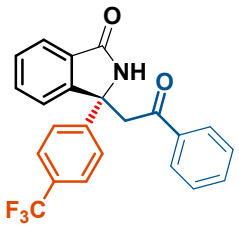
^{13}C NMR (151 MHz, DMSO) δ 196.6, 169.0, 150.8, 142.0, 136.6, 133.4, 132.0, 131.7, 130.6, 128.6, 128.4, 128.2, 128.1, 127.0, 123.1, 123.0, 64.0, 46.1.

HRMS (ESI): m/z $[M+H]^+$ for $C_{22}H_{16}ClNO_2$ (calcd 364.0874); found 362.0928

IR: *v* = 3225, 1680, 1503, 1355, 1276, 1214, 859, 827, 739, 650, 589 cm^{-1}

m.p. 236.0-238.4 °C

(R)-3-(2-oxo-2-phenylethyl)-3-(4-(trifluoromethyl)phenyl)isoindolin-1-one (5)



Isoindolinone alcohol **SI-5** (29.3 mg, 0.1 mmol) afforded product **5** (39.0 mg, 96% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 8/1; petroleum ether/ethyl acetate = 2/1. Reaction time: 8 days.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 10.4 min (major), t_{R2} = 15.4 min (minor); 93:7 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 9.03 (s, 1H), 7.95 (dd, J_1 = 8.3 Hz, J_2 = 1.2 Hz, 2H), 7.83 (d, J = 8.4 Hz, 2H), 7.72 (d, J = 7.7 Hz, 1H), 7.69 (d, J = 8.5 Hz, 2H), 7.66 (d, J = 7.5 Hz, 1H), 7.65 – 7.61 (m, 1H), 7.56 (td, J_1 = 7.6 Hz, J_2 = 1.1 Hz, 1H), 7.53 – 7.48 (m, 2H), 7.45 (td, J_1 = 7.5 Hz, J_2 = 0.8 Hz, 1H), 4.75 (d, J = 18.1 Hz, 1H), 3.88 (d, J = 18.1 Hz, 1H).

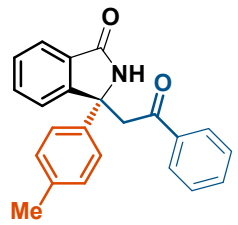
^{13}C NMR (151 MHz, DMSO) δ 196.6, 169.0, 150.5, 147.7 (2C), 136.5, 133.4, 132.1, 130.6, 128.6, 128.3, 128.1, 127.6 (q, $^2J_{C\text{-}CF3}$ = 31.9 Hz), 125.8, 125.5 (q, $^3J_{C\text{-}CF3}$ = 3.6 Hz), 124.2 (q, $^1J_{C\text{-}CF3}$ = 272.1 Hz), 123.1, 64.2, 46.3.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{16}F_3NO_2$ (calcd 396.1167); found 396.1207

IR: ν = 3064, 1677, 1483, 1325, 1239, 1115, 904, 783, 686, 618 cm^{-1}

m.p. 175.4-177.1 °C

(R)-3-(2-oxo-2-phenylethyl)-3-(p-tolyl)isoindolin-1-one (6)



Isoindolinone alcohol **SI-6** (23.9 mg, 0.1 mmol) afforded product **6** (31.1 mg, 97% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 7/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 9.9 min (major), t_{R2} = 13.1 min (minor); 95:5 e.r.).

$[\alpha]_D^{20}$ = +355 ° (c 1.02, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 8.82 (s, 1H), 7.94 (d, *J* = 8.4 Hz, 2H), 7.67 (d, *J* = 7.7 Hz, 1H), 7.62 (dt, J_1 = 7.4 Hz, J_2 = 3.6 Hz, 2H), 7.54 – 7.47 (m, 3H), 7.45 (d, *J* = 8.3 Hz, 2H), 7.41 (t, *J* = 7.3 Hz, 1H), 7.11 (d, *J* = 8.1 Hz, 2H), 4.58 (d, *J* = 17.6 Hz, 1H), 3.79 (d, *J* = 17.6 Hz, 1H), 2.23 (s, 3H).

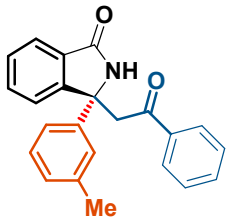
^{13}C NMR (75 MHz, DMSO) δ 196.8, 169.0, 151.4, 139.8, 136.8, 136.2, 133.3, 131.8, 130.6, 129.0, 128.6, 128.0, 127.9, 124.9, 123.1, 122.9, 64.2, 46.0, 20.4.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_2$ (calcd 342.1449); found 342.1482

IR: *v* = 3235, 1682, 1525, 1351, 1211, 1112, 990, 910, 859, 752, 590 cm^{-1}

m.p. 162.7-164.5 °C

(R)-3-(2-oxo-2-phenylethyl)-3-(m-tolyl)isoindolin-1-one (7)



Isoindolinone alcohol **SI-7** (23.9 mg, 0.1 mmol) afforded product **7** (31.7 mg, 93% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 9.7 min (major), t_{R2} = 12.6 min (minor); 95:5 e.r.).

$[\alpha]_D^{20}$ = +377 ° (c 1.01, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 8.82 (s, 1H), 7.94 (d, *J* = 7.3 Hz, 2H), 7.67 (d, *J* = 7.7 Hz, 1H), 7.64 – 7.59 (m, 2H), 7.54 – 7.47 (m, 3H), 7.45 (d, *J* = 8.3 Hz, 2H), 7.41 (t, *J* = 7.5 Hz, 1H), 7.10 (d, *J* = 8.1 Hz, 2H), 4.58 (d, *J* = 17.6 Hz, 1H), 3.79 (d, *J* = 17.6 Hz, 1H), 2.23 (s, 3H).

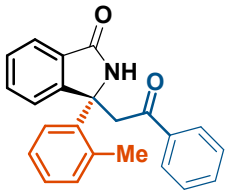
^{13}C NMR (151 MHz, DMSO) δ 196.8, 169.0, 151.4, 139.8, 136.8, 136.2, 133.3, 131.8, 130.6, 129.0, 128.6, 128.0, 127.9, 124.9, 123.1, 122.8, 64.2, 45.9, 20.4.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_2$ (calcd 342.1449); found 342.1480

IR: ν = 3430, 3162, 3061, 1693, 1530, 1378, 1279, 1225, 900, 857, 823, 685, 580 cm^{-1}

m.p. 160.2-162.2 °C

(R)-3-(2-oxo-2-phenylethyl)-3-(o-tolyl)isoindolin-1-one (8)



Isoindolinone alcohol **SI-9** (23.9 mg, 0.1 mmol) afforded product **8** (25.3 mg, 74% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 6 days. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 11.5 min (minor), t_{R2} = 14.5 min (major); 94:6 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 8.72 (s, 1H), 7.96 (d, *J* = 7.8 Hz, 2H), 7.67 (d, *J* = 7.5 Hz, 1H), 7.63 (t, *J* = 7.3 Hz, 1H), 7.55 – 7.47 (m, 4H), 7.45 (t, *J* = 7.4 Hz, 1H), 7.32 (d, *J* = 7.6 Hz, 1H), 7.20 – 7.13 (m, 2H), 7.03 (d, *J* = 7.1 Hz, 1H), 4.73 (d, *J* = 17.6 Hz, 1H), 3.55 (d, *J* = 17.6 Hz, 1H), 1.83 (s, 3H).

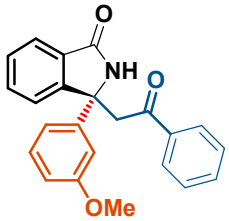
^{13}C NMR (151 MHz, DMSO) δ 197.2, 168.9, 150.0, 138.0, 136.8, 136.1, 133.3, 132.8, 132.2, 132.0, 128.6, 128.5, 128.1, 128.1, 127.5, 127.4, 126.0, 124.9, 123.2, 122.6, 65.0, 48.2, 20.6.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_2$ (calcd 342.1449); found 342.1468

IR: ν = 3446, 2967, 1693, 1512, 1371, 1257, 1218, 984, 833, 578 cm^{-1}

m.p. 178.1-180.0 °C

(R)-3-(3-methoxyphenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (9)



Isoindolinone alcohol **SI-8** (25.5 mg, 0.1 mmol) afforded product **9** (35.2 mg, 98% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 8/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 13.5 min (major), t_{R2} = 19.0 min (minor); 94:6 e.r.).

^{1}H NMR (600 MHz, Acetone) δ 8.05 (dd, J_1 = 8.3 Hz, J_1 = 1.1 Hz, 2H), 7.88 (s, 1H), 7.72 (t, J = 13.3, 2H), 7.64 (t, J = 7.4 Hz, 1H), 7.56 (td, J_1 = 7.6 Hz, J_2 = 1.0 Hz, 1H), 7.51 (t, J = 7.8 Hz, 2H), 7.47 (td, J_1 = 7.5 Hz, J_2 = 0.6 Hz, 1H), 7.27 – 7.14 (m, 3H), 6.82 – 6.71 (m, 1H), 5.01 (d, J = 18.1 Hz, 1H), 3.72 (s, 3H), 3.52 (d, J = 18.1 Hz, 1H).

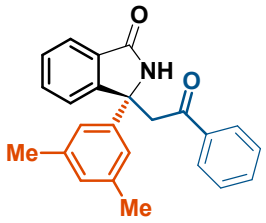
^{13}C NMR (151 MHz, Acetone) δ 198.3, 169.8, 161.0, 152.6, 145.0, 137.9, 134.3, 132.9, 131.4, 130.6, 129.5, 129.1, 129.0, 124.3, 123.9, 118.0, 112.9, 112.1, 65.4, 55.5, 47.3.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_3$ (calcd 358.1398); found 358.1434

IR: ν = 3439, 1667, 1510, 1375, 219, 1000, 914, 817, 687, 566 cm^{-1}

m.p. 144.0-145.7 °C

(R)-3-(3,5-dimethylphenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (10)



Isoindolinone alcohol **SI-10** (25.3mg, 0.1 mmol) afforded product **10** (29.9 mg, 84% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 27h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 70/30, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 7.7 min (minor), t_{R2} = 15.3 min (major); 94:6 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 8.78 (s, 1H), 7.94 (d, J = 7.9 Hz, 2H), 7.68 (d, J = 7.7 Hz, 1H), 7.66 – 7.57 (m, 2H), 7.56 – 7.46 (m, 3H), 7.41 (t, J = 7.4 Hz, 1H), 7.21 (s, 2H), 6.84 (s, 1H), 4.55 (d, J = 17.6 Hz, 1H), 3.79 (d, J 17.6 Hz, 1H), 2.22 (s, 6H).

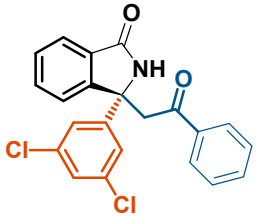
^{13}C NMR (151 MHz, DMSO) δ 196.8, 169.0, 151.3, 142.8, 137.5, 136.8, 133.3, 131.8, 130.6, 128.6, 128.4, 128.0, 127.9, 123.1, 122.8, 122.6, 64.2, 46.0, 21.1.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{21}NO_2$ (calcd 356.1606); found 356.1638

IR: ν = 3433, 2917, 1694, 1508, 1373, 1244, 1225, 1001, 918, 782, 580, 558 cm^{-1}

m.p. 180.5-182.3 °C

(R)-3-(3,5-dichlorophenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (11)



Isoindolinone alcohol **SI-11** (29.4 mg, 0.1 mmol) afforded product **11** (31.7 mg, 80% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 13 days. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 15.9 min (major), t_{R2} = 20.9 min (minor); 96:4 e.r.).

$[\alpha]_D^{20}$ = +376 ° (c 1.06, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 9.05 (s, 1H), 7.95 (d, *J* = 7.9 Hz, 2H), 7.78 (d, *J* = 7.7 Hz, 1H), 7.70 (s, 2H), 7.68 – 7.57 (m, 3H), 7.57 – 7.40 (m, 4H), 4.74 (d, *J* = 18.2 Hz, 1H), 3.85 (d, *J* = 18.2 Hz, 1H).

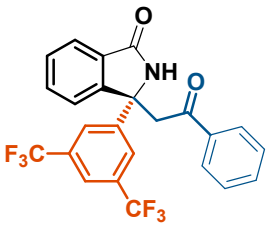
^{13}C NMR (151 MHz, DMSO) δ 196.5, 150.0, 147.5, 136.4, 134.3, 133.5, 132.3, 130.4, 128.6, 128.5, 128.1, 126.8, 123.9, 123.2, 123.0, 63.9, 46.4.

HRMS (ESI): m/z $[M+H]^+$ for $C_{22}H_{15}Cl_2NO_2$ (calcd 396.0513); found 396.0555

IR: ν = 3430, 3128, 3074, 1696, 1479, 1372, 1264, 1227, 918, 869, 817, 680, 622, 569 cm^{-1}

m.p. 201.9-203.6 °C

(R)-3-(3,5-bis(trifluoromethyl)phenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (12)



Isoindolinone alcohol **SI-12** (36.1 mg, 0.1 mmol) afforded product **12** (16.2 mg, 35% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 20/1. Reaction was stopped after 14 days.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 7.9 min (major), t_{R2} = 11.6 min (minor); 96.5:4.5 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 9.31 (s, 1H), 8.33 (s, 2H), 8.03 – 7.91 (m, 3H), 7.84 (d, *J* = 7.7 Hz, 1H), 7.72 – 7.58 (m, 3H), 7.55 – 7.41 (m, 3H), 4.95 (d, *J* = 18.4 Hz, 1H), 3.95 (d, *J* = 18.4 Hz, 1H).

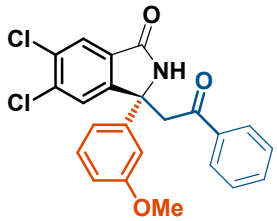
^{13}C NMR (151 MHz, DMSO) δ 197.0, 169.5, 150.3, 147.4, 136.8, 134.0, 133.0, 131.0 (q, $^2J_{C\text{-}CF3}$ = 32.6 Hz), 130.9, 129.2, 129.1, 128.6, 126.3, 123.8, 123.8 (q, $^1J_{C\text{-}CF3}$ = 273.2 Hz) 123.5, 121.5, 64.6, 47.3.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{15}F_6NO_2$ (calcd 464.1041); found 464.1080

IR: *v* = 3370, 1694, 1519, 1278, 1127, 960, 780, 749, 683 cm^{-1}

m.p. 147.7-149.5 °C

(R)-5,6-dichloro-3-(3-methoxyphenyl)-3-(2-oxo-2-phenylethyl)isoindolin-1-one (13)



Isoindolinone alcohol **SI-13** (32.4 mg, 0.1 mmol) afforded product **13** (41.8 mg, 98% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 50/1. Reaction time: 4 days.

Enantiomeric ratio determined by chiral (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 14.4 min (major), t_{R2} = 22.0 min (minor); 93:7 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 9.21 (s, 1H), 8.09 (s, 1H), 7.95 (dd, J_1 = 8.3, J_2 = 1.1 Hz, 2H), 7.83 (s, 1H), 7.64 (t, *J* = 7.4 Hz, 1H), 7.51 (t, *J* = 7.8 Hz, 2H), 7.26 (t, *J* = 8.3 Hz, 1H), 7.18 – 7.13 (m, 2H), 6.84 (dd, J_1 = 8.2, J_2 = 1.7 Hz, 1H), 4.56 (d, *J* = 17.8 Hz, 1H), 3.99 (d, *J* = 17.8 Hz, 1H), 3.73 (s, 3H).

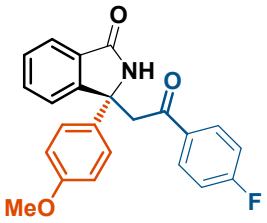
^{13}C NMR (151 MHz, DMSO) δ 196.5, 166.9, 159.5, 150.9, 143.5, 136.6, 134.5, 133.4, 131.5, 131.3, 129.9, 128. 7, 128.0, 125.5, 124.7, 117.1, 112.4, 111.4, 64.1, 55.1, 45.3.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{17}Cl_2NO_3$ (calcd 426.0619); found 426.0656

IR: *v* = 3432, 3163, 3012, 1697, 1506, 1395, 1274, 1228, 1004, 830, 727, 692, 469 cm^{-1}

m.p. 226.9-228.4 °C

(*R*)-3-(2-(4-fluorophenyl)-2-oxoethyl)-3-(4-methoxyphenyl)isoindolin-1-one (14)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **14** (35.3 mg, 94% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 7/1. Reaction time: 69h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 90/10, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 12.9 min (major), t_{R2} = 20.9 min (minor); 92:8 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 8.82 (s, 1H), 8.09 – 7.94 (m, 2H), 7.68 – 7.58 (m, 2H), 7.56 – 7.37 (m, 4H), 7.31 (t, *J* = 8.9 Hz, 2H), 6.86 (d, *J* = 8.9 Hz, 2H), 4.52 (d, *J* = 17.5 Hz, 1H), 3.81 (d, *J* = 17.4 Hz, 1H), 3.70 (s, 3H).

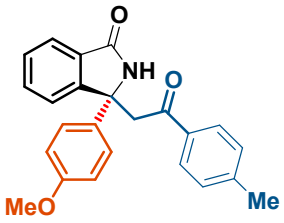
^{13}C NMR (151 MHz, DMSO) δ 195.5, 168.9, 165.0 (d, $^1J_{C\text{-}F}$ = 252.0 Hz), 158.3, 151.4, 134.6, 133.6 (d, $^4J_{C\text{-}F}$ = 2.7 Hz), 131.7, 131.1 (d, $^3J_{C\text{-}F}$ = 9.5 Hz), 130.6, 127.9, 126.2, 123.1, 122.8, 115.6 (d, $^2J_{C\text{-}F}$ = 21.9 Hz), 113.8, 64.0, 55.1, 45.8.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{18}FNO_3$ (calcd 376.1304); found 376.1346

IR: *v* = 3377, 1690, 1480, 1221, 1185, 1054, 869, 697, 579 cm^{-1}

m.p. 191.9-193.5 °C

(*R*)-3-(4-methoxyphenyl)-3-(2-oxo-2-(p-tolyl)ethyl)isoindolin-1-one (15)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **15** (34.1 mg, 92% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 7/1. Reaction time: 67h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 12.9 min (major), t_{R2} = 17.6 min (minor); 91:9 e.r.).

^{1}H NMR (300 MHz, CD_3CN) δ 7.87 (d, *J* = 8.2 Hz, 2H), 7.72 (d, *J* = 7.4 Hz, 1H), 7.67 – 7.20 (m, 8H), 6.83 (d, *J* = 8.9 Hz, 2H), 4.73 (d, *J* = 18.1 Hz, 1H), 3.72 (s, 3H), 3.38 (d, *J* = 18.1 Hz, 1H), 2.40 (s, 3H).

^{1}H NMR (300 MHz, DMSO) δ 8.78 (s, 1H), 7.84 (d, *J* = 8.2 Hz, 2H), 7.70 – 7.58 (m, 2H), 7.57 – 7.36 (m, 4H), 7.30 (d, *J* = 8.0 Hz, 2H), 6.85 (d, *J* = 8.9 Hz, 2H), 4.52 (d, *J* = 17.5 Hz, 1H), 3.90 – 3.54 (m, 4H), 2.36 (s, 3H).

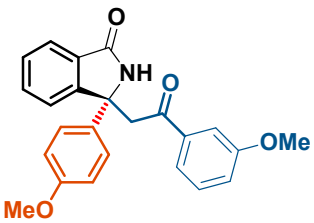
^{13}C NMR (151 MHz, DMSO) δ 196.3, 168.9, 158.2, 151.6, 143.7, 134.7, 134.4, 131.7, 130.6, 129.1, 128.2, 127.8, 126.2, 123.1, 122.8, 113.8, 64.0, 55.0, 45.7, 21.1.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{21}NO_3$ (calcd 372.1555); found 372.1596

IR: *v* = 3439, 1689, 1480, 1238, 1185, 1061, 857, 770, 740, 569 cm^{-1}

m.p. 190.5-192.0 °C

(*R*)-3-(4-methoxyphenyl)-3-(2-(3-methoxyphenyl)-2-oxoethyl)isoindolin-1-one (17)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **17** (32.9 mg, 85% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 7/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 80/20, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 19.0 min (major), t_{R2} = 24.7 min (minor); 92:8 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 8.81 (s, 1H), 7.71 – 7.59 (m, 2H), 7.59 – 7.33 (m, 7H), 7.19 (dd, J_1 = 7.8 Hz, J_2 = 2.2 Hz, 1H), 6.86 (d, J = 8.9 Hz, 2H), 4.53 (d, J = 17.6 Hz, 1H), 3.91 – 3.75 (m, 4H), 3.70 (s, 3H).

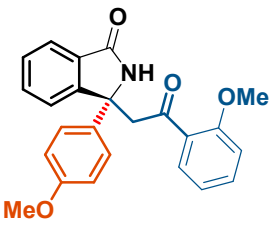
^{13}C NMR (75 MHz, DMSO) δ 196.6, 168.9, 159.3, 158.2, 151.5, 138.2, 134.6, 131.7, 130.6, 129.8, 127.8, 126.2, 123.1, 122.8, 120.6, 119.3, 113.8, 112.5, 64.0, 55.3, 55.1, 46.0.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{21}NO_4$ (calcd 388.1504); found 388.1546

IR: ν = 3266, 1690, 1498, 1288, 1258, 1064, 1018, 846, 764, 655, 583 cm^{-1}

m.p. 171.3-173.0 °C

(*R*)-3-(4-methoxyphenyl)-3-(2-(2-methoxyphenyl)-2-oxoethyl)isoindolin-1-one (18)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **18** (36.8 mg, 95% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IB (25 cm × 0.46 cm ID), hexane/iso-propanol = 60/40, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 9.1 min (major), t_{R2} = 11.1 min (minor); 92:8 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 8.84 (s, 1H), 7.58 (t, J = 7.1 Hz, 2H), 7.50 – 7.43 (m, 2H), 7.42 – 7.35 (m, 3H), 7.26 (dd, J_1 = 7.7 Hz, J_2 = 1.8 Hz, 1H), 7.08 (d, J = 8.3 Hz, 1H), 6.93 (t, J = 7.2 Hz, 1H), 6.88 – 6.83 (m, 2H), 4.23 (d, J = 17.1 Hz, 1H), 3.85 (s, 3H), 3.82 (d, J = 17.1 Hz, 1H).

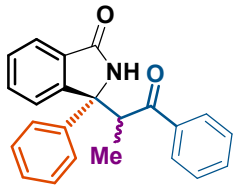
^{13}C NMR (151 MHz, DMSO) δ 198.6, 168.8, 158.2, 157.8, 151.2, 134.6, 133.5, 131.7, 130.8, 129.1, 128.3, 127.8, 126.2, 123.0, 122.8, 120.3, 113.8, 112.2, 64.2, 55.7, 55.1, 50.9.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{21}NO_4$ (calcd 388.1504); found 388.1548

IR: ν = 3233, 1684, 1529, 1345, 1252, 1008, 923, 869, 727, 589 cm^{-1}

m.p. 173.6-174.9 °C

(*R*)-3-((*S*)-1-oxo-1-phenylpropan-2-yl)-3-phenylisoindolin-1-one (20/20')



Isoindolinone alcohol **SI-1** (22.5 mg, 0.1 mmol) afforded products **20** (9.5 mg, 28% yield) and **20'** (23.5 mg, 69% yield) as white solids.

Compound 20

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IC (25 cm × 0.46 cm ID), hexane/iso-propanol = 70/30, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 16.1 min (minor), t_{R2} = 35.8 min (major); 66:34 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 8.55 (s, 1H), 8.10 (d, *J* = 7.4 Hz, 2H), 7.94 (d, *J* = 7.7 Hz, 1H), 7.79 – 7.36 (m, 8H), 7.21 (t, *J* = 7.5 Hz, 2H), 7.12 (d, *J* = 7.2 Hz, 1H), 5.29 (d, *J* = 7.1 Hz, 1H), 0.79 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (75 MHz, DMSO) δ 202.4, 169.3, 150.1, 142.9, 135.7, 133.7, 132.2, 130.7, 128.9, 128.5, 128.4, 128.4, 127.1, 124.8, 123.1, 122.9, 68.1, 45.9, 12.9.

HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_2$ (calcd 342.1449); found 342.1494

IR: *v* = 3417, 3190, 3058, 1694, 1513, 1375, 1219, 1111, 971, 831, 702, 580 cm^{-1}

m.p. 238.4-240.3 °C (decomposition)

Compound 20'

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IC (25 cm × 0.46 cm ID), hexane/iso-propanol = 60/40, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 12.3 min (major), t_{R2} = 23.5 min (minor); 87:13 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 9.40 (s, 1H), 7.87 – 7.59 (m, 5H), 7.58 – 7.11 (m, 9H), 5.02 (q, *J* = 6.9 Hz, 1H), 1.08 (d, *J* = 6.9 Hz, 3H).

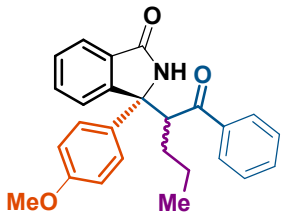
^{13}C NMR (151 MHz, DMSO) δ 200.6, 169.0, 148.4, 141.7, 137.7, 132.6, 131.4, 131.1, 128.6, 128.2, 128.0, 127.7, 127.4, 125.7, 124.1, 122.4, 68.5, 45.6, 13.9.

MS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_2$ (calcd 342.1449); found 342.2

IR: ν = 2932, 1689, 1509, 1262, 1235, 973, 887, 747, 576 cm^{-1}

m.p. 207.3-208.8 °C

(*R*)-3-(4-methoxyphenyl)-3-((*S*)-1-oxo-1-phenylpentan-2-yl)isoindolin-1-one (21/21')



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded products **21** (20.4 mg, 54% yield) and **21'** (14.4 mg, 39% yield) as white solids.

Compound 21

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 120h. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IC (25 cm × 0.46 cm ID), hexane/iso-propanol = 70/30, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 16.2 min (minor), t_{R2} = 19.5 min (major); 80:20 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 8.55 (s, 1H), 8.17 – 7.98 (m, 3H), 7.70 – 7.55 (m, 5H), 7.55 – 7.42 (m, 3H), 6.69 (d, J = 8.9 Hz, 2H), 5.09 (dd, J_1 = 9.4 Hz, J_2 = 2.6 Hz, 1H), 3.59 (s, 3H), 1.51 – 1.40 (m, 1H), 1.05 – 0.87 (m, 3H), 0.58 (t, J = 6.9 Hz, 3H).

^{13}C NMR (75 MHz, DMSO) δ 203.4, 168. 9, 158.2, 150.2, 137.8, 134.1, 133.5, 132.0, 130.8, 128.7, 128.4, 128.3, 126.5, 123.3, 122.8, 113.5, 68.2, 54.9, 50.6, 31.1, 20.6, 14.1.

HRMS (ESI): m/z $[M+H]^+$ for $C_{26}H_{25}NO_3$ (calcd 400.1868); found 400.1914

IR: ν = 2958, 1692, 1529, 1326, 1298, 1252, 863, 776, 695, 593 cm^{-1}

m.p. 103.4-104.8 °C

Compound 21'

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 120h. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IG (25 cm × 0.46 cm ID), hexane/iso-propanol = 50/50, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 22.3 min (major), t_{R2} = 37.0 min (minor); 56:44 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 9.32 (s, 1H), 7.79 – 7.61 (m, 4H), 7.54 (d, *J* = 7.7 Hz, 1H), 7.45 (t, *J* = 7.3 Hz, 1H), 7.39 (d, *J* = 7.4 Hz, 1H), 7.31 (t, *J* = 7.7 Hz, 2H), 7.14 (t, *J* = 7.3 Hz, 1H), 7.08 (t, *J* = 7.4 Hz, 1H), 6.91 (d, *J* = 8.8 Hz, 2H), 4.89 (dd, J_1 = 11.3 Hz, J_2 = 1.7 Hz, 1H), 3.72 (s, 3H), 1.97 – 1.86 (m, 1H), 1.25 – 1.22 (m, 1H), 1.21 – 1.13 (m, 1H), 1.11 – 1.00 (m, 1H), 0.75 (t, *J* = 7.3 Hz, 3H).

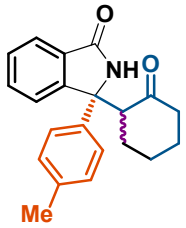
^{13}C NMR (151 MHz, DMSO) δ 200. 7, 168.8, 158.4, 148.4, 139.0, 133.5, 132.5, 130.9, 130.8, 128.1, 127.8, 127.5, 126.9, 124.1, 122.3, 113.9, 68.1, 55.1, 51.2, 31.1, 20.8, 14.1.

MS (ESI): m/z $[M+H]^+$ for $C_{26}H_{25}NO_3$ (calcd 400.1868); found 400.3

IR: *v* = 3058, 2961, 1679, 1530, 1351, 1331, 1254, 1031, 873, 687, 655, 573 cm^{-1}

m.p. 103.4-104.8 °C

(*R*)-3-((*S*)-2-oxocyclohexyl)-3-(p-tolyl)isoindolin-1-one (22/22')



Isoindolinone alcohol **SI-6** (23.9 mg, 0.1 mmol) afforded products **22** (26.2 mg, 82% yield) and **22'** (4.5 mg, 15% yield) as white solids.

Compound 22

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 40h. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 70/30, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 12.0 min (major), t_{R2} = 15.3 min (minor); 63:37 e.r.).

^{1}H NMR (300 MHz, Acetone) δ 7.68 (d, *J* = 7.4 Hz, 1H), 7.62 – 7.37 (m, 5H), 7.30 (s, 1H), 7.09 (d, *J* = 8.0 Hz, 2H), 4.30 (dd, J_1 = 10.8 Hz, J_2 = 6.7 Hz, 1H), 2.68 – 2.55 (m, 1H), 2.30 – 2.06 (m, 5H), 2.17 – 2.07 (m, 1H), 1.87 – 1.53 (m, 3H), 1.50 – 1.30 (m, 2H).

^{1}H NMR (300 MHz, DMSO) δ 8.26 (s, 1H), 7.61 (d, *J* = 7.4 Hz, 1H), 7.56 – 7.45 (m, 2H), 7.44 – 7.35 (m, 3H), 7.07 (d, *J* = 8.1 Hz, 2H), 4.25 (dd, J_1 = 11.9 Hz, J_2 = 5.3 Hz, 1H), 2.61 – 2.53 (m, 1H), 2.21 (s, 3H), 2.13 (d, *J* = 12.3 Hz, 1H), 2.07 – 1.94 (m, 1H), 1.76 – 1.60 (m, 2H), 1.59 – 1.41 (m, 1H), 1.39 – 1.12 (m, 2H).

^{13}C NMR (151 MHz, DMSO) δ 210.1, 169.5, 150.6, 140.6, 135.6, 132.2, 130.5, 128.9, 127.9, 124.3, 122.9, 122.4, 66.6, 55.2, 42.7, 28.6, 28.1, 24.3, 20.4.

HRMS (ESI): m/z $[M+H]^+$ for $C_{21}H_{21}NO_2$ (calcd 320.1606); found 320.1645

IR: ν = 3306, 3109, 2935, 1689, 1480, 1306, 1164, 1130, 914, 739, 548 cm^{-1}

m.p. 243.5-245.1 °C

Compound 22'

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 40h. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 5.8 min (minor), t_{R2} = 8.8 min (major); 78:22 e.r.).

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.85 (d, J = 7.2 Hz, 1H), 7.63 (d, J = 7.5 Hz, 1H), 7.58 – 7.41 (m, 2H), 7.24 – 7.00 (m, 5H), 3.36 (dd, J_1 = 12.6 Hz, J_2 = 5.0 Hz, 1H), 2.46 – 2.14 (m, 6H), 2.13 – 1.98 (m, 1H), 1.97 – 1.79 (m, 1H), 1.74 – 1.63 (m, 2H), 1.54 – 1.32 (m, 1H).

^{1}H NMR (600 MHz, CD_3CN) δ 7.65 (d, J = 7.5 Hz, 1H), 7.57 (d, J = 7.7 Hz, 1H), 7.50 (td, J_1 = 7.6 Hz, J_2 = 1.1 Hz, 1H), 7.40 (td, J_1 = 7.4 Hz, J_2 = 0.7 Hz, 1H), 7.31 (d, J = 8.3 Hz, 2H), 7.27 (s, 1H), 7.14 (d, J = 8.1 Hz, 2H), 3.80 (dd, J_1 = 12.9 Hz, J_2 = 4.7 Hz, 1H), 2.41 (m, 1H), 2.28 (s, 3H), 2.15 – 2.11 (m, 2H), 2.06 – 1.99 (m, 1H), 1.99 – 1.95 (m, 1H), 1.85 – 1.78 (m, 1H), 1.77 – 1.66 (m, 1H), 1.63 – 1.52 (m, 1H), 1.35 (qd, J_1 = 12.9 Hz, J_2 = 3.7 Hz, 1H).

^{13}C NMR (151 MHz, CD_3CN) δ 209.9, 170.9, 156.0, 155.4, 151.6, 140.4, 138.2, 133.1, 132.8, 130.3, 128.7, 126.2, 124.4, 123.8, 68.2, 56.3, 44.0, 30.8, 28.7, 26.0, 20.9.

MS (ESI): m/z $[M+H]^+$ for $C_{21}H_{21}NO_2$ (calcd 320.1606); found 320.2

IR: ν = 3195, 2937, 1687, 1529, 1314, 1281, 1125, 867, 740, 613, 546 cm^{-1}

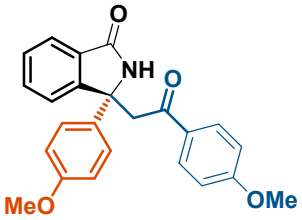
m.p. 144.8-146.3 °C

3.2. General procedure for synthesis of 3-alkylaryl isoindolinone derivatives 16, 19 and 24-34

3-aryl 3-hydroxyisoindolinones (0.1 mmol), chiral phosphoric acid **BA3** (7.5 mg, 0.01 mmol, 10 mol %) and ketone (0.5 mmol) were placed n a 10 mL Schlenk tube equipped with a magnetic stir bar under an argon atmosphere. Acetonitrile (1 mL) was added and reaction mixure was stirred at 80 °C until full consumption of starting material (monitored by TLC). The reaction mixture was concentrated under reduced pressure to give the residue, which was purified by column chromatography on silica gel to afford the corresponding products.

*3.2.1. Characterization data for 3-alkylaryl isoindolinone derivatives **16**, **19** and **24-34***

(*R*)-3-(4-methoxyphenyl)-3-(2-(4-methoxyphenyl)-2-oxoethyl)isoindolin-1-one (16)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **16** (34.4 mg, 89% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 72h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 13.9 min (major), t_{R2} = 22.7 min (minor); 92:8 e.r.).

^{1}H NMR (600 MHz, CD_3CN) δ 8.01 – 7.89 (m, 2H), 7.76 – 7.68 (m, 1H), 7.62 (s, 1H), 7.55 (td, J_1 = 7.6 Hz, J_2 = 1.1 Hz, 1H), 7.48 (d, J = 7.7 Hz, 1H), 7.44 (td, J_1 = 7.4 Hz, J_2 = 0.9 Hz, 1H), 7.39 – 7.35 (m, 2H), 7.02 – 6.96 (m, 2H), 6.86 – 6.78 (m, 2H), 4.71 (d, J = 18.0 Hz, 1H), 3.86 (s, 3H), 3.71 (s, 3H), 3.33 (d, J = 18.0 Hz, 1H).

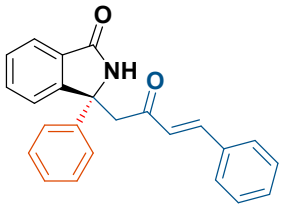
^{13}C NMR (151 MHz, CD_3CN) δ 197.2, 170.0, 165.0, 159.9, 153.2, 134.9, 133.3, 131.5, 131.1, 130.8, 129.2, 127.1, 124.4, 123.7, 115.0, 114.8, 65.2, 56.4, 55.9, 46.7.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{21}NO_4$ (calcd 388.1504); found 388.1544

IR: ν = 3394, 2949, 1697, 1532, 1371, 1284, 1177, 1023, 867, 789, 697, 580 cm^{-1}

m.p. 160.4-161.7 °C

(*R*,*E*)-3-(2-oxo-4-phenylbut-3-en-1-yl)-3-phenylisoindolin-1-one (19)



Isoindolinone alcohol **SI-1** (22.5 mg, 0.2 mmol) afforded product **19** (48.4 mg, 69% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 4/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IB (25 cm × 0.46 cm ID), hexane/iso-propanol = 50/50, λ 310 nm, 1.0 mL/min flow rate; t_{R1} = 23.7 min (major), t_{R2} = 37.6 min (minor); 96:4 e.r.).

$[\alpha]_D^{20}$ = +395 ° (c 1.04, $CHCl_3$)

^{1}H NMR (300 MHz, DMSO) δ 8.97 (s, 1H), 7.70 (d, *J* = 7.7 Hz, 1H), 7.66 – 7.50 (m, 7H), 7.47 – 7.38 (m, 4H), 7.37 – 7.30 (m, 2H), 7.28 – 7.21 (m, 1H), 6.77 (d, *J* = 16.3 Hz, 1H), 4.05 (d, *J* = 16.0 Hz, 1H), 3.62 (d, *J* = 16.0 Hz, 1H).

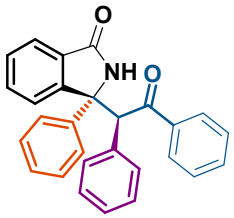
^{13}C NMR (151 MHz, DMSO) δ 196.3, 168.8, 150.7, 142.7, 142.4, 134.3, 131.8, 130.8, 130.6, 129.0, 128.5, 128.4, 128.1, 127.2, 126.8, 125.1, 123.3, 122.9, 64.5, 48.0.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{19}NO_2$ (calcd 354.1449); found 354.1492

IR: *v* = 3309, 3113, 2922, 1674, 1509, 1237, 1201, 1004, 817, 700 cm^{-1}

m.p. 221.2-222.5 °C

(*R*)-3-((*S*)-2-oxo-1,2-diphenylethyl)-3-phenylisoindolin-1-one (23)



Isoindolinone alcohol **SI-1** (22.5 mg, 0.1 mmol) afforded product **23** (27.9 mg, 69% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rzate; t_{R1} = 12.3 min (major), t_{R2} = 22.7 min (minor); 95:5 e.r.).

$[\alpha]_D^{20}$ = -272 ° (c 0.56, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 8.90 (s, 1H), 8.10 (d, *J* = 7.8 Hz, 1H), 8.08 – 8.00 (m, 2H), 7.82 (d, *J* = 7.5 Hz, 2H), 7.59 – 7.50 (m, 2H), 7.44 (t, *J* = 7.8 Hz, 2H), 7.34 – 7.21 (m, 4H), 7.21 – 7.11 (m, 3H), 7.05 – 6.96 (m, 3H), 6.61 (s, 1H).

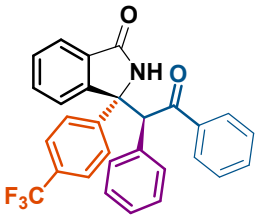
^{13}C NMR (75 MHz, DMSO) δ 198.1, 169.4, 149.8, 143.1, 136.0, 133.7, 133.2, 131.7, 130.3, 130.2, 128.9, 128.8, 128.8, 128.0, 127.8, 127.5, 127.3, 124.9, 123.8, 122.6, 68.8, 58.1.

HRMS (ESI): m/z $[M+H]^+$ for $C_{28}H_{21}NO_2$ (calcd 404.1606); found 404.1650

IR: *v* = 3433, 1699, 1512, 1365, 1215, 980, 789, 700, 570 cm^{-1}

m.p. 272.8-274.7 °C (decomposition)

(*R*)-3-((*S*)-2-oxo-1,2-diphenylethyl)-3-(4-(trifluoromethyl)phenyl)isoindolin-1-one (24)



Isoindolinone alcohol **SI-5** (29.3 mg, 0.1 mmol) afforded product **24** (43.4 mg, 92% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 20/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 8.5 min (major), t_{R2} = 14.6 min (minor); >99:1 e.r.).

$[\alpha]_D^{20}$ = -490 ° (c 1.02, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 9.11 (s, 1H), 8.12 (d, *J* = 7.8 Hz, 1H), 8.07 (d, *J* = 8.4 Hz, 2H), 8.03 (d, *J* = 7.3 Hz, 2H), 7.70 (d, *J* = 8.5 Hz, 2H), 7.60 – 7.51 (m, 2H), 7.43 (t, *J* = 7.8 Hz, 2H), 7.32 – 7.25 (m, 2H), 7.15 – 7.10 (m, 2H), 7.05 – 6.98 (m, 3H), 6.69 (s, 1H).

^{13}C NMR (151 MHz, DMSO) δ 197.8, 169.1, 148.8, 148.2, 135.7, 133.6, 133.0, 131.7, 130.4, 130.1, 128.8, 128.7, 128.2 (q, $^2J_{C\text{-}CF3}$ = 31.2 Hz), 128.2, 127.7, 127.4, 126.1 (q, $^3J_{C\text{-}CF3}$ = 3.6 Hz), 125.7, 124.6 (q, $^1J_{C\text{-}CF3}$ = 272.1 Hz), 123.7, 122.6, 68.5, 58.4.

HRMS (ESI): m/z $[M+H]^+$ for $C_{29}H_{20}F_3NO_2$ (calcd 472.1480); found 472.1513

IR: *v* = 3449, 1693, 1526, 1319, 1265, 120, 897, 843, 787, 696, 568 cm^{-1}

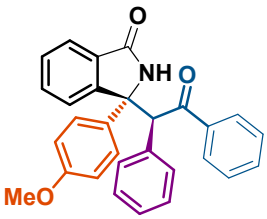
m.p. 278.3-279.9 °C (decomposition)

Scale-up procedure

3-hydroxyisoindolinone **SI-5** (600.0 mg, 2.0 mmol), chiral phosphoric acid **BA3** (154.4 mg, 0.2 mmol) and ketone (2.94 g, 10.2 mmol) were placed n a 50 mL Schlenk tube equipped with a magnetic stir bar under an argon atmosphere. Acetonitrile (20 mL) was added and reaction mixure was stirred at 80 °C until full consumption of **SI-5** (monitored by TLC) (70 hours). The reaction mixture was concentrated under reduced pressure to give the residue, which was purified by column chromatography on silica gel (dichloromethane/ethyl acetate = 20/1) to afford the corresponding product **24** as a white solid (888 mg, 92% yield, 99:1 e.r).

Enantiomeric ratio determined by chiral HPLC (Dr. Maisch ReproSil Chiral-AM (15 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 6.1 min (major), t_{R2} = 10.6 min (minor)).

(*R*)-3-(4-methoxyphenyl)-3-((*S*)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (25)



Isoindolinone alcohol **SI-2** (25.5 mg, 0.1 mmol) afforded product **25** (38.6 mg, 89% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 60h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 17.0 min (major), t_{R2} = 28.0 min (minor); 99:1 e.r.).

$[\alpha]_D^{20}$ = -463 ° (c 1.02, $CHCl_3$)).

^{1}H NMR (600 MHz, DMSO) δ 8.83 (s, 1H), 8.13 – 8.01 (m, 3H), 7.72 (d, *J* = 8.5 Hz, 2H), 7.54 (dd, J_1 = 16.0, J_2 = 7.9 Hz, 2H), 7.44 (t, *J* = 7.5 Hz, 2H), 7.30 – 7.19 (m, 2H), 7.18 – 7.10 (m, 2H), 7.06 – 6.94 (m, 3H), 6.84 (d, *J* = 8.5 Hz, 2H), 6.56 (s, 1H), 3.67 (s, 3H).

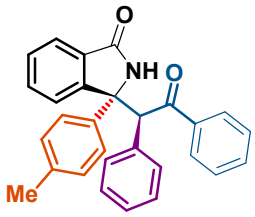
^{13}C NMR (75 MHz, DMSO) δ 198.0, 169.1, 158.2, 150.1, 136.0, 134.8, 133.5, 133.2, 131.4, 130.2, 130.1, 128.7, 128.7, 127.7, 127.7, 127.3, 126.1, 123.7, 122.4, 113.9, 68.2, 57.8, 55.0.

HRMS (ESI): m/z $[M+H]^+$ for $C_{29}H_{23}NO_3$ (calcd 434.1711); found 434.1760

IR: *v* = 3336, 1694, 1527, 1299, 1282, 1245, 891, 784, 699, 630 cm^{-1}

m.p. 262.4-264.0 °C (decomposition)

(*R*)-3-(4-methylphenyl)-3-((*S*)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (26)



Isoindolinone alcohol **SI-6** (23.9 mg, 0.1 mmol) afforded product **26** (32.6 mg, 78% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 13.1 min (major), t_{R2} = 21.4 min (minor); 96:4 e.r.).

$[\alpha]_D^{20}$ = -480 ° (c 1.03, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 8.83 (s, 1H), 8.10 – 8.03 (m, 3H), 7.69 (d, *J* = 8.4 Hz, 2H), 7.56 – 7.51 (m, 2H), 7.44 (t, *J* = 7.8 Hz, 2H), 7.28 – 7.21 (m, 2H), 7.17 – 7.12 (m, 2H), 7.09 (d, *J* = 8.1 Hz, 2H), 7.03 – 6.97 (m, 3H), 6.58 (s, 1H), 2.19 (s, 3H).

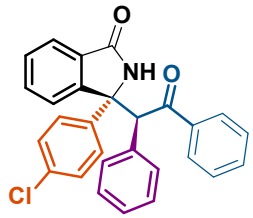
^{13}C NMR (75 MHz, DMSO) δ 198.0, 169.0, 149.8, 140.1, 136.2, 135.9, 133.5, 133.1, 131.4, 130.2, 130.1, 129.2, 128.7, 128.6, 127.7, 127.7, 127.3, 124.7, 123.7, 122.4, 68.4, 57.8, 20.3.

HRMS (ESI): m/z $[M+H]^+$ for $C_{29}H_{23}NO_2$ (calcd 418.1762); found 418.1810

IR: *v* = 3357, 2922, 1693, 1526, 1215, 1140, 1020, 890, 695 cm^{-1}

m.p. 260.2-262.0 °C (decomposition)

(*R*)-3-(4-chlorophenyl)-3-((*S*)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (27)



Isoindolinone alcohol **SI-4** (26.0 mg, 0.1 mmol) afforded product **27** (38.1 mg, 87% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 11.5 min (major), t_{R2} = 21.8 min (minor); 97.5:2.5 e.r.).

$[\alpha]_D^{20}$ = -465 ° (c 1.02, $CHCl_3$)

^{1}H NMR (300 MHz, DMSO) δ 9.00 (s, 1H), 8.15 – 7.99 (m, 3H), 7.86 (d, *J* = 8.7 Hz, 2H), 7.61 – 7.51 (m, 2H), 7.48 – 7.34 (m, 4H), 7.31 – 7.22 (m, 2H), 7.17 – 6.95 (m, 5H), 6.60 (s, 1H).

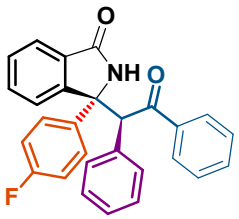
^{13}C NMR (151 MHz, DMSO) δ 197.8, 169.1, 149.2, 142.3, 135.8, 133.5, 133.0, 131.8, 131.6, 130.3, 130.1, 128.7, 128.7, 128.6, 128.0, 127.7, 127.4, 126.8, 123.6, 122.5, 68.3, 58.2.

HRMS (ESI): m/z $[M+H]^+$ for $C_{28}H_{20}ClNO_2$ (calcd 438.1216); found 438.1262

IR: *v* = 3356, 1696, 1508, 1302, 1218, 1130, 886, 829, 780, 690 cm^{-1}

m.p. 272.6-273.8 °C (decomposition)

(*R*)-3-(4-fluorophenyl)-3-((S)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (28)



Isoindolinone alcohol **SI-3** (24.3 mg, 0.1 mmol) afforded product **28** (37.1 mg, 88% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 11.6 min (major), t_{R2} = 20.1 min (minor); 97:3 e.r.).

$[\alpha]_D^{20}$ = -551 ° (c 1.16, $CHCl_3$)).

^{1}H NMR (600 MHz, DMSO) δ 8.98 (s, 1H), 8.10 (d, *J* = 7.8 Hz, 1H), 8.07 – 8.00 (m, 2H), 7.91 – 7.82 (m, 2H), 7.60 – 7.50 (m, 2H), 7.44 (t, *J* = 7.8 Hz, 2H), 7.32 – 7.22 (m, 2H), 7.19 – 7.08 (m, 4H), 7.05 – 6.96 (m, 3H), 6.59 (s, 1H).

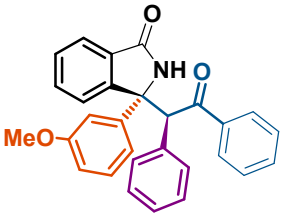
^{13}C NMR (151 MHz, DMSO) δ 197.9, 169.0, 161.2 (d, $^1J_{C\text{-}F}$ = 243.9 Hz), 149.5, 139.3 (d, $^4J_{C\text{-}F}$ = 2.9 Hz), 135.9, 133.5, 133.1, 131.6, 130.3, 130.1, 128.7, 128.7, 127.9, 127.7, 127.3, 127.0 (d, $^3J_{C\text{-}F}$ = 7.9 Hz), 123.7, 122.5, 115.3 (d, $^2J_{C\text{-}F}$ = 21.3 Hz), 68.2, 58.2.

HRMS (ESI): m/z $[M+H]^+$ for $C_{28}H_{20}FNO_2$ (calcd 422.1512); found 422.1558

IR: *v* = 3430, 1694, 1525, 1214, 1165, 1045, 891, 689, 569 cm^{-1}

m.p. 271.7-273.2 °C (decomposition)

(*R*)-3-(3-methoxyphenyl)-3-((*S*)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (29)



Isoindolinone alcohol **SI-8** (25.5 mg, 0.1 mmol) afforded product **29** (33.9 mg, 78% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 48h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 13.6 min (major), t_{R2} = 25.2 min (minor); 94:6 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 8.89 (s, 1H), 8.12 (d, *J* = 7.8 Hz, 1H), 8.10 – 8.05 (m, 2H), 7.59 – 7.50 (m, 2H), 7.45 (t, *J* = 7.8 Hz, 2H), 7.41 – 7.35 (m, 2H), 7.30 – 7.23 (m, 2H), 7.21 (t, *J* = 8.2 Hz, 1H), 7.17 – 7.12 (m, 2H), 7.04 – 6.97 (m, 3H), 6.78 – 6.72 (m, 1H), 6.60 (s, 1H), 3.68 (s, 3H).

^{13}C NMR (75 MHz, DMSO) δ 197.9, 169.1, 159.5, 149.5, 144.8, 136.0, 133.5, 133.1, 131.4, 130.3, 130.1, 129.7, 128.7 (2C), 127.9, 127.7, 127.3, 123.7, 122.4, 117.1, 112.0, 111.3, 68.6, 57.8, 55.0.

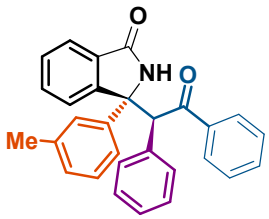
^{13}C NMR (75 MHz, Acetone) δ 198.5, 169.0, 160.1, 149.8, 144.6, 136.4, 133.4, 132.9, 131.3, 130.8, 130.2, 129.8, 128.7, 128.6, 127.8, 127.7, 127.3, 123.4, 122.7, 117.0, 112.2, 111.1, 68.8, 58.4, 54.5.

HRMS (ESI): m/z $[M+H]^+$ for $C_{29}H_{23}NO_3$ (calcd 434.1711); found 434.1761

IR: *v* = 3417, 1673, 1513, 1366, 1217, 1047, 903, 823, 700, 549 cm^{-1}

m.p. 270.6-272.0 °C (decomposition)

(*R*)-3-((*S*)-2-oxo-1,2-diphenylethyl)-3-(m-tolyl)isoindolin-1-one (30)



Isoindolinone alcohol **SI-7** (23.9 mg, 0.1 mmol) afforded product **30** (31.9 mg, 77% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Dr. Maisch ReproSil Chiral-AM (15 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 8.7 min (major), t_{R2} = 13.6 min (minor); 97.5:2.5 e.r.).

$[\alpha]_D^{20}$ = -385 ° (c 0.95, $CHCl_3$)

^{1}H NMR (600 MHz, DMSO) δ 8.83 (s, 1H), 8.07 (dd, J_1 = 11.1 Hz, J_2 = 7.9 Hz, 3H), 7.69 (d, J = 8.2 Hz, 2H), 7.58 – 7.50 (m, 2H), 7.44 (t, J = 7.7 Hz, 2H), 7.31 – 7.20 (m, 2H), 7.18 – 7.13 (m, 2H), 7.09 (d, J = 8.1 Hz, 2H), 7.00 (d, J = 6.6 Hz, 3H), 6.58 (s, 1H), 2.19 (s, 3H).

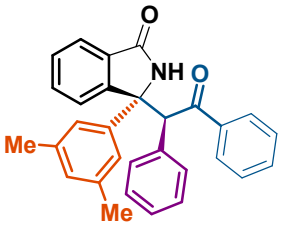
^{13}C NMR (151 MHz, DMSO) δ 197.9, 169.2, 149.8, 140.1, 136.2, 135.9, 134.3, 133.5, 133.1, 132.6, 131.4, 130.2, 130.1, 129.1, 128.7, 127.7, 127.6, 127.2, 124.7, 123.6, 122.9, 122.3, 68.4, 57.8, 20.3.

HRMS (ESI): m/z $[M+H]^+$ for $C_{29}H_{23}NO_2$ (calcd 418.1762); found 418.1811

IR: ν = 3357, 1693, 1525, 1214, 1155, 1131, 887, 780, 693 cm^{-1}

m.p. 246.9-248.7 °C (decomposition)

(*R*)-3-(3,5-dimethylphenyl)-3-((*S*)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (31)



Isoindolinone alcohol **SI-10** (25.3 mg, 0.1 mmol) afforded product **31** (32.0 mg, 74% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 40h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 5.7 min (major), t_{R2} = 8.4 min (minor); 90:10 e.r.).

^{1}H NMR (600 MHz, DMSO) δ 8.77 (s, 1H), 8.11 – 8.02 (m, 3H), 7.58 – 7.50 (m, 2H), 7.48 – 7.41 (m, 4H), 7.29 – 7.21 (m, 2H), 7.17 – 7.12 (m, 2H), 7.04 – 6.96 (m, 3H), 6.80 (s, 1H), 6.57 (s, 1H), 2.19 (s, 6H).

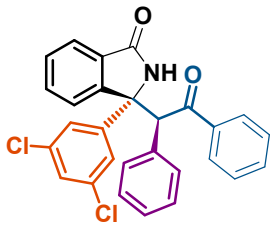
^{13}C NMR (75 MHz, DMSO) δ 198.1, 169.1, 149.7, 143.0, 137.6, 136.1, 133.4, 133.1, 131.4, 130.3, 130.1, 128.7, 128.7, 128.5, 127.8, 127.6, 127.2, 123.7, 122.6, 122.4, 68.5, 57.9, 21.1.

HRMS (ESI): m/z $[M+H]^+$ for $C_{30}H_{25}NO_2$ (calcd 432.1919); found 432.1968

IR: ν = 3441, 1696, 1510, 1365, 1232, 1214, 891, 849, 780, 586 cm^{-1}

m.p. 284.4-286.1 °C (decomposition)

(*R*)-3-(3,5-dichlorophenyl)-3-((*S*)-2-oxo-1,2-diphenylethyl)isoindolin-1-one (32)



Isoindolinone alcohol **SI-11** (29.4 mg, 0.1 mmol) afforded product **32** (45.2 mg, 96% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 10/1. Reaction time: 60h.

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 5.7 min (major), t_{R2} = 7.3 min (minor); 91:9 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 9.20 (s, 1H), 8.19 (d, J = 7.7 Hz, 1H), 8.11 – 7.88 (m, 4H), 7.69 – 7.38 (m, 5H), 7.36 – 7.23 (m, 2H), 7.21 – 6.89 (m, 5H), 6.62 (s, 1H).

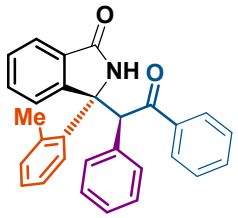
^{13}C NMR (151 MHz, DMSO) δ 197.7, 169.0, 148.3, 147.8, 135.8, 134.5, 133.6, 132.9, 131.9, 130.3, 130.1, 128.8, 128.7, 128.4, 127.8, 127.4, 126.9, 123.9, 123.6, 122.6, 68.1, 58.5.

HRMS (ESI): m/z $[M+H]^+$ for $C_{28}H_{19}Cl_2NO_2$ (calcd 472.0826); found 472.0882

IR: ν = 3417, 1693, 1480, 1215, 1181, 976, 906, 819, 706 cm^{-1}

m.p. 295.3-297.1 °C (decomposition)

(*R*)-3-((*S*)-2-oxo-1,2-diphenylethyl)-3-(*o*-tolyl)isoindolin-1-one (33)



Isoindolinone alcohol **SI-9** (23.9 mg, 0.1 mmol) afforded product **33** (16.3 mg, 39% yield) as a white solid.

Column chromatography eluent: dichloromethane/ethyl acetate = 15/1. Reaction time: 5 days. Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack AD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 10.7 min (major), t_{R2} = 17.4 min (minor); 60:40 e.r.).

^{1}H NMR (600 MHz, Acetone) δ 8.14 (d, *J* = 7.6 Hz, 2H), 7.92 (s, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.62 – 7.50 (m, 3H), 7.47 (t, *J* = 7.7 Hz, 2H), 7.34 – 7.27 (m, 2H), 7.16 – 7.04 (m, 5H), 7.04 – 6.96 (m, 3H), 6.61 (s, 1H), 2.00 (s, 3H).

^{13}C NMR (151 MHz, DMSO) δ 198.1, 169.2, 148.1, 139.1, 136.3, 135.9, 133.5, 133.2, 132.7, 132.2, 131.5, 130.5, 128.8, 128.7, 127.9, 127.5, 127.2, 127.1, 126.8, 126.1, 123.6, 121.7, 69.0, 58.6, 21.4.

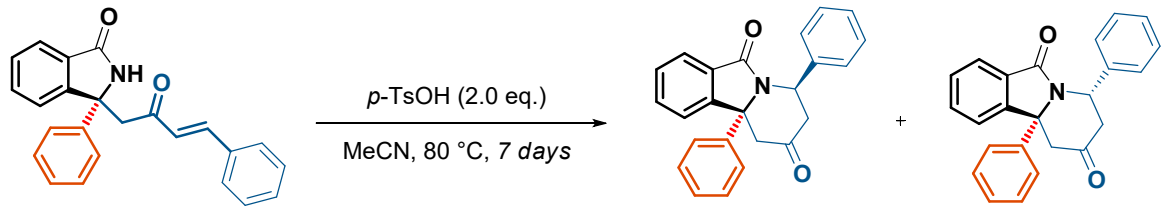
HRMS (ESI): m/z $[M+H]^+$ for $C_{29}H_{23}NO_2$ (calcd 418.1762); found 418.1812

IR: *v* = 3437, 1670, 1513, 1361, 1264, 1217, 980, 826, 703, 553 cm^{-1}

m.p. 243.3-245.0 °C (decomposition)

3.3. Transformations of products

3.3.1. Transformation 1:



19 **34** **34'**

To a solution of **19** (30 mg, 0.085 mmol) in acetonitrile (1.0 mL) *p*-toluensulfonic acid monohydrate (32.3 mg, 0.17 mmol) was added, and the resulting mixture was stirred in an oil bath at 80 °C. After 7 days, the solvent was evaporated and the residue was purified by column chromatography (dichloromethane/ethyl acetate = 50/1) to afford products **34** (2.9 mg, 10% yield) and **34'** (13.2 mg, 44% yield) as white solids.

Compound 34

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IB (25 cm × 0.46 cm ID), hexane/iso-propanol = 85/15, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 21.9 min (minor), t_{R2} = 24.0 min (major); 93:7 e.r.).

^{1}H NMR (300 MHz, DMSO) (600 MHz, DMSO) δ 7.65 (d, J = 7.5 Hz, 1H), 7.61 (t, J = 6.8 Hz, 3H), 7.58 (td, J_1 = 7.6 Hz, J_2 = 0.9 Hz, 1H), 7.48 – 7.41 (m, 3H), 7.34 – 7.28 (m, 3H), 7.25 – 7.20 (m, 3H), 5.48 (dd, J_1 = 7.3 Hz, J_2 = 2.4 Hz, 1H), 4.27 (d, J = 18.5 Hz, 1H), 3.20 (d, J = 18.5 Hz, 1H), 2.70 (dd, J_1 = 16.4 Hz, J_2 = 7.4 Hz, 1H), 2.38 (dd, , J_1 = 16.3 Hz, J_2 = 2.5 Hz, 1H).

^{13}C NMR (75 MHz, DMSO) δ 205.0 166.6, 150.4, 142.5, 141.3, 132.5, 129.7, 128.5, 127.9, 127.0, 125.9, 124.5, 123.3, 122.3, 67.6, 53.3, 47.3, 46.0.

MS (ESI): m/z $[M+H]^+$ for $C_{24}H_{19}NO_2$ (calcd 354.1449); found 354.2

IR: ν = 2898, 1682, 1510, 1372, 1043, 994, 803, 703, 573, 424 cm^{-1}

m.p. 232.6-234.0 °C (decomposition)

Compound 34'

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack IB (25 cm × 0.46 cm ID), hexane/iso-propanol = 85/15, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 18.2 min (major), t_{R2} = 37.9 min (minor); 93:7 e.r.).

^{1}H NMR (300 MHz, DMSO) (600 MHz, DMSO) δ 7.84 – 7.77 (m, 1H), 7.57 – 7.48 (m, 2H), 7.18 (d, *J* = 7.4 Hz, 1H), 7.15 – 7.04 (m, 9H), 5.78 (t, *J* = 7.1 Hz, 1H), 3.96 (d, *J* = 16.0 Hz, 1H), 2.99 – 2.87 (m, 2H), 2.58 – 2.52 (m, 1H).

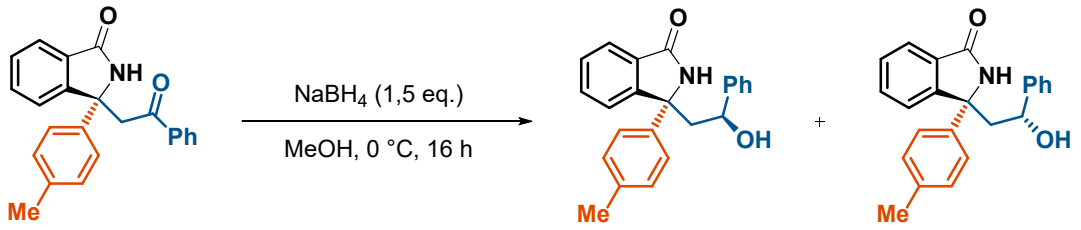
^{13}C NMR (75 MHz, DMSO) δ 206.1, 168.5, 151.9, 140.9, 139.3, 132.7, 129.0, 128.6, 128.3, 127.8, 127.5, 126.8, 126.3, 123.3, 122.2, 67.6, 52.3, 47.5, 42.8.

HRMS (ESI): m/z $[M+H]^+$ for $C_{24}H_{19}NO_2$ (calcd 354.1449); found 354.1501

IR: *v* = 3029, 1679, 1512, 1373, 1227, 1128, 1025, 859, 692, 483, 446 cm^{-1}

m.p. 168.2-169.9 °C (decomposition)

3.3.2. Transformation 2:



6 **35** **35'**

To a stirred solution of **6** (75.0 mg, 0.22 mmol) in methanol (2.2 mL), $NaBH_4$ (12.5 mg, 0.33 mmol) was added at 0 °C. The resulting mixture was stirred at room temperature until full consumption of **6** (monitored by TLC), and then quenched by saturated NH_4Cl (aq.). The mixture was extracted with EtOAc (3×10 mL), the organic extracts were combined, dried over Na_2SO_4, filtered and concentrated in vacuo. The obtained crude residue was purified by column chromatography (dichloromethane/ethyl acetate = 4/1) to give the corresponding alcohols **35** (39.0 mg, 52% yield) and **35'** (31.3 mg, 41% yield) as white solids.

Compound 35

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 90/10, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 8.0 min (major), t_{R2} = 10.9 min (minor); 95:5 e.r.).

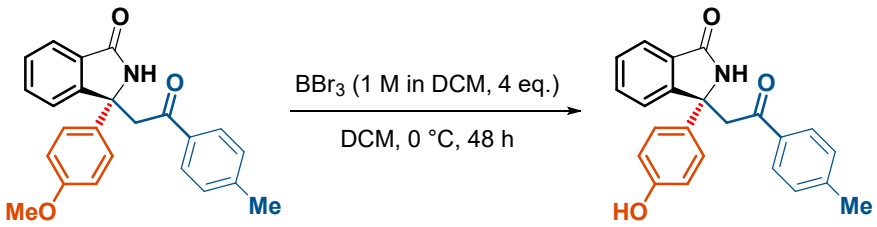
$[\alpha]_D^{20}$ = +135 ° (c 1.00, $CHCl_3$)

^{1}H NMR (300 MHz, CD_3CN) δ 7.82 – 7.61 (m, 2H), 7.61 – 7.45 (m, 4H), 7.45 – 7.11 (m, 8H), 4.78 – 4.58 (m, 1H), 3.53 (dd, J_1 = 3.9 Hz, J_2 = 1.5 Hz, 1H), 3.00 – 2.88 (m, 1H), 2.32 (s, 3H).
^{1}H NMR (600 MHz, $CDCl_3$) δ 8.03 (s, 1H), 7.74 (d, J = 7.5 Hz, 1H), 7.54 (d, J = 8.2 Hz, 2H), 7.45 – 7.39 (m, 2H), 7.38 – 7.29 (m, 5H), 7.28 – 7.24 (m, 1H), 7.23 (d, J = 8.1 Hz, 2H), 4.87 (dt, J_1 = 11.0 Hz, J_2 = 2.2 Hz, 1H), 3.43 (d, J = 1.9 Hz, 1H), 2.89 (dt, J_1 = 14.7 Hz, J_2 = 1.9 Hz, 1H), 2.35 (s, 3H), 2.18 (dd, J_1 = 14.9 Hz, J_2 = 11.0 Hz, 1H).
^{13}C NMR (151 MHz, $CDCl_3$) δ 170.6, 152.4, 144.6, 138.0, 137.5, 132.3, 130.1, 129.9, 128.8, 128.2, 128.0, 125.7, 125.3, 124.2, 122.1, 72.1, 66.9, 48.2, 21.1.
MS (ESI): m/z $[M+H]^+$ for $C_{23}H_{21}NO_2$ (calcd 344.1606); found 344.3
IR: ν = 3383, 1682, 1479, 1381, 1125, 1102, 851, 693, 578 cm^{-1}
m.p. 223.9-225.0°C

Compound 35'

Enantiomeric ratio determined by chiral HPLC (Daicel Chiralpack OD-H (25 cm × 0.46 cm ID), hexane/iso-propanol = 75/25, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 7.0 min (major), t_{R2} = 15.2 min (minor); 95:5 e.r.)
$[\alpha]_D^{20}$ = +130 ° (c 1.00, $CHCl_3$)
^{1}H NMR (300 MHz, CD_3CN) δ 7.73 – 7.59 (m, 1H), 7.49 – 7.31 (m, 5H), 7.31 – 7.03 (m, 8H), 4.41 – 4.27 (m, 1H), 3.33 (d, J = 4.1 Hz, 1H), 2.92 – 2.66 (m, 2H), 2.27 (s, 3H).
^{13}C NMR (151 MHz, CD_3CN) δ 170.5, 152.3, 146.5, 141.2, 138.3, 133.1, 131.9, 130.3, 129.2, 129.1, 128.1, 126.8, 126.2, 124.1, 123.8, 71.5, 66.6, 48.0, 20.9.
HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{21}NO_2$ (calcd 344.1606); found 344.1647
IR: ν = 3236, 2030, 1683, 1527, 1316, 1135, 1018, 859, 697, 541 cm^{-1}
m.p. 87.0-88.2 °C

3.3.3. Transformation 3:



15 **36**

To a 25 mL Schlenk flask, **15** (25.5 mg, 0.069 mmol) was added, followed by freshly distilled dichloromethane (1.4 mL) under an argon atmosphere, and the mixture was cooled to 0 °C. Then BBr_3 (280 µL, 1.0 M solution in dichloromethane, 0.28 mmol) was added dropwise at 0 °C. The reaction mixture was stirred at room temperature for 48 hours, and then quenched by H_2O. The resulting mixture was extracted with DCM (3×6 mL), the organic extracts were combined, dried over Na_2SO_4, filtered and concentrated in vacuo. The obtained crude residue was purified by column chromatography (petroleum ether/ethyl acetate = 2/1) to afford product **36 (**24.8 mg, 97% yield) as a white solid.

Enantiomeric ratio determined by chiral HPLC (Dr. Maisch ReproSil Chiral-AM (15 cm × 0.46 cm ID), hexane/iso-propanol = 65/35, λ 254 nm, 1.0 mL/min flow rate; t_{R1} = 19.7 min (major), t_{R2} = 26.9 min (minor); 90:10 e.r.).

^{1}H NMR (300 MHz, DMSO) δ 9.36 (s, 1H), 8.73 (s, 1H), 7.84 (d, *J* = 8.2 Hz, 2H), 7.68 – 7.57 (m, 2H), 7.52 (t, *J* = 7.0 Hz, 1H), 7.45 – 7.23 (m, 5H), 6.67 (d, *J* = 8.7 Hz, 2H), 4.45 (d, *J* = 17.3 Hz, 1H), 3.71 (d, *J* = 17.3 Hz, 1H), 2.36 (s, 3H).

^{13}C NMR (75 MHz, DMSO) δ 196.3, 168.8, 156.3, 151.7, 143.6, 134.4, 132.8, 131.6, 130.6, 129.1, 128.1, 127.7, 126.2, 123.0, 122.7, 115.1, 64.0, 45.5, 21.1.

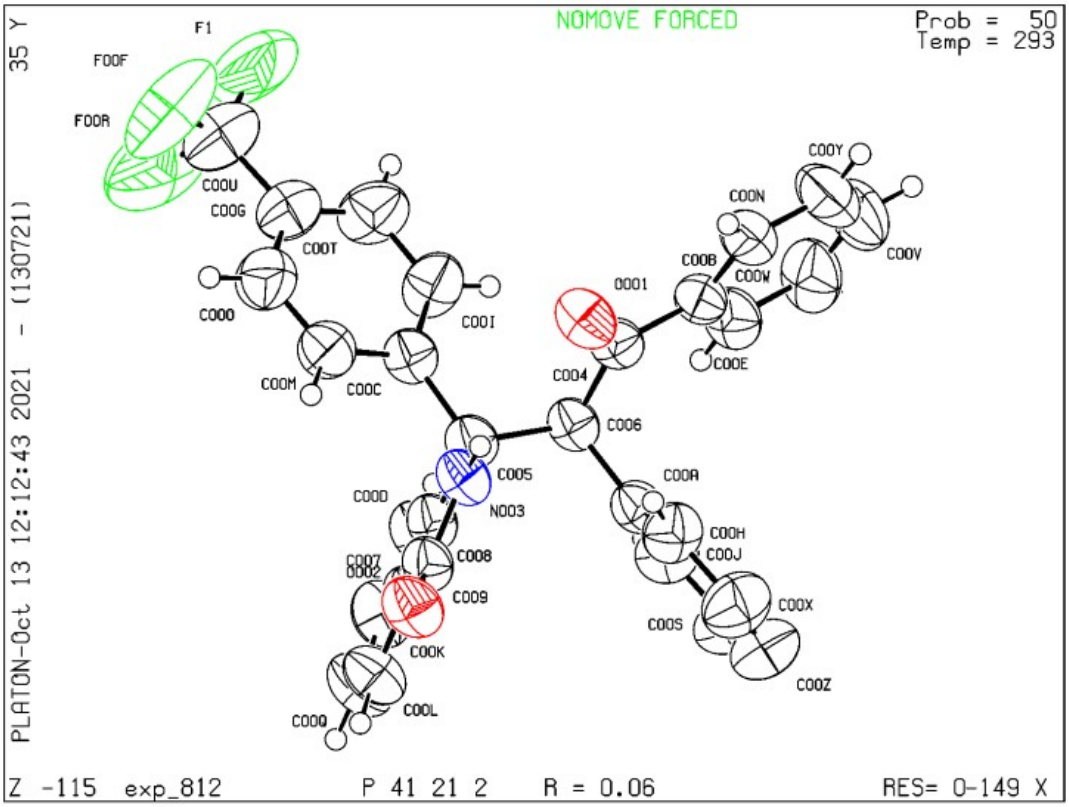
HRMS (ESI): m/z $[M+H]^+$ for $C_{23}H_{19}NO_3$ (calcd 358.1398); found 358.1427

IR: *v* = 3252, 1667, 1533, 1227, 1179, 918, 696, 580, 481 cm^{-1}

m.p. 146.3-148.2°

§ 4. X-ray Crystallography

Single crystal measurement was performed on an Oxford Diffraction Xcalibur Nova R (microfocus Cu tube) at room temperature [293(2) K]. Friedel pairs were measured to unambiguously establish absolute configuration of the stereogenic centre. Program package CrysAlis PRO [CrysAlis] was used for data reduction and multi-scan absorption correction. The crystal structure was solved by direct methods using Olex2.[1] Non-hydrogen atoms were refined isotropically followed by anisotropic refinement by full matrix least-squares calculations based on F^2. Hydrogen atoms were first located in the Fourier difference map, then positioned geometrically and allowed to ride on their respective parent atoms. Diagrams and publication materials were generated using ORTEP3,[2] PLATON[3] and Mercury®. Absolute configuration of the product **24** was determined by solving its crystal structure. Absolute configuration of other products was assigned by analogy. The crystal structure has been deposited at the Cambridge Crystallographic Centre (deposition number: CCDC 2102771). The data can be obtained free of charge at www.ccdc.cam.ac.uk/getstructures



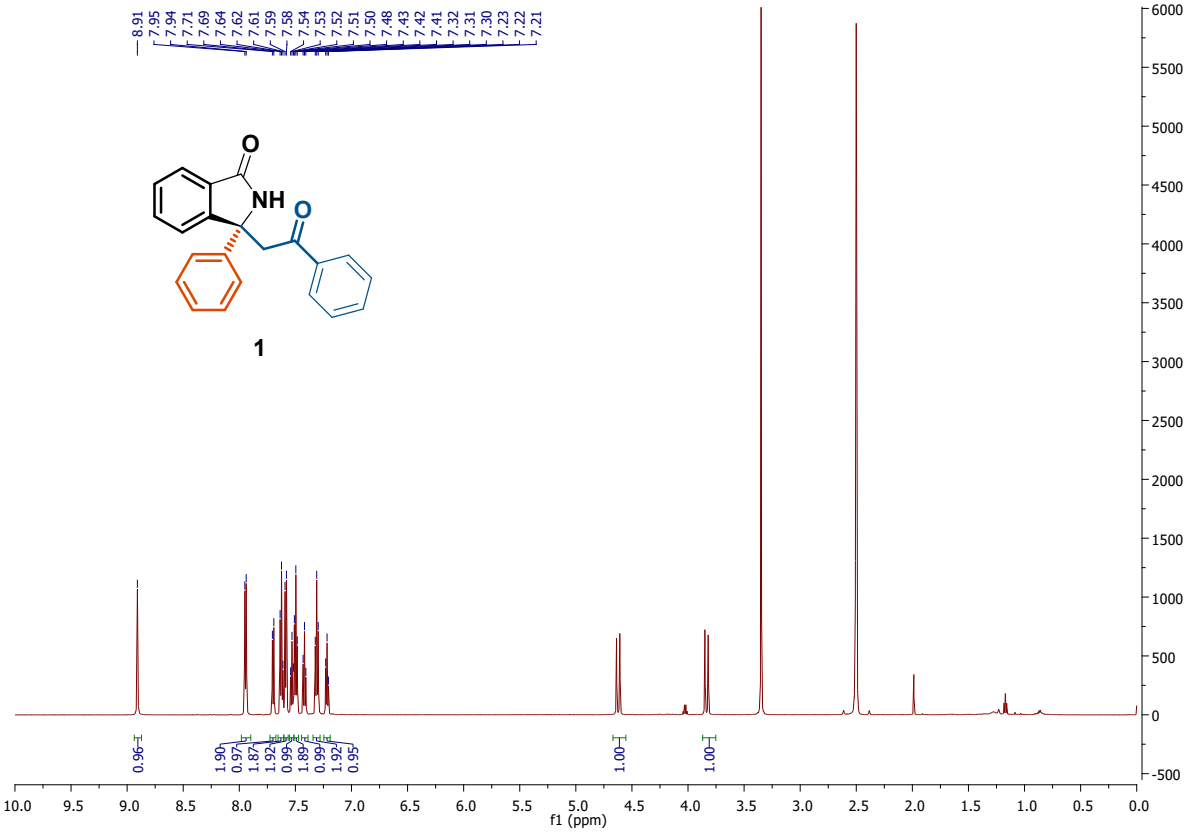
§ 5. References

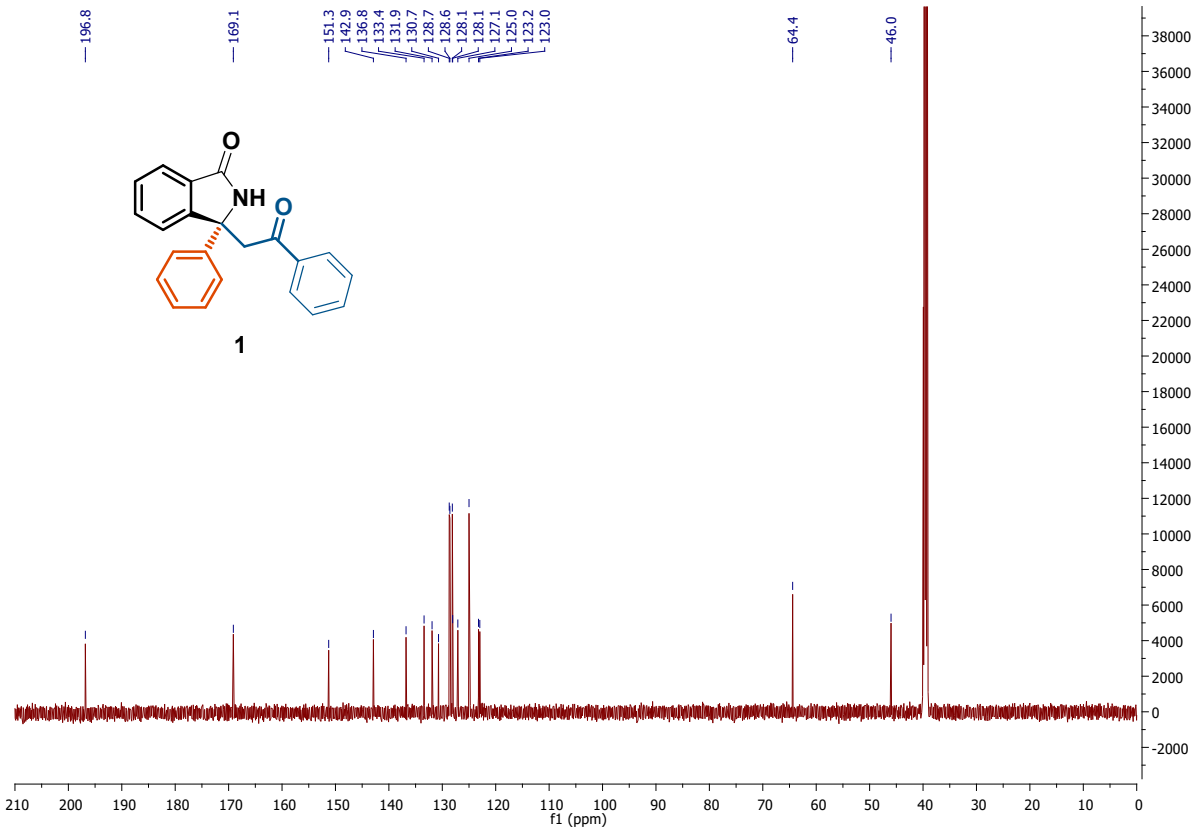
[1] Dolomanov, O. V.; Bourhis, L. J.; Gildea, R. J.; Howard, J. A. K., Puschmann, H. *J. Appl. Cryst.* **2009**, 42, 339.

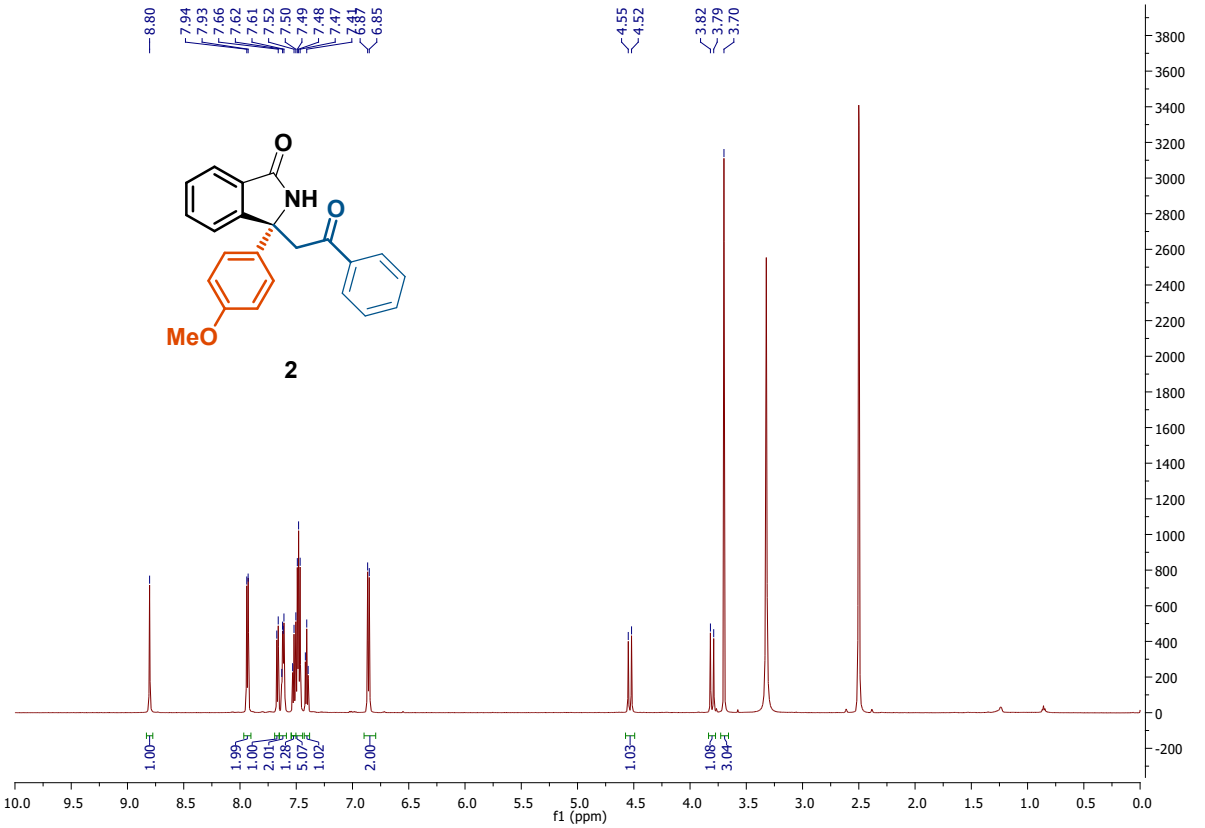
[2] Farrugia, L. J. *J. Appl. Crystallogr*. **2012**, 45, 849.

[3] Spek, A. L. *J. Appl. Crystallogr*. **2003**, 36, 7.

§ 6. NMR Spectra



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MeO
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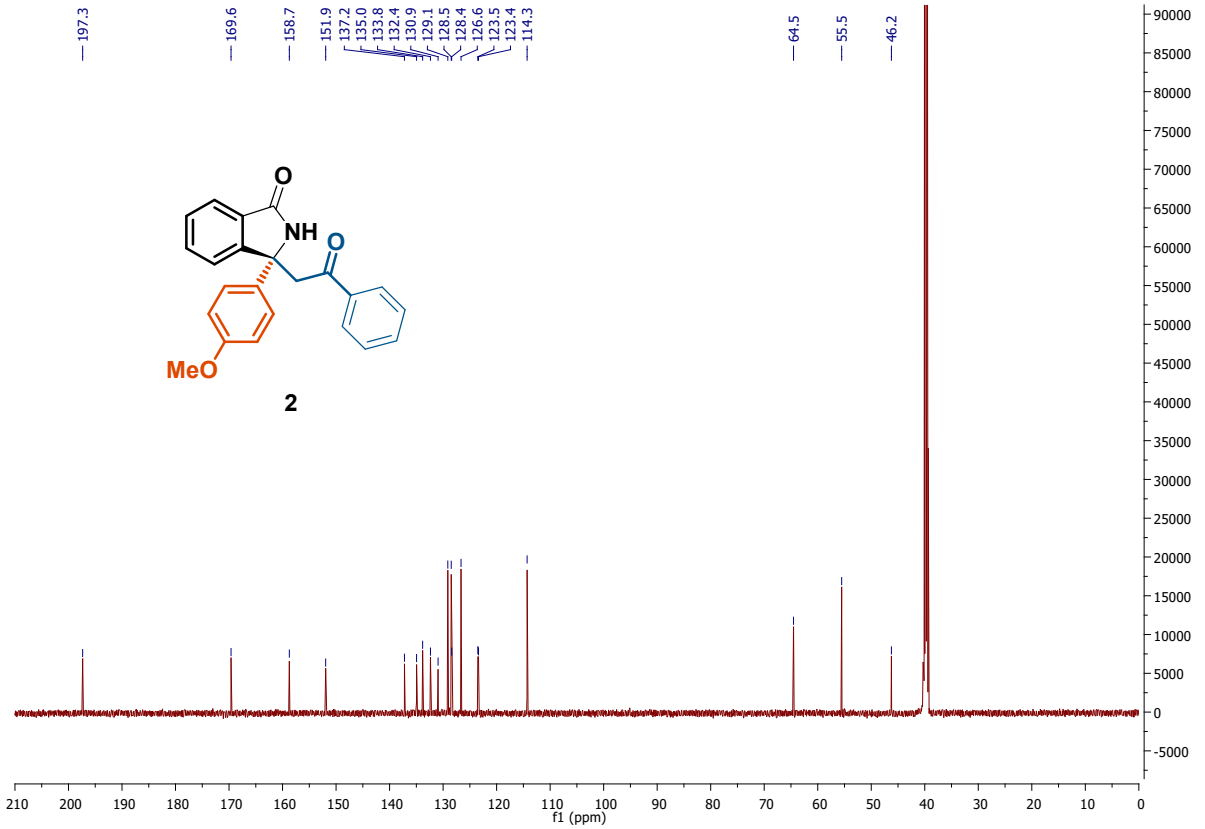
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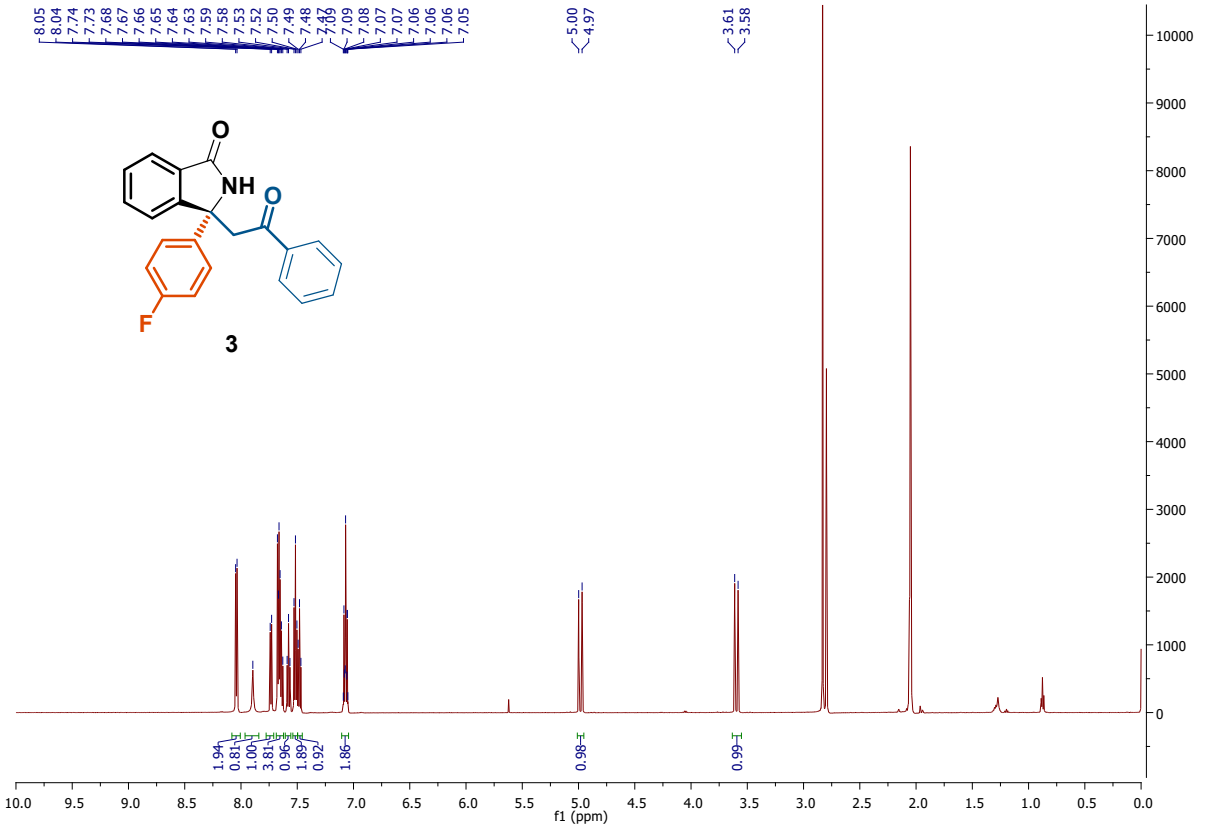
f1 (ppm)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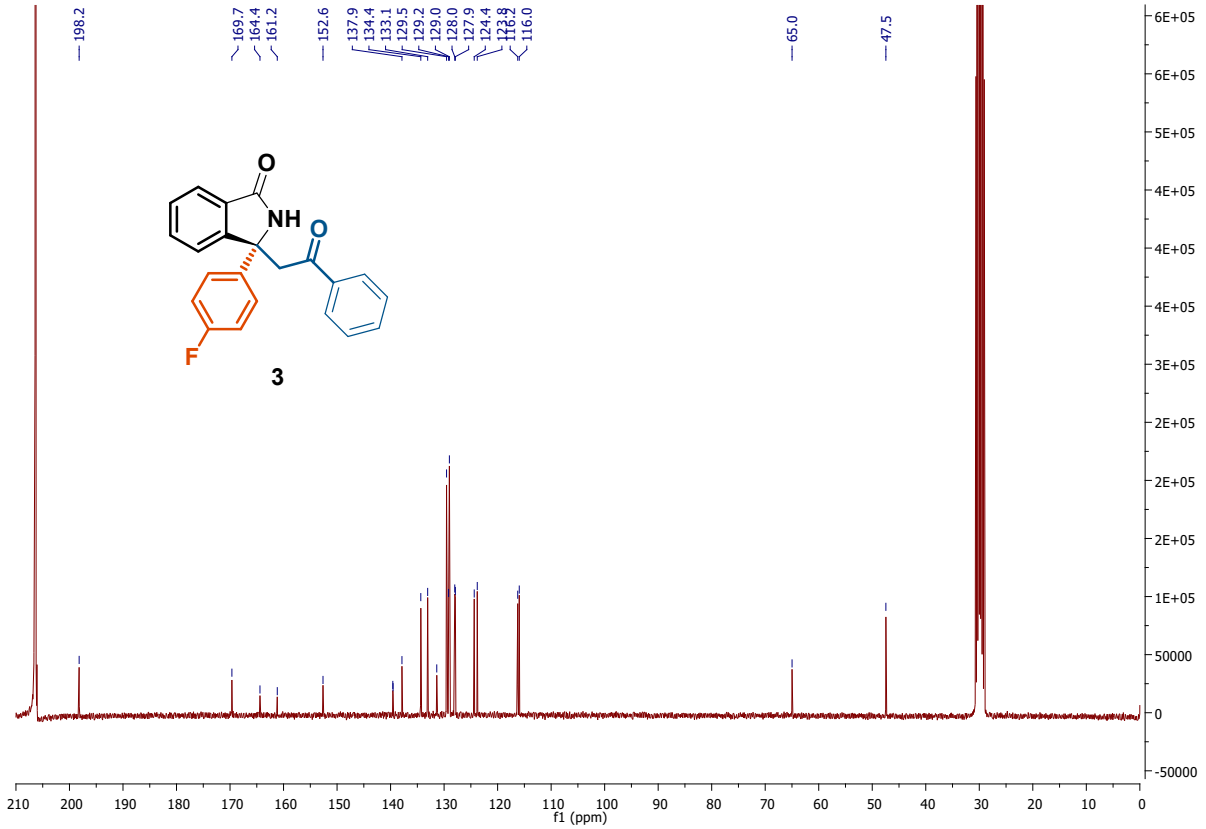
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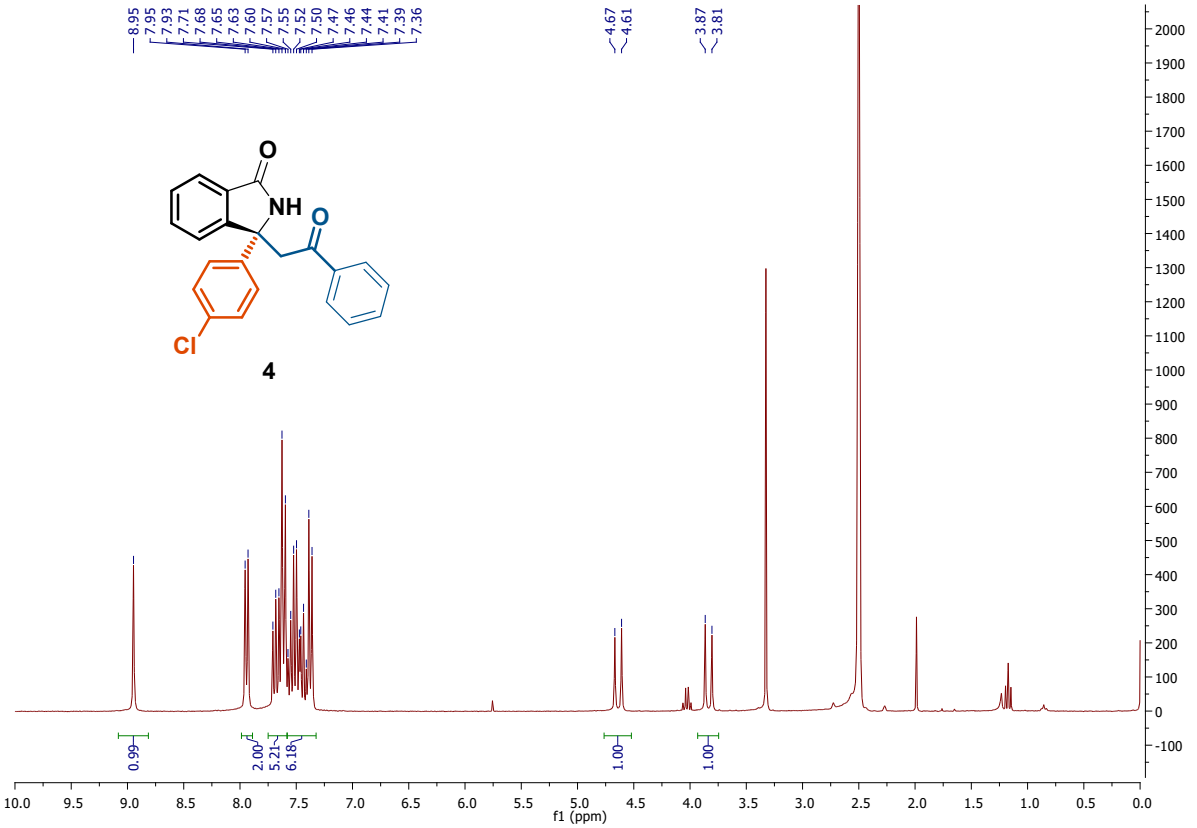
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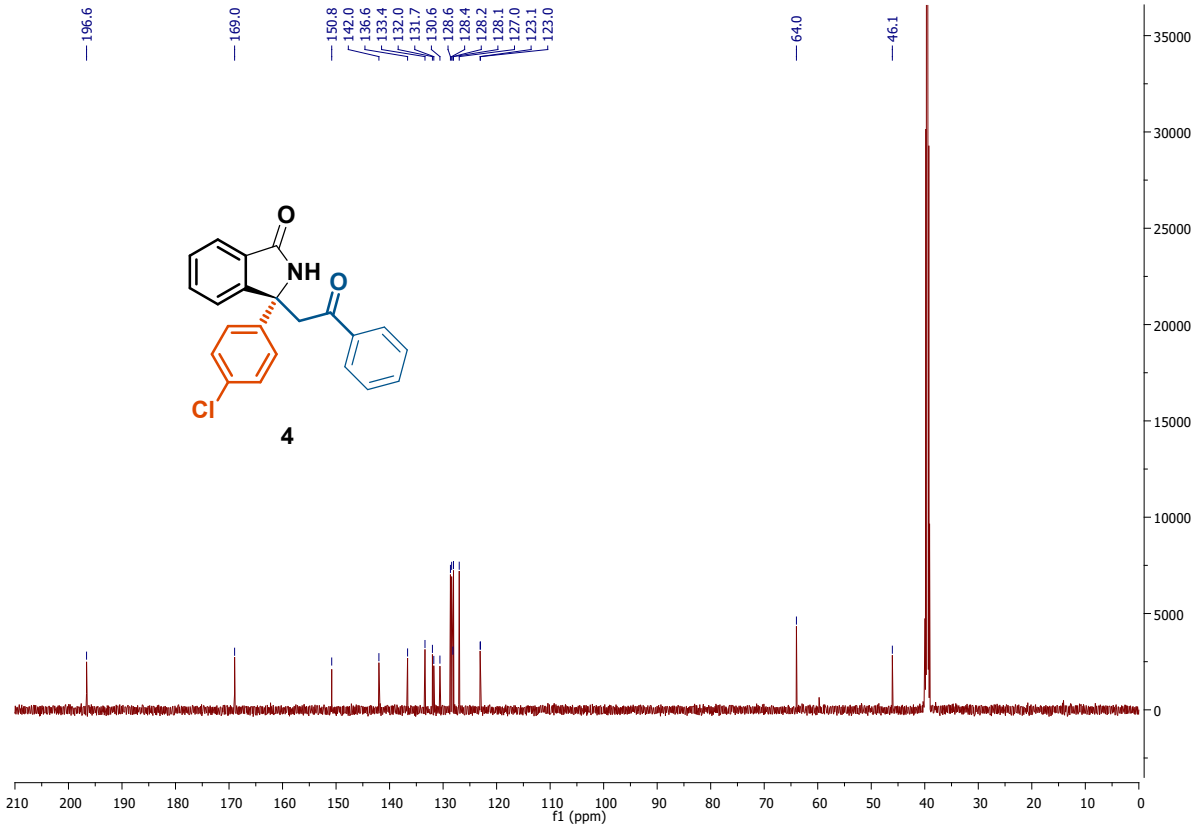
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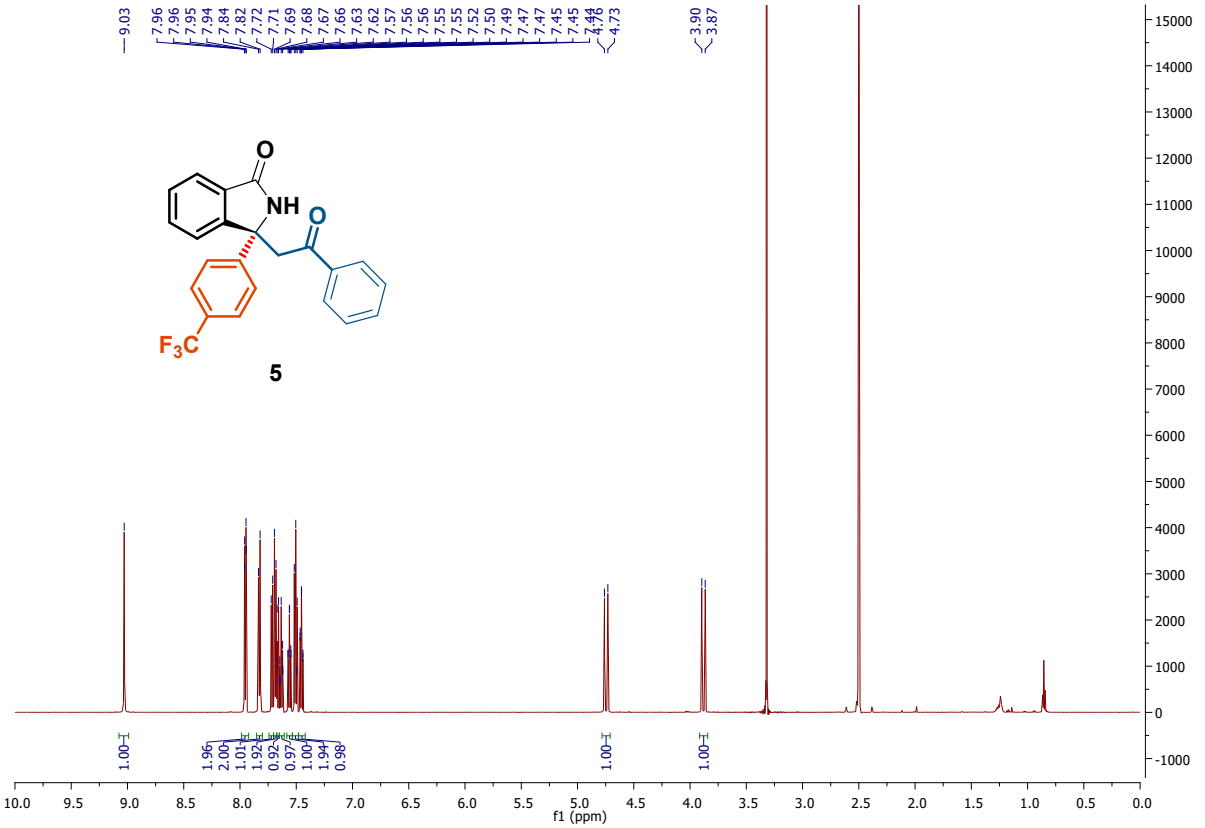
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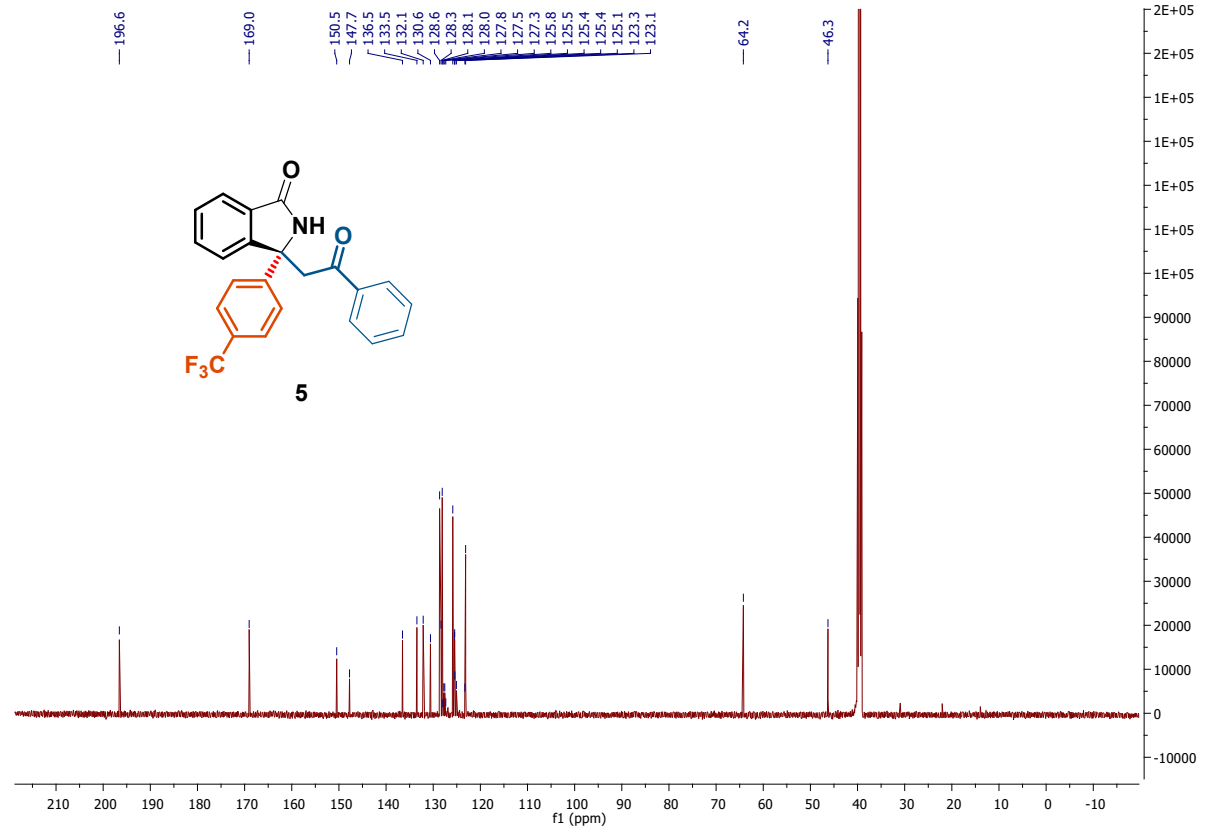
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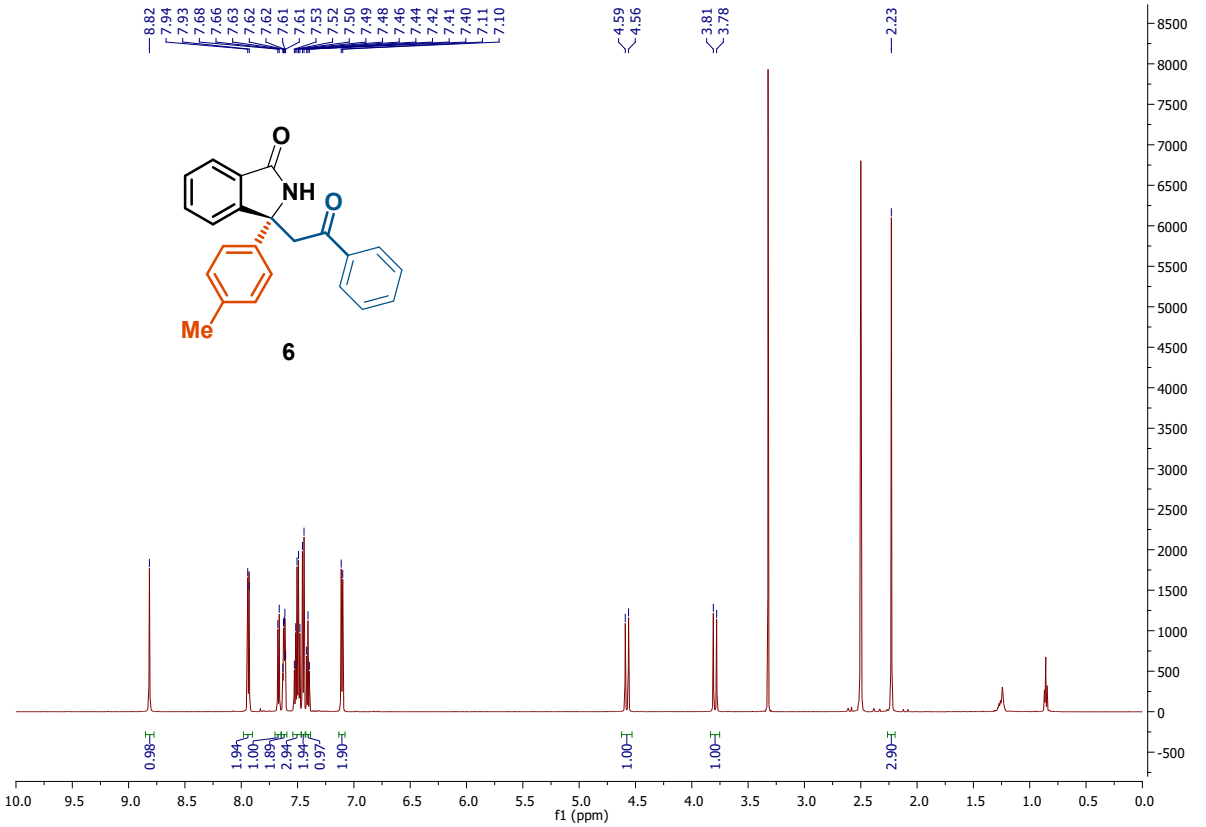
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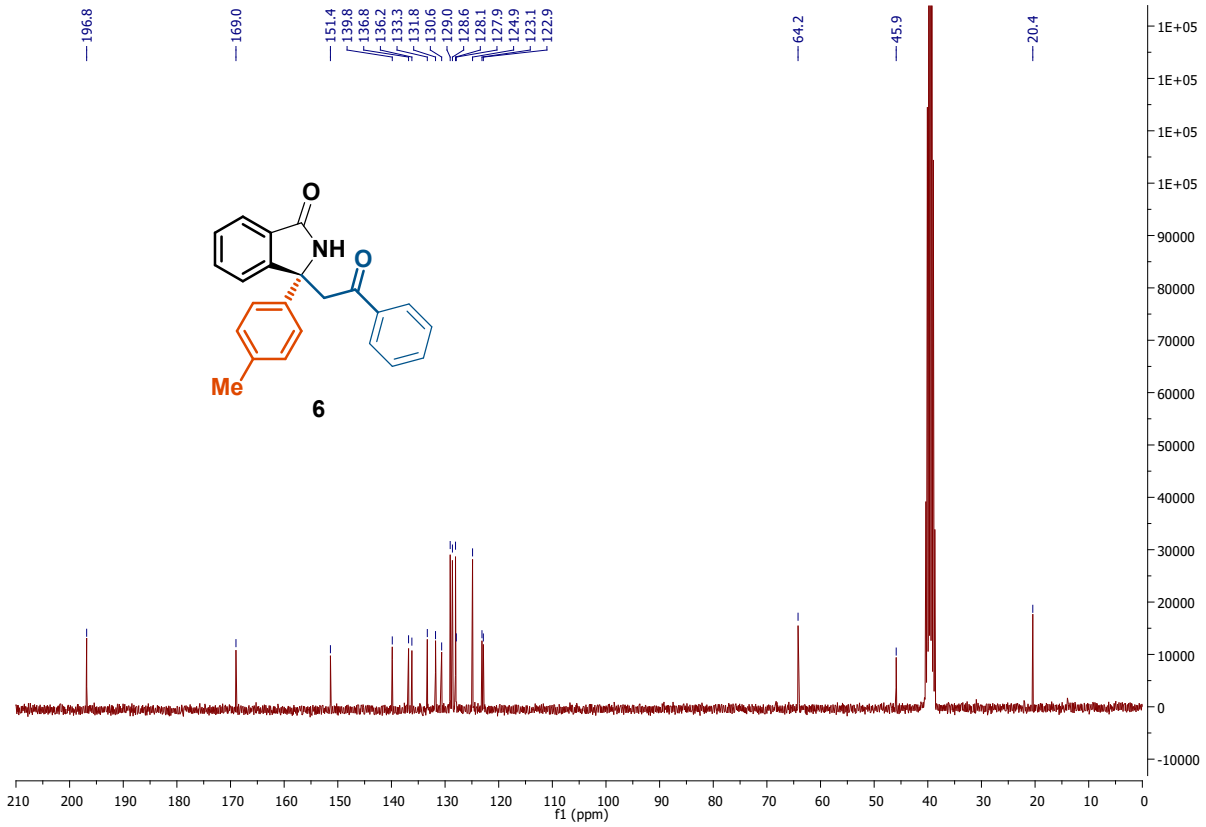
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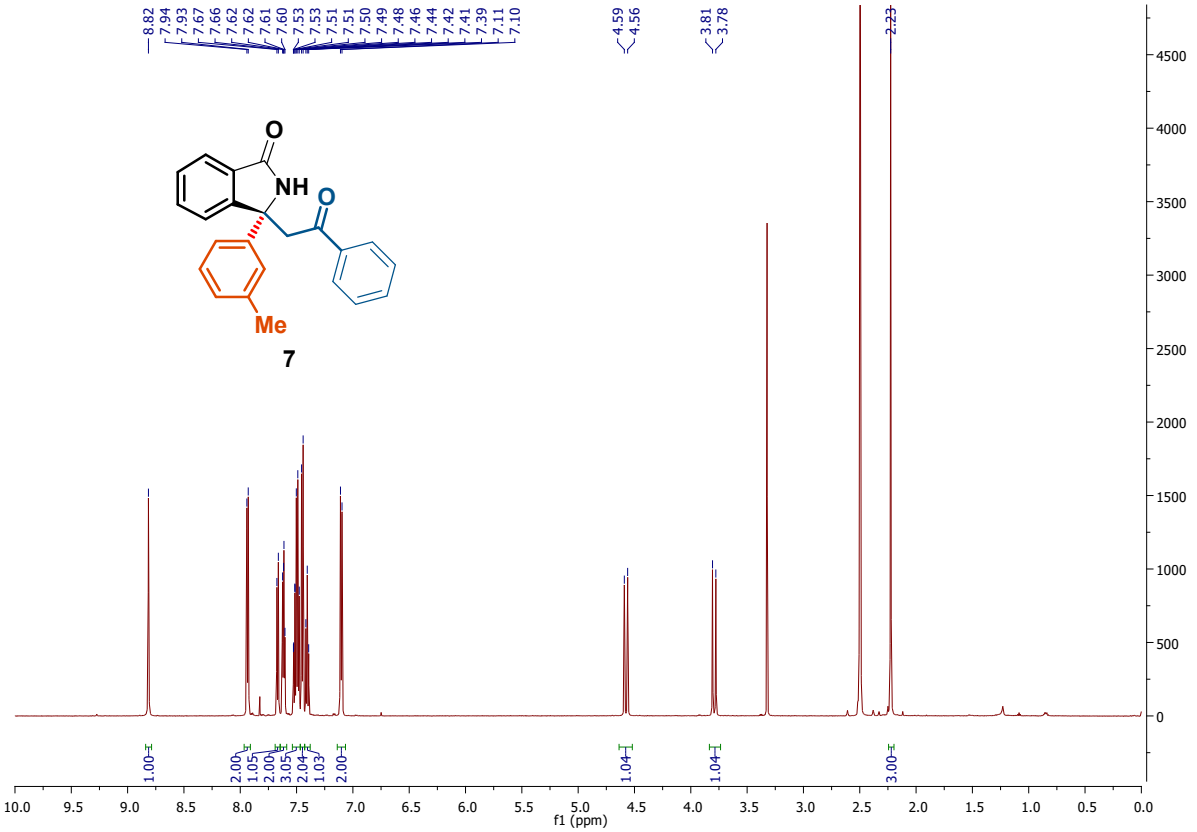
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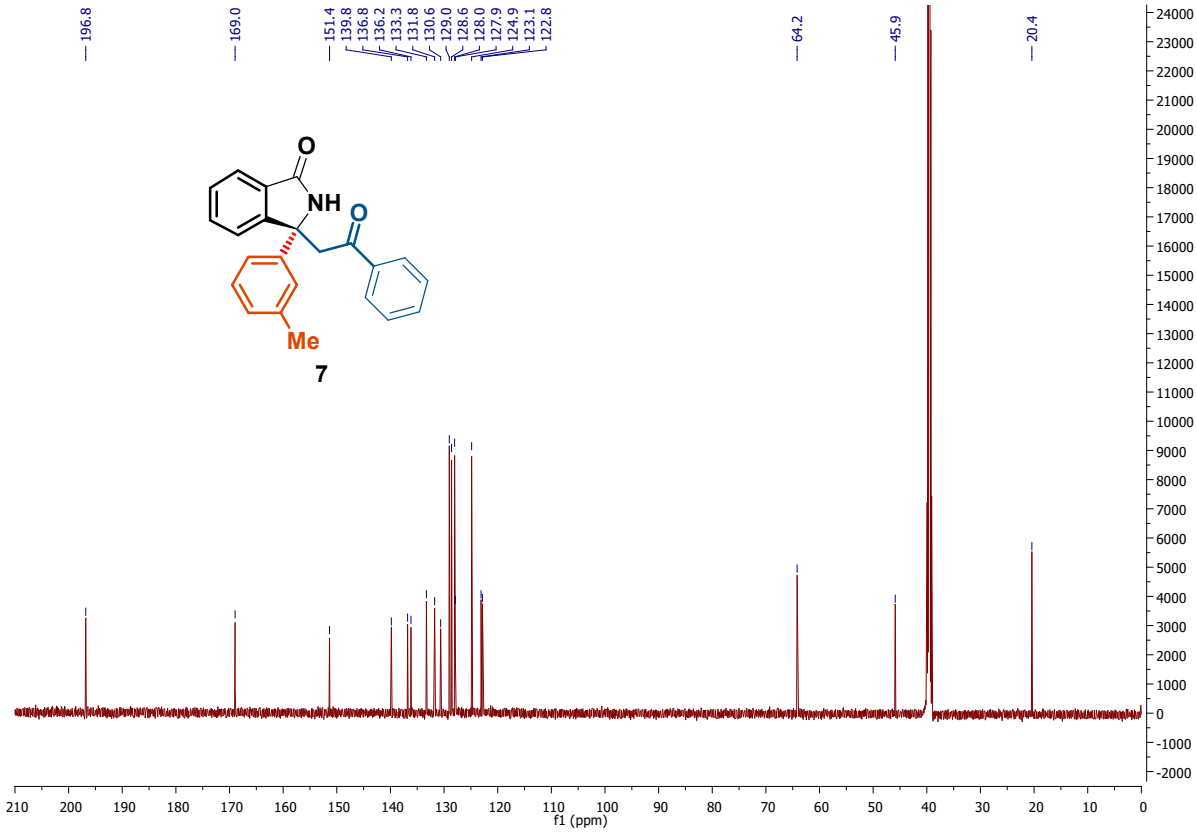
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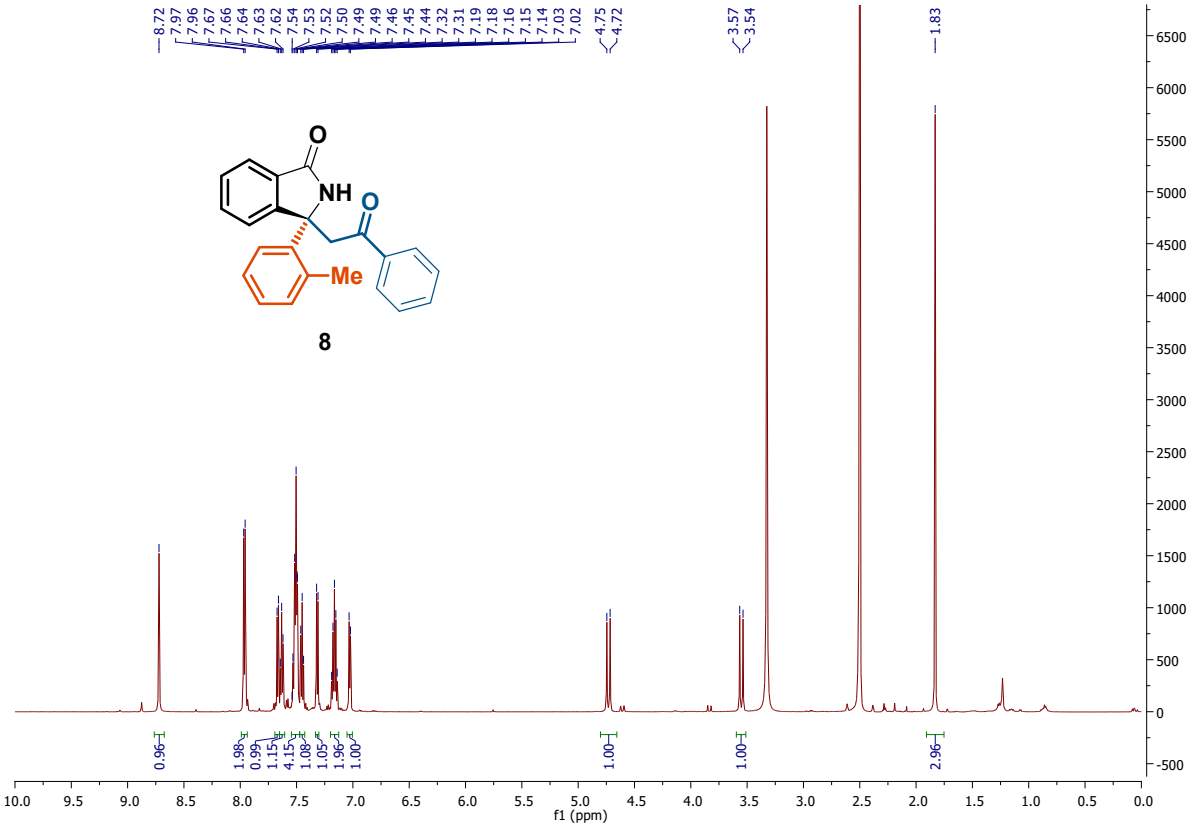
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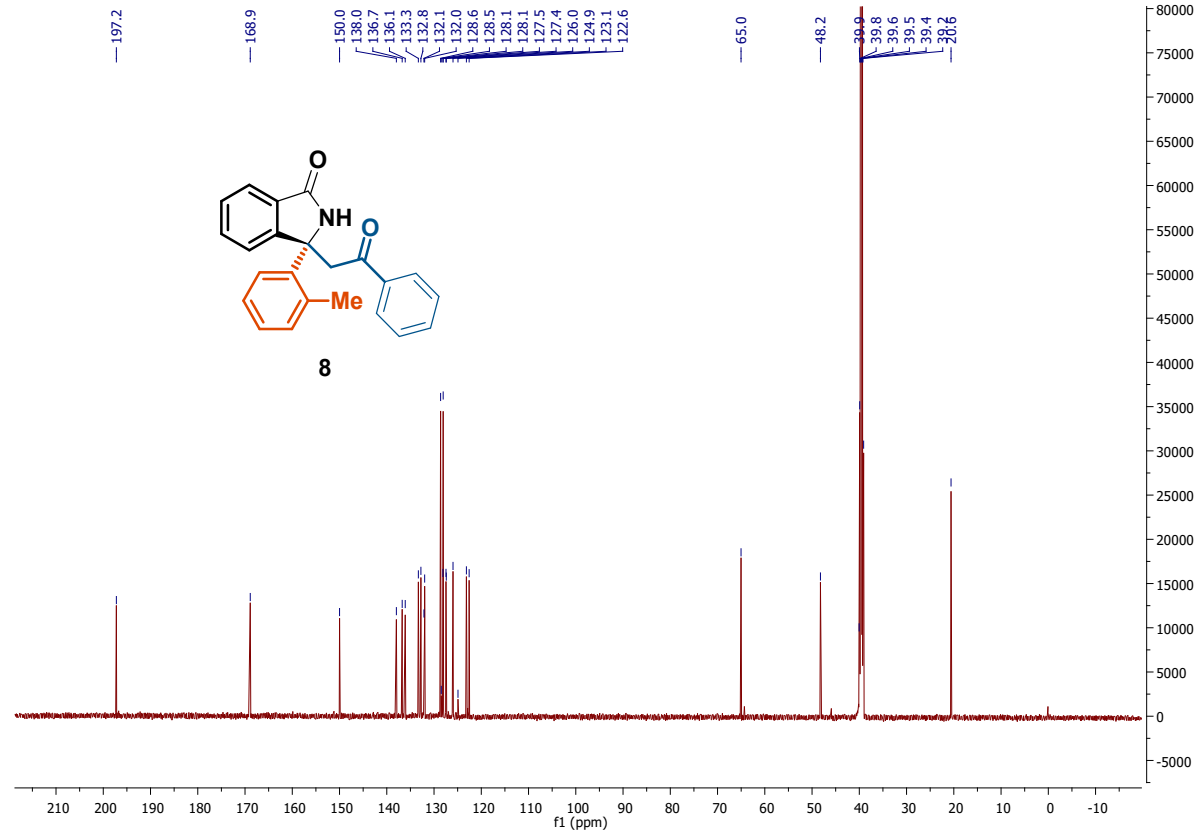
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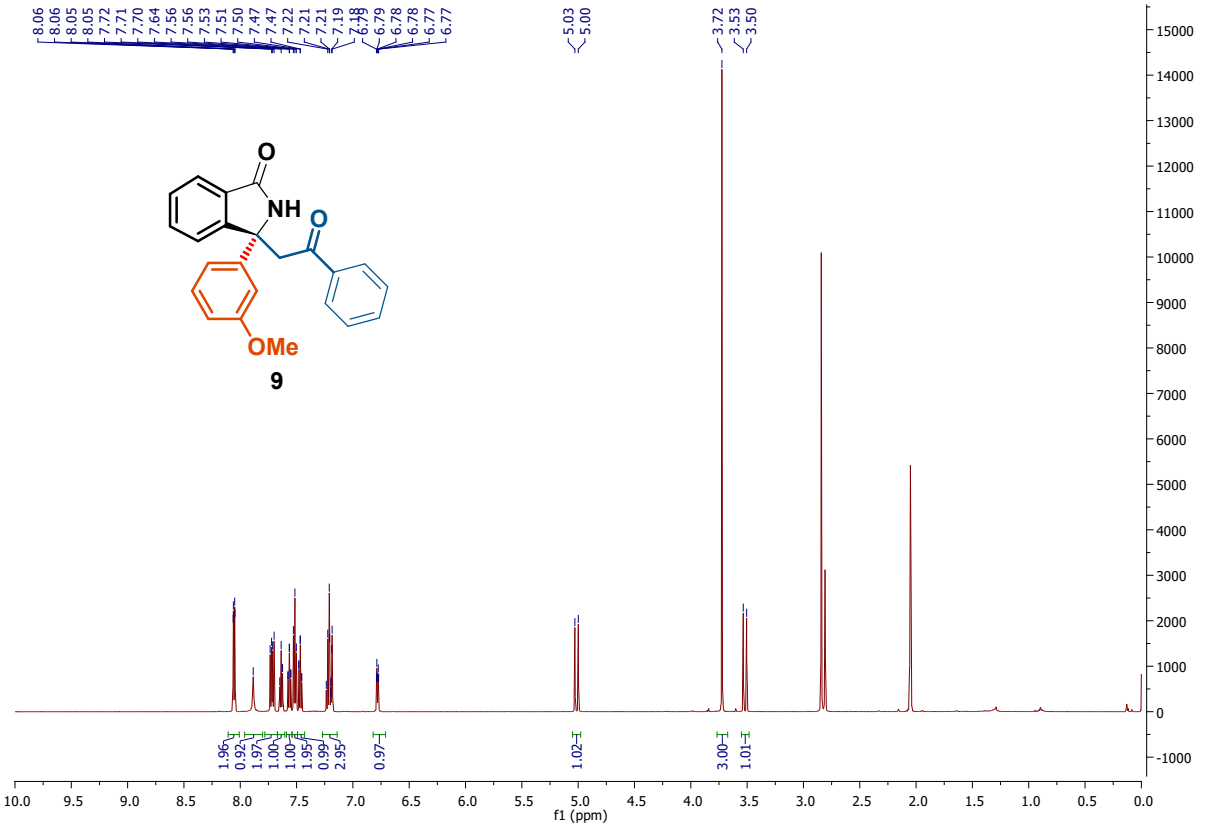
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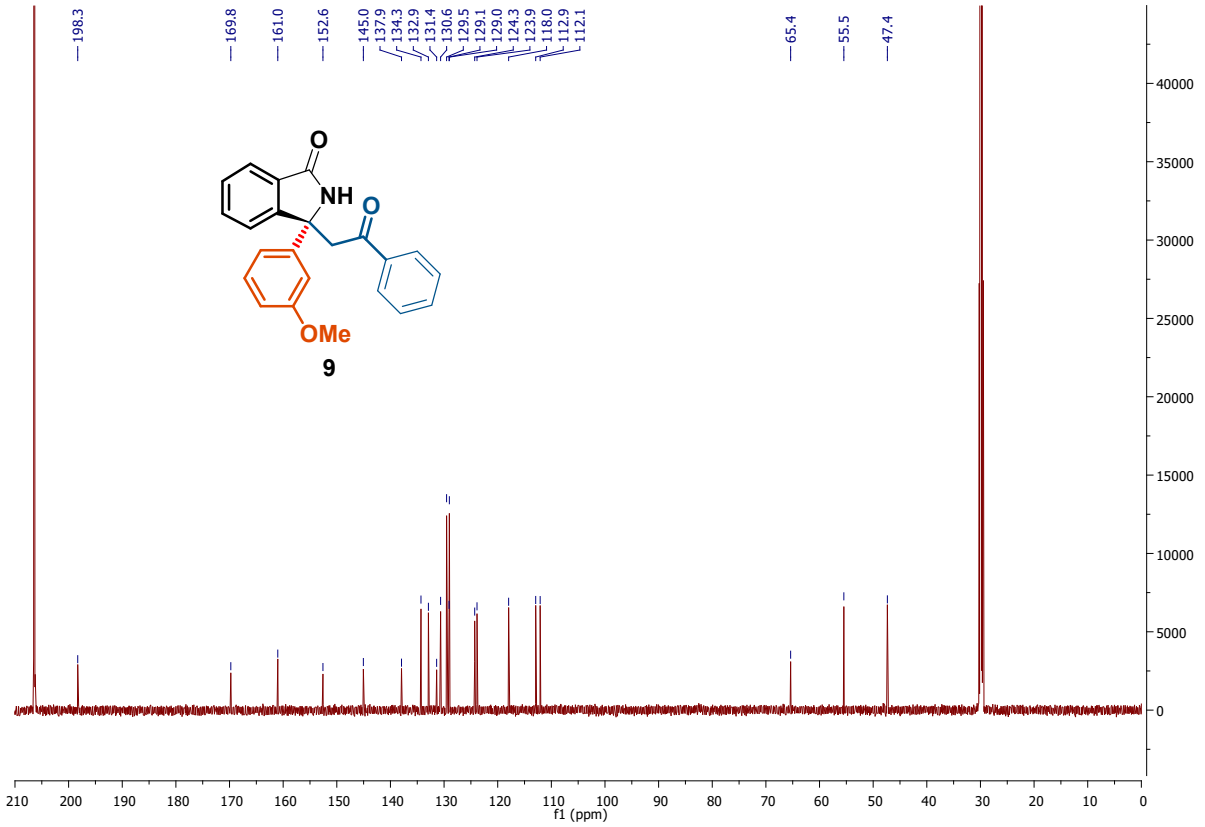
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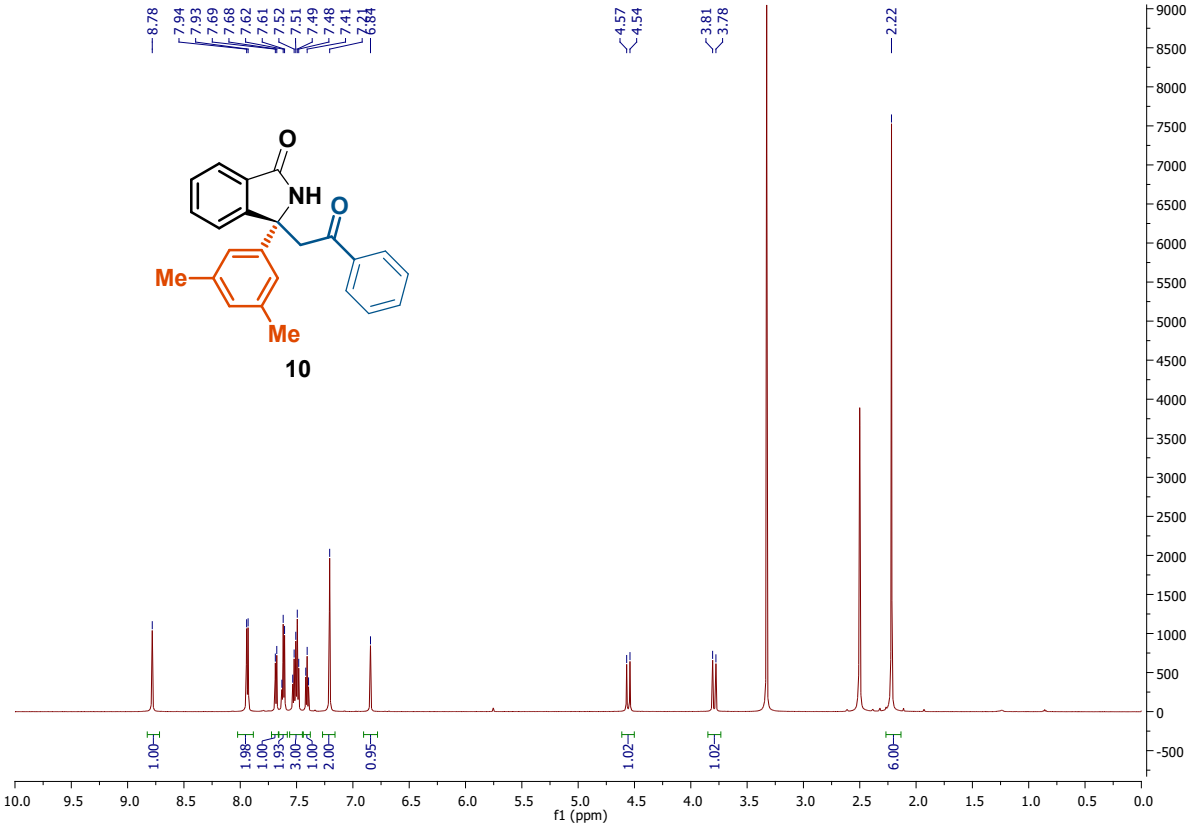
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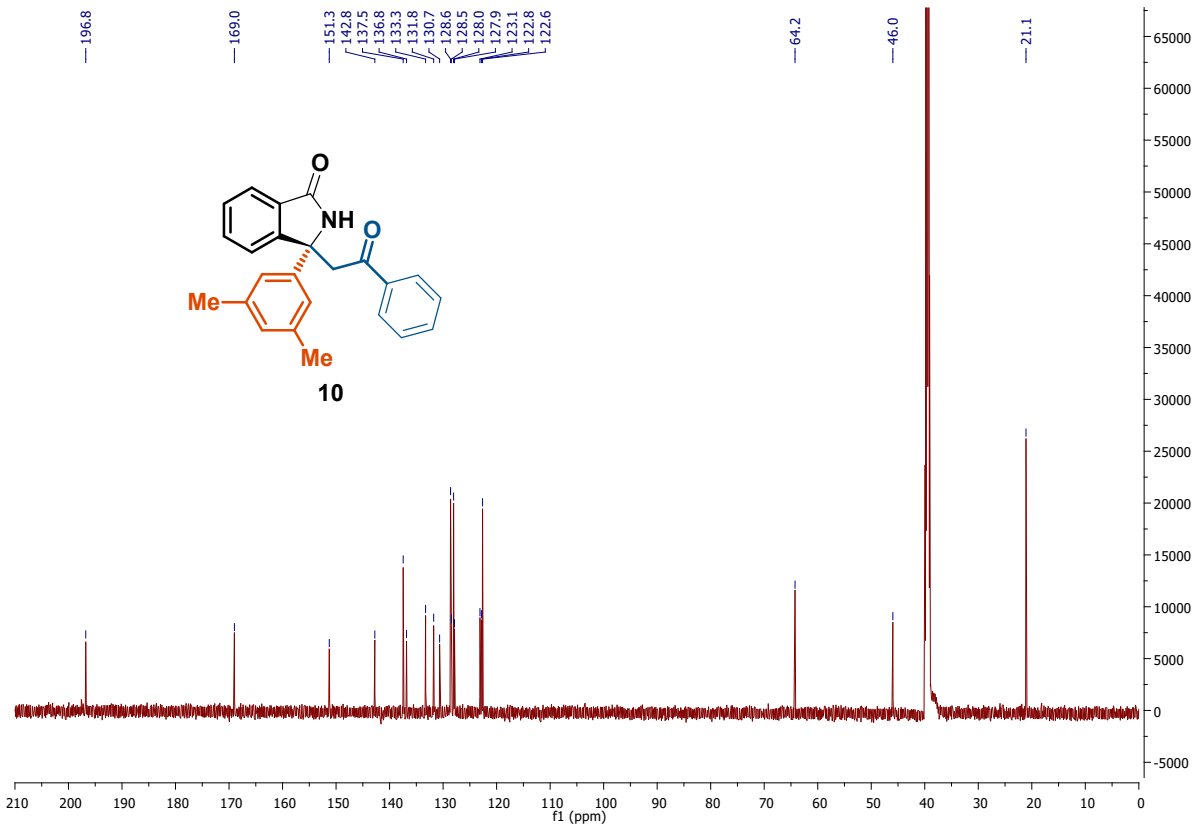
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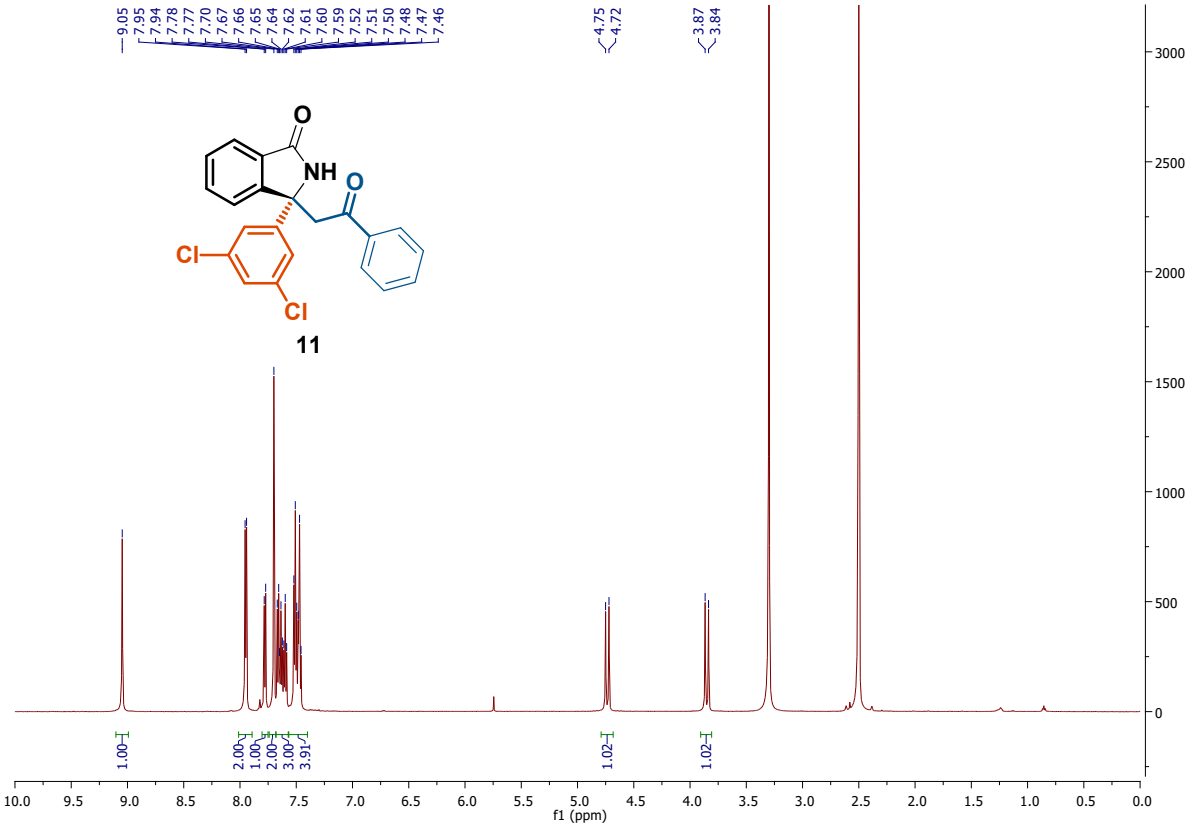
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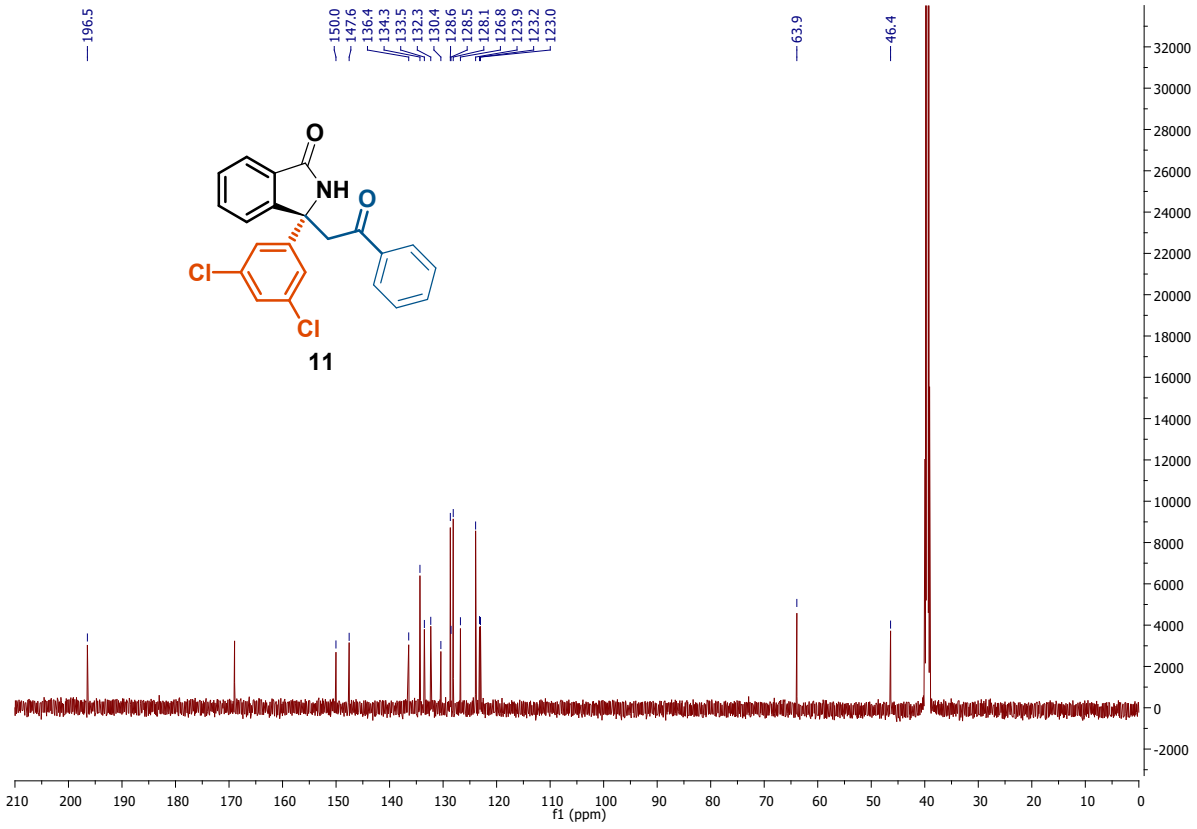
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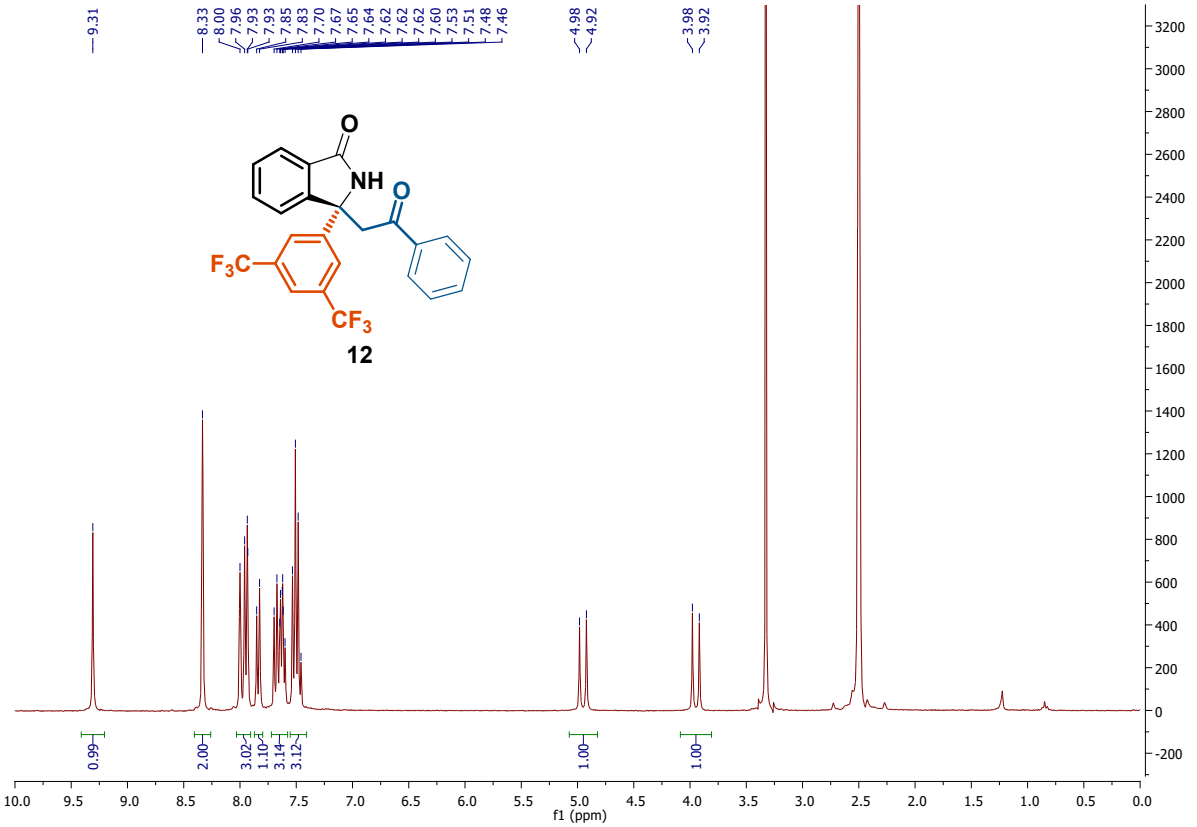
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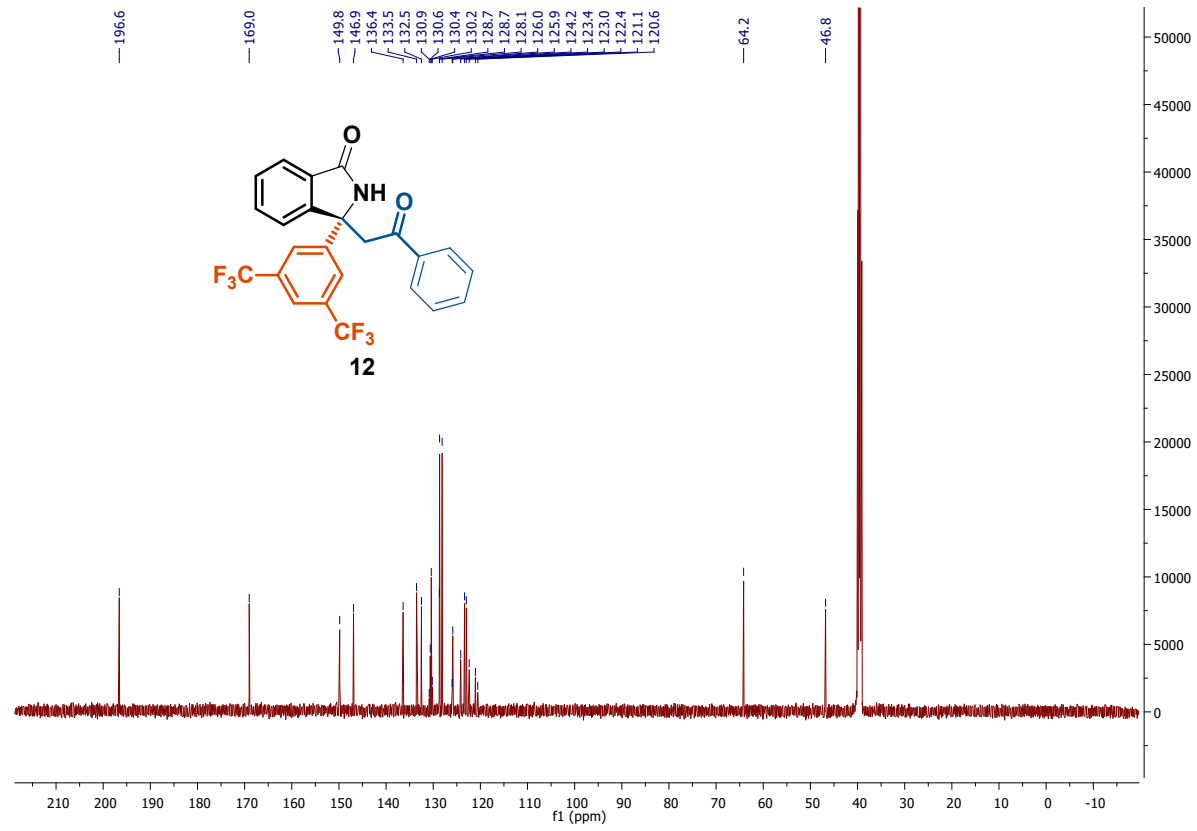
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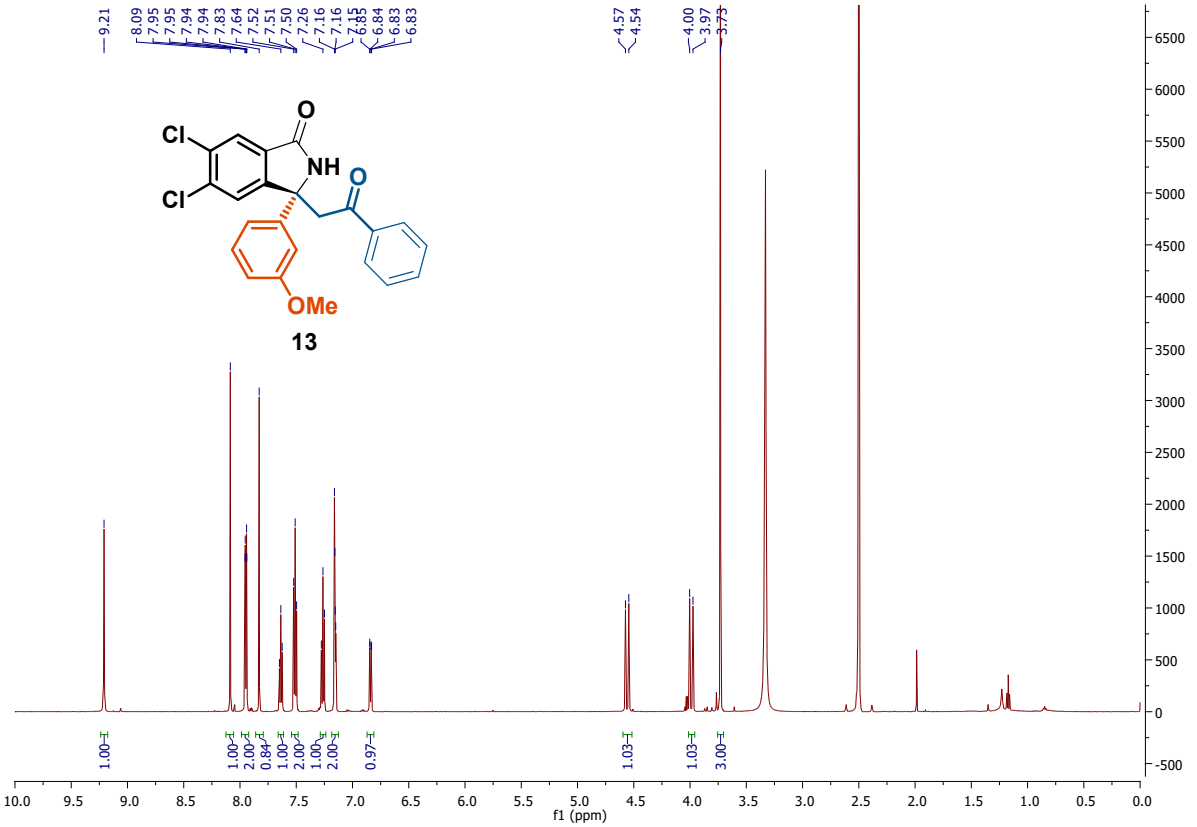
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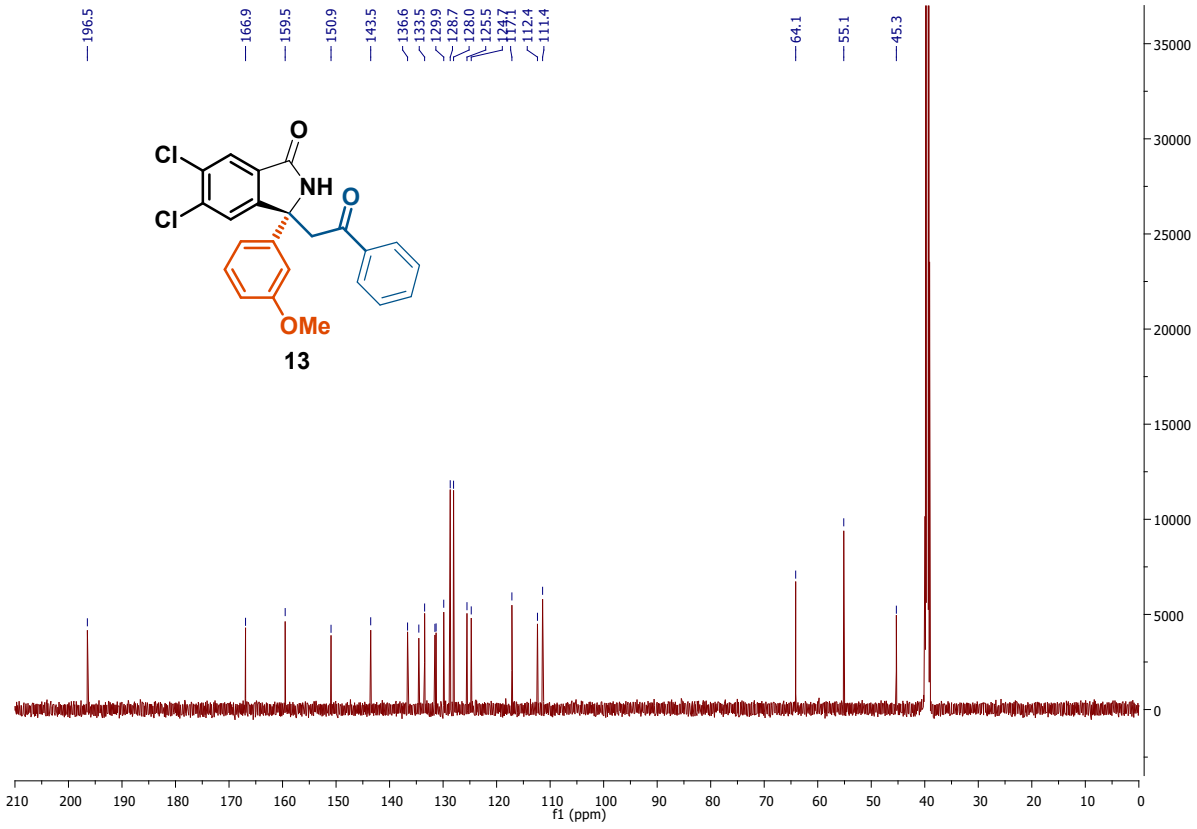
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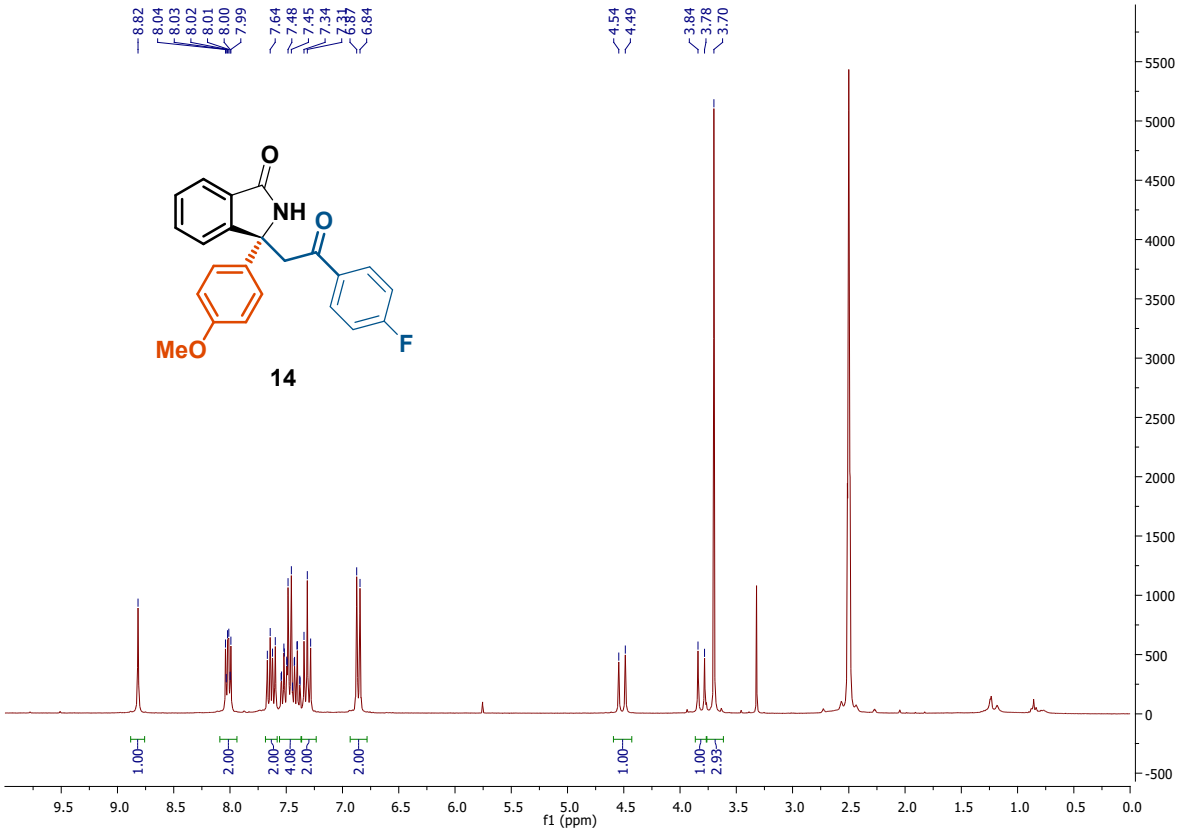
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7.48
7.45
7.34
7.31
6.87
6.84
4.54
4.49
3.84
3.78
3.70
O
NH
O
MeO
F
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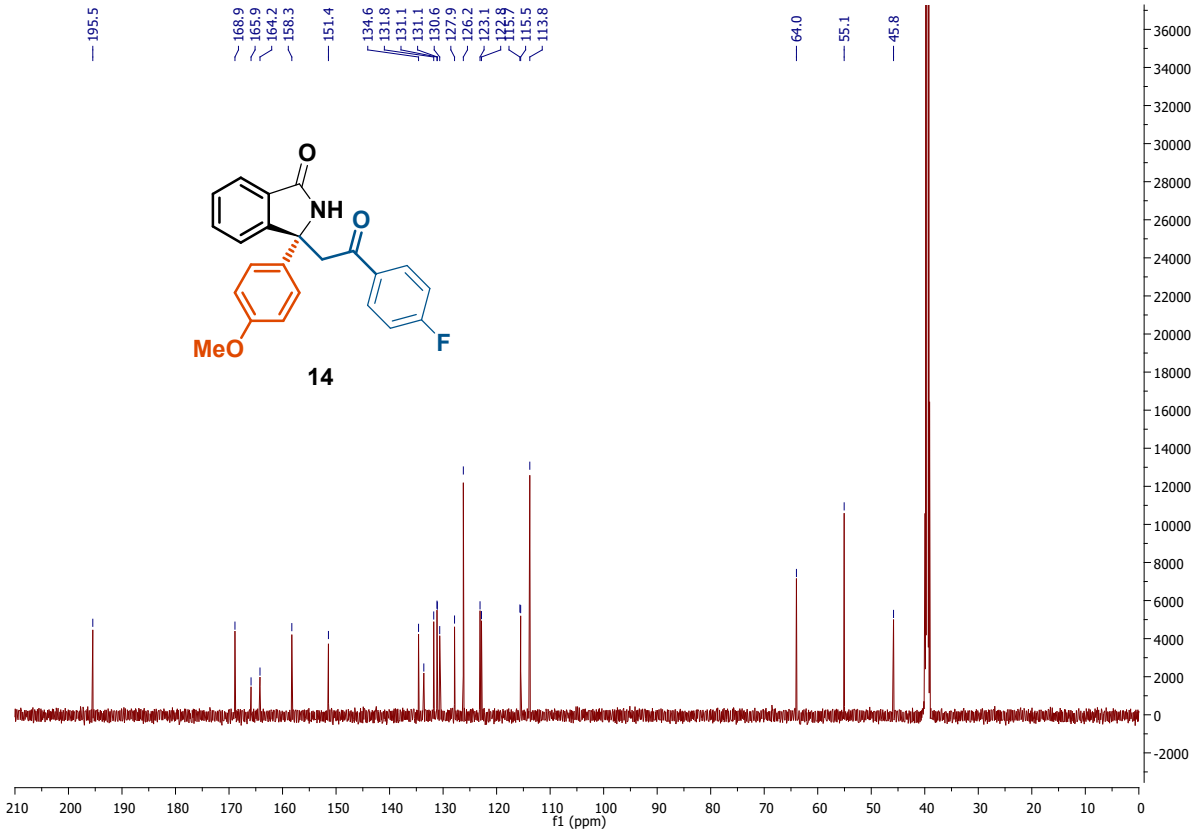
2.00
2.00
4.08
2.00
2.00
1.00
1.00
2.93
f1 (ppm)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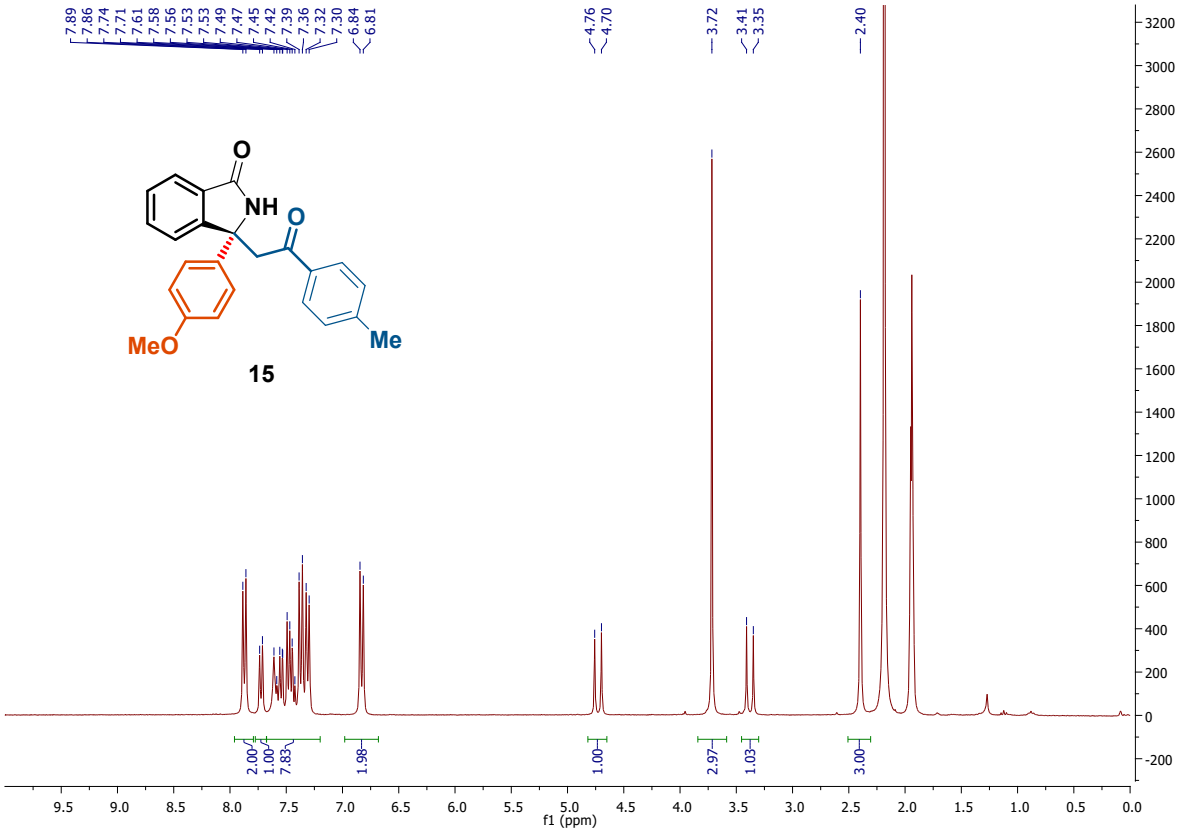
165.9
164.2
158.3
151.4
134.6
131.8
131.1
131.1
130.6
127.9
126.2
123.1
122.8
115.7
115.5
113.8
64.0
55.1
45.8
O
NH
O
MeO
F
14
f1 (ppm)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7.86
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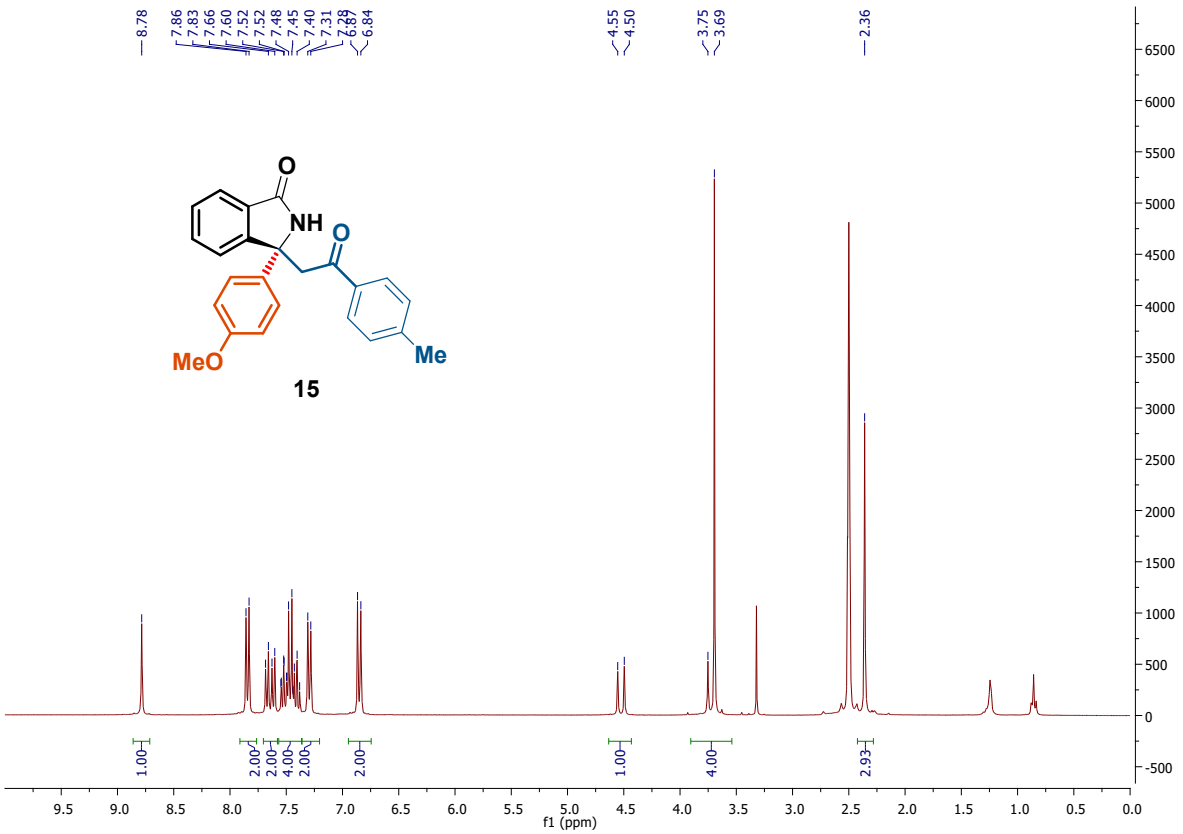
7.71
7.61
7.58
7.56
7.53
7.53
7.49
7.47
7.45
7.42
7.39
7.36
7.32
7.30
6.84
6.81
4.76
4.70
3.72
3.41
3.35
2.40
O
NH
O
MeO
Me
15
2.00
1.00
7.83
1.98
1.00
2.97
1.03
3.00
f1 (ppm)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7.86
7.83
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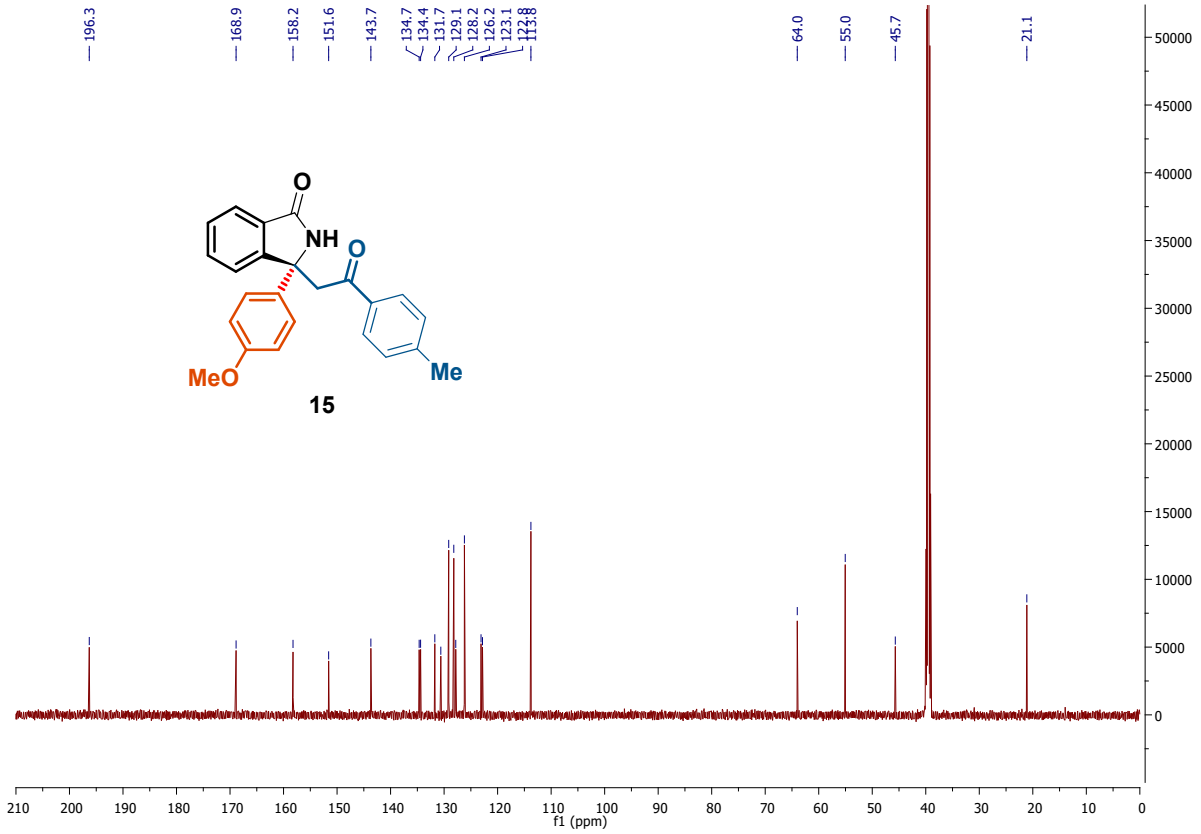
7.60
7.52
7.52
7.48
7.45
7.40
7.31
6.87
6.84
4.55
4.50
3.75
3.69
2.36
O
NH
O
MeO
Me
15
1.00
2.00
2.00
4.00
2.00
2.00
1.00
4.00
2.93
f1 (ppm)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143.7
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134.4
131.7
129.1
128.2
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123.1
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64.0
55.0
45.7
21.1
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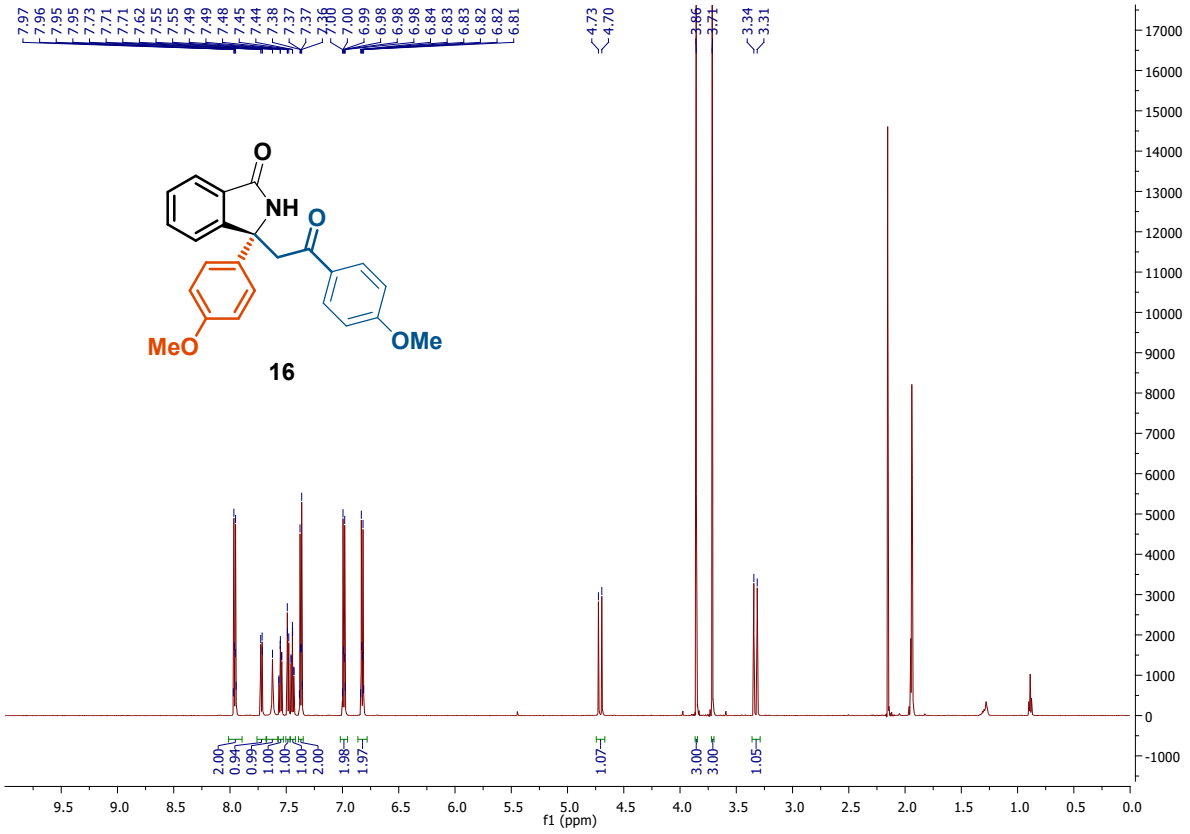
NH
O
MeO
Me
15
f1 (ppm)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7.71
7.71
7.62
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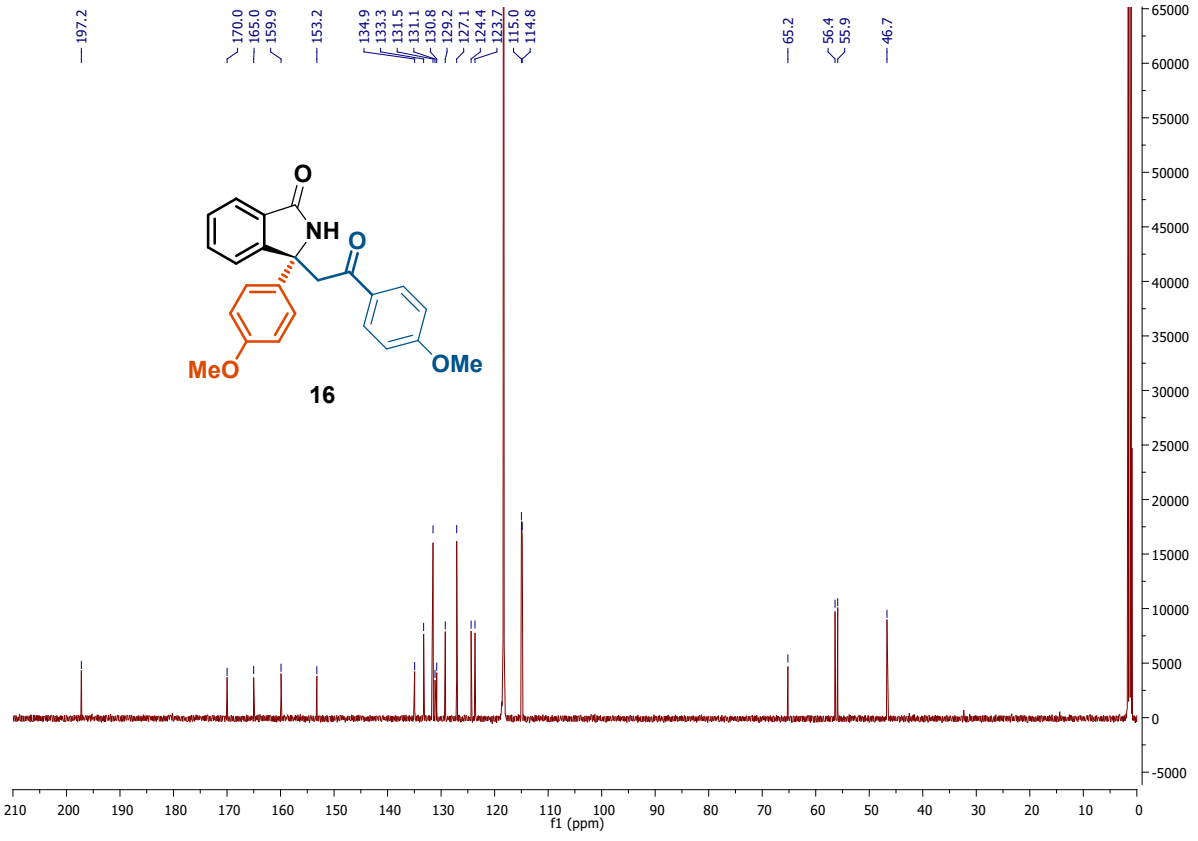
7.55
7.49
7.49
7.48
7.45
7.44
7.38
7.37
7.37
7.36
7.00
6.99
6.98
6.98
6.84
6.83
6.83
6.82
6.82
6.81
4.73
4.70
3.86
3.71
3.34
3.31
O
NH
O
MeO
OMe
16
2.00
0.94
0.99
1.00
1.00
1.00
2.00
1.98
1.97
1.07
3.00
3.00
1.05
f1 (ppm)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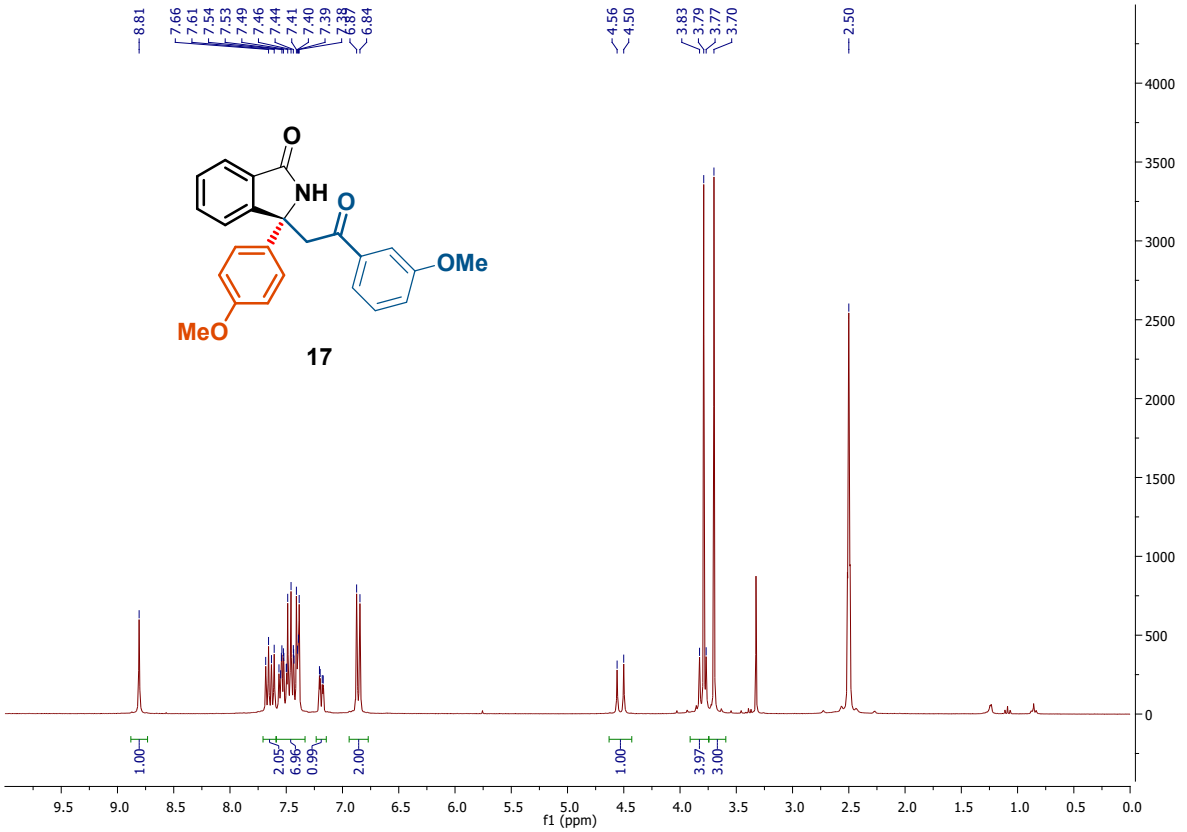
159.9
153.2
134.9
133.3
131.5
131.1
130.8
129.2
127.1
124.4
123.7
115.0
114.8
65.2
56.4
55.9
46.7
O
NH
O
MeO
OMe
16
f1 (ppm)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7.53
7.49
7.46
7.44
7.41
7.40
7.39
7.38
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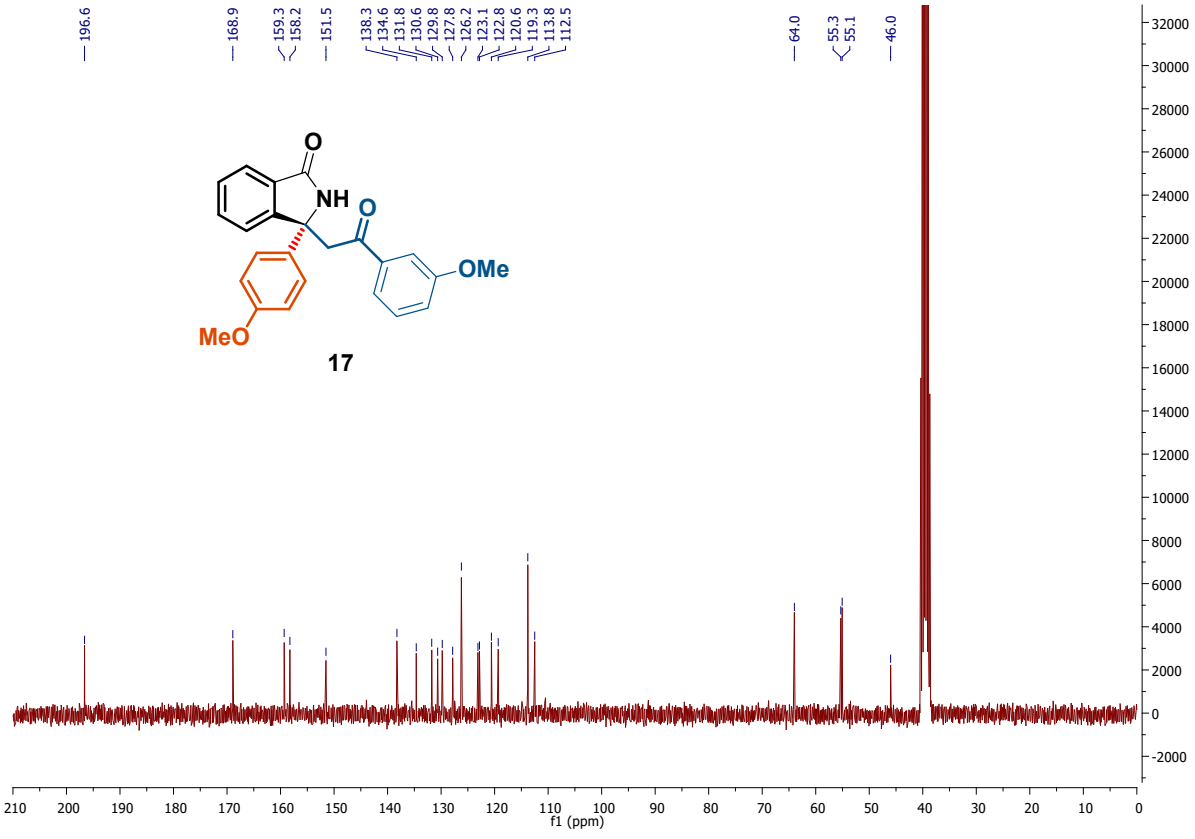
6.84
4.56
4.50
3.83
3.79
3.77
3.70
2.50
O
NH
O
OMe
MeO
17
1.00
2.05
6.96
0.99
2.00
1.00
3.97
3.00
f1 (ppm)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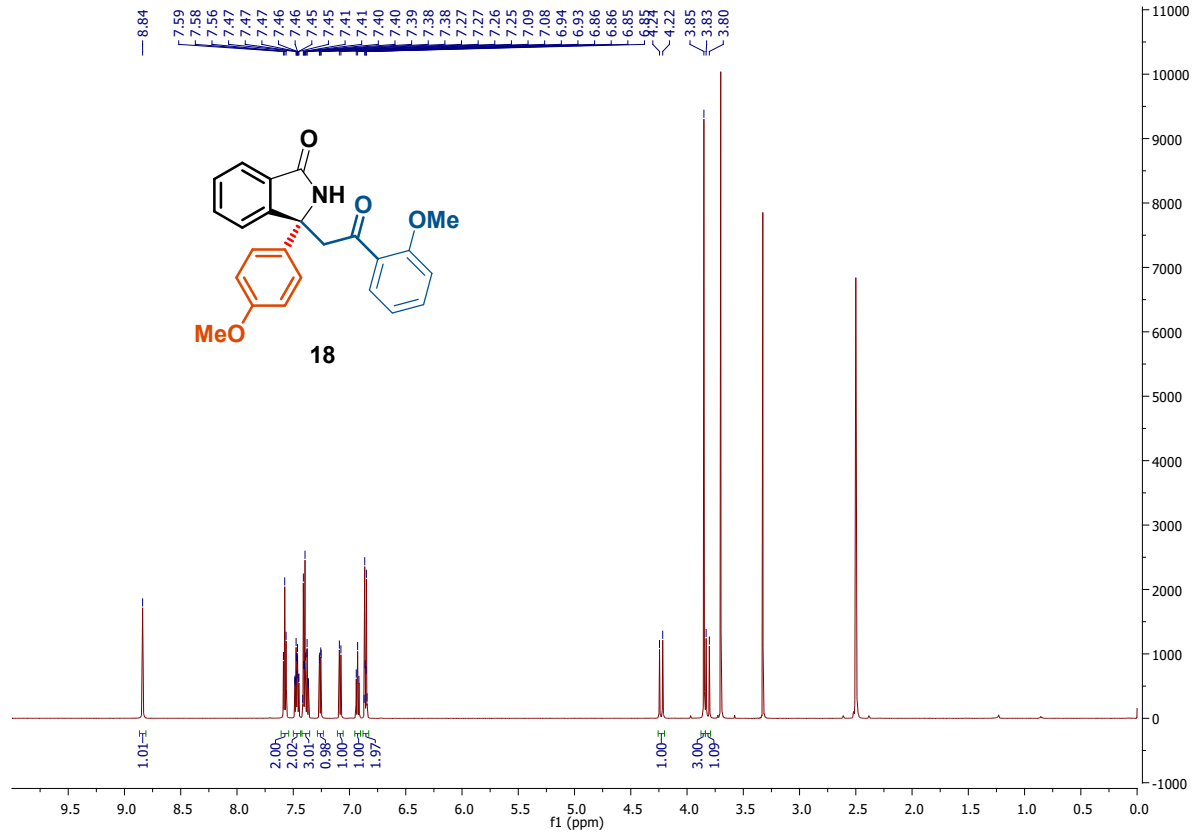
158.2
151.5
138.3
134.6
131.8
130.6
129.8
127.8
126.2
123.1
122.8
120.6
119.3
113.8
112.5
64.0
55.3
55.1
46.0
O
NH
O
OMe
MeO
17
f1 (ppm)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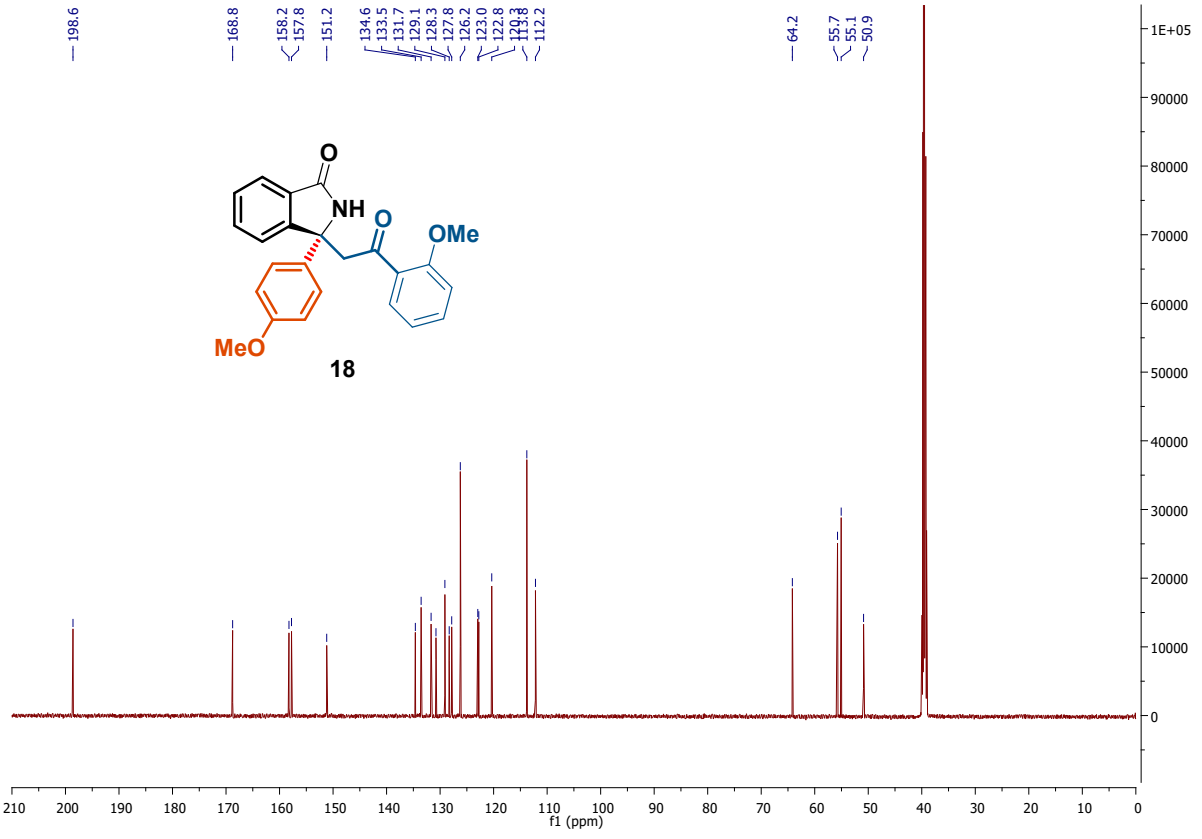
7.47
7.46
7.46
7.45
7.45
7.41
7.41
7.40
7.40
7.39
7.38
7.38
7.27
7.27
7.26
7.25
7.09
7.08
6.94
6.93
6.86
6.86
6.85
6.85
4.24
4.22
3.85
3.83
3.80
O
NH
O
OMe
MeO
18
1.01
2.00
2.02
3.01
0.98
1.00
1.00
1.97
1.00
3.00
1.09
f1 (ppm)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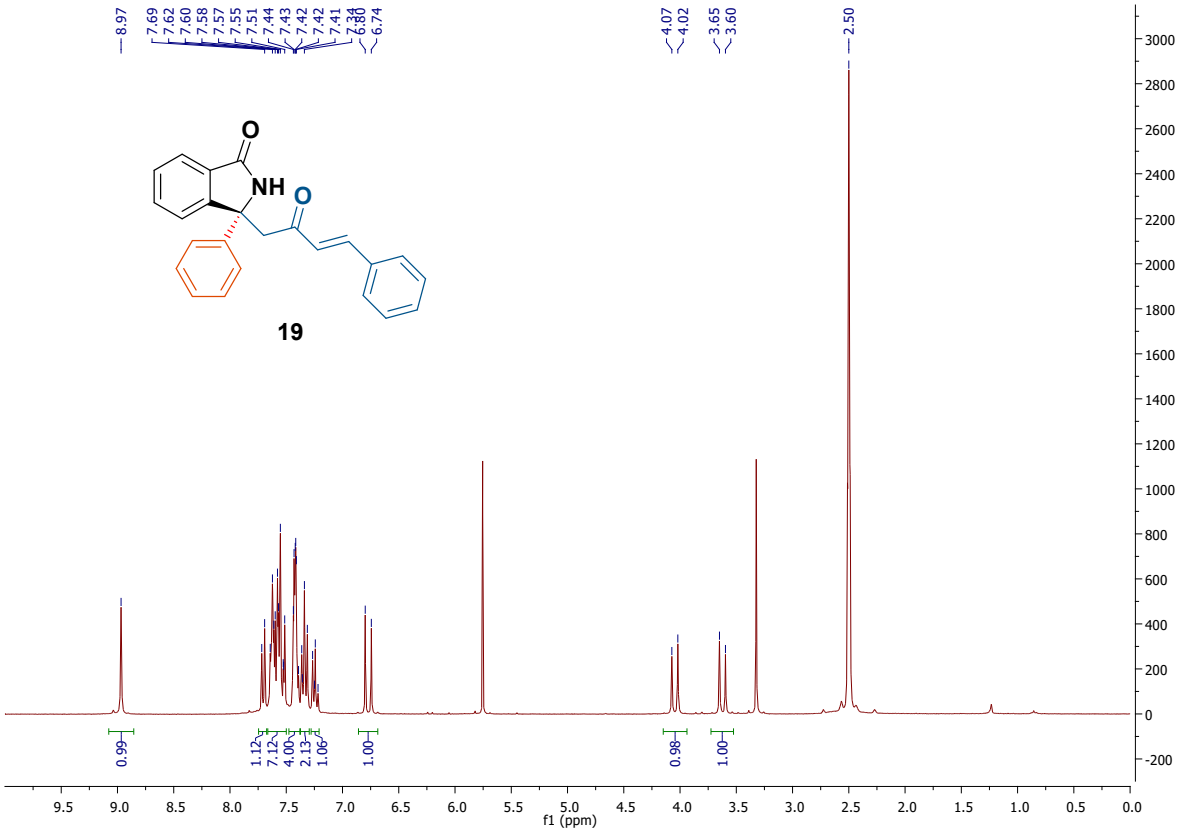
168.8
158.2
157.8
151.2
134.6
133.5
131.7
129.1
128.3
127.8
126.2
123.0
122.8
112.2
64.2
55.7
55.1
50.9
O
NH
O
OMe
MeO
18
f1 (ppm)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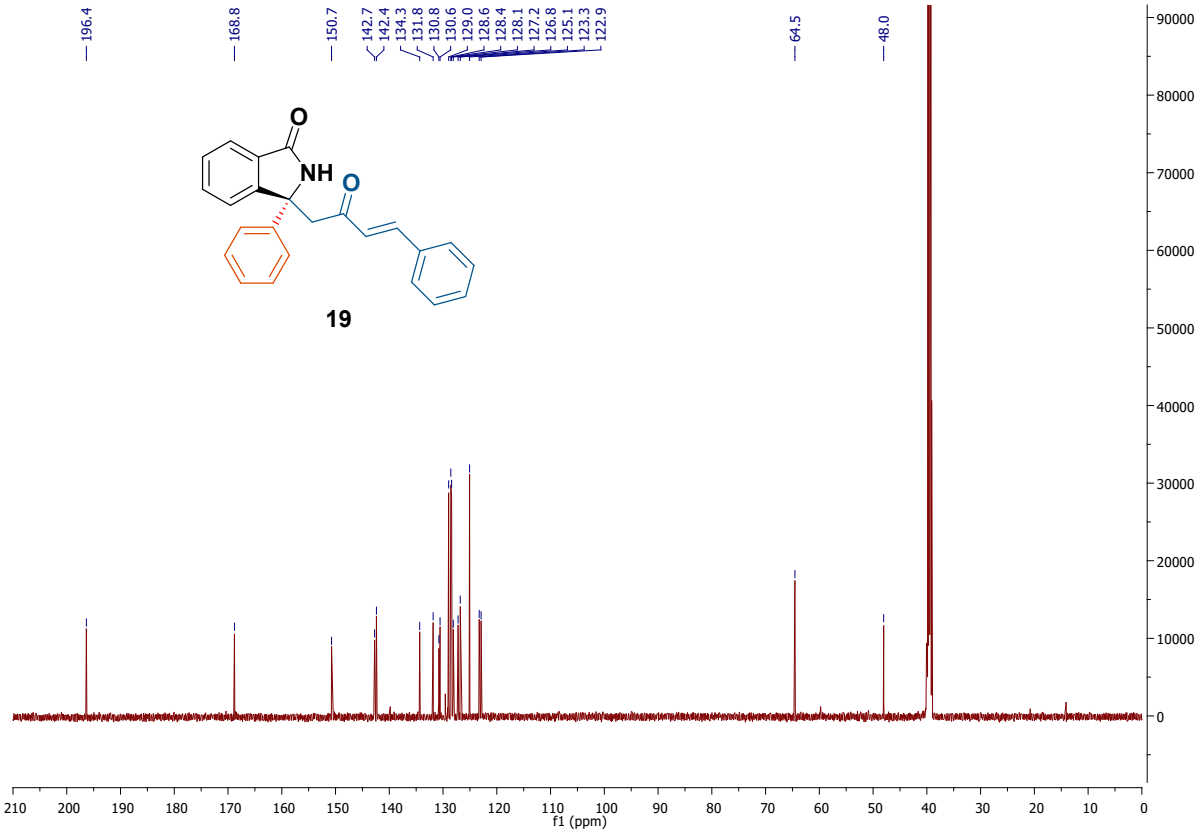
7.58
7.57
7.55
7.51
7.44
7.43
7.42
7.42
7.41
7.34
6.80
6.74
4.07
4.02
3.65
3.60
2.50
O
NH
O
19
0.99
1.12
7.12
4.00
2.13
1.06
1.00
0.98
1.00
f1 (ppm)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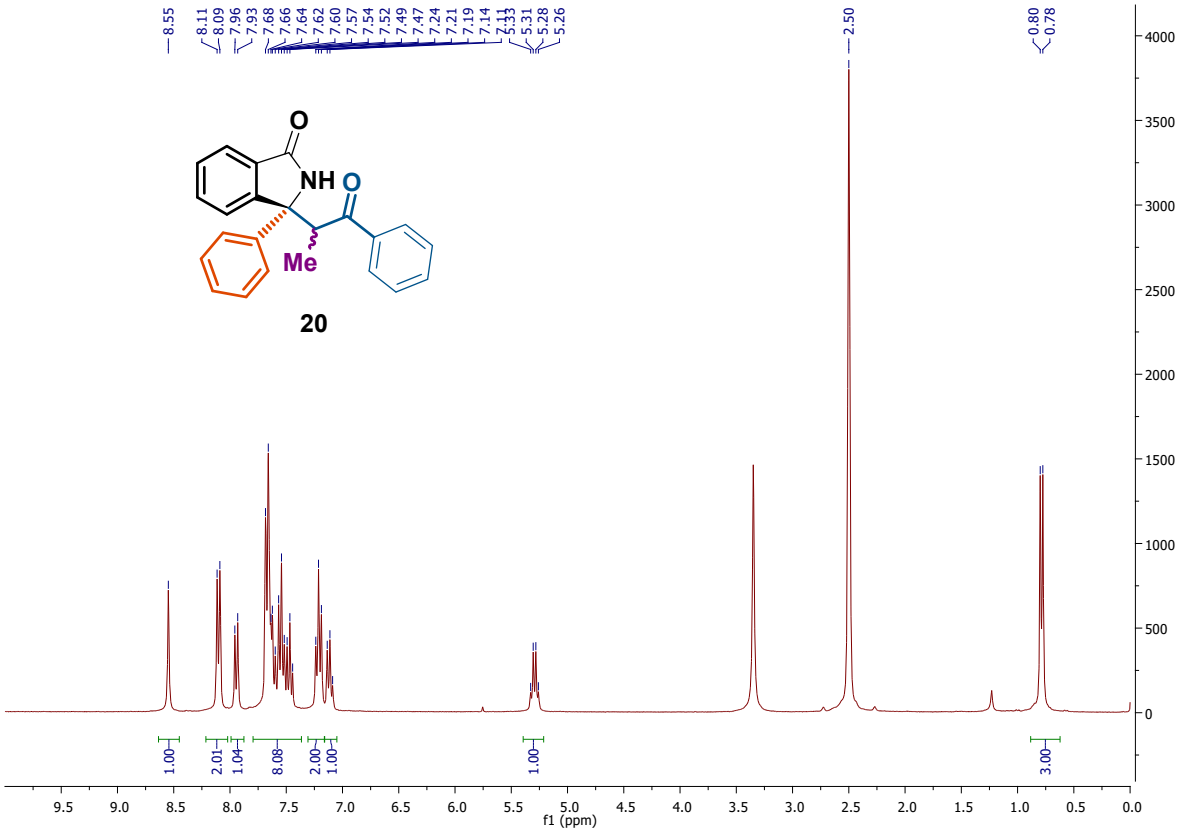
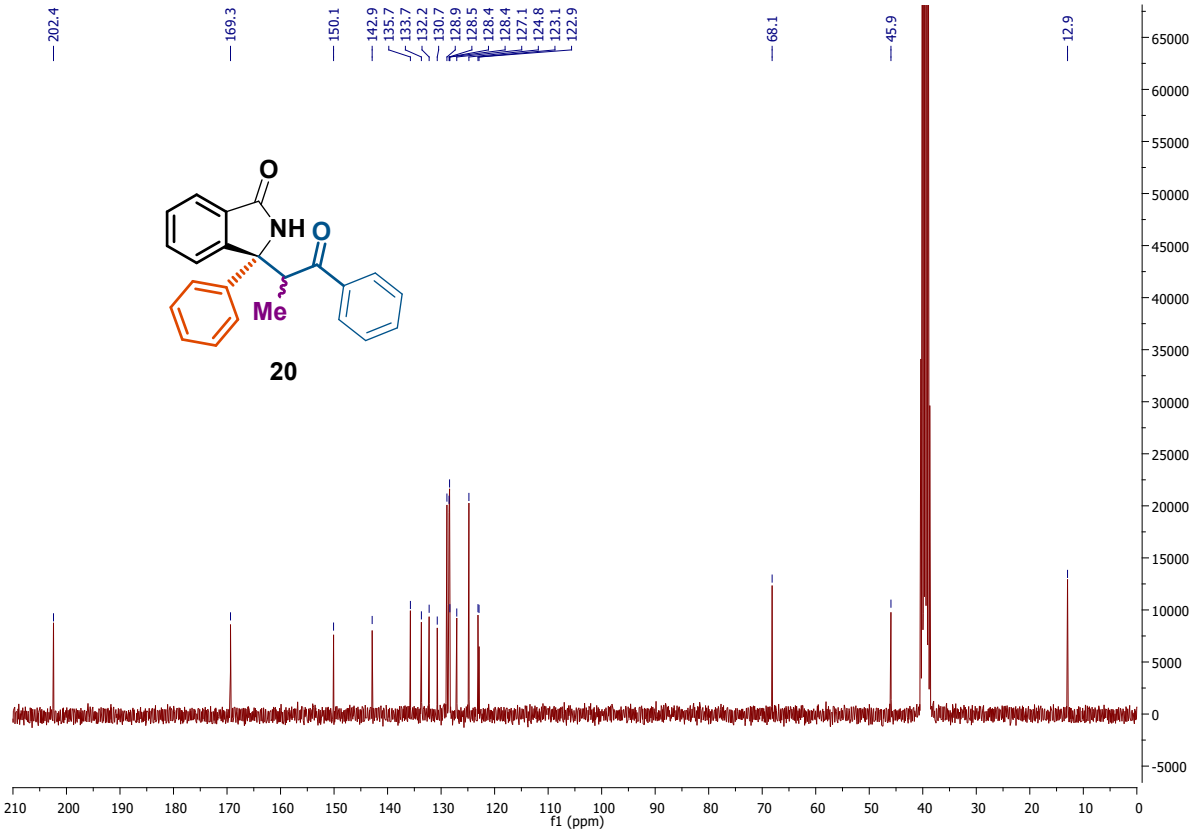
168.8
150.7
142.7
142.4
134.3
131.8
130.8
130.6
129.0
128.6
128.4
128.1
127.2
126.8
125.1
123.3
122.9
64.5
48.0
O
NH
O
19
f1 (ppm)


8.55
8.11
8.09
7.96
7.93
7.68
7.66
7.64
7.62
7.60
7.57
7.54
7.52
7.49
7.47
7.24
7.21
7.19
7.14
7.11
5.33
5.31
5.28
5.26
2.50
0.80
0.78
O
NH
O
Me
20
1.00
2.01
1.04
8.08
2.00
1.00
1.00
3.00
f1 (ppm)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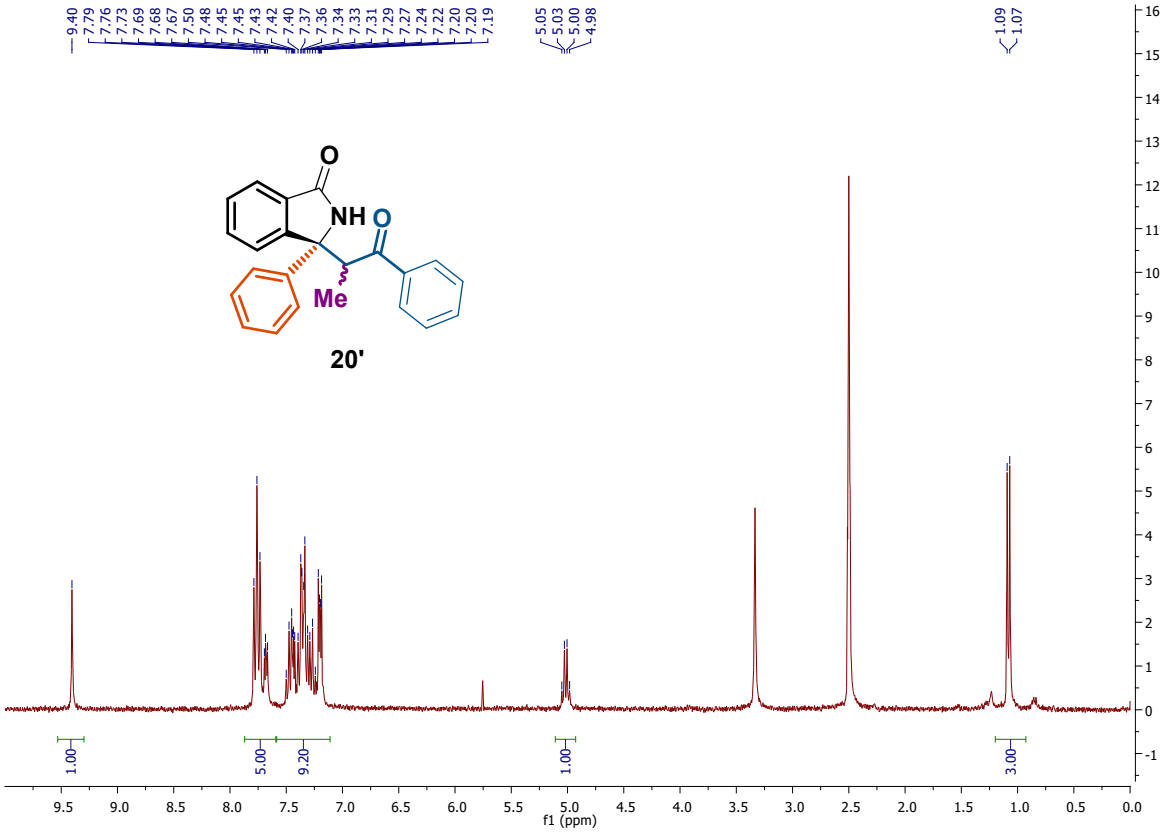
169.3
150.1
142.9
135.7
133.7
132.2
130.7
128.9
128.5
128.4
128.4
127.1
124.8
123.1
122.9
68.1
45.9
12.9
O
NH
O
Me
20
f1 (ppm)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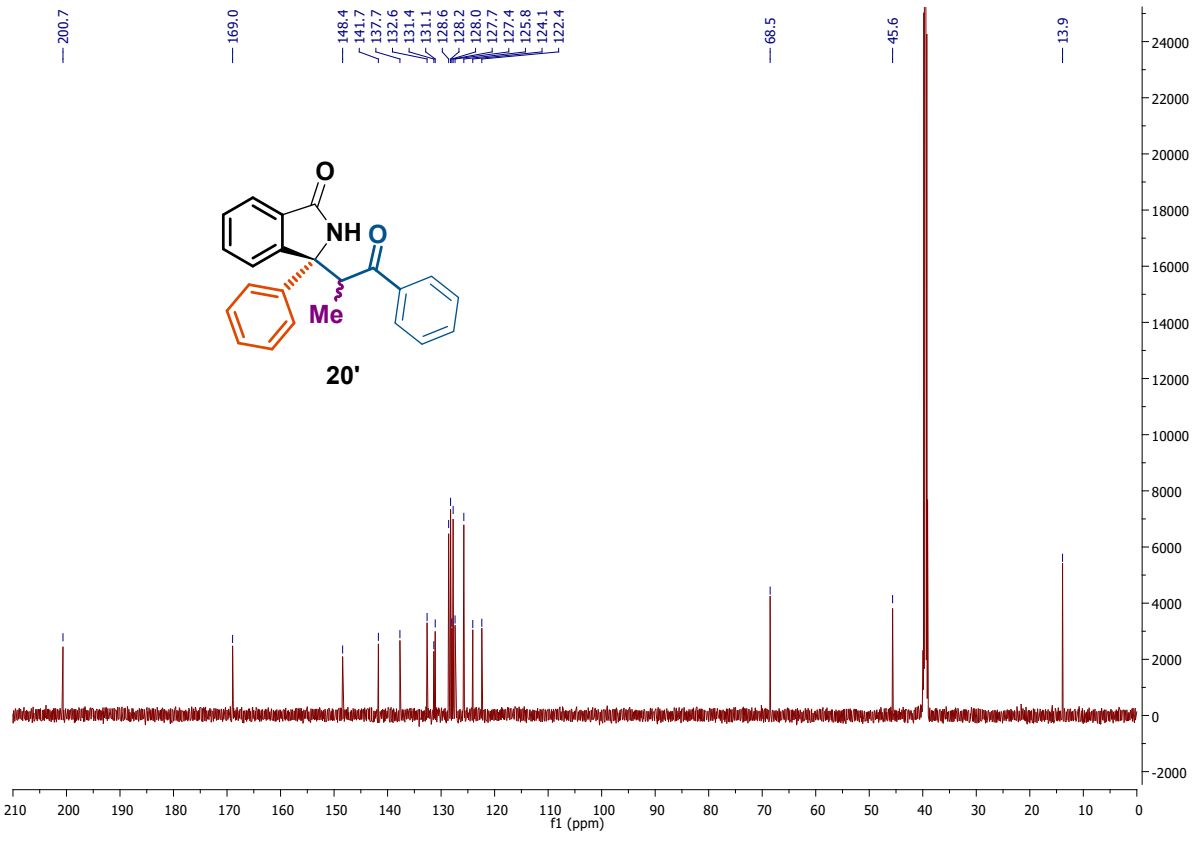
7.68
7.67
7.50
7.48
7.45
7.45
7.43
7.42
7.40
7.37
7.36
7.34
7.33
7.31
7.29
7.27
7.24
7.22
7.20
7.20
7.19
5.05
5.03
5.00
4.98
1.09
1.07
O
NH
O
Me
20'
1.00
5.00
9.20
1.00
3.00
f1 (ppm)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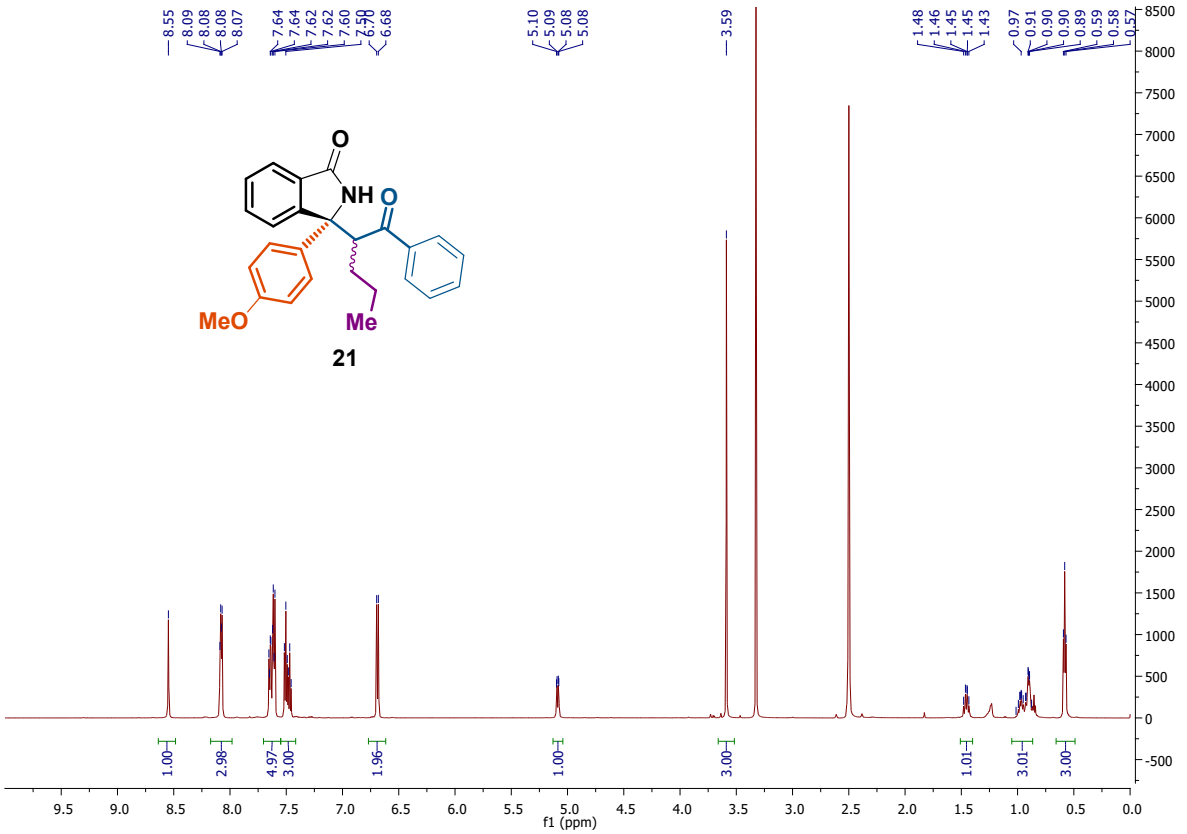
169.0
148.4
141.7
137.7
132.6
131.4
131.1
128.6
128.2
128.0
127.7
127.4
125.8
124.1
122.4
68.5
45.6
13.9
O
NH
O
Me
20'
f1 (ppm)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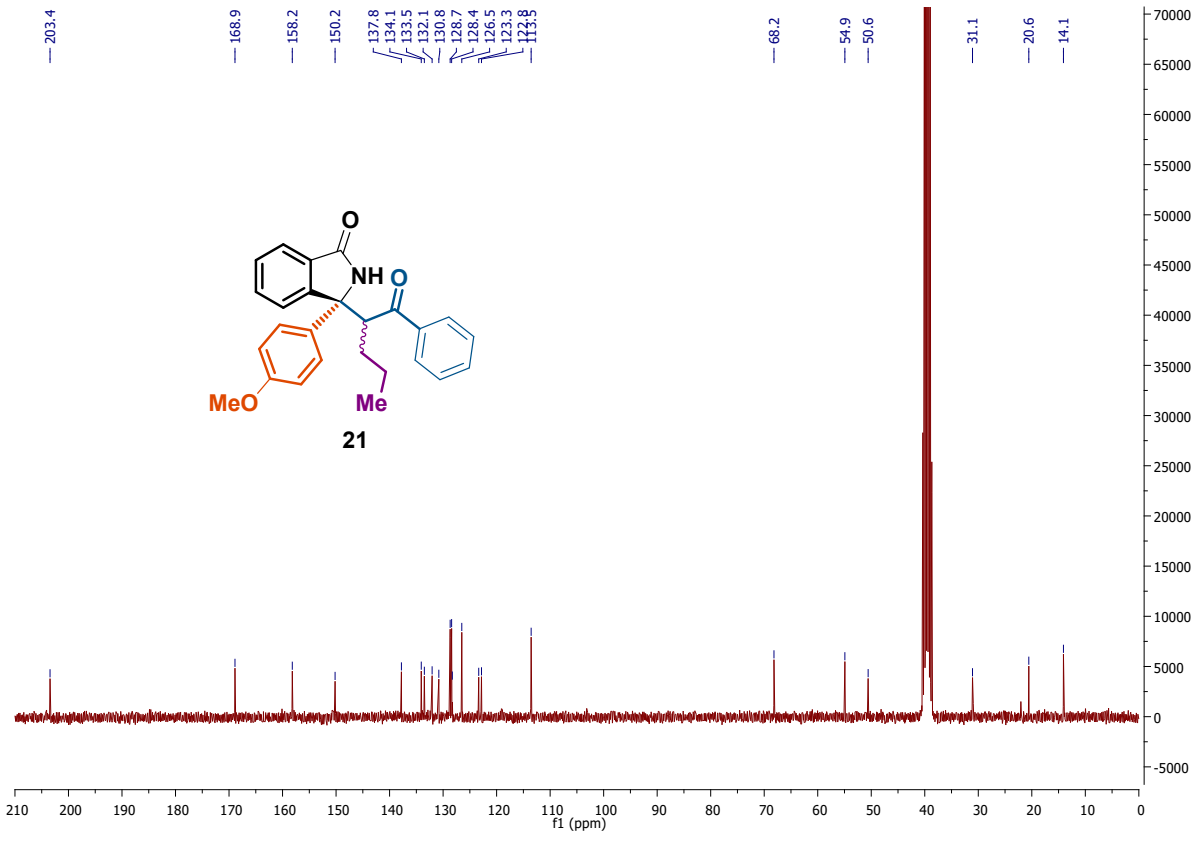
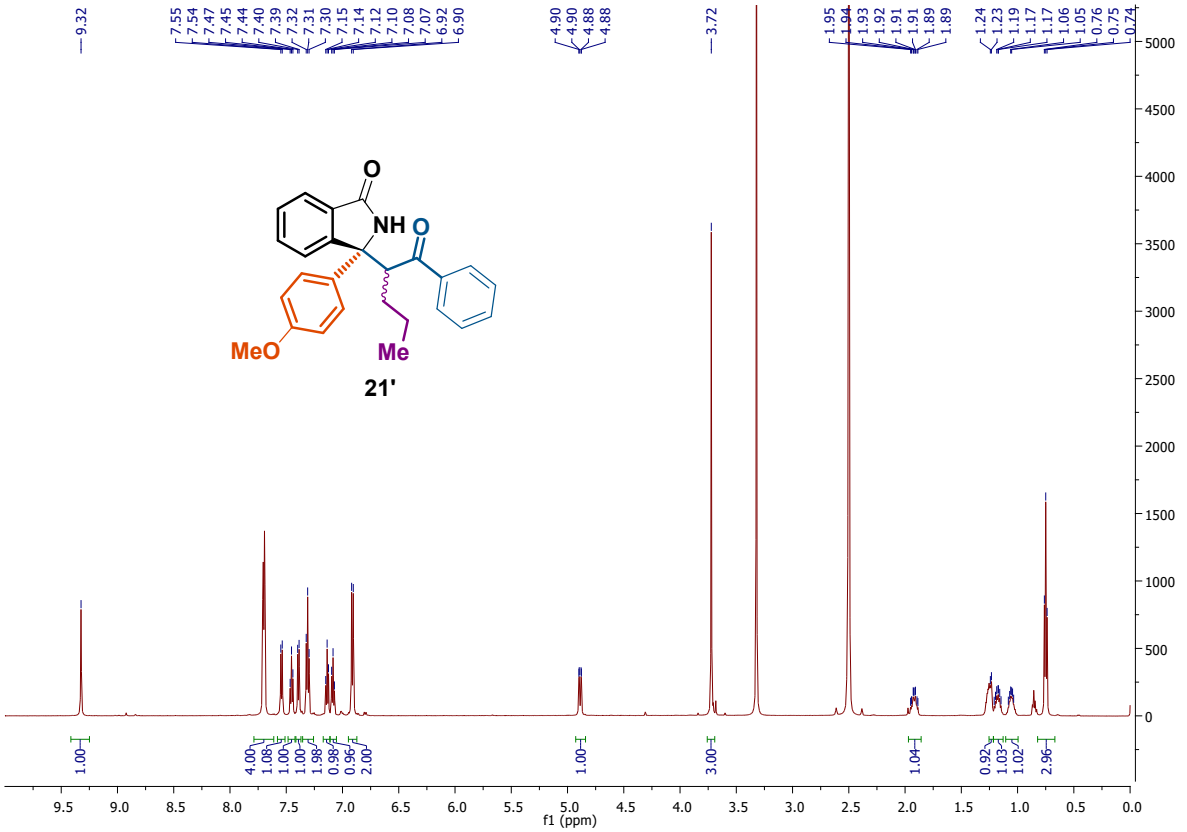
8.09
8.08
8.08
8.07
7.64
7.64
7.62
7.62
7.60
7.50
6.70
6.68
5.10
5.09
5.08
5.08
3.59
1.48
1.46
1.45
1.45
1.43
0.97
0.91
0.90
0.90
0.89
0.59
0.58
0.57
O
NH
O
MeO
Me
21
1.00
2.98
4.97
3.00
1.96
1.00
3.00
1.01
3.01
3.00
f1 (ppm)


203.4
168.9
158.2
150.2
137.8
134.1
133.5
132.1
130.8
128.7
128.4
126.5
123.3
68.2
54.9
50.6
31.1
20.6
14.1
O
NH
O
MeO
Me
21
f1 (ppm)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7.39
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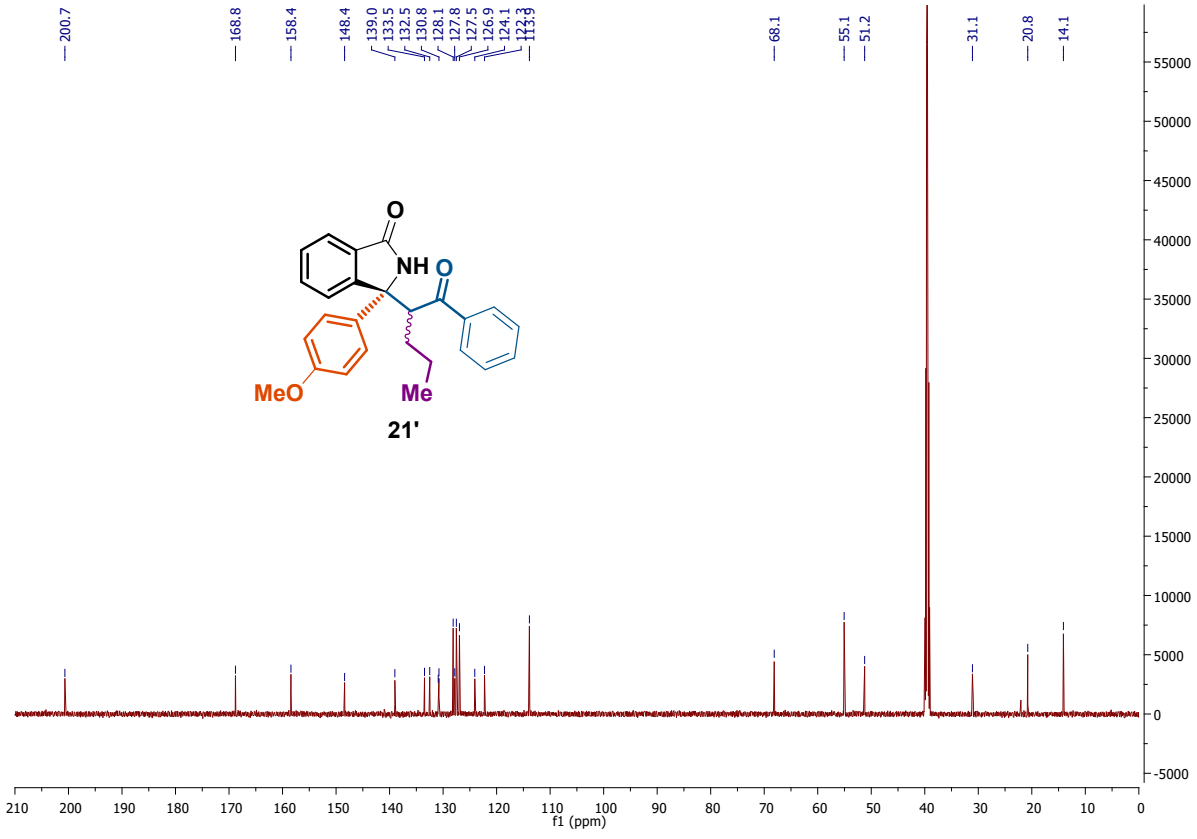
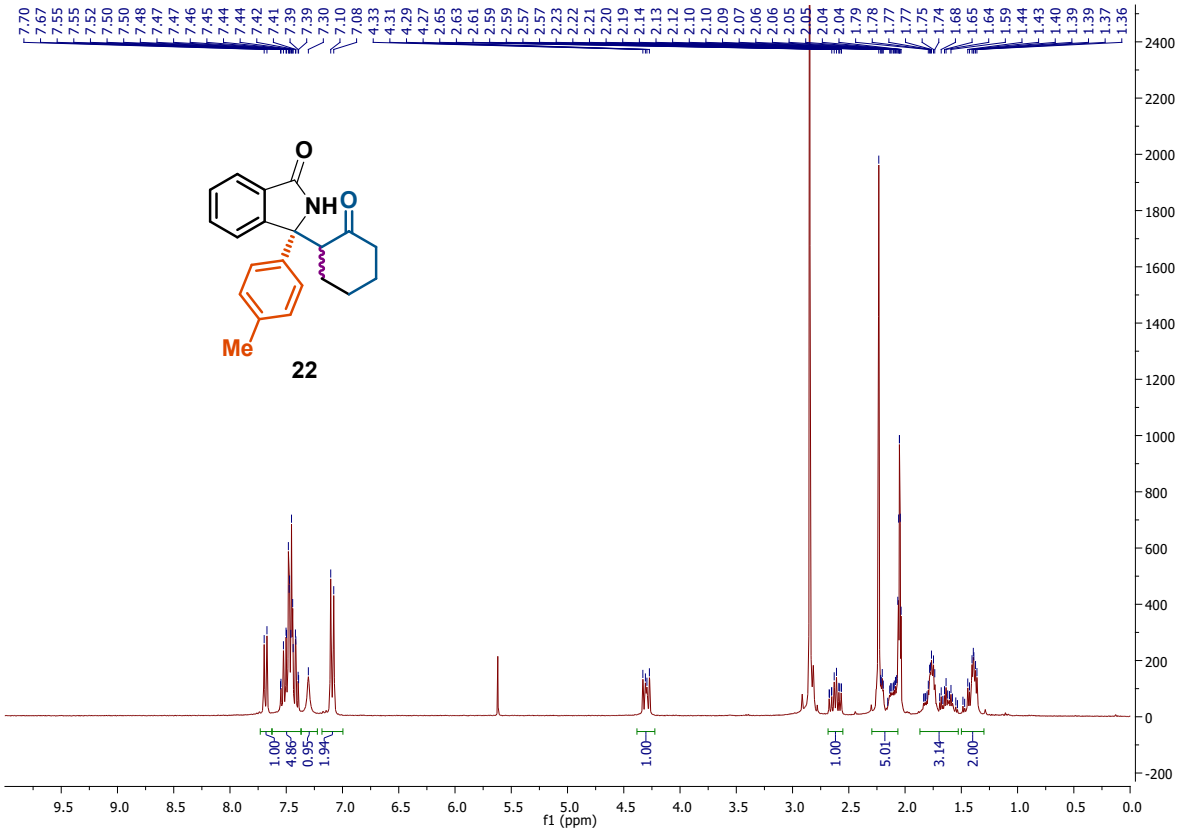
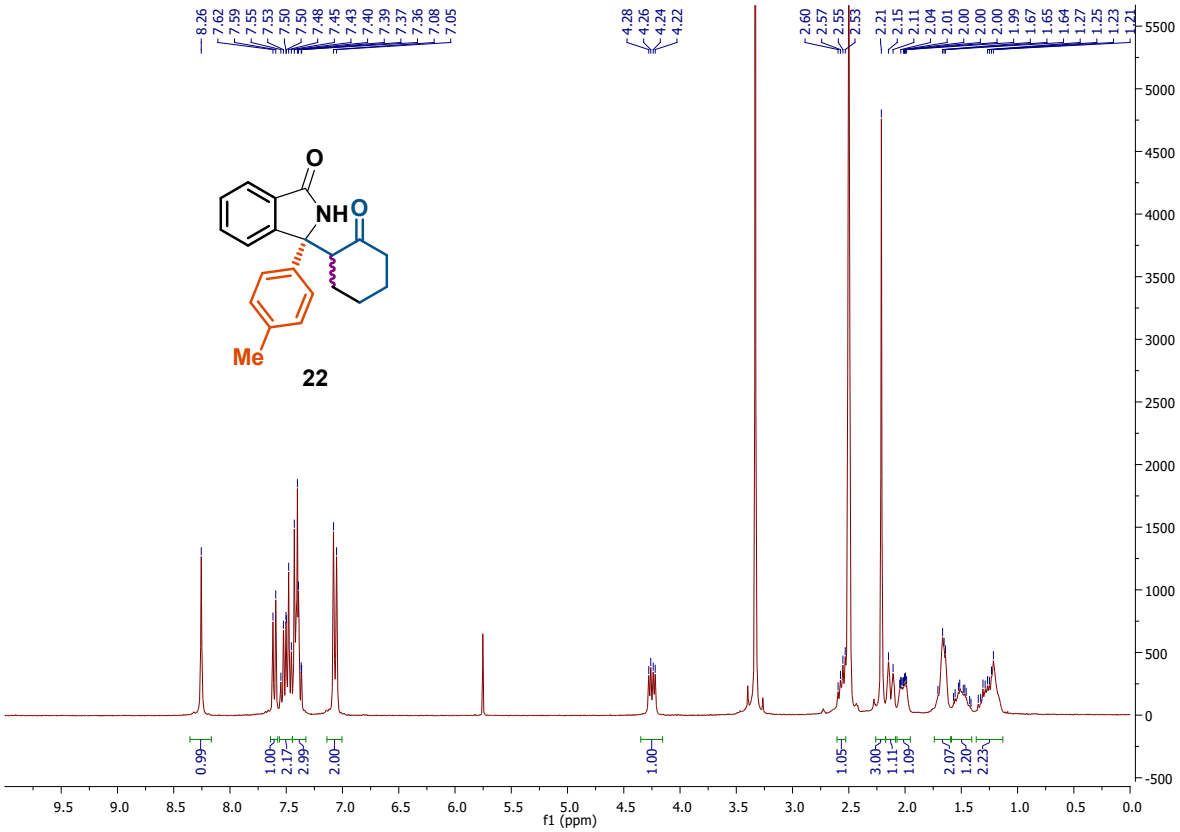
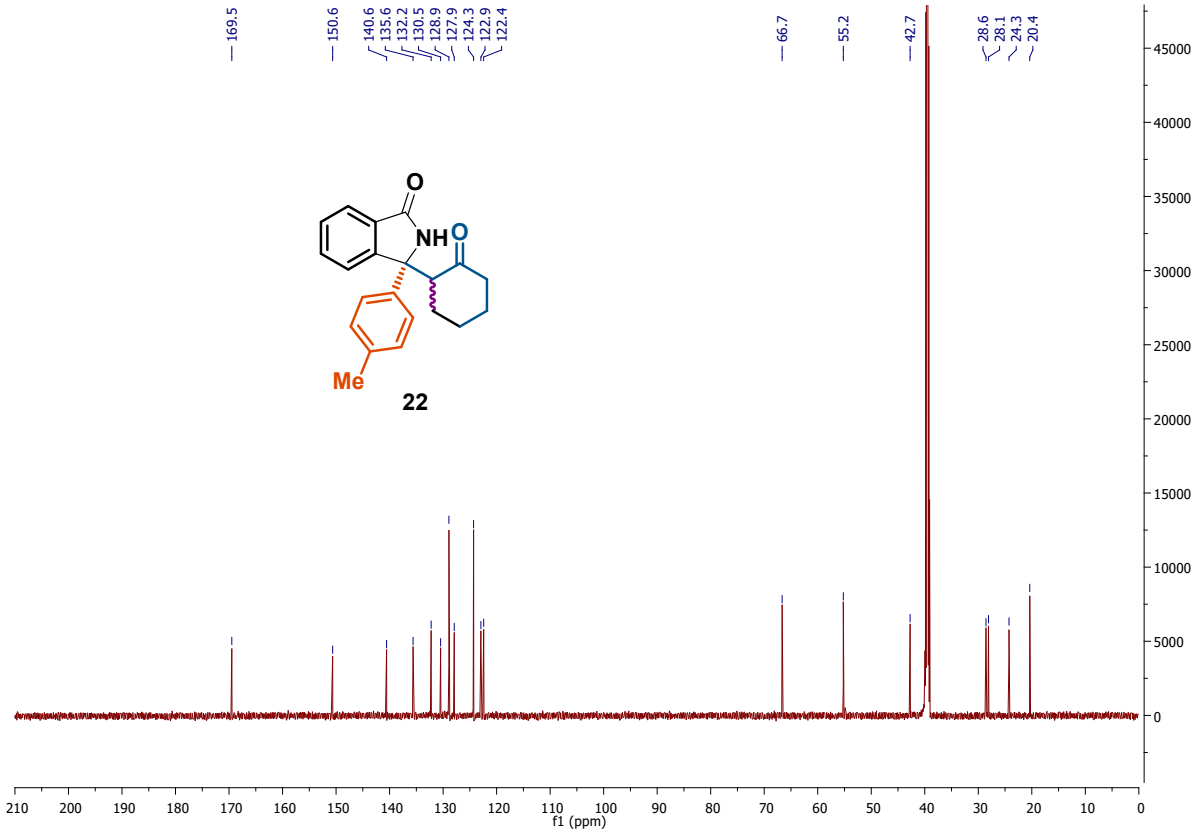
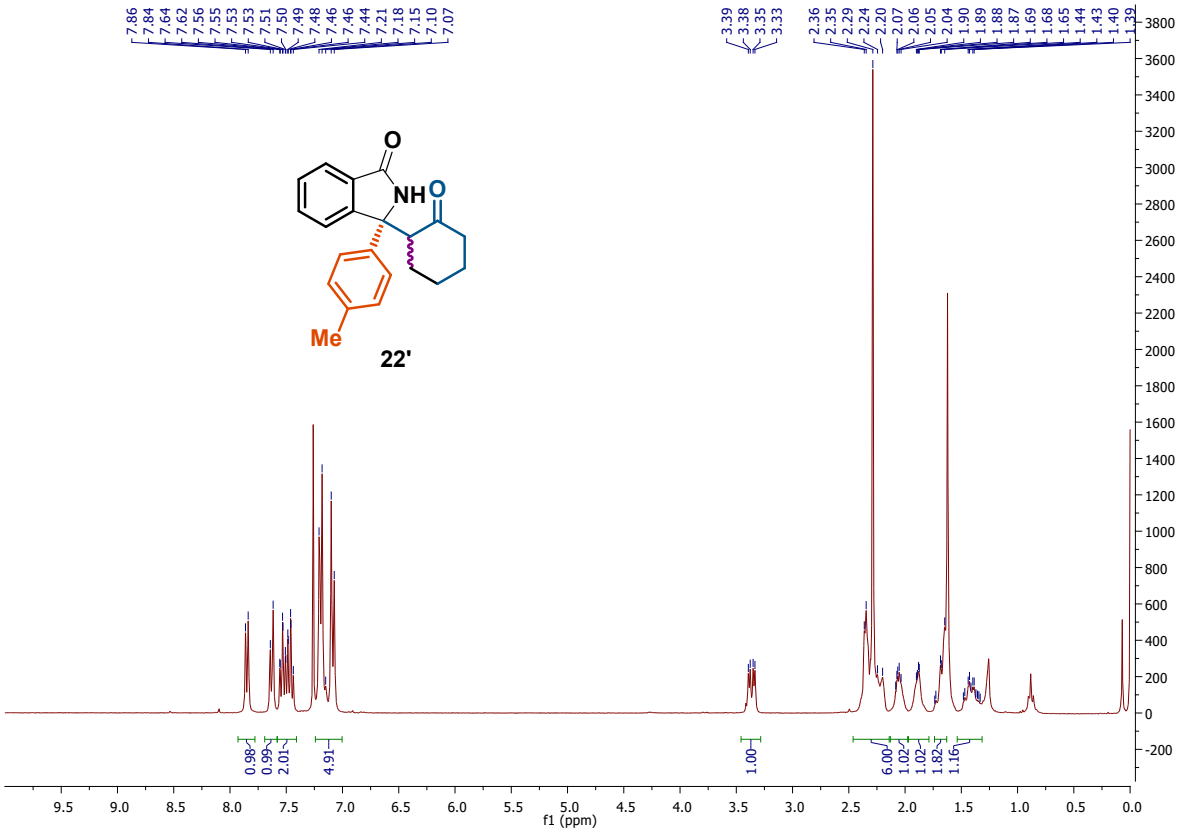
7.31
7.30
7.15
7.14
7.12
7.10
7.08
7.07
6.92
6.90
4.90
4.90
4.88
4.88
3.72
1.95
1.94
1.93
1.92
1.91
1.91
1.89
1.89
1.24
1.23
1.19
1.17
1.17
1.06
1.05
0.76
0.75
0.74
1.00
4.00
1.08
1.00
1.00
1.98
0.98
0.96
2.00
1.00
3.00
1.04
0.92
1.03
1.02
2.96
f1 (ppm)
O
NH
O
MeO
Me
21'

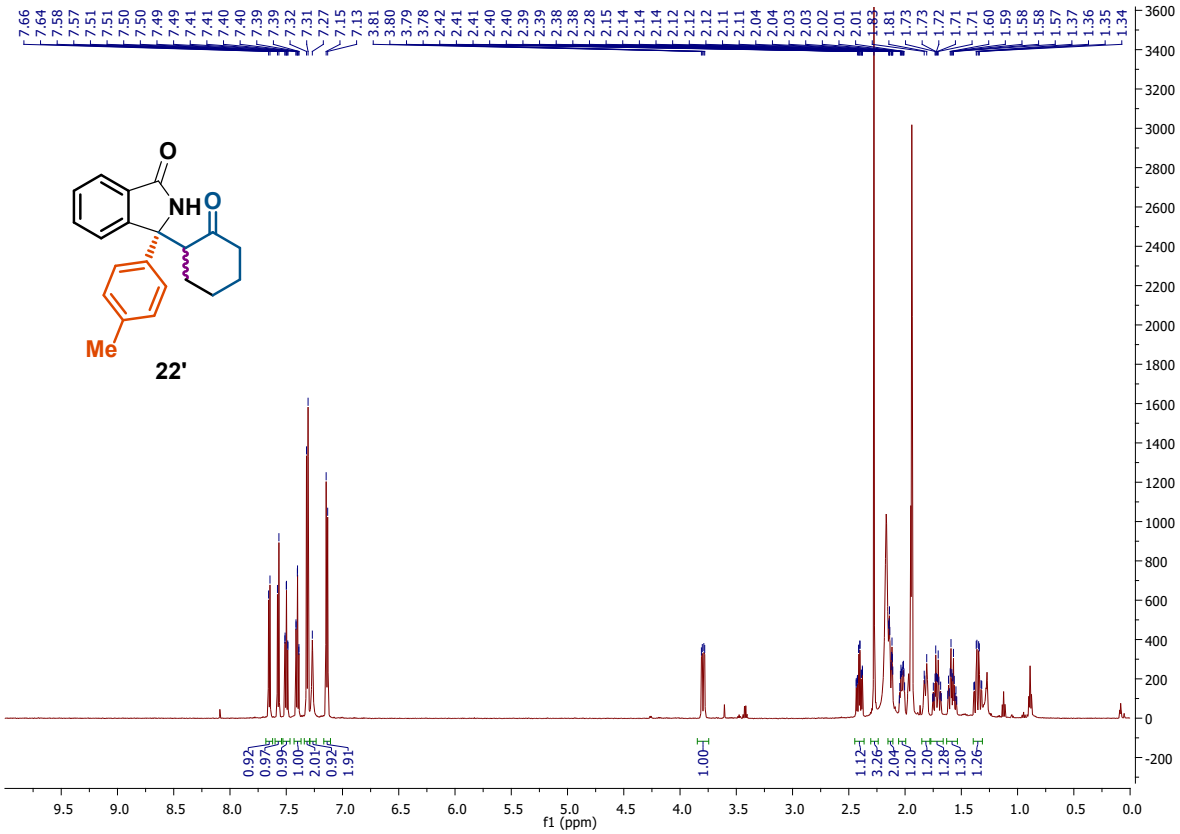

200.7
168.8
158.4
148.4
139.0
133.5
132.5
130.8
128.1
127.8
127.5
126.9
124.1
122.3
113.9
68.1
55.1
51.2
31.1
20.8
14.1
f1 (ppm)
O
NH
O
MeO
Me
21'

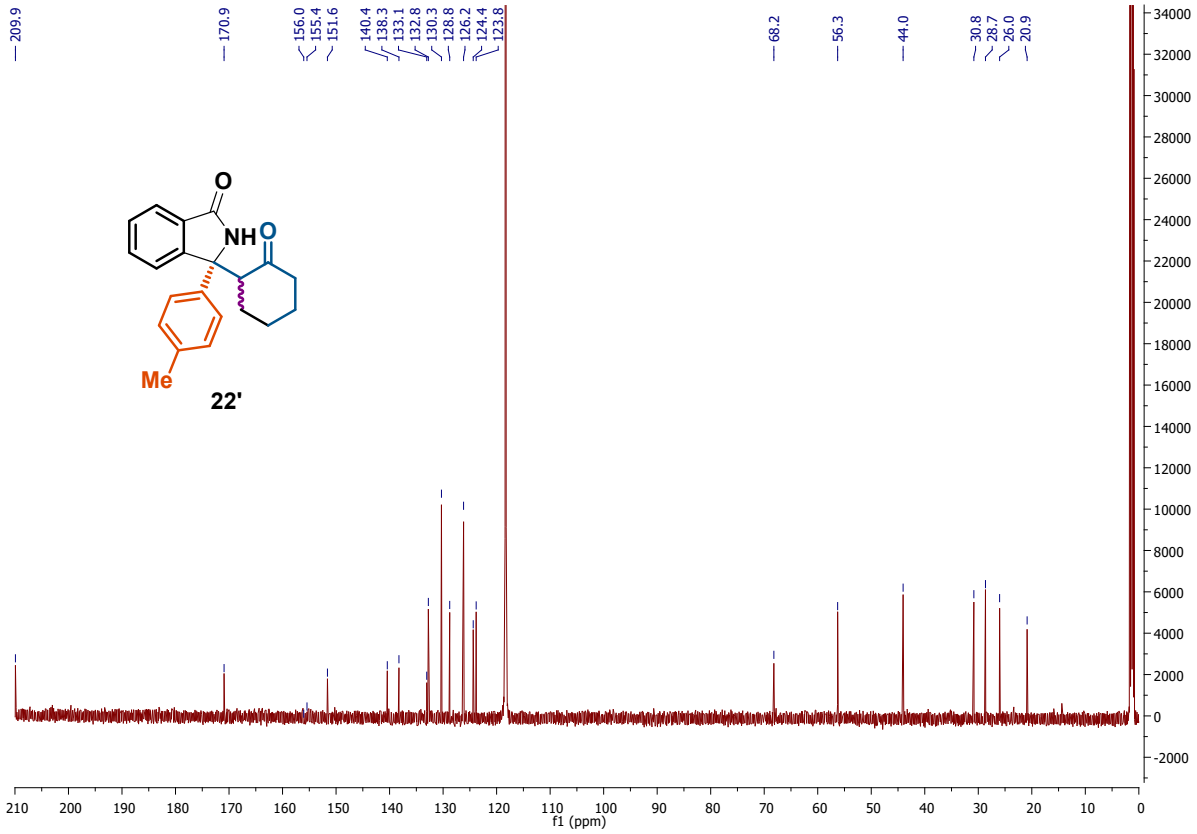

O
NH
O
Me
22
f1 (ppm)

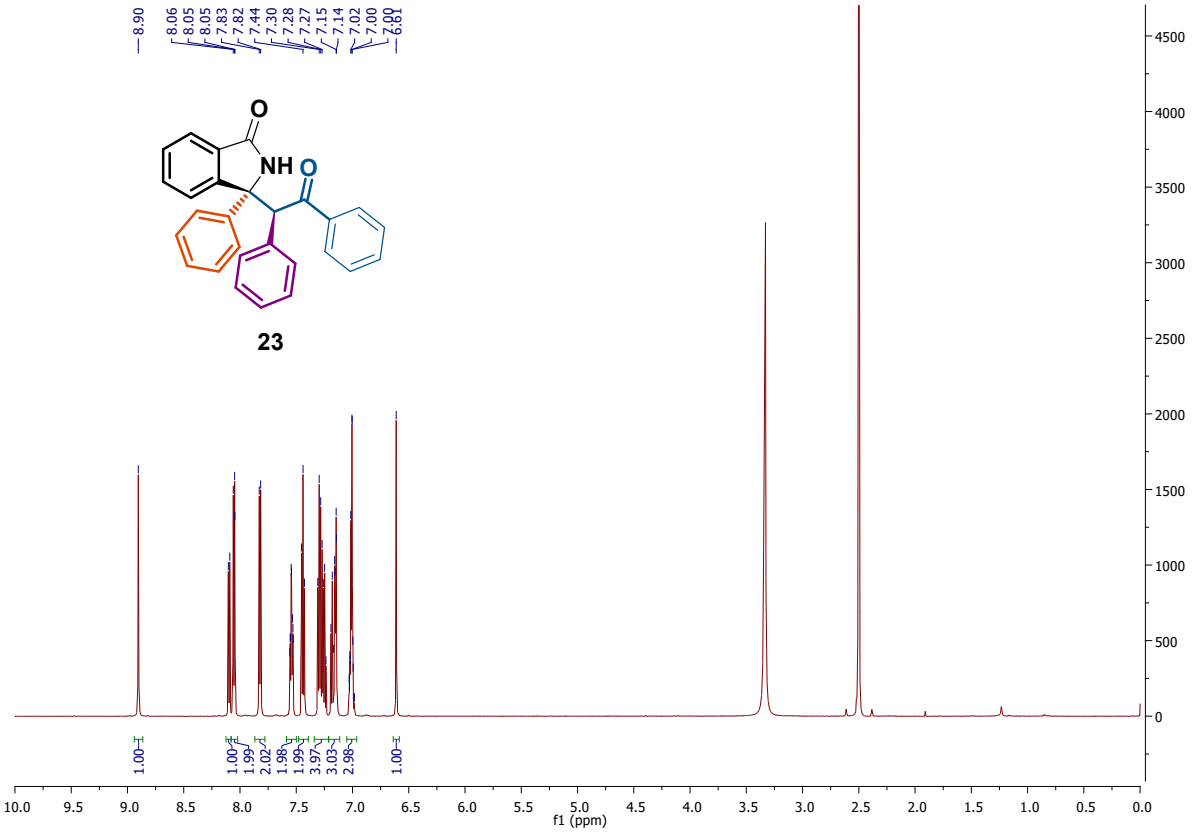

O
NH
O
Me
22
f1 (ppm)

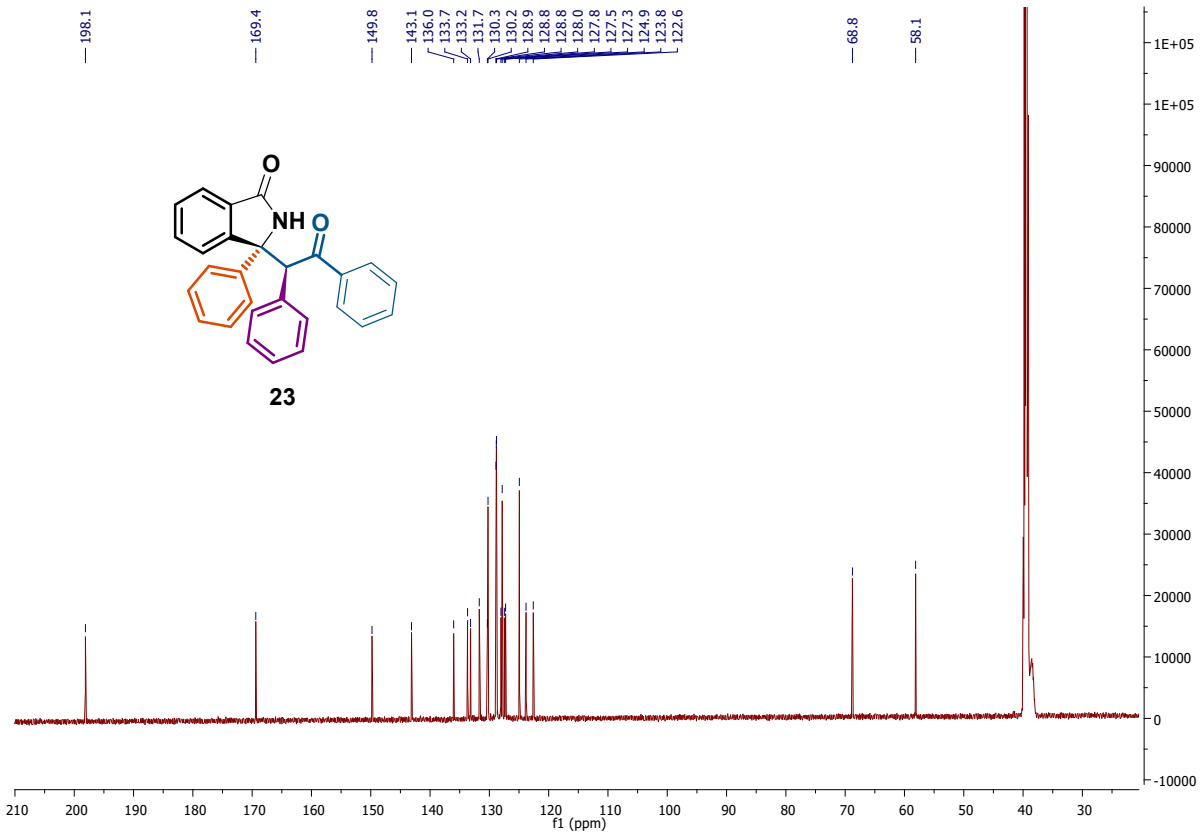

169.5
150.6
140.6
135.6
132.2
130.5
128.9
127.9
124.3
122.9
122.4
66.7
55.2
42.7
28.6
28.1
24.3
20.4
O
NH
O
Me
22
f1 (ppm)

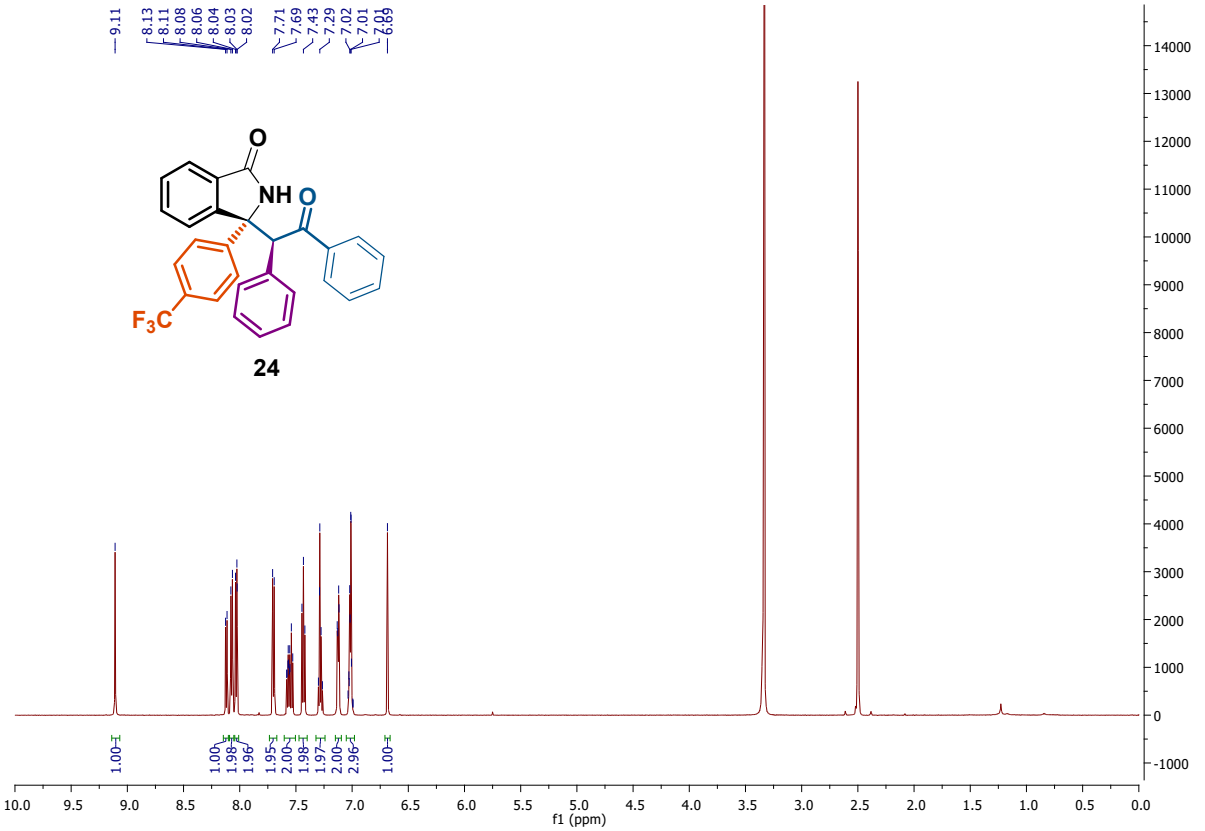

O
NH
O
Me
22'
f1 (ppm)


O
NH
O
Me
22'
f1 (ppm)


209.9
170.9
156.0
155.4
151.6
140.4
138.3
133.1
132.8
130.3
128.8
126.2
124.4
123.8
68.2
56.3
44.0
30.8
28.7
26.0
20.9
O
NH
O
Me
22'
f1 (ppm)


8.90
8.06
8.05
8.05
7.83
7.82
7.44
7.30
7.28
7.27
7.15
7.14
7.02
7.00
6.81
O
NH
O
23
1.00
1.00
1.99
2.02
1.98
1.99
3.97
3.03
2.98
1.00
f1 (ppm)


198.1
169.4
149.8
143.1
136.0
133.7
133.2
131.7
130.3
130.2
128.9
128.8
128.8
128.0
127.8
127.5
127.3
124.9
123.8
122.6
68.8
58.1
O
NH
O
23
f1 (ppm)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8.13
8.11
8.08
8.06
8.04
8.03
8.02
7.71
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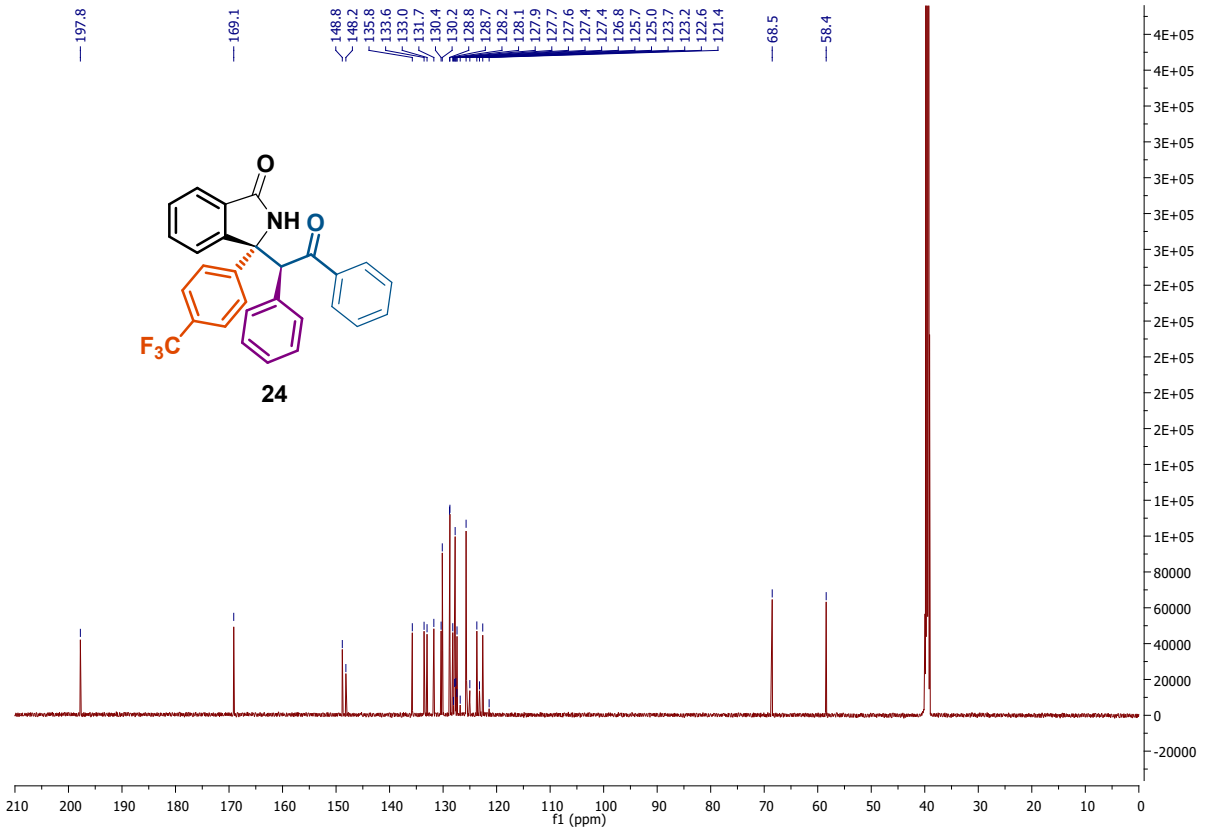
7.43
7.29
7.02
7.01
6.89
O
NH
O
F3C
24
f1 (ppm)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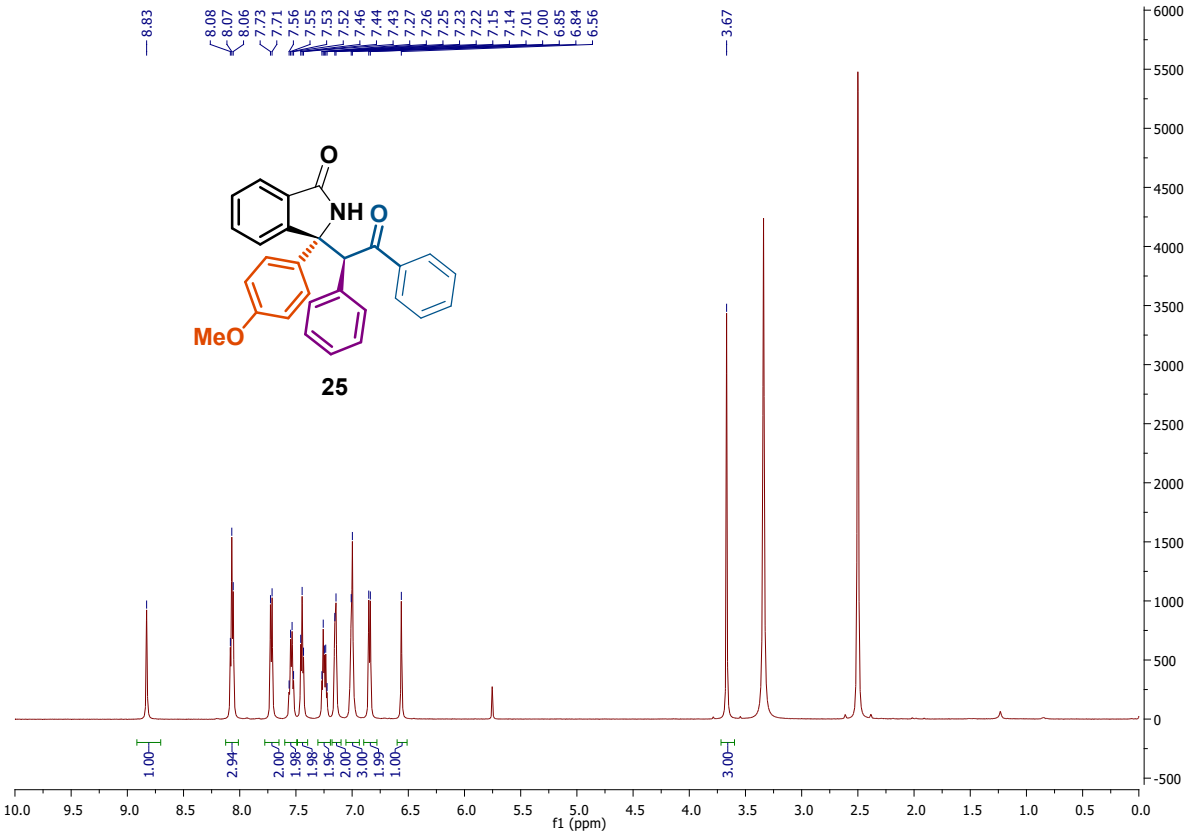
169.1
148.8
148.2
135.8
133.6
133.0
131.7
130.4
130.2
128.8
128.7
128.2
128.1
127.9
127.7
127.6
127.4
127.4
126.8
125.7
125.0
123.7
123.2
122.6
121.4
68.5
58.4
O
NH
O
F3C
24
f1 (ppm)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8.08
8.07
8.06
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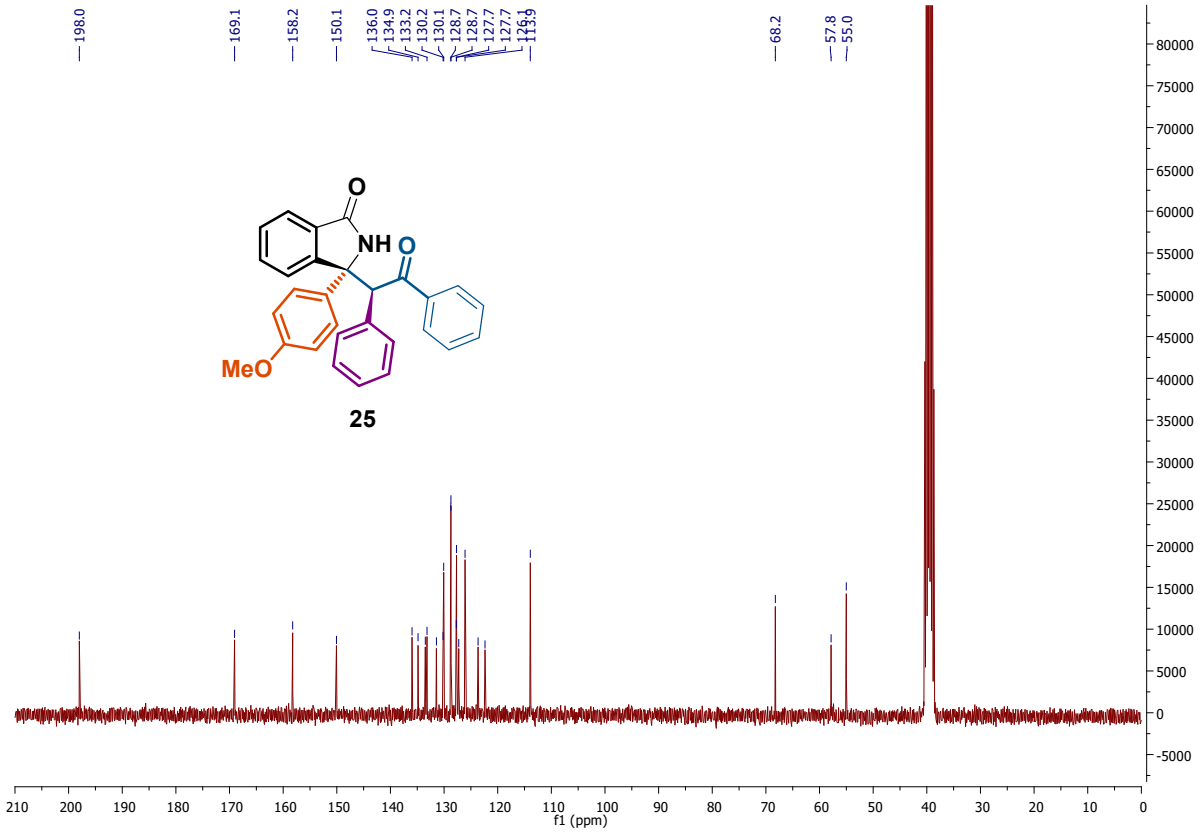
7.71
7.56
7.55
7.53
7.52
7.46
7.44
7.43
7.27
7.26
7.25
7.23
7.22
7.15
7.14
7.01
7.00
6.85
6.84
6.56
3.67
O
NH
O
MeO
25
1.00
2.94
2.00
1.98
1.98
1.96
2.00
3.00
1.99
1.00
3.00
f1 (ppm)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169.1
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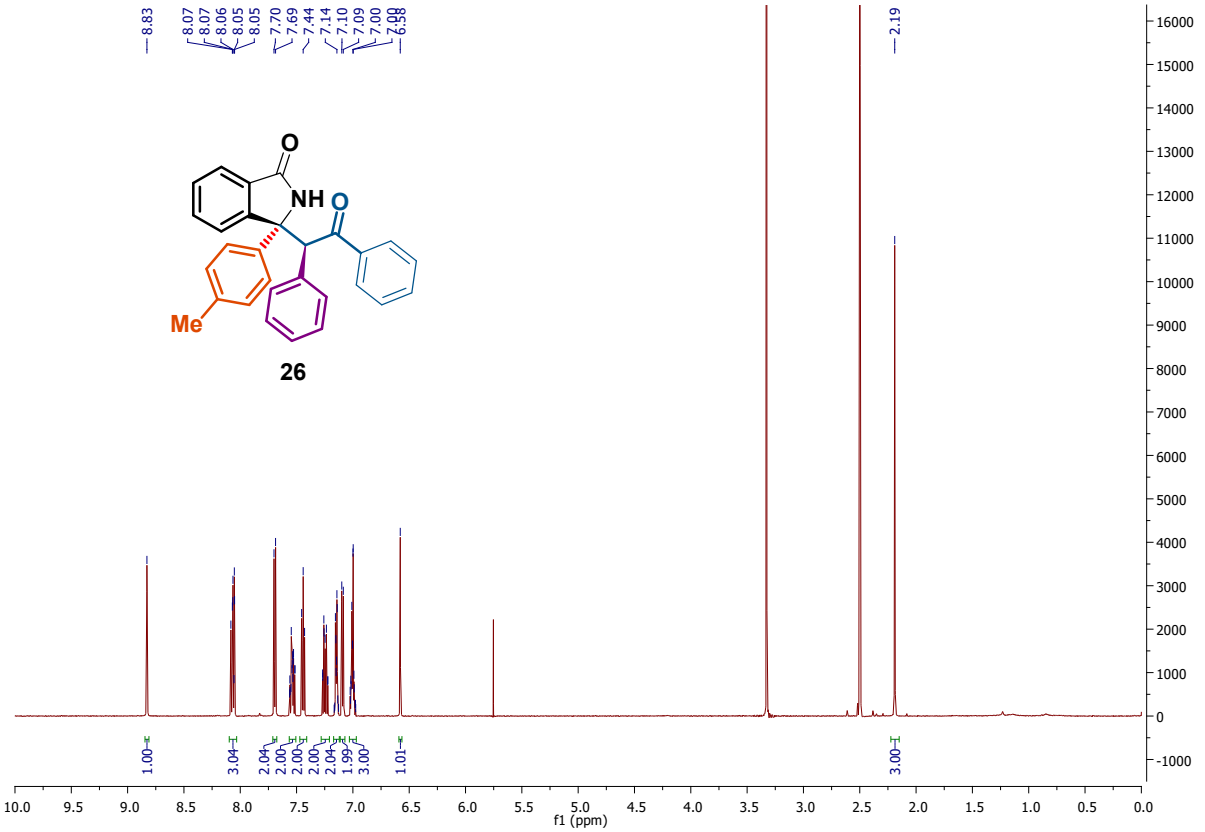
150.1
136.0
134.9
133.2
130.2
130.1
128.7
128.7
127.7
127.7
126.1
113.9
68.2
57.8
55.0
O
NH
O
MeO
25
f1 (ppm)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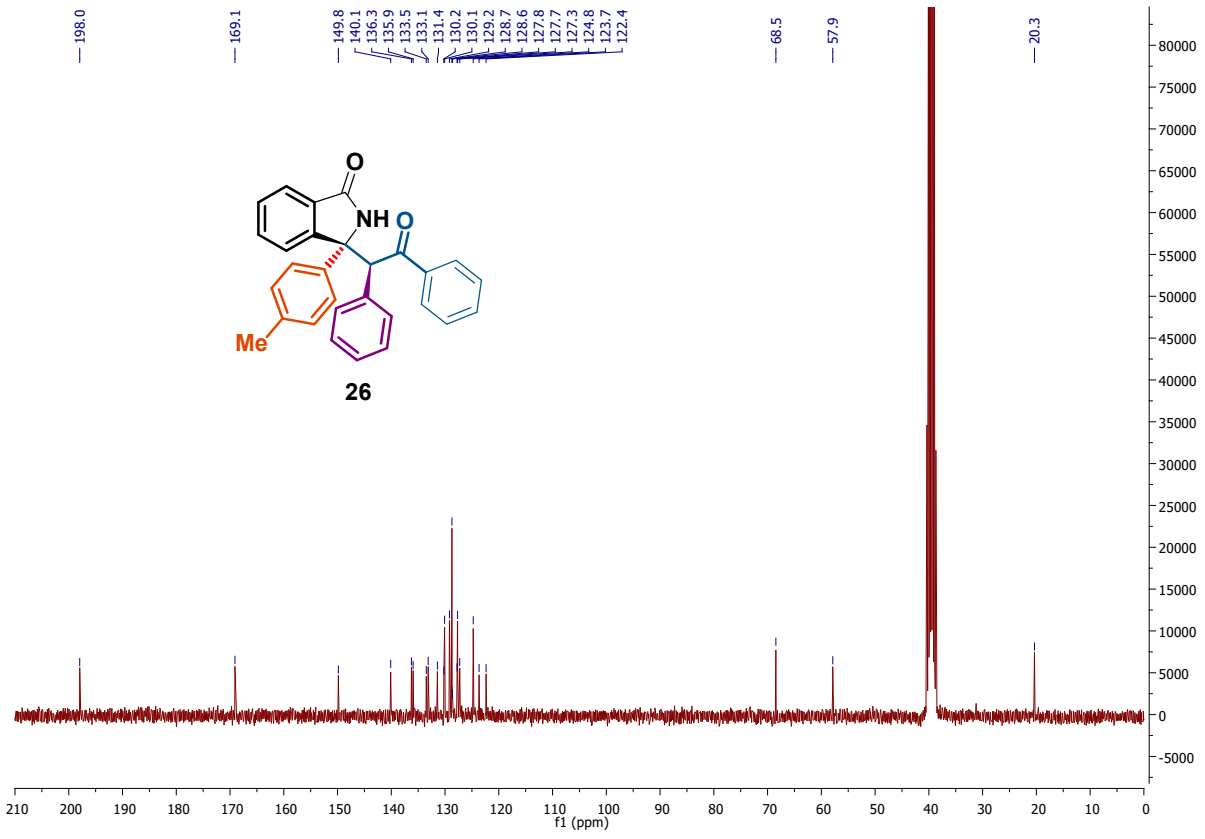
8.07
8.07
8.06
8.05
8.05
7.70
7.69
7.44
7.14
7.10
7.09
7.00
6.98
2.19
O
NH
O
Me
1.00
3.04
2.04
2.00
2.00
2.00
2.04
1.99
3.00
1.01
3.00
f1 (ppm)

26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133.5
133.1
131.4
130.2
130.1
129.2
128.7
128.6
127.8
127.7
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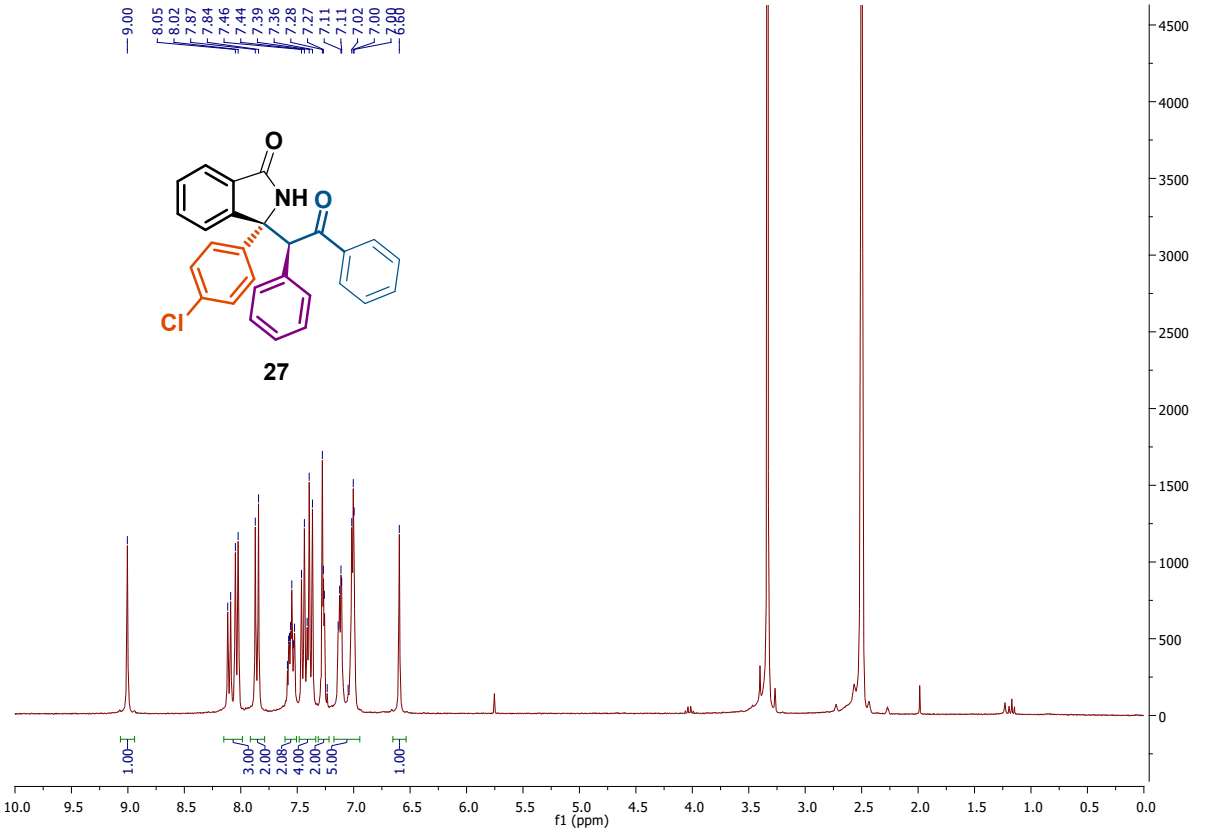
124.8
123.7
122.4
68.5
57.9
20.3
O
NH
O
Me
f1 (ppm)

26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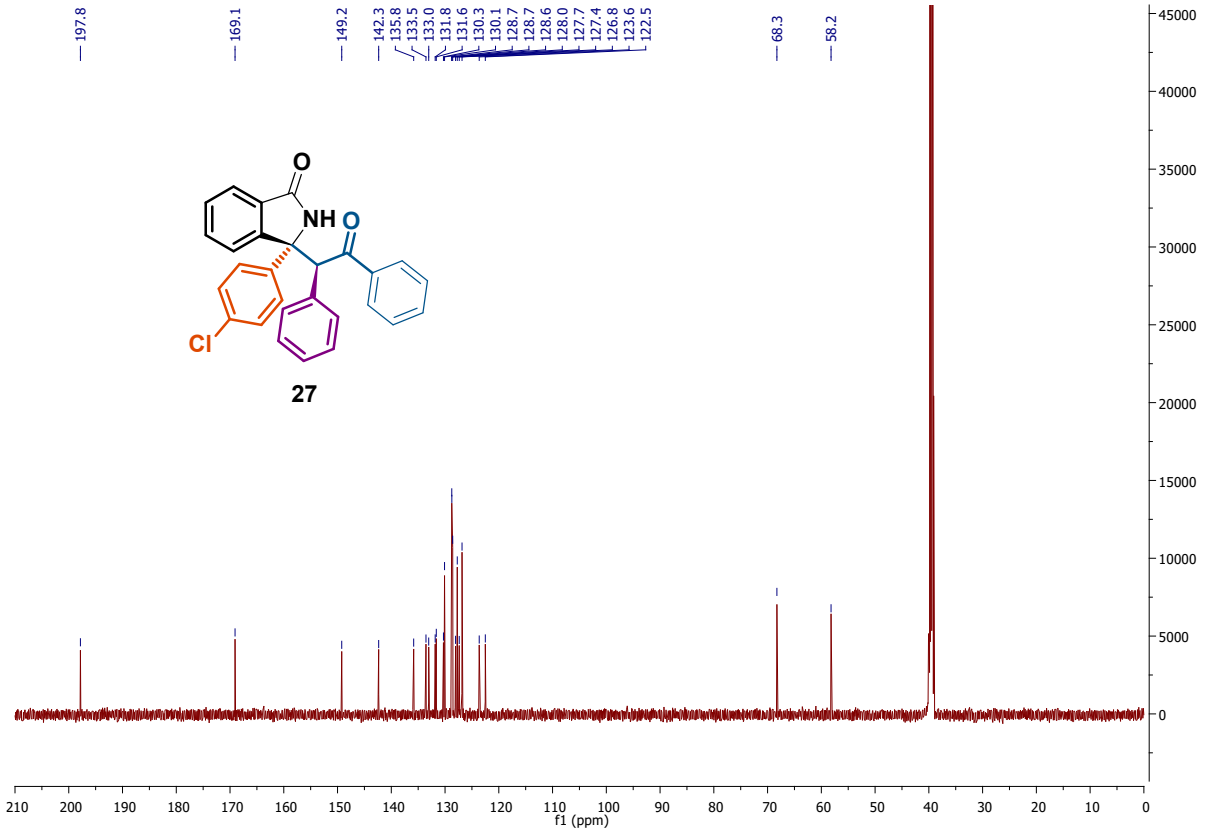
7.87
7.84
7.46
7.44
7.39
7.36
7.28
7.27
7.11
7.02
7.00
6.88
O
NH
O
Cl
27
1.00
3.00
2.00
2.08
4.00
2.00
5.00
1.00
f1 (ppm)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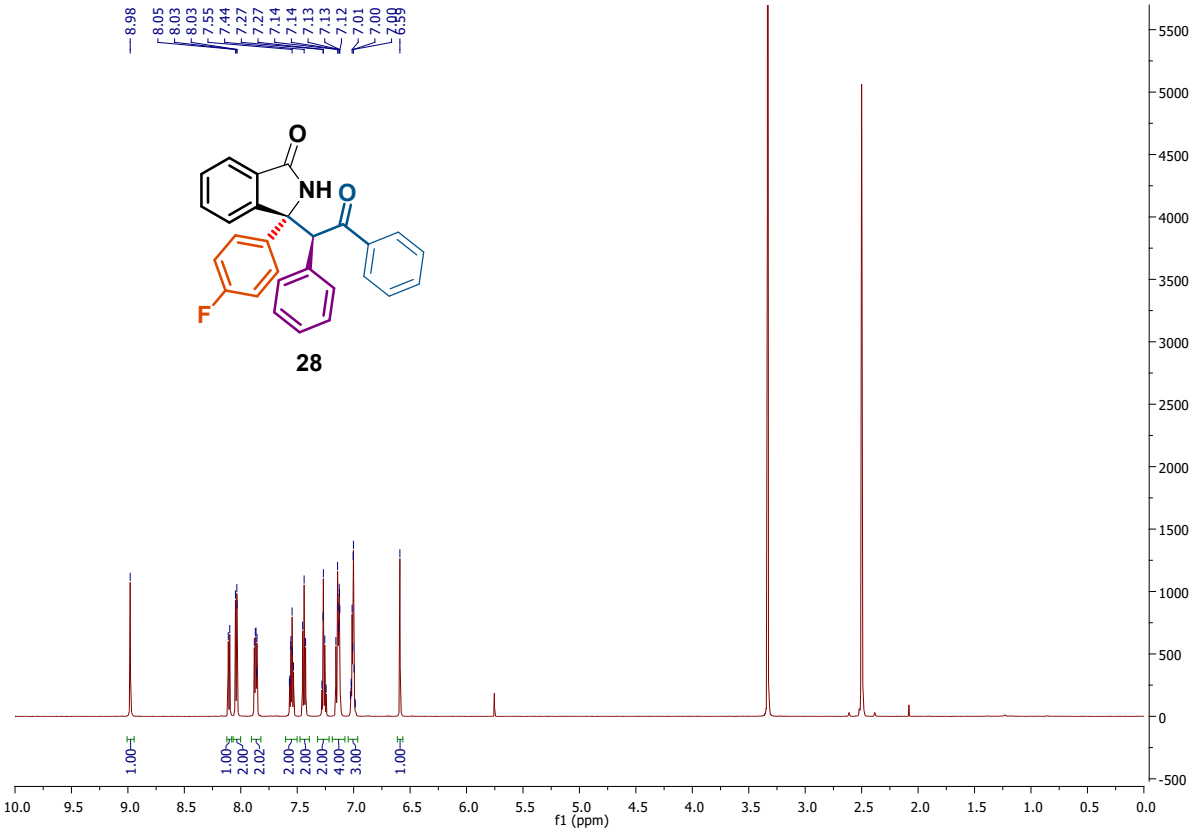
169.1
149.2
142.3
135.8
133.5
133.0
131.8
131.6
130.3
130.1
128.7
128.7
128.6
128.0
127.7
127.4
126.8
123.6
122.5
68.3
58.2
O
NH
O
Cl
27
f1 (ppm)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8.05
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8.03
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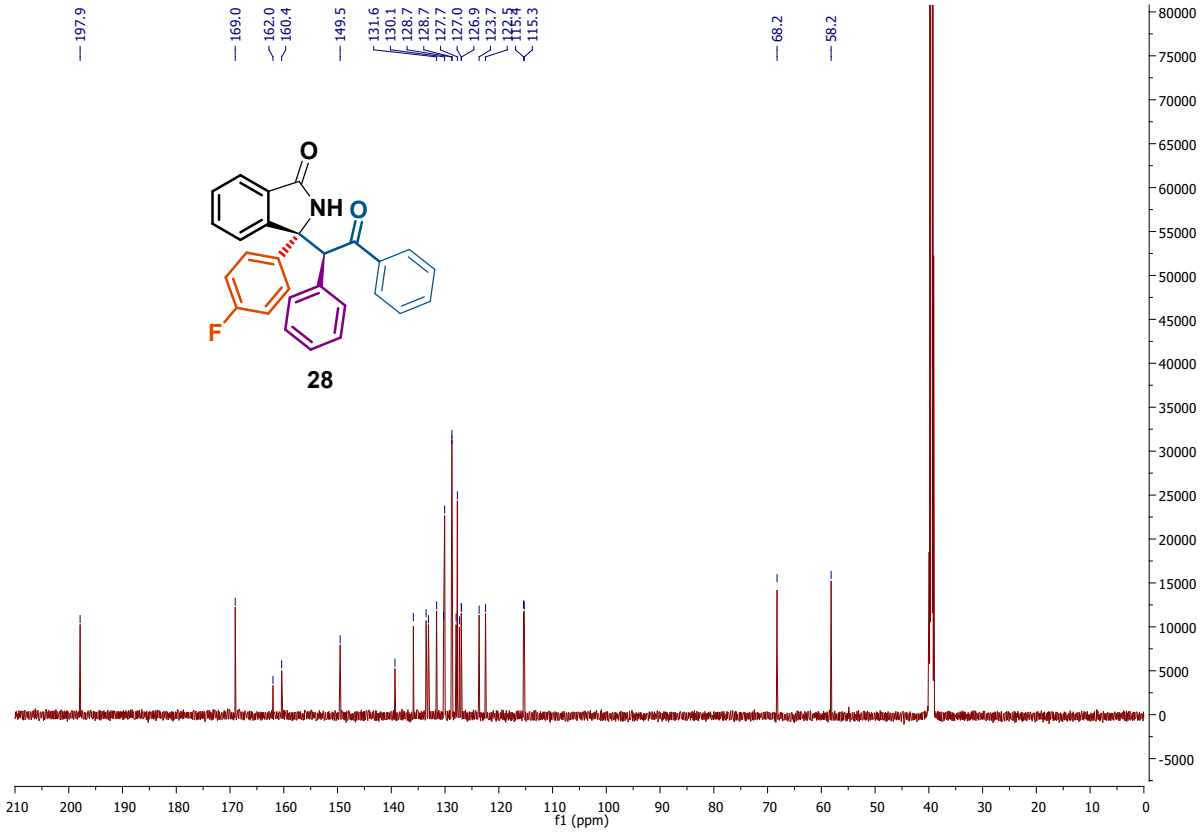
7.27
7.27
7.14
7.14
7.13
7.13
7.12
7.01
7.00
6.99
O
NH
O
F
28
1.00
1.00
2.00
2.02
2.00
2.00
2.00
4.00
3.00
1.00
f1 (ppm)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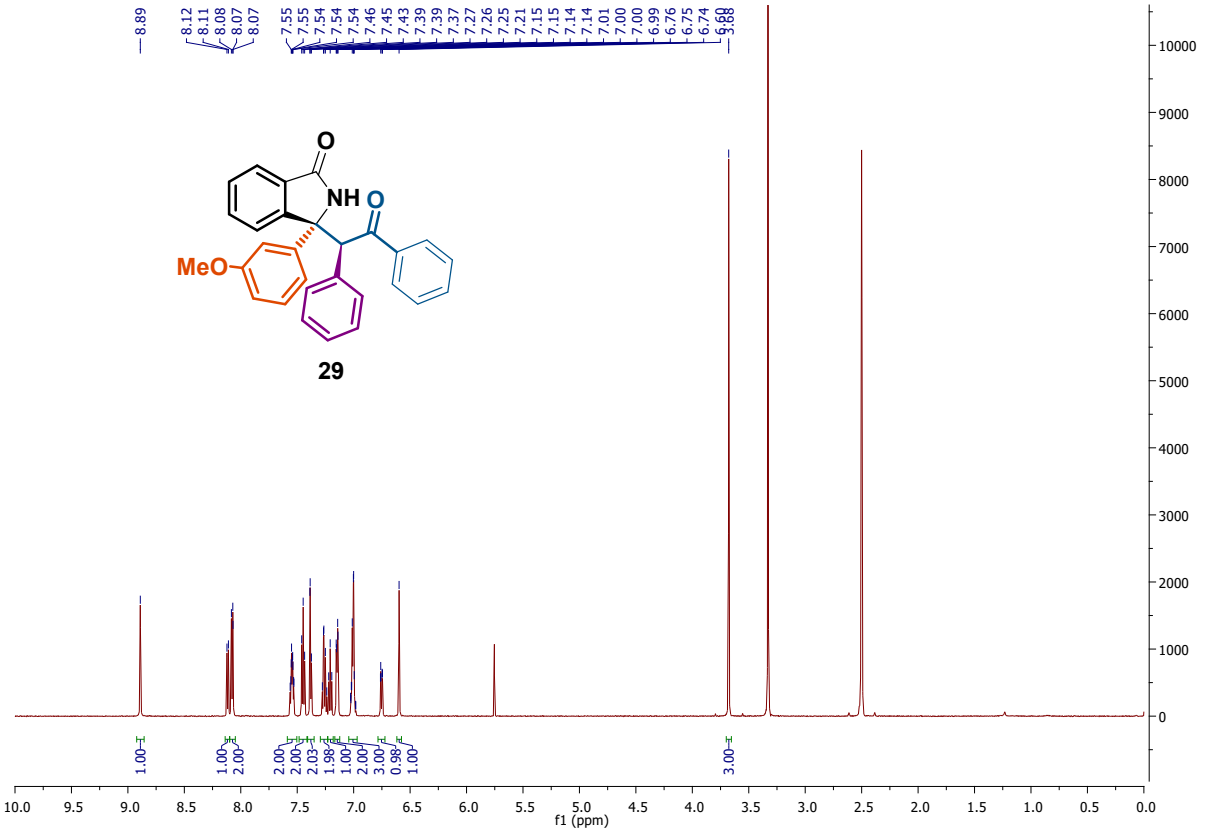
131.6
130.1
128.7
128.7
127.7
127.0
126.9
123.7
115.4
115.3
68.2
58.2
O
NH
O
F
28
f1 (ppm)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8.12
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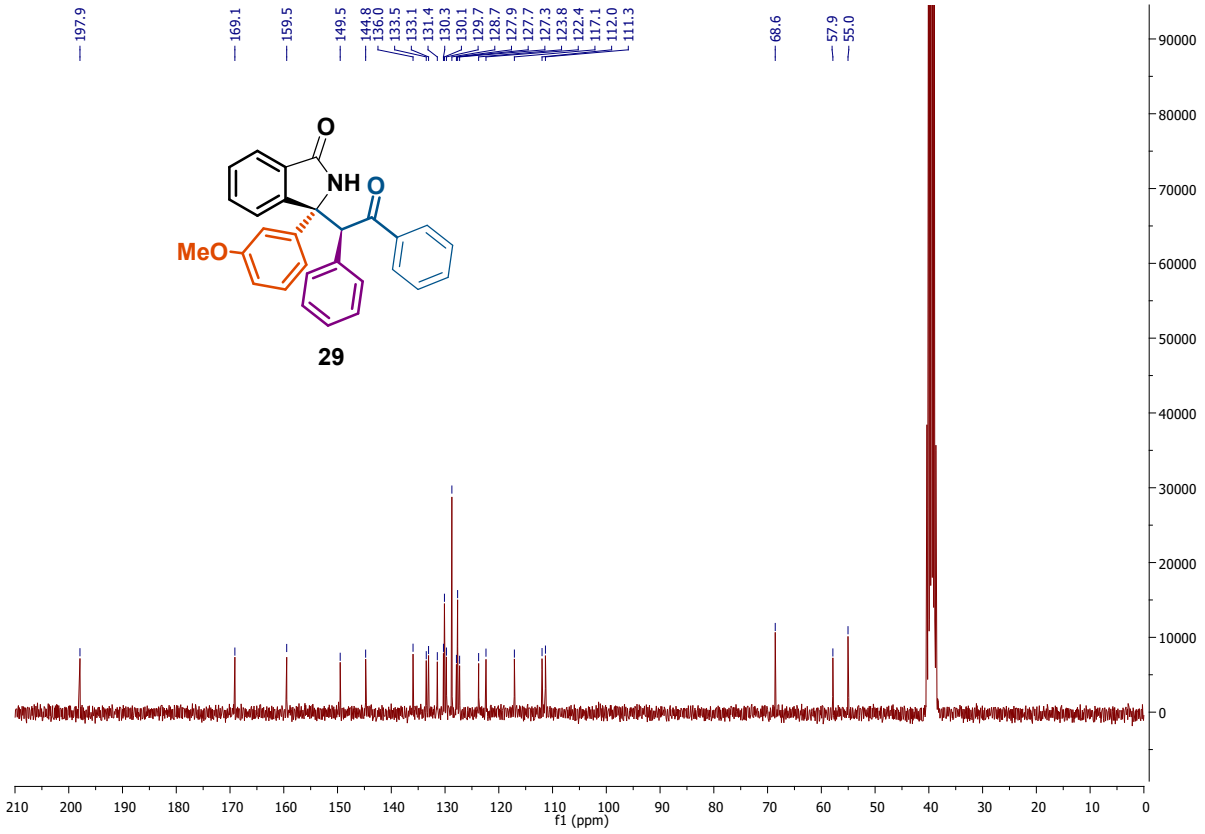
8.08
8.07
8.07
7.55
7.55
7.54
7.54
7.54
7.46
7.45
7.43
7.39
7.39
7.37
7.27
7.26
7.25
7.21
7.15
7.15
7.14
7.14
7.01
7.00
7.00
6.99
6.76
6.75
6.74
6.68
3.68
O
NH
O
MeO
29
f1 (ppm)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169.1
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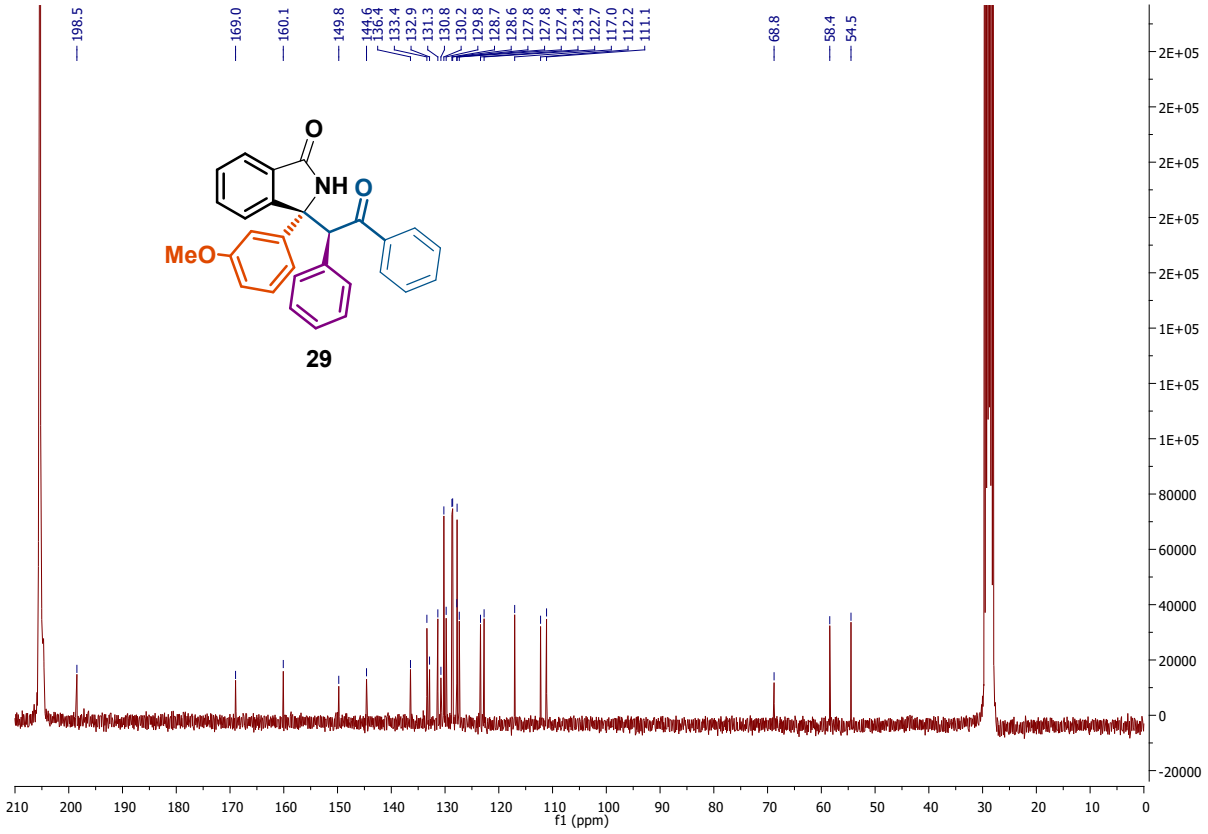
133.5
133.1
131.4
130.3
130.1
129.7
128.7
127.9
127.7
127.3
123.8
122.4
117.1
112.0
111.3
68.6
57.9
55.0
O
NH
O
MeO
29
f1 (ppm)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133.4
132.9
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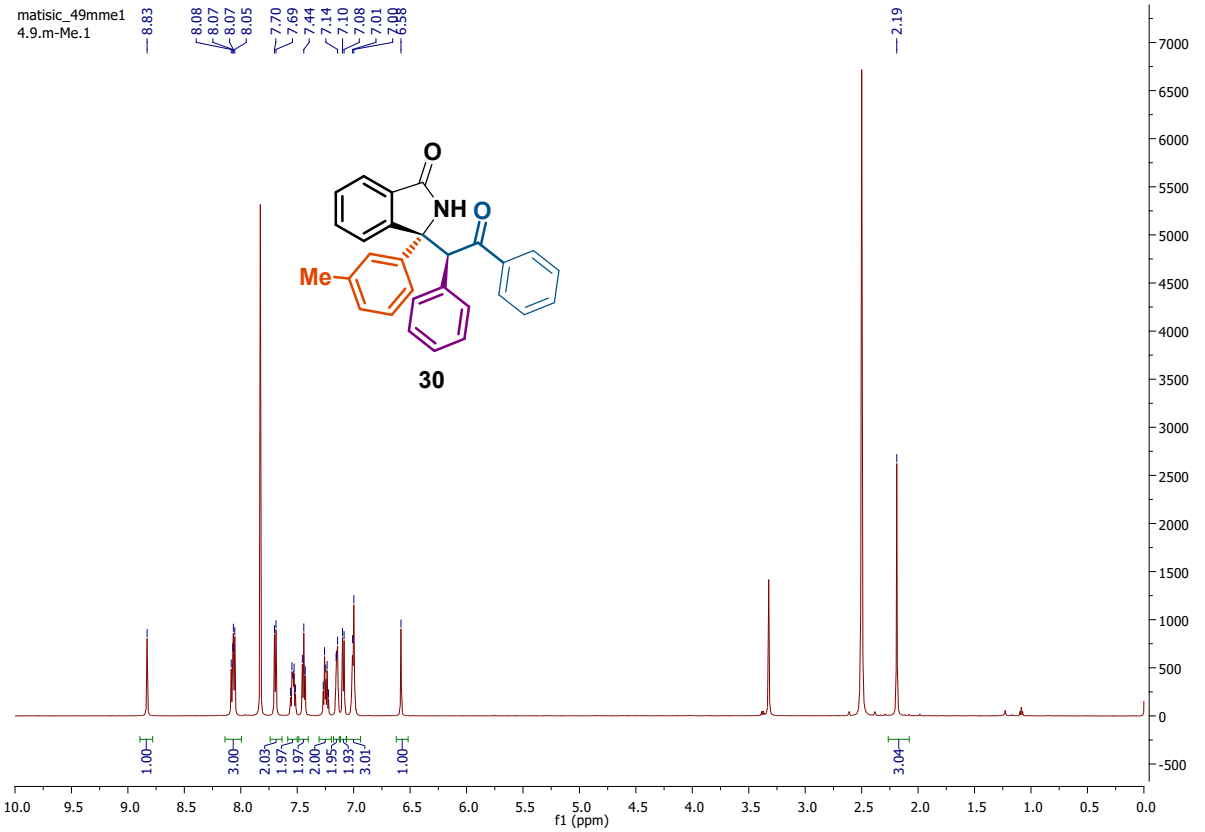
130.8
130.2
129.8
128.7
128.6
127.8
127.4
123.4
122.7
117.0
112.2
111.1
68.8
58.4
54.5
O
NH
O
MeO
29
f1 (ppm)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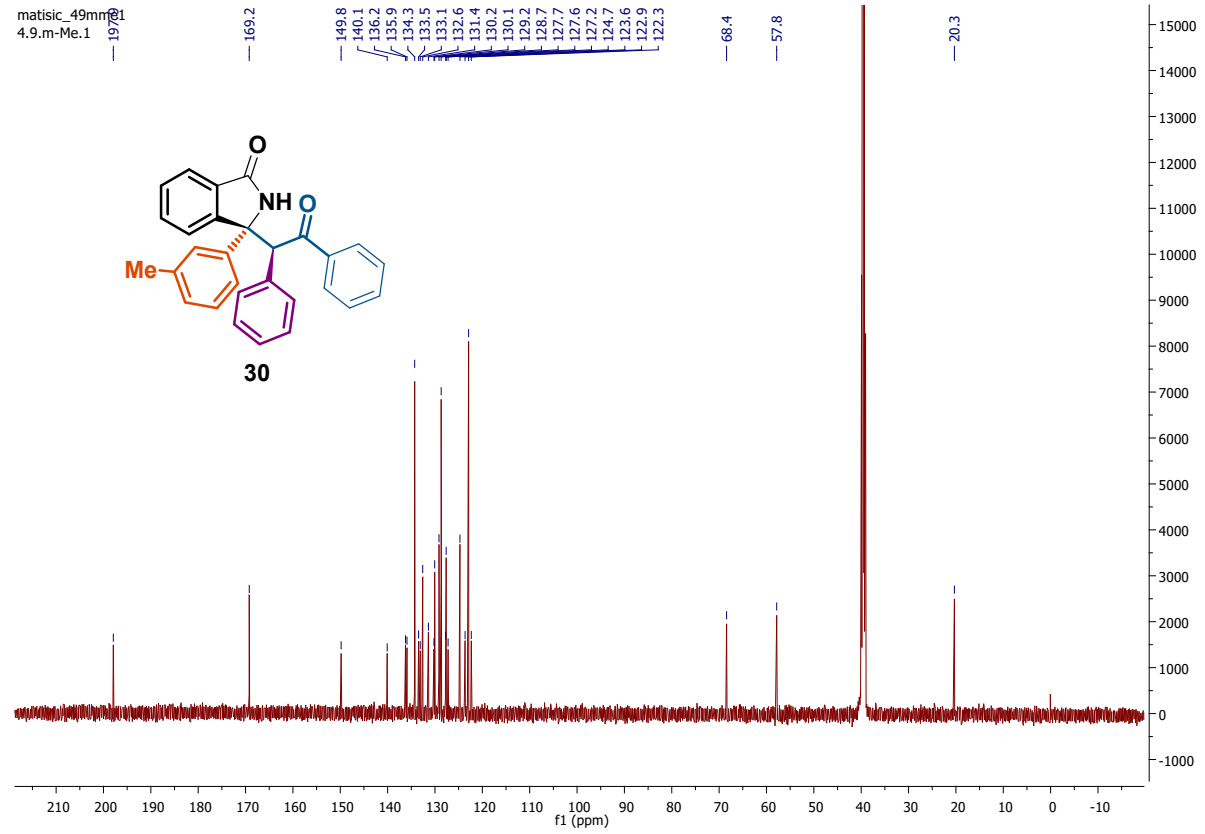
8.07
8.07
8.05
7.70
7.69
7.44
7.14
7.10
7.08
7.01
6.98
2.19
O
NH
O
Me
30
1.00
3.00
2.03
1.97
1.97
2.00
1.95
1.93
3.01
1.00
3.04
f1 (ppm)


matisic_49mme1
4.9.m-Me.1
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149.8
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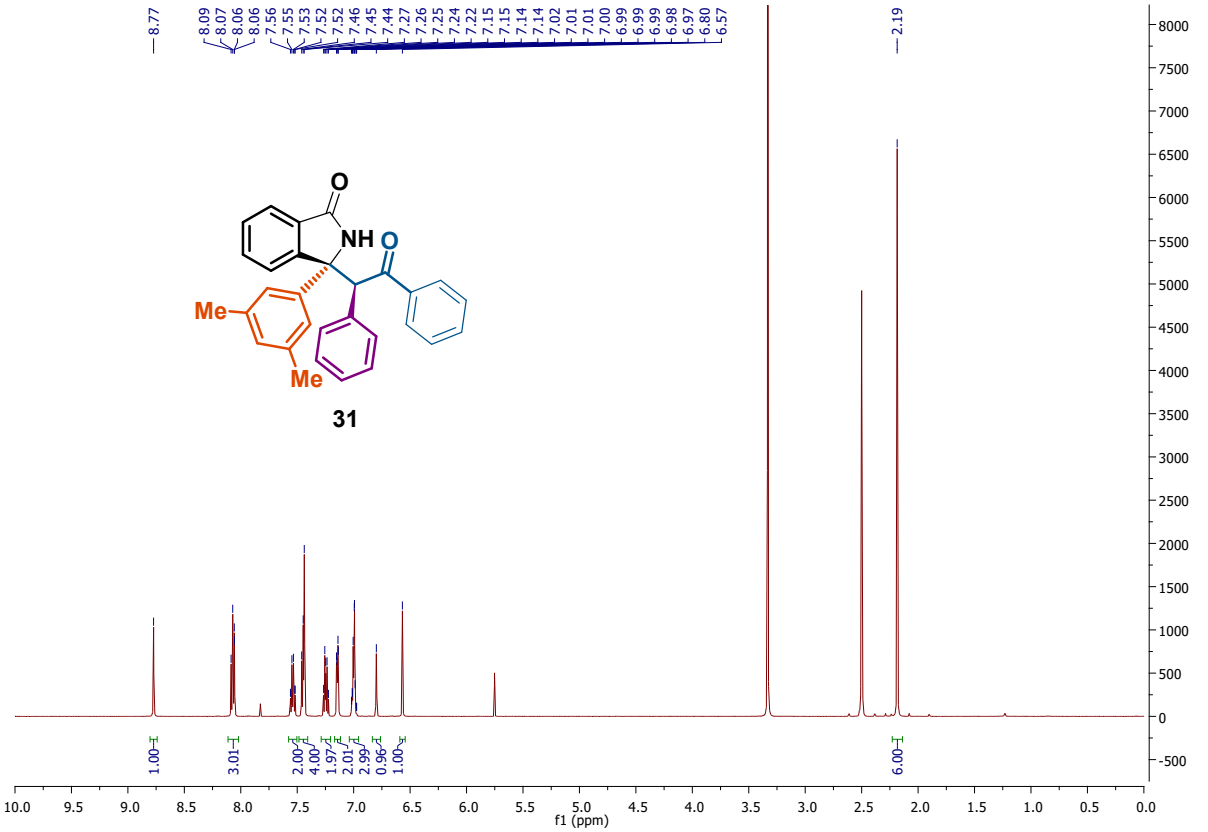
135.9
134.3
133.5
133.1
132.6
131.4
130.2
130.1
129.2
128.7
127.7
127.6
127.2
124.7
123.6
122.9
122.3
68.4
57.8
20.3
O
NH
O
Me
30
f1 (ppm)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7.53
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7.52
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7.44
7.27
7.26
7.25
7.24
7.22
7.15
7.15
7.14
7.14
7.02
7.01
7.01
7.00
6.99
6.99
6.99
6.98
6.97
6.80
6.57
2.19
O
NH
O
Me
Me
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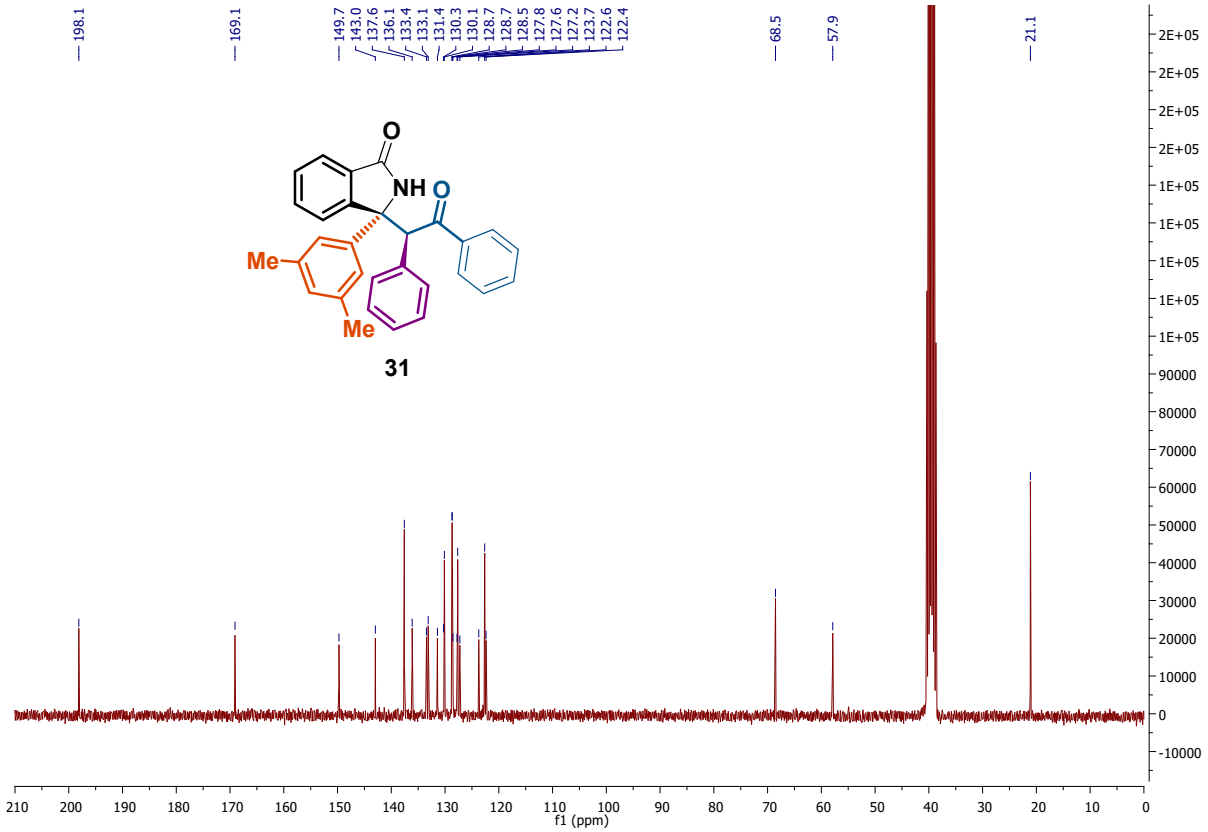
2.00
4.00
1.97
2.01
2.99
0.96
1.00
6.00
f1 (ppm)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143.0
137.6
136.1
133.4
133.1
131.4
130.3
130.1
128.7
128.7
128.5
127.8
127.6
127.2
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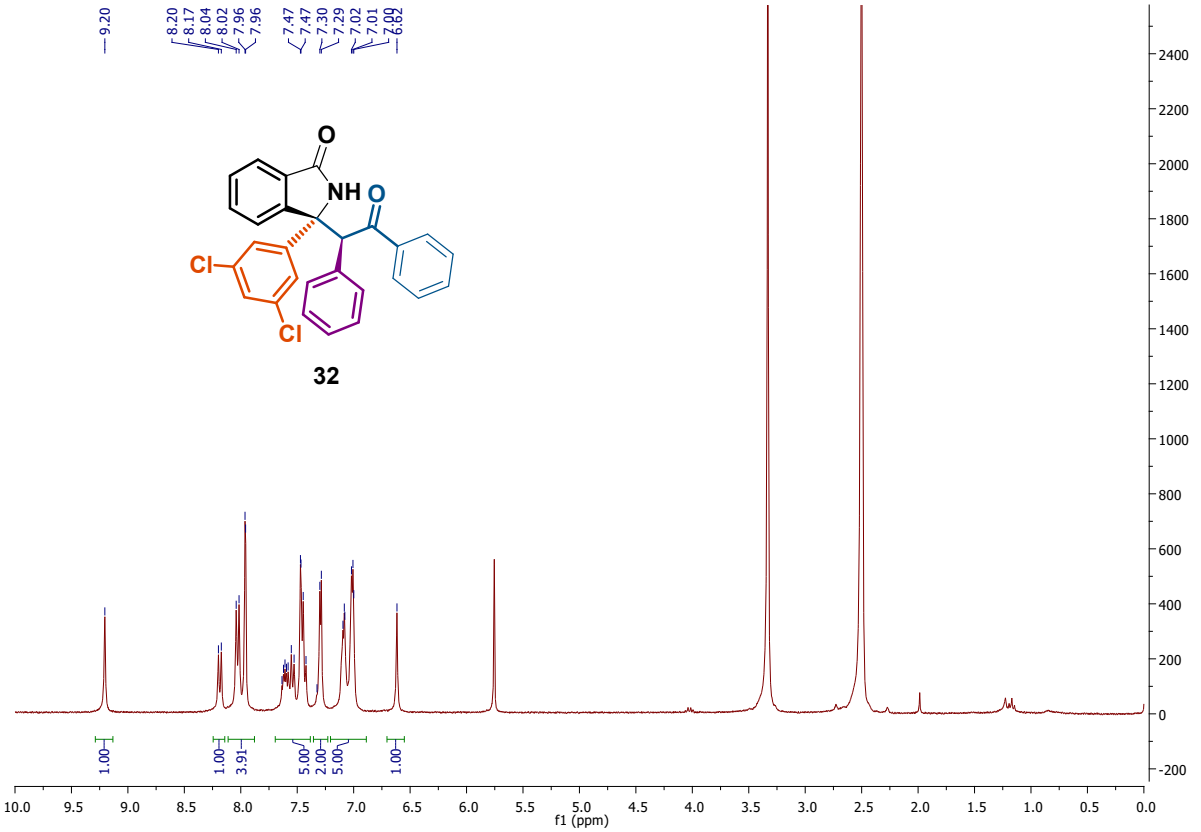
122.6
122.4
68.5
57.9
21.1
O
NH
O
Me
Me
31
f1 (ppm)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8.17
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8.02
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7.96
7.47
7.47
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7.29
7.02
7.01
6.82
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Cl
32
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1.00
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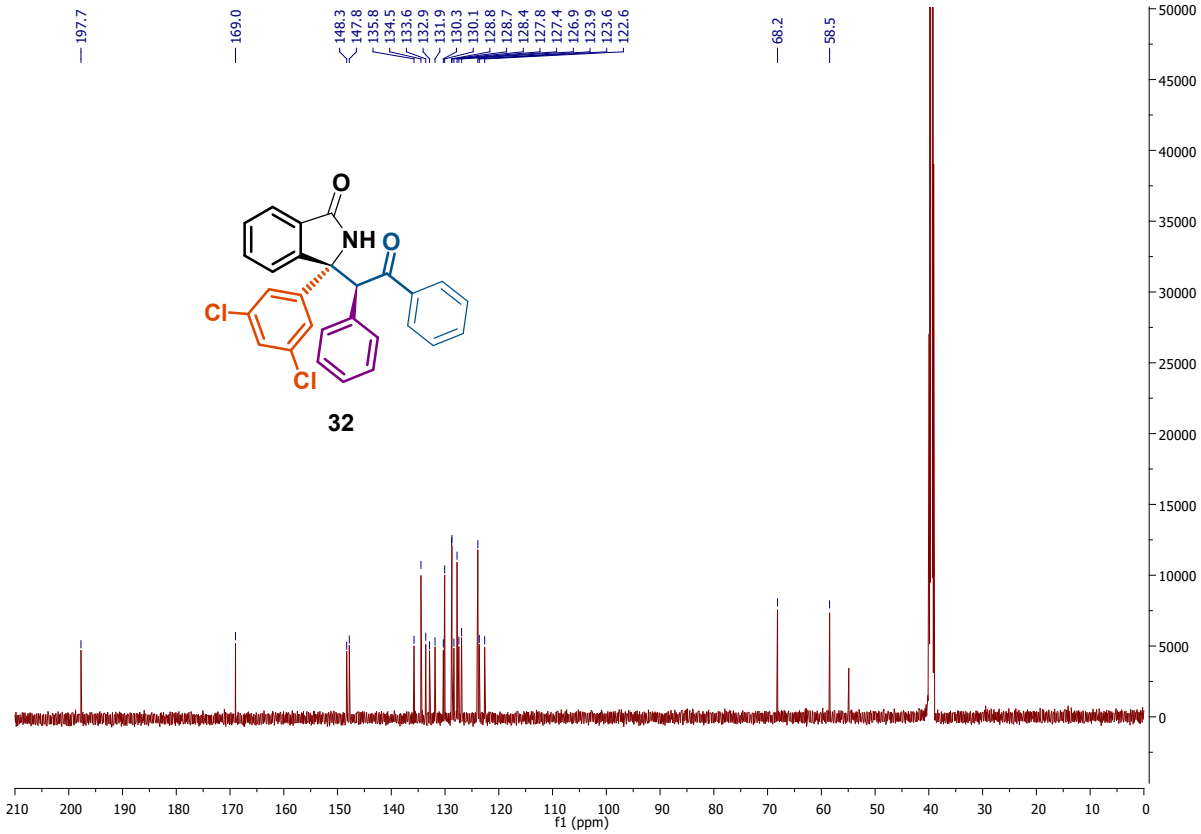
2.00
5.00
1.00
f1 (ppm)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148.3
147.8
135.8
134.5
133.6
132.9
131.9
130.3
130.1
128.8
128.7
128.4
127.8
127.4
126.9
123.9
123.6
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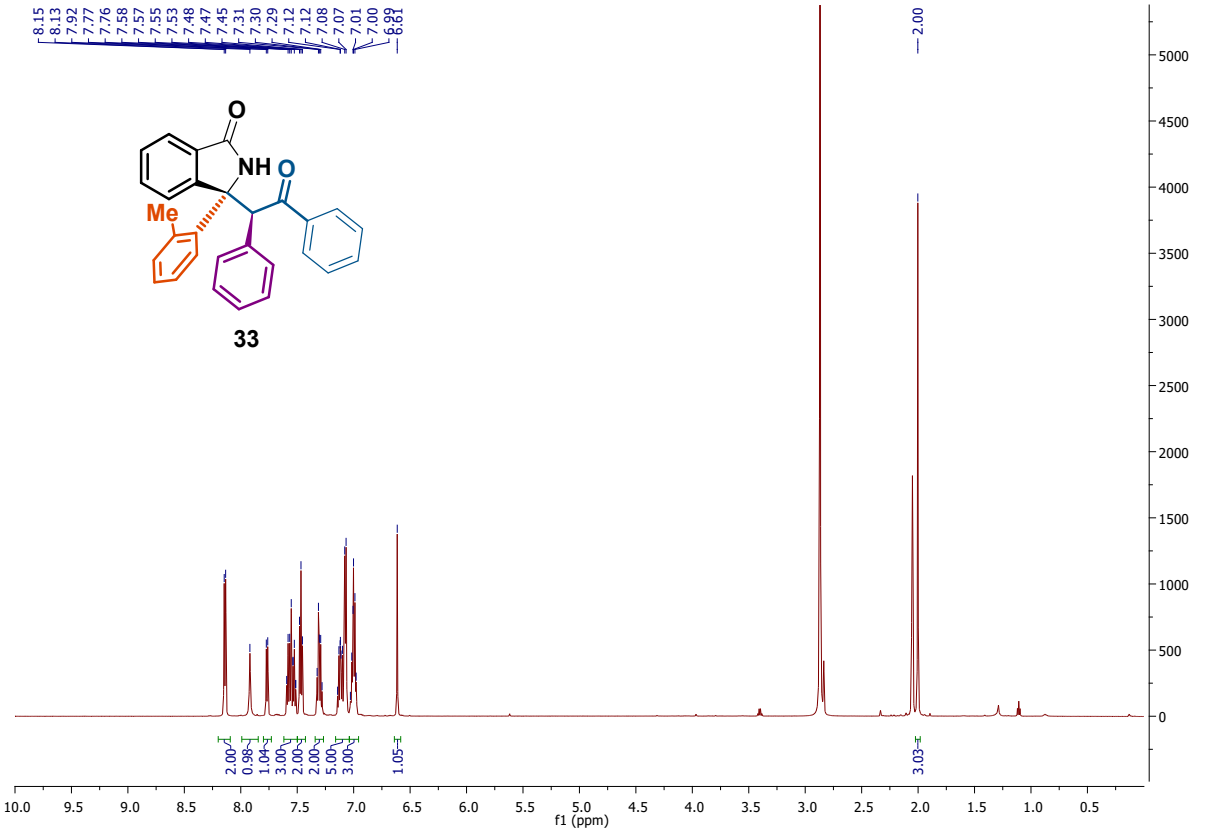
68.2
58.5
O
NH
O
Cl
Cl
32
f1 (ppm)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7.55
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7.31
7.30
7.29
7.12
7.12
7.08
7.07
7.01
7.00
6.99
6.61
2.00
O
NH
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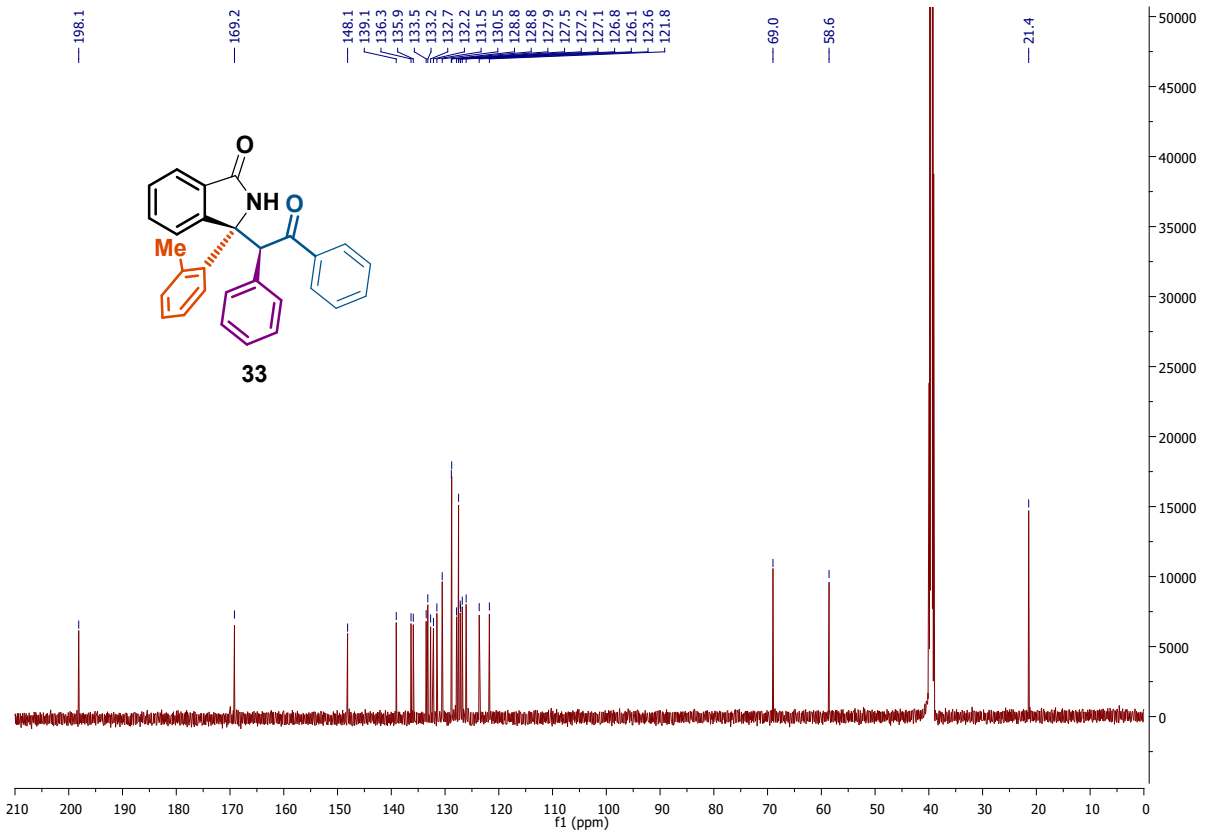
3.00
2.00
5.00
3.00
1.05
3.03
f1 (ppm)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139.1
136.3
135.9
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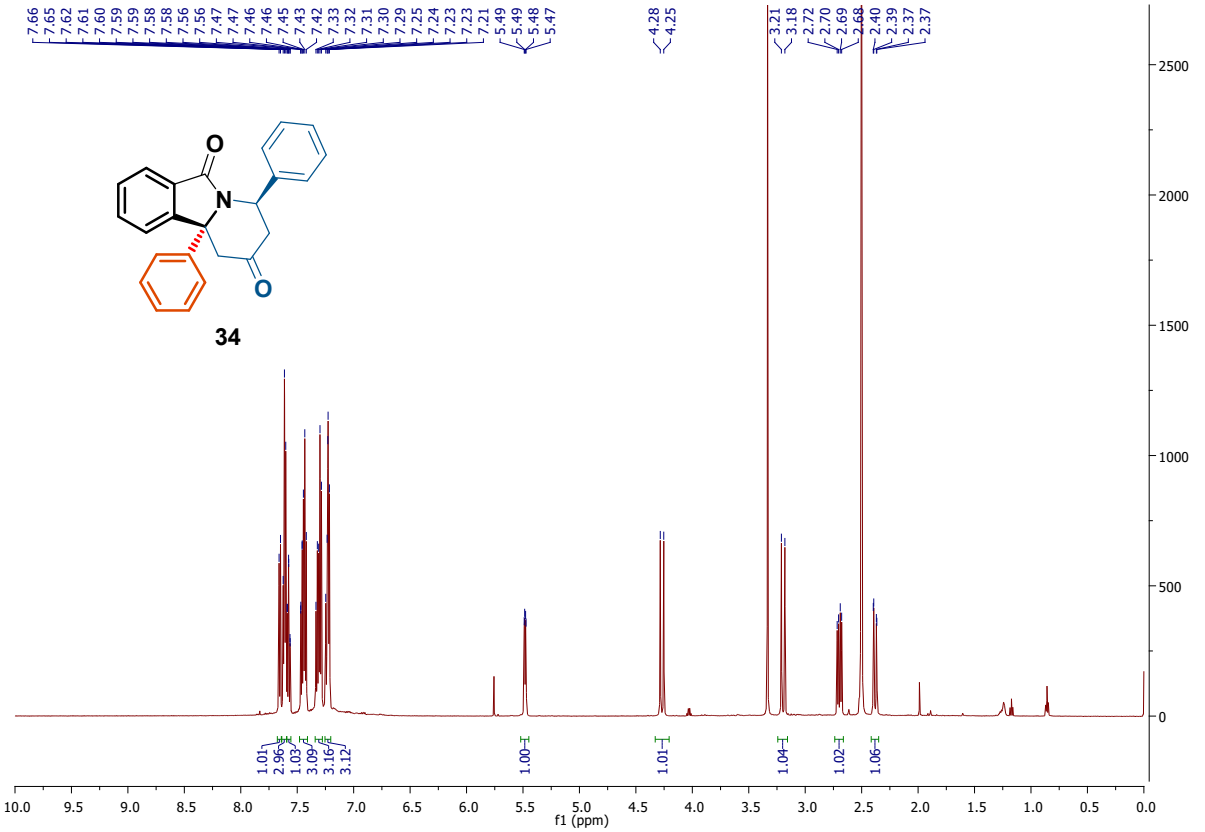
133.2
132.7
132.2
131.5
130.5
128.8
128.8
127.9
127.5
127.2
127.1
126.8
126.1
123.6
121.8
69.0
58.6
21.4
O
NH
O
Me
33
f1 (ppm)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7.58
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7.56
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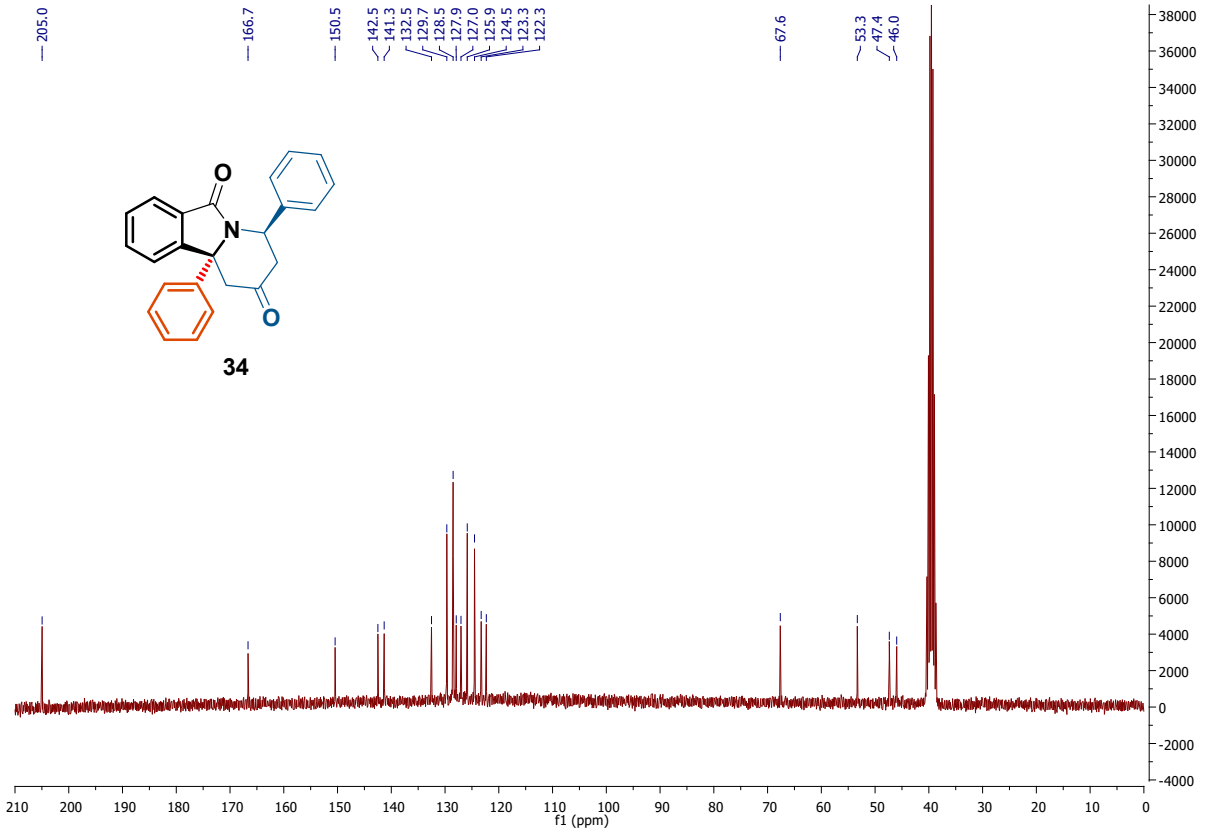
7.47
7.46
7.46
7.45
7.43
7.42
7.33
7.32
7.31
7.30
7.29
7.25
7.24
7.23
7.23
7.21
5.49
5.49
5.48
5.47
4.28
4.25
3.21
3.18
2.72
2.70
2.69
2.68
2.40
2.39
2.37
2.37
O
N
O
34
1.01
2.96
1.03
3.09
3.16
3.12
1.00
1.01
1.04
1.02
1.06
f1 (ppm)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141.3
132.5
129.7
128.5
127.9
127.0
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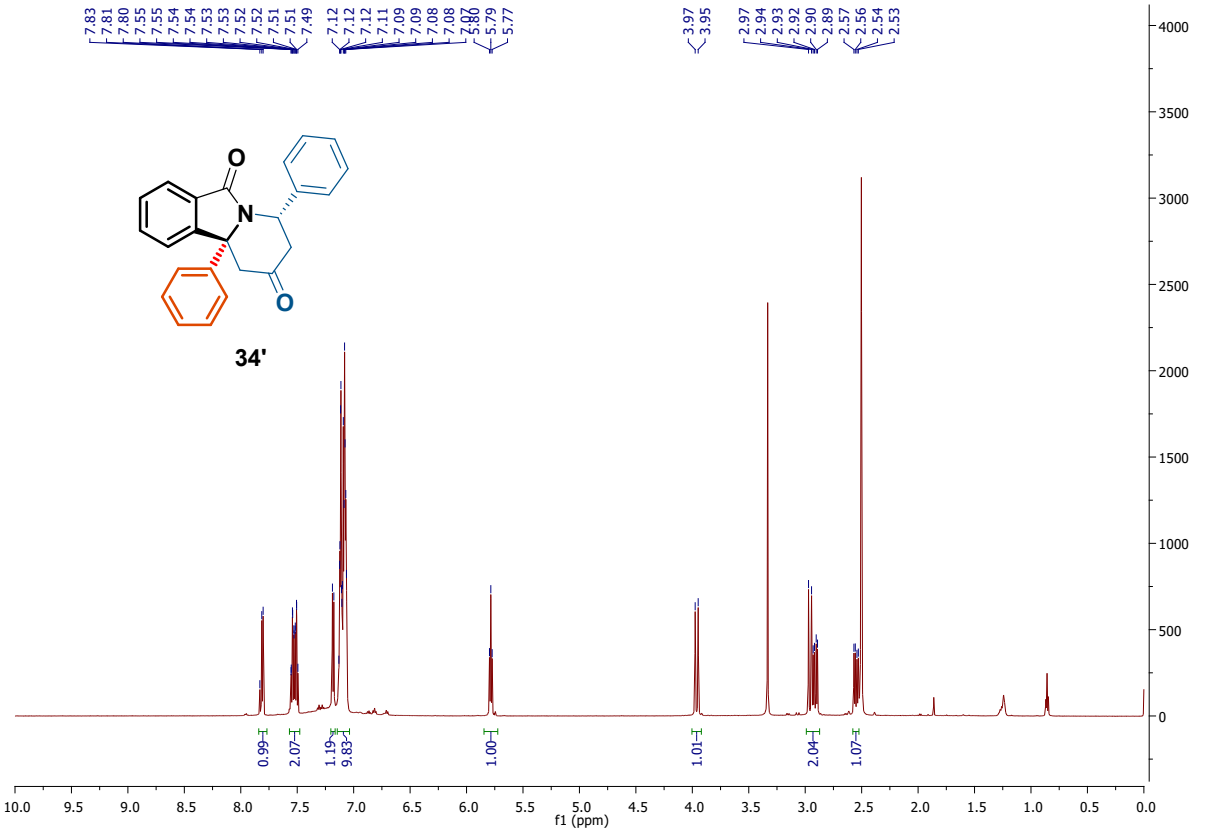
123.3
122.3
67.6
53.3
47.4
46.0
O
N
O
34
f1 (ppm)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7.53
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7.52
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7.51
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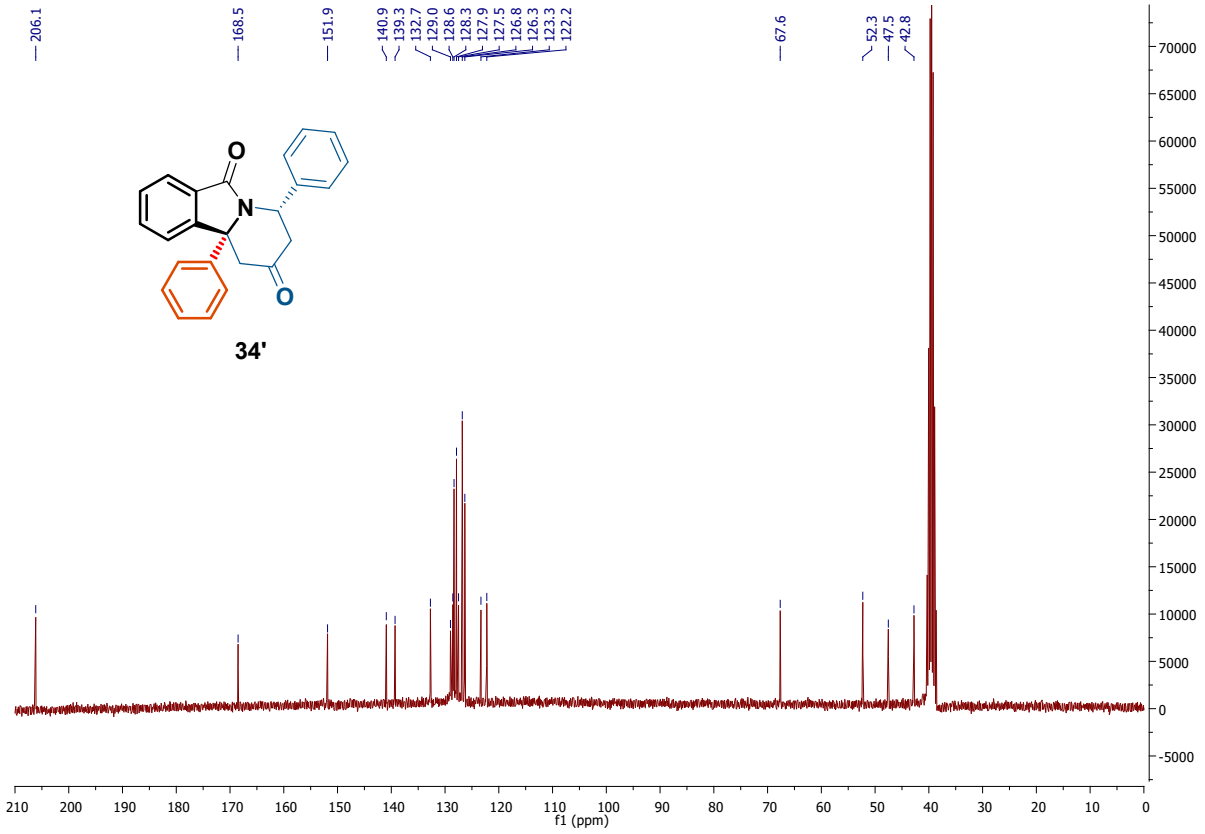
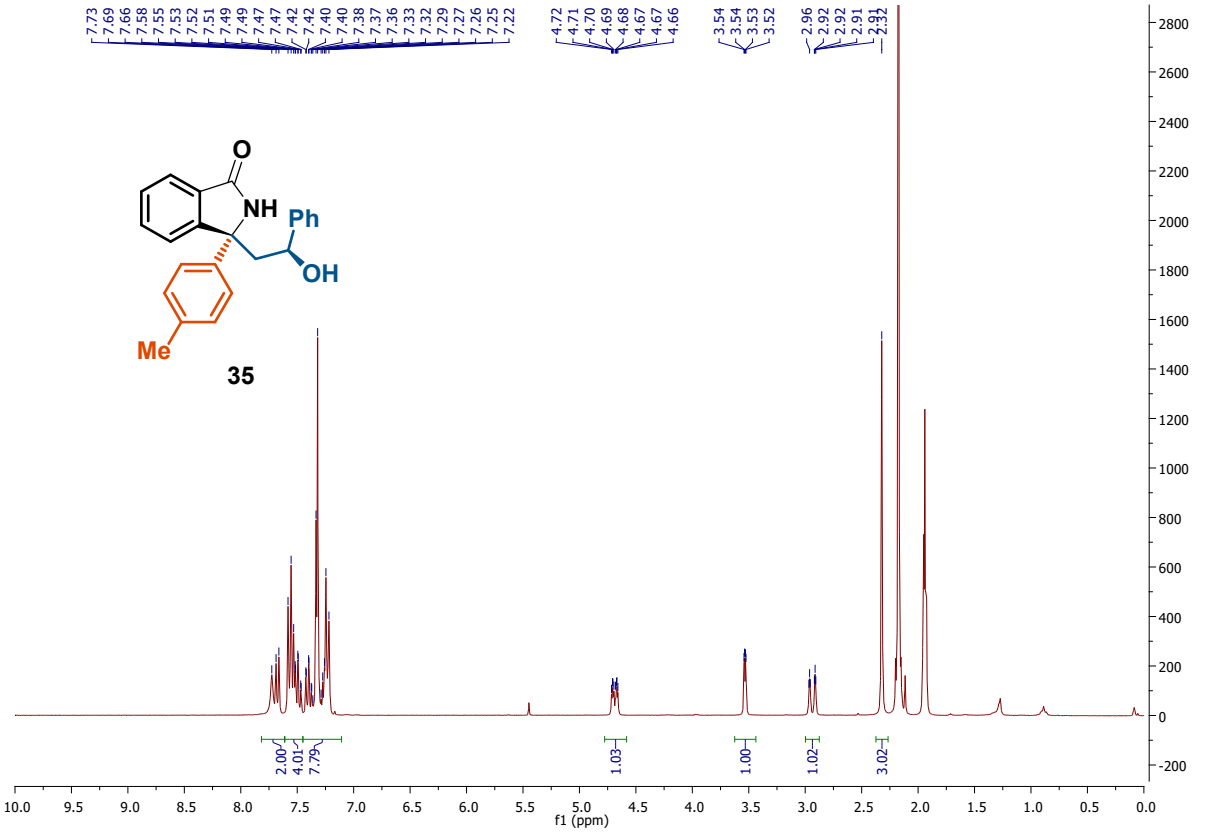
7.49
7.12
7.12
7.12
7.11
7.09
7.09
7.08
7.08
5.80
5.79
5.77
3.97
3.95
2.97
2.94
2.93
2.92
2.90
2.89
2.57
2.56
2.54
2.53
O
N
O
34'
0.99
2.07
1.19
9.83
1.00
1.01
2.04
1.07
f1 (ppm)


206.1
168.5
151.9
140.9
139.3
132.7
129.0
128.6
128.3
127.9
127.5
126.8
126.3
123.3
122.2
67.6
52.3
47.5
42.8
O
N
O
34'
f1 (ppm)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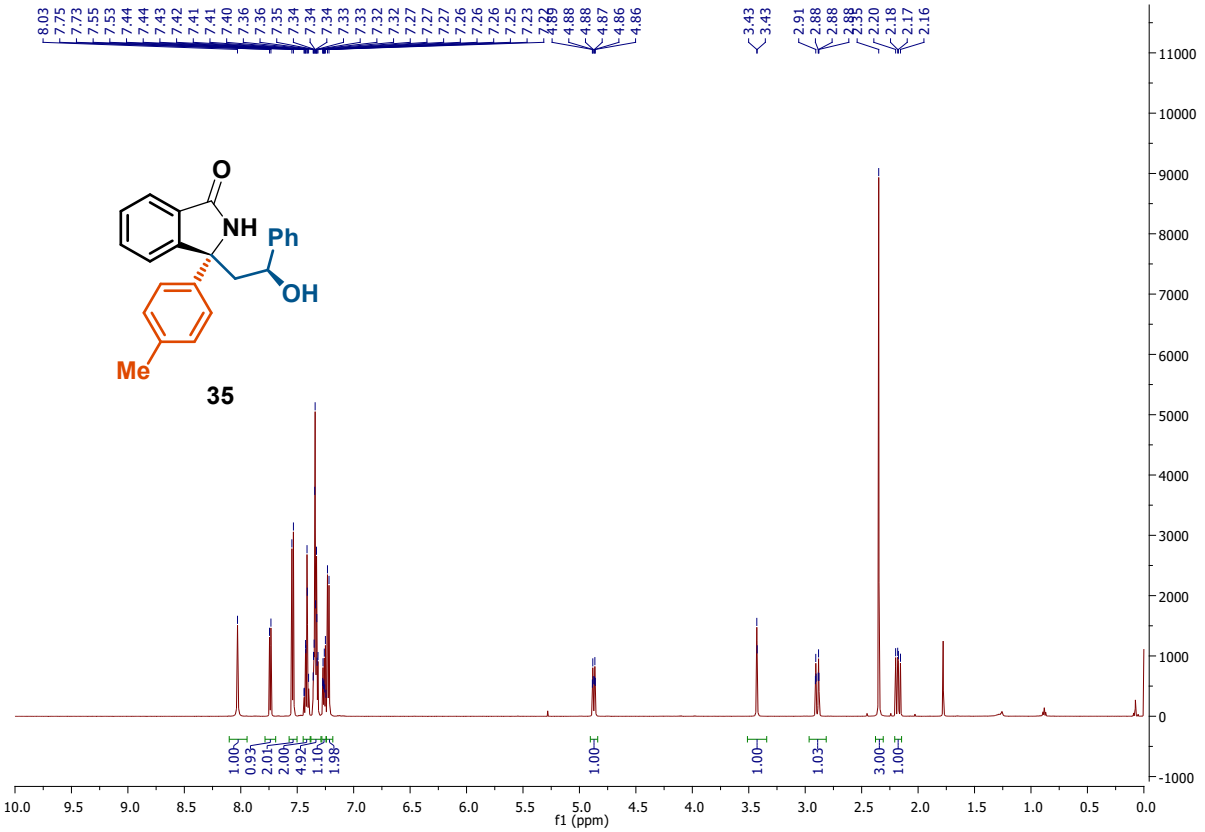
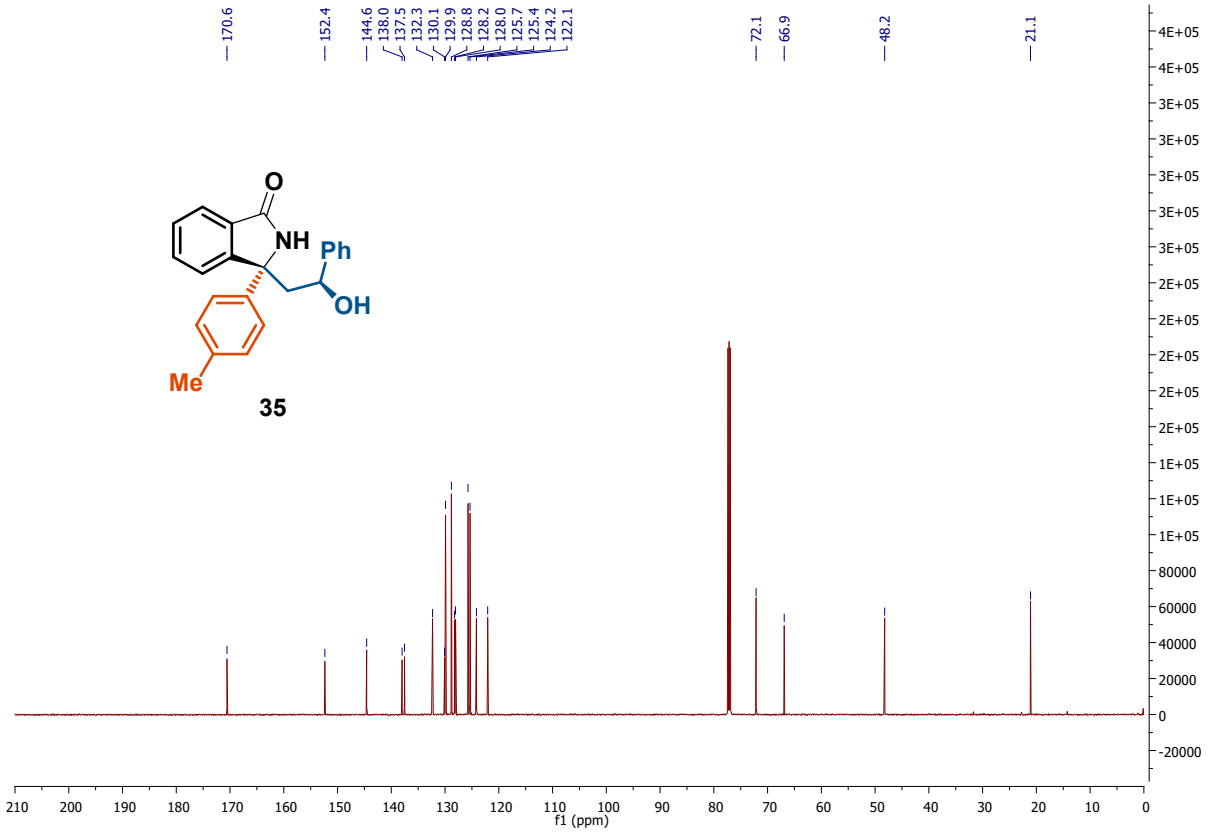
NH
Ph
OH
Me
35
f1 (ppm)


O
NH
Ph
OH
Me
35
f1 (ppm)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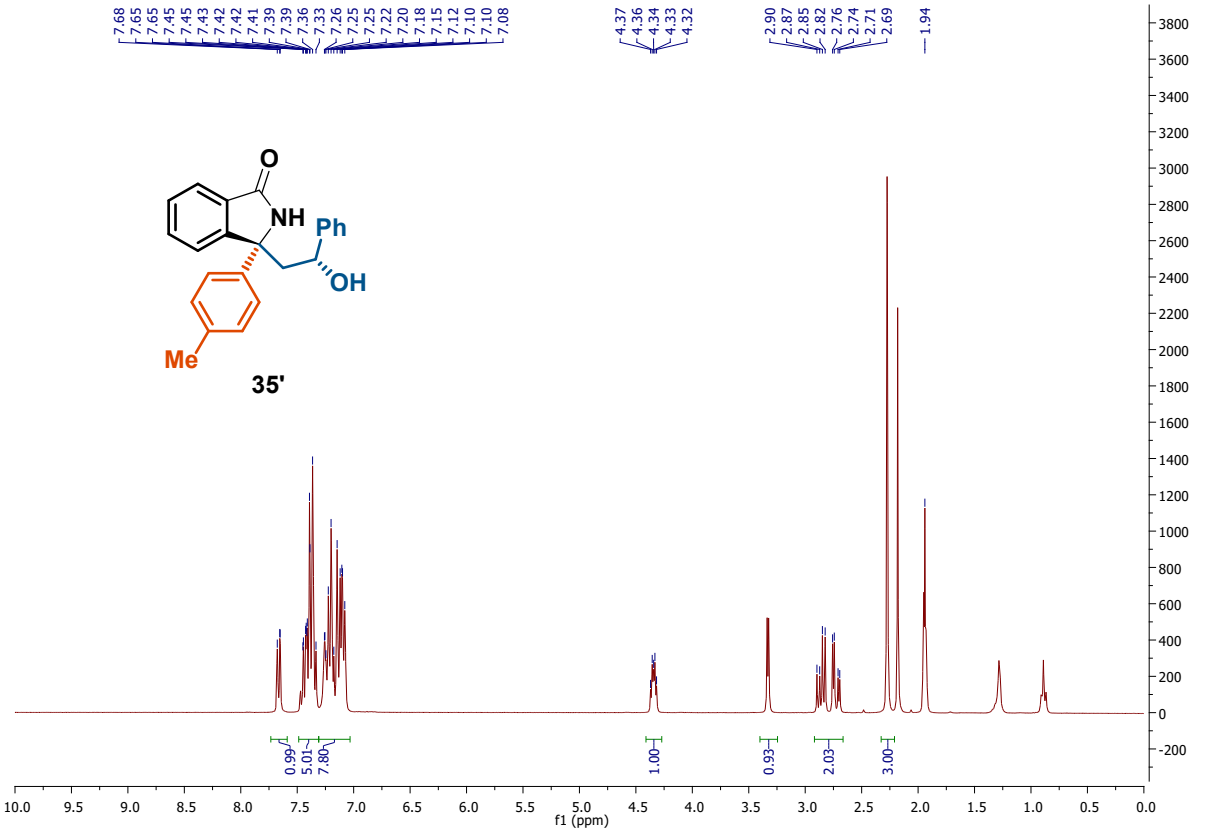
144.6
138.0
137.5
132.3
130.1
129.9
128.8
128.2
128.0
125.7
125.4
124.2
122.1
72.1
66.9
48.2
21.1
O
NH
Ph
OH
Me
35
f1 (ppm)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7.65
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7.45
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7.42
7.42
7.41
7.39
7.39
7.36
7.33
7.26
7.25
7.25
7.22
7.20
7.18
7.15
7.12
7.10
7.10
7.08
4.37
4.36
4.34
4.33
4.32
2.90
2.87
2.85
2.82
2.76
2.74
2.71
2.69
1.94
O
NH
Ph
OH
Me
35'
0.99
5.01
7.80
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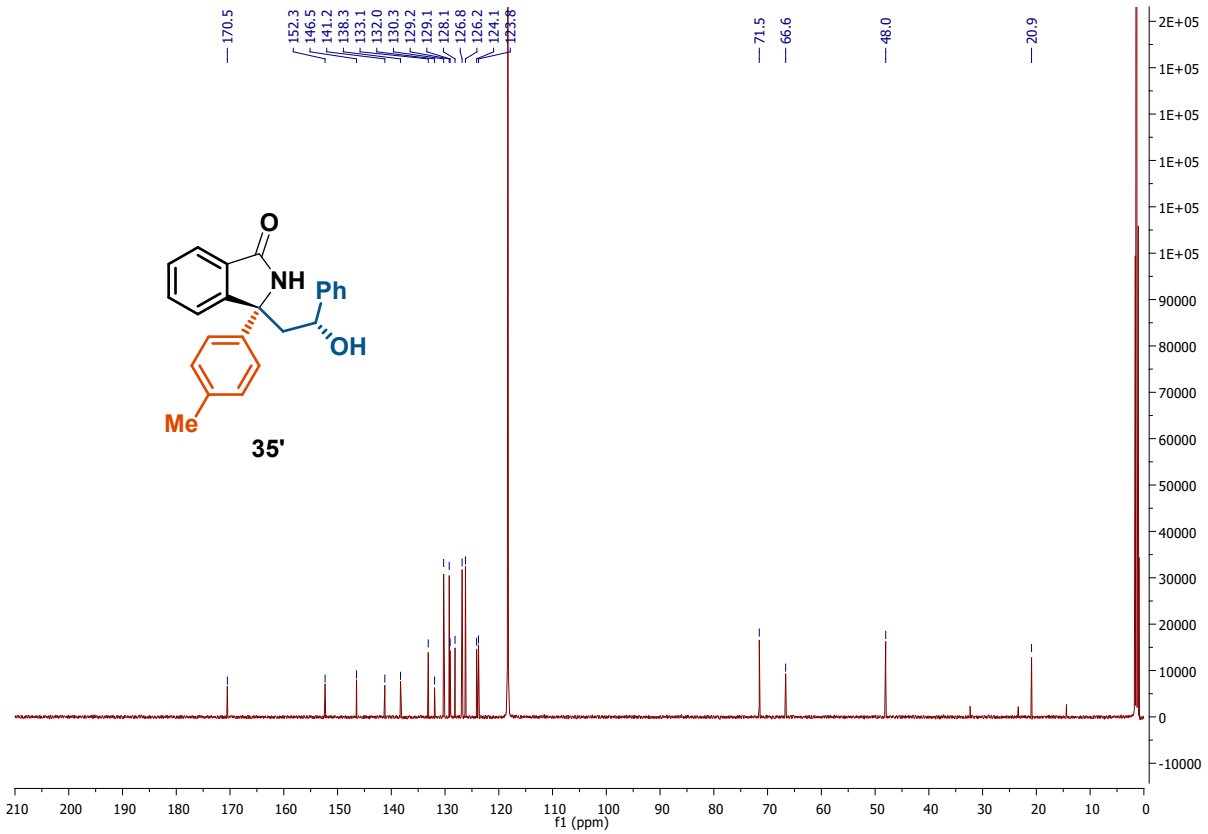
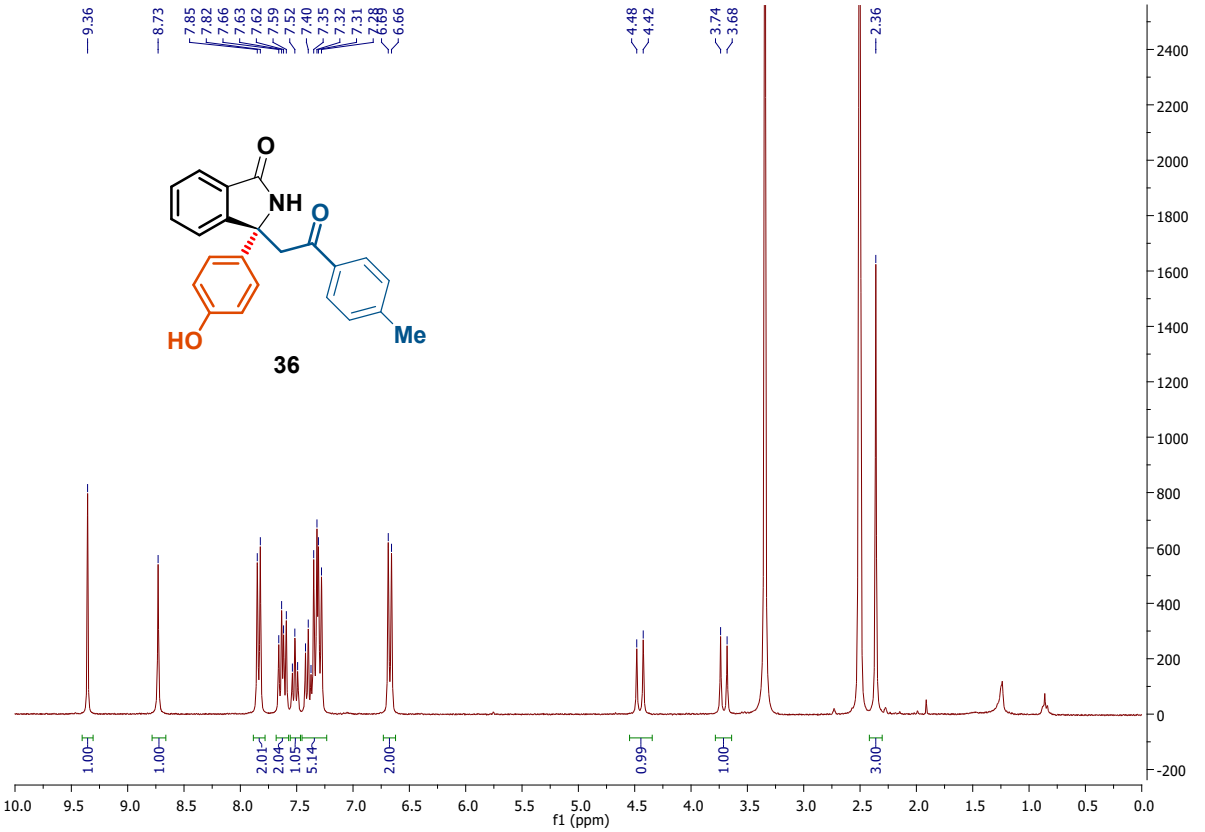
0.93
2.03
3.00
f1 (ppm)


170.5
152.3
146.5
141.2
138.3
133.1
132.0
130.3
129.2
129.1
128.1
126.8
126.2
124.1
123.8
71.5
66.6
48.0
20.9
O
NH
Ph
OH
Me
35'
f1 (ppm)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8.73
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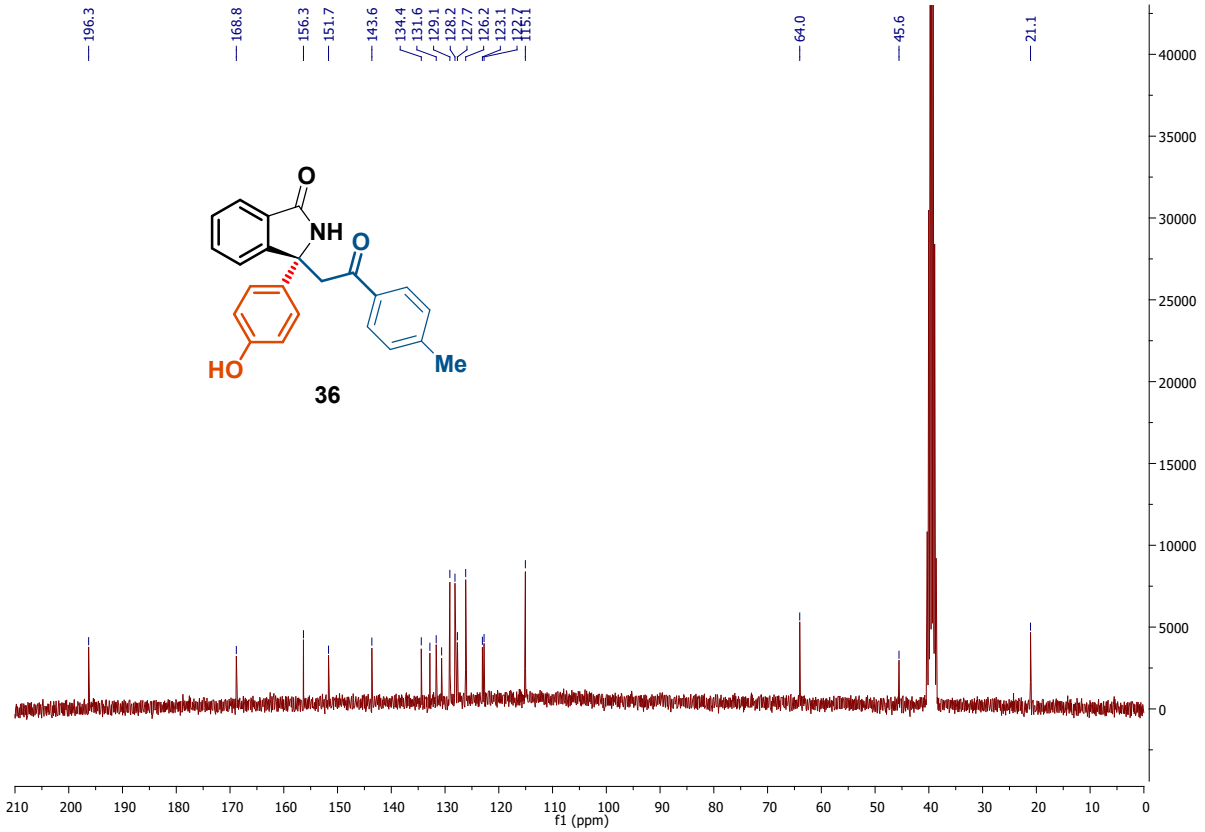
7.82
7.66
7.63
7.62
7.59
7.52
7.40
7.35
7.32
7.31
7.28
6.69
6.66
4.48
4.42
3.74
3.68
2.36
O
NH
O
HO
Me
36
1.00
1.00
2.01
2.04
1.05
5.14
2.00
0.99
1.00
3.00
f1 (ppm)


196.3
168.8
156.3
151.7
143.6
134.4
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129.1
128.2
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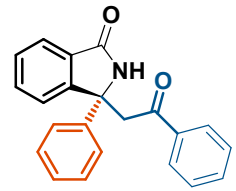
64.0
45.6
21.1
O
NH
O
HO
Me
36
f1 (ppm)

§ 7. HPLC Traces



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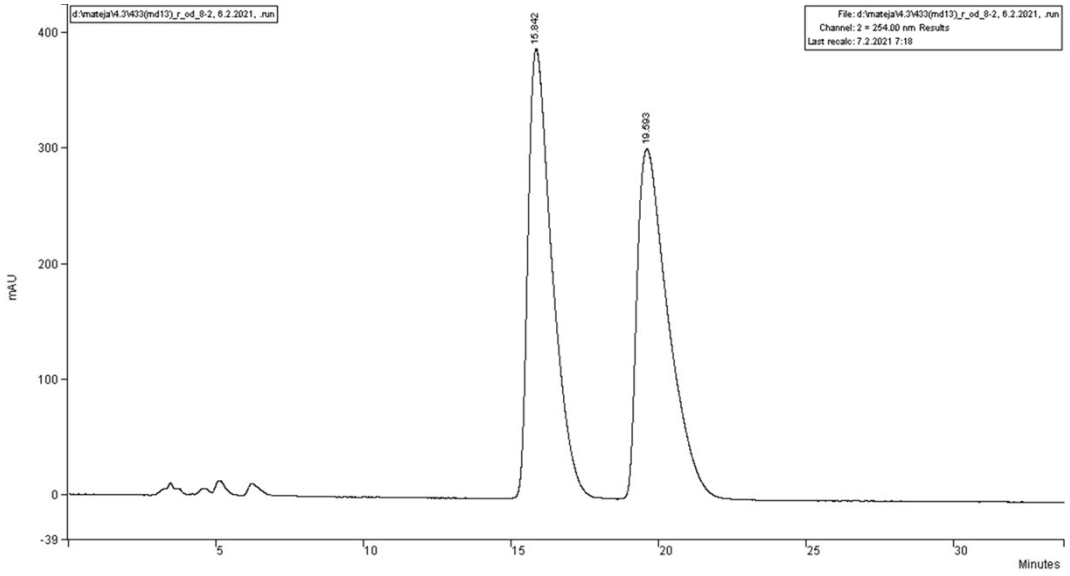
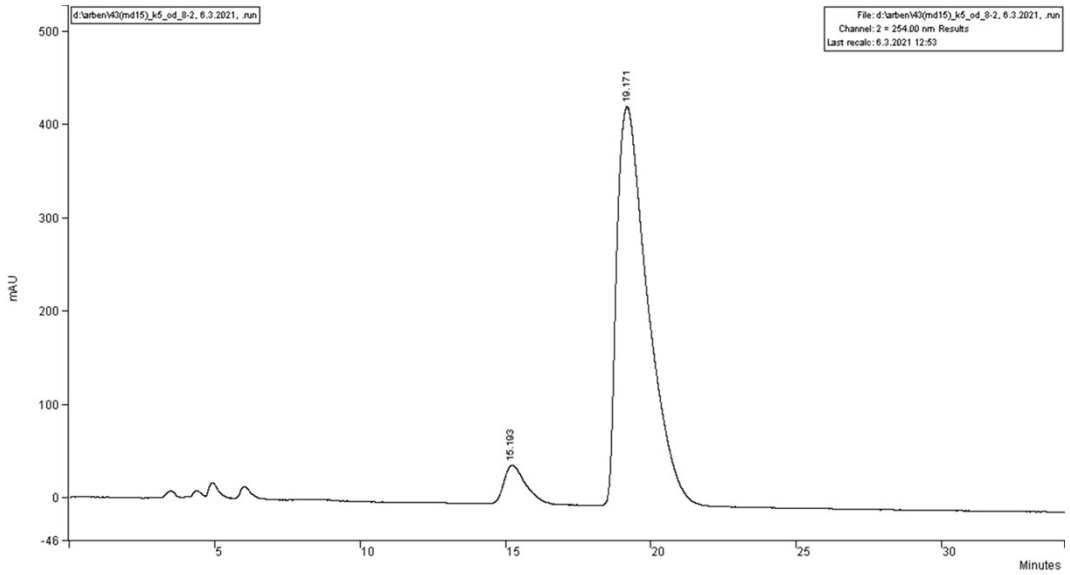


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9115	15.842	0.000	220341696	BB	51.7	
2		50.0885	19.593	0.000	221122688	BB	67.4	
Totals:		100.0000		0.000	441464384			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		6.1498	15.193	0.000	20703530	BB	45.9	
2		93.8502	19.171	0.000	315949536	BB	67.9	
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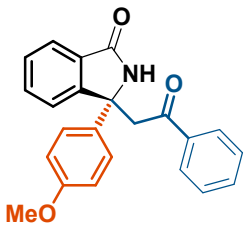

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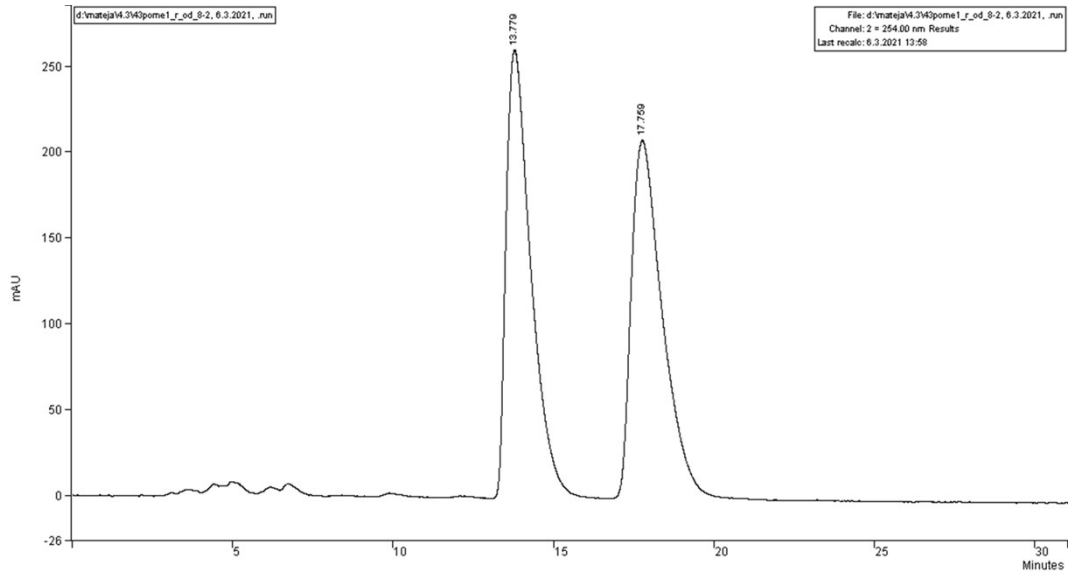
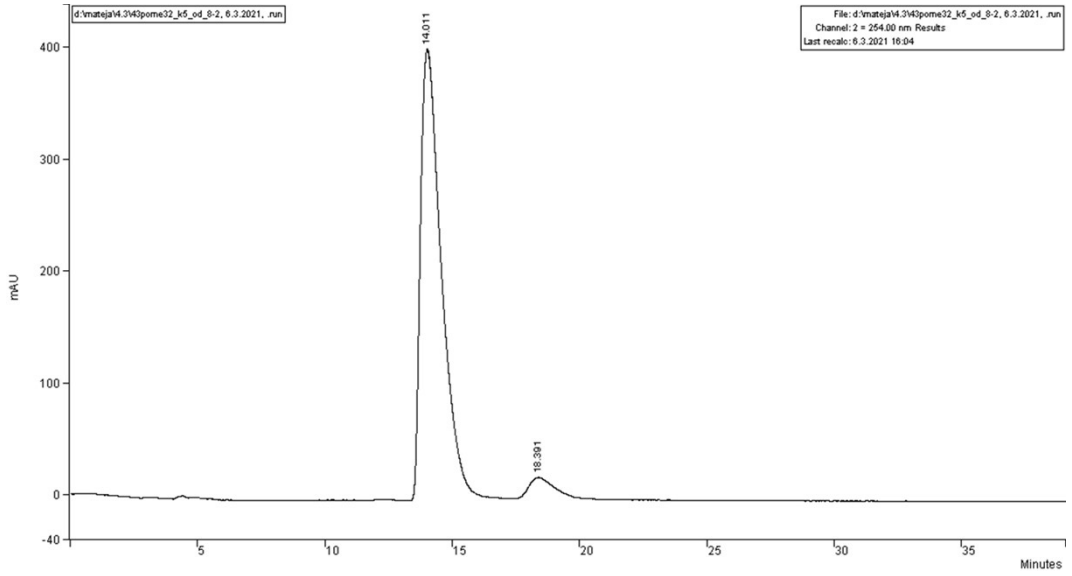
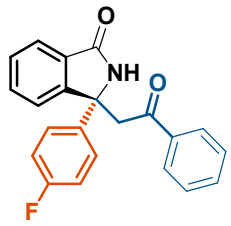


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0727	13.779	0.000	139866704	BB	49.1	
2		49.9273	17.759	0.000	139460384	BB	61.6	
Totals:		100.0000		0.000	279327088			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		95.0006	14.011	0.000	229655280	BB	52.1	
2		4.9994	18.391	0.000	12085668	BB	63.1	
Totals:		100.0000		0.000	241740948			



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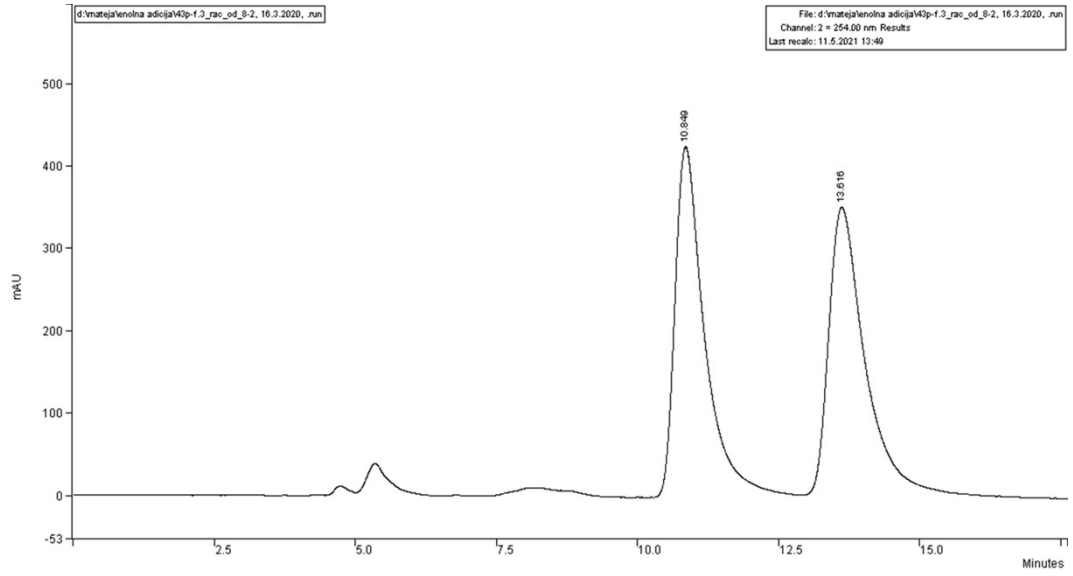
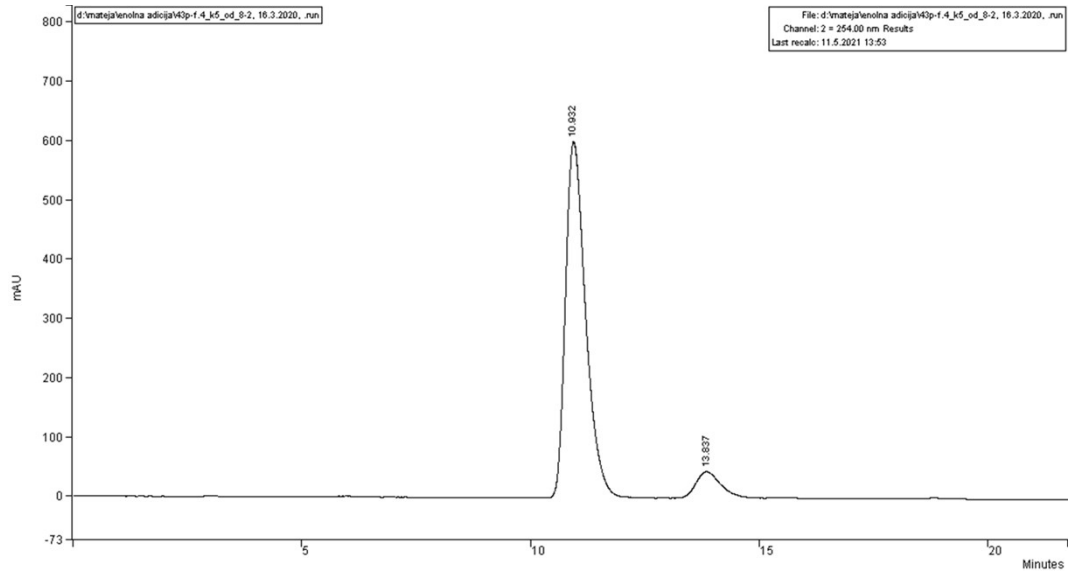
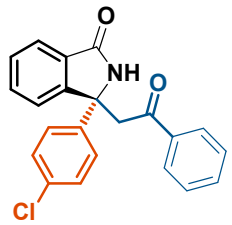


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9539	10.849	0.000	153504144	BB	30.8	
2		50.0461	13.616	0.000	153787312	BB	38.0	
Totals:		100.0000		0.000	307291456			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		92.8727	10.932	0.000	183630976	BB	27.9	
2		7.1273	13.837	0.000	14092275	BB	32.8	
Totals:		100.0000		0.000	197723251			



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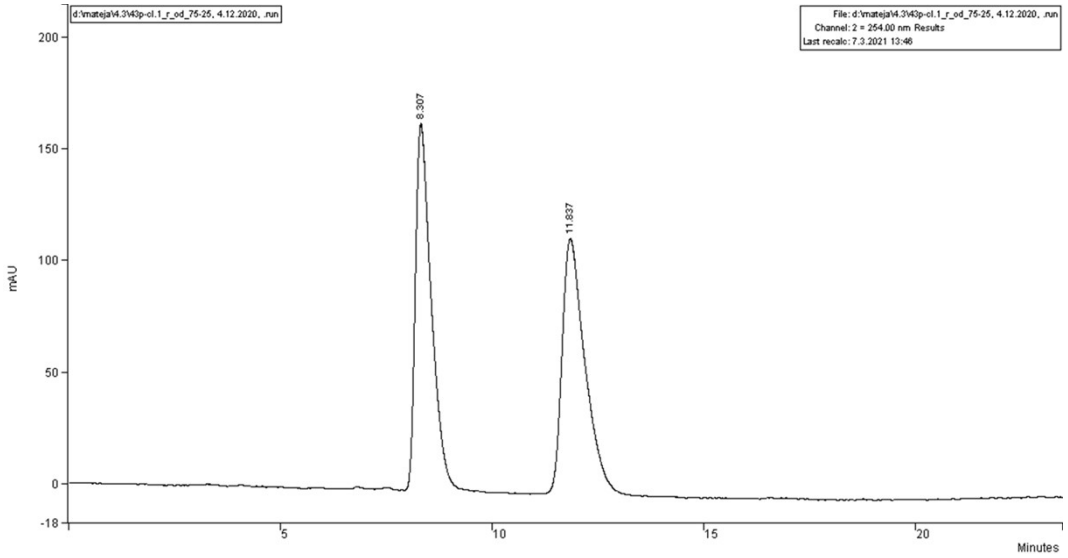
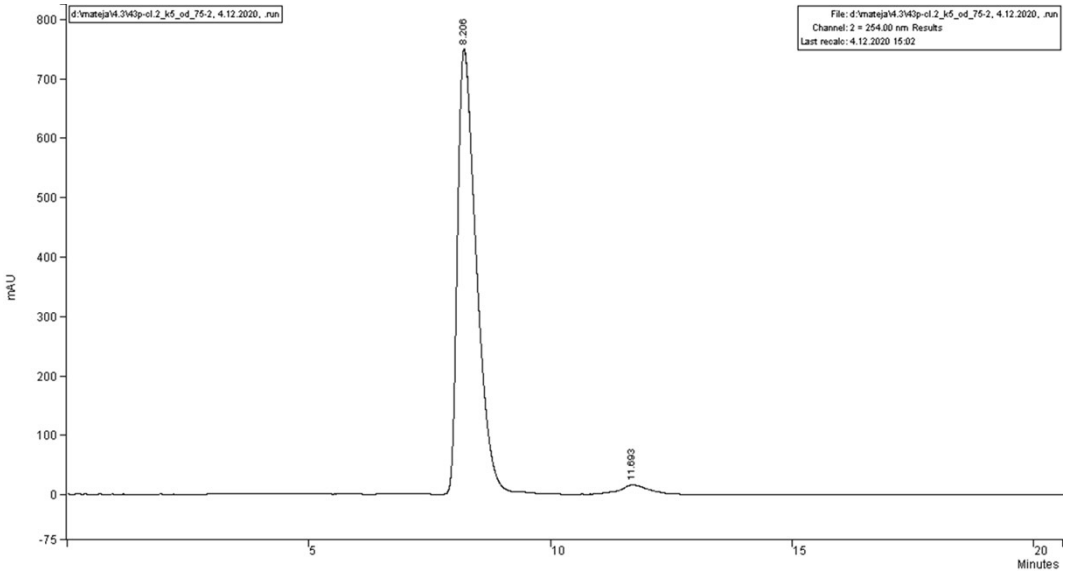
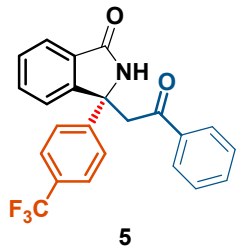


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0645	8.307	0.000	43182228	BB	23.7	
2		49.9355	11.837	0.000	43071016	BB	33.7	
	Totals:	100.0000		0.000	86253244			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		97.2361	8.206	0.000	200786560	BB	24.9	
2		2.7639	11.693	0.000	5707345	BB	32.7	
	Totals:	100.0000		0.000	206493905			



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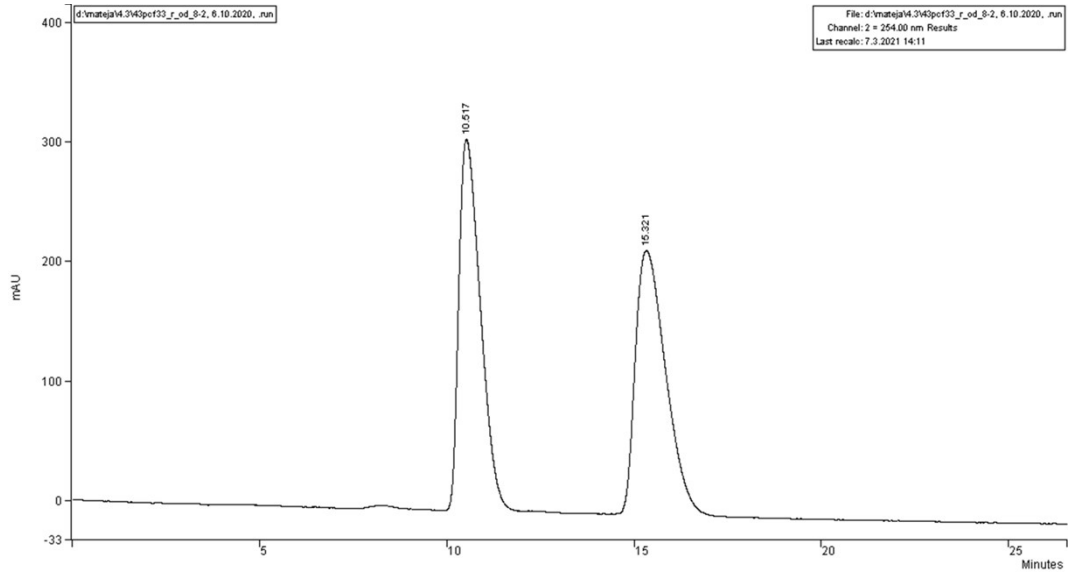
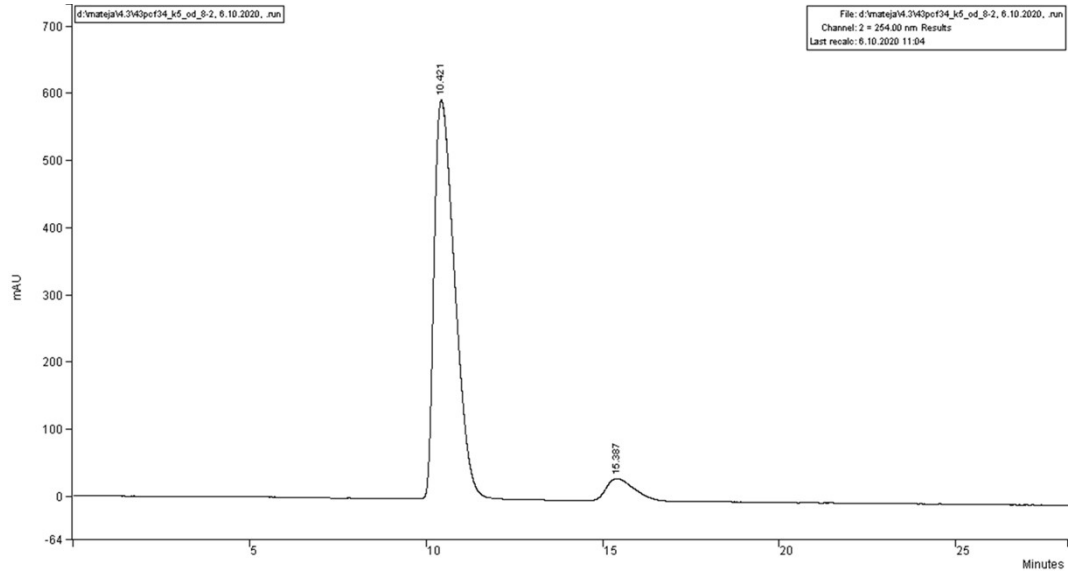
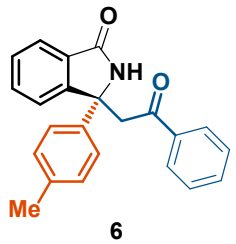


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0026	10.517	0.000	124533704	BB	37.9	
2		49.9974	15.321	0.000	124520560	BB	53.0	
Totals:		100.0000		0.000	249054264			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		93.0906	10.421	0.000	240758928	BB	38.5	
2		6.9094	15.387	0.000	17869722	BB	51.1	
Totals:		100.0000		0.000	258628650			



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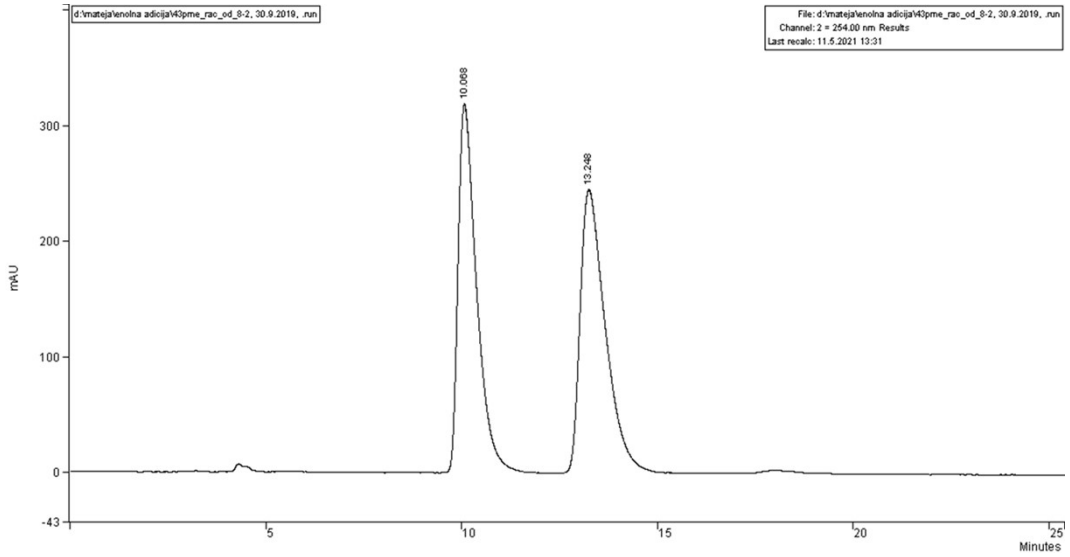
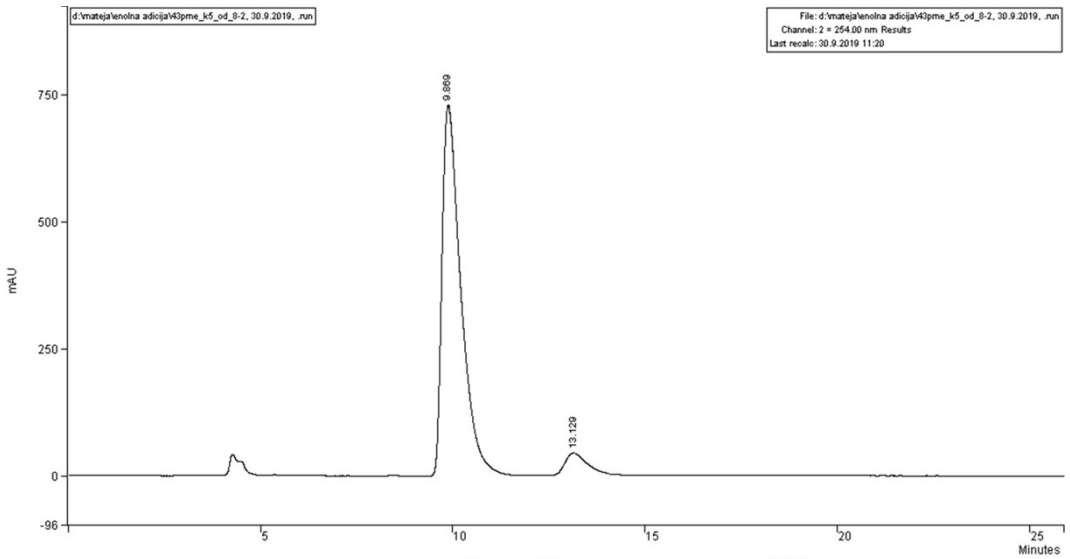
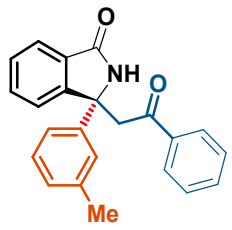


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.4188	10.068	0.000	104665448	BB	29.3	
2		50.5812	13.248	0.000	107127120	BB	40.4	
	Totals:	100.0000		0.000	211792568			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		94.6315	9.869	0.000	248307568	BB	30.5	
2		5.3685	13.129	0.000	14086662	BB	32.6	
	Totals:	100.0000		0.000	262394230			



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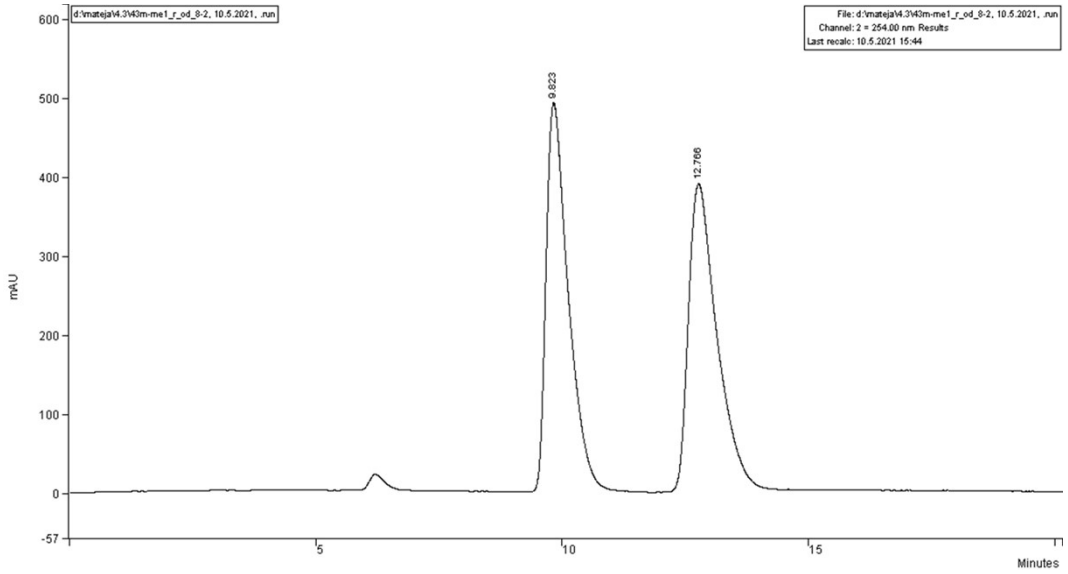
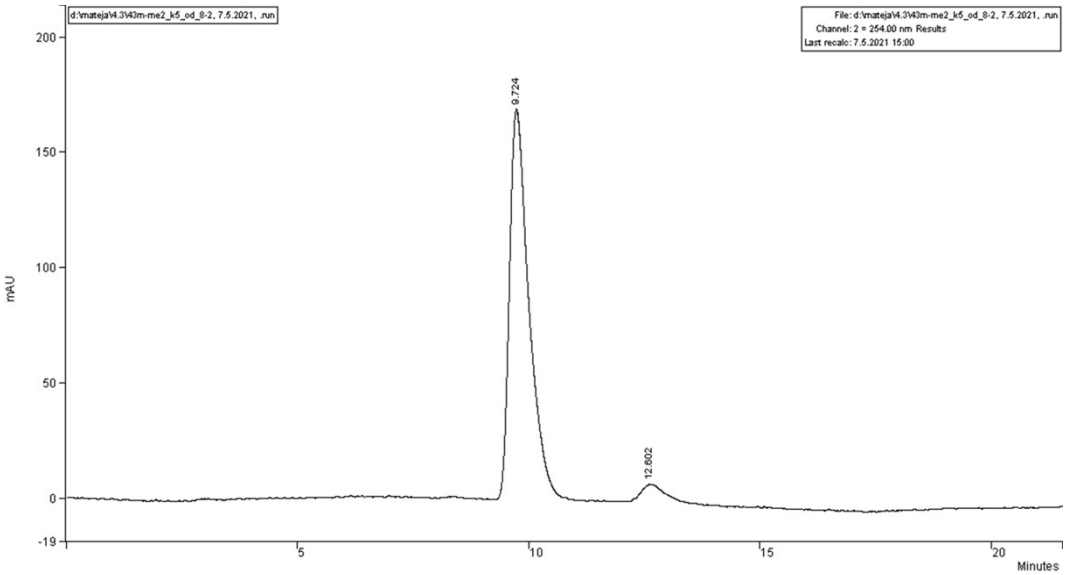
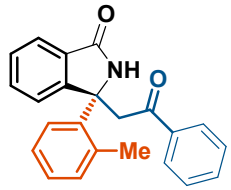


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.7691	9.823	0.000	153416256	BB	28.2	
2		50.2309	12.766	0.000	154839808	BB	36.2	
Totals:		100.0000		0.000	308256064			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		94.9017	9.724	0.000	49424856	BB	26.0	
2		5.0983	12.602	0.000	2655216	BB	30.0	
Totals:		100.0000		0.000	52080072			



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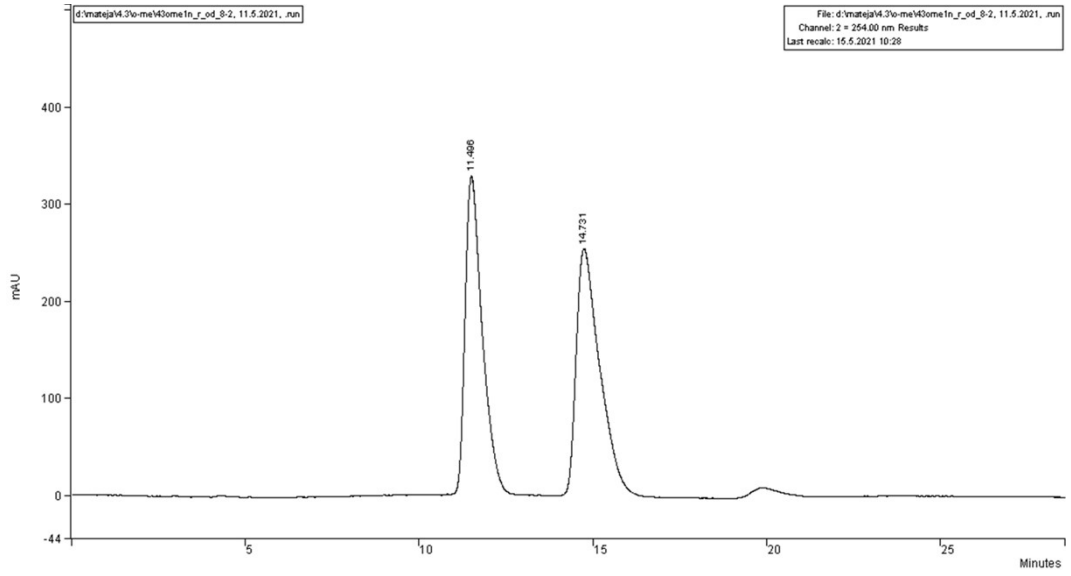
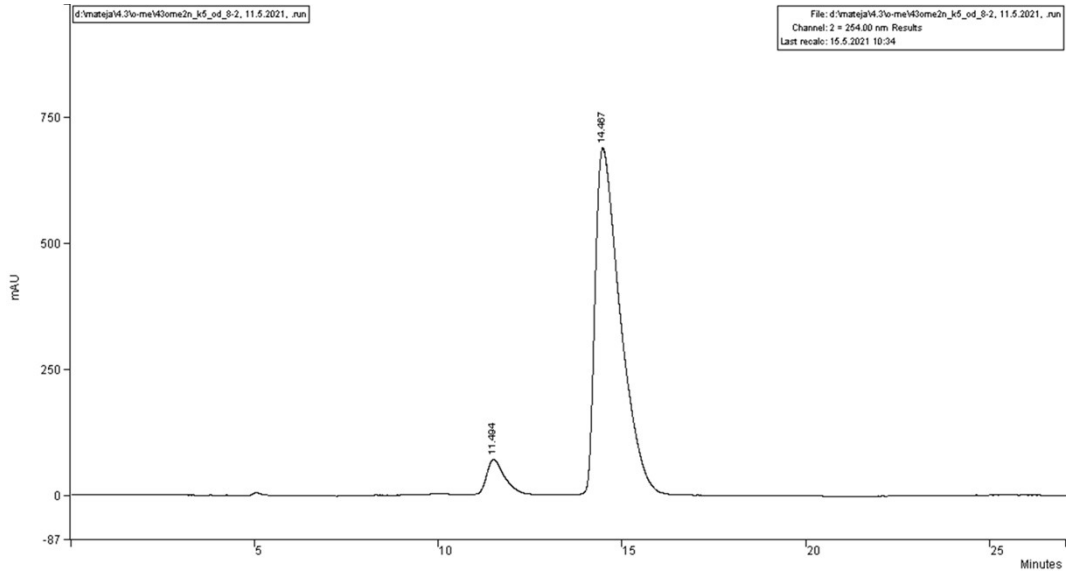


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.3939	11.496	0.000	112548344	BB	31.0	
2		49.6061	14.731	0.000	110788856	BB	42.9	
Totals:		100.0000		0.000	223337200			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		6.4894	11.494	0.000	22554198	BB	30.4	
2		93.5106	14.467	0.000	324999328	BB	43.4	
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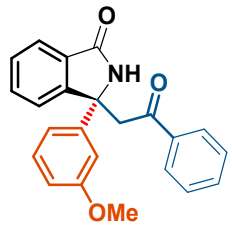

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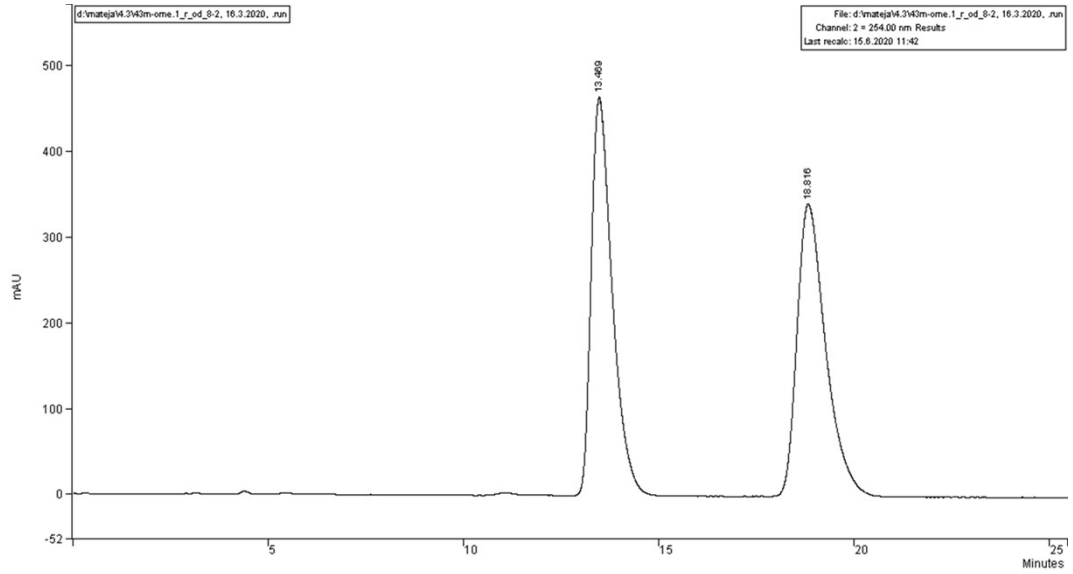

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9301	13.469	0.000	173832704	BB	33.9	
2		50.0699	18.816	0.000	174319648	BB	46.0	
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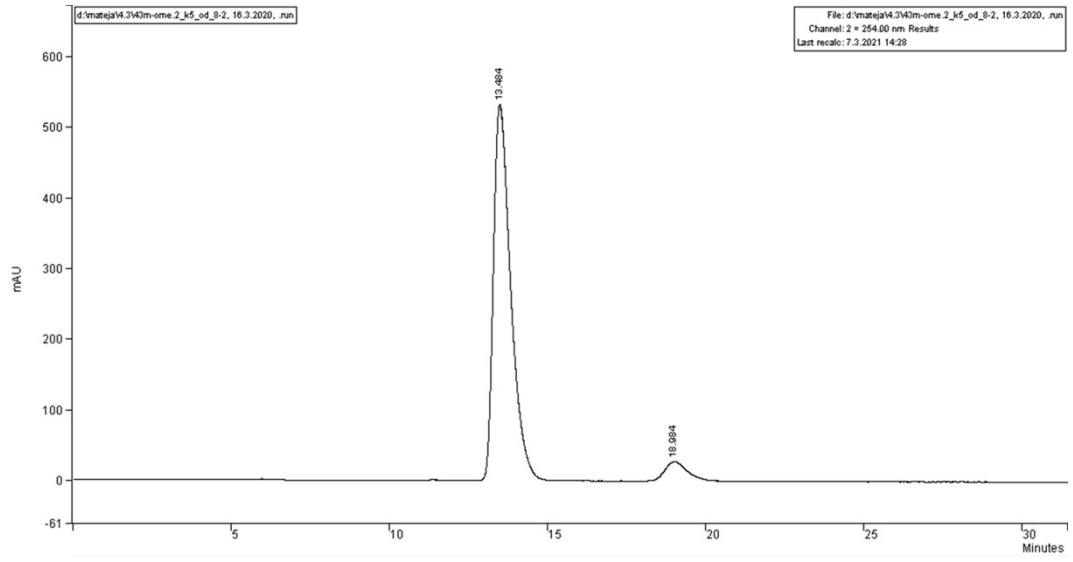

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		93.8528	13.484	0.000	202326640	BB	34.3	
2		6.1472	18.984	0.000	13251972	BB	44.9	
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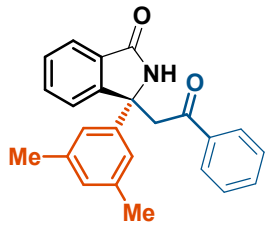

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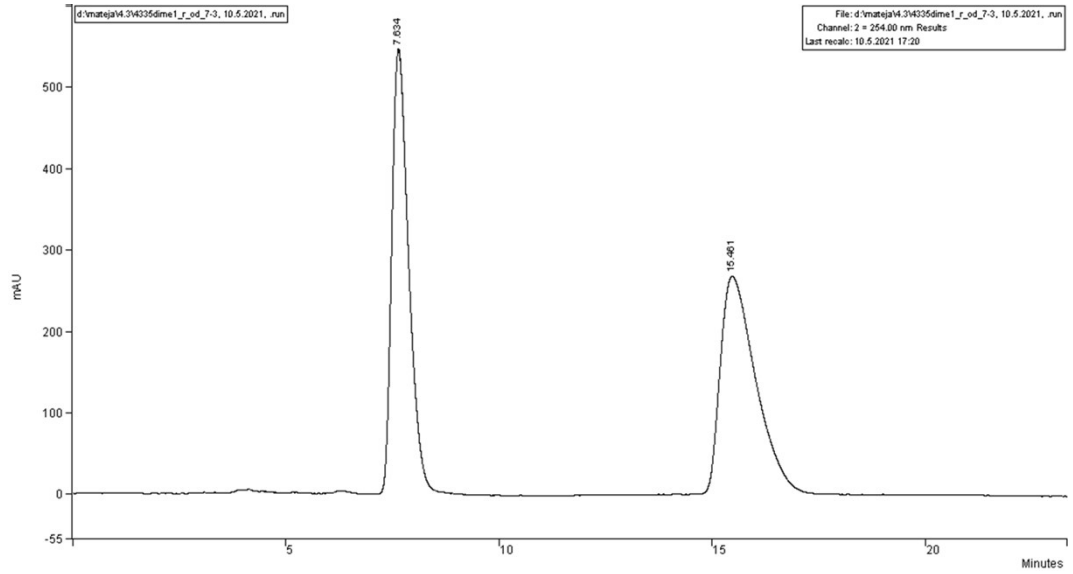
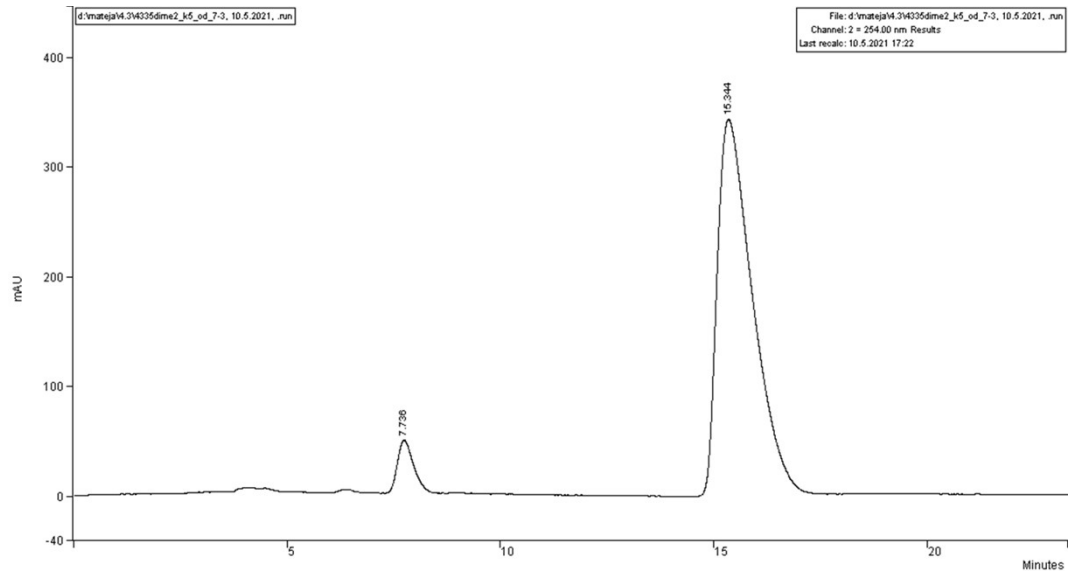


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.6881	7.634	0.000	151569488	BB	25.3	
2		50.3119	15.461	0.000	153472112	BB	53.6	
Totals:		100.0000		0.000	305041600			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		6.0784	7.736	0.000	12753639	BB	24.4	
2		93.9216	15.344	0.000	197064880	BB	53.6	
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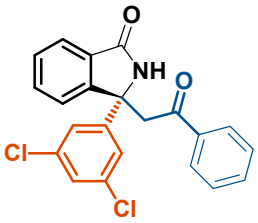
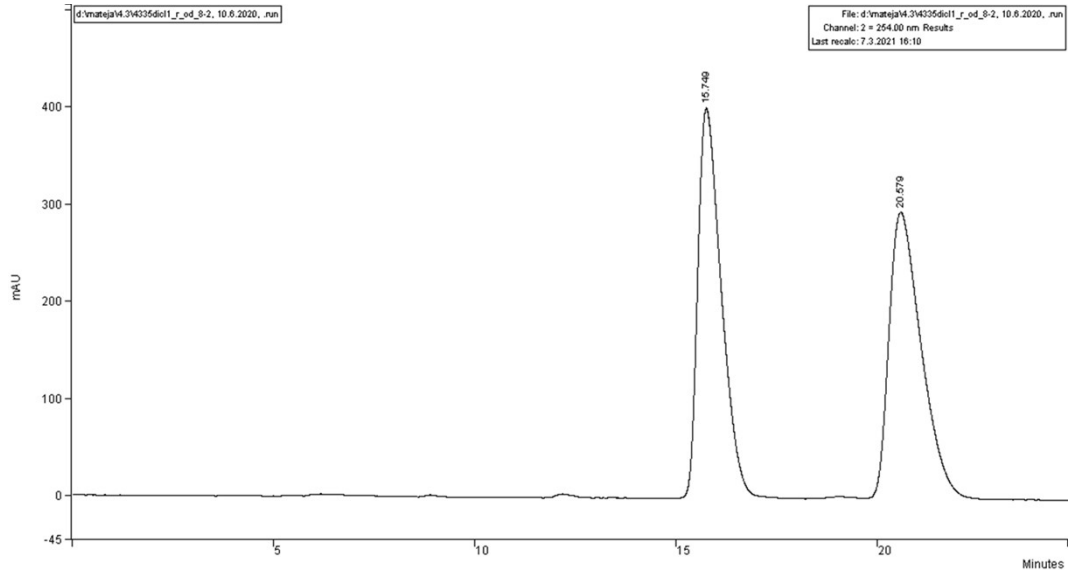
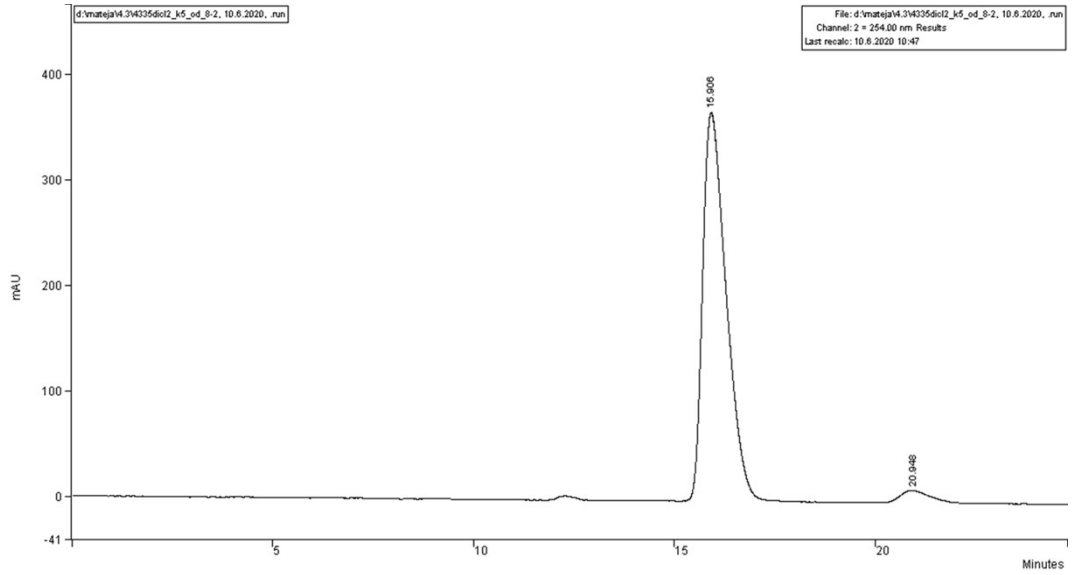


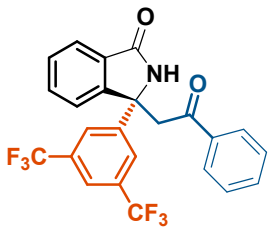
11



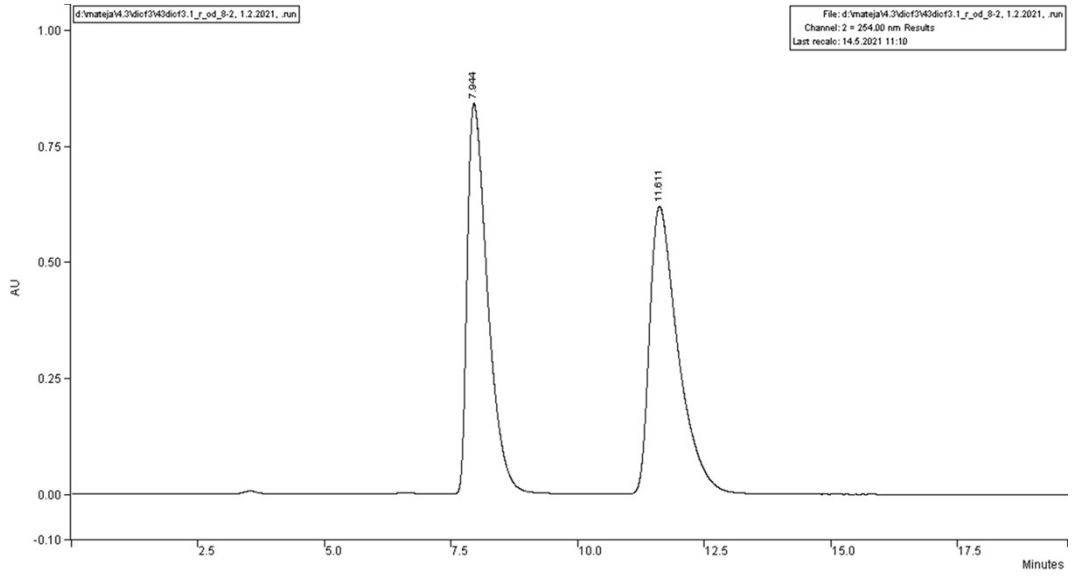
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.7824	15.749	0.000	161706272	BB	37.7	
2		50.2176	20.579	0.000	163119856	BB	51.6	
Totals:		100.0000		0.000	324826128			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		96.0510	15.906	0.000	149389168	BB	37.9	
2		3.9490	20.948	0.000	6141915	BB	47.3	
Totals:		100.0000		0.000	155531083			



12



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.6404	7.944	0.000	233967248	BB	25.3	
2		50.3596	11.611	0.000	237356640	BB	34.8	
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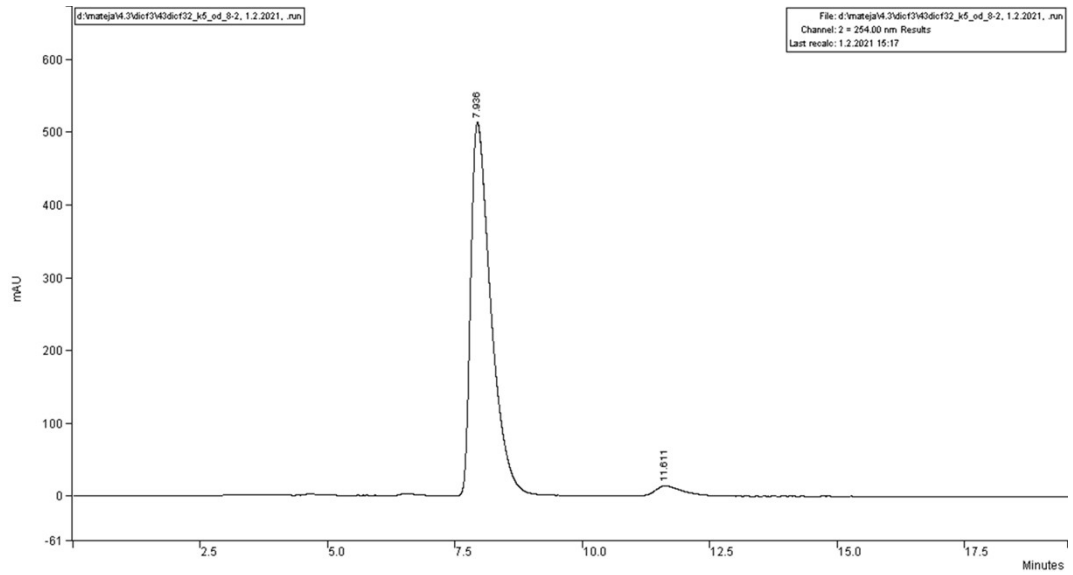
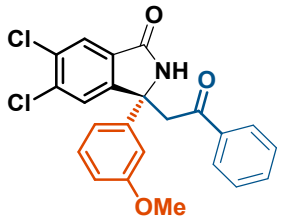
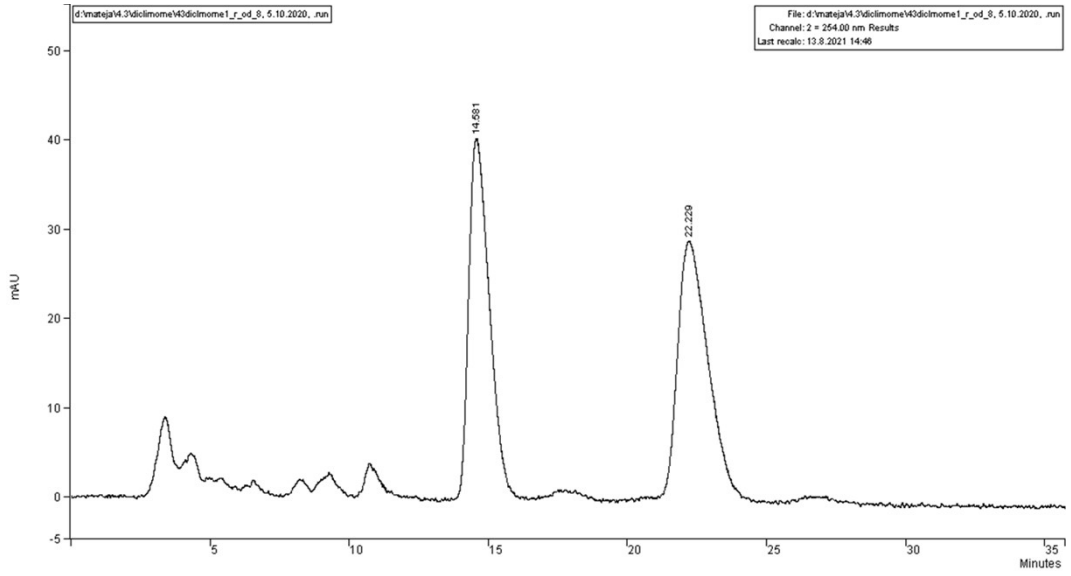


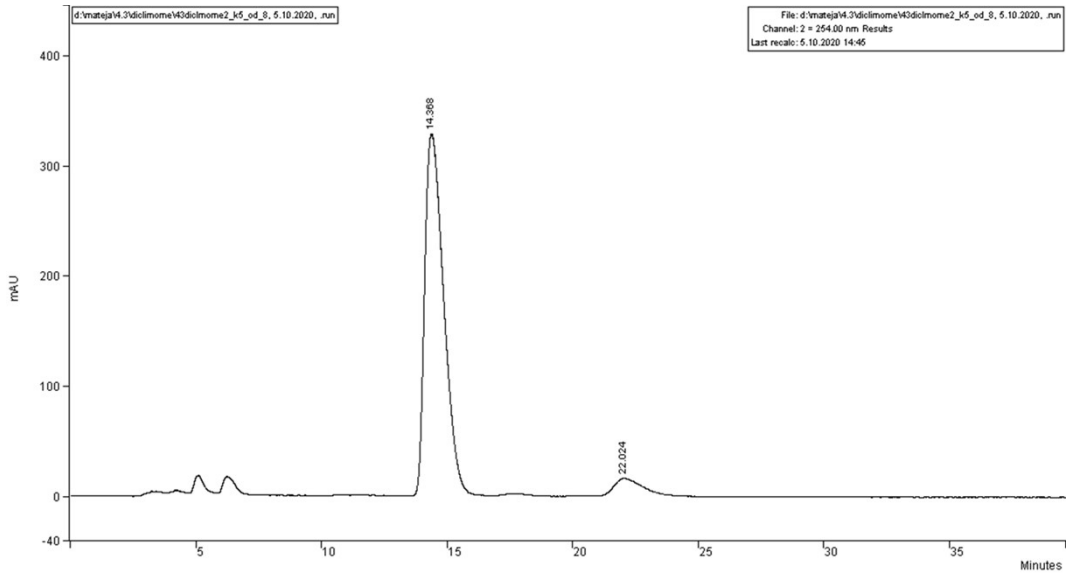
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		96.4970	7.936	0.000	140908160	BB	24.6	
2		3.5030	11.611	0.000	5115174	BB	32.8	
Totals:		100.0000		0.000	146023334			



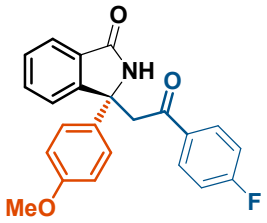
13



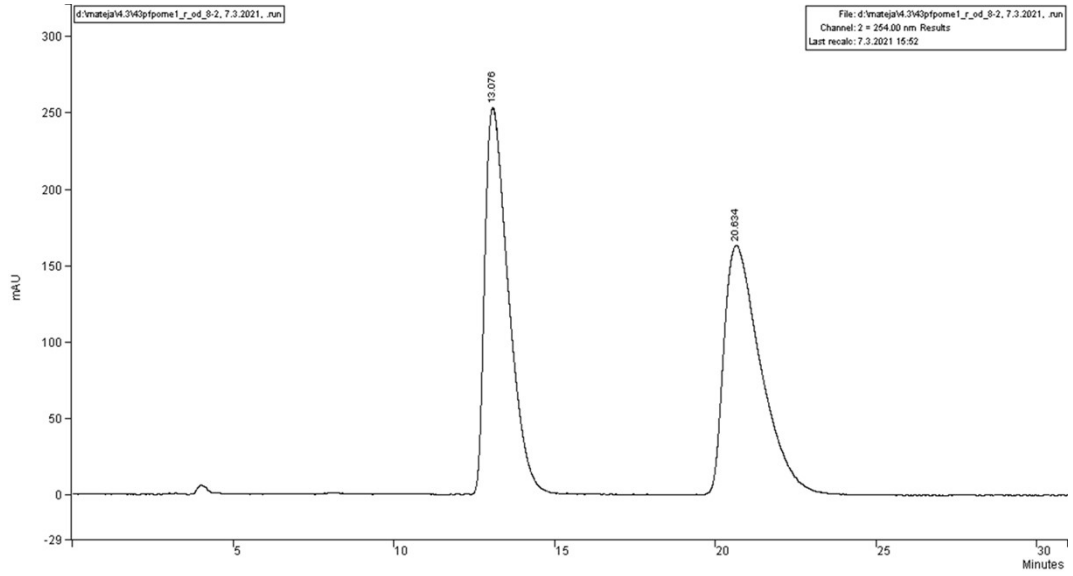
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9425	14.581	0.000	21012132	BB	48.9	
2		50.0575	22.229	0.000	21060502	BB	69.7	
Totals:		100.0000		0.000	42072634			



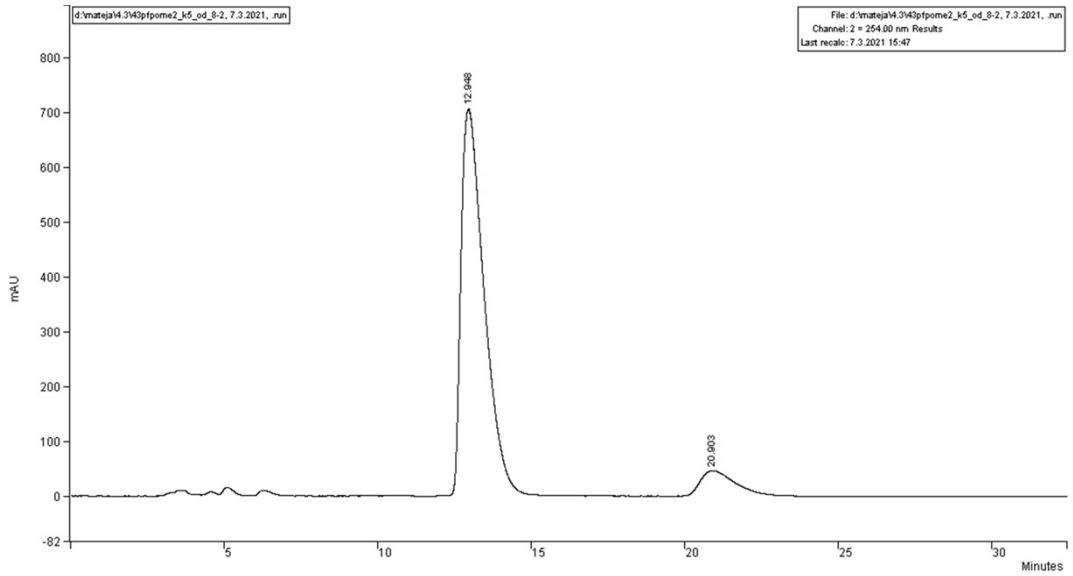
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		93.0983	14.368	0.000	172922624	BB	49.5	
2		6.9017	22.024	0.000	12819302	BB	71.5	
Totals:		100.0000		0.000	185741926			



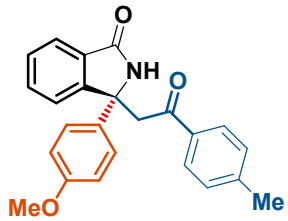
14



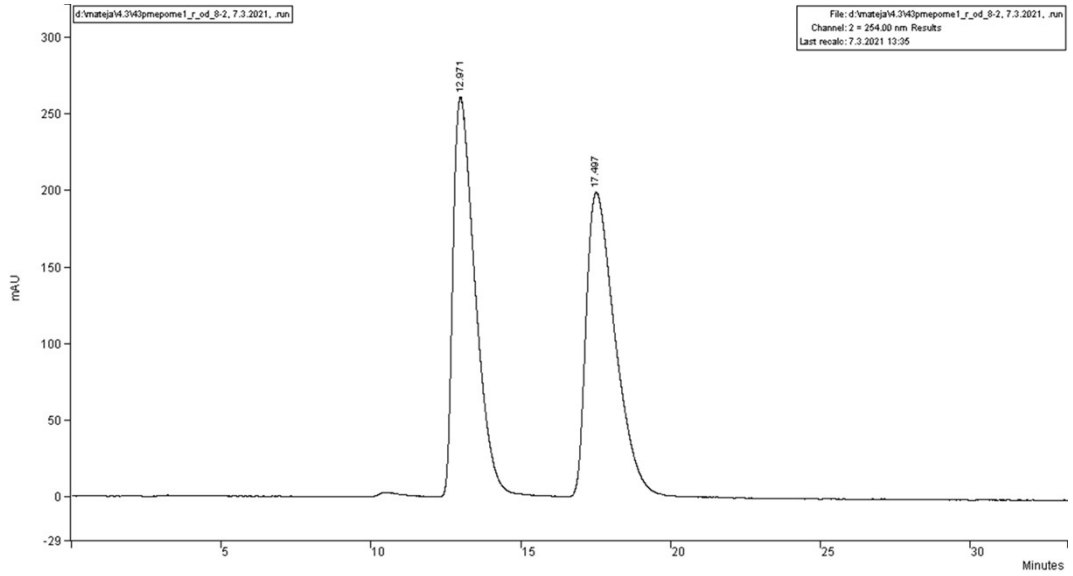
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9427	13.076	0.000	128634984	BB	47.2	
2		50.0573	20.634	0.000	128930344	BB	72.9	
Totals:		100.0000		0.000	257565328			



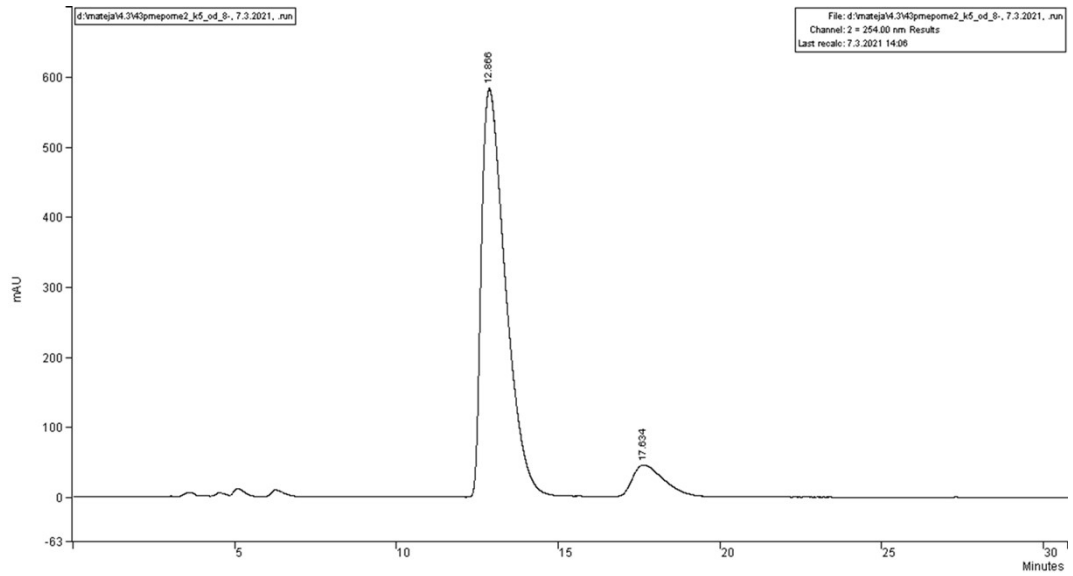
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		91.9372	12.948	0.000	368103776	BB	48.3	
2		8.0628	20.903	0.000	32282398	BB	72.4	
Totals:		100.0000		0.000	400386174			



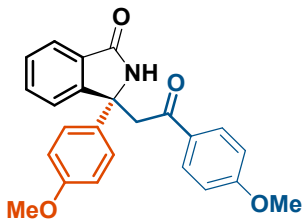
15



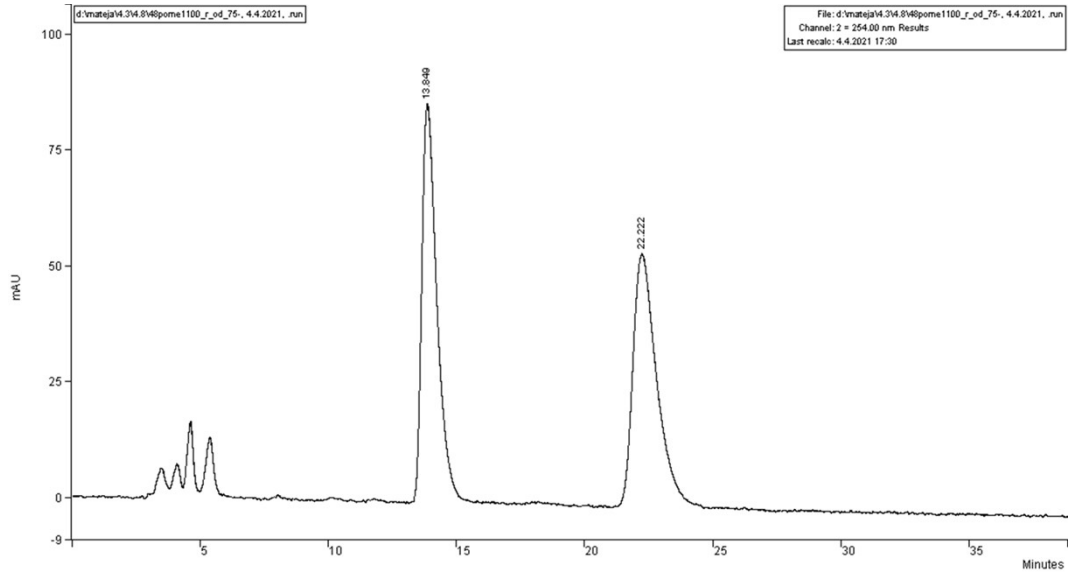
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9578	12.971	0.000	132021360	BB	47.3	
2		50.0422	17.497	0.000	132244584	BB	61.9	
Totals:		100.0000		0.000	264265944			



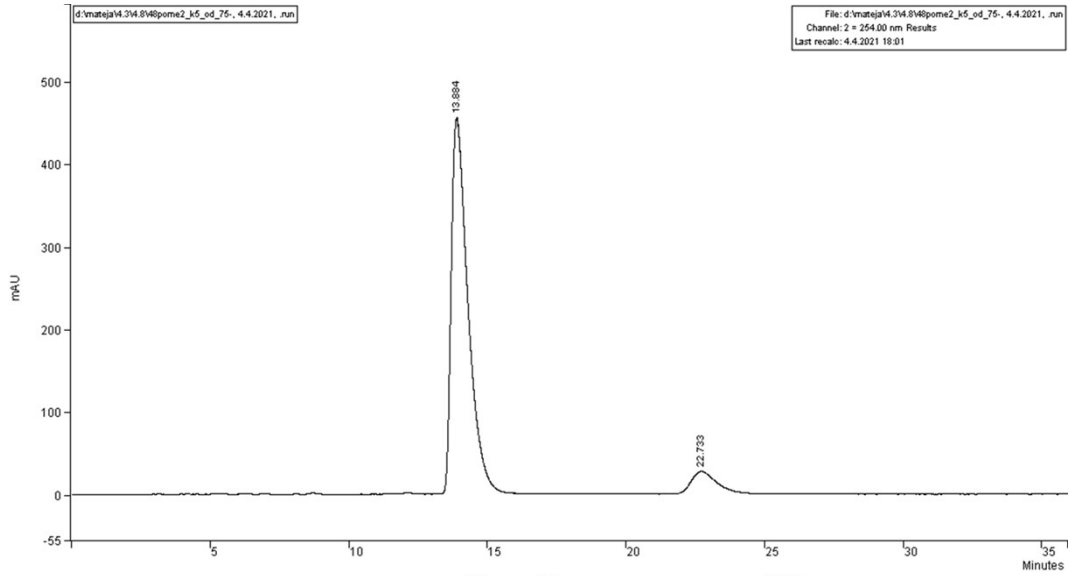
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		91.3861	12.866	0.000	300310016	BB	47.6	
2		8.6139	17.634	0.000	28306576	BB	61.9	
Totals:		100.0000		0.000	328616592			



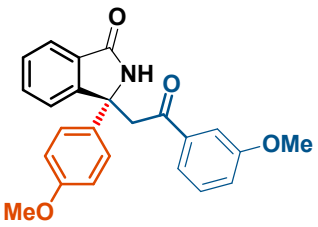
16



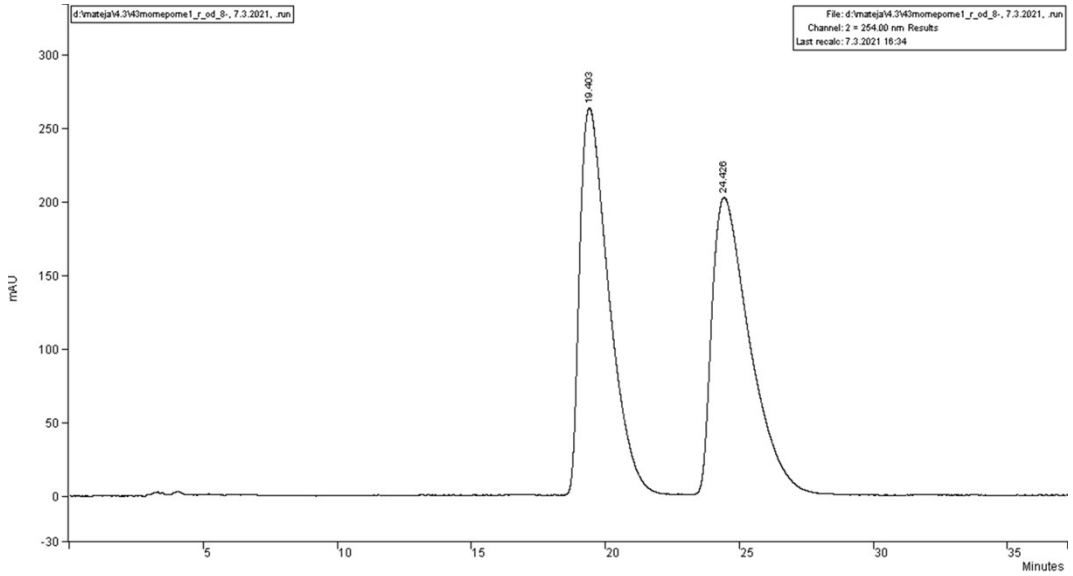
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9682	13.849	0.000	35434732	BB	36.8	
2		50.0318	22.222	0.000	35479800	BB	58.0	
Totals:		100.0000		0.000	70914532			



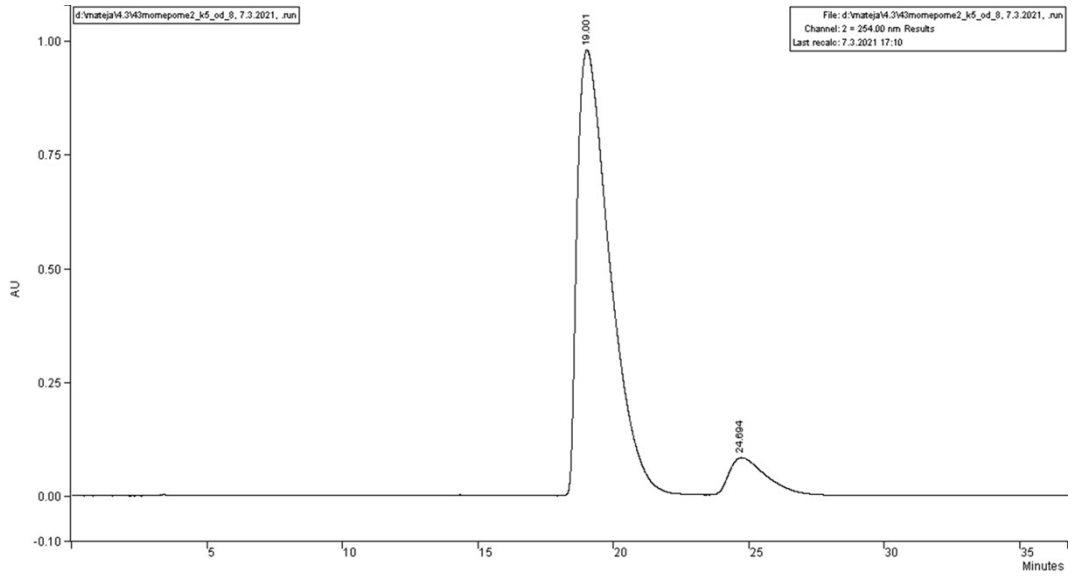
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		92.0701	13.884	0.000	190447536	BB	37.7	
2		7.9299	22.733	0.000	16403030	BB	57.7	
Totals:		100.0000		0.000	206850566			



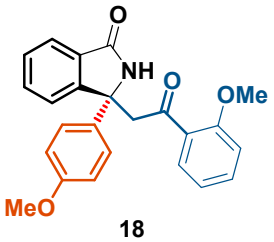
17



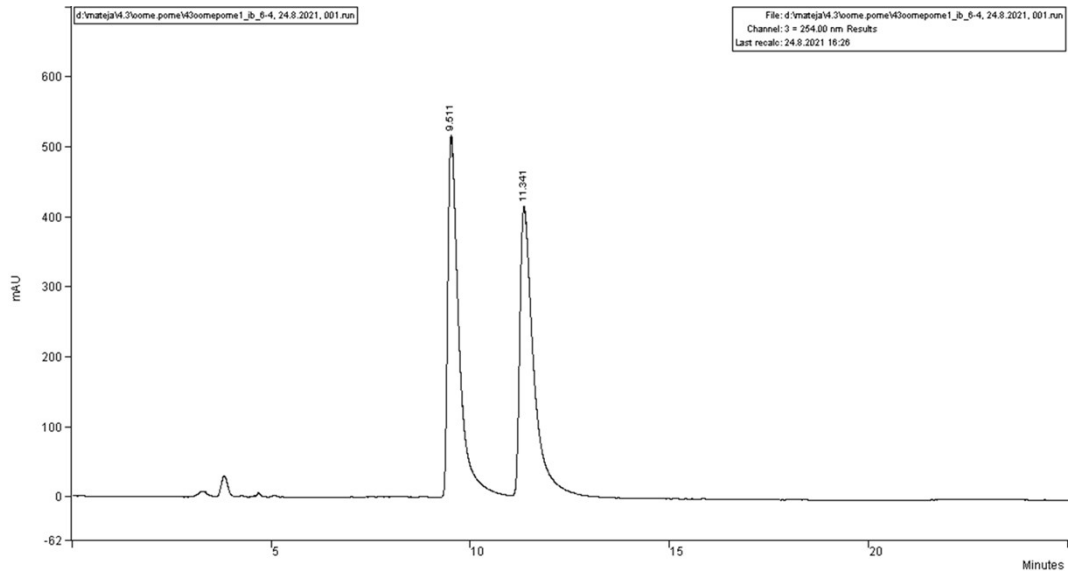
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.2992	19.403	0.000	197887136	BB	69.7	
2		49.7008	24.426	0.000	195532864	BB	89.5	
	Totals:	100.0000		0.000	393420000			



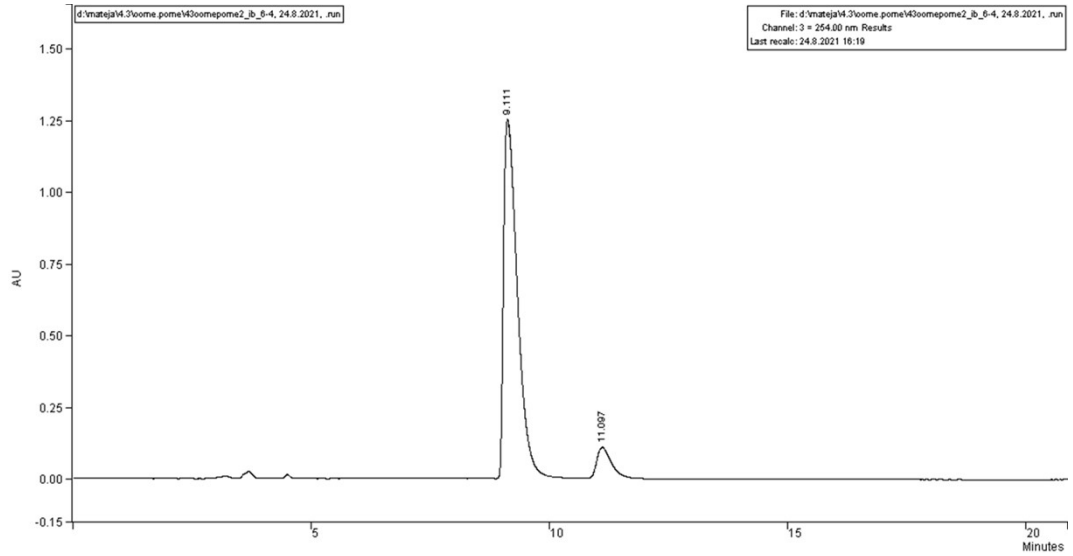
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		91.7883	19.001	0.000	818867264	BB	77.4	
2		8.2117	24.694	0.000	73258752	BB	85.1	
	Totals:	100.0000		0.000	892126016			



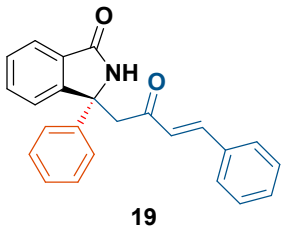
18



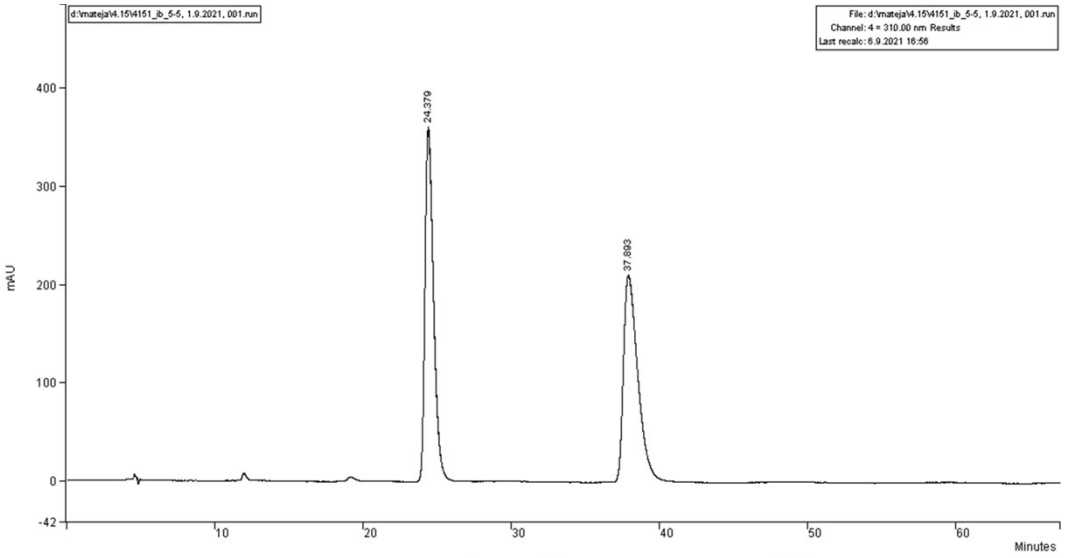
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.1380	9.511	0.000	100529040	BB	16.2	
2		49.8620	11.341	0.000	99975648	BB	19.9	
Totals:		100.0000		0.000	200504688			



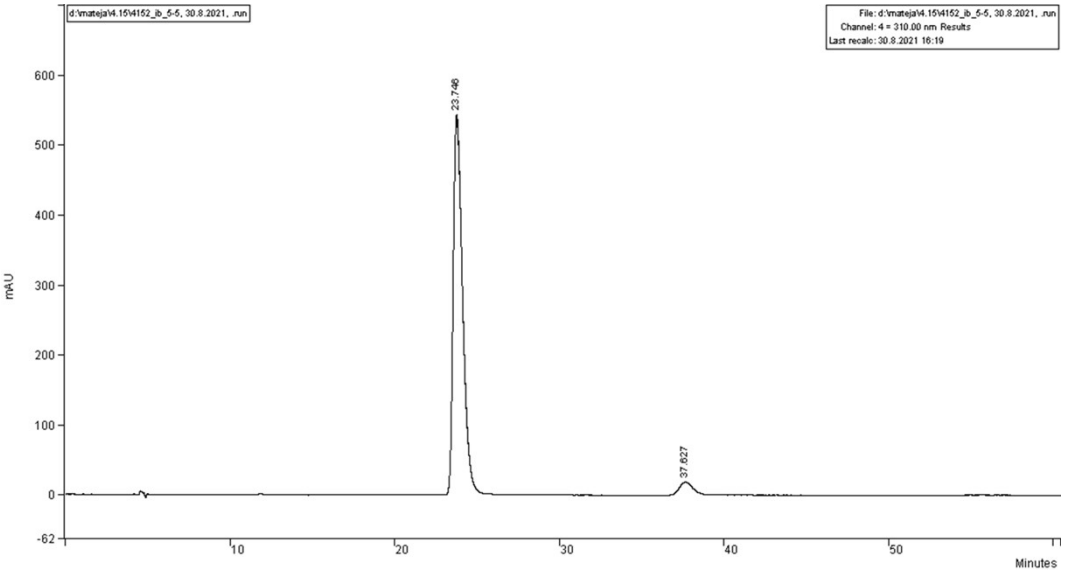
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		91.9374	9.111	0.000	253608048	BB	18.4	
2		8.0626	11.097	0.000	22240604	BB	18.9	
Totals:		100.0000		0.000	275848652			



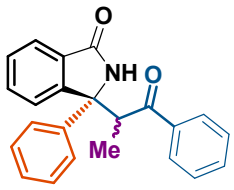
19



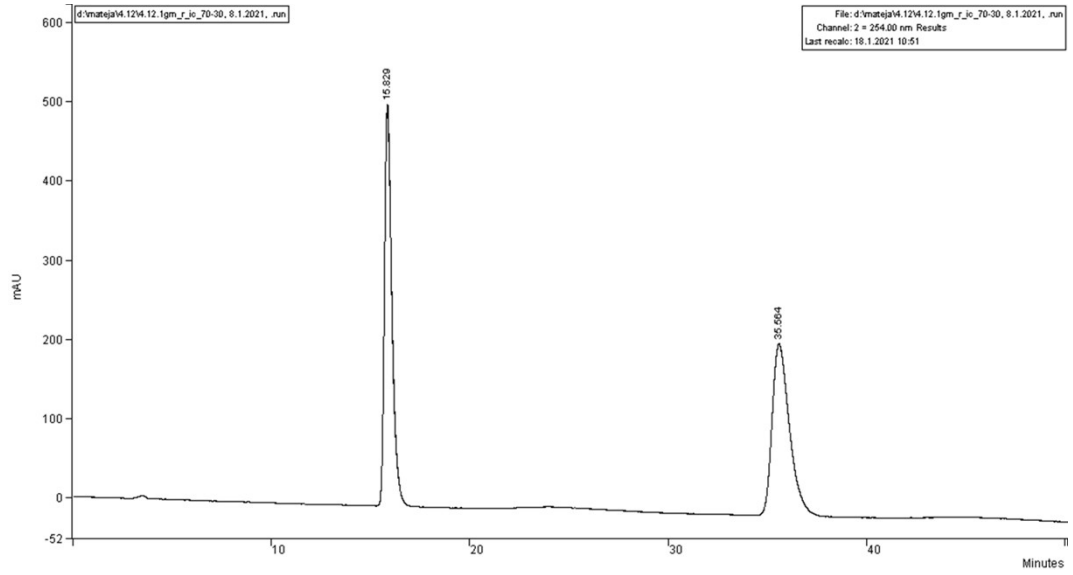
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.3526	24.379	0.000	144896256	BB	36.6	
2		49.6474	37.893	0.000	142867024	BB	61.4	
Totals:		100.0000		0.000	287763280			



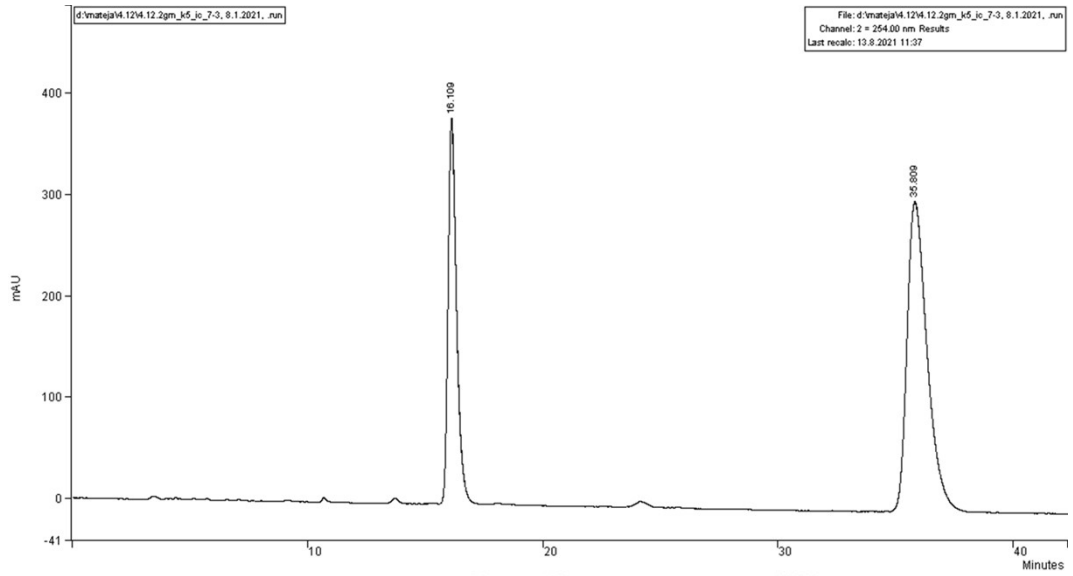
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		95.6764	23.746	0.000	214433984	BB	36.2	
2		4.3236	37.627	0.000	9690237	BB	51.8	
Totals:		100.0000		0.000	224124221			



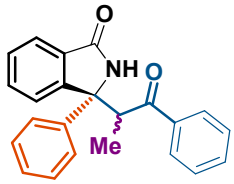
20



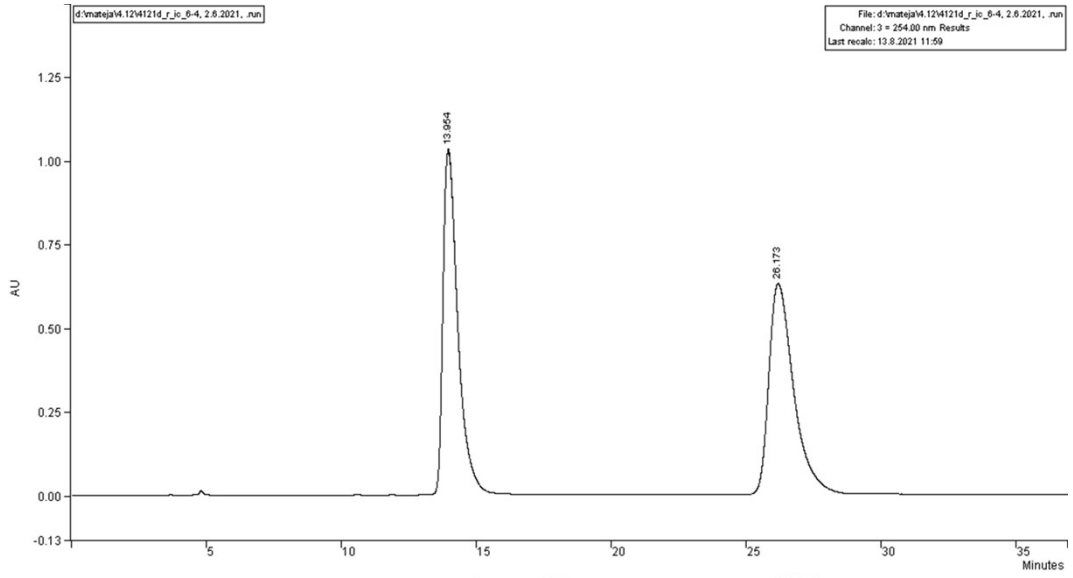
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0131	15.829	0.000	132384960	BB	23.2	
2		49.9869	35.564	0.000	132315480	BB	54.9	
	Totals:	100.0000		0.000	264700440			



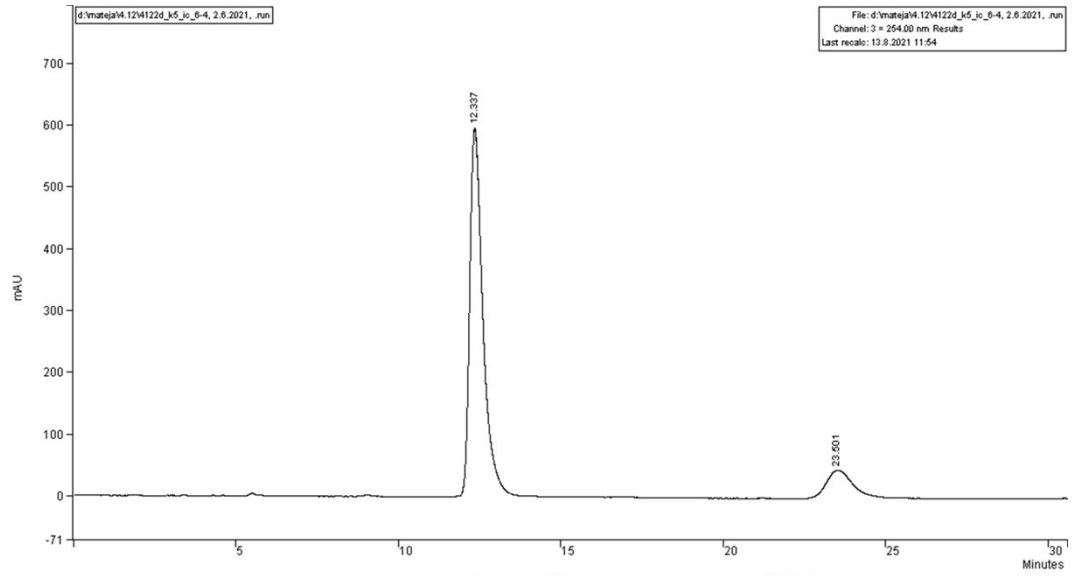
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		34.1264	16.109	0.000	94257176	BB	22.3	
2		65.8736	35.809	0.000	181942656	BB	53.7	
	Totals:	100.0000		0.000	276199832			



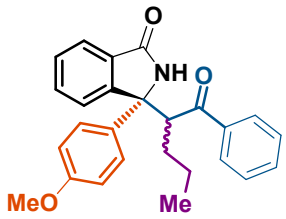
20'



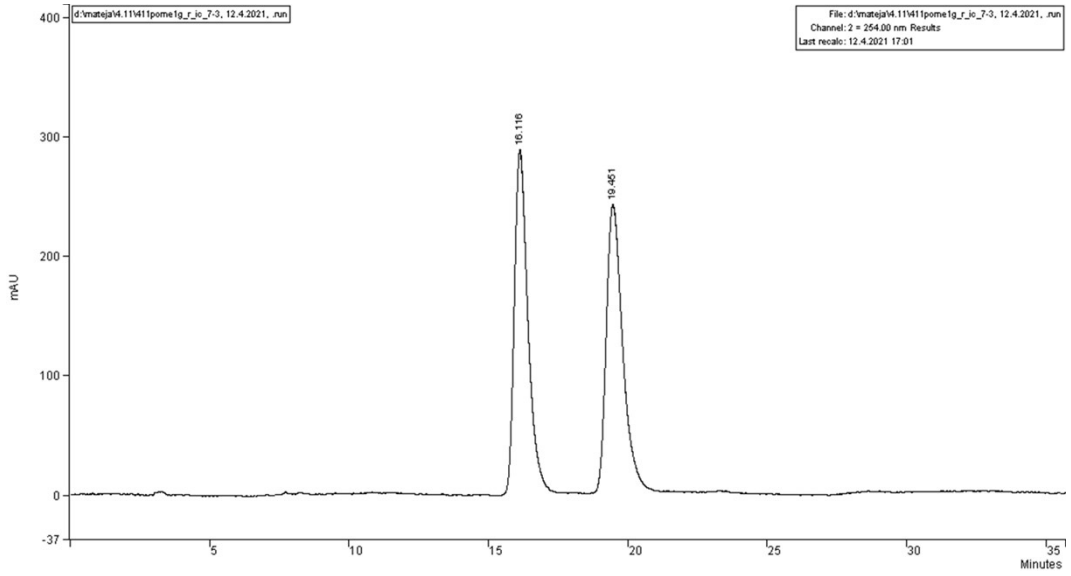
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9826	13.954	0.000	397184736	BB	33.7	
2		50.0174	26.173	0.000	397460960	BB	56.4	
	Totals:	100.0000		0.000	794645696			



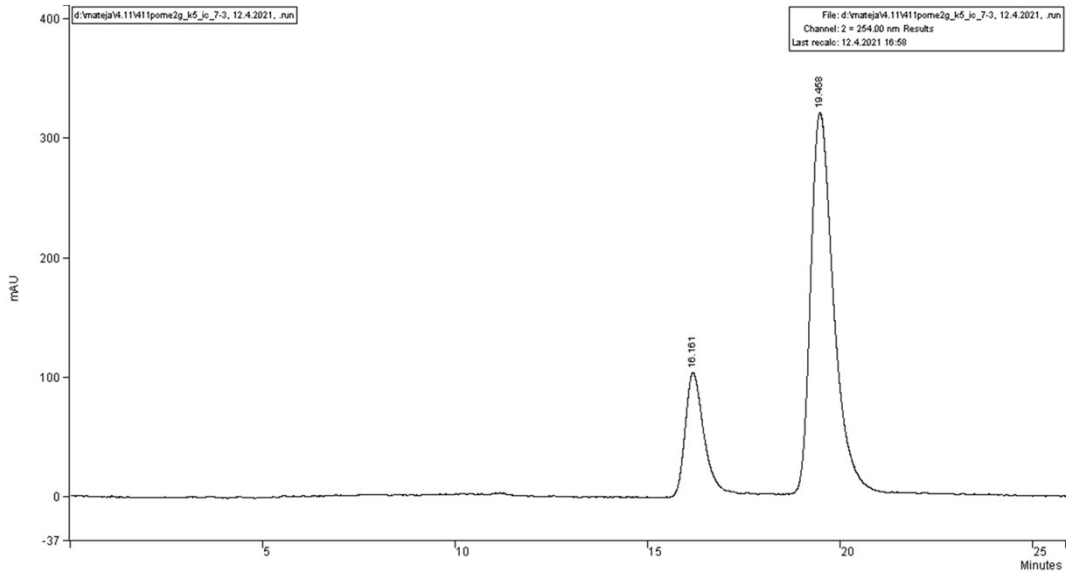
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		86.9676	12.337	0.000	168561776	BB	24.6	
2		13.0324	23.501	0.000	25259672	BB	51.5	
	Totals:	100.0000		0.000	193821448			



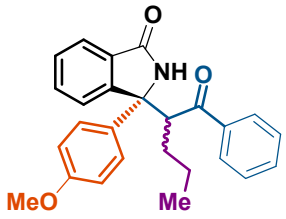
21



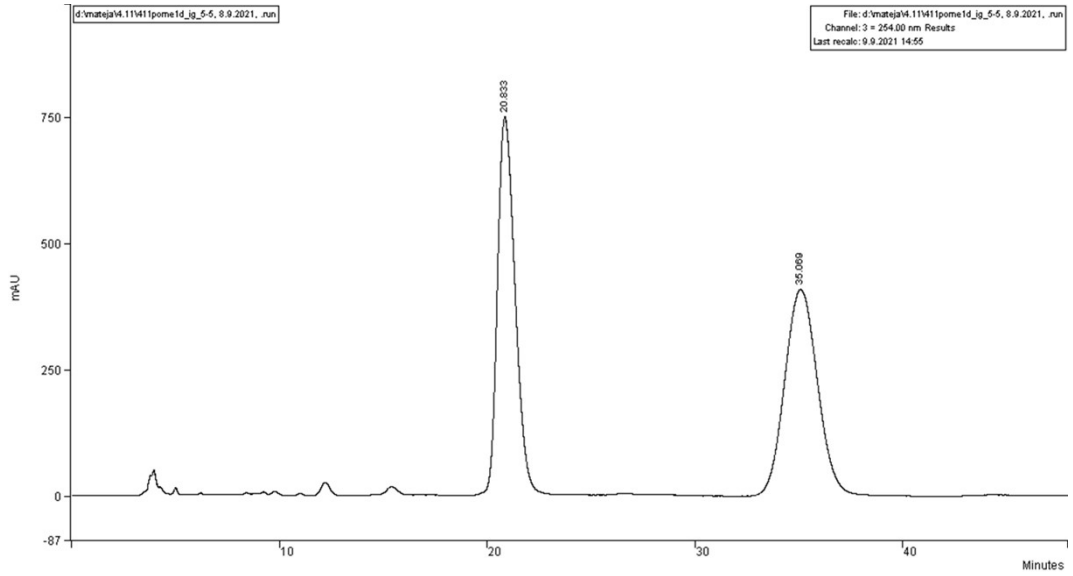
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.7059	16.116	0.000	97868696	BB	30.4	
2		50.2941	19.451	0.000	99026968	BB	36.7	
Totals:		100.0000		0.000	196895664			



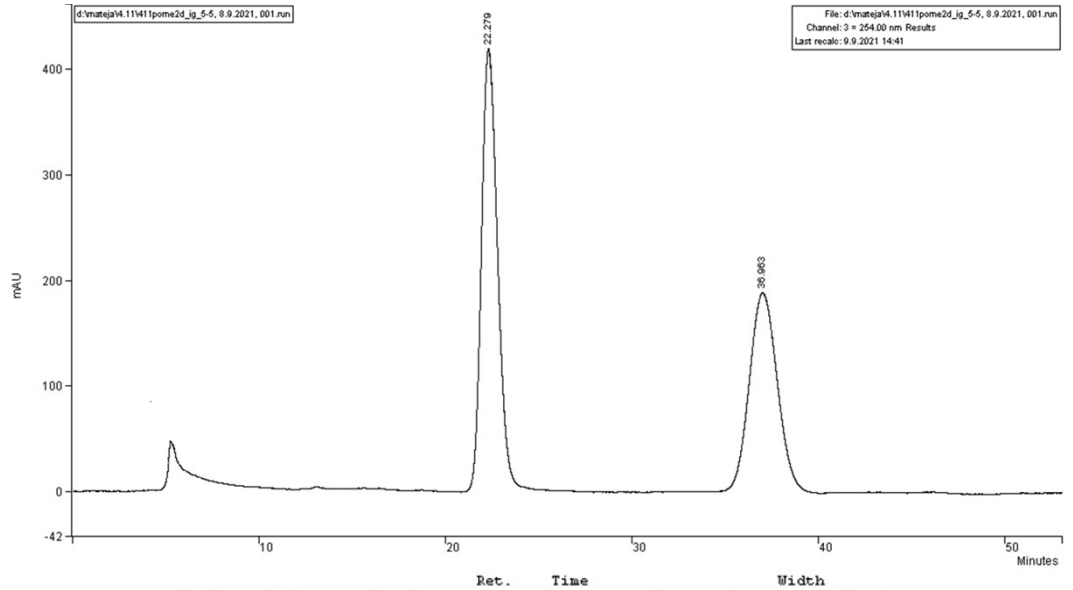
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		20.2592	16.161	0.000	33331016	BB	30.4	
2		79.7408	19.458	0.000	131192184	BB	36.8	
Totals:		100.0000		0.000	164523200			



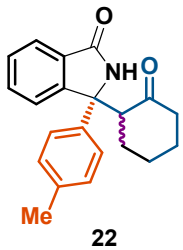
21'



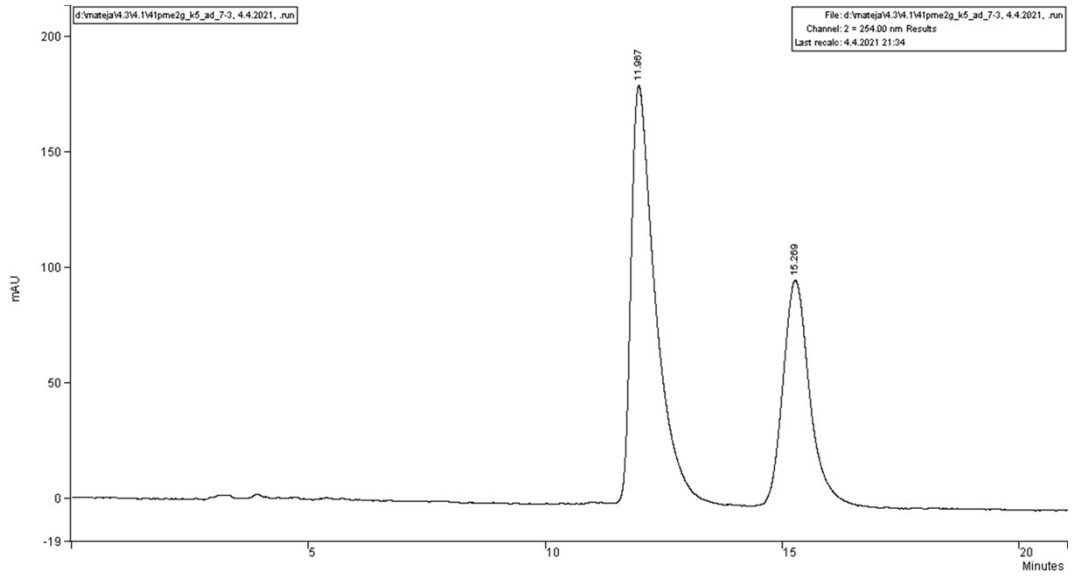
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.7575	20.833	0.000	441845664	BB	54.8	
2		50.2425	35.069	0.000	446152608	BB	102.8	
Totals:		100.0000		0.000	887998272			



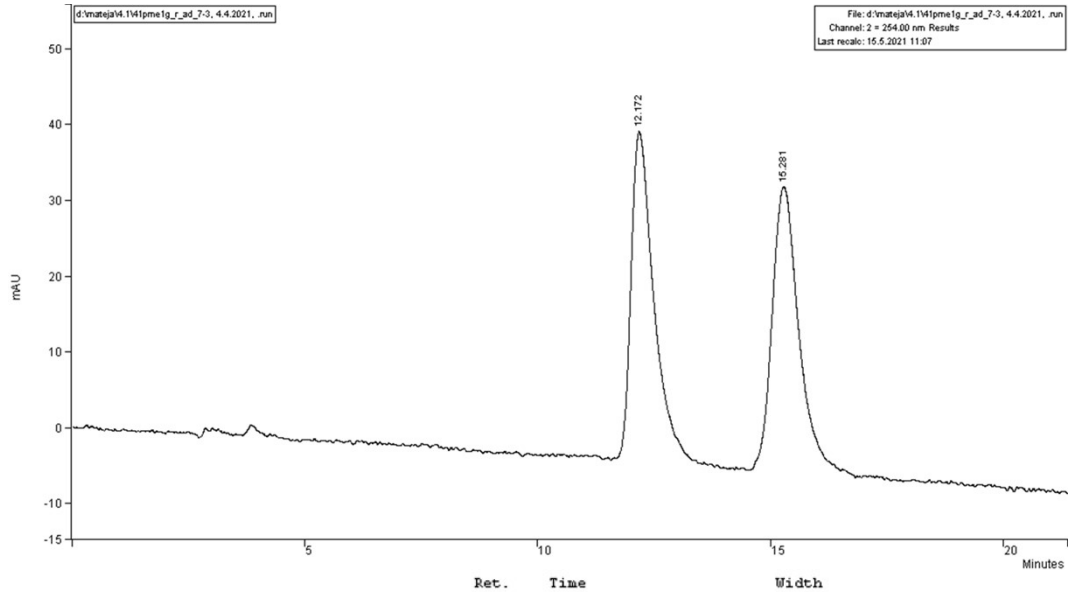
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		55.7372	22.279	0.000	248230096	BB	55.5	
2		44.2628	36.963	0.000	197127648	BB	97.6	
Totals:		100.0000		0.000	445357744			



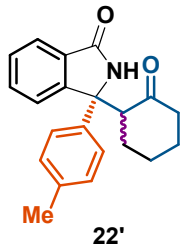
22



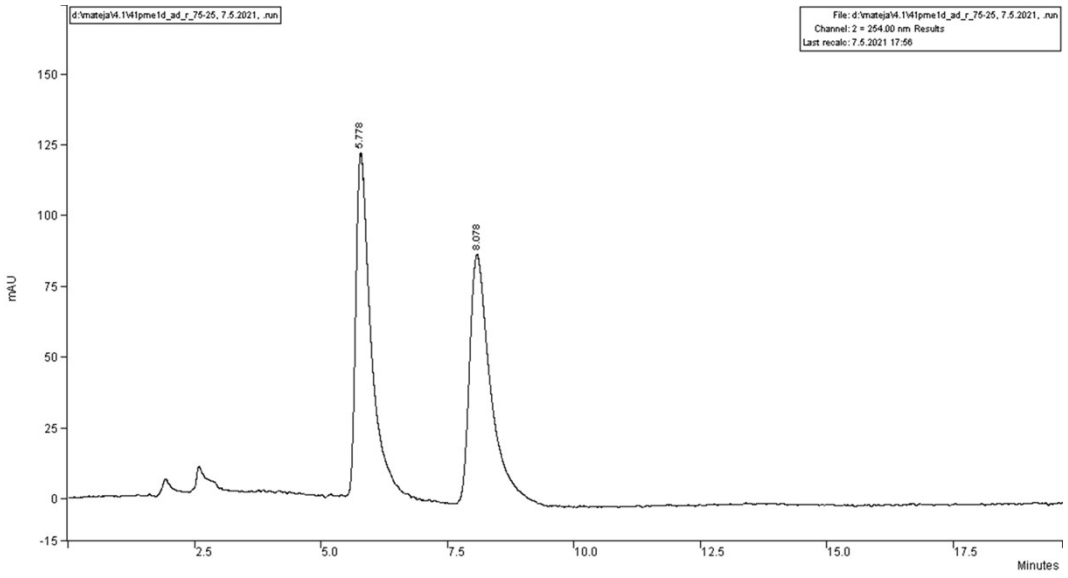
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		62.5790	11.967	0.000	65077876	BB	31.0	
2		37.4210	15.269	0.000	38915200	BB	34.8	
Totals:		100.0000		0.000	103993076			



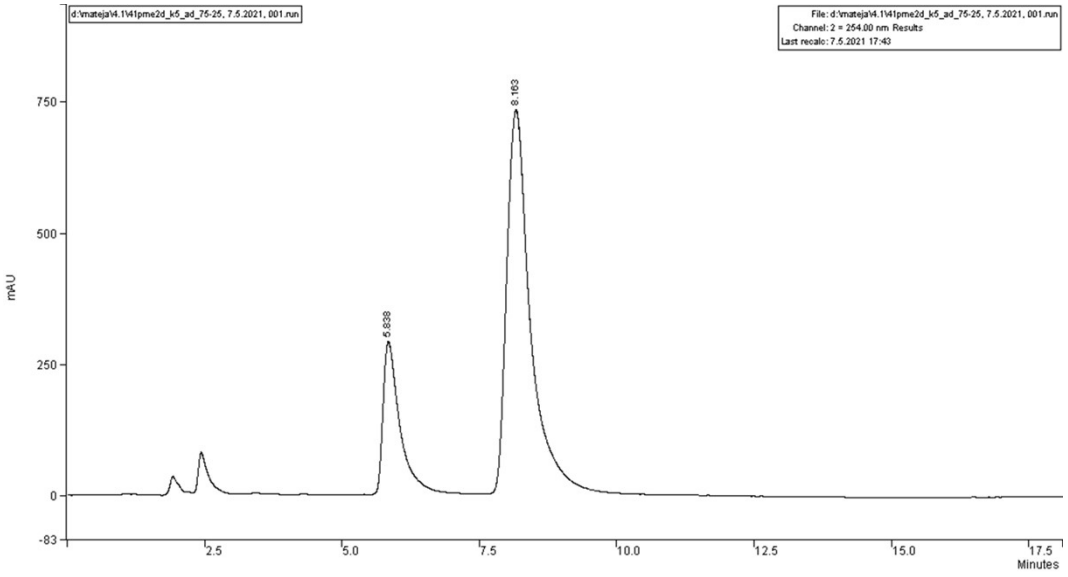
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.1341	12.172	0.000	14655473	BB	29.7	
2		49.8659	15.281	0.000	14577050	BB	35.1	
Totals:		100.0000		0.000	29232523			



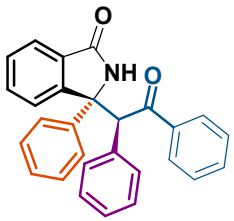
22'



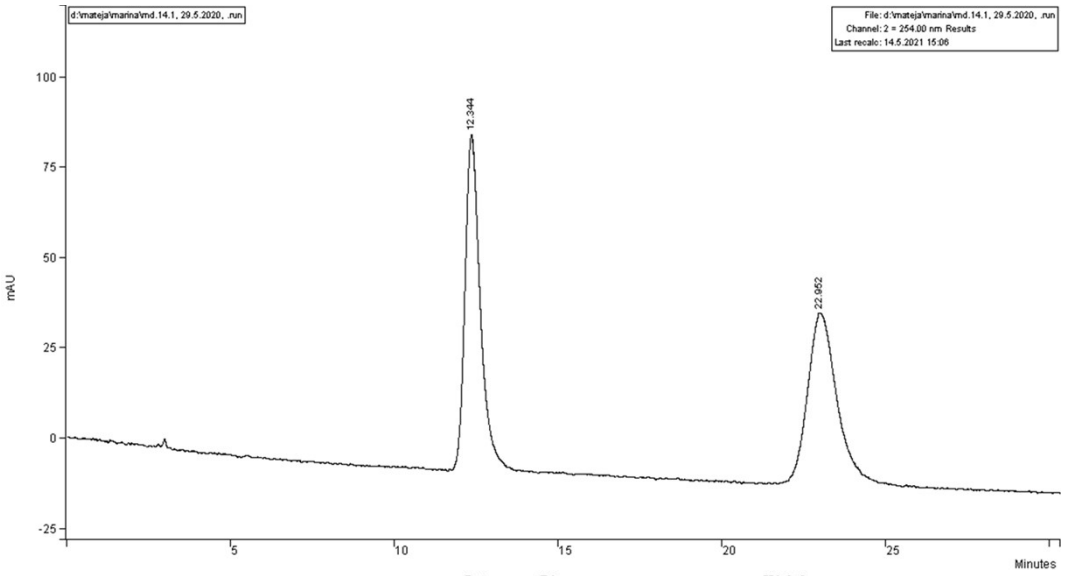
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		21.9068	5.838	0.000	62453368	BB	17.6	
2		78.0932	8.163	0.000	222633600	BB	25.0	
Totals:		100.0000		0.000	285086968			



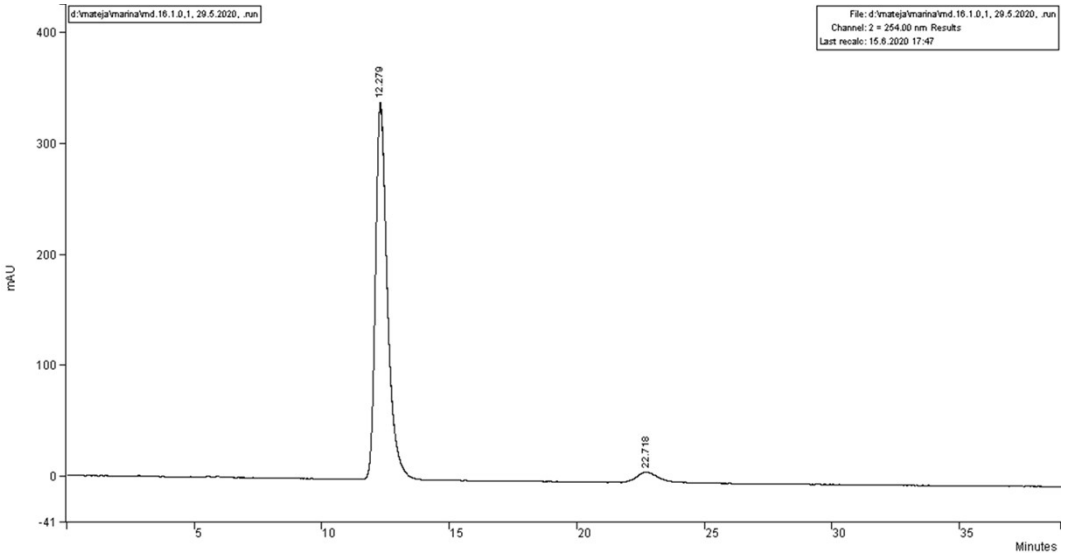
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9540	7.231	0.000	53541952	BB	22.3	
2		50.0460	8.834	0.000	53640580	BB	28.0	
Totals:		100.0000		0.000	107182532			



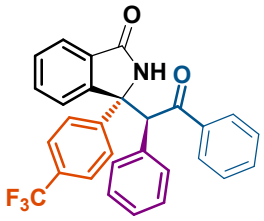
23



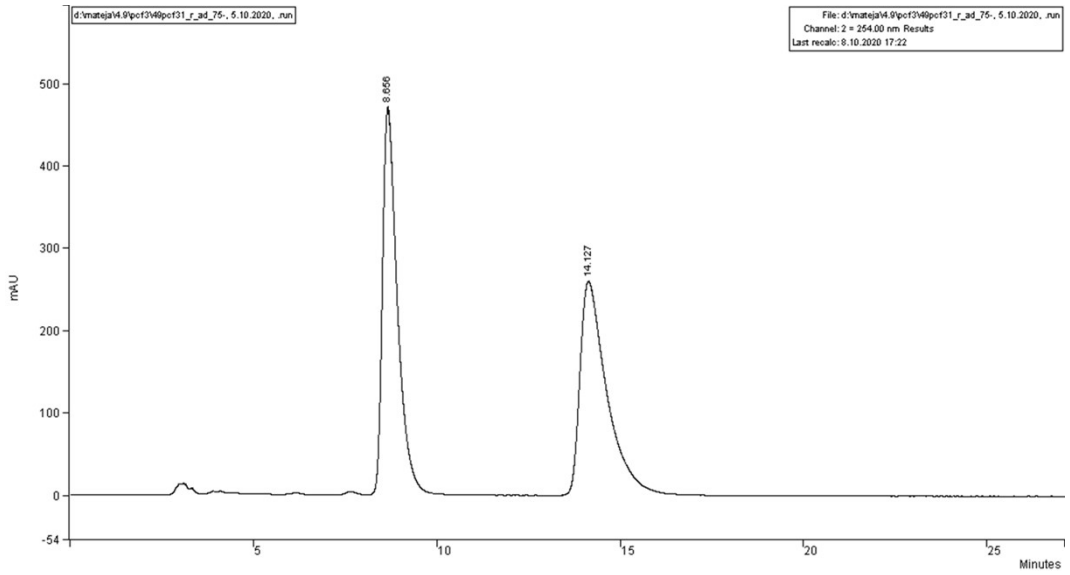
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.7817	12.344	0.000	30111154	BB	28.4	
2		49.2183	22.952	0.000	29184166	BB	54.7	
Totals:		100.0000		0.000	59295320			



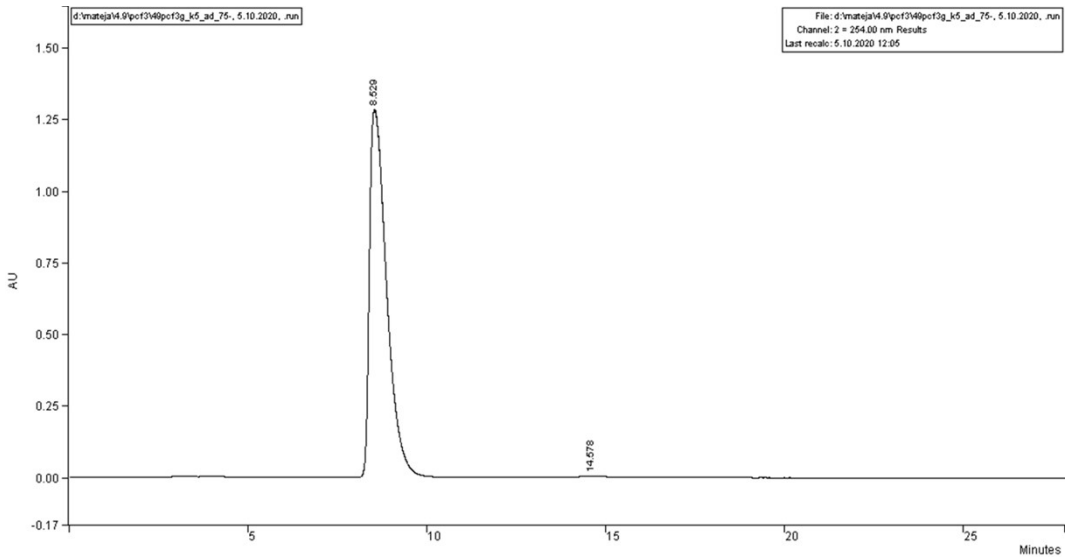
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		95.2593	12.279	0.000	109921616	BB	28.3	
2		4.7407	22.718	0.000	5470408	BB	51.7	
Totals:		100.0000		0.000	115392024			



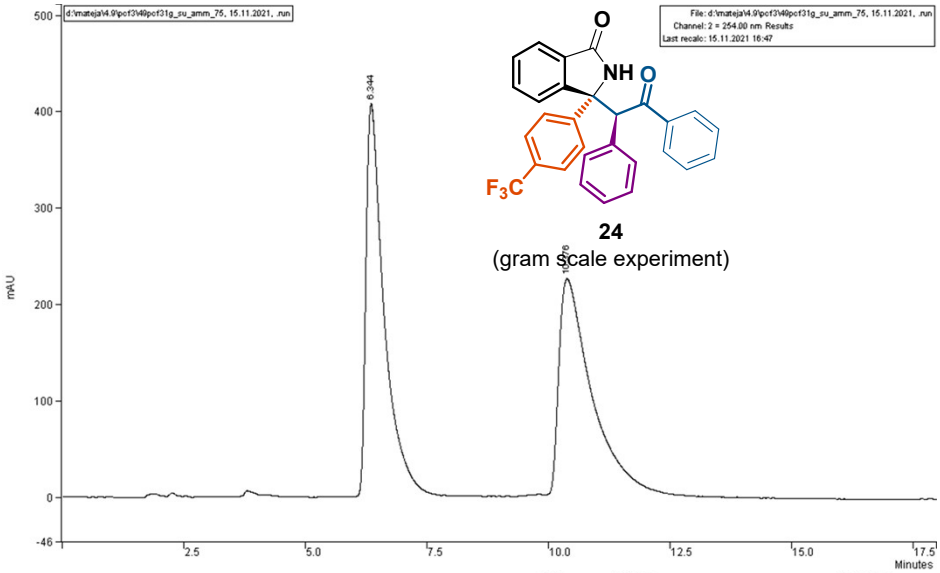
24



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0721	8.656	0.000	132171512	BB	24.8	
2		49.9279	14.127	0.000	131790656	BB	44.1	
Totals:		100.0000		0.000	263962168			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		99.4073	8.529	0.000	428756096	BB	30.1	
2		0.5927	14.578	0.000	2556531	BB	41.4	
Totals:		100.0000		0.000	431312627			



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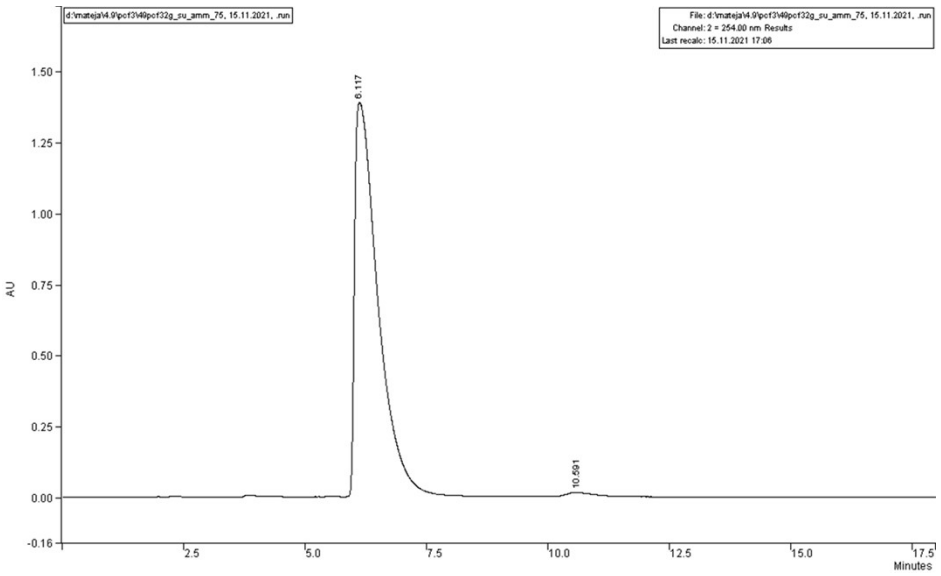
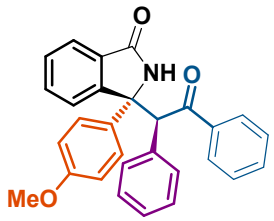
(gram scale experiment)

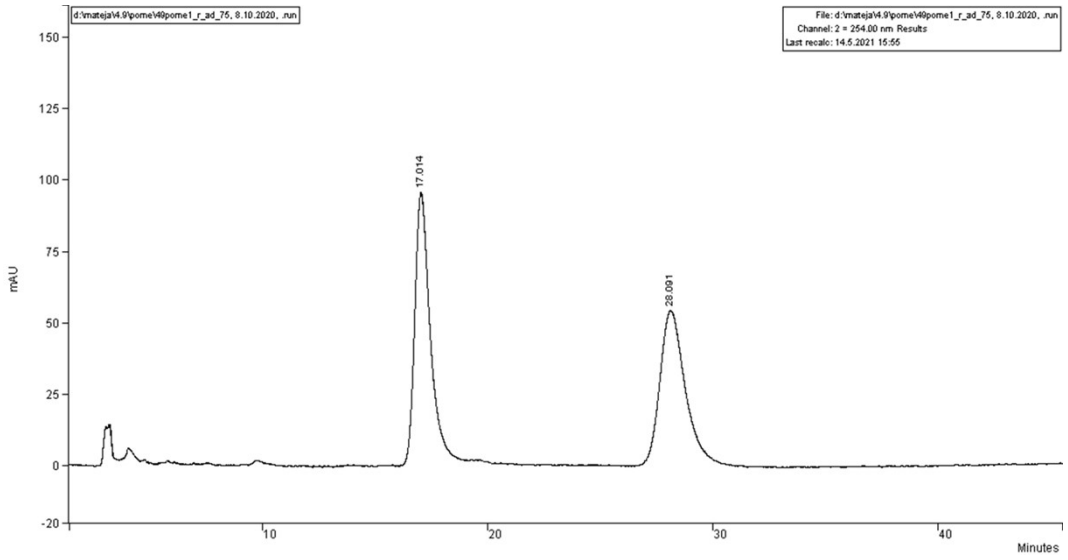
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0970	6.344	0.000	106936608	BB	21.8	
2		49.9030	10.376	0.000	106522400	BB	39.5	
Totals:		100.0000		0.000	213459008			



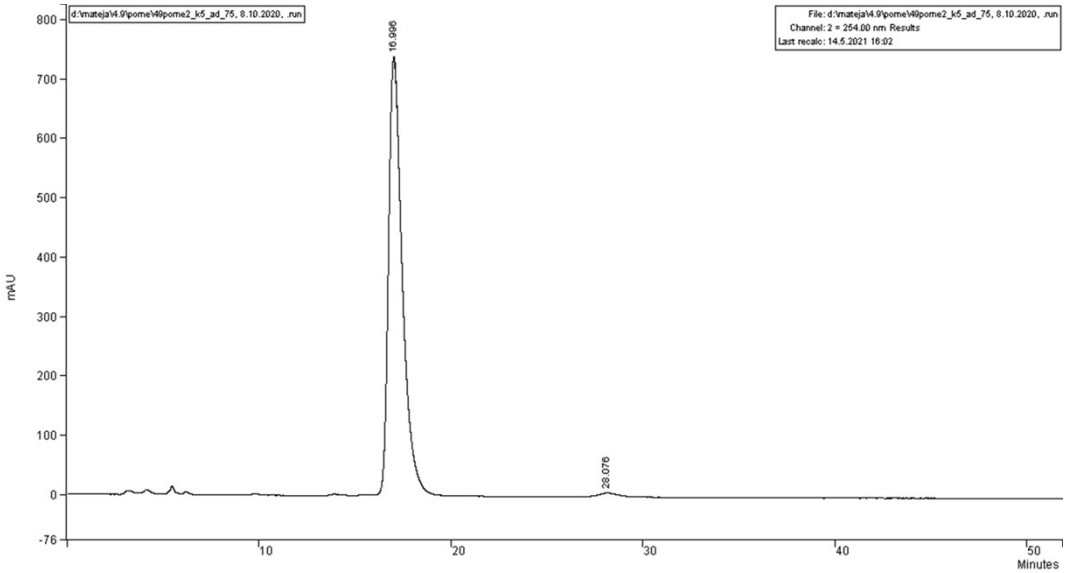
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		99.0020	6.117	0.000	464159200	BB	29.3	
2		0.9980	10.591	0.000	4679216	BB	35.8	
Totals:		100.0000		0.000	468838416			



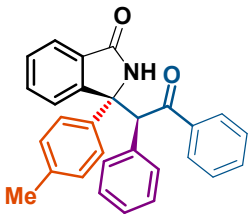
25



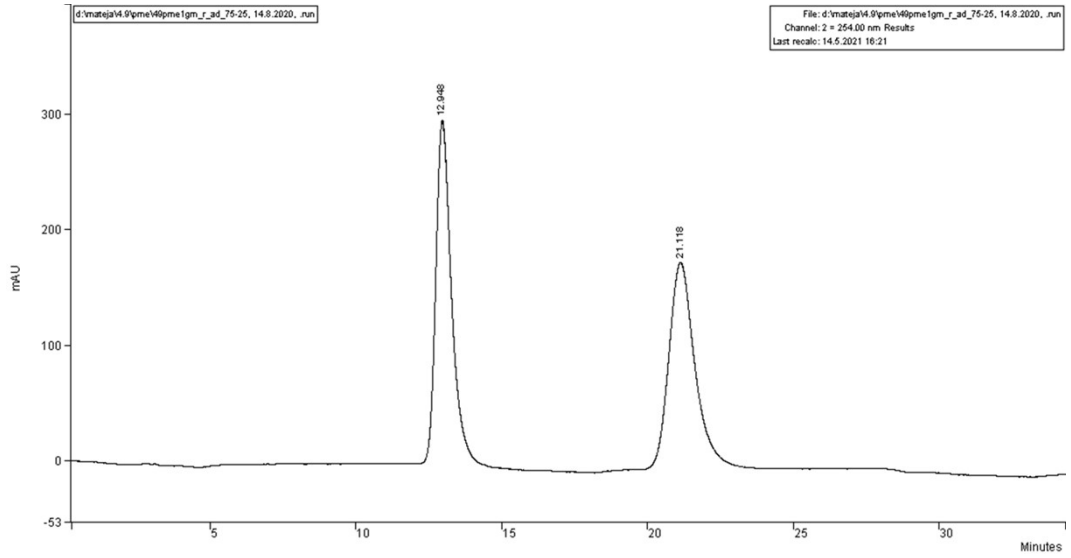
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.4493	17.014	0.000	41891672	BB	41.5	
2		49.5507	28.091	0.000	41145560	BB	69.5	
Totals:		100.0000		0.000	83037232			



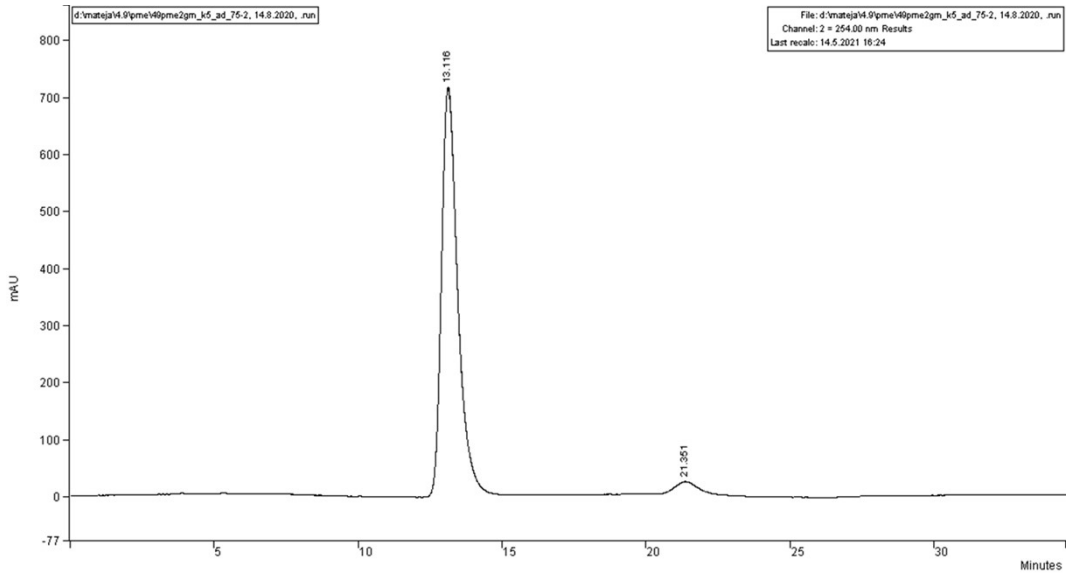
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		98.7981	16.996	0.000	367251648	BB	44.1	
2		1.2019	28.076	0.000	4467603	BB	63.3	
Totals:		100.0000		0.000	371719251			



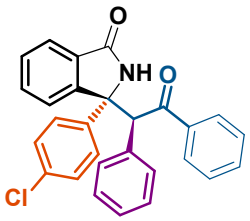
26



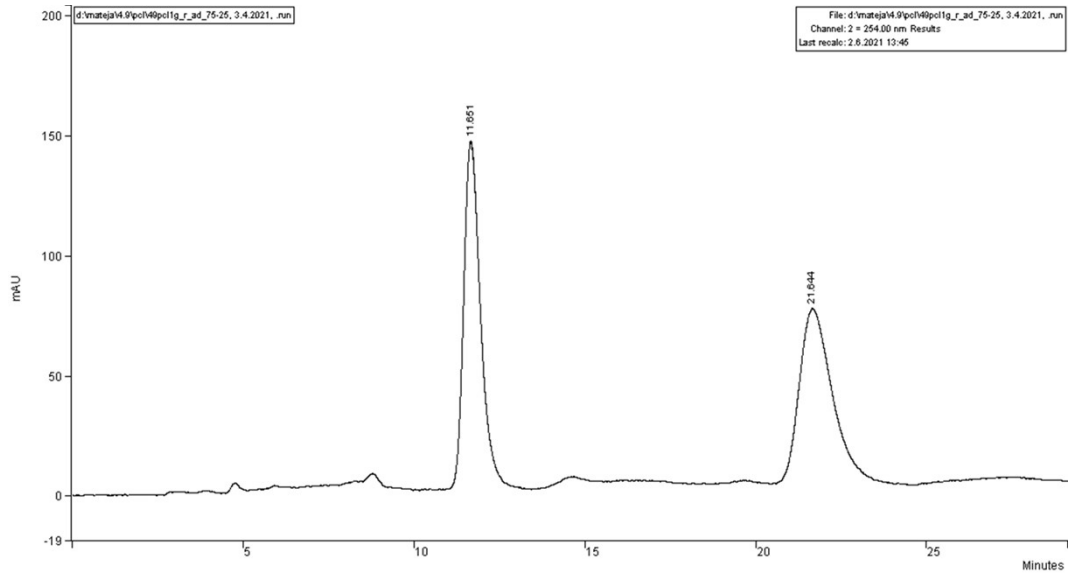
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.2775	12.948	0.000	110284888	BB	32.8	
2		49.7225	21.118	0.000	109067472	BB	55.2	
Totals:		100.0000		0.000	219352360			



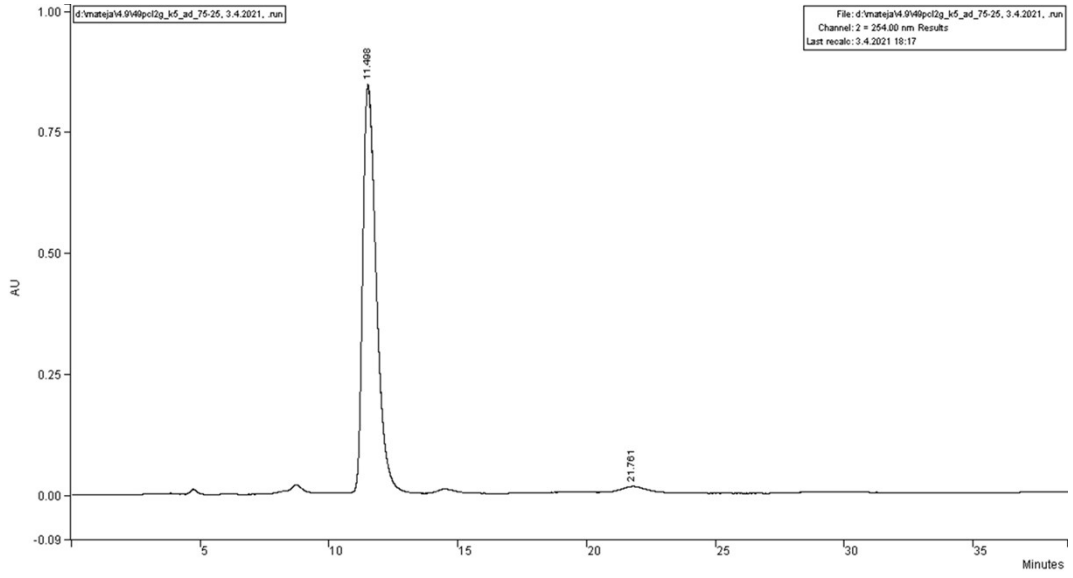
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		96.0714	13.116	0.000	280468096	BB	34.7	
2		3.9286	21.351	0.000	11469114	BB	49.0	
Totals:		100.0000		0.000	291937210			



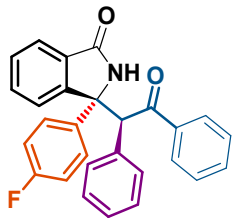
27



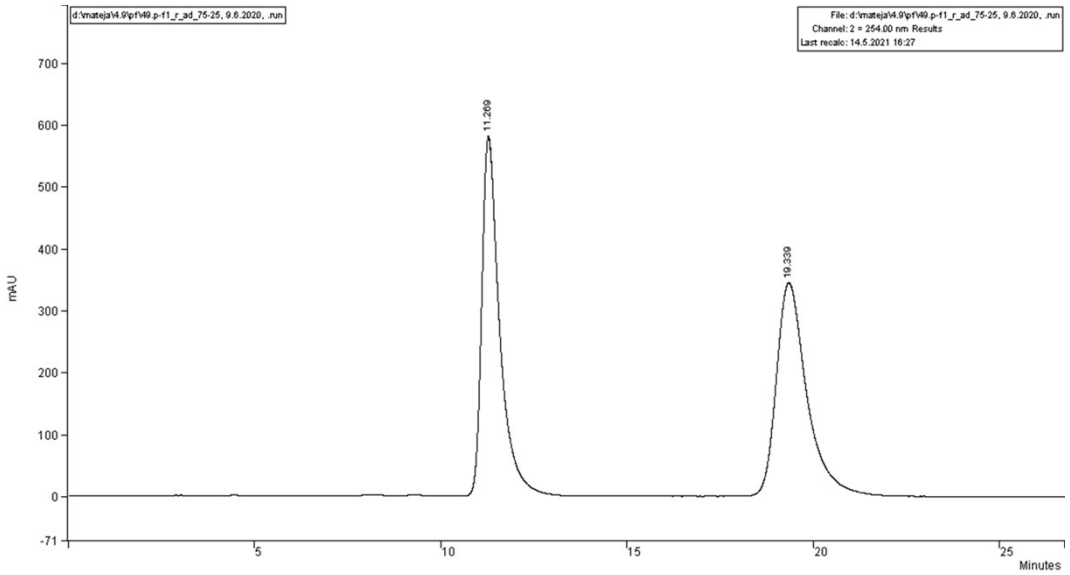
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.2723	11.651	0.000	49639676	BB	30.6	
2		49.7277	21.644	0.000	49101952	BB	61.0	
	Totals:	100.0000		0.000	98741628			



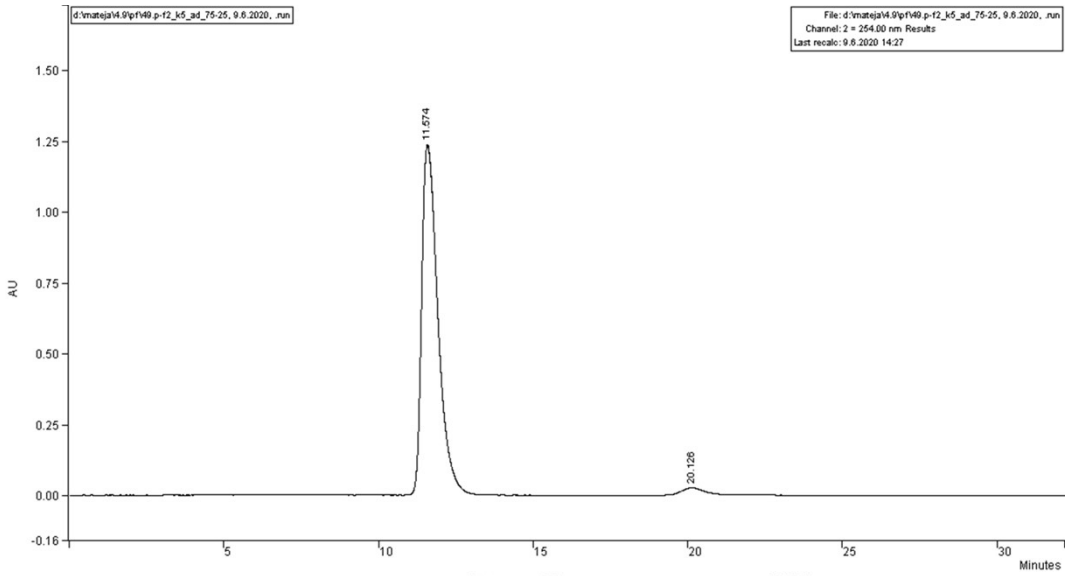
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		97.6834	11.498	0.000	307596224	BB	33.2	
2		2.3166	21.761	0.000	7294914	BB	56.9	
	Totals:	100.0000		0.000	314891138			



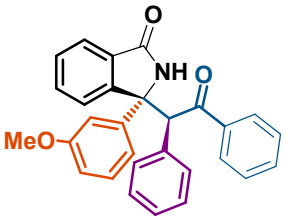
28



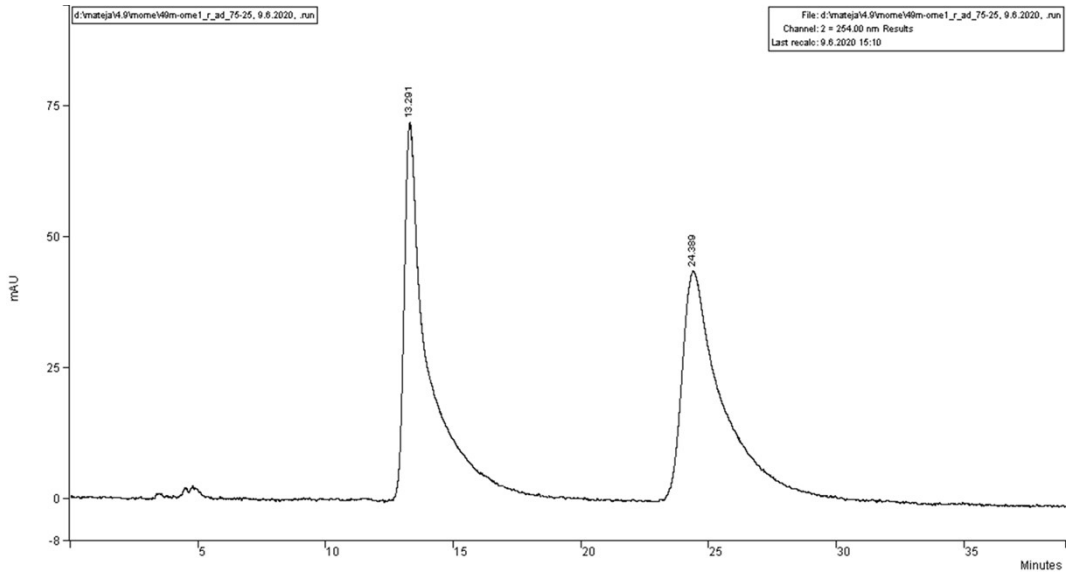
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9721	11.269	0.000	192940256	BB	28.2	
2		50.0279	19.339	0.000	193155936	BB	49.2	
	Totals:	100.0000		0.000	386096192			



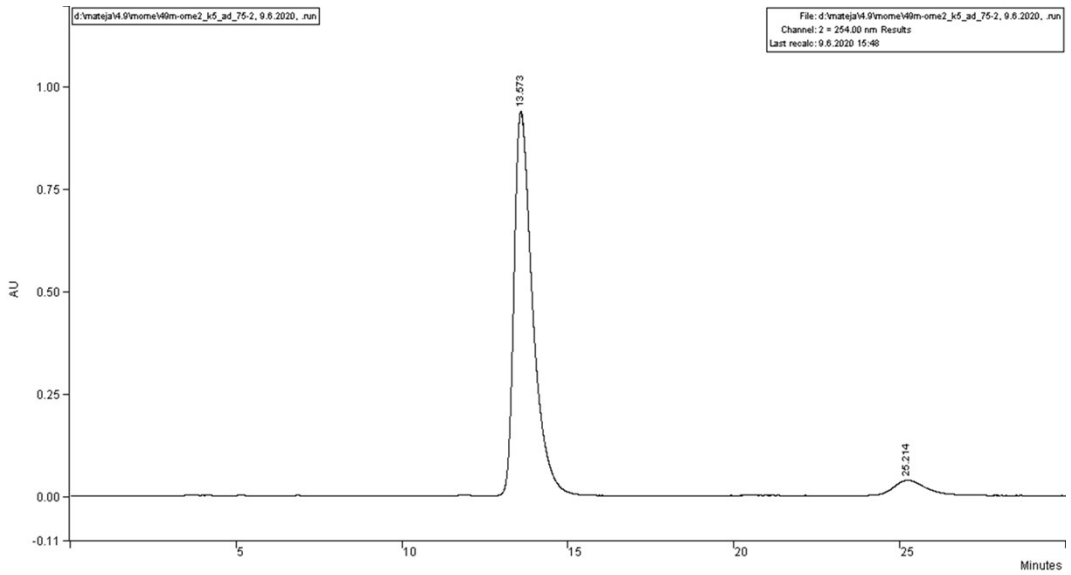
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		97.2493	11.574	0.000	449189504	BB	32.7	
2		2.7507	20.126	0.000	12705196	BB	47.8	
	Totals:	100.0000		0.000	461894700			



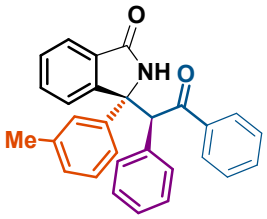
29



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.5493	13.291	0.000	49666768	BB	39.0	
2		50.4507	24.389	0.000	50570396	BB	83.5	
	Totals:	100.0000		0.000	100237164			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		93.8158	13.573	0.000	366204608	BB	34.2	
2		6.1842	25.214	0.000	24139540	BB	60.2	
	Totals:	100.0000		0.000	390344148			



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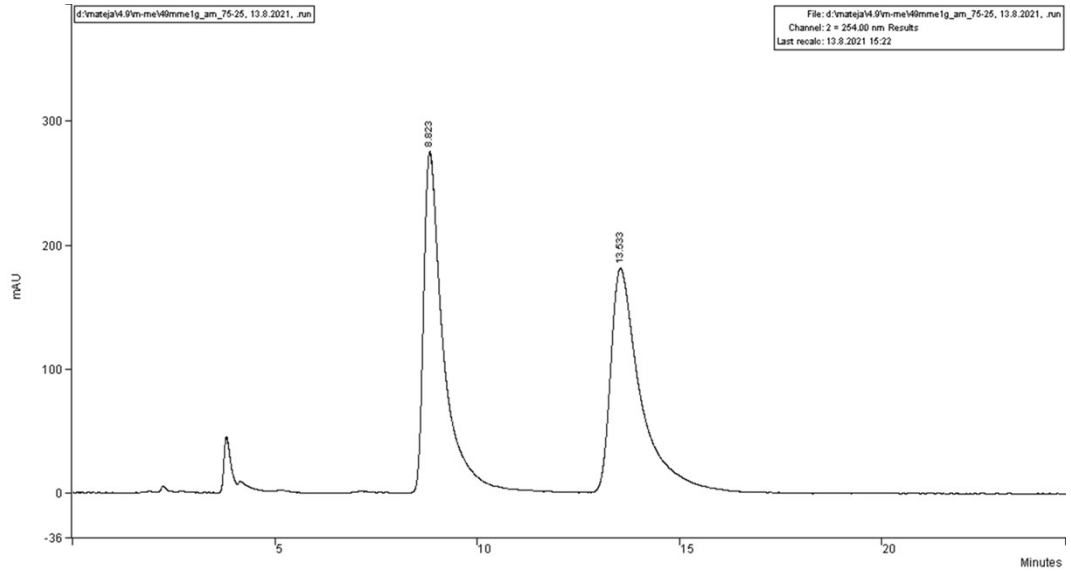
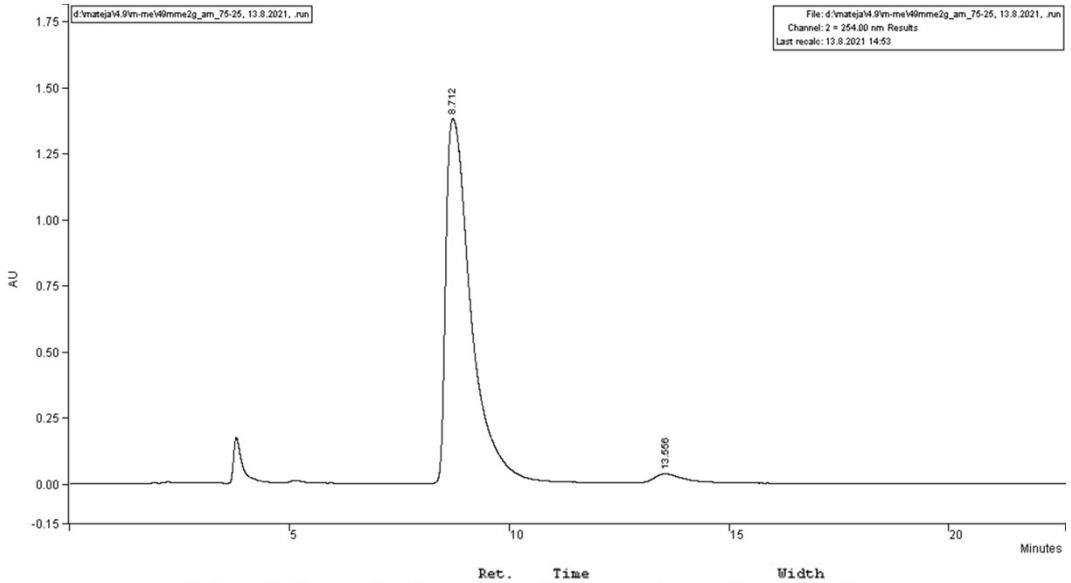
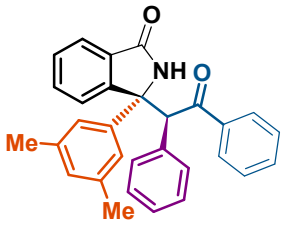


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0168	8.823	0.000	94119272	BB	26.8	
2		49.9832	13.533	0.000	94056024	BB	41.3	
Totals:		100.0000		0.000	188175296			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		97.5183	8.712	0.000	546556864	BB	33.9	
2		2.4817	13.556	0.000	13908887	BB	39.6	
Totals:		100.0000		0.000	560465751			



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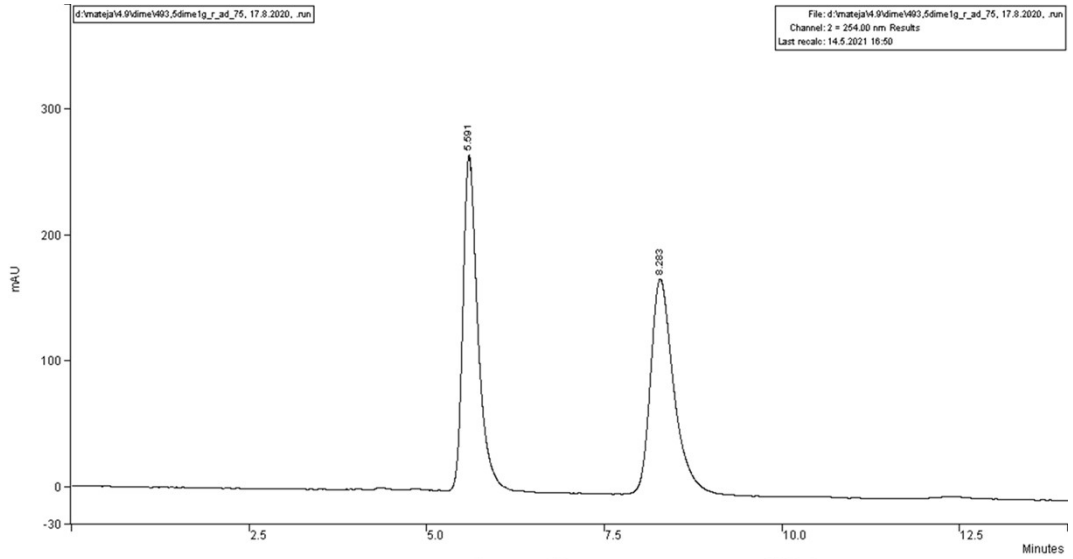
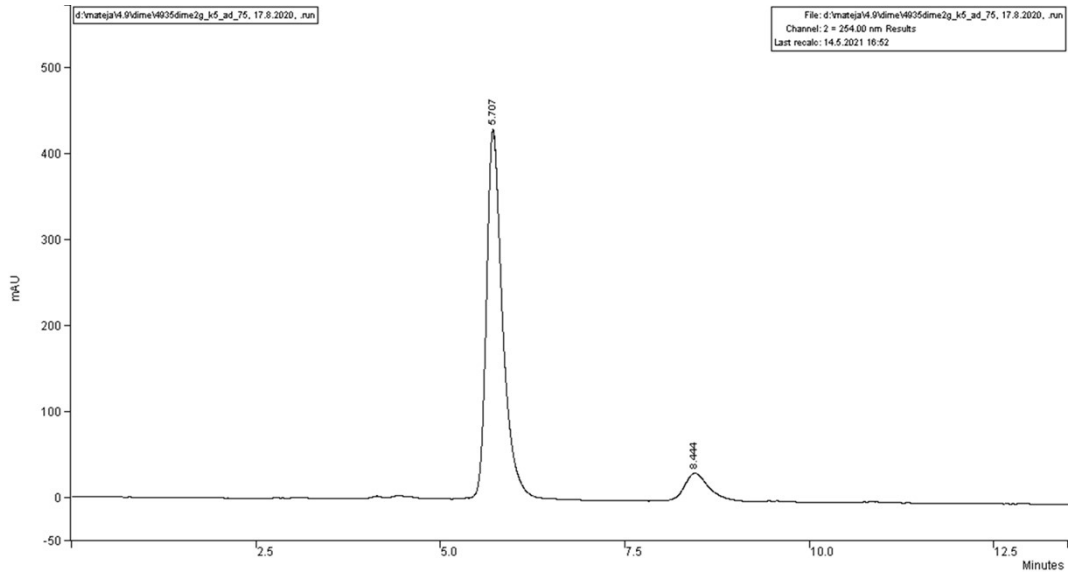
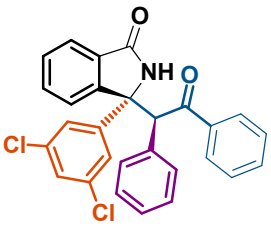


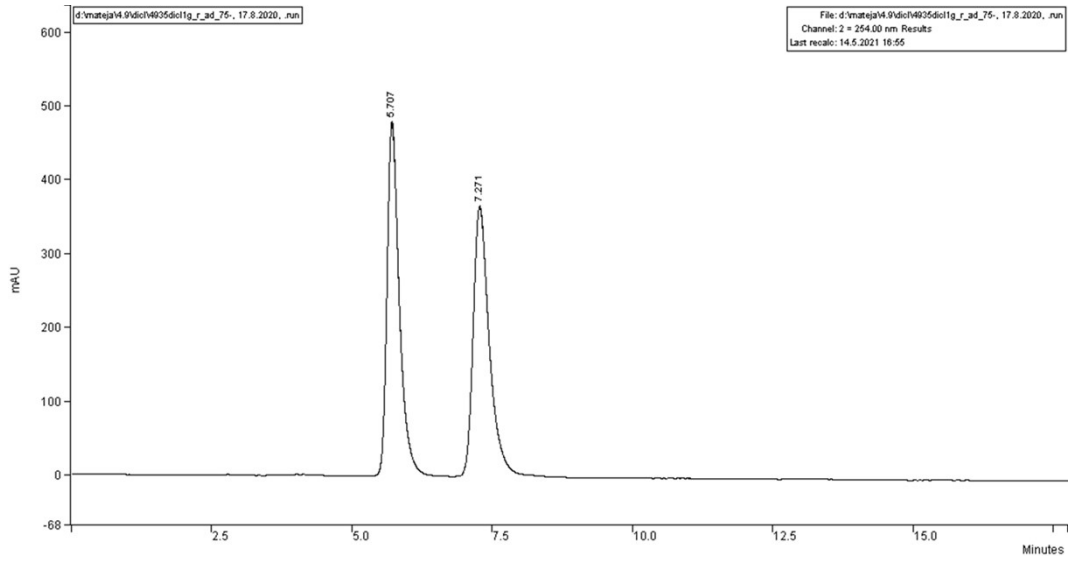
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9912	5.591	0.000	38989176	BB	12.7	
2		50.0088	8.283	0.000	39002872	BB	20.0	
Totals:		100.0000		0.000	77992048			



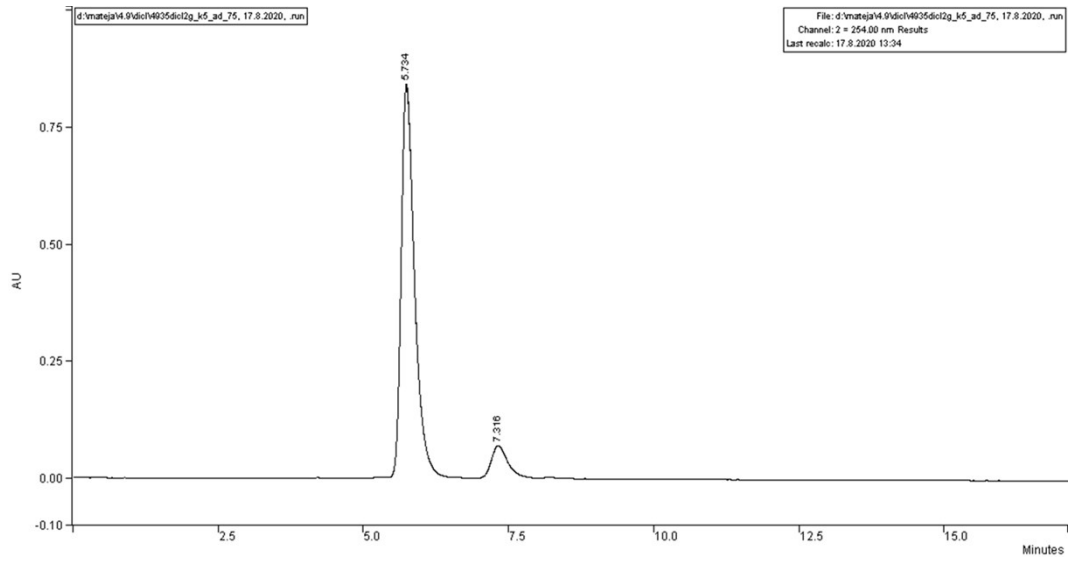
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		90.2753	5.707	0.000	64436064	BB	13.2	
2		9.7247	8.444	0.000	6941229	BB	20.0	
Totals:		100.0000		0.000	71377293			



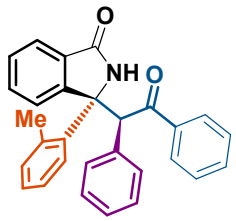
32



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.1824	5.707	0.000	72706488	BB	13.3	
2		49.8176	7.271	0.000	72177968	BB	17.5	
Totals:		100.0000		0.000	144884456			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		90.9003	5.734	0.000	133341688	BB	14.1	
2		9.0997	7.316	0.000	13348322	BB	17.4	
Totals:		100.0000		0.000	146690010			



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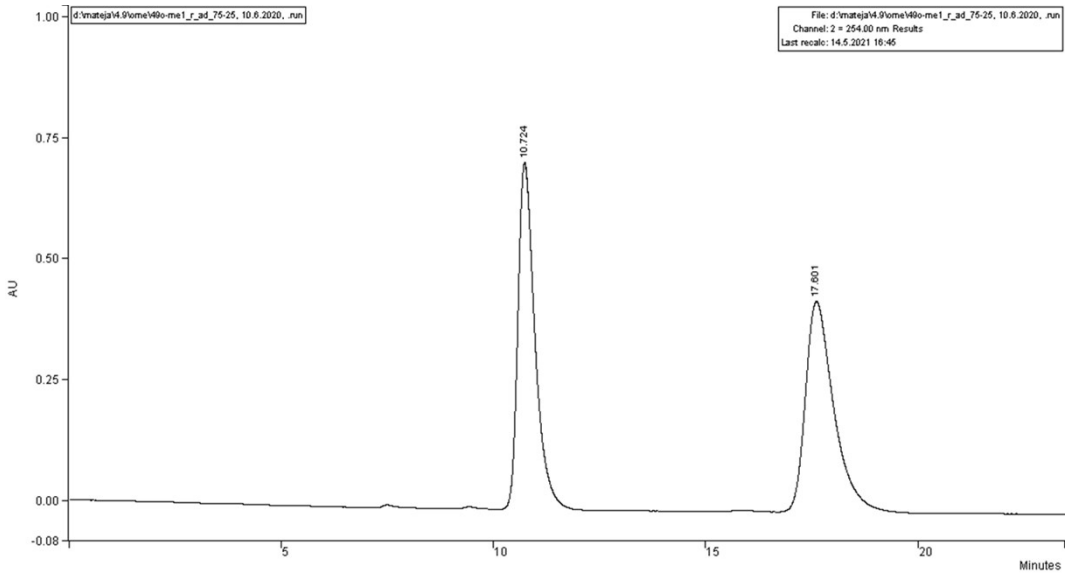
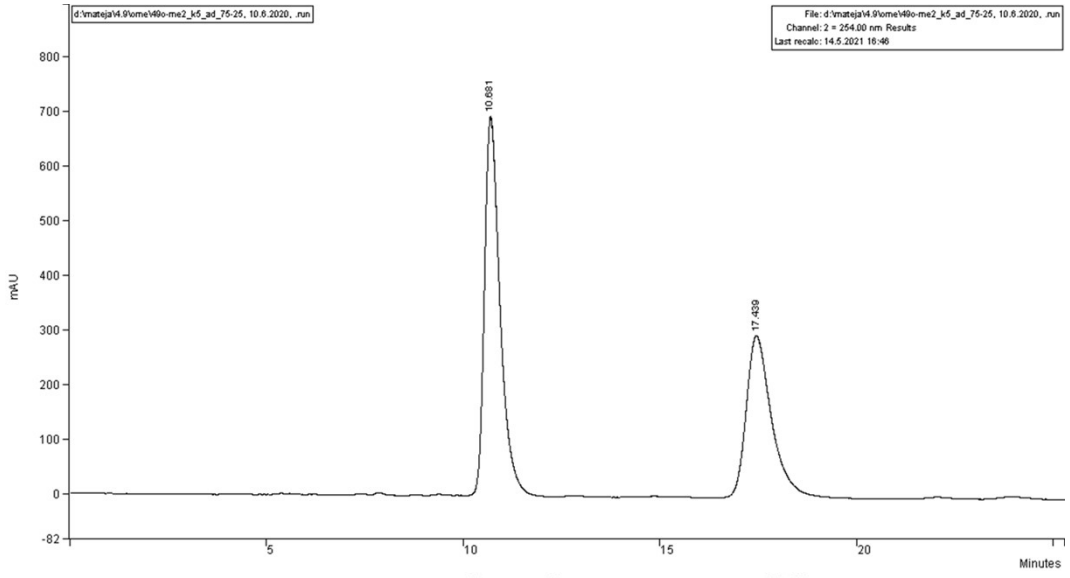
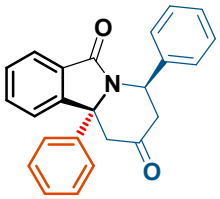


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0796	10.724	0.000	199910160	BB	24.6	
2		49.9204	17.601	0.000	199274704	BB	40.9	
Totals:		100.0000		0.000	399184864			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		59.9407	10.681	0.000	190419952	BB	24.3	
2		40.0593	17.439	0.000	127260720	BB	39.1	
Totals:		100.0000		0.000	317680672			



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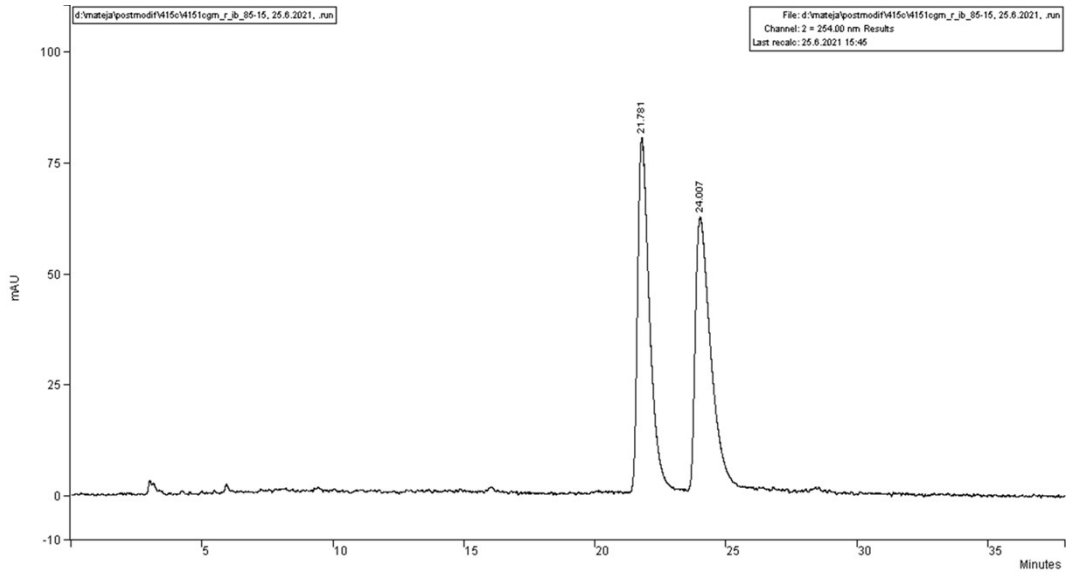
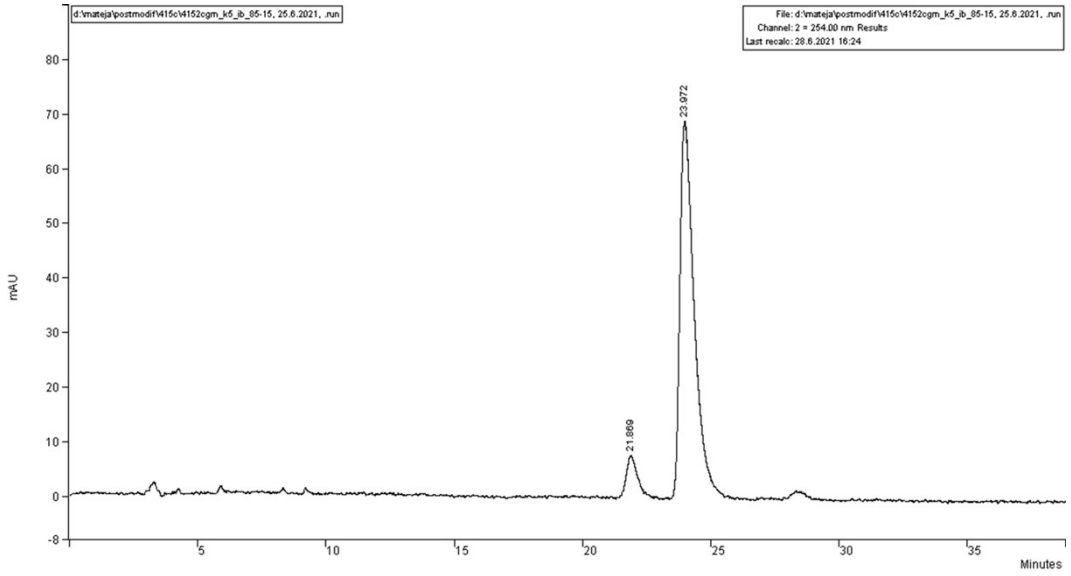
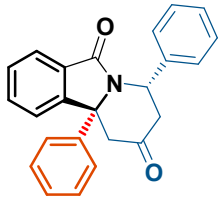


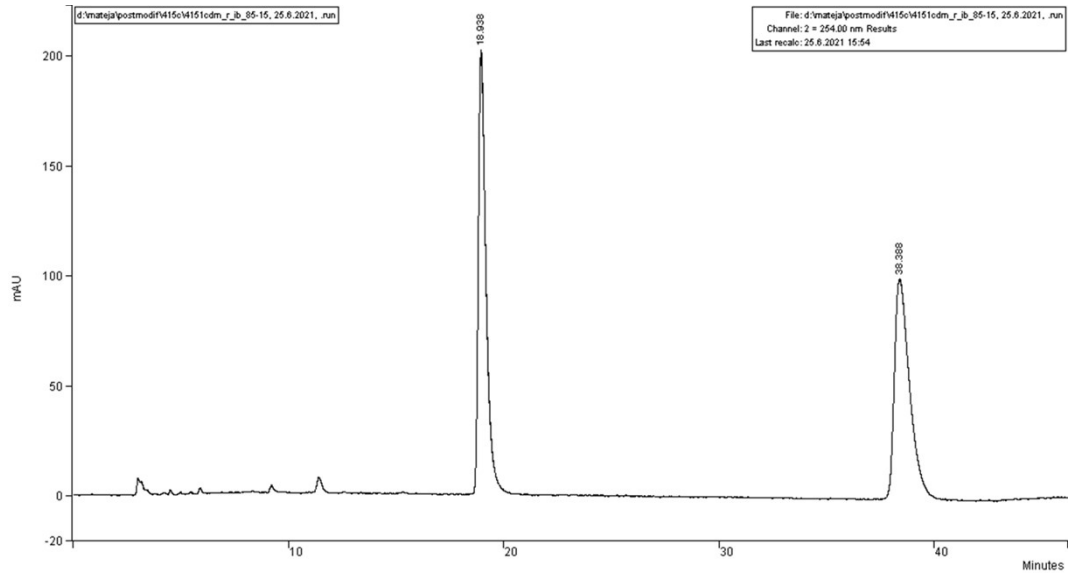
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.0187	21.781	0.000	25057158	BB	28.2	
2		49.9813	24.007	0.000	25038402	BB	37.1	
Totals:		100.0000		0.000	50095560			



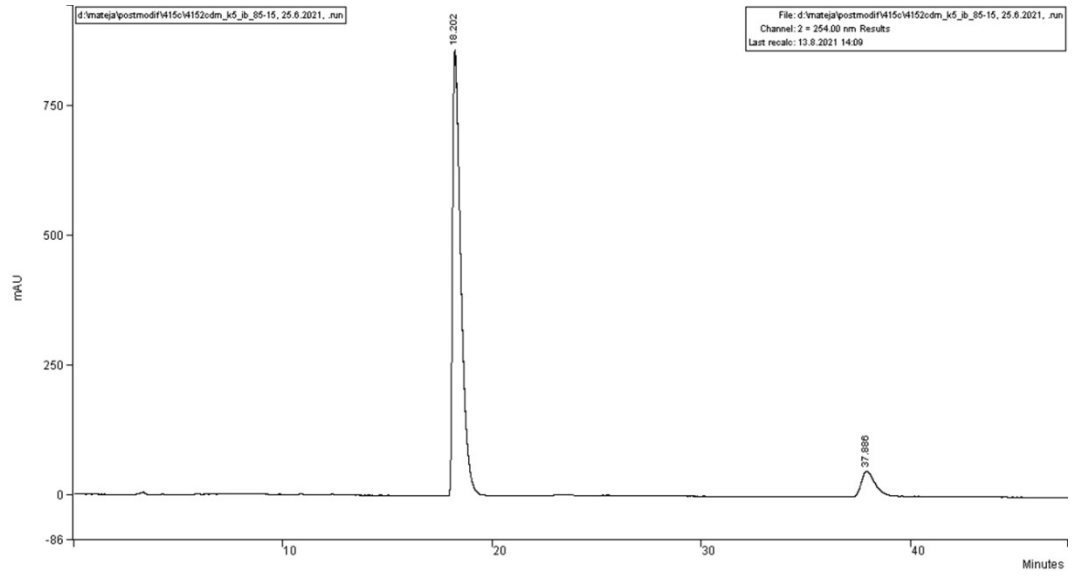
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		7.0261	21.869	0.000	2043914	BB	26.1	
2		92.9739	23.972	0.000	27046570	BB	34.4	
Totals:		100.0000		0.000	29090484			



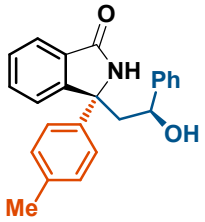
34'



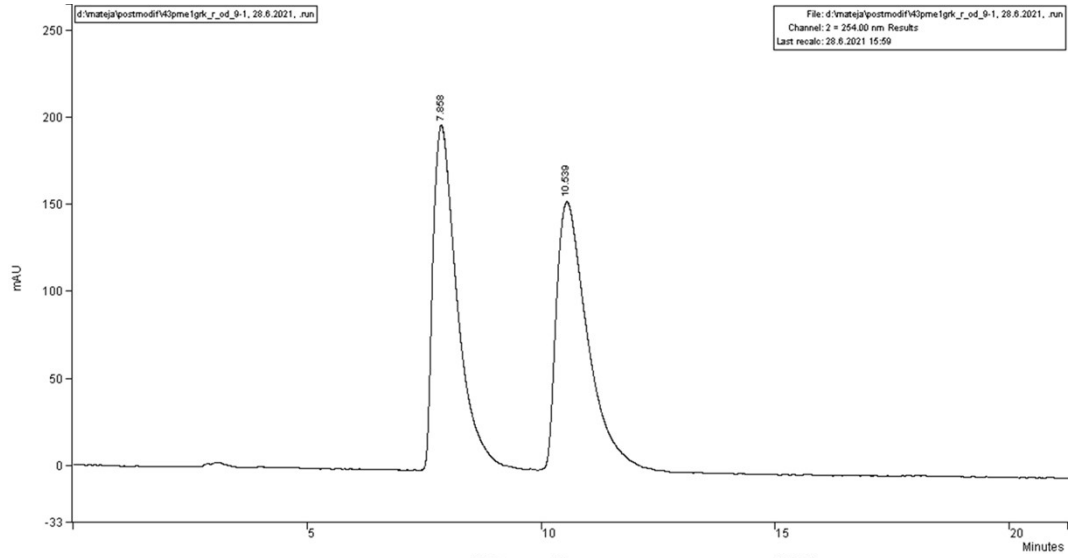
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.4572	18.938	0.000	49949740	BB	21.7	
2		49.5428	38.388	0.000	49044444	BB	44.2	
Totals:		100.0000		0.000	98994184			



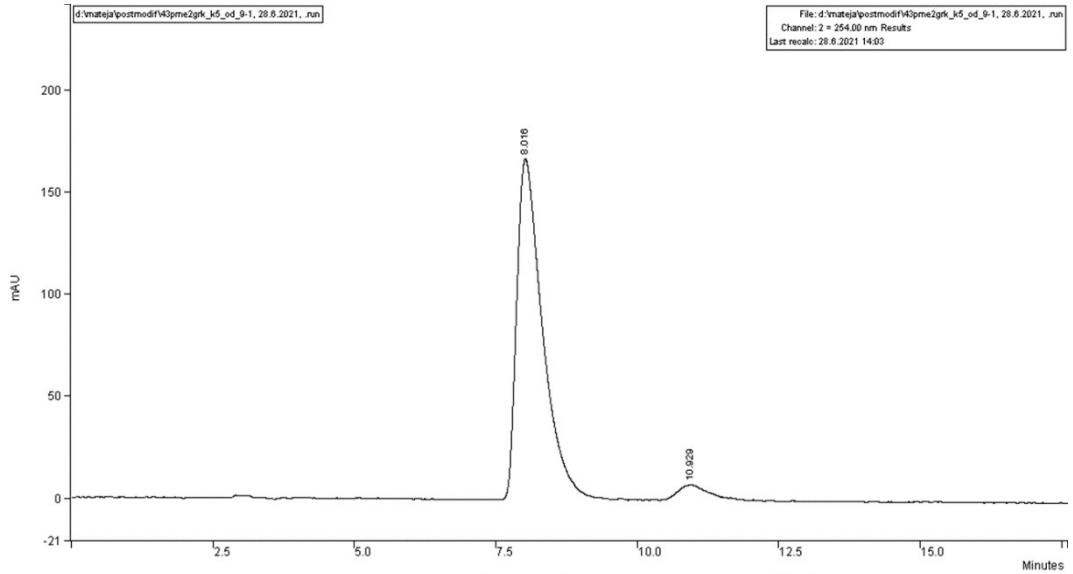
Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		93.0337	18.202	0.000	235739776	BB	24.8	
2		6.9663	37.886	0.000	17652158	BB	37.4	
Totals:		100.0000		0.000	253391934			



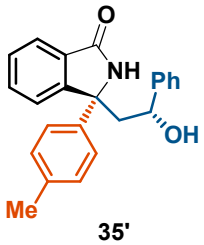
35



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.9688	7.858	0.000	71461912	BB	32.1	
2		50.0312	10.539	0.000	71551128	BB	41.6	
Totals:		100.0000		0.000	143013040			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		94.9674	8.016	0.000	52805812	BB	28.3	
2		5.0326	10.929	0.000	2798355	BB	32.6	
Totals:		100.0000		0.000	55604167			



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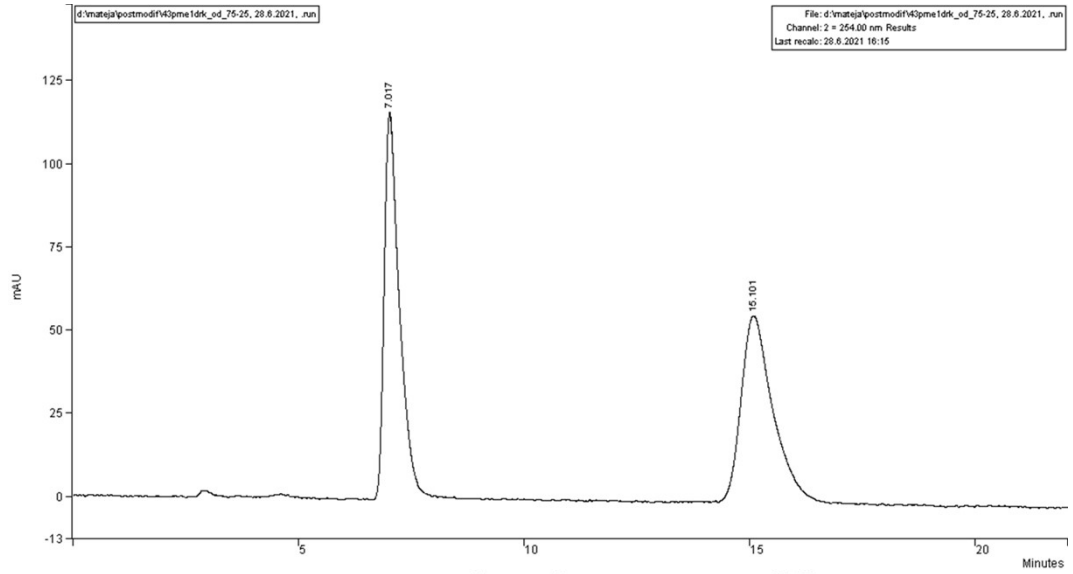
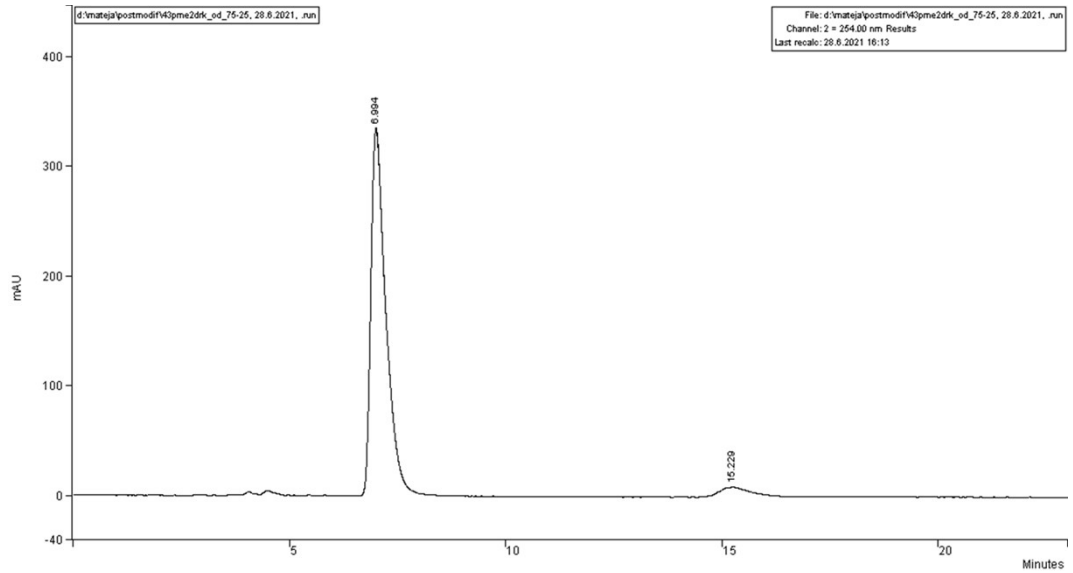
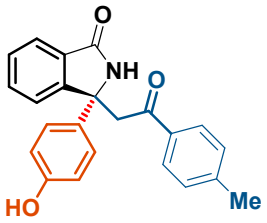


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		50.1835	7.017	0.000	27564072	BB	20.9	
2		49.8165	15.101	0.000	27362524	BB	43.4	
Totals:		100.0000		0.000	54926596			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		94.6716	6.994	0.000	81049192	BB	21.3	
2		5.3284	15.229	0.000	4561712	BB	47.9	
Totals:		100.0000		0.000	85610904			



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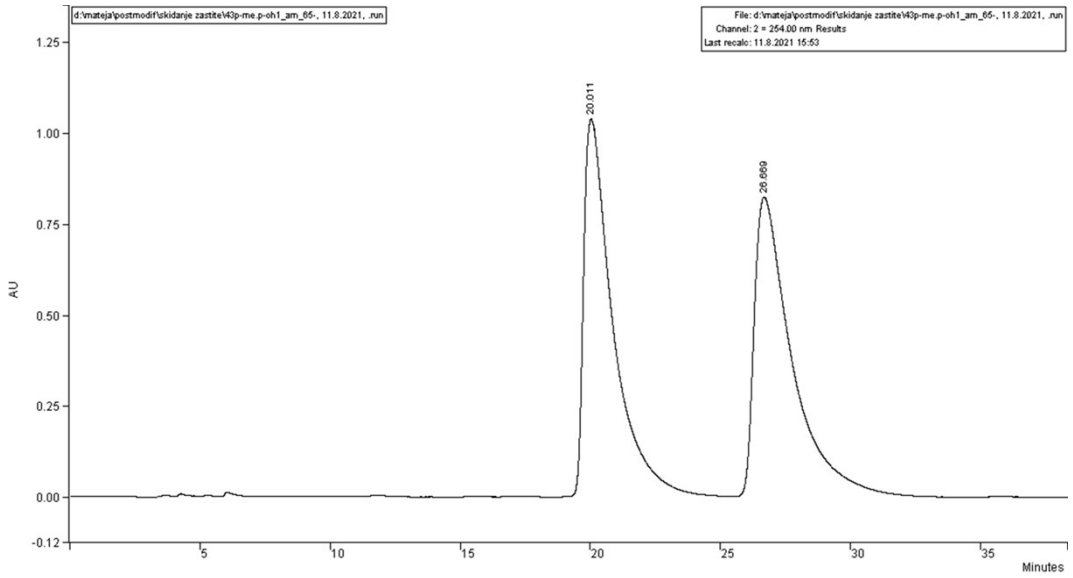
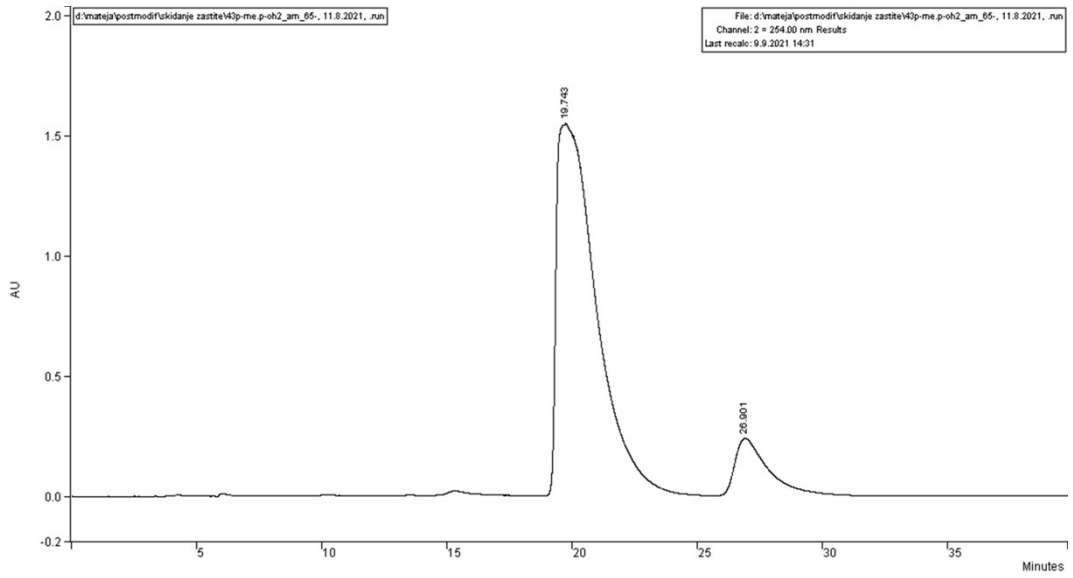


Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		49.5636	20.011	0.000	813059776	BB	64.7	
2		50.4364	26.669	0.000	827376512	BB	84.0	
	Totals:	100.0000		0.000	1640436288			



Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1		89.9531	19.743	0.000	1720451584	BB	98.8	
2		10.0469	26.901	0.000	192157280	BB	75.4	
	Totals:	100.0000		0.000	1912608864			