

## Supporting Information

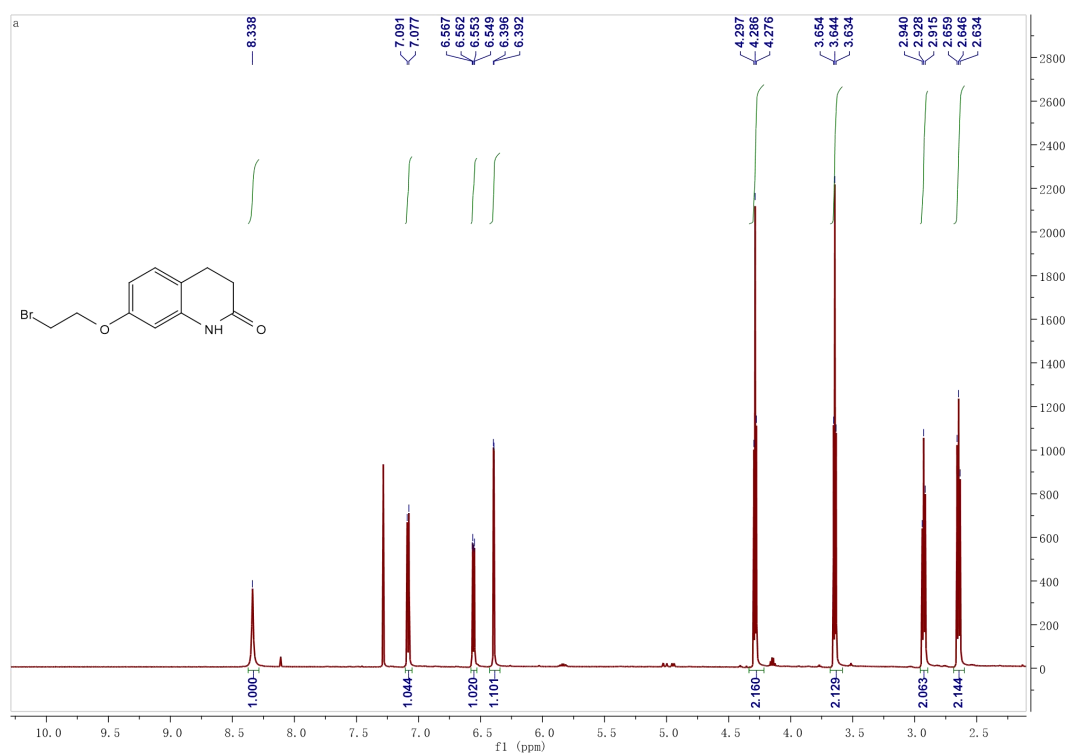
**Design, synthesis and biological evaluation of new 3,4-dihydro-2(1*H*)-quinolinone-dithiocarbamate derivatives as multifunctional agents for the treatment of Alzheimer's disease**

Jie Guo\*, Airen Xu\*, Maojun Cheng, Yang Wan, Rikang Wang, Yuanying Fang, Yi Jin, Sai-Sai Xie, Jing Liu

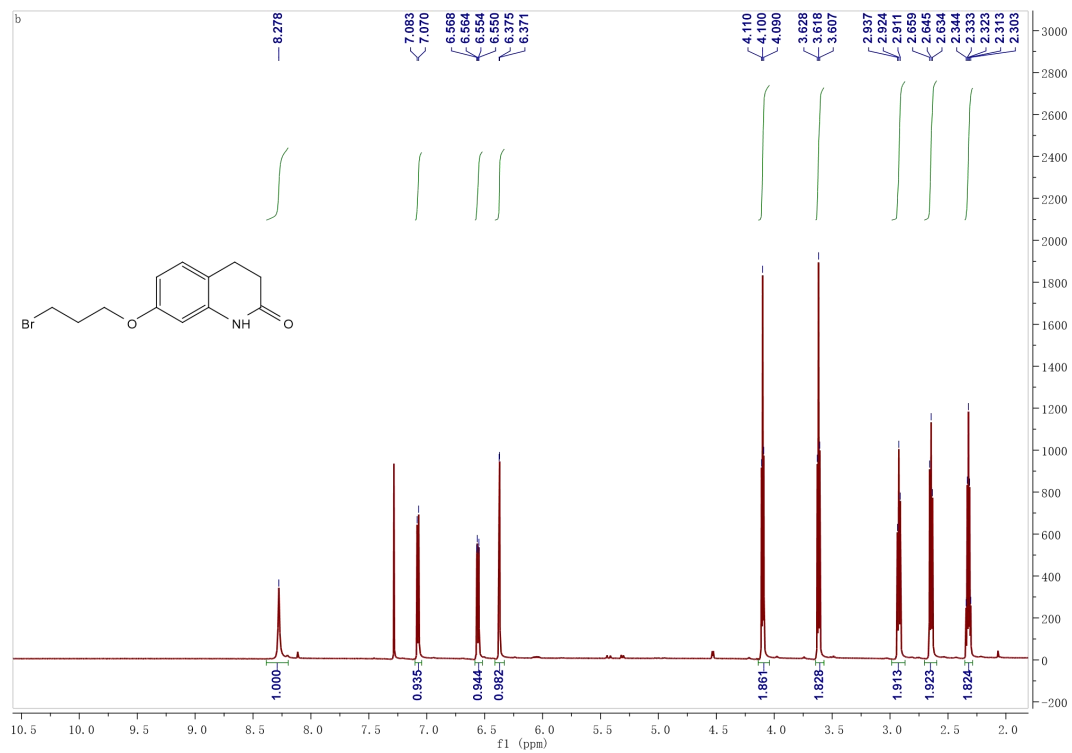
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3. The error analysis of the HRMS results
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# 1. The <sup>1</sup>H NMR charts of intermediates 2a-i



**Figure S1** <sup>1</sup>H NMR chart of compound **2a** in CDCl<sub>3</sub>.



**Figure S2** <sup>1</sup>H NMR chart of compound **2b** in CDCl<sub>3</sub>.

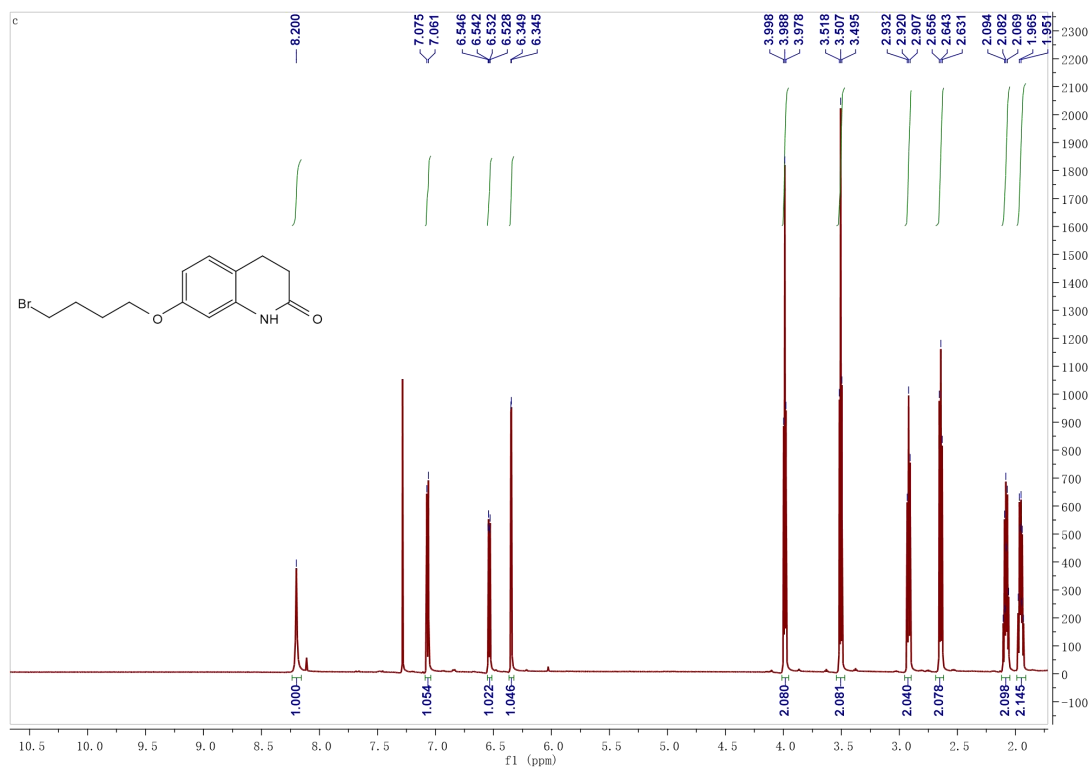


Figure S3  $^1\text{H}$  NMR chart of compound 2c in  $\text{CDCl}_3$ .

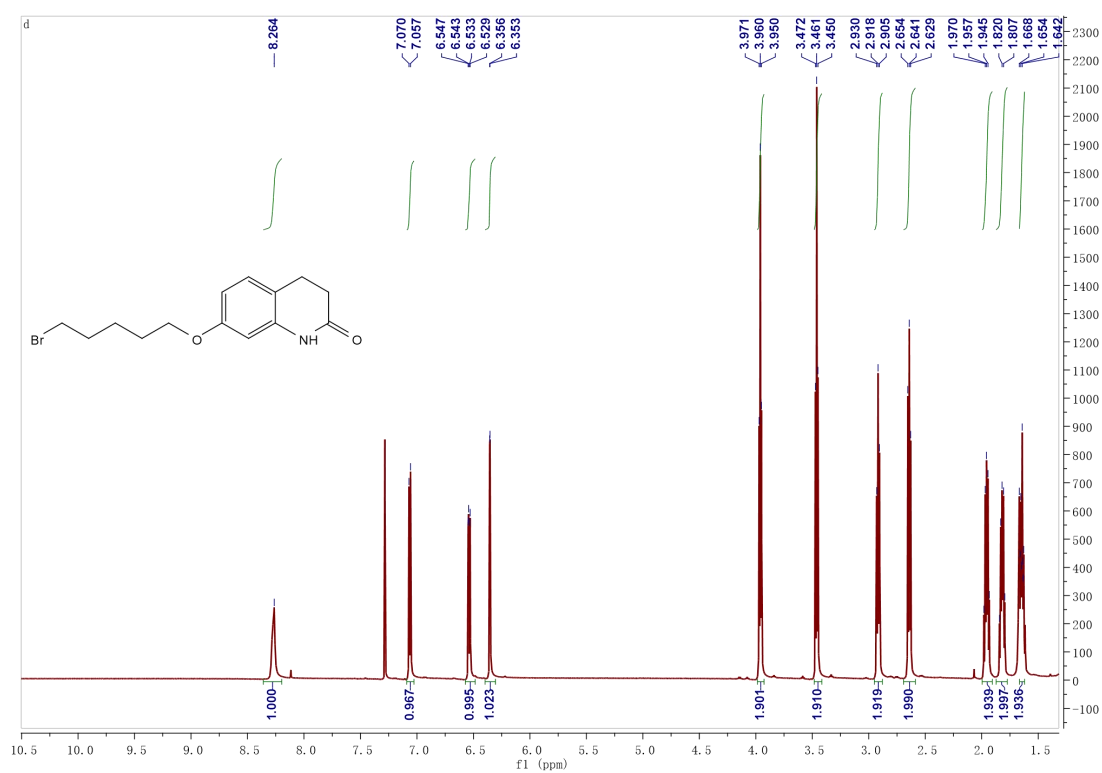


Figure S4  $^1\text{H}$  NMR chart of compound 2d in  $\text{CDCl}_3$ .



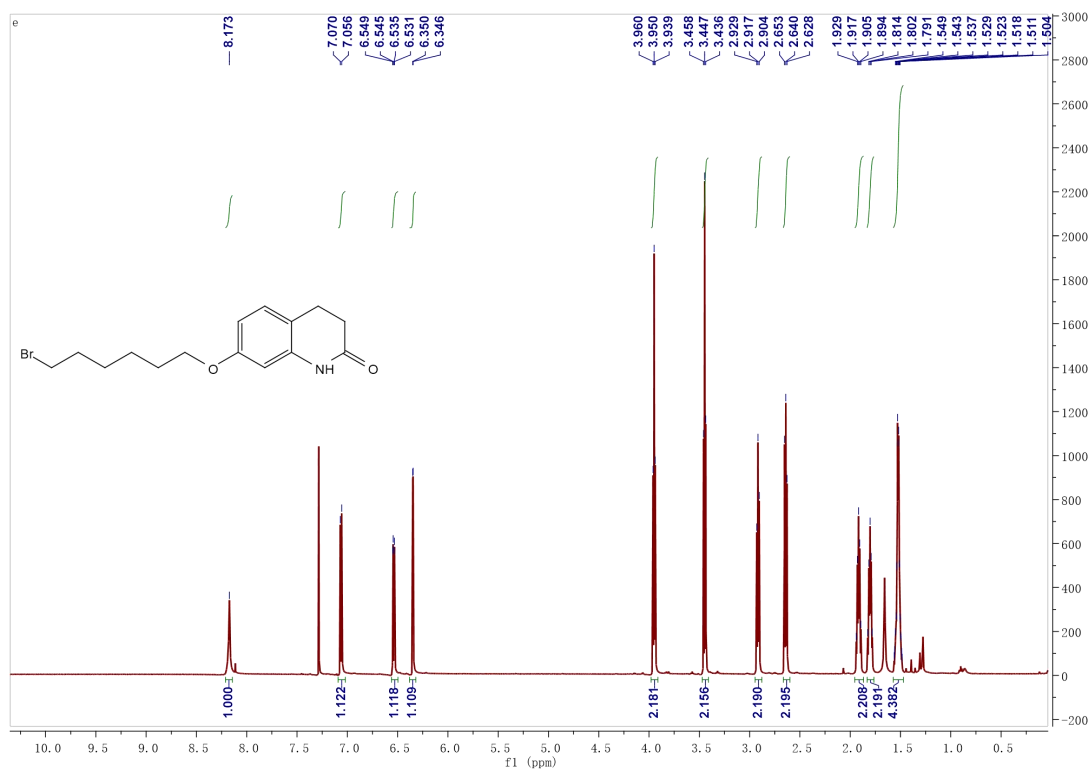


Figure S5 <sup>1</sup>H NMR chart of compound **2e** in CDCl<sub>3</sub>.

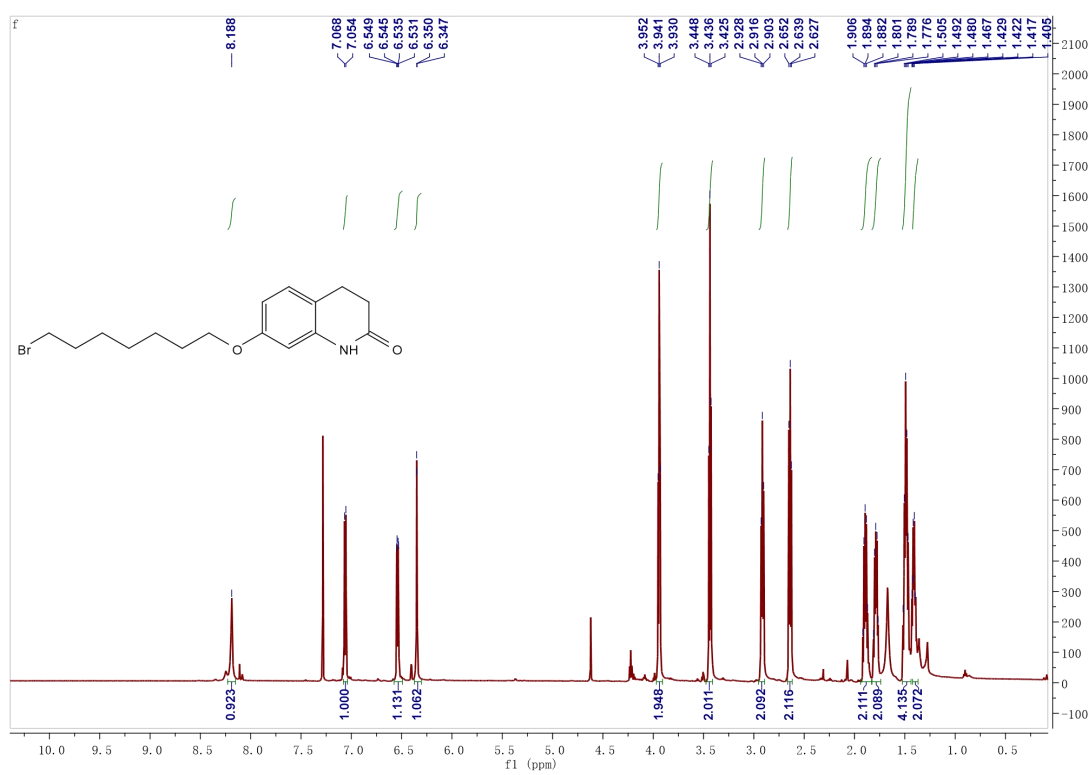


Figure S6 <sup>1</sup>H NMR chart of compound **2f** in CDCl<sub>3</sub>.

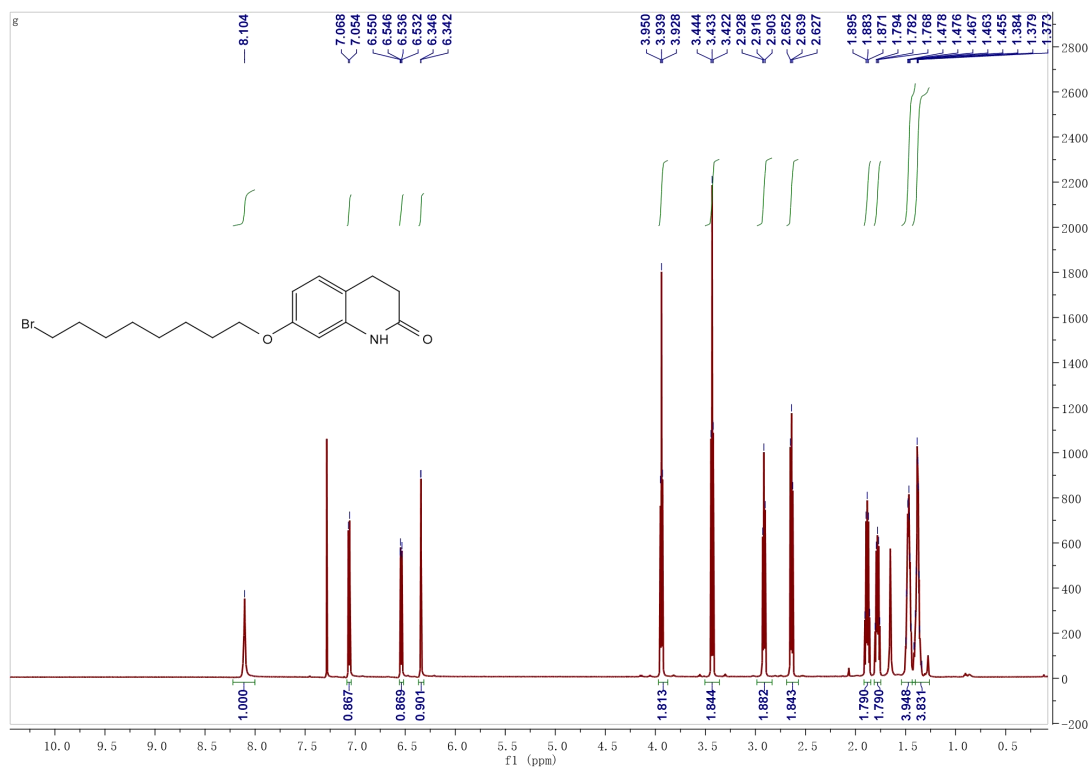


Figure S7  $^1\text{H}$  NMR chart of compound 2g in  $\text{CDCl}_3$ .

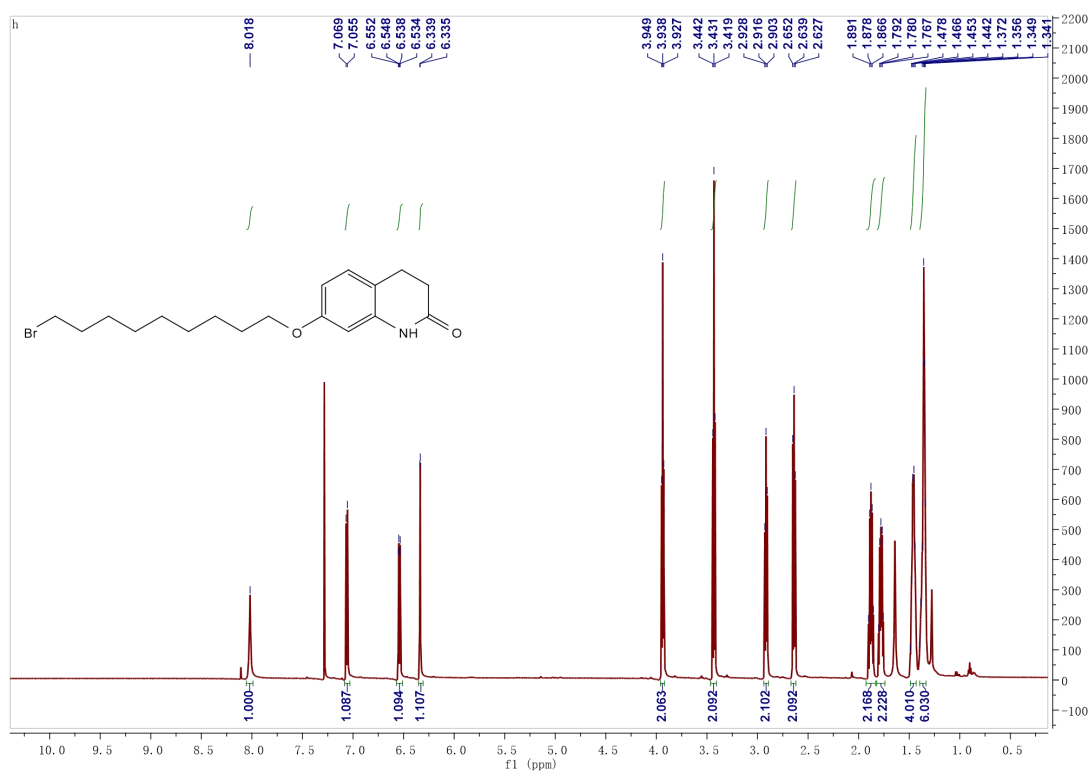


Figure S8  $^1\text{H}$  NMR chart of compound 2h in  $\text{CDCl}_3$ .

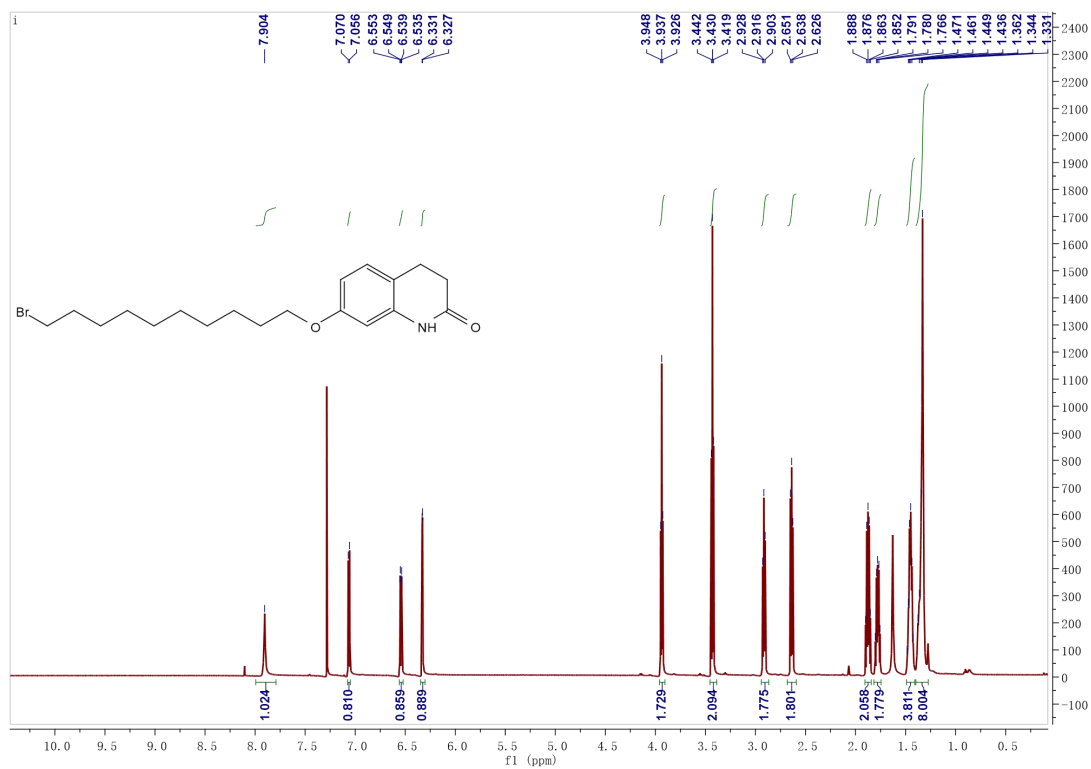


Figure S9  $^1\text{H}$  NMR chart of compound **2i** in  $\text{CDCl}_3$ .

2. The  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR, HRMS and HPLC charts of the target compounds and 3a-i, 3e<sub>1</sub>-e<sub>11</sub>

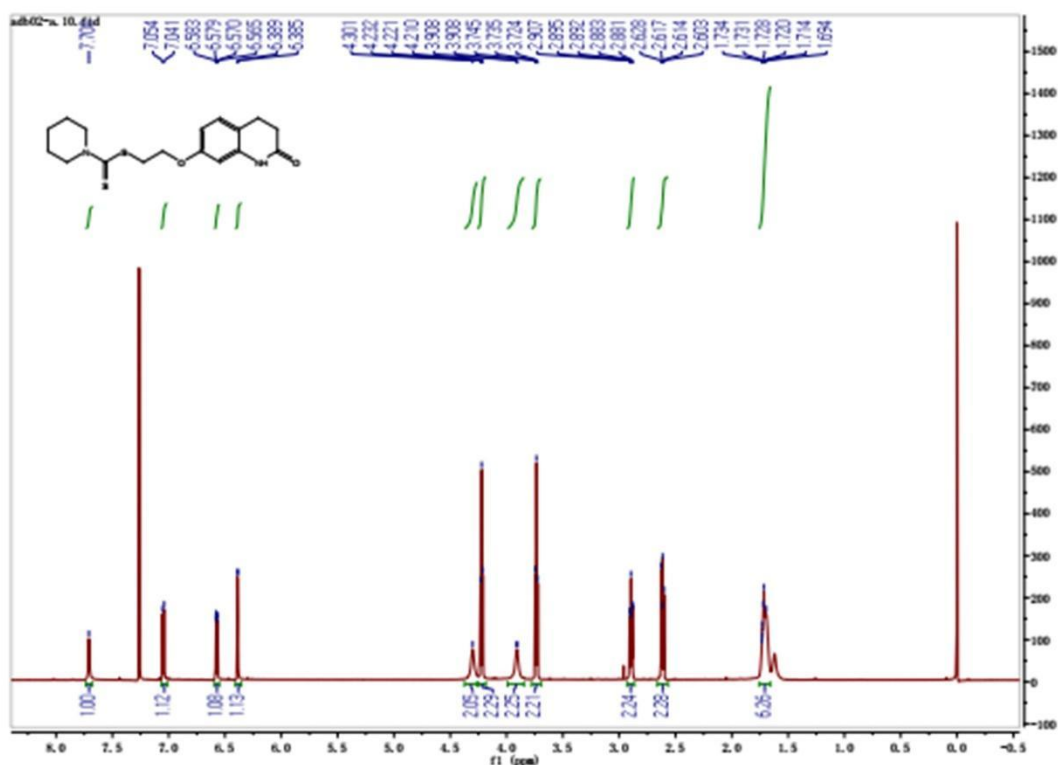


Figure S10  $^1\text{H}$  NMR chart of compound 3a in  $\text{CDCl}_3$ .

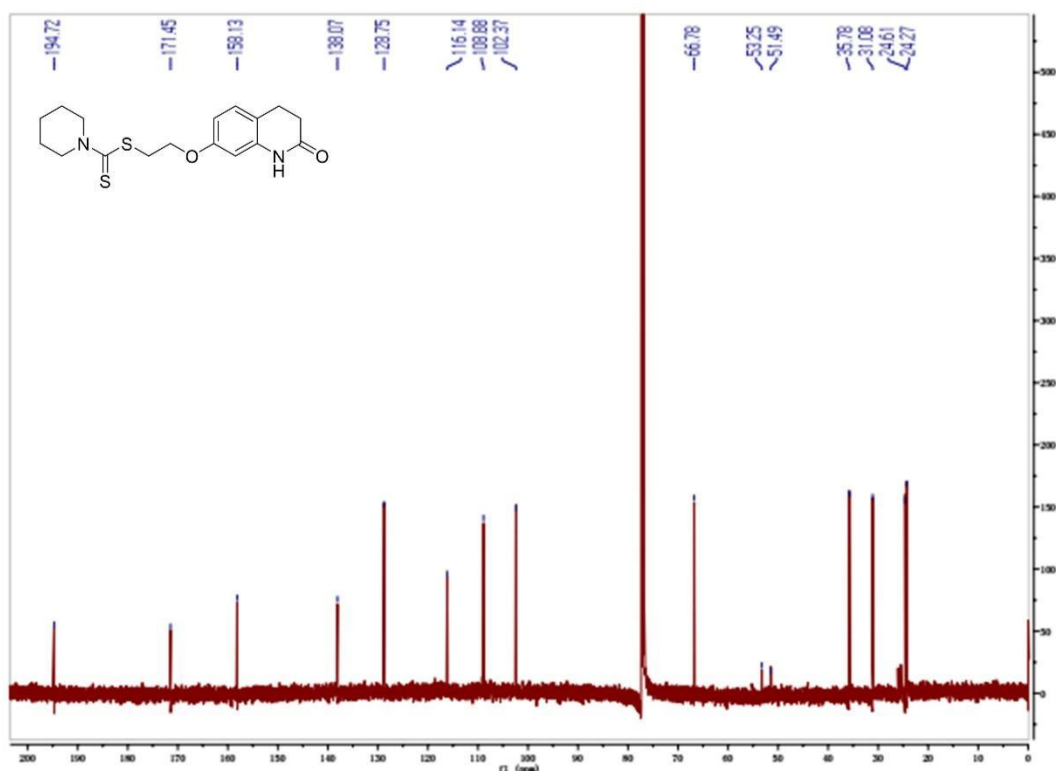
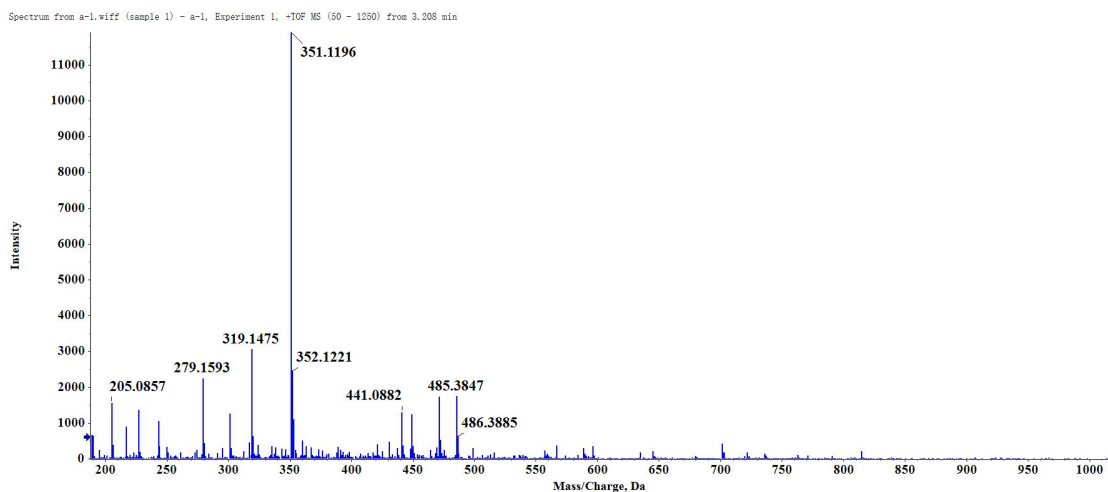
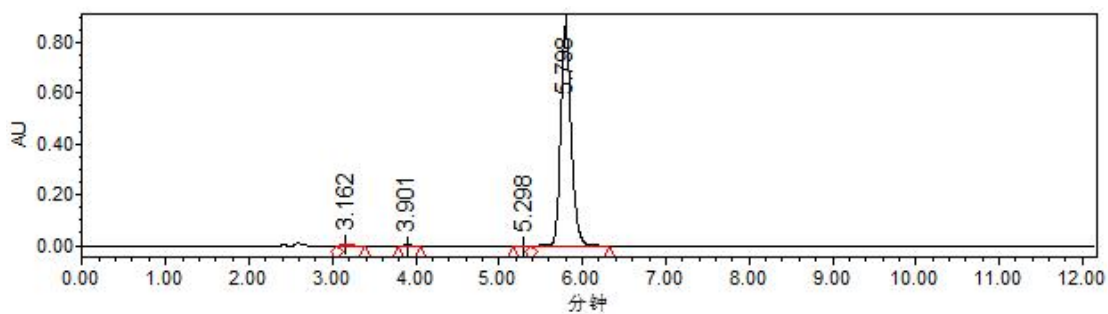


Figure S11  $^{13}\text{C}$  NMR chart of compound 3a in  $\text{CDCl}_3$ .



**Figure S12** HRMS (ESI) spectrum of compound **3a**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		3.162	37757	0.5	6928
2		3.901	7797	0.1	1372
3		5.298	2807	0.04	409
4		5.798	7544851	99.36	867131

**Figure S13** Chromatographic report of HPLC analysis of compound **3a**.

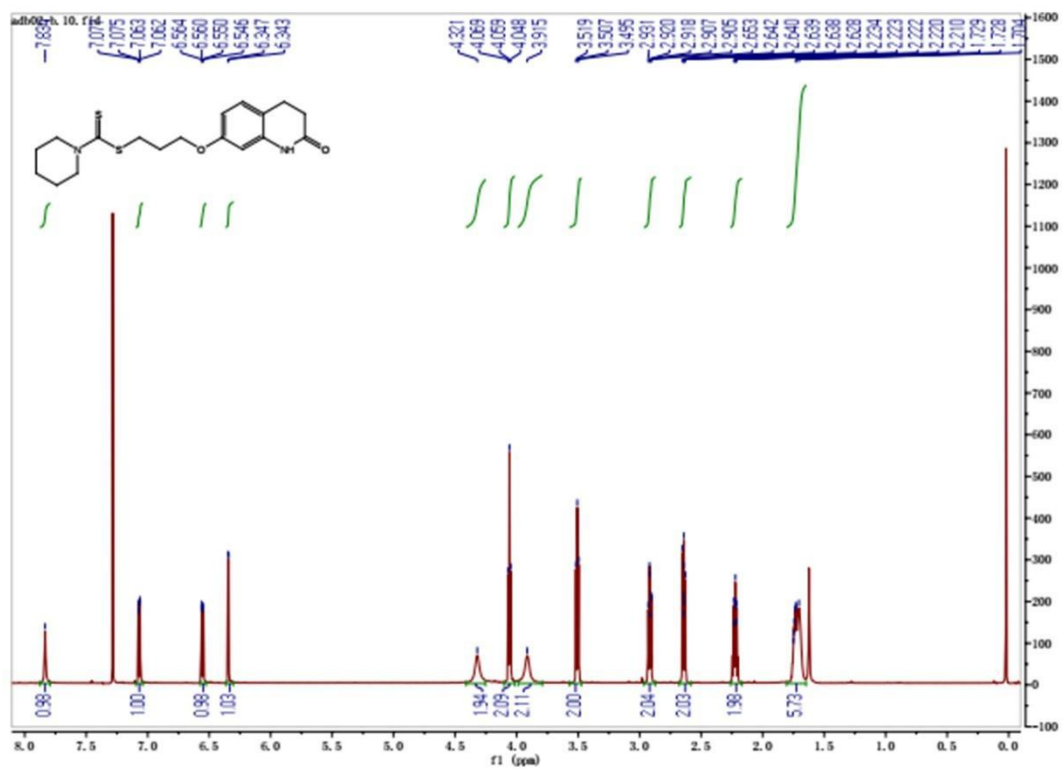


Figure S14 <sup>1</sup>H NMR chart of compound **3b** in CDCl<sub>3</sub>.

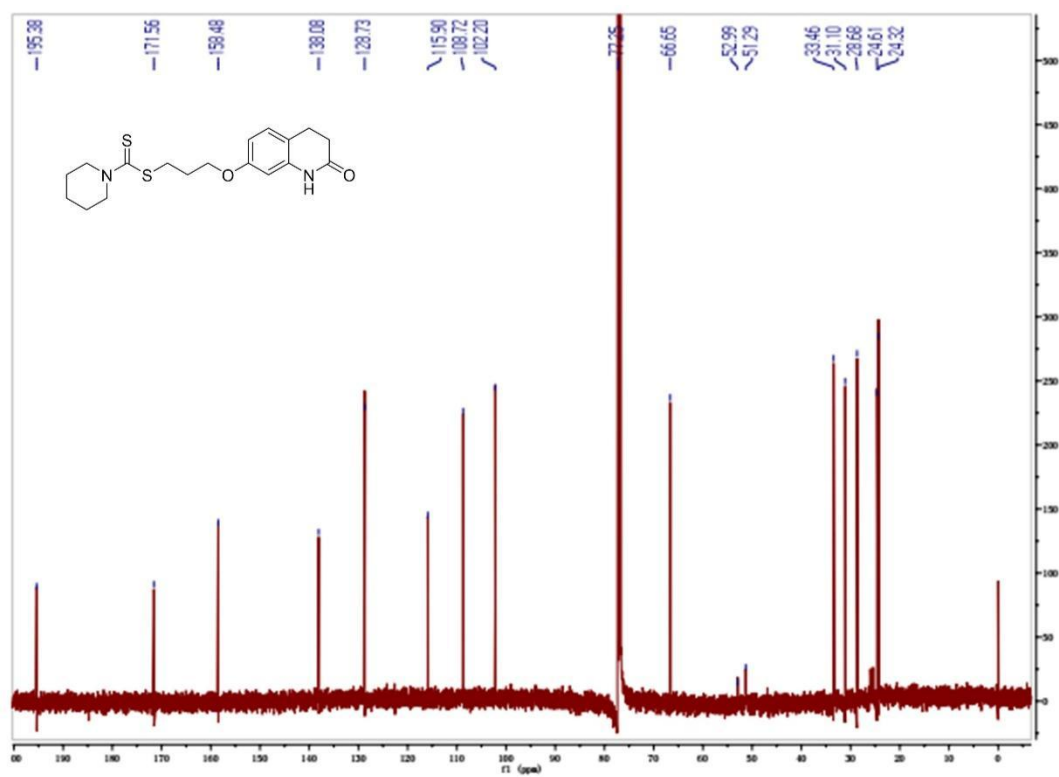
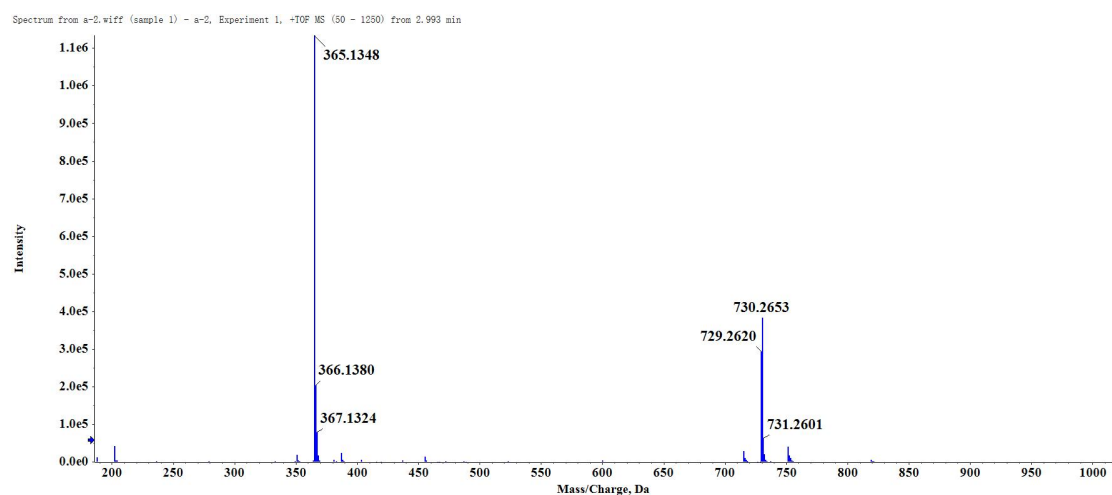
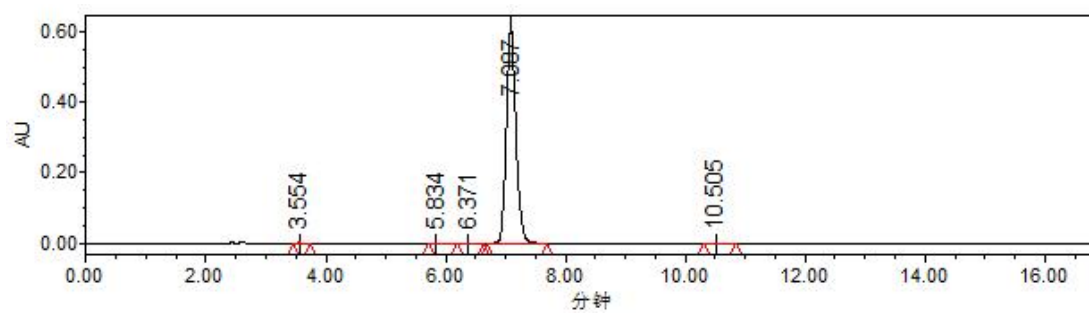


Figure S15 <sup>13</sup>C NMR chart of compound **3b** in CDCl<sub>3</sub>.



**Figure S16** HRMS (ESI) spectrum of compound **3b**.



Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1	3.554	5130	0.08	879
2	5.834	5307	0.08	458
3	6.371	3536	0.05	328
4	7.087	6803993	99.69	614030
5	10.505	6885	0.10	485

**Figure S17** Chromatographic report of HPLC analysis of compound **3b**.

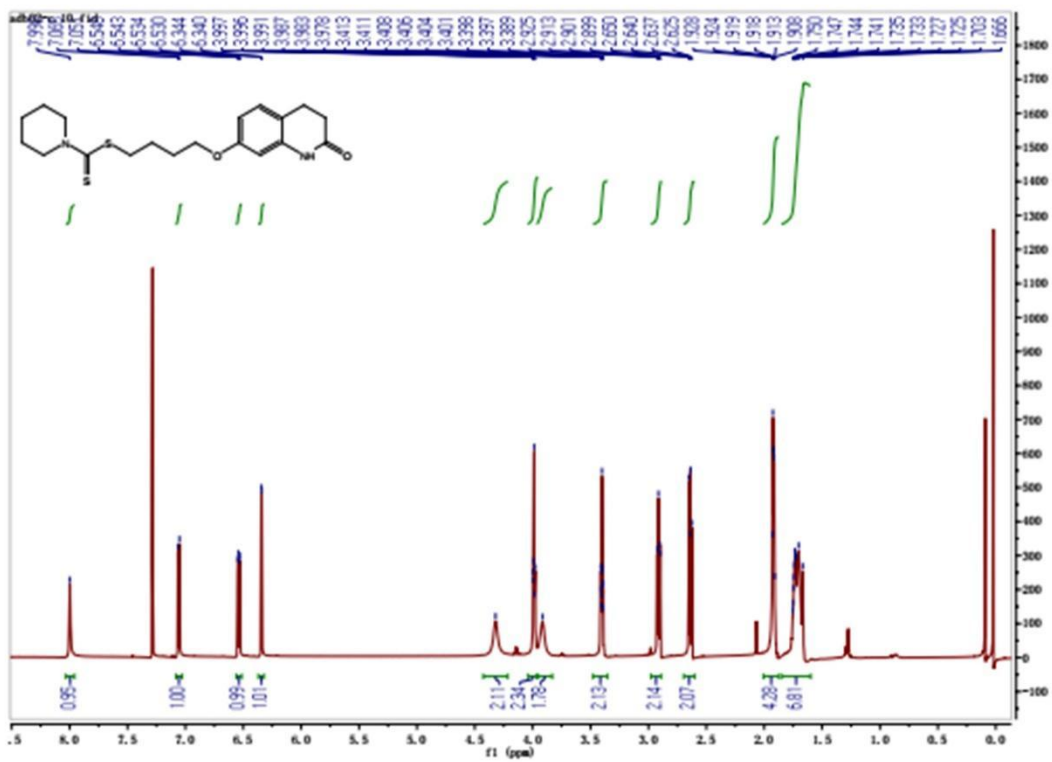


Figure S18  $^1\text{H}$  NMR chart of compound **3c** in  $\text{CDCl}_3$ .

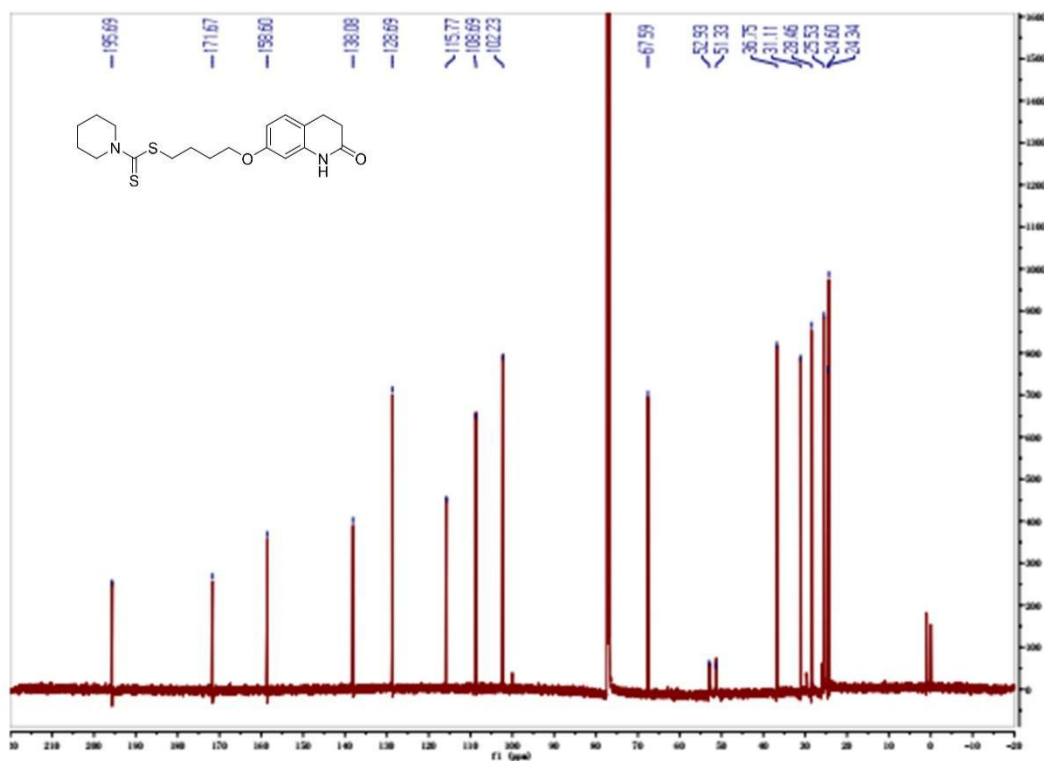
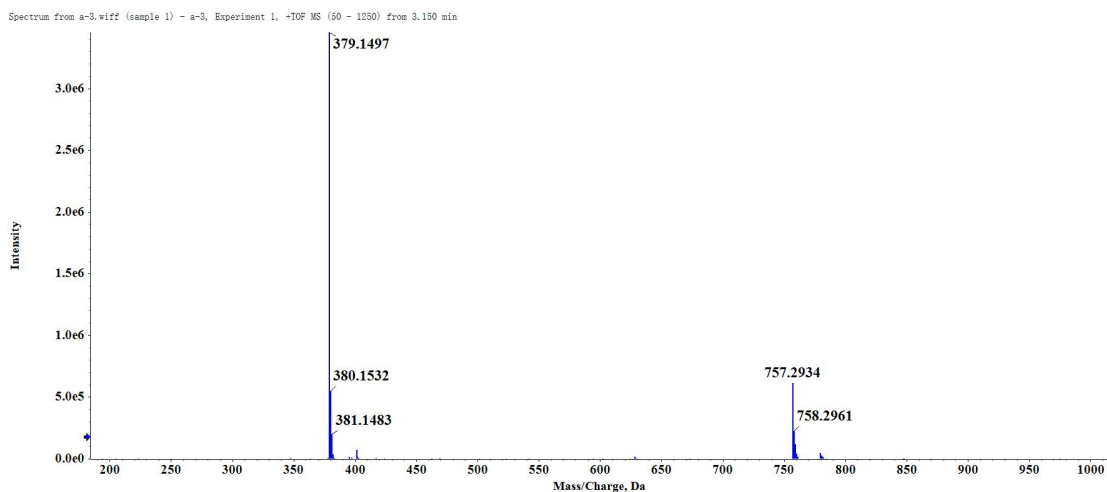
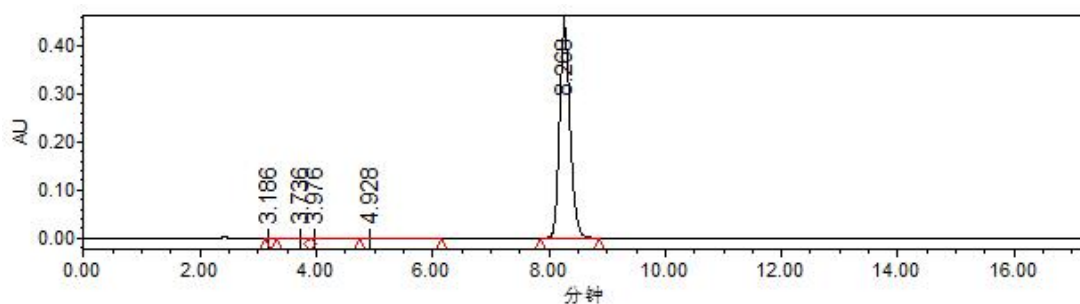


Figure S19  $^{13}\text{C}$  NMR chart of compound **3c** in  $\text{CDCl}_3$ .





**Figure S20** HRMS (ESI) spectrum of compound **3c**.



**Figure S21** Chromatographic report of HPLC analysis of compound **3c**.

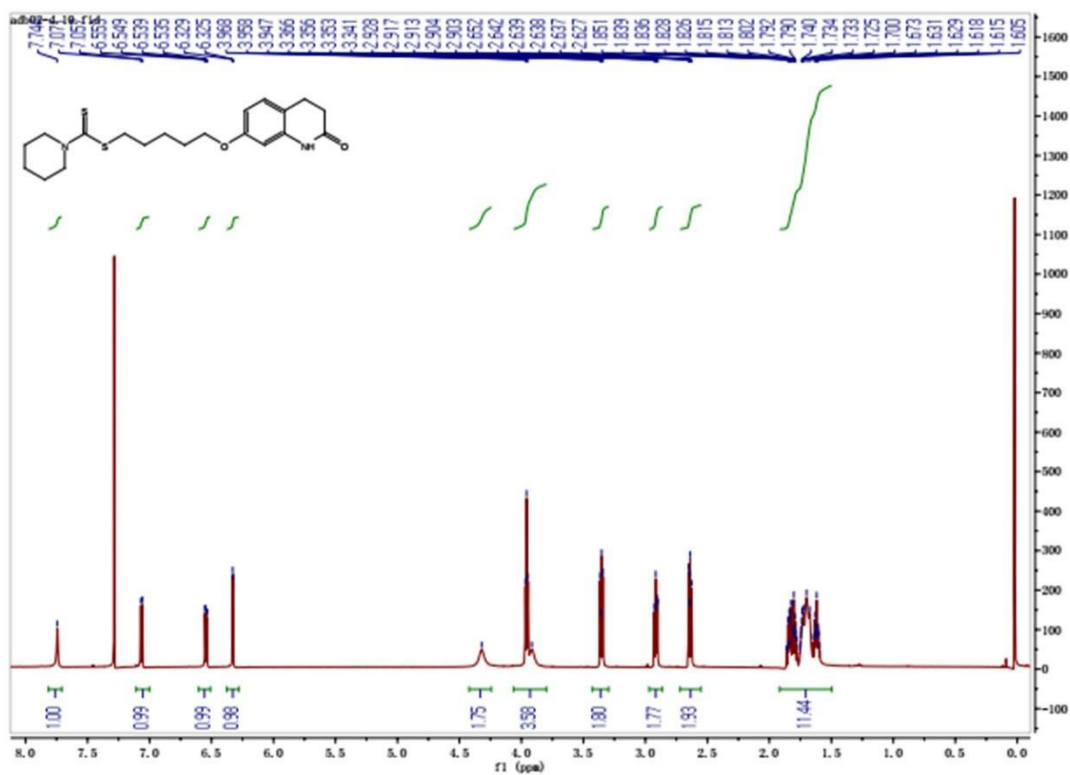


Figure S22  $^1\text{H}$  NMR chart of compound 3d in  $\text{CDCl}_3$ .

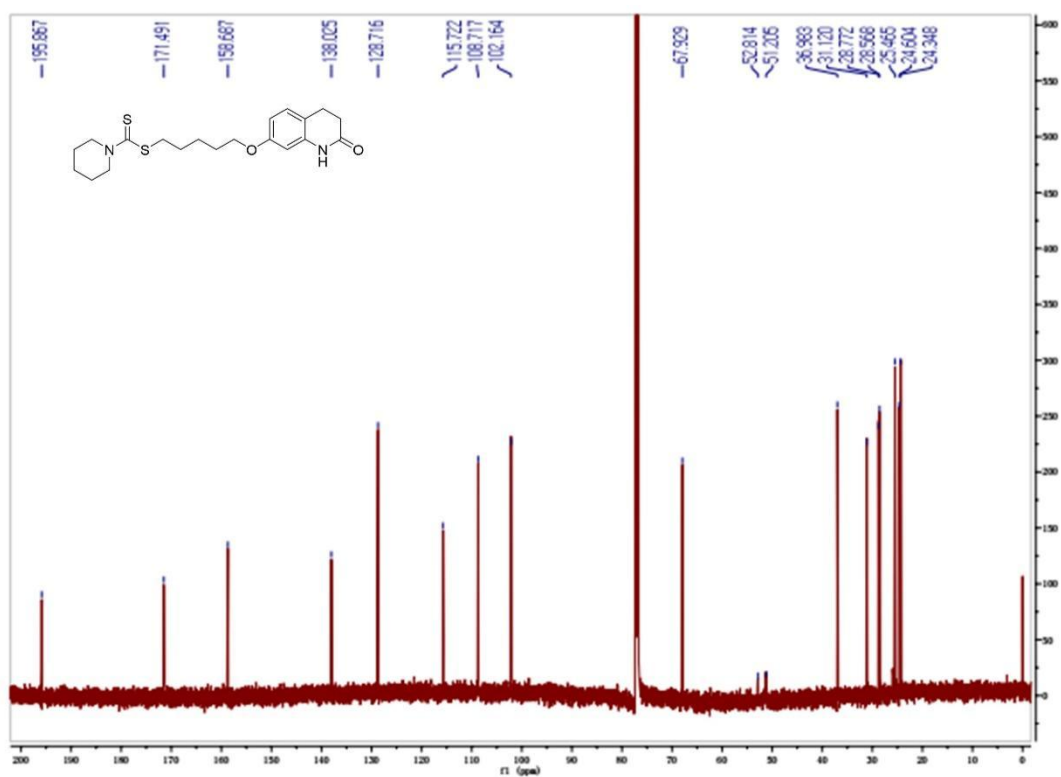
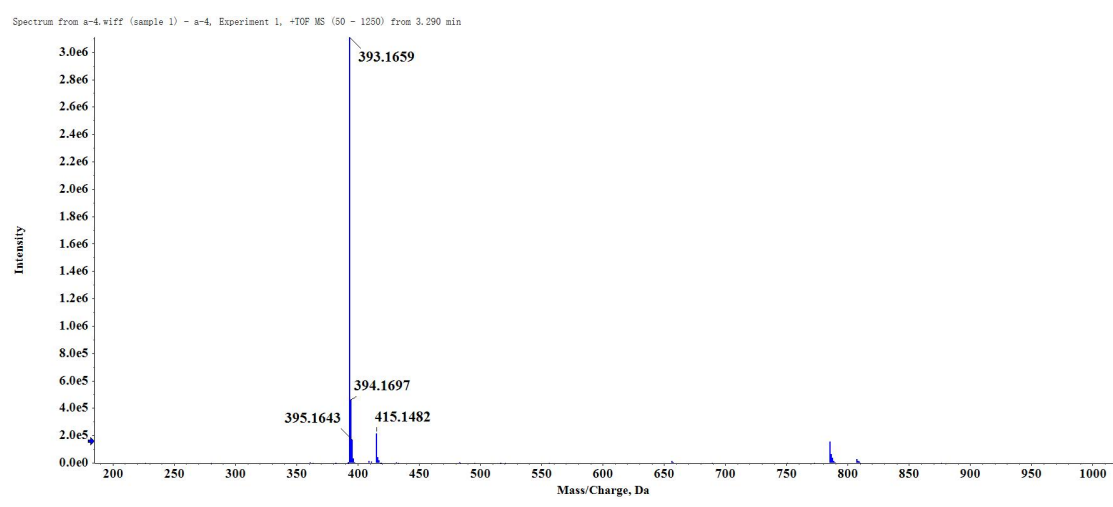
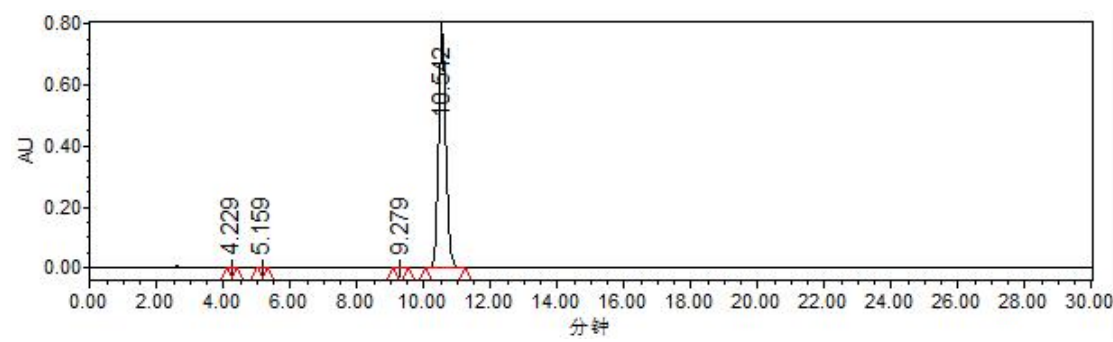


Figure S23  $^{13}\text{C}$  NMR chart of compound 3d in  $\text{CDCl}_3$ .



**Figure S24** HRMS (ESI) spectrum of compound **3d**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		4.229	5024	0.04	768
2		5.159	4003	0.03	442
3		9.279	10628	0.09	858
4		10.542	11851553	99.83	767427

**Figure S25** Chromatographic report of HPLC analysis of compound **3d**.

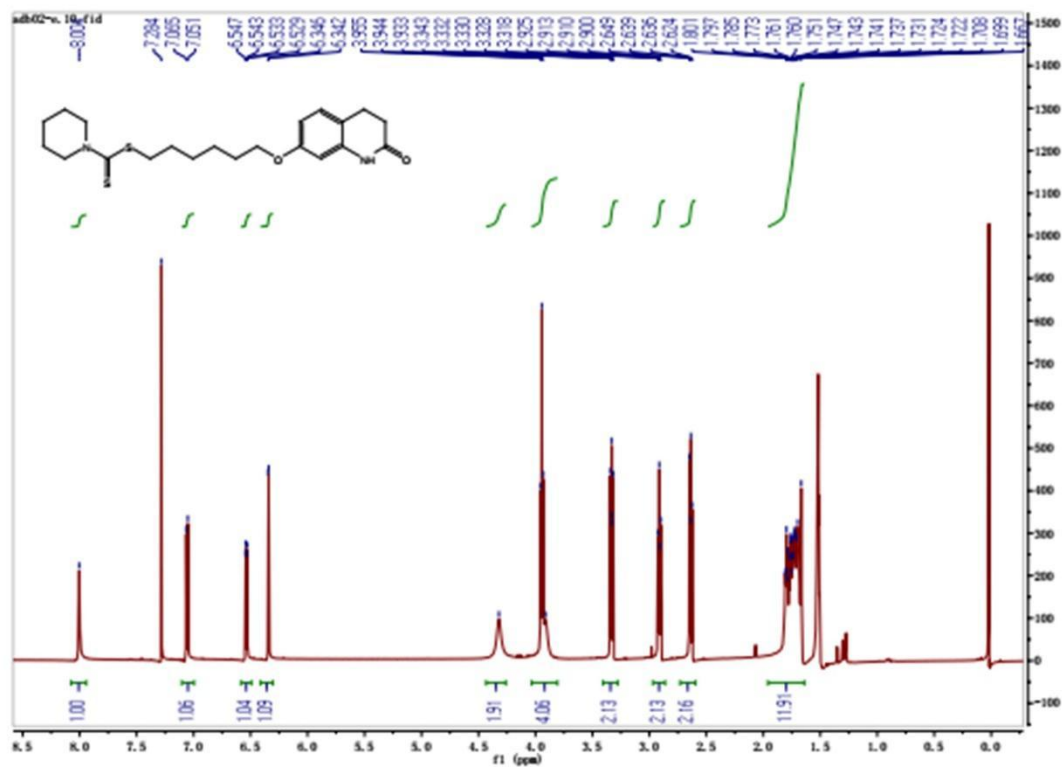


Figure S26 <sup>1</sup>H NMR chart of compound 3e in CDCl<sub>3</sub>.

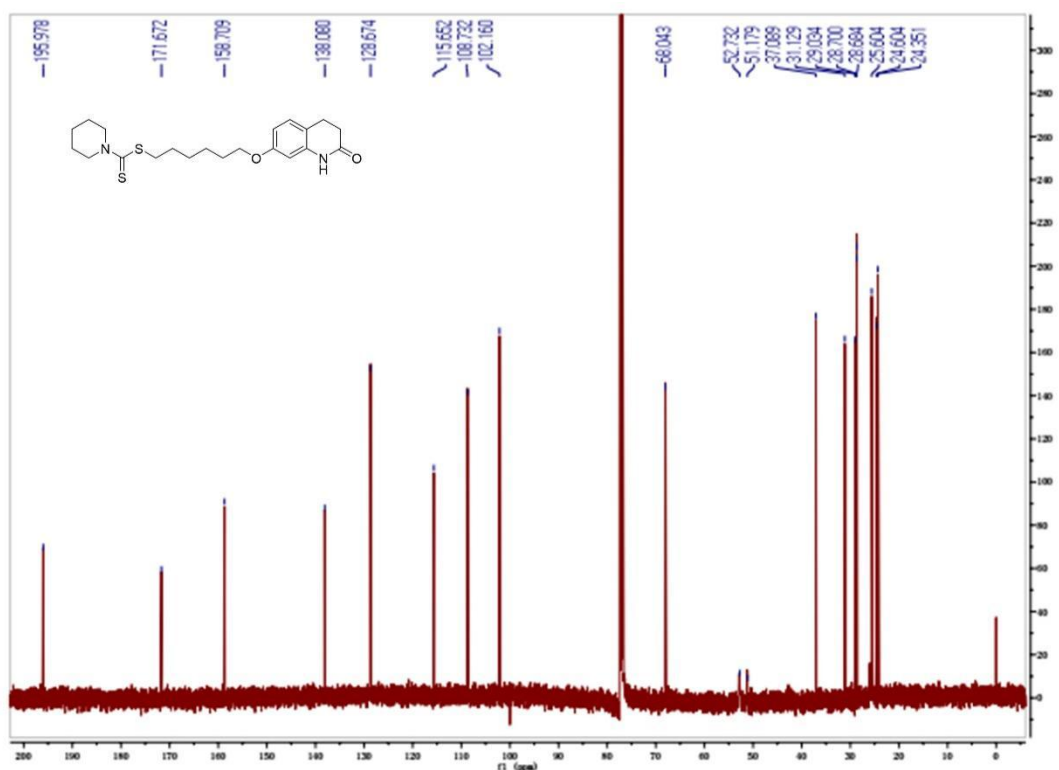
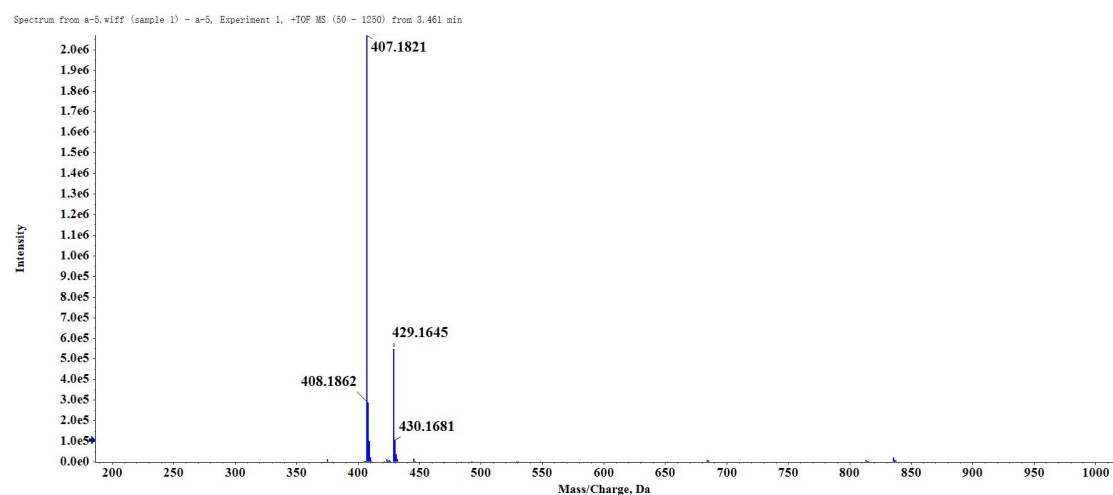
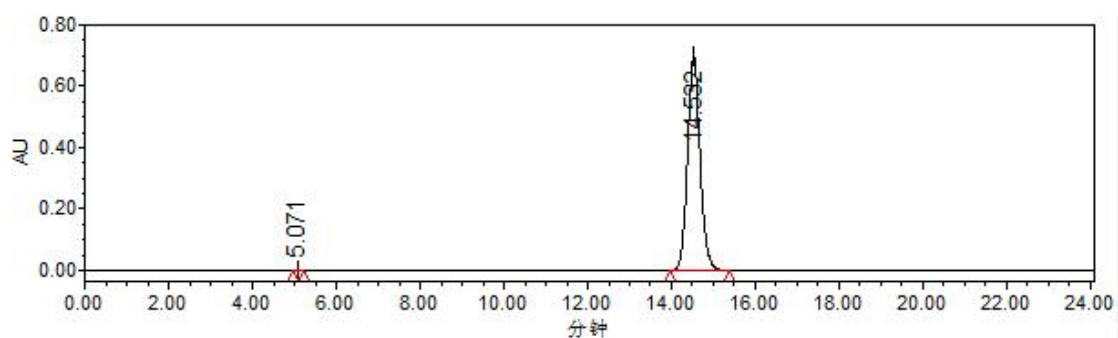


Figure S27 <sup>13</sup>C NMR chart of compound 3e in CDCl<sub>3</sub>.



**Figure S28** HRMS (ESI) spectrum of compound **3e**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		5.071	2895	0.02	389
2		14.532	14510125	99.98	695616

**Figure S29** Chromatographic report of HPLC analysis of compound **3e**.

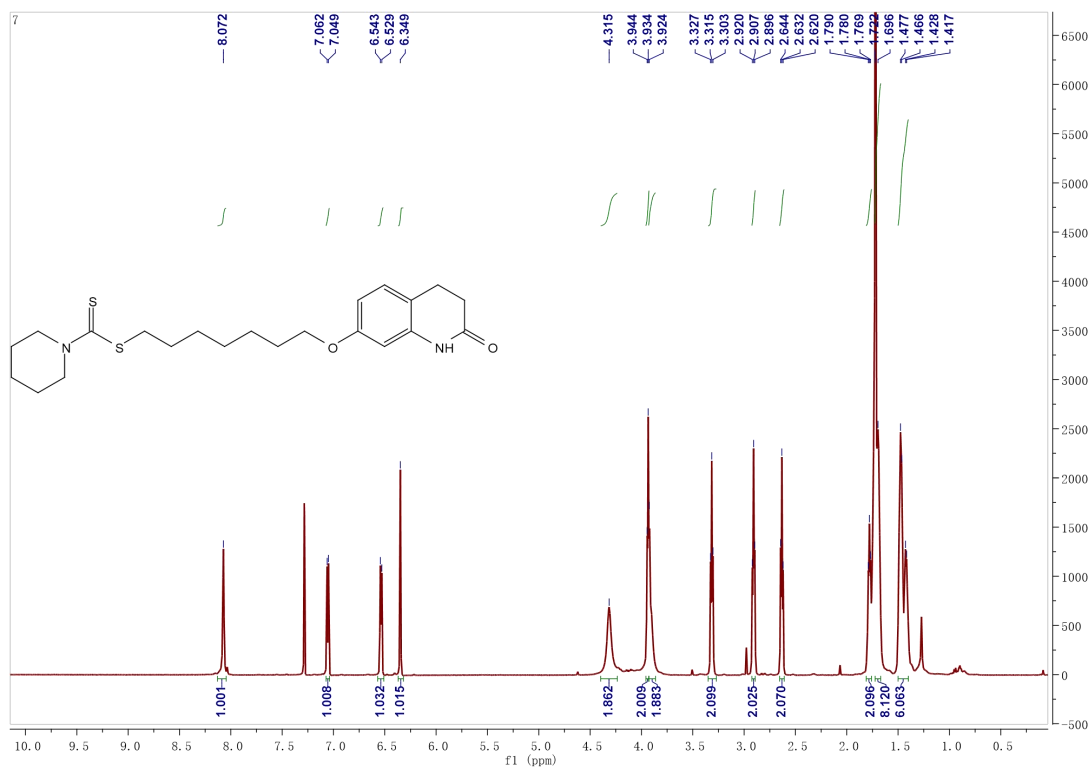


Figure S30  $^1\text{H}$  NMR chart of compound **3f** in  $\text{CDCl}_3$ .

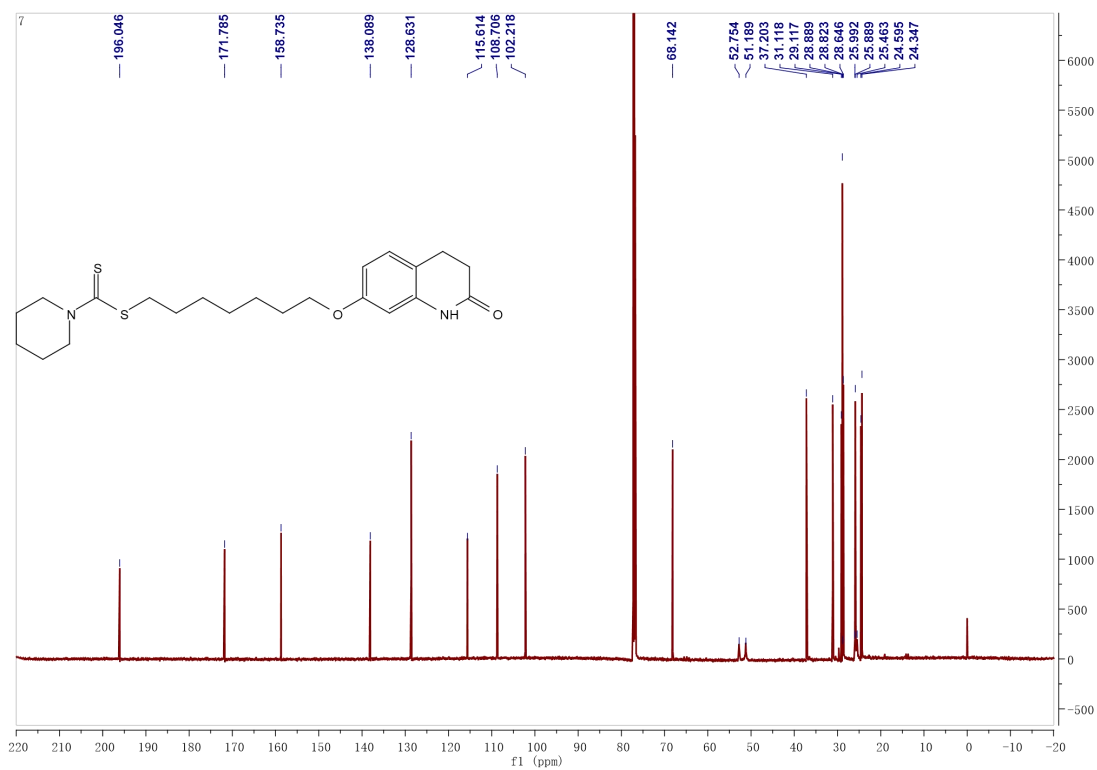
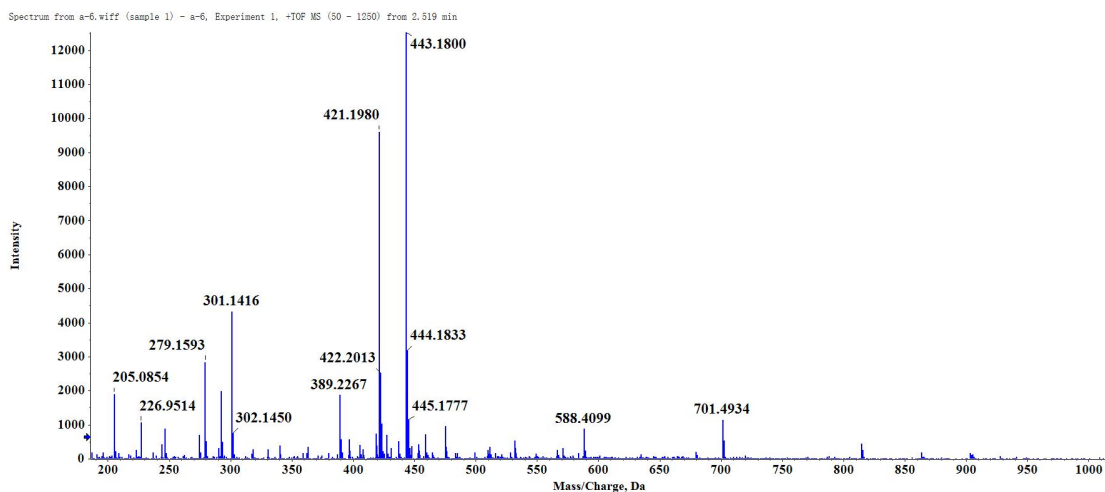
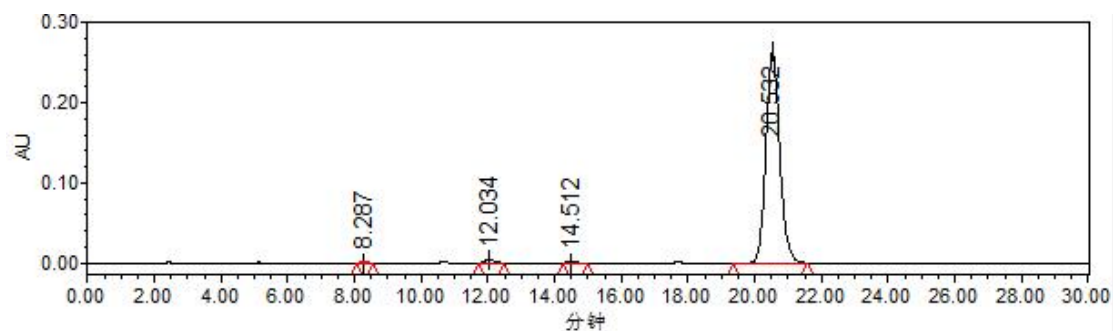


Figure S31  $^{13}\text{C}$  NMR chart of compound **3f** in  $\text{CDCl}_3$ .



**Figure S32** HRMS (ESI) spectrum of compound **3f**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		8.287	15744	0.21	1270
2		12.034	80255	1.05	4396
3		14.512	12361	0.16	621
4		20.532	7542608	98.58	262644

**Figure S33** Chromatographic report of HPLC analysis of compound **3f**.

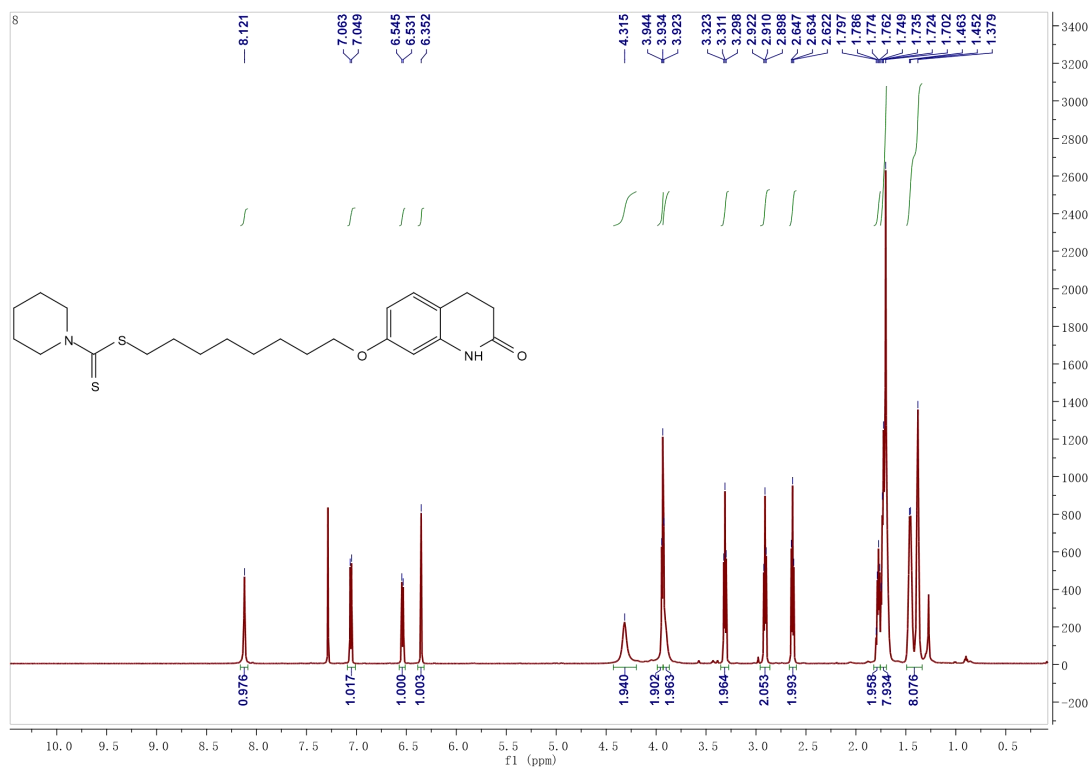


Figure S34  $^1\text{H}$  NMR chart of compound **3g** in  $\text{CDCl}_3$ .

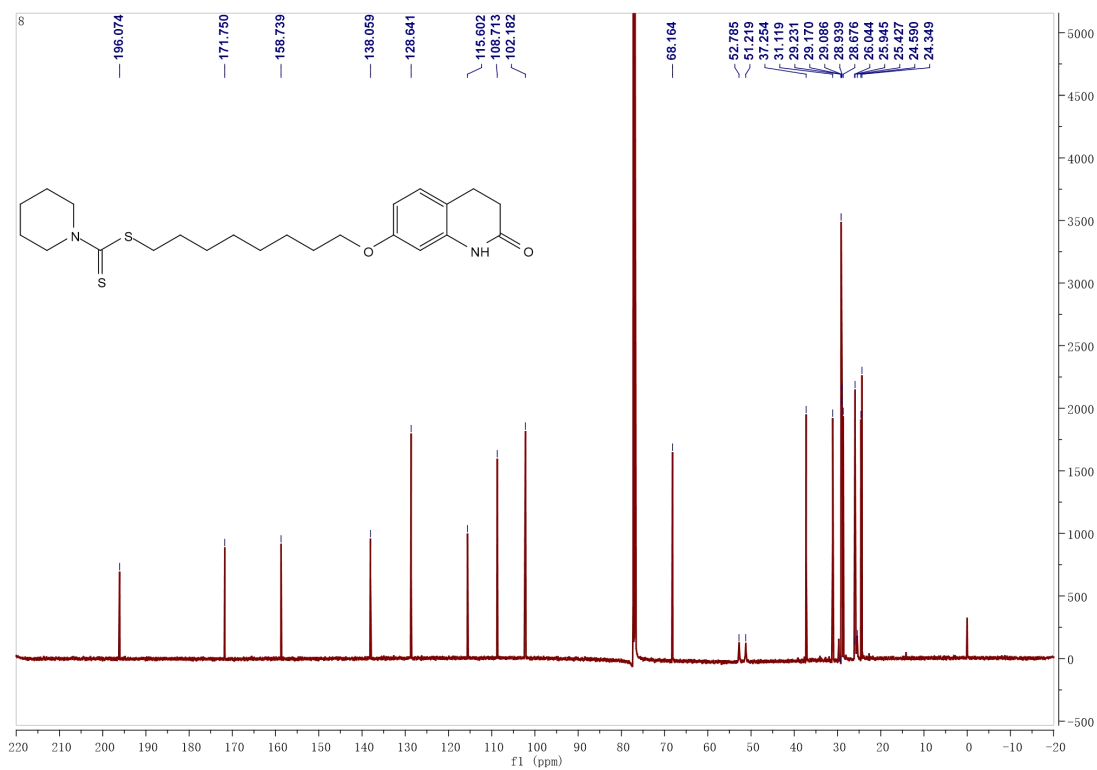
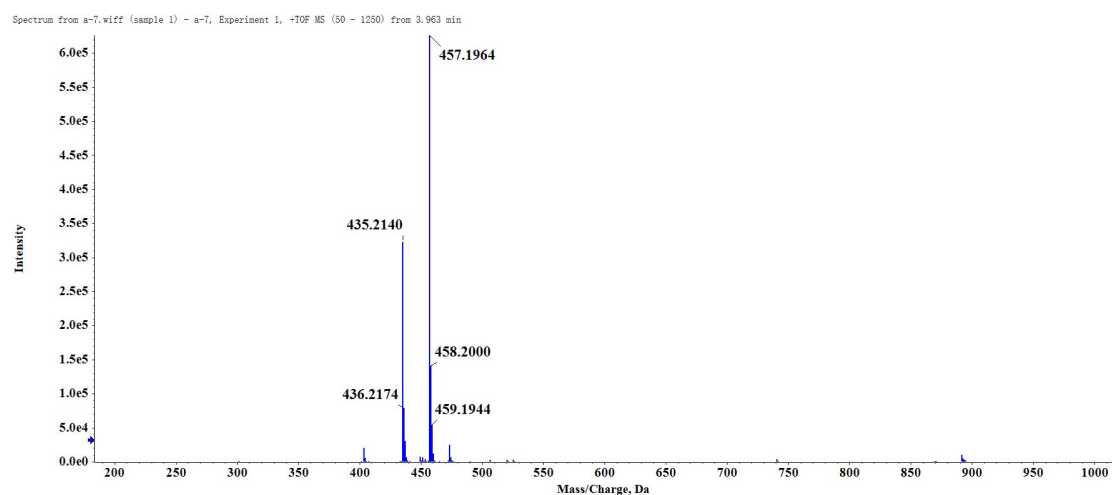
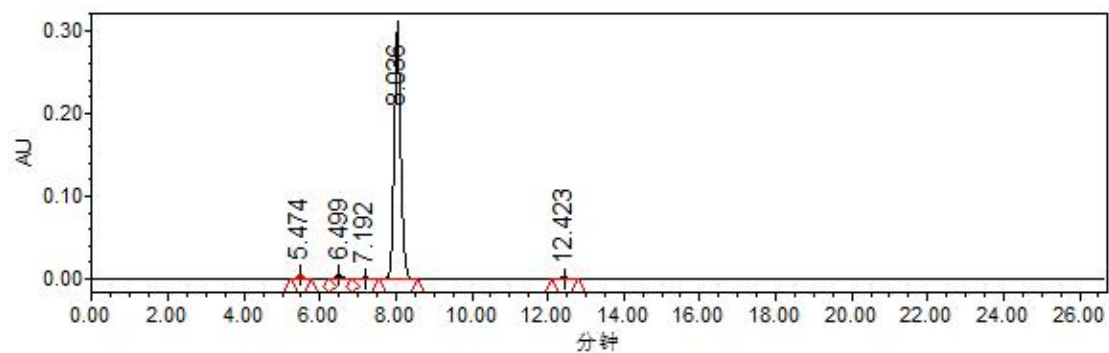


Figure S35  $^{13}\text{C}$  NMR chart of compound **3g** in  $\text{CDCl}_3$ .





**Figure S36** HRMS (ESI) spectrum of compound **3g**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		5.474	49633	1.33	5876
2		6.499	66960	1.79	6959
3		7.192	24379	0.65	2255
4		8.036	355581	95.24	298971
5		12.423	36546	0.98	1815

**Figure S37** Chromatographic report of HPLC analysis of compound **3g**.

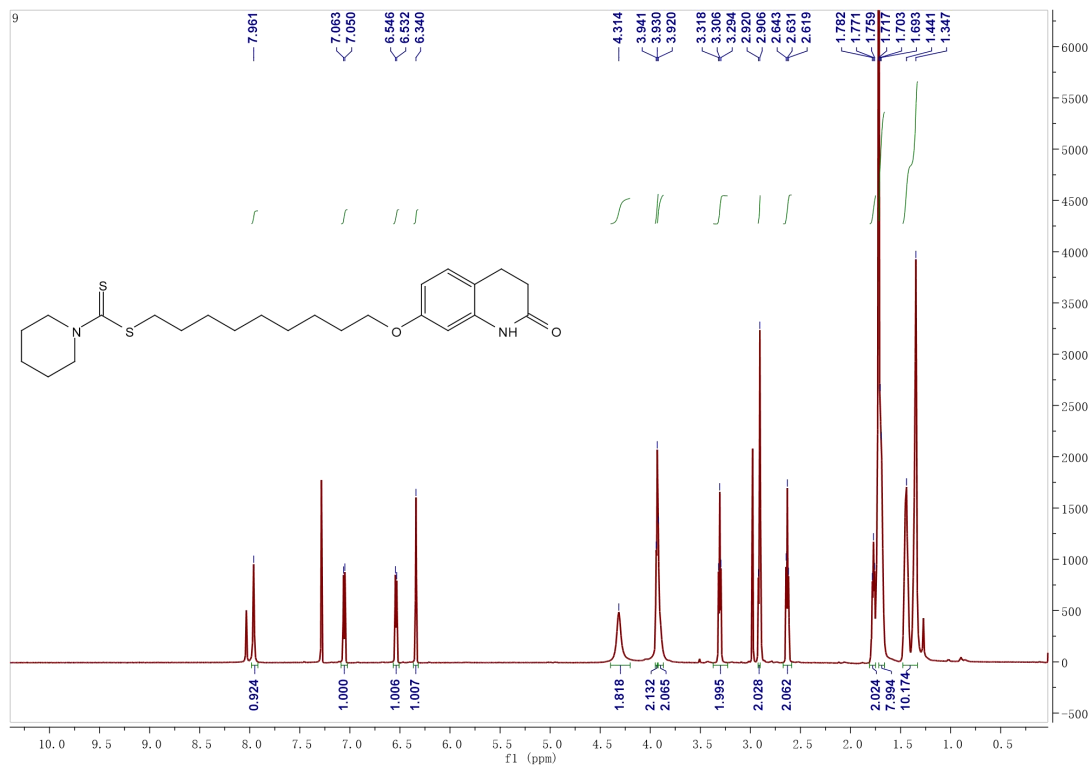


Figure S38  $^1\text{H}$  NMR chart of compound 3h in  $\text{CDCl}_3$ .

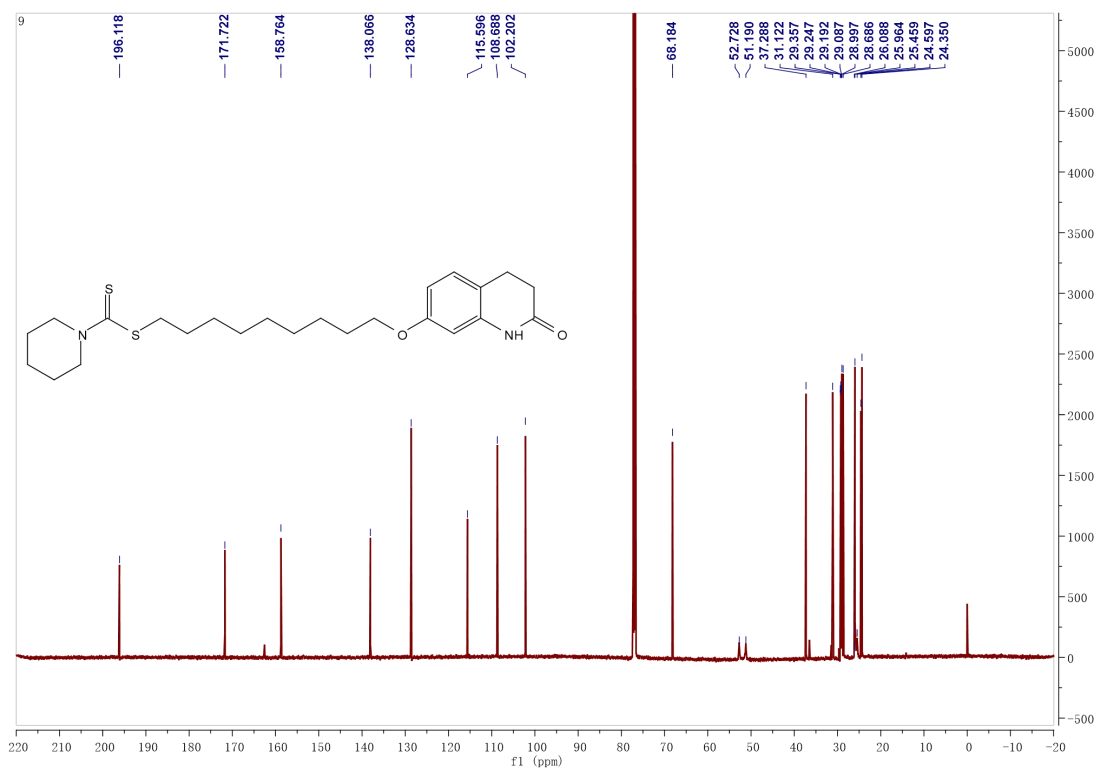
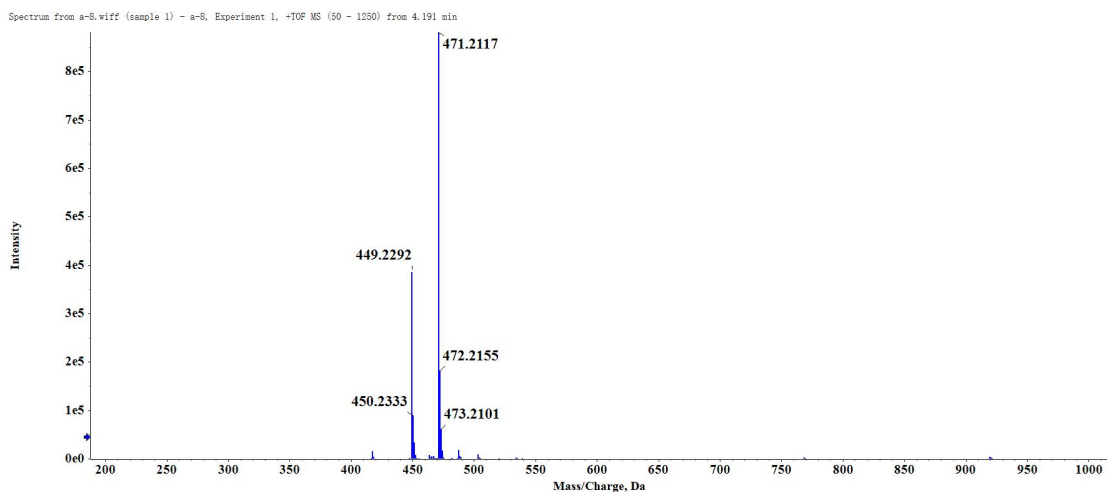
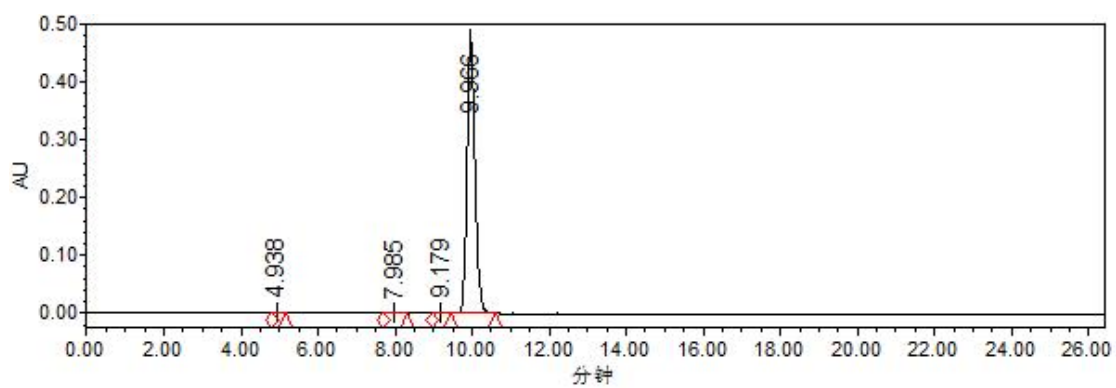


Figure S39  $^{13}\text{C}$  NMR chart of compound 3h in  $\text{CDCl}_3$ .



**Figure S40** HRMS (ESI) spectrum of compound **3h**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		4.938	18132	0.26	2284
2		7.985	39952	0.58	2122
3		9.179	39506	0.57	2969
4		9.966	6801256	98.59	472104

**Figure S41** Chromatographic report of HPLC analysis of compound **3h**.

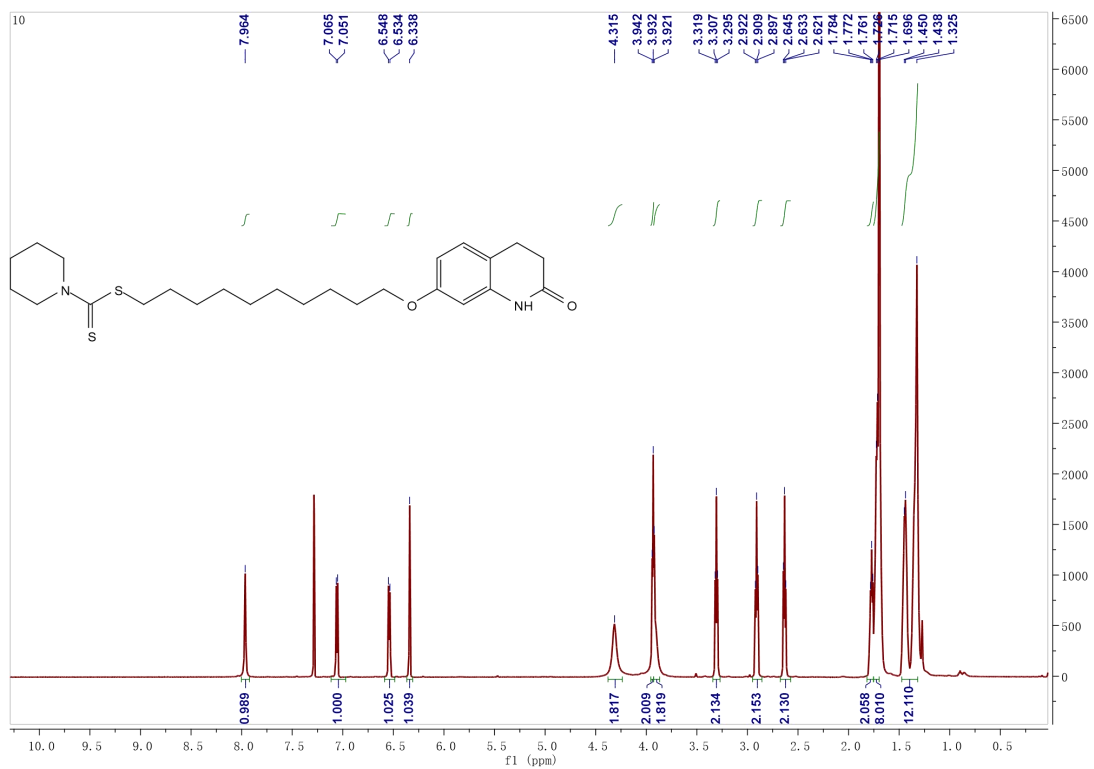


Figure S42 <sup>1</sup>H NMR chart of compound 3i in CDCl<sub>3</sub>.

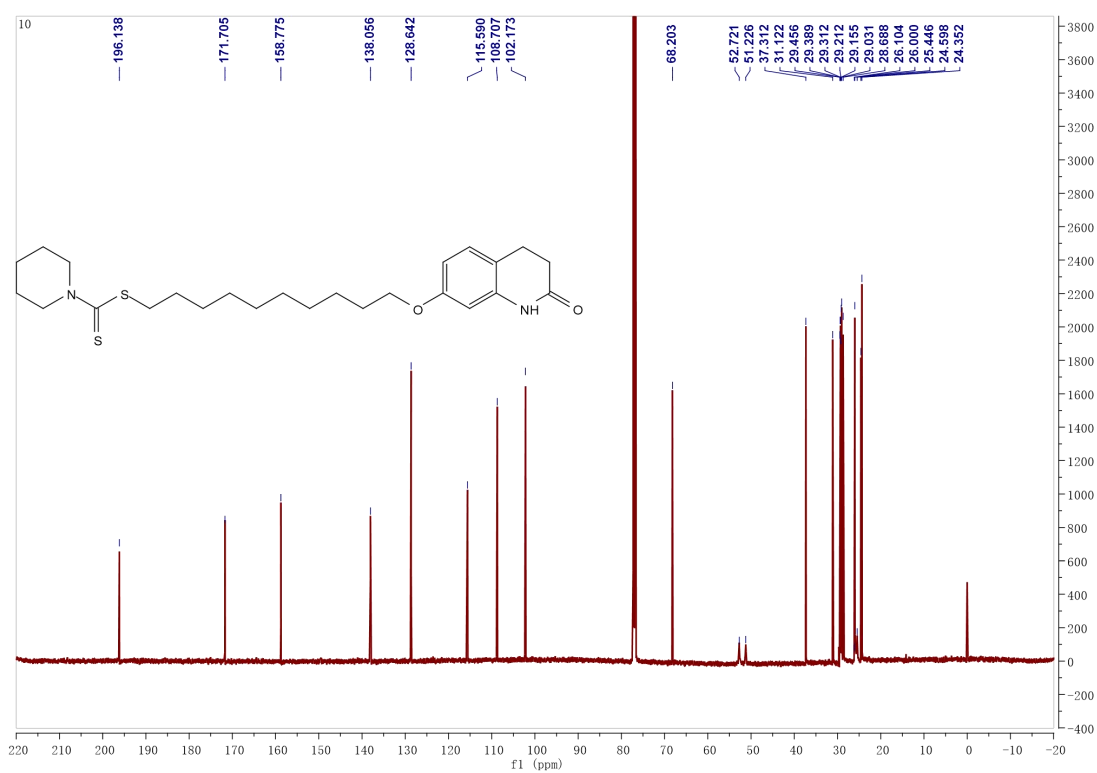
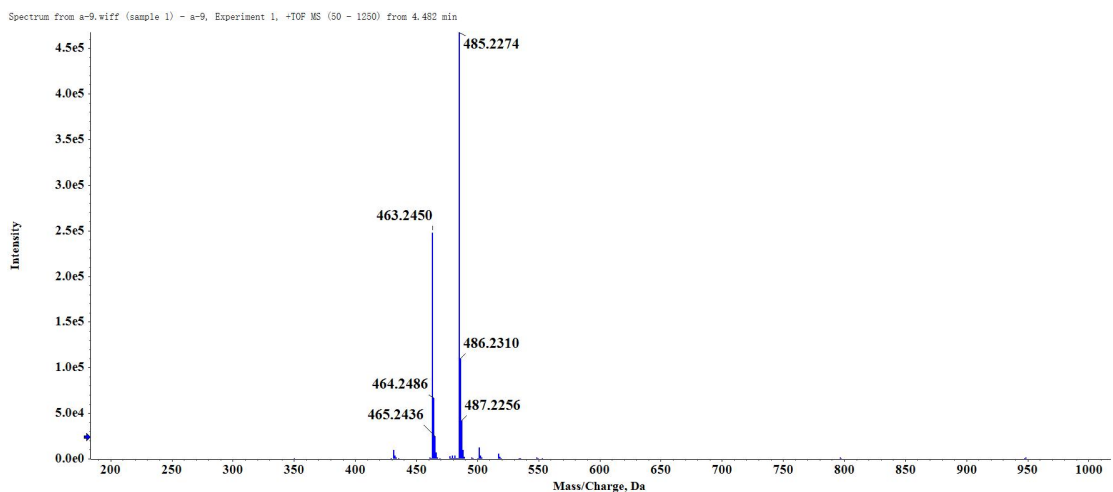
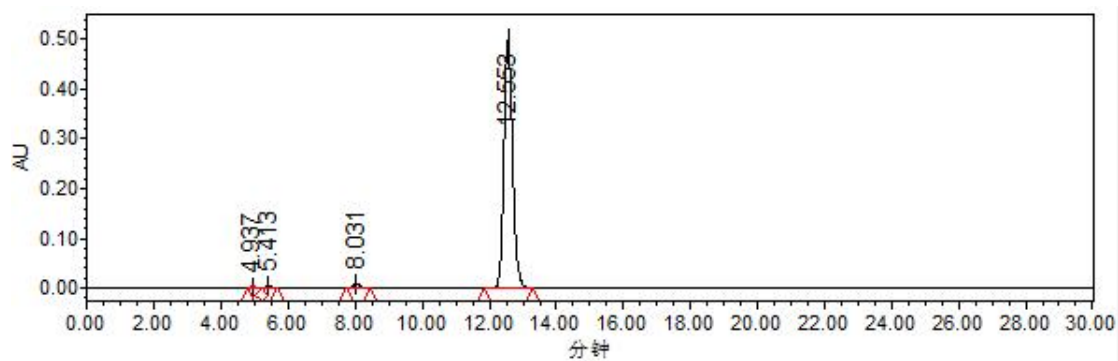


Figure S43 <sup>13</sup>C NMR chart of compound 3i in CDCl<sub>3</sub>.



**Figure S44** HRMS (ESI) spectrum of compound **3i**.



**Figure S45** Chromatographic report of HPLC analysis of compound **3i**.

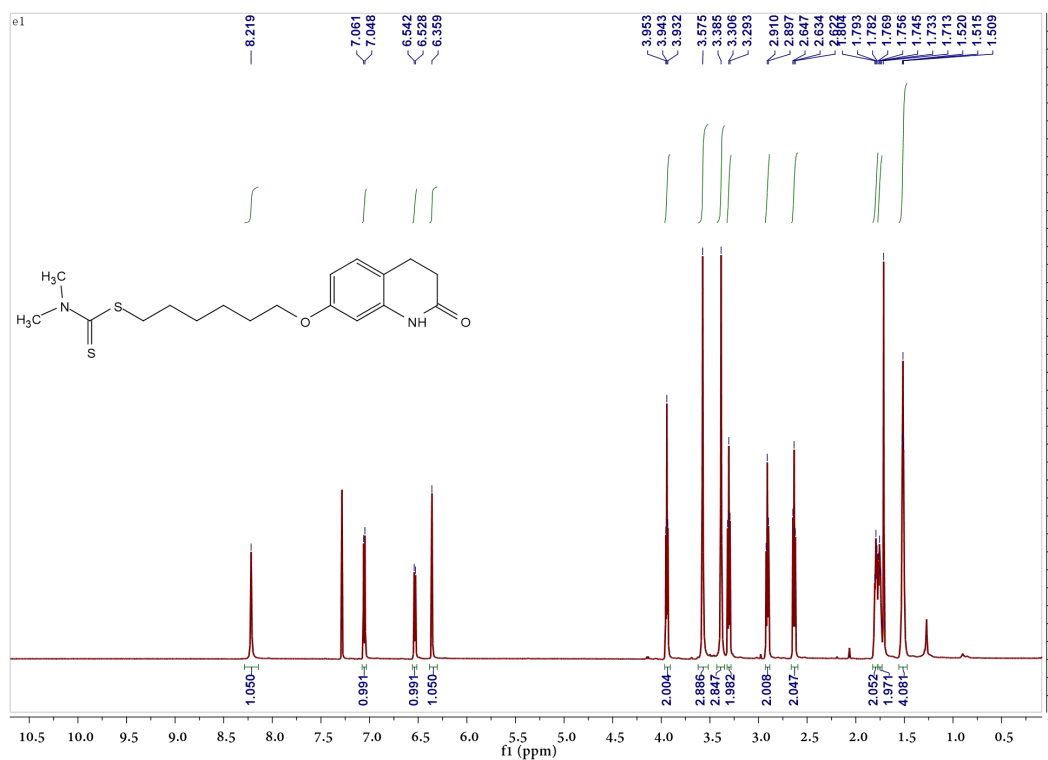


Figure S46  $^1\text{H}$  NMR chart of compound **3e1** in  $\text{CDCl}_3$ .

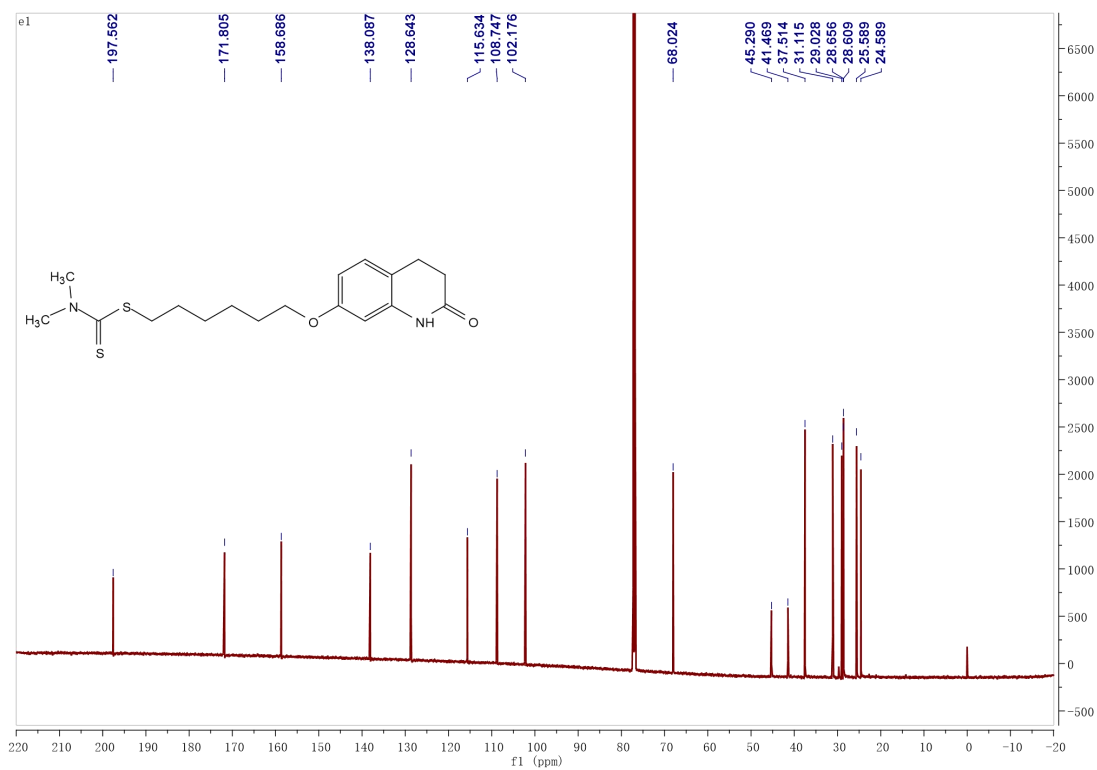
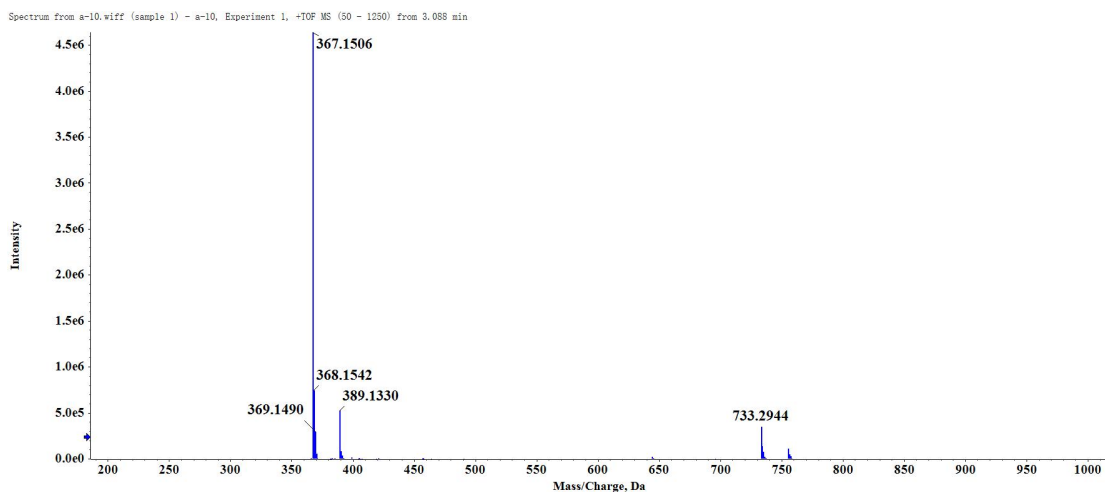
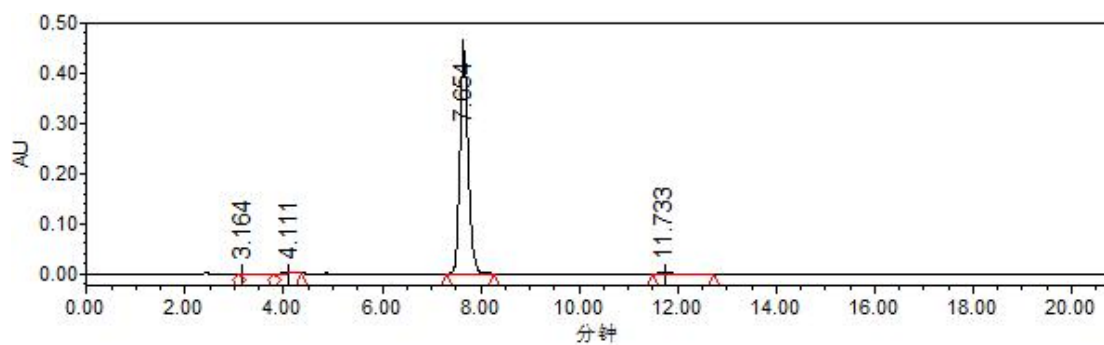


Figure S47  $^{13}\text{C}$  NMR chart of compound **3e1** in  $\text{CDCl}_3$ .



**Figure S48** HRMS (ESI) spectrum of compound **3e<sub>1</sub>**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		3.164	10986	0.21	642
2		4.111	20265	0.38	1377
3		7.654	5285531	99.16	447421
4		11.733	13509	0.25	598

**Figure S49** Chromatographic report of HPLC analysis of compound **3e<sub>1</sub>**.

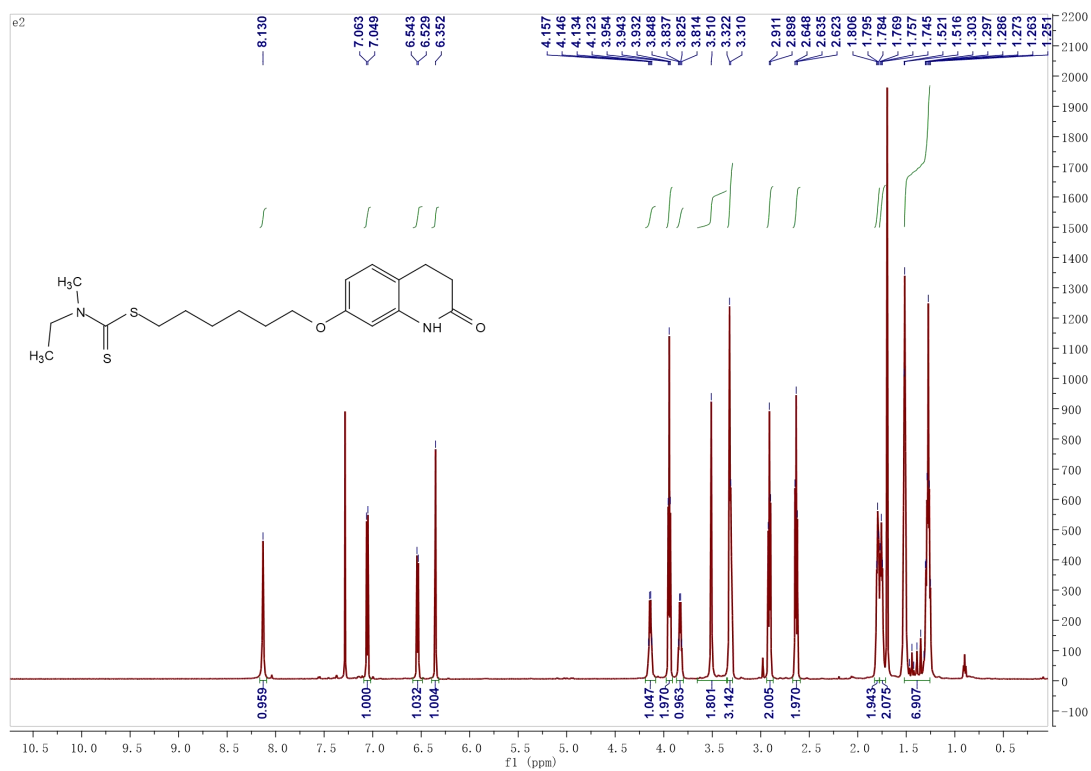


Figure S50  $^1\text{H}$  NMR chart of compound **3e2** in  $\text{CDCl}_3$ .

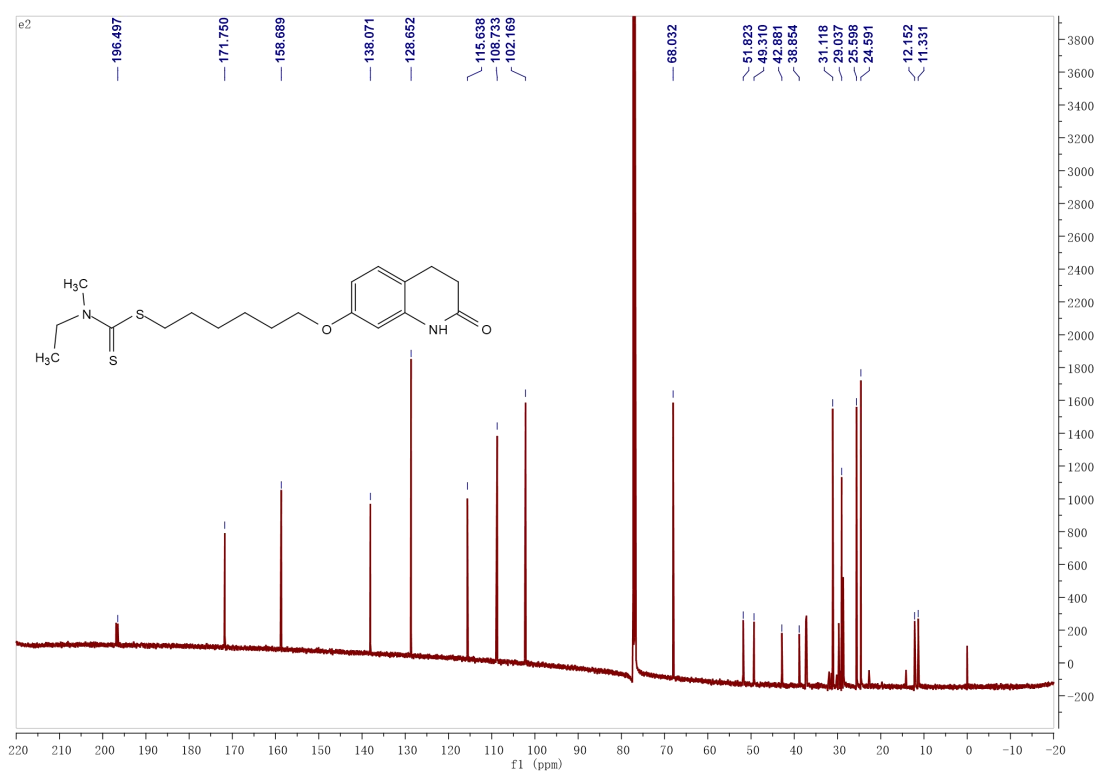


Figure S51  $^{13}\text{C}$  NMR chart of compound **3e2** in  $\text{CDCl}_3$ .



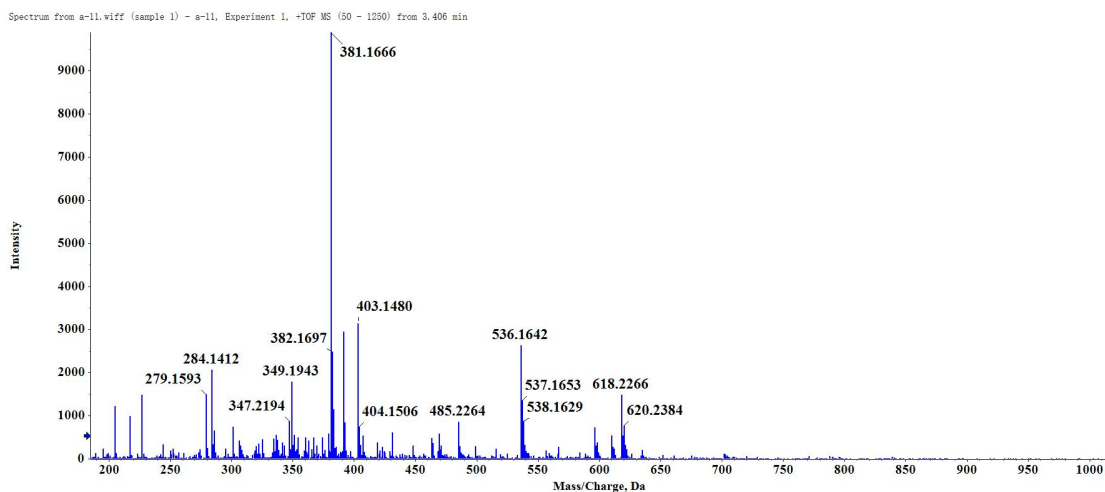
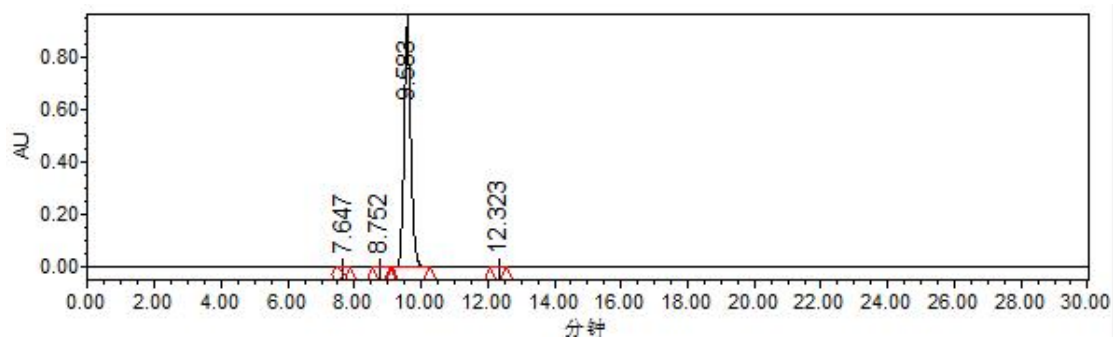


Figure S52 HRMS (ESI) spectrum of compound **3e<sub>2</sub>**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		7.647	12501	0.09	1073
2		8.752	7755	0.06	521
3		9.583	13161985	99.77	917522
4		12.323	9899	0.08	671

Figure S53 Chromatographic report of HPLC analysis of compound **3e<sub>2</sub>**.

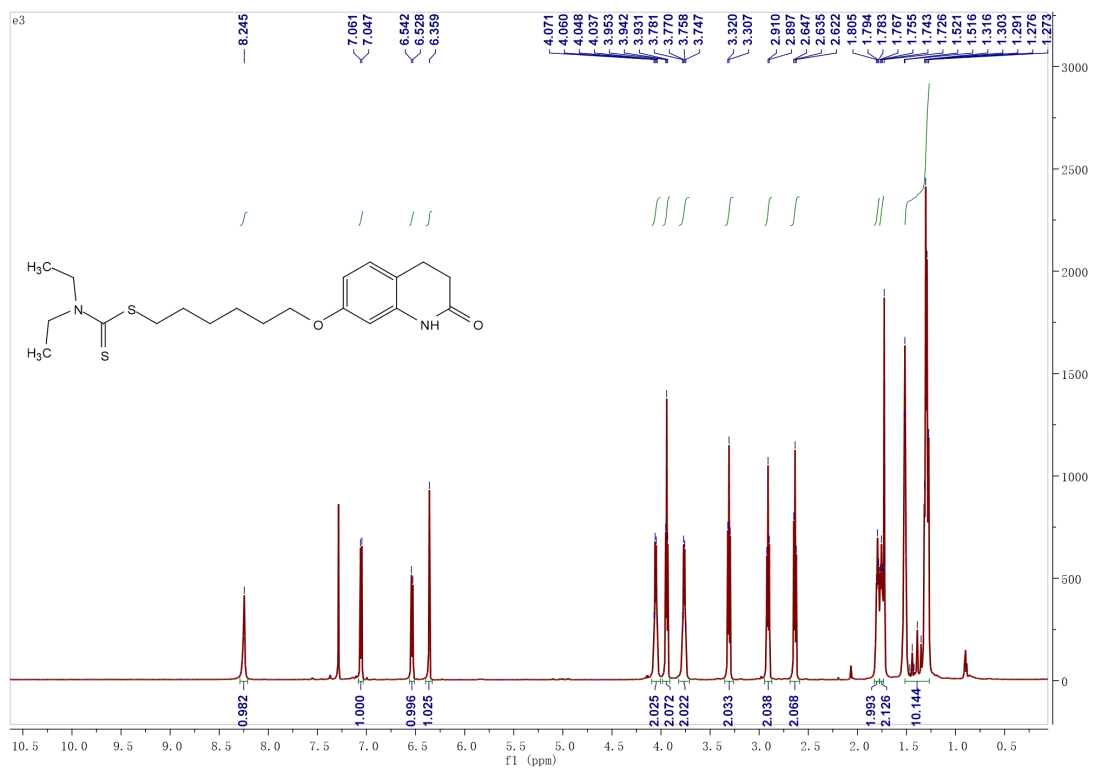


Figure S54  $^1\text{H}$  NMR chart of compound **3e3** in  $\text{CDCl}_3$ .

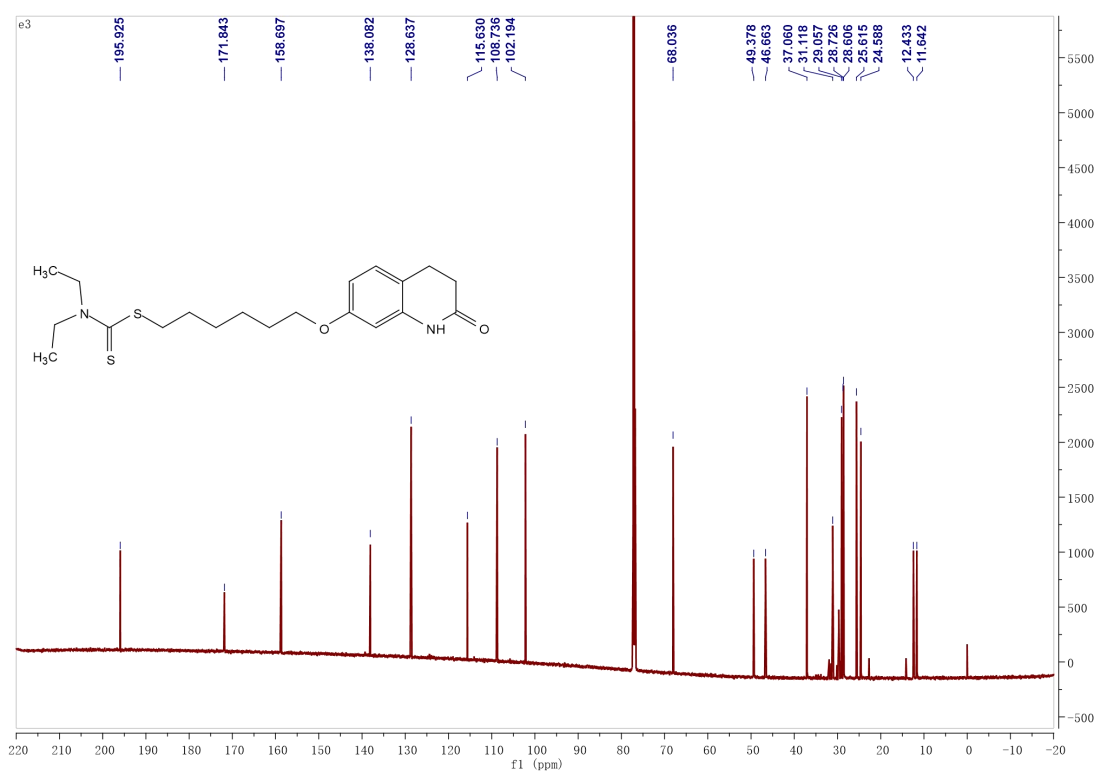
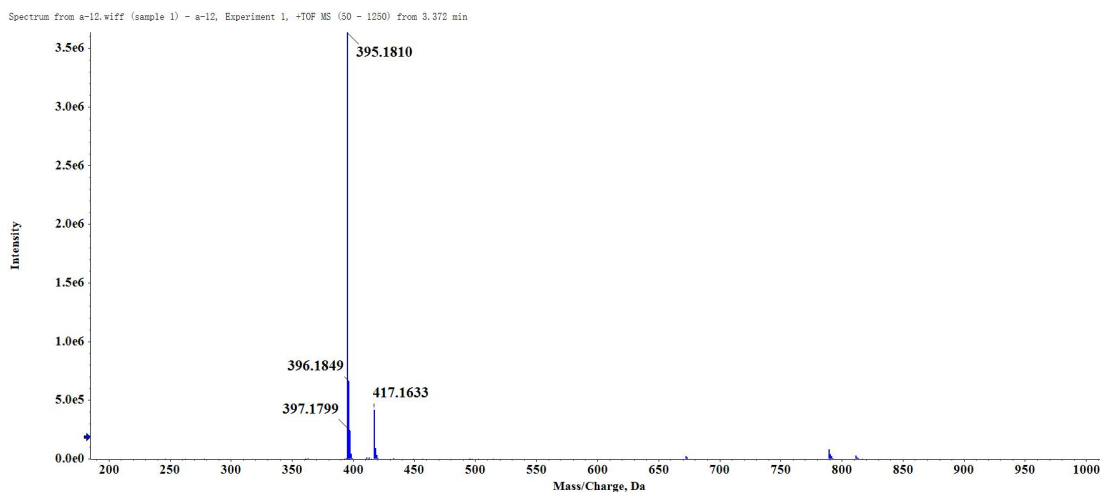
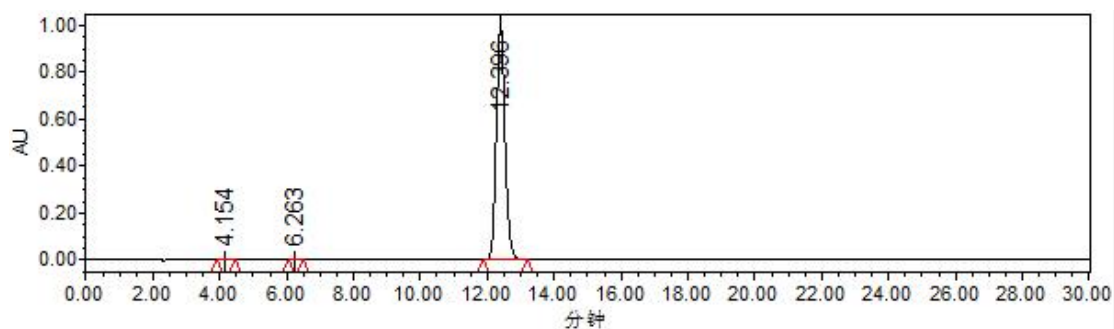


Figure S55  $^{13}\text{C}$  NMR chart of compound **3e3** in  $\text{CDCl}_3$ .



**Figure S56** HRMS (ESI) spectrum of compound **3e<sub>3</sub>**.



	Name	Retention time (min)	Area (mV*s)	%Area	Height (mV)
1		4.154	4576	0.03	288
2		6.263	10048	0.06	956
3		12.396	17993692	99.92	995282

**Figure S57** Chromatographic report of HPLC analysis of compound **3e<sub>3</sub>**.

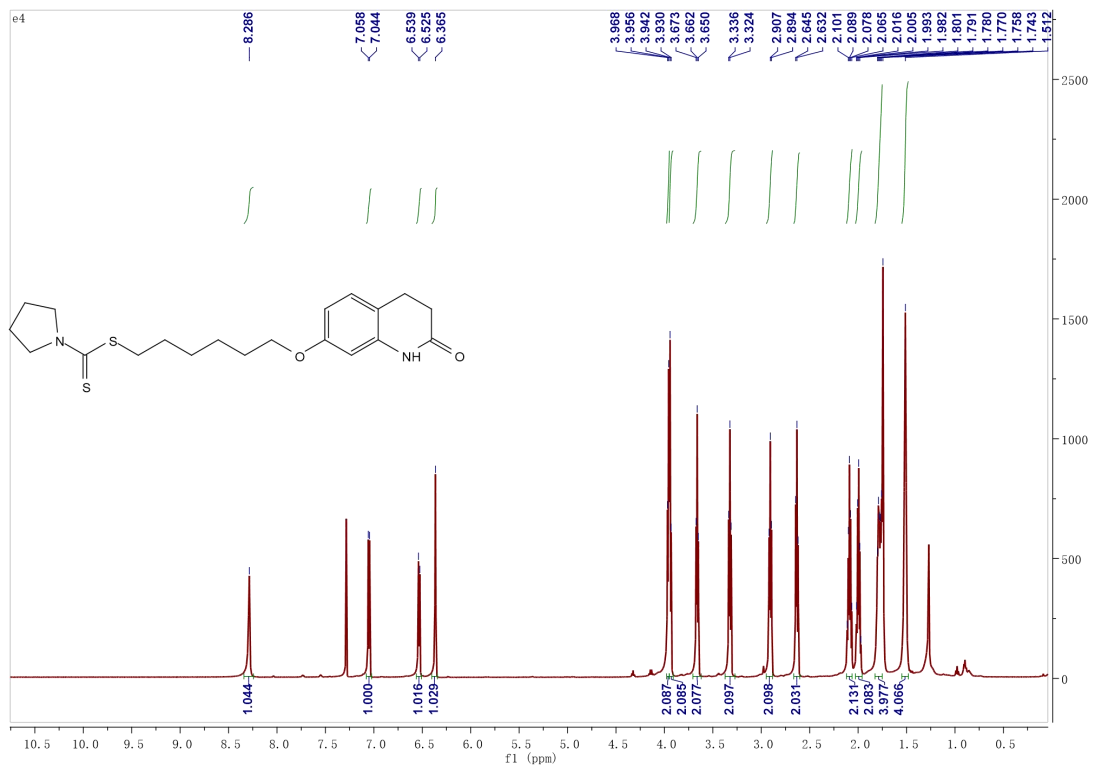


Figure S58 <sup>1</sup>H NMR chart of compound **3e4** in CDCl<sub>3</sub>.

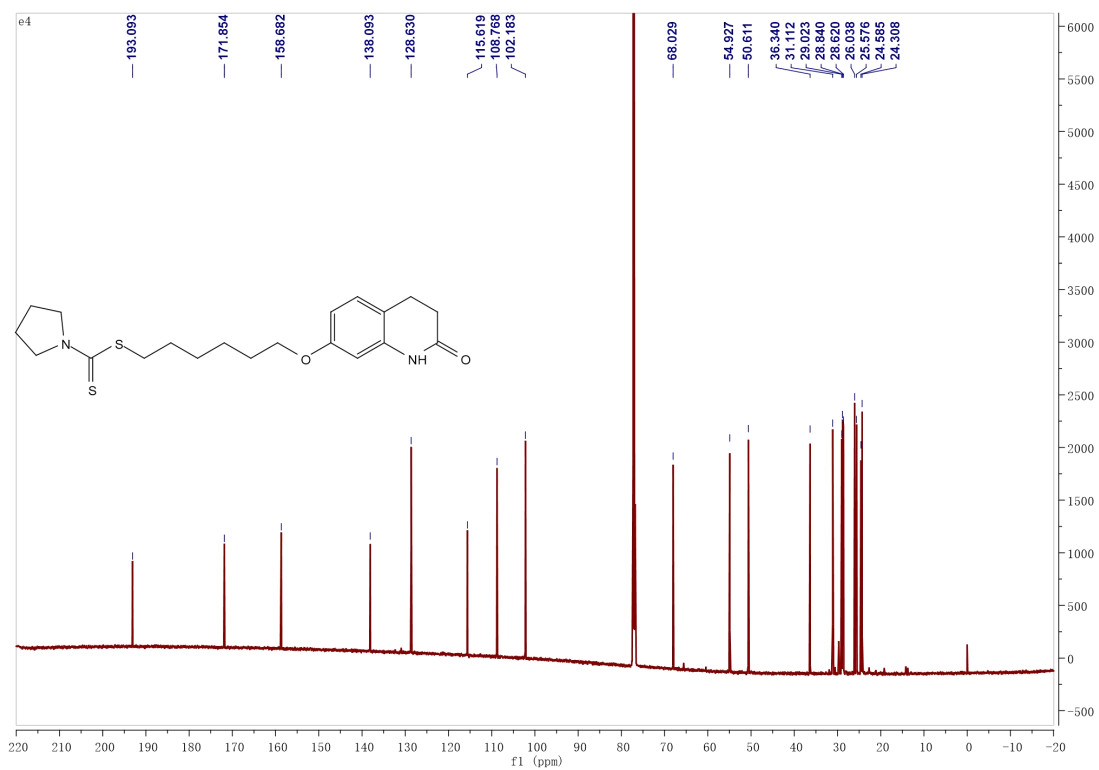
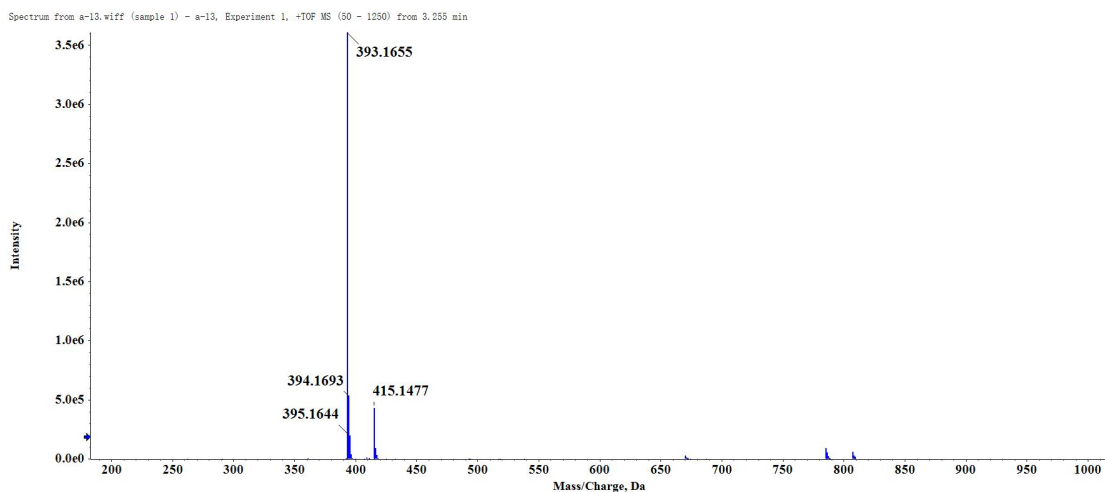
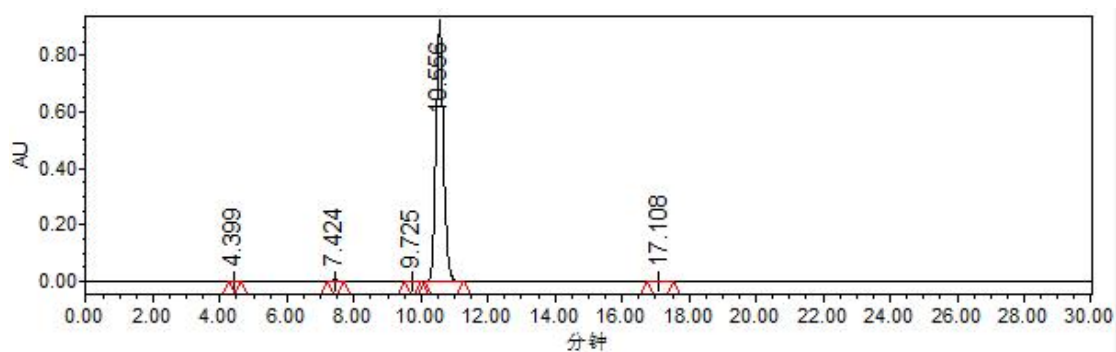


Figure S59 <sup>13</sup>C NMR chart of compound **3e4** in CDCl<sub>3</sub>.



**Figure S60** HRMS (ESI) spectrum of compound **3e4**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		4.399	17320	0.12	2604
2		7.424	38792	0.28	3766
3		9.725	11624	0.08	851
4		10.556	13963859	99.19	892792
5		17.108	46236	0.33	1992

**Figure S61** Chromatographic report of HPLC analysis of compound **3e4**.

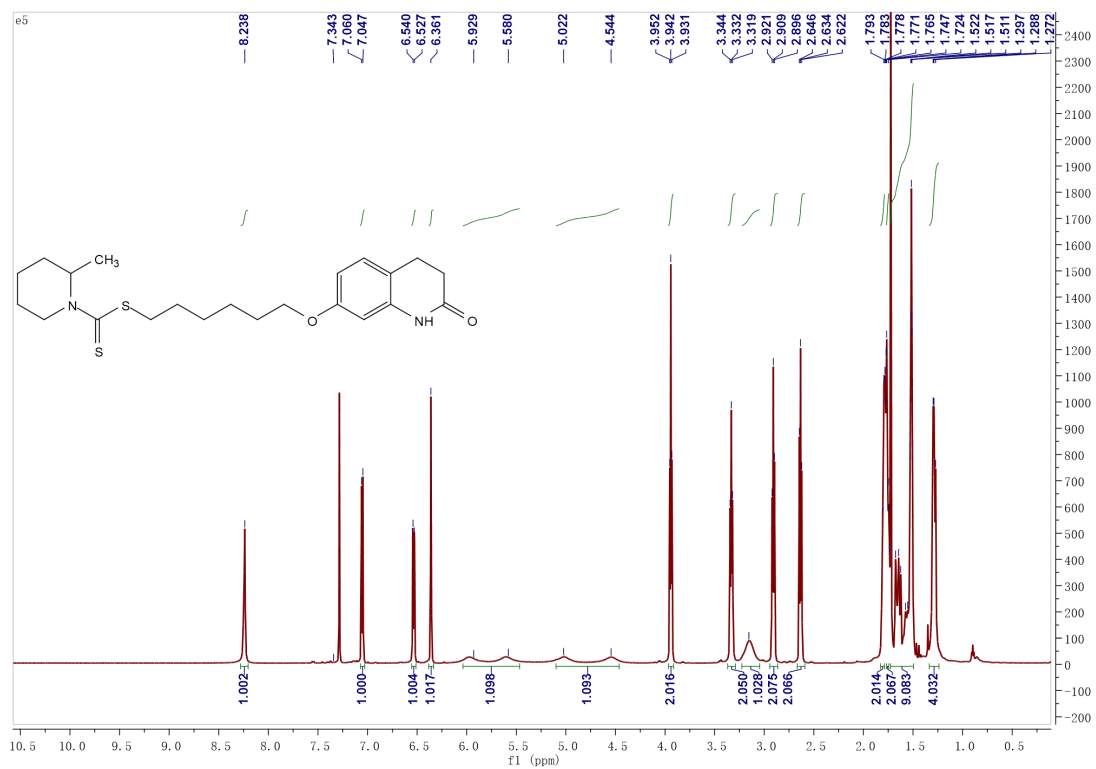


Figure S62  $^1\text{H}$  NMR chart of compound **3e5** in  $\text{CDCl}_3$ .

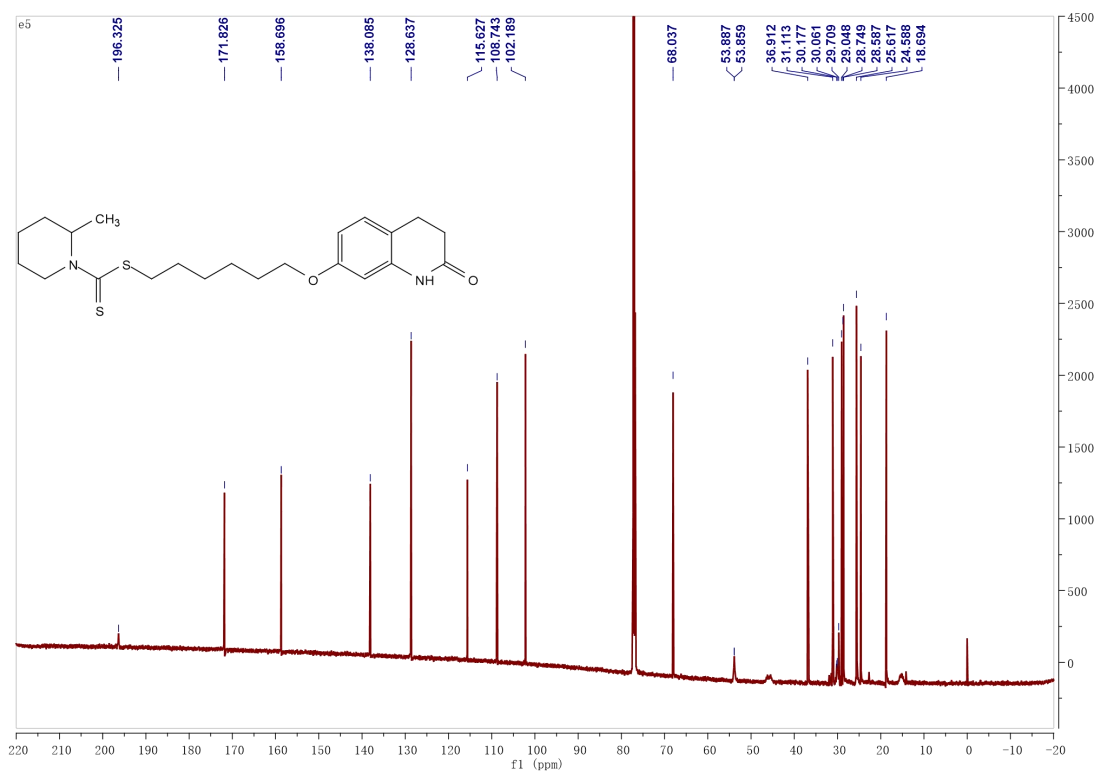
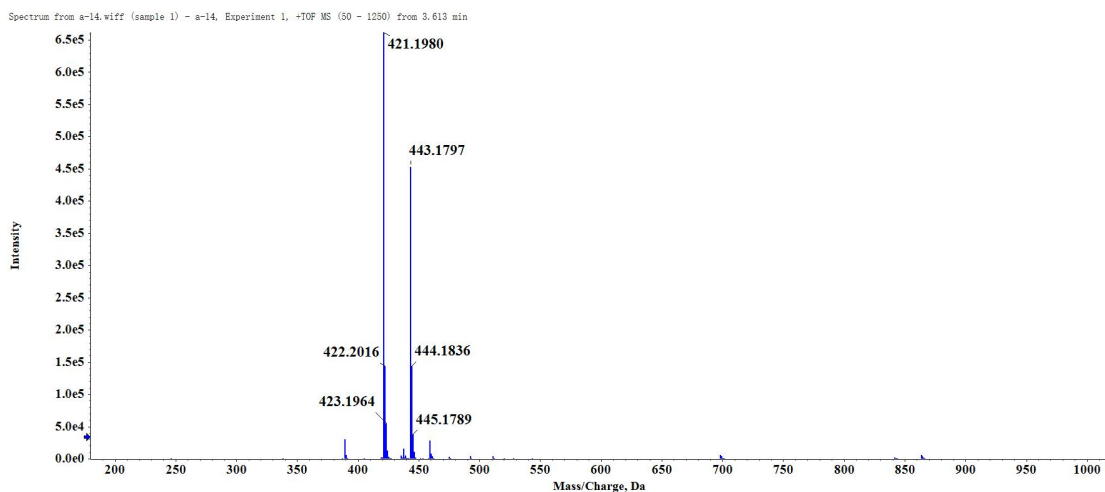
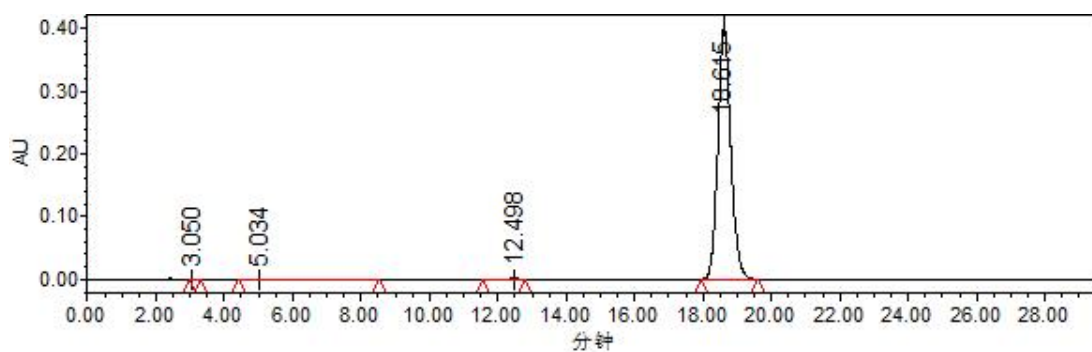


Figure S63  $^{13}\text{C}$  NMR chart of compound **3e5** in  $\text{CDCl}_3$ .



**Figure S64** HRMS (ESI) spectrum of compound **3e<sub>5</sub>**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		3.05	2354	0.02	279
2		5.034	17078	0.16	363
3		12.498	27969	0.26	1243
4		18.615	10614143	99.56	401167

**Figure S65** Chromatographic report of HPLC analysis of compound **3e<sub>5</sub>**.

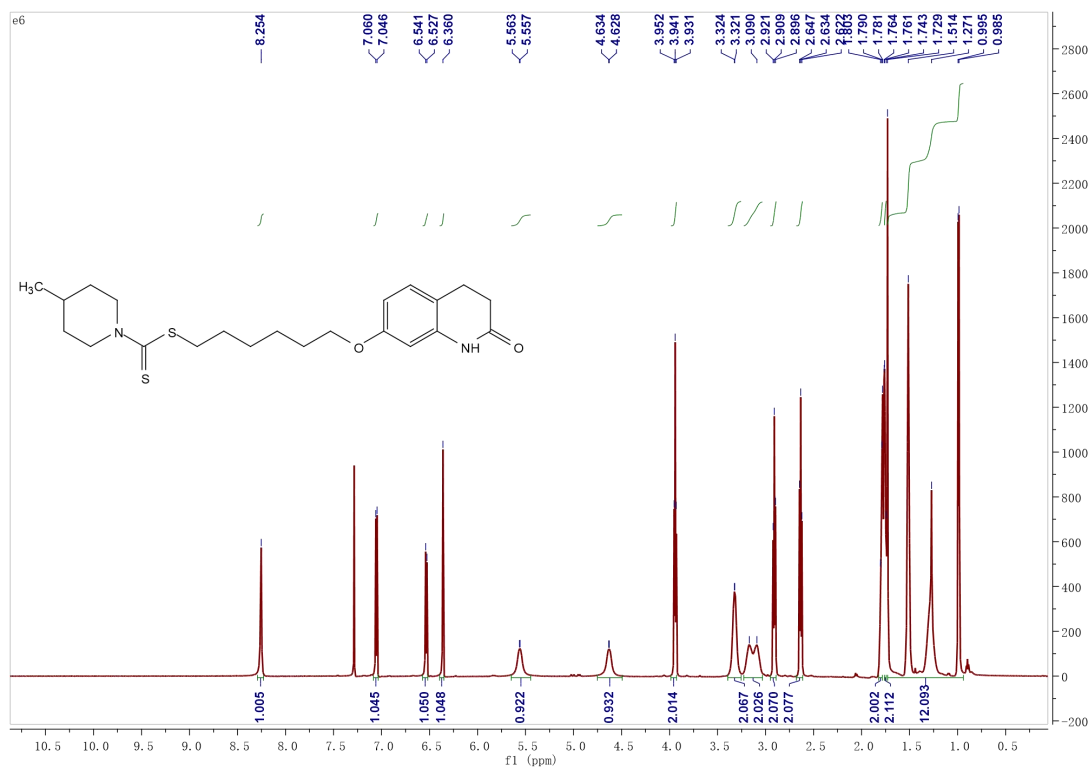


Figure S66  $^1\text{H}$  NMR chart of compound **3e6** in  $\text{CDCl}_3$ .

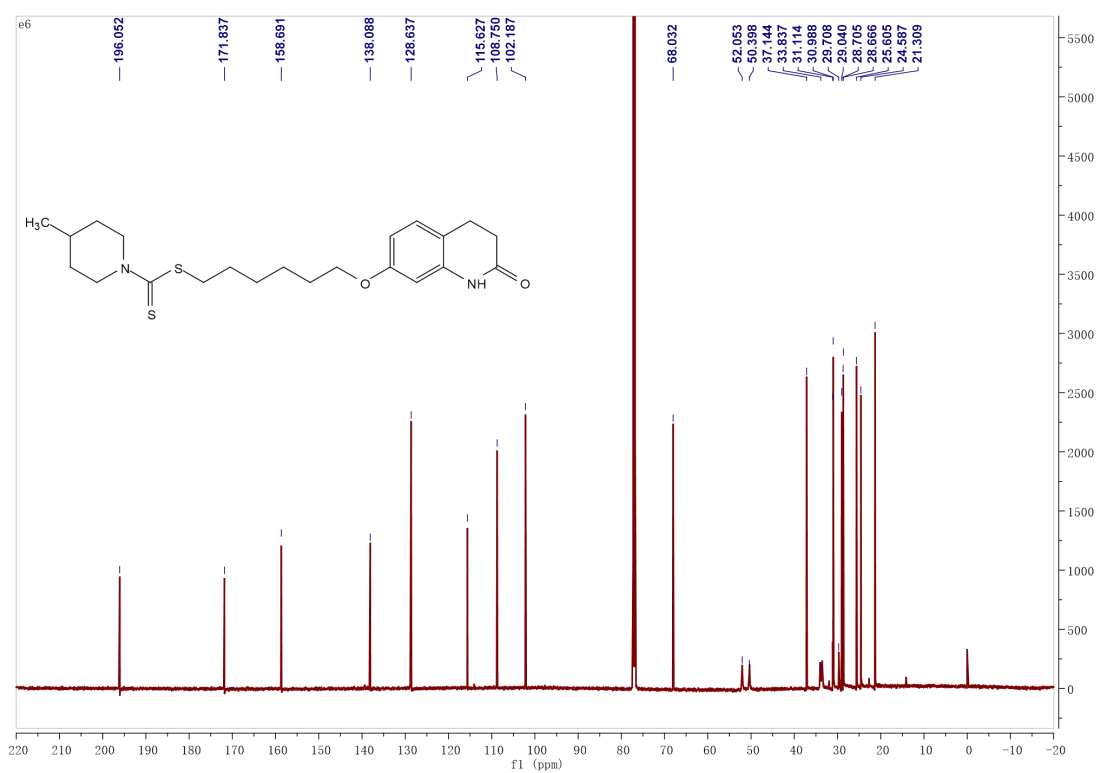
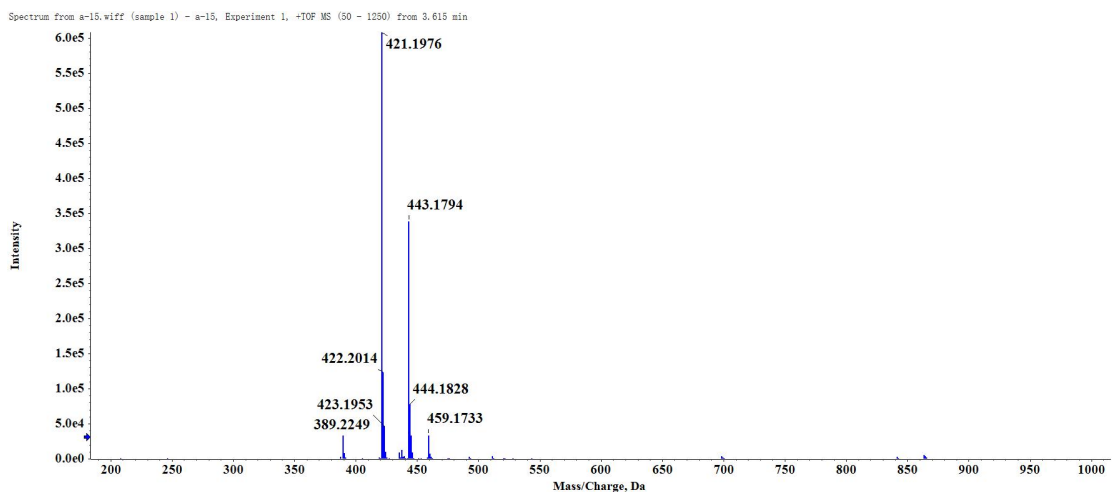
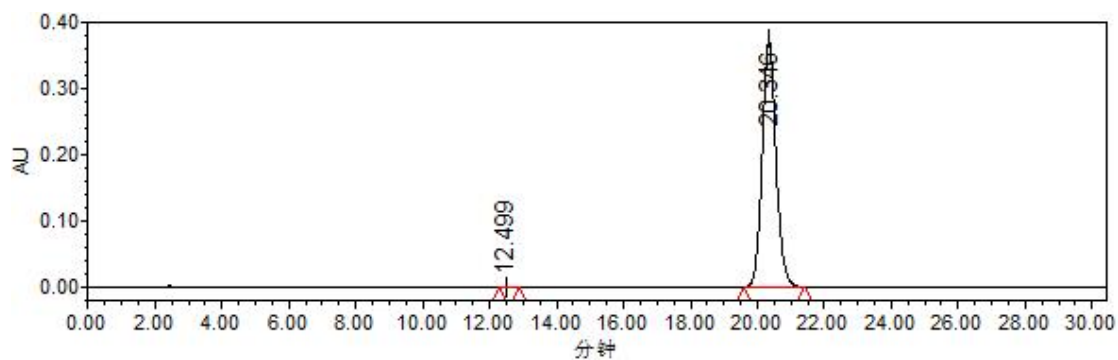


Figure S67  $^{13}\text{C}$  NMR chart of compound **3e6** in  $\text{CDCl}_3$ .





**Figure S68** HRMS (ESI) spectrum of compound **3e6**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		12.480	14647	0.14	521
2		17.908	1989	0.02	114
3		20.346	10695950	99.79	374400
4		24.705	6055	0.06	216

**Figure S69** Chromatographic report of HPLC analysis of compound **3e6**.

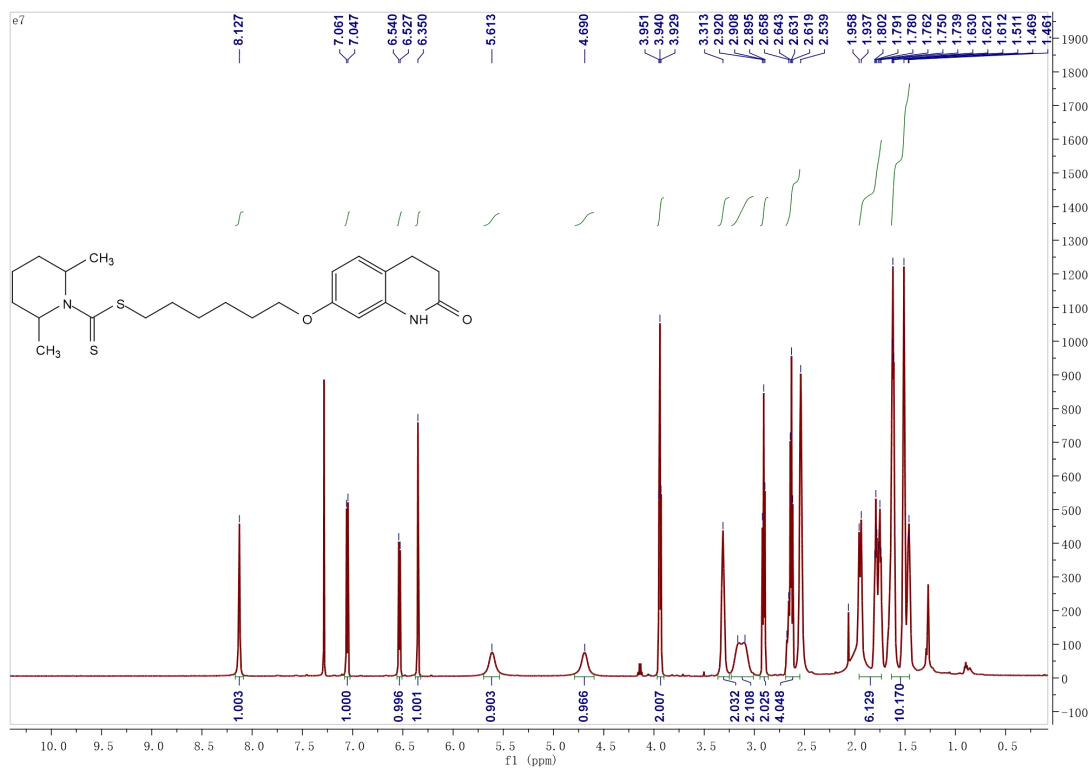


Figure S70  $^1\text{H}$  NMR chart of compound **3e7** in  $\text{CDCl}_3$ .

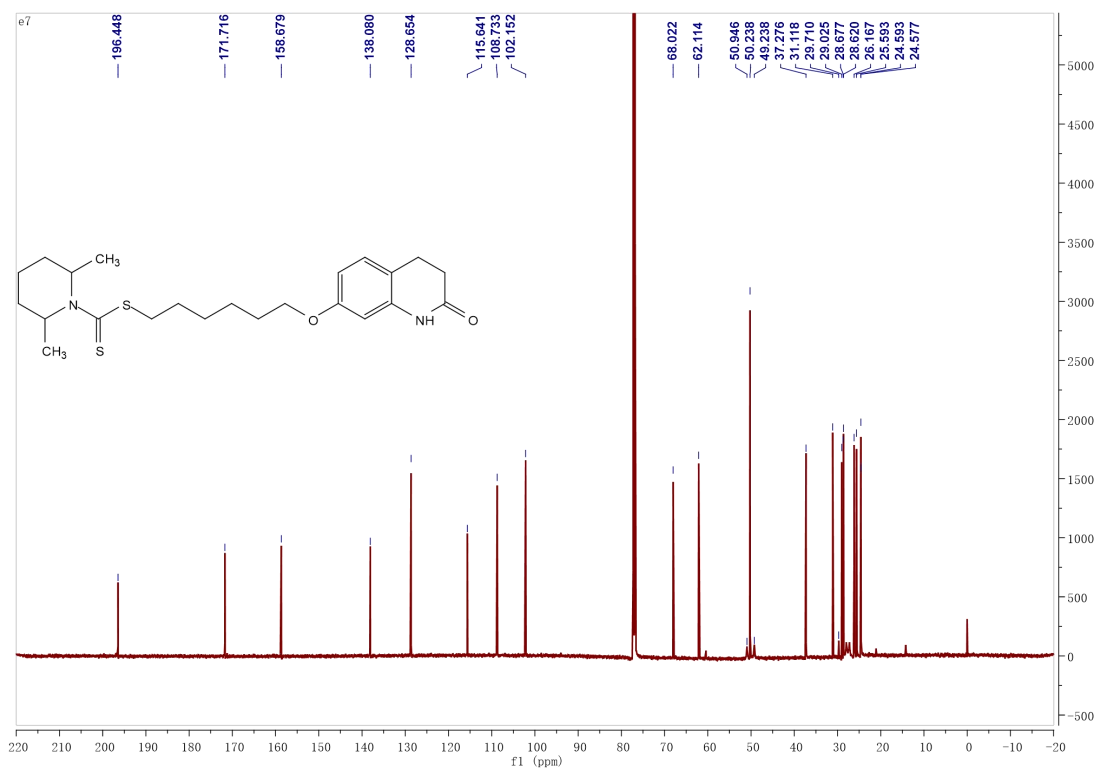
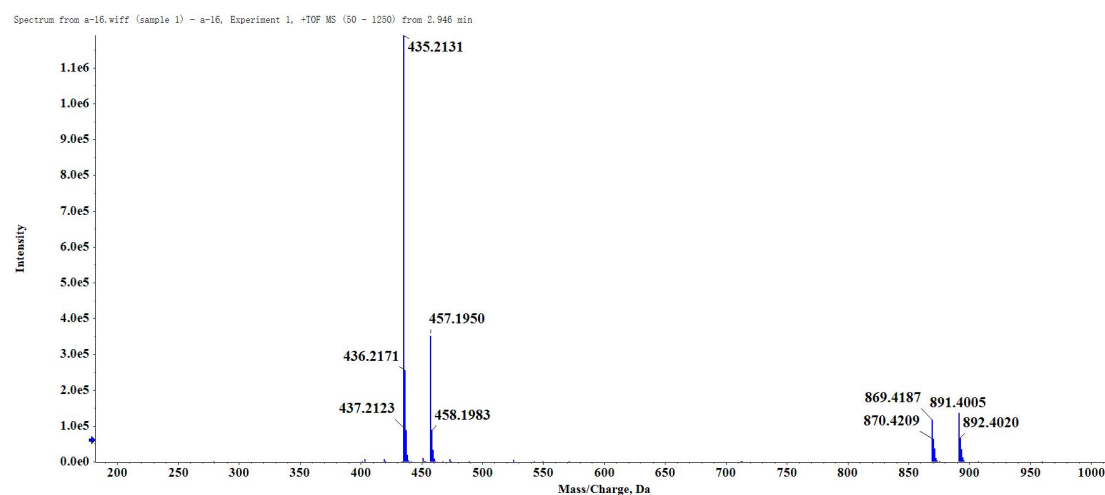
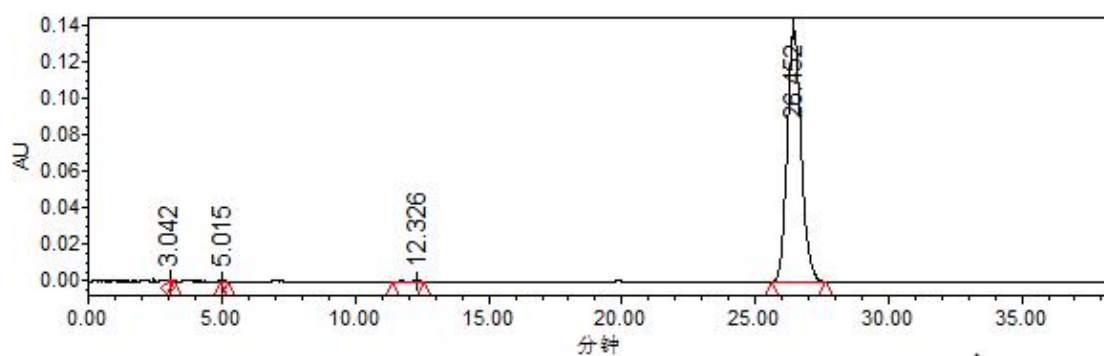


Figure S71  $^{13}\text{C}$  NMR chart of compound **3e7** in  $\text{CDCl}_3$ .



**Figure S72** HRMS (ESI) spectrum of compound **3e7**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		3.042	4707	0.09	743
2		5.015	2236	0.04	330
3		12.326	16657	0.33	695
4		26.452	5027849	99.53	137706

**Figure S73** Chromatographic report of HPLC analysis of compound **3e7**.

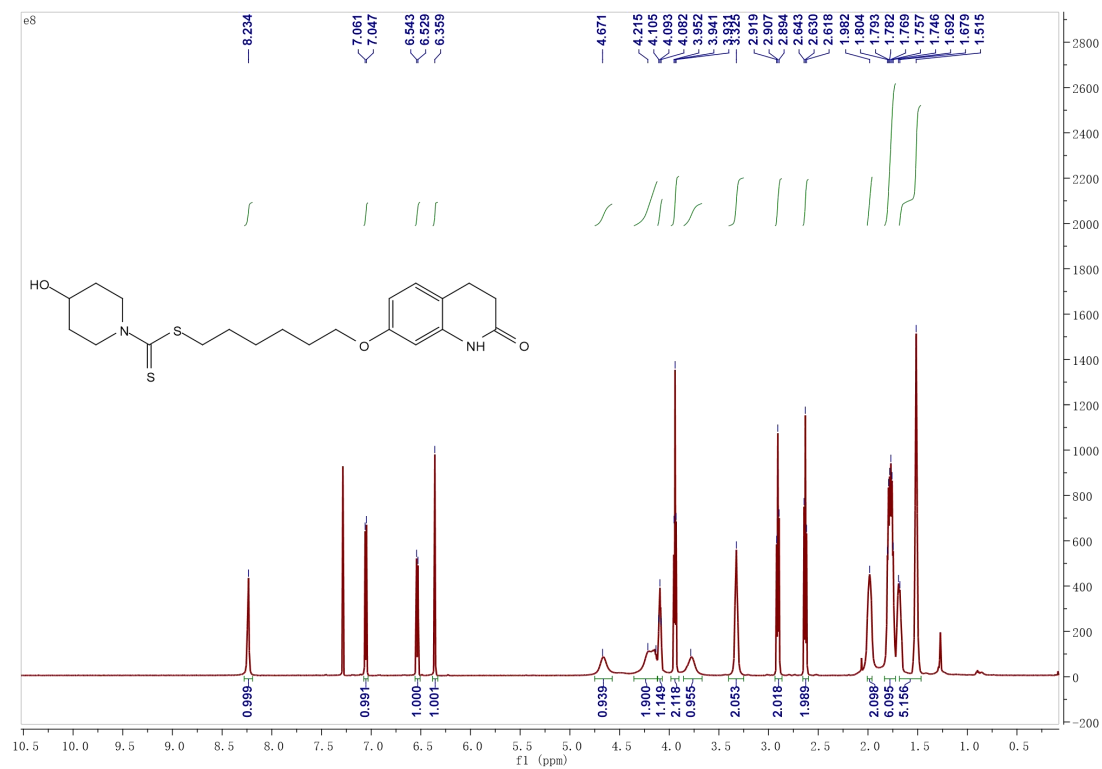


Figure S74  $^1\text{H}$  NMR chart of compound **3e8** in  $\text{CDCl}_3$ .

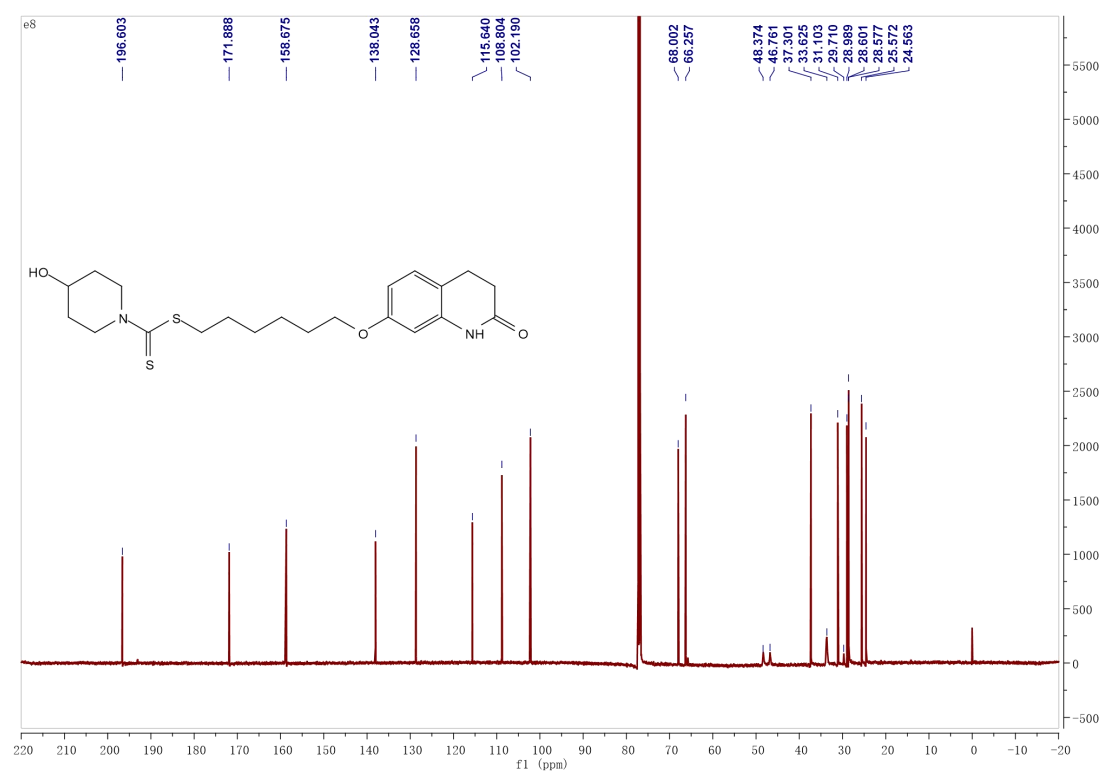


Figure S75  $^{13}\text{C}$  NMR chart of compound **3e8** in  $\text{CDCl}_3$ .

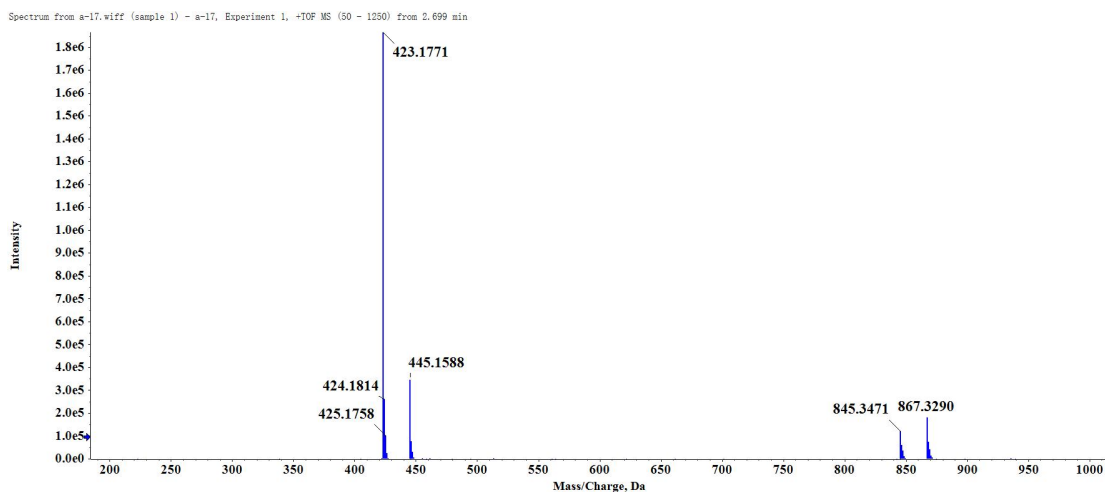
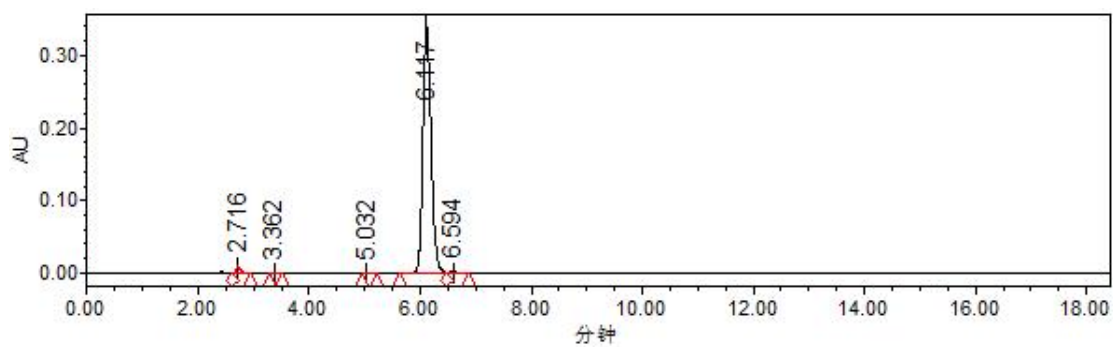


Figure S76 HRMS (ESI) spectrum of compound **3e<sub>8</sub>**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		2.716	52941	1.48	9777
2		3.362	2408	0.07	449
3		5.032	1972	0.06	322
4		6.117	3507432	97.91	339192
5		6.594	17450	0.49	1536

Figure S77 Chromatographic report of HPLC analysis of compound **3e<sub>8</sub>**.

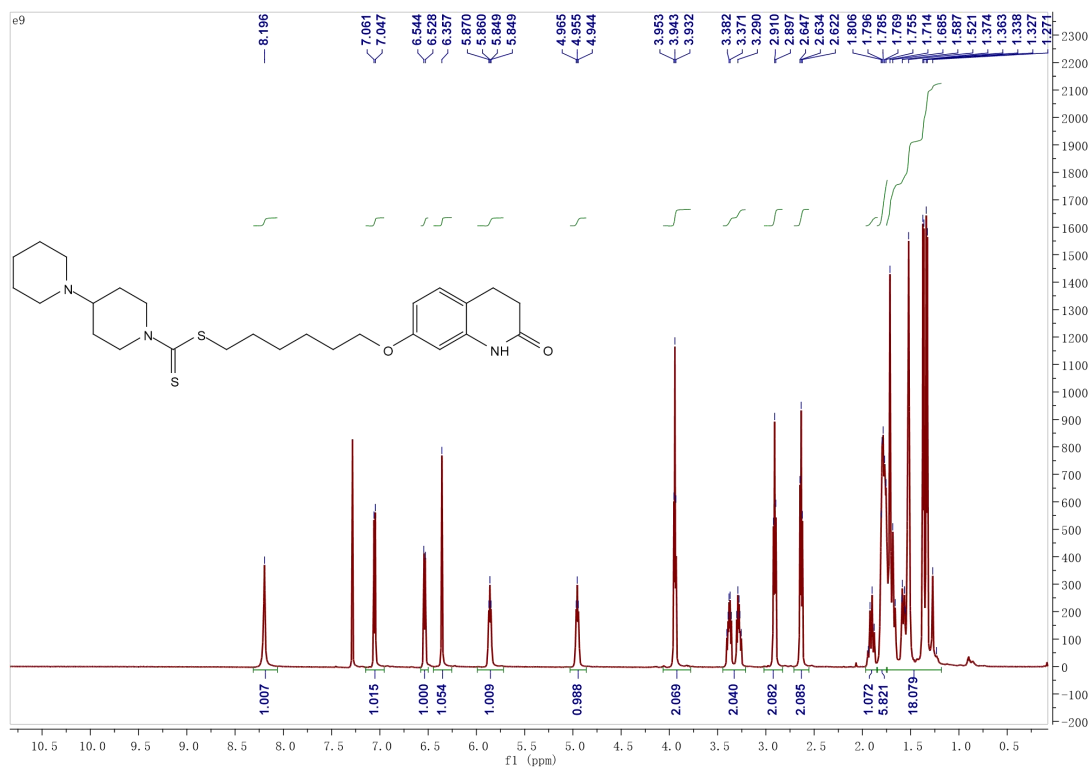


Figure S78  $^1\text{H}$  NMR chart of compound **3e9** in  $\text{CDCl}_3$ .

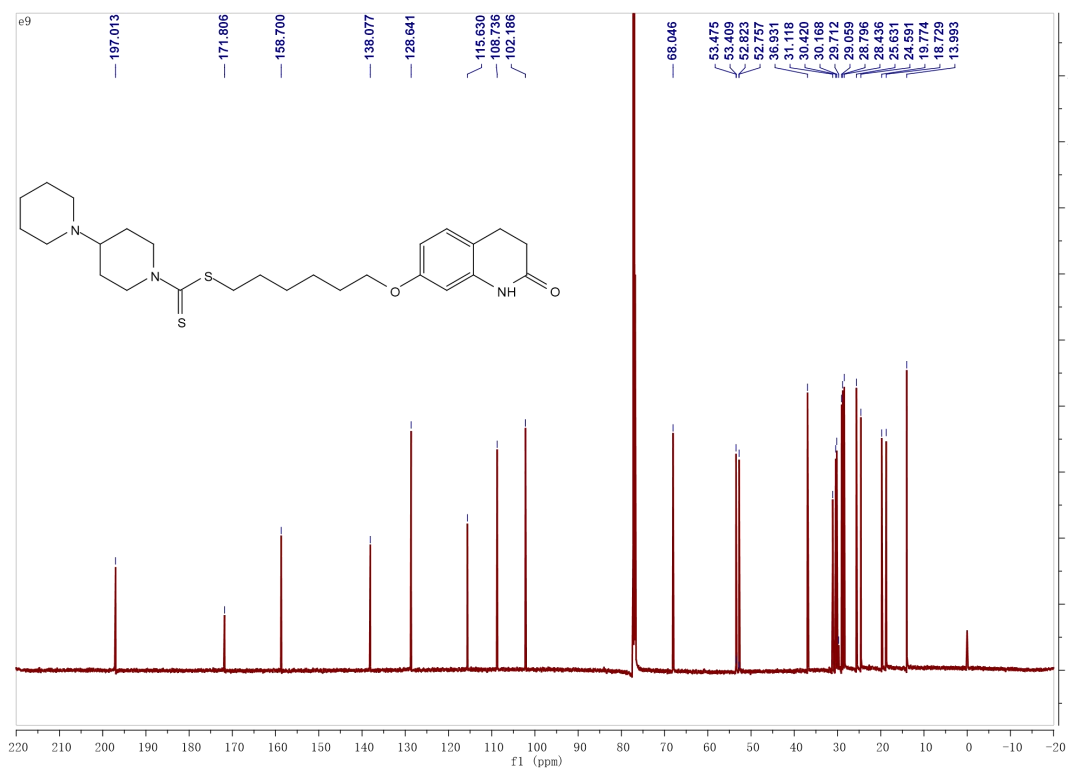
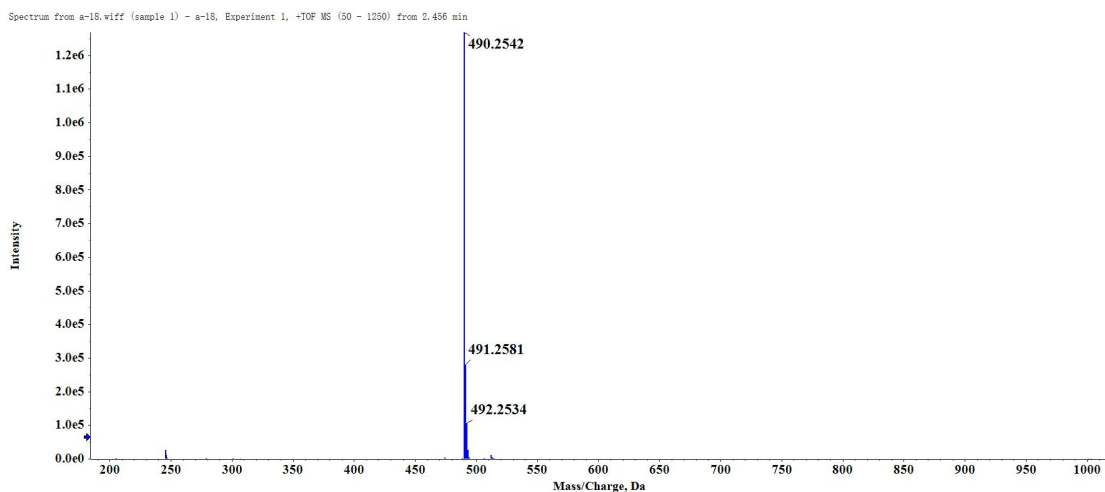
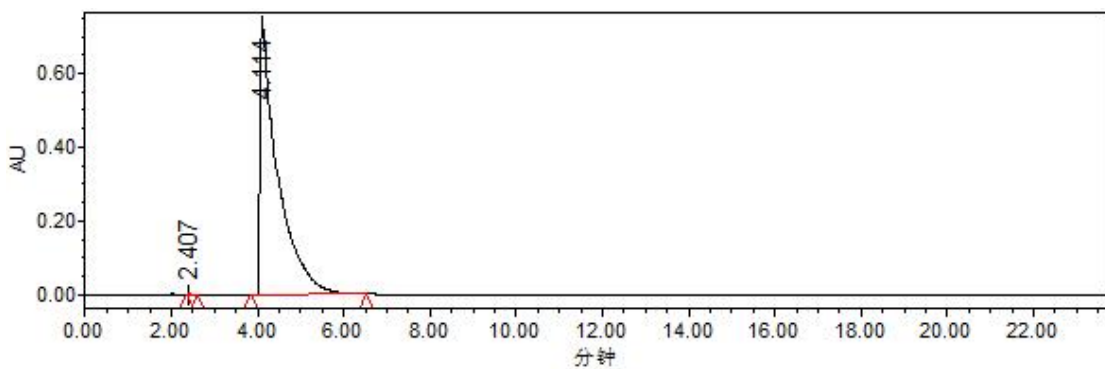


Figure S79  $^{13}\text{C}$  NMR chart of compound **3e9** in  $\text{CDCl}_3$ .



**Figure S80** HRMS (ESI) spectrum of compound **3e9**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		2.407	11916	0.06	2513
2		4.114	21233627	99.94	727678

**Figure S81** Chromatographic report of HPLC analysis of compound **3e9**.

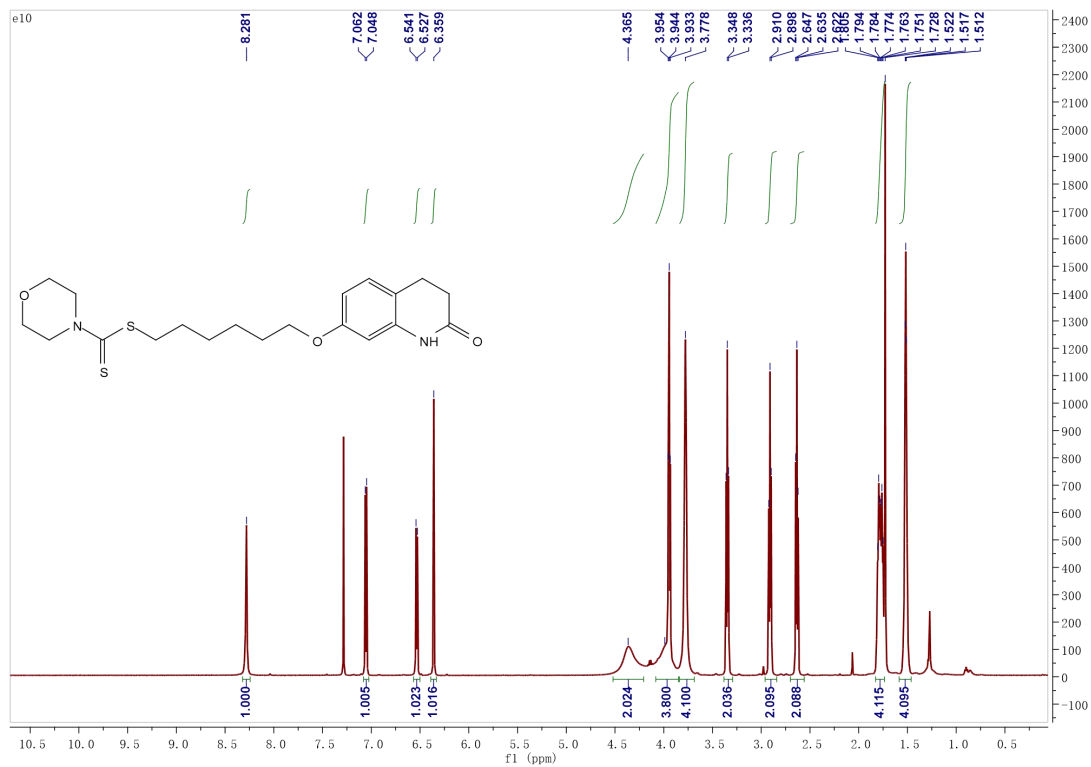


Figure S82 <sup>1</sup>H NMR chart of compound **3e<sub>10</sub>** in CDCl<sub>3</sub>.

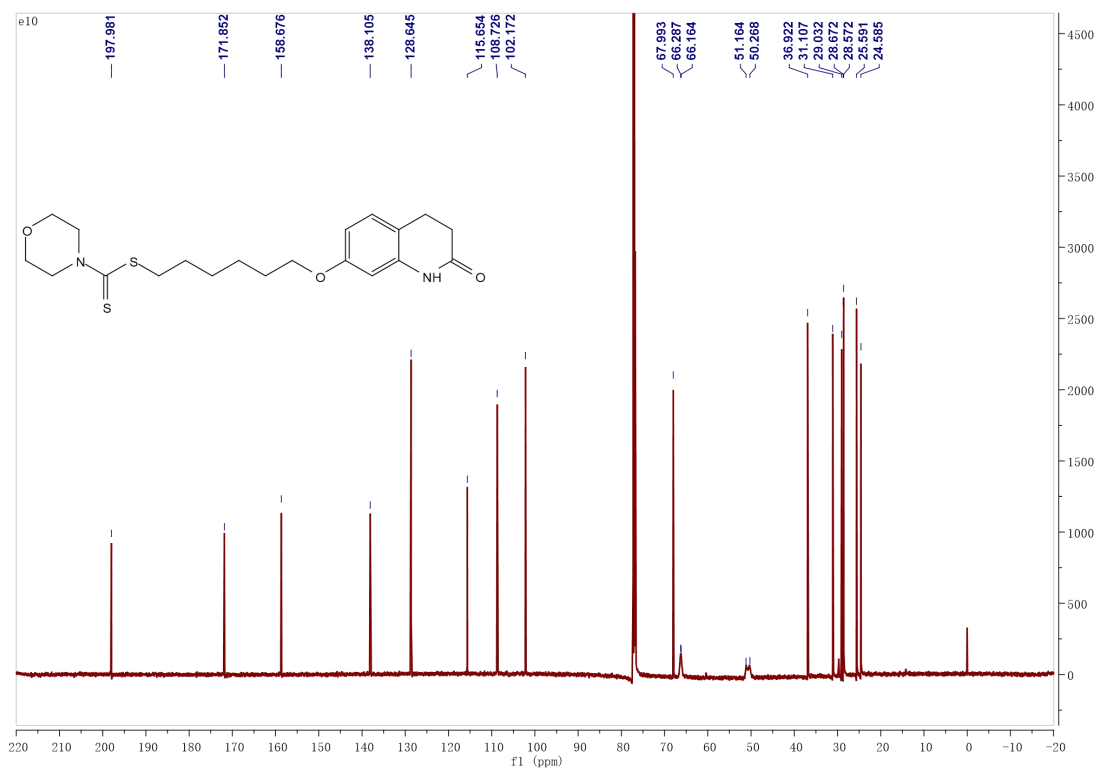


Figure S83 <sup>13</sup>C NMR chart of compound **3e<sub>10</sub>** in CDCl<sub>3</sub>.



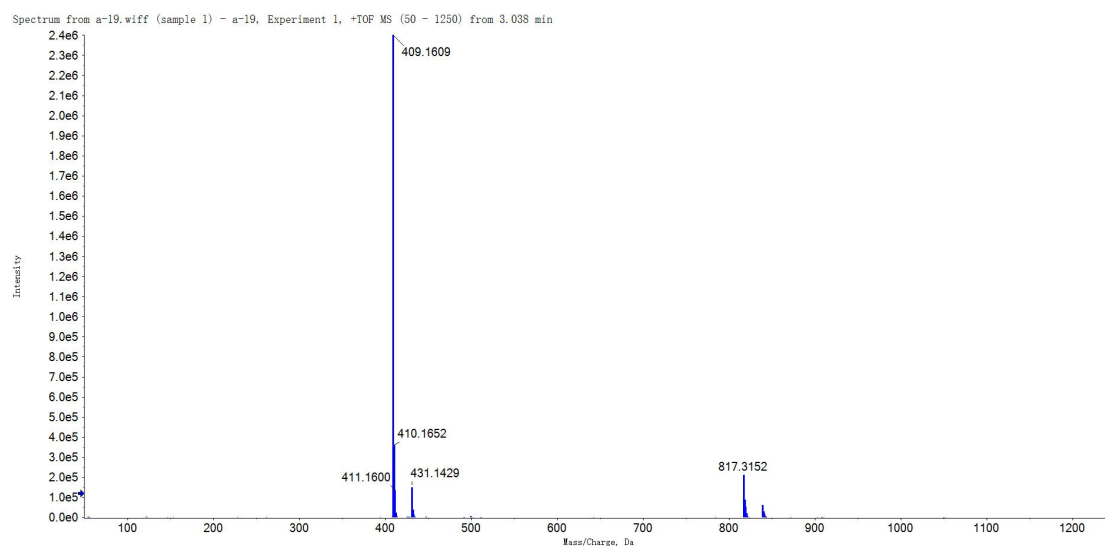
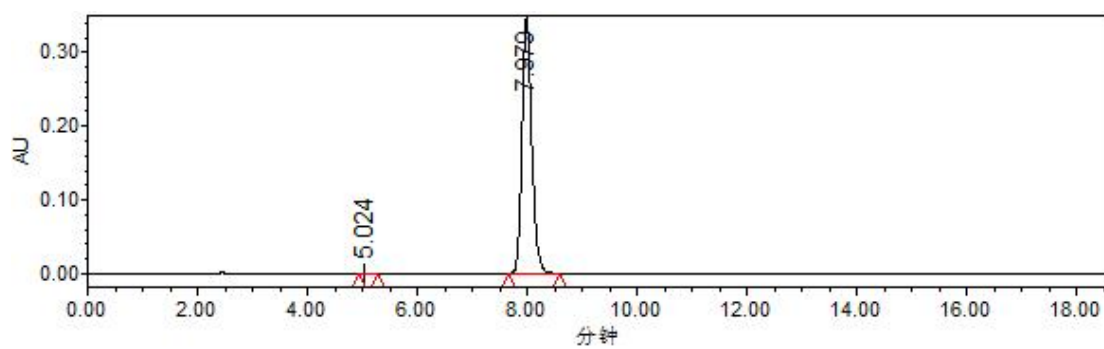


Figure S84 HRMS (ESI) spectrum of compound **3e<sub>10</sub>**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		5.024	3015	0.07	426
2		7.979	4325077	99.93	347322

Figure S85 Chromatographic report of HPLC analysis of compound **3e<sub>10</sub>**.

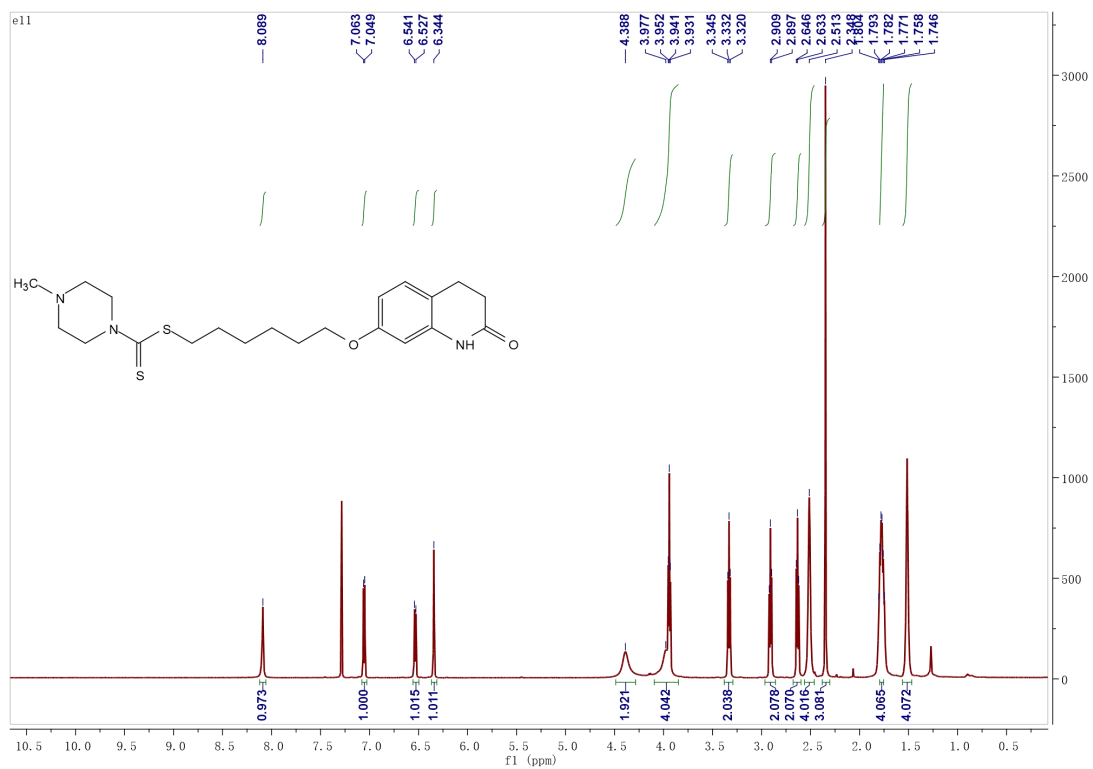


Figure S86 <sup>1</sup>H NMR chart of compound **3e<sub>11</sub>** in CDCl<sub>3</sub>.

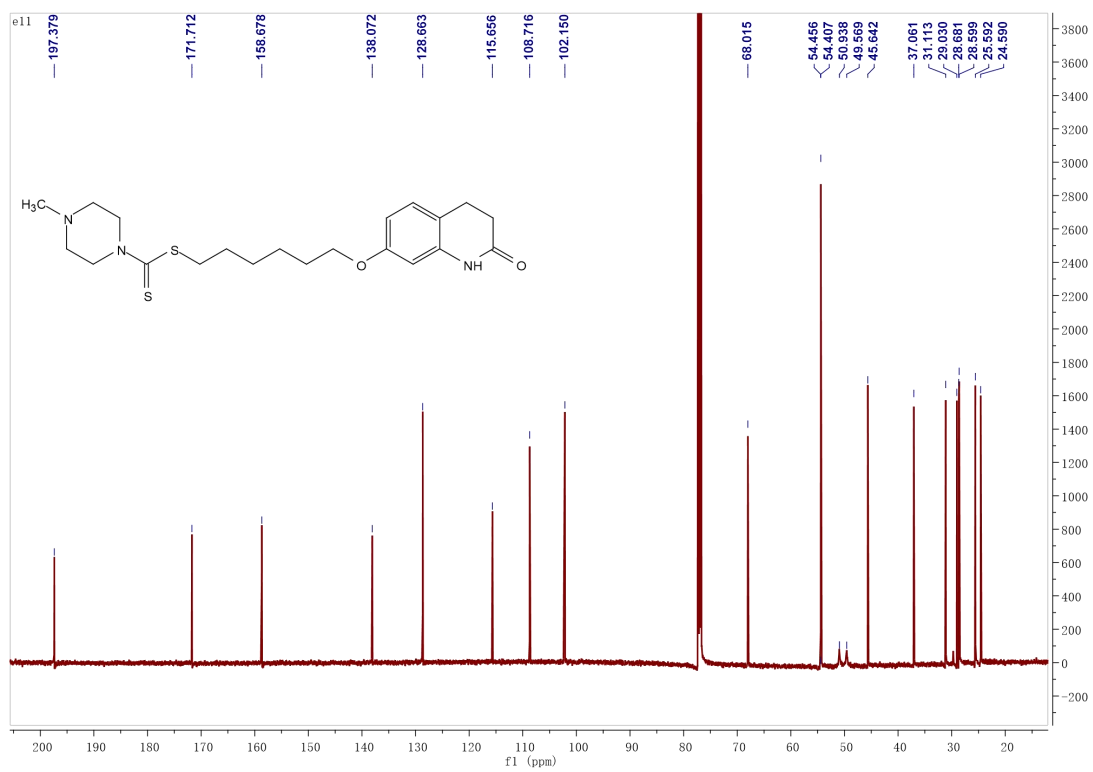
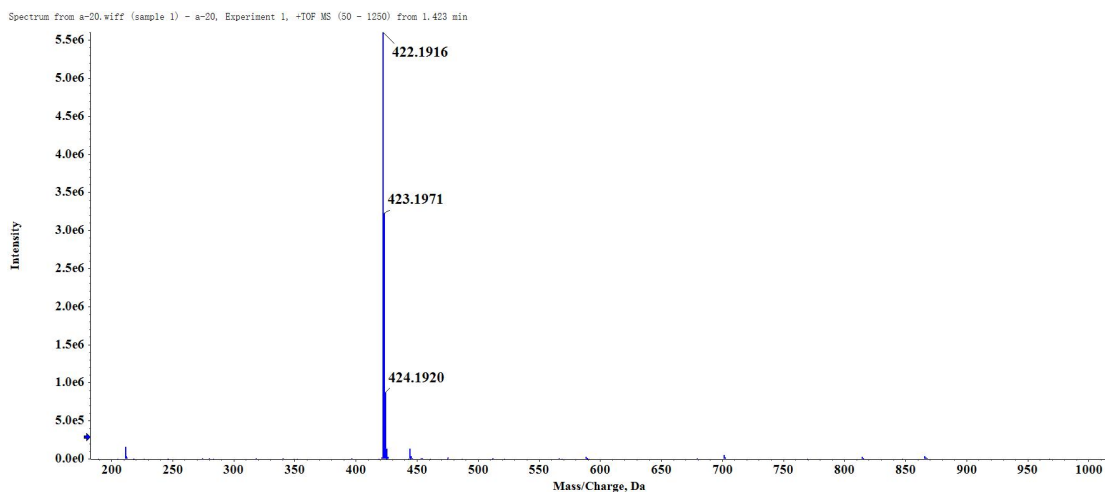
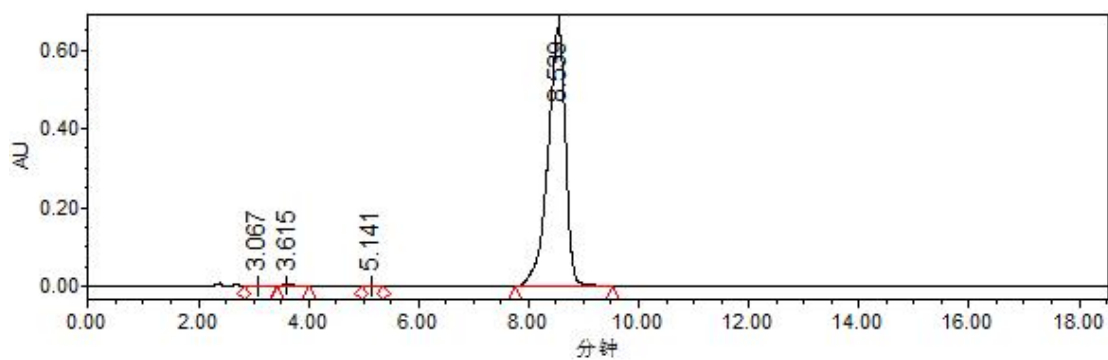


Figure S87 <sup>13</sup>C NMR chart of compound **3e<sub>11</sub>** in CDCl<sub>3</sub>.



**Figure S88** HRMS (ESI) spectrum of compound **3e<sub>11</sub>**.



	Name	Retention time	Area (mV*s)	%Area	Height (mV)
1		3.067	37862	0.26	1817
2		3.615	64059	0.44	4451
3		5.141	17595	0.12	1813
4		8.539	14533412	99.18	655479

**Figure S89** Chromatographic report of HPLC analysis of compound **3e<sub>11</sub>**.

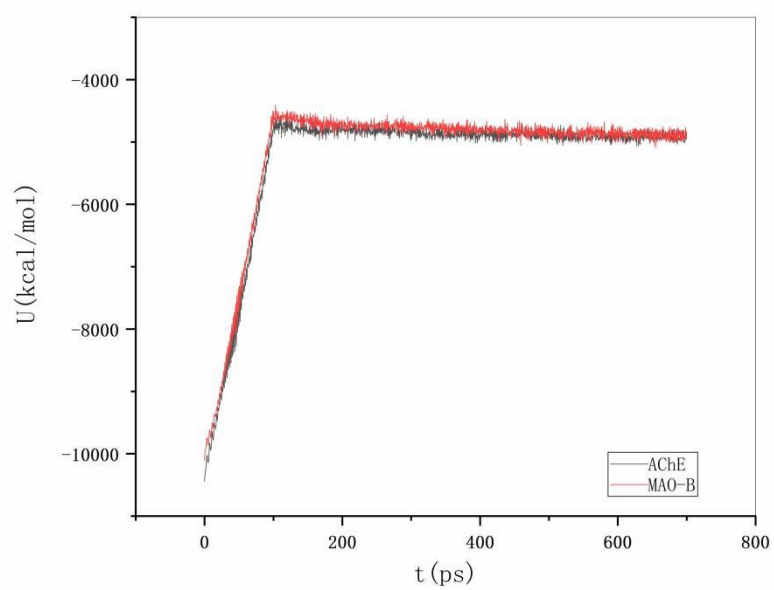
### 3. The error analysis of the HRMS results

**Table S1** The error analysis of the HRMS results of compound **3a-i**, **3e<sub>1</sub>-e<sub>11</sub>**

Compound	M <sub>0</sub>	M <sub>t</sub>	error analysis value (ppm) <sup>a</sup>
<b>3a</b>	351.1196	351.1196	0
<b>3b</b>	365.1352	365.1348	1.01
<b>3c</b>	379.1509	379.1497	3.16
<b>3d</b>	393.1665	393.1659	1.53
<b>3e</b>	407.1822	407.1821	0.25
<b>3f</b>	421.1978	421.1980	-0.47
<b>3g</b>	435.2135	435.2140	-1.15
<b>3h</b>	449.2291	449.2292	-0.22
<b>3i</b>	463.2448	463.245	-0.43
<b>3e<sub>1</sub></b>	367.1509	367.1506	0.82
<b>3e<sub>2</sub></b>	381.1665	381.1666	-0.26
<b>3e<sub>3</sub></b>	395.1822	395.181	3.04
<b>3e<sub>4</sub></b>	393.1665	393.1655	2.54
<b>3e<sub>5</sub></b>	421.1978	421.198	-0.47
<b>3e<sub>6</sub></b>	421.1978	421.1976	0.47
<b>3e<sub>7</sub></b>	435.2135	435.2131	0.92
<b>3e<sub>8</sub></b>	423.1771	423.1771	0
<b>3e<sub>9</sub></b>	490.2557	490.2542	3.06
<b>3e<sub>10</sub></b>	409.1614	409.1609	1.22
<b>3e<sub>11</sub></b>	422.1935	422.1916	4.50

Note: <sup>a</sup> error analysis value: error analysis value (ppm)=(M<sub>0</sub>-M<sub>t</sub>)/M<sub>0</sub>×10<sup>6</sup>; M<sub>0</sub>: theoretical value, M<sub>t</sub>: measured value.

#### 4. Molecular dynamics simulation



**Figure S90** The evaluation of potential energy of complex of **3e**-hAChE (marked in dark) and **3e**-hMAO-B (marked in red).