Supplementary Information:

# Highly Diastereoselective Friedel-Crafts reaction of Arenes with an *N-tert*-Butanesulfinylimino Ester: Efficient Synthesis of Optically Active α-Arylglycines

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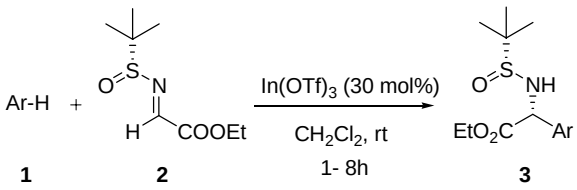
## 1. General

Unless otherwise specified, all reactions were carried out in flame-dried glassware with magnetic stirring under an atmosphere of nitrogen. Solvents were dried and distilled by standard procedures. NMR spectra were recorded on a Varian spectrometer (300 MHz for $^{1}H$, and 100 MHz for $^{13}C$). Chemical shifts are reported in δ ppm referenced to an internal $SiMe_4$ standard for $^{1}H$ NMR and chloroform-*d* (δ 77.16) for $^{13}C$ NMR. HPLC was performed on a JASCO 2000 instrument by using Daicel AS-H, AD-H and AD-3 column with 2-propanol/hexane as the eluent at 214 nm.

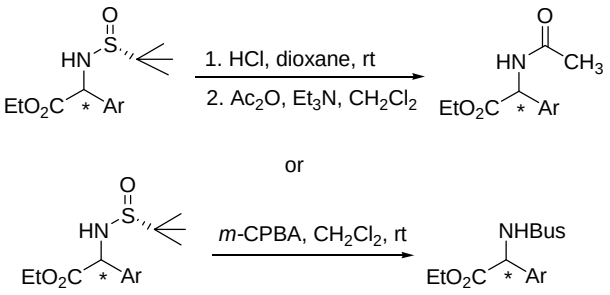
## 2. General Procedure for $In(OTf)_3$-catalyzed Friedel-Crafts Reaction of Arenes 1 with *N-tert*-Butanesulfinylimino Ester 2.




**1** **2** **3**

Under nitrogen atmosphere, $In(OTf)_3$ (0.075 mmol, 30 mol%) was placed into a glass reaction vessel, glyoxylate imine **2** (0.25 mmol) in 2 mL of dry $CH_2Cl_2$ and arene **1** (0.375 mmol) were added successively. The mixture was stirred at room temperature and monitored by TLC. When the reaction was over, a saturated aq. $NH_4Cl$ was added and the mixture was extracted with $CH_2Cl_2$ (10 mL×3). The combined organic phase was dried over $Na_2SO_4$, filtered, and concentrated. The residue was purified by silica gel flash chromatography to afford the corresponding α-arylglycine product **3**.

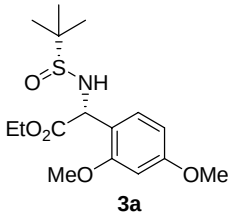
## 3. Determination of the Diastereoselectivity / Enantiomeric Excess.




The diastereoselectivities of the α-arylglycine products were measured as enantiomeric excess for their acetate or *N*-sulfonylate derivatives after the removal or oxidation of the sulfinyl group by chiral HPLC analysis. α-Arylglycines **3e** and **4** were converted to the corresponding *N*-sulfonylate, all others were converted to their acetate. The HPLC reference compound was a mixture of related products consisting of *R* and *S* enantiomers.

## 4. Characterization and HPLC of the Obtained Chiral α-Arylglycines

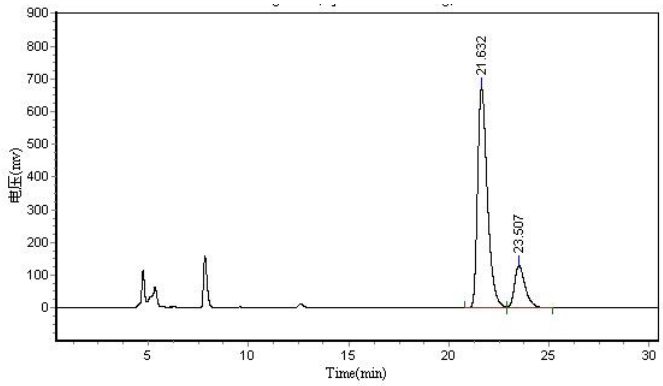
(*R*)-ethyl 2-(2,4-dimethoxyphenyl)-2((*R*)-1,1-dimethylethylsulfinamido)acetate (**3a**).




**3a**

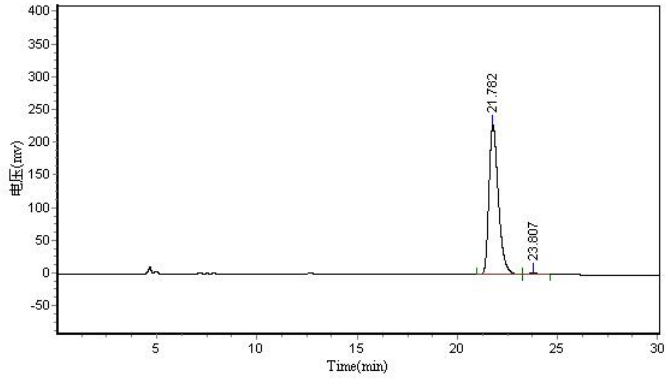
89% yield, yellow oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.15 (s, 9H), 1.18 (t, 3H), 3.77 (s, 3H), 3.79 (s, 3H), 4.13-4.20 (m, 2H), 4.51 (d, *J* = 4.2 Hz, 1H), 5.19 (d, *J* = 4.2 Hz, 1H), 6.43-6.45 (m, 2H), 7.10 (d, *J* = 9.0 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.14, 22.51, 55.39, 55.55, 55.82, 56.00, 61.85, 98.94, 104.22, 118.74, 130.12, 158.21, 161.03, 172.03; ESI-MS (*m/z*, %) 344 $[M+H]^+$; ESI-HRMS calcd for $C_{16}H_{25}NNaO_5S$ $[M+Na^+]$ 366.1351, found 366.1351.

HPLC (**acetate**): 98% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 21.8 min (maj), 23.8 min.




Results

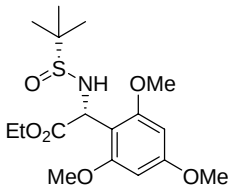
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 21.632 | 674104.563 | 22894638.000 | 82.5333 |
| 2 | | 23.507 | 129262.539 | 4845249.500 | 17.4667 |
| Total | | | 803367.102 | 27739887.500 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 21.782 | 228540.984 | 7478351.000 | 99.1270 |
| 2 | | 23.807 | 1939.009 | 65857.797 | 0.8730 |
| Total | | | 230479.993 | 7544208.797 | 100.0000 |

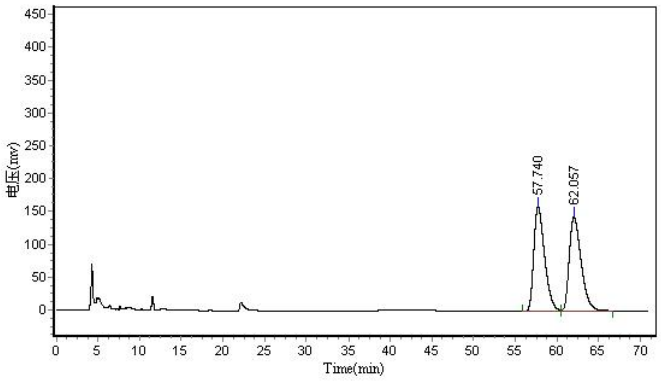
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2,4,6-trimethoxyphenyl)acetate (**3b**).




**3b**

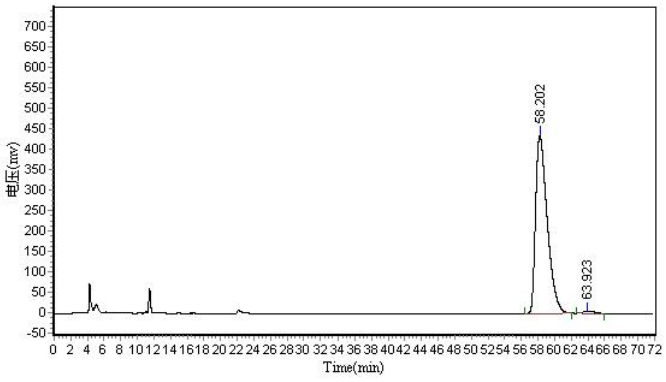
91% yield, colorless oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.10 (s, 9H), 1.17 (t, 3H), 3.77 (s, 6H), 3.80 (s, 3H), 4.09-4.22 (m, 2H), 4.58 (d, *J* = 5.1 Hz, 1H), 5.49 (d, *J* = 5.1 Hz, 1H), 6.09 (s, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.27, 22.44, 51.35, 55.39, 55.76, 55.85, 61.59, 90.68, 107.92, 158.83, 161.38, 172.55; ESI-MS (*m/z*, %) 374 $[M+H]^+$; ESI-HRMS calcd for $C_{17}H_{27}NNaO_6S$ $[M+Na^+]$ 396.1457, found 396.1454.

HPLC (**acetate**): 97% de. Chiracel AD-3 Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 95 / 5; flow = 0.7 mL / min; Retention time: 58.2 min (maj), 63.9 min.




Results

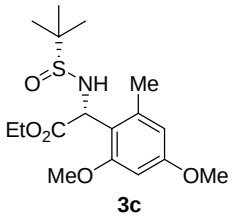
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 57.740 | 158619.875 | 14331035.000 | 50.0777 |
| 2 | | 62.057 | 143025.125 | 14286591.000 | 49.9223 |
| Total | | | 301645.000 | 28617626.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 58.202 | 434911.063 | 42354564.000 | 98.6595 |
| 2 | | 63.923 | 6152.331 | 575495.313 | 1.3405 |
| Total | | | 441063.393 | 42930059.313 | 100.0000 |

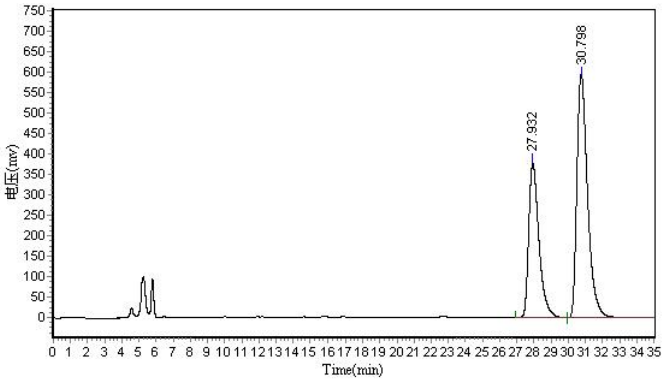
(*R*)-ethyl 2-(2,4-dimethoxy-6-methylphenyl)-2-((*R*)-1,1-dimethylethylsulfinamido)acetate (**3c**).




**3c**

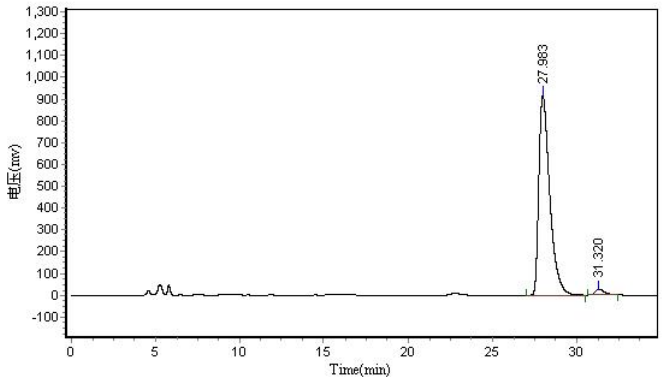
84% yield, colorless oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.11 (s, 9H), 1.16 (t, 3H), 2.36 (s, 3H), 3.73 (s, 3H), 3.78 (s, 3H), 4.09-4.21 (m, 2H), 4.63 (d, *J* = 3.0 Hz, 1H), 5.33 (d, *J* = 3.9 Hz, 1H), 6.29 (d, *J* = 5.7 Hz, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.24, 20.24, 22.50, 53.44, 55.26. 55.63, 55.71, 61.79, 96.58, 107.05, 117.52, 139.22, 158.74, 160.17, 172.34; ESI-MS (*m/z*, %) 358 $[M+H]^+$; ESI-HRMS calcd for $C_{17}H_{28}NO_5S$ $[M+H^+]$ 358.1688, found 358.1697.

HPLC (**acetate**): 95% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 95 / 5; flow = 0.7 mL / min; Retention time: 28.0 min (maj), 31.3 min.




Results

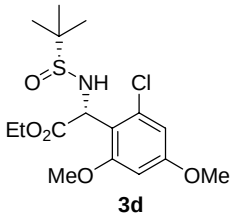
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 27.932 | 374280.063 | 15683889.000 | 37.6559 |
| 2 | | 30.798 | 594641.938 | 25966694.000 | 62.3441 |
| Total | | | 968922.000 | 41650583.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 27.983 | 914985.313 | 41353624.000 | 97.4477 |
| 2 | | 31.320 | 25893.891 | 1083123.125 | 2.5523 |
| Total | | | 940879.203 | 42436747.125 | 100.0000 |

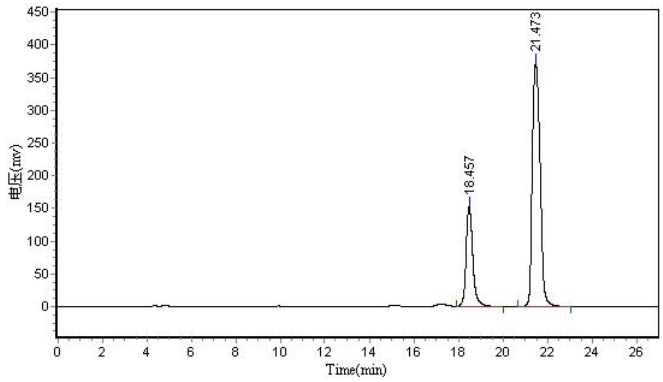
(*R*)-ethyl 2-(2-chloro-4,6-dimethoxyphenyl)-2-((*R*)-1,1-dimethylethylsulfinamido)acetate (**3d**).




**3d**

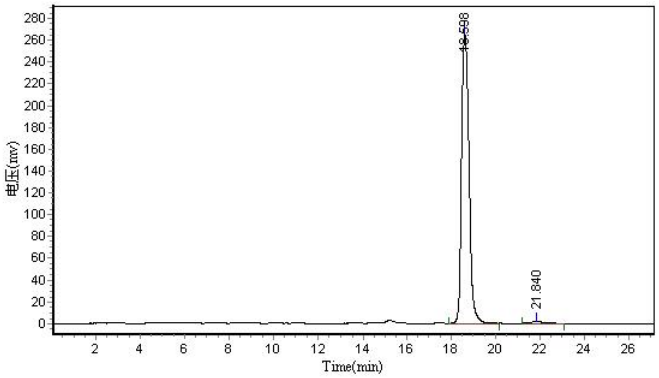
80% yield, yellow oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.12 (s, 9H), 1.18 (t, 3H), 3.76 (s, 3H), 3.79 (s, 3H), 4.09-4.23 (m, 2H), 4.59 (d, *J* = 4.2 Hz, 1H), 5.60 (d, *J* = 4.2 Hz, 1H), 6.34 (d, *J* = 2.1 Hz, 1H), 6.52 (d, *J* = 2.4 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.22, 22.44, 55.65, 55.91, 56.01, 62.07, 97.93, 106.12, 117.96, 135.60, 159.09, 160.55, 171.42; ESI-MS (*m/z*, %) 378 $[M+H]^+$; ESI-HRMS calcd for $C_{16}H_{24}ClNNaO_5S$ $[M+Na^+]$ 400.0961, found 400.0945.

HPLC (**acetate**): 98% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 18.6 min (maj), 21.8 min.




Results

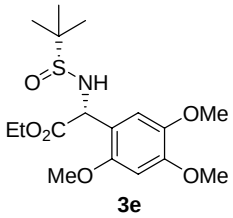
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 18.457 | 151422.688 | 3190979.000 | 25.9984 |
| 2 | | 21.473 | 371378.250 | 9082754.000 | 74.0016 |
| Total | | | 522800.938 | 12273733.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 18.598 | 264955.781 | 6240307.000 | 98.9436 |
| 2 | | 21.840 | 1725.836 | 66625.203 | 1.0564 |
| Total | | | 266681.617 | 6306932.203 | 100.0000 |

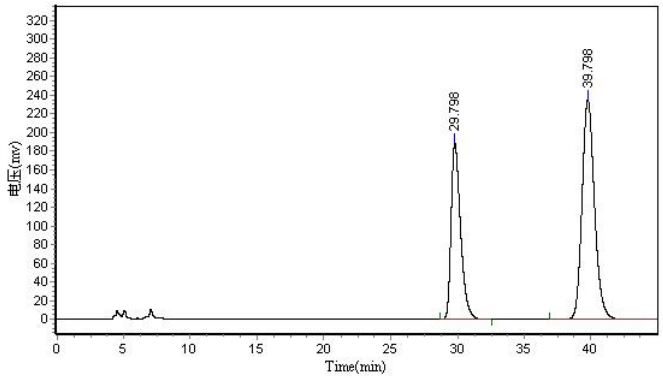
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2,4,5-trimethoxyphenyl)acetate (**3e**).




**3e**

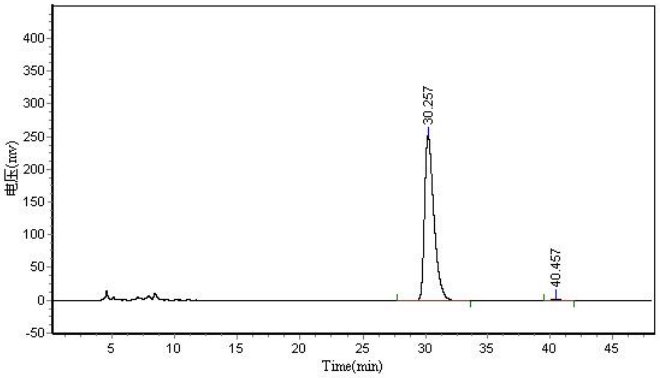
86% yield, colorless oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.16 (s, 9H), 1.17 (t, 3H), 3.79 (s, 3H), 3.80 (s, 3H), 3.87 (s, 3H), 4.11-4.21 (m, 2H), 4.51 (d, *J* = 3.3 Hz, 1H), 5.30 (d, *J* = 3.9 Hz, 1H), 6.51 (s, 1H), 6.74 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.15, 22.56, 55.13, 55.85, 56.09, 56.57, 56.93, 61.97, 97.96, 112.45, 117.52, 143.19, 149.81, 151.89, 171.98; ESI-MS (*m/z*, %) 396 $[M+Na]^+$; ESI-HRMS calcd for $C_{17}H_{27}NNaO_6S$ $[M+Na^+]$ 396.1457, found 396.1455.

HPLC (**sulfonylate**): 98% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 80 / 20; flow = 0.7 mL / min; Retention time: 30.2 min (maj), 40.4 min.




Results

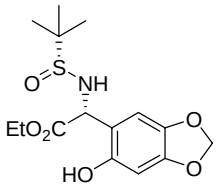
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 29.798 | 187152.141 | 9339194.000 | 37.9489 |
| 2 | | 39.798 | 234610.594 | 15270694.000 | 62.0511 |
| Total | | | 421762.734 | 24609888.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 30.257 | 252606.844 | 13109203.000 | 99.2008 |
| 2 | | 40.457 | 1576.393 | 105611.766 | 0.7992 |
| Total | | | 254183.237 | 13214814.766 | 100.0000 |

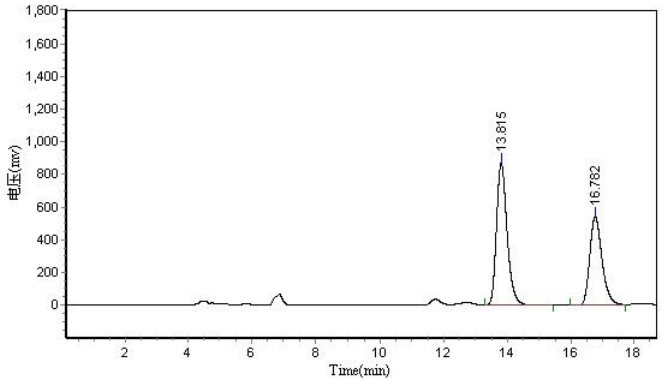
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2-hydroxy-4,5-dimethoxyphenyl)acetate (**3f**).



**3f**

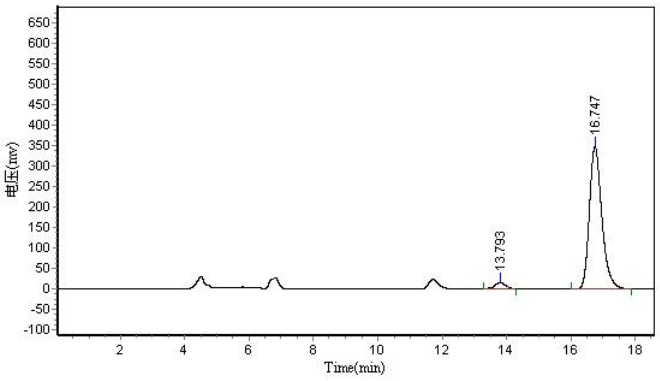
72% yield, yellow oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.21 (t, 3H), 1.25 (s, 9H), 4.10-4.28 (m, 2H), 4.52 (d, *J* = 1.5 Hz, 1H), 5.21 (d, *J* = 2.7 Hz, 1H), 5.89 (s, 2H), 6.46 (s, 1H), 6.62 (s, 1H), 7.90 (br, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.16, 22.71, 55.87, 56.30, 62.49, 99.56, 101.35, 108.15, 113.68, 141.28, 148.77, 150.90, 171.63; ESI-MS (*m/z*, %) 344 $[M+H]^+$.

HPLC (**acetate**): 93% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 80 / 20; flow = 0.7 mL / min; Retention time: 13.8 min, 16.7 min (maj).




Results

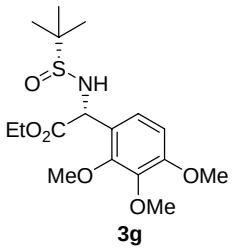
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 13.815 | 865754.625 | 20158124.000 | 57.9533 |
| 2 | | 16.782 | 541351.438 | 14625280.000 | 42.0467 |
| Total | | | 1407106.063 | 34783404.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 13.793 | 15598.970 | 338129.750 | 3.4856 |
| 2 | | 16.747 | 346773.219 | 9362763.000 | 96.5144 |
| Total | | | 362372.188 | 9700892.750 | 100.0000 |

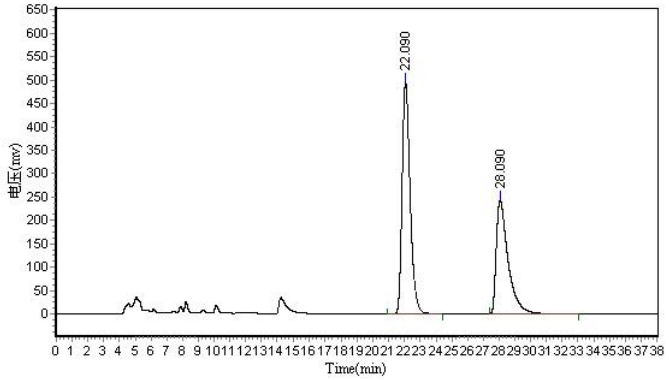
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2,3,4-trimethoxyphenyl)acetate (**3g**).




**3g**

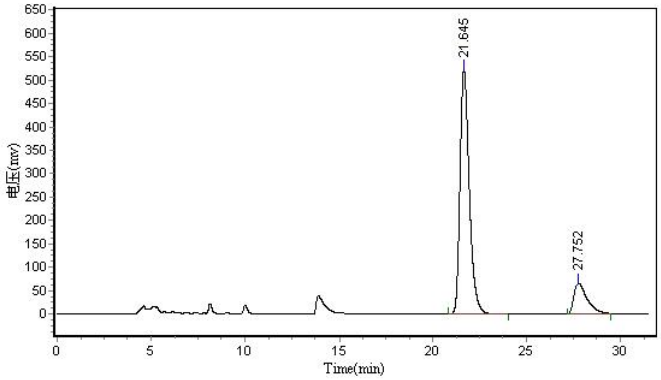
60% yield, yellow oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.17 (s, 9H), 1.18 (t, 3H), 3.84 (s, 6H), 3.88 (s, 3H), 4.11-4.24 (m, 2H), 4.59 (d, *J* = 3.9 Hz, 1H), 5.18 (d, *J* = 3.6 Hz, 1H), 6.60 (d, *J* = 8.4 Hz, 1H), 6.91 (d, *J* = 8.4 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.13, 22.61, 55.75, 55.84, 55.98, 60.77, 61.14, 62.06, 106.98, 123.75, 123.90, 142.15, 151.91, 154.07, 171.84; ESI-MS (*m/z*, %) 374 $[M+H]^+$; ESI-HRMS calcd for $C_{17}H_{27}NNaO_6S$ $[M+Na^+]$ 396.1457, found 396.1467.

HPLC (**acetate**): 70% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 21.6 min (maj), 27.8 min.




Results

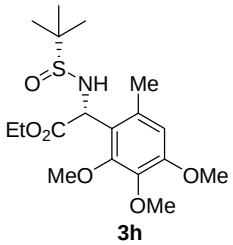
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 22.090 | 495091.188 | 17524566.000 | 58.1538 |
| 2 | | 28.090 | 242659.625 | 12610315.000 | 41.8462 |
| Total | | | 737750.813 | 30134881.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 21.645 | 523384.250 | 17966410.000 | 84.7425 |
| 2 | | 27.752 | 65641.320 | 3234764.000 | 15.2575 |
| Total | | | 589025.570 | 21201174.000 | 100.0000 |

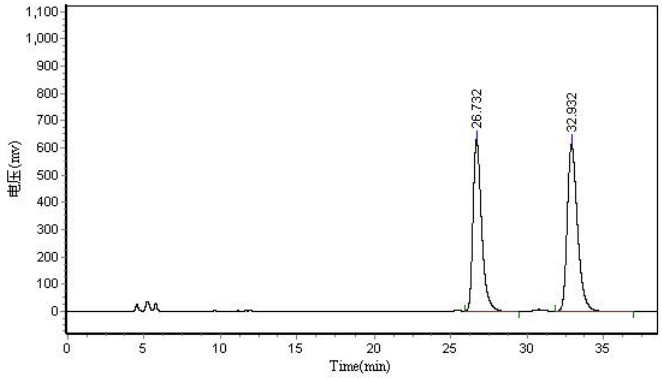
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2,3,4-trimethoxy-6-methylphenyl)acetate (**3h**).




**3h**

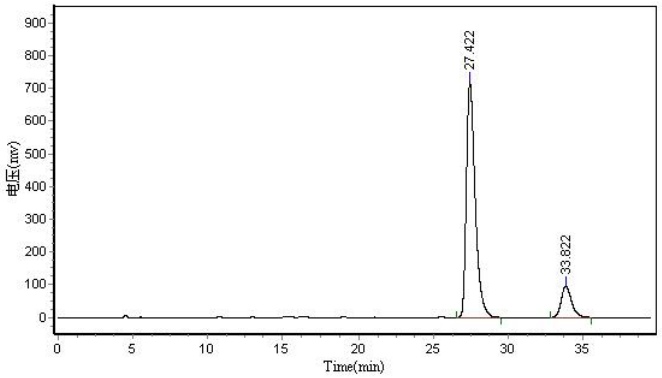
74% yield, yellow oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.15 (s, 9H), 1.18 (t, 3H), 2.34 (s, 3H), 3.79 (s, 3H), 3.83 (s, 3H), 3.85 (s, 3H), 4.08-4.22 (m, 2H), 4.73 (d, *J* = 1.2 Hz, 1H), 5.29 (d, *J* = 2.7 Hz, 1H), 6.46 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.22, 19.97, 22.61, 53.61, 55.76, 55.82, 60.70, 60.98, 61.99, 109.11, 122.28, 132.79, 139.91, 152.28, 153.17, 172.08; ESI-MS (*m/z*, %) 388 $[M+H]^+$; ESI-HRMS calcd for $C_{18}H_{30}NO_6S$ $[M+H^+]$ 388.1794, found: 388.1791.

HPLC (**acetate**): 73% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 95 / 5; flow = 0.7 mL / min; Retention time: 27.4 min (maj), 33.8 min.




Results

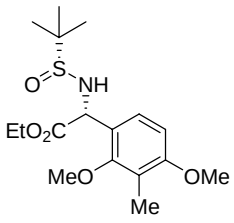
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 26.732 | 627613.938 | 24727806.000 | 46.3511 |
| 2 | | 32.932 | 610408.250 | 28621154.000 | 53.6489 |
| Total | | | 1238022.188 | 53348960.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 27.422 | 717405.188 | 29391672.000 | 86.4847 |
| 2 | | 33.822 | 95841.773 | 4593169.000 | 13.5153 |
| Total | | | 813246.961 | 33984841.000 | 100.0000 |

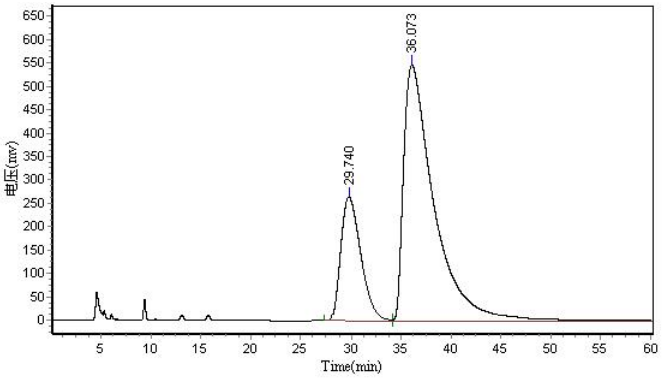
(*R*)-ethyl 2-(2,4-dimethoxy-3-methylphenyl)-2-((*R*)-1,1-dimethylethylsulfinamido)acetate (**3i**).




**3i**

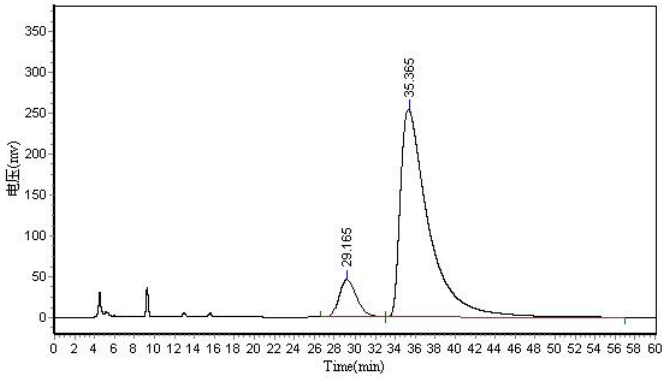
72% yield, yellow oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.16-1.18 (m, 12H), 2.15 (s, 3H), 3.77 (s, 3H), 3.81 (s, 3H), 4.09-4.23 (m, 2H), 4.59 (d, *J* = 3.0 Hz, 1H), 5.27 (d, *J* = 3.9 Hz, 1H), 6.60 (d, *J* = 8.4 Hz, 1H), 7.06 (d, *J* = 8.1 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 9.56, 14.15, 22.67, 55.09, 55.66, 55.84, 61.55, 62.10, 106.18, 119.99, 123.10, 126.58, 157.46, 159.03, 172.15; ESI-MS (*m/z*, %) 380 $[M+Na]^+$; ESI-HRMS calcd for $C_{17}H_{27}NNaO_5S$ $[M+Na^+]$ 380.1508, found 380.1506.

HPLC (**acetate**): 79% de. Chiracel AS-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 29.2 min, 35.4 min (maj).




Results

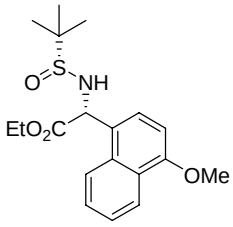
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 29.740 | 264567.031 | 37120236.000 | 24.1669 |
| 2 | | 36.073 | 546097.250 | 116479080.000 | 75.8331 |
| Total | | | 810664.281 | 153599316.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 29.165 | 45889.371 | 5695477.000 | 10.2159 |
| 2 | | 35.365 | 253721.891 | 50055768.000 | 89.7841 |
| Total | | | 299611.262 | 55751245.000 | 100.0000 |

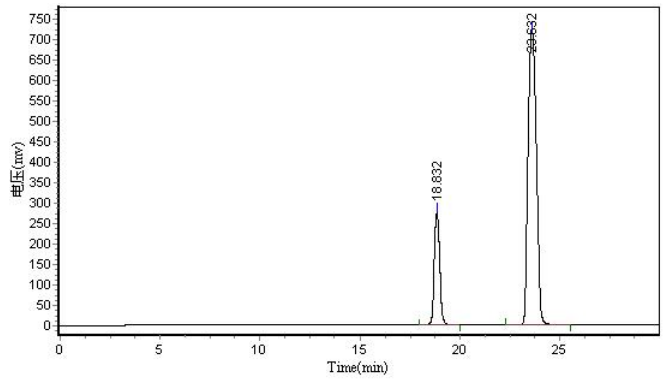
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(4-methoxynaphthalen-1-yl)acetate (**3j**).



**3j**

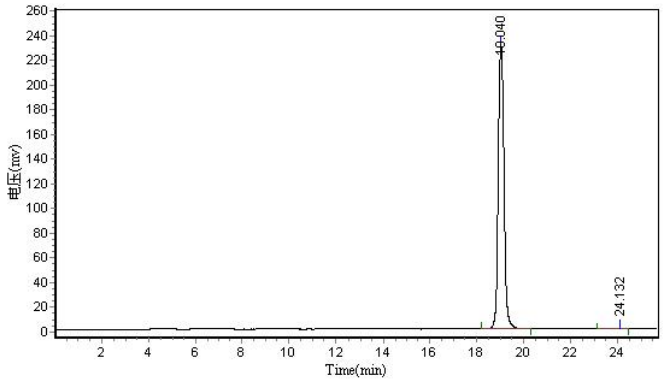
66% yield, white solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.10 (t, 3H), 1.13 (s, 9H), 4.01 (s, 3H), 4.08-4.21 (m, 2H), 4.66 (s, 1H), 5.50 (s, 1H), 6.76 (d, *J* = 8.1 Hz, 1H), 7.41 (d, *J* = 8.4 Hz, 1H), 7.47-7.51 (m, 2H), 7.98 (d, *J* = 7.8 Hz, 1H), 8.30 (d, *J* = 7.8 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.08, 22.63, 55.63, 55.79, 59.32, 62.33, 102.97, 122.79, 123.90, 124.34, 125.33, 126.33, 126.95, 128.62, 131.90, 156.24, 172.41; ESI-MS (*m/z*, %) 364 $[M+H]^+$; ESI-HRMS calcd for $C_{19}H_{25}NNaO_4S$ $[M+Na^+]$ 386.1402, found 386.1411.

HPLC (**acetate**): >99% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 19.0 min (maj), 24.1 min.




Results

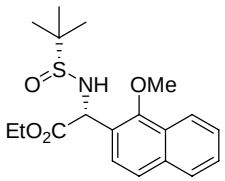
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 18.832 | 273026.938 | 5296722.500 | 20.1718 |
| 2 | | 23.632 | 720571.500 | 20961286.000 | 79.8282 |
| Total | | | 993598.438 | 26258008.500 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 19.040 | 229190.500 | 3953454.250 | 99.7716 |
| 2 | | 24.132 | 148.073 | 6737.400 | 0.1700 |
| Total | | | 229418.663 | 3962504.750 | 100.0000 |

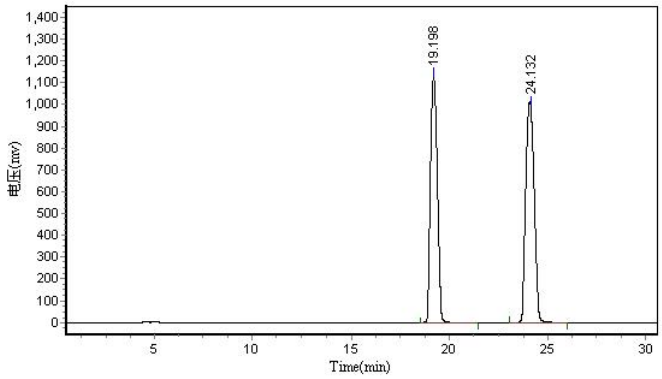
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(1-methoxynaphthalen-2-yl)acetate (**3j′**).




**3j'**

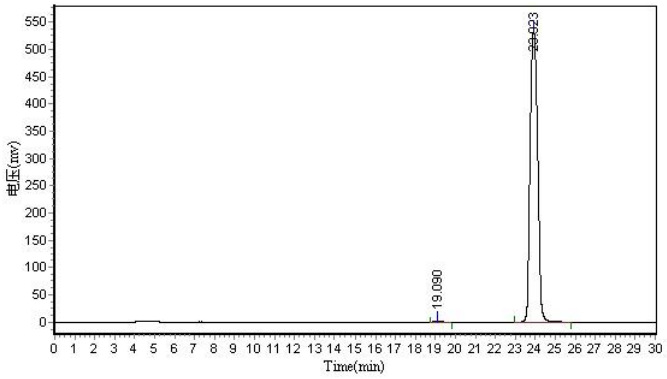
22% yield, white solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.13 (t, 3H), 1.21 (s, 9H), 4.00 (s, 3H), 4.07-4.21 (m, 2H), 5.73 (d, *J* = 3.9 Hz, 1H), 6.77 (d, *J* = 7.8 Hz, 1H), 7.47-7.61 (m, 3H), 8.18 (d, *J* = 8.4 Hz, 1H), 8.31 (d, *J* = 8.4 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.12, 22.65, 55.68, 56.46, 56.74, 61.88, 103.27, 122.85, 123.40, 125.06, 125.51, 126.11, 127.19, 127.46, 131.78, 156.21, 172.01; ESI-MS (*m/z*, %) 364 $[M+H]^+$; ESI-HRMS calcd for $C_{19}H_{25}NNaO_4S$ $[M+Na^+]$ 386.1402, found 386.1390.

HPLC (**acetate**): >99% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 19.1 min, 23.9 min (maj).




Results

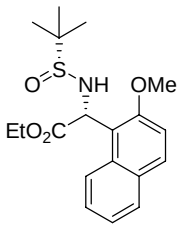
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 19.198 | 1123718.875 | 27573620.000 | 47.5011 |
| 2 | | 24.132 | 1007838.500 | 30474742.000 | 52.4989 |
| Total | | | 2131557.375 | 58048362.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 19.090 | 407.462 | 10616.800 | 0.0761 |
| 2 | | 23.923 | 535504.375 | 13946546.000 | 99.9239 |
| Total | | | 535911.837 | 13957162.800 | 100.0000 |

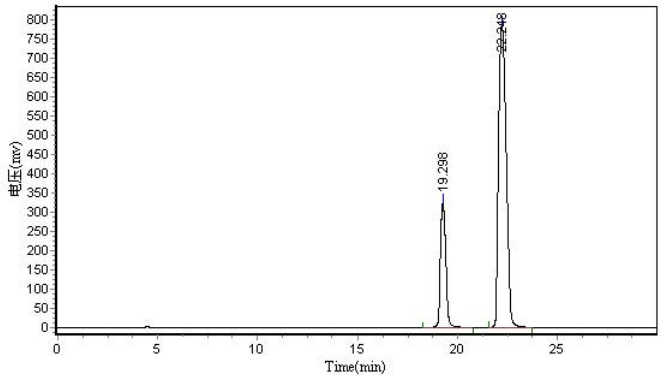
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2-methoxynaphthalen-1-yl)acetate (**3k**).



**3k**

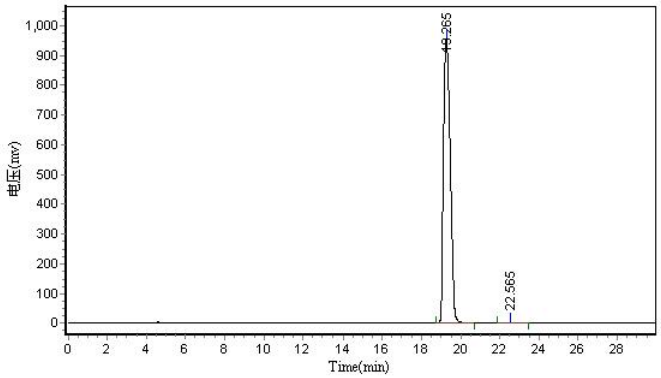
72% yield, white solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.06-1.10 (m, 12H), 3.98 (s, 3H), 4.11-4.18 (m, 2H), 4.76 (s, 1H), 6.10 (s, 1H), 7.28-7.36 (m, 2H), 7.46 (dd, *J* = 8.4 Hz, 7.2 Hz, 1H), 7.78 (d, *J* = 8.1 Hz, 1H), 7.84 (d, *J* = 9.0 Hz, 1H), 7.93 (d, *J* = 9.0 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.14, 22.51, 52.18, 55.69, 57.17, 62.12, 113.67, 118.42, 123.34, 123.76, 127.09, 128.75, 129.47, 130.90, 132.31, 155.83, 172.77; ESI-MS (*m/z*, %) 364 $[M+H]^+$; ESI-HRMS calcd for $C_{19}H_{26}NO_4S$ $[M+H^+]$ 364.1582, found: 364.1578.

HPLC (**acetate**): >99% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 19.3 min (maj), 22.6 min.




Results

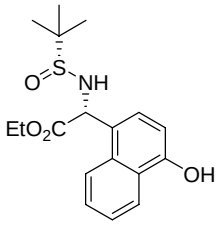
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 19.298 | 320611.969 | 6083979.500 | 22.5435 |
| 2 | | 22.248 | 783896.563 | 20903754.000 | 77.4565 |
| Total | | | 1104508.531 | 26987733.500 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 19.265 | 950367.125 | 22983524.000 | 99.8262 |
| 2 | | 22.565 | 1149.328 | 40010.262 | 0.1738 |
| Total | | | 951516.453 | 23023534.262 | 100.0000 |

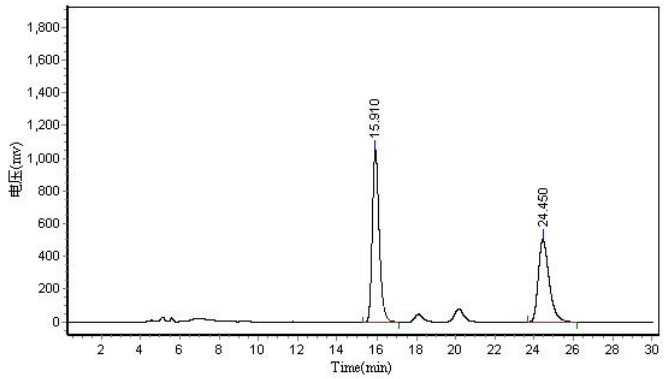
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(4-hydroxynaphthalen-1-yl)acetate (**3l**).



**3l**

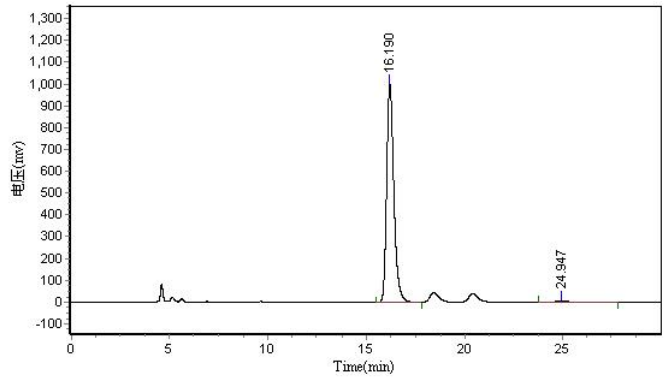
74% yield, yellow solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.06 (t, 3H), 1.18 (s, 9H), 4.09-4.18 (m, 2H), 4.77 (d, *J* = 2.1 Hz, 1H), 5.49 (d, *J* = 2.1 Hz 1H), 6.78 (d, *J* = 7.8 Hz 1H), 7.32 (d, *J* = 7.8 Hz, 1H), 7.43-7.46 (m, 2H), 7.92-7.96 (m, 1H), 8.18 (s, 1H), 8.28-8.32 (m, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.04, 22.74, 56.03, 59.76, 62.42, 107.83, 122.59, 123.16, 123.86, 124.93, 125.69, 126.80, 129.66, 132.14, 153.98, 172.40; ESI-MS (*m/z*, %) 350 $[M+H]^+$; ESI-HRMS calcd for $C_{18}H_{23}NNaO_4S$ $[M+Na^+]$ 372.1246, found 372.1244.

HPLC (**acetate**): 98% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 16.2 min (maj), 24.9 min.




Results

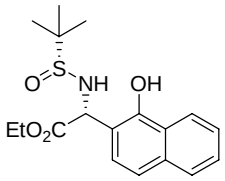
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 15.910 | 1049745.750 | 25747068.000 | 57.0066 |
| 2 | | 24.450 | 503980.844 | 19417976.000 | 42.9934 |
| Total | | | 1553726.594 | 45165044.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 16.190 | 996699.875 | 25443638.000 | 98.9571 |
| 2 | | 24.947 | 6078.157 | 268154.406 | 1.0429 |
| Total | | | 1002778.032 | 25711792.406 | 100.0000 |

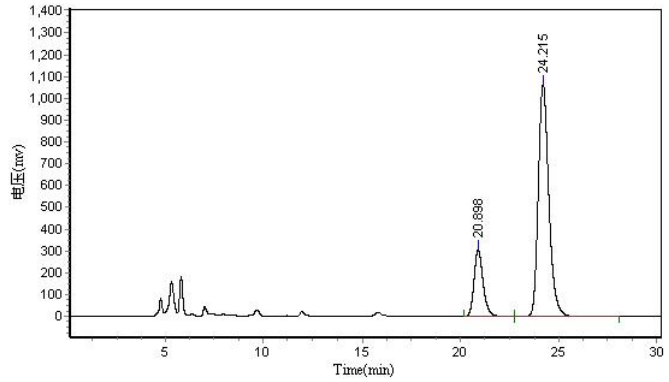
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(1-hydroxynaphthalen-2-yl)acetate (**3l'**).




**3l'**

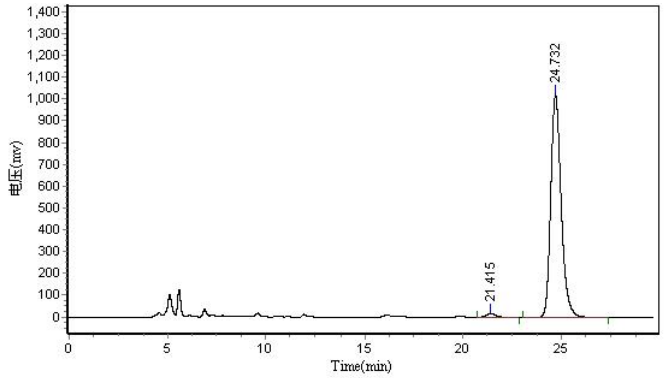
15% yield, yellow solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.19 (t, 3H), 1.28 (s, 9H), 4.11-4.29 (m, 2H), 4.59 (s, 1H), 5.36 (d, *J* = 2.7 Hz, 1H), 7.25 (d, *J* = 8.4 Hz, 1H), 7.39 (d, *J* = 8.7 Hz, 1H), 7.45-7.52 (m, 2H), 7.76-7.79 (m, 1H), 8.26-8.30 (m, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.11, 22.68, 56.53, 57.25, 62.76, 114.46, 120.34, 122.67, 125.57, 126.79, 127.07, 127.51, 134.83, 151.71, 171.29; ESI-MS (*m/z*, %) 372 $[M+Na]^+$; ESI-HRMS calcd for $C_{18}H_{23}NNaO_4S$ $[M+Na^+]$ 372.1246, found 372.1253.

HPLC (**acetate**): 97% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 21.4 min, 24.7 min (maj).




Results

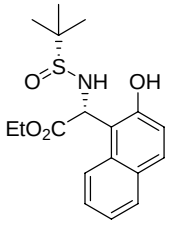
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 20.898 | 306281.656 | 9774731.000 | 19.7613 |
| 2 | | 24.215 | 1063924.750 | 39689376.000 | 80.2387 |
| Total | | | 1370206.406 | 49464107.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 21.415 | 15704.157 | 495847.688 | 1.3039 |
| 2 | | 24.732 | 1017129.375 | 37533068.000 | 98.6961 |
| Total | | | 1032833.532 | 38028915.688 | 100.0000 |

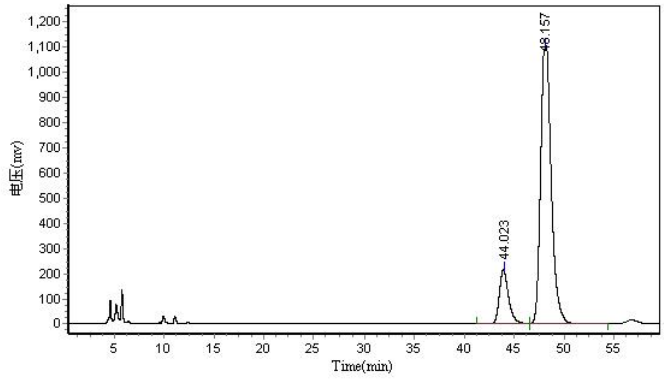
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(2-hydroxynaphthalen-1-yl)acetate (**3m**).



**3m**

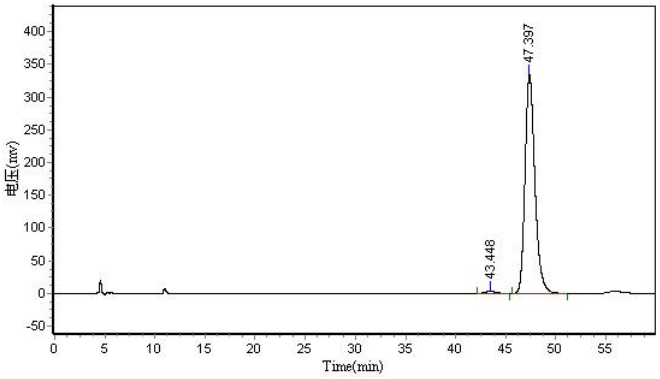
70% yield, yellow solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.05 (t, 3H), 1.21 (s, 9H), 4.05-4.18 (m, 2H), 4.82 (s, 1H), 6.22 (s, 1H),7.17 (d, *J* = 8.7 Hz, 1H), 7.26 (dd, *J* = 6.6 Hz, 8.4Hz, 1H), 7.39 (dd, *J* = 8.4 Hz, 7.2Hz, 1H), 7.67-7.74 (dd, *J* = 8.7 Hz, 8.4Hz, 2H), 7.80 (d, *J* = 8.4Hz, 1H), 9.55 (br, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.07, 22.72, 52.00, 55.76, 62.32, 112.46, 118.40, 122.77, 122.90, 126.69, 128.74, 128.95, 130.81, 132.61, 155.18, 173.00; ESI-MS (*m/z*, %) 372 $[M+Na]^+$; ESI-HRMS calcd for $C_{18}H_{23}NNaO_4S$ $[M+Na^+]$ 372.1246, found 372.1246.

HPLC (**acetate**): 98% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 95 / 5; flow = 0.7 mL / min; Retention time: 43.4 min (maj), 47.4 min.




Results

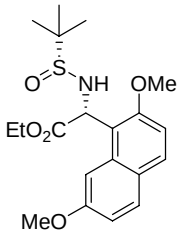
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 44.023 | 213212.313 | 13811243.000 | 14.4132 |
| 2 | | 48.157 | 1090117.125 | 82012416.000 | 85.5868 |
| Total | | | 1303329.438 | 95823659.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 43.448 | 3228.474 | 208958.484 | 0.9039 |
| 2 | | 47.397 | 334161.000 | 22907366.000 | 99.0961 |
| Total | | | 337389.474 | 23116324.484 | 100.0000 |

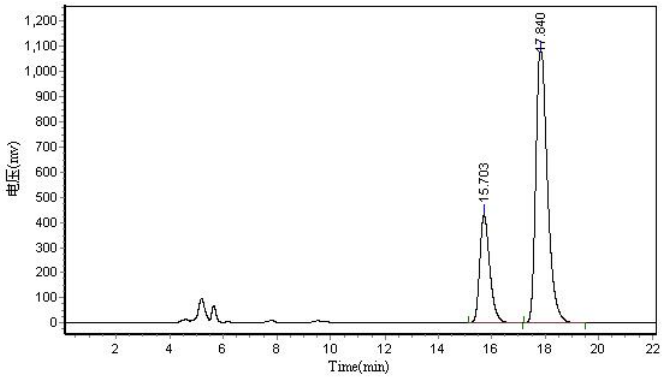
(*R*)-ethyl 2-(2,7-dimethoxynaphthalen-1-yl)-2-((*R*)-1,1-dimethylethylsulfinamido)acetate (**3n**).




**3n**

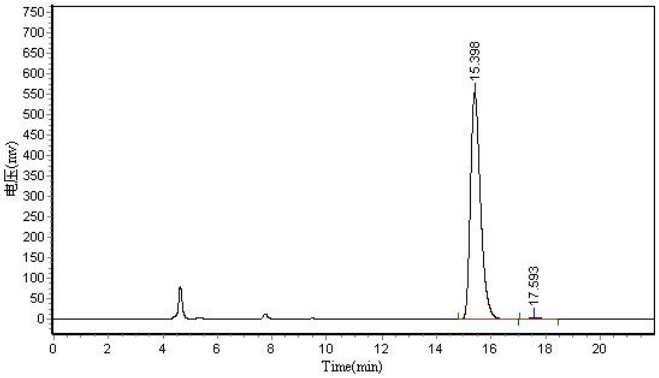
74% yield, white solid. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.05-1.24 (m, 12H), 3.86 (s, 3H), 3.95 (s, 3H), 4.10-4.17 (m, 2H), 4.71 (s, 1H), 6.06 (s, 1H), 6.96-7.00 (dd, *J* = 1.5 Hz, 8.7 Hz, 1H), 7.11 (d, *J* = 8.7 Hz, 1H), 7.25 (d, *J* = 1.5 Hz, 1H), 7.64 (d, *J* = 9.3 Hz, 1H), 7.738 (d, *J* = 6.9 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.16, 14.29, 22.55, 52.14, 55.33, 55.57, 57.00, 62.09, 101.66, 110.87, 116.61, 124.82, 130.20, 130.53, 133.79, 156.50, 158.59, 172.88; ESI-MS (*m/z*, %) 416 $[M+Na]^+$; ESI-HRMS calcd for $C_{20}H_{27}NNaO_5S$ $[M+Na^+]$ 416.1508, found 416.1516.

HPLC (**acetate**): 98% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 15.4 min (maj), 17.6 min.




Results

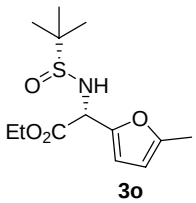
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 15.703 | 429111.094 | 11110039.000 | 25.3948 |
| 2 | | 17.840 | 1077589.375 | 32639272.000 | 74.6052 |
| Total | | | 1506700.469 | 43749311.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 15.398 | 555048.375 | 14239966.000 | 99.1422 |
| 2 | | 17.593 | 4385.118 | 123213.297 | 0.8578 |
| Total | | | 559433.493 | 14363179.297 | 100.0000 |

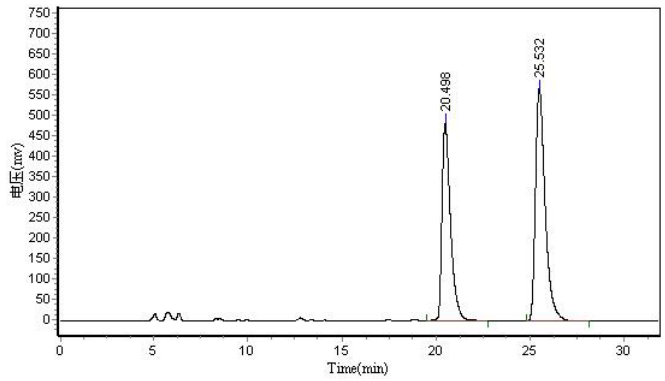
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(5-methylfuran-2-yl)acetate (**3o**).




**3o**

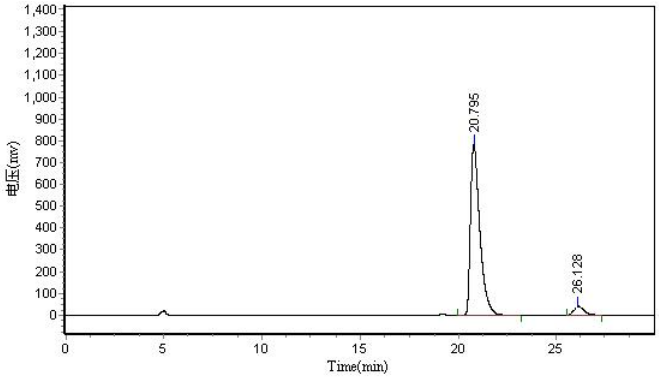
90% yield, colorless oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.22 (s, 9H), 1.25 (t, 3H), 2.25 (s, 3H), 4.19-4.28 (m, 2H), 4.41 (d, *J* = 4.8 Hz, 1H), 5.03 (d, *J* = 5.4 Hz, 1H), 5.91 (s, 1H), 6.18 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 13.07, 14.13, 22.57, 55.36, 56.23, 62.52, 106.53, 109.86, 147.66, 153.04, 169.70; ESI-MS (*m/z*, %) 310 $[M+Na]^+$; ESI-HRMS calcd for $C_{13}H_{21}NNaO_4S$ $[M+Na^+]$ 310.1089, found 310.1094.

HPLC (**acetate**): 90% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 95 / 5; flow = 0.7 mL / min; Retention time: 20.8 min (maj), 26.1 min.




Results

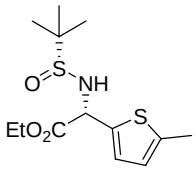
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 20.498 | 482514.063 | 15349944.000 | 42.8937 |
| 2 | | 25.532 | 567507.625 | 20436054.000 | 57.1063 |
| Total | | | 1050021.688 | 35785998.000 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 20.795 | 782548.563 | 26013320.000 | 94.9549 |
| 2 | | 26.128 | 40046.980 | 1382126.250 | 5.0451 |
| Total | | | 822595.543 | 27395446.250 | 100.0000 |

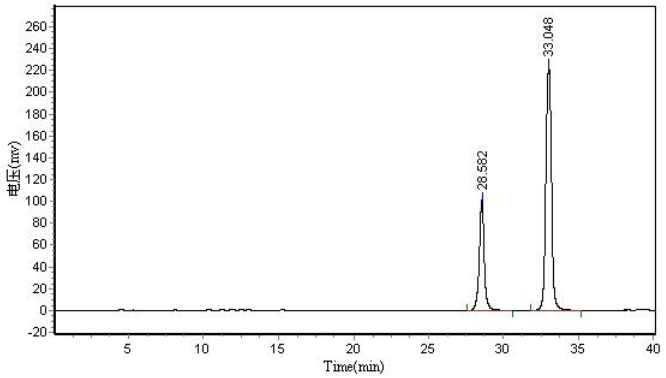
(*R*)-ethyl 2-((*R*)-1,1-dimethylethylsulfinamido)-2-(5-methylthiophen-2-yl)acetate (**3p**).




**3p**

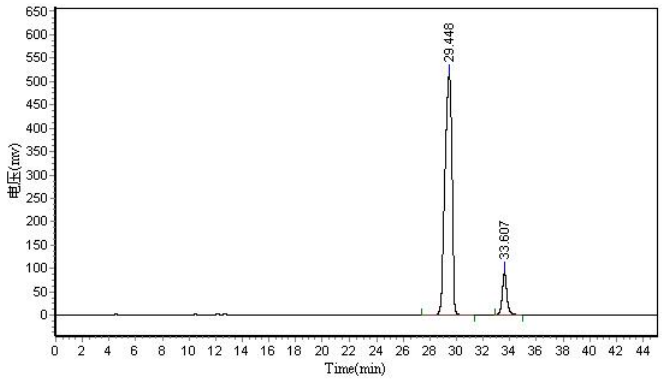
74% yield, colorless oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.26 (m, 12H), 2.44 (s, 3H), 4.18-4.28 (m, 2H), 4.57 (d, *J* = 4.8 Hz, 1H), 5.20 (d, *J* = 4.8 Hz, 1H), 6.60-6.61 (m, 1H), 6.84 (d, *J* = 3.3 Hz, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.14, 15.54, 22.73, 56.35, 56.95, 62.60, 125.18, 126.38, 137.78, 140.82, 170.57; ESI-MS (*m/z*, %) 326 $[M+Na]^+$; ESI-HRMS calcd for $C_{13}H_{21}NNaO_3S_2$ $[M+Na^+]$ 326.0860, found 326.0862.

HPLC (**acetate**): 79% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 90 / 10; flow = 0.7 mL / min; Retention time: 29.4 min (maj), 33.6 min.




Results

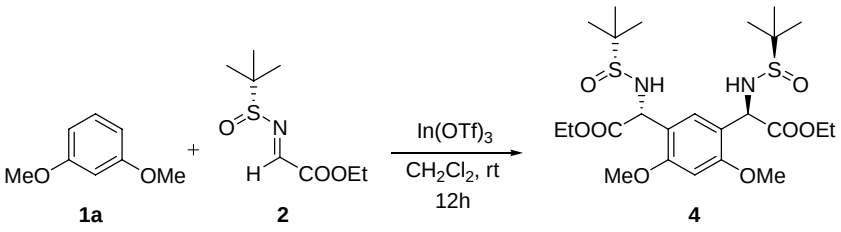
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 28.582 | 100177.695 | 2339595.750 | 28.4702 |
| 2 | | 33.048 | 222872.891 | 5878101.000 | 71.5298 |
| Total | | | 323050.586 | 8217696.750 | 100.0000 |




Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 29.448 | 515467.469 | 18963830.000 | 89.4490 |
| 2 | | 33.607 | 91384.148 | 2236887.750 | 10.5510 |
| Total | | | 606851.617 | 21200717.750 | 100.0000 |

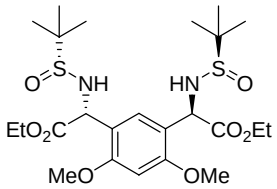
**5. General procedure for the synthesis of the chiral Friedel-Crafts dialkylation product (4).**




Under nitrogen atmosphere, $In(OTf)_3$ (0.25 mmol, 1equiv) was placed into a glass reaction vessel, glyoxylate imine **2** (0.25 mmol) in 2 mL of dry $CH_2Cl_2$ and arene **1** (0.125 mmol) were added successively. The mixture was stirred at room temperature and monitored by TLC. When the reaction was over, a saturated aq. $NH_4Cl$ was added and the mixture was extracted with $CH_2Cl_2$ (10 mL×3). The combined organic phase was dried over $Na_2SO_4$, filtered, and concentrated. The residue was purified by silica gel flash chromatography to afford the corresponding product **4**.

## 6. Characterization and HPLC of the chiral Friedel-Crafts dialkylation product (4).

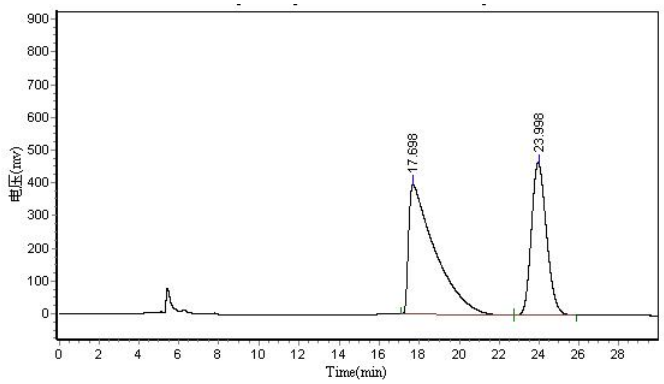
(2R,2'R,26R)-diethyl-2,2'-(4,6-dimethoxy-1,3-phenylene)bis(2-((*R*)-1,1-dimethylethylsulfinamido )acetate) (**4**).




**4**

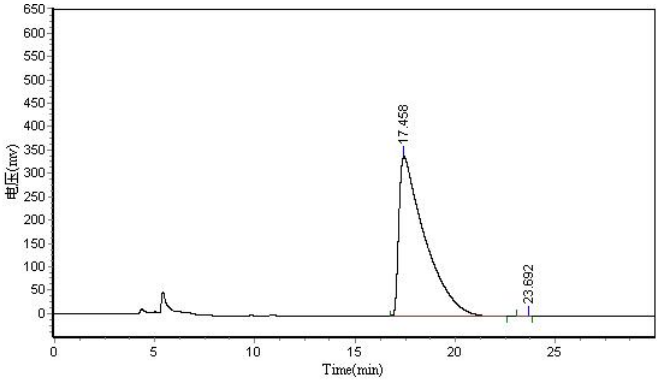
43% yield, colorless oil. $^{1}$H NMR (300 MHz, $CDCl_3$): δ 1.14-1.20 (m, 24H), 3.85 (s, 6H), 4.08-4.21 (m, 4H), 4.51 (d, $J$ = 4.2 Hz, 2H), 5.29 (d, $J$ = 4.2 Hz, 2H), 6.44 (s, 1H), 7.07 (s, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$): δ 14.17, 22.58, 55.00, 55.87, 55.90, 61.94, 95.56, 118.29, 129.81, 158.38, 171.73; ESI-MS (*m/z*, %) 549 $[M+H]^+$; ESI-HRMS calcd for $C_{24}H_{40}N_2NaO_8S_2$ $[M+Na^+]$ 571.2124, found 571.2133.

HPLC (**sulfonylate**): >99% de. Chiracel AD-H Column (250 mm); detected at 214 nm; n-hexane / i-propanol = 70 / 30; flow = 0.7 mL / min; Retention time: 17.4 min (maj), 23.7 min.




Results

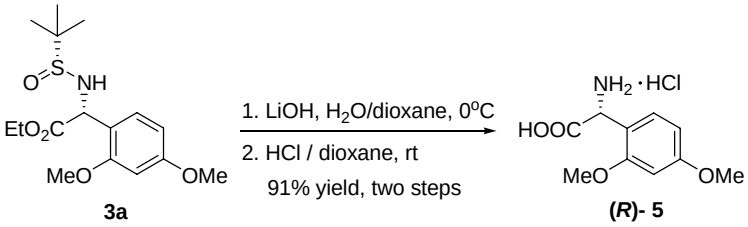
| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 17.698 | 399575.188 | 37348212.000 | 60.1960 |
| 2 | | 23.998 | 465545.938 | 24696174.000 | 39.8040 |
| Total | | | 865121.125 | 62044386.000 | 100.0000 |



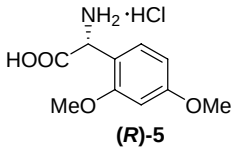

Results

| Peak No. | Peak ID | Ret Time | Height | Area | Conc. |
|---|---|---|---|---|---|
| 1 | | 17.458 | 341869.594 | 30889148.000 | 99.9964 |
| 2 | | 23.692 | 39.592 | 1116.209 | 0.0036 |
| Total | | | 341909.186 | 30890264.209 | 100.0000 |

**7. The synthesis and HPLC of (*R*)-2-(chloroamino)-2-(2,4-dimethoxyphenyl)acetic acid ((*R*)-5).**



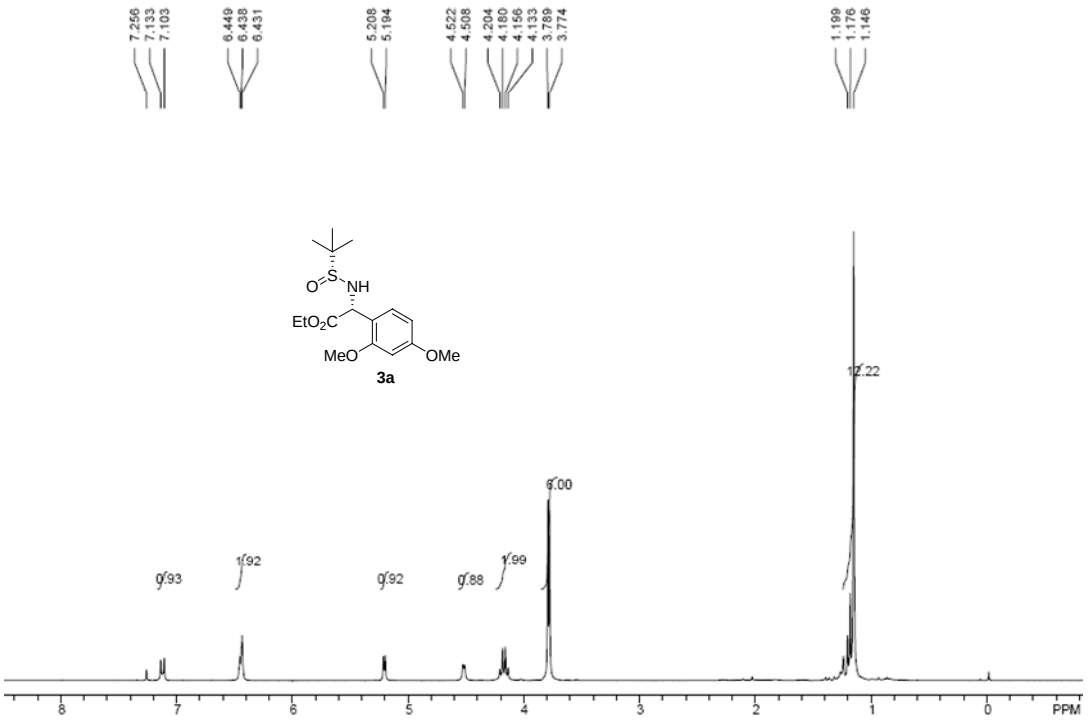

To a round bottomed flask containing LiOH (37.8 mg, 0.9mmol, 10 equiv) was added distilled $H_2O$ (5.0 mL), and the resulting solution was cooled to 0 °C. A solution of **3a** (30.0 mg, 0.09 mmol, 1.0 equiv) in dioxane (5.0 mL) was cannulated into the reaction flask. The resulting solution was stirred at 0 °C for 3 h. The reaction mixture was then concentrated to remove the dioxane, and the remaining material was diluted with distilled $H_2O$ (3 mL) and EtOAc (3 mL) and placed in a seperatory funnel. 1 N $NaHSO_4$ (2 mL) was added and the aqueous layer was extracted with EtOAc (5×4 mL). The combined organic layers were dried over $Na_2SO_4$, filtered, and concentrated under reduced pressure. The crude product was isolated with no further purification as a white solid. Subsequently, the crude product was treated with 5 mL solution of dry HCl in 1, 4-dioxane at room temperature for 1 h. The reaction mixture was concentrated *en vacuo*, and the amine hydrochloride was precipitated with dry diethyl ether. The precipitate was collected by filtration and washed with diethyl ether to yield the **(*R*)-5** (20 mg, 91% yield) as a white solid.

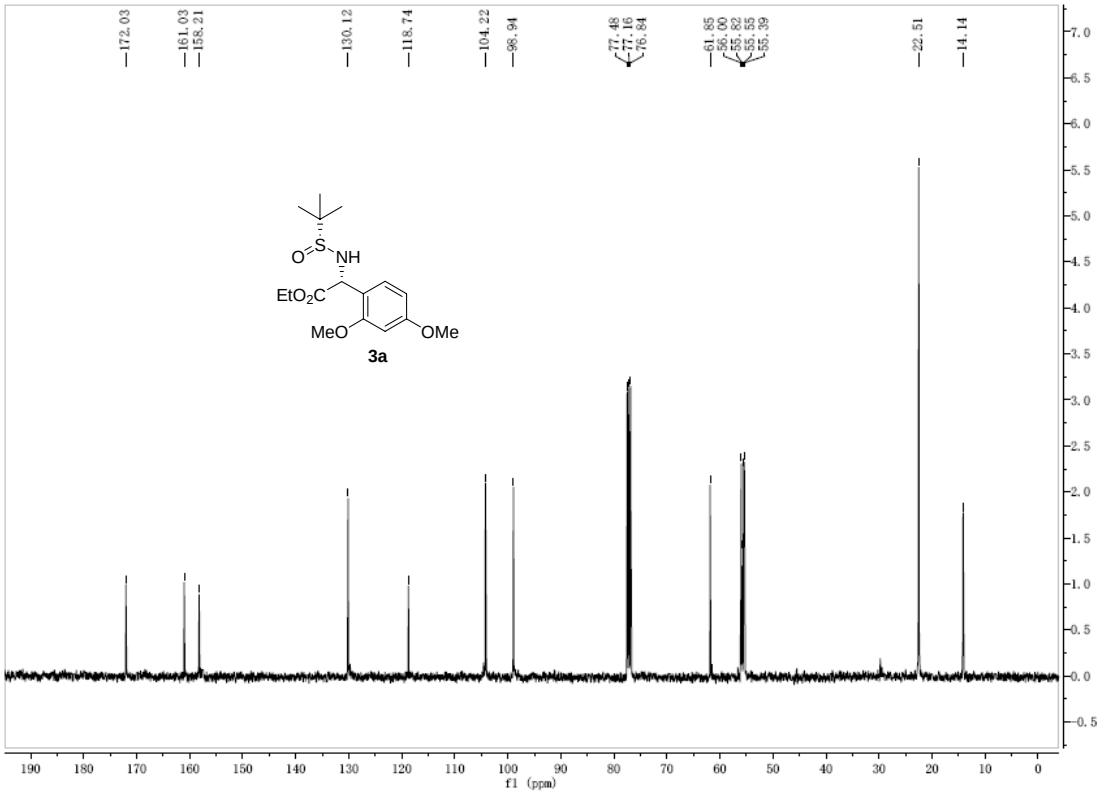


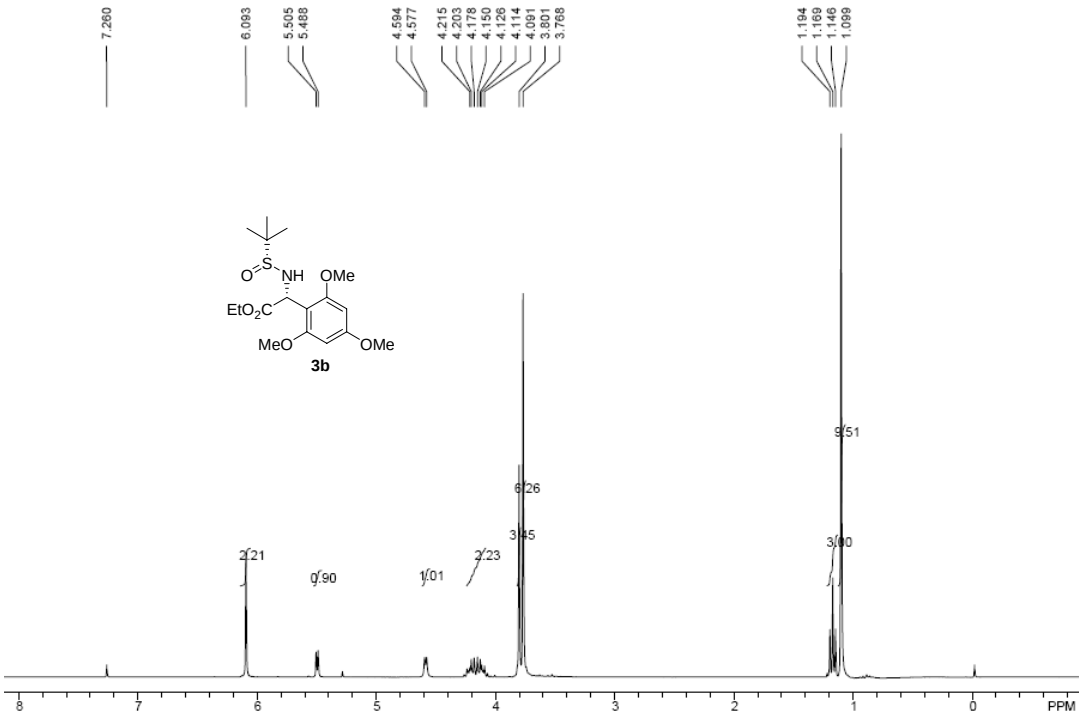

91% yield, white solid. $[\alpha]_D^{20}$ = -111.2 (*c* 0.5, MeOH); The absolute configuration was determined to be (*R*) according to literature [lit[1] $[\alpha]_D^{22}$ = +106.6 (*c* 1.0 MeOH)]. $^1$H NMR (300 MHz, $CD_3OD$): δ 3.83 (s, 3H), 3.88 (s, 3H), 5.10 (s, 1H), 6.58-6.61 (dd, *J* = 2.4 Hz, 8.4 Hz, 1H), 6.64 (d, *J* = 2.1 Hz, 1H), 7.27 (d, *J* = 8.4 Hz, 1H); $^{13}$C NMR (100 MHz, $CD_3OD$): δ 53.75, 56.06, 56.24, 99.73, 106.42, 114.21, 132.48, 159.90, 164.16, 171.17.

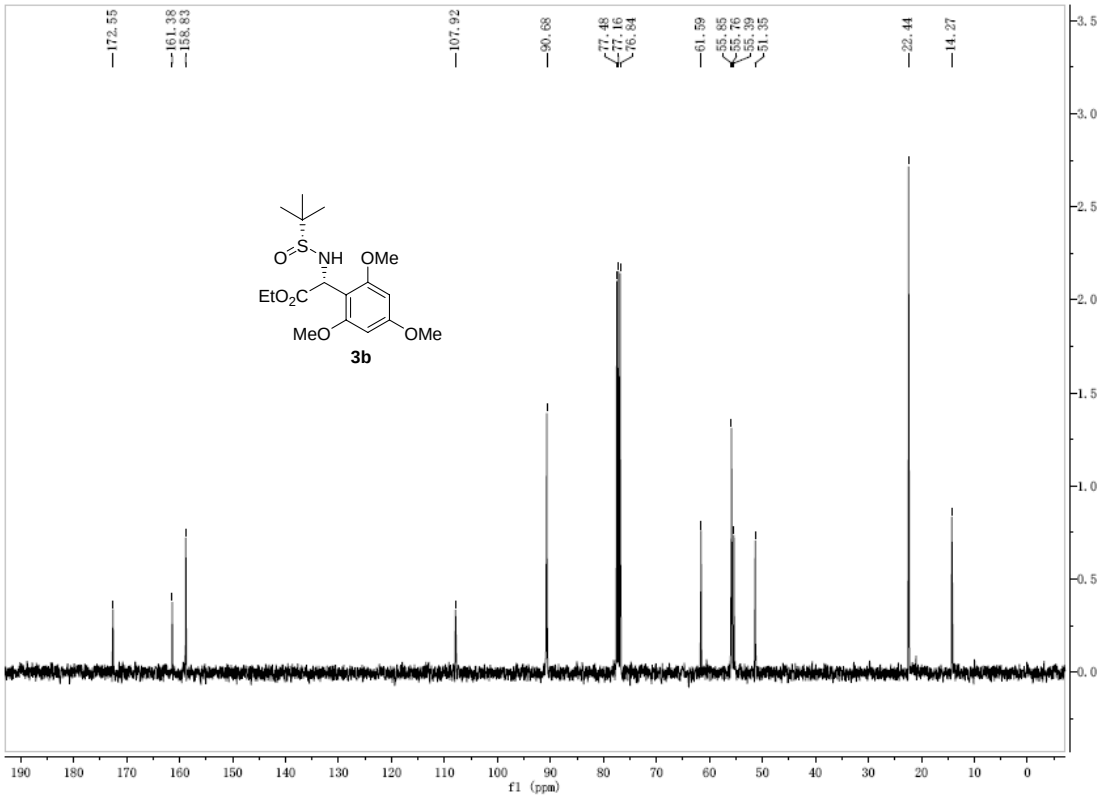
Ref 1: D. Enders, M. Seppelt, and T. Beck, *Adv. Synth. Catal.*, 2010, **352**, 1413.

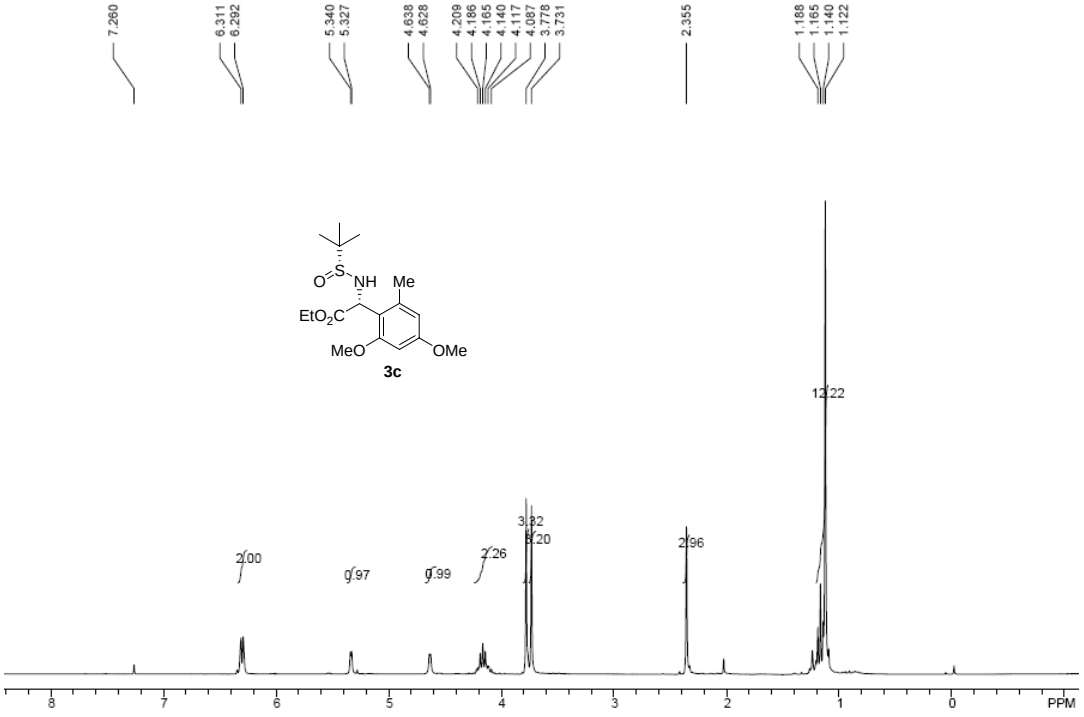
## 8. Copies of $^{1}H$ and $^{13}C$ NMR Spectra of Compounds 3a-p, 4 and (*R*)-5.

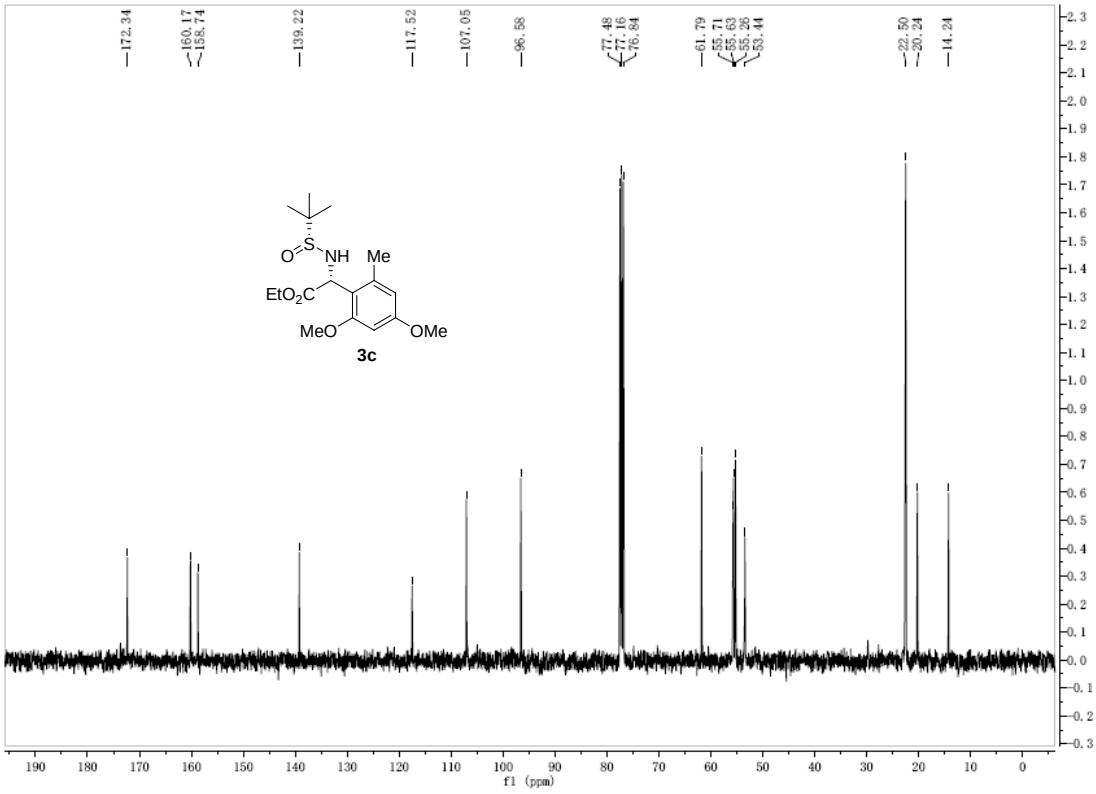


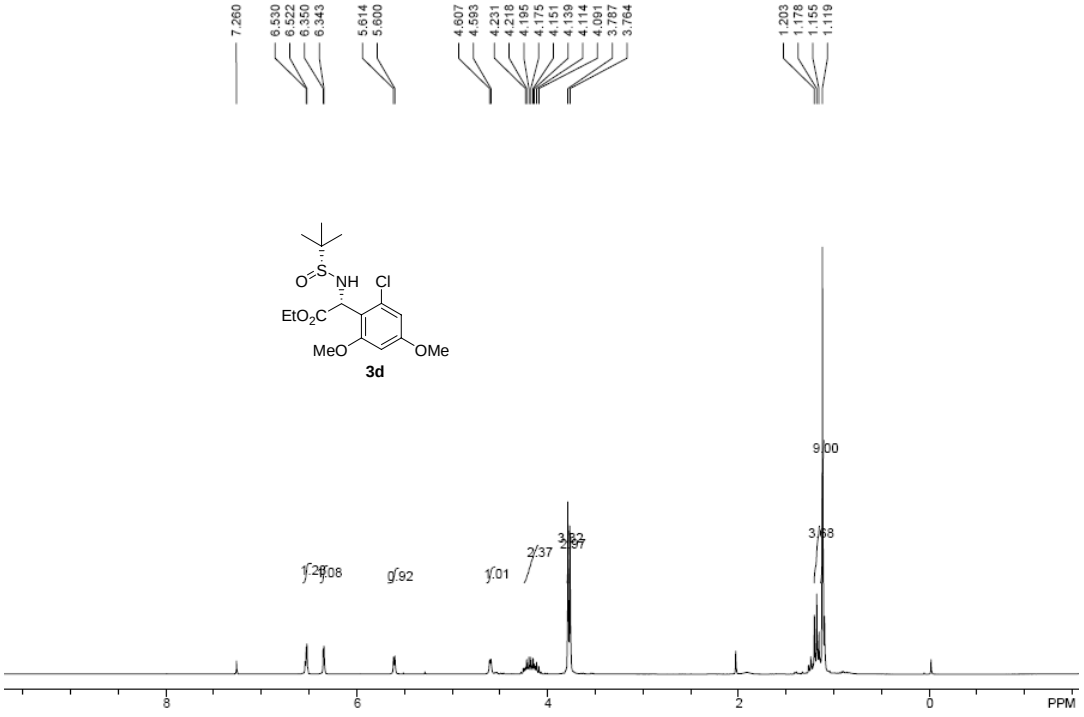



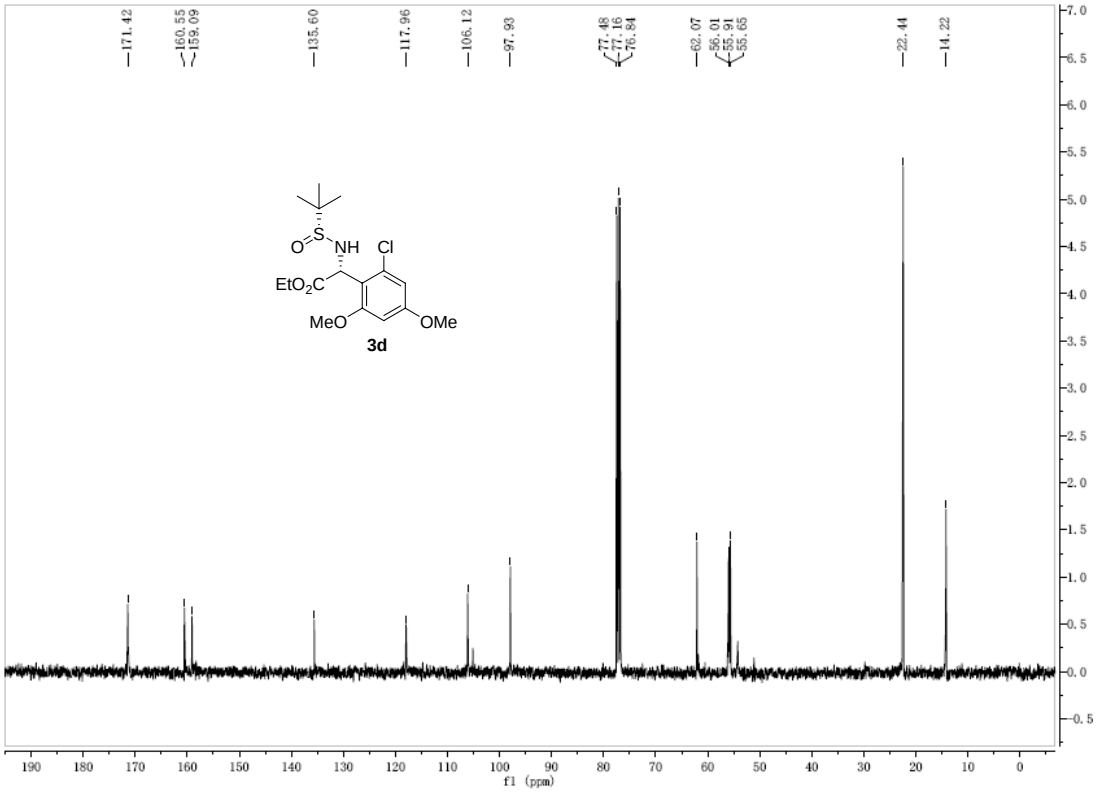

7.260
6.093
5.505
5.488
4.594
4.577
4.215
4.203
4.178
4.150
4.126
4.114
4.091
3.801
3.768
1.194
1.169
1.146
1.089
NH
OMe
EtO2C
MeO
OMe
3b
9.51
6.26
3.45
3.00
2.21
0.90
1.01
2.23
PPM


172.55
161.38
158.83
107.92
90.68
77.48
77.16
76.84
61.59
55.85
55.76
55.39
51.35
22.44
14.27
NH
OMe
EtO2C
MeO
OMe
3b
f1 (ppm)


7.260
6.311
6.292
5.340
5.327
4.638
4.628
4.209
4.186
4.165
4.140
4.117
4.087
3.778
3.731
2.355
1.188
1.165
1.140
1.122
NH
Me
EtO2C
MeO
OMe
3c
12.22
3.32
3.20
2.96
2.26
2.00
0.97
0.99
PPM


172.34
160.17
158.74
139.22
117.52
107.05
96.58
77.48
77.16
76.84
61.79
55.71
55.63
55.26
53.44
22.50
20.24
14.24
NH
Me
EtO2C
MeO
OMe
3c
f1 (ppm)


7.260
6.530
6.522
6.350
6.343
5.614
5.600
4.607
4.593
4.231
4.218
4.195
4.175
4.151
4.139
4.114
4.091
3.787
3.764
1.203
1.178
1.155
1.119
NH
Cl
EtO2C
MeO
OMe
3d
9.00
3.68
2.37
1.01
0.92
PPM


171.42
160.55
159.09
135.60
117.96
106.12
97.93
77.48
77.16
76.84
62.07
56.01
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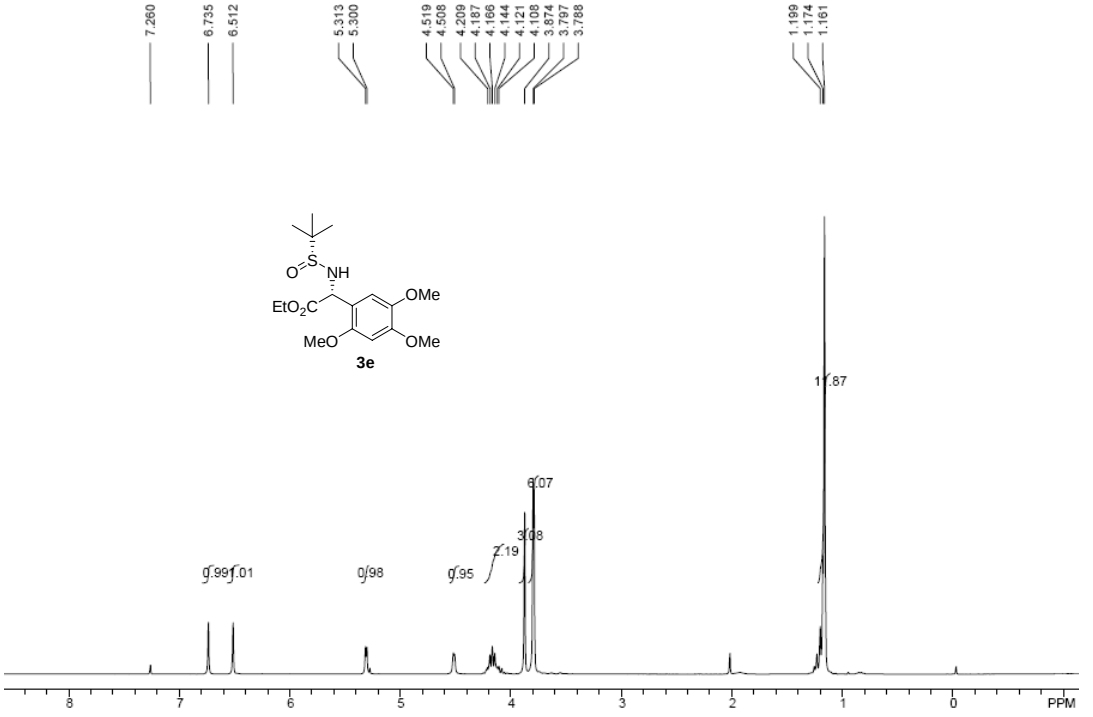
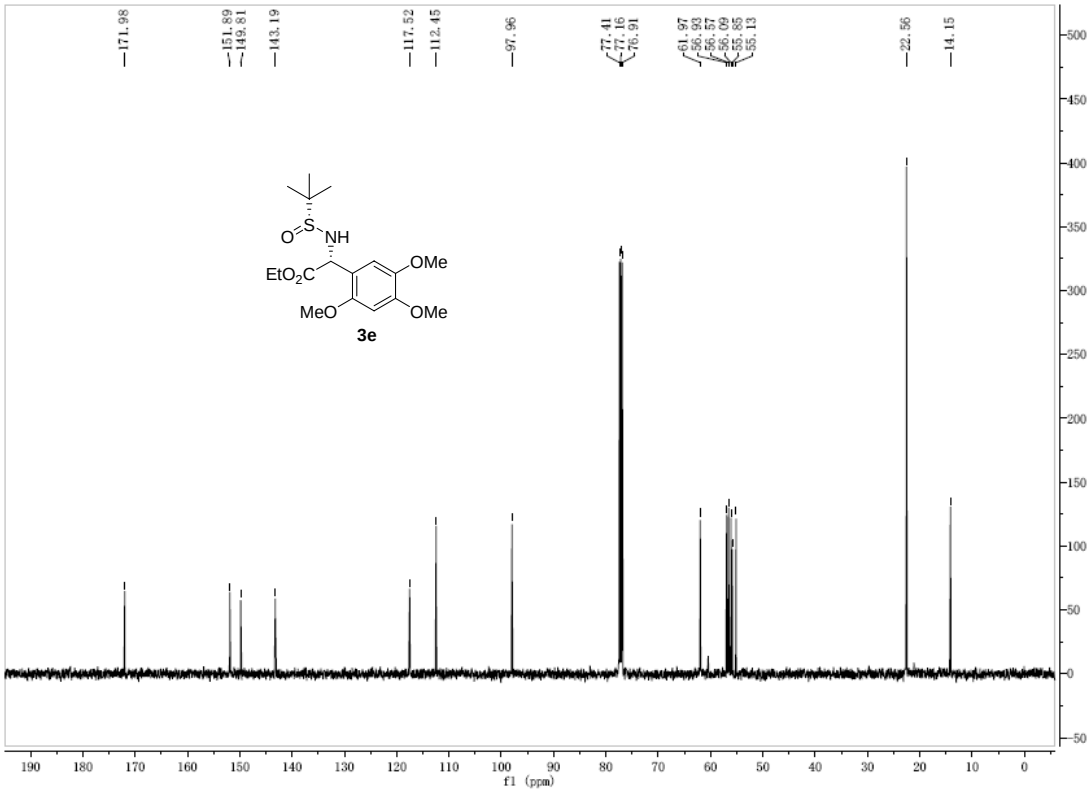
55.65
22.44
14.22
NH
Cl
EtO2C
MeO
OMe
3d
f1 (ppm)


7.260
6.735
6.512
5.313
5.300
4.519
4.508
4.209
4.187
4.166
4.144
4.121
4.108
3.874
3.797
3.788
1.199
1.174
1.161
NH
OMe
EtO2C
MeO
OMe
3e
11.87
6.07
3.08
2.19
0.99
1.01
0.98
0.95
PPM


171.98
151.89
149.81
143.19
117.52
112.45
97.96
77.41
77.16
76.91
61.97
56.83
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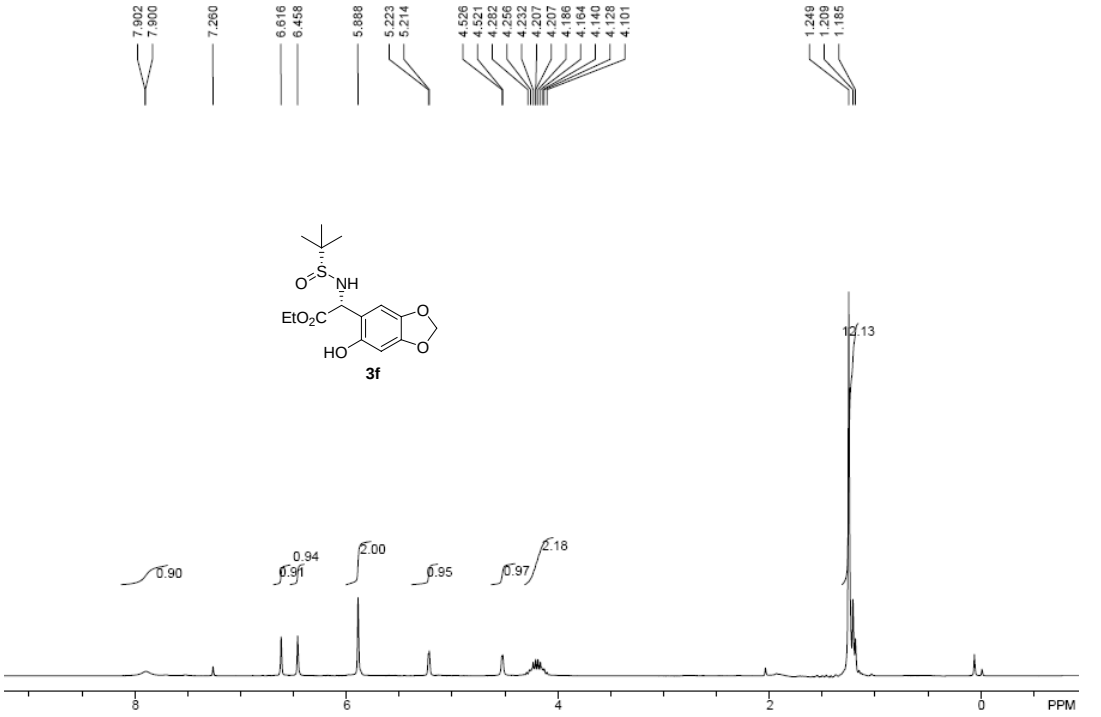
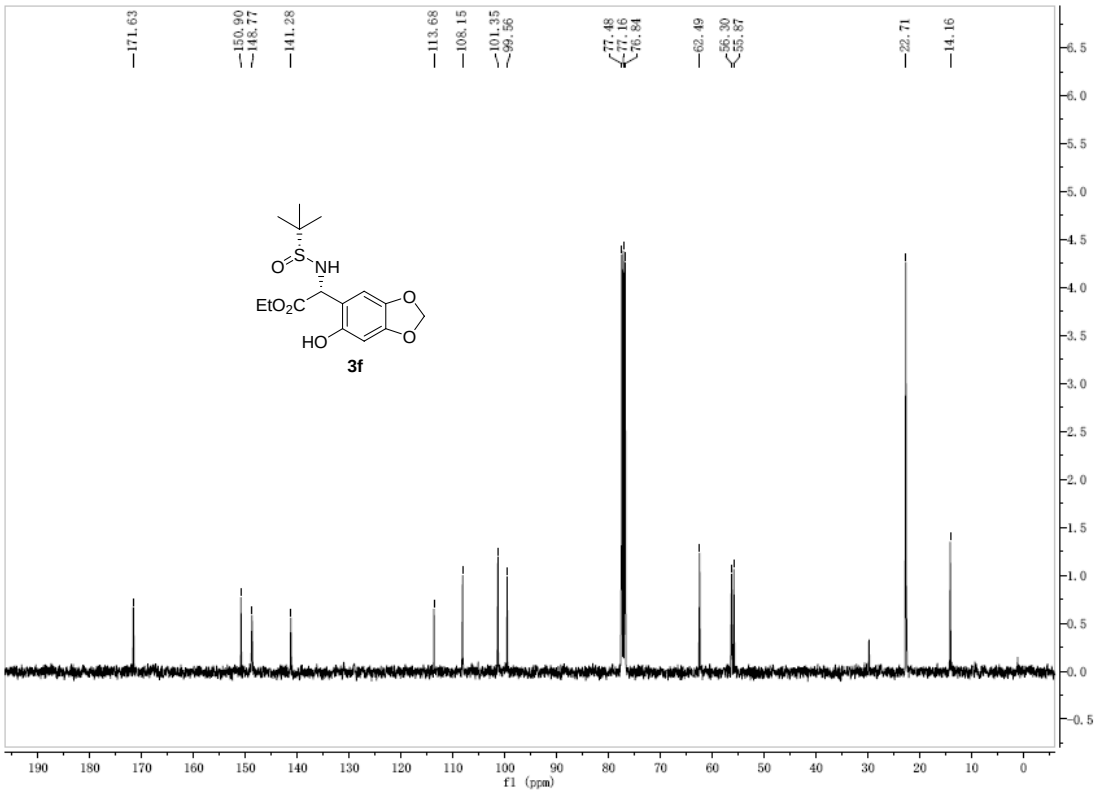
55.13
22.56
14.15
NH
OMe
EtO2C
MeO
OMe
3e
f1 (ppm)


7.902
7.900
7.260
6.616
6.458
5.888
5.223
5.214
4.526
4.521
4.282
4.256
4.232
4.207
4.207
4.186
4.164
4.140
4.128
4.101
1.249
1.209
1.185
NH
EtO2C
HO
3f
12.13
0.90
0.94
0.91
2.00
0.95
0.97
2.18
8
6
4
2
0
PPM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99.56
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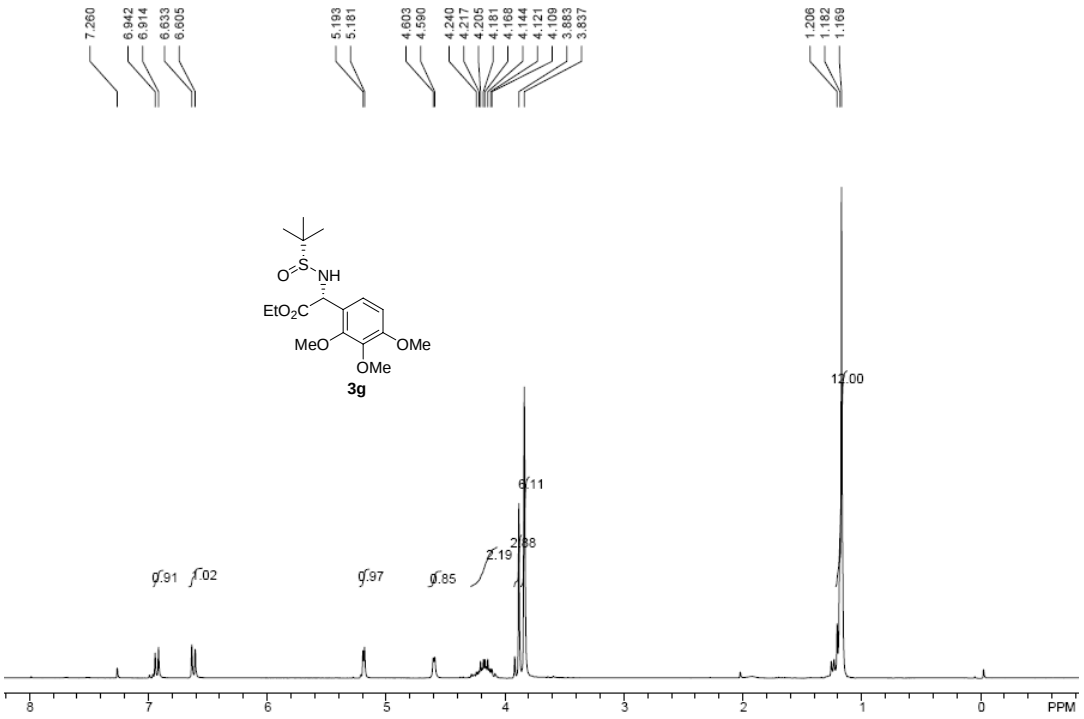
62.49
56.30
55.87
22.71
14.16
NH
EtO2C
HO
3f
f1 (ppm)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5.181
4.603
4.590
4.240
4.217
4.205
4.181
4.168
4.144
4.121
4.109
3.883
3.837
1.206
1.182
1.169
NH
EtO2C
MeO
OMe
OMe
3g
12.00
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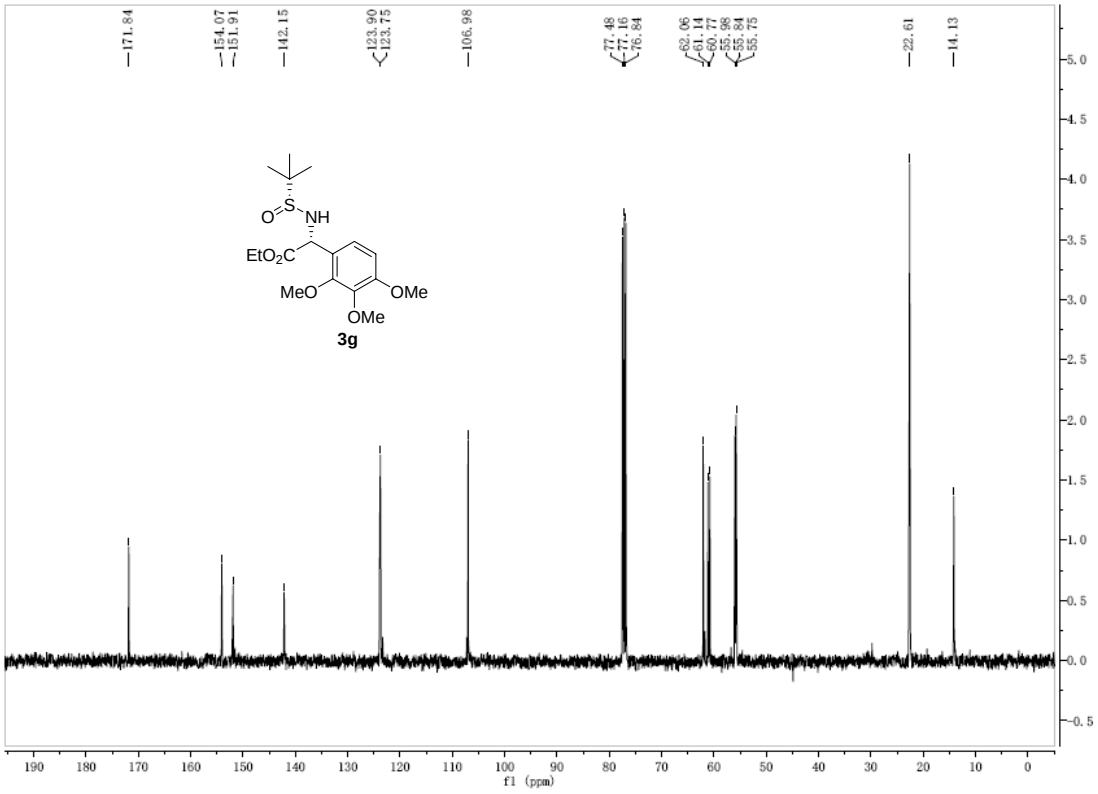
2.88
2.19
0.91
1.02
0.97
0.85
PPM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77.48
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62.06
61.14
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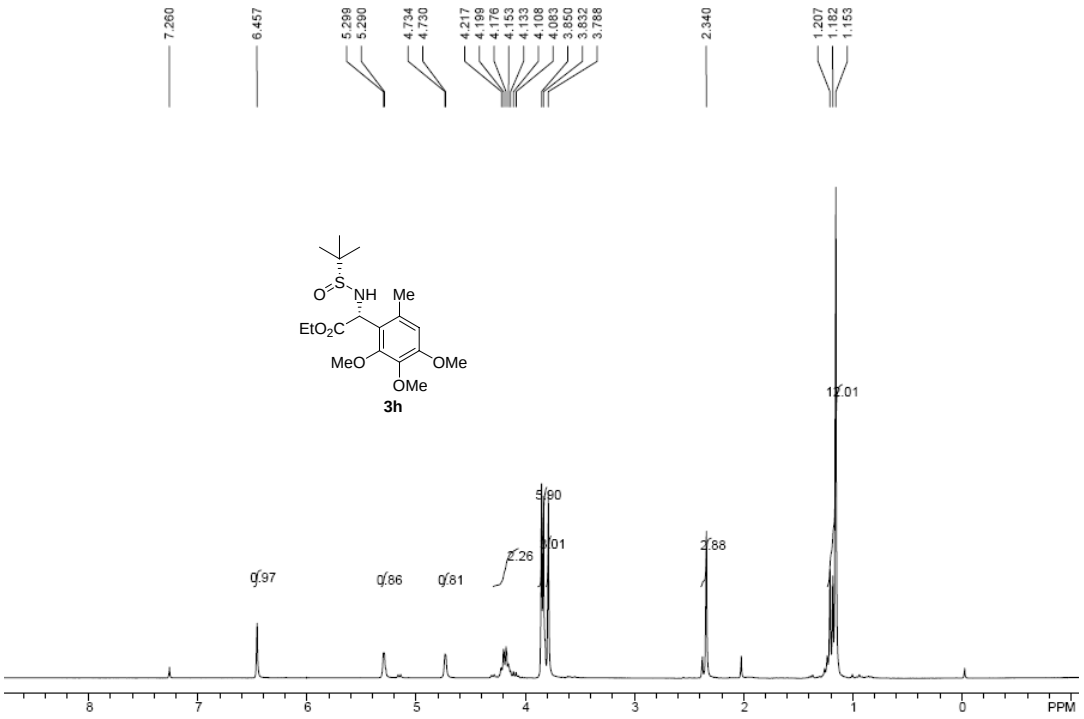
55.75
22.61
14.13
NH
EtO2C
MeO
OMe
OMe
3g
f1 (ppm)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4.199
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4.108
4.083
3.850
3.832
3.788
2.340
1.207
1.182
1.153
NH
Me
MeO
OMe
OMe
3h
12.01
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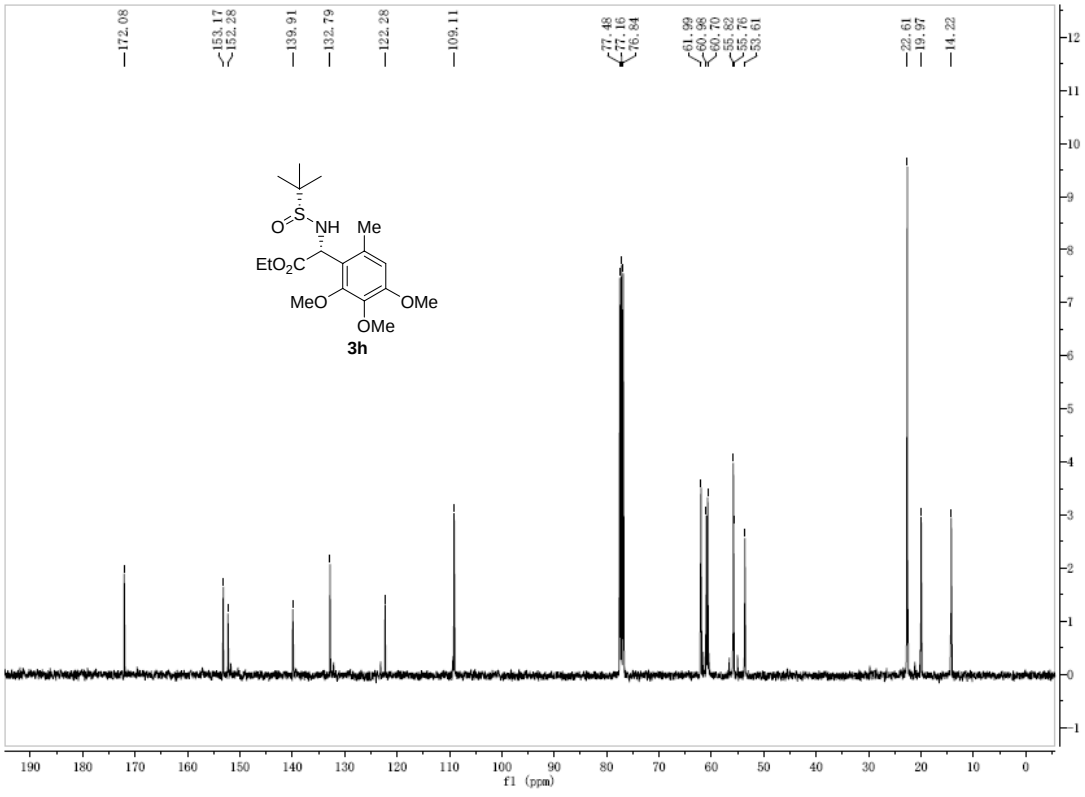
5.01
2.88
2.26
0.97
0.86
0.81
PPM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122.28
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77.48
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76.84
61.99
60.98
60.70
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53.61
22.61
19.97
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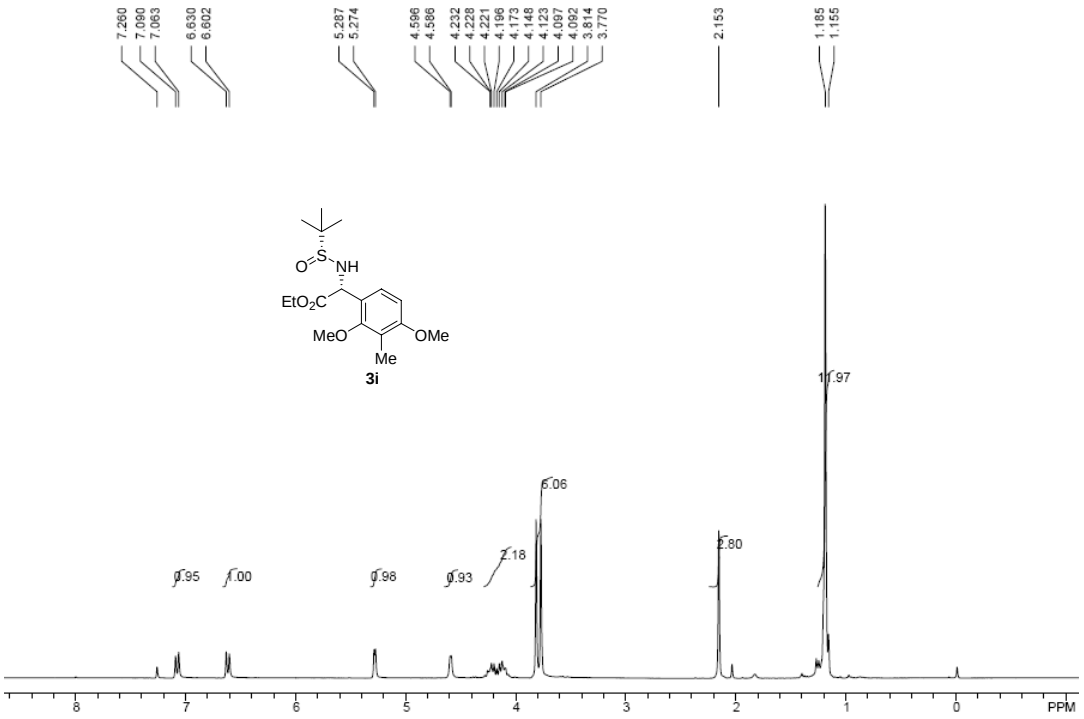
Me
MeO
OMe
OMe
3h
f1 (ppm)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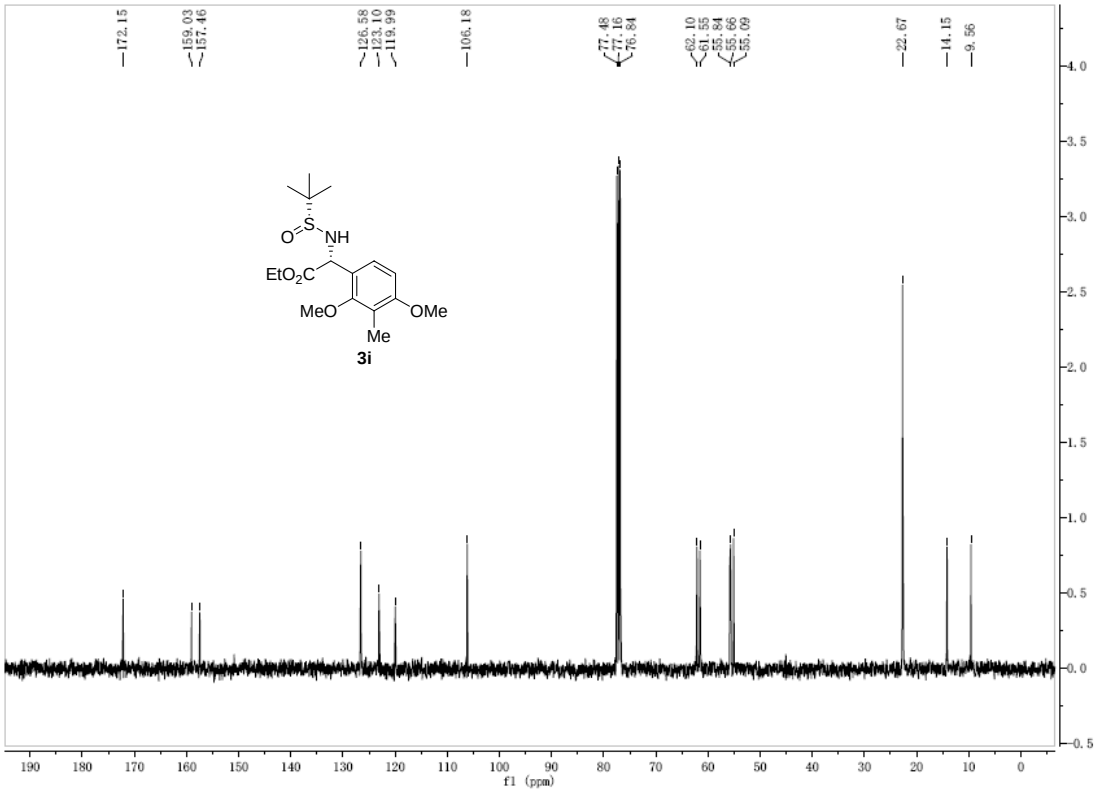
4.196
4.173
4.148
4.123
4.097
4.092
3.814
3.770
2.153
1.185
1.155
NH
EtO2C
MeO
OMe
Me
3i
11.97
6.06
2.80
2.18
0.95
1.00
0.98
0.93
PPM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126.58
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77.48
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76.84
62.10
61.55
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22.67
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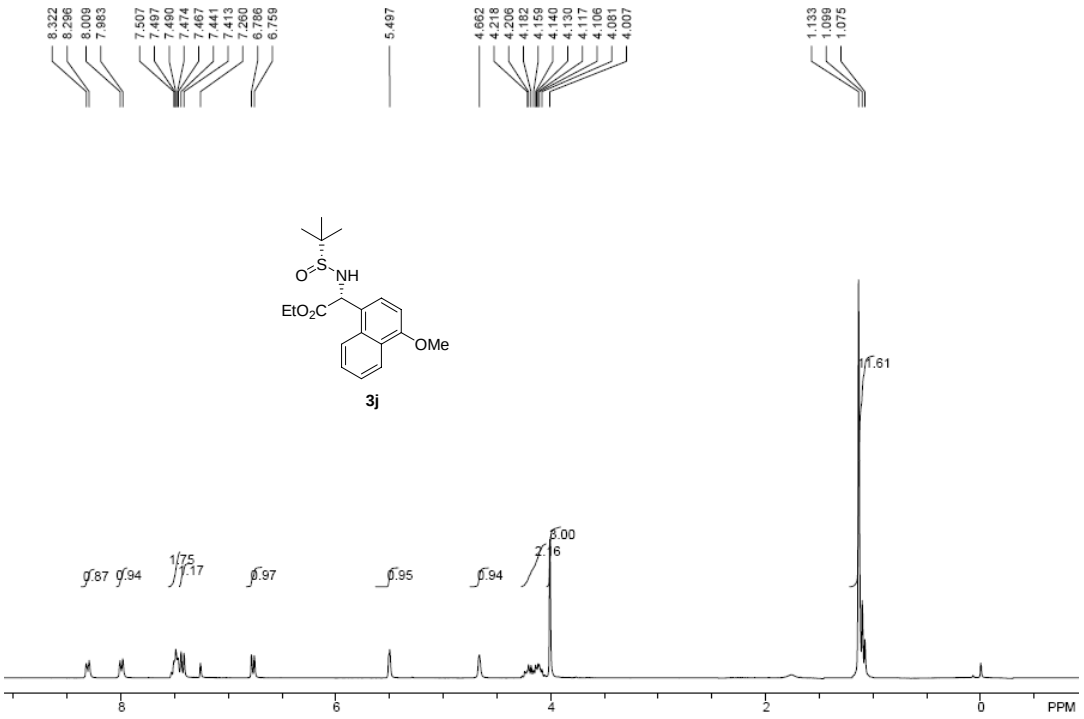
EtO2C
MeO
OMe
Me
3i
f1 (ppm)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7.260
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6.759
5.497
4.662
4.218
4.206
4.182
4.159
4.140
4.130
4.117
4.106
4.081
4.007
1.133
1.099
1.075
O
S
NH
EtO2C
OMe
3j
11.61
3.00
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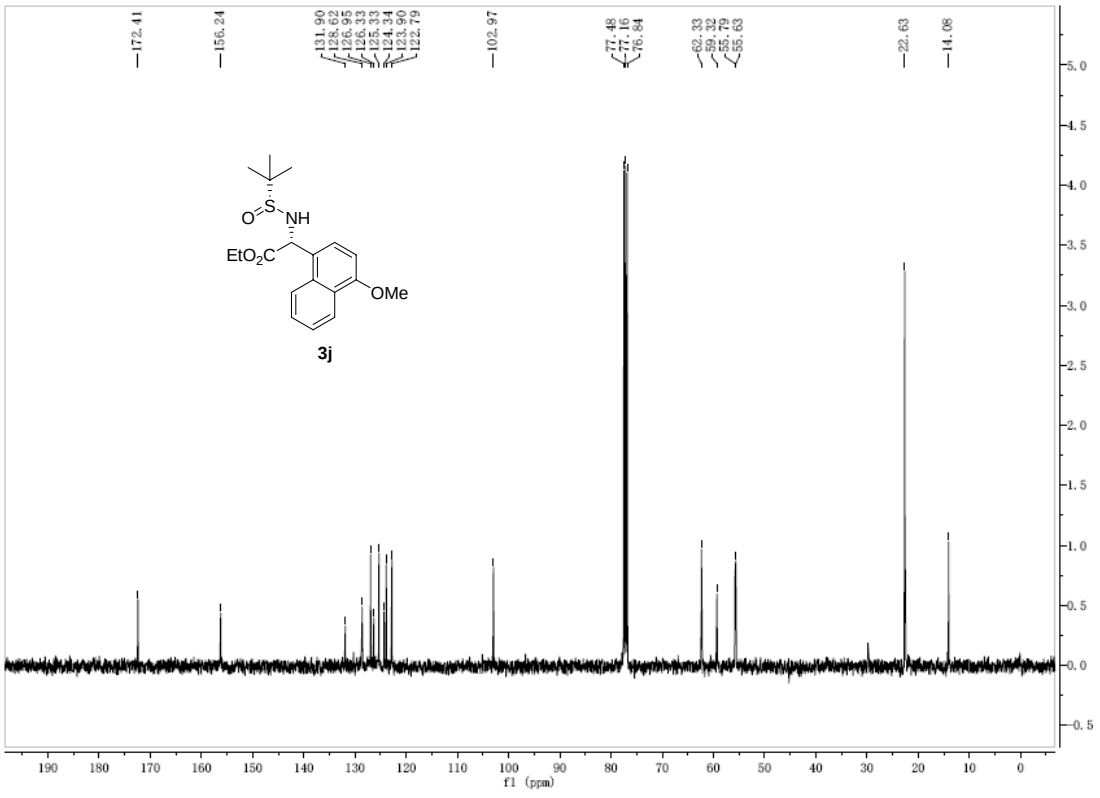
1.75
1.17
0.87
0.94
0.97
0.95
0.94
8
6
4
2
0
PPM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126.95
126.33
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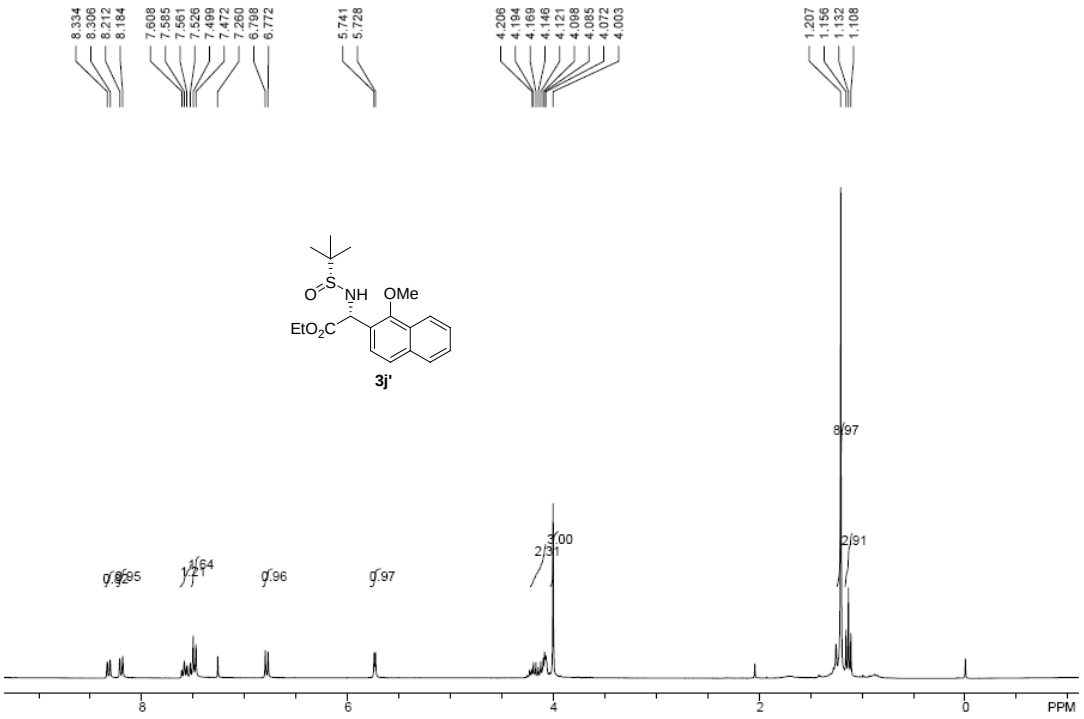
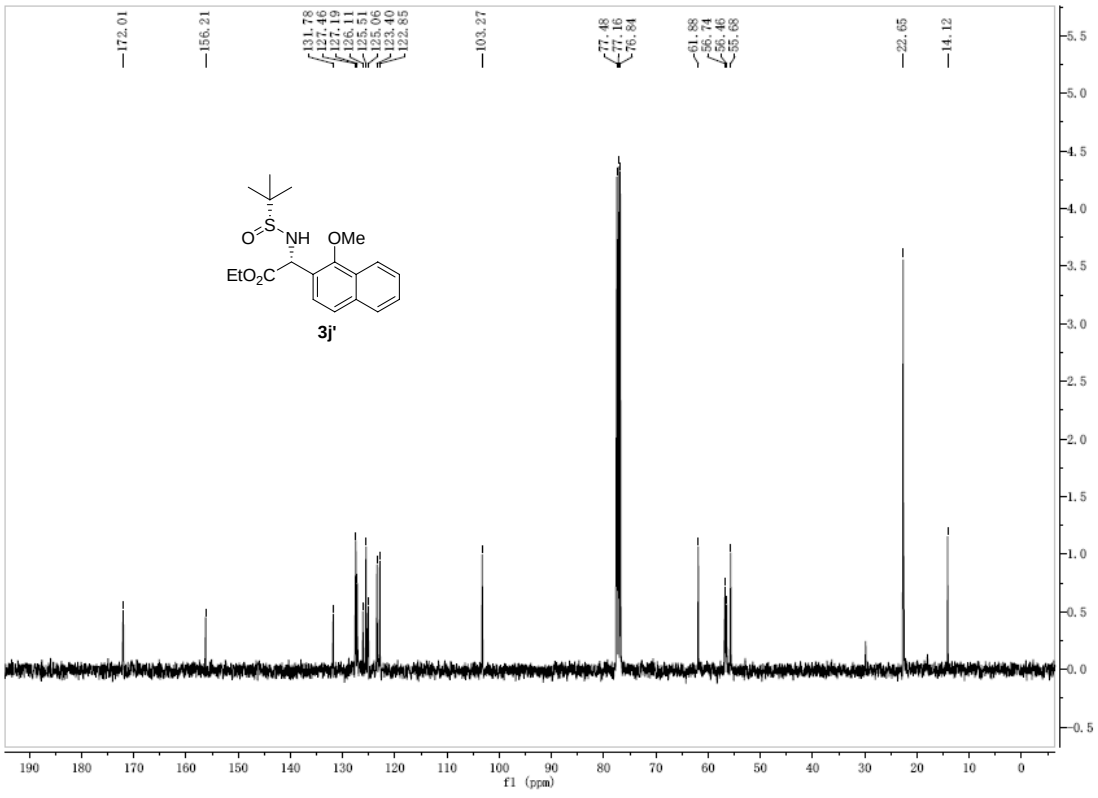
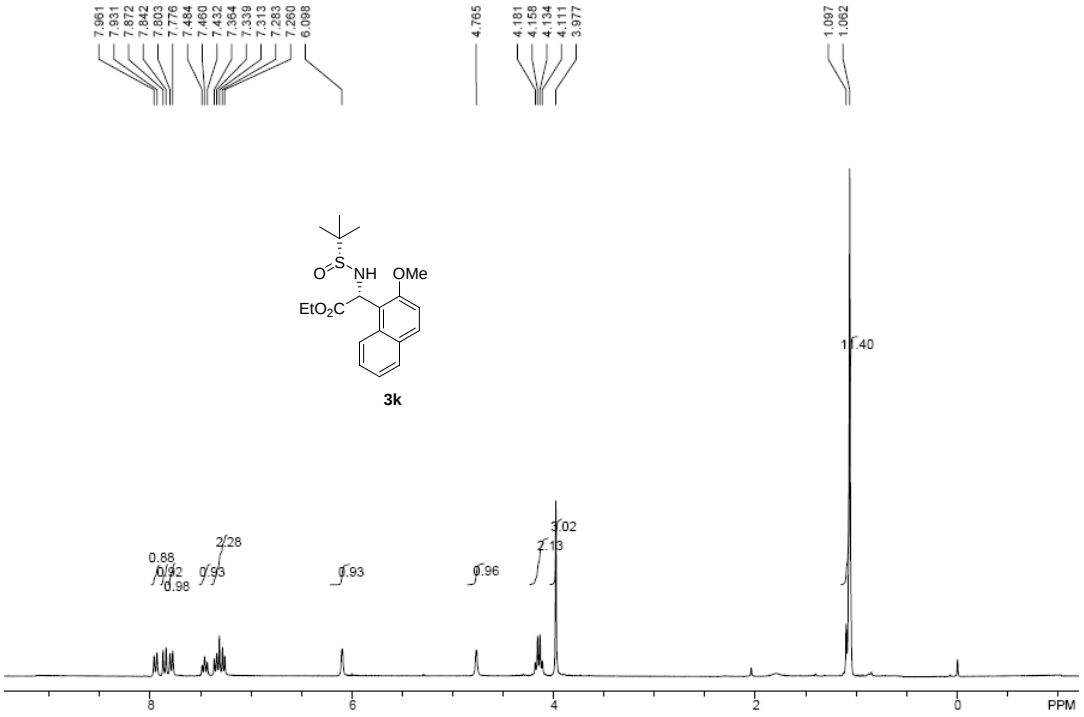
124.34
123.90
122.79
102.97
77.48
77.16
76.84
62.33
59.32
55.79
55.63
22.63
14.08
O
S
NH
EtO2C
OMe
3j
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

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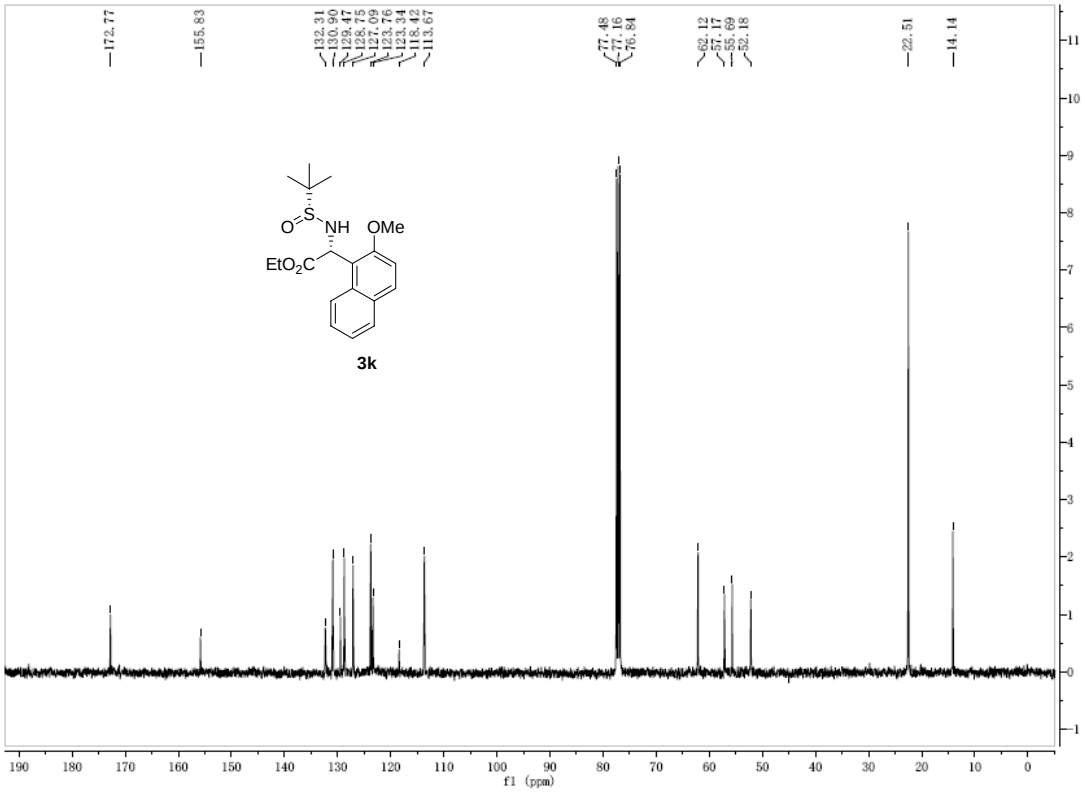
7.460
7.432
7.364
7.339
7.313
7.283
7.260
6.098
4.765
4.181
4.158
4.134
4.111
3.977
1.097
1.062
O
S
NH
OMe
EtO2C
3k
11.40
3.02
2.13
2.28
0.88
0.92
0.98
0.93
0.93
0.96
8
6
4
2
0
PPM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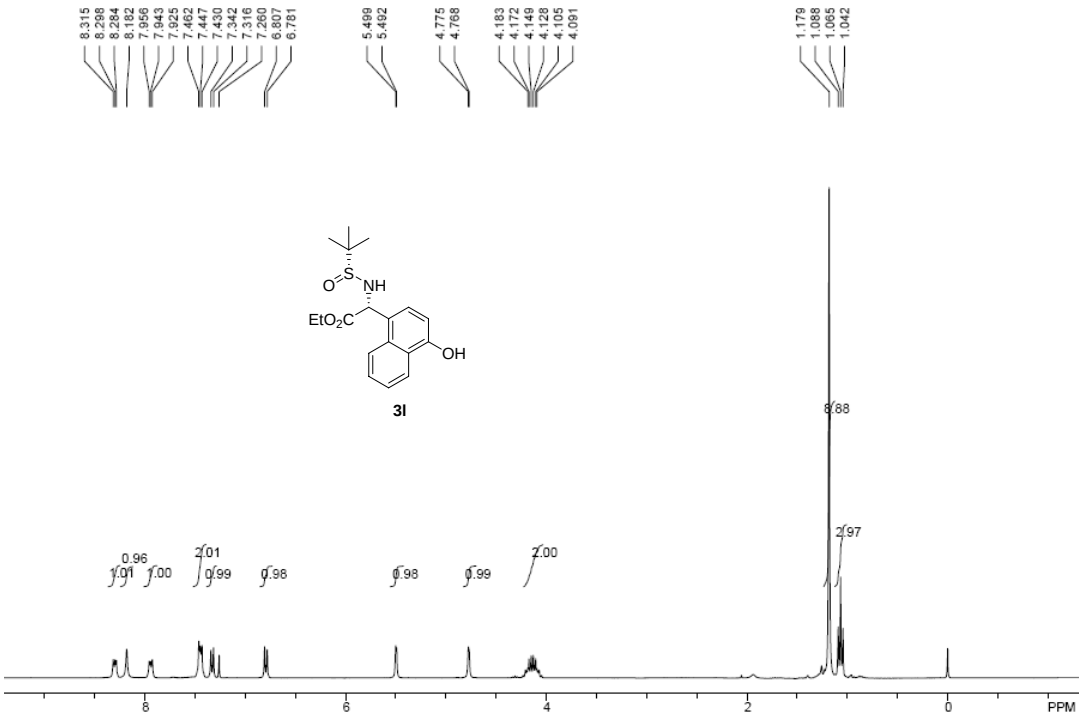
128.09
127.76
123.34
118.42
113.67
77.48
77.16
76.84
62.12
57.17
55.69
52.18
22.51
14.14
O
S
NH
OMe
EtO2C
3k
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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8.182
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7.462
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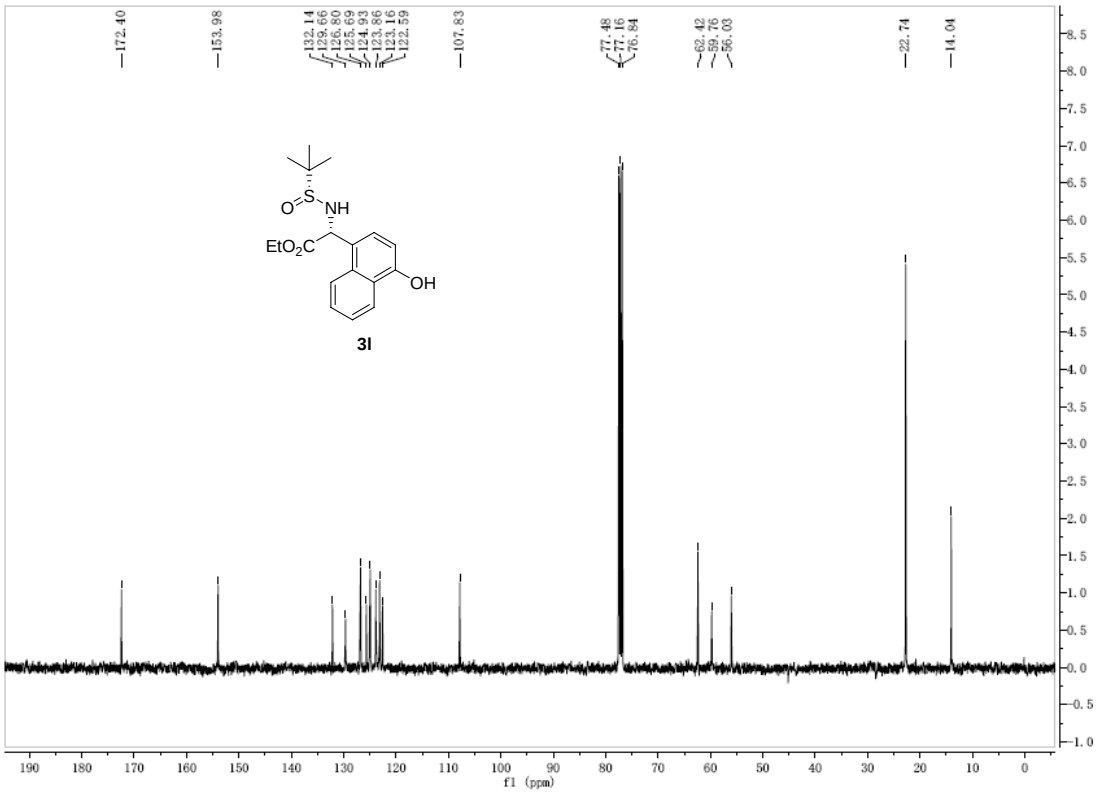
7.430
7.342
7.316
7.260
6.807
6.781
5.499
5.492
4.775
4.768
4.183
4.172
4.149
4.128
4.105
4.091
1.179
1.088
1.065
1.042
NH
EtO2C
OH
3l
8.88
2.97
0.96
1.01
1.00
2.01
0.99
0.98
0.98
0.99
2.00
8
6
4
2
0
PPM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125.69
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123.16
122.59
107.83
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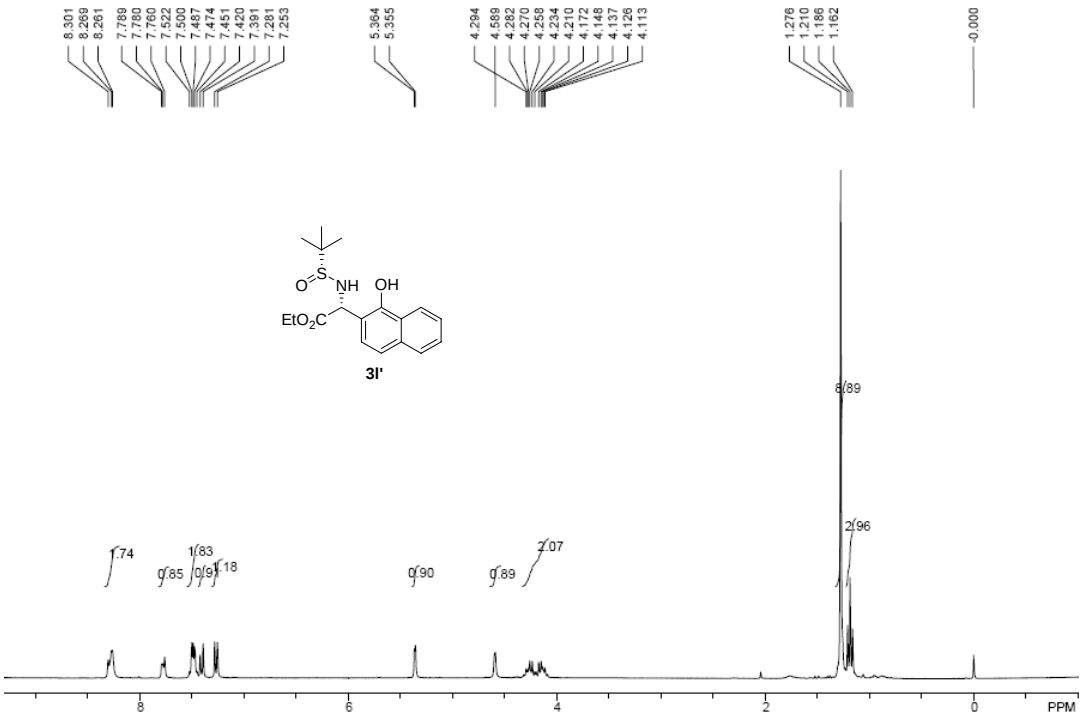
77.16
76.84
62.42
59.76
56.03
22.74
14.04
NH
EtO2C
OH
3l
f1 (ppm)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7.500
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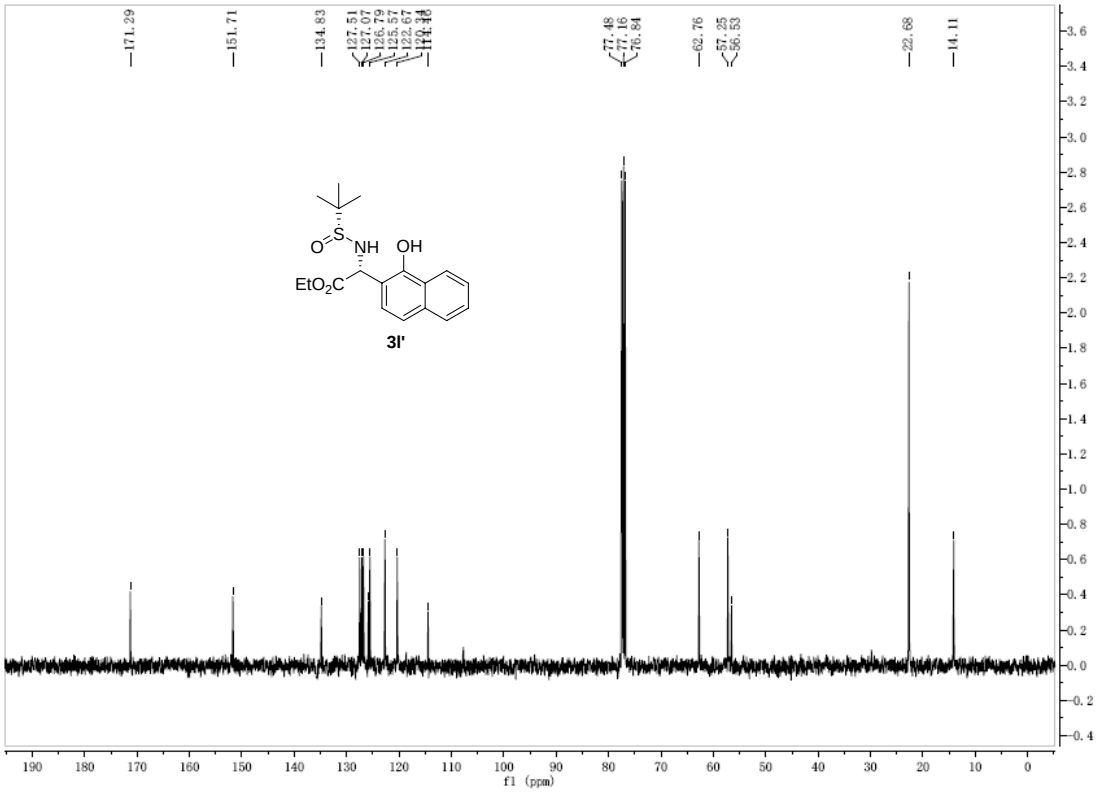
7.451
7.420
7.391
7.281
7.253
5.364
5.355
4.294
4.589
4.282
4.270
4.258
4.234
4.210
4.172
4.148
4.137
4.126
4.113
1.276
1.210
1.186
1.162
0.000
NH
OH
O
S
EtO2C
3l'
8.89
2.96
2.07
1.83
1.74
1.18
0.90
0.89
0.85
8
6
4
2
0
PPM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126.79
125.57
122.67
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77.16
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56.53
22.68
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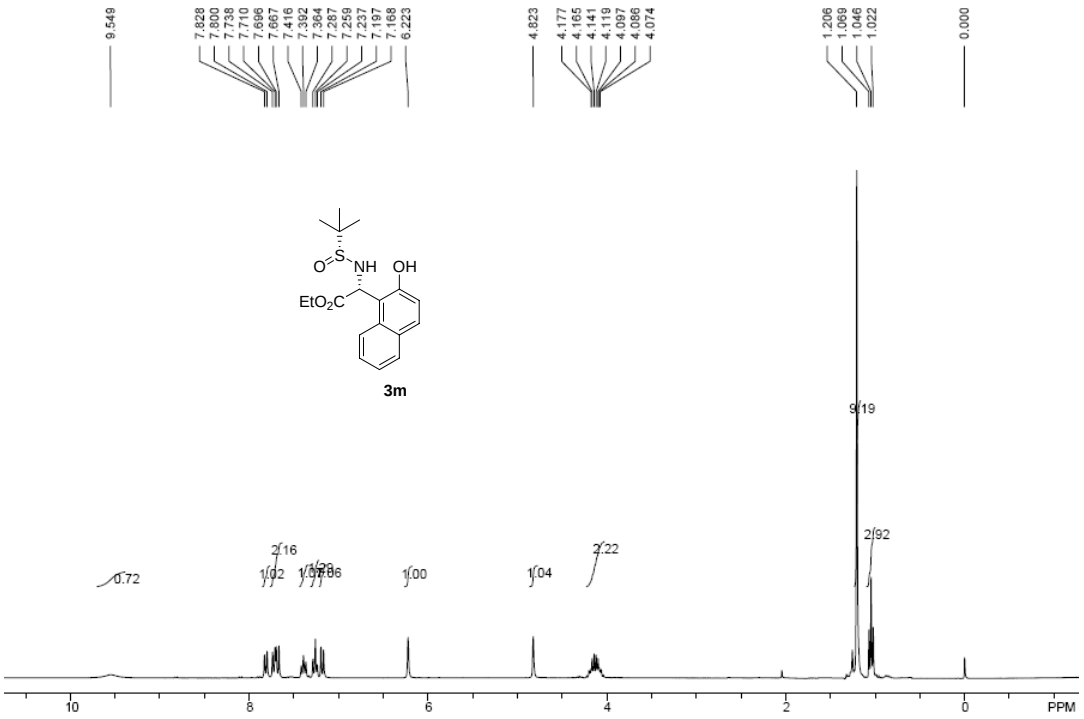
NH
OH
O
S
EtO2C
3l'
f1 (ppm)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7.738
7.710
7.696
7.667
7.416
7.392
7.364
7.287
7.259
7.237
7.197
7.168
6.223
4.823
4.177
4.165
4.141
4.119
4.097
4.086
4.074
1.206
1.069
1.046
1.022
0.000
NH
OH
EtO2C
3m
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2.16
1.02
1.00
1.04
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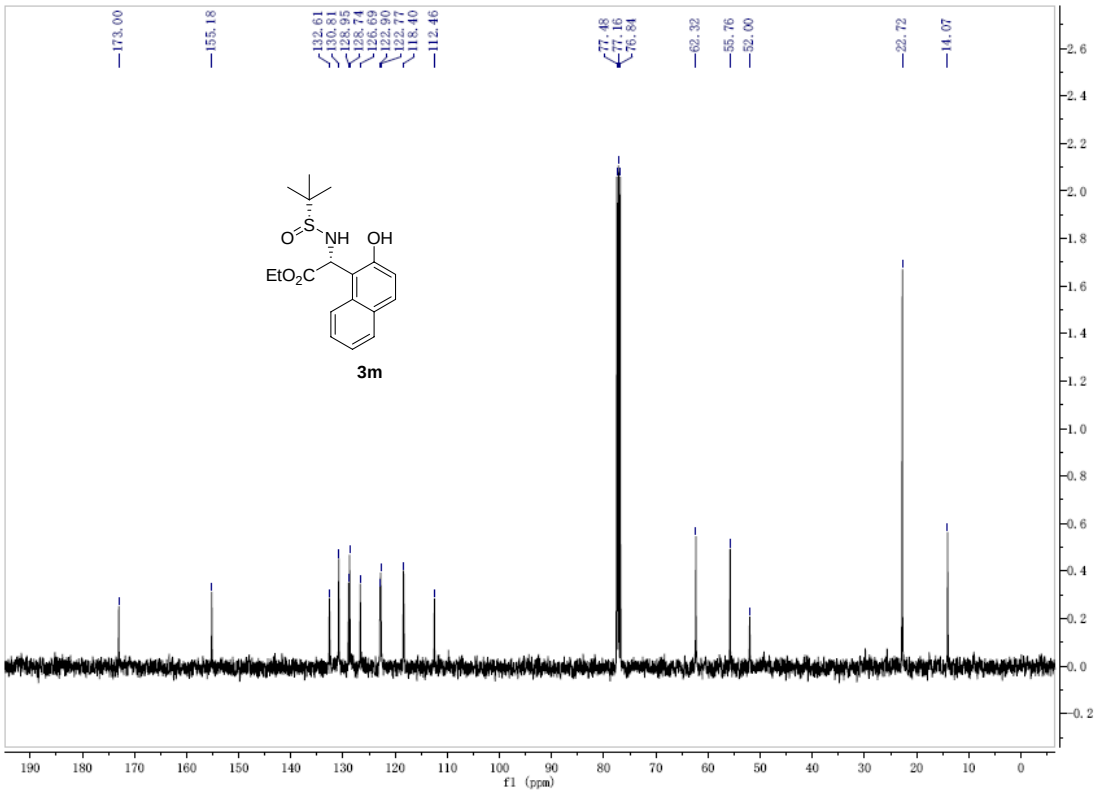
10
8
6
4
2
0
PPM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122.90
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112.46
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76.84
62.32
55.76
52.00
22.72
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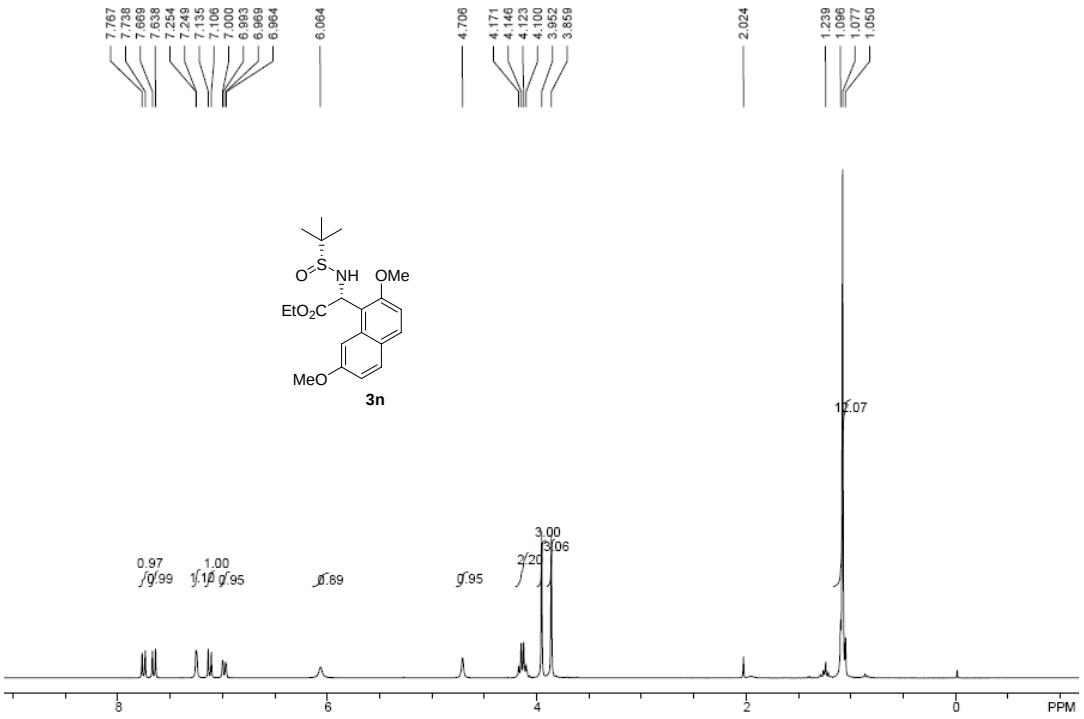
NH
OH
EtO2C
3m
f1 (ppm)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7.106
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6.964
6.064
4.706
4.171
4.146
4.123
4.100
3.952
3.859
2.024
1.239
1.096
1.077
1.050
3n
12.07
3.00
3.06
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0.99
1.00
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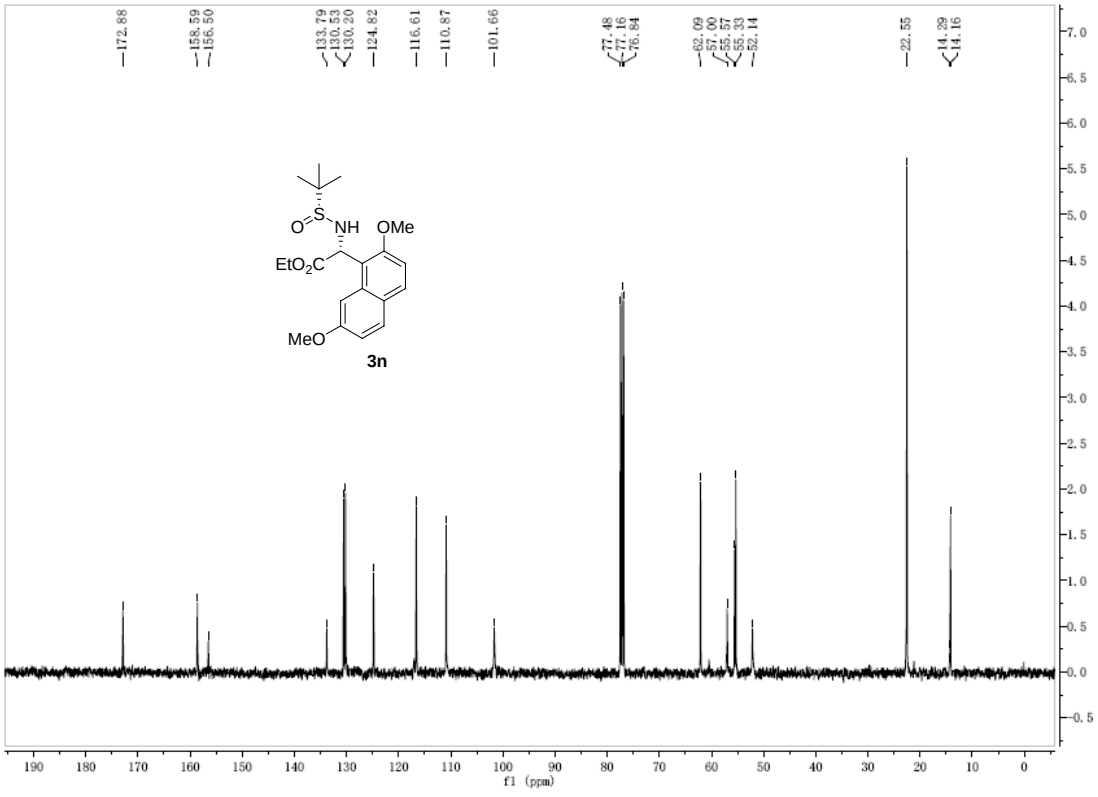
0.95
8
6
4
2
0
PPM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130.20
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116.61
110.87
101.66
77.48
77.16
76.84
62.09
57.00
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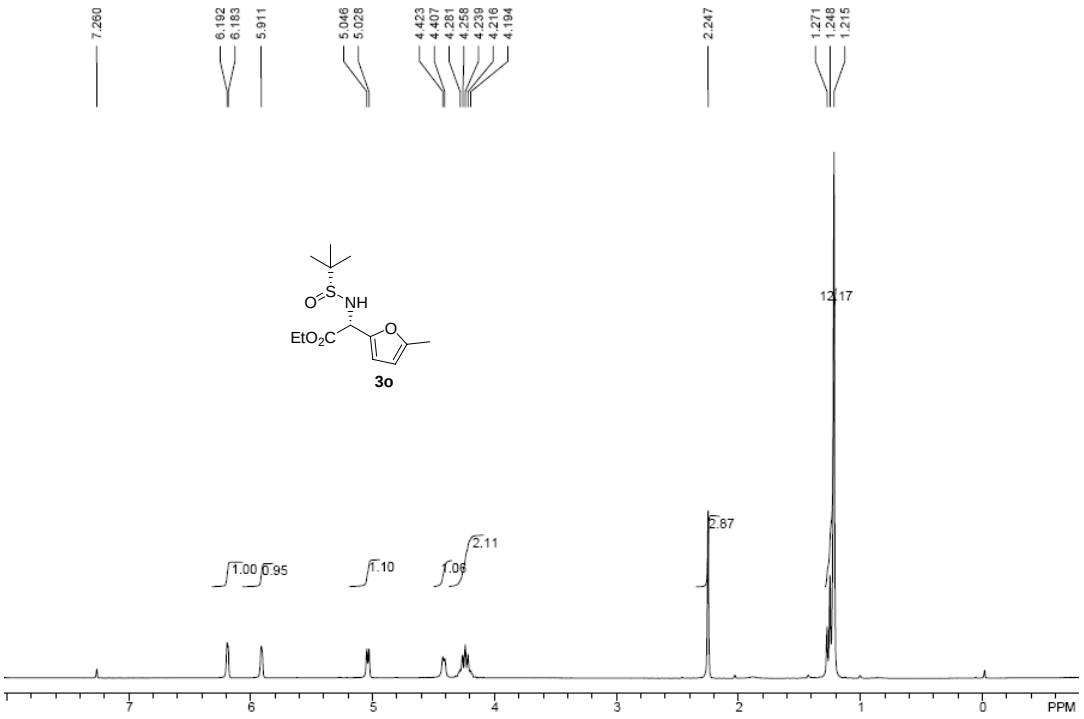
55.33
52.14
22.55
14.29
14.16
3n
f1 (ppm)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5.046
5.028
4.423
4.407
4.281
4.258
4.239
4.216
4.194
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1.271
1.248
1.215
3o
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2.87
2.11
1.00
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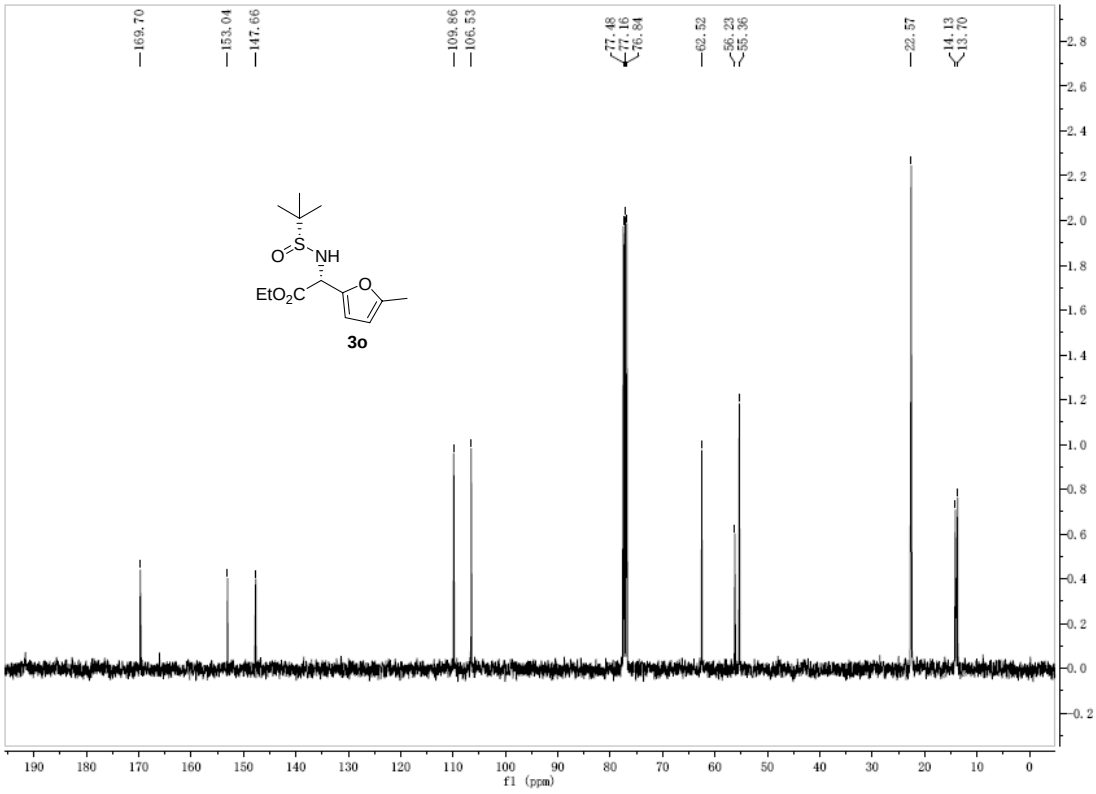
1.10
1.06
PPM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76.84
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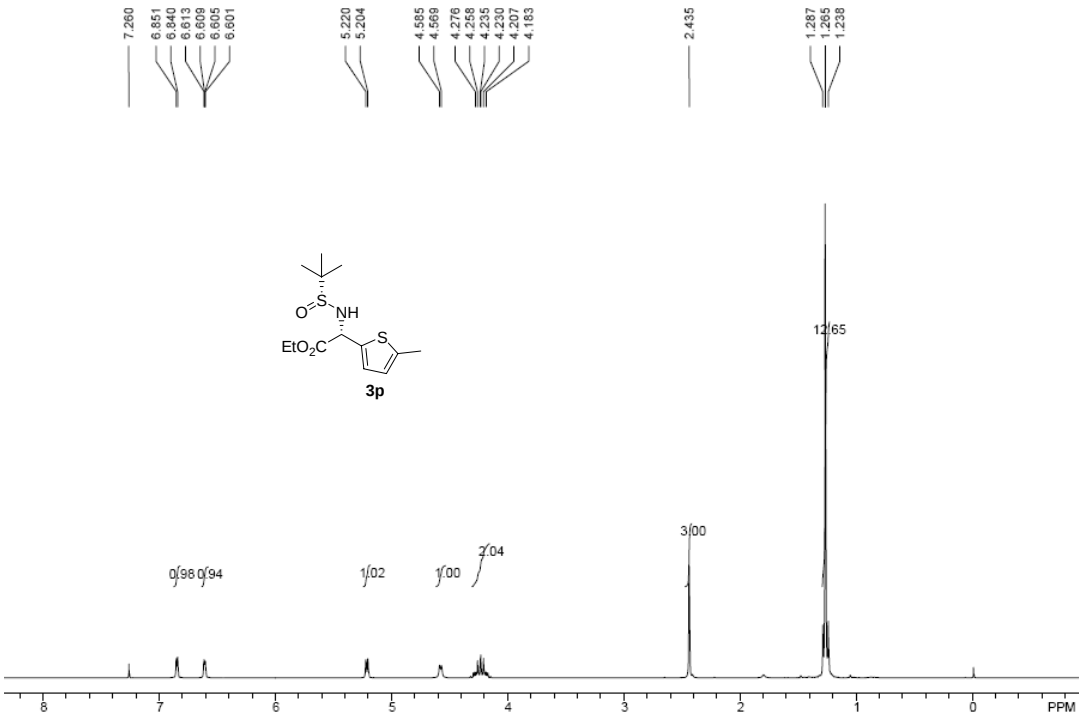
56.23
55.36
22.57
14.13
13.70
3o
f1 (ppm)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6.609
6.605
6.601
5.220
5.204
4.585
4.569
4.276
4.258
4.235
4.230
4.207
4.183
2.435
1.287
1.265
1.238
3p
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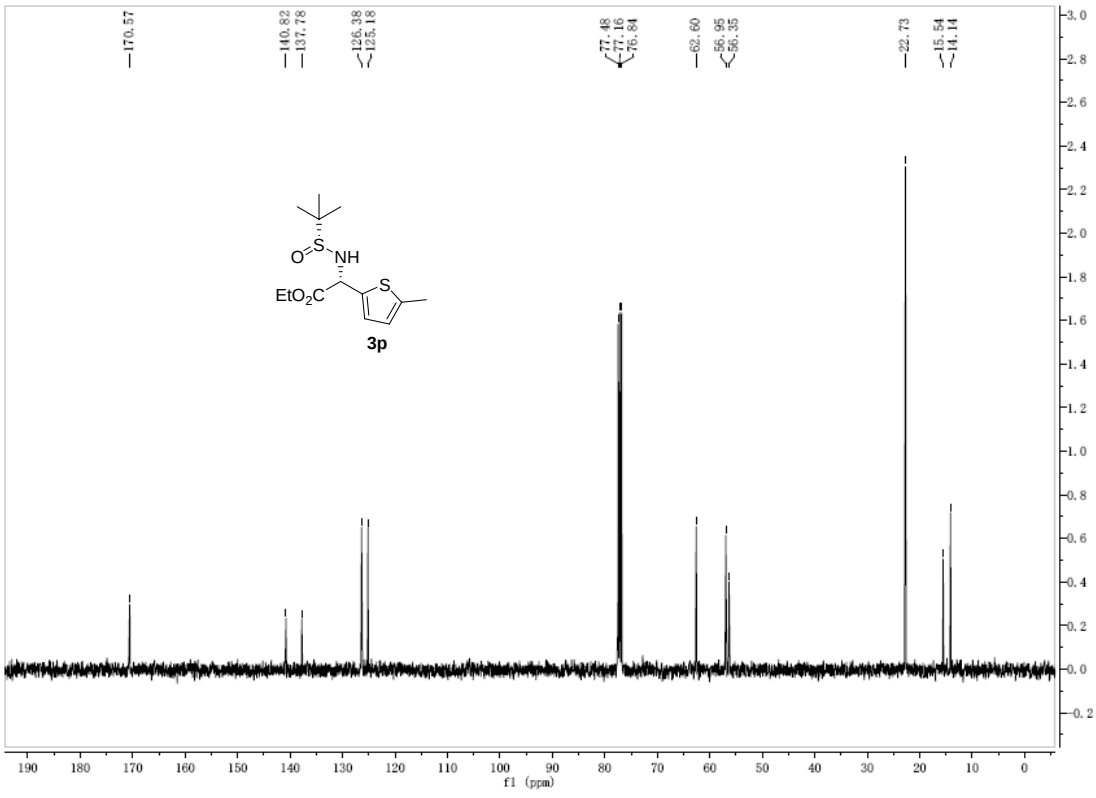
2.04
1.02
1.00
0.98
0.94
PPM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137.78
126.38
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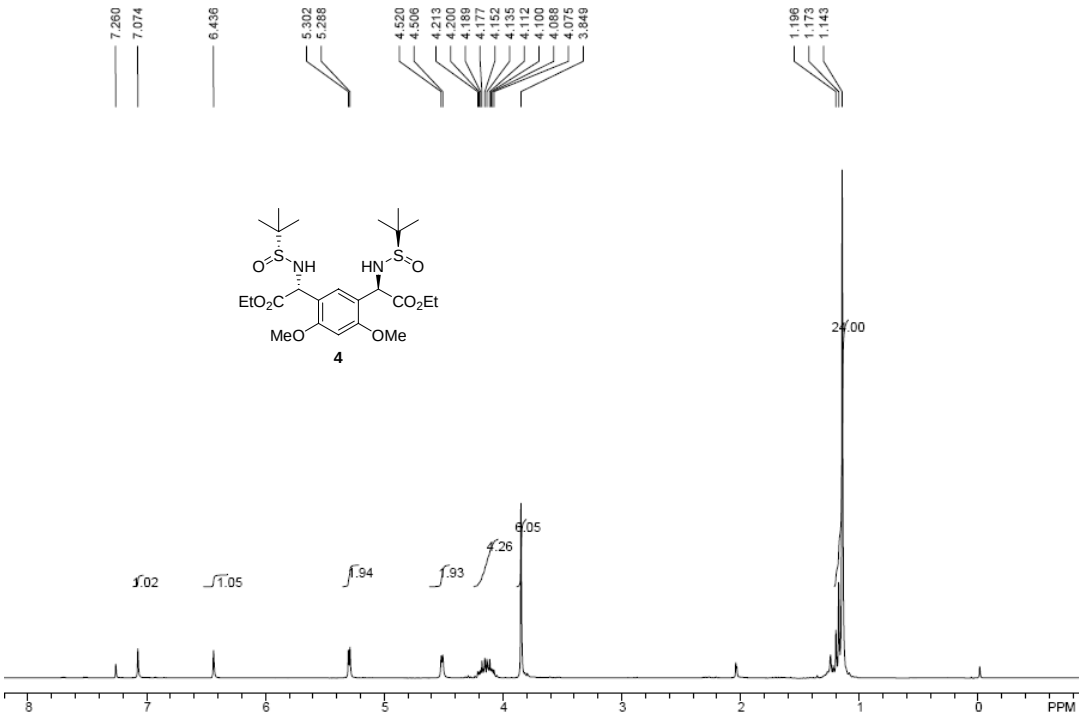
76.84
62.60
56.95
56.35
22.73
15.54
14.14
3p
f1 (ppm)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5.288
4.520
4.506
4.213
4.200
4.189
4.177
4.152
4.135
4.112
4.100
4.088
4.075
3.849
1.196
1.173
1.143
NH
HN
EtO2C
CO2Et
MeO
OMe
4
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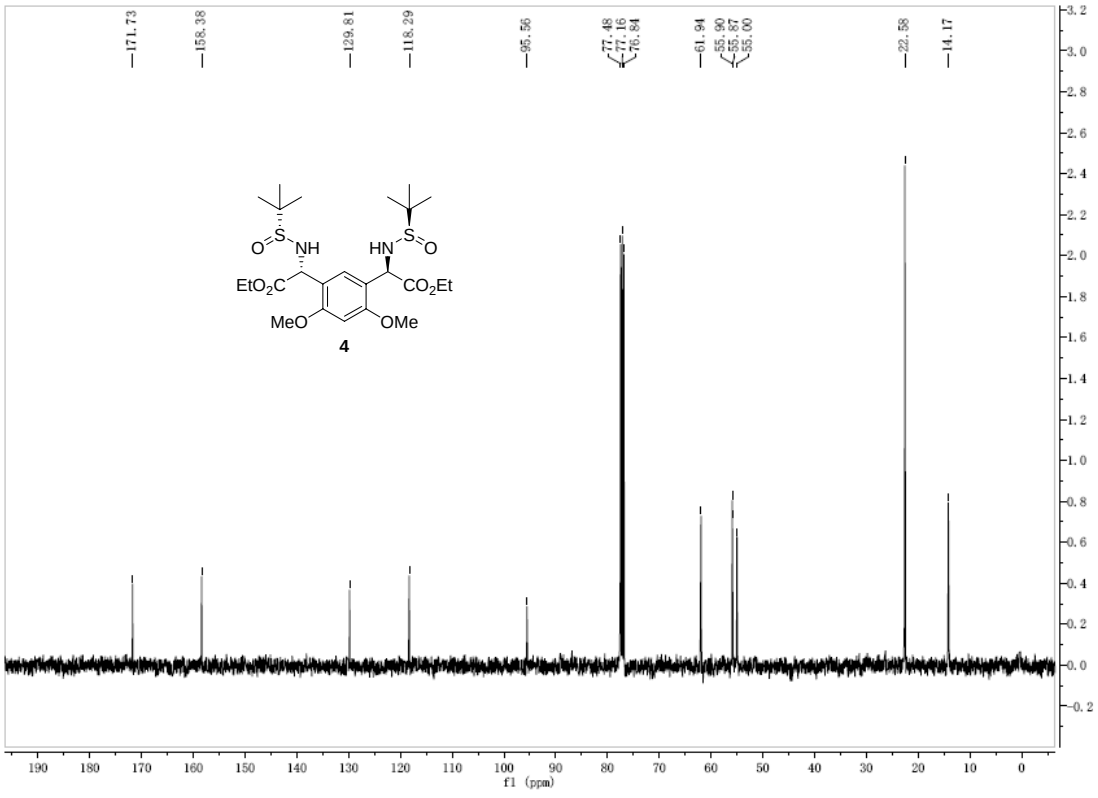
6.05
4.26
1.94
1.93
1.02
1.05
PPM


171.73
158.38
129.81
118.29
95.56
77.48
77.16
76.84
61.94
55.90
55.87
55.00
22.58
14.17
NH
HN
EtO2C
CO2Et
MeO
OMe
4
f1 (ppm)