Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

Copper-Catalyzed Functionlization/Transformation of Styrenes with Polyhaloalkanes and Arenes Enables Heteroarene-Containing *gem*-Dihaloalkenes Synthesis

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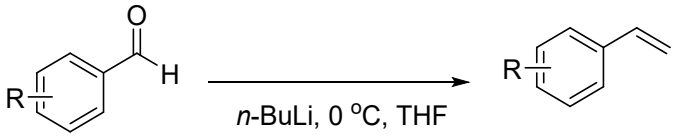
(A) General Experimental Procedures

(a) General information

The ^{1}H ^{13}C NMR and ^{19}F NMR spectra were recorded in CDCl3 solvent on an NMR spectrometer using TMS as internal standard. GC-MS data were recorded on SHIMADZU QP2020. HRMS was measured on an electrospray ionization (ESI) apparatus using time-of-flight (TOF) mass spectrometry. Melting points are uncorrected.

(b) Synthesis of Alkene.

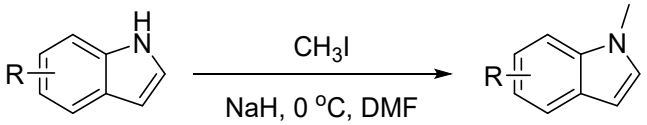
Alkene were synthesized according to the literature.



A solution of Aldehyde (5 mmol) and Methyltriphenylphosphonium bromide (5.5 mmol) in THF (8 mL) was cooled to 0 °C for about 30 min, then *n*-BuLi (7. 5mmol) was added. After stirring for 3 h at 25 °C. For the work-up, the mixture was treated with water (10 mL) and extracted with EtOAc (3×4 mL). The combined organic phases were dried with Na_2SO_4 and concentrated under vacuum, and the residue was purified by column chromatography.

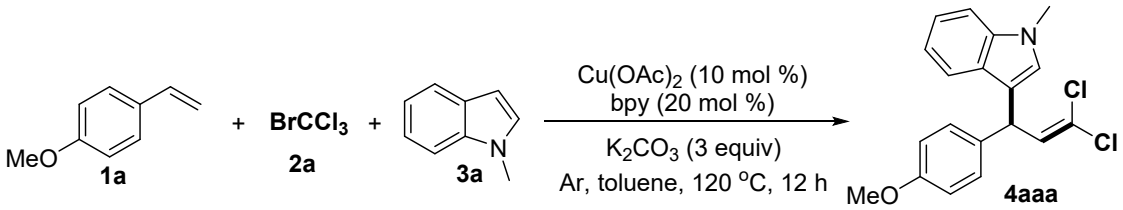
(C) Synthesis of Methyl indole.

Methyl indole were synthesized according to the literature.



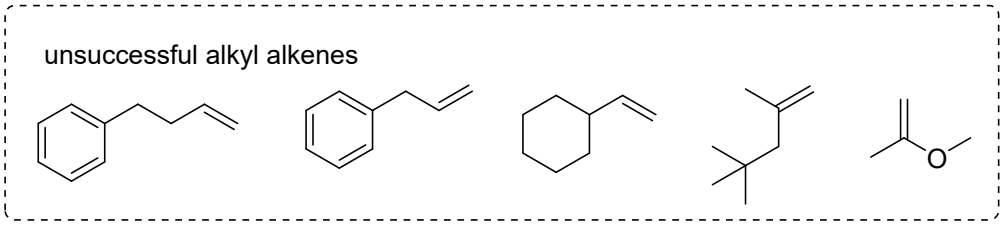
A solution of Indole (5 mmol) in DMF (8 mL) was cooled to 0 °C, NaH (7.5mmol) was added and stirring for 10 min at 0 °C, then CH_3I added and stirring for 30 min. For the work-up, the mixture was treated with water (10 mL) and extracted with EtOAc (3×4 mL). The combined organic phases were dried with Na_2SO_4 and concentrated under vacuum, and the residue was purified by column chromatography.

(c) General procedure



To a Schlenk tube were added 1-methoxy-4-vinylbenzene **1a** (0.2 mmol), $BrCCl_3$ **2a** (3 equiv, 0.6 mmol), 1-methyl-1H-indole **3a** (2 equiv, 0.4 mmol), $Cu(OAC)_2$ (10 mol%, 0.02 mmol), bpy (20 mol%, 0.04 mmol), K_2CO_3 (0.6 mmol, 3equiv; 82.8 mg), and toluene (2 mL). Then the mixture was stirred under argon atmosphere at 120 °C in oil bath for 12 h until consumption of starting material as monitored by TLC and/or GC-MS analysis. After the reaction was finished, the concentrated in vacuum, and the resulting residue was purified by silica gel column chromatography (PE/EA) to afford products.

Alkyl olefins are also not compatible with this reaction system, and we speculate that the alkyl radical or alkyl carbocation, which derived from alkyl olefins, are less stable than benzyl radicals and benzyl carbocation.



Scheme S1. Unsuccessful alkyl alkenes.

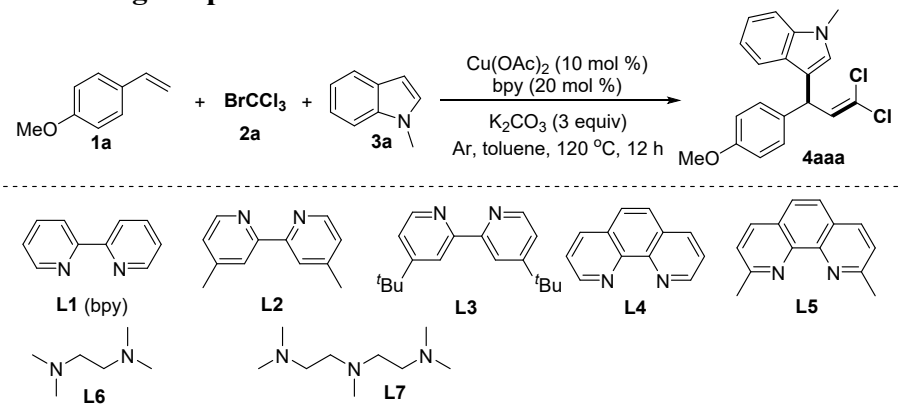
(d) Experimental Procedure for the 1 mmol Scale.

To a Schlenk tube were added 1-methoxy-4-vinylbenzene **1a** (1 mmol; 134.1 mg), $BrCCl_3$ **2a** (3 equiv, 0.6 mmol, 594.1 mg), 1-methyl-1*H*-indole **3a** (2 equiv, 2 mmol, 262.4 mg), $Cu(OAc)_2$ (20 mol%, 0.02 mmol; 18.7 mg), bpy (20 mol%, 0.04mmol; 31.1 mg), K_2CO_3

(3 mmol, 3equiv; 415.2 mg), and toluene (10 mL). Then the mixture was stirred under argon atmosphere at 120 °C in oil bath for 12 h until consumption of starting material as monitored by TLC and/or GC-MS analysis. After the reaction was finished, the concentrated in vacuum, and the resulting residue was purified by silica gel column chromatography (PE/EA = 50: 1) to afford product **4aaa** in 80% yield (276.7 mg).

(e) Screening of optimal reaction conditions

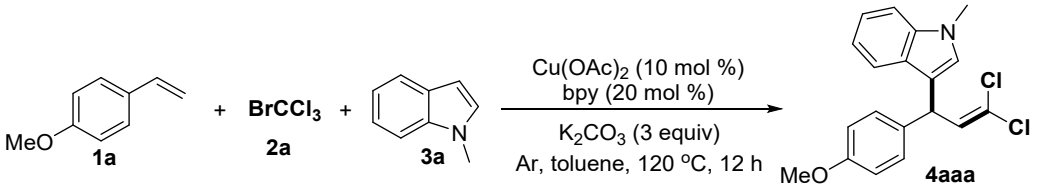
Table S1. Screening of optimal reaction conditions



Entry	Catalyst	Ligand	Solvent	temperature	Yield (%)
1	CuTc	**L1**	toluene	120 °C	68
2	$Cu(MeCN)_4PF_6$	**L1**	toluene	120 °C	69
3	$CuCl_2$	**L1**	toluene	120 °C	45
4	**$Cu(OAc)_2$**	**L1**	**toluene**	**120 °C**	**84**
5	CuI	**L1**	toluene	120 °C	63
6	CuBr	**L1**	toluene	120 °C	55
7	$Cu(OTf)_2$	**L1**	toluene	120 °C	71
8	$Cu(acac)_2$	**L1**	toluene	120 °C	56
9	Cu_2O	**L1**	toluene	120 °C	32
10	\	**L1**	toluene	120 °C	Trace
12	$Cu(OAc)_2$	**L2**	toluene	120 °C	66
13	$Cu(OAc)_2$	**L3**	toluene	120 °C	55
14	$Cu(OAc)_2$	**L4**	toluene	120 °C	65
15	$Cu(OAc)_2$	**L5**	toluene	120 °C	62
16	$Cu(OAc)_2$	**L6**	toluene	120 °C	55
17	$Cu(OAc)_2$	**L7**	toluene	120 °C	50
18	$Cu(OAc)_2$	\	toluene	120 °C	Trace
19	$Cu(OAc)_2$	**L1**	toluene	50 °C	27
20	$Cu(OAc)_2$	**L1**	toluene	80 °C	35
21	$Cu(OAc)_2$	**L1**	toluene	100 °C	43
22	$Cu(OAc)_2$	**L1**	toluene	130 °C	67

[a] Reaction conditions: **1a** (0.2 mmol), **2a** (0.6 mmol, 3 equiv), **3a** (0.4 mmol, 2 equiv), Catalyst (0.02 mmol, 10 mol %), Ligand (0.04 mmol, 20 mol %) and base (0.6 mmol, 3 equiv) in solvent (2 mL), 120 °C, 12 h under argon atmosphere.

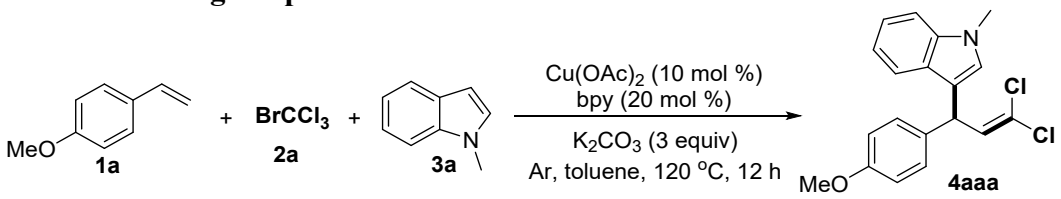
Table S2. Screening of optimal reaction conditions for solvents.



Entry	Catalyst	Ligand	Solvent	Yield (%)
1	$Cu(OAc)_2$	bpy	MeCN	43
2	$Cu(OAc)_2$	bpy	EtOH	37
3	$Cu(OAc)_2$	bpy	1,4-dioxane	47
4	$Cu(OAc)_2$	bpy	PhCl	42
5	**$Cu(OAc)_2$**	**bpy**	**PhMe**	**83**
6	$Cu(OAc)_2$	bpy	Acetone	21
7	$Cu(OAc)_2$	bpy	DMF	39
8	$Cu(OAc)_2$	bpy	DMA	68
9	$Cu(OAc)_2$	bpy	$PhCF_3$	32
10	$Cu(OAc)_2$	bpy	THF	55
11	$Cu(OAc)_2$	bpy	DMSO	NR

[a] Reaction conditions: **1a** (0.2 mmol), **2a** (0.6 mmol, 3 equiv), **3a** (0.4 mmol, 2 equiv), Catalyst (0.02 mmol, 10 mol %), Ligand (0.04 mmol, 20 mol %) and base (0.6 mmol, 3 equiv) in solvent (2 mL), 120 °C, 12 h under argon atmosphere.

Table S3. Screening of optimal reaction conditions for base.



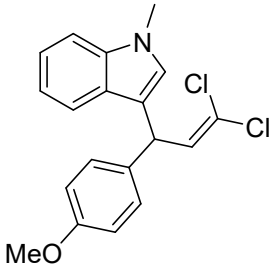
Entry	**Base**	Yield (%)
1	Without base	32
2	Na_2CO_3	67
3	Ag_2CO_3	55
4	K_3PO_4	63
5	NaOAc	51
6	2,6-Lutidine	66
7	Triethylamine	40

[a] Reaction conditions: **1a** (0.2 mmol), **2a** (0.6 mmol, 3 equiv), **3a** (0.4 mmol, 2 equiv), Catalyst (0.02 mmol, 10 mol %), Ligand (0.04 mmol, 20 mol %) and base (0.6 mmol, 3 equiv) in solvent (2 mL), 120

°C, 12 h under argon atmosphere.

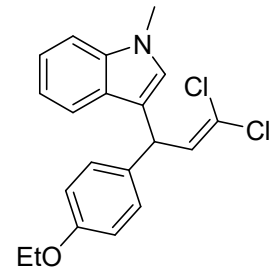
(B) Analytical data

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aaa):



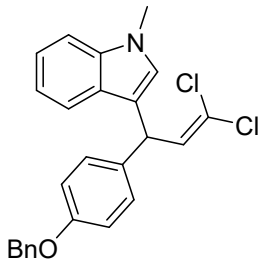
Following the general procedure A, product **4aaa** was obtained as a brown oil (58.0 mg, 84% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22-7.18 (m, 1H), 7.16-7.08 (m, 4H), 6.98-6.91 (m, 1H), 6.79-6.72 (m, 2H), 6.70-6.65 (m, 1H), 6.27 (s, 1H), 5.21-5.09 (m, 1H), 3.69 (s, 3H), 3.63 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.4, 136.4, 132.7, 131.2, 127.8, 125.8, 120.8, 118.7, 118.0, 114.3, 112.9, 108.3, 54.2, 41.6, 31.7; LRMS (EI, 70 eV) *m/z* (%): 347 (M^++2, 24), 345 (M^+, 35), 310 (89), 207 (100), 179 (94); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{18}Cl_2NO$ 346.0760; Found 346.0761.

3-(3,3-dichloro-1-(4-ethoxyphenyl)allyl)-1-methyl-1H-indole (4baa):



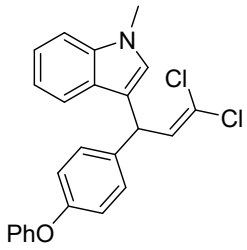
Following the general procedure A, product **4baa** was obtained as a brown oil (59.6 mg, 83% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (400 MHz,$CDCl_3$) δ 7.38 (d, *J* = 8.0 Hz, 1H), 7.33 (d, *J* = 8.4 Hz, 1H), 7.25 (m, 3H), 7.07 (m, 1H), 6.88 (d, *J* = 8.4 Hz, 2H), 6.80 (s, 1H), 6.40 (d, *J* = 10.0 Hz, 1H), 5.28 (d, *J* = 10.0 Hz, 1H), 4.04 (m, 2H), 3.76 (s, 3H), 1.44 (t, *J* = 6.8 Hz, 3H).); ^{13}C NMR (100 MHz, $CDCl_3$) δ 133.6, 132.4, 128.9, 126.9, 121.9, 119.8, 119.1, 115.4, 114.6, 109.4, 63.4, 42.7 , 32.7, 14.9; LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 19), 359 (M^+, 29), 324 (100), 288 (31), 193 (92); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0916.

3-(1-(4-(benzyloxy)phenyl)-3,3-dichloroallyl)-1-methyl-1*H*-indole (4caa):



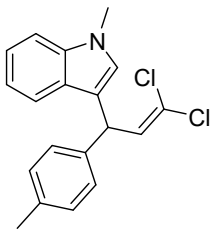
Following the general procedure A, product **4caa** was obtained as a brown oil (57.3 mg, 68% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.45-7.28 (m, 7H), 7.23-7.19 (m, 3H), 7.06-7.00 (m, 1H), 6.96-6.88 (m, 2H), 6.79-6.73 (m, 1H), 6.35 (s, 1H), 5.26-5.19 (m, 1H), 5.03 (s, 2H), 3.74 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.7, 137.1, 134.1, 132.3, 128.9, 128.6, 128.0, 127.5, 126.9, 121.9, 119.8, 119.1, 115.3, 115.0, 109.4, 70.1, 42.7, 32.8; LRMS (EI, 70 eV) *m/z* (%): 423 (M^++2, 6), 421 (M^+, 24), 340 (71), 304 (29), 209 (94); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{25}H_{22}Cl_2NO$ 422.1073; Found 422.1077.

3-(3,3-dichloro-1-(4-phenoxyphenyl)allyl)-1-methyl-1H-indole(4daa):



Following the general procedure A, product **4daa** was obtained as a brown oil (63.5 mg, 78% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 (d, *J* = 6.5 Hz, 4H), 7.19-7.12 (m, 3H), 7.04-6.91 (m, 4H), 6.87 (d, *J* = 8.0 Hz, 2H), 6.72 (s, 1H), 6.30 (d, *J* = 10.0 Hz, 1H), 5.19 (d, *J* = 10.0 Hz, 1H), 3.69 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 156.0, 132.0, 129.7, 129.1, 126.8, 123.2, 122.0, 119.7, 119.2, 119.0, 118.9, 109.4, 42.8, 32.8; LRMS (EI, 70 eV) *m/z* (%): 409 (M^++2, 23), 407 (M^+, 32), 372 (100), 336 (43), 241 (87); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{24}H_{20}Cl_2NO$ 408.0916; Found 408.0906.

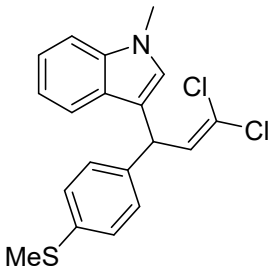
3-(3,3-dichloro-1-(p-tolyl)allyl)-1-methyl-1*H*-indole (4eaa):



Following the general procedure A, product **4eaa** was obtained as a brown oil (31.6 mg, 48% yield, R_f = 0.6 (PE/EA = 80 : 1); ^{1}H NMR (400

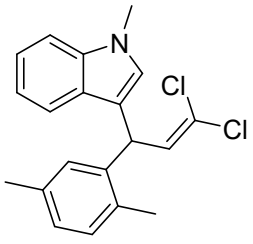
MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.0 Hz, 1H), 7.39 (d, *J* = 8.4 Hz, 1H), 7.36 - 7.28 (m, 3H), 7.23 (m, 2H), 7.15 (m, 1H), 6.86 (s, 1H), 6.51 (d, *J* = 10.0 Hz, 1H), 5.39 (d, *J* = 10.0 Hz, 1H), 3.80 (s, 3H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 138.8, 136.5, 132.4, 129.4, 127.9, 126.9, 126.9, 122.0, 119.8, 119.2, 115.3, 109.5, 43.2, 32.8, 21.2; LRMS (EI, 70 eV) *m/z* (%): 331 (M^++2, 47), 329 (M^+, 70),294 (81), 207 (77), 147 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{18}Cl_2N$ 330.0811; Found 330.0807.

3-(3,3-dichloro-1-(4-(methylthio)phenyl)allyl)-1-methyl-1H-indole (4faa):



Following the general procedure A, product **4faa** was obtained as a brown oil (36.2 mg, 50% yield, R_f = 0.6 (PE/EA = 30 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (m, 2H), 7.25 (m, 5H), 7.08 (d, *J* = 7.6 Hz, 1H), 6.80 (s, 1H), 6.39 (d, *J* = 10.0 Hz, 1H), 5.28 (d, *J* = 10.0 Hz, 1H), 3.76 (s, 3H), 2.49 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 138.6, 136.8 , 131.9, 128.4, 126.9, 127.0, 122.0, 119.7, 119.2, 115.0, 109.4, 43.0, 32.8, 16.0; LRMS (EI, 70 eV) *m/z* (%): 363 (M^++2, 34), 361 (M^+, 45), 326 (87), 290 (44), 195 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{18}Cl_2NS$ 362.0532; Found 362.0534.

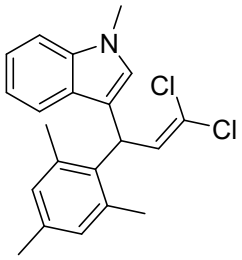
3-(3,3-dichloro-1-(2,5-dimethylphenyl)allyl)-1-methyl-1*H*-indole (4haa):



Following the general procedure A, product **4haa** was obtained as a brown oil (53.5 mg, 78% yield, R_f = 0.6 (PE/EA = 80 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.23-7.19 (m, 1H), 7.08 (d, *J* = 7.5 Hz, 5H), 6.90 (d, *J* = 8.0 Hz, 3H), 6.74 (d, *J* = 8.0 Hz, 1H), 4.33 (s, 3H), 3.46 (s, 3H), 2.90 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 150.6, 134.9, 134.5, 129.2, 128.6, 126.6, 126.4, 126.1, 118.7, 115.2, 50.8, 46.6, 29.2; LRMS (EI, 70 eV) *m/z* (%):345 (M^++2, 35), 343 (M^+, 53), 308 (35), 238 (23), 177 (100); HRMS (ESI-

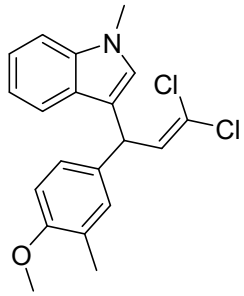
TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2N$ 344.0967; Found 344.0957.

3-(3,3-dichloro-1-mesitylallyl)-1-methyl-1H-indole (4iaa):



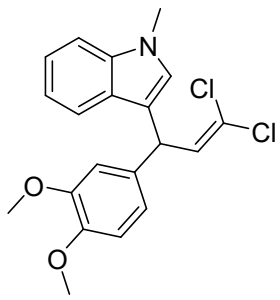
Following the general procedure A, product **4iaa** was obtained as a brown oil (64.2 mg, 90% yield, R_f = 0.6 (PE/EA = 80 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (m, 2H), 7.22 (d, *J* = 7.6 Hz, 1H), 7.06 (m, 1H), 6.90 (s, 2H), 6.62 (d, *J* = 8.8 Hz, 1H), 6.50 (s, 1H), 5.61 (d, *J* = 8.8 Hz, 1H), 3.71 (s, 3H), 2.32 (s, 3H), 2.30 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ136.8, 136.2, 134.6, 132.6, 130.0, 126.5, 121.7, 119.5, 119.0, 114.1, 109.3, 39.2, 32.7, 21.4, 20.8; LRMS (EI, 70 eV) *m/z* (%): 359 (M^++2, 53), 357 (M^+, 80), 322 (98), 245 (24), 191(100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{21}H_{22}Cl_2N$ 358.1124; Found 358.1124.

3-(3,3-dichloro-1-(4-methoxy-3-methylphenyl)allyl)-1-methyl-1H-indole(4jaa):



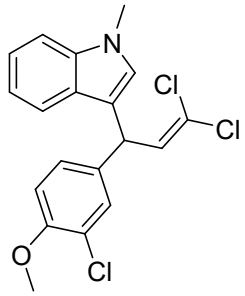
Following the general procedure A, product **4Jaa** was obtained as a brown oil (48.8 mg, 68% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.0 Hz, 1H), 7.29 (d, *J* = 8.4 Hz, 1H), 7.24-7.20 (m, 1H), 7.11-6.98 (m, 3H), 6.82-6.70 (m, 2H), 6.47-6.23 (m, 1H), 5.19 (d, *J* = 10.0 Hz, 1H), 3.81 (s, 3H), 3.74 (s, 3H), 2.18 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 156.6, 137.4, 133.3, 132.5, 130.2, 126.8, 126.8, 126.0, 121.8, 120.0, 1198, 119.1, 115.6, 109.9, 109.3, 55.4, 42.7, 32.7, 16.4; LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 14), 359 (M^+, 21), 324 (69), 202 (38), 193(100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0912.

3-(3,3-dichloro-1-(3,4-dimethoxyphenyl)allyl)-1-methyl-1H-indole(4kaa):



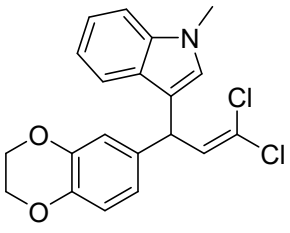
Following the general procedure A, product **4kaa** was obtained as a brown oil (52.5 mg, 70% yield, R_f = 0.5 (PE/EA = 20 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.32 (m, 1H), 7.31-7.28 (m, 1H), 7.27-7.18 (m, 2H), 7.04 (s, 1H), 6.87-6.75 (m, 3H), 6.36 (s, 1H), 5.28-5.2 (m, 1H), 3.87 (s, 3H), 3.81 (s, 3H), 3.75 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 149.1, 147.9, 137.4, 134.2, 132.2, 126.9, 126.8, 121.9, 119.8, 119.7, 119.1, 115.3, 111.3, 111.2, 109.4, 55.9, 43.1, 32.8; LRMS (EI, 70 eV) *m/z* (%): 377 (M^++2, 18), 375 (M^+, 18), 340 (85), 304 (31), 209 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO_2$ 376.0866; Found 376.0867.

3-(3,3-dichloro-1-(4-methoxy-3-methylphenyl)allyl)-1-methyl-1H-indole(4laa):



Following the general procedure A, product **4laa** was obtained as a brown oil (53.1 mg, 72% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31-7.28 (m, 2H), 7.23 (d, *J* = 7.2 Hz, 2H), 7.13 (dd, *J* = 8.0, 2.4 Hz, 1H), 7.05 (d, *J* = 8.0 Hz, 1H), 6.85 (d, *J* = 8.8 Hz, 1H), 6.78 (s, 1H), 6.32 (d, *J* = 10.0 Hz, 1H), 5.20 (d, *J* = 9.9 Hz, 1H), 3.87 (s, 3H), 3.74 (s, 3H) ; ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.9, 137.5, 134.9, 131.6, 129.6, 127.1, 126.8, 126.6, 122.6, 122.0, 120.9, 119.6, 119.3, 114.7, 112.1, 109.5, 56.2, 42.5, 32.8; LRMS (EI, 70 eV) *m/z* (%): 381 (M^++2, 45), 379 (M^+, 47), 344 (100), 284 (17), 213 (55); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}Cl_3NO$ 380.0370; Found 380.0371.

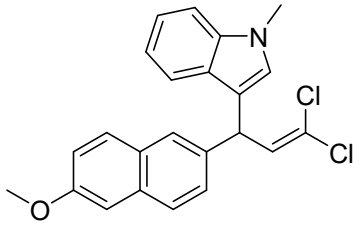
3-(3,3-dichloro-1-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)allyl)-1-methyl-1H-indole (4maa):



Following the general procedure A, product **4maa** was obtained as a brown oil (59.7 mg, 80% yield, R_f = 0.5 (PE/EA = 30 : 1);

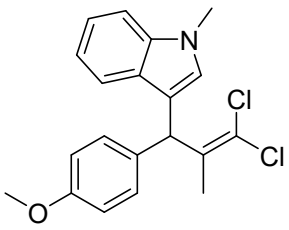
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41-7.33 (m, 1H), 7.31-7.29 (m, 1H), 7.23-7.19 (m, 1H), 7.05 (s, 1H), 6.84-6.72 (m, 4H), 6.34 (d, *J* = 12.5 Hz, 1H), 5.18 (d, *J* = 7.0 Hz, 1H), 4.28-4.20 (m, 4H), 3.74 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 143.4, 137.4, 135.0, 132.0, 126.7, 121.8, 120.8, 119.7, 119.1, 116.6, 115.1, 109.3, 64.4, 64.3, 42.7, 32.7; LRMS (EI, 70 eV) *m/z* (%): 375 (M^++2, 22), 373 (M^+, 33), 302 (47), 246 (14), 207 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{18}Cl_2NO_2$ 374.0709; Found 374.0710.

3-(3,3-dichloro-1-(6-methoxynaphthalen-2-yl)allyl)-1-methyl-1H-indole (4naa):



Following the general procedure A, product **4naa** was obtained as a brown oil (59.4 mg, 63% yield, R_f = 0.5 (PE/EA = 30 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 – 7.66 (m, 3H), 7.38-7.29 (m, 3H), 7.25 (s, 1H), 7.13 (d, *J* = 9.6 Hz, 2H), 7.01 (t, *J* = 7.6 Hz, 1H), 6.79 (s, 1H), 6.45 (d, *J* = 10.0 Hz, 1H), 5.41 (d, *J* = 10.0 Hz, 1H), 3.91 (s, 3H), 3.75 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.6, 137.4, 136.8, 133.6, 132.0, 129.3, 129.0, 127.2, 127.0, 126.9, 126.0, 121.9, 119.7, 119.2, 118.9, 115.2, 109.4, 105.6, 55.4, 43.4, 32.8; LRMS (EI, 70 eV) *m/z* (%): 397 (M^++2, 17), 395 (M^+, 26), 360 (49), 347 (27), 229 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{23}H_{20}Cl_2NO$ 396.0916; Found 396.0915.

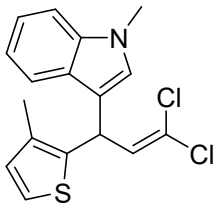
3-(3,3-dichloro-1-(4-methoxyphenyl)-2-methylallyl)-1-methyl-1H-indole (4oaa):



Following the general procedure A, product **4oaa** was obtained as a brown oil (58.9 mg, 82% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32-7.67 (m, 1H), 7.25-7.15 (m, 4H), 7.05-7.0 (m, 1H), 6.9-6.8 (m, 2H), 6.68 (s, 1H), 5.74 (s, 1H), 3.79 (s, 3H), 3.73 (s, 3H), 1.79 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.4, 137.3, 136.7,

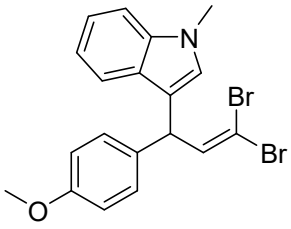
132.8, 129.5, 127.8, 127.5, 121.9, 119.9, 119.1, 114.5, 113.8, 109.3, 55.3, 45.9, 32.8, 18.2; LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 30), 359 (M^+, 45), 324 (35), 250 (100), 193 (47); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0919.

3-(3,3-dichloro-1-(3-methylthiophen-2-yl)allyl)-1-methyl-1H-indole (4paa):



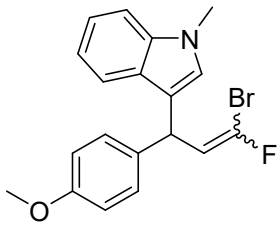
Following the general procedure A, product **4paa** was obtained as a brown oil (53.6 mg, 80% yield, R_f = 0.6 (PE/EA = 30 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48-7.41 (m, 1H), 7.32-7.28 (m, 1H), 7.24-7.20 (m, 1H), 7.13-7.04 (m, 2H), 6.87-6.83 (m, 1H), 6.80 (s, 1H), 6.33 (d, *J* = 11.0 Hz, 1H), 5.52 (d, *J* = 10.0 Hz, 1H), 3.75 (s, 3H), 2.24 (s, 3H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 137.4, 133.7, 131.6, 130.2, 126.7, 122.5, 122.1, 120.9, 119.5, 119.3, 115.0, 109.5, 37.3, 32.9, 14.1; LRMS (EI, 70 eV) *m/z* (%): 337 (M^++2, 19), 335 (M^+, 28), 300 (100), 264 (47),202 (52); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{17}H_{16}Cl_2NS$ 336.0375; Found 336.0388

3-(3,3-dibromo-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aca):



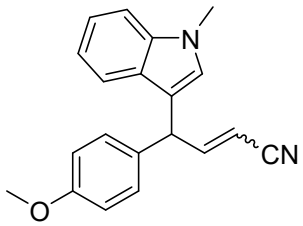
Following the general procedure A, product **4aca** was obtained as a brown oil (56.3 mg, 65% yield, R_f = 0.6 (PE/EA = 60 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31 (t, *J* = 8.4 Hz, 2H), 7.25-7.20 (m, 3H), 7.04 (d, *J* = 7.6 Hz, 1H), 6.89 -6.81 (m, 3H), 6.78 (s, 1H), 5.14 (d, *J* = 12.0 Hz, 1H), 3.79 (s, 3H), 3.75 (s, 3H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.5, 140.6, 137.4, 133.3, 128.9, 126.9, 126.7, 121.9, 119.8, 119.1, 114.8, 114.0, 109.4, 55.3, 46.0, 32.8; LRMS (EI, 70 eV) *m/z* (%): 435 (M^++2, 30), 433 (M^+, 15), 354 (51), 274 (71), 223 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{18}Br_2NO$ 433.9750; Found 433.9764.

3-(3-bromo-3-fluoro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4ada):



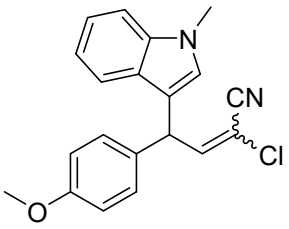
Following the general procedure A, product **4ada** was obtained as a brown oil (60.4 mg, 81% yield, *E:Z* = 1:1; R_f = 0.6 (PE/EA = 50 : 1)); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27-7.17 (m, 2H), 7.12 (dq, *J* = 7.2, 2.8, 2.3 Hz, 4H), 6.94 (t, *J* = 7.5 Hz, 1H), 6.75 (d, *J* = 8.4 Hz, 2H), 6.66 (s, 1H), 5.93 (dd, *J* = 12.8, 10.2 Hz, 0.52H), 5.49 (dd, *J* = 30.0, 10.4 Hz, 0.48H), 5.21 (d, *J* = 10.4 Hz, 0.50H), 4.86 (dd, *J* = 10.3, 3.6 Hz, 0.54H), 3.68 (s, 3H), 3.62 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.3, 157.2, 136.4, 133.3, 127.7, 125.8, 125.7, 125.7, 125.6, 120.8, 118.7, 118.6, 118.0, 118.0, 114.9, 114.8, 114.7, 114.6, 112.9, 112.5, 112.3, 108.3, 76.2, 54.2, 40.3, 40.3, 37.8, 37.7, 31.6; ^{19}F NMR (376 MHz, $CDCl_3$) δ -72.52, -75.56. LRMS (EI, 70 eV) *m/z* (%): 375 (M^++2, 31), 373 (M^+, 32), 294 (100), 250(21),163(81); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{18}BrFNO$ 374.0550; Found 374.0559.

3-(3-bromo-3-fluoro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4afa):



Following the general procedure A, product **4afa** was obtained as a brown oil (36.2 mg, 60% yield, *E*:*Z* = 2.3:1; R_f = 0.6 (PE/EA = 10 : 1)); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34-7.04 (m, 7H), 6.94-6.72 (m, 3H), 6.64 (s, 1H), 5.44 (d, *J* = 10.4 Hz, 0.27H), 5.36 (d, *J* = 10.4 Hz, 0.29H), 5.21 (dd, J = 16.4, 2.0 Hz, 0.70H), 5.02 (d, *J* = 6.0 Hz, 0.72H), 3.77 (d, *J* = 3.2 Hz, 3H), 3.71 (d, *J* = 4.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.8,

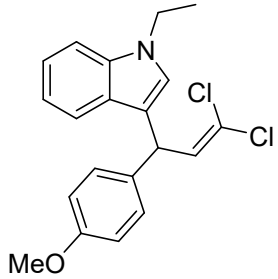
156.9, 155.7, 137.4, 132.0, 129.5, 129.0, 127.7, 127.0, 126.7, 122.2, 122.1, 119.8, 119.4, 119.4, 119.3, 117.8, 114.3, 114.0, 109.6, 109.5, 100.5, 98.0, 55.3, 45.4, 44.5, 32.8; LRMS (EI, 70 eV) *m/z* (%): 304 (M^++2, 3), 302 (M^+, 100), 287 (22), 193(23),144(25); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{19}N_2O$ 303.1492; Found 303.1492.



2-chloro-4-(4-methoxyphenyl)-4-(1-methyl-1H-indol-3-yl)but-2-enenitrile (4aga):

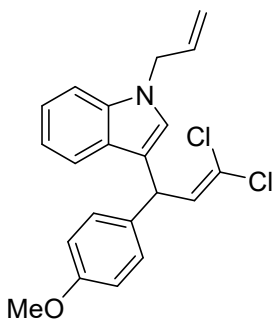
Following the general procedure A, product **4aga** was obtained as a brown oil (40.3 mg, 60% yield, *E*:*Z* = 1:1; R_f = 0.6 (PE/EA = 10 : 1); ^1H NMR (400 MHz, $CDCl_3$) δ 7.30 (dd, *J* = 8.0, 2.4 Hz, 2H), 7.25 -7.17 (m, 3H), 7.08-6.97 (m, 2H), 6.85 (d, *J* = 8.4 Hz, 2H), 6.80 (s, 1H), 5.35 (d, *J* = 11.2 Hz, 1H), 3.77 (s, 3H), 3.73 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.0, 150.2, 137.5, 132.0, 128.9, 127.1, 126.4, 122.3, 119.6, 114.4, 113.6, 109.6, 101.9, 55.4, 44.4; LRMS (EI, 70 eV) *m/z* (%):338 (M^++2, 7), 336 (M^+, 21), 301 (100), 193(40),170(51); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{18}ClN_2O$ 337.1102; Found 337.1101.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-ethyl-1H-indole(4aab):



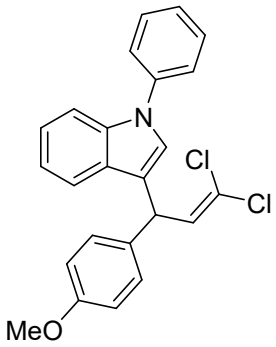
Following the general procedure A, product **4aab** was obtained as a brown oil (52.4 mg, 73% yield, R_f = 0.6 (PE/EA = 50 : 1); ^1H NMR (500 MHz, $CDCl_3$) δ 7.36-7.28 (m, 2H), 7.25-7.18 (m, 3H), 7.02 (d, *J* = 3.5 Hz, 1H), 6.91-6.81 (m, 3H), 6.34 (s, 1H), 5.22 (s, 1H), 4.26-4.06 (m, 2H), 3.79 (s, 3H), 1.43 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.4, 132.3, 128.9, 125.1, 121.7, 119.9, 119.0, 114.0, 109.4, 55.3, 42.8, 15.5;LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 34), 357 (M^+, 51), 324 (100), 288 (55), 179 (92); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0920.

1-allyl-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1H-indole(4aac):



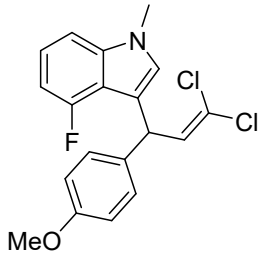
Following the general procedure A, product 4**aac** was obtained as a brown oil (59.4 mg, 80% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (d, *J* = 4.6 Hz, 1H), 7.25-7.14 (m, 4H), 7.03 (d, *J* = 7.2 Hz, 1H), 6.87-6.80 (m, 3H), 6.35 (d, *J* = 10.0 Hz, 1H), 5.97 (ddd, *J* = 11.9, 10.2, 5.1 Hz, 1H), 5.27 – 5.17 (m, 2H), 5.09 (dt, *J* = 17.0, 1.6 Hz, 1H), 4.67 (dt, *J* = 5.6, 1.6 Hz, 2H), 3.78 (s, 3H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.5, 136.9, 133.8, 133.4, 132.3, 128.9, 127.0, 125.8, 121.9, 119.9, 119.3, 117.4, 115.8, 114.0, 109.8, 55.3, 48.8, 42.8; LRMS (EI, 70 eV) *m/z* (%): 373 (M^++2, 23), 371 (M^+, 34), 336 (100), 228 (21), 179 (98); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{21}H_{20}Cl_2NO$ 372.0916; Found 372.0918.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-phenyl-1H-indole(4aad):



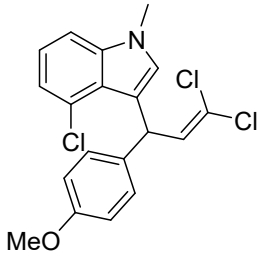
Following the general procedure A, product **4aad** was obtained as a brown oil (65,2mg, 80% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.60-7.44 (m, 5H), 7.38 (d, *J* = 8.0 Hz, 1H), 7.32 (tt, J = 6.0, 2.6 Hz, 1H), 7.23 (dd, J = 16.0, 6.4 Hz, 3H), 7.13-7.03 (m, 2H), 6.86 (d, *J* = 8.4 Hz, 2H), 6.39 (d, *J* = 10.0Hz, 1H), 5.29 (d, *J* = 9.6Hz, 1H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.6, 139.6, 136.6, 133.4, 132.0, 129.7, 129.0, 127.8, 126.5, 125.9 , 124.3, 122.8, 120.3, 120.0, 118.0, 114.2, 110.7, 55.3, 42.8; LRMS (EI, 70 eV) *m/z* (%): 409 (M^++2, 20), 407 (M^+, 29), 372 (93), 336 (35), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{24}H_{20}Cl_2NO$ 408.0916; Found 408.0919.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-4-fluoro-1-methyl-1H-indole (4aae):



Following the general procedure A, product **4aae** was obtained as a brown oil (56.6 mg, 78% yield, R_f = 0.6 (PE/EA = 30 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25-7.21 (m, 1H), 7.19-7.14 (m, 1H), 7.13-7.09 (m, 1H), 7.07-7.03 (m, 1H), 6.86-6.78 (m, 3H), 6.74-6.64 (m, 1H), 6.40 (s, 1H), 5.45-5.35 (m, 1H), 3.76 (s, 3H), 3.72 (s, 3H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.3, 132.5, 128.6, 126.9, 113.8, 105.5, 55.2, 42.8, 33.1; ^{19}F NMR (471 MHz, $CDCl_3$) δ -120.02. HRMS (EI, 70 eV) *m/z* (%): 365 (M^++2, 9), 363 (M^+, 13), 328 (100), 292 (26), 179 (91); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}Cl_2FNO$ 364.0666; Found 364.0666.

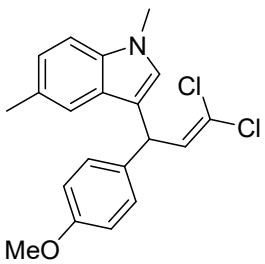
4-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aaf):



Following the general procedure A, product **4aaf** was obtained as a brown oil (60.1 mg, 80% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$)δ 7.26-7.22 (m, 1H), 7.16-7.12 (m, 2H), 7.12-7.08 (m, 1H), 7.05-7.00 (m, 1H), 6.85-6.75 (m, 3H), 6.35 (s, 1H), 5.90-5.75 (m, 1H), 3.77 (s, 3H), 3.73 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.2, 138.6, 135.3, 133.2, 128.8 , 128.2, 122.4, 120.5, 113.8, 108.1, 55.2, 42.0, 33.1; LRMS (EI, 70 eV) *m/z* (%):381 (M^++2, 9), 379 (M^+, 10), 344 (85), 308 (25), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}Cl_3NO$ 380.0370; Found 380.0361.

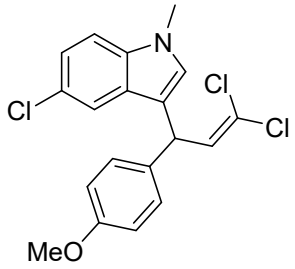
3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,5-dimethyl-1H-indole (4aag):

Following the



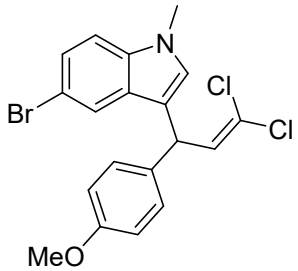
general procedure A, product **4aag** was

obtained as a brown oil (64.8 mg, 90% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (s, 1H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.11 (s, 1H), 7.04 (d, *J* = 8.4 Hz, 1H), 6.84 (d, *J* = 8.3 Hz, 2H), 6.72 (s, 1H), 6.34 (d, *J* = 10.0 Hz, 1H), 5.20 (d, *J* = 10.0 Hz, 1H), 3.79 (s, 3H), 3.71 (s, 3H), 2.38 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.4, 135.9, 132.4, 128.8, 126.9, 123.5, 120.1, 119.3, 114.7, 114.0, 109.1, 55.3, 42.6, 32.8, 21.5 ; LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 24), 359 (M^+, 36), 324 (84), 288 (40), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0918.



5-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aah):

Following the general procedure A, product **4aah** was obtained as a brown oil (59.1 mg, 78% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 (s, 1H), 7.21-7.11 (m, 4H), 6.90-6.84 (m, 2H), 6.81-6.77 (m, 1H), 6.31 (s, 1H), 5.25-5.10 (m, 1H), 3.78 (s, 3H), 3.72 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.6, 133.4, 131.9, 128.8, 128.1, 125.0, 122.2, 119.1, 114.1, 110.4, 55.3, 42.5, 33.0; LRMS (EI, 70 eV) *m/z* (%): 381(M^++2, 10), 379 (M^+, 10), 344 (83), 308 (25), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}Cl_3NO$ 380.0370; Found 380.0365.

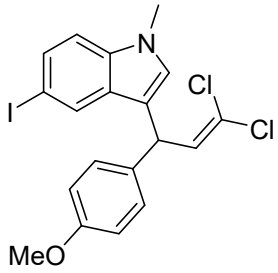


5-bromo-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aai):

Following the general procedure A, product **4aai** was obtained as a brown oil (74.5 mg, 88% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 (s, 1H), 7.30-7.25 (m, 1H), 7.20-7.10 (m, 3H), 6.88-6.82 (m, 2H), 6.80-6.76 (m, 1H), 6.32 (s, 1H), 5.25-5.12 (m, 1H), 3.78

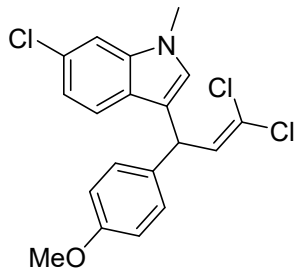
(s, 3H), 3.72 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 133.3, 131.9, 128.8, 127.9, 124.8, 122.2, 114.1, 110.9, 55.3, 42.4, 32.9 ;LRMS (EI, 70 eV) *m/z* (%): 425(M^++2, 5), 423 (M^+, 3), 390 (69), 309 (48), 274 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}BrCl_2NO$ 423.9865; Found 423.9864.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-5-iodo-1-methyl-1H-indole (4aaj):



Following the general procedure A, product **4aaj** was obtained as a brown oil (59.3 mg, 63% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.63 (s, 1H), 7.50-7.40 (m, 1H), 7.28-7.22 (m, 1H), 7.20-7.12 (m, 1H), 7.08-7.00 (m, 1H), 6.90-6.80 (m, 2H), 6.78-6.70 (m, 1H), 6.31 (s, 1H), 5.22-5.10 (m, 1H), 3.79 (s, 3H), 3.70 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.6, 136.5, 133.4, 131.9, 130.3, 128.8, 128.4, 127.6, 114.8, 114.1, 111.4, 82.8, 55.3, 42.4, 32.9; LRMS (EI, 70 eV) *m/z* (%): 473 (M^++2, 19), 471 (M^+, 23), 436 (17), 309 (36), 274 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}Cl_2INO$ 471.9726; Found 471.9719.

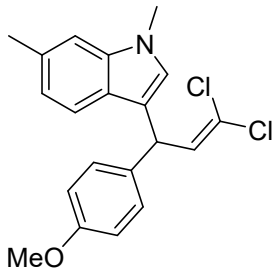
6-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aak):



Following the general procedure A, product **4aak** was obtained as a brown oil (37.9 mg, 50% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30-7.26 (m, 2H), 7.20-7.14 (m, 2H), 7.01-6.95 (m, 1H), 6..90-6.89 (m, 2H), 6.80-6.75 (m, 1H), 6.31 (s, 1H), 5.25-5.15 (s, 1H), 3.79 (s, 3H), 3.71 (s, 3H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.5, 133.4, 131.9, 128.8, 128.1, 127.5, 125.3, 120.6, 120.5, 119.8, 115.7, 114.1, 109.4, 55.3, 42.6, 32.9 ; LRMS (EI, 70 eV) *m/z* (%): 381 (M^++2, 13), 379 (M^+, 13), 344 (100), 308 (28), 179 (98); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{17}Cl_3NO$ 380.0370; Found

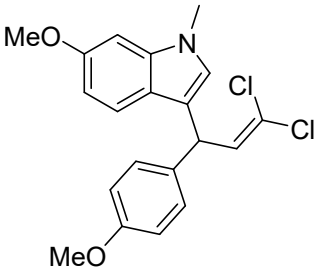
380.0363.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,6-dimethyl-1H-indole (4aal):



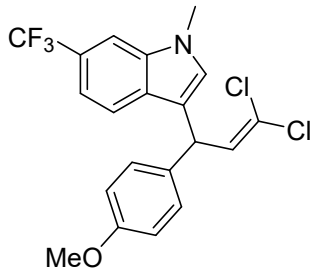
Following the general procedure A, product 4aal was obtained as a brown oil (42.3 mg, 59% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22-7.17 (s, 3H), 7.12-7.06 (m, 1H), 6.90-6.81 (m, 3H), 6.71-6.66 (m, 1H), 6.34 (s, 1H), 5.40-5.10 (m, 1H), 3.78 (s, 3H), 3.69 (s, 3H), 2.46 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.4, 137.9, 133.9, 132.4, 131.8, 128.9, 126.3, 120.9, 119.4, 115.2, 114.0, 109.4, 55.3, 42.8, 32.7, 21.9;LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 33), 359 (M^+, 51), 324 (100), 288 (58), 264 (26); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0918.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-6-methoxy-1-methyl-1H-indole (4aam):



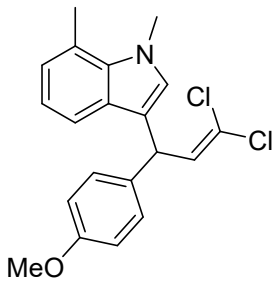
Following the general procedure A, product **4aam** was obtained as a brown oil (30.1 mg, 40% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.24-7.12 (m, 3H), 6.90-6.80 (m, 2H), 6.73 (s, 1H), 6.69 (d, *J* = 8.0 Hz, 1H), 6.66 (s, 1H), 6.32 (d, *J* = 11.0 Hz, 1H), 5.18 (d, *J* = 10.5 Hz, 1H), 3.85 (s, 3H), 3.78 (s, 3H), 3.68 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.4, 156.5, 138.2, 133.8, 132.3, 128.9, 125.7, 121.1, 120.4, 120.2, 115.4, 114.0, 109.0, 93.0, 55.7, 55.3, 42.8, 32.8;LRMS (EI, 70 eV) *m/z* (%): 377 (M^++2, 55), 375 (M^+, 85), 340 (100), 304 (60), 179 (62); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO_2$ 376.0866; Found 376.0864.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-6-(trifluoromethyl)-1H-indole (4aan):



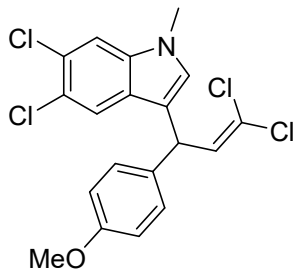
Following the general procedure A, product **4aan** was obtained as a brown oil (59.4 mg, 70% yield, R_f = 0.5 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.57 (s, 1H), 7.42-7.33 (m, 1H), 7.20-7.10 (m, 2H), 6.98-6.90 (m, 1H), 6.88-6.78 (m, 2H), 6.33 (s, 1H), 5.40-5.10 (m, 1H), 3.86-3.75 (m, 6H).; ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.6, 133.3, 131.8, 129.4, 128.9, 128.8, 120.2, 115.8, 114.1, 107.0, 55.3, 42.5, 33.0; ^{19}F NMR (471 MHz, $CDCl_3$) δ -60.56. LRMS (EI, 70 eV) *m/z* (%): 415 (M^++2, 8), 413 (M^+, 12), 378 (89), 342 (25), 179 (100);377 (M^++2, 55), 375 (85), 340 (100), 304 (60), 179 (62); HRMS (ESI-TOF) *m/z*: [M + H]$^+$ Calcd for $C_{20}H_{19}Cl_2F_3NO$ 414.0634; Found 414.0644.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,7-dimethyl-1H-indolee (4aao):



Following the general procedure A, product **4aao** was obtained as a brown oil (64.6 mg, 90% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22-7.10 (m, 3H), 6.93-6.86 (m, 2H), 6.85-6.77 (m, 2H), 6.70-6.60 (m, 1H), 6.31 (s, 1H), 5.38-4.98 (m, 1H), 3.99 (s, 3H), 3.77 (s, 3H), 2.73 (s, 3H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.4, 133.8, 132.3, 128.9, 128.5, 127.9, 124.6, 121.4, 119.5, 117.8, 115.0, 114.0, 55.3, 42.6, 36.7, 19.7;LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 31), 359 (M^+, 47), 324 (80), 288 (62), 179 (100); HRMS (ESI-TOF) *m/z*: [M + H]$^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0914.

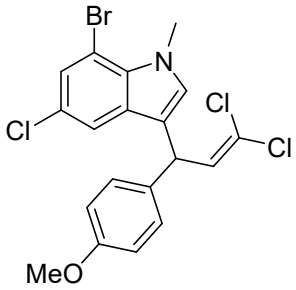
5,6-dichloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aap):



Following the general procedure A, product **4aap** was obtained as a brown oil (61.8 mg, 75% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H

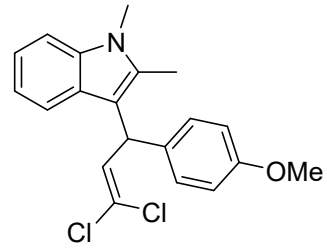
NMR (500 MHz, $CDCl_3$) δ 7.36 (s, 1H), 7.32 (s, 1H), 7.24-7.08 (s, 2H), 6.93-6.82 (m, 2H), 6.80 (s, 1H), 6.28 (d, *J* = 8.5 Hz, 1H), 5.14 (d, *J* = 8.0 Hz, 1H), 3.79 (s, 3H), 3.69 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.6, 133.1, 131.6, 128.7, 128.7, 126.3, 126.0, 123.3, 120.8, 120.7, 115.2, 114.2, 111.0, 55.3, 42.4, 33.0; LRMS (EI, 70 eV) *m/z* (%):415 (M^++2, 14), 413 (M^+, 11), 378 (54), 308 (15), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{16}Cl_4NO$ 413.9981; Found 413.9996

7-bromo-5-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aaq):



Following the general procedure A, product **4aaq** was obtained as a brown oil (29.2 mg, 32% yield, R_f = 0.6 (PE/EA = 20 : 1); ^1H NMR (500 MHz, $CDCl_3$) δ 7.31 (s, 1H), 7.20-7.10 (m, 3H), 6.89-6.81 (m, 2H), 6.78-6.72 (m, 1H), 6.26 (s, 1H), 5.19-5.04 (m, 1H), 4.09 (s, 3H), 3.81 (s, 3H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.6, 132.9, 131.5, 131.1, 130.1, 128.7, 126.6, 125.0, 120.9, 118.4, 114.2, 104.1, 55.3, 42.2, 36.8; LRMS (EI, 70 eV) *m/z* (%): 459 (M^++2, 17), 457 (M^+,9), 424 (74), 308 (26), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{16}BrCl_3NO$ 457.9475; Found 457.9484.

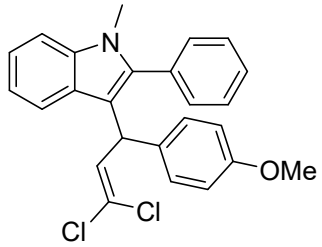
3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,2-dimethyl-1H-indole (4aar):



Following the general procedure A, product **4aar** was obtained as a brown oil (56.0 mg, 78% yield, R_f = 0.6 (PE/EA = 50 : 1); ^1H NMR (500 MHz, $CDCl_3$) δ 7.31-7.21 (m, 2H), 7.2-7.05 (m, 3H), 7.00-6.90 (m, 1H), 6.88-6.76 (m, 2H), 6.58-6.46 (s, 1H), 5.42-5.18 (s, 1H), 3.77 (s, 3H), 3.67 (s, 3H), 2.39 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.2, 137.0, 134.0, 133.4, 131.7, 128.5, 126.2, 120.8, 120.4, 119.2, 119.0,

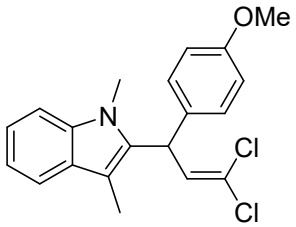
113.8, 110.5, 108.9, 55.3, 41.6, 29.7, 10.7;LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 21), 359 (M^+,35), 324 (83), 288 (45), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0914.

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-2-phenyl-1H-indole(4aas):



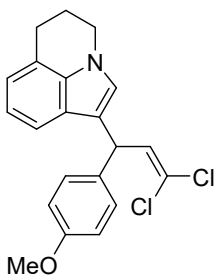
Following the general procedure A, product 4**aas** was obtained as a brown oil (53.0 mg, 63% yield, R_f = 0.6 (PE/EA = 80 : 1); ^1H NMR (500 MHz, $CDCl_3$) δ 7.40-7.24 (m, 5H), 7.15-6.95 (m, 5H), 6.75-6.60 (m, 2H), 6.46-6.29 (m, 1H), 5.14-4.92 (m, 1H), 3.64 (s, 3H), 3.49 (s, 3H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.2, 133.7, 131.6, 130.9, 128.5, 128.4, 121.9, 120.5, 120.2, 119.6, 113.8, 112.3, 109.7, 55.3, 41.9, 30.9; LRMS (EI, 70 eV) *m/z* (%): 423 (M^++2, 30), 421 (M^+,46), 386 (100), 350 (64), 179(53); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{25}H_{22}Cl_2NO$ 422.1073; Found 422.1071.

2-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,3-dimethyl-1H-indole (4aat):



Following the general procedure A, product **4aat** was obtained as a brown oil (22.3 mg, 31% yield, R_f = 0.6 (PE/EA = 50 : 1); ^1H NMR (500 MHz, $CDCl_3$) δ 7.58-7.38 (m, 1H), 7.19-7.12 (m, 3H), 7.00-6.88 (m, 2H), 6.81-6.66 (m, 2H), 6.42-6.19 (m, 1H), 5.47-5.27 (m, 1H), 3.71 (s, 3H), 3.41 (s, 3H), 2.21 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 134.2, 131.5, 129.3, 128.4, 128.1, 122.8, 121.6, 119.0, 118.6, 114.2, 108.8, 77.2, 55.3, 41.3, 30.7; LRMS (EI, 70 eV) *m/z* (%): 361 (M^++2, 50), 359 (M^+, 78), 324 (100), 288 (89), 179 (87); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{20}H_{20}Cl_2NO$ 360.0916; Found 360.0916.

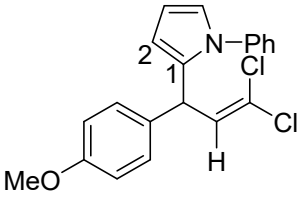
1-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-5,6-dihydro-4H-



pyrrolo[3,2,1-ij]quinoline(4aau):

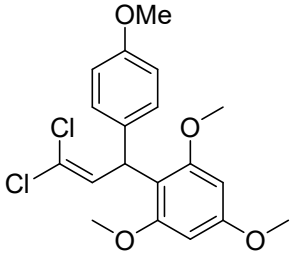
Following the general procedure A, product **4aau** was obtained as a brown oil (63.1 mg, 85% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15-7.11 (m, 2H), 7.06-6.99 (m, 1H), 6.88-6.80 (m, 2H), 6.78-6.73 (m, 2H), 6.72-6.67 (m, 1H), 6.29 (s, 1H), 5.13 (d, *J* = 8.5 Hz, 1H), 4.06-3.93 (m, 2H), 3.70 (s, 3H), 2.93-2.83 (m, 2H), 2.19-2.07 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.4, 132.9, 131.4, 127.8, 123.0, 120.8, 119.0, 118.4, 117.7, 116.2, 114.3, 112.9, 54.2, 42.9, 42.0, 23.6, 21.8;LRMS (EI, 70 eV) *m/z* (%): 373 (M^++2, 4), 371 (M^+, 80), 356 (19), 265 (100), 91 (51); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{21}H_{20}Cl_2NO$ 372.0916; Found 372.0919.

2-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-phenyl-1H-pyrrole (4aav):



Following the general procedure A, product 4aaa was obtained as a brown oil (49.3 mg, 68 % yield, R_f = 0.6 (PE/EA = 50 : 1; C1:C2 = 6.1:1); ^{1}H NMR (500 MHz, DMSO-D6) δ δ 7.59-7.50 (m, 0.38H), 7.48-7.39 (m, 2.75H), 7.34-7.28 (m, 0.39H), 7.24-7.16 (m, 2.45H), 6.95-6.92 (m, 1.81H), 6.91-6.89 (m, 0.28H), 6.85-6.79 (m, 2.09H), 6.77-6.75 (m, 0.18H), 6.63-6.57 (m, 0.83H), 6.21-6.14 (s, 1H), 4.88 (d, *J* = 9.5 Hz, 1H), 3.70 (s, 3H); ^{13}C NMR (126 MHz, DMSO-D6) δ 158.6, 158.5, 140.2, 139.7, 135.1, 134.0, 133.3, 132.9, 132.7, 130.1, 129.7, 129.0, 128.9, 128.2, 127.1, 126.8, 125.6, 123.2, 119.9, 119.5, 119.0, 118.50, 116.7, 114.4, 114.2, 110.6, 108.7, 108.5, 60.7, 55.5, 43.9, 42.9;; LRMS (EI, 70 eV) m/z (%): 359 (M^++2, 9), 357 (M+, 14), 322 (100), 288 (5), 179 (15); HRMS (ESI-TOF) m/z: [M + H]+ Calcd for $C_{20}H_{18}Cl_2NO$ 358.0760; Found 357.0762.

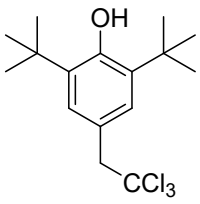
2-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,3,5-trimethoxybenzene (4aaw):



Following the general procedure A, product **4aaw** was obtained

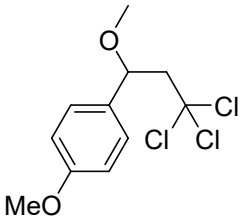
as a brown oil (23.4 mg, 31% yield, R_f = 0.6 (PE/EA = 20 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.27-7.25 (m, 1H), 7.08-7.05 (m, 1H), 6.80-6.75 (m, 2H), 6.16 (d, *J* = 5.5 Hz, 2H), 5.64-5.56 (m, 1H), 3.89 (s, 1H), 3.81 (s, 3H), 3.78-3.70 (m, 9H) ; ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.3, 158.9, 134.5, 132.0, 127.9, 113.4, 91.4, 55.9, 55.3, 55.2, 39.2;LRMS (EI, 70 eV) *m/z* (%): 384 (M^++2, 7), 382 (M^+, 10), 347 (50), 311 (100), 179 (18); HRMS (ESI-TOF) *m/z*: [M + H]$^+$ Calcd for $C_{19}H_{21}Cl_2O_4$ 383.0811; Found 383.0831.

1,3-di-tert-butyl-5-methyl-2-(trichloromethoxy)benzene (5a):



Following the general procedure A, product **5a** was obtained as a brown oil (22.2 mg, 33% yield, R_f = 0.6 (PE/EA = 100 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (s, 1H), 7.22 (s, 1H), 5.27 (s, 1H), 3.83 (s, 2H), 1.45 (s, 18H) ; ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.9, 135.4, 128.5, 124.2, 100.0, 59.9, 34.3, 30.3;LRMS (EI, 70 eV) *m/z* (%): 338 (M^++2, 5), 336 (M^+, 21), 321 (15), 285(15),219(100); HRMS (ESI-TOF) *m/z*: [M + H]$^+$ Calcd for $C_{16}H_{24}Cl_3O$ 337.0887; Found 337.0881.

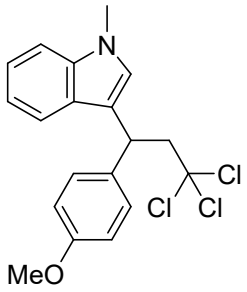
1-methoxy-4-(3,3,3-trichloro-1-methoxypropyl)benzene(5b):



Following the general procedure A , product **5b** was obtained as a brown oil (37.1 mg, 66% yield R_f = 0.6 (PE/EA = 100 : 1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.15 (m, 2H), 7.07 -6.42 (m, 2H), 4.60-4.50 (m, 1H), 3.81 (s, 3H), 3.37 -3.14 (m, 4H), 2.97 (dd, *J* = 15.2, 3.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.5, 132.7, 127.9, 114.1, 80.7, 62.1, 56.4, 55.3;LRMS (EI, 70 eV) *m/z* (%): 284 (M^++2, 4), 282 (M^+, 4), 151 (100), 135 (21), 91 (7); HRMS (ESI-TOF) *m/z*: [M + H]$^+$ Calcd for $C_{11}H_{14}Cl_3O_2$ 283.0054; Found

283.0053.

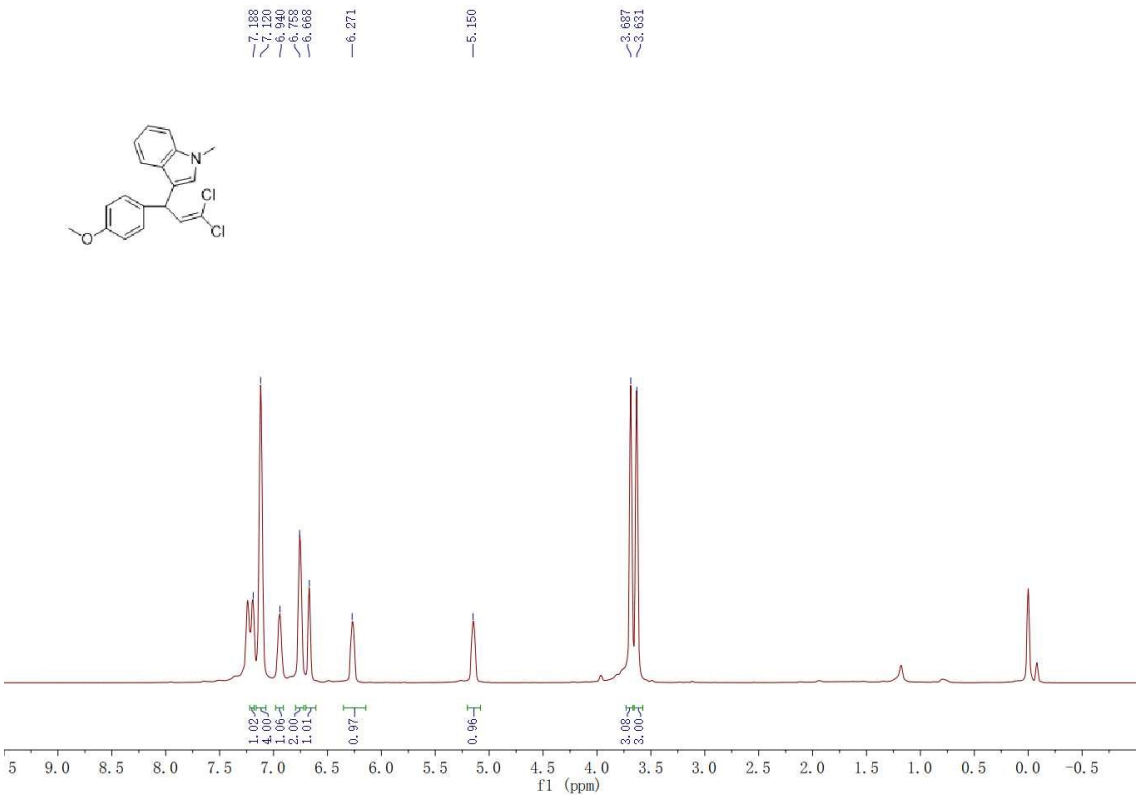
1-methyl-3-(3,3,3-trichloro-1-(4-methoxyphenyl)propyl)-1H-indole(5c):



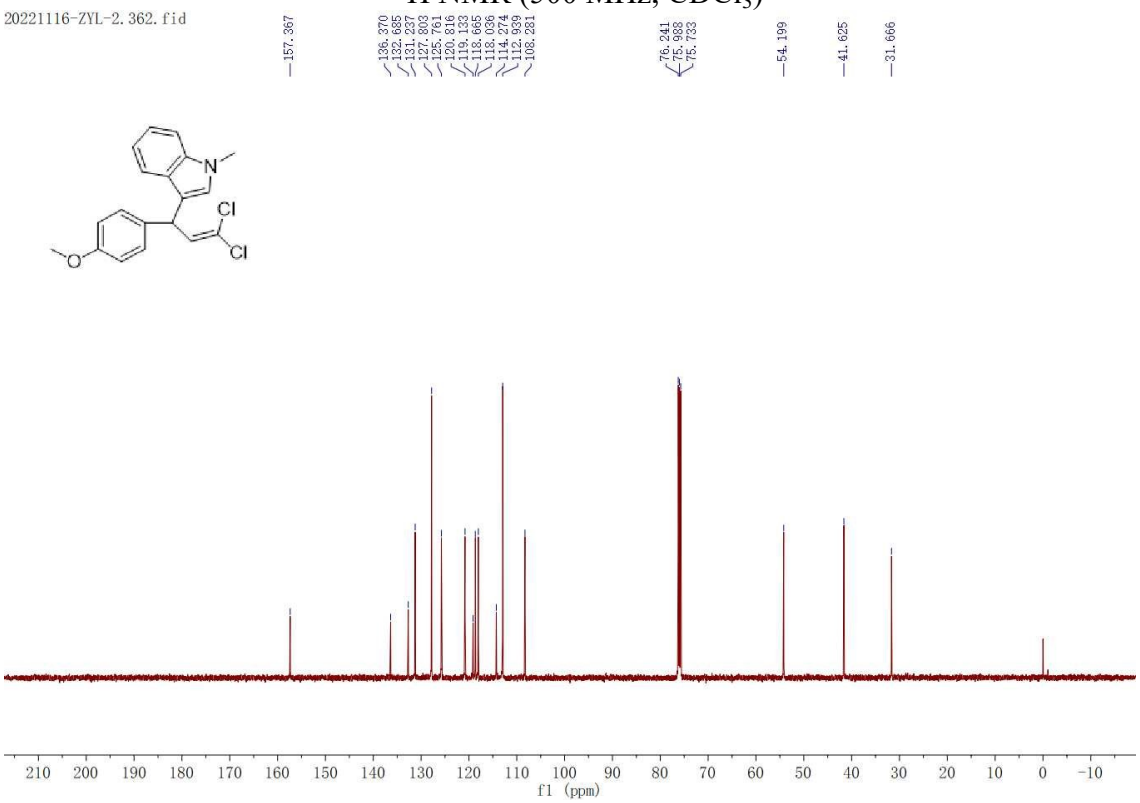
Following the general procedure A , product **5c** was obtained as a brown oil (39.5 mg, 50% yield, R_f = 0.6 (PE/EA = 50 : 1); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.66-7.57 (m, 1H), 7.33-7.20 (m, 4H), 7.14-7.04 (m, 1H), 6.90-6.82 (m, 2H), 6.74 (m, 1H), 4.84-4.70 (m, 1H), 3.78 (s, 3H), 3.72 (s, 3H), 3.65-3.45 (m, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.2, 137.3, 135.3, 129.2, 126.6, 121.9, 119.3, 119.1, 113.9, 109.4, 99.2, 60.1, 55.2, 40.4, 32.7;LRMS (EI, 70 eV) *m/z* (%): 383 (M^++2, 6), 381 (M^+, 17), 344 (41), 308 (31), 179 (100); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{19}H_{19}Cl_3NO$ 382.0527; Found 382.0524.

(C) Spectra

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aaa):

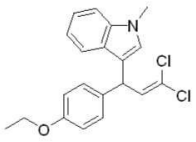


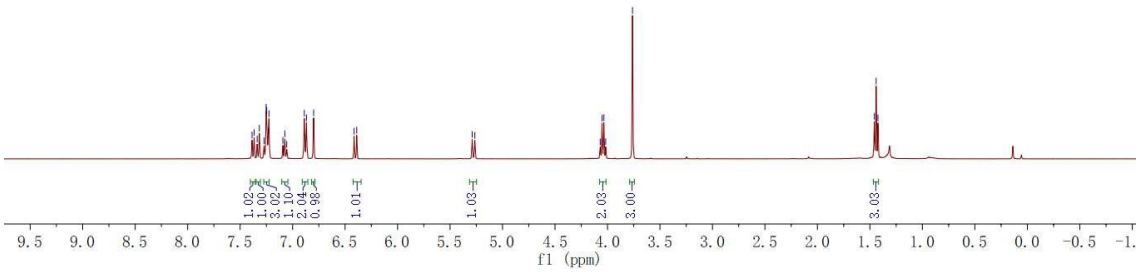
^{1}H NMR (500 MHz, $CDCl_3$)



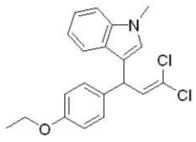
^{13}C NMR (126 MHz, $CDCl_3$)

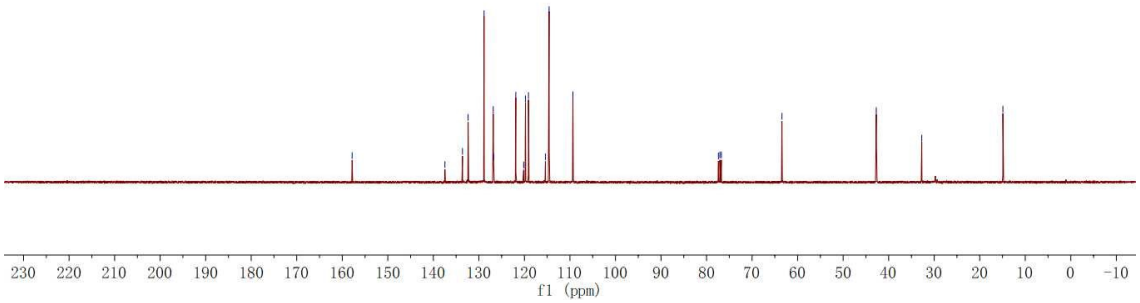
3-(3,3-dichloro-1-(4-ethoxyphenyl)allyl)-1-methyl-1H-indole (4baa):





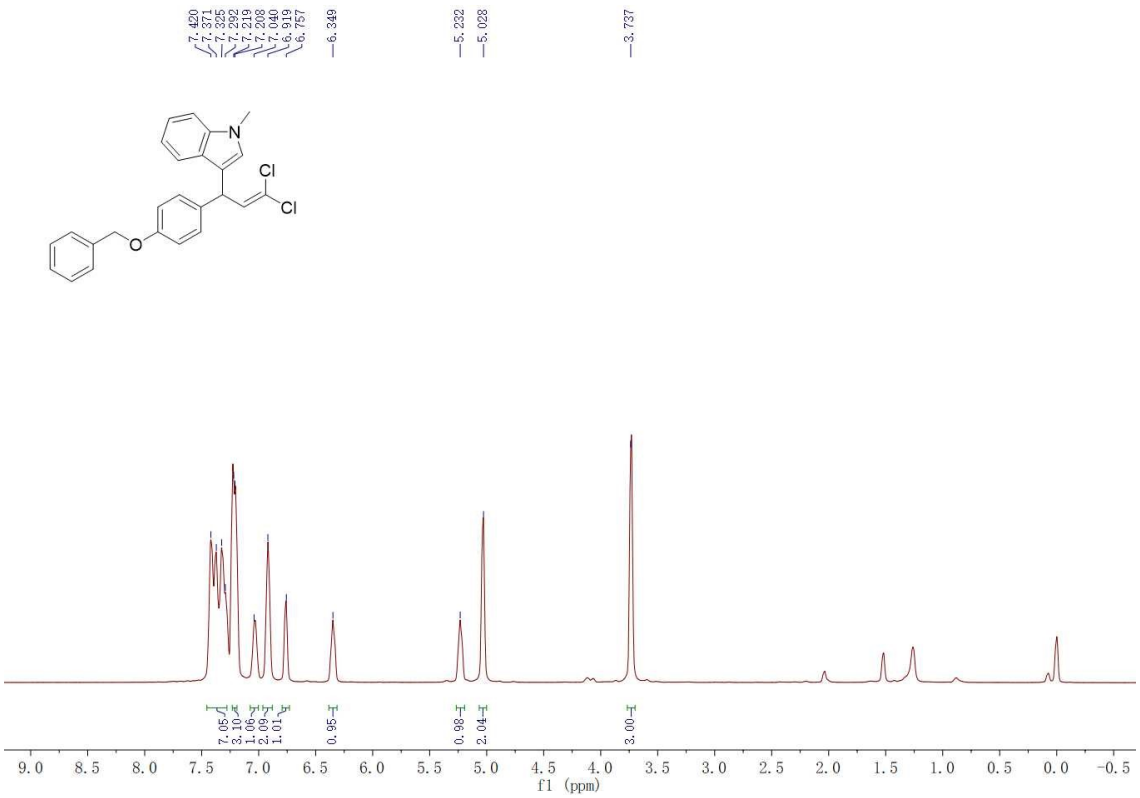
^{1}H NMR (400 MHz, $CDCl_3$)



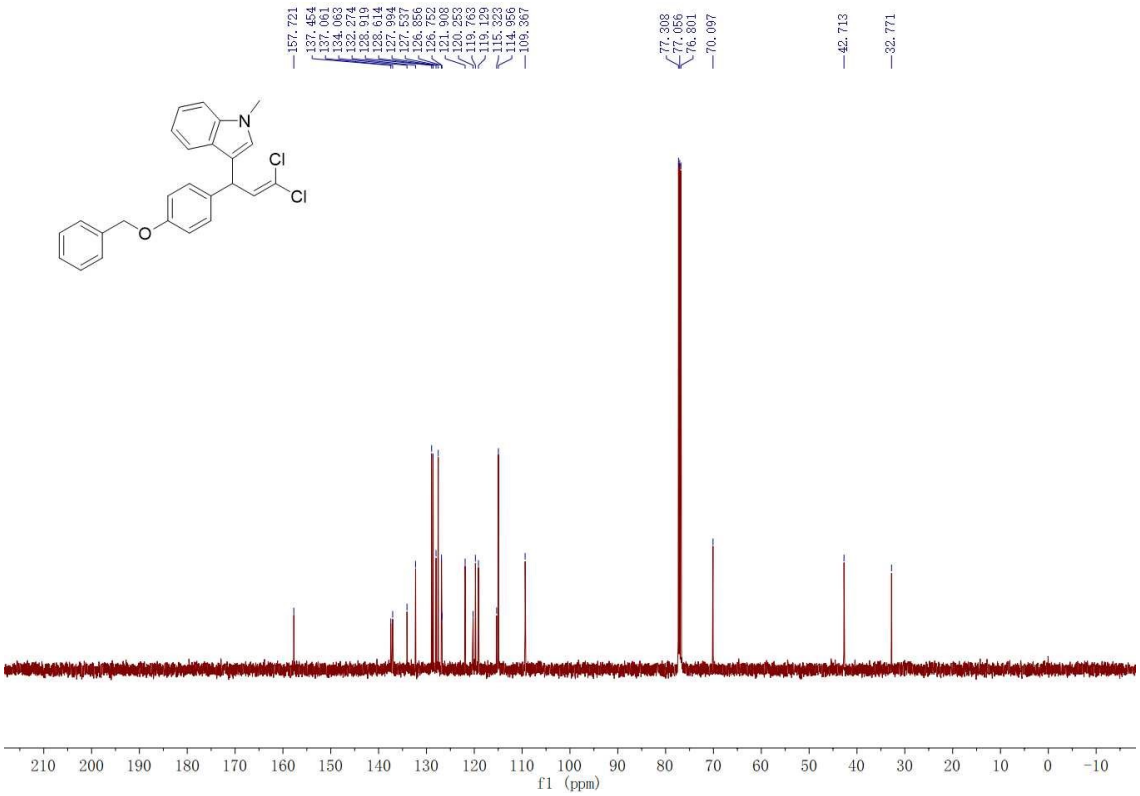


^{13}C NMR (100 MHz, $CDCl_3$)

3-(1-(4-(benzyloxy)phenyl)-3,3-dichloroallyl)-1-methyl-1H-indole (4caa):

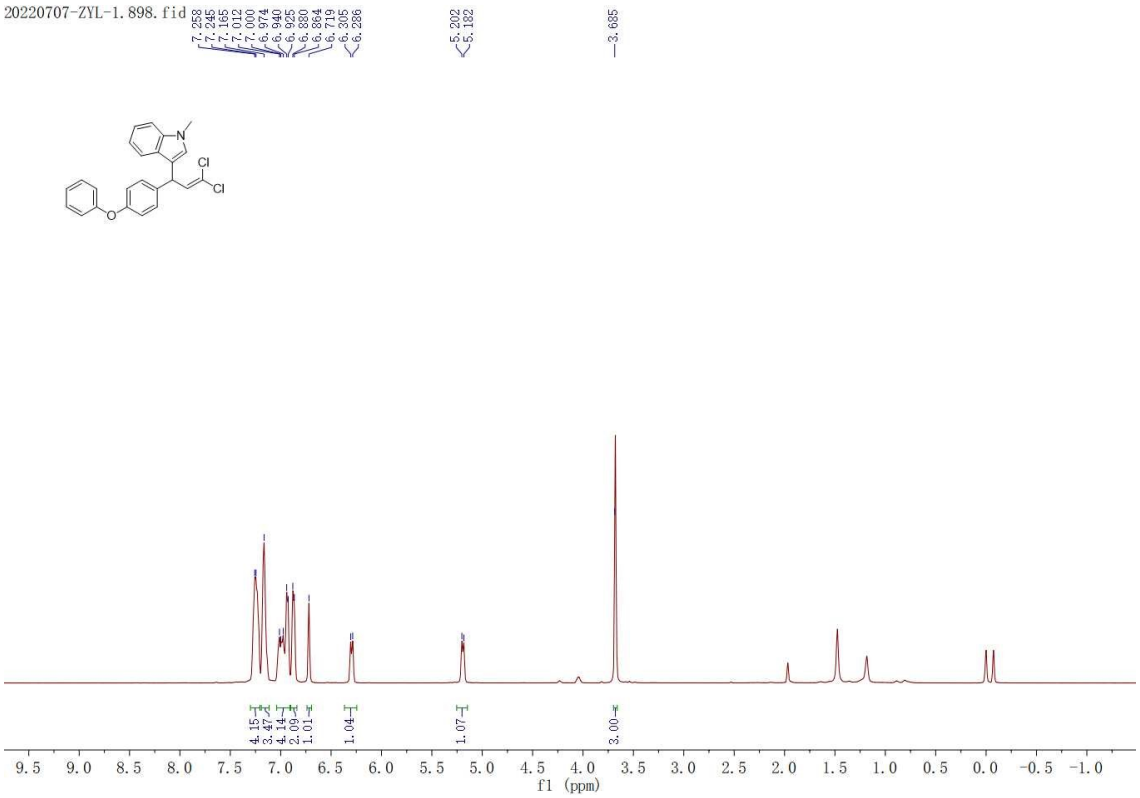


^{1}H NMR (500 MHz, $CDCl_3$)

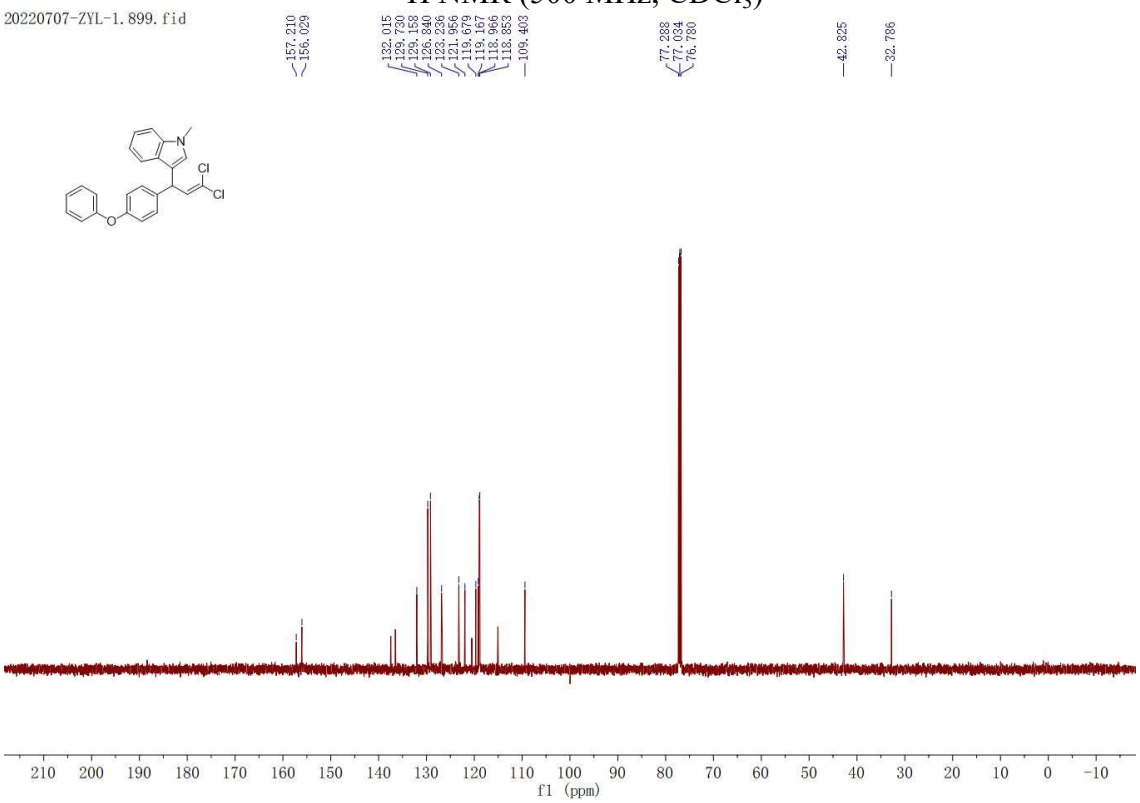


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-phenoxyphenyl)allyl)-1-methyl-1H-indole (4daa):

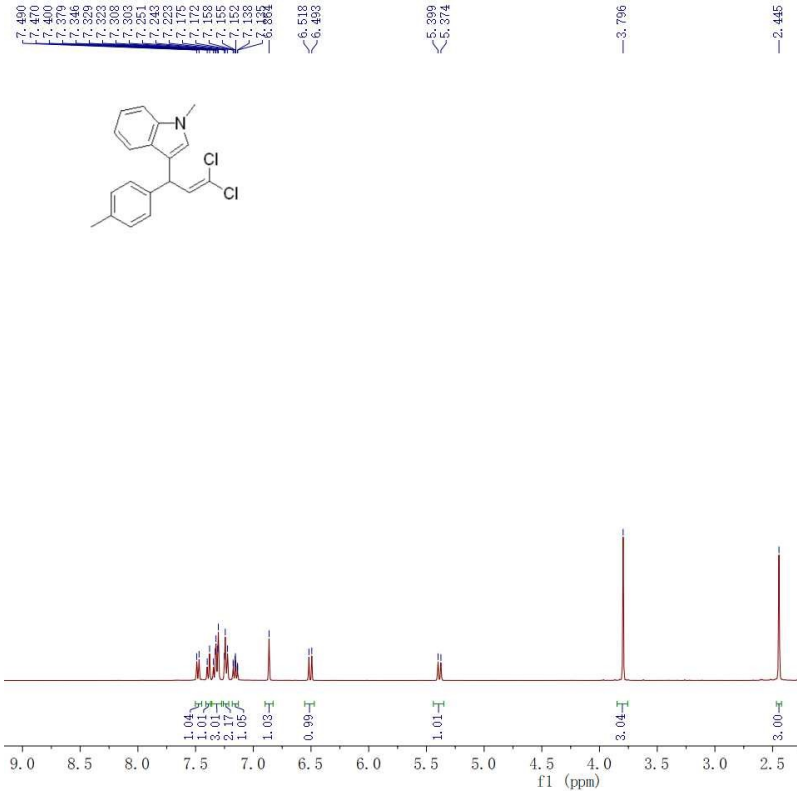


^{1}H NMR (500 MHz, $CDCl_3$)

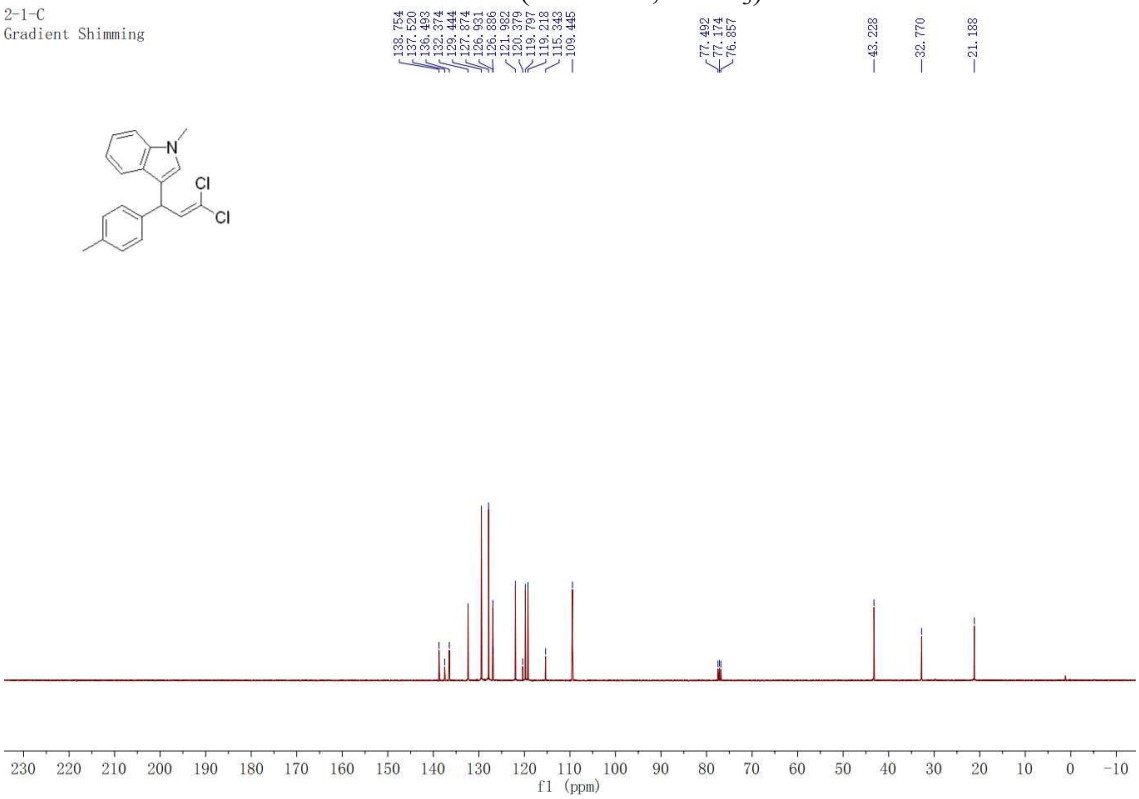


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(p-tolyl)allyl)-1-methyl-1H-indole (4eaa):

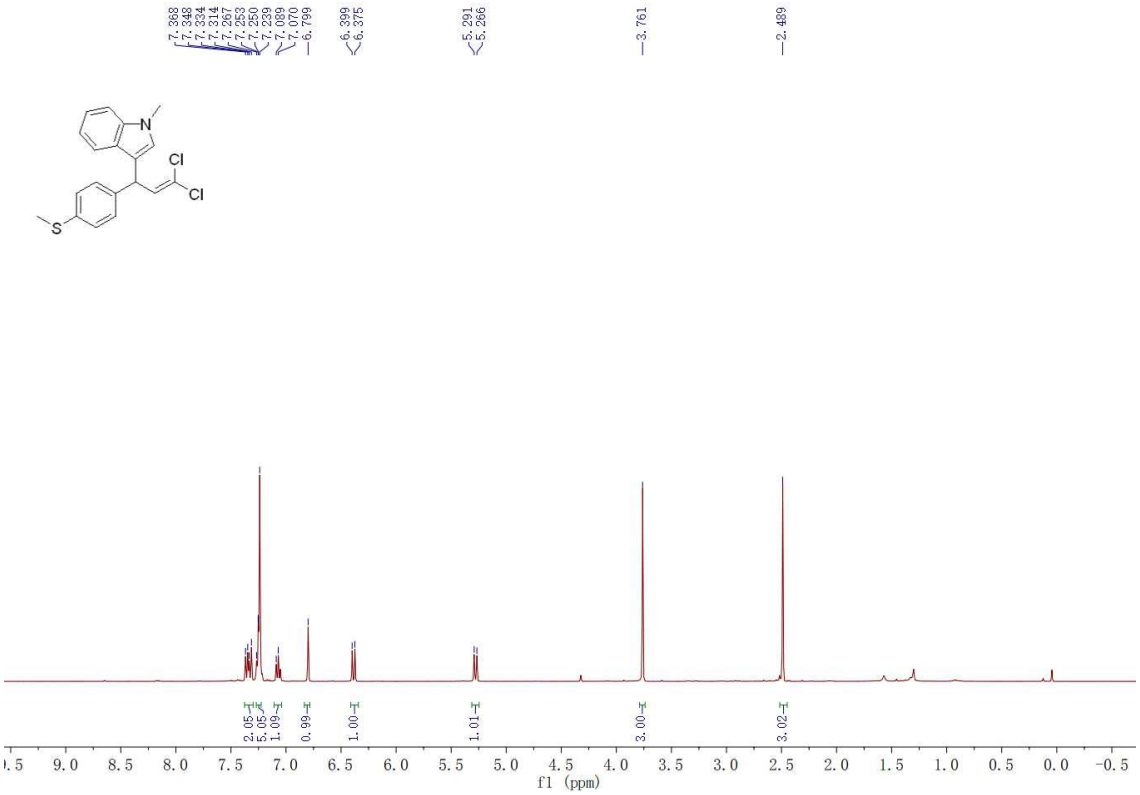


^{1}H NMR (400 MHz, $CDCl_3$)

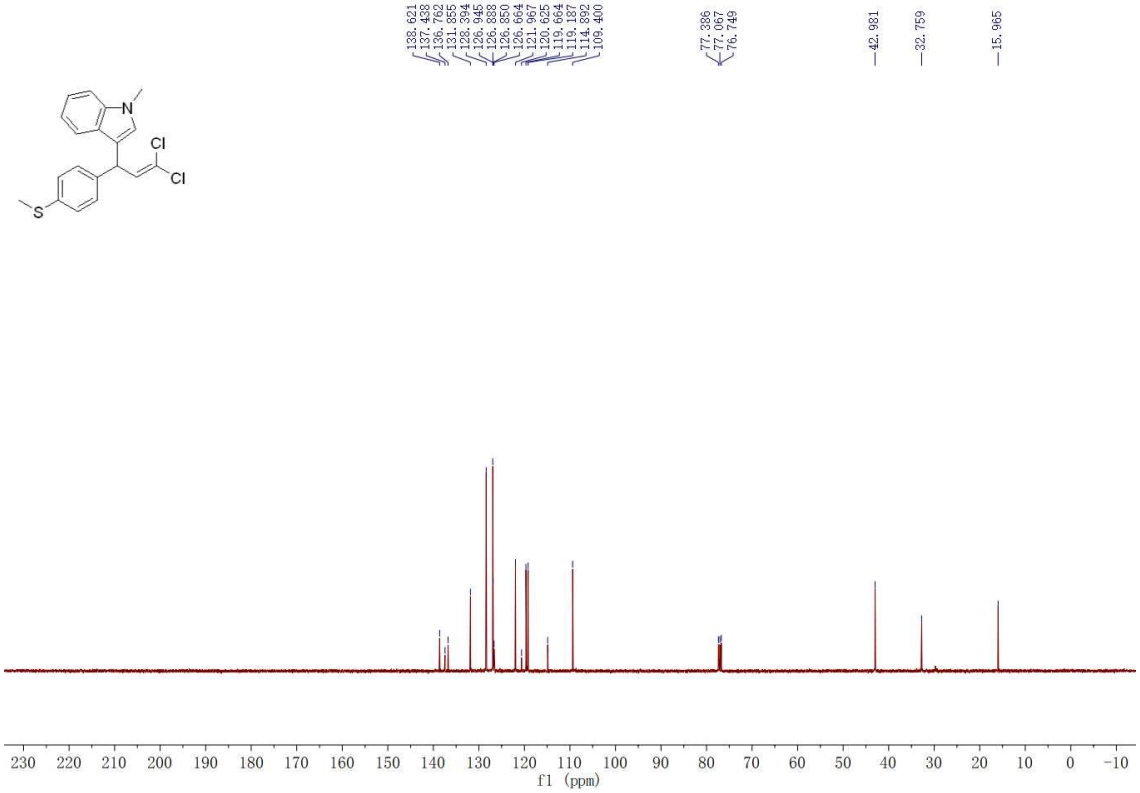


^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-(methylthio)phenyl)allyl)-1-methyl-1H-indole (4faa):

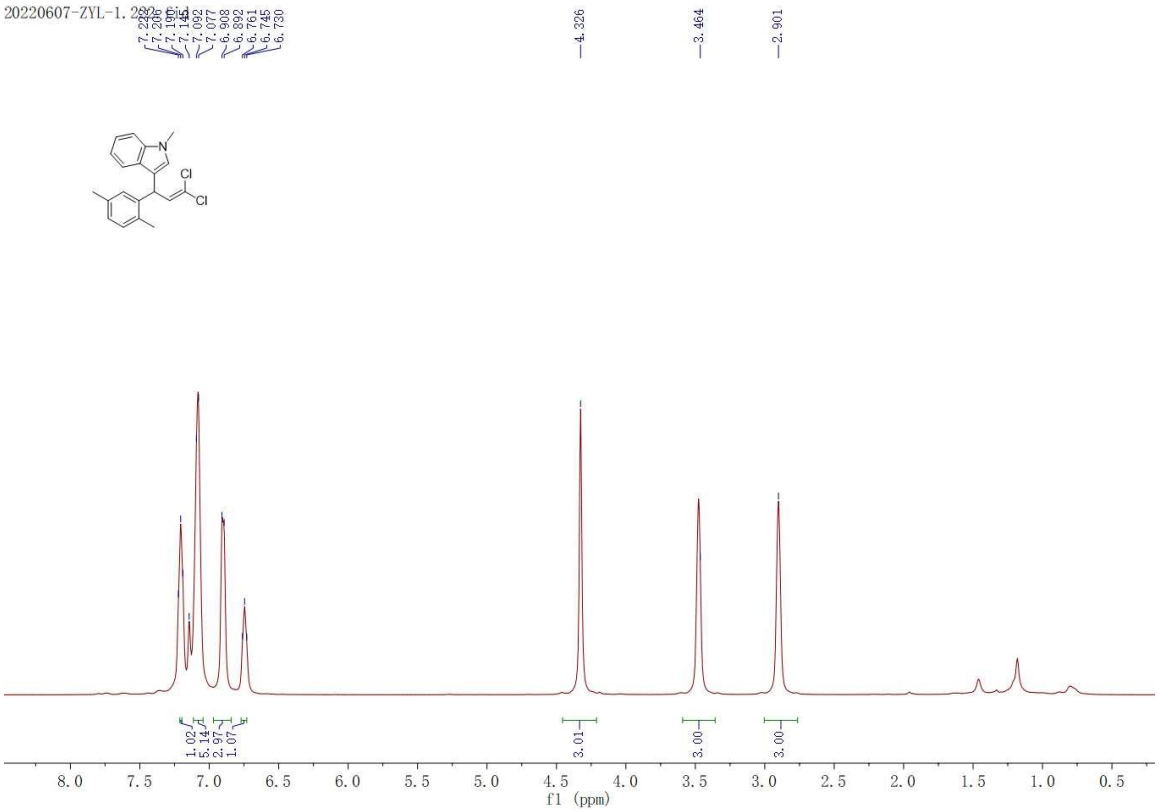


^{1}H NMR (400 MHz, $CDCl_3$)

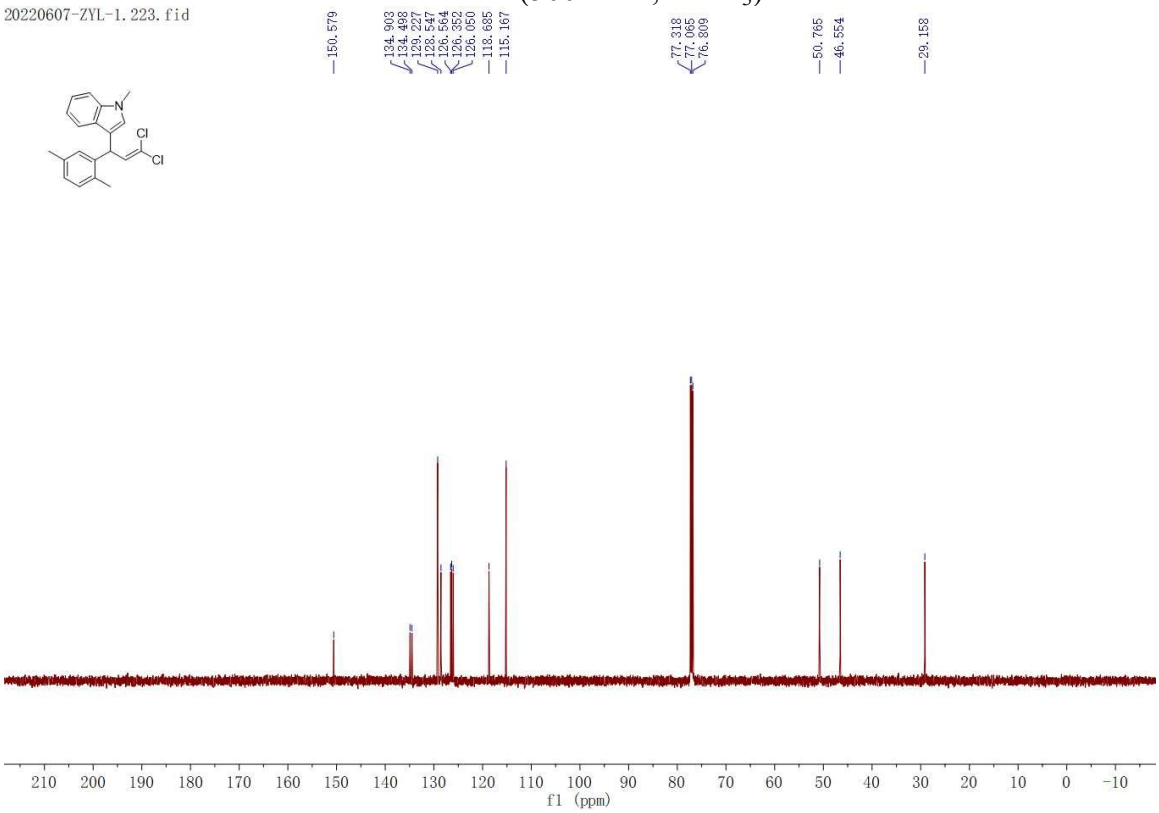


^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(2,5-dimethylphenyl)allyl)-1-methyl-1H-indole (4haa):

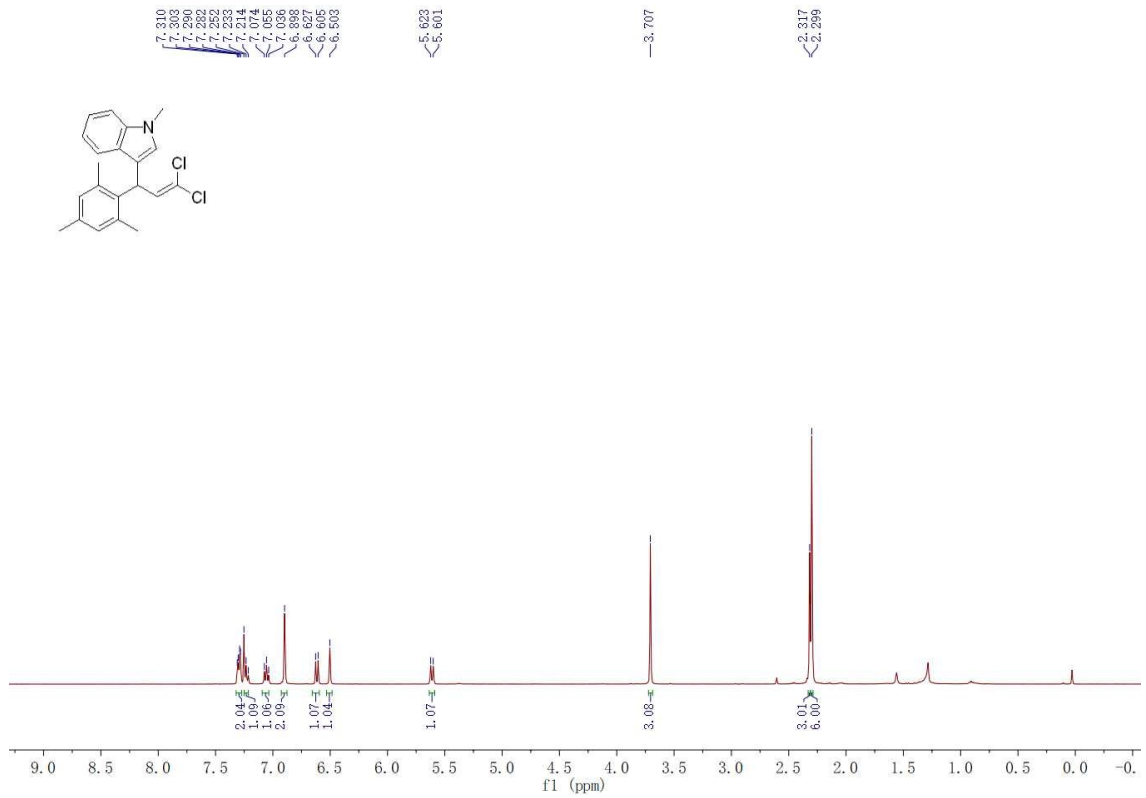


^{1}H NMR (500 MHz, $CDCl_3$)

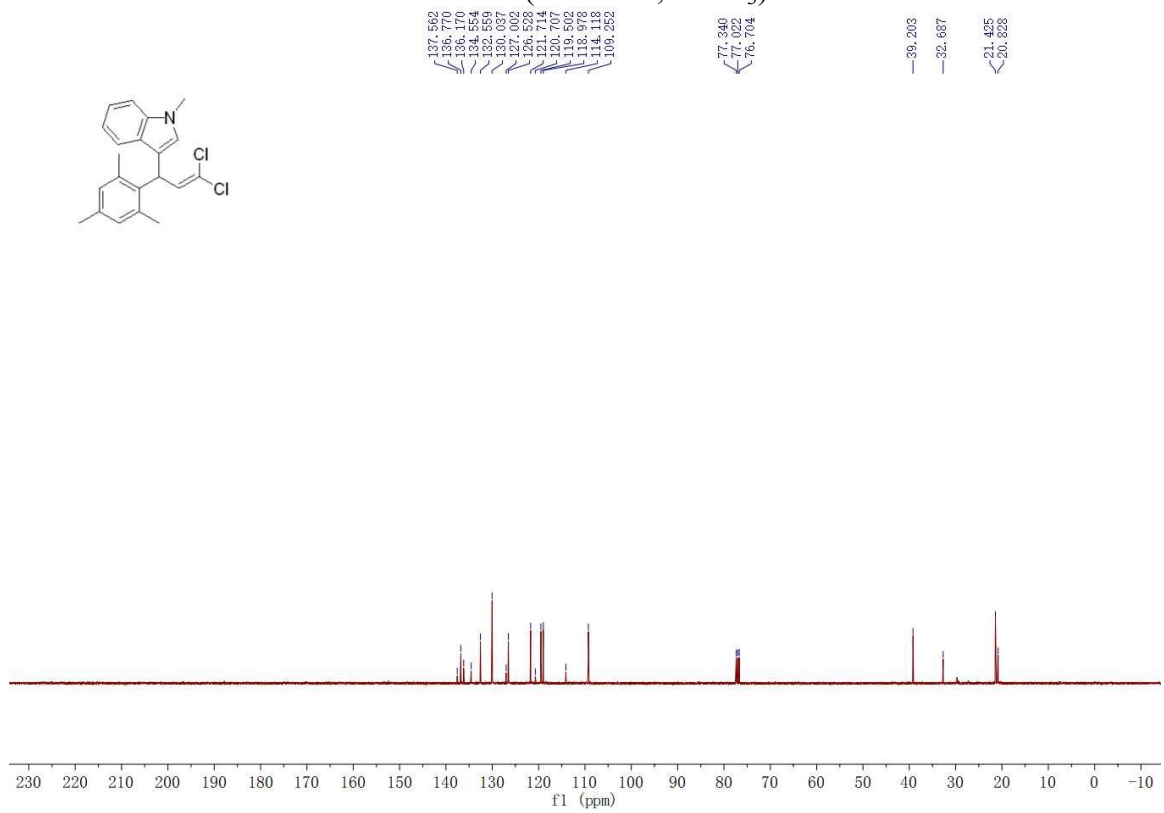


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-mesitylallyl)-1-methyl-1H-indole (4iaa):

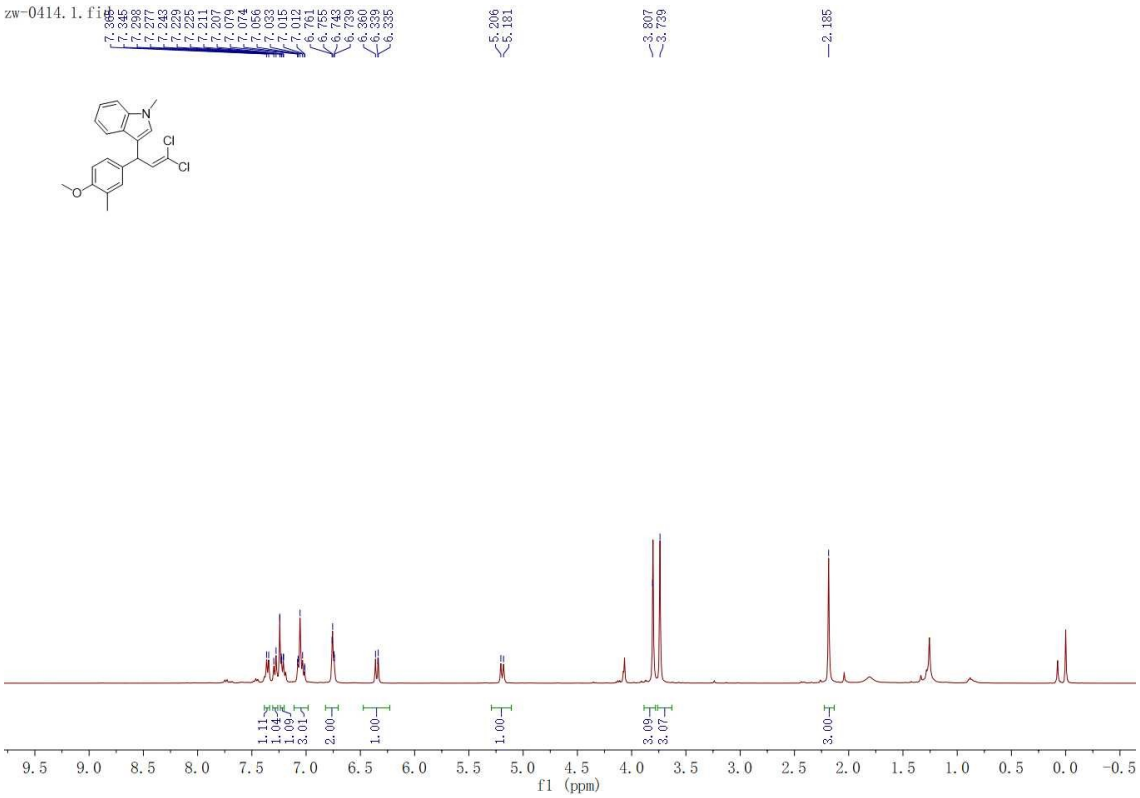


^{1}H NMR (400 MHz, $CDCl_3$)

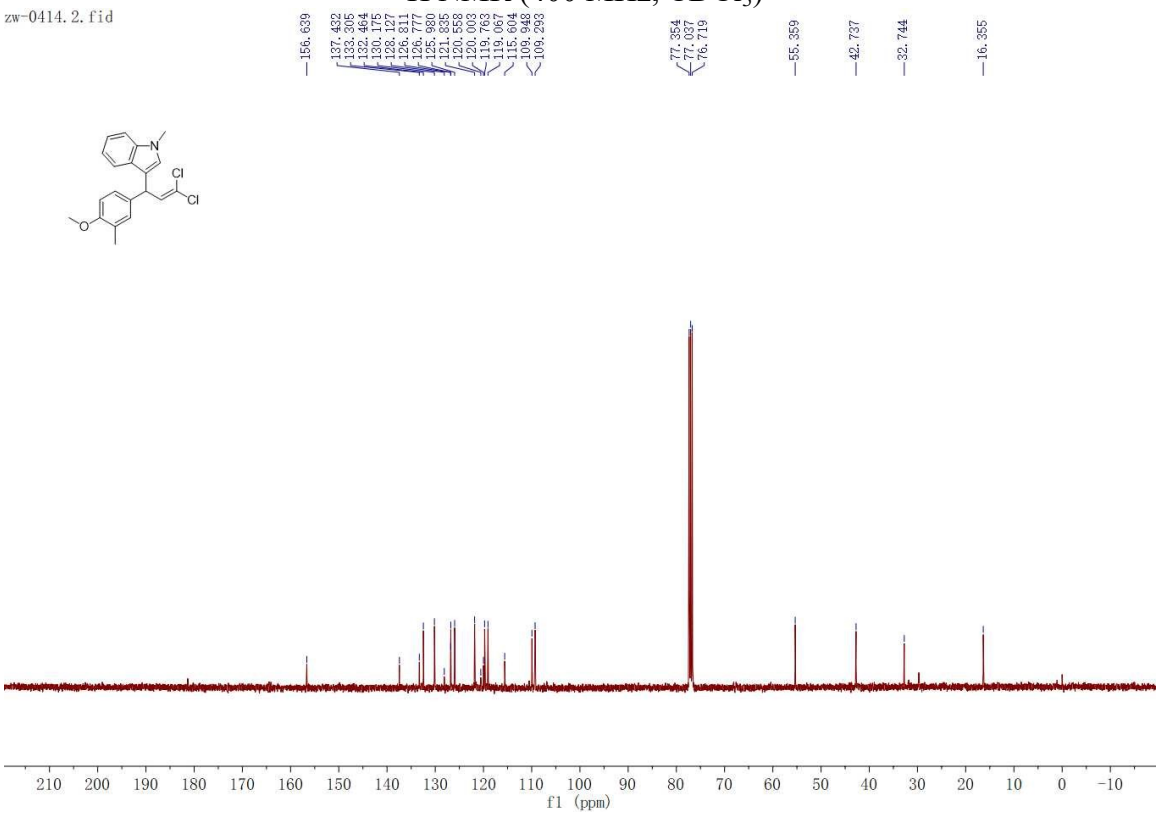


^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxy-3-methylphenyl)allyl)-1-methyl-1H-indole (4jaa):

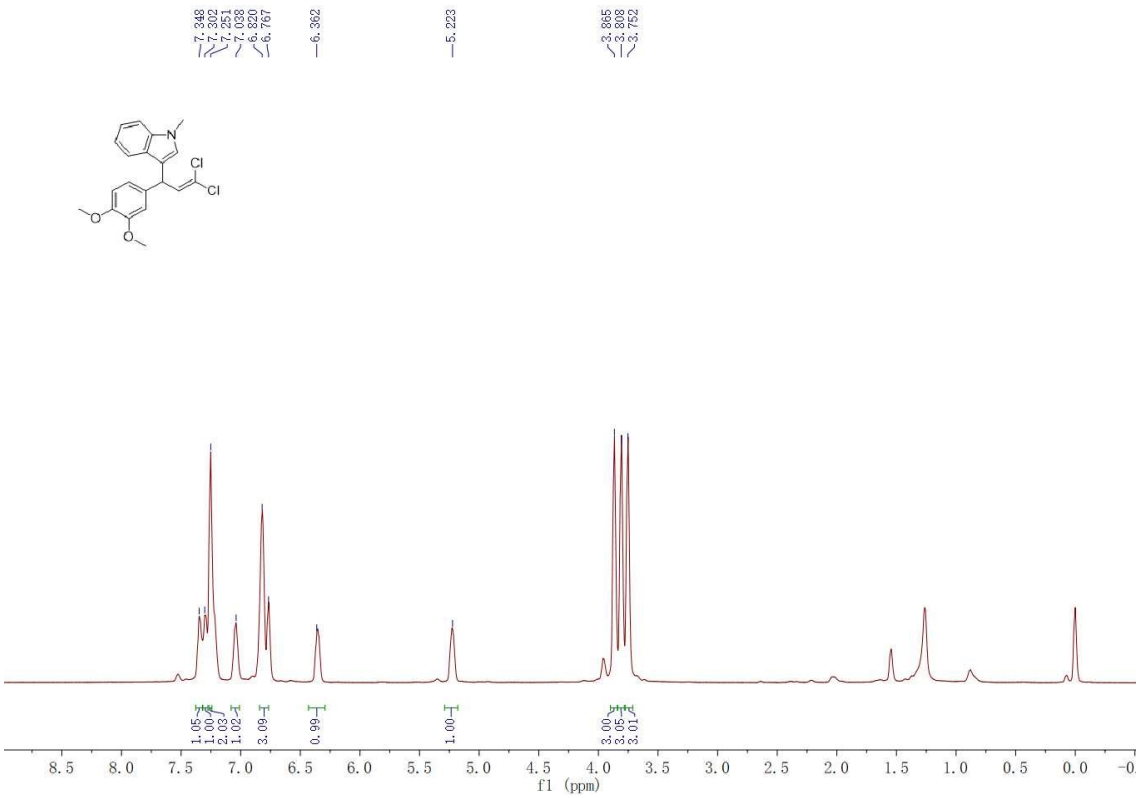


^{1}H NMR (400 MHz, $CDCl_3$)

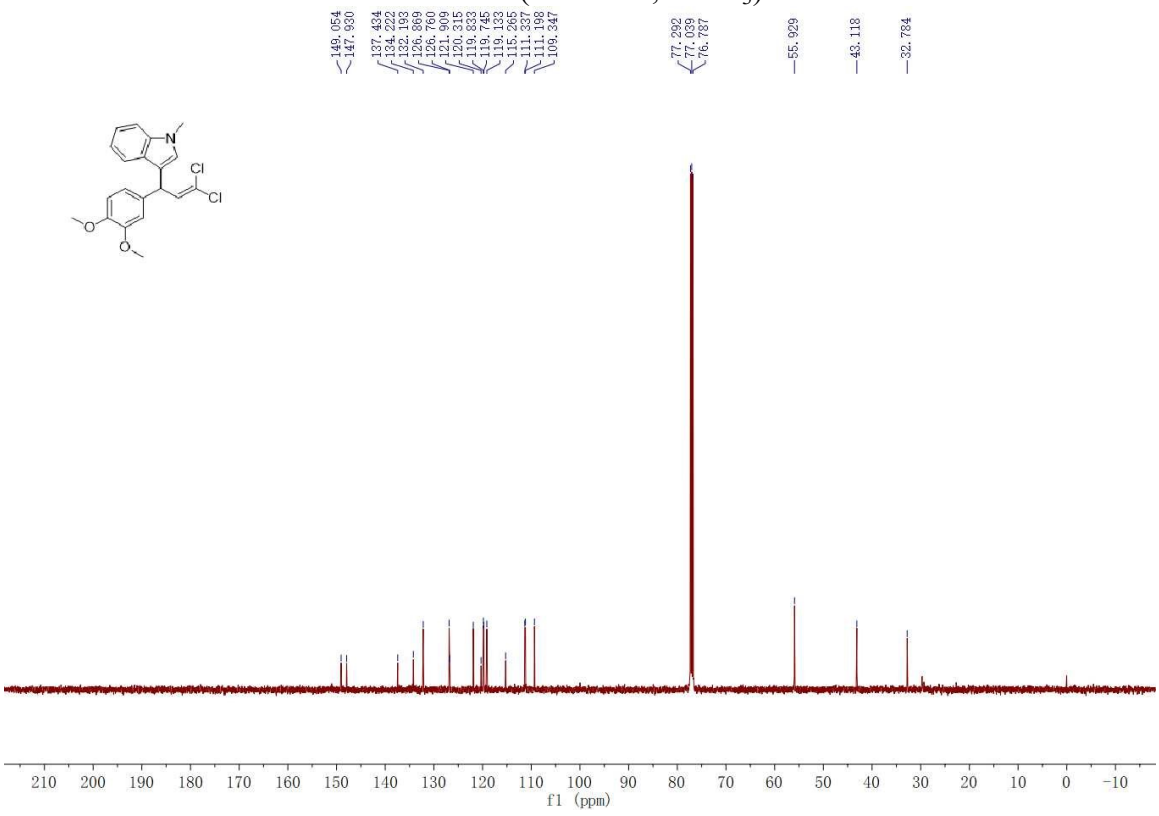


^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(3,4-dimethoxyphenyl)allyl)-1-methyl-1H-indole (4kaa):

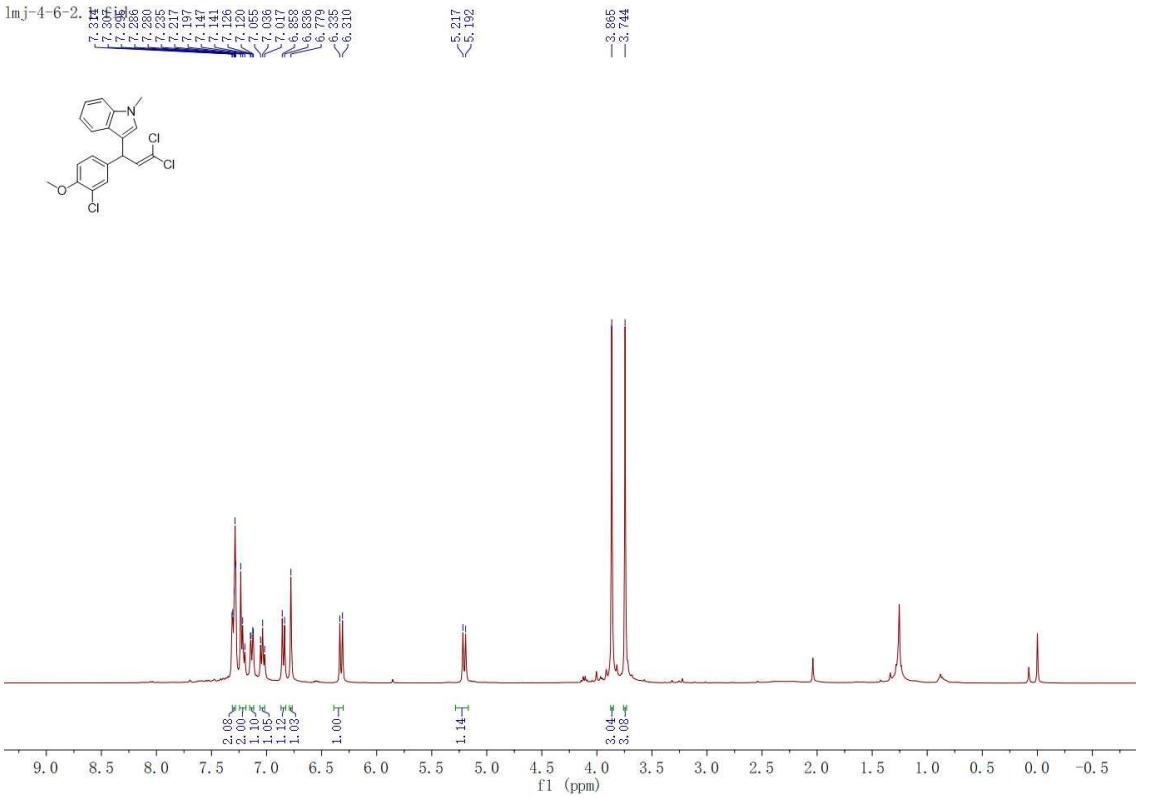


^{1}H NMR (500 MHz, $CDCl_3$)

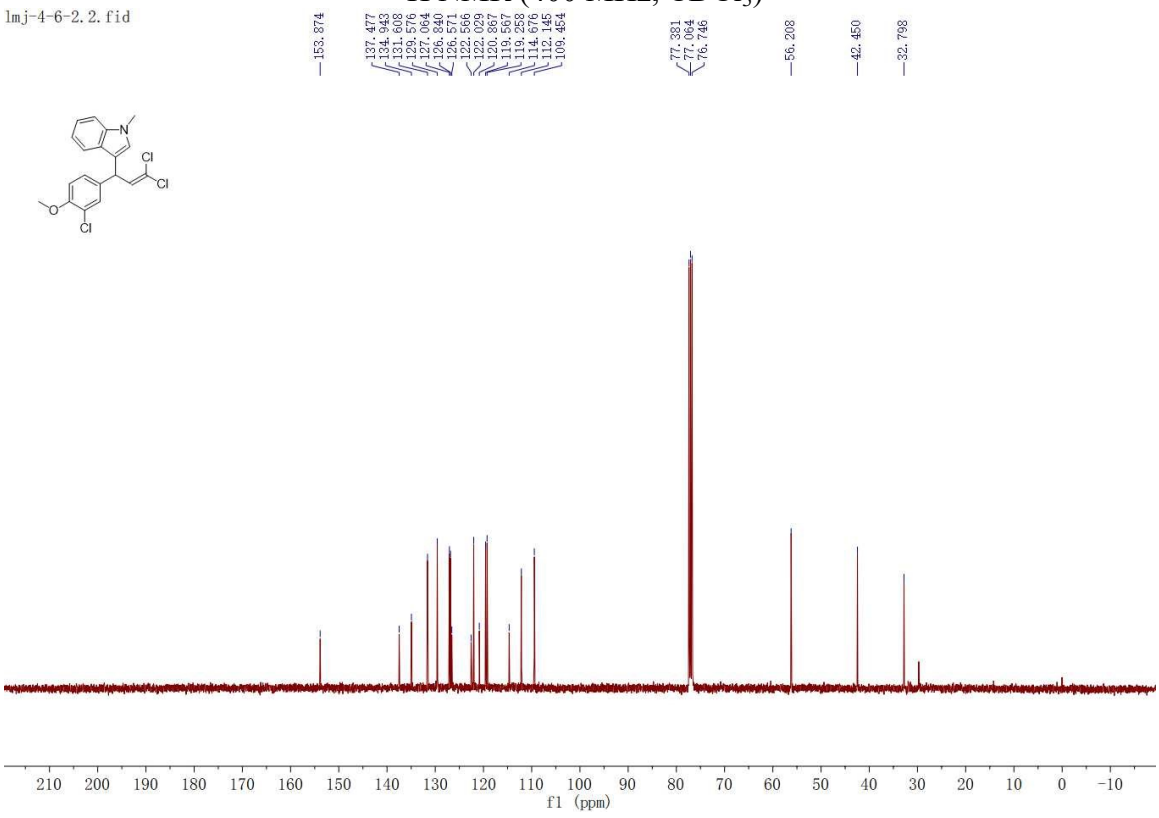


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(3-chloro-4-methoxyphenyl)allyl)-1-methyl-1H-indole (4laa):



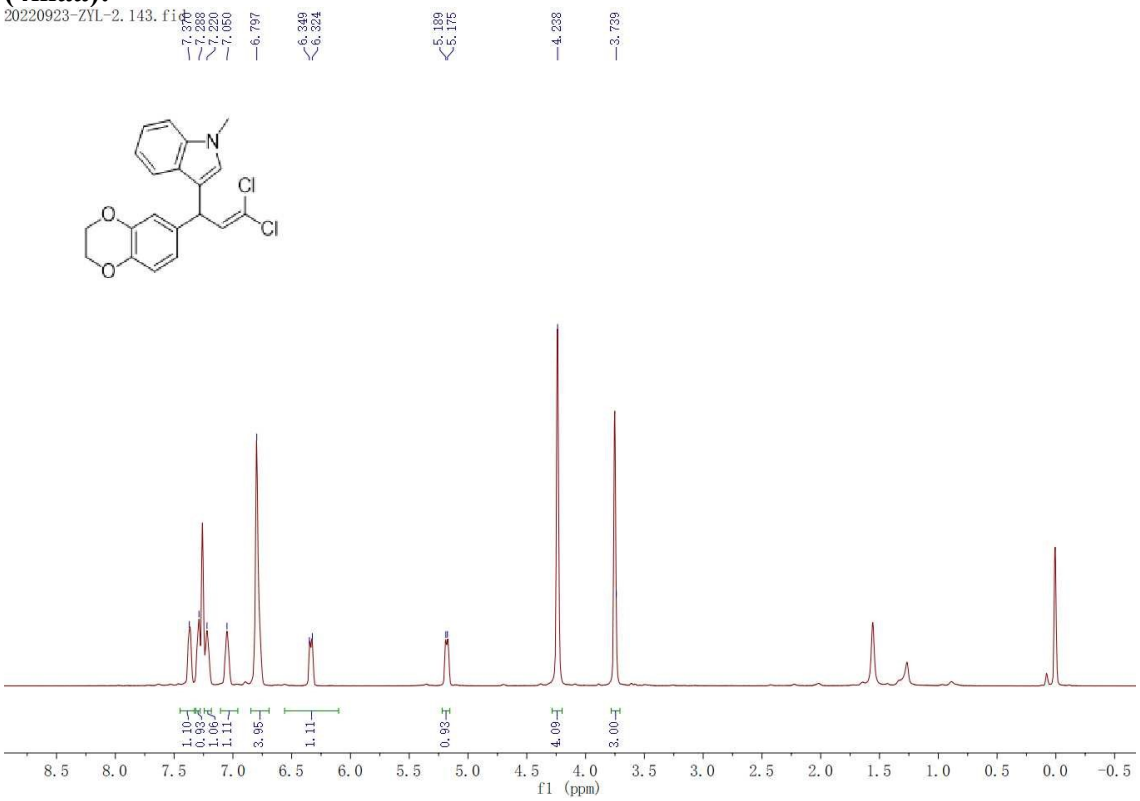
^{1}H NMR (400 MHz, $CDCl_3$)



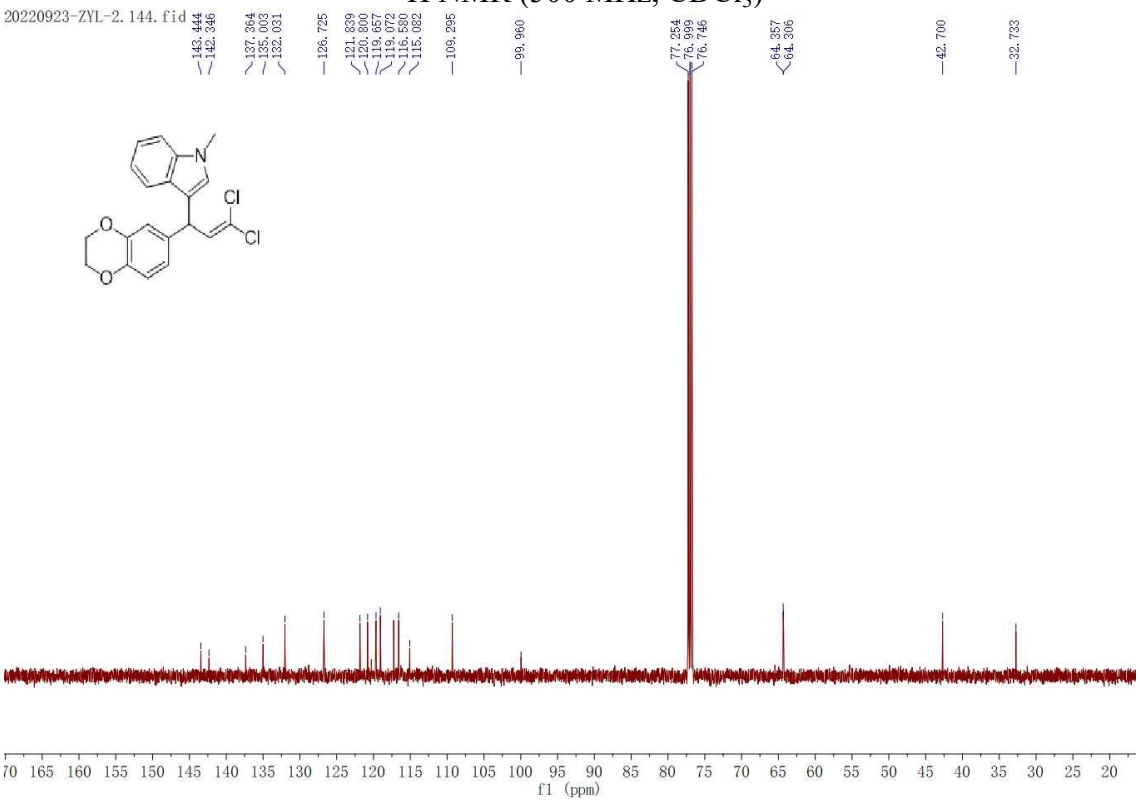
^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)allyl)-1-methyl-1H-indole

(4maa):

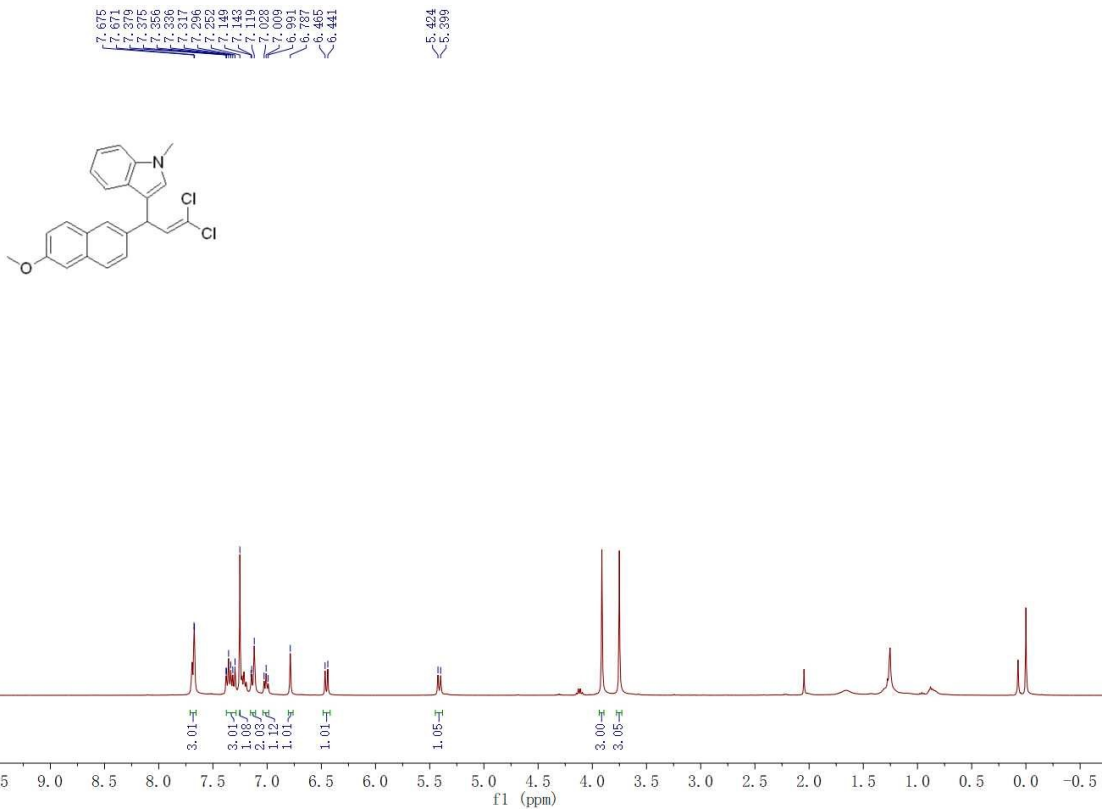


^{1}H NMR (500 MHz, $CDCl_3$)

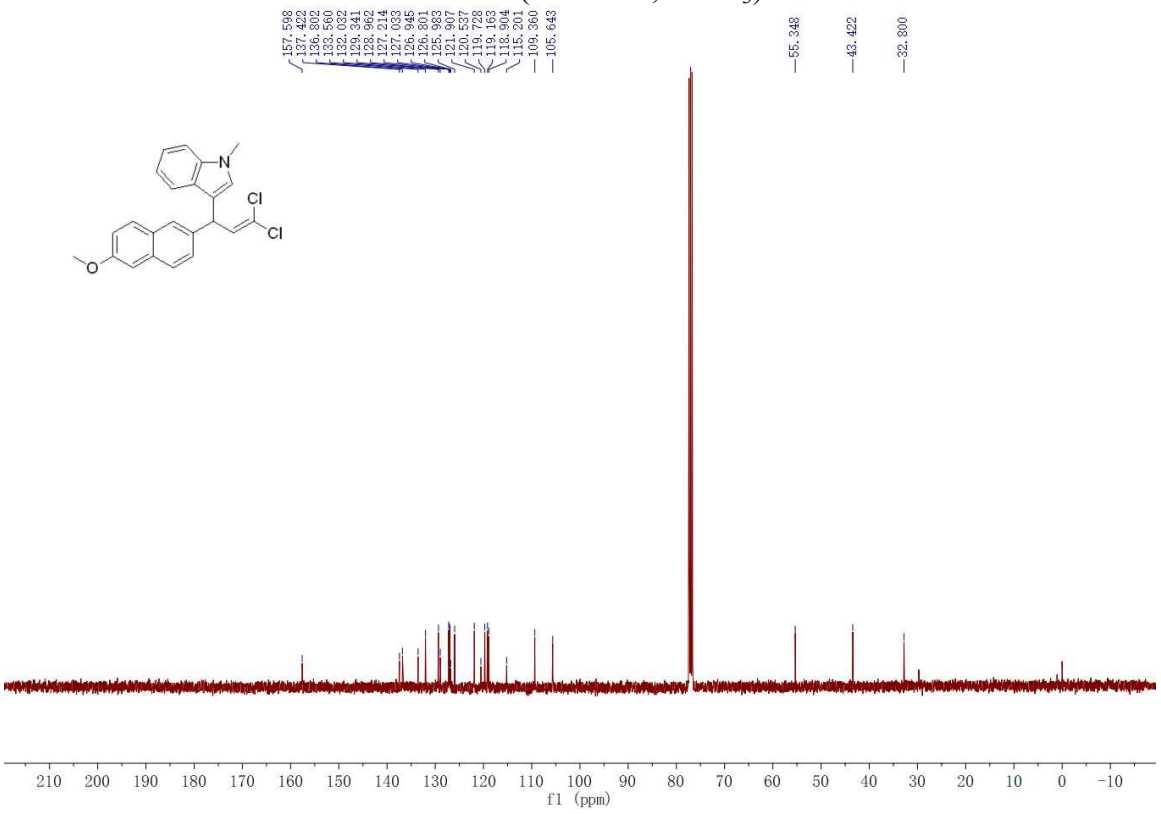


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(6-methoxynaphthalen-2-yl)allyl)-1-methyl-1H-indole (4oaa):

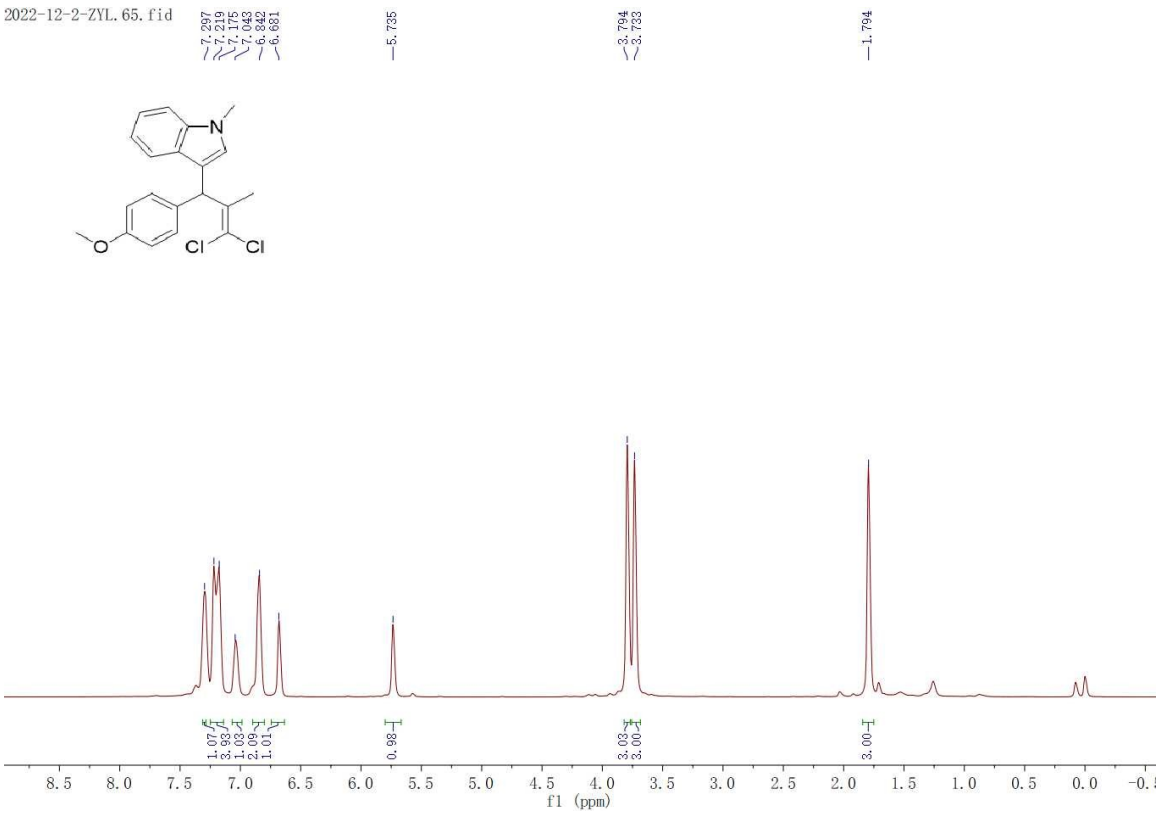


^{1}H NMR (400 MHz, $CDCl_3$)

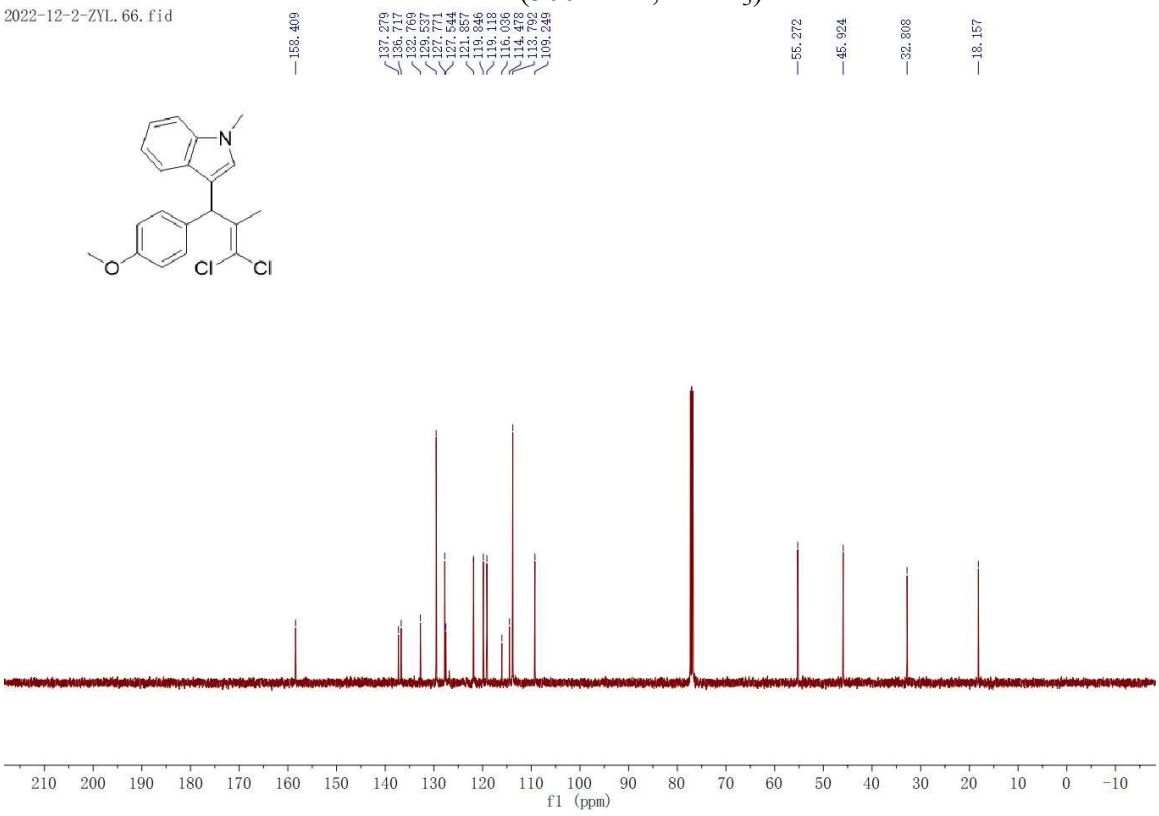


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)-2-methylallyl)-1-methyl-1H-indole (4paa):

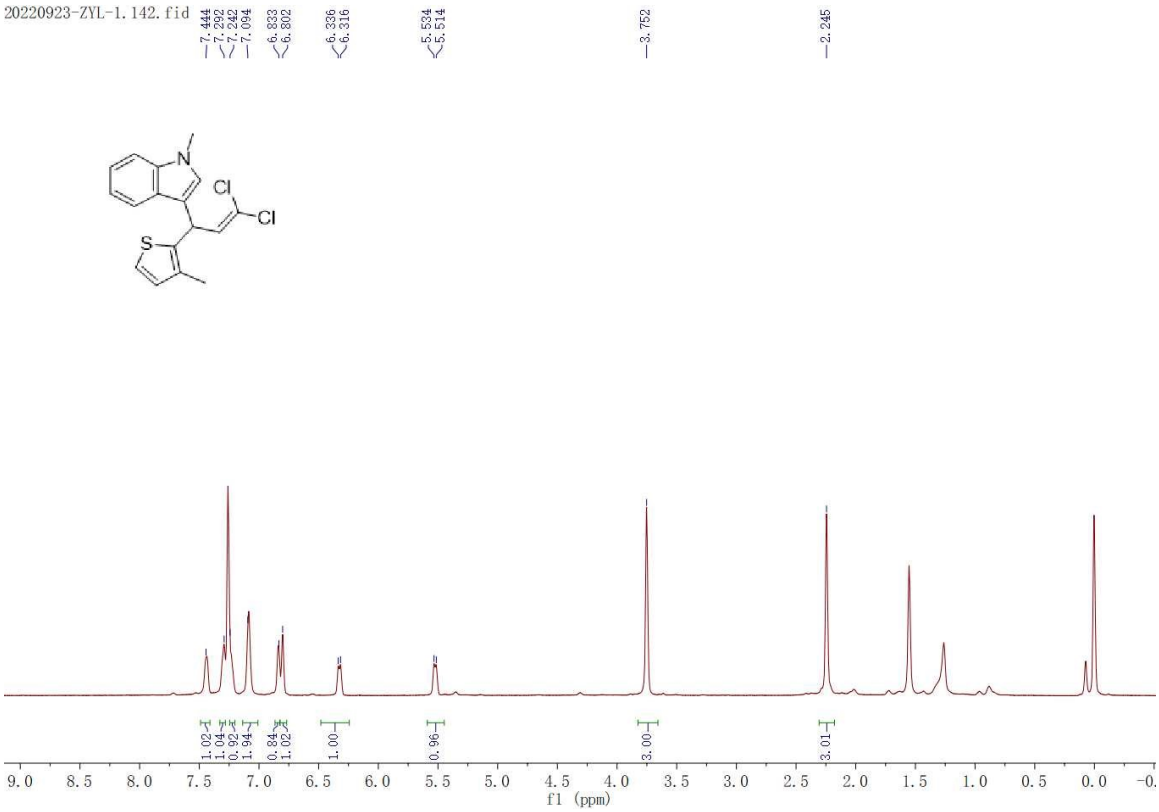


^{1}H NMR (500 MHz, $CDCl_3$)

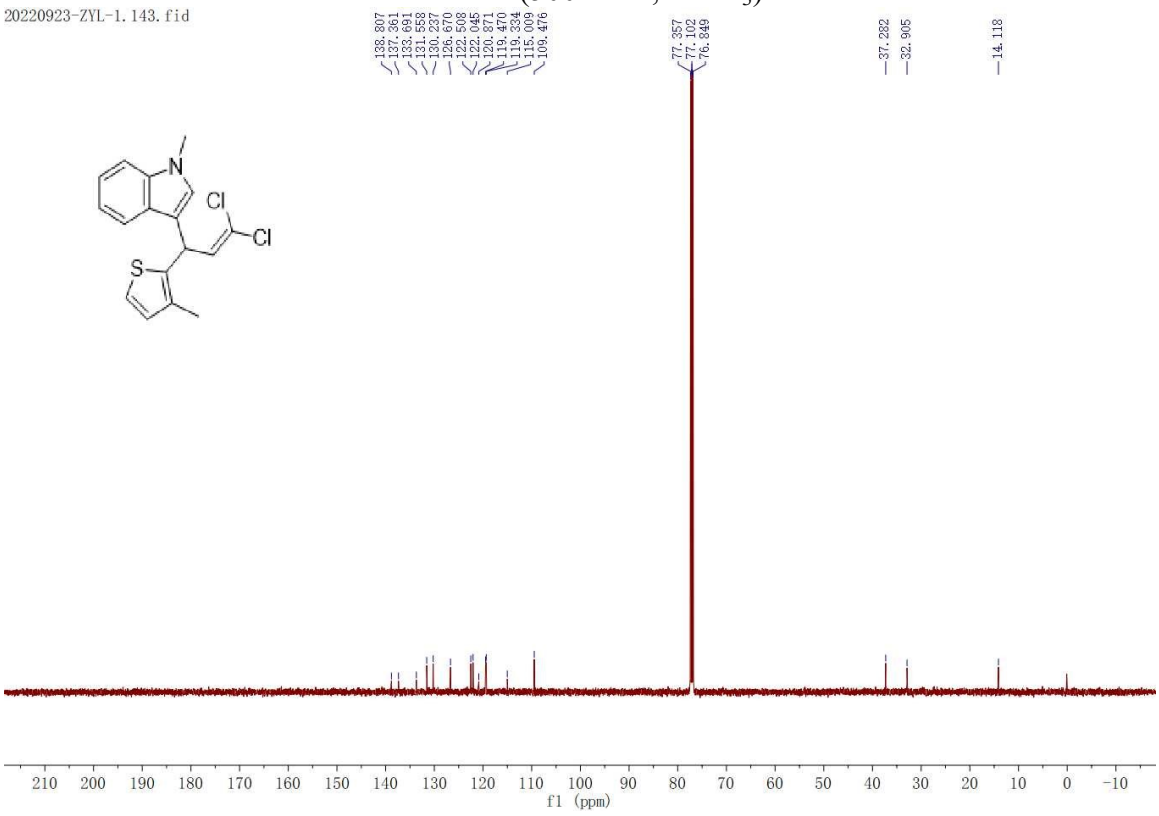


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(3-methylthiophen-2-yl)allyl)-1-methyl-1H-indole (4paa):

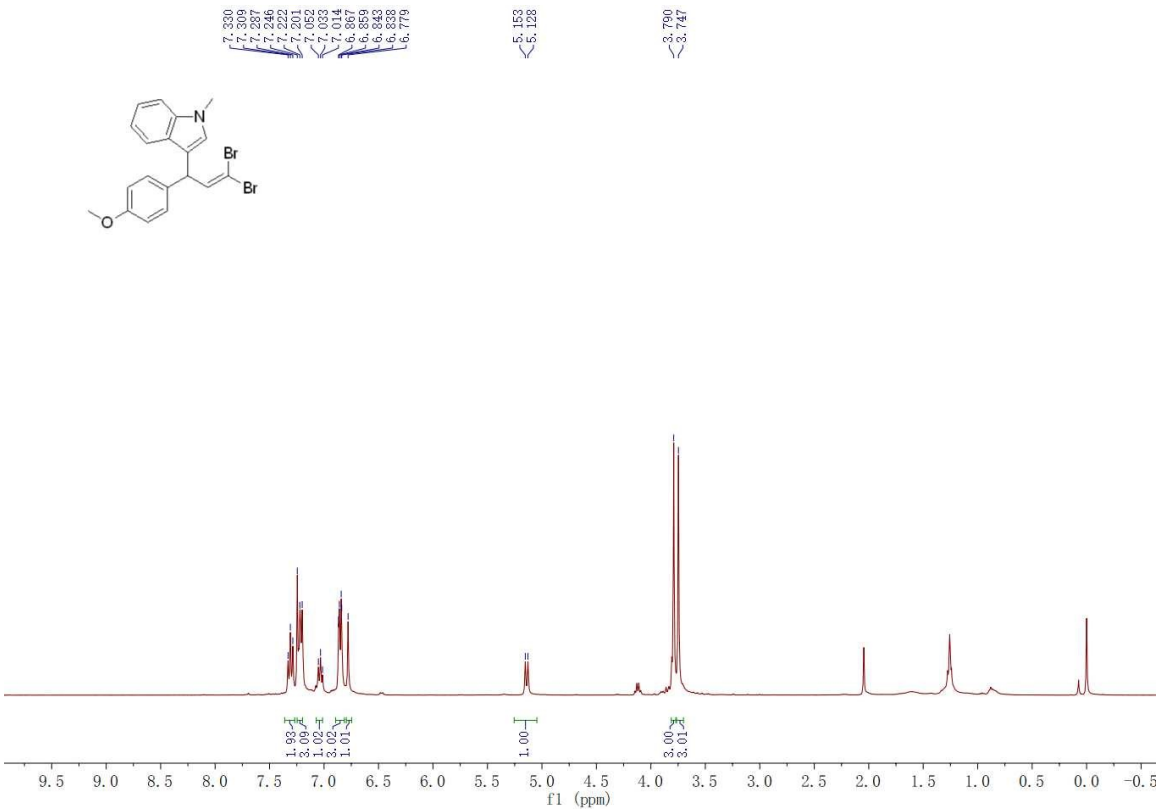


^{1}H NMR (500 MHz, $CDCl_3$)

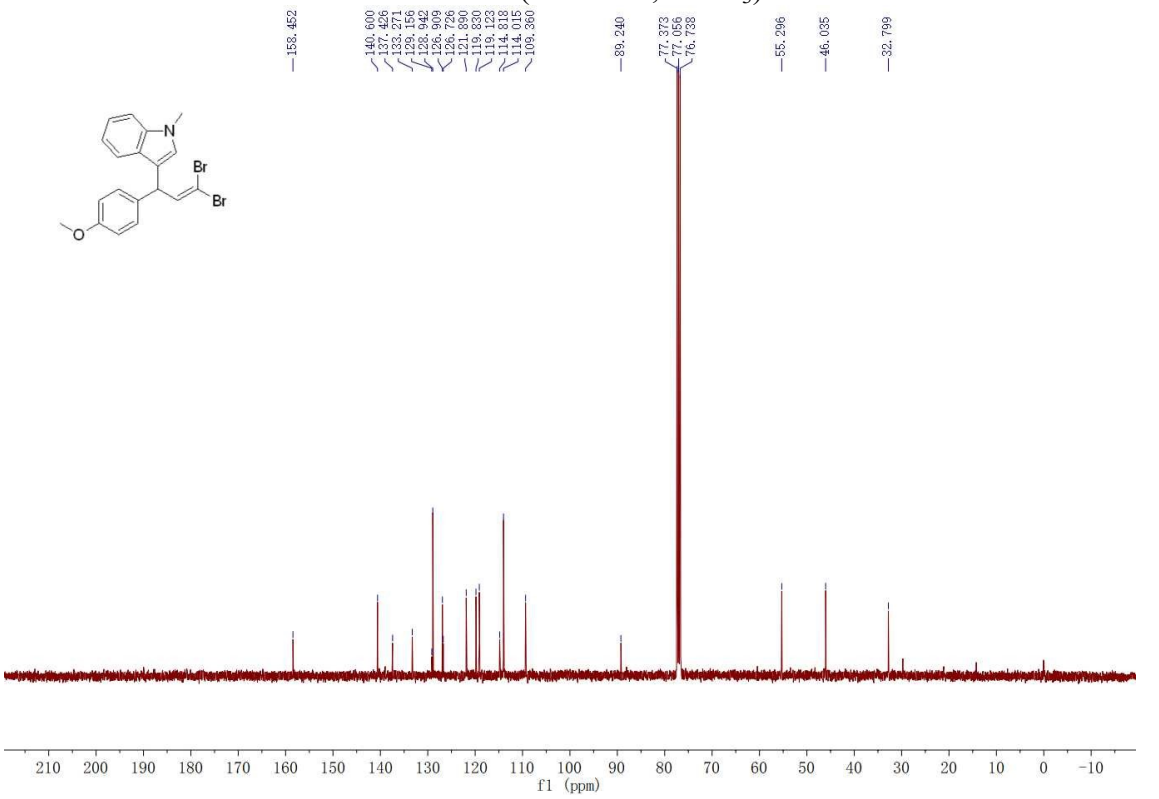


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dibromo-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aca):

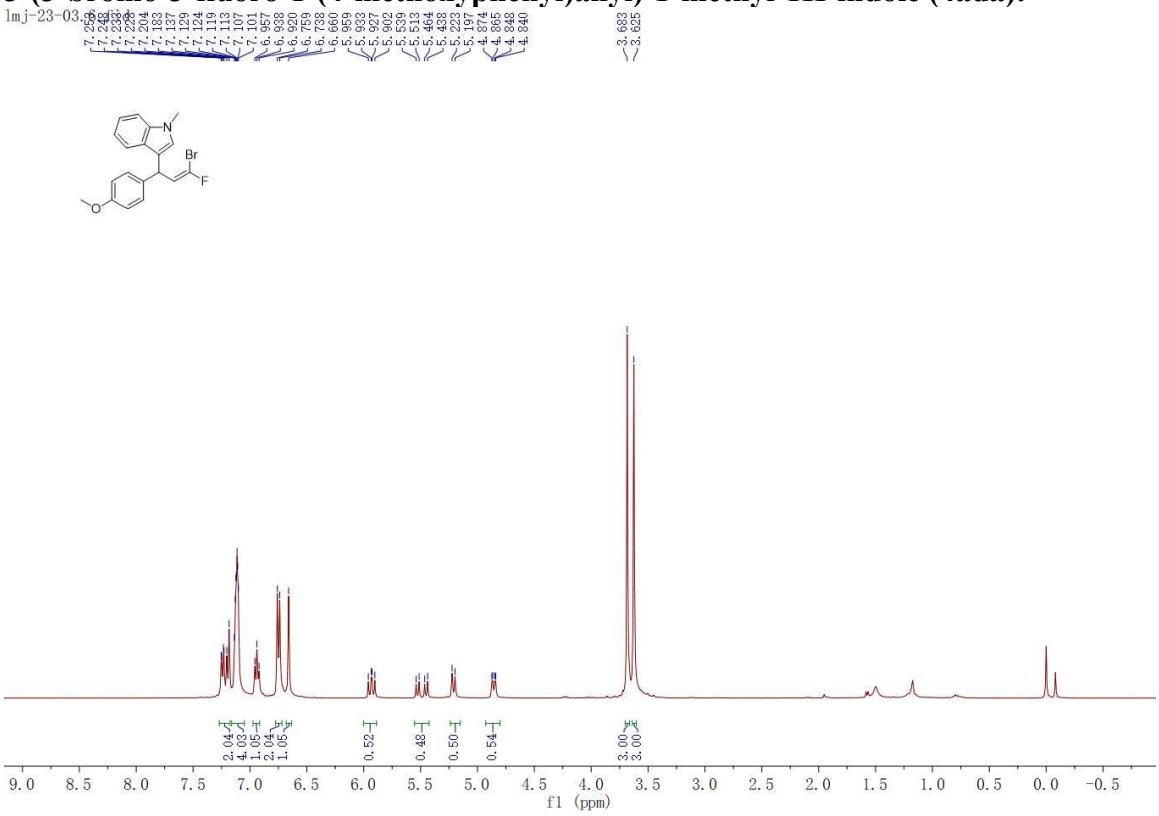


^{1}H NMR (400 MHz, $CDCl_3$)

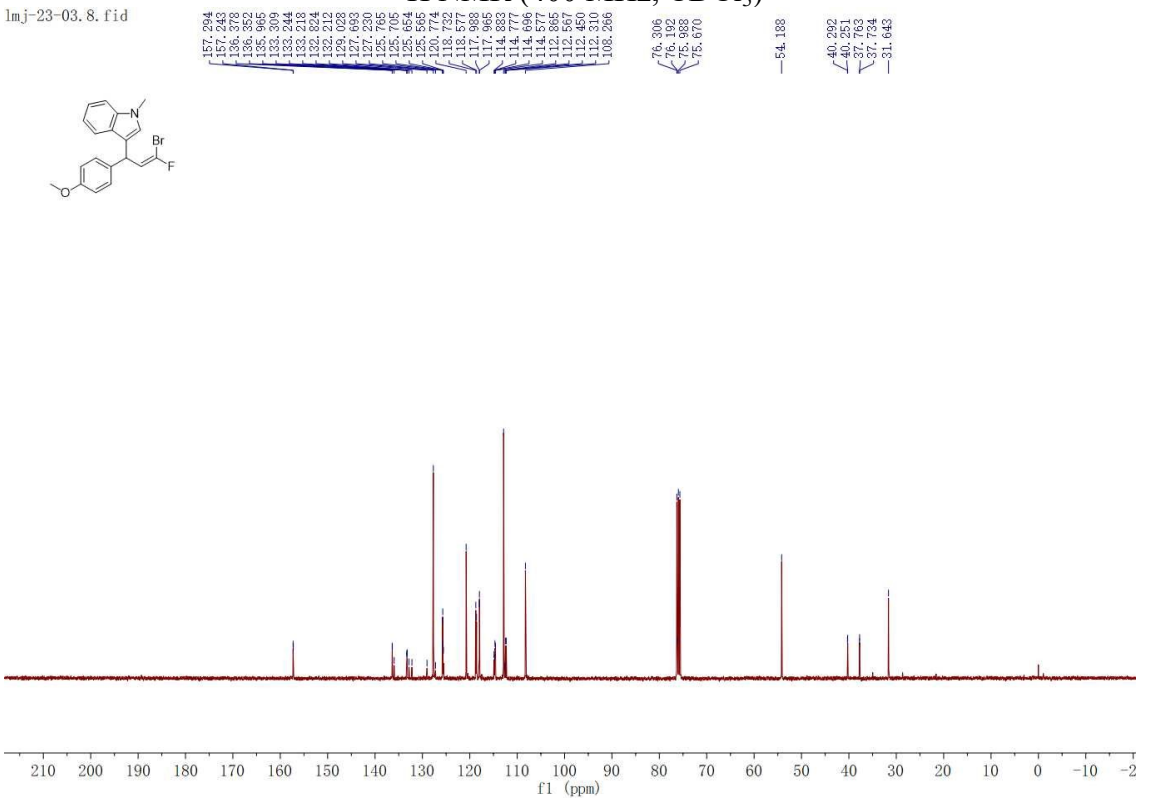


^{13}C NMR (100 MHz, $CDCl_3$)

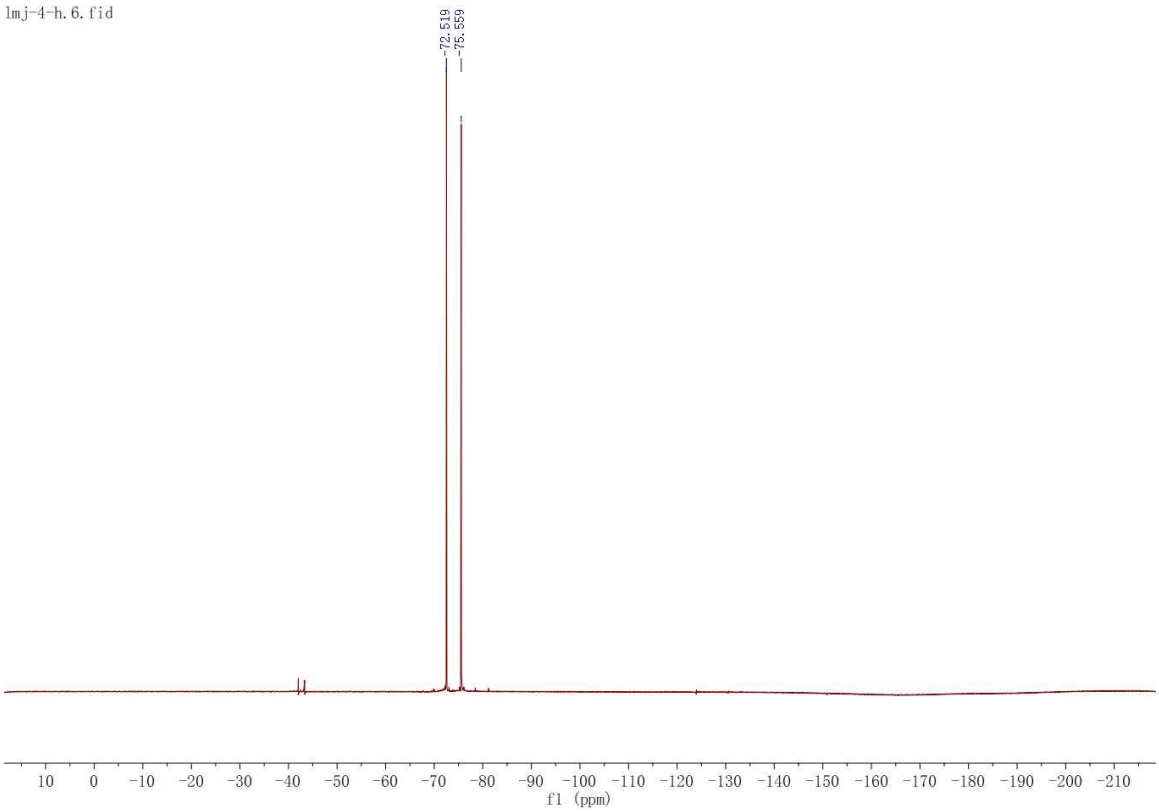
3-(3-bromo-3-fluoro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4ada):



^{1}H NMR (400 MHz, $CDCl_3$)

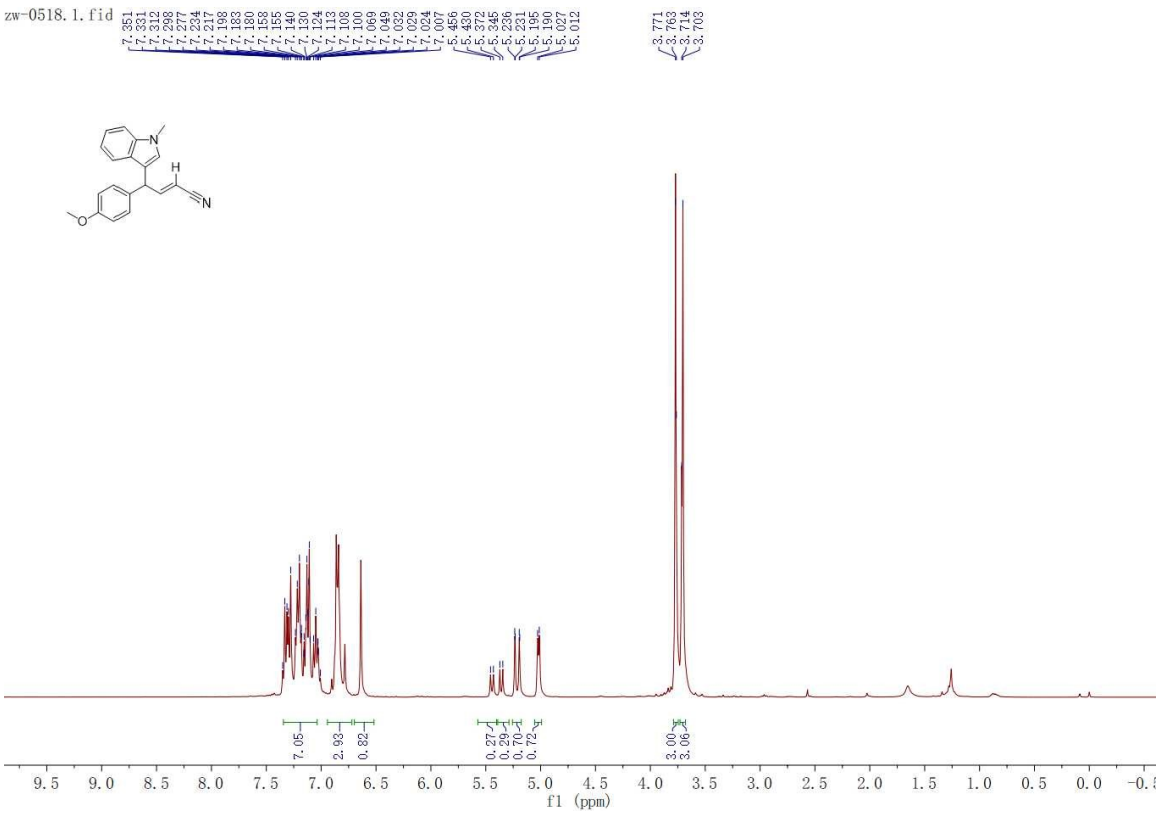


^{13}C NMR (100 MHz, $CDCl_3$)

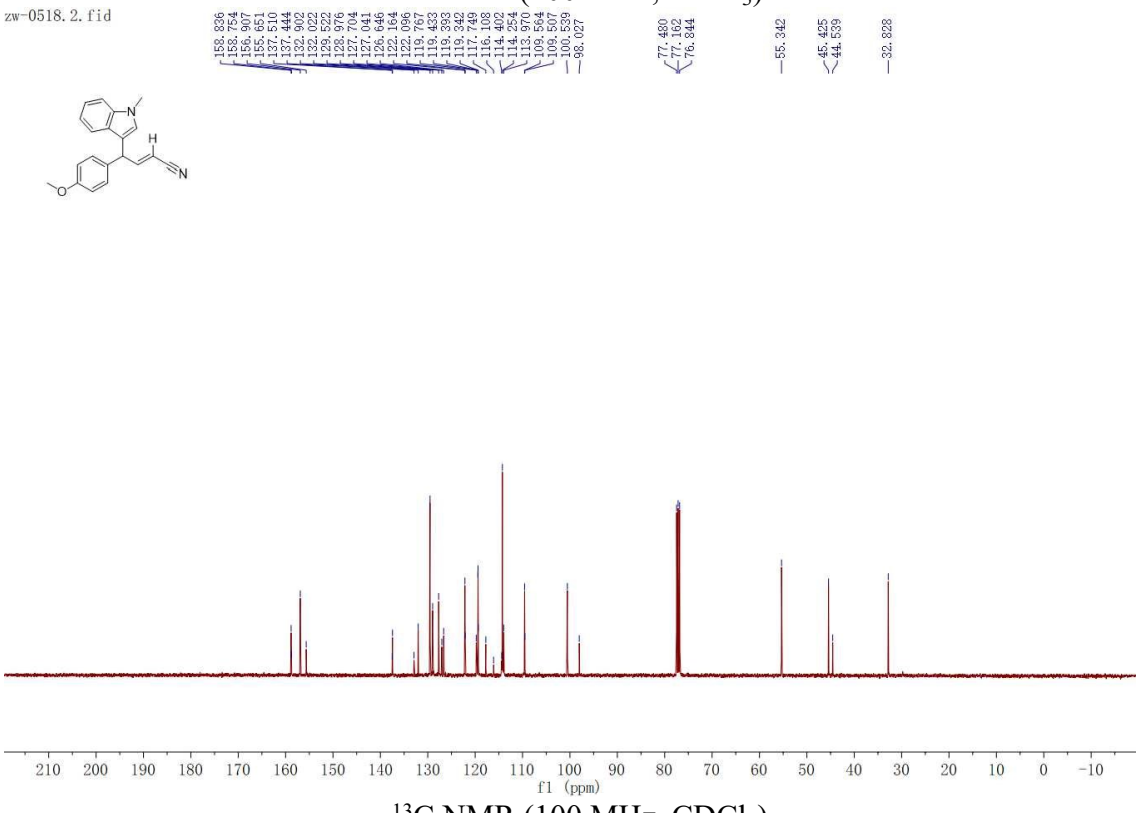


^{19}F NMR (471 MHz, $CDCl_3$)

3-(3-bromo-3-fluoro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4afa):

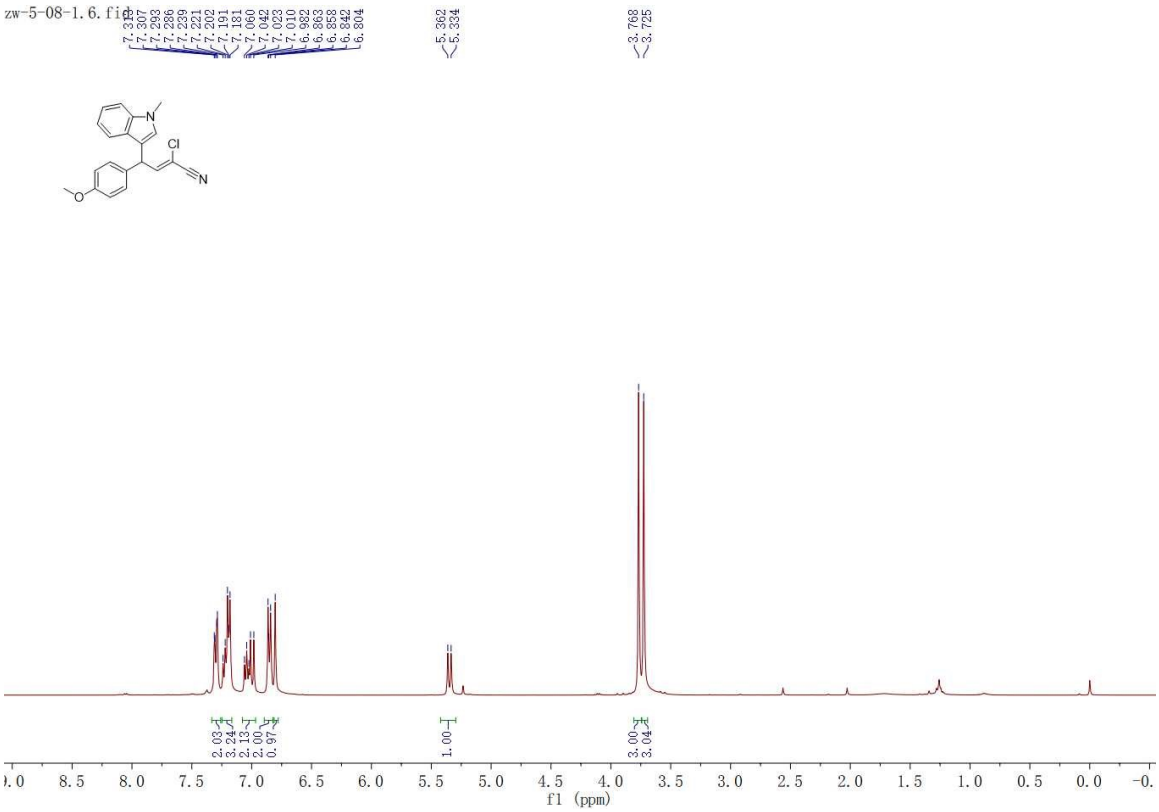


^{1}H NMR (400 MHz, $CDCl_3$)

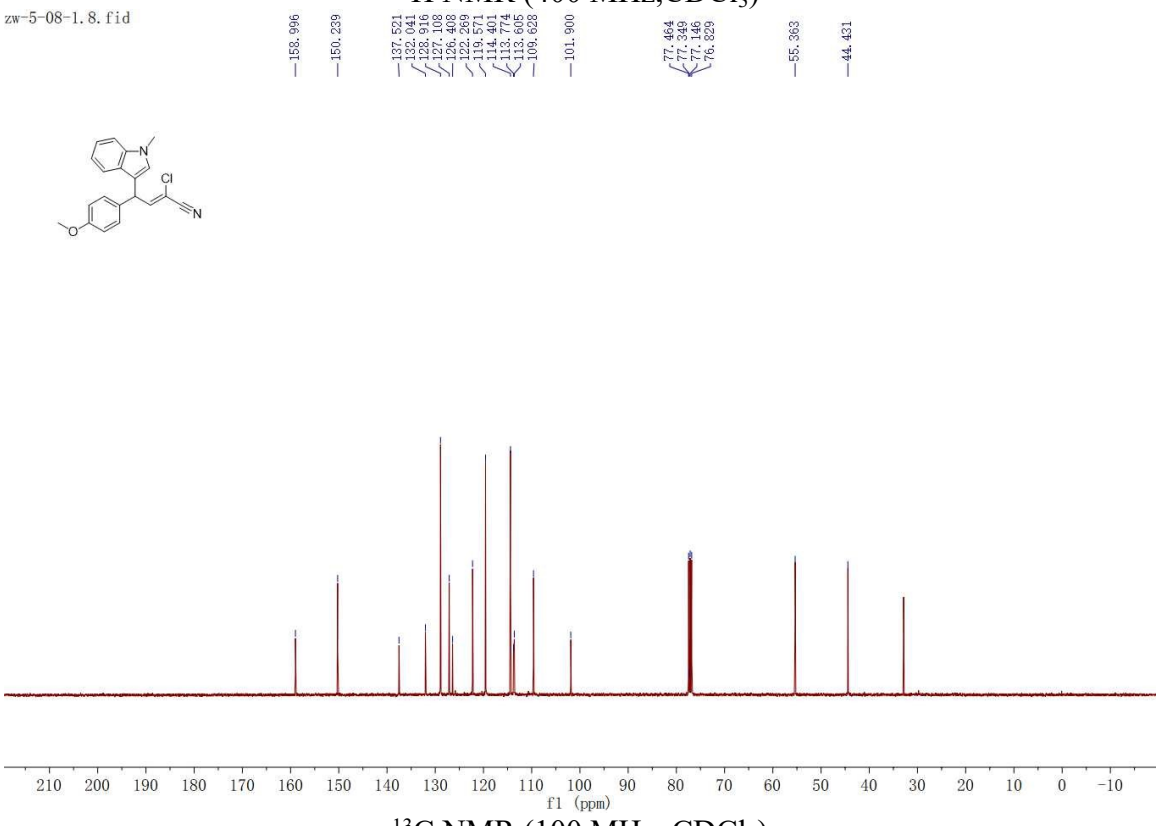


^{13}C NMR (100 MHz, $CDCl_3$)

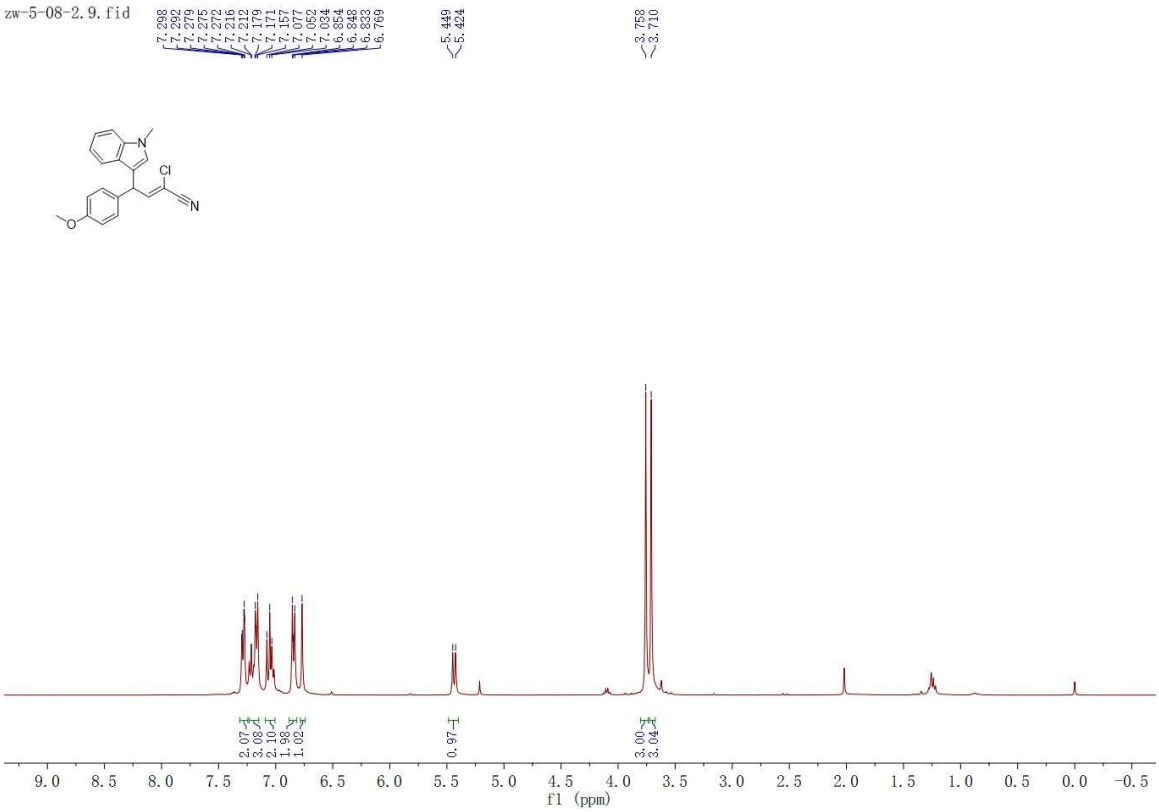
2-chloro-4-(4-methoxyphenyl)-4-(1-methyl-1H-indol-3-yl)but-2-enenitrile (4aga):



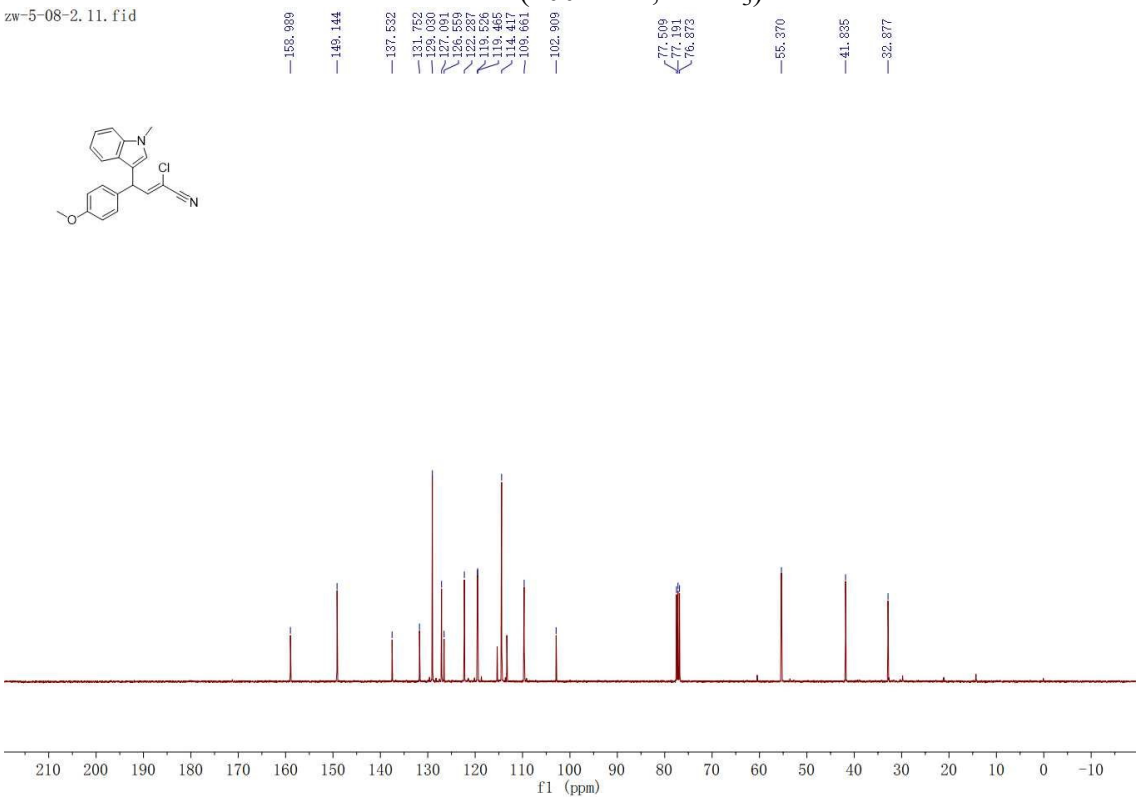
^{1}H NMR (400 MHz,$CDCl_3$)



^{13}C NMR (100 MHz, $CDCl_3$)

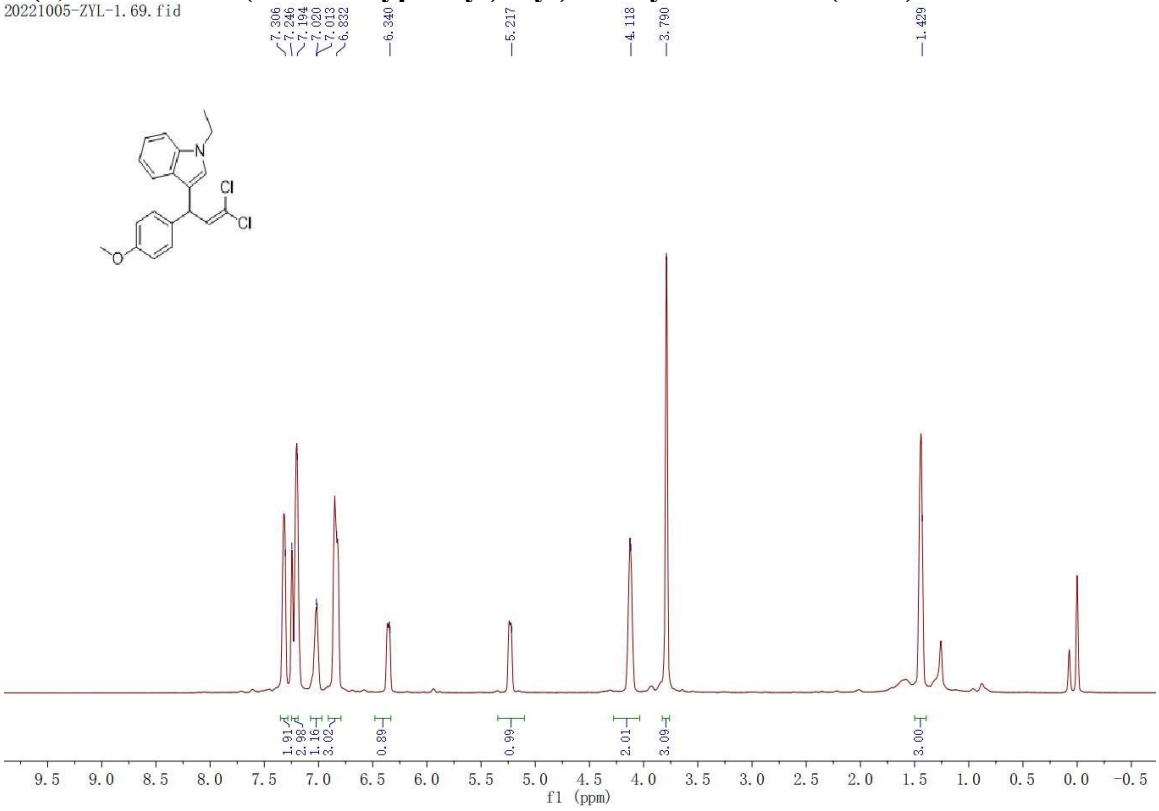


^{1}H NMR (400 MHz, $CDCl_3$)

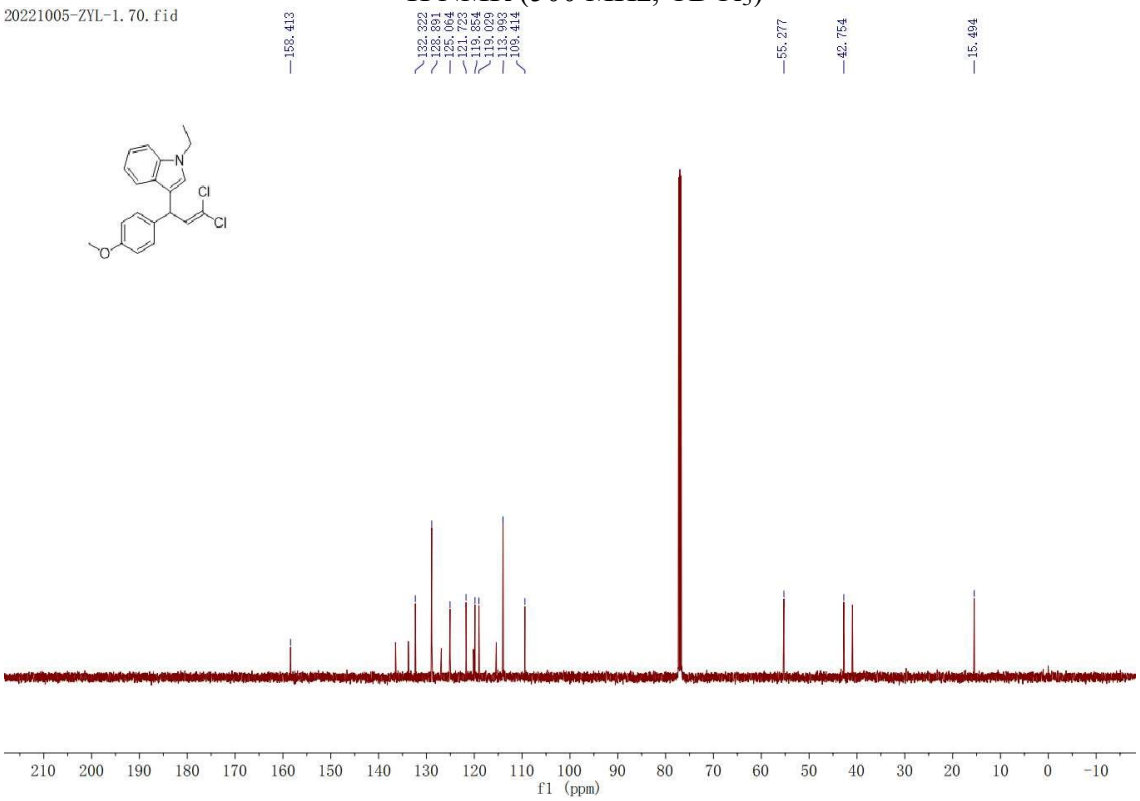


^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-ethyl-1H-indole (4aab):

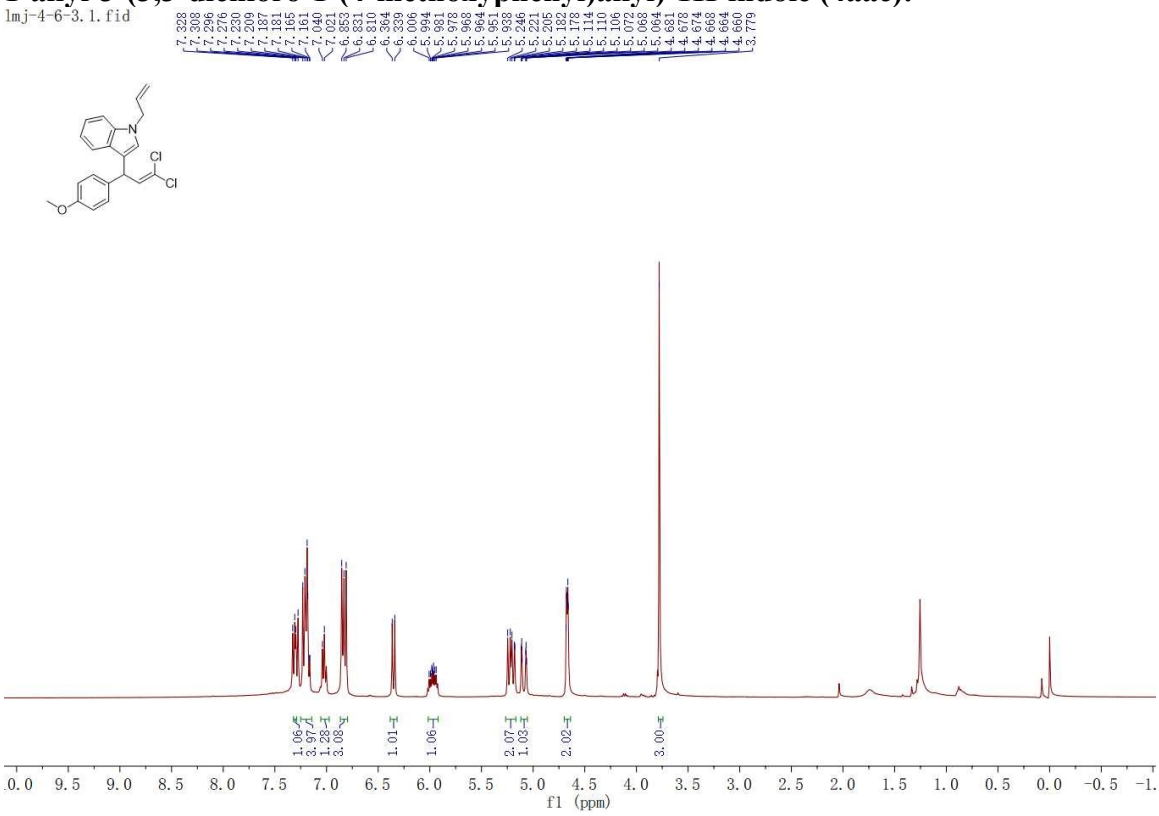


^{1}H NMR (500 MHz, $CDCl_3$)

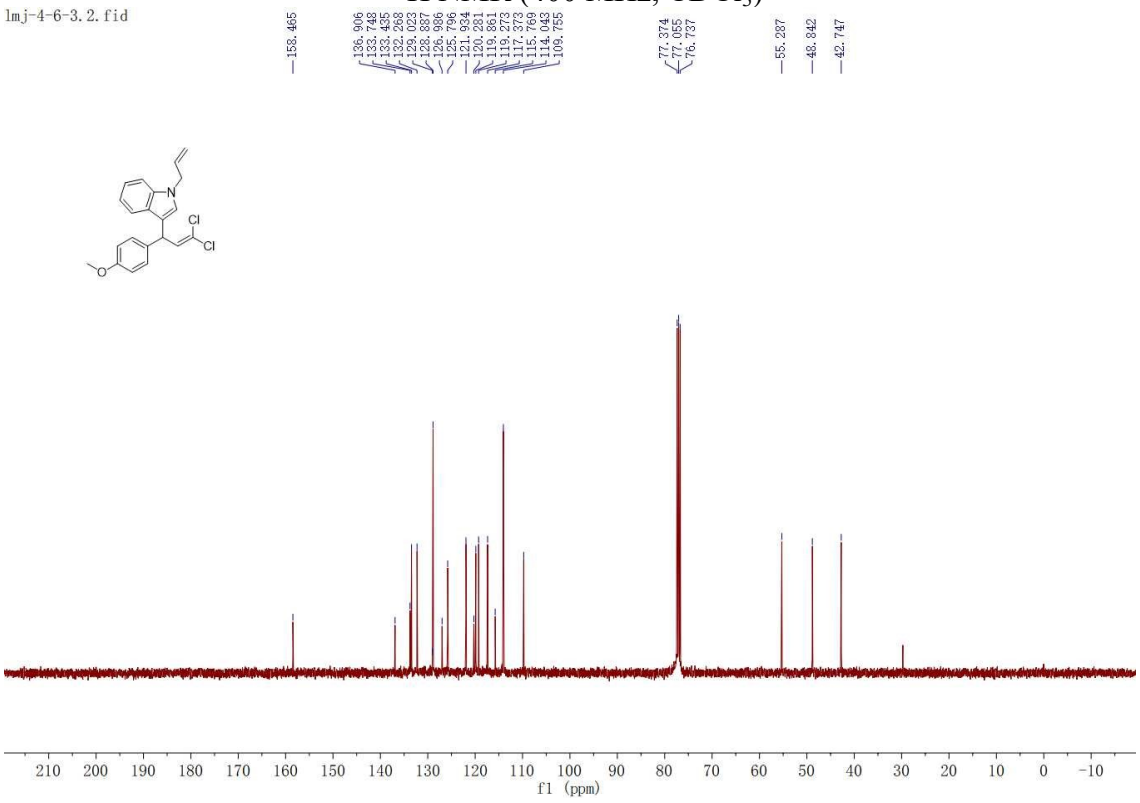


^{13}C NMR (126 MHz, $CDCl_3$)

1-allyl-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1H-indole (4aac):

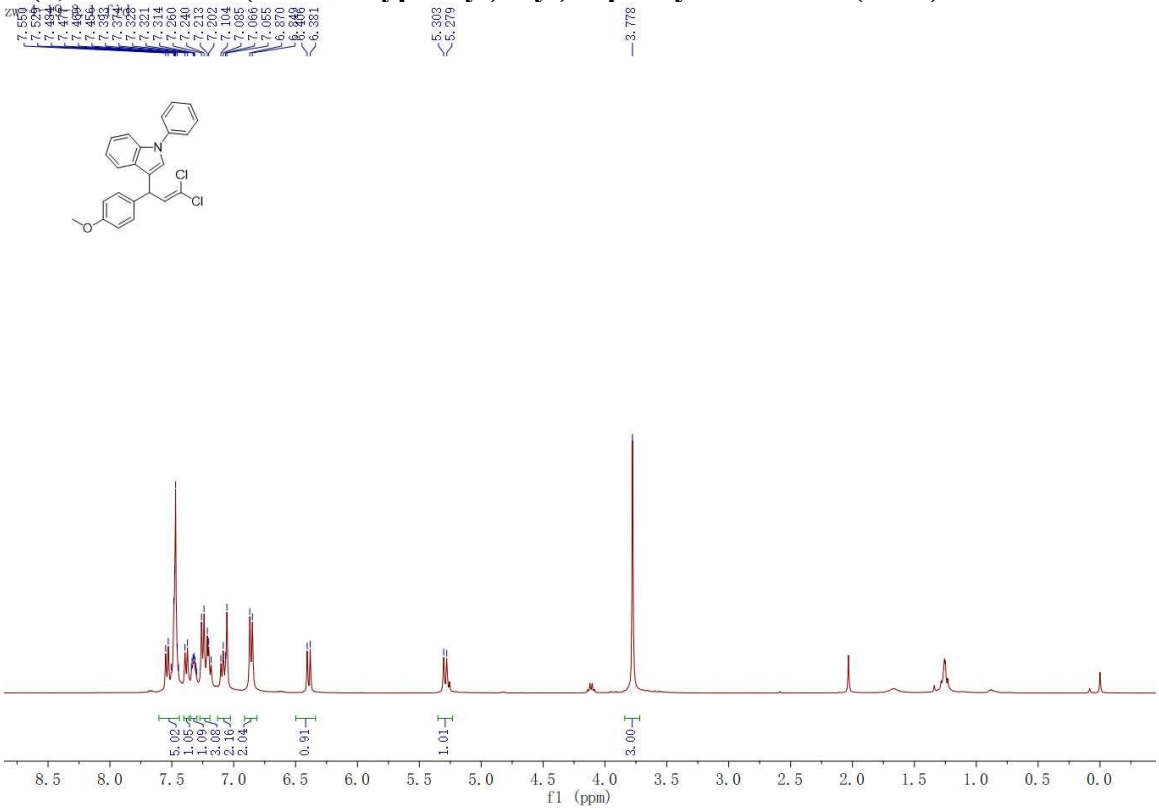


^{1}H NMR (400 MHz, $CDCl_3$)

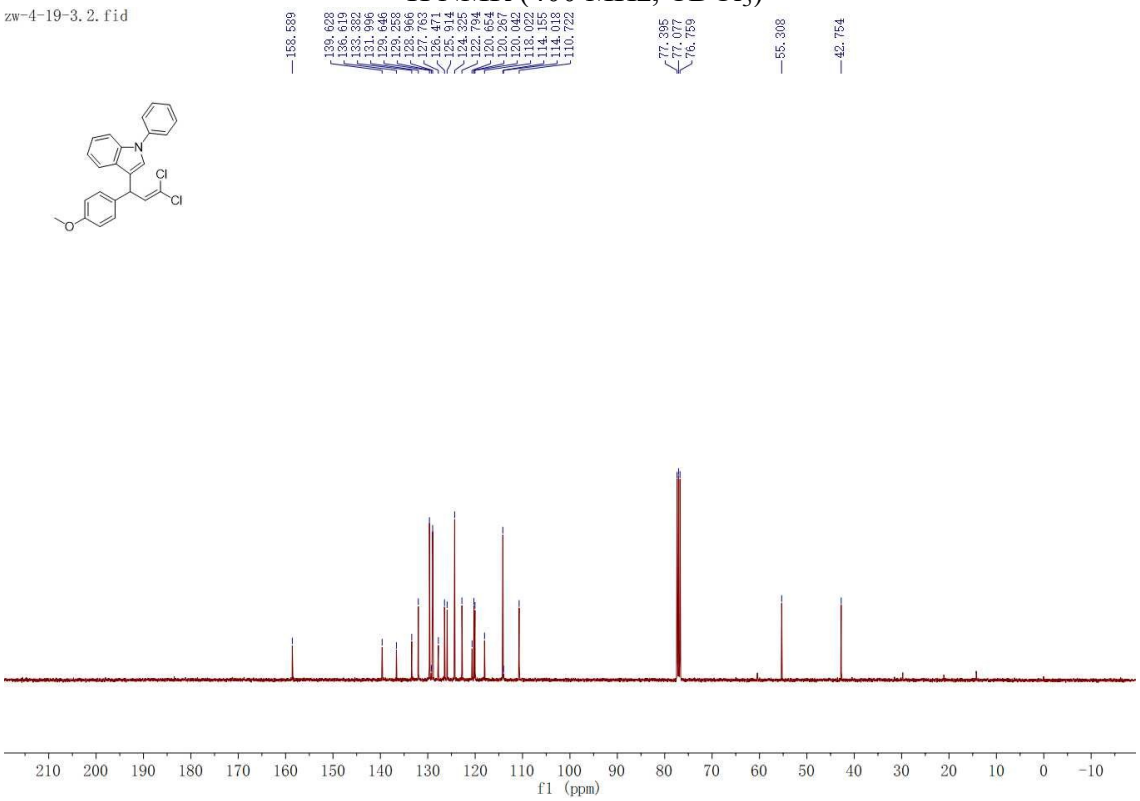


^{13}C NMR (100 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-phenyl-1H-indole (4aad):

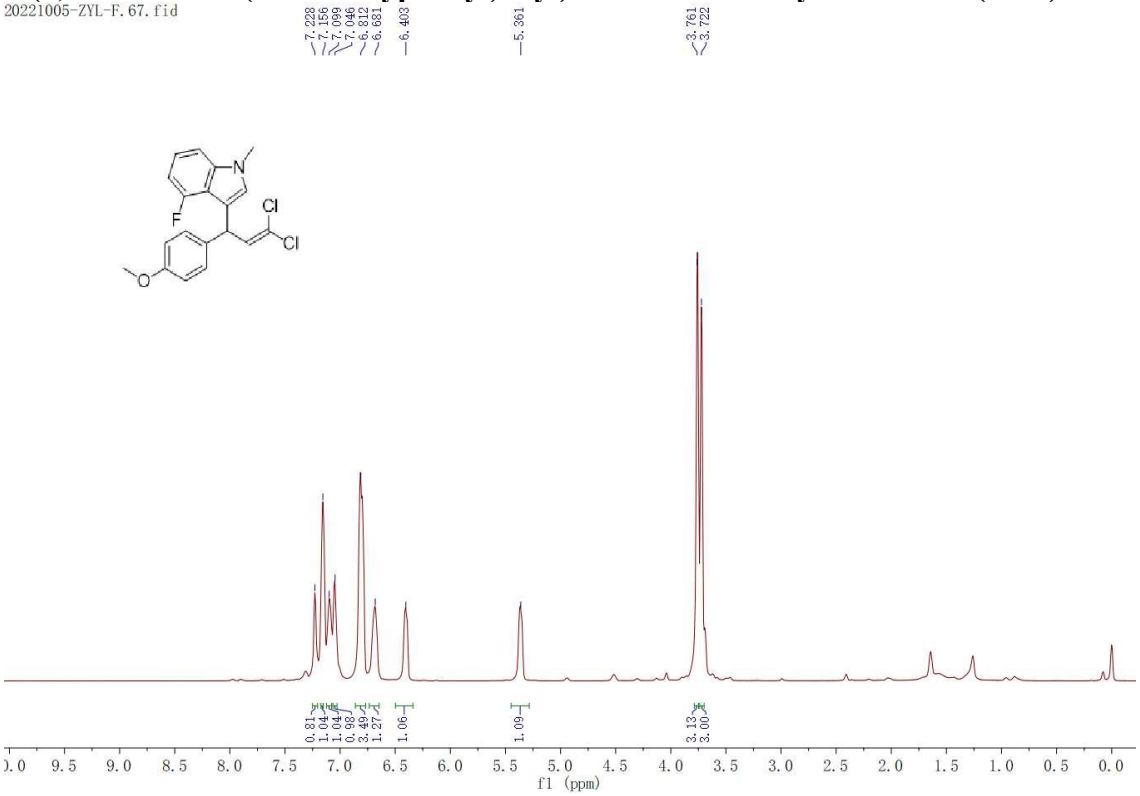


^{1}H NMR (400 MHz, $CDCl_3$)

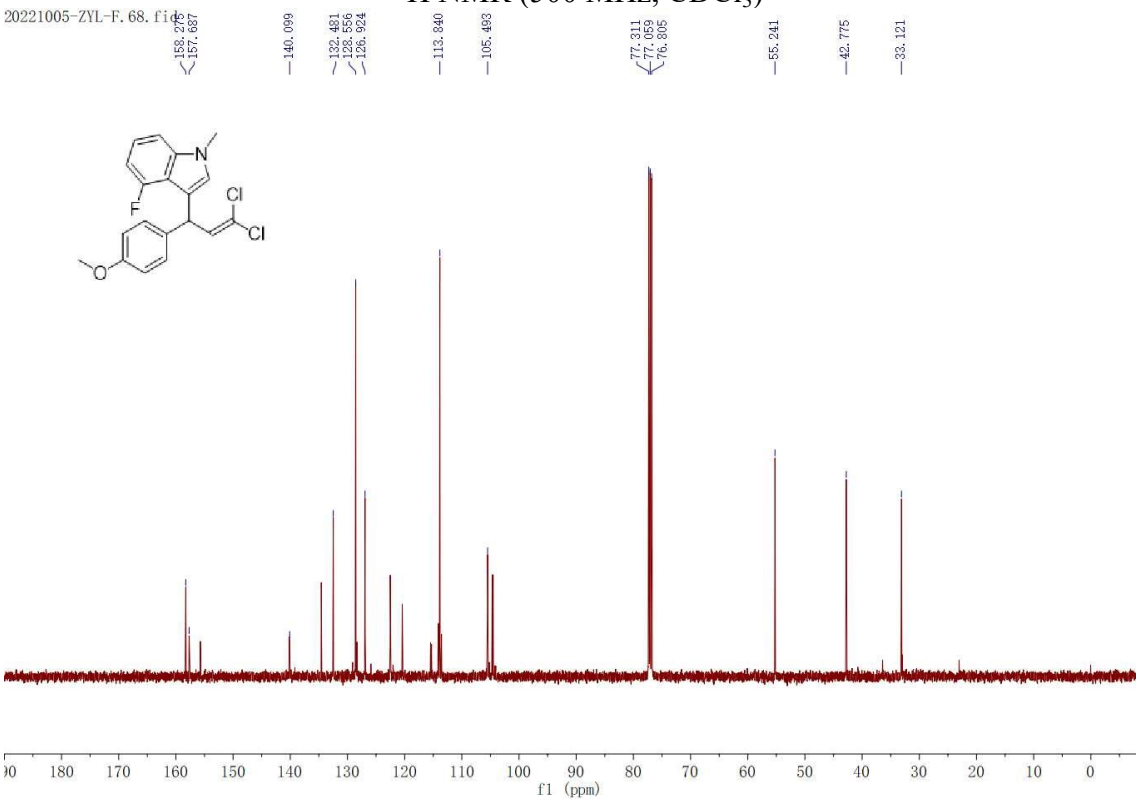


^{13}C NMR (100 MHz, $CDCl_3$)

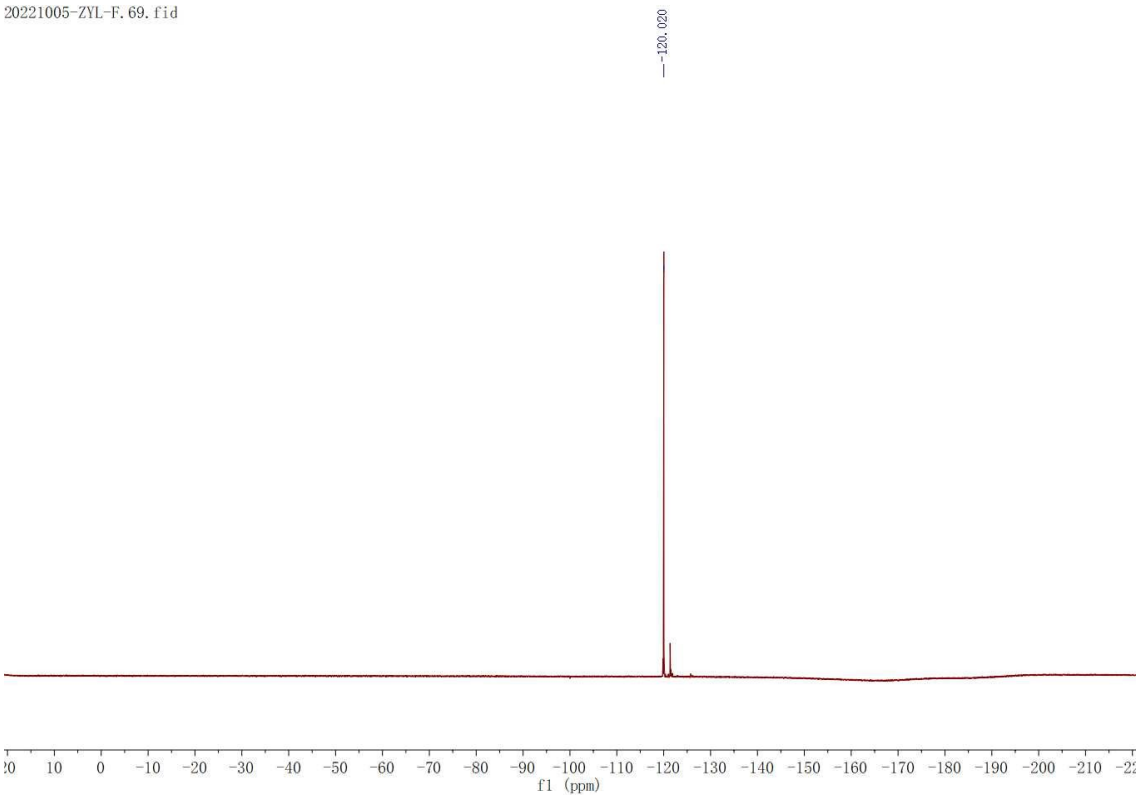
3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-4-fluoro-1-methyl-1H-indole (4aae):



^{1}H NMR (500 MHz, $CDCl_3$)

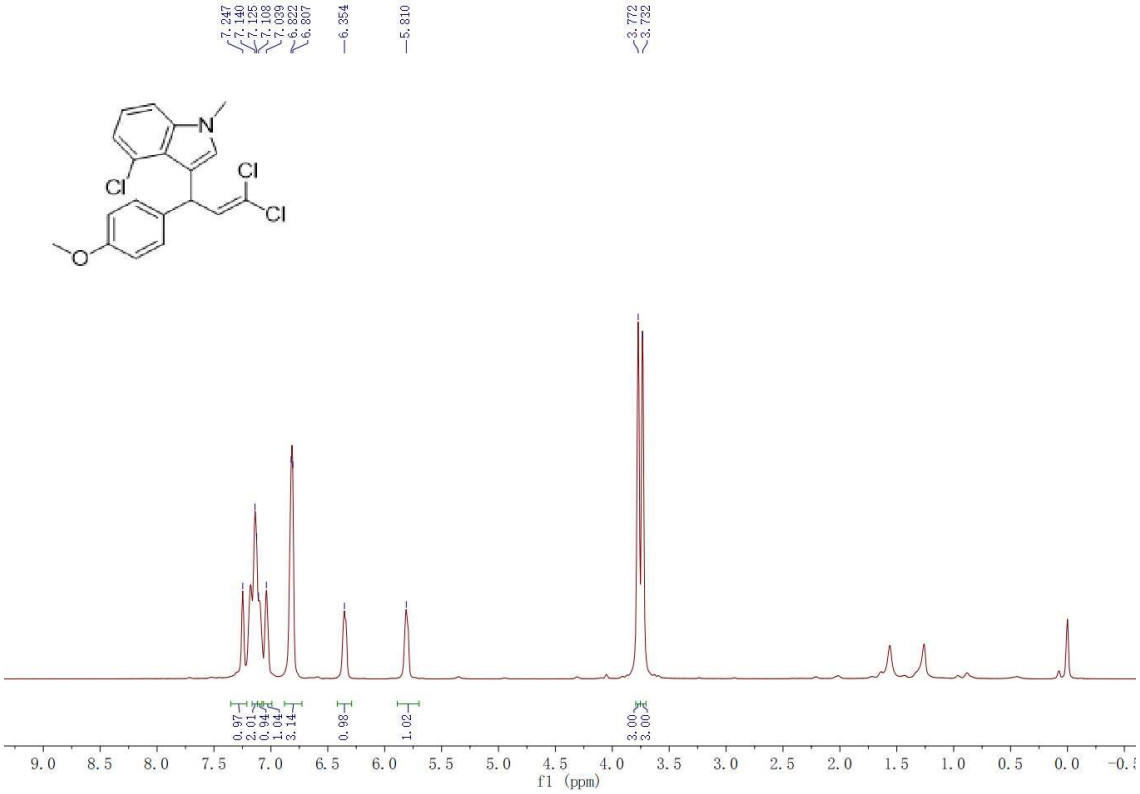


^{13}C NMR (126 MHz, $CDCl_3$)

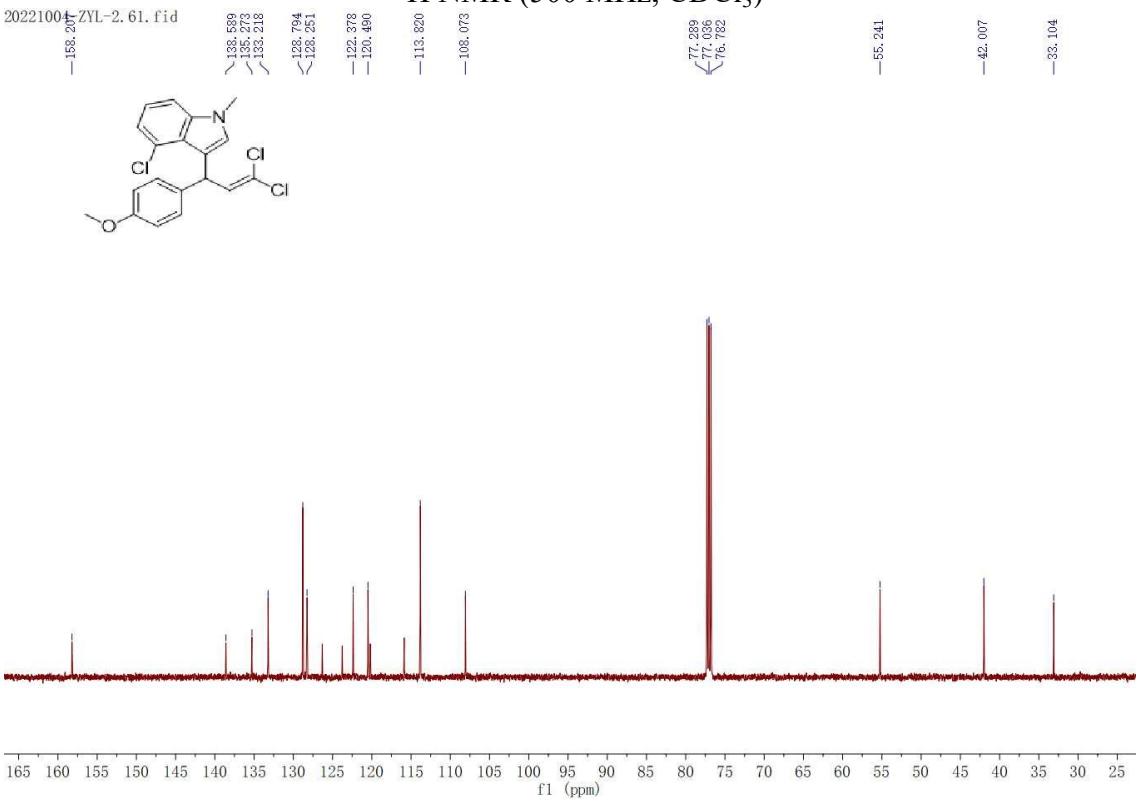


^{19}F NMR (471 MHz, $CDCl_3$)

4-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aaf):

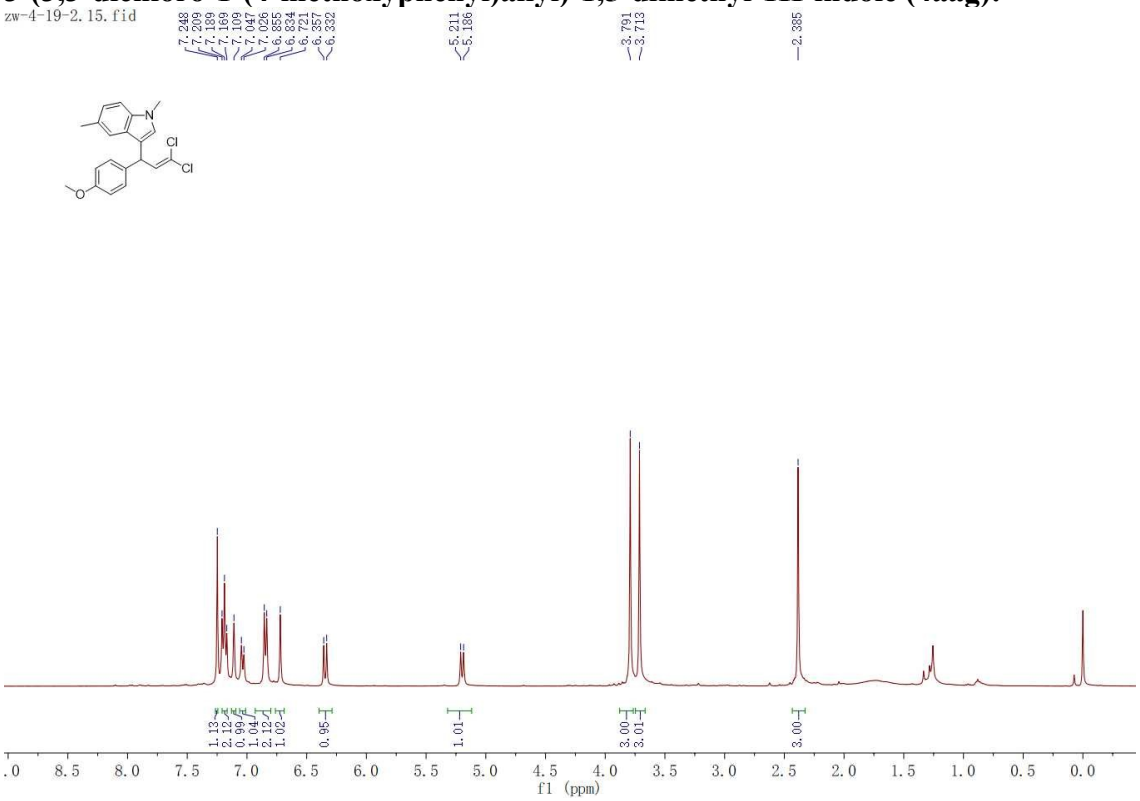


^{1}H NMR (500 MHz, $CDCl_3$)

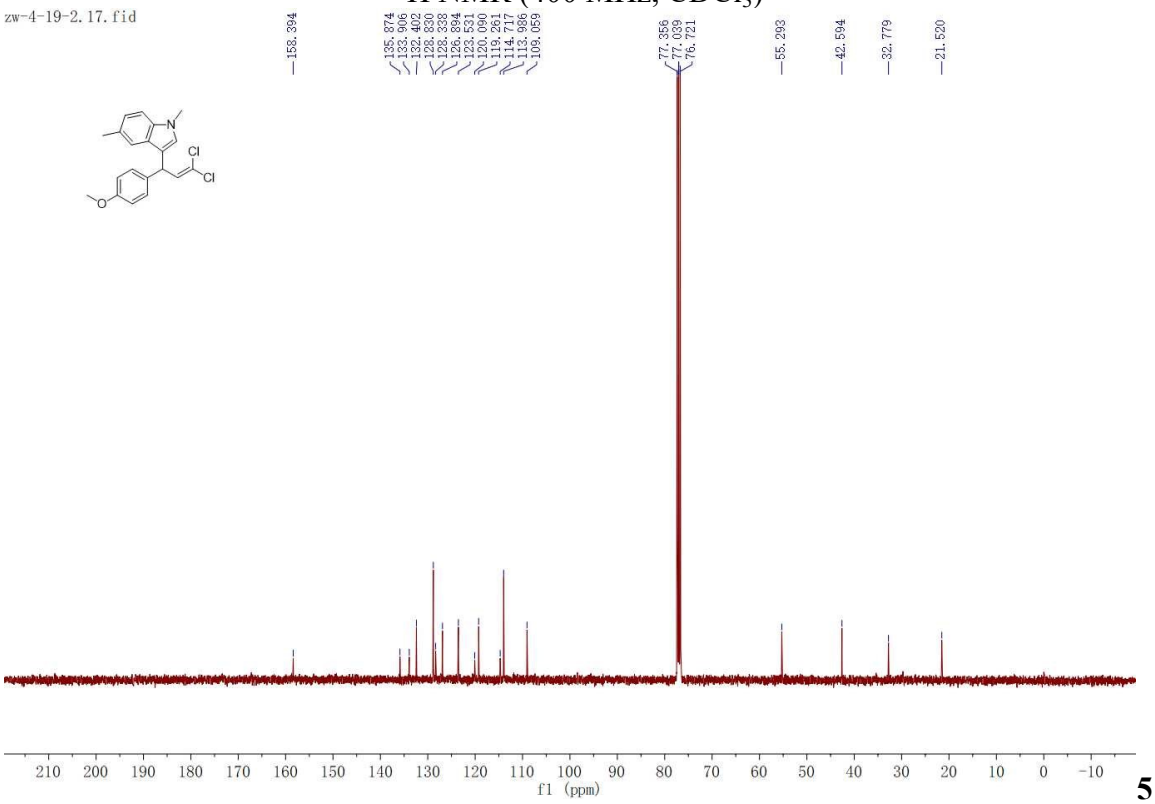


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,5-dimethyl-1H-indole (4aag):



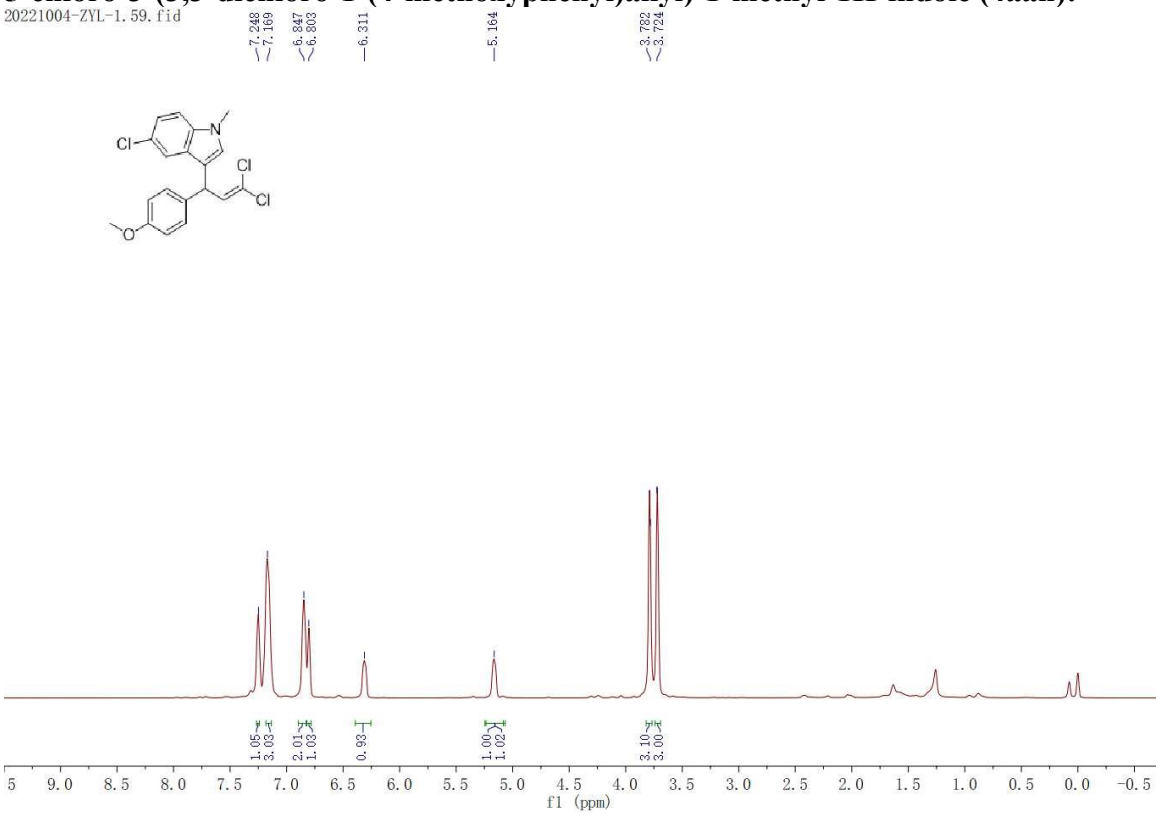
^{1}H NMR (400 MHz, $CDCl_3$)



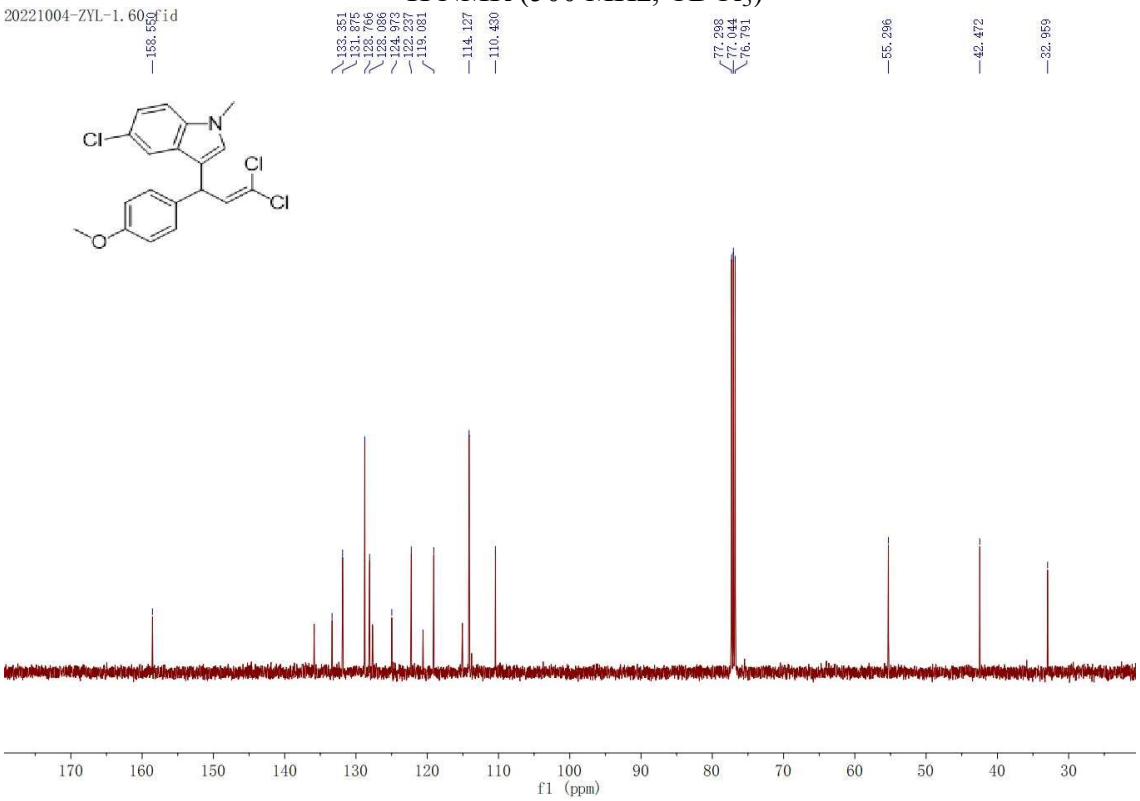
5

^{13}C NMR (100 MHz, $CDCl_3$)

5-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aah):

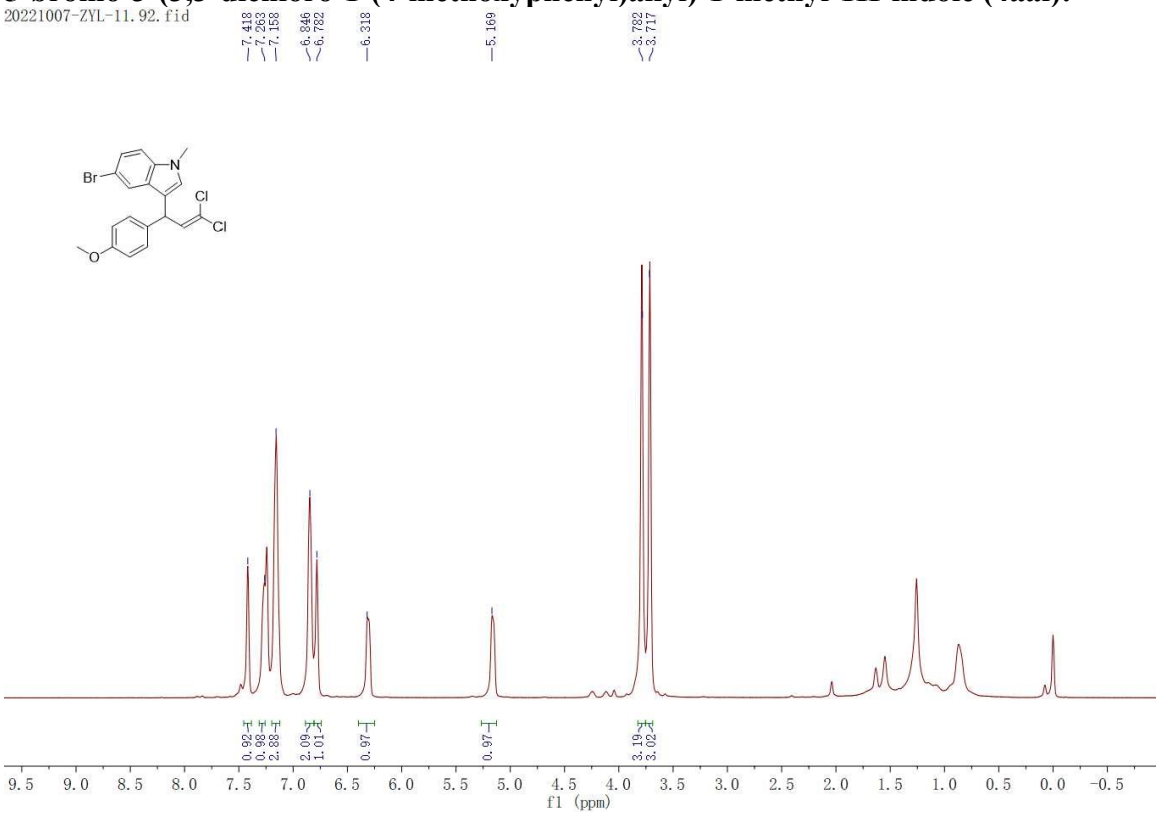


^{1}H NMR (500 MHz, $CDCl_3$)

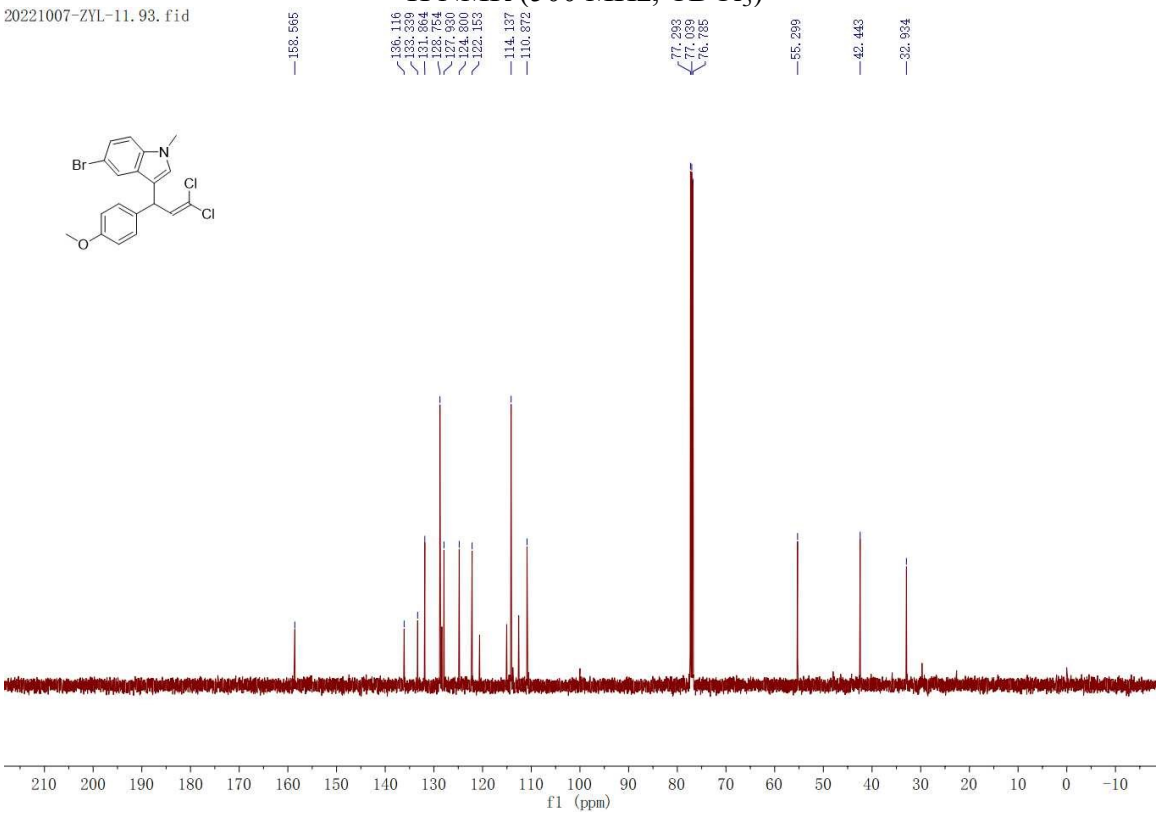


^{13}C NMR (126 MHz, $CDCl_3$)

5-bromo-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aai):

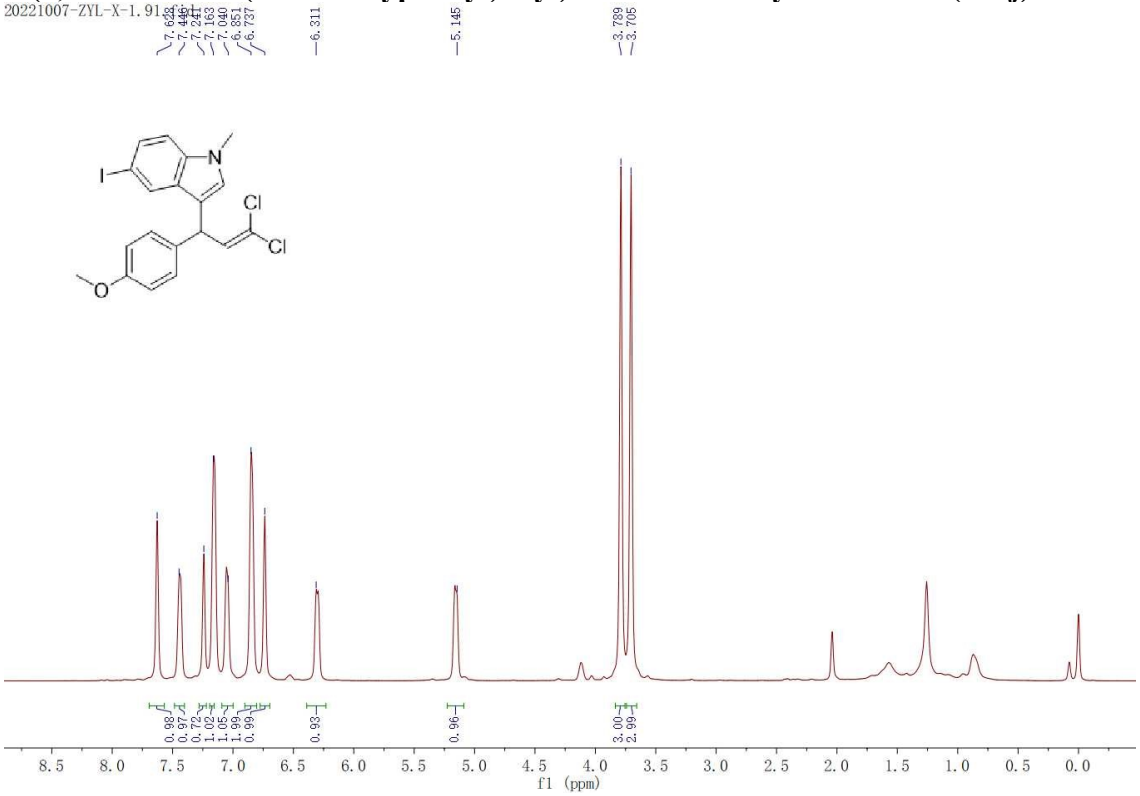


^{1}H NMR (500 MHz, $CDCl_3$)

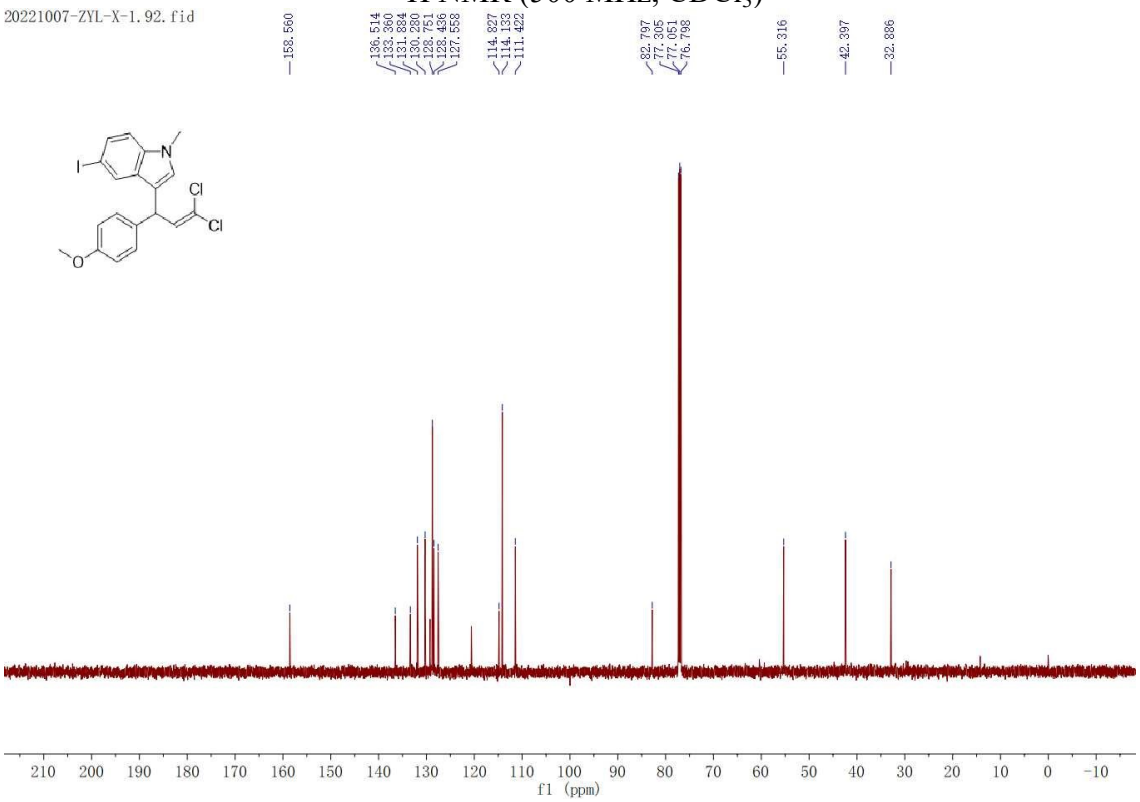


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-5-iodo-1-methyl-1H-indole (4aaj):

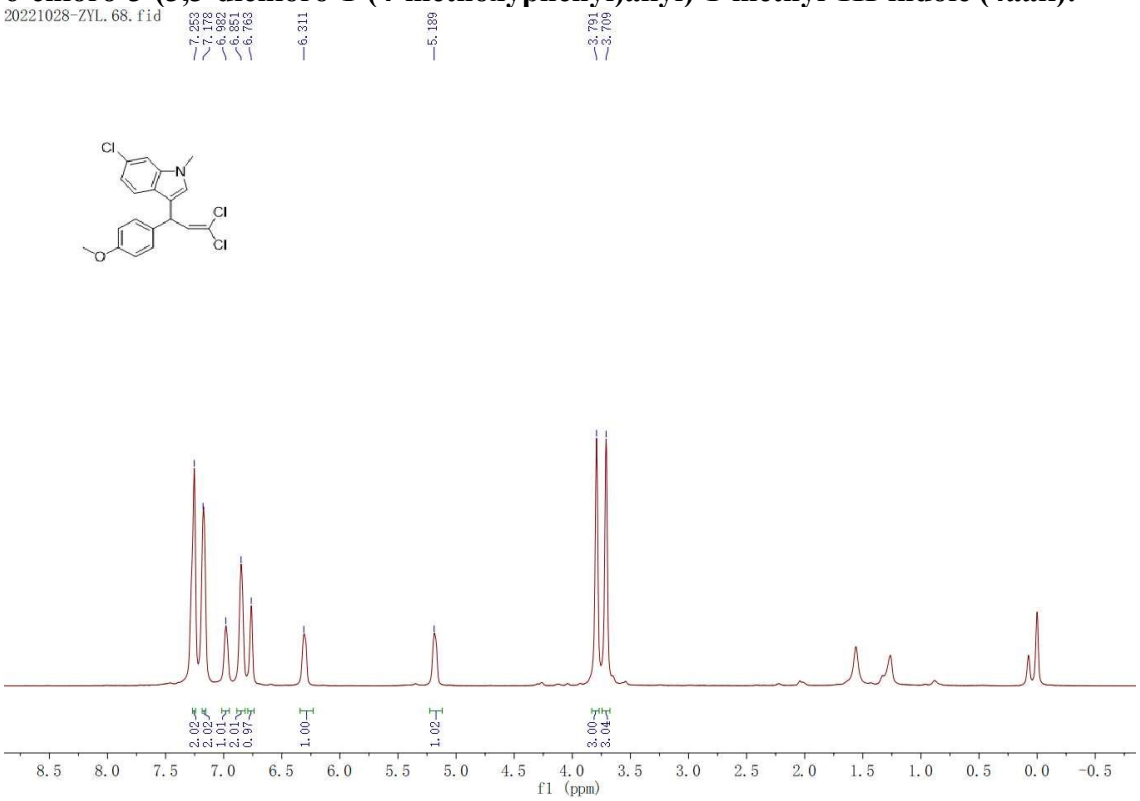


^{1}H NMR (500 MHz, $CDCl_3$)

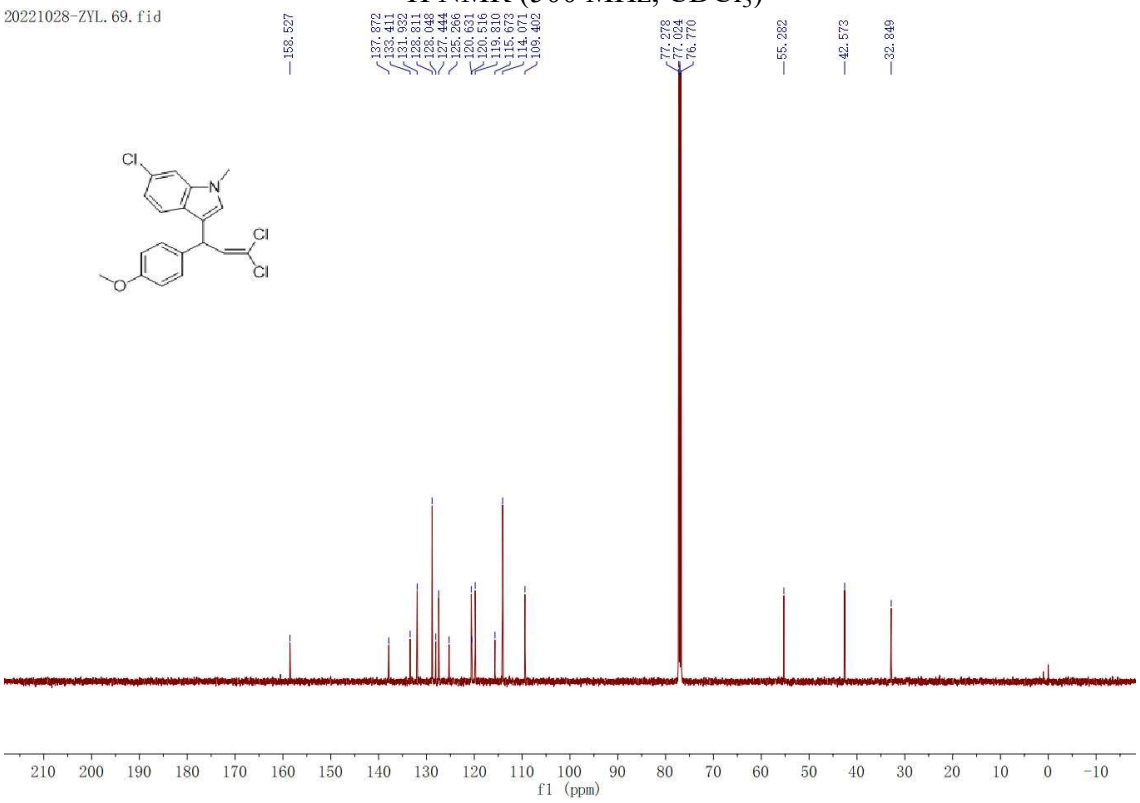


^{13}C NMR (126 MHz, $CDCl_3$)

6-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aak):

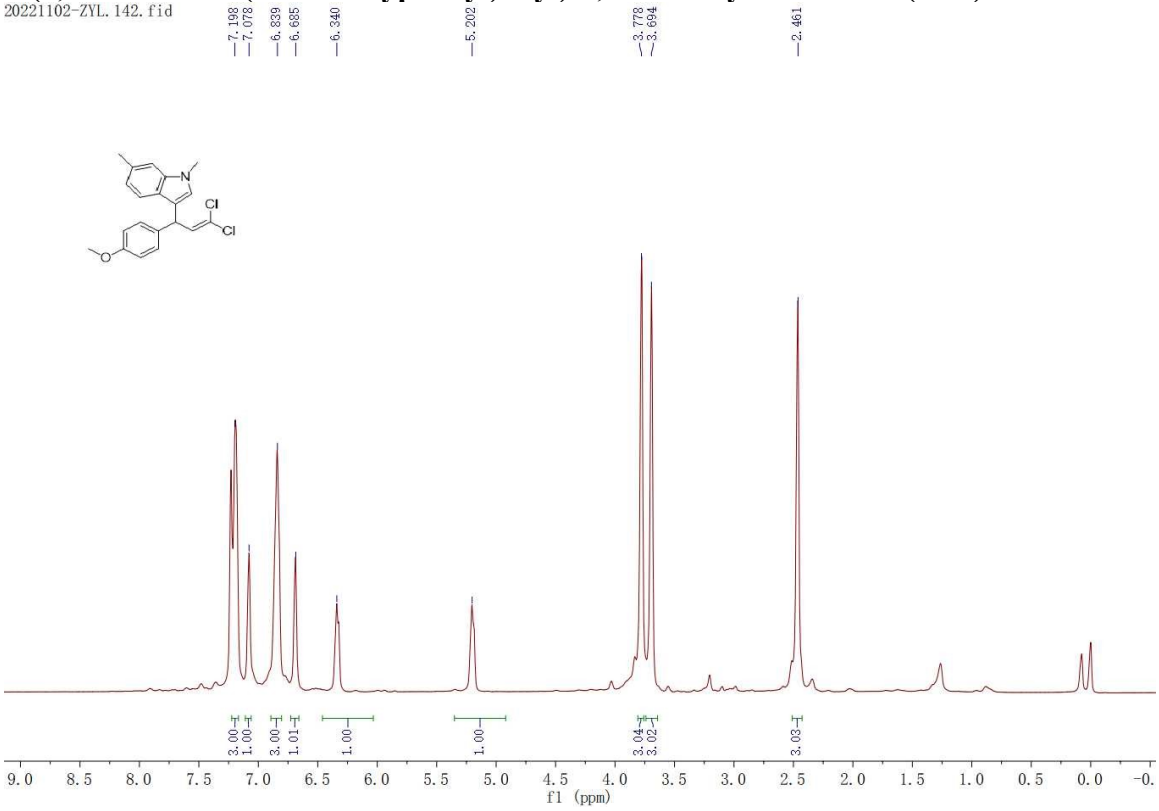


^{1}H NMR (500 MHz, $CDCl_3$)

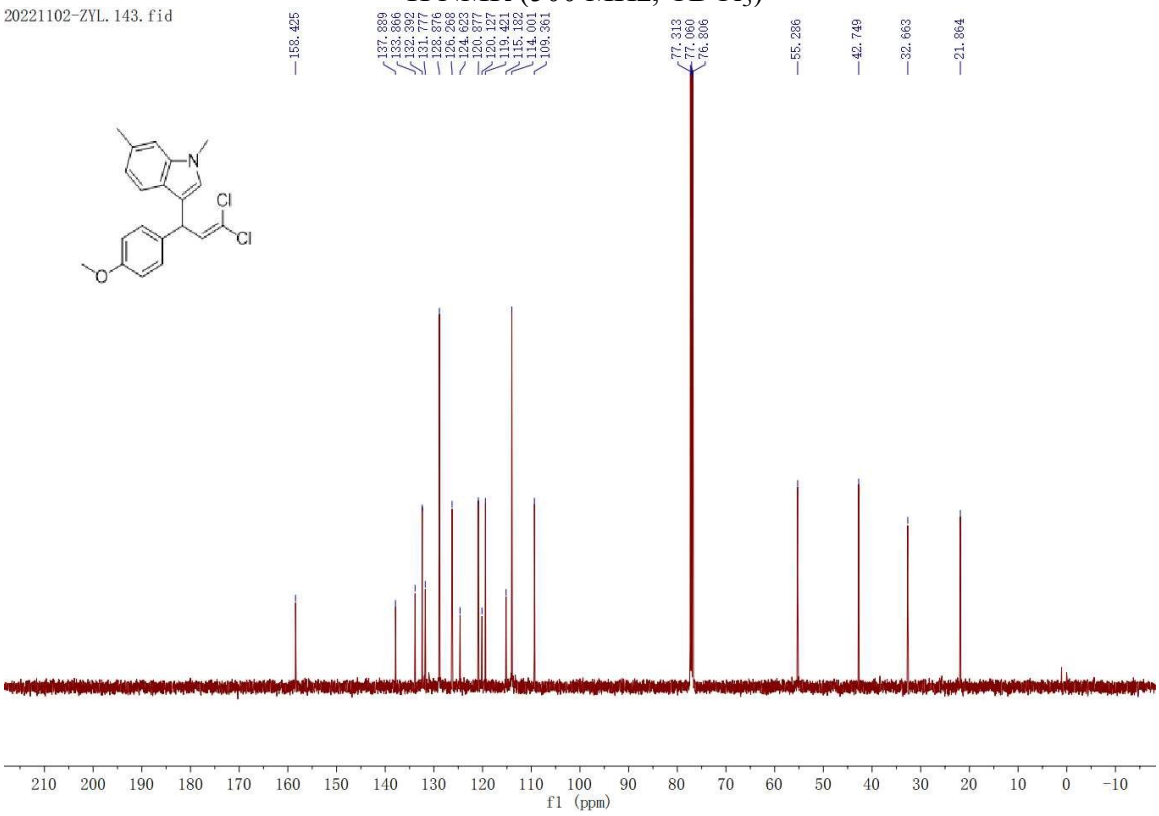


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,6-dimethyl-1H-indole (4aal):

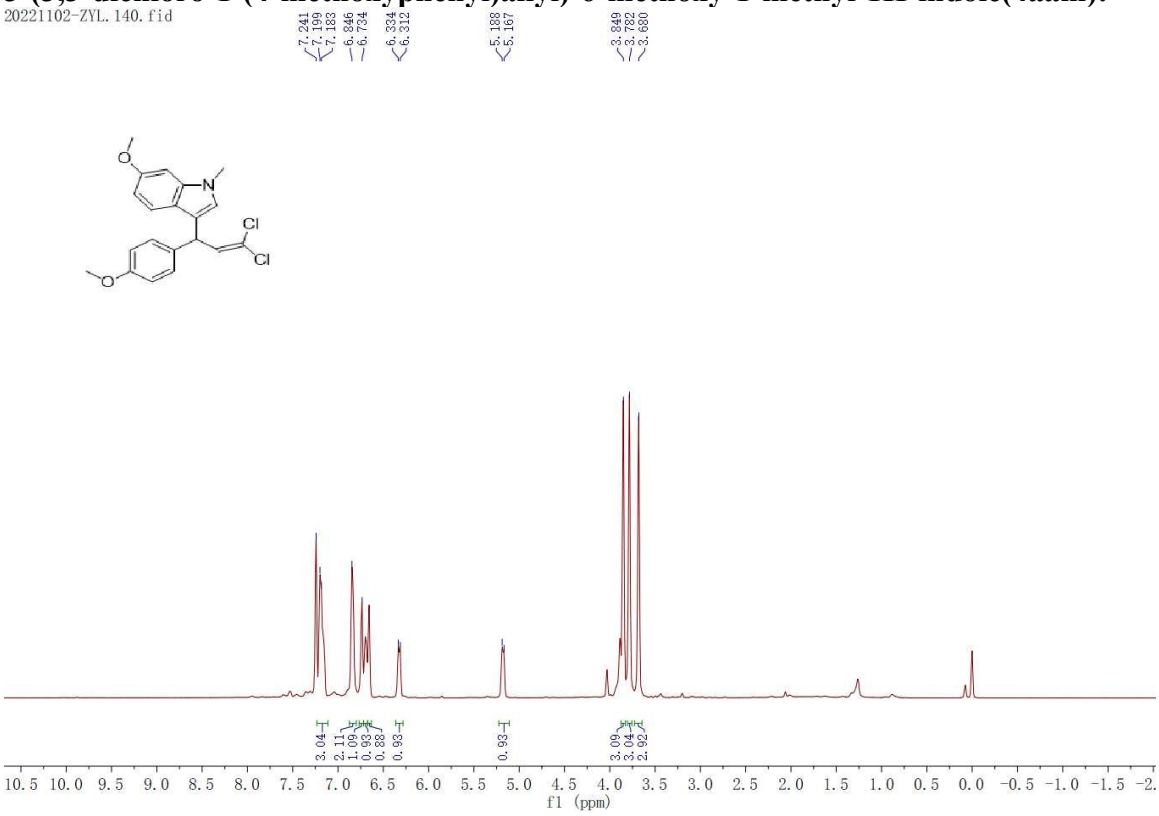


^{1}H NMR (500 MHz, $CDCl_3$)

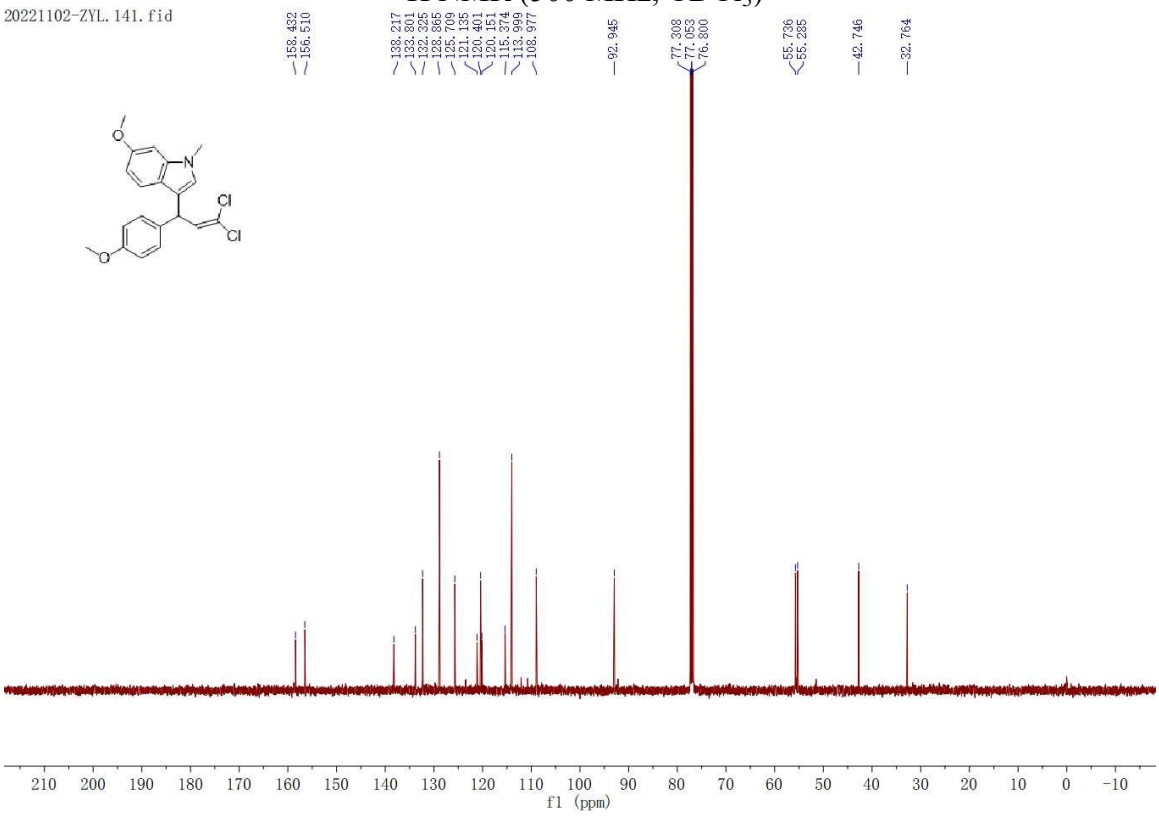


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-6-methoxy-1-methyl-1H-indole(4aam):

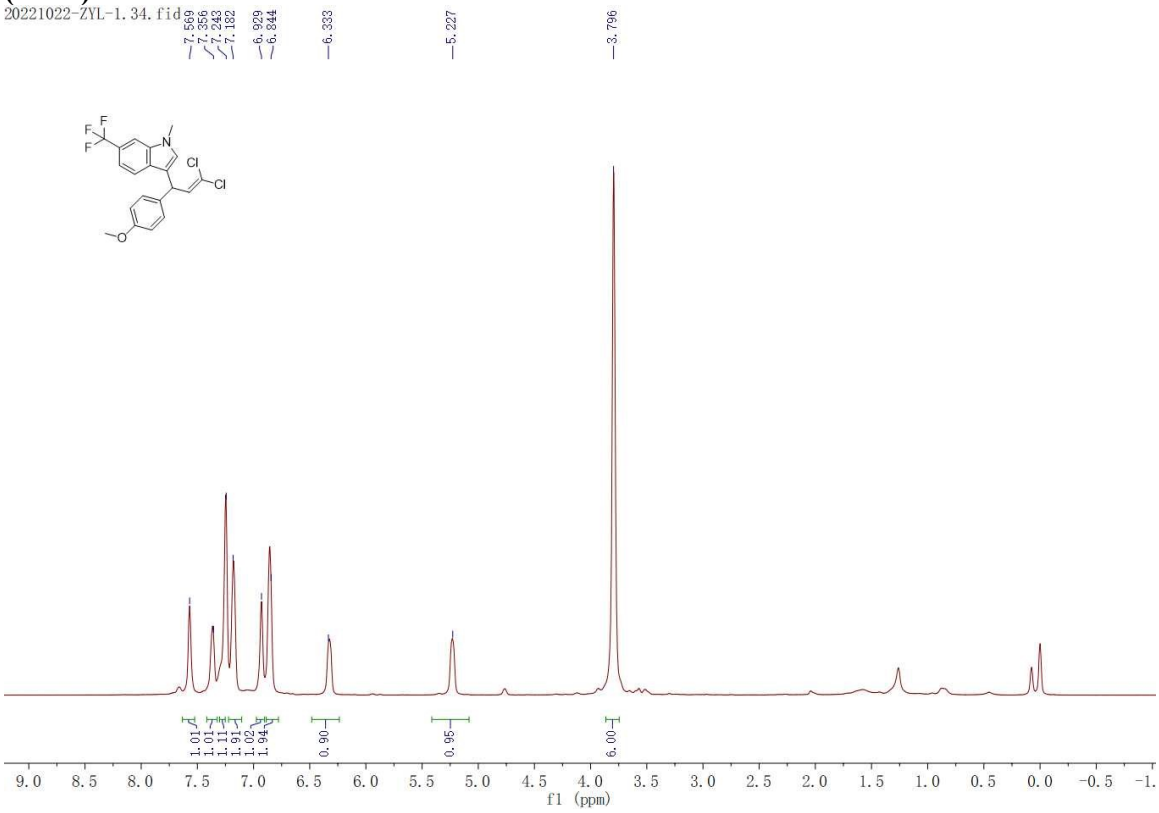


^{1}H NMR (500 MHz, $CDCl_3$)

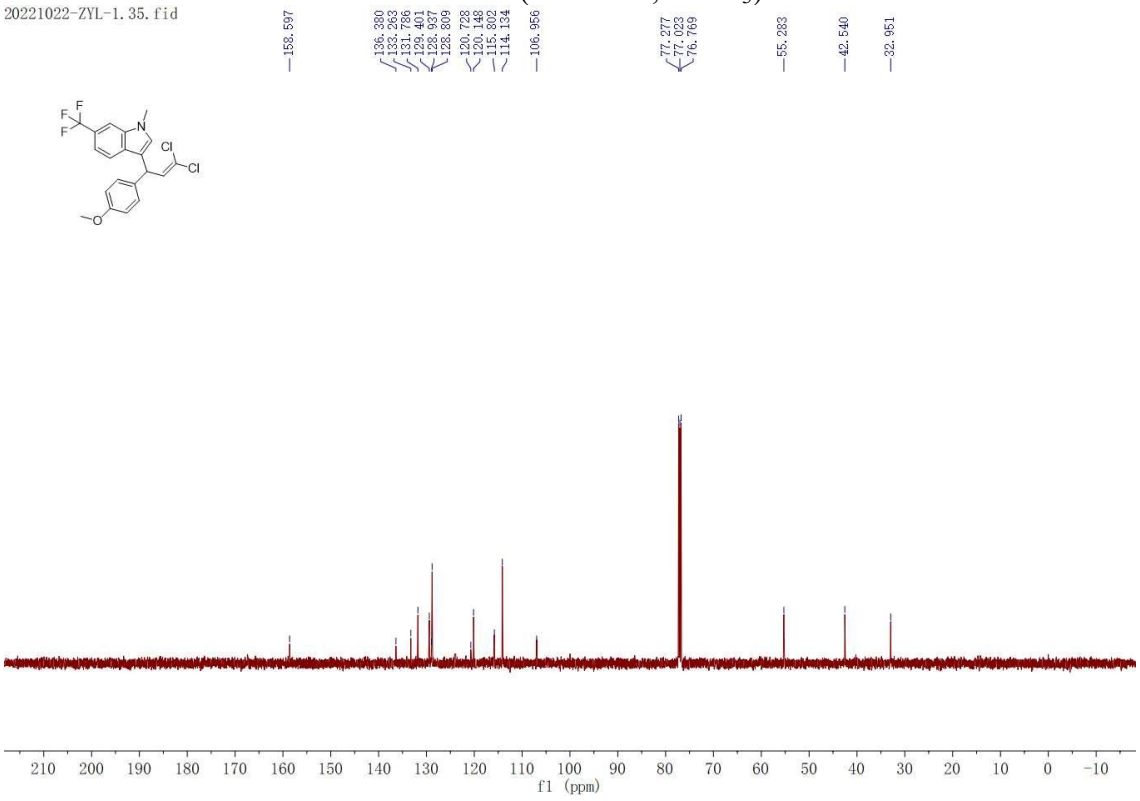


^{13}C NMR (126 MHz, $CDCl_3$)

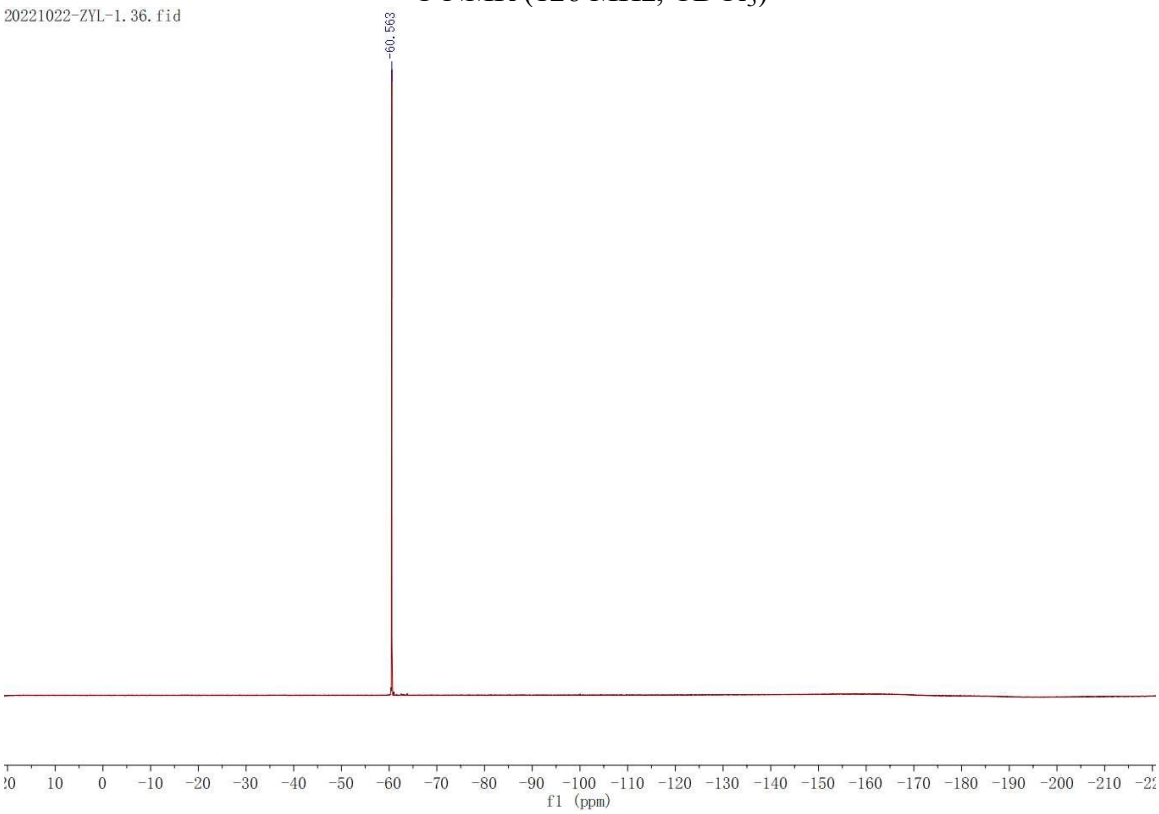
3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-6-(trifluoromethyl)-1H-indole (4aan):



^{1}H NMR (500 MHz, $CDCl_3$)

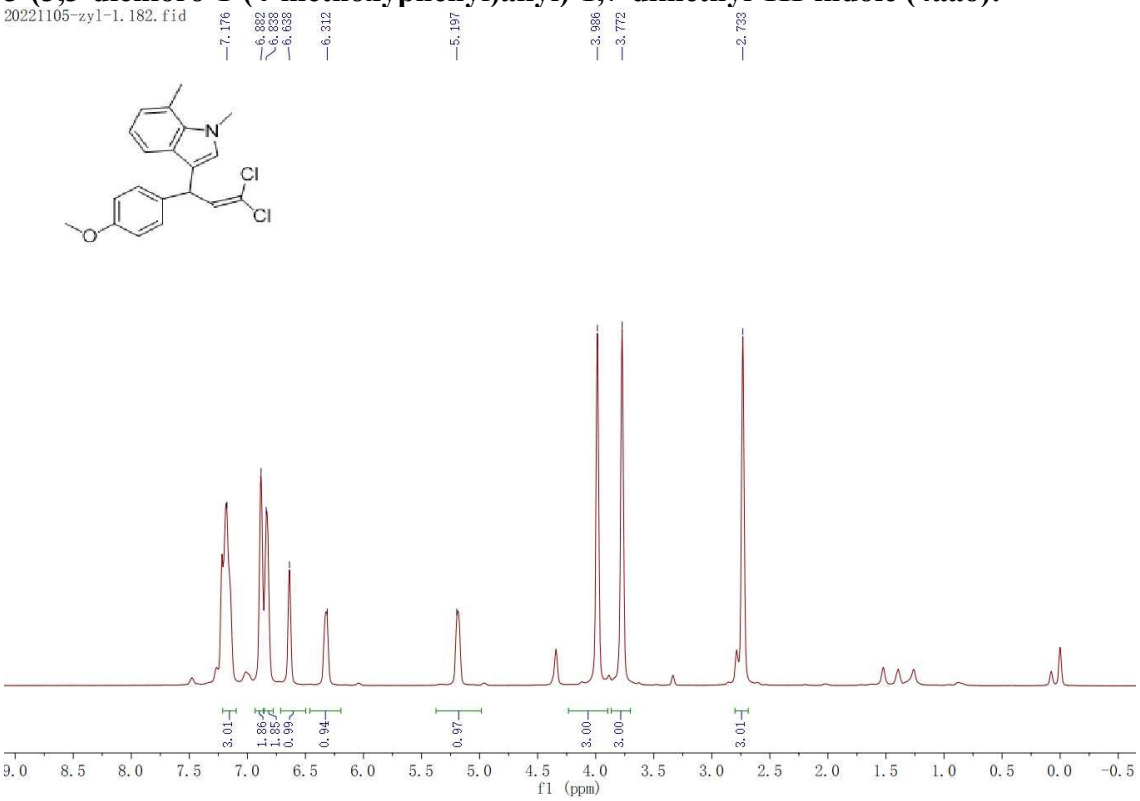


^{13}C NMR (126 MHz, $CDCl_3$)

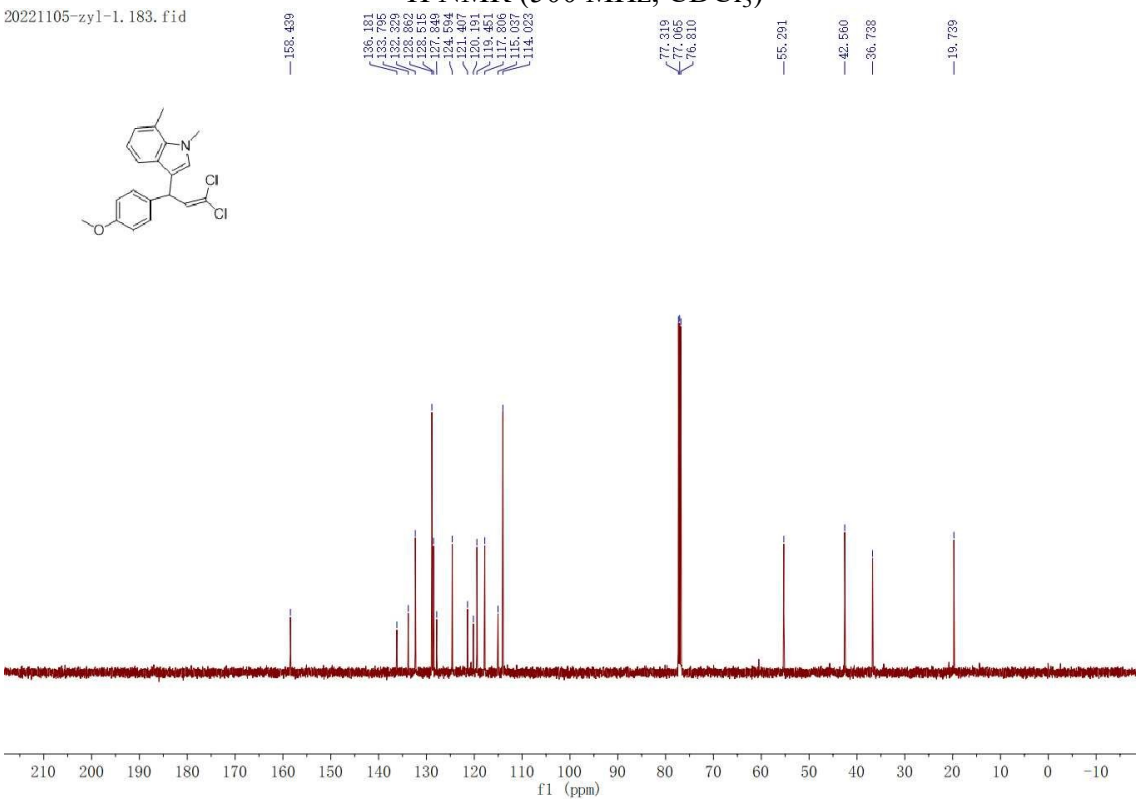


^{19}F NMR (471 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,7-dimethyl-1H-indole (4aao):

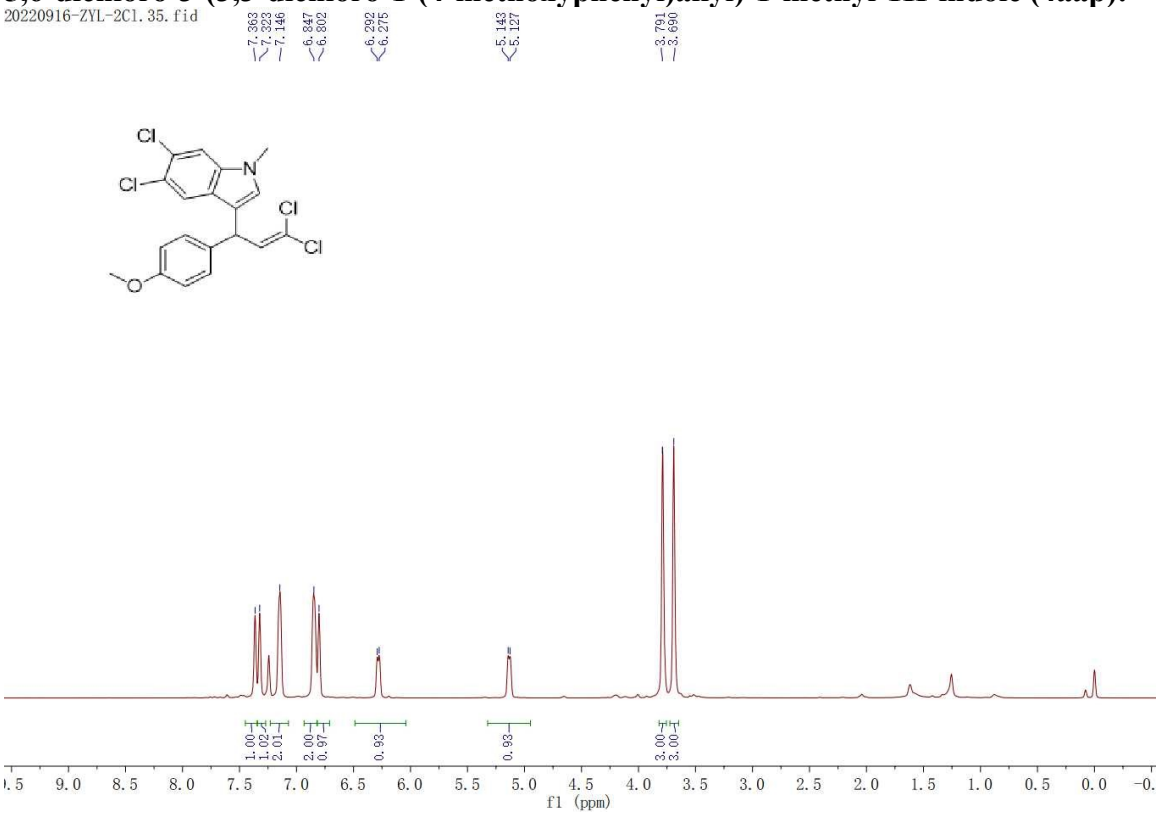


^{1}H NMR (500 MHz, $CDCl_3$)

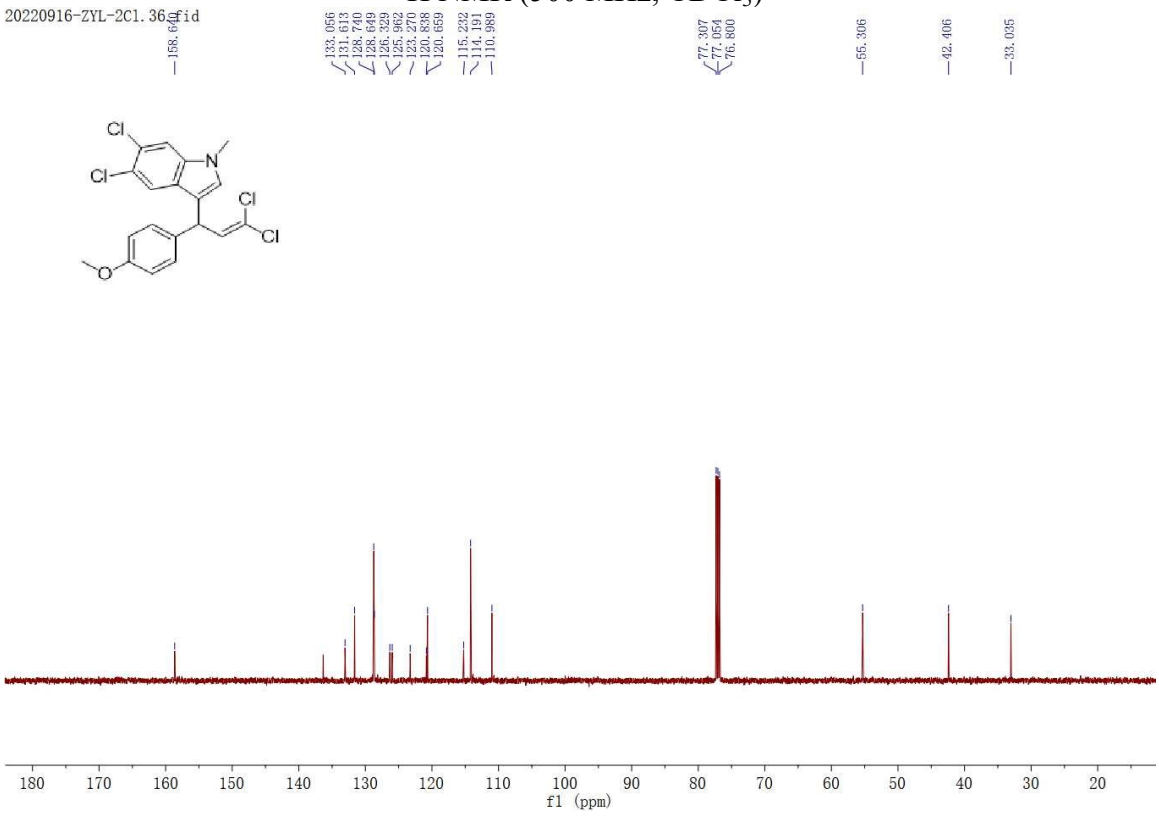


^{13}C NMR (126 MHz, $CDCl_3$)

5,6-dichloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aap):

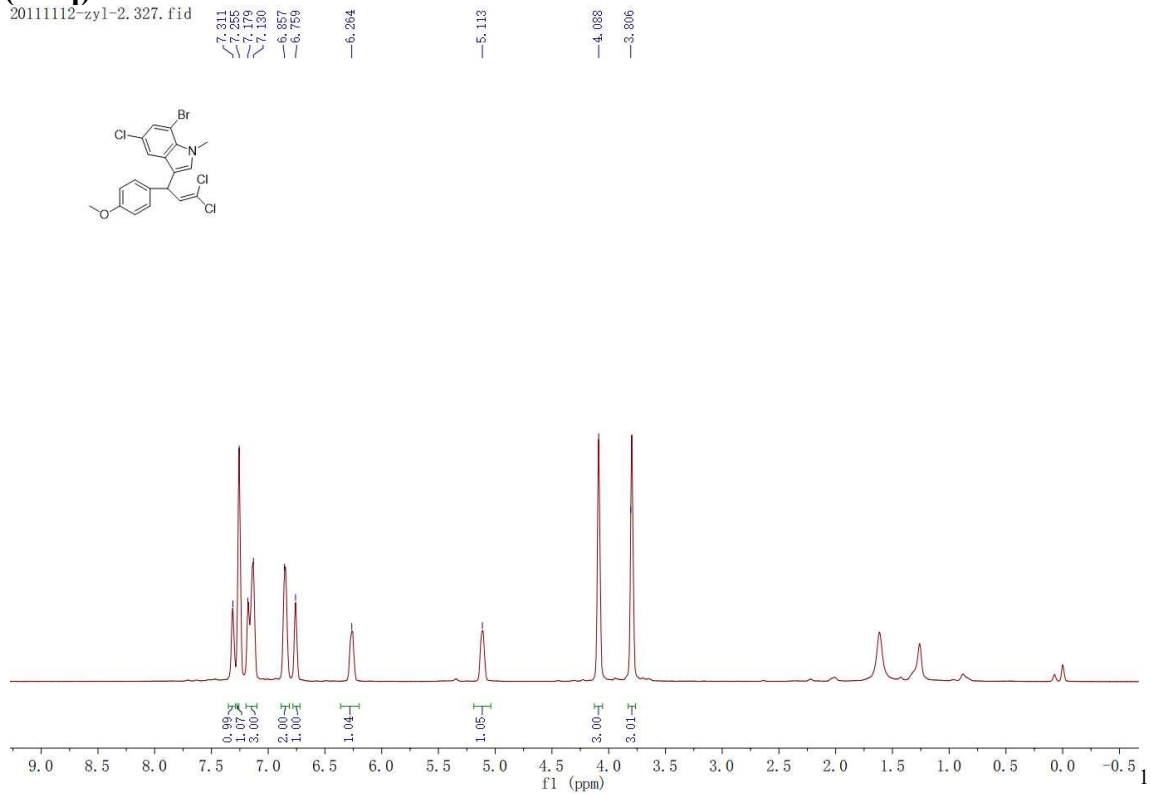


^{1}H NMR (500 MHz, $CDCl_3$)

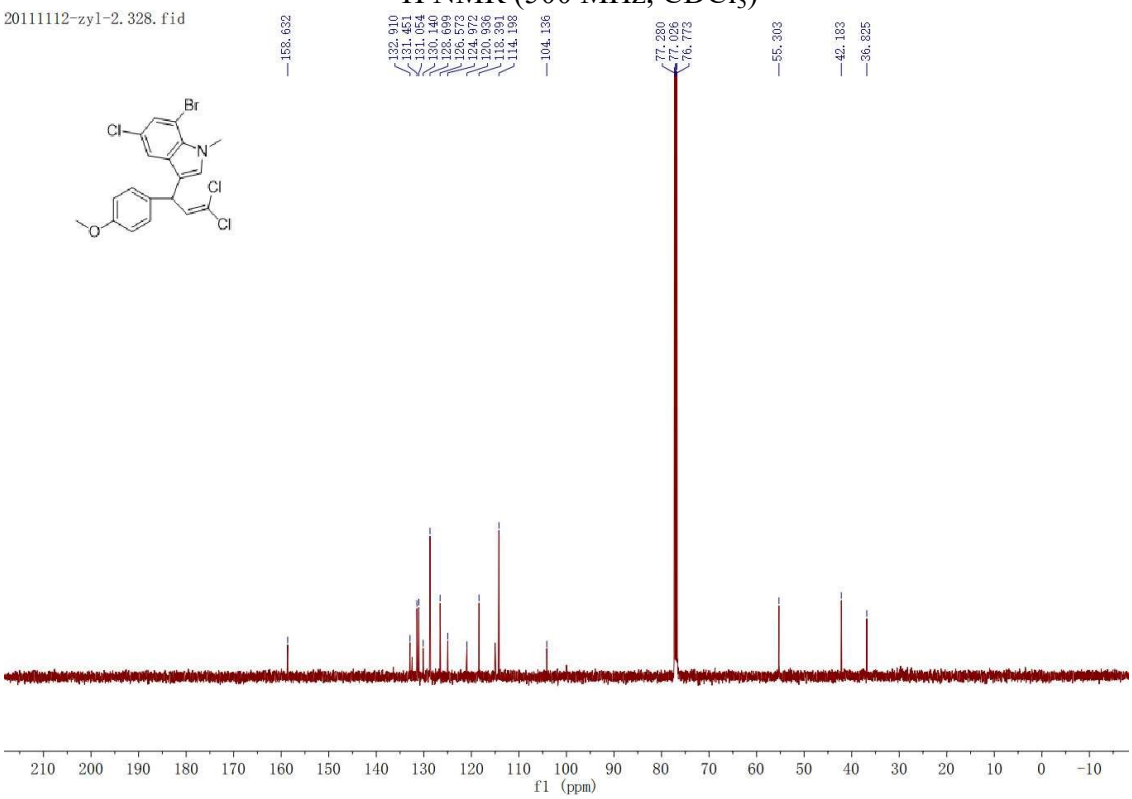


^{13}C NMR (126 MHz, $CDCl_3$)

7-bromo-5-chloro-3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-1H-indole (4aaq):

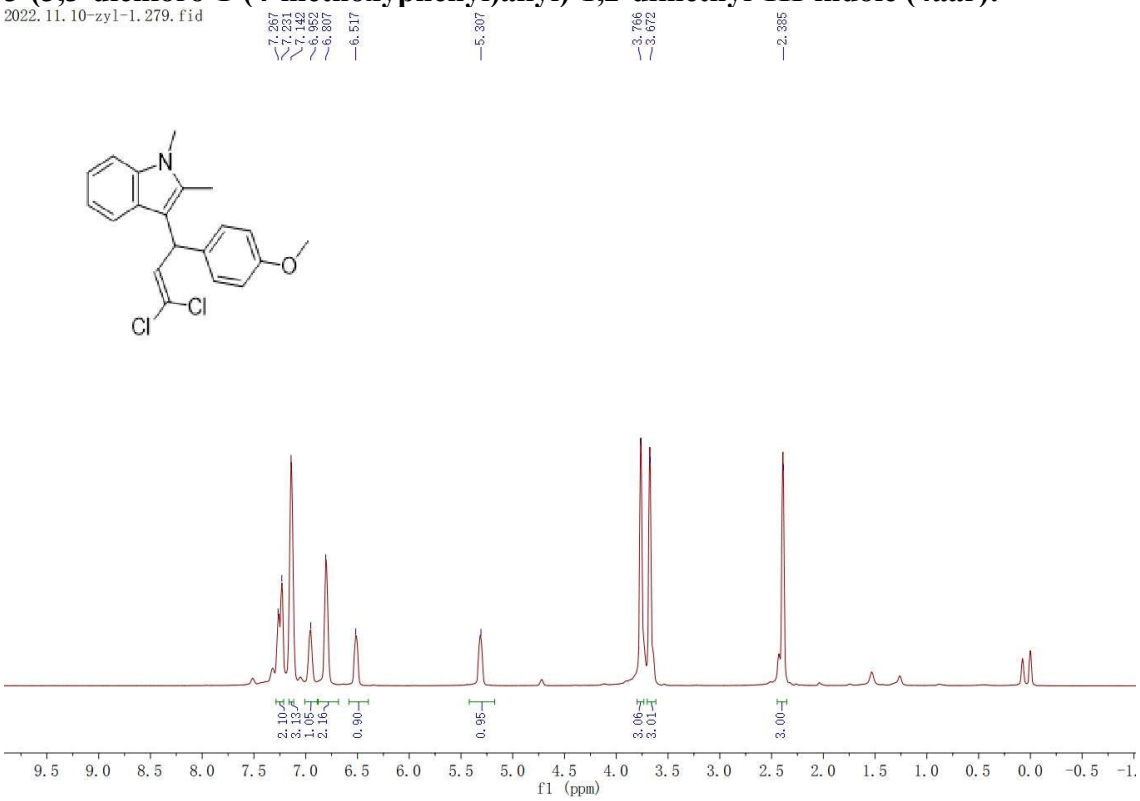


^{1}H NMR (500 MHz, $CDCl_3$)

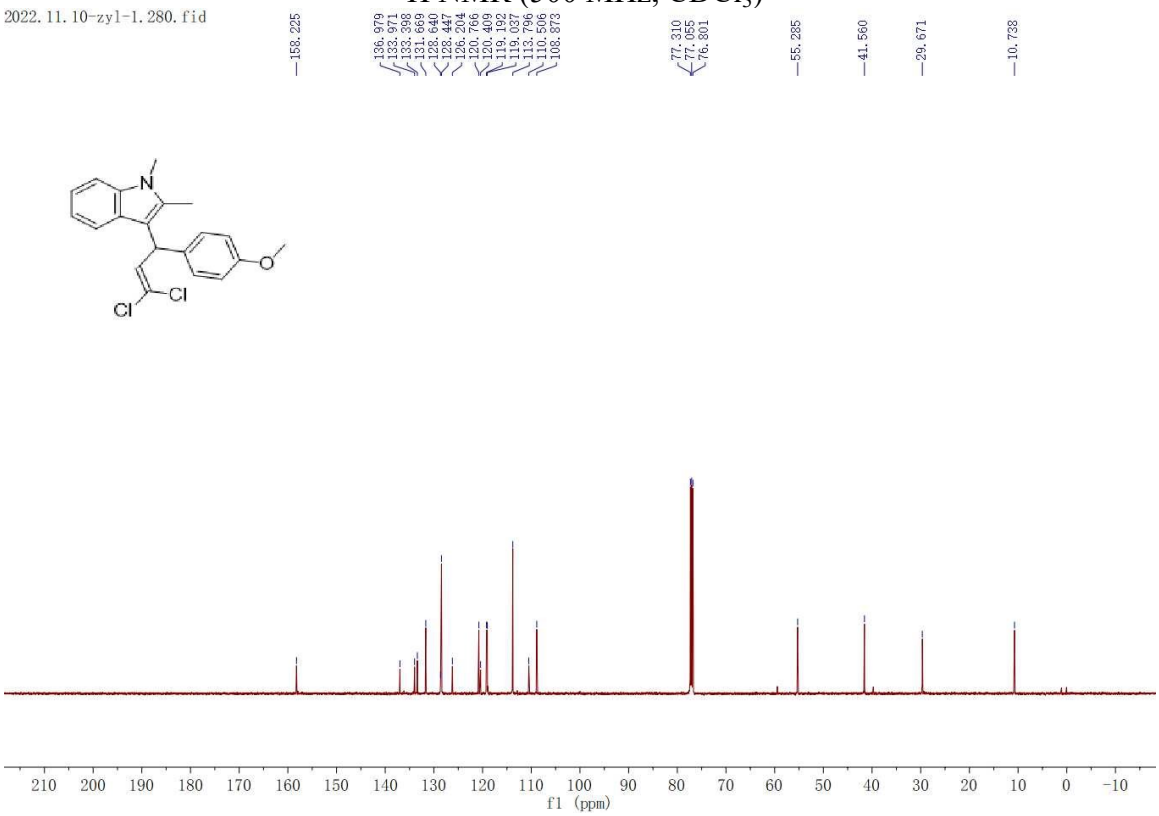


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,2-dimethyl-1H-indole (4aar):

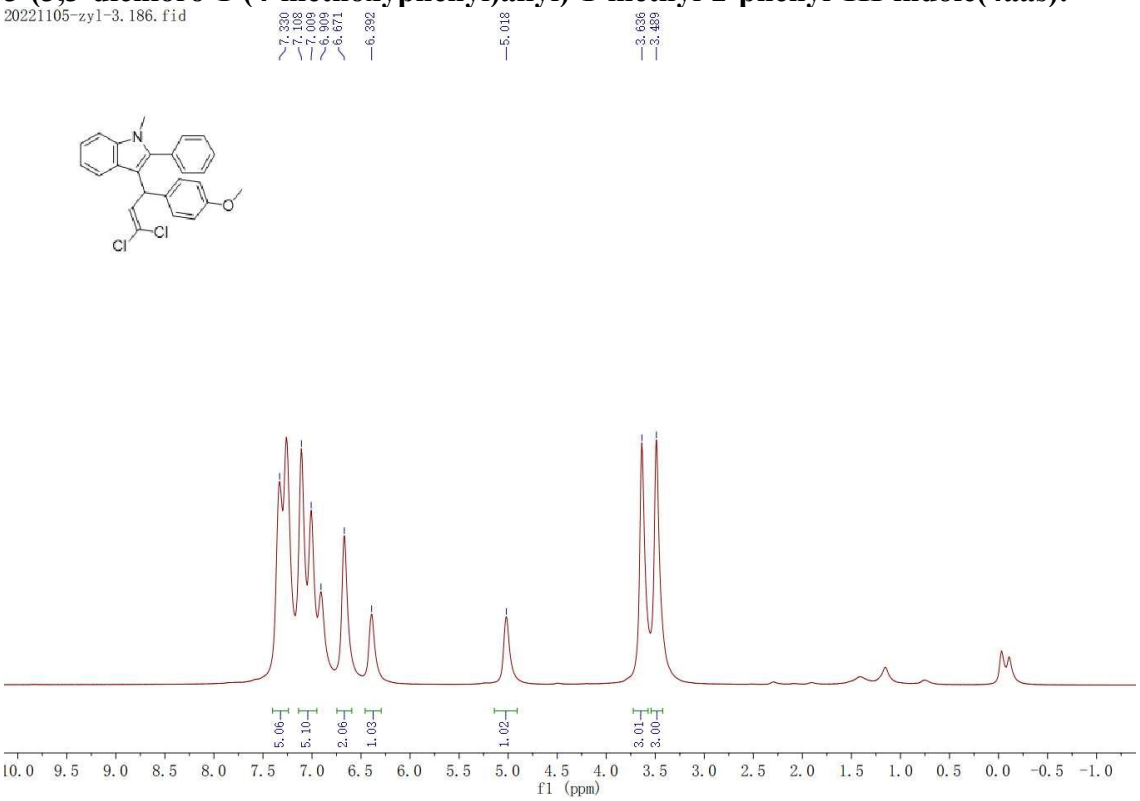


^{1}H NMR (500 MHz, $CDCl_3$)

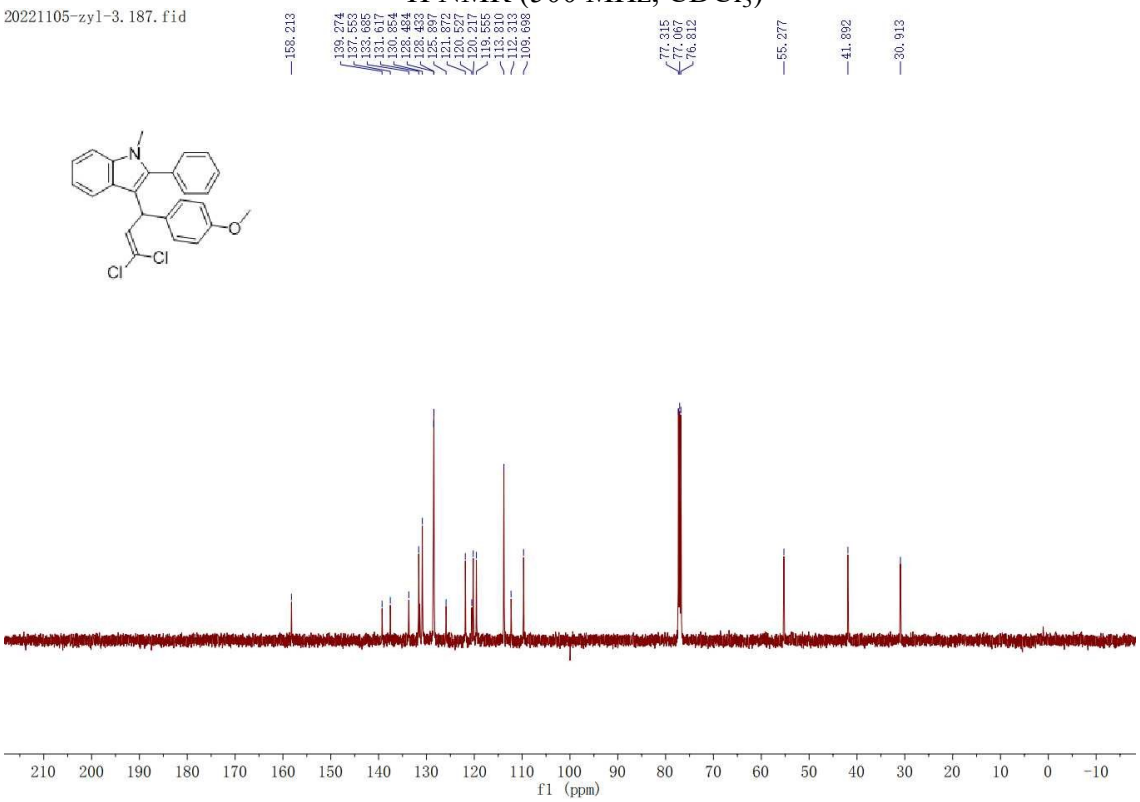


^{13}C NMR (126 MHz, $CDCl_3$)

3-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-methyl-2-phenyl-1H-indole(4aas):

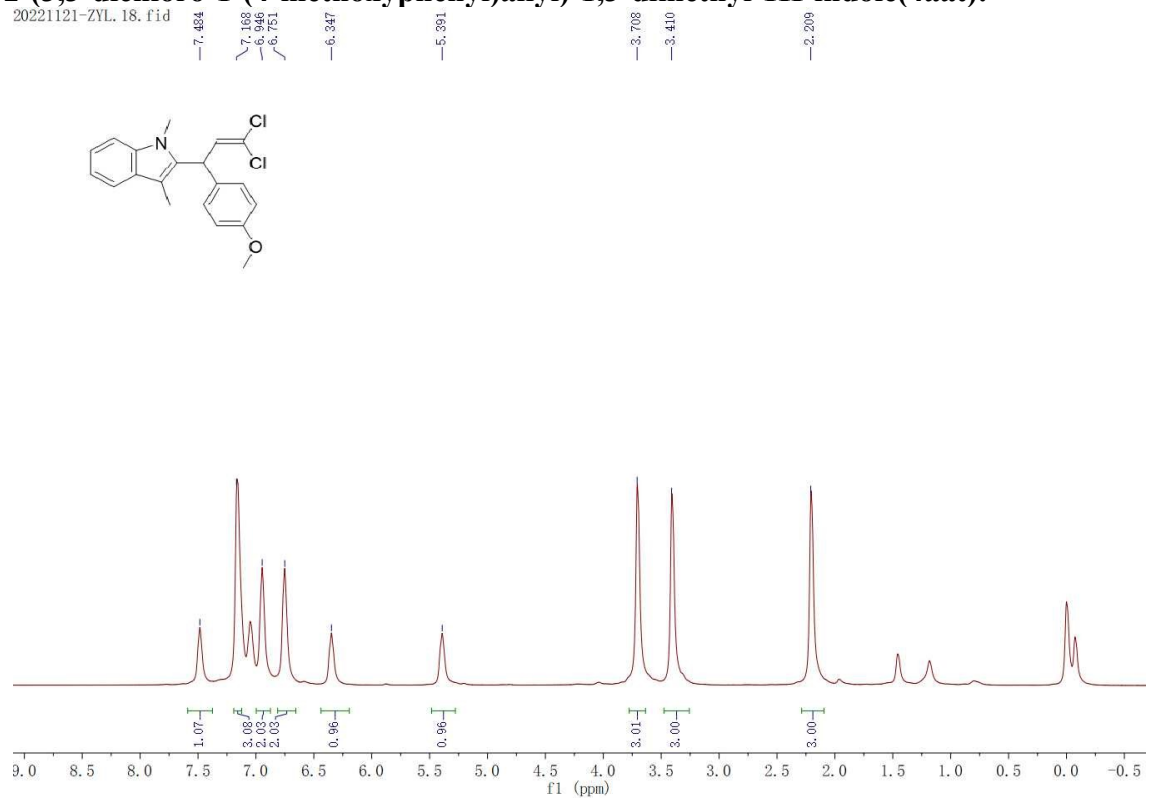


^{1}H NMR (500 MHz, $CDCl_3$)

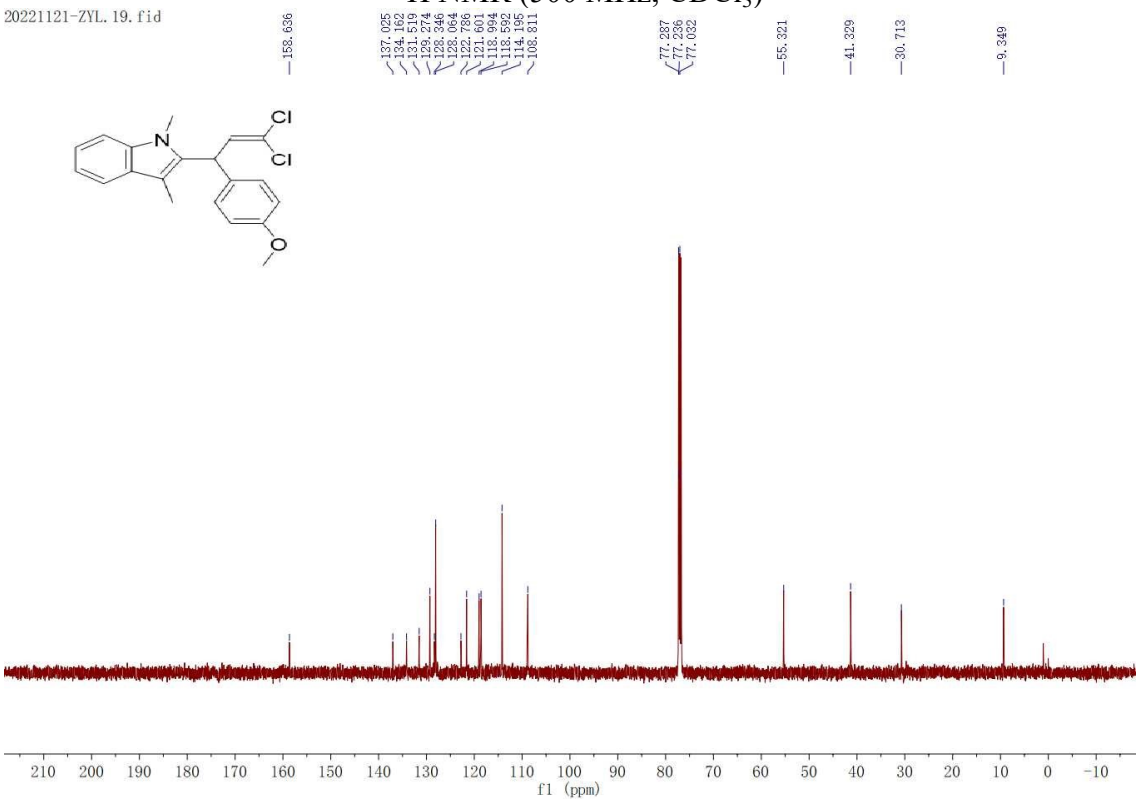


^{13}C NMR (126 MHz, $CDCl_3$)

2-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,3-dimethyl-1H-indole(4aat):

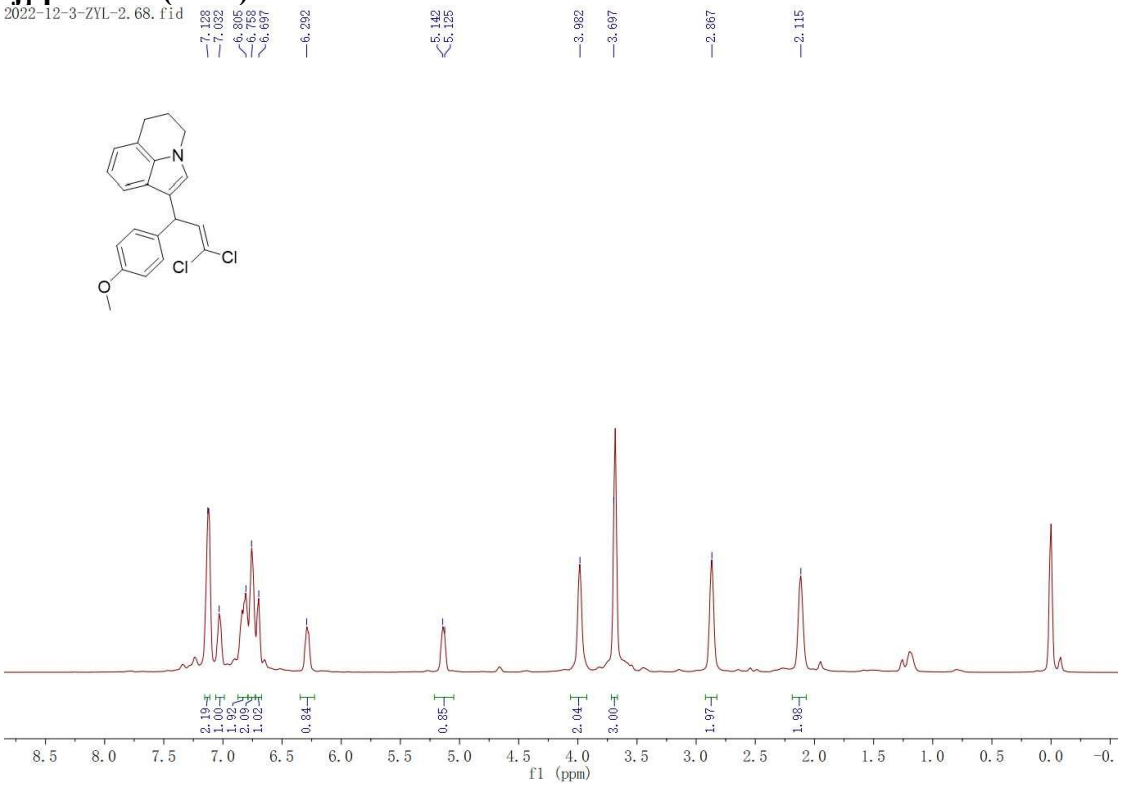


^{1}H NMR (500 MHz, $CDCl_3$)

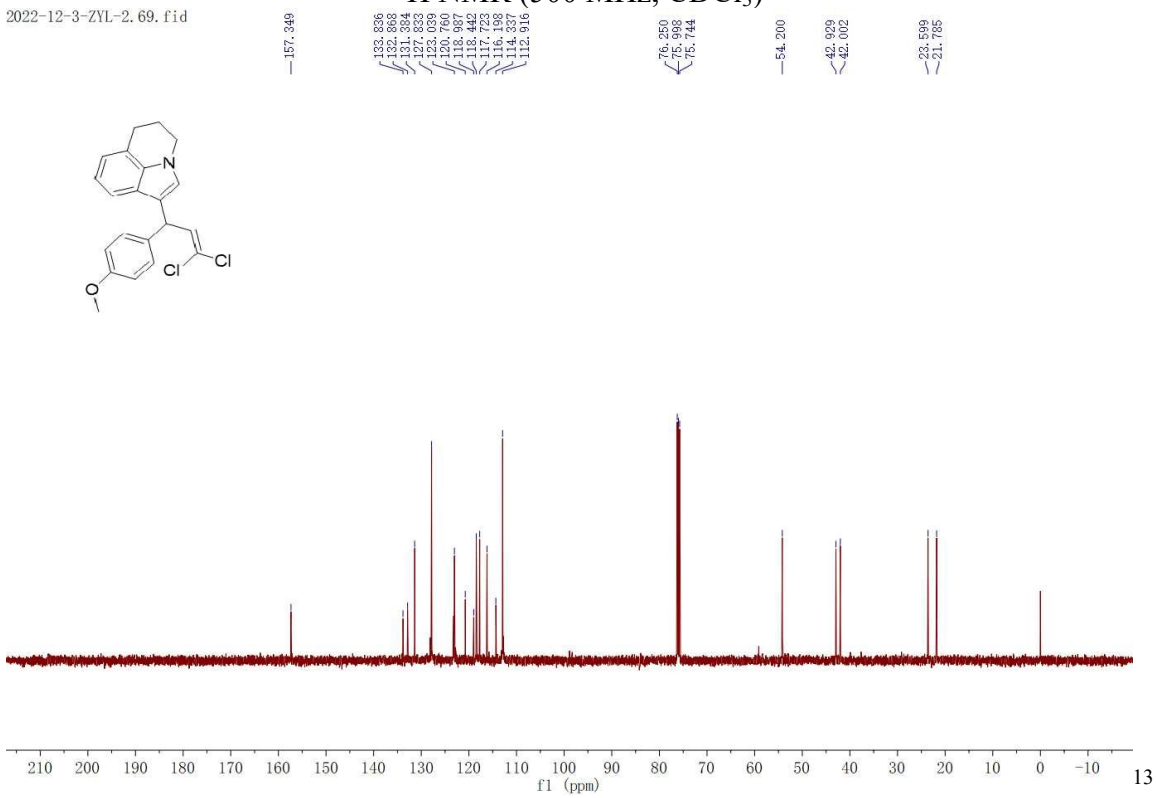


^{13}C NMR (126 MHz, $CDCl_3$)

1-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-5,6-dihydro-4H-pyrrolo[3,2,1-ij]quinoline(4aau):

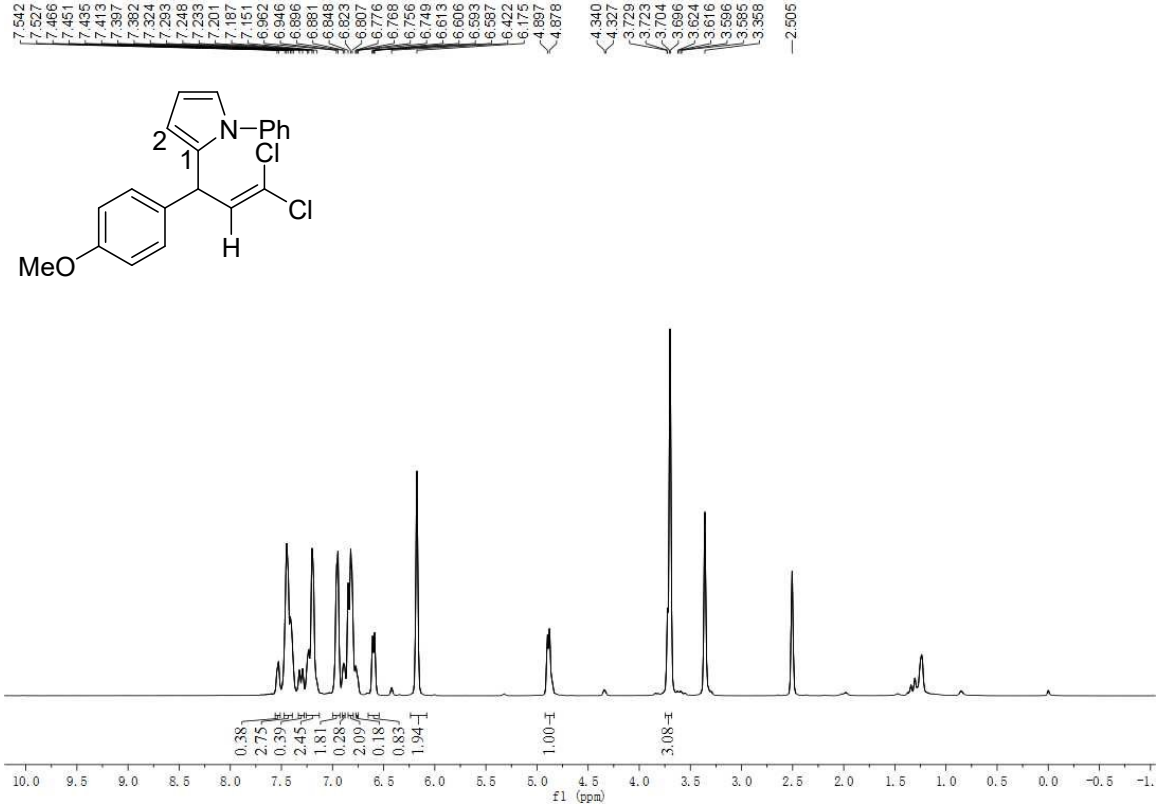


^{1}H NMR (500 MHz, $CDCl_3$)

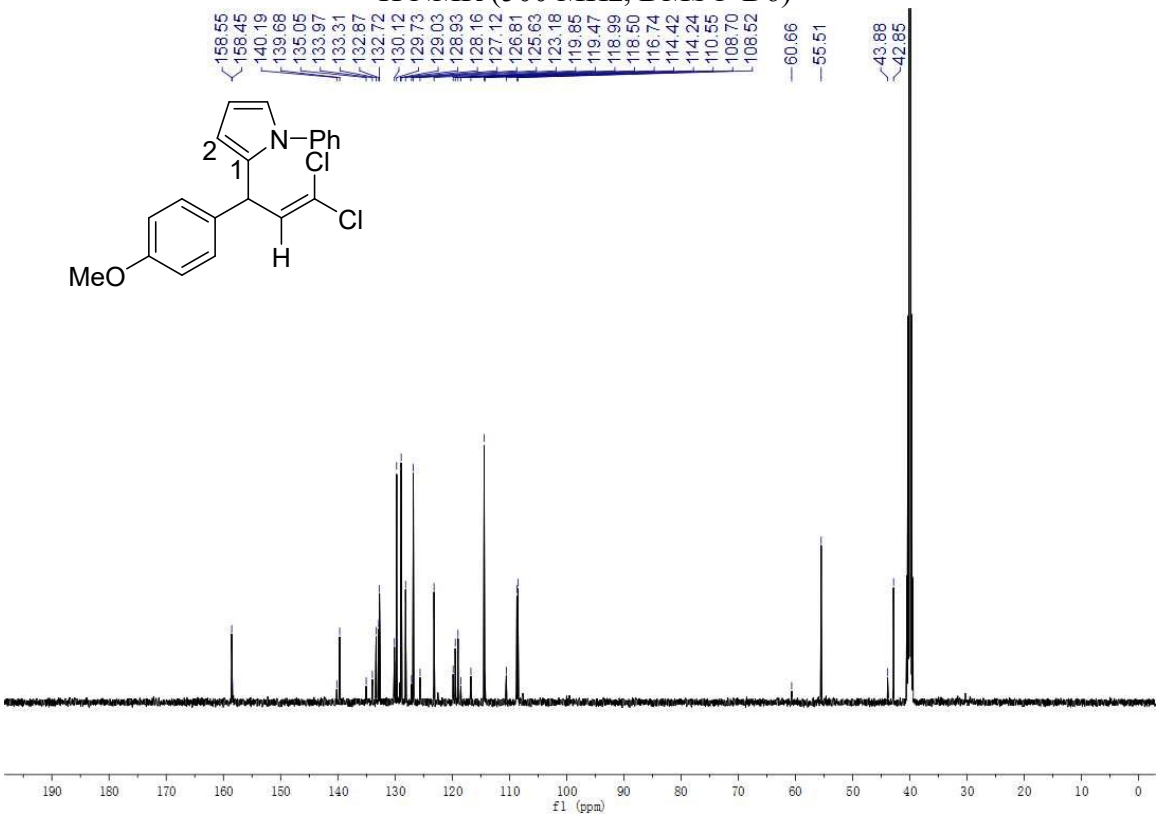


C NMR (126 MHz, $CDCl_3$)

2-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1-phenyl-1H-pyrrole (4aav)

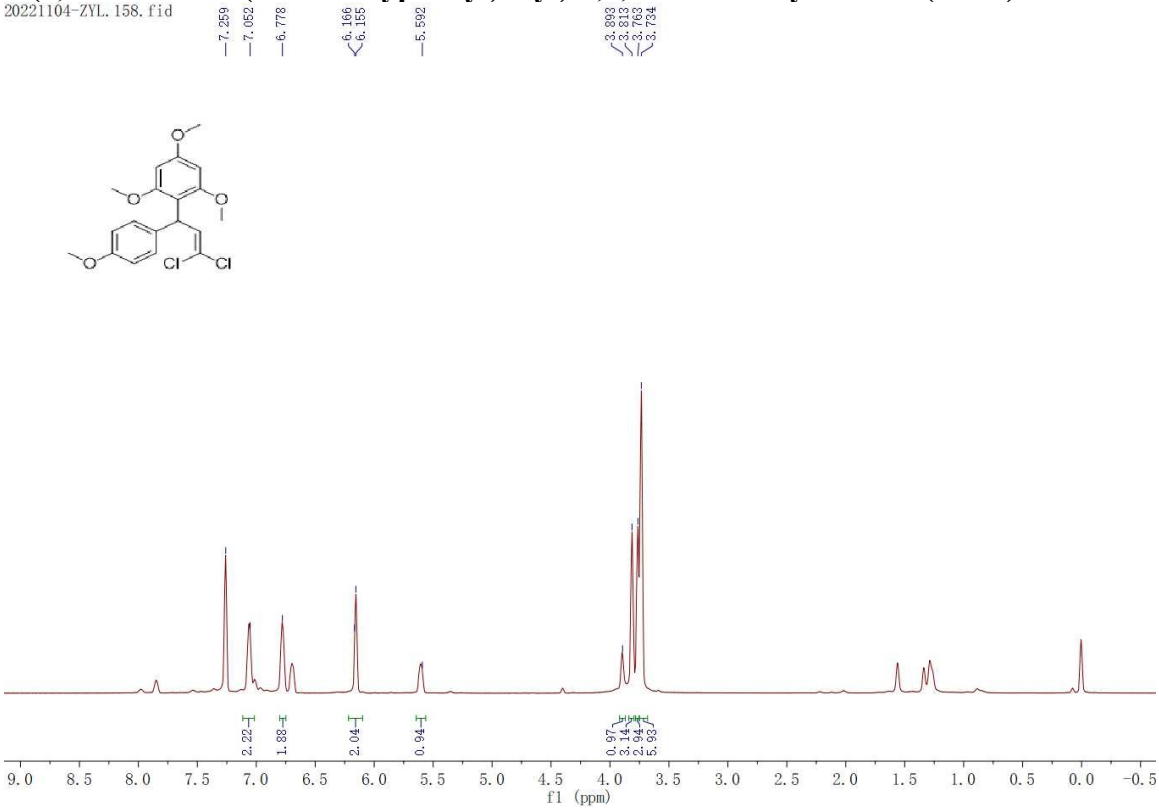


^{1}H NMR (500 MHz, DMSO-D6)

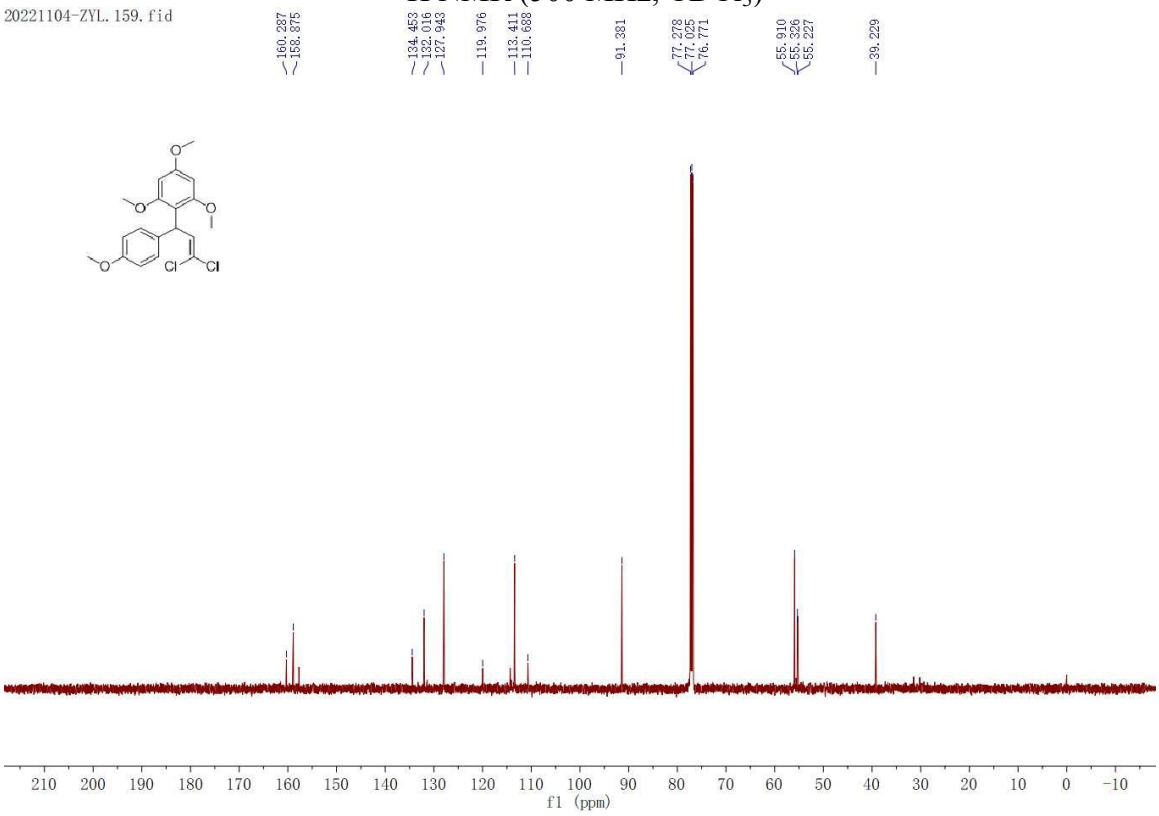


^{13}C NMR (126 MHz, DMSO-D6)

2-(3,3-dichloro-1-(4-methoxyphenyl)allyl)-1,3,5-trimethoxybenzene (4aaw):

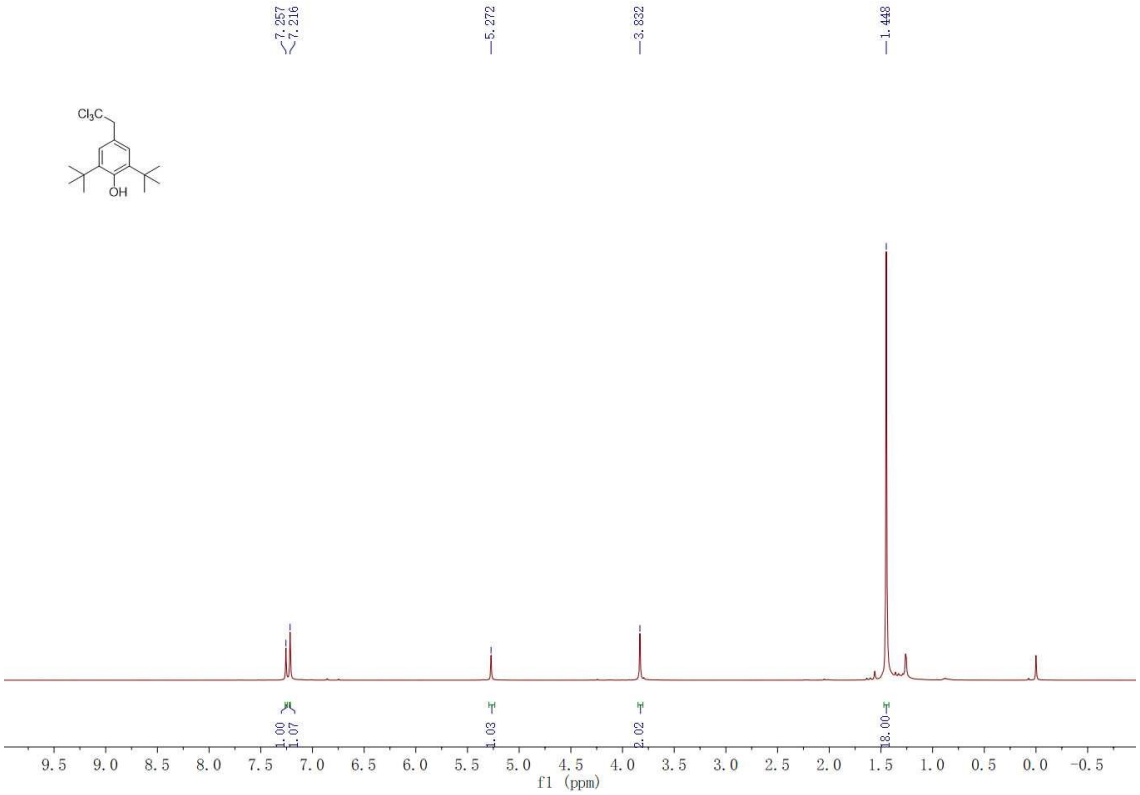


^{1}H NMR (500 MHz, $CDCl_3$)

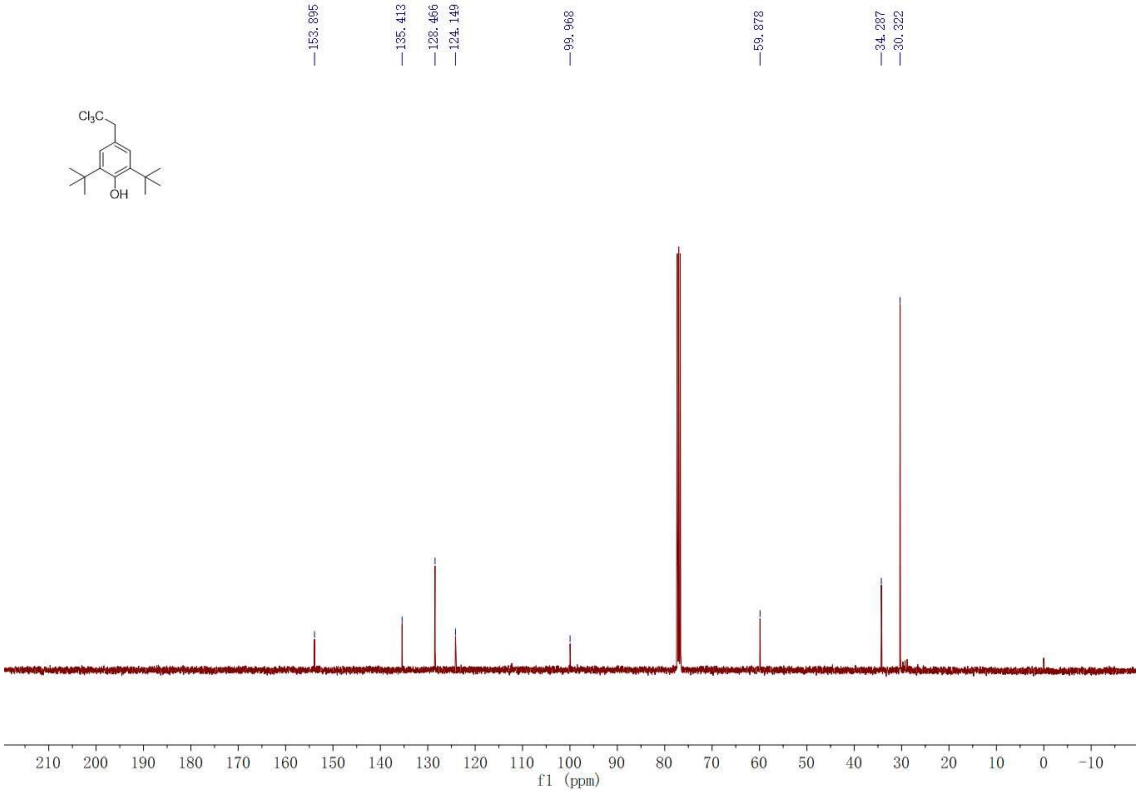


^{13}C NMR (126 MHz, $CDCl_3$)

1,3-di-tert-butyl-5-methyl-2-(trichloromethoxy)benzene (5a):

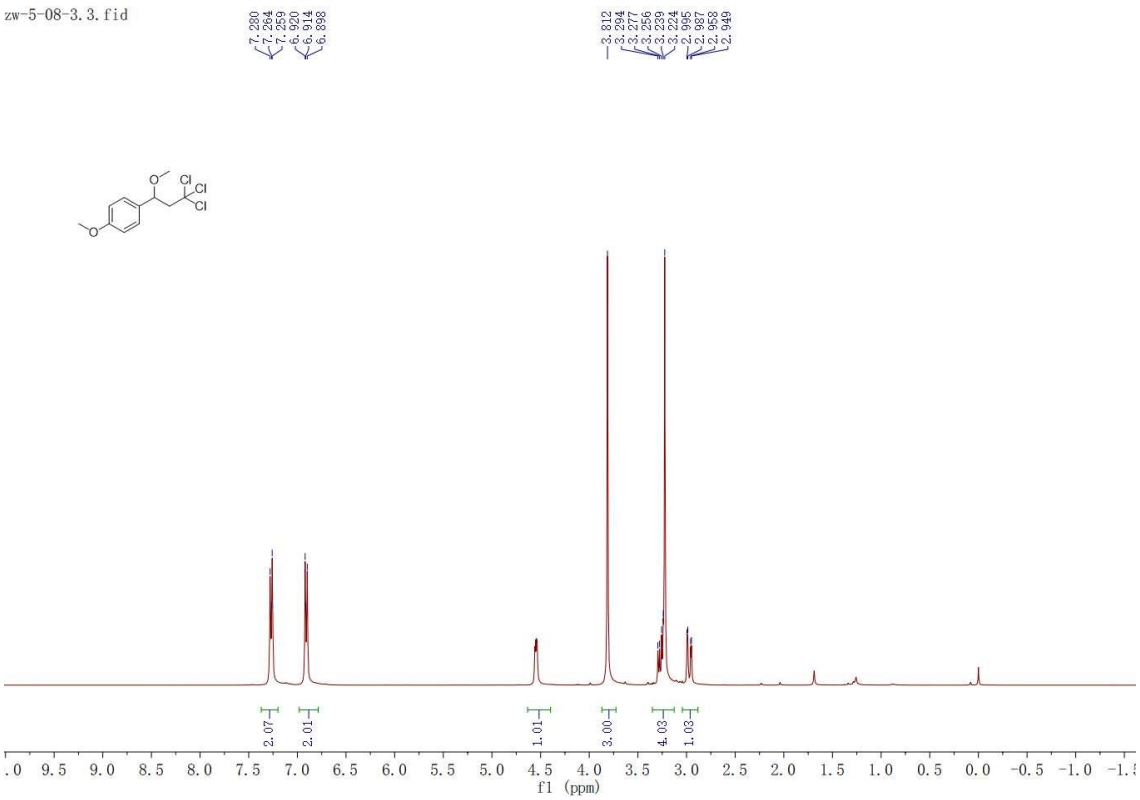


^{1}H NMR (400 MHz, $CDCl_3$)

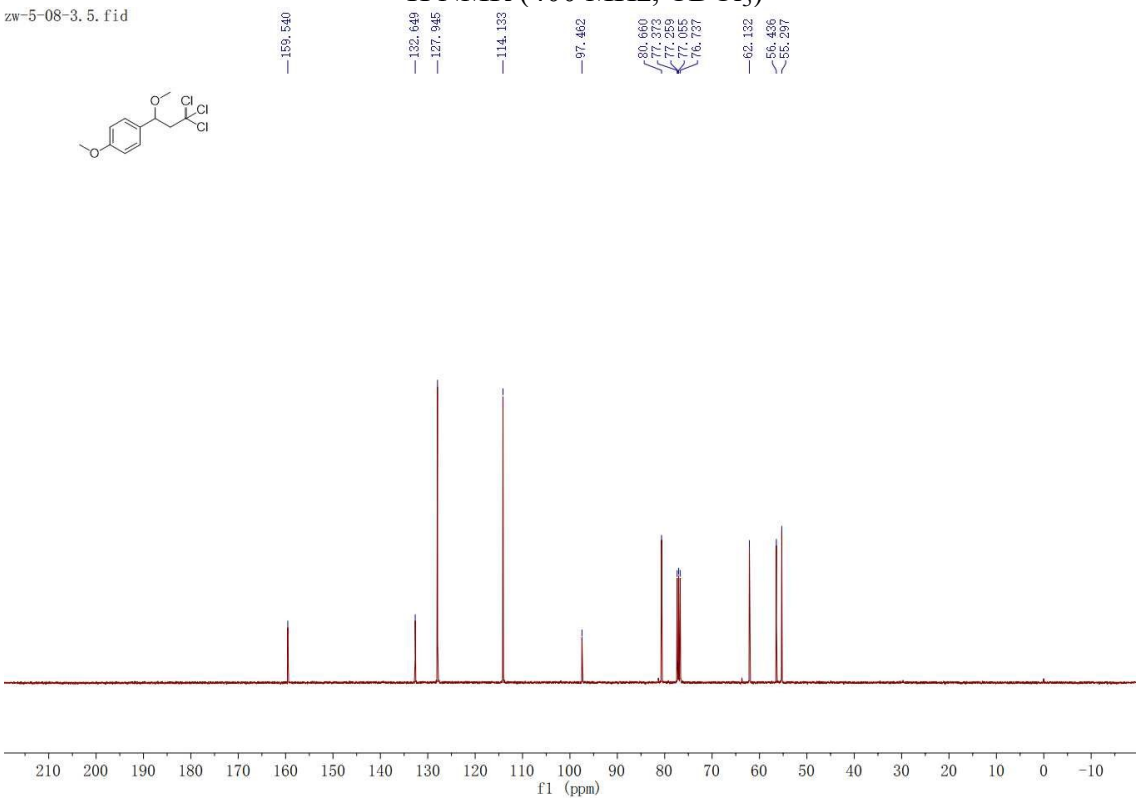


^{13}C NMR (100MHz, $CDCl_3$)

1-methoxy-4-(3,3,3-trichloro-1-methoxypropyl)benzene(5b):

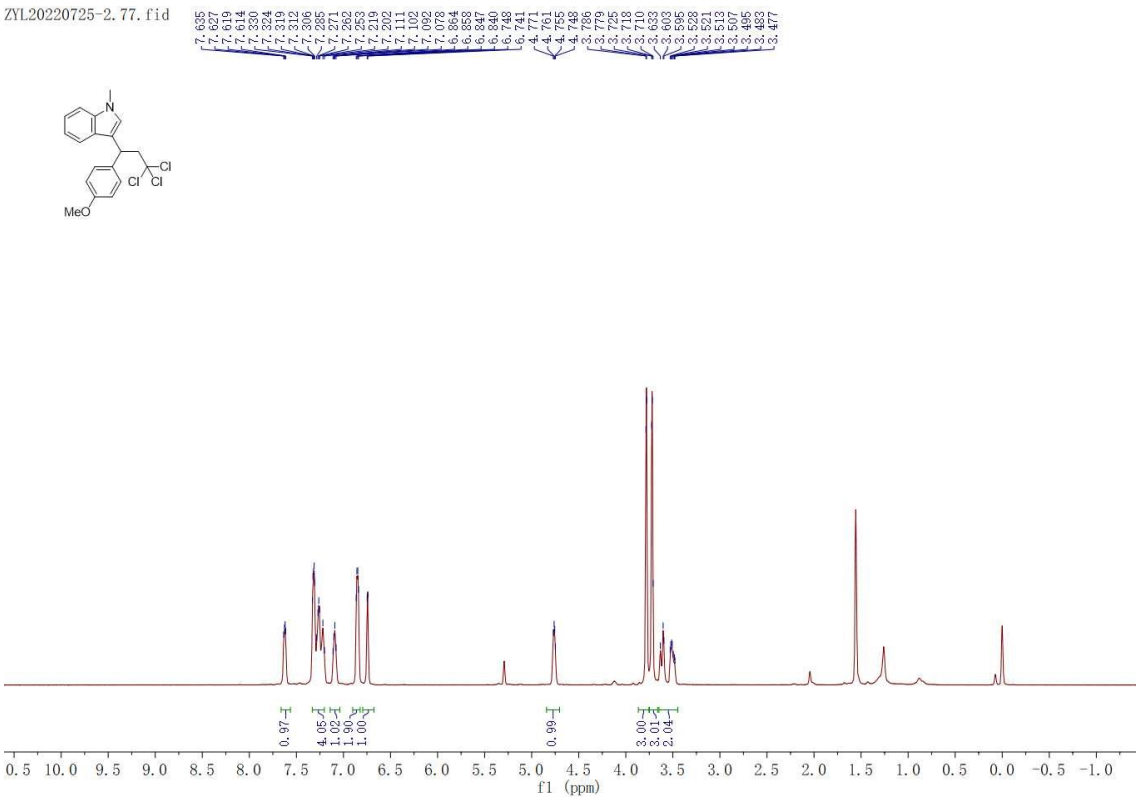


^{1}H NMR (400 MHz, $CDCl_3$)

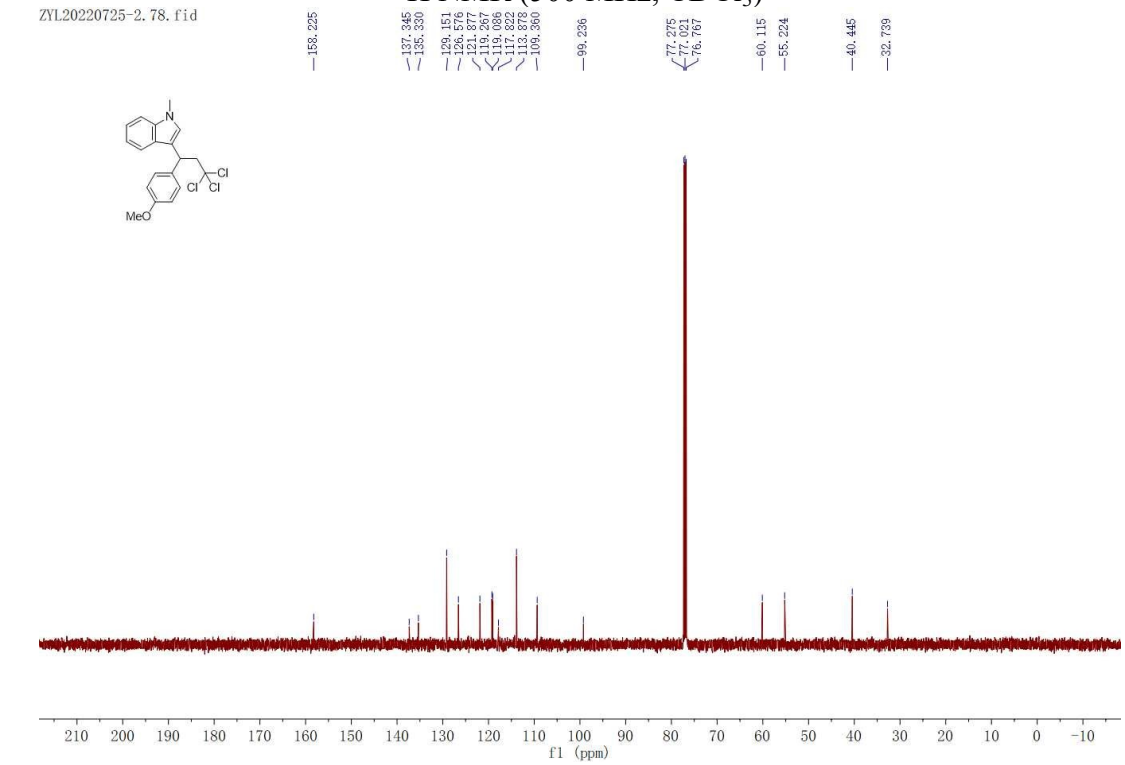


^{13}C NMR (100 MHz, $CDCl_3$)

1-methyl-3-(3,3,3-trichloro-1-(4-methoxyphenyl)propyl)-1H-indole(5c):



^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (126 MHz, $CDCl_3$)