Supporting Information

$CuSO_4$ catalyzed three-component reaction of α-diazo ester, water and isatin : an efficient and green approach to oxindole derivatives

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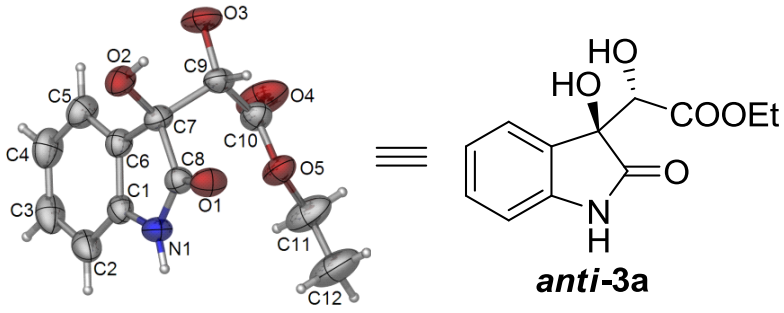
Gneral Information: Diazoesters **1** were prepared according to literature.[1] Isatins **2** and copper sulfate which were commercially available, were used without further purification.All reactions were carried out under atmosphere. All NMR spectra were recorded using a Brucker-300 MHz, 400 MHz ,500 MHz spectrometer or JNM-EX-400 MHz spectrometer in DMSO-d_6 unless otherwise noted. Chemical shifts (δ value) were reported in ppm down field from internal tetramethylsilane (TMS).Chemical shifts are reported in parts per million as follows: chemical shift, multiplicity (s=singlet, d = doublet, t = triplet, m = multiplet).HRMS (ESI) Mass Spectra were recorded on a Bruker micrOTOF II Instrument or IonSpec FT-ICR mass spectrometer.

General procedure for the copper-catalyzed three-component reaction of diazoesters, water and isatins: to a 10 mL flask with a stir bar was added isatin **2** (0.5 mmol) and 2 mL water, then the mixture was stirred fiercely to form suspension to which copper sulfate (0.05 mmol) was added in one portion. A mixture of diazoester **1** (2mmol) in 5 mL water was syringed to the suspension within one hour. Eventually, colorful suspension turned into a clear solution. When the reaction was finished as monitored by TLC, the reaction mixture was washed with petroleum ether (3×3 mL) to remove impurities with low polarity, then extracted with 15 mL ethyl acetate for 3 times. The combined organic phase was washed with saturated brine, dried over anhydrous sodium sulfate, filtered and then concentrated to provide the product, which was then crystallized from petroleum ether and ethyl acetate.

X-ray diffraction parameters and data for ***anti*-3a (CCDC 907747)**



Bond precision: C-C = 0.0023 A Wavelength=0.71073

Cell: a=10.6093(4) b=7.2105(3) c=16.4024(6)
alpha=90 beta=106.323(1) gamma=90

Temperature: 296 K

	Calculated	Reported
Volume	1204.18(8)	1204.18(8)
Space group	P 21/n	P2(1)/n
Hall group	-P 2yn	?
Moiety formula	C12 H13 N O5	?
Sum formula	C12 H13 N O5	C12 H13 N O5
Mr	251.23	251.23
Dx,g cm-3	1.386	1.386
Z	4	4
Mu (mm-1)	0.109	0.109
F000	528.0	528.0
F000'	528.32	
h,k,lmax	12,8,19	12,8,19
Nref	2130	2127
Tmin,Tmax	0.965,0.975	0.965,0.975
Tmin'	0.965	

Correction method= MULTI-SCAN

Data completeness= 0.999 Theta(max)= 25.010

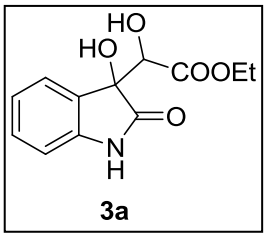
R(reflections)= 0.0355(1822) wR2(reflections)= 0.0966(2127)

S = 1.029 Npar= 164

Notes and references

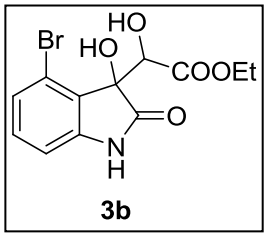
1. M. P. Doyle, M. A. Mckervey and T. Ye, *Modern Catalytic Methods Synthesis with Diazo Compounds*; Wiley: New York, 1998.; J. B. Hendrickson and W. A. Wolf, *J. Org. Chem.*, 1968, **33**, 3610.

Analytical Data for the Products



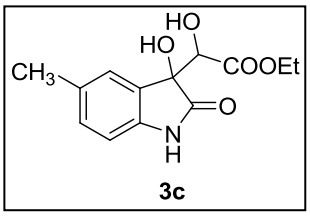
3a

The desired products **3a** was afforded by crystalization in 90% yield as yellow solids (***anti*-3a : *syn*-3a = 80 : 20**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3a**) 0.86 (t, *J* = 7.0 Hz, 3H), 3.77-3.82 (m, 2H), 4.38 (d, *J* = 5.1 Hz, 1H), 5.82 (d, *J* = 5.0 Hz, 1H), 6.14 (s, 1H), 6.74 (d, 1H), 6.87-6.93 (m, 1H), 7.15-7.19 (m, 1H), 7.39 (d, 1H), 10.22 (s, 1H); (***syn*-3a**) 1.21 (t, *J* = 7.1 Hz, 3H), 4.12-4.18 (m, 2H), 4.34 (d, *J* = 5.9 Hz, 1H), 5.57 (d, *J* = 5.9 Hz, 1H), 6.12 (s, 1H), 6.76 (d, 1H), 6.87-6.93 (m, 1H), 7.15-7.19(m, 2H), 10.24 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6): 13.44, 14.04, 59.94, 60.13, 73.35, 73.73, 75.83, 76.51, 109.13, 109.24, 120.94, 121.03, 125.51, 125.76, 128.57, 129.08, 129.15, 142.54, 143.15, 169.90, 171.25, 176.76, 177.73; HRMS (ESI): Exact mass calcd for $C_{12}H_{13}NNaO_5$ $[M+Na]^+$: 274.0686, Found 274.0720.



3b

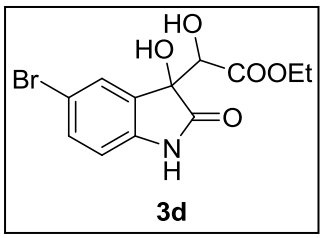
The desired products **3b** was afforded by crystalization in 40% yield as yellow solids (***anti*-3a : *syn*-3a = 83 : 17**). (mixture of diastereomers) ^{1}H NMR (400MHz, DMSO-d_6): δ (***anti*-3b**) 1.21 (t, *J* = 7.1 Hz, 3H), 4.11-4.16 (m, 2H), 4.77 (s, 1H), 5.52 (s, 1H), 5.91 (s, 1H), 6.76 (d, *J* = 7.4 Hz, 1H), 7.07-7.15 (m, 2H), 10.39 (s, 1H); (***syn*-3b**) 0.88 (t,*J* = 7.1 Hz, 3H), 3.85-3.87 (m, 2H), 4.77 (s, 1H), 5.45 (s, 1H), 6.34 (s, 1H), 6.76 (d, *J* = 7.4 Hz, 1H), 7.07-7.15 (m, 2H), 10.53 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6): 13.40, 14.03, 60.21, 60.32, 70.71, 73.23, 76.97, 78.39, 108.75, 108.97, 118.58, 125.35, 125.59, 128.53, 130.99, 131.36, 144.65, 145.23, 171.19, 175.88, 176.42; HRMS (ESI): Exact mass calcd for $C_{12}H_{12}BrNNaO_5$ $[M+ Na]^+$: 351.9791, Found 351.9810.



3c

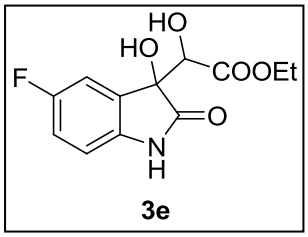
The desired products **3c** was afforded by crystalization in 85% yield as yellow solids (***anti*-3c : *syn*-3c = 89 : 11**). (mixture of diastereomers) ^{1}H NMR (300 MHz, DMSO-d_6): δ (***anti*-3c)** 0.85

(t, *J* = 7.2 Hz, 3H), 2.20 (s, 1H), 3.75-3.82 (m, 2H), 4.34 (d, *J* = 5.4 Hz, 1H), 5.80 (d, *J* = 5.4 Hz, 1H), 6.08 (s, 1H), 6.60-6.64 (m, 1H), 6.95-7.00 (m, 1H), 7.20 (s, 1H), 10.10 (s, 1H); (***syn*-3c**) 1.20 (t, *J* = 7.0 Hz, 3H), 2.20 (s, 1H), 4.16-4.20 (m, 2H), 4.30 (d, *J* = 6.0 Hz, 1H), 5.55 (d, *J* = 6.3 Hz, 1H), 6.08 (s, 1H), 6.60-6.64 (m, 1H), 6.95-7.00 (m, 2H), 10.13 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6): 13.46, 14.04, 20.65, 20.71, 59.90, 60.10, 73.44, 73.73, 75.93, 76.57, 108.84, 126.15, 129.15, 129.29, 129.63, 140.09, 169.92, 176.76, 177.70; HRMS (ESI): Exact mass calcd for $C_{13}H_{15}NNaO_5$ [M+ Na]$^+$: 288.0842, Found 288.0846.



3d

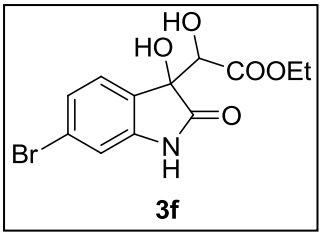
The desired products **3d** was afforded by crystalization in 65% yield as yellow solids (***anti*-3d : *syn*-3d = 91 : 9**). (mixture of diastereomers) ^{1}H NMR (300 MHz, DMSO-d_6): δ (***anti*-3d**) 0.88 (t, *J* = 7.0 Hz, 3H), 3.78-3.85 (m, 2H), 4.35 (d, *J* = 5.7 Hz, 1H), 6.03 (d, *J* =5.7 Hz, 1H), 6.35 (s, 1H), 6.69-6.71 (m, 1H), 7.33-7.37 (m, 1H), 7.49-7.50 (d, 1H), 10.38 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6): 13.48, 14.05, 60.11, 60.30, 73.28, 73.72, 76.62, 111.20, 112.72, 128.31, 128.87, 131.47, 131.81, 141.89, 142.55, 169.77, 176.25. HRMS (ESI): Exact mass calcd for $C_{12}H_{12}BrNNaO_5$ [M+Na]$^+$: 351.9791, Found 351.9843.



3e

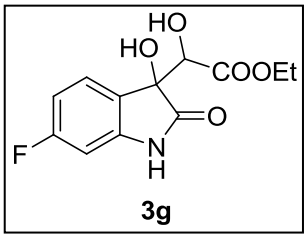
The desired product **3e** was afforded by crystalization in 64% yield as yellow solids (***anti*-3e : *syn*-3e = 69 : 31**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3e)** 0.77 (t, *J* = 7.0 Hz, 3H), 3.68-3.73 (m, 2H), 4.26 (d, *J* = 5.6 Hz, 1H), 5.88 (d, *J* = 6.0 Hz, 1H), 6.24 (s, 1H), 6.60-6.64 (m, 1H), 6.88-6.93 (m, 1H), 7.08 (d, *J* = 8.4 Hz, 1H), 10.17 (s, 1H); (***syn*-3e**) 1.11 (t, *J* = 7.0 Hz, 3H), 4.02-4.08 (m, 2H), 4.21 (d, *J* = 6.4 Hz, 1H), 5.65 (d, *J* = 6.0 Hz, 1H), 6.22 (s, 1H), 6.60-6.64 (m, 1H), 6.88-6.93 (m, 2H), 10.21 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 14.49, 15.04, 61.10,

61.28, 74.22, 74.70, 77.17, 77.79, 110.88, 110.96, 114.05, 114.30, 114.54, 114.79, 116.28, 116.51, 131.66, 131.74, 139.73, 140.37, 157.30, 159.64, 170.81, 172.19, 177.67, 178.76; HRMS (ESI): Exact mass calcd for $C_{12}H_{12}FNNaO_5$ $[M+ Na]^+$: 292.0592, Found 292.0597.



3f

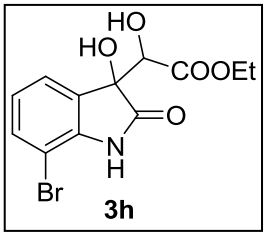
The desired products **3f** was afforded by crystalization in 54% yield as yellow solids (***anti*-3f : *syn*-3f = 72 : 28**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3f**) 0.78 (t, *J* = 7.0 Hz, 3H), 3.68-3.73 (m, 2H), 4.24 (d, *J* = 4.8 Hz, 1H), 5.88 (d, *J* = 5.2 Hz, 1H), 6.20 (s, 1H), 6.77 (s, 1H), 6.96-7.00 (m, 1H), 7.19 (d, *J* = 7.6 Hz, 1H), 10.28 (s, 1H); (***syn*-3f**) 1.10 (t, *J* = 7.2 Hz, 3H), 4.02-4.04 (m, 2H), 4.18 (d, *J* = 6.0 Hz, 1H), 5.60 (d, *J* = 6.0 Hz, 1H), 6.16 (s, 1H), 6.78 (s, 1H), 6.96-7.00 (m, 2H), 10.29 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 14.50, 15.07, 16.11, 16.25, 74.11, 74.64, 76.56, 77.38, 112.98, 113.06, 122.90, 124.61, 124.74, 128.36, 128.70, 128.90, 129.46, 145.28, 145.91, 170.80, 172.10, 177.59, 178.67; HRMS (ESI): Exact mass calcd for $C_{12}H_{12}BrNNaO_5$ $[M+ Na]^+$: 351.9791, Found 351.9845.



3g

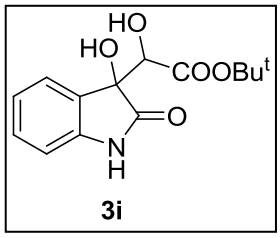
The desired products **3g** was afforded by crystalization in 66% yield as yellow solids (***anti*-3g : *syn*-3g = 72 : 28**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3g**) 0.90 (t, *J* = 7.1 Hz, 3H), 3.82-3.85 (m, 2H), 4.38 (d, *J* = 5.3 Hz, 1H), 5.92 (d, *J* = 5.4 Hz, 1H), 6.24 (s, 1H), 6.55-6.58 (m, 1H), 6.69-6.72 (m, 1H), 7.38-7.42 (m, 1H), 10.38 (s, 1H); (***syn*-3g**) 1.23 (t, *J* = 7.1 Hz, 3H), 4.15-4.17 (m, 2H), 4.33 (d, *J* = 6.1 Hz, 1H), 5.65 (d, *J* = 6.1 Hz, 1H), 6.20 (s, 1H), 6.55-6.58 (m, 1H), 6.69-6.72(m, 1H), 7.19-7.22 (m, 1H), 10.40 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.97, 14.53, 60.54, 60.70, 73.69, 74.22, 75.92, 76.68, 97.67, 97.94, 107.45, 107.67, 124.93, 125.56, 127.52, 127.62, 144.81, 144.93, 162.15, 164.56, 170.35, 171.67, 177.53, 178.56; HRMS (ESI):

Exact mass calcd for $C_{12}H_{12}FNNaO_5$ [M+ Na]$^+$: 292.0592, Found 292.0585.



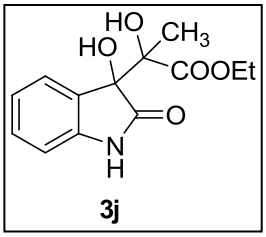
3h

The desired products **3h** was afforded by crystalization in 78% yield as yellow solids (***anti*-3h : *syn*-3h = 80 : 20**). (mixture of diastereomers) ^{1}H NMR (500 MHz, DMSO-d_6): δ (***anti*-3h**) 0.87 (t, *J* = 7.0 Hz, 3H), 3.78-3.88 (m, 2H), 4.39 (d, *J* = 4.5 Hz, 1H), 6.01 (d, *J* = 4.0 Hz, 1H), 6.39 (s, 1H), 6.85-6.89 (m, 1H), 7.37-7.41 (m, 2H), 10.58 (s, 1H); (***syn*-3h**) 1.22 (t, *J* = 7.0 Hz, 3H), 4.14-4.17 (m, 2H), 4.33 (d, *J* = 5.5 Hz, 1H), 5.75 (d, *J* = 5.5 Hz, 1H), 6.35 (s, 1H), 6.85-6.89 (m, 1H), 7.19 (d, *J* = 7.0 Hz, 1H), 7.37-7.41 (m, 1H), 10.58 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.88, 14.54, 60.58, 60.74, 73.86, 74.25, 77.06, 77.92, 102.14, 123.24, 123.40, 125.00, 125.32, 131.15, 131.60, 132.47, 134.01, 142.02, 142.41, 170.21, 174.45, 177.11; HRMS (ESI): Exact mass calcd for $C_{12}H_{12}BrNNaO_5$ [M+ Na]$^+$: 351.9791, Found 351.9806.



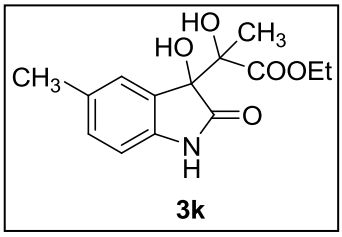
3i

The desired products **3i** was afforded by crystalization in 82% yield as yellow solids (***anti*-3i : *syn*-3i = 67 : 33**). (mixture of diastereomers) ^{1}H NMR (300 MHz, DMSO-d_6): δ (***anti*-3i**) 1.05 (s, 9H), 4.27 (d, *J* = 5.3 Hz, 1H), 5.58 (d, *J* = 5.3 Hz, 1H), 6.06 (s, 1H), 6.77 (d, *J* = 7.7 Hz, 1H), 6.86-6.94 (m, 1H), 7.16-7.22 (m, 1H), 7.38 (d, *J* = 7.2 Hz, 1H), 10.24 (s, 1H); (***syn*-3i**) 1.38 (s, 9H), 4.23 (d, *J* = 6.6 Hz, 1H), 5.30 (d, *J* = 6.6 Hz, 1H), 6.05 (s, 1H), 6.77 (d, *J* = 7.7 Hz, 1H), 6.86-6.94 (m, 1H), 7.16-7.22 (m, 1H), 7.25 (d, *J* = 7.3 Hz, 1H), 10.24 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 26.95, 27.57, 73.48, 74.14, 75.52, 76.23, 80.40, 80.75, 109.10, 109.25, 120.92, 120.98, 125.74, 128.74, 129.07, 129.13, 129.16, 142.72, 143.02, 168.85, 170.33, 176.79, 177.75; HRMS (ESI): Exact mass calcd for $C_{14}H_{17}NNaO_5$ [M+ Na]$^+$: 302.0999, Found 302.1005.



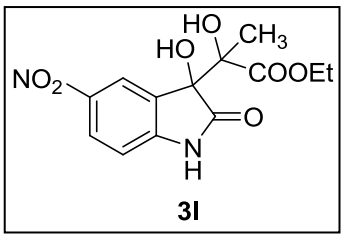
3j

The desired products **3j** was afforded by crystalization in 92% yield as yellow solids (***anti*-3j : *syn*-3j = 63 : 37**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3j**) 0.88 (t, *J* = 7.0 Hz, 3H), 1.53 (s, 3H), 3.78-3.82 (m, 2H), 5.40 (s, 1H), 5.91 (s, 1H), 6.69-6.76 (m, 1H), 6.83-6.90 (m, 1H), 7.11-7.18 (m, 1H), 7.46 (d, *J* = 7.6 Hz, 1H), 10.13 (s, 1H); (***syn*-3j**) 1.10 (t, *J* = 7.0 Hz, 3H), 1.46 (s, 3H), 4.03-4.05 (m, 2H), 5.18 (s, 1H), 6.03 (s, 1H), 6.69-6.76 (m, 1H), 6.83-6.90 (m, 1H), 7.11-7.19 (m, 2H), 10.26 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.41, 13.75, 19.17, 20.24, 60.20, 60.50, 76.99, 77.27, 77.74, 108.80, 109.30, 120.72, 121.11, 124.99, 126.38, 129.05, 129.21, 129.49, 129.85, 142.40, 142.76, 172.91, 173.00, 176.64, 177.58; HRMS (ESI): Exact mass calcd for $C_{13}H_{15}NNaO_5$ [M+ Na]$^{+}$: 288.0842, Found 288.0867.



3k

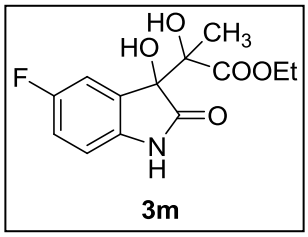
The desired products **3k** was afforded by crystalization in 67% yield as yellow solids (***anti*-3k : *syn*-3k = 91 : 9**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3k**) 0.90 (t, *J* = 6.8 Hz, 3H), 1.53 (s, 3H), 2.21 (s, 3H), 3.80-3.85 (m, 2H), 5.33 (s, 1H), 5.83 (s, 1H), 6.59 (d, *J* = 7.6 Hz, 1H), 6.96 (d, *J* = 7.6 Hz, 1H), 7.29 (s, 1H), 10.03 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.44, 20.28, 20.73, 60.19, 77.14, 77.70, 108.53, 127.03, 129.21, 129.28, 129.87, 139.96, 173.04, 176.68; HRMS (ESI): Exact mass calcd for $C_{14}H_{17}NNaO_5$ [M+Na]$^{+}$: 302.0999, Found 302.1004.



3l

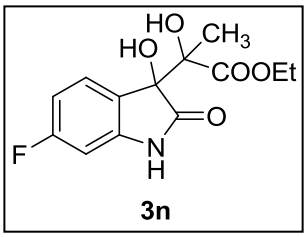
The desired products **3l** was afforded by crystalization in 73% yield as yellow solids (***anti*-3l : *syn*-3l = 58 : 42**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3l**) 1.22 (t, *J* = 7.1 Hz, 3H), 1.51 (s, 3H), 4.11-4.19 (m, 2H), 5.47 (s, 1H), 6.38 (s, 1H), 6.88-6.96 (m, 1H), 7.87 (s, 1H), 8.26-8.32 (m, 1H), 10.89 (s, 1H); (***syn*-3l**) 0.87 (t, *J* = 7.1 Hz, 3H), 1.58 (s, 3H), 3.76-3.84 (m, 2H), 5.83 (s, 1H), 6.33 (s,

1H), 6.88-6.96 (m, 1H), 8.15-8.19 (m, 2H), 10.84 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.41, 13.93, 19.42, 19.93, 60.39, 60.81, 76.35, 77.52, 77.60, 78.07, 109.14, 109.42, 120.41, 122.13, 126.49, 126.54, 130.85, 141.47, 149.11, 149.79, 172.58, 172.80, 176.73, 177.52; HRMS (ESI): Exact mass calcd for $C_{13}H_{14}N_2NaO_7$ $[M+Na]^+$: 333.0693, Found 333.0694.



3m

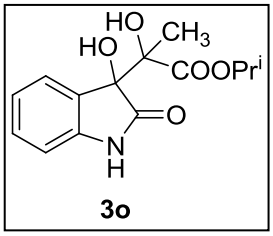
The desired products **3m** was afforded by crystalization in 66% yield as yellow solids (***anti*-3m : *syn*-3m = 60 : 40**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3m**) 0.89 (t, *J* = 7.1 Hz, 3H), 1.55 (s, 3H), 3.80-3.85 (m, 2H), 5.59 (s, 1H), 6.12 (s, 1H), 6.68-6.71 (m, 1H), 6.98-7.04 (m, 1H), 7.25-7.29 (m, 1H), 10.18 (s, 1H); (***syn*-3m**) 1.15 (t, *J* = 7.1 Hz, 3H), 1.44 (s, 3H), 4.05-4.12 (m, 2H), 5.29 (s, 1H), 6.19 (s, 1H), 6.73-6.77 (m, 1H), 6.89-6.77 (m, 1H), 6.98-7.04 (m, 1H), 10.28 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.40, 13.81, 19.27, 20.02, 60.27, 60.59, 77.14, 77.57, 77.83, 109.40, 109.48, 109.94, 110.02, 112.57, 112.82, 113.95, 114,.20, 115.13, 115.29, 115.36, 115.52, 131.28, 131.36, 131.51, 131.59, 138.54, 138.55, 138.99, 139.01, 156.08, 156.32, 158.42, 158.66, 172.76, 176.44, 177.36; HRMS (ESI): Exact mass calcd for $C_{13}H_{14}FNNaO_5$ $[M+Na]^+$: 306.0748, Found 306.0766.



3n

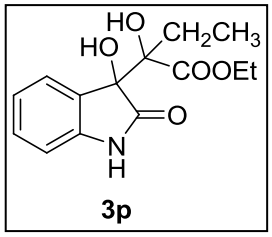
The desired products **3n** was afforded by crystalization in 60% yield as yellow solids (***anti*-3n : *syn*-3n = 64 : 36**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3n**) 0.91 (t, *J* = 7.1 Hz, 3H), 1.54 (s, 3H), 3.81-3.86 (m, 2H), 5.51 (s, 1H), 6.00 (s, 1H), 6.50-6.72 (m, 2H), 7.46-7.49 (m, 1H), 10.29 (s, 1H); (***syn*-3n**) 1.15 (t, *J* = 7.1 Hz, 3H), 1.46 (s, 3H), 4.06-4.11 (m, 2H), 5.20 (s, 1H), 6.07(s, 1H), 6.50-6.72 (m, 2H), 7.08-7.11 (m, 1H), 10.38 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 13.44, 13.83, 19.25, 20.15, 60.25, 60.57, 76.49, 77.10, 77.64, 77.85, 96.73, 96.99, 97.25, 97.52, 106.59,

106.81, 106.95, 107.17, 125.53, 125.56, 125.89, 125.92, 126.43, 126.53, 127.94, 128.04, 144.13, 144.25, 144.59, 144.71, 161.58, 164.00, 172.89, 176.81, 177.69; HRMS (EI): Exact mass calcd for $C_{13}H_{14}FNNaO_5$ $[M+Na]^+$: 306.0724, Found 306.0748.



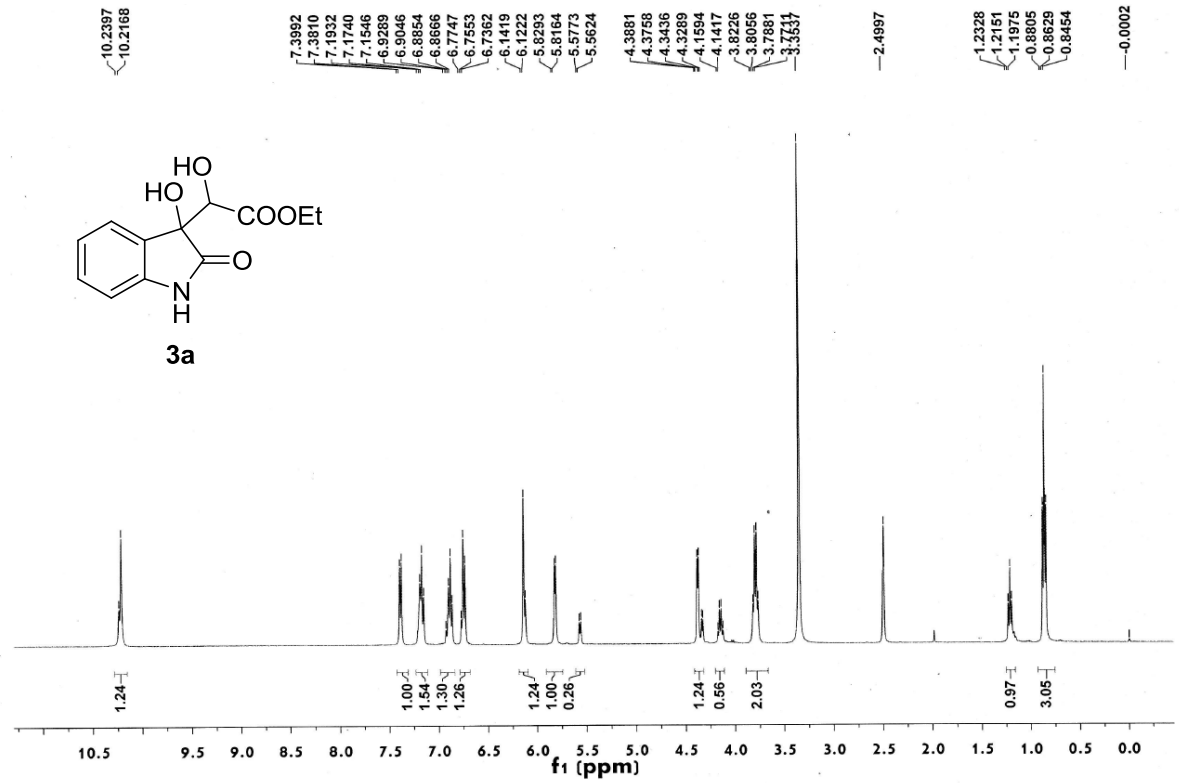
3o

The desired products **3o** was afforded by crystalization in 82% yield as yellow solids (***anti*-3o : *syn*-3o = 56 : 44**). (mixture of diastereomers) ^{1}H NMR (400 MHz, DMSO-d_6): δ (***anti*-3o**) 0.90 (m, 6H), 1.54 (s, 3H), 4.59 (m, 1H), 5.34 (s, 1H), 5.89 (s, 1H), 6.69-6.92 (m, 2H), 7.13-7.20 (m, 2H), 7.48-7.49 (d, *J* = 6.8 Hz, 1H), 10.13 (s, 1H); (***syn*-3o**) 1.06 (m, 6H), 1.46 (s, 3H), 4.78 (m, 1H), 5.16 (s, 1H), 6.05 (s, 1H), 6.69-6.92 (m, 2H), 7.13-7.20 (m, 2H), 10.33 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 18.98, 20.23, 20.68, 20.99, 21.08, 21.22, 67.82, 68.14, 76.71, 76.94, 77.65, 77.81, 108.78, 109.44, 120.68, 121.21, 125.18, 126.44, 129.03, 129.29, 129.36, 129.91, 142.48, 142.70, 172.23, 172.42, 176.58, 177.87; HRMS (ESI): Exact mass calcd for $C_{14}H_{17}NNaO_5$ $[M+Na]^+$: 302.0999, Found 302.1032.



3p

The desired products **3p** was afforded by crystalization in 68% yield as yellow solids (***anti*-3p : *syn*-3p = 50 : 50**). (mixture of diastereomers) ^{1}H NMR (500 MHz, DMSO-d_6): δ (***anti*-3p**) 0.75 (t, *J* = 7.0 Hz, 3H), 0.96 (t, *J* = 7.0 Hz, 3H), 1.90-1.92 (m, 1H), 2.49-2.50 (m, 1H), 4.07-4.14 (m, 2H), 4.60 (s, 1H), 5.87 (s, 1H), 6.88-6.92 (m, 2H), 7.11 (d, *J* = 7.5 Hz, 1H), 7.47 (d, *J* = 7.5 Hz, 1H), 10.04 (s, 1H); (***syn*-3p**) 0.75 (t, *J* = 7.0 Hz, 3H), 1.14 (t, *J* = 7.0 Hz, 3H), 2.07-2.08 (m, 2H), 3.87-3.89 (m, 2H), 4.81 (s, 1H), 5.76 (s, 1H), 6.71-6.76 (m, 2H), 7.15-7.18 (m, 2H), 10.10 (s, 1H); ^{13}C NMR (100 MHz, DMSO-d_6) 7.50, 7.62, 13.56, 13.93, 23.53, 24.62, 60.34, 60.69, 77.75, 77.94, 81.21, 81.40, 108.85, 109.19, 120.81, 121.04, 124.88, 126.43, 129.15, 129.91, 142.31, 142.89, 172.06, 172.45, 176.84, 177.45; HRMS (ESI): Exact mass calcd for $C_{14}H_{17}NNaO_5$ $[M+Na]^+$: 302.0999, Found 302.1029.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7.1932
7.1740
7.1546
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6.9046
6.8854
6.8666
6.7747
6.7553
6.7362
6.1419
6.1222
5.8293
5.8164
5.7773
5.5624
4.3881
4.3758
4.3436
4.3289
4.1594
4.1417
3.8226
3.8056
3.7881
3.7711
3.7537
2.4997
1.2328
1.2151
1.1975
0.8805
0.8629
0.8454
-0.0002
HO
HO
COOEt
O
N
H
3a
1.24
1.00
1.54
1.30
1.26
1.24
1.00
0.26
1.24
0.56
2.03
0.97
3.05
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
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1.0
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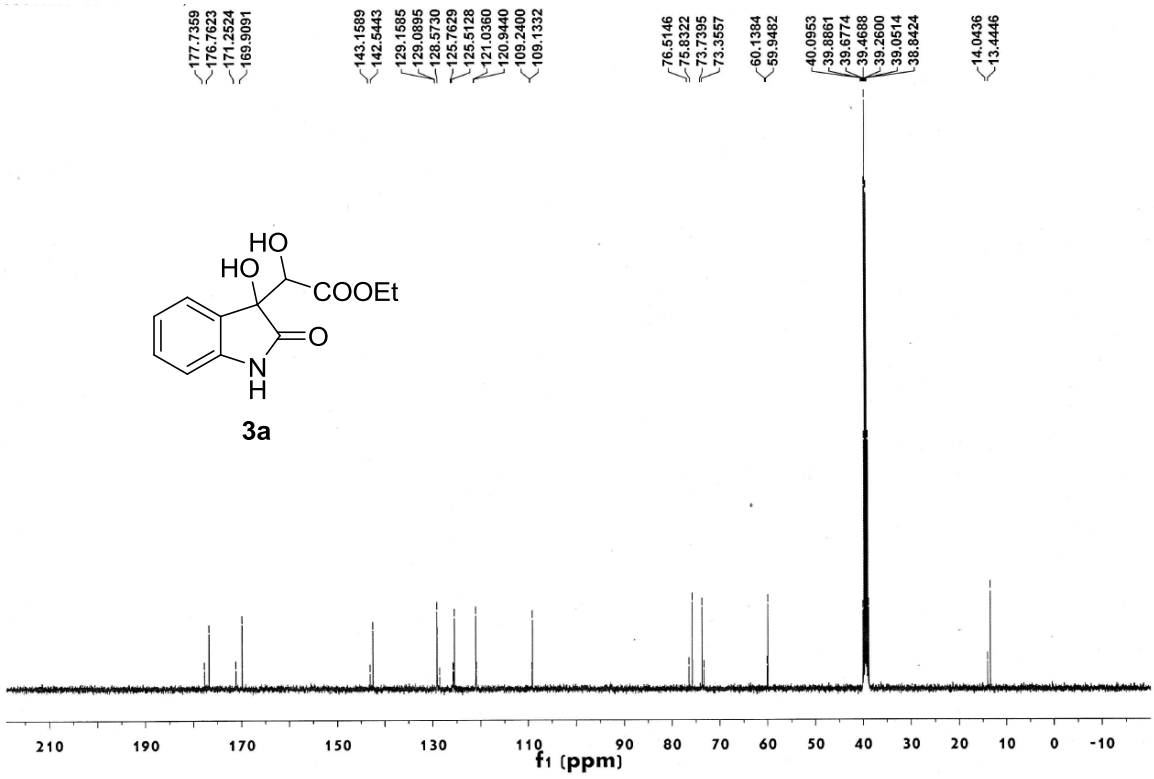
0.0
f1 (ppm)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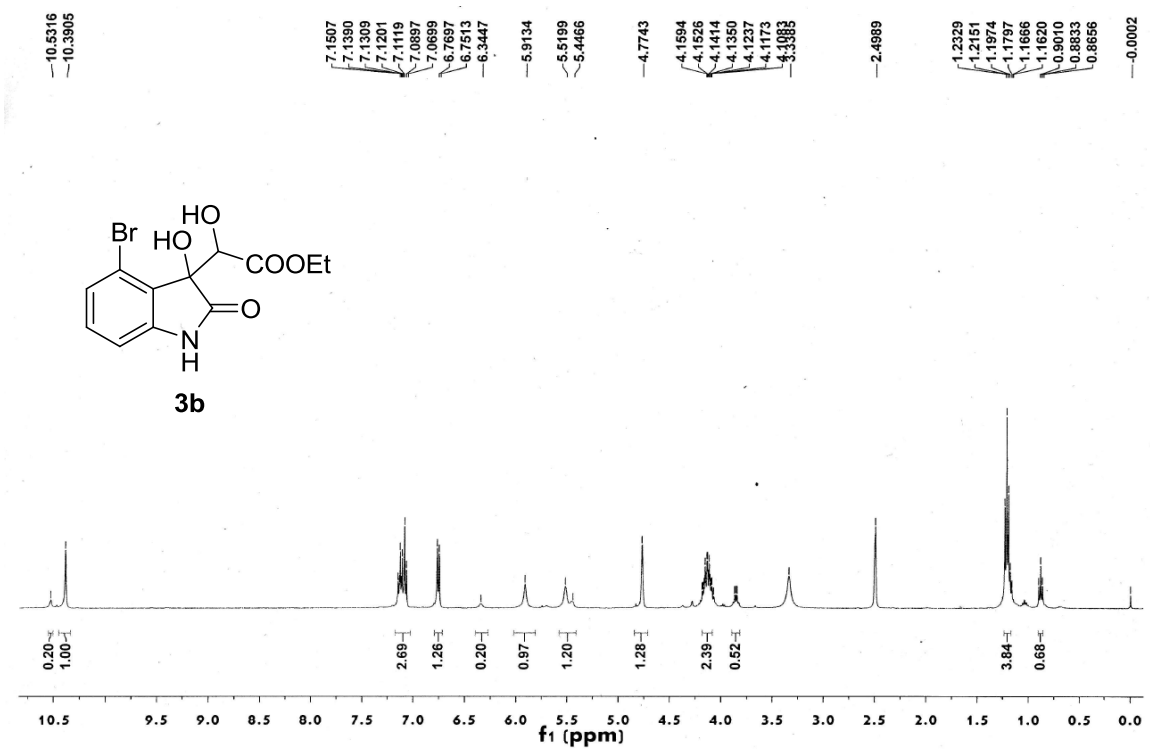
171.2524
169.9091
143.1589
142.5443
129.1585
129.0895
128.5730
125.7629
125.5128
121.0360
120.9440
109.2400
109.1332
76.5146
75.8322
73.7395
73.3557
60.1384
59.9482
40.0953
39.8861
39.6774
39.4688
39.2600
39.0514
38.8424
14.0436
13.4446
HO
HO
COOEt
O
N
H
3a
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.1309
7.1201
7.1119
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7.0699
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6.7513
6.3447
5.9134
5.5199
5.4466
4.7743
4.1594
4.1526
4.1414
4.1350
4.1237
4.1173
4.1083
3.3385
2.4989
1.2329
1.2151
1.1974
1.1797
1.1666
1.1620
1.0010
0.9010
0.8833
0.8656
0.0002
Br
HO
HO
COOEt
O
N
H
3b
0.20
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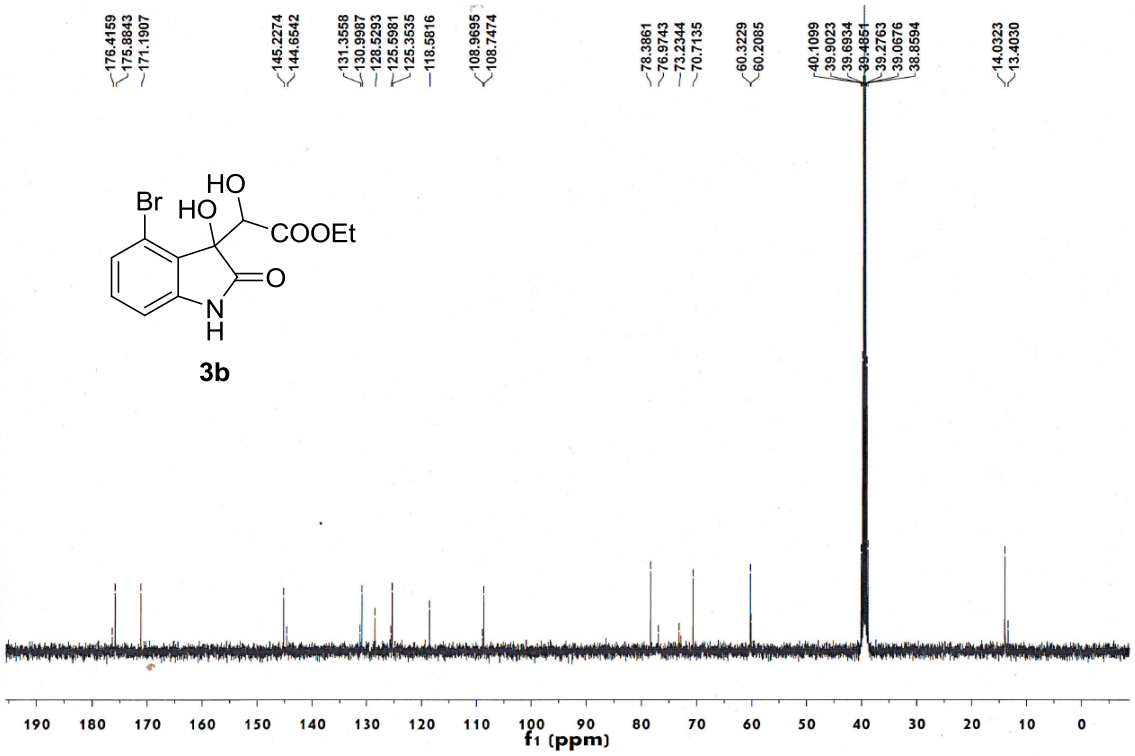
2.69
1.26
0.20
0.97
1.20
1.28
2.39
0.52
3.84
0.68
f1 (ppm)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171.1907
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130.9987
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125.3535
118.5816
108.9695
108.7474
78.3861
76.9743
73.2344
70.7135
60.3229
60.2085
40.1099
39.9023
39.6934
39.4851
39.2763
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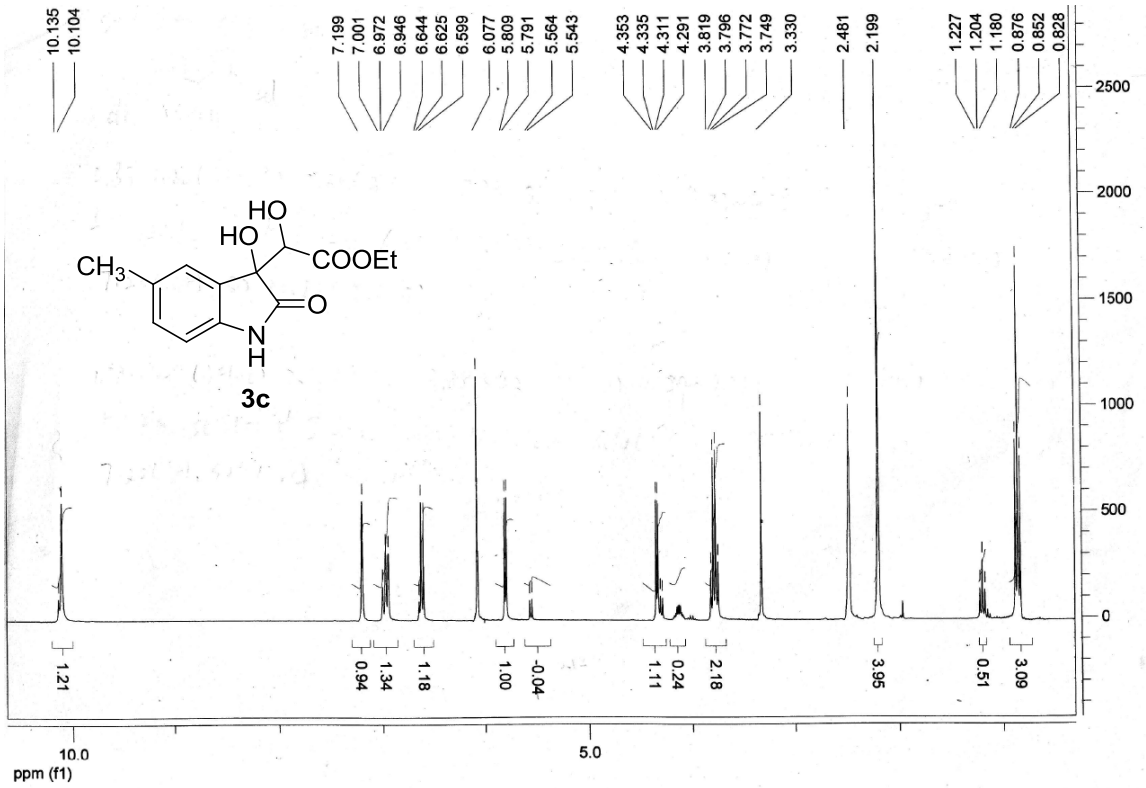
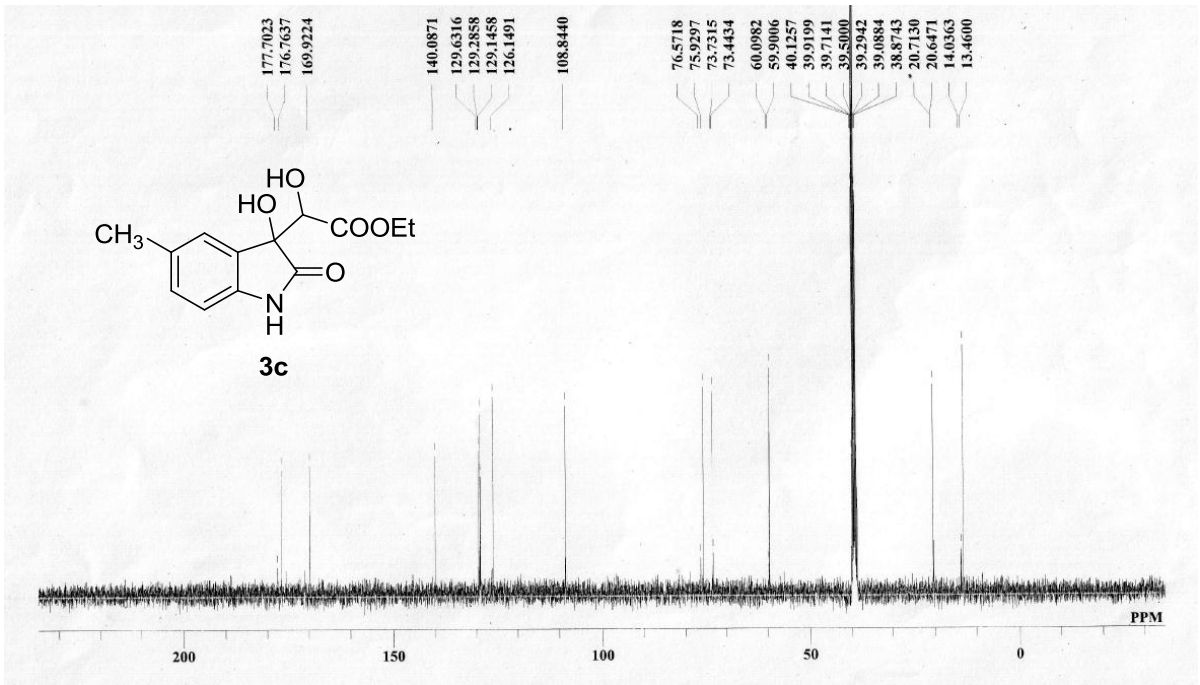
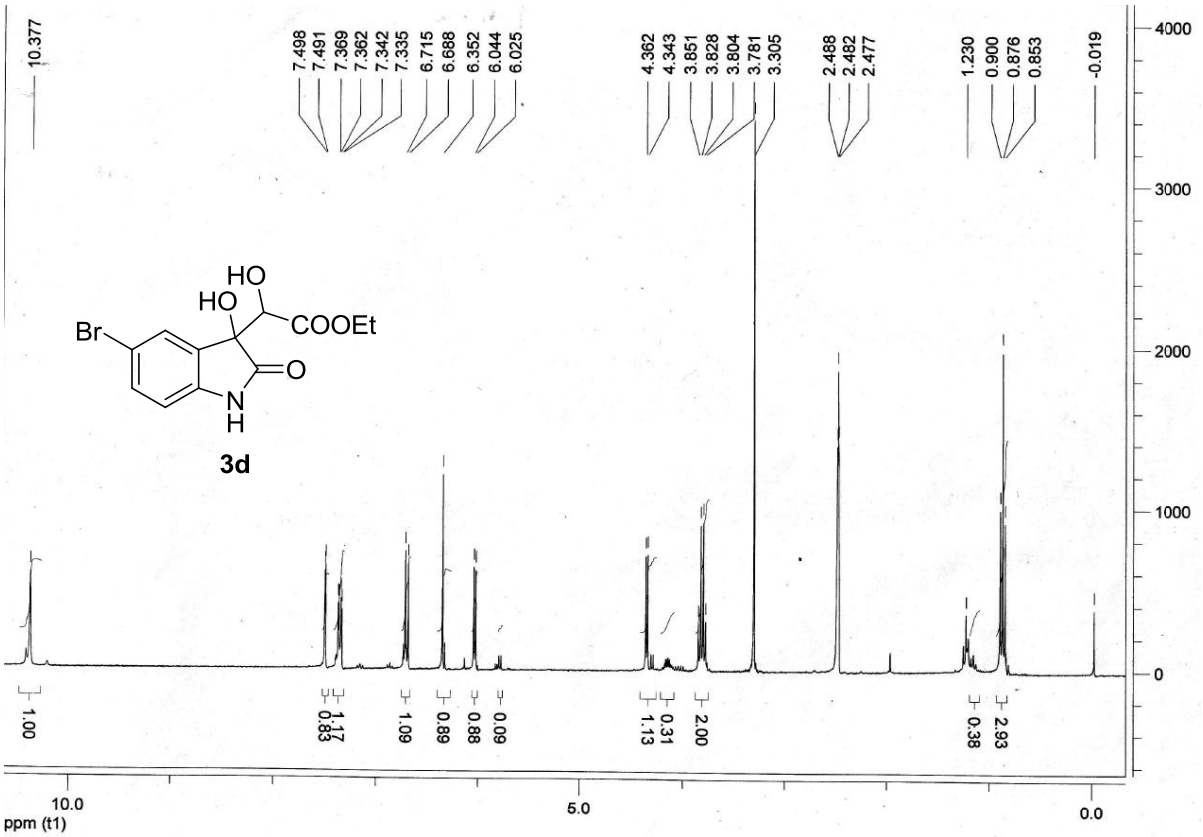
Br
HO
HO
COOEt
O
N
H
3b
f1 (ppm)



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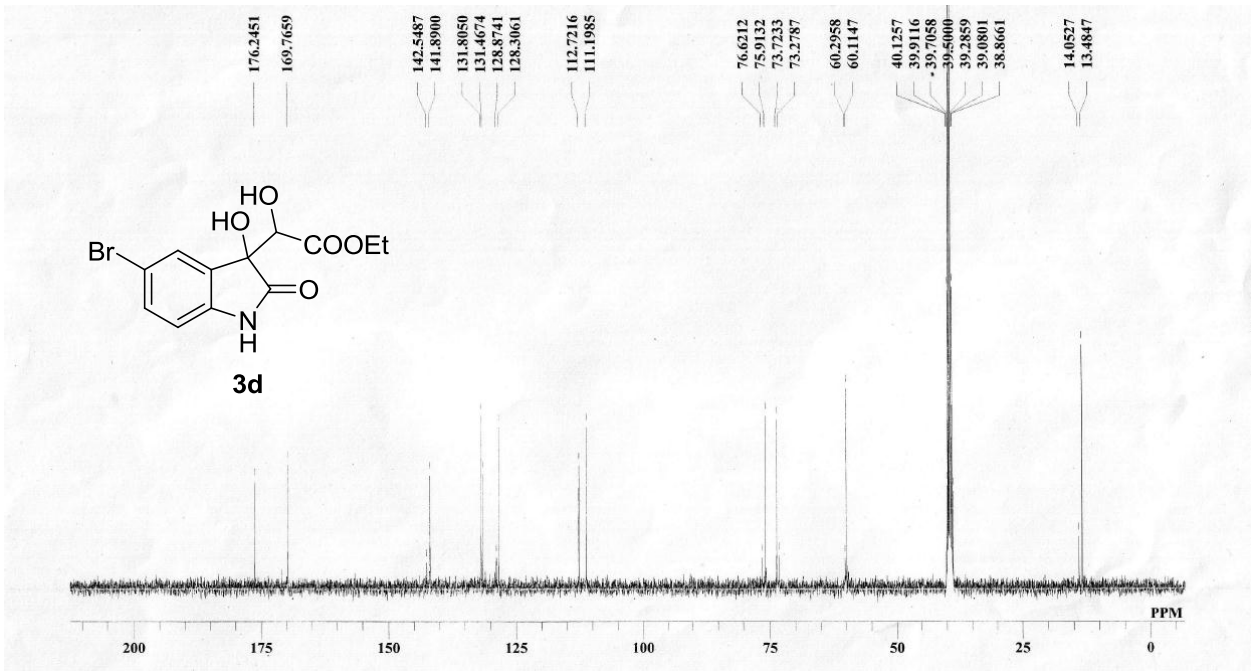
7.342
7.335
6.715
6.688
6.352
6.044
6.025
4.362
4.343
3.851
3.828
3.804
3.781
3.305
2.488
2.482
2.477
1.230
0.900
0.876
0.853
-0.019
HO
HO
COOEt
Br
O
N
H
3d
1.00
0.83
1.17
1.09
0.89
0.88
0.09
1.13
0.31
2.00
0.38
2.93
4000
3000
2000
1000
0
10.0
ppm (t1)
5.0
0.0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131.8050
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76.6212
75.9132
73.7233
73.2787
60.2958
60.1147
40.1257
39.9116
39.7058
39.5000
39.2859
39.0801
38.8661
14.0527
13.4847
HO
HO
COOEt
Br
O
N
H
3d
PPM
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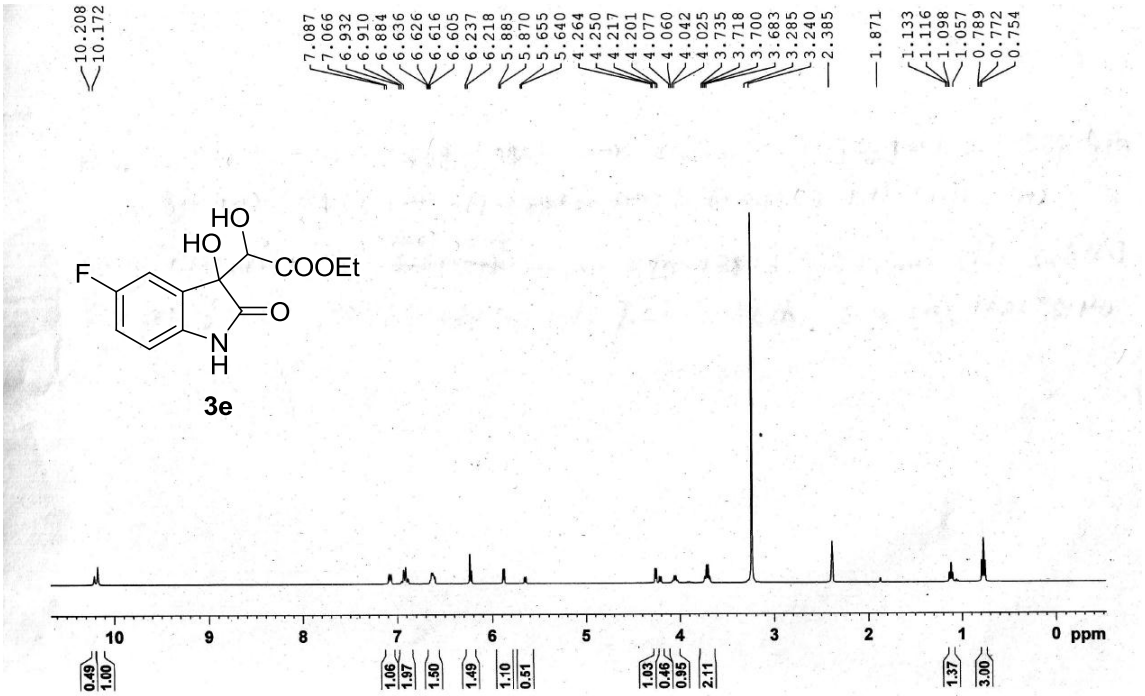
175
150
125
100
75
50
25
0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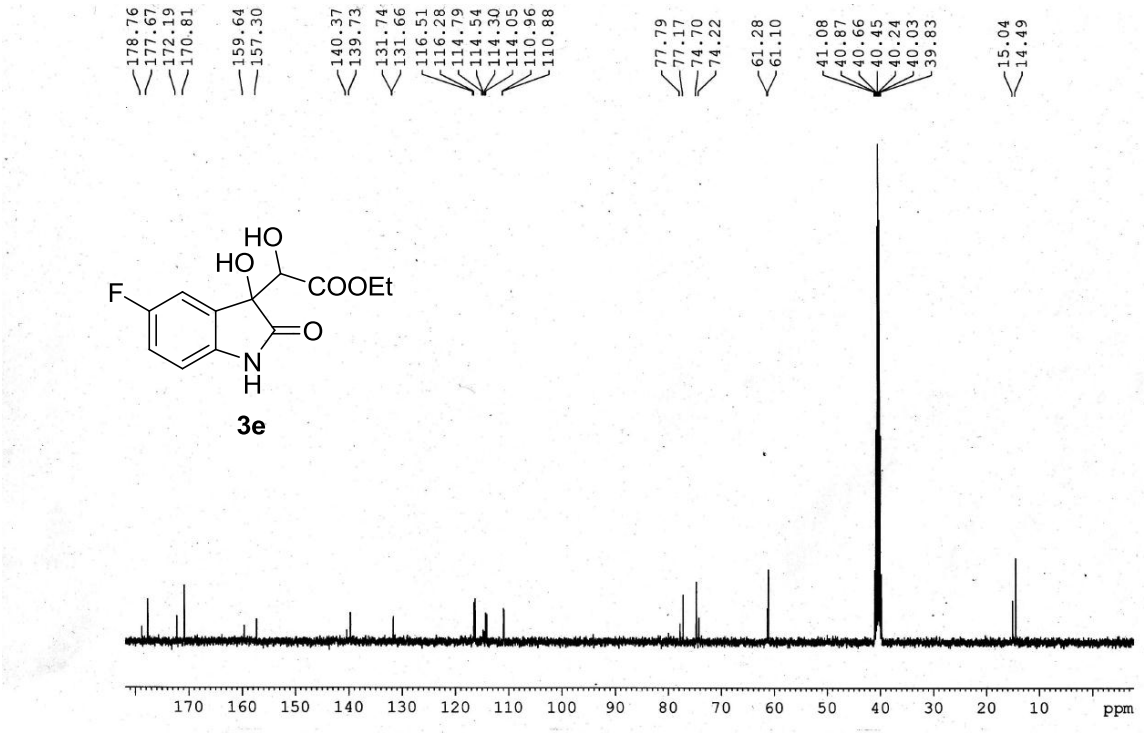
6.910
6.884
6.636
6.626
6.616
6.605
6.237
6.218
5.885
5.870
5.655
5.640
4.264
4.250
4.217
4.201
4.077
4.060
4.042
4.025
3.735
3.718
3.700
3.683
3.285
3.240
2.385
1.871
1.133
1.116
1.098
1.057
0.789
0.772
0.754
HO
HO
COOEt
F
O
N
H
3e
10
9
8
7
6
5
4
3
2
1
0 ppm
0.49
1.00
1.06
1.97
1.50
1.49
1.10
0.51
1.03
0.46
0.95
2.11
1.37
3.00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114.79
114.54
114.30
114.05
110.96
110.88
77.79
77.17
74.70
74.22
61.28
61.10
41.08
40.87
40.66
40.45
40.24
40.03
39.83
15.04
14.49
HO
HO
COOEt
F
O
N
H
3e
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150
140
130
120
110
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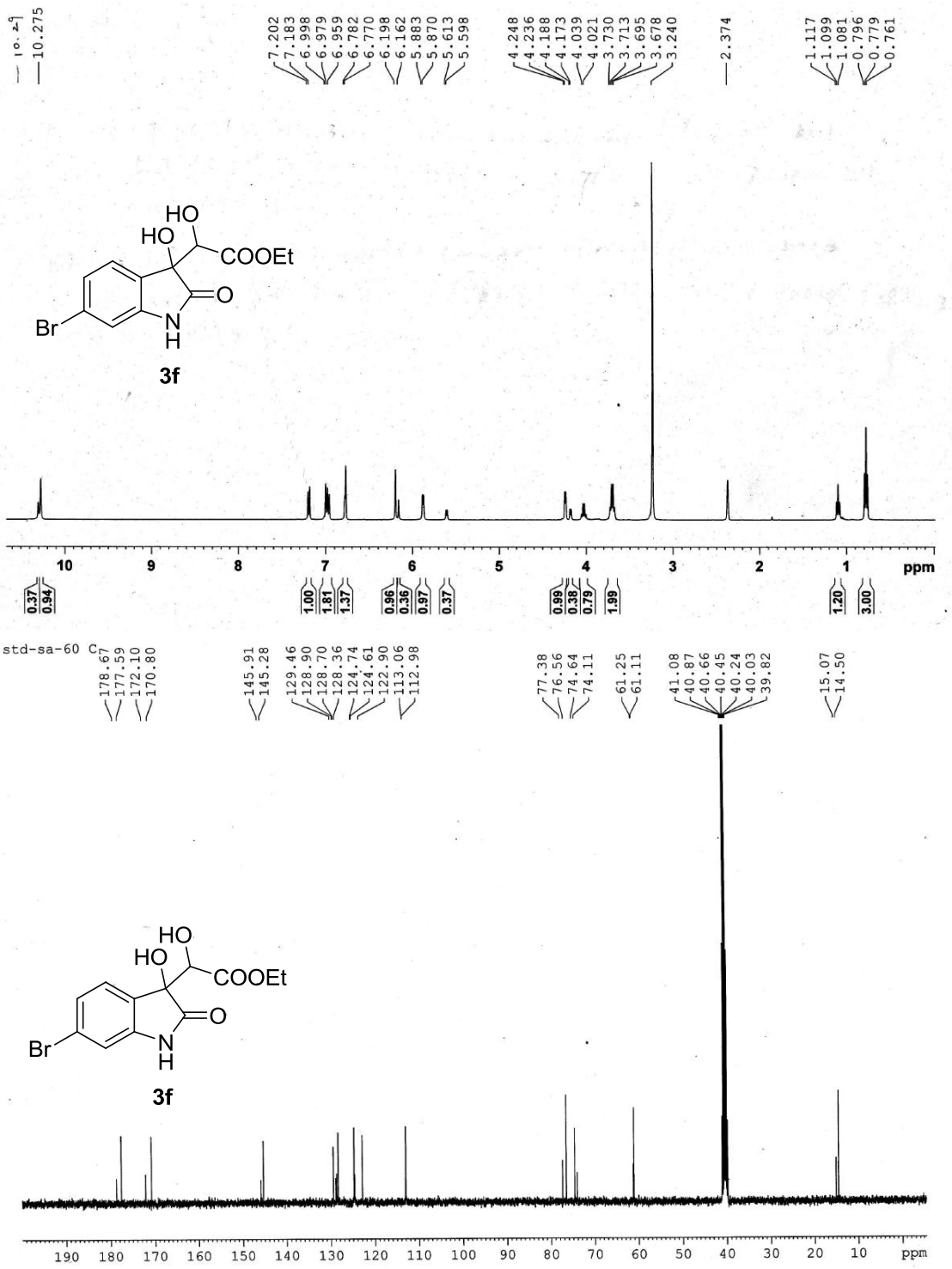
70
60
50
40
30
20
10
ppm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6.770
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6.162
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5.613
5.598
4.248
4.236
4.188
4.173
4.039
4.021
3.730
3.713
3.695
3.678
3.240
2.374
1.117
1.099
1.081
0.796
0.779
0.761
HO
HO
COOEt
O
Br
N
H
3f
ppm
0.37
0.94
1.00
1.81
1.37
0.96
0.36
0.97
0.37
0.99
0.38
0.79
1.99
1.20
3.00
std-sa-60 C
178.67
177.59
172.10
170.80
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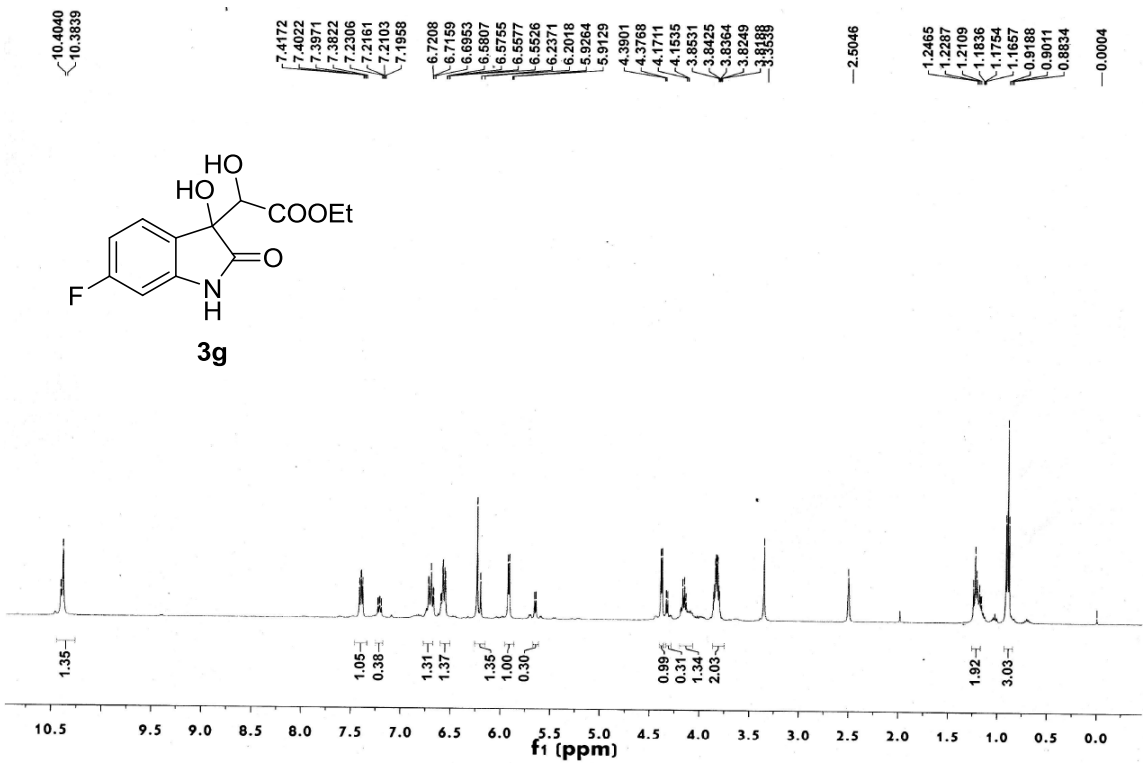
145.28
129.46
128.90
128.70
128.36
124.74
124.61
122.90
113.06
112.98
77.38
76.56
74.64
74.11
61.25
61.11
41.08
40.87
40.66
40.45
40.24
40.03
39.82
15.07
14.50
HO
HO
COOEt
O
Br
N
H
3f
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm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7.2103
7.1958
6.7208
6.7159
6.6953
6.5807
6.5755
6.5577
6.5526
6.2371
6.2018
5.9264
5.9129
4.3901
4.3768
4.1711
4.1535
3.8531
3.8425
3.8364
3.8249
2.5046
1.2465
1.2287
1.2109
1.1836
1.1754
1.1657
0.9188
0.9011
0.8834
0.0004
HO
HO
COOEt
O
N
H
F
3g
1.35
1.05
0.38
1.31
1.37
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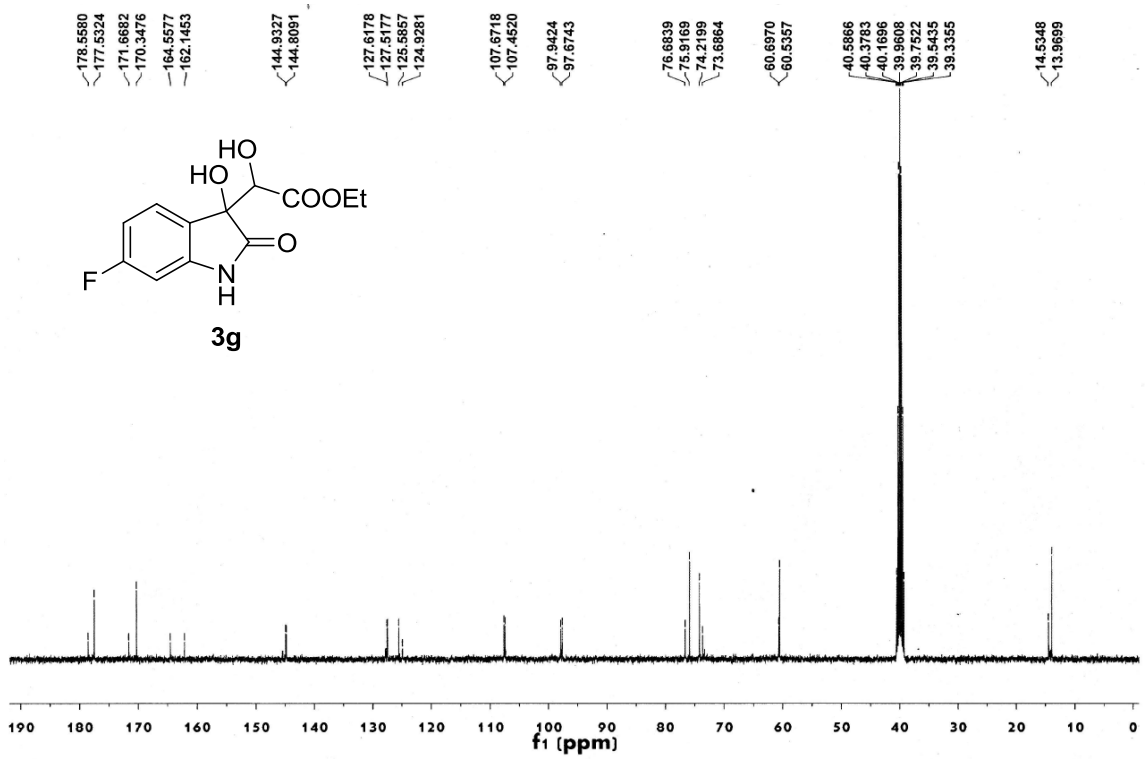
1.00
0.30
0.99
0.31
1.34
2.03
1.92
3.03
f1 (ppm)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125.5857
124.9281
107.6718
107.4520
97.9424
97.6743
76.6839
75.9169
74.2199
73.6864
60.6970
60.5357
40.5866
40.3783
40.1696
39.9608
39.7522
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14.5348
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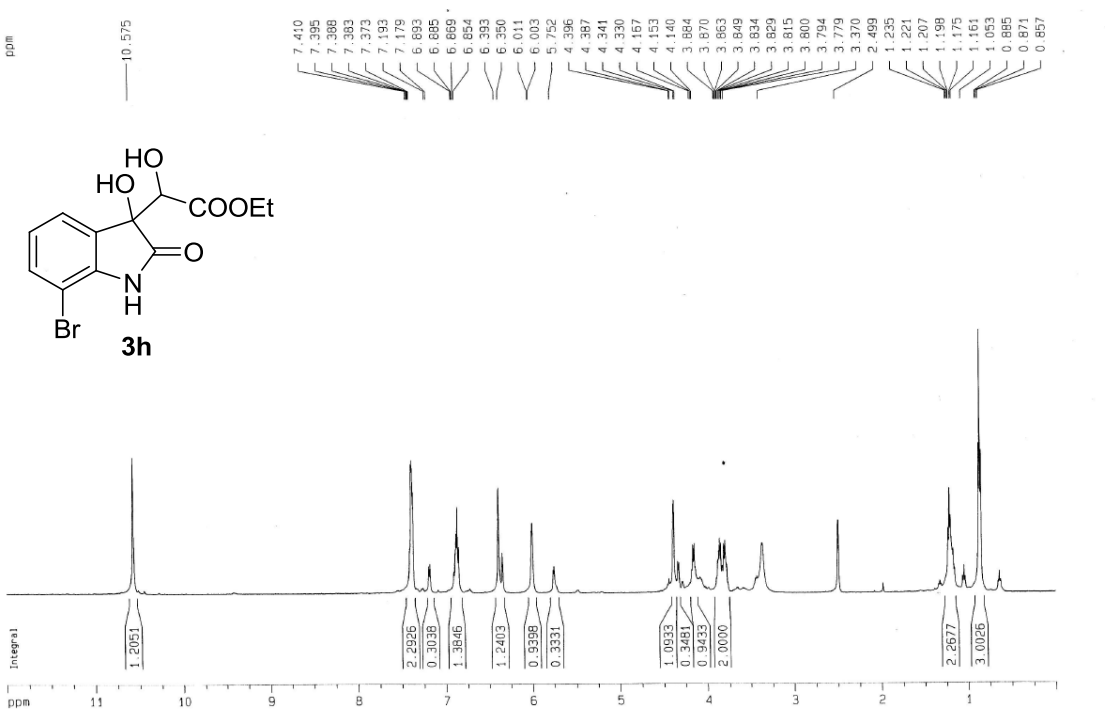
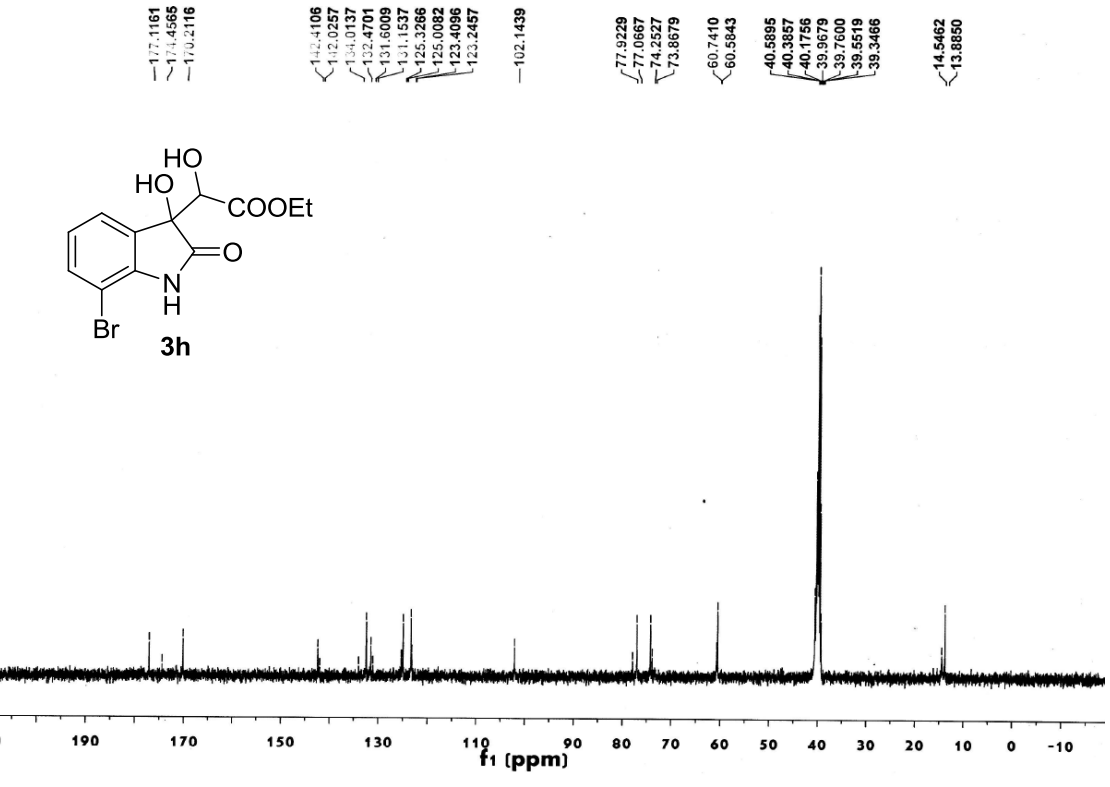
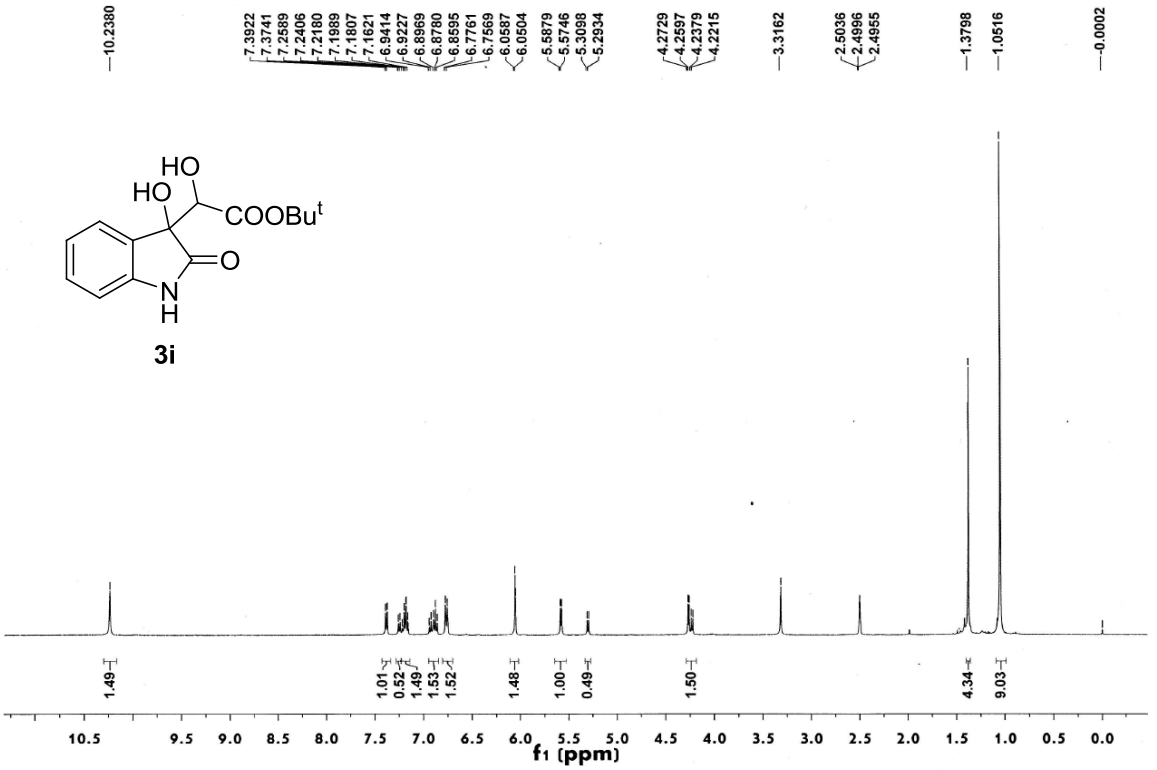
HO
HO
COOEt
O
N
H
F
3g
f1 (ppm)


HO
HO
COOEt
O
N
H
Br
3h


HO
HO
COOEt
O
N
H
Br
3h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4.2729
4.2597
4.2379
4.2215
3.3162
2.5036
2.4996
2.4955
1.3798
1.0516
0.0002
HO
HO
COOBu^t
O
N
H
3i
1.49
1.01
0.52
1.49
1.53
1.52
1.48
1.00
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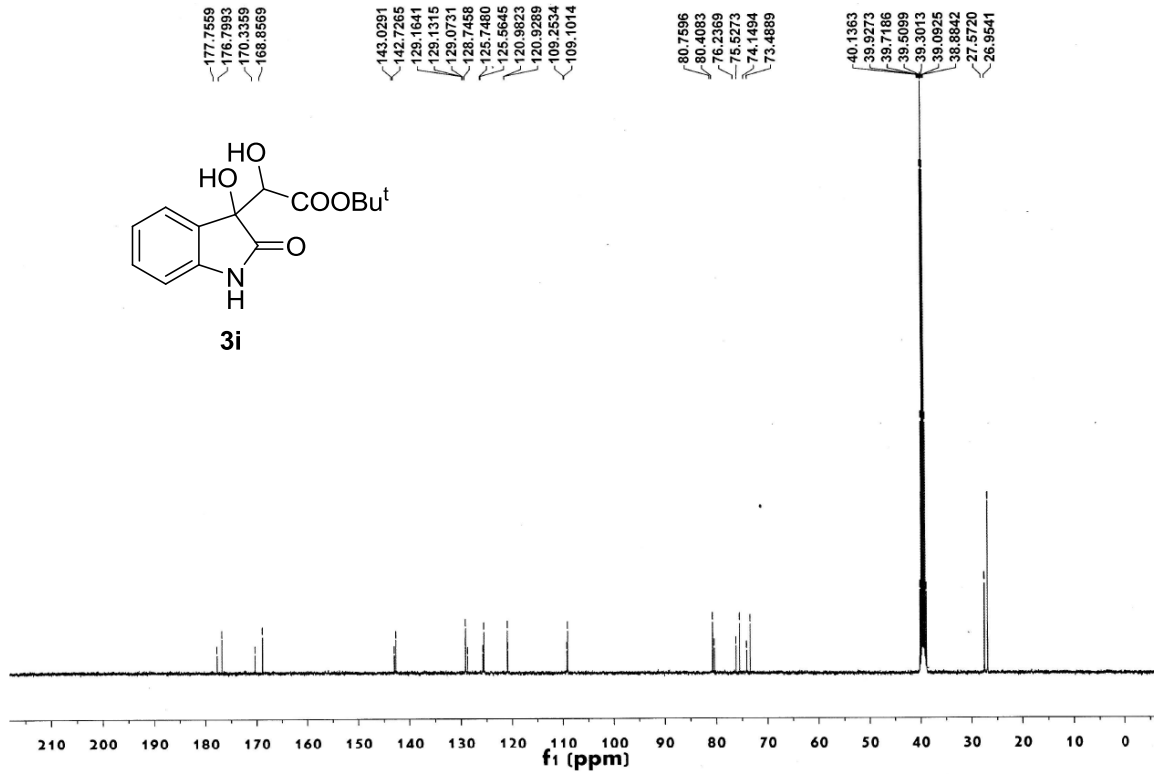
1.50
4.34
9.03
f1 (ppm)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143.0291
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129.1641
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128.7458
125.7480
125.5645
120.9823
120.9289
109.2534
109.1014
80.7596
80.4083
76.2369
75.5273
74.1494
73.4889
40.1363
39.9273
39.7186
39.5099
39.3013
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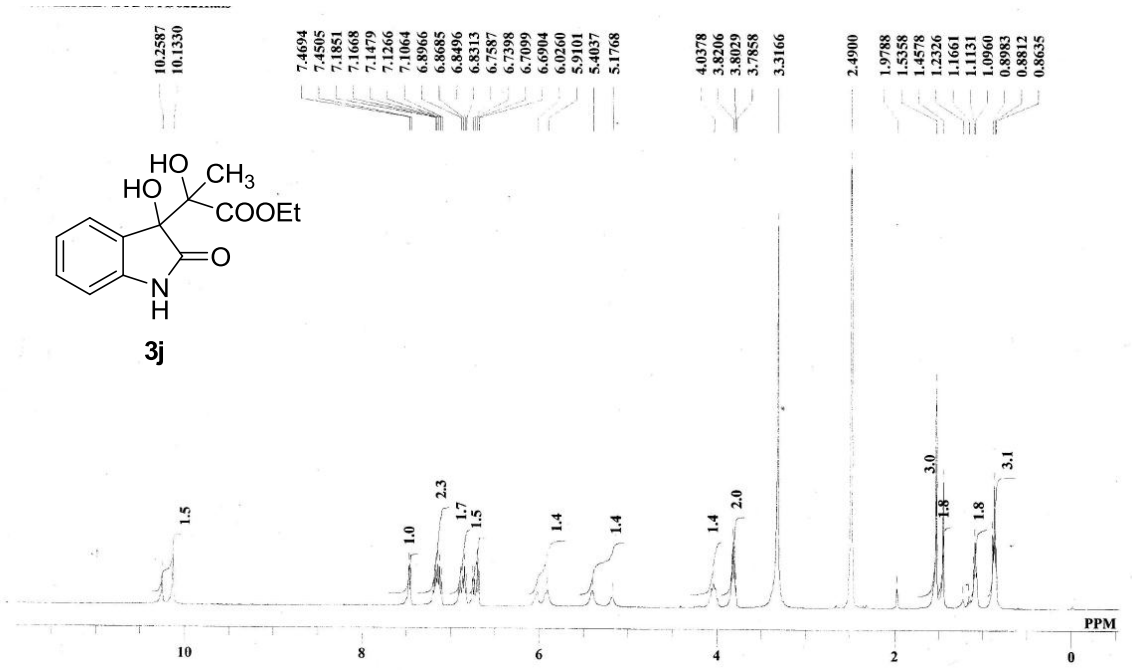
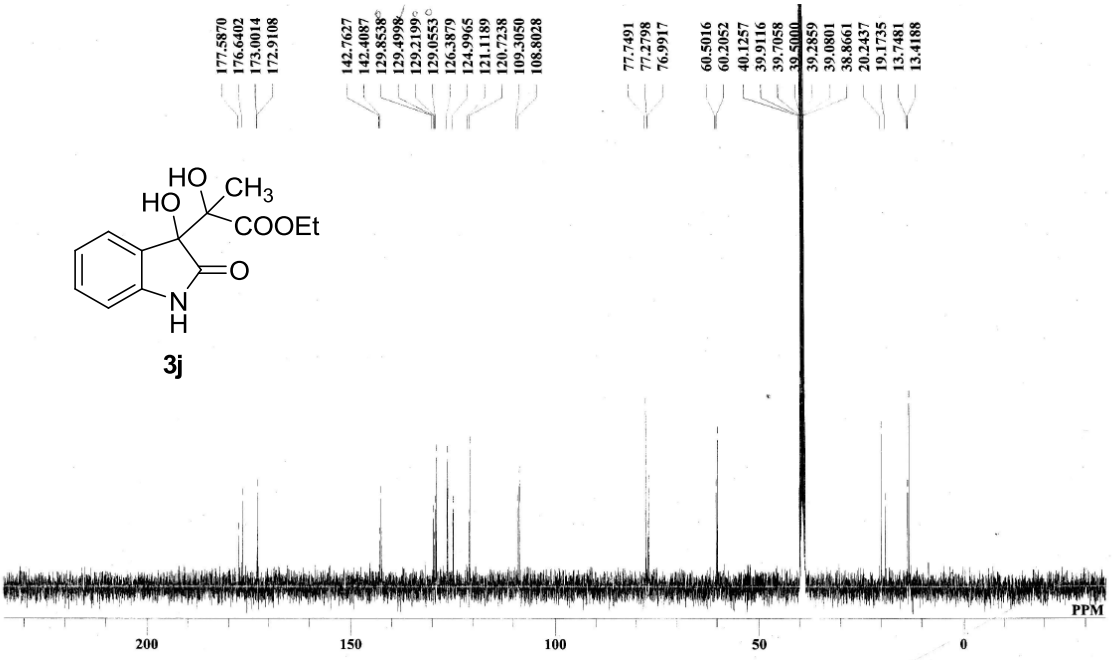
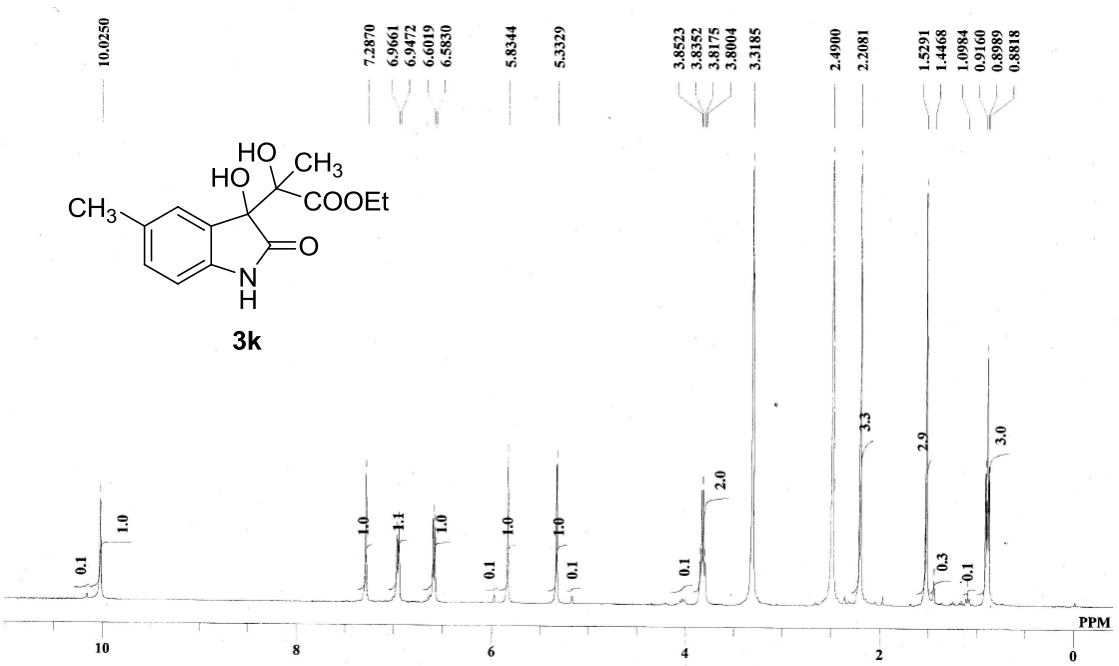
27.5720
26.9541
HO
HO
COOBu^t
O
N
H
3i
f1 (ppm)



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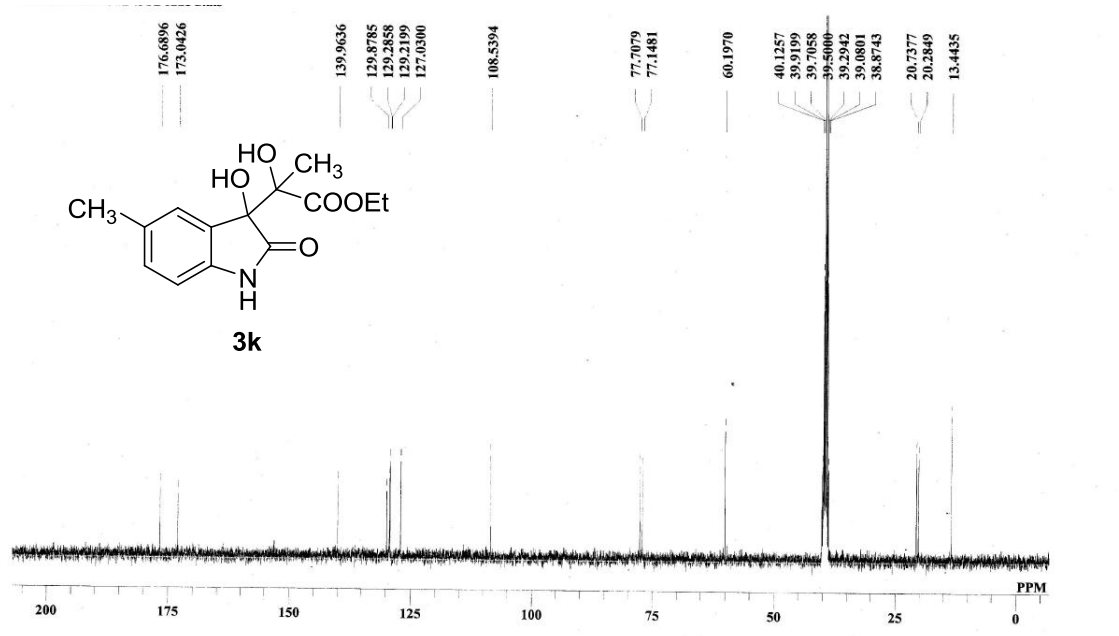
6.6019
6.5830
5.8344
5.3329
3.8523
3.8352
3.8175
3.8004
3.3185
2.4900
2.2081
1.5291
1.4468
1.0984
0.9160
0.8989
0.8818
HO
HO
CH3
COOEt
CH3
O
N
H
3k
PPM
10
8
6
4
2
0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173.0426
139.9636
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129.2858
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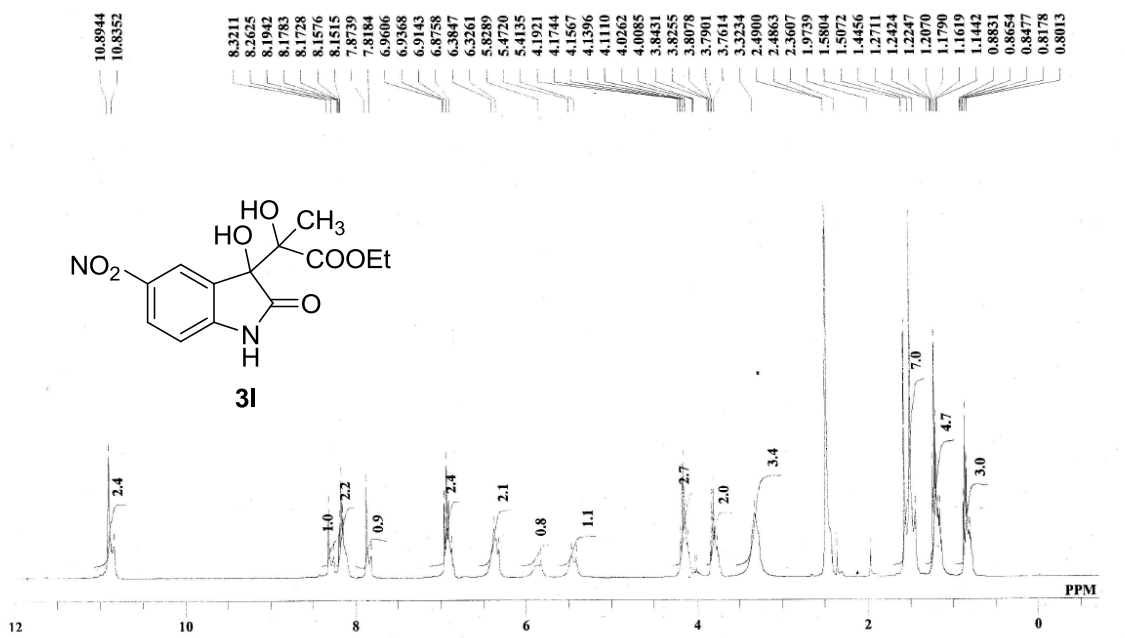
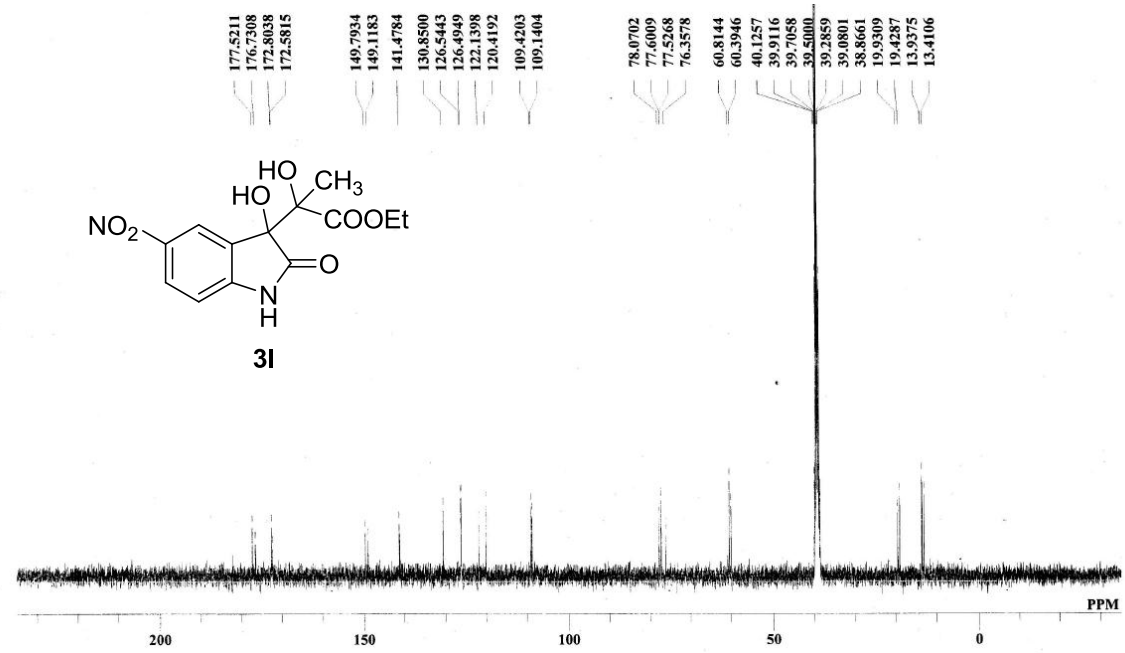
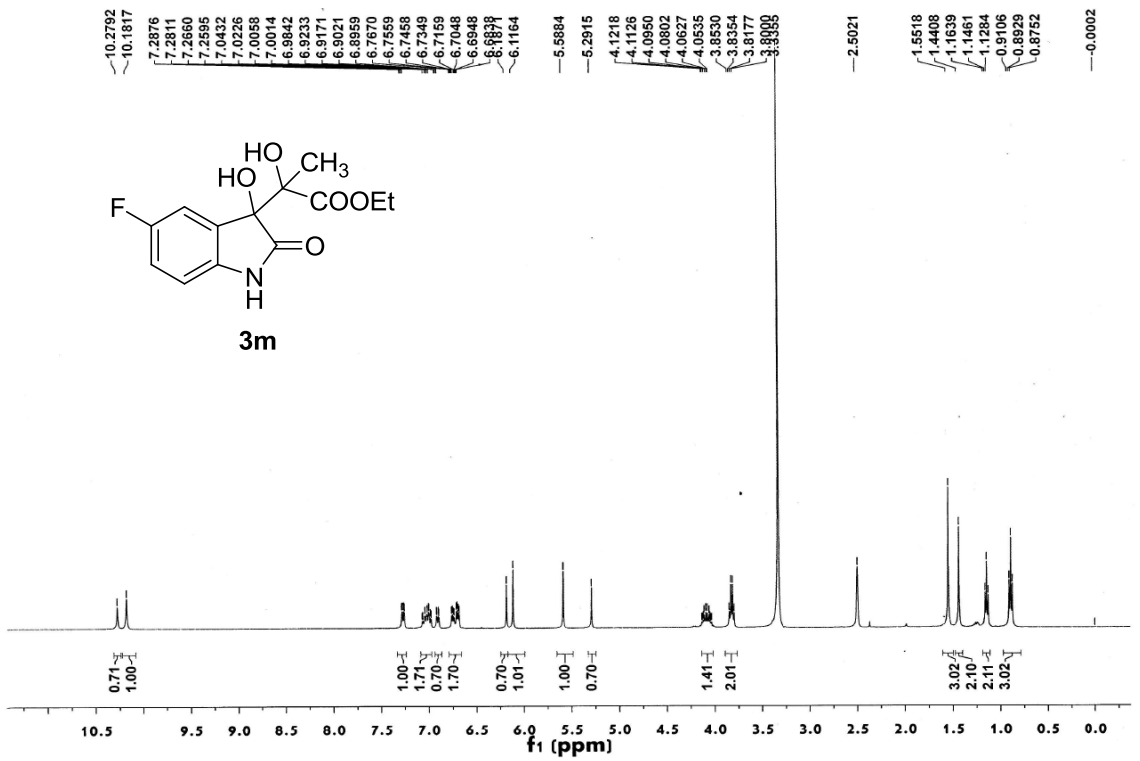
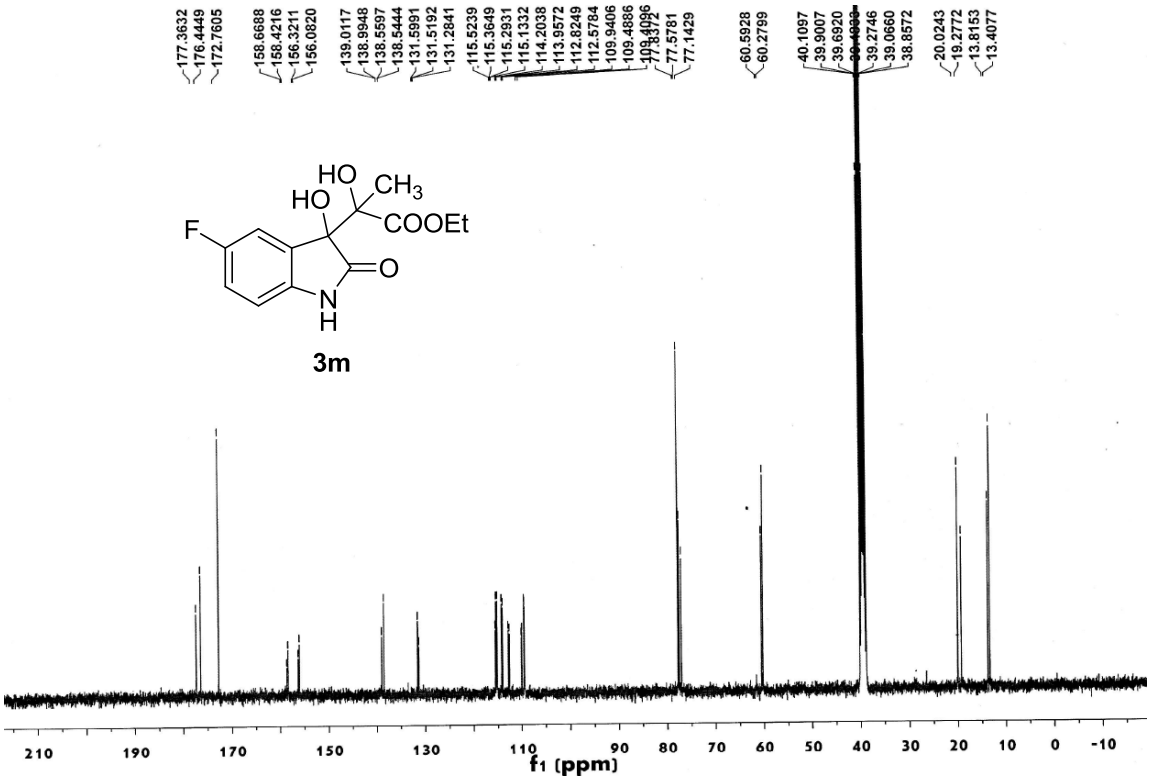
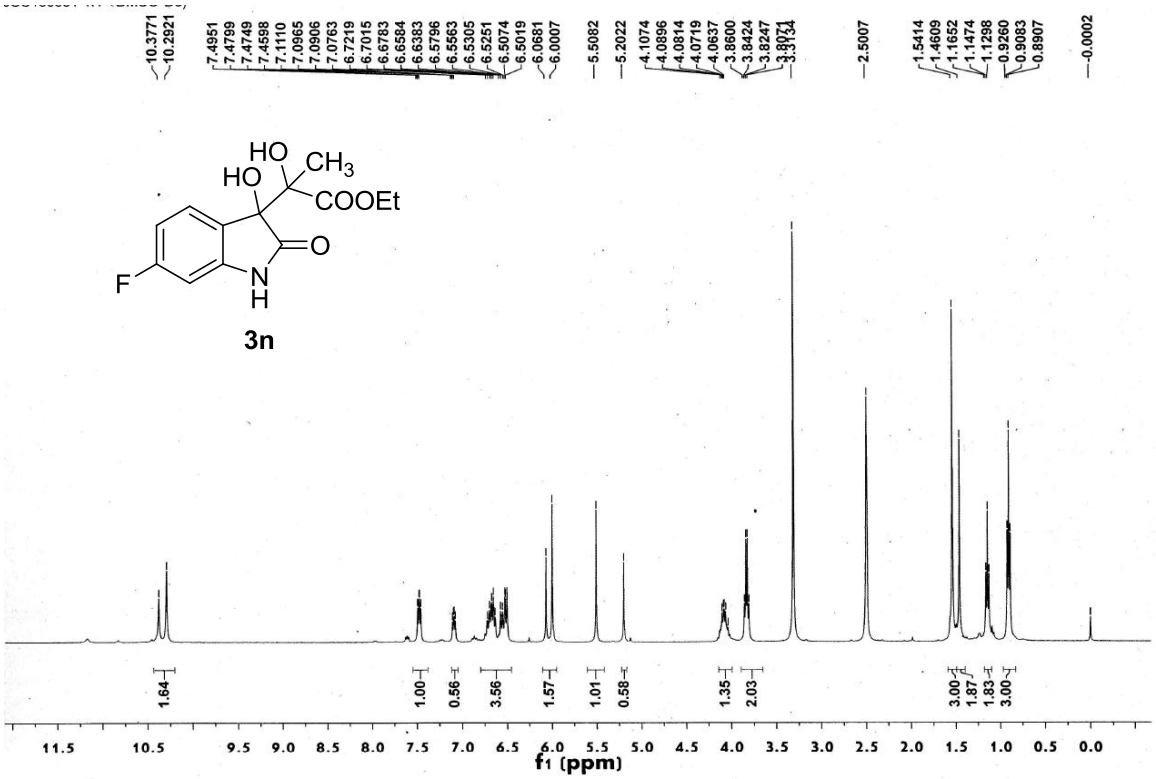
127.0300
108.5394
77.7079
77.1481
60.1970
40.1257
39.9199
39.7058
39.5000
39.2942
39.0801
38.8743
20.7377
20.2849
13.4435
HO
HO
CH3
COOEt
CH3
O
N
H
3k
PPM
200
175
150
125
100
75
50
25
0

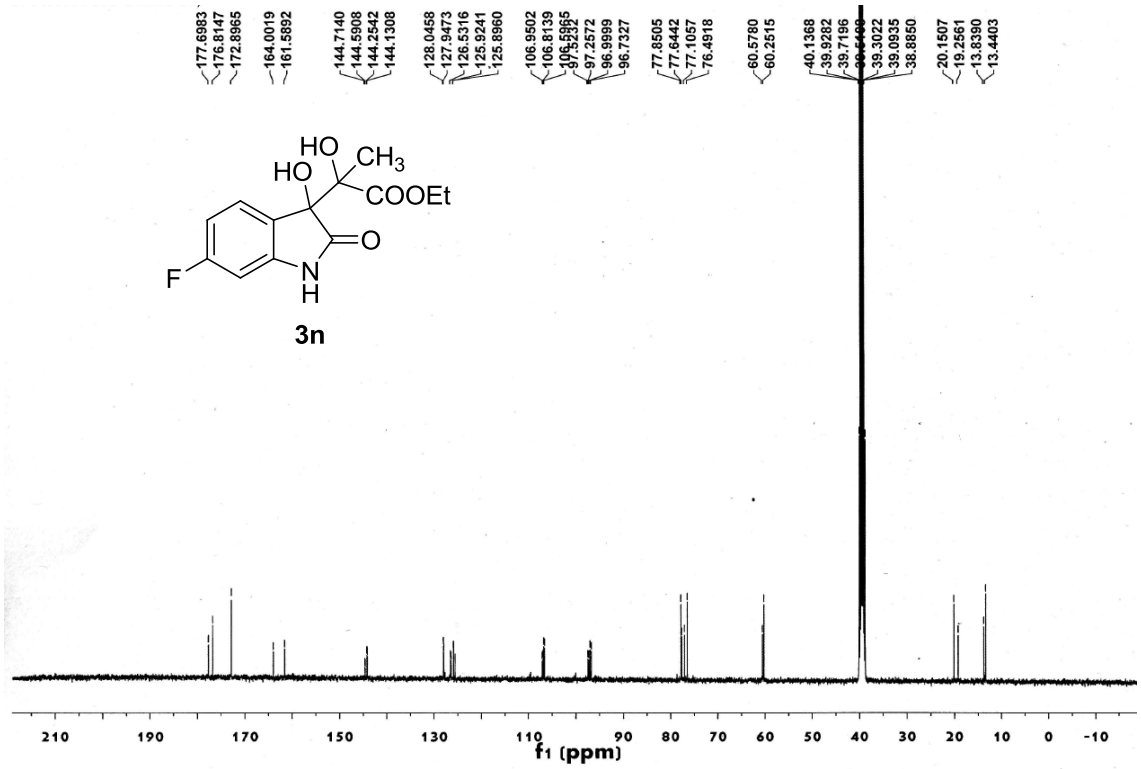


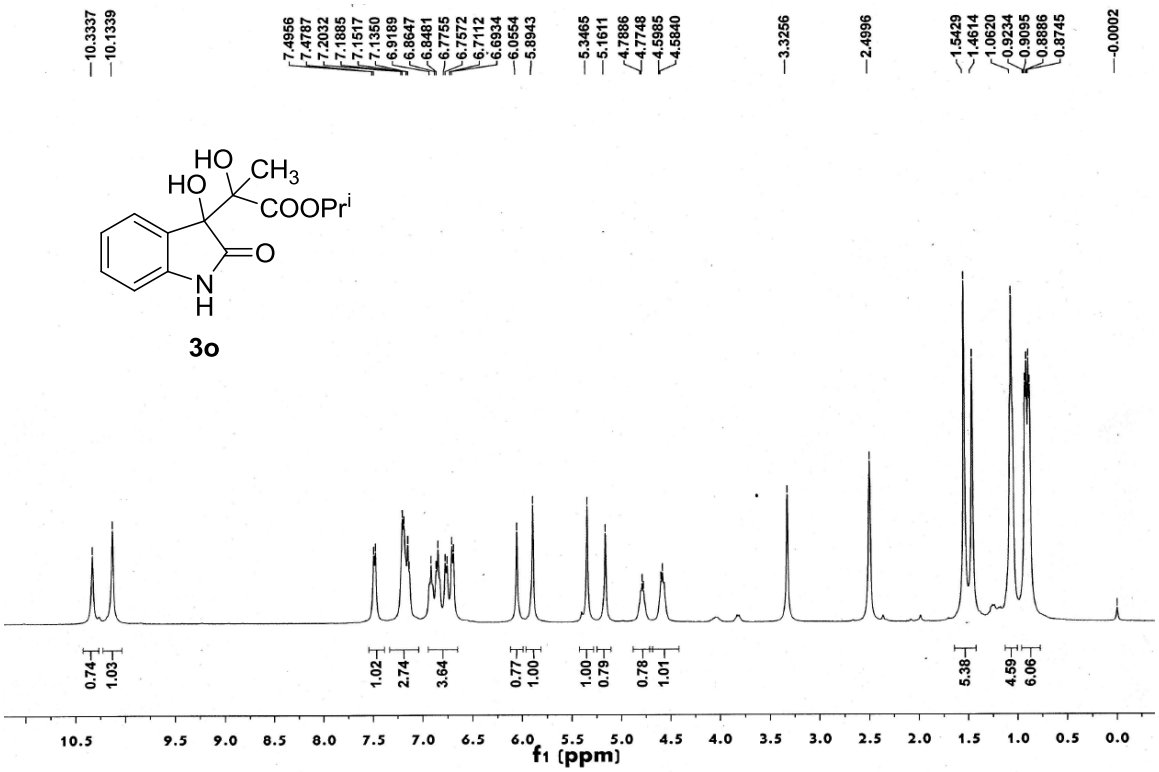







HO
HO
CH3
COOEt
O
N
H
F
3n
f1 (ppm)


HO
HO
CH3
COOEt
O
N
H
F
3n
f1 (ppm)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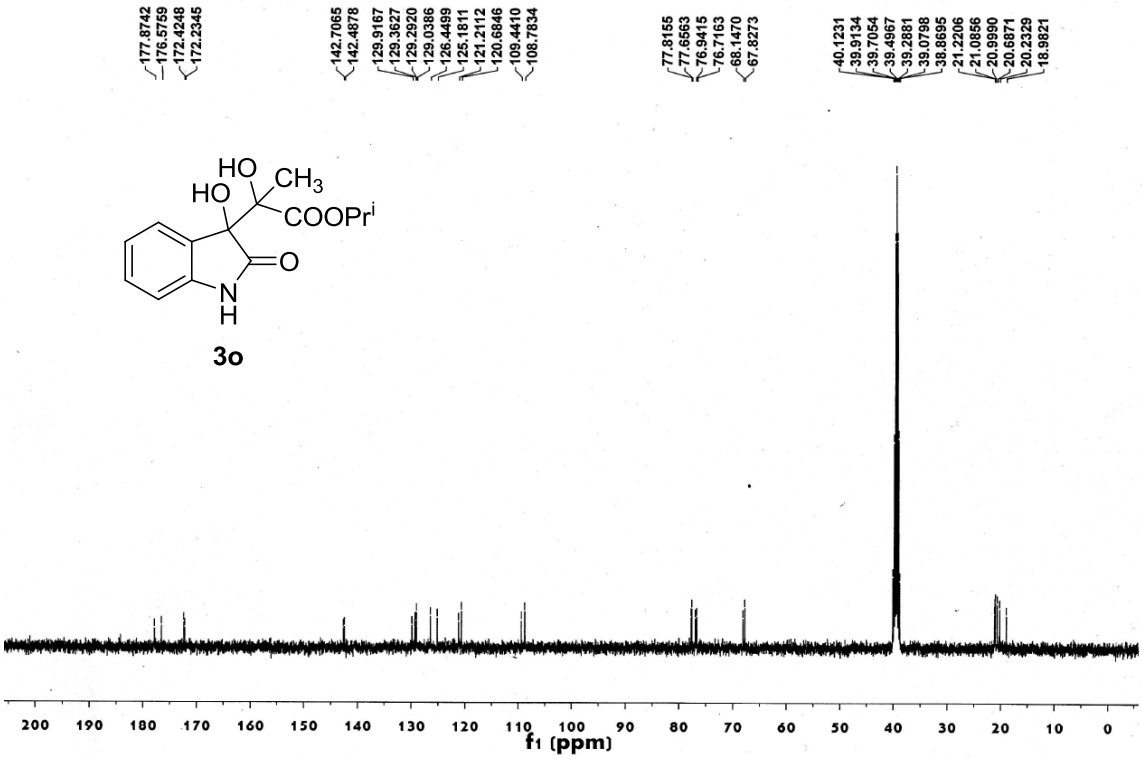
7.4787
7.2032
7.1885
7.1517
7.1350
6.9189
6.8647
6.8481
6.7755
6.7572
6.7112
6.6934
6.0554
5.8943
5.3465
5.1611
4.7886
4.7748
4.5985
4.5840
3.3256
2.4996
1.5429
1.4614
1.0620
0.9234
0.9095
0.8886
0.8745
0.0002
HO
CH3
HO
COOPri
O
N
H
3o
0.74
1.03
1.02
2.74
3.64
0.77
1.00
1.00
0.79
0.78
1.01
5.38
4.59
6.06
f1 (ppm)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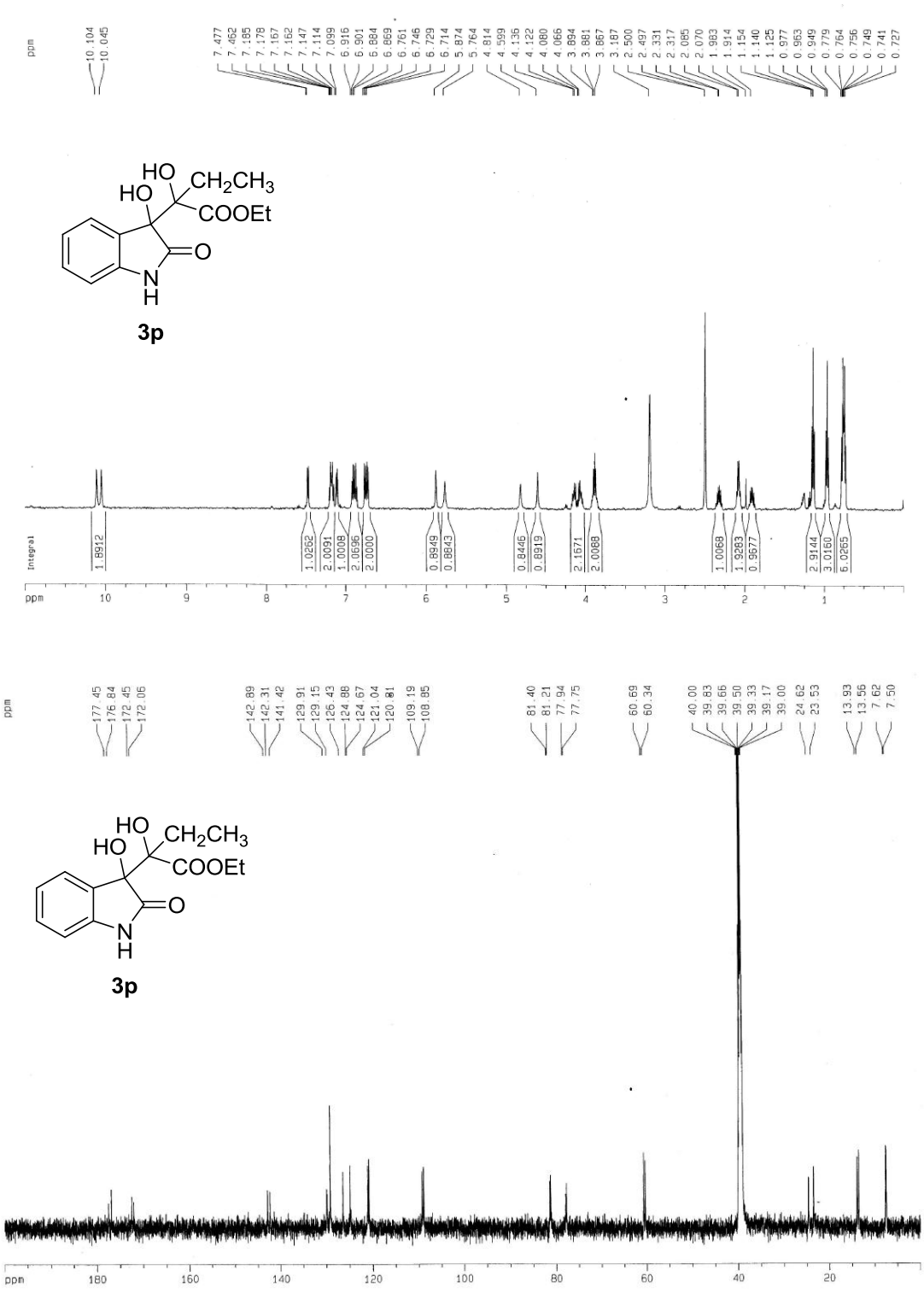
176.5759
172.4248
172.2345
142.7065
142.4878
129.9167
129.3627
129.2920
129.0386
126.4499
125.1811
121.2112
120.6846
109.4410
108.7834
77.8155
77.6563
76.9415
76.7163
68.1470
67.8273
40.1231
39.9134
39.7054
39.4967
39.2881
39.0798
38.8695
21.2206
21.0856
20.9990
20.6871
20.2329
18.9821
HO
CH3
HO
COOPri
O
N
H
3o
f1 (ppm)


HO
HO
CH2CH3
COOEt
O
N
H
3p
ppm
integral
3p