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

Highly Enantioselective Michael Addition Reactions of 2-Substituted Benzofuran-3(*2H*)-ones to Nitroolefins

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Electronic Supplementary Information

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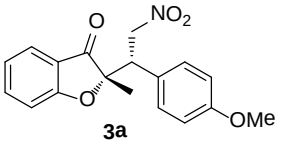
1. General Information: Commercial reagents were used as received, unless otherwise stated. ^{1}H and ^{13}C NMR were recorded on 400 MHz spectrometer. Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as the internal standard. The following abbreviations were used to designate chemical shift mutiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet. All first-order splitting patterns were assigned on the basis of the appearance of the multiplet. Splitting patterns that could not be easily interpreted are designated as multiplet (m). Mass spectra were obtained using electrospray ionization (ESI) mass spectrometer. 2-Substituted benzofuran-3(*2H*)-ones were synthesized according to the literature procedure. [1] Nitroolefins were synthesized according to the literature procedure. [2]

2. General experimental Michael addition reaction procedure

To a stirred solution of 2-substituted benzofuran-3(*2H*)-one **1** (0.1 mmol) and **5c** (0.02 mmol) in dry $CHCl_3$ (0.5 mL) at room temperature was added nitroolefin **2** (0.12 mmol, 1.2 equiv). The reactions were monitored by TLC. After **1** was consumed, the reaction solution was concentrated *in vacuo* and the crude was purified by flash chromatography eluting with (petroleum ether/ethyl acetate 10:1) to afford the products **3**. The regioselectivity was determined by ^{1}H NMR spectroscopy of crude product. The *ee* values were determined by chiral HPLC analysis.

3. Datas, NMR copies and HPLC copies

Compound 3a: 2-(1-(4-methoxyphenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3a

Compound 3a: yellow solid, 90% isolated yield.

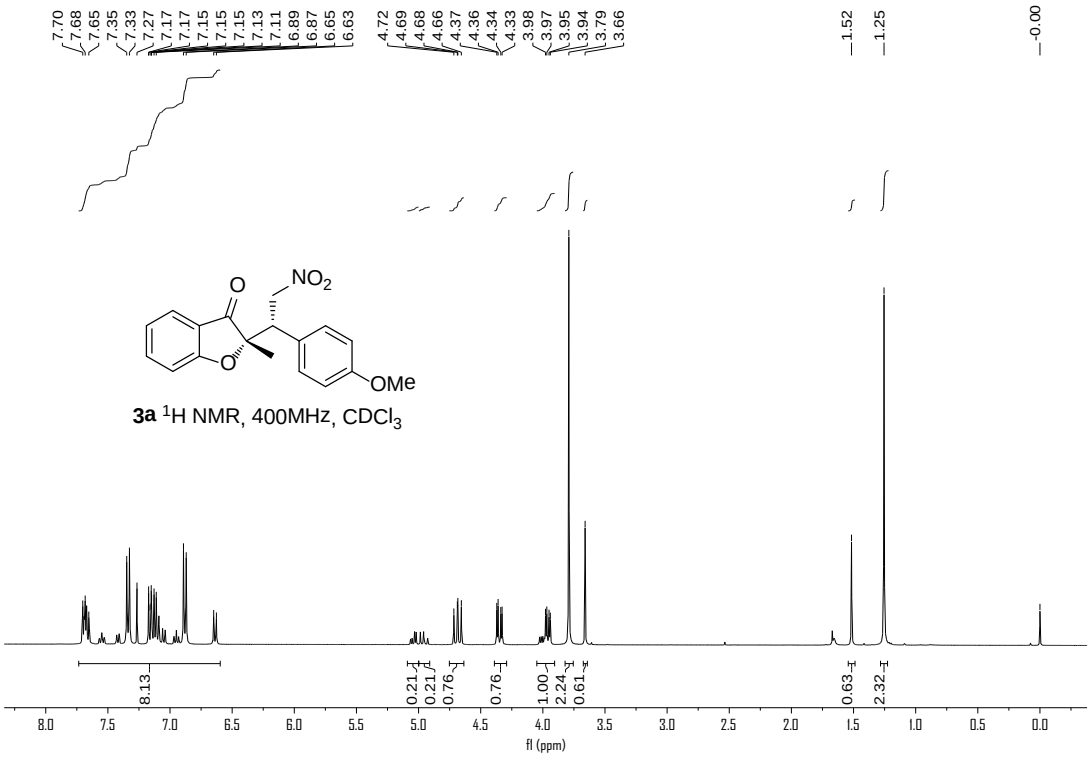
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 – 6.59 (m, 8H), 4.68 (dd, *J* = 12.9, 11.3 Hz, 1H), 4.34 (dd, *J* = 12.8, 4.2 Hz, 1H), 3.95 (dd, *J* = 11.3, 4.2 Hz, 1H), 3.78 (s, 2H), 3.65 (s, 1H), 1.51 (s, 1H), 1.25 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.67 , 171.32 , 159.69 , 139.03 , 130.51 , 126.36 , 124.92 , 122.70 , 120.15 , 114.28 , 113.89 , 113.73 , 113.13 , 90.43 , 75.88 , 55.33 , 49.02 , 21.53 .

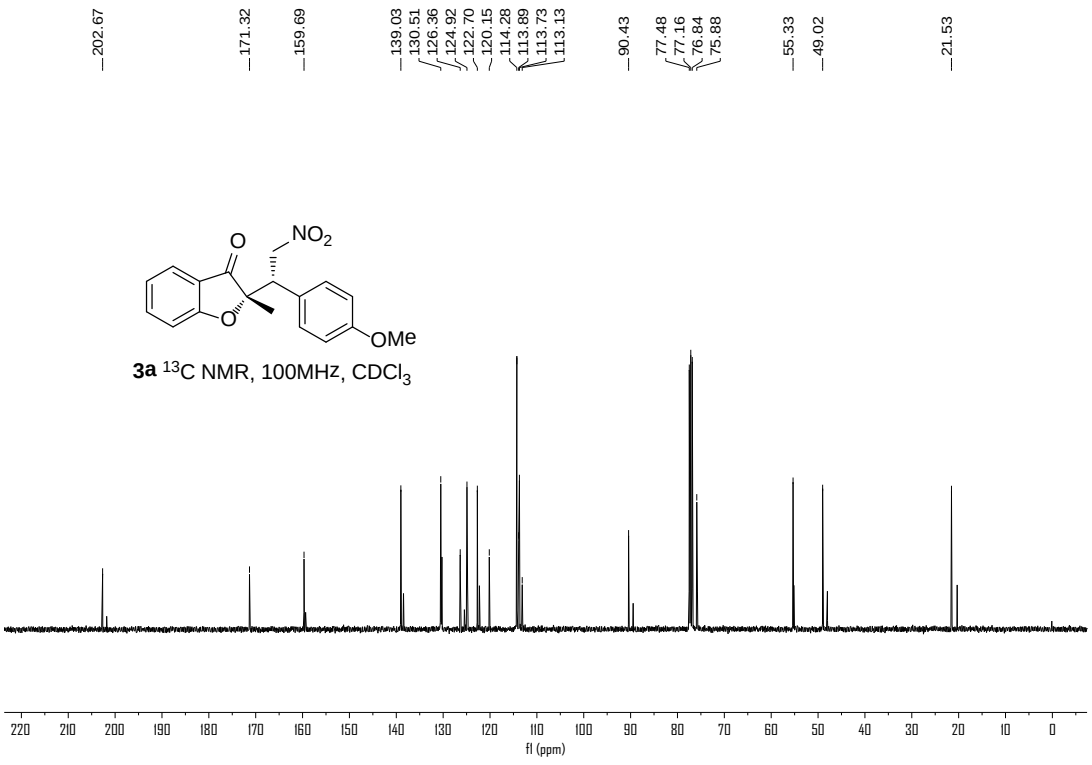
HRMS (ESI) caled for $C_{18}H_{17}NO_5$ $(M+Na)^+$: 350.1004, found: 350.1000.

HPLC The enantiomeric excess was determined by HPLC with an OD-H column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 12.98 min, t_2 = 17.94 min; minor isomer: t_3 = 16.61 min, t_4= 20.68 min.

$[\alpha]^{25}_D$ -51.8 (c = 0.8, $CHCl_3$).

NMR copies of major product of compound **3a**





HPLC copies of compound **3a**:

rac iPrOH/Hex 1/9 OD-H

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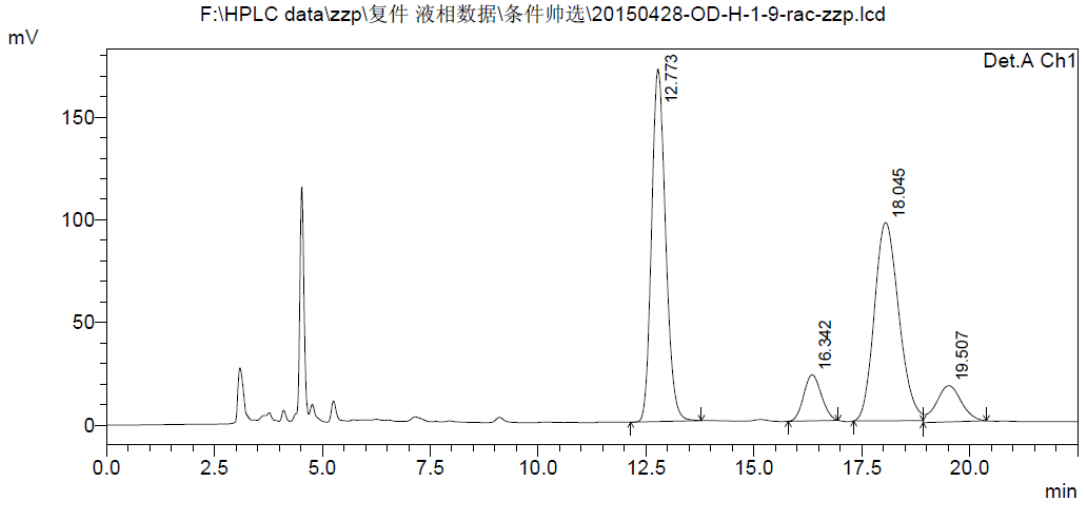

1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.773	3872608	171686	42.916	55.676
2	16.342	638232	22442	7.073	7.278
3	18.045	3797862	96575	42.087	31.319
4	19.507	715053	17662	7.924	5.728
Total		9023755	308365	100.000	100.000

3a iPrOH/Hex 1/9 OD-H

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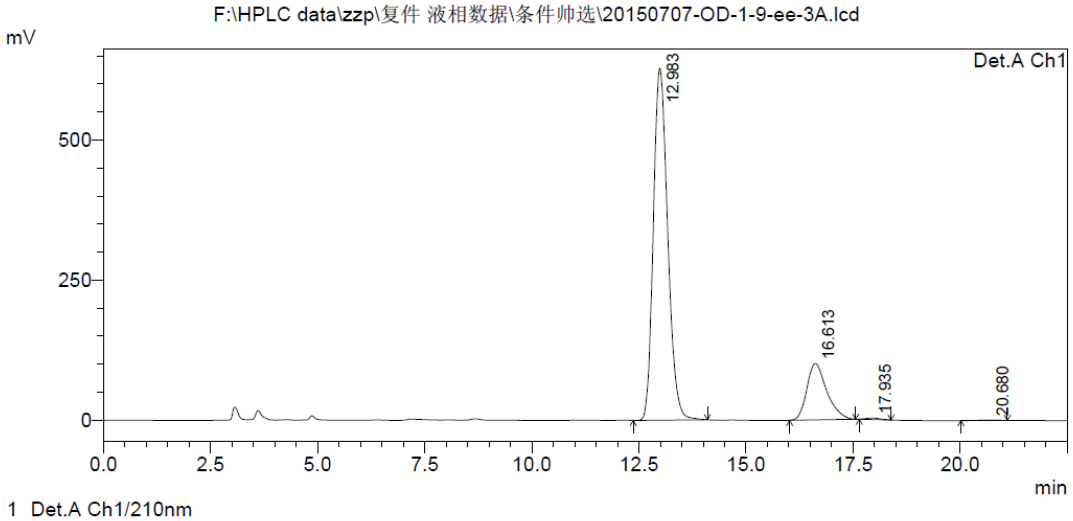


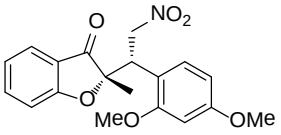
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.983	14635542	627569	81.453	85.802
2	16.613	3254679	100709	18.114	13.769
3	17.935	65152	2712	0.363	0.371
4	20.680	12738	424	0.071	0.058
Total		17968111	731413	100.000	100.000

Compound 3b: 2-(1-(2,4-dimethoxyphenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3b

Compound 3b: yellow oil, 95% isolated yield.

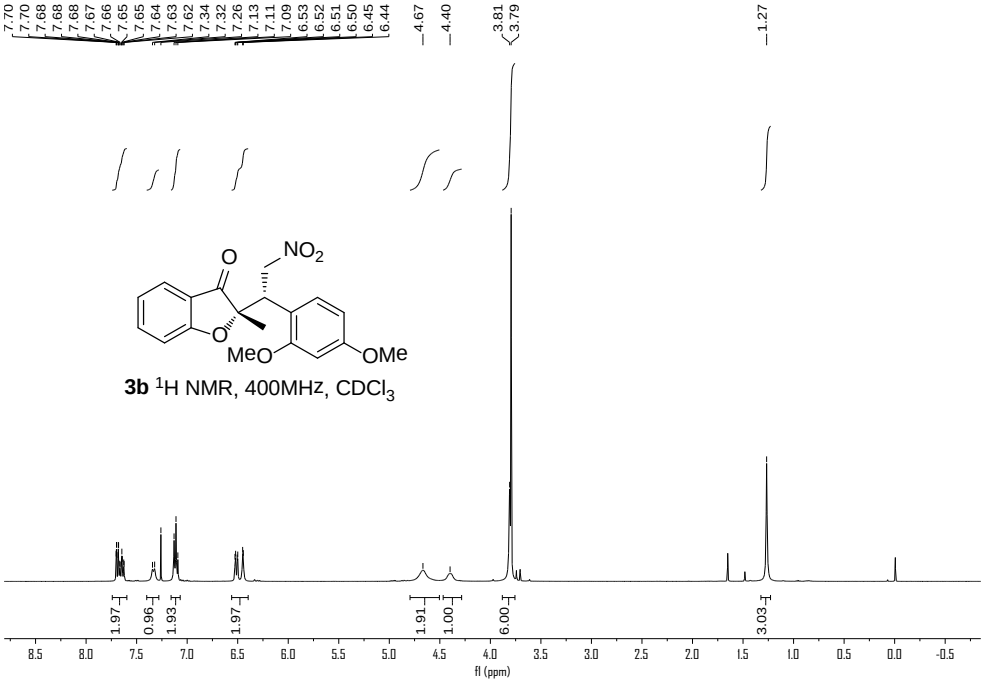
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 – 7.60 (m, 2H), 7.33 (d, *J* = 8.5 Hz, 1H), 7.11 (t, *J* = 7.5 Hz, 2H), 6.56 – 6.40 (m, 2H), 4.67 (s, 2H), 4.40 (s, 1H), 3.80 (d, *J* = 6.1 Hz, 6H), 1.27 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.55 , 171.12 , 160.78 , 159.23 , 138.74 , 124.83 , 122.48 , 120.36 , 115.25 , 113.65 , 104.96 , 98.84 , 90.65 , 75.27 , 55.79 , 55.42 , 20.83 .

HRMS (ESI) caled for $C_{19}H_{19}NO_6$ $(M+Na)^+$: 380.1110, found: 380.1109.

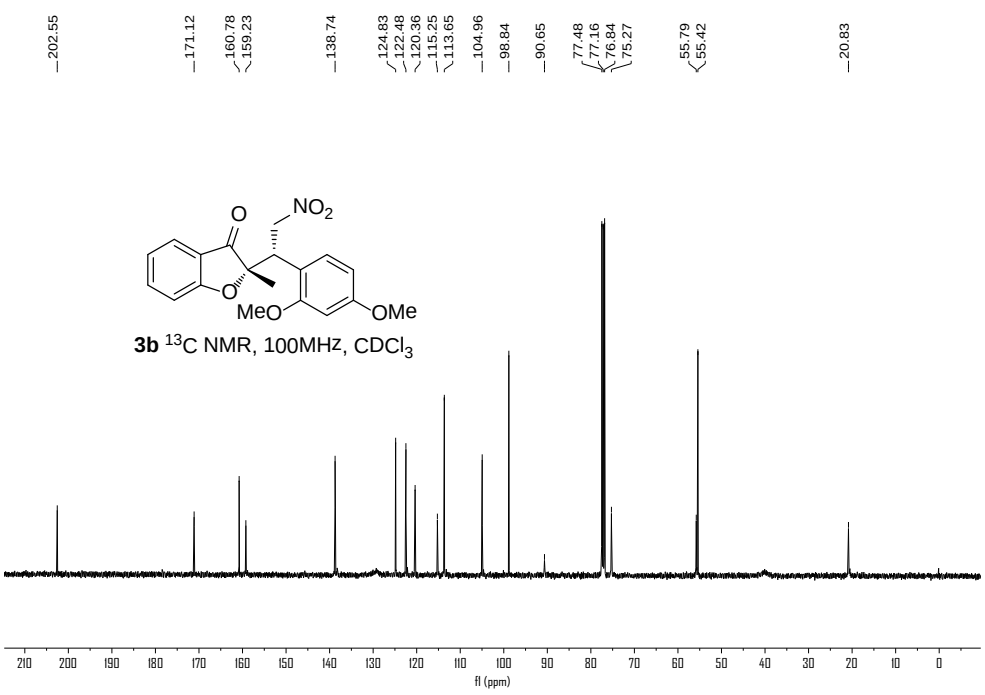
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 23.96 min, t_2 = 25.52 min; minor isomer: t_3 = 19.65 min, t_4= 20.57 min.

$[\alpha]^{25}_D$ -291.0 (c = 0.7, $CHCl_3$).

NMR copies of major product of compound **3b**:



3b ^{1}H NMR, 400MHz, $CDCl_3$

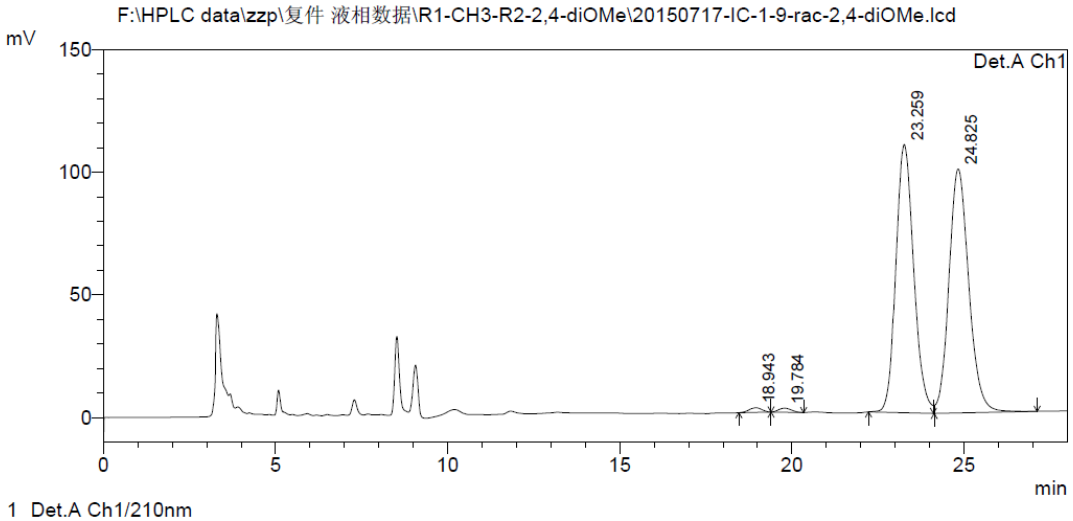


3b ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3b**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



1 Det.A Ch1/210nm

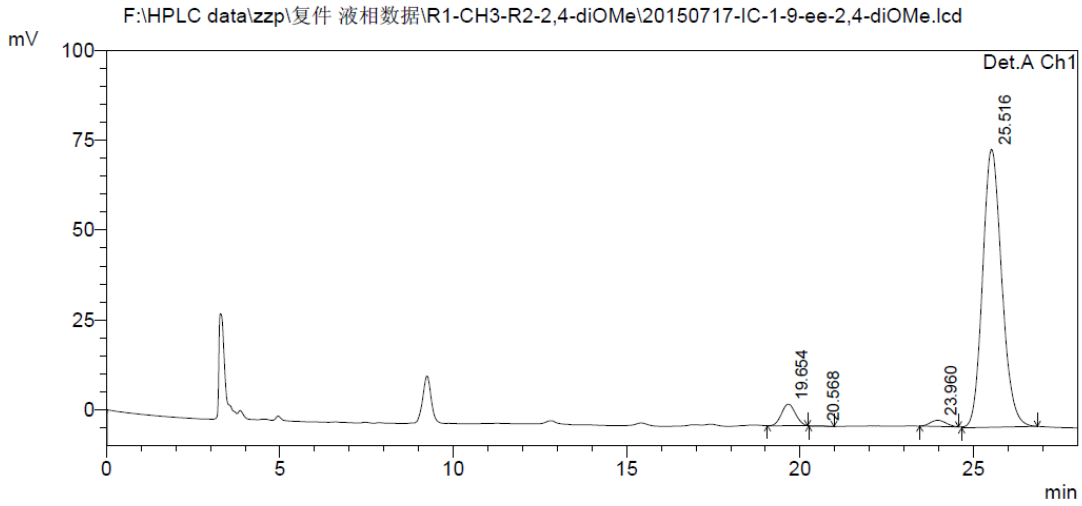
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	18.943	48503	1902	0.605	0.896
2	19.784	42629	1686	0.532	0.794
3	23.259	3940273	109289	49.138	51.474
4	24.825	3987331	99440	49.725	46.836
Total		8018736	212318	100.000	100.000

3b iPrOH/Hex 1/9 IC

<Chromatogram>



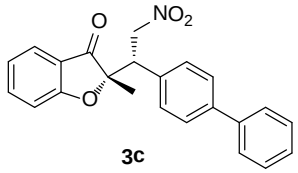
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	19.654	167527	5996	5.248	7.040
2	20.568	1601	109	0.050	0.128
3	23.960	52889	1695	1.657	1.990
4	25.516	2970457	77371	93.046	90.842
Total		3192474	85171	100.000	100.000

Compound 3c: 2-(1-([1,1'-biphenyl]-4-yl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3c

Compound 3c: white solid, 78% isolated yield.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.29 (m, 11H), 7.24 – 6.89 (m, 2H), 4.77 (dd, *J* = 13.1, 11.2 Hz, 1H), 4.41 (dd, *J* = 13.1, 4.1 Hz, 1H), 4.07 (dd, *J* = 11.2, 4.1 Hz, 1H), 1.56 (s, 1H), 1.31 (s, 2H).

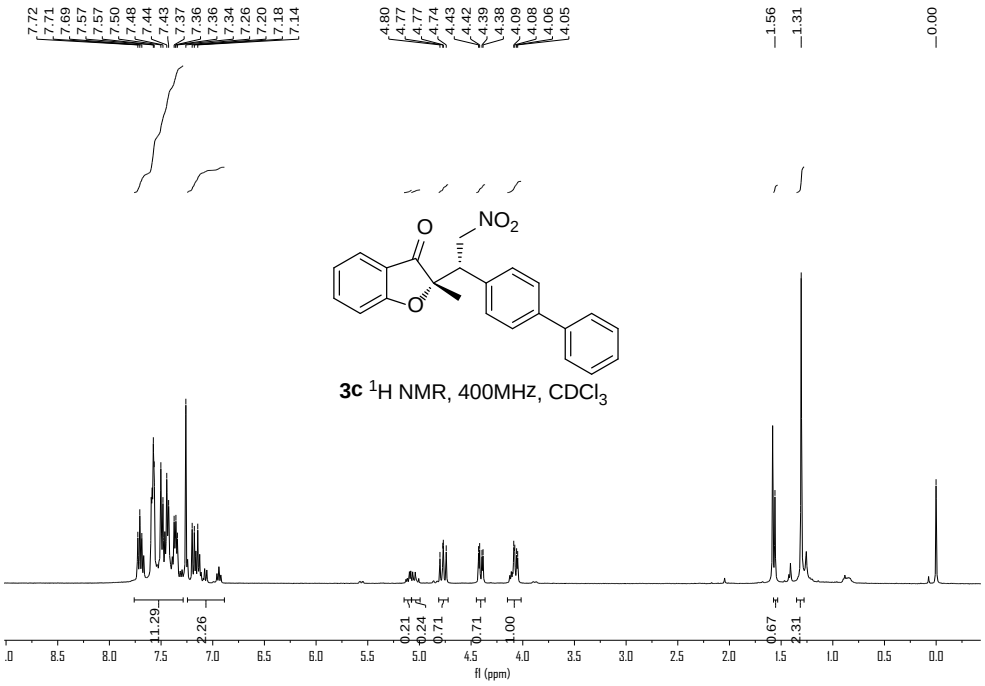
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.54, 171.36, 141.46, 140.47, 139.11, 138.57, 133.51, 129.85, 129.59, 128.95, 128.83, 127.67, 127.61, 127.20, 127.07, 125.01, 122.81, 120.16, 113.78, 90.24, 77.48, 77.16, 76.84, 75.69, 49.37, 21.66.

HRMS (ESI) caled for $C_{23}H_{19}NO_4$ $(M+Na)^+$: 396.1212, found: 396.1208.

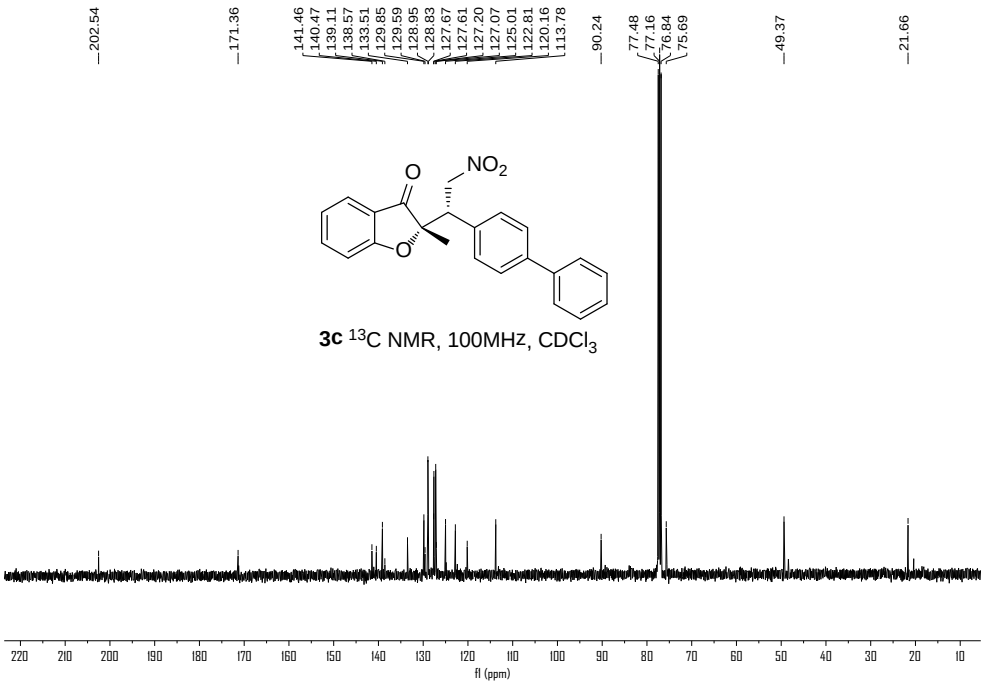
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:19), 1.0 mL/min; major isomer: t_1 = 23.64 min, t_2 = 34.19 min; minor isomer: t_3 = 29.29 min, t_4= 31.99 min).

$[\alpha]^{25}_{D}$ -112.4 (c = 0.9, $CHCl_3$).

NMR copies of major product of compound **3c**:



3c ^{1}H NMR, 400MHz, $CDCl_3$

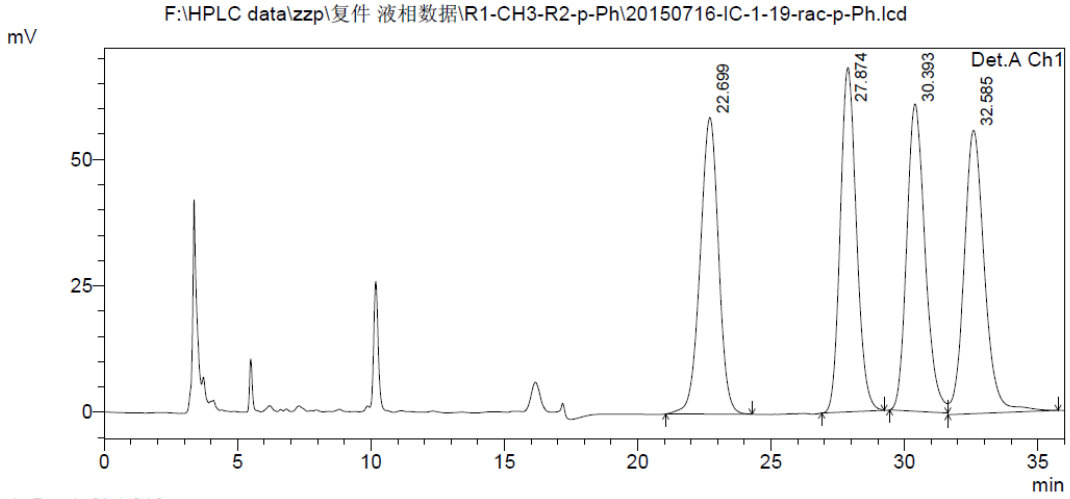


3c ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3c**:

rac iPrOH/Hex 1/19 IC

<Chromatogram>



1 Det.A Ch1/210nm

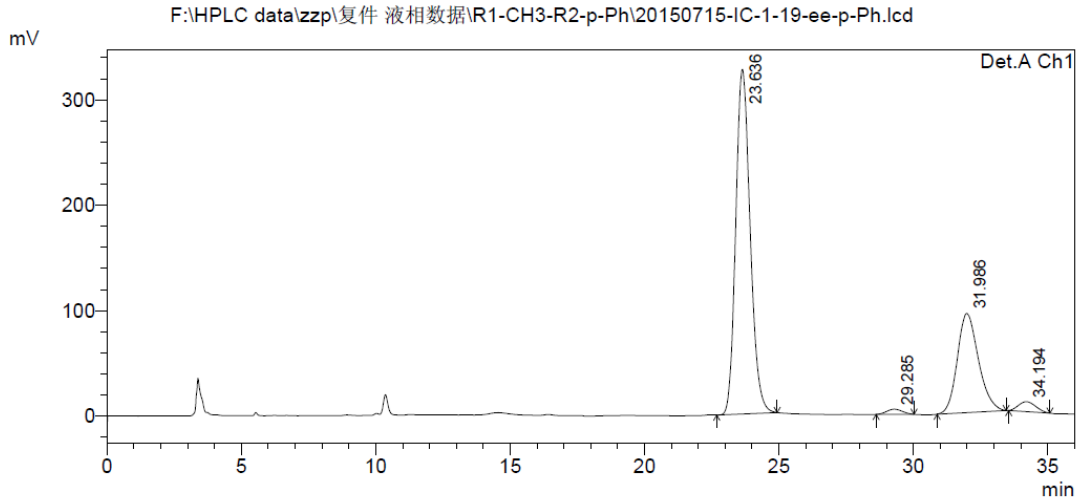
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	22.699	2811693	58624	24.322	24.078
2	27.874	2864479	68063	24.779	27.955
3	30.393	2905933	60752	25.137	24.952
4	32.585	2978057	56031	25.761	23.014
Total		11560162	243470	100.000	100.000

3c iPrOH/Hex 1/19 IC

<Chromatogram>



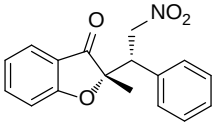
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	23.636	12211666	327056	67.922	75.103
2	29.285	197184	4884	1.097	1.122
3	31.986	5149781	94148	28.643	21.620
4	34.194	420364	9386	2.338	2.155
Total		17978994	435474	100.000	100.000

Compound 3d: 2-methyl-2-(2-nitro-1-phenylethyl)benzofuran-3(2H)-one



3d

Compound 3d: light yellow oil, 99% isolated yield.

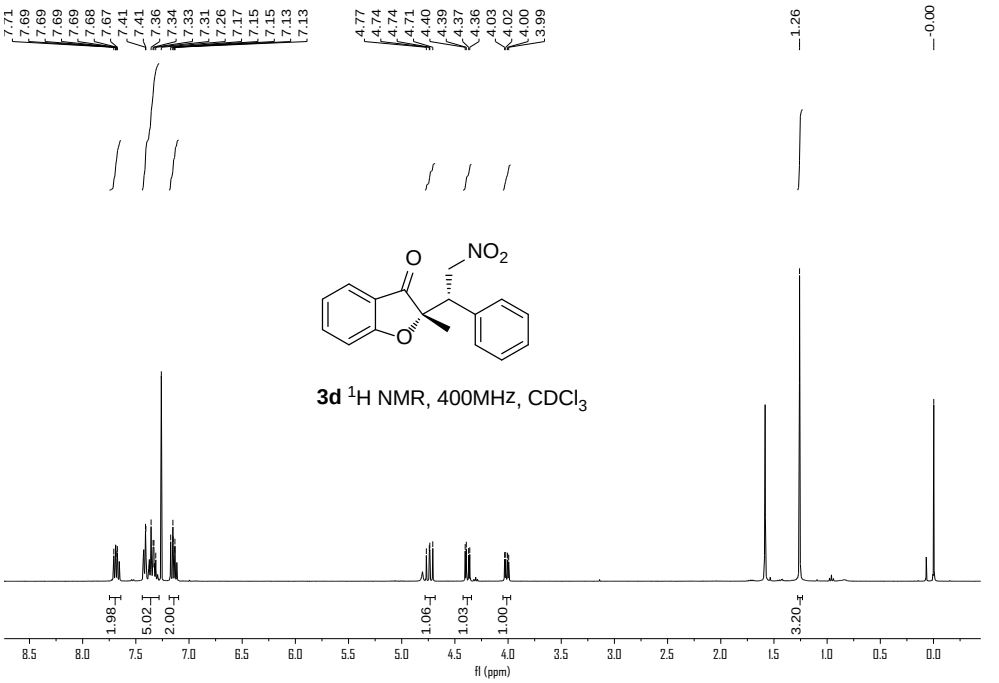
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 – 7.64 (m, 2H), 7.44 – 7.28 (m, 5H), 7.19 – 7.10 (m, 2H), 4.74 (dd, *J* = 13.1, 11.1 Hz, 1H), 4.38 (dd, *J* = 13.0, 4.2 Hz, 1H), 4.01 (dd, *J* = 11.1, 4.2 Hz, 1H), 1.26 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.57, 171.35, 139.08, 134.53, 129.43, 129.19, 128.93, 128.65, 128.51, 124.98, 122.77, 120.15, 113.75, 90.21, 75.72, 49.68, 21.59.

HRMS (ESI) caled for $C_{17}H_{15}NO_4$ $(M+Na)^+$: 320.0899, found: 320.0898.

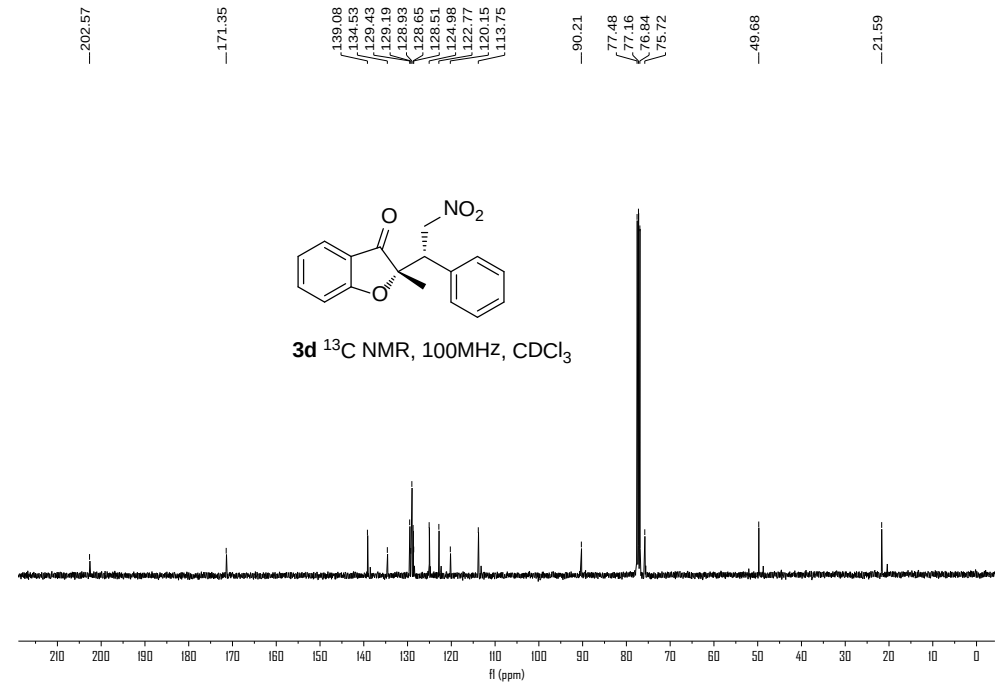
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 12.40 min, t_2 = 17.99 min; minor isomer: t_3 = 13.80 min, t_4= 14.97 min).

$[\alpha]^{25}_{D}$ -267.7 (c = 0.9, $CHCl_3$).

NMR copies of major product of compound **3d**:



3d ^{1}H NMR, 400MHz, $CDCl_3$



3d ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3d**:

rac iPrOH/Hex 1/9 IC

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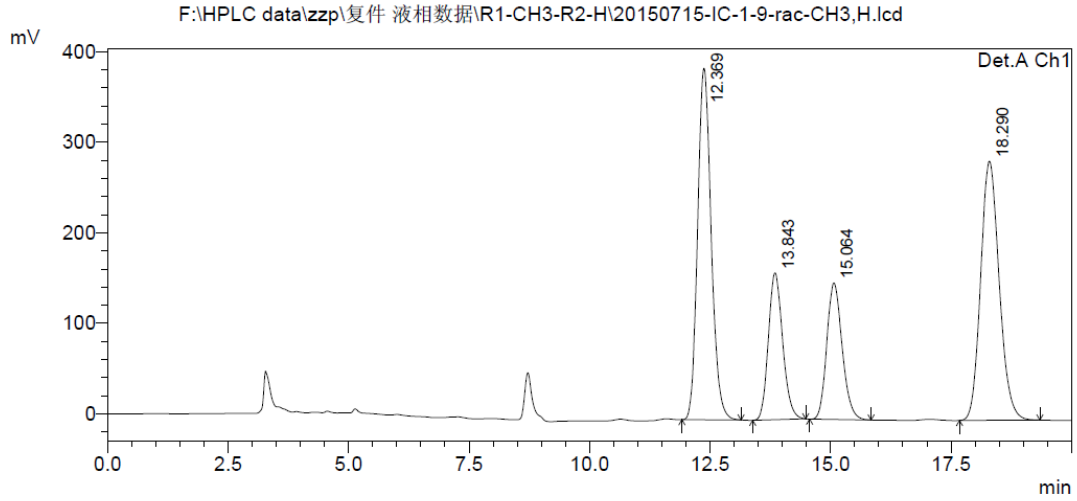


1 Det.A Ch1/210nm

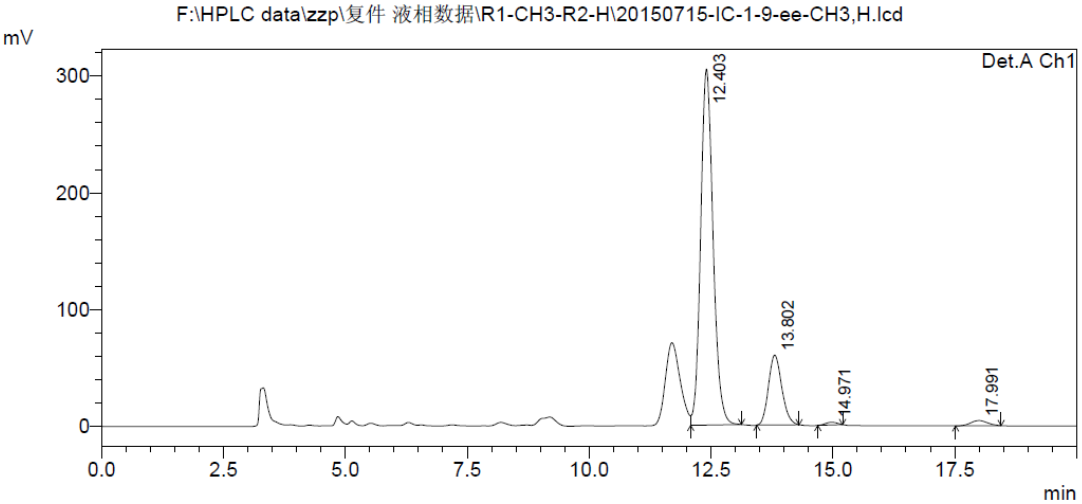
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.369	7593428	388380	34.562	39.331
2	13.843	3348692	162132	15.242	16.419
3	15.064	3354320	150865	15.267	15.278
4	18.290	7674143	286101	34.929	28.973
Total		21970583	987477	100.000	100.000

3d iPrOH/Hex 1/9 IC

<Chromatogram>



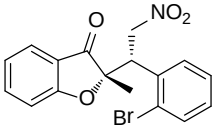
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.403	5394153	304841	80.816	82.081
2	13.802	1137757	59771	17.046	16.094
3	14.971	37757	2328	0.566	0.627
4	17.991	104914	4451	1.572	1.199
Total		6674581	371391	100.000	100.000

Compound 3e: 2-(1-(2-bromophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3e

Compound 3e: yellow oil, 96% isolated yield.

^{1}H NMR (400 MHz, $CDCl_3$) δ7.74 – 7.57 (m, 4H), 7.36 (td, *J* = 7.6, 1.3 Hz, 1H), 7.22 – 7.12 (m, 3H), 4.88 (dd, *J* = 11.1, 4.2 Hz, 1H), 4.72 (dd, *J* = 13.2, 11.1 Hz, 1H), 4.41 (dd, *J* = 13.2, 4.2 Hz, 1H), 1.30 (s, 3H).

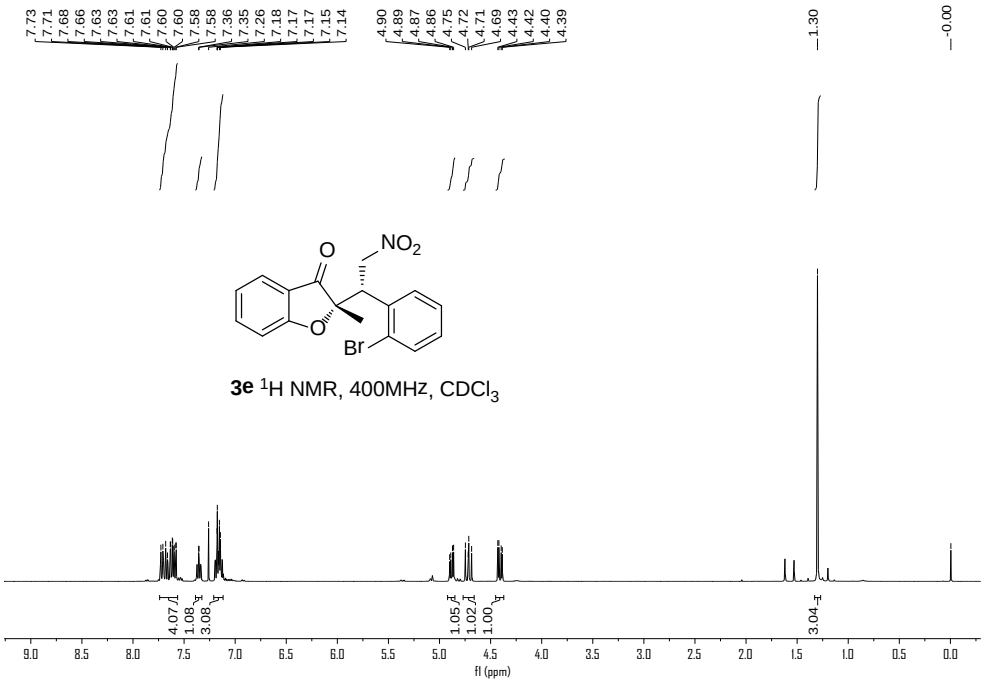
^{13}C NMR (100 MHz, $CDCl_3$) δ201.84 , 171.11 , 139.10 , 134.42 , 133.68 , 129.94 , 128.90 , 128.07 , 127.23 , 125.08 , 122.87 , 120.07 , 113.69 , 90.16 , 75.17 , 46.98 , 20.92 .

HRMS (ESI) caled for $C_{17}H_{14}BrNO_4$ $(M+Na)^+$: 398.0004, found: 398.0004.

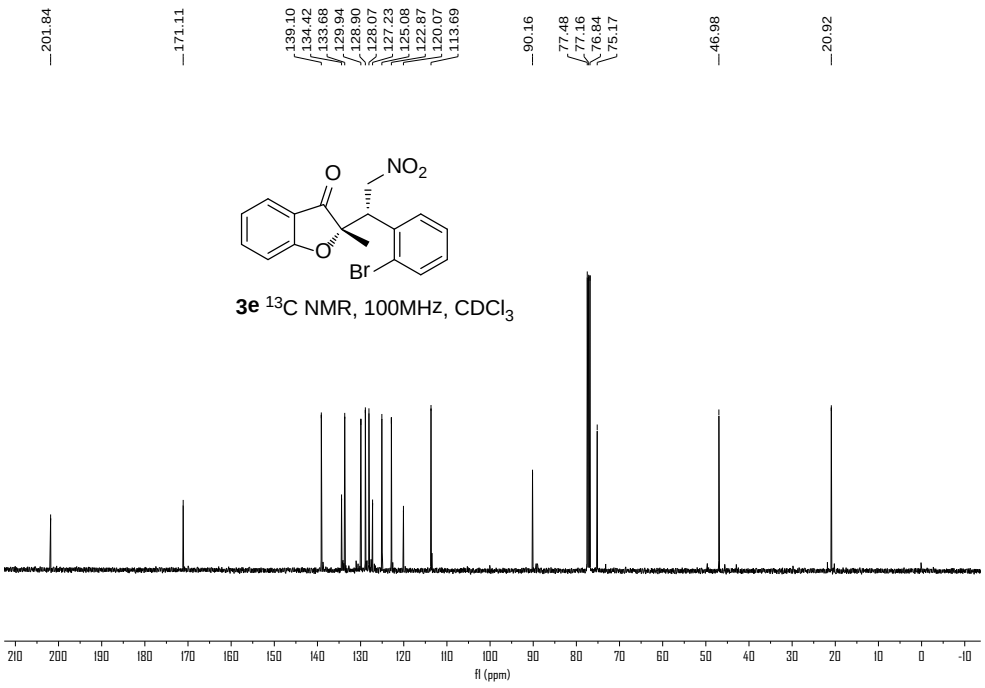
HPLC The enantiomeric excess was determined by HPLC with an AD-H column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 10.21 min, t_2 = 12.27 min; minor isomer: t_3 = 9.79 min, t_4= 11.48 min).

$[\alpha]^{25}_{D}$ -232.9 (c = 0.9, $CHCl_3$)

NMR copies of major product of compound **3e**:



3e ^{1}H NMR, 400MHz, $CDCl_3$

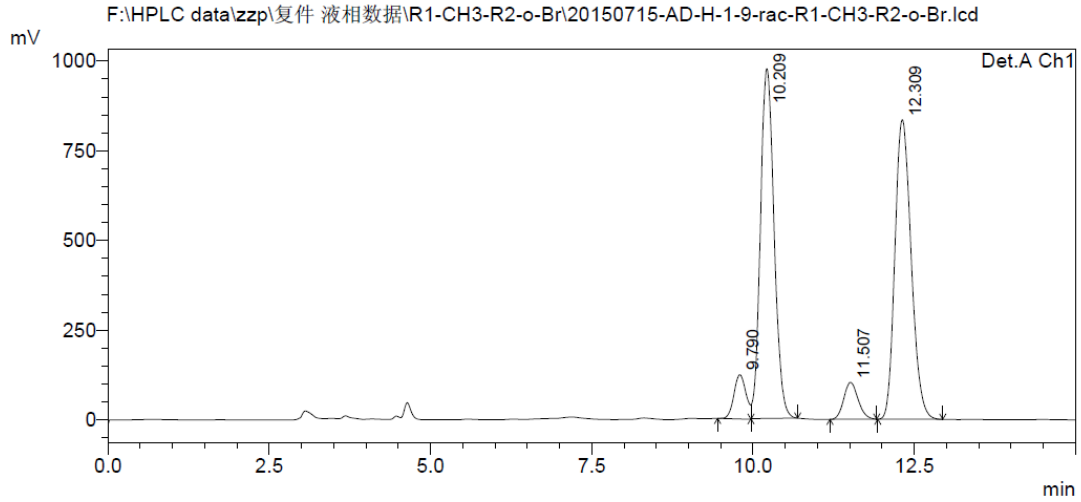


3e ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3e**:

rac iPrOH/Hex 1/9 AD-H

<Chromatogram>



1 Det.A Ch1/210nm

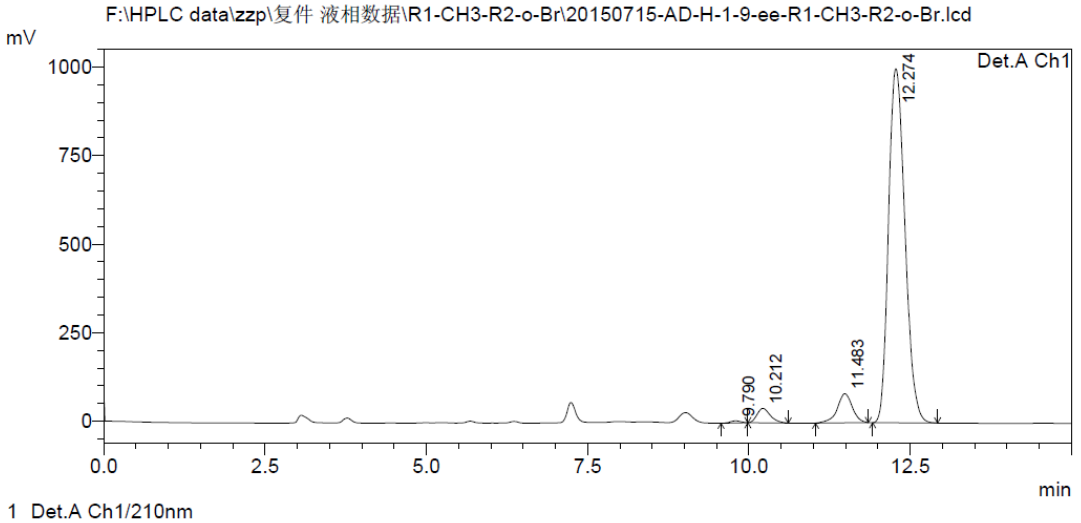
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.790	1616225	123388	5.008	6.060
2	10.209	14393241	975015	44.599	47.885
3	11.507	1589855	102939	4.926	5.056
4	12.309	14673108	834804	45.466	40.999
Total		32272429	2036146	100.000	100.000

3e iPrOH/Hex 1/9 AD-H

<Chromatogram>



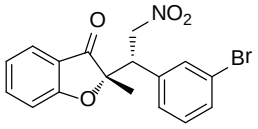
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.790	64017	5850	0.325	0.518
2	10.212	582917	40720	2.958	3.607
3	11.483	1330964	82240	6.754	7.285
4	12.274	17727565	1000052	89.963	88.589
Total		19705463	1128863	100.000	100.000

Compound 3f: 2-(1-(3-bromophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3f

Compound 3f: yellow oil, 77% isolated yield.

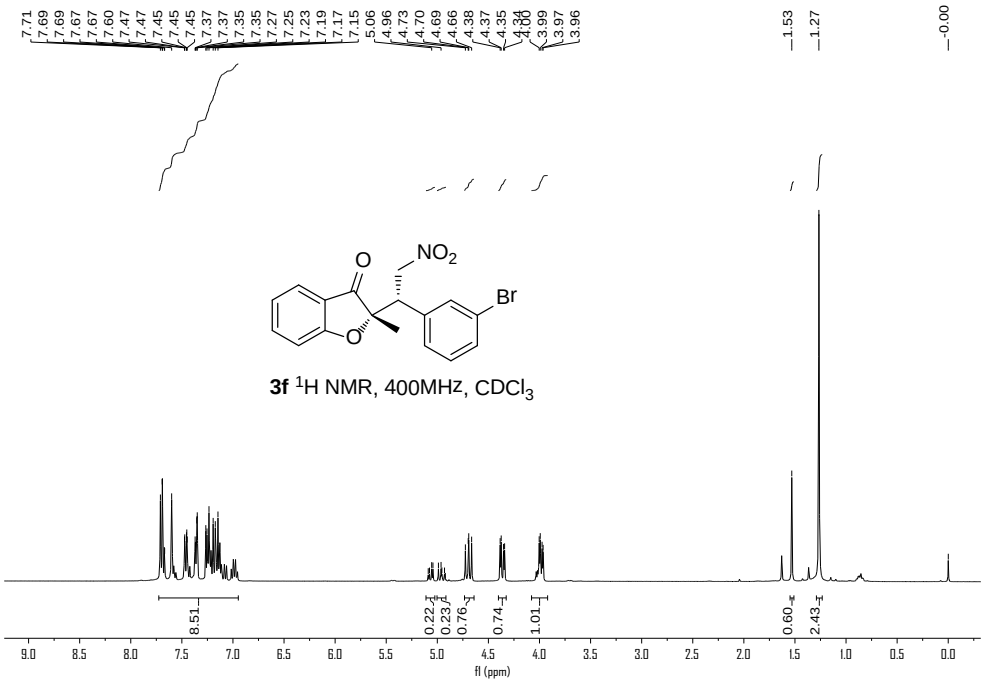
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 – 6.95 (m, 8H), 4.69 (dd, *J* = 13.3, 11.2 Hz, 1H), 4.36 (dd, *J* = 13.3, 4.1 Hz, 1H), 3.98 (dd, *J* = 11.3, 4.1 Hz, 1H), 1.27 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.07 , 171.24 , 139.21 , 136.96 , 132.33 , 131.87 , 131.54 , 130.46 , 128.16 , 125.00 , 122.93 , 120.00 , 113.79 , 89.77 , 75.41 , 49.25 , 21.57.

HRMS (ESI) caled for $C_{17}H_{14}BrNO_4$ $(M+Na)^+$: 398.0004, found: 398.0001.

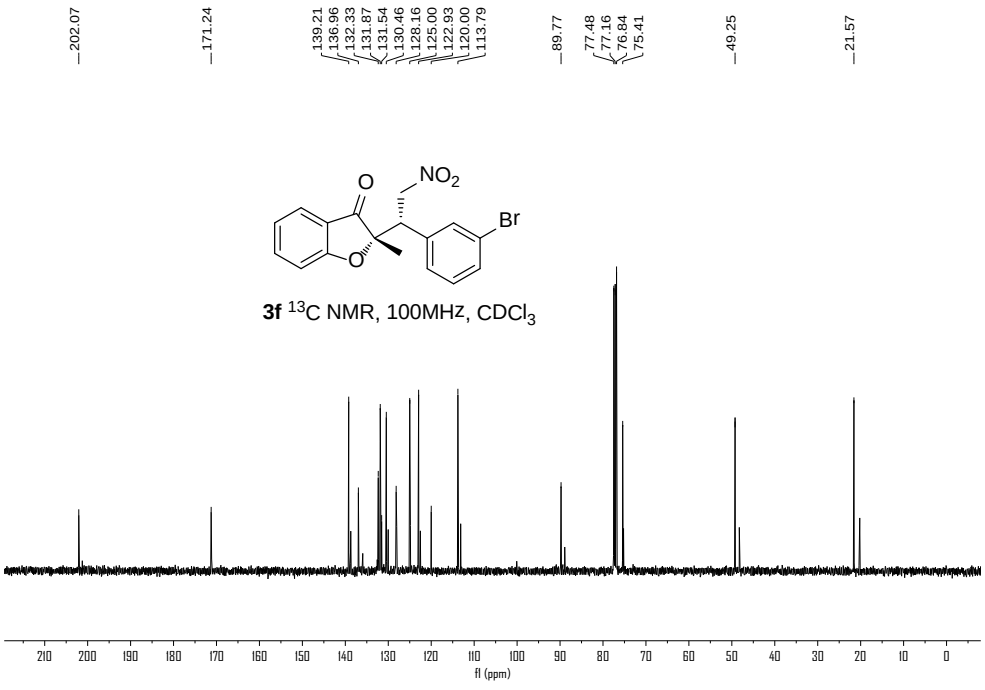
HPLC The enantiomeric excess was determined by HPLC with an AD-H column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 8.78 min, t_2 = 14.94 min; minor isomer: t_3 = 9.79 min, t_4= 11.86 min).

$[\alpha]^{25}_{D}$ -245.8 (c = 0.9, $CHCl_3$)

NMR copies of major product of compound **3f**:



3f ^{1}H NMR, 400MHz, $CDCl_3$

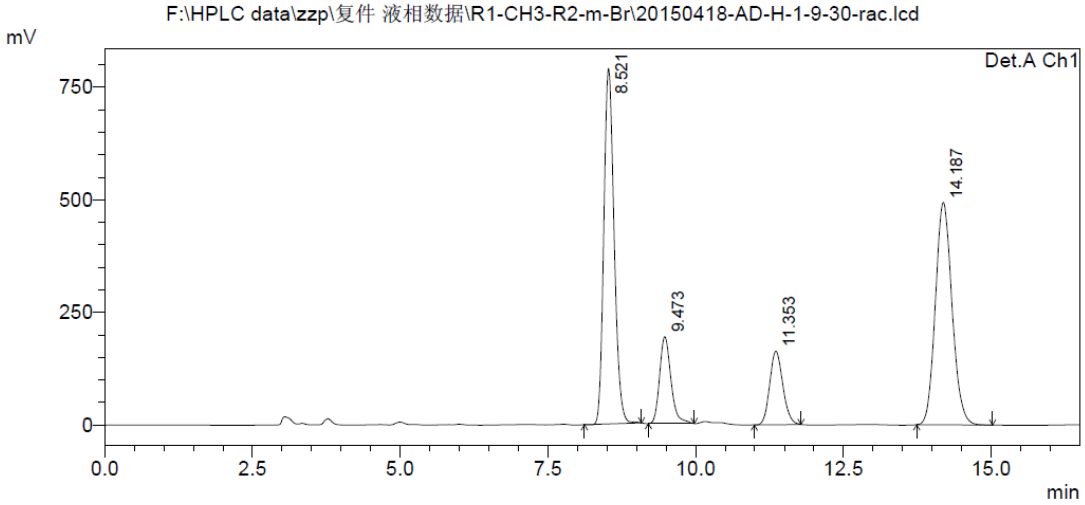


3f ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3f**:

rac iPrOH/Hex 1/9 AD-H

<Chromatogram>



1 Det.A Ch1/210nm

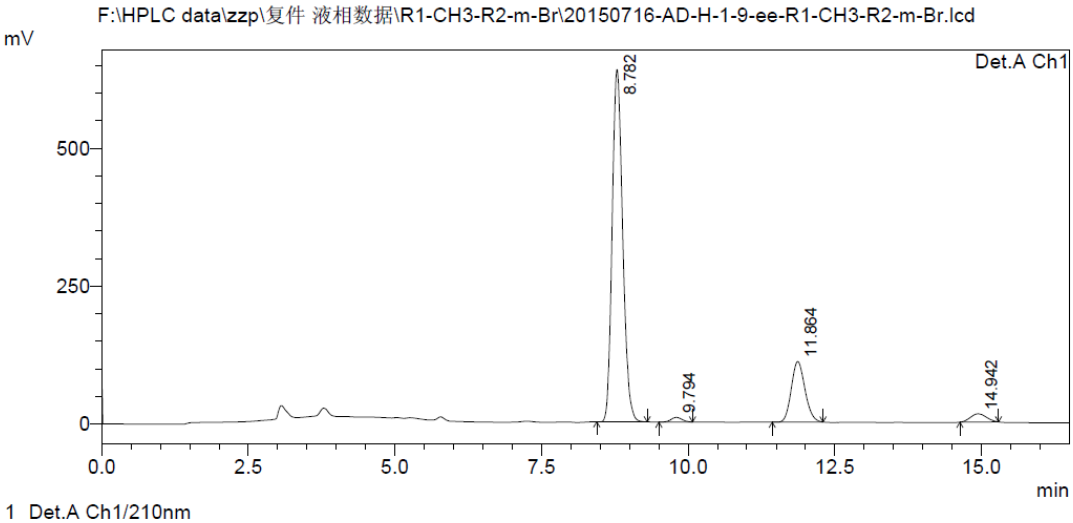
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.521	9549026	789273	39.225	48.139
2	9.473	2574945	192974	10.577	11.770
3	11.353	2528009	163426	10.384	9.968
4	14.187	9692554	493881	39.814	30.123
Total		24344534	1639554	100.000	100.000

3f iPrOH/Hex 1/9 AD-H

<Chromatogram>



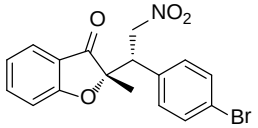
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.782	7984558	639206	78.574	82.722
2	9.794	111220	8524	1.094	1.103
3	11.864	1781296	109925	17.529	14.226
4	14.942	284731	15061	2.802	1.949
Total		10161805	772715	100.000	100.000

Compound 3g: 2-(1-(4-bromophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3g

Compound 3g: yellow oil, 96% isolated yield.

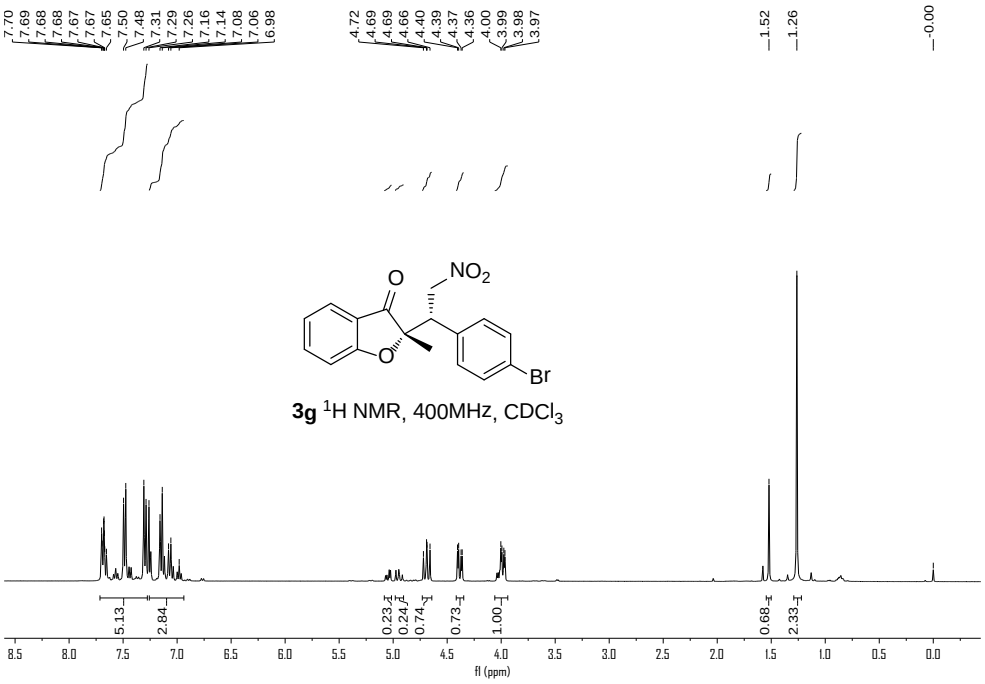
^{1}H NMR (400 MHz, $CDCl_3$) δ7.71 – 7.28 (m, 5H), 7.26 – 6.94 (m, 3H), 4.69 (dd, *J* = 13.1, 11.3 Hz, 1H), 4.38 (dd, *J* = 13.1, 4.1 Hz, 1H), 3.98 (dd, *J* = 11.1, 4.0 Hz, 1H), 1.52 (s, 1H), 1.26 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.16 , 171.23 , 139.21 , 133.60 , 132.13 , 131.72 , 131.08 , 130.81 , 125.00 , 122.92 , 122.57 , 120.00 , 113.74 , 89.74 , 75.44 , 49.14 , 21.55.

HRMS (ESI) caled for $C_{17}H_{14}BrNO_4$ $(M+Na)^+$: 398.0004, found: 398.0002.

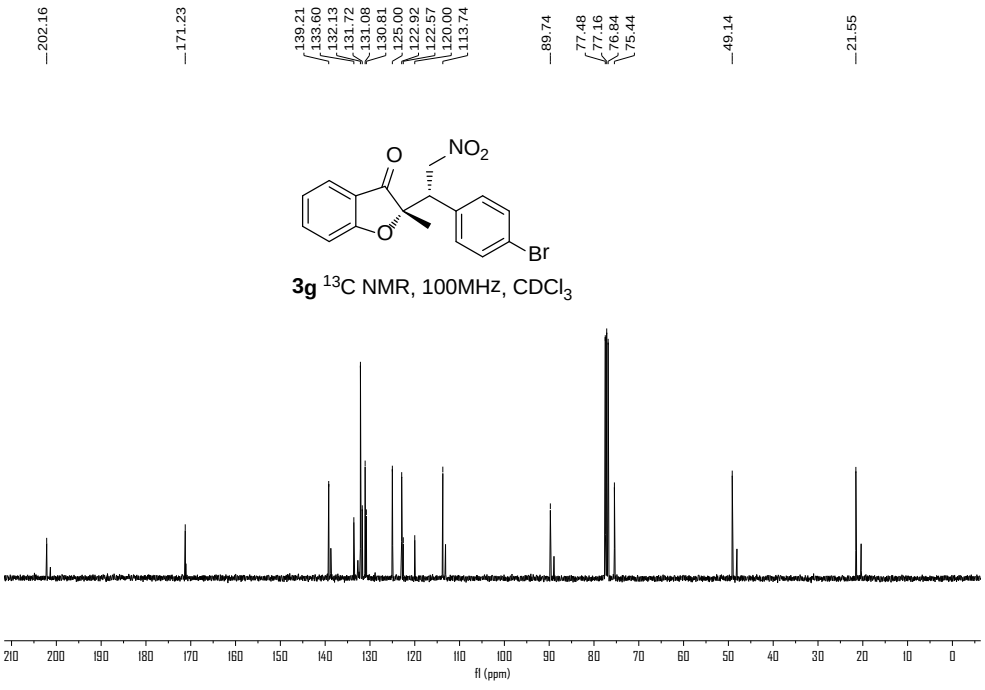
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 11.81 min, t_2 = 16.91 min; minor isomer: t_3 = 13.11 min, t_4= 13.68 min).

$[\alpha]^{25}_D$ -124.4 (c = 0.9, $CHCl_3$)

NMR copies of major product of compound **3g**:



3g ^{1}H NMR, 400MHz, $CDCl_3$

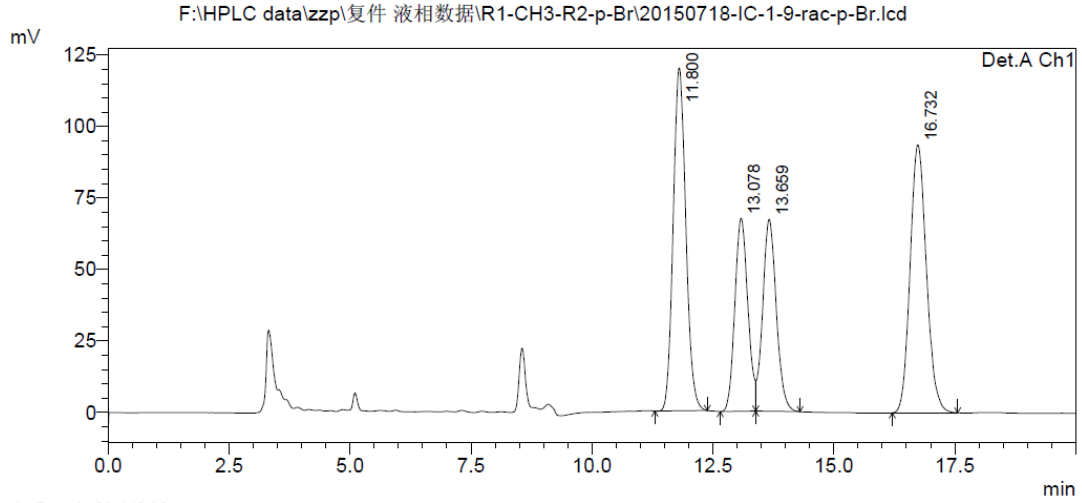


3g ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3g**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



1 Det.A Ch1/210nm

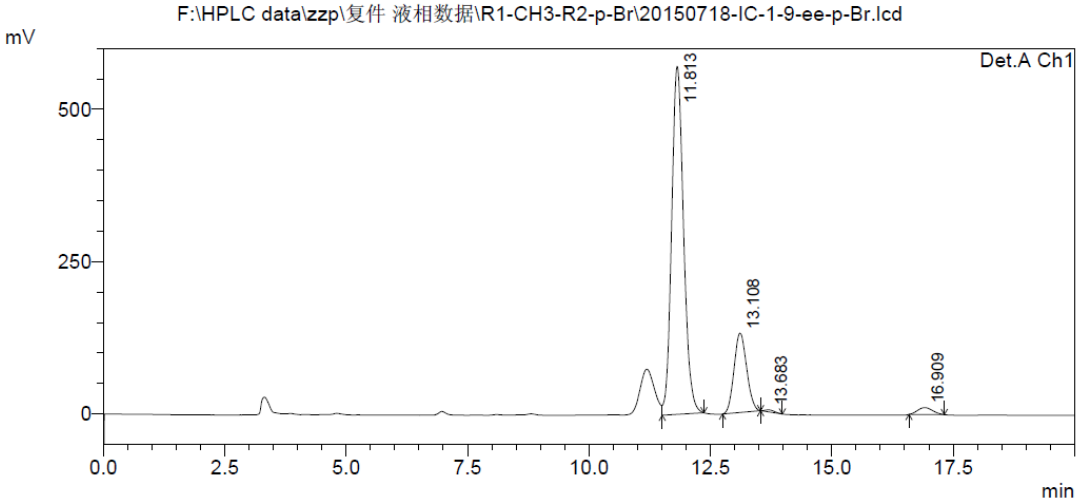
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.800	2184093	119868	31.399	34.432
2	13.078	1260788	67458	18.125	19.377
3	13.659	1313739	67082	18.886	19.269
4	16.732	2197380	93721	31.590	26.921
Total		6955999	348129	100.000	100.000

3g iPrOH/Hex 1/9 IC

<Chromatogram>



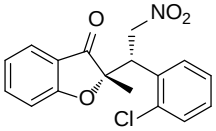
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.813	9769493	571502	78.695	79.731
2	13.108	2355271	130596	18.972	18.220
3	13.683	46652	3371	0.376	0.470
4	16.909	242919	11320	1.957	1.579
Total		12414335	716789	100.000	100.000

Compound 3h: 2-(1-(2-chlorophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3h

Compound 3h: yellow oil, 87% isolated yield.

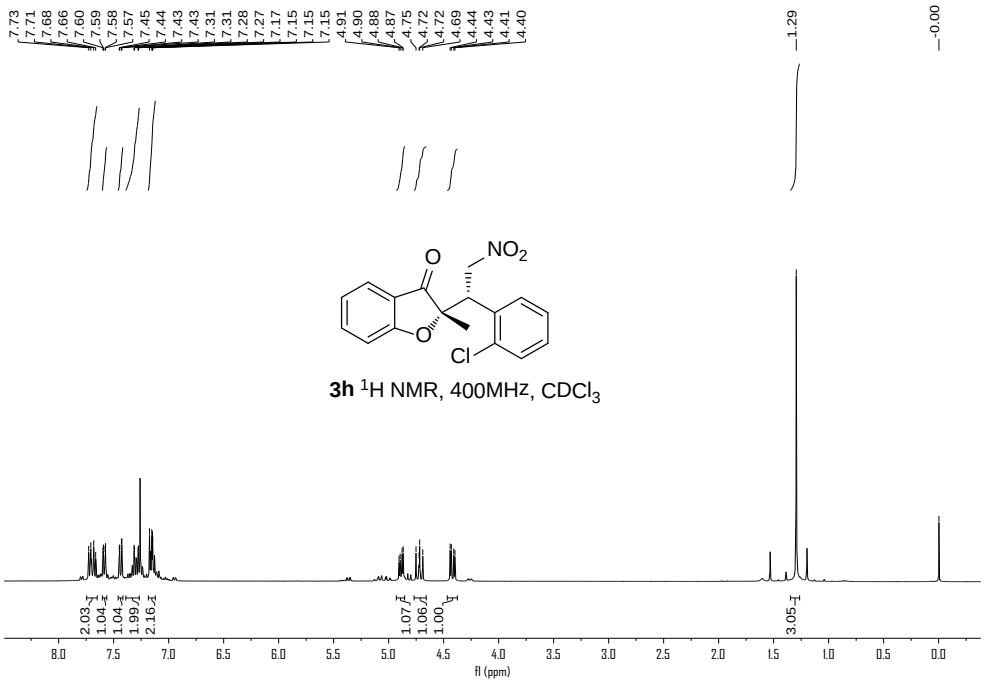
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 (dd, *J* = 17.9, 7.4 Hz, 2H), 7.59 (dd, *J* = 7.7, 1.8 Hz, 1H), 7.44 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.29 (dd, *J* = 14.7, 1.7 Hz, 2H), 7.18 – 7.12 (m, 2H), 4.89 (dd, *J* = 11.2, 4.2 Hz, 1H), 4.72 (dd, *J* = 13.3, 11.2 Hz, 1H), 4.42 (dd, *J* = 13.3, 4.2 Hz, 1H), 1.29 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ201.88 , 171.14 , 139.11 , 136.24 , 132.68 , 130.27 , 129.68 , 128.82 , 127.43 , 125.08 , 122.87 , 120.10 , 113.70 , 90.13 , 75.03 , 44.18 , 20.86.

HRMS (ESI) caled for $C_{17}H_{14}ClNO_4$ $(M+Na)^+$: 354.0509, found: 354.0507.

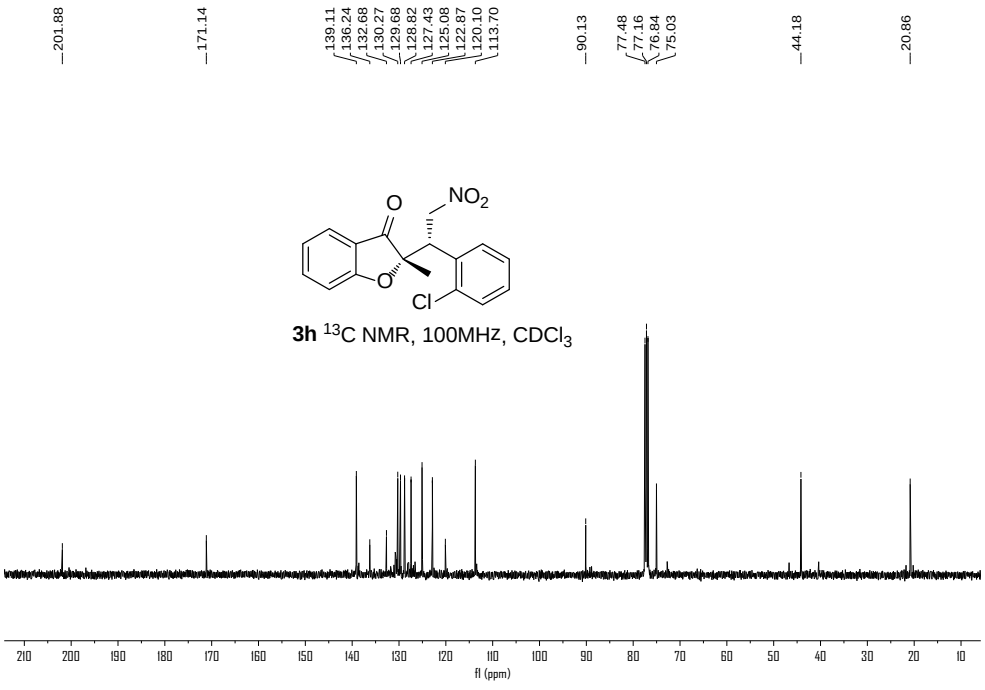
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 15.22 min, t_2 = 16.05 min; minor isomer: t_3 = 13.55 min, t_4= 21.25 min).

$[\alpha]^{25}_{D}$ -276.7 (c = 0.8, $CHCl_3$)

NMR copies of major product of compound **3h**:



3h ^{1}H NMR, 400MHz, $CDCl_3$

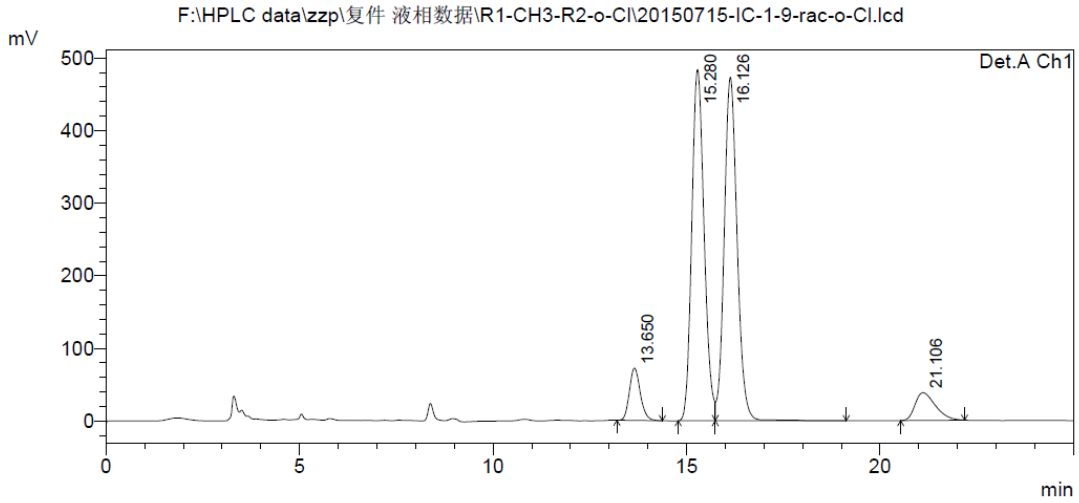


3h ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3h**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



1 Det.A Ch1/210nm

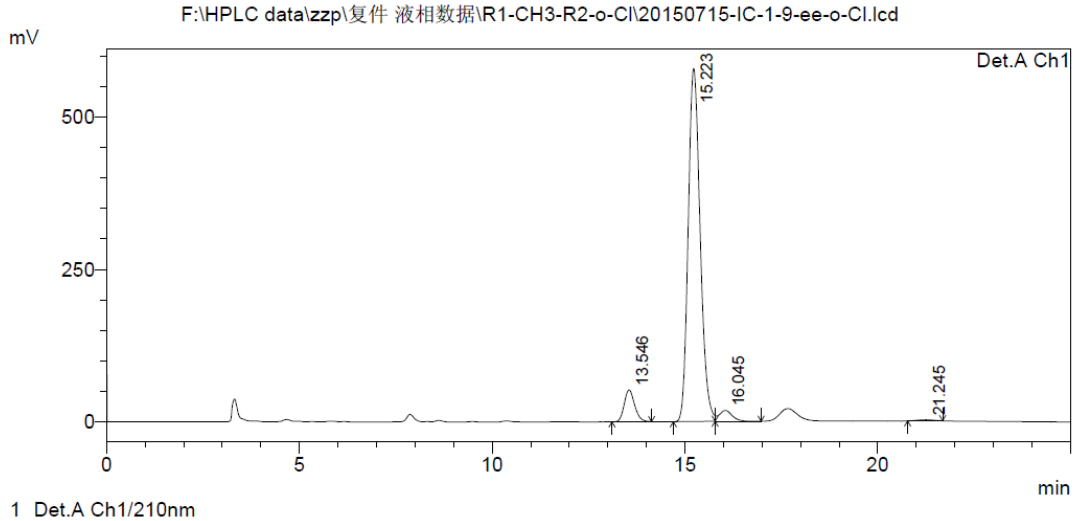
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.650	1408116	72101	5.752	6.756
2	15.280	10718552	483882	43.781	45.342
3	16.126	10960818	472989	44.770	44.322
4	21.106	1394845	38203	5.697	3.580
Total		24482331	1067174	100.000	100.000

3h iPrOH/Hex 1/9 IC

<Chromatogram>



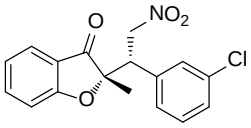
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	13.546	983983	52365	7.060	8.037
2	15.223	12482804	579655	89.561	88.968
3	16.045	422489	17823	3.031	2.736
4	21.245	48516	1687	0.348	0.259
Total		13937791	651531	100.000	100.000

Compound 3i: 2-(1-(3-chlorophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3i

Compound 3i: Colorless oil, 84% isolated yield.

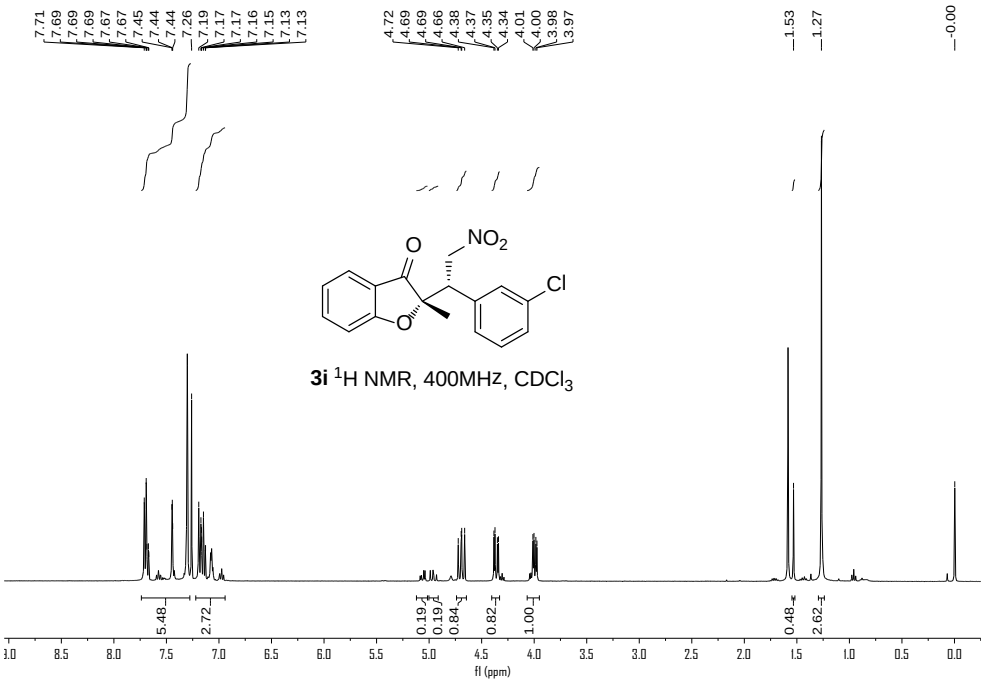
^{1}H NMR (400 MHz, $CDCl_3$) δ7.76 – 7.28 (m,5H), 7.22 – 6.94 (m, 3H), 4.69 (dd, *J* = 13.2, 11.2 Hz, 1H), 4.36 (dd, *J* = 13.3, 4.1 Hz, 1H), 3.99 (dd, *J* = 11.2, 4.1 Hz, 1H), 1.27 (s, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.12, 171.29, 139.23, 136.70, 130.21, 129.77, 129.47, 128.98, 127.77, 125.04, 122.95, 120.04, 113.80, 89.81, 75.46, 49.33, 21.59.

HRMS (ESI) caled for $C_{17}H_{14}ClNO_4$ $(M+Na)^+$: 354.0509, found: 354.0508.

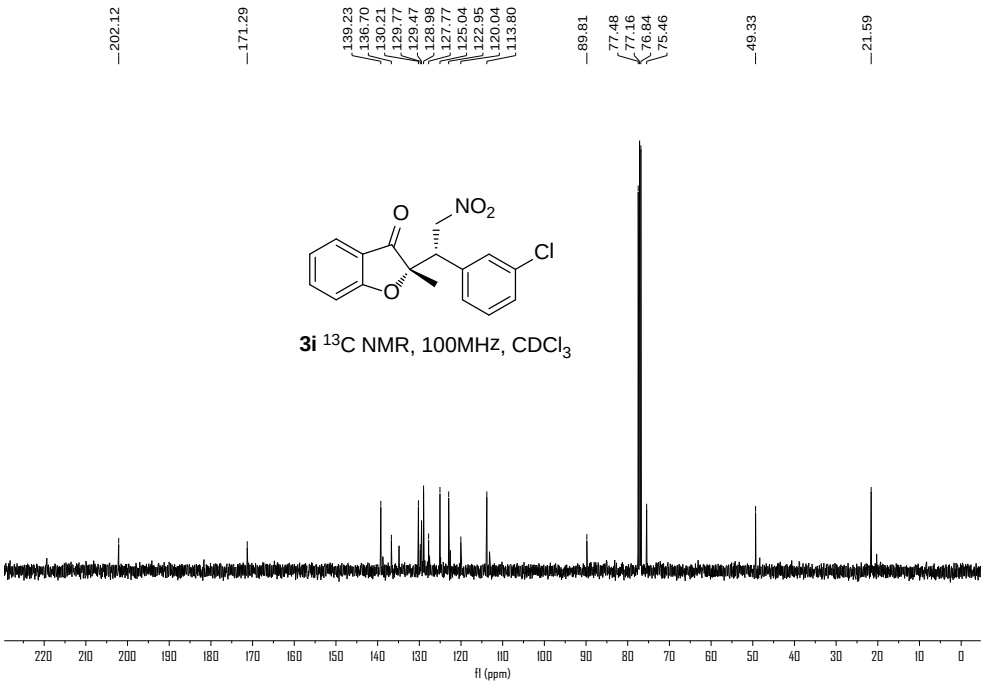
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=2:98), 1.0 mL/min; major isomer: t_1 = 22.85 min, t_2 = 32.95 min; minor isomer: t_3 = 29.24 min, t_4= 31.03 min)..

$[\alpha]^{25}_{D}$ -293.3 (c = 0.6, $CHCl_3$)

NMR copies of major product of compound **3i**:



3i ^{1}H NMR, 400MHz, $CDCl_3$

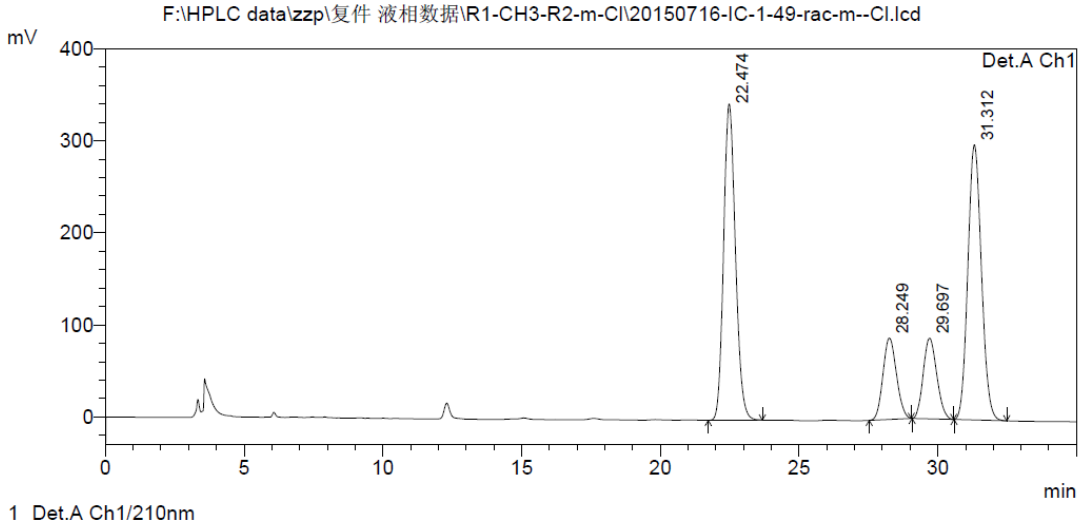


3i ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3i**:

rac iPrOH/Hex 2/98 IC

<Chromatogram>



1 Det.A Ch1/210nm

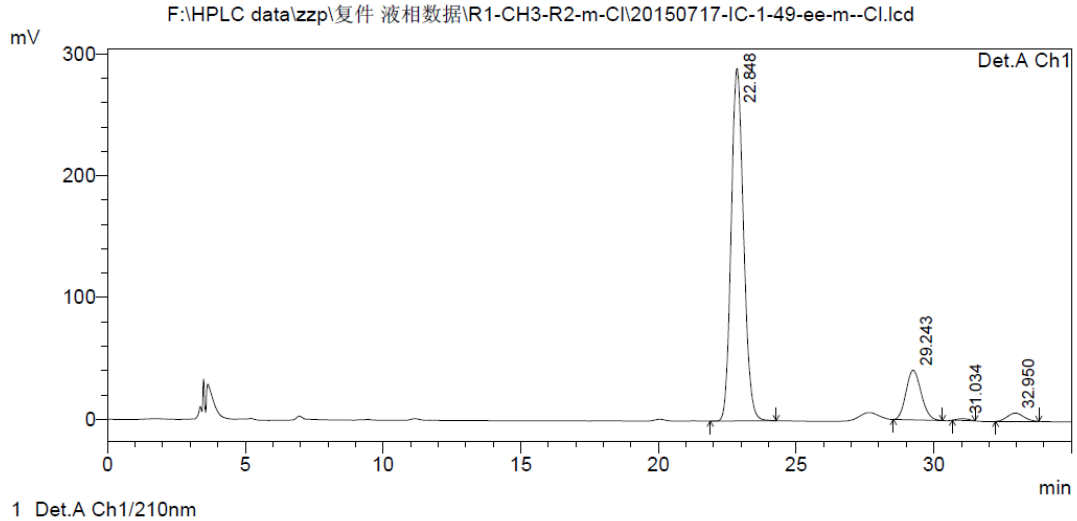
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	22.474	10207632	343534	38.763	41.969
2	28.249	2993211	88507	11.366	10.813
3	29.697	2970321	87625	11.280	10.705
4	31.312	10162559	298881	38.591	36.514
Total		26333723	818546	100.000	100.000

3i iPrOH/Hex 2/98 IC

<Chromatogram>



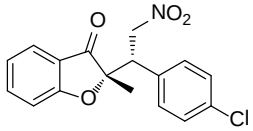
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	22.848	9067694	289579	82.838	85.499
2	29.243	1556060	40805	14.215	12.048
3	31.034	42949	1510	0.392	0.446
4	32.950	279569	6799	2.554	2.008
Total		10946272	338694	100.000	100.000

Compound 3j: 2-(1-(4-chlorophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3j

Compound 3j: yellow oil, 96% isolated yield.

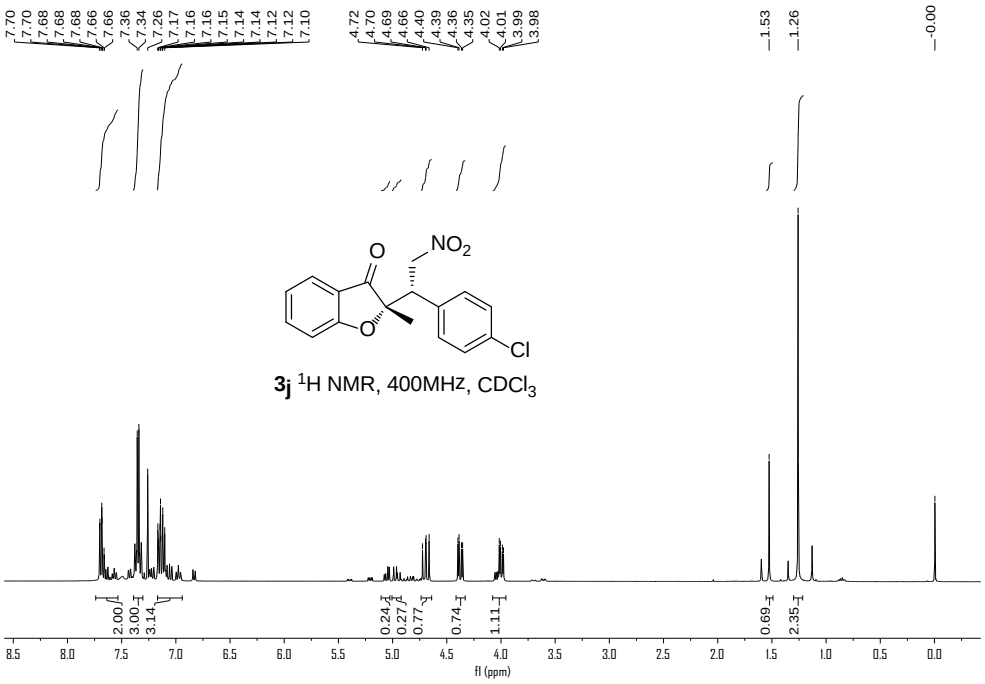
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 – 7.53 (m, 2H), 7.35 (d, *J* = 6.2 Hz, 3H), 7.17 – 6.94 (m, 3H), 4.69 (dd, *J* = 13.1, 11.3 Hz, 1H), 4.38 (dd, *J* = 13.1, 4.1 Hz, 1H), 4.00 (dd, *J* = 11.4, 4.1 Hz, 1H), 1.53 (s, 1H), 1.26 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.20 , 171.25 , 139.21 , 134.69 , 133.07 , 130.77 , 130.51 , 129.18 , 128.78 , 125.01 , 122.92 , 120.04 , 113.74 , 89.83 , 75.52 , 49.10 , 21.56.

HRMS (ESI) caled for $C_{17}H_{14}ClNO_4$ $(M+Na)^+$: 354.0509, found: 354.0508.

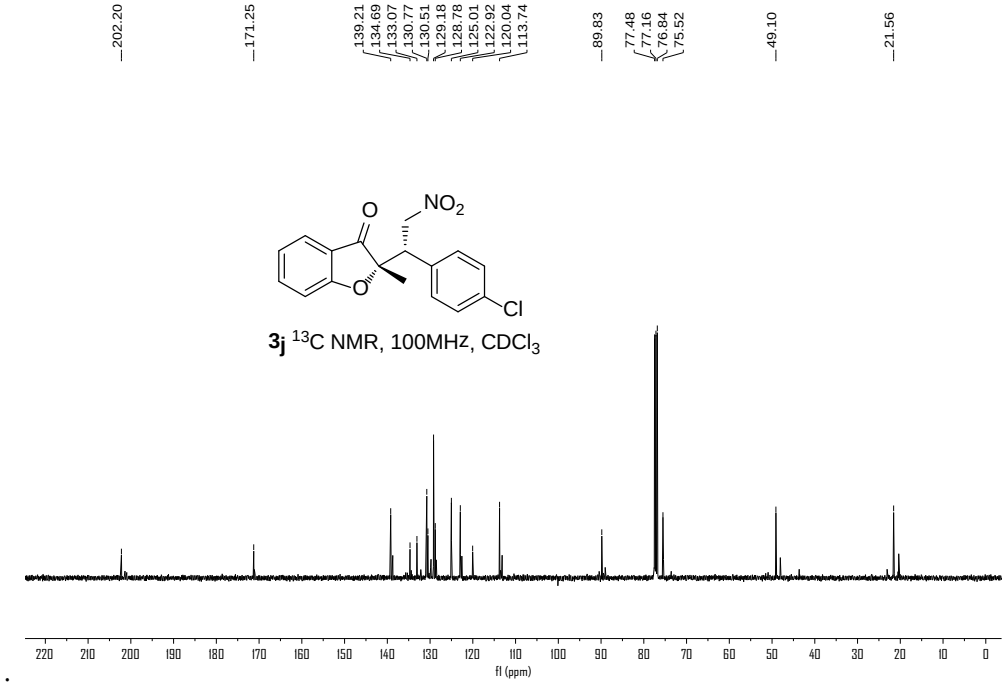
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:19), 1.0 mL/min; major isomer: t_1 = 16.01 min, t_2 = 23.56 min; minor isomer: t_3 = 18.33 min, t_4= 19.32 min)..

$[\alpha]^{25}_{D}$ -70.1 (c = 0.9, $CHCl_3$)

NMR copies of major product of compound **3j**:



3j ^{1}H NMR, 400MHz, $CDCl_3$



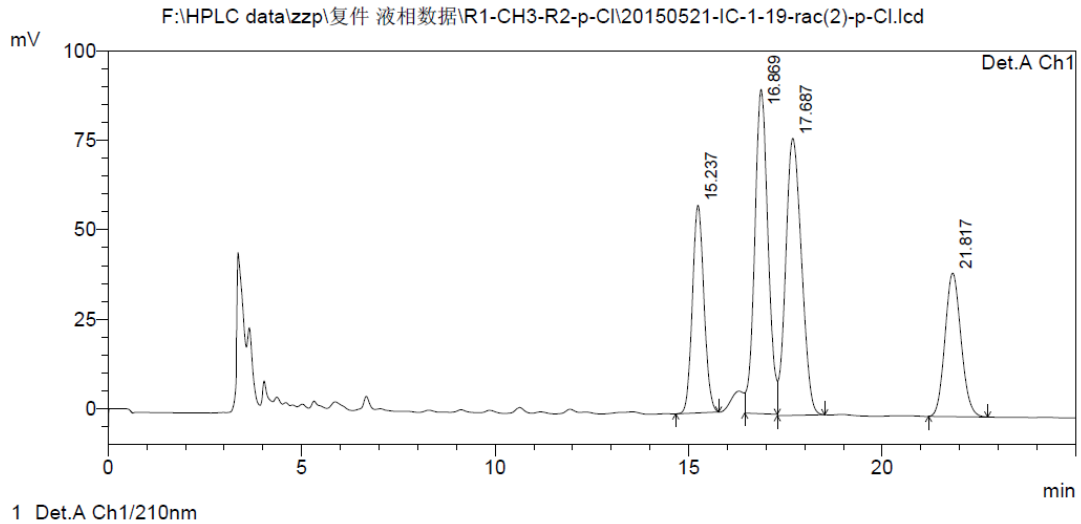
3j ^{13}C NMR, 100MHz, $CDCl_3$

.

HPLC copies of compound **3j**:

rac iPrOH/Hex 1/19 IC

<Chromatogram>



1 Det.A Ch1/210nm

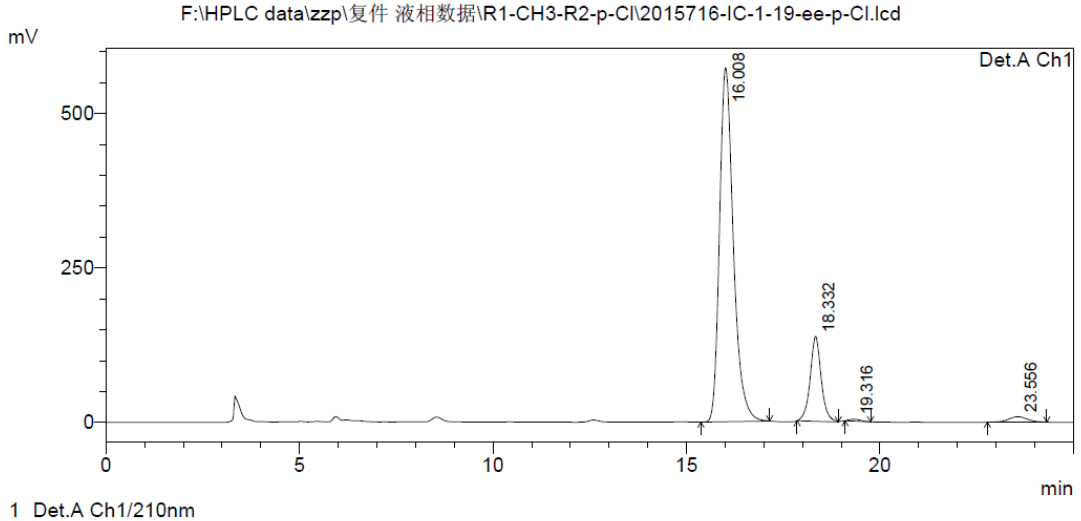
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.237	1207110	58033	17.917	21.802
2	16.869	2161028	90651	32.075	34.055
3	17.687	2211960	77415	32.831	29.083
4	21.817	1157270	40089	17.177	15.061
Total		6737368	266188	100.000	100.000

3j iPrOH/Hex 1/19 IC

<Chromatogram>



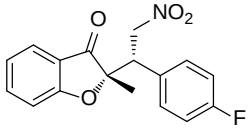
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	16.008	14219887	572879	82.142	79.324
2	18.332	2730045	137411	15.770	19.027
3	19.316	60813	3020	0.351	0.418
4	23.556	300542	8893	1.736	1.231
Total		17311288	722203	100.000	100.000

Compound 3k: 2-(1-(4-fluorophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3k

Compound 3k: Colorless oil, 99% isolated yield.

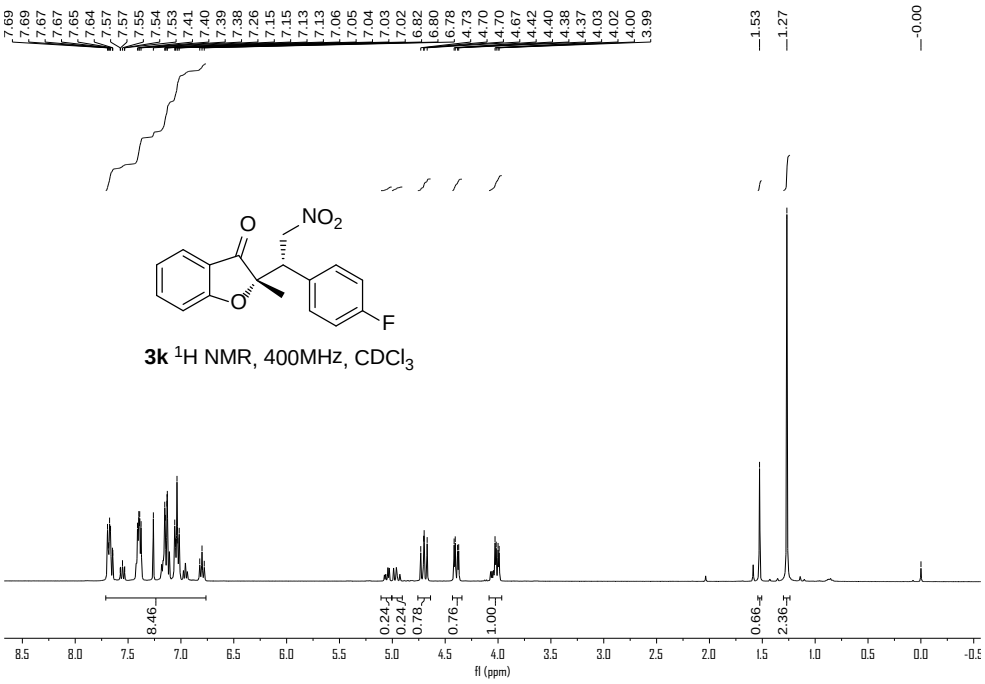
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 – 6.76 (m, 8H), 4.70 (dd, *J* = 13.0, 11.3 Hz, 1H), 4.39 (dd, *J* = 13.1, 4.2 Hz, 1H), 4.01 (dd, *J* = 11.3, 4.3 Hz, 1H), 1.53 (s, 1H), 1.27 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.32 , 171.25 , 164.04 , 139.16 , 131.14 , 131.06 , 124.97 , 122.86 , 120.08 , 116.04 , 115.82 , 113.71 , 113.11 , 89.97 , 75.68 , 48.99 , 21.52

HRMS (ESI) caled for $C_{17}H_{14}FNO_4$ $(M+Na)^+$: 338.0805, found: 338.0802.

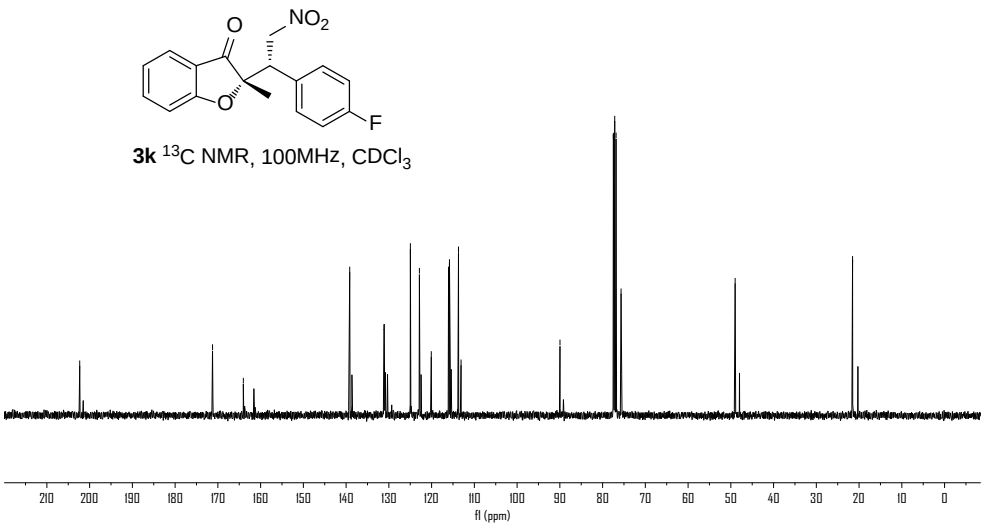
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 10.76 min, t_2 = 14.91 min; minor isomer: t_3 = 11.63 min, t_4= 11.93 min).

$[\alpha]^{25}_{D}$ -43.3 (c = 0.8, $CHCl_3$)

NMR copies of major product of compound **3k**:



3k ^{1}H NMR, 400MHz, $CDCl_3$

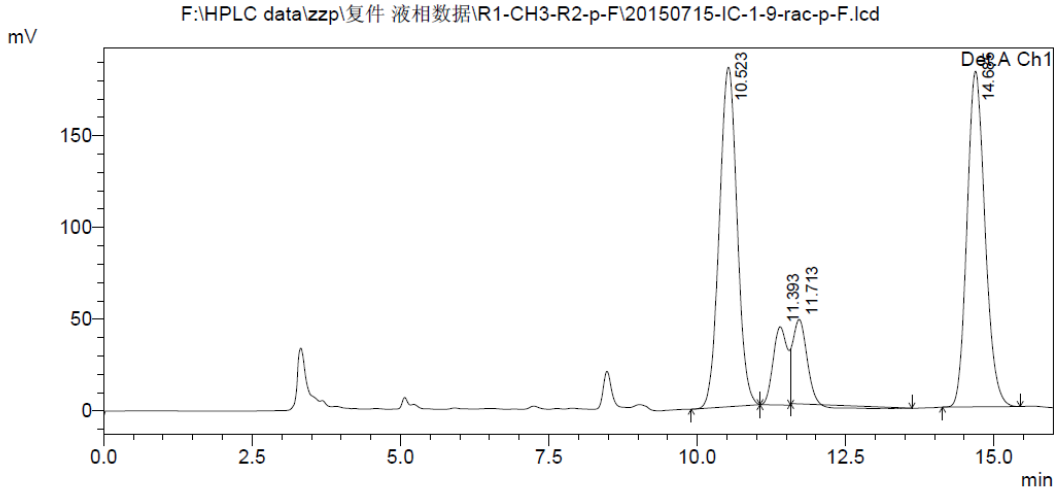


3k ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3k**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



1 Det.A Ch1/210nm

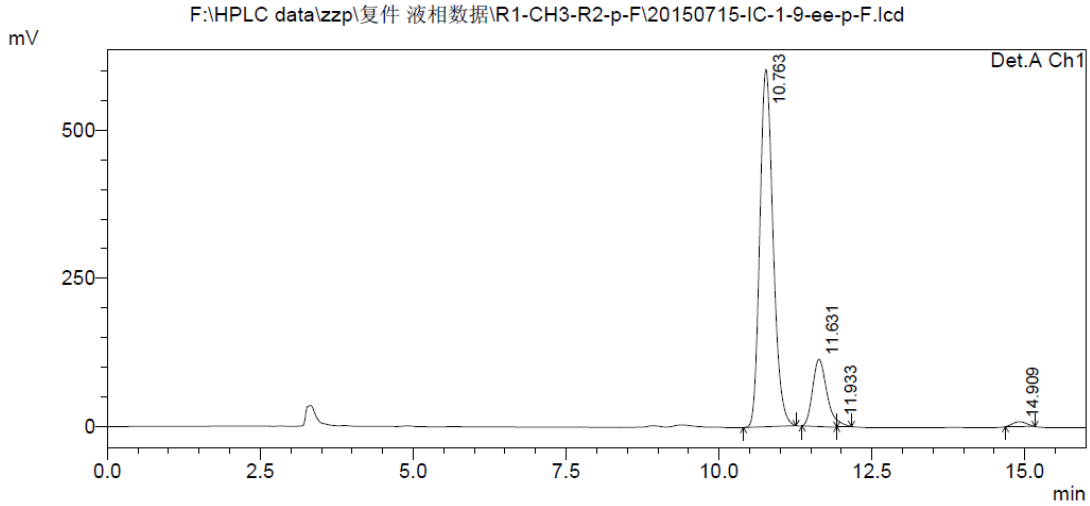
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.523	3846931	185109	42.210	40.530
2	11.393	732649	42645	8.039	9.337
3	11.713	665144	46027	7.298	10.078
4	14.685	3869019	182938	42.453	40.055
Total		9113743	456718	100.000	100.000

3k iPrOH/Hex 1/9 IC

<Chromatogram>



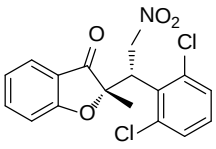
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.763	9086554	603208	82.041	82.013
2	11.631	1799474	113595	16.247	15.445
3	11.933	60924	10612	0.550	1.443
4	14.909	128632	8086	1.161	1.099
Total		11075584	735500	100.000	100.000

Compound 3l: 2-(1-(2,6-dichlorophenyl)-2-nitroethyl)-2-methylbenzofuran-3(2H)-one



3l

Compound 3l: light yellow oil, 87% isolated yield.

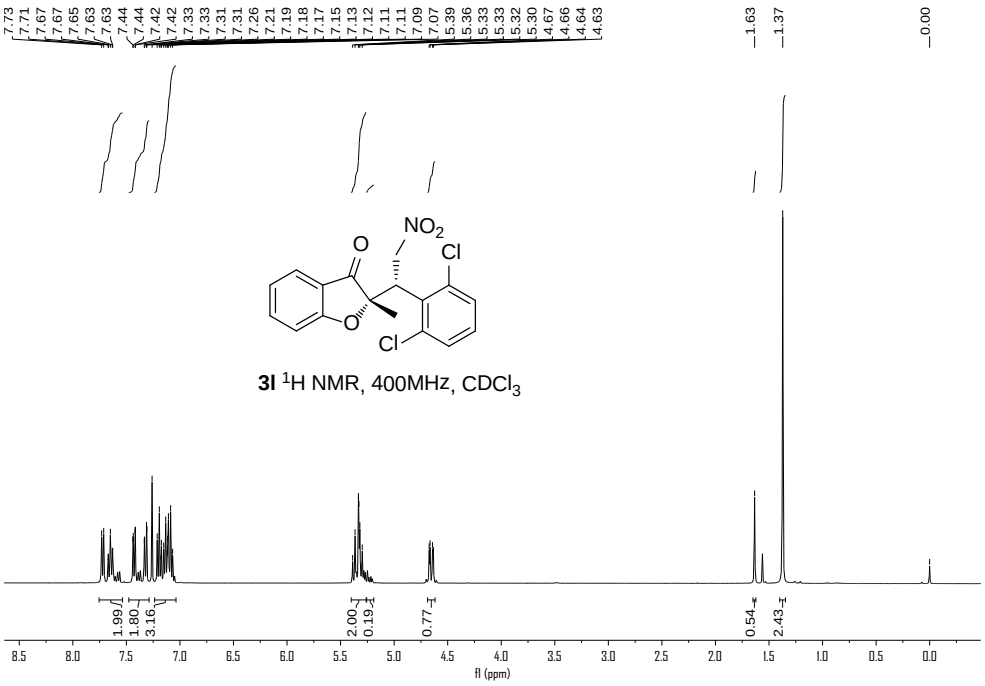
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.54 (m, 2H), 7.37 (ddd, *J* = 42.5, 8.2, 1.3 Hz, 2H), 7.24 – 7.04 (m, 3H), 5.40 – 5.26 (m, 2H), 4.65 (dd, *J* = 12.6, 3.4 Hz, 1H), 1.63 (s, 1H), 1.37 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.92 , 171.17 , 138.93 , 138.57 , 135.28 , 130.86 , 130.67 , 130.03 , 129.24 , 125.13 , 122.73 , 119.69 , 113.66 , 89.72 , 73.03 , 45.43 , 21.38

HRMS (ESI) caled for $C_{17}H_{13}Cl_2NO_4$ $(M+Na)^+$: 388.0119, found: 388.0118.

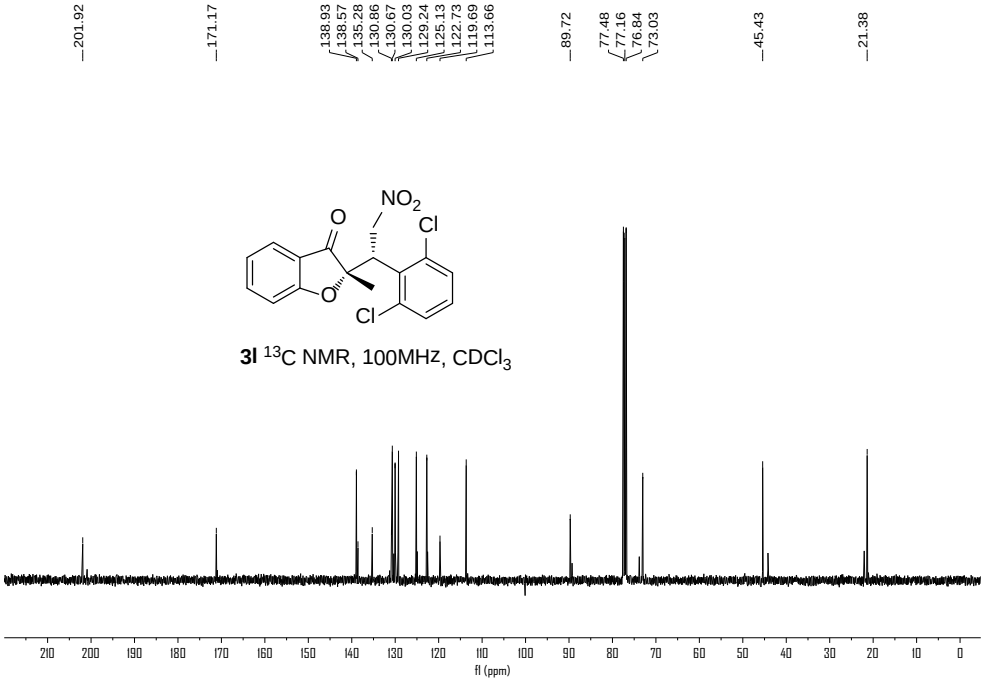
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 17.65 min, t_2 = 18.64 min; minor isomer: t_3 = 14.30 min, t_4= 15.36 min)

$[\alpha]^{25}_{D}$ -31.3 (c = 0.5, $CHCl_3$)

NMR copies of major product of compound **3l**:



3l ^{1}H NMR, 400MHz, $CDCl_3$

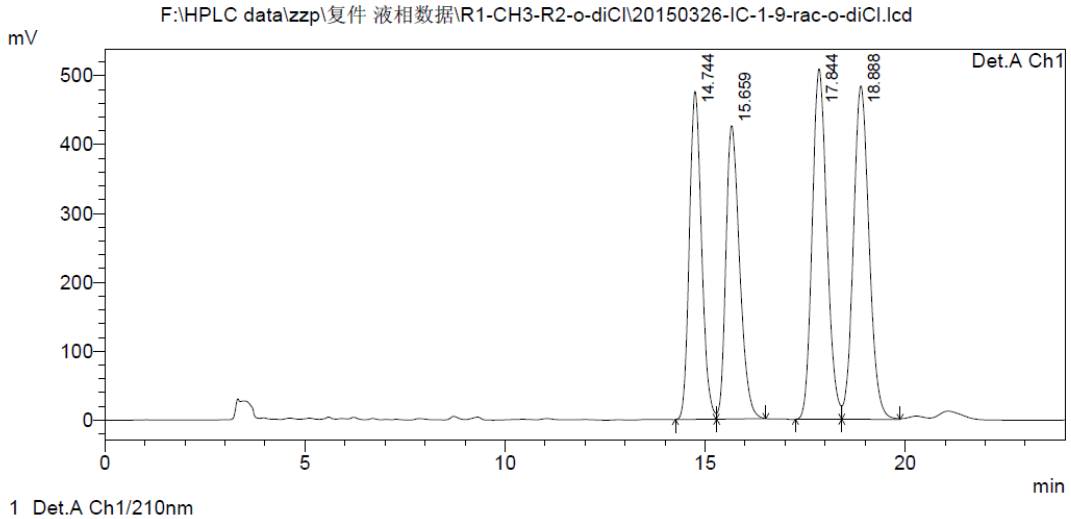


3l ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3l**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



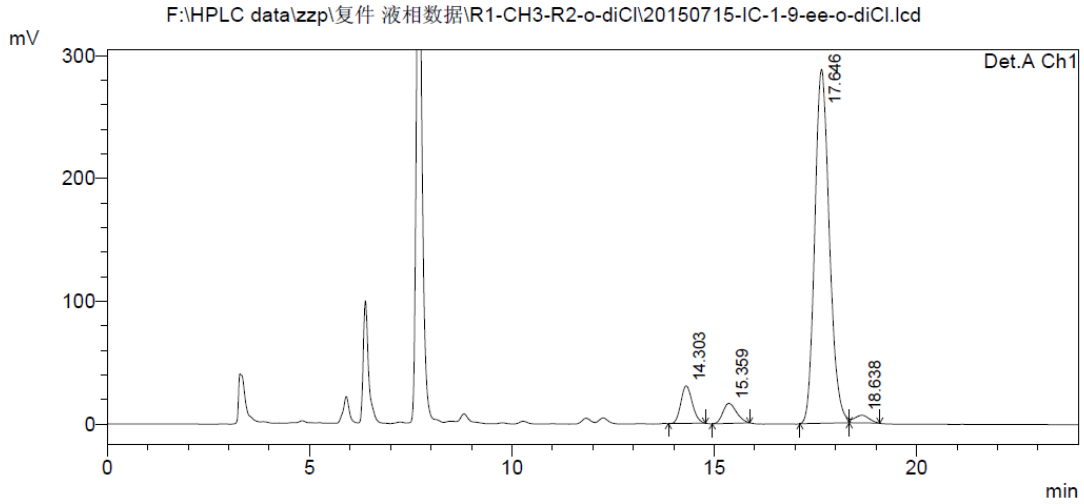
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.744	10089769	476001	21.736	25.132
2	15.659	10155206	425581	21.877	22.470
3	17.844	12983764	508622	27.970	26.854
4	18.888	13191426	483790	28.417	25.543
Total		46420165	1893994	100.000	100.000

3l iPrOH/Hex 1/9 IC

<Chromatogram>

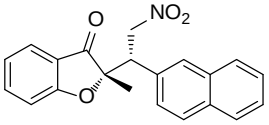


PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	14.303	600659	30615	7.177	8.960
2	15.359	380986	16434	4.552	4.809
3	17.646	7226135	288340	86.339	84.385
4	18.638	161743	6309	1.933	1.846
Total		8369524	341697	100.000	100.000

Compound 3m: 2-methyl-2-(1-(naphthalen-2-yl)-2-nitroethyl)benzofuran-3(2H)-one



3m

Compound 3m: light yellow soild, 86% isolated yield.

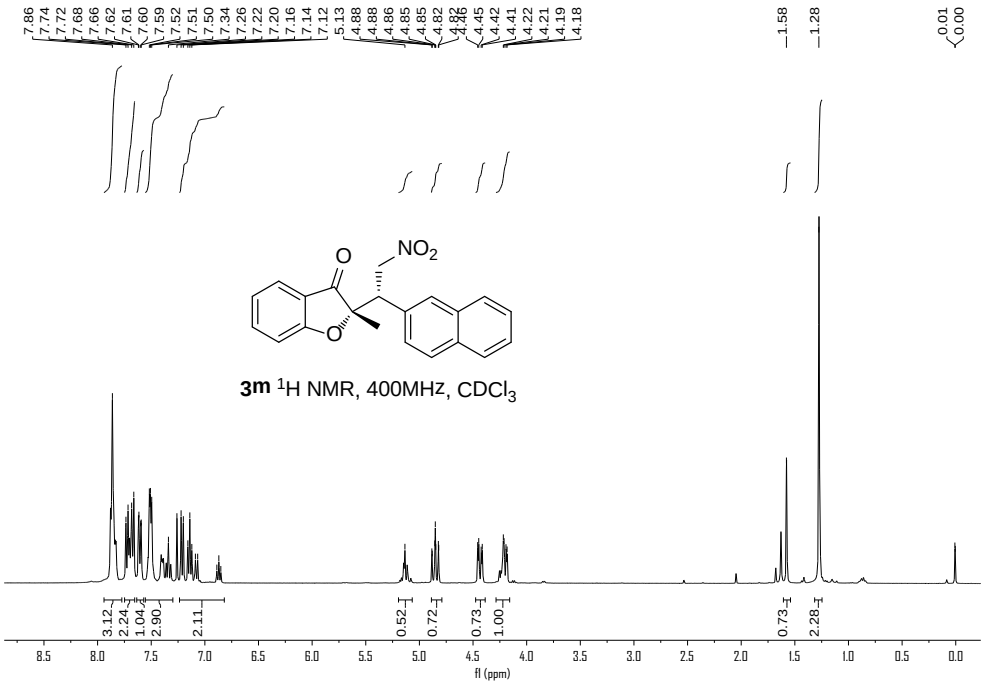
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (s, 3H), 7.70 (dd, *J* = 21.3, 7.9 Hz, 2H), 7.61 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.55 – 7.30 (m, 3H), 7.24 – 6.82 (m, 2H), 5.13 (s, 1H), 4.44 (dd, *J* = 13.0, 4.0 Hz, 1H), 4.20 (dd, *J* = 10.6, 3.4 Hz, 1H), 1.58 (s, 1H), 1.28 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.56 , 171.37 , 139.12 , 138.52 , 133.27 , 133.24 , 132.05 , 129.23 , 128.84 , 128.16 , 127.78 , 127.54 , 126.59, 125.00 , 122.82 , 120.09 , 113.79 , 90.37 , 75.80 , 49.85 , 21.71

HRMS (ESI) caled for $C_{21}H_{17}NO_4$ $(M+Na)^+$: 370.1055, found: 370.1055.

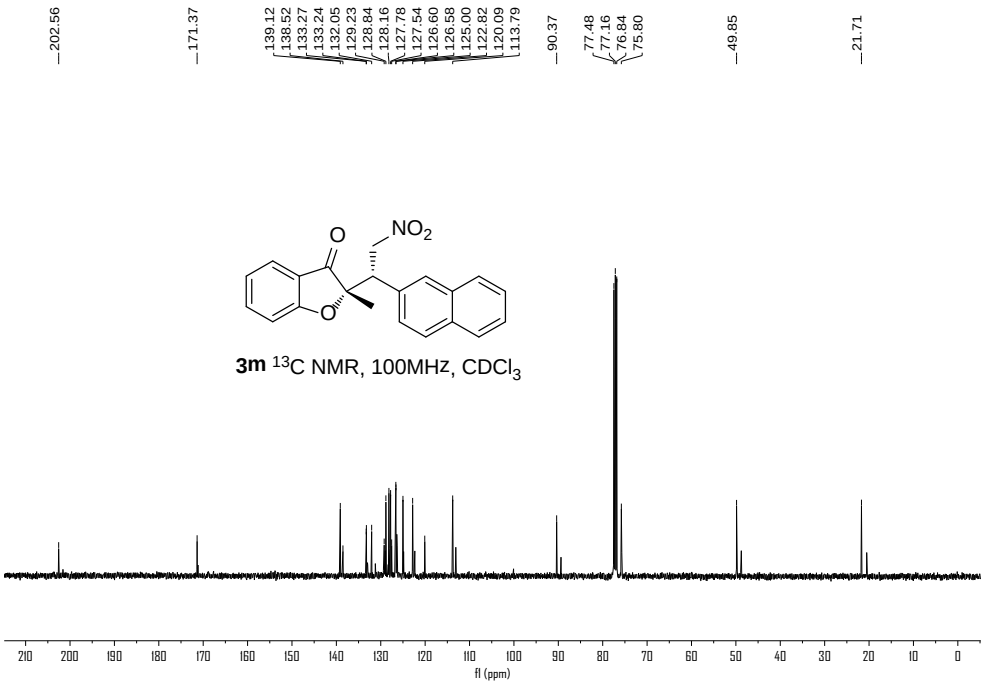
HPLC The enantiomeric excess was determined by HPLC with an AD-H column at 210 nm (2-propanol: hexane=1:19), 1.0 mL/min; major isomer: t_1 = 15.71 min, t_2 = 25.99 min; minor isomer: t_3 = 17.92 min, t_4= 27.53 min).

$[\alpha]^{25}_{D}$ -331.4 (c = 0.6, $CHCl_3$)

NMR copies of major product of compound **3m**:



3m ^{1}H NMR, 400MHz, $CDCl_3$

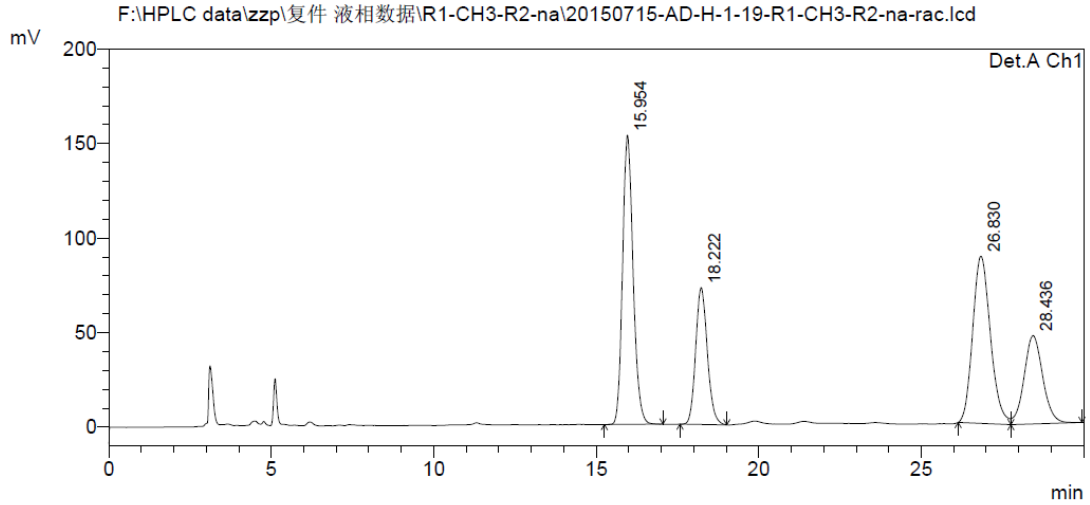


3m ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3m**:

rac iPrOH/Hex 1/19 AD-H

<Chromatogram>



1 Det.A Ch1/210nm

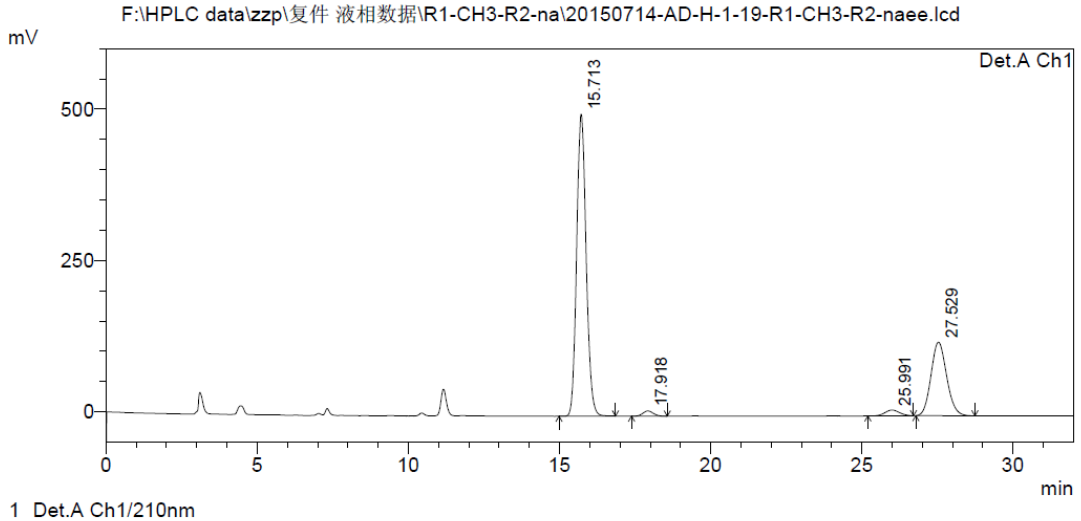
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.954	3452541	153007	32.931	42.426
2	18.222	1808730	72461	17.252	20.092
3	26.830	3357392	88444	32.024	24.524
4	28.436	1865357	46734	17.792	12.958
Total		10484020	360646	100.000	100.000

3m iPrOH/Hex 1/19 AD-H

<Chromatogram>



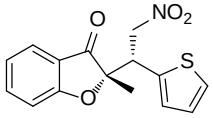
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	15.713	10882809	498831	68.975	78.113
2	17.918	203150	8560	1.288	1.340
3	25.991	319311	9628	2.024	1.508
4	27.529	4372539	121585	27.713	19.039
Total		15777809	638604	100.000	100.000

Compound 3n: 2-methyl-2-(2-nitro-1-(thiophen-2-yl)ethyl)benzofuran-3(2H)-one



3n

Compound 3n: brown oil, 92% isolated yield.

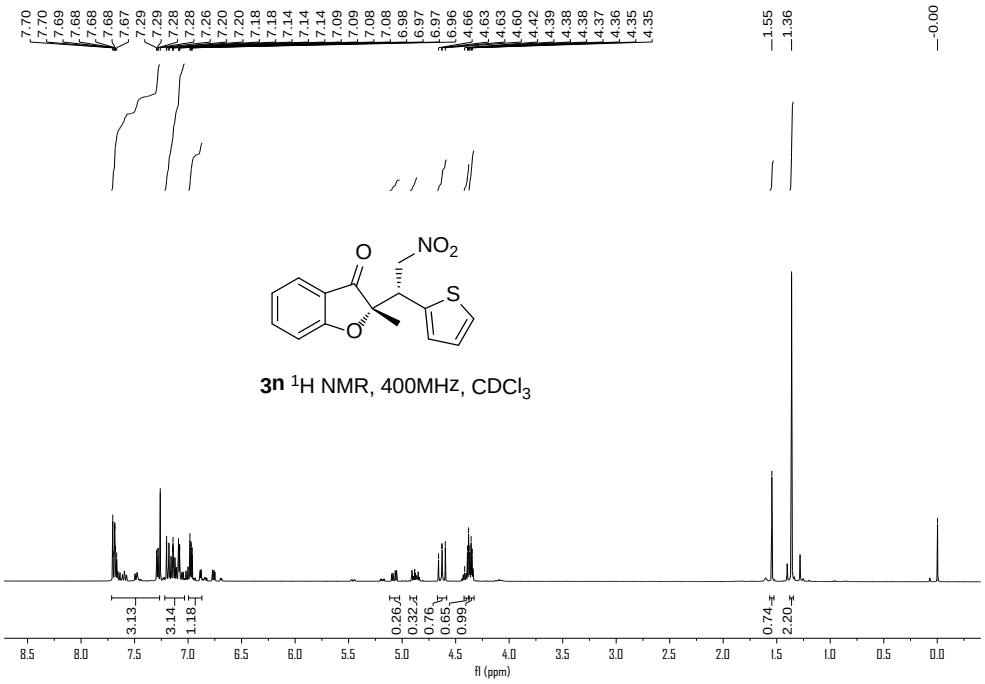
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 – 7.27 (m, 3H), 7.22 – 7.03 (m, 3H), 6.97 (dd, *J* = 5.1, 3.5 Hz, 1H), 4.63 (dd, *J* = 13.5, 11.8 Hz, 1H), 4.42 – 4.38 (m, 1H), 4.38 – 4.33 (m, 1H), 1.55 (s, 1H), 1.36 (s, 2H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 201.99 , 171.35 , 139.15 , 136.05 , 128.79 , 127.01 , 126.49 , 126.21 , 124.99 , 122.88 , 120.20 , 89.71 , 76.55 , 45.38 , 21.33

HRMS (ESI) caled for $C_{15}H_{13}NO_4S$ $(M+Na)^+$: 326.0463, found: 326.0460.

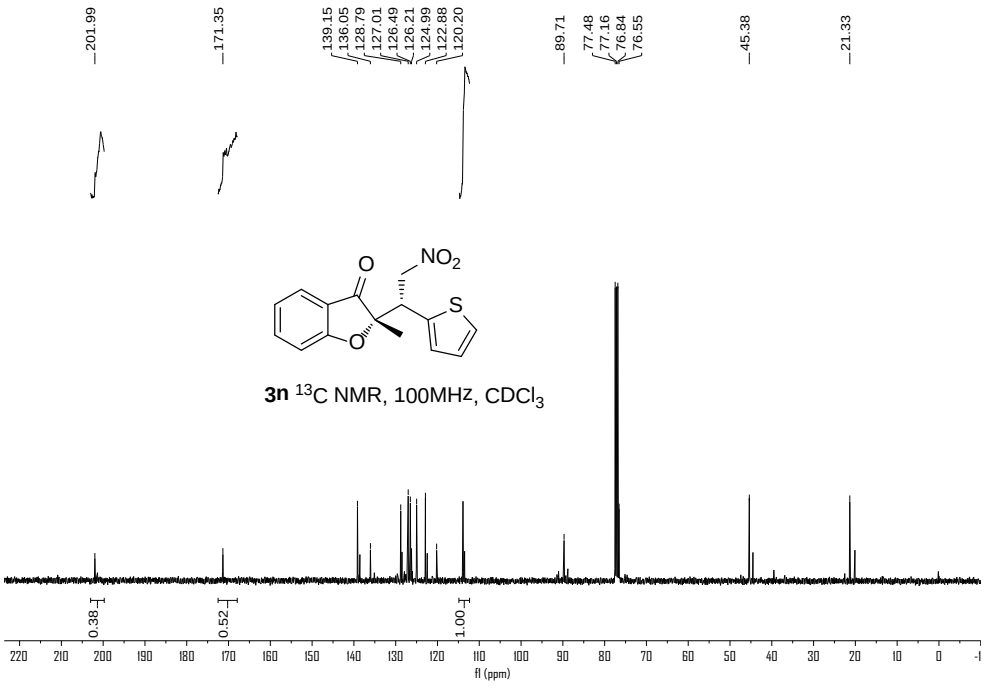
HPLC The enantiomeric excess was determined by HPLC with an AD-H column at 210 nm (2-propanol: hexane=1:19), 1.0 mL/min; major isomer: t_1 = 12.03 min, t_2 = 14.82 min; minor isomer: t_3 = 14.13 min, t_4= 16.14 min).

$[\alpha]^{25}_D$ -60.0 (c = 0.6, $CHCl_3$)

NMR copies of major product of compound **3n**:



3n ^{1}H NMR, 400MHz, $CDCl_3$

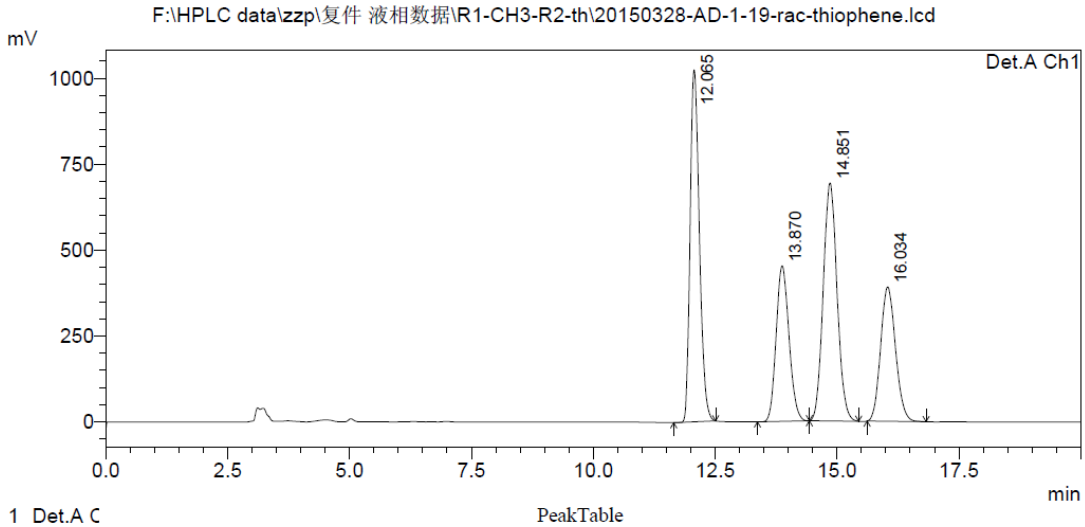


3n ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3n**:

rac iPrOH/Hex 1/19 AD-H

<Chromatogram>



1 Det.A C

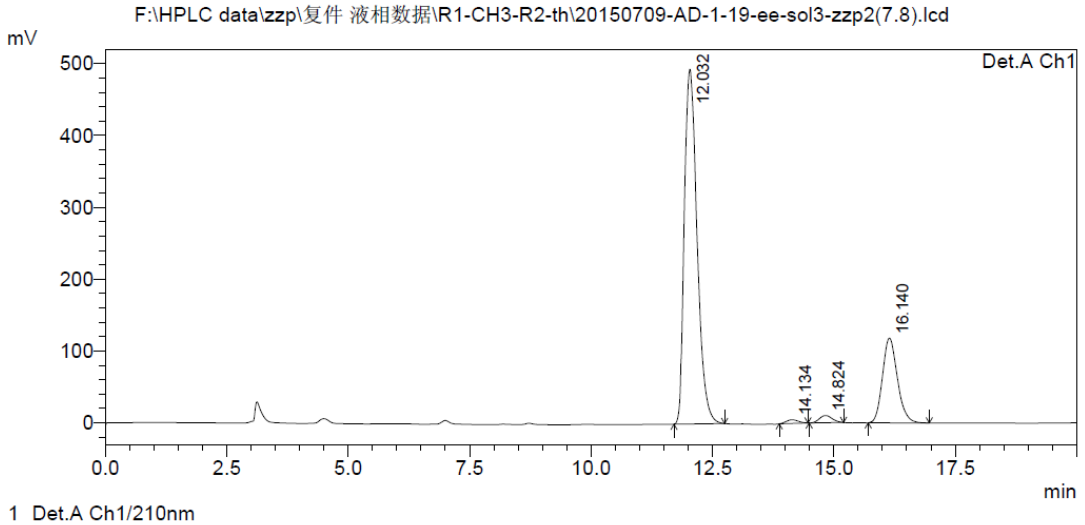
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.065	13544962	1024038	30.860	40.004
2	13.870	8302731	452342	18.916	17.671
3	14.851	13711949	692470	31.240	27.051
4	16.034	8332220	390983	18.984	15.274
Total		43891863	2559833	100.000	100.000

3n iPrOH/Hex 1/19 AD-H

<Chromatogram>



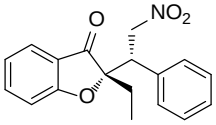
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	12.032	9001929	493982	76.329	78.746
2	14.134	88561	5160	0.751	0.823
3	14.824	184878	10132	1.568	1.615
4	16.140	2518240	118034	21.353	18.816
Total		11793609	627308	100.000	100.000

Compound 3o: 2-ethyl-2-(2-nitro-1-phenylethyl)benzofuran-3(2H)-one



3o

Compound 3o: Colorless oil, 99% isolated yield.

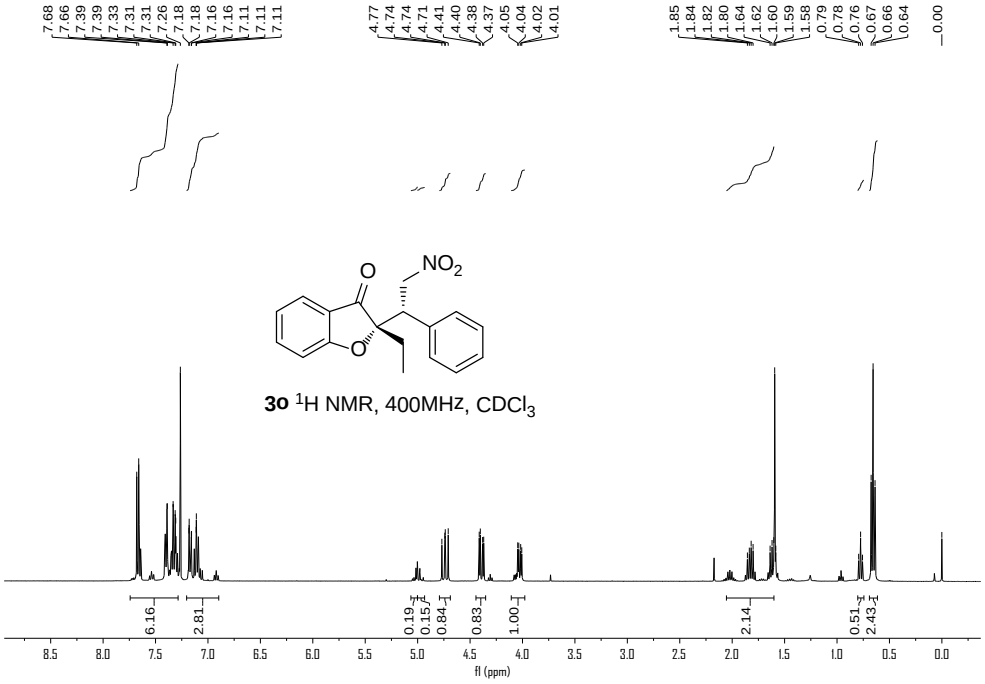
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 – 7.28 (m, 6H), 7.20 – 6.90 (m, 3H), 4.74 (dd, *J* = 13.0, 11.3 Hz, 1H), 4.39 (dd, *J* = 13.0, 4.1 Hz, 1H), 4.03 (dd, *J* = 11.3, 4.1 Hz, 1H), 2.05 – 1.60 (m, 2H), 0.72 (dt, *J* = 47.8, 7.4 Hz, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.77 , 172.30 , 139.05 , 134.59 , 129.46 , 129.36 , 128.84 , 128.58 , 128.45 , 124.36 , 122.58 , 121.83 , 113.30 , 93.10 , 75.81 , 49.55 , 28.90 , 7.00 .

HRMS (ESI) caled for $C_{18}H_{17}NO_4$ $(M+Na)^+$: 334.1055, found: 334.1052.

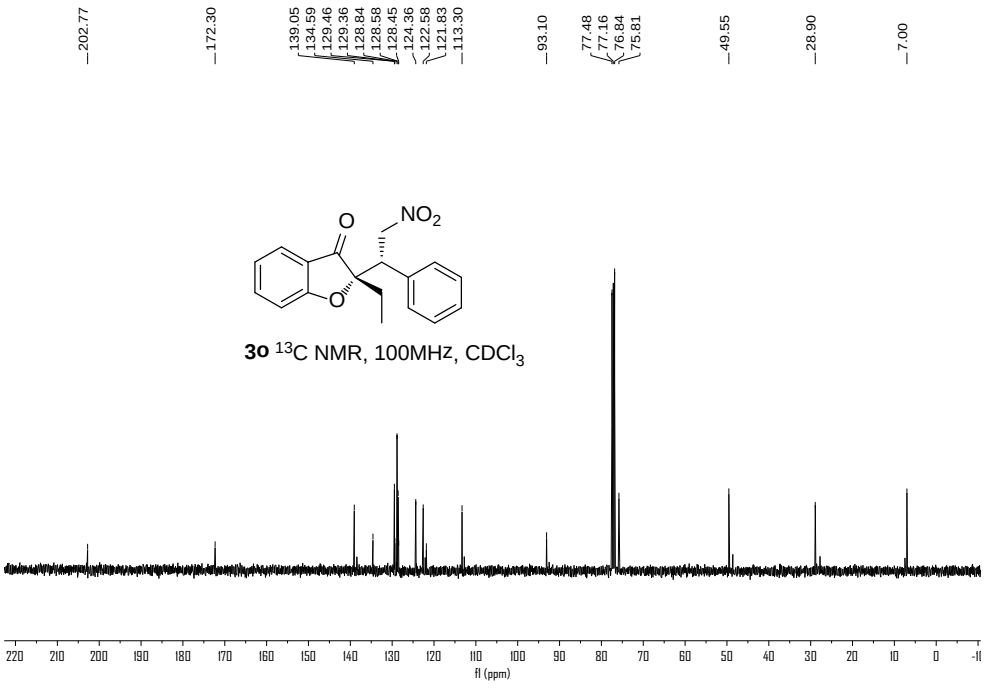
HPLC The enantiomeric excess was determined by HPLC with an AD-H column at 210 nm (2-propanol: hexane=1:19), 1.0 mL/min; major isomer: t_1 = 11.87 min, t_2 = 15.49 min; minor isomer: t_3 = 11.25 min, t_4= 14.10 min).

$[\alpha]^{25}_{D}$ -170.8 (c = 0.9, $CHCl_3$)

NMR copies of major product of compound **3o**:



3o ^{1}H NMR, 400MHz, $CDCl_3$

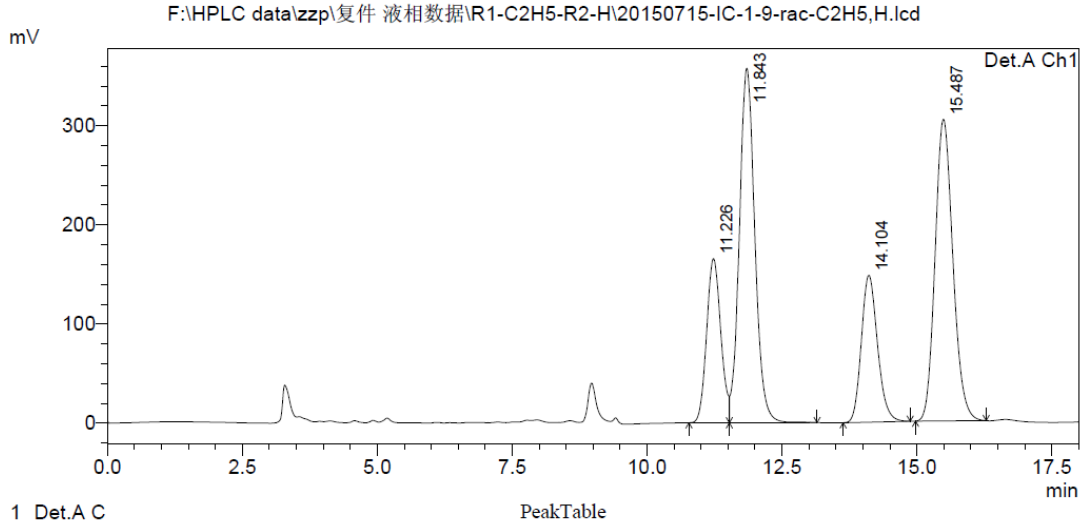


3o ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3o**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



1 Det.A C

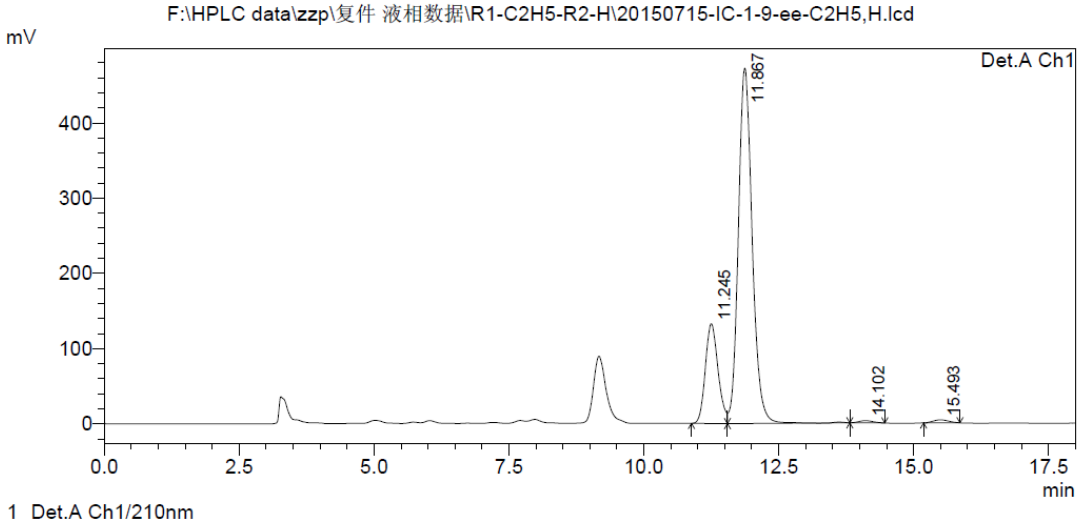
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.226	3037215	165656	14.987	16.971
2	11.843	7135451	357802	35.209	36.655
3	14.104	3092352	148211	15.259	15.183
4	15.487	7001071	304463	34.546	31.191
Total		20266089	976133	100.000	100.000

3o iPrOH/Hex 1/9 IC

<Chromatogram>



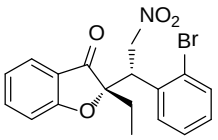
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.245	2174319	132610	20.301	21.679
2	11.867	8403674	472138	78.464	77.183
3	14.102	52222	2930	0.488	0.479
4	15.493	80038	4033	0.747	0.659
Total		10710254	611711	100.000	100.000

Compound 3p: 2-(1-(2-bromophenyl)-2-nitroethyl)-2-ethylbenzofuran-3(2H)-one



3p

Compound 3p: yellow oil, 95% isolated yield.

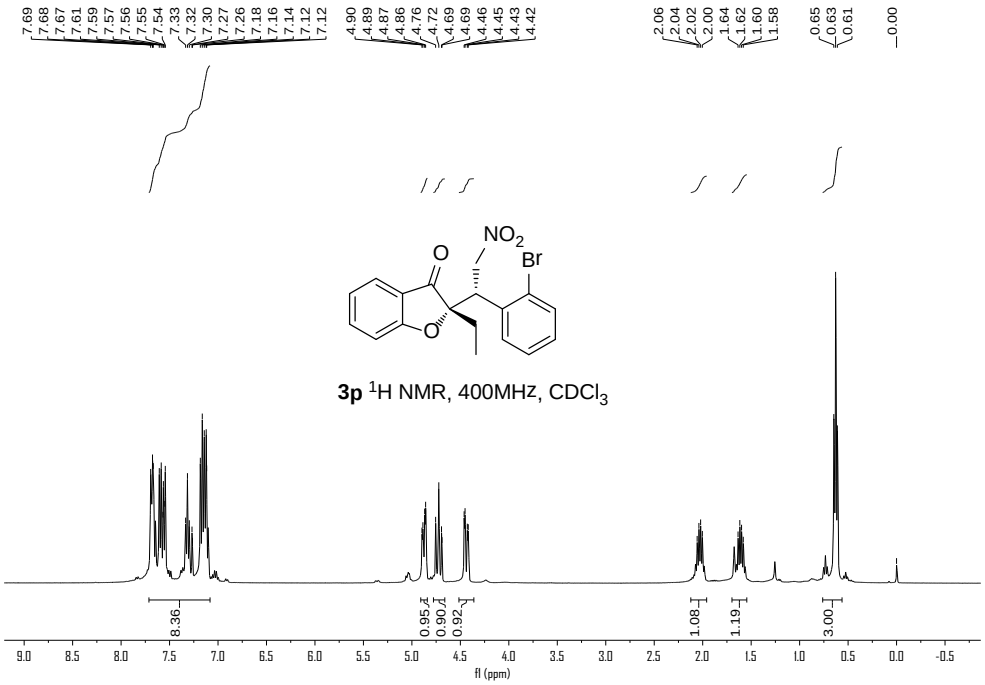
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 – 7.08 (m, 8H), 4.91 – 4.84 (m, 1H), 4.72 (t, *J* = 12.2 Hz, 1H), 4.44 (dd, *J* = 13.1, 3.8 Hz, 1H), 2.03 (dd, *J* = 14.3, 7.2 Hz, 1H), 1.61 (dd, *J* = 14.3, 7.2 Hz, 1H), 0.63 (t, *J* = 7.3 Hz, 3H).
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.24 , 172.18 , 139.13 , 134.48 , 133.60 , 129.83 , 128.84 , 127.96 , 127.22 , 124.36 , 122.66 , 121.76 , 113.16 , 93.20 , 75.25 , 47.08 , 28.19 , 7.01

HRMS (ESI) caled for $C_{18}H_{16}BrNO_4$ $(M+Na)^+$: 412.0160, found: 412.0155.

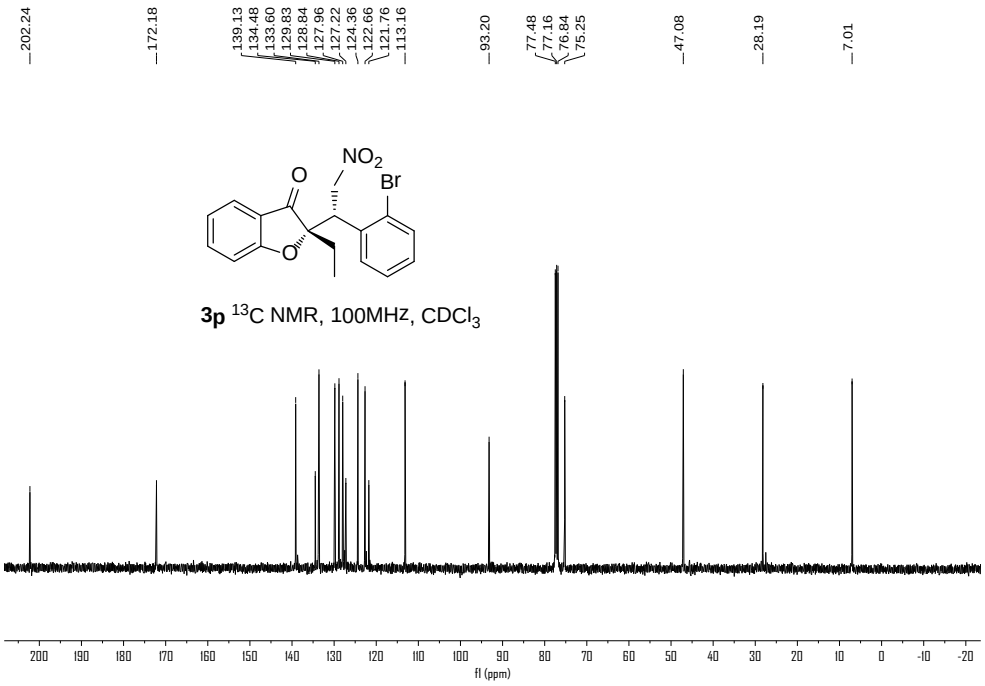
HPLC The enantiomeric excess was determined by HPLC with an OD-H column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 10.05 min, t_2 = 13.79 min; minor isomer: t_3 = 12.15 min, t_4= 12.48 min).

$[\alpha]^{25}_{D}$ -216.2 (c = 1.0, $CHCl_3$)

NMR copies of major product of compound **3p**:



3p ^{1}H NMR, 400MHz, $CDCl_3$

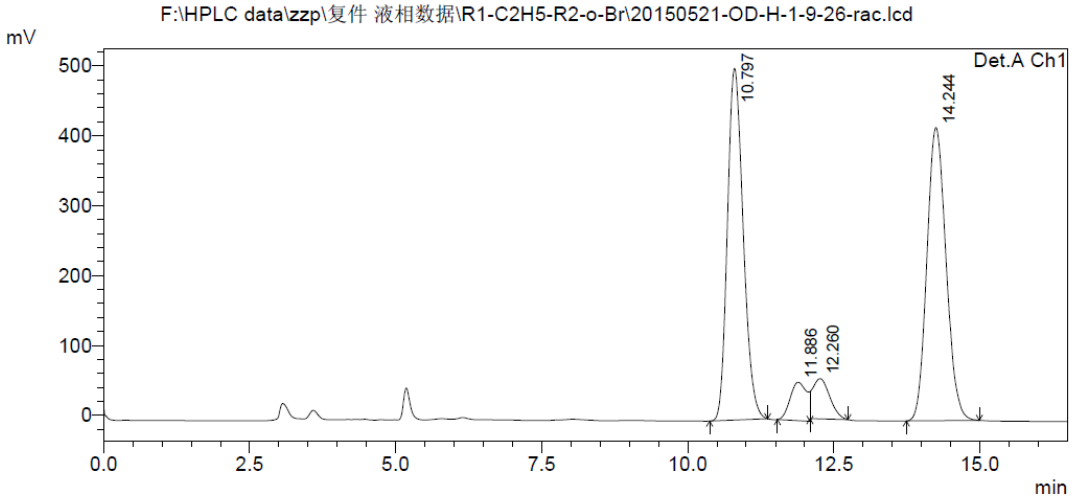


3p ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3p**:

rac iPrOH/Hex 1/9 OD-H

<Chromatogram>



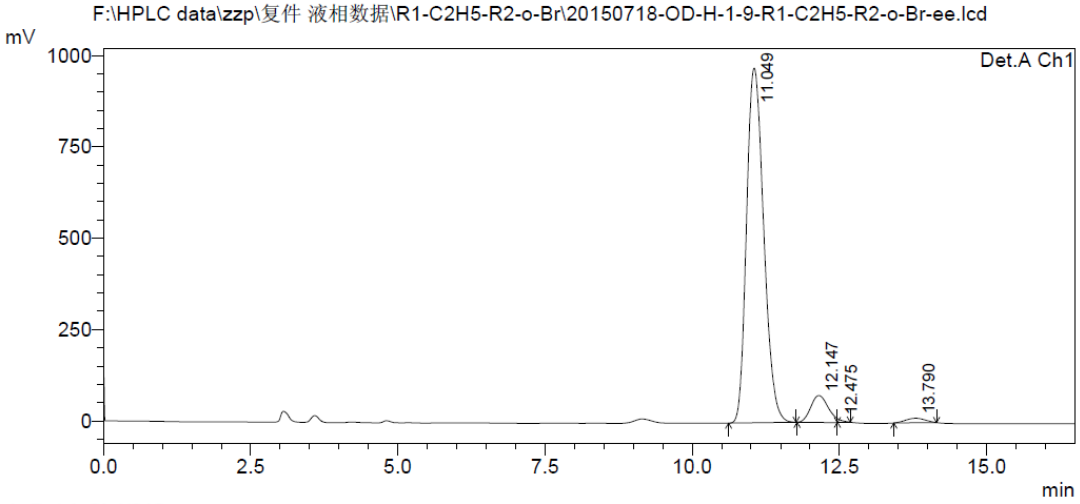
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	10.797	9477445	503709	44.434	48.616
2	11.886	1104623	54998	5.179	5.308
3	12.260	1172758	57574	5.498	5.557
4	14.244	9574449	419806	44.889	40.518
Total		21329275	1036087	100.000	100.000

3p iPrOH/Hex 1/9 OD-H

<Chromatogram>

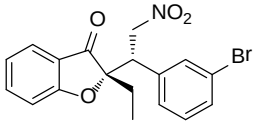


PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.049	19693054	970700	91.492	91.106
2	12.147	1505242	73723	6.993	6.919
3	12.475	42278	8701	0.196	0.817
4	13.790	283805	12333	1.319	1.157
Total		21524379	1065457	100.000	100.000

Compound 3q: 2-(1-(3-bromophenyl)-2-nitroethyl)-2-ethylbenzofuran-3(2H)-one



3q

Compound 3q: yellow soild, 62% isolated yield.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 – 7.30 (m, 5H), 7.24 – 6.92 (m, 3H), 4.70 (dd, *J* = 13.0, 11.3, 1.4 Hz, 1H), 4.43 – 4.34 (m, 1H), 3.99 (dd, *J* = 11.2, 4.0 Hz, 1H), 2.10 – 1.56 (m, 2H), 0.84 – 0.62 (m, 3H).

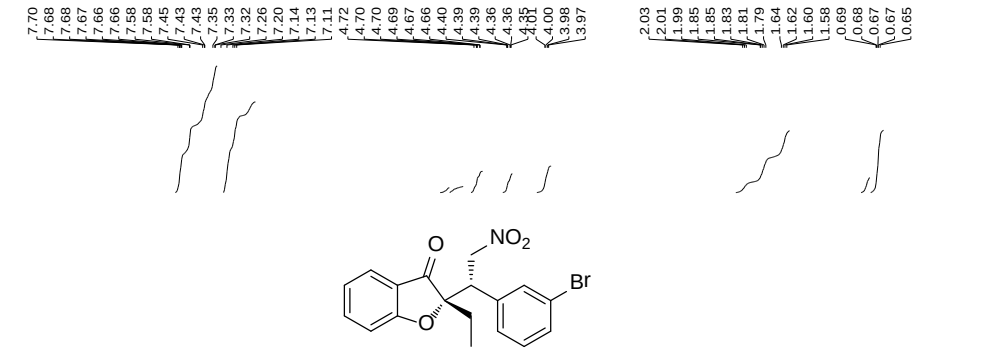
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.31 , 172.21 , 139.21 , 136.97 , 132.39 , 131.81 , 130.36 , 128.16 , 124.40 , 122.91 , 122.76 , 121.67 , 113.34 , 92.67 , 75.48 , 49.11 , 28.89 , 6.98.

HRMS (ESI) caled for $C_{18}H_{16}BrNO_4$ $(M+Na)^+$: 412.0160, found: 412.0157.

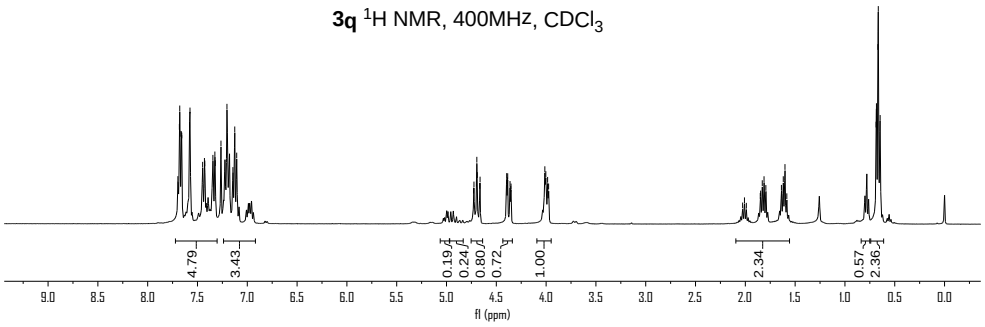
HPLC The enantiomeric excess was determined by HPLC with an IC column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 9.91 min, t_2 = 13.07 min; minor isomer: t_3 = 11.14 min, t_4= 12.30 min).

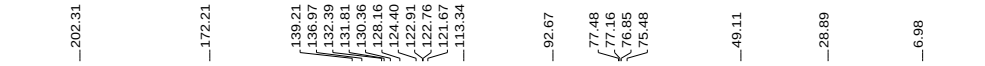
$[\alpha]^{25}_{D}$ -96.9 (c = 0.2, $CHCl_3$)

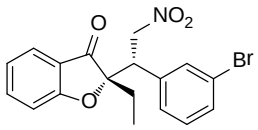
NMR copies of major product of compound **3q**:



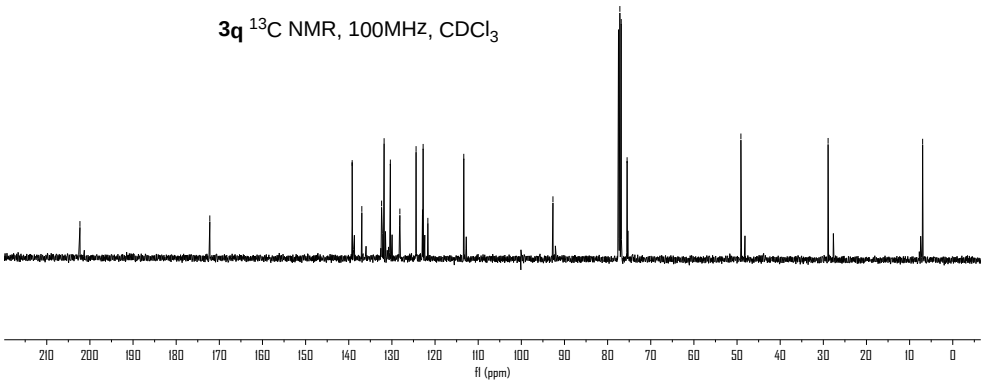
3q ^{1}H NMR, 400MHz, $CDCl_3$







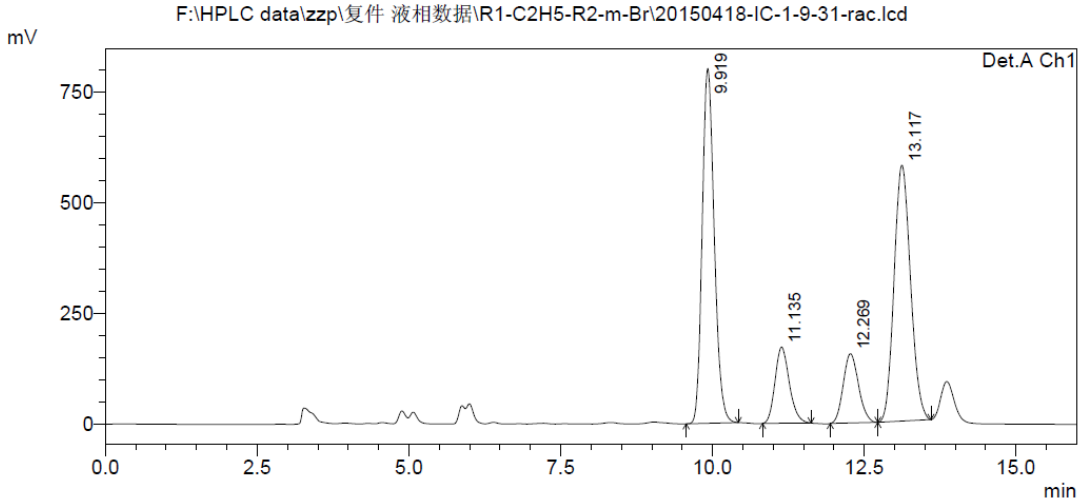
3q ^{13}C NMR, 100MHz, $CDCl_3$



HPLC copies of compound **3q**:

rac iPrOH/Hex 1/9 IC

<Chromatogram>



1 Det.A Ch1/210nm

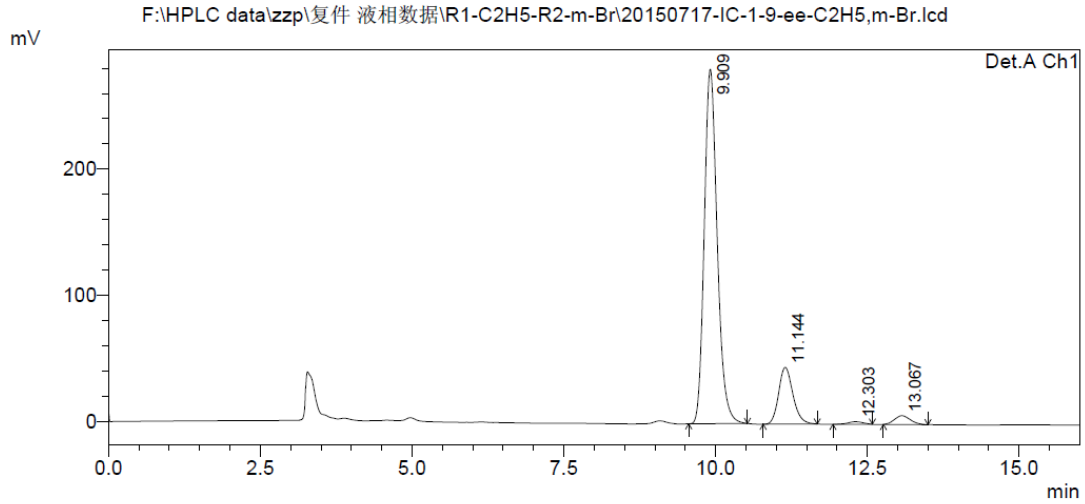
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.919	11039426	800510	40.142	46.931
2	11.135	2825819	171755	10.275	10.069
3	12.269	2736720	156214	9.951	9.158
4	13.117	10898936	577256	39.631	33.842
Total		27500901	1705734	100.000	100.000

3q iPrOH/Hex 1/9 IC

<Chromatogram>



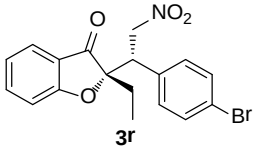
1 Det.A Ch1/210nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	9.909	4166280	280854	82.282	83.856
2	11.144	736488	45048	14.545	13.450
3	12.303	34033	2040	0.672	0.609
4	13.067	126630	6981	2.501	2.084
Total		5063430	334924	100.000	100.000

Compound 3r: 2-(1-(4-bromophenyl)-2-nitroethyl)-2-ethylbenzofuran-3(2H)-one



3r

Compound 3r: Colorless oil, 92% isolated yield.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 – 7.27 (m, 5H), 7.26 – 6.93 (m, 3H), 4.69 (dd, *J* = 13.1, 11.4 Hz, 1H), 4.38 (dd, *J* = 13.1, 4.1 Hz, 1H), 4.00 (dd, *J* = 11.5, 4.0 Hz, 1H), 2.11 – 1.61 (m, 2H), 0.66 (t, *J* = 7.4 Hz, 3H).

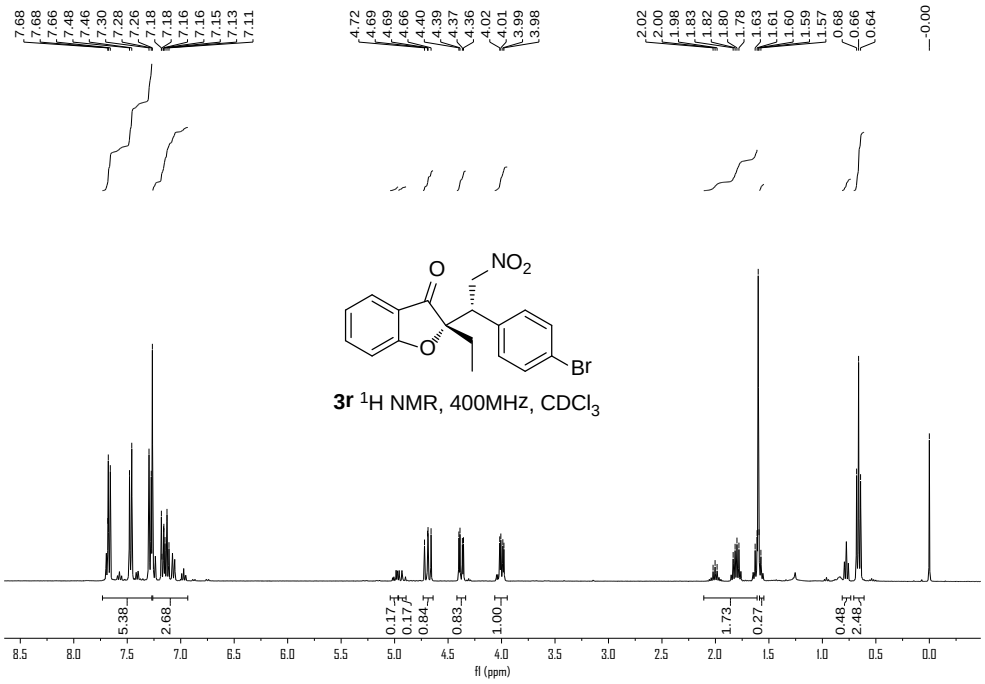
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.42 , 172.19 , 139.22 , 138.72 , 133.63 , 132.74 , 132.06 , 131.11 , 130.97 , 124.43 , 122.77 , 121.67 , 113.31 , 92.67 , 75.54 , 48.96 , 28.89 , 6.98 .

HRMS (ESI) caled for $C_{18}H_{16}BrNO_4$ $(M+Na)^+$: 412.0160, found: 412.0159.

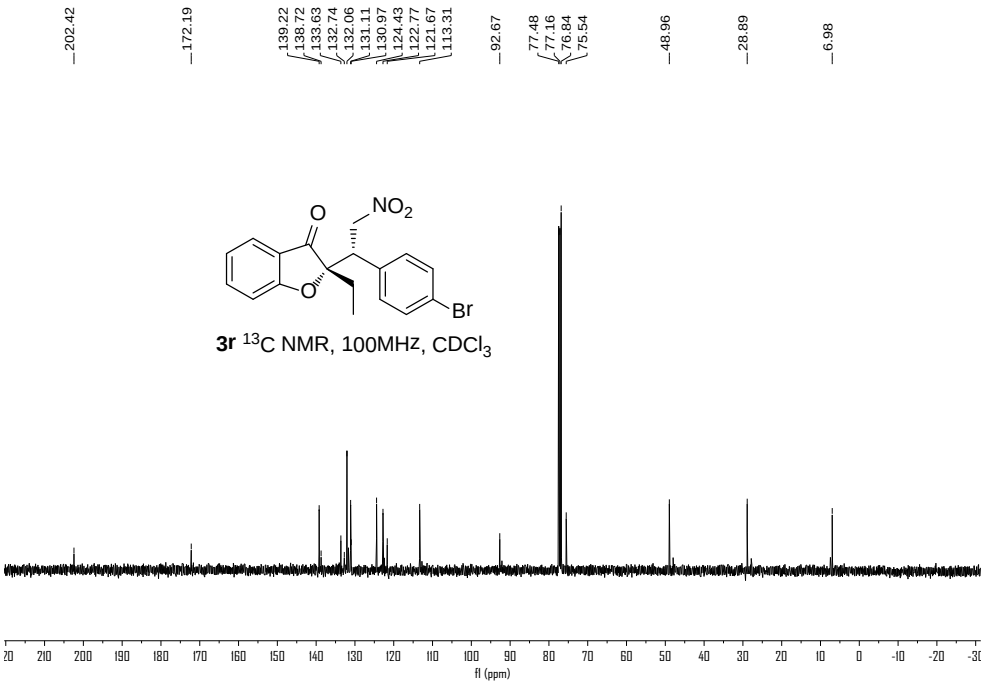
HPLC The enantiomeric excess was determined by HPLC with an OD-H column at 210 nm (2-propanol: hexane=1:9), 1.0 mL/min; major isomer: t_1 = 11.25 min, t_2 = 16.48 min; minor isomer: t_3 = 13.78 min, t_4= 15.54 min).

$[\alpha]^{25}_{D}$ -232.3 (c = 1.0, $CHCl_3$)

NMR copies of major product of compound **3r**:



3r ^{1}H NMR, 400MHz, $CDCl_3$

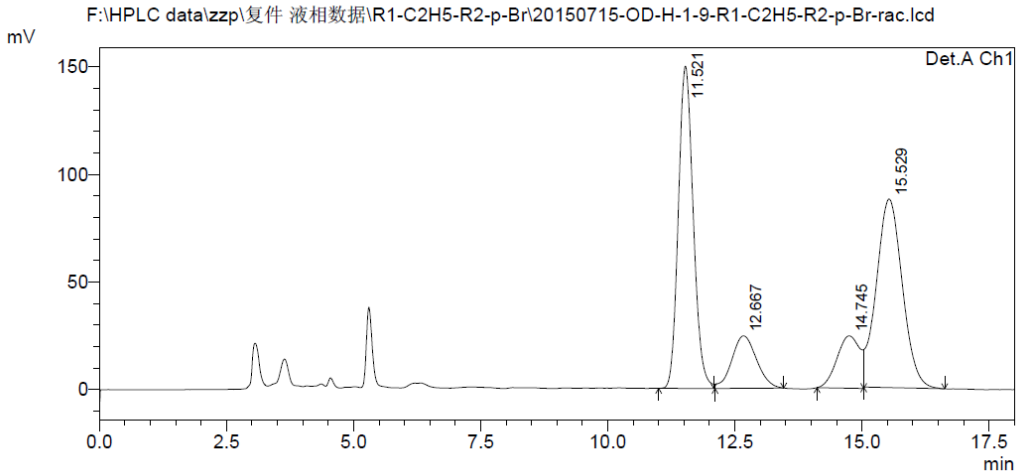


3r ^{13}C NMR, 100MHz, $CDCl_3$

HPLC copies of compound **3r**:

rac iPrOH/Hex 1/9 OD-H

<Chromatogram>



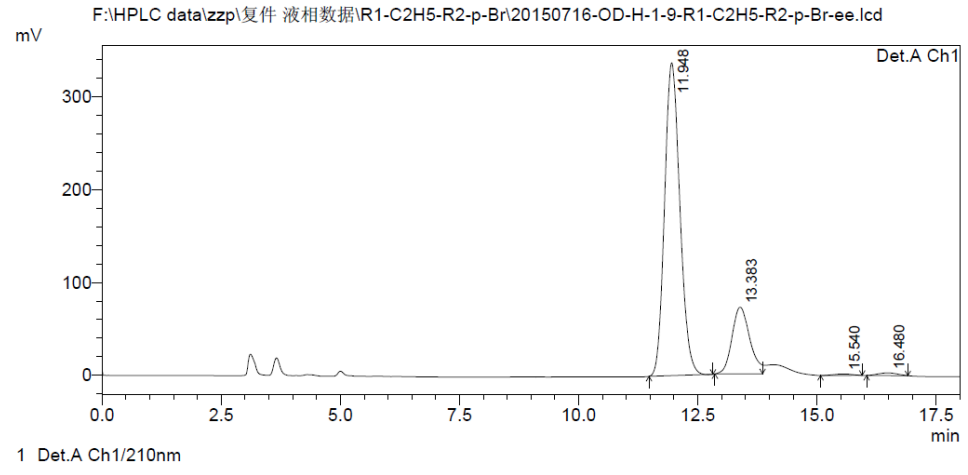
PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.521	3059559	149776	39.343	52.349
2	12.667	823005	24352	10.583	8.511
3	14.745	767021	24324	9.863	8.502
4	15.529	3126998	87658	40.210	30.638
Total		7776583	286111	100.000	100.000

3r iPrOH/Hex 1/9 OD-H

<Chromatogram>

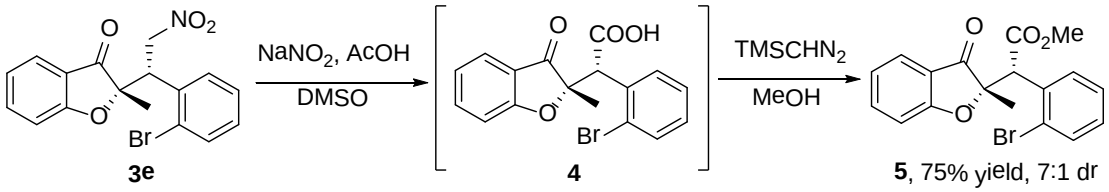


PeakTable

Detector A Ch1 210nm

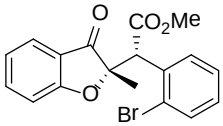
Peak#	Ret. Time	Area	Height	Area %	Height %
1	11.948	7529892	336863	79.199	81.572
2	13.383	1857649	71737	19.539	17.371
3	15.540	40676	1528	0.428	0.370
4	16.480	79388	2836	0.835	0.687
Total		9507605	412964	100.000	100.000

Details for the transformation of the conjugate adduct:



3e (1.0 mmol) was dissolved in DMSO (2.5 mL) at room temperature, $NaNO_2$ (3 equiv.) was added, followed by the addition of acetic acid (10 equiv.). The resulting mixture was heated to 40 ^oC and then stirred at that temperature for 16 h. Aqueous HCl solution (1N, 10 mL) was added to the mixture, and the resulting mixture was extracted with ethyl acetate (30 mL x 3). The combined organic phases were washed with brine, dried over anhydrous Na_2SO_4, concentrated and purified by column chromatography (hexane/ethyl acetate = 2:1) to afford acid **4** as a light yellow oil (70% yield). **4** (0.23 mmol) was dissolved in MeOH (2 mL) and the resulting solution was cooled down to 0 ^oC. Then $TMSCHN_2$ (1.15 mL, 2M solution in hexane, 10 equiv.) was added in portions (100 μL every 15 min, 12 times). The reaction mixture was diluted with ethyl acetate (10 mL) and water (10 mL). The organic layer was separated and the aqueous layer was extracted with ethyl acetate (10 mL x 2). The combined organic phases were washed with brine and dried over anhydrous Na_2SO_4, filtered and concentrated. And the residue was purified by column chromatography (hexane/ethylacetate = 6:1) to afford the methyl ester **5** as a light yellow oil (75% yield, 7:1 dr).

Compound 5: methyl 2-(2-bromophenyl)-2-(2-methyl-3-oxo-2,3-dihydrobenzofuran-2-yl)acetate



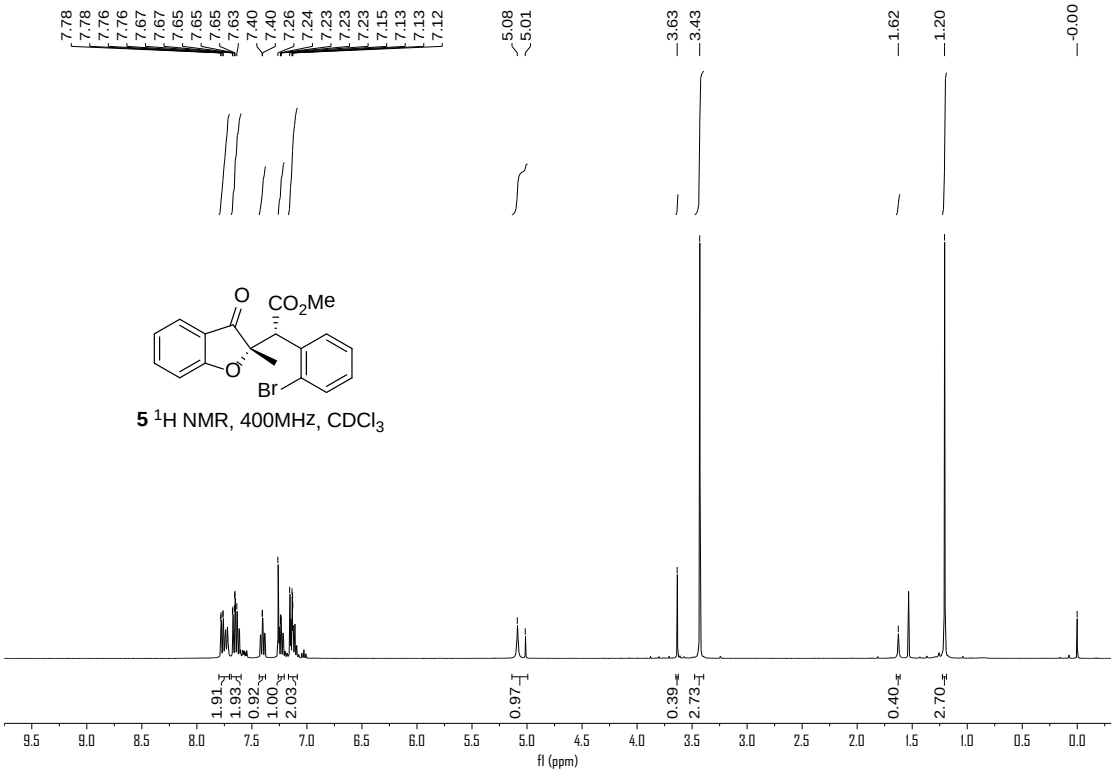
5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (dd, *J* = 7.7, 0.8 Hz, 2H), 7.68 – 7.59 (m, 2H), 7.40 (d, *J* = 1.3 Hz, 1H), 7.23 (dd, *J* = 1.7, 0.7 Hz, 1H), 7.16 – 7.08 (m, 2H), 5.05 (d, *J* = 29.0 Hz, 1H), 3.43 (s, 3H), 1.20 (s, 3H).

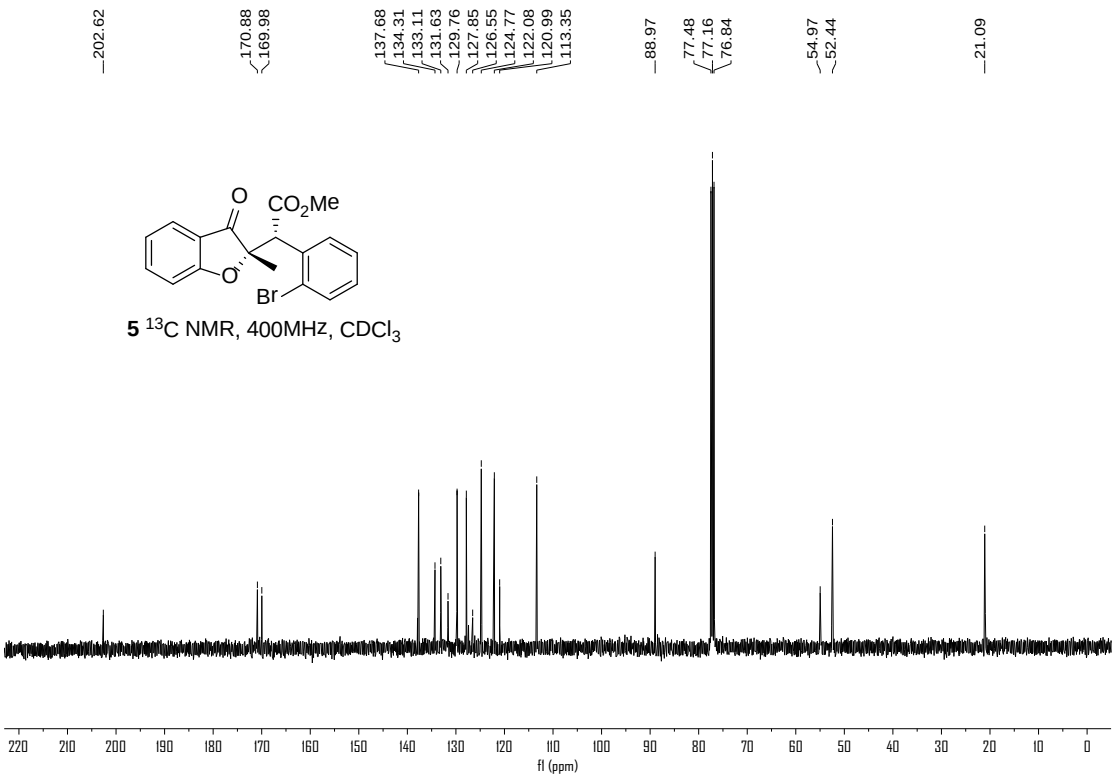
^{13}C NMR (100 MHz, $CDCl_3$) δ 202.62, 170.88, 169.98, 137.68, 134.31, 133.11, 131.63, 129.76, 127.85, 126.55, 124.77, 122.08, 120.99, 113.35, 88.97, 54.97, 52.44, 21.09.

HRMS (ESI) caled for $C_{18}H_{15}BrO_4$ $(M+H)^+$: 375.0220, found: 375.0226.

$[\alpha]^{25}_D$ +13.6 (c = 0.8, $CHCl_3$).



5 ^{1}H NMR, 400MHz, $CDCl_3$



5 ^{13}C NMR, 400MHz, $CDCl_3$

4. X-ray crystallography data of 3p.

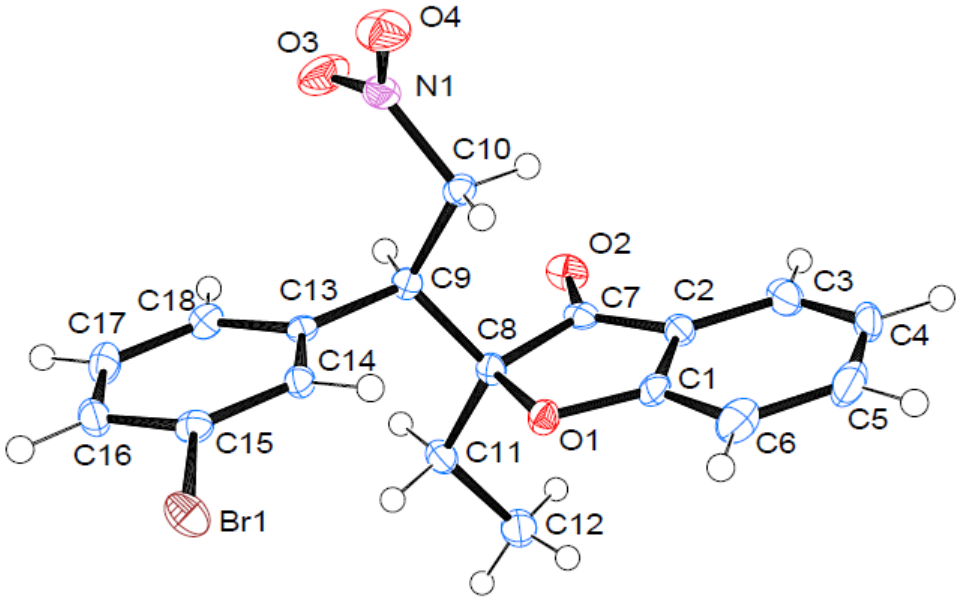


Figure S1 X-ray crystallography data of **3q.**

Table 1. Crystal data and structure refinement for shelxl.

Identification code	shelxl
Empirical formula	C18 H16 Br N O4
Formula weight	390.23
Temperature	113(2) K
Wavelength	0.71075 A
Crystal system, space group	Monoclinic, P2(1)
Unit cell dimensions	a = 9.528(3) A alpha = 90 deg. b = 7.509(2) A beta = 99.729(7) deg. c = 11.706(4) A gamma = 90 deg.
Volume	825.5(4) A^3
Z, Calculated density	2, 1.570 Mg/m^3
Absorption coefficient	2.512 mm^-1
F(000)	396
Crystal size	0.220 x 0.200 x 0.160 mm
Theta range for data collection	1.765 to 28.754 deg.
Limiting indices	-11<=h<=12, -10<=k<=10, -15<=l<=15
Reflections collected / unique	11465 / 4145 [R(int) = 0.0246]
Completeness to theta = 25.242	99.9 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.668 and 0.564
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	4145 / 1 / 218
Goodness-of-fit on F^2	0.874
Final R indices [I>2sigma(I)]	R1 = 0.0197, wR2 = 0.0366
R indices (all data)	R1 = 0.0225, wR2 = 0.0368
Absolute structure parameter	-0.002(3)
Extinction coefficient	n/a
Largest diff. peak and hole	0.581 and -0.360 e.A^-3

5. Reference

1. (*a*) C. –Y. Lee, E. –H. Chew, M. –L. Go, *Eur. J. Med. Chem.* 2010, **45**, 2957; (*b*) M. Morimoto, H. Fukumoto, T. Nozoe, A. Hagiwara and K. Komai, *J. Agric. Food Chem.*, 2007, **55**, 700.

2. X. Li, X.-S. Xue, C. Liu, B. Wang, B.-X. Tan, J.-L. Jin, Y.-Y. Zhang, N. Dong and J.-P. Cheng, *Org. Biomol. Chem*., 2012, **10**, 413.