

Supporting Information

Design, Synthesis, Antifungal Evaluation of Cryptolepine Derivatives against Phytopathogenic Fungi

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1. *In vitro* EC₅₀ values of all synthetic compounds against four phytopathogenic fungi in detail.

Compound	<i>Sclerotinia sclerotiorum</i>				
	EC ₅₀ (µg/mL)	95% CI	Regression equation	R ²	Chi-square value
a1	5.507	4.057-7.306	Y=-1.04+1.41X	0.998	0.141
a2	1.246	0.681-1.870	Y=-0.11+1.33X	0.952	3.645
a3	1.038	0.380-1.814	Y=-0.02+0.95X	0.942	2.381
a4	3.136	1.121-5.792	Y=-0.63+1.24X	0.897	7.381
a5	5.466	1.353-16.252	Y=-0.95+1.66X	0.852	40.732
a6	>30	-	-	-	-
a7	3.248	2.620-3.933	Y=-1.23+2.45X	0.992	1.951
a8	3.099	2.381-3.886	Y=-0.98+2.00X	0.994	0.625
a9	6.306	5.008-7.889	Y=-1.49+1.85X	0.980	3.085
a10	4.472	3.420-5.694	Y=-1.11+1.69X	0.968	4.177
a11	12.119	9.849-15.176	Y=-2.25+2.07X	0.997	0.483
a12	2.445	1.859-3.071	Y=-0.83+2.11X	0.993	1.040
a13	1.852	1.761-2.748	Y=-0.76+2.69X	0.975	3.380
a14	2.714	1.931-3.572	Y=-0.67+1.58X	0.963	3.573
a15	2.520	2.011-3.062	Y=-1.06+2.69X	0.976	3.680
a16	1.283	0.876-1.703	Y=-0.25+2.13X	0.993	1.323
a17	1.193	0.747-1.666	Y=-0.16+1.80X	0.977	1.678
a18	1.353	0.903-1.823	Y=-0.35+2.06X	0.951	2.465
a19	1.424	0.540-2.356	Y=-0.19+1.90X	0.993	11.693
a20	1.664	1.340-1.992	Y=-0.57+2.71X	0.991	5.898
a21	1.148	0.685-1.576	Y=-0.12+3.14X	0.987	6.897
a22	17.933	12.492-28.236	Y=-3.15+2.50X	0.975	8.282
a23	2.177	1.588-2.805	Y=-0.58+1.78X	0.940	6.037
a24	1.476	1.279-2.313	Y=-0.48+1.95X	0.994	0.622
b1	>30	-	-	-	-

b2	>30	-	-	-	-
b3	>30	-	-	-	-
c1	8.217	4.406-15.927	$Y=-1.88+1.96X$	0.902	12.268
c2	>30	-	-	-	-
c3	>30	-	-	-	-
d1	24.250	20.635-29.610	$Y=-3.79+2.76X$	0.977	6.062
d2	8.682	6.492-11.575	$Y=-1.34+1.44X$	0.972	2.404
d3	21.263	14.439-36.163	$Y=-2.89+2.19X$	0.965	7.068
d4	25.083	20.864-31.067	$Y=-2.89+2.19X$	0.985	4.679
e1	>30	-	-	-	-
e2	>30	-	-	-	-
e3	>30	-	-	-	-
e4	>30	-	-	-	-
f1	3.302	2.640-4.029	$Y=-1.15+2.27X$	0.981	3.802
f2	3.226	2.475-4.232	$Y=-0.89+1.73X$	0.978	3.044
g1	>30	-	-	-	-
g2	>30	-	-	-	-
h1	2.498	1.969-3.060	$Y=-1.00+2.54X$	0.981	3.103
h2	6.706	5.476-8.190	$Y=-1.76+2.14X$	0.993	1.198
i1	>30	-	-	-	-
i2	>30	-	-	-	-
j1	19.421	13.473-25.939	$Y=-2.47+1.93X$	0.943	1.303

<i>Botrytis cinerea</i>					
Compound	EC ₅₀ (µg/mL)	95% CI	Regression equation	R ²	Chi-square value
a1	0.050	0.033-0.068	Y=1.68+1.28X	0.986	2.573
a2	0.037	0.023-0.047	Y=2.41+1.73X	0.978	5.509
a3	0.027	0.019-0.038	Y=2.43+1.53X	0.982	3.273
a4	3.954	2.923-5.003	Y=-1.00+1.68X	0.992	0.771
a5	0.034	0.025-0.047	Y=2.45+1.62X	0.976	5.214
a6	3.078	2.257-3.986	Y=-0.83+1.69X	0.968	3.591
a7	0.876	0.595-1.195	Y=-0.09+1.64X	0.981	2.597
a8	0.066	0.027-0.124	Y=-0.88+0.74X	0.955	4.590
a9	1.027	0.644-1.643	Y=-0.47+1.23X	0.972	2.361
a10	0.148	0.093-0.212	Y=1.17+1.46X	0.992	0.644
a11	2.115	1.377-2.917	Y=-0.47+1.44X	0.996	0.299
a12	0.042	0.028-0.059	Y=1.72+1.22X	0.987	7.042
a13	0.065	0.042-0.091	Y=1.89+1.69X	0.968	1.163
a14	0.068	0.041-0.101	Y=1.42+1.18X	0.992	1.329
a15	0.131	0.091-1.177	Y=1.22+1.35X	0.985	3.450
a16	0.041	0.020-0.067	Y=1.51+0.99X	0.949	7.321
a17	0.087	0.063-0.115	Y=1.95+1.79X	0.980	4.346
a18	0.159	0.095-0.238	Y=1.01+1.22X	0.983	12.280
a19	0.037	0.026-0.051	Y=2.13+1.52X	0.989	2.476
a20	0.034	0.023-0.046	Y=2.50+1.77X	0.958	6.134
a21	0.037	0.026-0.051	Y=2.23+1.58X	0.979	5.826
a22	0.047	0.032-0.065	Y=1.89+1.51X	0.959	4.192
a23	0.056	0.040-0.074	Y=1.90+1.46X	0.987	3.264

a24	0.071	0.049-0.096	$Y=1.89+1.55X$	0.957	6.823
b1	>30	-	-	-	-
b2	>30	-	-	-	-
b3	>30	-	-	-	-
c1	0.041	0.026-0.059	$Y=1.72+1.32X$	0.931	3.079
c2	>30	-	-	-	-
c3	>30	-	-	-	-
d1	3.970	3.225-4.804	$Y=-1.35+2.31X$	0.977	5.132
d2	1.655	0.603-2.822	$Y=-0.46+2.34X$	0.924	12.054
d3	1.198	0.774-1.642	$Y=-0.28+2.15X$	0.958	5.546
d4	3.303	2.580-4.099	$Y=-1.05+2.05X$	0.978	3.715
e1	>30	-	-	-	-
e2	>30	-	-	-	-
e3	>30	-	-	-	-
e4	>30	-	-	-	-
f1	1.450	0.762-2.165	$Y=-0.40+2.47X$	0.971	6.764
f2	1.513	1.057-1.988	$Y=-0.36+2.01X$	0.986	2.299
g1	>30	-	-	-	-
g2	>30	-	-	-	-
h1	1.644	0.545-2.915	$Y=-0.60+2.20X$	0.870	9.033
h2	1.938	1.432-2.469	$Y=-0.60+2.11X$	0.989	2.188
i1	>30	-	-	-	-
i2	>30	-	-	-	-
j1	>30	-	-	-	-

Fusarium graminearum

Compound	EC ₅₀ (µg/mL)	95% CI	Regression equation	R ²	Chi-square value
a1	21.838	18.198-26.887	Y=-3.38+2.52X	0.993	4.142
a2	13.728	11.486-16.939	Y=-3.20+2.77X	0.980	3.224
a3	10.912	8.526-14.821	Y=-1.72+1.65X	0.980	2.243
a4	>30	-	-	-	-
a5	18.920	11.555-38.205	Y=-3.21+2.49X	0.934	14.504
a6	20.815	17.734-24.841	Y=-3.99+3.03X	0.983	4.806
a7	>30	-	-	-	-
a8	>30	-	-	-	-
a9	>30	-	-	-	-
a10	26.669		Y=-4.06+2.83X	0.910	6.457
a11	21.970	13.903-43.146	Y=-3.24+2.40X	0.940	11.337
a12	>30	-	-	-	-
a13	>30	-	-	-	-
a14	>30	-	-	-	-
a15	>30	-	-	-	-
a16	>30	-	-	-	-
a17	>30	-	-	-	-
a18	>30	-	-	-	-
a19	>30	-	-	-	-
a20	>30	-	-	-	-
a21	>30	-	-	-	-
a22	>30	-	-	-	-
a23	>30	-	-	-	-
a24	>30	-	-	-	-
b1	>30	-	-	-	-
b2	>30	-	-	-	-

b3	>30	-	-	-	-
c1	>30	-	-	-	-
c2	>30	-	-	-	-
c3	>30	-	-	-	-
d1	14.069	10.179-20.360	$Y=-1.45+1.27X$	0.994	0.411
d2	20.752	15.320-30.616	$Y=-1.90+1.44X$	0.992	0.681
d3	24.000	20.360-31.407	$Y=-3.35+2.39X$	0.982	5.993
d4	>30	-	-	-	-
e1	>30	-	-	-	-
e2	23.996	18.610-31.098	$Y=-3.17+2.30X$	0.977	0.713
e3	21.892	16.360-28.663	$Y=-2.85+2.13X$	0.981	0.503
e4	>30	-	-	-	-
f1	5.599	1.698-9.258	$Y=-0.77+1.04X$	0.973	1.297
f2	14.712	9.694-21.714	$Y=-1.49+1.28X$	0.989	0.249
g1	>30	-	-	-	-
g2	>30	-	-	-	-
h1	16.914	12.484-23.256	$Y=-2.01+1.63X$	0.958	1.541
h2	>30	-	-	-	-
i1	>30	-	-	-	-
i2	>30	-	-	-	-
j1	22.188	15.340-31.223	$Y=-2.32+1.73X$	0.992	0.026

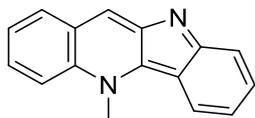
Rhizoctonia solani

Compound	EC ₅₀ (µg/mL)	95% CI	Regression equation	R ²	Chi-square value
a1	>30	-	-	-	-
a2	>30	-	-	-	-
a3	>30	-	-	-	-
a4	>30	-	-	-	-
a5	>30	-	-	-	-
a6	>30	-	-	-	-
a7	>30	-	-	-	-
a8	>30	-	-	-	-
a9	>30	-	-	-	-
a10	>30	-	-	-	-
a11	>30	-	-	-	-
a12	>30	-	-	-	-
a13	>30	-	-	-	-
a14	>30	-	-	-	-
a15	>30	-	-	-	-
a16	>30	-	-	-	-
a17	>30	-	-	-	-
a18	>30	-	-	-	-
a19	>30	-	-	-	-
a20	>30	-	-	-	-
a21	>30	-	-	-	-
a22	>30	-	-	-	-
a23	>30	-	-	-	-
a24	>30	-	-	-	-
b1	>30	-	-	-	-
b2	>30	-	-	-	-

b3	>30	-	-	-	-
c1	>30	-	-	-	-
c2	>30	-	-	-	-
c3	>30	-	-	-	-
d1	6.170	4.919-7.684	$Y=-1.50+1.90X$	0.987	2.107
d2	3.821	2.739-5.067	$Y=-0.83+1.45X$	0.960	3.620
d3	9.395	6.863-11.804	$Y=-1.43+1.51X$	0.989	1.005
d4	22.449	18.723- 30.845	$Y=-2.82+2.04X$	0.976	2.265
e1	>30	-	-	-	-
e2	>30	-	-	-	-
e3	>30	-	-	-	-
e4	>30	-	-	-	-
f1	3.632	2.843-4.511	$Y=-1.09+1.98X$	0.982	2.722
f2	5.321	4.114-6.765	$Y=-1.22+1.70X$	0.991	1.070
g1	>30	-	-	-	-
g2	>30	-	-	-	-
h1	9.911	8.007-12.408	$Y=-1.99+2.00X$	0.997	0.471
h2	18.649	14.117- 26.284	$Y=-1.98+1.55X$	0.991	0.918
i1	>30	-	-	-	-
i2	>30	-	-	-	-
j1	>30	-	-	-	-

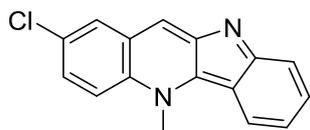
2. Physical properties of target compounds.

a1: 5-methyl-5*H*-indolo[3,2-*b*]quinoline (Cryptolepine)



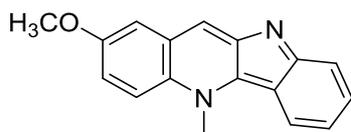
Yield: 34%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.88 (s, 1H), 8.56 (dd, $J = 11.2, 8.8$ Hz, 2H), 8.40 (dd, $J = 8.2, 1.4$ Hz, 1H), 7.90 (t, $J = 6.8$ Hz, 1H), 7.69 (dd, $J = 13.2, 7.9$ Hz, 2H), 7.54 (t, $J = 6.7$ Hz, 1H), 7.09 – 6.99 (m, 1H), 4.90 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 160.96, 145.31, 139.40, 133.11, 130.72, 129.96, 129.25, 126.58, 125.48, 124.80, 124.18, 119.59, 116.88, 116.85, 114.12, 39.67. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{12}\text{N}_2$ $[\text{M}+\text{H}]^+$: 233.1072; found: 233.2218.

a2: 2-chloro-5-methyl-5*H*-indolo[3,2-*b*]quinoline



Yield: 31%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.88 (s, 1H), 8.55 (d, $J = 9.6$ Hz, 1H), 8.51 (d, $J = 2.4$ Hz, 1H), 8.47 (d, $J = 8.5$ Hz, 1H), 7.86 (dd, $J = 9.4, 2.5$ Hz, 1H), 7.66 (d, $J = 8.5$ Hz, 1H), 7.55 (t, $J = 7.6$ Hz, 1H), 7.05 (t, $J = 7.5$ Hz, 1H), 4.90 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 160.94, 145.29, 139.88, 131.46, 131.30, 128.85, 128.49, 127.98, 125.66, 125.60, 125.19, 119.59, 119.37, 117.29, 114.15, 39.88. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{11}\text{ClN}_2$ $[\text{M}+\text{H}]^+$: 267.0611; found: 267.1808.

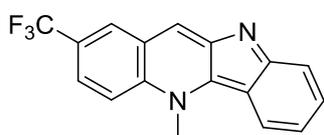
a3: 2-methoxy-5-methyl-5*H*-indolo[3,2-*b*]quinoline



Yield: 27%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.81 (s, 1H), 8.50 – 8.46

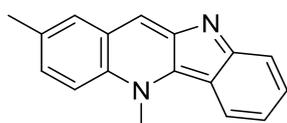
(m, 1H), 8.45 (d, $J = 5.5$ Hz, 1H), 7.85 – 7.75 (m, 1H), 7.64 (d, $J = 8.6$ Hz, 1H), 7.53 (dd, $J = 8.0, 5.7, 4.0$ Hz, 2H), 7.04 (t, $J = 7.5$ Hz, 1H), 4.91 (s, 3H), 3.95 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 160.18, 155.69, 145.29, 138.48, 130.41, 128.90, 126.33, 125.25, 124.93, 121.53, 119.17, 118.58, 116.59, 114.31, 107.25, 56.09, 39.48. MS-ESI m/z : calcd for $\text{C}_{17}\text{H}_{14}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 263.1106; found: 263.2067.

a4: 5-methyl-2-(trifluoromethyl)-5H-indolo[3,2-*b*]quinoline



Yield: 26%, purple solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.14 (s, 1H), 8.94 (s, 1H), 8.74 (d, $J = 9.4$ Hz, 1H), 8.53 (d, $J = 8.5$ Hz, 1H), 8.11 (dd, $J = 9.3, 2.2$ Hz, 1H), 7.70 (d, $J = 8.6$ Hz, 1H), 7.59 (dd, $J = 8.6, 6.6$ Hz, 1H), 7.15 – 7.04 (m, 1H), 4.97 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 160.12, 154.23, 145.35, 140.39, 133.87, 131.56, 128.11, 127.14, 125.76, 123.79, 123.56, 120.05 (q, $J = 21.6$ Hz), 118.81, 117.57, 114.14, 39.88, 39.66. MS-ESI m/z : calcd for $\text{C}_{17}\text{H}_{11}\text{F}_3\text{N}_2$ $[\text{M}+\text{H}]^+$: 301.0874; found: 301.2167.

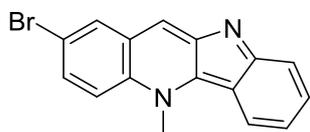
a5: 2,5-dimethyl-5H-indolo[3,2-*b*]quinoline



Yield: 21%, purple solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.82 (s, 1H), 8.48 (d, $J = 8.4$ Hz, 1H), 8.41 (d, $J = 9.1$ Hz, 1H), 8.12 (s, 1H), 7.74 (dd, $J = 9.2, 2.1$ Hz, 1H), 7.65 (d, $J = 8.5$ Hz, 1H), 7.55 (dd, $J = 8.6, 6.6$ Hz, 1H), 7.07 (t, $J = 7.6$ Hz, 1H), 4.88 (s, 3H), 2.57 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 158.94, 143.97, 138.89, 133.94, 131.93, 131.67, 130.83, 128.39, 125.66, 125.40, 125.16, 118.89, 117.14, 116.83, 114.07, 39.50,

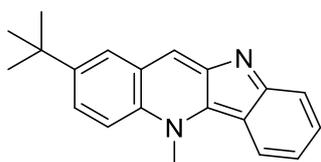
21.11. MS-ESI m/z: calcd for C₁₇H₁₄N₂ [M+H]⁺:247.1157; found:247.2256.

a6: 2-bromo-5-methyl-5H-indolo[3,2-b]quinoline



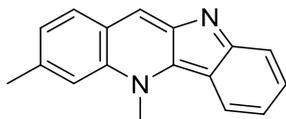
Yield: 27%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.91 (s, 1H), 8.69 (d, *J* = 2.7 Hz, 1H), 8.52 (s, 1H), 8.49 (d, *J* = 2.6 Hz, 1H), 7.98 (d, *J* = 9.5 Hz, 1H), 7.67 (d, *J* = 8.6 Hz, 1H), 7.57 (t, *J* = 7.6 Hz, 1H), 7.08 (t, *J* = 7.5 Hz, 1H), 4.92 (d, *J* = 3.8 Hz, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 157.26, 151.23, 146.38, 137.21, 135.60, 131.34, 130.18, 127.40, 123.05, 120.64, 117.51, 117.40, 115.57, 111.21, 97.16, 39.51. MS-ESI m/z: calcd for C₁₆H₁₁BrN₂ [M+H]⁺: 311.0106; found: 311.1138.

a7: 2-(*tert*-butyl)-5-methyl-5H-indolo[3,2-b]quinoline



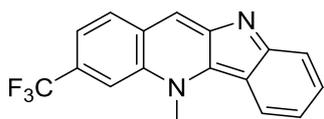
Yield: 22%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.96 (s, 1H), 8.52 (d, *J* = 8.4 Hz, 1H), 8.48 (d, *J* = 9.4 Hz, 1H), 8.34 (d, *J* = 2.2 Hz, 1H), 8.04 (dd, *J* = 9.4, 2.3 Hz, 1H), 7.67 (d, *J* = 8.5 Hz, 1H), 7.60 – 7.53 (m, 1H), 7.12 – 7.05 (m, 1H), 4.92 (s, 3H), 1.46 (s, 9H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 158.69, 146.92, 138.84, 132.02, 130.87, 128.70, 128.31, 126.54, 125.46, 124.72, 120.78, 118.78, 117.26, 116.94, 114.20, 97.06, 39.61, 35.54 (3C). MS-ESI m/z: calcd for C₂₀H₂₀N₂ [M+H]⁺: 289.1626; found: 289.1435.

a8: 3, 5-dimethyl-5H-indolo[3,2-b]quinoline



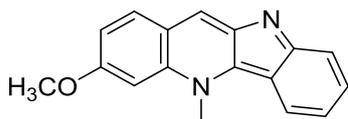
Yield: 26%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.82 (s, 1H), 8.48 (d, *J* = 8.4 Hz, 1H), 8.41 (d, *J* = 9.1 Hz, 1H), 8.12 (s, 1H), 7.74 (dd, *J* = 9.2, 2.1 Hz, 1H), 7.65 (d, *J* = 8.5 Hz, 1H), 7.55 (dd, *J* = 8.6, 6.6 Hz, 1H), 7.07 (t, *J* = 7.6 Hz, 1H), 4.88 (s, 3H), 2.57 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 158.94, 143.97, 138.89, 133.94, 131.93, 131.67, 130.83, 128.39, 125.66, 125.44, 125.16, 118.89, 117.14, 116.83, 114.23, 39.50, 21.11. MS-ESI *m/z*: calcd for C₁₇H₁₄N₂ [M+H]⁺: 247.1157; found: 247.2317.

a9: 5-methyl-3-(trifluoromethyl)-5H-indolo[3,2-*b*]quinoline



Yield: 28%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 9.04 (s, 1H), 8.88 (s, 1H), 8.64 (d, *J* = 8.6 Hz, 1H), 8.56 (d, *J* = 8.5 Hz, 1H), 7.96 (d, *J* = 8.6 Hz, 1H), 7.71 (d, *J* = 8.7 Hz, 1H), 7.61 (t, *J* = 7.6 Hz, 1H), 7.11 (t, *J* = 7.4 Hz, 1H), 5.03 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 161.26, 156.93, 141.68, 137.08, 135.70, 131.64, 130.18, 127.40, 126.27, 125.05(q, *J* = 22.3 Hz), 120.54, 118.70, 117.40, 117.27, 114.21, 104.35, 39.47. MS-ESI *m/z*: calcd for C₁₇H₁₁F₃N₂ [M+H]⁺: 301.0874; found: 301.0781.

a10: 3-methoxy-5-methyl-5H-indolo[3,2-*b*]quinoline



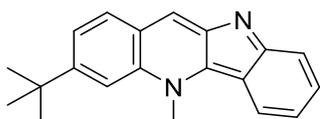
Yield: 22%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.92 (s, 1H), 8.49 (d, *J* = 8.5 Hz, 1H), 8.31 (d, *J* = 9.0 Hz, 1H), 7.72 (s, 1H), 7.66 (d, *J* = 8.6 Hz, 1H), 7.52 (t, *J*

= 7.7 Hz, 1H), 7.42 – 7.35 (m, 1H), 7.07 (t, $J = 7.6$ Hz, 1H), 4.86 (s, 3H), 4.08 (s, 3H).

^{13}C NMR (100 MHz, DMSO- d_6) δ : 159.32, 157.24, 144.39, 139.78, 133.33, 131.90, 129.38, 126.93, 123.18, 120.55, 119.38, 117.40, 116.72, 113.81, 97.16, 56.62, 39.51.

MS-ESI m/z : calcd for $\text{C}_{17}\text{H}_{14}\text{N}_2\text{O}$ $[\text{M}+\text{H}]^+$: 263.1106; found: 263.1927.

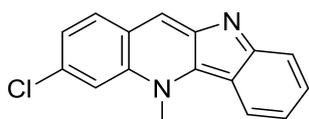
a11: 3-(*tert*-butyl)-5-methyl-5*H*-indolo[3,2-*b*]quinolone



Yield: 24%, purple solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.91 (s, 1H), 8.49 (d, $J = 8.5$ Hz, 1H), 8.34 (d, $J = 8.7$ Hz, 1H), 8.24 (s, 1H), 7.90 – 7.82 (m, 1H), 7.66 (d, $J = 8.6$ Hz, 1H), 7.53 (t, $J = 7.6$ Hz, 1H), 7.06 (t, $J = 7.5$ Hz, 1H), 4.92 (s, 3H), 1.50 (s, 9H).

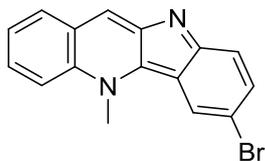
^{13}C NMR (100 MHz, DMSO- d_6) δ : 159.06, 152.85, 143.84, 139.02, 133.36, 130.56, 129.71, 126.34, 125.38, 123.40, 123.20, 119.16, 117.03, 114.21, 111.89, 39.23, 36.18, 31.45 (3C). MS-ESI m/z : calcd for $\text{C}_{20}\text{H}_{20}\text{N}_2$ $[\text{M}+\text{H}]^+$: 289.1626; found: 289.1773.

a12: 3-chloro-5-methyl-5*H*-indolo[3,2-*b*]quinoline



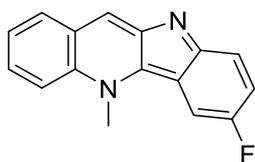
Yield: 33%, purple solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.82 (s, 1H), 8.56 (dd, $J = 9.8, 4.6$ Hz, 1H), 8.41 (s, 1H), 8.13 (d, $J = 9.3$ Hz, 1H), 7.79 (t, $J = 9.1$ Hz, 1H), 7.65 – 7.51 (m, 2H), 7.08 (t, $J = 7.5$ Hz, 1H), 4.84 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 160.04, 157.61, 154.07, 140.25, 138.98, 132.54, 131.08, 125.91, 124.49, 120.00, 119.12, 116.65, 113.88, 112.69, 112.46, 40.27. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{11}\text{ClN}_2$ $[\text{M}+\text{H}]^+$: 268.0581; found: 268.1989.

a13: 7-bromo-5-methyl-5H-indolo[3,2-b]quinoline



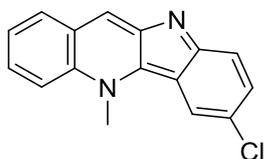
Yield: 32%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 9.05 (s, 1H), 8.70 (s, 1H), 8.58 (d, $J = 9.0$ Hz, 1H), 8.44 (d, $J = 8.3$ Hz, 1H), 8.02 – 7.87 (m, 1H), 7.74 (t, $J = 7.5$ Hz, 1H), 7.69 – 7.60 (m, 2H), 4.92 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$): δ 172.5, 137.85, 134.70, 134.64, 131.51, 130.30, 127.68, 127.68, 127.30, 125.99, 125.91, 118.84, 117.67, 115.57, 110.97, 41.26. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{11}\text{BrN}_2$ $[\text{M}+\text{H}]^+$: 311.0106; found: 311.0507.

a14: 7-fluoro-5-methyl-5H-indolo[3,2-b]quinoline



Yield: 27%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 9.01 (s, 1H), 8.53 (d, $J = 9.1$ Hz, 1H), 8.40 (d, $J = 8.3$ Hz, 1H), 8.29 (d, $J = 10.5$ Hz, 1H), 7.93 (t, $J = 7.9$ Hz, 1H), 7.70 (m, 2H), 7.48 (t, $J = 7.2$ Hz, 1H), 4.88 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 162.34, 159.57, 155.34, 143.28, 140.36, 134.51, 132.59, 127.62, 125.38, 123.06, 119.44, 117.24, 115.26, 113.12, 112.66, 41.04. m/z : calcd for $\text{C}_{16}\text{H}_{11}\text{FN}_2$ $[\text{M}+\text{H}]^+$: 251.0906; found: 251.0689.

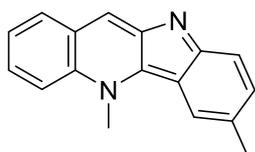
a15: 7-chloro-5-methyl-5H-indolo[3,2-b]quinoline



Yield: 21%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 9.05 (s, 1H), 8.65 – 8.55

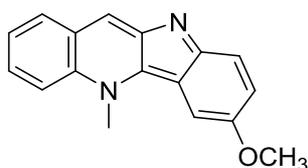
(m, 2H), 8.43 (d, $J = 8.2$ Hz, 1H), 7.96 (t, $J = 8.7$ Hz, 1H), 7.72 (m, 2H), 7.54 (dd, $J = 9.1, 2.1$ Hz, 1H), 4.92 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 159.54, 158.36, 156.19, 141.28, 137.38, 133.0, 131.48, 127.19, 125.69, 123.26, 121.46, 118.68, 115.74, 113.64, 111.32, 40.62. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{11}\text{ClN}_2$ $[\text{M}+\text{H}]^+$: 268.0611; found: 268.1989.

a16: 5,7-dimethyl-5H-indolo[3,2-*b*]quinoline



Yield: 21%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.90 (s, 1H), 8.50 (d, $J = 9.0$ Hz, 1H), 8.38 (d, $J = 8.2$ Hz, 1H), 8.25 (s, 1H), 7.91 (t, $J = 7.9$ Hz, 1H), 7.69 (t, $J = 7.5$ Hz, 1H), 7.58 (d, $J = 8.7$ Hz, 1H), 7.40 (d, $J = 8.7$ Hz, 1H), 4.88 (s, 3H), 2.48 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 157.55, 143.58, 138.55, 133.56, 133.41, 129.98, 129.59, 126.20, 126.07, 124.79, 124.39, 124.07, 118.61, 116.95, 113.89, 39.31, 21.79. MS-ESI m/z : calcd for $\text{C}_{17}\text{H}_{14}\text{N}_2$ $[\text{M}+\text{H}]^+$: 247.1157; found: 247.0727.

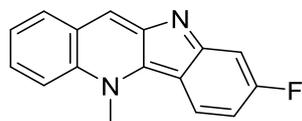
a17: 7-methoxy-5-methyl-5H-indolo[3,2-*b*]quinoline



Yield: 24%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.98 (s, 1H), 8.54 (d, $J = 9.0$ Hz, 1H), 8.41 (d, $J = 8.2$ Hz, 1H), 7.95 (t, $J = 7.9$ Hz, 1H), 7.88 (d, $J = 2.5$ Hz, 1H), 7.73 – 7.64 (m, 2H), 7.35 (dd, $J = 2.5$ Hz, 1H), 4.94 (s, 3H), 3.93 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 157.56, 147.89, 141.35, 133.38, 129.10, 127.43, 127.23, 125.87, 124.63, 123.55, 119.25, 118.40, 117.06, 115.72, 111.46, 55.36, 39.56. MS-ESI

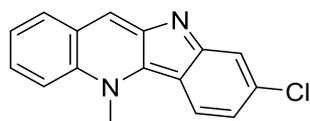
m/z: calcd for C₁₇H₁₄N₂O [M+H]⁺: 263.1106; found: 263.1298.

a18: 8-fluoro-5-methyl-5H-indolo[3,2-b]quinoline



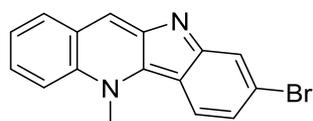
Yield: 23%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.89 (s, 1H), 8.54 – 8.49 (m, 2H), 8.36 (d, *J* = 8.3, 1H), 7.93 (t, *J* = 6.8 Hz, 1H), 7.71 (t, *J* = 7.9 Hz, 1H), 7.29 (d, *J* = 11.0, 1H), 6.94 (t, *J* = 9.1 Hz, 1H), 4.84 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 154.80, 150.22, 146.30, 139.35, 138.02, 130.94, 129.67, 128.51, 127.55, 126.19, 125.97, 119.25, 117.22, 114.35, 110.30, 40.54. MS-ESI m/z: calcd for C₁₆H₁₁FN₂ [M+H]⁺ : 251.0906; found: 251.1054.

a19: 8-chloro-5-methyl-5H-indolo[3,2-b]quinoline



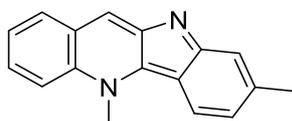
Yield: 25%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 9.03 (s, 1H), 8.65 – 8.51 (m, 2H), 8.43 (d, *J* = 8.2 Hz, 1H), 8.06 – 7.90 (m, 1H), 7.71 (dd, *J* = 13.9, 8.2 Hz, 2H), 7.52 (dd, *J* = 9.1, 2.2 Hz, 1H), 4.92 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 158.06, 157.25, 152.05, 143.46, 140.28, 134.62, 133.48, 127.82, 125.26, 123.58, 121.16, 118.72, 115.83, 113.37, 112.43, 39.67. MS-ESI m/z: calcd for C₁₆H₁₁ClN₂ [M+H]⁺ : 267.0611; found: 267.0152.

a20: 8-bromo-5-methyl-5H-indolo[3,2-b]quinoline



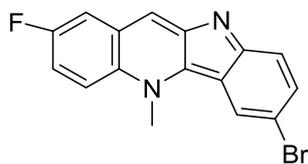
Yield: 21%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.98 (s, 1H), 8.53 (dd, $J = 10.8, 9.0$ Hz, 2H), 8.44 – 8.35 (m, 1H), 7.94 (s, 1H), 7.81 – 7.56 (m, 2H), 7.02 (dd, $J = 8.9, 2.0$ Hz, 1H), 4.91 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 160.40, 145.64, 135.49, 133.47, 130.08, 129.76, 129.21, 127.38, 127.04, 125.15, 124.57, 118.25, 117.09, 117.05, 112.98, 39.61. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{11}\text{BrN}_2$ $[\text{M}+\text{H}]^+$: 310.0106; found: 310.0925.

a21: 5,8-methyl-5H-indolo[3,2-*b*]quinoline



Yield: 21%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.94 (s, 1H), 8.52 (d, $J = 8.5$ Hz, 1H), 8.35 (s, 1H), 8.31 (d, $J = 8.4$ Hz, 1H), 7.67 (d, $J = 8.4$ Hz, 1H), 7.58 (d, $J = 1.3$ Hz, 1H), 7.56 (t, $J = 1.6$ Hz, 1H), 7.09 (m, 1H), 4.90 (s, 3H), 2.69 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 158.14, 144.04, 138.66, 133.51, 133.37, 130.00, 129.48, 126.31, 125.89, 124.75, 124.29, 124.09, 118.91, 116.95, 113.94, 39.31, 31.82. MS-ESI m/z : calcd for $\text{C}_{17}\text{H}_{14}\text{N}_2$ $[\text{M}+\text{H}]^+$: 247.1157; found: 247.0405.

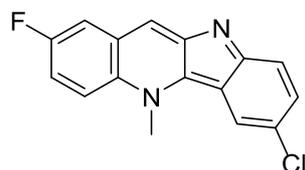
a22: 7-bromo-2-fluoro-5-methyl-5H-indolo[3,2-*b*]quinoline



Yield: 17%, purple solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.75 (s, 1H), 8.55 (dd, $J = 9.8, 4.7$ Hz, 1H), 8.44 (dd, $J = 9.2, 5.9$ Hz, 1H), 8.12 (dd, $J = 9.5, 3.0$ Hz, 1H), 7.77 (t, $J = 9.7$ Hz, 1H), 7.23 (dd, $J = 11.3, 2.5$ Hz, 1H), 6.84 (t, $J = 9.2$ Hz, 1H), 4.82 (s, 3H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 159.54, 157.12, 146.13, 139.83, 137.54, 130.05,

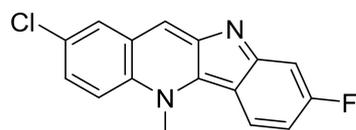
127.77, 125.66, 119.86, 118.50, 112.54, 111.52, 107.09, 106.83, 102.58, 39.89. MS-ESI
m/z: calcd for C₁₆H₁₀BrFN₂ [M+H]⁺: 330.1724; found: 330.2136.

a23: 8-chloro-2-fluoro-5-methyl-5H-indolo[3,2-b]quinoline



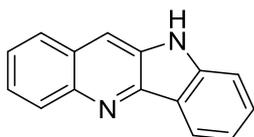
Yield: 21%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 8.95 (s, 1H), 8.57 (dd, *J* = 9.7, 2.4 Hz, 1H), 8.53 (d, *J* = 2.7 Hz, 1H), 8.28 (t, *J* = 8.5, Hz, 1H), 7.89 (dd, *J* = 9.5, 2.6 Hz, 1H), 7.70 (m, 1H), 7.49 (t, *J* = 9.2 Hz, 1H), 4.87 (d, *J* = 2.5 Hz, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 156.26, 143.08, 134.99, 134.34, 132.92, 132.13, 128.42, 127.47, 124.87, 123.58, 123.32, 120.70, 115.24, 113.82, 111.52, 40.93. MS-ESI m/z: calcd for C₁₆H₁₀ClFN₂ [M+H]⁺: 285.0217; found:285.0389.

a24:2-chloro-8-fluoro-5-methyl-5H-indolo[3,2-b]quinoline



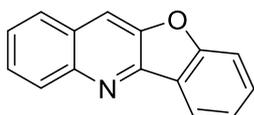
Yield: 21%, purple solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ: 9.00 (s, 1H), 8.68 (dd, *J* = 9.8, 4.7 Hz, 1H), 8.58 (d, *J* = 2.0 Hz, 1H), 8.25 (dd, *J* = 9.4, 3.1 Hz, 1H), 7.95 – 7.83 (m, 1H), 7.70 (d, *J* = 9.0 Hz, 1H), 7.57 (dd, *J* = 9.0, 2.1 Hz, 1H), 4.94 (s, 3H). ¹³C NMR (100 MHz, DMSO-*d*₆) δ: 146.50, 144.62, 144.27, 130.92, 130.61, 129.68, 127.40, 126.90, 124.10, 122.63, 122.23, 121.61, 120.77, 118.54, 112.52, 39.25. MS-ESI m/z: calcd for C₁₆H₁₀ClFN₂ [M+H]⁺: 285.0217; found:285.0389.

b1: 10H-indolo[3,2-b]quinoline



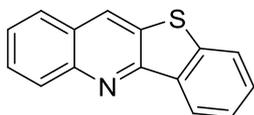
Yield: 45%, white solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 11.43 (s, 1H), 8.37 (d, $J = 7.7$ Hz, 1H), 8.29 (s, 1H), 8.21 (d, $J = 8.5$ Hz, 1H), 8.16 – 8.07 (m, 1H), 7.73 – 7.53 (m, 4H), 7.35 – 7.23 (m, 1H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 146.23, 144.54, 143.91, 132.95, 130.17, 129.20, 127.98, 127.22, 126.50, 125.33, 121.84, 121.49, 119.82, 113.48, 112.00. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_{10}\text{N}_2$ $[\text{M}+\text{H}]^+$: 219.0844; found: 219.1694.

b2: benzofuro[3,2-*b*]quinoline



Yield: 33%, white solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 8.62 (s, 1H), 8.39 – 8.33 (m, 1H), 8.26 (d, $J = 8.5$ Hz, 1H), 8.17 (dd, $J = 8.3, 1.5$ Hz, 1H), 7.87 – 7.74 (m, 3H), 7.68 (t, $J = 8.1$ Hz, 1H), 7.61 – 7.50 (m, 1H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 159.37, 147.61, 146.97, 146.00, 131.93, 129.22, 128.80, 128.68, 127.61, 126.70, 124.49, 122.68, 122.39, 115.39, 112.97. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_9\text{ON}$ $[\text{M}+\text{H}]^+$: 220.0684; found: 220.1809.

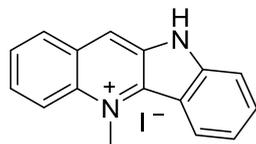
b3: benzo[4,5]thieno[3,2-*b*]quinoline



Yield: 42%, white solid. ^1H NMR (400 MHz, $\text{DMSO-}d_6$) δ : 9.07 (s, 1H), 8.56 (d, $J = 8.0$ Hz, 1H), 8.24 (d, $J = 8.5$ Hz, 1H), 8.11 (t, $J = 8.2$ Hz, 2H), 7.84 (t, $J = 8.4$ Hz, 1H), 7.76 – 7.71 (m, 1H), 7.71 – 7.65 (m, 1H), 7.62 (d, $J = 7.4$ Hz, 1H). ^{13}C NMR (100 MHz, $\text{DMSO-}d_6$) δ : 153.56, 146.28, 141.27, 133.87, 131.39, 130.85, 130.47, 129.81, 129.33,

128.04, 126.91, 126.81, 125.93, 124.19, 123.91. MS-ESI m/z : calcd for $C_{15}H_9SN$
[$M+H$] $^+$: 236.0456; found: 236.1200.

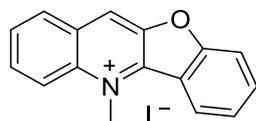
c1: 5-methyl-10H-indolo[3,2-*b*]quinolin-5-ium iodide



Yield: 36%, yellow solid. 1H NMR (400 MHz, $DMSO-d_6$) δ : 11.53 (s, 1H), 9.30 (s, 1H), 8.82 (d, $J = 8.5$ Hz, 1H), 8.78 (d, $J = 9.1$ Hz, 1H), 8.59 (d, $J = 8.3$ Hz, 1H), 8.18 (t, $J = 8.8$, Hz, 1H), 8.00 – 7.92 (m, 2H), 7.86 (d, $J = 8.4$ Hz, 1H), 7.53 (t, $J = 7.7$ Hz, 1H), 5.05 (s, 3H). ^{13}C NMR (100 MHz, $DMSO-d_6$) δ : 146.24, 138.58, 135.81, 134.43, 133.78, 132.89, 130.31, 127.54, 126.78, 126.70, 125.32, 121.86, 118.33, 114.35, 113.69, 40.71.

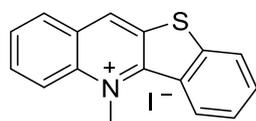
MS-ESI m/z : calcd for $C_{16}H_{13}N_2^+$ [M] $^+$: 233.1165; found: 233.0908.

c2: 5-methylbenzofuro[3,2-*b*]quinolin-5-ium iodide



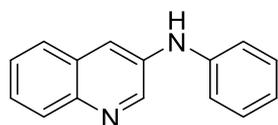
Yield: 36%, yellow solid. 1H NMR (400 MHz, $DMSO-d_6$) δ : 9.66 (s, 1H), 8.90 (d, $J = 8.2$ Hz, 1H), 8.84 (d, $J = 9.1$ Hz, 1H), 8.59 (dd, $J = 8.3, 1.5$ Hz, 1H), 8.30 (t, $J = 8.8$ Hz, 1H), 8.19 – 8.13 (m, 2H), 8.12 – 8.03 (m, 1H), 7.81 (t, $J = 8.2$, Hz, 1H), 5.02 (s, 3H). ^{13}C NMR (100 MHz, $DMSO-d_6$) δ : 160.30, 147.98, 143.28, 137.42, 136.70, 134.59, 130.96, 129.30, 127.73, 127.30, 126.18, 126.03, 118.95, 116.85, 114.15, 41.13. MS-ESI m/z : calcd for $C_{16}H_{12}ON^+$ [M] $^+$: 234.0925; found: 234.2108.

c3: 5-methylbenzo[4,5]thieno[3,2-*b*]quinolin-5-ium iodide



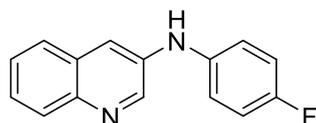
Yield: 47%, yellow solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.76 (s, 1H), 8.97 (d, J = 8.2 Hz, 1H), 8.90 (d, J = 9.1 Hz, 1H), 8.73 (dd, J = 8.3, 1.5 Hz, 1H), 8.44 (t, J = 8.8 Hz, 1H), 8.32 – 8.26 (m, 2H), 8.22 – 8.17 (m, 1H), 7.88 (dd, J = 8.4, 2.6 Hz, 1H), 5.02 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 163.27, 150.23, 144.25, 140.42, 138.28, 135.11, 133.27, 130.33, 128.76, 127.48, 126.27, 126.11, 117.45, 116.42, 115.19, 41.64. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{12}\text{SN}^+$ $[\text{M}]^+$: 250.0765; found: 250.3482.

d1: *N*-phenylquinolin-3-amine



Yield: 82%, white solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.58 (s, 1H), 8.72 (d, J = 2.7 Hz, 1H), 8.01 (d, J = 2.6 Hz, 1H), 7.93 (d, J = 2.1 Hz, 1H), 7.85 (d, J = 2.8 Hz, 1H), 7.81 – 7.77 (m, 2H), 7.47 (dd, J = 6.3, 3.3 Hz, 2H), 7.34 (dd, J = 8.5, 7.2 Hz, 2H), 6.96 (t, J = 7.2 Hz, 1H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 150.24, 147.62, 147.43, 142.67, 134.65, 133.96, 133.67, 132.05, 131.82, 130.88, 126.19, 125.23, 122.77, 118.99, 116.34. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_{12}\text{N}_2$ $[\text{M}+\text{H}]^+$: 221.1074; found: 221.1878.

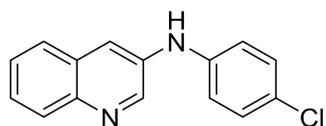
d2: *N*-(4-fluorophenyl)-quinolin-3-amine



Yield, 81%, white solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.68 (d, J = 2.3 Hz, 2H), 7.86 (dd, J = 6.2, 3.4 Hz, 1H), 7.81 – 7.71 (m, 2H), 7.47 (t, J = 6.3, Hz, 2H), 7.27 (dd, J = 8.9, 4.8 Hz, 2H), 7.18 (t, J = 8.6 Hz, 2H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 156.28, 145.22, 142.79, 138.94, 138.42, 129.24, 128.92, 127.31, 126.98, 126.03,

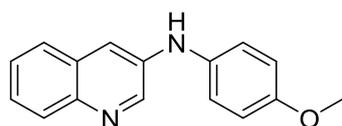
120.40, 120.32, 116.58, 116.36, 113.35. MS-ESI m/z : calcd for $C_{15}H_{11}FN_2$ $[M+H]^+$: 239.0906; found: 239.1086.

d3: *N*-(4-chlorophenyl)-quinolin-3-amine



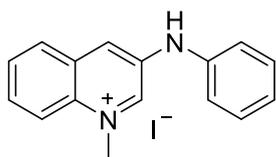
Yield, 73%; white solid. 1H NMR (400 MHz, DMSO- d_6) δ : 8.84 (s, 1H), 8.70 (d, $J = 2.7$ Hz, 1H), 7.88 (dd, $J = 7.3, 3.4$ Hz, 2H), 7.84 – 7.78 (m, 1H), 7.53 – 7.45 (m, 2H), 7.33 (dd, $J = 7.7, 2.7$ Hz, 2H), 7.25 (d, $J = 8.9$ Hz, 2H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 155.37, 145.60, 143.11, 141.84, 137.36, 129.68, 129.08, 128.94, 127.37, 127.17, 126.46, 124.48, 119.24, 115.23, 115.18. MS-ESI m/z : calcd for $C_{15}H_{11}ClN_2$ $[M+H]^+$: 255.0611; found: 255.0790.

d4: *N*-(4-methoxyphenyl)-quinolin-3-amine



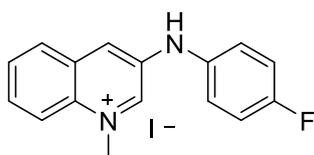
Yield: 77%, yellow solid. 1H NMR (400 MHz, DMSO- d_6) δ : 8.64 (d, $J = 2.8$ Hz, 1H), 8.45 (s, 1H), 7.84 (dd, $J = 7.2, 2.4$ Hz, 1H), 7.73 – 7.66 (m, 1H), 7.57 (d, $J = 2.8$ Hz, 1H), 7.47 – 7.37 (m, 2H), 7.18 (dd, $J = 7.4, 2.6$ Hz, 2H), 7.01 – 6.91 (m, 2H), 3.76 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 155.06, 144.89, 142.37, 139.59, 135.21, 129.45, 129.23, 128.89, 127.23, 127.11, 126.74, 125.46, 121.56, 115.21, 111.54, 55.71. MS-ESI m/z : calcd for $C_{16}H_{14}N_2O$ $[M+H]^+$: 251.1106; found: 251.1295.

e1: 1-methyl-3-(phenylamino)quinolin-1-ium iodide



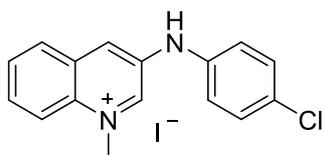
Yield: 65%, yellow solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.36 (s, 1H), 9.19 (d, J = 2.5 Hz, 1H), 8.58 (d, J = 2.5 Hz, 1H), 8.33 (d, J = 8.8 Hz, 1H), 8.25 (dd, J = 8.2, 1.5 Hz, 1H), 7.93 (t, J = 8.7 Hz, 1H), 7.86 (t, J = 7.6 Hz, 1H), 7.43 (t, J = 7.7 Hz, 2H), 7.39 – 7.31 (m, 2H), 7.12 (t, J = 7.4 Hz, 1H), 4.60 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 150.21, 143.24, 140.89, 139.04, 134.25, 133.67, 133.53, 131.35, 130.79, 130.25, 128.98, 125.25, 124.80, 123.50, 119.20, 46.23. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{15}\text{N}_2^+$ $[\text{M}]^+$: 235.1230; found: 235.2057.

e2: 3-((4-fluorophenyl)amino)-1-methylquinolin-1-ium iodide



Yield: 63%, red solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.29 (s, 1H), 9.14 (d, J = 2.6 Hz, 1H), 8.48 (d, J = 2.6 Hz, 1H), 8.32 (d, J = 8.8 Hz, 1H), 8.22 (dd, J = 8.2, 1.5 Hz, 1H), 7.92 (t, J = 8.7 Hz, 1H), 7.88 – 7.81 (m, 1H), 7.44 – 7.33 (m, 2H), 7.28 (t, J = 8.8 Hz, 2H), 4.60 (s, 3H) ^{13}C NMR (100 MHz, DMSO- d_6) δ : 150.21, 142.76, 139.65, 137.10, 133.58, 131.25, 130.80, 130.26, 128.90, 124.14, 122.12, 122.04, 119.19, 117.04, 116.82, 46.17. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{14}\text{FN}_2^+$ $[\text{M}]^+$: 253.1136; found: 253.1503.

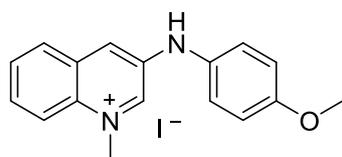
e3: 3-((4-chlorophenyl)amino)-1-methylquinolin-1-ium iodide



Yield: 67%, red solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 10.12 (s, 1H), 9.58 (s, 1H),

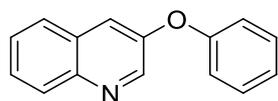
8.62 – 8.55 (m, 1H), 8.27 (d, $J = 8.8$ Hz, 1H), 8.17 (d, $J = 8.2$ Hz, 1H), 7.90 (t, $J = 7.8$ Hz, 1H), 7.83 (t, $J = 7.5$ Hz, 1H), 7.34 (t, $J = 5.7$ Hz, 4H), 4.56 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 150.23, 144.29, 140.12, 138.73, 133.51, 131.25, 130.66, 130.18, 129.80, 128.93, 126.44, 125.32, 124.30, 120.50, 119.07, 45.88. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{14}\text{ClN}_2^+ [\text{M}]^+$: 269.0840; found: 269.0723.

e4: 3-((4-methoxyphenyl)amino)-1-methylquinolin-1-ium iodide

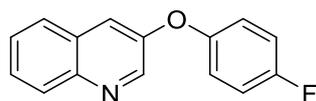


Yield: 62%, red solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.11 (s, 1H), 9.04 (d, $J = 2.6$ Hz, 1H), 8.31 (d, $J = 2.5$ Hz, 1H), 8.28 (d, $J = 8.6$ Hz, 1H), 8.17 (d, $J = 8.1$ Hz, 1H), 7.98 – 7.78 (m, 2H), 7.33 – 7.26 (m, 2H), 7.11 – 6.97 (m, 2H), 4.57 (s, 3H), 3.79 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 156.50, 142.16, 140.72, 138.22, 133.14, 130.93, 130.69, 130.18, 129.86, 128.70, 125.92, 122.99, 122.31, 119.14, 115.56, 55.85, 46.15. MS-ESI m/z : calcd for $\text{C}_{17}\text{H}_{17}\text{N}_2\text{O}^+ [\text{M}]^+$: 265.1335; found: 265.1690.

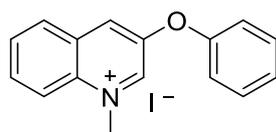
f1: 3-phenoxyquinoline



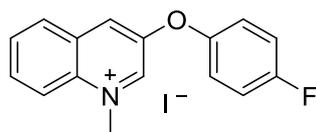
Yield: 68%, yellow liquid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.82 (d, $J = 2.9$ Hz, 1H), 8.04 (d, $J = 8.4$ Hz, 1H), 7.91 (d, $J = 8.2$ Hz, 1H), 7.79 (d, $J = 2.8$ Hz, 1H), 7.68 (t, $J = 7.6$ Hz, 1H), 7.58 (t, $J = 7.5$ Hz, 1H), 7.47 (t, $J = 7.8$ Hz, 2H), 7.24 (t, $J = 7.4$ Hz, 1H), 7.18 (d, $J = 8.0$ Hz, 2H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 156.40, 151.00, 145.37, 144.72, 134.84, 130.84, 129.16, 128.78, 128.52, 128.00, 127.85, 127.77, 124.84, 120.66, 119.53. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_{11}\text{NO} [\text{M}+\text{H}]^+$: 222.0843; found: 222.1729.

f2: 3-(4-fluorophenoxy)quinoline

Yield: 62%, yellow liquid. $^1\text{H NMR}$ (400 MHz, $\text{DMSO-}d_6$) δ : 8.82 (d, $J = 2.8$ Hz, 1H), 8.03 (d, $J = 8.4$ Hz, 1H), 7.95 – 7.87 (m, 1H), 7.74 (d, $J = 2.9$ Hz, 1H), 7.68 (t, $J = 8.4$ Hz, 1H), 7.62 – 7.55 (m, 1H), 7.32 (t, $J = 8.8$ Hz, 2H), 7.26 (dd, $J = 9.2, 4.6$ Hz, 2H). $^{13}\text{C NMR}$ (100 MHz, $\text{DMSO-}d_6$) δ : 155.78, 150.21, 148.36, 143.76, 134.09, 131.90, 131.43, 130.75, 130.14, 129.83, 128.74, 128.43, 128.18, 124.48, 116.76. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_{10}\text{FNO}$ $[\text{M}+\text{H}]^+$: 240.0746; found: 240.0825.

g1: 1-methyl-3-phenoxyquinolin-1-ium iodide

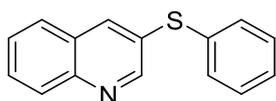
Yield: 47%, yellow solid. $^1\text{H NMR}$ (400 MHz, $\text{DMSO-}d_6$) δ : 9.83 (s, 1H), 8.84 (s, 1H), 8.50 (d, $J = 9.0$ Hz, 1H), 8.38 (d, $J = 8.3$ Hz, 1H), 8.19 (t, $J = 8.0$ Hz, 1H), 8.01 (t, $J = 7.7$ Hz, 1H), 7.55 (t, $J = 7.7$ Hz, 2H), 7.33 (t, $J = 6.2$ Hz, 3H), 4.68 (s, 3H). $^{13}\text{C NMR}$ (100 MHz, $\text{DMSO-}d_6$) δ : 155.78, 150.62, 145.73, 136.04, 134.09, 131.90, 131.18, 130.75, 130.17, 130.08, 128.53, 125.88, 124.21, 119.51, 119.45, 46.00. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{14}\text{NO}^+$ $[\text{M}]^+$: 236.1152; found: 236.1893.

g2: 3-(4-fluorophenoxy)-1-methylquinolin-1-ium iodide

Yield: 42%, yellow solid. $^1\text{H NMR}$ (400 MHz, $\text{DMSO-}d_6$) δ : 9.77 (d, $J = 2.6$ Hz, 1H), 8.79 (d, $J = 2.6$ Hz, 1H), 8.49 (d, $J = 8.9$ Hz, 1H), 8.36 (d, $J = 8.3$ Hz, 1H), 8.18 (t, $J =$

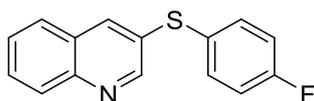
8.0 Hz, 1H), 8.01 (t, $J = 7.6$ Hz, 1H), 7.40 (d, $J = 6.5$ Hz, 4H), 4.67 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 161.06, 158.66, 151.58, 151.17, 145.36, 135.89, 134.01, 131.10, 130.77, 130.14, 121.99, 121.90, 119.43, 117.92, 117.68, 45.97. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{13}\text{FNO}^+$ $[\text{M}]^+$: 255.0976; found: 254.2811.

h1: 3-(phenylthio)quinoline



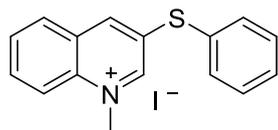
Yield: 61%, white solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.79 (s, 1H), 8.39 (s, 1H), 8.03 (d, $J = 8.5$ Hz, 1H), 7.95 (d, $J = 8.4$ Hz, 1H), 7.76 (t, $J = 6.7$ Hz, 1H), 7.51 (t, $J = 8.1$ Hz, 2H), 7.40 – 7.31 (m, 4H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 152.47, 146.70, 145.87, 138.29, 136.63, 134.58, 131.05, 130.57, 130.28, 129.22, 129.18, 128.32, 128.24, 128.00, 127.61. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_{11}\text{SN}$ $[\text{M}+\text{H}]^+$: 238.0612; found: 238.3218.

h2: 3-((4-fluorophenyl)thio)quinoline



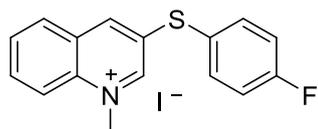
Yield: 66%, white solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.78 (d, $J = 2.3$ Hz, 1H), 8.31 (d, $J = 2.4$ Hz, 1H), 8.01 (d, $J = 8.4$ Hz, 1H), 7.94 (dd, $J = 8.3, 1.4$ Hz, 1H), 7.76 (t, $J = 8.4$ Hz, 1H), 7.63 (t, $J = 8.2$ Hz, 1H), 7.56 – 7.46 (m, 2H), 7.34 – 7.22 (m, 2H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 163.70, 161.26, 151.82, 146.60, 137.20, 134.48, 134.39, 130.42, 130.03, 129.21, 128.30, 128.18, 127.97, 117.55, 117.33. MS-ESI m/z : calcd for $\text{C}_{15}\text{H}_{10}\text{FSN}$ $[\text{M}+\text{H}]^+$: 256.0518; found: 256.0318.

i1: 1-methyl-3-(phenylthio)quinolin-1-ium iodide



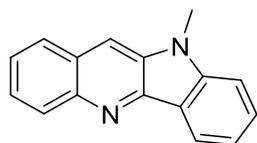
Yield: 48%, yellow solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.72 (d, $J = 2.0$ Hz, 1H), 9.20 (d, $J = 2.1$ Hz, 1H), 8.50 (d, $J = 8.9$ Hz, 1H), 8.40 (d, $J = 8.2$ Hz, 1H), 8.22 (t, $J = 7.1$ Hz, 1H), 8.05 (t, $J = 7.6$ Hz, 1H), 7.60 – 7.53 (m, 2H), 7.47 (dd, $J = 7.9, 3.1$ Hz, 3H), 4.63 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 152.22, 148.02, 145.75, 137.78, 135.95, 132.70, 131.66, 130.98, 130.63, 130.35, 129.77, 129.22, 127.56, 119.61, 117.38, 45.87. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{14}\text{SN}^+$ $[\text{M}]^+$: 252.0841; found: 252.3515.

i2: 3-((4-fluorophenyl)thio)-1-methylquinolin-1-ium iodide



Yield: 39%, yellow solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 9.67 (d, $J = 2.1$ Hz, 1H), 9.11 (d, $J = 2.0$ Hz, 1H), 8.49 (d, $J = 8.9$ Hz, 1H), 8.43 – 8.35 (m, 1H), 8.25 (t, $J = 8.7$ Hz, 1H), 8.04 (t, $J = 7.6$ Hz, 1H), 7.78 – 7.63 (m, 2H), 7.44 – 7.30 (t, ($J = 7.7$ Hz, 2H), 4.62 (s, 3H). ^{13}C NMR (100 MHz, DMSO- d_6) δ : 164.33, 161.88, 151.52, 146.75, 137.58, 135.78, 135.38, 131.70, 130.96, 130.27, 129.74, 127.44, 119.57, 117.97, 117.75, 45.88. MS-ESI m/z : calcd for $\text{C}_{16}\text{H}_{13}\text{FSN}^+$ $[\text{M}]^+$: 271.0723; found: 271.1154.

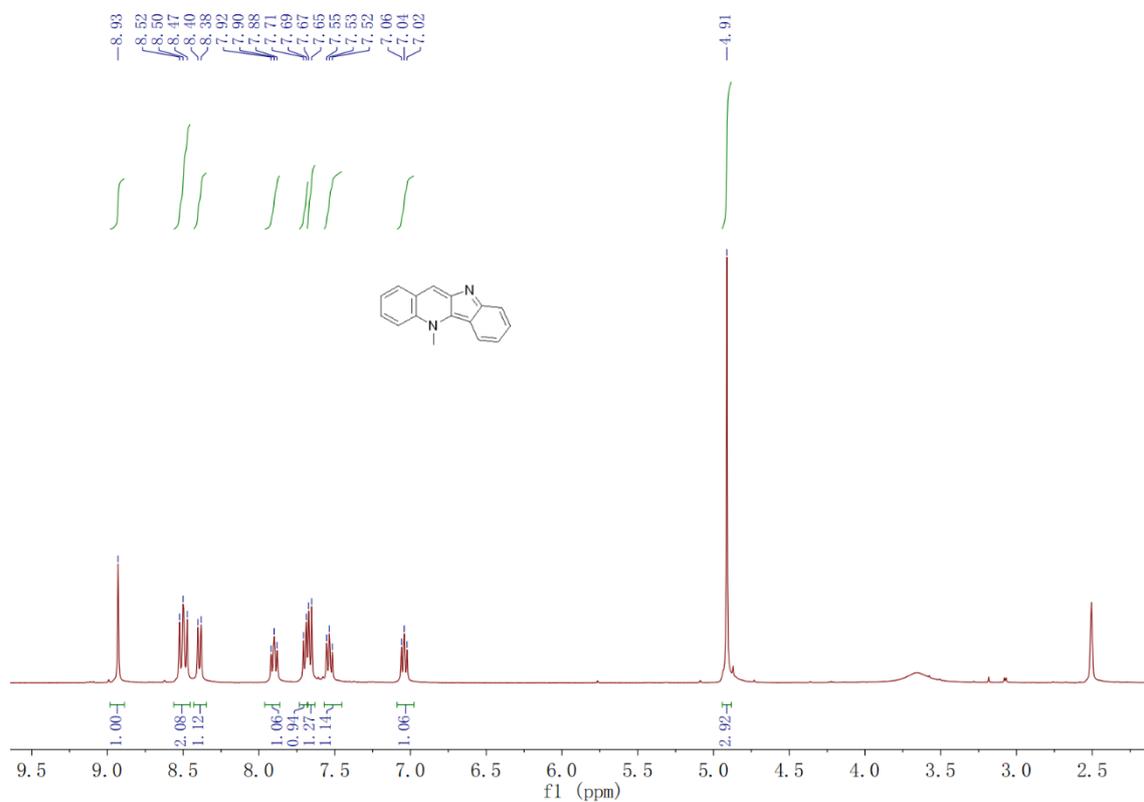
j1: 10-methyl-10H-indolo[3,2-*b*]quinoline



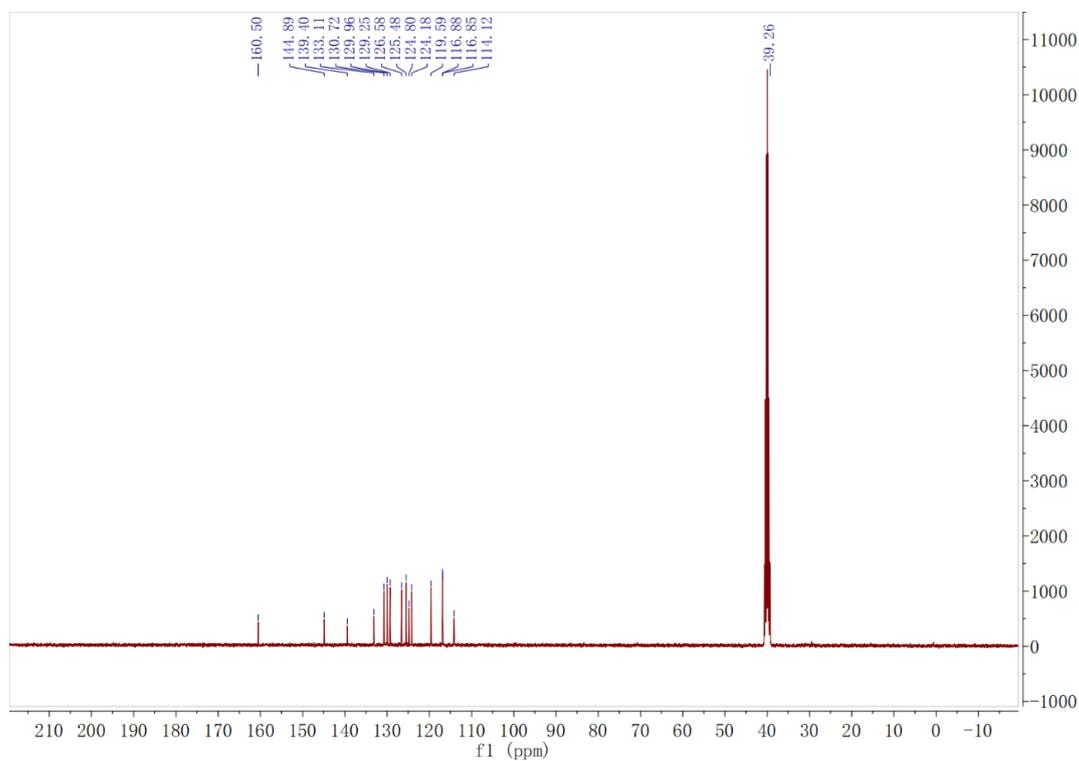
Yield: 39%, yellow solid. ^1H NMR (400 MHz, DMSO- d_6) δ : 8.41 – 8.37 (m, 2H), 8.26 – 8.20 (m, 1H), 8.11 (dd, $J = 8.3, 1.6$ Hz, 1H), 7.75 – 7.66 (m, 3H), 7.59 (t, $J = 8.1$ Hz,

1H), 7.34 (m, 1H), 3.94 (s, 3H). ¹³C NMR (100 MHz, DMSO- *d*₆): δ 145.50, 145.24, 143.83, 134.18, 130.31, 129.25, 127.97, 127.11, 126.62, 125.64, 121.77, 121.22, 119.97, 111.99, 109.96, 29.58. MS-ESI *m/z*: calcd for C₁₆H₁₂N₂ [M+H]⁺: 233.1034; found: 233.1189.

3. Spectrograms of the representative compounds.



The ^1H NMR spectrogram of compound **a1**



The ^{13}C NMR spectrogram of compound **a1**

L-1

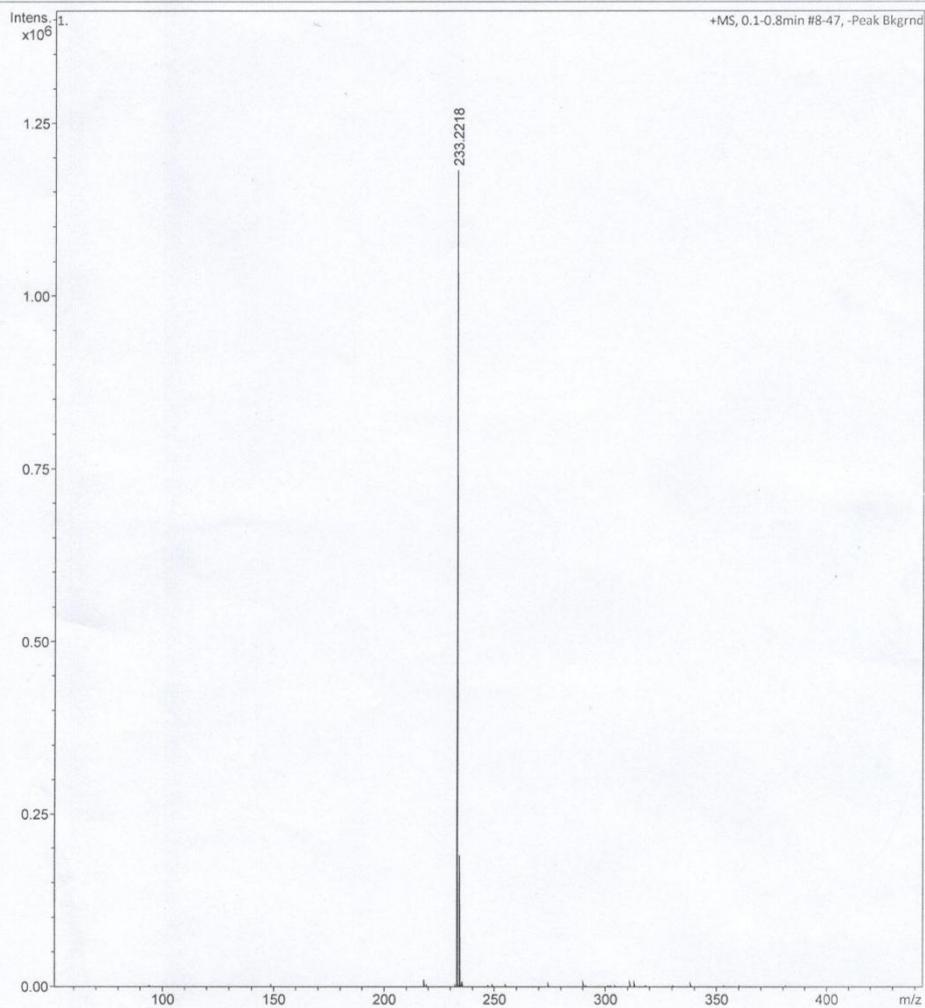
Generic Display Report

Analysis Info

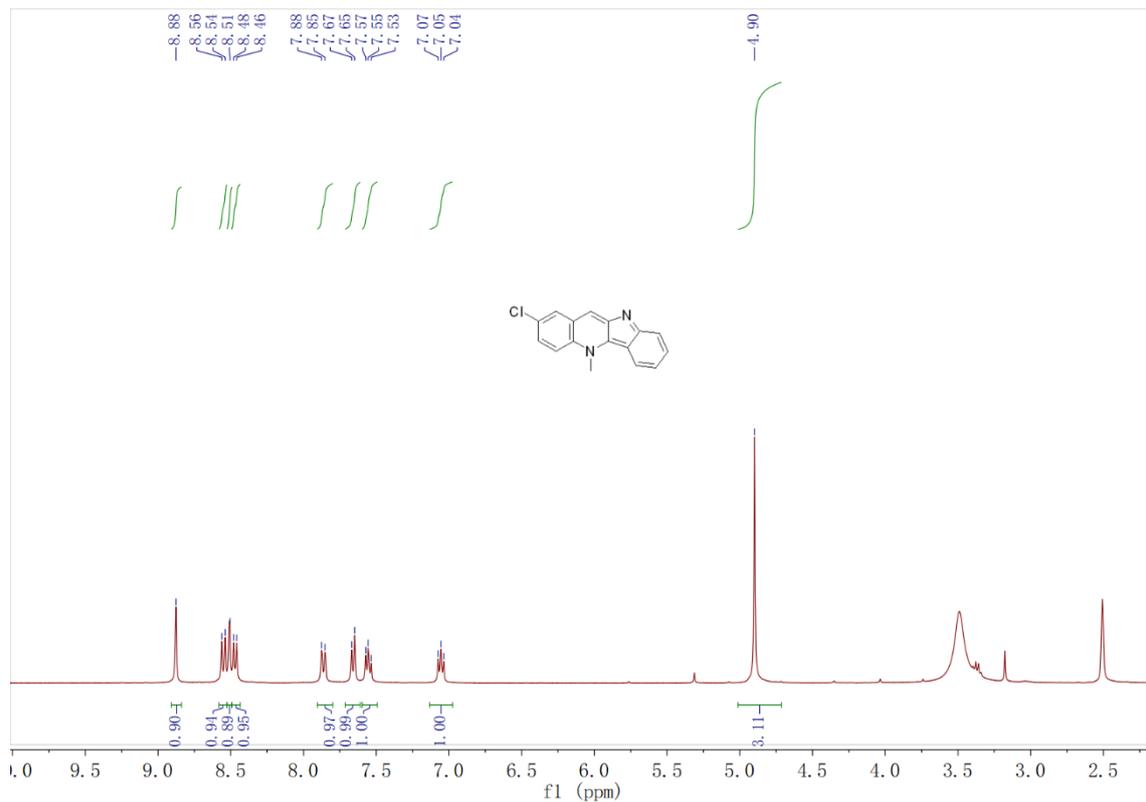
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200525
Comment

Acquisition Date 5/25/2020 3:17:43 PM

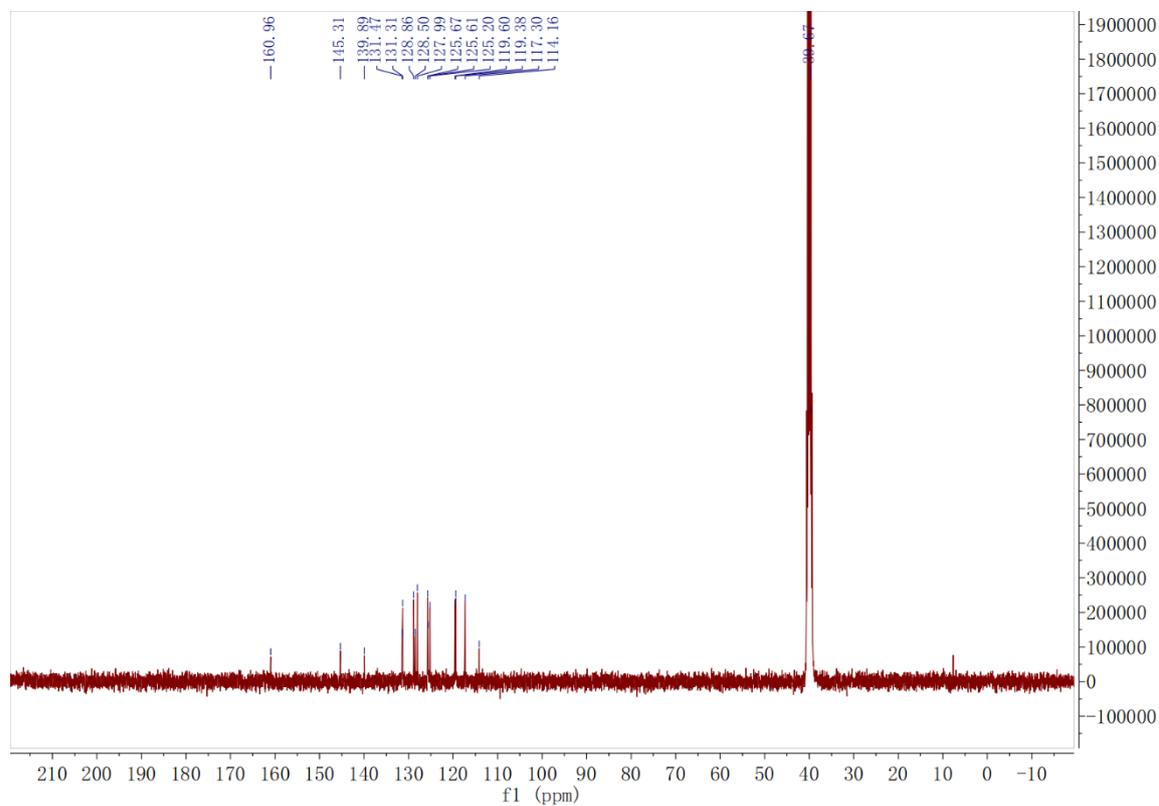
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a1**



The ^1H NMR spectrogram of compound **a2**



The ^{13}C NMR spectrogram of compound **a2**

L-2

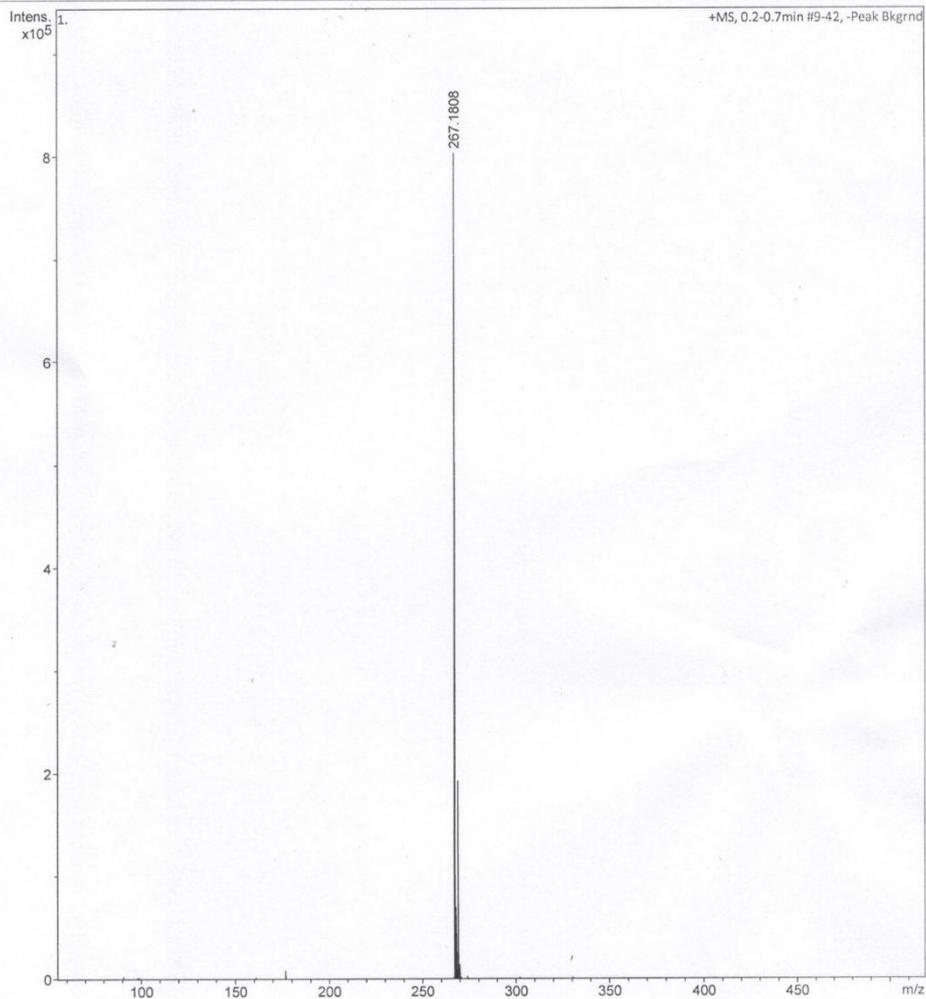
Generic Display Report

Analysis Info

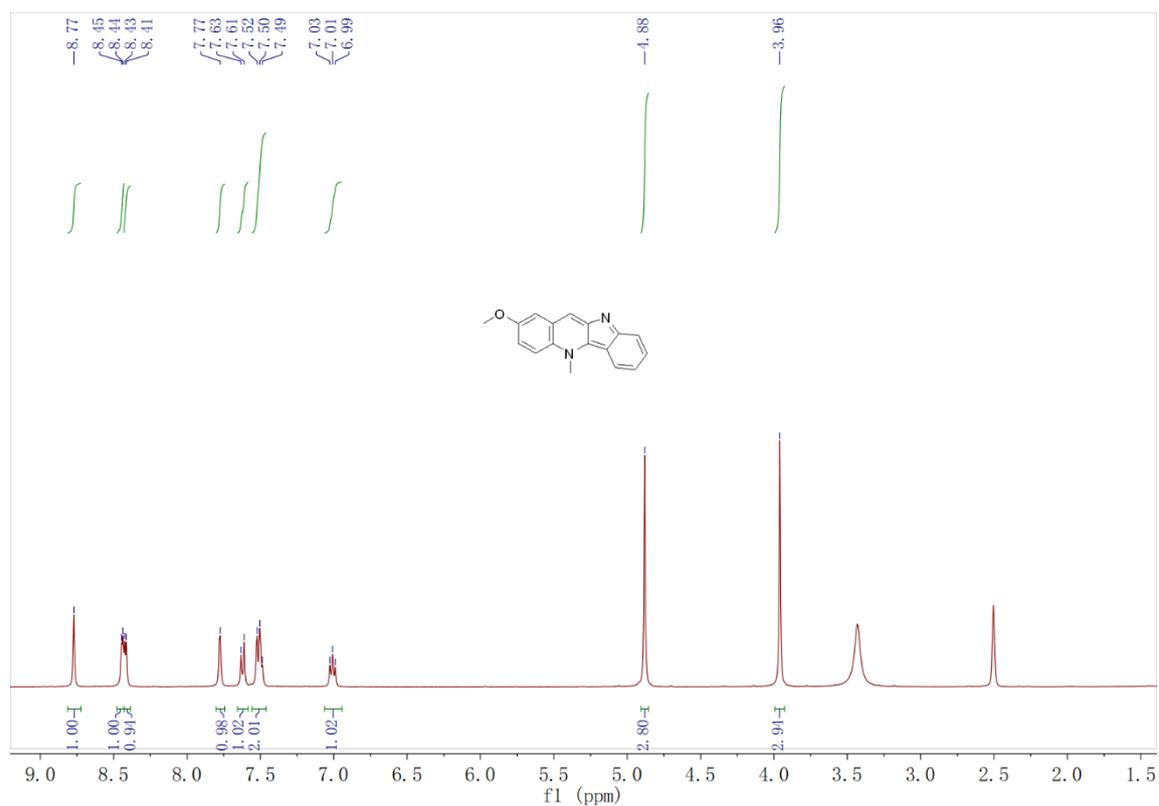
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200529_1
Comment

Acquisition Date 5/29/2020 12:47:36 PM

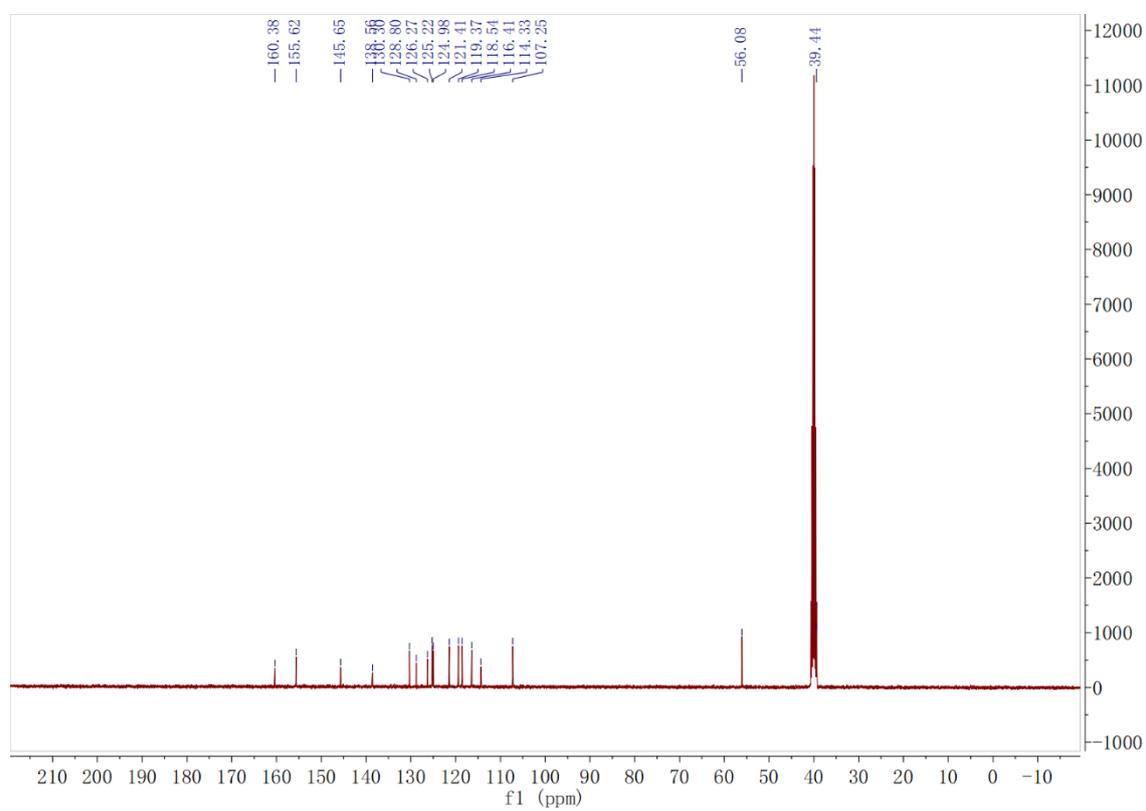
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a2**



The ^1H NMR spectrogram of compound **a3**



The ^{13}C NMR spectrogram of compound **a3**

L-3

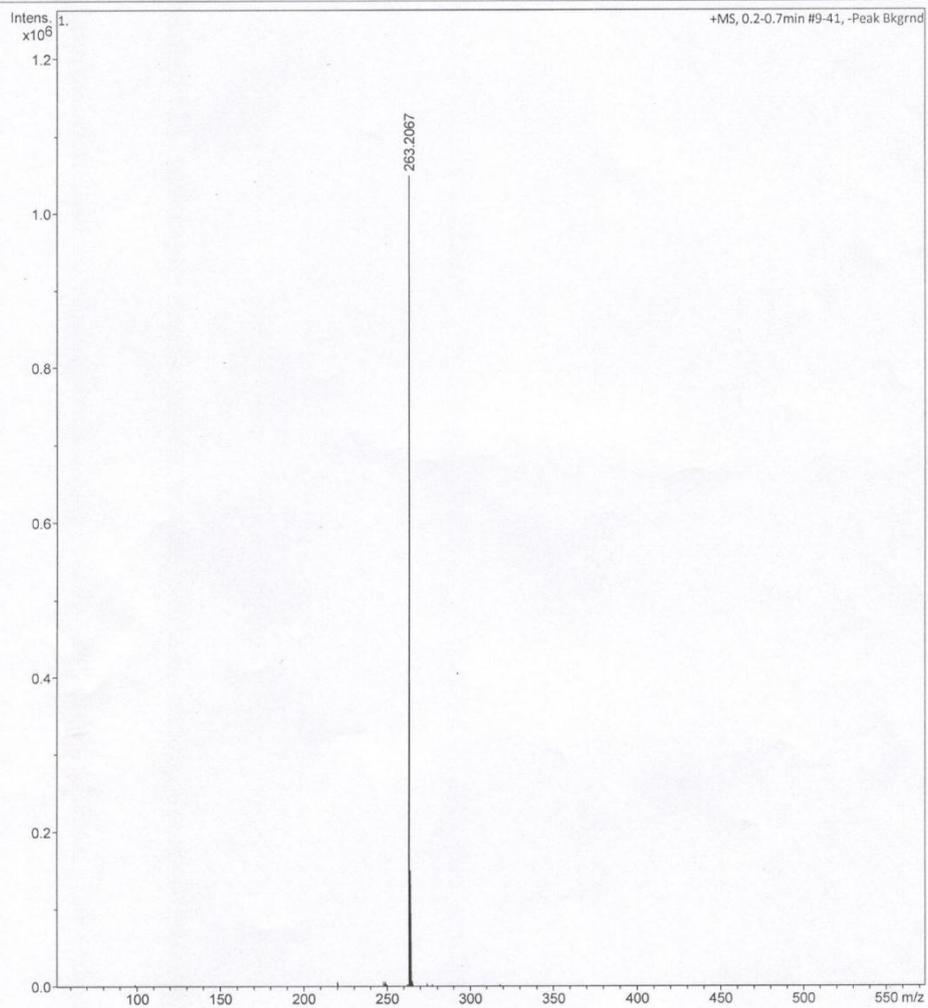
Generic Display Report

Analysis Info

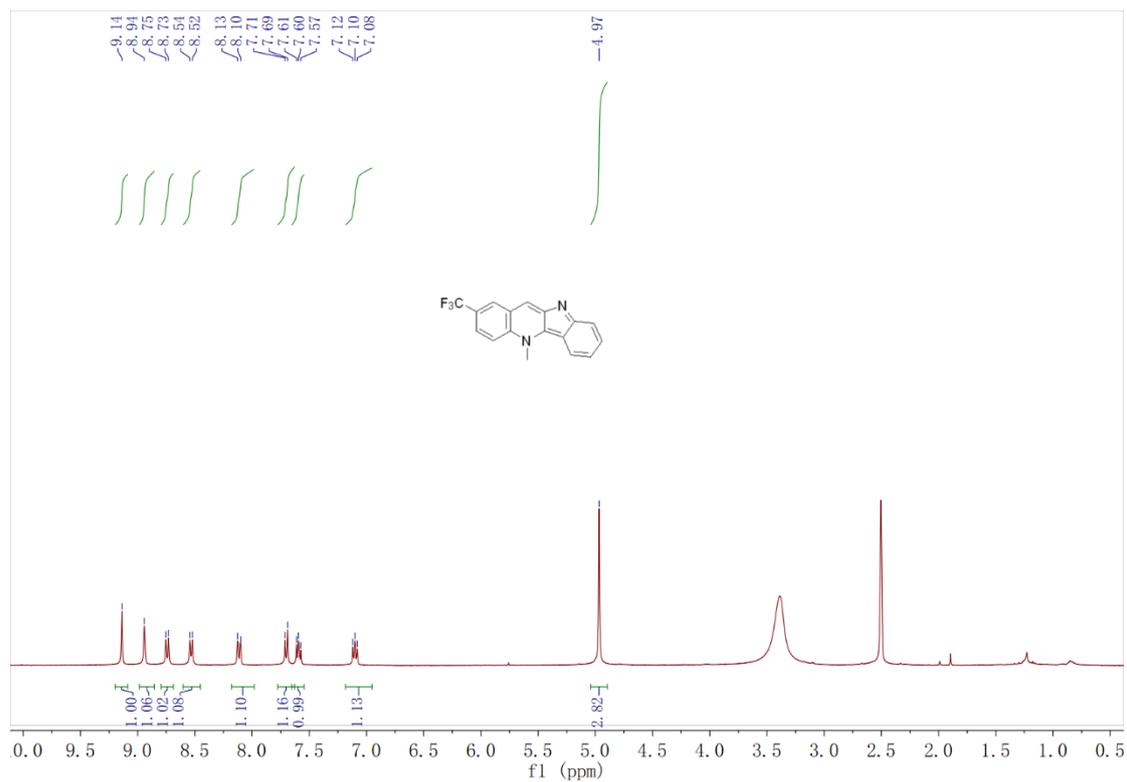
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Method POS_100-1200_For LC.m
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Comment

Acquisition Date 5/8/2020 1:57:47 PM

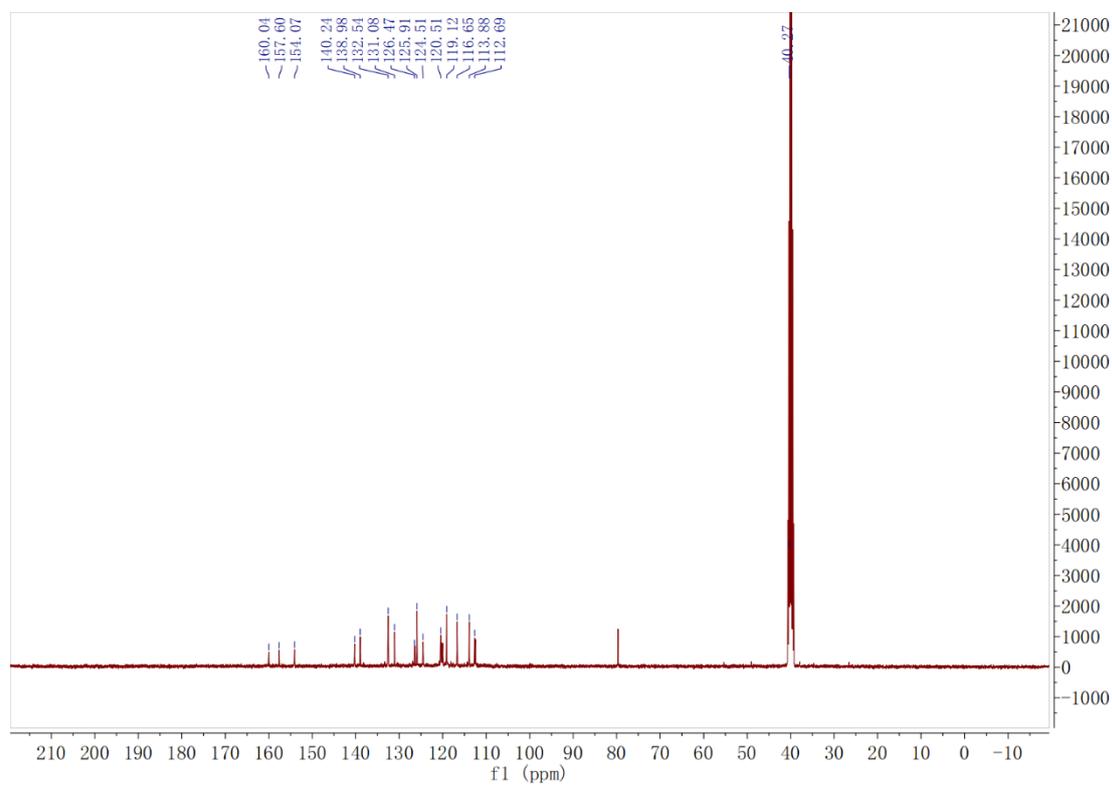
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a3**



The ^1H NMR spectrogram of compound **a4**



The ^{13}C NMR spectrogram of compound **a4**

24

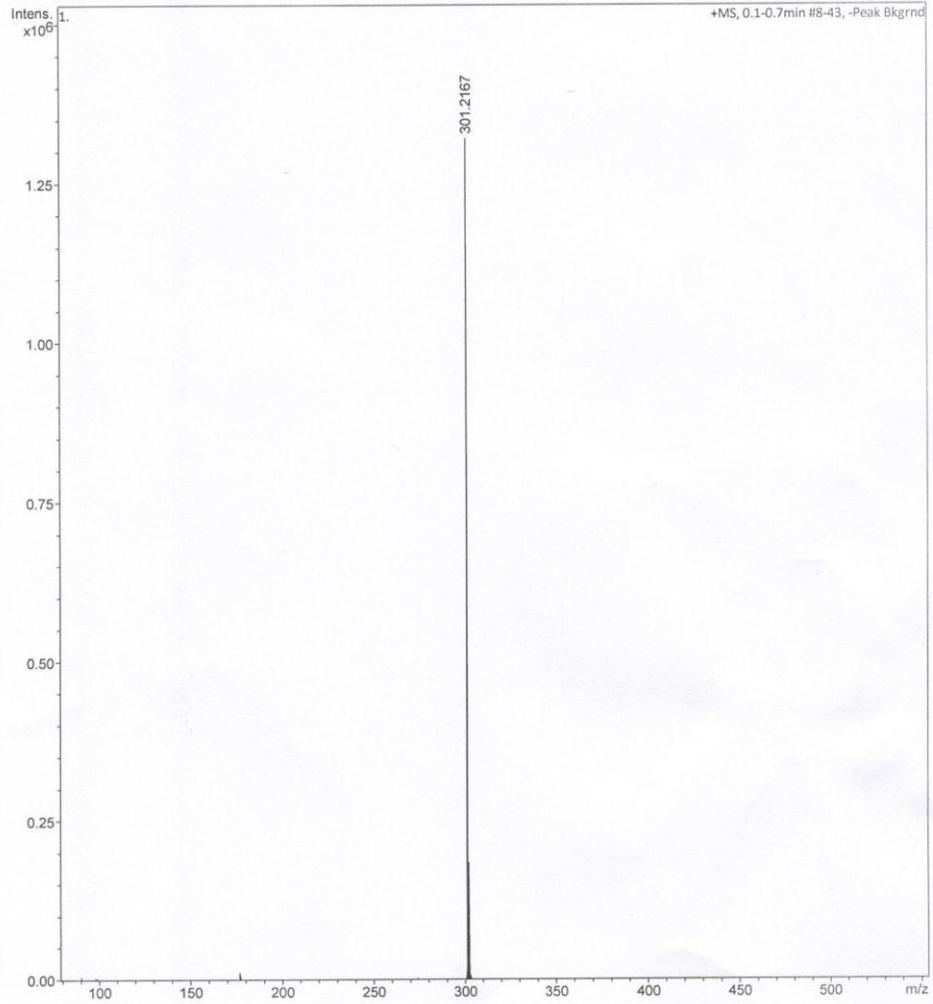
Generic Display Report

Analysis Info

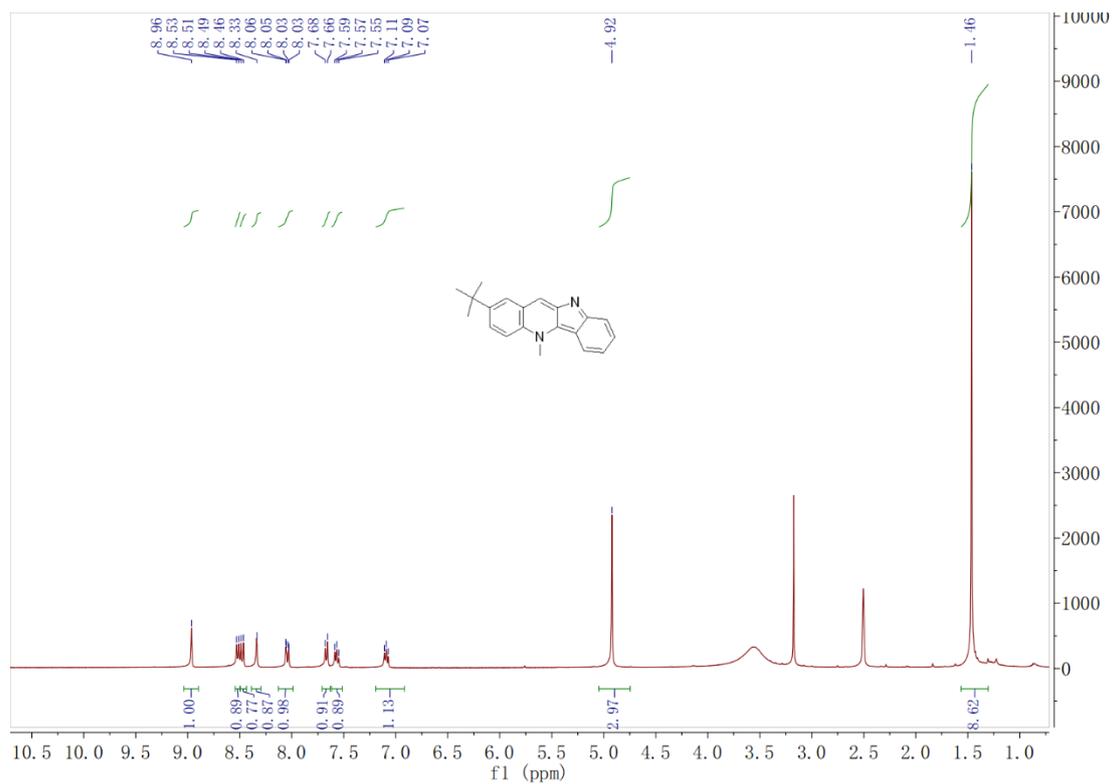
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Sample Name LIUHUA200529_2
Comment

Acquisition Date 5/29/2020 12:50:40 PM

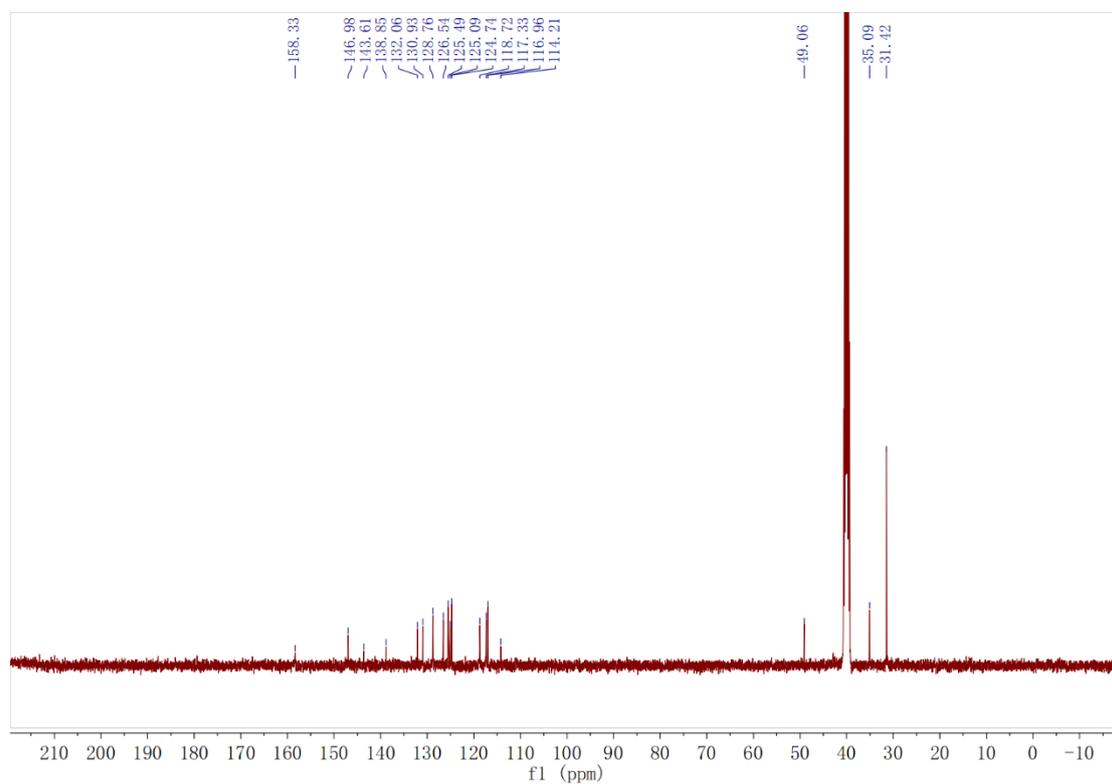
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a4**



The ^1H NMR spectrogram of compound **a7**

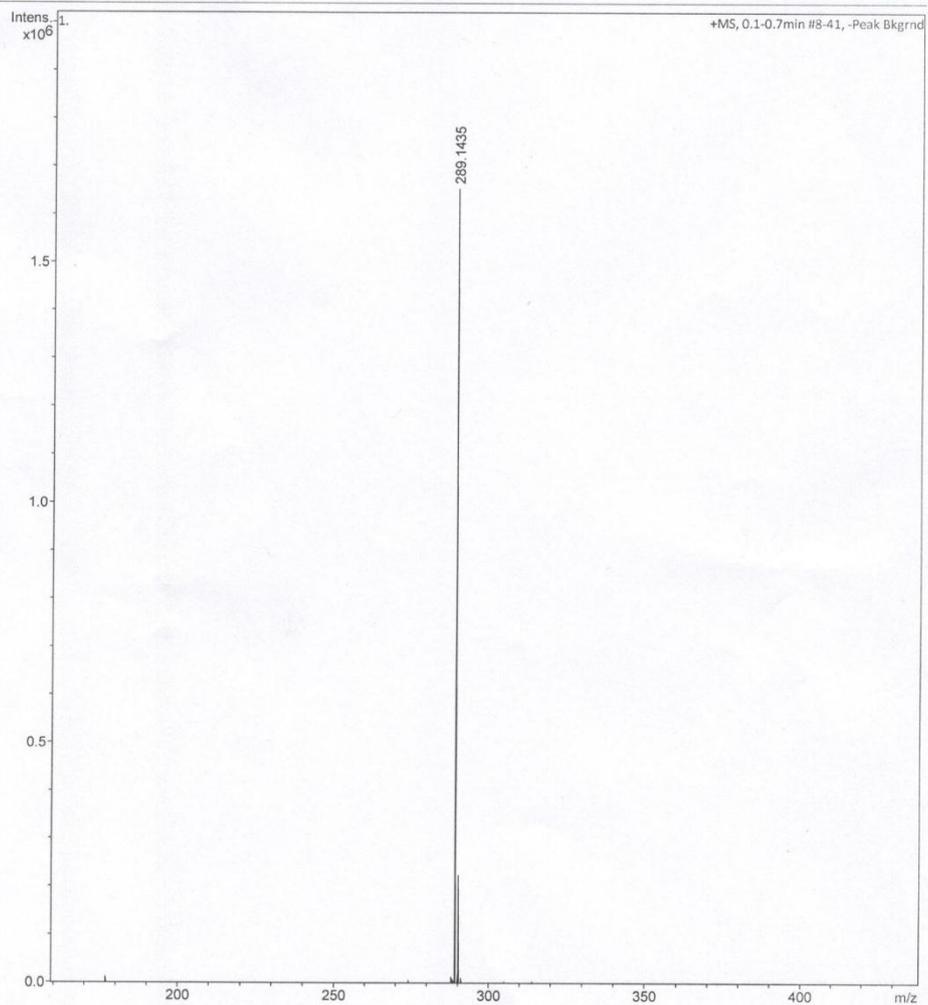


The ^{13}C NMR spectrogram of compound **a7**

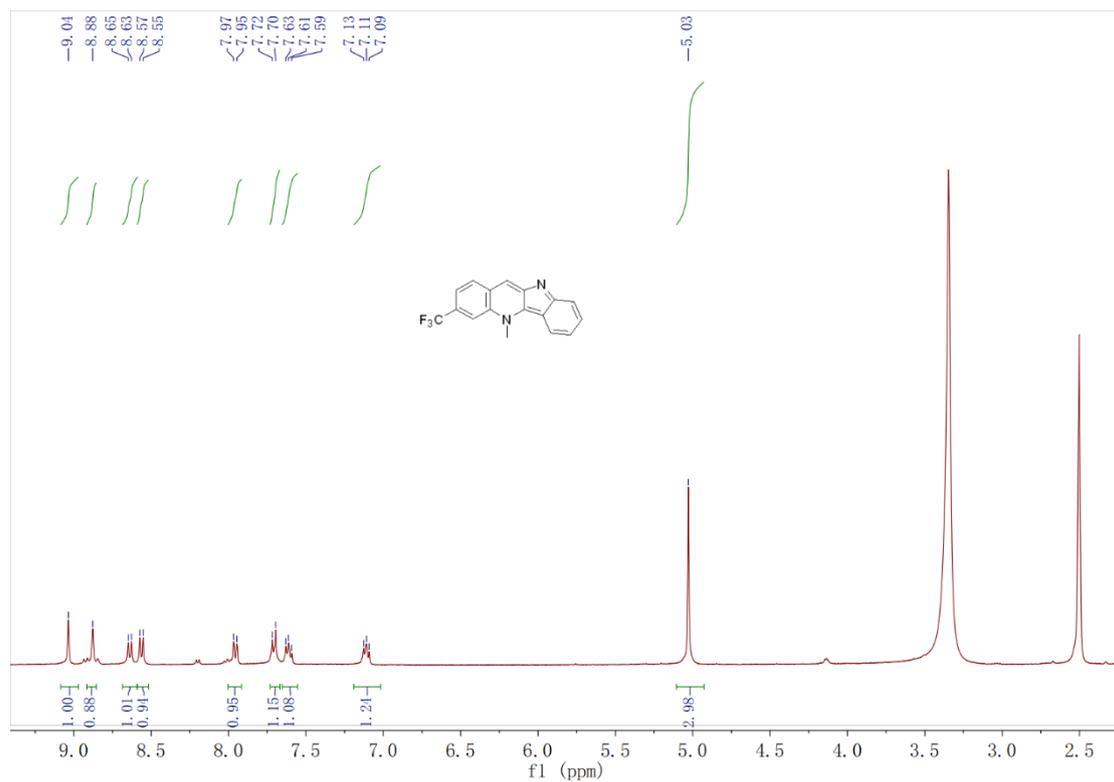
L-7

Generic Display Report

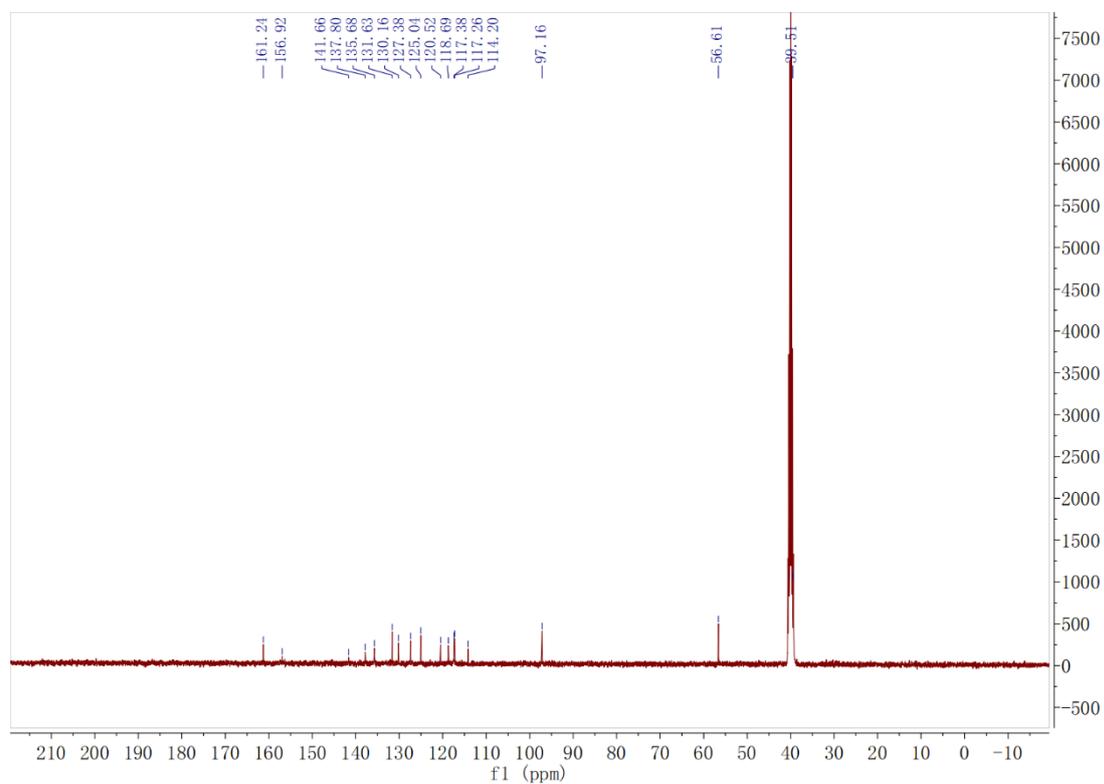
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Analysis Name	D:\Data\yangy\new\LIUHUA200601_5_28_01_31334.d	Operator	LZU
Method	POS_100-1200_For LC.m	Instrument	micrOTOF
Sample Name	LIUHUA200601_5		
Comment			



The Mass spectrogram of compound **a7**



The ¹H NMR spectrogram of compound **a9**



The ¹³C NMR spectrogram of compound **a9**

L-9

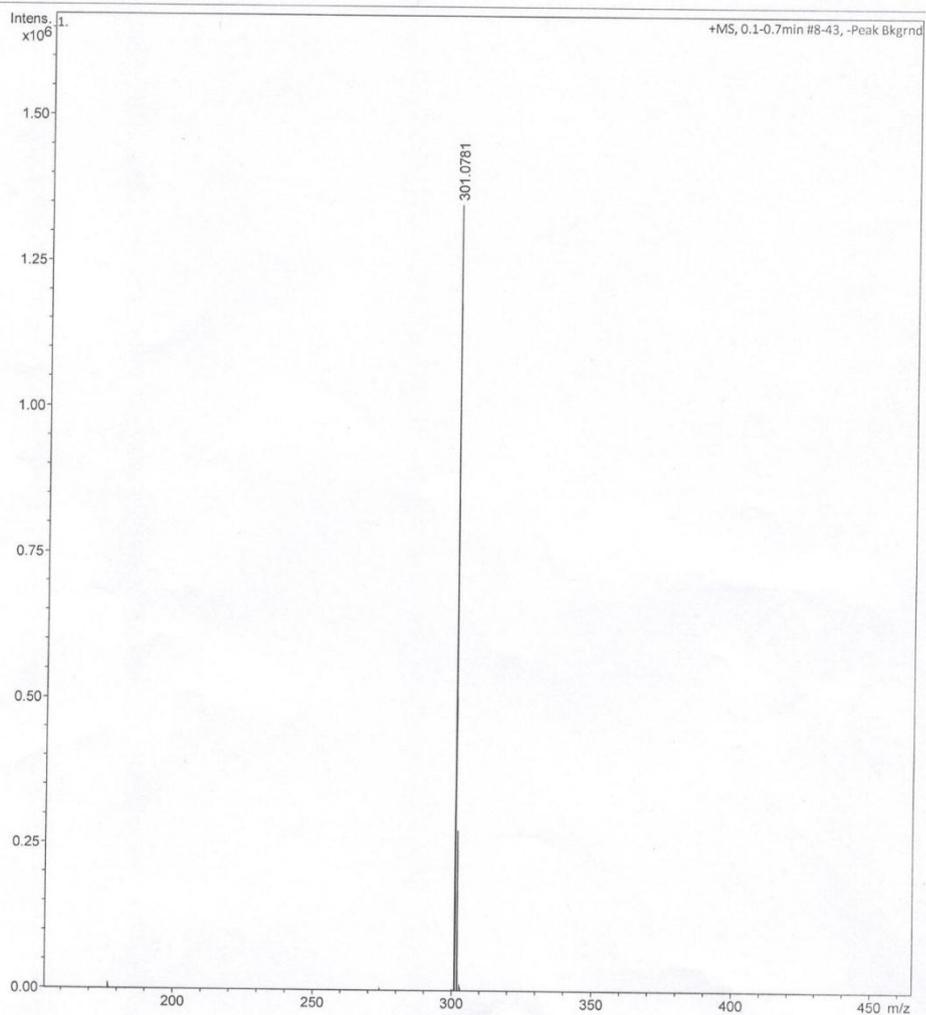
Generic Display Report

Analysis Info

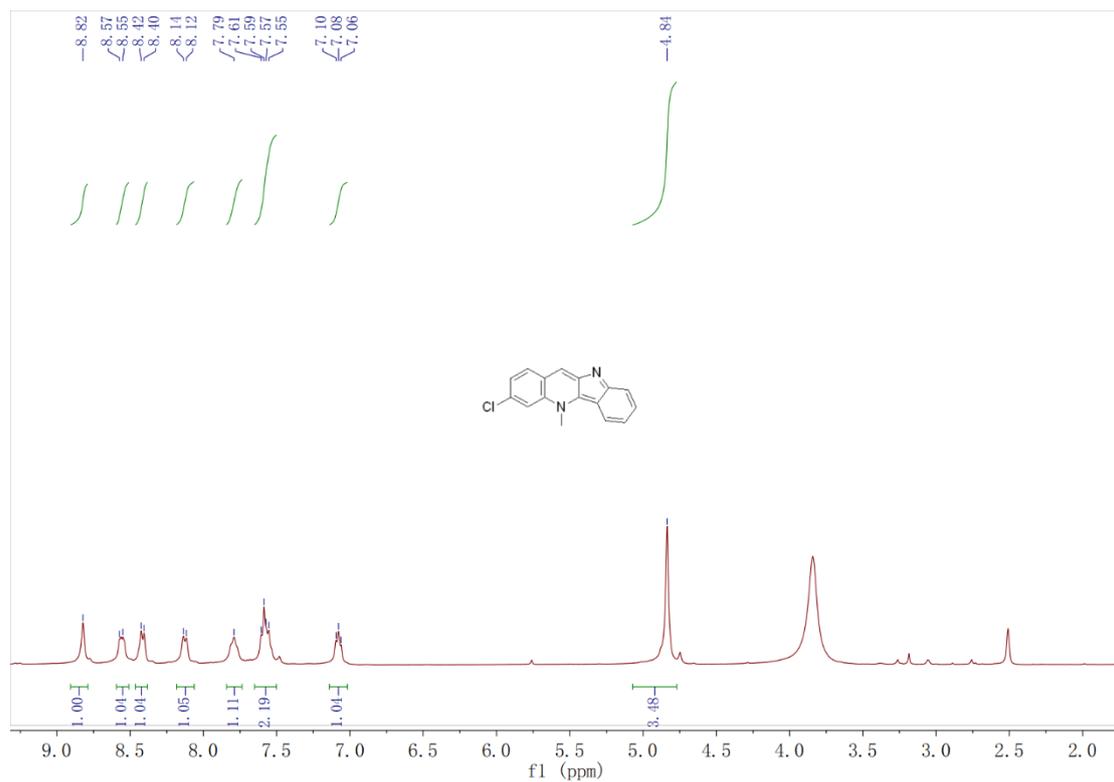
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200601_2
Comment

Acquisition Date 6/1/2020 1:13:07 PM

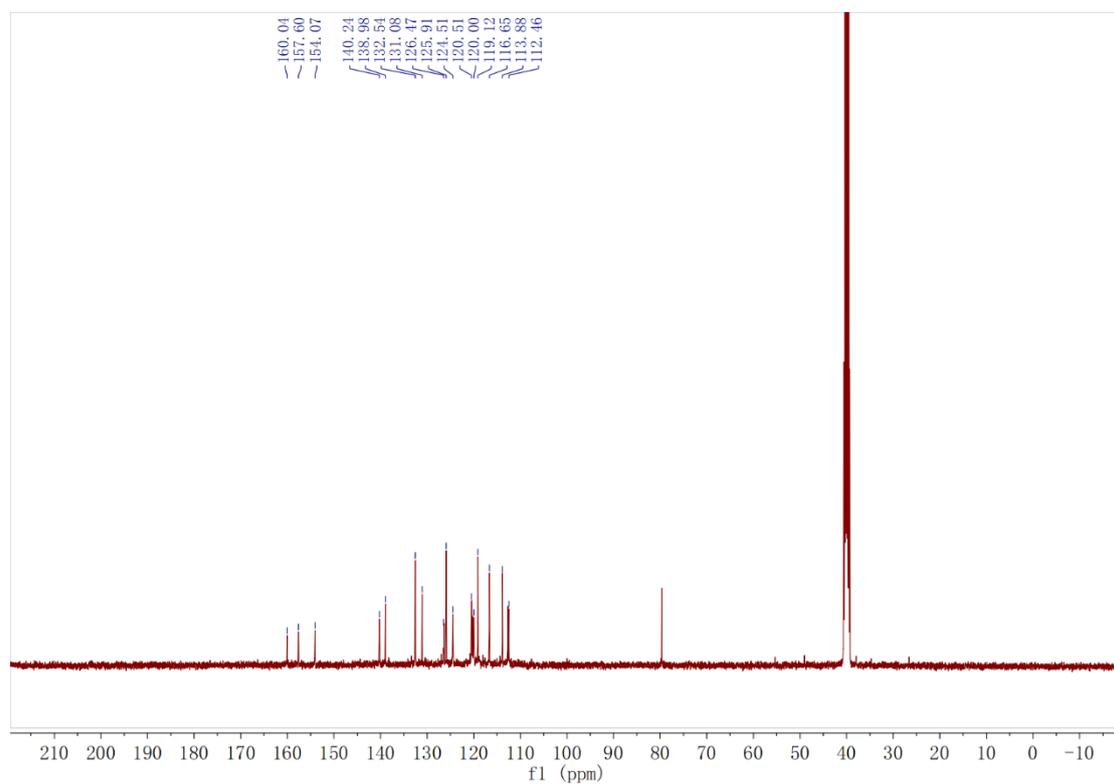
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a9**



The ¹H NMR spectrogram of compound **a12**



The ¹³C NMR spectrogram of compound **a12**

3

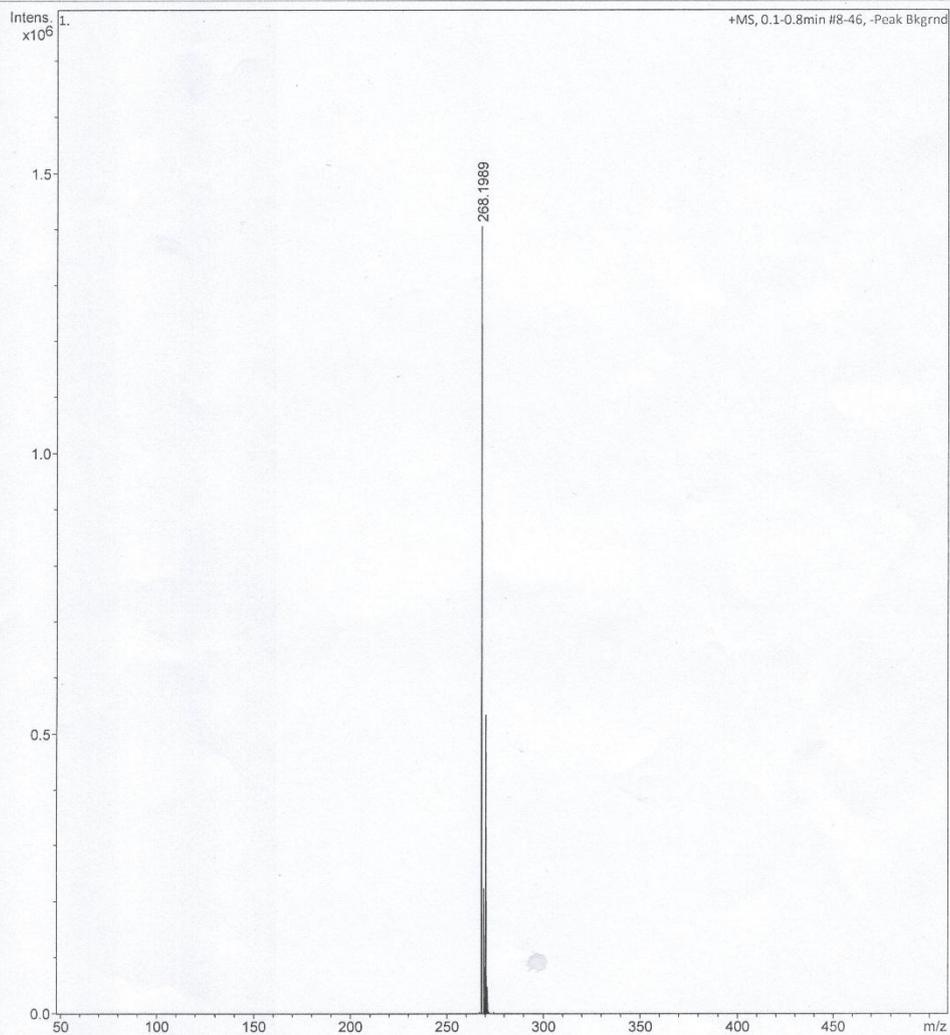
Generic Display Report

Analysis Info

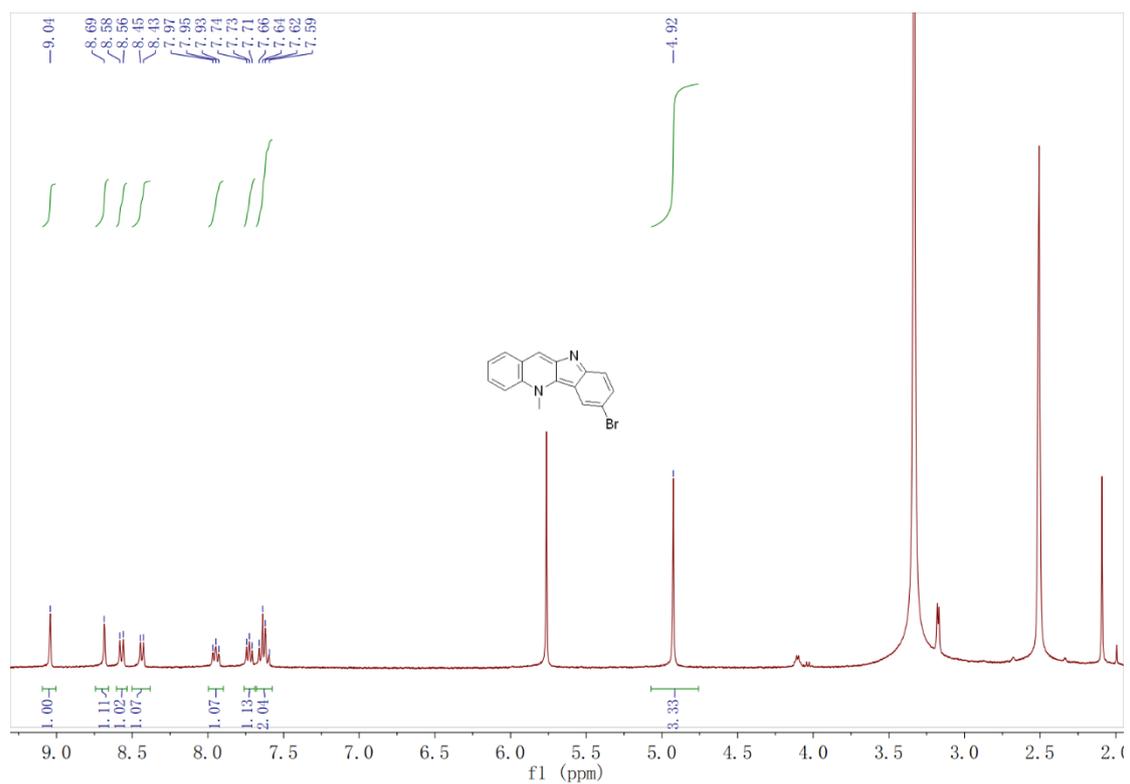
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200512_3
Comment

Acquisition Date 5/12/2020 2:45:16 PM

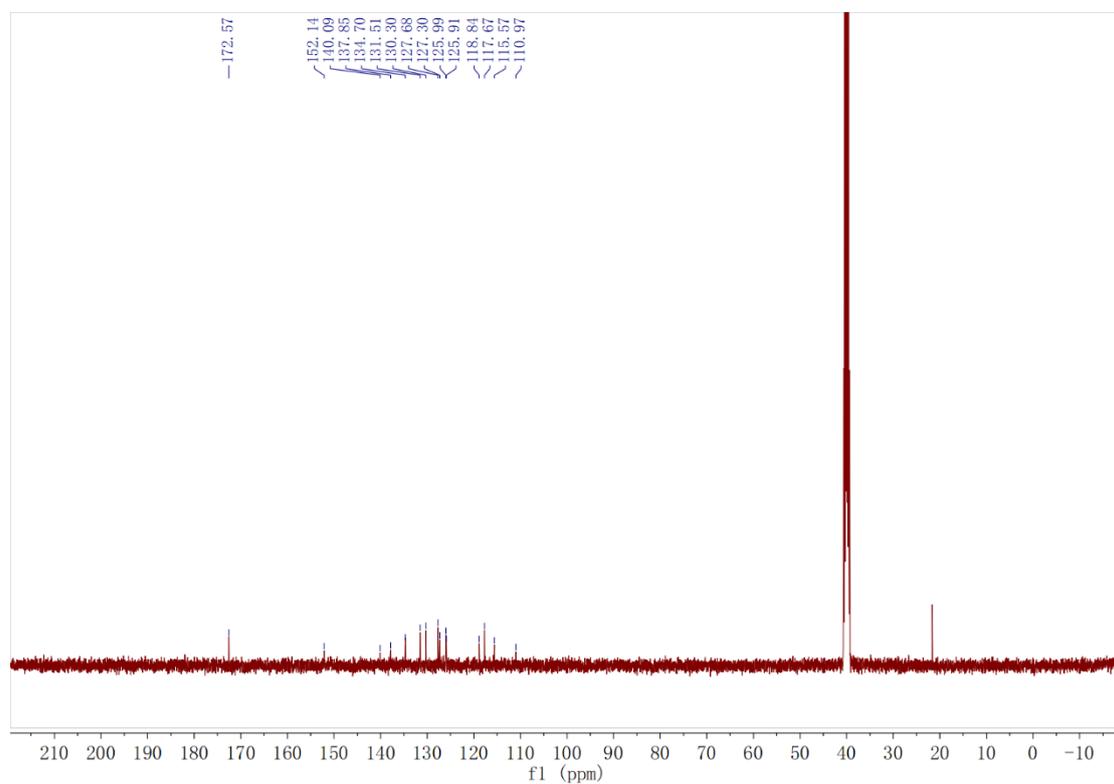
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound a12



The ¹H NMR spectrogram of compound **a13**



The ¹³C NMR spectrogram of compound **a13**

原: OYJ-1. 5. 邱伟
邱伟

Generic Display Report

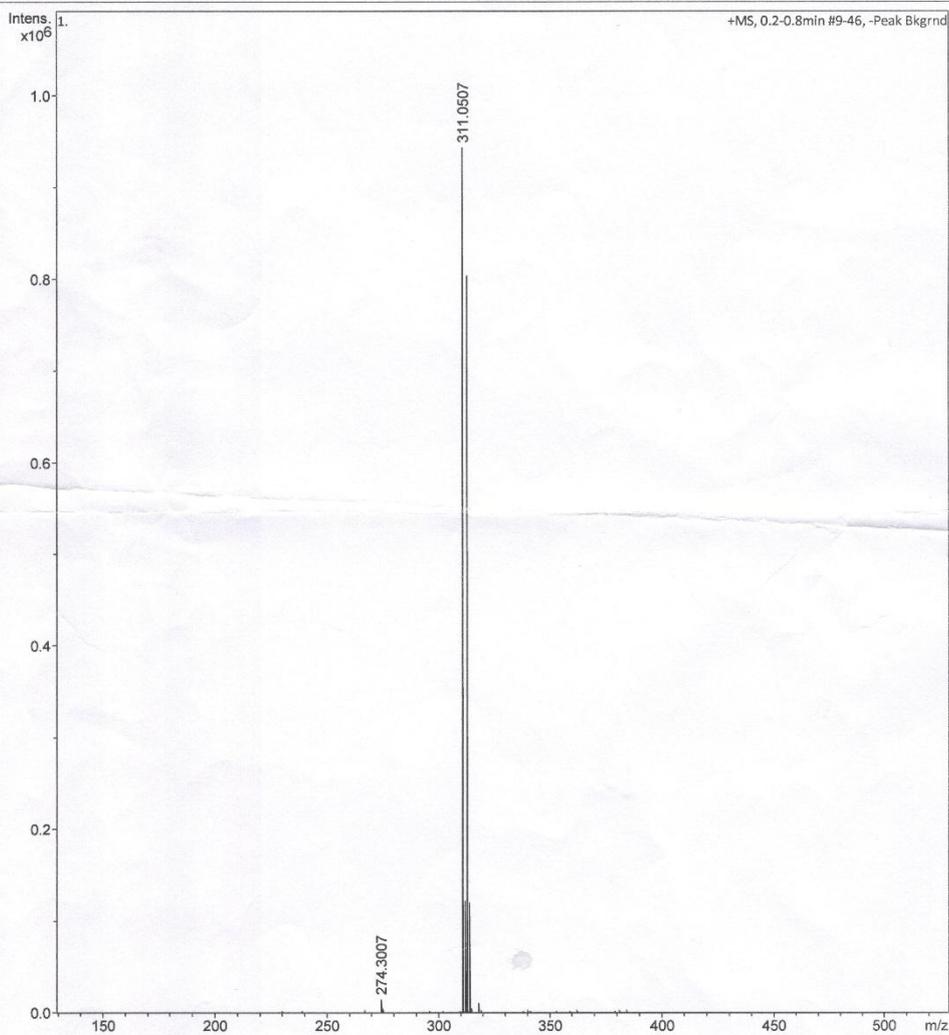
Analysis Info

Analysis Name D:\Data\yangynew\CHENYONGJIA190613_1_34_01_24387.d
Method POS_100-1200_ForLC.m
Sample Name CHENYONGJIA190613_1
Comment

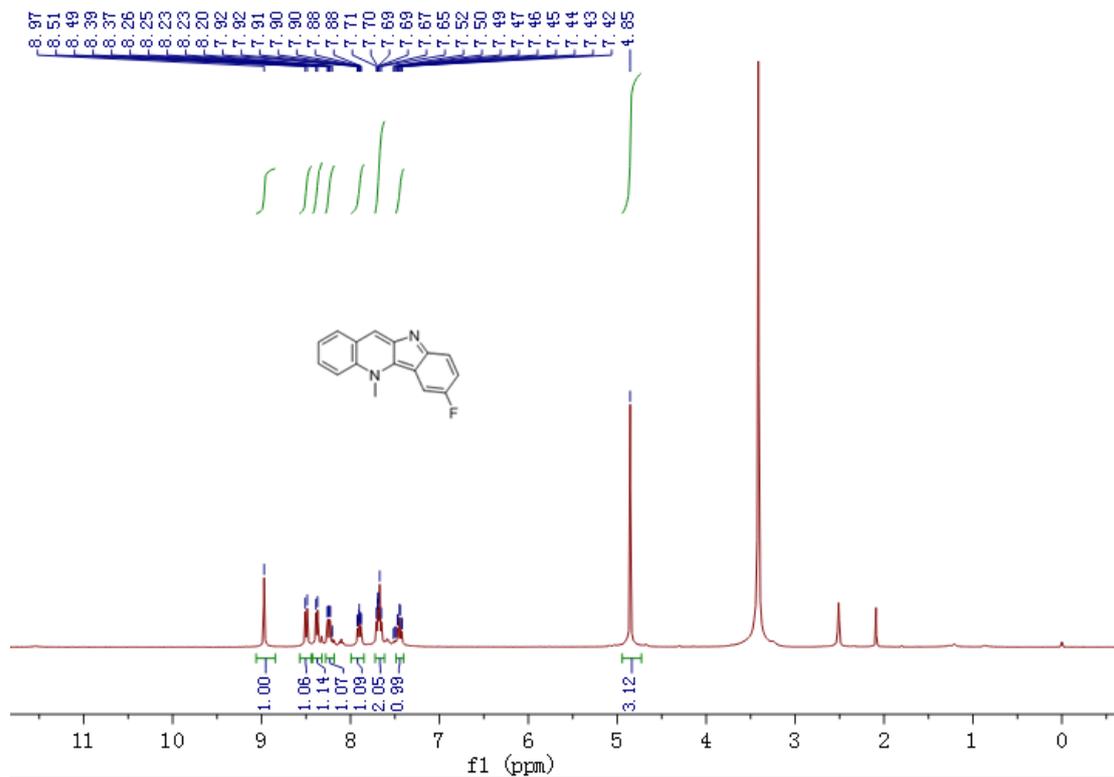
Acquisition Date 6/13/2019 1:46:20 PM

Operator LZU

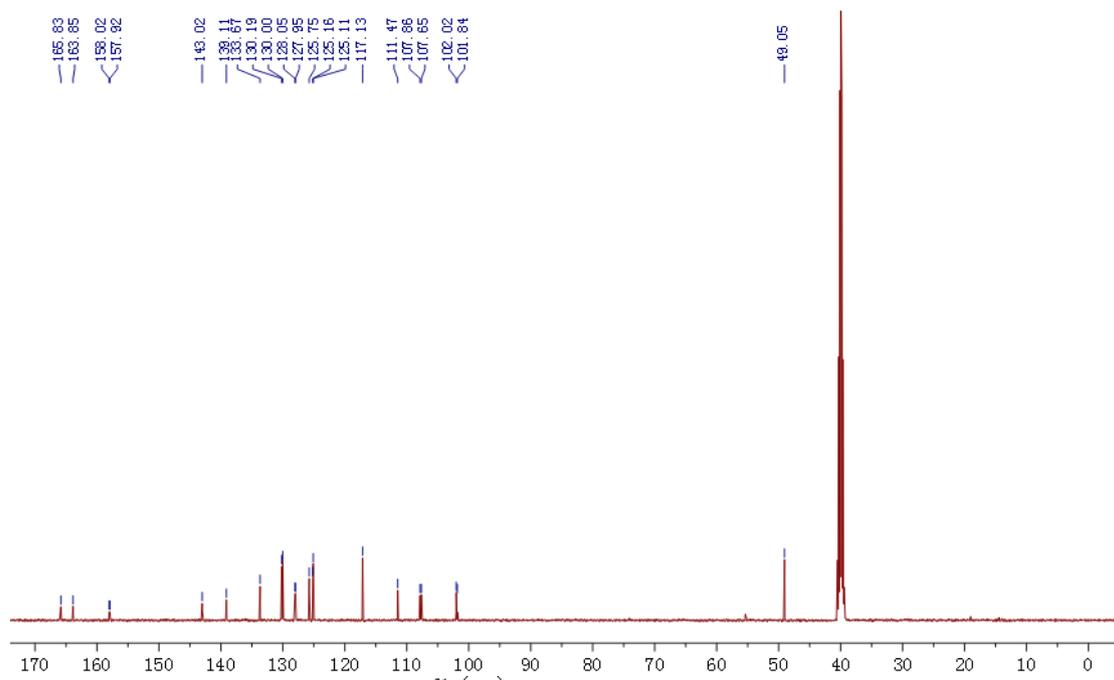
Instrument micrOTOF



The Mass spectrogram of compound **a13**



The ^1H NMR spectrogram of compound **a14**



The ^{13}C NMR spectrogram of compound **a14**

Generic Display Report

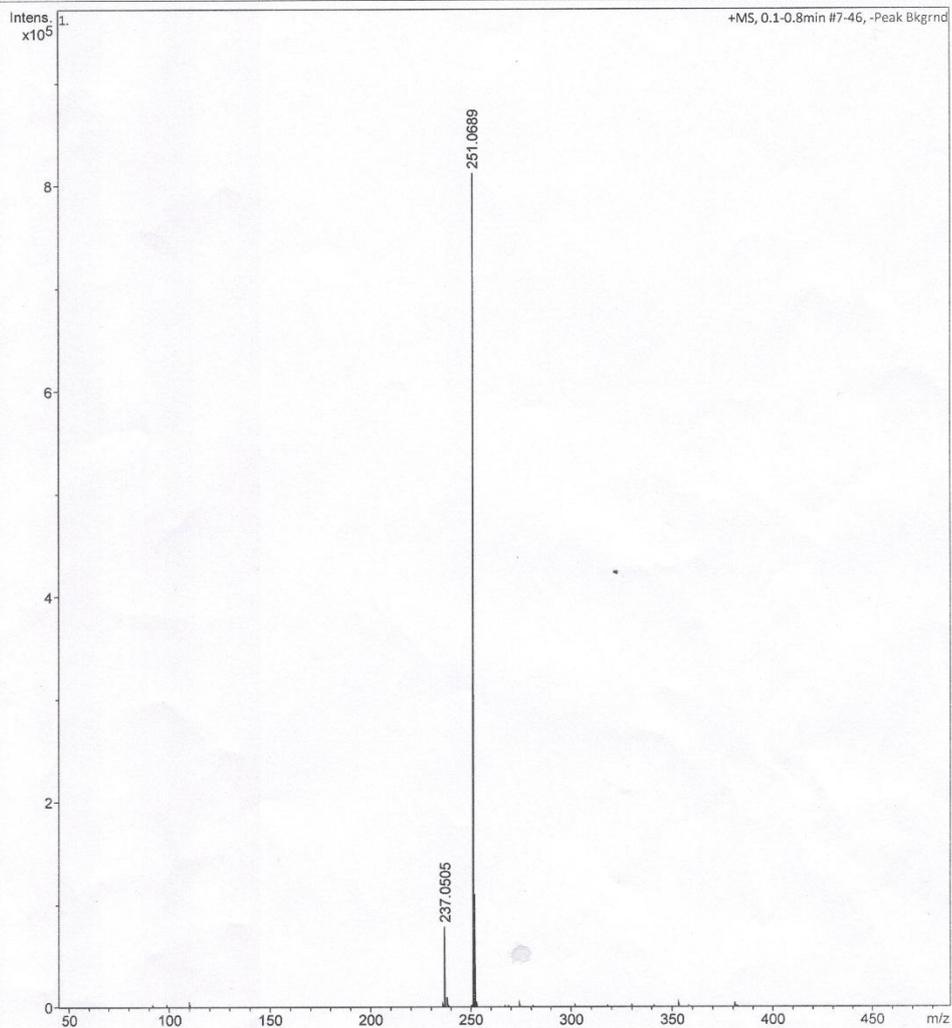
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Analysis Info

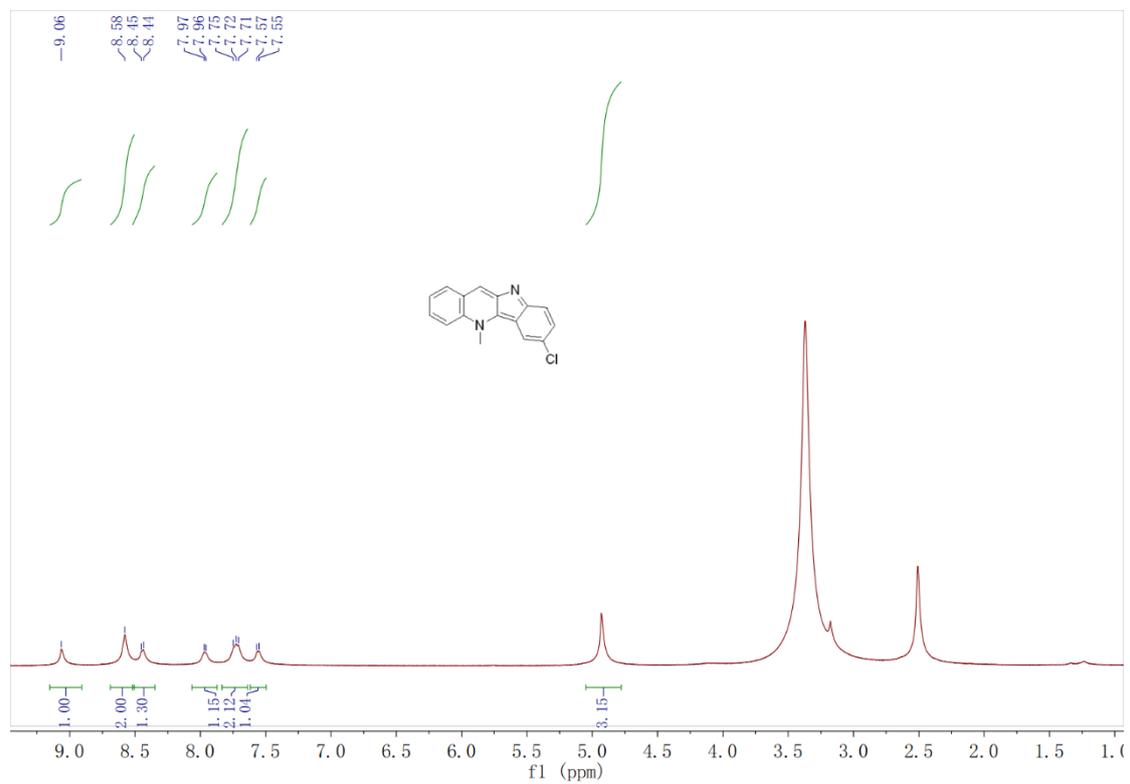
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Sample Name CHUQINGRU200930_1
Comment

Acquisition Date 9/30/2020 1:28:54 PM

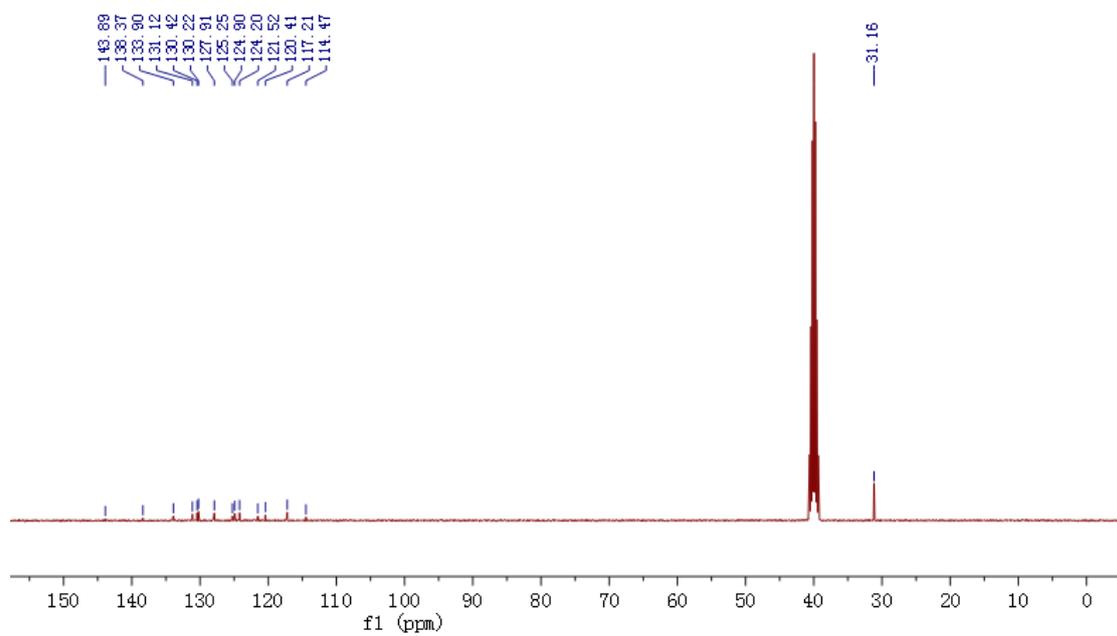
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a14**



The ^1H NMR spectrogram of compound **a15**



The ^{13}C NMR spectrogram of compound **a15**

Generic Display Report

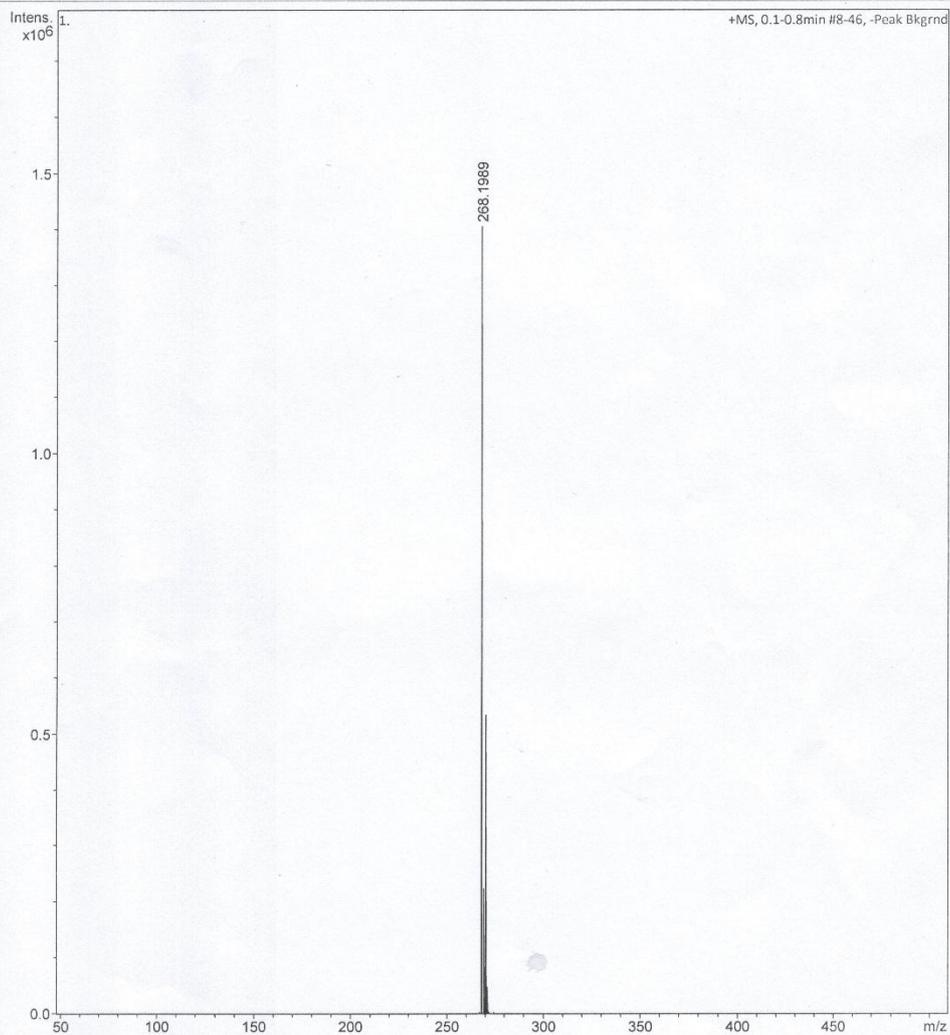
3

Analysis Info

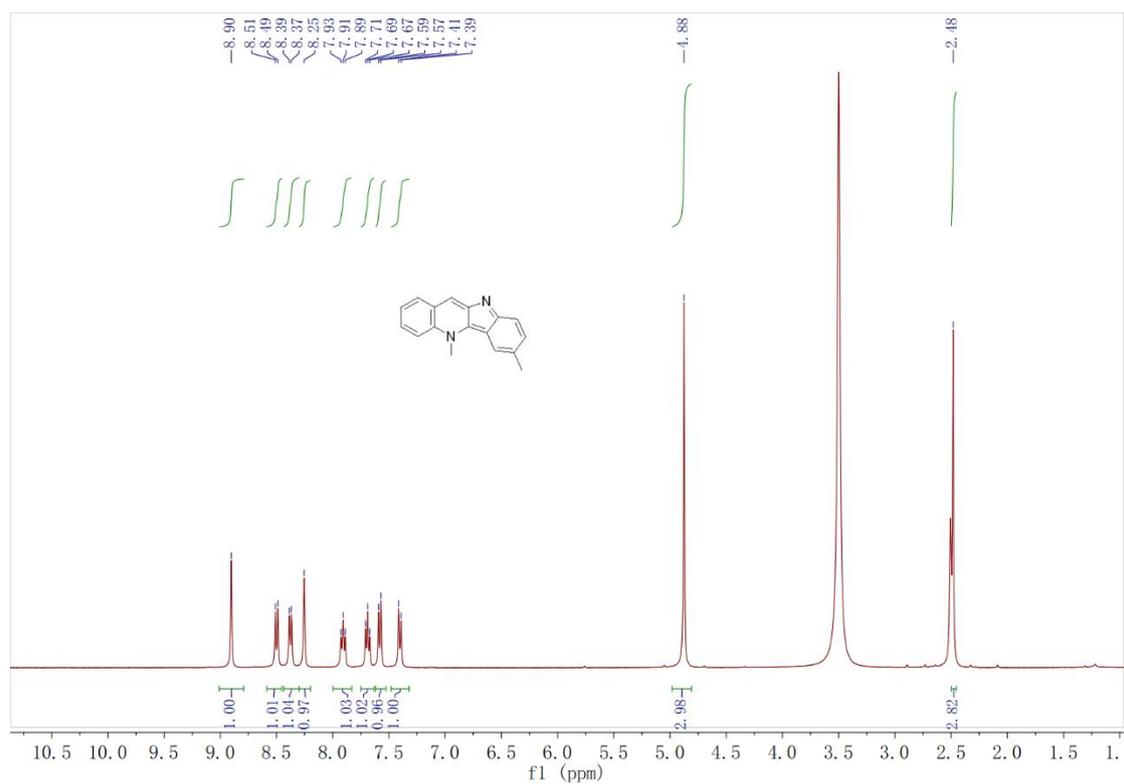
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200512_3
Comment

Acquisition Date 5/12/2020 2:45:16 PM

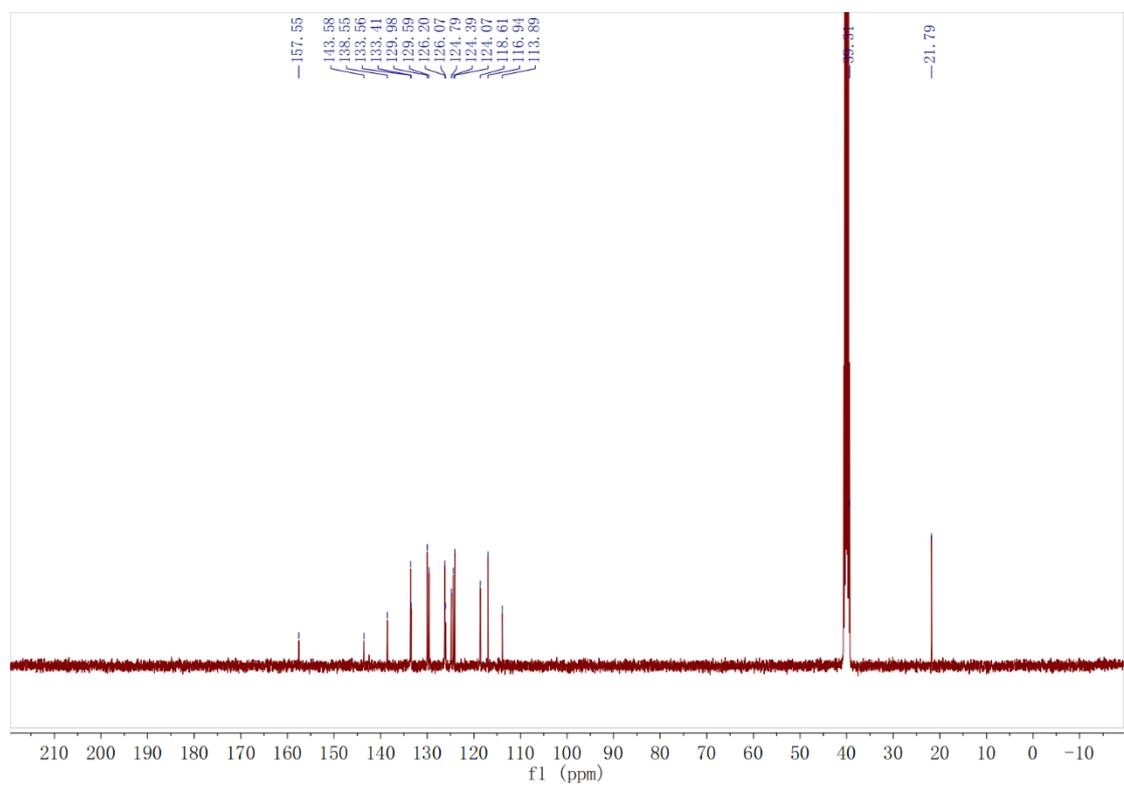
Operator LZU
Instrument microTOF



The Mass spectrogram of compound **a15**



The ^1H NMR spectrogram of compound **a16**



The ^{13}C NMR spectrogram of compound **a16**

Generic Display Report

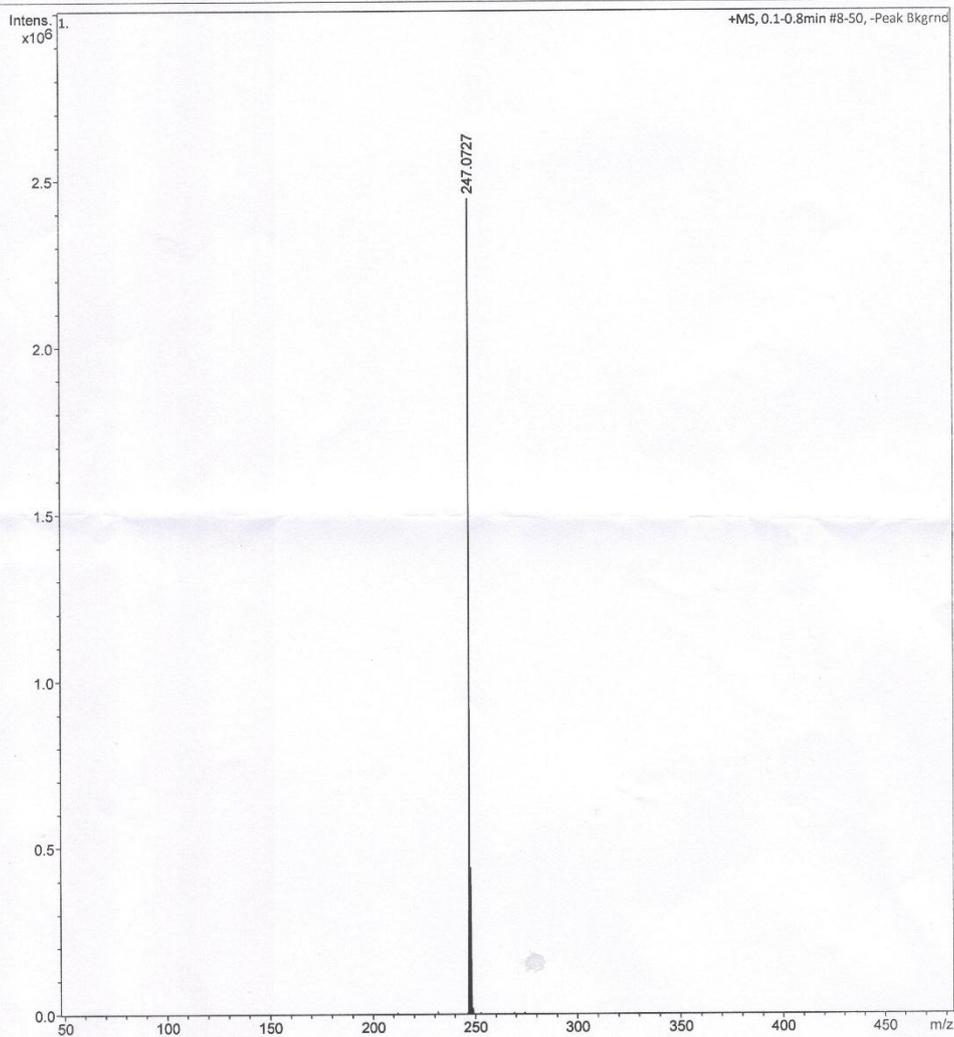
Analysis Info

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Method POS_100-1200_For LC.m
Sample Name CHENYONGJIA201118_7
Comment

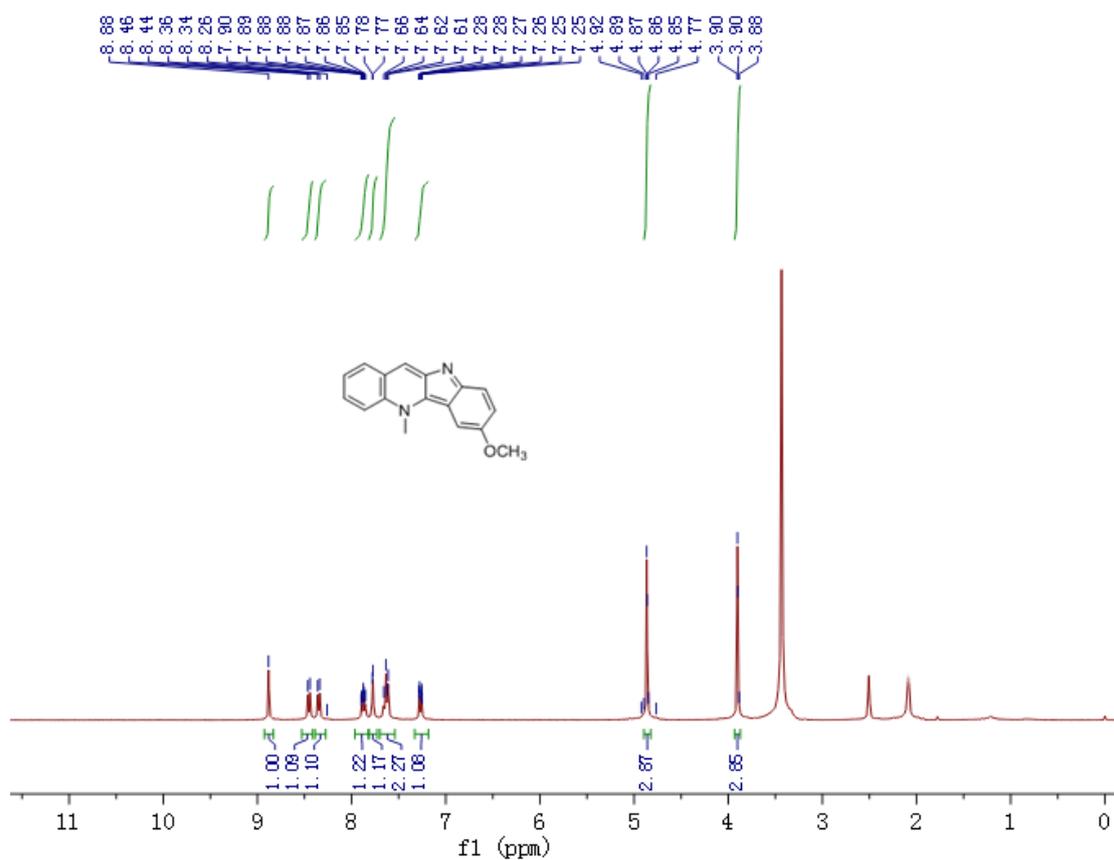
Acquisition Date 11/18/2020 12:29:51 PM

Operator LZU
Instrument micrOTOF

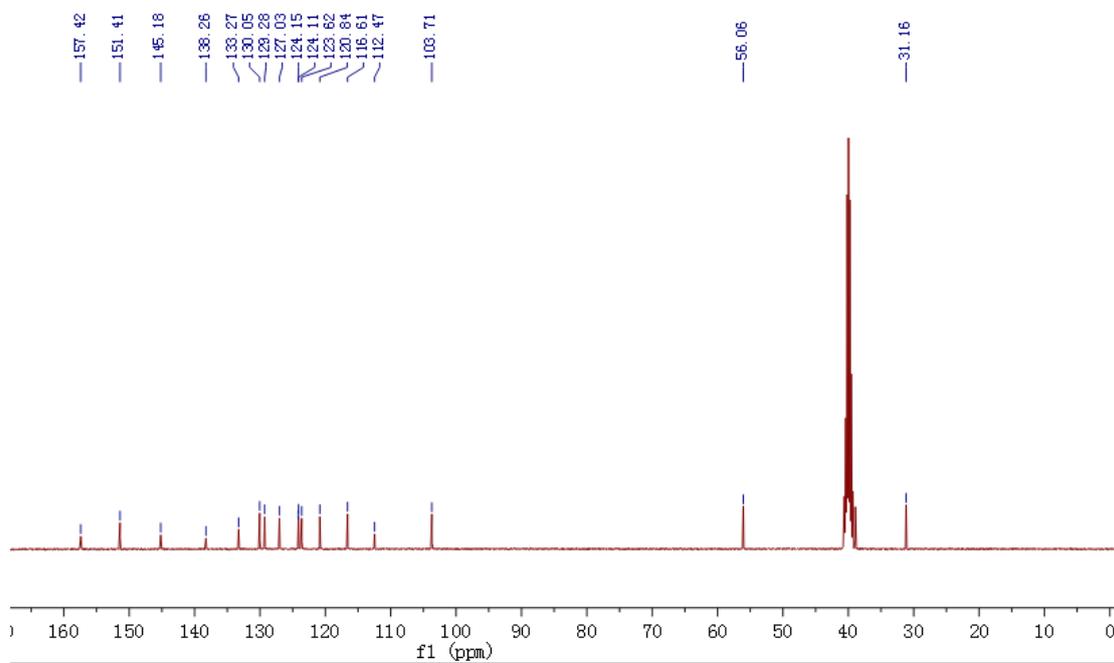
5-013



The Mass spectrogram of compound **a16**



The ¹H NMR spectrogram of compound **a17**



The ¹³C NMR spectrogram of compound **a17**

5-0043

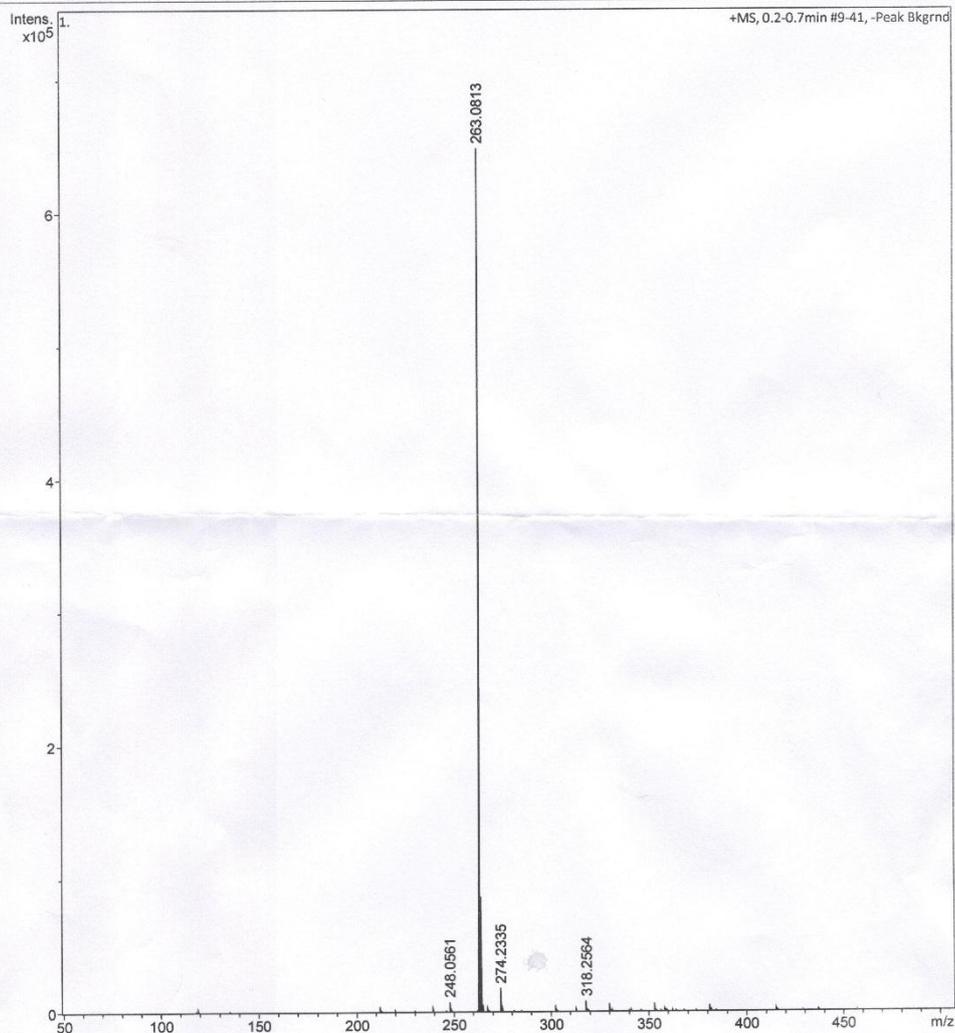
Generic Display Report

Analysis Info

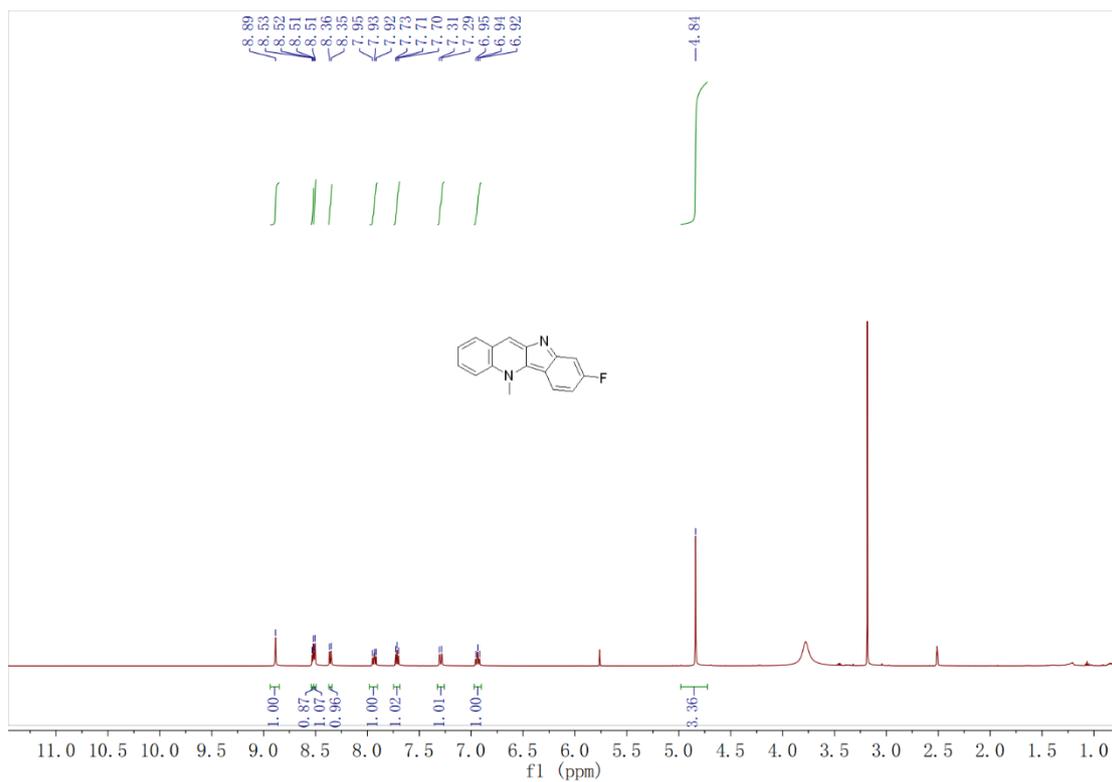
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Method POS_100-1200_ForLC.m
Sample Name CHENYONGJIA201113_2
Comment

Acquisition Date 11/13/2020 1:18:53 PM

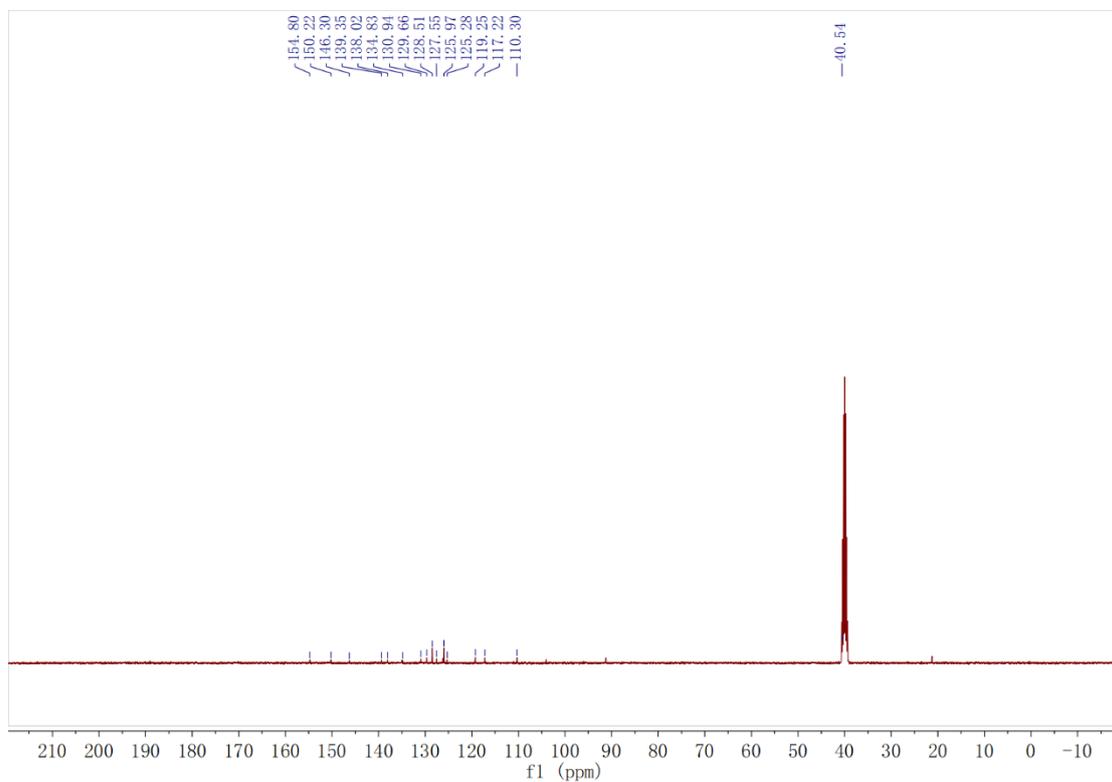
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a17**



The ^1H NMR spectrogram of compound **a18**



The ^{13}C NMR spectrogram of compound **a18**

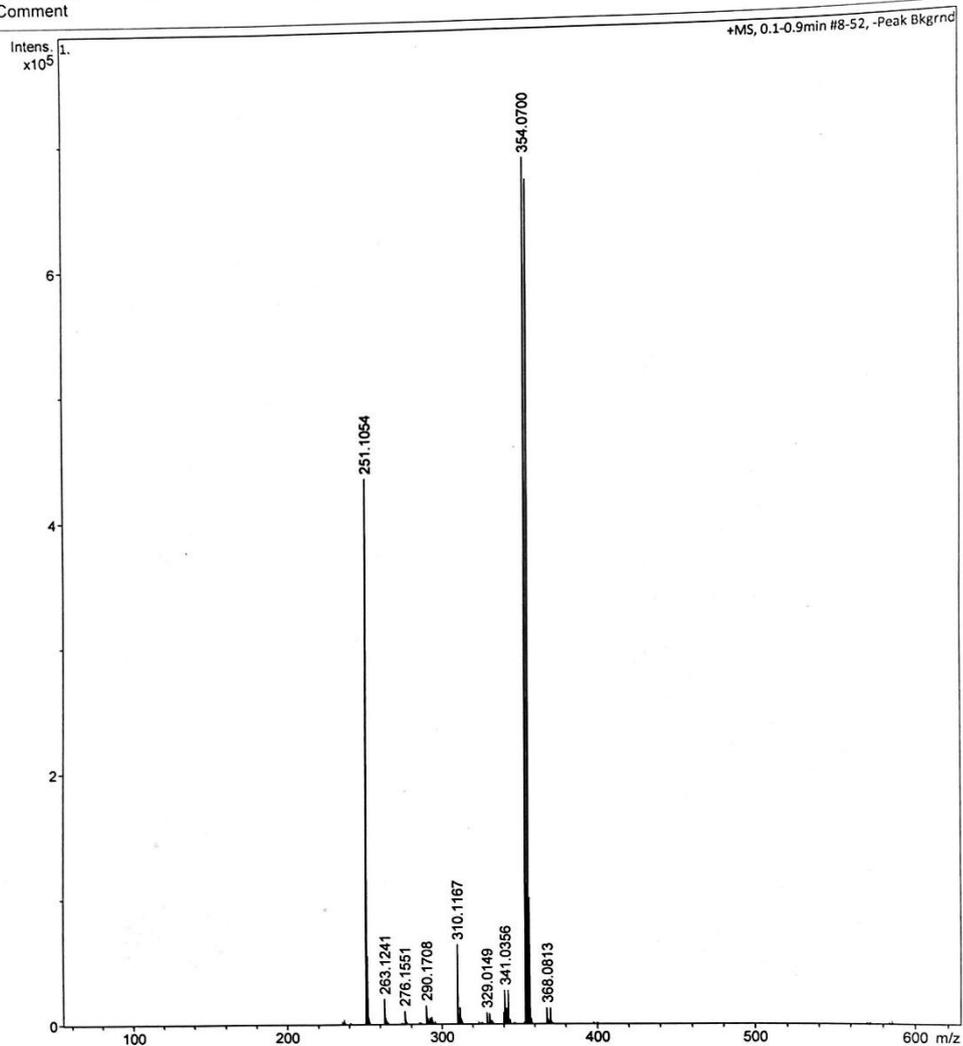
Generic Display Report

Analysis Info

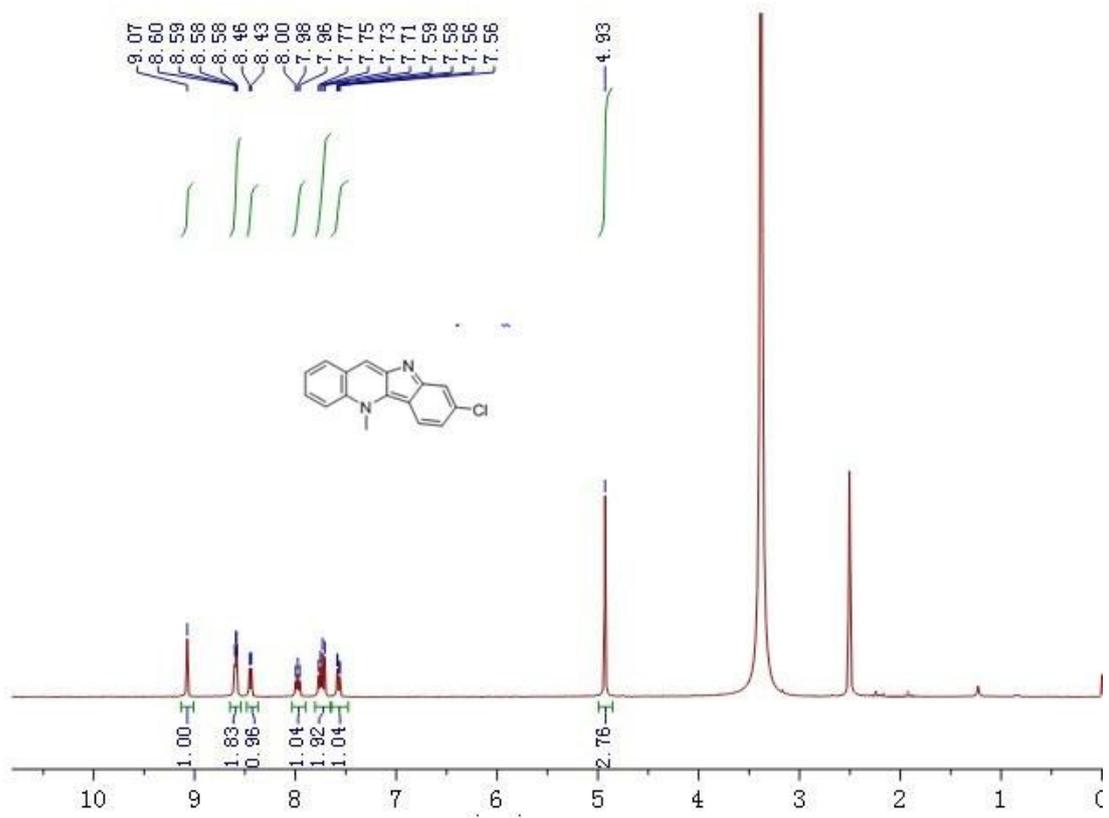
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Method POS_100-1200_For LC.m
Sample Name CHENYONGJIA201204_20
Comment

Acquisition Date 12/4/2020 12:17:53 PM

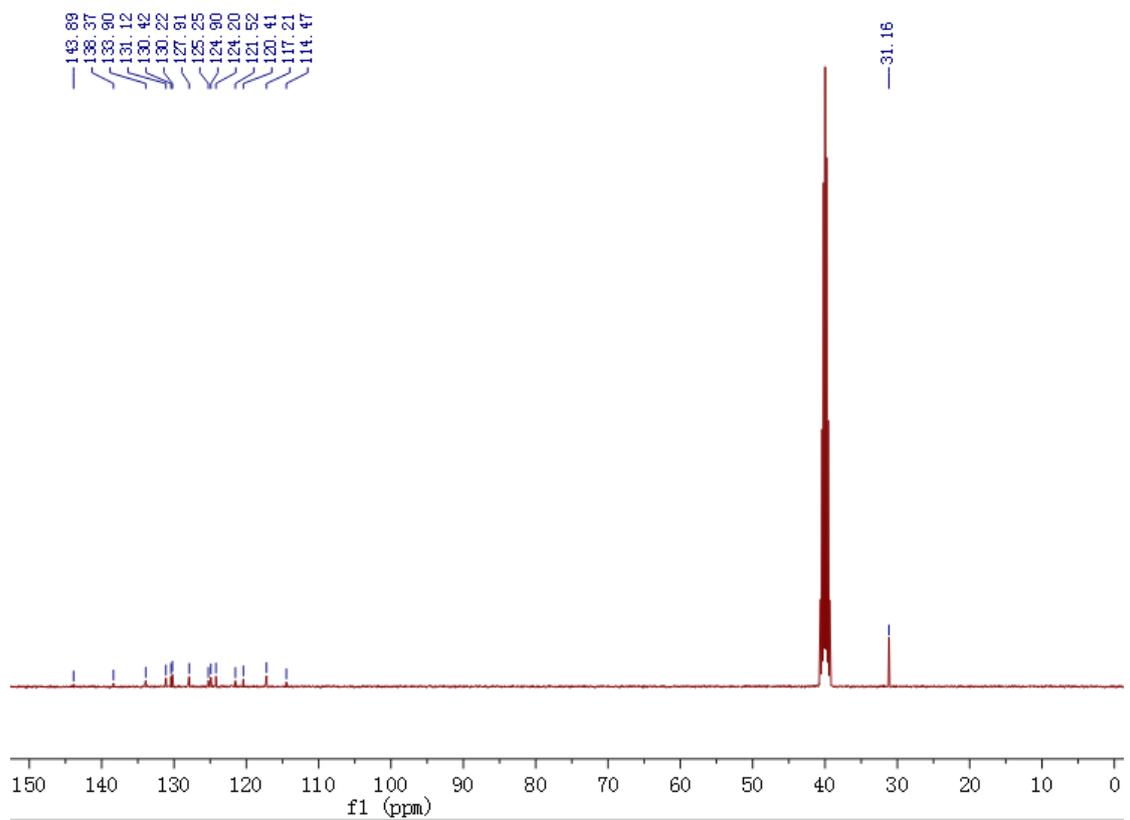
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a18**



The ¹H NMR spectrogram of compound **a19**



The ¹³C NMR spectrogram of compound **a19**

Generic Display Report

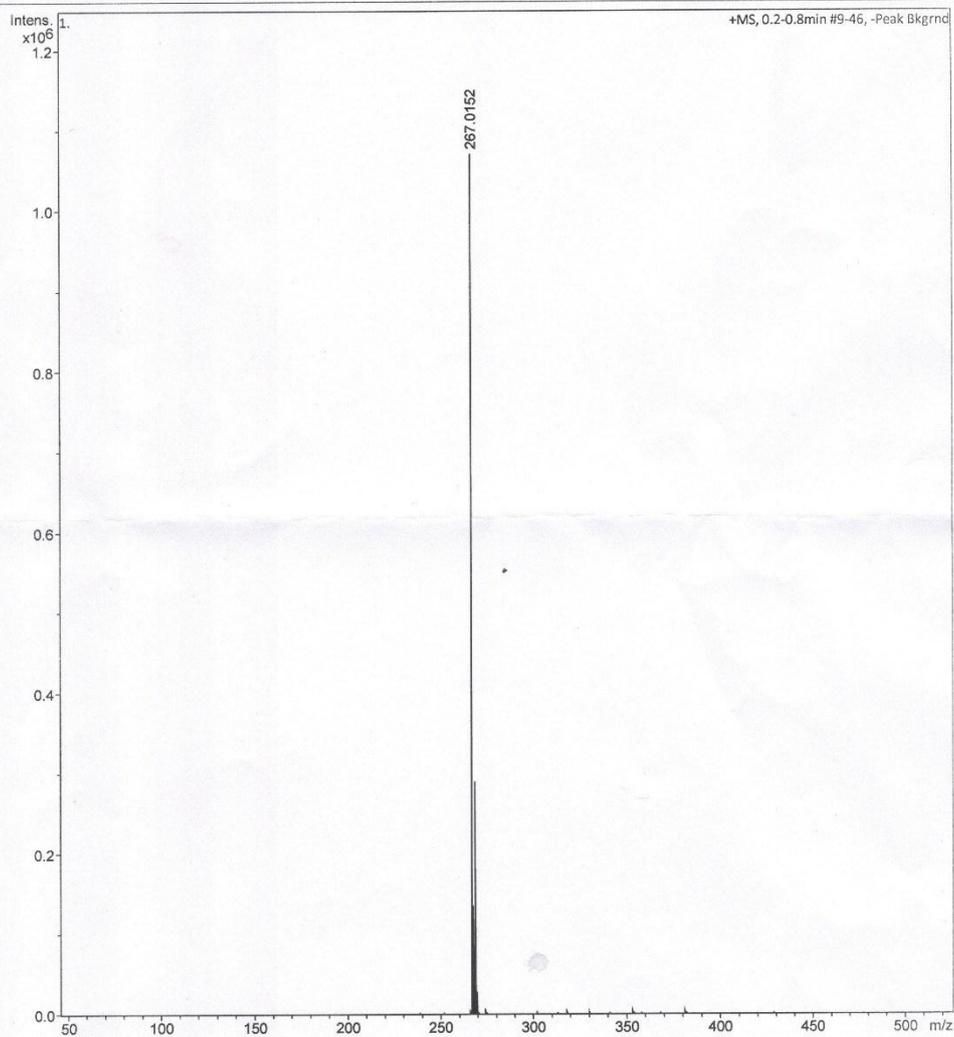
Analysis Info

Analysis Name D:\Data\yang\new\CHENYONGJIA201118_6_13_01_35388.d
Method POS_100-1200_For LC.m
Sample Name CHENYONGJIA201118_6
Comment

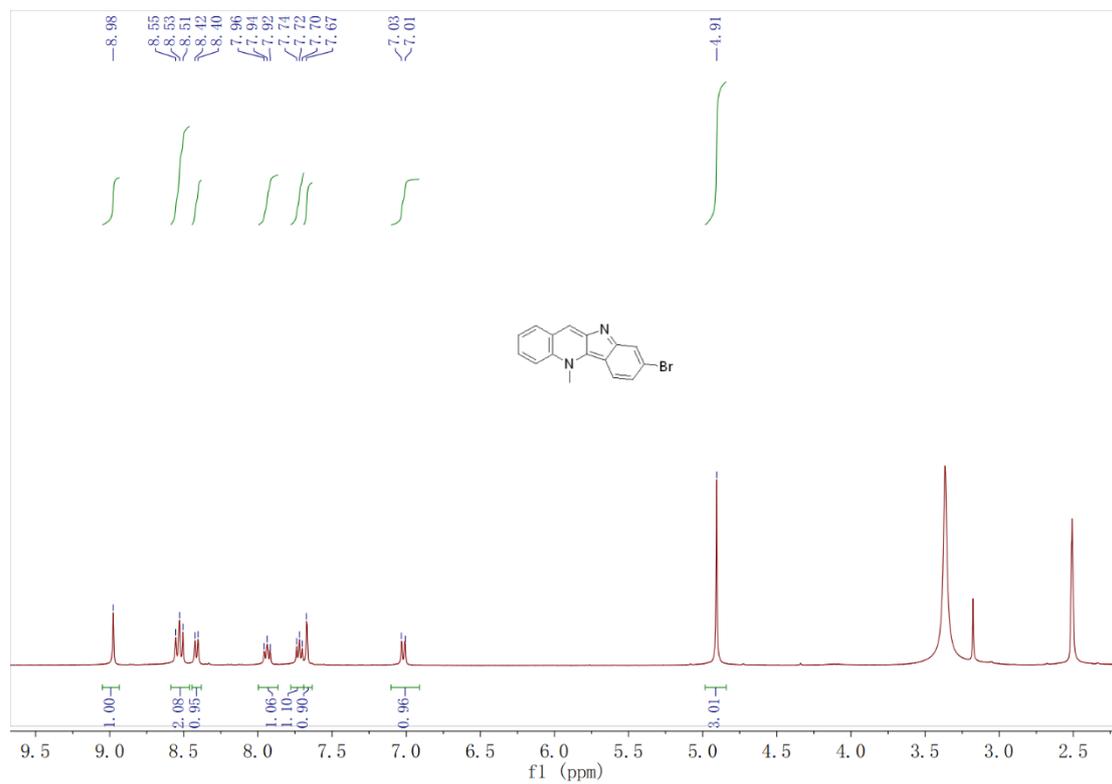
Acquisition Date 11/18/2020 12:26:46 PM

Operator LZU
Instrument microTOF

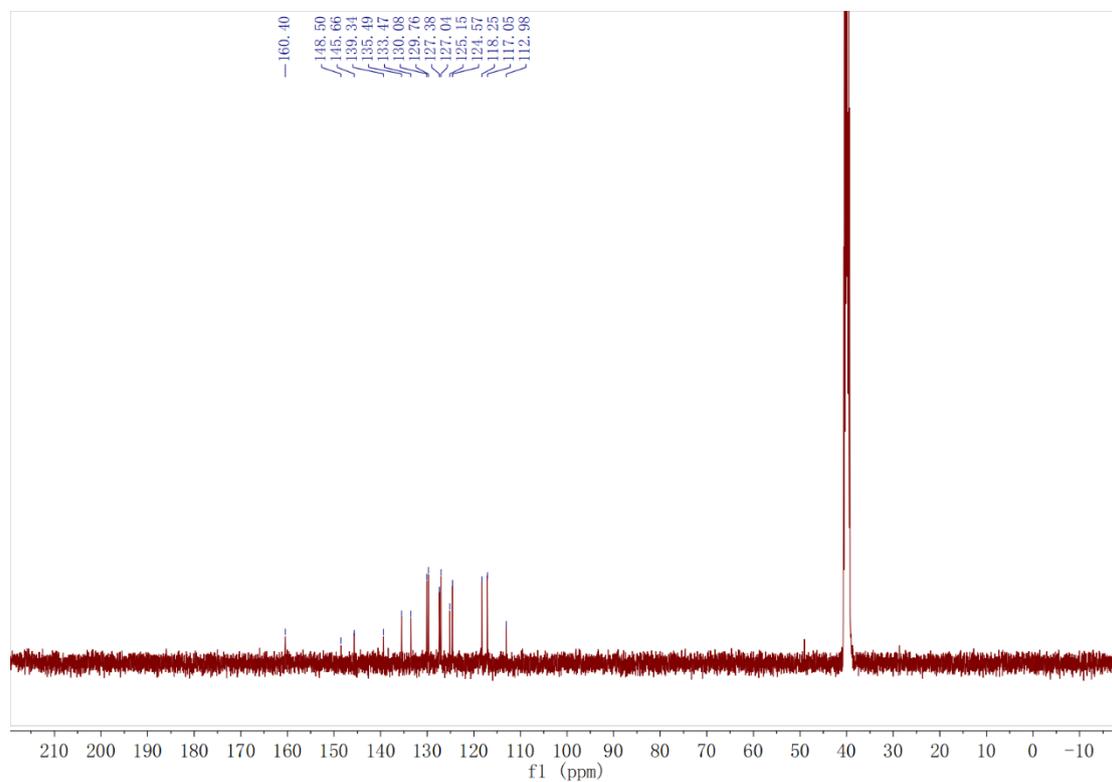
6-a



The Mass spectrogram of compound **a19**



The ^1H NMR spectrogram of compound **a20**

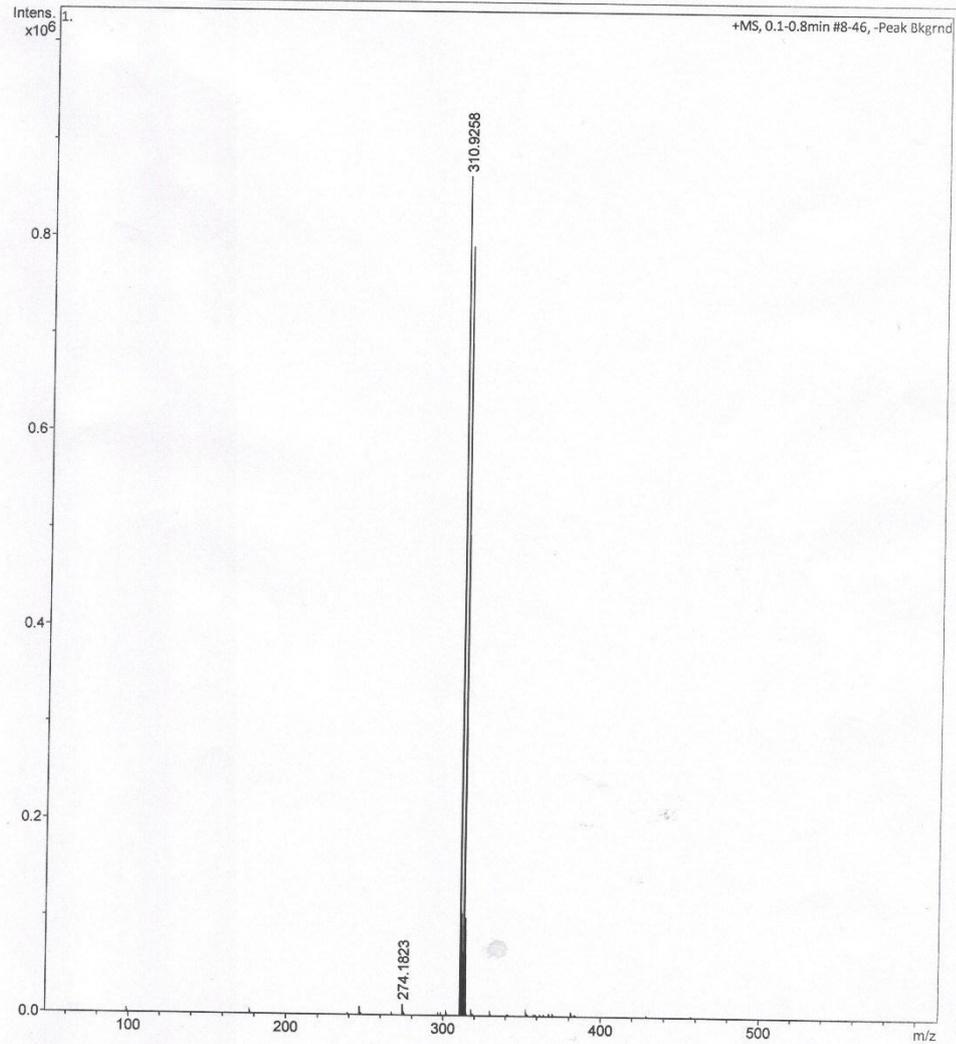


The ^{13}C NMR spectrogram of compound **a20**

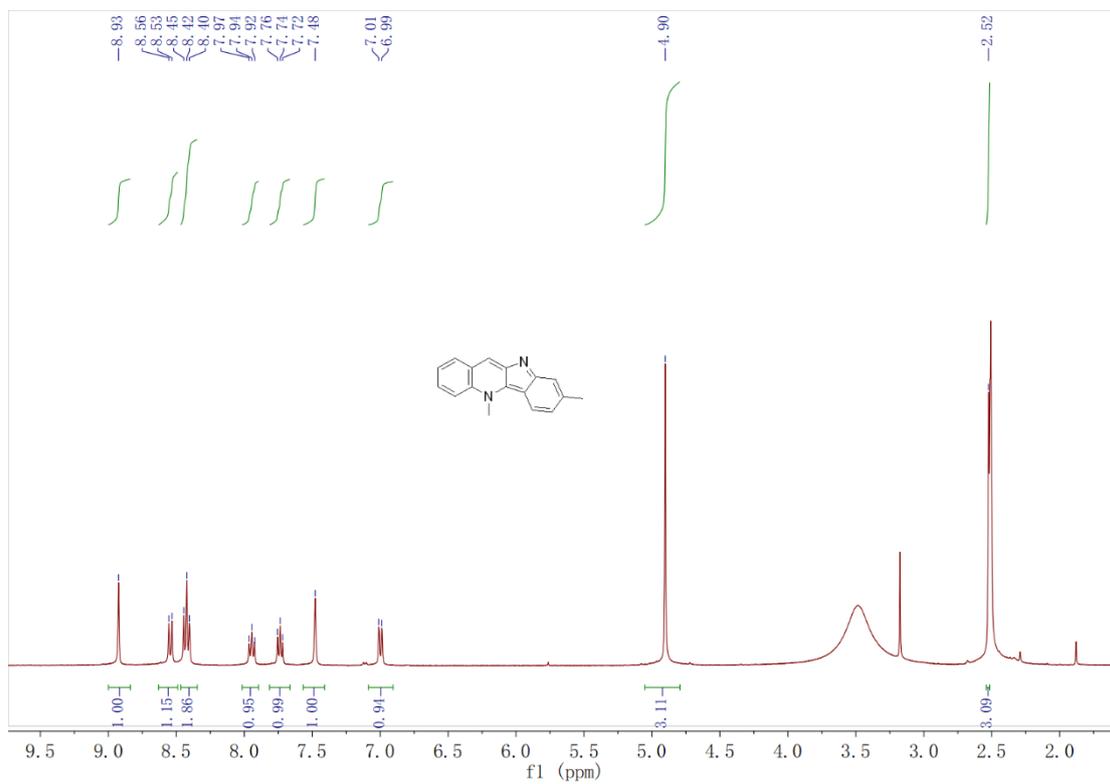
Generic Display Report

Analysis Info

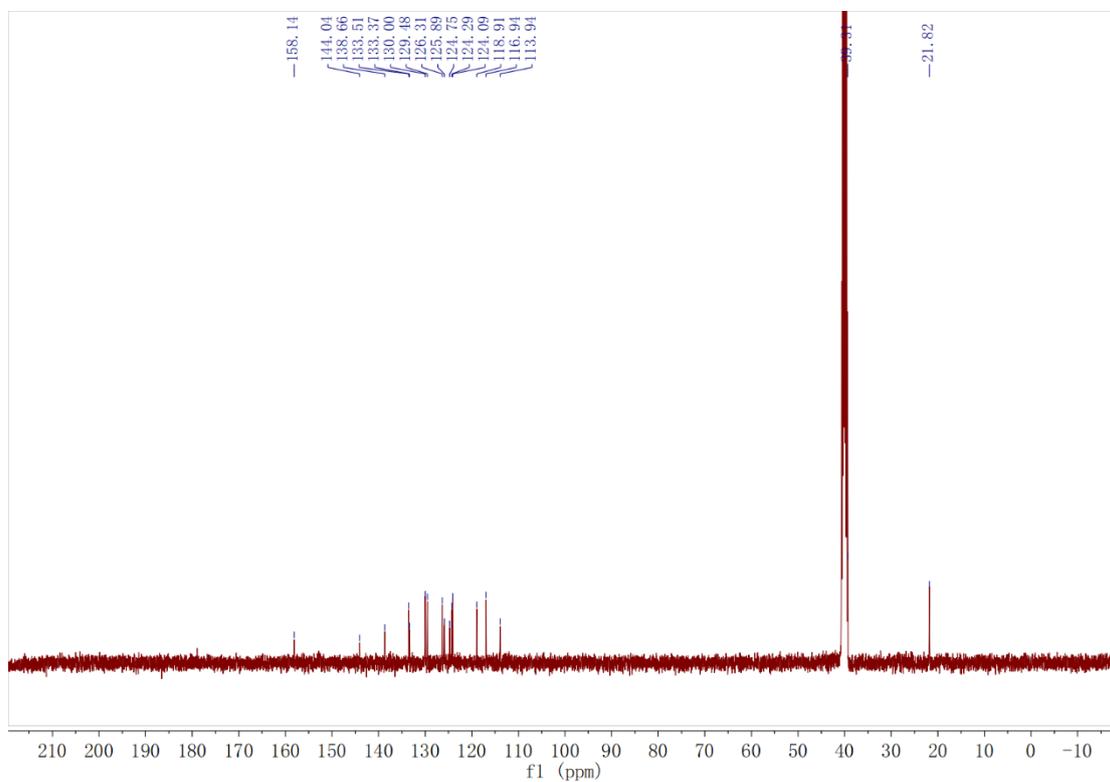
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Method	POS_100-1200_For LC.m	Operator	LZU
Sample Name	CHENYONGJIA201124_5	Instrument	micrOTOF
Comment			



The Mass spectrogram of compound **a20**



The ^1H NMR spectrogram of compound **a21**



The ^{13}C NMR spectrogram of compound **a21**

Generic Display Report

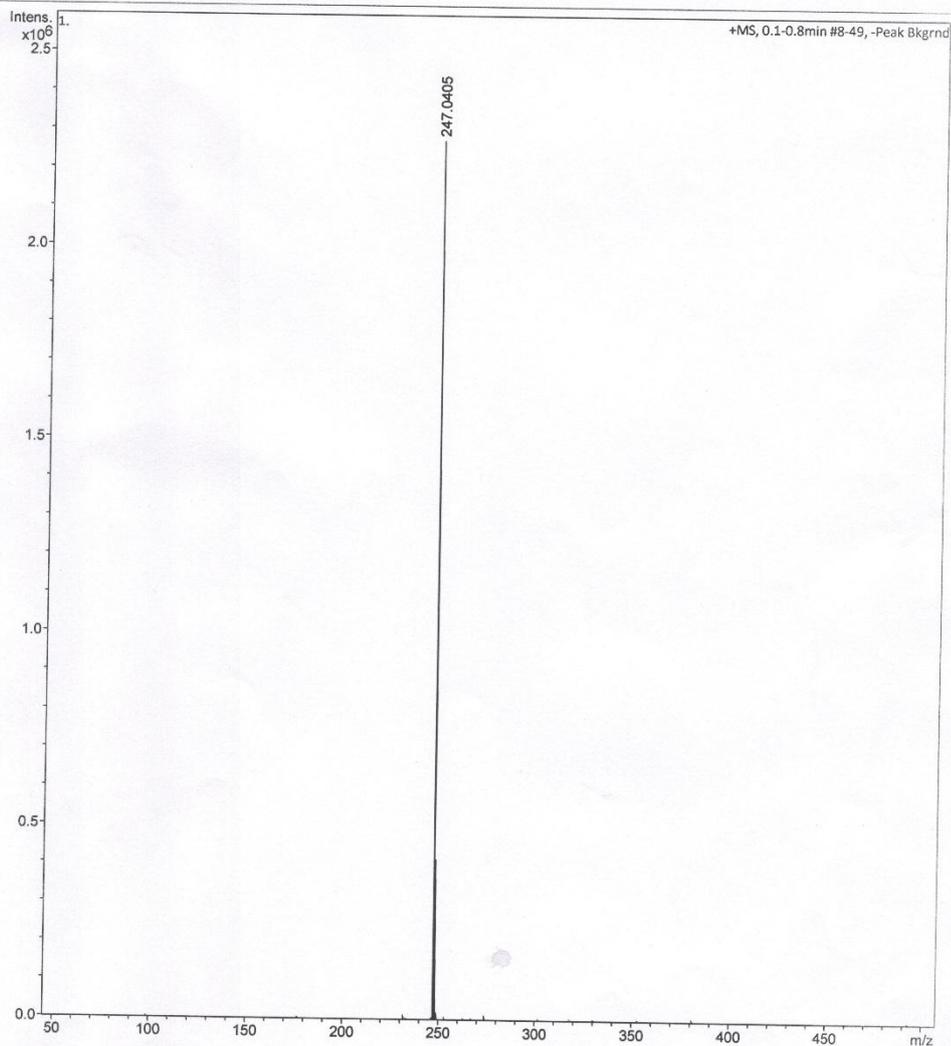
6-a13

Analysis Info

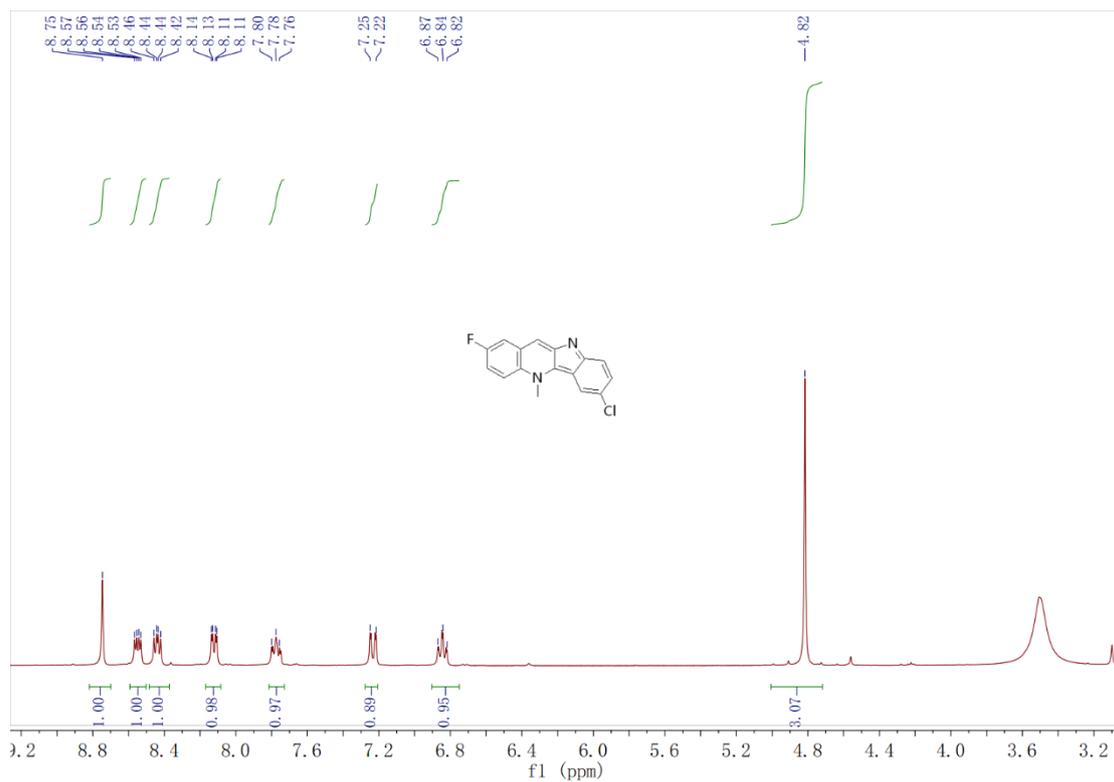
Analysis Name D:\Data\yang\new\CHENYONGJIA201124_4_15_01_35529.d
Method POS_100-1200_For LC.m
Sample Name CHENYONGJIA201124_4
Comment

Acquisition Date 11/24/2020 12:19:39 PM

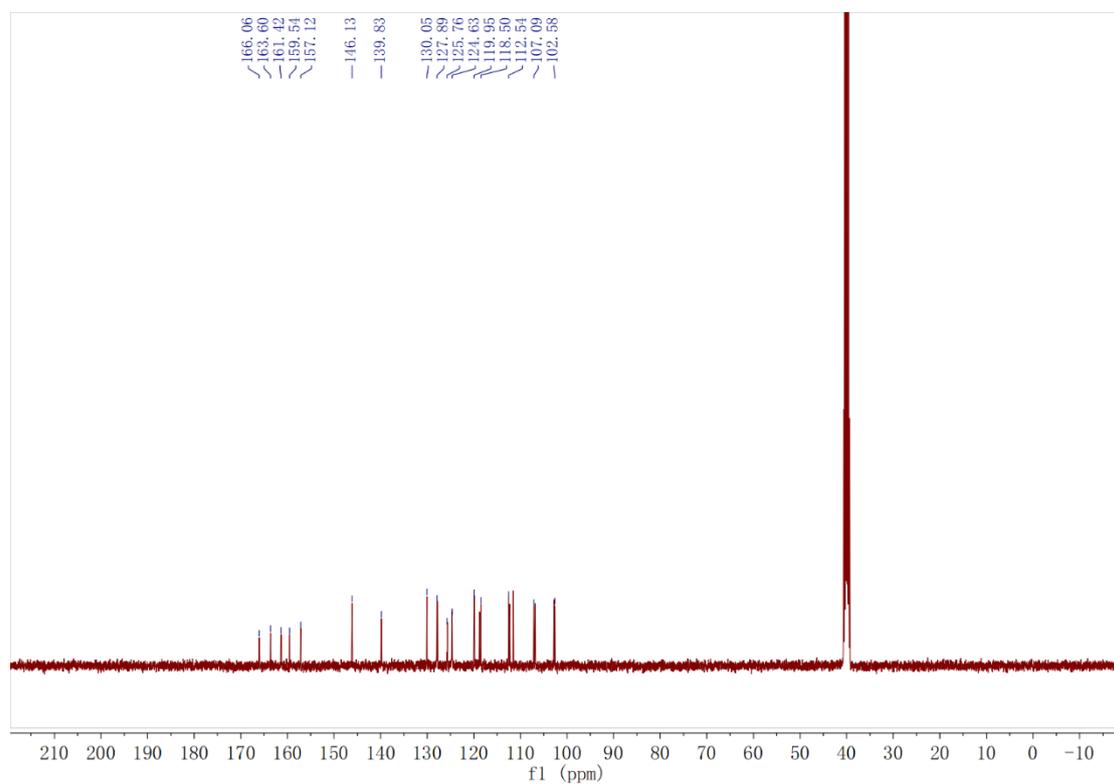
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a21**



The ^1H NMR spectrogram of compound **a23**



The ^{13}C NMR spectrogram of compound **a23**

L-23

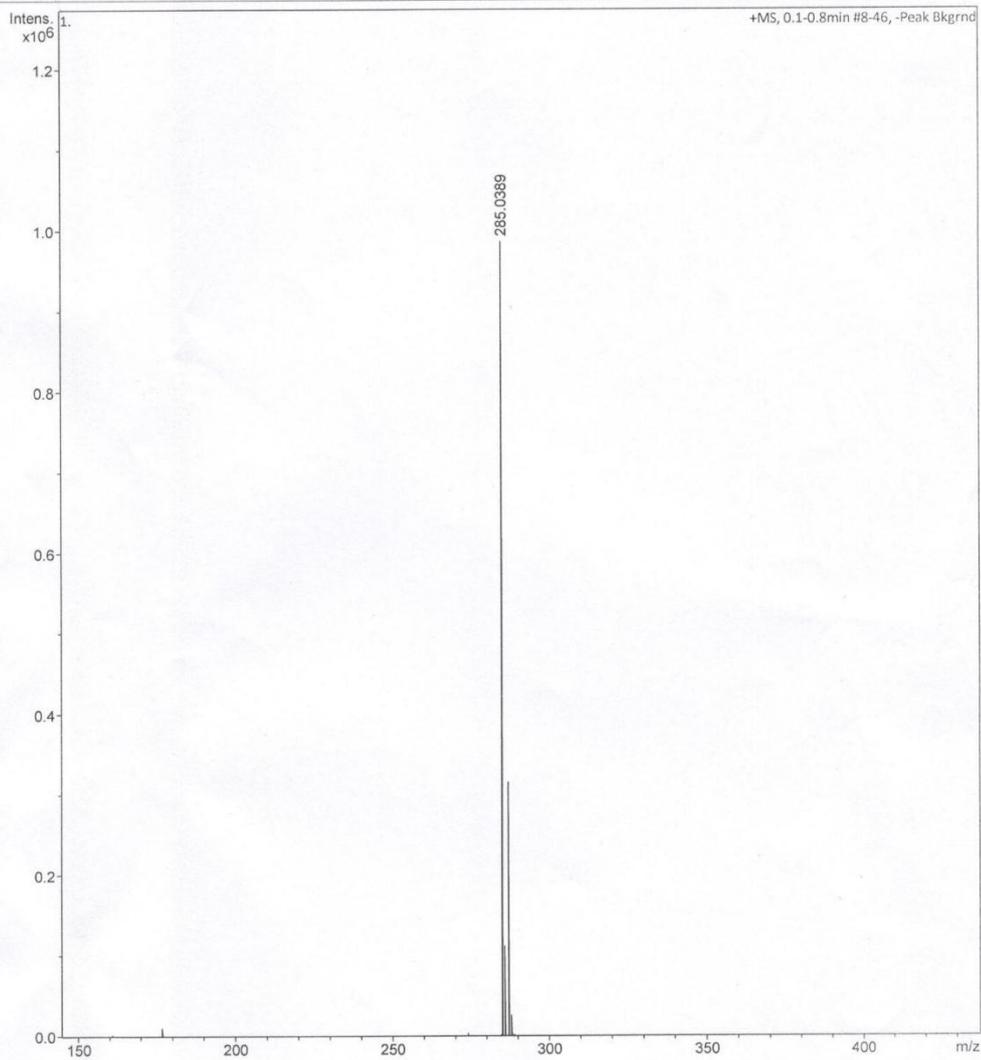
Generic Display Report

Analysis Info

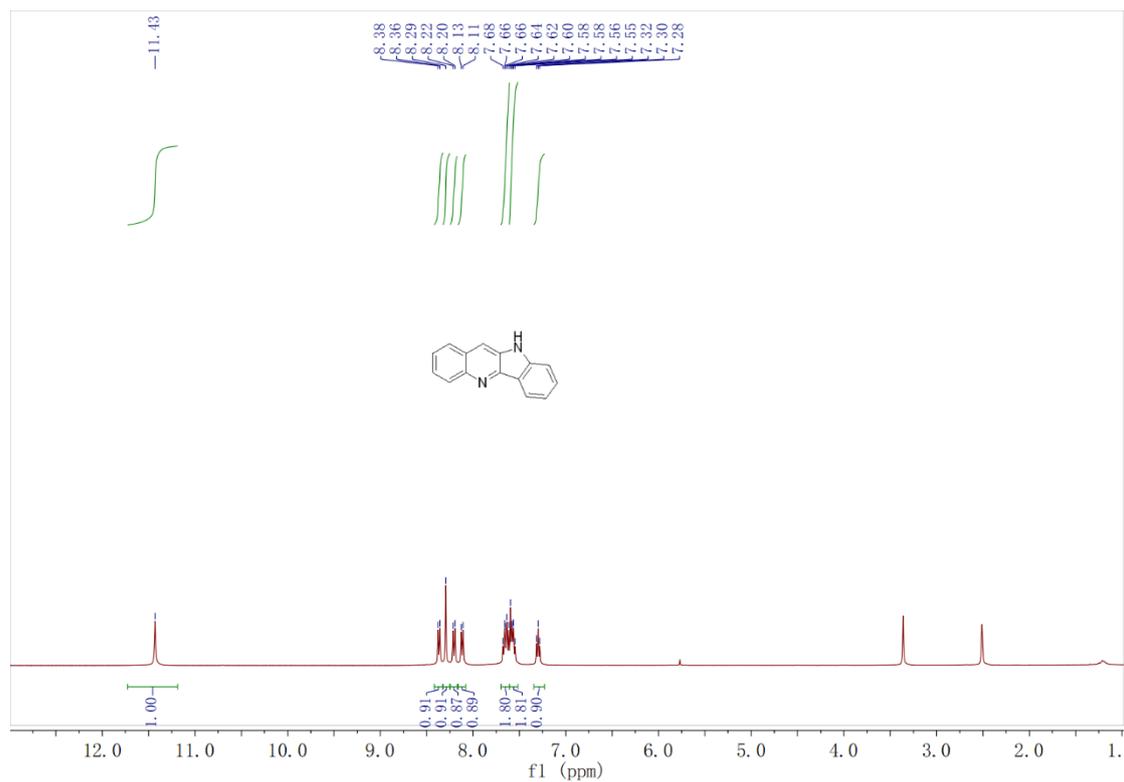
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Sample Name LIUHUA200601_1
Comment

Acquisition Date 6/1/2020 1:09:57 PM

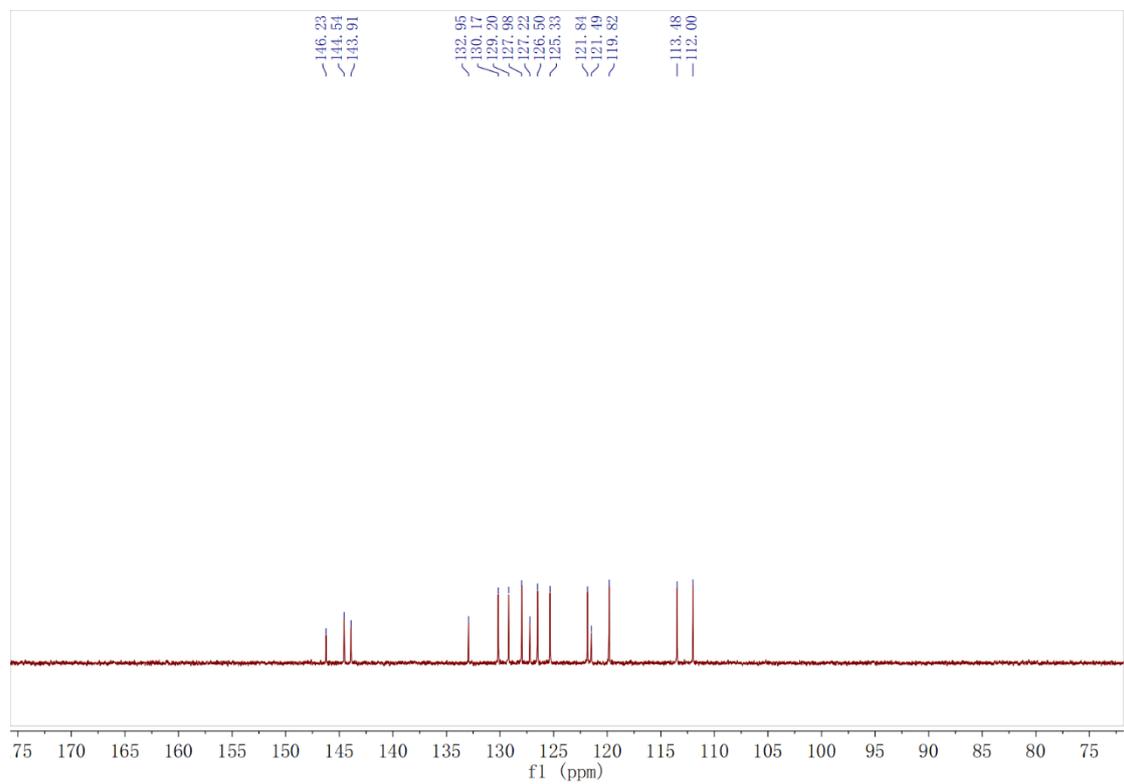
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **a23**



The ¹H NMR spectrogram of compound **b1**



The ¹³C NMR spectrogram of compound **b1**

2

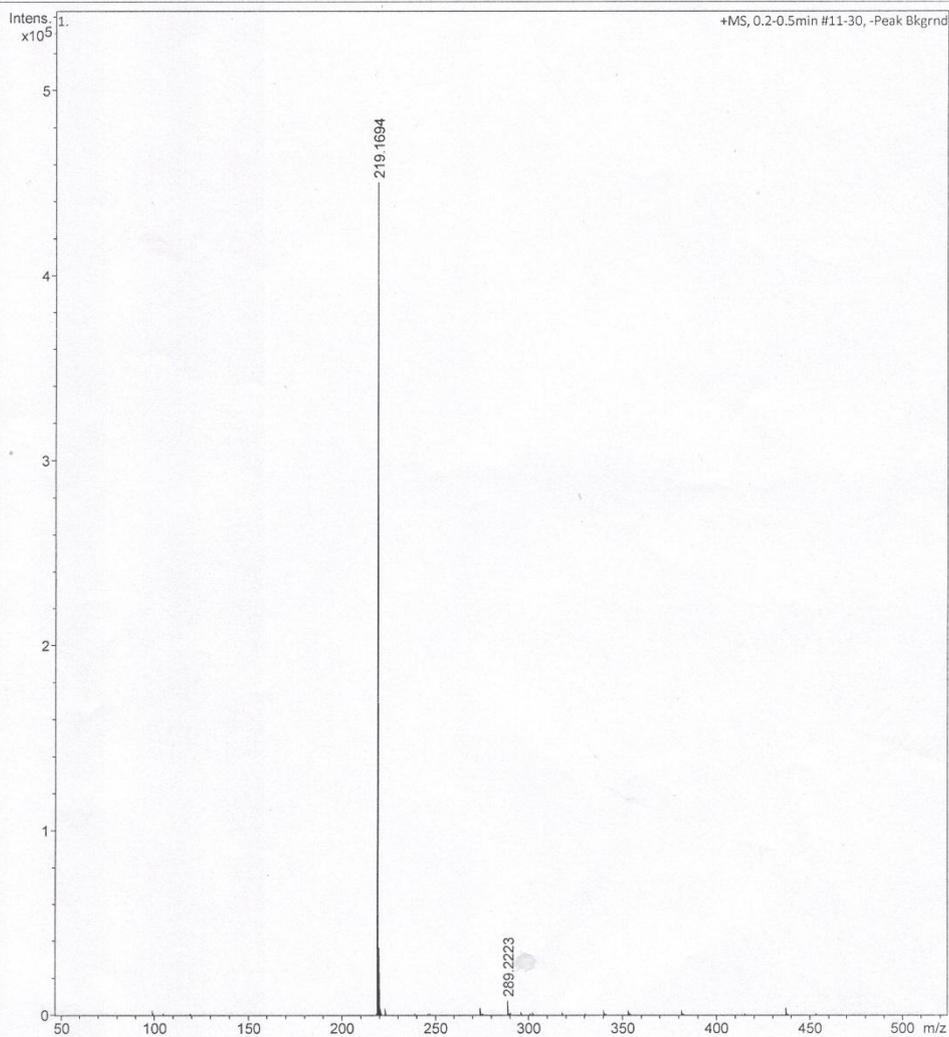
Generic Display Report

Analysis Info

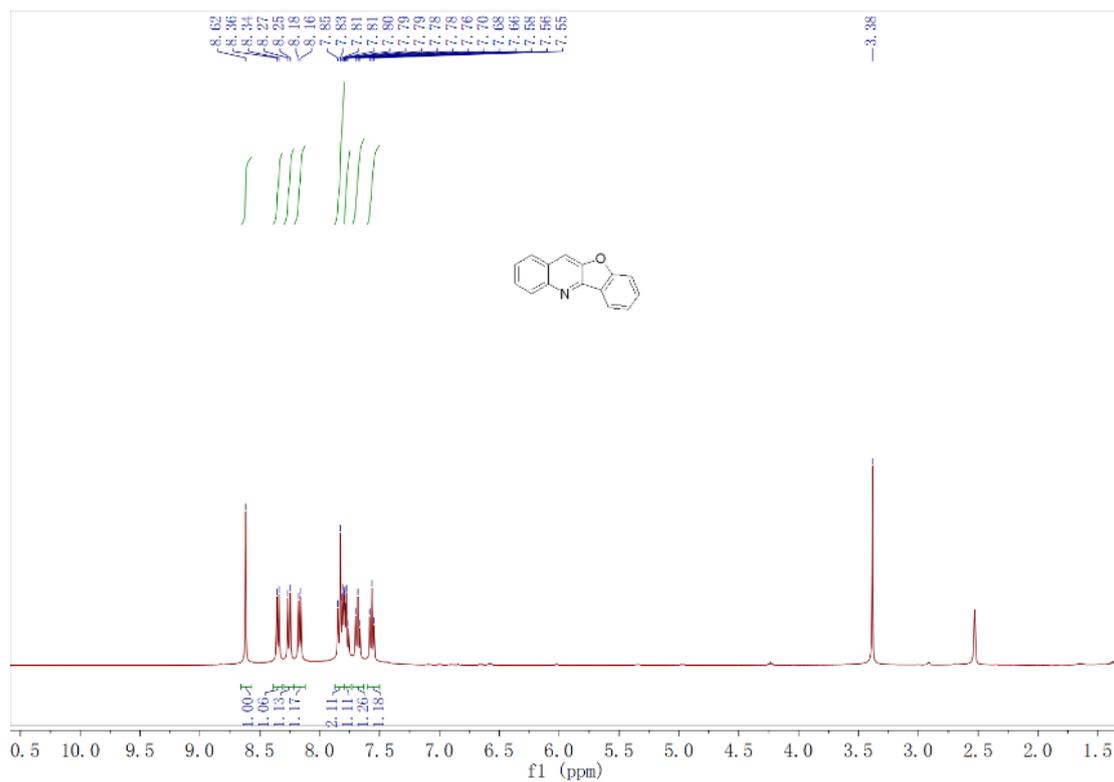
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200508_4
Comment

Acquisition Date 5/8/2020 1:54:39 PM

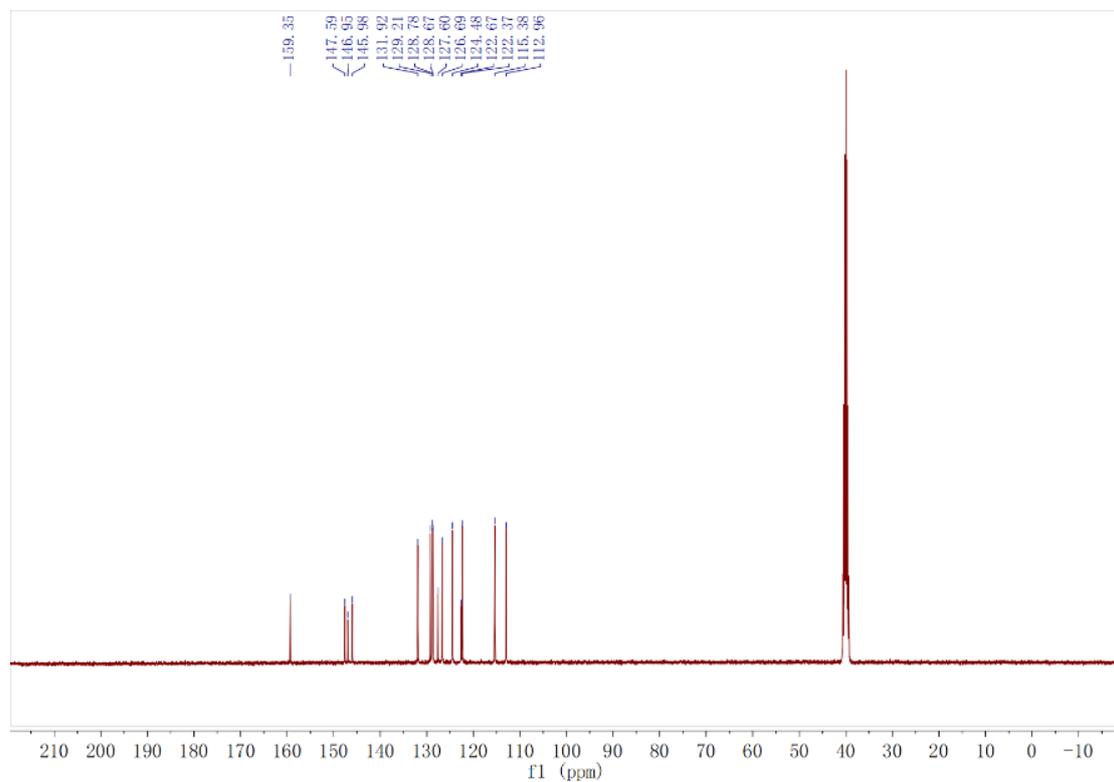
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **b1**



The ¹H NMR spectrogram of compound **b2**



The ¹³C NMR spectrogram of compound **b2**

L-27

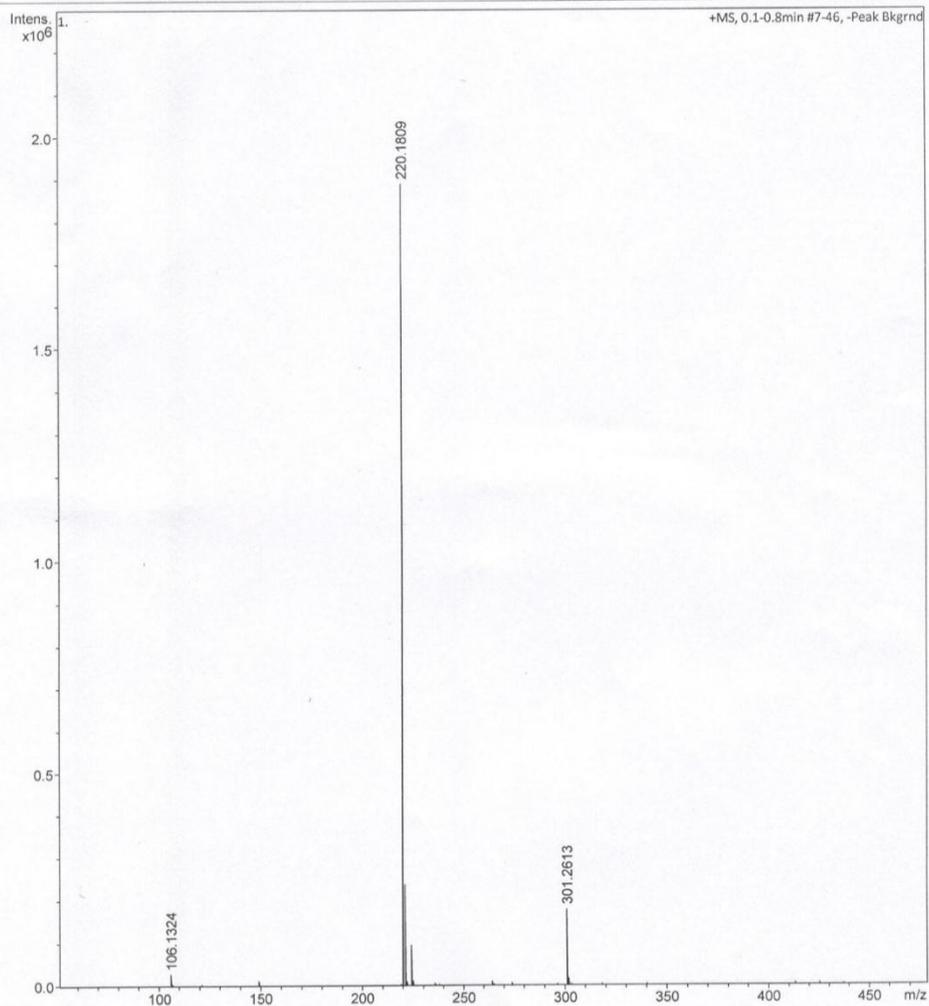
Generic Display Report

Analysis Info

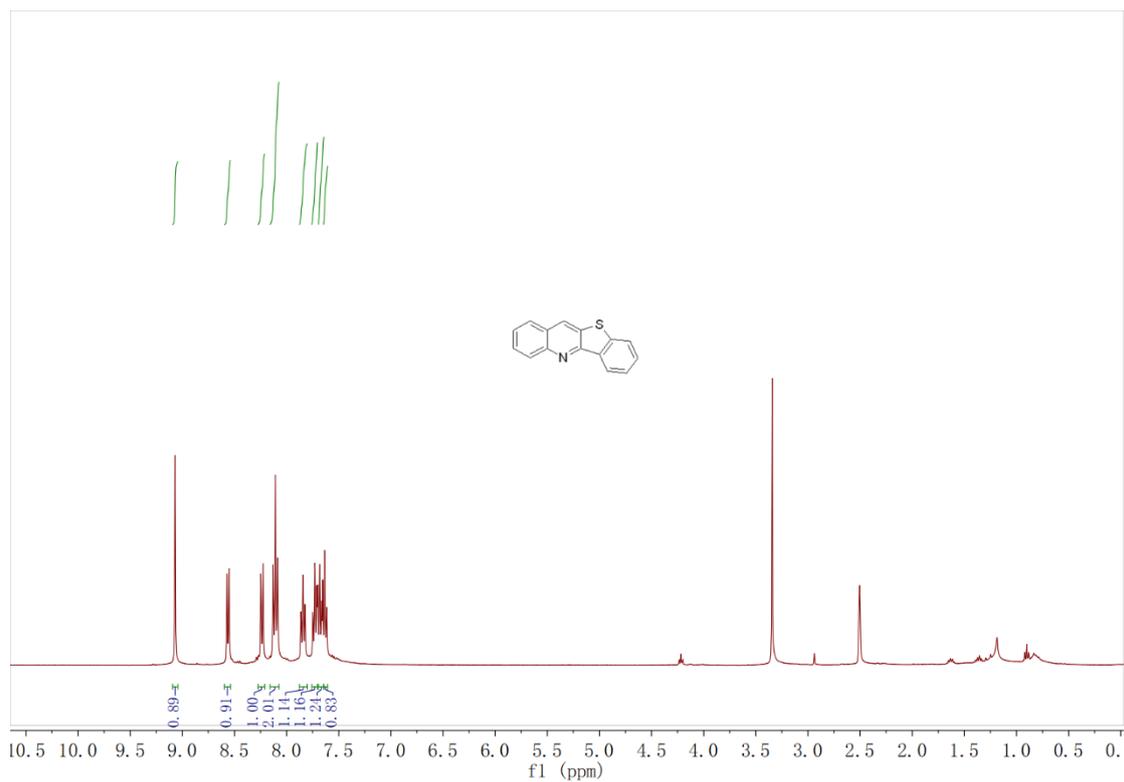
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Method POS_100-1200_For LC.m
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Comment

Acquisition Date 5/7/2020 1:55:58 PM

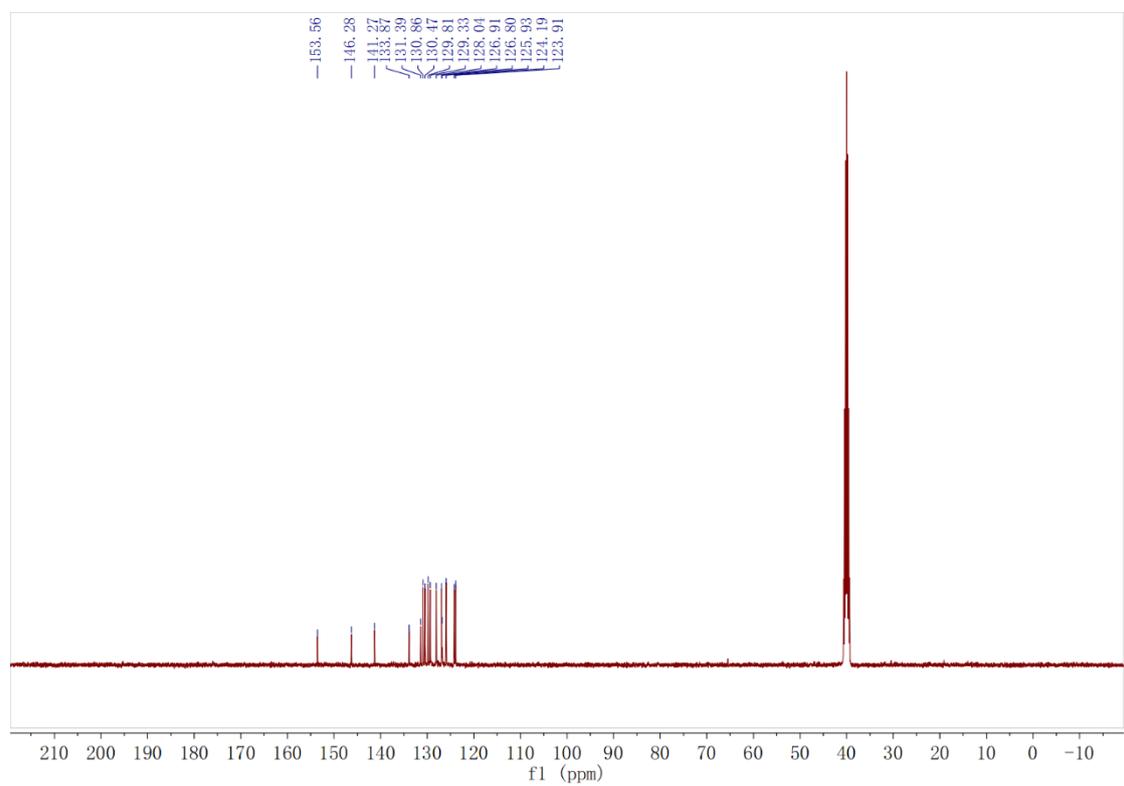
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **b2**



The ¹H NMR spectrogram of compound **b3**

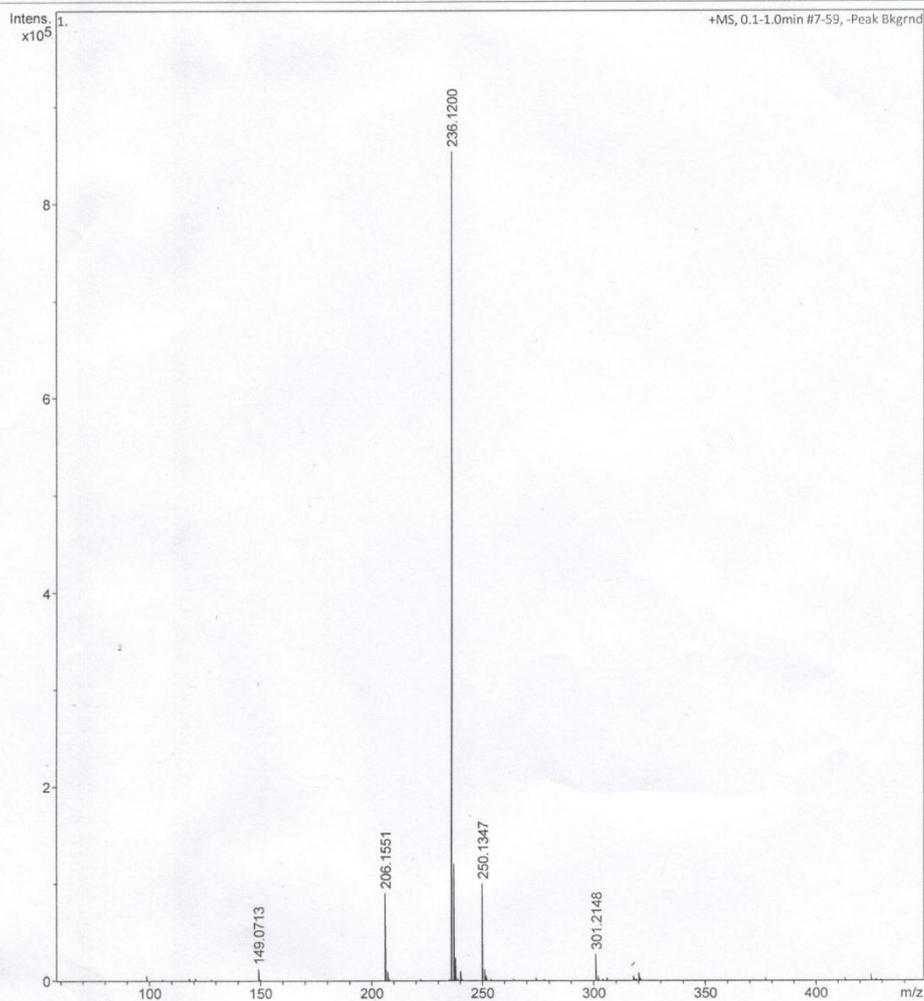


The ¹³C NMR spectrogram of compound **b3**

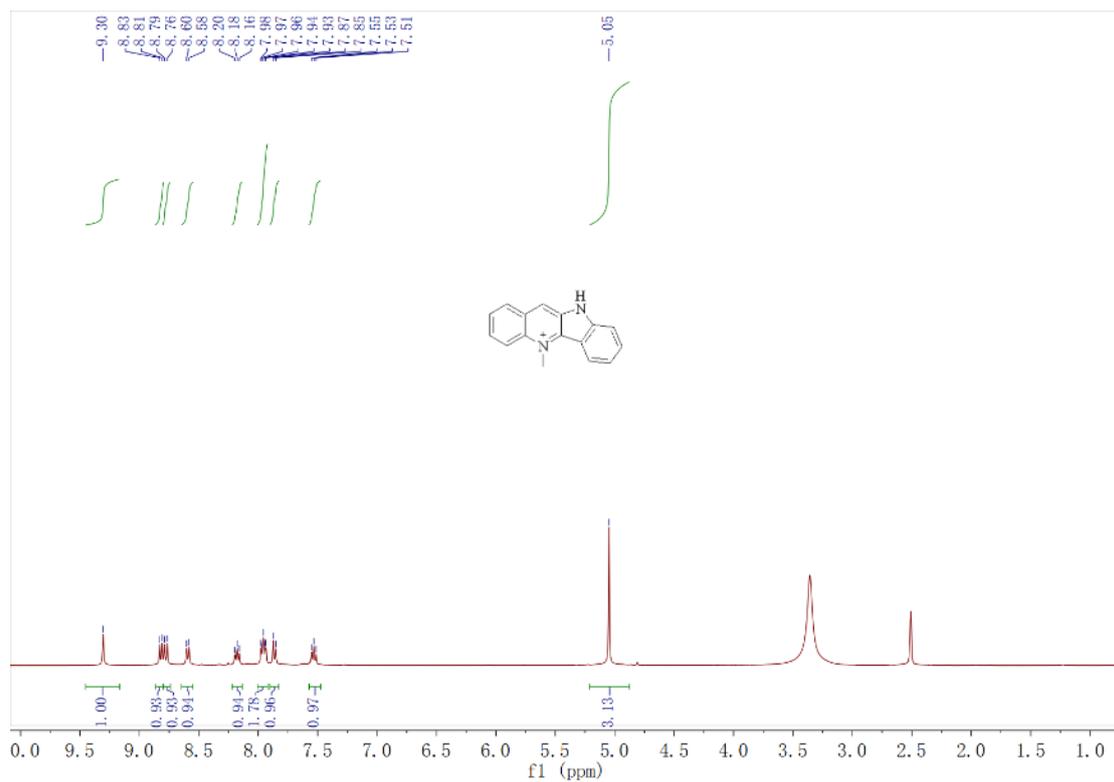
L-31

Generic Display Report

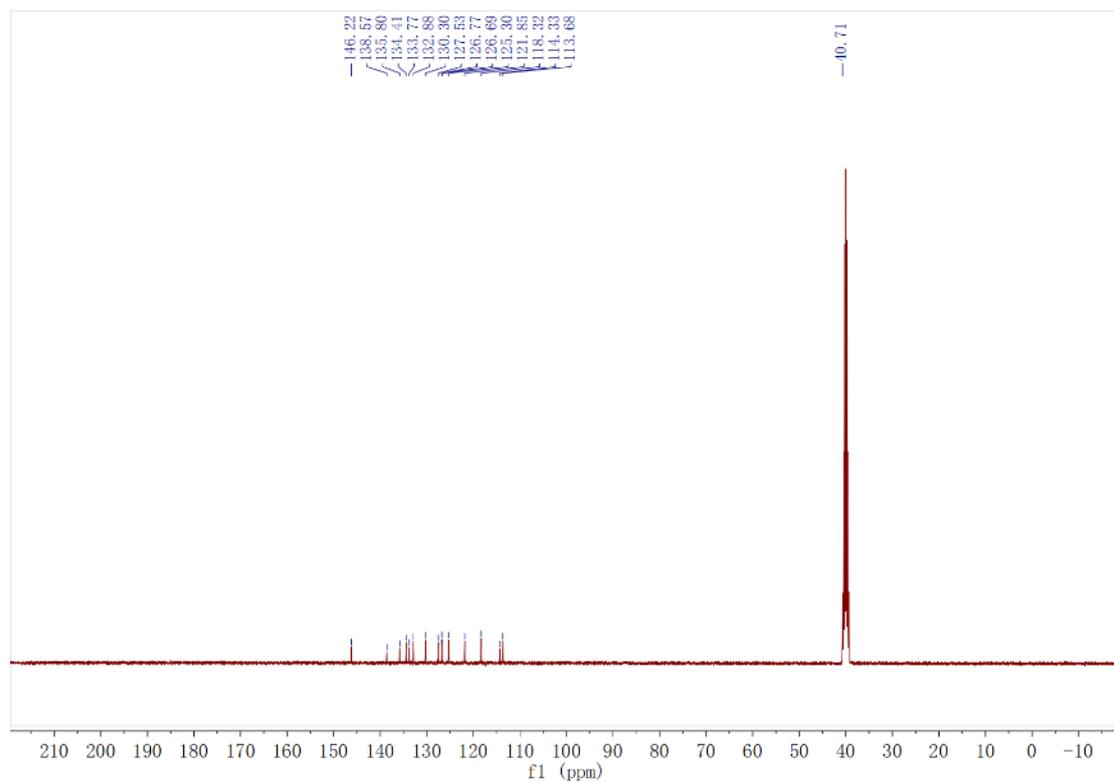
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Method	POS_100-1200_For LC.m	Operator	LZU
Sample Name	LIUHUA200520	Instrument	micrOTOF
Comment			



The Mass spectrogram of compound **b3**



The ¹H NMR spectrogram of compound **c1**



The ¹³C NMR spectrogram of compound **c1**

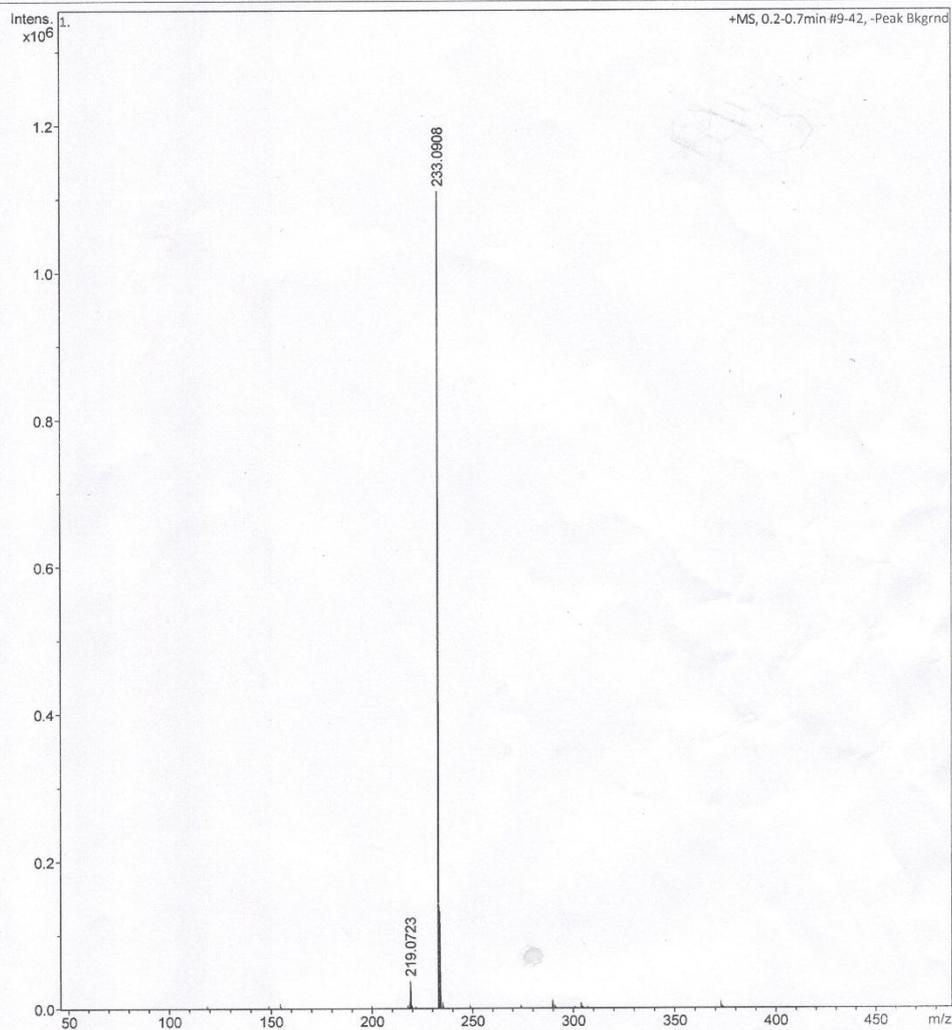
Generic Display Report

Analysis Info

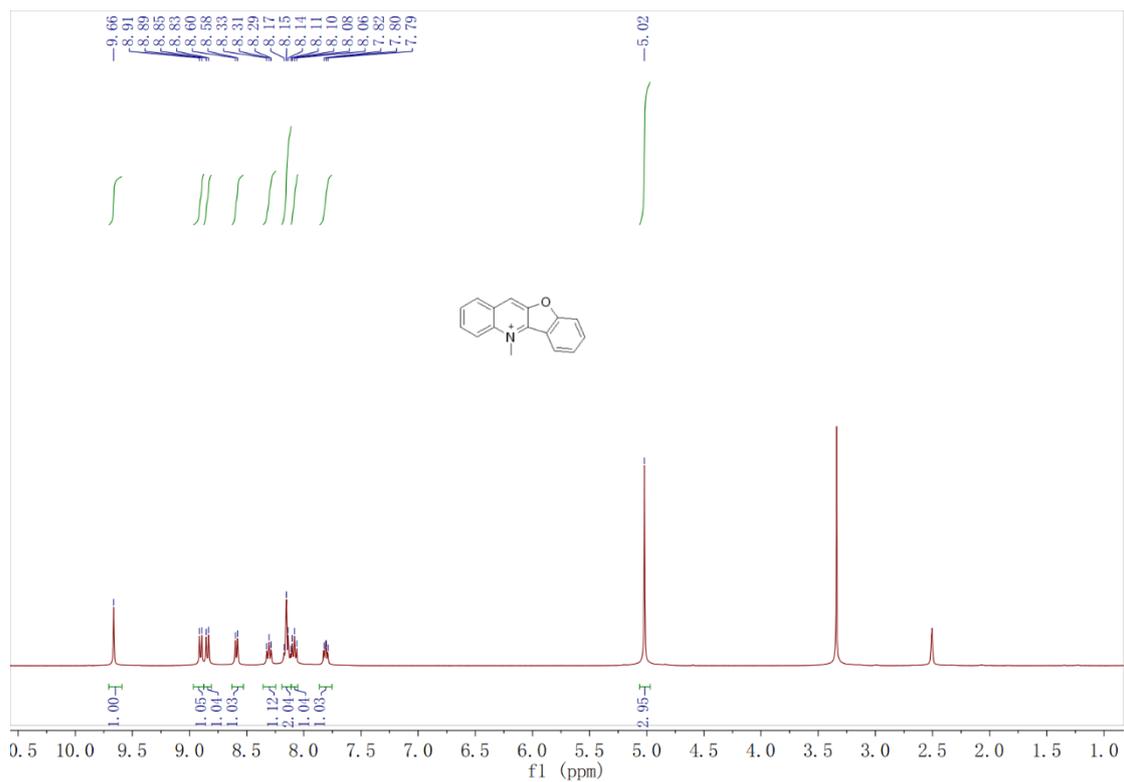
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Method POS_100-1200_For LC.m
Sample Name CHUQINGRU200731
Comment

Acquisition Date 7/31/2020 2:19:46 PM

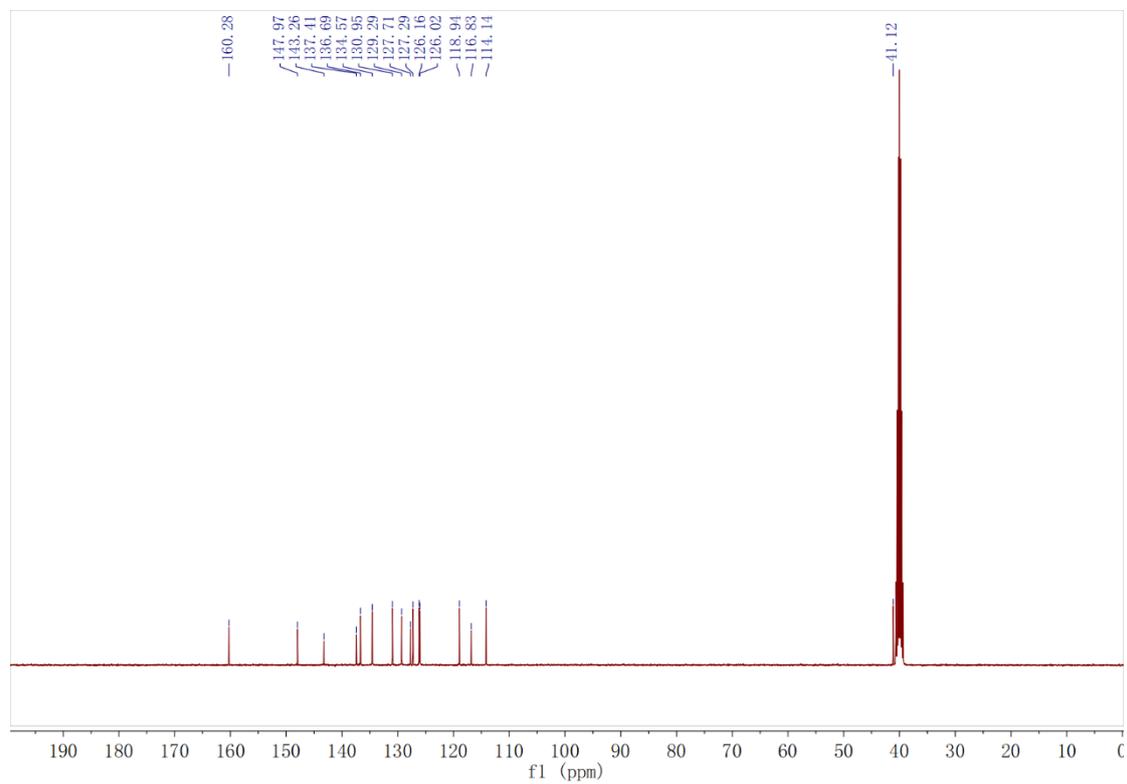
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **c1**



The ¹H NMR spectrogram of compound **c2**



The ¹³C NMR spectrogram of compound **c2**

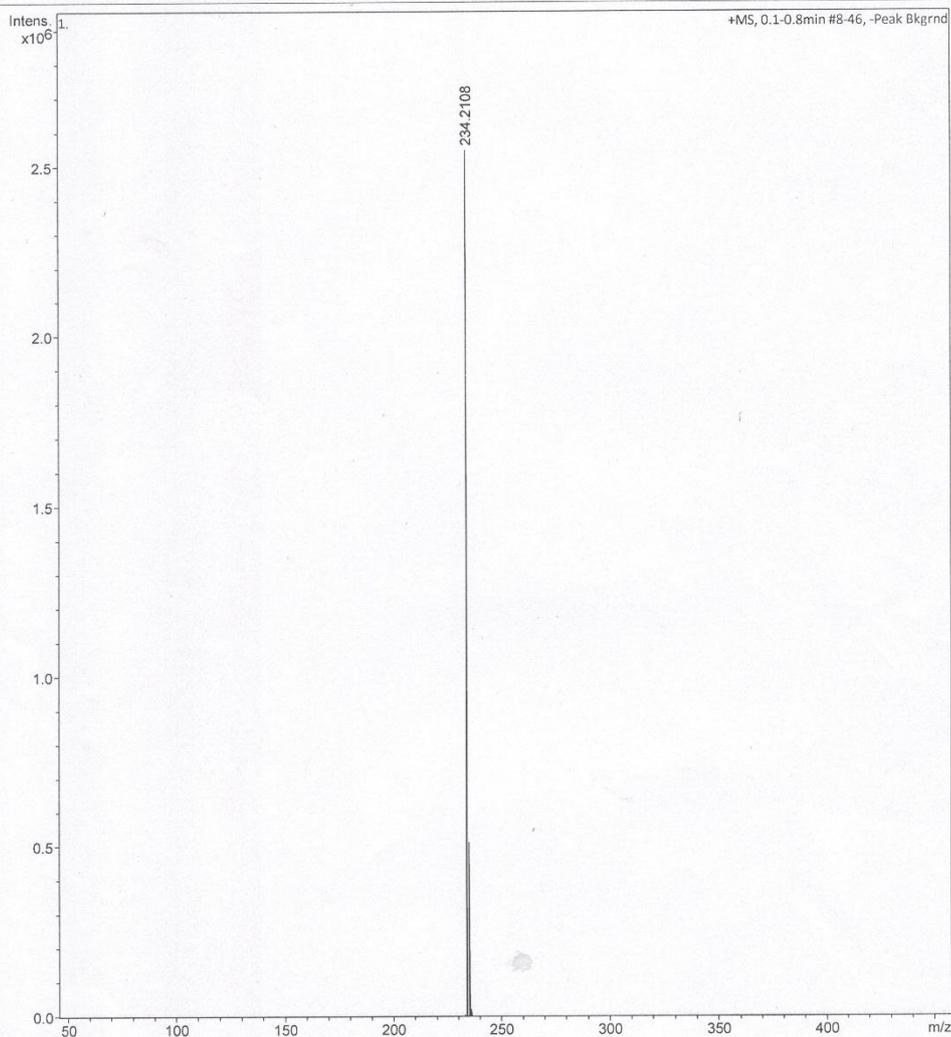
Generic Display Report

Analysis Info

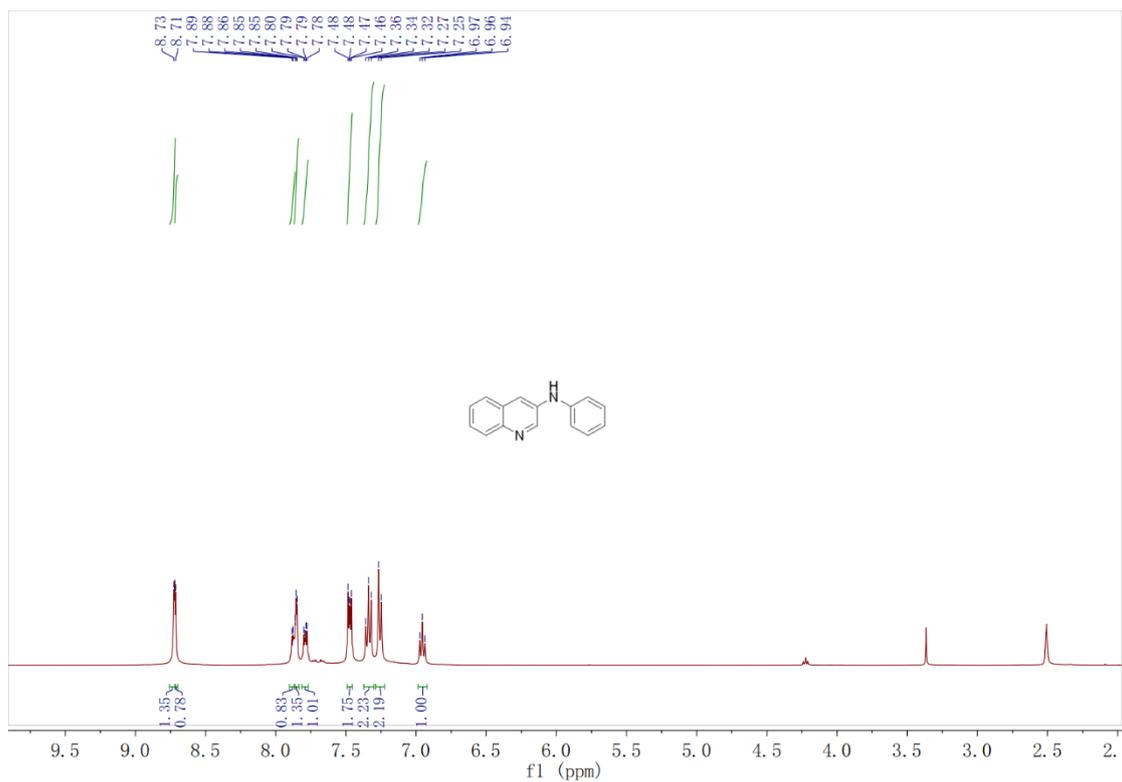
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Comment

Acquisition Date 4/27/2020 1:56:03 PM

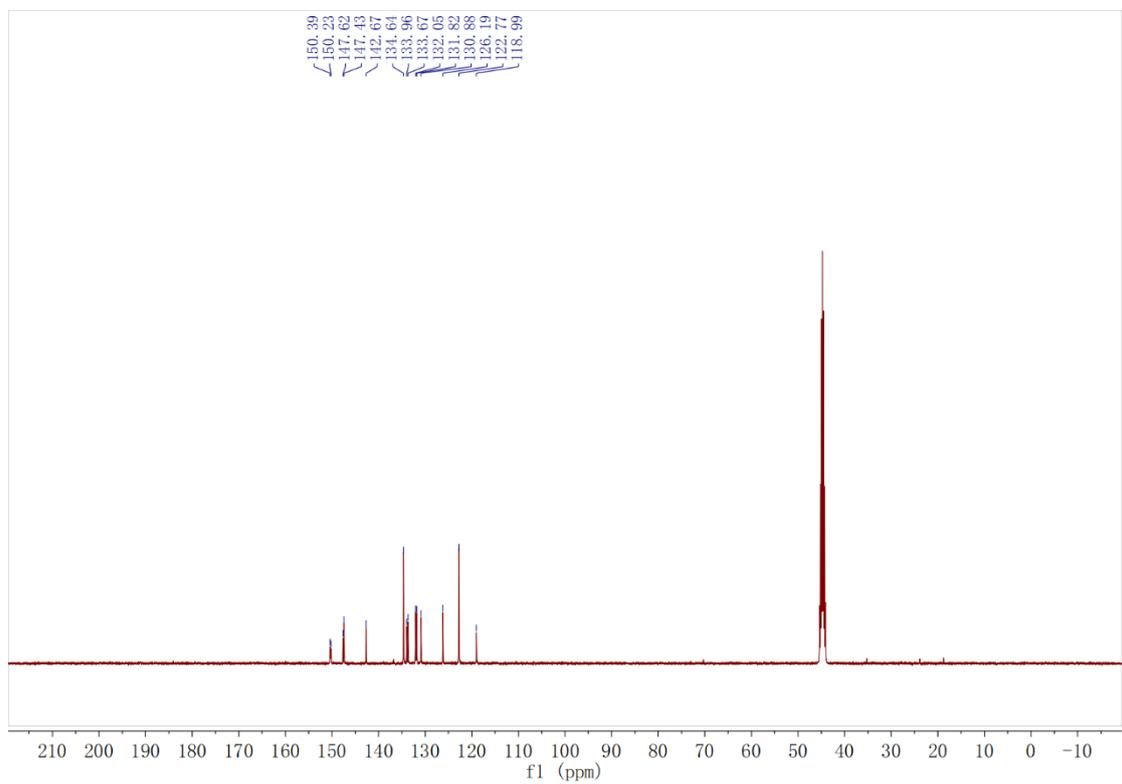
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **c2**



The ¹H NMR spectrogram of compound **d1**

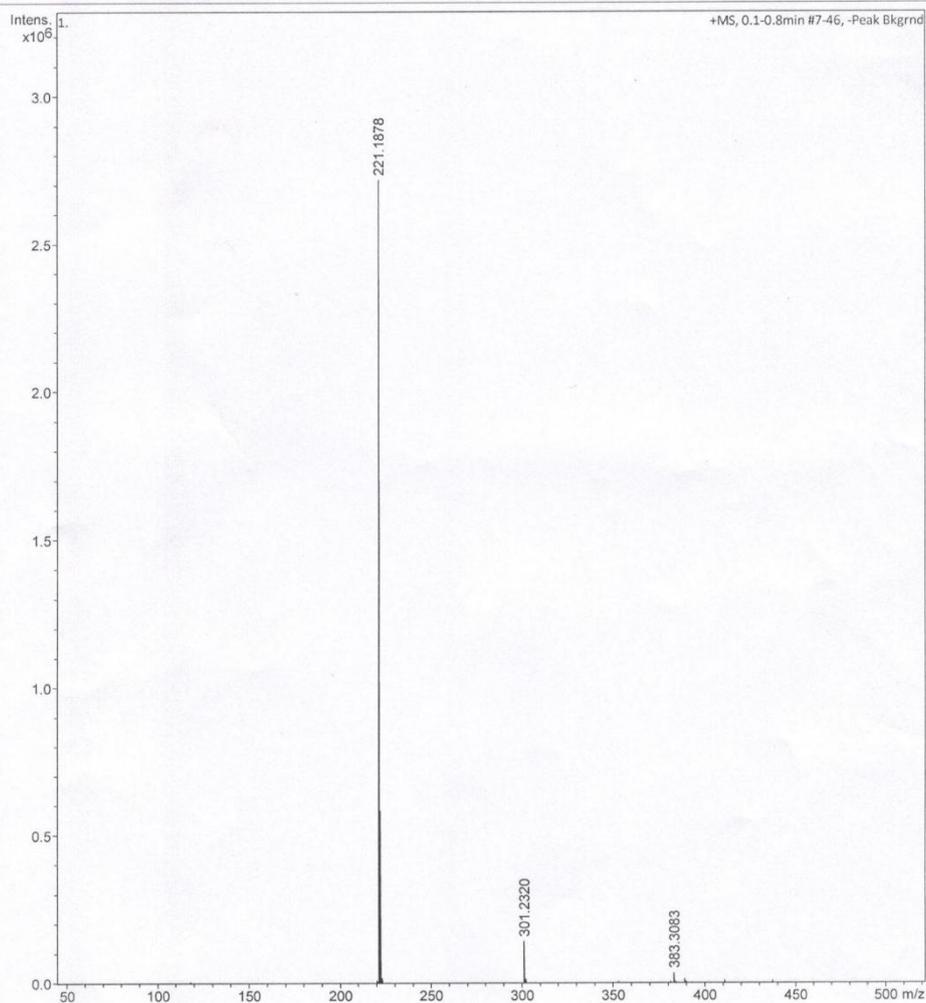


The ¹³C NMR spectrogram of compound **d1**

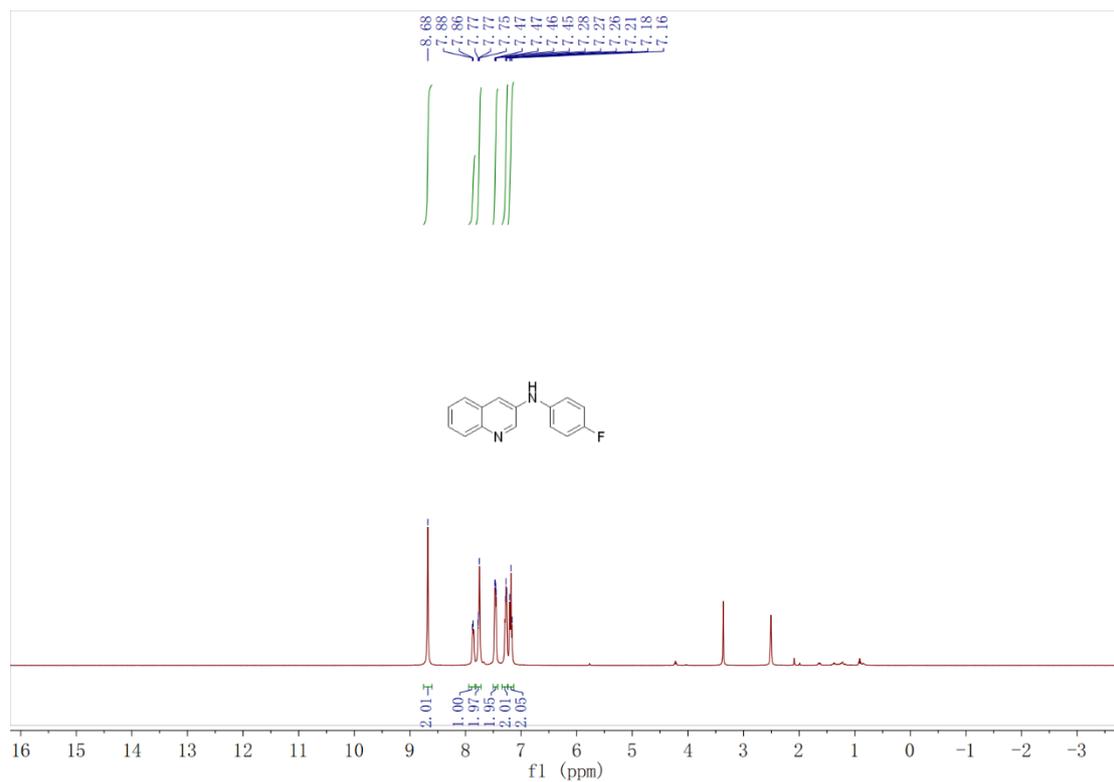
L-42

Generic Display Report

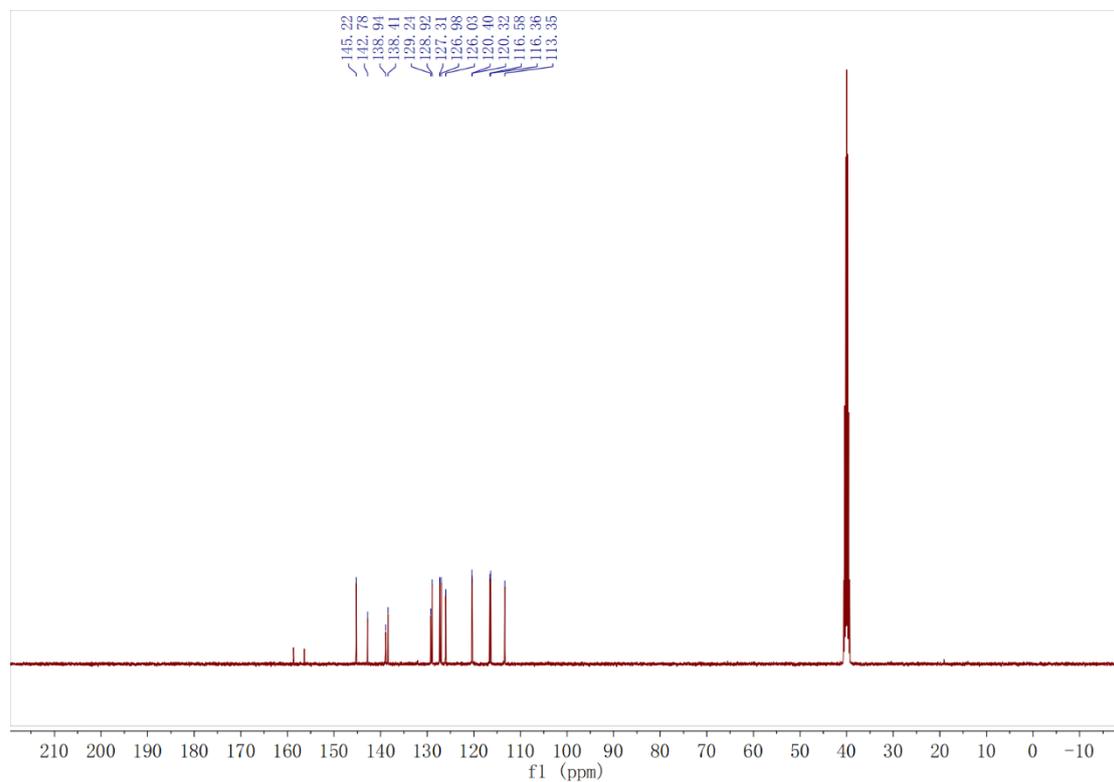
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Analysis Name	D:\Datayangy\new\LIUHUA200508_3_33_01_30457.d		
Method	POS_100-1200_For LC.m	Operator	LZU
Sample Name	LIUHUA200508_3	Instrument	micrOTOF
Comment			



The Mass spectrogram of compound **d1**



The ^1H NMR spectrogram of compound **d2**



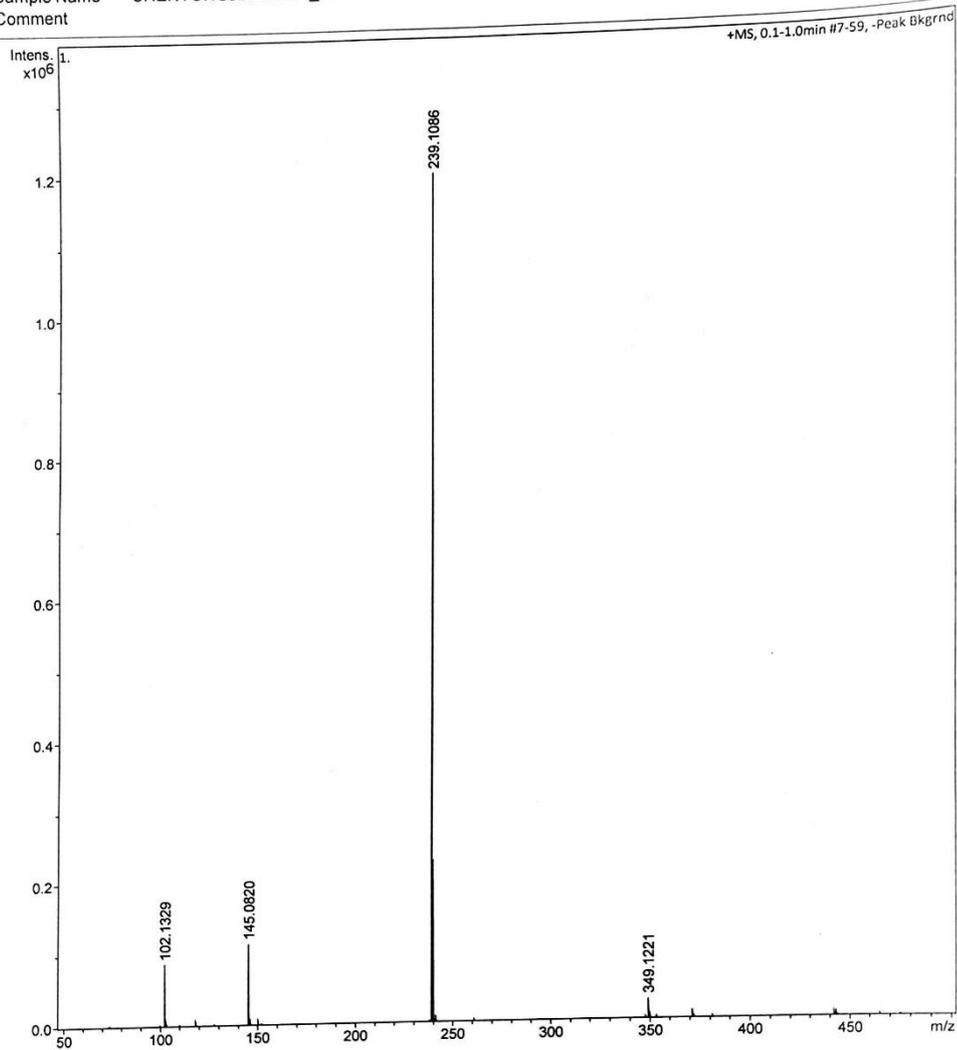
The ^{13}C NMR spectrogram of compound **d2**

Generic Display Report

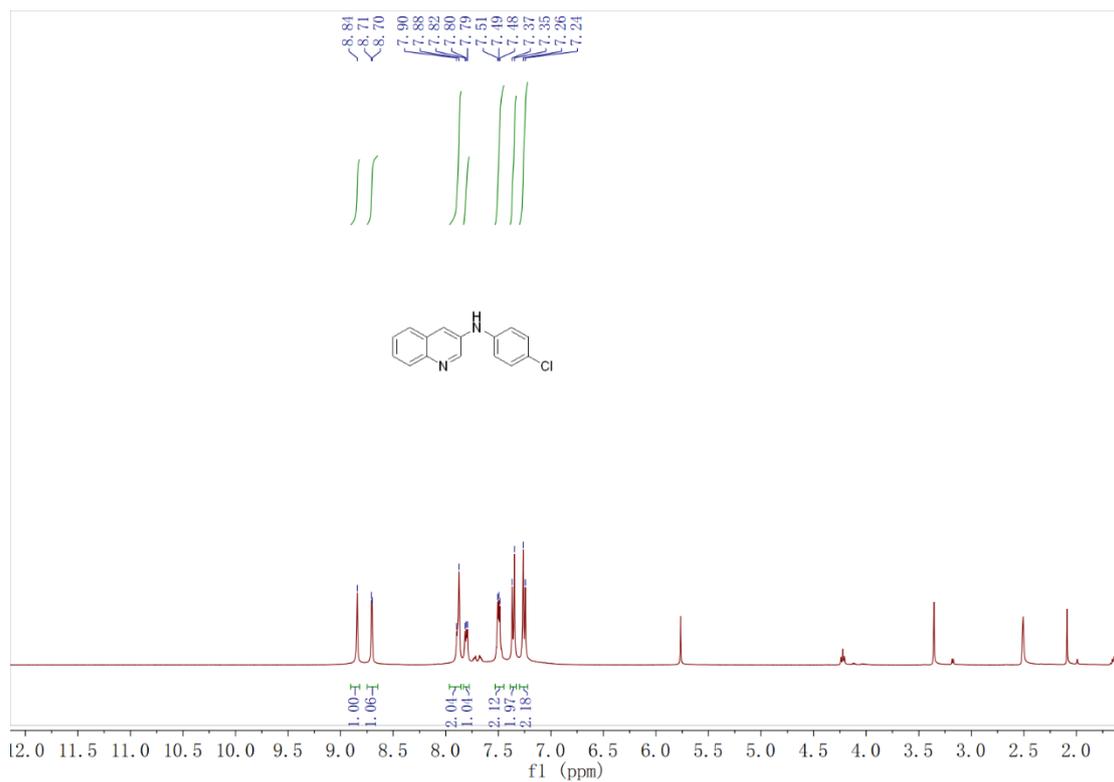
Analysis Info

Analysis Name D:\Data\yang\new\CHENYONGJIA201204_23_9_01_35805.d
Method POS_100-1200_ForLC.m
Sample Name CHENYONGJIA201204_23
Comment

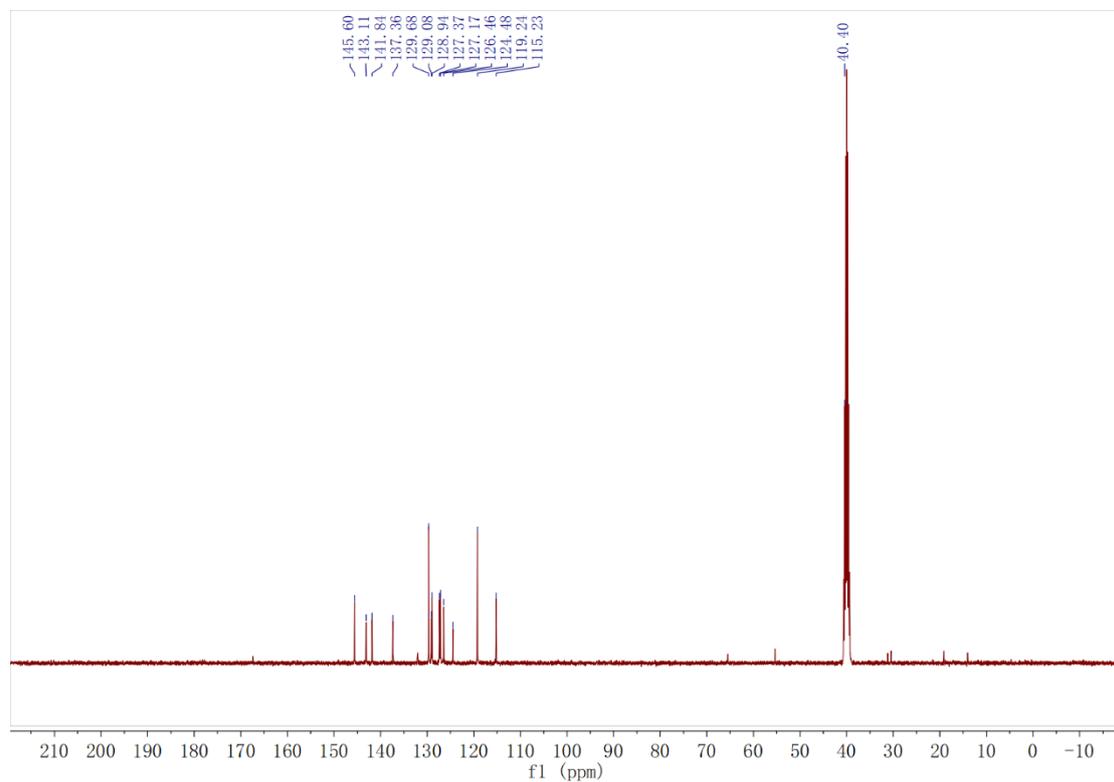
Acquisition Date 12/4/2020 12:27:06 PM
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **d2**



The ¹H NMR spectrogram of compound **d3**

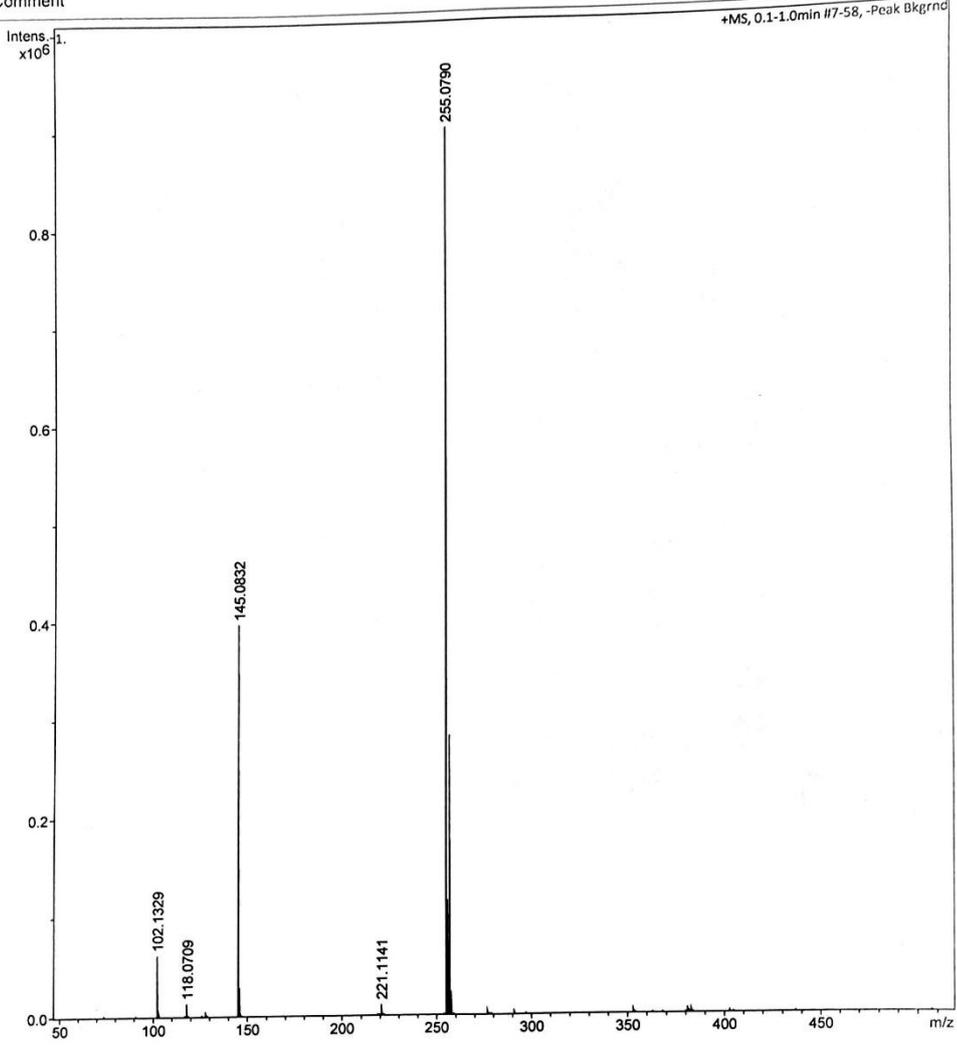


The ¹³C NMR spectrogram of compound **d3**

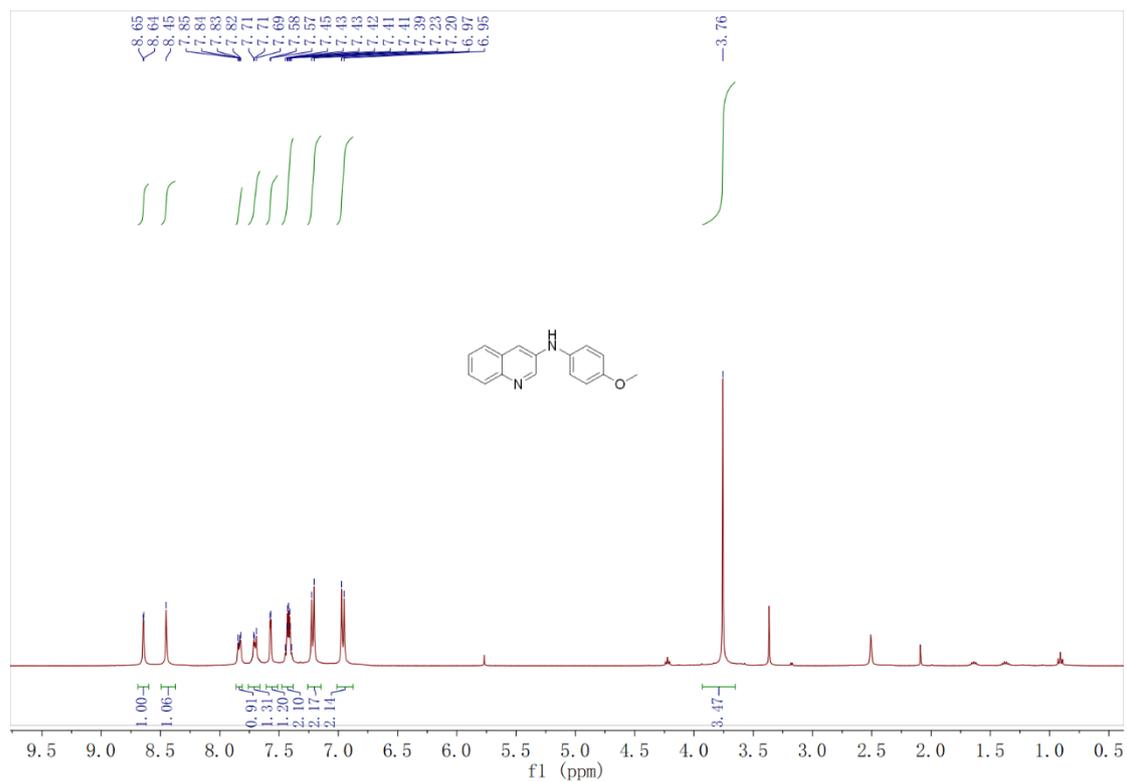
刘子强

Generic Display Report

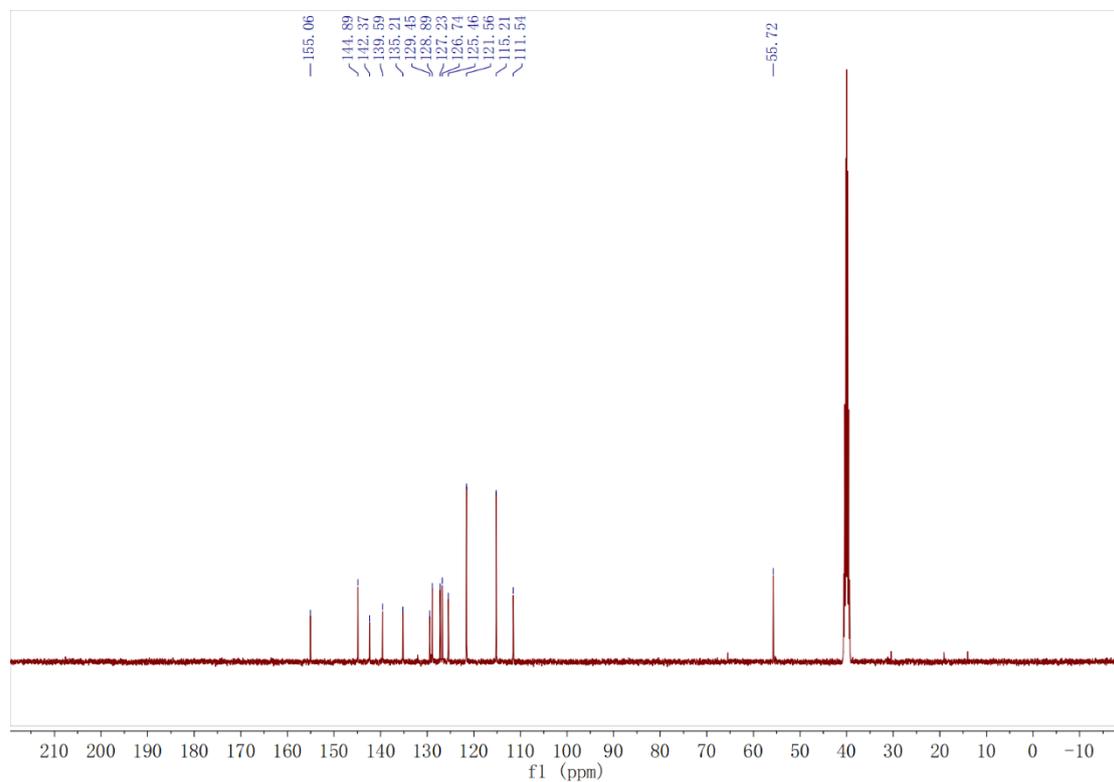
Analysis Info
Analysis Name D:\Data\yang\new\CHENYONGJIA201204_26_12_01_35808.d
Method POS_100-1200_ForLC.m
Sample Name CHENYONGJIA201204_26
Comment
Acquisition Date 12/4/2020 12:36:26 PM
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **d3**



The ^1H NMR spectrogram of compound **d4**



The ^{13}C NMR spectrogram of compound **d4**

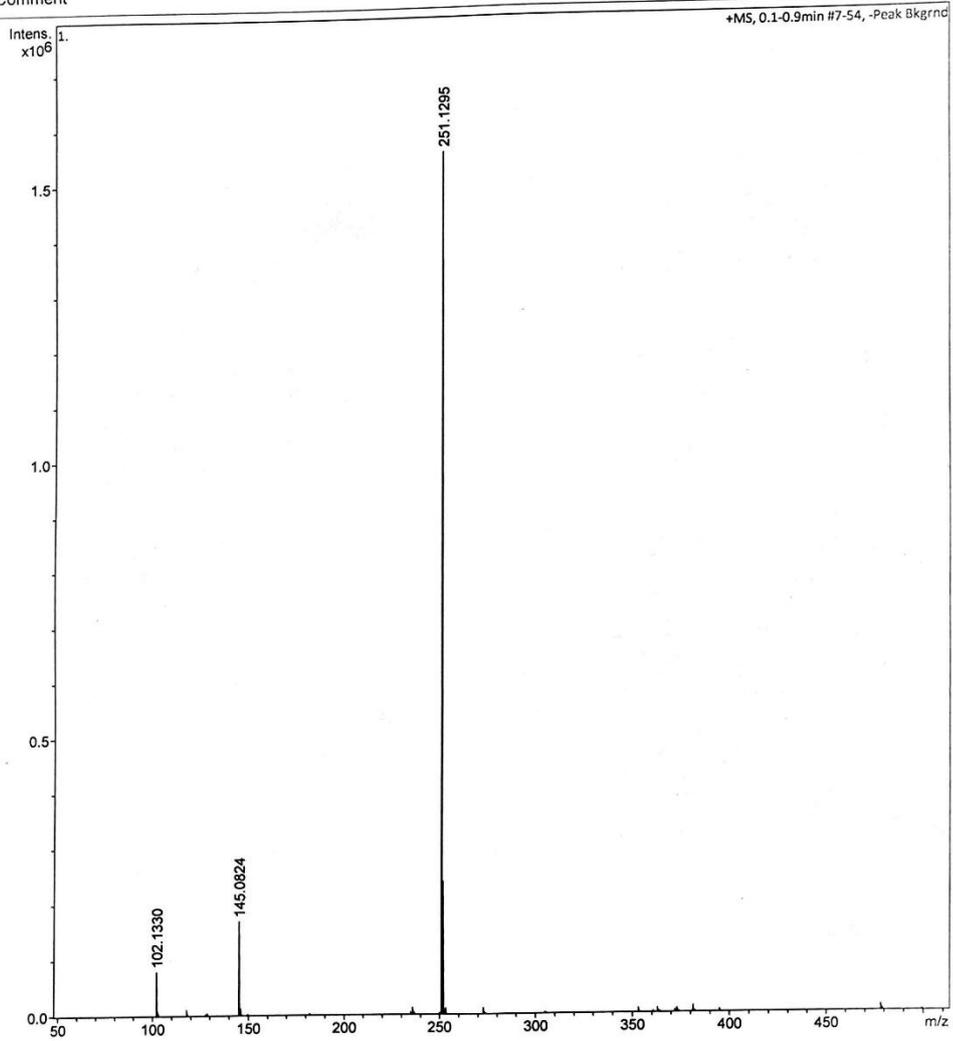
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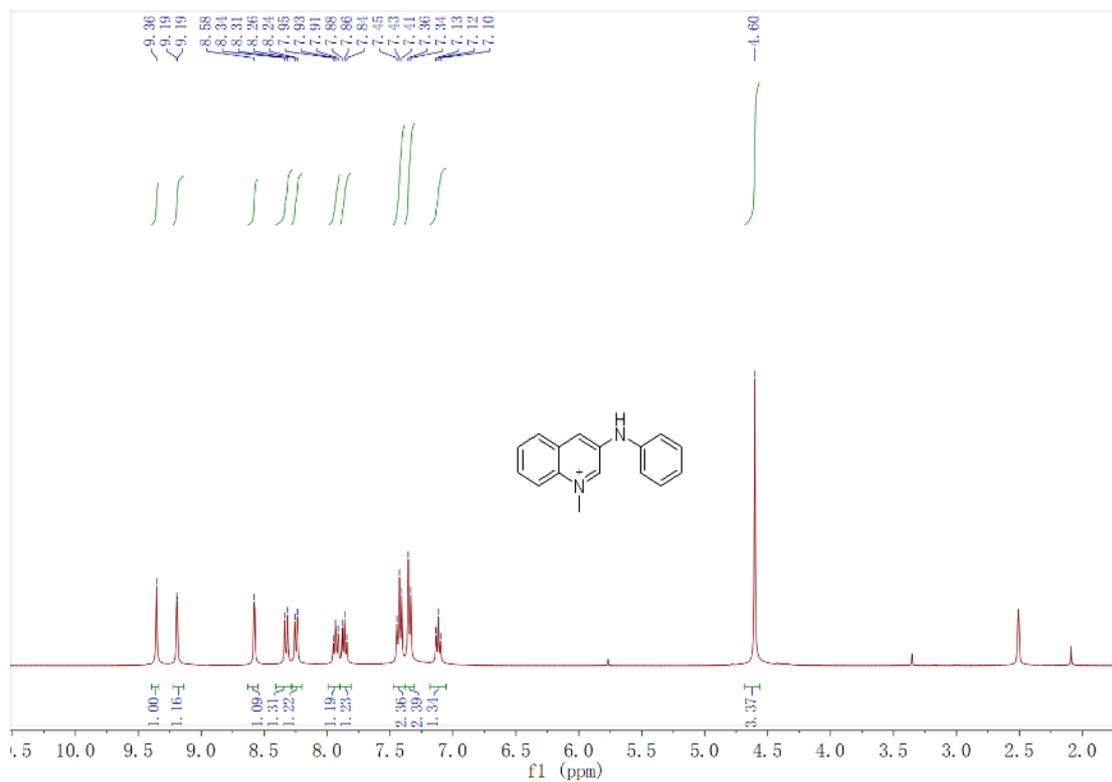
Analysis Info

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Method POS_100-1200_For LC.m
Sample Name CHENYONGJIA201204_25
Comment

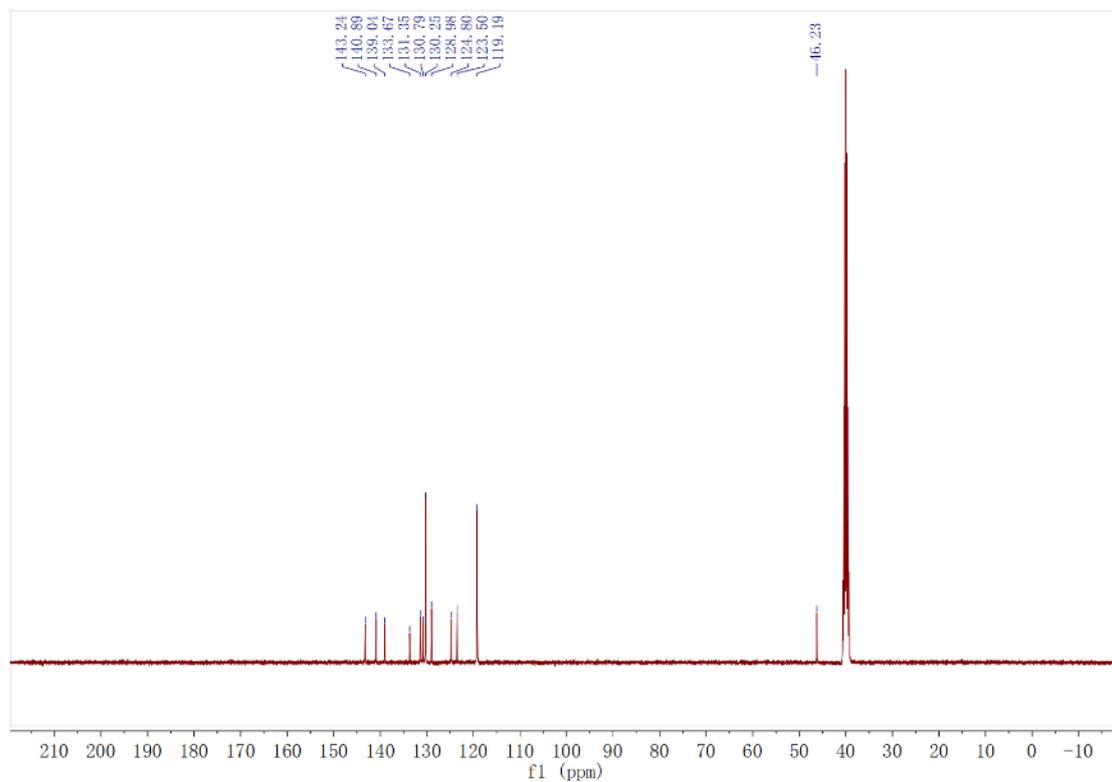
Acquisition Date 12/4/2020 12:33:18 PM
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **d4**



The ^1H NMR spectrogram of compound e1



The ^{13}C NMR spectrogram of compound e1

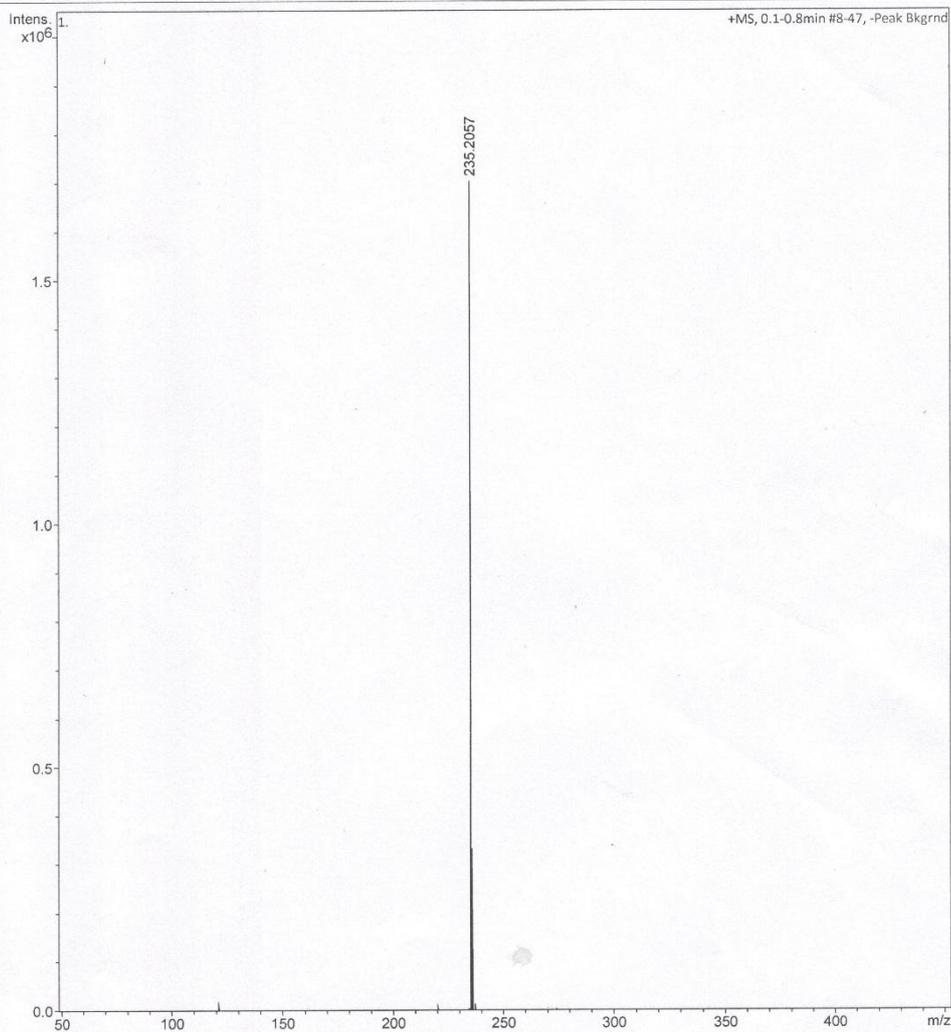
Generic Display Report

Analysis Info

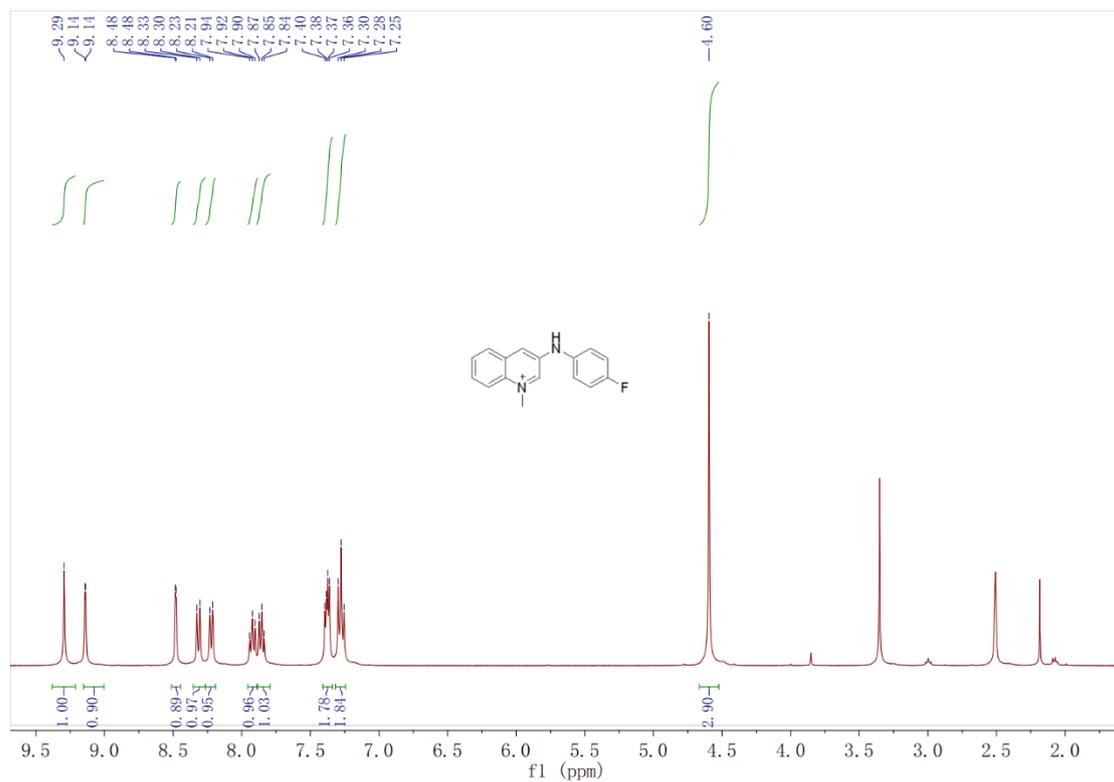
Analysis Name D:\Data\yang\new\LIUHUA200428_2_29_01_30219.d
Method POS_100-1200_For LC.m
Sample Name LIUHUA200428_2
Comment

Acquisition Date 4/28/2020 1:17:21 PM

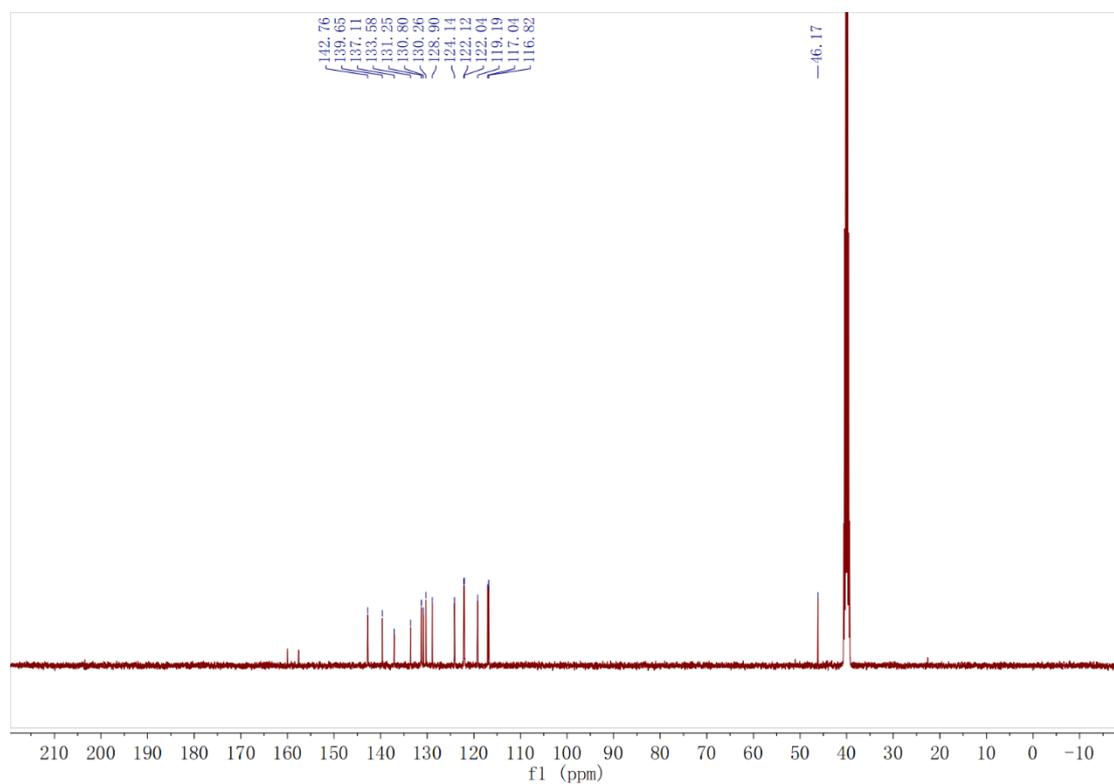
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **e1**



The ^1H NMR spectrogram of compound **e2**



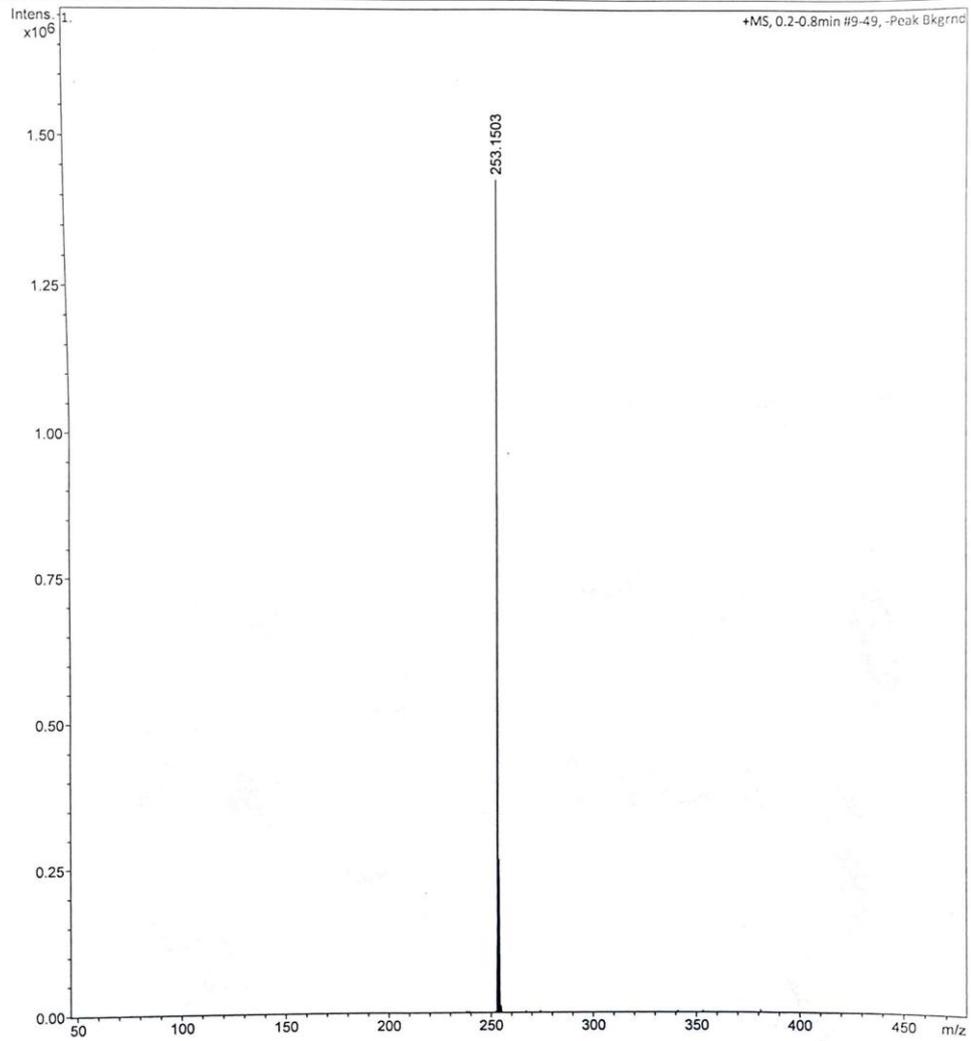
The ^{13}C NMR spectrogram of compound **e2**

Generic Display Report

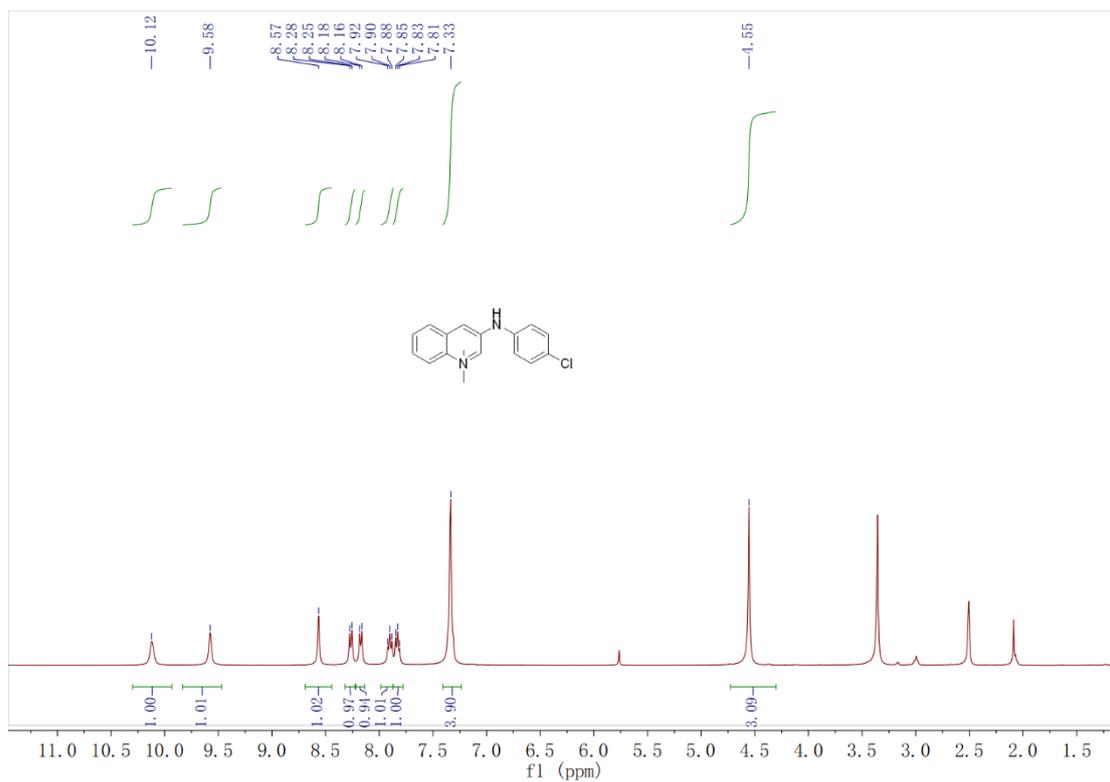
Analysis Info

Analysis Name D:\Data\yang\new\CHENYONGJIA201203_15_6_01_35756.d
Method POS_100-1200_For LC.m
Sample Name CHENYONGJIA201203_15
Comment

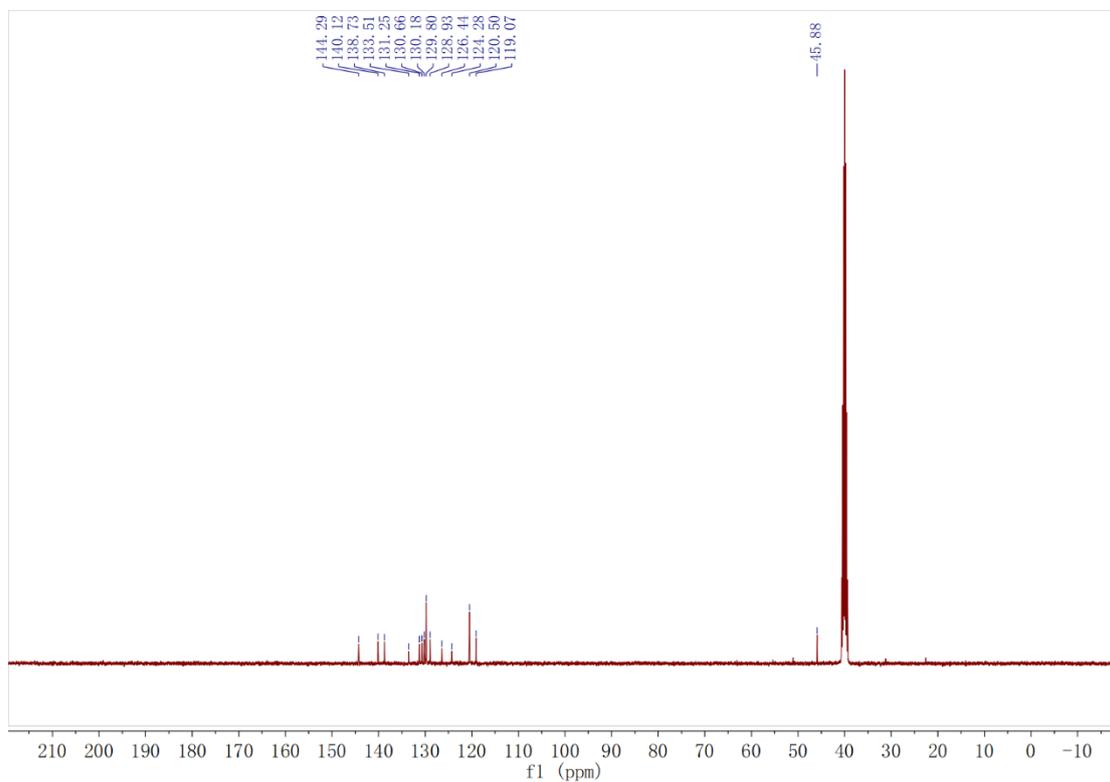
Acquisition Date 12/3/2020 12:17:53 PM
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **e2**



The ¹H NMR spectrogram of compound **e3**



The ¹³C NMR spectrogram of compound **e3**

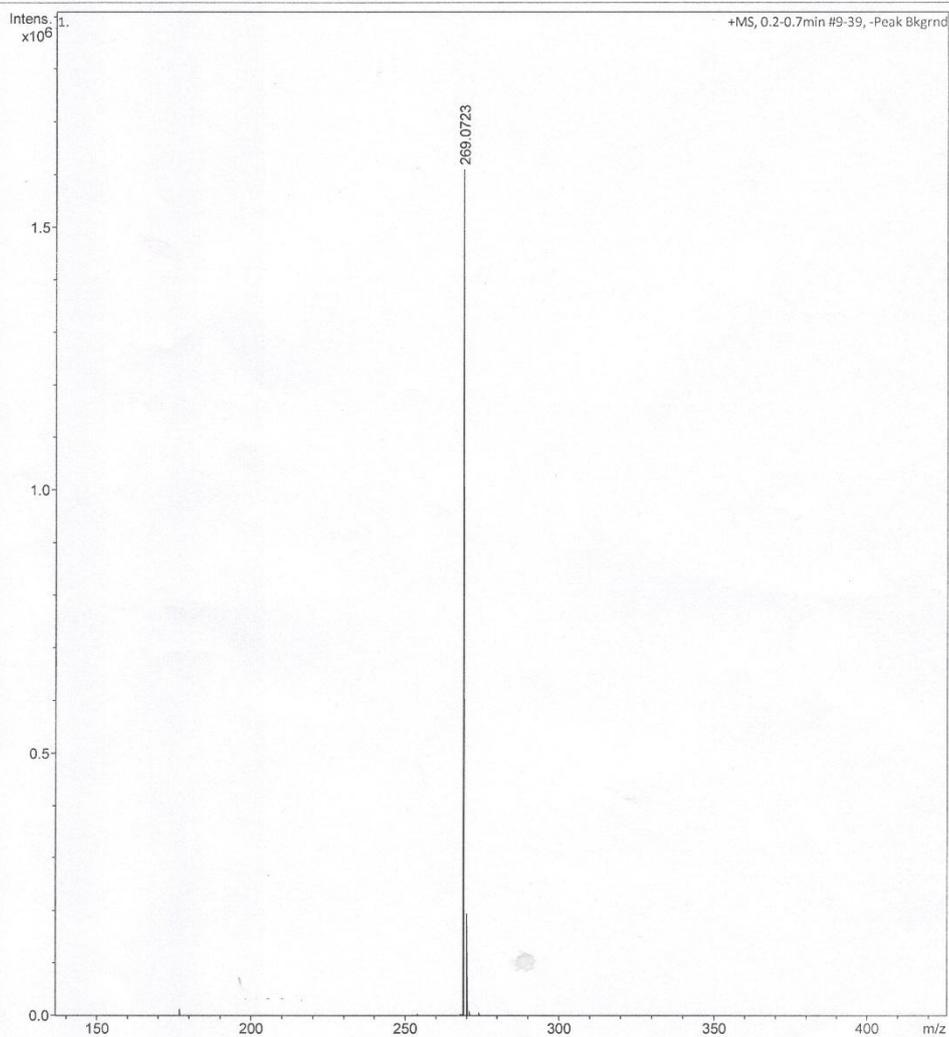
Generic Display Report

Analysis Info

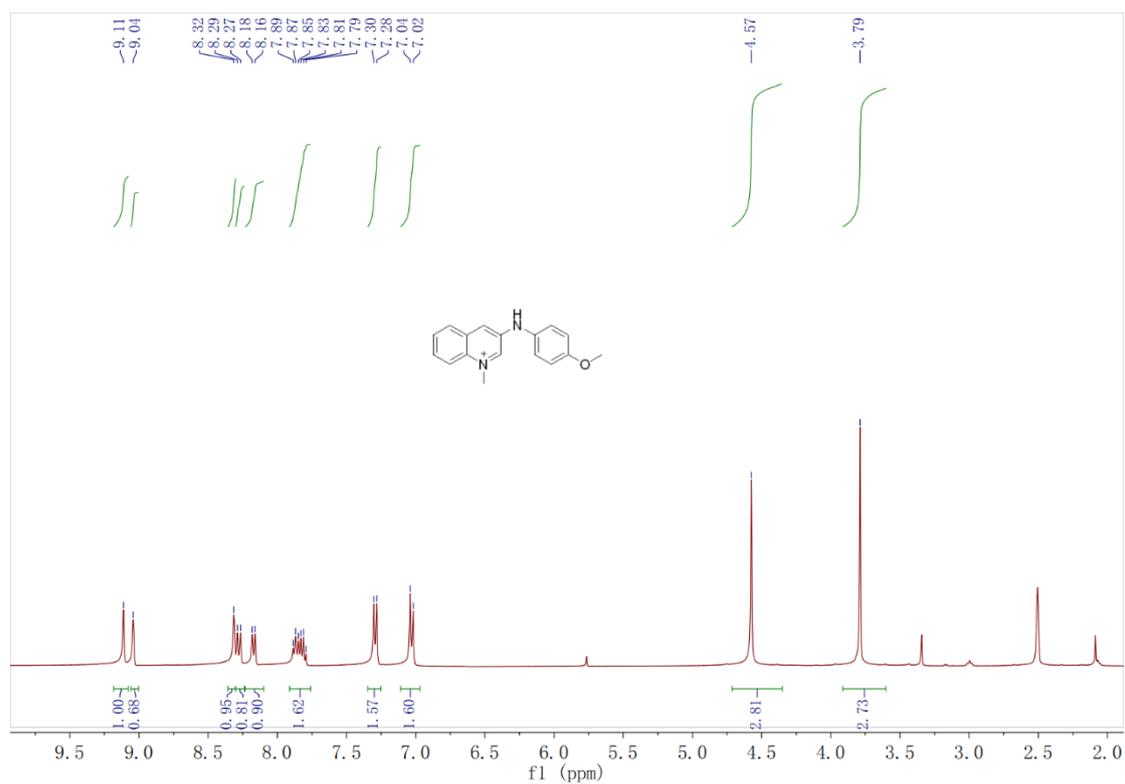
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Sample Name LIUHUA200601_3
Comment

Acquisition Date 6/1/2020 1:16:15 PM

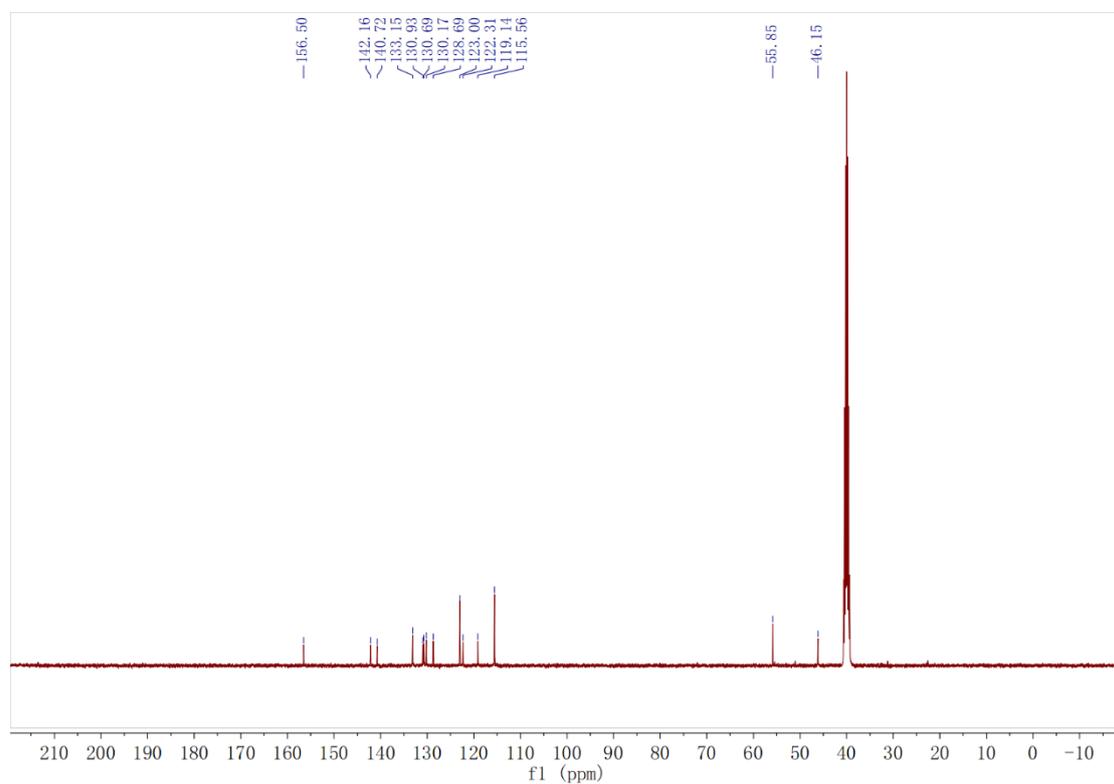
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **e3**



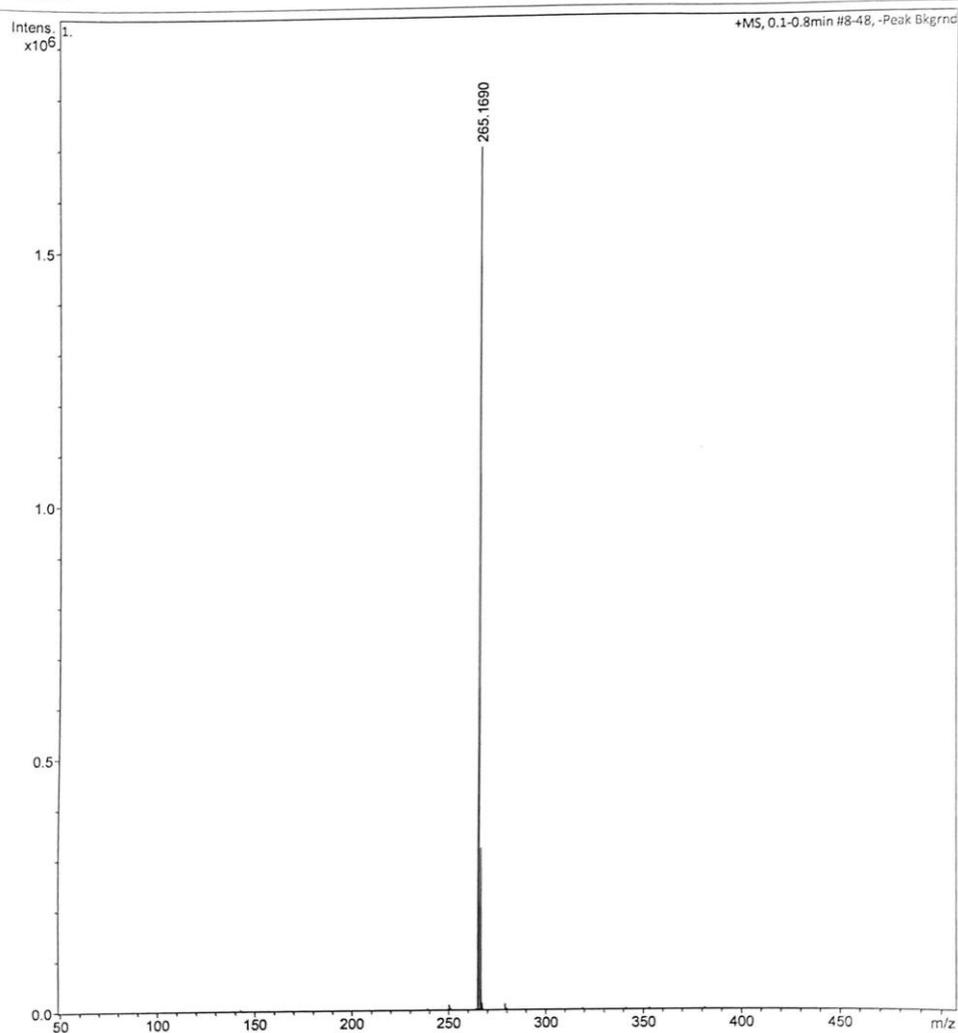
The ^1H NMR spectrogram of compound **e4**



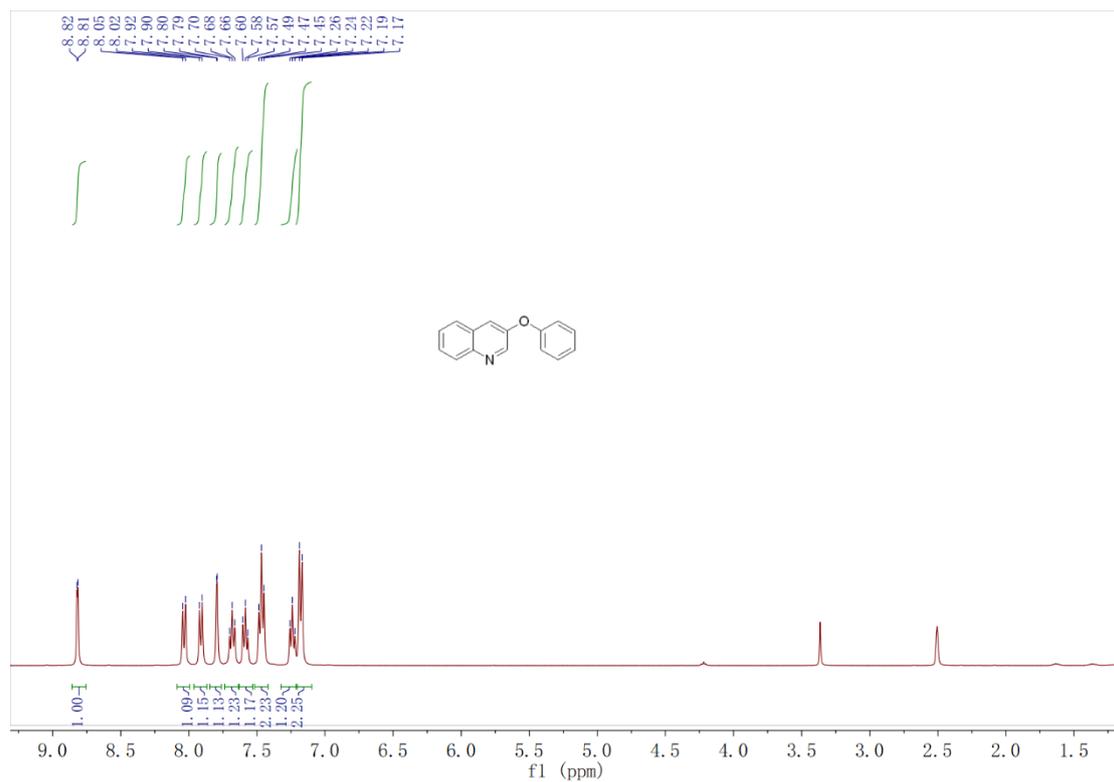
The ^{13}C NMR spectrogram of compound **e4**

Generic Display Report

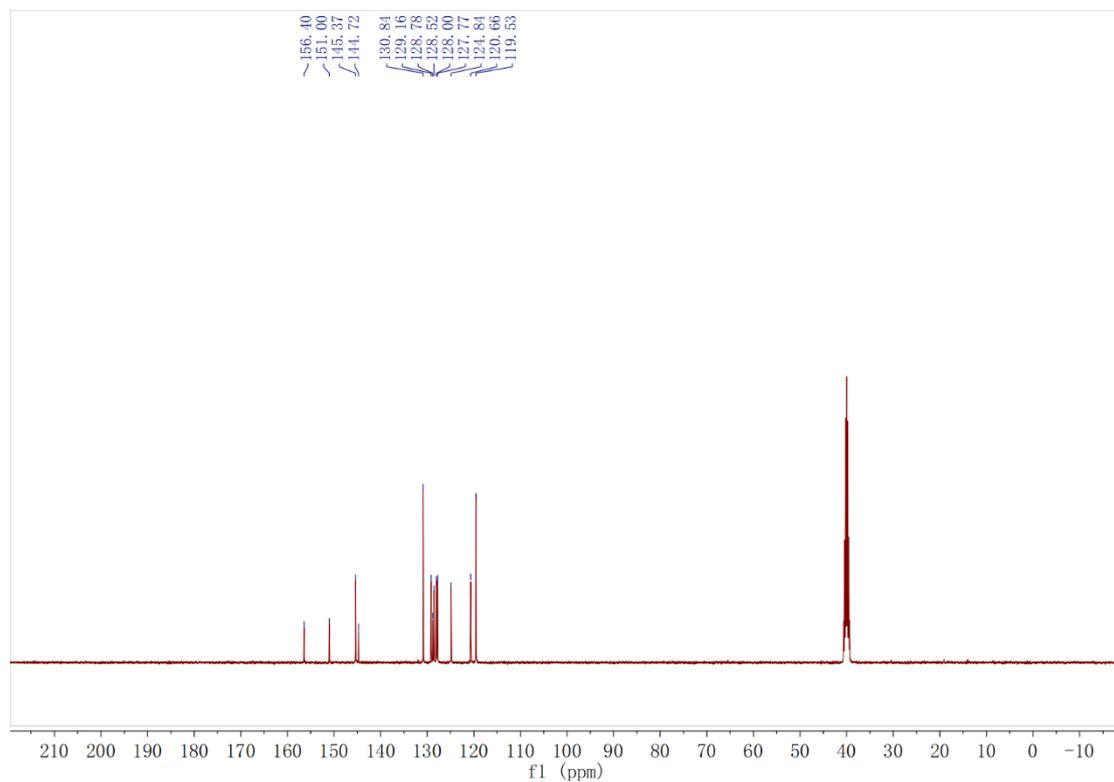
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Method	POS_100-1200_For LC.m	Instrument	micrOTOF
Sample Name	CHENYONGJIA201203_14		
Comment			



The Mass spectrogram of compound **e4**



The ^1H NMR spectrogram of compound **f1**



The ^{13}C NMR spectrogram of compound **f1**

L-38

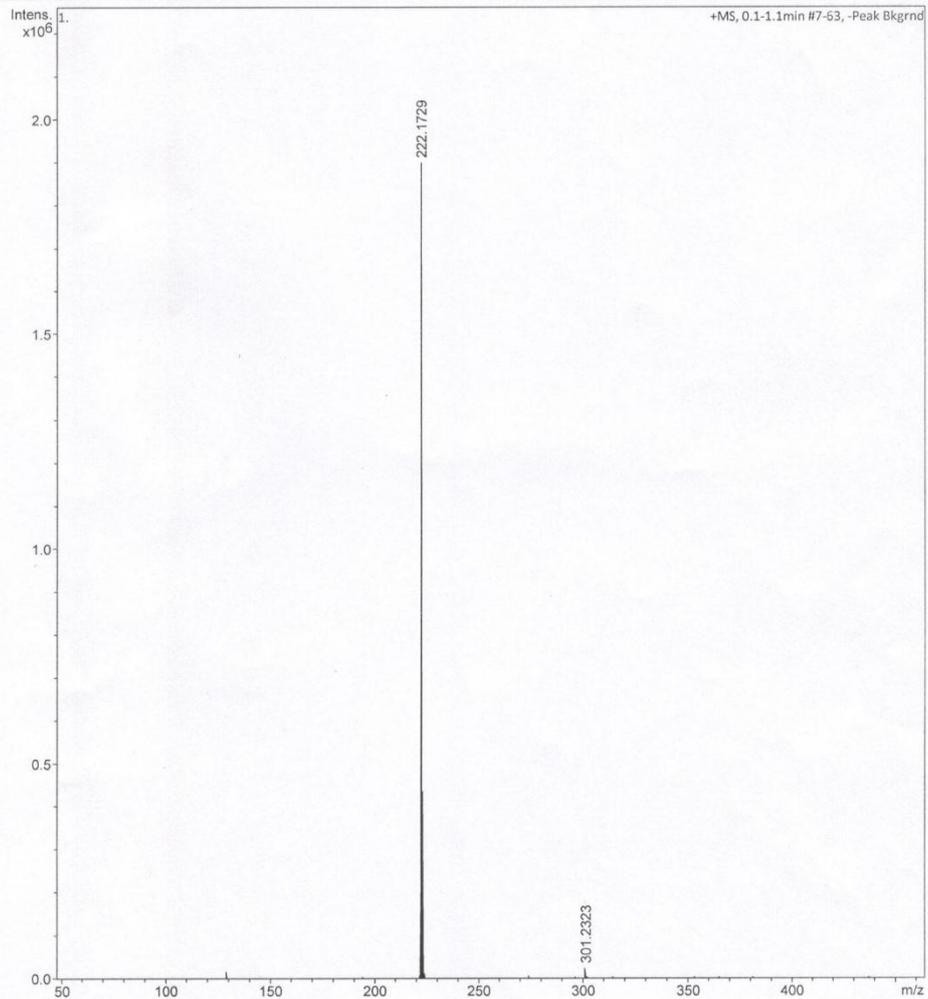
Generic Display Report

Analysis Info

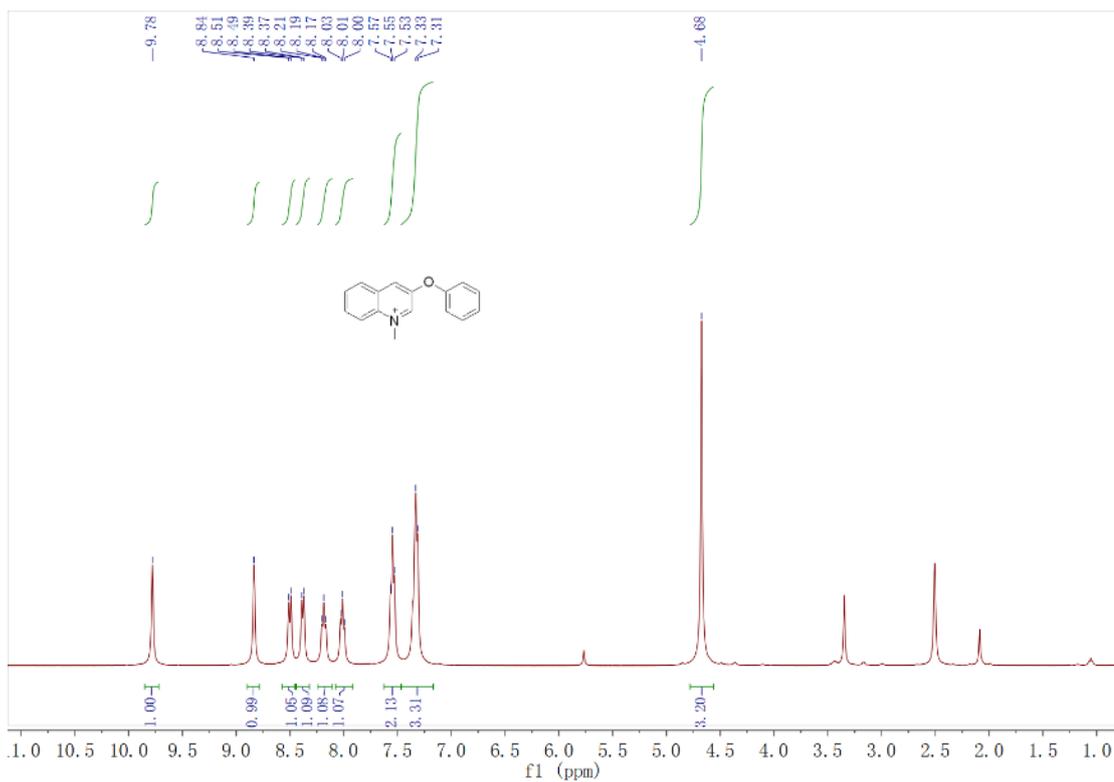
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Method POS_100-1200_For LC.m
Sample Name LIUHUA200508_2
Comment

Acquisition Date 5/8/2020 1:48:25 PM

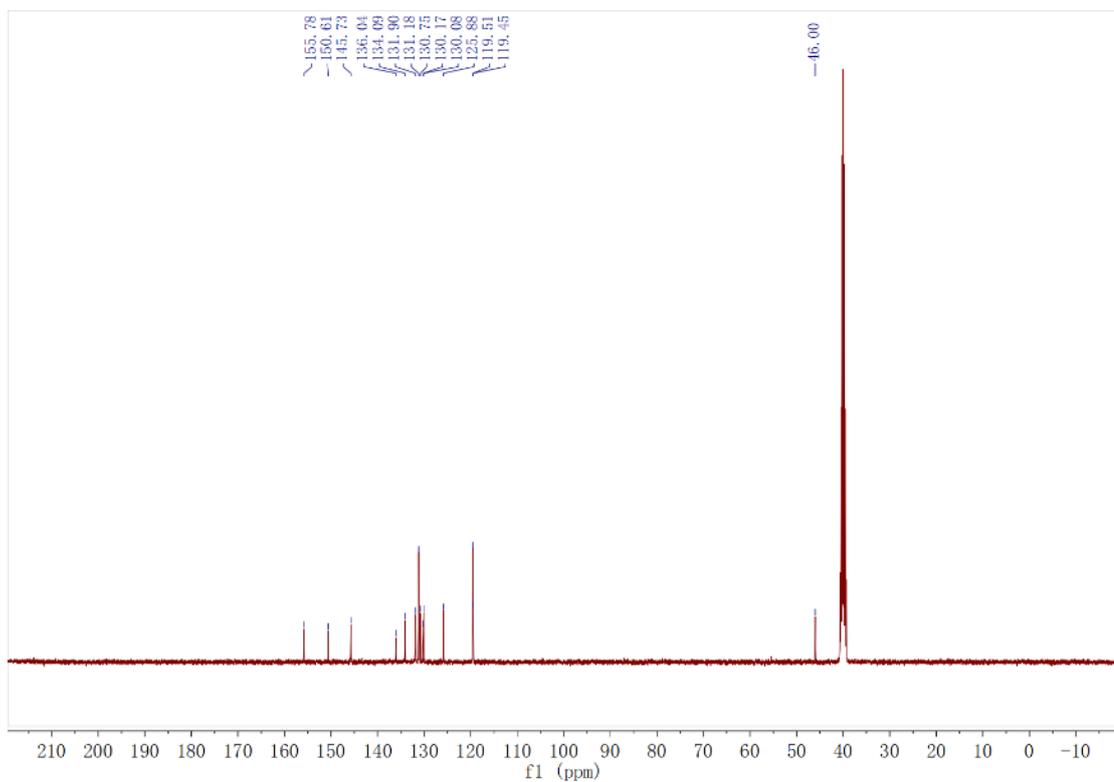
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **f1**



The ^1H NMR spectrogram of compound **g1**



The ^{13}C NMR spectrogram of compound **g1**

L-39

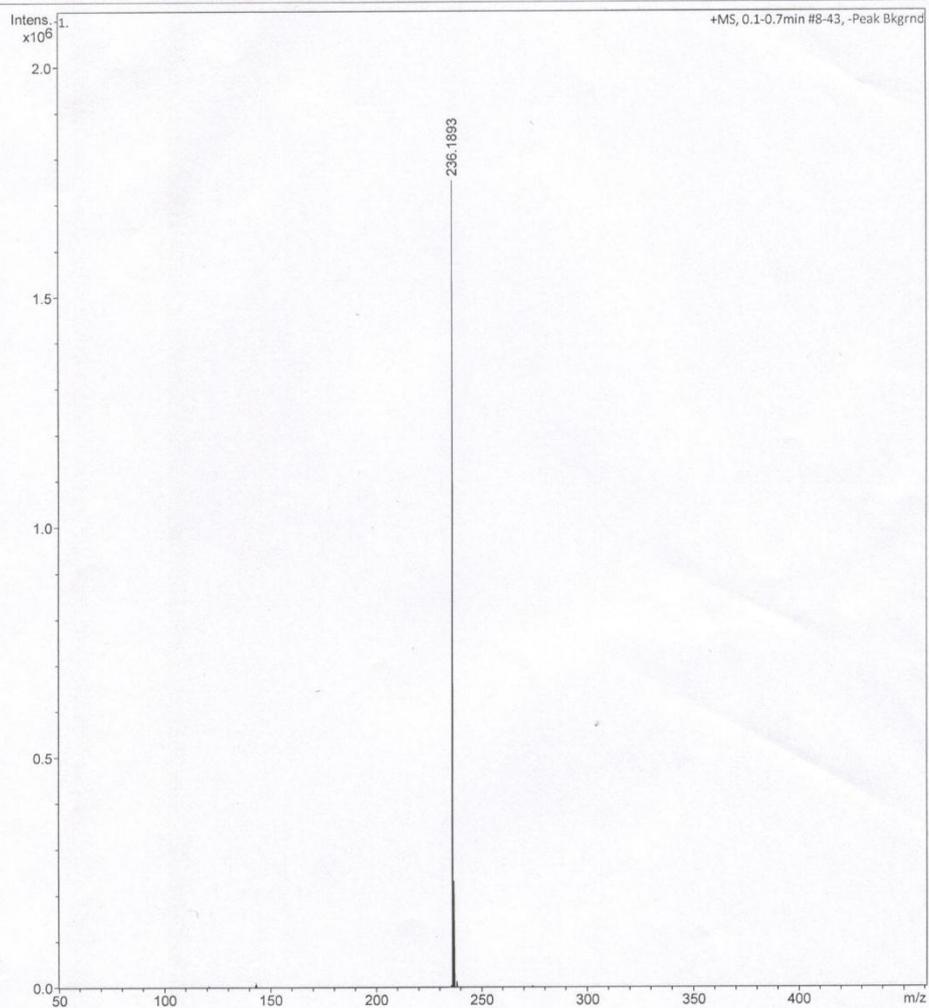
Generic Display Report

Analysis Info

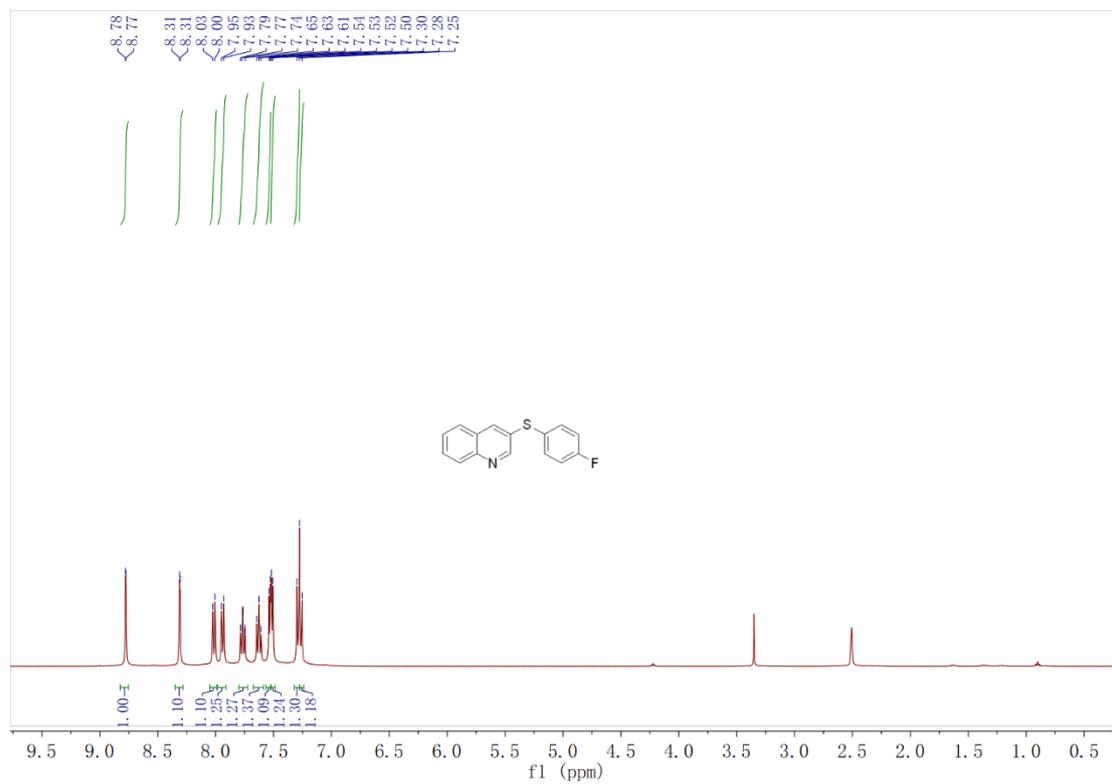
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Comment

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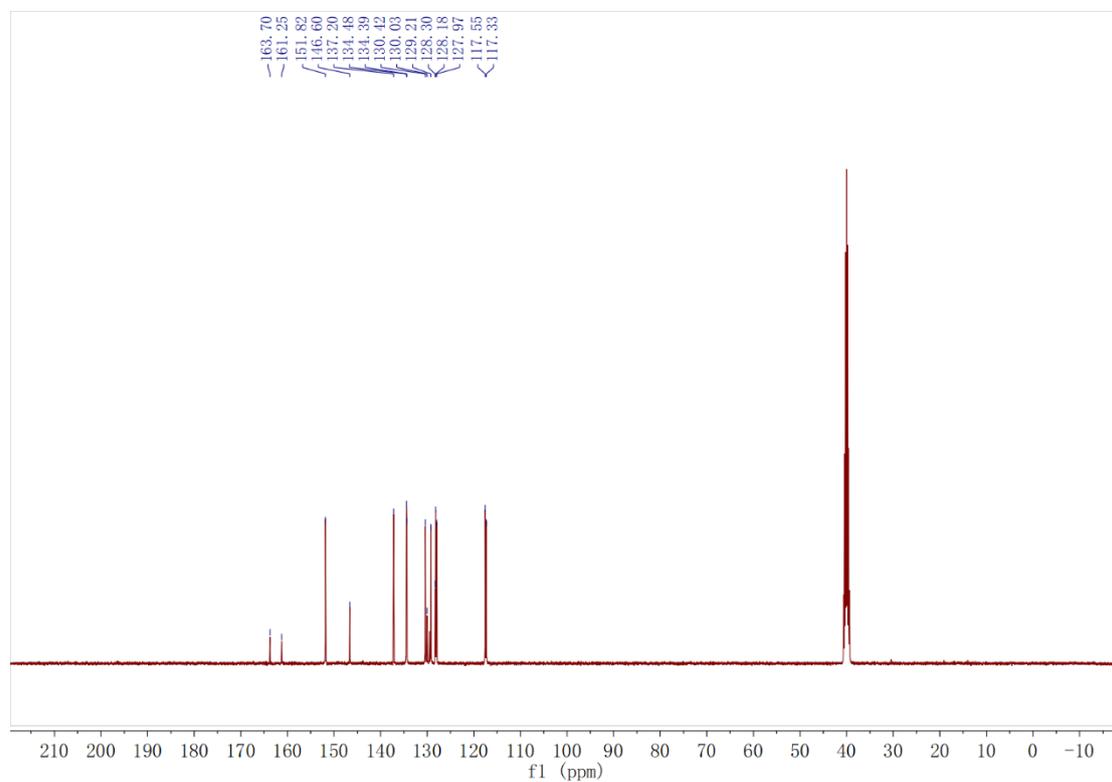
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **g1**



The ^1H NMR spectrogram of compound **h2**



The ^{13}C NMR spectrogram of compound **h2**

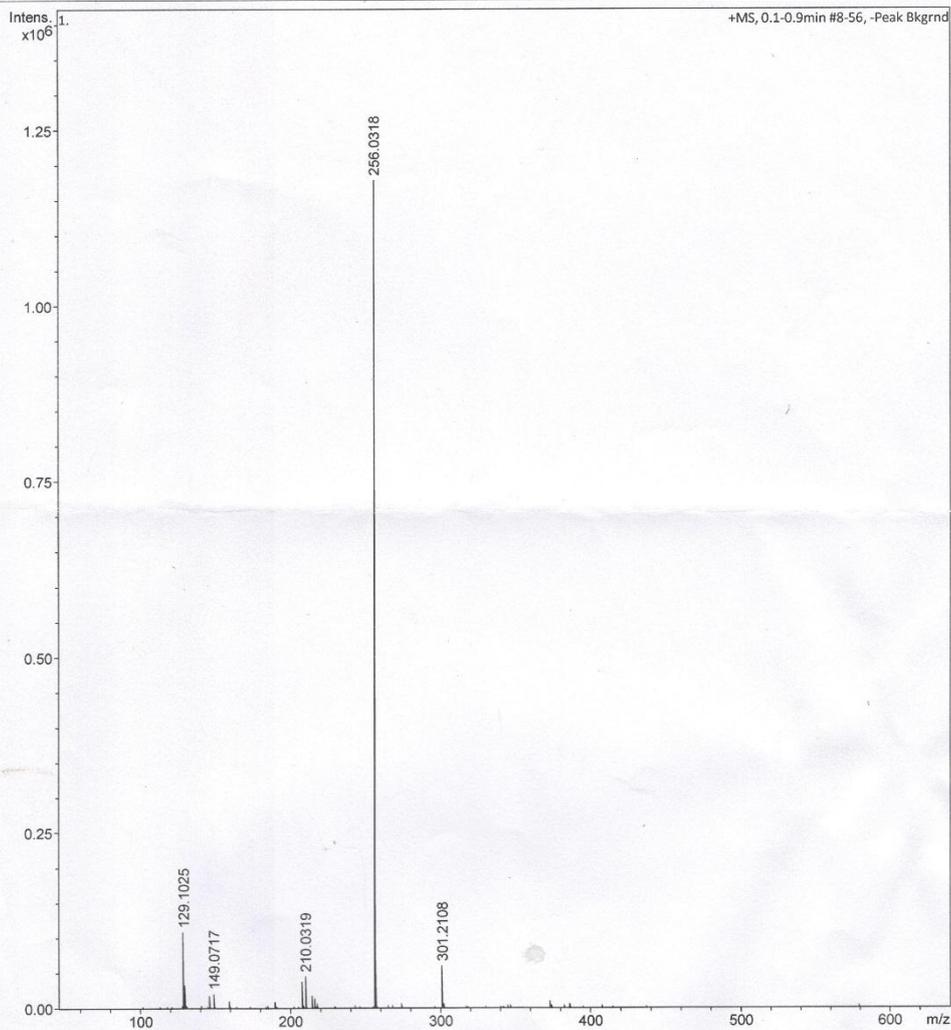
Generic Display Report

Analysis Info

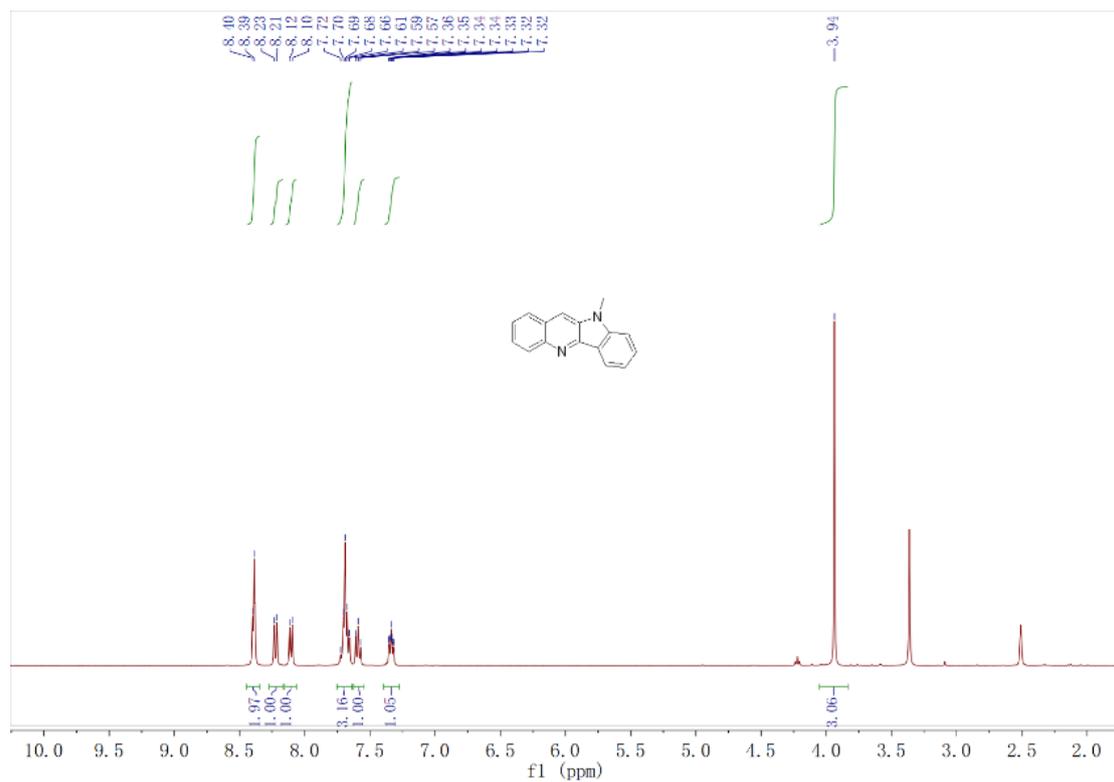
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Method POS_100-1200_For LC.m
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Comment

Acquisition Date 11/13/2019 2:52:06 PM

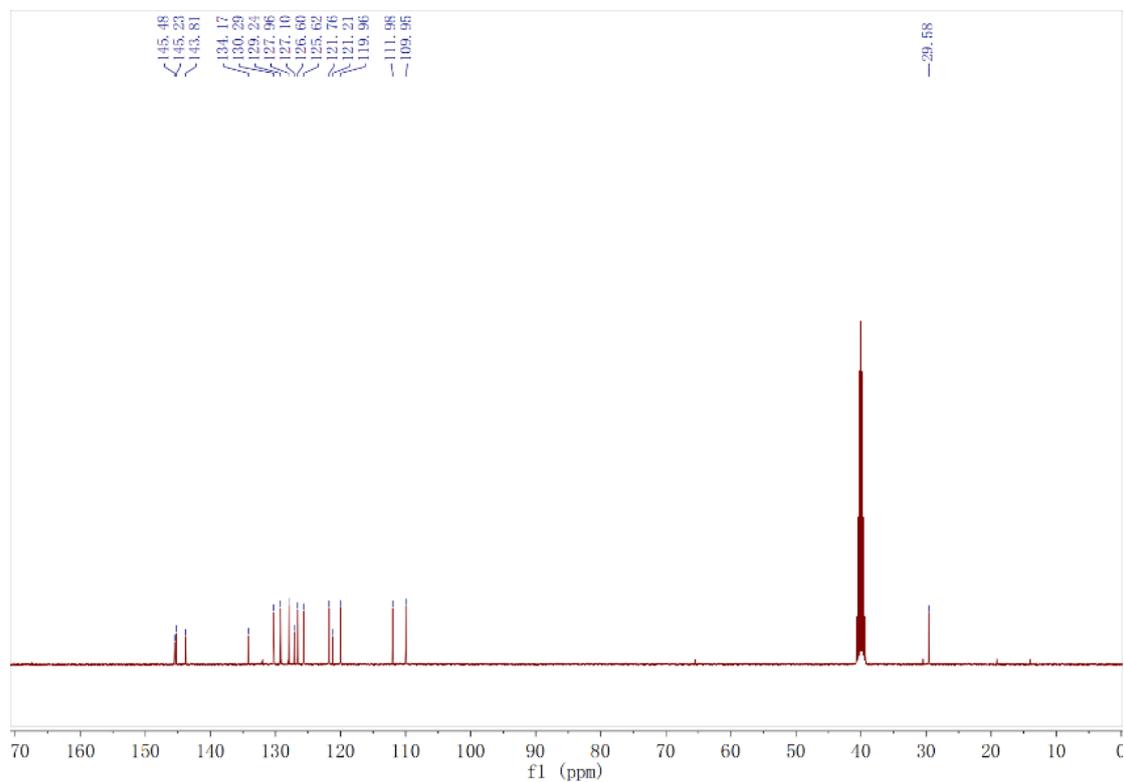
Operator LZU
Instrument micrOTOF



The Mass spectrogram of compound **h2**



The ¹H NMR spectrogram of compound **j**

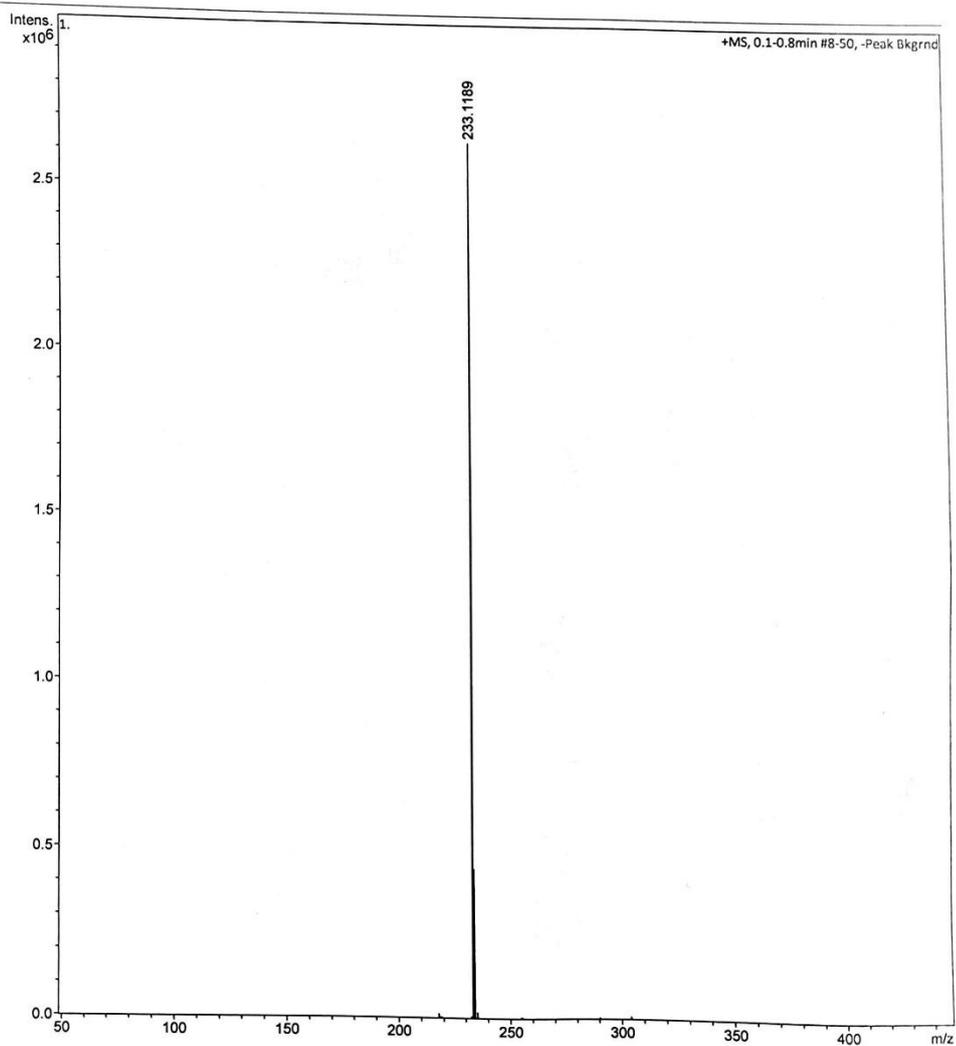


The ¹³C NMR spectrogram of compound **j1**

Generic Display Report

Analysis Info

Analysis Name D:\Data\yangy\new\CHENYONGJIA201204_27_13_01_35809.d Acquisition Date 12/4/2020 12:39:32 PM
Method POS_100-1200_For LC.m Operator LZU
Sample Name CHENYONGJIA201204_27 Instrument micrOTOF
Comment



The Mass spectrogram of compound j