

## **Supporting information**

# ***Meta-, Regioselective Amination of Cyclic Diaryliodoniums through C-I and C-O Bond Cleavages: an Access to Functionalized Coumarins***

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## The general information for the synthetic experiments

Synthesis details for key compounds are described here. All solvents were commercially available and were used without a further purification unless stated. The chemicals used were either purchased from commercial sources or prepared according to literature procedures. The  $^1\text{H}$  and  $^{13}\text{C}$  nuclear magnetic resonance (NMR) spectra were recorded on a Bruker Avance spectrometer 400 at 400 MHz and 100 MHz respectively. Chemical shifts are given in ppm ( $\delta$ ) referenced to  $\text{CDCl}_3$  with 7.26 for  $^1\text{H}$  and 77.10 for  $^{13}\text{C}\{^1\text{H}\}$ , and to  $d_6\text{-DMSO}$  with 2.50 for  $^1\text{H}$  and 39.5 for  $^{13}\text{C}\{^1\text{H}\}$ . In the case of multiplet, the signals are reported as intervals. Signals are abbreviated as follows: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet. Coupling constants are expressed in hertz. High-resolution mass spectra (HRMS) were recorded on Thermo Fisher spectrometer, Orbitrap QExactive GC/MS (EI mode) and Orbitrap QExactive LC/MS (ESI mode) or BRUKER VPEXII spectrometer (ESI mode). The progress of the reactions was monitored by thin-layer chromatography on a glass plate coated with silica gel with fluorescent indicator (GF254). Column chromatography was performed on silica gel (200-300 mesh).

**Table S1. Optimization of the reaction conditions**

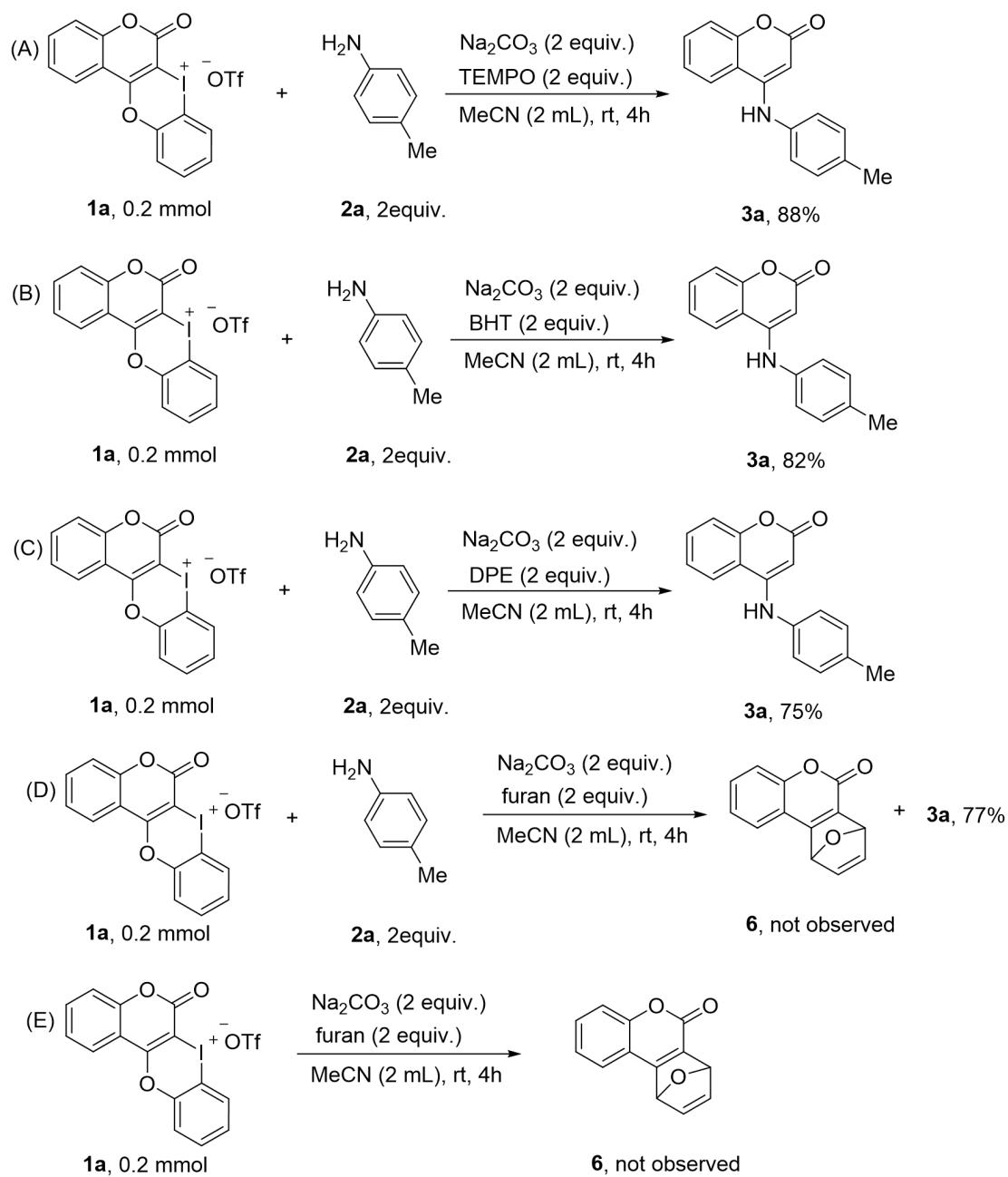
The reaction scheme shows the coupling of compound **1a** (a substituted phenyl iodide) with compound **2a** (4-methyl-N-phenylaniline) under different conditions to yield compound **3a** (4-(4-methylphenyl)-2-phenylphenol).

Entry	Solvent	Base	Additive	Time(h)	Yield(%) <sup>a</sup>
<b>1</b>	DCM	Na <sub>2</sub> CO <sub>3</sub>	Cu(OAc) <sub>2</sub>	12	36
<b>2</b>	DCM	Na <sub>2</sub> CO <sub>3</sub>	CuI	12	46
<b>3</b>	DCM	Na <sub>2</sub> CO <sub>3</sub>	CuCl	12	33
<b>4</b>	DCM	Na <sub>2</sub> CO <sub>3</sub>	Cu(TFA) <sub>2</sub>	12	39
<b>5</b>	DCM	Na <sub>2</sub> CO <sub>3</sub>	Cu(OTf) <sub>2</sub>	12	41
<b>7</b>	DCM	Na <sub>2</sub> CO <sub>3</sub>	-	12	44
<b>8</b>	EA	Na <sub>2</sub> CO <sub>3</sub>	-	12	55
<b>9</b>	MeOH	Na <sub>2</sub> CO <sub>3</sub>	-	12	34
<b>10</b>	DMF	Na <sub>2</sub> CO <sub>3</sub>	-	12	35
<b>11</b>	DMSO	Na <sub>2</sub> CO <sub>3</sub>	-	12	24
<b>12</b>	Toluene	Na <sub>2</sub> CO <sub>3</sub>	-	12	33
<b>13</b>	DCE	Na <sub>2</sub> CO <sub>3</sub>	-	12	39
<b>14</b>	THF	Na <sub>2</sub> CO <sub>3</sub>	-	12	33
<b>15</b>	Dioxane	Na <sub>2</sub> CO <sub>3</sub>	-	12	41
<b>16</b>	MeCN	Na <sub>2</sub> CO <sub>3</sub>	-	12	99
<b>17</b>	MeCN	NaH	-	12	33
<b>18</b>	MeCN	TEA	-	12	36
<b>19</b>	MeCN	DIPEA	-	12	38
<b>20</b>	MeCN	NaHCO <sub>3</sub>	-	12	46
<b>21</b>	MeCN	<i>t</i> BuOK	-	12	52
<b>22</b>	MeCN	DABCO	-	12	25
<b>23</b>	MeCN	K <sub>2</sub> CO <sub>3</sub>	-	12	40
<b>24</b>	MeCN	-	-	12	31
<b>25</b>	MeCN	Na <sub>2</sub> CO <sub>3</sub>	-	12	47 <sup>b</sup>
<b>26</b>	MeCN	Na <sub>2</sub> CO <sub>3</sub>	-	0.5	92
<b>27</b>	MeCN	Na <sub>2</sub> CO <sub>3</sub>	-	1	94
<b>28</b>	MeCN	Na <sub>2</sub> CO <sub>3</sub>	-	2	95
<b>29</b>	MeCN	Na <sub>2</sub> CO <sub>3</sub>	-	4	99

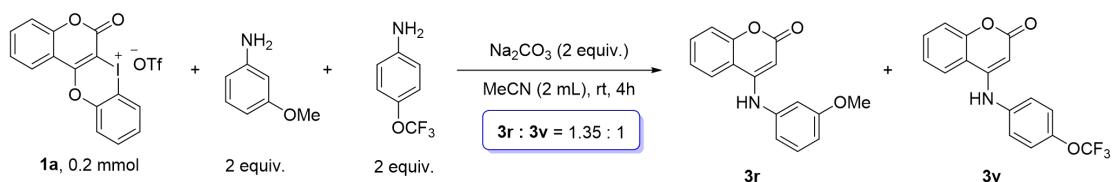
Reaction conditions<sup>a</sup>: **1a** (0.1 mmol), **2a** (2 equiv.), Base (2 equiv.), copper (10 mol%), solvent (1 mL),

rt, reaction proceeded under argon, isolated yield. <sup>b</sup>yield: **2a** (1.1 equiv.) was added.

**Scheme S1. Mechanistic Experiments**

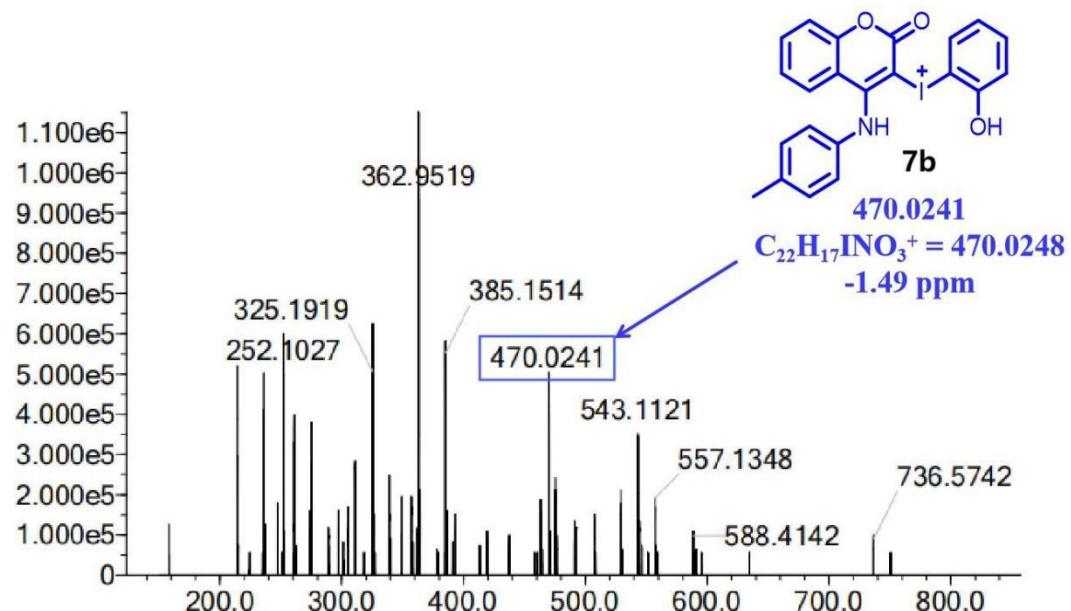


**Scheme S2. Competitive Experiments**



**Figure S1. Mass spectroscopy of the reaction mixture**

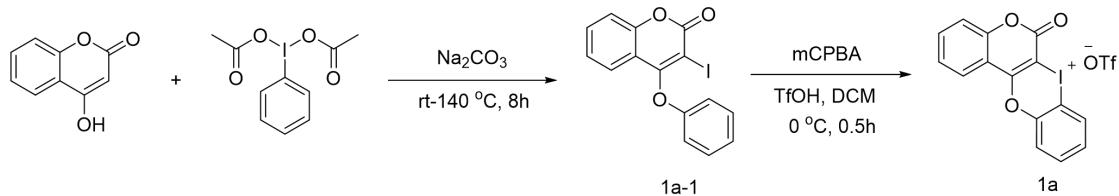
To **1a** (39 µmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (97.62 µmol, 2 equiv.), *p*-toluidine **2a** (97.62 µmol, 2 equiv.), MeCN (1 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 10 mins. Then, one drop of the crude reaction mixture was diluted with HPLC MeOH (1 mL) and delivered to ESI-HRMS for detection.



## General procedures for the synthesis of cyclic diaryliodoniums

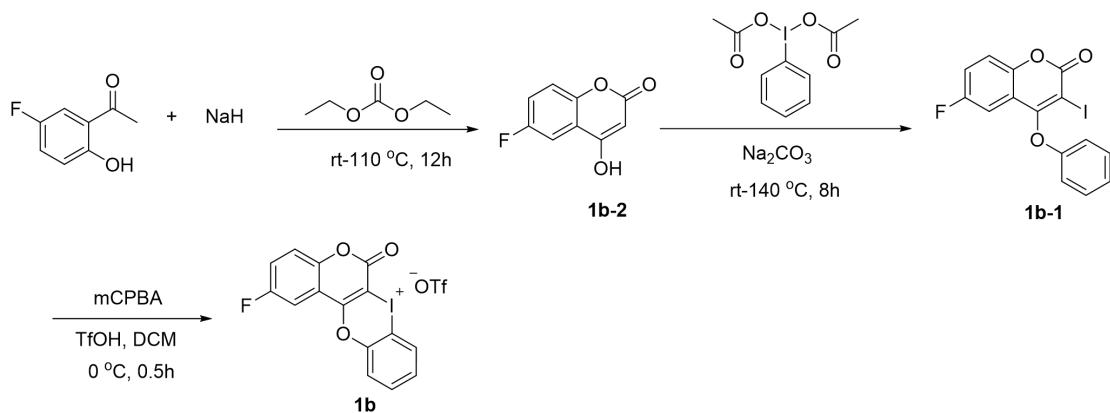
### Synthesis of 6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-i um trifluoromethanesulfonate

(1a):



**3-Iodo-4-phenoxy-2H-chromen-2-one (1a-1):** To (diacetoxyiodo)benzene (24.67 mmol, 1 equiv.) in a flask was added  $\text{Na}_2\text{CO}_3$  (49.34 mmol, 2 equiv.),  $\text{H}_2\text{O}$  (30 mL). The reaction mixture was stirred at room temperature for 0.5h, 4-hydroxy-2H-chromen-2-one (1 equiv.) was then added, and the reaction was continued for four hours. After that, the reaction mixture was filtered and dried in vacuum to give a white solid, which was dissolved in DMF (20 mL), stirred at  $140^\circ\text{C}$  heated by an oil bath for 6h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~2/1) to provide product 1a-1 (7.22 g, 80%) as a white solid.

**6-Oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-i um trifluoromethanesulfonate (1a):** To 1a-1 (14.50 mmol, 1 equiv.), in a flask was added DCM (45 mL), *m*CPBA (85%, 25.75 mmol, 1.5 equiv.) and  $\text{TfOH}$  (43.50 mmol, 3 equiv.) in an ice bath. Half an hour later, the reaction was finished according to TLC, the reaction solution was evaporated in vacuum, and precipitated with ether (20 mL), One hour later, it was filtered and vacuum-dried to obtain 1a (9.0 g, 89%) as a brown solid.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  8.36 (d,  $J$  = 8.2 Hz, 1H), 8.10 (d,  $J$  = 8.0 Hz, 1H), 8.05 (d,  $J$  = 8.2 Hz, 1H), 7.91 (t,  $J$  = 7.8 Hz, 1H), 7.75 (t,  $J$  = 7.7 Hz, 1H), 7.62 (dd,  $J$  = 16.1, 8.0 Hz, 2H), 7.55 (t,  $J$  = 7.8 Hz, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (101 MHz, DMSO)  $\delta$  163.8, 156.7, 153.3, 149.9, 135.6, 133.6, 133.4, 129.6, 125.6, 123.8, 121.7, 117.1, 114.7, 97.6, 84.3.  $^{19}\text{F}$  NMR (376 MHz, DMSO)  $\delta$  -77.73 ppm. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_8\text{O}_3\text{I} [\text{M}-\text{OTf}]^+$ : 362.9513, Found: 362.9502.



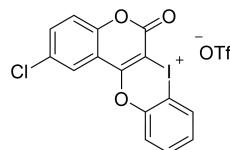
**6-Fluoro-4-hydroxy-2H-chromen-2-one (1b-2):** To 1-(5-fluoro-2-hydroxyphenyl)ethan-1-one (3.24 mmol, 1 equiv.) in a flask was added NaH (60%, 16.22 mmol, 5 equiv.), toluene (10 mL). The reaction mixture was stirred at room temperature for 0.5h, and diethyl carbonate (10 mL) was stirred at 110 °C heated by an oil bath for 12h. After that, 1M HCl (20 mL) was added and quenched, and extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The solid was precipitated in MTBE (10 mL). Filtered again to give **1b-2** (399 mg, 68%) as a brown solid.<sup>1</sup>

**6-Fluoro-3-iodo-4-phenoxy-2H-chromen-2-one (1b-1):** To (diacetoxyiodo)benzene (2.22 mmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (4.43 mmol, 2 equiv.), H<sub>2</sub>O (8 mL). The reaction mixture was stirred at room temperature for 0.5h, **1b-2** (1 equiv.) was then added, and the reaction was continued for four hours. After that, the reaction mixture was filtered and dried in vacuum to give a white solid, which was dissolved in DMF (20 mL), stirred at 140 °C heated by an oil bath for 6h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~2/1) to provide product **1b-1** (400 mg, 47%) as a light yellow solid.

**2-fluoro-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-i um trifluoromethanesulfonate (1b):** To **1b-1** (1.05 mmol, 1 equiv.), in a flask was added DCM (10 mL), *m*CPBA (85%, 1.57 mmol, 1.5 equiv.) and TfOH (3.14 mmol, 3 equiv.) in an ice bath. Half an hour later, the reaction was finished according to TLC, the reaction solution was evaporated in vacuum, and precipitated with ether (10 mL), One hour later, it was filtered and vacuum-dried to obtain **1b** (460 mg, 83%) as a brown solid. <sup>1</sup>H NMR

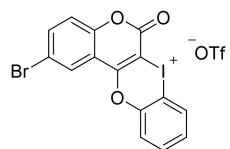
(400 MHz, DMSO) δ 8.27 (d,  $J$  = 5.4 Hz, 1H), 8.15 (d,  $J$  = 9.6 Hz, 1H), 8.10 (d,  $J$  = 7.0 Hz, 1H), 7.84 – 7.67 (m, 3H), 7.56 (t,  $J$  = 7.8 Hz, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (101 MHz, DMSO) δ 163.0, 159.9, 157.4, 156.6, 149.9, 149.7, 133.4, 129.6, 122.9, 121.9, 119.4, 115.9, 109.7, 97.4, 85.6.  $^{19}\text{F}$  NMR (376 MHz, DMSO) δ -77.74, -115.58 ppm. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_7\text{O}_3\text{FI} [\text{M}-\text{OTf}]^+$ : 380.9418, Found: 380.9416.

**2-chloro-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-ium trifluoromethanesulfonate (1c):**  
**1c** was synthesized according to **1b**.



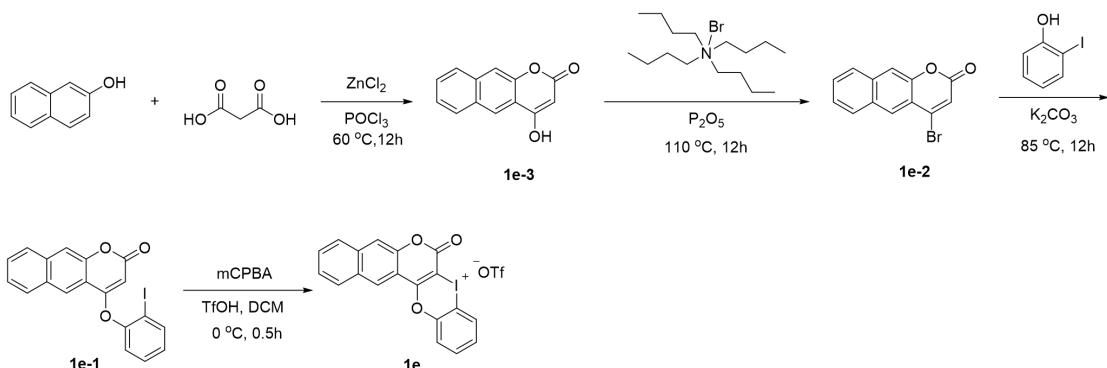
$^1\text{H}$  NMR (400 MHz, DMSO) δ 8.46 (s, 1H), 8.20 (d,  $J$  = 7.7 Hz, 1H), 8.10 (d,  $J$  = 7.6 Hz, 1H), 7.94 (d,  $J$  = 8.1 Hz, 1H), 7.75 (t, 1H), 7.68 (d,  $J$  = 8.8 Hz, 1H), 7.55 (t,  $J$  = 7.3 Hz, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (101 MHz, DMSO) δ 162.7, 156.4, 151.9, 149.9, 135.0, 133.5, 133.3, 129.8, 129.6, 123.0, 122.0, 119.1, 116.2, 97.3, 85.4.  $^{19}\text{F}$  NMR (376 MHz, DMSO) δ -77.73 ppm. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_7\text{O}_3\text{ClI} [\text{M}-\text{OTf}]^+$ : 396.9123, Found: 396.9120.

**2-bromo-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-ium trifluoromethanesulfonate (1d):**  
**1d** was synthesized according to **1b**.



$^1\text{H}$  NMR (400 MHz, DMSO) δ 8.57 (s, 1H), 8.21 (d,  $J$  = 7.8 Hz, 1H), 8.09 (d,  $J$  = 7.9 Hz, 1H), 8.05 (d,  $J$  = 8.5 Hz, 1H), 7.74 (t,  $J$  = 6.7 Hz, 1H), 7.61 (d,  $J$  = 8.7 Hz, 1H), 7.56 (t, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO) δ 162.7, 156.4, 152.3, 149.9, 137.9, 133.5, 133.3, 129.6, 125.8, 122.0, 119.3, 117.6, 116.6, 97.3, 85.3.  $^{19}\text{F}$  NMR (376 MHz, DMSO) δ -77.75 ppm. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_7\text{O}_3\text{BrI} [\text{M}-\text{OTf}]^+$ : 440.8618, Found: 440.8616.

**Synthesis was of 6-oxo-6H-benzo[b]benzo[6,7]chromeno[4,3-e][1,4]iodaoxin-5-ium trifluoromethanesulfonate (1e):**



**4-Hydroxy-2H-benzo[g]chromen-2-one (1e-3):** To naphthalen-2-ol (3.47 mmol, 1 equiv.) in a flask was added malonic acid (4.16 mmol, 51.2 equiv.),  $ZnCl_2$  (10.40 mmol, 3 equiv.),  $POCl_3$  (10.40 mmol, 1 equiv.). The reaction mixture was stirred at  $60^\circ C$  for 12h. The reaction mixture was poured into cold water stirred vigorously, extracted by DCM. The solid was precipitated in MTBE (10 mL). Filtered again to give **1e-3** (640 mg, 87%) as a brown solid.<sup>2</sup>

**4-Bromo-2H-benzo[g]chromen-2-one (1e-2):** To **1e-3** (3.02 mmol, 1 equiv.) in a flask was added tetrabutylammonium bromide (7.54 mmol, 2.5 equiv.),  $P_2O_5$  (9.05 mmol, 3 equiv.), toluene (10 mL), the reaction mixture was stirred at  $110^\circ C$  for 12h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $H_2O$  and brine and dried over anhydrous  $Na_2SO_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **1e-2** (450 mg, 54%) as a brown solid.<sup>3</sup>

**4-(2-Iodophenoxy)-2H-benzo[g]chromen-2-one (1e-1):** To **1e-2** (1.60 mmol, 1 equiv.) in a flask was added 2-iodophenol (2.40 mmol, 2 equiv.),  $K_2CO_3$  (3.20 mmol, 2 equiv.), MeCN (5 mL), the reaction mixture was stirred at  $85^\circ C$  for 12h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $H_2O$  and brine and dried over anhydrous  $Na_2SO_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~1/1) to provide **1e-1** (574 mg, 87%) as a brown solid.

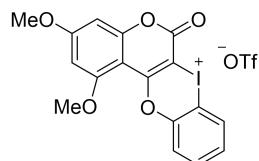
#### 6-oxo-6H-benzo[b]benzo[6,7]

#### chromeno[4,3-e][1,4]iodaoxin-5-iun

**trifluoromethanesulfonate (1e):** To **1e-1** (1.38 mmol, 1 equiv.), in a flask was added DCM (10 mL), *m*CPBA (85%, 2.06 mmol, 1.5 equiv.) and TfOH (4.13 mmol, 3 equiv.) in an ice bath. Half an hour

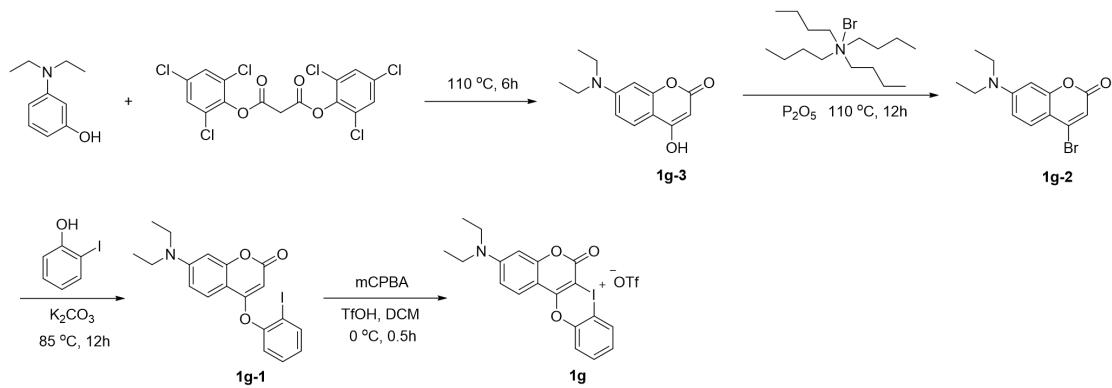
later, the reaction was finished according to TLC, the reaction solution was evaporated in vacuum, and precipitated with ether (10 mL), One hour later, it was filtered and vacuum-dried to obtain **1e** (602 mg, 78%) as a light yellow solid. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.48 (d, J = 8.7 Hz, 1H), 8.45 (d, J = 9.1 Hz, 1H), 8.20 (d, J = 7.9 Hz, 1H), 8.14 (d, J = 9.1 Hz, 1H), 8.04 – 7.95 (m, 2H), 7.82 – 7.70 (m, 3H), 7.59 (t, J = 8.0 Hz, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO) δ 167.9, 156.6, 155.5, 150.8, 137.4, 133.5, 133.4, 130.6, 130.2, 129.8, 127.4, 126.8, 125.2, 122.3, 121.8, 116.9, 108.7, 99.4, 86.4. <sup>19</sup>F NMR (376 MHz, DMSO) δ -77.72 ppm. HRMS (ESI) calcd for C<sub>19</sub>H<sub>10</sub>O<sub>3</sub>I [M-OTf]<sup>+</sup>: 412.9669, Found: 412.9666.

**1,3-dimethoxy-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-i um trifluoromethanesulfonate (1f):** **1f** was synthesized according to **1e**.



<sup>1</sup>H NMR (400 MHz, DMSO) δ 8.06 (d, J = 7.8 Hz, 1H), 7.73 (t, 1H), 7.54 (dt, J = 5.6, 3.3 Hz, 1H), 6.80 (s, 1H), 6.70 (s, 1H), 4.08 (s, 3H), 3.93 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO) δ 166.4, 165.8, 158.9, 157.2, 156.7, 150.9, 133.5, 133.1, 129.3, 122.0, 100.3, 99.4, 96.7, 94.2, 81.8, 57.0, 56.6. <sup>19</sup>F NMR (376 MHz, DMSO) δ -77.74 ppm. HRMS (ESI) calcd for C<sub>17</sub>H<sub>12</sub>IO<sub>5</sub> [M-OTf]<sup>+</sup>: 422.9724, Found: 422.9720.

**Synthesis of 3-(diethylamino)-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-i um trifluoromethanesulfonate (1g):**



**7-(Diethylamino)-4-hydroxy-2H-chromen-2-one (1g-3):** To 3-(diethylamino)phenol (6.05 mmol, 1

equiv.) in a flask was added bis(2,4,6-trichlorophenyl) malonate (7.87 mmol, 1.3 equiv.), toluene (10 mL). The reaction mixture was stirred at 110 °C for 6h. The reaction mixture was filtered and obtained green solid **1g-3** (1.10 g, 78%).<sup>4</sup>

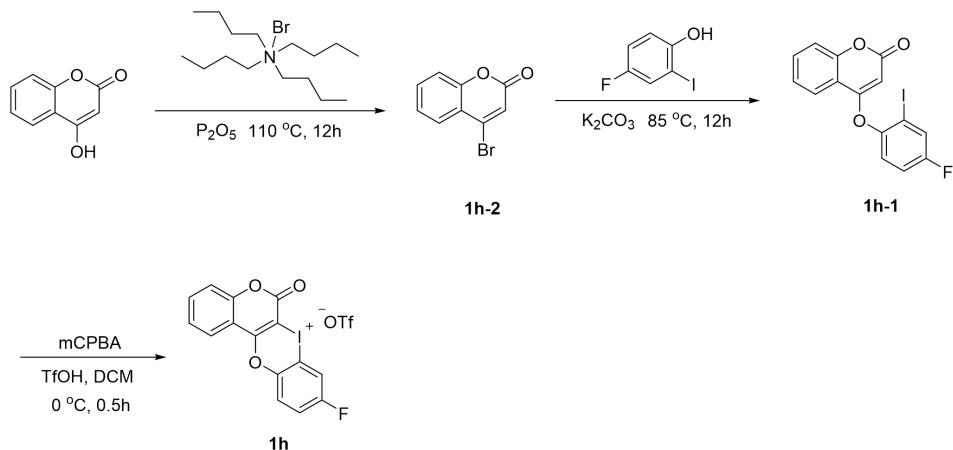
**4-Bromo-7-(diethylamino)-2H-chromen-2-one (1g-2):** To **1g-3** (4.72 mmol, 1 equiv.) in a flask was added tetrabutylammonium bromide (9.43 mmol, 2 equiv.), P<sub>2</sub>O<sub>5</sub> (9.43 mmol, 2 equiv.), toluene (10 mL), the reaction mixture was stirred at 110 °C for 12h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **1g-2** (495 mg, 35%) as a yellow solid.

**7-(Diethylamino)-4-(2-iodophenoxy)-2H-chromen-2-one (1g-1):** To **1g-2** (1.65 mmol, 1 equiv.) in a flask was added 2-iodophenol (2.48 mmol, 1.5 equiv.), K<sub>2</sub>CO<sub>3</sub> (3.31 mmol, 2 equiv.), MeCN (5 mL), the reaction mixture was stirred at 85 °C for 12h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~1/1) to provide **1g-1** (510 mg, 71%) as a yellow solid.

### **3-(diethylamino)-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-iun**

**trifluoromethanesulfonate (1g):** To **1g-1** (1.15 mmol, 1 equiv.), in a flask was added DCM (10 mL), mCPBA (85%, 1.72 mmol, 1.5 equiv.) and TfOH (2.30 mmol, 3 equiv.) in an ice bath. Half an hour later, the reaction was finished according to TLC, the reaction solution was evaporated in vacuum, and precipitated with ether (10 mL), One hour later, it was filtered and vacuum-dried to obtain **1g** (590 mg, 88%) as a light yellow solid. <sup>1</sup>H NMR (400 MHz, DMSO) δ 8.04 (t, *J* = 9.8 Hz, 2H), 7.97 (d, *J* = 8.1 Hz, 1H), 7.72 (t, *J* = 7.8 Hz, 1H), 7.51 (t, *J* = 7.7 Hz, 1H), 6.89 (d, *J* = 9.2 Hz, 1H), 6.71 (s, 1H), 3.51 (q, *J* = 6.8 Hz, 4H), 1.14 (dd, *J* = 13.6, 6.7 Hz, 6H). <sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO) δ 162.9, 156.2, 153.6, 150.0, 147.3, 133.6, 129.7, 125.9, 121.7, 119.1, 117.9, 116.6, 111.1, 97.7, 86.6, 66.4, 48.8, 26.9, 7.8. <sup>19</sup>F NMR (376 MHz, DMSO) δ -77.75 ppm. HRMS (ESI) calcd for C<sub>19</sub>H<sub>17</sub>INO<sub>3</sub> [M-OTf]<sup>+</sup>: 434.0248, Found: 434.0242.

**Synthesis of 9-fluoro-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-ium trifluoromethanesulfonate (1h):**



**4-Bromo-2H-chromen-2-one (1h-2):** To 4-hydroxy-2H-chromen-2-one (12.33 mmol, 1 equiv.) in a flask was added Tetrabutylammonium bromide (18.50 mmol, 1.5 equiv.),  $\text{P}_2\text{O}_5$  (24.67 mmol, 2 equiv.), Toluene (30 mL), the reaction mixture was stirred at  $110^\circ\text{C}$  for 12h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **1h-2** (2.57 g, 93%) as a white solid.

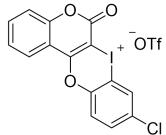
**4-(4-Fluoro-2-iodophenoxy)-2H-chromen-2-one (1h-1):** To **1h-2** (2.22 mmol, 1 equiv.) in a flask was added 4-fluoro-2-iodophenol (2.67 mmol, 1.2 equiv.),  $\text{K}_2\text{CO}_3$  (4.44 mmol, 2 equiv.), MeCN (5 mL), The reaction mixture was stirred at  $85^\circ\text{C}$  for 12h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~1/1) to provide **1h-1** (609 mg, 72%) as a white solid.

**9-fluoro-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-ium trifluoromethanesulfonate (1h):** To **1h-1** (1.57 mmol, 1 equiv.), in a flask was added DCM (10 mL),  $m\text{CPBA}$  (85%, 2.36 mmol, 1.5 equiv.) and  $\text{TfOH}$  (3.14 mmol, 3 equiv.) in an ice bath. Half an hour later, the reaction was finished according to TLC, the reaction solution was evaporated in vacuum, and precipitated with ether (10 mL),

One hour later, it was filtered and vacuum-dried to obtain **1h** (675 mg, 81%) as a light yellow solid. <sup>1</sup>H NMR (400 MHz, DMSO) δ 8.37 (d, J = 7.9 Hz, 1H), 8.13 (dd, J = 9.1, 4.6 Hz, 1H), 7.96 (d, J = 10.7 Hz, 1H), 7.91 (t, J = 7.9 Hz, 1H), 7.74 – 7.55 (m, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO) δ 164.1, 161.3, 158.8, 156.7, 153.3, 146.9, 135.6, 125.6, 123.8, 122.8, 120.6, 117.1, 114.7, 98.2, 84.6. <sup>19</sup>F NMR (376 MHz, DMSO) δ -77.75, -111.98 ppm. HRMS (ESI) calcd for C<sub>15</sub>H<sub>7</sub>O<sub>3</sub>FI [M-OTf]<sup>+</sup>: 380.9418, Found: 380.9415.

**9-chloro-6-oxo-6H-benzo[b]chromeno[4,3-e][1,4]iodaoxin-7-i um trifluoromethanesulfonate (1i):**

**1i** was synthesized according to **1h**.



<sup>1</sup>H NMR (500 MHz, DMSO) δ 8.37 (d, J = 9.3 Hz, 1H), 8.15 (d, J = 2.3 Hz, 1H), 8.09 (d, J = 8.8 Hz, 1H), 7.91 (t, J = 8.6 Hz, 1H), 7.86 (d, J = 8.8 Hz, 1H), 7.65 (d, J = 8.4 Hz, 1H), 7.61 (t, J = 7.7 Hz, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO) δ 163.8, 156.7, 153.2, 149.3, 135.7, 133.3, 132.4, 125.6, 123.9, 122.8, 117.1, 114.7, 98.5, 84.5. <sup>19</sup>F NMR (376 MHz, DMSO) δ -77.74 ppm. HRMS (ESI) calcd for C<sub>15</sub>H<sub>7</sub>ClIO<sub>3</sub> [M-OTf]<sup>+</sup>: 396.9123, Found: 396.9107.

## Synthesis of coumarin derivatives 3, 4

**Representative synthetic procedure A.** To **1** (0.2 mmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (2 equiv.), amine **2** (2 equiv.), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide products.

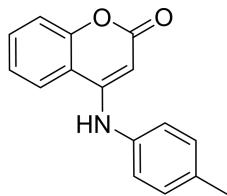
**Representative synthetic procedure B.** To **1** (0.2 mmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (2 equiv.), amine **2** (2 equiv.), MeCN (2 mL). The reaction mixture was stirred at 60 °C under Ar

atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide products.

**Representative synthetic procedure C.** To **1** (0.2 mmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (2 equiv.), amine **2** (2 equiv.), CuI (10 mmol%), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide products.

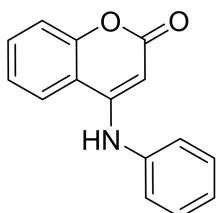
**Representative synthetic procedure D.** To **1** (0.2 mmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (2 equiv.), amine **2** (2 equiv.), CuI (10 mmol%), MeCN (2 mL). The reaction mixture was stirred at 60 °C under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide products.

#### 4-(p-tolylamino)-2H-chromen-2-one (**3a**):



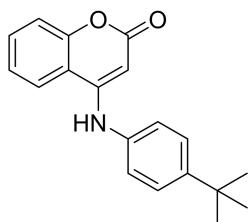
**3a** (48 mg, 99% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.26 (s, 1H), 8.24 (d, *J* = 7.4 Hz, 1H), 7.66 (t, *J* = 7.2 Hz, 1H), 7.40 (d, *J* = 7.6 Hz, 1H), 7.37 (d, *J* = 8.2 Hz, 1H), 7.30 (d, *J* = 8.3 Hz, 2H), 7.25 (d, *J* = 8.3 Hz, 2H), 5.21 (s, 1H), 2.35 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.5, 153.4, 152.8, 135.5, 132. 130.1, 125.3, 123.6, 122.8, 117.1, 114.5, 84.0, 20.7. HRMS (ESI) calcd for C<sub>16</sub>H<sub>13</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 252.1019, Found: 252,1016.

#### 4-(phenylamino)-2H-chromen-2-one (**3b**)



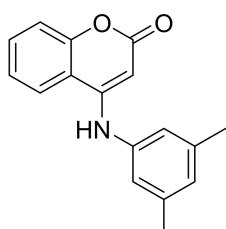
**3b** (37 mg, 80% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.65 (d, *J* = 8.0 Hz, 1H), 7.59 (t, *J* = 7.8 Hz, 1H), 7.48 – 7.41 (m, 2H), 7.38 (d, *J* = 8.3 Hz, 1H), 7.34 (t, *J* = 8.1 Hz, 1H), 7.30 (t, *J* = 7.6 Hz, 3H), 6.73 (s, 1H), 5.74 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.4, 153.4, 152.4, 138.2, 132.4, 129.5, 126.0, 125.1, 123.6, 122.8, 117.0, 114.5, 99.5, 84.4, 54.9. HRMS (ESI) calcd for C<sub>15</sub>H<sub>12</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 238.0863, Found: 238.0858.

#### 4-((4-(tert-butyl)phenyl)amino)-2H-chromen-2-one (**3c**)



**3c** (40 mg, 69% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.27 (s, 1H), 8.24 (d, *J* = 7.7 Hz, 1H), 7.66 (t, *J* = 7.5 Hz, 1H), 7.50 (d, *J* = 8.5 Hz, 2H), 7.39 (dd, *J* = 14.4, 7.8 Hz, 2H), 7.30 (d, *J* = 8.4 Hz, 2H), 5.26 (s, 1H), 1.32 (s, 9H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.8, 153.6, 152.8, 148.8, 135.6, 132.6, 126.4, 124.9, 123.9, 122.8, 117.3, 114.6, 84.2, 34.4, 31.24. HRMS (ESI) calcd for C<sub>19</sub>H<sub>19</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 294.1489, Found: 294.1487.

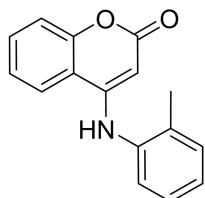
#### 4-((3,5-dimethylphenyl)amino)-2H-chromen-2-one (**3d**)



**3d** (46 mg, 89% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.21 (s, 1H), 8.24 (d, *J* = 7.4 Hz, 1H), 7.65 (t, *J* = 7.3 Hz, 1H), 7.38 (dd, *J* = 12.4, 7.8 Hz, 2H), 6.96 (d, *J* = 19.2 Hz, 3H), 5.30 (s, 1H), 2.31 (s, 5H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO) δ

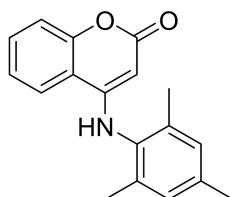
161.5, 153.4, 152.4, 138.8, 138.0, 132.3, 127.5, 123.6, 122.8, 122.6, 117.0, 114.5, 84.3, 20.9. HRMS (ESI) calcd for C<sub>17</sub>H<sub>15</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 266.1176, Found: 266.1171.

**4-(o-tolylamino)-2H-chromen-2-one (3e)**



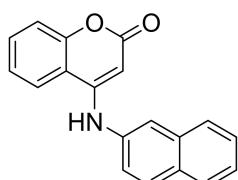
**3e** (30 mg, 61% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.67 (d, *J* = 8.0 Hz, 1H), 7.59 (t, *J* = 7.8 Hz, 1H), 7.40 – 7.30 (m, 3H), 7.26 (m, 3H), 6.60 (s, 1H), 5.20 (s, 1H), 2.27 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 163.2, 154.1, 152.4, 135.6, 135.1, 132.2, 131.6, 128.1, 127.5, 127.3, 123.8, 120.4, 118.2, 114.4, 86.9, 17.8. HRMS (ESI) calcd for C<sub>16</sub>H<sub>13</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 252.1019, Found: 252.1023.

**4-(mesitylamino)-2H-chromen-2-one (3f)**



**3f** (9 mg, 17% yield) was obtained according to the general procedure **C** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (500 MHz, DMSO) δ 9.08 (s, 1H), 8.27 (d, *J* = 6.5 Hz, 1H), 7.66 (d, 1H), 7.38 (t, 2H), 7.05 (s, 2H), 4.39 (s, 1H), 2.29 (s, 3H), 2.12 (s, 6H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO) δ 161.50, 153.48, 153.0, 137.1, 135.6, 132.3, 132.0, 129.2, 123.6, 122.6, 117.1, 114.2, 82.2, 20.6, 17.3. HRMS (ESI) calcd for C<sub>17</sub>H<sub>15</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 280.1332, Found: 280.1324.

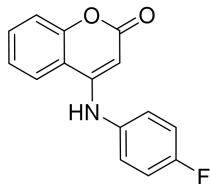
**4-(naphthalen-2-ylamino)-2H-chromen-2-one (3g)**



**3g** (53 mg, 94% yield) was obtained according to the general procedure **C** as a green solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.91 (d, *J* = 8.6 Hz, 1H), 7.87 (d, *J* = 8.5 Hz, 1H), 7.81 (d, *J* = 6.9 Hz, 1H), 7.75 (d, *J* = 1.6

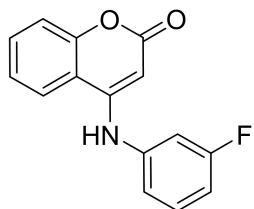
Hz, 1H), 7.69 (d,  $J$  = 8.2 Hz, 1H), 7.61 (t,  $J$  = 7.2 Hz, 1H), 7.57 – 7.49 (m, 2H), 7.42 (dd,  $J$  = 8.5, 2.6 Hz, 2H), 7.36 (t,  $J$  = 7.6 Hz, 1H), 6.82 (s, 1H), 5.87 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  161.5, 153.4, 152.3, 135.9, 133.5, 132.4, 131.0, 129.3, 127.7, 127.5, 126.8, 125.9, 124.0, 123.7, 122.9, 122.0, 117.1, 114.6, 84.8. HRMS (ESI) calcd for  $\text{C}_{19}\text{H}_{13}\text{NO}_2$  [M+H] $^+$ : 288.1019, Found: 288.1016.

**4-((4-fluorophenyl)amino)-2H-chromen-2-one (3h)**



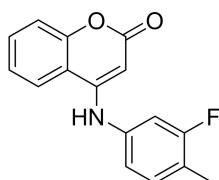
**3h** (34 mg, 67% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  9.23 (s, 1H), 8.16 (d,  $J$  = 7.8 Hz, 1H), 7.60 (t, 1H), 7.38 – 7.31 (m, 3H), 7.26 (t,  $J$  = 8.8 Hz, 2H), 5.12 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)  $\delta$  161.4, 160.9, 159.0, 153.4, 152.8, 134.4, 132.4, 127.6, 123.6, 122.75, 117.1, 116.4, 116.3, 114.4, 84.3.  $^{19}\text{F}$  NMR (376 MHz, DMSO)  $\delta$  -115.8 ppm. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{11}\text{NO}_2\text{F}$  [M+H] $^+$ : 256.0768, Found: 256.0766.

**4-((3-fluorophenyl)amino)-2H-chromen-2-one (3i)**



**3i** (41 mg, 82% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1.  $^1\text{H}$  NMR (500 MHz, DMSO)  $\delta$  9.37 (s, 1H), 8.21 (d,  $J$  = 7.3 Hz, 1H), 7.68 (t,  $J$  = 7.8 Hz, 1H), 7.55 – 7.48 (q, 1H), 7.44 – 7.37 (m, 2H), 7.26 (m,  $J$  = 8.5, 3.9 Hz, 2H), 7.12 (t,  $J$  = 8.9 Hz, 1H), 5.45 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)  $\delta$  163.5, 161.5, 153.4, 151.9, 140.3, 132.5, 131.2, 123.7, 122.9, 120.6, 117.1, 114.5, 112.4, 111.6, 85.7.  $^{19}\text{F}$  NMR (376 MHz, DMSO)  $\delta$  -111.42 ppm. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{10}\text{FNO}_2$  [M+H] $^+$ : 256.0768, Found: 256.0767.

**4-((3-fluoro-4-methylphenyl)amino)-2H-chromen-2-one (3j)**



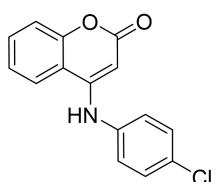
**3j** (46 mg, 88% yield) was obtained according to the general procedure C as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.60 (dd, *J* = 15.8, 7.7 Hz, 2H), 7.38 (d, *J* = 8.1 Hz, 1H), 7.33 (t, *J* = 7.7 Hz, 1H), 7.23 (d, *J* = 7.9 Hz, 1H), 7.03 – 6.93 (m, 2H), 6.65 (s, 1H), 5.73 (s, 1H), 2.30 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.9, 161.4, 153.4, 152.2, 137.6, 132.4, 132.2, 123.7, 122.8, 121.8, 120.7, 117.1, 114.4, 111.8, 111.6, 85.0, 13.84. <sup>19</sup>F NMR (376 MHz, DMSO) δ -115.40, -116.41, -119.48 ppm. HRMS (ESI) calcd for C<sub>16</sub>H<sub>13</sub>NO<sub>2</sub>F [M+H]<sup>+</sup>: 270.0925, Found: 270.0923.

#### 4-((2-fluorophenyl)amino)-2H-chromen-2-one (**3k**)



**3k** (24 mg, 48% yield) was obtained according to the general procedure A as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.30 (s, 1H), 8.24 (d, *J* = 7.9 Hz, 1H), 7.68 (t, *J* = 7.5 Hz, 1H), 7.53 – 7.29 (m, 7H), 4.87 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO) δ 161.3, 158.0, 156.0, 153.3, 152.8, 132.5, 129.1, 125.4, 123.8, 122.8, 117.1, 116.9, 116.7, 114.2, 85.1. <sup>19</sup>F NMR (376 MHz, DMSO) δ -120.39 ppm. HRMS (ESI) calcd for C<sub>16</sub>H<sub>13</sub>NO<sub>2</sub>F [M+H]<sup>+</sup>: 256.0768, Found: 256.0765.

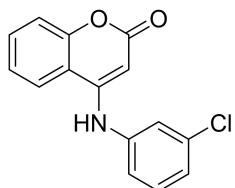
#### 4-((4-chlorophenyl)amino)-2H-chromen-2-one (**3l**)



**3l** (48 mg, 90% yield) was obtained according to the general procedure A as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.32 (s, 1H), 8.22 (d, *J* = 7.8 Hz, 1H), 7.67 (s, 1H), 7.53 (d, *J* = 8.6 Hz, 2H), 7.40 (dd, *J* = 12.1, 8.4 Hz, 4H), 5.35 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO) δ 161.4, 153.4, 152.1, 137.3,

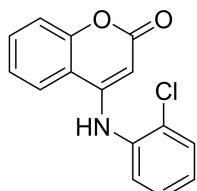
132.4, 129.7, 129.5, 126.5, 123.6, 122.8, 117.1, 114.4, 85.0. HRMS (ESI) calcd for C<sub>15</sub>H<sub>10</sub>ClNO<sub>2</sub> [M+H]<sup>+</sup>: 272.0473, Found: 272.0469.

**4-((3-chlorophenyl)amino)-2H-chromen-2-one (3m)**



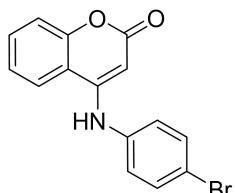
**3m** (30 mg, 57% yield) was obtained according to the general procedure A as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.33 (s, 1H), 8.20 (d, *J* = 7.8 Hz, 1H), 7.67 (t, 1H), 7.50 (d, *J* = 8.1 Hz, 1H), 7.46 (d, 1H), 7.40 (t, *J* = 7.2 Hz, 3H), 7.34 (d, *J* = 7.9 Hz, 1H), 5.42 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO) δ 161.6, 153.5, 152.2, 140.1, 133.8, 132.7, 131.3, 125.7, 124.5, 123.9, 123.4, 122.9, 117.2, 114.5, 85.7. HRMS (ESI) calcd for C<sub>15</sub>H<sub>10</sub>ClNO<sub>2</sub> [M+H]<sup>+</sup>: 272.0473, Found: 272.0471.

**4-((2-chlorophenyl)amino)-2H-chromen-2-one (3n)**



**3n** (16 mg, 30% yield) was obtained according to the general procedure C as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.43 (s, 1H), 8.26 (d, *J* = 8.1 Hz, 1H), 7.68 (t, *J* = 7.8 Hz, 2H), 7.52 (dd, *J* = 4.2, 1.8 Hz, 2H), 7.49 – 7.44 (m, 1H), 7.40 (t, *J* = 7.4 Hz, 2H), 4.64 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.2, 153.3, 152.9, 135.0, 132.5, 131.4, 130.5, 130.1, 129.4, 128.7, 123.8, 122.8, 117.1, 114.1, 84.8. HRMS (ESI) calcd for C<sub>15</sub>H<sub>11</sub>NO<sub>2</sub>Cl [M+H]<sup>+</sup>: 272.0473, Found: 272.0470.

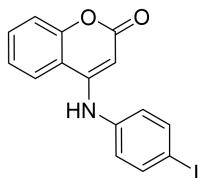
**4-((4-bromophenyl)amino)-2H-chromen-2-one (3o)**



**3o** (34 mg, 55% yield) was obtained according to the general procedure A as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.31 (s, 1H), 8.22 (d, *J* = 7.8 Hz, 1H), 7.66 (d, *J* = 8.2 Hz, 3H), 7.46 – 7.30 (m, 4H),

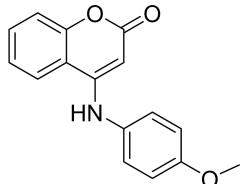
5.37 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  161.3, 153.4, 152.0, 137.8, 132.5, 132.4, 126.8, 123.7, 122.8, 117.9, 117.1, 114.4, 85.1. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{10}\text{BrNO}_2$  [M+H] $^+$ : 315.9968, Found: 315.9966.

**4-((4-iodophenyl)amino)-2H-chromen-2-one (3p)**



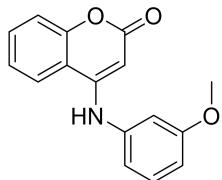
**3p** (41 mg, 58% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  9.30 (s, 1H), 8.21 (d,  $J$  = 7.8 Hz, 1H), 7.81 (d,  $J$  = 8.4 Hz, 2H), 7.66 (t,  $J$  = 7.5 Hz, 1H), 7.40 (dd,  $J$  = 12.7, 7.9 Hz, 2H), 7.21 (d,  $J$  = 8.5 Hz, 2H), 5.39 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  161.3, 153.4, 151.9, 138.2, 132.4, 126.8, 123.6, 122.8, 117.1, 114.5, 90.2, 85.2. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{10}\text{INO}_2$  [M+H] $^+$ : 363.9829, Found: 363.9825.

**4-((4-methoxyphenyl)amino)-2H-chromen-2-one (3q)**



**3q** (47 mg, 89% yield) was obtained according to the general procedure **C** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.62 (d,  $J$  = 8.0 Hz, 1H), 7.58 (t,  $J$  = 7.8 Hz, 1H), 7.38 (d,  $J$  = 8.1 Hz, 1H), 7.32 (t,  $J$  = 7.7 Hz, 1H), 7.21 (d,  $J$  = 8.8 Hz, 2H), 6.96 (d,  $J$  = 8.8 Hz, 2H), 6.61 (s, 1H), 5.51 (s, 2H), 3.85 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  158.5, 154.0, 152.9, 132.2, 130.0, 127.2, 123.8, 120.4, 118.1, 115.1, 114.5, 86.4, 55.7. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{13}\text{NO}_3$  [M+H] $^+$ : 268.0968, Found: 268.0966.

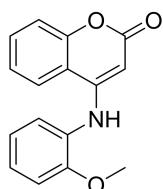
**4-((3-methoxyphenyl)amino)-2H-chromen-2-one (3r)**



**3r** (41 mg, 79% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400

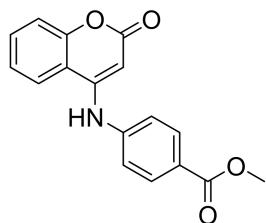
MHz, DMSO) δ 9.27 (s, 1H), 8.23 (d,  $J$  = 8.0 Hz, 1H), 7.66 (t,  $J$  = 7.9 Hz, 1H), 7.39 (dd,  $J$  = 13.4, 5.3 Hz, 3H), 6.99 – 6.91 (m, 2H), 6.88 (d,  $J$  = 8.2 Hz, 1H), 5.37 (s, 1H), 3.79 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO) δ 161.5, 160.1, 153.4, 152.3, 139.5, 132.4, 130.3, 123.6, 122.8, 117.0, 114.5, 111.5, 110.6, 84.9, 55.3. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{13}\text{NO}_3$  [M+H] $^+$ : 268.0968, Found: 268.0967.

**4-((2-methoxyphenyl)amino)-2H-chromen-2-one (3s)**



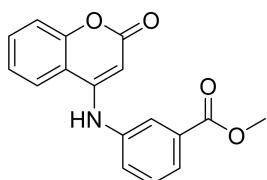
**3s** (27 mg, 52% yield) was obtained according to the general procedure C as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO) δ 9.04 (s, 1H), 8.25 (d,  $J$  = 7.7 Hz, 1H), 7.65 (t,  $J$  = 7.6 Hz, 1H), 7.38 (dd,  $J$  = 14.5, 7.8 Hz, 3H), 7.31 (d,  $J$  = 7.2 Hz, 1H), 7.21 (d,  $J$  = 8.1 Hz, 1H), 7.07 (t,  $J$  = 7.7 Hz, 1H), 4.72 (s, 1H), 3.80 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO) δ 161.5, 154.6, 153.3, 153.2, 132.3, 128.8, 128.5, 125.8, 123.6, 122.8, 121.0, 117.0, 114.4, 112.6, 83.9, 55.6. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{13}\text{NO}_3$  [M+H] $^+$ : 268.0968, Found: 268.0964.

**methyl 4-((2-oxo-2H-chromen-4-yl)amino)benzoate (3t)**



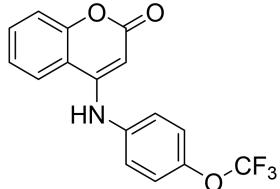
**3t** (44 mg, 57% yield) was obtained according to the general procedure A as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ ) δ 8.10 (d,  $J$  = 8.6 Hz, 2H), 7.66 (d,  $J$  = 7.9 Hz, 1H), 7.61 (t,  $J$  = 7.8 Hz, 1H), 7.36 (m,  $J$  = 8.6 Hz, 4H), 6.84 (s, 1H), 5.98 (s, 1H), 3.94 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO) δ 165.7, 161.3, 153.4, 151.1, 143.4, 132.6, 130.7, 125.6, 123.7, 123.0, 117.1, 114.6, 99.5, 87.2, 52.1. HRMS (ESI) calcd for  $\text{C}_{17}\text{H}_{13}\text{NO}_4$  [M+H] $^+$ : 296.0917, Found: 296.0916.

**methyl 3-((2-oxo-2H-chromen-4-yl)amino)benzoate (3u)**



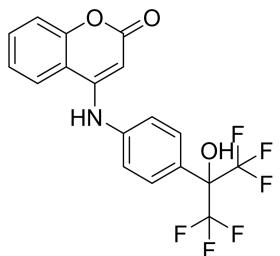
**3u** (44 mg, 76% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.97 – 7.95 (m, 1H), 7.65 (d, *J* = 8.1 Hz, 1H), 7.60 (t, *J* = 7.8 Hz, 1H), 7.54 – 7.51 (m, 2H), 7.39 (d, *J* = 7.7 Hz, 1H), 7.35 (t, *J* = 7.7 Hz, 1H), 5.73 (s, 1H), 3.94 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 166.3, 163.0, 154.0, 151.6, 138.0, 132.5, 132.1, 130.0, 129.1, 127.6, 125.8, 124.0, 120.4, 118.2, 114.4, 87.8, 52.6. HRMS (ESI) calcd for C<sub>17</sub>H<sub>13</sub>NO<sub>4</sub> [M+H]<sup>+</sup>: 296.0917, Found: 296.0915.

#### 4-((4-(trifluoromethoxy)phenyl)amino)-2H-chromen-2-one (**3v**)



**3v** (47 mg, 74% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.35 (s, 1H), 8.22 (d, *J* = 7.9 Hz, 1H), 7.68 (t, *J* = 7.6 Hz, 1H), 7.50 (q, *J* = 8.9 Hz, 4H), 7.41 (dd, *J* = 14.5, 7.9 Hz, 2H), 5.37 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.5, 153.4, 152.3, 145.6, 137.6, 132.6, 126.6, 123.8, 122.9, 122.4, 117.2, 114.5, 99.6, 85.1. <sup>19</sup>F NMR (376 MHz, DMSO) δ -56.96 ppm. HRMS (ESI) calcd for C<sub>16</sub>H<sub>9</sub>NO<sub>3</sub>F<sub>3</sub> [M+H]<sup>+</sup>: 322.0686, Found: 322.0684

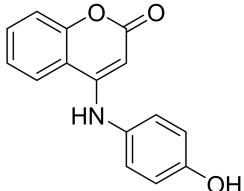
#### 4-((4-(1,1,1,3,3-hexafluoro-2-hydroxypropan-2-yl)phenyl)amino)-2H-chromen-2-one (**3w**)



**3w** (36 mg, 46% yield) was obtained according to the general procedure **C** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.42 (s, 1H), 8.79 (d, *J* = 13.2 Hz, 1H), 8.24 (d, *J* = 7.9 Hz, 1H), 7.77 (d, *J* = 8.3 Hz, 2H), 7.68 (t, *J* = 7.6 Hz, 1H), 7.55 (d, *J* = 8.5 Hz, 2H), 7.41 (dd, *J* = 13.9, 7.8 Hz, 2H), 5.50 (s, 1H),

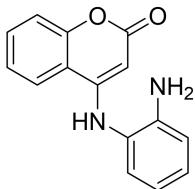
3.07 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  161.4, 153.4, 151.7, 140.3, 132.6, 128.2, 127.3, 124.1, 123.7, 123.0, 117.1, 114.5, 85.7, 26.8.  $^{19}\text{F}$  NMR (376 MHz, DMSO)  $\delta$  -73.76, -73.95 ppm. HRMS (ESI) calcd for  $\text{C}_{18}\text{H}_{11}\text{F}_6\text{NO}_3$  [ $\text{M}+\text{H}]^+$ : 404.0716, Found: 404.0714.

#### 4-((4-hydroxyphenyl)amino)-2H-chromen-2-one (3x)



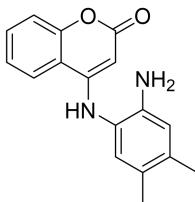
**3x** (49 mg, 99% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  9.62 (s, 1H), 9.15 (s, 1H), 8.21 (d,  $J$  = 7.8 Hz, 1H), 7.64 (t,  $J$  = 7.6 Hz, 1H), 7.37 (d,  $J$  = 4.4 Hz, 2H), 7.15 (d,  $J$  = 8.3 Hz, 2H), 6.87 (d,  $J$  = 8.4 Hz, 2H), 5.04 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  161.9, 156.0, 153.7, 153.5, 132.5, 129.1, 127.6, 123.8, 122.8, 117.2, 116.2, 114.6, 83.4. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{11}\text{NO}_3$  [ $\text{M}+\text{H}]^+$ : 254.0812, Found: 254.0807.

#### 4-((2-aminophenyl)amino)-2H-chromen-2-one (3y)



**3y** (48 mg, 96% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  8.95 (s, 1H), 8.24 (d,  $J$  = 8.0 Hz, 1H), 7.63 (t,  $J$  = 8.4 Hz, 1H), 7.37 (dd,  $J$  = 13.5, 7.5 Hz, 2H), 7.09 (t,  $J$  = 8.3 Hz, 1H), 7.02 (d,  $J$  = 7.7 Hz, 1H), 6.83 (d,  $J$  = 9.1 Hz, 1H), 6.63 (t,  $J$  = 7.5 Hz, 1H), 5.10 (s, 2H), 4.66 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)  $\delta$  161.8, 153.4, 153.1, 144.9, 132.0, 128.4, 123.4, 123.3, 121.5, 116.9, 116.3, 115.6, 114.8, 83.7. HRMS (ESI) calcd for  $\text{C}_{15}\text{H}_{12}\text{N}_2\text{O}_2$  [ $\text{M}+\text{H}]^+$ : 253.0972, Found: 253.0968.

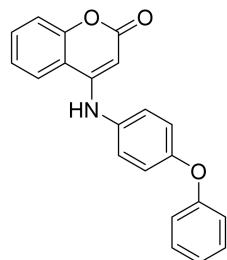
#### 4-((2-amino-4,5-dimethylphenyl)amino)-2H-chromen-2-one (3z)



**3z** (59 mg, 99% yield) was obtained according to the general procedure **A** as a light yellow solid. The

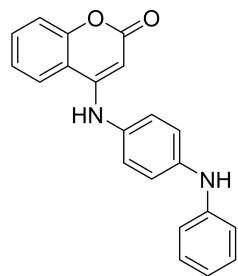
crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (500 MHz, DMSO) δ 8.86 (s, 1H), 8.24 (d, *J* = 7.8 Hz, 1H), 7.62 (t, *J* = 7.4 Hz, 1H), 7.35 (dd, *J* = 15.3, 7.9 Hz, 2H), 6.78 (s, 1H), 6.63 (s, 1H), 4.78 (s, 2H), 4.66 (s, 1H), 2.14 (s, 3H), 2.10 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.7, 153.4, 153.2, 142.3, 136.0, 131.9, 128.8, 123.9, 123.3, 123.2, 119.2, 117.0, 116.8, 114.8, 83.5, 19.3, 18.3. HRMS (ESI) calcd for C<sub>17</sub>H<sub>16</sub>N<sub>2</sub>O<sub>2</sub> [M+H]<sup>+</sup>: 281.1285, Found: 281.1282.

#### **4-((4-phenoxyphenyl)amino)-2H-chromen-2-one (3aa)**



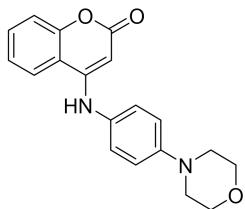
**3aa** (34 mg, 53% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.20 (s, 1H), 8.31 (s, 1H), 8.23 (d, *J* = 7.9 Hz, 1H), 7.65 (t, *J* = 7.7 Hz, 1H), 7.38 (dd, *J* = 12.9, 7.9 Hz, 2H), 7.26 (t, 2H), 7.22 (d, *J* = 9.0 Hz, 2H), 7.17 (d, *J* = 8.8 Hz, 2H), 7.12 (d, *J* = 7.9 Hz, 2H), 6.85 (t, *J* = 7.2 Hz, 1H), 5.16 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.5, 153.4, 153.1, 143.1, 141.9, 132.3, 129.4, 129.2, 126.8, 123.5, 122.7, 120.0, 117.1, 117.0, 114.5, 83.4. HRMS (ESI) calcd for C<sub>21</sub>H<sub>15</sub>NO<sub>3</sub> [M+H]<sup>+</sup>: 330.1125, Found: 330.1123.

#### **4-((4-(phenylamino)phenyl)amino)-2H-chromen-2-one (3ab)**



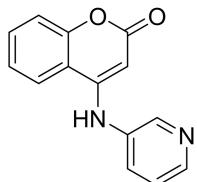
**3ab** (50 mg, 78% yield) was obtained according to the general procedure **C** as a light black solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.28 (s, 1H), 8.24 (s, 1H), 7.66 (s, 1H), 7.40 (m, 6H), 7.24 – 7.04 (m, 5H), 5.25 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO) δ 161.6, 156.7, 154.7, 153.4, 153.0, 133.4, 132.5, 130.2, 127.3, 123.7, 122.8, 119.6, 118.8, 117.2, 114.5, 84.2. HRMS (ESI) calcd for C<sub>21</sub>H<sub>16</sub>N<sub>2</sub>O<sub>2</sub> [M+H]<sup>+</sup>: 329.1285, Found: 329.1281.

**4-((4-morpholinophenyl)amino)-2H-chromen-2-one (3ac)**



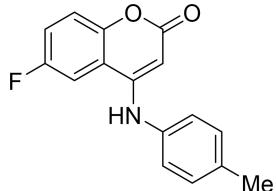
**3ac** (33 mg, 37% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (500 MHz, DMSO) δ 9.19 (s, 1H), 8.23 (d, *J* = 7.9 Hz, 1H), 7.64 (t, *J* = 7.7 Hz, 1H), 7.37 (dd, *J* = 15.3, 7.9 Hz, 2H), 7.22 (d, *J* = 8.5 Hz, 2H), 7.04 (d, *J* = 8.5 Hz, 2H), 5.10 (s, 1H), 3.75 (s, 4H), 3.14 (s, 4H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 162.1, 153.8, 153.7, 149.9, 132.8, 129.6, 127.0, 124.1, 123.1, 117.5, 116.1, 114.9, 83.8, 66.5, 48.8. HRMS (ESI) calcd for C<sub>19</sub>H<sub>18</sub>N<sub>2</sub>O<sub>3</sub> [M+H]<sup>+</sup>: 323.1390, Found: 323.1388.

**4-(pyridin-3-ylamino)-2H-chromen-2-one (3ad)**



**3ad** (33 mg, 71% yield) was obtained according to the general procedure **C** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.39 (s, 1H), 8.62 (s, 1H), 8.49 (d, *J* = 4.2 Hz, 1H), 8.23 (d, *J* = 8.1 Hz, 1H), 7.86 (d, *J* = 8.2 Hz, 1H), 7.69 (t, *J* = 7.8 Hz, 1H), 7.52 (dd, *J* = 8.1, 4.8 Hz, 1H), 7.42 (dd, *J* = 15.8, 8.0 Hz, 2H), 5.30 (s, 1H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.4, 153.4, 152.5, 146.8, 146.4, 135.2, 132.6, 132.5, 124.3, 123.8, 122.9, 117.2, 114.4, 85.2. HRMS (ESI) calcd for C<sub>14</sub>H<sub>11</sub>N<sub>2</sub>O<sub>2</sub> [M+H]<sup>+</sup>: 239.0815, Found: 239.0812.

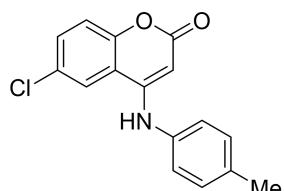
**6-fluoro-4-(p-tolylamino)-2H-chromen-2-one (3ae)**



**3ae** (51 mg, 99% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400

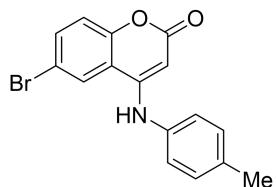
MHz, DMSO) δ 9.20 (s, 1H), 8.14 (dd,  $J = 10.0, 2.9$  Hz, 1H), 7.57 – 7.51 (m, 1H), 7.43 (dd,  $J = 9.1, 4.8$  Hz, 1H), 7.30 (d,  $J = 8.2$  Hz, 2H), 7.25 (d,  $J = 8.4$  Hz, 2H), 5.26 (s, 1H), 2.35 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO) δ 161.4, 159.1, 156.7, 152.0, 149.8, 135.6, 135.3, 130.1, 125.1, 119.7, 119.1, 108.9, 108.7, 84.4, 20.6. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{12}\text{FNO}_2$  [M+H] $^+$ : 270.0925, Found: 270.0921.

**6-chloro-4-(p-tolylamino)-2H-chromen-2-one (3af)**



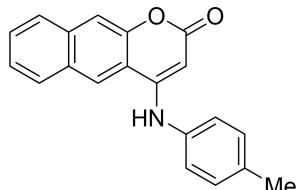
**3af** (44 mg, 84% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO) δ 9.30 (s, 1H), 8.39 (s, 1H), 7.69 (d,  $J = 7.6$  Hz, 1H), 7.42 (s, 1H), 7.27 (d,  $J = 13.1$  Hz, 4H), 5.26 (s, 1H), 2.34 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO) δ 161.2, 152.1, 151.7, 135.6, 135.3, 132.0, 130.1, 127.9, 125.0, 122.5, 119.1, 116.0, 84.5, 20.7. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{12}\text{ClNO}_2$  [M+H] $^+$ : 286.0629, Found: 286.0627.

**6-bromo-4-(p-tolylamino)-2H-chromen-2-one (3ag)**



**3ag** (48 mg, 87% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO) δ 9.30 (s, 1H), 8.51 (s, 1H), 7.81 (d,  $J = 7.5$  Hz, 1H), 7.35 (d,  $J = 8.8$  Hz, 1H), 7.27 (dd,  $J = 21.4, 8.1$  Hz, 4H), 5.26 (s, 1H), 2.34 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO) δ 161.1, 152.5, 151.7, 135.6, 135.3, 134.8, 130.1, 125.4, 125.0, 119.4, 116.4, 115.7, 84.4, 20.7. HRMS (ESI) calcd for  $\text{C}_{16}\text{H}_{12}\text{BrNO}_2$  [M+H] $^+$ : 330.0124, Found: 330.0122.

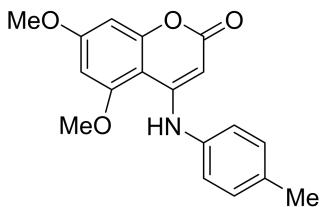
**4-(p-tolylamino)-2H-benzo[g]chromen-2-one (3ah)**



**3ah** (46 mg, 86% yield) was obtained according to the general procedure **A** as a light yellow solid. The

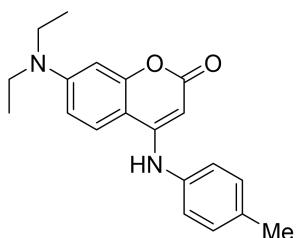
crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.71 (d, *J* = 8.7 Hz, 1H), 7.97 (d, *J* = 8.7 Hz, 2H), 7.65 (t, *J* = 7.6 Hz, 1H), 7.59 – 7.54 (t, 1H), 7.45 (d, *J* = 9.0 Hz, 1H), 7.28 (s, 1H), 7.19 (d, *J* = 8.2 Hz, 2H), 7.03 (s, 1H), 5.79 (s, 1H), 2.40 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.1, 152.5, 151.7, 135.6, 135.3, 134.8, 130.1, 125.4, 125.0, 119.4, 116.4, 115.7, 84.4, 20.7. HRMS (ESI) calcd for C<sub>20</sub>H<sub>16</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 302.1176, Found: 302.1173.

**5,7-dimethoxy-4-(p-tolylamino)-2H-chromen-2-one (3ai)**



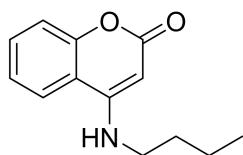
**3ai** (37 mg, 67% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 8.85 (s, 1H), 7.21 (d, *J* = 7.9 Hz, 2H), 7.15 (d, *J* = 8.0 Hz, 2H), 6.48 (s, 1H), 6.35 (s, 1H), 3.98 (s, 3H), 3.86 (s, 3H), 2.37 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 163.2, 162.6, 158.3, 157.6, 155.2, 136.6, 135.1, 130.3, 125.7, 95.5, 94.5, 82.0, 56.7, 55.9, 21.2. HRMS (ESI) calcd for C<sub>18</sub>H<sub>17</sub>NO<sub>4</sub> [M+H]<sup>+</sup>: 312.1230, Found: 312.1225.

**7-(diethylamino)-4-(p-tolylamino)-2H-chromen-2-one (3aj)**



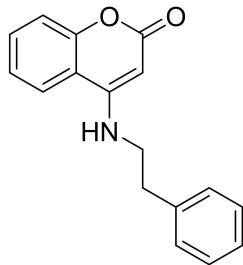
**3aj** (41 mg, 75% yield) was obtained according to the general procedure **A** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.40 (d, *J* = 9.0 Hz, 1H), 7.19 (d, *J* = 8.1 Hz, 2H), 7.14 (d, *J* = 8.2 Hz, 2H), 6.59 (d, *J* = 9.0 Hz, 1H), 6.55 (s, 1H), 6.50 (d, *J* = 2.4 Hz, 1H), 3.41 (q, *J* = 7.1 Hz, 4H), 2.36 (s, 3H), 1.21 (t, *J* = 7.1 Hz, 6H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>) δ 164.4, 156.3, 152.8, 150.8, 136.0, 135.4, 130.2, 124.8, 121.6, 108.2, 102.7, 98.4, 82.9, 44.8, 21.1, 12.6. HRMS (ESI) calcd for C<sub>20</sub>H<sub>22</sub>N<sub>2</sub>O<sub>2</sub> [M+H]<sup>+</sup>: 323.1754, Found: 323.1751.

**4-(butylamino)-2H-chromen-2-one (4a)**



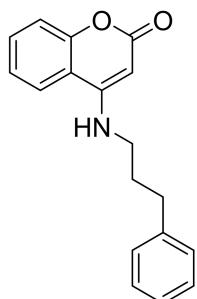
**4a** (32 mg, 75% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.51 (t, *J* = 7.8 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.32 (d, *J* = 8.3 Hz, 1H), 7.24 (t, 1H), 5.31 (s, 1H), 5.21 (s, 1H), 3.27 (dd, *J* = 12.6, 7.0 Hz, 2H), 1.76 – 1.68 (m, 2H), 1.51 – 1.42 (m, 2H), 0.98 (t, *J* = 7.4 Hz, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 163.4, 153.8, 153.0, 131.9, 123.5, 120.1, 118.1, 114.4, 83.9, 43.0, 30.6, 20.4, 13.9. HRMS (ESI) calcd for C<sub>13</sub>H<sub>15</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 218.1178, Found: 218.1176.

#### **4-(phenethylamino)-2H-chromen-2-one (4b)**



**4b** (39 mg, 75% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.44 (t, *J* = 7.7 Hz, 1H), 7.27 (dd, *J* = 13.3, 5.6 Hz, 3H), 7.22 (d, *J* = 3.3 Hz, 1H), 7.20 (d, *J* = 2.7 Hz, 1H), 7.15 (dd, *J* = 14.5, 7.1 Hz, 3H), 5.32 (s, 1H), 3.49 (dd, *J* = 12.5, 6.9 Hz, 2H), 2.97 (t, *J* = 7.0 Hz, 2H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 163.2, 153.8, 152.7, 138.0, 132.0, 129.2, 128.8, 127.2, 123.6, 120.0, 118.1, 114.3, 84.3, 44.0, 34.4. HRMS (ESI) calcd for C<sub>17</sub>H<sub>16</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 266.1176, Found: 266.1172.

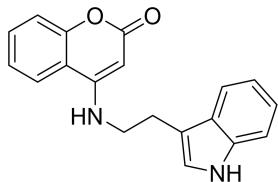
#### **4-((3-phenylpropyl)amino)-2H-chromen-2-one (4c)**



**4c** (13 mg, 24% yield) was obtained according to the general procedure **D** as a light yellow solid. The

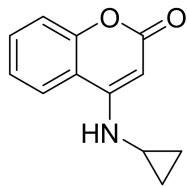
crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  8.06 (d,  $J$  = 7.1 Hz, 1H), 7.65 (t,  $J$  = 5.1 Hz, 1H), 7.58 (t,  $J$  = 7.1 Hz, 1H), 7.34 – 7.27 (m, 4H), 7.24 (d,  $J$  = 6.8 Hz, 2H), 7.18 (t,  $J$  = 7.1 Hz, 1H), 5.11 (s, 1H), 3.26 (dd,  $J$  = 12.9, 6.8 Hz, 2H), 2.73 – 2.65 (m, 2H), 2.00 – 1.88 (m, 2H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)  $\delta$  161.6, 153.2, 153.1, 141.6, 131.9, 128.4, 125.9, 123.3, 122.5, 117.0, 114.5, 81.3, 41.9, 32.6, 29.2. HRMS (ESI) calcd for  $\text{C}_{18}\text{H}_{17}\text{NO}_2$  [M+H] $^+$ : 280.1332, Found: 280.1329.

**4-((2-(1H-indol-3-yl)ethyl)amino)-2H-chromen-2-one (4d)**



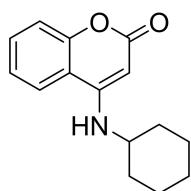
**4d** (20 mg, 33% yield) was obtained according to the general procedure **D** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  10.86 (s, 1H), 8.05 (d,  $J$  = 7.3 Hz, 1H), 7.77 (t,  $J$  = 5.3 Hz, 1H), 7.59 (t,  $J$  = 7.7 Hz, 1H), 7.56 (d, 1H), 7.33 (m,  $J$  = 15.4, 8.1 Hz, 3H), 7.26 (s, 1H), 7.07 (t,  $J$  = 7.8 Hz, 1H), 6.98 (t,  $J$  = 7.4 Hz, 1H), 5.23 (s, 1H), 3.54 (q,  $J$  = 13.9, 6.5 Hz, 2H), 3.07 (t,  $J$  = 7.4 Hz, 2H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  161.6, 153.1, 153.1, 136.2, 131.9, 127.2, 123.3, 123.0, 122.5, 121.0, 118.4, 118.1, 117.0, 114.5, 111.5, 111.4, 81.3, 43.2, 23.5. HRMS (ESI) calcd for  $\text{C}_{19}\text{H}_{16}\text{N}_2\text{O}_2$  [M+H] $^+$ : 305.1285, Found: 305.1282.

**4-(cyclopropylamino)-2H-chromen-2-one (4e)**



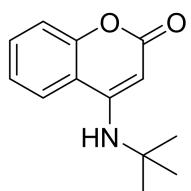
**4e** (10 mg, 24% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.51 (t,  $J$  = 7.8 Hz, 1H), 7.47 (d,  $J$  = 11.7 Hz, 1H), 7.31 (d,  $J$  = 8.2 Hz, 1H), 7.23 (t,  $J$  = 7.6 Hz, 1H), 5.75 (s, 1H), 2.66 – 2.55 (m, 1H), 0.95 – 0.87 (m, 2H), 0.73 – 0.67 (m, 2H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  163.3, 154.2, 153.7, 131.9, 123.6, 120.3, 118.0, 114.3, 86.0, 24.7, 7.6. HRMS (ESI) calcd for  $\text{C}_{12}\text{H}_{12}\text{NO}_2$  [M+H] $^+$ : 202.0863, Found: 202.0862.

**4-(cyclohexylamino)-2H-chromen-2-one (4f)**



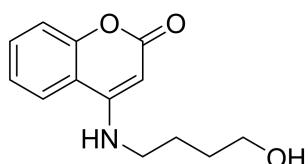
**4f** (29 mg, 61% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.50 (t, *J* = 8.8 Hz, 2H), 7.29 (d, *J* = 8.2 Hz, 1H), 7.23 (t, *J* = 7.6 Hz, 1H), 5.32 (s, 1H), 3.39 (dt, *J* = 13.4, 6.6 Hz, 1H), 2.10 (d, *J* = 11.0 Hz, 2H), 1.84 – 1.76 (m, 2H), 1.69 (d, *J* = 13.1 Hz, 1H), 1.48 – 1.20 (m, 5H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>) δ 163.6, 153.7, 151.9, 131.8, 123.4, 120.6, 117.8, 114.5, 83.4, 51.8, 32.2, 25.6, 24.9. HRMS (ESI) calcd for C<sub>15</sub>H<sub>18</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 244.1332, Found: 244.1326.

#### 4-(tert-butylamino)-2H-chromen-2-one (**4g**)



**4g** (35 mg, 83% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.51 (t, *J* = 7.2 Hz, 1H), 7.36 (d, *J* = 7.6 Hz, 1H), 7.32 (d, *J* = 8.2 Hz, 1H), 7.24 (d, *J* = 7.4 Hz, 1H), 5.56 (s, 1H), 3.49 (s, 1H), 1.51 (s, 9H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 162.9, 153.7, 150.6, 131.8, 123.4, 119.9, 118.3, 114.9, 86.4, 52.4, 29.0. HRMS (ESI) calcd for C<sub>13</sub>H<sub>16</sub>NO<sub>2</sub> [M+H]<sup>+</sup>: 218.1176, Found: 218.1174.

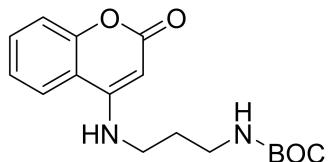
#### 4-((4-hydroxybutyl)amino)-2H-chromen-2-one (**4h**)



**4h** (36mg, 79% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using DCM/MeOH= 20/1-8/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.55 (d, *J* = 8.0 Hz, 1H), 7.48 (t, *J* = 7.6 Hz, 1H), 7.28 (d, 1H), 7.22 (t, *J* = 7.6 Hz, 1H), 6.16 (s, 1H), 5.26 (s, 1H), 3.78 (t, *J* = 5.8 Hz, 2H), 3.28 (dd, *J* = 11.6, 6.2 Hz, 2H), 1.90 (dt, *J* = 13.3, 6.8 Hz, 2H), 1.75 (dt, *J* = 12.9, 6.4 Hz, 2H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, CDCl<sub>3</sub>) δ 163.6, 153.3, 131.8,

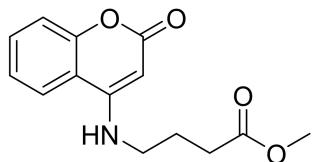
123.5, 120.5, 118.0, 83.5, 62.4, 43.2, 29.9, 25.0. HRMS (ESI) calcd for C<sub>13</sub>H<sub>16</sub>NO<sub>3</sub> [M+H]<sup>+</sup>: 234.1125, Found: 234.1120.

**tert-butyl (3-((2-oxo-2H-chromen-4-yl)amino)propyl)carbamate (4i)**



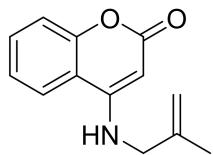
**4i** (58 mg, 93% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.78 (d, *J* = 7.7 Hz, 1H), 7.52 (t, *J* = 7.2 Hz, 1H), 7.33 – 7.27 (m, 2H), 5.29 (s, 1H), 3.37 (q, *J* = 12.0, 5.9 Hz, 2H), 3.27 (q, *J* = 12.4, 6.3 Hz, 2H), 1.85 – 1.78 (m, 2H), 1.49 (s, 9H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>) δ 163.8, 157.5, 153.8, 153.4, 131.8, 123.7, 121.2, 117.8, 114.8, 82.6, 80.2, 39.1, 37.2, 28.6, 28.5. HRMS (ESI) calcd for C<sub>17</sub>H<sub>22</sub>N<sub>2</sub>O<sub>4</sub> [M+H]<sup>+</sup>: 319.1652, Found: 319.1648.

**methyl 4-((2-oxo-2H-chromen-4-yl)amino)butanoate (4j)**



**4j** (40 mg, 78% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.62 (d, *J* = 8.0 Hz, 1H), 7.53 (t, *J* = 7.7 Hz, 1H), 7.32 (d, *J* = 8.3 Hz, 1H), 7.29 (t, 1H), 5.28 (s, 1H), 3.74 (s, 3H), 3.34 (dd, *J* = 11.3, 6.0 Hz, 2H), 2.58 (t, 2H), 2.16 – 2.08 (m, 2H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>) δ 175.3, 163.4, 153.7, 153.3, 131.82, 123.6, 120.8, 117.9, 114.6, 83.4, 52.3, 43.5, 32.4, 22.7. HRMS (ESI) calcd for C<sub>14</sub>H<sub>15</sub>NO<sub>4</sub> [M+H]<sup>+</sup>: 262.1074, Found: 262.1072.

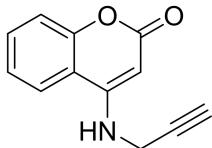
**4-((2-methylallyl)amino)-2H-chromen-2-one (4k)**



**4k** (22 mg, 79% yield) was obtained according to the general procedure **D** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc= 15/1-1/1. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.54 (t, *J* = 7.8 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.35 (d, *J* = 7.6 Hz, 1H), 7.28 (d, *J* =

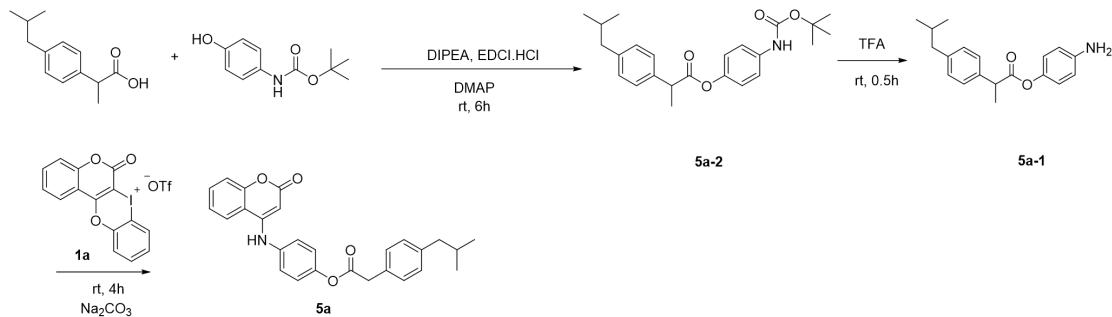
8.1 Hz, 1H), 5.33 (s, 1H), 4.99 (d,  $J$  = 6.4 Hz, 2H), 3.86 (d,  $J$  = 5.7 Hz, 2H), 1.82 (s, 3H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz,  $\text{CDCl}_3$ )  $\delta$  163.2, 153.8, 152.9, 139.6, 132.0, 123.6, 120.1, 118.2, 114.34, 112.8, 85.0, 49.0, 20.5. HRMS (ESI) calcd for  $\text{C}_{13}\text{H}_{14}\text{NO}_2$  [ $\text{M}+\text{H}]^+$ : 216.1019, Found: 216.1019.

#### **4-(prop-2-yn-1-ylamino)-2H-chromen-2-one (4l)**



**4l** (22 mg, 57% yield) was obtained according to the general procedure **B** as a light yellow solid. The crude product was purified by column chromatography using PE/EtOAc = 15/1-1/1.  $^1\text{H}$  NMR (400 MHz, DMSO)  $\delta$  8.06 (s, 1H), 7.97 (d,  $J$  = 8.4 Hz, 1H), 7.60 (t,  $J$  = 7.3 Hz, 1H), 7.40 – 7.27 (m, 2H), 5.27 (s, 1H), 4.12 (dd,  $J$  = 5.4, 2.2 Hz, 2H), 3.27 (s, 1H).  $^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)  $\delta$  161.4, 153.1, 152.7, 132.1, 123.6, 122.4, 117.1, 114.3, 83.3, 79.5, 74.6, 31.6. HRMS (ESI) calcd for  $\text{C}_{12}\text{H}_{10}\text{NO}_2$  [ $\text{M}+\text{H}]^+$ : 200.0706, Found: 200.0705.

#### **Synthesis of drug and bioactive molecule derivatives (5a-5g):**

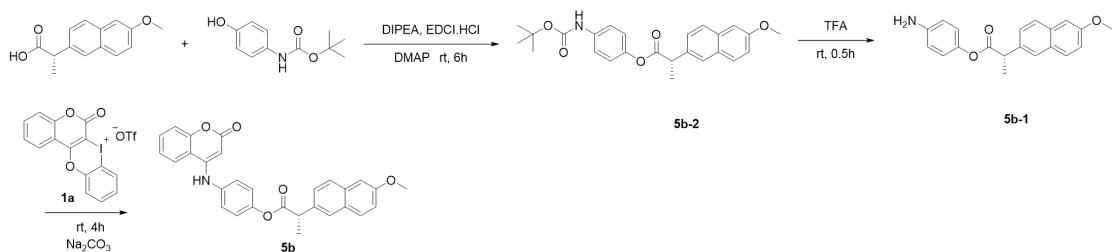


**4-((tert-Butoxycarbonyl)amino)phenyl 2-(4-isobutylphenyl)propanoate (5a-2):** To Ibuprofen (2.42 mmol, 1 equiv.) in a flask was added tert-butyl (4-hydroxyphenyl) carbamate (2.91 mmol, 1.2 equiv.), DMAP (2.42 mmol, 1 equiv.), EDCI·HCl (2.67 mmol, 1.1 equiv.), DIPEA (4.85 mmol, 2 equiv.), DCM (5 mL). The reaction mixture was stirred at room temperature for 6h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~2/1) to provide **5a-2** (950 mg, 99%) as a white solid.

**4-Aminophenyl 2-(4-isobutylphenyl)propanoate (5a-1):** To **5a-2** in a flask was added DCM (8 mL),

TFA (2 mL), the reaction mixture was stirred at room temperature for 1h. The reaction solution was evaporated in vacuum, giving crude **5a-1** as a yellow solid. The crude **5a-1** was used for the next step without further purification.

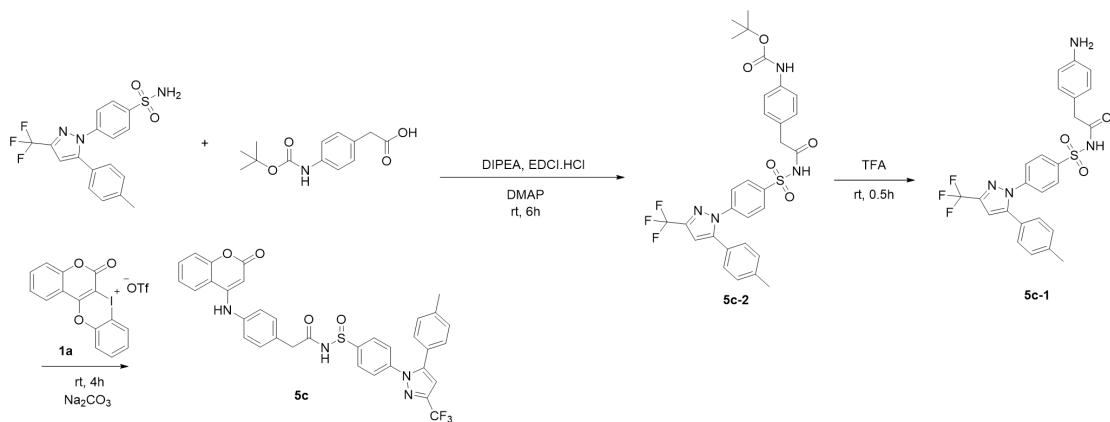
**4-((2-Oxo-2H-chromen-4-yl)amino)phenyl 2-(4-isobutylphenyl)acetate (**5a**):** To **1a** (195.24  $\mu\text{mol}$ , 1 equiv.) in a flask was added  $\text{Na}_2\text{CO}_3$  (390.48  $\mu\text{mol}$ , 2 equiv.), **5a-1** (390.48  $\mu\text{mol}$ , 2 equiv.), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5a** (80 mg, 93%) as a brown solid.  $^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )  $\delta$  7.69 (d,  $J$  = 7.7 Hz, 1H), 7.58 – 7.51 (m, 1H), 7.38 – 7.25 (m, 5H), 7.22 (dd,  $J$  = 9.0, 2.5 Hz, 2H), 7.17 (d,  $J$  = 8.0 Hz, 2H), 7.06 – 6.99 (m, 2H), 5.61 (s, 1H), 3.96 (q,  $J$  = 7.2 Hz, 1H), 2.49 (d,  $J$  = 7.1 Hz, 2H), 1.88 (td,  $J$  = 13.2, 6.6 Hz, 1H), 1.63 (d,  $J$  = 7.1 Hz, 3H), 1.59 (d,  $J$  = 7.2 Hz, 1H), 0.92 (dd,  $J$  = 6.4, 3.9 Hz, 6H).  $^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)  $\delta$  173.0, 161.6, 153.5, 152.7, 148.2, 140.2, 137.5, 135.9, 132.6, 129.5, 127.3, 126.4, 123.8, 122.9, 122.7, 117.2, 114.5, 84.5, 44.3, 44.3, 29.7, 22.3, 18.6. HRMS (ESI) calcd for  $\text{C}_{28}\text{H}_{27}\text{NO}_4$  [ $\text{M}+\text{H}]^+$ : 442.2013, Found: 442.2008.



**4-((tert-Butoxycarbonyl)amino)phenyl-2-(6-methoxynaphthalen-2-yl)propanoate (**5b-2**):** To Naproxen (2.17 mmol, 1 equiv.) in a flask was added tert-butyl (4-hydroxyphenyl)carbamate (2.61 mmol, 1.2 equiv.), DMAP (2.17 mmol, 1 equiv.), EDCI·HCl (2.39 mmol, 1.1 equiv.), DIPEA (4.34 mmol, 2 equiv.), DCM (5 mL). The reaction mixture was stirred at room temperature for 6h, the reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~2/1) to provide **5b-2** (818 mg, 89%) as a pink solid.

**4-Aminophenyl-2-(6-methoxynaphthalen-2-yl)propanoate (5b-1):** To **5b-2** in a flask was added DCM (8 mL), TFA (2 mL), the reaction mixture was stirred at room temperature for 1h. The reaction solution was evaporated in vacuum, giving crude **5b-1** as a yellow solid. The crude **5b-1** was used for the next step without further purification.

**4-((2-Oxo-2H-chromen-4-yl)amino)phenyl-2-(6-methoxynaphthalen-2-yl)propanoate (5b):** To **1a** (195.24  $\mu$ mol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (390.48  $\mu$ mol, 2 equiv.), **5b-1** (390.48  $\mu$ mol, 2 equiv.), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5b** (111 mg, 81%) as a black solid. <sup>1</sup>H NMR (400 MHz, DMSO)  $\delta$  9.29 (s, 1H), 8.21 (d, *J* = 7.6 Hz, 1H), 7.86 (dd, *J* = 8.6, 3.6 Hz, 3H), 7.66 (t, *J* = 7.7 Hz, 1H), 7.53 (d, *J* = 10.1 Hz, 1H), 7.39 (q, *J* = 6.0 Hz, 4H), 7.33 (d, *J* = 2.3 Hz, 1H), 7.20 – 7.13 (m, 3H), 5.25 (s, 1H), 3.88 (s, 3H), 3.07 (s, 1H), 1.62 (d, *J* = 7.1 Hz, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO)  $\delta$  173.4, 161.9, 157.8, 153.8, 152.9, 148.5, 136.2, 135.7, 133.9, 132.9, 129.7, 129.0, 127.8, 126.7, 126.7, 126.4, 124.1, 123.2, 123.1, 119.4, 117.5, 114.9, 114.5, 106.2, 84.9, 55.7, 49.2, 45.0, 27.3, 18.9. HRMS (ESI) calcd for C<sub>29</sub>H<sub>24</sub>NO<sub>5</sub> [M+H]<sup>+</sup>: 466.1649, Found: 466.1646.



#### tert-Butyl

#### (4-(2-Oxo-2-((4-(5-(p-tolyl)-3-(trifluoromethyl)-1H-pyrazol-1-

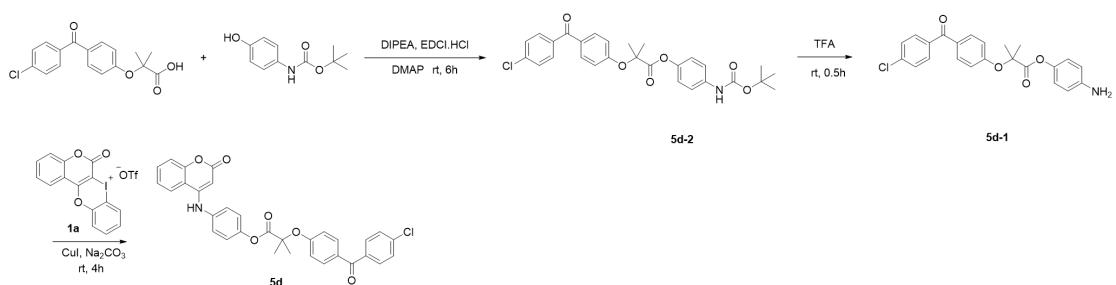
**(4-(2-Oxo-2-((4-(5-(p-tolyl)-3-(trifluoromethyl)-1H-pyrazol-1-yl)phenyl)sulfonamido)ethyl)phenyl)carbamate (5c-2):** To Celecoxib (1.31 mmol, 1 equiv.) in a flask was added 2-(4-((tert-butoxycarbonyl)amino)phenyl)acetic acid (1.57 mmol, 1.2 equiv.), DMAP (1.31 mmol, 1 equiv.), EDCI·HCl (1.44 mmol, 1.1 equiv.), DIPEA (2.62 mmol, 2 equiv.), DCM (5

mL). The reaction mixture was stirred at room temperature for 6h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (DCM/MeOH = 50/1~30/1) to provide **5c-2** (639 mg, 86%) as a white solid.

**2-(4-Aminophenyl)-N-((4-(5-(p-tolyl)-3-(trifluoromethyl)-1H-pyrazol-1-yl)phenyl)sulfonyl)acetamide (5c-1):**

To **5c-2** in a flask was added DCM (8 mL), TFA (2 mL), The reaction mixture was stirred at room temperature for 1h. The reaction solution was evaporated in vacuum, giving crude **5c-1** as a yellow solid. The crude **5c-1** was used for the next step without further purification.

**2-((2-Oxo-2H-chromen-4-yl)amino)phenyl-N-((4-(5-(p-tolyl)-3-(trifluoromethyl)-1H-pyrazol-1-yl)phenyl)sulfinyl)acetamide (5c):** To **1a** (195.24 μmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (390.48 μmol, 2 equiv.), **5c-1** (390.48 μmol, 2 equiv.), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5c** (157 mg, 83%) as a light yellow solid. <sup>1</sup>H NMR (400 MHz, DMSO) δ 9.25 (s, 1H), 8.22 (d, *J* = 7.8 Hz, 1H), 7.93 (d, *J* = 8.6 Hz, 2H), 7.66 (t, *J* = 7.5 Hz, 1H), 7.54 (d, *J* = 8.6 Hz, 2H), 7.39 (dd, *J* = 13.5, 7.9 Hz, 2H), 7.26 (s, 4H), 7.17 (d, *J* = 4.4 Hz, 4H), 5.25 (s, 1H), 3.57 (s, 2H), 2.29 (s, 3H). <sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO) δ 161.7, 153.5, 152.7, 145.4, 141.7, 139.2, 136.7, 132.6, 130.5, 129.6, 128.8, 128.6, 125.8, 125.4, 124.9, 123.8, 122.9, 117.2, 114.6, 106.2, 84.4, 43.1, 20.9.

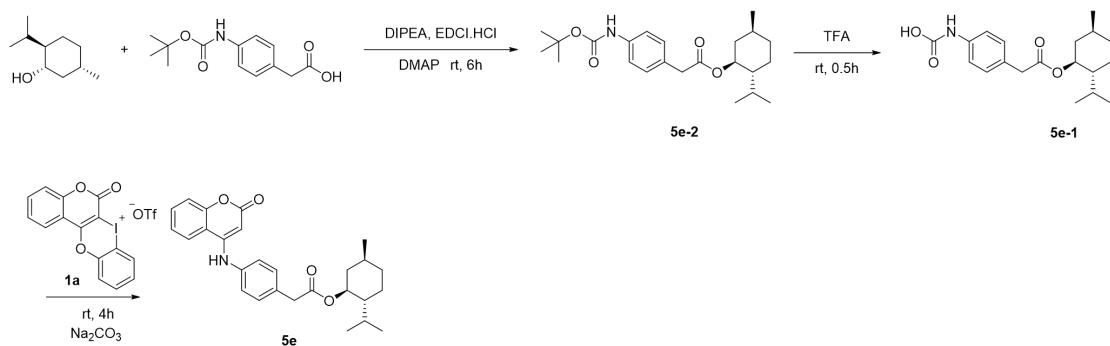


**4-((tert-Butoxycarbonyl)amino)phenyl 2-(4-(4-chlorobenzoyl)phenoxy)-2-methylpropanoate (5d-2)**

**2):** To Fenofibrate (1.57 mmol, 1 equiv.) in a flask was added tert-butyl (4-hydroxyphenyl)carbamate (1.88 mmol, 1.2 equiv.), DMAP (1.57 mmol, 1 equiv.), EDCI·HCl (1.73 mmol, 1.1 equiv.), DIPEA (3.14 mmol, 2 equiv.), DCM (5 mL). The reaction mixture was stirred at room temperature for 6h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~2/1) to provide **5d-2** (871 mg, 99%) as brown solid.

**4-Aminophenyl 2-(4-(4-chlorobenzoyl)phenoxy)-2-methylpropanoate (5d-1):** To **5d-2** in a flask was added DCM (8 mL), TFA (2 mL), the reaction mixture was stirred at room temperature for 1h. The reaction solution was evaporated in vacuum, giving crude **5d-1** as a yellow solid. The crude **5d-1** was used for the next step without further purification.

**4-((2-Oxo-2H-chromen-4-yl)amino)phenyl 2-(4-(4-chlorobenzoyl)phenoxy)-2-methylpropanoate (5d):** To **1a** (195.24 μmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (390.48 μmol, 2 equiv.), **5d-1** (390.48 μmol, 2 equiv.), CuI (10 mmol%), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5d** (140 mg, 86%) as a light yellow solid. <sup>1</sup>H NMR (500 MHz, CDCl<sub>3</sub>) δ 7.69 (d, *J* = 8.8 Hz, 3H), 7.61 (d, *J* = 8.4 Hz, 2H), 7.45 (t, *J* = 7.4 Hz, 1H), 7.35 (d, *J* = 8.4 Hz, 2H), 7.23 – 7.14 (m, 4H), 6.91 (dd, *J* = 16.6, 8.7 Hz, 4H), 5.52 (s, 1H), 1.75 (s, 7H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>) δ 194.5, 172.4, 163.4, 159.6, 153.9, 152.4, 148.3, 138.7, 136.3, 135.8, 132.3, 131.3, 130.8, 128.7, 126.1, 123.9, 122.5, 121.1, 117.9, 117.4, 114.5, 86.8, 79.5, 25.5. HRMS (ESI) calcd for C<sub>32</sub>H<sub>24</sub>ClNO<sub>6</sub> [M+H]<sup>+</sup>: 554.1365, Found: 554.1362.



**(1S,2R,5S)-2-isopropyl-5-methylcyclohexyl 2-(4-((tert-butoxycarbonyl)amino)phenyl)acetate (5e-2):**

To Menthol (3.20 mmol, 1 equiv.) in a flask was added tert-butyl (4-hydroxyphenyl)carbamate (3.84 mmol, 1.2 equiv.), DMAP (3.20 mmol, 1 equiv.), EDCI·HCl (3.52 mmol, 1.1 equiv.), DIPEA (6.40 mmol, 2 equiv.), DCM (5 mL). The reaction mixture was stirred at room temperature for 6h, the reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~2/1) to provide **5e-2** (865 mg, 69%) as a white solid.

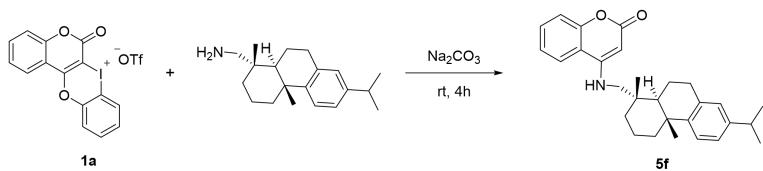
**(4-(((1S,2R,5S)-2-isopropyl-5-methylcyclohexyl)oxy)-2-oxoethyl)phenyl)carbamic acid (5e-1):**

To **5e-2** in a flask was added DCM (8 mL), TFA (2 mL), the reaction mixture was stirred at room temperature for 1h. The reaction solution was evaporated in vacuum, giving crude **5e-1** as a yellow solid. The crude **5e-1** was used for the next step without further purification.

**(1S,2R,5S)-2-isopropyl-5-methylcyclohexyl 2-(4-((2-oxo-2H-chromen-4-yl)amino)phenyl)acetate (5e):**

To **1a** (195.24 μmol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (390.48 μmol, 2 equiv.), **5e-1** (390.48 μmol, 2 equiv.), MeCN (2 mL). the reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5e** (99 mg, 54%) as a green solid. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) δ 7.63 (d, *J* = 7.2 Hz, 1H), 7.55 – 7.48 (m, 1H), 7.31 – 7.27 (m, 2H), 7.24 (d, *J* = 7.6 Hz, 1H), 7.21 – 7.16 (m, 3H), 6.87 (s, 1H), 5.64 (s, 1H), 3.66 (s, 3H), 3.59 (s, 2H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>) δ 171.9, 163.3, 154.0, 151.9, 136.6, 132.3, 130.8, 125.0, 123.8, 120.6, 118.1,

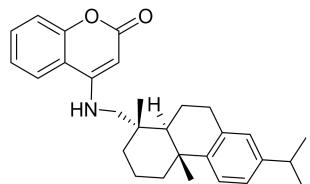
114.6, 87.2, 52.4, 40.7. HRMS (ESI) calcd for  $C_{27}H_{32}NO_4$  [M+H]<sup>+</sup>: 434.2317, Found: 434.2321.



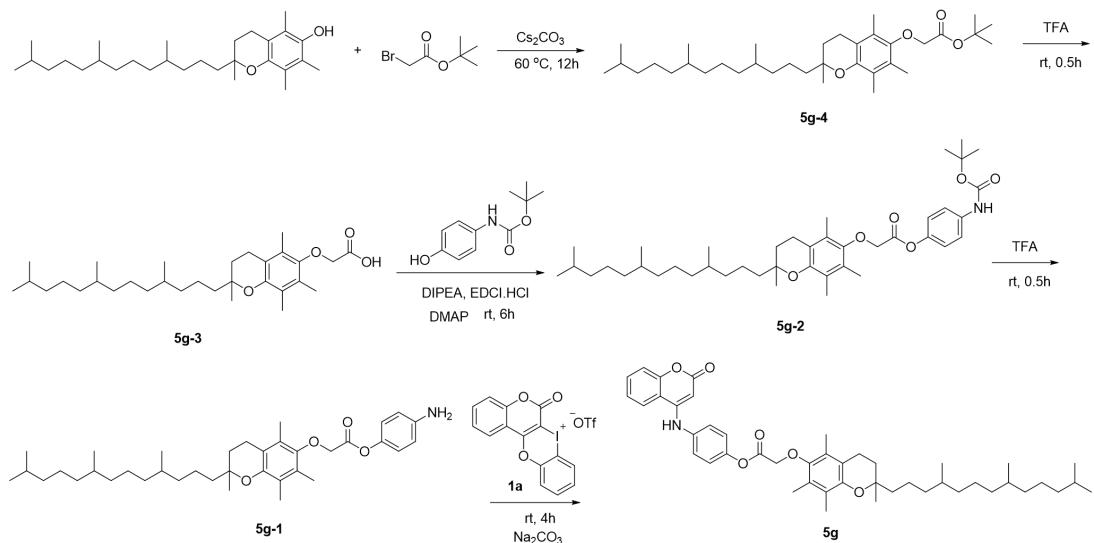
**4-(((1S,4aR,10aS)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methyl)amino)-2H-chromen-2-one (5f):**

To **1a** (195.24  $\mu$ mol, 1 equiv.) in a flask was added  $Na_2CO_3$  (390.48  $\mu$ mol, 2 equiv.), dehydroabietylamine (390.48  $\mu$ mol, 2 equiv.), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $H_2O$  and brine and dried over anhydrous  $Na_2SO_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5f** (45 mg, 54%) as a white solid.

**rac-4-(((1R,4aS,10aS)-7-isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-yl)methyl)amino)-2H-chromen-2-one (5f)**



**5f** (45 mg, 55% yield) was obtained according to the general procedure A as a light yellow solid.  $^1H$  NMR (400 MHz,  $CDCl_3$ )  $\delta$  7.52 (t,  $J$  = 11.3, 4.3 Hz, 1H), 7.35 (t,  $J$  = 8.9 Hz, 2H), 7.23 (d,  $J$  = 7.2 Hz, 1H), 7.19 (d,  $J$  = 8.2 Hz, 1H), 7.02 (d,  $J$  = 8.1 Hz, 1H), 6.91 (s, 1H), 5.40 (s, 1H), 5.08 (s, 1H), 3.22 – 3.08 (m, 2H), 2.97 (d,  $J$  = 13.3 Hz, 1H), 2.84 (td,  $J$  = 13.8, 8.5 Hz, 2H), 2.36 (d,  $J$  = 12.5 Hz, 1H), 1.90 – 1.78 (m, 3H), 1.44 (ddd,  $J$  = 18.4, 13.3, 5.2 Hz, 2H), 1.26 (s, 3H), 1.24 (s, 3H), 1.22 (s, 3H), 1.09 (s, 3H).  $^{13}C\{^1H\}$  NMR (100 MHz,  $CDCl_3$ )  $\delta$  163.2, 153.7, 153.0, 146.8, 146.1, 134.5, 132.0, 127.1, 124.4, 124.3, 123.6, 119.7, 118.3, 114.4, 84.3, 53.7, 46.4, 38.4, 37.8, 36.8, 33.6, 30.4, 25.6, 24.1, 24.1, 19.3, 18.7, 0.1. HRMS (ESI) calcd for  $C_{29}H_{35}NO_2$  [M+H]<sup>+</sup>: 430.2741, Found: 430.2737.



**tert-Butyl 2-((2,5,7,8-tetramethyl-2-(4,8,12-trimethyltridecyl)chroman-6-yl)oxy)acetate (5g-4):** To Vitamin E (2.23 mmol, 1 equiv.) in a flask was added tert-butyl 2-bromoacetate (3.48 mmol, 1.5 equiv.),  $\text{Cs}_2\text{CO}_3$  (4.64 mmol, 2 equiv.), DMF (10 mL), the reaction mixture was stirred at  $60^\circ\text{C}$  for 12 h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~3/1) to provide 5g-4 (1.6 g, 99%) as light yellow liquid.

**2-((2,5,7,8-Tetramethyl-2-(4,8,12-trimethyltridecyl)chroman-6-yl)oxy)acetic acid (5g-3):** To 5g-4 in a flask was added DCM (16 mL), TFA (4 mL), the reaction mixture was stirred at room temperature for 1 h. The reaction solution was evaporated in vacuum, giving crude 5g-3 as a yellow liquid. The crude 5g-3 was used for the next step without further purification.

**4-((tert-Butoxycarbonyl)amino)phenyl 2-((2,5,7,8-tetramethyl-2-(4,8,12-trimethyltridecyl)chroman-6-yl)oxy)acetate (5g-2):** To 5g-3 (1.84 mmol, 1 equiv.) in a flask was added tert-butyl (4-hydroxyphenyl)carbamate (2.21 mmol, 1.2 equiv.), EDCl·HCl (2.03 mmol, 1.1 equiv.), DIPEA (3.68 mmol, 2 equiv.), DMAP (1.84 mmol, 1 equiv.), DCM (10 mL), the reaction mixture was stirred at room temperature for 6 h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with  $\text{H}_2\text{O}$  and brine and dried over anhydrous  $\text{Na}_2\text{SO}_4$ , evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 10/1~1/1) to provide 5g-2 (681 mg, 54%) as light yellow solid.

**4-Aminophenyl 2-((2,5,7,8-tetramethyl-2-(4,8,12-trimethyltridecyl)chroman-6-yl)oxy)acetate (5g-1):**

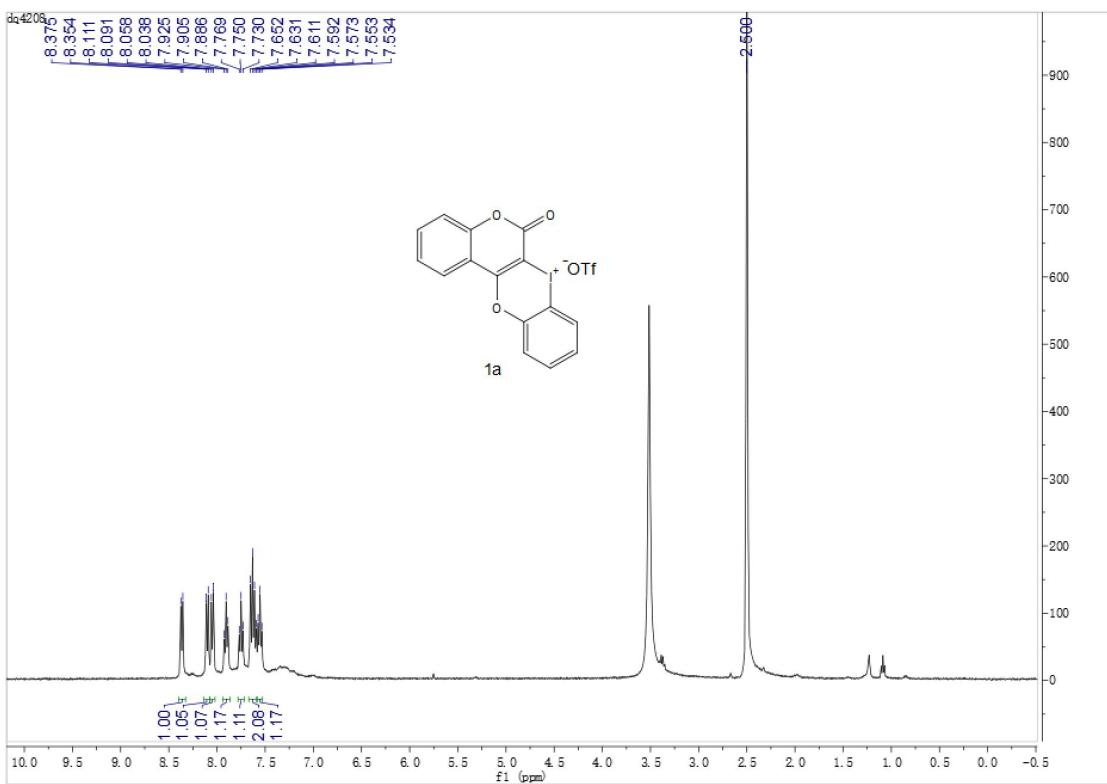
To **5g-2** in a flask was added DCM (16 mL), TFA (4 mL), the reaction mixture was stirred at room temperature for 1h. The reaction solution was evaporated in vacuum, giving crude **5g-1** as a yellow liquid. The crude **5g-1** was used for the next step without further purification.

**4-((2-Oxo-2H-chromen-4-yl)amino)phenyl**

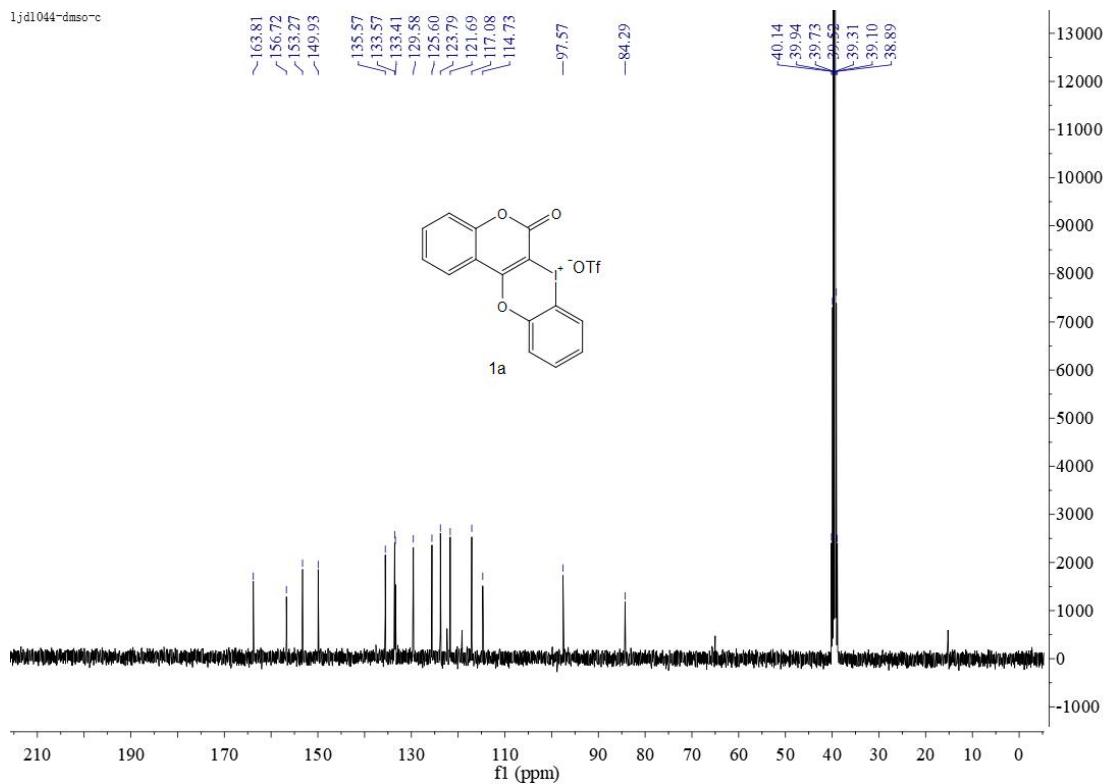
**2-((2,5,7,8-tetramethyl-2-(4,8,12-**

**trimethyltridecyl)chroman-6-yl)oxy)acetate (5g):** To **1a** (195.24  $\mu$ mol, 1 equiv.) in a flask was added Na<sub>2</sub>CO<sub>3</sub> (390.48  $\mu$ mol, 2 equiv.), **5g-1** (390.48  $\mu$ mol, 2 equiv.), MeCN (2 mL). The reaction mixture was stirred at room temperature under Ar atmosphere for 4h. The reaction was monitored by TLC. When the reaction was completed, the remained mixture was extracted with EtOAc, the combined organic layers were washed with H<sub>2</sub>O and brine and dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, evaporated in vacuum. The residue was purified by column chromatography on a silica gel (PE/EtOAc = 15/1~1/1) to provide **5g** (44 mg, 31%) as a light yellow solid. <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.65 (d, *J* = 7.9 Hz, 1H), 7.60 (t, *J* = 7.8 Hz, 1H), 7.39 (d, *J* = 8.2 Hz, 1H), 7.34 (d, *J* = 8.8 Hz, 3H), 7.28 (d, 2H), 6.68 (s, 1H), 5.71 (s, 1H), 4.58 (s, 2H), 2.60 (t, *J* = 6.7 Hz, 2H), 2.25 (s, 3H), 2.21 (s, 3H), 2.10 (s, 3H), 1.80 (dq, *J* = 19.3, 6.6 Hz, 2H), 1.55 (s, 3H), 1.53 – 1.49 (m, 2H), 1.45 – 1.35 (m, 4H), 1.32 – 1.22 (m, 12H), 1.18 – 1.05 (m, 6H), 0.88 (s, 3H), 0.87 – 0.83 (m, 6H). <sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, CDCl<sub>3</sub>)  $\delta$  168.0, 163.0, 154.1, 151.8, 148.6, 148.4, 147.9, 135.4, 132.4, 127.6, 126.1, 125.8, 123.9, 123.4, 122.9, 120.4, 118.2, 118.0, 114.4, 87.6, 75.1, 70.0, 40.2, 39.5, 37.5, 32.9, 32.8, 31.4, 29.8, 28.1, 25.0, 24.6, 24.0, 22.9, 22.8, 21.2, 20.8, 19.9, 19.8, 13.0, 12.2, 12.0, 1.2, 0.1. HRMS (ESI) calcd for C<sub>46</sub>H<sub>62</sub>NO<sub>6</sub> [M+H]<sup>+</sup>: 724.4572, Found: 724.4563.

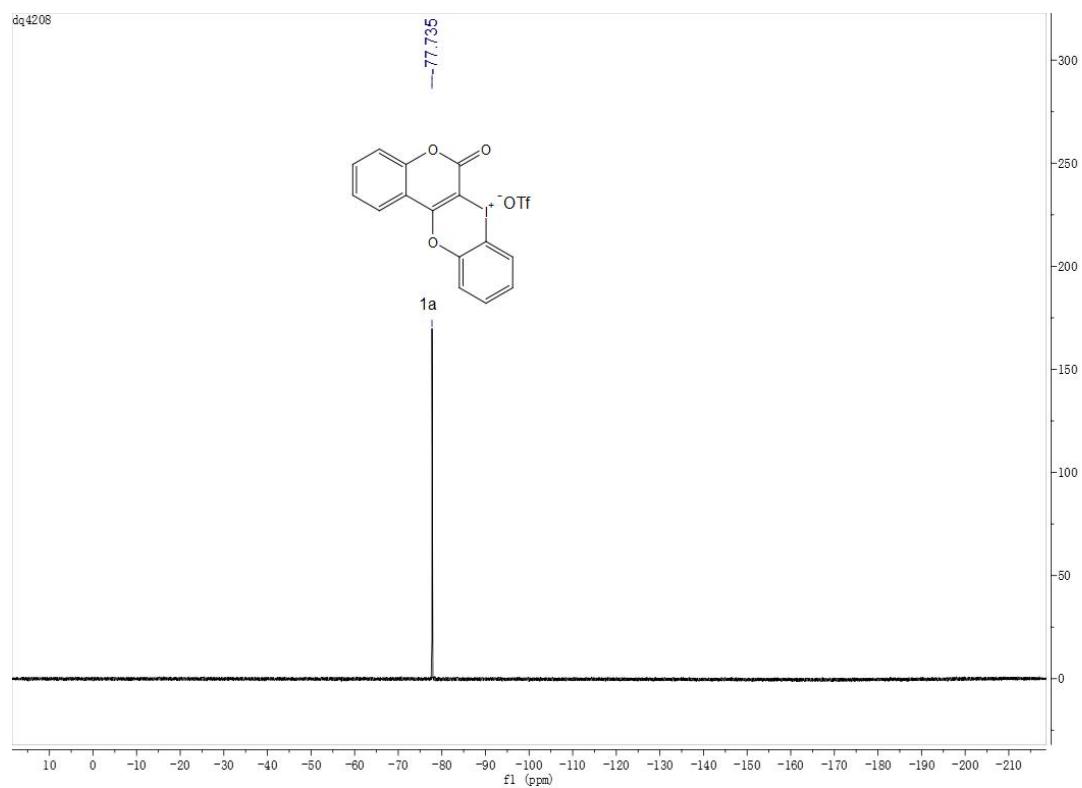
<sup>1</sup>H NMR (400 MHz, DMSO)



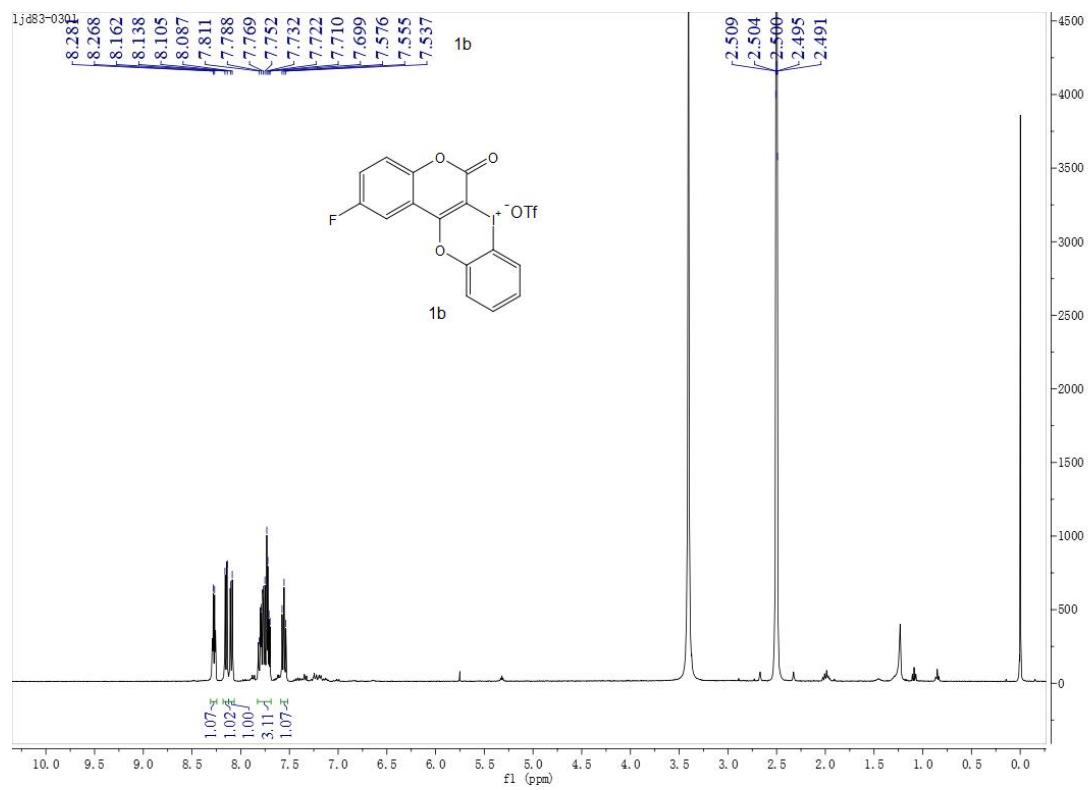
<sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO)



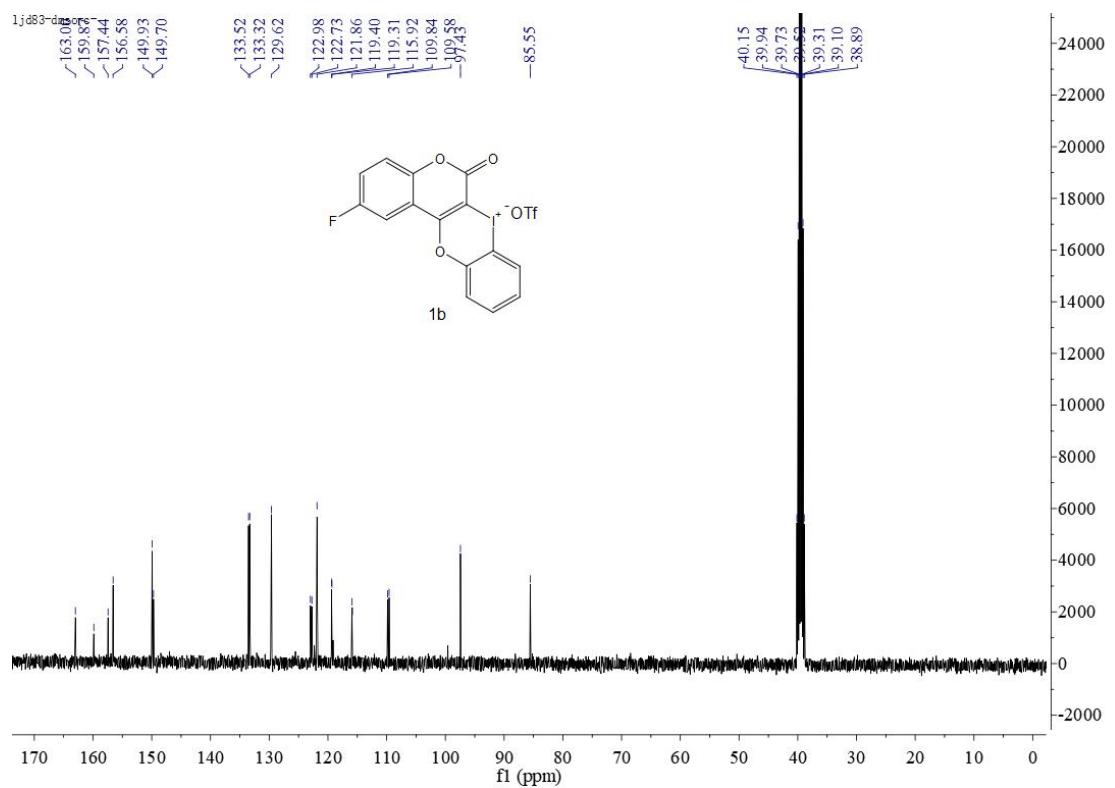
<sup>19</sup>F NMR (376 MHz, DMSO)



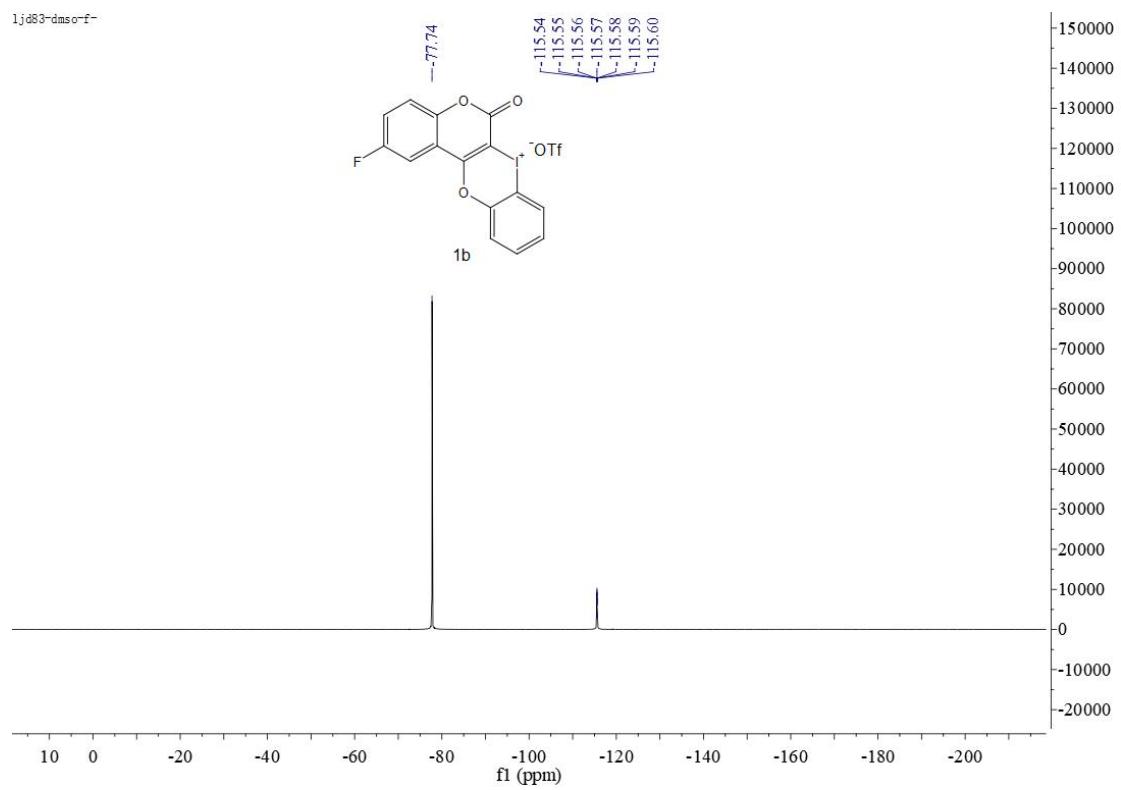
<sup>1</sup>H NMR (400 MHz, DMSO)



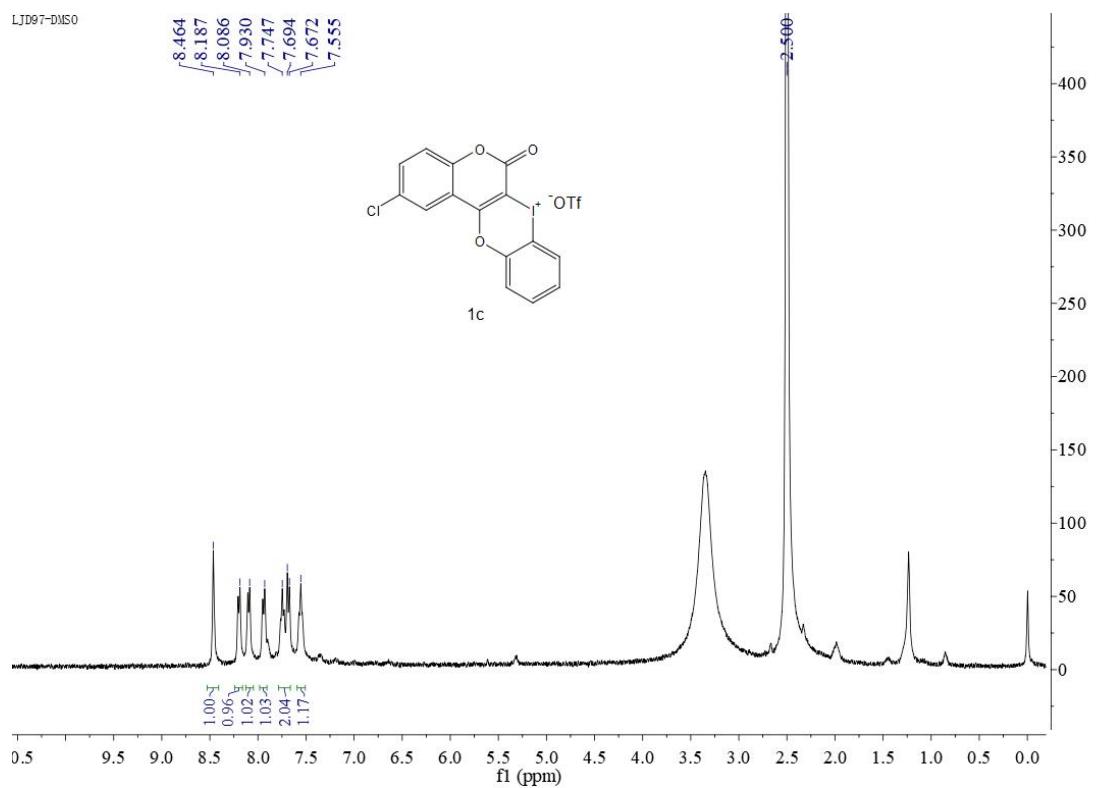
$^{13}\text{C}\{\text{H}\}$  NMR (101 MHz, DMSO)



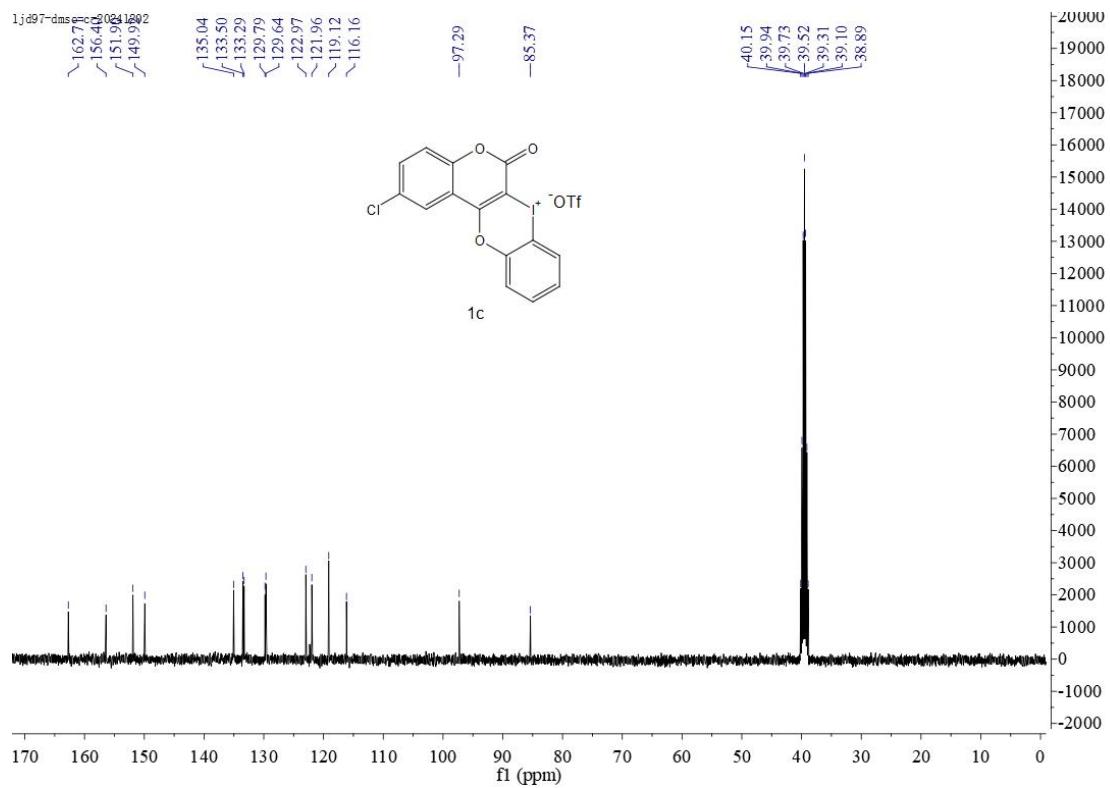
$^{19}\text{F}$  NMR (376 MHz, DMSO)



<sup>1</sup>H NMR (400 MHz, DMSO)

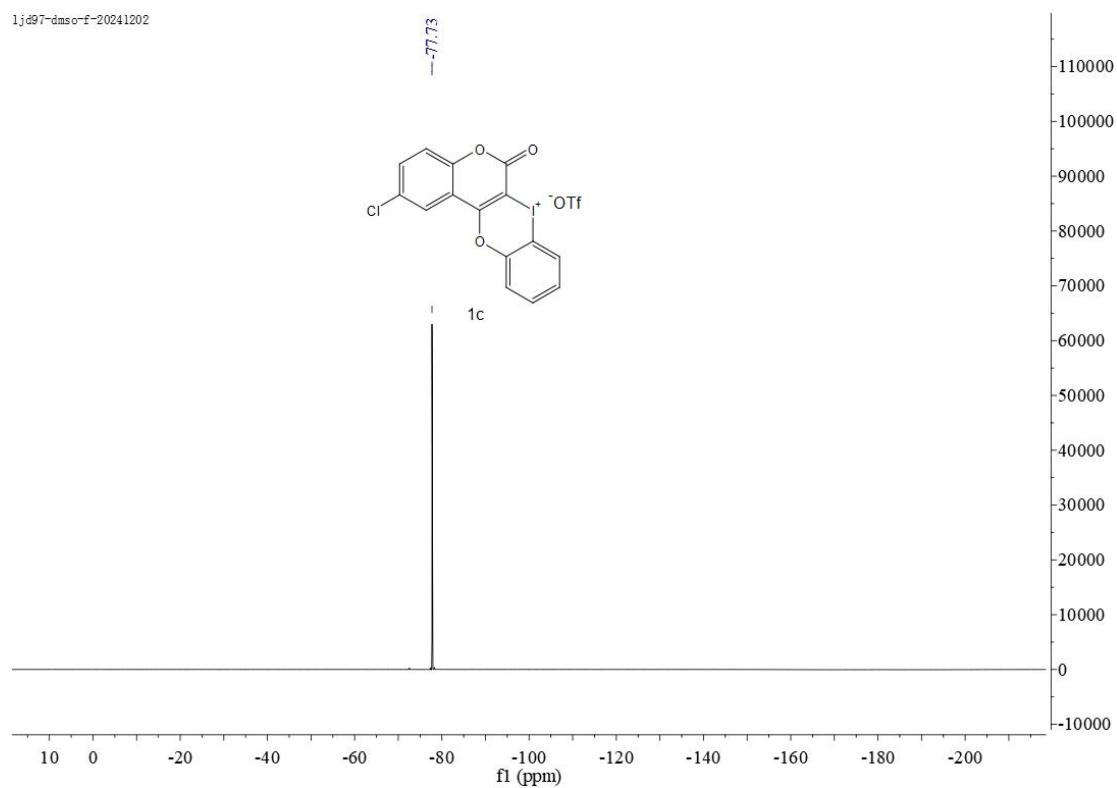


<sup>13</sup>C{<sup>1</sup>H} NMR (101 MHz, DMSO)



<sup>19</sup>F NMR (376 MHz, DMSO)

1jg97-dmso-f-20241202



<sup>1</sup>H NMR (400 MHz, DMSO)

1jd101-dmso

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8.215

8.196

8.101

8.082

8.063

8.042

7.762

7.744

7.728

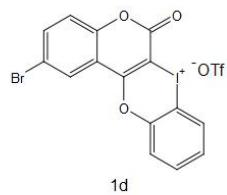
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7.599

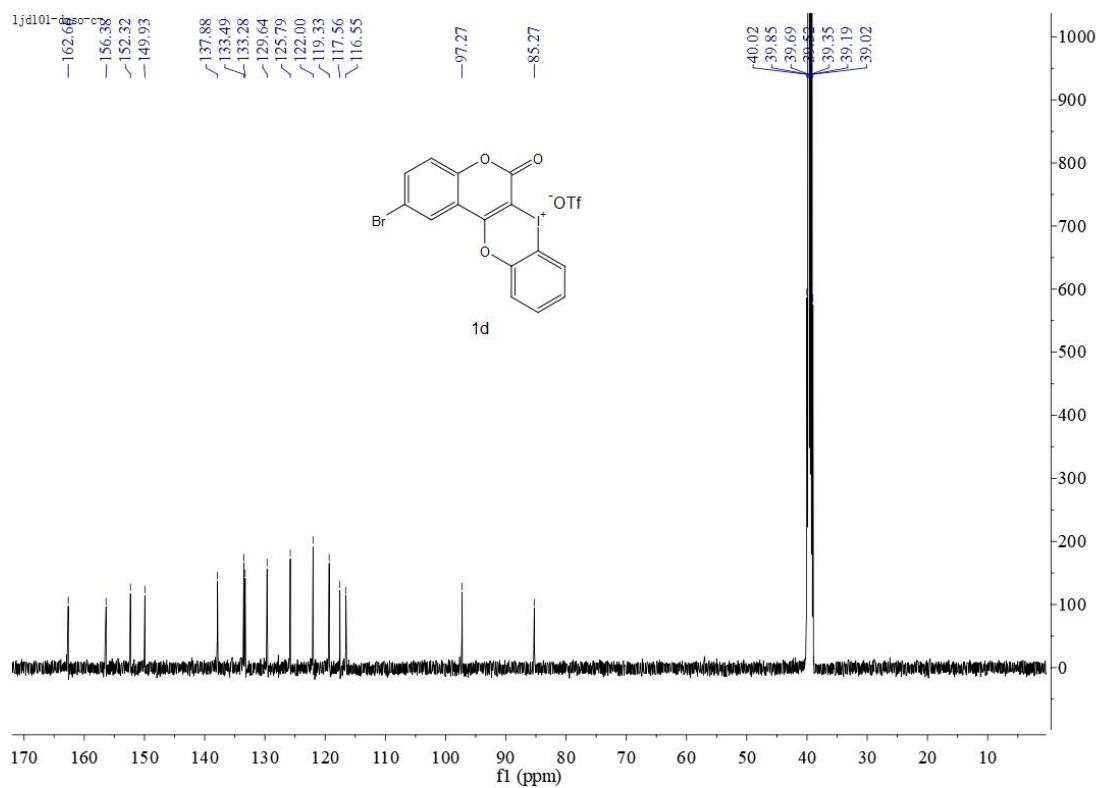
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7.555

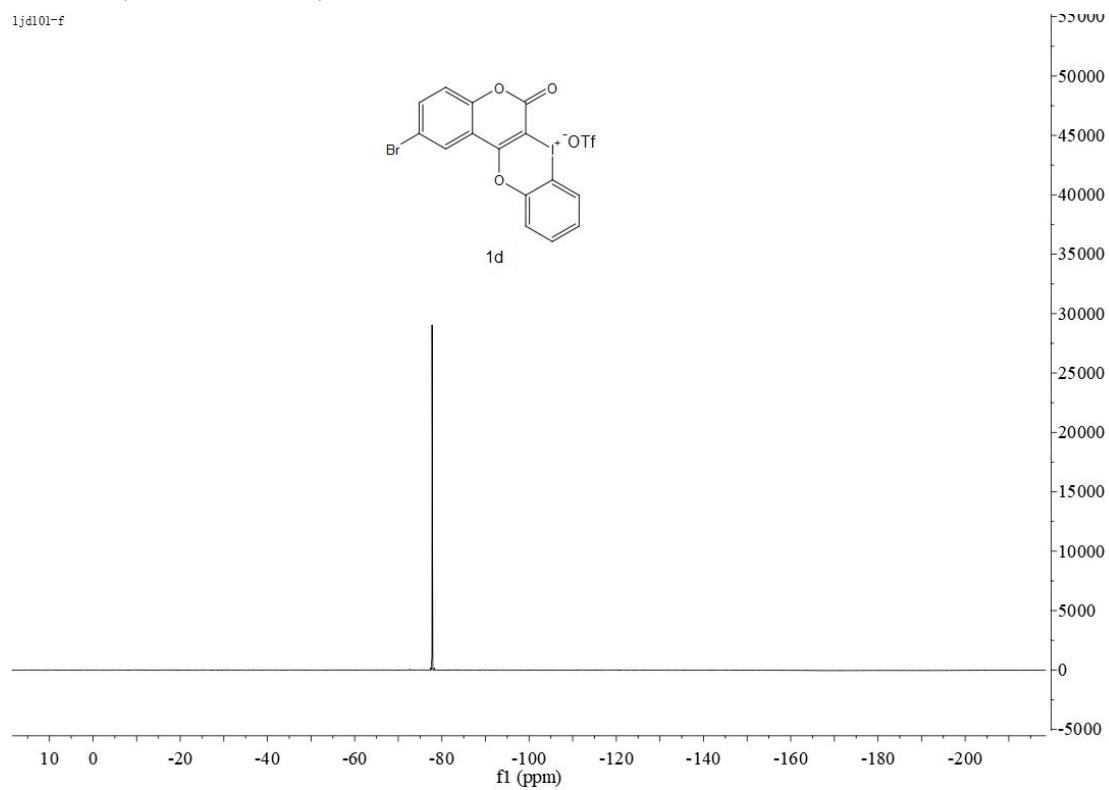
7.536



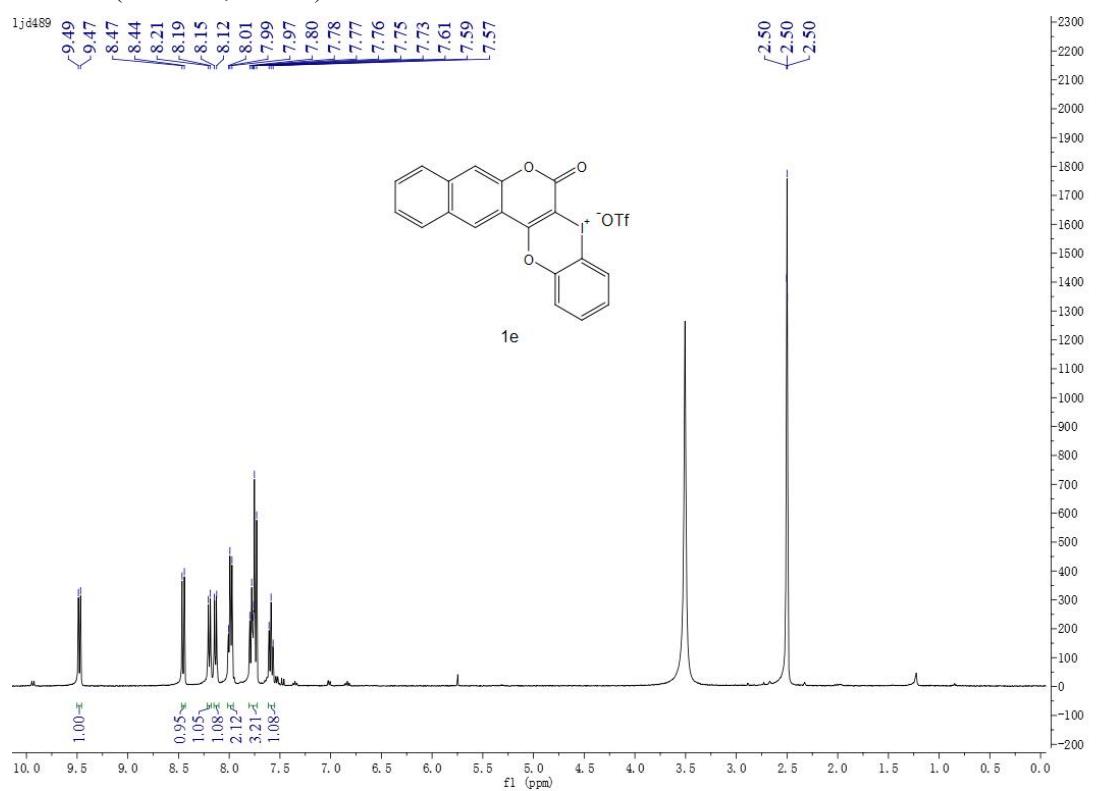
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



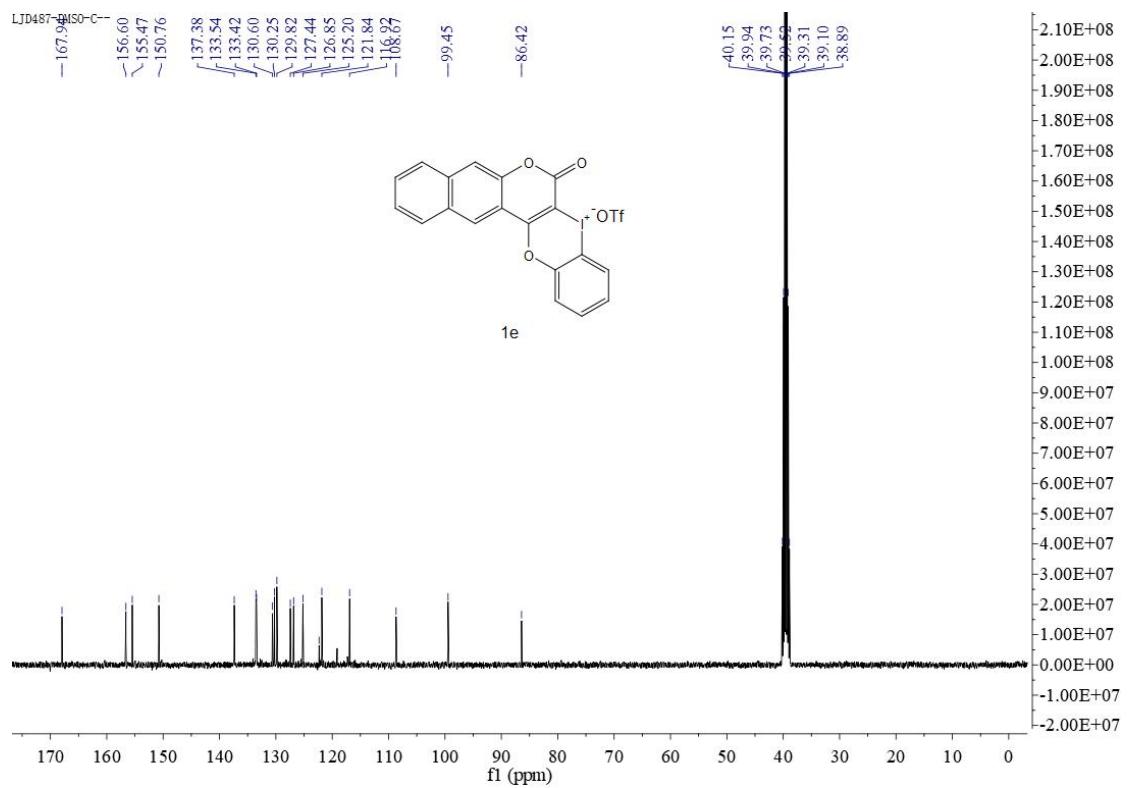
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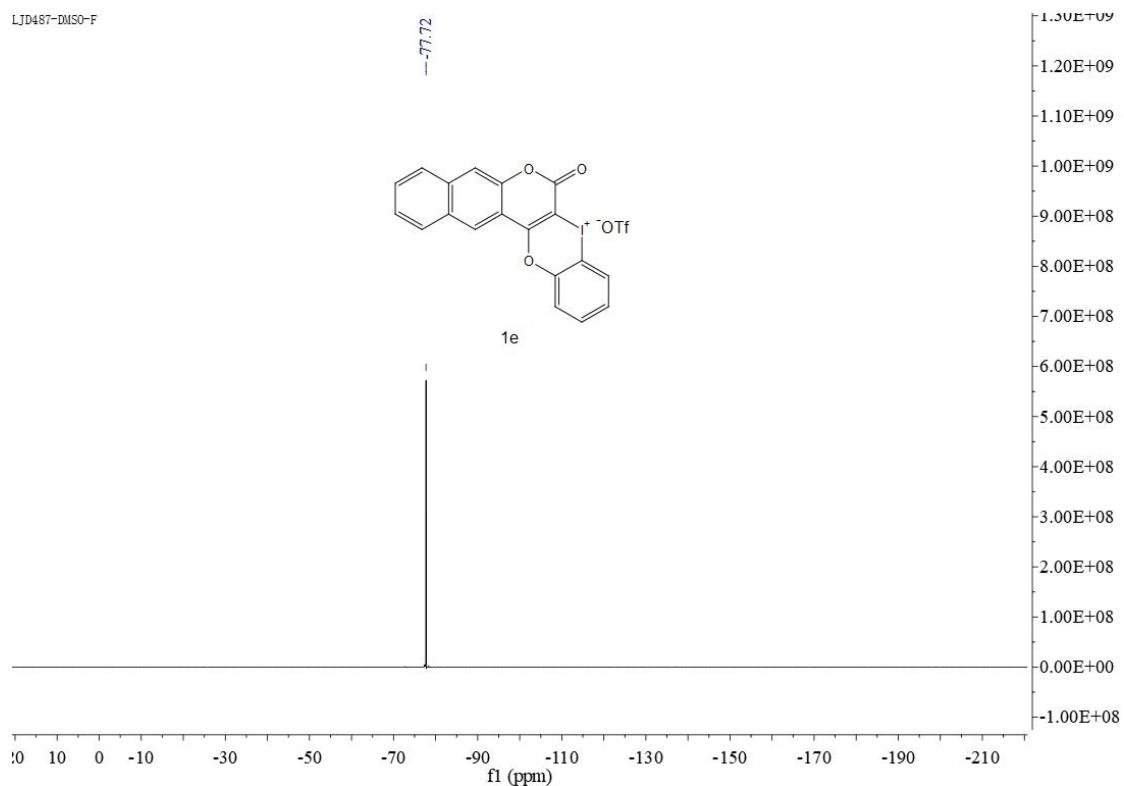
<sup>1</sup>H NMR (400 MHz, DMSO)



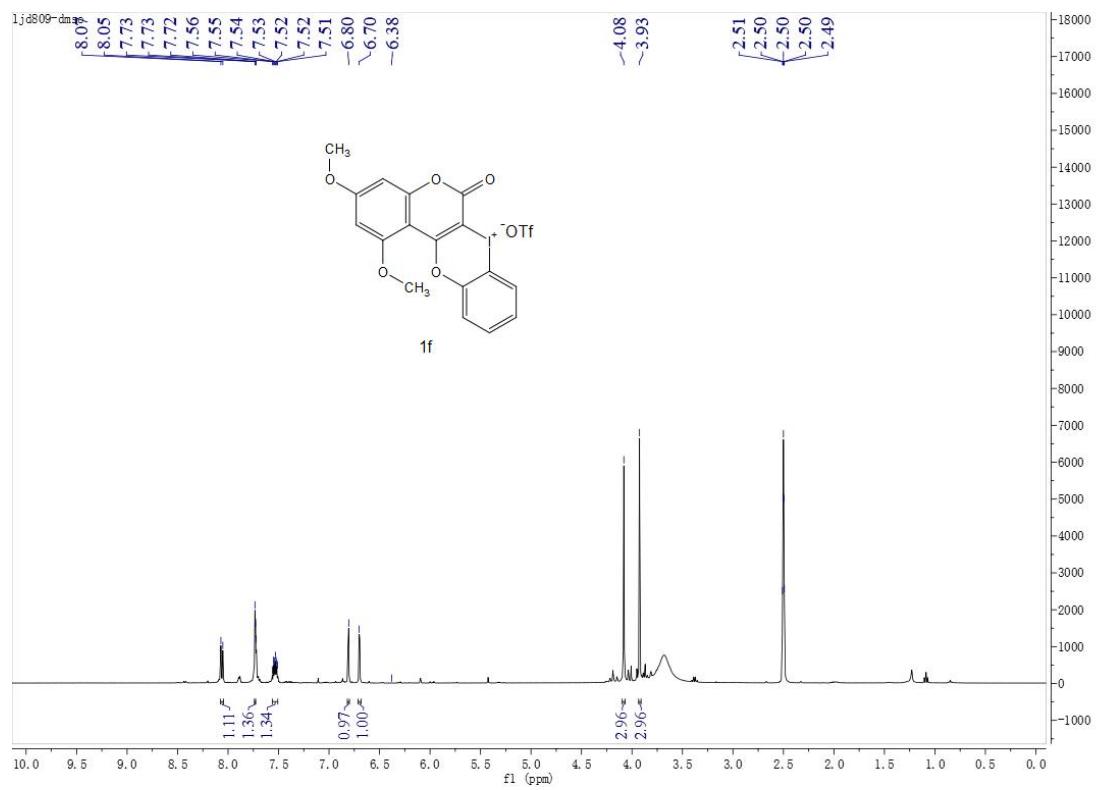
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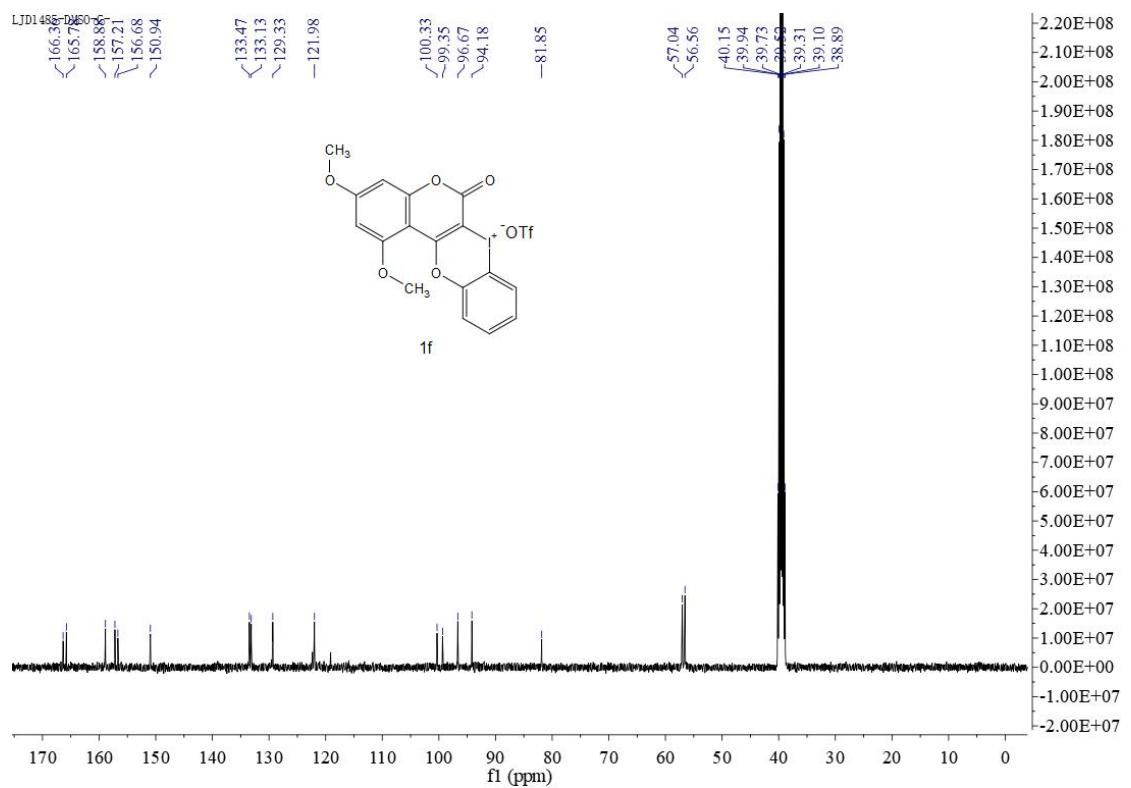
<sup>19</sup>F NMR (376 MHz, DMSO)



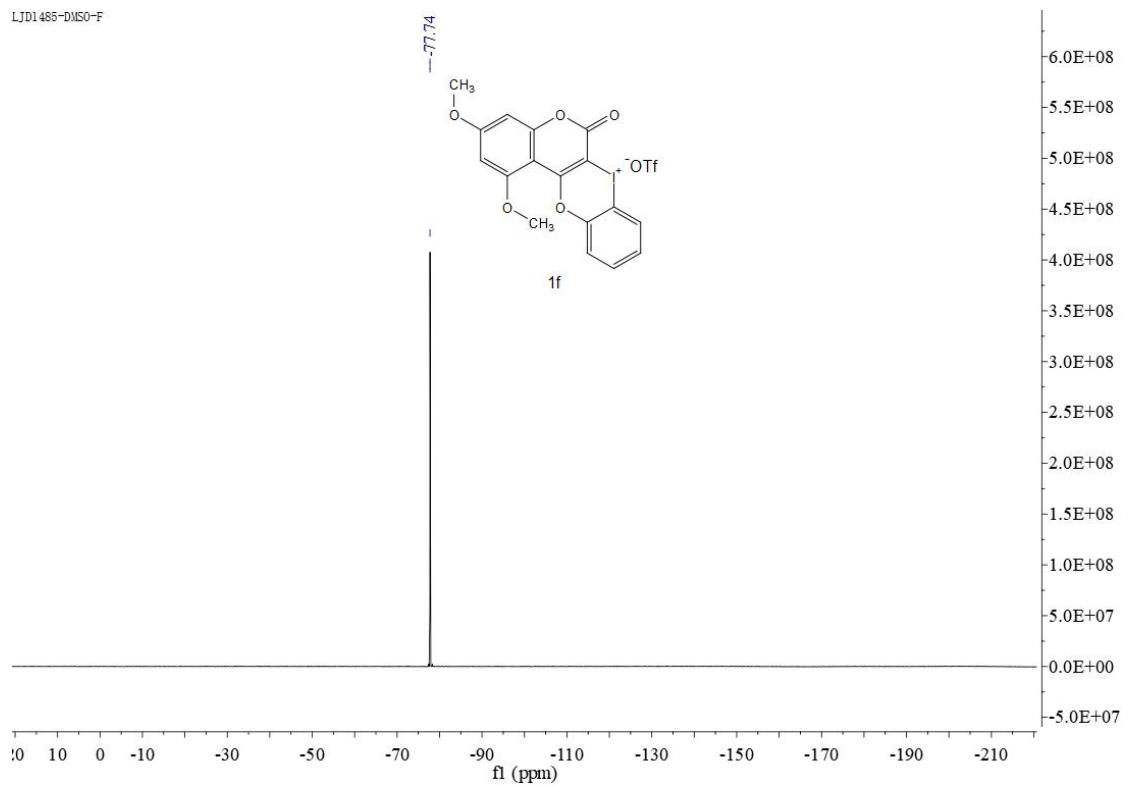
<sup>1</sup>H NMR (400 MHz, DMSO)



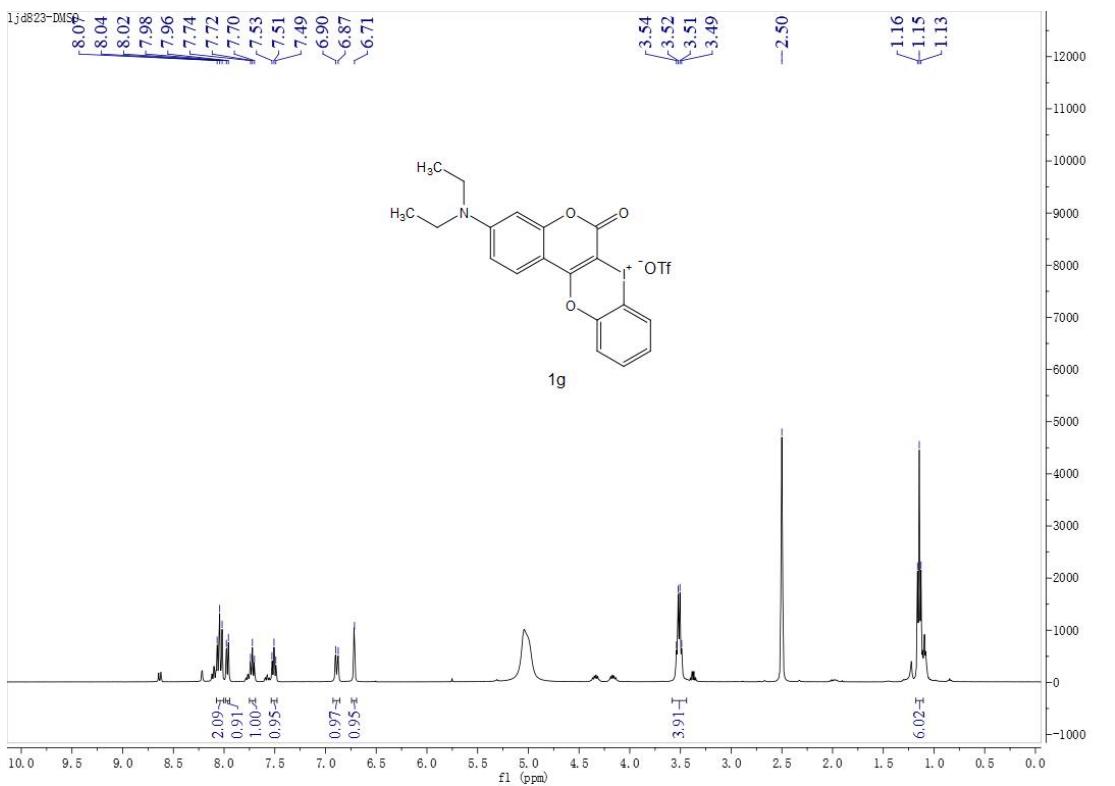
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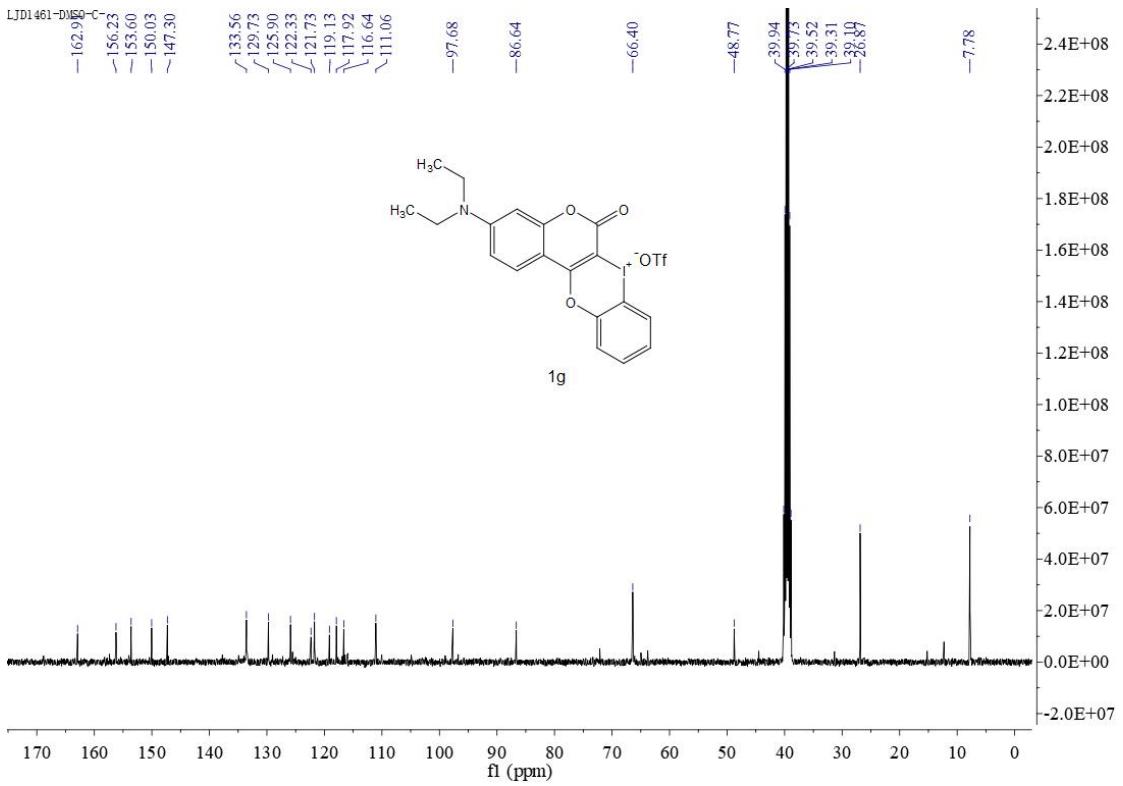
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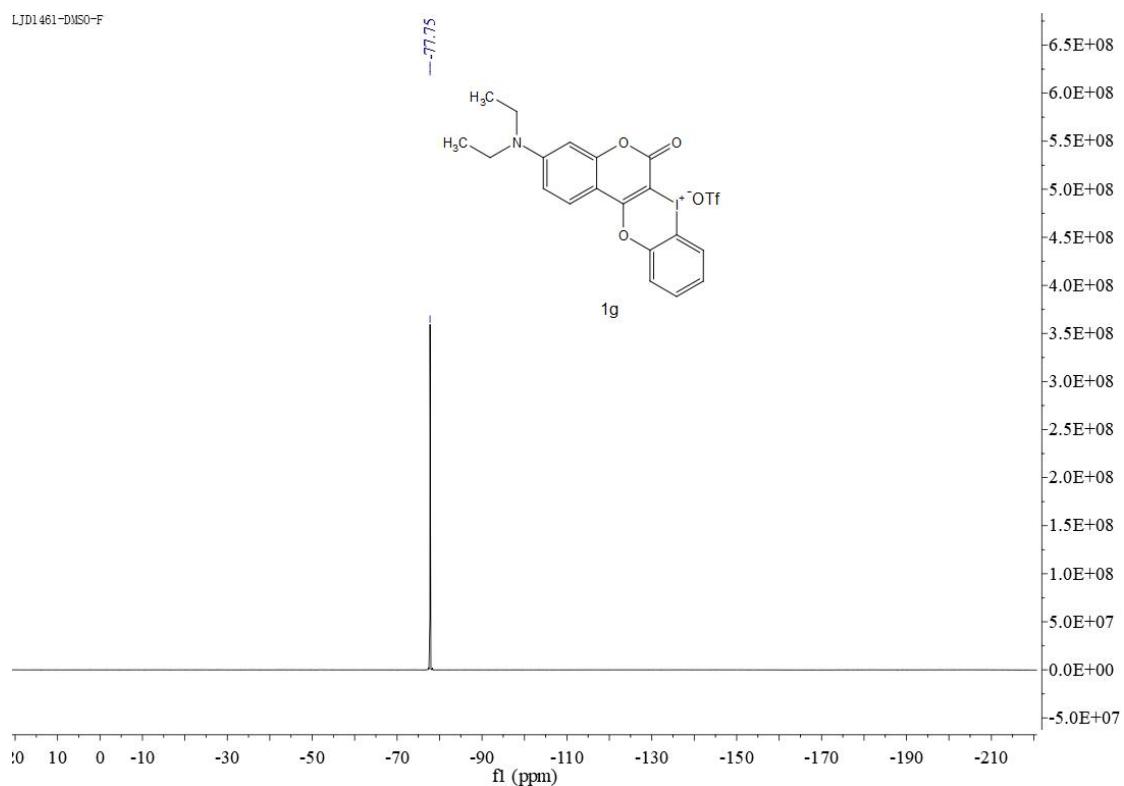
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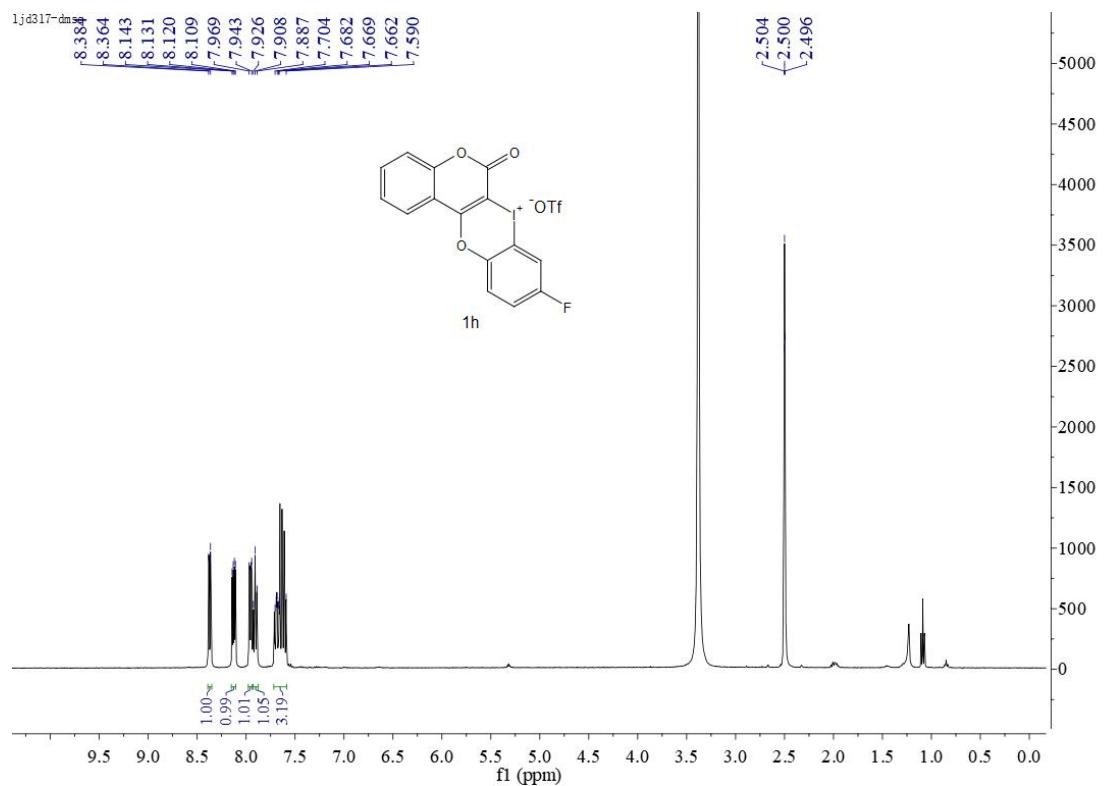
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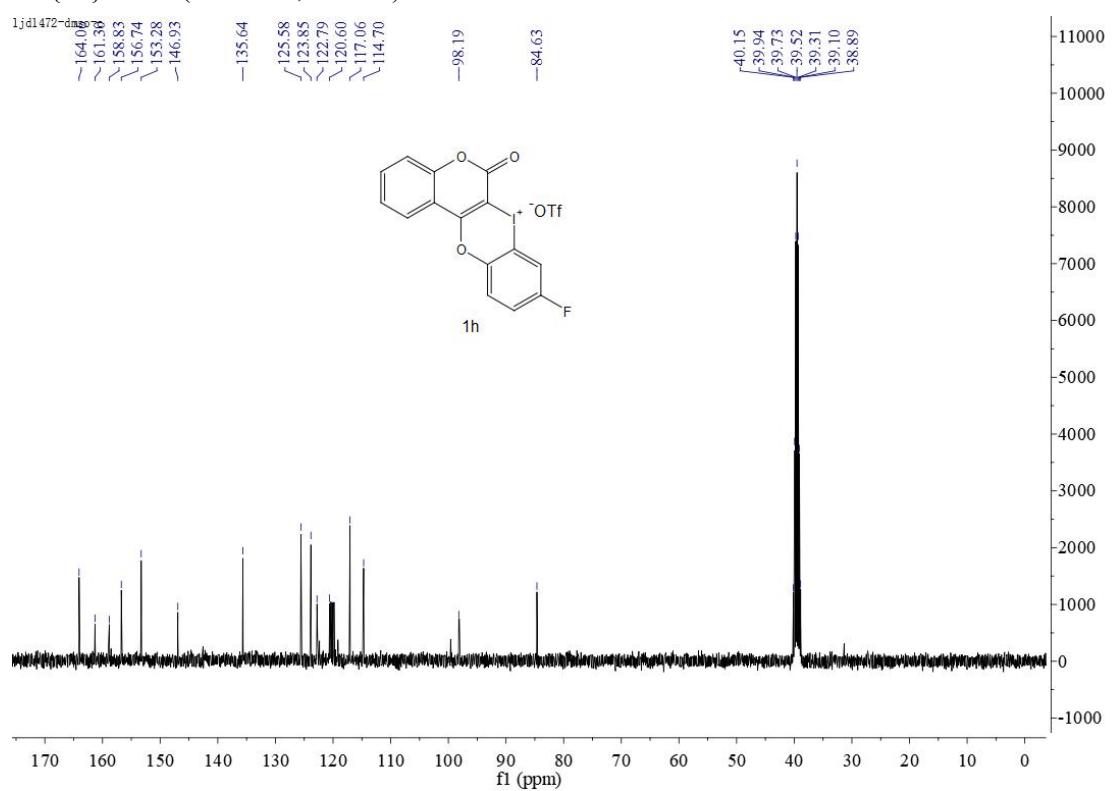
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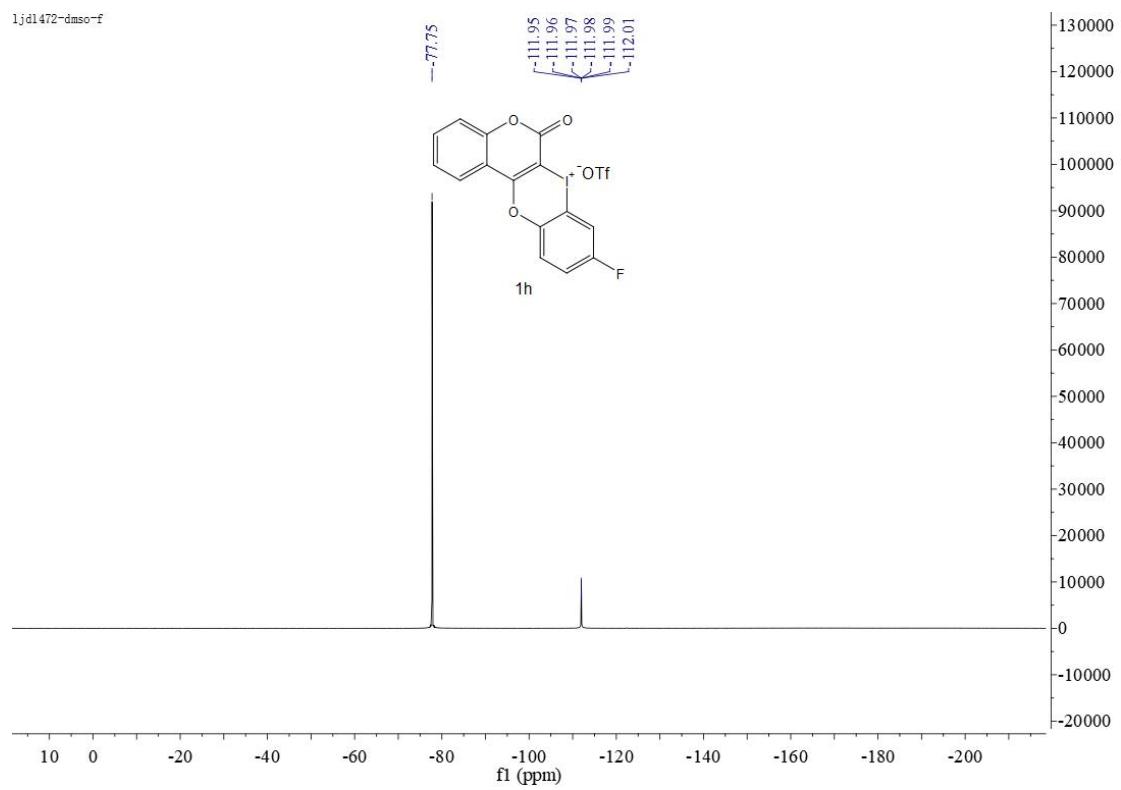
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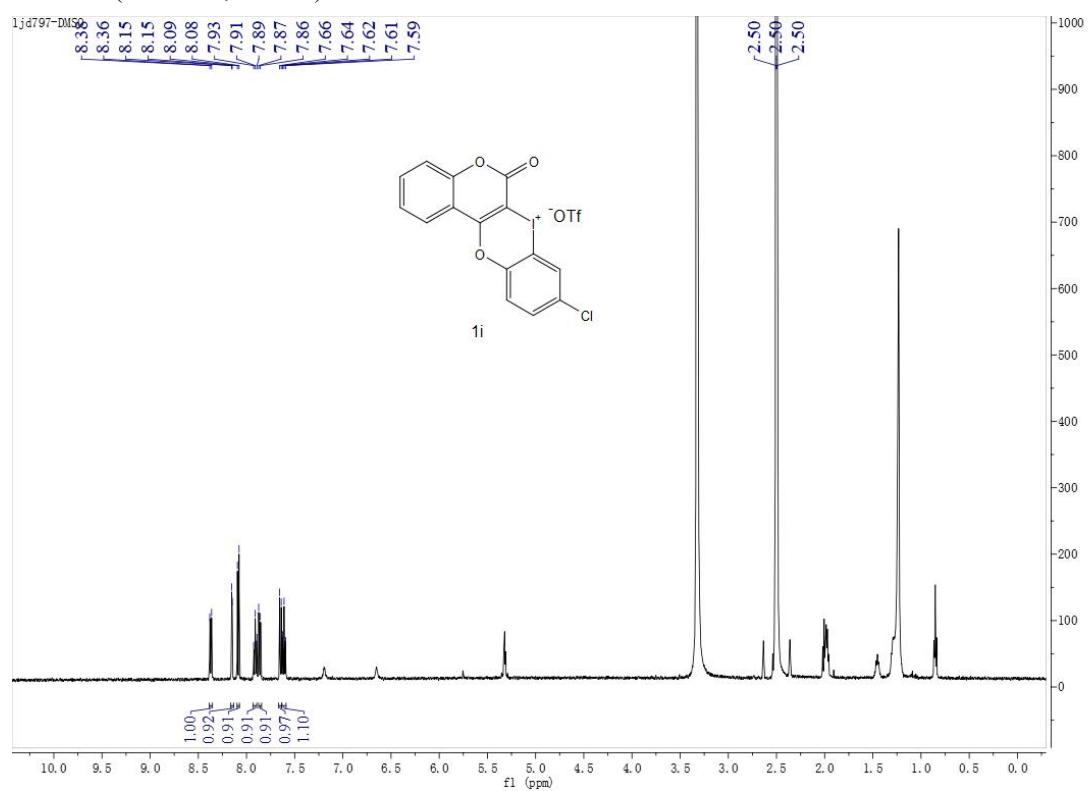
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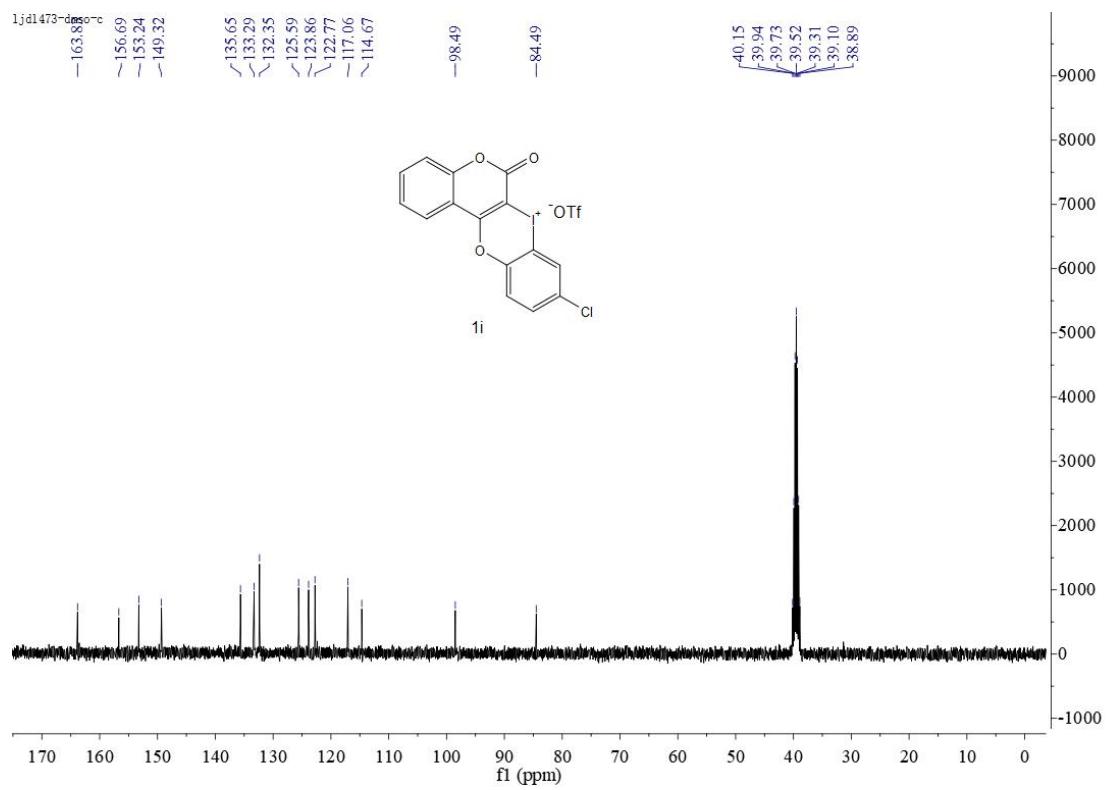
$^{19}\text{F}$  NMR (376 MHz, DMSO)



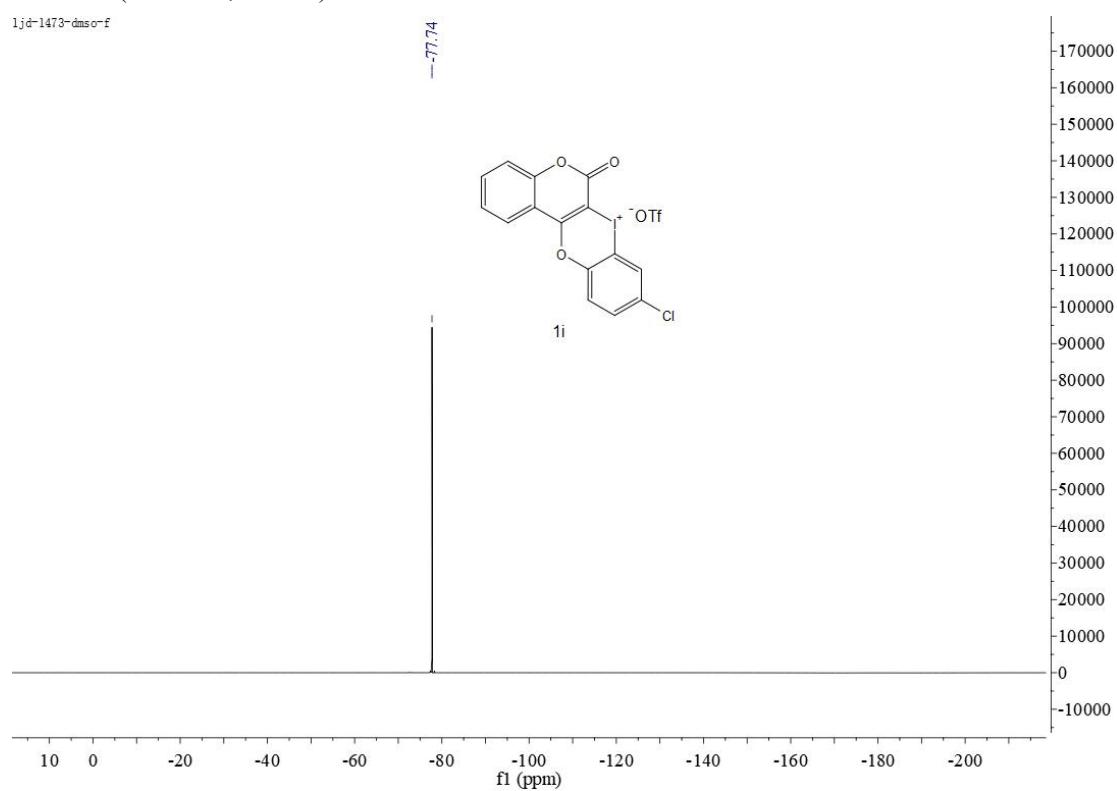
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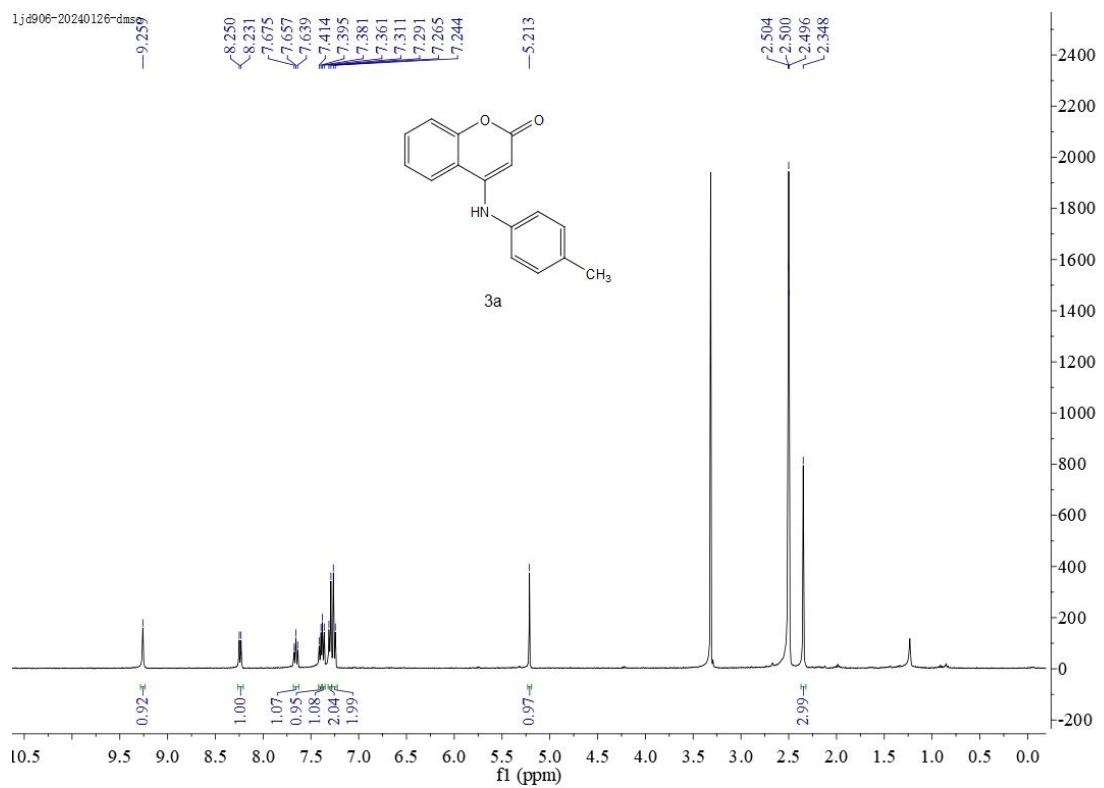
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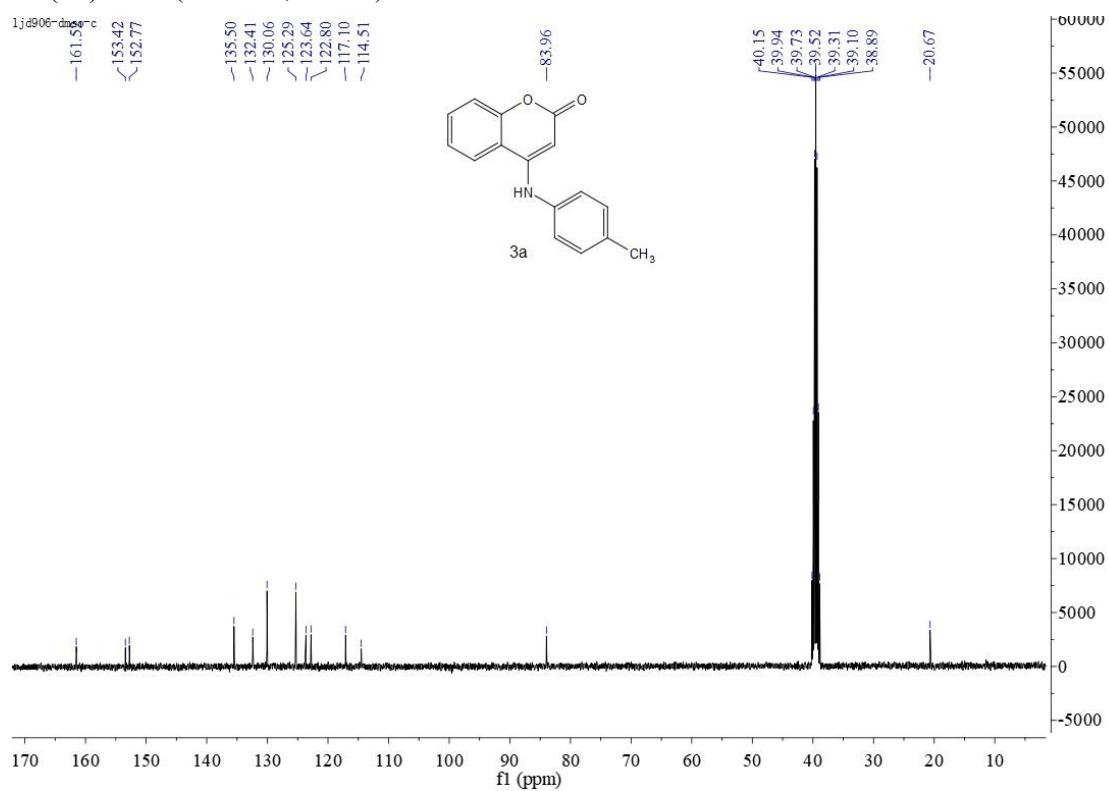
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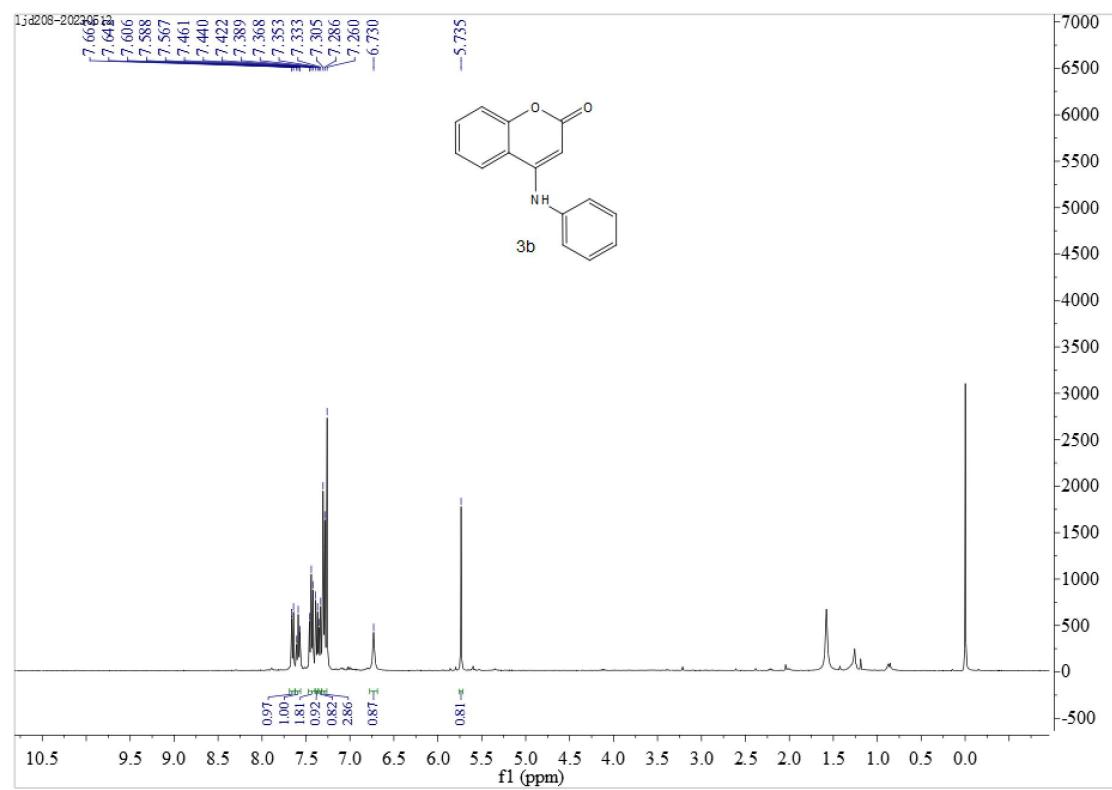
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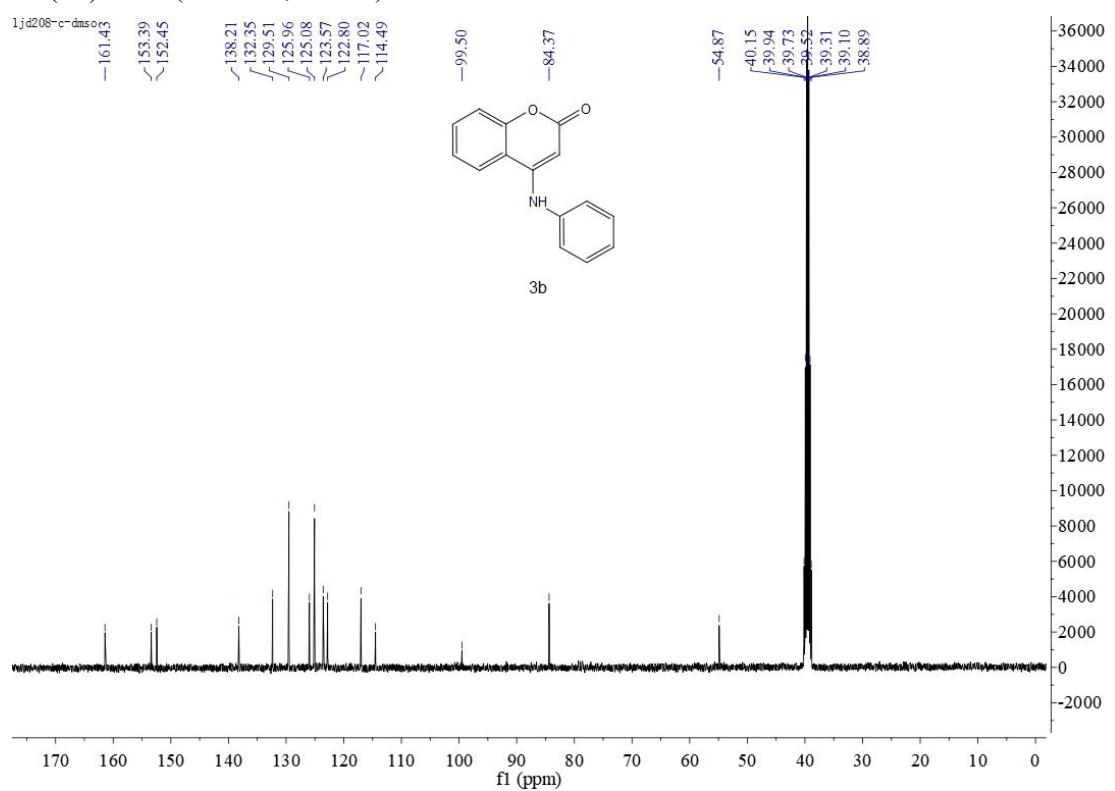
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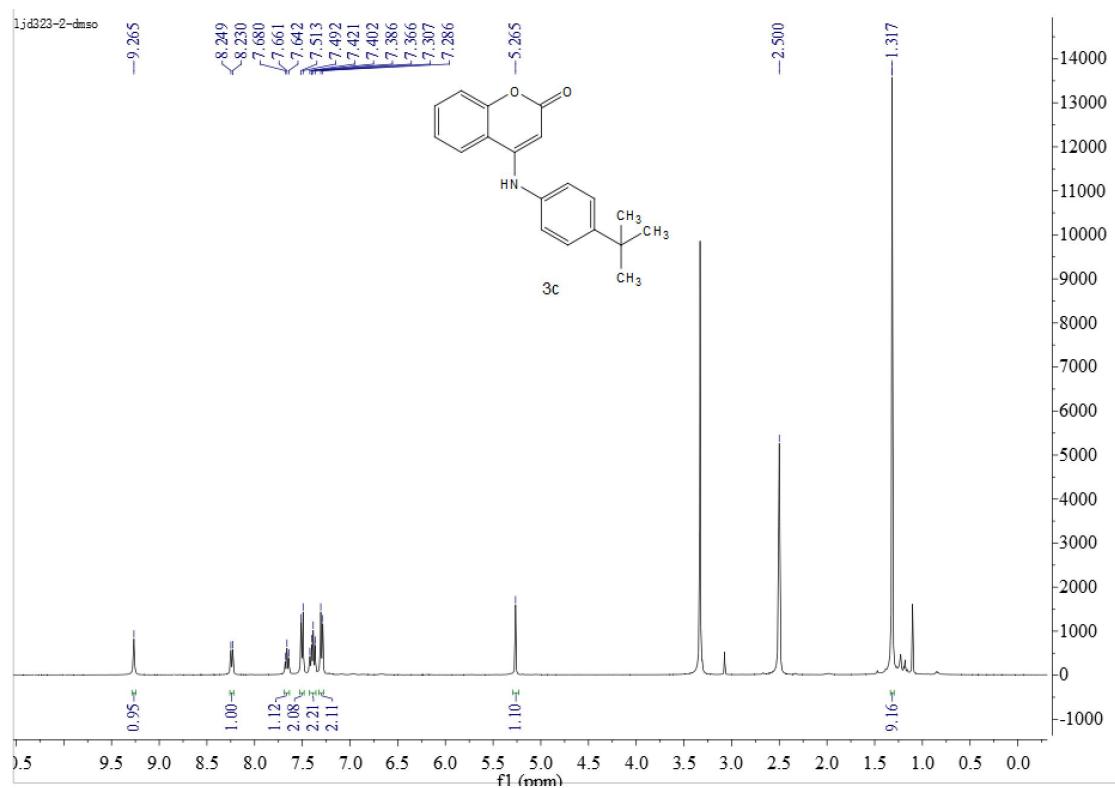
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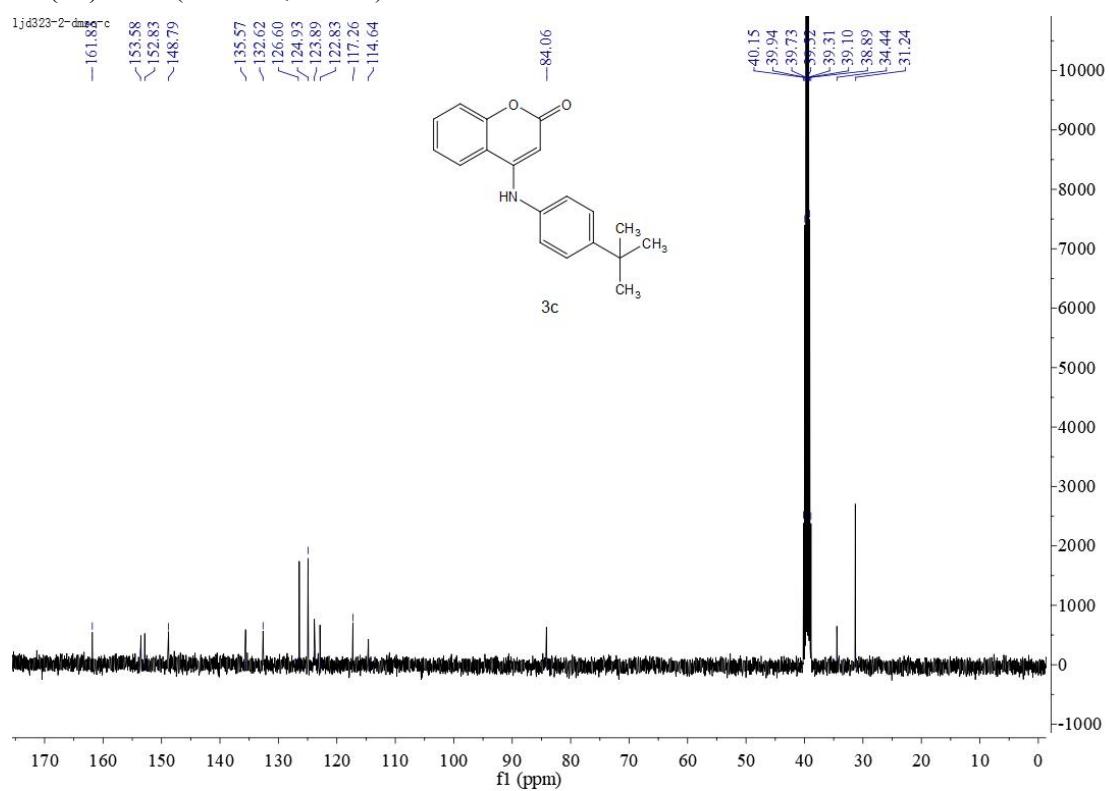
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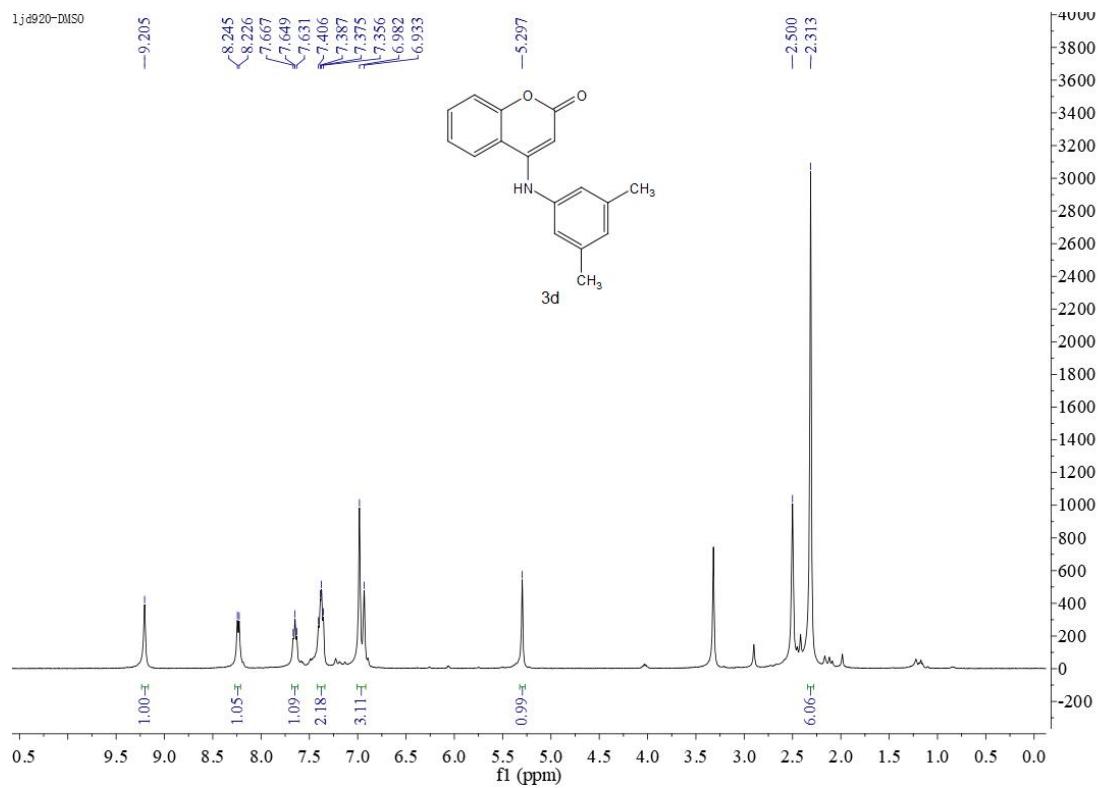
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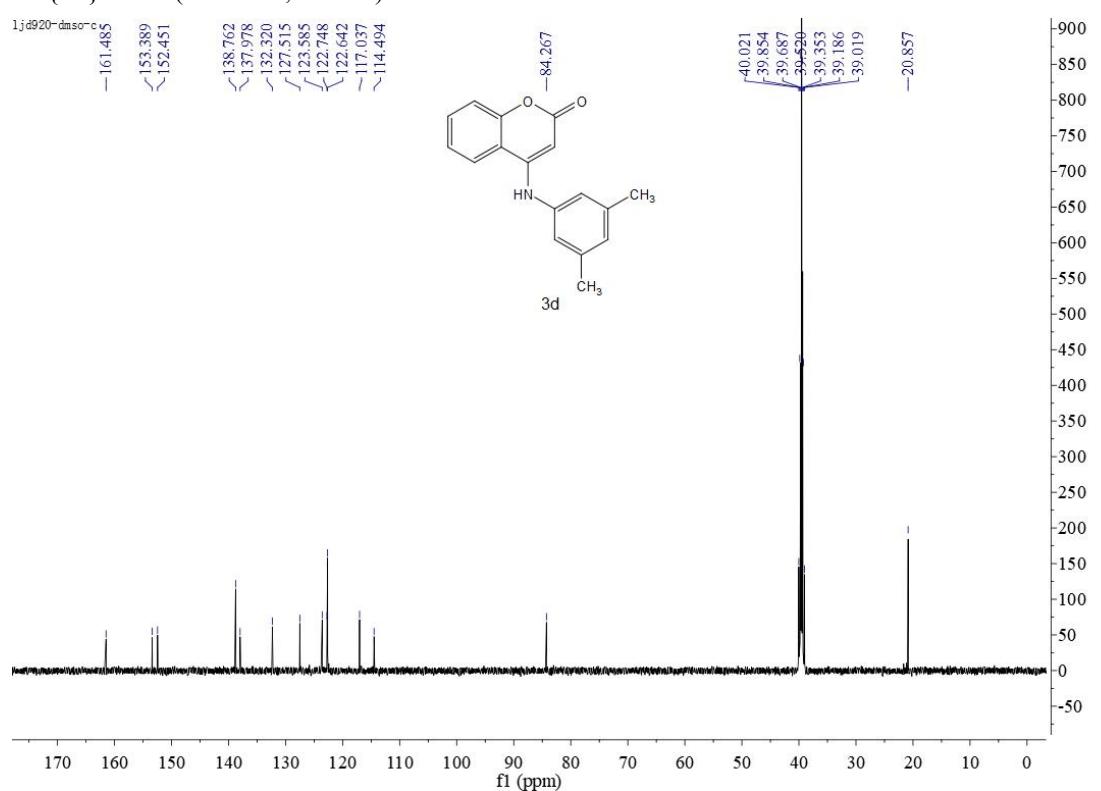
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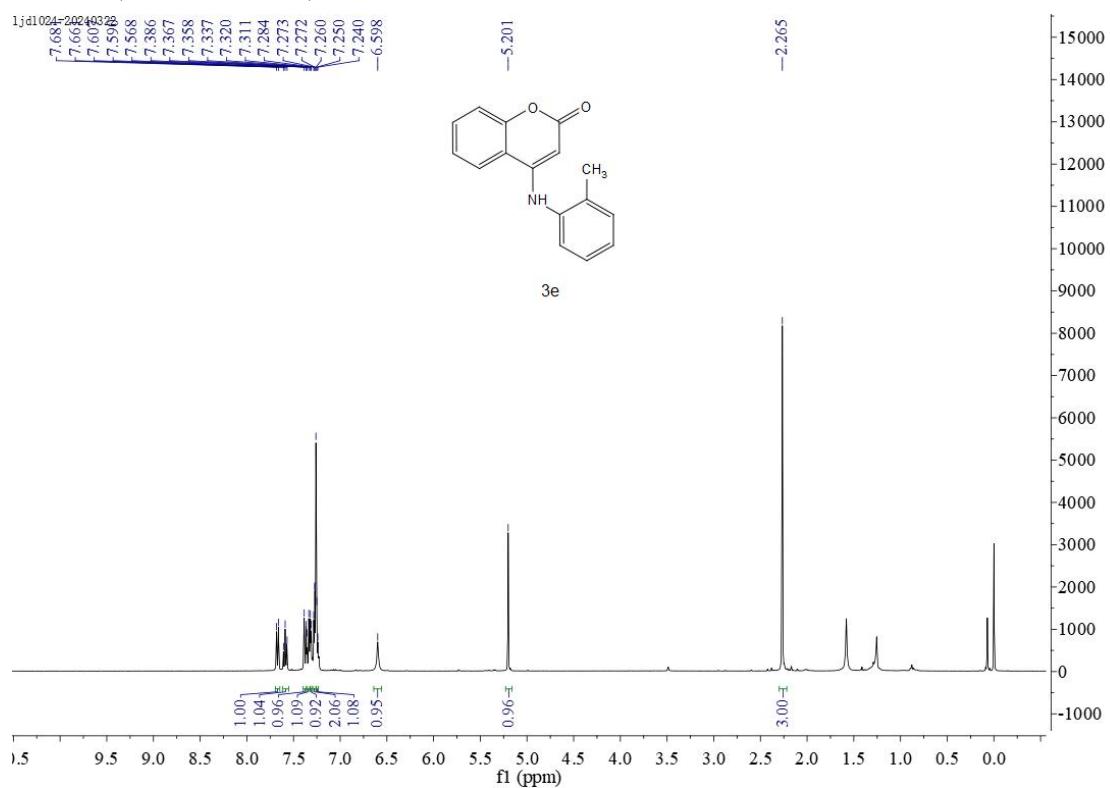
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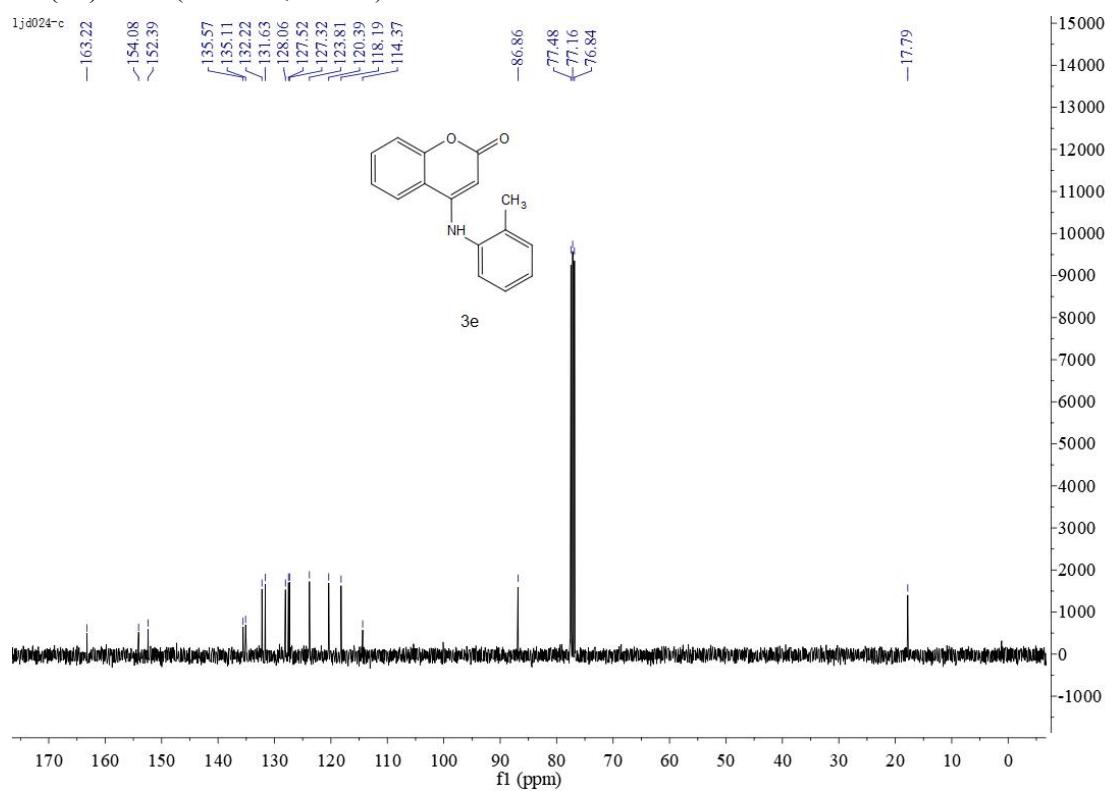
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



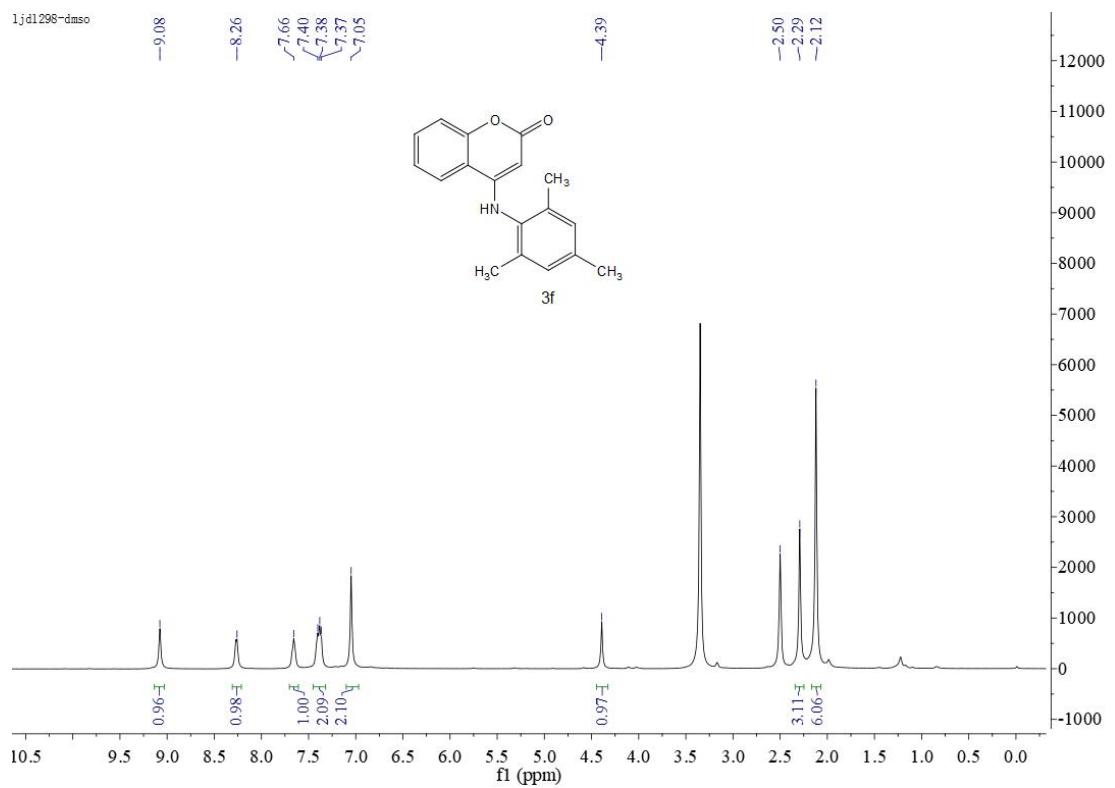
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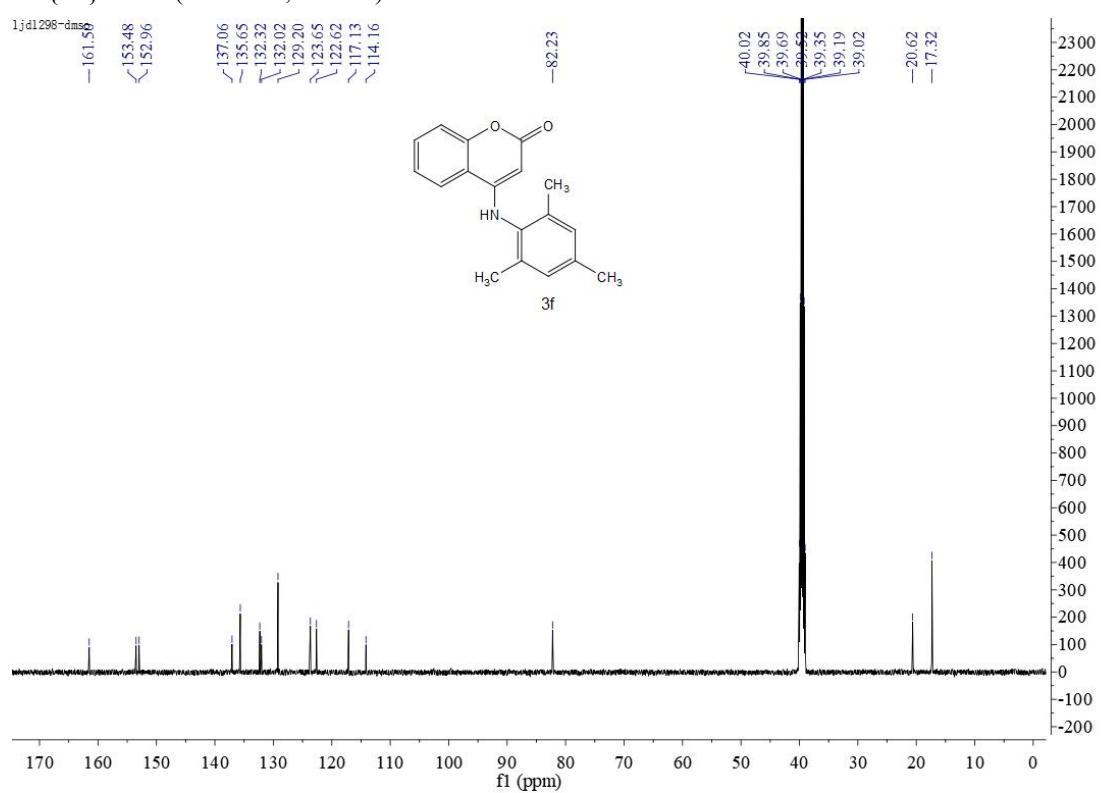
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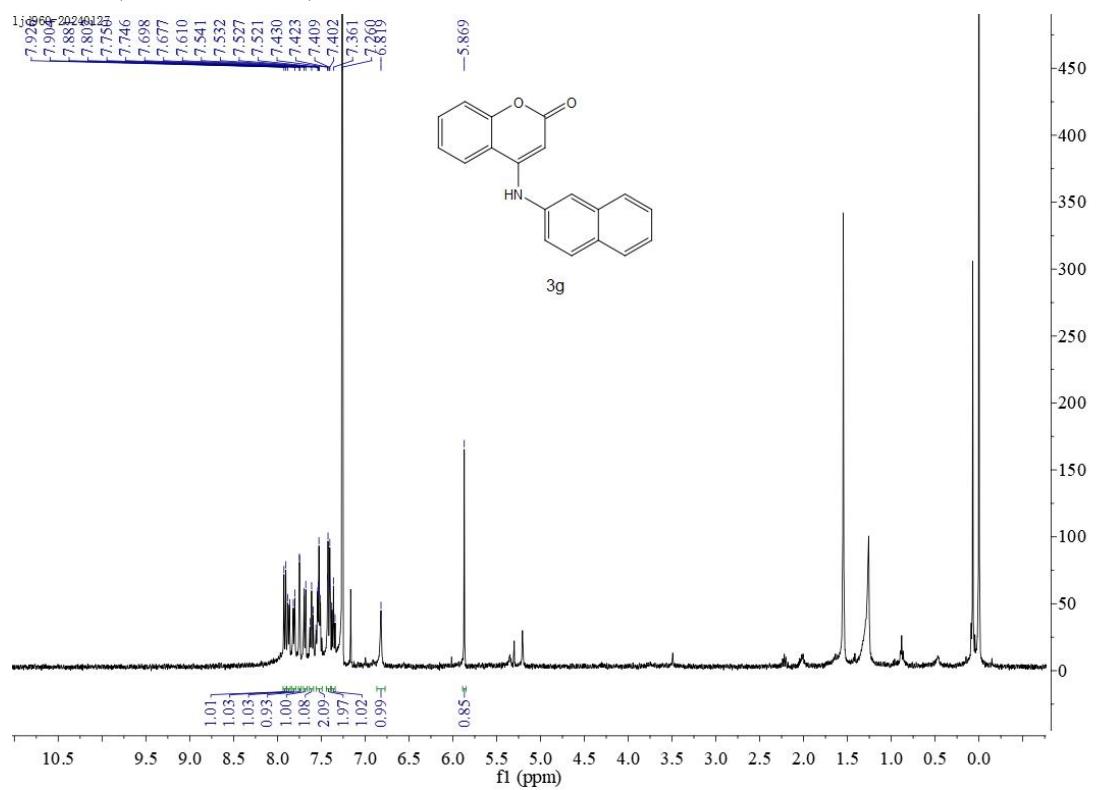
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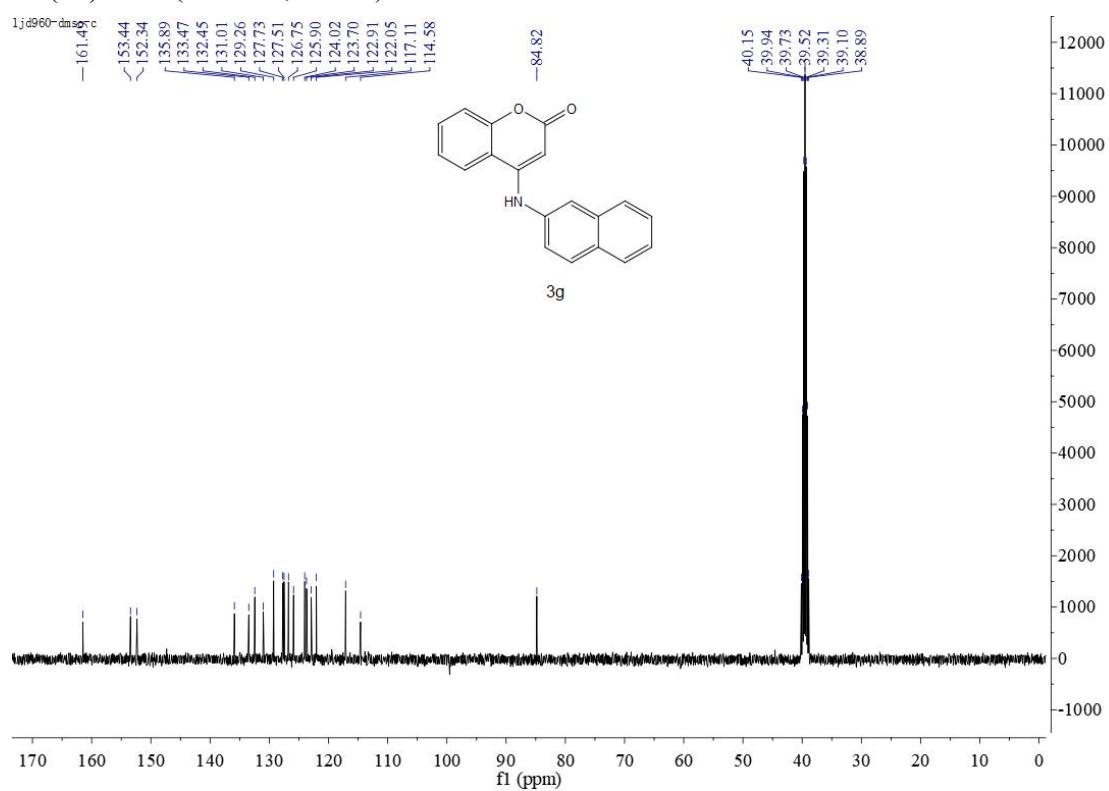
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



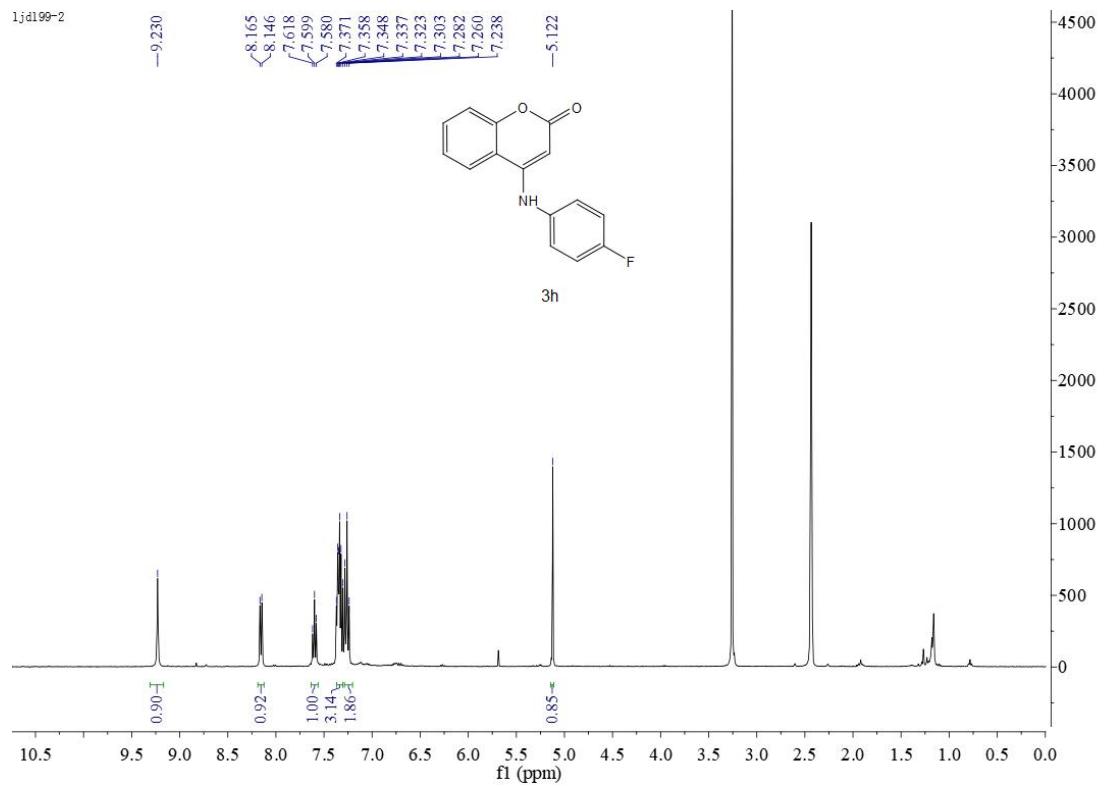
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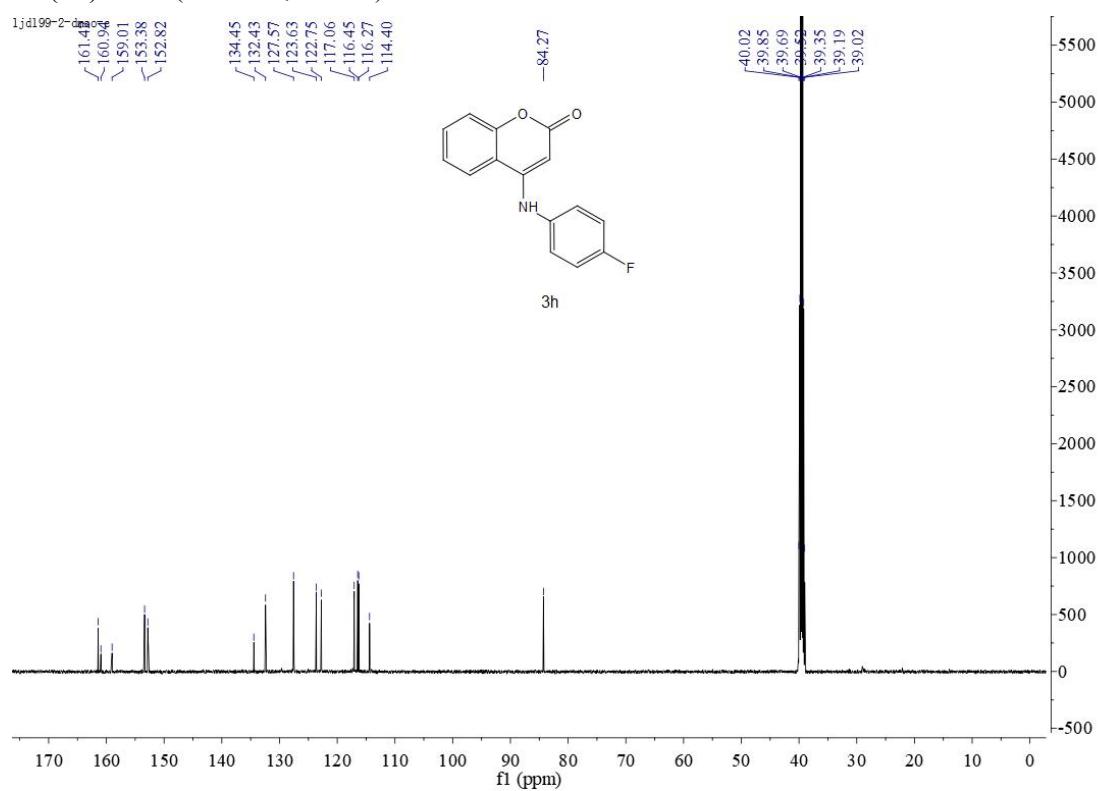
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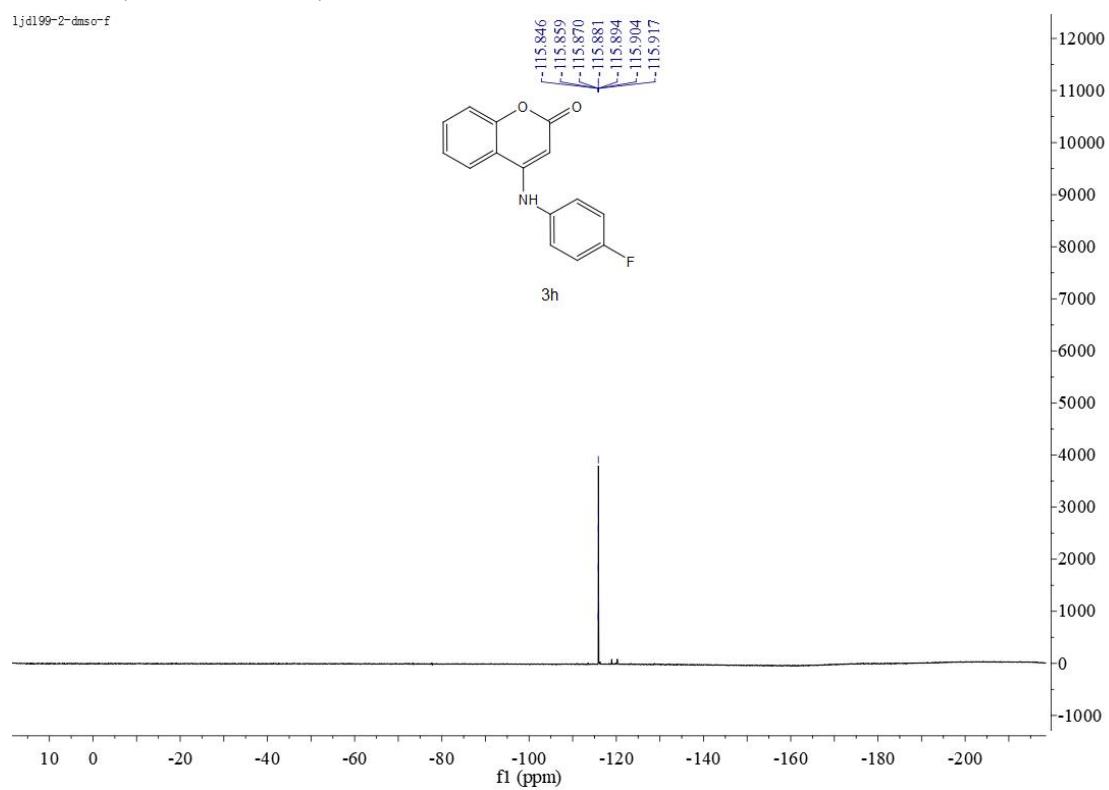
$^1\text{H}$  NMR (400 MHz, DMSO)



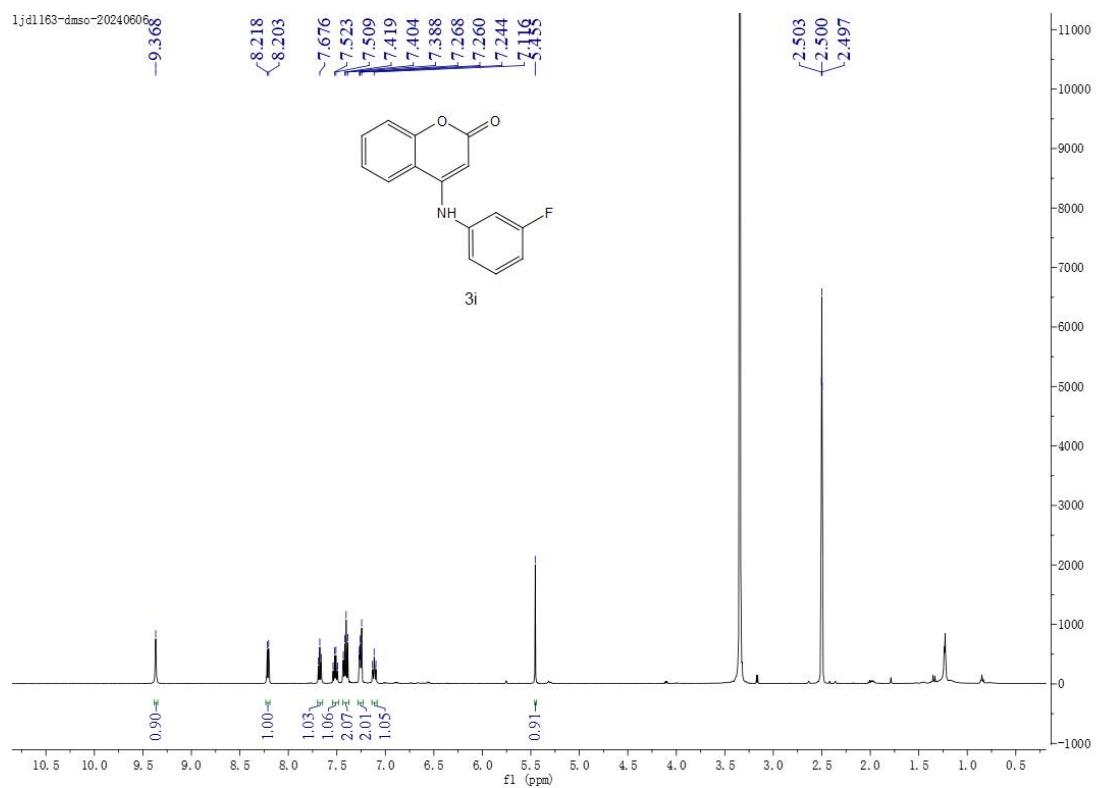
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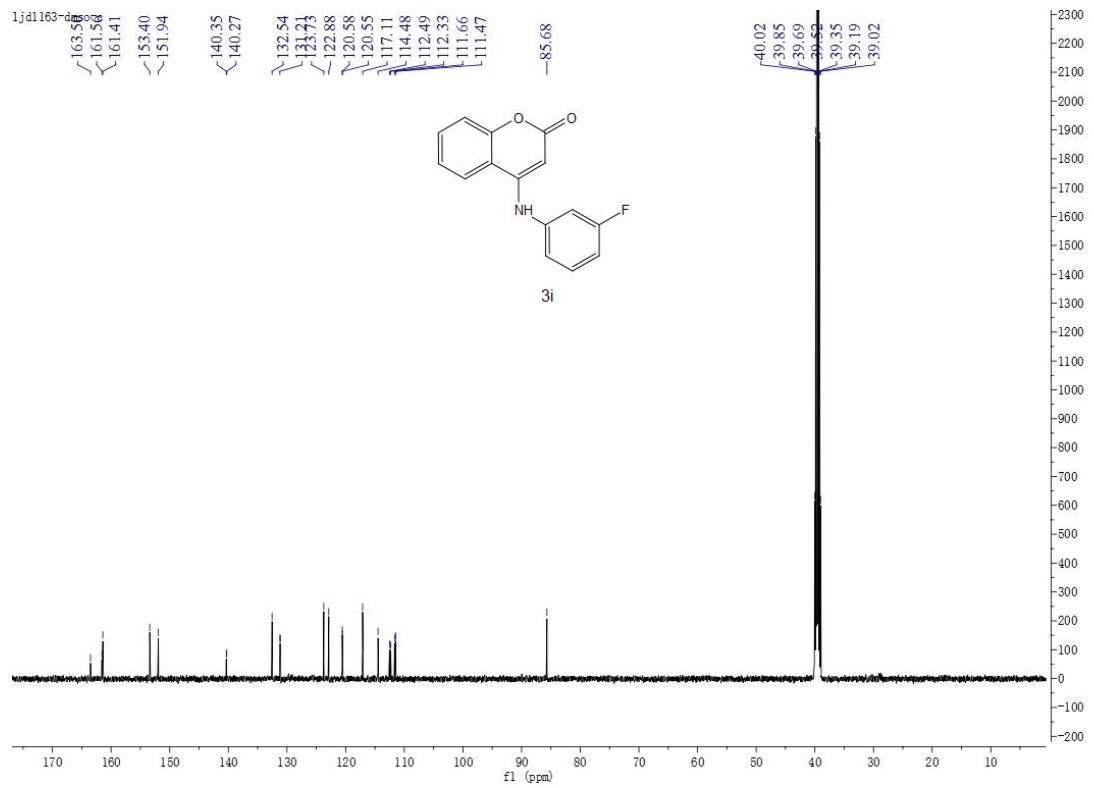
$^{19}\text{F}$  NMR (376 MHz, DMSO)



<sup>1</sup>H NMR (500 MHz, DMSO)

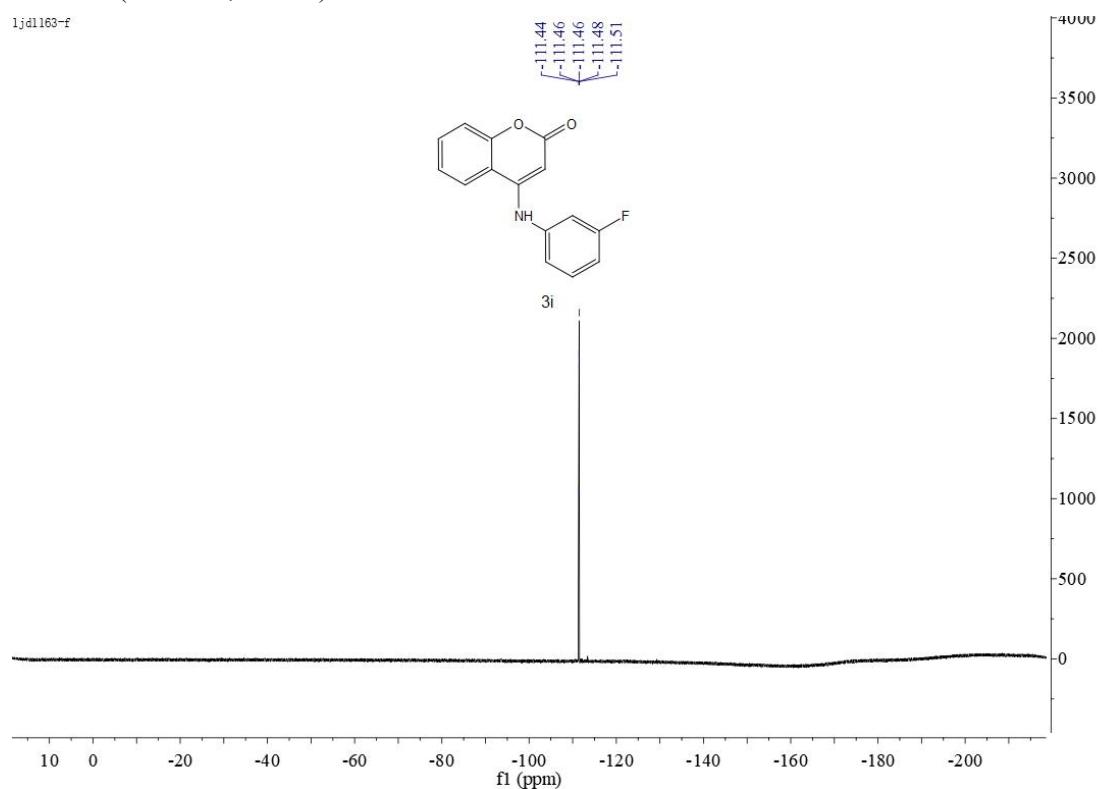


<sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO)



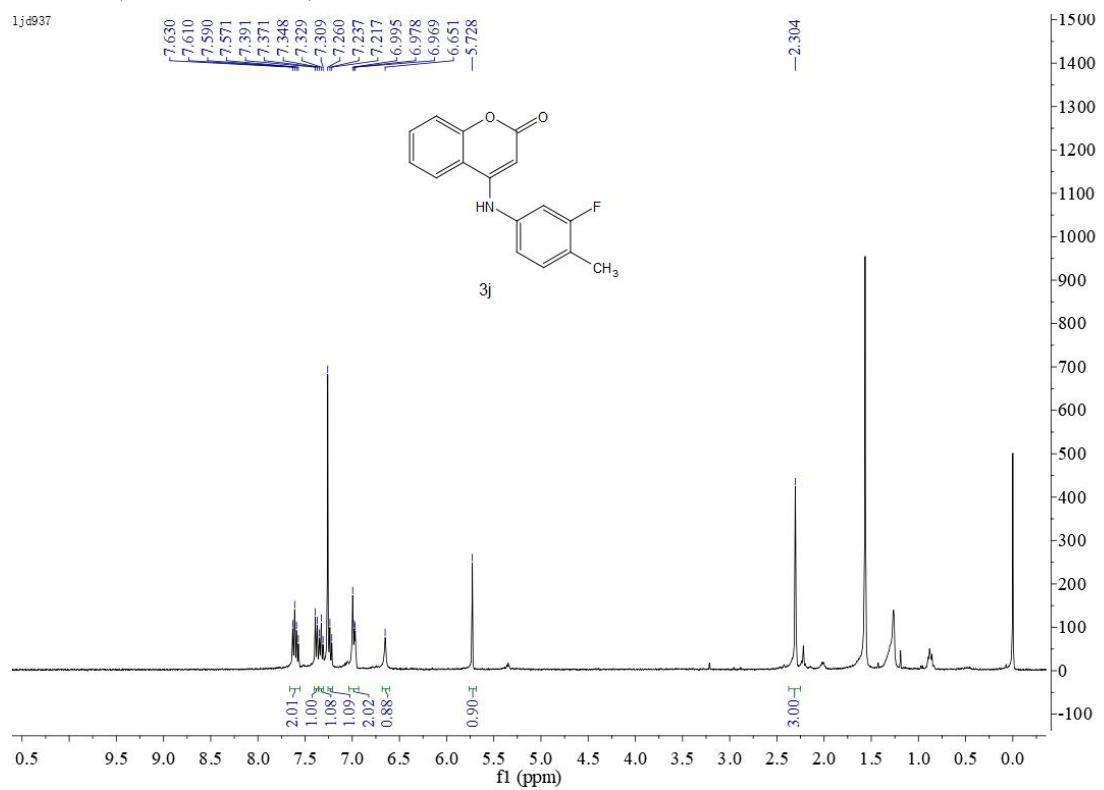
<sup>19</sup>F NMR (376 MHz, DMSO)

1jdl163-f

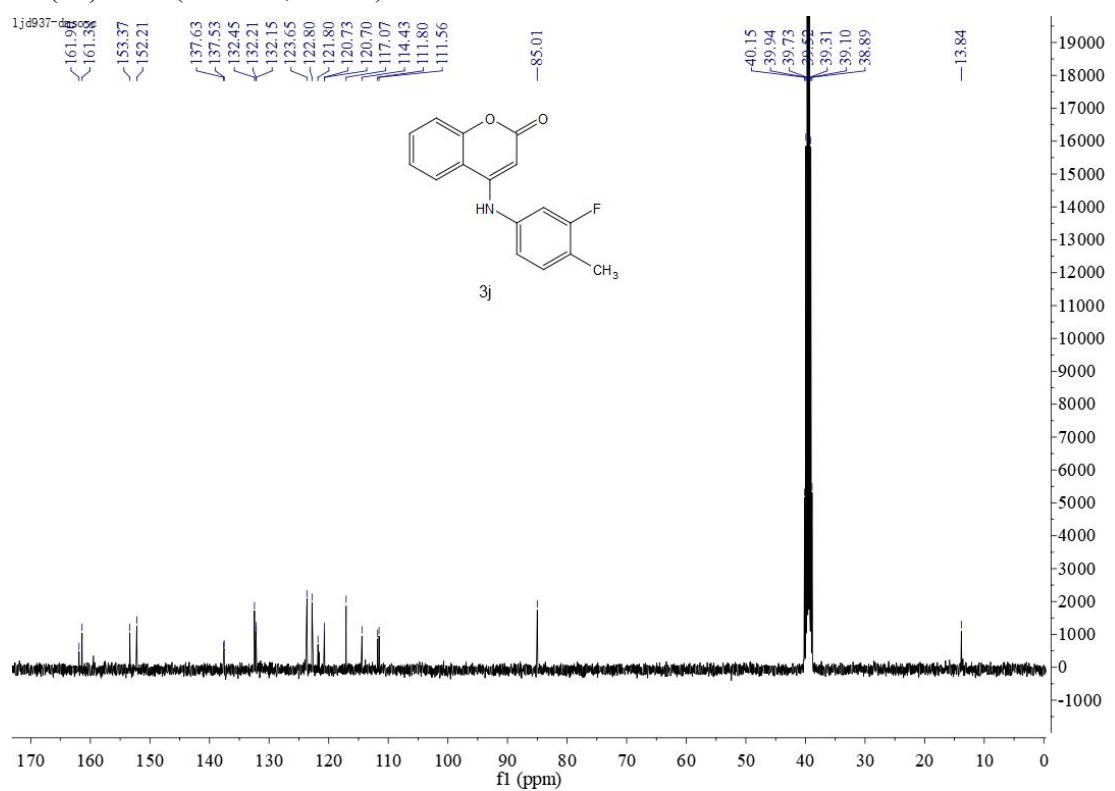


<sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)

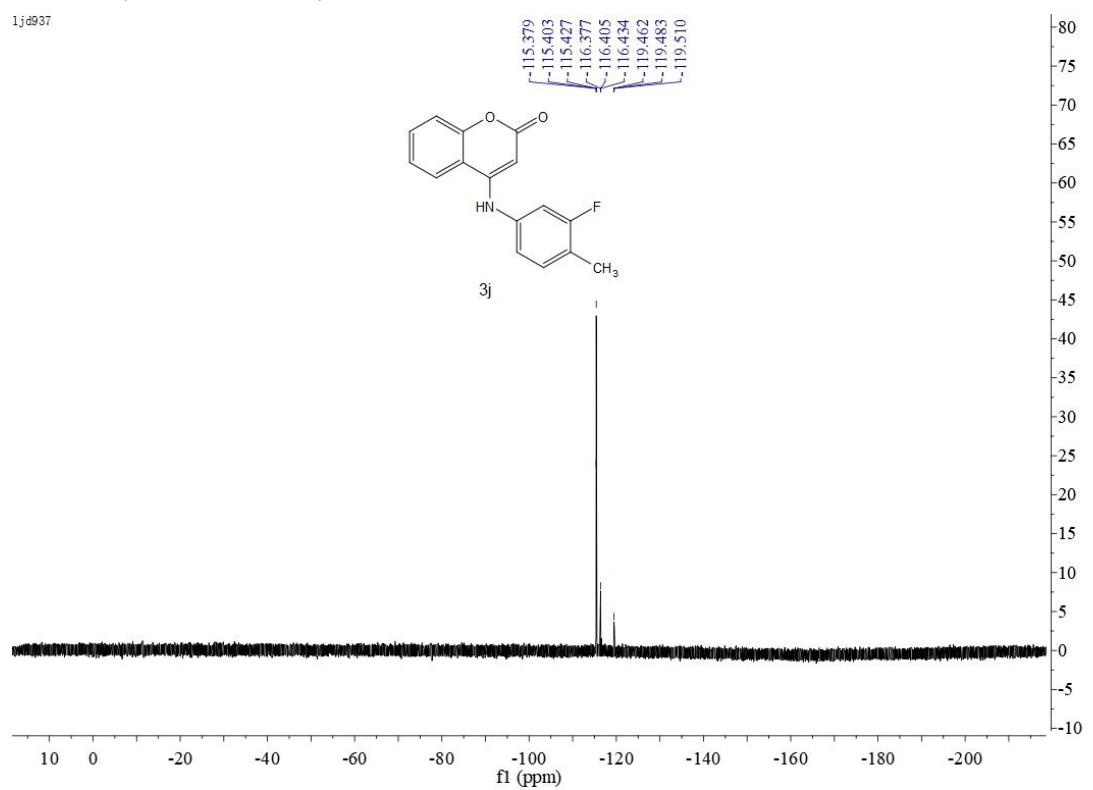
1jd937



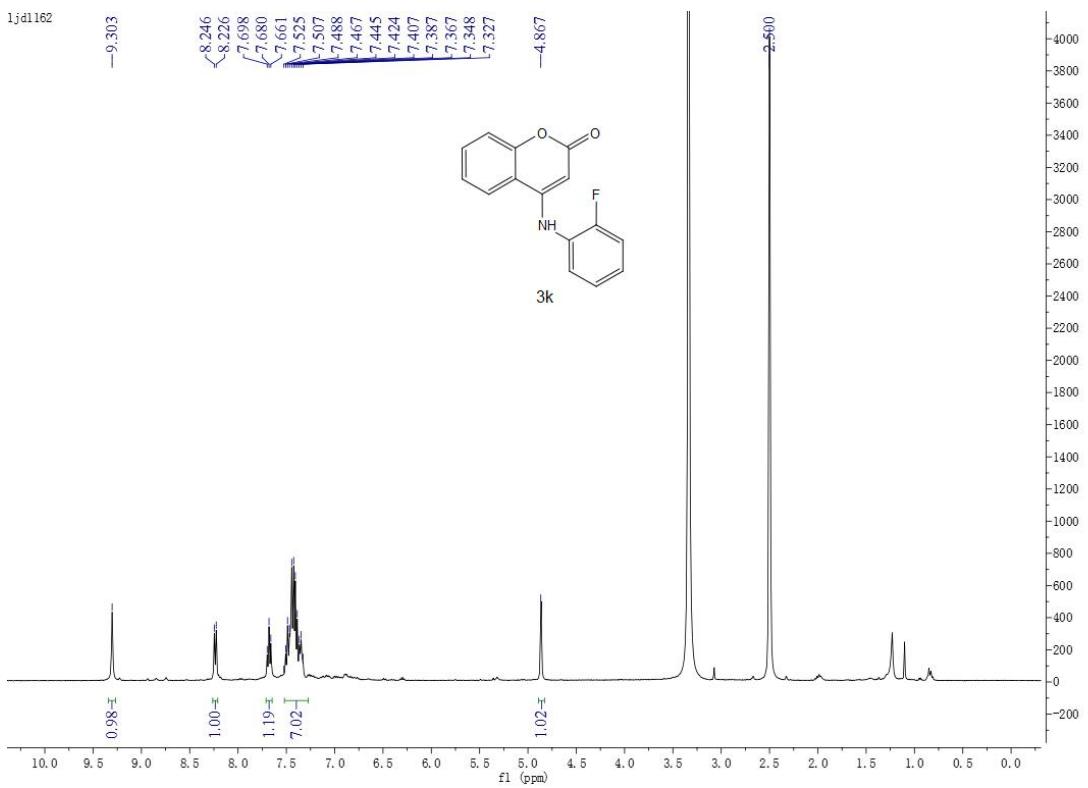
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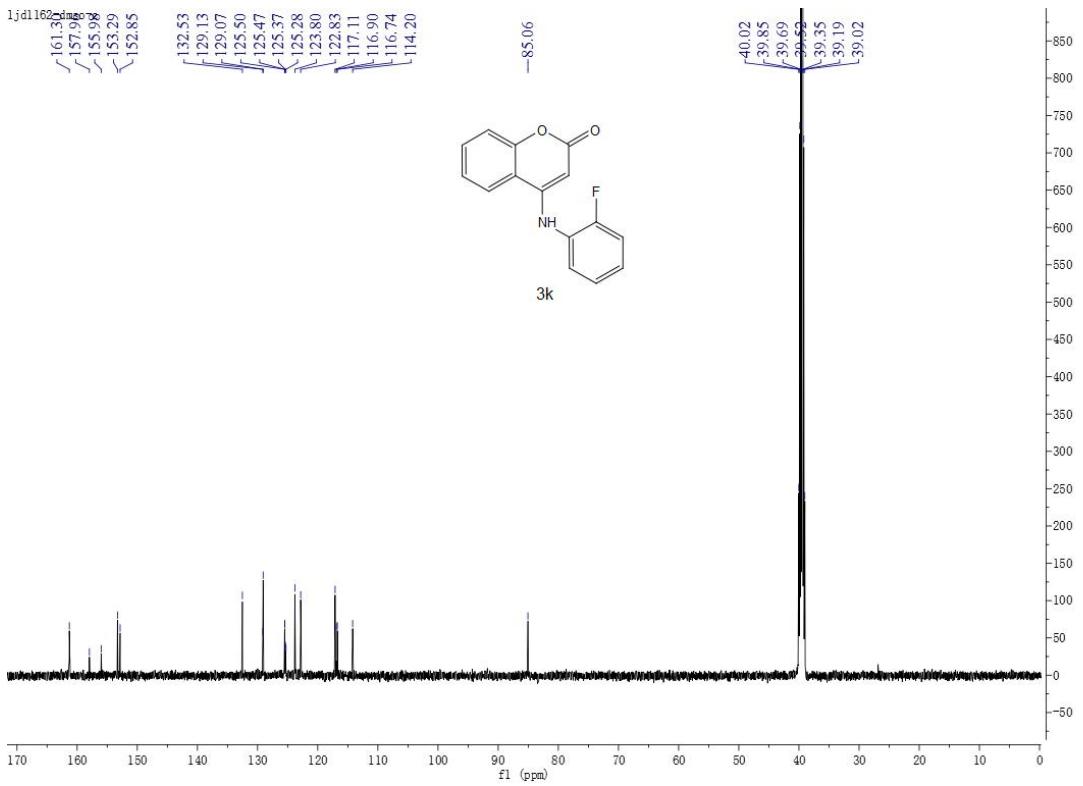
$^{19}\text{F}$  NMR (376 MHz, DMSO)



<sup>1</sup>H NMR (400 MHz, DMSO)

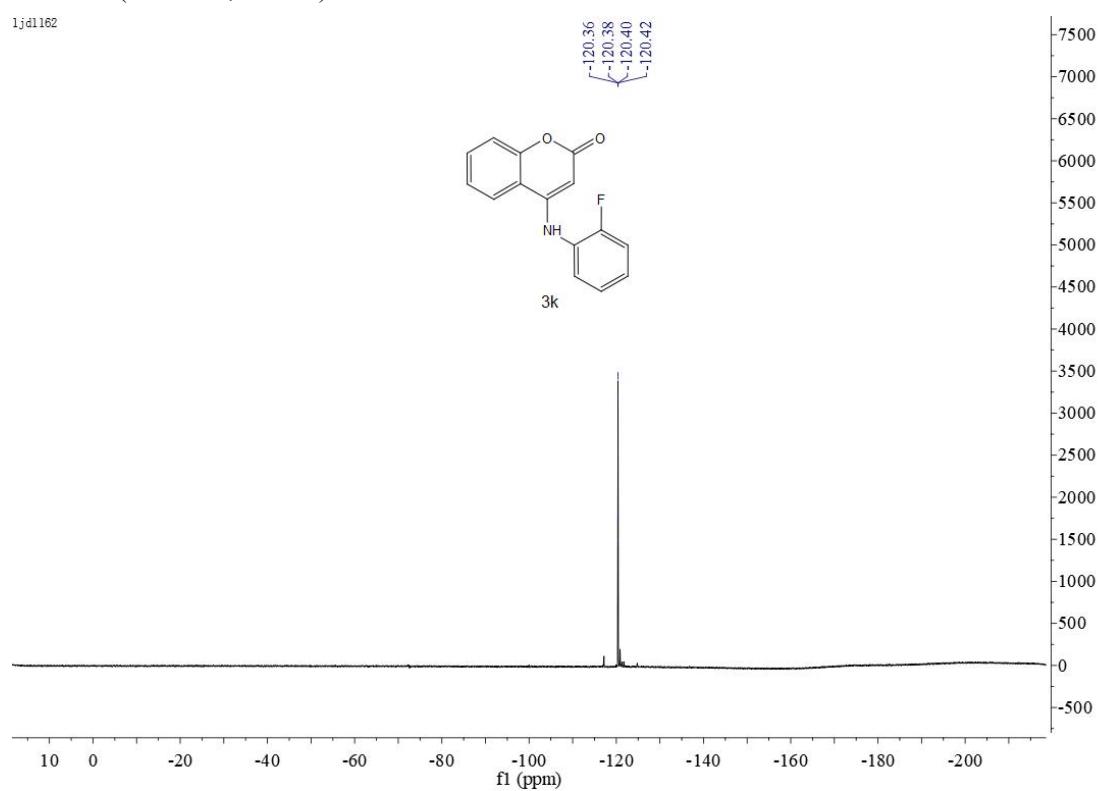
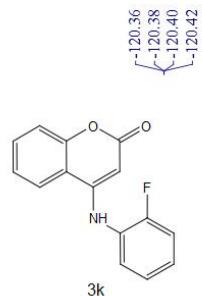


<sup>13</sup>C{<sup>1</sup>H} NMR (126 MHz, DMSO)



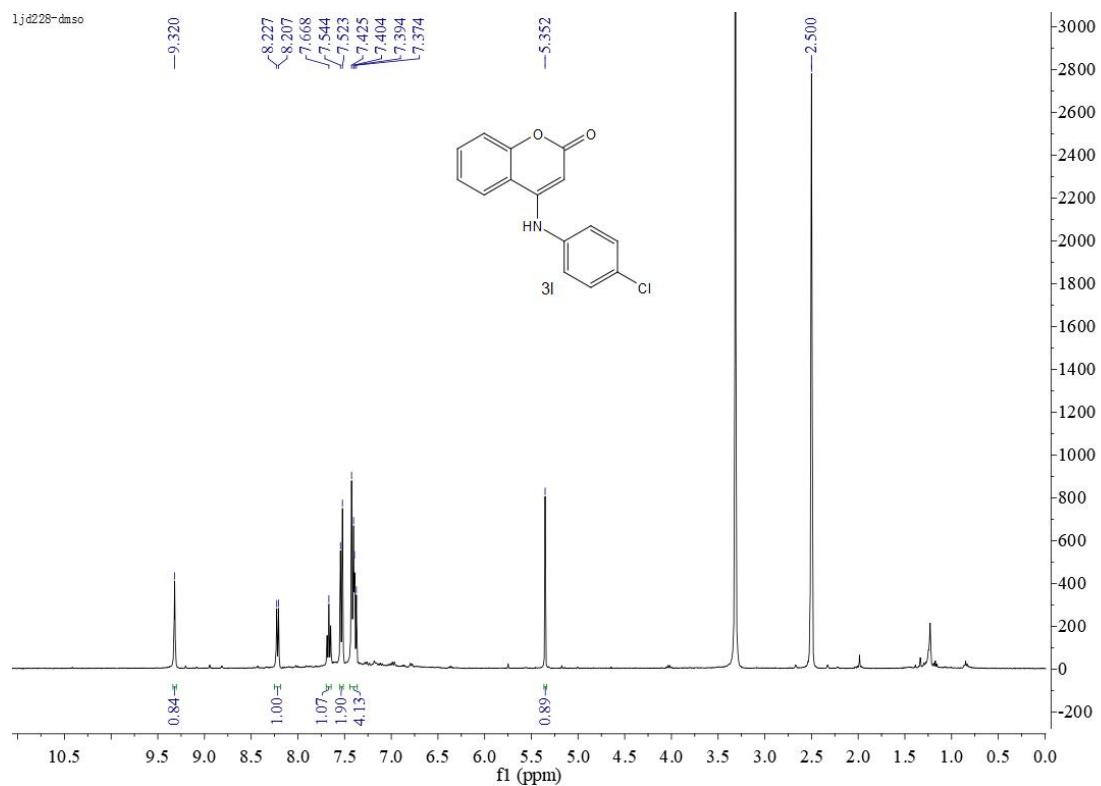
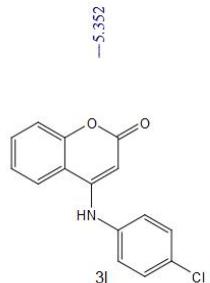
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1jdl162

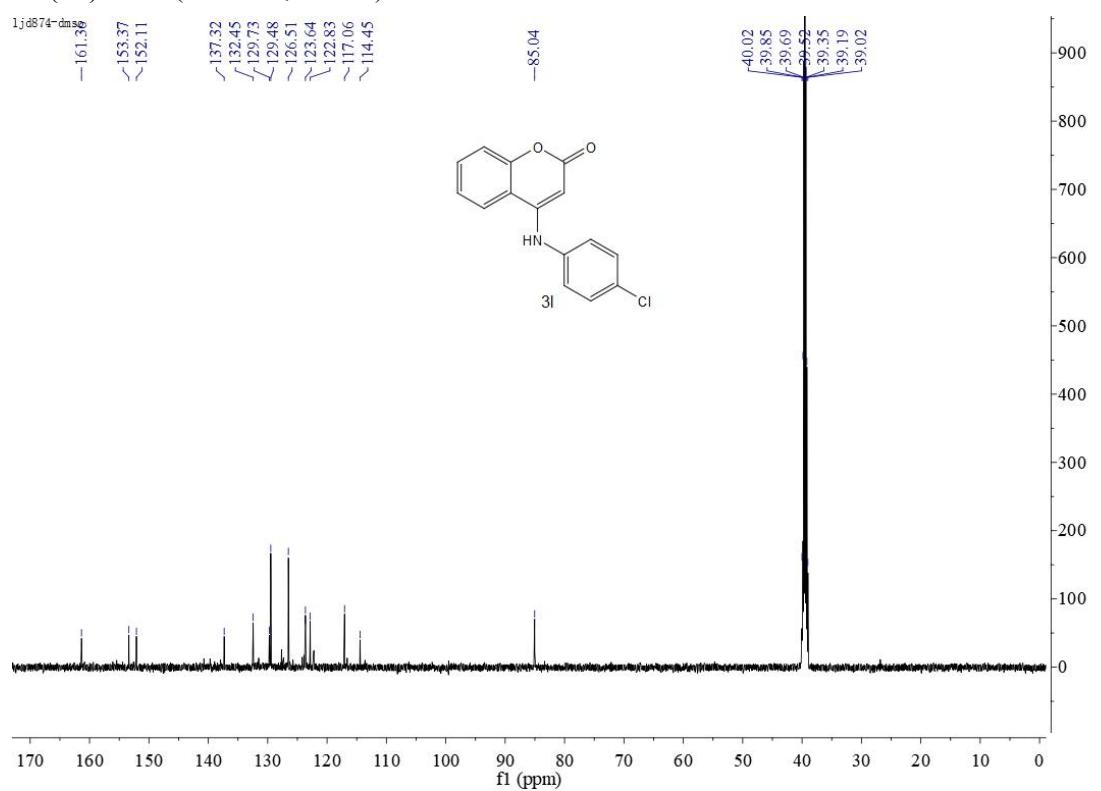


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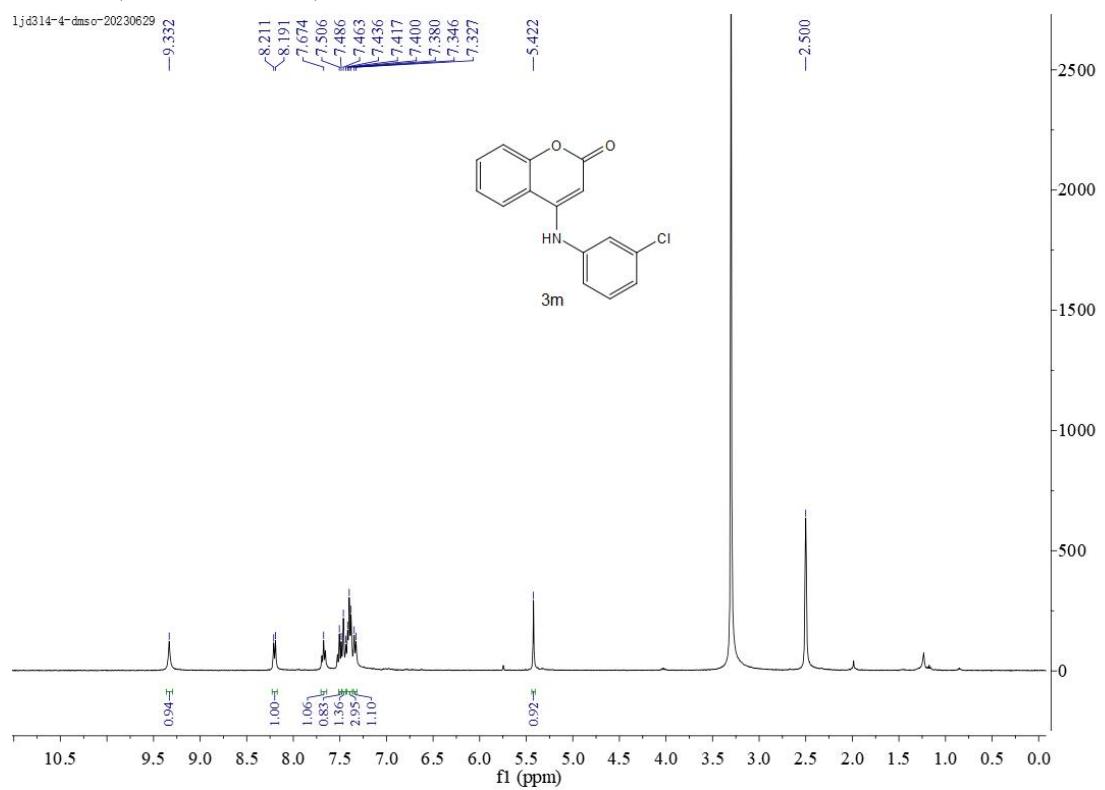
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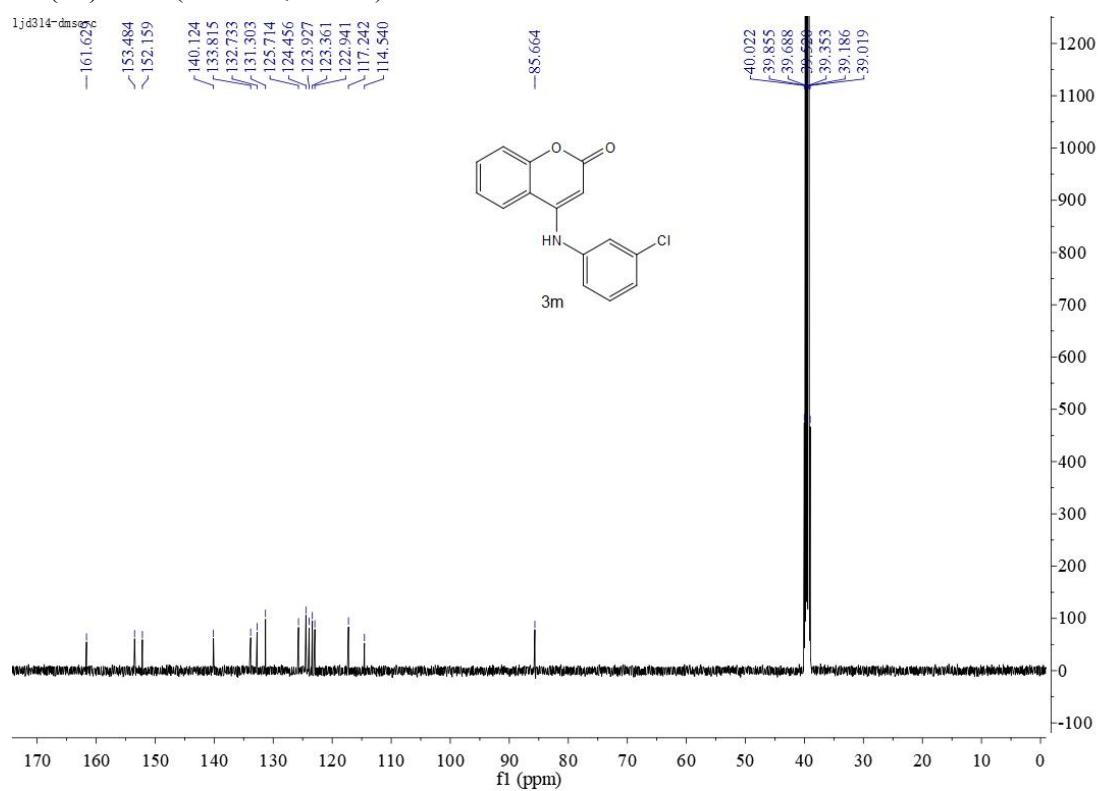
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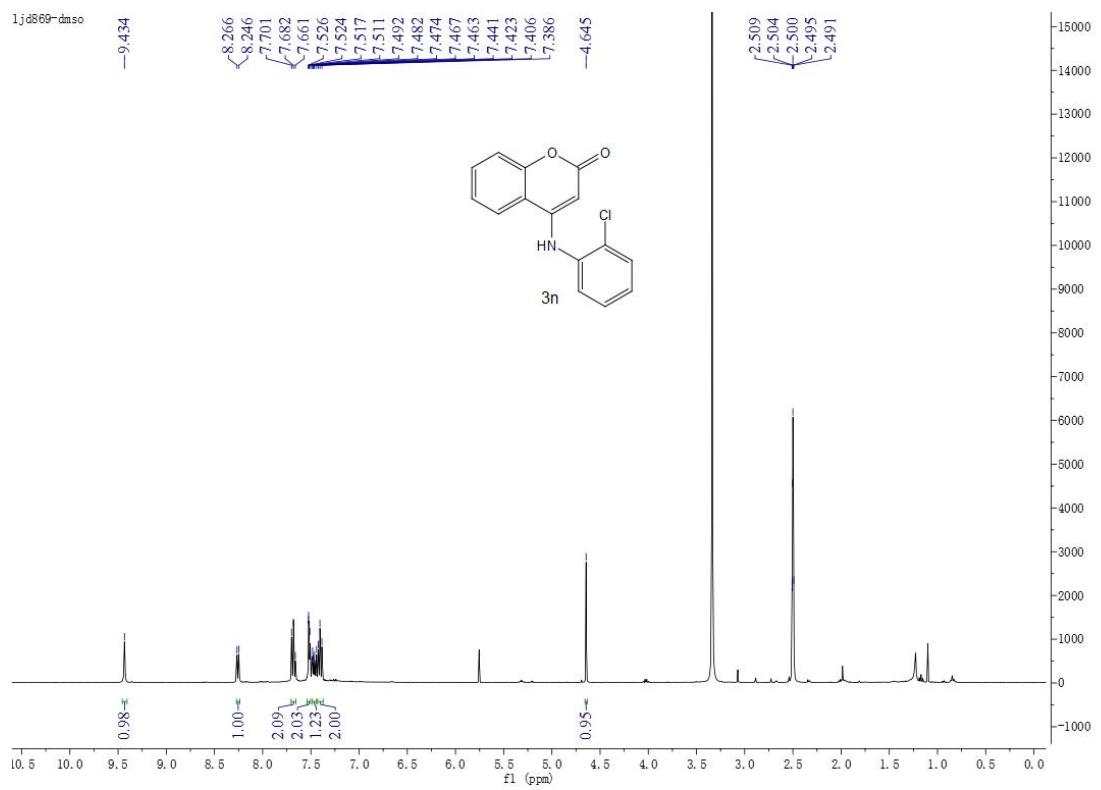
$^1\text{H}$  NMR (400 MHz, DMSO)



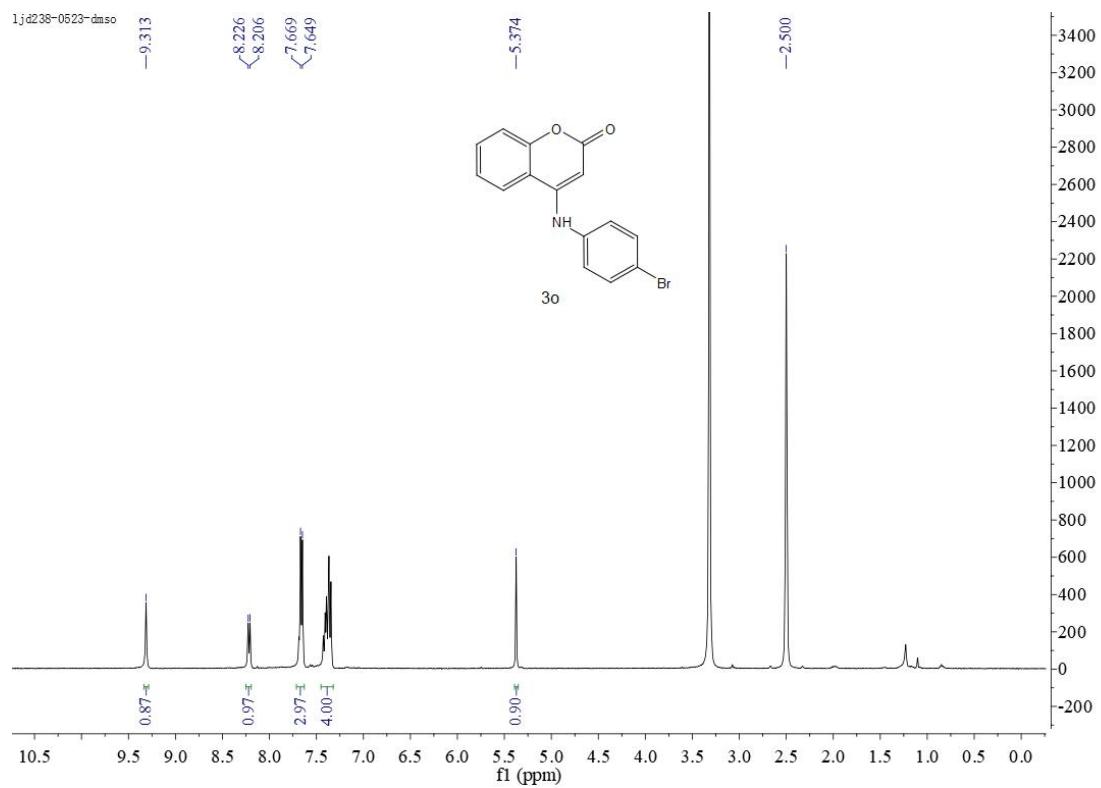
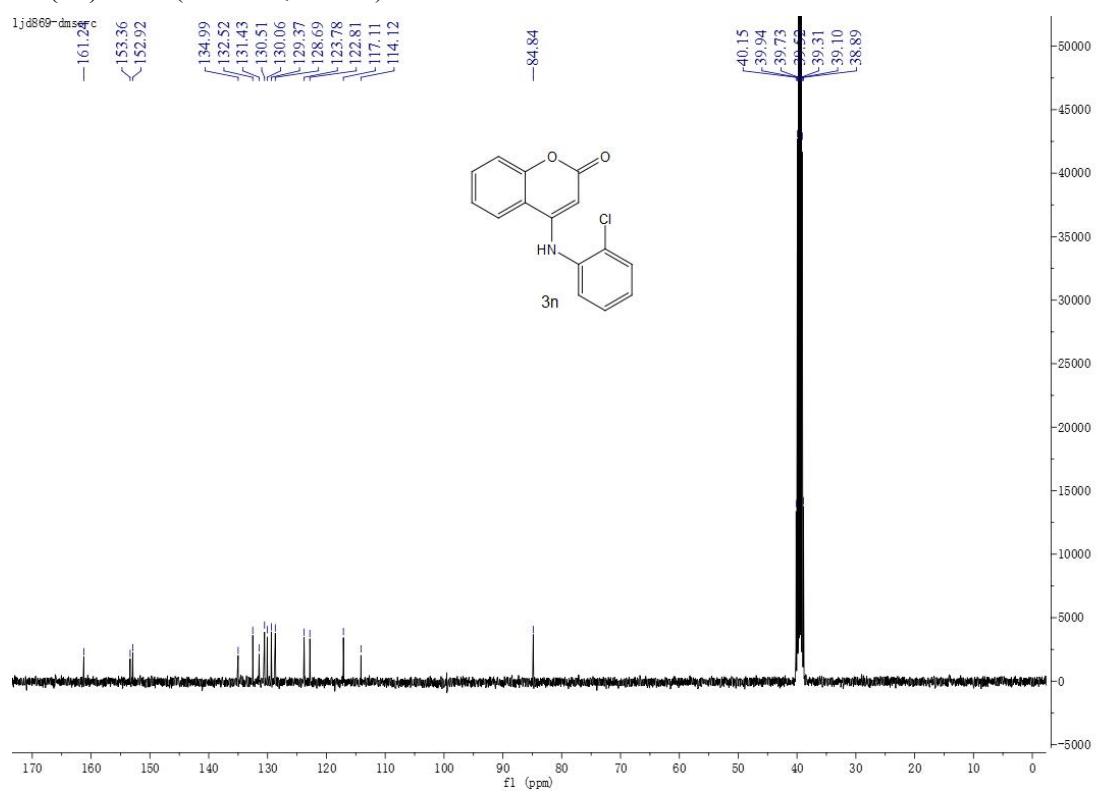
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



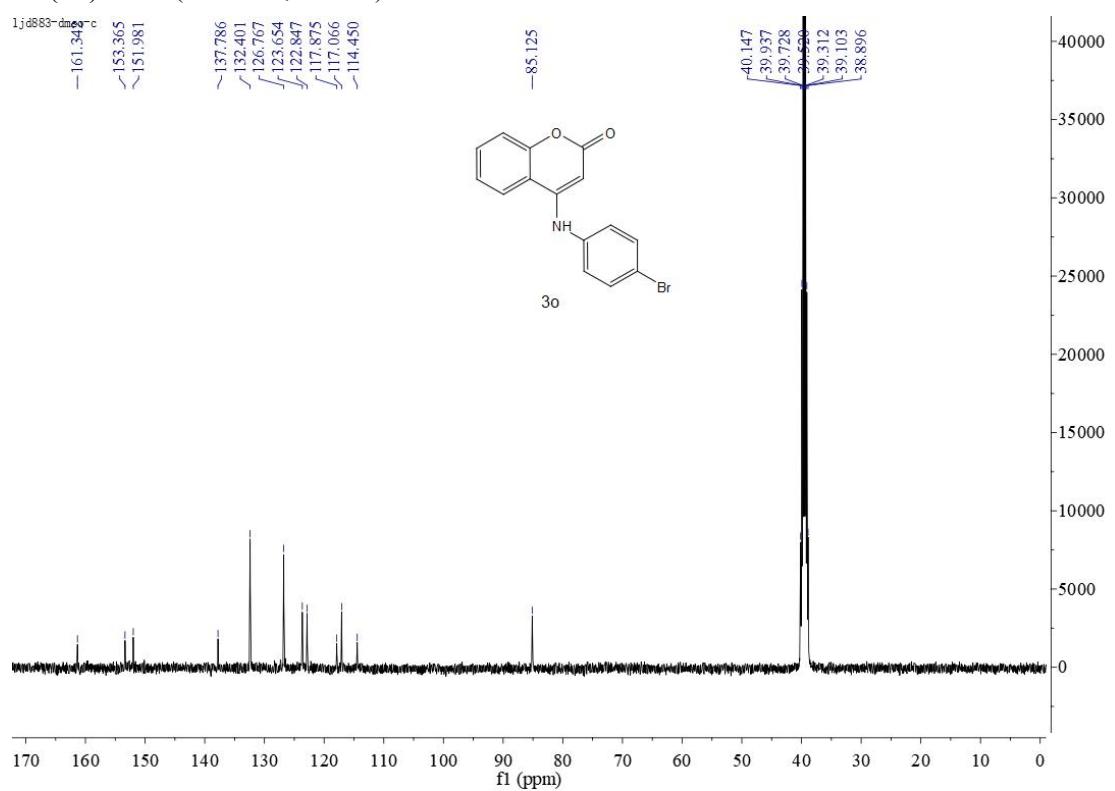
$^1\text{H}$  NMR (400 MHz, DMSO)



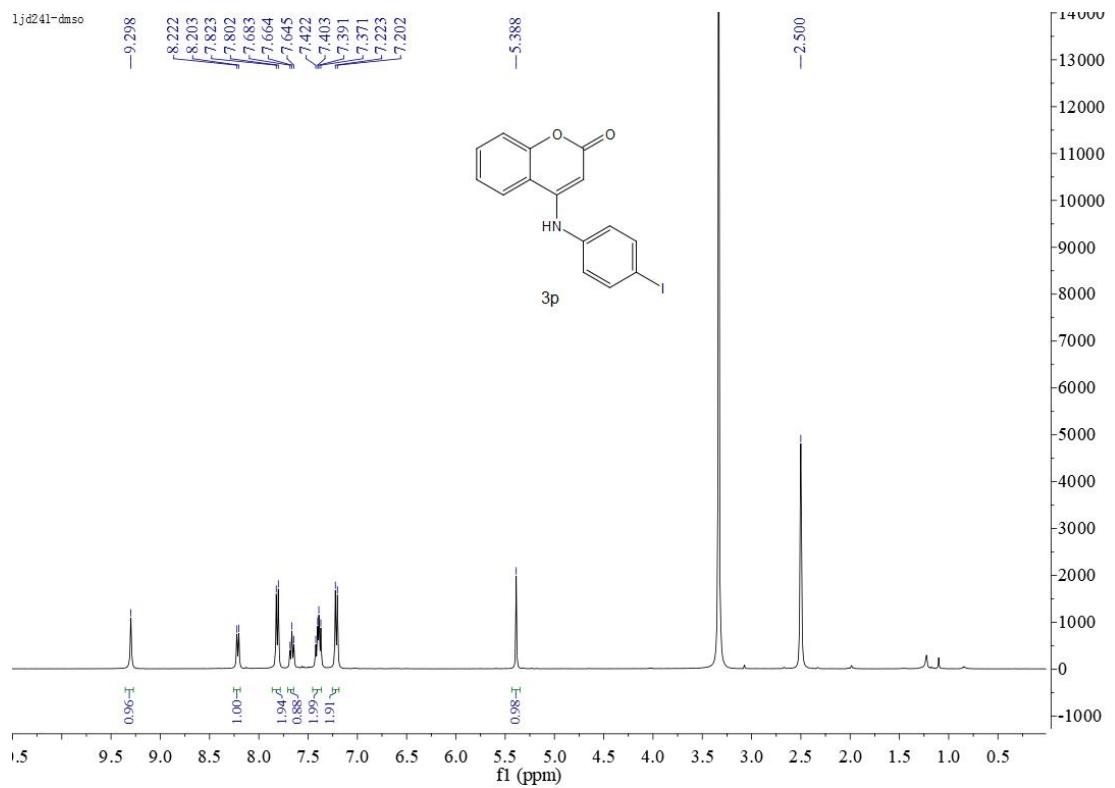
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



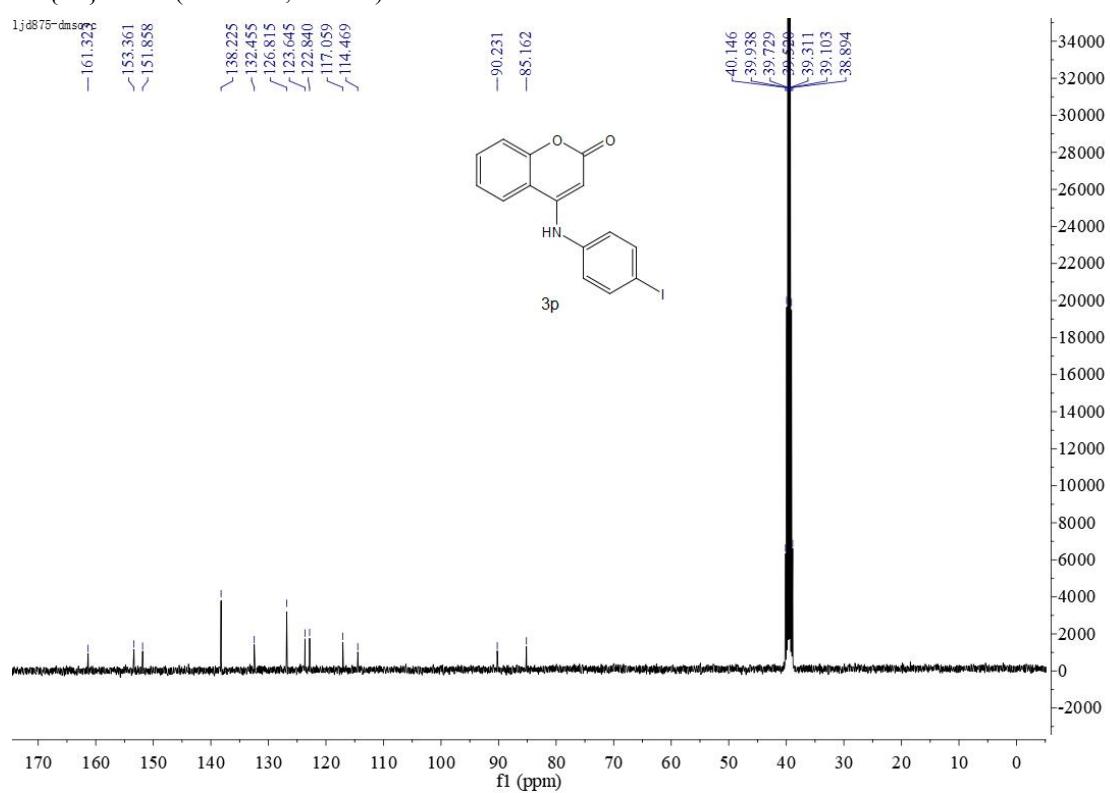
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



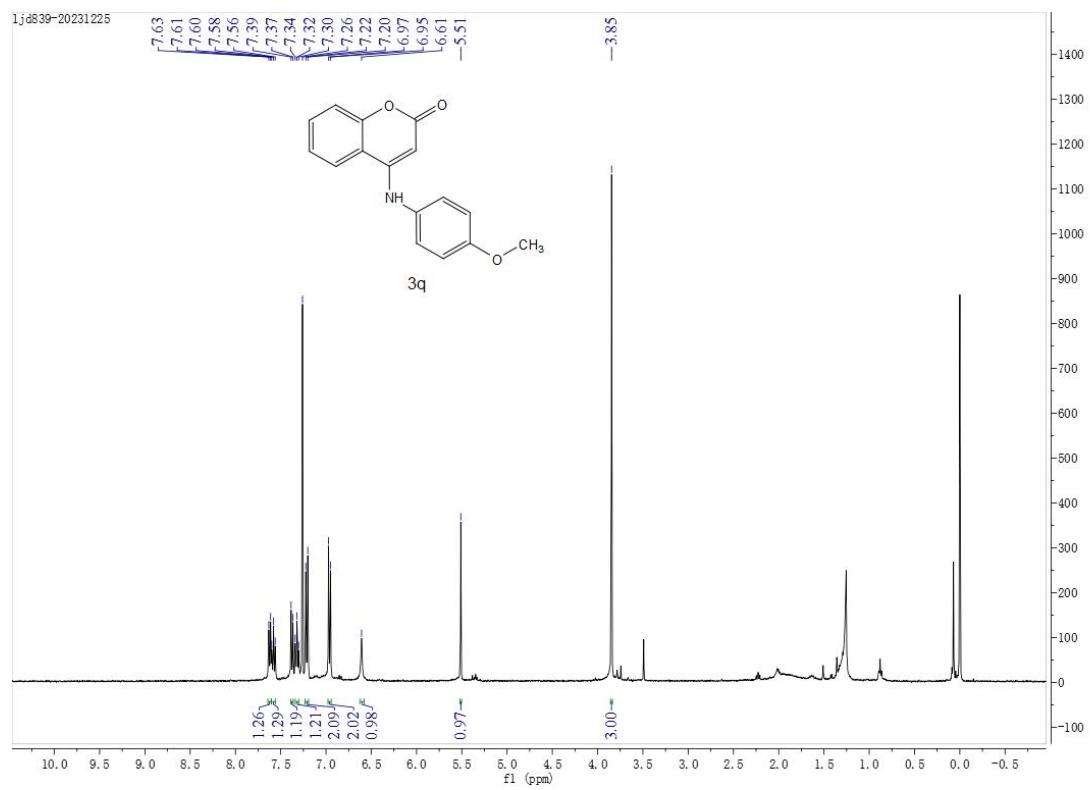
$^1\text{H}$  NMR (400 MHz, DMSO)



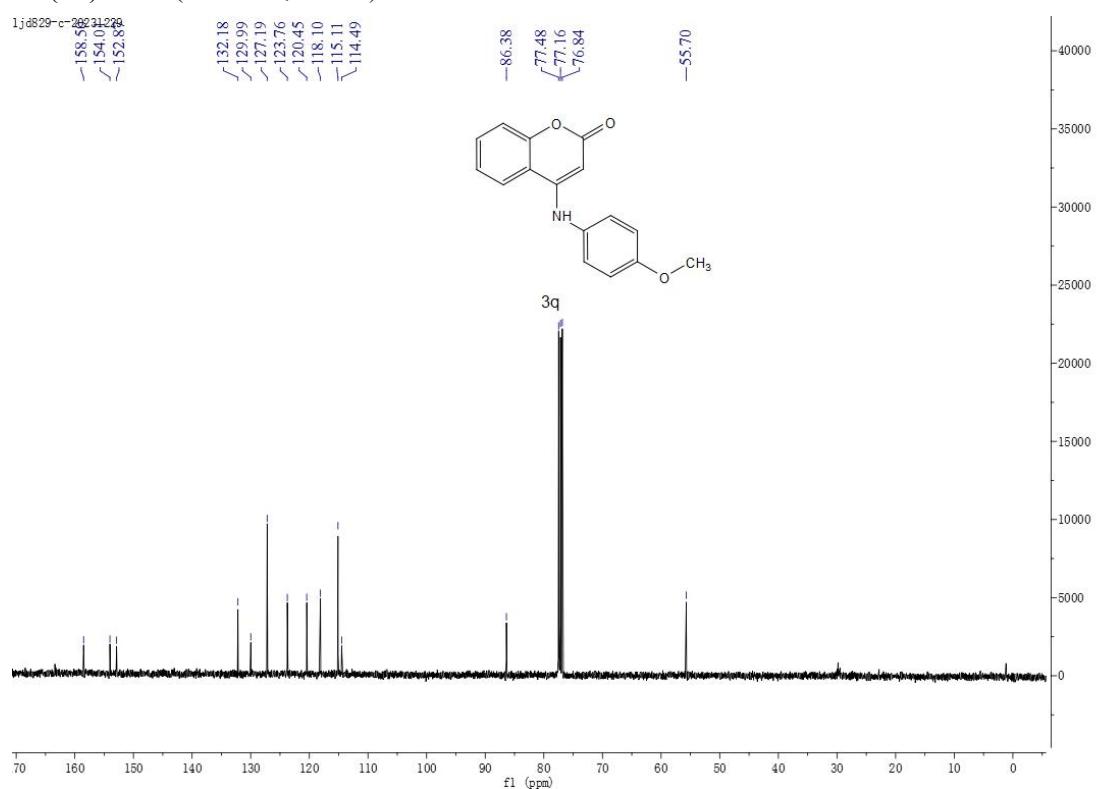
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



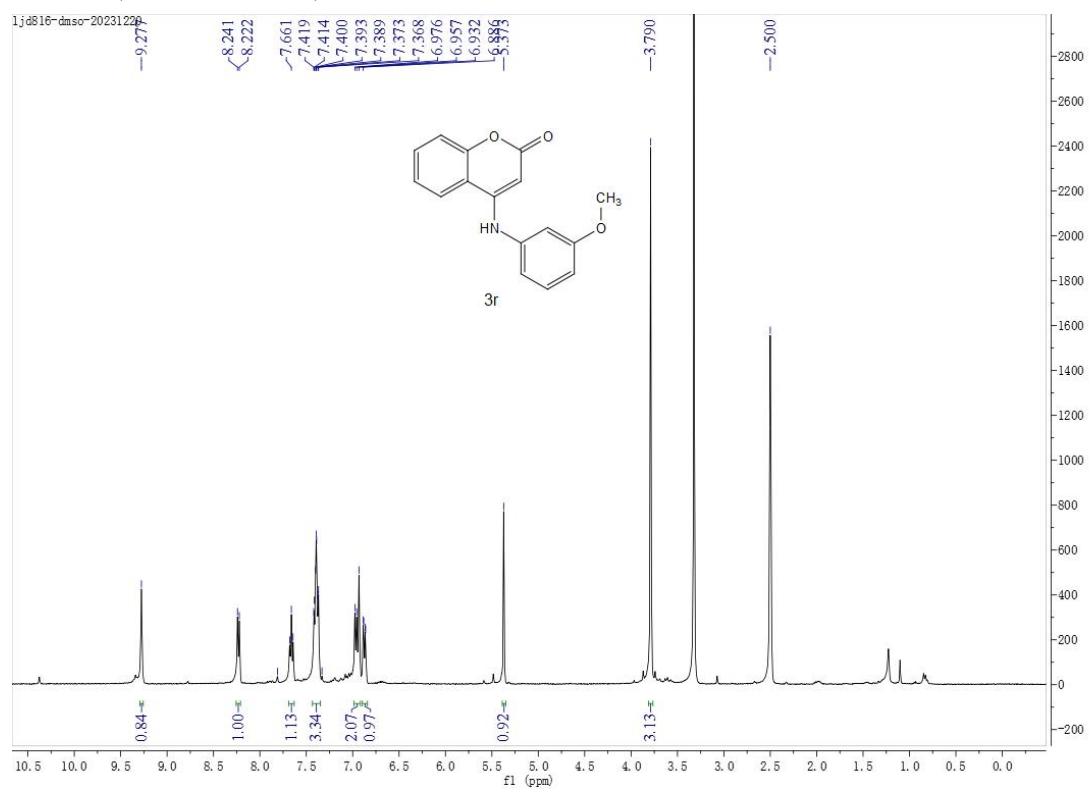
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



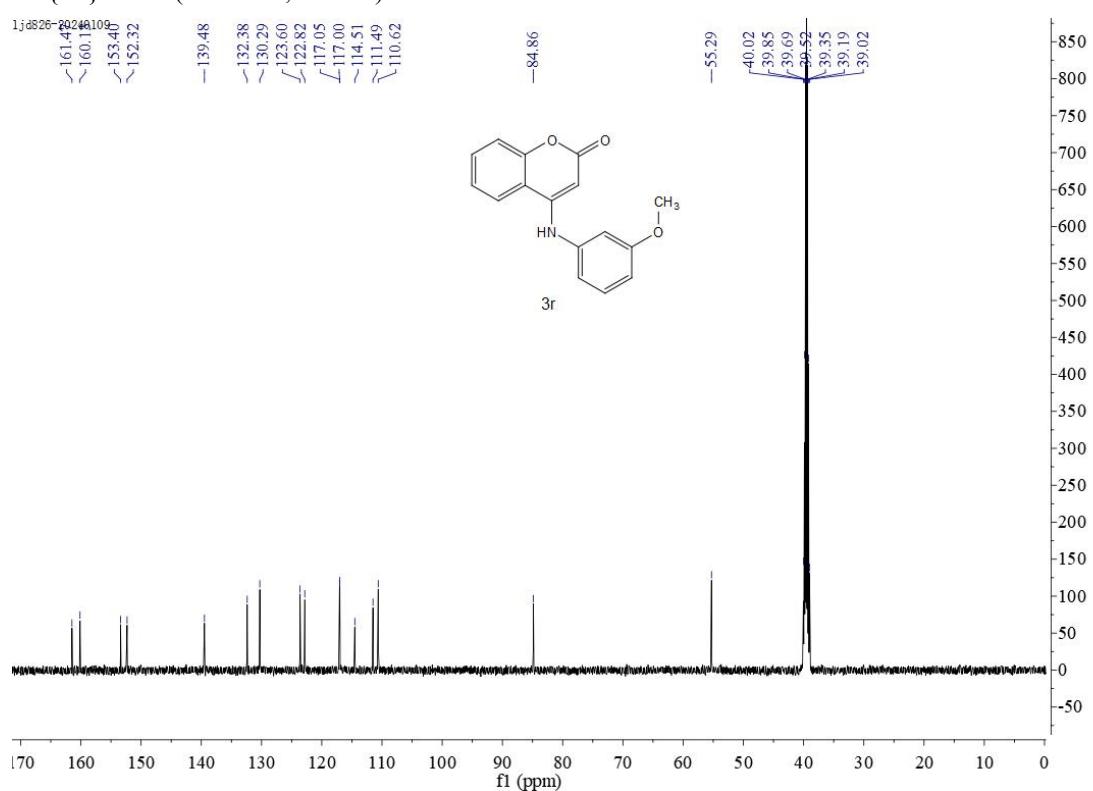
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )



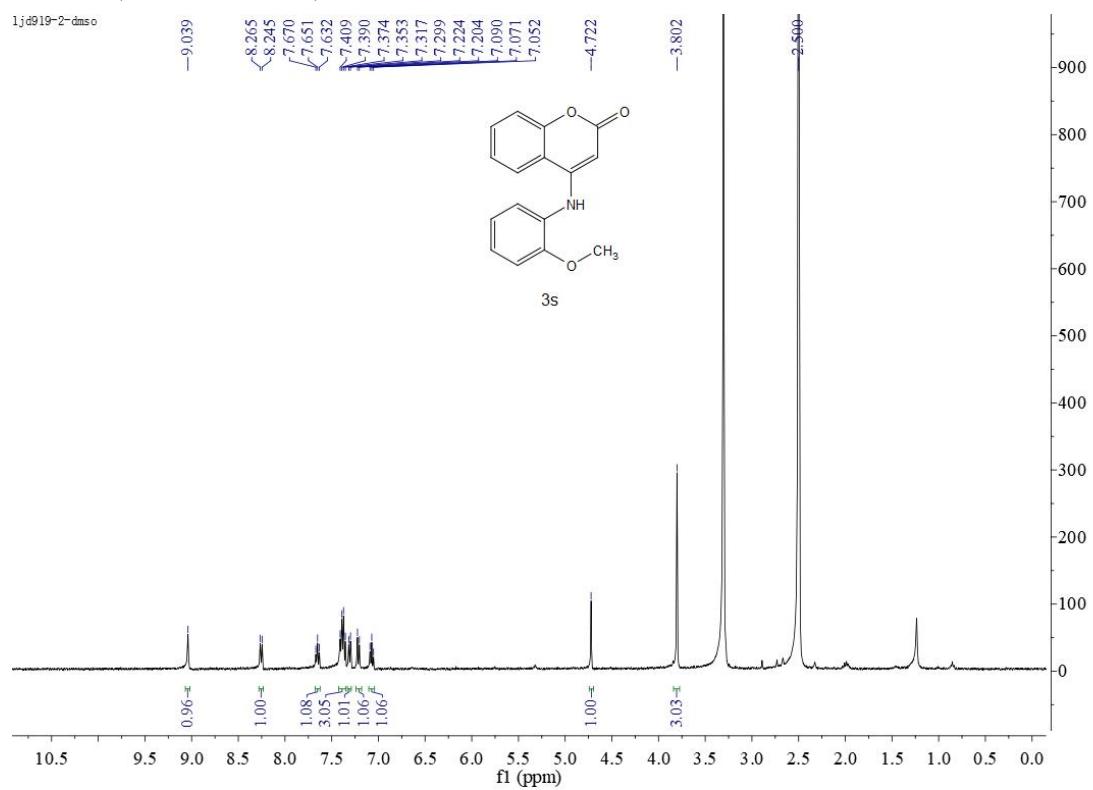
$^1\text{H}$  NMR (400 MHz, DMSO)



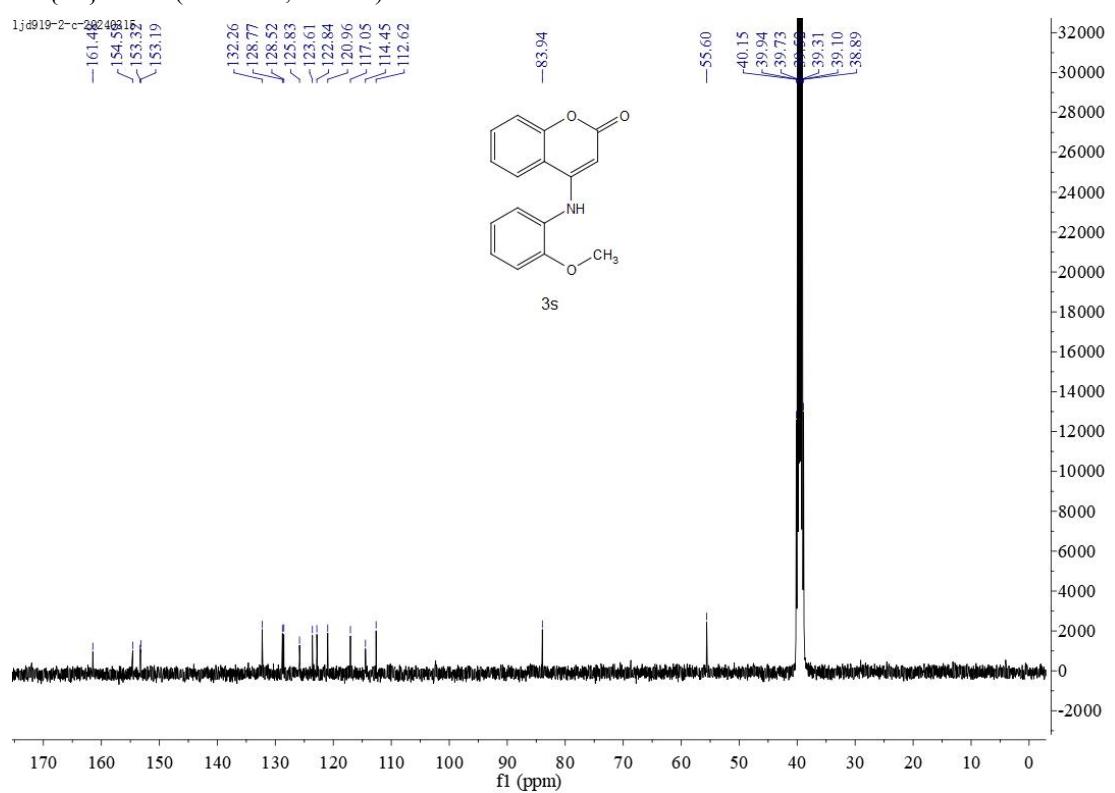
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



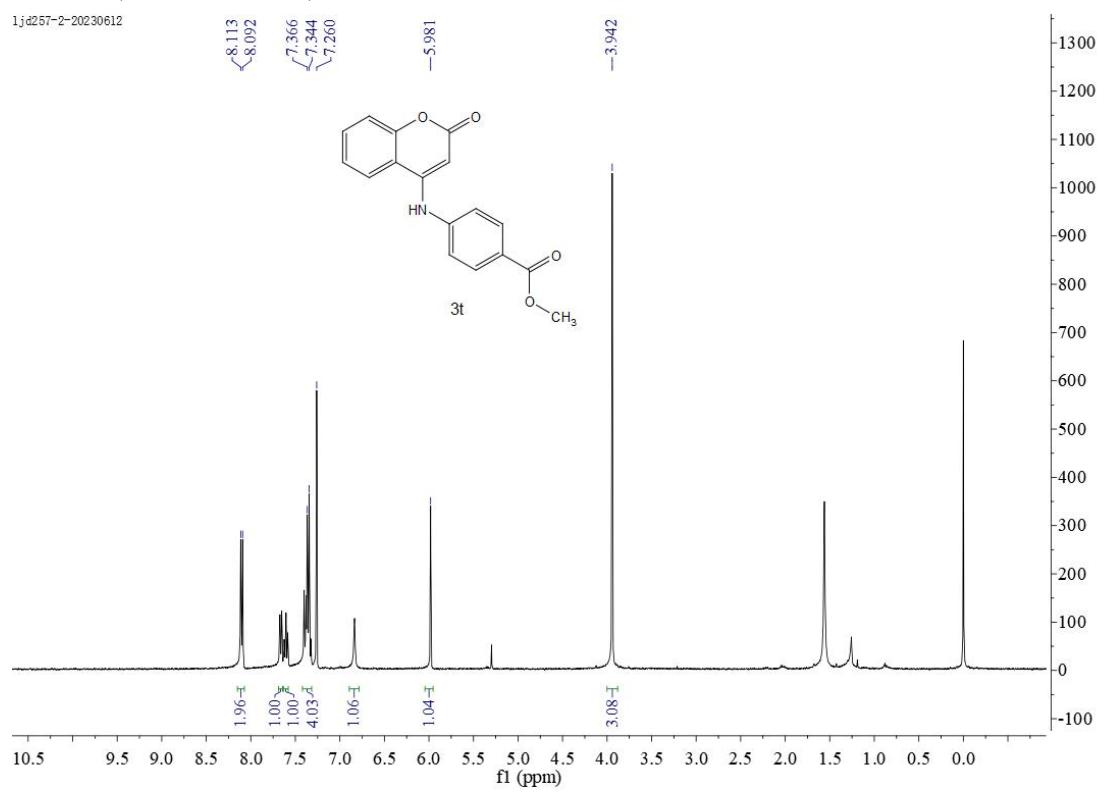
$^1\text{H}$  NMR (400 MHz, DMSO)



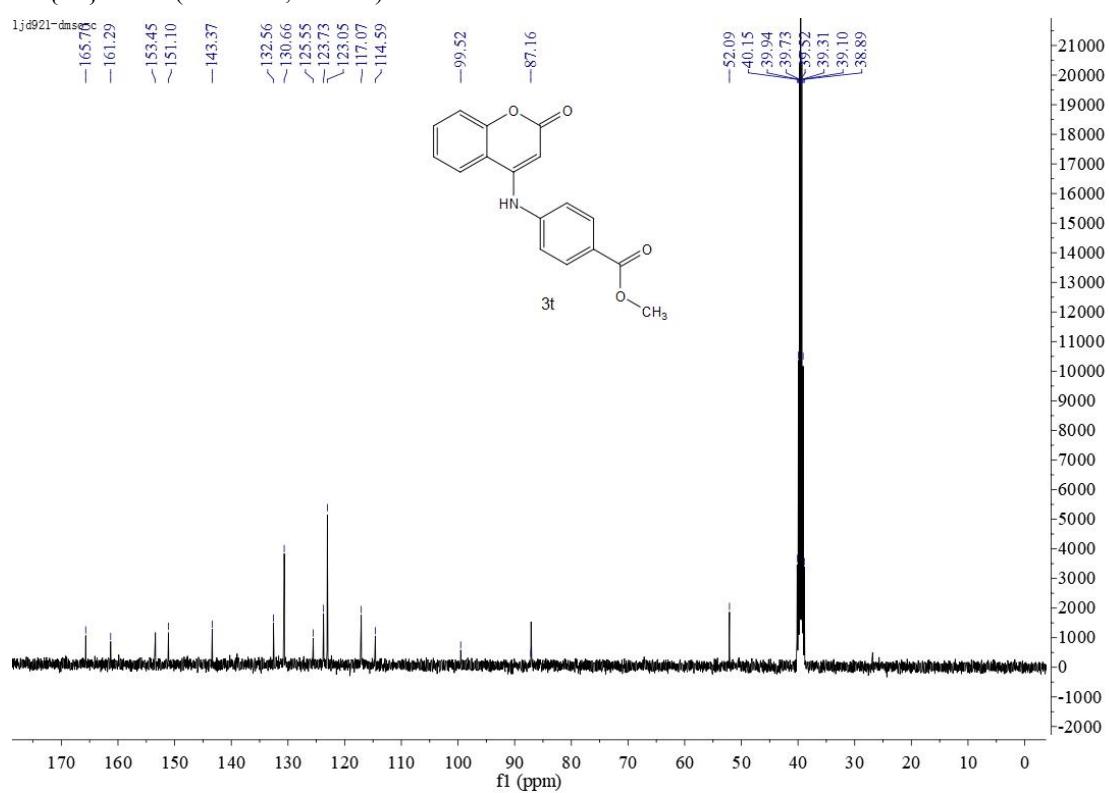
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



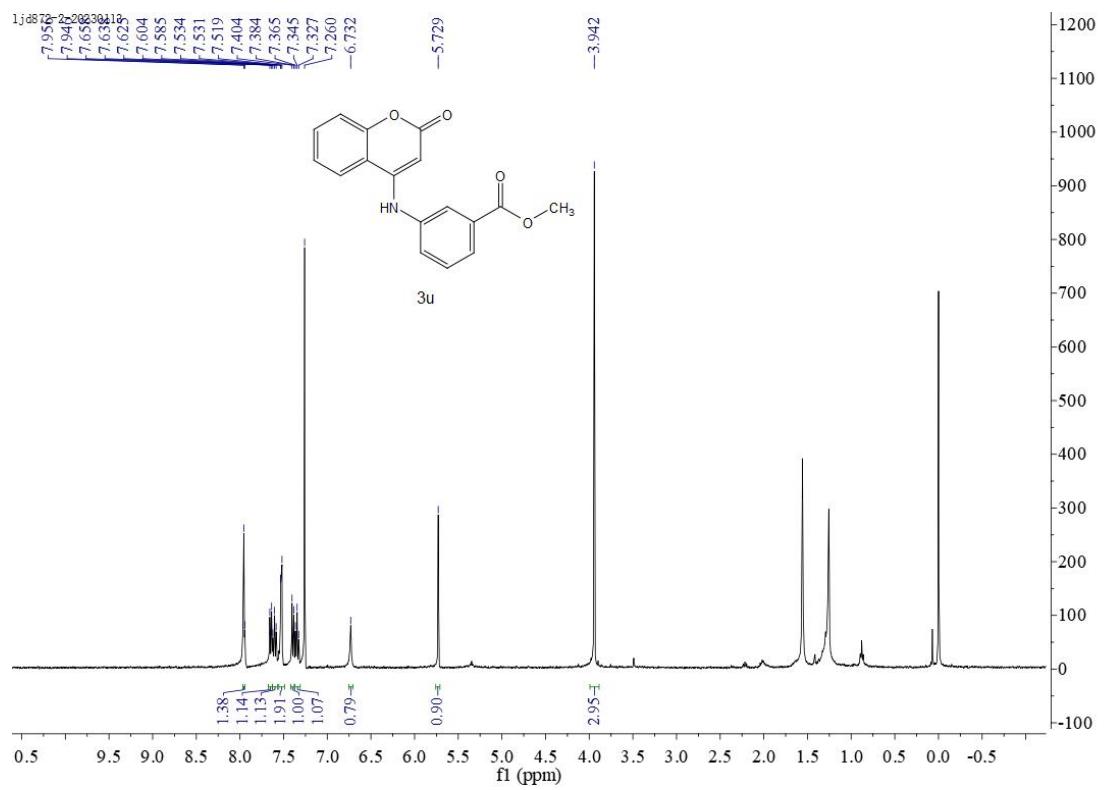
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



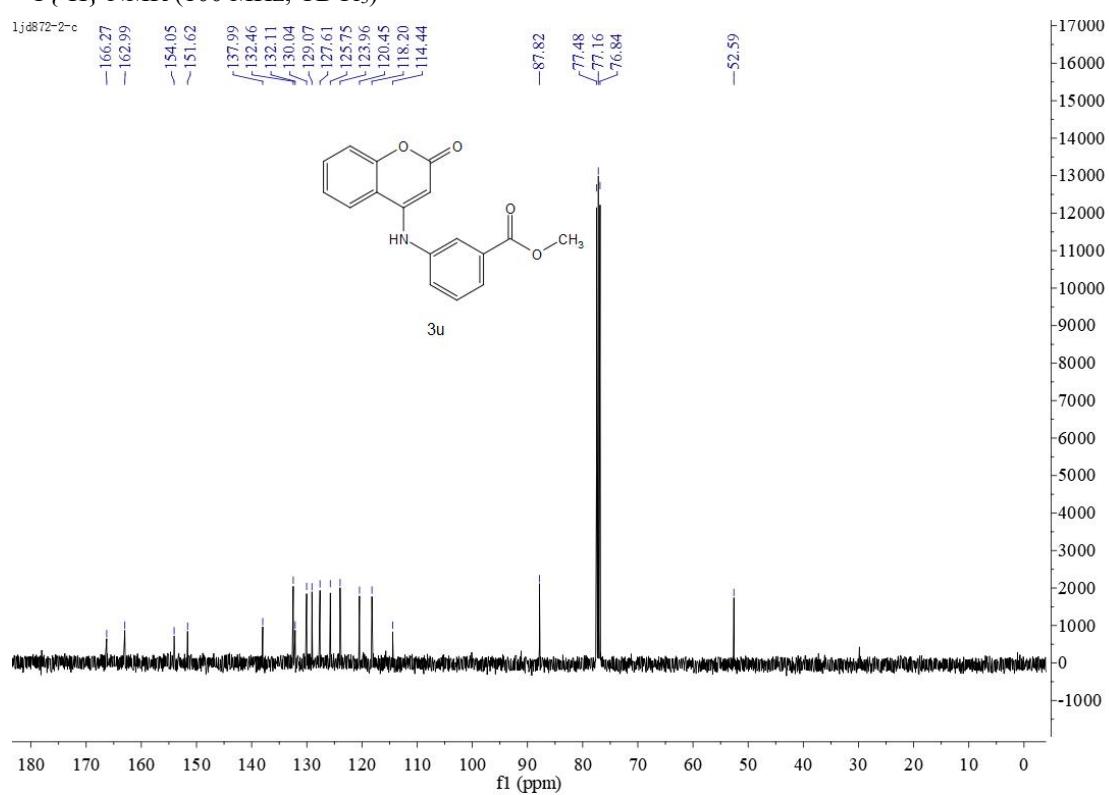
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



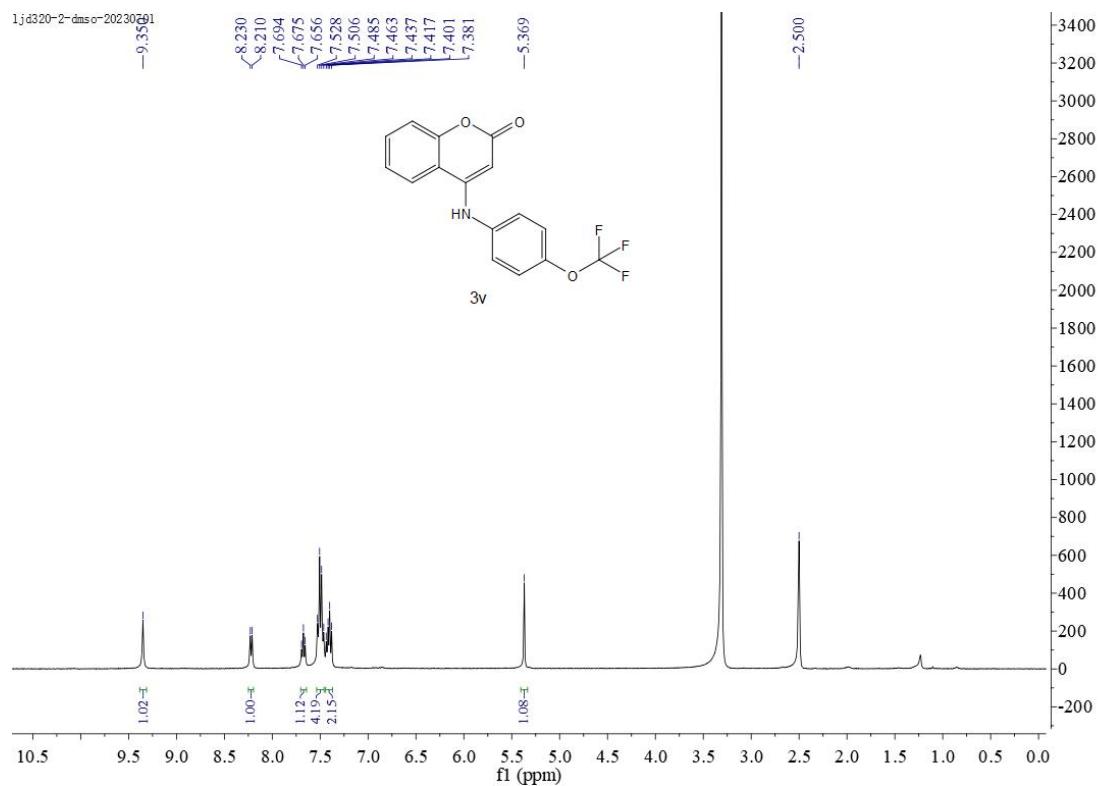
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



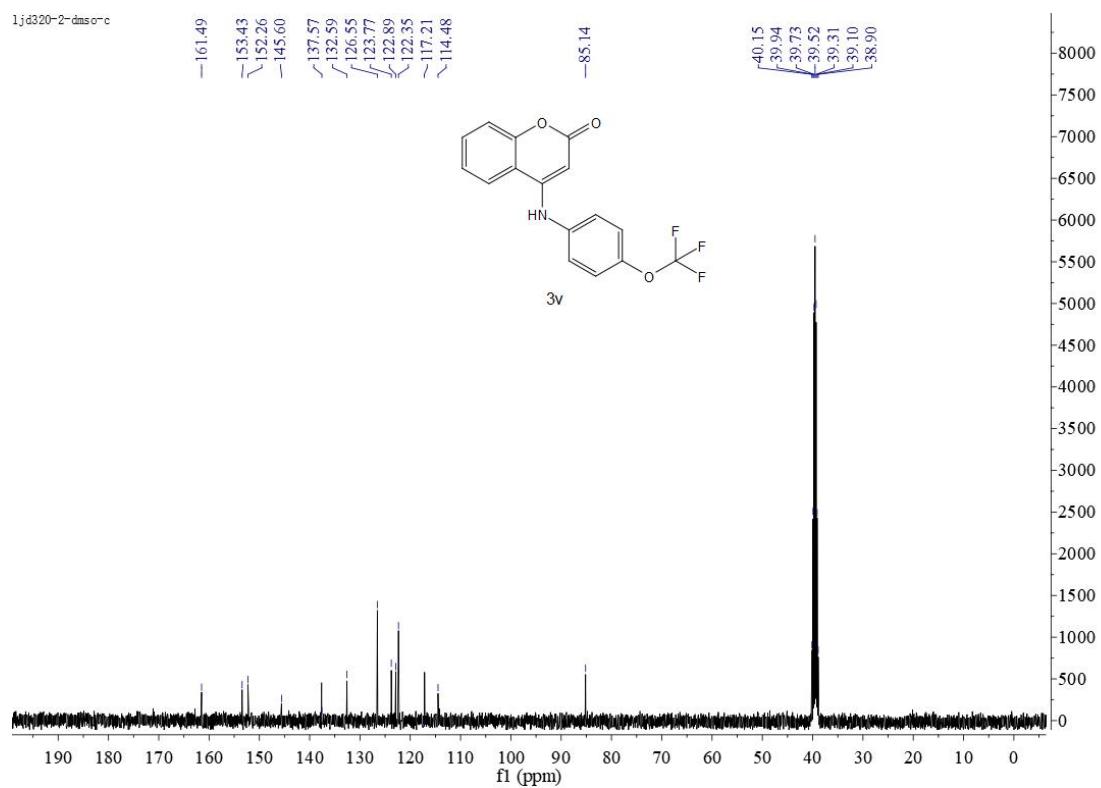
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )



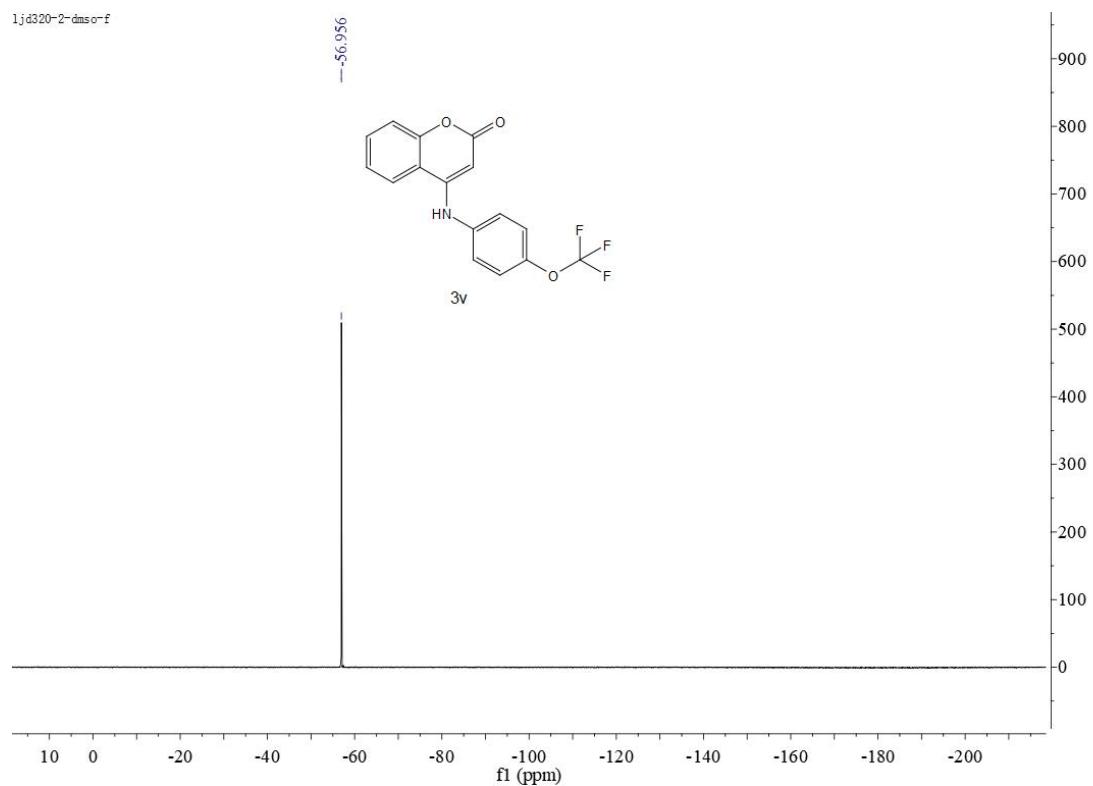
$^1\text{H}$  NMR (400 MHz, DMSO)



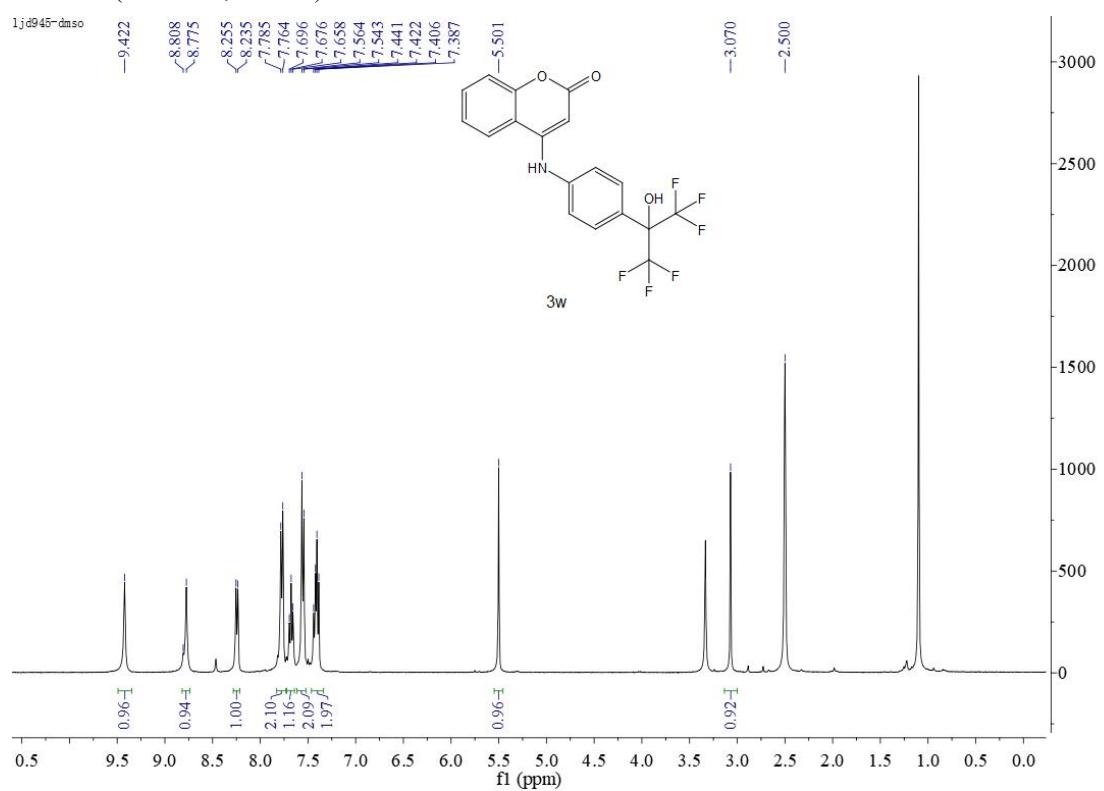
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



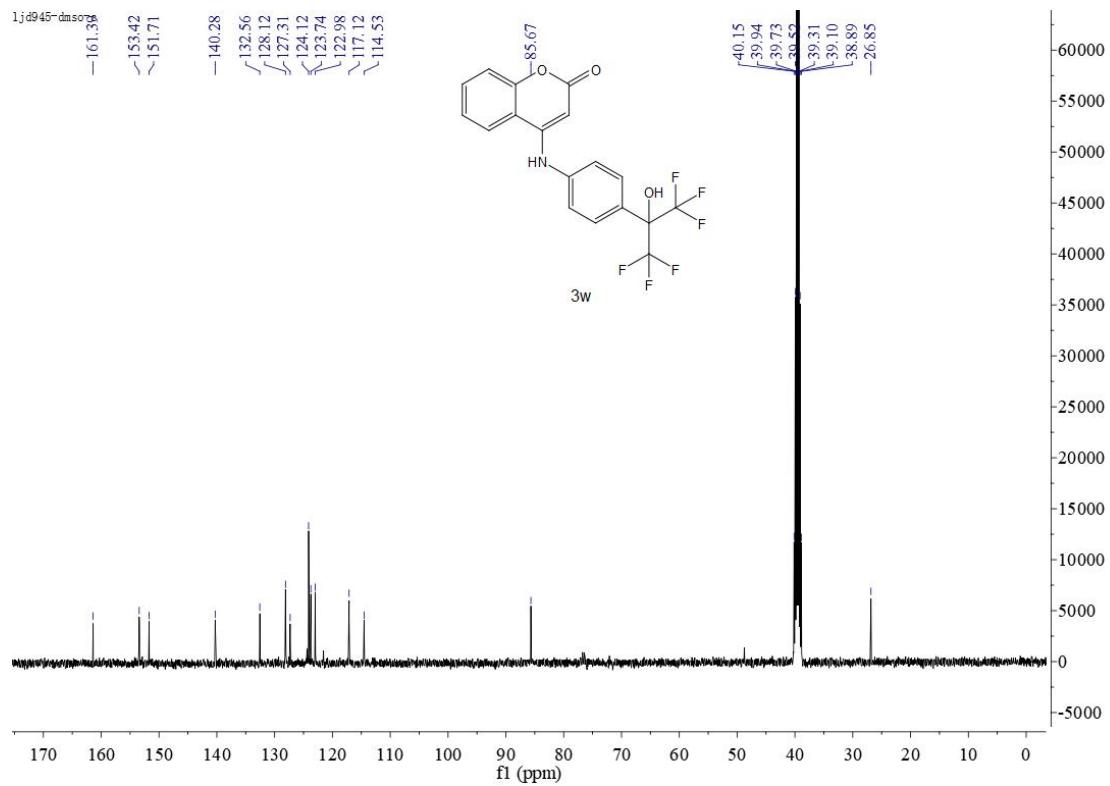
$^{19}\text{F}$  NMR (376 MHz, DMSO)



<sup>1</sup>H NMR (400 MHz, DMSO)

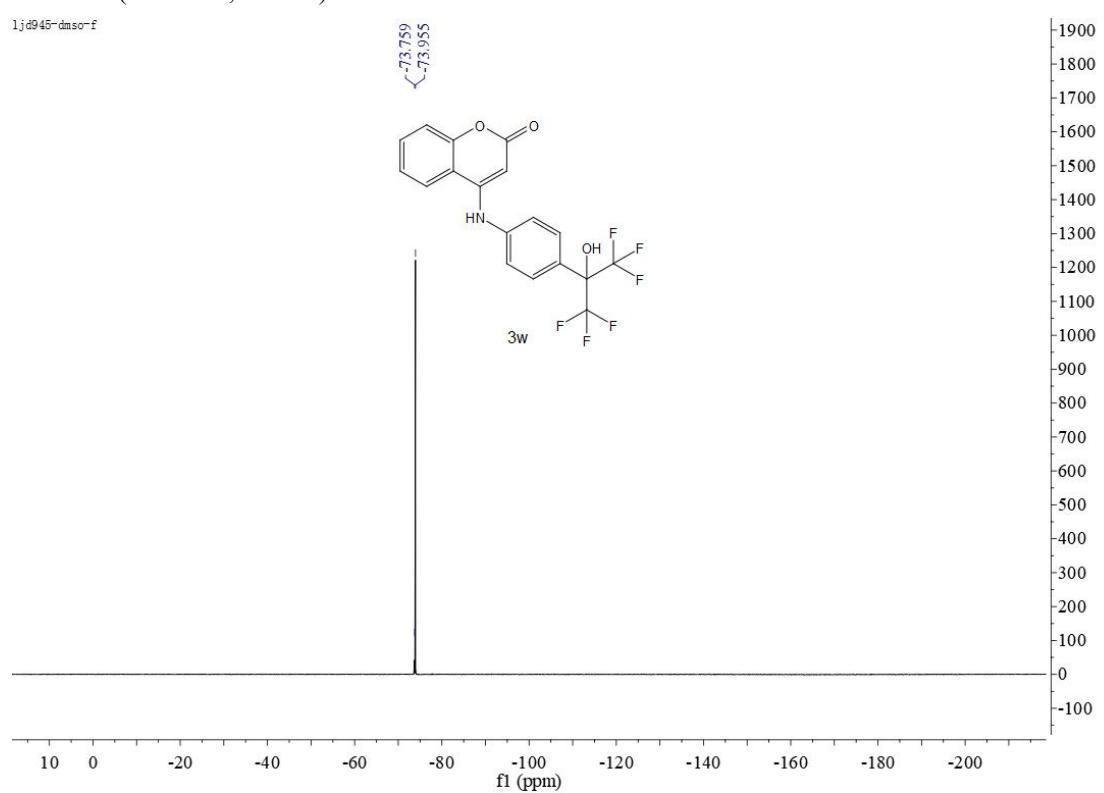


<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO)



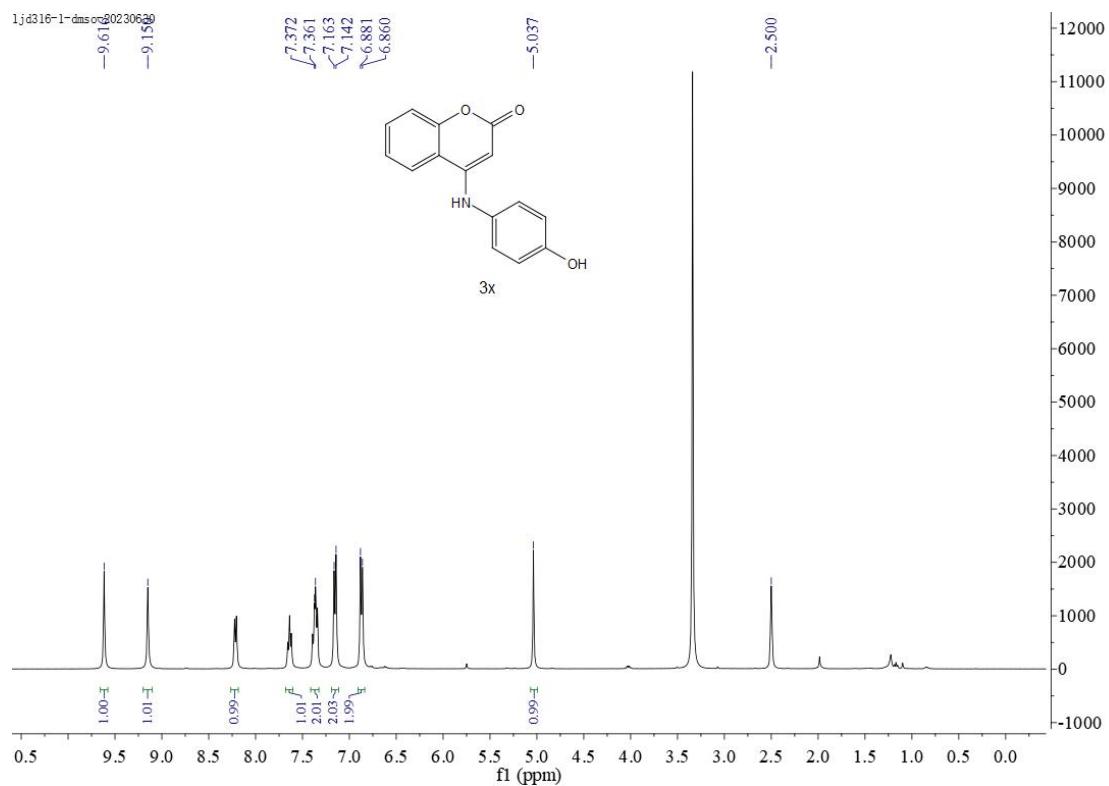
<sup>19</sup>F NMR (376 MHz, DMSO)

1j945-dmso-f

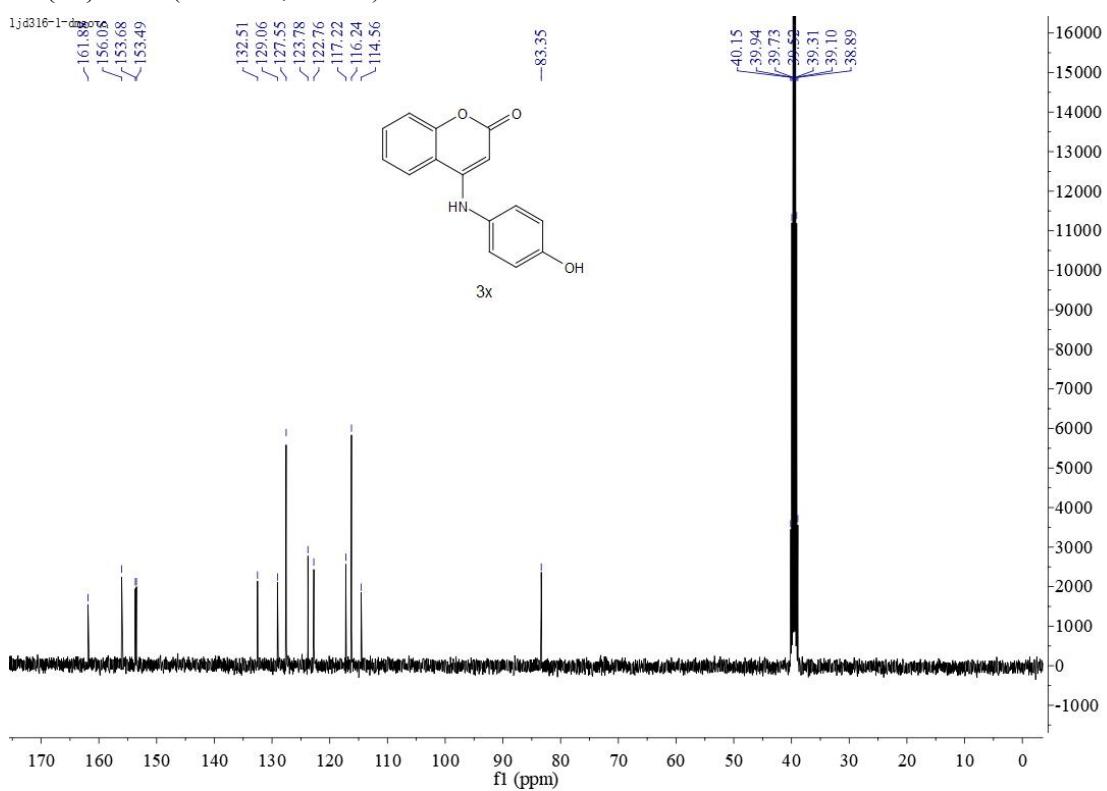


<sup>1</sup>H NMR (400 MHz, DMSO)

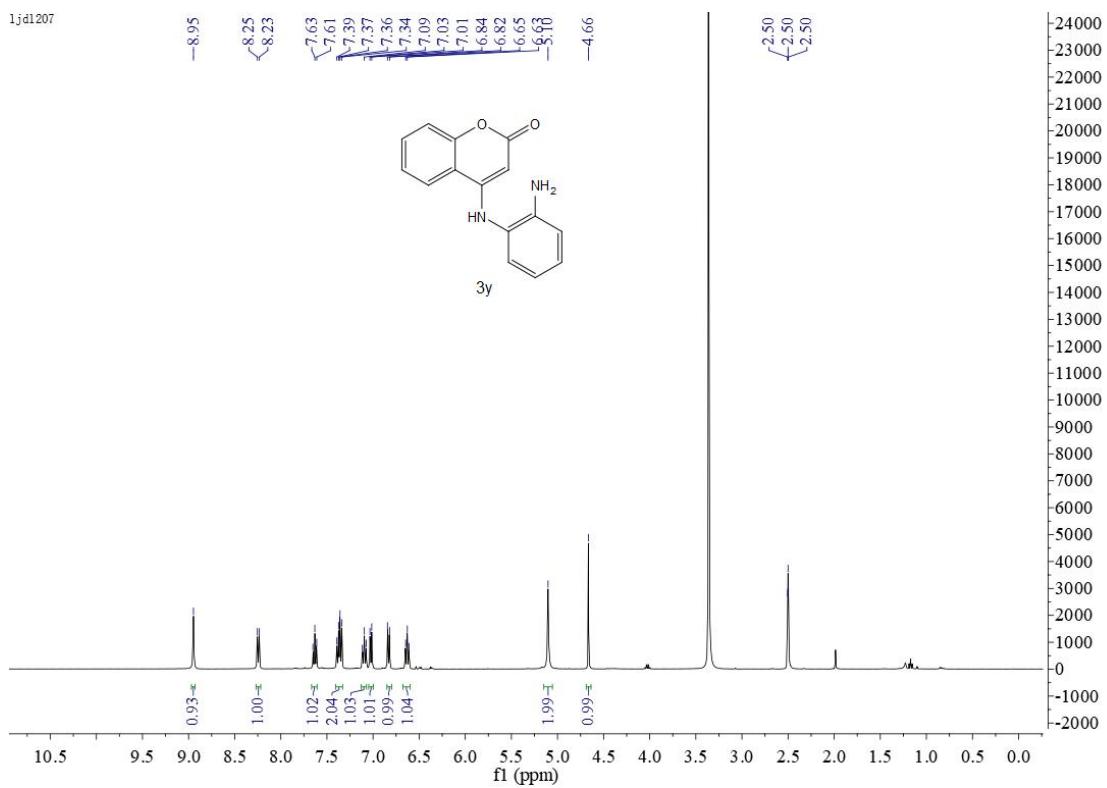
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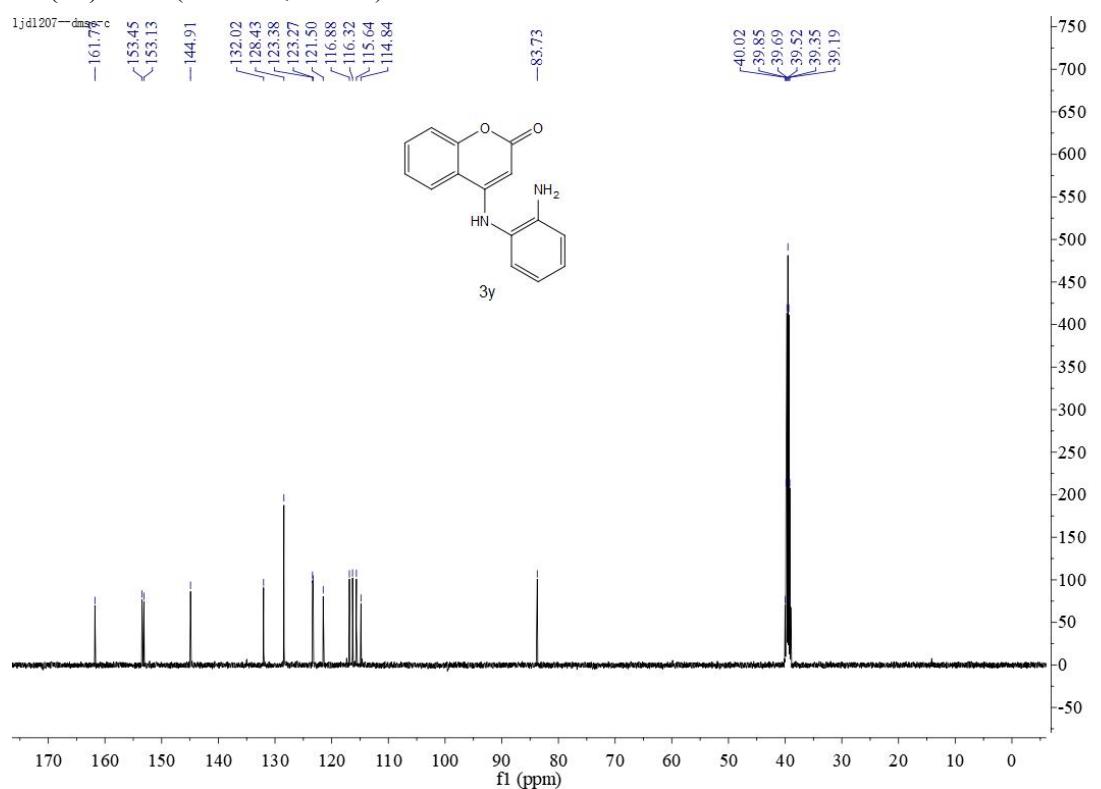
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



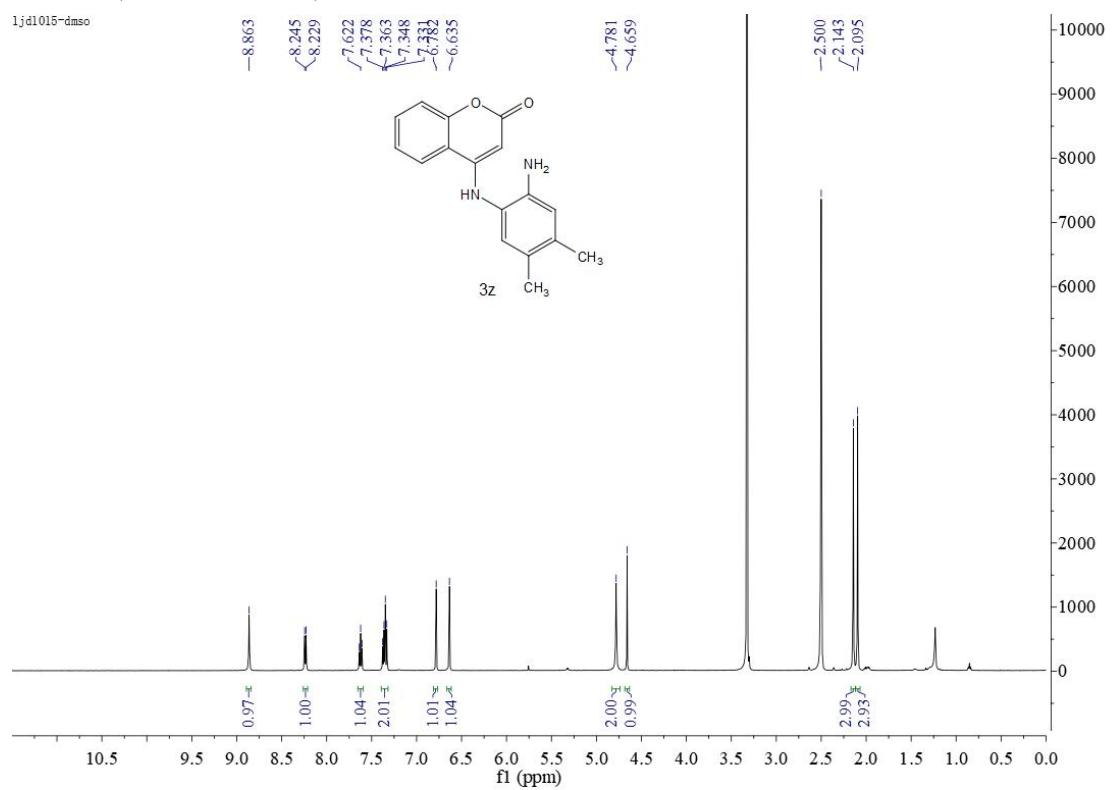
$^1\text{H}$  NMR (400 MHz, DMSO)



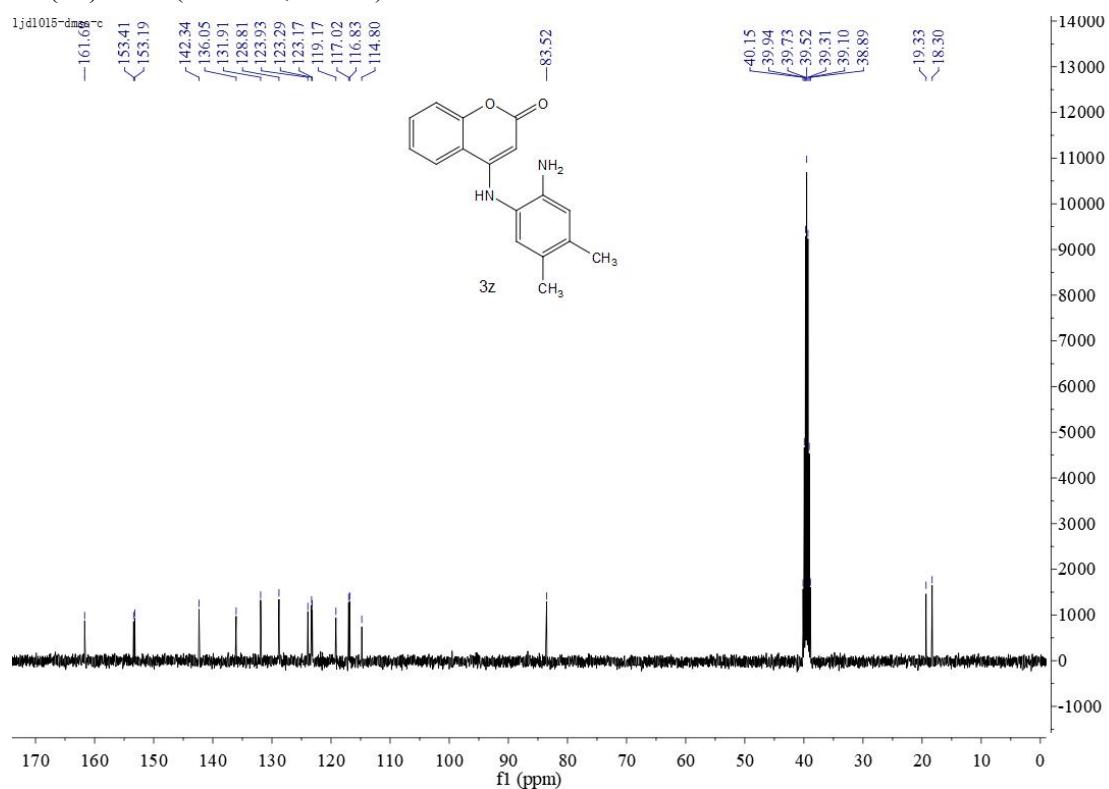
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



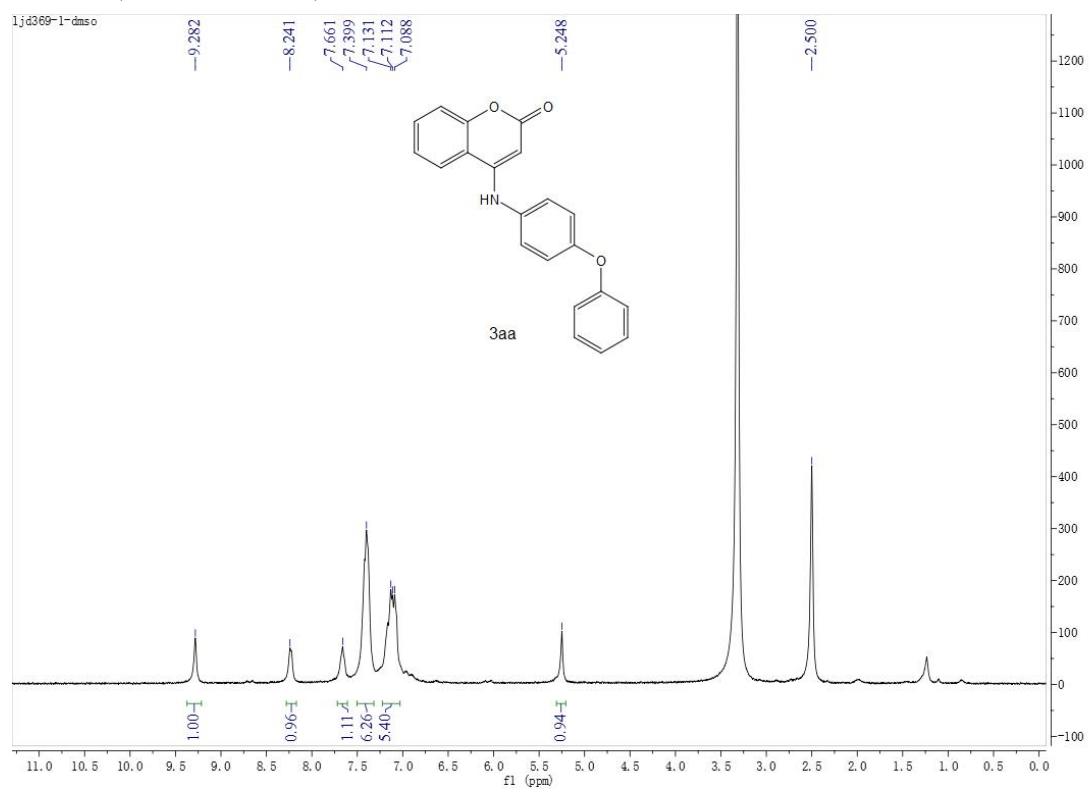
$^1\text{H}$  NMR (500 MHz, DMSO)



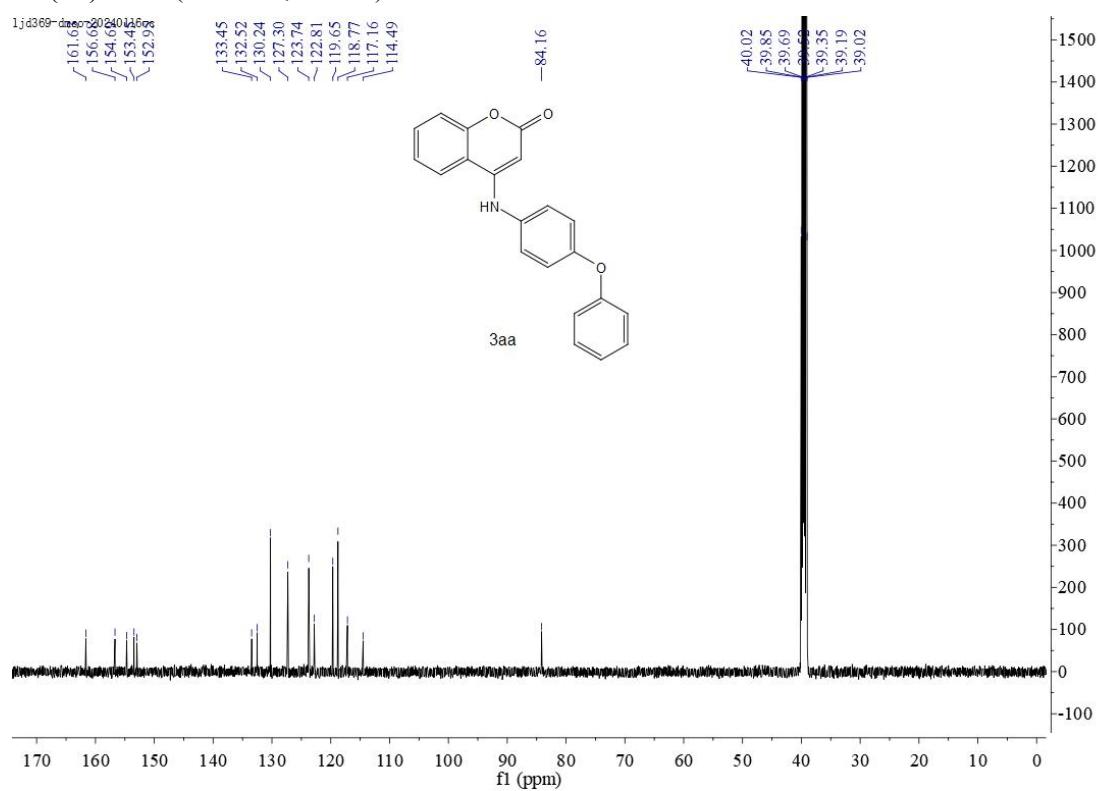
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



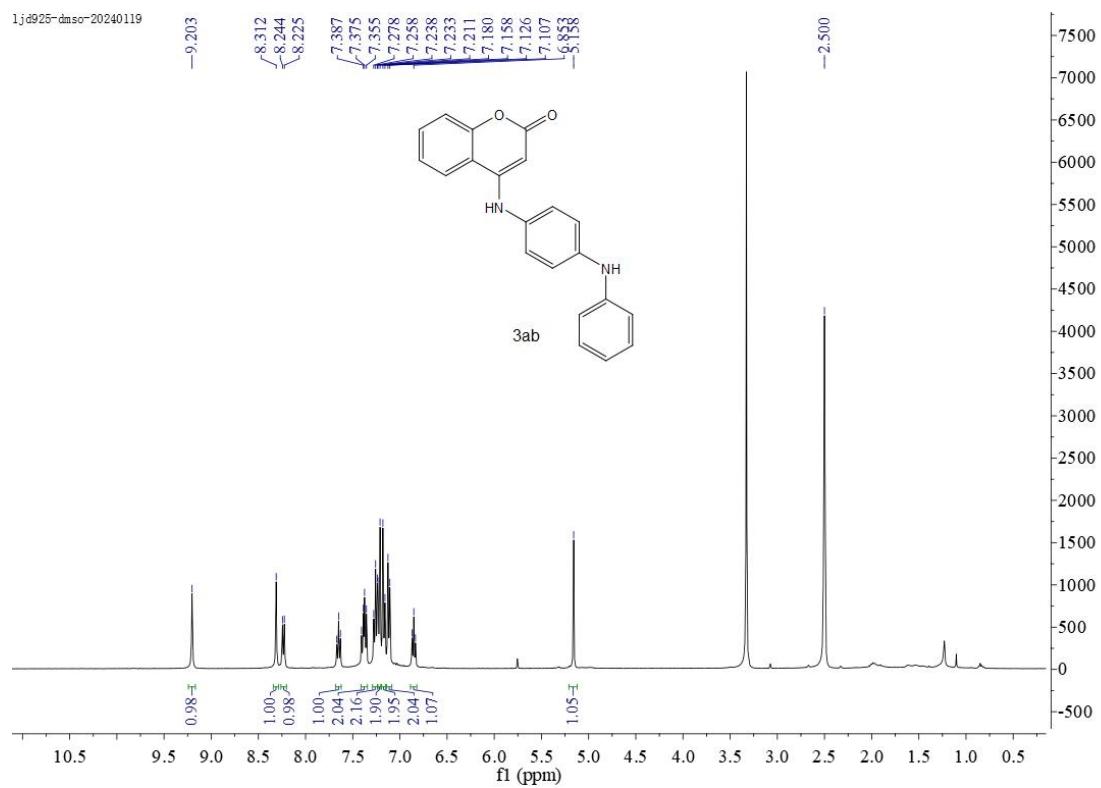
$^1\text{H}$  NMR (400 MHz, DMSO)



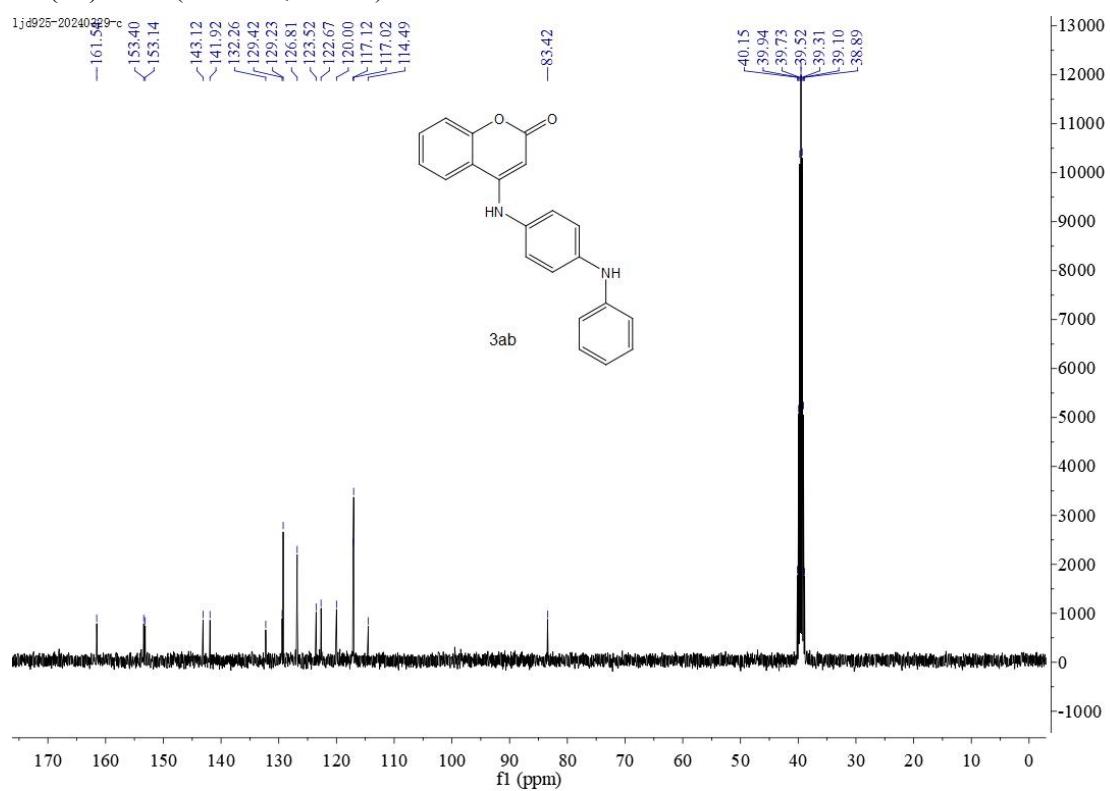
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



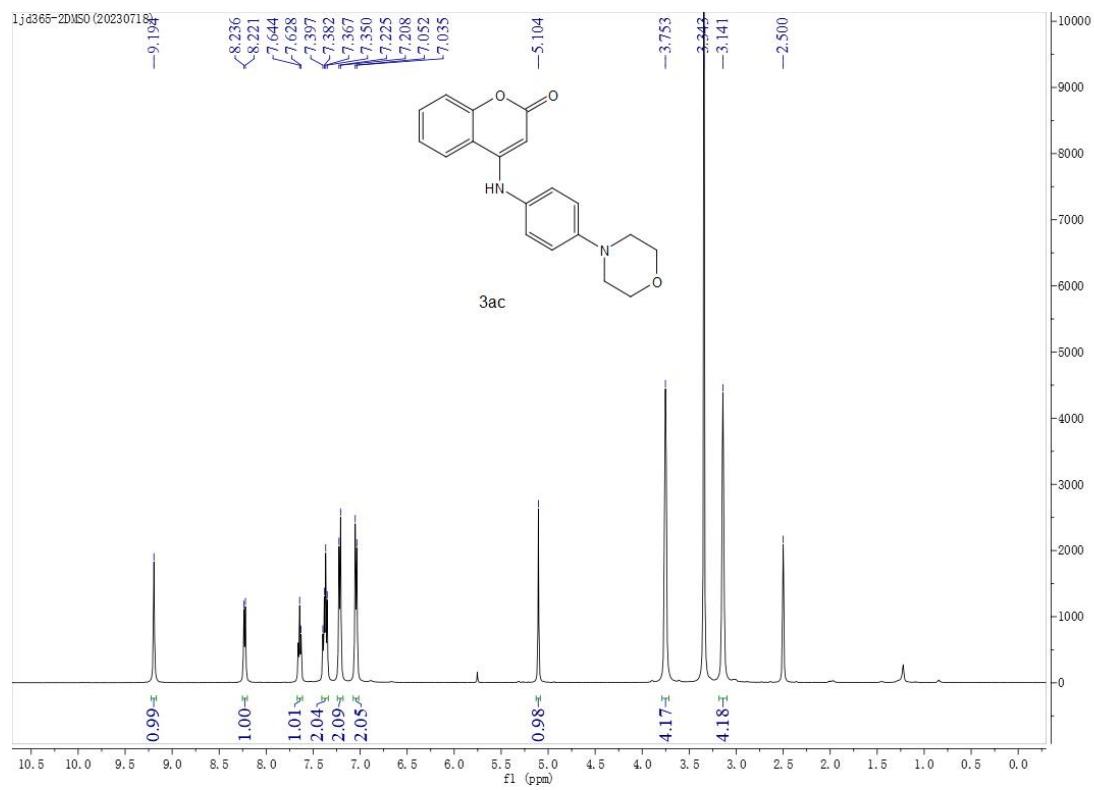
$^1\text{H}$  NMR (400 MHz, DMSO)



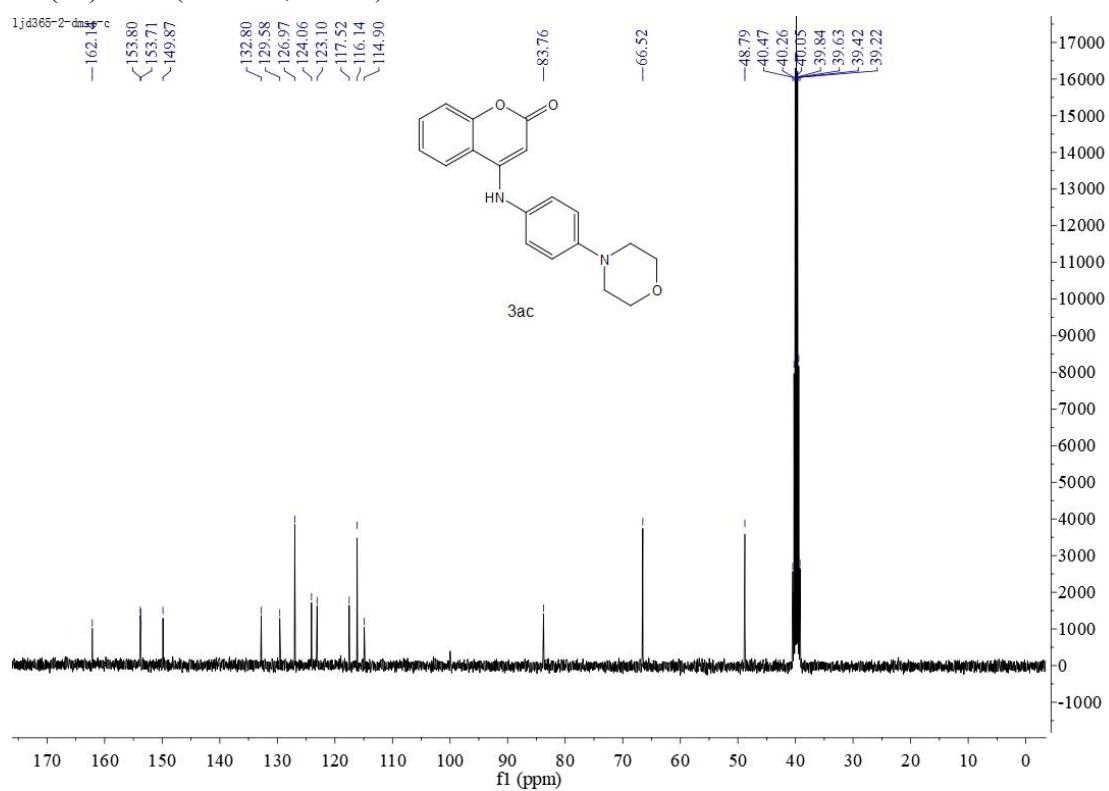
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



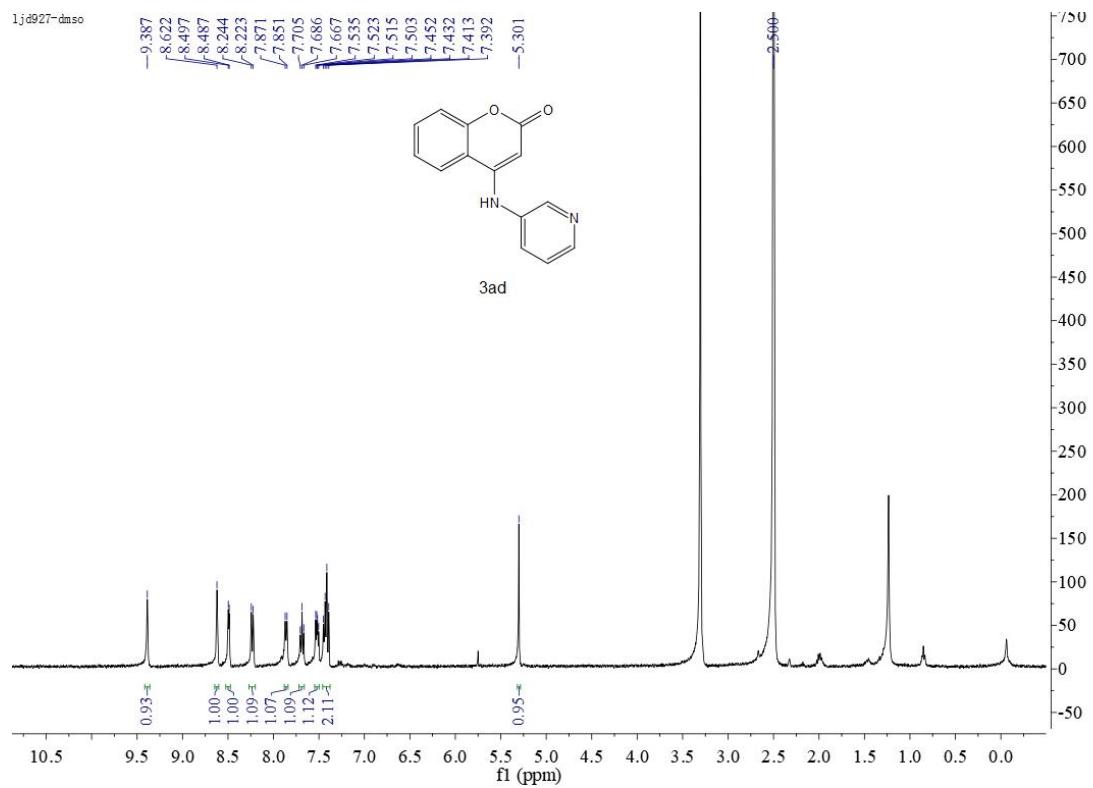
$^1\text{H}$  NMR (500 MHz, DMSO)



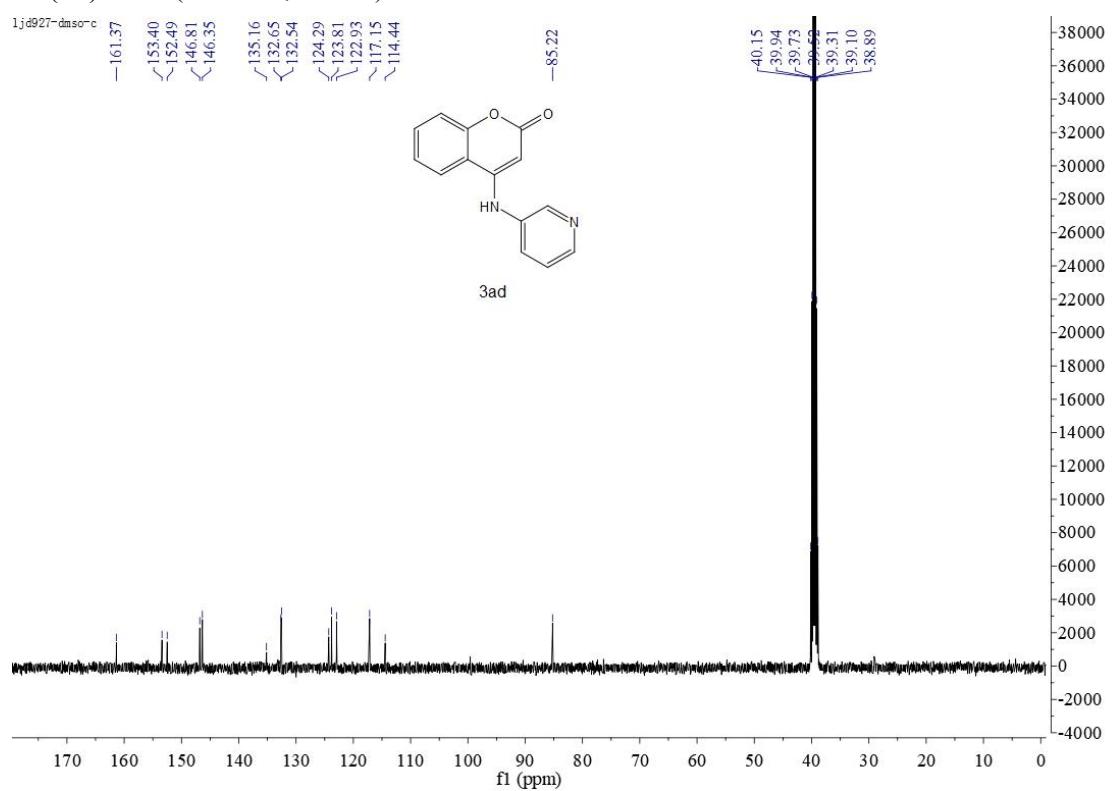
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



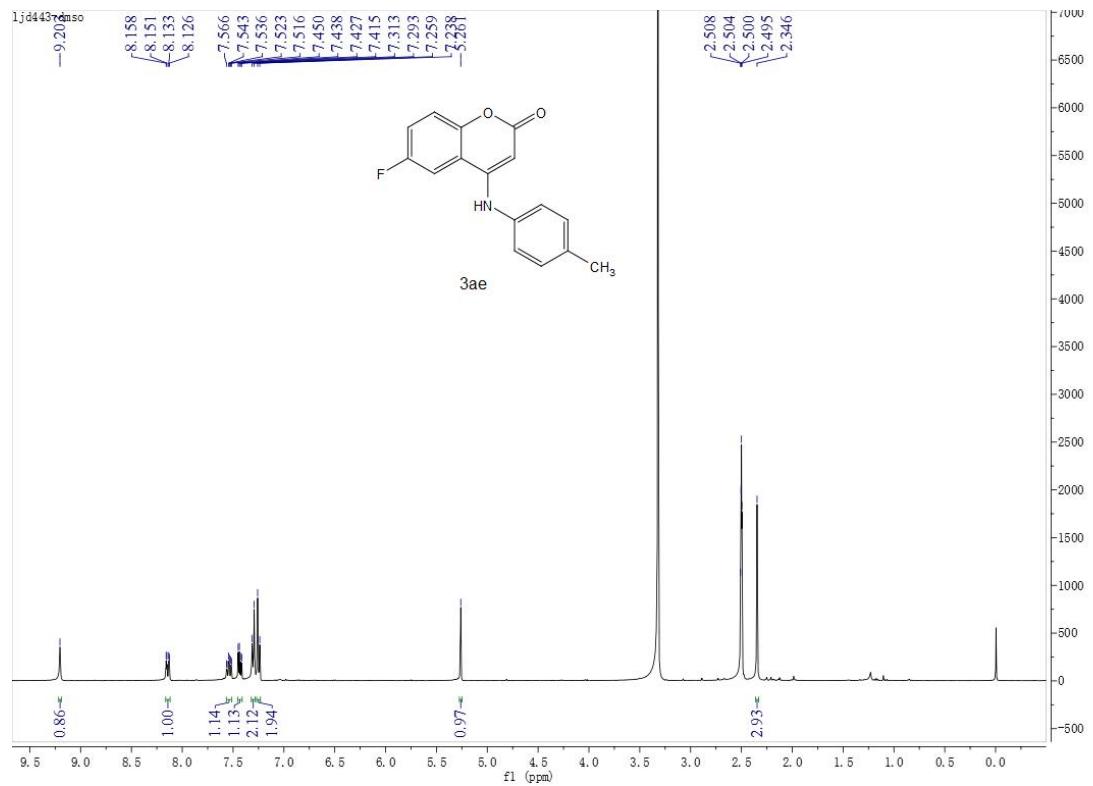
$^1\text{H}$  NMR (400 MHz, DMSO)



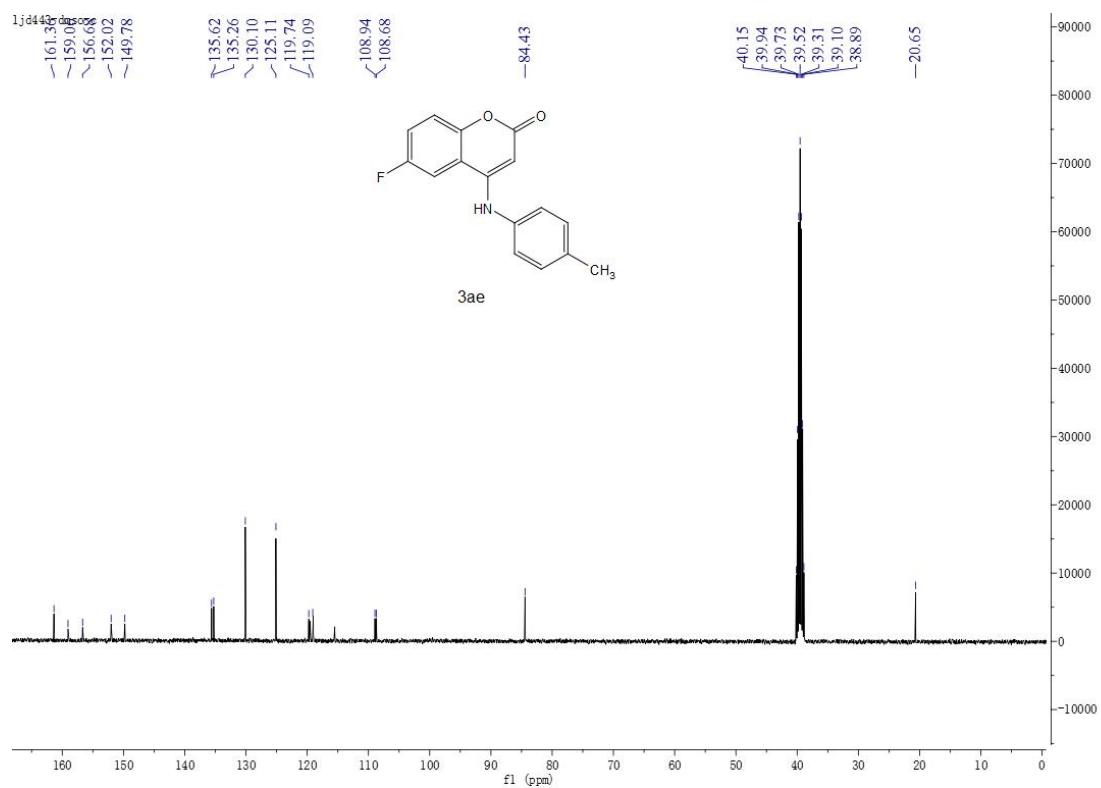
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



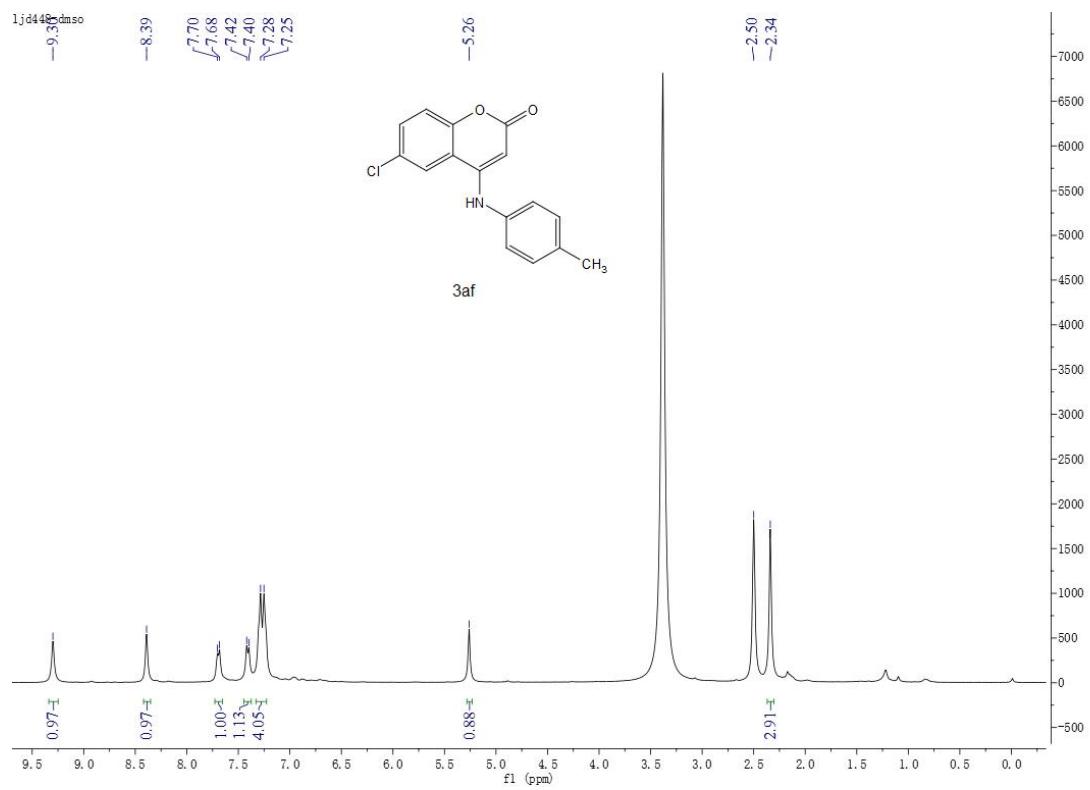
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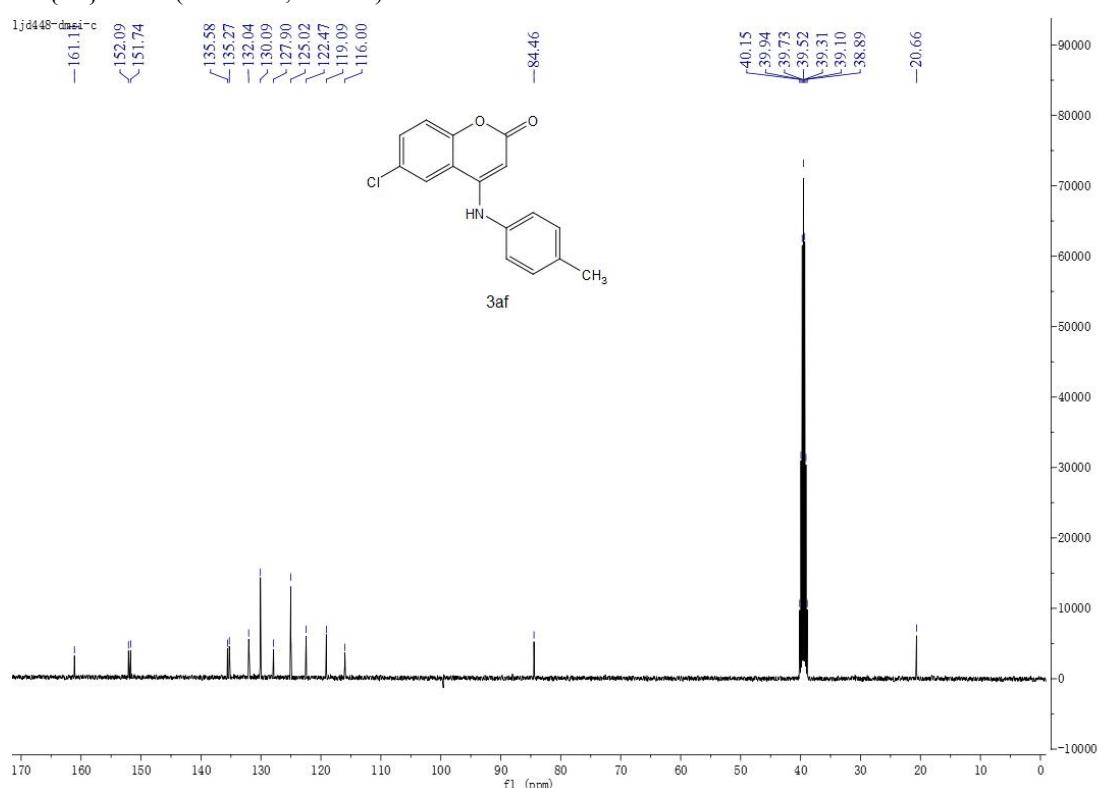
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO)



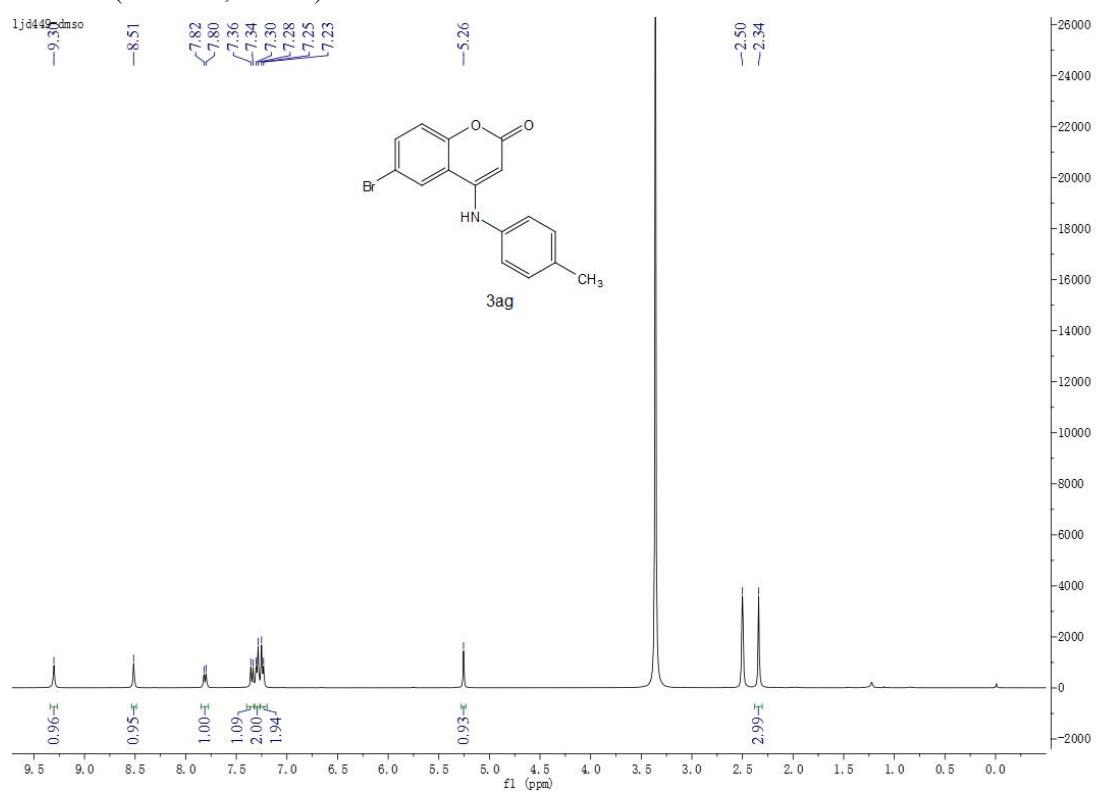
<sup>1</sup>H NMR (400 MHz, DMSO)



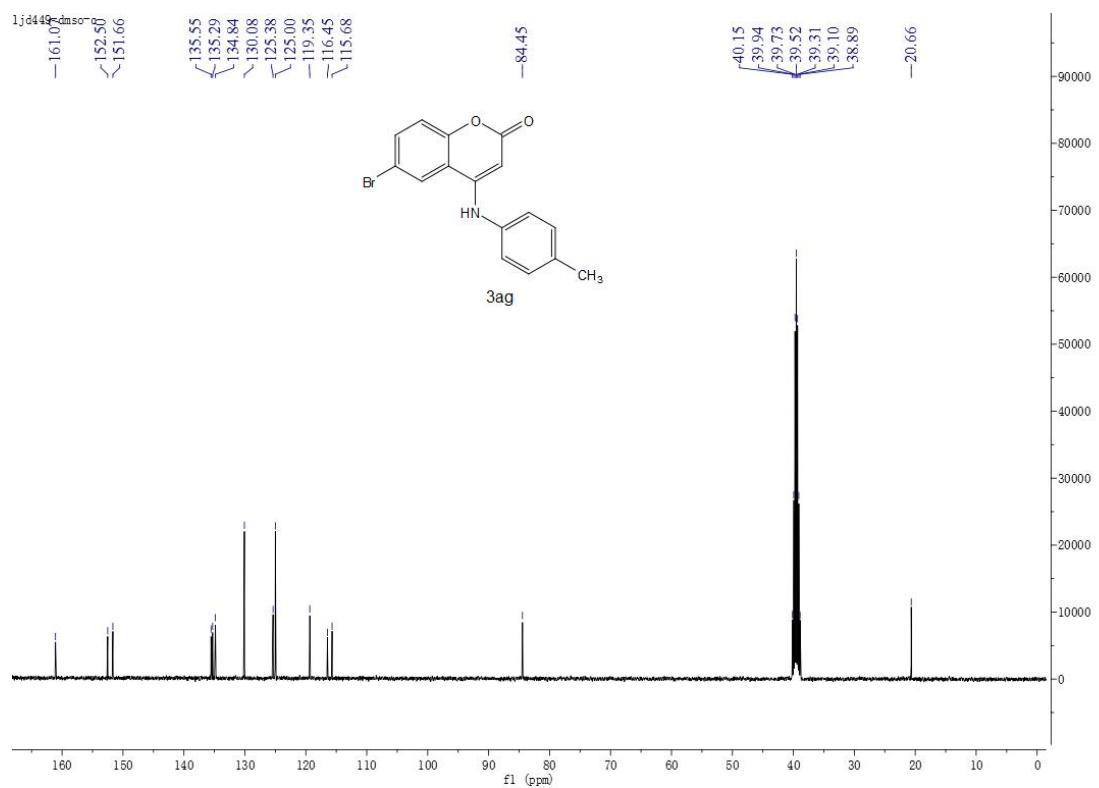
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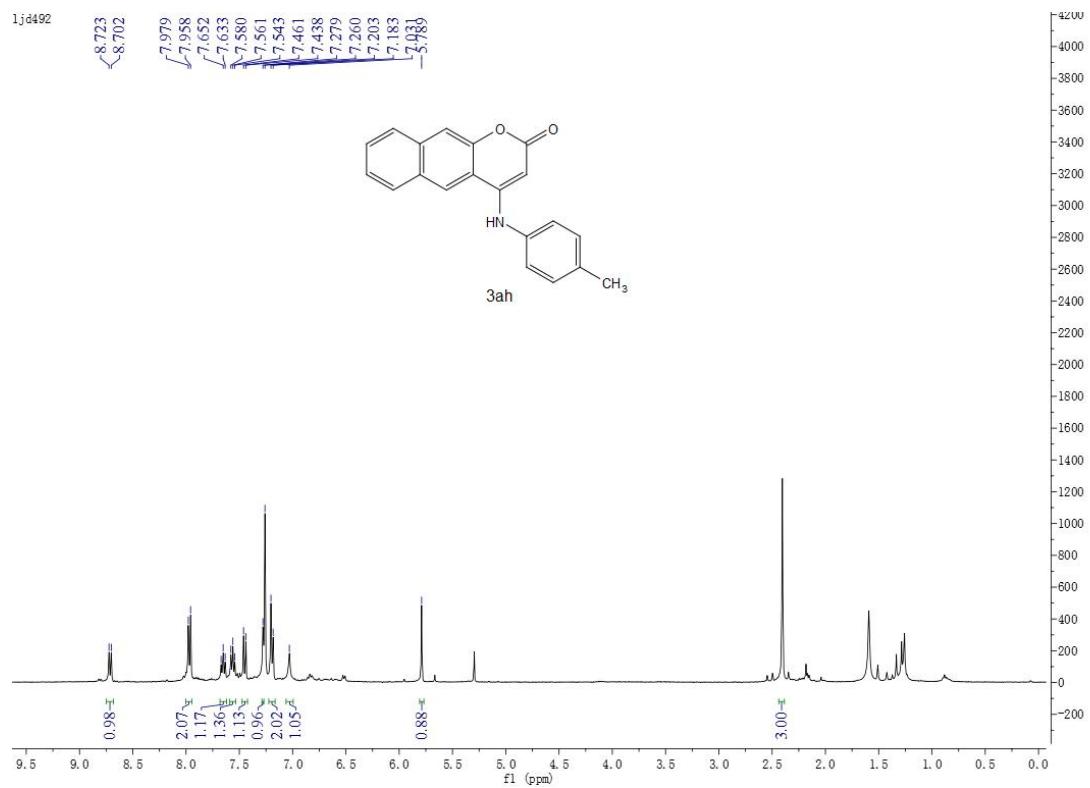
$^1\text{H}$  NMR (400 MHz, DMSO)



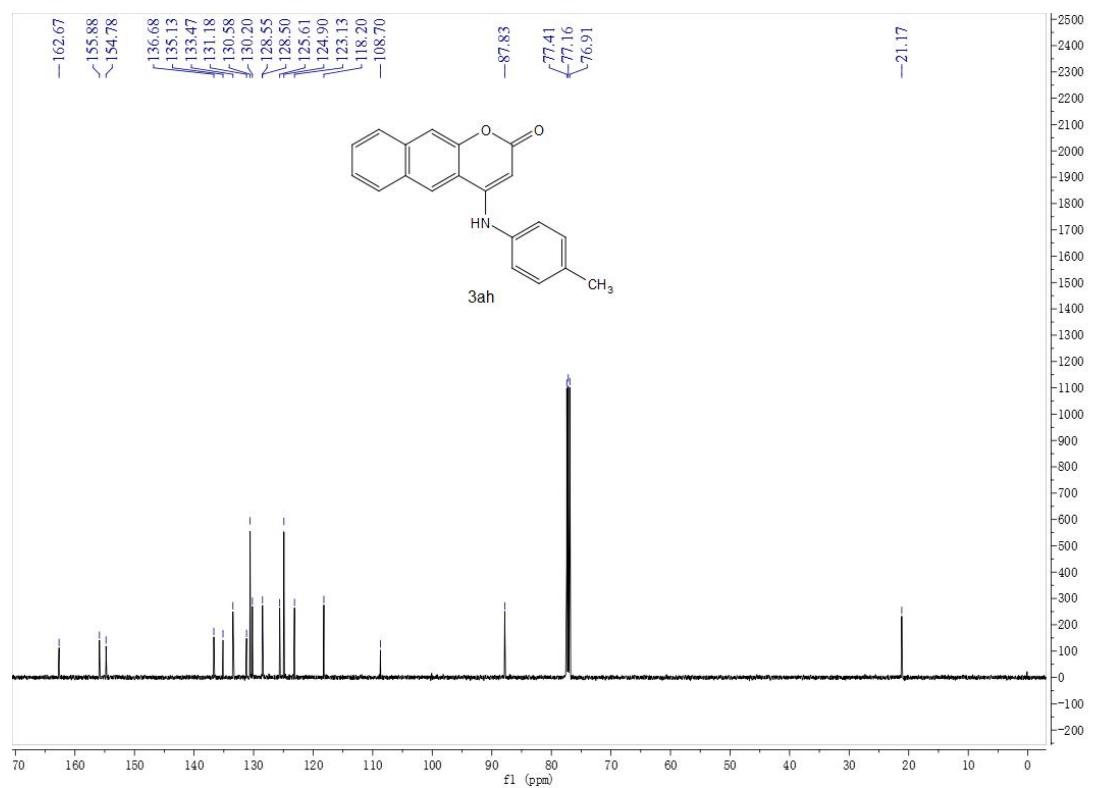
<sup>13</sup>C{<sup>1</sup>H} NMR (100 MHz, DMSO)



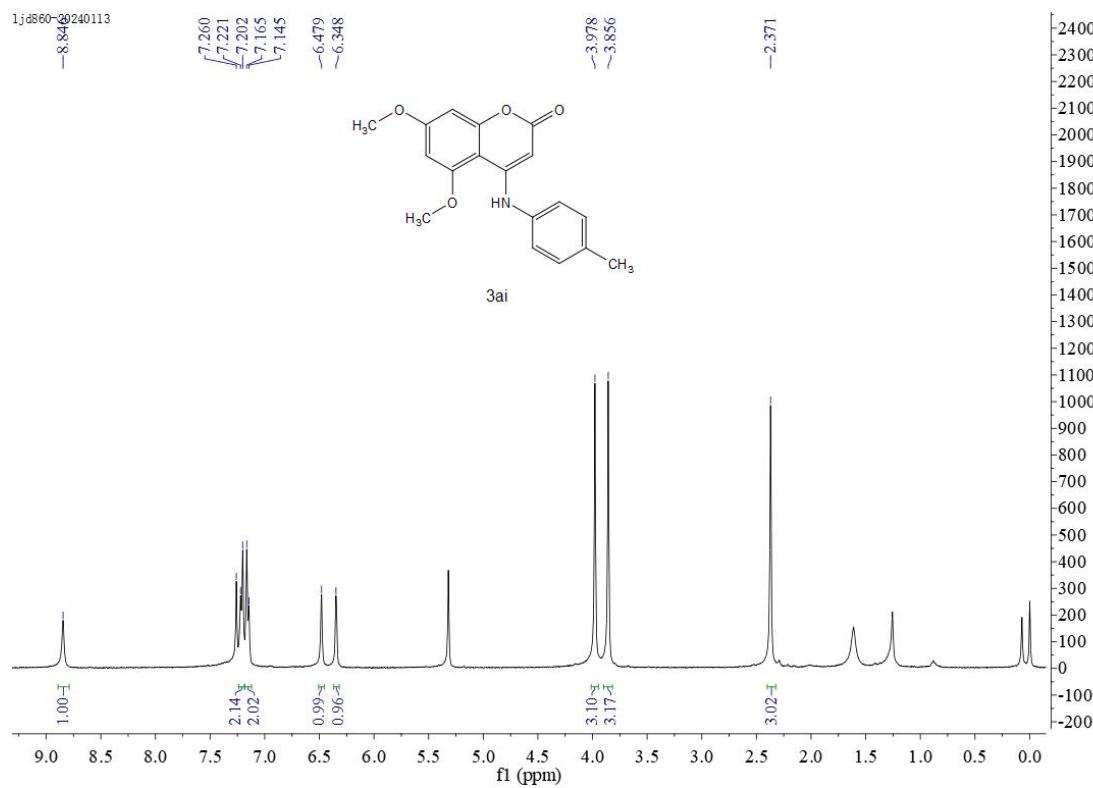
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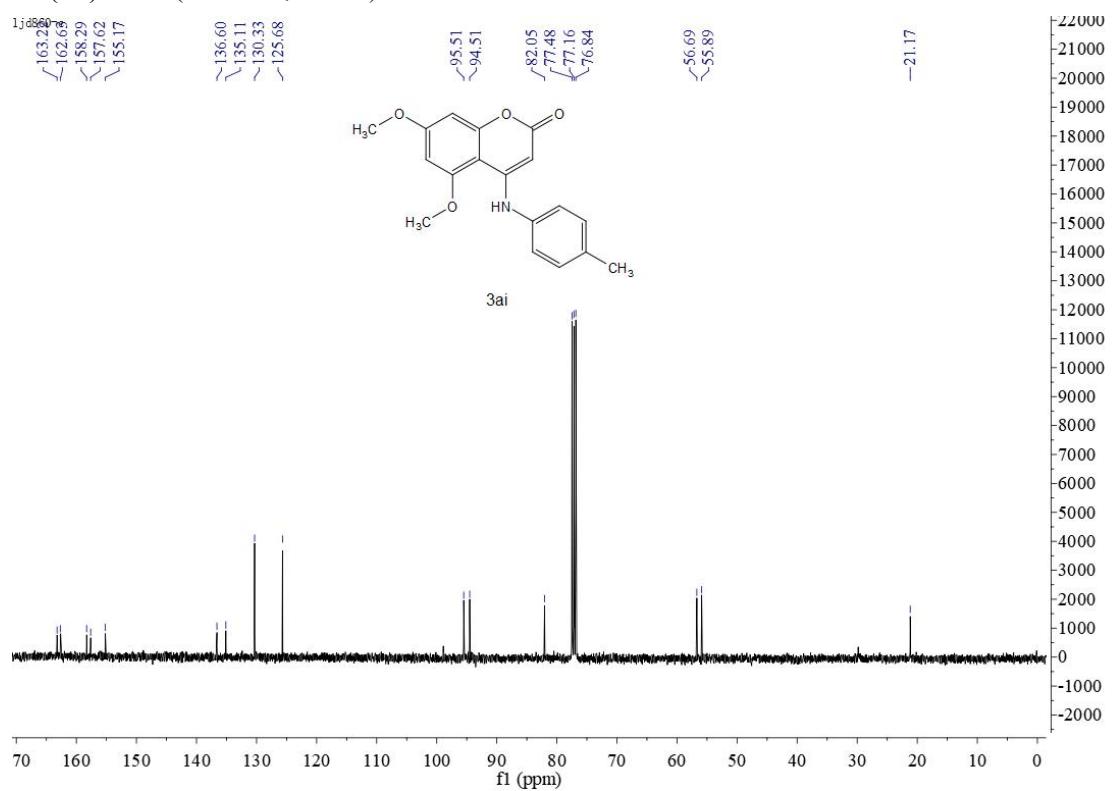
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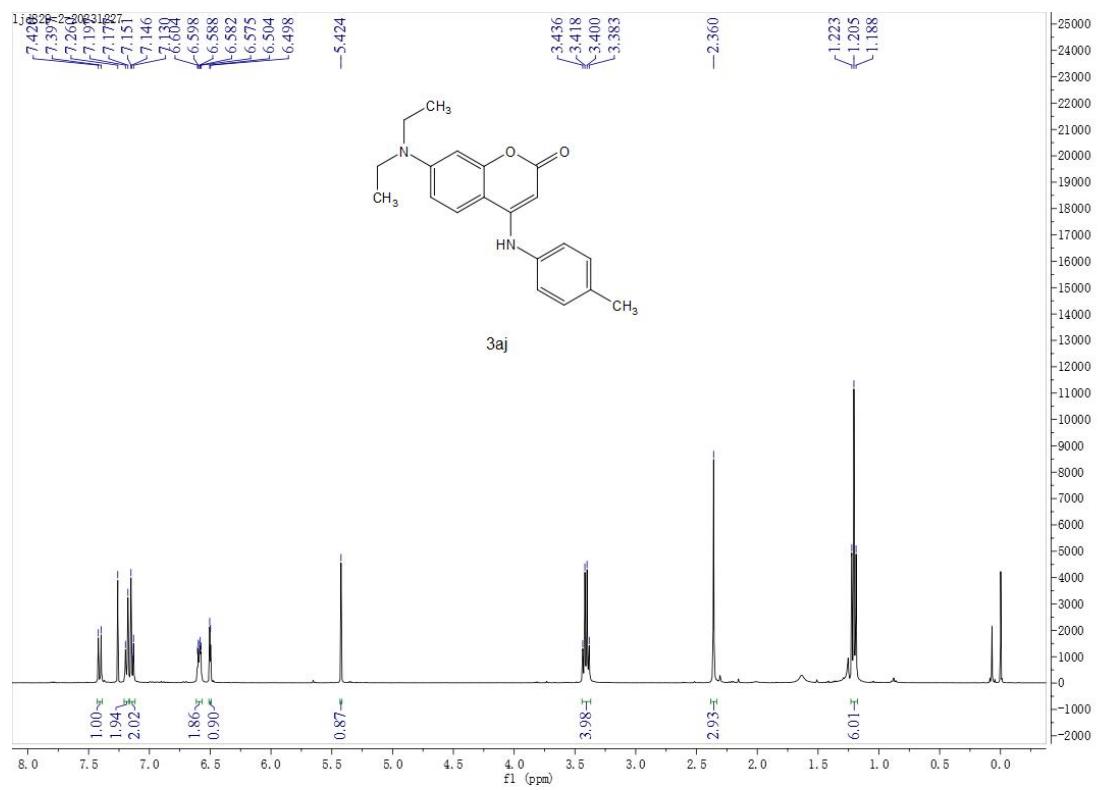
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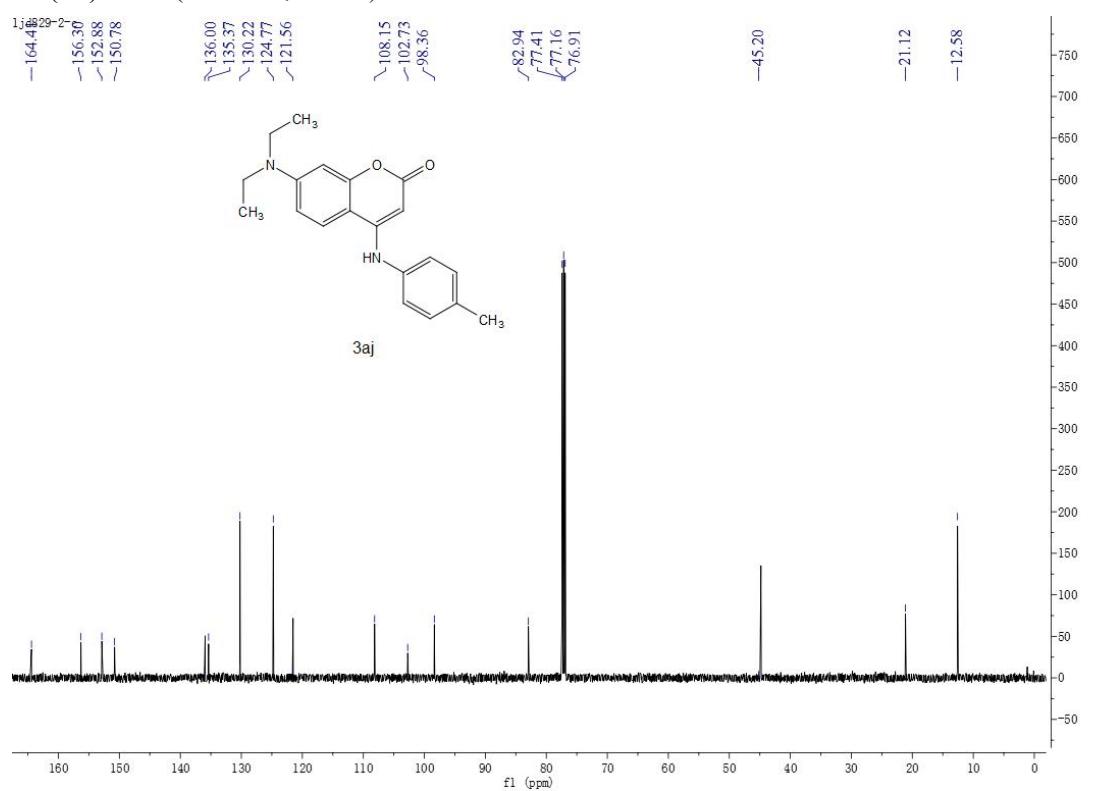
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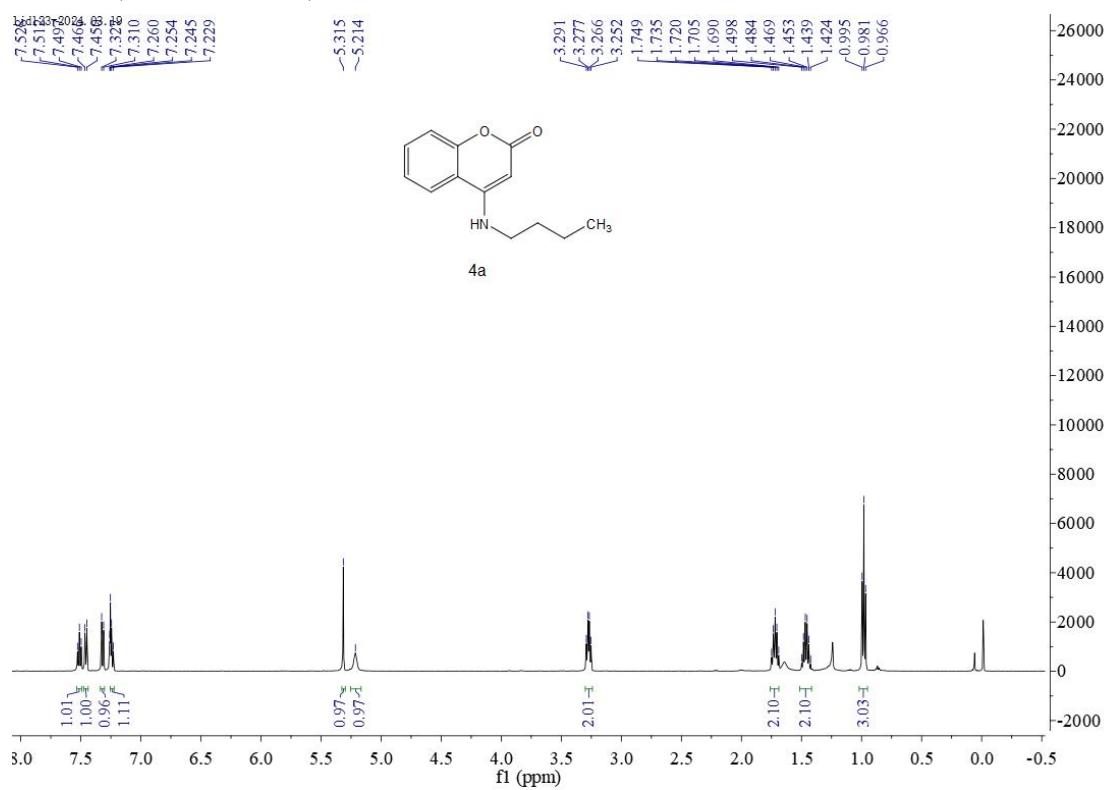
$^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



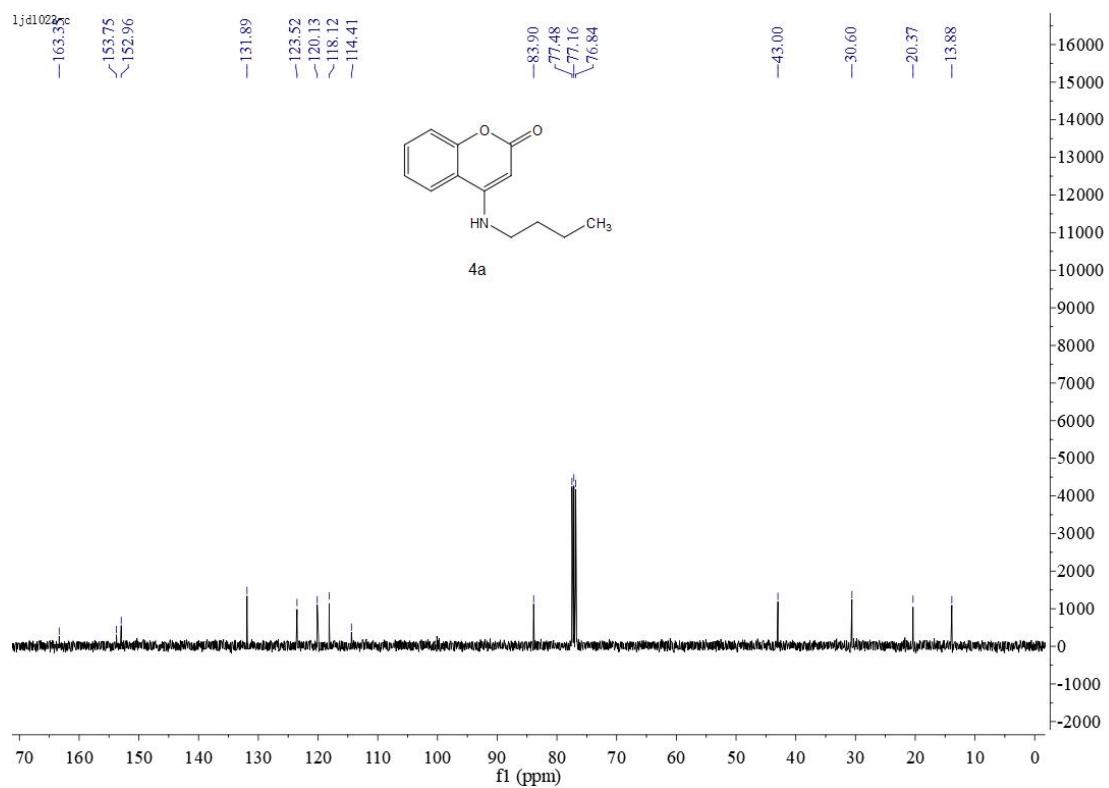
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz,  $\text{CDCl}_3$ )



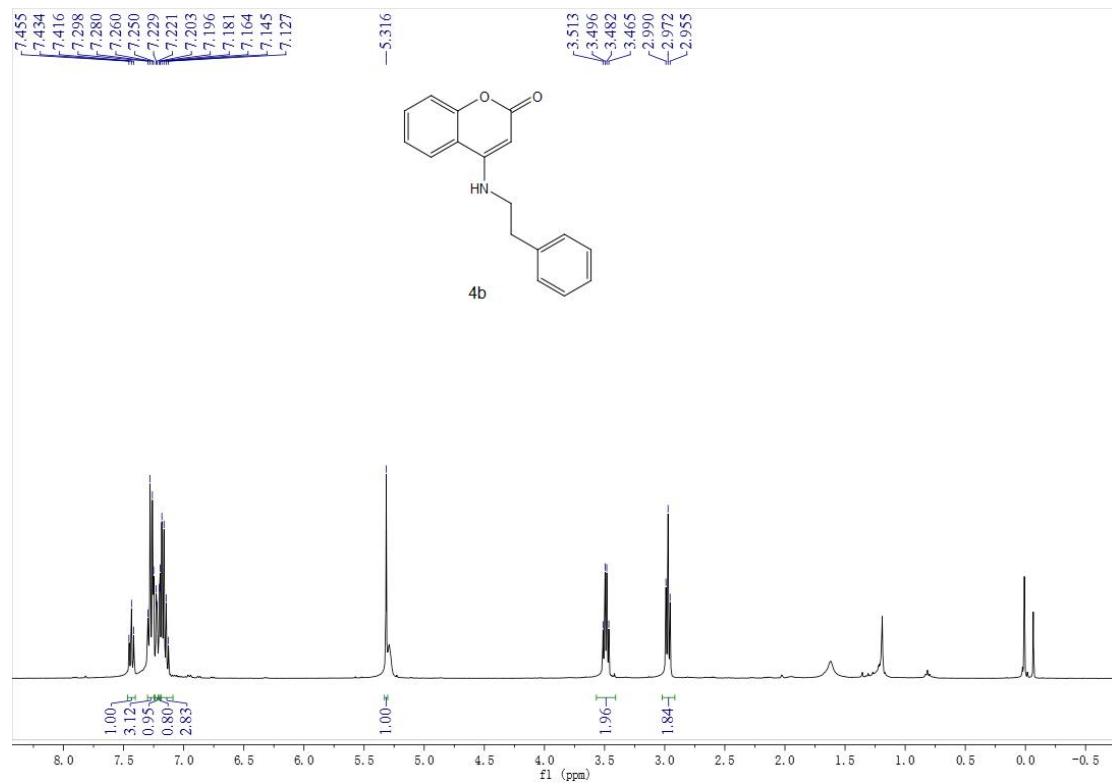
$^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



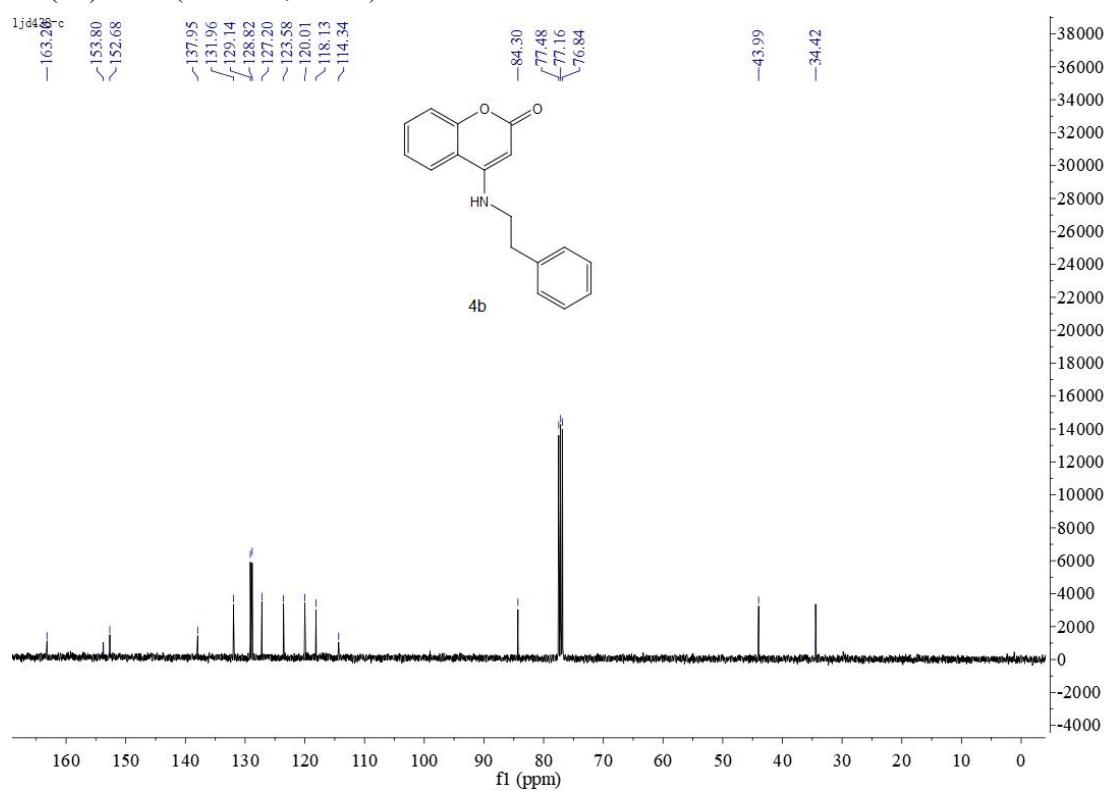
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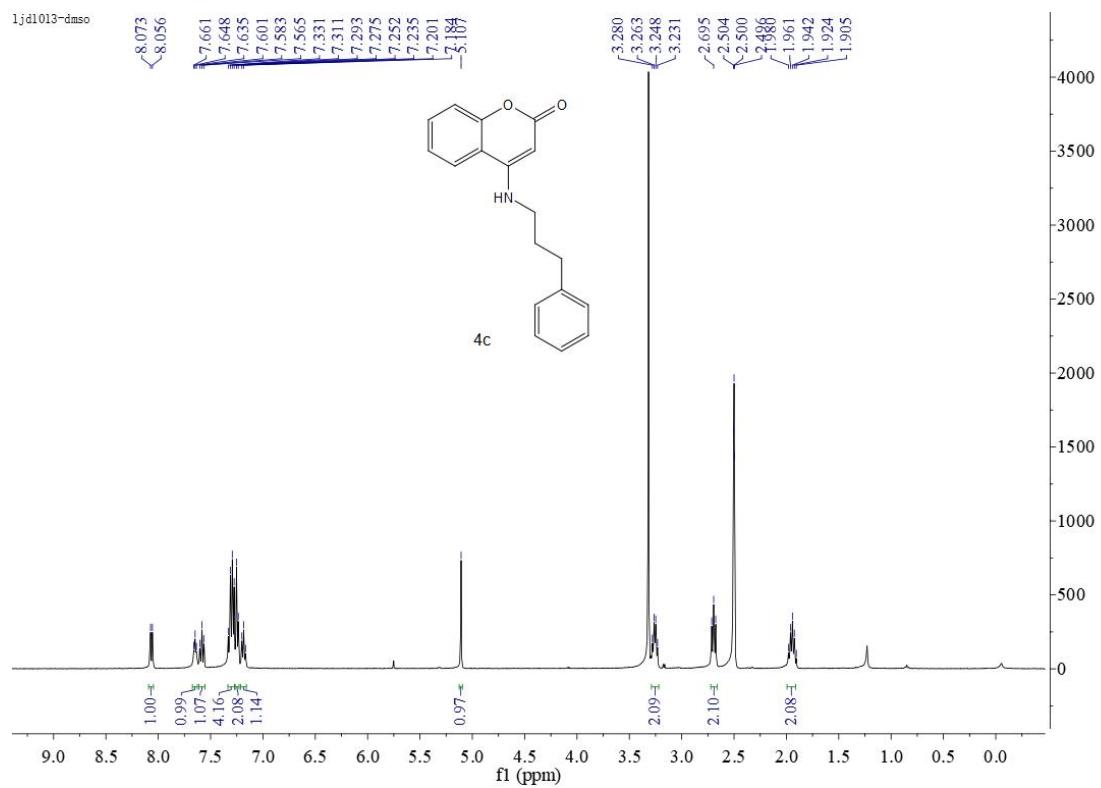
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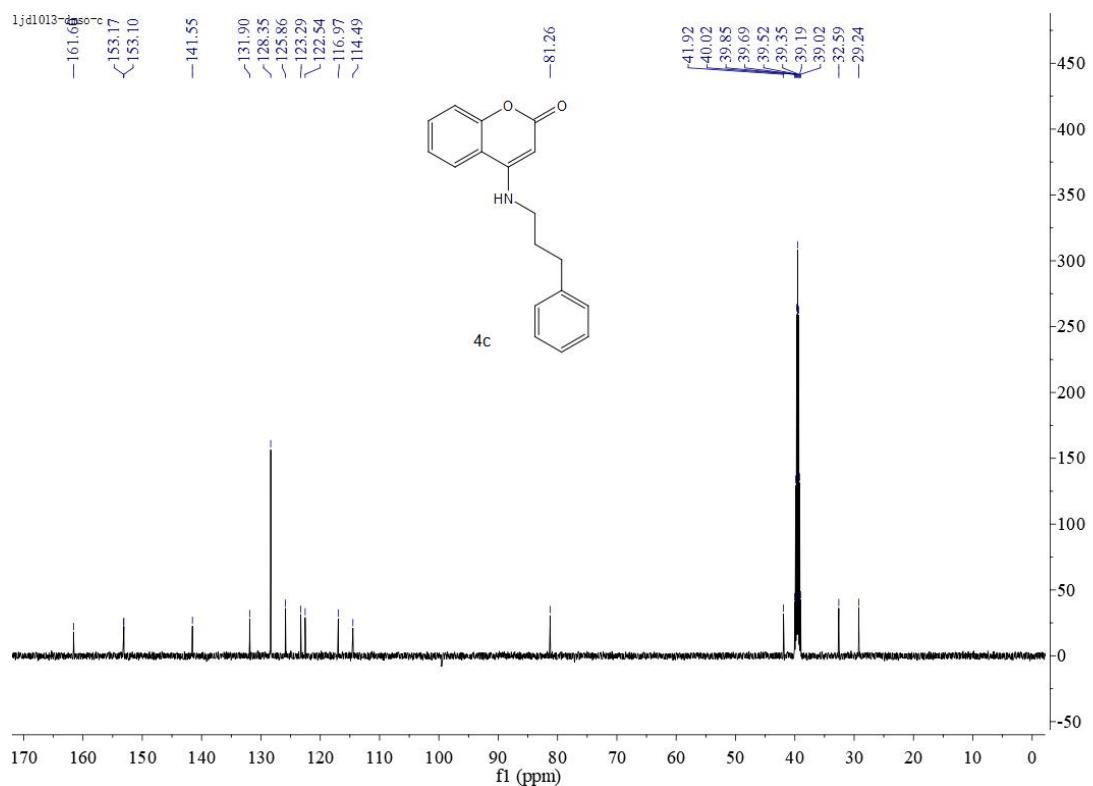
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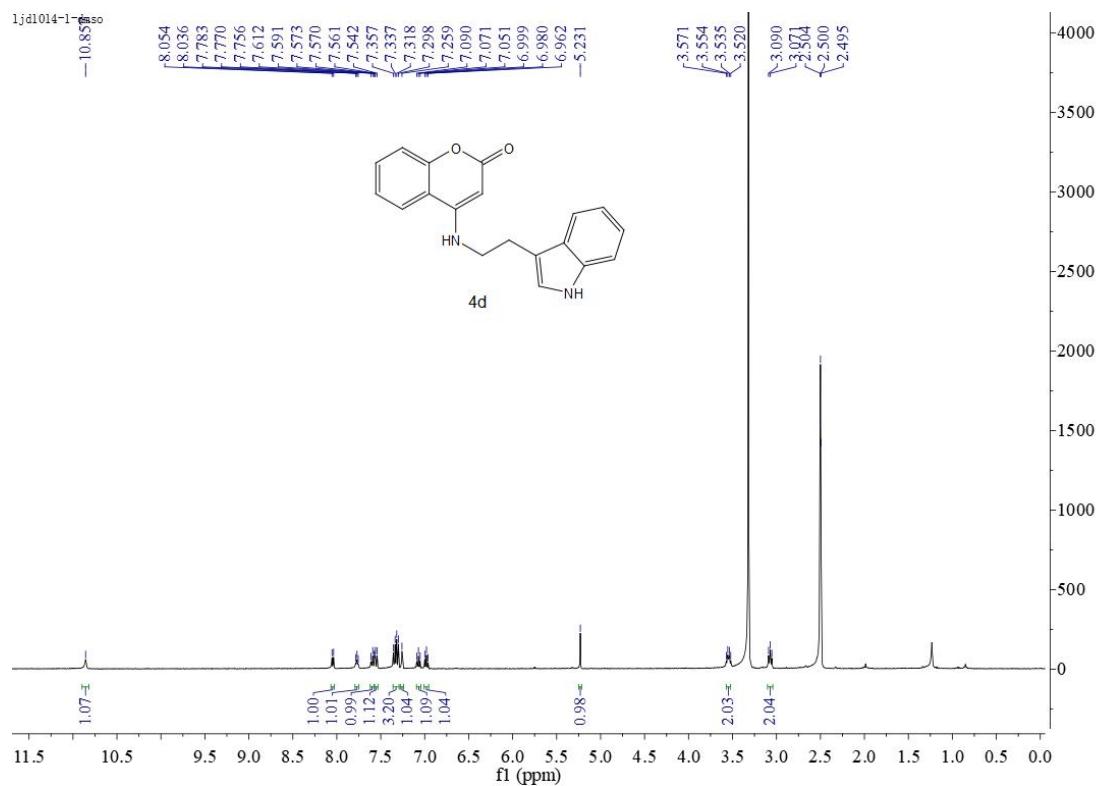
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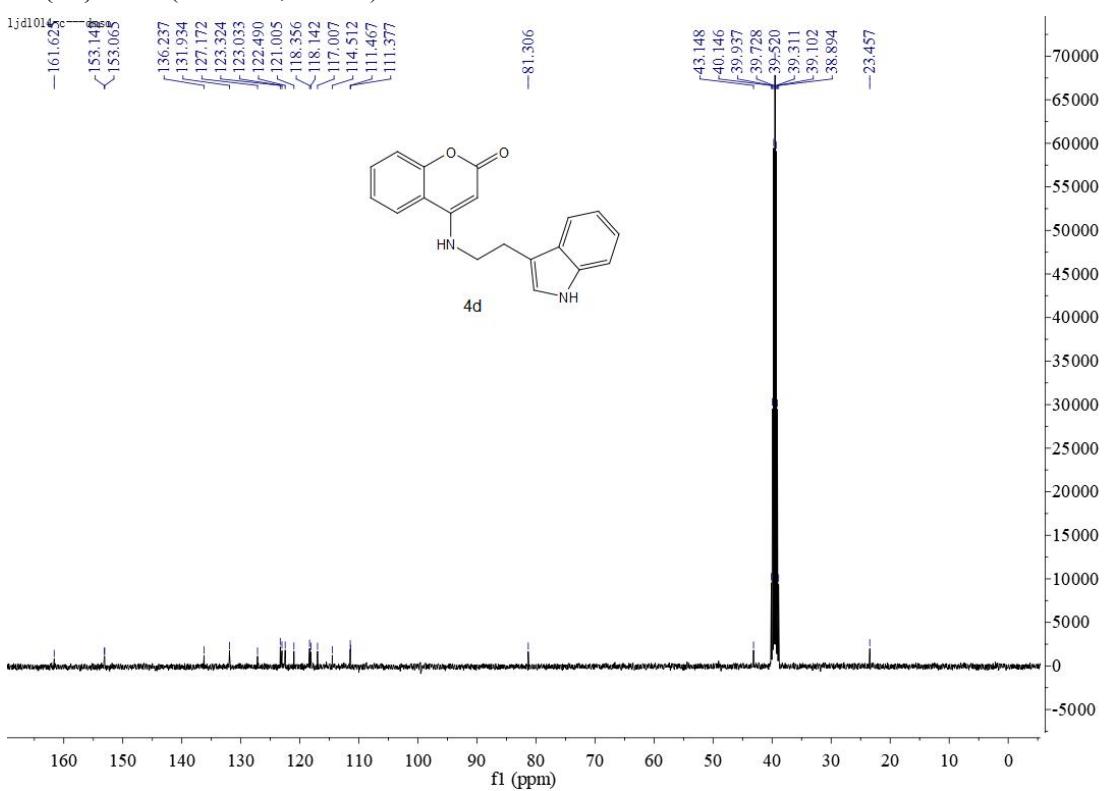
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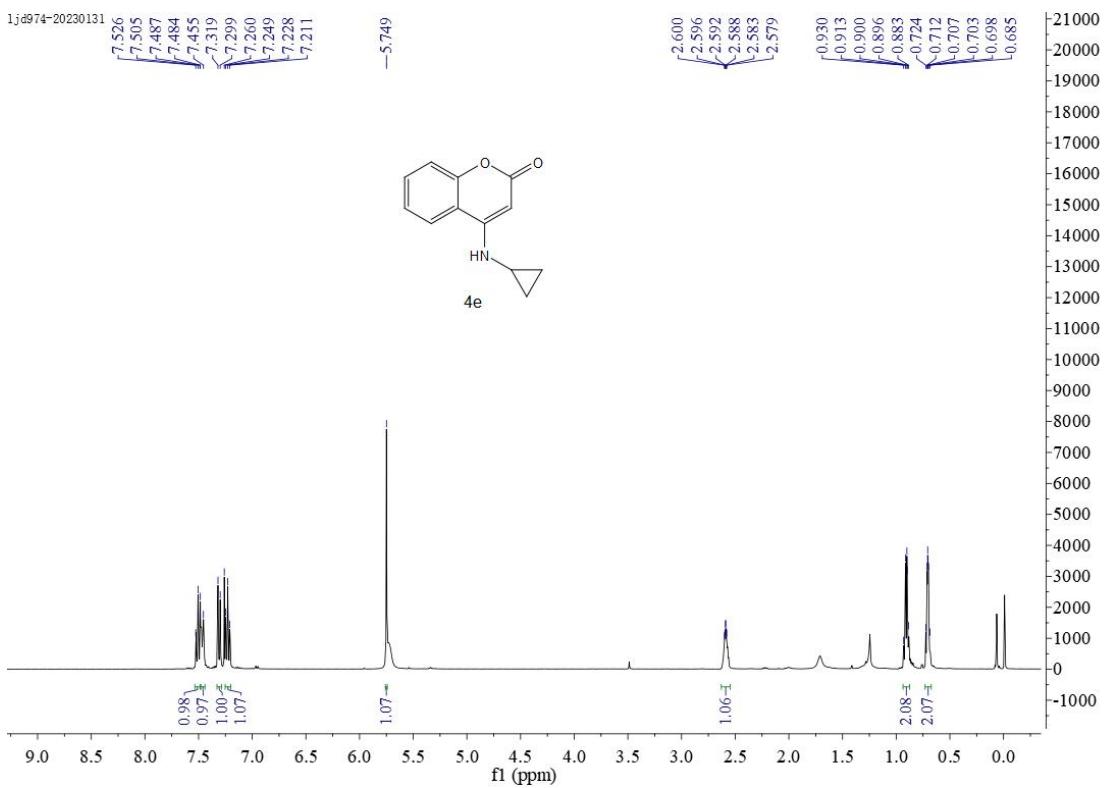
$^1\text{H}$  NMR (400 MHz, DMSO)



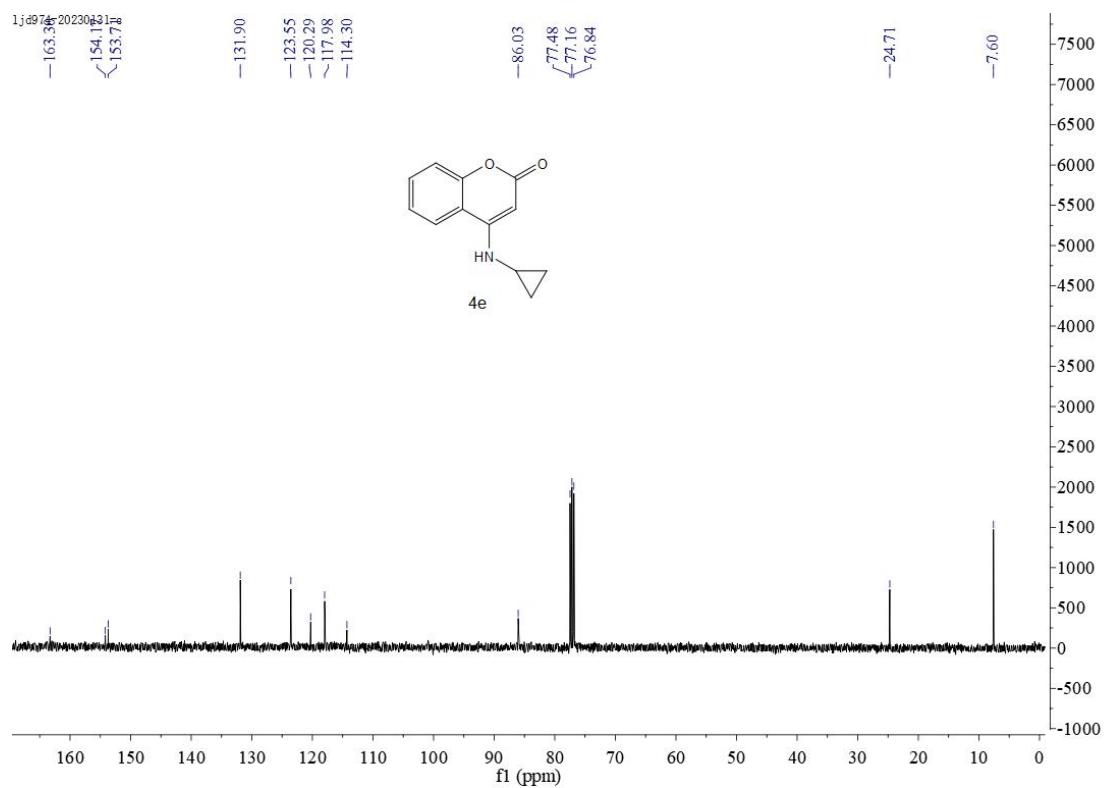
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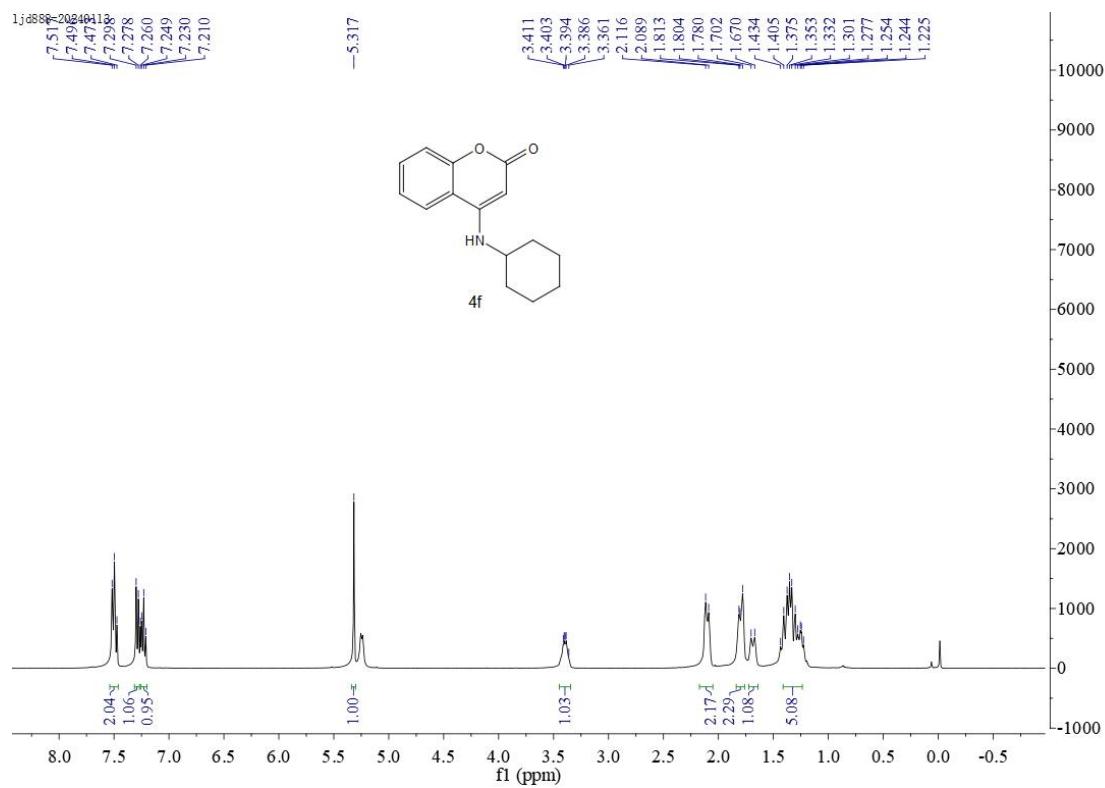
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



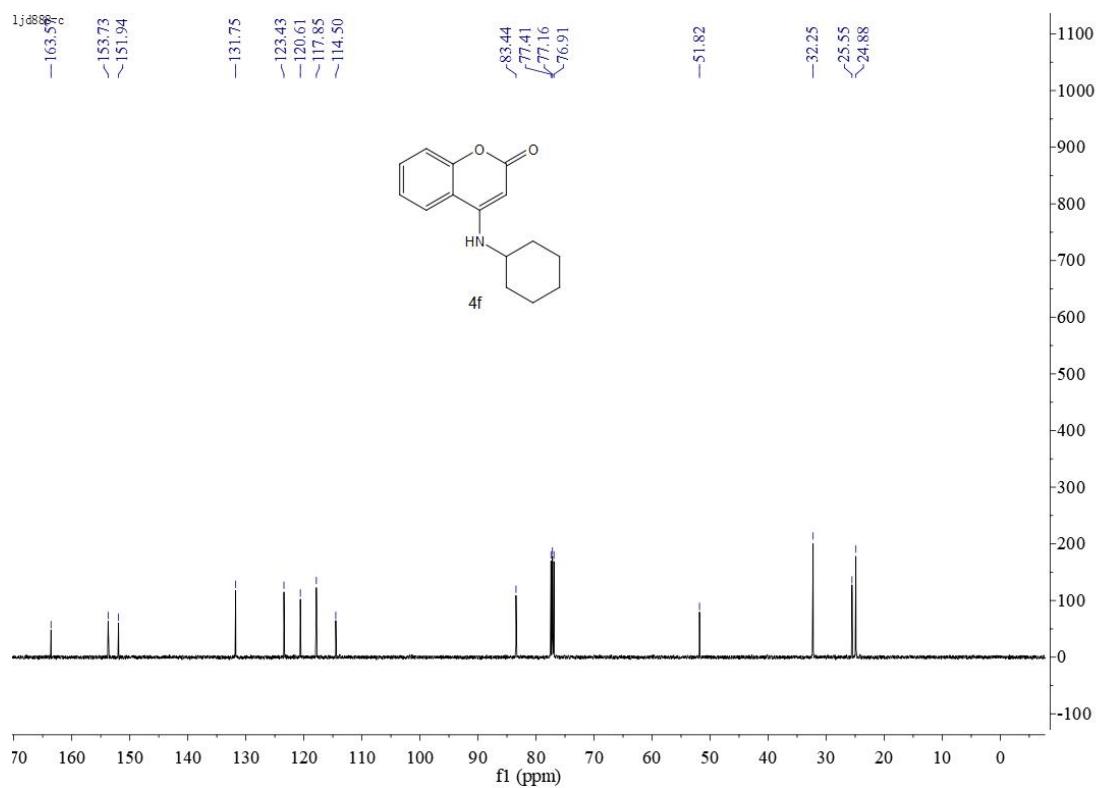
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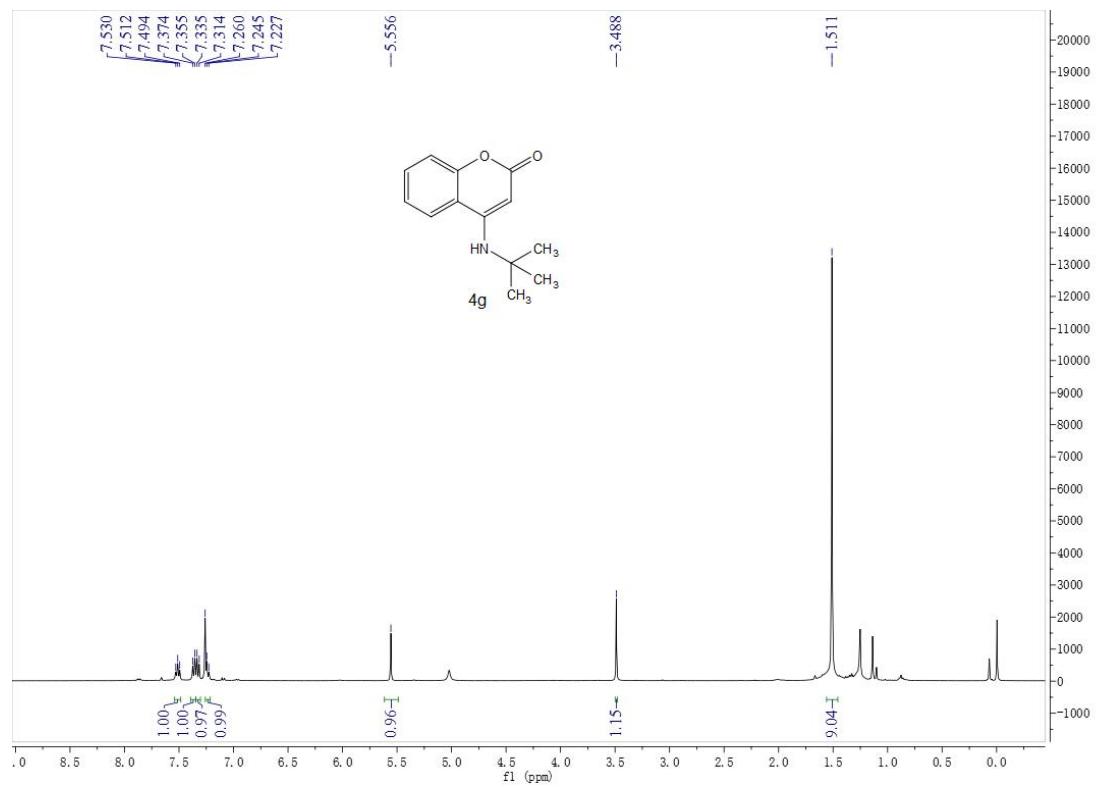
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



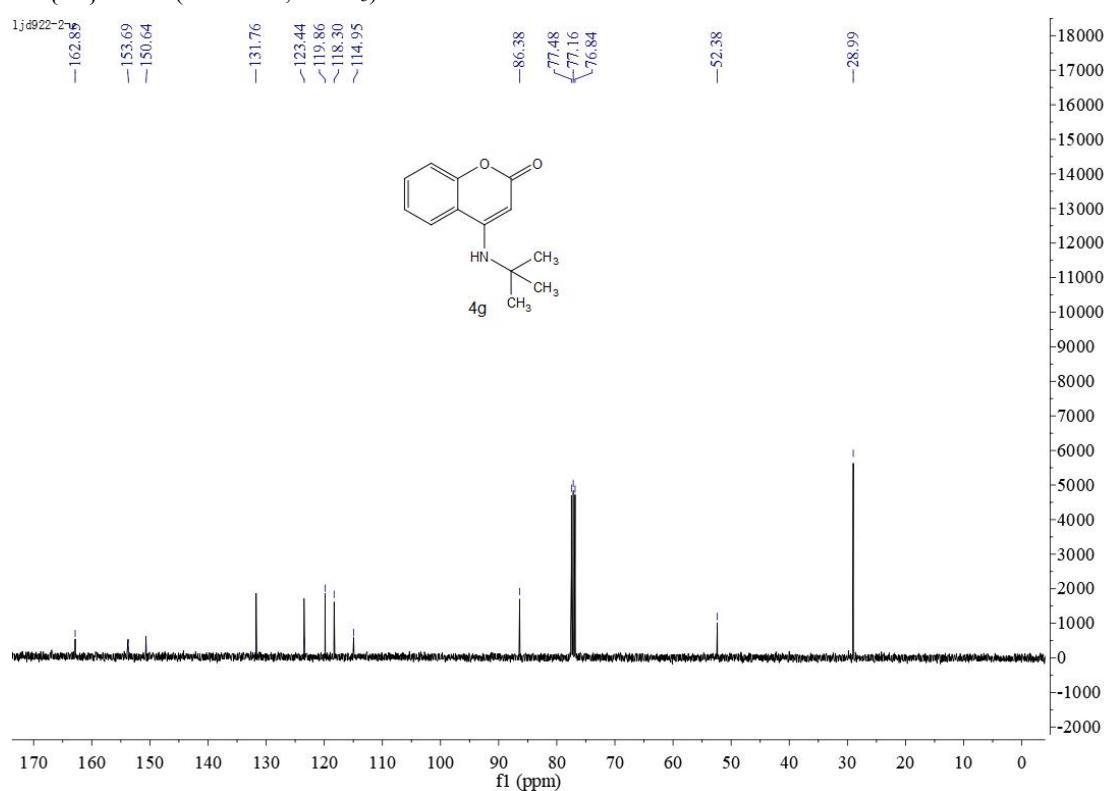
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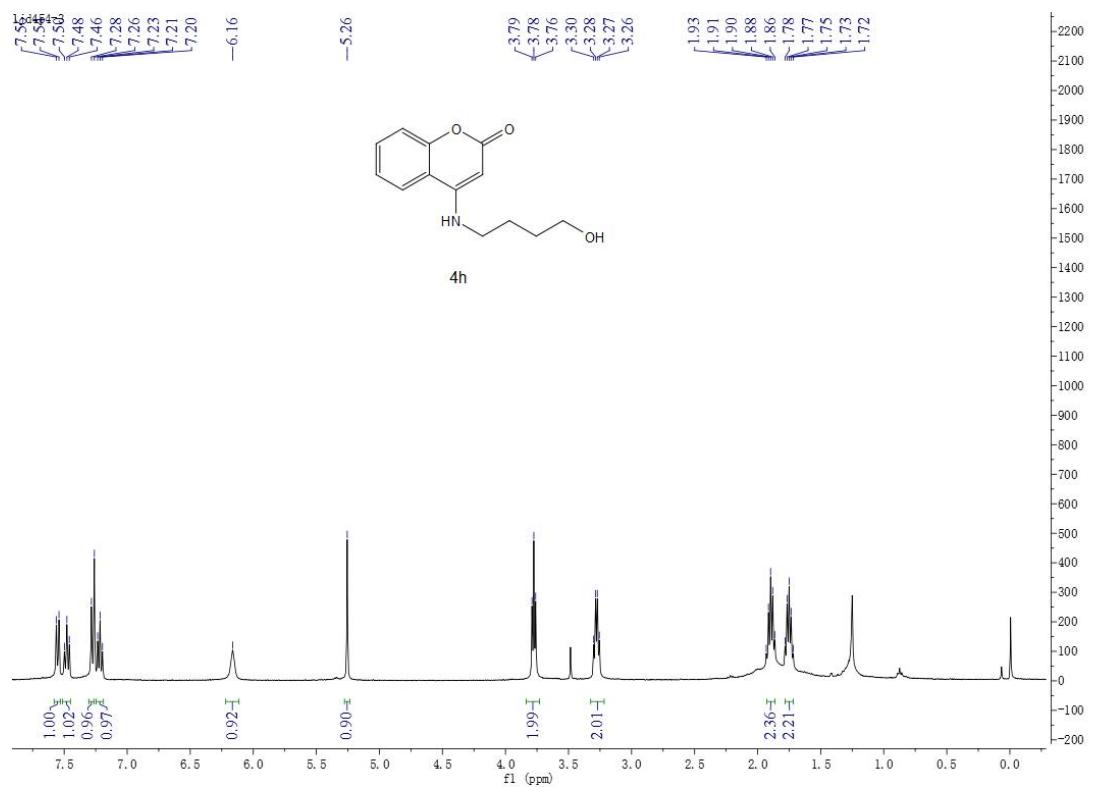
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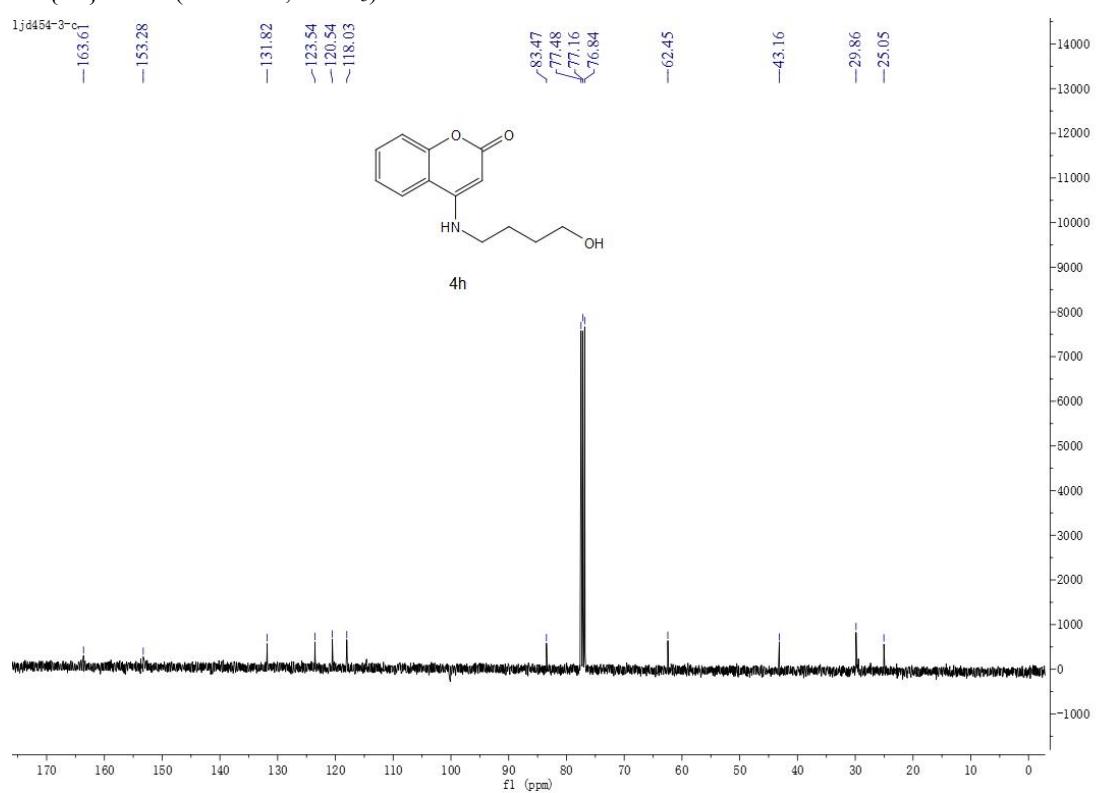
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )



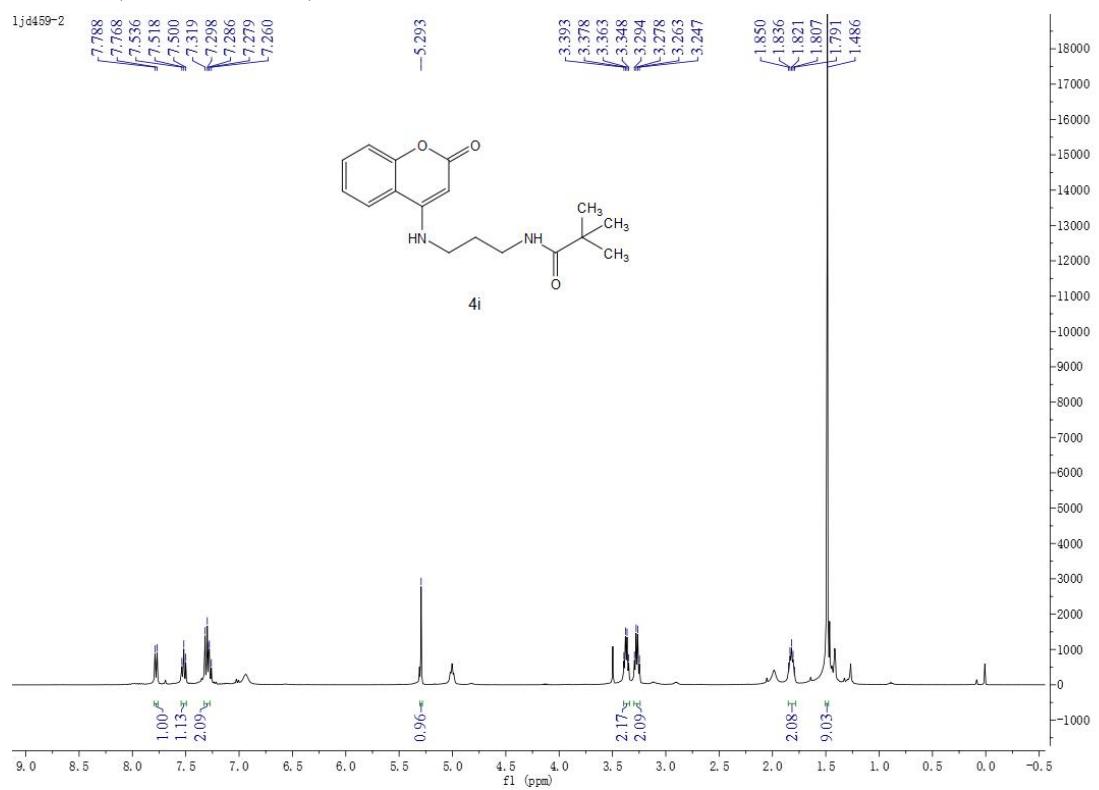
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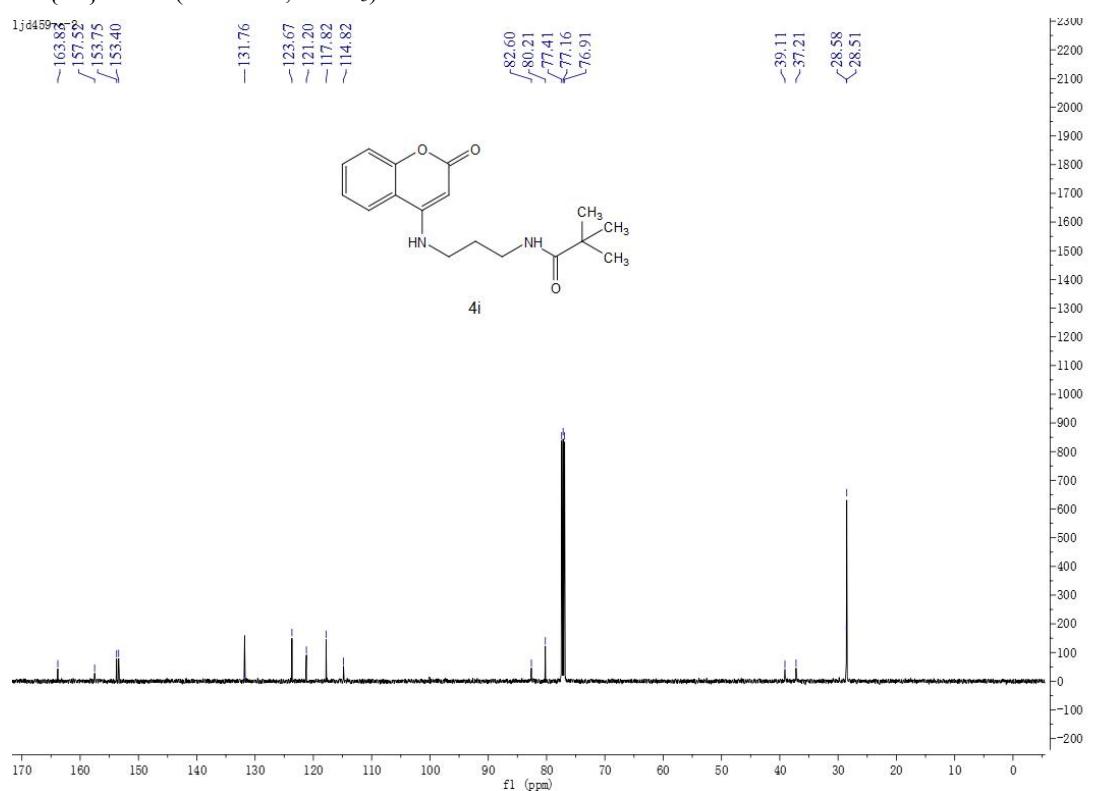
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$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



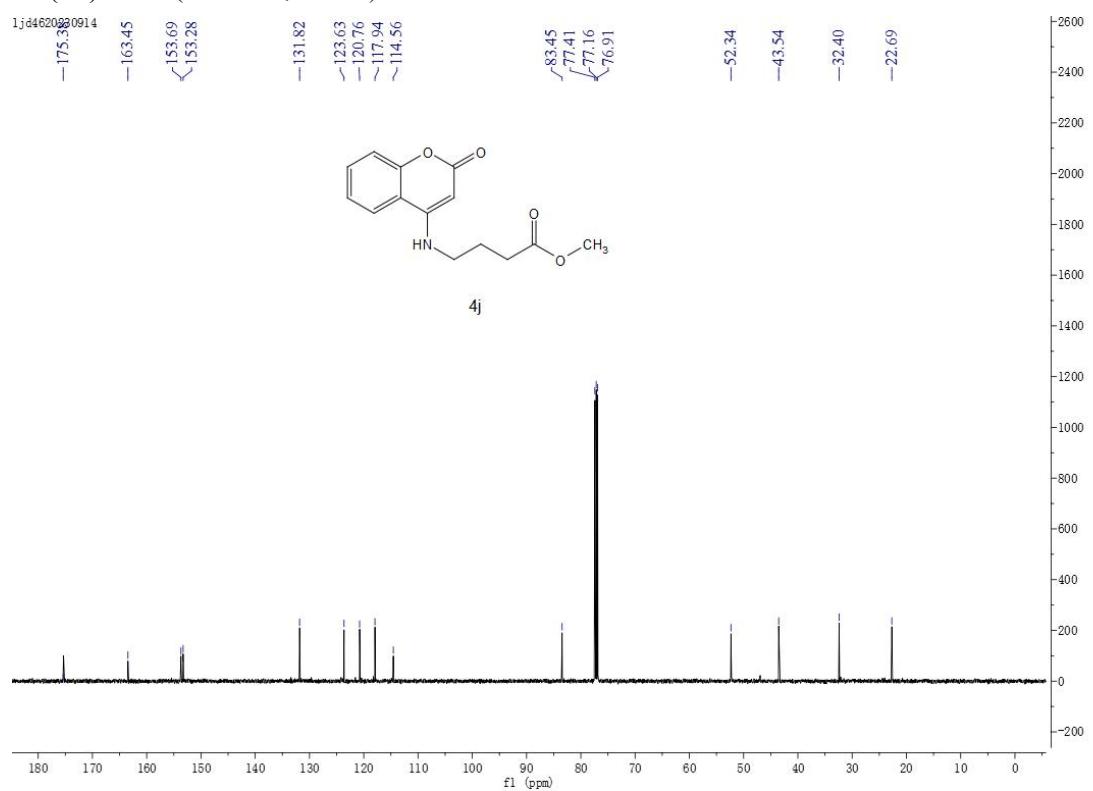
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz,  $\text{CDCl}_3$ )



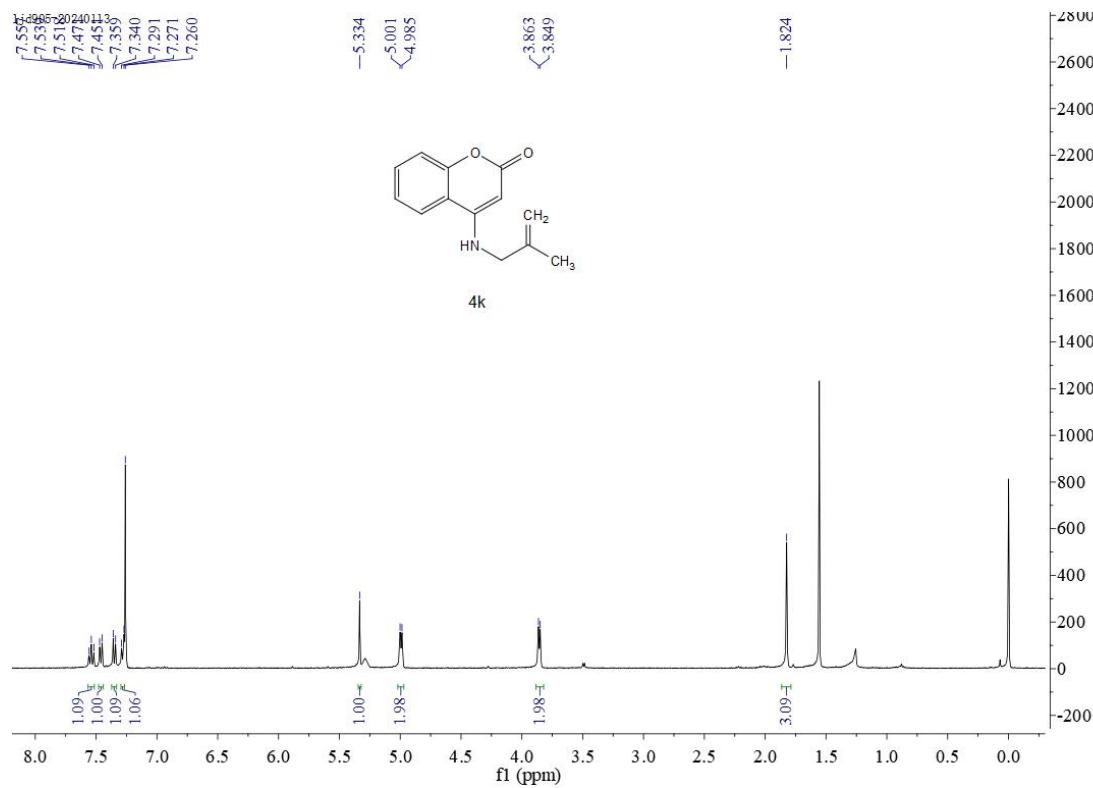
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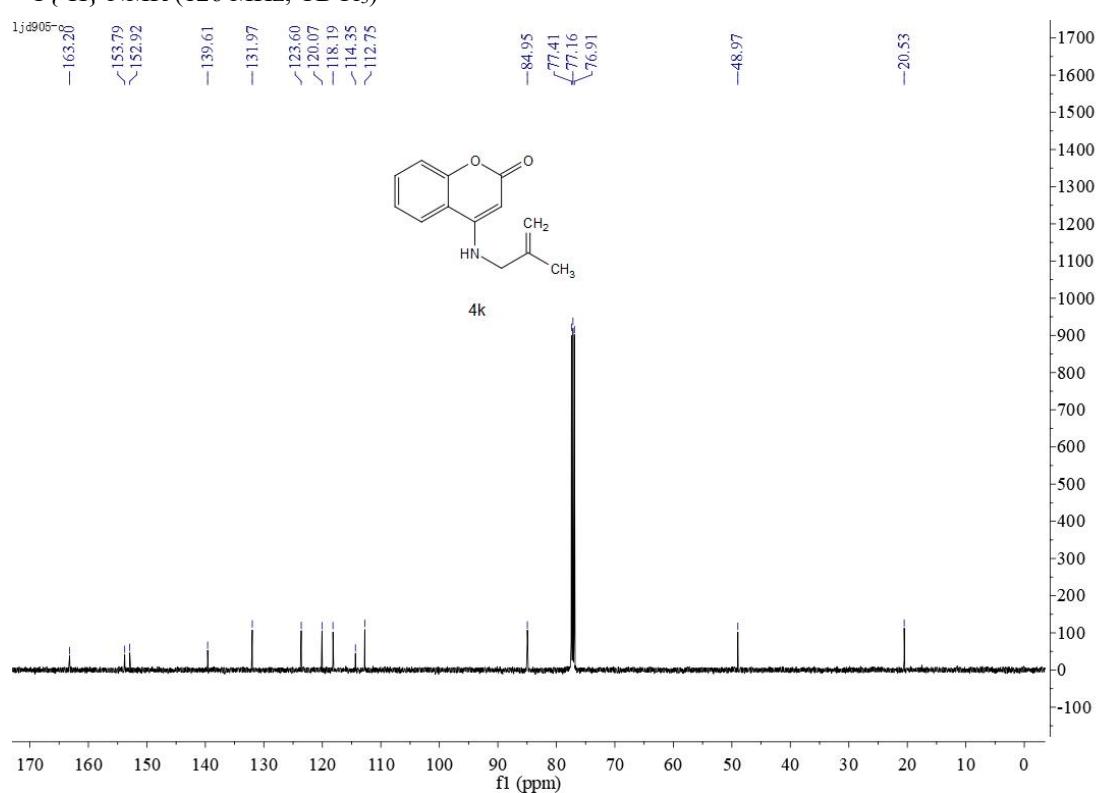
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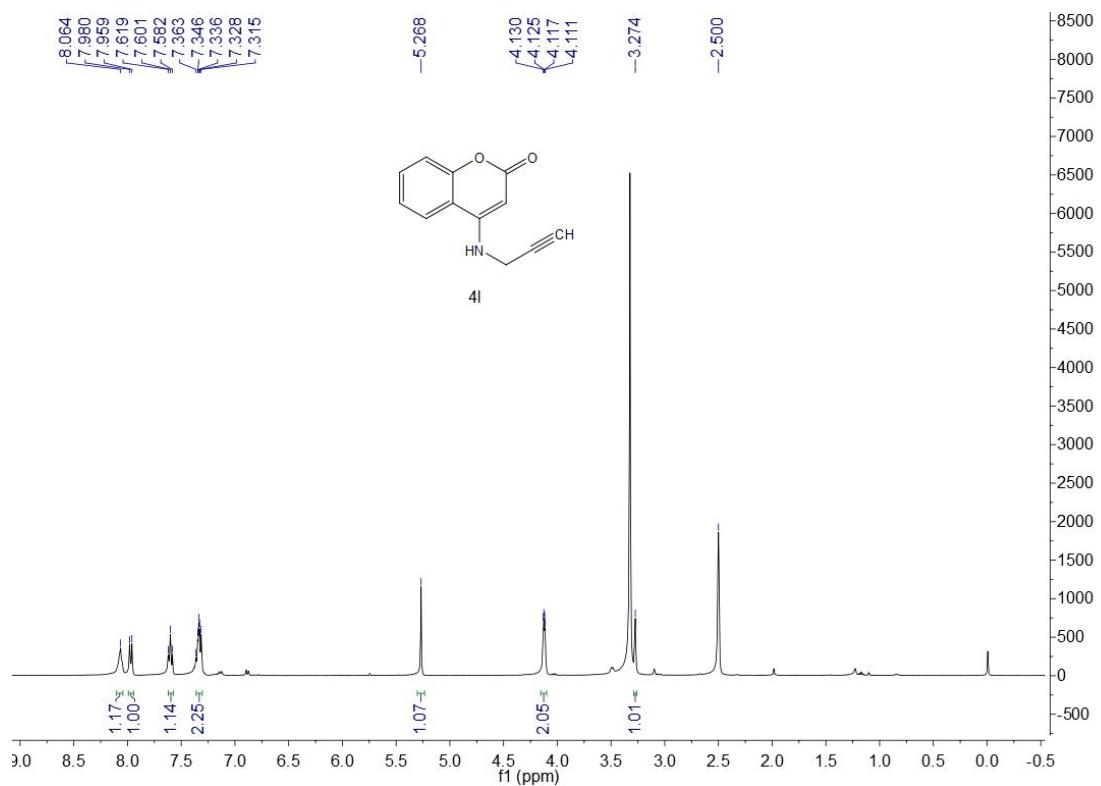
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



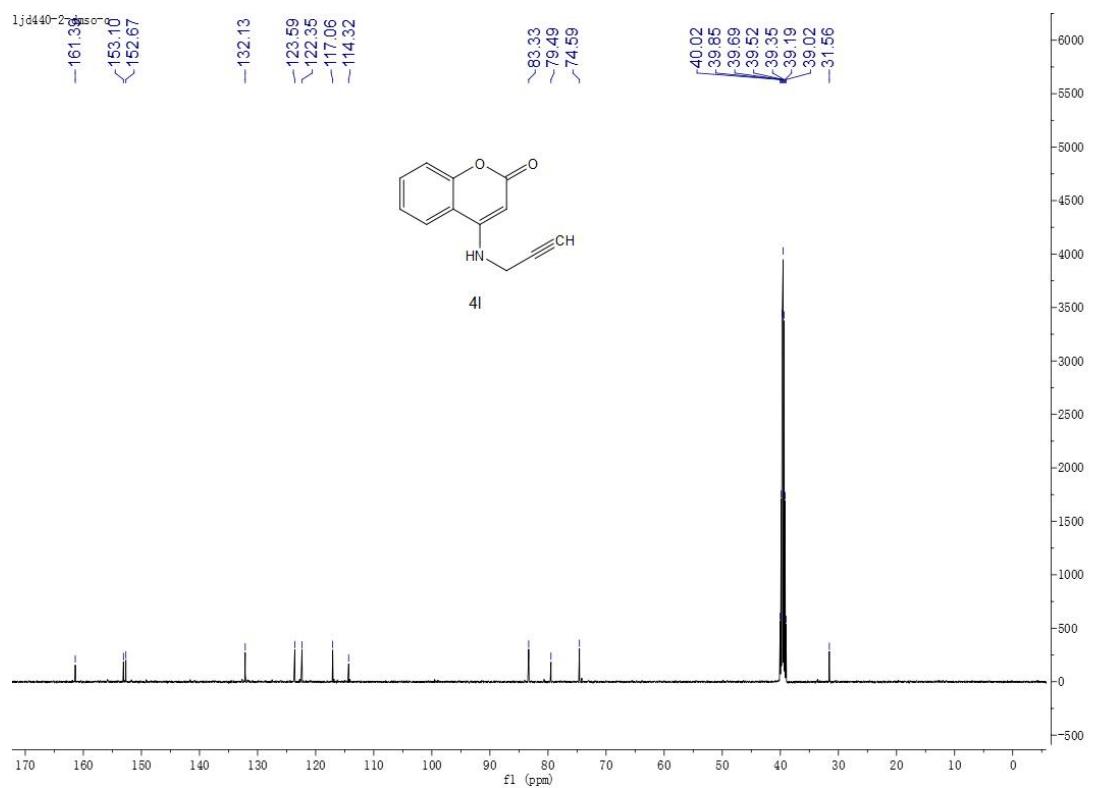
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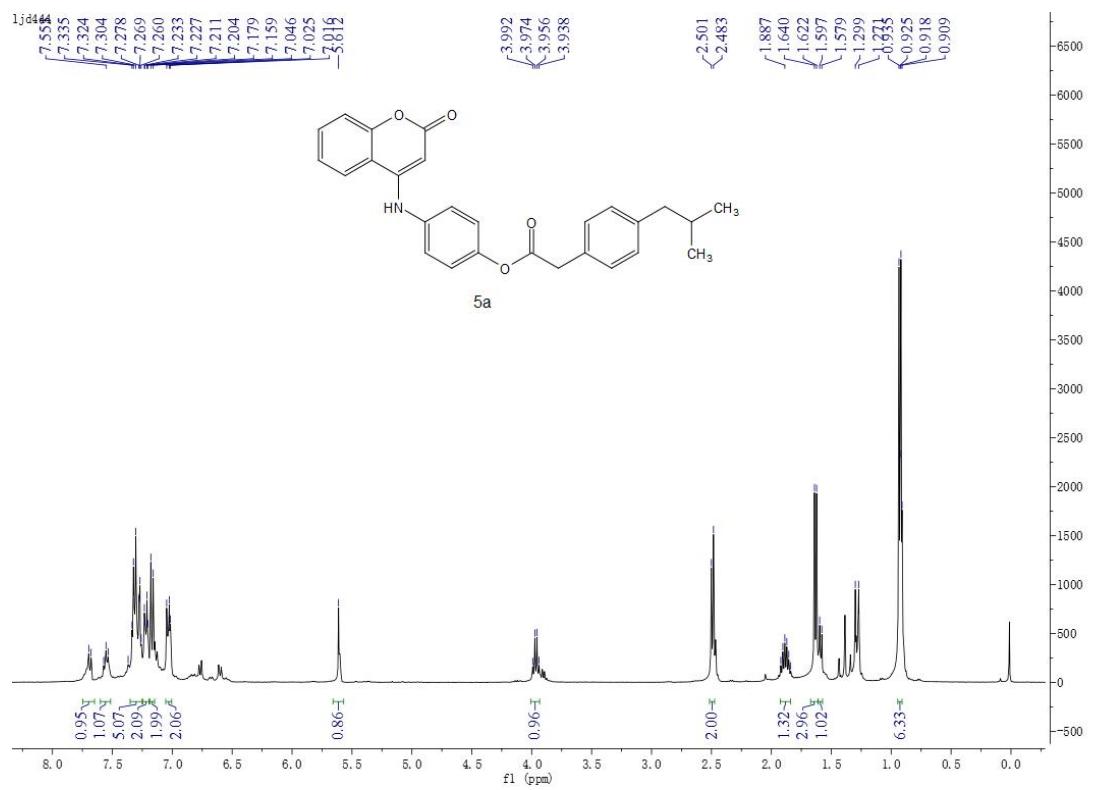
$^1\text{H}$  NMR (400 MHz, DMSO)



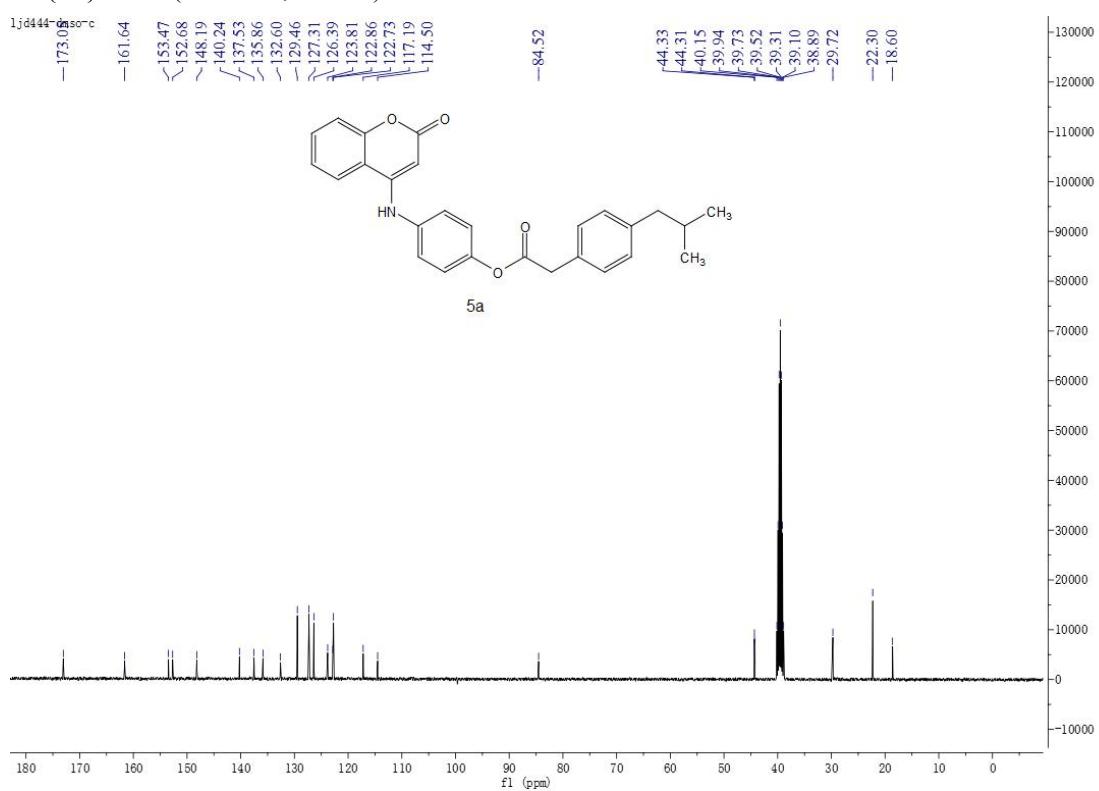
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



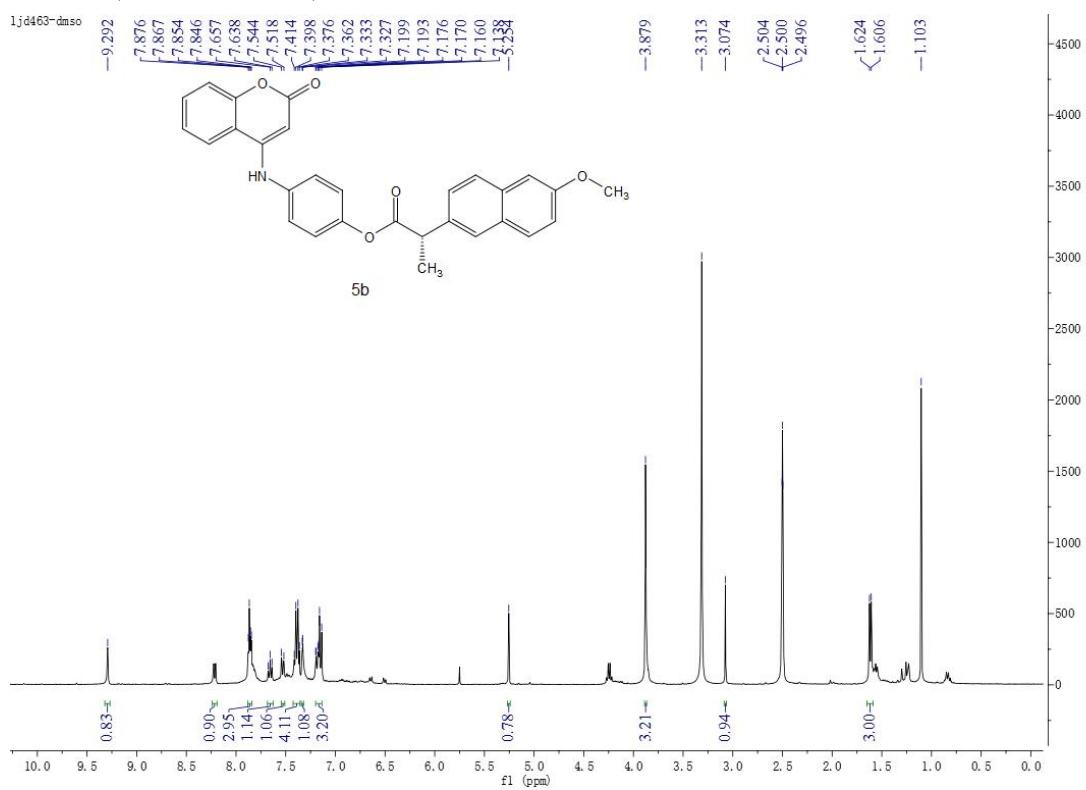
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



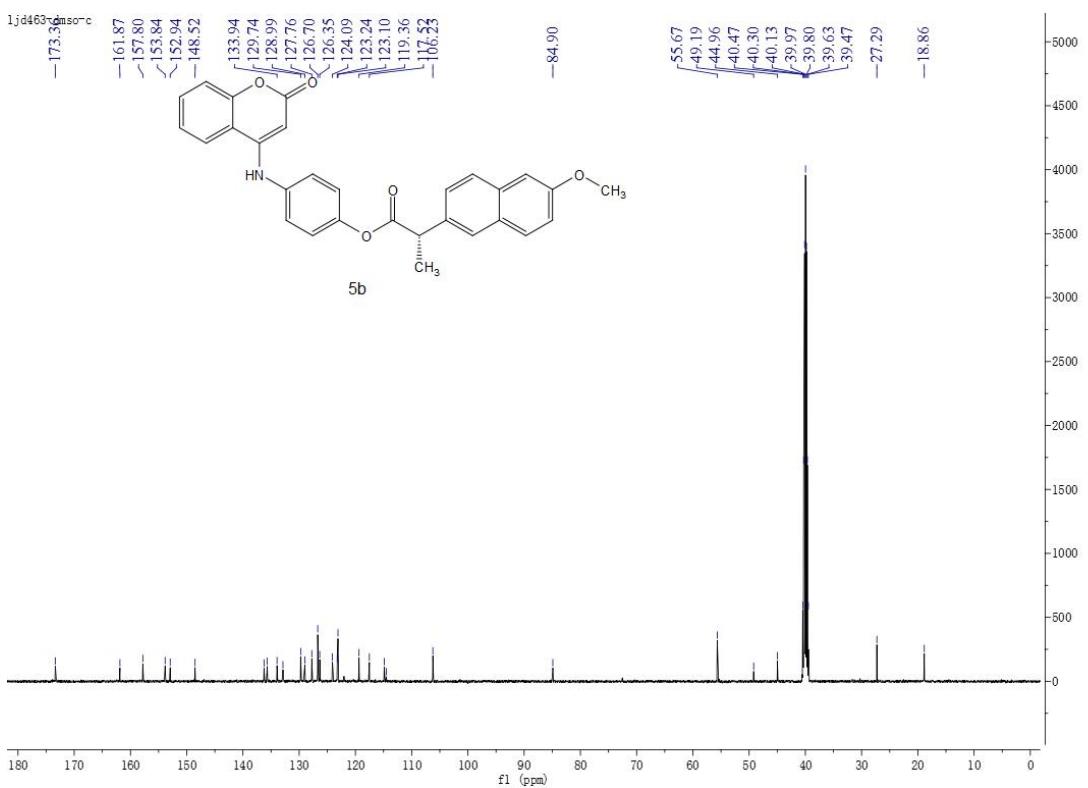
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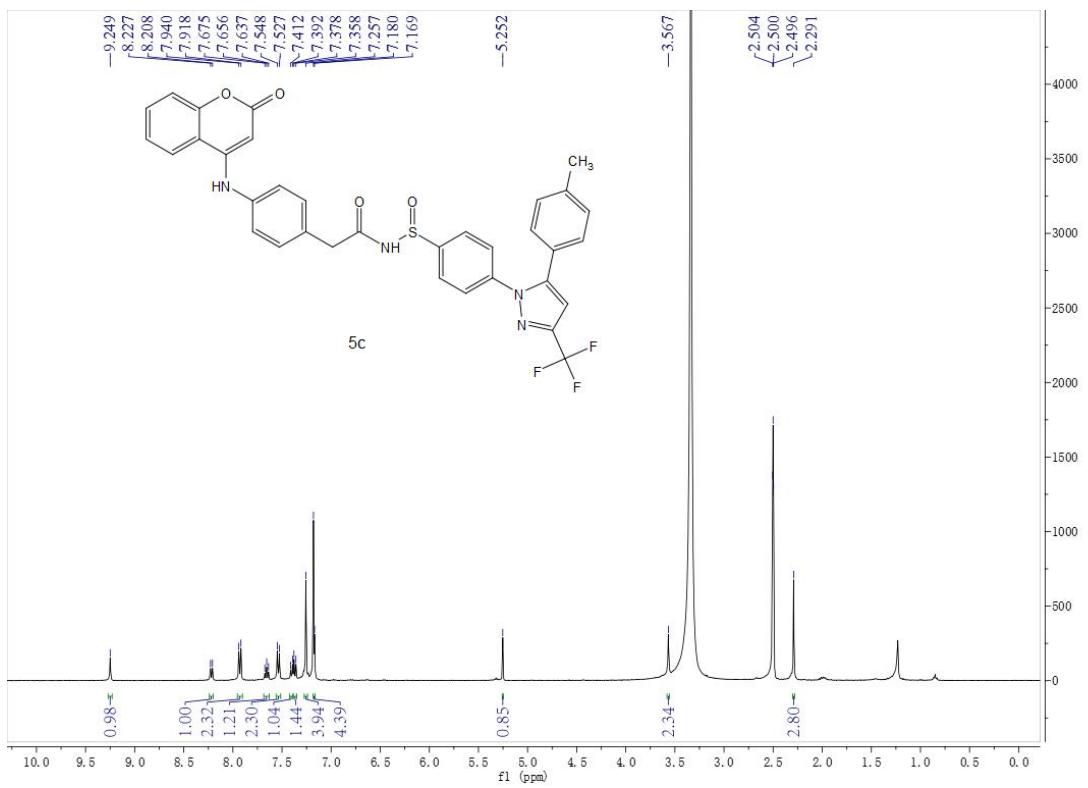
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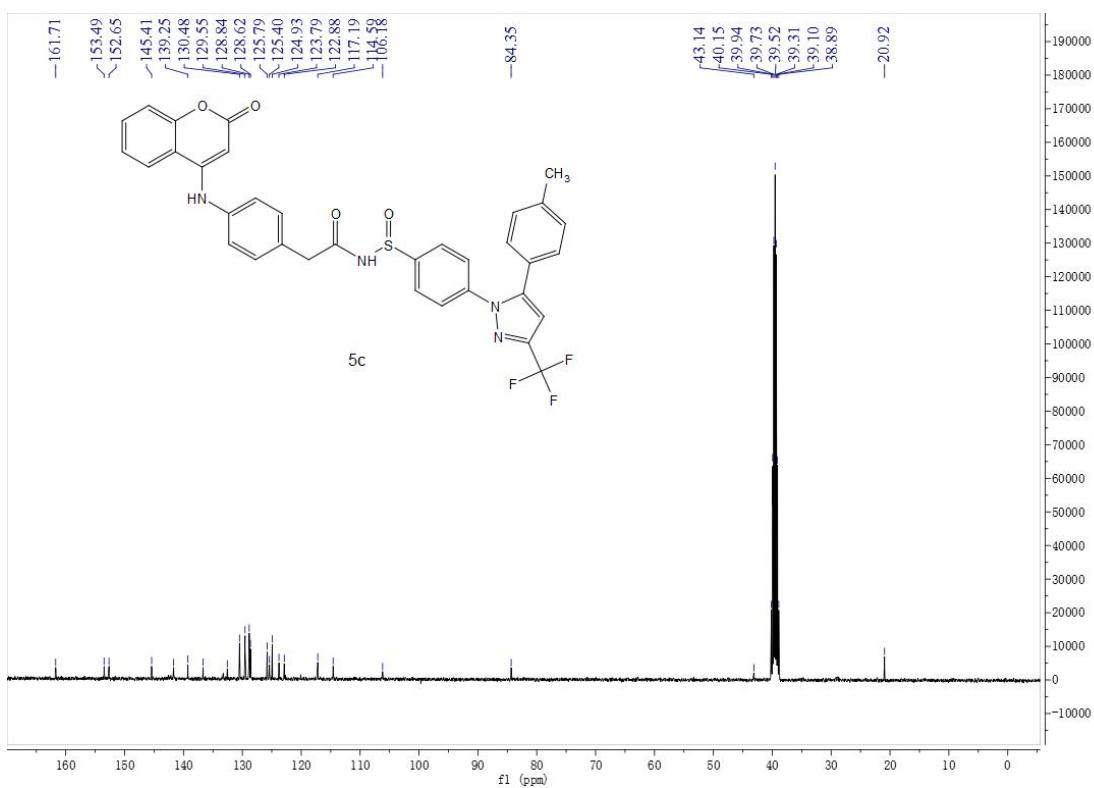
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz, DMSO)



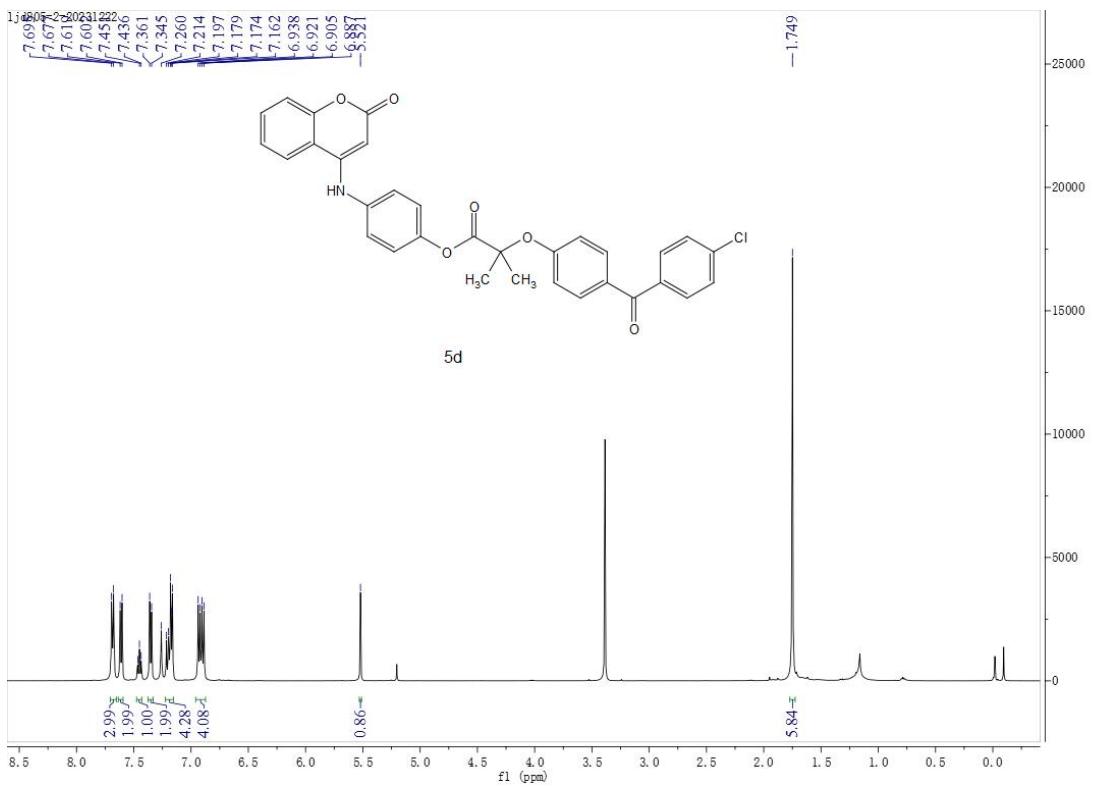
$^1\text{H}$  NMR (400 MHz, DMSO)



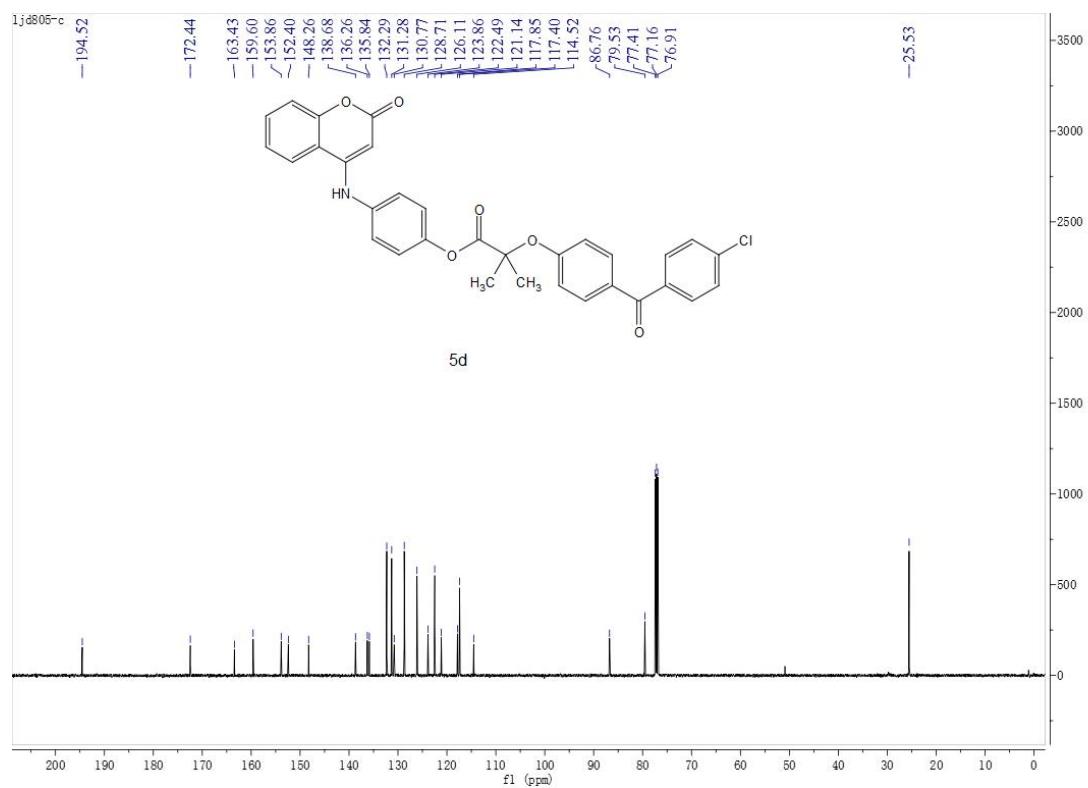
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz, DMSO)



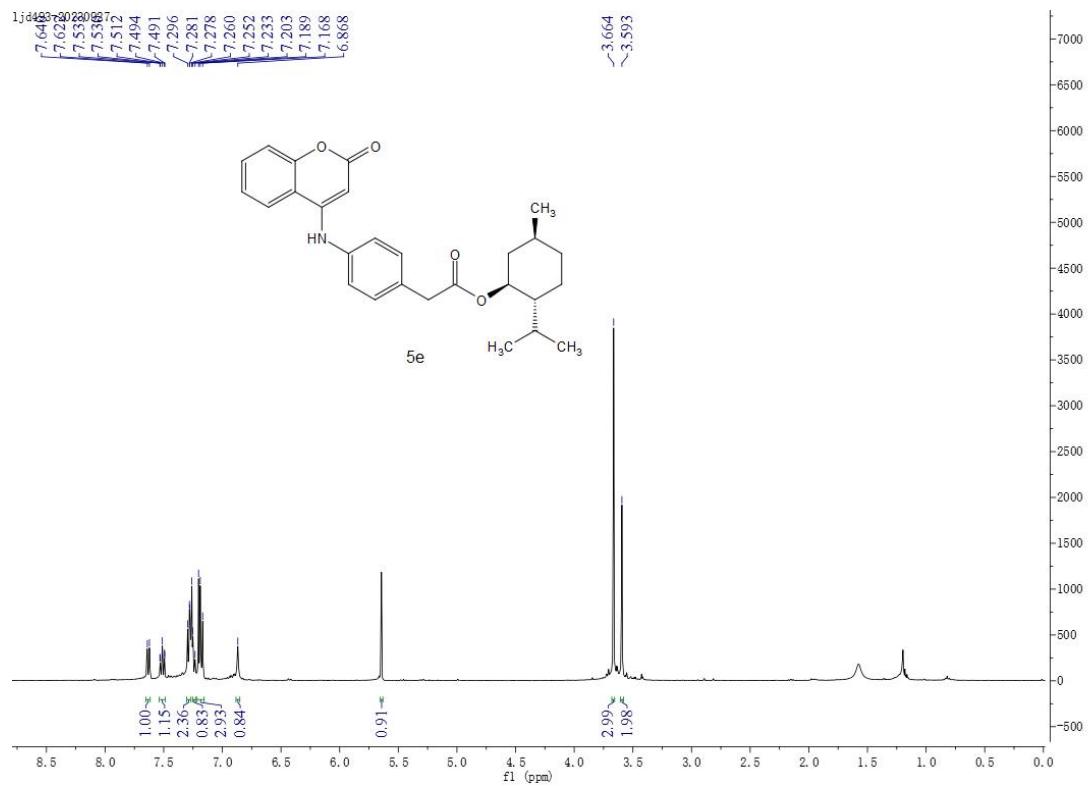
$^1\text{H}$  NMR (500 MHz,  $\text{CDCl}_3$ )



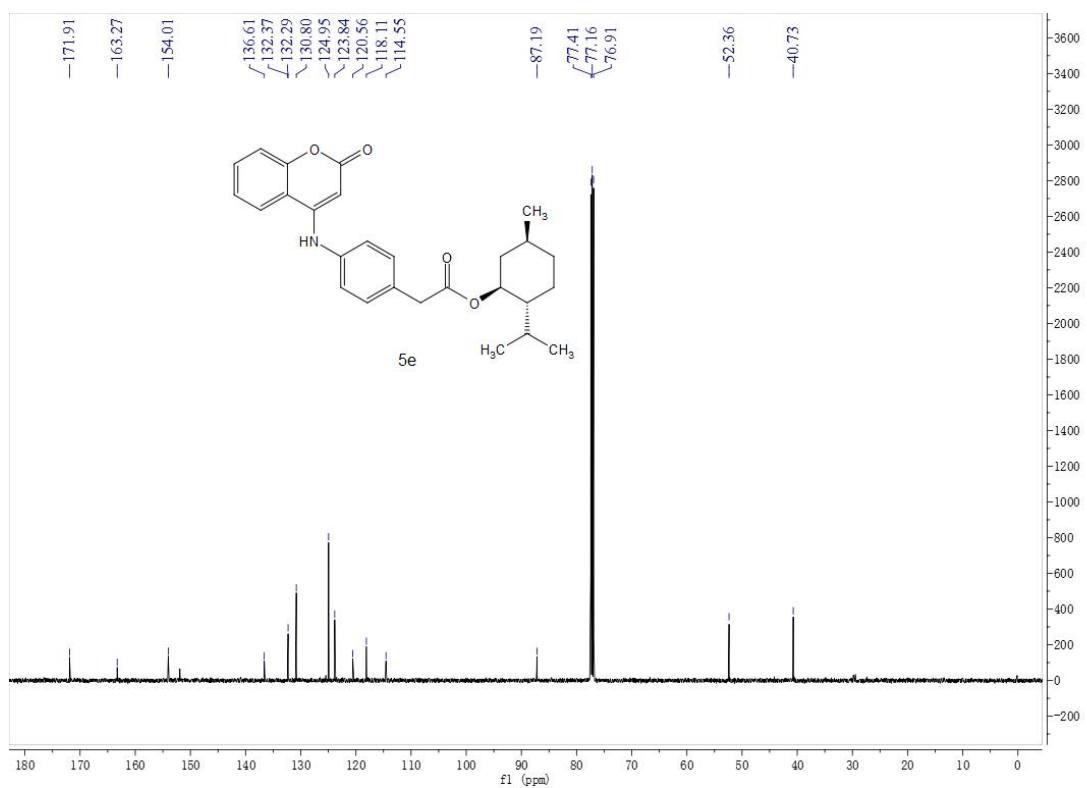
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz,  $\text{CDCl}_3$ )



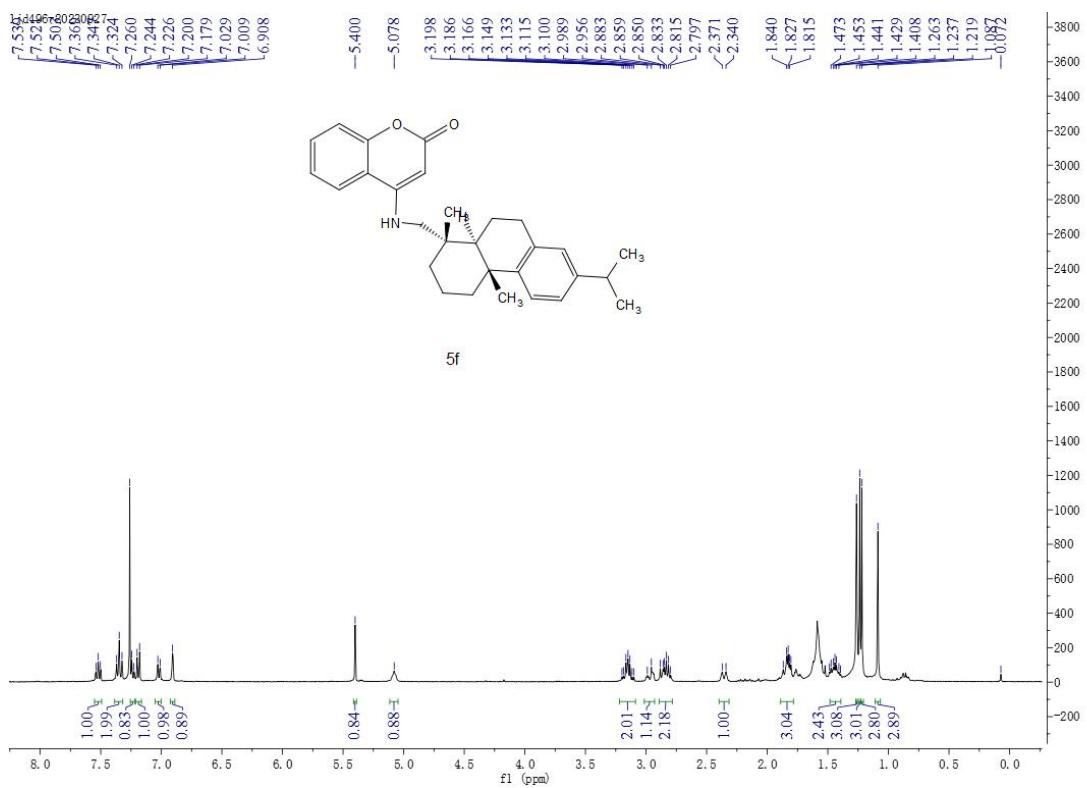
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



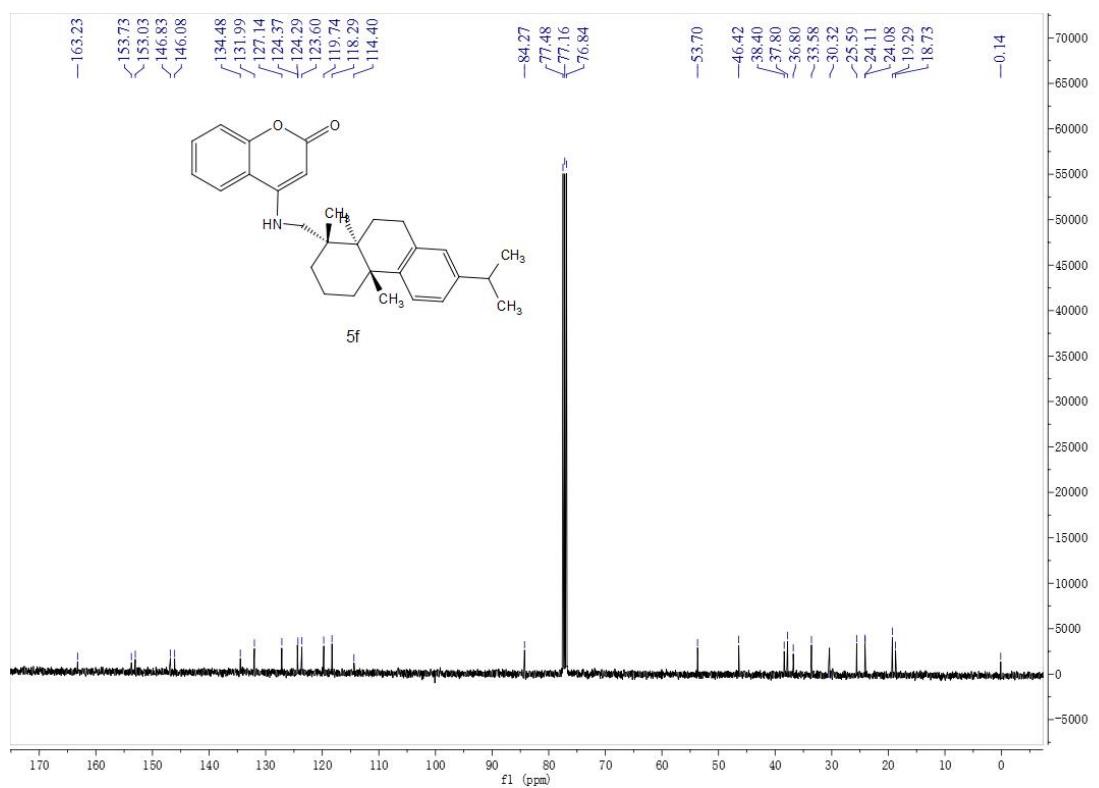
$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz,  $\text{CDCl}_3$ )



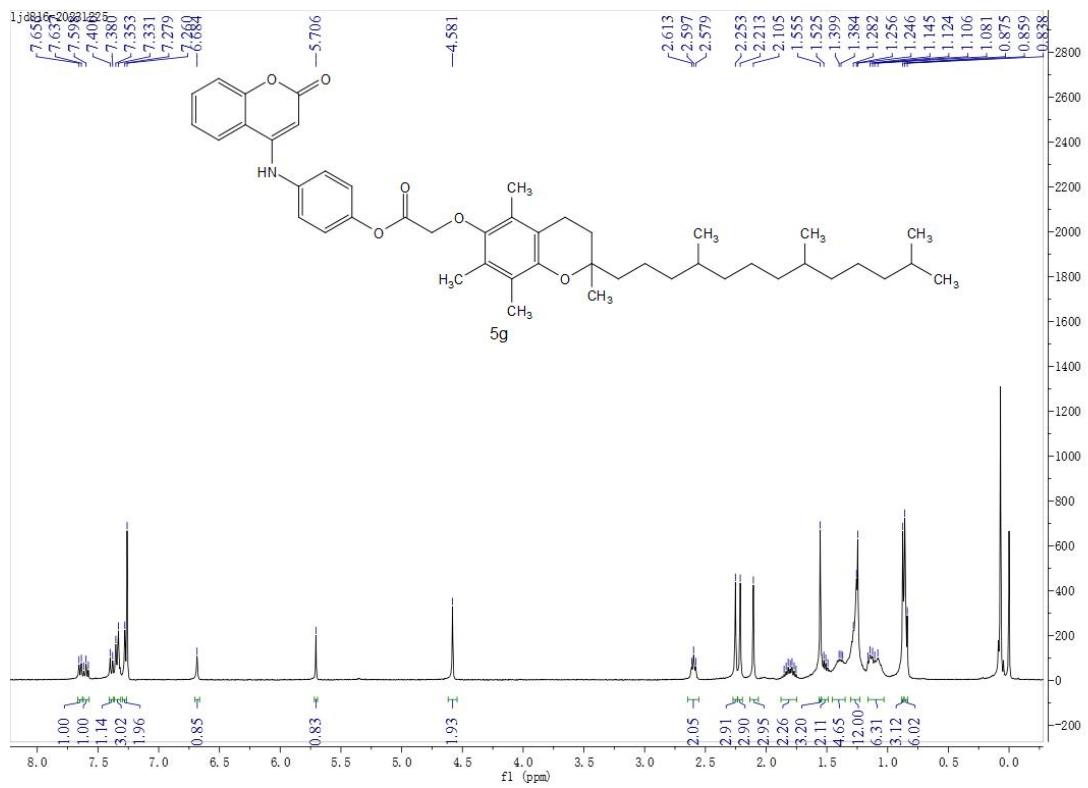
$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



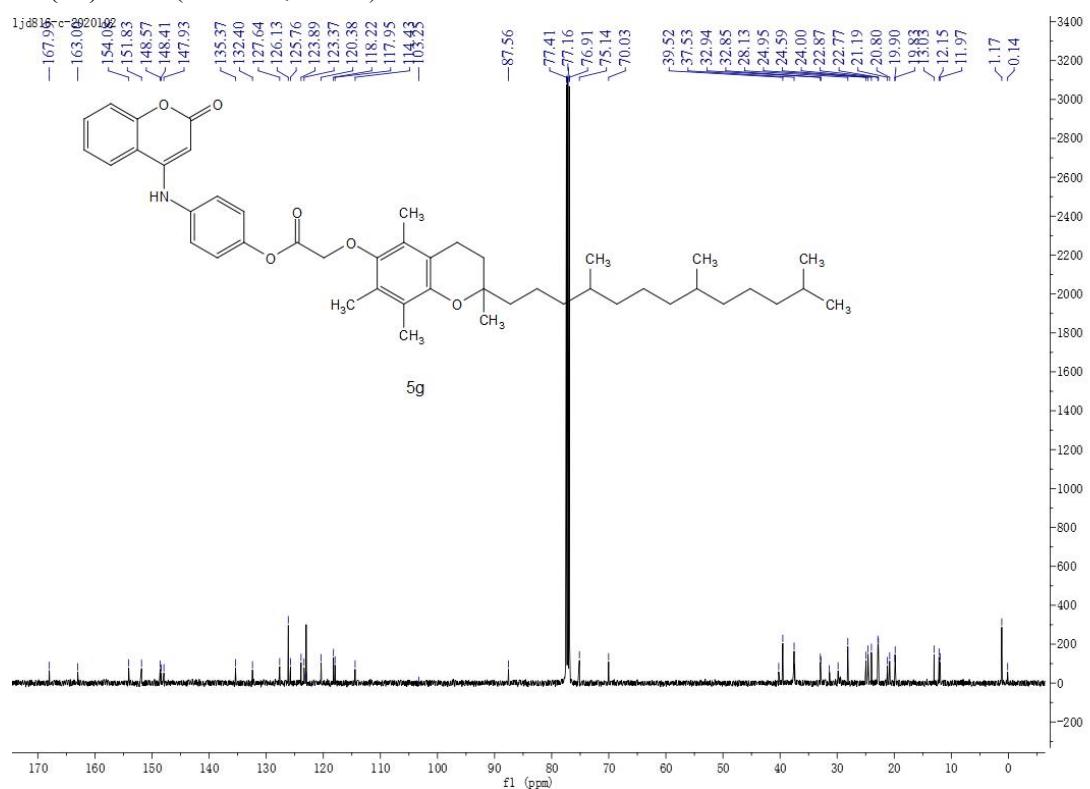
$^{13}\text{C}\{\text{H}\}$  NMR (100 MHz,  $\text{CDCl}_3$ )



$^1\text{H}$  NMR (400 MHz,  $\text{CDCl}_3$ )



$^{13}\text{C}\{\text{H}\}$  NMR (126 MHz,  $\text{CDCl}_3$ )



## **References:**

1. Chu, X.; Tang, Z.; Ma, J.; He, L.; Feng, L.; Ma, C. Synthesis of furo [3,2-c] coumarins via I<sub>2</sub>/TBHP-mediated reaction of 4-hydroxycoumarins with terminal alkynes. *Org. Lett.* **2018**, *74*, 970-974.
2. (a) Blanco-Acuna, E.; Vazquez-Lopez, L.; Garcia-Ortega, L. AIEgens-NLOphores coumarin-triphenylamine chalcone derivatives: Synthesis, photophysical properties and DFT computational study. *J. Mol. Struct.* **2023**, *1271*, 134009. (b) Heimark, L.; Toon, S.; Low, L.; Swinney, D.; Trager, W. The synthesis of deuterium labelled metabolites of warfarin and phenprocoumon. *Journal of Labelled Compounds and Radiopharmaceuticals.* **1986**, *23*, 137-148.
3. Li, W.; Liu, J.; Zhou, M.; Ma, L.; Zhang, M. Visible light-enabled regioselective chlorination of coumarins using CuCl<sub>2</sub> via LMCT excitation. *Org. Biomol. Chem.* **2022**, *20*, 6667-6672.
4. Arnaud, C.; Pierre-Yves, R.; Anthony, R. Straightforward access to water-soluble unsymmetrical sulfoxanthene dyes: application to the preparation of far-red fluorescent dyes with large stokes' shifts. *Chem. Eur. J.* **2014**, *20*, 8330-8337.