Ru-Catalyzed C-H Alkenylation to Arene Ring of Pirfenidone Using Pyridone as Directing Group

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Supporting Information

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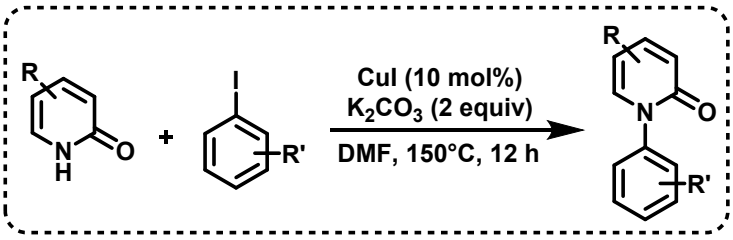
I. General information

Reactions were performed using borosil sealed tube vial with dry solvents under anhydrous conditions, unless otherwise noted. Anhydrous 1, 2-dichloroethane was used. Ethyl acetate (EtOAc) and petroleum ether were purchased commercially and were used without further purification, unless otherwise stated. Column chromatography was done in 60Å-120Å silica gel of Merck Company. All spectra ^{1}H NMR, ^{13}C NMR, recorded on Bruker AV 400 MHz spectrometer in $CDCl_3$ using as internal standards the residual $CHCl_3$ for ^{1}H NMR (δ = 7.26 ppm) and the deuterated solvent signal for ^{13}C NMR (δ = 77.16 ppm). The following abbreviations were used to describe peak splitting patterns when appropriate: s = singlet, d = doublet, t = triplet, q = quartet, dd = doublet of doublet, m = multiplet. Coupling constants (*J*) were reported in Hertz (Hz). HRMS analysis was performed using *Q*-TOF mass spectrometer of the SAIF Division in CSIR-CDRI Lucknow. IR analysis was also performed in SAIF Division. Reagents and starting materials were purchased from Aldrich, Alfa Aesar and other commercial sources and used without further purification unless otherwise noted.

General Procedure for Synthesis of N-aryl pyridone (A):



To a flame dried sealed tube containingpyridin-2(1H)-one (1.0 equiv) in dry DMF, was added corresponding aryl iodide (1.5 equiv). To the resulting solution was added anhydrous K_2CO_3(2.0 equiv.) and CuI (10 mol %). The reaction mixture was then heated to 150 °C. After 6 hours, the reaction mixture was cooled to room temperature, quenched with chilled H_2O, and extracted with ethyl acetate (three times). The combined organic layers were washed with brine, dried with anhydrous Na_2SO_4, and concentrated in vacuo. The crude residue was purified by column chromatography to afford the desired *N*-aryl pyridone derivatives.

General Procedure for Sulfonamide Synthesis (B): To a round-bottom flask equipped with a Teflon-coated magnetic stir bar were added the sulfonyl chloride (1.0 equiv) and anhydrous dichloromethane (3 mL/mmol). After the solution was stirred for 15 minutes at 0°C in an ice bath, the propargyl amine (1.1 equiv.), was added drop wise, followed by dropwise addition of triethylamine (2 equiv) and DMAP (10 mol%). The reaction was allowed to warm to room temperature and stir for 3 h. Upon completion, the reaction mixture was quenched with aqueous $NaHCO_3$ and extracted with DCM.The combined organic extracts were then dried with Na_2SO_4, filtered, and concentrated in vacuo. The crude sulfonamide product was purified by silica gel flash column chromatography.

General Procedure for Amide Synthesis from Carboxylic Acids (C): To carboxylic acid (1.0 equiv) in anhydrous DCM at 0 °C was added EDCI.HCl (1.5 equiv), and HOBt (1.5 equiv). The mixture was stirred for 10 min, before addition of the propargylamine (1.5 equiv). The reaction mixture was stirred at room temperature for 16 h, after that it was diluted with DCM. The organic phase was washed with H_2O and brine, dried over Na_2SO_4 and concentrated in vacuo. Crude product was purified by silica gel flash column chromatography.

General Procedure for Sonogashira Coupling (D): To a flame-dried 25-mL round-bottom flask equipped with a Teflon-coated magnetic stir bar were added $Pd(PPh_3)_2Cl_2$ (5 mol %), CuI (10 mol %), the corresponding terminal alkyne (1 mmol), and anhydrous THF:Et_3N (1:1). After the addition of the solvent, the solution was degassed for 10 min at room

temperature followed by the addition of appropriate aryl iodide (1.1 equiv) and the reaction was allowed to stir at room temperature. Upon completion, the reaction mixture was quenched with water and extracted with ethyl acetate. The combined organic extracts were then dried with Na_2SO_4, filtered, and concentrated in vacuo. The crude product was purified by silica gel column chromatography.

General Procedure for propargylation (E): To a solution of the corresponding starting material (for **3f**and **3h)**(1.0 mmol) in dry DMF was added K_2CO_3 (3.0 equiv). The resulting solution was stirred for 1 h at room temperature. Then, the propargyl bromide (2.0 equiv) was added dropwise through a syringe. The reaction mixture was stirred at room temperature for another 12 h. When the reaction was considered complete as determined by TLC analysis, the mixture was quenched with water and extracted with ethyl acetate. The combined organic layers were dried over anhydrous Na_2SO_4, concentrated under reduced pressure and purified by silica gel flash column chromatography.

General procedure for the preparation of alkyne from 2-butynoic acid via decarboxylative Sonogashira coupling (F):

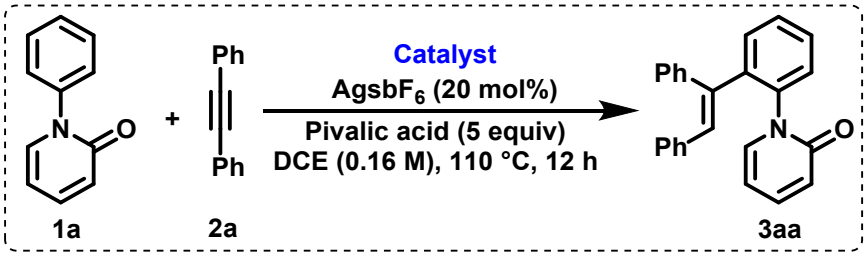
To a flame dried sealed tube was added $PdCl_2(PPh_3)_2$ (5 mol %), 1,4-bis(diphenylphosphino)butane (10 mol %), and DMSO (0.5 M). To the resulting solution was added aryl halide(for example, 5-bromo-1, 3-benzodioxole,6-bromoquinoline)(1 equiv.), 2-butynoic acid (1.5 equiv.), and DBU (3 equiv.). The reaction mixture was then heated to 110 °C. After 2 hours, the reaction mixture was cooled to room temperature, quenched with H_2O, and extracted with DCM. The combined organic layers were washed with H_2O and brine, dried with anhydrous Na_2SO_4, filtered, and concentrated in vacuo. The crude residue was purified by column chromatography to afford the desired alkynes.

Synthesis of precursors: The N-aryl pyridone derivatives **(1a, 1b, 3c, 3d, 3e)**[1] as the precursors for the starting were prepared via reported methods. Compound **2j**[2], **2l**[3]and compound (**2k**, **2o**, **4p, 4q, 4r, 4s, 4t, 4u, and 4v)**[4]were prepared from reported method.

[1]S. Yu, Y. Li, X. Zhou, H. Wang, L. Kong, and X. Li, *Org. Lett.* 2016, ***18***, 2812–2815.
[2] M. -N. Zhao, Y. Zhang, N. Ge, L. Yu, S. Wang, Z.-H. Rena, and Z.-H. Guan. *Org. Chem. Front*., 2020, ***7***, 763–767.
[3] S. Ozaki, S. Mitoh, and H. Ohmori, *Chem. Pharm. Bull*., 1995, ***43***, 1435-1440.
[4]Raziullah; M. Kumar, A. A. Khan, H. S. Dutta, A. Ahmad, J. Vaishnav, R. Kant, R. S. Ampapathi, and D. Koley, *Eur. J. Org. Chem.,* 2021, ***2021***, 2107–2113.

I. Optimizing the Reaction Conditions for alkenylation :

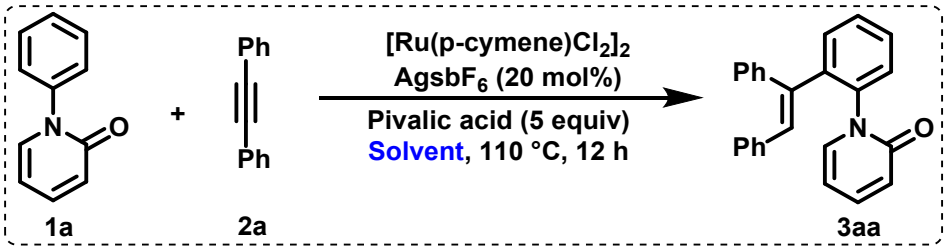
Table SI-1: Screening of Catalyst[a]



S. No.	Catalyst	Yield[b] (%)
1	Cp*CoCOI$_2$ (10 mol %)	n.d
2	**[Ru(p-cymene)Cl$_2$]$_2$ (5 mol %)**	**94**
3	Co(OAc)$_2$ (20 mol%)	n.d
4	Ni(OAc)$_2$ (20 mol%)	n.d
5	Pd(OAc)$_2$ (10 mol%)	n.d

[a]Reaction conditions: **1a** (0.25 mmol), **2a** (0.3 mmol), DCE (0.16 M), [b]NMR yields based on the **1a** using 1,3,5-trimethoxybenzene (0.25 mmol) as internal standard.

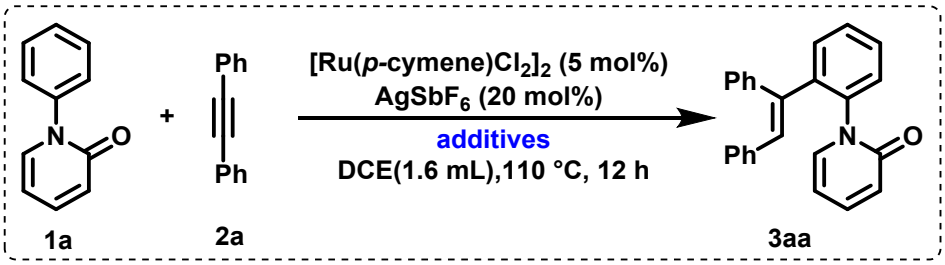
Table SI-2: Solvents Screening[a]



S. No.	Solvent	Yield[b] (%)
1	DCE	94
2	ACN	n.d
3	MeOH	14
4	EtOH	23
5	Isopropanol	17
6	Ethyl acetate	82
7	2-MeTHF	57
8	DMSO	n.d
9	Ethyl acetate	82
10	DMF	n.d
11	MTBE	10

[a]Reaction conditions: **1a** (0.25 mmol), **2a** (0.3 mmol), Solvent (0.16 M), [b]NMR yields using 1,3,5-trimethoxybenzene (0.25 mmol) as internal standard based on the (**1a**) starting material.

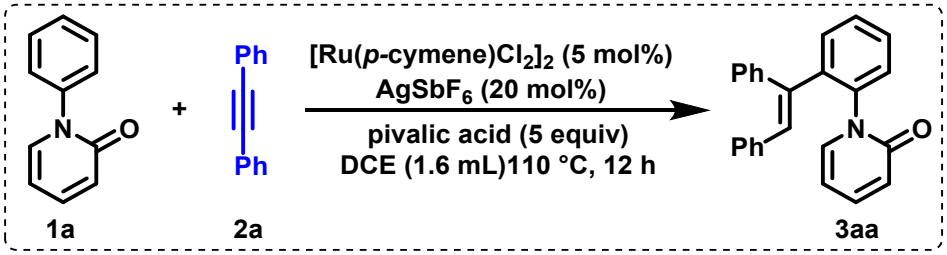
Table SI-3: Screening of Additives[a]



S. No.	Additive (equiv)	Yield [b](%)
1	AdCOOH (5)	87
2	Acetic acid (5)	88
3	Mesitoic acid (5)	49
4	Benzoic acid (5)	30
5	*p*-Toluene sulfonic acid (5)	n.d
6	Pivalic acid (1)	63
7	Pivalic acid (2)	69
8	Pivalic acid (3)	75
9	Pivalic acid (4)	82
10	**Pivalic acid (5)**	**94**

[a]Reaction conditions: **1a** (0.25 mmol), **2a** (0.3 mmol), DCE (0.16 M), [b]NMR yields using 1,3,5-trimethoxybenzene (0.25 mmol) as internal standard based on the (**1a**) starting material.

Table SI-4: Screening the amount of diphenylacetylene[a]

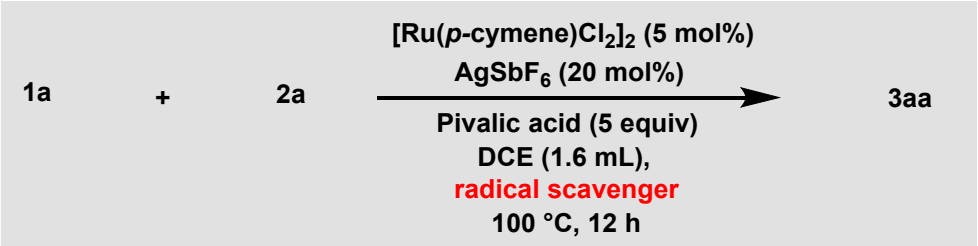


S. No.	2a (equiv)	Yield [b](%)
1	1.0	85
2	1.5	93
3	2	88

[a]Reaction conditions: **1a** (0.25 mmol), DCE (0.16 M), [b]NMR yields using 1,3,5-trimethoxybenzene (0.25 mmol) as internal standard based on **1a**.

Control experiments for mechanistic aspect:

SI-CE-a: Reaction in the Presence of Radical Scavengers

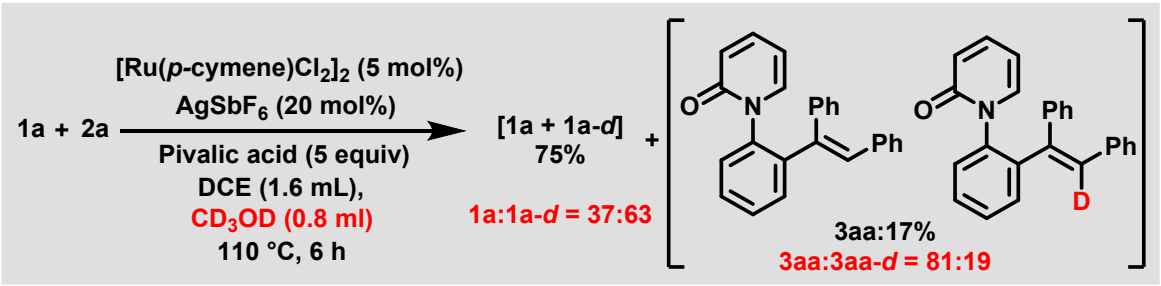


To a solution of **1a** (0.25 mmol) in 1, 2 dichloroethane (1.6 mL, 0.16 M), [Ru(*p*-cymene)Cl_2]$_2$(7.6 mg, 5 mol %) diphenylacetylene (0.30 mmol, 1.2 equiv.), $AgSbF_6$ (17 mg, 20 mol%) and pivalic acid (125 mg, 5 equiv) and radical scavenger (0.25 mmol, 1 equiv) were added in sealed tube vial and the vial was sealed. Next, the reaction mixture was kept at 100 ˚C (preheated oil bath) for 12 hours. After completion of the reaction, internal standard was added and the reaction mixture was quenched with saturated solution of sodium hydrogen carbonate. The reaction mixture was extracted with ethyl acetate (2 x 15 mL) and the organic layer was washed with brine solution followed by drying over Na_2SO_4. The organic layer was evaporated via rotavapor and yield was calculated by crude ^{1}HNMR analysis using internal standard.

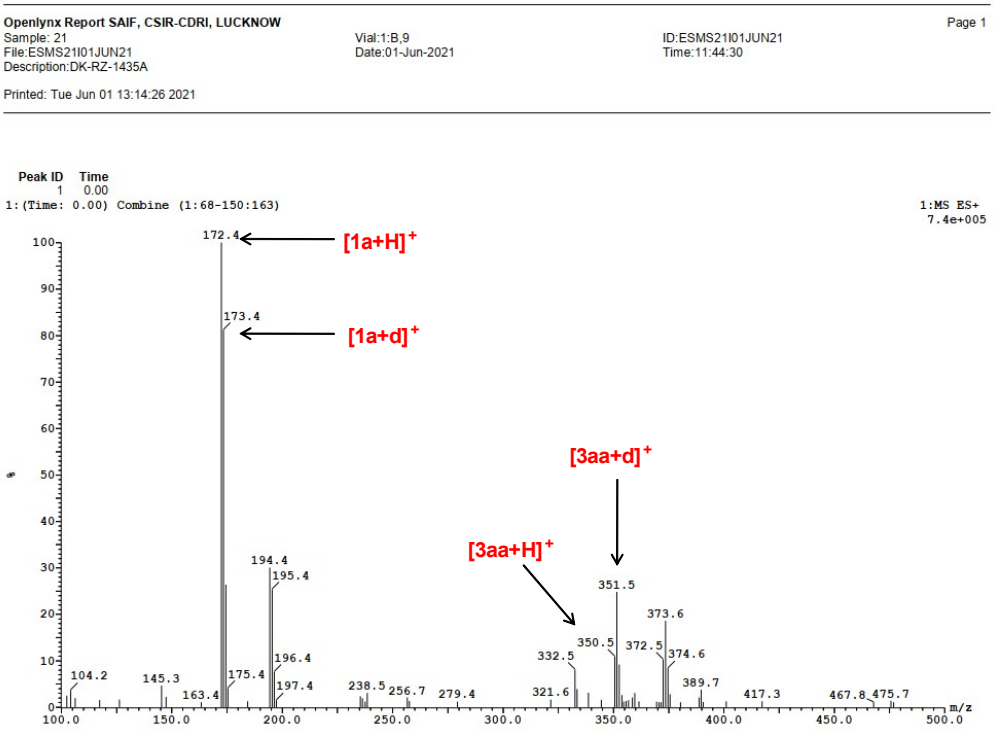
Entry	Radical scavenger	equivalent	(3aa) Yield (%)
1	TEMPO	1	67
2	BHT	1	74

H/D Exchange Experiments:

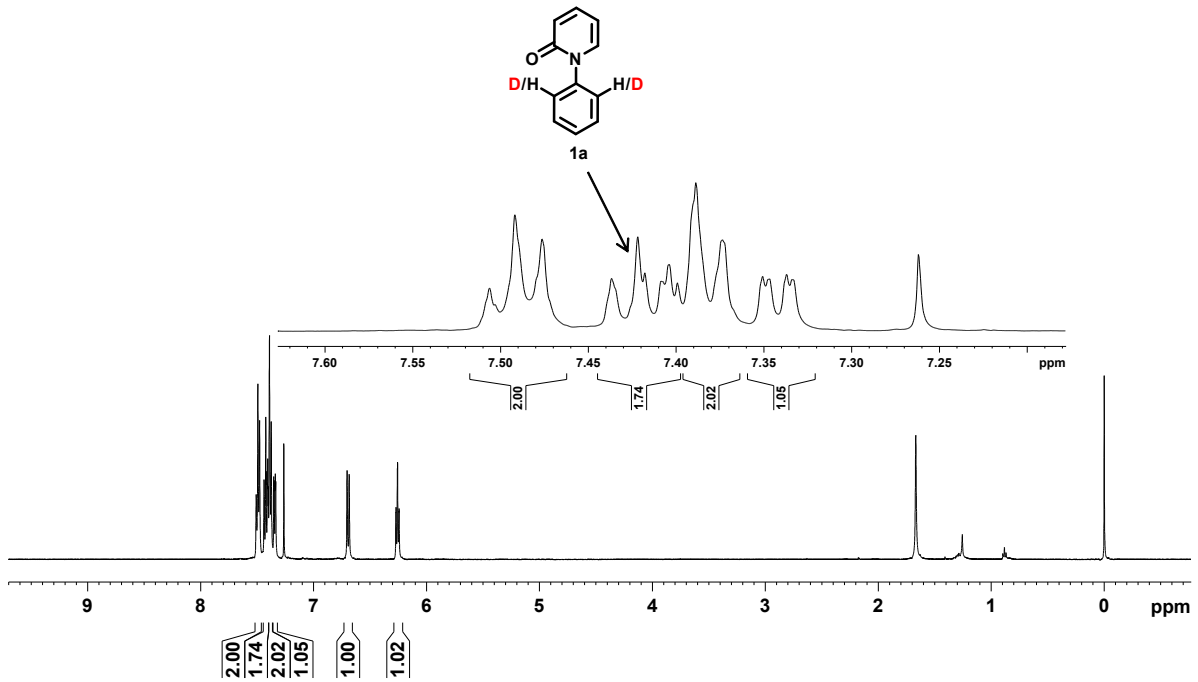
SI-CE-b: In the presence of Diphenylacetylene



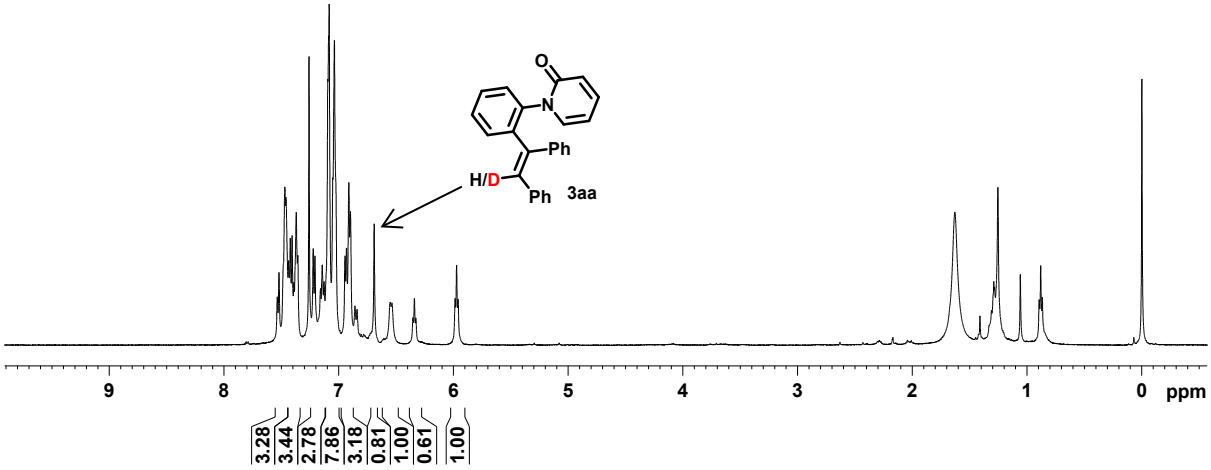
To a solution of **1a** (0.25 mmol) in 1,2 dichloroethane (1.6 mL, 0.16 M), [Ru(*p*-cymene)Cl_2]$_2$(7.6 mg, 5 mol%), diphenylacetylene (0.30 mmol, 1.2 equiv.), $AgSbF_6$ (17 mg, 20 mol%) and pivalic acid (125 mg, 5 equiv) and CD_3OD (0.8 mL) were added in sealed tube vial and the vial was sealed. Next, the reaction mixture was kept at 110 ˚C (preheated oil bath) for 3 hours. After that, the reaction mixture was quenched with saturated solution of sodiumhydrogen carbonate. The reaction mixture was extracted with ethyl acetate (2 x 15 mL) and the organic layer was washed with brine solution followed by drying over Na_2SO_4. The organic layer was evaporated via rotavapor and crude mixture was purified by silica gel (40 % Ethyl Acetate/Hexane) column chromatography to yield the corresponding **1a**in 75% (**1a:1a-*d*= 37:63**) and **3aa**in 17% (**3aa:3aa-*d* = 81:19**) yields.



ESI-mass spectrum of **3aa** (+ **3aa-*d***) obtained through experiment SI-CE-b

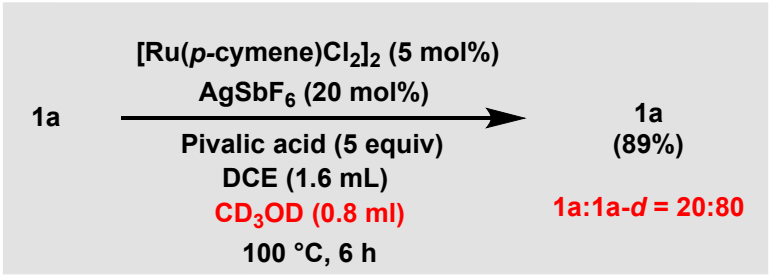


^{1}H NMR of recovered **1a** (+ **1a**-*d*) in $CDCl_3$ after experiment SI-CE-b (400 MHz)

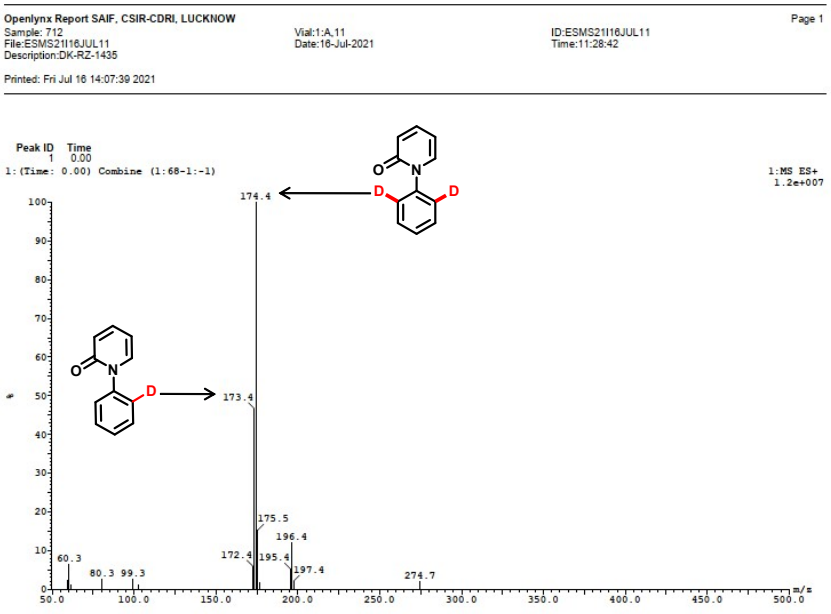


^{1}H NMR of **3aa**(+ **3aa**-***d***) in $CDCl_3$ after experiment SI-CE-b (400 MHz)

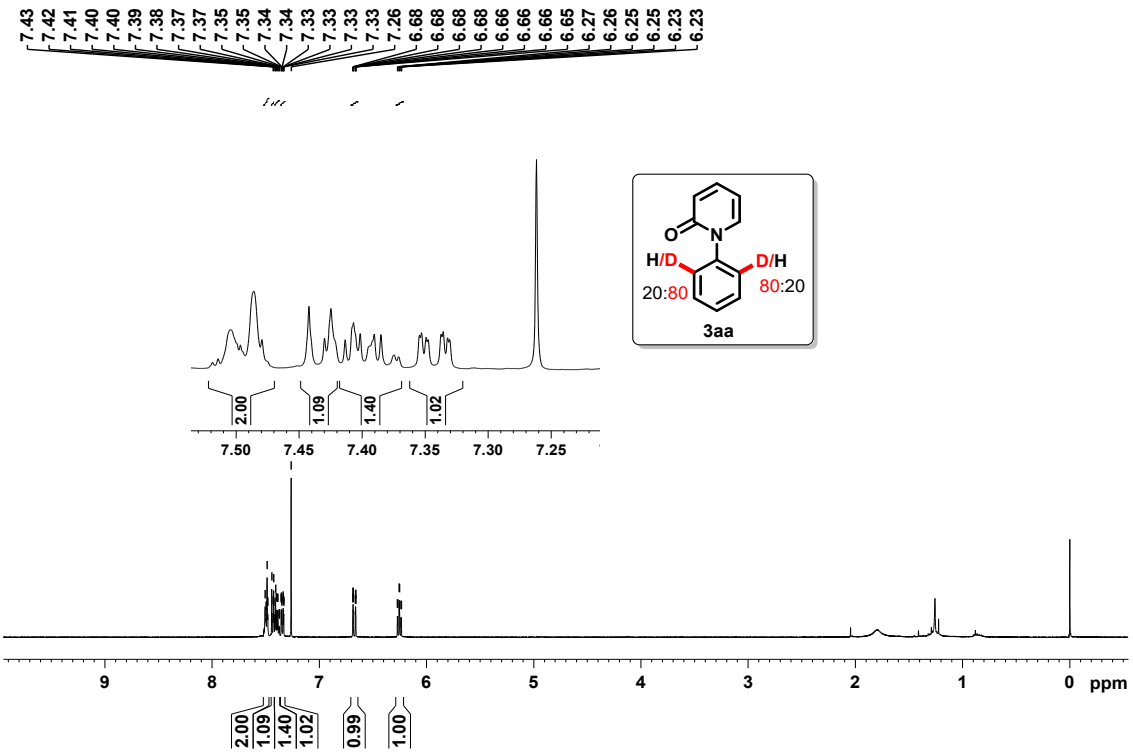
SI-CE-c: In the absence of diphenylacetylene



To a solution of **1a** (0.25 mmol) in 1, 2 dichloroethane (1.6 mL, 0.16 M), [Ru(*p*-cymene)Cl_2]$_2$ (7.6 mg, 5 mol %), $AgSbF_6$ (17 mg, 20 mol%) and pivalic acid (125 mg, 5 equiv) and CD_3OD (0.8 mL) were added in sealed tube vial and the vial was sealed. Next, the reaction mixture was kept at 110 ˚C (preheated oil bath) for 6 hours. After that, the reaction mixture was quenched with saturated solution of sodium hydrogen carbonate. The reaction mixture was extracted with ethyl acetate (2 x 15 mL) and the organic layer was washed with brine solution followed by drying over Na_2SO_4. The organic layer was evaporated via rotavapor and crude mixture was purified by silica gel (50% Ethyl Acetate/Hexane) column chromatography to yield the corresponding **1a** in 89% (**1a:1a*d* = 20:80**).

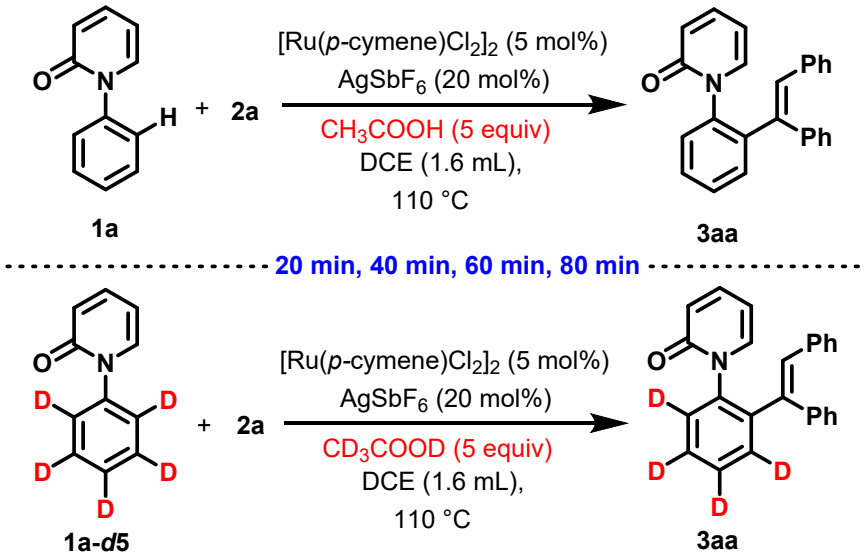


ESI-mass spectrum of **3aa** (+ **3aa-*d***) obtained through experiment SI-CE-c



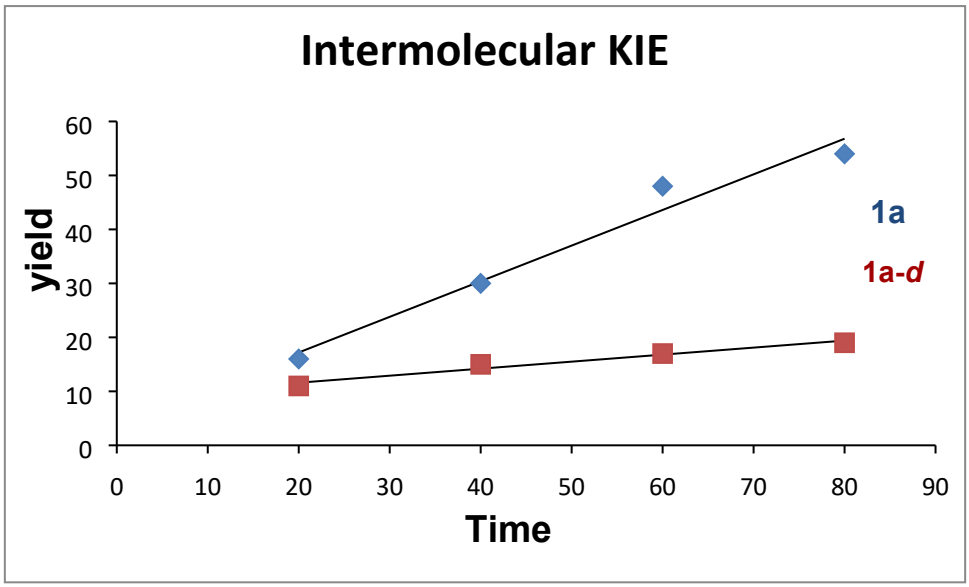
^{1}H NMR of recovered **1a** (+ **1a-*d***) in $CDCl_3$ after experiment SI-CE-c (400 MHz)

SI-CE-d: Independent Kinetic Isotope Effect Study:



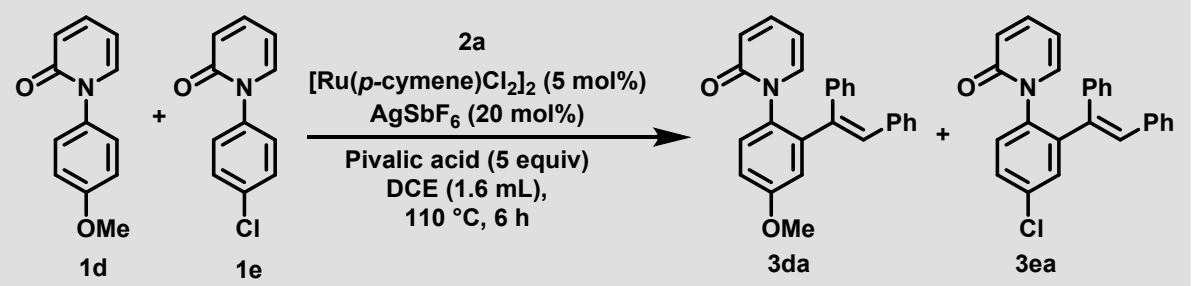
To a solution of either **1a** (0.25 mmol) or **1a-*d*** in 1,2 dichloroethane (1.6 mL, 0.16 M), [Ru(*p*-cymene)Cl_2]$_2$(7.6 mg, 5 mol%) diphenylacetylene (0.30 mmol, 1.2 equiv.), $AgSbF_6$ (17 mg, 20 mol%) and acetic acid (for **1a**)/acetic acid-d_4(for **1a-*d***) (29 µl, 5 equiv) were added in sealed tube vial and the vial was sealed. Next, the reaction mixture was kept at 100 ˚C (preheated oil bath) for the designated time (20 min, 40 min, 60 min, and 80 min). After completion of the reaction, the reaction mixture was quenched with saturated solution of sodium hydrogen carbonate. The reaction mixture was separately extracted with ethyl acetate (2 x 15 mL) and the organic layer was washed with brine solution followed by drying over Na_2SO_4. The organic layer was evaporated via rotavapor and crude mixture was purified by silica gel column chromatography to yield the corresponding trisubstituted olefin for the designated time.

Time (min / Yield (%)	20	40	60	80
3aa from **1a**	16	30	48	54
3aa from **1a-*d***	11	15	17	19

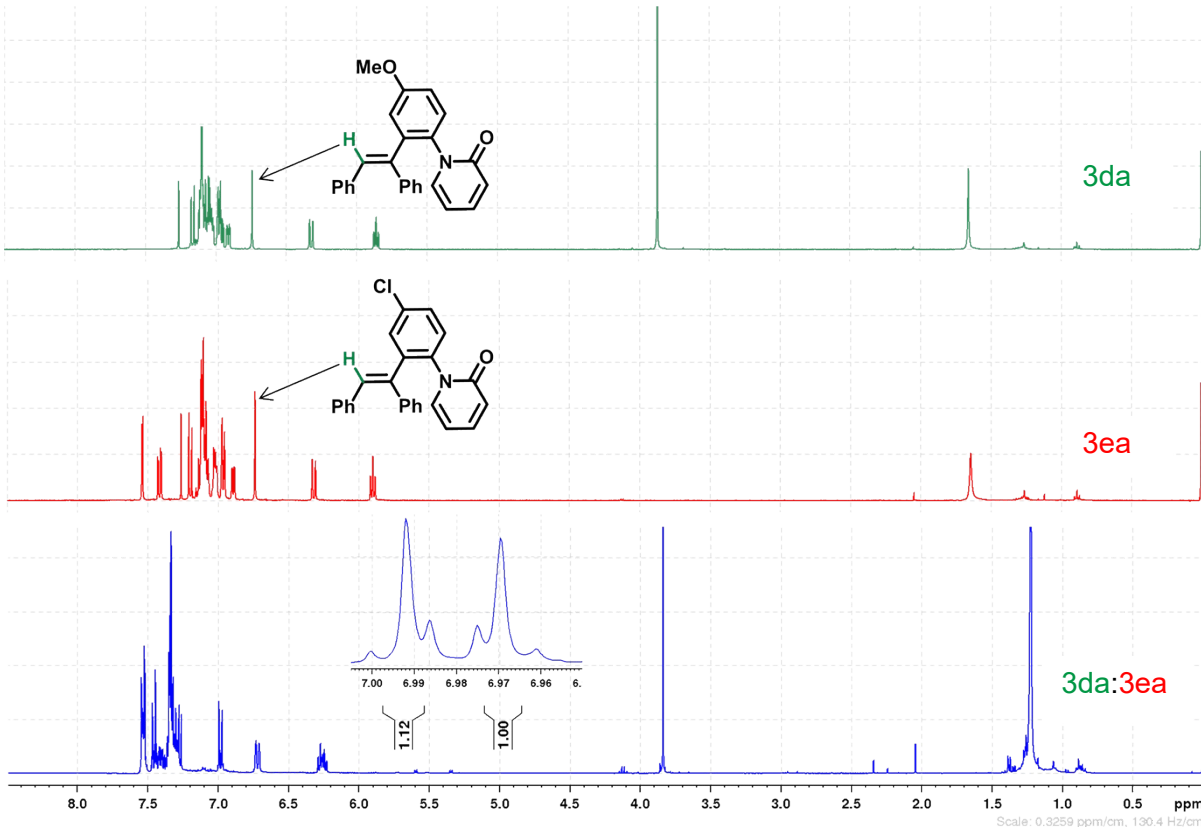


KIE = 5.07

SI-CE-e: Competitive experiment with *N*-aryl pyridone derivative:



To a solution of 1-phenylpyridin-2(1H)-one **1d** (0.25 mmol) and **1e** (0.25 mmol) in 1, 2 dichloroethane (1.6 mL, 0.16 M), [Ru(*p*-cymene)Cl_2]$_2$ (7.6 mg, 5 mol%) diphenylacetylene (0.30 mmol, 1.2 equiv.), $AgSbF_6$ (17 mg, 20 mol%) and pivalic acid (125 mg, 5 equiv)were added in sealed tube vial and the vial was sealed. Next, the reaction mixture was kept at 100 ˚C (preheated oil bath) for 6 hours. After that, the reaction mixture was quenched with saturated solution of sodium hydrogen carbonate. The reaction mixture was extracted with ethyl acetate (2 x 15 mL) and the organic layer was washed with brine solution followed by drying over $Na_2SO_4$and yield was calculated by ^{1}H NMR of the corresponding hydroarylated product.



Crude ^{1}H NMR of the experiment SI-CE-e (400 MHz) [compared with **3da** and **3ea**]

X-ray crystal structure

Crystallographic summary of compound 3aa, in figure 1 and table 1

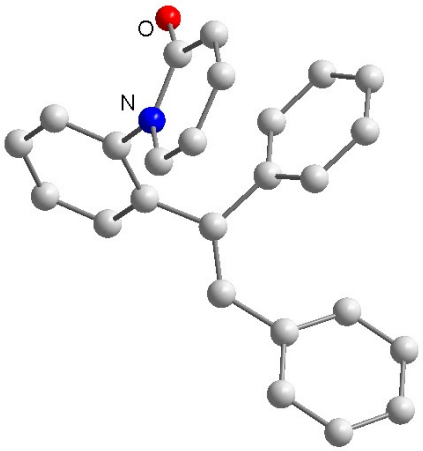


Figure1. ORTEP diagram drawn with 50% ellipsoid probability for non-H atoms of the crystal structure of compound **3aa** determined at 273 K.

Crystallization:Crystals of compound **3aa,** was grown from the solvent 40% (EthylAcetate/Hexane) by slow evaporation method.

X-Ray Data Collection and Structure Refinement Details:

A good quality single crystals of size 0.26 x 0.18 x 0.12 mm, was selected under a polarizing microscope and was mounted on a glass fiber for data collection. Single crystal X-ray data for compound-**3aa**, was collected on a CCD Bruker SMART APEX-II 3 circle diffractometer equipped with the APEX2 goniometer and enhanced sensitivity (HG) APEX2 CCD detector in the 4x4 bin mode using the monochromated Mo-Kα radiation generated from the microfocus sealed tube MicroMax-003 X-ray generator equipped with specially designed confocal multilayer optics. Data collection was performed using ω-scans of 0.5^{o} steps at273 (2) K. Cell determination, data collection and data reduction was performed using the RigakuCrystalClear-SM Expert 2.1 b24[5] software. Structure solution and refinement were performed by using SHELXTL-NT[6]. Refinement of coordinates and anisotropic thermal parameters of non-hydrogen atoms were carried out by the full-matrix least-squares method. The hydrogen atoms attached tocarbon atoms were generated with idealized geometries and isotropically refined using a riding model.

Table1. X-ray crystallographic data for compound **3aa**.

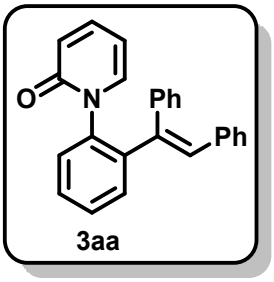
[5] CrystalClear 2.1, Rigaku Corporation, Tokyo, Japan.
[6] G. M. Sheldrick, *ActaCrystallogr. Sect. A.,* 2008, ***64***, 112–122.

Compound	**3aa**
Empirical formula	$C_{25}H_{19}NO$
Formula weight	349.44
Crystal System	Orthorhombic
Space group	*P 21 21 21*
a (Å)	8.1351(4)
b (Å)	10.7687(6)
c (Å)	20.8228(11)
α (°)	90.00
β(°)	90.00
γ (°)	90.00
V (Å^3)	1824.17(17)
Z	4
D_c (g/cm^3)	1.2723
F_{000}	736.3116
Temperature (K)	100 (2)
Radiation (λ,Å)	0.71073
θ_{max} (°)	28.35
Total reflections	4546
Unique reflections	4253
Reflections [$I > 2\sigma(I)$]	37492
Parameters	244
R_{int}	0.0439
Goodness-of-fit	1.0493
R [$F^2 > 2\sigma(F^2)$]	0.0395
wR (F^2, all data)	0.0916
CCDC No.	2046703

General procedure for the synthesis of Trisubstituted olefin (G): To a solution of *N*-aryl pyridone (0.25 mmol) in 1,2 dichloroethane (1.6 mL, 0.16 M), [Ru(*p*-cymene)Cl_2]$_2$(7.6 mg, 5 mol%) diphenylacetylene (0.30 mmol, 1.2 equiv.), $AgSbF_6$ (17 mg, 20 mol%) and pivalic acid (125 mg, 5 equiv) were added in sealed tube vial and the vial was sealed. Next, the reaction mixture was kept at 110 ˚C (preheated oil bath) for 12 hours. After completion of the reaction, the reaction mixture was quenched with saturated solution of sodium hydrogen carbonate. The reaction mixture was extracted with ethyl acetate (2 x 15 mL) and the organic layer was washed with brine solution followed by drying over Na_2SO_4. The organic layer was evaporated via rotavapor and crude mixture was purified by silica gel column chromatography to yield the corresponding trisubstituted olefin.

Synthesis and characterization of compounds:

(E)-1-(2-(1,2-diphenylvinyl) phenyl) pyridin-2(1H)-one (3aa):



3aa was prepared according to general procedure (**G**) using N-aryl pyridine **1a** (43 mg, 0.25 mmol), diphenylacetylene **2a** (53 mg, 0.30 mmol).The crude reaction mixture was purified by column chromatography using 50% EtOAc/Hexane to afford **3aa** (82 mg, 94%) as a white solid.

R_f: 0.50 (silica gel, 60% EtOAc/Hexane);

M.P: 118 - 120 ºC.

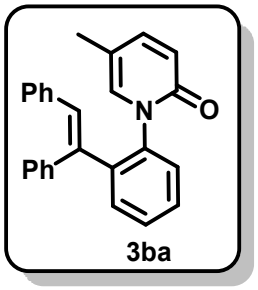
IR (in KBr, cm^{-1}): ν_{max}:. 3003, 2361, 1795, 1664, 1591, 1559, 1537, 841;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.53 – 7.50 (m, 1H), 7.48 − 7.41 (m, 2H), 7.26 –7.23 (m, 1H), 7.13 – 7.04 (m, 7H), 7.04 – 7.0 (m, 2H), 6.99 – 6.93 (m, 3H), 6.71 (s, 1H), 6.23 (dt, *J* = 0.80 Hz, 9.28 Hz, 1H), 5.89 (td, *J* = 6.71 Hz, 1.28 Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.1, 141.9, 139.6, 139.3, 139.5, 138.2, 137.0, 131.9, 131.7, 129.5, 129.1, 128.8, 128.6, 128.3, 128.0, 127.4, 127.1, 121.6, 105.3.

HRMS (ESI): calcd for $C_{25}H_{20}NO^+$ $[M+H]^+$ 350.1545, found 350.1547.

(E)-1-(2-(1,2-diphenylvinyl) phenyl)-5-methylpyridin-2(1H)-one (3ba):



3ba

3ba was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), diphenylacetylene **2a** (53 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 50% EtOAc/Hexane to afford **3ba** (70 mg, 77%) as anoff white solid.

R_f: 0.50 (silica gel, 60% EtOAc/Hexane);

M.P: 138 - 140 ºC.

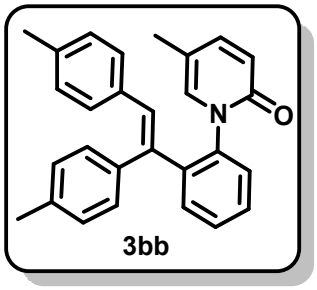
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2362, 1742, 1673, 1648, 1609, 826, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.56 – 7.51 (m, 1H), 7.48 − 7.40 (m, 2H), 7.24 – 7.19 (m, 1H), 7.13 – 7.01 (m, 8H), 6.98– 6.92 (m, 3H), 6.75 (s, 1H), 6.57 (s, 1H), 6.30 (d, J = 9.33 Hz, 1H), 1.81 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.4, 142.4, 142.0, 139.7, 139.2, 137.0, 135.6, 131.8, 131.6, 129.6, 129.5, 129.1, 128.9, 128.4, 128.1, 128.0, 127.2, 120.7, 114.3, 16.8.

HRMS (ESI): calcd for $C_{26}H_{23}NO^+$ $[M+H]^+$ 364.1701, found 364.1700.

(E)-1-(2-(1, 2-di-p-tolylvinyl) phenyl)-5-methylpyridin-2(1H)-one (3bb):



3bb was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1,2-di-*p*-tolylethyne **2b** (62 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 15% Acetone/Hexane to afford **3bb** (55 mg, 56%) as a white solid.

R_f: 0.50 (silica gel, 40% Acetone/Hexane);

M.P: 80 - 82 ºC.

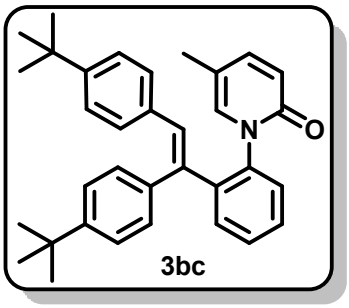
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2361, 1794, 1772, 1741, 1699, 1539, 1514, 823, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.50 (dd, *J* = 7.45 Hz, 2.03 Hz, 1H), 7.45 − 7.38 (m, 2H), 7.20 (dd, *J* = 7.16 Hz, 1.70 Hz, 1H), 6.96 – 6.90 (m, 5H), 6.89 – 6.82 (m, 4H), 6.65 (s, 1H), 6.57 (brs, 1H), 6.30 (d, *J* = 9.28 Hz, 1H), 2.26 (s, 3H), 2.24 (s, 3H), 1.80 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.4, 142.2, 142.0, 139.3, 138.6, 136.5, 135.5, 134.3, 131.5, 131.2, 129.3, 129.3, 128.8, 128.7, 128.5, 128.5, 128.3, 120.8, 113.7, 21.2, 21.1, 16.6.

HRMS (ESI): calcd for $C_{28}H_{27}NO^+$ $[M+H]^+$ 392.2014, found 392.2026.

(E)-1-(2-(1,2-bis(4-(tert-butyl) phenyl) vinyl) phenyl)-5-methylpyridin-2(1H)-one (3bc):



3bc was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1,2-bis(4-(tert-butyl)phenyl)ethyne **2c** (87 mg, 0.30 mmol).The crude reaction mixture was purified by column chromatography using 10% Acetone/Hexane to afford **3bc** (25 mg, 21%) as a colourless liquid.

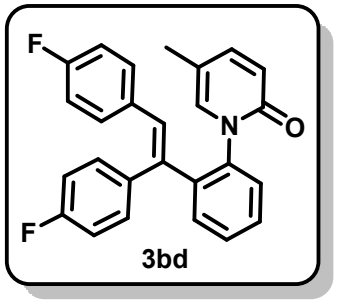
R_f: 0.50 (silica gel, 20% Acetone/Hexane);

IR (in KBr, cm^{-1}): ν_{max}: 2967, 2361, 1741, 1651, 1539, 1514, 1491, 771, 750;
^{1}H NMR (400 MHz,$CDCl_3$): δ 7.53 – 7.49 (m, 1H), 7.46 − 7.36 (m, 2H), 7.23 – 7.18 (m, 1H), 7.14 – 7.07 (m, 4H), 7.02 – 6.96 (m, 2H), 6.94 (dd, *J* = 9.3Hz, 2.6 Hz, 1H), 6.92 −6.88 (m, 2H), 6.6 (s, 1H), 6.60 (brs, 1H), 6.27 (d, *J* = 9.4 Hz, 1H), 1.82 (d, *J* = 0.7 Hz, 3H), 1.27(s, 9H), 1.25 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.4, 1501, 150.0, 142.4, 142.1, 139.4, 138.7, 136.3, 135.6, 134.3, 131.7, 131.3, 129.2, 129.1, 128.9, 128.5, 124.9, 124.9, 121.1, 113.7, 34.6, 31.3, 17.0.

HRMS (ESI): calcd for $C_{34}H_{39}NO^+$ $[M+H]^+$ 476.2953, found 476.2956.

(E)-1-(2-(1, 2-bis (4-fluorophenyl) vinyl) phenyl)-5-methylpyridin-2(1H)-one (3bd):



3bd was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1,2-bis(4-fluorophenyl)ethyne **2d** (64 mg, 0.30 mmol).The crude reaction mixture

was purified by column chromatography using 20% Acetone/Hexane to afford **3bd** (78 mg, 78%) as a white solid.

R_f: 0.50 (silica gel, 50% Acetone/Hexane);

M.P: 139 - 141 ºC.

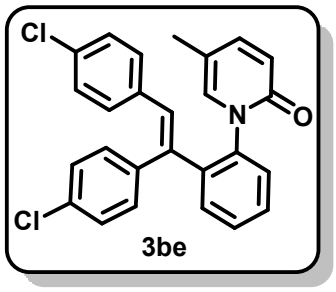
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2362, 1771, 1677, 1540, 1512, 1457, 827, 871;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.53 – 7.42 (m, 3H), 7.24 − 7.19 (m, 1H), 7.02 – 6.95 (m, 3H), 6.94 – 6.88 (m, 2H), 6.84 – 6.74 (m, 4H), 6.68 (s, 1H), 6.59 (s, 1H), 6.31 (d, *J* = 9.3 Hz, 1H), 1.86 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.3, 160.9 (d, *J* = 38.9 Hz), 142.3, 141.6, 139.4, 138.7, 135.4, 135.1 (d, *J* = 3.6 Hz), 134.0 (d, *J* = 266.0 Hz), 131.5, 131.4, 131.3, 131.2, 131.1, 130.7, 129.1, 128.5, 121.1, 115.3, 115.2, 113.1, 115.0, 141.1, 16.8.

HRMS (ESI): calcd for $C_{26}H_{21}F_2NO^+$ $[M+H]^+$ 400.1513, found 400.1527.

(E)-1-(2-(1, 2-bis (4-chlorophenyl) vinyl) phenyl)-5-methylpyridin-2(1H)-one (3be):



3be

3be was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1,2-bis(4-chlorophenyl)ethyne **2e** (74 mg, 0.30 mmol).The crude reaction mixture was purified by column chromatography using 20% Acetone/Hexane to afford **3be** (80 mg, 74%) as a white solid.

R_f: 0.50 (silica gel, 40% Acetone/Hexane);

M.P: 104 - 106 ºC.

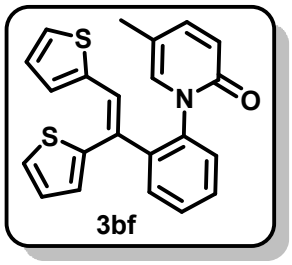
IR (in KBr, cm^{-1}): ν_{max}: 3002, 2363, 2321, 1770, 1646, 1533, 1515, 1463, 823, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.52 – 7.41 (m, 3H), 7.24 − 7.17 (m, 1H), 7.12 – 7.02 (m, 4H), 7.02 – 6.92 (m, 3H), 6.99 – 6.83 (m, 2H), 6.69 (s, 1H), 6.53 (brs, 1H), 6.32 (d, *J* = 9.3 Hz, 1H), 1.84 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.3, 142.4, 141.4, 139.5, 139.3, 137.6, 135.3, 135.2, 133.3, 133.0, 131.5, 131.0, 130.8, 129.3, 129.2, 128.5, 128.5, 128.4, 121.1, 114.3, 16.8.

HRMS (ESI): calcd for $C_{26}H_{21}Cl_2NO^+$ $[M+H]^+$ 432.0922, found 432.0921.

(E)-1-(2-(1, 2-bis (4-chlorophenyl) vinyl) phenyl)-5-methylpyridin-2(1H)-one (3bf):



3bf

3bf was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1, 2-di(thiophen-2-yl)ethyne **2f** (57 mg, 0.30 mmol).The crude reaction mixture was purified by column chromatography using 15% Acetone/Hexane to afford **3bf** (55 mg, 59%) as a brown liquid.

R_f: 0.50 (silica gel, 50% Acetone/Hexane);

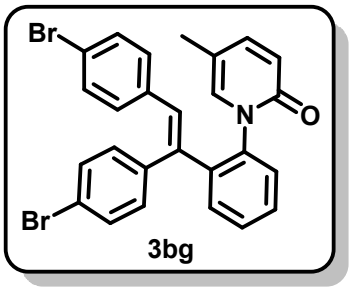
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2320, 1675, 1515, 1456, 771, 695;

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.65 – 7.57 (m, 1H), 7.56 − 7.46 (m, 3H), 7.18 (s, 1H), 7.13 – 7.07 (m, 2H), 7.01 (dd, *J* = 9.4, 2.6 Hz, 1H), 6.95 – 6.83 (m, 3H), 6.97 – 6.57 (m, 2H), 6.29 (d, *J* = 9.15 Hz, 1H), 1.75 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.2, 142.3, 135.3, 132.4, 129.8, 129.7, 129.5, 128.8, 128.3, 127.9, 127.7, 126.8, 126.4, 124.4, 120.8, 120.6, 113.4, 16.8.

HRMS (ESI): calcd for $C_{22}H_{19}NOS_2^+$ $[M+H]^+$ 376.0830, found 376.0836.

(E)-1-(2-(1, 2-bis (4-bromophenyl)vinyl)phenyl)-5-methylpyridin-2(1H)-one (3bg):



3bg was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1, 2-bis(4-bromophenyl)ethyne **2g** (99.9 mg, 0.30 mmol).The crude reaction mixture was purified by column chromatography using 10% Acetone/Hexane to afford **3bg** (92 mg, 71%) as a white solid.

M.P: 77 - 79 ºC.

R_f: 0.50 (silica gel, 40% Ethyl acetate/Hexane);

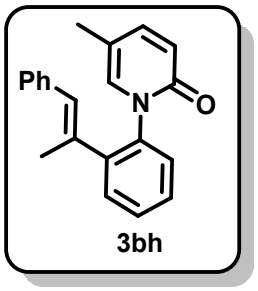
IR (in KBr, cm^{-1}): ν_{max}:. 3000, 2359, 1675, 1598, 1531, 1491, 824, 757;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.52 – 7.43 (m, 3H), 7.27 − 7.17 (m, 5H), 6.99 (dd, *J* = 9.48 Hz, 2.70 Hz,1H), 6.89 (d, *J* = 8.42 Hz, 2H), 6.81(d, *J* = 8.50 Hz, 2H), 6.67(s, 1H), 6.52 (brs, 1H), 6.32 (d, *J* = 9.48 Hz, 1H), 1.84 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.3, 142.4, 141.4, 139.4, 138.1, 135.7, 135.3, 131.5, 131.3, 131.2, 131.1, 131.0, 129.4, 129.2, 128.4, 121.5, 121.3, 121.0, 114.3, 16.8.

HRMS (ESI): calcd for $C_{26}H_{20}Br_2NO^+$ $[M+H]^+$ 519.9912, found 519.9915.

(E)-5-methyl-1-(2-(1-phenylprop-1-en-1-yl) phenyl) pyridin-2(1H)-one (3bh):



3bh was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), prop-1-yn-1-ylbenzene **2h** (35 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 20% Acetone/Hexane to afford **3bh** (61 mg, 81%) as a white solid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

M.P: 122 - 124 ºC.

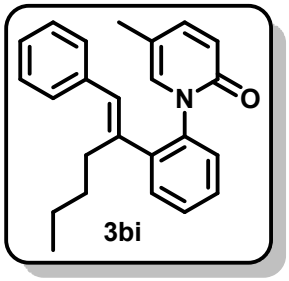
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2360, 2322, 1794, 1678, 1540, 1514, 1455, 772, 695;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.49 – 7.37 (m, 3H), 7.34 − 7.29 (m, 3H), 7.25 – 7.20 (m, 2H), 7.19 – 7.15 (m, 2H), 7.04 – 7.0 (m, 1H), 6.59 (d, *J* = 9.4 Hz,1H), 6.41 (s, 1H), 2.05 (d, *J* = 0.93 Hz, 3H), 2.0 (d, *J* = 1.4, Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.2, 142.9, 142.8, 138.4, 137.7, 136.1, 135.6, 130.8, 129.7, 129.0, 128.9, 128.3, 128.2, 128.1, 126.1, 126.8, 121.5, 114.5, 18.4, 17.0.

HRMS (ESI): calcd for $C_{21}H_{21}NO^+$ $[M+H]^+$ 302.1545, found 302.1556.

(E)-5-methyl-1-(2-(1-phenylpent-1-en-1-yl) phenyl) pyridin-2(1H)-one (3bi):



3bi was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 4hex-1-yn-1-ylbenzene **2i** (48 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 10% Acetone/Hexane to afford **3bi** (55 mg, 64%) as a white solid.

R_f: 0.50 (silica gel, 20% Acetone/Hexane);

M.P: 84 - 86 ºC.

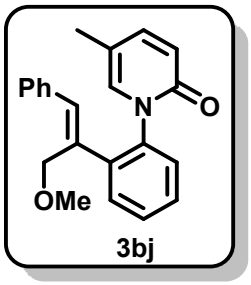
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2361, 2322, 1771, 1676, 1540, 1516, 1457, 771, 750;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.45 – 7.38 (m, 3H), 7.37 − 7.28 (m, 3H), 7.25 – 7.18 (m, 2H), 7.14 (d, *J* = 7.4 Hz, 2H), 7.01 (brs, 1H), 6.58 (d, *J* = 9.26 Hz, 1H), 6.49 (s, 1H), 2.56 – 2.39 (m, 1H), 2.18 – 2.07 (m, 1H), 2.04 (s, 3H), 1.42 – 1.10 (m, 4H), 0.76 (t, *J* = 7.15 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.2, 142.7, 141.1, 140.7, 138.7, 136.3, 131.4, 130.4, 128.8, 128.7, 128.6, 128.3, 128.0, 126.7, 121.4, 114.1, 30.9, 30.6, 22.8, 17.0, 13.9.

HRMS (ESI): calcd for $C_{24}H_{27}NO^+$ $[M+H]^+$ 344.2014, found 344.2017.

(E)-1-(2-(3-methoxy-1-phenylprop-1-en-1-yl) phenyl)-5-methylpyridin-2(1H)-one (3bj):



3bj

3bj was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), (3-methoxyprop-1-yn-1-yl) benzene **2j** (44 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 25% Acetone/Hexane to afford **3bj** (60 mg, 72%) as a brown solid.

R_f: 0.50 (silica gel, 50% Acetone/Hexane);

M.P: 88 - 90 ºC.

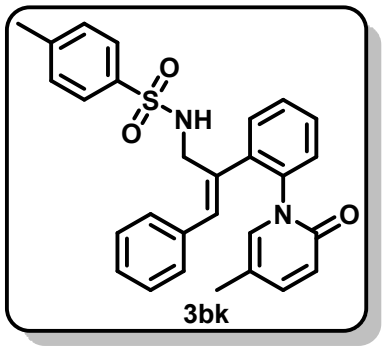
IR (in KBr, cm^{-1}): $\nu_{max:}$ 3000, 2362, 2322, 1794, 1677, 1540, 1516, 1457, 771, 747;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.58 (m, 1H), 7.47 − 7.38 (m, 2H), 7.38 – 7.31 (m, 1H), 7.31 – 7.27 (m, 2H), 7.25–7.20 (m, 2H), 7.17 – 7.11 (m, 3H), 6.61 (s, 1H), 6.55 (d, *J* = 9.51 Hz, 1H), 4.12 (q, *J* = 25.5, 10.5 Hz,2H), 3.26 (s, 3H), 2.06 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.3, 142.8, 139.9, 139.0, 136.8, 135.3, 135.0, 129.9, 128.9, 128.8, 128.3, 128.2, 128.2, 127.4, 121.2, 114.2, 58.5, 17.0.

HRMS (ESI): calcd for $C_{22}H_{23}NO_2^+$ $[M+H]^+$ 332.1651, found 332.1659.

(E)-4-methyl-N-(3-(2-(5-methyl-2-oxopyridin-1(2H)-yl) phenyl)-3-phenylallyl) benzenesulfonamide (3bk):



3bk

3bk was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 4-methyl-N-(3-phenylprop-2-yn-1-yl) benzenesulfonamide **2k** (75 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Acetone/Hexane to afford **3bk** (75 mg, 64%) as a white solid.

$R_{f:}$ 0.50 (silica gel, 40% Acetone/Hexane);

M.P: 150 - 152 ºC.

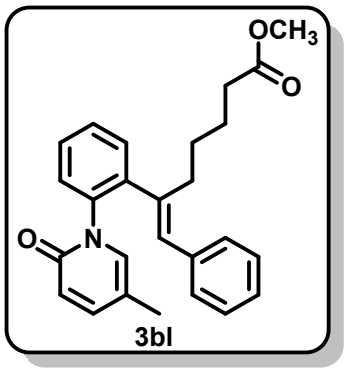
IR (in KBr, cm^{-1}): $\nu_{max:}$ 3008, 2360, 2322, 1990, 1964, 1772, 1741, 1598, 1558, 1539, 830, 772;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.61 (d, *J* = 8.2 Hz,2H), 7.42 − 7.33 (m, 2H), 7.28 – 7.24 (m, 3H), 7.23– 7.21 (m, 3H), 7.18–7.14 (m, 2H), 7.11(d, *J* = 8.10 Hz, 2H), 7.0−6.95 (m, 2H), 6.57 (d, *J* = 9.40 Hz, 1H), 6.18 (s, 1H), 4.11 – 3.81 (m, 2H), 2.40 (s,3H), 2.09 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.8, 143.3, 142.2, 139.5, 138.3, 136.0, 135.8, 134.3, 129.2, 128.7, 128.4, 128.3, 128.2, 127.6, 127.5, 127.2, 121.4, 43.7, 21.4, 17.0.

HRMS (ESI): calcd for $C_{28}H_{27}N_2O_3S^+$ $[M+H]^+$ 471.1742, found 471.1742.

Methyl (E)-7-(2-(5-methyl-2-oxopyridin-1(2H)-yl) phenyl)-7-phenylhept-6-enoate (3bl):



3bl was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), methyl 7-phenylhept-6-ynoate **2l** (65 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Ethyl acetate /Hexane to afford **3bl** (75 mg, 75%) as a yellowish liquid.

R_f: 0.50 (silica gel, 40% Acetone/Hexane);

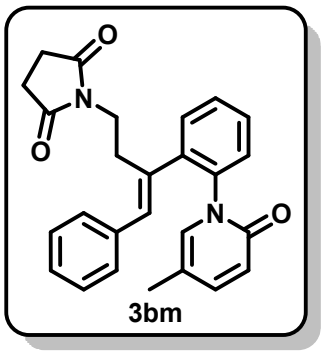
IR (in KBr, cm^{-1}): ν_{max}: 3006, 2360, 2322, 1771, 1734, 1673, 1651, 1558, 1538, 771, 750;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.45 – 7.39 (m, 3H), 7.35 – 7.32 (m, 1H), 7.32 −7.28 (m, 2H), 7.25 − 7.19 (m, 2H), 7.12 (d, *J* = 7.52 Hz,2H), 7.01 (s, 1H), 6.58 (d, *J* = 9.30 Hz, 1H), 6.51 (s, 1H), 3.59 (s, 3H), 2.55 – 2.41 (m, 1H), 2.11 – 2.09 (m, 3H), 2.05 (s, 3H), 1.57 – 1.42 (m, 2H), 1.37 – 1.20 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 174.1, 162.1, 142.8, 140.8, 140.2, 138.6, 137.5, 136.3, 131.9, 130.5, 128.9, 128.7, 128.6, 128.3, 128.2, 126.9, 121.4, 114.2, 51.5, 33.7, 30.7, 27.8, 24.8, 17.0.

HRMS (ESI): calcd for $C_{26}H_{28}NO_3^+$ $[M+H]^+$ 402.2069, found 402.2088.

Ethyl (E)-3-(2-(2-oxopyridin-1(2H)-yl) phenyl)-3-phenylacrylate (3bm):



3bm was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1-(4-phenylbut-3-yn-1-yl)pyrrolidine-2,5-dione **2m** (68 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 20% Acetone/Hexane to afford **3bm** as mixture of regioisomer (rr = 4:1, 93 mg, 90%).

R_f: 0.50 (silica gel, 50% Acetone/Hexane);

M.P: 85 - 87 ºC.

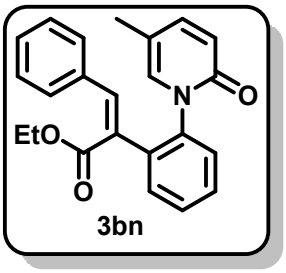
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2362, 2321, 1867, 1771, 1741, 1701, 1674, 1517, 1455, 1398, 826, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.64 (dd, *J* = 7.45 Hz, 1.71 Hz,1H), 7.51 − 7.41 (m, 2H), 7.35 – 7.29 (m, 3H), 7.25− 7.20 (m, 2H), 7.19– 7.14(m, 2H), 7.07(s, 1H), 6.57 (d, *J* = 9.42 Hz,1H), 6.53 (s, 1H), 3.55 – 3.39 (m, 2H), 2.28 – 2.78 (m, 1H), 2.52 – 2.40 (m, 2H), 2.40–2.35 (t, *J* = 5.48 Hz, 1H), 2.35–2.26 (m, 2H), 2.05 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 177.1, 161.8, 144.1, 140.2, 138.5, 136.9, 136.5, 136.3, 134.0, 130.8, 129.4, 128.7, 128.6, 128.6, 128.3, 127.3, 120.5, 37.4, 28.4, 28.1, 17.0;

HRMS (ESI): calcd for $C_{26}H_{26}N_2O_3^+$ $[M+H]^+$ 413.1865, found 413.1869.

Ethyl (E)-3-(2-(2-oxopyridin-1(2H)-yl) phenyl)-3-phenylacrylate (3bn):



3bn was prepared according to general procedure (**G**) using pirfenidone **1b** (56 mg, 0.25 mmol), ethyl 3-phenylpropiolate **2n** (54 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 20% Acetone/Hexane to afford **3bn** as a mixture of regioisomer (rr = 2:1, 45 mg, 50%).

R_f: 0.50 (silica gel, 50% Acetone/Hexane);

M.P: 172 - 174 ºC.

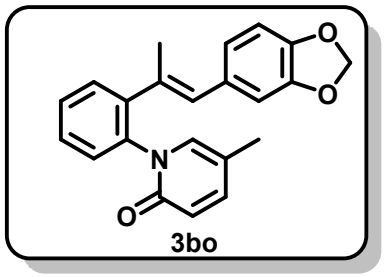
IR (in KBr, cm^{-1}): ν_{max}: 3003, 2361, 2322, 1890, 1794, 1772, 1740, 1651, 1538, 1524, 1515, 828, 771;

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.55– 7.49 (m, 2H), 7.49 − 7.43 (m, 3H), 7.39 – 7.35 (m, 1H), 7.34− 7.30 (m, 1H), 7.23– 7.17(m, 3H), 7.05(s, 1H), 6.97 (s, 1H), 6.52 (d, *J* = 9.47 Hz, 1H), 4.06 – 3.98 (m, 1H), 3.97 – 3.83 (m, 1H), 2.04 (s, 3H), 1.0 (t, *J* = 7.11 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.9, 142.6, 142.5, 139.3, 138.6, 136.3, 136.0, 135.7, 135.3, 130.9, 130.7, 129.3, 129.3, 129.0, 128.6, 128.4, 128.3, 128.0, 126.5, 121.4, 121.1, 114.2, 61.1, 17.0, 16.9, 13.6;

HRMS (ESI): calcd for $C_{23}H_{22}NO_3^+$ $[M+H]^+$ 360.1600, found 360.1598.

(E)-1-(2-(1-(benzo[d][1,3]dioxol-5-yl)prop-1-en-1-yl)phenyl)-5-methylpyridin-2(1H)-one (3bo):



3bo was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol),5-(prop-1-yn-1-yl) benzo[d][1,3]dioxole **2o** (48 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Ethyl acetate /Hexane to afford **3aa** as mixture of regioisomer (rr = 4:1, 57 mg, 66%) as a yellow liquid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

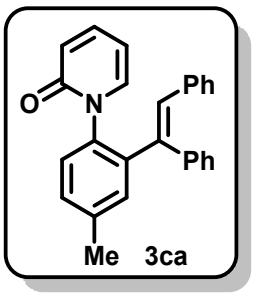
IR (in KBr, cm^{-1}): ν_{max}:. 3001, 2362, 2320, 1770, 1740, 1646, 1563, 1532, 1511, 825, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.44 – 7.37 (m, 3H), 7.33 – 7.30 (m, 1H), 7.25 −7.21 (m, 1H), 7.04 – 6.94 (m, 1H), 6.76 (d, *J* = 7.94 Hz,1H), 6.68 (d, *J* = 1.56 Hz, 1H), 6.66 – 6.62 (m, 1H), 6.58 (d, *J* = 9.28 Hz, 1H), 6.30 (s, 1H), 5.94 (s, 2H), 2.05 (s, 3H), 1.98 (d, *J* = 1.40 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.2, 147.5, 146.3, 142.9, 142.8, 138.4, 136.1, 134.5, 131.8, 130.5, 129.6, 128.9, 128.3, 128.0, 122.8, 121.5, 114.5, 109.1, 108.2, 101.1, 18.9, 17.0.

HRMS (ESI): calcd for $C_{22}H_{20}NO_3^+$ $[M+H]^+$ 346.1443, found 346.1447.

(E)-1-(2-(1, 2-diphenylvinyl)-4-methylphenyl) pyridin-2(1H)-one (3ca):



3ca was prepared according to general procedure (**G**) using N-aryl pyridone **1c** (50.25 mg, 0.25 mmol), diphenyl acetylene **2a** (54 mg, 0.30 mmol). The crude reaction mixture was

purified by column chromatography using 15% acetone /Hexane to afford **3ca** (68 mg, 75%) as a white solid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

M.P: 130-12 ºC.

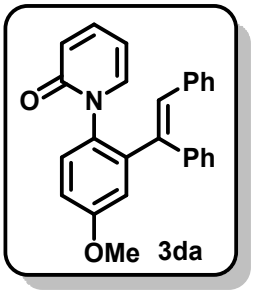
IR (in KBr, cm^{-1}): ν_{max}: 2996, 1664, 1585, 1537, 1493, 1451, 770, 697;

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.33 (s,1H), 7.25– 7.20 (m, 1H), 7.13−7.04 (m, 8H), 7.02–6.90 (m, 5H), 6.70(s, 1H), 6.32(d, *J* = 8.67 Hz, 1H), 5.86(t, *J* = 6.10 Hz, 1H), 2.42 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.1, 141.4, 139.3, 139.0, 139.9, 138.2, 137.0, 136.7, 132.1, 131.6, 129.4, 129.4, 129.4, 128.1, 128.1, 127.8, 127.2, 126.9, 121.3, 105.1, 21.1.

HRMS (ESI): calcd for $C_{26}H_{22}NO^+$ $[M+H]^+$ 364.1701, found 364.1709.

(E)-1-(2-(1, 2-diphenylvinyl)-4-methoxyphenyl)-5-methylpyridin-2(1H)-one (3da):



3da was prepared according to general procedure (**G**) using N-aryl pyridone **1d** (50.25 mg, 0.25 mmol), diphenyl acetylene **2a** (54 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 15% acetone /Hexane to afford **3da** (60 mg, 63%) as a white solid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

M.P: 147 - 149 ºC.

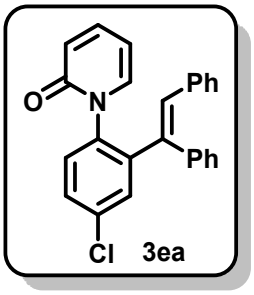
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2321, 1653, 1514, 1224, 771, 698;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.16 (d, *J* = 8.67 Hz, 1H), 7.12 – 7.06 (m, 6H), 7.06 −7.0 (m, 4H), 6.99 – 6.93 (m, 3H), 6.90 (dd, *J* = 6.82 Hz,2.22 Hz, 1H), 6.73 (s, 1H), 6.31 (d, *J* = 9.37 Hz, 1H), 5.85 (dt, *J* = 6.75 Hz, 1.39 Hz, 1H), 3.86 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.4, 159.7, 143.0, 139.7, 139.4, 139.8, 138.6, 136.9, 132.2, 131.8, 129.6, 129.5, 129.5, 128.3, 128.0, 127.4, 127.1, 121.4, 116.9, 113.9, 105.2, 55.3.

HRMS (ESI): calcd for $C_{26}H_{22}NO_2^+$ $[M+H]^+$ 380.1651, found 380.1653.

(E)-1-(4-chloro-2-(1, 2-diphenylvinyl) phenyl)-5-methylpyridin-2(1H)-one (3ea):



3ea was prepared according to general procedure (**G**) using N-aryl pyridone **1e** (51.25 mg, 0.25 mmol), diphenyl acetylene **2a** (54 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 10% Acetone /Hexane to afford **3ea** (45 mg, 47%) as a yellow liquid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

M.P: 158 - 160 ºC.

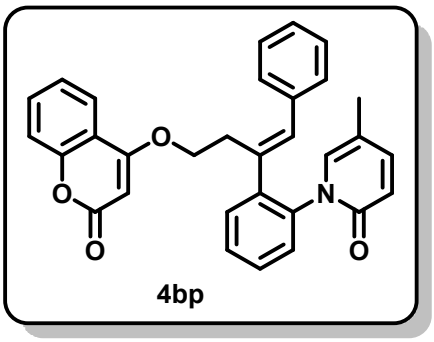
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2362, 2321, 1918, 1794, 1771, 1672, 1539, 1516, 1457, 771, 696;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.53 (d, *J* = 2.41 Hz, 1H), 7.41 (dd, *J* = 8.44 Hz, 2.41 Hz, 1H), 7.19 (d, *J* = 8.41 Hz, 1H), 7.13 – 7.06 (m, 7H), 7.04 – 6.99 (m, 2H), 6.98 – 6.93 (m, 2H), 6.88 (dd, *J* = 6.89 Hz, 2.27 Hz, 1H), 6.73 (s, 1H), 6.30 (td, *J* = 9.21 Hz, 0.90 Hz, 1H), 5.89 (dt, *J* = 6.72 Hz, 1.31 Hz, 1H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.8, 143.4, 139.5, 138.4, 138.2, 137.7, 137.6, 136.2, 134.8, 132.5, 131.4, 129.8, 129.4, 129.3, 128.7, 128.3, 127.9, 127.5, 127.3, 121.5, 105.4.

HRMS (ESI): calcd for $C_{25}H_{19}ClNO^+$ $[M+H]^+$ 384.1155, found 384.1163.

(E)-5-methyl-1-(2-(4-((2-oxo-2H-chromen-4-yl) oxy)-1-phenylbut-1-en-1-yl) phenyl) pyridin-2(1H)-one (4bp):



4bp was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 4-(4-phenylbut-3-yn-1-yl) oxy-2H-chromen-2-one **(3p)** (87 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Ethyl acetate /Hexane to afford **4bp** (101 mg, 85%) as a white solid.

R_f: 0.50 (silica gel, 40% Acetone/Hexane);

M.P: 76 - 78 ºC.

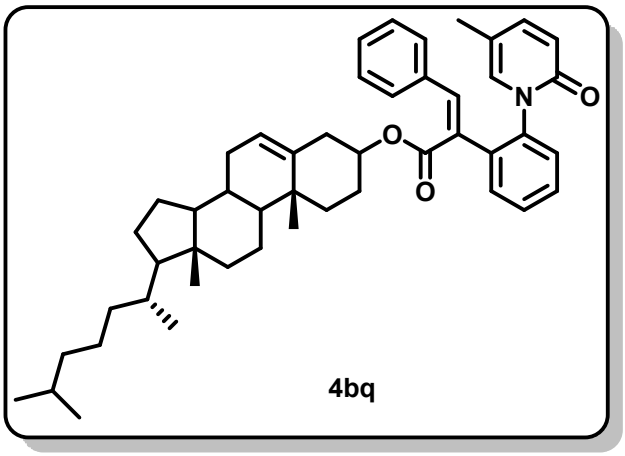
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2363, 2320, 1770, 1693, 1676, 1546, 1531, 1551, 1484, 824, 770;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.25 – 7.48(m, 2H), 7.46 – 7.40 (m, 3H), 7.38 −7.31 (m, 3H), 7.30 − 7.26 (m, 2H), 7.25 – 7.13 (m,4H), 7.01 (s, 1H), 6.70 (s, 1H), 6.57 (d, J = 9.52 Hz, 1H), 5.50 (s, 1H), 4.07 (t, J = 5.22 Hz, 2H), 2.23 – 3.09 (m, 1H), 2.78 – 2.67 (m, 1H), 2.01 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 165.3, 162.8, 153.4, 143.0, 139.8, 139.0, 139.9, 136.1, 135.8, 134.4, 132.3, 130.3, 129.3, 128.9, 128.8, 128.6, 128.6, 127.4, 123.8, 123.2, 121.5, 116.8, 115.8, 114.6, 90.7, 30.2, 17.0.

HRMS (ESI): calcd for $C_{31}H_{26}NO_4^+$ $[M+H]^+$ 476.1862, found 476.1859.

(10R, 13R)-10,13-dimethyl-17-((R)-6-methylheptan-2-yl) 2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl (Z)-2-(2-(5-methyl-2-oxopyridin-1(2H)-yl)phenyl)-3-phenylacrylate (4bq**):**



4bq was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), (10R,13R)-10, 13-dimethyl-17-(R)-6-methylheptan-2-yl)-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl 3-phenylpropiolate **3q** (154 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Ethyl acetate/Hexane to afford **4bq** (72 mg, 41%) as a colourless liquid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

IR (in KBr, cm^{-1}): ν_{max}: 3000, 2361, 2322, 1867, 1742, 1676, 1648, 1516, 1457, 1422, 771, 693;

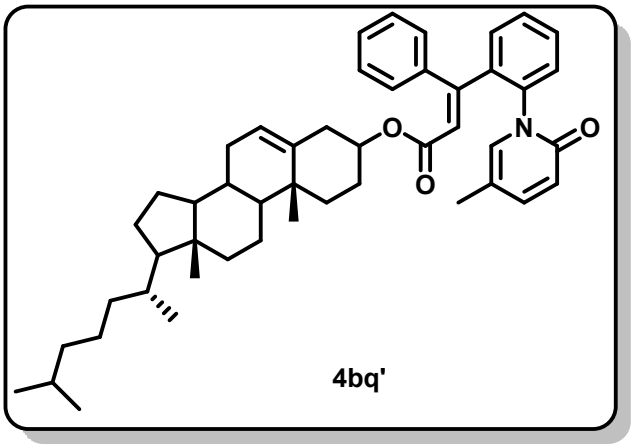
^{1}H NMR (400 MHz,$CDCl_3$): δ 7.53 – 7.43 (m, 3H), 7.37 − 7.31 (m, 1H), 7.29 – 7.25 (m, 3H), 7.22 − 7.15 (m, 3H), 7.09 (s, 1H), 6.91 (d, *J* = 6.30 Hz, 1H), 6.53 (d, *J* = 9.18 Hz, 1H), 5.41 – 5.21 (m, 1H), 4.57 − 4.38 (m, 1H), 2.20(m, 1H), 2.04 (s, 3H), 2.02 – 1.89 (m, 2H), 1.86 − 1.74 (m, 2H), 1.72 − 1.64 (m, 1H), 1.50 – 1.23 (m, 11H), 1.18 – 0.97 (m, 10H), 0.91 – 0.88 (m, 6H), 0.86 (dd, *J* = 6.57 Hz, 1.64 Hz, 6H), 0.65 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 167.6, 162.2, 142.9, 139.5, 138.7, 138.7, 136.5, 136.5, 136.5, 136.3, 136.0, 131.2, 130.7, 129.3, 129.1, 128.5, 128.3, 128.1, 122.9, 122.7, 121.2,

114.4, 75.3, 56.8, 50.1, 42.4, 39.8, 37.7, 37.0, 36.7, 36.3, 35.9, 32.0, 31.9, 28.3, 28.1, 27.3, 24.4, 23.9, 22.9, 22.7, 21.1, 19.3, 18.8, 17.1, 11.9.

HRMS (ESI): calcd for $C_{48}H_{62}NO_3^+$ $[M+H]^+$ 700.4730, found 700.4716.

(10R, 13R)-10,13-dimethyl-17- (R)-6-methylheptan-2-yl)-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl (E)-3-(2-(5-methyl-2-oxopyridin-1(2H)-yl)phenyl)-3-phenylacrylate (4bq'):



4bq' was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), (10R,13R)-10,13-dimethyl-17-(R)-6-methylheptan-2-yl)-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1*H*-cyclopenta[a]phenanthren-3-yl 3-phenylpropiolate **3q** (154 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Ethyl acetate/Hexane to afford **4bq'** (72 mg, 41%) as a colourless liquid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

IR (in KBr, cm^{-1}): $\nu_{max:}$ 3000, 2361, 2322, 1867, 1742, 1676, 1648, 1516, 1457, 1422, 771, 693;

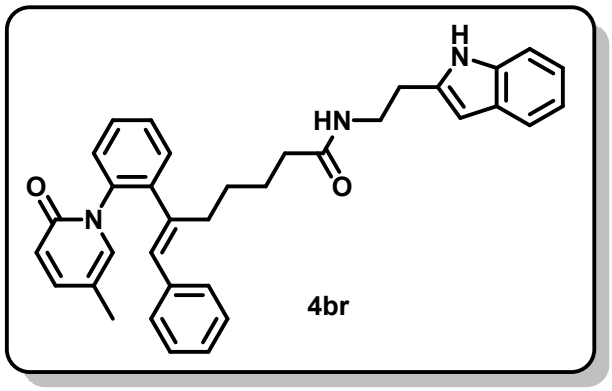
^{1}H NMR (400 MHz,$CDCl_3$): δ 7.55 − 7.51 (m, 1H), 7.50 – 7.45 (m, 2H), 7.22 – 7.16 (m, 2H), 7.12 (t, *J* = 7.52 Hz, 2H), 7.04 – 6.95 (m, 3H), 6.44 − 6.36 (m, 1H), 6.36 − 6.28 (dd, *J* = 9.47, 2.21 Hz, 1H), 6.14 (s, 1H), 5.36 – 5.23 (m, 1H), 4.61 – 4.37 (m, 1H), 2.22 – 2.09 (m, 2H), 2.06 – 1.88), (m, 3H), 1.83 – 1.78 (m, 4H), 1.55 – 1.47 (m, 3H), 1.47 – 1.31 (m, 8H),

1.18 – 1.05 (m, 7H), 1.04 – 0.98 (m, 3H), 0.95 (s, 1H), 0.90 (d, *J* = 6.49 Hz, 4H), 0.86 (d, *J* = 1.68 Hz, 3H), 0.85 (d, *J* = 1.59 Hz, 3H), 0.66 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 165.3, 161.3, 142.4, 137.9, 135.2, 131.1, 130.2, 129.1, 128.8, 128.2, 127.5, 122.6, 121.0, 56.8, 56.2, 50.1, 42.4, 39.8, 39.6, 37.9, 37.0, 36.7, 36.3, 35.9, 31.9, 29.8, 28.3, 28.1, 27.6, 24.4, 23.9, 22.9, 22.7, 21.1, 19.4, 18.8, 16.8, 11.9.

HRMS (ESI): calcd for $C_{48}H_{62}NO_3^+$ $[M+H]^+$ 700.4730, found 700.4716.

(E)-1-(2-(3-(9H-carbazol-9-yl)-1-phenylprop-1-en-1-yl) phenyl) pyridin-2(1H)-one (4br):



4br was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), *N*-(2-(1H-indol-2-yl) ethyl)-7-phenylhept-6-ynamide **3r** (84 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 15% Acetone/Hexane to afford **4br** (54 mg, 46%) as a yellow solid.

R_f: 0.50 (silica gel, 40% Ethyl acetate/Hexane);

M.P: 117 - 119 ºC.

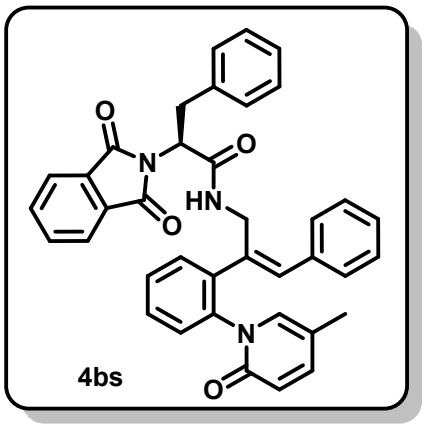
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2363, 2321, 1867, 1770, 1740, 1693, 1546, 1531, 1515, 1229, 770;

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.50 (s, 1H), 7.56 (d, *J* = 7.76 Hz, 1H), 7.45 – 7.39 (m, 2H), 7.38− 7.29 (m, 6H), 7.24– 7.20 (m, 1H), 7.19– 7.12 (m, 3H), 7.10 – 7.05 (m, 2H), 6.76 (s, 1H), 6.60 (d, *J* = 9.03 Hz, 1H), 6.49 (s, 1H), 6.39 (t, *J* = 6.02 Hz, 1H), 3.46 – 3.25 (m, 2H), 2.86 – 2.72 (m, 2H), 2.52 – 2.37 (m, 1H), 2.07 (s, 3H), 1.98 – 1.84 (m, 7H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 173.1, 143.4, 141.4, 141.0, 137.3, 136.9, 136.5, 131.9, 131.3, 129.1, 128.6, 128.5, 128.3, 127.0, 122.5, 121.9, 121.1, 119.2, 118.8, 112.9, 111.4, 39.4, 35.6, 29.9, 26.9, 25.4, 25.2, 17.0.

HRMS (ESI): calcd for $C_{35}H_{36}N_3O_2^+$ $[M+H]^+$ 530.2808, found 530.2816.

(E)-1-(2-(3-(9H-carbazol-9-yl)-1-phenylprop-1-en-1-yl) phenyl) pyridin-2(1H)-one (4bs):



4bs was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), (*S*)-2-(1, 3-dioxoisoindolin-2-yl)-3-phenyl-*N*-(3-phenylprop-2-yn-1-yl) propanamide **3s** (122 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 15% Acetone/Hexane to afford **4bs** (80 mg, 54%) as a regioisomer.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

M.P: 78 - 80 ºC.

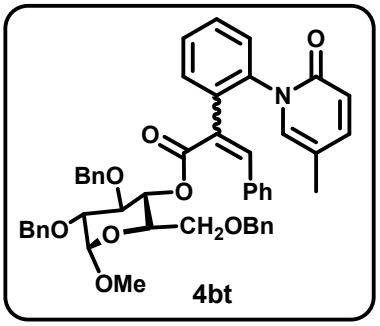
IR (in KBr, cm^{-1}): ν_{max}: 3008, 2361, 2322, 1794, 1773, 1740, 1670, 1538, 1524, 1455, 770, 697;

^{1}H NMR (400 MHz, $CDCl_3$): δ 8.24 (d, *J* = 5.02 Hz, 1H), 7.71 − 7.67 (m, 2H), 7.62 – 7.57 (m, 2H), 7.57− 7.53 (m, 2H), 7.53– 7.49 (m, 3H), 7.49– 7.45 (m, 2H), 7.44 – 7.34 (m, 3H), 7.33 – 7.27 (m, 3H), 7.23 – 7.16 (m, 4H), 7.15–7.10 (m, 3H), 7.09 – 7.04 (m, 8H), 7.04 – 7.0 (m, 2H), 6.98 (d, *J* = 7.39 Hz, 2H), 6.96 – 6.92 (m, 3H), 6.28 (d, *J* = 9.31 Hz, 1H), 6.16 (s, 1H), 6.13 (s, 1H), 5.80 (d, *J* = 9.31H z, 1H), 4.96 – 4.87 (m, 2H), 4.76 – 4.64 (m, 2H), 4.20 – 4.11 (m, 2H), 3.62 – 3.54 (m, 1H), 3.46 – 3.37 (m, 1H), 3.37 – 3.25 (m, 2H), 2.08 (s, 2H), 2.08 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 168.5, 168.0, 167.6, 161.9, 143.0, 142.7, 141.2, 137.9, 136.2, 136.1, 135.4, 134.5, 133.4, 133.1, 132.9, 132.4, 132.1, 129.4, 129.4, 129.3, 129.0, 128.9, 128.7, 128.7, 128.6, 128.4, 128.4, 128.3, 127.6, 127.5, 127.5, 127.2, 126.7126.4, 123.0, 122.9, 121.5, 121.3, 121.0, 115.7, 115.0, 55.1, 54.6, 40.9, 40.5, 34.1, 34.0, 29.8, 17.1.

HRMS (ESI): calcd for $C_{38}H_{32}N_3O_4^+$ $[M+H]^+$ 594.2393, found 594.2388.

(3R, 4S, 5R, 6S)-4, 5-bis (benzyloxy)-2-((benzyloxy)methyl)-6-methoxytetrahydro-2H-pyran-3-yl (Z)-2-(2-(5-methyl-2-oxopyridin-1(2H)-yl)phenyl)-3-phenylacrylate (4bt):



4bt was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), (3R, 4S, 5R, 6S)-4, 5-bis(benzyloxy)-2-((benzyloxy)methyl)-6-methoxytetrahydro-2H-pyran-3-yl 3-phenylpropiolate **3t** (178 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 15% Acetone/Hexane to afford **4bt** as mixture of regioisomer (68 mg, 35%) as a brown liquid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

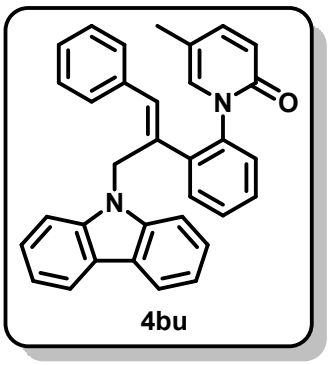
IR (in KBr, cm^{-1}): ν_{max}: 3008, 2361, 2322, 1794, 1773, 1740, 1670, 1538, 1524, 1455, 770, 697;

^{1}H NMR (400 MHz, $CDCl_3$): δ 7.51 – 7.43 (m,2H), 7.36 − 7.29 (m, 10H), 7.25 – 7.19 (m, 7H), 7.19− 7.12 (m, 6H), 6.96 (s, 2H), 6.55 (t, *J* = 8.94 Hz, 1H), 5.08 (q, *J* = 18.49 Hz, 8.96 Hz, 1H), 4.80 (q, *J* = 2.6 Hz, 11.80 Hz, 1H), 4.68 – 4.62 (m, 1H), 4.58–4.56 (m, 1H), 4.47 (s, 1H), 4.38 (d, *J* = 2.79 Hz, 1H), 3.78 (t, *J* = 9.37 Hz, 1H), 3.73 – 3.64 (m, 1H), 3.32 – 3.26 (m, 1H), 1.95 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 164.2, 141.4, 140.1, 139.4, 138.7, 138.5, 138.2, 138.1, 137.9, 137.8, 136.1, 135.4, 135.0, 131.0, 130.3, 129.4, 129.2, 129.0, 128.7, 127.3, 126.7, 120.9, 120.5, 98.1, 98.0, 97.9, 79.6, 79.4, 79.3, 79.2, 79.0, 75.4, 74.7, 74.3, 73.7, 73.6, 73.4, 71.1, 70.9, 69.3, 68.9, 68.7, 55.5, 55.4, 55.3, 29.8, 27.2, 17.0, 16.7.

HRMS (ESI): calcd for $C_{49}H_{48}NO_8^+$ $[M+H]^+$ 778.3380, found 778.3397.

(*E*)-1-(2-(3-(9*H*-carbazol-9-yl)-1-phenylprop-1-en-1-yl) phenyl) pyridin-2(1*H*)-one (4bu):



4bu was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), ethyl 3-phenylpropiolate **3u** (84 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 15% Acetone/Hexane to afford **4bu** (54 mg, 46%) as a yellow liquid.

R_f: 0.50 (silica gel, 30% Acetone/Hexane);

M.P: 185-187 ºC.

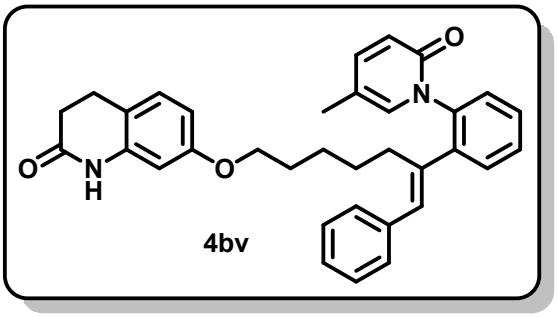
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2363, 2321, 1770, 1741, 1646, 1546, 1531, 1515, 770, 700;

^{1}H NMR (400 MHz,$CDCl_3$): δ 7.98 (d, *J* = 7.51 Hz, 2H), 7.46 − 7.40 (m, 2H), 7.38 – 7.33 (m, 1H), 7.25 − 7.22 (m, 3H), 7.22 – 7.14 (m, 4H), 7.13 – 7.08 (m, 2H), 6.98 (dt, *J* = 7.67 Hz, 1.25 Hz, 1H), 6.91 (d, *J* = 8.12 Hz, 2H), 6.74 (s, 1H), 6.66 – 6.57 (m, 2H), 6.32 (s,1H), 5.39 (s, 2H), 1.69 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.5, 143.0, 140.9, 139.7, 138.7, 136.5, 136.0, 134.0, 130.2, 129.2, 128.7, 128.6, 128.4, 127.8, 125.6, 122.8, 120.8, 119.9, 118.9, 114.6, 109.7, 43.2, 16.8.

HRMS (ESI): calcd for $C_{33}H_{27}N_2O^+$ $[M+H]^+$ 467.2123, found 467.2123.

(E)- 7 - 7-(2-(5-methyl-2 –oxopyridin-1(2H)-yl) phenyl)-7 – phenylhept-6-en-1-yl) oxy-3, 4 – dihydroquinolin-2(1H)-one (4bv):



4bv was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 7-(7-phenylhept-6-yn-1-yl) oxy)-3, 4-dihydroquinolin-2(1H)-one **3v** (100 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 30% Ethyl acetate/Hexane to afford **4bv** (65 mg, 50%) as a colourless gummy liquid.

R_f: 0.50 (silica gel, 40% Ethyl acetate/Hexane);

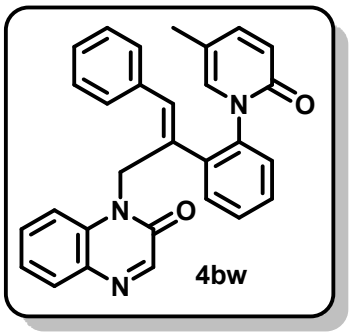
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2321, 1771, 1748, 1670, 1593, 1576, 1558, 1497, 829, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 8.0(s, 1H), 7.47– 7.44 (m, 1H), 7.44 – 7.40 (m, 3H)7.34 (t, *J* = 7.61 Hz, 2H), 7.27− 7.22 (m, 2H), 7.16(d, *J* = 7.61 Hz,2H), 7.06(s,1H), 7.01 (d, *J* = 8.39 Hz,1H), 6.63 (d, *J* = 9.34 Hz, 1H), 6.53 (s, 1H), 6.46 (d, *J* = 8.21 Hz,1H), 6.29 (s,1H), 3.80 (t, *J*=6.52 Hz, 2H), 2.89 (t, *J* = 7.58 Hz, 3H), 2.61 (t, *J* = 7.35 Hz,2H), 2.55 – 2.48 (m, 1H), 2.07 (s,3H), 1.61(t, *J* = 6.37 Hz, 2H), 1.37 – 1.29 (m, 4H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 171.5, 162.2, 158.7, 142.9, 140.9, 140.8, 138.3, 137.6, 136.4, 131.7, 130.6, 128.9, 128.7, 128.7, 128.4, 128.2, 126.9, 121.4, 115.7, 114.4, 109.3, 102.2, 68.1, 31.2, 30.9, 28.6, 27.9, 25.8, 24.7, 17.0.

HRMS (ESI): calcd for $C_{34}H_{35}N2O_3^+$ $[M+H]^+$ 519.2648, found 519.2649.

(E)-1-(3-(2-(5-methyl-2-oxopyridin-1(2H)-yl) phenyl)-3-phenylallyl) quinoxalin-2(1H)-one (4bw):



4bw was prepared according to general procedure (**G**) using pirfenidone **1b** (46.25 mg, 0.25 mmol), 1-(3-phenylprop-2-y-1-yl) quinoxalin-2(1H)-one **3w** (78 mg, 0.30 mmol). The crude reaction mixture was purified by column chromatography using 20% Acetone/Hexane to afford **4bw** (48 mg, 43%) as yellow solid.

R_f: 0.50 (silica gel, 50% Acetone/Hexane);

M.P: 133 - 135 ºC.

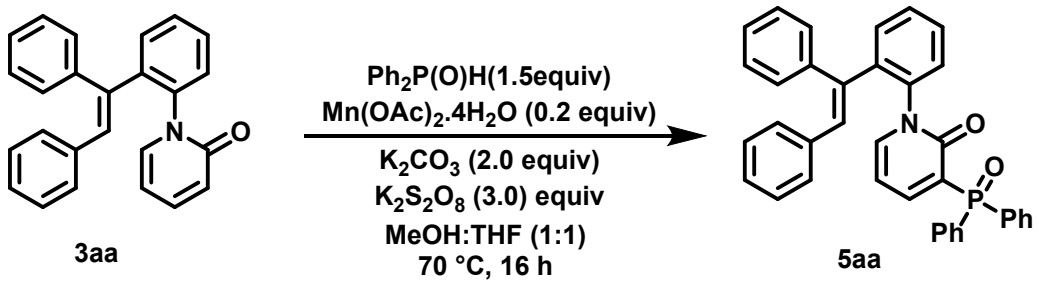
IR (in KBr, cm^{-1}): $\nu_{max:}$ 3007, 2361, 2322, 1772, 1740, 1651, 1558, 1539, 1515, 1491, 827, 771;

^{1}H NMR (400 MHz,$CDCl_3$): δ 8.01(s, 1H), 7.79 (dd, *J* = 7.76, 1.66 Hz, 1H), 7.38 – 7.32 (m, 5H), 7.32 − 7.27 (m, 3H), 7.25 – 7.21 (m, 1H), 7.13 (dt, J = 7.63Hz, 1.22 Hz, 1H), 7.09 (d,*J* = 7.31 Hz,2H), 6.92 (s, 1H), 6.85 (d, *J* = 8.34 Hz, 1H), 6.69 (d, *J* = 7.56 Hz, 1H), 6.54 (d, *J* = 9.32 Hz, 1H), 5.38 (dd, *J* = 15.33, 1.54 Hz, 1H), 5.06 (d, *J* = 15.30 Hz, 1H), 2.11 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 162.4, 154.9, 149.9, 143.0, 140.1, 137.1, 136.5, 135.7, 135.5, 133.3, 132.5, 131.6, 131.0, 130.5, 129.7, 129.2, 128.8, 128.5, 128.2, 128.0, 123.9, 121.1, 114.9, 114.3, 42.6, 17.2.

HRMS (ESI): calcd for $C_{29}H_{24}N_3O_2^+$ $[M+H]^+$ 446.1869, found 446.1878.

(E)-3-(diphenylphosphoryl)-1-(2-(1, 2-diphenylvinyl) phenyl)-5-methylpyridin-2(1H)-one:



To a sealed tube vial containing **3aa** (50 mg, 0.143 mmol, 1.00 equiv) in MeOH: THF (1:1) was added sequentially diphenylphosphine oxide (44 mg, 0.21 mmol, 1.5 equiv), $Mn(OAc)_2$ (20 mol %), K_2CO_3 (2.0 equiv) and $K_2S_2O_8$ (3.0 equiv). The mixture was stirred at 70°C for 16 h. After completion of the reaction, the solvent was removed under reduced pressure and the residue was dissolved in ethyl acetate washed with water and brine, concentrated, purified by column chromatography with 30% Acetone/Hexane to afford **5aa** (32 mg, 41%) as a yellow liquid.

R_f: 0.50 (silica gel, 60% Ethyl acetate/Hexane);

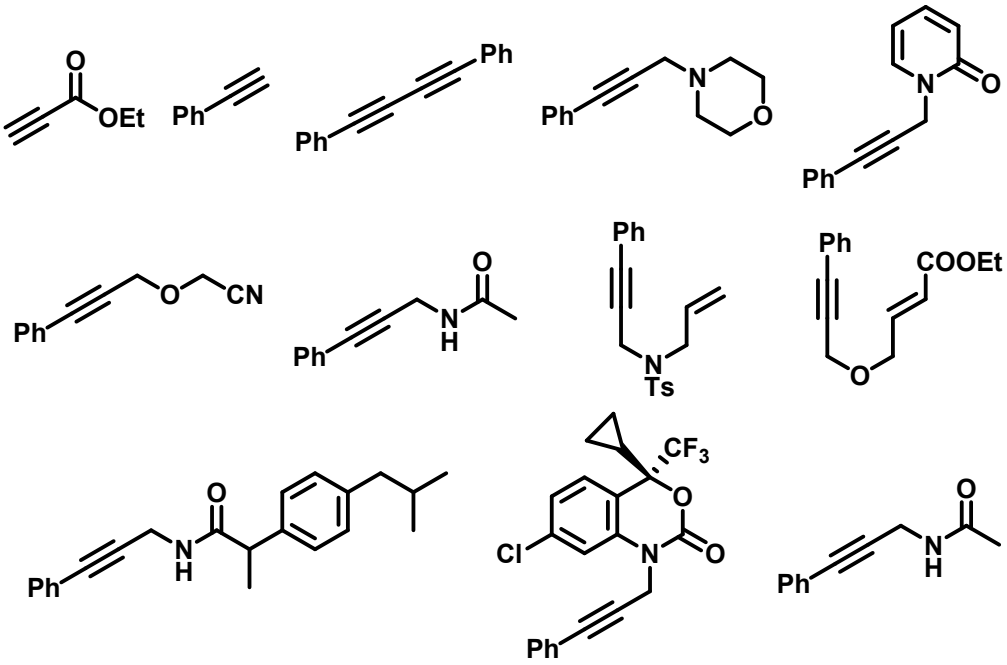
IR (in KBr, cm^{-1}): ν_{max}: 3000, 2360, 2323, 1772, 1746, 1650, 1540, 1521, 1491, 1473, 771, 749;

^{1}H NMR (400 MHz,$CDCl_3$): δ 8.34 – 8.25 (m, 1H), 7.90 – 7.74 (m, 4H), 7.50 – 7.35 (m, 6H), 7.29 (dt, J = 7.33 Hz, 1.49 Hz, 1H), 7.24– 7.19 (m, 2H), 7.14 (dd, 7.37 Hz, 1.40 Hz, 1H), 7.12 – 7.05 (m, 4H), 6.97 – 6.89 (m, 3H), 6.84 (d, *J* = 7.26 Hz, 2H), 6.66 (dd, *J* = 7.82 Hz, 1.31Hz, 2H), 6.59 (s,1H), 6.06 (dt, *J* = 6.88 Hz, 2.0 Hz, 1H).

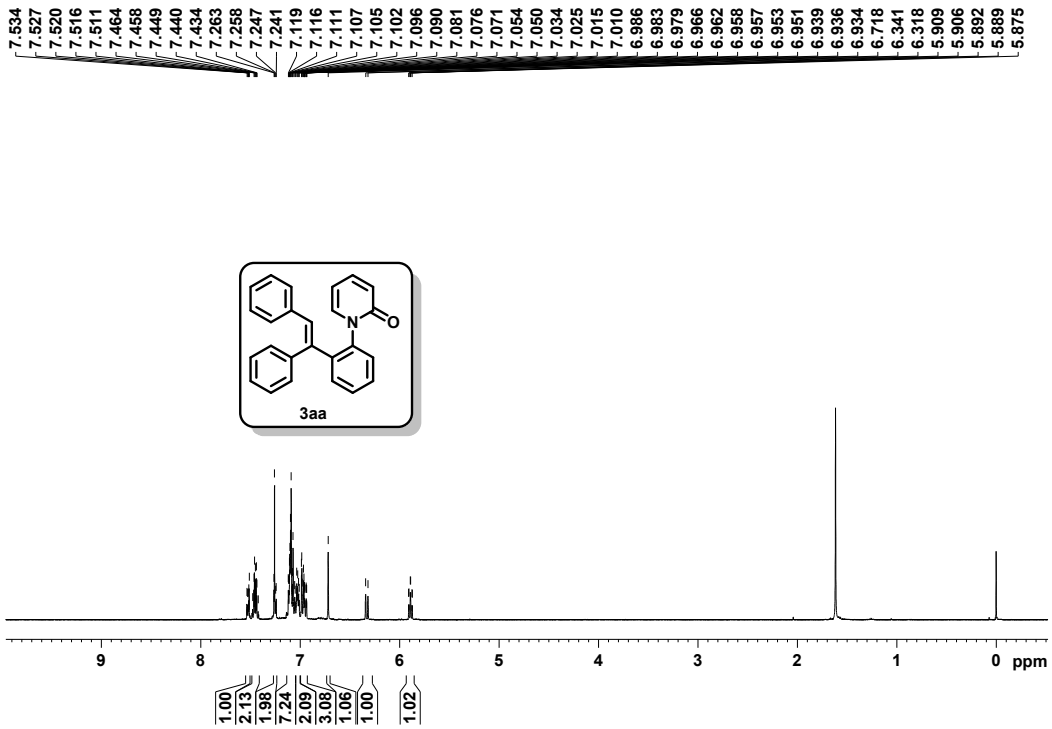
^{13}C NMR (100 MHz, $CDCl_3$): δ 160.4, 149.1, 142.7, 141.8, 139.0, 138.8, 138.4, 136.4, 132.3, 132.2, 132.0, 131.8, 131.7, 129.4, 129.3, 129.1, 128.8, 128.2, 128.1, 127.9, 127.9, 127.8, 127.4, 127.2, 105.5, 105.4.

HRMS (ESI): calcd for $C_{37}H_{29}NO_2P^+$ $[M+H]^+$ 550.1936, found 550.1946.

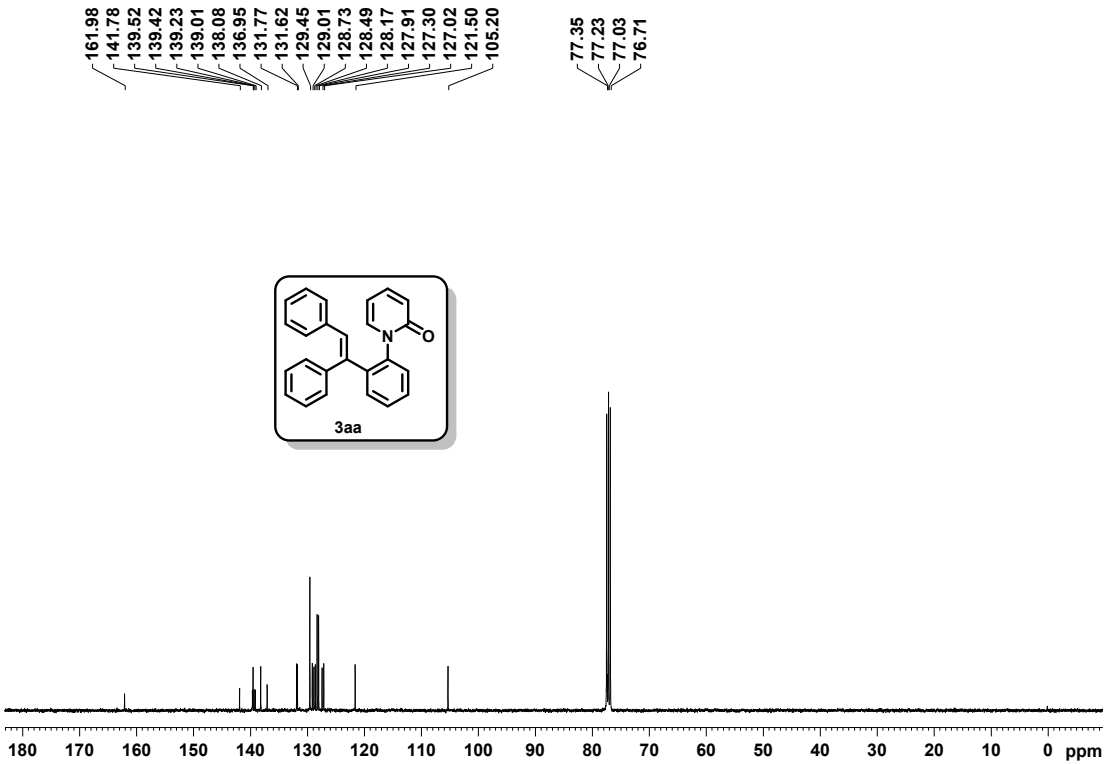
List of unsuccessful substrate:



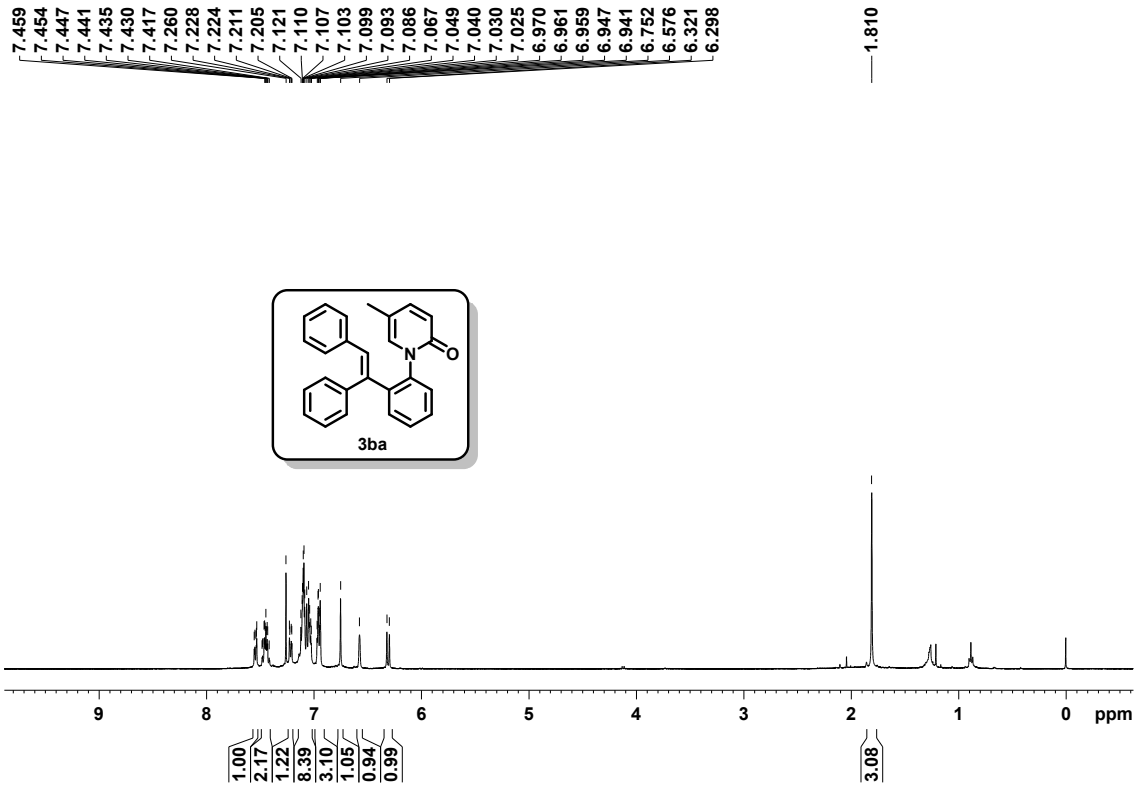
^{1}H and ^{13}C NMR spectra



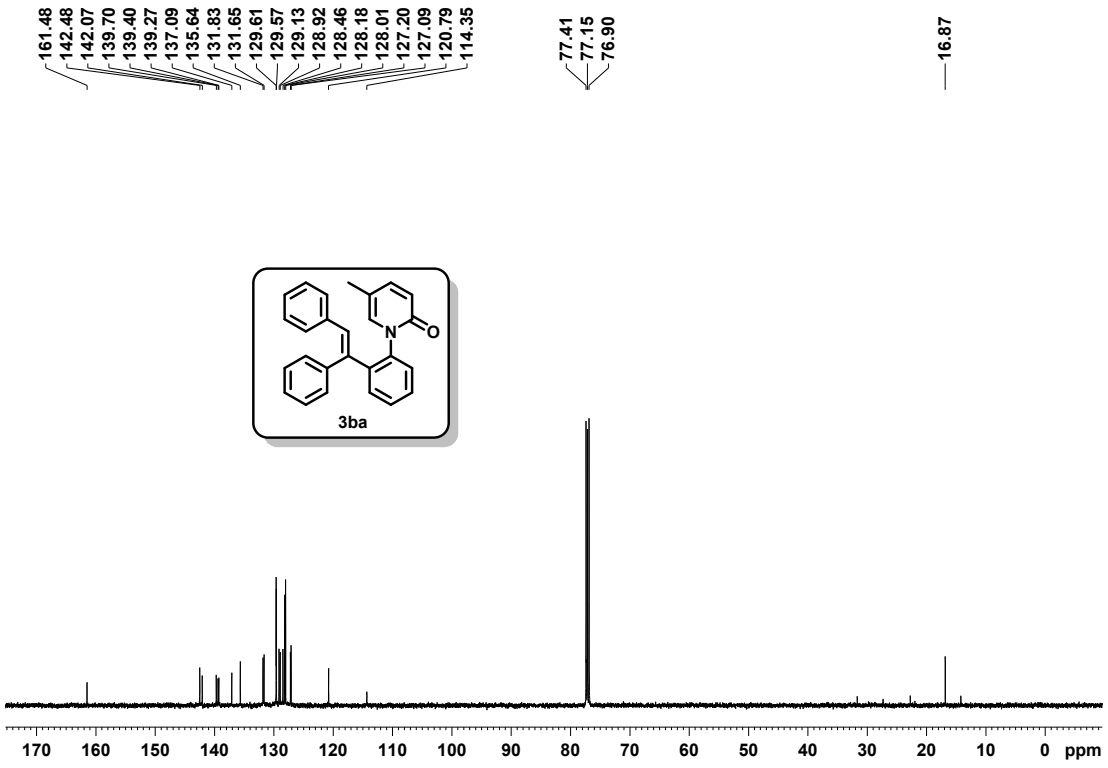
^{1}H NMR spectrum of **3aa** (400 MHz, $CDCl_3$)



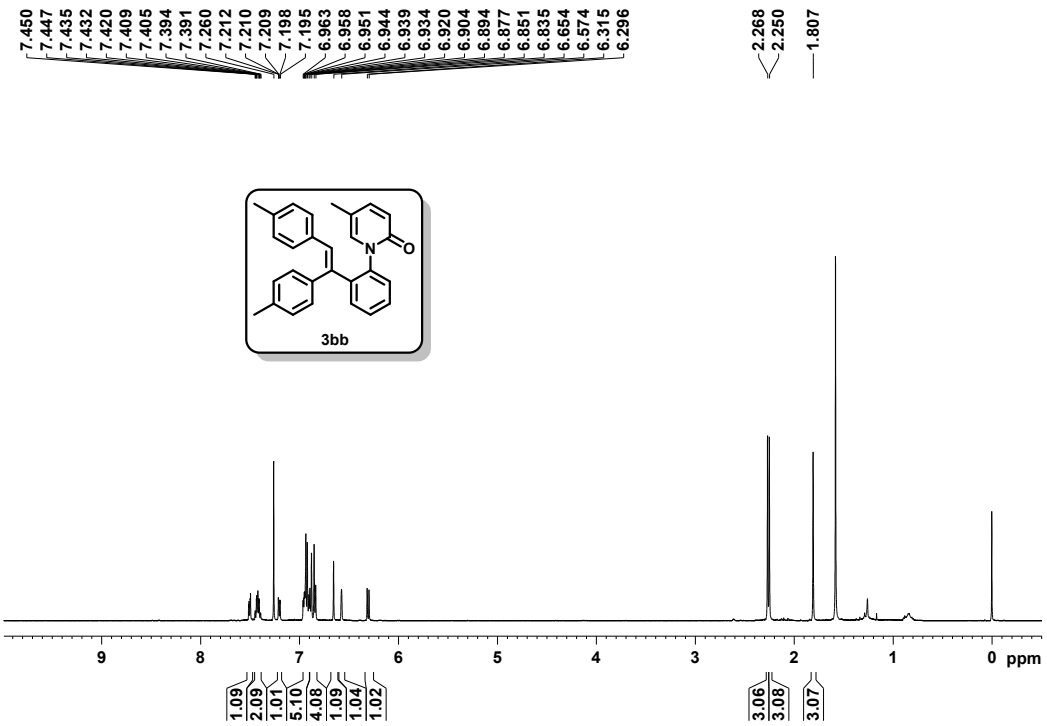
^{13}C NMR spectrum of **3aa** (100 MHz, $CDCl_3$)



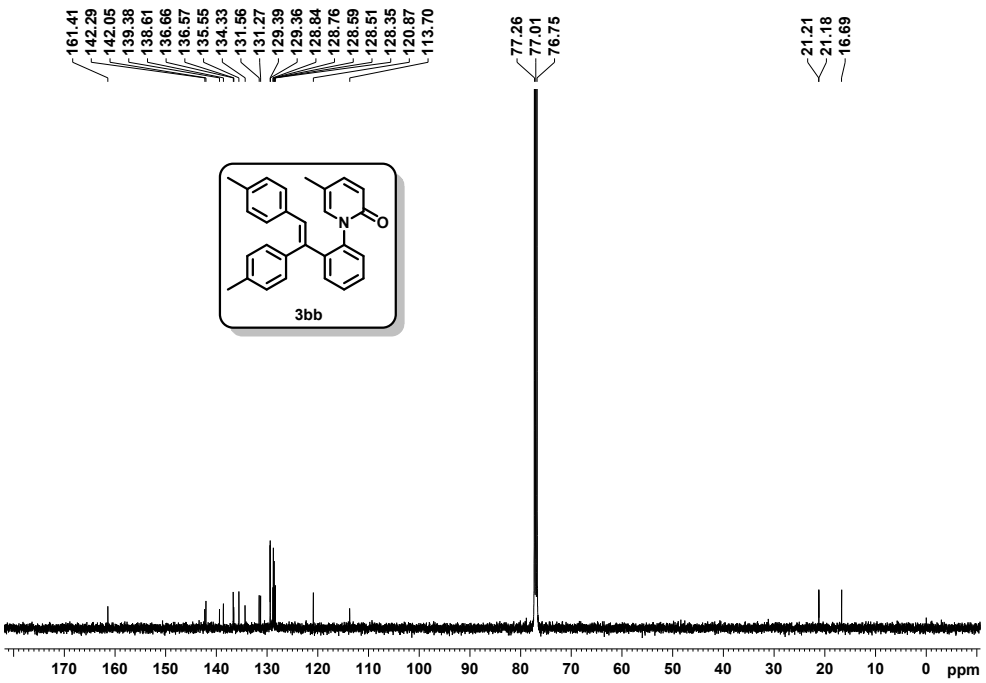
^{1}H NMR spectrum of **3ba** (400 MHz, $CDCl_3$)



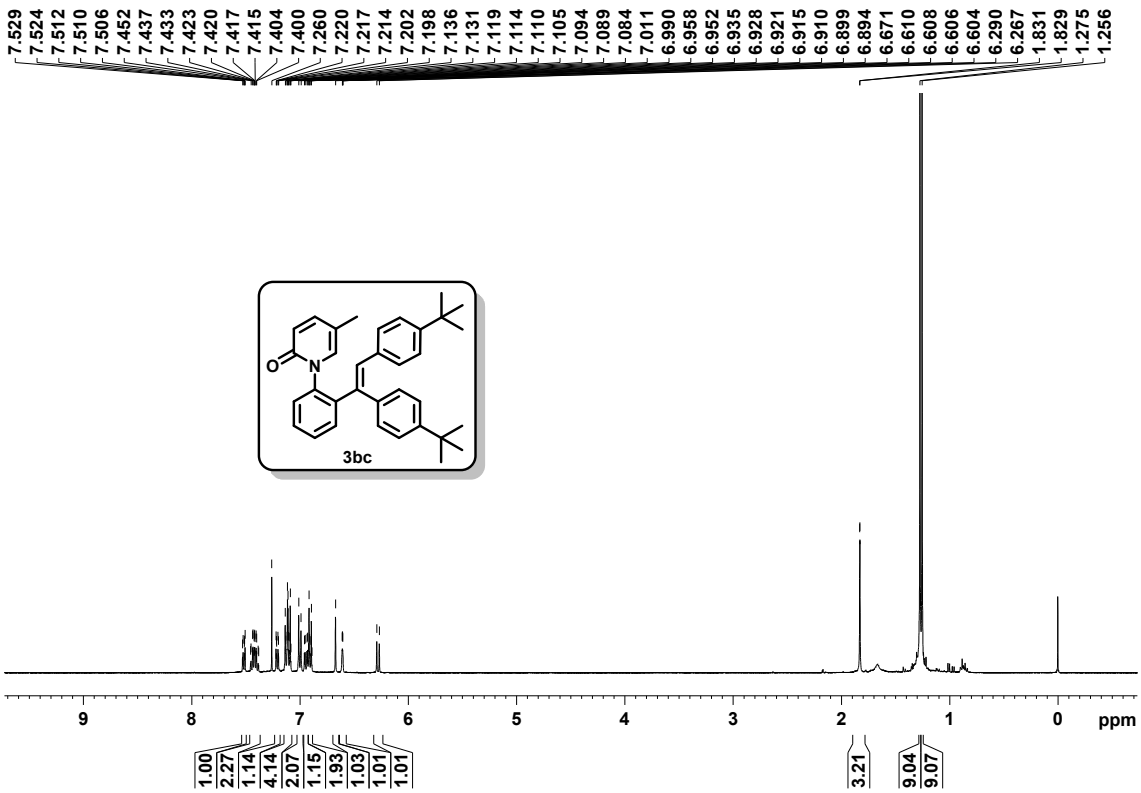
^{13}C NMR spectrum of **3ba** (100 MHz, $CDCl_3$)



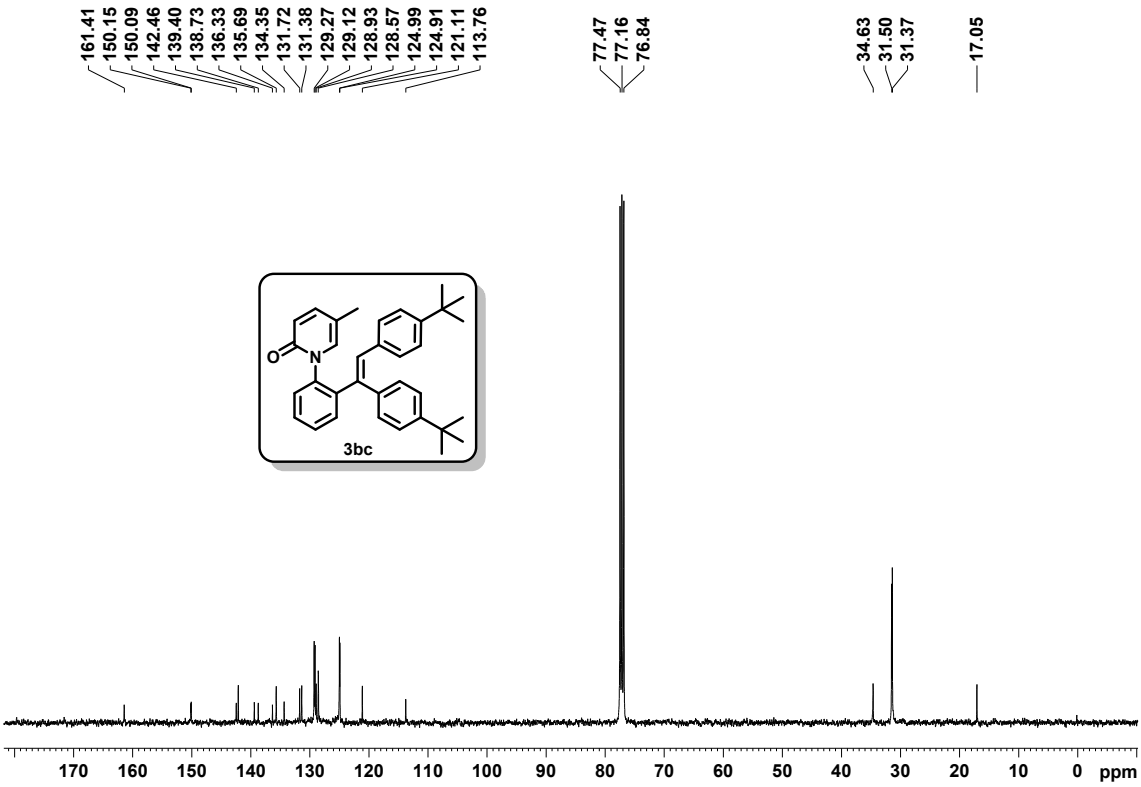
^{1}H NMR spectrum of **3bb** (400 MHz, $CDCl_3$)



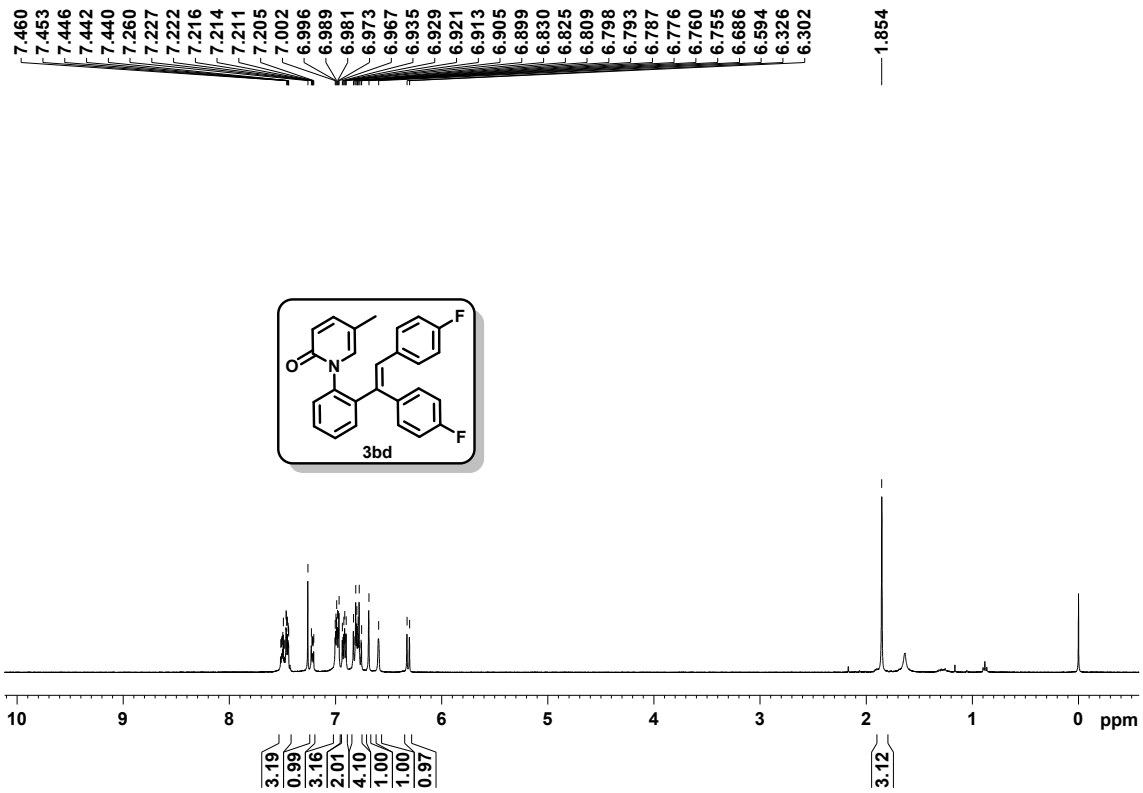
^{13}C NMR spectrum of **3bb** (100 MHz, $CDCl_3$)



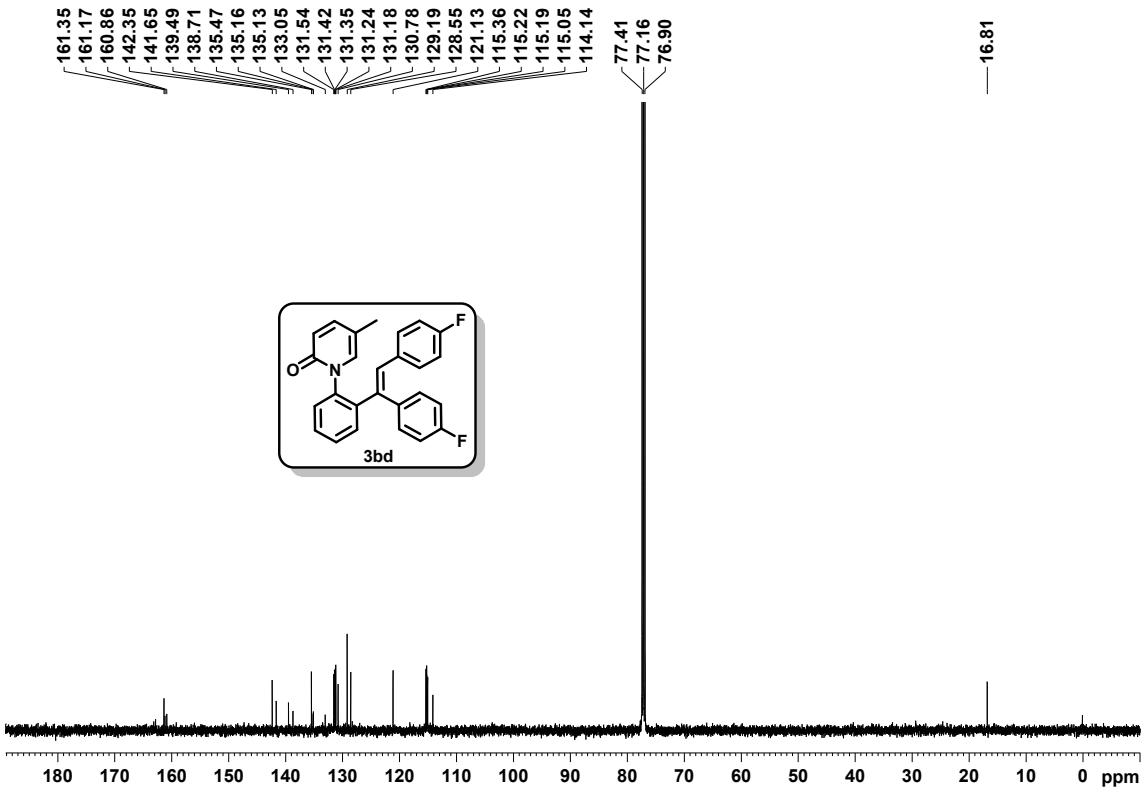
^{1}H NMR spectrum of **3bc** (400 MHz, $CDCl_3$)



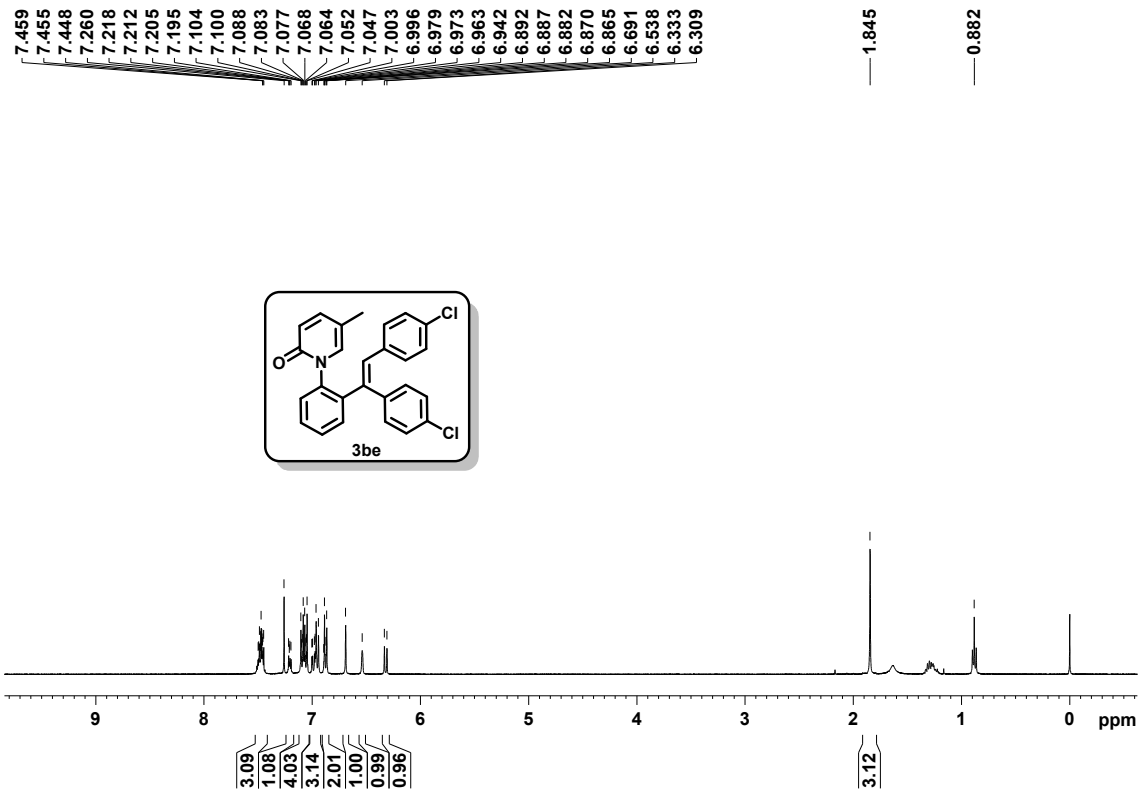
^{13}C NMR spectrum of **3bc** (100 MHz, $CDCl_3$)



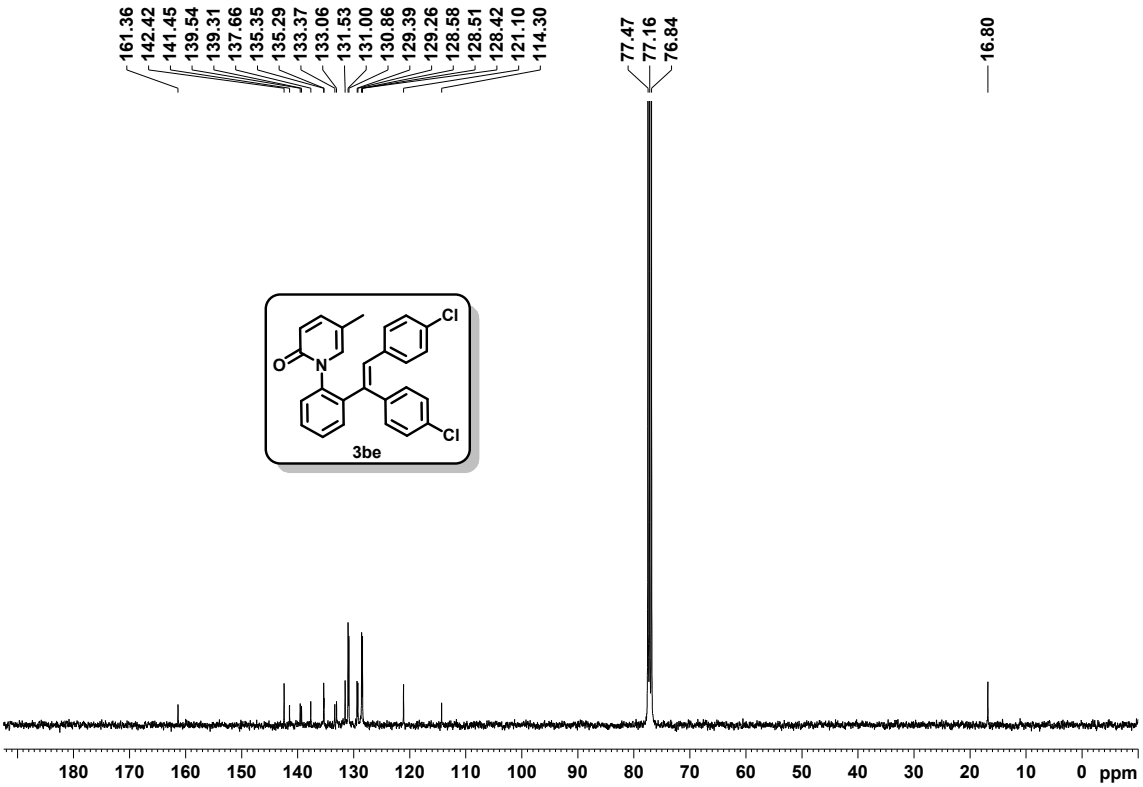
^{1}H NMR spectrum of **3bd** (400 MHz, $CDCl_3$)



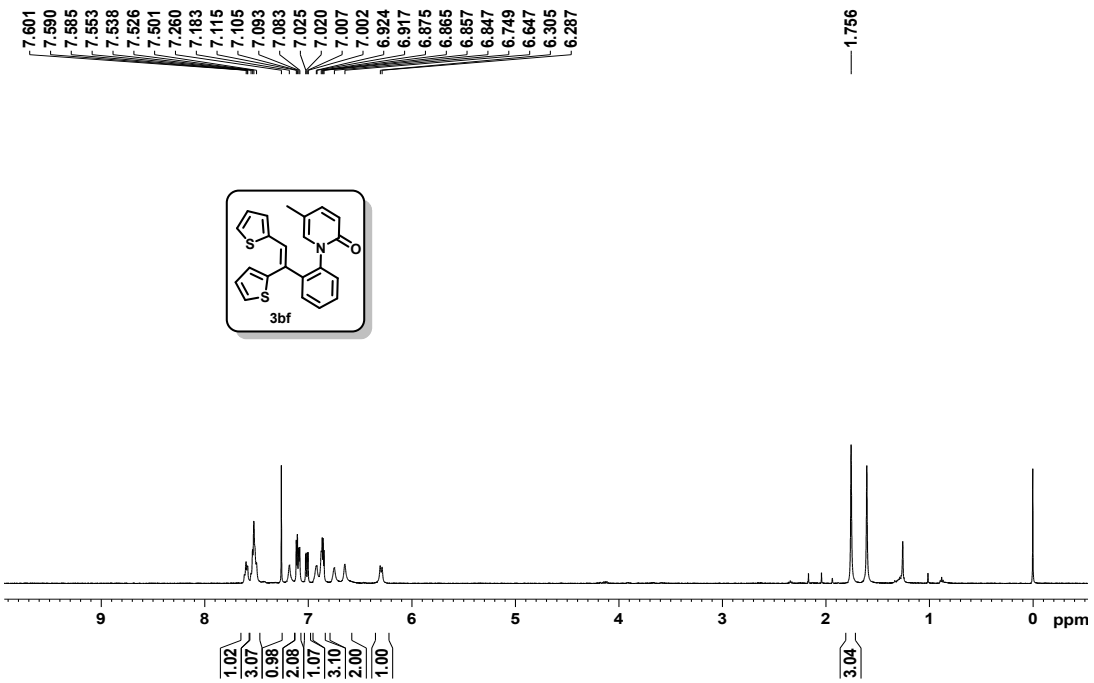
^{13}C NMR spectrum of **3bd** (100 MHz, $CDCl_3$)



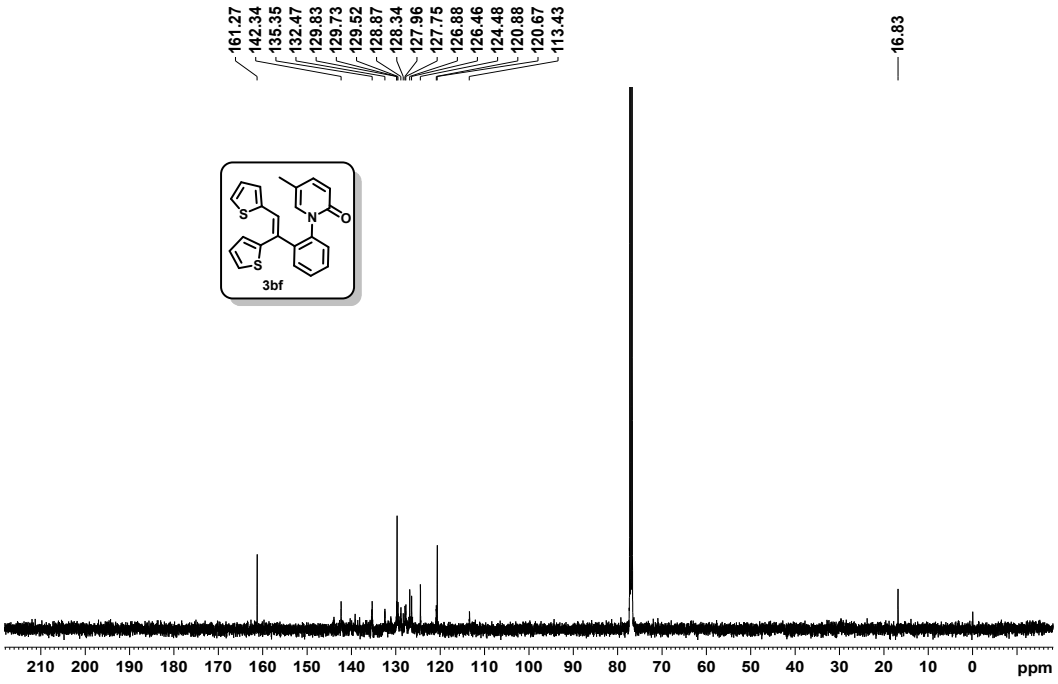
^{1}H NMR spectrum of **3be** (400 MHz, $CDCl_3$)



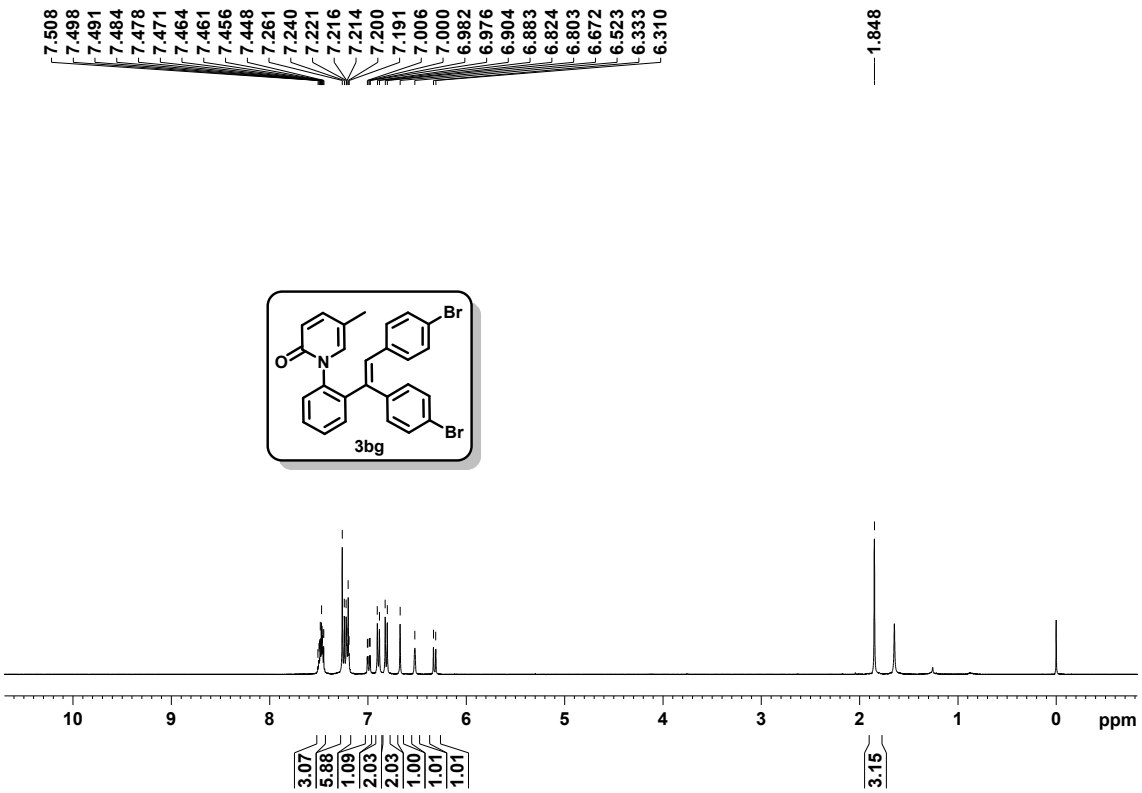
^{13}C NMR spectrum of **3be** (100 MHz, $CDCl_3$)



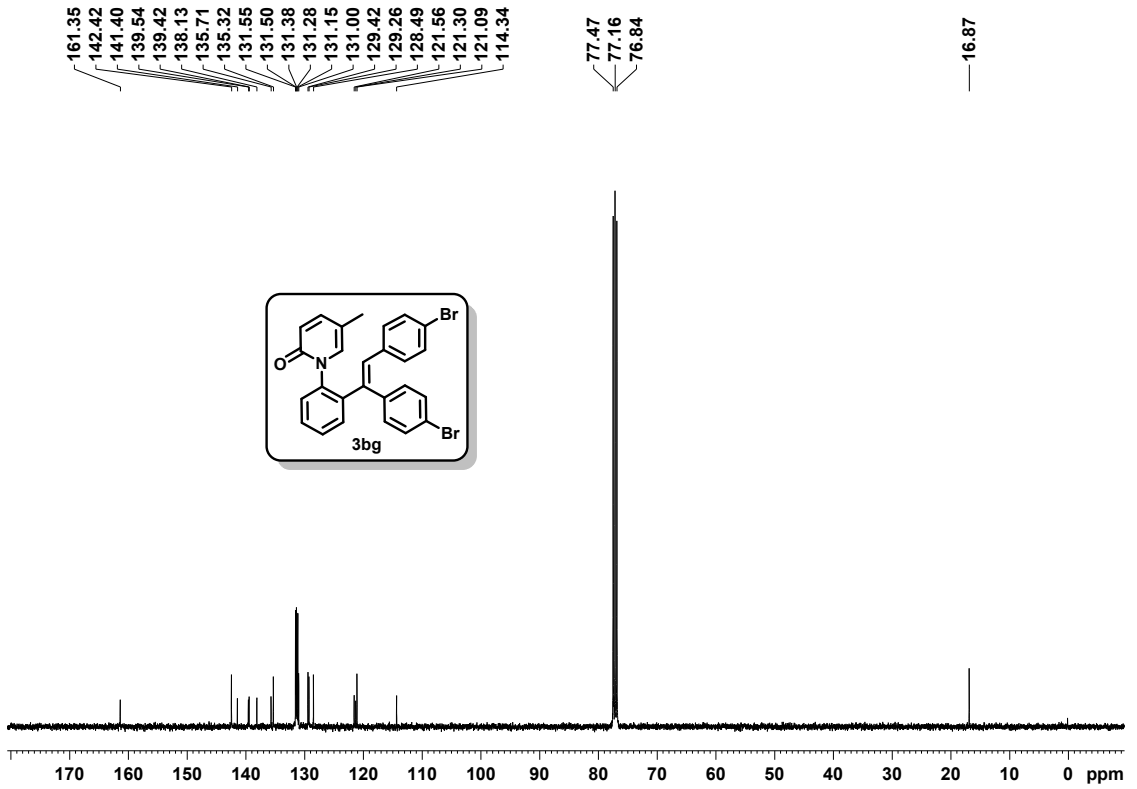
^{1}H NMR spectrum of **3bf** (400 MHz, $CDCl_3$)



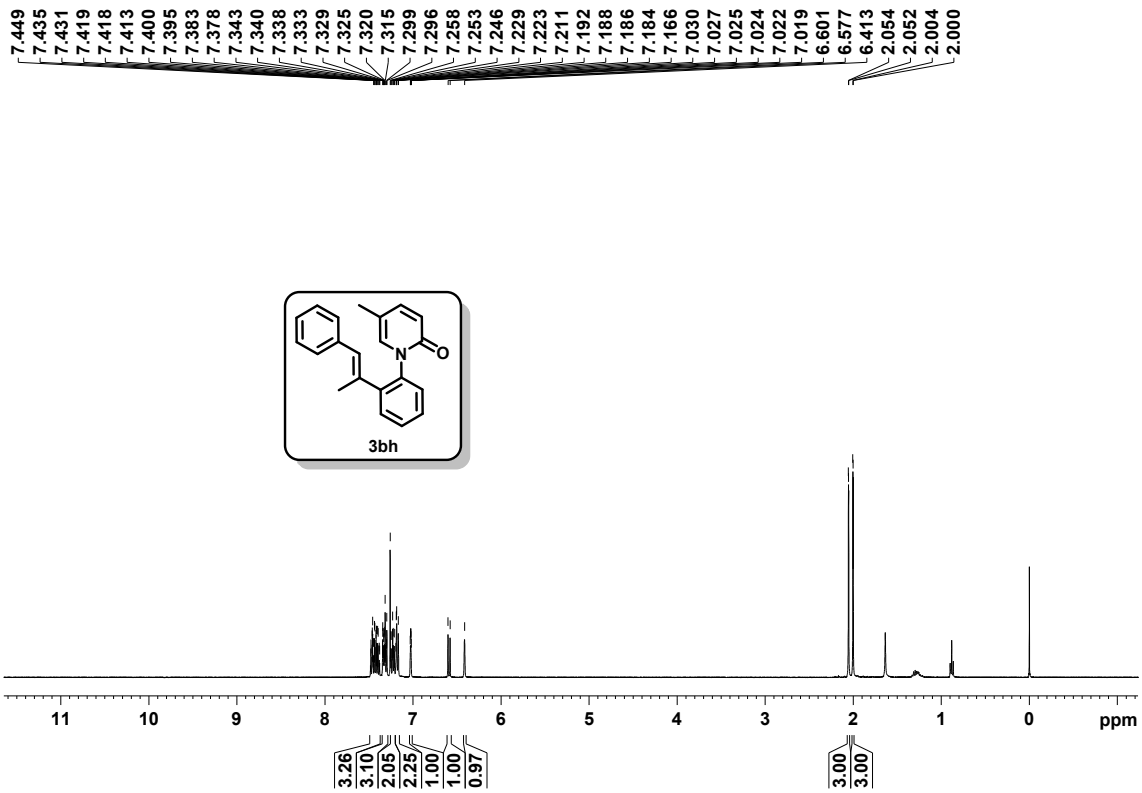
^{13}C NMR spectrum of **3bf** (100 MHz, $CDCl_3$)



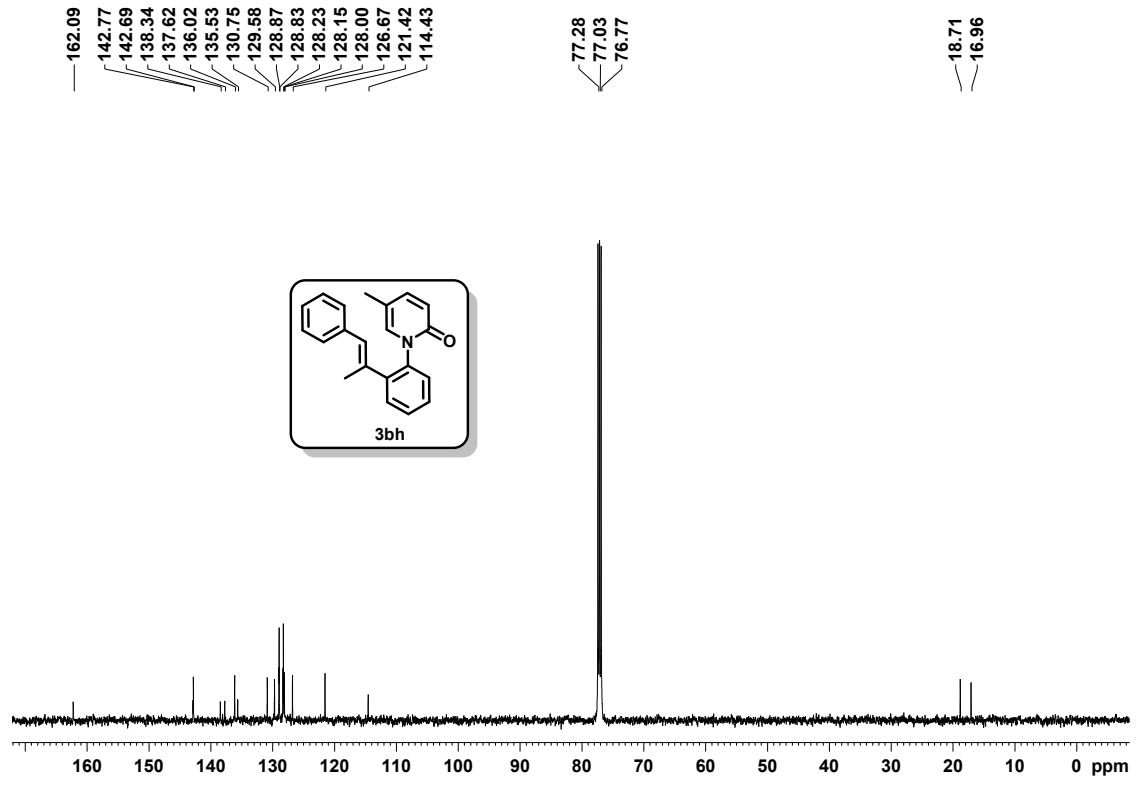
^{1}H NMR spectrum of **3bg** (400 MHz, $CDCl_3$)



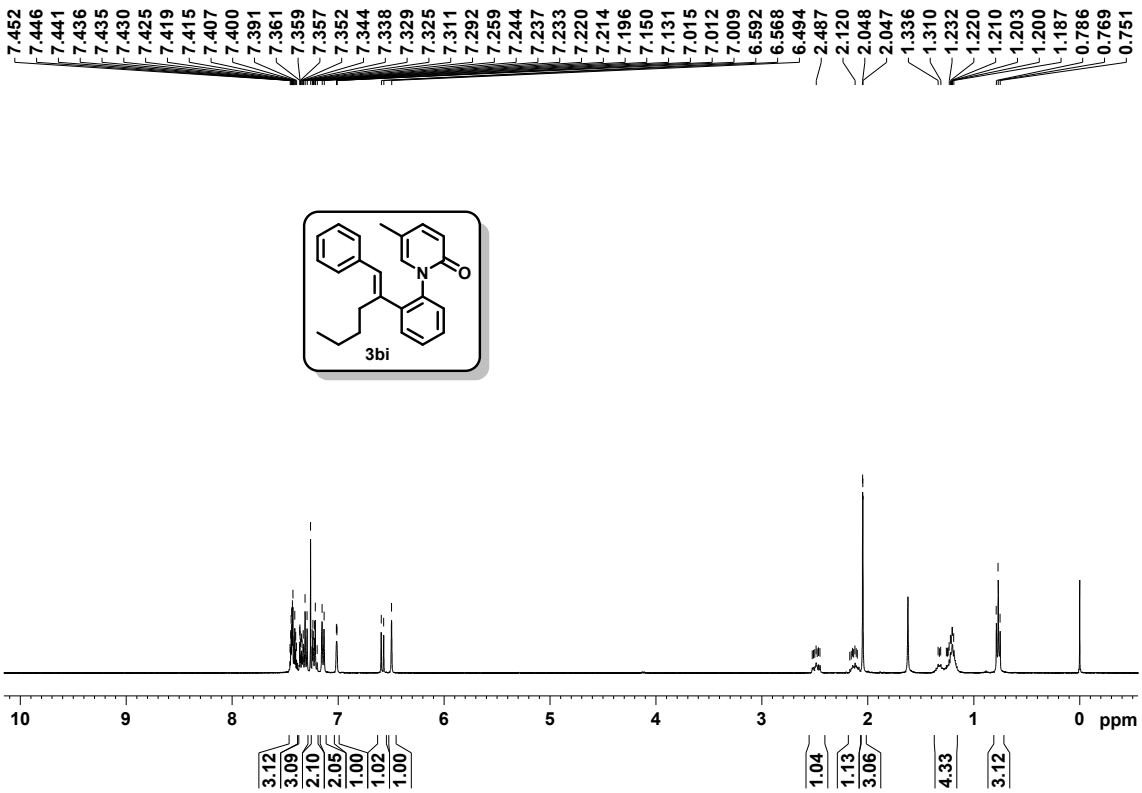
^{13}C NMR spectrum of **3bg** (100 MHz, $CDCl_3$)



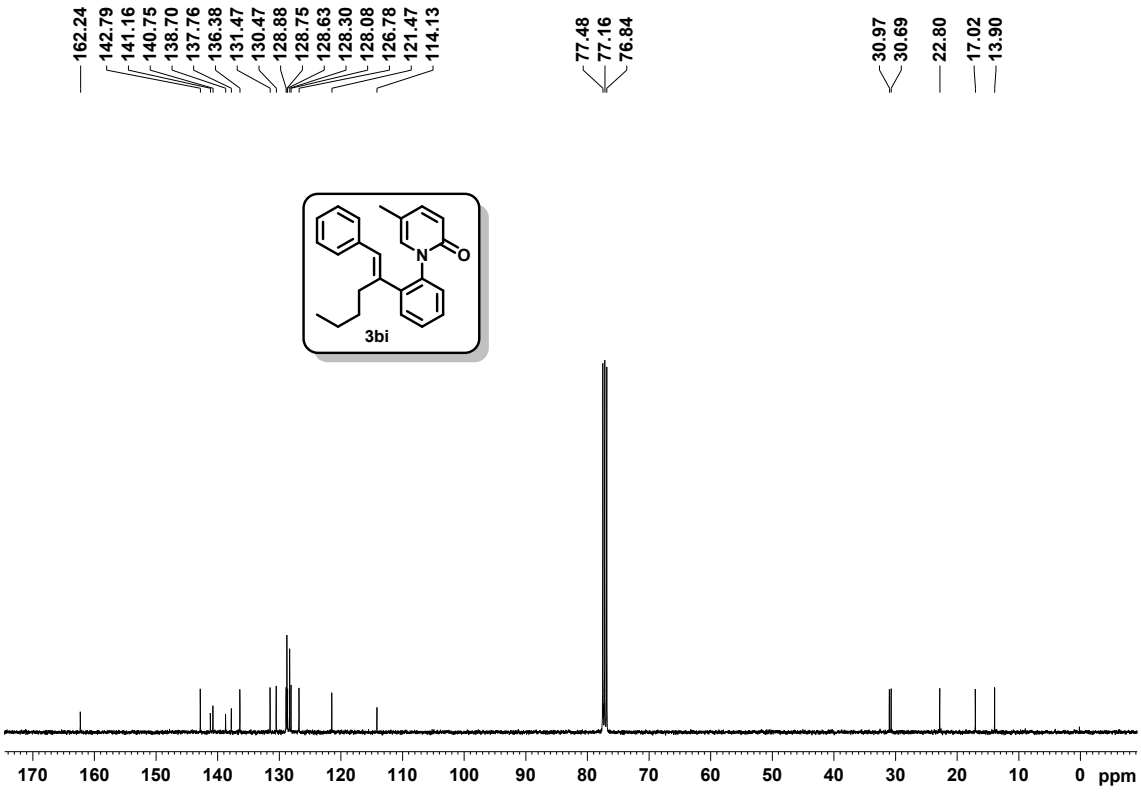
^{1}H NMR spectrum of **3bh** (400 MHz, $CDCl_3$)



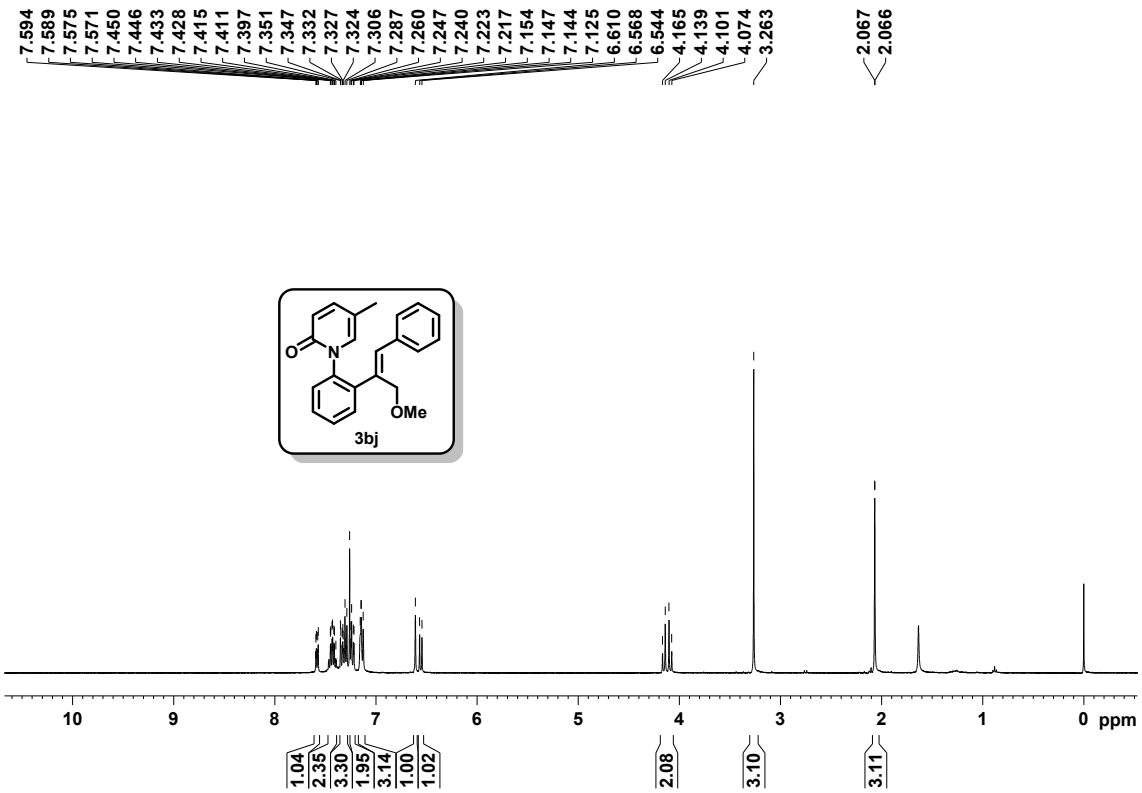
^{13}C NMR spectrum of **3bh** (100 MHz, $CDCl_3$)



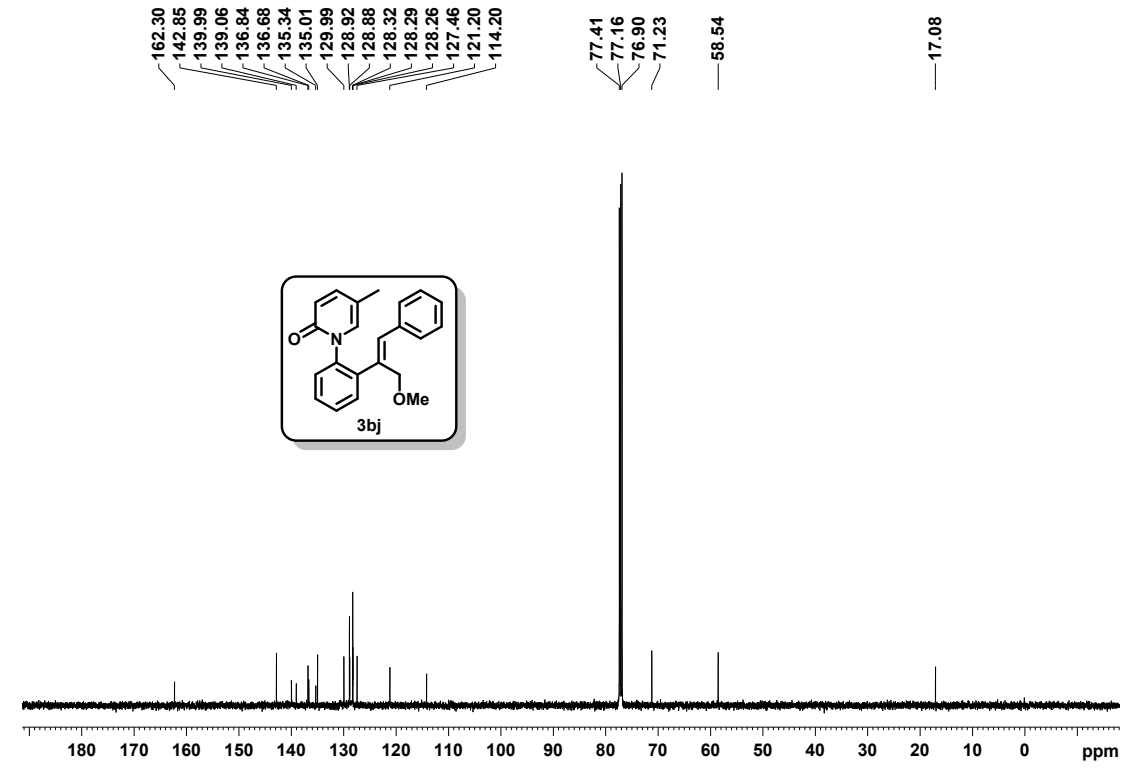
^{1}H NMR spectrum of **3bi** (400 MHz, $CDCl_3$)



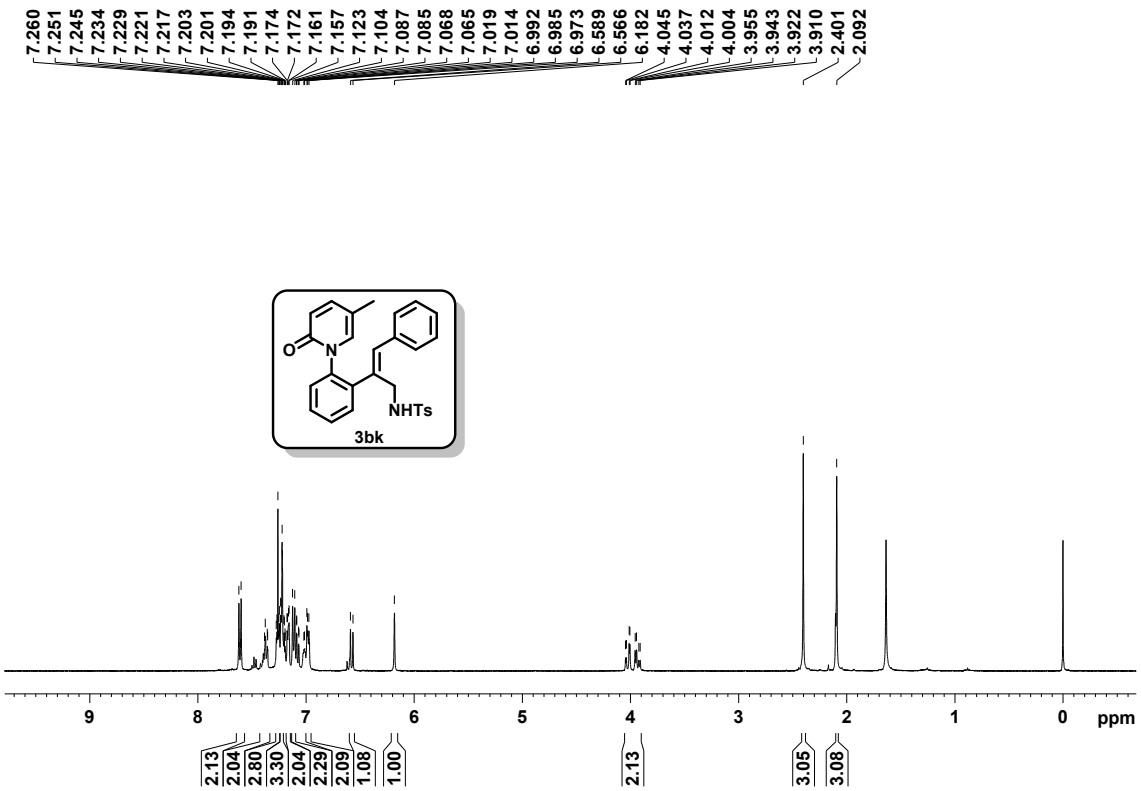
^{13}C NMR spectrum of **3bi** (100 MHz, $CDCl_3$)



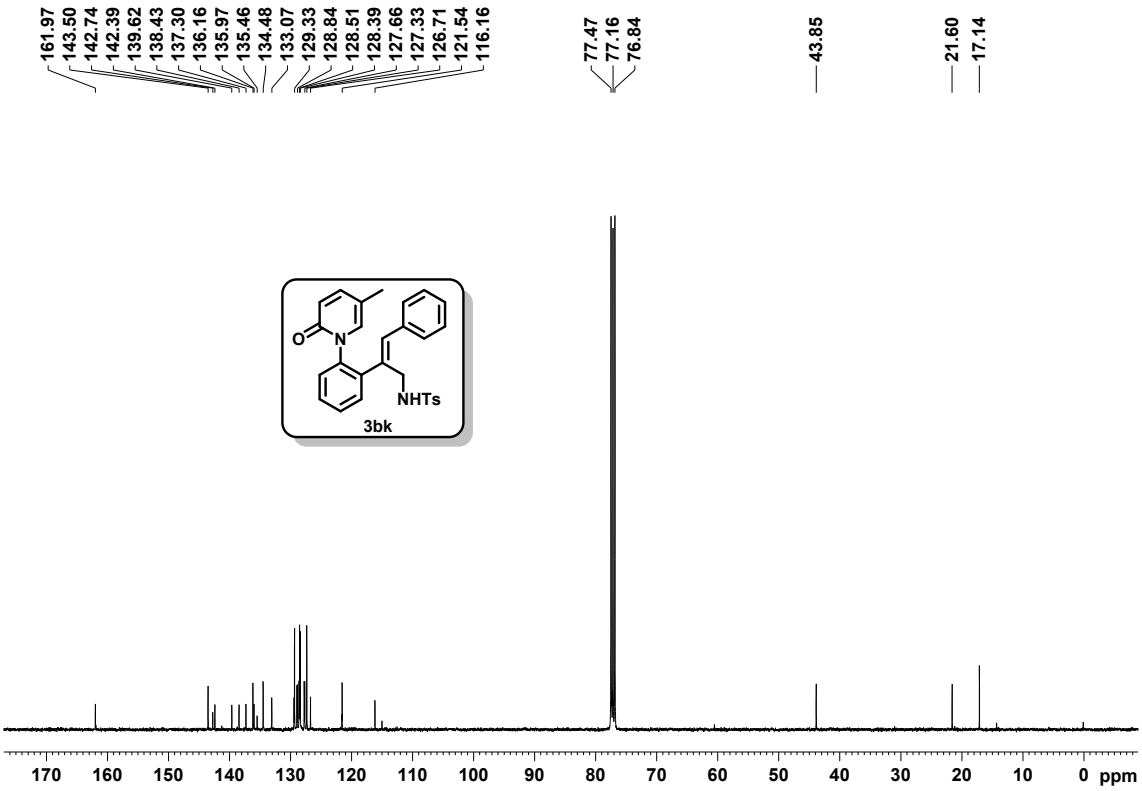
^{1}H NMR spectrum of **3bj** (400 MHz, $CDCl_3$)



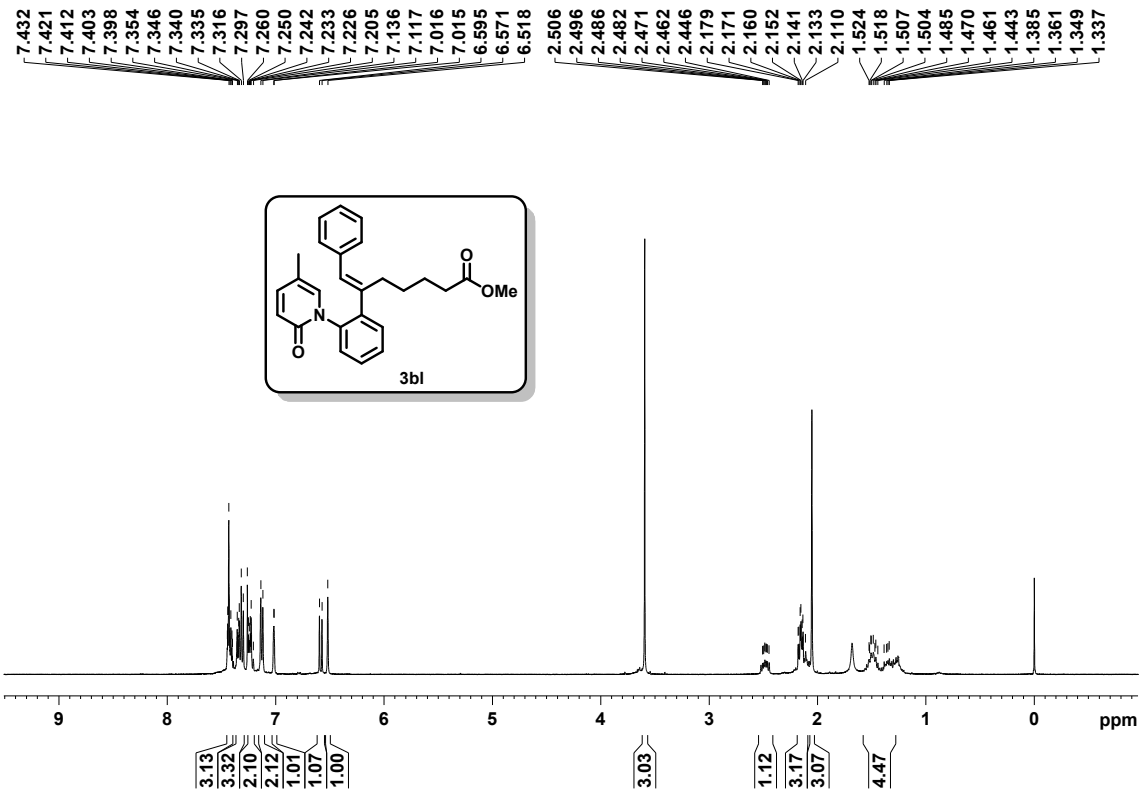
^{13}C NMR spectrum of **3bj** (100 MHz, $CDCl_3$)



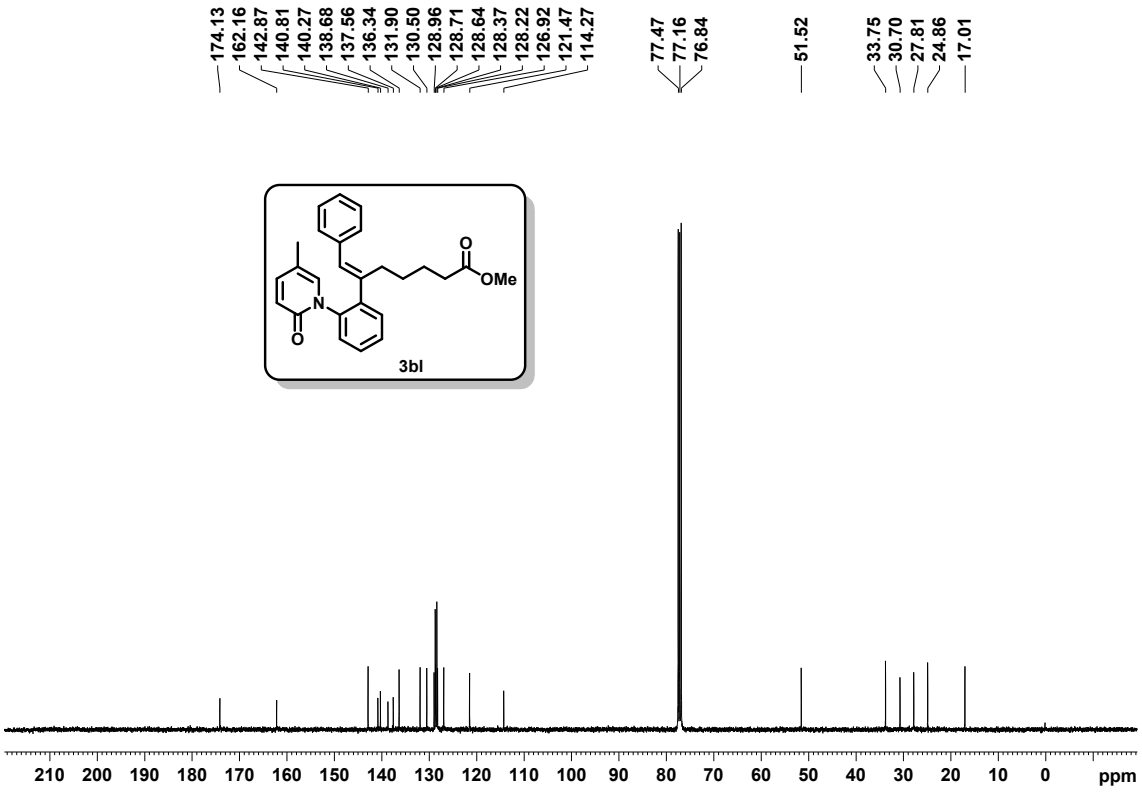
^{1}H NMR spectrum of **3bk** (400 MHz, $CDCl_3$)



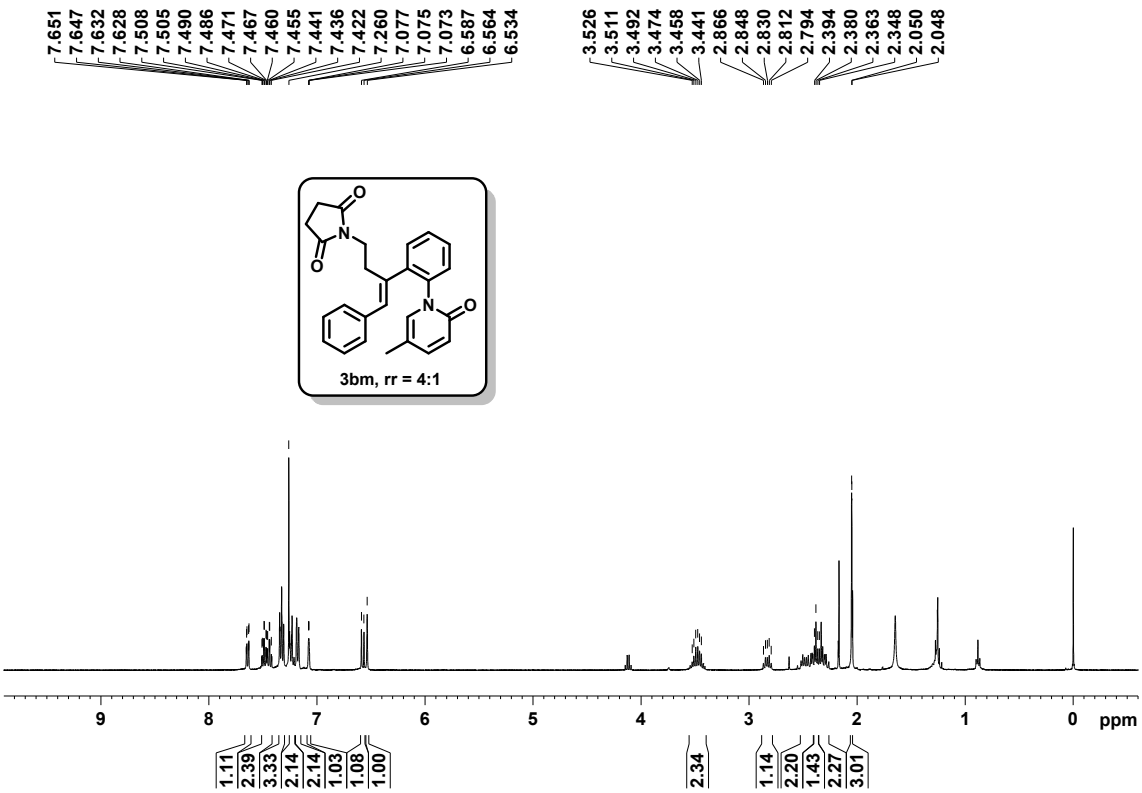
^{13}C NMR spectrum of **3bk** (100 MHz, $CDCl_3$)



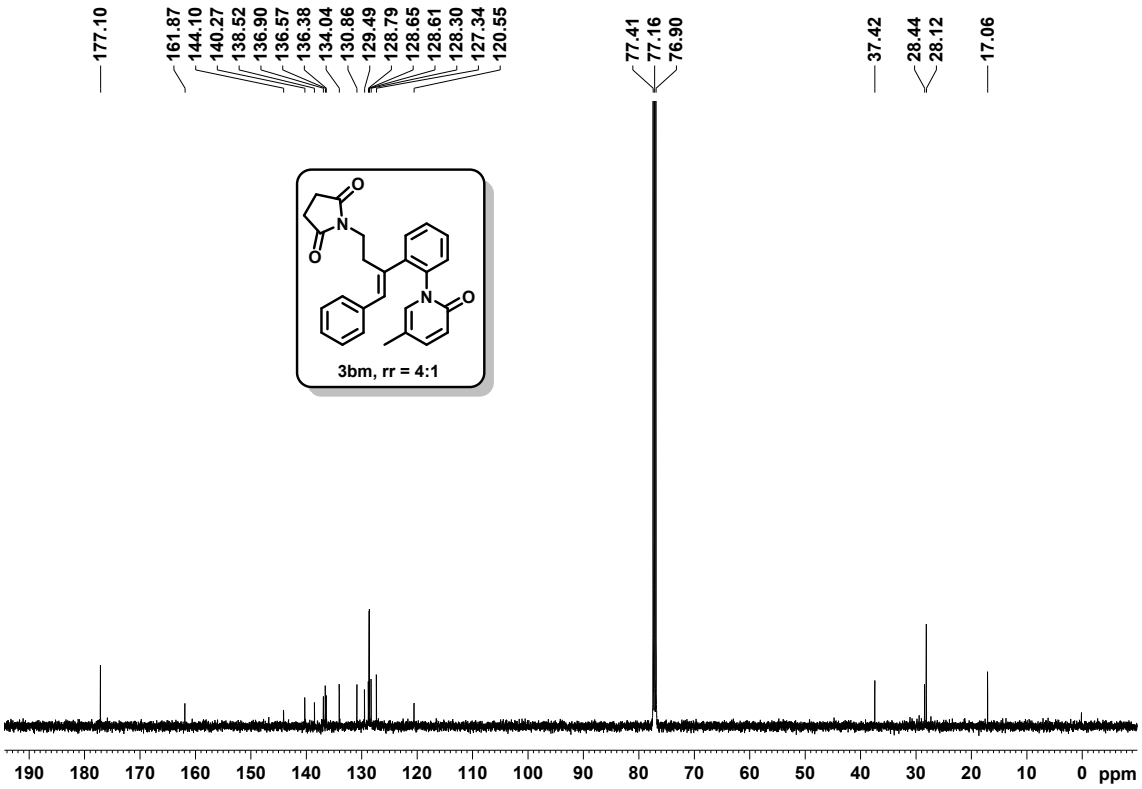
^{1}H NMR spectrum of **3bl** (400 MHz, $CDCl_3$)



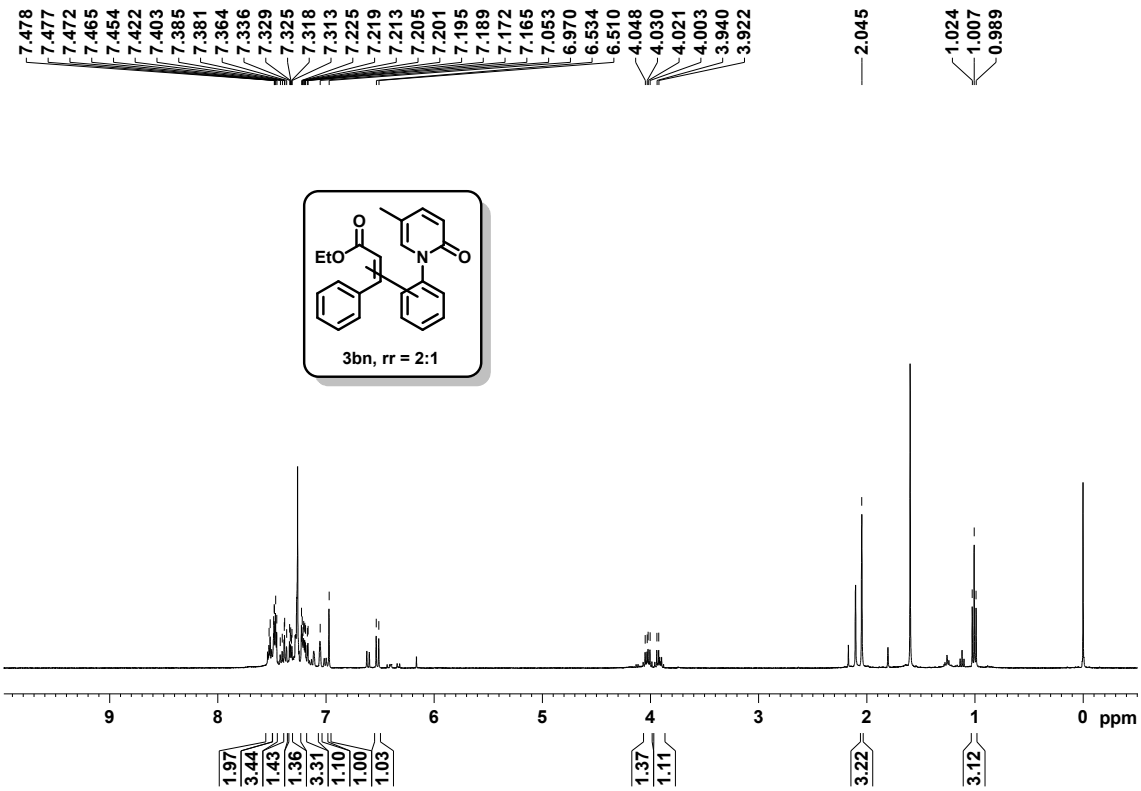
^{13}C NMR spectrum of **3bl** (100 MHz, $CDCl_3$)



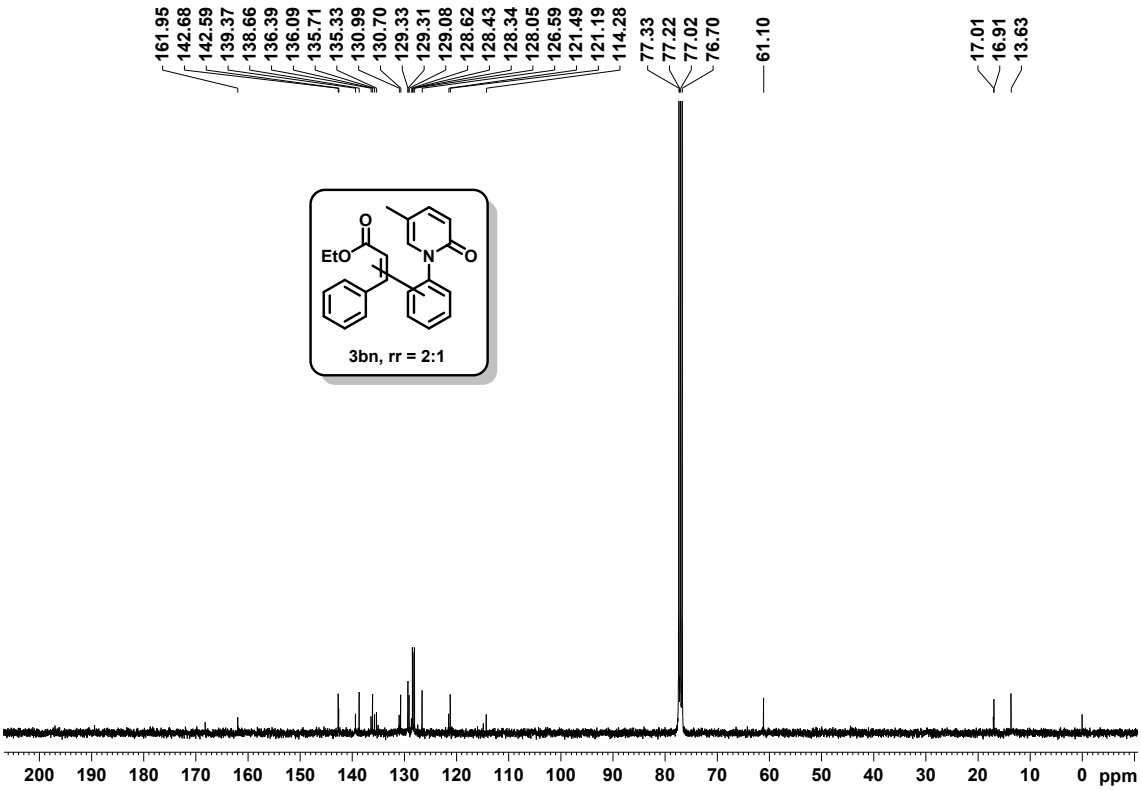
^{1}H NMR spectrum of **3bm** (400 MHz, $CDCl_3$)



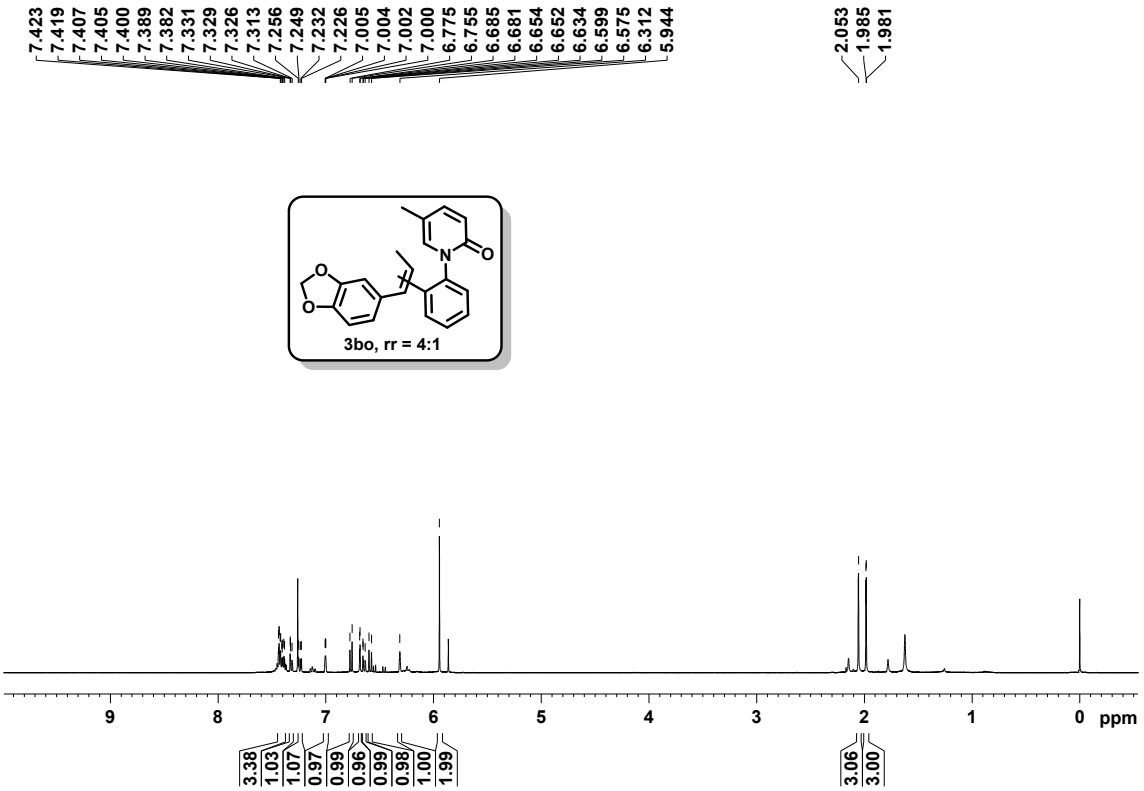
^{13}C NMR spectrum of **3bm** (100 MHz, $CDCl_3$)



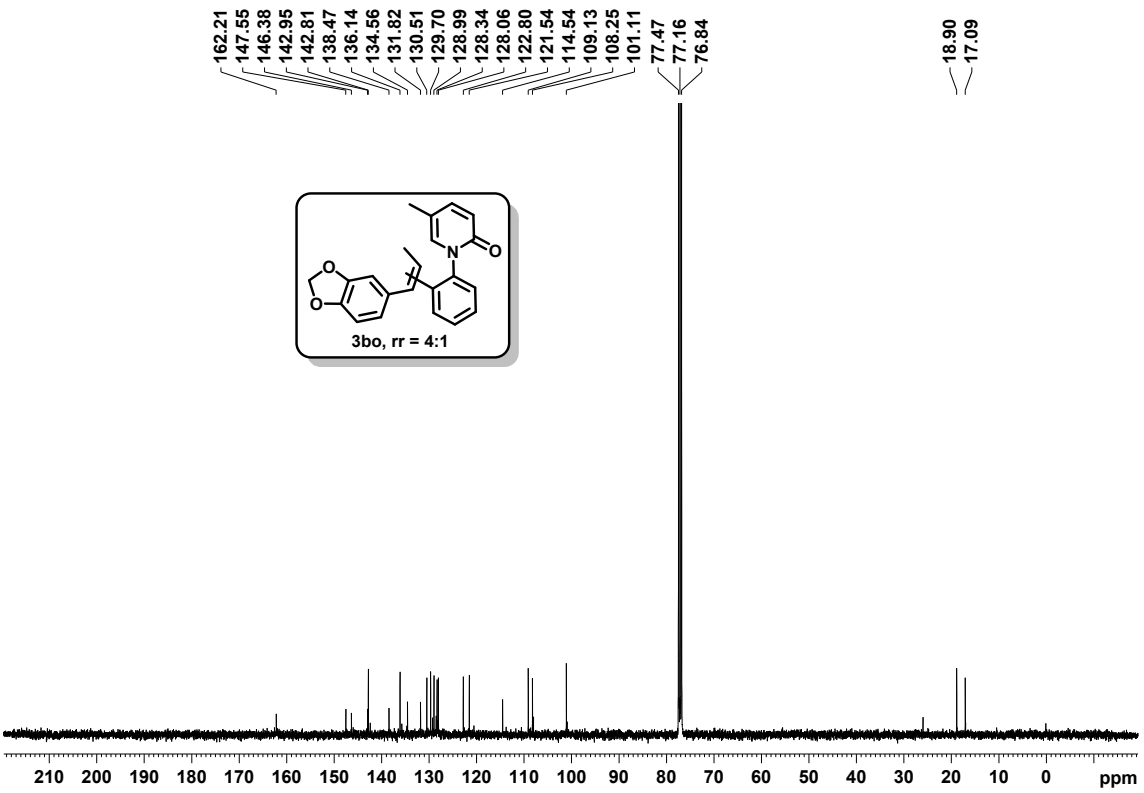
^{1}H NMR spectrum of **3bn** (400 MHz, $CDCl_3$)



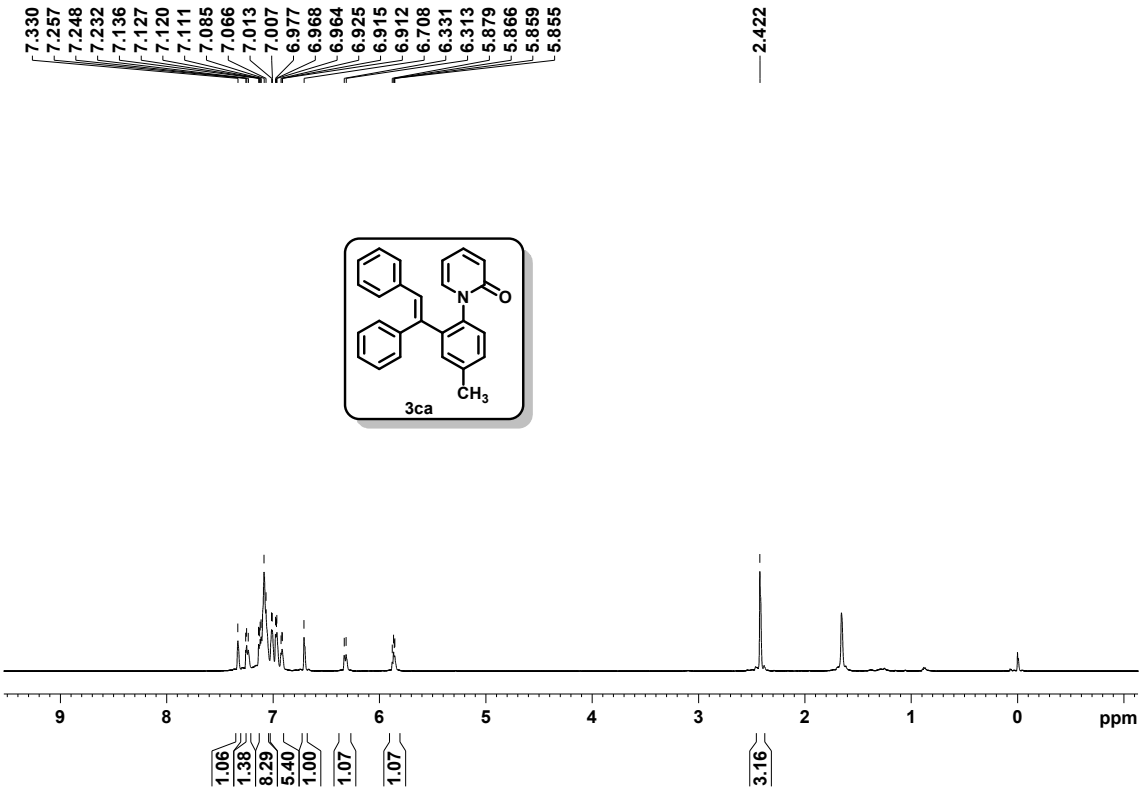
^{13}C NMR spectrum of **3bn** (100 MHz, $CDCl_3$)



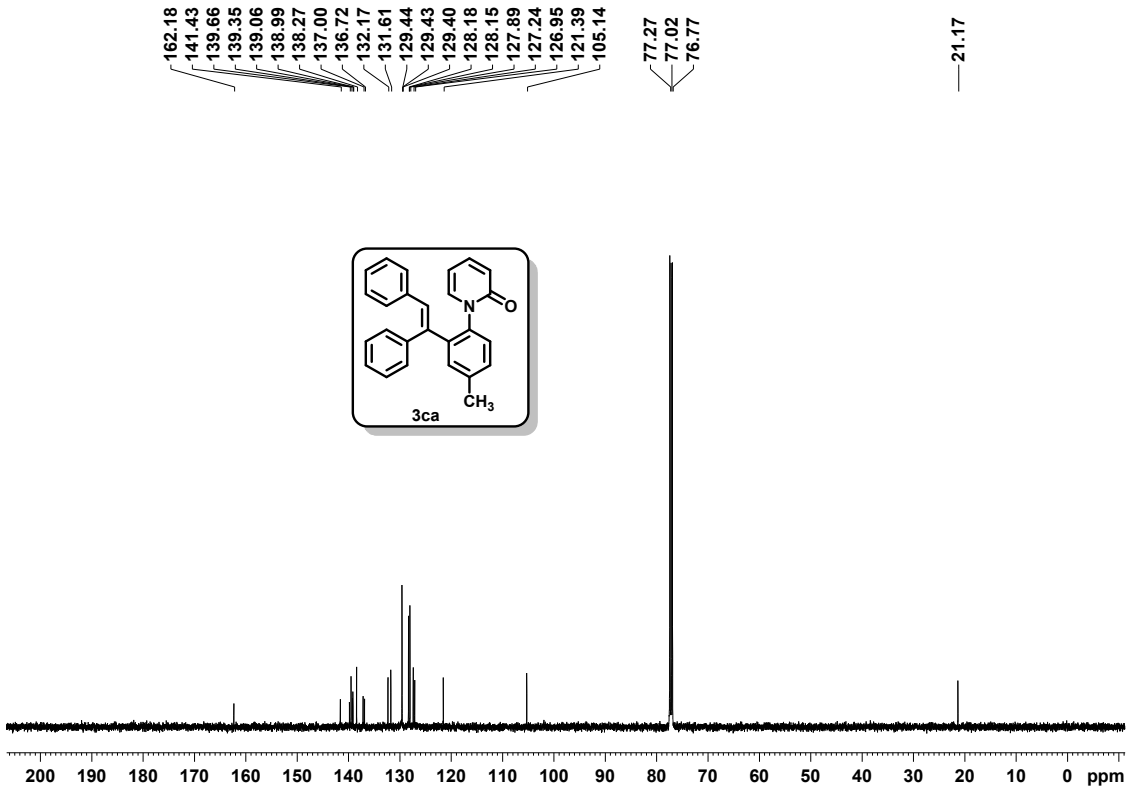
^{1}H NMR spectrum of **3bo** (400 MHz, $CDCl_3$)



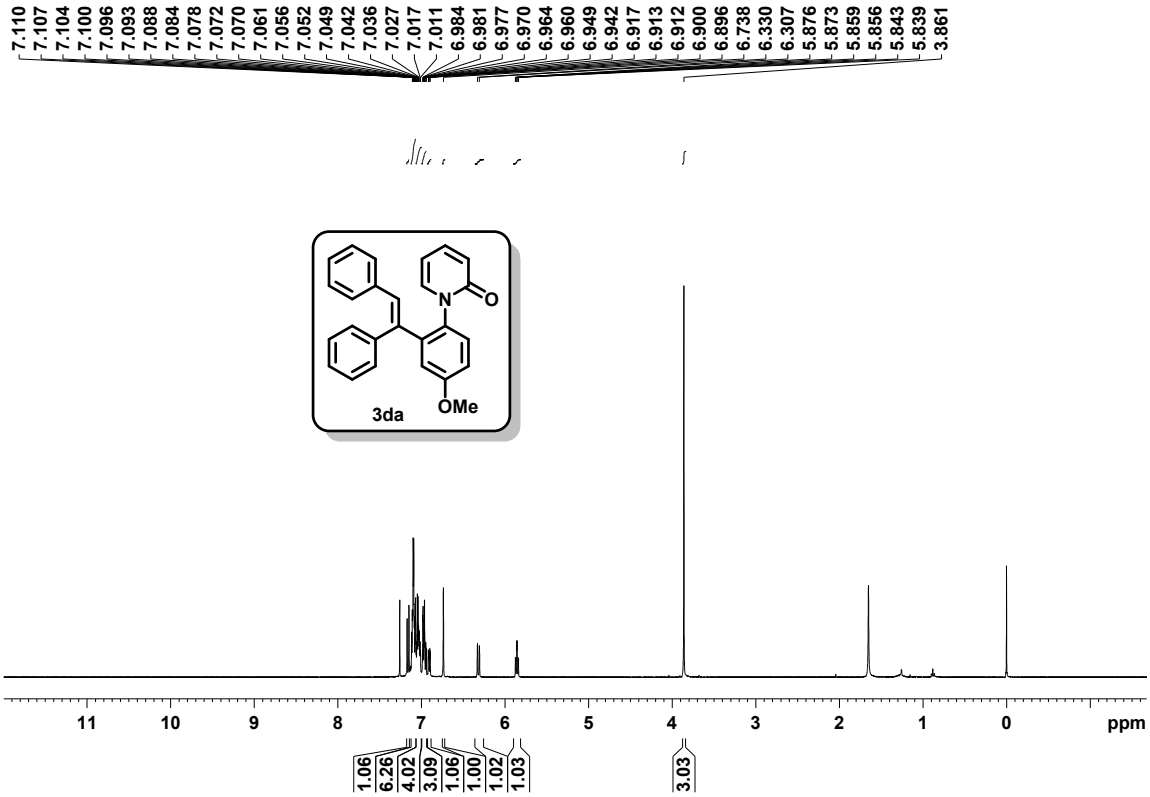
^{13}C NMR spectrum of **3bo** (100 MHz, $CDCl_3$)



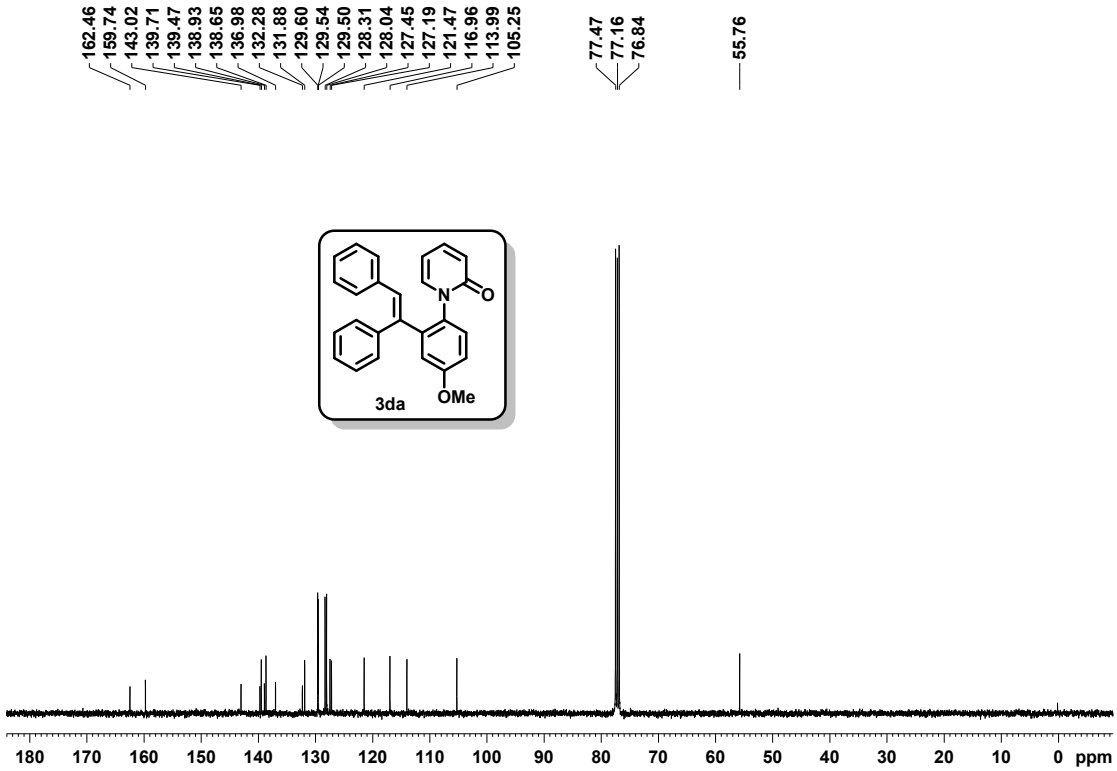
^{1}H NMR spectrum of **3ca** (400 MHz, $CDCl_3$)



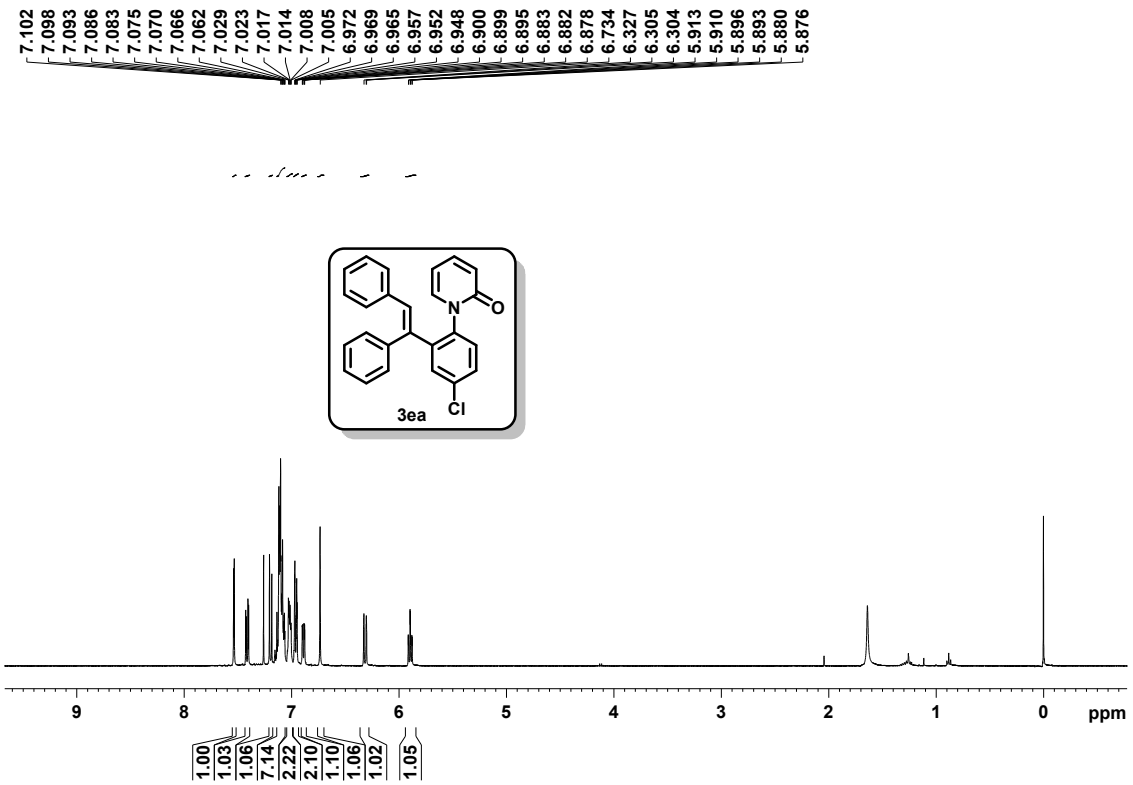
^{13}C NMR spectrum of **3ca** (100 MHz, $CDCl_3$)



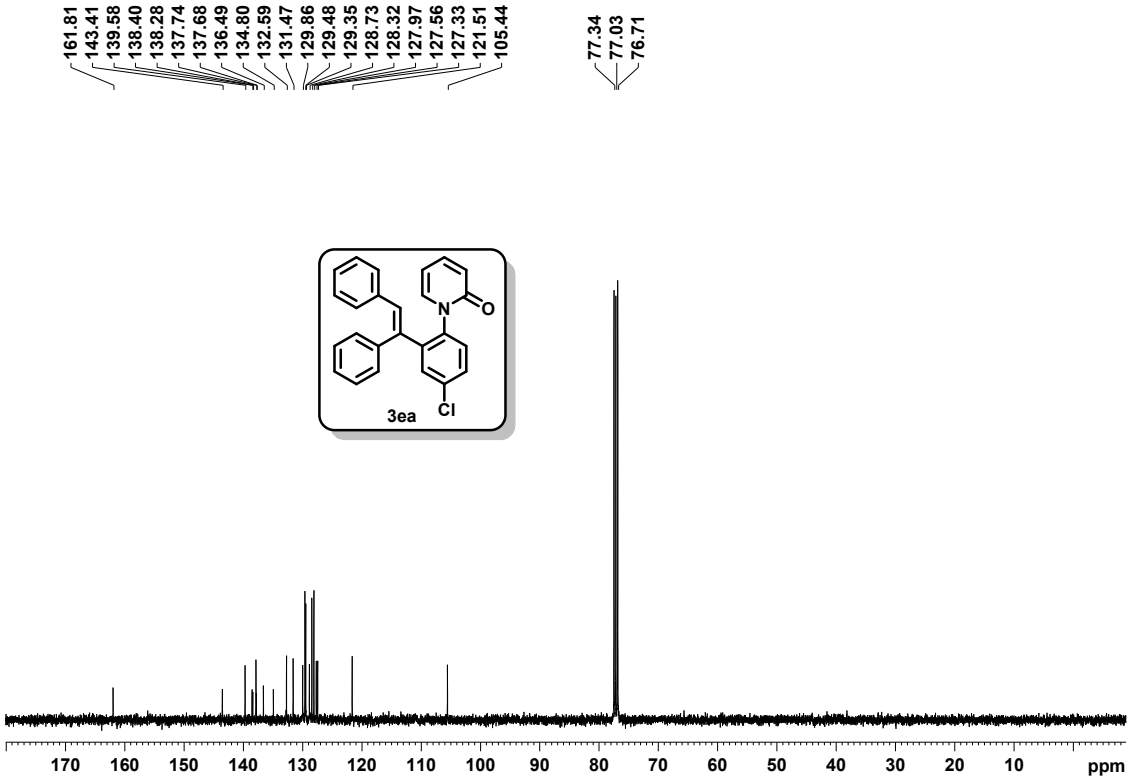
^{1}H NMR spectrum of **3da** (400 MHz, $CDCl_3$)



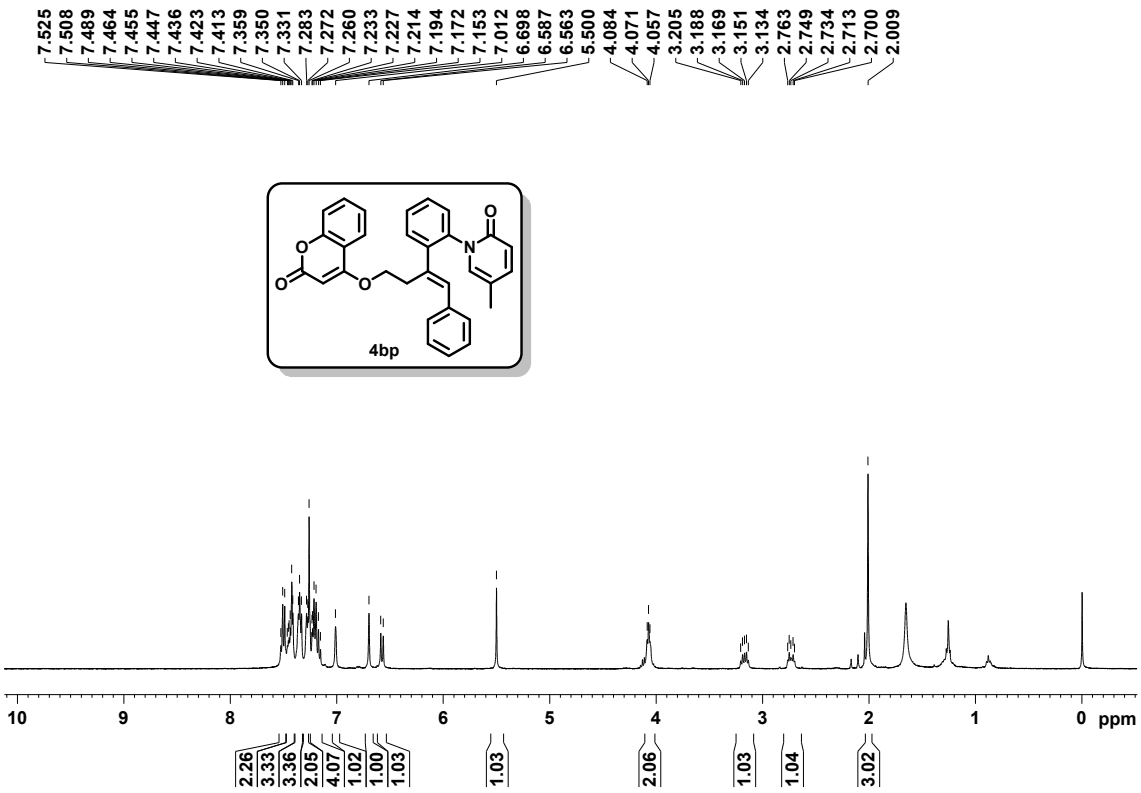
^{13}C NMR spectrum of **3da** (100 MHz, $CDCl_3$)



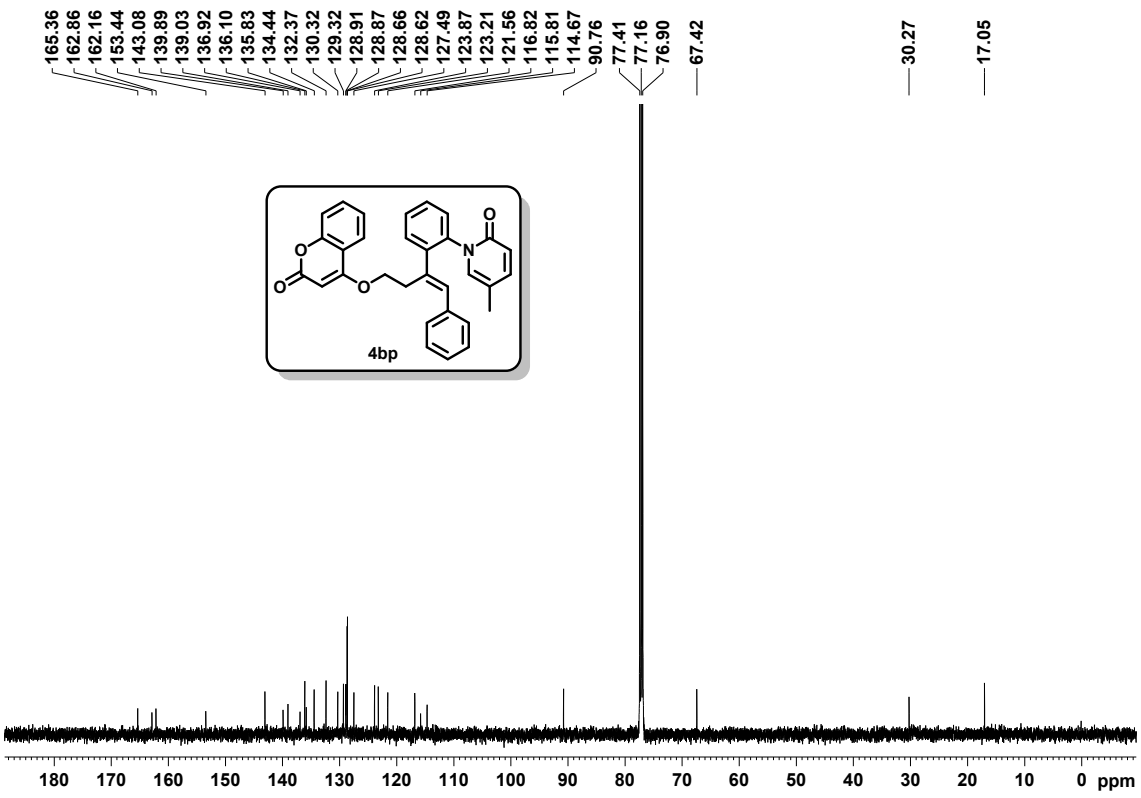
^{1}H NMR spectrum of **3ea** (400 MHz, $CDCl_3$)



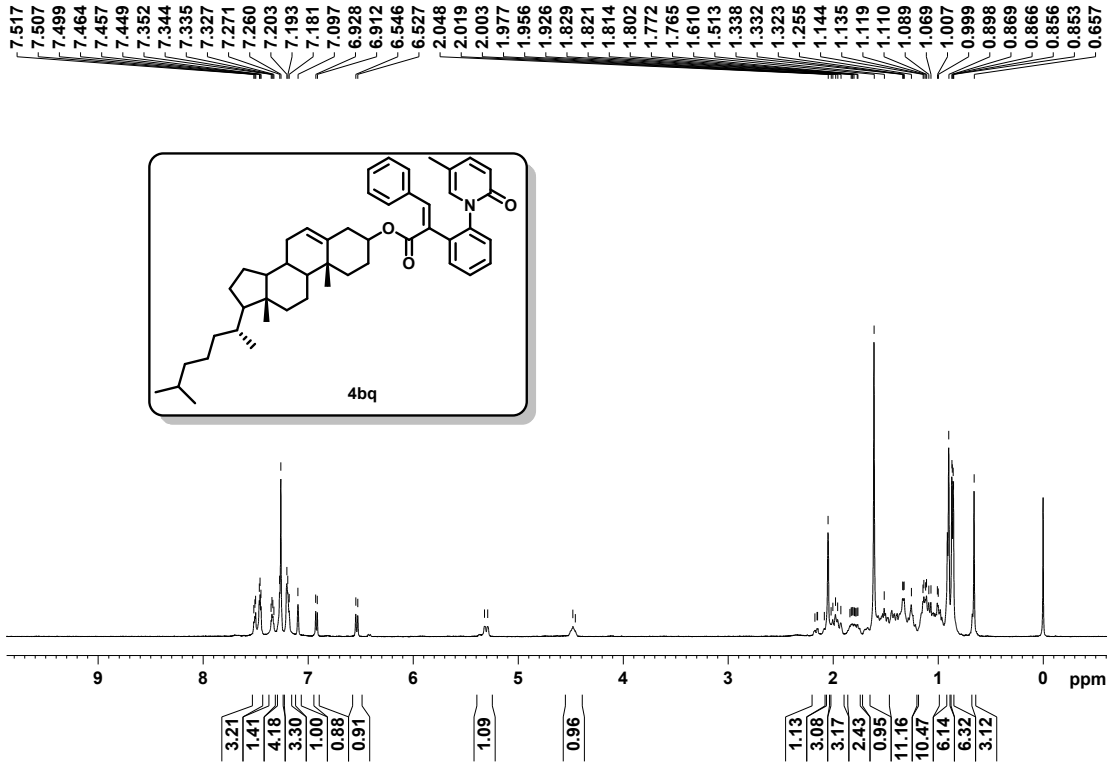
^{13}C NMR spectrum of **3ea** (100 MHz, $CDCl_3$)



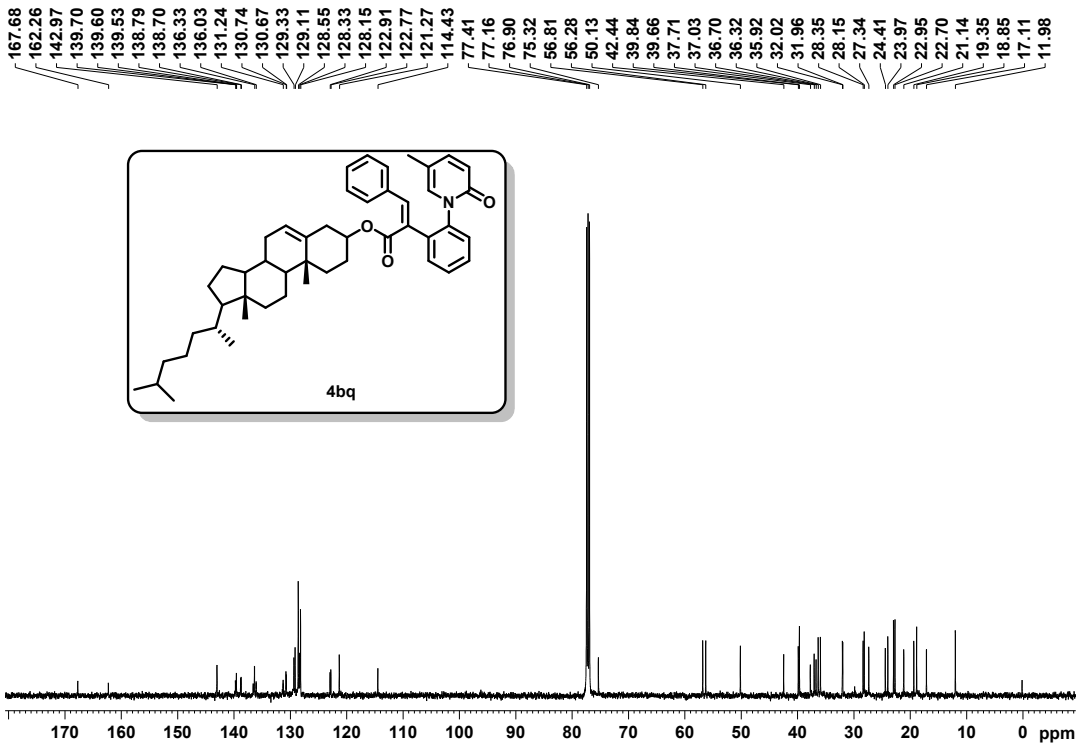
^{1}H NMR spectrum of **4bp** (400 MHz, $CDCl_3$)



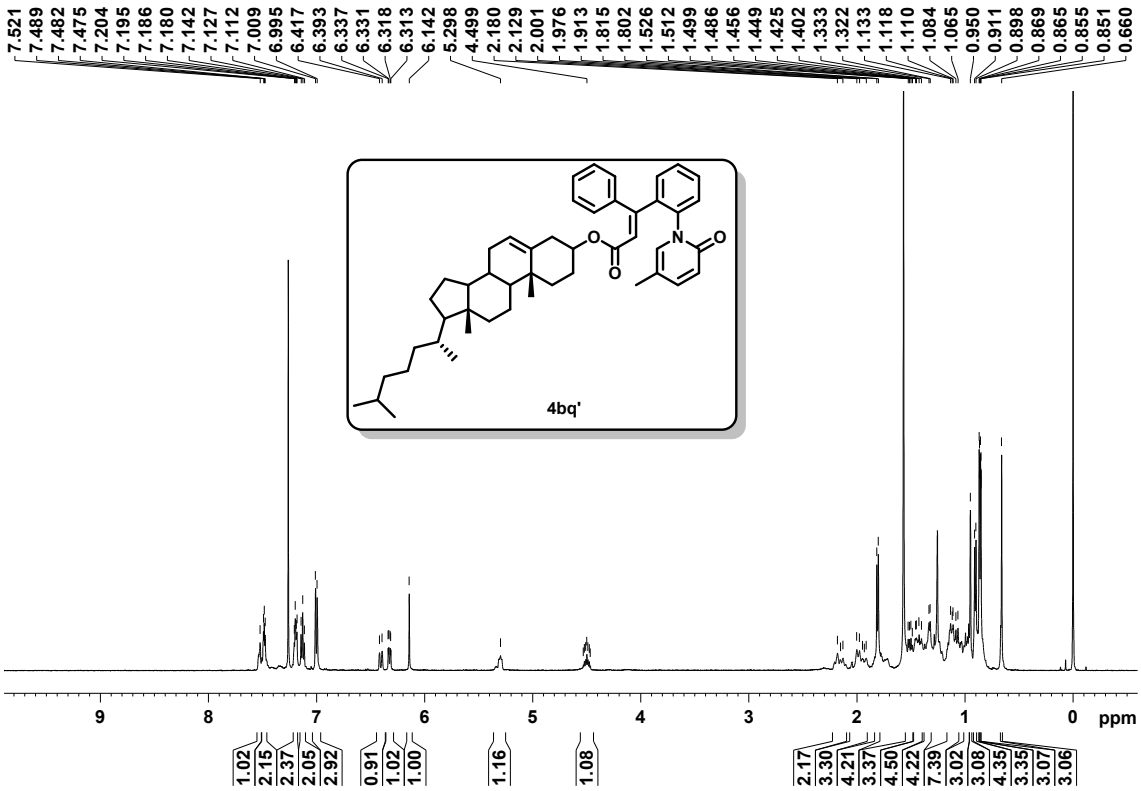
^{13}C NMR spectrum of **4bp** (100 MHz, $CDCl_3$)



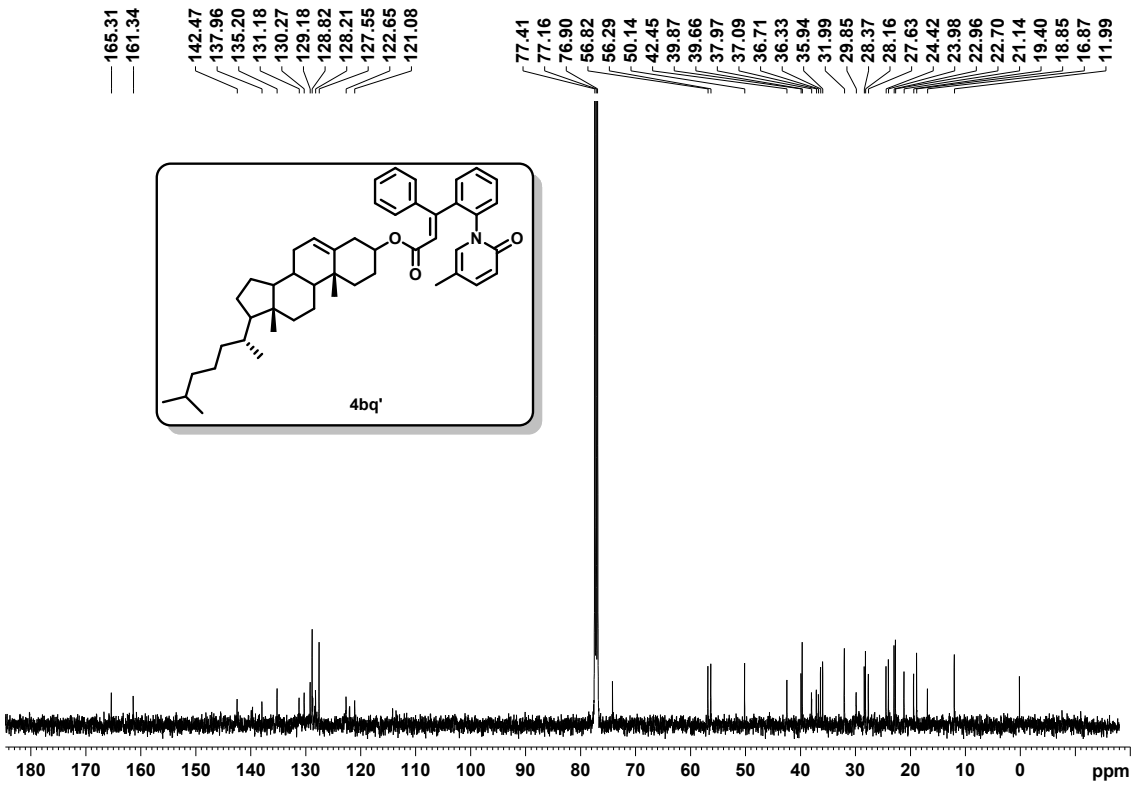
^{1}H NMR spectrum of **4bq** (400 MHz, $CDCl_3$)



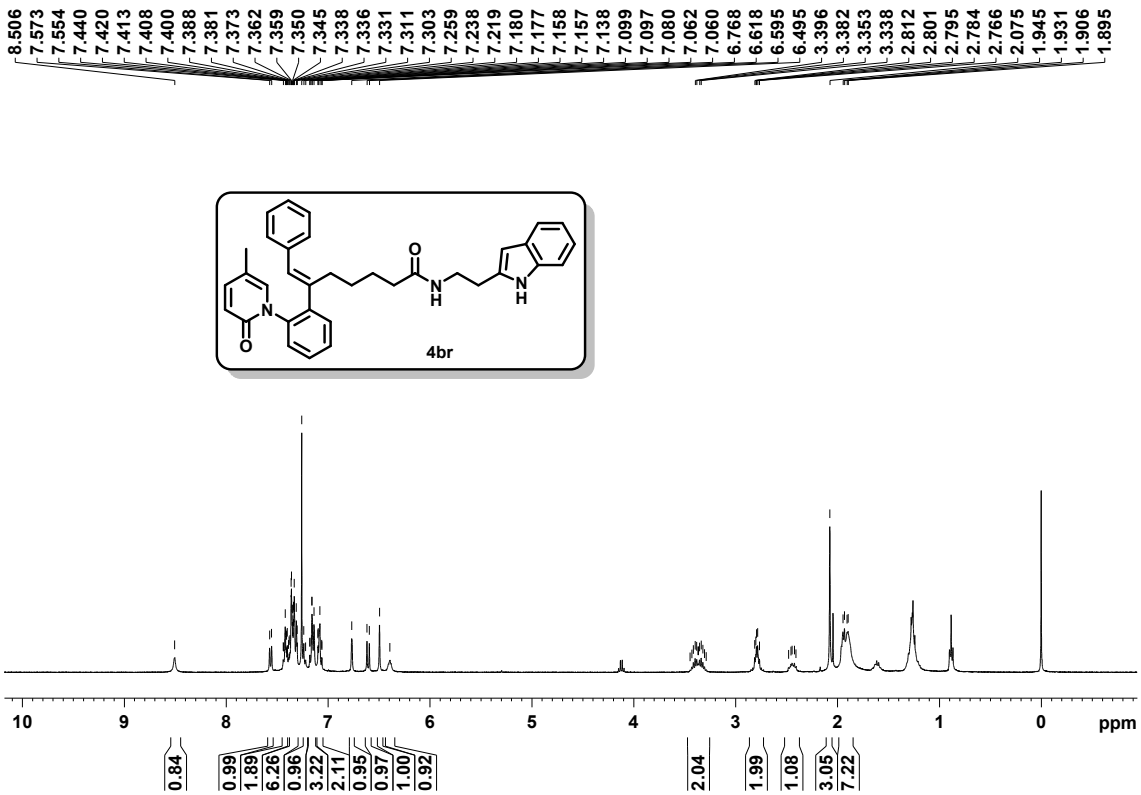
^{13}C NMR spectrum of **4bq** (100 MHz, $CDCl_3$)



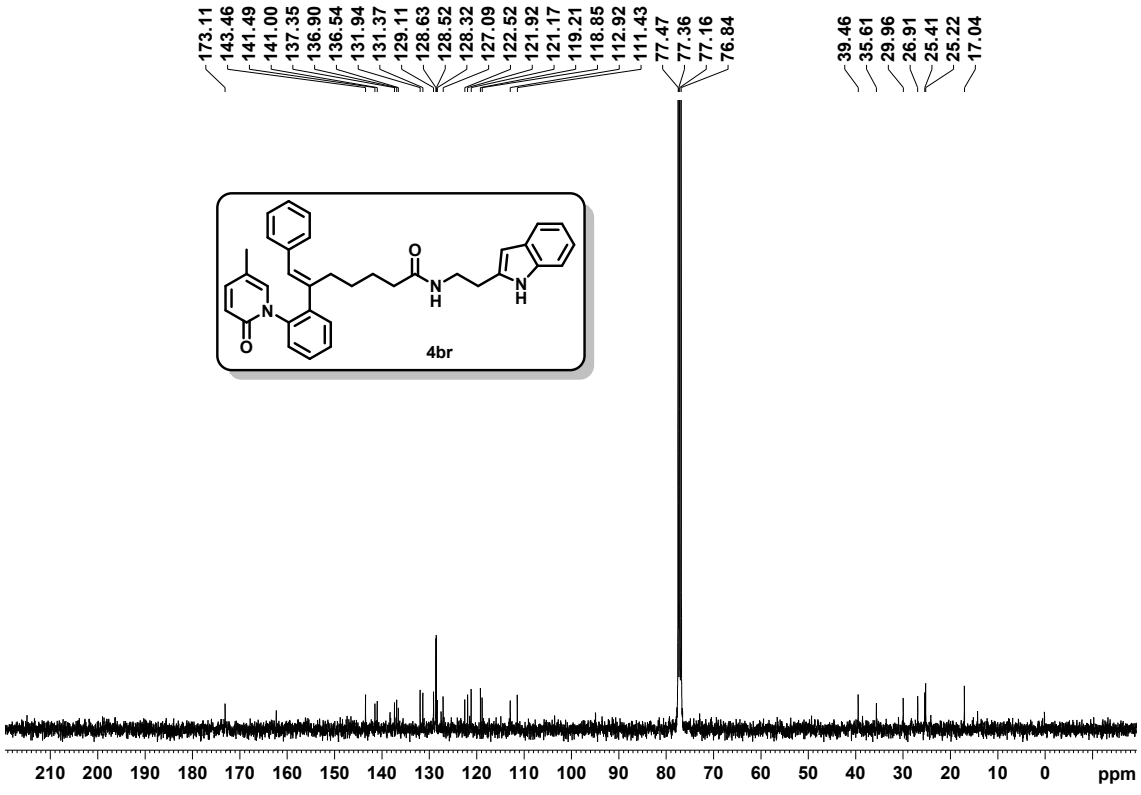
^{1}H NMR spectrum of **4bq'** (400 MHz, $CDCl_3$)



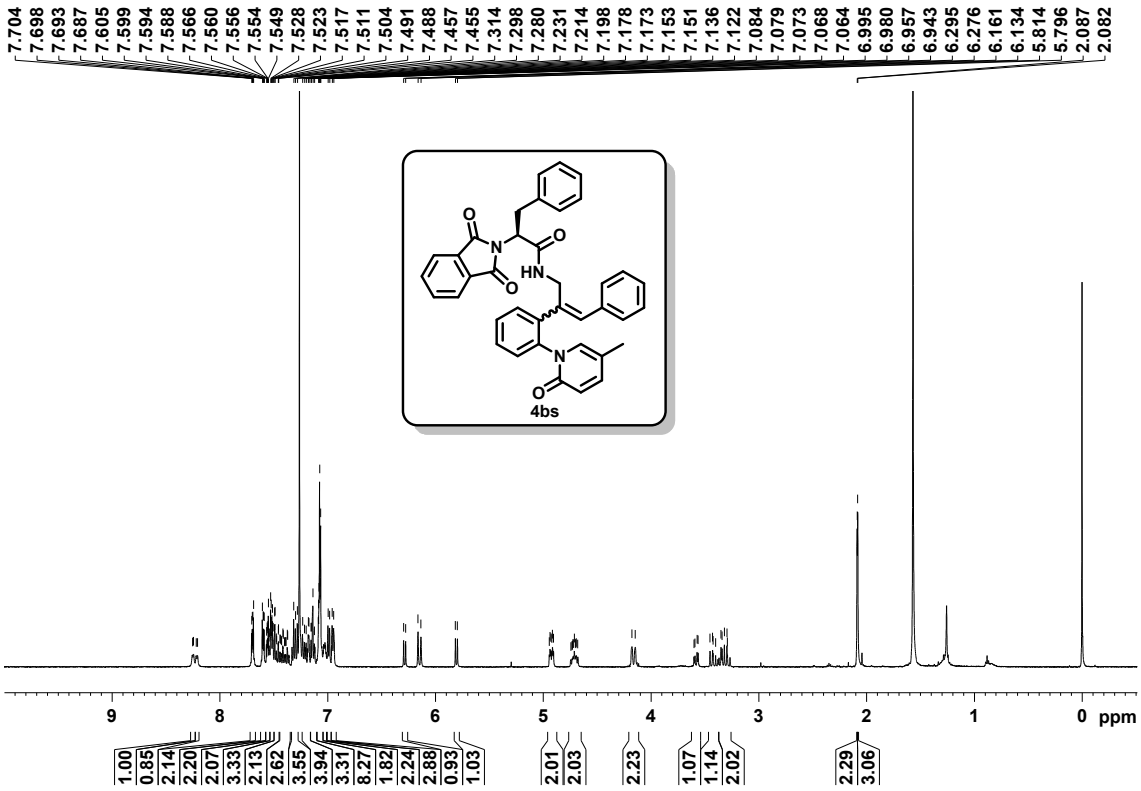
^{13}C NMR spectrum of **4bq'** (100 MHz, $CDCl_3$)



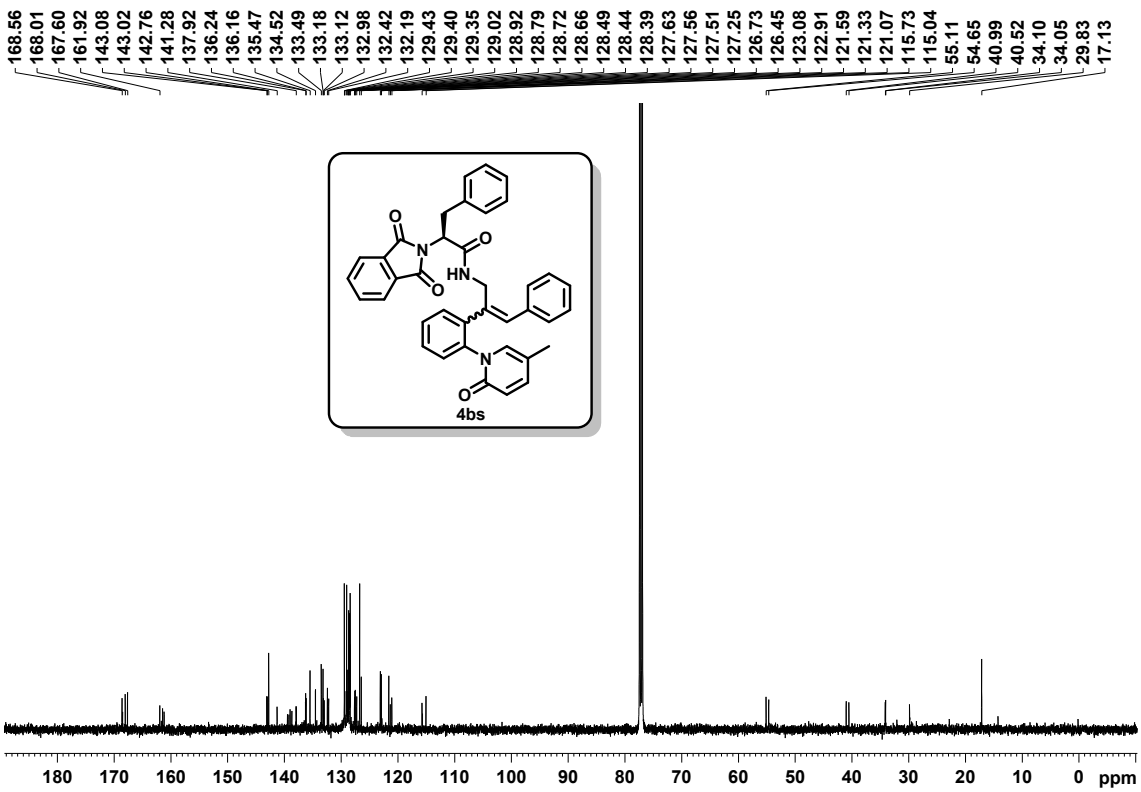
^{1}H NMR spectrum of **4br** (400 MHz, $CDCl_3$)



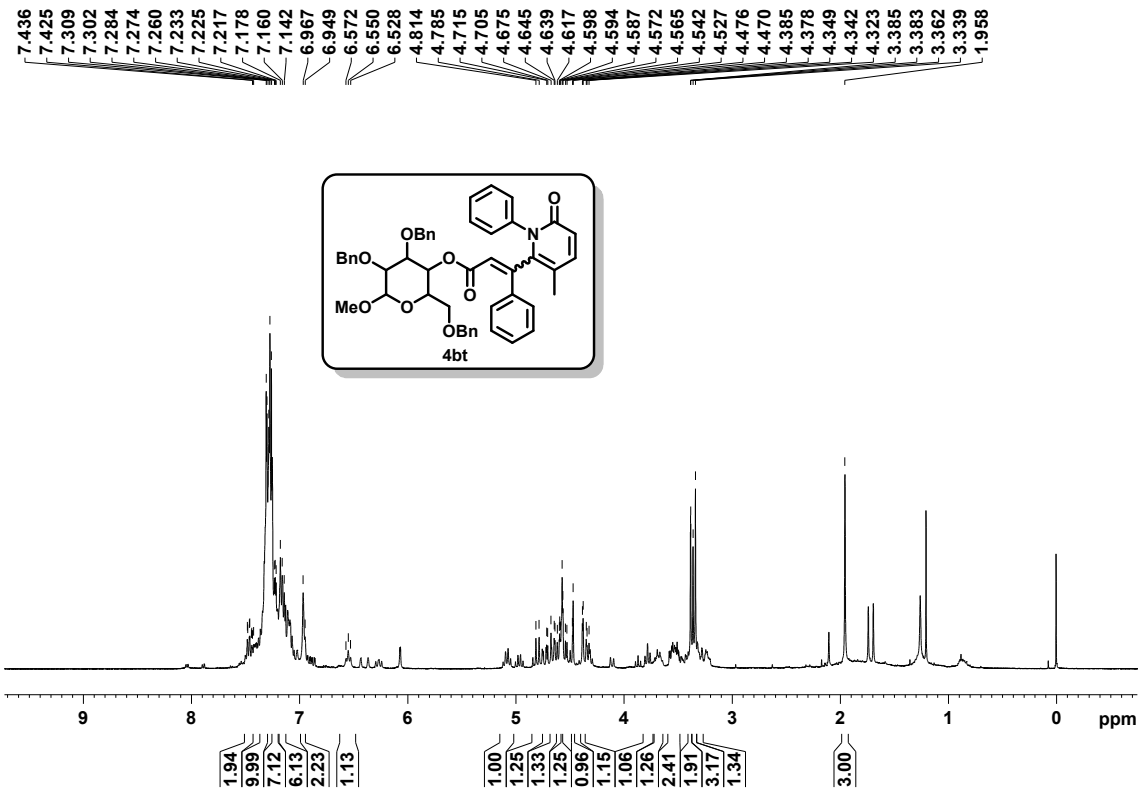
^{13}C NMR spectrum of **4br** (100 MHz, $CDCl_3$)



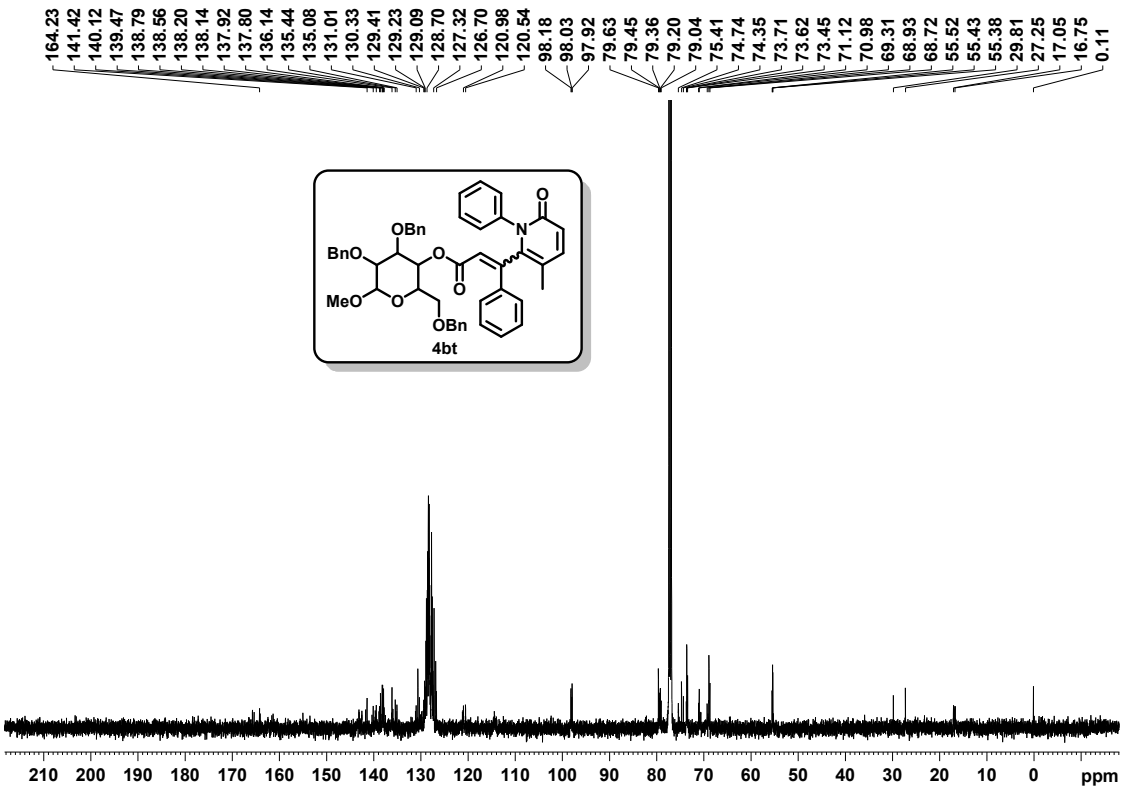
^{1}H NMR spectrum of **4bs** (400 MHz, $CDCl_3$)



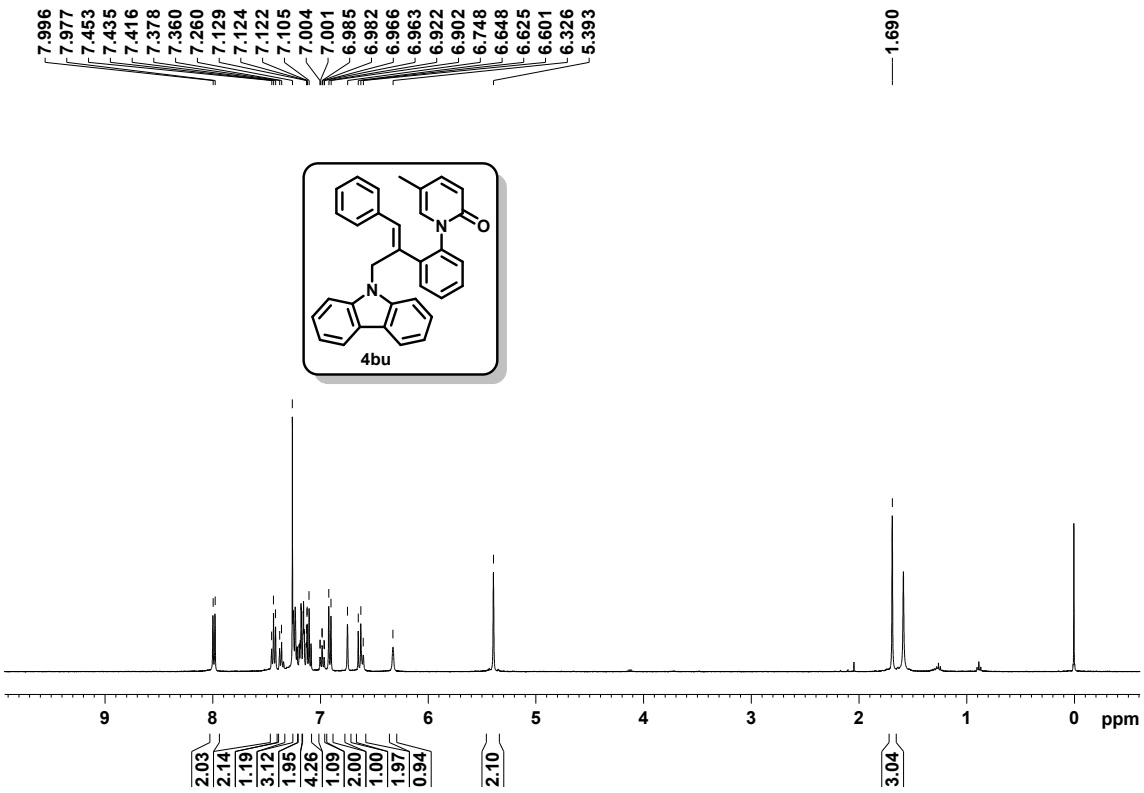
^{13}C NMR spectrum of **4bs** (100 MHz, $CDCl_3$)



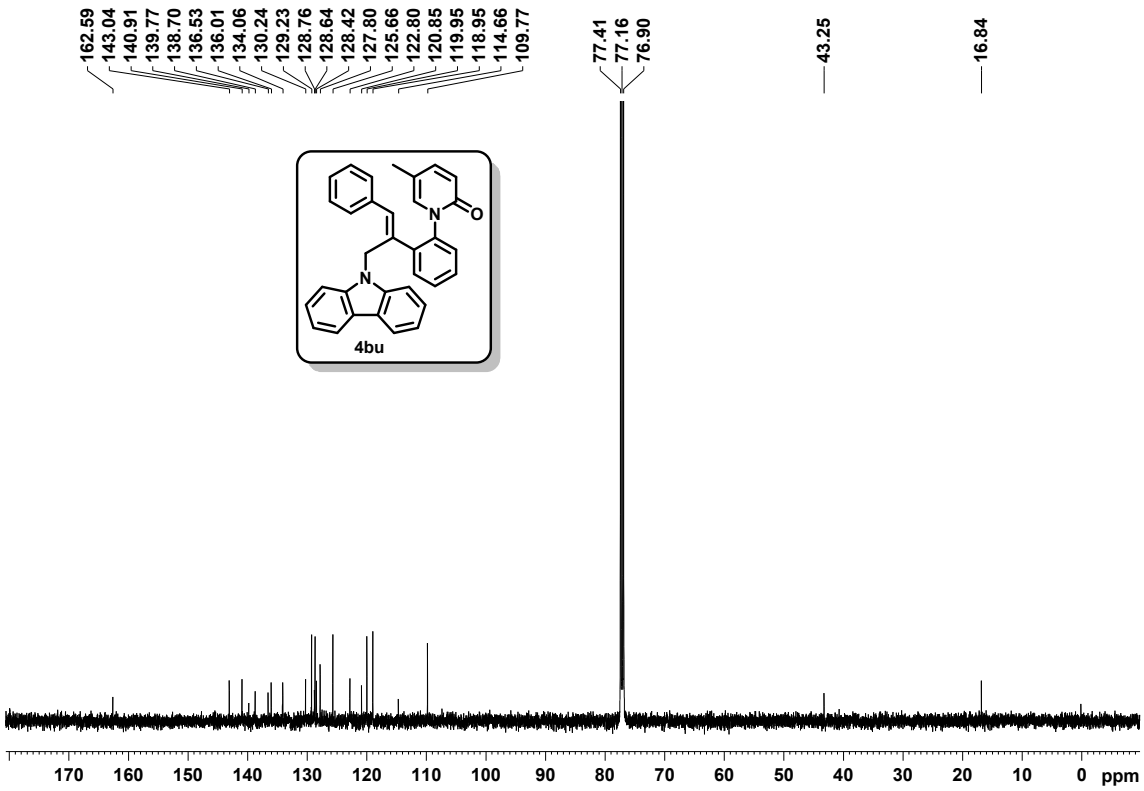
^{1}H NMR spectrum of **4bt** (400 MHz, $CDCl_3$)



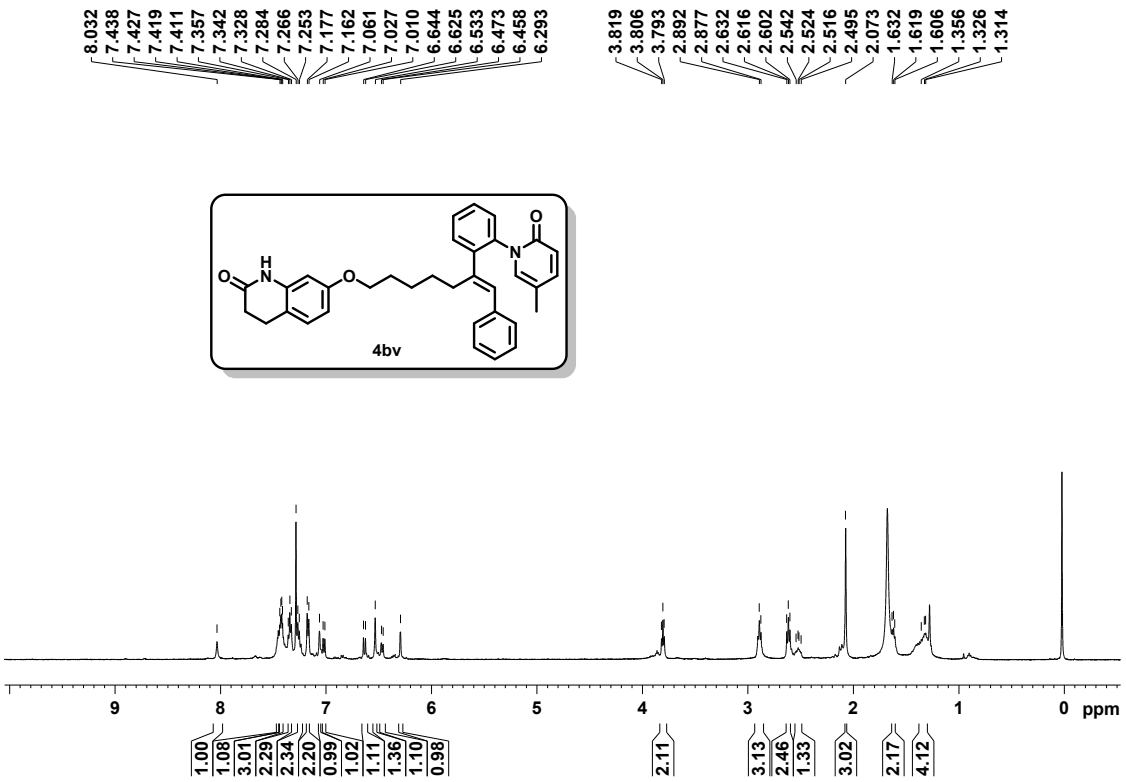
^{13}C NMR spectrum of **4bt** (100 MHz, $CDCl_3$)



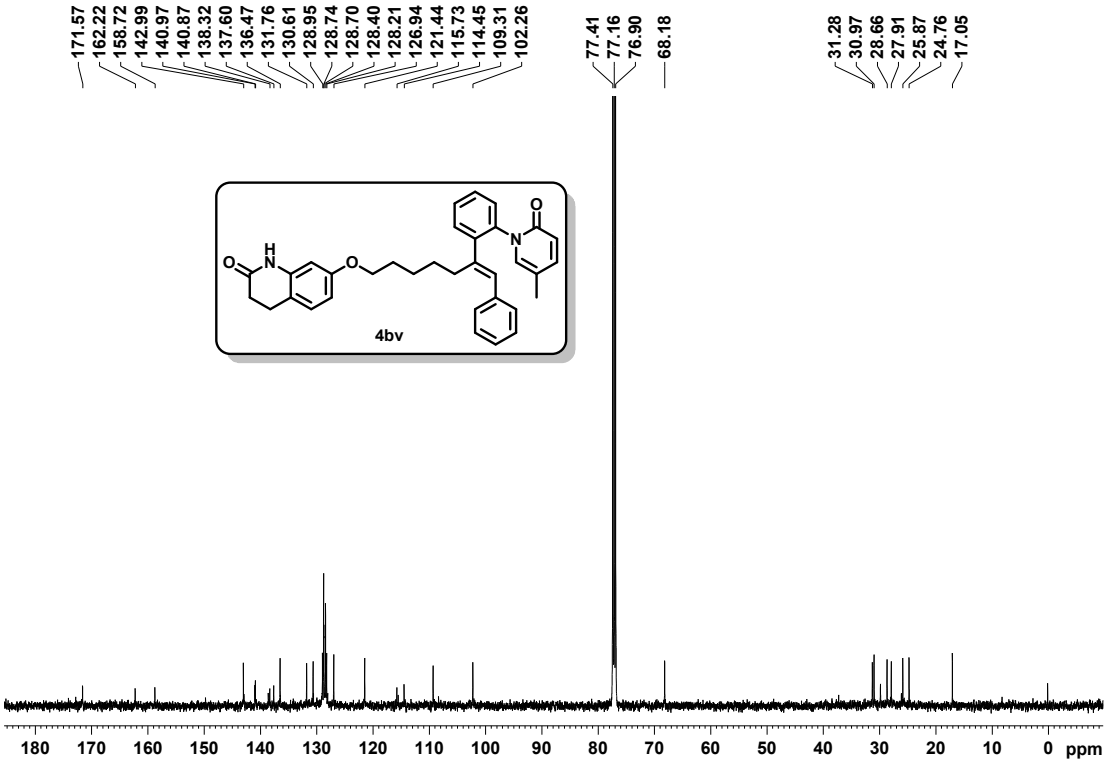
^{1}H NMR spectrum of **4bu** (400 MHz, $CDCl_3$)



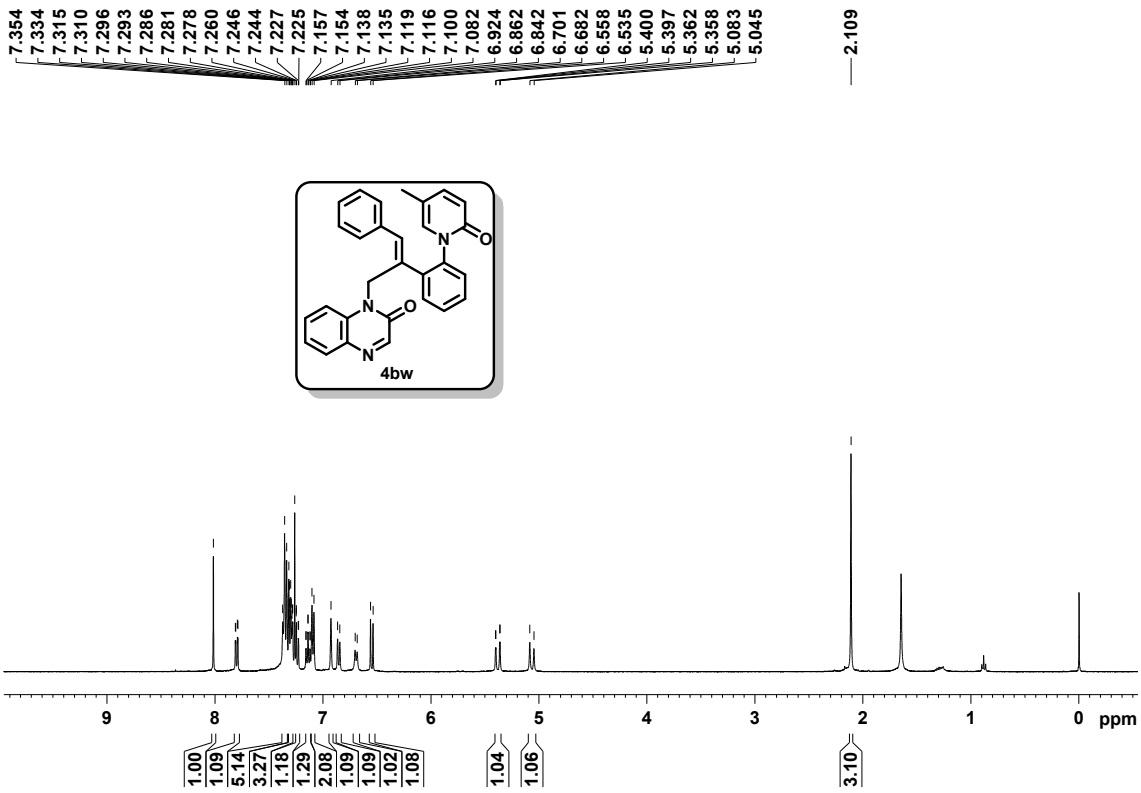
^{13}C NMR spectrum of **4bu** (100 MHz, $CDCl_3$)



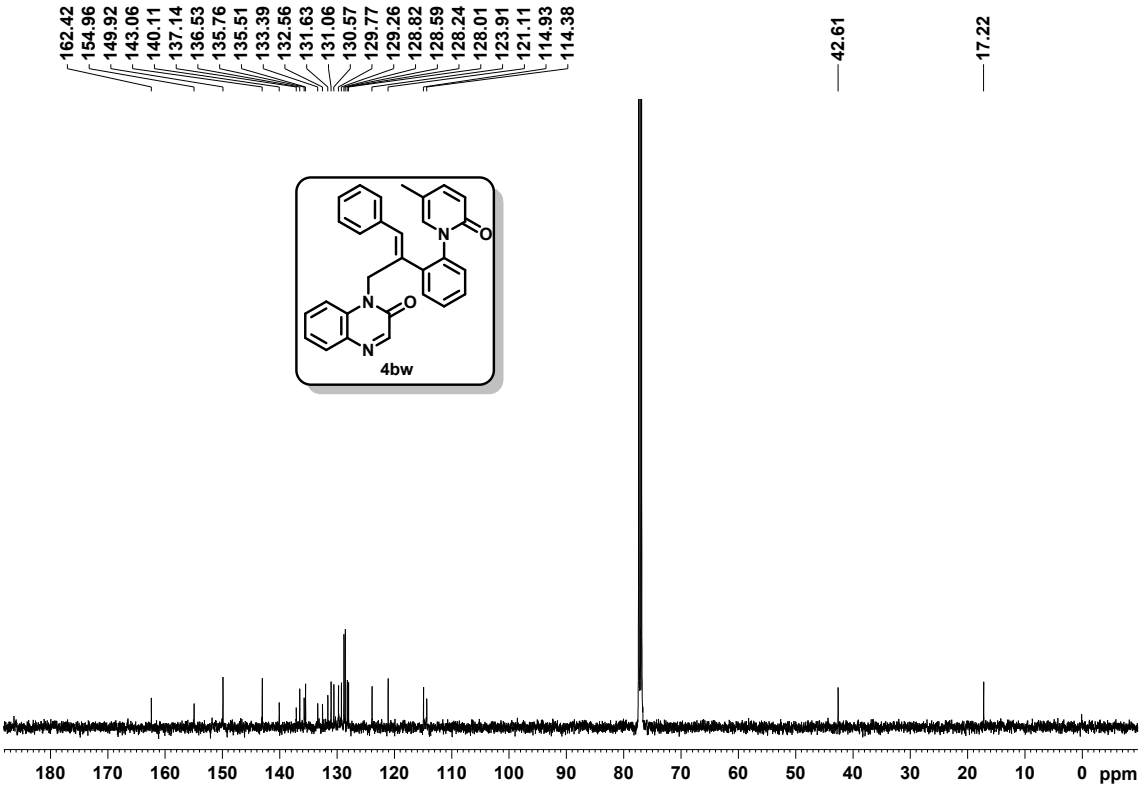
^{1}H NMR spectrum of **4bv** (400 MHz, $CDCl_3$)



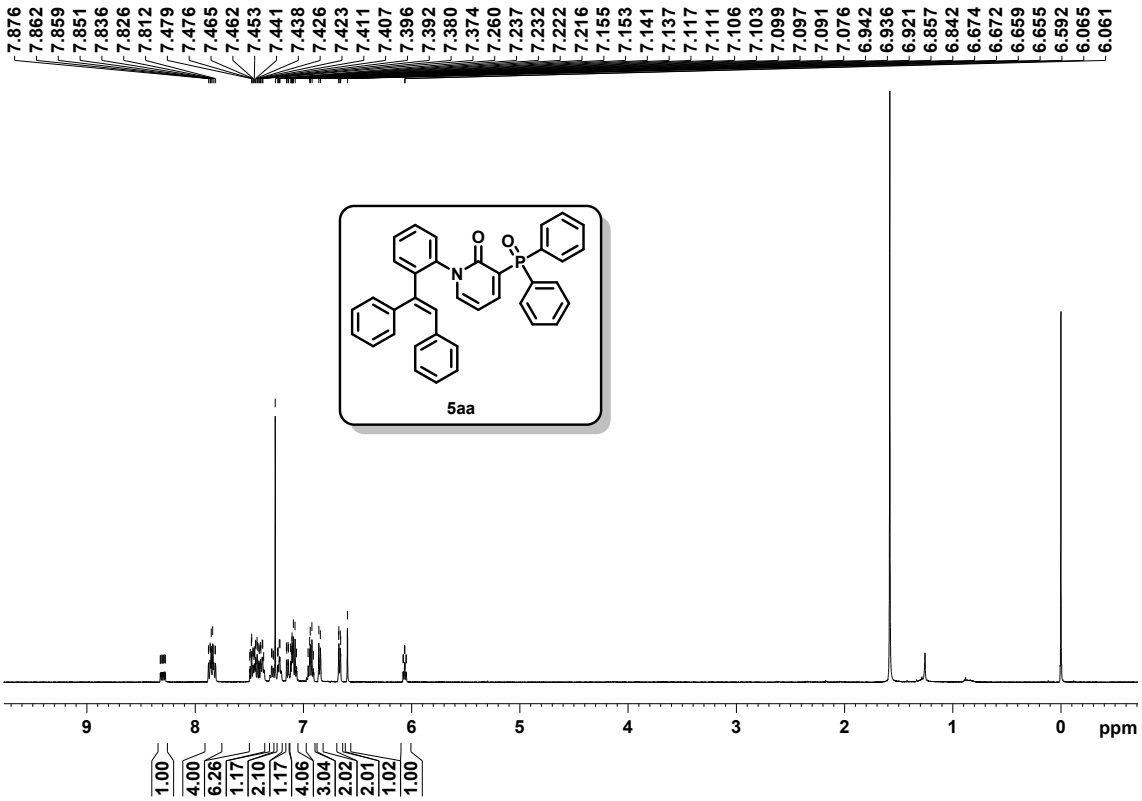
^{13}C NMR spectrum of **4bv** (100 MHz, $CDCl_3$)



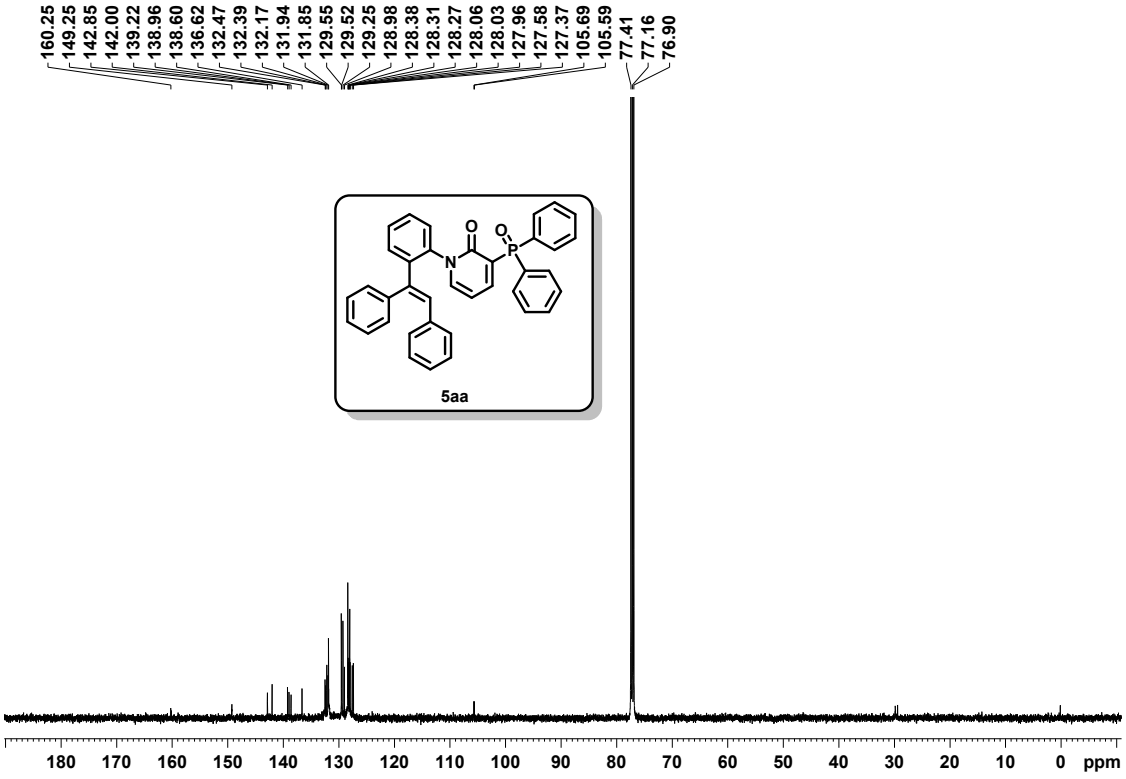
^{1}H NMR spectrum of **4bw** (400 MHz, $CDCl_3$)



^{13}C NMR spectrum of **4bw** (100 MHz, $CDCl_3$)



^{1}H NMR spectrum of **5aa** (400 MHz, $CDCl_3$)



^{13}C NMR spectrum of **5aa** (100 MHz, $CDCl_3$)