# **Supporting Information**

# One-pot Synthesis of Symmetrical Bis-sulfonyl 2,6-Diarylpyridines via $BiCl_3$ -Catalyzed and $K_2S_2O_8$ -Mediated Domino Annulation of $\beta$ -Ketosulfones and N,N-Dimethylacetamide

Meng-Yang Chang\*a,b,c and Chun-Yi Lina

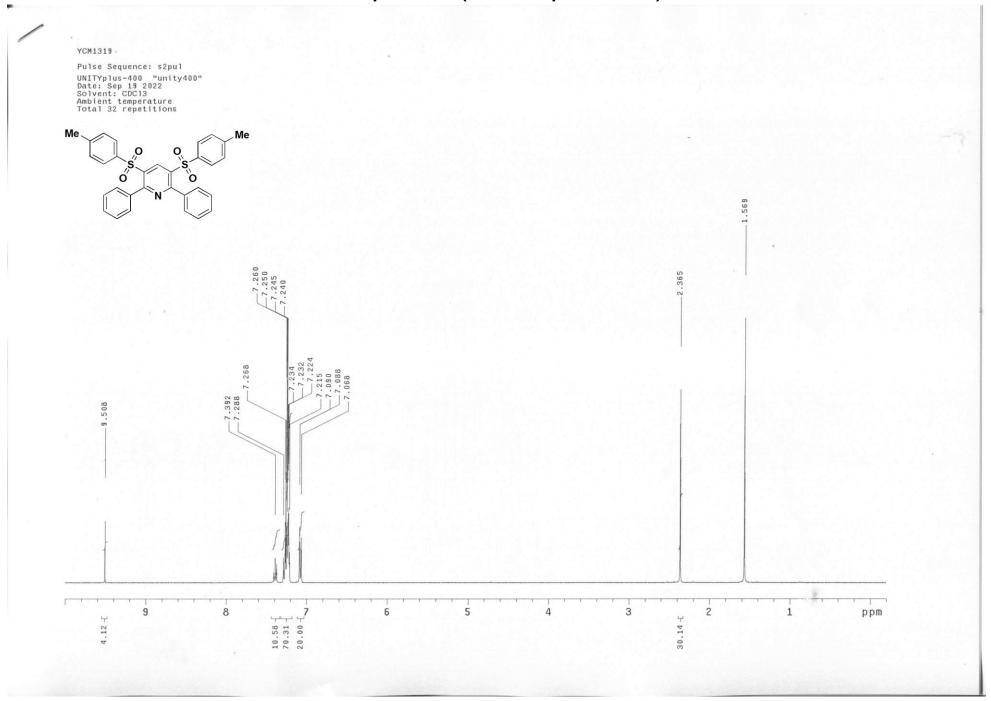
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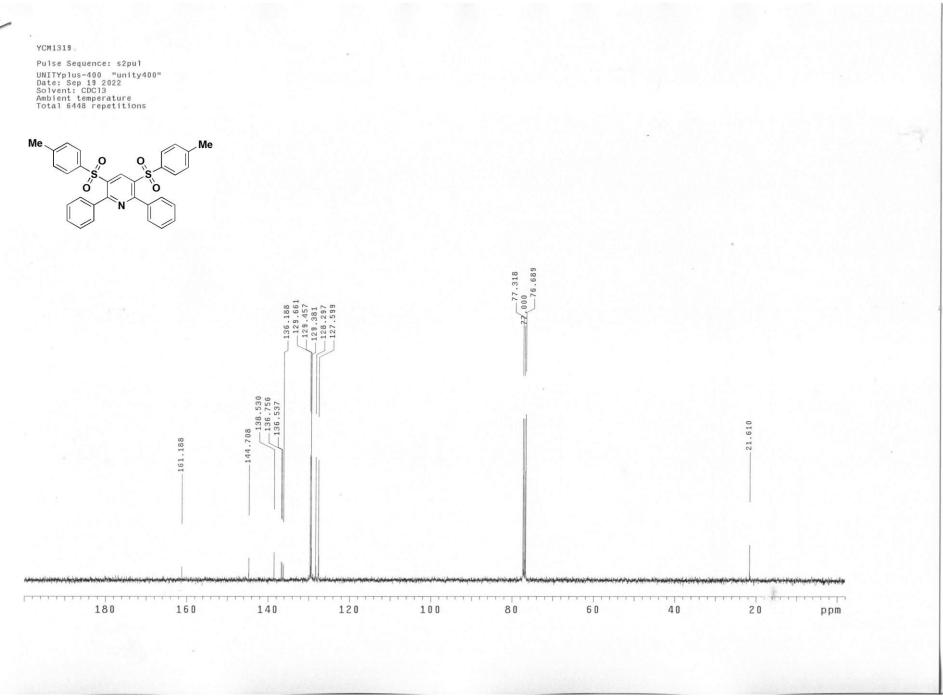
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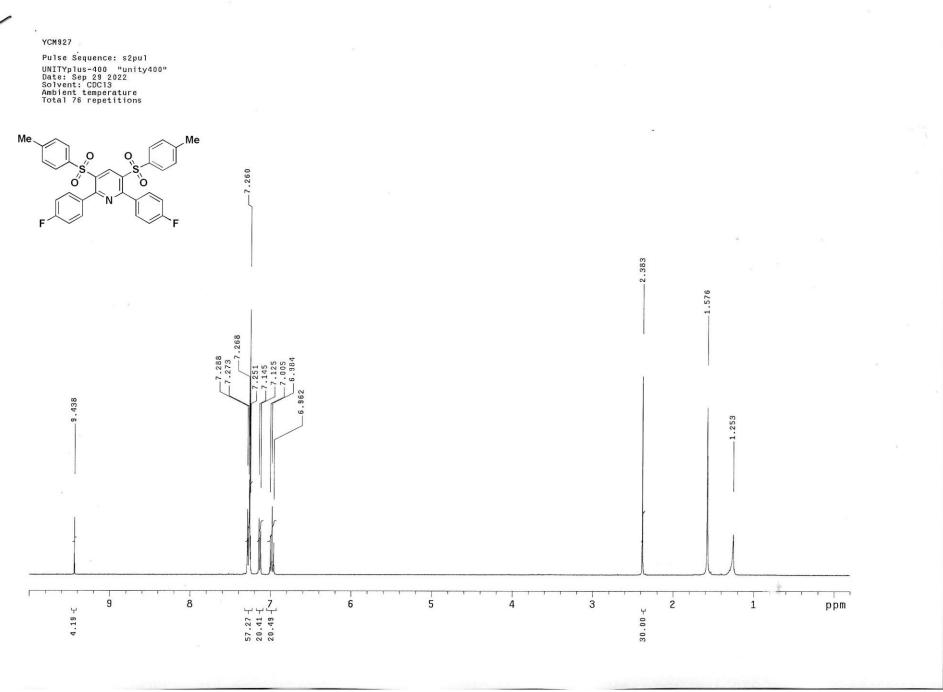
Compound 4a (<sup>1</sup>H-NMR spectral data)



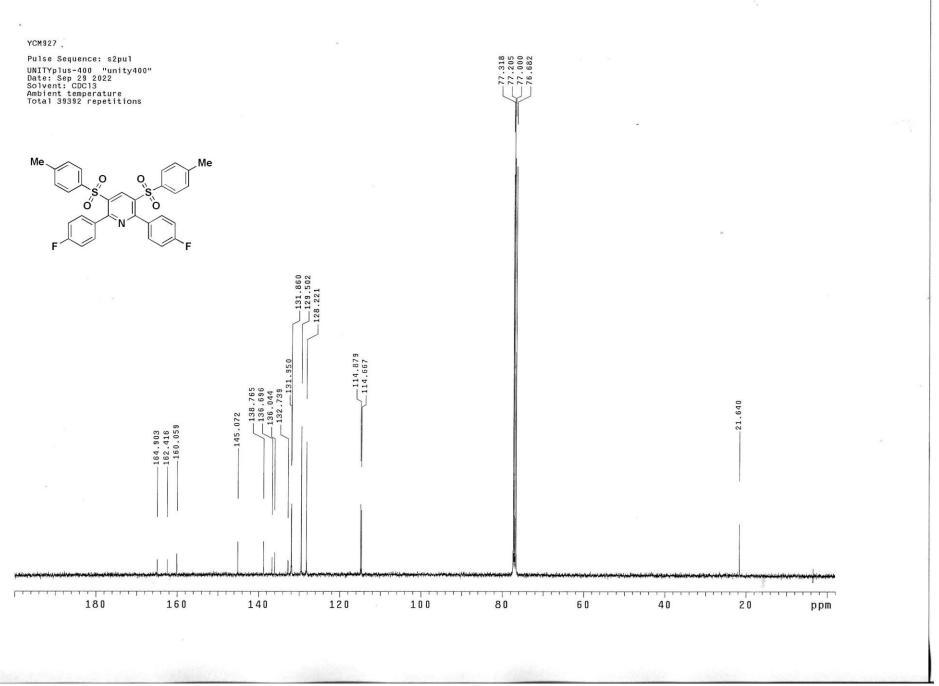
# Compound 4a (13C-NMR spectral data)



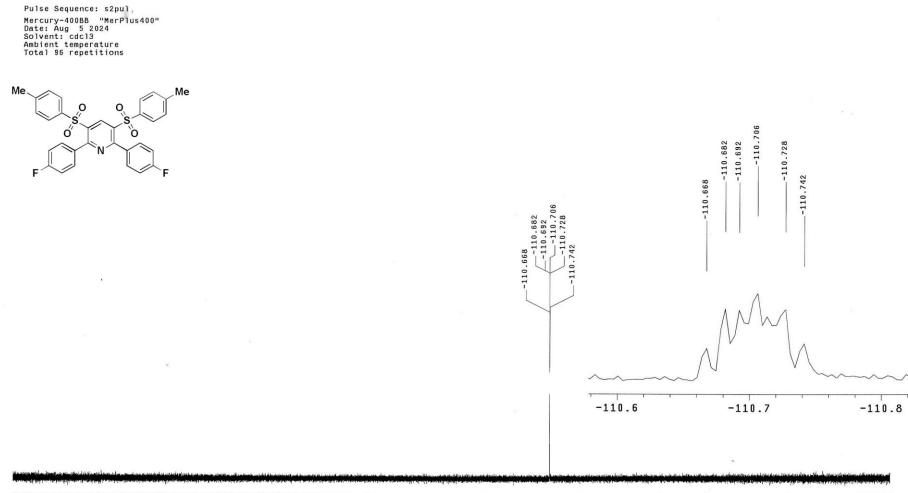
# Compound 4b (<sup>1</sup>H-NMR spectral data)

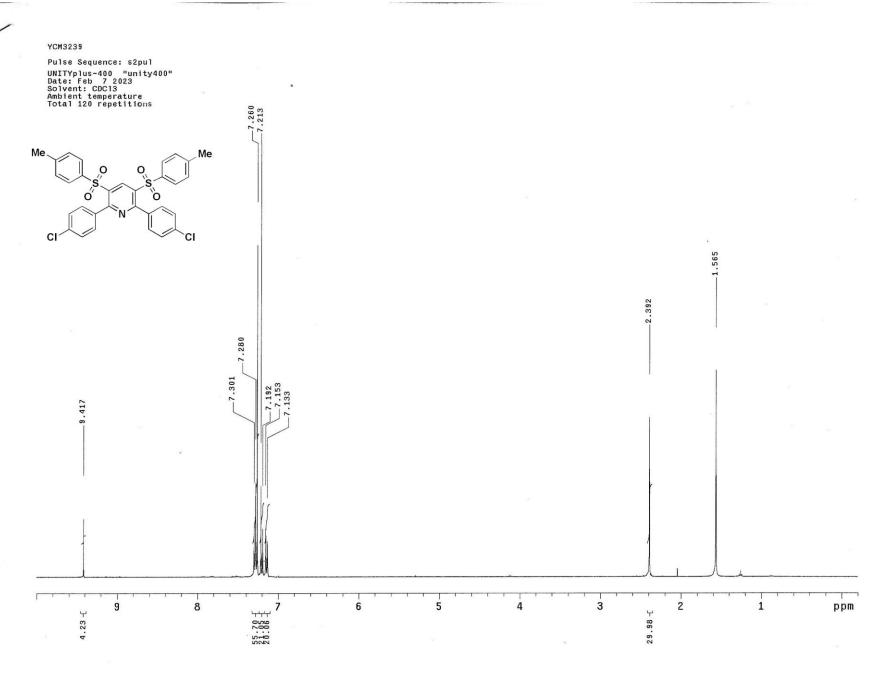


# Compound 4b (13C-NMR spectral data)



# Compound 4b (19F-NMR spectral data)

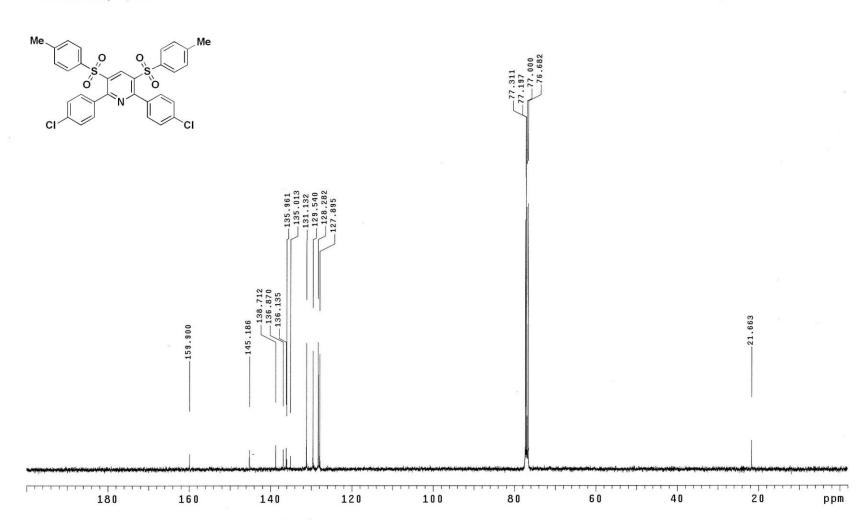




# Compound 4c (<sup>13</sup>C-NMR spectral data)

### YCM3239

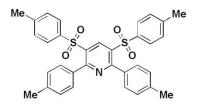
Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Feb 7 2023 Solvent: CDC13 Ambient temperature Total 32160 repetitions

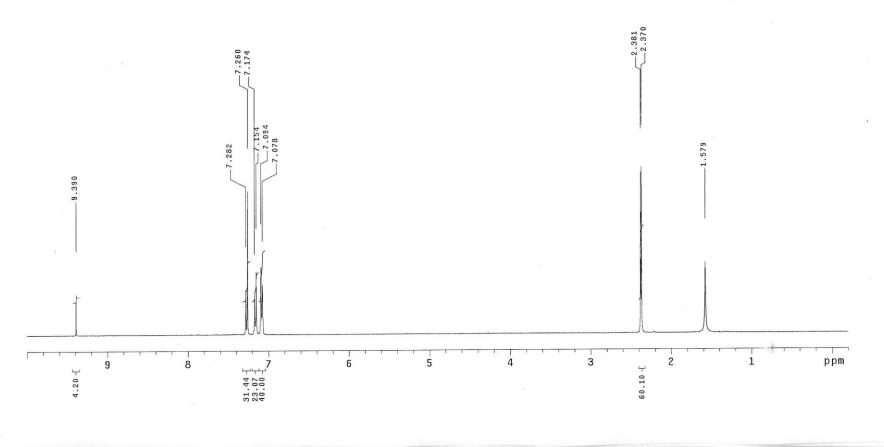


# Compound 4d (<sup>1</sup>H-NMR spectral data)

### YCM1006

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Oct 6 2022
Solvent: CDC13
Ambient temperature
Total 32 repetitions

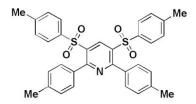


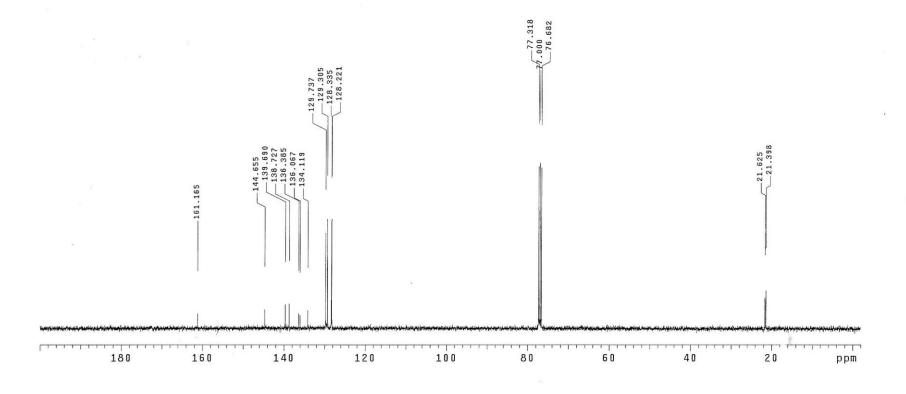


# Compound 4d (13C-NMR spectral data)

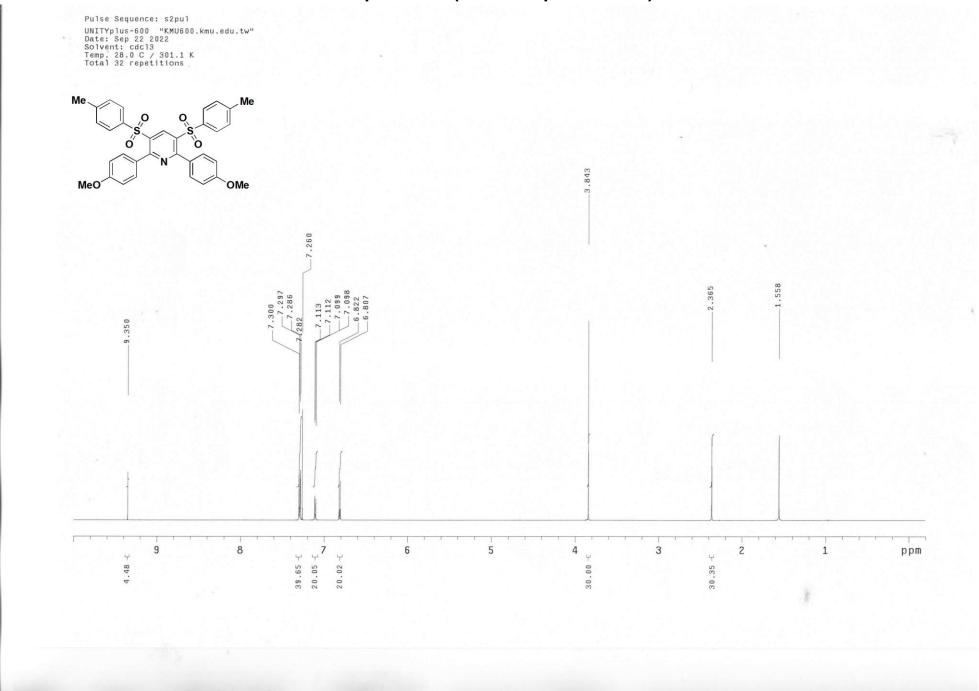
YCM1006

Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Oct 6 2022 Solvent: CDC13 Ambient temperature Total 7056 repetitions

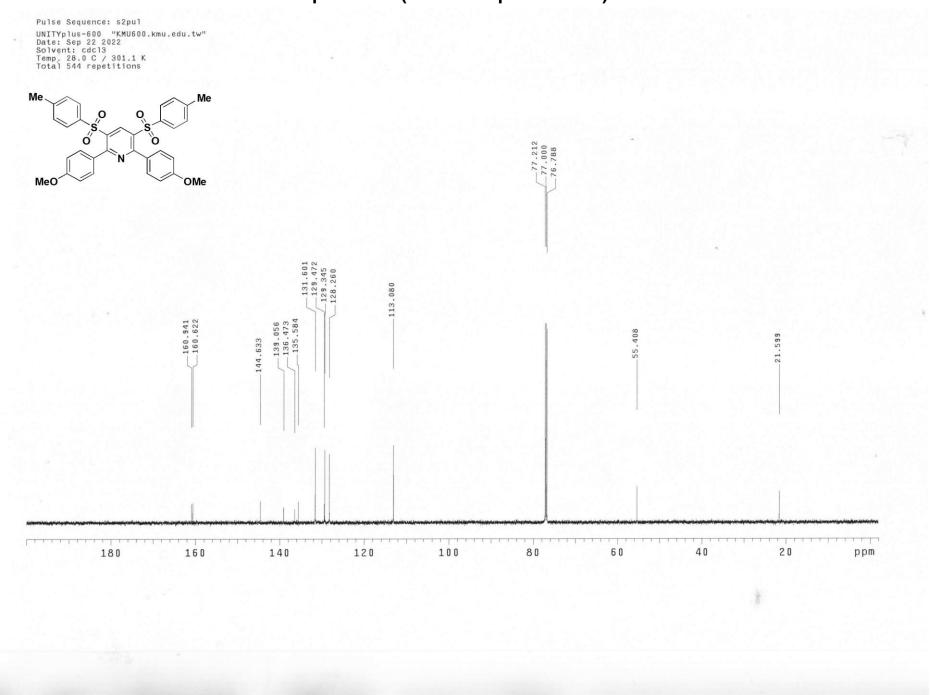




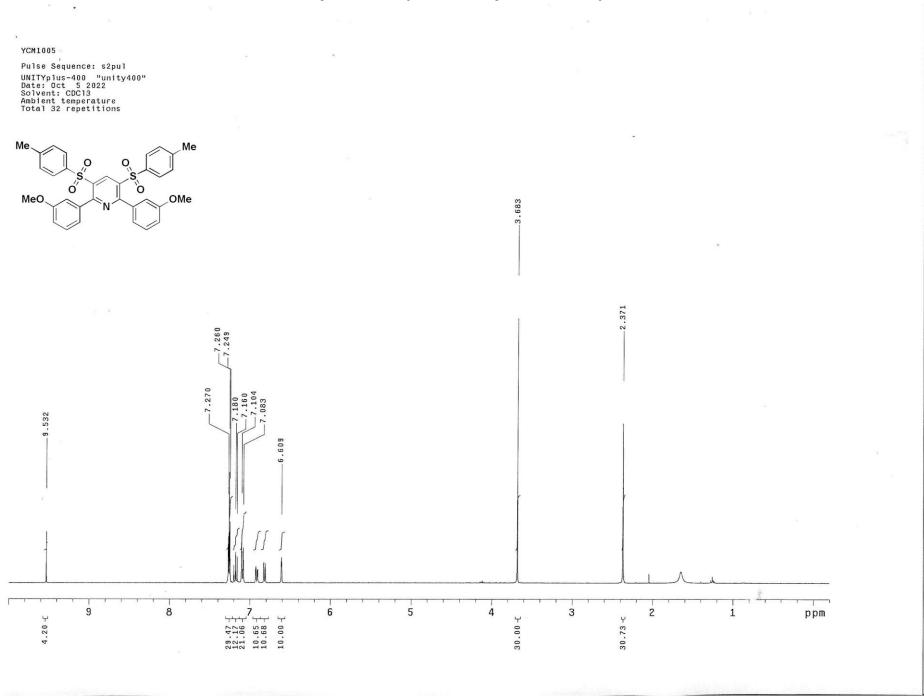
# Compound 4e (<sup>1</sup>H-NMR spectral data)



# Compound 4e (13C-NMR spectral data)



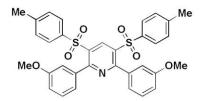
# Compound 4f (1H-NMR spectral data)

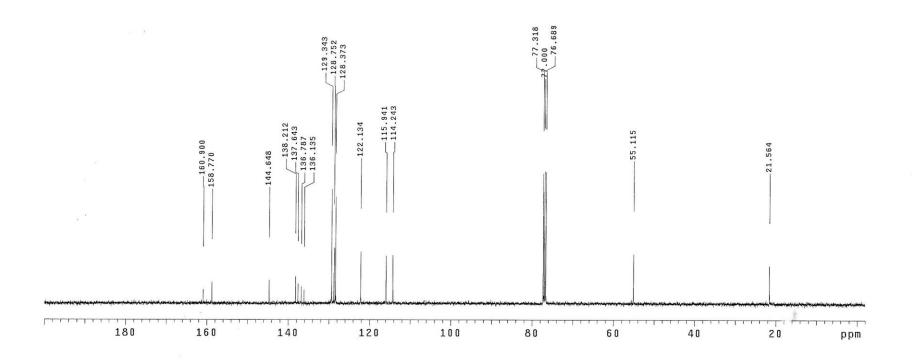


# Compound 4f (13C-NMR spectral data)

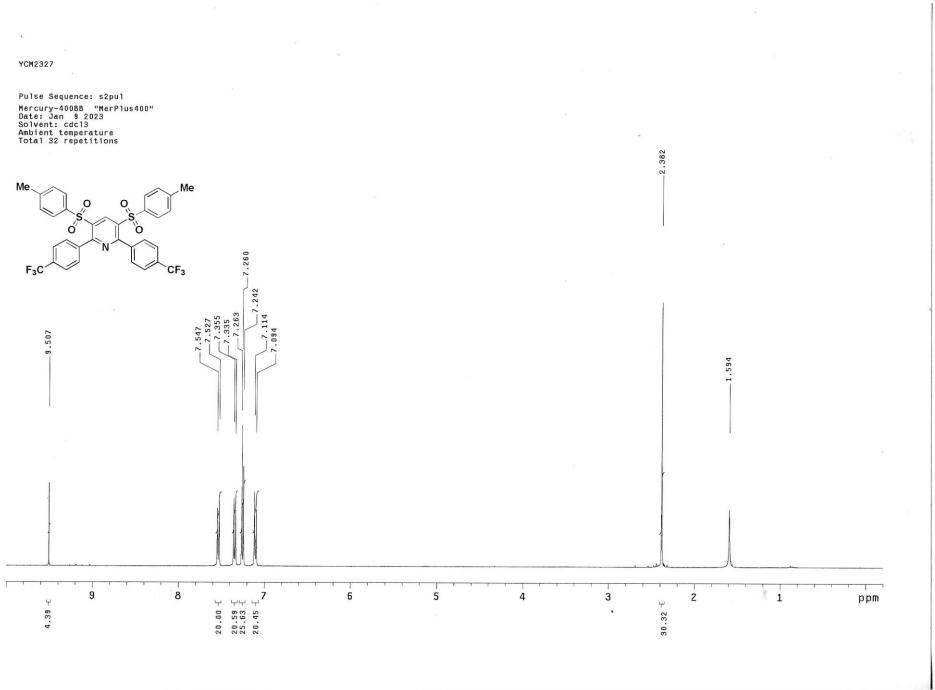
YCM1005

Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Oct 5 2022 Solvent: CDC13 Ambient temperature Total 7200 repetitions

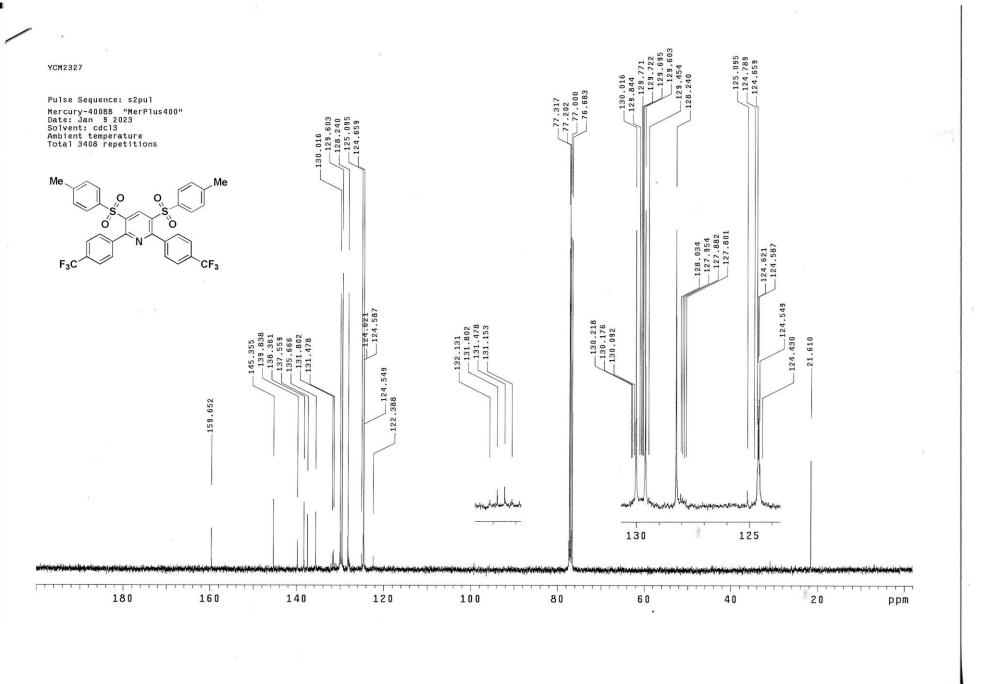




# Compound 4g (<sup>1</sup>H-NMR spectral data)



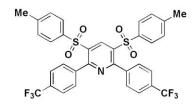
# Compound 4g (<sup>13</sup>C-NMR spectral data)



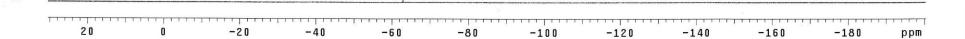
# Compound 4g (19F-NMR spectral data)

4g

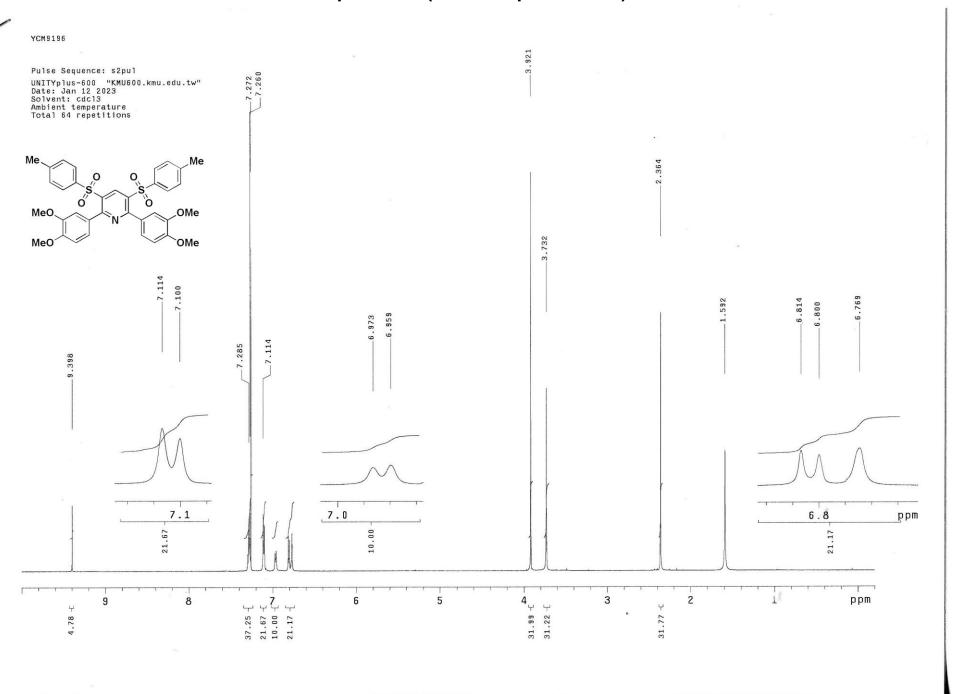
Pulse Sequence: s2pul,
Mercury-400BB "MerPlus400"
Date: Aug 5 2024
Solvent: cdc13
Ambient temperature
Total 64 repetitions



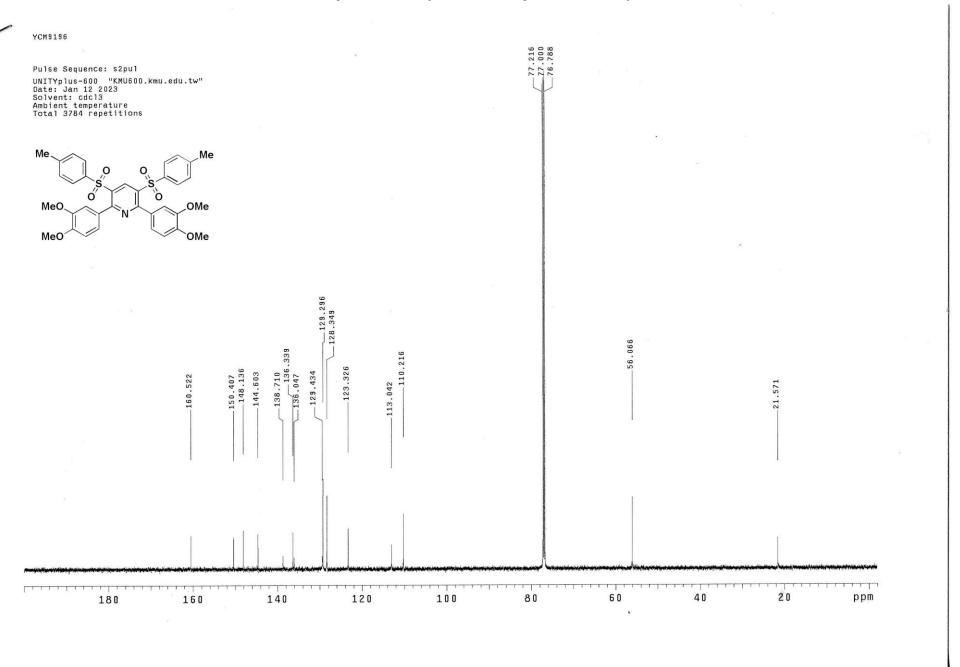
-62.932



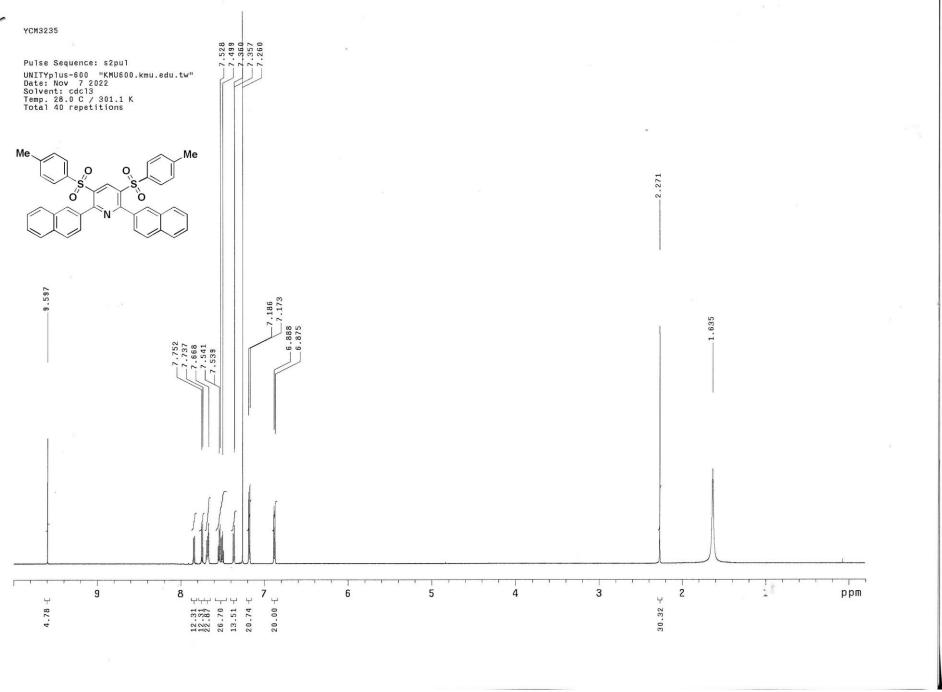
# Compound 4h (<sup>1</sup>H-NMR spectral data)



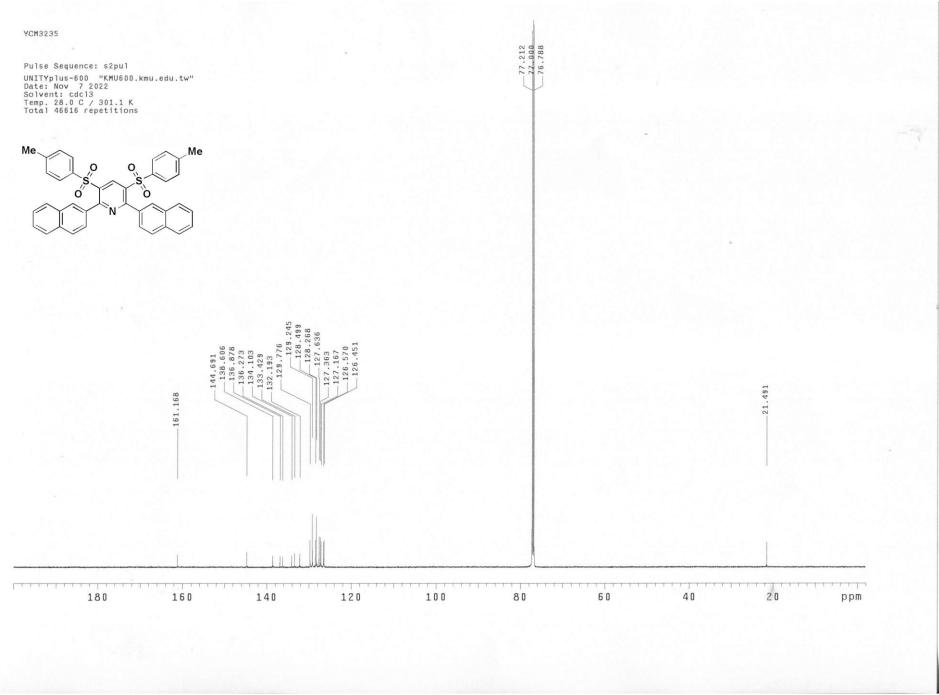
# Compound 4h (13C-NMR spectral data)



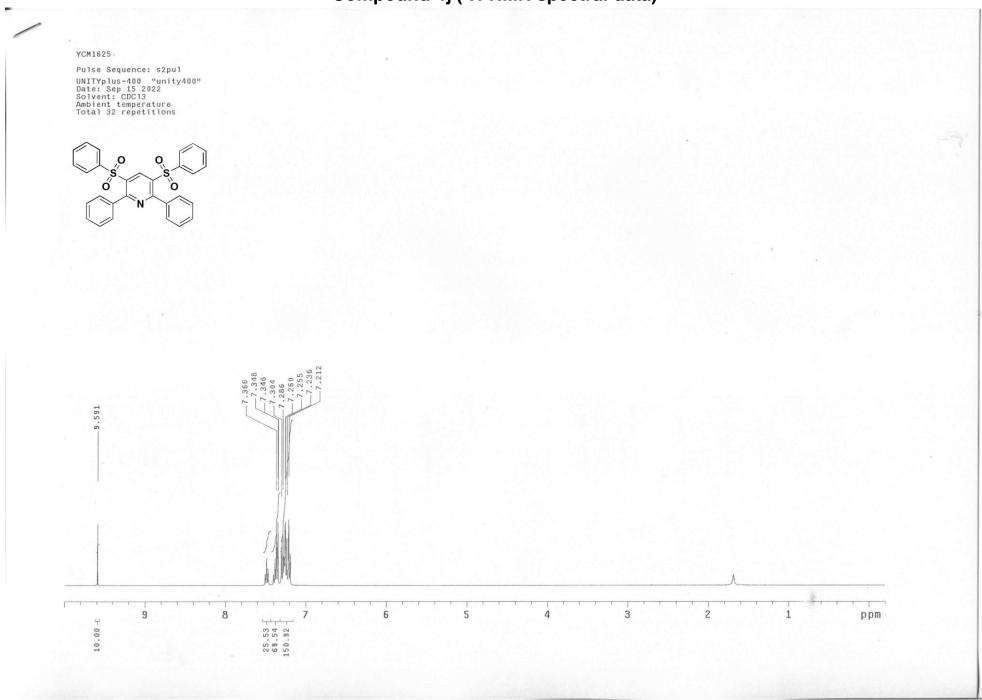
# Compound 4i (<sup>1</sup>H-NMR spectral data)



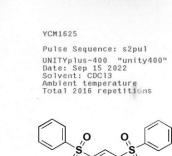


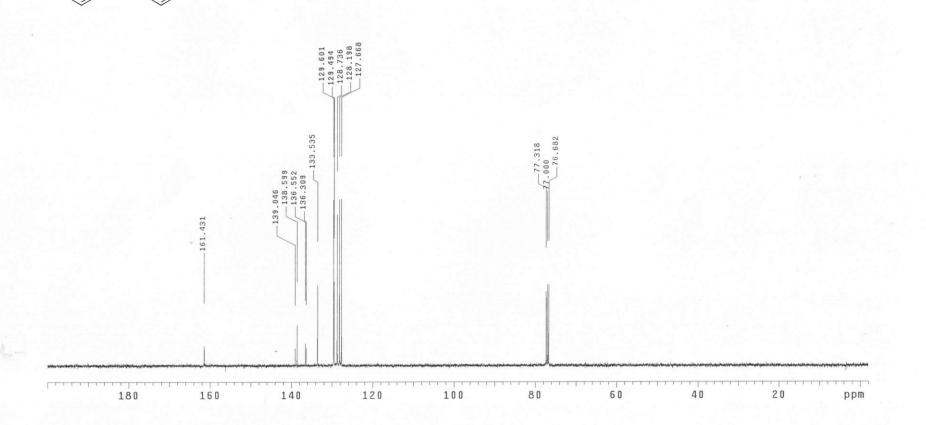


# Compound 4j (<sup>1</sup>H-NMR spectral data)

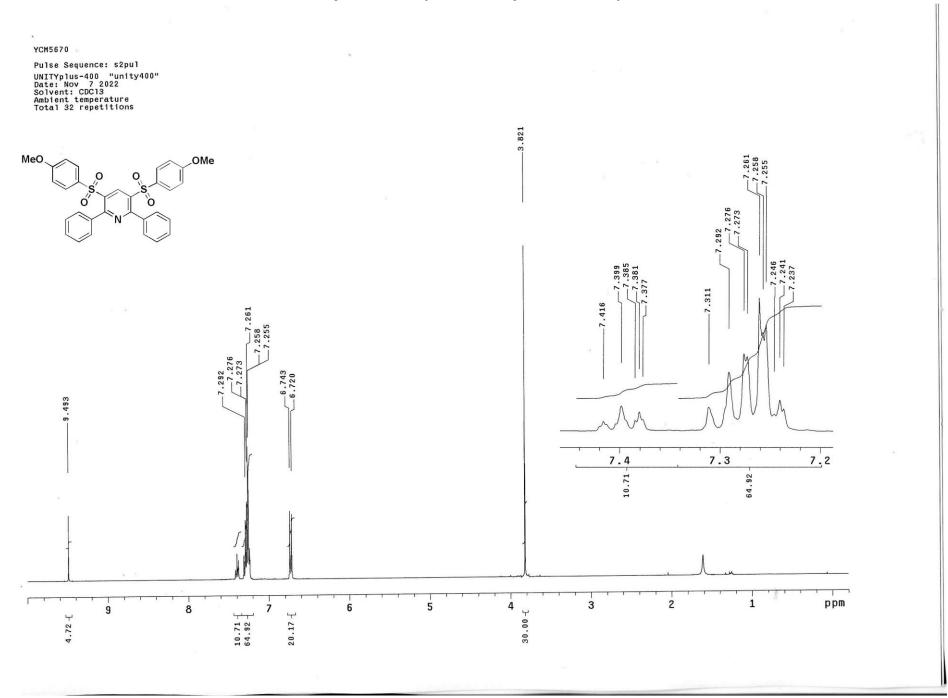


# Compound 4j (13C-NMR spectral data)





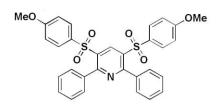
# Compound 4k (<sup>1</sup>H-NMR spectral data)

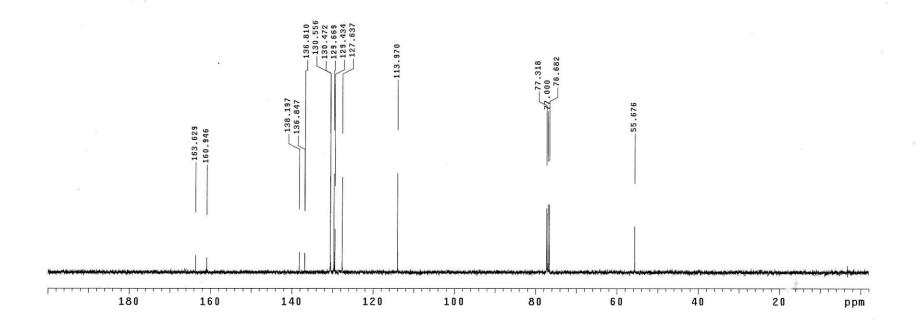


# Compound 4k (13C-NMR spectral data)

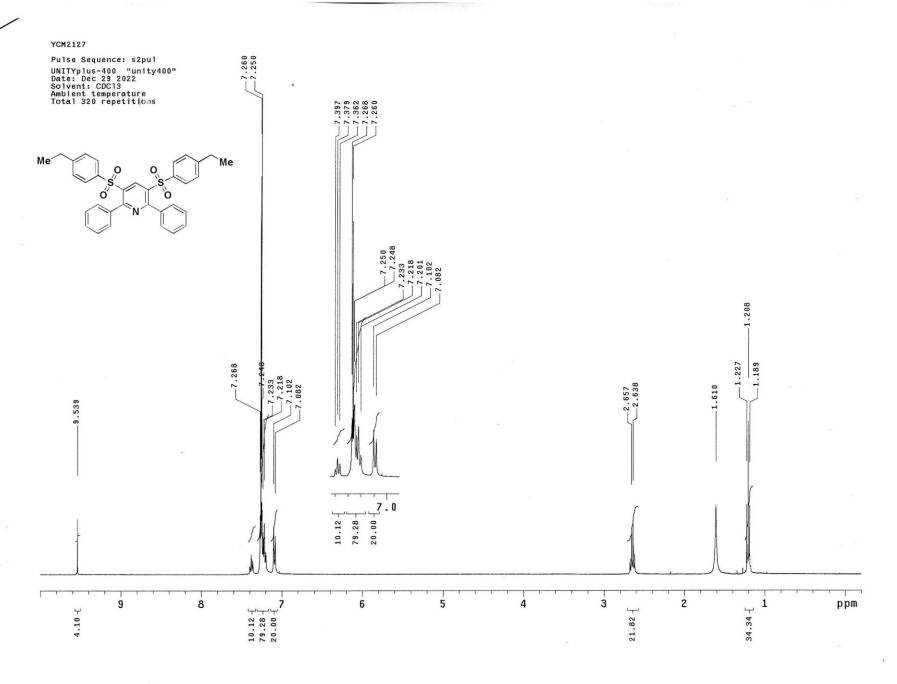
### YCM5670

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Nov 7 2022
Solvent: CDC13
Ambient temperature
Total 1072 repetitions

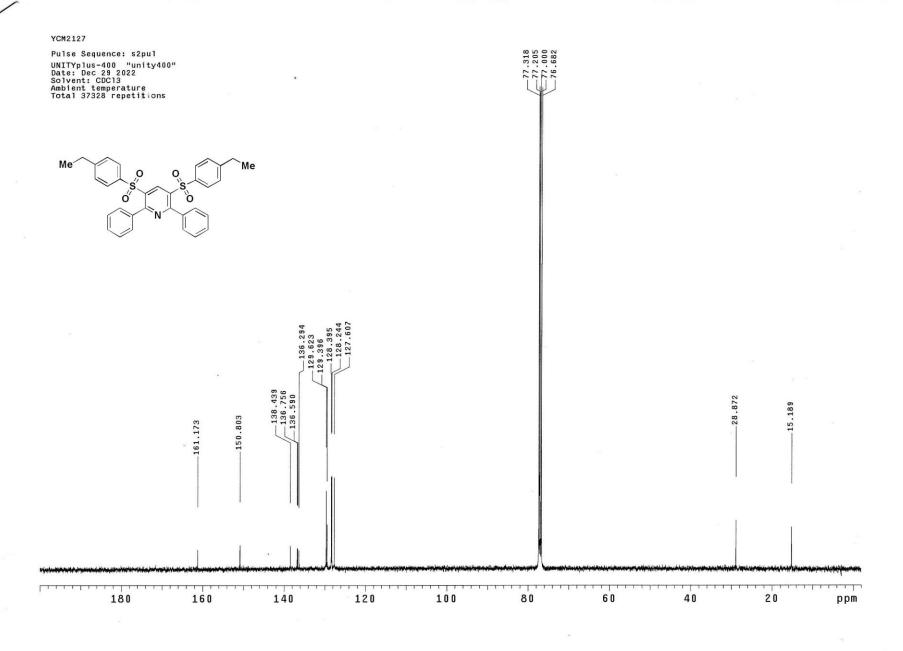




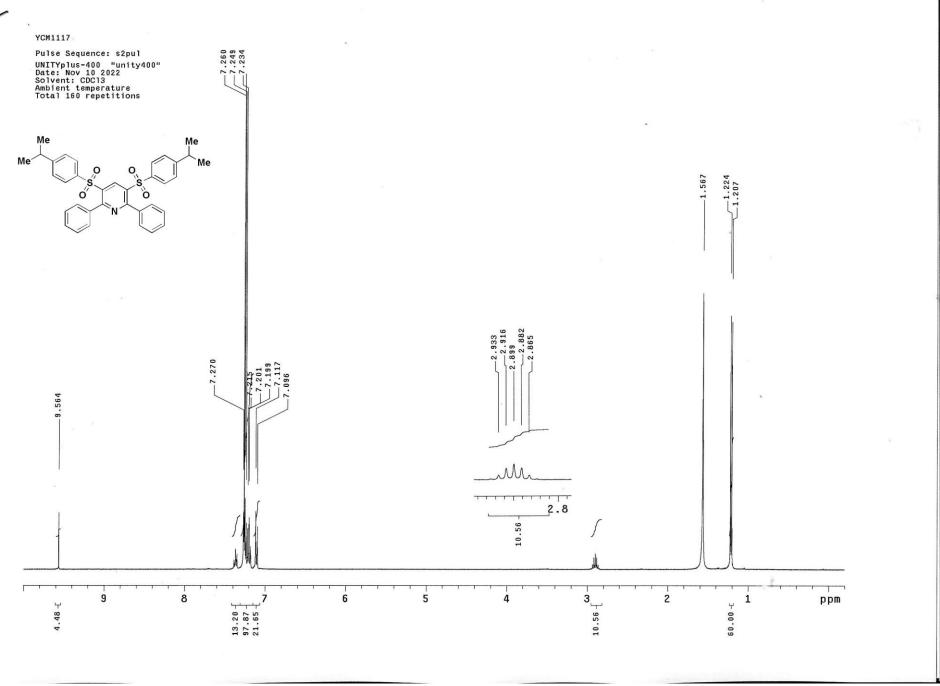
# Compound 4I (<sup>1</sup>H-NMR spectral data)



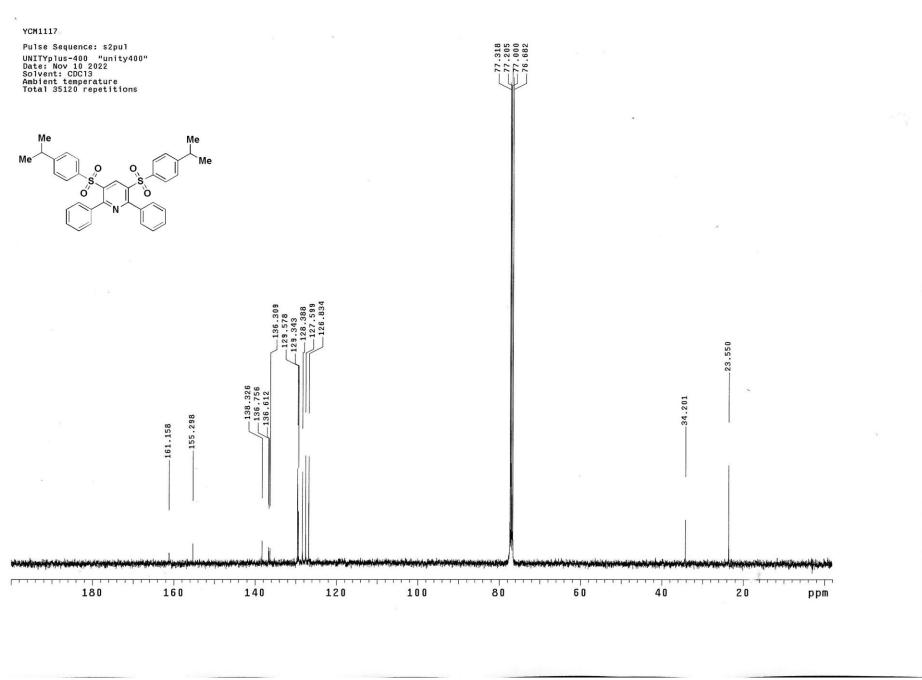
# Compound 4I (13C-NMR spectral data)



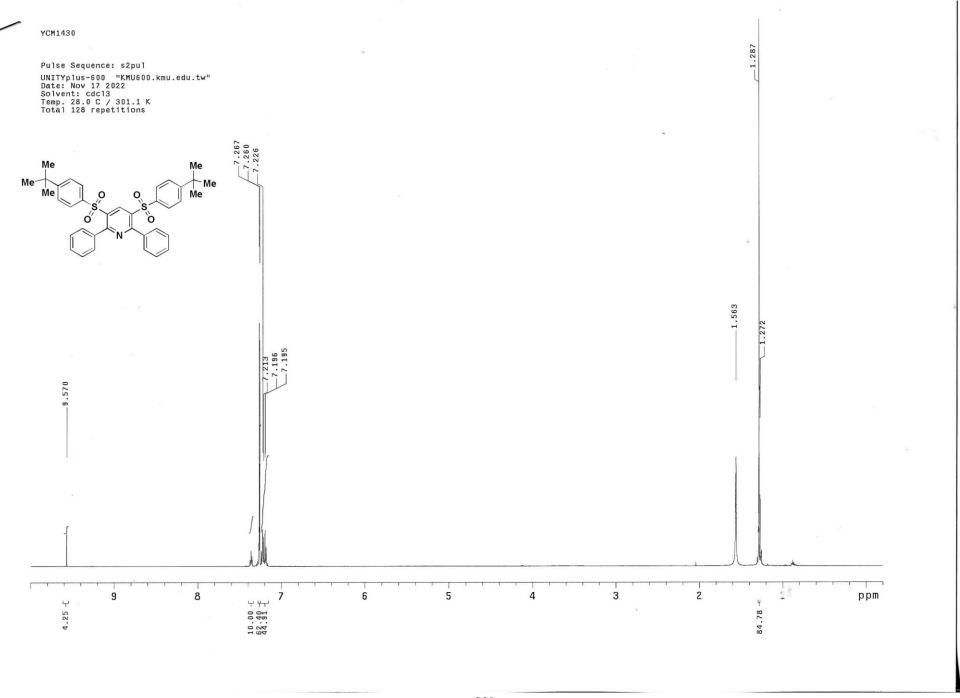
# Compound 4m (<sup>1</sup>H-NMR spectral data)



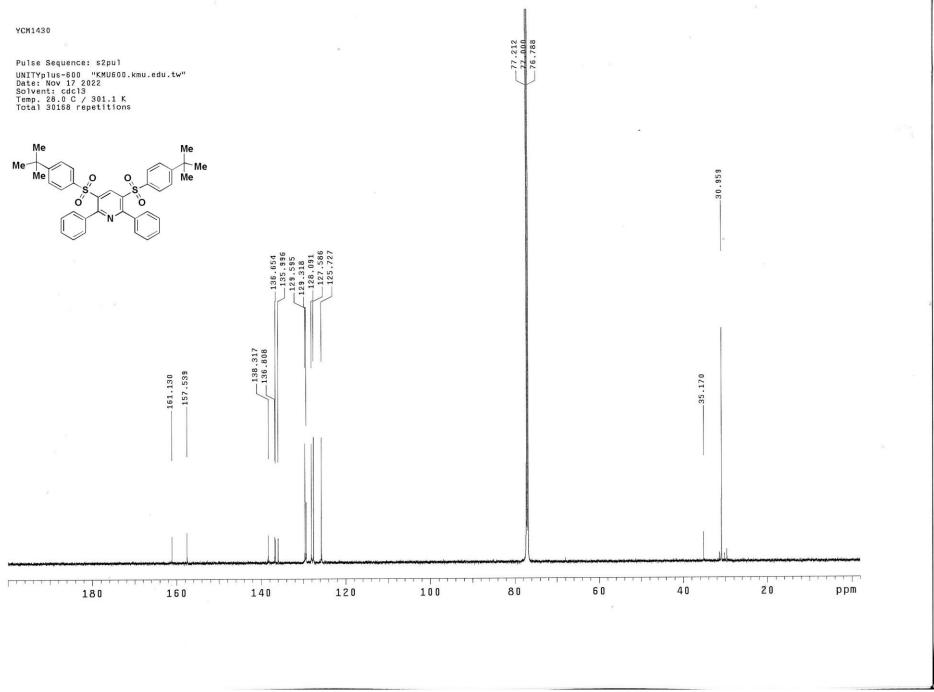
# Compound 4m (<sup>13</sup>C-NMR spectral data)



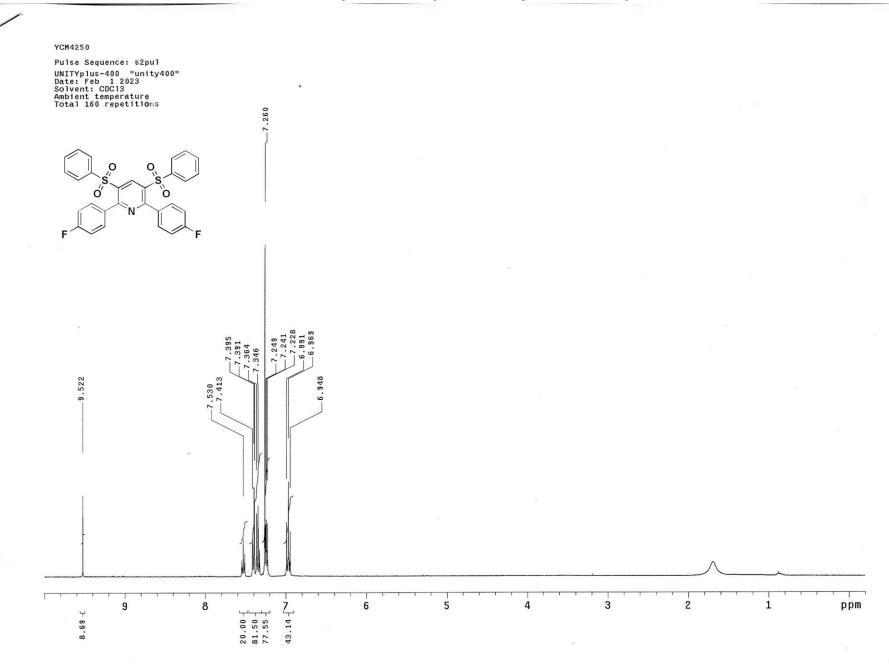
# Compound 4n (<sup>1</sup>H-NMR spectral data)



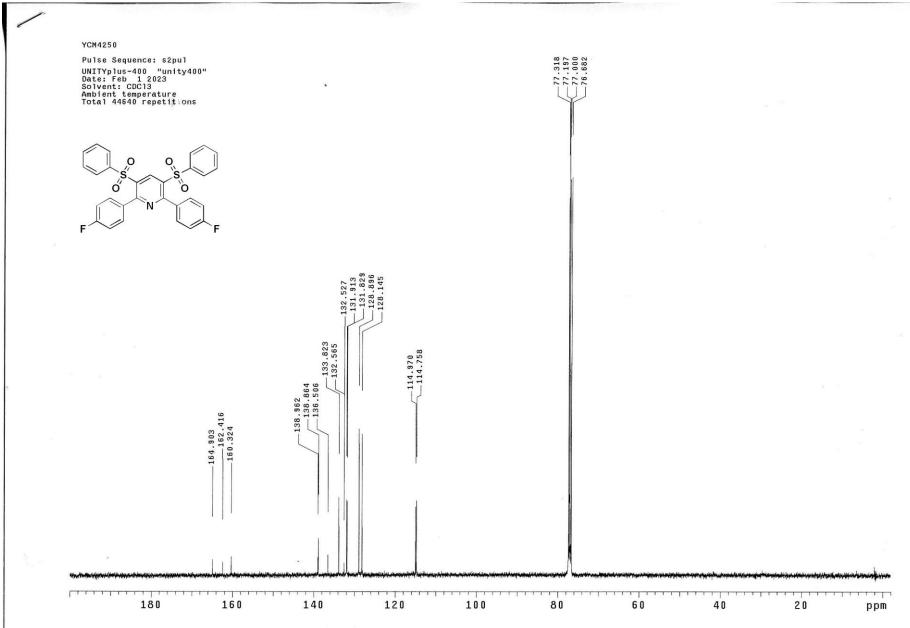




# Compound 4o (<sup>1</sup>H-NMR spectral data)

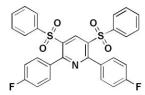


# Compound 40 (13C-NMR spectral data)



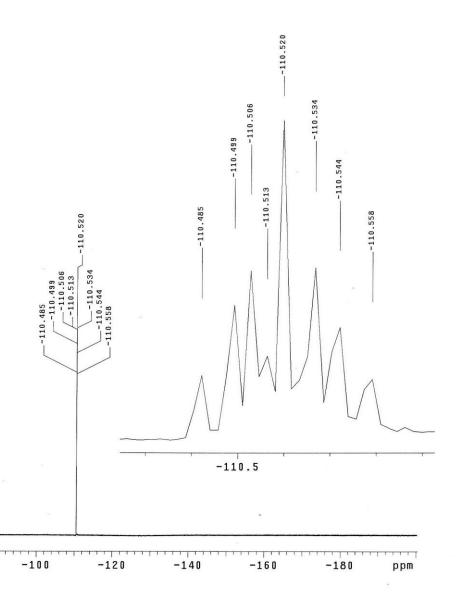


Pulse Sequence: s2pul,
Mercury-400BB "MerPlus400"
Date: Aug 5 2024
Solvent: cdcl3
Ambient temperature
Total 1824 repetitions



20

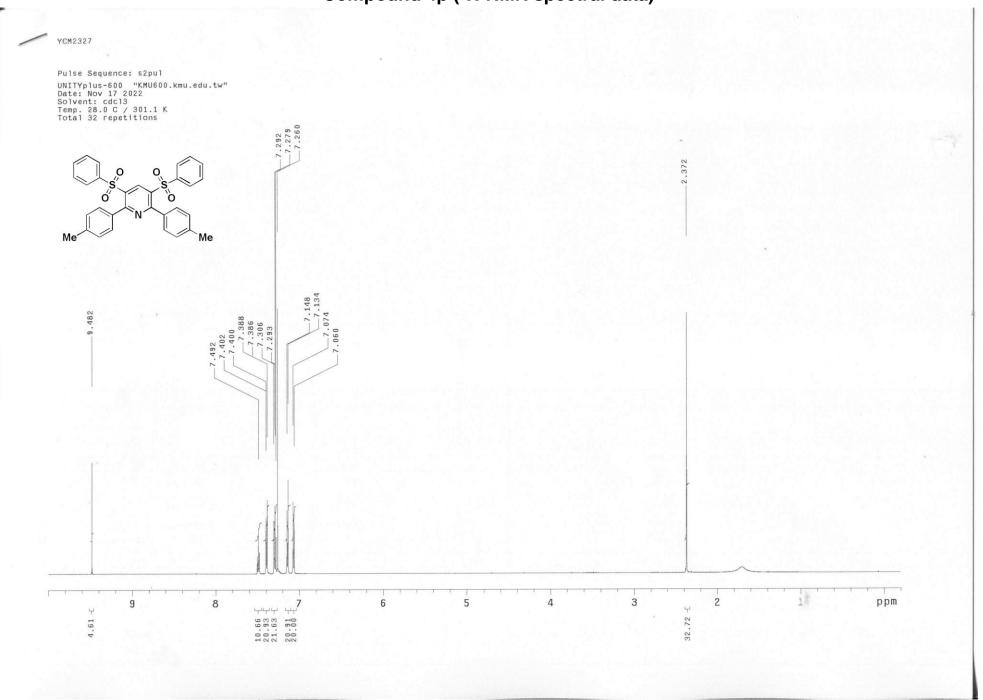
-20



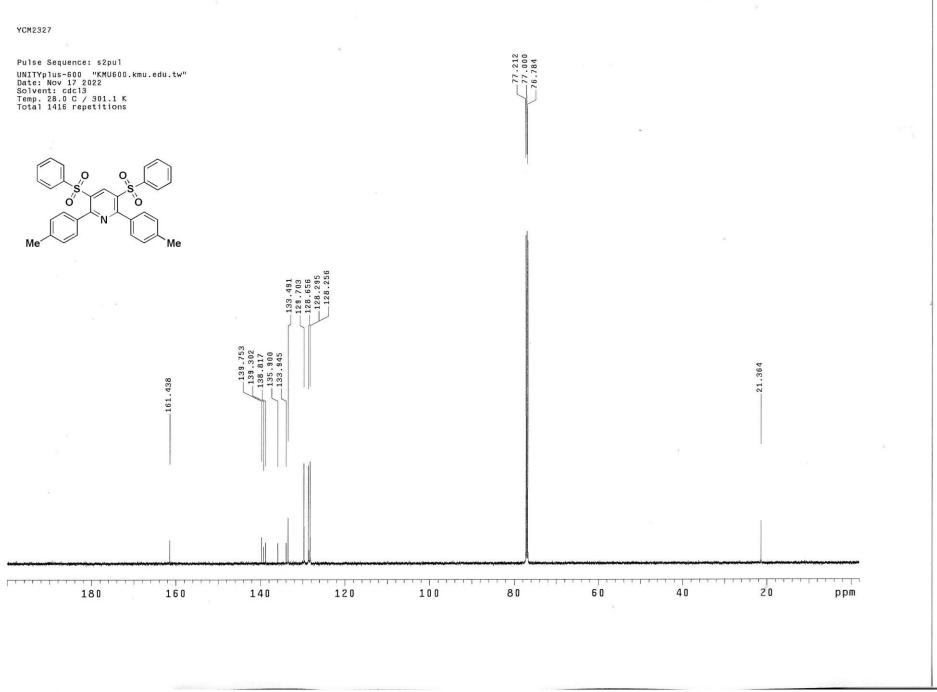
-80

-60

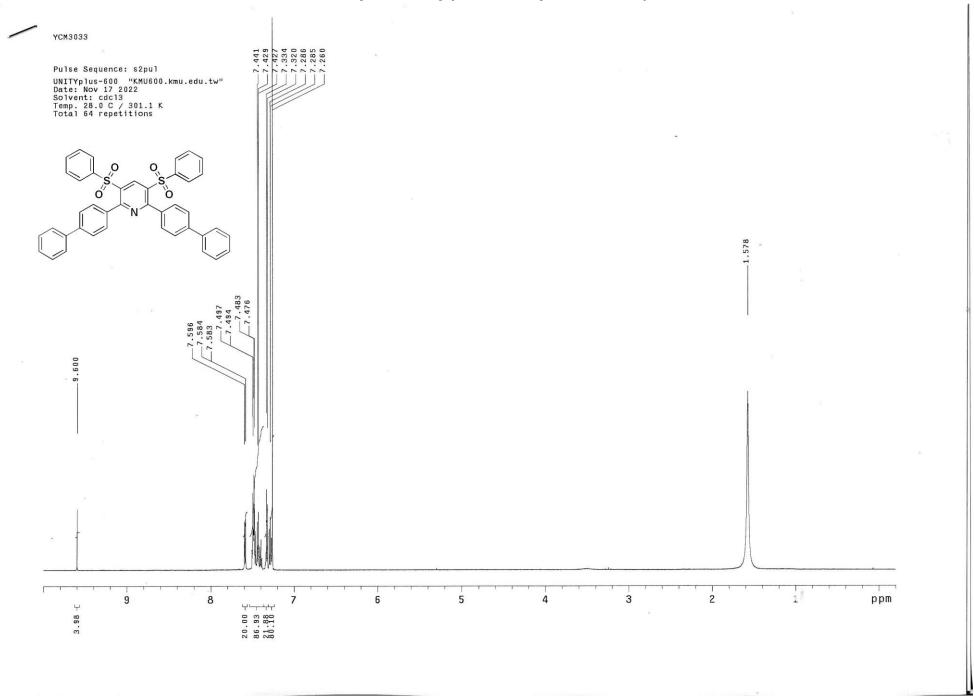
# Compound 4p (<sup>1</sup>H-NMR spectral data)



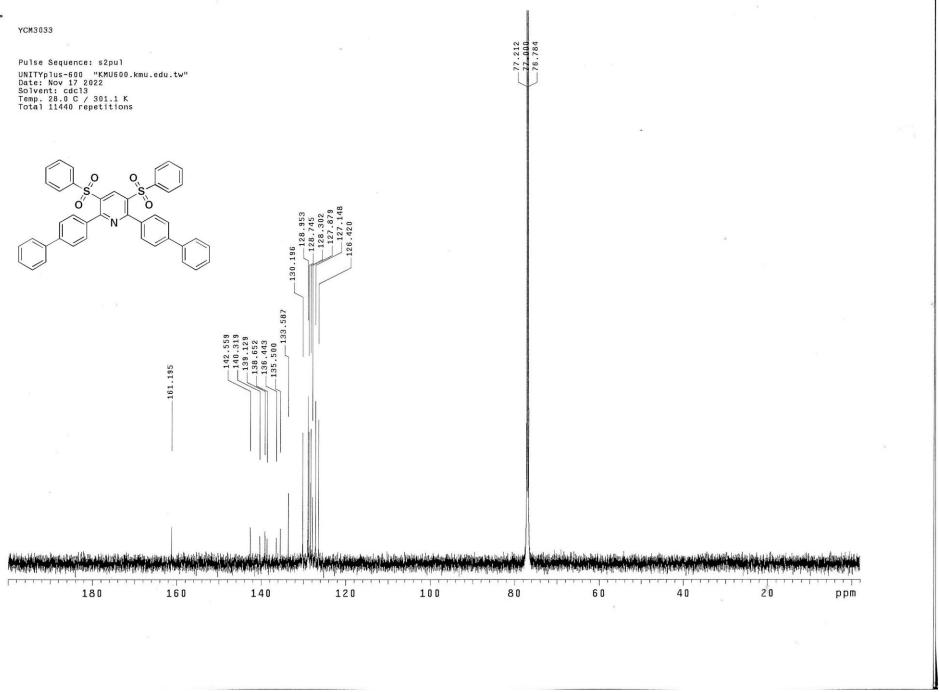
# Compound 4p (13C-NMR spectral data)



# Compound 4q (<sup>1</sup>H-NMR spectral data)



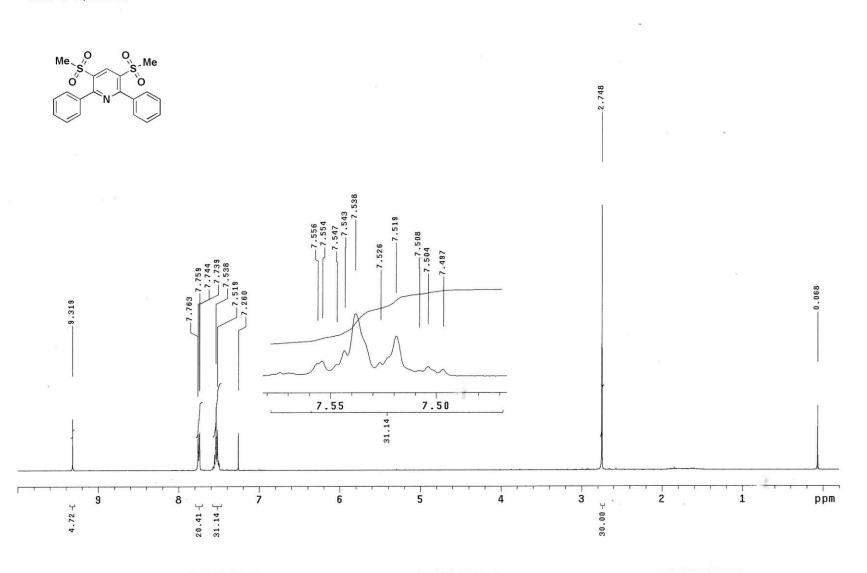
# Compound 4q (13C-NMR spectral data)



# Compound 4r (<sup>1</sup>H-NMR spectral data)



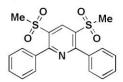
Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Nov 29 2022 Solvent: CDC13 Ambient temperature Total 32 repetitions

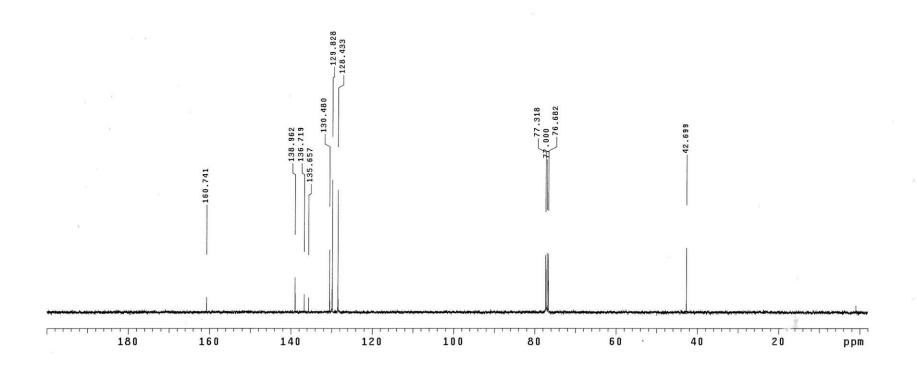


# Compound 4r (13C-NMR spectral data)

### YCM5962

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Nov 29 2022
Solvent: CDC13
Ambient temperature
Total 2080 repetitions

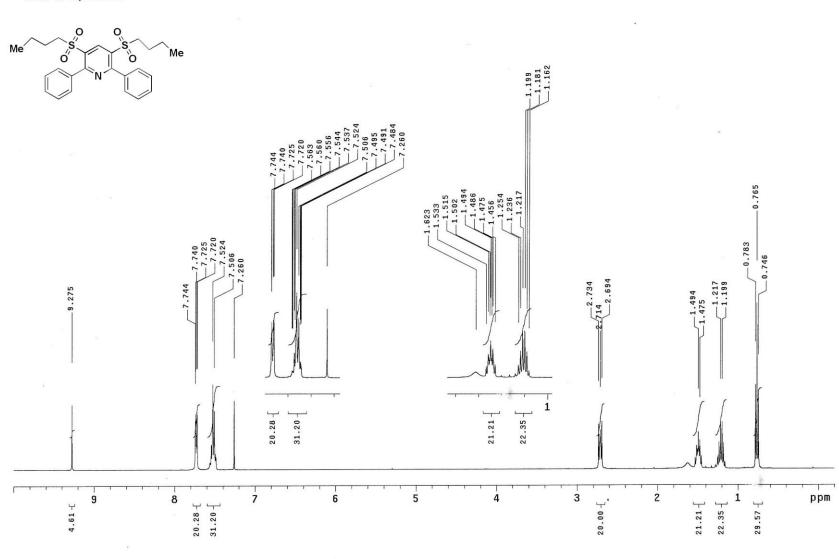




# Compound 4s (<sup>1</sup>H-NMR spectral data)



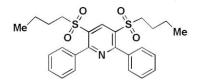
Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Dec 22 2022 Solvent: CDC13 Ambient temperature Total 32 repetitions

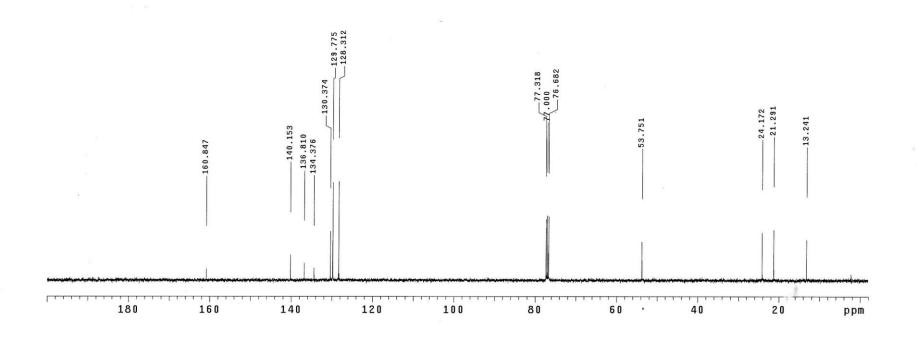


# Compound 4s (13C-NMR spectral data)

YCM2143

Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Dec 22 2022 Solvent: CDC13 Ambient temperature Total 1872 repetitions

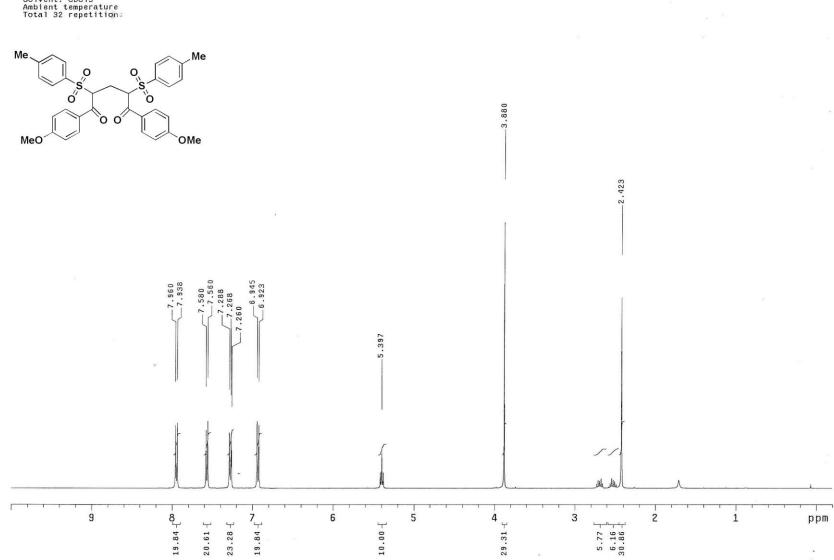




# Compound 5 (<sup>1</sup>H-NMR spectral data)

### YCM5282

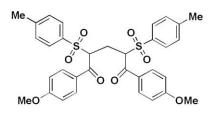
Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Sep 30 2024 Solvent: CDC13 Ambient temperature Total 32 repetitions

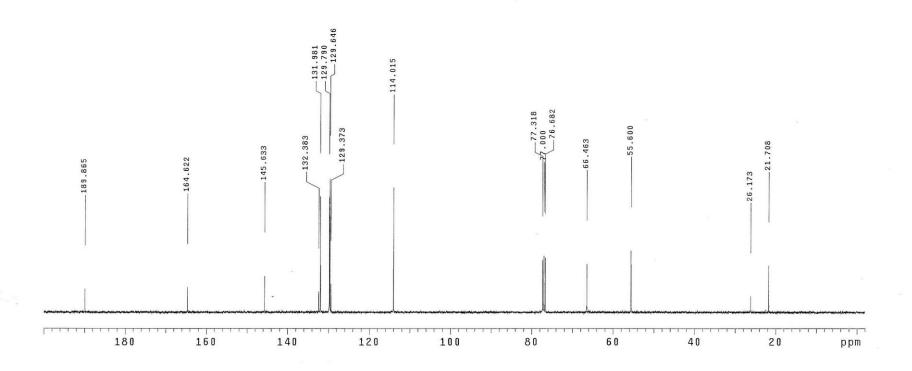


# Compound 5 (13C-NMR spectral data)

YCM5282

Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Sep 30 2024 Solvent: CDC13 Ambient temperature Total 2048 repetitions

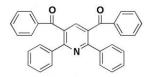


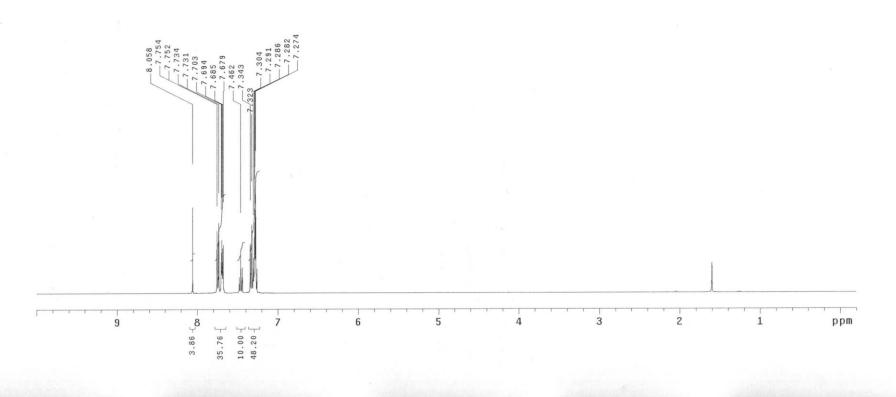


# Compound 6a (<sup>1</sup>H-NMR spectral data)

### HANOPh14

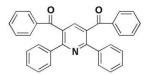
Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Oct 22 2018 Solvent: CDC13 Ambient temperature Total 32 repetitions

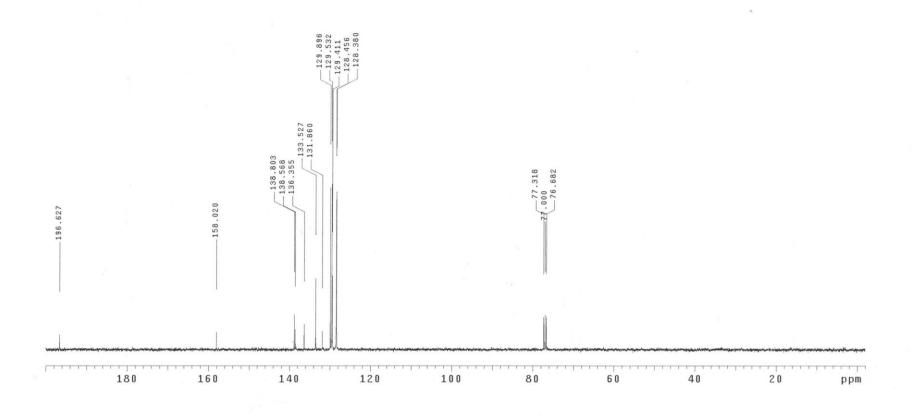




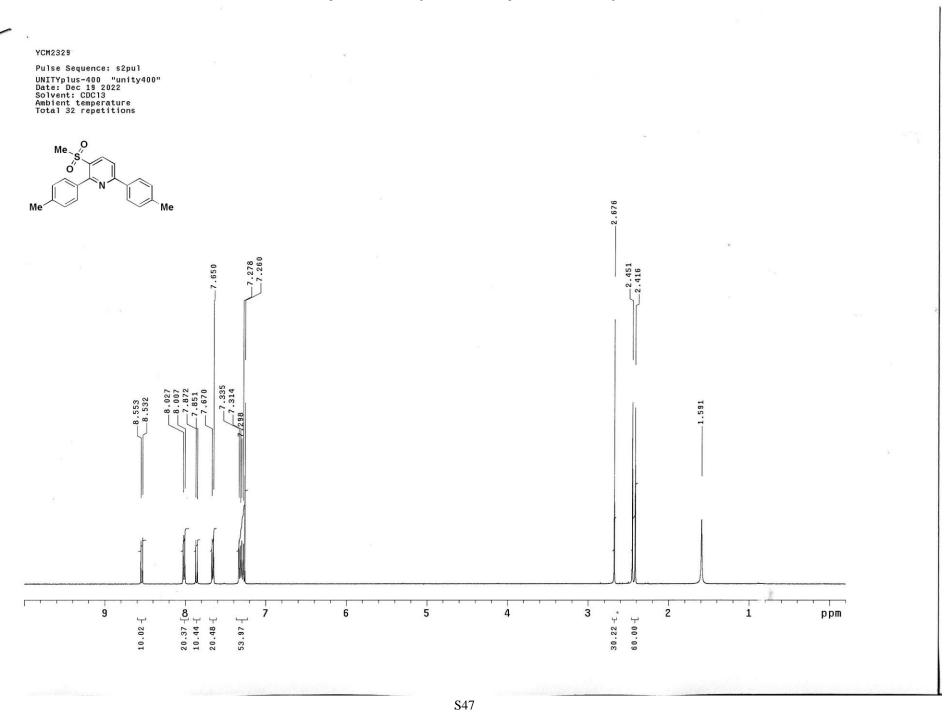
### HANOPh14

Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Oct 22 2018 Solvent: CDC13 Ambient temperature Total 400 repetitions

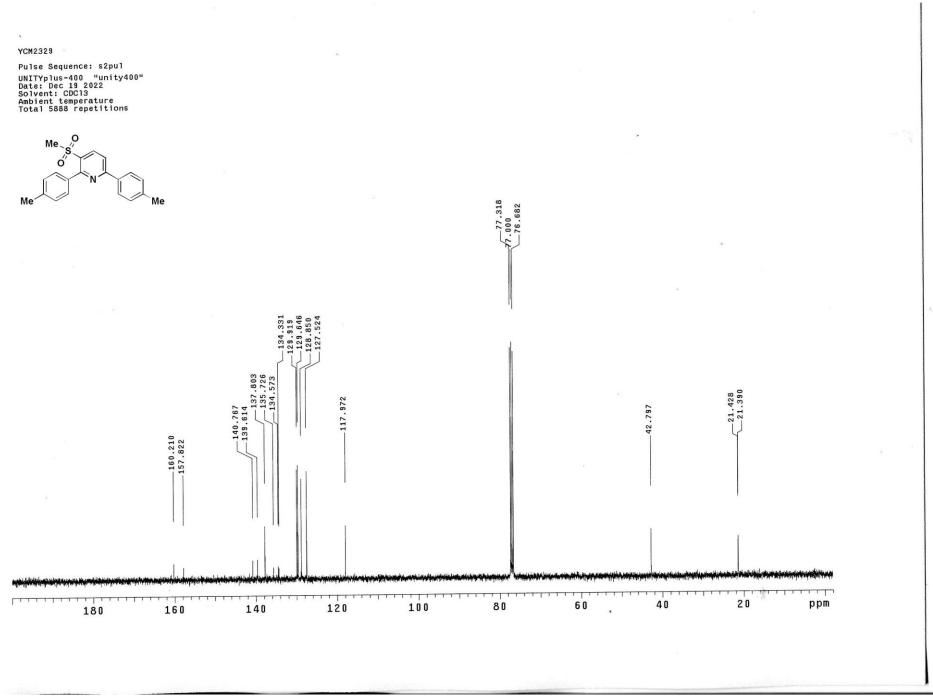




# Compound 8a (1H-NMR spectral data)

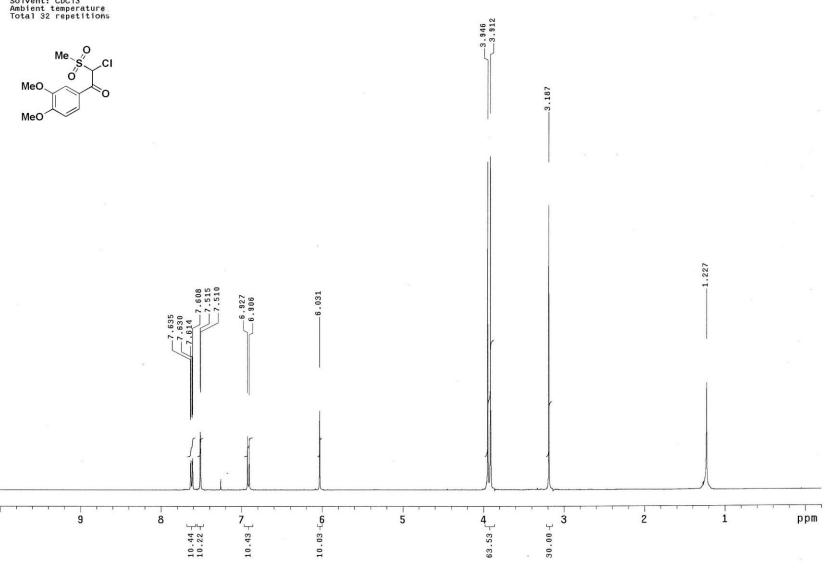


# Compound 8a (13C-NMR spectral data)



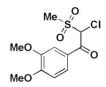


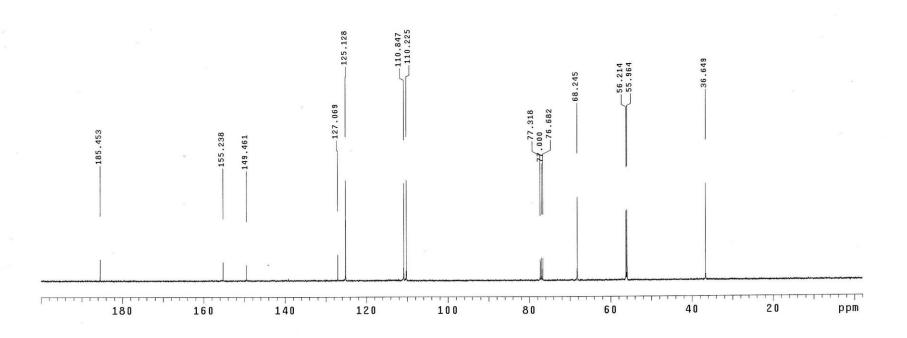
Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Jul 26 2023 Solvent: CDC13 Ambient temperature Total 32 repetitions



YC5160

Pulse Sequence: s2pul UNITYplus-400 "unity400" Date: Jul 26 2023 Solvent: CDC13 Ambient temperature Total 1232 repetitions

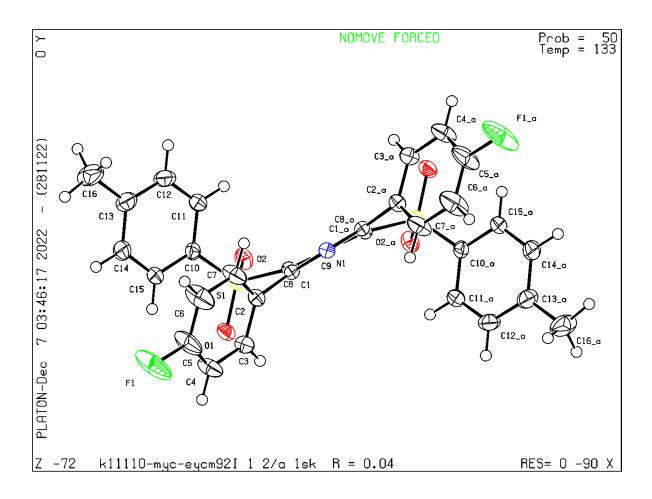




### X-ray crystal data of compound 4b

**Sample preparation**: A solution of compound **4b** (30 mg) in CH<sub>2</sub>Cl<sub>2</sub> (10 mL) was placed in a tube (10 mL). EtOAc (2 mL) was added slowly to the vial with a dropper. The vial was closed with little cotton and kept at room temperature for 2 days. Then, colorless prisms were observed.

**Crystal measurement**: X-ray crystal structures were determined with a Bruker Enraf-Nonius single-crystal diffractometer (CAD4, Kappa CCD). Thermal ellipsoids are drawn at 50% probability level.



Empirical formula C<sub>31</sub>H<sub>23</sub>F<sub>2</sub>NO<sub>4</sub>S<sub>2</sub>

Formula weight 575.62 Temperature/K 133(2)

Crystal system monoclinic

Space group I2/a

a/Å 12.1425(3) b/Å 13.6754(3) c/Å 18.9825(4)

 $\alpha$ / $^{\circ}$  90

 $\beta/^{\circ}$  105.144(2)

γ/° 90

Volume/Å <sup>3</sup> 3042.65(12)

Z 4

 $\begin{array}{lll} \rho_{calc} g/cm^{3} & 1.257 \\ \mu/mm^{-1} & 0.222 \\ F(000) & 1192.0 \end{array}$ 

Crystal size/mm<sup>3</sup>  $0.15 \times 0.15 \times 0.1$ 

Radiation Mo K $\alpha$  ( $\lambda = 0.71073$ )

 $2\Theta$  range for data collection/° 3.716 to 49.996

Index ranges  $-14 \le h \le 14, -16 \le k \le 16, -22 \le l \le 22$ 

Reflections collected 19630

Independent reflections  $2685 [R_{int} = 0.0308, R_{sigma} = 0.0197]$ 

Data/restraints/parameters 2685/18/183

Goodness-of-fit on  $F^2$  1.058

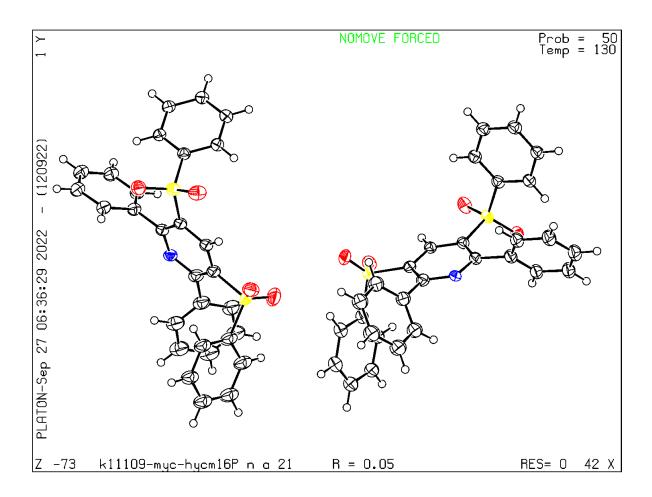
Final R indexes [I>= $2\sigma$  (I)] R<sub>1</sub> = 0.0363, wR<sub>2</sub> = 0.0959 Final R indexes [all data] R<sub>1</sub> = 0.0390, wR<sub>2</sub> = 0.0976

Largest diff. peak/hole / e Å -3 0.53/-0.46

### X-ray crystal data of compound 4j

**Sample preparation**: A solution of compound **4j** (30 mg) in CH<sub>2</sub>Cl<sub>2</sub> (10 mL) was placed in a tube (10 mL). EtOAc (2 mL) was added slowly to the vial with a dropper. The vial was closed with little cotton and kept at room temperature for 2 days. Then, colorless prisms were observed.

**Crystal measurement**: X-ray crystal structures were determined with a Bruker Enraf-Nonius single-crystal diffractometer (CAD4, Kappa CCD). Thermal ellipsoids are drawn at 50% probability level.



Temperature/K 130(2)

Crystal system orthorhombic

Space group Pna2<sub>1</sub>

a/Å 16.1179(3) b/Å 12.2499(2) c/Å 26.8761(5)

 $\begin{array}{ccc} \alpha/^{\circ} & & 90 \\ \beta/^{\circ} & & 90 \\ \gamma/^{\circ} & & 90 \end{array}$ 

Volume/Å <sup>3</sup> 5306.49(16)

Z 4

 $\rho_{caleg/cm^3}$  1.281  $\mu/mm^{-1}$  0.235 F(000) 2128.0

Crystal size/mm<sup>3</sup>  $0.4 \times 0.2 \times 0.2$ 

Radiation  $MoK\alpha (\lambda = 0.71073)$ 

 $2\Theta$  range for data collection/° 3.654 to 49.998

Index ranges  $-19 \le h \le 15, -14 \le k \le 12, -31 \le l \le 31$ 

Reflections collected 36279

Independent reflections  $8765 [R_{int} = 0.0266, R_{sigma} = 0.0280]$ 

Data/restraints/parameters 8765/361/649

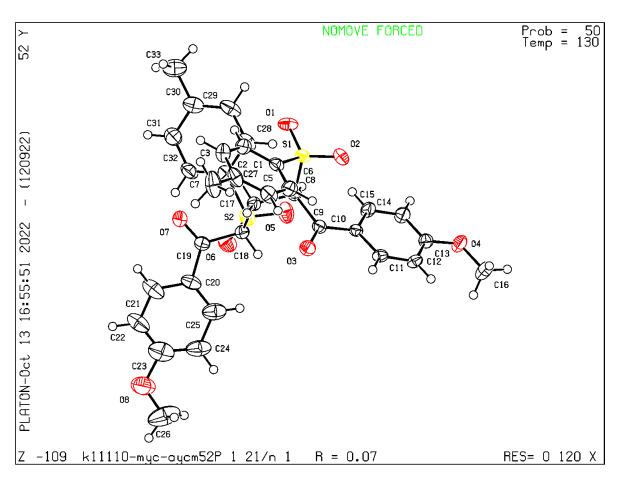
Goodness-of-fit on  $F^2$  1.060

Largest diff. peak/hole / e Å  $^{-3}$  0.47/-0.60 Flack parameter 0.070(19)

### X-ray crystal data of compound 5

**Sample preparation**: A solution of compound **5** (30 mg) in CH<sub>2</sub>Cl<sub>2</sub> (10 mL) was placed in a tube (10 mL). EtOAc (2 mL) was added slowly to the vial with a dropper. The vial was closed with little cotton and kept at room temperature for 2 days. Then, colorless prisms were observed.

**Crystal measurement**: X-ray crystal structures were determined with a Bruker Enraf-Nonius single-crystal diffractometer (CAD4, Kappa CCD). Thermal ellipsoids are drawn at 50% probability level.



Empirical formula C<sub>33</sub>H<sub>32</sub>O<sub>8</sub>S<sub>2</sub>

Formula weight 620.70 Temperature/K 130(2)

Crystal system monoclinic

Space group  $P2_1/n$ 

a/Å 12.3904(6) b/Å 21.7691(7) c/Å 12.4795(6)

α/° 90

β/° 117.735(6)

γ/° 90

Volume/Å <sup>3</sup> 2979.3(3)

Z 4

 $\begin{array}{lll} \rho_{calc} g/cm^{3} & 1.384 \\ \mu/mm^{-1} & 0.231 \\ F(000) & 1304.0 \end{array}$ 

Crystal size/mm<sup>3</sup>  $0.4 \times 0.4 \times 0.3$ 

Radiation MoK $\alpha$  ( $\lambda = 0.71073$ )

 $2\Theta$  range for data collection/° 3.742 to 49.994

Index ranges  $-14 \le h \le 14, -25 \le k \le 25, -14 \le l \le 14$ 

Reflections collected 59375

Independent reflections 5233 [ $R_{int} = 0.0810$ ,  $R_{sigma} = 0.0350$ ]

Data/restraints/parameters 5233/84/392

Goodness-of-fit on  $F^2$  1.026

Final R indexes [I>= $2\sigma$  (I)]  $R_1 = 0.0717$ ,  $wR_2 = 0.1723$ Final R indexes [all data]  $R_1 = 0.0830$ ,  $wR_2 = 0.1793$ 

Largest diff. peak/hole / e  $\mbox{Å}^{-3}$  1.48/-0.65