# Supporting information

**for**

# One-pot Synthesis of α-sulfoximinophosphonate via Kabachnik–Fields Reaction

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## 1. General information

The starting material sulfoximines were synthesized in the laboratory following a reported method.[1] The arylaldehydes, phosphite esters**,** anhydrous tetrahydrofuran and $InCl_3$ were purchased from various suppliers and used as received. $^{1}$H (400 and 500 MHz), $^{13}$C NMR (101 and 126 MHz) and $^{31}$P NMR (162 and 202 MHz) spectra were recorded on BRUKER NMR spectrophotometer. $CDCl_3$ were used as solvent to record NMR spectra. $^{31}$P NMR was taken for some compounds (**4aa, 4ab, 4ba, 4bb, 4ca, 4ea, 4fa, 4fb, 4fe, 4ff, 4fg, 4fk, 4ga**). HR Mass spectra were recorded with Agilent QTOF G6545 spectrometer at 50,000 resolutions using ESI mode. Melting points were uncorrected. All geometric and intensity data of the crystal was collected using a Super-Nova (Mo) X-ray diffractometer equipped with a micro-focus sealed X-ray tube Mo-Kα (λ = 0.71073 Å) X-ray source and HyPix3000 detector with increasing ω (width of 0.3 per frame) at a scan speed of 10 s per frame.

## 2. General procedure for one pot synthesis of α-sulfoximinophosphonate (4aa)

A 15 mL screw cap seal tube was charged with a magnetic stirring bar, sulfoximine (**1**, 31.8 mg, 0.188 mmol), aldehyde (**2**, 20.0 mg, 0.188 mmol), di-alkyl/aryl phosphite (**3**, 26.0 mg, 0.188 mmol), tetrahydrofuran (1.5 mL) and $InCl_3$ (10 mol %). The tube was firmly closed and stirred at 70 °C for 16 h. After completion, the reaction mixture was quenched by water and extracted with ethyl acetate (3 x 15 mL). The combined organic extracts were dried over anhydrous $Na_2SO_4$ and filtered. The filtrate was evaporated and purified by column chromatography over silica gel (100-200 mesh) using EtOAc/Hexane (40%) as eluent to afford desired α-sulfoximinophosphonate (**4aa**).

With unsymmetrical sulfoximines, the products (Original manuscript, scheme 2, **4aa**-**4ea**) were obtained as diastereomeric mixture (almost 1:1 ratio), and we were able to separate two diastereomers in some of the cases (**4ca, 4ea**).

In case of symmetrical sulfoximines, we applied excess equivalents of phosphite (1.6 equiv.), and the reaction was performed at 80 °C. The products (Original manuscript, scheme 3, **4fa**-**4gd**) were obtained as single isomer.

## 3. General procedure for Suzuki−Miyaura coupling reaction of bromine containing α-sulfoximinophosphonate

A mixture of bromine containing α-sulfoximinophosphonate (**4fa,** 30.0 mg, 0.0464 mmol), arylboronic acid (**5**, 10.5 mg, 0.139 mmol), $K_2CO_3$ (32.0 mg, 0.232 mmol), $PPh_3$ (1.2 mg, 10 mol %) in 1,4-dioxane (3.0 mL), and distilled water (1.2 mL) was degassed with a stream of argon passing through the solution for 15 min. Thereafter, $Pd(PPh_3)_2Cl_2$ (1.6 mg, 5 mol %) was added, and the reaction mixture was stirred under argon atmosphere for 4 h at 90 °C. After completion, the reaction mixture was cooled, diluted with water (15 mL), and extracted with DCM (3 × 20 mL). The collected organic phase was dried over $Na_2SO_4$, filtered, and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel with 25 - 30% of EtOAc/Hexane as the eluent to give product **6**.

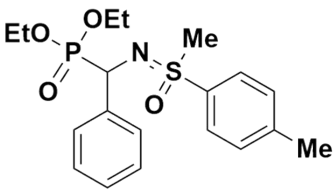
## 4. General procedure for Bechamp reduction of nitro containing α-sulfoximinophosphonate

In a screw cap sealed tube, compound **4fa** (60 mg, 0.0928 mmol), Fe powder (23.3 mg, 0.417 mmol) and concentrated acetic acid (27 µl, 1.671 mmol) were suspended in $H_2O$ (66 µL) and EtOH (132 µL). The resulting suspension was stirred for 2 h at 70 °C. After cooling down to room temperature the reaction mixture was extracted with DCM (3 x 15 mL). The collected organic phase was washed with a saturated $NaHCO_3$ solution (3 x 10 mL), brine (2 x 10 mL), dried over $Na_2SO_4$ and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel with 2% of MeOH/DCM as the eluent to give product **7a**.

**5. Characterisation data of the isolated compounds**

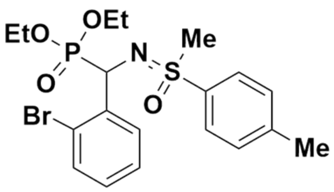
Unsymmetrical sulfoximines provided the products (**4aa–4ea**) as diastereomeric mixture (almost 1:1 ratio), and we were able to separate the diastereomers in some of the cases (**4ca, 4ea**). Yields were calculated by accumulating the amount of diastereomers for compounds (**4aa–4ea**).

**Compound 4aa:** (We were able to isolate only one diastereomer in pure form; Yield: 59%, 44 mg from 0.188 mmol of corresponding sulfoximine)




**Diastereomer-1:** It was obtained as yellowish sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.48 (d, $J$ = 8.0 Hz, 2H), 7.37 – 7.27 (m, 3H), 7.17 (d, $J$ = 7.5 Hz, 2H), 7.07 (d, $J$ = 8.0 Hz, 2H), 4.50 (d, $J_{H-P}$ = 19.5 Hz, 1H), 4.22 - 4.16 (m, 2H), 4.01 – 3.85 (m, 2H), 3.15 (s, 3H), 2.32 (s, 3H), 1.31 (t, $J$ = 7.0 Hz, 3H), 1.13 (t, $J$ = 7.0 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 144.2, 135.7, 130.1, 129.6, 129.1, 128.6, 128.4 (d, $J_{C-P}$ = 6.3 Hz), 128.1 (d, $J_{C-P}$ = 2.5 Hz), 63.1 (d, $J_{C-P}$ = 7.5 Hz), 63.0 (d, $J_{C-P}$ = 7.5 Hz), 57.1 (d, $J_{C-P}$ = 167.5 Hz), 45.8, 21.6, 16.5, 16.4. $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 22.7. HRMS (ESI) calcd for $C_{19}H_{27}NO_4PS$ $[M+H]^+$: 396.1393; found: 396.1400.

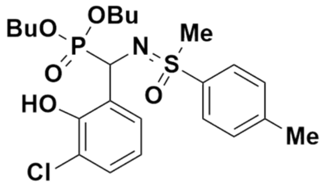
**Compound 4ab:** (Obtained as diastereomeric mixture (approx. 1:1); Yield: 76%, 39 mg from 0.108 mmol of corresponding sulfoximine)




It was obtained as colorless sticky liquid. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ 7.98 - 7.88 (m, 4H), 7.44 - 7.42 (m, 3H), 7.37 (m, 2H), 7.34 - 7.28 (m, 2H), 7.25 - 7.23 (m, 1H), 7.10 - 7.01 (m, 4H), 5.08 (d, $J_{H-P}$ = 20.0 Hz, 1H), 5.02 (d, $J_{H-P}$ = 20.8 Hz, 1H), 4.33 – 4.25 (m, 2H), 4.13 – 3.82 (m, 6H), 3.15 (s, 3H), 3.04 (s, 3H), 2.45 (s, 3H), 2.34 (s, 3H), 1.36 (t, $J$ = 6.8 Hz, 3H), 1.26 (t, $J$ = 7.2 Hz, 3H), 1.16 (t, $J$ = 6.8 Hz, 3H), 1.09 (t, $J$ = 7.2 Hz, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 144.2, 143.8, 142.7, 138.1, 137.4, 135.3, 135.1, 132.3 (d, $J_{C-P}$ =

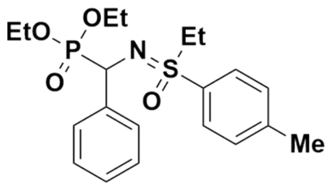
2.0 Hz), 131.9 (d, $J_{C-P}$ = 5.0 Hz), 131.8, 130.1, 129.6, 129.1, 128.9 (d, $J_{C-P}$ = 3.0 Hz), 128.7 (d, $J_{C-P}$ = 3.0 Hz), 128.6, 127.6 (d, $J_{C-P}$ = 3.0 Hz), 127.5 (d, $J_{C-P}$ = 3.0 Hz), 63.8 (d, $J_{C-P}$ = 7.0 Hz), 63.3 (d, $J_{C-P}$ = 7.0 Hz), 62.9 (d, $J_{C-P}$ = 8.0 Hz), 62.8 (d, $J_{C-P}$ = 7.0 Hz), 55.6 (d, $J_{C-P}$ = 171.7 Hz), 55.5 (d, $J_{C-P}$ = 171.7 Hz), 45.4, 45.0, 21.7, 21.6, 16.6 (d, $J_{C-P}$ = 6.0 Hz), 16.5 (d, $J_{C-P}$ = 8.0 Hz), 16.3 (d, $J_{C-P}$ = 6.0 Hz), 16.3 (2 Carbon peaks are merged with other carbons in aromatic range). $^{31}$P NMR (162 MHz, $CDCl_3$): $\delta$ 22.4. HRMS (ESI) calcd for $C_{19}H_{26}{}^{79}BrNO_4PS$ $[M+H]^+$: 474.0498; found: 474.0514.

**Compound 4ac:** (Obtained as diastereomeric mixture (approx. 1:1); Yield: 36%, 35 mg from 0.191 mmol of corresponding sulfoximine)



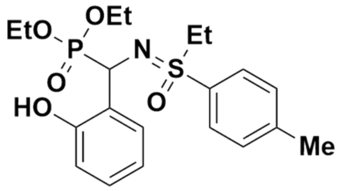

It was obtained as colorless sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.93 (d, $J$ = 8.5 Hz, 1H), 7.55 (d, $J$ = 8.5 Hz, 2H), 7.38 (d, $J$ = 8.0 Hz, 2H), 7.23 – 7.21 (m, 1H), 7.15 - 7.09 (m, 4H), 6.95 (d, $J$ = 7.5 Hz, 1H), 6.72 - 6.69 (m, 2H), 6.55 (t, $J$ = 7.5 Hz, 1H), 4.62 (d, $J_{H-P}$ = 20.0 Hz, 1H), 4.60 (d, $J_{H-P}$ = 21.0 Hz, 1H), 4.07 – 4.00 (m, 4H), 3.98 – 3.84 (m, 4H), 3.20 (s, 3H), 3.08 (s, 3H), 2.45 (s, 3H), 2.34 (s, 3H), 1.62 - 1.49 (m, 8H), 1.35 – 1.23 (m, 8H), 0.90 - 0.87 (m, 6H), 0.86 – 0.81 (m, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 152.6 (d, $J_{C-P}$ = 3.7 Hz), 145.0, 144.7, 134.9, 134.3, 130.3, 129.9, 129.5 (d, $J_{C-P}$ = 2.5 Hz), 129.3 (d, $J_{C-P}$ = 2.5 Hz), 129.0, 128.2, 128.1 (d, $J_{C-P}$ = 6.3 Hz), 127.7 (d, $J_{C-P}$ = 7.5 Hz), 122.8 (d, $J_{C-P}$ = 2.5 Hz), 122.2 (d, $J_{C-P}$ = 3.7 Hz), 119.7 (d, $J_{C-P}$ = 1.2 Hz), 119.4 (d, $J_{C-P}$ = 1.2 Hz), 67.5 (d, $J_{C-P}$ = 7.5 Hz), 67.2 (d, $J_{C-P}$ = 7.5 Hz), 67.1 (d, $J_{C-P}$ = 2.5 Hz), 67.0 (d, $J_{C-P}$ = 2.5 Hz), 55.9 (d, $J_{C-P}$ = 168.8 Hz), 55.3 (d, $J_{C-P}$ = 166.3 Hz), 45.4, 44.9, 32.6 (d, $J_{C-P}$ = 6.3 Hz), 32.6, 32.5, 32.5, 21.7, 21.5, 18.7(1C merged here), 18.6, 18.6, 13.7 (2C merged here), 13.6, 13.6 (3 Carbon peaks are merged with other carbons in aromatic range). HRMS (ESI) calcd for $C_{23}H_{34}{}^{35}ClNO_5PS$ $[M+H]^+$: 502.1578; found: 502.1590.

**Compound 4ba:** (We were able to isolate only one diastereomer in pure form; Yield: 60%, 23 mg from 0.094 mmol of corresponding sulfoximine)



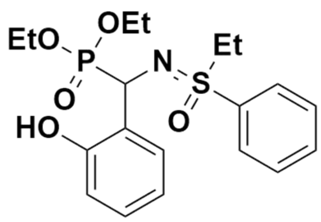

**Diastereomer-1:** It was obtained as yellow sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.90 (d, $J$ = 8.0 Hz, 2H), 7.49 (d, $J$ = 7.5 Hz, 2H), 7.36 (d, $J$ = 8.0 Hz, 2H), 7.28 (t, $J$ = 7.5 Hz, 2H), 7.23 - 7.20 (m, 1H), 4.48 (d, $J_{H-P}$ = 20.5 Hz, 1H), 4.08 – 3.92 (m, 4H), 3.32 - 3.15 (m, 2H), 2.45 (s, 3H), 1.23 – 1.14 (m, 9H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 144.3, 138.7, 133.1, 130.1, 130.0, 128.3 (d, $J_{C-P}$ = 6.3 Hz), 128.1 (d, $J_{C-P}$ = 2.5 Hz), 127.5 (d, $J_{C-P}$ = 2.5 Hz), 63.3 (d, $J_{C-P}$ = 7.5 Hz), 62.9 (d, $J_{C-P}$ = 7.5 Hz), 56.8 (d, $J_{C-P}$ = 167.5 Hz), 51.5, 21.7, 16.5 (d, $J_{C-P}$ = 6.3 Hz), 16.4, 7.6. $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 22.7. HRMS (ESI) calcd for $C_{20}H_{29}NO_4PS$ $[M+H]^+$: 410.1549; found: 410.1557.

**Compound 4bb:** (We were able to isolate only one diastereomer in pure form; Yield: 53%, 55 mg from 0.245 mmol of corresponding sulfoximine)




**Diastereomer-1:** It was obtained as colourless sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.48 (d, $J$ = 8.5 Hz, 2H), 7.11-7.07 (m, 3H), 6.82 (d, $J$ = 8.0 Hz, 1H), 6.75 (d, $J$ = 7.5 Hz, 1H), 6.60 (t, $J$ = 7.5 Hz, 1H), 4.57 (d, $J_{H-P}$ = 20.0 Hz, 1H), 4.16 – 4.11 (m, 2H), 3.99 – 3.90 (m, 2H), 3.32 – 3.24 (m, 2H), 2.32 (s, 3H), 1.27 (t, $J$ = 7.0 Hz, 3H), 1.25 – 1.19 (m, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 156.9 (d, $J_{C-P}$ = 3.7 Hz), 144.5, 133.0 (d, $J_{C-P}$ = 1.2 Hz), 129.8 (d, $J_{C-P}$ = 3.7 Hz), 129.6 (d, $J_{C-P}$ = 7.5 Hz), 129.3, 128.9 (d, $J_{C-P}$ = 3.7 Hz), 121.5 (d, $J_{C-P}$ = 2.5 Hz), 119.3 (d, $J_{C-P}$ = 1.2 Hz), 117.8 (d, $J_{C-P}$ = 3.7 Hz), 63.9 (d, $J_{C-P}$ = 6.3 Hz), 63.2 (d, $J_{C-P}$ = 7.5 Hz), 55.5 (d, $J_{C-P}$ = 165.0 Hz), 51.2, 21.5, 16.5 (d, $J_{C-P}$ = 6.3 Hz), 16.4 (d, $J_{C-P}$ = 6.3 Hz), 7.4. $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 22.5. HRMS (ESI) calcd for $C_{20}H_{29}NO_5PS$ $[M+H]^+$: 426.1499; found: 426.1505.

**Compound 4ca:** (Yield: 53%, 54 mg from 0.245 mmol of corresponding sulfoximine)

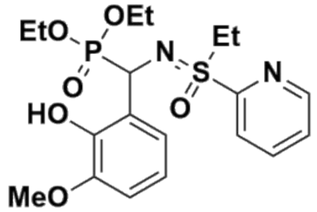



**Diastereomer-1**: It was obtained as yellowish sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 9.32 (brs, 1H), 7.62 (d, $J$ = 8.5 Hz, 2H), 7.46 (t, $J$ = 7.5 Hz, 1H), 7.31 (t, $J$ = 7.5 Hz, 2H), 7.06 (t, $J$ = 7.5 Hz, 1H), 6.82 (d, $J$ = 8.0 Hz, 1H), 6.72 (d, $J$ = 8.0 Hz, 1H), 6.58 (t, $J$ = 7.5 Hz, 1H), 4.58 (d, $J_{H-P}$ = 20.5 Hz, 1H), 4.19 - 4.12 (m, 2H), 4.08 - 3.90 (m, 2H), 3.38 – 3.24 (m, 2H), 1.30 (t, $J$ = 7.0 Hz, 3H), 1.26 (t, $J$ = 7.5 Hz, 3H), 1.19 (t, $J$ = 7.0 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 156.8 (d, $J_{C-P}$ = 3.7 Hz), 136.4 (d, $J_{C-P}$ = 1.2 Hz), 133.4, 129.7 (d, $J_{C-P}$ = 6.3 Hz), 129.5, 129.2 (d, $J_{C-P}$ = 6.3 Hz), 129.1 (d, $J_{C-P}$ = 3.7 Hz), 121.5 (d, $J_{C-P}$ = 2.5 Hz), 119.3 (d, $J_{C-P}$ = 1.2 Hz), 117.9 (d, $J_{C-P}$ = 2.5 Hz), 64.0 (d, $J_{C-P}$ = 7.5 Hz), 63.2 (d, $J_{C-P}$ = 7.5 Hz), 55.4 (d, $J_{C-P}$ = 166.3 Hz), 51.1, 16.6 (d, $J_{C-P}$ = 5.0 Hz), 16.4 (d, $J_{C-P}$ = 6.3 Hz), 7.3. $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 22.8. HRMS (ESI) calcd for $C_{19}H_{27}NO_5PS$ $[M+H]^+$: 412.1342; found: 412.1339.

**Diastereomer-2**: It was obtained as a yellowish sticky liquid. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ 9.31 (brs, 1H), 8.04 (d, $J$ = 7.2 Hz, 2H), 7.67 (t, $J$ = 7.2 Hz, 1H), 7.61 - 7.58 (m, 2H), 7.15 (t, $J$ = 8.0 Hz, 1H), 7.01 (d, $J$ = 7.6 Hz, 1H), 6.88 (d, $J$ = 8.0 Hz, 1H), 6.77 (t, $J$ = 7.6 Hz, 1H), 4.60 (d, $J_{H-P}$ = 20.8 Hz, 1H), 4.07 – 3.92 (m, 4H), 3.29 – 3.15 (m, 2H), 1.22 (t, $J$ = 7.2 Hz, 3H), 1.18

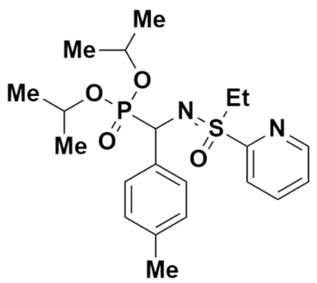
(t, $J$ = 7.6 Hz, 6H). $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 156.9 (d, $J_{C-P}$ = 4.0 Hz), 135.8, 133.8, 129.8, 129.5, 129.2 (d, $J_{C-P}$ = 5.0 Hz), 129.2 (d, $J_{C-P}$ = 3.0 Hz), 122.2 (d, $J_{C-P}$ = 3.0 Hz), 119.6 (d, $J_{C-P}$ = 2.0 Hz), 117.9 (d, $J_{C-P}$ = 3.0 Hz), 63.4, 63.4, 56.1 (d, $J_{C-P}$ = 167.6 Hz), 51.4, 16.5 (d, $J_{C-P}$ = 6.0 Hz), 16.4 (d, $J_{C-P}$ = 6.0 Hz), 7.4. $^{31}$P NMR (162 MHz, $CDCl_3$): $\delta$ 22.7. HRMS (ESI) calcd for $C_{19}H_{27}NO_5PS$ $[M+H]^+$: 412.1342; found: 412.1337.

**Compound 4da:** (Obtained as diastereomeric mixture (approx. 1:1); Yield: 63% (55 mg from 0.197 mmol of corresponding sulfoximine)




It was obtained as brown sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 8.71 – 8.69 (m, 1H), 8.40 – 8.39 (m, 1H), 8.21 (d, $J$ = 8.0 Hz, 1H), 7.92 (t, $J$ = 7.5 Hz, 1H), 7.77 (d, $J$ = 8.0 Hz, 1H), 7.64 - 7.60 (m, 1H), 7.50 – 7.48 (m, 1H), 7.22 – 7.19 (m, 1H), 6.91 - 6.89 (m, 1H), 6.75 (d, $J$ = 4.5 Hz, 2H), 6.55 – 6.46 (m, 3H), 4.89 (s, 1H), 4.85 (s, 1H), 4.11 – 3.87 (m, 9H), 3.82 (s, 3H), 3.73 (s, 3H), 3.53 – 3.45 (m, 3H), 1.28 – 1.22 (m, 9H), 1.15 – 1.10 (m, 9H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 156.0, 150.1, 149.8, 148.3 (d, $J_{C-P}$ = 2.5 Hz), 148.1 (d, $J_{C-P}$ = 2.5 Hz), 145.4, 138.0, 137.3, 126.9, 126.2, 123.9, 123.2 (d, $J_{C-P}$ = 2.5 Hz), 122.9, 121.9 (d, $J_{C-P}$ = 6.3 Hz), 121.8 (d, $J_{C-P}$ = 2.5 Hz), 121.7 (d, $J_{C-P}$ = 5.0 Hz), 119.2 (d, $J_{C-P}$ = 1.2 Hz), 118.7 (d, $J_{C-P}$ = 2.5 Hz), 110.8 (d, $J_{C-P}$ = 3.7 Hz), 110.7 (d, $J_{C-P}$ = 3.7 Hz), 63.7 (d, $J_{C-P}$ = 7.5 Hz), 63.4 (d, $J_{C-P}$ = 7.5 Hz), 63.3 (d, $J_{C-P}$ = 7.5 Hz), 63.2, 56.0 (d, $J_{C-P}$ = 3.7 Hz), 53.2 (d, $J_{C-P}$ = 166.3 Hz), 52.8 (d, $J_{C-P}$ = 166.3 Hz), 47.3, 46.7, 31.7, 29.7 (d, $J_{C-P}$ = 7.5 Hz), 16.5 (d, $J_{C-P}$ = 5.0 Hz), 16.4 (d, $J_{C-P}$ = 5.0 Hz), 16.3, 6.9, 6.6 (2 Carbon peaks are merged with other carbons in aromatic range). HRMS (ESI) calcd for $C_{19}H_{28}N_2O_6PS$ $[M+H]^+$: 443.1400; found: 443.1413.

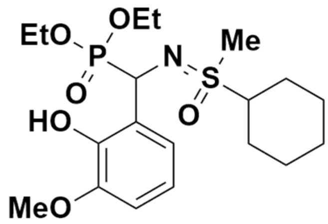
**Compound 4db:** (Obtained as diastereomeric mixture (approx. 1:1); Yield: 45%, 33 mg from 0.166 mmol of corresponding sulfoximine)




It was obtained as colorless sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 8.70 (d, $J$ = 4.5 Hz, 1H), 8.39 (d, $J$ = 4.5 Hz, 1H), 8.24 (d, $J$ = 8.0 Hz, 1H), 7.90 (t, $J$ = 7.5 Hz, 1H), 7.60 (d, $J$ = 8.0 Hz, 1H), 7.52 - 7.45 (m, 2H), 7.36 (d, $J$ = 6.5 Hz, 2H), 7.18 – 7.15 (m, 1H), 7.06 – 7.04 (m, 4H), 6.74 (d, $J$ = 7.5 Hz, 2H), 4.77 - 4.71 (m, 1H), 4.63 (d, $J_{H-P}$ = 19.5 Hz, 1H), 4.60 - 4.52 (m, 2H), 4.50 (d, $J_{H-P}$ = 19.5 Hz, 1H), 3.69 – 3.61 (m, 1H), 3.52 – 3.35 (m, 4H), 2.28 (s, 3H), 2.14 (s, 3H), 1.30 - 1.26 (m, 7H), 1.23 – 1.16 (m, 14H), 1.08 -1.04 (m, 6H), 1.00 (d, $J$ = 6.0 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 157.8, 156.7, 150.1, 149.5, 137.8, 137.0, 136.9 (d, $J_{C-P}$ = 3.7 Hz), 136.3 (d, $J_{C-P}$ =

3.7 Hz), 136.0 (d, $J_{C-P}$ = 2.5 Hz), 134.1 (d, $J_{C-P}$ = 3.7 Hz), 129.0 (d, $J_{C-P}$ = 6.3 Hz), 128.6, 128.6 (d, $J_{C-P}$ = 6.3 Hz), 128.1 (d, $J_{C-P}$ = 2.5 Hz), 126.6, 125.5, 124.0, 122.9, 71.6, 71.5 (d, $J_{C-P}$ = 7.5 Hz), 71.4 (d, $J_{C-P}$ = 7.5 Hz), 71.2 (d, $J_{C-P}$ = 6.3 Hz), 56.5 (d, $J_{C-P}$ = 170.1 Hz), 55.6 (d, $J_{C-P}$ = 171.3 Hz), 47.7, 46.8, 29.7, 24.3, 24.3 (d, $J_{C-P}$ = 2.5 Hz), 24.2 (d, $J_{C-P}$ = 2.5 Hz), 24.0 (d, $J_{C-P}$ = 5.0 Hz), 23.9 (d, $J_{C-P}$ = 5.0 Hz), 23.5 (d, $J_{C-P}$ = 2.5 Hz), 23.5 (d, $J_{C-P}$ = 2.5 Hz), 21.2, 21.0, 7.2, 6.6. HRMS (ESI) calcd for $C_{21}H_{32}N_2O_4PS$ $[M+H]^+$: 439.1815; found: 439.1816.

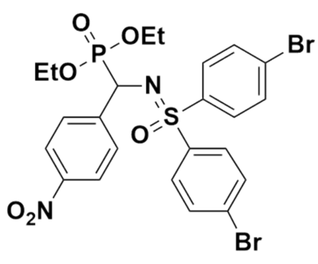
**Compound 4ea: (**Yield: 52%, 44.5 mg from 0.197 mmol of corresponding starting material)




**Diastereomer-1:** It was obtained as colourless sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 6.76 – 6.70 (m, 3H), 4.91 (d, $J_{H-P}$ = 18.5 Hz, 1H), 4.10 – 3.94 (m, 4H), 3.83 (s, 3H), 2.99 (s, 3H), 2.91 – 2.84 (m, 1H), 2.20 – 2.12 (m, 2H), 1.88 – 1.82 (m, 2H), 1.65 (d, $J$ = 12.0 Hz, 1H), 1.48 – 1.34 (m, 3H), 1.24 – 1.21 (m, 6H), 1.16 – 1.08 (m, 2H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 148.5 (d, $J_{C-P}$ = 2.5 Hz), 146.6 (d, $J_{C-P}$ = 5.0 Hz), 122.0 (d, $J_{C-P}$ = 2.5 Hz), 121.6 (d, $J_{C-P}$ = 5.0 Hz), 118.7 (d, $J_{C-P}$ = 2.5 Hz), 110.9 (d, $J_{C-P}$ = 2.5 Hz), 64.0, 63.5 (d, $J_{C-P}$ = 7.5 Hz), 63.1 (d, $J_{C-P}$ = 6.3 Hz), 56.0, 54.0 (d, $J_{C-P}$ = 165.0 Hz), 37.3 (d, $J_{C-P}$ = 2.5 Hz), 26.3, 25.7, 25.5, 25.4, 25.0, 16.6 (d, $J_{C-P}$ = 6.3 Hz), 16.4 (d, $J_{C-P}$ = 6.3 Hz). $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 22.3. HRMS (ESI) calcd for $C_{19}H_{33}NO_6PS$ $[M+H]^+$: 434.1761; found: 434.1775.

**Diastereomer-2:** It was obtained as colourless sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 6.86 – 6.77 (m, 3H), 4.97 (d, $J_{H-P}$ = 21.5 Hz, 1H), 4.13 – 4.07 (m, 3H), 4.01 - 3.96 (m, 1H), 3.85 (s, 3H), 3.07 (brs, 1H), 2.61 (s, 3H), 2.30 (t, $J$ = 10.5 Hz, 2H), 1.95 (d, $J$ = 13.5 Hz, 2H), 1.74 (d, $J$ = 13.0 Hz, 2H), 1.58 - 1.49 (m, 3H), 1.34 – 1.31 (m, 2H), 1.26 (t, $J$ = 7.0 Hz, 3H), 1.22 (t, $J$ = 7.0 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 148.6, 146.0, 122.2, 121.6 (d, $J_{C-P}$ = 5.0 Hz), 119.4, 111.1 (d, $J_{C-P}$ = 3.7 Hz), 63.7 (d, $J_{C-P}$ = 6.3 Hz), 63.5, 63.2 (d, $J_{C-P}$ = 7.5 Hz), 56.0, 54.0 (d, $J_{C-P}$ = 167.5 Hz), 36.7, 25.8, 25.6, 25.4, 25.3, 25.1, 16.6 (d, $J_{C-P}$ = 5.0 Hz), 16.5 (d, $J_{C-P}$ = 6.3 Hz). HRMS (ESI) calcd for $C_{19}H_{33}NO_6PS$ $[M+H]^+$: 434.1761; found: 434.1774.

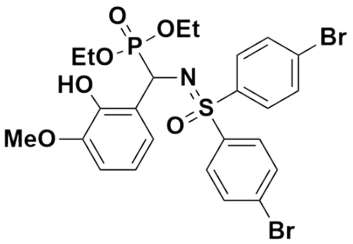
**Compound 4fa:** (Yield: 50% (43 mg from 0.132 mmol of corresponding sulfoximine)




It was obtained as white solid, mp 185-187 °C. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 8.14 (d, $J$ = 8.5 Hz, 2H), 7.91 (d, $J$ = 9.0 Hz, 2H), 7.76 (d, $J$ = 8.5 Hz, 2H), 7.67 – 7.62 (m, 4H), 7.55 (d, $J$ = 8.5 Hz, 2H), 4.62 (d, $J_{H-P}$ = 20.5 Hz, 1H), 4.21 – 4.04 (m, 4H), 1.28 -122 (m, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 147.4 (d, $J_{C-P}$ = 3.7 Hz), 146.1 (d,

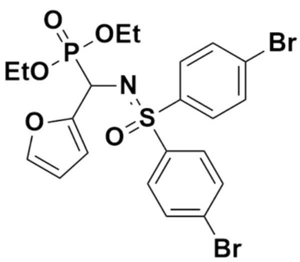
$J_{C\text{-}P}$ = 3.7 Hz), 139.3, 137.7, 132.9, 132.6, 130.9, 130.7, 130.1, 128.9, 128.7, 123.3, 63.4, 63.3, 56.6 (d, $J_{C\text{-}P}$ = 160.0 Hz), 16.5 (d, $J_{C\text{-}P}$ = 6.3 Hz), 16.4 (d, $J_{C\text{-}P}$ = 6.3 Hz). $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 20.1. HRMS (ESI) calcd for $C_{23}H_{24}{}^{79}Br_2N_2O_6PS$ $[M+H]^+$: 644.9454; found: 644.9467.

**Compound 4fb:** (Yield: 62%, 43 mg from 0.106 mmol of corresponding sulfoximine)



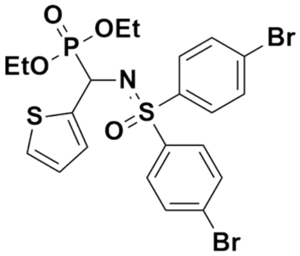

It was obtained as yellow oil. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ 7.92 (d, $J$ = 8.8 Hz, 2H), 7.62 (d, $J$ = 8.4 Hz, 2H), 7.55 (d, $J$ = 8.8 Hz, 2H), 7.40 (d, $J$ = 8.8 Hz, 2H), 6.78 (s, 1H), 6.73 – 6.67 (m, 2H), 4.83 (d, $J_{H\text{-}P}$ = 19.6 Hz, 1H), 4.16 – 3.95 (m, 4H), 3.84 (s, 3H), 1.25 (t, $J$ = 7.2 Hz, 3H), 1.19 (t, $J$ = 6.8 Hz, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 148.1, 144.7, 138.9, 138.5, 132.7, 132.2, 130.3, 130.1, 128.7, 128.1, 122.8, 121.9 (d, $J_{C\text{-}P}$ = 6.0 Hz), 119.5(d, $J_{C\text{-}P}$ = 1.0 Hz), 110.7 (d, $J_{C\text{-}P}$ = 2.0 Hz), 64.0 (d, $J_{C\text{-}P}$ = 7.0 Hz), 63.5 (d, $J_{C\text{-}P}$ = 7.0 Hz), 56.0, 52.8 (d, $J_{C\text{-}P}$ = 163.6 Hz), 16.5 (d, $J_{C\text{-}P}$ = 6.0 Hz), 16.4 (d, $J_{C\text{-}P}$ = 5.0 Hz). $^{31}$P NMR (162 MHz, $CDCl_3$): $\delta$ 22.9. HRMS (ESI) calcd for $C_{24}H_{27}{}^{79}Br_2NO_6PS$ $[M+H]^+$: 645.9658; found: 645.9658.

**Compound 4fc:** (Yield: 29%, 36 mg from 0.208 mmol of corresponding sulfoximine)



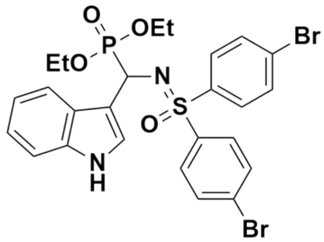

It was obtained as yellowish sticky liquid. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.91 (d, $J$ = 8.5 Hz, 2H), 7.71 (d, $J$ = 8.5 Hz, 2H), 7.62 (d, $J$ = 9.0 Hz, 2H), 7.51 (d, $J$ = 8.5 Hz, 2H), 7.27 – 7.26 (m, 1H), 6.31 (t, $J$ = 3.0 Hz, 1H), 6.26 – 6.25 (m, 1H), 4.68 (d, $J_{H\text{-}P}$ = 20.5 Hz, 1H), 4.21 – 4.10 (m, 4H), 1.29 - 1.25 (m, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 150.7 (d, $J_{C\text{-}P}$ = 3.7 Hz), 142.0 (d, $J_{C\text{-}P}$ = 2.5 Hz), 139.7, 138.4, 132.8, 132.4, 130.5, 130.2, 128.5, 128.2, 110.7 (d, $J_{C\text{-}P}$ = 2.5 Hz), 108.8 (d, $J_{C\text{-}P}$ = 7.5 Hz), 63.5 (d, $J_{C\text{-}P}$ = 7.5 Hz), 63.4 (d, $J_{C\text{-}P}$ = 7.5 Hz), 50.3 (d, $J_{C\text{-}P}$ = 173.8 Hz) 16.5, 16.6. HRMS (ESI) calcd for $C_{21}H_{23}{}^{79}Br_2NO_5PS$ $[M+H]^+$: 589.9396; found: 589.9396.

**Compound 4fd:** (Yield: 42%, 41 mg from 0.160 mmol of corresponding sulfoximine)




It was obtained as colorless sticky liquid. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.95 (d, $J$ = 8.5 Hz, 2H), 7.69 (d, $J$ = 9.0 Hz, 2H), 7.62 (d, $J$ = 8.5 Hz, 2H), 7.49 (d, $J$ = 8.5 Hz, 2H), 7.20 - 7.19 (m, 1H), 6.92 - 6.87 (m, 2H), 4.83 (d, $J_{H\text{-}P}$ = 18.5 Hz, 1H), 4.15 - 4.07 (m, 4H), 1.27 – 1.23 (m, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 141.7 (d, $J_{C\text{-}P}$ = 3.7 Hz), 139.1, 138.4, 132.7, 132.5, 130.6, 130.3, 128.6, 128.3, 126.6 (d, $J_{C\text{-}P}$ = 2.5 Hz), 125.7 (d,

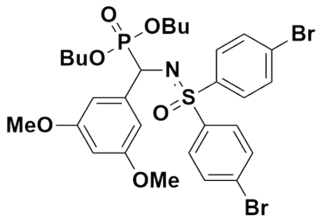
$J_{C-P}$ = 8.8 Hz), 125.2 (d, $J_{C-P}$ = 3.7 Hz), 63.6 (d, $J_{C-P}$ = 6.3 Hz), 63.5 (d, $J_{C-P}$ = 5.0 Hz), 52.5 (d, $J_{C-P}$ = 173.8 Hz), 16.5 (d, $J_{C-P}$ = 1.2 Hz), 16.5 (d, $J_{C-P}$ = 2.5 Hz). HRMS (ESI) calcd for $C_{21}H_{23}{}^{79}Br_2NO_4PS_2$ $[M+H]^+$: 605.9167; found: 605.9157.




**Compound 4fe:** (Yield: 40%, 35 mg from 0.137 mmol of corresponding sulfoximine)

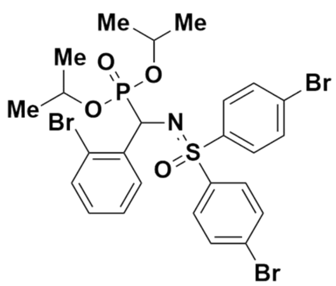
It was obtained as pale-yellow sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.88 - 7.86 (m, 2H), 7.62 - 7.58 (m, 2H), 7.58 – 7.52 (m, 2H), 7.30 - 7.27 (m, 2H), 7.21 – 7.17 (m, 1H), 7.12 - 7.07 (m, 2H), 7.03 – 7.00 (m, 1H), 6.85 (d, $J$ = 7.5 Hz, 1H), 4.93 (d, $J_{H-P}$ = 18.5 Hz, 1H), 4.16 – 4.06 (m, 2H), 3.92 - 3.85 (m, 2H), 1.26 (t, $J$ = 7.0 Hz, 3H), 1.12 (t, $J$ = 7.5 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 142.3, 139.0, 136.1,132.6, 132.6, 132.0, 130.4, 130.2, 129.6, 128.2, 127.8, 124.4, 122.0, 120.1, 119.4, 111.2, 63.3 (d, $J_{C-P}$ = 7.5 Hz), 63.1 (d, $J_{C-P}$ = 7.5 Hz), 49.1 (d, $J_{C-P}$ = 176.4 Hz), 16.6 (d, $J_{C-P}$ = 6.3 Hz), 16.5 (d, $J_{C-P}$ = 6.3 Hz). $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 21.3. HRMS (ESI) calcd for $C_{25}H_{26}{}^{79}Br_2N_2O_4PS$ $[M+H]^+$: 638.9712; found: 638.9722.

**Compound 4ff:** (Yield: 81%, 70 mg from 0.120 mmol of corresponding sulfoximine).




It was obtained as colorless sticky liquid. $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.91 (d, $J$ = 8.5 Hz, 2H), 7.66 (d, $J$ = 8.5 Hz, 2H), 7.60 (d, $J$ = 8.5 Hz, 2H), 7.46 (d, $J$ = 8.5 Hz, 2H), 6.57 (s, 2H), 6.30 (s, 1H), 4.46 (d, $J_{H-P}$ = 19.5 Hz, 1H), 4.04 – 3.93 (m, 4H), 3.72 (s, 6H), 1.59 – 1.51 (m, 4H), 1.32 - 1.26 (m, 4H), 0.86 - 0.82 (m, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 160.4 (d, $J_{C-P}$ = 6.3 Hz), 140.2 (d, $J_{C-P}$ = 2.5 Hz), 139.6, 138.5, 132.6, 132.3, 130.6, 130.3, 128.4, 128.1, 106.6 (d, $J_{C-P}$ = 5.0 Hz), 99.9, 66.9 (d, $J_{C-P}$ = 3.7 Hz), 66.9 (d, $J_{C-P}$ = 5.0 Hz), 56.8 (d, $J_{C-P}$ = 167.5 Hz), 55.3 (1C merged here), 32.7, 32.6, 18.7 (1C merged here), 13.6 (1C merged here). $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 21.6. HRMS (ESI) calcd for $C_{29}H_{37}{}^{79}Br_2NO_6PS$ $[M+H]^+$: 716.0440; found: 716.0443.

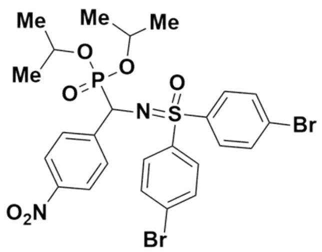
**Compound 4fg:** (Yield: 51%, 40 mg from 0.108 mmol of corresponding sulfoximine)




It was obtained as colorless sticky liquid. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ 7.96 (d, $J$ = 8.0 Hz, 1H), 7.91 (d, $J$ = 8.4 Hz, 2H), 7.63 – 7.57 (m, 4H), 7.43 (d, $J$ = 8.4 Hz, 2H), 7.34 - 7.28 (m, 2H), 7.05 (t, $J$ = 7.6 Hz, 1H), 5.08 (d, $J_{H-P}$ = 20.0 Hz, 1H), 4.77 - 4.61 (m, 1H), 4.69 - 4.61 (m, 1H), 1.32 (d, $J$ = 6.4 Hz, 3H), 1.27 (d, $J$ = 6.0

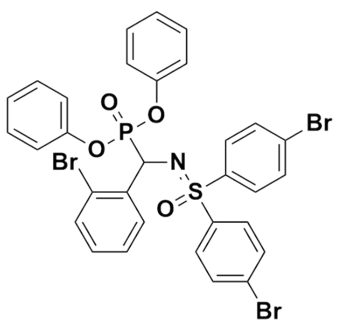
Hz, 3H), 1.24 (d, $J$ = 6.4 Hz, 3H), 1.05 (d, $J$ = 6.4 Hz, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 139.5, 138.4, 138.2 (d, $J_{C\text{-}P}$ = 2.0 Hz), 132.7, 132.2, 132.0 (d, $J_{C\text{-}P}$ = 1.0 Hz), 131.7 (d, $J_{C\text{-}P}$ = 4.0 Hz), 130.6, 130.2, 128.8 (d, $J_{C\text{-}P}$ = 3.0 Hz), 128.4, 128.0, 127.5 (d, $J_{C\text{-}P}$ = 3.0 Hz), 124.1, 72.0 (d, $J_{C\text{-}P}$ = 7.0 Hz), 71.8 (d, $J_{C\text{-}P}$ = 7.0 Hz), 54.9 (d, $J_{C\text{-}P}$ = 173.7 Hz), 24.5 (d, $J_{C\text{-}P}$ = 3.0 Hz), 24.2 (d, $J_{C\text{-}P}$ = 3.0 Hz), 24.0 (d, $J_{C\text{-}P}$ = 6.0 Hz), 23.4 (d, $J_{C\text{-}P}$ = 6.0 Hz). $^{31}$P NMR (162 MHz, $CDCl_3$): $\delta$ 20.1. HRMS (ESI) calcd for $C_{25}H_{28}{}^{79}Br_3NO_4PS$ $[M+H]^+$: 705.9021; found: 705.9030.

**Compound 4fh:** (Yield: 64%, 57 mg from 0.132 mmol of corresponding sulfoximine)

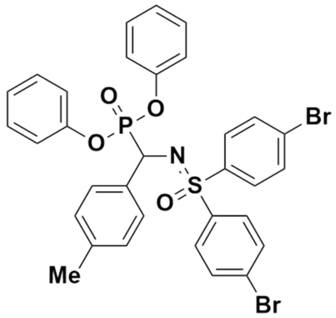



It was obtained as brown solid, mp 137-139 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ 8.11 (d, $J$ = 8.4 Hz, 2H), 7.93 (d, $J$ = 8.4 Hz, 2H), 7.80 (d, $J$ = 8.8 Hz, 2H), 7.66 (d, $J$ = 8.4 Hz, 2H), 7.62 - 7.59 (m, 2H), 7.55 (d, $J$ = 8.8 Hz, 2H), 4.85 - 4.77 (m, 1H) 4.66 – 4.60 (m, 1H), 4.56 (d, $J_{H\text{-}P}$ = 20.8 Hz, 1H), 1.35 (d, $J$ = 6.0 Hz, 3H), 1.31 (d, $J$ = 6.0 Hz, 3H), 1.27 (d, $J$ = 6.4 Hz, 3H), 1.24 (d, $J$ = 6.0 Hz, 3H). $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 147.2 (d, $J_{C\text{-}P}$ = 4.0 Hz), 146.4 (d, $J_{C\text{-}P}$ = 4.0 Hz), 139.6, 137.5, 133.0, 132.6, 130.9, 130.0, 129.2 (d, $J_{C\text{-}P}$ = 6.0 Hz), 128.8, 128.6, 123.1 (d, $J_{C\text{-}P}$ = 3.0 Hz), 72.5 (d, $J_{C\text{-}P}$ = 8.0 Hz), 72.0 (d, $J_{C\text{-}P}$ = 8.0 Hz), 57.0 (d, $J_{C\text{-}P}$ = 168.6 Hz), 24.4 (d, $J_{C\text{-}P}$ = 3.0 Hz), 24.1 (d, $J_{C\text{-}P}$ = 5.0 Hz), 24.0 (d, $J_{C\text{-}P}$ = 4.0 Hz), 23.7 (d, $J_{C\text{-}P}$ = 5.0 Hz). HRMS (ESI) calcd for $C_{25}H_{28}{}^{79}Br_2N_2O_6PS$ $[M+H]^+$: 672.9767; found: 672.9767.

**Compound 4fi:** (Yield: 45%, 38 mg from 0.108 mmol of corresponding sulfoximine)



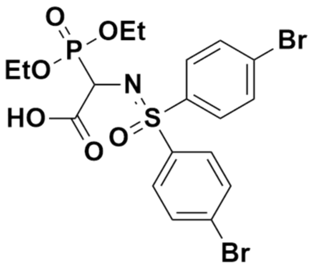

It was obtained as colorless sticky liquid. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ 8.09 (d, $J$ = 8.0 Hz, 1H), 7.82 (d, $J$ = 8.8 Hz, 2H), 7.61 (d, $J$ = 8.4 Hz, 2H), 7.56 (d, $J$ = 8.4 Hz, 2H), 7.45 - 7.41 (m, 3H), 7.36 (t, $J$ = 7.6 Hz, 1H), 7.28 - 7.27 (m, 1H), 7.25 -7.21 (m, 3H), 7.17 – 7.13 (m, 3H), 7.12 - 7.08 (m, 4H), 5.56 (d, $J_{H\text{-}P}$ = 20.0 Hz, 1H). $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 151.1 (d, $J_{C\text{-}P}$ = 9.0 Hz), 150.9 (d, $J_{C\text{-}P}$ = 11.1 Hz), 139.1, 137.8, 137.0 (d, $J_{C\text{-}P}$ = 3.0 Hz),132.8, 132.6, 132.4 (d, $J_{C\text{-}P}$ = 2.0 Hz), 132.3, 131.8 (d, $J_{C\text{-}P}$ = 5.0 Hz), 130.5, 130.1, 129.6 (d, $J_{C\text{-}P}$ = 6.0 Hz), 129.5 (d, $J_{C\text{-}P}$ = 3.0 Hz), 128.6, 128.3, 127.8 (d, $J_{C\text{-}P}$ = 3.0 Hz), 124.9 (d, $J_{C\text{-}P}$ = 8.0 Hz), 123.9 (d, $J_{C\text{-}P}$ = 10.1 Hz), 120.7, 120.6, 120.5, 55.7 (d, $J_{C\text{-}P}$ = 175.7 Hz). HRMS (ESI) calcd for $C_{31}H_{24}{}^{79}Br_3NO_4PS$ $[M+H]^+$: 773.8708; found: 773.8710.



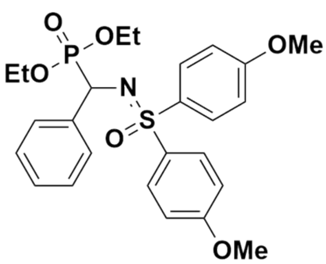
**Compound 4fj:** (Yield: 34%, 40 mg from 0.166 mmol of corresponding sulfoximine)

It was obtained as yellowish sticky liquid. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ 7.86 (d, $J$ = 8.8 Hz, 2H), 7.64 – 7.59 (m, 4H), 7.46 – 7.43 (m, 4H), 7.26 – 7.22 (m, 4H), 7.14 – 7.08 (m, 8H), 4.90 (d, $J_{H\text{-}P}$ = 18.8 Hz, 1H), 2.34. $^{13}$C NMR (101 MHz, $CDCl_3$): $\delta$ 151.2 (d, $J_{C\text{-}P}$ = 9.0 Hz), 150.9 (d, $J_{C\text{-}P}$ = 11.1 Hz), 139.5, 138.1, 137.8 (d, $J_{C\text{-}P}$ = 4.0 Hz), 133.9 (d, $J_{C\text{-}P}$ = 4.0 Hz), 132.8, 132.3, 130.7, 130.2, 129.6, 129.5, 129.1 (d, $J_{C\text{-}P}$ = 3.0 Hz), 128.6, 128.5, 128.3, 126.3, 124.9 (d, $J_{C\text{-}P}$ = 3.0 Hz), 120.9 (d, $J_{C\text{-}P}$ = 4.0 Hz), 120.6 (d, $J_{C\text{-}P}$ = 4.0 Hz), 57.1 (d, $J_{C\text{-}P}$ = 171.7 Hz), 21.3 (d, $J_{C\text{-}P}$ = 1.0 Hz). HRMS (ESI) calcd for $C_{32}H_{27}{}^{79}Br_2NO_4PS$ $[M+H]^+$: 709.9760; found: 709.9767.

**Compound 4fk:** (Yield: 21%, 16 mg from 0.135 mmol of corresponding sulfoximine)



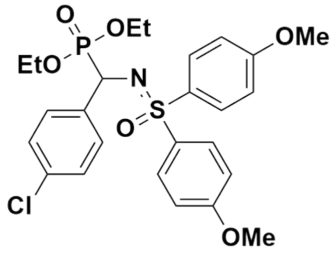
It was obtained as a yellowish sticky liquid. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ 8.02 (d, $J$ = 8.5 Hz, 2H), 7.93 (d, $J$ = 8.5 Hz, 2H), 7.69 (d, $J$ = 9.0 Hz, 2H), 7.66 (d, $J$ = 8.5 Hz, 2H), 4.68 (d, $J$ = 14.0 Hz, 1H), 4.30 - 4.24 (m, 2H), 4.23 - 4.18 (m, 2H), 1.40 (t, $J$ = 7.0 Hz, 3H), 1.31 (t, $J$ = 7.0 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 175.6, 133.26 (1C is merged here), 129.7 ,129.6 (1C is merged here), 129.5, 129.3 (1C is merged here), 64.3, 63.3, 48.2, 16.6, 16.6. $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 16.7. HRMS (ESI) calcd for $C_{18}H_{21}{}^{79}Br_2NO_6PS$ $[M+H]^+$: 567.9188; found: 567.9188.



**Compound 4ga:** (Yield: 84%, 80 mg from 0.188 mmol of corresponding sulfoximine)

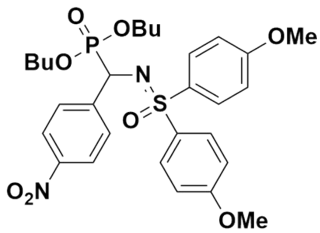
It was obtained as brownish sticky liquid. $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ 7.96 (d, $J$ = 9.0 Hz, 2H), 7.73 (d, $J$ = 9.0 Hz, 2H), 7.46 (d, $J$ = 7.5 Hz, 2H), 7.27 – 7.20 (m, 3H), 6.94 (d, $J$ = 9.0 Hz, 2H), 6.79 (d, $J$ = 9.0 Hz, 2H), 4.56 (d, $J_{H\text{-}P}$ = 20.0 Hz, 1H), 4.11 – 4.04 (m, 4H), 3.82 (s, 3H), 3.78 (s, 3H), 1.23 (t, $J$ = 7.5 Hz, 6H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 163.1, 163.0, 138.5 (d, $J_{C\text{-}P}$ = 2.5 Hz), 132.1, 131.4, 131.0, 130.8, 128.5 (d, $J_{C\text{-}P}$ = 6.3 Hz), 128.0 (d, $J_{C\text{-}P}$ = 1.2 Hz), 127.4 (d, $J_{C\text{-}P}$ = 3.7 Hz), 114.5, 114.2, 63.4 (d, $J_{C\text{-}P}$ = 7.5 Hz), 63.1 (d, $J_{C\text{-}P}$ = 6.3 Hz), 56.8 (d, $J_{C\text{-}P}$ = 166.3 Hz), 55.7, 55.6, 16.5, 16.5. $^{31}$P NMR (202 MHz, $CDCl_3$): $\delta$ 22.3. HRMS (ESI) calcd for $C_{25}H_{31}NO_6PS$ $[M+H]^+$: 504.1604; found: 504.1609.

**Compound 4gb:** (Yield: 78%, 60 mg from 0.142 mmol of corresponding sulfoximine)



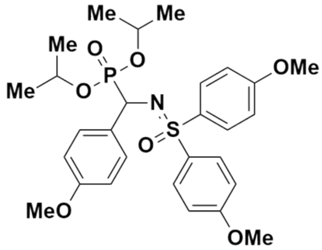

It was obtained as colorless sticky liquid. [1]H NMR (500 MHz, $CDCl_3$): $\delta$ 8.12 (d, $J$ = 8.5 Hz, 2H), 7.95 (d, $J$ = 9.0 Hz, 2H), 7.77 (d, $J$ = 9.0 Hz, 2H), 7.65 (d, $J$ = 9.0 Hz, 1H), 6.96 (d, $J$ = 9.0 Hz, 2H), 6.84 (d, $J$ = 9.0 Hz, 2H), 4.64 (d, $J_{H-P}$ = 21.0 Hz, 1H), 4.20 – 4.08 (m, 4H), 3.84 (s, 3H), 3.79 (s, 3H), 1.27 (t, $J$ = 7.0 Hz, 3H), 1.24 (t, $J$ = 7.0 Hz, 3H). [13]C NMR (126 MHz, $CDCl_3$): $\delta$ 163.2, 163.1, 147.2, 146.9 (d, $J_{C-P}$ = 2.5 Hz), 132.3, 131.1, 130.8, 130.5, 129.3 (d, $J_{C-P}$ = 6.3 Hz), 123.2 (d, $J_{C-P}$ = 2.5 Hz), 114.7, 114.4, 63.59 (d, $J_{C-P}$ = 5.0 Hz), 63.5 (d, $J_{C-P}$ = 6.3 Hz), 56.8 (d, $J_{C-P}$ = 165.0 Hz), 55.7, 55.7, 16.6 (d, $J_{C-P}$ = 6.3 Hz), 16.5 (d, $J_{C-P}$ = 6.3 Hz). HRMS (ESI) calcd for $C_{25}H_{30}{}^{35}ClNO_6PS$ $[M+H]^+$: 538.1214; found: 538.1231.

**Compound 4gc:** (Yield: 73%, 58 mg from 0.132 mmol of corresponding sulfoximine)



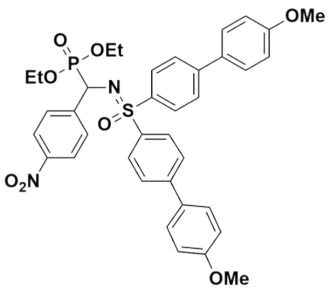

It was obtained as brown sticky liquid. [1]H NMR (400 MHz, $CDCl_3$): $\delta$ 8.11 (d, $J$ = 8.4 Hz, 2H), 7.94 (d, $J$ = 8.8 Hz, 2H), 7.78 (d, $J$ = 8.8 Hz, 2H), 7.65 - 7.62 (m, 2H), 6.96 (d, $J$ = 9.2 Hz, 2H), 6.83 (d, $J$ = 8.8 Hz, 2H), 4.64 (d, $J_{H-P}$ = 21.2 Hz, 1H), 4.14 – 4.07 (m, 2H), 4.03 - 4.00 (m, 2H), 3.83 (s, 3H), 3.79 (s, 3H), 1.60 – 1.55 (m, 4H), 1.33 - 1.26 (m, 4H), 0.91 - 0.87 (m, 3H), 0.85 - 0.82 (m, 3H). [13]C NMR (101 MHz, $CDCl_3$): $\delta$ 163.2, 163.1, 147.0 (d, $J_{C-P}$ = 3.0 Hz), 131.0, 130.4, 129.8, 129.2 (d, $J_{C-P}$ = 5.0 Hz), 127.7 (d, $J_{C-P}$ = 5.0 Hz), 123.4 (d, $J_{C-P}$ = 2.0 Hz), 123.1 (d, $J_{C-P}$ = 2.0 Hz), 114.7, 114.3, 67.3 (d, $J_{C-P}$ = 7.0 Hz), 67.0 (d, $J_{C-P}$ = 7.0 Hz), 56.7 (d, $J_{C-P}$ = 166.6 Hz), 55.7, 55.7, 32.7 (d, $J_{C-P}$ = 6.0 Hz), 32.6 (d, $J_{C-P}$ = 5.0 Hz), 18.7 (d, $J_{C-P}$ = 6.0 Hz), 18.6, 13.7 (d, $J_{C-P}$ = 4.0 Hz), 13.6. HRMS (ESI) calcd for $C_{29}H_{38}N_2O_8PS$ $[M+H]^+$: 605.2081; found: 605.2089.

**Compound 4gd:** (Yield: 71%, 73 mg from 0.183 mmol of corresponding sulfoximine)



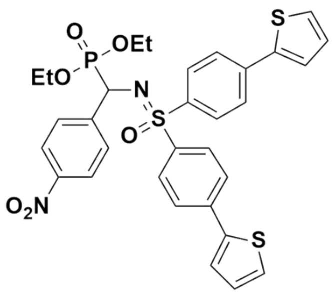

It was obtained as brownish sticky liquid. [1]H NMR (500 MHz, $CDCl_3$): $\delta$ 7.96 (d, $J$ = 9.0 Hz, 2H), 7.76 (d, $J$ = 9.0 Hz, 2H), 7.33 (d, $J$ = 8.5 Hz, 2H), 6.93 (d, $J$ = 8.5 Hz, 2H), 6.79 (d, $J$ = 9.0 Hz, 2H), 6.77 (d, $J$ = 8.5 Hz, 2H), 4.72 – 4.60 (m, 2H), 4.44 (d, $J_{H-P}$ = 19.5 Hz, 1H), 3.81 (s, 3H), 3.77 (s, 3H), 3.76 (s, 3H), 1.29 (d, $J$ = 6.5 Hz, 3H), 1.24 (d, $J$ = 6.0 Hz, 3H), 1.22 (d, $J$ = 6.0 Hz, 3H), 1.14 (d, $J$ = 6.0 Hz, 3H). [13]C NMR (126 MHz, $CDCl_3$): $\delta$ 162.9, 162.8, 158.8, 133.0 (d, $J_{C-P}$ = 8.8 Hz), 131.6, 131.1, 130.7, 129.8, 129.7, 114.5, 114.1, 113.3, 71.6 (d, $J_{C-P}$ = 6.3 Hz), 71.4 (d, $J_{C-P}$ = 8.8 Hz), 56.7 (d, $J_{C-P}$ = 171.3 Hz), 55.6, 55.6, 55.3, 24.5, 24.2 (d, $J_{C-P}$ = 2.5 Hz), 24.0 (d, $J_{C-P}$ = 5.0 Hz), 23.7 (d, $J_{C-P}$ = 5.0 Hz). HRMS (ESI) calcd for $C_{28}H_{37}NO_7PS$ $[M+H]^+$: 562.2023; found: 562.2026.

**Compound 6a:** (Yield: 92%, 30 mg from 0.046 mmol of **4fa**)

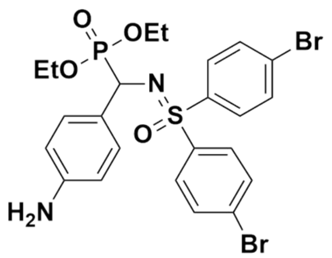



It was obtained as colorless sticky liquid. [1]H NMR (500 MHz, $CDCl_3$): $\delta$ 8.14 (d, $J$ = 8.5 Hz, 2H), 8.11 (d, $J$ = 8.5 Hz, 2H), 7.92 (d, $J$ = 8.5 Hz, 2H), 7.70 - 7.67 (m, 4H), 7.66 – 7.64 (m, 2H), 7.55 (d, $J$ = 8.5 Hz, 2H), 7.52 (d, $J$ = 9.0 Hz, 2H), 7.46 (d, $J$ = 7.0 Hz, 2H), 6.99 – 6.95 (d, $J$ = 9.0 Hz, 2H), 4.74 (d, $J_{H-P}$ = 21.0 Hz, 1H), 4.24 – 4.09 (m, 4H), 3.85 (s, 3H), 3.84 (s, 3H), 1.29 (t, $J$ = 7.0 Hz, 3H), 1.26 (t, $J$ = 7.0 Hz, 3H). [13]C NMR (126 MHz, $CDCl_3$): $\delta$ 160.3, 147.3, 146.8, 145.7, 145.6, 138.3, 132.2, 132.2, 132.1, 131.6 (d, $J_{C-P}$ = 8.8 Hz), 129.6, 129.3 (d, $J_{C-P}$ = 5.0 Hz), 129.1, 128.7, 128.6, 128.5, 127.6, 127.2, 123.2, 114.6, 63.6, 63.5, 56.7 (d, $J_{C-P}$ = 166.3 Hz), 55.5 (1C merged here), 16.6, 16.5 (d, $J_{C-P}$ = 6.3 Hz). HRMS (ESI) calcd for $C_{37}H_{38}N_2O_8PS$ $[M+H]^+$: 701.2081; found: 701.2080.

**Compound 6b:** (Yield: 83%, 25 mg from 0.046 mmol of **4fa**)




It was obtained as pale-yellow sticky liquid. [1]H NMR (500 MHz, $CDCl_3$): $\delta$ 8.28 (d, $J$ = 9.0 Hz, 1H), 8.14 (d, $J$ = 8.5 Hz, 2H), 8.06 (d, $J$ = 8.5 Hz, 2H), 7.88 (d, $J$ = 9.0 Hz, 2H), 7.73 (d, $J$ = 8.5 Hz, 2H), 7.69 - 7.67 (m, 2H), 7.61 (d, $J$ = 9.0 Hz, 2H), 7.41 – 7.40 (m, 1H), 7.38 – 7.36 (m, 2H), 7.11 – 7.08 (m, 2H), 4.71 (d, $J_{H-P}$ = 21.0 Hz, 1H), 4.23 – 4.09 (m, 4H), 1.29 (t, $J$ = 7.0 Hz, 3H), 1.26 (t, $J$ = 7.0 Hz, 3H). [13]C NMR (126 MHz, $CDCl_3$): $\delta$ 147.3 (d, $J_{C-P}$ = 3.7 Hz), 146.6 (d, $J_{C-P}$ = 3.7 Hz), 142.2, 142.1, 139.2, 139.1, 138.7, 137.3, 132.2, 132.1, 129.9, 129.3, 128.7 (d, $J_{C-P}$ = 6.3 Hz), 128.6 (d, $J_{C-P}$ = 2.5 Hz), 127.1, 126.6, 126.3, 125.2 (d, $J_{C-P}$ = 3.7 Hz), 123.9, 123.3 (d, $J_{C-P}$ = 2.5 Hz), 63.6 (d, $J_{C-P}$ = 7.5 Hz), 63.5 (d, $J_{C-P}$ = 7.5 Hz), 56.7 (d, $J_{C-P}$ = 165.0 Hz), 16.6 (d, $J_{C-P}$ = 5.0 Hz), 16.5 (d, $J_{C-P}$ = 5.0 Hz). HRMS (ESI) calcd for $C_{31}H_{30}N_2O_6PS_3$ $[M+H]^+$: 653.0998; found: 653.0998.




**Compound 7a: (**Yield: 63%, 36 mg from 0.092 mmol of **4fa**)

It was obtained as colorless sticky liquid. $^{1}$H NMR (500 MHz, CDCl3): $\delta$ 7.90 (d, $J$ = 7.5 Hz, 2H), 7.65 (d, $J$ = 7.4 Hz, 2H), 7.61 (d, $J$ = 7.0 Hz, 2H), 7.47 (d, $J$ = 7.0 Hz, 2H), 7.18 (d, $J$ = 8.5 Hz, 2H), 6.57 (d, $J$ = 7.0 Hz, 2H), 4.43 (d, $J_{H\text{-}P}$ = 18.5 Hz, 1H), 4.09 – 3.94 (m, 4H), 3.64 (brs, 2H), 1.24 (t, $J$ = 7.0 Hz, 3H), 1.20 (t, $J$ = 7.0 Hz, 3H). $^{13}$C NMR (126 MHz, $CDCl_3$): $\delta$ 145.9, 139.7, 138.8, 132.6, 132.3, 130.6, 130.4, 129.4 (d, $J_{C\text{-}P}$ = 6.3 Hz), 128.3, 128.1, 127.8, 114.9(d, $J_{C\text{-}P}$ = 1.2 Hz), 63.2 (d, $J_{C\text{-}P}$ = 7.5 Hz), 63.1 (d, $J_{C\text{-}P}$ = 6.3 Hz), 56.2 (d, $J_{C\text{-}P}$ = 170.1 Hz), 16.6 (d, $J_{C\text{-}P}$ = 3.7 Hz), 16.5 (d, $J_{C\text{-}P}$ = 3.7 Hz). HRMS (ESI) calcd for $C_{23}H_{26}{}^{79}Br_2N_2O_4PS$ $[M+H]^+$: 614.9712; found: 614.9713.

## 6. X-ray crystallographic study of 4fa

The **4fa** compounds crystal (CCDC 2169259) was mounted on Hampton cryoloops. All geometric and intensity data of the crystal was collected using a Super-Nova (Mo) X-ray diffractometer equipped with a micro-focus sealed X-ray tube Mo-Kα (λ = 0.71073 Å) X-ray source and HyPix3000 detector with increasing ▯ (width of 0.3 per frame) at a scan speed of 10 s per frame. The CrysAlisPro software was used for data acquisition and data extraction. Using Olex2, the structure was solved with the SIR2004 structure solution program using Direct Methods and refined with the ShelXL refinement package using Least Squares minimization. All non-hydrogen atoms were refined with anisotropic thermal parameters.

**Sample Preparation:** The needle like crystal was obtained from the vaporization (at room temp) of DCM/Hexane mixture.

**Figure S1**. ORTEP diagram of compound **4fa** with thermal ellipsoid set to 50 % probability level

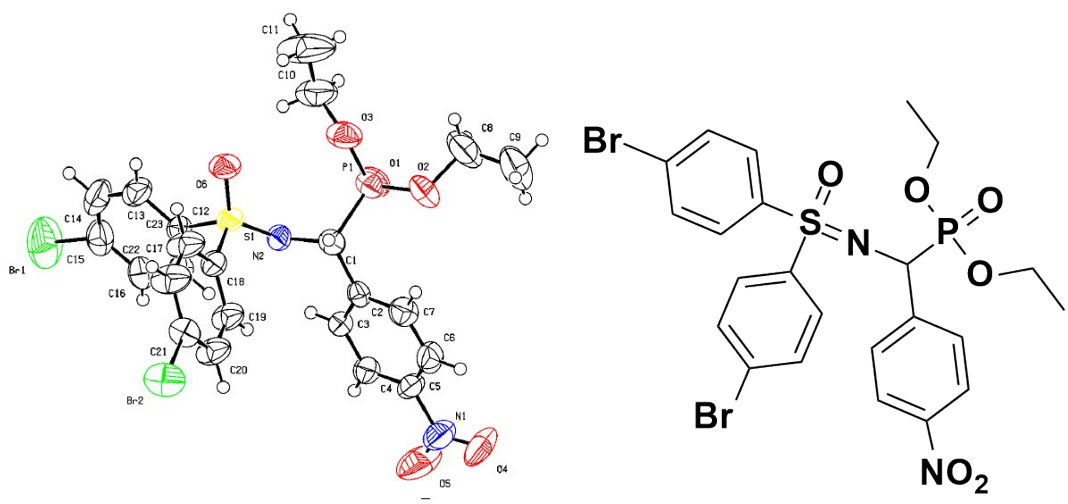


**Table S1**. Crystallographic parameters for **4fa**

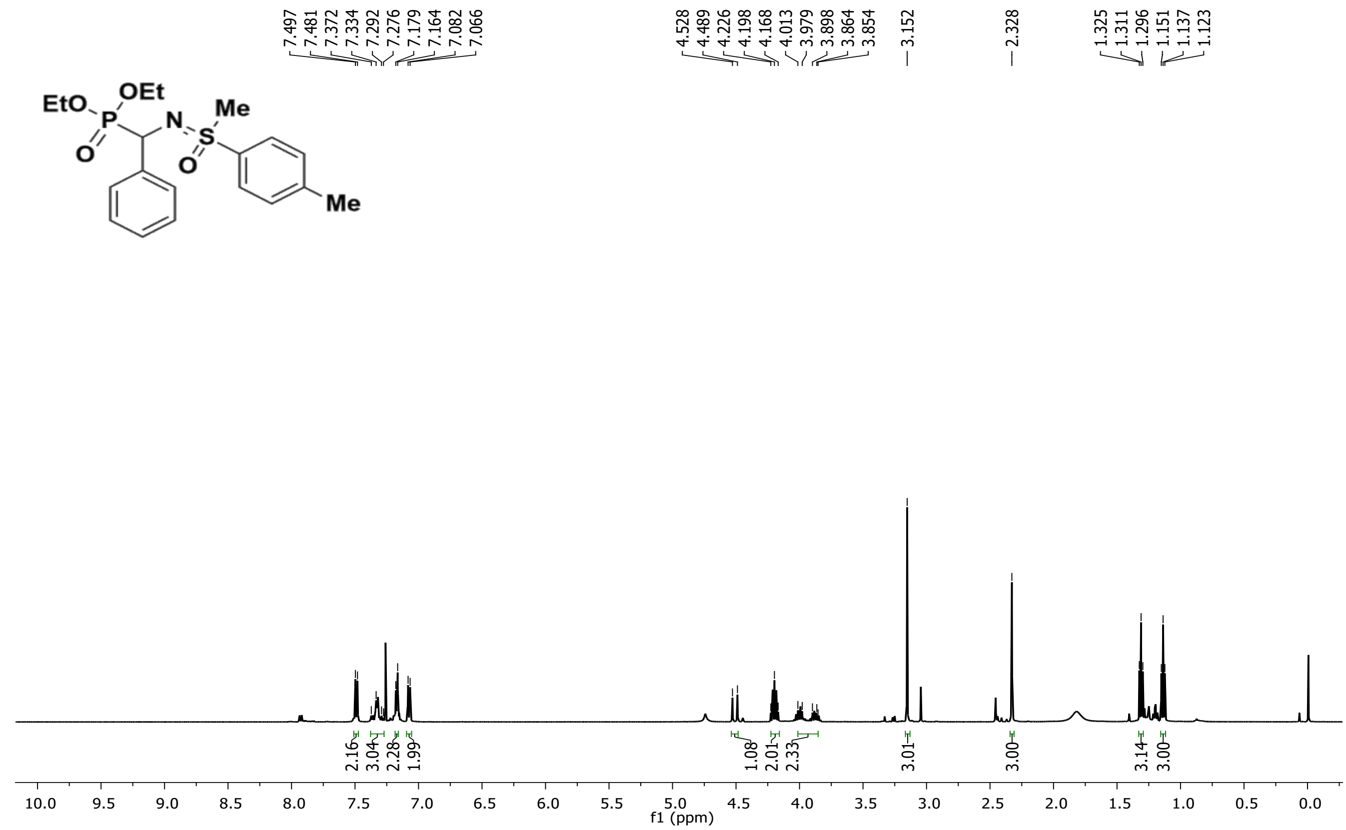
| | |
|---|---|
| CCDC number | 2169259 |
| Identification code | RK-KN4fa |
| Empirical formula | $C_{23}H_{23}Br_2N_2O_6PS$ |
| Formula weight | 646.28 |
| Temperature/K | 293(2) |
| Crystal system | Triclinic |
| Space group | P-1 |
| a/Å | 9.8628(3) |
| b/Å | 11.0438(6) |
| c/Å | 12.7968(7) |
| α/° | 73.419(5) |
| β/° | 86.038(4) |
| γ/° | 82.267(4) |
| Volume/Å3 | 1323.06(12) |
| Z | 2 |
| ρcalcg/cm3 | 1.622 |
| μ/mm-1 | 3.243 |
| F(000) | 648.0 |
| Crystal size/mm3 | 0.24 × 0.2 × 0.18 |
| Radiation | MoKα (λ = 0.71073) |
| 2Θ range for data collection/° | 6.648 to 54.748 |
| Index ranges | -12 ≤ h ≤ 12, -14 ≤ k ≤ 11, -15 ≤ l ≤ 16 |
| Reflections collected | 18053 |
| Independent reflections | 5636 |
| [$R_{int}$/ $R_{sigma}$] | 0.0322/ 0.0565 |
| Data/restraints/parameters | 5636/0/318 |
| Goodness-of-fit on F2 | 1.019 |
| Final R indexes [I>=2σ (I)] | R1 = 0.0540, wR2 = 0.0962 |
| Final R indexes [all data] | R1 = 0.1063, wR2 = 0.1098 |
| Largest diff. peak/hole / e $Å^{-3}$ | 0.46/-0.48 |

## 7. Reference

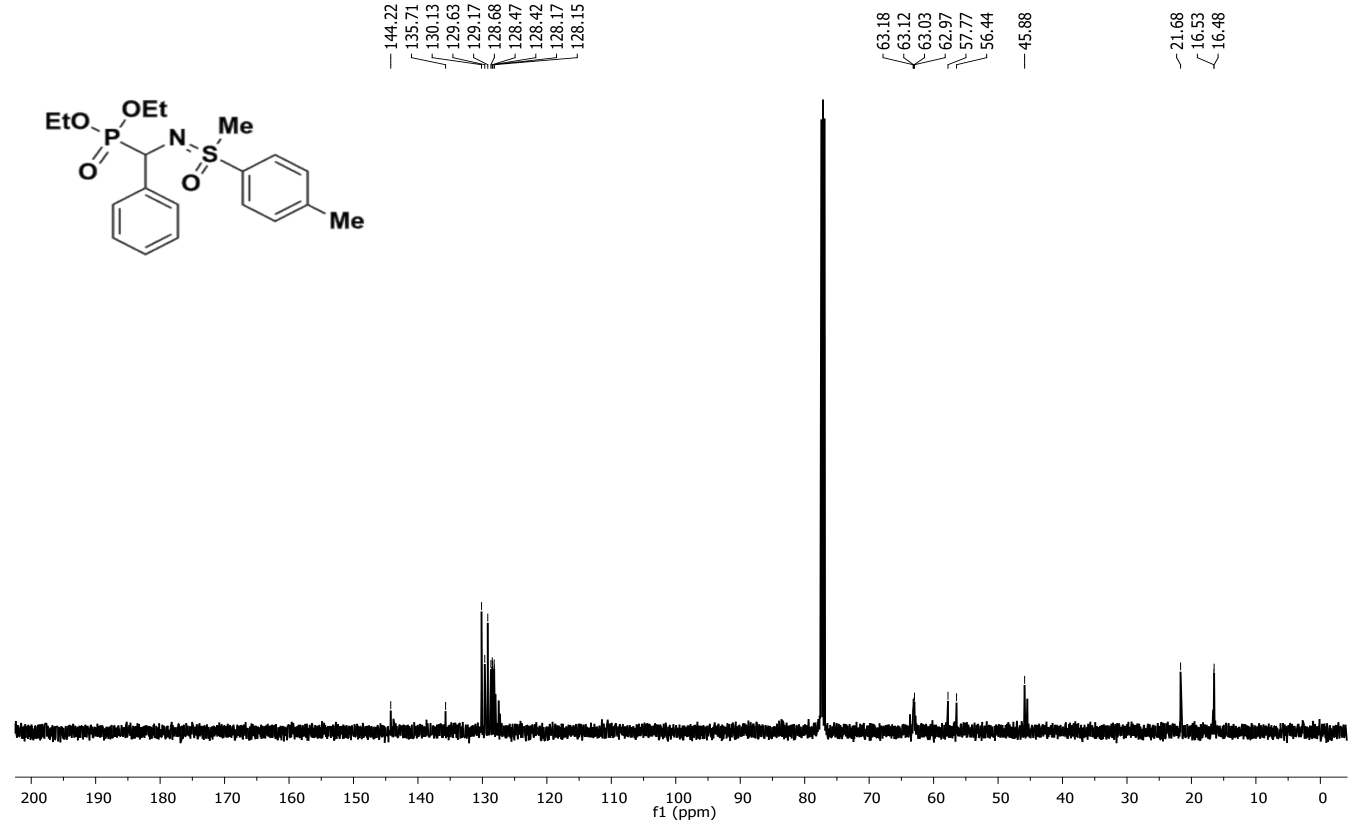
[1] Y. Xie, B. Zhou, S. Zhou, S. Zhou, W. Wei, J. Liu, Y. Zhan, D. Cheng, M. Chen, Y. Li, B. Wang, X.-s Xue. Z. Li, *ChemistrySelect* **2017,** *2*, 1620-1624.

## 8. NMR spectra

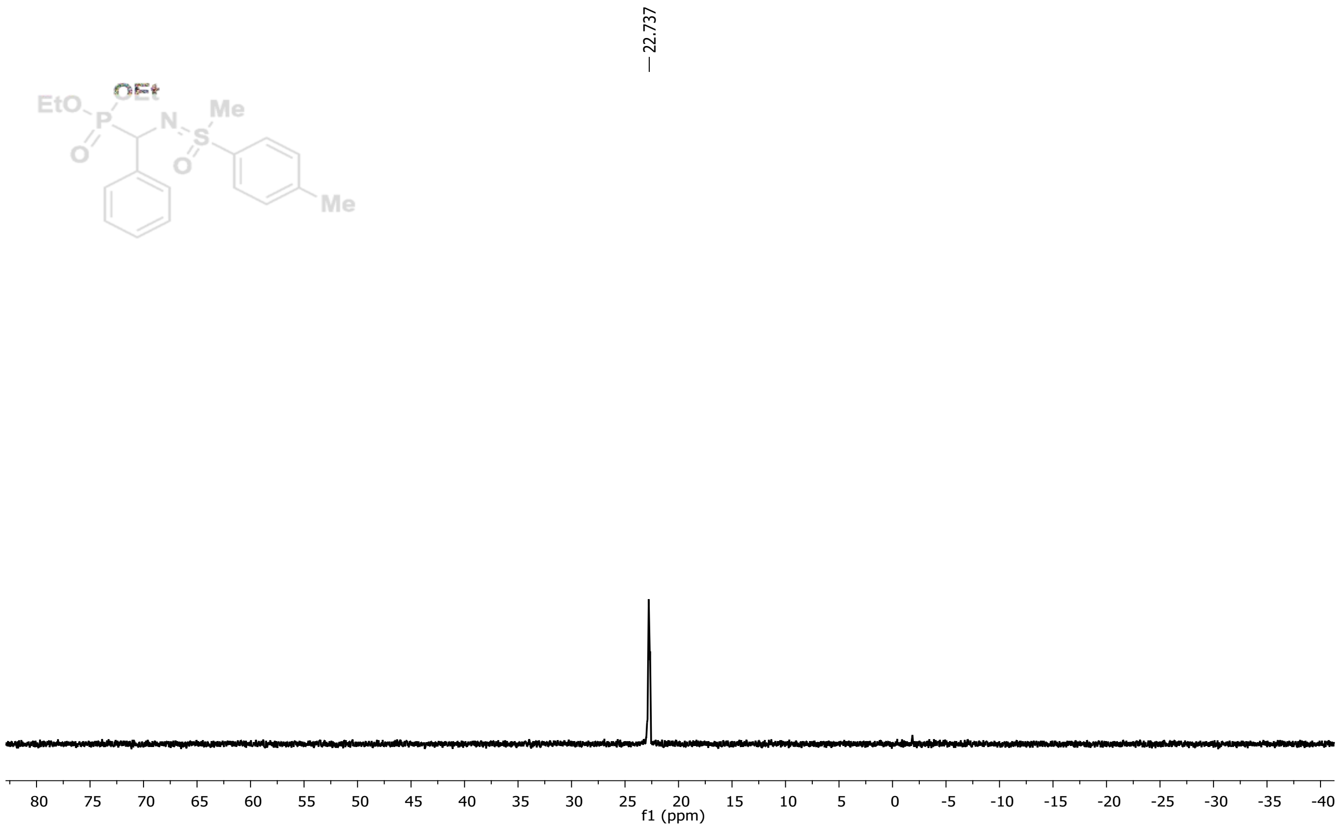
$^{1}H$ NMR of **4aa** (Diastereomer- 1) (500 MHz, $CDCl_3$)



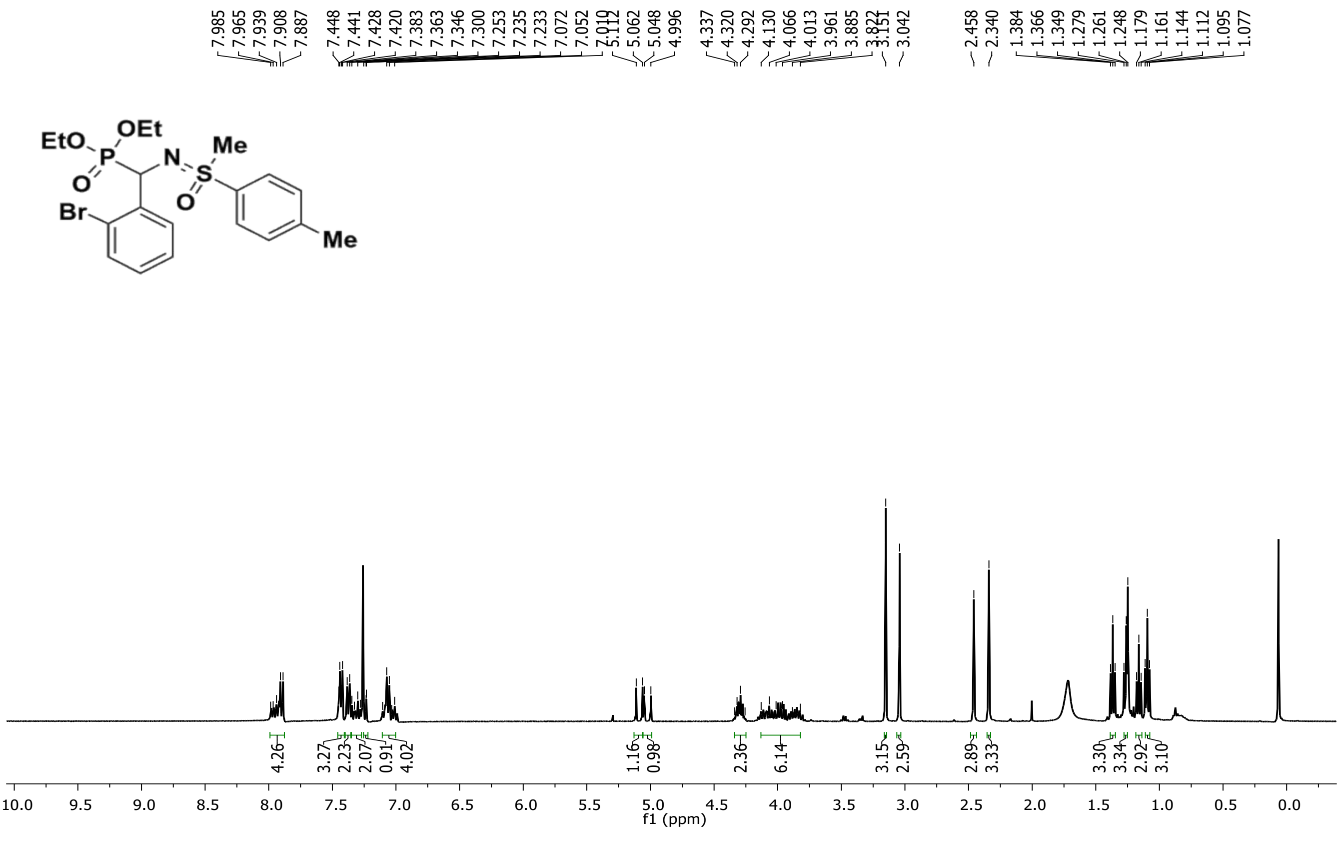

$^{13}C$ {$^{1}H$} NMR of **4aa** (Diastereomer- 1) (126 MHz, $CDCl_3$)



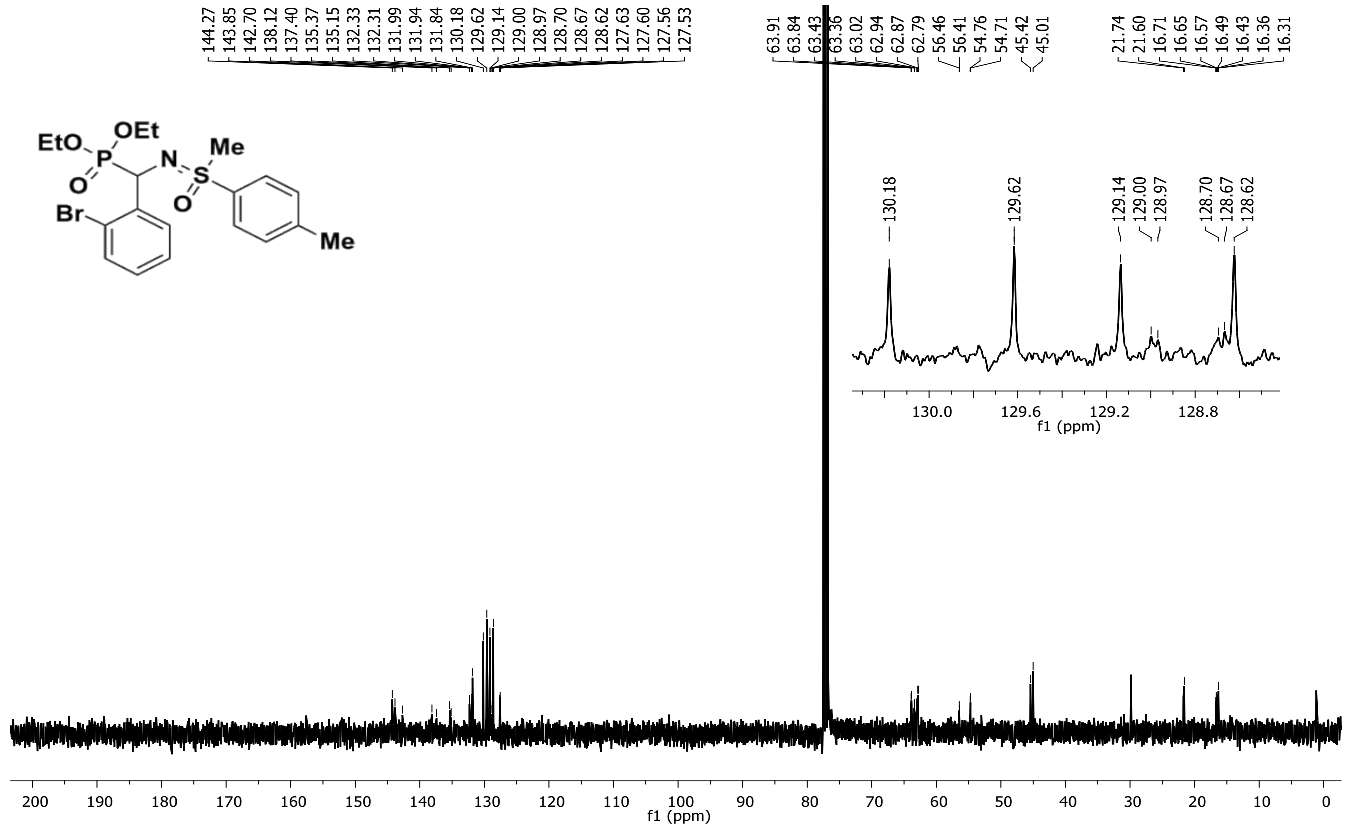
$^{31}$P NMR of **4aa** (Diastereomer- 1) (202 MHz, $CDCl_3$)



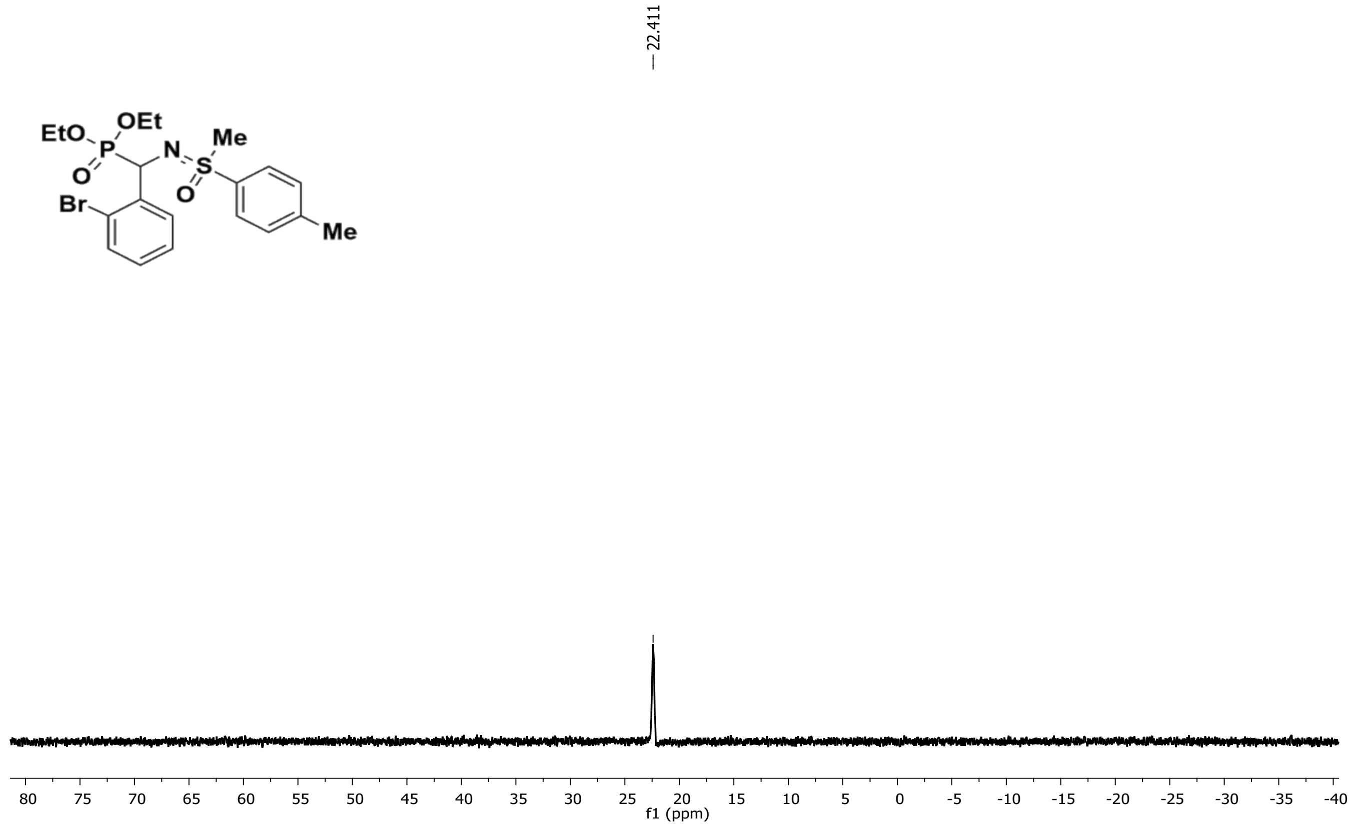

$^{1}$H NMR of **4ab** (Mixture of 2 Diastereomers) (400 MHz, $CDCl_3$)



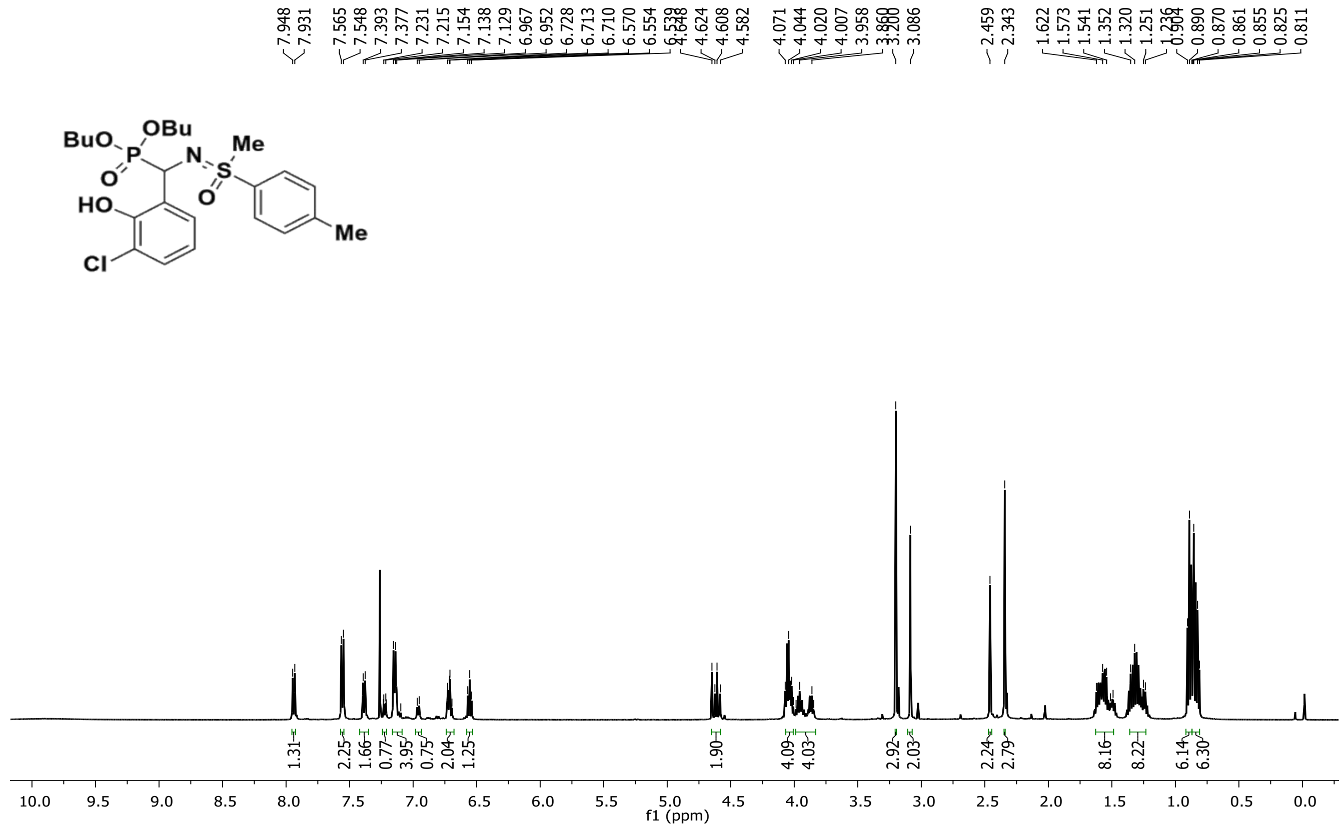
$^{13}C$ {$^{1}H$} NMR of **4ab** (Mixture of 2 Diastereomers) (101 MHz, $CDCl_3$)



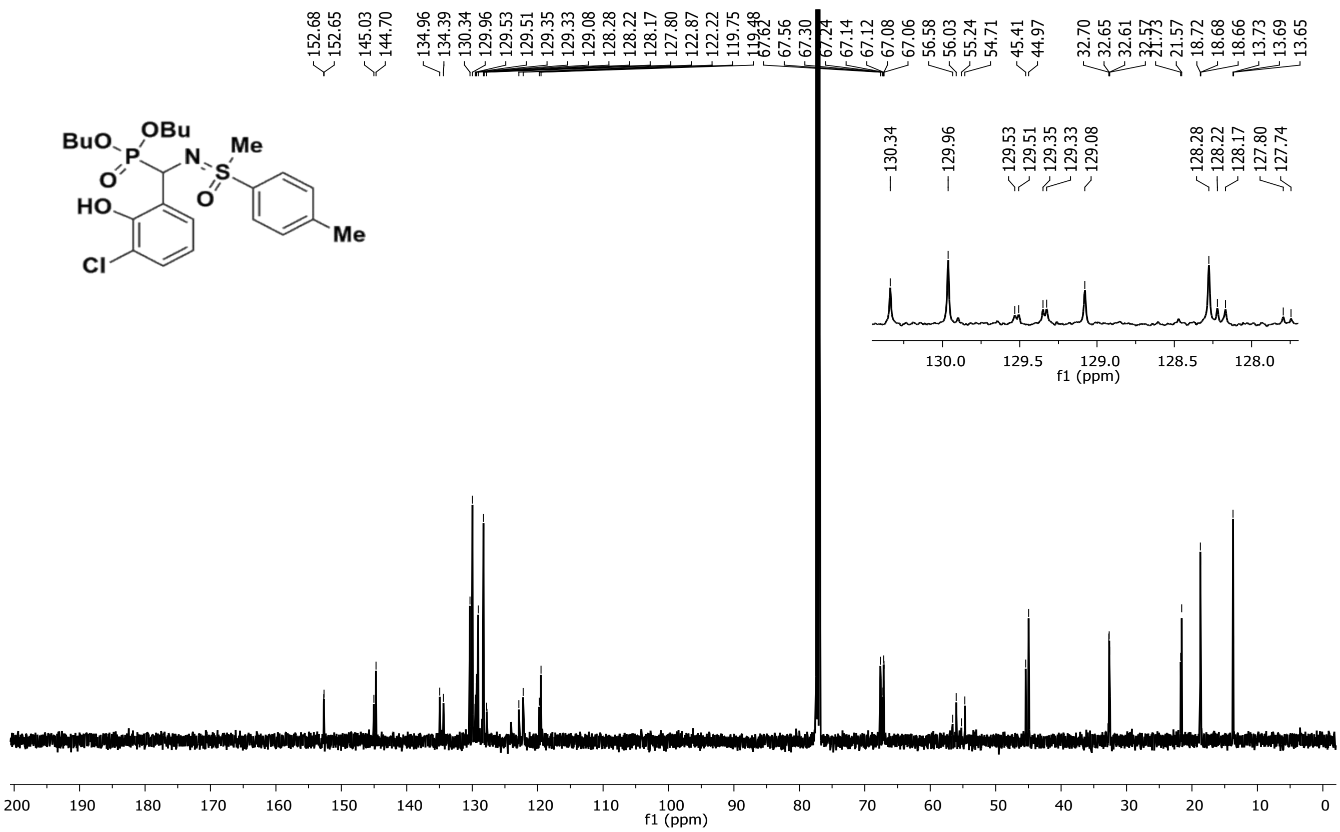

$^{31}P$ NMR of **4ab** ( mixture of two Diastereomers) (162 MHz, $CDCl_3$)



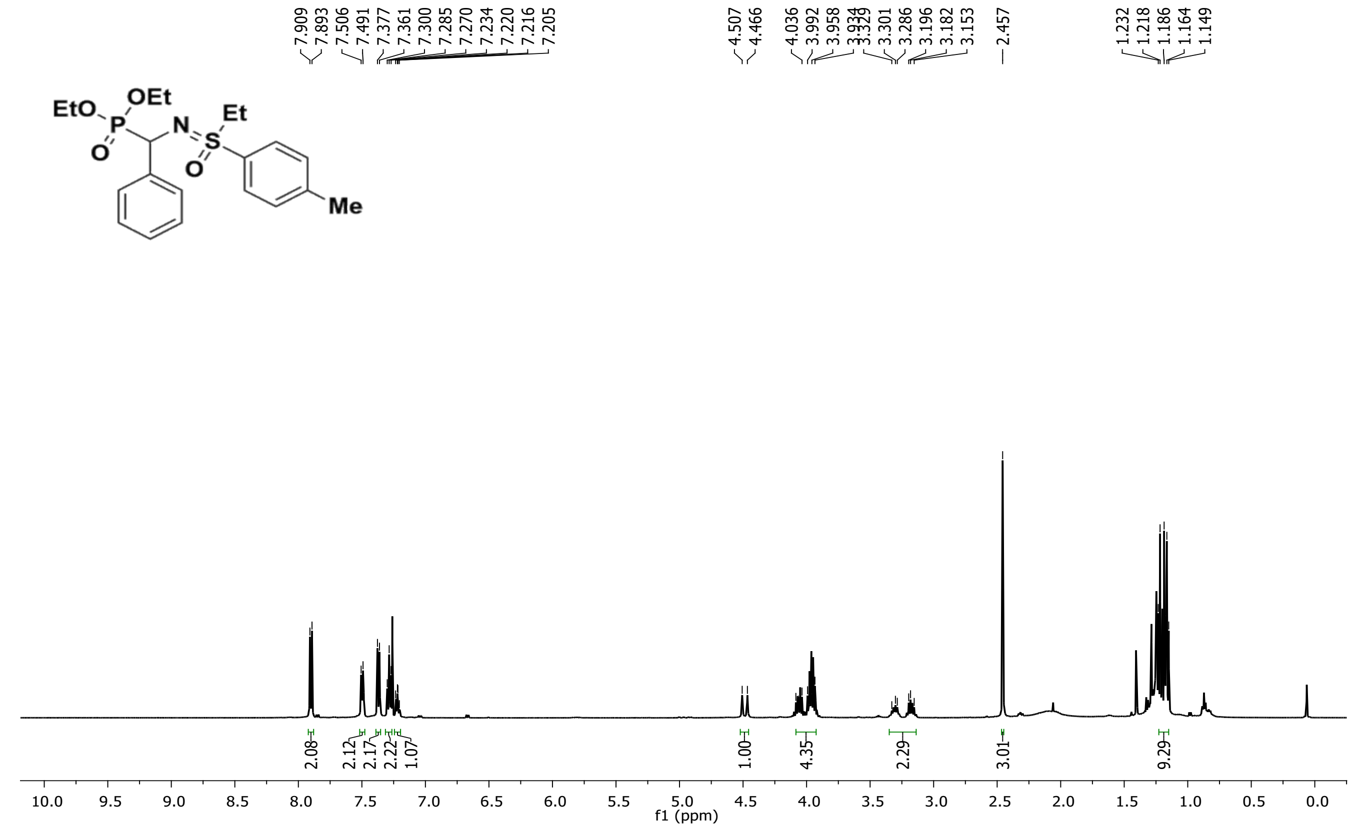
$^{1}H$ NMR of **4ac** (Mixture of 2 Diastereomers) (500 MHz, $CDCl_3$)



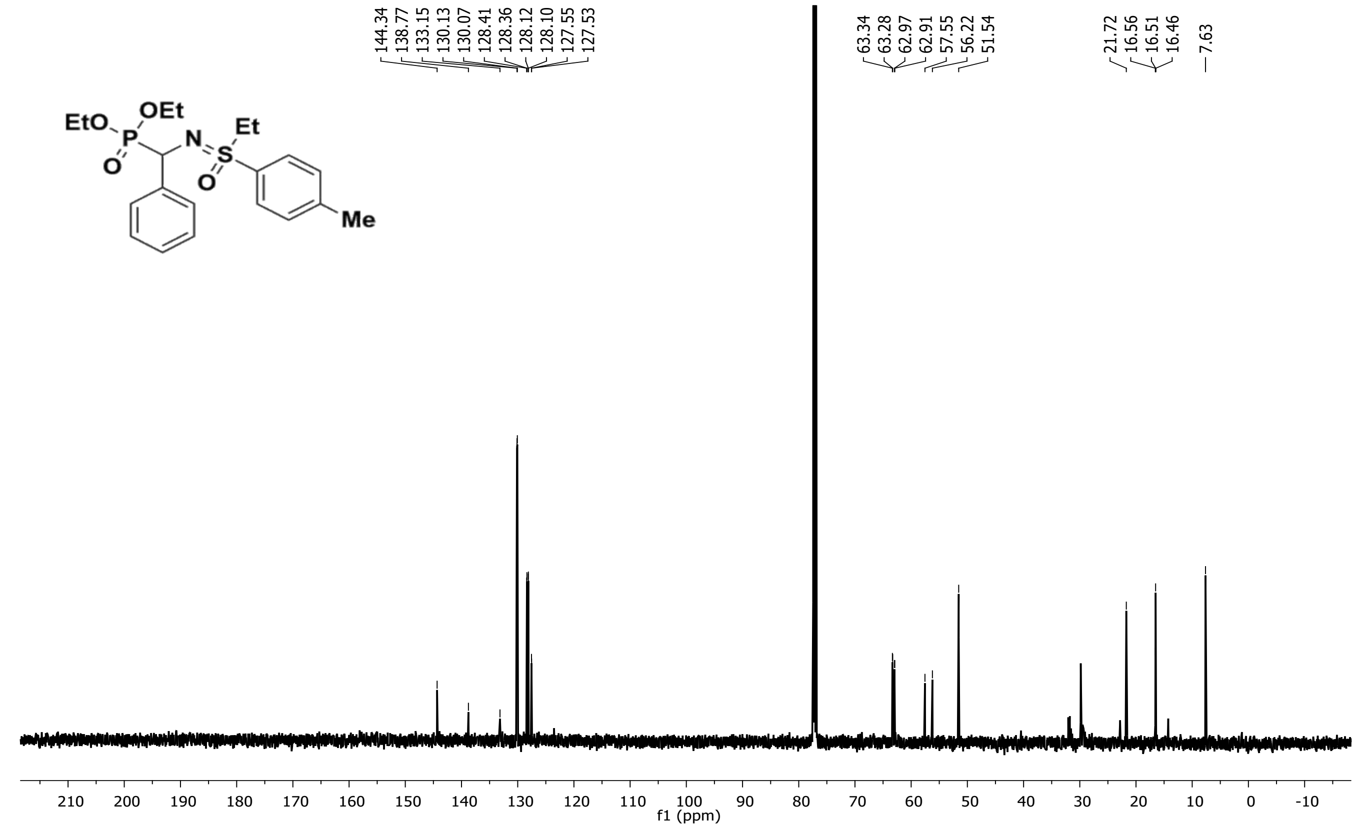

$^{13}C$ {$^{1}H$} NMR of **4ac** (Mixture of 2 Diastereomers) (126 MHz, $CDCl_3$)



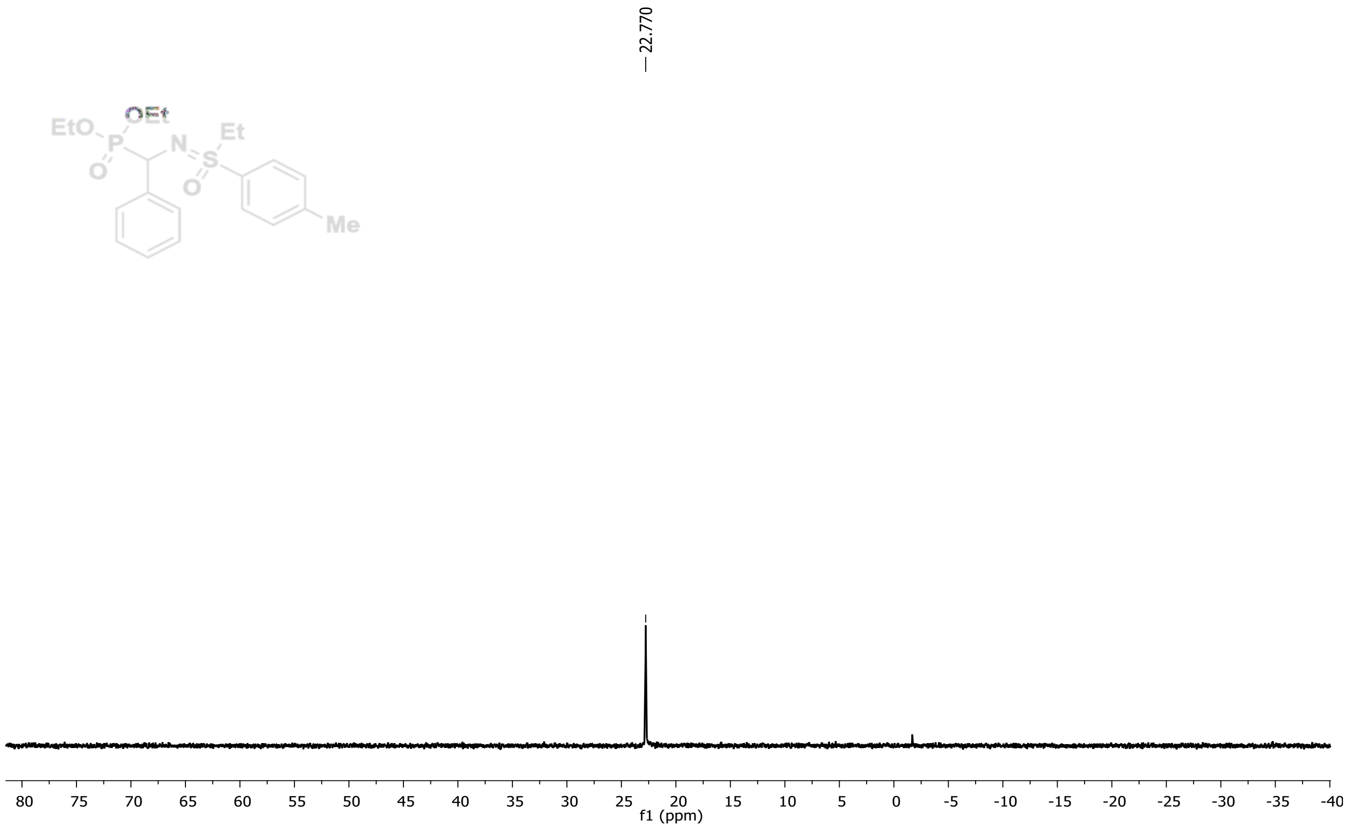
$^{1}H$ NMR of **4ba** (Diastereomer- 1) (500 MHz, $CDCl_3$)



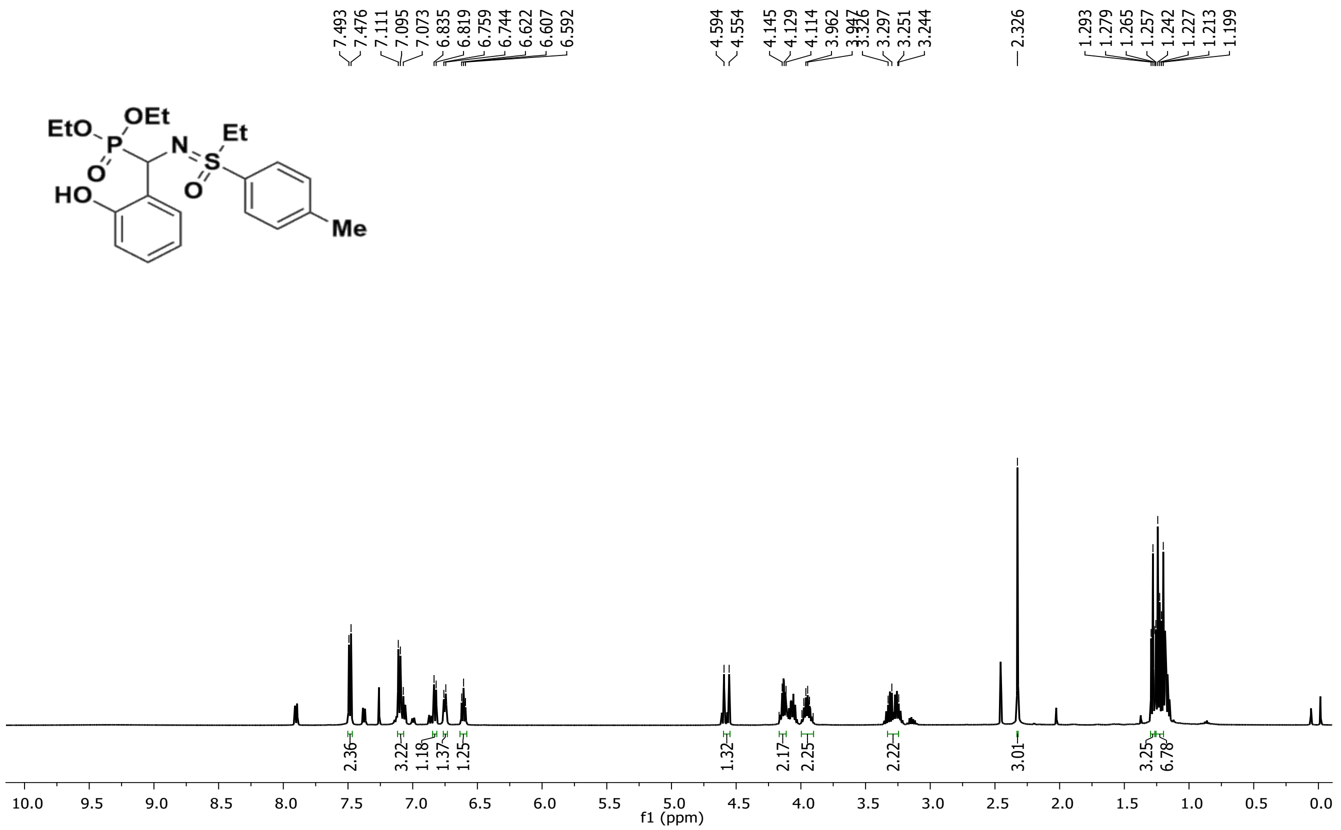

$^{13}C$ {$^{1}H$} NMR of **4ba** (Diastereomer- 1) (126 MHz, $CDCl_3$)



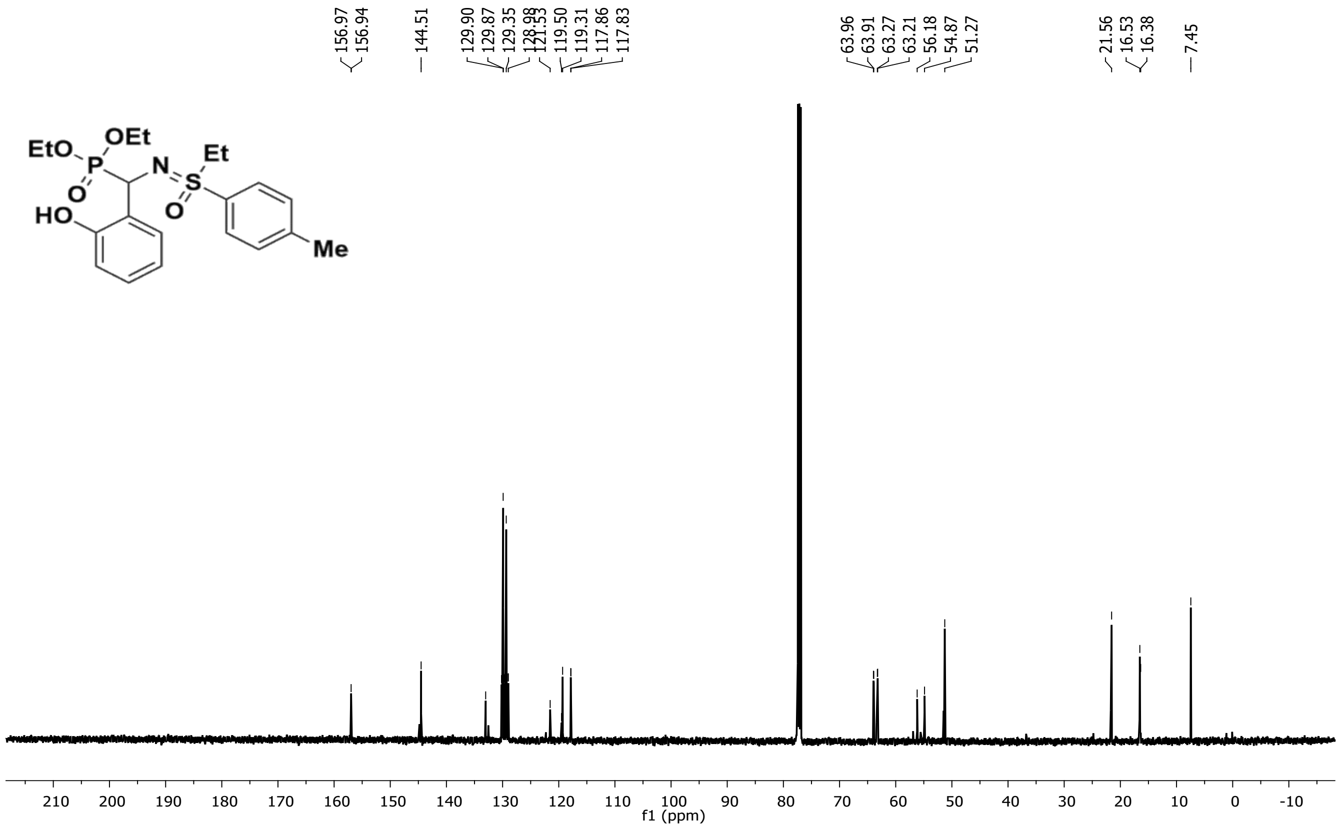
$^{31}$P NMR of **4ba** (Diastereomer- 1) (202 MHz, $CDCl_3$)



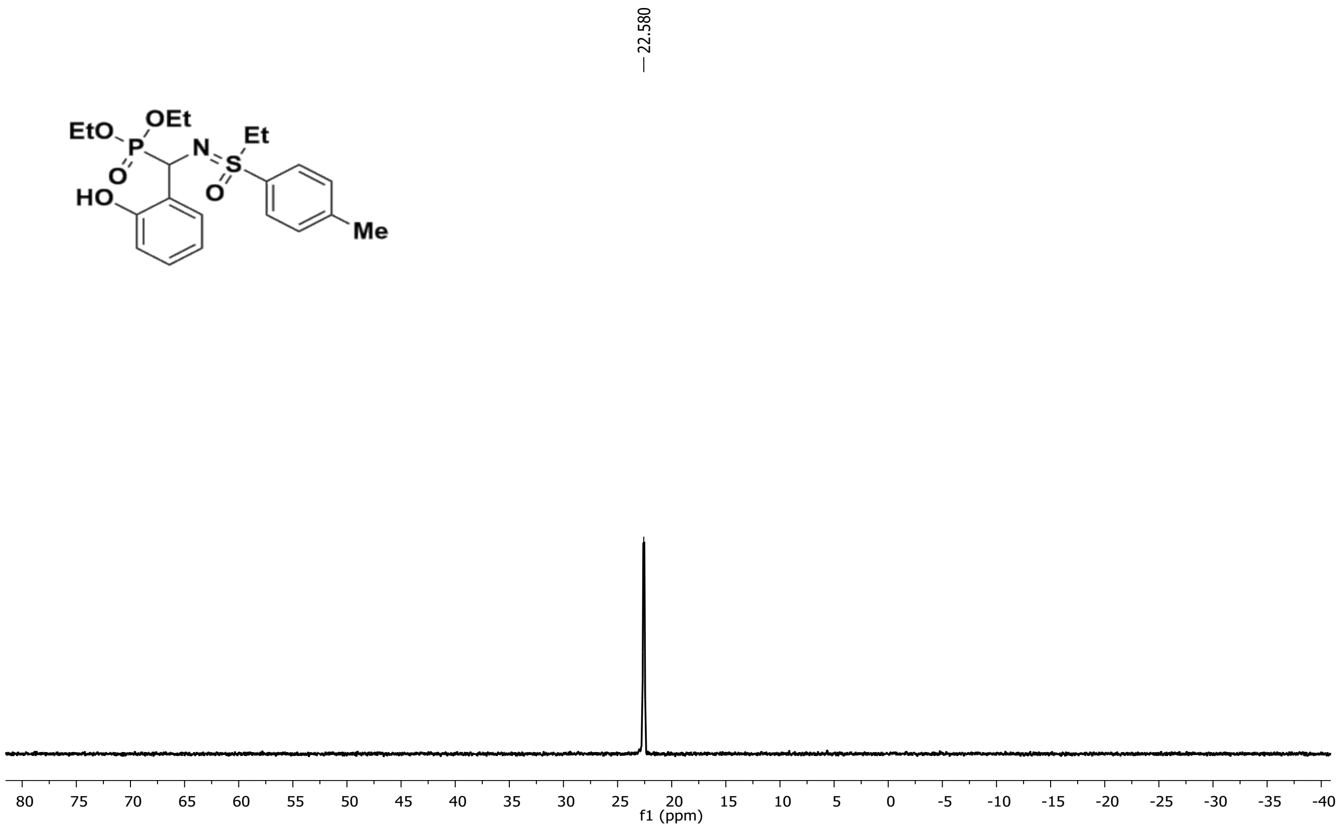

$^{1}$H NMR of **4bb** (Diastereomer- 1) (500 MHz, $CDCl_3$)



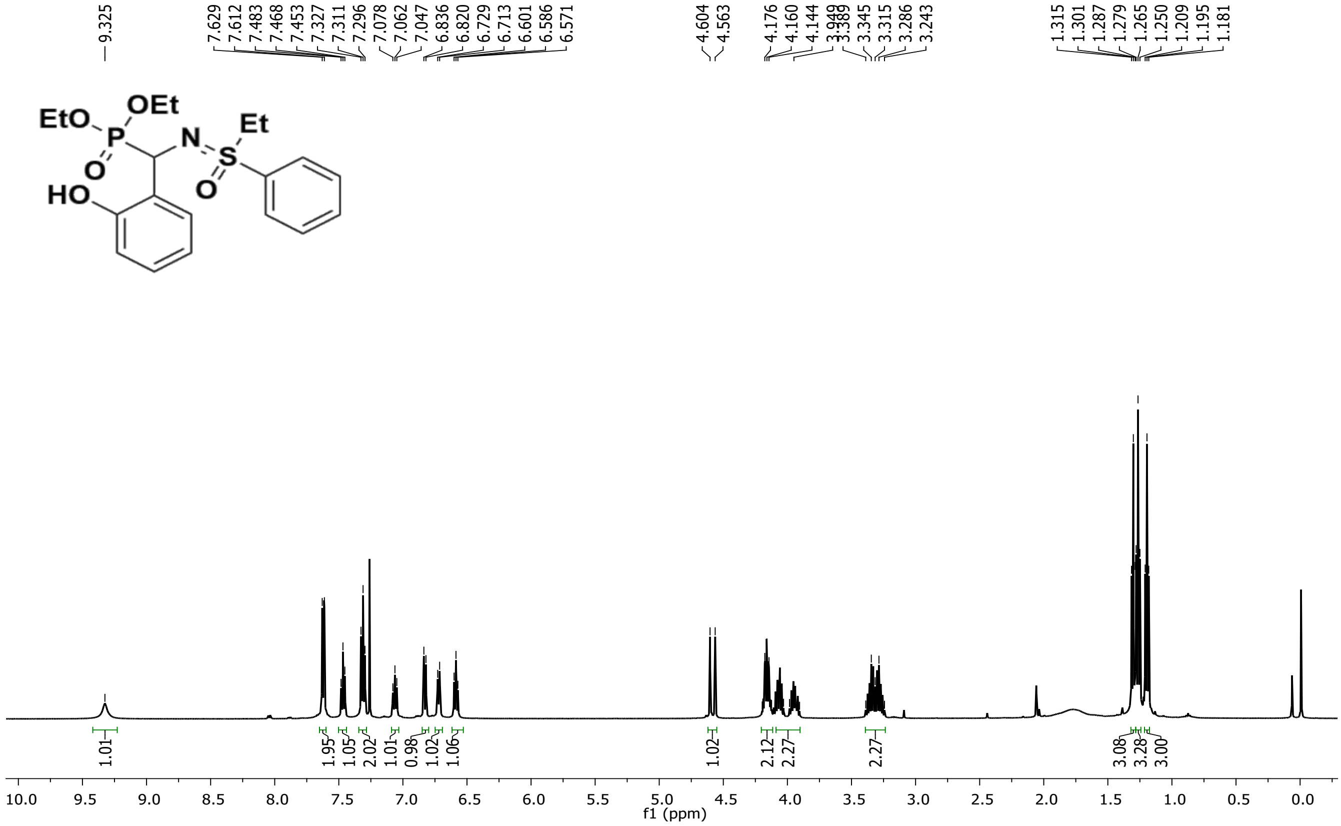
$^{13}C\{^1H\}$ NMR of **4bb** (Diastereomer- 1) (126 MHz, $CDCl_3$)



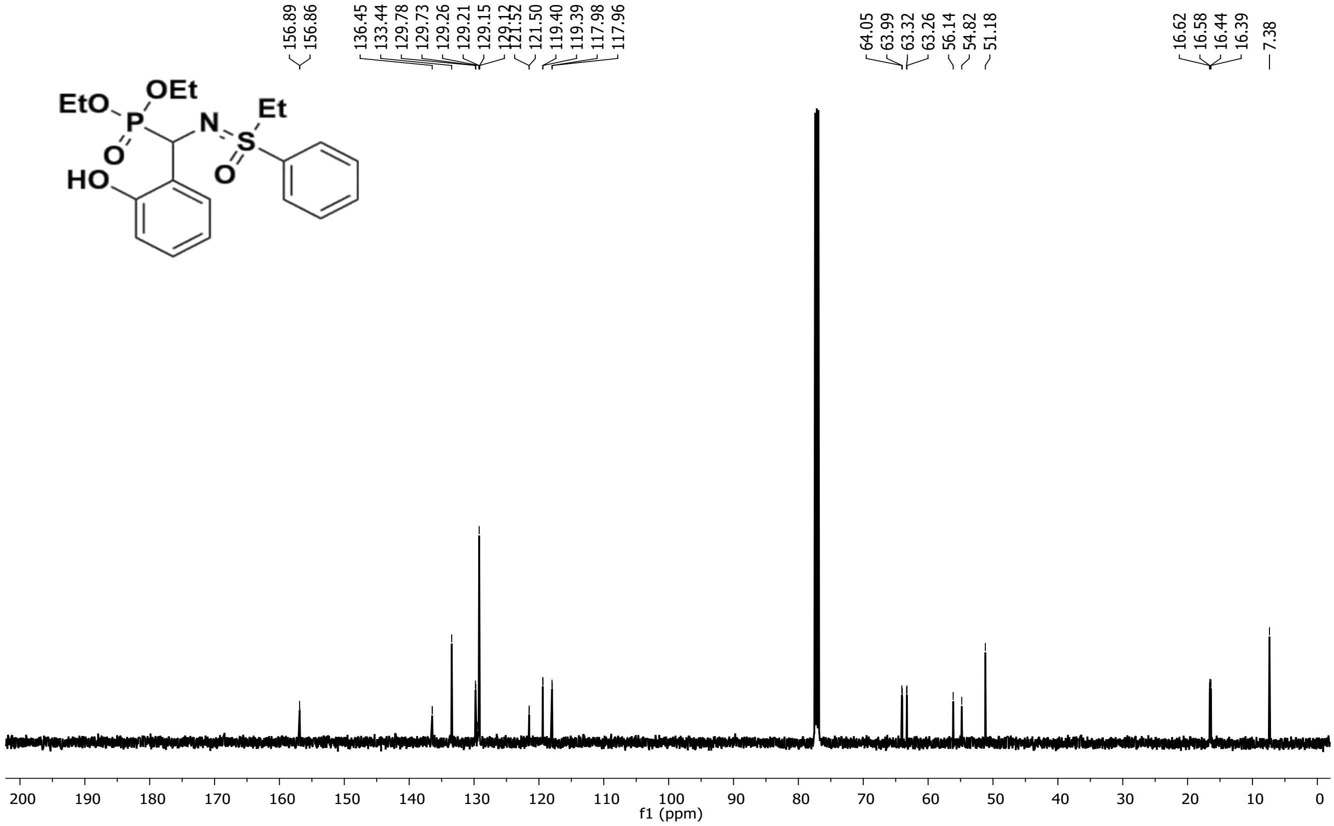

$^{31}P$ NMR of **4bb** (Diastereomer- 1) (202 MHz, $CDCl_3$)



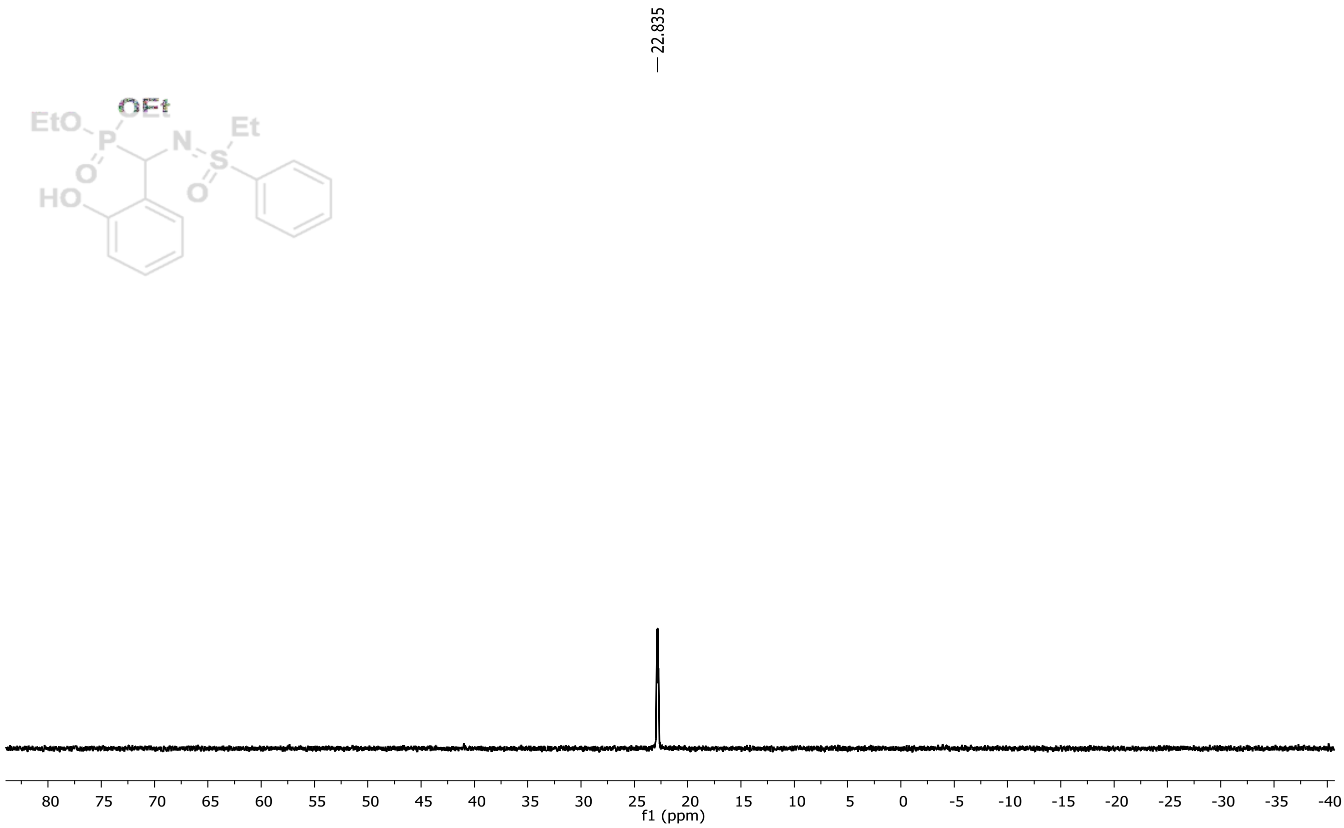
$^{1}H$ NMR of **4ca** (Diastereomer- 1) (500 MHz, $CDCl_3$)



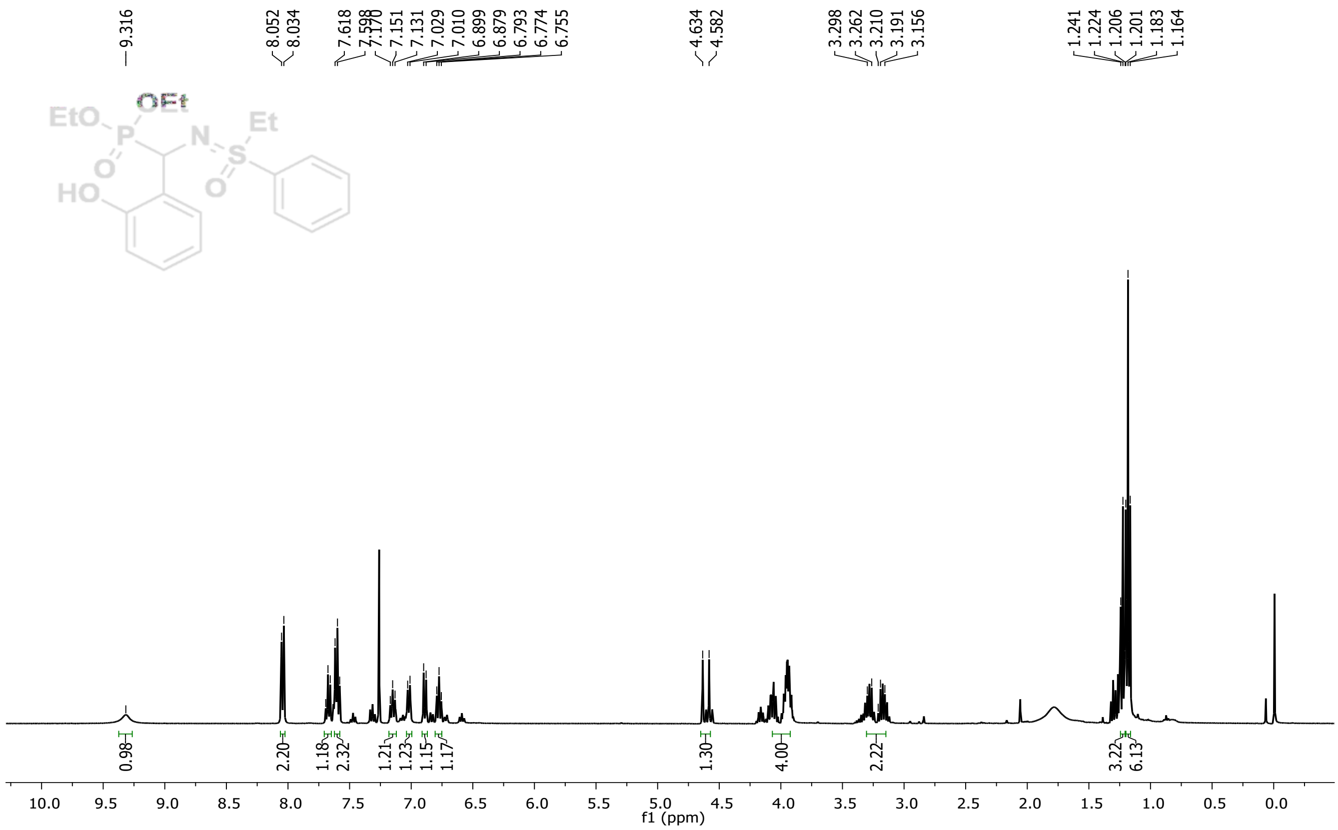

$^{13}C$ {$^{1}H$} NMR of **4ca** (Diastereomer- 1) (126 MHz, $CDCl_3$)



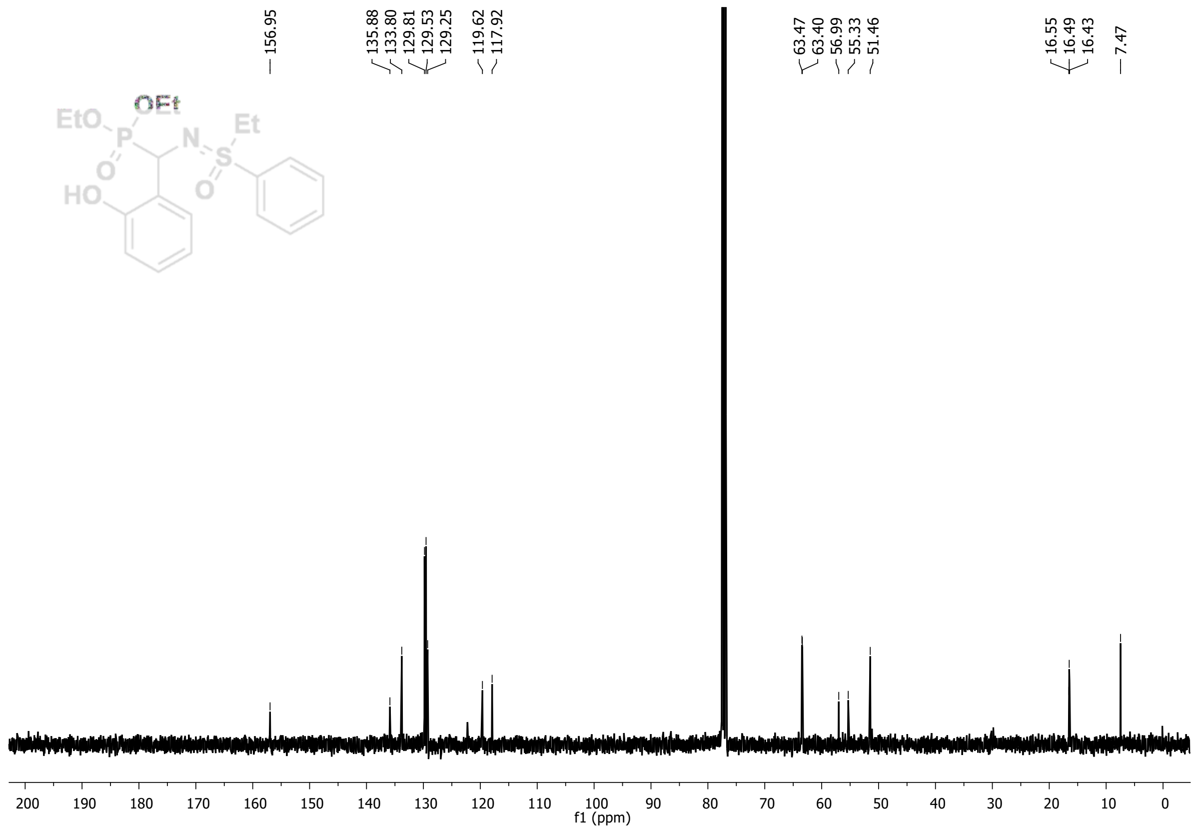
$^{31}P$ NMR of **4ca** (Diastereomer- 1) (202 MHz, $CDCl_3$)



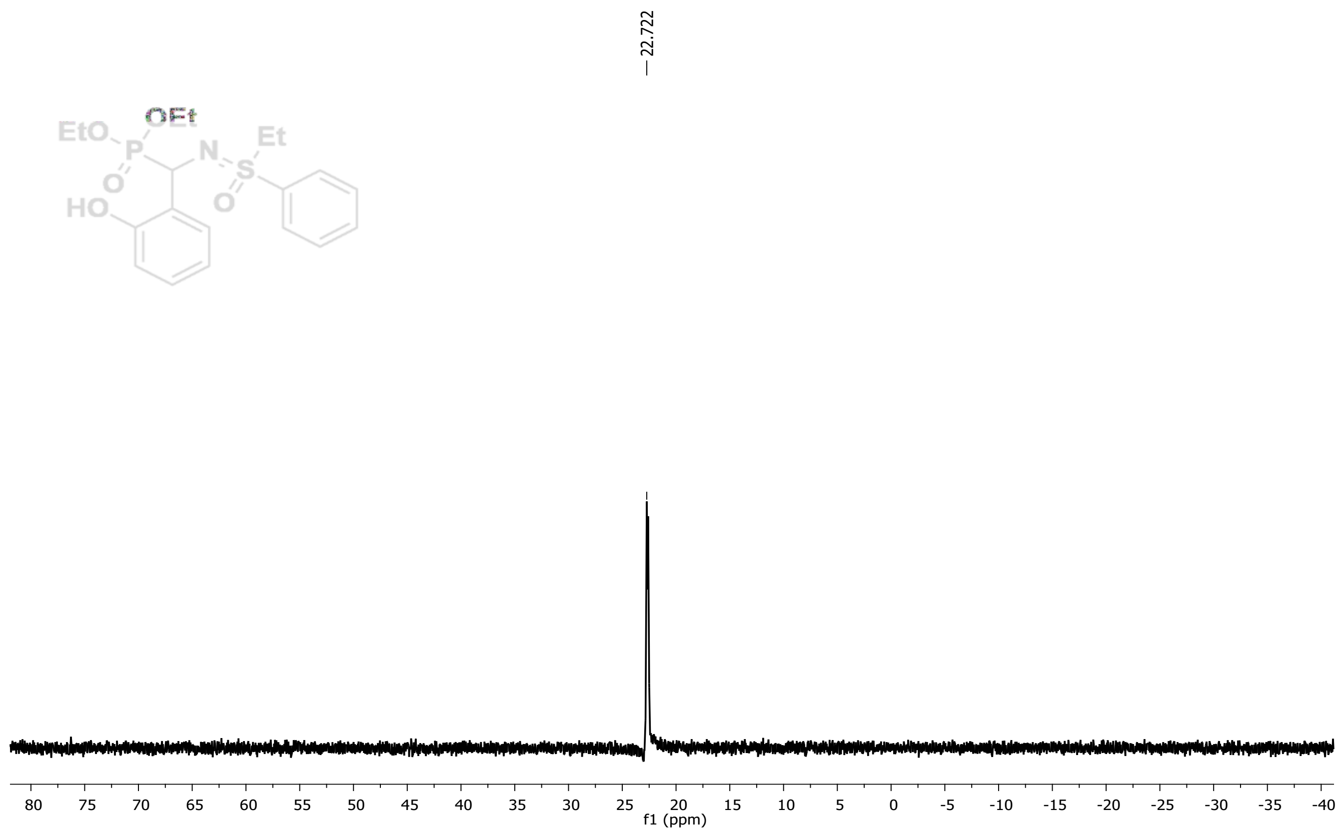

$^{1}H$ NMR of **4ca** (Diastereomer- 2) (400 MHz, $CDCl_3$)



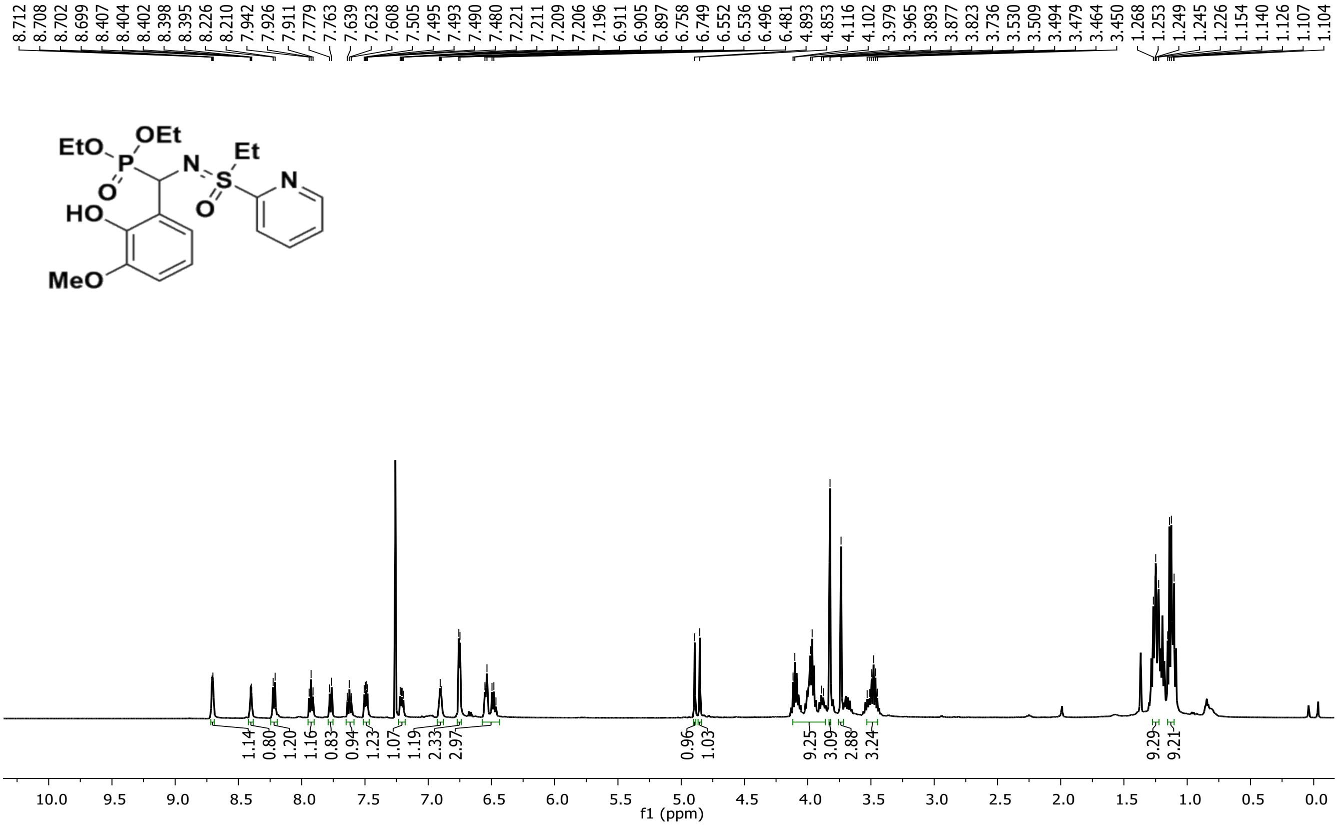
$^{13}C\{^1H\}$ NMR of **4ca** (Diastereomer- 2) (101 MHz, $CDCl_3$)



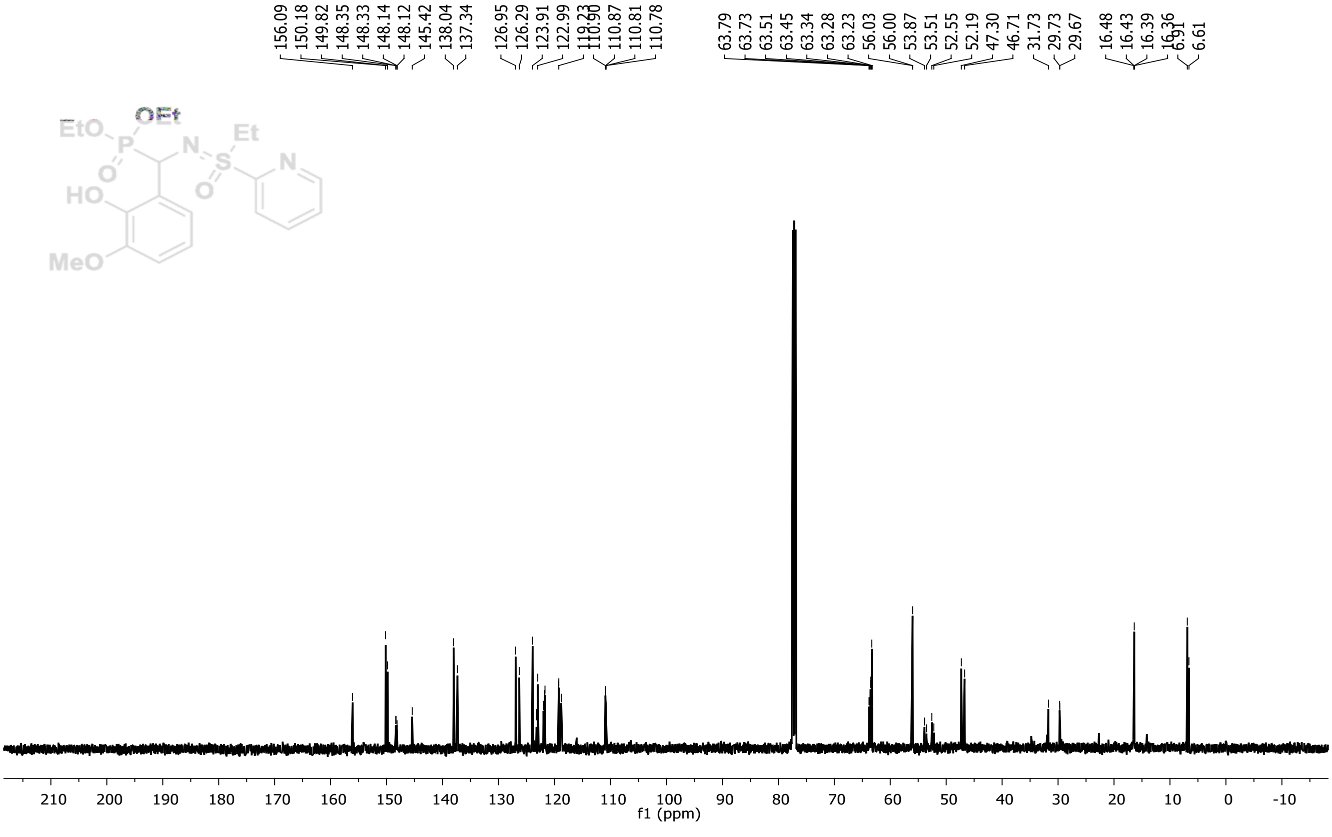

$^{31}P$ NMR of **4ca** (Diastereomer- 2) (162 MHz, $CDCl_3$)



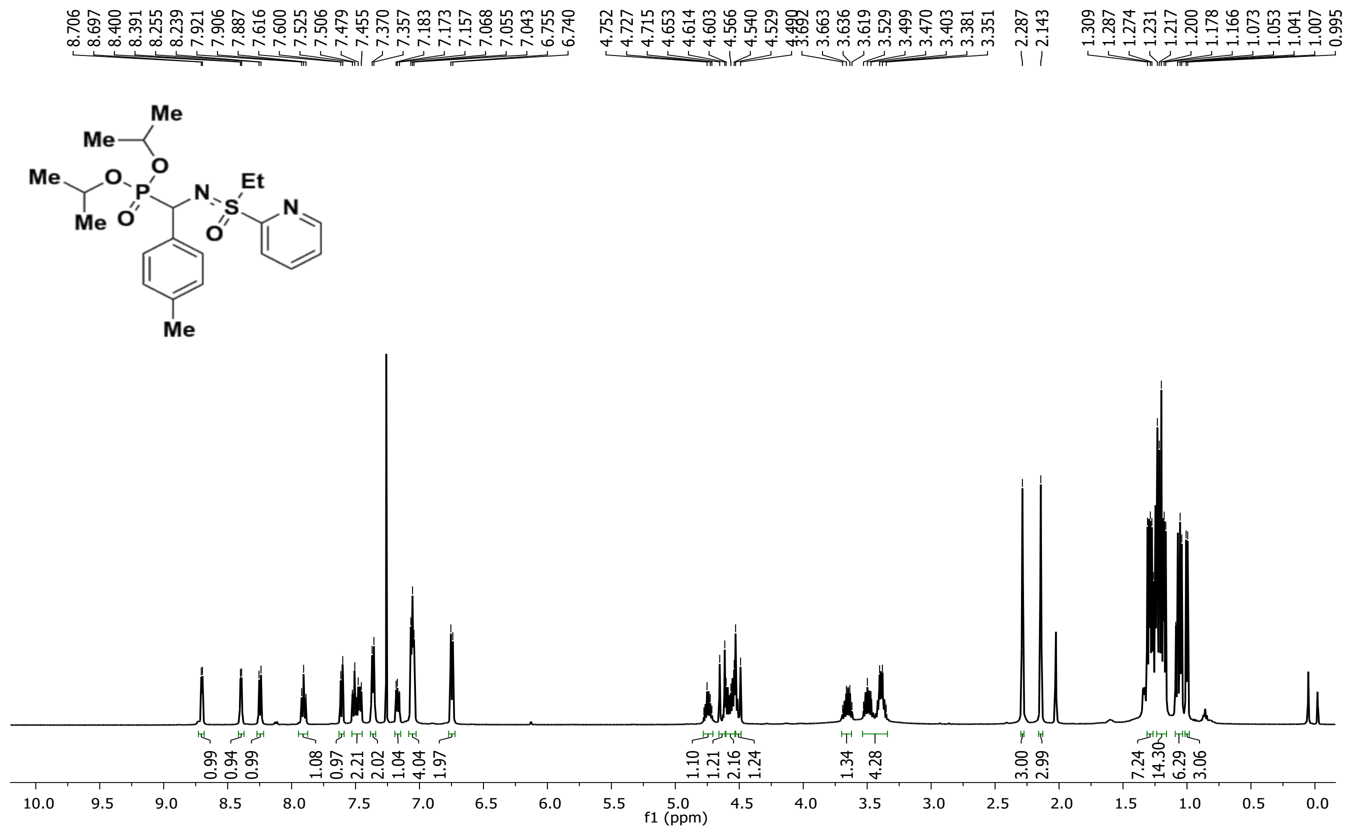
[1]H NMR of **4da** (Mixture of 2 Diastereomers) (500 MHz, $CDCl_3$)



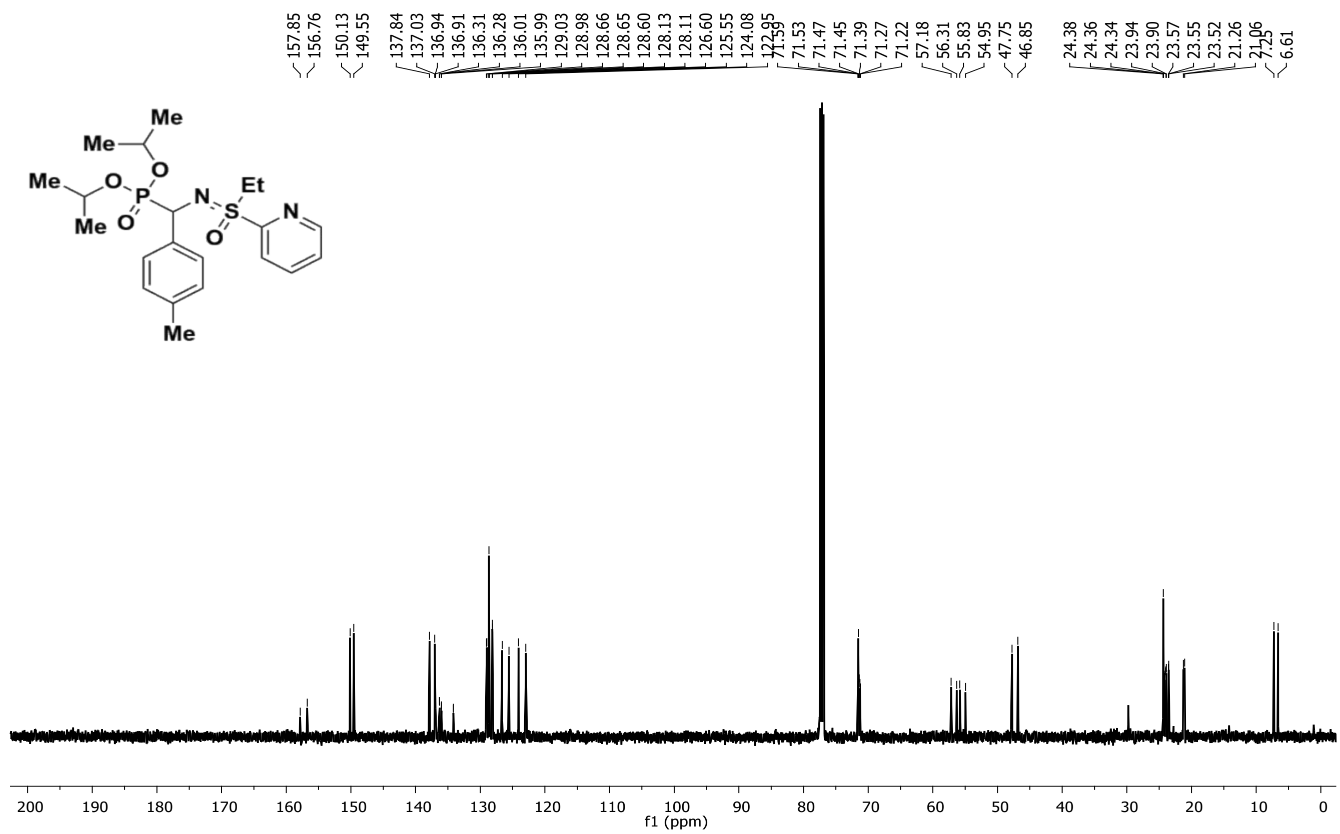

[13]C {[1]H} NMR of **4da** (Mixture of 2 Diastereomers) (126 MHz, $CDCl_3$)



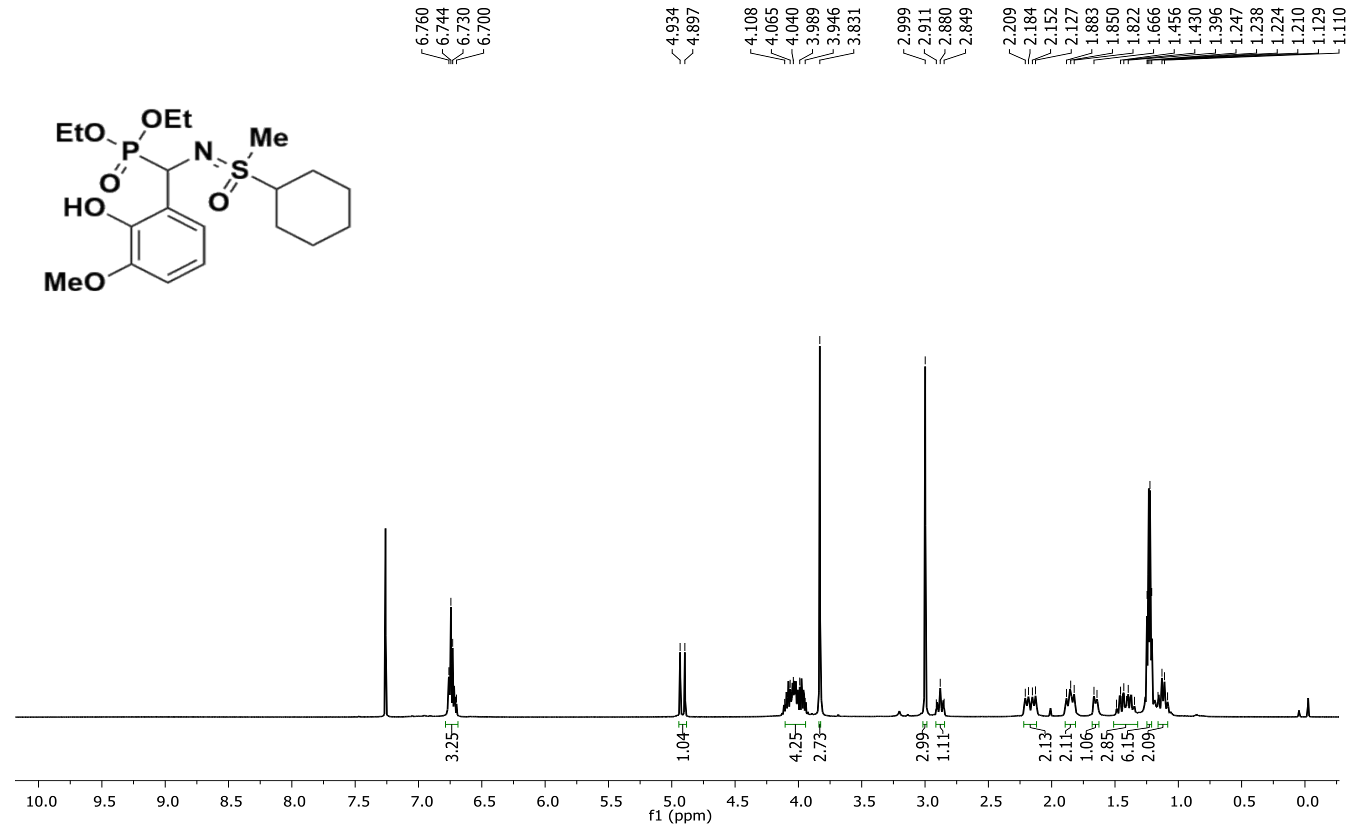
$^{1}$H NMR of **4db** (Mixture of 2 Diastereomers) (500 MHz, $CDCl_3$)



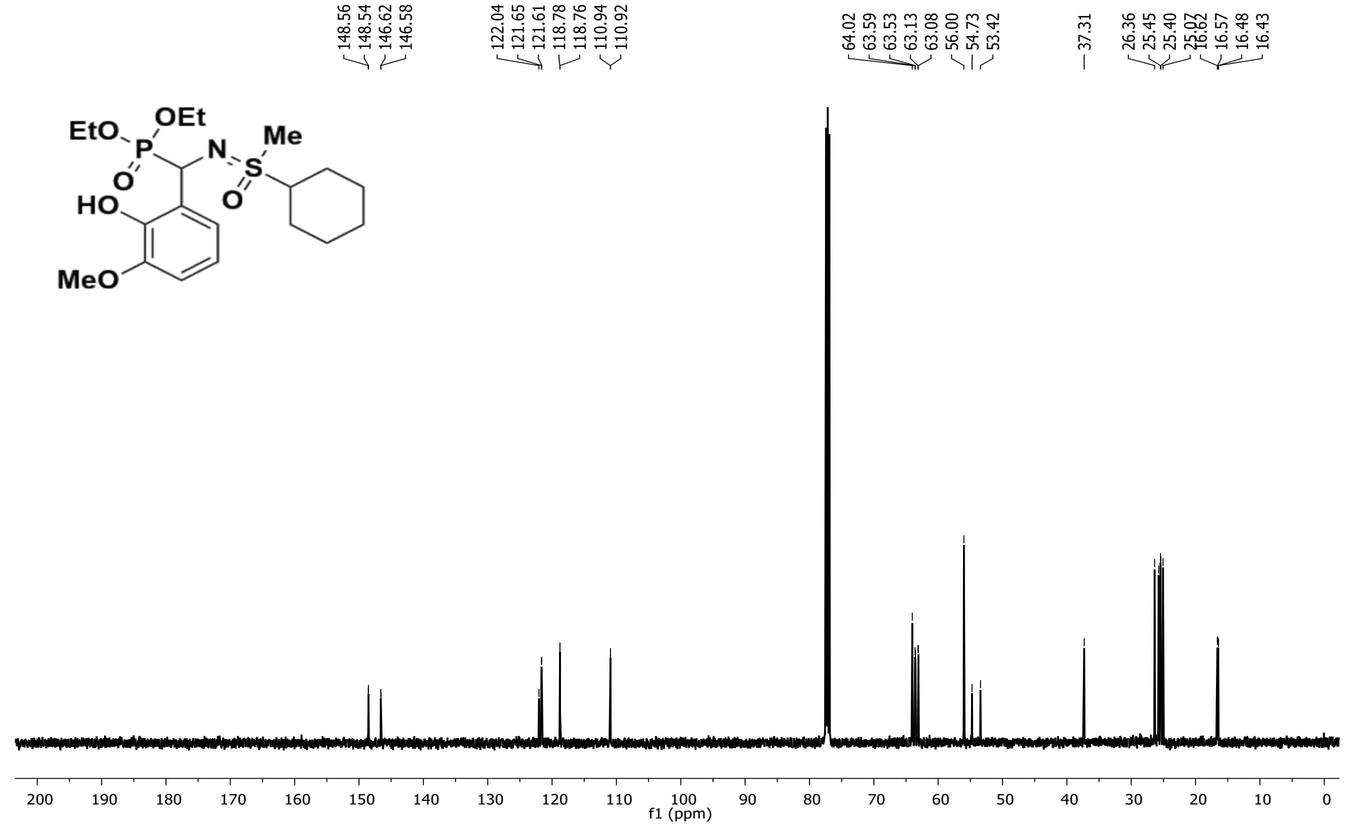

$^{13}$C {$^{1}$H} NMR of **4db** (Mixture of 2 Diastereomers) (126 MHz, $CDCl_3$)



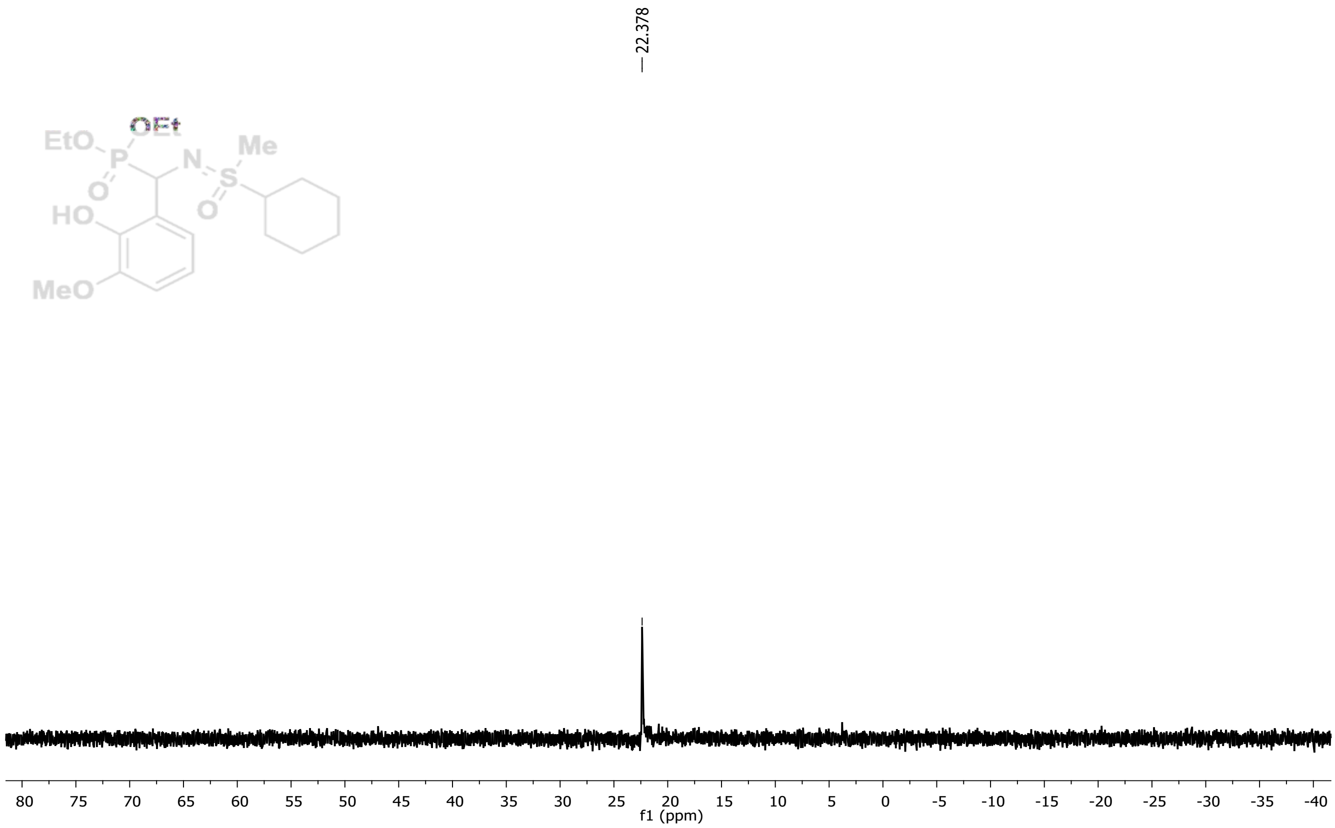
$^{1}H$ NMR of **4ea** (Diastereomer- 1) (500 MHz, $CDCl_3$)



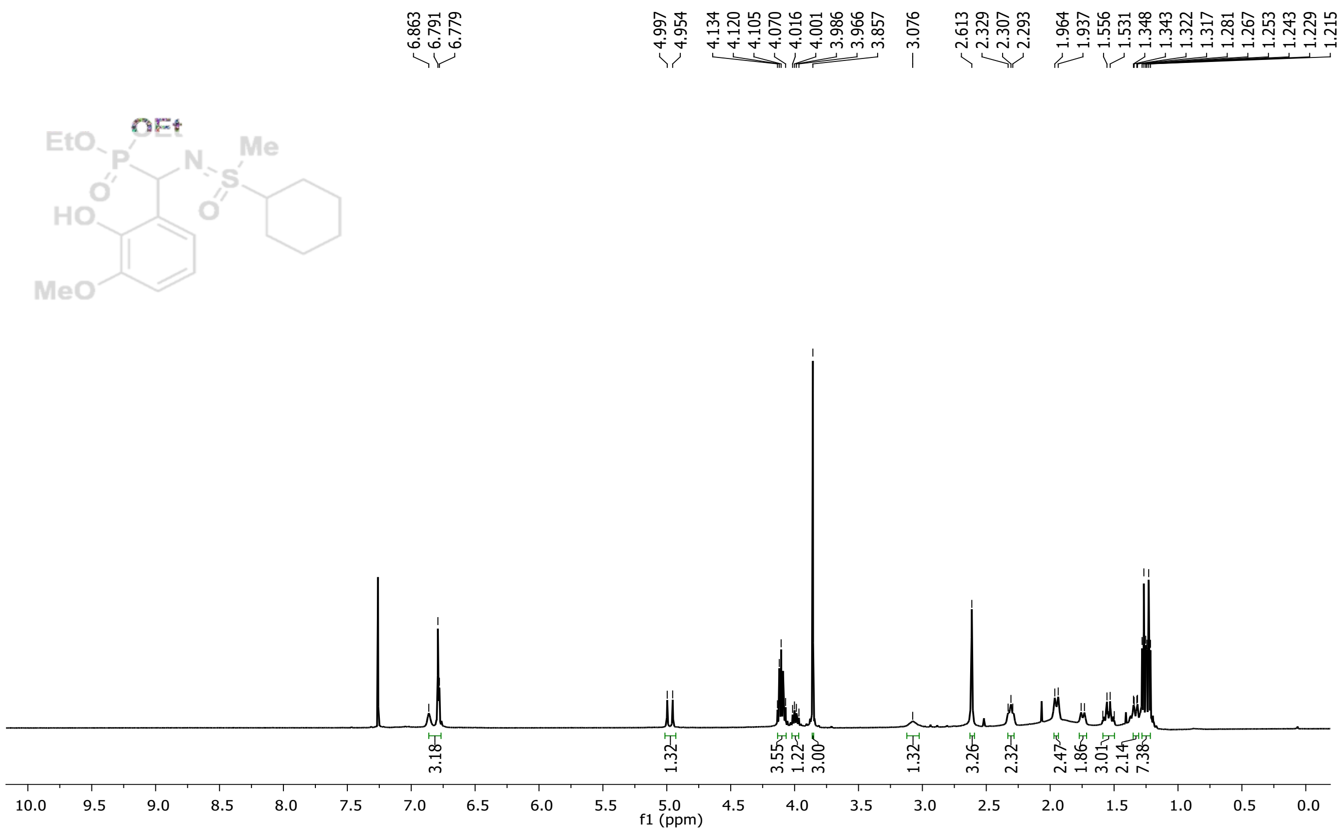

$^{13}C$ {$^{1}H$} NMR of **4ea** (Diastereomer- 1) (126 MHz, $CDCl_3$)



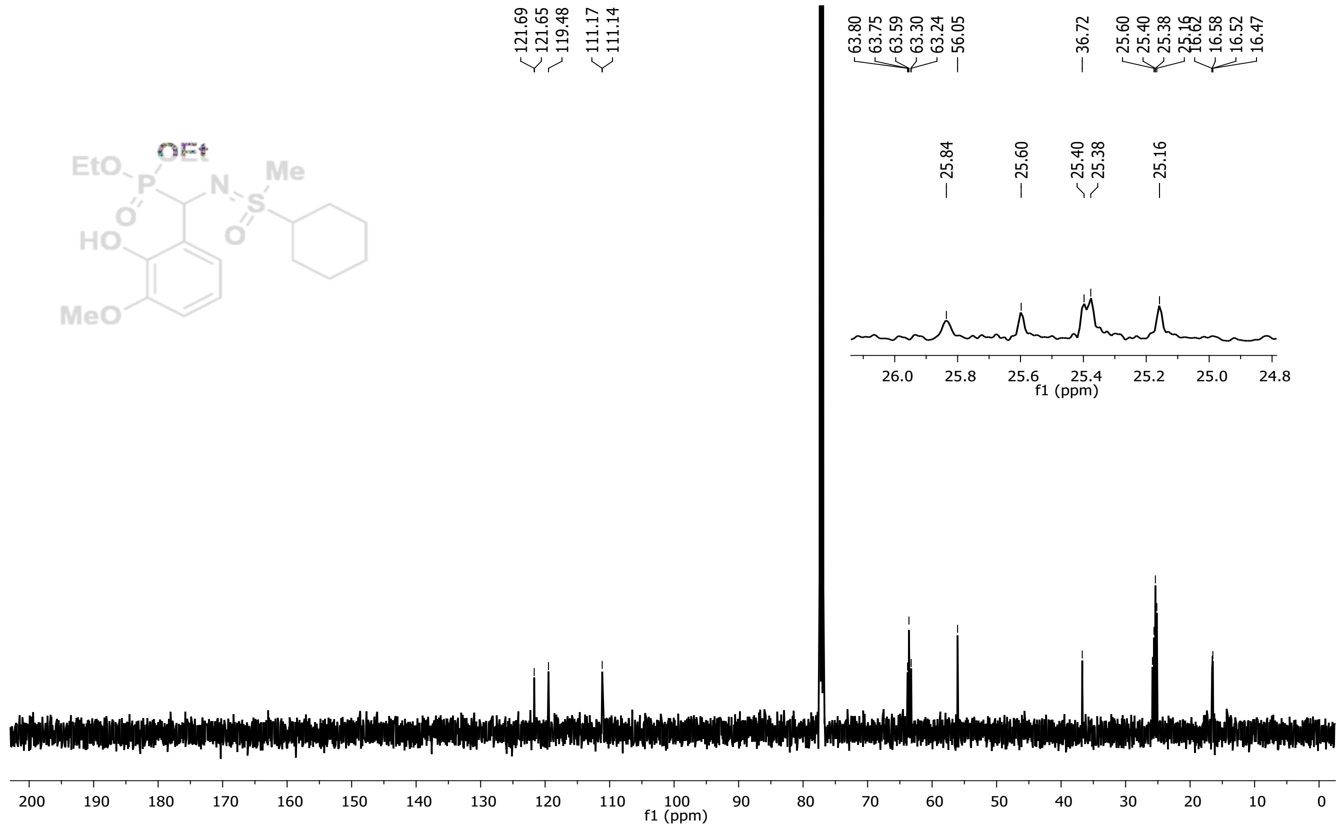
$^{31}$P NMR of **4ea** (Diastereomer- 1) (202 MHz, $CDCl_3$)



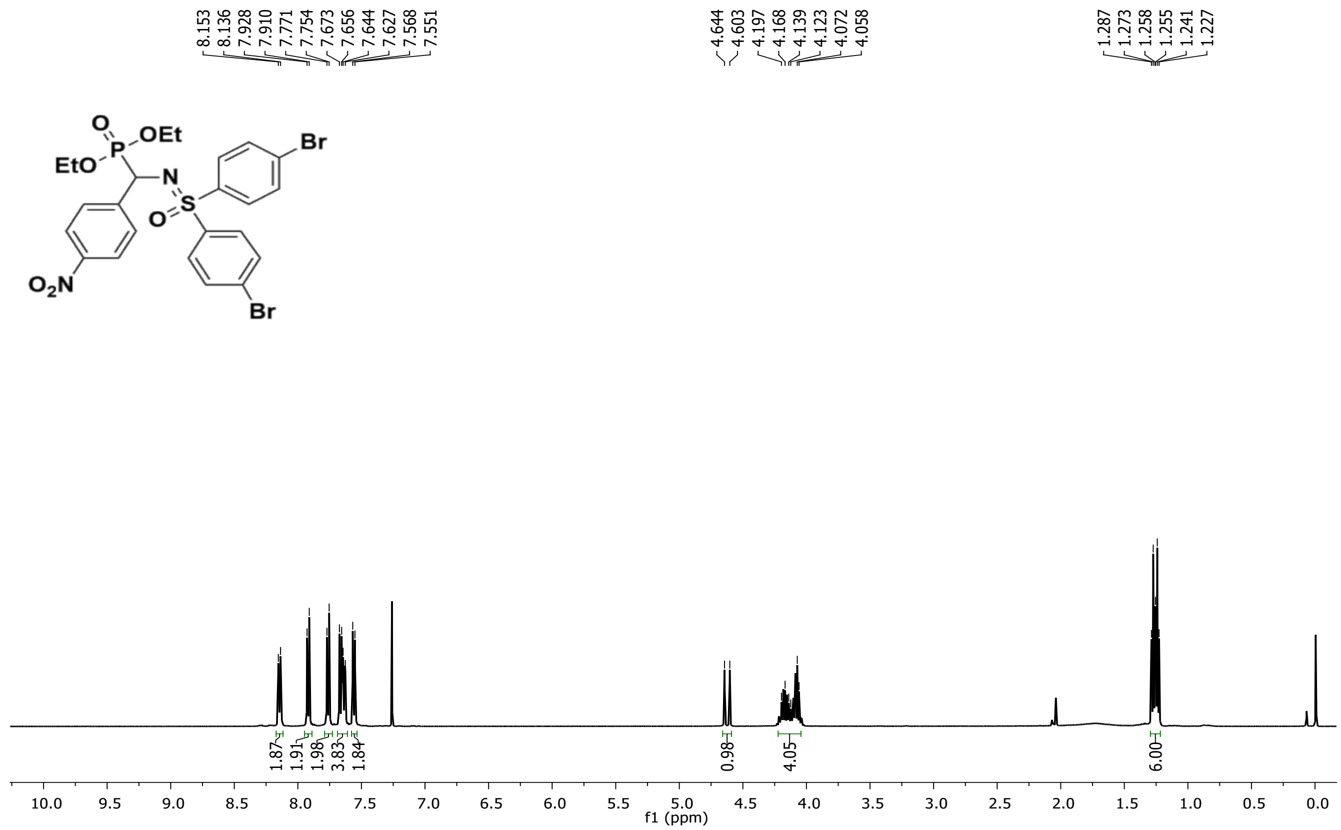

$^{1}$H NMR of **4ea** (Diastereomer- 2) (500 MHz, $CDCl_3$)



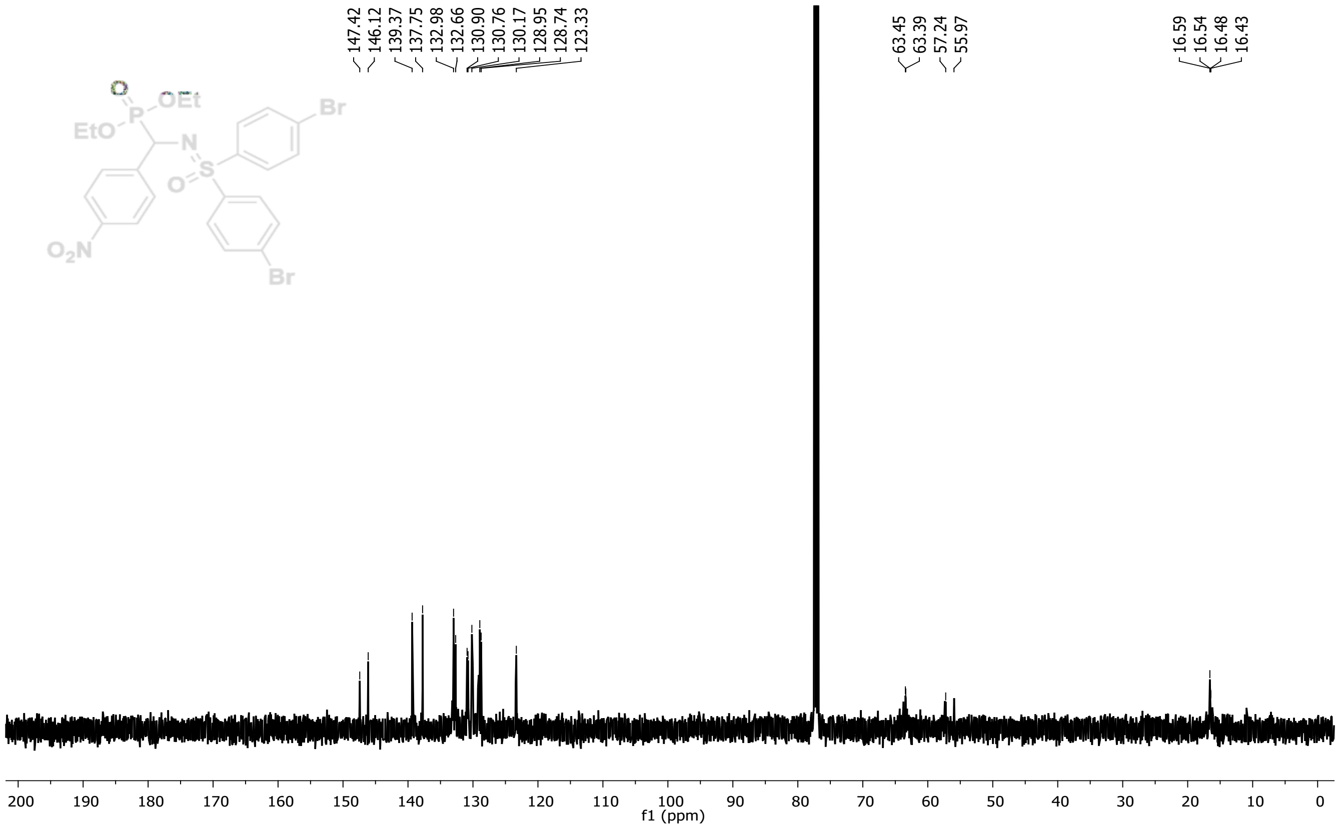
$^{13}C$ {$^{1}H$} NMR of **4ea** (Diastereomer- 2) (126 MHz, $CDCl_3$)



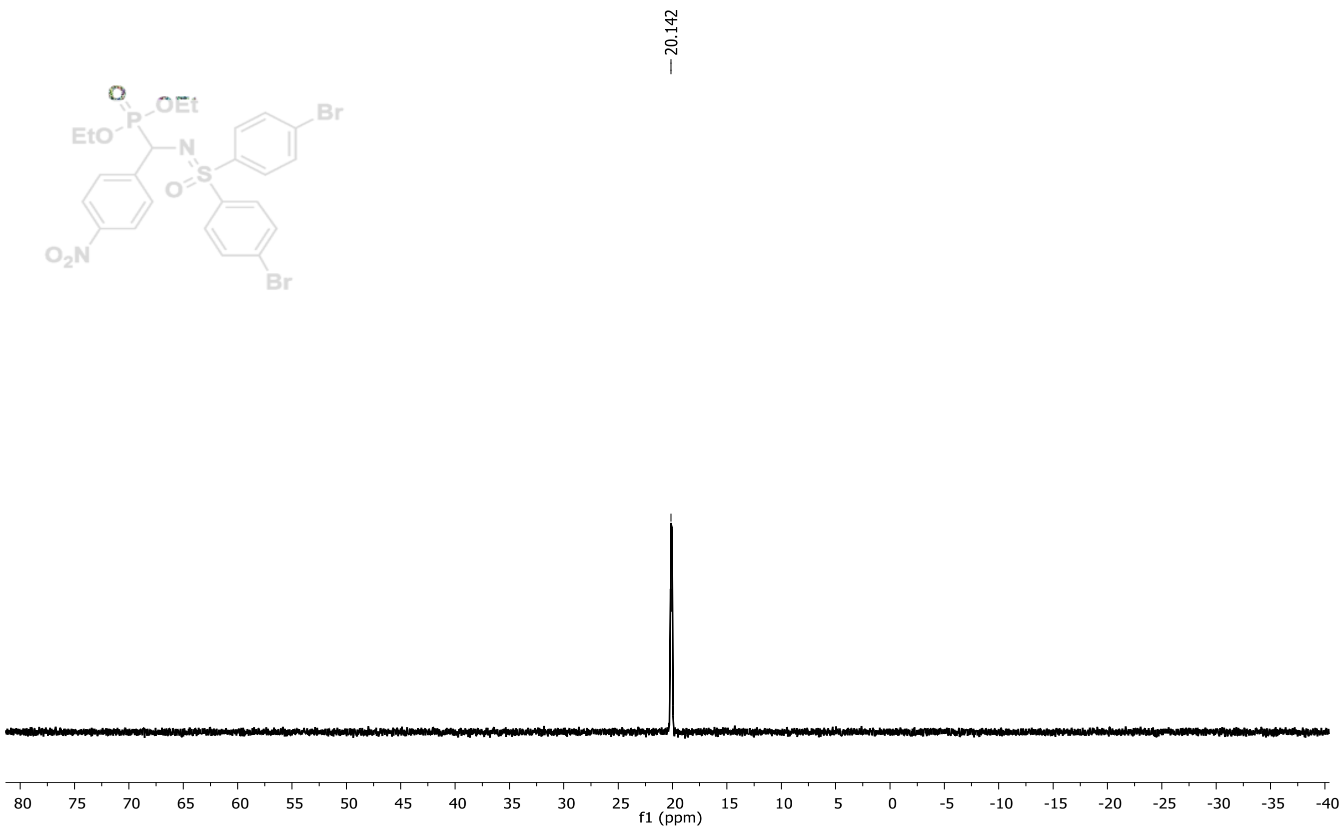

$^{1}H$ NMR of **4fa** (500 MHz, $CDCl_3$)



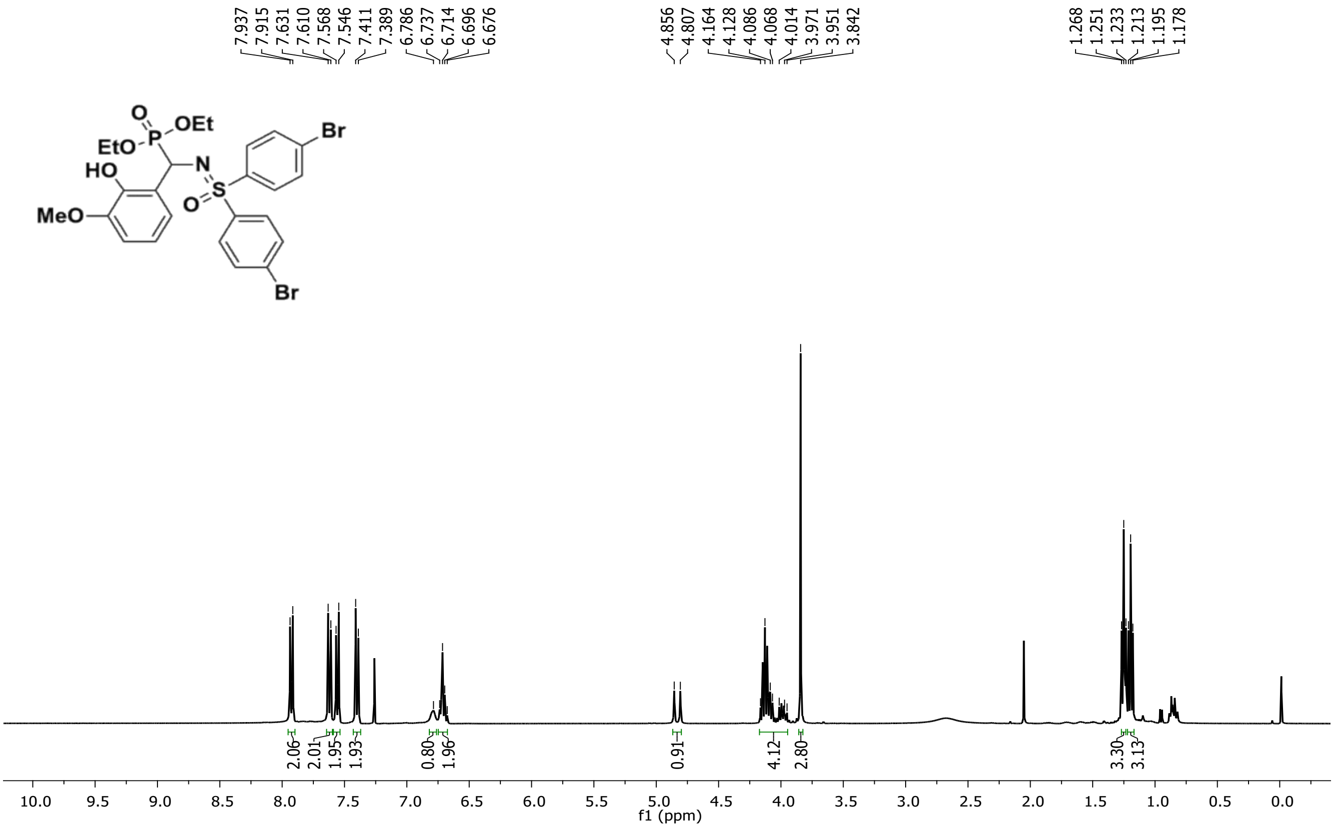
$^{13}C$ {$^{1}H$} NMR of **4fa** (126 MHz, $CDCl_3$)



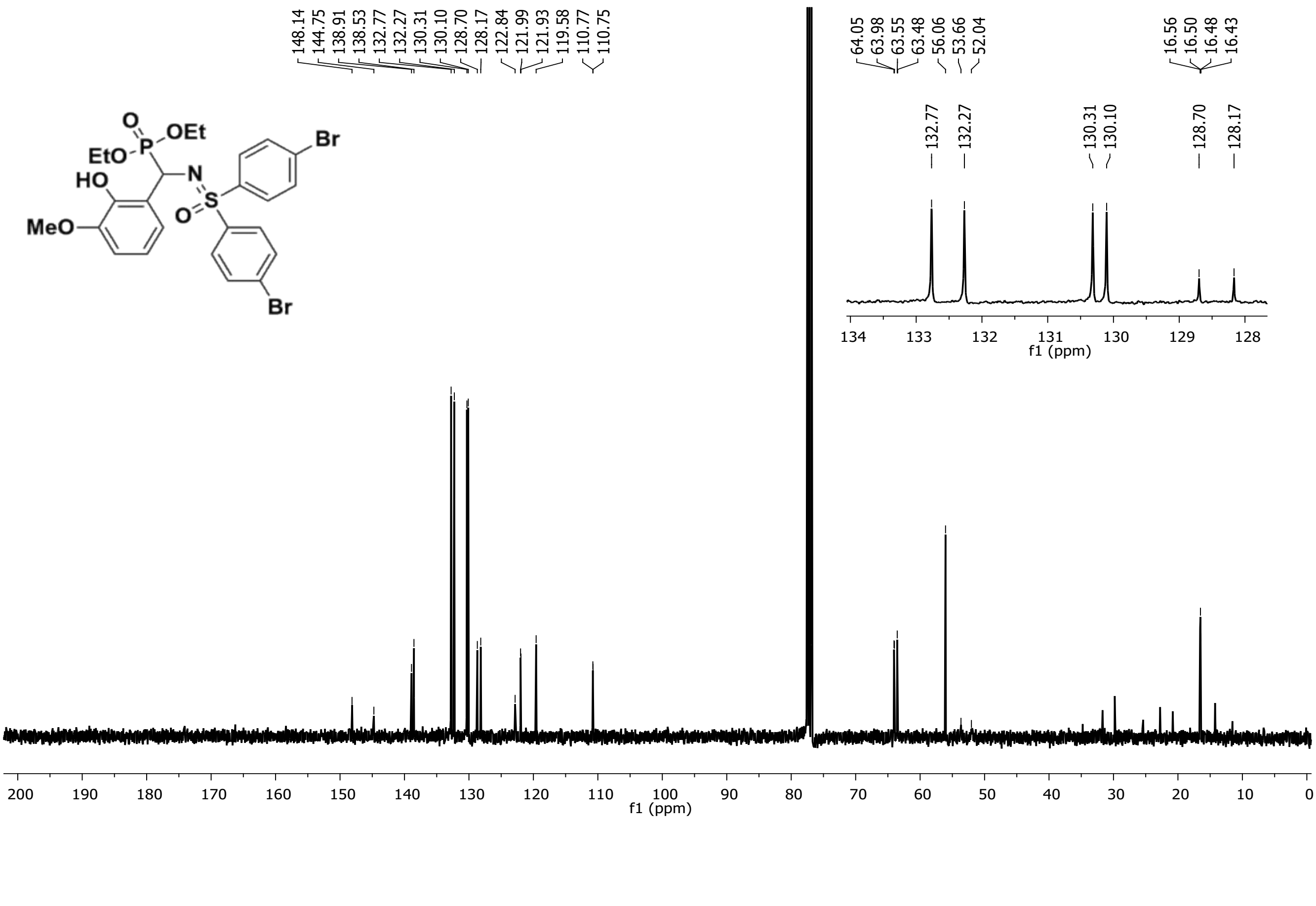

$^{31}P$ NMR of **4fa** (202 MHz, $CDCl_3$)



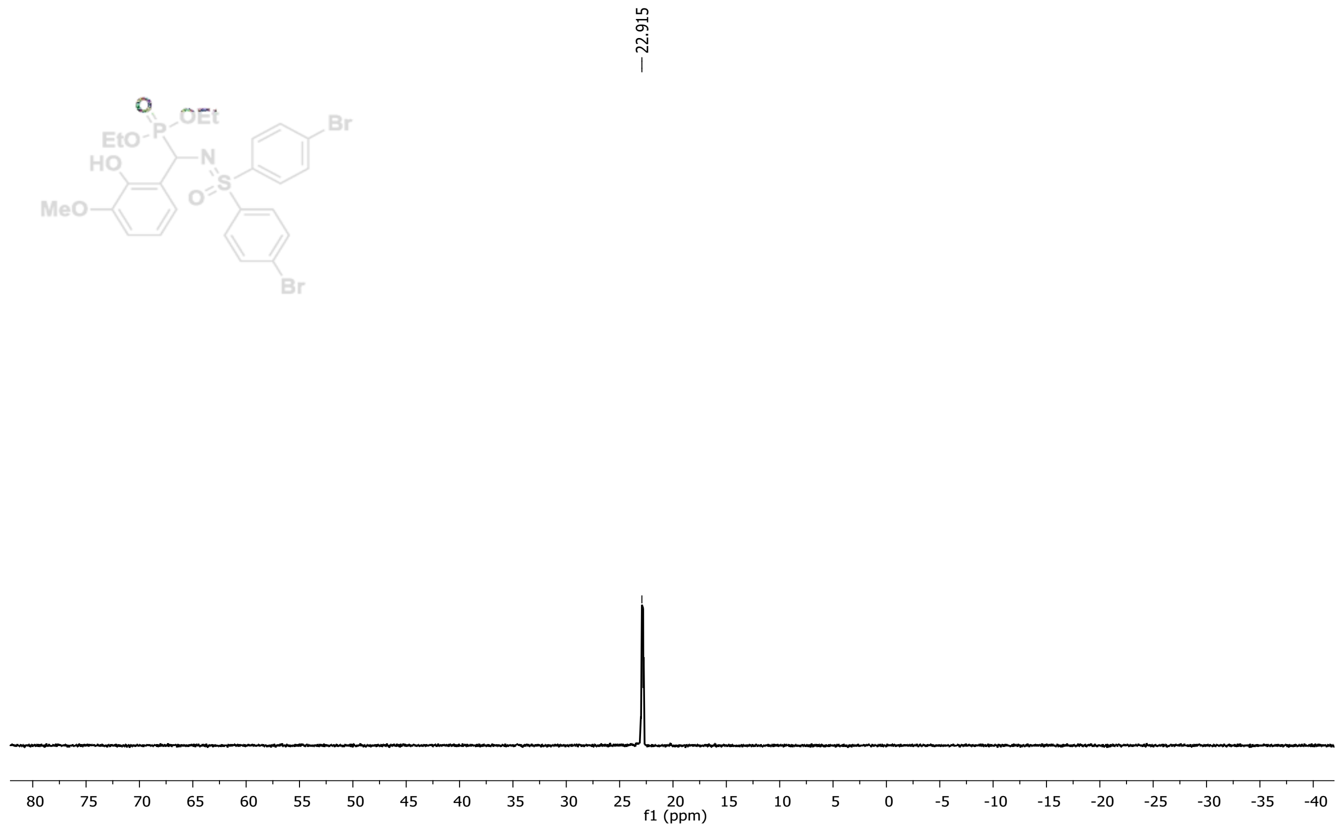
$^1$H NMR of **4fb** (400 MHz, $CDCl_3$)



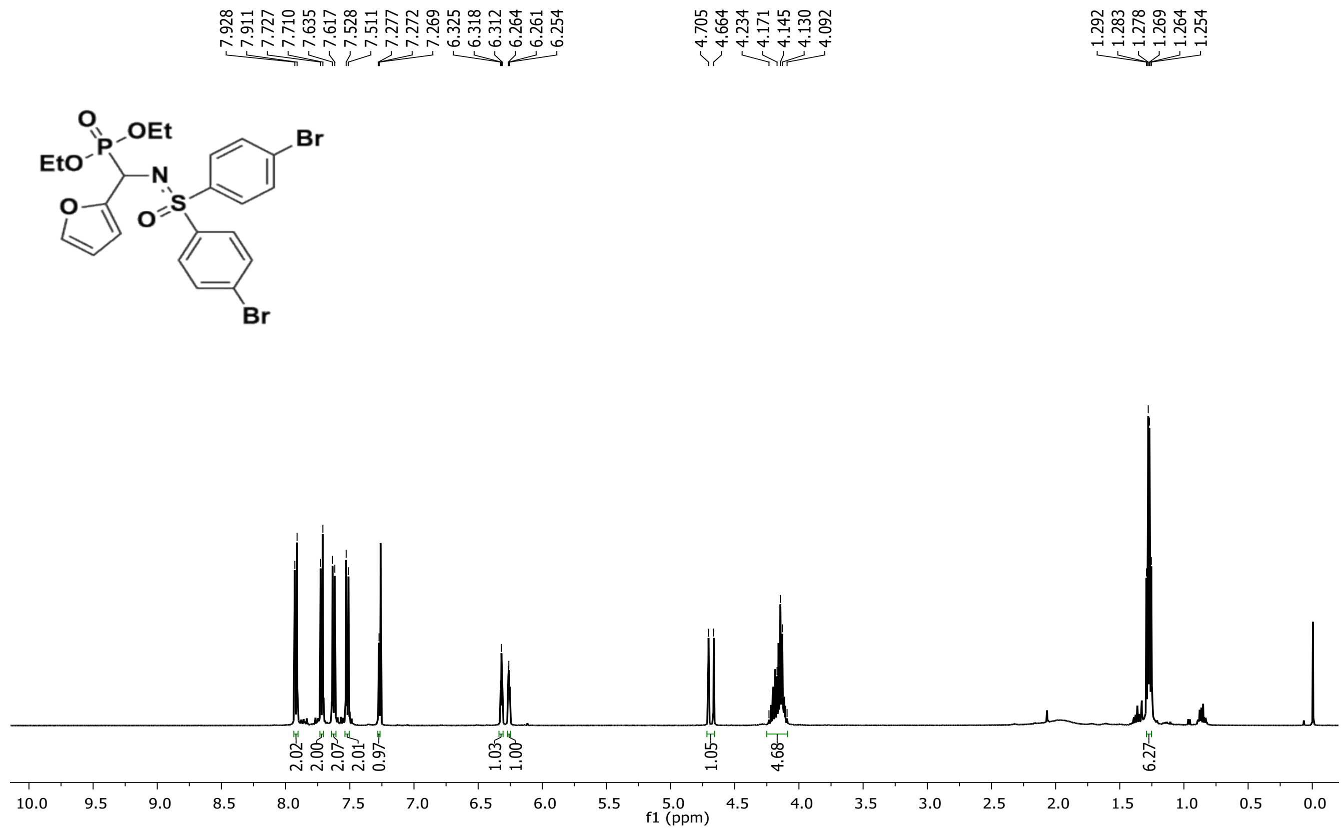
$^{13}$C {$^1$H} NMR of **4fb** (101 MHz, $CDCl_3$)



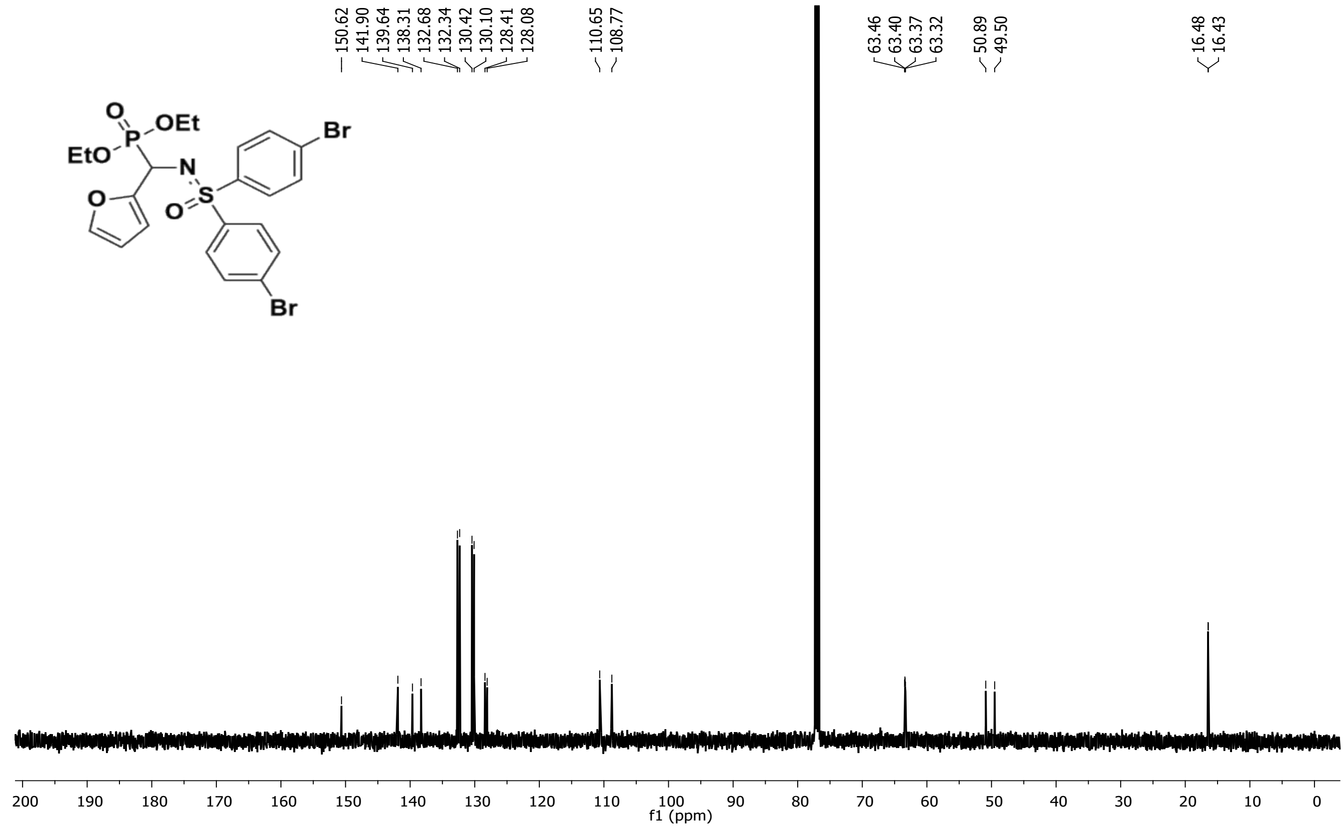
$^{31}$P NMR of **4fb** (162 MHz, $CDCl_3$)



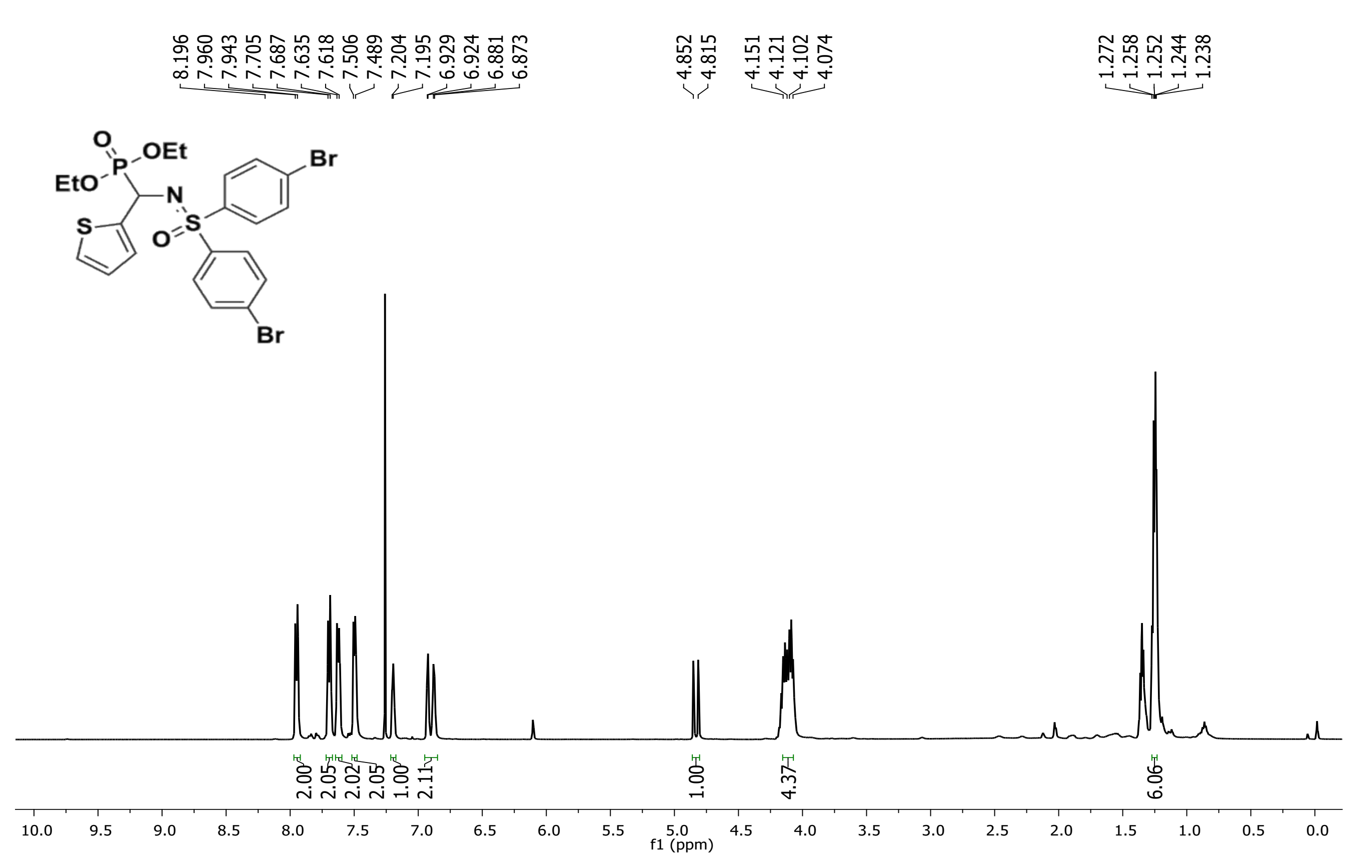

$^{1}$H NMR of **4fc** (500 MHz, $CDCl_3$)



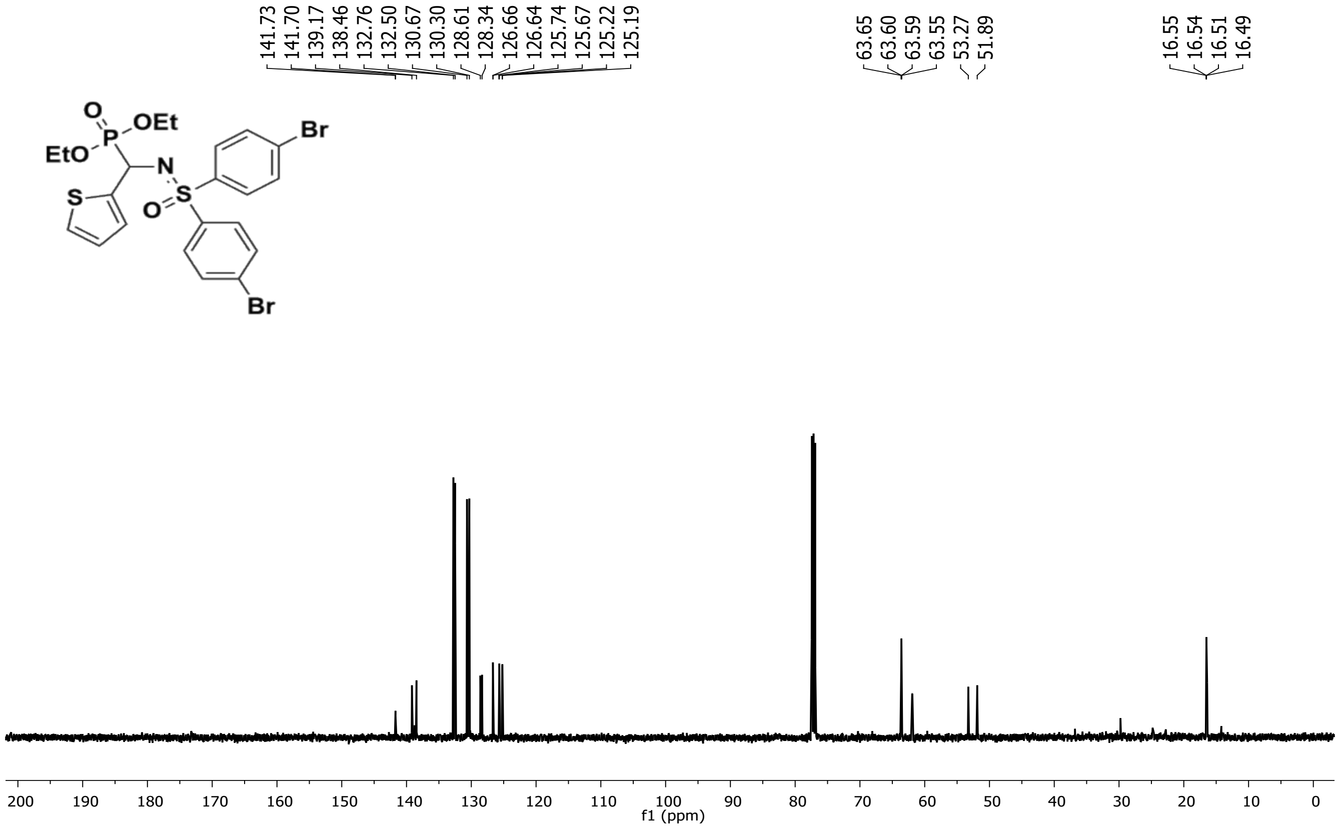
$^{13}C$ {$^{1}H$} NMR of **4fc** (126 MHz, $CDCl_3$)



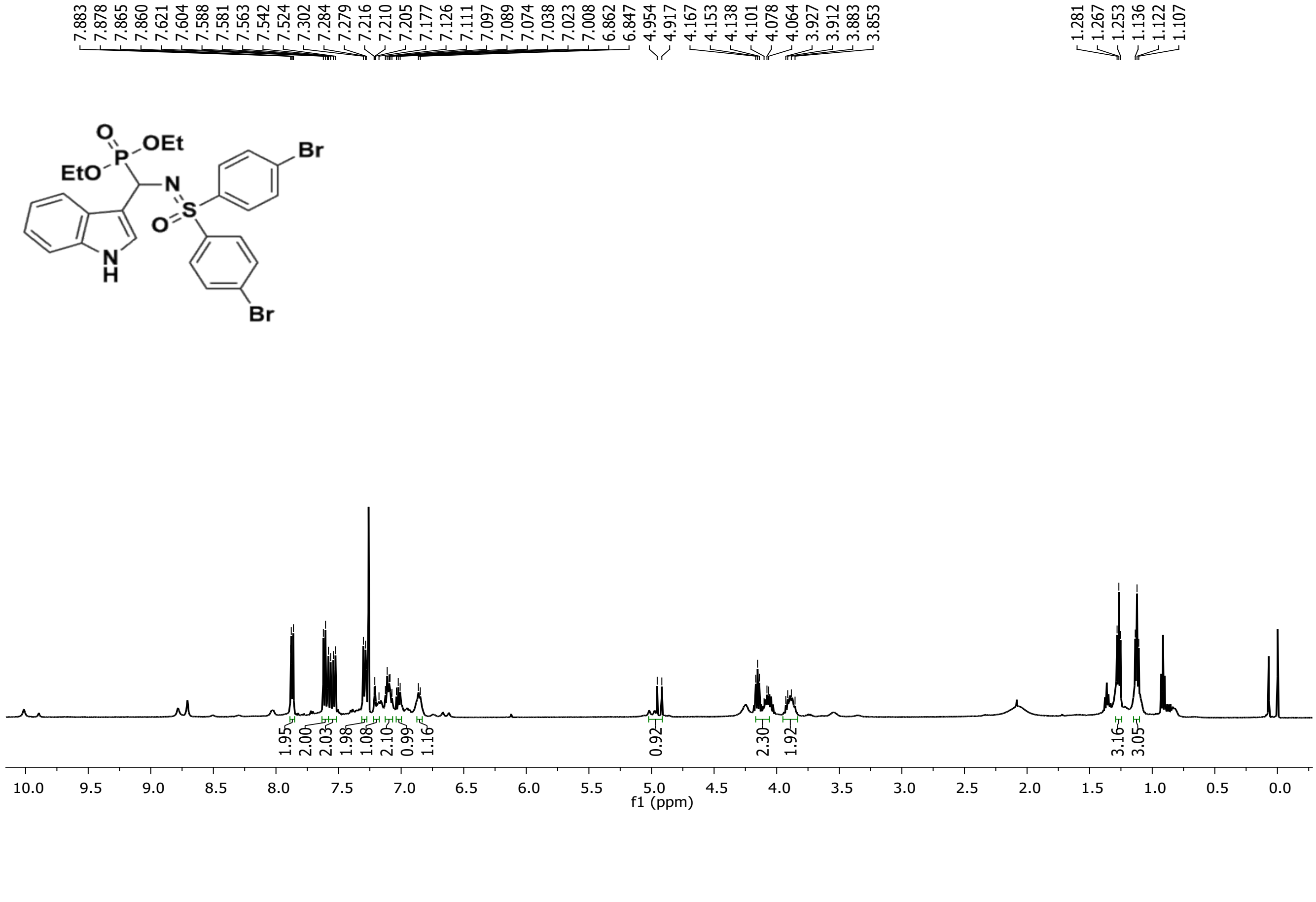

$^{1}H$ NMR of **4fd** (500 MHz, $CDCl_3$)



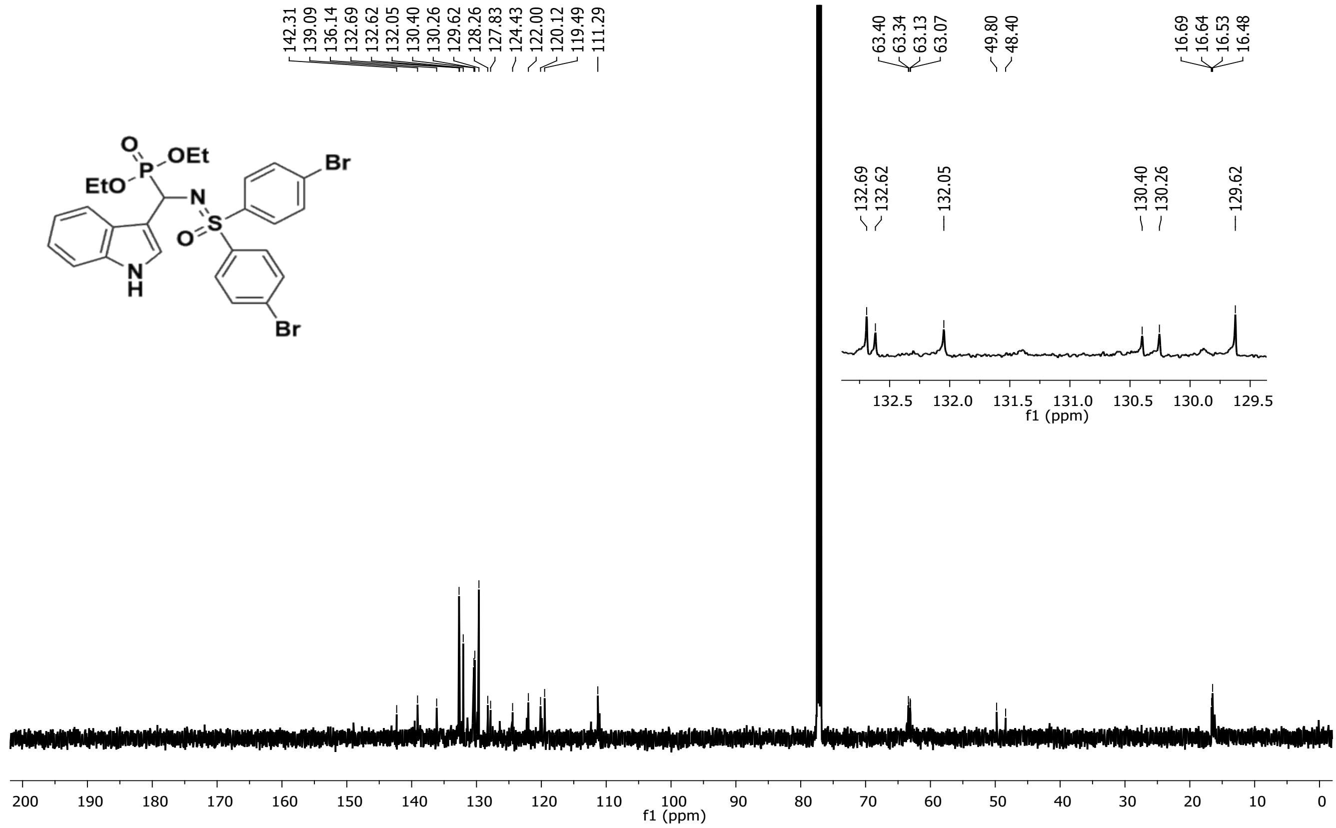

$^{13}C$ {$^{1}H$} NMR of **4fd** (126 MHz, $CDCl_3$)



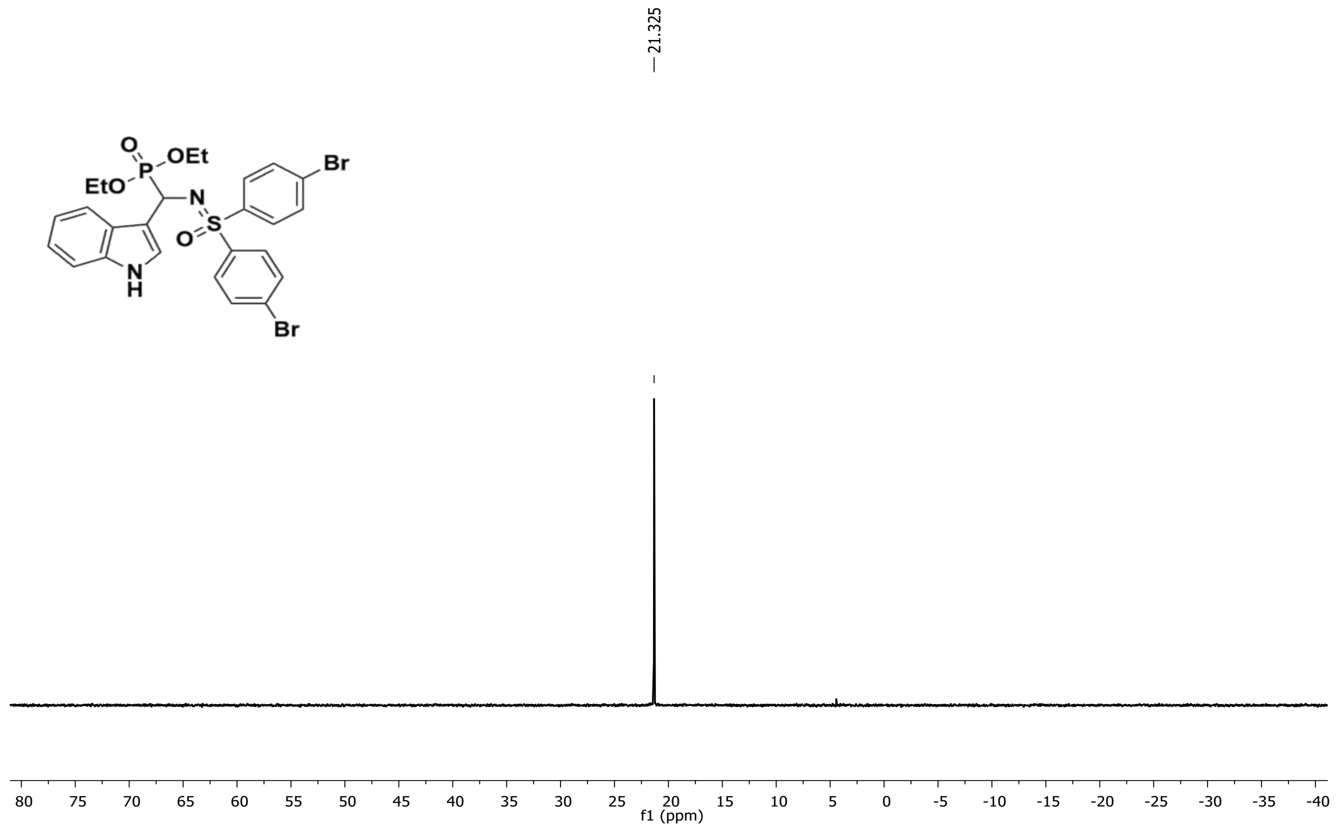

[1]H NMR of **4fe** (Mixture of 2 Diastereomers) (500 MHz, $CDCl_3$)



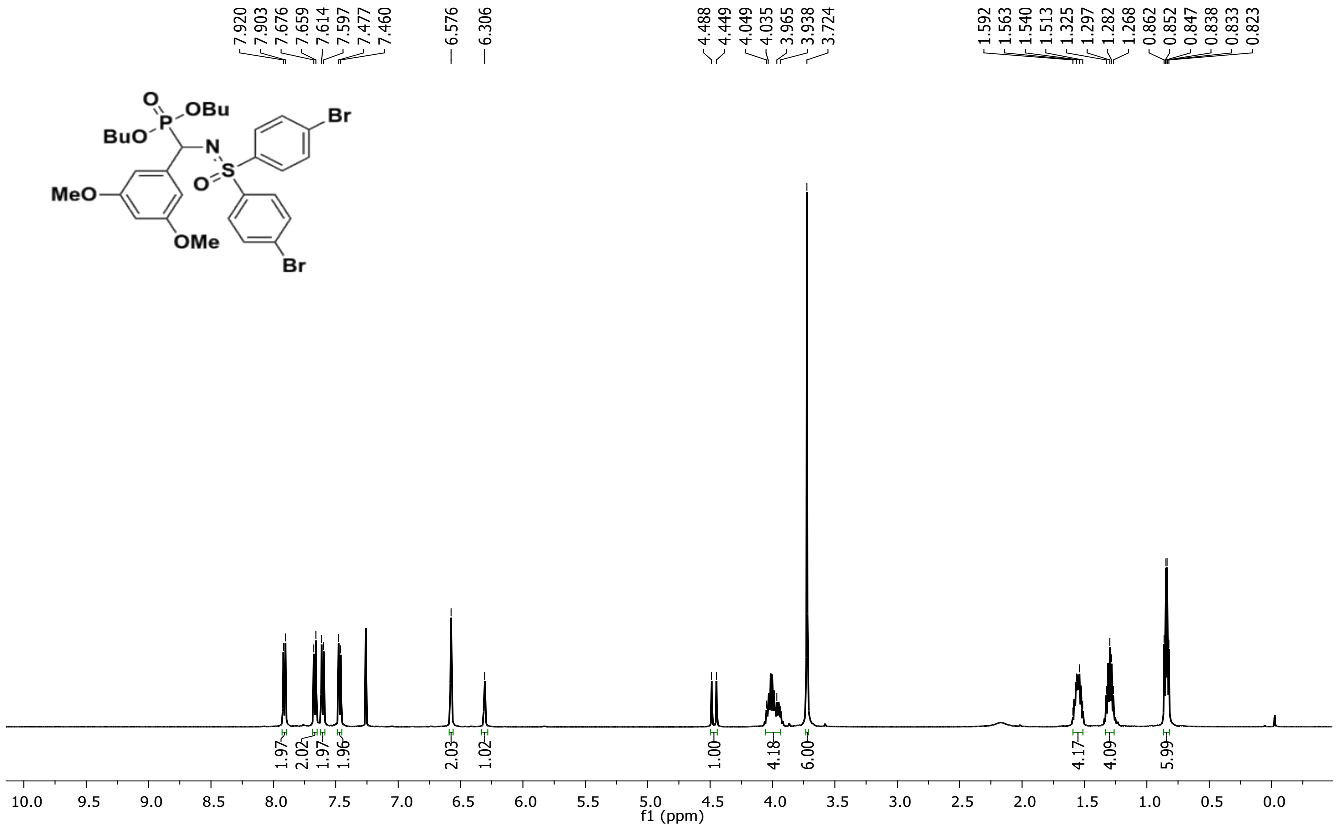
$^{13}C$ {$^{1}H$} NMR of **4fe** (Mixture of 2 Diastereomers) (126 MHz, $CDCl_3$)



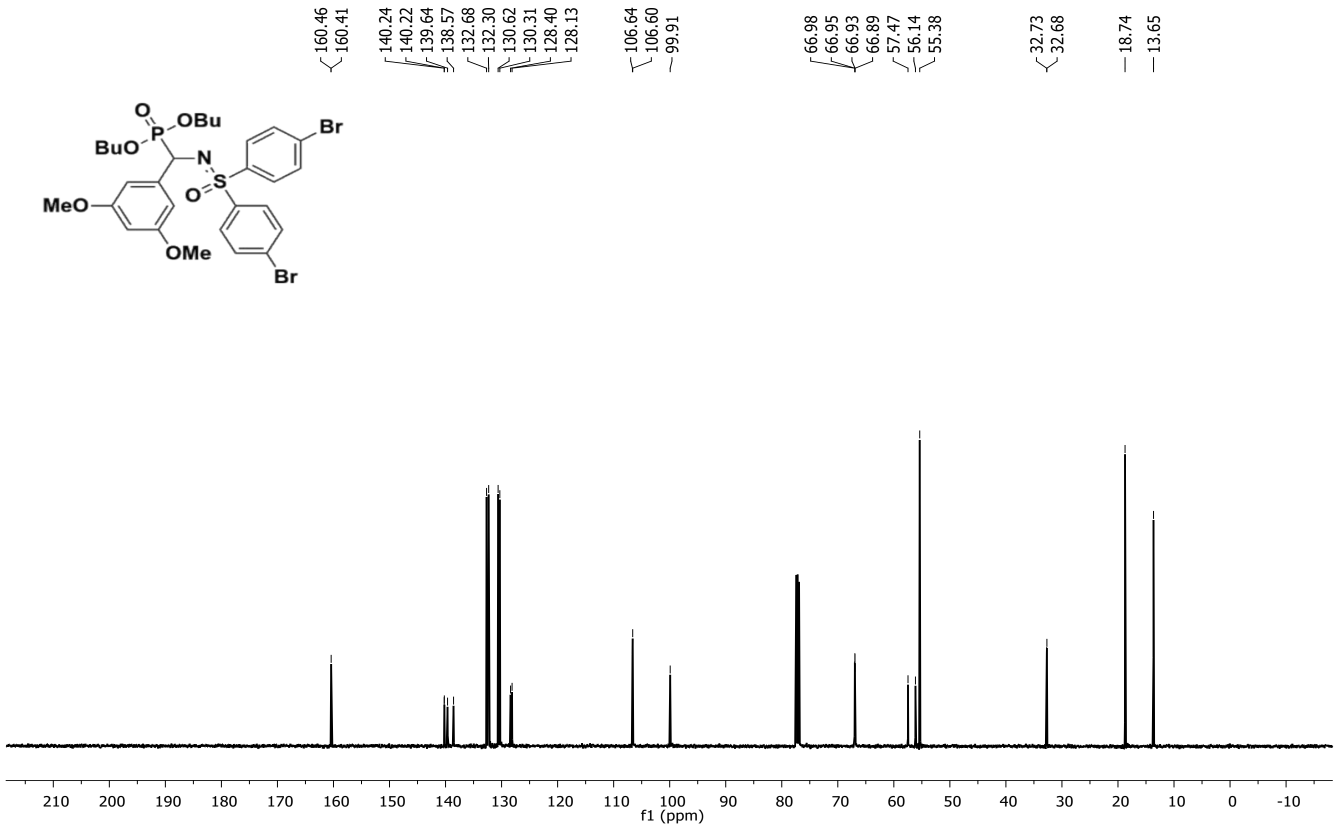

$^{31}P$ NMR of **4fe** ( mixture of two Diastereomers) (202 MHz, $CDCl_3$)



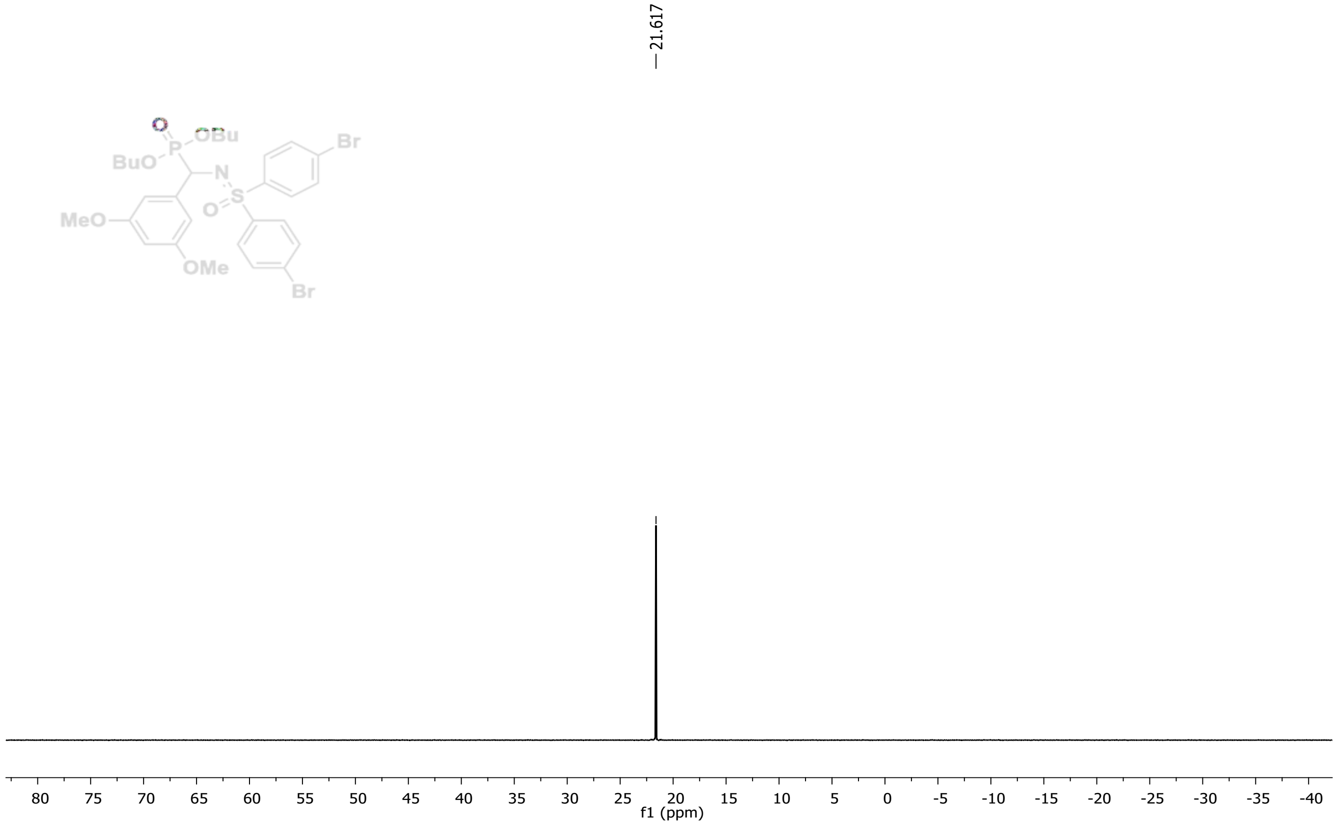
$^{1}H$ NMR of **4ff** (500 MHz, $CDCl_3$)



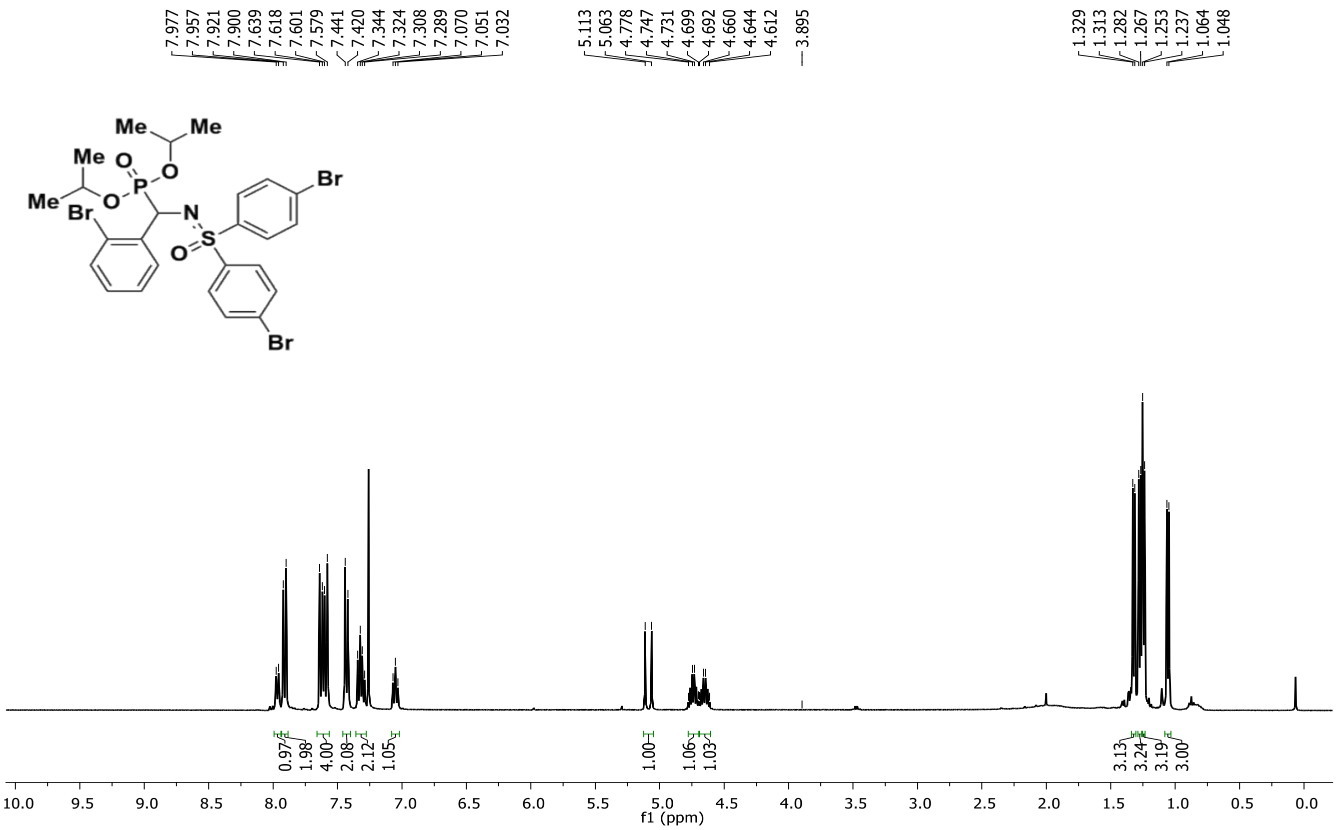

$^{13}C$ {$^{1}H$} NMR of **4ff** (126 MHz, $CDCl_3$)



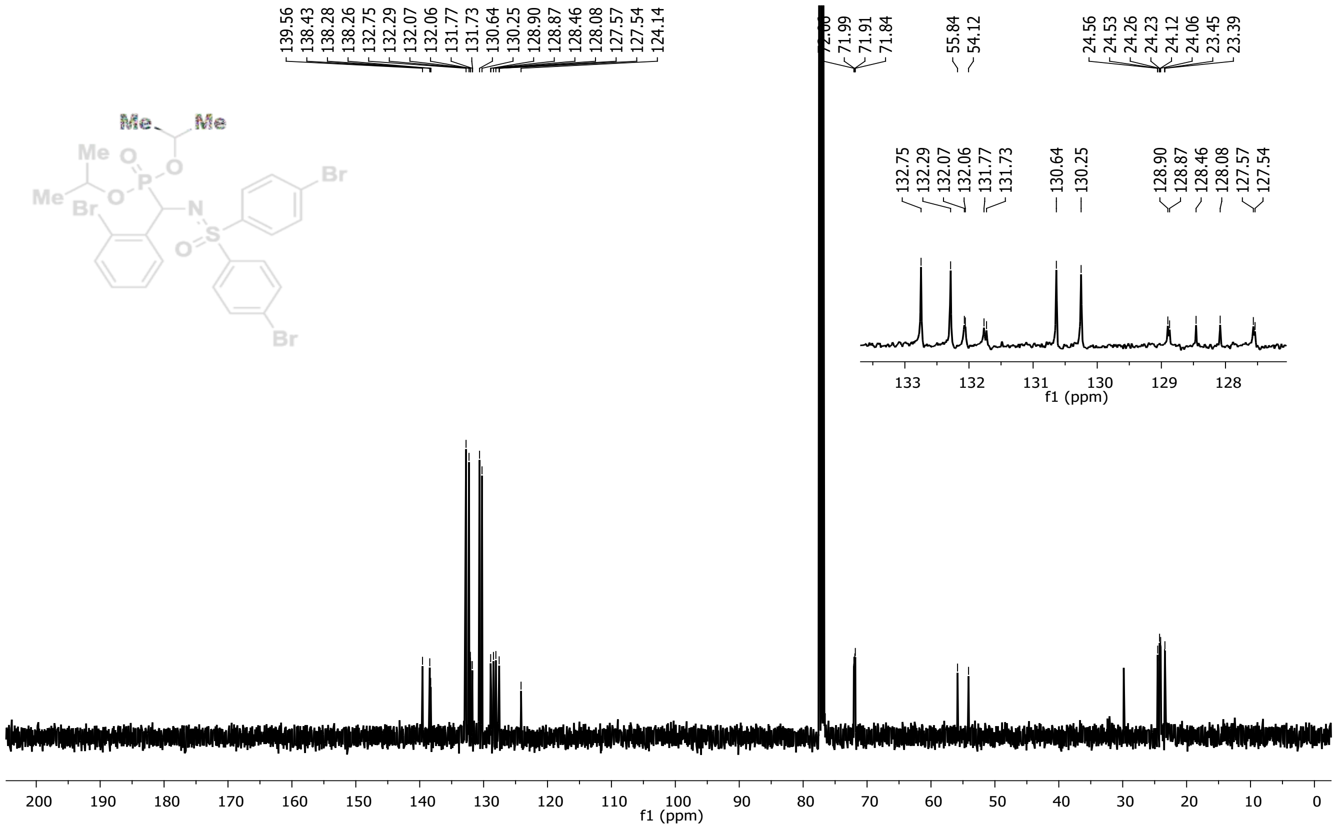
$^{31}$P NMR of **4ff** (202 MHz, $CDCl_3$)



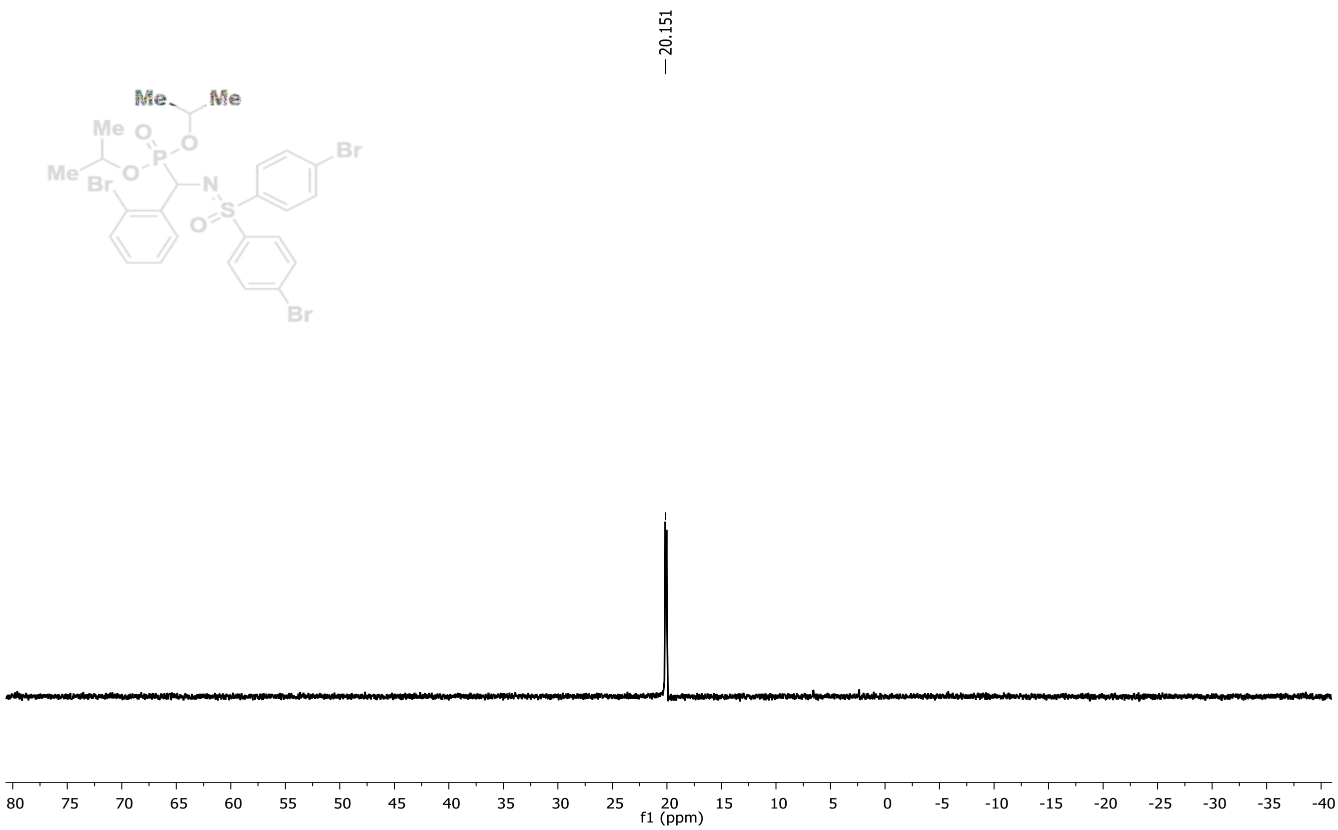

$^{1}$H NMR of **4fg** (400 MHz, $CDCl_3$)



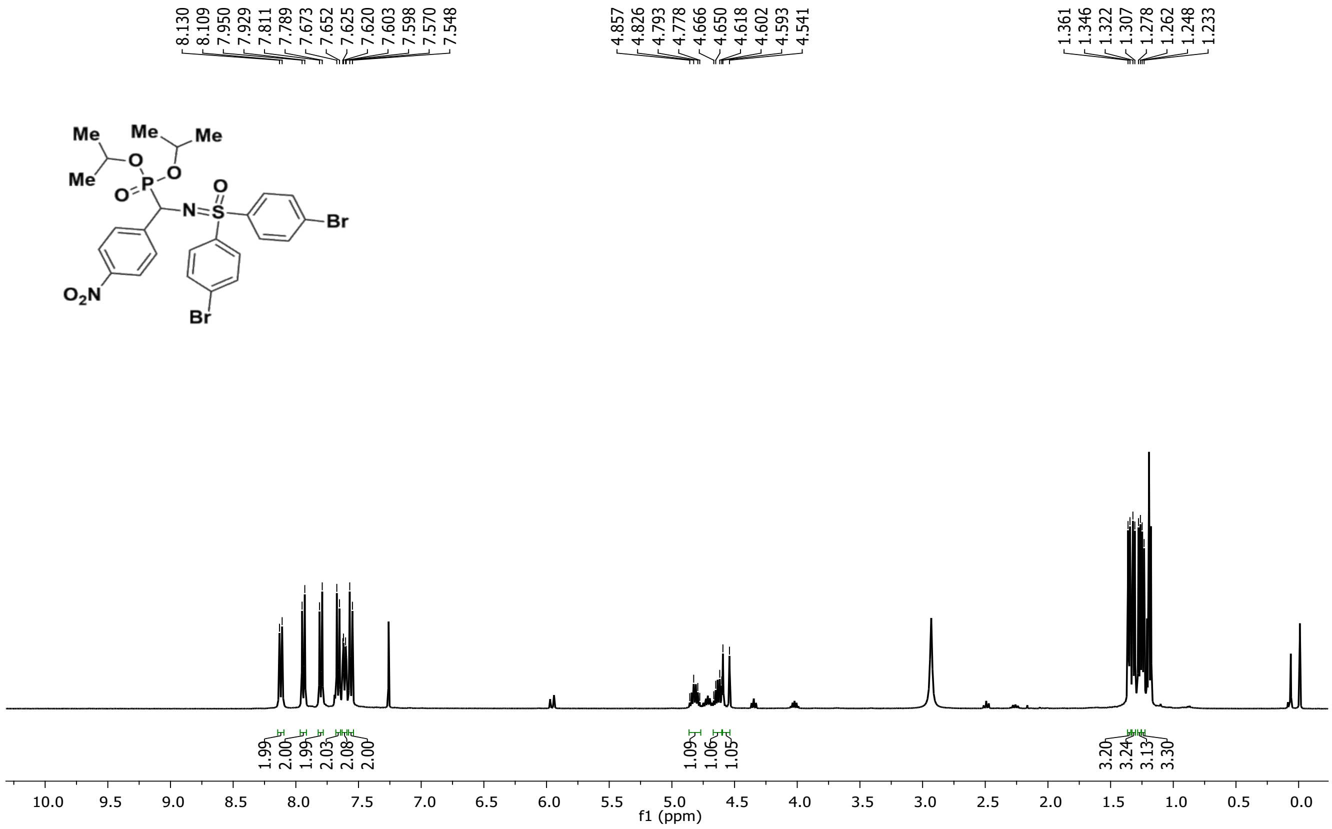
$^{13}C$ {$^{1}H$} NMR of **4fg** (101 MHz, $CDCl_3$)



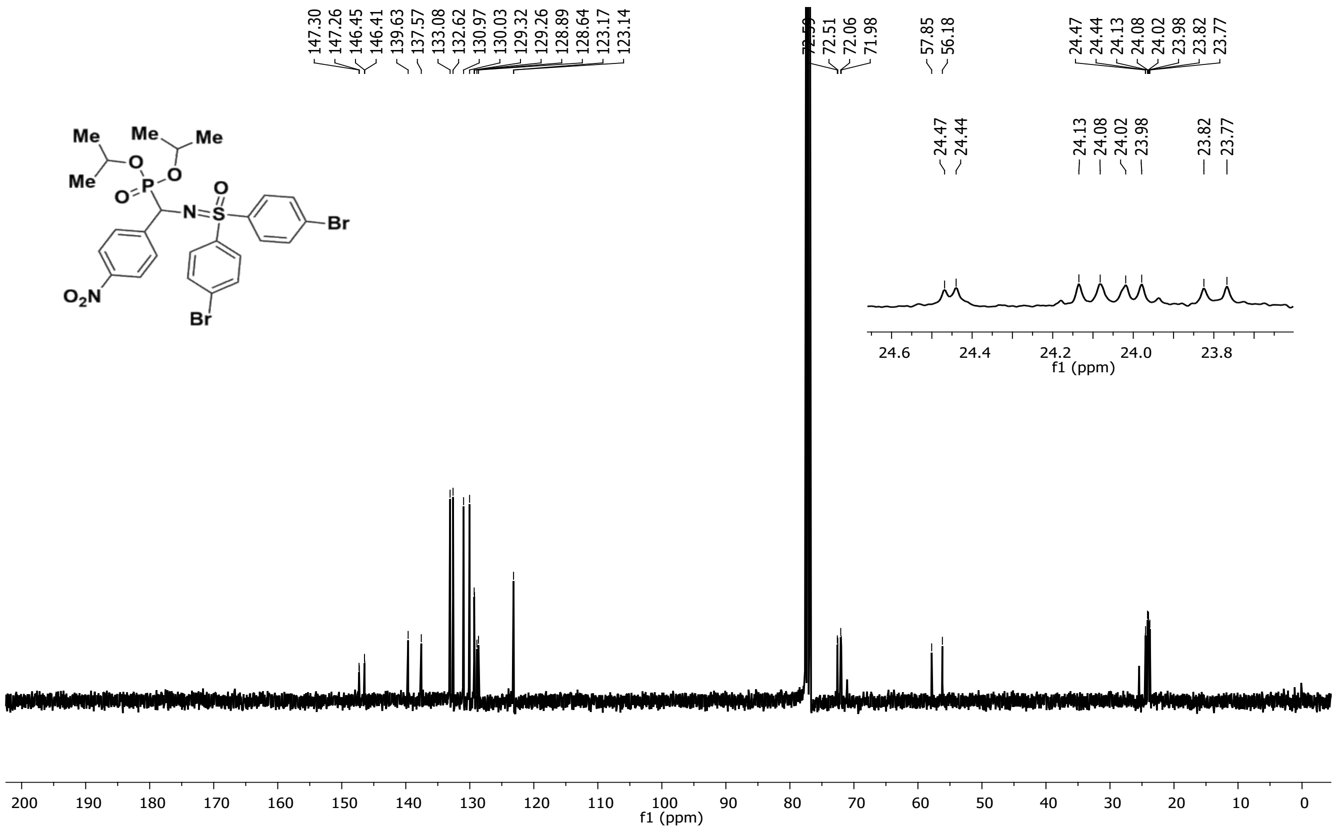
$^{31}P$ NMR of **4fg** (162 MHz, $CDCl_3$)



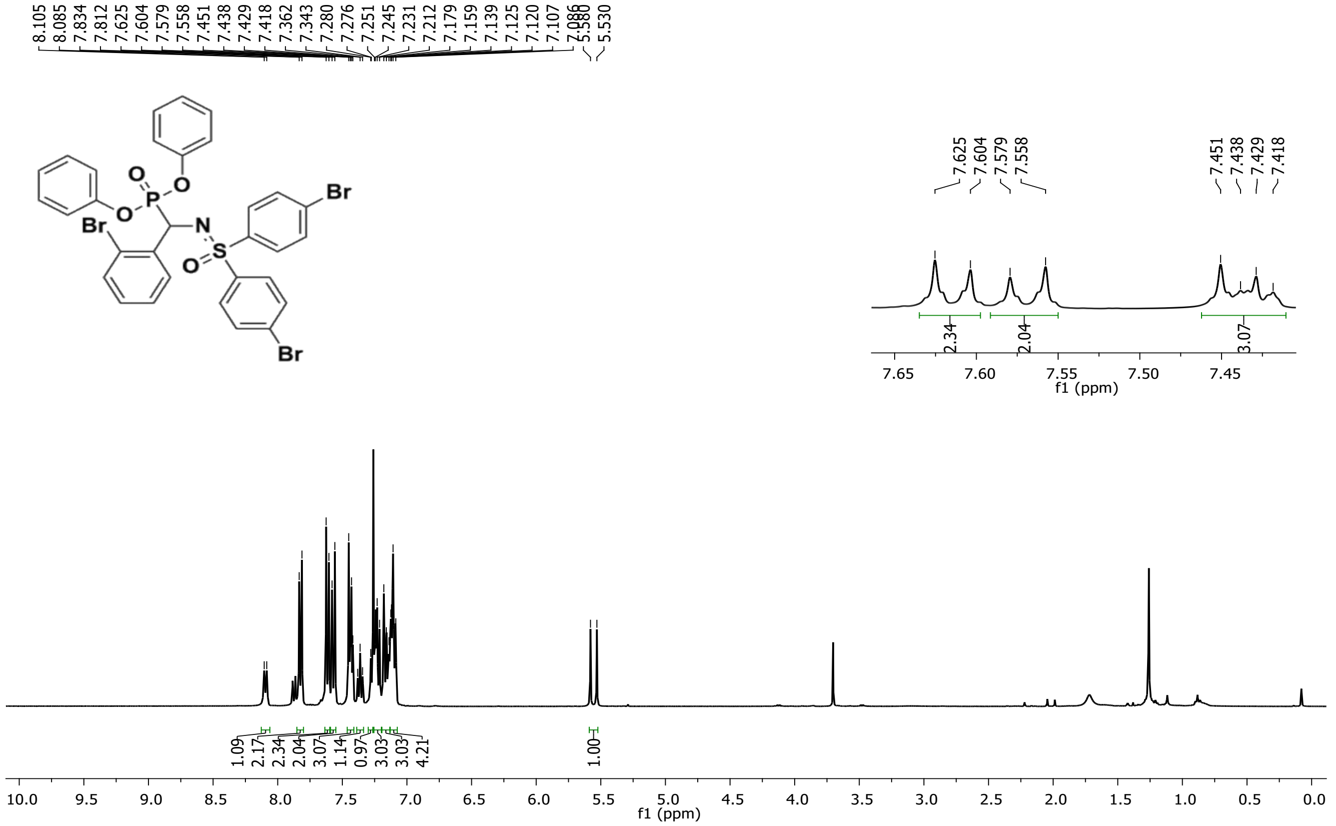
$^{1}H$ NMR of **4fh** (400 MHz, $CDCl_3$)



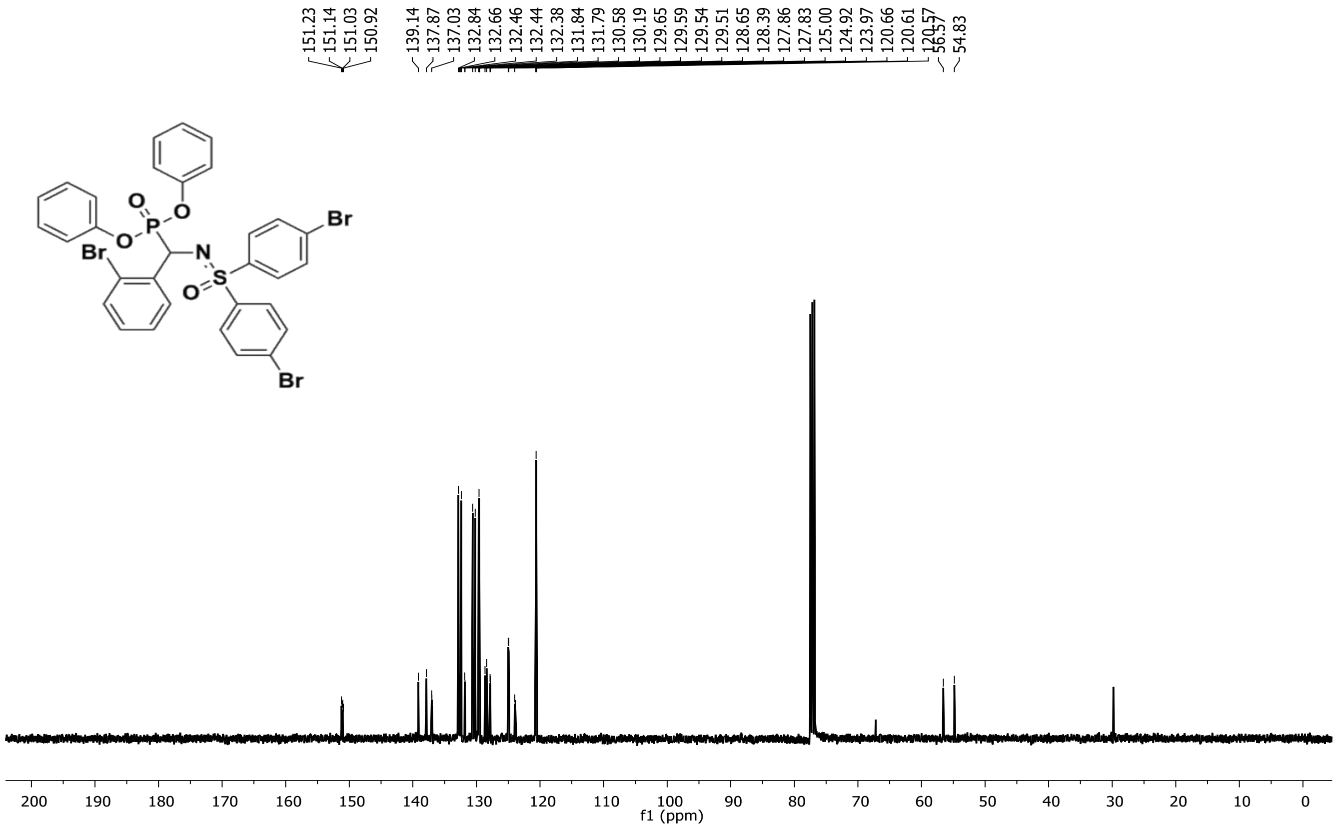
$^{13}C$ {$^{1}H$} NMR of **4fh** (101 MHz, $CDCl_3$)



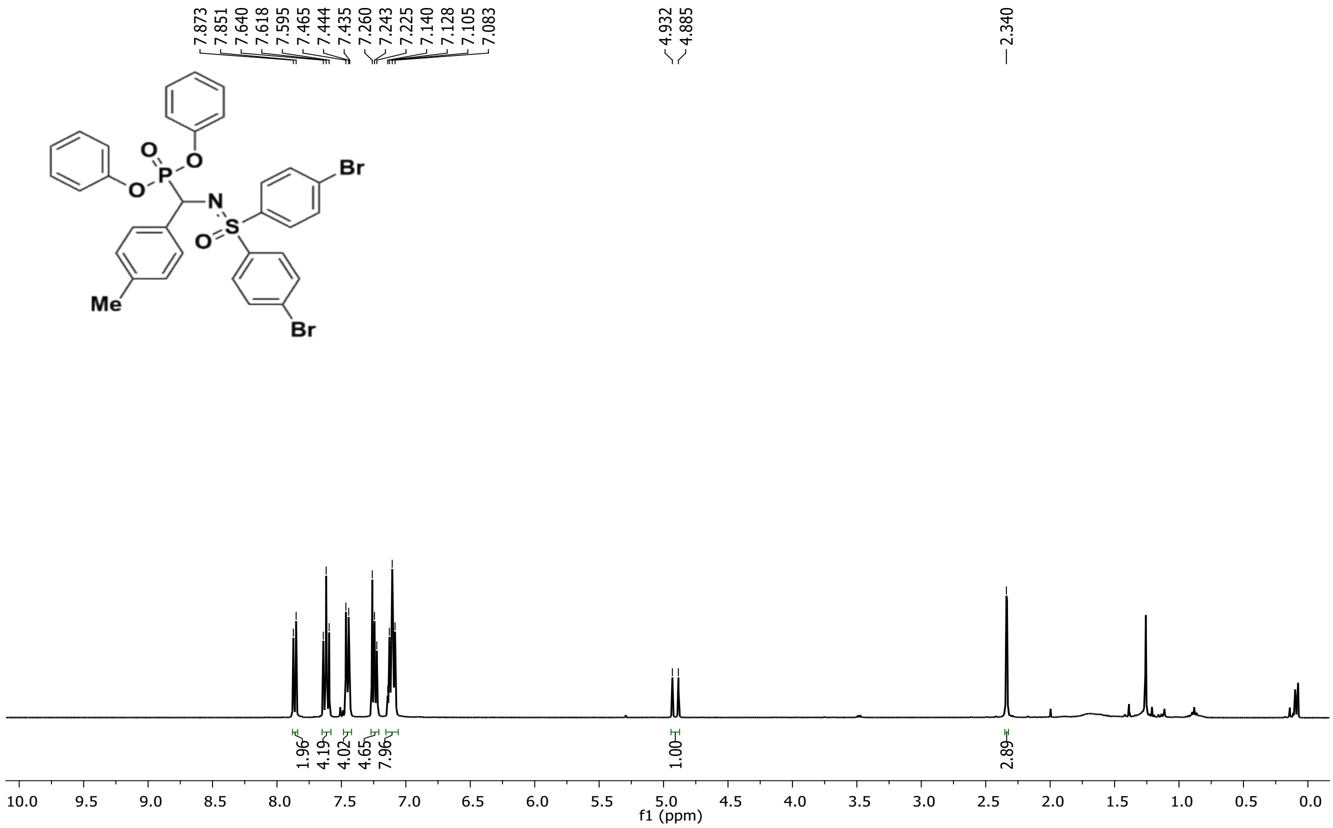
[1]H NMR of **4fi** (400 MHz, $CDCl_3$)



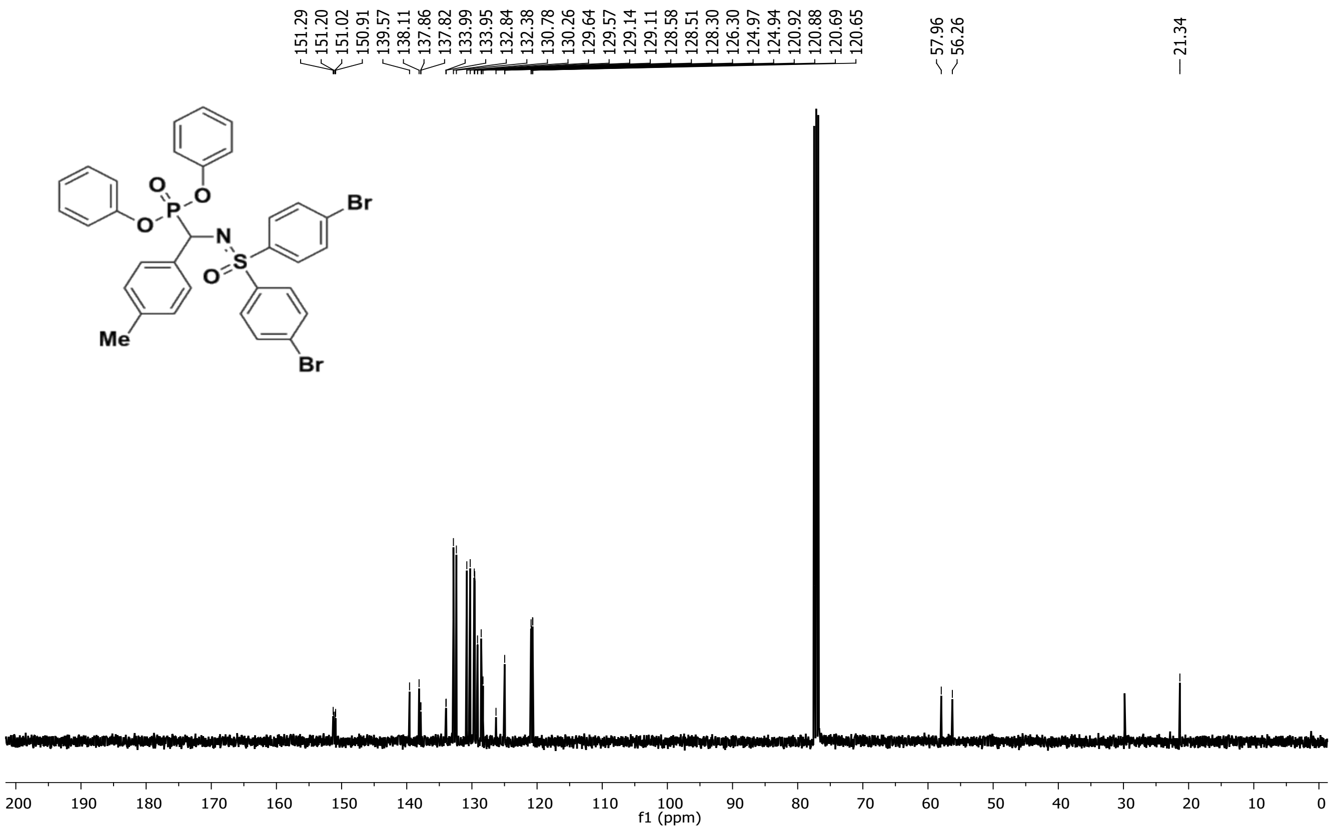

[13]C {[1]H} NMR of **4fi** (101 MHz, $CDCl_3$)



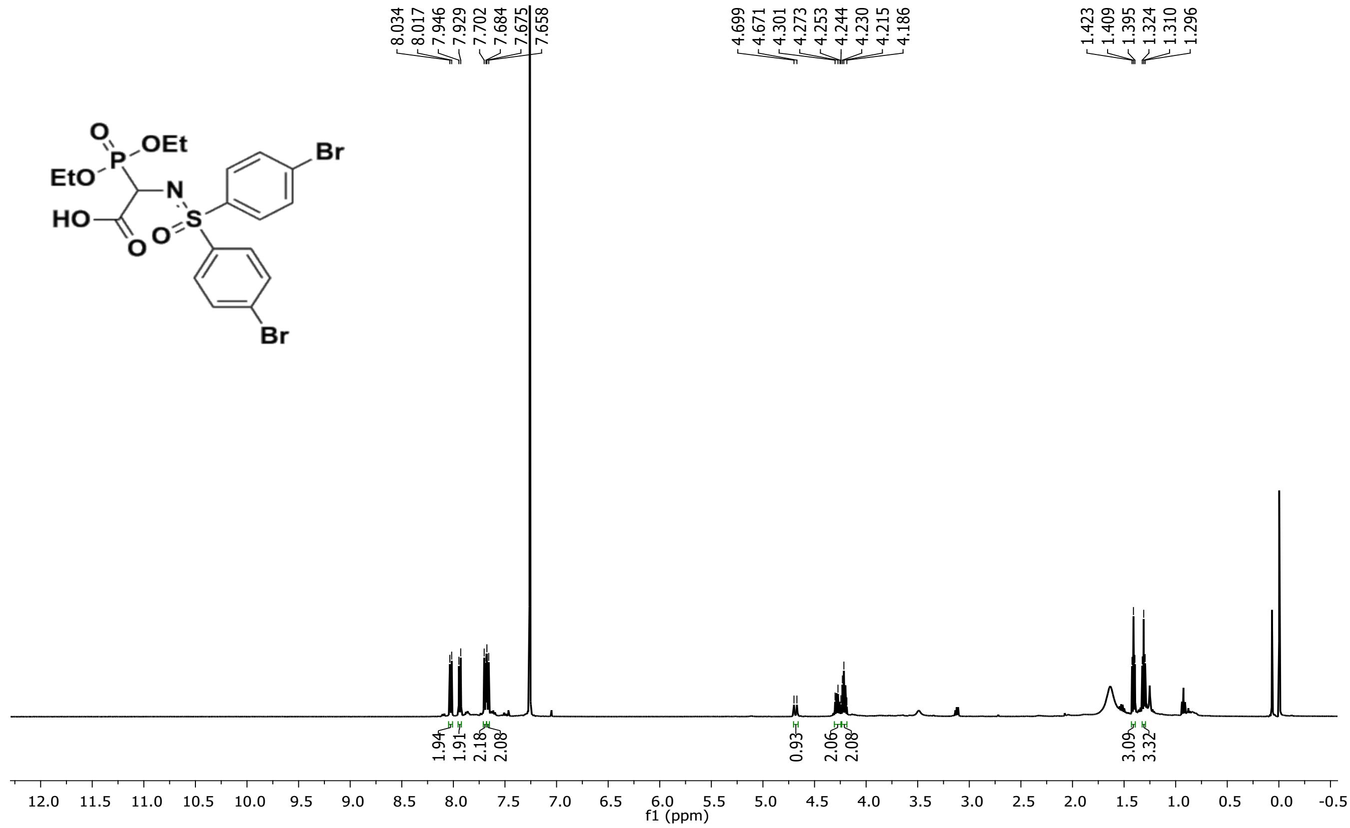
$^{1}H$ NMR of **4fj** (400 MHz, $CDCl_3$)



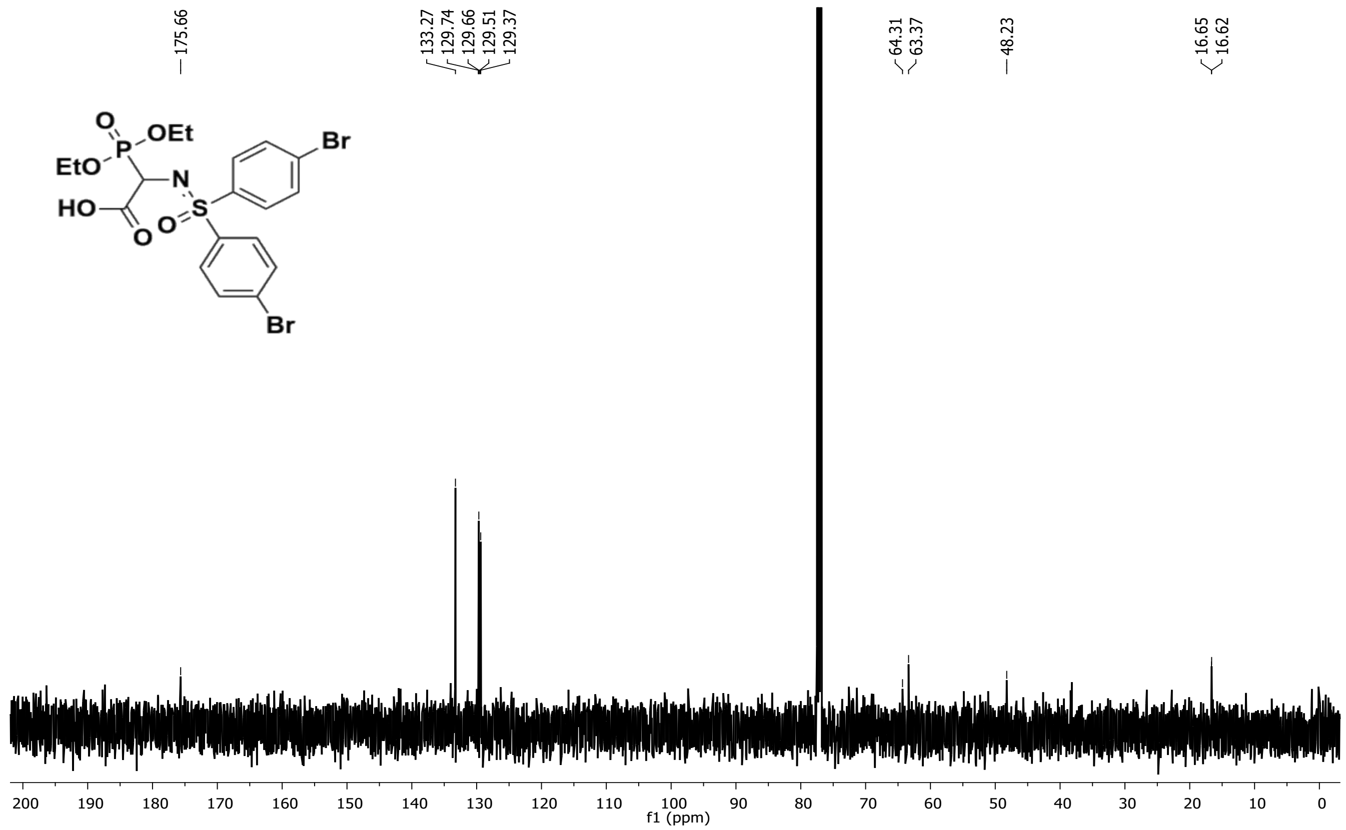

$^{13}C$ {$^{1}H$} NMR of **4fj** (101 MHz, $CDCl_3$)



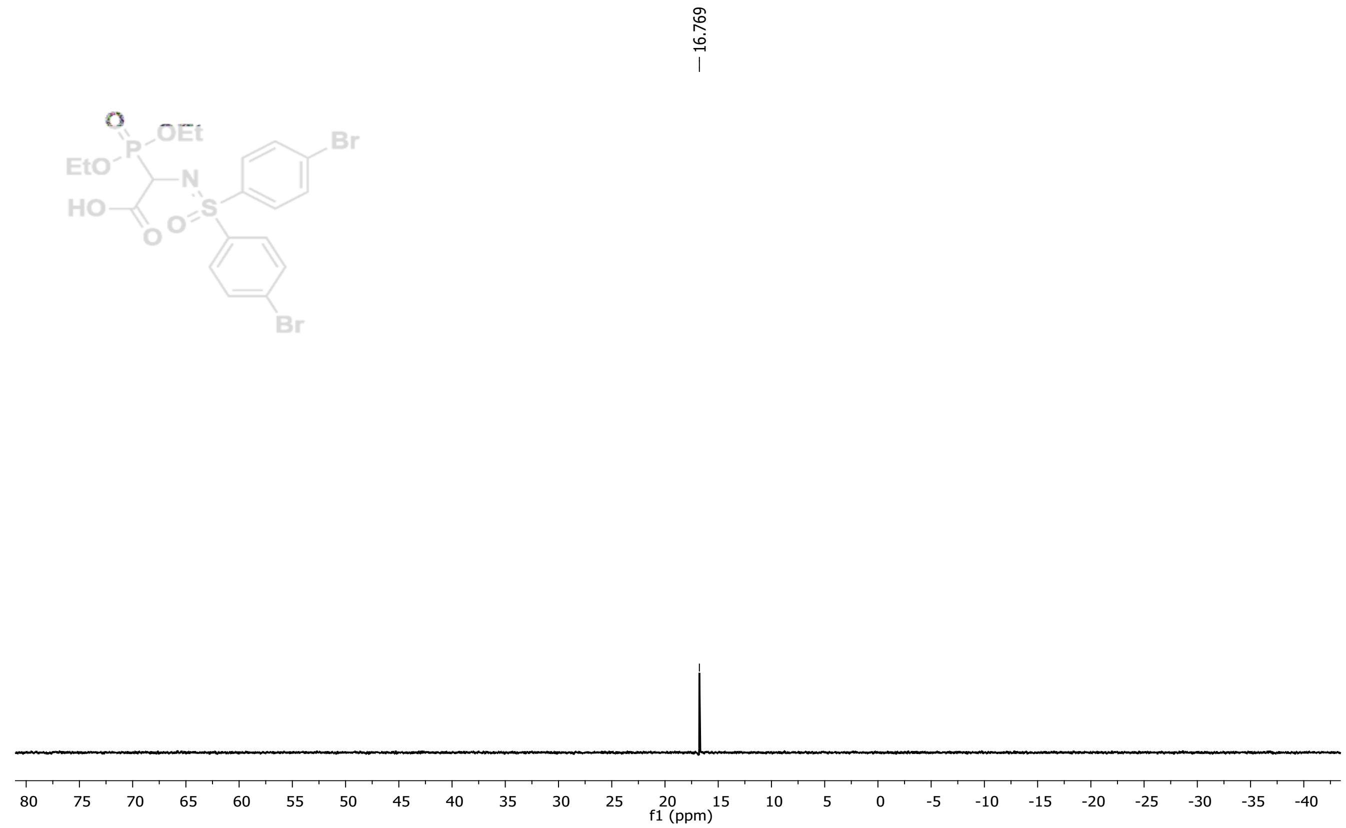
$^{1}$H NMR of **4fk** (500 MHz, $CDCl_3$)



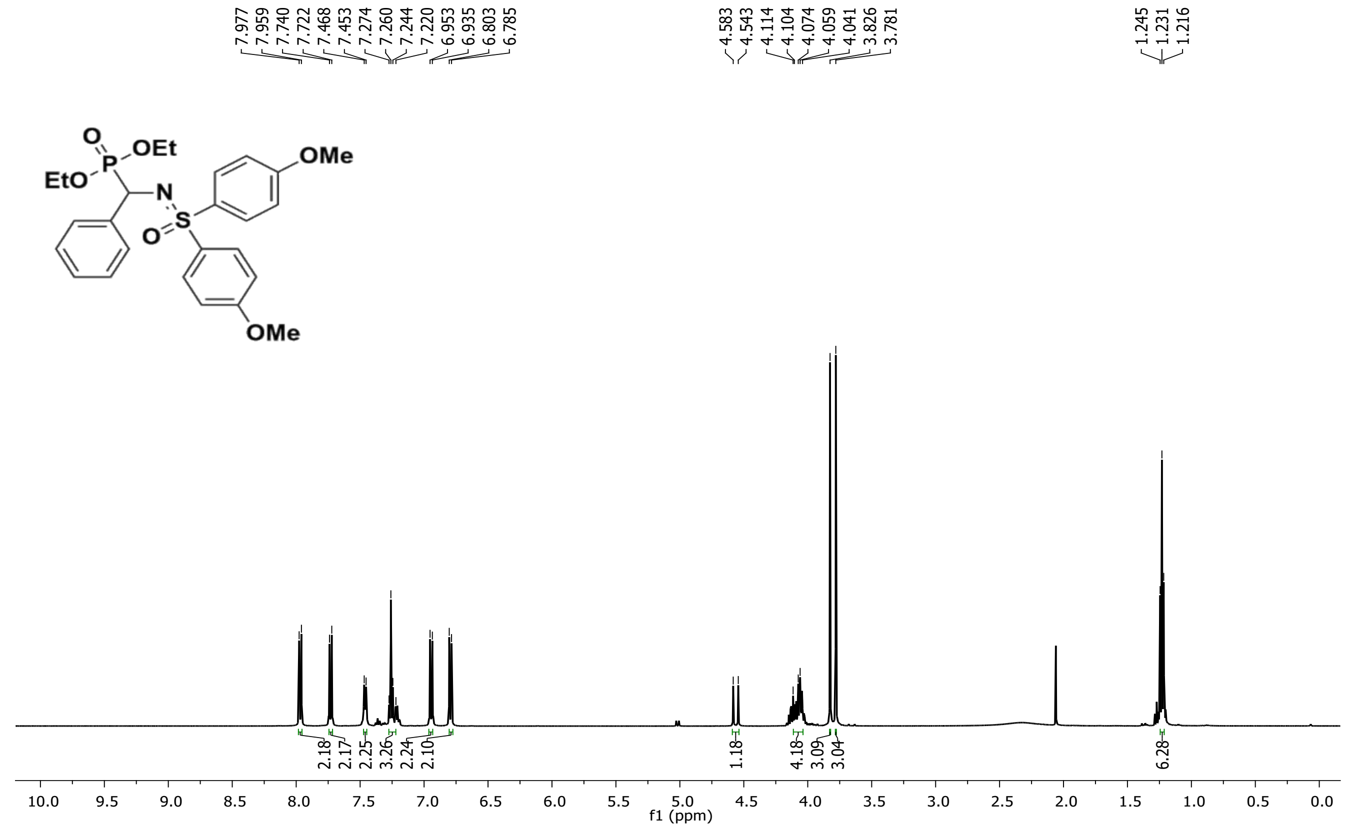

$^{13}$C {$^{1}$H} NMR of **4fk** (126 MHz, $CDCl_3$)



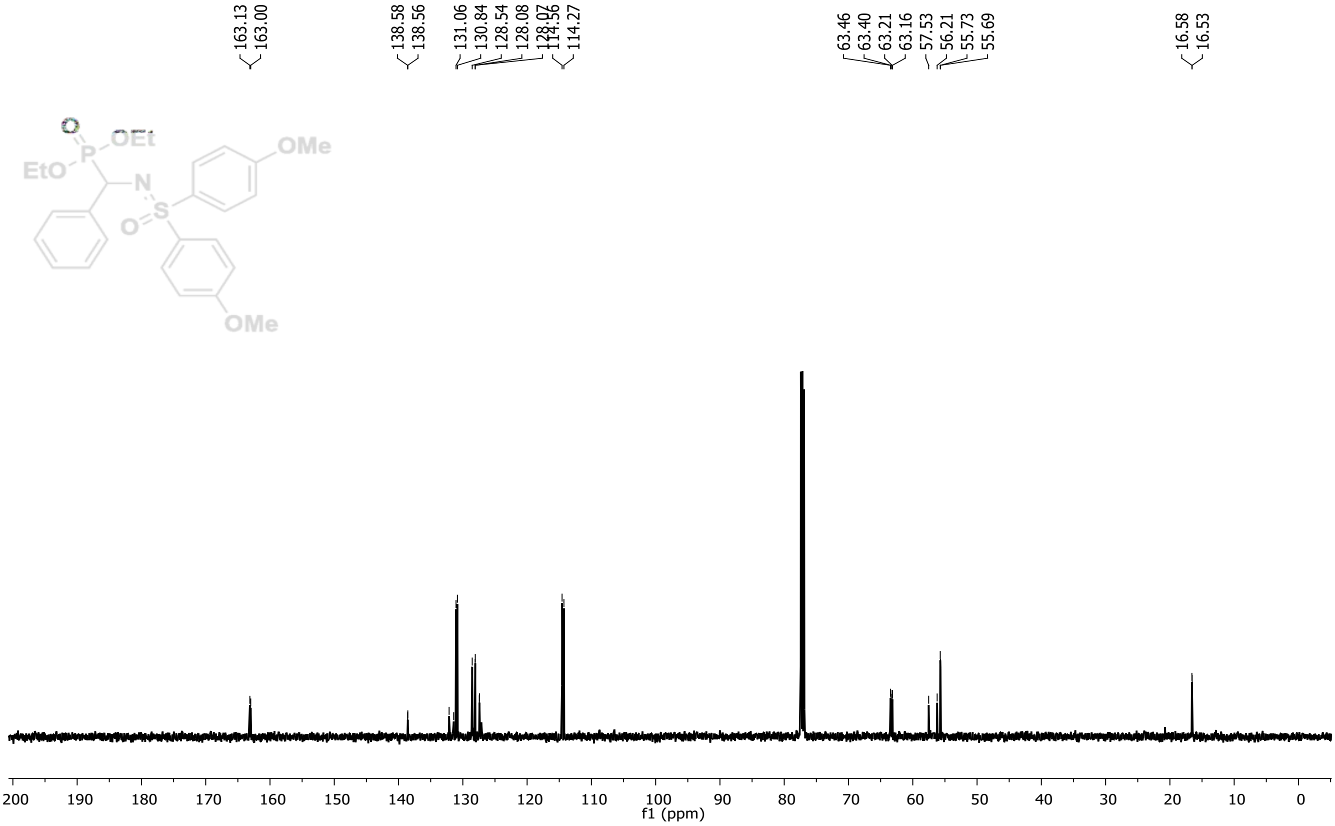
$^{31}$P NMR of **4fk** (202 MHz, $CDCl_3$)



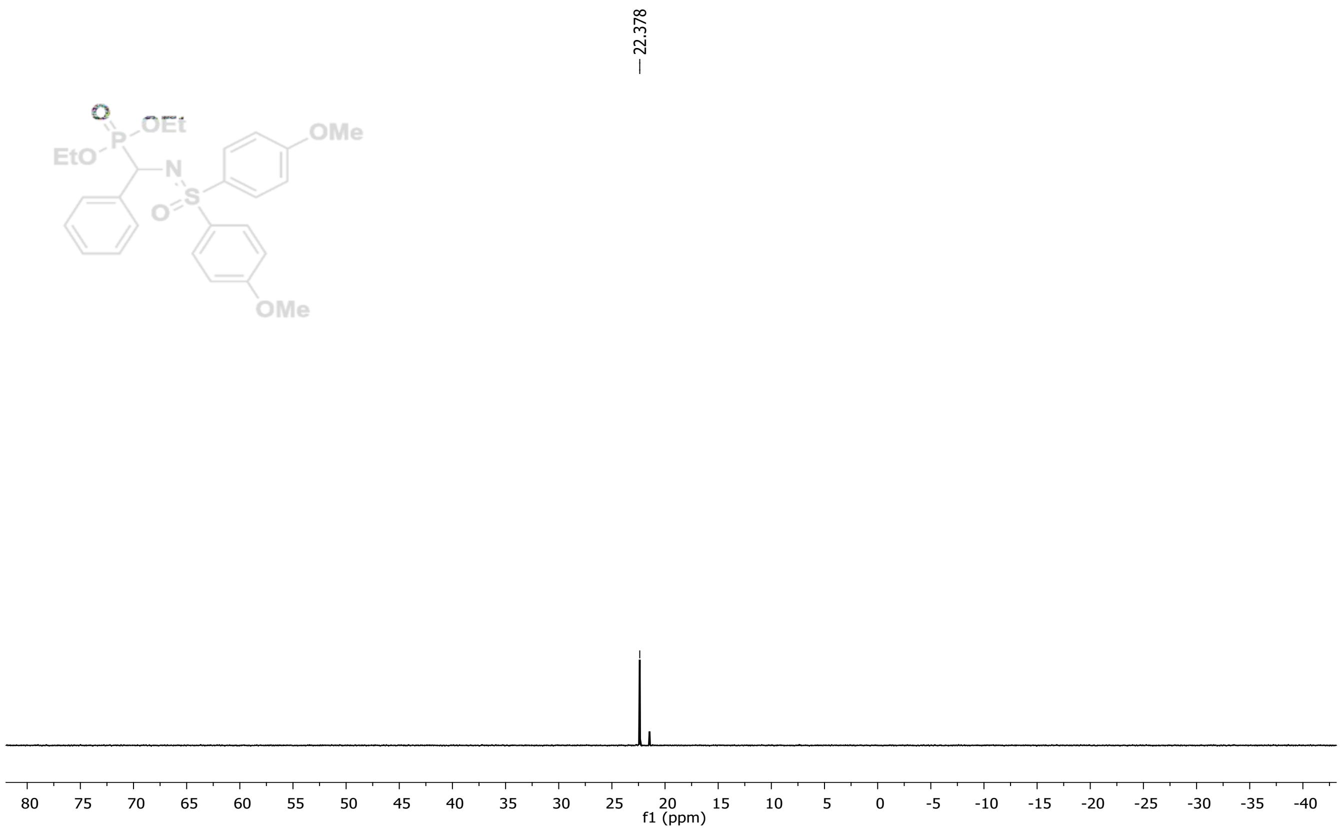

$^{1}$H NMR of **4ga** (500 MHz, $CDCl_3$)



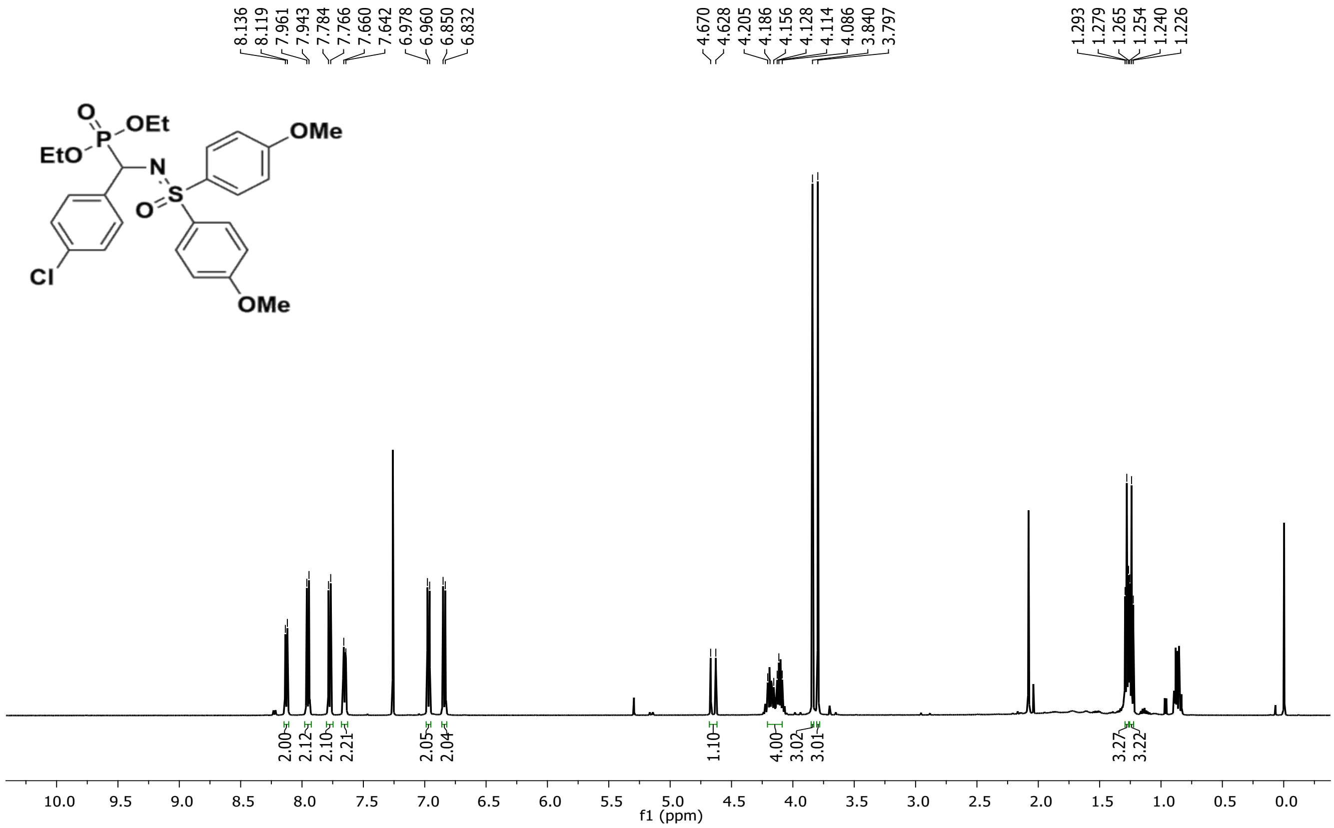
$^{13}C$ {$^{1}H$} NMR of **4ga** (126 MHz, $CDCl_3$)



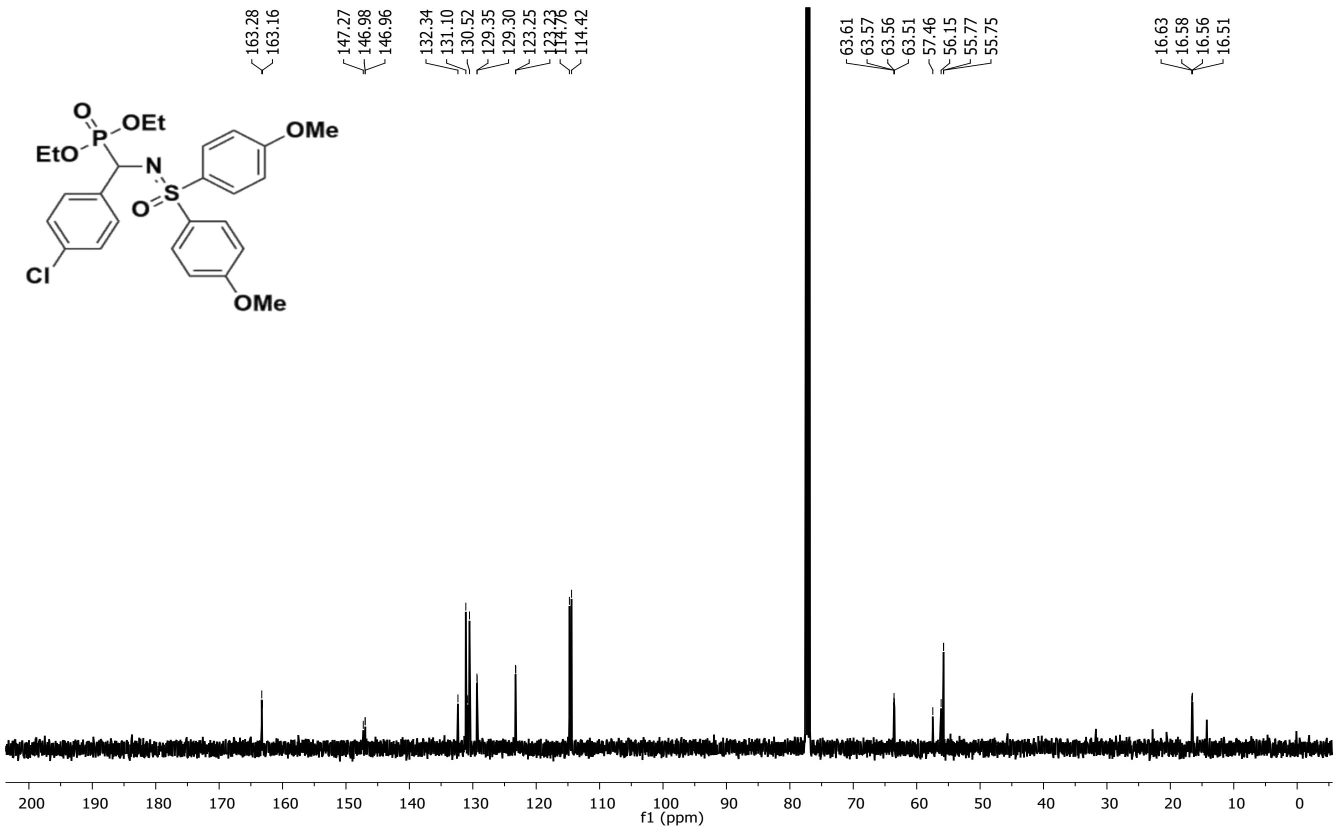

$^{31}P$ NMR of **4ga** (202 MHz, $CDCl_3$)



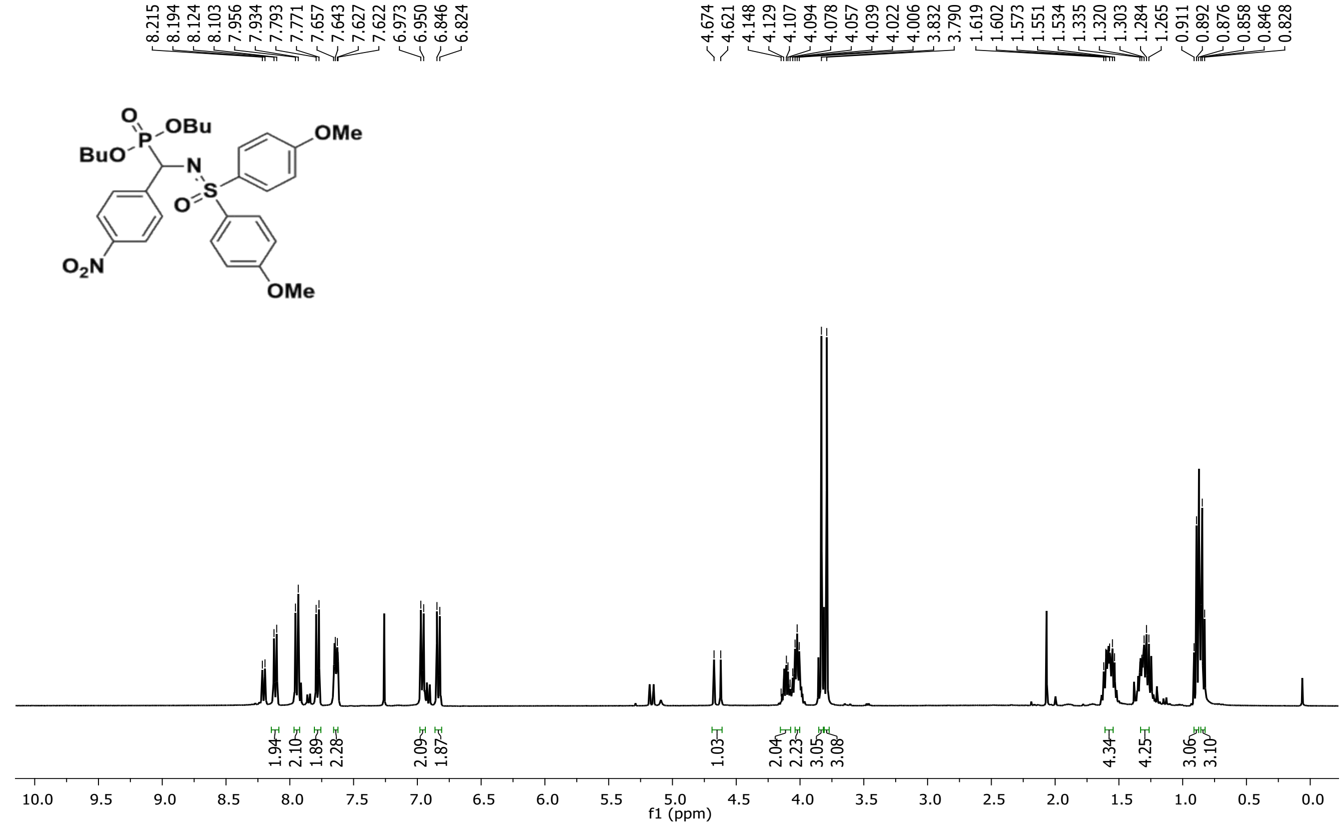
$^{1}H$ NMR of **4gb** (500 MHz, $CDCl_3$)



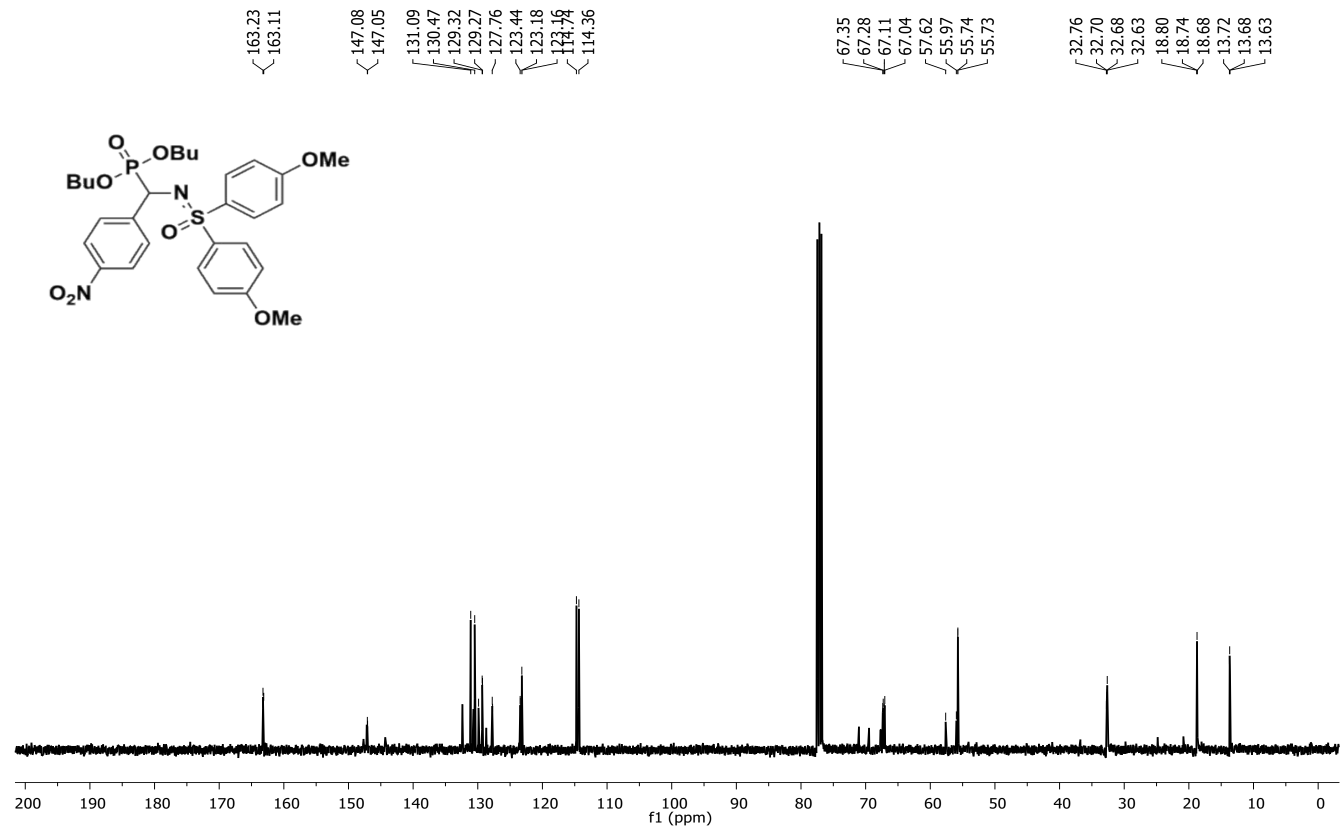
$^{13}C$ {$^{1}H$} NMR of **4gb** (126 MHz, $CDCl_3$)



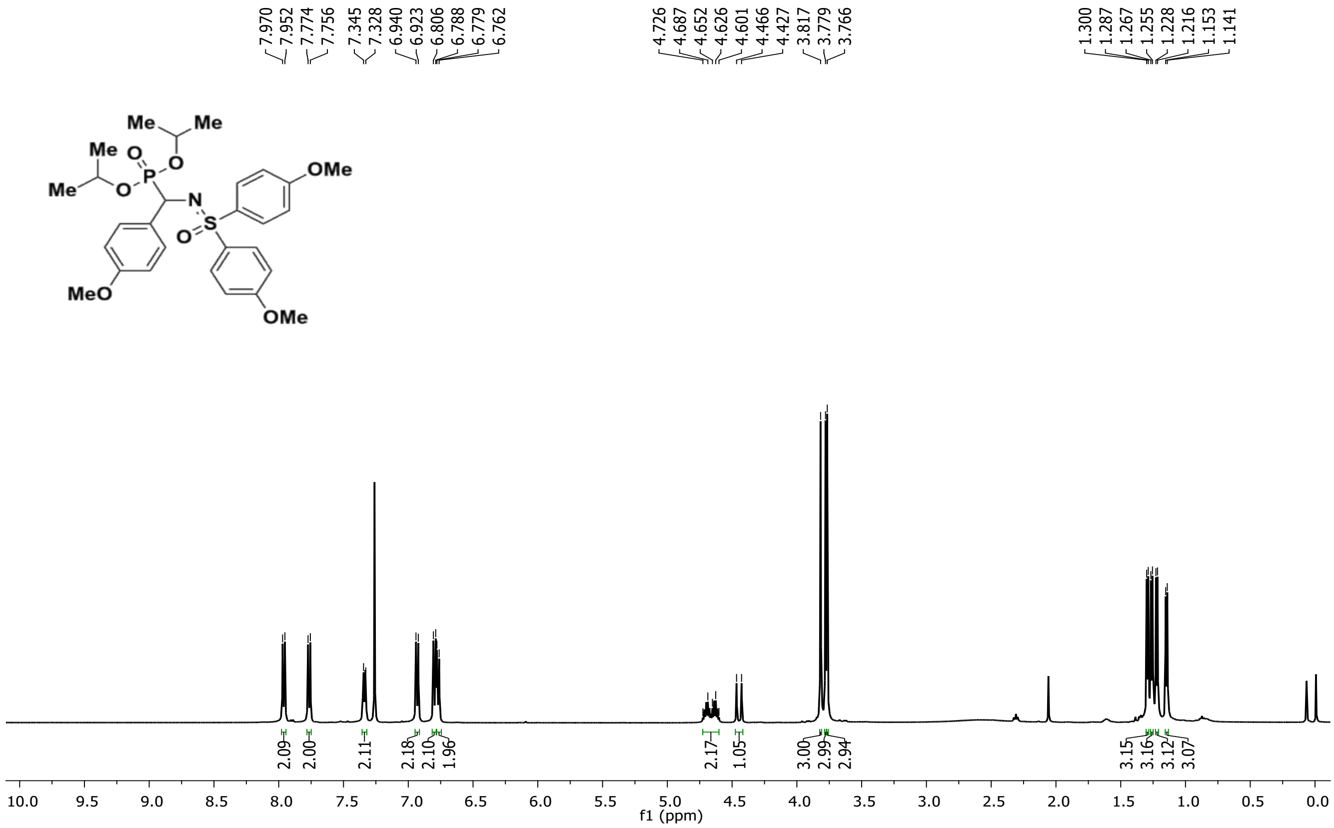
$^{1}H$ NMR of **4gc** (400 MHz, $CDCl_3$)



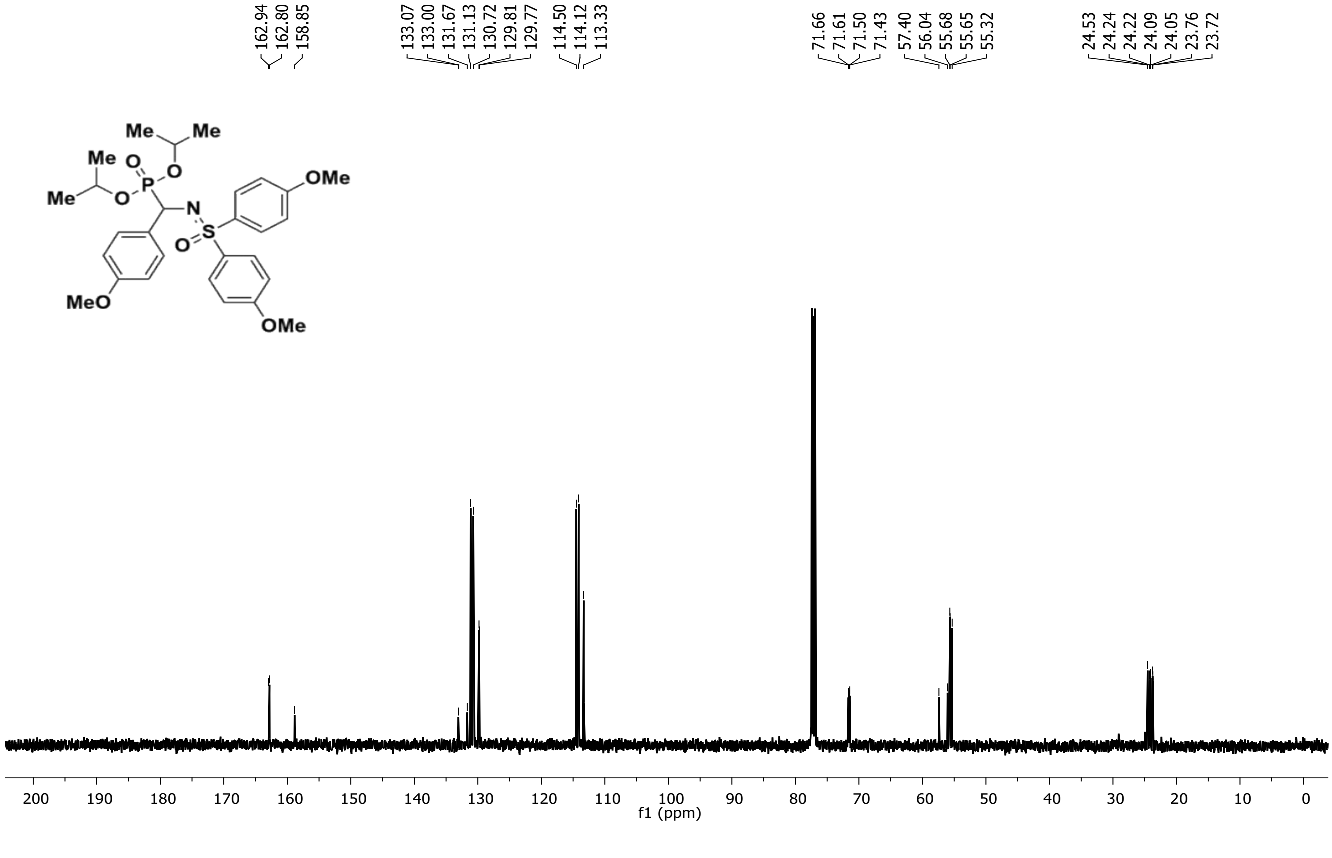

$^{13}C$ {$^{1}H$} NMR of **4gc** (101 MHz, $CDCl_3$)



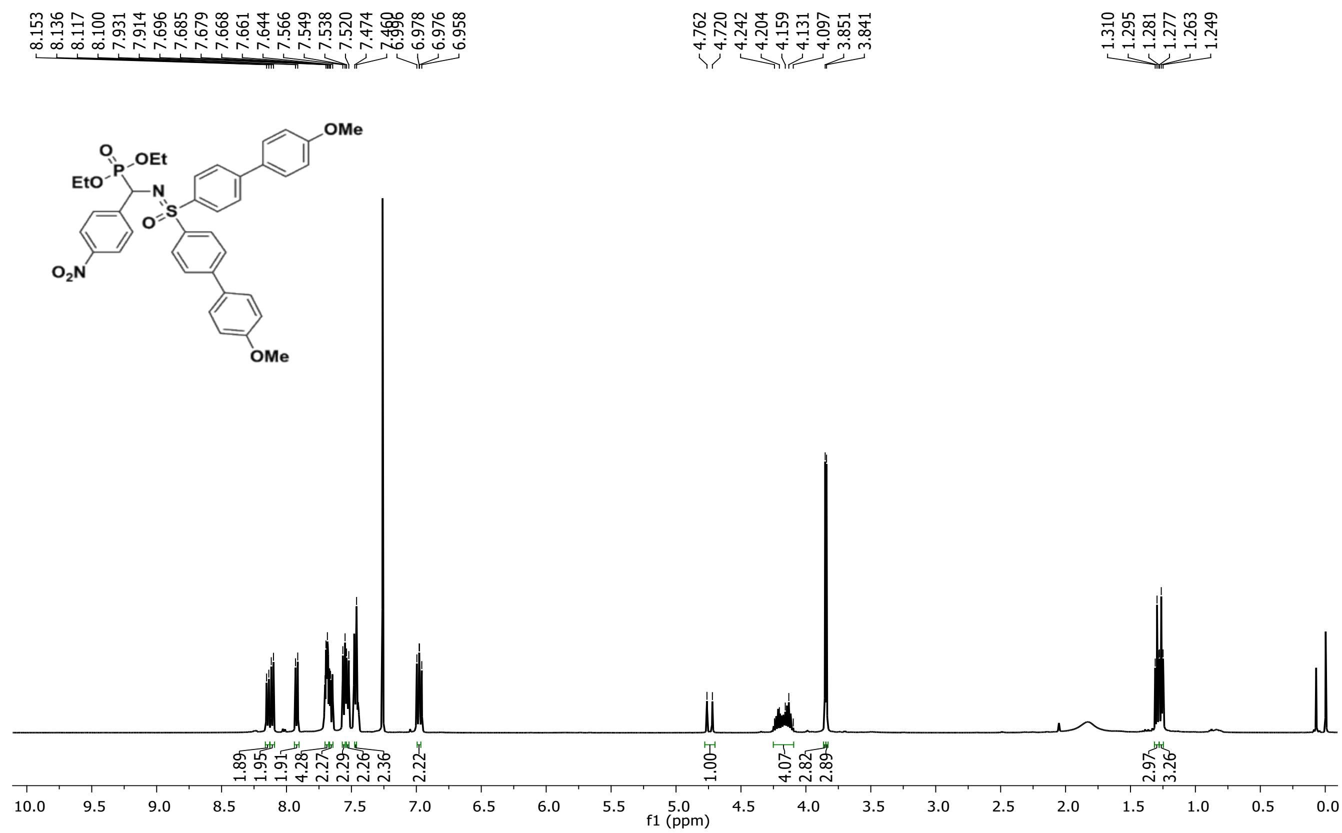
$^{1}H$ NMR of **4gd** (500 MHz, $CDCl_3$)



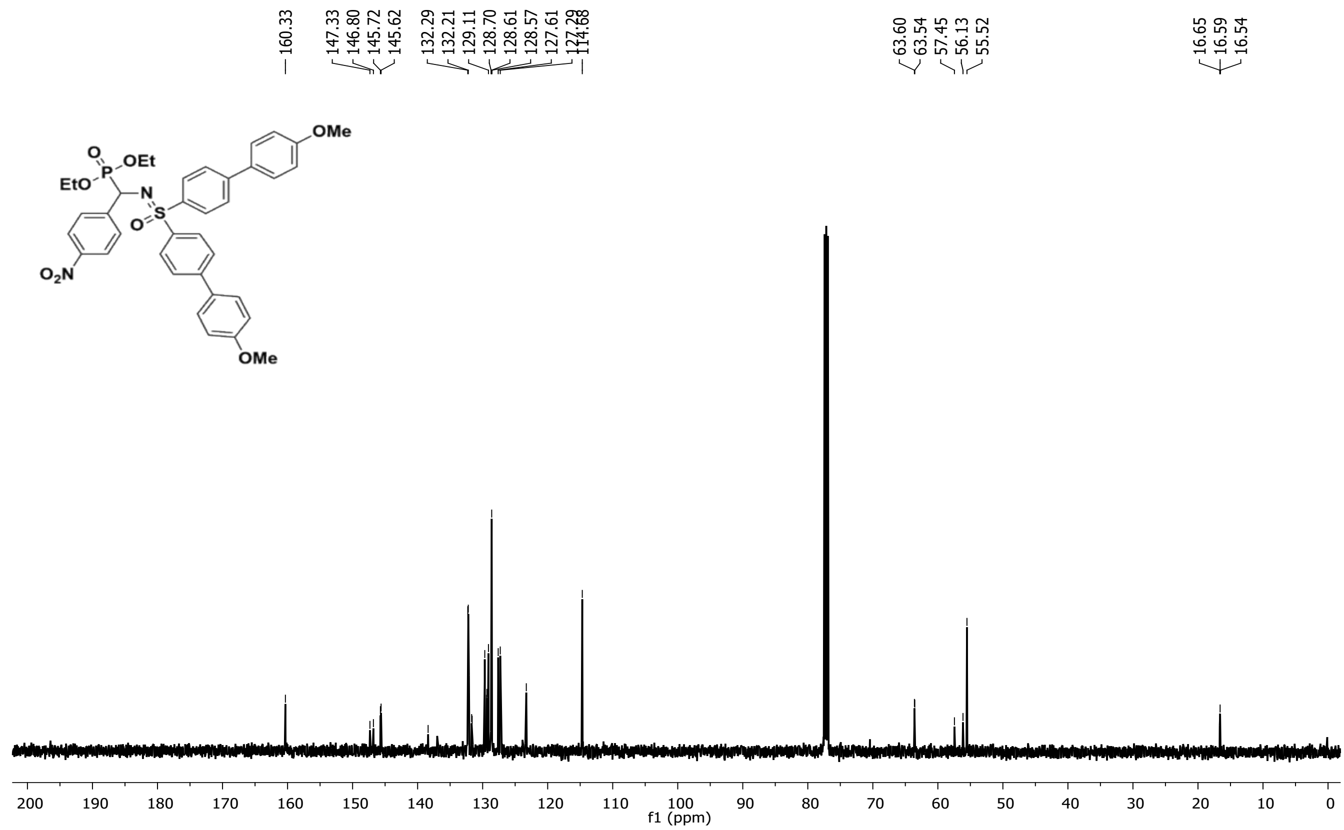
$^{13}C$ {$^{1}H$} NMR of **4gd** (126 MHz, $CDCl_3$)



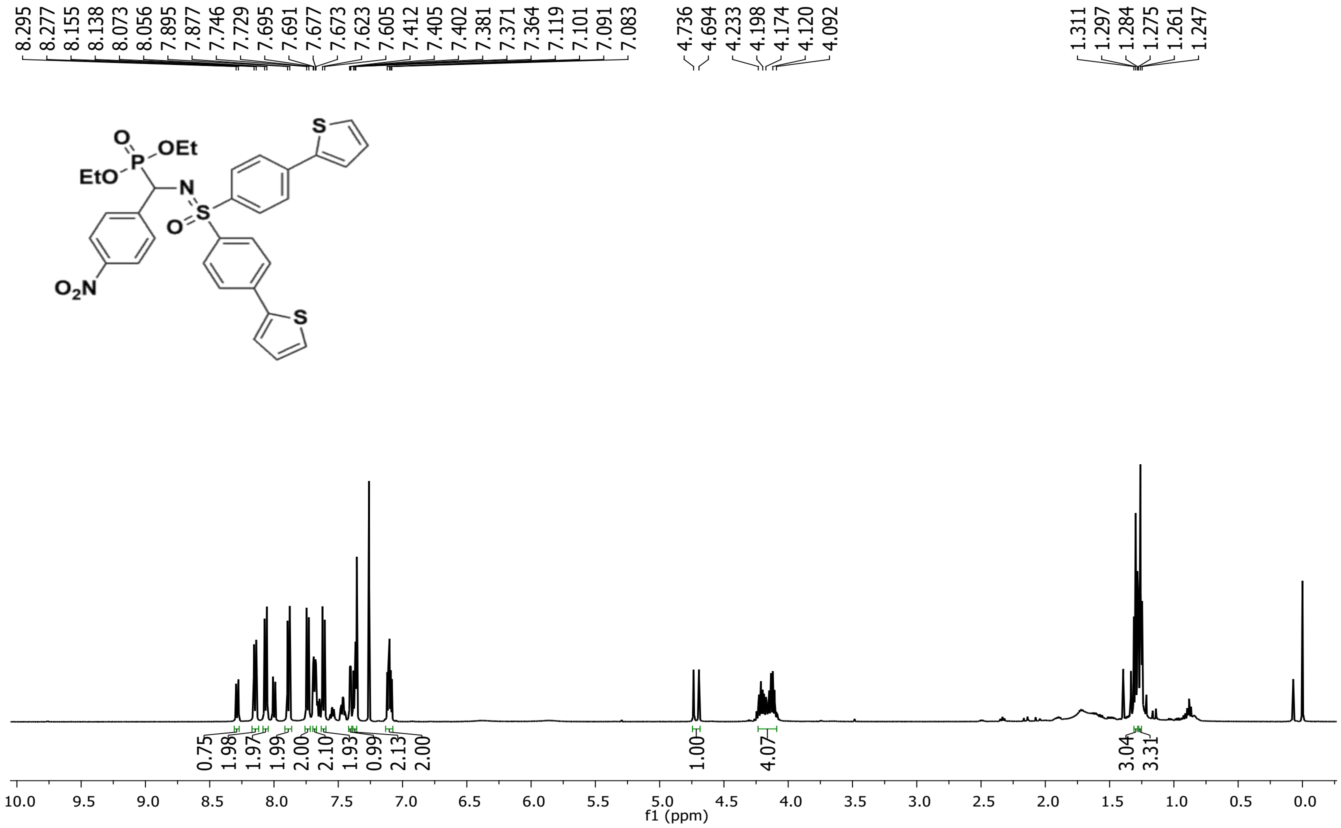
$^1H$ NMR of **6a** (500 MHz, $CDCl_3$)



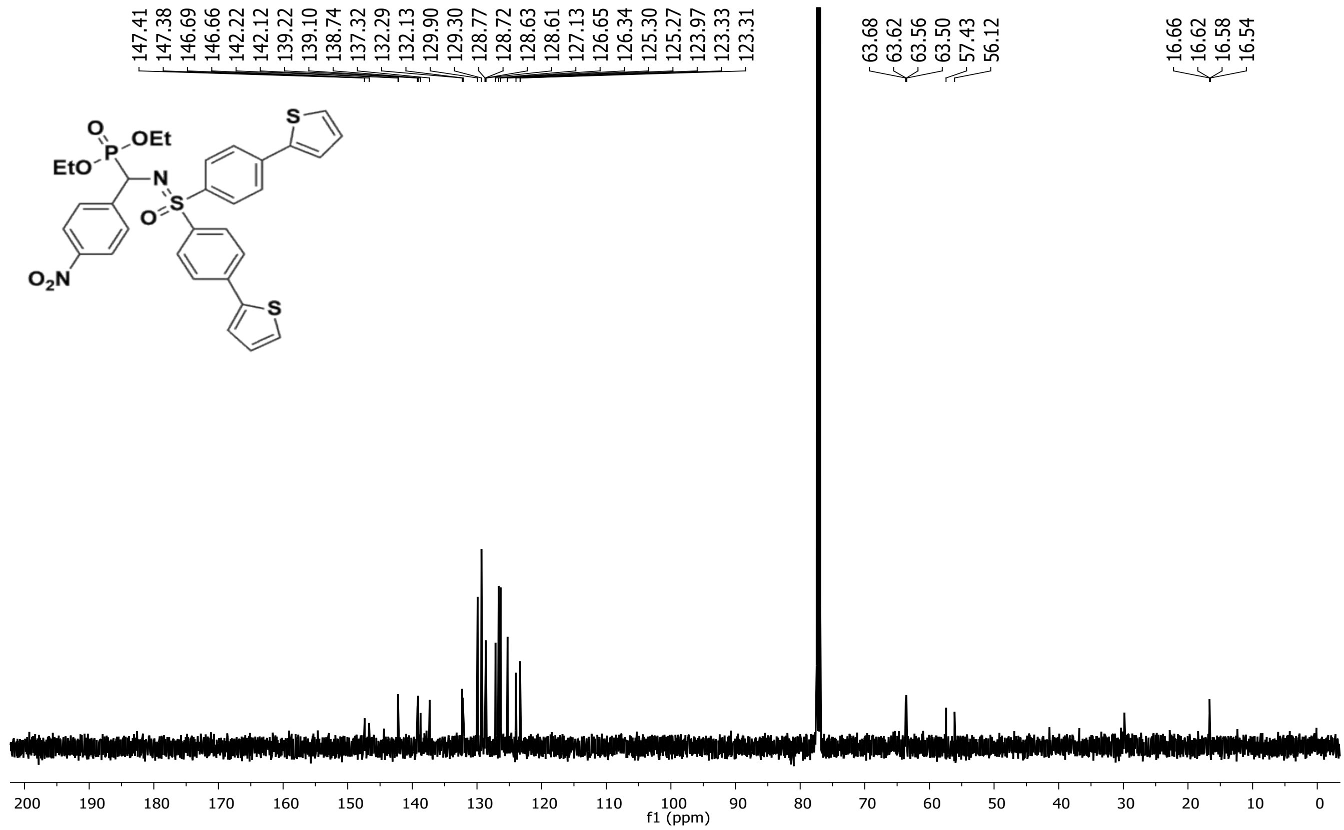

$^{13}C$ {$^1H$} NMR of **6a** (126 MHz, $CDCl_3$)



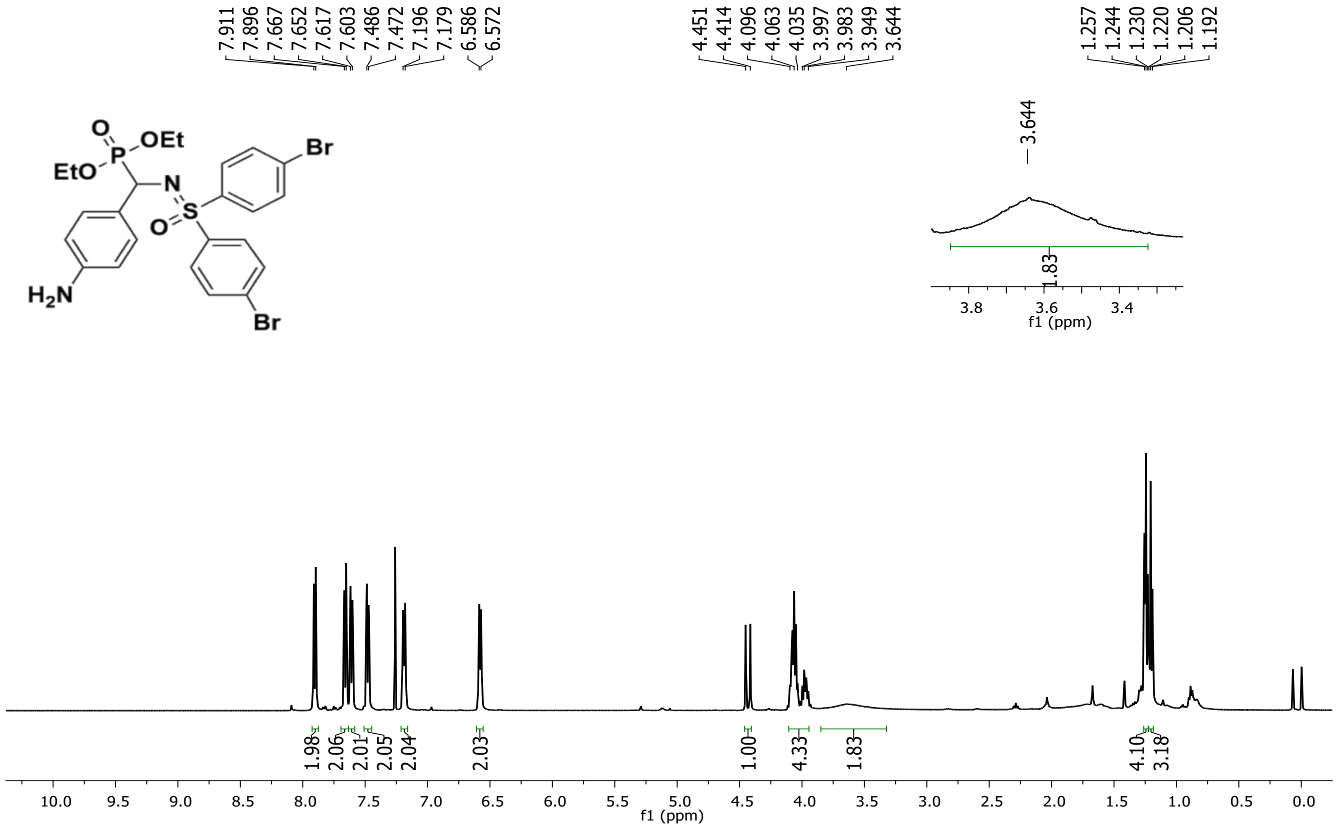
$^{1}H$ NMR of **6b** (500 MHz, $CDCl_3$)




$^{13}C$ {$^{1}H$} NMR of **6b** (126 MHz, $CDCl_3$)



$^{1}H$ NMR of **7a** (500 MHz, $CDCl_3$)



$^{13}C\ \{^{1}H\}$ NMR of **7a** (126 MHz, $CDCl_3$)