β-Caryolane Derivatives as Novel Anti-Colorectal Cancer Agents: Synthesis and *in vitro* Biological Evaluation

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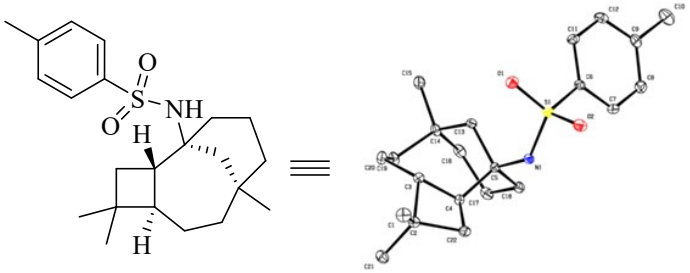
Table S1. Crystal Structure of SA-1

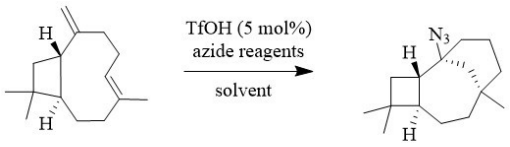


SA-1

CCDC 1942093

Identification code	1942093
Empirical formula	$C_{22}H_{33}NO_2S$
Formula weight	375.57
Temperature (K)	100.0
a, b, c (Å)	a=8.7454(3) b=10.4909(4) c=12.6708(5)
Volume	1047.61(7)
Space group	P1
Z	2
μ (mm-1)	0.170
F000	408.0
h, k, lmax	11,13,16

Table S2. Optimization of the acid-catalyzed reaction conditions of azide reagents and β-CP. General procedure: Reactions were performed at 30°C for 16 h under air atmosphere using β-CP (0.2 mmol), azide reagents (0.1 mmol), and solvent (2 mL), with TfOH (5.0% equiv.) as catalyst, unless noted otherwise. The yield was calculated based on the ^{1}H NMR data with trimethoxybenzene as the internal standard and azide source as the reference.



β-CP **NC**

Entry	Azide reagent	Solvent	Time (h)	yield
1	$TMSN_3$	1,4-dioxane	16	92%
2	NaN_3	1,4-dioxane	16	44%
3	DPPA	1,4-dioxane	16	43%
4	$TMSN_3$	DCM	16	96%
5	$TMSN_3$	1,2-DCE	16	76%
6	$TMSN_3$	1,4-dioxane	4	87%
7	$TMSN_3$	1,4-dioxane	8	91%

Table S3. Inhibition rate of β-caryolane derivatives (SA, CA and NC) on HT-29 cells at concentrations of 50 μM and 10 μM.

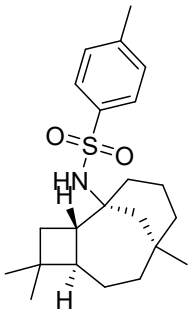
Cmpd	Inhibition rate %		Cmpd	Inhibition rate %		Cmpd	Inhibition rate %		Cmpd	Inhibition rate %	
	50 μM	10 μM		50 μM	10 μM		50 μM	10 μM		50 μM	10 μM
SA-1	94.62	< 50%	**SA-18**	93.86	< 50%	**CA-1**	99.42[a]	< 50%	**NC-11**	16.83	< 50%
SA-2	97.68	< 50%	**SA-19**	100	< 50%	**CA-2**	74.88[a]	< 50%	**NC-12**	89.88	< 50%
SA-3	87.18	< 50%	**SA-20**	96.14	< 50%	**CA-3**	98.56[a]	< 50%	**NC-13**	32.3	< 50%
SA-4	98.94	< 50%	**SA-21**	89.3	50.38%	**CA-7**	66.32[a]	< 50%	**NC-14**	78.27	53.38%
SA-5	99.49	< 50%	**SA-22**	77.15	< 50%	**CA-8**	62.38[a]	< 50%	**NC-15**	72.3	62.69%
SA-6	97.4	< 50%	**SA-23**	79.82	< 50%	**CA-9**	61.52[a]	< 50%	**NC-16**	98.53	91.64%
SA-7	15.84	-	**SA-24**	56.42	< 50%	**CA-10**	96.64[a]	< 50%	**NC-17**	86.04	< 50%
SA-8	98.86	< 50%	**SA-25**	48.57	< 50%	**NC-1**	<50%	<50%	**NC-18**	74.43	68.09%
SA-9	48.26	< 50%	**SA-26**	98.64	< 50%	**NC-2**	44.79	< 50%	**NC-19**	78.51	66.86%
SA-10	83.75	< 50%	**SA-27**	71.37	< 50%	**NC-3**	36.17	< 50%	**NC-20**	92.96	80.20%
SA-11	75.89	< 50%	**SA-28**	51.78	< 50%	**NC-4**	44.95	< 50%	**NC-21**	78.32	66.28%
SA-12	70.66	< 50%	**SA-29**	-	82.55%	**NC-5**	40.42	< 50%	**NC-22**	75.15	67.31%
SA-13	98.14	< 50%	**SA-30**	-	73.98%	**NC-6**	93.83	< 50%	**NC-23**	84.11	75.65%
SA-14	98.3	< 50%	**SA-31**	-	55.24%	**NC-7**	88.8	< 50%	**NC-24**	83.74	76.62%
SA-15	100	< 50%	**SA-32**	-	78.01%	**NC-8**	45.77	< 50%			

	SA-16	98.72	< 50%	**SA-33**	47	< 50%	**NC-9**	54.99	< 50%			
	SA-17	93.54	< 50%	**SA-34**	90.18	< 50%	**NC-10**	72.94	< 50%	□	□	□

"-", not determined; "a", measured at 300 μM

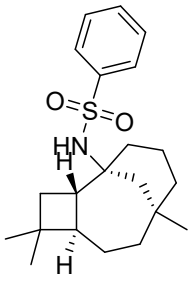
1. Characterization data of target compounds

4-Methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzenesul fonamide (**SA-1**)



According to the general procedure A, compound SA-1 could be obtained with 100% yield as white solid using β-Caryophyllene and p-Toluenesulfonamide as substrates. Recrystallisation (DCM/hexane) of a portion of this material afforded an analytically pure sample of **SA-1** as fine white crystals. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.3 Hz, 2H), 7.26 (s, *J* = 8.3 Hz, 2H), 4.36 (s, 1H), 2.42 (s, 3H), 2.34 – 2.25 (m, 1H), 1.75-1.64 (m, 4H), 1.59 (d, *J* = 10.4 Hz, 2H), 1.52-1.48 (m, 1H), 1.46 – 1.39 (m, 3H), 1.32 – 1.25 (m, 3H), 1.22 (d, *J* = 12.9 Hz, 1H), 1.11 – 1.05 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.78 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.54, 141.47, 129.40, 126.79, 58.97, 45.78, 44.96, 40.05, 37.44, 36.99, 36.89, 35.13, 34.43, 34.28, 33.57, 30.48, 21.85, 21.50, 20.77, 20.06.

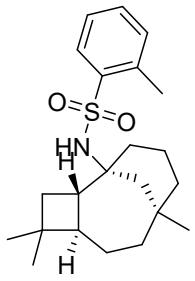
N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzenesulfonamide (**SA-2**)



According to the general procedure A, compound **SA-2** could be obtained with 88% yield as white solid using β-Caryophyllene and benzenesulfomide as substrates.
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 – 7.85 (m, 2H), 7.55 – 7.45 (m, 3H), 4.48 (s, 1H), 2.30 (td, *J* = 11.0, 8.2 Hz, 1H), 1.73 – 1.66 (m, 3H), 1.62 – 1.57 (m, 3H), 1.54 – 1.48 (m, 2H), 1.46 – 1.36 (m, 3H), 1.34 – 1.28 (m, 2H), 1.21 (d, *J* = 12.9 Hz, 1H), 1.11 – 1.04 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.78 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.29, 131.98, 128.82, 126.76, 59.12, 45.79, 45.02, 40.05, 37.41, 37.01, 36.88, 35.23, 34.46, 34.29, 33.55, 30.51, 21.85, 20.75, 20.06.

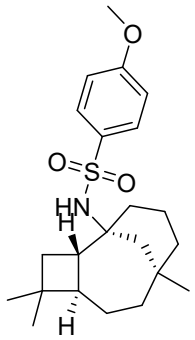
2-Methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-

yl)benzenesul fonamide (**SA-3**)



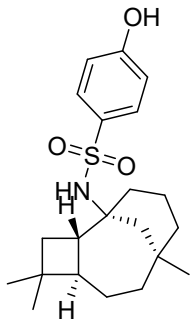
According to the general procedure A, compound **SA-3** could be obtained with 80% yield as white solid using β-Caryophyllene and 2-methylbenzene-1-sulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (dd, *J* = 5.6, 2.9 Hz, 1H), 7.42 (td, *J* = 7.5, 1.2 Hz, 1H), 7.29 (dd, *J* = 7.4, 3.6 Hz, 2H), 4.34 (s, 1H), 2.68 (s, 3H), 2.32 (td, *J* = 11.0, 8.2 Hz, 1H), 1.80 – 1.71 (m, 2H), 1.70 – 1.62 (m, 2H), 1.60 (d, *J* = 10.2 Hz, 1H), 1.55 – 1.47 (m, 3H), 1.45 – 1.38 (m, 2H), 1.34 – 1.27 (m, 3H), 1.22 (d, *J* = 13.6 Hz, 1H), 1.09 – 1.04 (m, 1H), 1.02 (s, 3H), 0.99 (s, 3H), 0.76 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.99, 136.49, 132.28, 132.16, 128.80, 126.05, 59.16, 45.67, 45.03, 40.00, 37.36, 36.97, 36.83, 35.16, 34.52, 34.32, 33.50, 30.54, 21.81, 20.76, 20.35, 20.07.

4-Methoxy-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzene sulfonamide (**SA-4**)



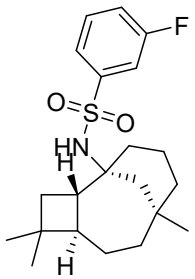
According to the general procedure A, compound **SA-4** could be obtained with 90% yield as white solid using β-Caryophyllene and p-methoxybenzenesulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.74 (m, 2H), 6.99 – 6.90 (m, 2H), 4.33 (s, 1H), 3.86 (s, 3H), 2.34 – 2.24 (m, 1H), 1.78 – 1.67 (m, 3H), 1.67 – 1.58 (m, 2H), 1.52 – 1.37 (m, 4H), 1.30-1.25 (m, 4H), 1.22(d, *J* = 12.8 Hz, 1H), 1.11 – 1.03 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.79 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.30, 136.12, 128.87, 113.91, 58.89, 55.56, 45.72, 44.99, 40.00, 37.44, 36.92, 36.86, 35.19, 34.46, 34.29, 33.57, 30.51, 21.83, 20.76, 20.07.

4-Hydroxy-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzene sulfonamide (**SA-5**)



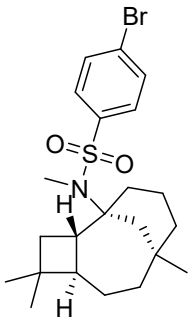
According to the general procedure A, compound **SA-5** could be obtained with 80% yield as white solid using β-Caryophyllene and 4-hydroxybenzenesulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.72 (m, 2H), 6.91 – 6.86 (m, 2H), 6.12 (s, 1H), 4.36 (s, 1H), 2.28 (ddd, J = 17.5, 10.4, 5.4 Hz, 1H), 1.78 – 1.69 (m, 3H), 1.62 – 1.58 (m, 1H), 1.53 – 1.42 (m, 4H), 1.37 – 1.30 (m, 3H), 1.28-1.25 (m, 2H), 1.22 (d, J = 12.9 Hz, 1H), 1.12 – 1.07 (m, 1H), 1.00 (s, 3H), 0.98 (s, 3H), 0.79 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 159.05, 135.93, 129.12, 115.55, 58.97, 45.70, 44.99, 39.99, 37.43, 36.91, 36.85, 35.19, 34.47, 34.29, 33.57, 30.52, 21.82, 20.76, 20.06.

3-Fluoro-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzenesul fonamide (**SA-6**)



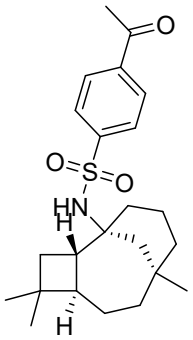
According to the general procedure A, compound **SA-6** could be obtained with 77% yield as white solid using β-Caryophyllene and 3-fluorobenzenesulfonamide as substrates;^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 7.8 Hz, 1H), 7.58 (d, *J* = 8.4 Hz, 1H), 7.47 (dt, *J* = 13.4, 6.7 Hz, 1H), 7.23 (td, *J* = 8.3, 1.1 Hz, 1H), 4.52 (s, 1H), 2.31 (dd, *J* = 19.5, 11.1 Hz, 1H), 1.77– 1.71 (m, 2H), 1.65– 1.58(m, 2H), 1.54-1.41 (m, 4H), 1.39 – 1.25 (m, 5H), 1.20 (d, *J* = 12.8 Hz, 1H), 1.11 – 1.06 (m, 1H), 1.01 (s, 3H), 0.99 (s, 3H), 0.80 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.28 (d, *J* = 250.7 Hz), 146.36 (d, *J* = 6.7 Hz), 130.60 (d, *J* = 7.6 Hz), 122.50 (d, *J* = 3.1 Hz), 119.18 (d, *J* = 21.5 Hz), 114.18 (d, *J* = 24.2 Hz), 59.45, 45.92, 45.11, 40.06, 37.37, 37.12, 36.90, 35.21, 34.46, 34.31, 33.55, 30.51, 21.88, 20.73, 20.04.

3-Bromo-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzenesul fonamide (**SA-7**)



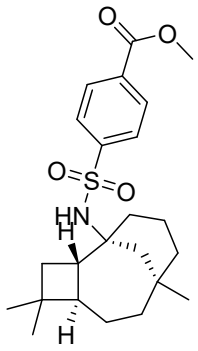
According to the general procedure A, compound **SA-7** could be obtained with 67% yield as white solid using β-Caryophyllene and 4-bromo-N-methylbenzenesulphonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 – 7.56 (m, 2H), 7.54 – 7.48 (m, 2H), 2.89 (s, 3H), 2.35 (d, *J* = 12.9 Hz, 1H), 2.17 – 2.00 (m, 2H), 1.96 – 1.87 (m, 1H), 1.76 (dd, *J* = 9.6, 7.9 Hz, 1H), 1.69 – 1.59 (m, 2H), 1.51 – 1.44 (m, 1H), 1.43 – 1.37 (m, 2H), 1.29 – 1.25 (m, 1H), 1.19 (d, *J*=12.8Hz, 1H), 1.11 – 1.02 (m, 2H), 0.94 (s, 3H), 0.90 (s, 3H), 0.87 – 0.78 (m, 2H), 0.73 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.87, 132.00, 128.01, 126.29, 65.40, 46.10, 44.68, 41.61, 39.08, 38.08, 36.48, 36.34, 34.50, 34.18,34.12, 33.93, 30.37, 22.74, 20.89, 20.40.

5-Acetyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzenesul fonamide (**SA-8**)



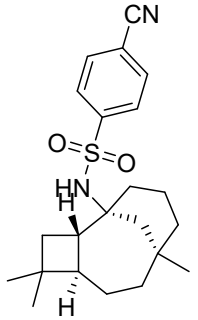
According to the general procedure A, compound **SA-8** could be obtained with 78% yield as white solid using β-Caryophyllene and 4-acetylbenzenesulphonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 8.6 Hz, 2H), 8.00 (d, *J* = 8.6 Hz, 2H), 5.22 (s, 1H), 2.66 (s, 3H), 2.29 (dt, *J* = 11.6, 6.9 Hz, 1H), 1.82– 1.64 (m, 6H), 1.55 – 1.45 (m, 2H), 1.44 – 1.40 (m, 1H), 1.36 – 1.26 (m, 4H), 1.14 (d, *J* = 12.9 Hz, 1H), 1.10 – 1.04 (m, 1H), 0.99 (s, 3H), 0.98 (s, 3H), 0.77 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.99, 148.42, 139.37, 128.78, 126.98, 59.46, 46.03, 44.85, 40.02, 37.37, 37.21, 36.86, 35.02, 34.34, 34.20, 33.54, 30.43, 26.87, 21.83, 20.76, 19.98.

Methyl-4-(N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)sulfamoyl) benzoate (**SA-9**)



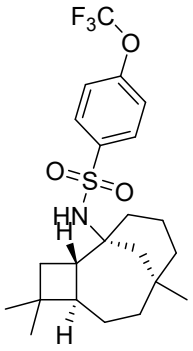
According to the general procedure A, compound **SA-9** could be obtained with 81% yield as white solid using β-Caryophyllene and methyl 4-sulphamoylbenzoate as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 – 8.07 (m, 2H), 8.02 – 7.91 (m, 2H), 4.67 (s, 1H), 3.96 (s, 3H), 2.30 (td, *J* = 10.8, 8.3 Hz, 1H), 1.78-1.67 (m, 4H), 1.64-1.61 (m, 1H), 1.56-1.43 (m, 2H), 1.46 – 1.37 (m, 2H), 1.36 – 1.28 (m, 3H), 1.28 – 1.23 (m, 1H), 1.17 (d, *J* = 12.8 Hz, 1H), 1.10 – 1.04 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.78 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 165.83, 148.27, 133.18, 130.13, 126.80, 59.45, 52.59, 45.90, 45.03, 40.02, 37.36, 37.10, 36.86, 35.26, 34.45, 34.29, 33.53, 30.50, 21.84, 20.73, 20.02.

4-Cyano-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzenesul fonamide (**SA-10**)



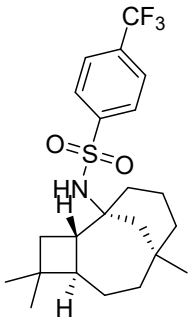
According to the general procedure A, compound **SA-10** could be obtained with 58% yield as white solid using β-Caryophyllene and 4-sulphamoylbenzonitrile as substrates;^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 – 7.96 (m, 2H), 7.81 – 7.77 (m, 2H), 4.51 (s, 1H), 2.38 – 2.26 (m, 1H), 1.76 – 1.68 (m, 4H), 1.63 – 1.57 (m, 2H), 1.53 (s, 1H), 1.47-1.41 (m, 2H), 1.38 – 1.28 (m, 4H), 1.16 (d, *J* = 12.8 Hz, 1H), 1.13 – 1.06 (m, 1H), 1.02 (s, 3H), 0.99 (s, 3H), 0.80 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 148.44, 132.77, 127.41, 117.50, 115.75, 59.84, 46.12, 45.20, 40.07, 37.31, 37.25, 36.90, 35.31, 34.48, 34.34, 33.56, 30.54, 21.90, 20.69, 20.00.

4-(Trifluoromethoxy)-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.02,5]dodecan-1-yl)benzenesulfonamide (**SA-11**)



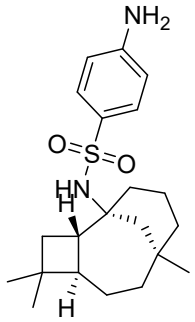
According to the general procedure A, compound **SA-11** could be obtained with 94% yield as white solid using β-Caryophyllene and 4-(trifluoromethoxy)benzenesulfona mide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 – 7.89 (m, 2H), 7.31 (d, *J* = 8.4 Hz, 2H), 4.48 (s, 1H), 2.37 – 2.26 (m, 1H), 1.76 – 1.67 (m, 4H), 1.1.63-1.58 (m, 2H), 1.53-1.48(m, 1H), 1.41-1.35(m, 2H), 1.35 – 1.25 (m, 4H), 1.19 (d, *J* = 12.8 Hz, 1H), 1.09-1.05(m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.80 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 151.59, 142.68, 128.86, 120.74, 59.48, 46.01, 45.13, 40.08, 37.37, 37.15, 36.92, 35.21, 34.46, 34.30, 33.55, 30.50, 26.92, 21.90, 20.72, 20.03.

4-(Trifluoromethyl)-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzenesulfonamide (**SA-12**)



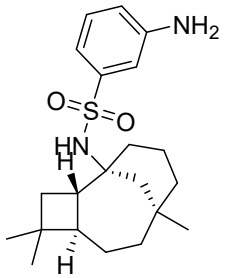
According to the general procedure A, compound **SA-12** could be obtained with 91% yield as white solid using β-Caryophyllene and 4-(trifluoromethyl)benzenesulfona mide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.3 Hz, 2H), 7.75 (d, *J* = 8.3 Hz, 2H), 4.55 (s, 1H), 2.40 – 2.24 (m, 1H), 1.78 – 1.68 (m, 4H), 1.63 – 1.58 (m, 1H), 1.58 – 1.53 (m, 2H),1.49-1.40 (m, 2H), 1.38 – 1.26 (m, 4H), 1.18 (d, *J* = 12.8 Hz, 1H),1.12-1.08(m, 1H), 1.02 (s, 3H), 0.99 (s, 3H), 0.80 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.80, 133.75 (d), 133.57, 127.22, 126.05 (q, *J* = 3.7 Hz), 59.66, 46.11, 45.16, 40.11, 37.33,37.23, 36.94, 35.20, 34.45, 34.32, 33.56, 30.51, 21.92, 20.71, 20.02.

4-Amino-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzenesul fonamide (**SA-13**)



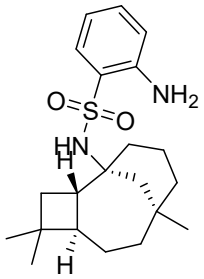
According to the general procedure A, compound **SA-13** could be obtained with 56% yield as white solid using β-Caryophyllene and p-aminobenzensulfonamide as substrates. HRMS (ESI) for $C_{21}H_{32}N_2O_2S$: calculated, $[M+H]^+$ = 377.2263, found 377.2250; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.6 Hz, 2H), 6.68 (d, *J* = 8.6 Hz, 2H), 4.32 (s, 1H), 2.37 – 2.26 (m, 1H), 1.78-1.70 (m, 2H), 1.69 – 1.59 (m, 4H), 1.58 – 1.49 (m, 3H), 1.48 – 1.39 (m, 3H), 1.34 – 1.30 (m, 3H), 1.24 (d, *J* = 12.8 Hz, 1H), 1.10 – 1.04 (m, 1H), 1.00 (s, 3H), 0.98 (s, 3H), 0.79 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.47, 133.22, 128.87, 114.18, 58.68, 45.63, 44.93, 39.99, 37.48, 36.86, 35.17, 34.45, 34.29, 33.58, 30.50, 29.71, 21.82, 20.78, 20.09.

3-Amino-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzenesul fonamide (**SA-14**)



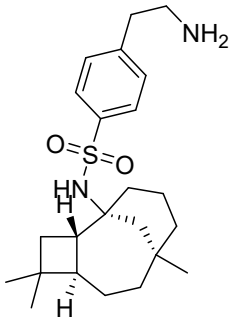
According to the general procedure A, compound **SA-14** could be obtained with 61% yield as white solid using β-Caryophyllene and m-aminobenzensulfonamide as substrates. HRMS (ESI) for $C_{21}H_{32}N_2O_2S$: calculated, $[M+H]^+$ = 377.2263, found 377.2250; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.17 (d, *J* = 5.0 Hz, 2H), 7.11 (s, 1H), 6.78 – 6.70 (m, 1H), 4.41 (s, 1H), 2.23 (td, *J* = 10.8, 8.2 Hz, 1H), 1.73 – 1.64 (m, 2H), 1.61 – 1.52 (m, 3H), 1.51 – 1.41 (m, 2H), 1.40 – 1.30 (m, 3H), 1.28 – 1.21 (m, 3H), 1.16 (d, *J* = 8.9 Hz, 1H), 1.04 – 0.98 (m, 1H), 0.94 (s, 3H), 0.91 (s, 3H), 0.73 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.55, 144.17, 128.71, 117.38, 115.72, 111.82, 58.03, 44.80, 43.97, 39.10, 36.40, 36.06, 35.91, 34.04, 33.38, 33.25, 32.56, 29.46, 20.87, 19.75, 19.05.

2-Amino-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzenesul fonamide (**SA-15**).



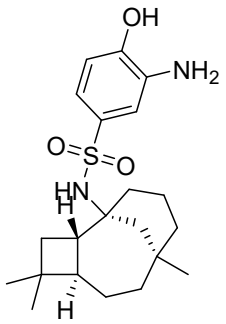
According to the general procedure A, compound **SA-15** could be obtained with 40% yield as white solid using β-Caryophyllene and o-aminobenzensulfonamide as substrates. HRMS (ESI) for $C_{21}H_{32}N_2O_2S$: calculated, $[M+H]^+$ = 377.2263, found 377.2250; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 8.0, 1.4 Hz, 1H), 7.31 – 7.26 (m, 1H), 6.81 – 6.71 (m, 2H), 4.73 (s, 1H), 2.33 – 2.23 (m, 1H), 1.71 (ddd, *J* = 15.4, 10.6, 5.7 Hz, 2H), 1.66 – 1.59 (m, 3H), 1.59 – 1.46 (m, 3H), 1.44 – 1.36 (m, 2H), 1.34 – 1.24 (m, 3H), 1.22 (d, *J* = 12.8 Hz, 1H), 1.05 (ddd, *J* = 8.6, 6.1, 2.9 Hz, 1H), 0.99 (s, 3H), 0.97 (s, 3H), 0.77 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.52, 133.45, 129.08, 126.35, 117.74, 117.63, 59.04, 45.17, 44.75, 39.81, 37.46, 36.73, 36.57, 35.23, 34.46, 34.35, 33.52, 30.45, 21.68, 20.79, 20.14.

4-(2-Aminoethyl)-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzenesulfonamide (**SA-16**).



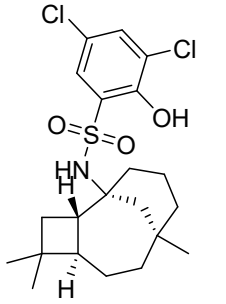
According to the general procedure A, compound **SA-16** could be obtained with 90% yield as yellow oil using β-Caryophyllene and 4-(2-aminoethyl)benzenesulfonamide as substrates; HRMS (ESI) for $C_{23}H_{36}N_2O_2S$: calculated, $[M+H]^+$ = 405.2576, found 405.2572; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 8.2 Hz, 2H), 7.31 (d, *J* = 8.2 Hz, 2H), 4.65 (s, 1H), 3.13 (s, 2H), 3.08 – 3.02 (t, *J* = 6.8 Hz, 2H), 2.90 (t, *J* = 6.8 Hz, 2H), 2.30 (dd, *J* = 19.8, 10.9 Hz, 1H), 1.79 – 1.67 (m, 4H), 1.66-1.60 (m, 2H), 1.56 – 1.47 (m, 2H), 1.47 – 1.39 (m, 2H), 1.37-1.30 (m, 3H), 1.18 (d, *J* = 12.9 Hz, 1H), 1.11 – 1.04 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.78 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.31, 142.57, 129.33, 127.01, 59.22, 45.96, 45.01, 42.41, 40.12, 37.41, 37.20, 36.94, 35.10, 34.40, 34.27, 33.59, 30.51, 29.71, 21.90, 20.77, 20.05.

2-Amino-4-hydroxy-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl) benzenesulfonamide (**SA-17**)



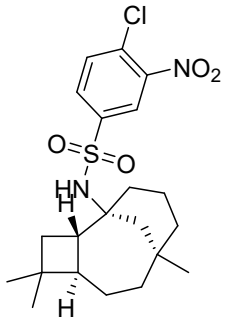
According to the general procedure A, compound **SA-17** could be obtained with 90% yield as white solid using β-Caryophyllene and 3-amino-4-hydroxybenzenesul phonamide as substrates; HRMS (ESI) for $C_{21}H_{32}N_2O_3S$: calculated, $[M+H]^+$ = 393.2212, found 393.1975; ^{1}H NMR (400 MHz, DMSO) δ 9.83 (s, 1H), 7.03 (d, *J* = 2.2 Hz, 1H), 6.93 (s, 1H), 6.86 (dd, *J* = 8.2, 2.2 Hz, 1H), 6.70 (d, *J* = 8.2 Hz, 1H), 5.07 (s, 2H), 2.26 – 2.10 (m, 1H), 1.90 – 1.80 (m, 1H), 1.80 – 1.62 (m, 4H), 1.60 – 1.32 (m, 5H), 1.31 – 1.08 (m, 4H), 0.97 (s, 3H), 0.95 (s, 3H), 0.87 – 0.80 (m, 1H), 0.74 (s, 3H); ^{13}C NMR (101 MHz, DMSO) δ 147.24, 136.51,136.65, 115.80, 113.79, 112.32, 66.83, 58.01, 46.17, 44.01, 37.76,37.75, 36.80, 34.37, 34.00, 33.88, 30.71, 21.87, 21.36, 19.88.

3,5-Dichloro-2-hydroxy-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.02,5]dodecan-1-yl)benzenesulfonamide (**SA-18**)



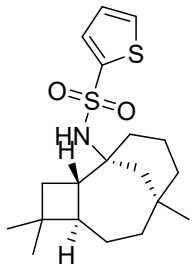
According to the general procedure A, compound **SA-18** could be obtained with 65% yield as white solid using β-Caryophyllene and 3,5-dichloro-2-hydroxy-benzenesulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.64 (s, 1H), 7.53 (d, *J* = 2.5 Hz, 1H), 7.45 (d, *J* = 2.5 Hz, 1H), 4.66 (s, 1H), 2.31 – 2.22 (m, 1H), 1.69 – 1.62 (m, 4H), 1.621.56 (m, 2H), 1.47 – 1.37 (m, 4H), 1.36 – 1.29 (m, 3H), 1.14(d, *J* = 12.8 Hz, 2H), 1.05-1.01 (m, 1H), 0.95 (s, 3H), 0.92 (s, 3H), 0.76 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.75 , 132.99 , 128.61 , 125.45 , 123.91 , 123.05 , 59.33 , 44.69 , 44.16 , 38.90 , 36.24, 36.07, 35.79 , 34.06 , 33.47, 33.36 , 32.47 , 29.47 , 28.68 , 20.78 , 19.65 , 19.01.

2-Chloro-3-nitro-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl) benzenesulfonamide (**SA-19**)



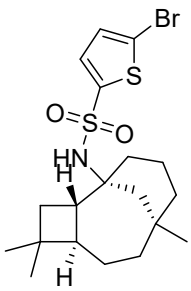
According to the general procedure A, compound **SA-19** could be obtained with 85% yield as white solid using β-Caryophyllene and 4-chloro-3-nitrobenzenesulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.36 (d, *J* = 2.1 Hz, 1H), 7.99 (dd, *J* = 8.4, 2.1 Hz, 1H), 7.69 (d, *J* = 8.5 Hz, 1H), 4.59 (s, 1H), 2.33 (td, *J* = 10.9, 8.2 Hz, 1H), 1.78-1.71 (m, 4H), 1.66 – 1.59 (m, 2H), 1.54 – 1.43 (m, 4H), 1.38 – 1.32 (m, 3H), 1.18 (d, *J* = 12.8 Hz, 1H), 1.13-1.09 (m, 1H), 1.02 (s, 3H), 1.00 (s, 3H), 0.82 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 147.69 , 144.52 , 132.72 , 130.84 , 130.74 , 124.25 , 60.16 , 46.19 , 45.24 , 40.10 , 37.33 , 37.29 , 36.94 , 35.31 , 34.49 , 34.37 , 33.57 , 30.51 , 21.93 , 20.69 , 20.01.

N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)thiophene-2-sulfonami de (**SA-20**)



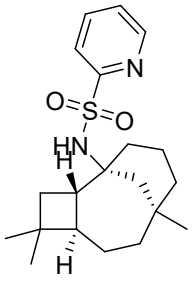
According to the general procedure A, compound **SA-20** could be obtained with 92% yield as white solid using β-Caryophyllene and 2-methylbenzene-1-sulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57 (dd, *J* = 3.7, 1.3 Hz, 1H), 7.53 (dd, *J* = 5.0, 1.3 Hz, 1H), 7.02 (dd, *J* = 5.0, 3.7 Hz, 1H), 4.51 (s, 1H), 2.38 – 2.28 (m, 1H), 1.77-1.72 (m, 2H), 1.70 – 1.65 (m, 3H), 1.59 – 1.56 (m, 2H), 1.54 – 1.48 (m, 3H), 1.48-1.44 (m, 2H), 1.33-1.29 (m, 2H), 1.11 – 1.08 (m, 1H), 1.01 (s, 3H), 0.99 (s, 3H), 0.82 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.07 , 131.37 , 131.00 , 126.92 , 59.65 , 45.37 , 44.99 , 40.04 , 37.42 , 36.91 , 36.88 , 35.09 , 34.49 , 34.34 , 33.58 , 30.49 , 21.84 , 20.76 , 20.10.

4-Bromo-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)thiophene-2-sulfonamide (**SA-21**)



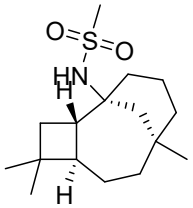
According to the general procedure A, compound **SA-21** could be obtained with 96% yield as white solid using β-Caryophyllene and 5-bromothiophene-2-sulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (d, *J* = 3.7 Hz, 1H), 7.00 (d, *J* = 4.0 Hz, 1H), 4.55 (s, 1H), 2.39 – 2.26 (m, 1H), 1.81-1.75 (m, 2H), 1.72 – 1.66 (m, 2H), 1.64-1.59 (m, 1H), 1.59 – 1.52 (m, 3H), 1.52 – 1.45 (m, 2H), 1.36 – 1.24 (m, 4H), 1.15 – 1.10 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.85 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.85 , 131.31 , 129.90 , 118.93 , 59.95 , 45.65 , 45.09 , 40.08 , 37.39 , 37.08 , 36.94 , 34.99 , 34.48 , 34.38 , 33.60 , 30.49 , 21.90 , 20.73 , 20.07.

N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)pyridine-2-sulfonam ide (**SA-22**)



According to the general procedure A, compound **SA-22** could be obtained with 78% yield as white solid using β-Caryophyllene and pyridine-2-sulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.64 (ddd, *J* = 4.7, 1.6, 0.8 Hz, 1H), 8.00 – 7.90 (m, 1H), 7.84 (td, *J* = 7.7, 1.7 Hz, 1H), 7.42 (ddd, *J* = 7.6, 4.7, 1.1 Hz, 1H), 5.15 (s, 1H), 2.24 (dt, *J* = 12.0, 9.3 Hz, 1H), 1.79 – 1.73 (m, 1H), 1.70 - 1.65 (m, 1H), 1.63 – 1.58 (m, 2H), 1.46 – 1.35 (m, 3H), 1.27 – 1.17 (m, 3H), 1.07 (d, *J* = 12.8 Hz, 1H), 1.04 – 0.98 (m, 1H), 0.95 (s, 3H), 0.92 (s, 3H), 0.71 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.54 , 149.76 , 138.06 , 126.21 , 121.28 , 63.76 , 45.89 , 44.80 , 39.96 , 37.41 , 37.06 , 36.87 , 35.37 , 34.30 , 34.28 , 33.54 , 30.39 , 21.84 , 20.78 , 20.08.

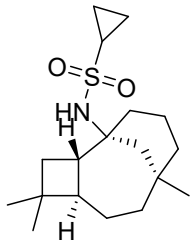
N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)methanesulfonamide (**SA-23**)



According to the general procedure A, compound **SA-23** could be obtained with 80% yield as white solid using β-Caryophyllene and methanesulfonamide as substrates; ^{1}H

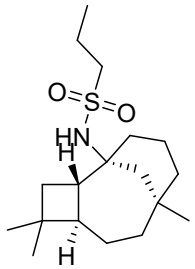
NMR (400 MHz, $CDCl_3$) δ 4.17 (s, 1H), 3.03 (s, 3H), 2.34 (ddd, *J* = 11.9, 10.7, 8.1 Hz, 1H), 1.90 – 1.85 (m, 1H), 1.83 – 1.76 (m, 2H), 1.76 – 1.73 (m, 1H), 1.72 – 1.66 (m, 2H), 1.59 – 1.46 (m, 3H), 1.45 – 1.39 (m, 2H), 1.37 – 1.26 (m, 2H), 1.19 – 1.11 (m, 2H), 1.01 (s, 3H), 0.99 (s, 3H), 0.90 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 58.91 , 46.00 , 45.48 , 45.09 , 40.09 , 37.54 , 37.14 , 37.08 , 35.64 , 34.48 , 34.40 , 33.81 , 30.45 , 22.04 , 20.75 , 20.19.

N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)cyclopropanesulfonamide (**SA-24**).



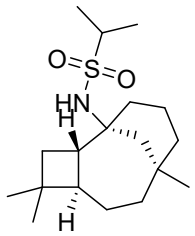
According to the general procedure A, compound **SA-24** could be obtained with 87% yield as white solid using β-Caryophyllene and cyclopropanesulfonamide as substrates; ^1H NMR (400 MHz, $CDCl_3$) δ 4.37 (s, 1H), 2.40 (tt, *J* = 8.0, 4.9 Hz, 1H), 2.25 (td, *J* = 10.7, 8.1 Hz, 1H), 1.83 – 1.76 (m, 2H), 1.76 – 1.71 (m, 2H), 1.60 (dd, *J* = 11.7, 6.1 Hz, 2H), 1.53 – 1.42 (m, 3H), 1.38 – 1.33 (m, 2H), 1.30 – 1.23 (m, 2H), 1.21 (d, *J*=12.8Hz, 1H), 1.12 – 1.06 (m, 3H), 1.06 – 1.03 (m, 1H), 0.94 (s, 3H), 0.92 (s, 3H), 0.89 (dd, *J* = 5.2, 2.9 Hz, 1H), 0.83 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 58.45, 46.45, 44.87, 40.05, 37.60, 37.12, 37.02, 36.25, 34.40, 34.33, 34.28, 33.83, 30.41, 22.00, 20.81, 20.25, 6.81, 6.51.

N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)propane-1-sulfon amide (**SA-25**)



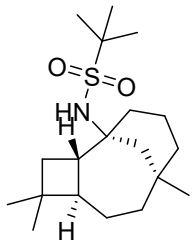
According to the general procedure A, compound **SA-25** could be obtained with 69% yield as white solid using β-Caryophyllene and propanesulfonamide as substrates; ^1H NMR (400 MHz, $CDCl_3$) δ 3.90 (s, 1H), 2.99 – 2.89 (m, 2H), 2.31 – 2.21 (m, 1H), 1.80 – 1.74 (m, 3H), 1.65 – 1.60 (m, 3H), 1.47 – 1.41 (m, 4H), 1.35 – 1.31 (m, 2H), 1.30 – 1.22 (m, 2H), 1.10 – 1.04 (m, 2H), 1.01 – 0.97 (m, 4H), 0.94 (s, 3H), 0.92 (s, 3H), 0.83 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 58.89, 58.77, 46.02, 45.13, 40.12, 37.54, 37.09, 37.07, 35.76, 34.49, 34.41, 33.80, 30.49, 22.03, 20.75, 20.20, 17.92, 13.00.

N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)propane-2-sulfona mide (**SA-26**)



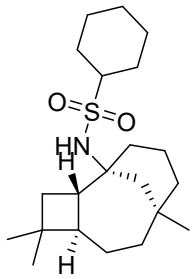
According to the general procedure A, compound **SA-26** could be obtained with 78% yield as white solid using β-Caryophyllene and isopropylsulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.02 (s, 1H), 3.03 (dt, *J* = 13.6, 6.8 Hz, 1H), 2.26 (td, *J* = 10.9, 8.2 Hz, 1H), 1.80 – 1.74 (m, 2H), 1.72 – 1.68 (m, 1H), 1.64 – 1.57 (m, 3H), 1.51 (d, *J* = 10.2 Hz, 1H), 1.49 – 1.43 (m, 2H), 1.42 – 1.37 (m, 1H), 1.35 (d, *J* = 5.7 Hz, 1H), 1.32 (d, *J* = 6.8 Hz, 3H), 1.30 (d, *J* = 6.9 Hz, 3H), 1.28 – 1.17 (m, 2H), 1.09 – 1.03 (m, 2H), 0.94 (s, 3H), 0.92 (s, 3H), 0.82 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 58.78, 56.29, 45.92, 45.01, 40.20, 37.52, 37.07, 37.05, 35.90, 34.42, 34.33, 33.80, 30.47, 22.02, 20.78, 20.21, 17.09, 16.74.

2-Methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)propane-2-sulfonamide (**SA-27**)



According to the general procedure A, compound SA-27 could be obtained with 70% yield as white solid using β-Caryophyllene and *tert*-butylsulfonamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.42 (s, 1H), 2.31 (td, *J* = 11.1, 8.2 Hz, 1H), 1.81 – 1.71 (m, 3H), 1.71 – 1.65 (m, 2H), 1.64 (s, 1H), 1.61 – 1.55 (m, 1H), 1.53 – 1.43 (m, 4H), 1.42 – 1.38 (m, 1H), 1.31 (s, 9H), 1.29 – 1.23 (m, 1H), 1.10 – 1.03 (m, 2H), 0.94 (s, 3H), 0.93 (s, 3H), 0.81 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 60.27, 59.72, 46.29, 45.34, 40.87, 37.52, 37.29, 37.13, 36.14, 34.61, 34.38, 33.93, 30.58, 24.65, 22.19, 20.71, 20.49.

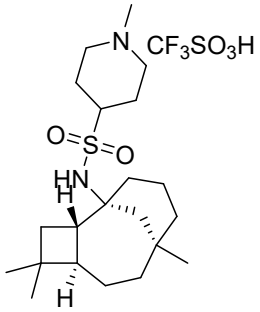
N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)cyclohexanesulfona mide (**SA-28**)



According to the general procedure A, compound **SA-28** could be obtained with 52% yield as white solid using β-Caryophyllene and cyclohexanesulfonamide as substrates;

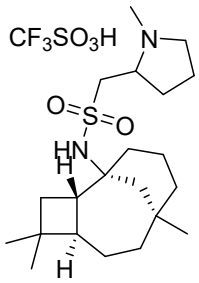
^{1}H NMR (400 MHz, $CDCl_3$) δ 3.90 (s, 1H), 2.70 (tt, *J* = 12.0, 3.4 Hz, 1H), 2.31 – 2.21 (m, 1H), 2.13 (t, *J* = 12.8 Hz, 2H), 1.85 – 1.77 (m, 3H), 1.75 – 1.68 (m, 2H), 1.67 – 1.59 (m, 4H), 1.50 – 1.42 (m, 4H), 1.36 – 1.29 (m, 3H), 1.28 – 1.16 (m, 4H), 1.10 – 1.01 (m, 3H), 0.94 (s, 3H), 0.92 (s, 3H), 0.82 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 64.44, 58.81, 46.27, 45.12, 40.32, 37.55, 37.21, 37.18, 35.83, 34.44, 34.32, 33.85, 30.48, 26.85 , 26.60, 25.35, 25.24, 22.11, 20.77, 20.23.

1-Methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)piperidine-4-sulfonamide trifluoromethanesulfonate (**SA-29**)



According to the general procedure A, compound **SA-29** could be obtained with 43% yield as white solid using β-Caryophyllene and 1-Methyl-4-piperidinesulfonamide as substrates; HRMS (ESI) for $C_{21}H_{38}N_2O_2S$: calculated, $[M+H]^+$ = 383.2732, found 383.2544; ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.66 (s, 1H), 3.55 – 3.31 (m, 4H), 3.10 – 2.85 (m, 3H), 2.75 (s, 3H),2.33 – 2.22 (m, 3H), 2.12 (brs, 2H), 1.91 – 1.82 (m, 1H), 1.81 – 1.66 (m, 3H), 1.66 – 1.55 (m, 2H), 1.52 – 1.40 (m, 3H), 1.40 – 1.31 (m, 1H), 1.20 (d, *J* = 12.6 Hz, 2H), 1.12 – 1.00 (m, 2H), 0.94 (s, 3H), 0.92 (s, 3H), 0.82 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 120.20 (q, *J* = 375.2 Hz), 59.86, 53.08, 46.30, 45.04, 44.17, 40.33, 37.66, 37.45, 37.25, 35.63, 34.35, 34.22, 33.77, 30.43, 24.34, 24.12, 22.13, 20.75, 20.16.

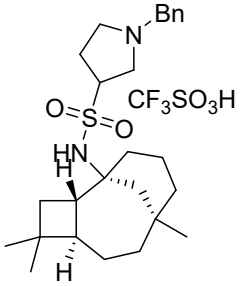
1-(1-Methylpyrrolidin-2-yl)-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dode can-1-yl)methanesulfonamide trifluoromethanesulfonate (**SA-30**)



According to the general procedure A, compound **SA-30** could be obtained with 36% yield as white solid using β-Caryophyllene and (1-methylpyrrolidin-2-yl)methanesulfonamide as substrates; HRMS (ESI) for $C_{21}H_{38}N_2O_2S$: calculated, $[M+H]^+$ = 383.2732, found 383.2540; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.93 (s, 1H) , 5.10 (s, 1H), 3.93 (brs, 1H), 3.86 – 3.68 (m, 2H), 3.47 (d, *J* = 9.3 Hz, 1H), 3.16 (d, *J* = 8.7 Hz, 1H), 3.07 (s, 3H), 2.59 (brs, 1H), 2.41 – 2.28 (m, 1H), 2.27 – 2.08 (m, 3H), 2.00 (d,

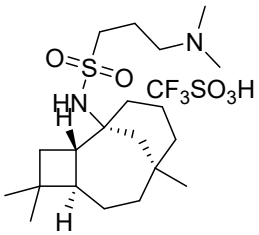
J = 11.1 Hz, 1H), 1.88 – 1.74 (m, 3H), 1.74 – 1.65 (m, 2H), 1.64 – 1.47 (m, 4H), 1.44 (d, *J* = 13.4 Hz, 1H), 1.38 – 1.30 (m, 2H), 1.20 – 1.10 (m, 2H), 1.02 (s, 3H), 1.00 (s, 3H), 0.91 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 65.68, 60.43, 60.25, 57.25, 57.14, 46.37, 45.03, 41.66, 40.16, 37.74, 37.49, 37.18, 35.59, 34.45, 34.23, 33.73, 30.68, 30.34, 22.14, 22.08, 21.06, 20.73, 20.17, 14.20.

1-Benzyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)pyrrolidine -3-sulfonamide trifluoromethanesulfonate (**SA-31**)



According to the general procedure A, compound **SA-31** could be obtained with 37% yield as white solid using β-Caryophyllene and 1-benzylpyrrolidine-3-sulfonamide as substrates; HRMS (ESI) for $C_{26}H_{40}N_2O_2S$: calculated, $[M+H]^+$ = 445.2889, found 445.2680; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 – 7.15 (m, 5H), 4.37 – 4.19 (m, 1H), 3.79 – 3.63 (m, 3H), 3.27 – 3.11 (m, 1H), 2.95 – 2.86 (m, 1H), 2.86 – 2.78 (m, 1H), 2.68 – 2.60 (m, 1H), 2.29 – 2.15 (m, 3H), 1.75 – 1.63 (m, 4H), 1.61 – 1.54 (m, 3H), 1.44 – 1.38 (m, 2H), 1.37 - 1.33 (m, 1H), 1.30 (d, *J* = 3.1 Hz, 1H), 1.28 – 1.22 (m, 2H), 1.08 – 1.01 (m, 2H), 0.92 (s, 1.5H), 0.91 (s, 1.5H), 0.90 (s, 3H), 0.89 (s, 1.5H), 0.81 (s, 3H), 0.80 (s, 1.5H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 129.21, 128.62, 128.61, 127.85, 62.92, 62.88, 59.71, 59.66, 59.27, 59.23, 54.92, 54.49, 53.39, 53.25, 45.73, 44.96, 39.97, 39.92, 37.47, 36.98, 36.94, 36.92, 36.18, 36.10, 34.49, 34.41, 34.39, 33.75, 33.69, 30.52, 29.70, 27.02, 26.63, 21.92, 21.86, 20.20, 20.19.

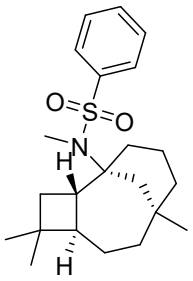
3-(Dimethylamino)-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)propane-1-sulfonamide trifluoromethanesulfonate (**SA-32**)



According to the general procedure A, compound **SA-32** could be obtained with 32% yield as white solid using β-Caryophyllene and 3-(dimethylamino)propane-1-sulfonamide as substrates; HRMS (ESI) for $C_{20}H_{38}N_2O_2S$: calculated, $[M+H]^+$ = 371.2732, found 371.2545; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.37 (s, 1H), 4.87(s, 1H), 3.14 (dt, *J* = 14.5, 6.6 Hz, 4H), 2.77 (s, 6H), 2.29 – 2.11 (m, 3H), 1.87 (d, *J* = 11.3 Hz, 1H), 1.79 – 1.72 (m, 2H), 1.63 – 1.55 (m, 2H), 1.51 – 1.41 (m, 3H), 1.41 – 1.30 (m, 2H), 1.29 – 1.16 (m, 3H), 1.09 – 1.01 (m, 2H), 0.93 (s, 3H), 0.92 (s, 3H), 0.82 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 120.2 (q, *J* = 375.2 Hz), 59.52, 56.69, 53.69, 46.22,

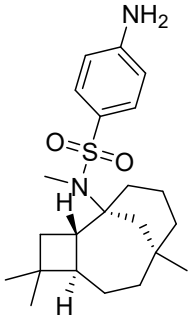
44.91, 43.79, 40.22, 37.64, 37.50, 37.20, 35.59, 34.33, 34.19, 33.79, 30.38, 22.10, 20.76, 20.26, 20.15.

N-Methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzene sulfonamide (**SA-33**)



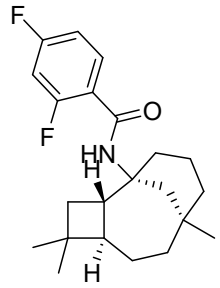
According to the general procedure A, compound **SA-33** could be obtained with 60% yield as white solid using β-Caryophyllene and N-methylbenzenesulfonamide as substrates; HRMS (ESI) for $C_{22}H_{33}NO_2S$: calculated, $[M+H]^+$ = 376.2310, found 376.2144; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 – 7.67 (m, 2H), 7.48 – 7.33 (m, 3H), 2.90 (s, 3H), 2.34 (dd, *J* = 12.8, 1.0 Hz, 1H), 2.17 – 2.08 (m, 1H), 2.08 – 2.00 (m, 1H), 1.96 – 1.88 (m, 1H), 1.76 (dd, *J* = 9.6, 7.9 Hz, 1H), 1.63 – 1.56 (m, 2H), 1.49 – 1.43 (m, 1H), 1.39 (dt, *J* = 6.1, 2.8 Hz, 2H), 1.26 – 1.18 (m, 2H), 1.14 – 1.06 (m, 1H), 1.06 – 1.00 (m, 1H), 0.93 (s, 3H), 0.90 (s, 3H), 0.85 – 0.76 (m, 2H), 0.71 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.83, 131.65, 128.75, 126.41, 65.14, 45.99, 44.53, 41.59, 39.06, 37.99, 36.53, 36.21, 34.45, 34.13, 34.10, 33.94, 30.34, 22.67, 20.90, 20.38.

4-Amino-N-methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benzenesulfonamide (**SA-34**)



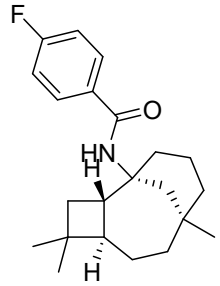
According to the general procedure A, compound **SA-34** could be obtained with 53% yield as white solid using β-Caryophyllene and N-methylbenzenesulfonamide as substrates; HRMS (ESI) for $C_{22}H_{34}N_2O_2S$: calculated, $[M+H]^+$ = 391.2419, found 391.2247; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 – 7.42 (m, 2H), 6.66 – 6.51 (m, 2H), 4.19 – 3.83 (brs, 2H), 2.83 (s, 3H), 2.29 (d, *J* = 13.1 Hz, 1H), 2.15 – 2.07 (m, 1H), 2.03 – 1.97 (m, 1H), 1.90 (ddd, *J* = 12.0, 7.8, 6.5 Hz, 1H), 1.74 (dd, *J* = 9.5, 7.8 Hz, 1H), 1.61 – 1.55 (m, 2H), 1.49 – 1.43 (m, 1H), 1.42 - 1.35 (m, 2H), 1.28 - 1.21 (m, 2H), 1.15 – 1.10 (m, 1H), 1.06(d, *J*=12.8Hz, 1H), 1.04 - 0.99 (m, 1H), 0.92 (s, 3H), 0.89 (s, 3H), 0.86 - 0.79 (m, 1H), 0.73 (s, 3H)。^{13}C NMR (101 MHz, $CDCl_3$) δ 149.58, 133.57, 128.50, 113.95, 64.81, 45.88, 44.44, 41.49, 39.10, 37.83, 36.68, 35.94, 34.46, 34.13, 34.08, 33.89, 30.31, 22.50, 20.90, 20.40.

2,4-Difluoro-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benz amide (**CA-1**).



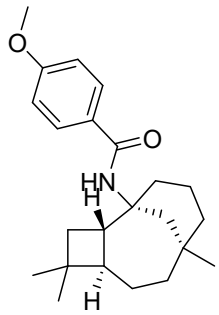
According to the general procedure B, compound **CA-1** could be obtained with 70% yield as white solid using β-Caryophyllene and 2,4-difluorobenzamide as substrates; HRMS (ESI) for $C_{22}H_{29}F_2NO$: calculated, $[M+H]^+$ = 362.2295, found 362.2070; ^1H NMR (400 MHz, $CDCl_3$) δ 8.05 (td, *J* = 9.0, 6.7 Hz, 1H), 7.02 – 6.91 (m, 1H), 6.91 – 6.79 (m, 1H), 6.40 (d, *J* = 12.9 Hz, 1H), 2.45 (td, *J* = 11.0, 8.0 Hz, 1H), 2.34 (m, 1H), 1.89 – 1.74 (m, 4H), 1.71 – 1.63 (m, 2H), 1.63 – 1.55 (m, 2H), 1.48 (m, 2H), 1.39 (m, 1H), 1.32 (m, 1H), 1.17 (m, 2H), 1.01 (s, 3H), 0.98 (s, 3H), 0.92 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 165.68 (d, *J* = 13.0 Hz), 163.16 (d, *J* = 12.5 Hz), 161.82 (d, *J* = 12.3 Hz), 161.09 (d, *J* = 3.8 Hz), 133.63 (dd, *J* = 10.0, 3.9 Hz), 118.89, 112.21 (dd, *J* = 21.0, 3.4 Hz), 104.33, 104.06 (d, *J* = 3.4 Hz), 103.79, 56.32, 46.24, 45.87, 41.36, 38.11, 37.97, 37.31, 35.53, 34.42, 34.32, 34.04, 30.55, 23.01, 20.74, 20.07.

4-Fluoro-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.02,5]dodecan-1-yl)benzamide (**CA-2**)



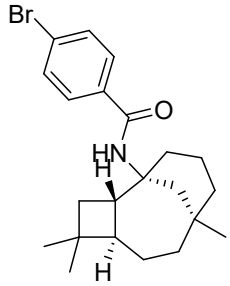
According to the general procedure B, compound **CA-2** could be obtained with 44% yield as white solid using β-Caryophyllene and 4-fluorobenzamide as substrates; HRMS (ESI) for $C_{22}H_{30}FNO$: calculated, $[M+H]^+$ = 344.2390, found 344.2236; ^1H NMR (400 MHz, $CDCl_3$) δ 7.78 – 7.64 (m, 2H), 7.11 – 7.00 (m, 2H), 5.83 (s, 1H), 2.50 – 2.48 (m, 2H), 1.95 – 1.88 (m, 1H), 1.88 – 1.74 (m, 3H), 1.70 – 1.60 (m, 1H), 1.60 – 1.48 (m, 3H), 1.42 – 1.36 (m, 2H), 1.34 – 1.25 (m, 2H), 1.22 – 1.10 (m, 2H), 1.01 (s, 3H),0.97 (s, 3H), 0.91 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 165.60, 163.17, 132.31 (d, *J* = 3.0 Hz), 128.97 (d, *J* = 8.8 Hz), 115.41 (d, *J* = 22 Hz,), 115.30, 55.93, 46.40, 46.16, 41.53, 38.19, 37.32, 35.77, 34.38, 34.31, 34.10, 30.58, 23.10, 20.73, 20.05.

4-Methoxy-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)benza mide (**CA-3**)



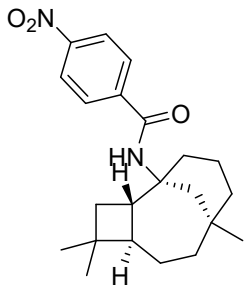
According to the general procedure B, compound **CA-3** could be obtained with 30% yield as white solid using β-Caryophyllene and 4-methoxybenzamide as substrates; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.8 Hz, 2H), 6.83 (d, *J* = 8.8 Hz, 2H), 5.73 (s, 1H), 3.76 (s, 3H), 2.42 – 2.30 (m, 2H), 1.85 – 1.71 (m, 4H), 1.61 – 1.56 (m, 1H), 1.53 – 1.48 (m, 2H), 1.44-1.40 (M, 1H), 1.34 (d, *J* = 12.7 Hz, 1H), 1.31 – 1.17 (m, 3H), 1.14 – 1.06 (m, 2H), 0.93 (s, 3H), 0.89 (s, 3H), 0.84 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 165.11, 160.76, 127.41, 112.60, 54.62, 54.36, 45.29, 45.15, 40.51, 37.13, 37.08, 36.34, 34.76, 33.35, 33.27, 33.06, 29.55, 22.04, 19.73, 19.05.

4-Bromo-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzamide (**CA-7**)



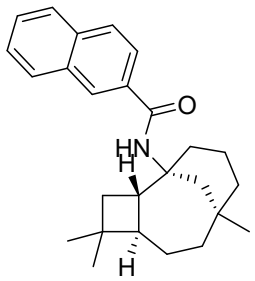
According to the general procedure B, compound **CA-7** could be obtained with 30% yield as white solid using β-Caryophyllene and 4-bromobenzamide as substrates; HRMS (ESI) for $C_{22}H_{30}BrNO$: calculated, $[M+H]^+$ = 404.1589, found 404.1417; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.41 (m, 4H), 5.74 (s, 1H), 2.41 – 2.30 (m, 2H), 1.86 – 1.81 (m, 1H), 1.78-1.68 (m, 2H), 1.61 – 1.53 (m, 1H), 1.53 – 1.37 (m, 4H), 1.36 – 1.28 (m, 2H), 1.24 – 1.16 (m, 2H), 1.15 – 1.04 (m, 2H), 0.94 (s, 3H), 0.89 (s, 3H), 0.84 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.62, 133.94, 130.64, 127.35, 124.51, 54.99, 45.39, 45.10, 40.49, 37.16, 37.13, 36.28, 34.70, 33.37, 33.30, 33.07, 29.56, 22.07, 19.69, 19.01.

4-Nitro-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzamide (**CA-8**)



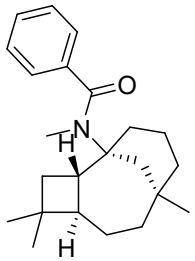
According to the general procedure B, compound **CA-8** could be obtained with 35% yield as white solid using β-Caryophyllene and 4-nitrobenzamide as substrates; HRMS (ESI) for $C_{22}H_{30}N_2O_3$: calculated, $[M+H]^+$ = 371.2335, found 371.2165; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 10.8Hz, 2H), 7.86 (d, *J* = 12.1 Hz, 2H), 5.91 (s, 1H), 2.46 (td, *J* = 11.5, 8.1 Hz, 2H), 1.95 (d, *J* = 12.7 Hz, 1H), 1.90 – 1.80 (m, 3H), 1.75 – 1.65 (m, 3H), 1.63 – 1.56 (m, 2H), 1.43 – 1.38 (m, 2H), 1.37– 1.33 (m, 1H), 1.32 – 1.27 (m, 2H), 1.23 – 1.15 (m, 2H), 1.02 (s, 3H), 0.98 (s, 3H), 0.93 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.64, 149.29, 141.77, 127.91, 123.77, 123.72, 56.53, 46.54, 46.09, 41.54, 38.25, 38.23, 37.25, 35.72, 34.43, 34.38, 34.12, 30.60, 23.13, 20.69, 20.02.

N-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-2-naphthamide (**CA-9**)



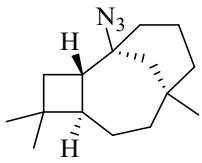
According to the general procedure B, compound **CA-9** could be obtained with 38% yield as white solid using β-Caryophyllene and 2-naphthamide as substrates; HRMS (ESI) for $C_{26}H_{33}NO$: calculated, $[M+H]^+$ = 376.2640, found 376.2463; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 7.93 – 7.87 (m, 1H), 7.85 (dd, *J* = 8.7, 5.1 Hz, 2H), 7.78 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.56 – 7.48 (m, 2H), 6.03 (s, 1H), 2.55-2.40 (m, 2H), 1.98 (d, *J* = 12.7 Hz, 1H), 1.92-1.81 (m, 3H), 1.72 – 1.56 (m, 4H), 1.53 – 1.46 (m, 2H), 1.43 – 1.38 (m, 2H), 1.23 – 1.15 (m, 2H), 1.02 (s, 3H), 0.98 (s, 3H), 0.93 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.70, 134.53, 133.38, 132.69, 128.84, 128.35, 127.73, 127.38, 126.90, 126.66, 123.70, 58.16, 55.99, 46.41, 46.28, 41.61, 38.27, 38.23, 37.40, 35.87, 34.43, 34.35, 34.14, 30.62, 23.13, 20.79, 20.11.

N-Methyl-N-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)benzamide (**CA-11**)



According to the general procedure B, compound **CA-11** could be obtained with 20% yield as white solid using β-Caryophyllene and N-methylbenzamide as substrates; HRMS (ESI) for $C_{23}H_{33}NO$: calculated, $[M+H]^+$ = 340.2640, found 340.2476; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.30 (m, 5H), 2.90 (s, 3H), 2.81 – 2.69 (m, 1H), 2.57 (d, *J* = 12.8 Hz, 1H), 2.41 (td, *J* = 11.0, 8.1 Hz, 1H), 2.03 – 1.93 (m, 1H), 1.89 (dd, *J* = 9.7, 8.1 Hz, 1H), 1.84 – 1.73 (m, 2H), 1.69-1.63 (m, 1H), 1.56 – 1.48 (m, 3H), 1.45 – 1.34 (m, 4H), 1.23 – 1.18 (m, 1H), 1.17 – 1.10 (m, 1H), 1.01 (s, 6H), 0.95 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 172.75, 139.52, 129.17, 128.29, 127.22, 61.53, 48.70, 44.27, 44.04, 40.08, 39.84, 36.62, 36.44, 35.93, 34.85, 34.58, 33.85, 30.89, 24.49, 20.83, 20.53.

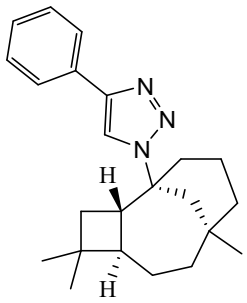
(1R,2S,5R,8S)-1-Azido-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecane (**NC**)



NC

A flask equipped with a septum and a magnetic stir bar was charged with β-CP (2.0 mmol), azidotrimethylsilane (1.0 mmol), and dichloromethane (5.0 mL). Then TfOH (4.4 μL, 5 mol%) was added to the mixture. The mixture was stirred at 30 ℃ for 16 hours, then the reaction mixture was successively washed with saturated aq. $NaHCO_3$ and saturated brine and concentrated. The residue was purified by column chromatography (silica gel, hexane/EtOAc) to give the product as colorless oil; ^{1}H NMR (600 MHz, $CDCl_3$) δ 2.32 (ddd, *J* = 12.1, 10.4, 8.0 Hz, 1H), 1.90 – 1.85 (m, 1H), 1.85 – 1.81 (m, 1H), 1.79 (dt, *J* = 13.1, 2.5 Hz, 1H), 1.76 – 1.71 (m, 2H), 1.70 – 1.66 (m, 1H), 1.63 (d, *J* = 10.1 Hz, 1H), 1.57 – 1.53 (m, 1H), 1.54 – 1.50 (m, 1H), 1.49 – 1.41 (m, 2H), 1.39 – 1.34 (m, 1H), 1.19 – 1.15 (m, 1H), 1.14 – 1.08 (m, 2H), 1.04 (s, 3H), 1.01 (s, 3H), 0.93 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 63.12, 45.74, 45.33, 39.86, 37.46, 36.90, 36.10, 35.16, 34.73, 34.42, 33.37, 30.70, 21.97, 20.79, 20.27.

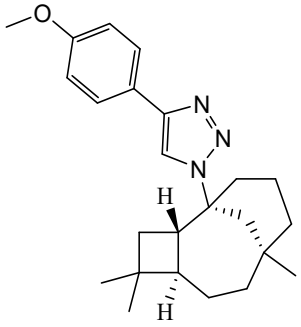
4-Phenyl-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole (**NC-1**)



NC-1

According to the general procedure C, compound **NC-1** could be obtained with 78% yield as white solid using **NC** and phenylacetylene as substrates; HRMS (ESI) for $C_{23}H_{32}N_3$: calculated, $[M+H]^+$ = 350.2596, found 350.2599; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.92 – 7.86 (m, 2H), 7.79 (s, 1H), 7.45 (t, *J* = 7.6 Hz, 2H), 7.37 – 7.32 (m, 1H), 2.74 (dt, *J* = 13.0, 2.4 Hz, 1H), 2.61 (ddd, *J* = 12.2, 10.4, 8.0 Hz, 1H), 2.47 – 2.40 (m, 1H), 2.12 – 2.01 (m, 3H), 1.87 (dt, *J* = 13.9, 4.1 Hz, 2H), 1.80 – 1.61 (m, 5H), 1.61 – 1.56 (m, 1H), 1.51 (d, *J* = 13.0 Hz, 1H), 1.49 – 1.43 (m, 2H), 1.34 – 1.26 (m, 2H), 1.26 – 1.20 (m, 1H), 1.04 (s, 4H), 1.00 (s, 3H), 0.88 (s, 3H), 0.34 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 146.54, 131.05, 128.94, 128.08, 125.81, 117.23, 64.05, 45.21, 45.08, 40.56, 37.40, 37.03, 36.32, 36.07, 34.34, 34.32, 33.52, 30.39, 21.93, 20.85, 20.02.

4-(4-Methoxyphenyl)-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole (**NC-2**)

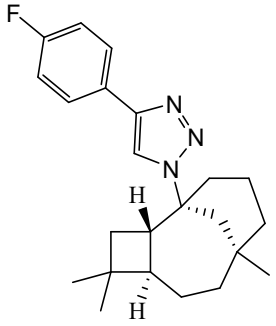


NC-2

According to the general procedure C, compound **NC-2** could be obtained with 52% yield as white solid using **NC** and 4-Ethynylanisole as substrates; HRMS (ESI) for $C_{24}H_{34}N_3O$: calculated, $[M+H]^+$ = 380.2702, found 380.2708; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.7 Hz, 2H), 7.70 (s, 1H), 6.97 (d, *J* = 8.8 Hz, 2H), 3.85 (s, 3H), 2.72 (dt, *J* = 13.0, 2.4 Hz, 1H), 2.59 (ddd, *J* = 12.1, 10.4, 8.0 Hz, 1H), 2.41 (ddt, *J* = 11.8, 5.3, 3.1 Hz, 1H), 2.07 (dt, *J* = 12.1, 7.3 Hz, 1H), 2.01 (dtd, *J* = 16.7, 7.4, 3.6 Hz, 1H), 1.94 – 1.87 (m, 1H), 1.87 – 1.82 (m, 1H), 1.74 (td, *J* = 12.1, 5.3 Hz, 1H), 1.71 – 1.66 (m, 1H), 1.64 (td, *J* = 6.7, 3.4 Hz, 1H), 1.60 – 1.54 (m, 1H), 1.51 – 1.41 (m, 4H), 1.37 (d, *J* = 22.9 Hz, 1H), 1.33 – 1.25 (m, 4H), 1.20 (dd, *J* = 13.1, 4.7 Hz, 1H), 1.02 (s, 3H), 0.99 (s, 3H), 0.87 (s, 3H), 0.34 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 159.48, 146.45, 127.00, 124.05, 116.38, 114.28, 63.72, 55.43, 45.14, 45.05, 40.53,

37.38, 37.00, 36.25, 36.01, 34.26, 34.24, 33.48, 30.35, 21.89, 20.83, 19.98.

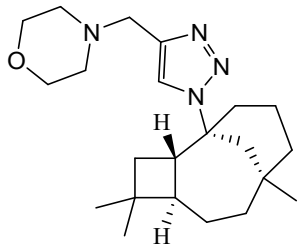
4-(4-Fluorophenyl)-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazole (**NC-3**)



NC-3

According to the general procedure C, compound **NC-3** could be obtained with 45% yield as white solid using **NC** and 4-fluorophenylacetylene as substrates; HRMS (ESI) for $C_{23}H_{31}FN_3$: calculated, $[M+H]^+$ = 368.2502, found 368.2505; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.82 (td, *J* = 6.0, 2.9 Hz, 2H), 7.67 (s, 1H), 7.17 – 7.07 (m, 2H), 4.67 (dd, *J* = 13.3, 5.6 Hz, 1H), 2.36 (t, *J* = 12.5 Hz, 1H), 1.95 (dd, *J* = 11.6, 5.6 Hz, 1H), 1.59 (s, 1H), 1.56 – 1.42 (m, 5H), 1.40 – 1.34 (m, 1H), 1.34 – 1.28 (m, 2H), 1.28 – 1.24 (m, 2H), 1.24 – 1.20 (m, 1H), 1.19 (s, 2H), 1.18 – 1.10 (m, 2H), 1.00 (s, 3H), 0.92 (s, 2H), 0.89 – 0.81 (m, 2H), 0.15 (td, *J* = 12.9, 4.8 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 163.53, 161.89, 146.11, 127.51, 127.46, 118.93, 115.97, 115.83, 69.93, 51.44, 45.14, 43.78, 43.11, 40.30, 38.18, 33.25, 32.85, 32.82, 30.90, 30.45, 24.77, 20.69, 18.49.

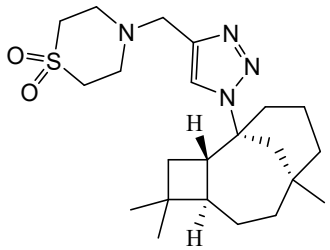
4-((1-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methyl)morpholine (**NC-4**)



NC-4

According to the general procedure C, compound **NC-4** could be obtained with 62% yield as white solid using **NC** and 4-prop-2-ynyl-morpholine as substrates; HRMS (ESI) for $C_{22}H_{37}N_4O$: calculated, $[M+H]^+$ = 373.2967, found 373.2972; ^{1}H NMR (600 MHz, CD_3OD) δ 8.02 (s, 1H), 3.78 (s, 2H), 3.72 (t, *J* = 4.4 Hz, 4H), 2.73 – 2.65 (m, 2H), 2.60 (s, 4H), 2.47 (dt, *J* = 12.2, 3.2 Hz, 1H), 2.11 – 2.04 (m, 2H), 1.87 (dt, *J* = 14.5, 4.3 Hz, 1H), 1.79 – 1.63 (m, 4H), 1.62 – 1.55 (m, 1H), 1.49 (ddd, *J* = 14.0, 6.9, 2.7 Hz, 1H), 1.44 (s, 1H), 1.43 – 1.40 (m, 1H), 1.31 (ddd, *J* = 14.1, 6.4, 3.8 Hz, 1H), 1.24 (td, *J* = 13.0, 4.8 Hz, 1H), 1.03 (s, 3H), 1.01 (s, 3H), 0.87 (s, 3H), 0.09 (d, *J* = 10.0 Hz, 1H); ^{13}C NMR (151 MHz, CD_3OD) δ 141.15, 122.02, 65.96, 64.01, 52.64, 52.43, 44.84, 44.50, 40.12, 36.92, 36.39, 35.76, 35.11, 33.76, 33.68, 32.28, 29.26, 21.21, 19.52, 19.38.

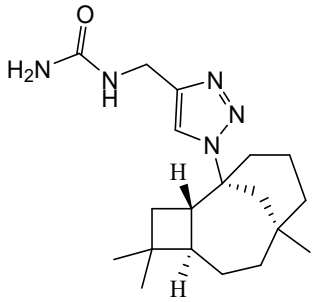
4-((1-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methyl)thiomorpholine 1,1-dioxide (**NC-5**)



NC-5

According to the general procedure C, compound **NC-5** could be obtained with 43% yield as white solid using **NC** and 4-(prop-2-yn-1-yl)thiomorpholine-1,1-dioxide as substrates; HRMS (ESI) for $C_{22}H_{37}N_4O_2S$: calculated, $[M+H]^+$ = 421.2637, found 421.2637; ^{1}H NMR (600 MHz, CD_3OD) δ 8.01 (s, 1H), 3.86 (s, 2H), 3.11 (t, *J* = 5.0 Hz, 4H), 2.99 (dd, *J* = 7.2, 3.7 Hz, 4H), 2.74 – 2.62 (m, 2H), 2.46 (dp, *J* = 11.6, 3.0 Hz, 1H), 2.09 – 1.99 (m, 2H), 1.85 (dt, *J* = 15.1, 4.5 Hz, 1H), 1.78 – 1.61 (m, 4H), 1.60 – 1.54 (m, 1H), 1.48 (dtd, *J* = 13.9, 6.8, 4.0 Hz, 1H), 1.44 – 1.38 (m, 2H), 1.29 (ddd, *J* = 14.1, 6.4, 3.9 Hz, 2H), 1.26 – 1.20 (m, 1H), 1.02 (s, 3H), 1.00 (s, 3H), 0.85 (s, 3H), 0.05 (t, *J* = 10.0 Hz, 1H); ^{13}C NMR (151 MHz, CD_3OD) δ 142.15, 121.64, 64.00, 51.03, 50.69, 50.68, 50.04, 44.85, 44.45, 40.18, 36.92, 36.40, 35.79, 35.10, 33.76, 33.67, 32.28, 29.32, 21.23, 19.52, 19.38.

1-((1-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.02,5]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methyl)urea (**NC-6**)

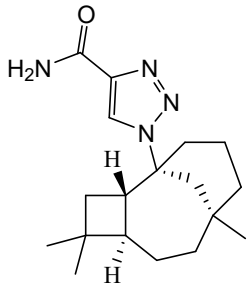


NC-6

According to the general procedure C, compound **NC-6** could be obtained with 56% yield as white solid using **NC** and 1-(prop-2-ynyl)urea as substrates; HRMS (ESI) for $C_{19}H_{32}N_5O$: calculated, $[M+H]^+$ = 346.2607, found 346.2601; ^{1}H NMR (600 MHz, CD_3OD) δ 7.89 (s, 1H), 5.51 (s, 2H), 4.38 (s, 2H), 2.74 – 2.63 (m, 2H), 2.44 (d, J = 12.4 Hz, 1H), 1.87 (dd, J = 17.8, 9.4 Hz, 2H), 1.74 (dt, J = 16.1, 4.9 Hz, 2H), 1.72 – 1.61 (m, 3H), 1.57 (d, J = 14.0 Hz, 2H), 1.49 (ddd, J = 11.3, 7.1, 3.6 Hz, 2H), 1.45 – 1.39 (m, 2H), 1.37 – 1.30 (m, 3H), 1.26 (t, J = 7.1 Hz, 2H), 1.03 (s, 3H), 1.01 (s, 3H), 0.87 (s, 3H), 0.12 (t, J = 10.0 Hz, 1H); ^{13}C NMR (151 MHz, CD_3OD) δ 171.59, 116.72, 63.94, 60.13, 53.39, 44.82, 44.52, 40.07, 36.93, 36.40, 35.70, 35.19, 33.65, 32.28, 29.22, 21.21, 19.54, 13.05.

1-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-

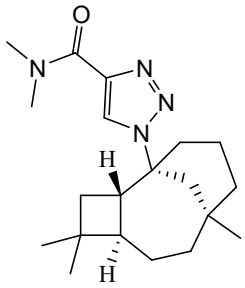
triazole-4-carboxamide (**NC-7**)



NC-7

According to the general procedure C, compound **NC-7** could be obtained with 76% yield as white solid using **NC** and prop-2-ynamide as substrates; HRMS (ESI) for $C_{18}H_{29}N_4O$: calculated, $[M+H]^+$ = 317.2341, found 317.2340; ^1H NMR (600 MHz, CD_3OD) δ 8.39 (s, 1H), 2.69 (ddt, *J* = 12.2, 10.2, 2.4 Hz, 2H), 2.51 – 2.44 (m, 1H), 2.10 – 2.02 (m, 2H), 1.90 – 1.82 (m, 1H), 1.78 – 1.62 (m, 3H), 1.60 – 1.54 (m, 1H), 1.49 (ddd, *J* = 10.0, 6.9, 3.5 Hz, 1H), 1.46 – 1.40 (m, 2H), 1.30 (ddd, *J* = 14.1, 6.5, 3.8 Hz, 1H), 1.23 (td, *J* = 13.1, 4.8 Hz, 1H), 1.02 (s, 3H), 1.00 (s, 3H), 0.86 (s, 3H), 0.11 (t, *J* = 10.0 Hz, 1H); ^{13}C NMR (151 MHz, CD_3OD) δ 165.05, 142.80, 125.09, 65.95, 46.29, 45.89, 41.45, 38.28, 37.84, 37.21, 36.62, 35.22, 35.14, 33.70, 30.62, 22.66, 20.90, 20.80.

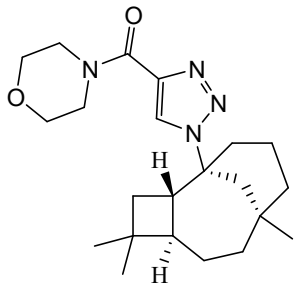
N,N-Dimethyl-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxamide (**NC-8**)



NC-8

According to the general procedure C, compound **NC-8** could be obtained with 70% yield as white solid using NC and N,N-dimethyl-2-propynamide; HRMS (ESI) for $C_{20}H_{33}N_4O$: calculated, $[M+H]^+$ = 345.2654, found 345.2650; ^1H NMR (600 MHz, $CDCl_3$) δ 8.10 (s, 1H), 3.59 (s, 4H), 3.11 (s, 4H), 2.65 (dt, *J* = 13.0, 2.4 Hz, 1H), 2.56 (ddd, *J* = 12.2, 10.4, 8.0 Hz, 1H), 2.37 (ddd, *J* = 11.9, 5.2, 2.9 Hz, 1H), 2.05 – 1.96 (m, 2H), 1.87 – 1.81 (m, 1H), 1.71 – 1.57 (m, 5H), 1.57 – 1.51 (m, 2H), 1.46 – 1.39 (m, 4H), 1.29 – 1.22 (m, 5H), 1.17 (ddt, *J* = 13.4, 8.1, 4.0 Hz, 2H), 0.99 (s, 3H), 0.96 (s, 3H), 0.85 (s, 3H), 0.20 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 161.74, 143.54, 125.78, 64.16, 45.07, 44.99, 40.34, 38.81, 37.21, 36.90, 36.48, 36.25, 35.77, 34.23, 34.19, 33.37, 30.25, 29.70, 21.80, 20.65, 19.86.

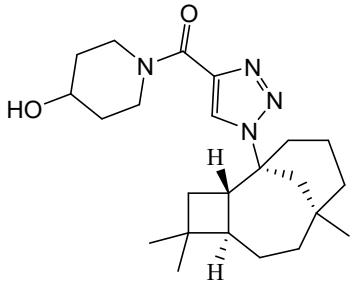
Morpholino(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-9**)



NC-9

According to the general procedure D, compound **NC-9** could be obtained with 62% yield as white solid using **NC-13** and morpholine; HRMS (ESI) for $C_{22}H_{35}N_4O_2$: calculated, $[M+H]^+$ = 387.2760, found 387.2755; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.12 (s, 1H), 4.44 (dd, *J* = 6.2, 3.5 Hz, 2H), 3.78 (s, 5H), 2.64 (dt, *J* = 13.0, 2.4 Hz, 1H), 2.57 (ddd, *J* = 12.2, 10.4, 8.0 Hz, 1H), 2.43 – 2.31 (m, 1H), 2.05 – 1.93 (m, 2H), 1.89 – 1.80 (m, 1H), 1.71 – 1.58 (m, 5H), 1.58 – 1.51 (m, 2H), 1.46 – 1.38 (m, 3H), 1.27 (ddt, *J* = 12.2, 5.5, 3.0 Hz, 2H), 1.22 – 1.15 (m, 2H), 0.99 (s, 3H), 0.97 (s, 3H), 0.86 (s, 3H), 0.22 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.20, 143.11, 126.23, 67.31, 66.96, 64.34, 47.31, 45.14, 45.04, 43.10, 40.32, 37.20, 36.90, 36.30, 35.83, 34.28, 34.22, 33.39, 30.26, 21.82, 20.64, 19.86.

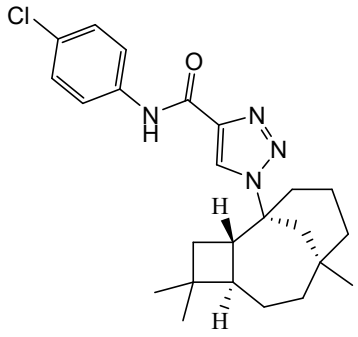
(4-Hydroxypiperidin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-10**)



NC-10

According to the general procedure D, compound **NC-10** could be obtained with 48% yield as white solid using **NC-13** and piperidin-4-ol; HRMS (ESI) for $C_{23}H_{37}N_4O_2$: calculated, $[M+H]^+$ = 401.2917, found 401.2924; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.06 (s, 1H), 4.74 – 4.64 (m, 1H), 4.22 – 4.15 (m, 1H), 3.98 (dt, *J* = 8.2, 4.2 Hz, 1H), 3.82 – 3.74 (m, 1H), 3.69 (p, *J* = 6.7 Hz, 1H), 3.34 (dp, *J* = 13.4, 3.8 Hz, 1H), 3.16 (q, *J* = 7.4 Hz, 1H), 2.66 – 2.59 (m, 2H), 2.59 – 2.52 (m, 1H), 2.36 (d, *J* = 11.8 Hz, 1H), 2.03 – 1.92 (m, 5H), 1.86 – 1.79 (m, 1H), 1.62 (dddd, *J* = 27.9, 14.2, 10.8, 5.6 Hz, 6H), 1.53 (d, *J* = 13.8 Hz, 1H), 1.39 (dd, *J* = 13.3, 5.7 Hz, 9H), 1.25 (ddd, *J* = 13.8, 6.9, 3.8 Hz, 2H), 1.20 – 1.13 (m, 1H), 0.97 (s, 3H), 0.95 (s, 3H), 0.84 (s, 3H), 0.19 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.38, 142.96, 125.63, 67.11, 64.33, 55.31, 45.11, 45.09, 44.96, 43.95, 43.32, 40.32, 40.29, 37.15, 36.88, 36.28, 36.25, 35.78, 35.75, 34.85, 34.84, 34.21, 34.18, 33.94, 33.37, 30.25, 21.80, 20.61, 19.82, 12.55.

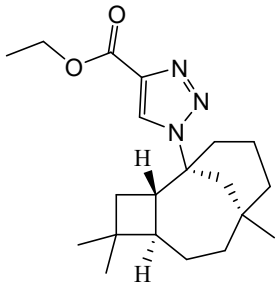
N-(4-Chlorophenyl)-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxamide (**NC-11**)



NC-11

According to the general procedure D, compound **NC-11** could be obtained with 89% yield as light yellow solid using **NC-13** and 4-chloroaniline; HRMS (ESI) for $C_{24}H_{32}ClN_4O$: calculated, $[M+H]^+$ = 427.2265, found 427.2267; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.97 (s, 1H), 8.15 (s, 1H), 7.69 – 7.63 (m, 2H), 7.37 – 7.30 (m, 2H), 2.67 (dt, *J* = 12.9, 2.4 Hz, 1H), 2.59 (ddd, *J* = 12.2, 10.3, 8.0 Hz, 1H), 2.45 – 2.36 (m, 1H), 2.01 (ddd, *J* = 17.5, 12.1, 9.0 Hz, 2H), 1.90 – 1.81 (m, 1H), 1.74 – 1.59 (m, 4H), 1.59 – 1.53 (m, 1H), 1.48 – 1.38 (m, 3H), 1.29 (ddd, *J* = 13.1, 6.6, 3.1 Hz, 1H), 1.20 (td, *J* = 13.0, 4.8 Hz, 1H), 1.01 (s, 3H), 0.97 (s, 3H), 0.86 (s, 3H), 0.18 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 158.49, 142.18, 136.32, 129.48, 129.25, 123.52, 121.18, 64.98, 45.26, 45.10, 40.46, 37.27, 36.97, 36.41, 35.97, 34.41, 34.38, 33.47, 30.42, 21.89, 20.75, 19.96.

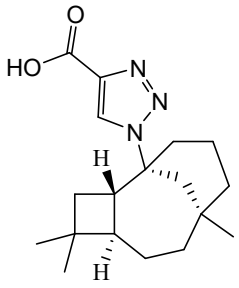
Ethyl-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxylate (**NC-12**)



NC-12

According to the general procedure C, compound **NC-12** could be obtained with 88% yield as white solid using **NC** and ethyl propiolate; HRMS (ESI) for $C_{20}H_{32}N_3O_2$: calculated, $[M+H]^+$ = 346.2495, found 346.2495; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.03 (s, 1H), 4.36 (q, *J* = 7.1 Hz, 3H), 2.63 (dt, *J* = 13.0, 2.4 Hz, 1H), 2.52 (ddd, *J* = 12.1, 10.3, 8.0 Hz, 1H), 2.33 (ddd, *J* = 12.1, 5.2, 2.8 Hz, 1H), 2.02 – 1.87 (m, 3H), 1.83 – 1.74 (m, 2H), 1.66 – 1.46 (m, 6H), 1.40 – 1.32 (m, 7H), 1.27 – 1.17 (m, 2H), 1.17 – 1.08 (m, 2H), 0.94 (s, 4H), 0.91 (s, 4H), 0.87 – 0.82 (m, 1H), 0.80 (s, 4H), 0.14 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 161.29, 139.14, 124.99, 64.53, 61.14, 45.01, 44.94, 40.25, 37.17, 36.83, 36.17, 35.83, 34.25, 34.22, 33.32, 30.22, 21.73, 20.65, 19.81, 14.35.

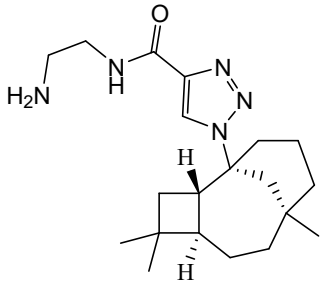
1-((1R,2S,5R,8S)-4,4,8-Trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxylic acid (**NC-13**)



NC-13

NC-12 (1.1g, 3.2 mmol) dissolved in a mixture of THF (15 m L) and water (5 mL), then lithium hydroxide monohydrate (403 mg, 9.6 mmol) was added, and stirred at room temperature for 6 h. THF was distilled in vacuum, and 1 M HCl was added to adjusted the pH to 3-4, white solid was formed, and filtered, washed with water, dried under vacuum in 40 ℃ overnight, 965 mg **NC-13** was given as white solid, with 95% yield. HRMS (ESI) for $C_{18}H_{28}N_3O_2$: calculated, $[M+H]^+$ = 318.2182, found 318.2178; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.19 – 8.15 (m, 1H), 2.67 (d, *J* = 12.9 Hz, 1H), 2.62 – 2.53 (m, 1H), 2.43 – 2.35 (m, 1H), 2.02 (td, *J* = 11.3, 4.8 Hz, 2H), 1.85 (dd, *J* = 14.1, 5.2 Hz, 2H), 1.72 – 1.49 (m, 7H), 1.47 – 1.40 (m, 4H), 1.32 – 1.23 (m, 2H), 1.22 – 1.15 (m, 2H), 1.00 (d, *J* = 2.7 Hz, 4H), 0.96 (s, 3H), 0.86 (d, *J* = 2.8 Hz, 3H), 0.18 (t, *J* = 10.1 Hz, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 164.49, 138.47, 138.45, 125.93, 125.86, 65.12, 45.19, 45.04, 40.38, 37.25, 36.95, 36.36, 35.96, 34.41, 34.38, 33.44, 30.37, 21.86, 20.73, 19.93.

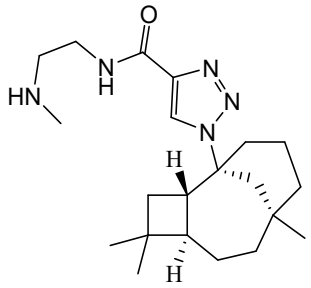
N-(2-Aminoethyl)-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxamide (**NC-14**)



NC-14

According to the general procedure C, compound **NC-14** could be obtained with 58% yield as white solid using **NC-13** and ethylenediamine; HRMS (ESI) for $C_{20}H_{34}N_5O$: calculated, $[M+H]^+$ = 360.2763, found 360.2766; ^{1}H NMR (600 MHz, CD_3OD) δ 8.43 (d, *J* = 1.4 Hz, 1H), 3.68 (t, *J* = 5.9 Hz, 2H), 3.35 (s, 1H), 3.16 (t, *J* = 6.1 Hz, 2H), 2.75 – 2.65 (m, 2H), 2.47 (ddt, *J* = 11.9, 5.6, 3.2 Hz, 1H), 2.12 – 2.02 (m, 2H), 1.91 – 1.83 (m, 1H), 1.74 (ddd, *J* = 19.9, 10.0, 4.8 Hz, 1H), 1.71 – 1.62 (m, 2H), 1.60 – 1.54 (m, 1H), 1.48 (dtd, *J* = 14.2, 6.8, 4.1 Hz, 1H), 1.45 – 1.42 (m, 1H), 1.41 (s, 1H), 1.30 (ddd, *J* = 14.2, 6.5, 3.9 Hz, 1H), 1.27 – 1.20 (m, 1H), 1.02 (s, 3H), 1.00 (s, 3H), 0.85 (s, 3H), 0.10 (t, *J* = 10.0 Hz, 1H); ^{13}C NMR (151 MHz, CD_3OD) δ 163.92, 142.66, 124.99, 66.02, 46.30, 45.93, 41.41, 41.11, 38.38, 38.26, 37.80, 37.24, 36.65, 35.22, 35.14, 33.68, 30.63, 22.63, 20.89, 20.79.

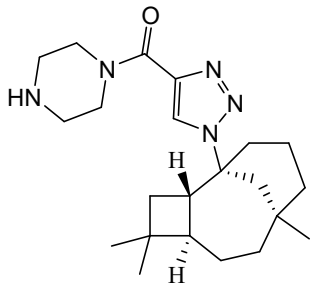
N-(2-(Methylamino)ethyl)-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxamide (**NC-15**)



NC-15

According to the general procedure D, compound **NC-15** could be obtained with 57% yield as white solid using **NC-13** and N-boc-N-methylethylenediamine; HRMS (ESI) for $C_{21}H_{36}N_5O$: calculated, $[M+H]^+$ = 374.2920, found 374.2921; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.82 (s, 1H), 8.17 (s, 1H), 3.85 (s, 2H), 3.32 (s, 2H), 2.77 (s, 3H), 2.59 (t, *J* = 15.0 Hz, 2H), 2.46 – 2.31 (m, 1H), 1.97 (s, 2H), 1.84 (s, 1H), 1.60 (dt, *J* = 41.2, 14.1 Hz, 5H), 1.41 (t, *J* = 11.7 Hz, 3H), 1.34 – 1.25 (m, 1H), 1.20 (t, *J* = 13.1 Hz, 1H), 1.01 (s, 3H), 0.97 (s, 3H), 0.85 (s, 3H), 0.14 (s, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 161.77, 141.74, 123.45, 64.79, 49.18, 45.25, 44.98, 40.39, 37.24, 36.98, 36.40, 36.31, 35.96, 34.34, 33.55, 33.50, 30.40, 21.88, 20.71, 19.94.

Piperazin-1-yl(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-16**)

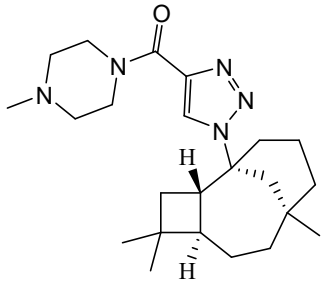


NC-16

According to the general procedure C, compound **NC-16** could be obtained with 66% yield as white solid using **NC-13** and piperazine; HRMS (ESI) for $C_{22}H_{36}N_5O$: calculated, $[M+H]^+$ = 386.2920, found 386.2919; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.08 (d, *J* = 1.2 Hz, 1H), 4.32 (t, *J* = 5.0 Hz, 2H), 3.74 (q, *J* = 4.1 Hz, 2H), 2.95 (q, *J* = 4.8 Hz, 4H), 2.62 (dd, *J* = 13.0, 3.0 Hz, 1H), 2.55 (td, *J* = 11.3, 8.7 Hz, 1H), 2.40 – 2.31 (m, 1H), 1.98 (dq, *J* = 14.8, 7.3 Hz, 4H), 1.81 (dt, *J* = 14.6, 4.3 Hz, 1H), 1.71 – 1.55 (m, 3H), 1.53 (d, *J* = 13.5 Hz, 1H), 1.44 – 1.35 (m, 3H), 1.25 (ddd, *J* = 13.8, 6.8, 3.4 Hz, 1H), 1.16 (td, *J* = 13.1, 4.8 Hz, 1H), 0.97 (s, 3H), 0.95 (s, 3H), 0.84 (s, 3H), 0.21 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.32, 143.41, 126.14, 64.34, 48.14, 46.79, 46.16, 45.21, 45.13, 43.93, 40.41, 37.30, 37.00, 36.38, 35.90, 34.35, 34.30, 33.49, 30.35, 21.91, 20.74, 19.96.

(4-Methylpiperazin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-

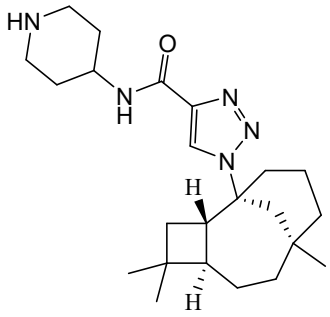
trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-17**)



NC-17

According to the general procedure C, compound **NC-17** could be obtained with 58% yield as white solid using **NC-13** and 1-methylpiperazine; HRMS (ESI) for $C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3100; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.11 (s, 1H), 4.41 (d, *J* = 6.0 Hz, 2H), 3.81 (d, *J* = 5.2 Hz, 3H), 2.65 (dt, *J* = 12.9, 2.4 Hz, 1H), 2.61 – 2.47 (m, 6H), 2.42 – 2.36 (m, 1H), 2.34 (d, *J* = 2.1 Hz, 4H), 2.01 (dd, *J* = 12.2, 7.1 Hz, 1H), 1.85 (ddt, *J* = 13.1, 6.7, 3.4 Hz, 1H), 1.67 (ddt, *J* = 12.3, 9.8, 3.5 Hz, 2H), 1.64 – 1.59 (m, 2H), 1.55 (dt, *J* = 14.3, 3.0 Hz, 1H), 1.43 (ddd, *J* = 9.9, 7.1, 4.0 Hz, 3H), 1.31 – 1.24 (m, 2H), 1.22 – 1.15 (m, 1H), 1.00 (d, *J* = 2.5 Hz, 3H), 0.97 (d, *J* = 2.1 Hz, 3H), 0.87 (d, *J* = 2.1 Hz, 3H), 0.23 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.13, 143.28, 126.07, 64.25, 55.51, 54.83, 46.47, 45.99, 45.10, 45.02, 42.58, 40.31, 37.20, 36.89, 36.27, 35.80, 34.25, 34.19, 33.38, 30.24, 21.81, 20.64, 19.85.

N-(Piperidin-4-yl)-1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazole-4-carboxamide (**NC-18**)

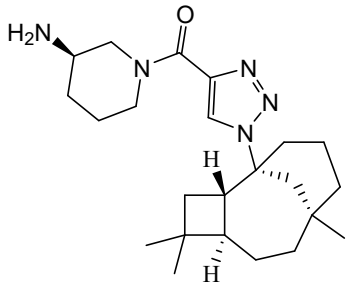


NC-18

According to the general procedure D, compound **NC-18** could be obtained with 57% yield as white solid using **NC-13** and 4-amino-cyclohexanecarboxylic acid tert-butyl ester; HRMS (ESI) for $C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3074; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20 (s, 1H), 7.76 (d, *J* = 8.1 Hz, 1H), 4.22 (dt, *J* = 7.5, 3.7 Hz, 1H), 3.63 – 3.54 (m, 3H), 3.18 – 3.10 (m, 3H), 2.60 (d, *J* = 12.9 Hz, 1H), 2.52 (td, *J* = 11.0, 8.1 Hz, 1H), 2.39 – 2.31 (m, 1H), 2.24 – 2.16 (m, 3H), 2.11 (t, *J* = 13.0 Hz, 3H), 1.99 – 1.91 (m, 2H), 1.78 (dt, *J* = 13.7, 4.1 Hz, 2H), 1.65 – 1.54 (m, 4H), 1.49 (d, *J* = 13.2 Hz, 2H), 1.37 (t, *J* = 11.9 Hz, 3H), 1.23 (ddd, *J* = 13.1, 6.3, 2.9 Hz, 2H), 1.17 – 1.09 (m, 2H), 0.95 (s, 4H), 0.91 (s, 3H), 0.81 (s, 3H), 0.14 (t, *J* = 10.2 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.33, 141.74, 123.47, 64.67, 50.54, 45.12, 44.97,

44.31, 43.31, 40.34, 37.20, 36.93, 36.34, 35.92, 34.29, 34.26, 33.43, 30.35, 30.33, 28.60, 21.83, 20.67, 19.89.

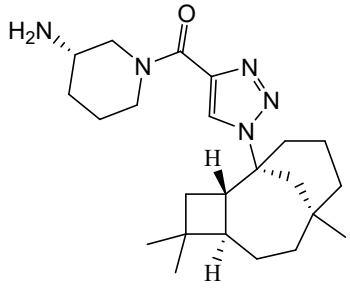
((R)-3-Aminopiperidin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-19**)



NC-19

According to the general procedure D, compound **NC-19** could be obtained with 67% yield as white solid using **NC-13** and (R)- 3-boc-aminopiperidine; HRMS (ESI) for $C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3077; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.11 (s, 1H), 5.00 – 4.93 (m, 1H), 4.91 – 4.81 (m, 1H), 4.45 (d, *J* = 11.7 Hz, 1H), 4.19 (dt, *J* = 13.7, 4.7 Hz, 1H), 3.54 – 3.35 (m, 1H), 3.21 – 3.07 (m, 1H), 3.01 (d, *J* = 10.1 Hz, 1H), 2.95 – 2.82 (m, 1H), 2.66 (t, *J* = 12.7 Hz, 1H), 2.58 (td, *J* = 11.1, 8.1 Hz, 1H), 2.39 (dq, *J* = 12.0, 3.6 Hz, 1H), 2.16 – 1.97 (m, 8H), 1.85 (tp, *J* = 8.7, 5.0 Hz, 3H), 1.73 – 1.59 (m, 5H), 1.56 (d, *J* = 13.7 Hz, 1H), 1.53 – 1.40 (m, 5H), 1.24 – 1.17 (m, 1H), 1.01 (s, 3H), 0.98 (s, 3H), 0.88 (s, 3H), 0.24 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.41, 143.38, 126.02, 125.97, 64.29, 64.27, 45.14, 45.08, 45.02, 43.25, 40.31, 37.20, 36.90, 36.30, 36.28, 35.80, 34.26, 34.20, 33.38, 30.26, 24.57, 23.23, 21.81, 20.64, 19.86.

((S)-3-Aminopiperidin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.$0^{2,5}$]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-20**)

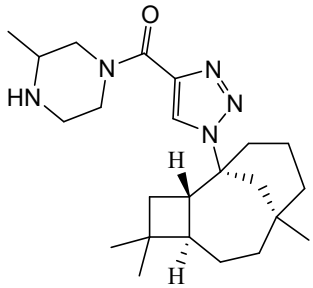


NC-20

According to the general procedure D, compound **NC-20** could be obtained with 70% yield as white solid using **NC-13** and (S)- 3-boc-aminopiperidine; HRMS (ESI) for $C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3075; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.09 (s, 1H), 5.01 – 4.79 (m, 2H), 4.47 – 4.35 (m, 1H), 4.19 (dd, *J* = 12.4, 5.2 Hz, 1H), 3.40 (ddd, *J* = 31.5, 13.1, 5.7 Hz, 2H), 3.12 (td, *J* = 11.4, 6.3 Hz, 1H), 3.05 (tt, *J* = 8.4, 3.7 Hz, 1H), 2.97 (dq, *J* = 8.9, 4.5 Hz, 1H), 2.83 (dd, *J* = 12.6, 9.2 Hz, 1H), 2.63 (d, *J* = 13.1 Hz, 2H), 2.60 – 2.50 (m, 2H), 2.41 – 2.19 (m, 8H), 2.05 – 1.93 (m, 6H), 1.88 – 1.77 (m, 5H), 1.71 – 1.49 (m, 11H), 1.48 – 1.37 (m, 8H), 1.31 – 1.21 (m,

5H), 1.20 – 1.13 (m, 2H), 0.97 (d, J = 15.1 Hz, 9H), 0.85 (s, 5H), 0.21 (s, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.53, 143.35, 126.03, 64.26, 64.22, 60.38, 54.39, 50.67, 48.31, 47.77, 46.95, 45.10, 44.98, 43.22, 40.30, 37.18, 36.89, 36.28, 35.80, 30.23, 21.80, 20.62, 19.84, 14.18.

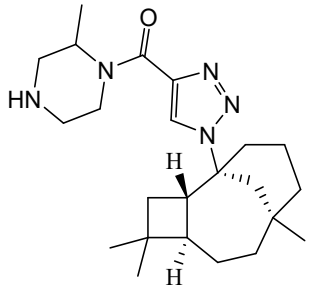
(3-Methylpiperazin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-21**)



NC-21

According to the general procedure D, compound **NC-21** could be obtained with 53% yield as white solid using **NC-13** and 1-boc-2-methylpiperazine; HRMS (ESI) for $C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3074; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.08 (s, 1H), 5.37 – 5.23 (m, 1H), 4.57 (d, J = 11.4 Hz, 1H), 3.47 (d, J = 1.1 Hz, 2H), 3.32 (ddt, J = 23.6, 13.2, 6.7 Hz, 1H), 3.12 (d, J = 15.6 Hz, 1H), 3.05 – 2.86 (m, 4H), 2.64 (q, J = 9.8 Hz, 1H), 2.60 – 2.51 (m, 2H), 2.37 (td, J = 13.0, 7.0 Hz, 1H), 2.34 – 2.13 (m, 3H), 2.00 (td, J = 15.1, 5.0 Hz, 2H), 1.83 (dt, J = 14.5, 4.2 Hz, 1H), 1.70 – 1.57 (m, 4H), 1.54 (d, J = 13.5 Hz, 1H), 1.42 (tt, J = 10.8, 4.8 Hz, 3H), 1.27 (ddd, J = 14.3, 7.2, 3.9 Hz, 2H), 1.16 (td, J = 10.7, 5.5 Hz, 4H), 0.99 (s, 3H), 0.96 (s, 3H), 0.85 (s, 3H), 0.21 (t, J = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.34, 160.25, 143.26, 143.19, 143.14, 126.20, 126.13, 126.07, 64.50, 53.49, 51.73, 51.68, 51.11, 50.93, 49.44, 47.01, 46.99, 46.48, 46.45, 45.67, 45.63, 45.30, 45.26, 45.23, 45.21, 45.13, 45.11, 42.87, 40.48, 40.44, 40.42, 37.32, 37.06, 37.02, 36.45, 36.43, 36.40, 35.96, 35.91, 34.39, 34.35, 34.34, 33.53, 33.50, 30.39, 21.97, 21.93, 20.76, 19.98, 19.37, 19.03.

(2-Methylpiperazin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-22**)

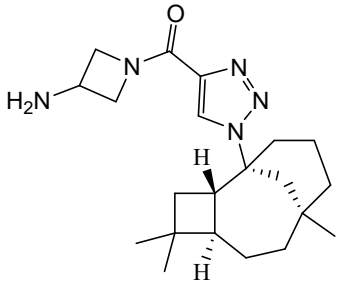


NC-22

According to the general procedure D, compound **NC-22** could be obtained with 67% yield as white solid using **NC-13** and 4-boc-2-methylpiperazine; HRMS (ESI) for $C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3080; ^{1}H NMR (600 MHz,

$CDCl_3$) δ 8.15 – 8.03 (m, 1H), 5.65 – 5.39 (m, 1H), 5.18 (s, 1H), 4.83 (s, 1H), 4.47 (s, 1H), 3.46 (d, *J* = 1.7 Hz, 1H), 3.18 – 2.99 (m, 3H), 2.87 (dd, *J* = 28.1, 14.2 Hz, 2H), 2.69 – 2.60 (m, 1H), 2.56 (td, *J* = 11.2, 8.1 Hz, 1H), 2.37 (dt, *J* = 12.3, 3.9 Hz, 1H), 2.23 (d, *J* = 23.4 Hz, 3H), 1.99 (ddd, *J* = 18.7, 9.4, 4.0 Hz, 2H), 1.82 (dt, *J* = 14.5, 4.2 Hz, 1H), 1.71 – 1.56 (m, 4H), 1.53 (d, *J* = 13.7 Hz, 1H), 1.46 – 1.35 (m, 6H), 1.26 (ddd, *J* = 13.8, 7.3, 3.9 Hz, 2H), 1.17 (td, *J* = 13.1, 4.8 Hz, 1H), 0.98 (s, 3H), 0.96 (s, 3H), 0.85 (s, 3H), 0.22 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.60, 143.39, 126.09, 126.05, 64.41, 45.25, 45.23, 45.13, 45.12, 40.46, 40.42, 37.32, 37.05, 37.01, 36.42, 36.40, 35.95, 35.91, 34.38, 34.37, 34.32, 33.52, 33.50, 30.38, 30.36, 21.96, 21.93, 20.75, 19.98.

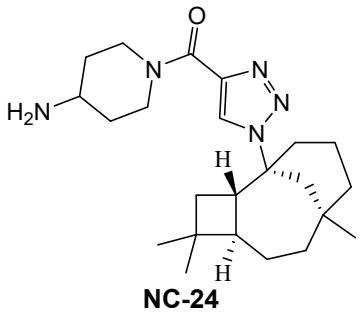
(3-Aminoazetidin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-23**)



NC-23

According to the general procedure D, compound **NC-23** could be obtained with 86% yield as white solid using **NC-13** and 3-N-boc-amino-azetidine; HRMS (ESI) for $C_{21}H_{34}N_5O$: calculated, $[M+H]^+$ = 372.2763, found 372.2762; ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.07 (d, *J* = 8.3 Hz, 1H), 8.42 (s, 1H), 5.30 – 5.17 (m, 1H), 4.54 (t, *J* = 8.8 Hz, 4H), 2.63 (d, *J* = 12.9 Hz, 1H), 2.56 (q, *J* = 10.2 Hz, 1H), 2.41 (d, *J* = 12.1 Hz, 1H), 1.95 (dq, *J* = 13.4, 6.9 Hz, 2H), 1.86 – 1.75 (m, 1H), 1.68 – 1.56 (m, 3H), 1.56 – 1.45 (m, 2H), 1.40 (q, *J* = 11.9 Hz, 3H), 1.31 – 1.22 (m, 2H), 1.16 (td, *J* = 13.0, 5.0 Hz, 2H), 0.98 (d, *J* = 5.4 Hz, 3H), 0.93 (s, 3H), 0.81 (s, 3H), 0.15 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.78, 141.47, 124.24, 64.89, 53.37, 45.21, 44.96, 41.54, 40.44, 37.27, 37.02, 36.49, 36.01, 34.35, 34.33, 33.53, 30.44, 21.93, 20.73, 19.98.

(4-Aminopiperidin-1-yl)(1-((1R,2S,5R,8S)-4,4,8-trimethyltricyclo[6.3.1.0^{2,5}]dodecan-1-yl)-1H-1,2,3-triazol-4-yl)methanone (**NC-24**)



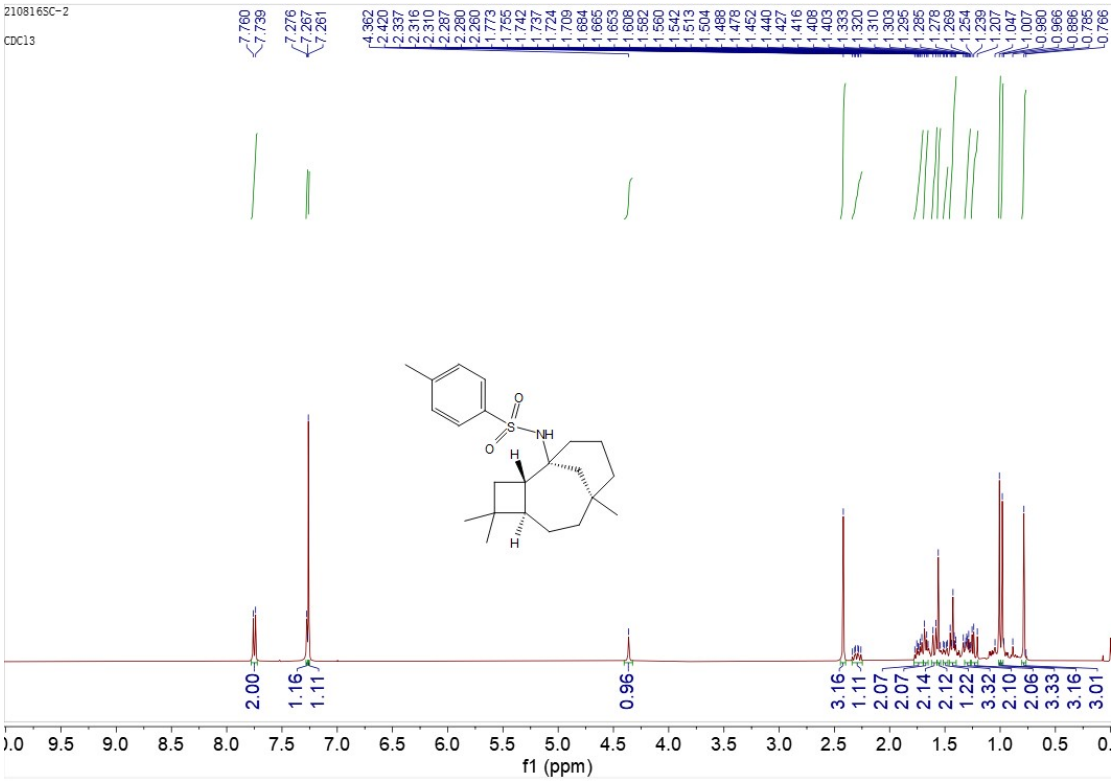
NC-24

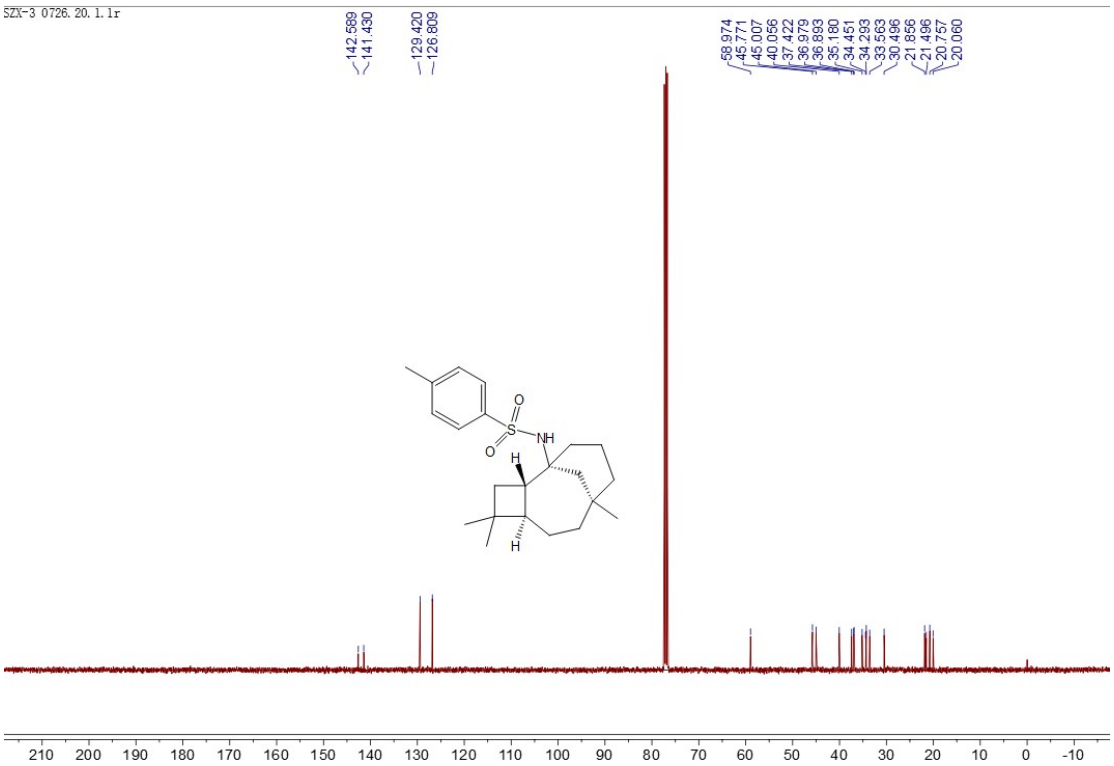
According to the general procedure D, compound **NC-24** could be obtained with 52% yield as white solid using **NC-13** and 4-N-boc-aminopiperidine; HRMS (ESI) for

$C_{23}H_{38}N_5O$: calculated, $[M+H]^+$ = 400.3076, found 400.3076; ^1H NMR (600 MHz, $CDCl_3$) δ 8.16 – 8.04 (m, 1H), 5.10 (d, *J* = 14.4 Hz, 1H), 4.65 (d, *J* = 35.3 Hz, 6H), 3.55 (d, *J* = 11.5 Hz, 1H), 3.30 (d, *J* = 12.9 Hz, 1H), 3.13 (q, *J* = 7.1 Hz, 3H), 2.90 (q, *J* = 11.9 Hz, 1H), 2.53 (t, *J* = 15.1 Hz, 1H), 2.25 (t, *J* = 16.7 Hz, 3H), 1.95 (dd, *J* = 37.1, 11.5 Hz, 2H), 1.79 (t, *J* = 19.1 Hz, 3H), 1.61 (dt, *J* = 30.0, 13.0 Hz, 3H), 1.54 – 1.45 (m, 2H), 1.36 (dt, *J* = 16.1, 10.4 Hz, 7H), 1.29 – 1.21 (m, 3H), 1.20 – 1.10 (m, 2H), 0.94 (s, 3H), 0.92 (s, 3H), 0.81 (s, 3H), 0.17 (t, *J* = 10.1 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 160.61, 142.47, 142.42, 125.81, 64.44, 48.87, 46.18, 44.86, 41.21, 40.35, 37.15, 36.98, 35.77, 34.24, 34.21, 33.43, 30.62, 30.33, 29.72, 21.86, 20.63, 19.84, 8.77.

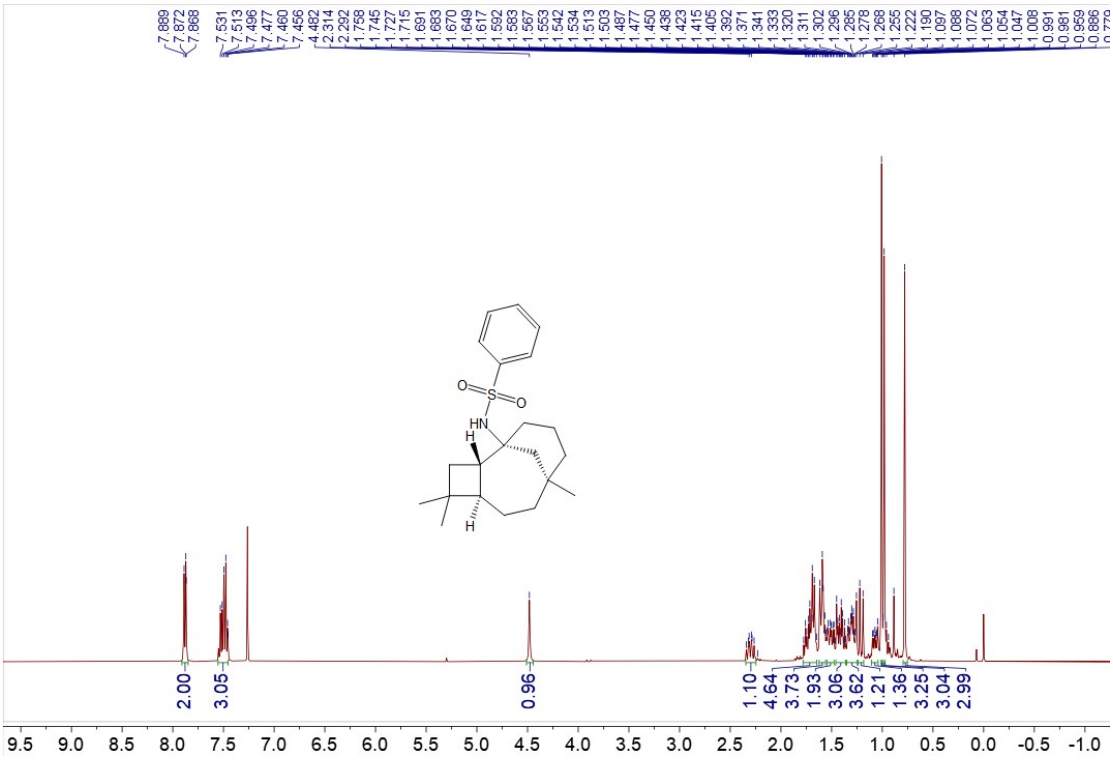
2. ^{1}H NMR and ^{13}C NMR spectra of β-caryolane derivatives

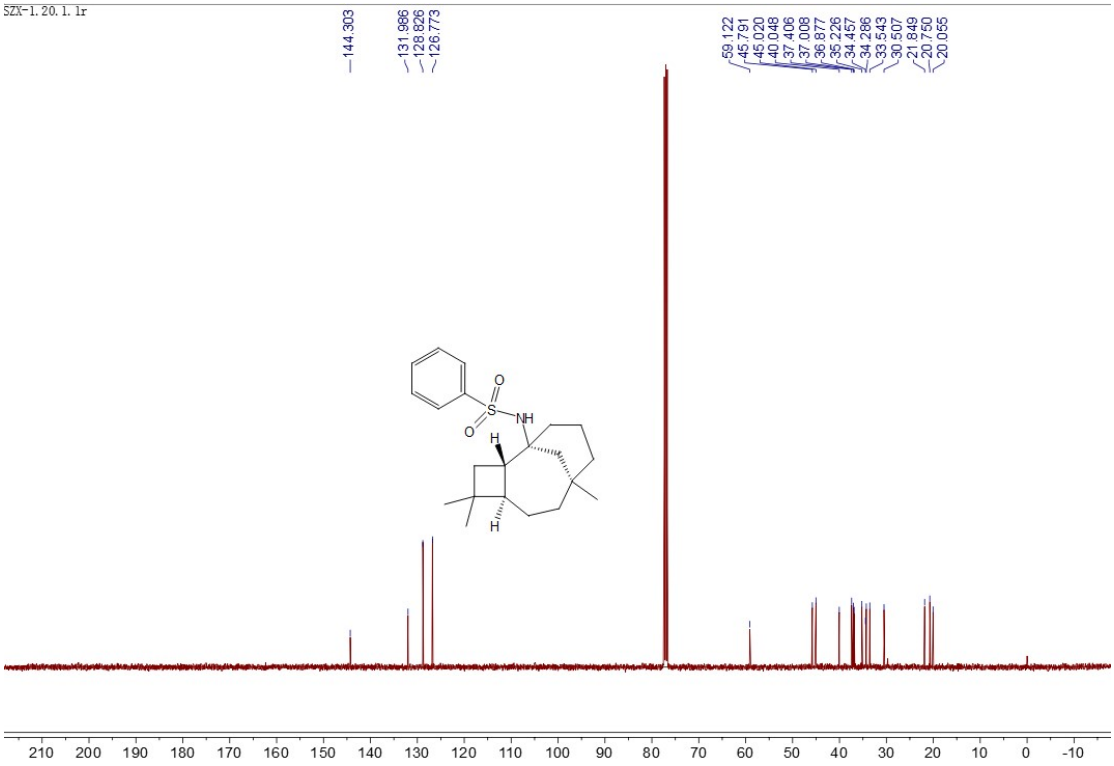
Compound **SA-1**



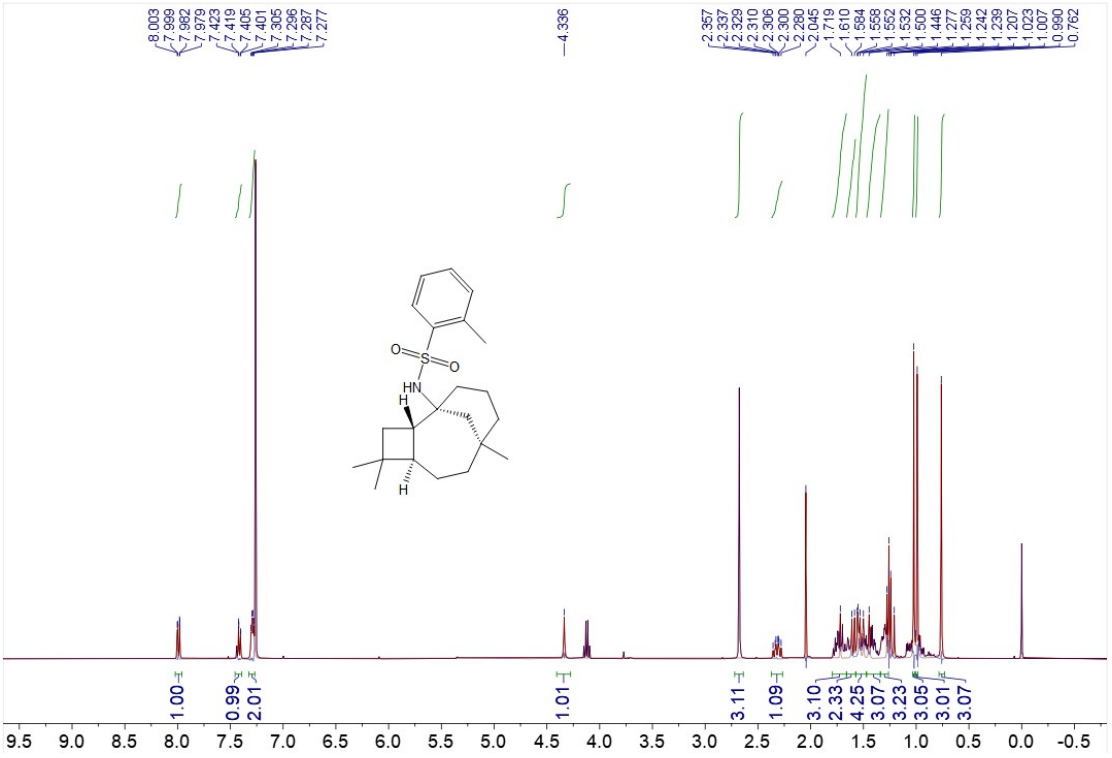


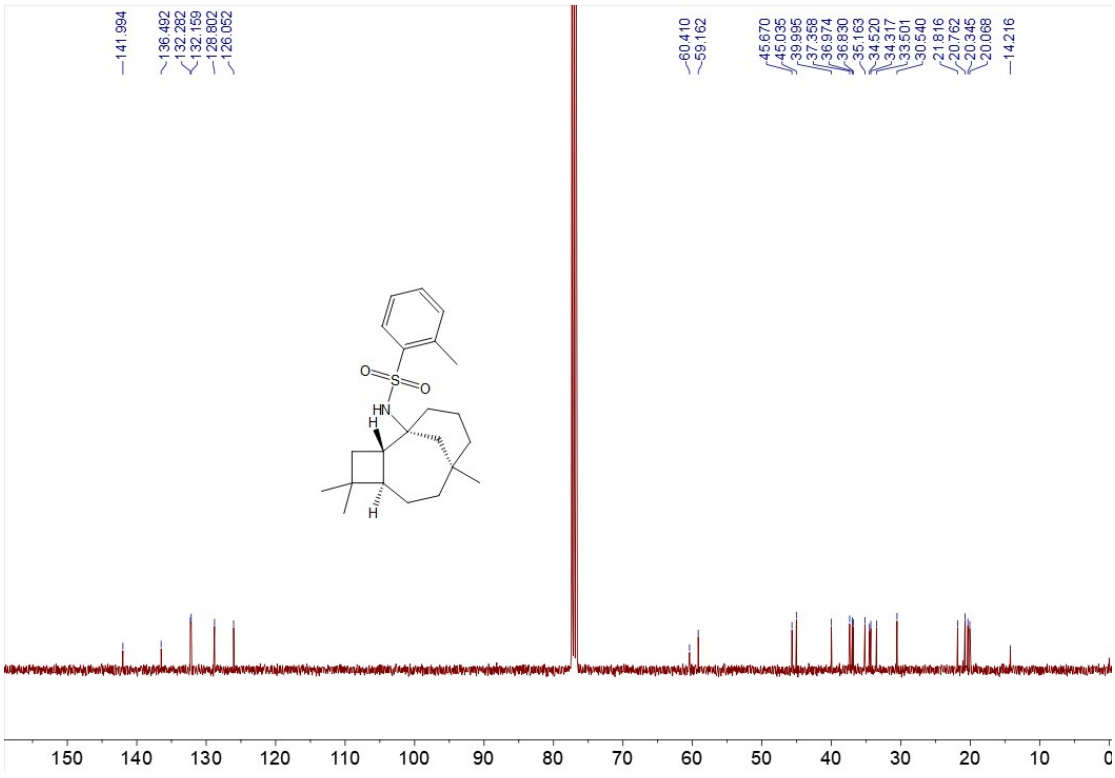
Compound SA-2



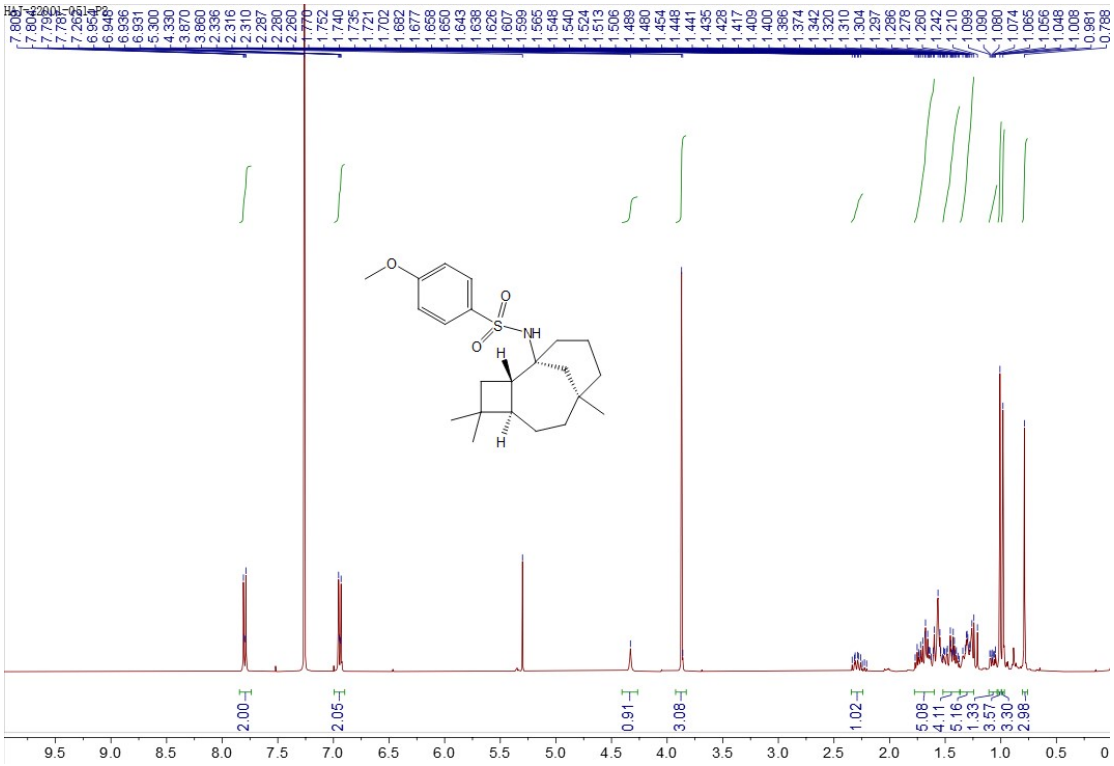


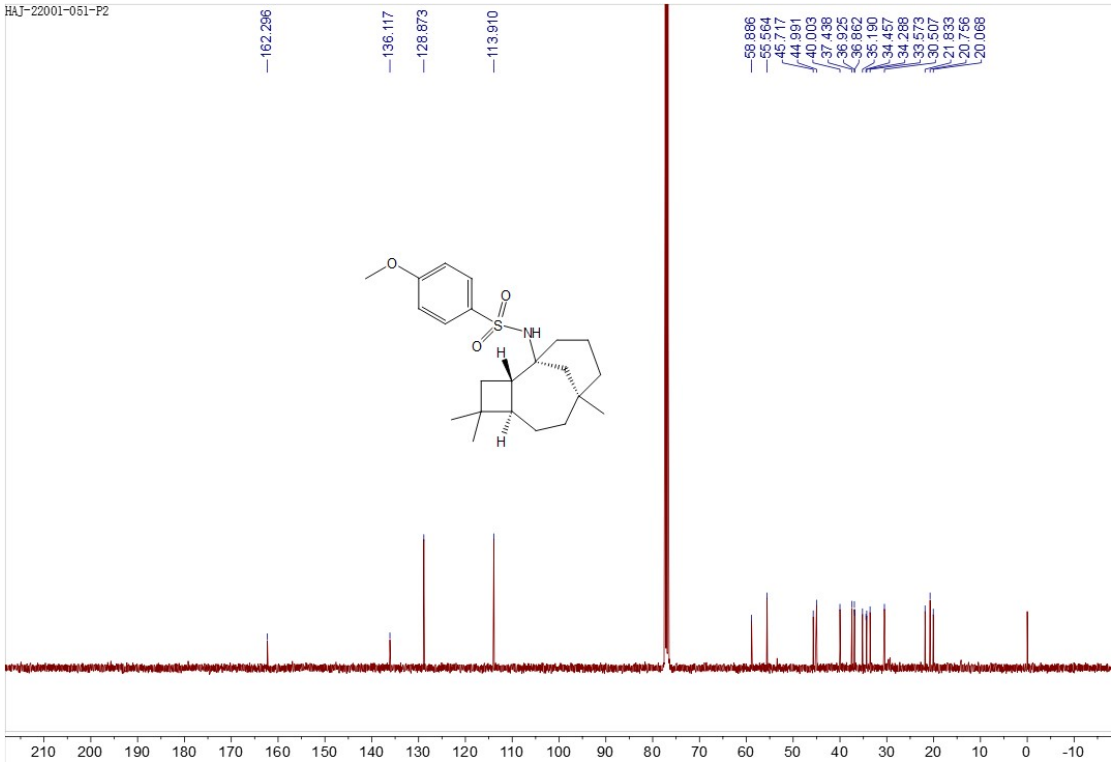
Compound SA-3



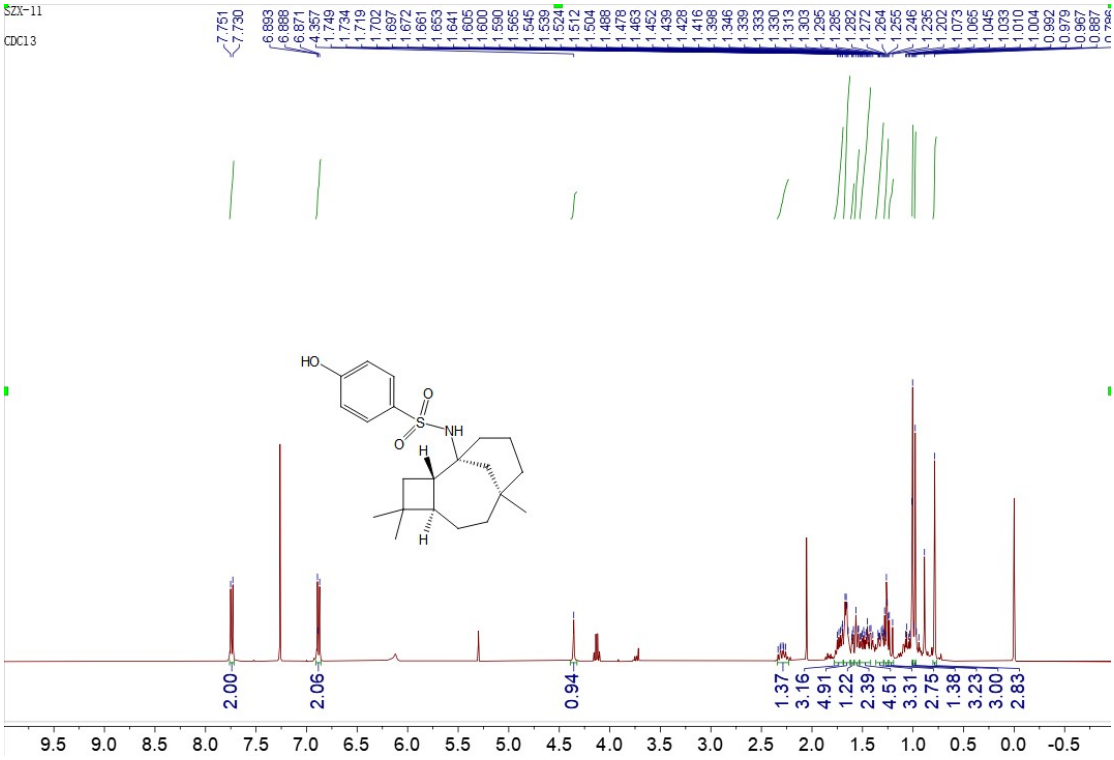


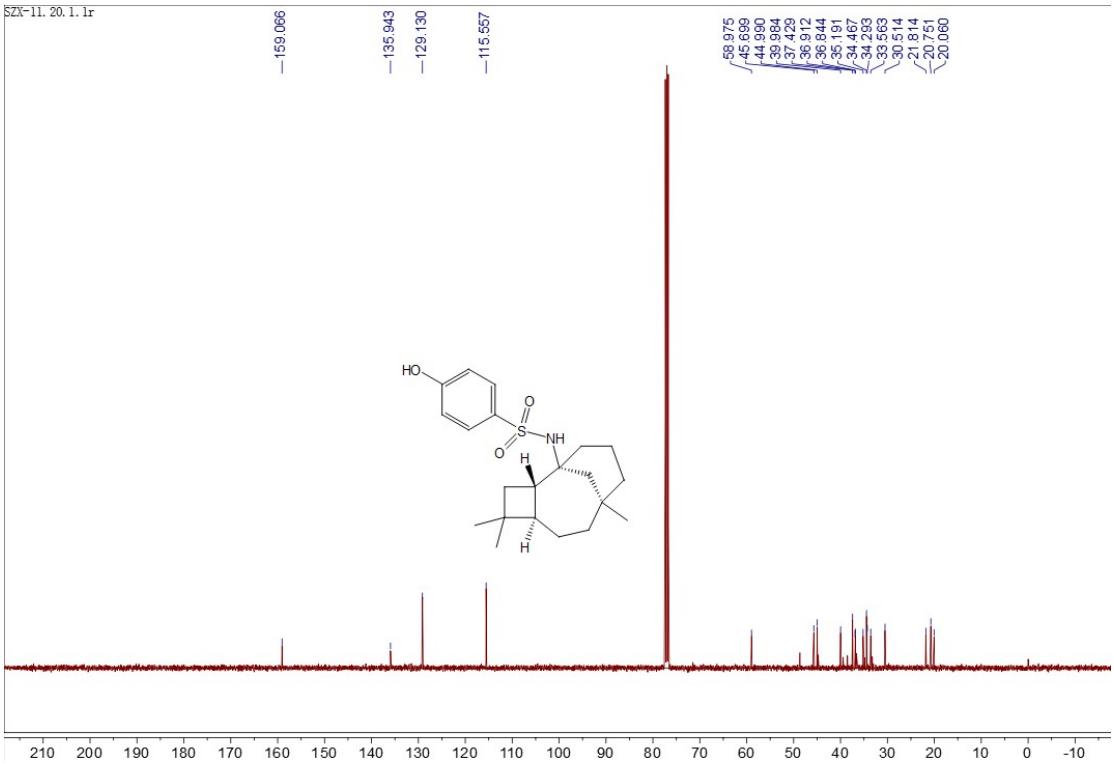
Compound SA-4



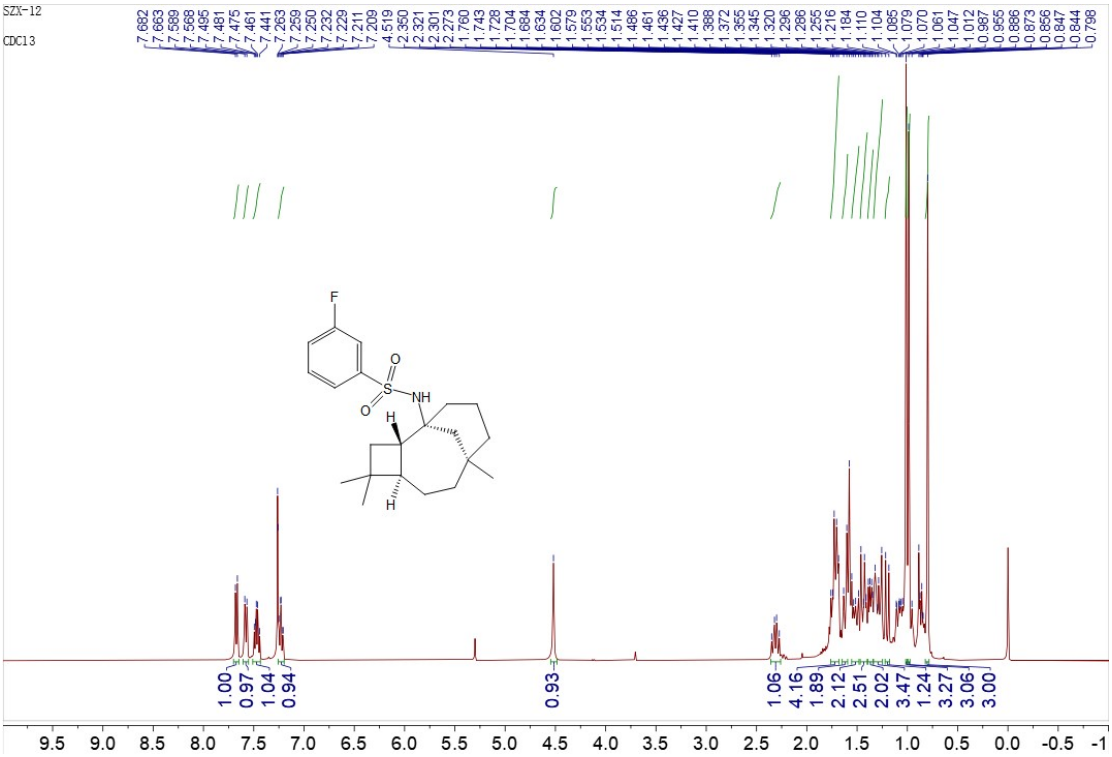


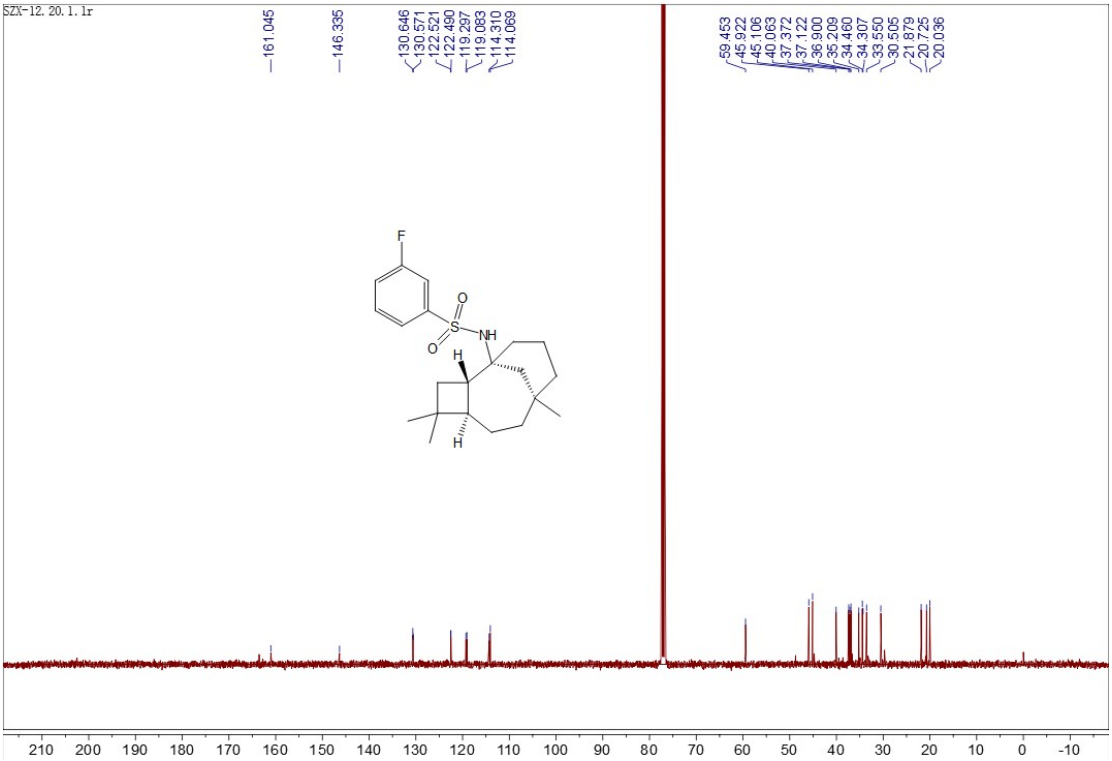
Compound SA-5



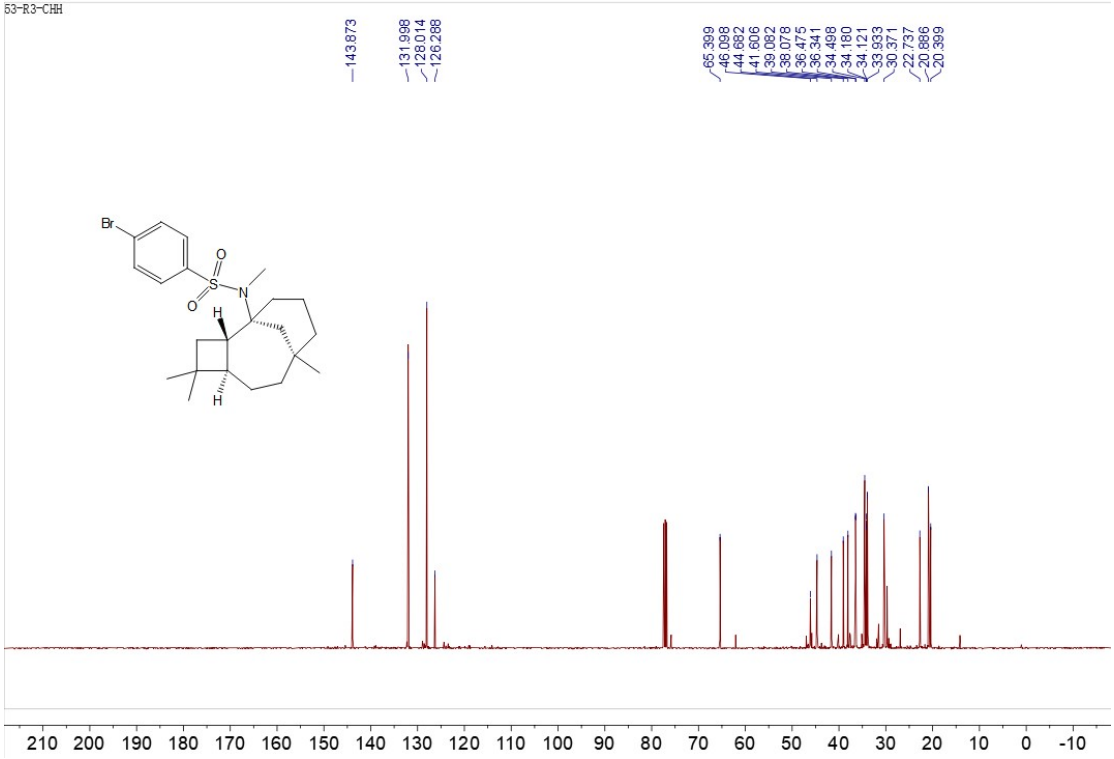


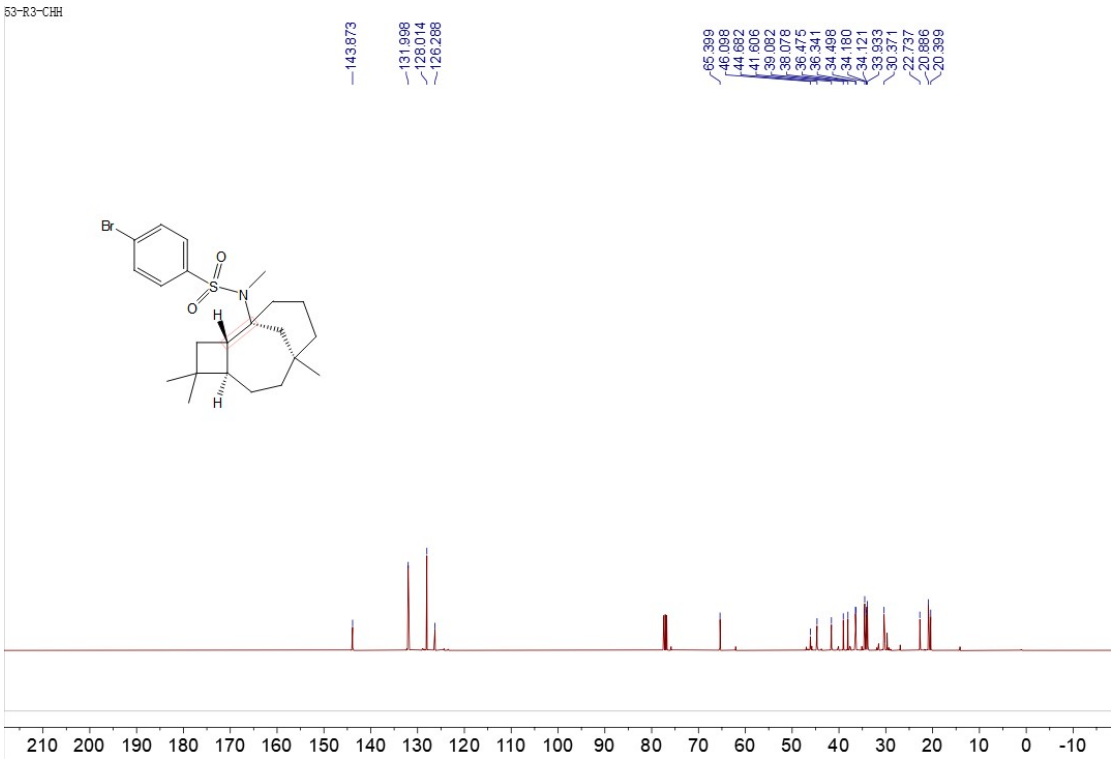
Compound SA-6



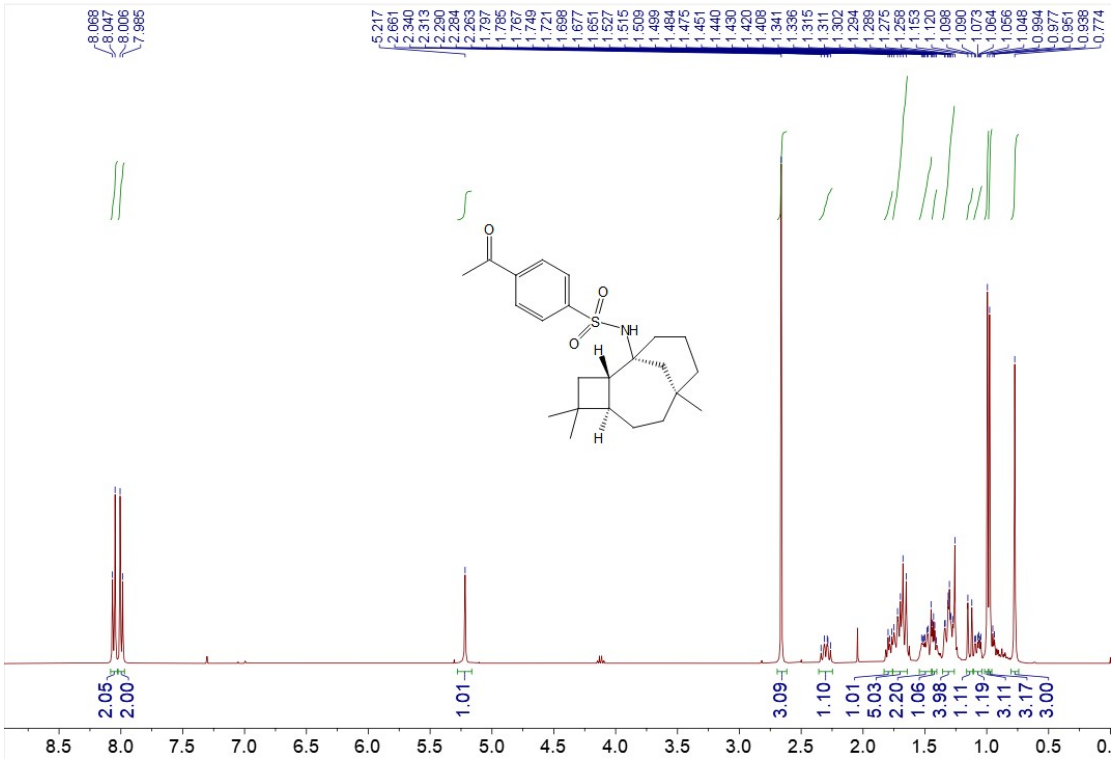


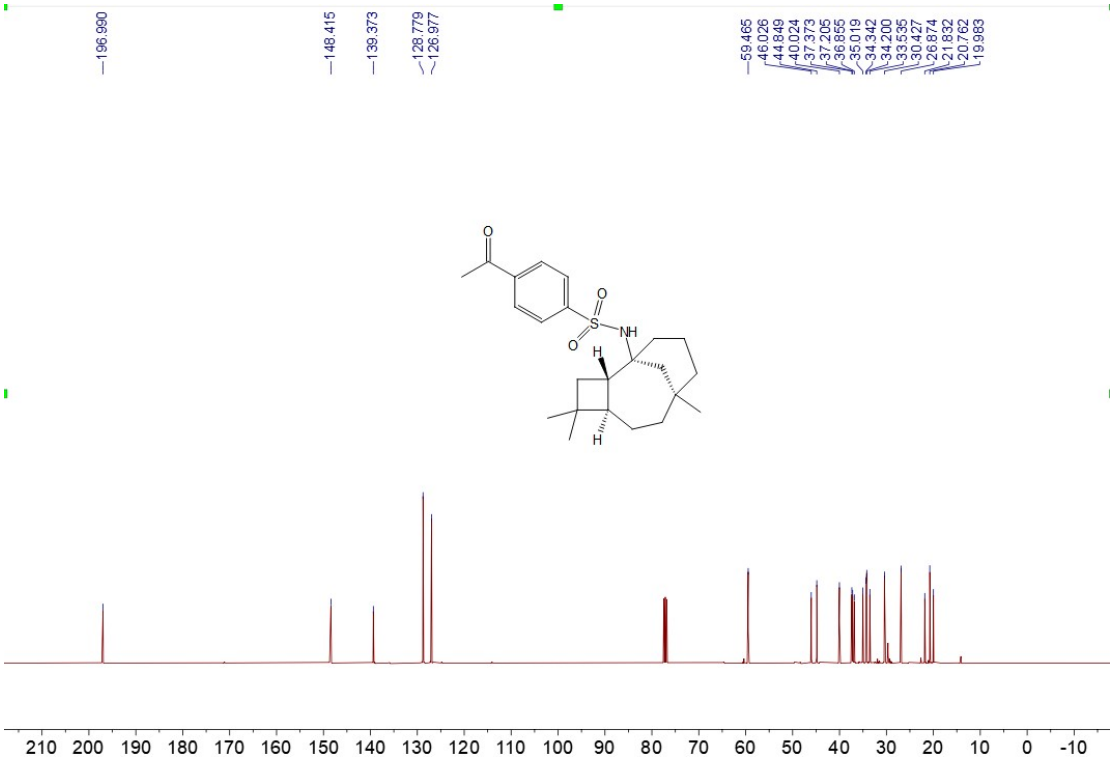
Compound SA-7



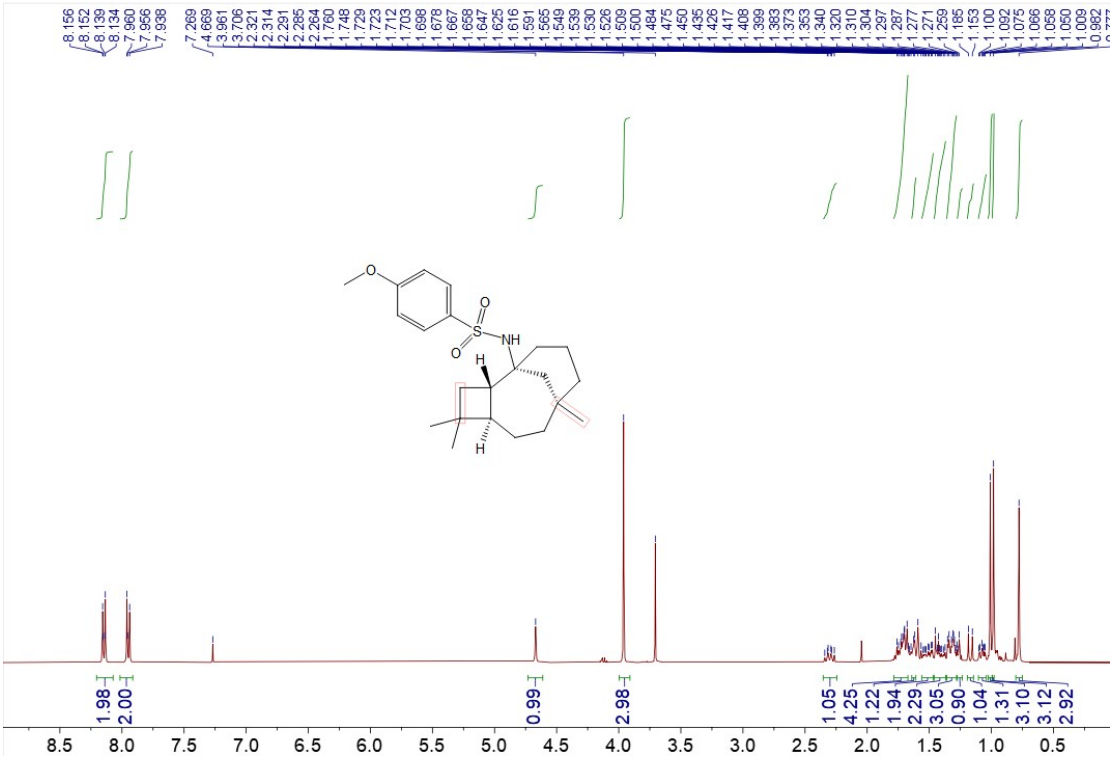


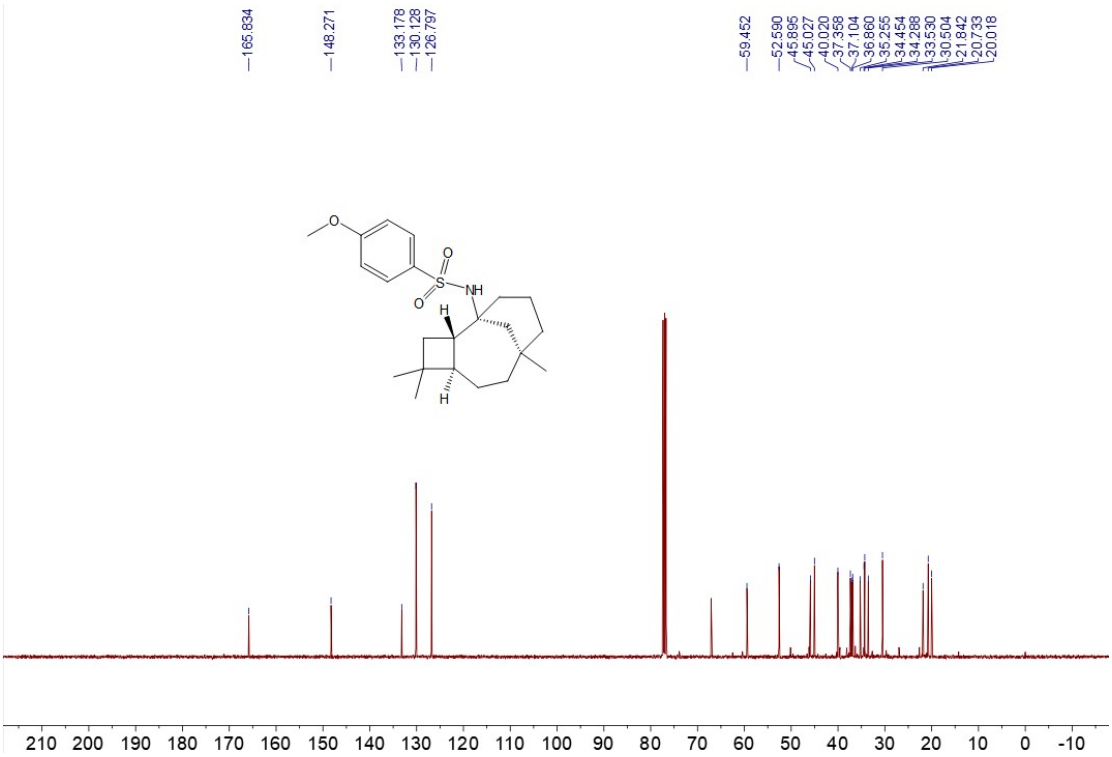
Compound SA-8



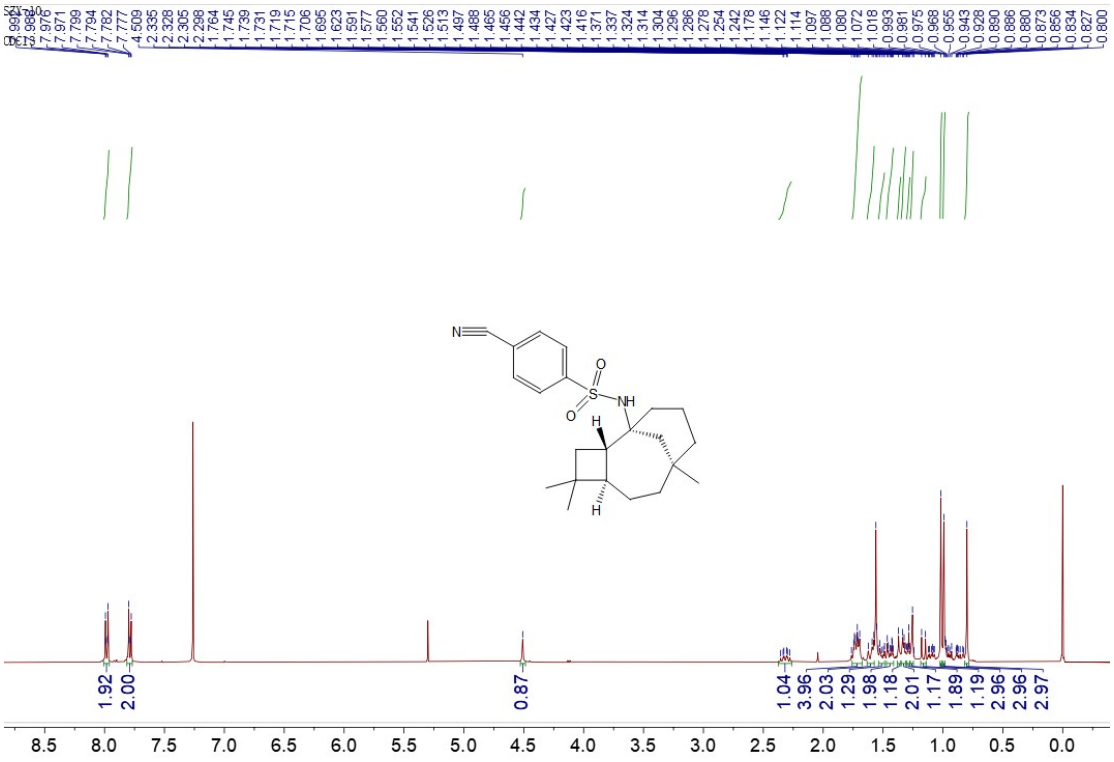


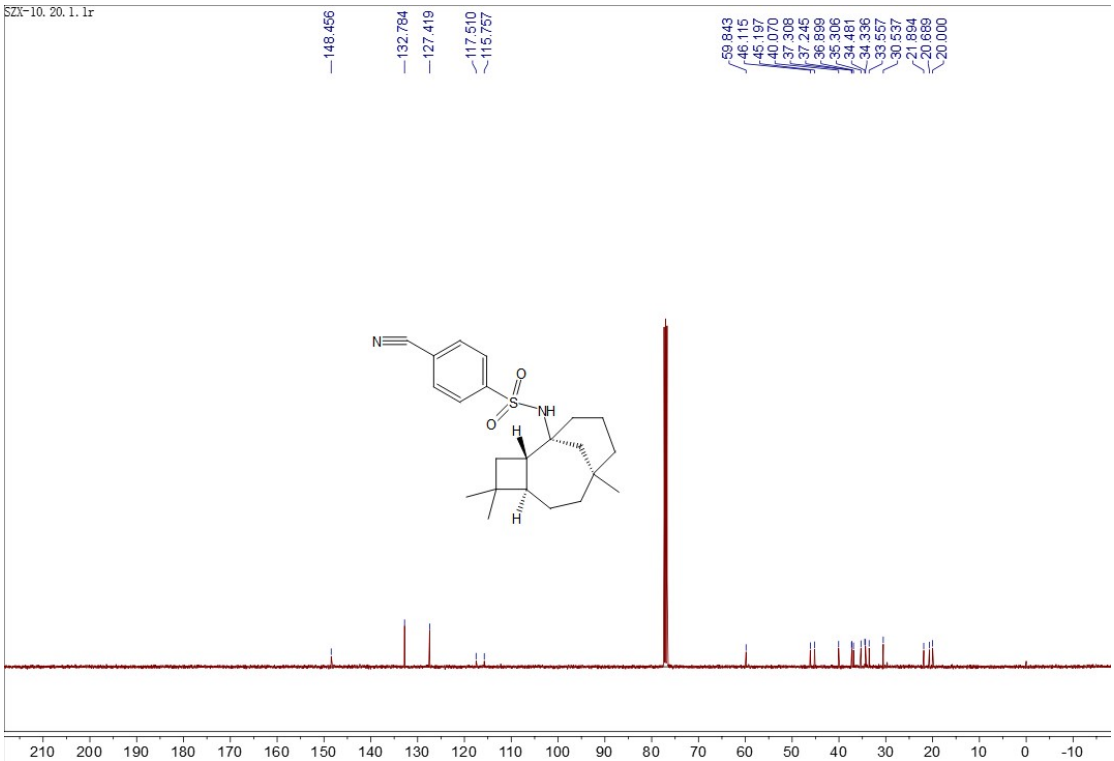
Compound SA-9



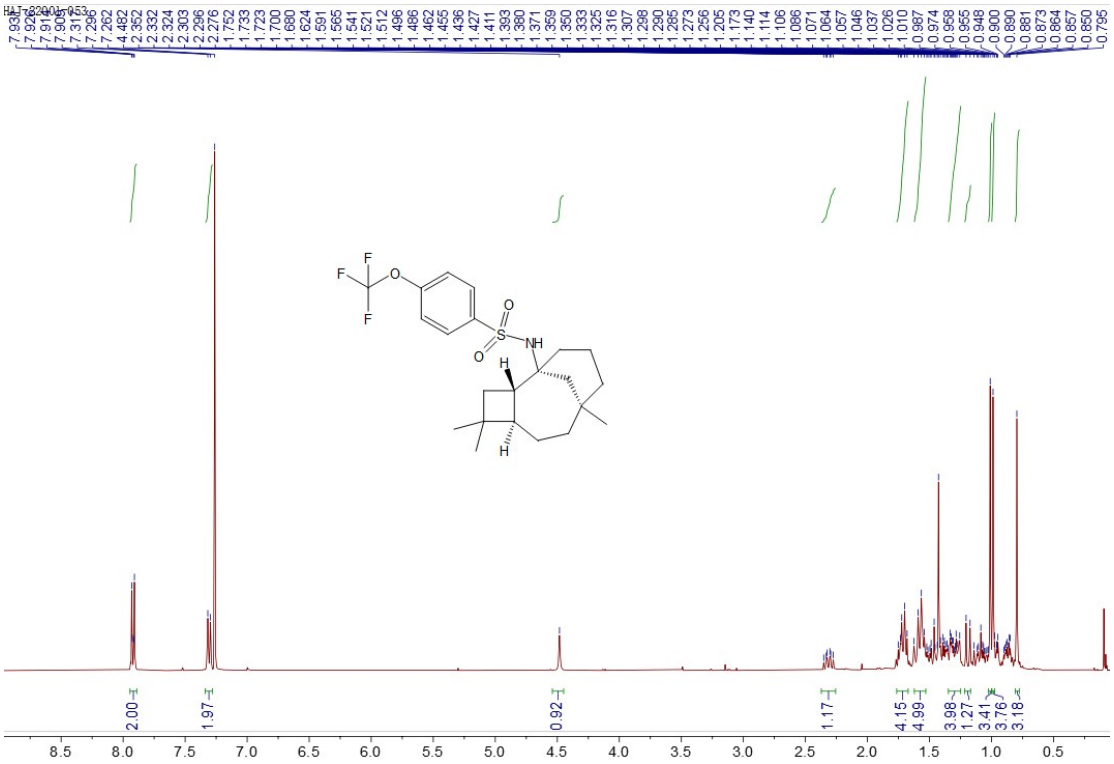


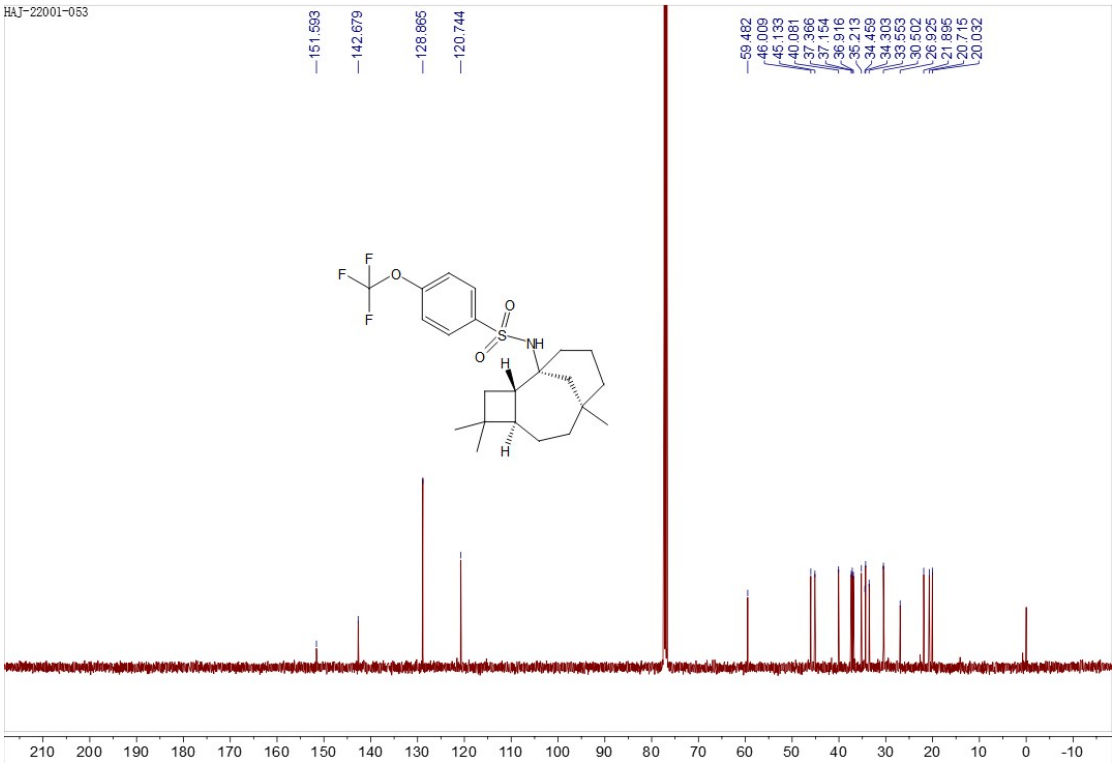
Compound SA-10



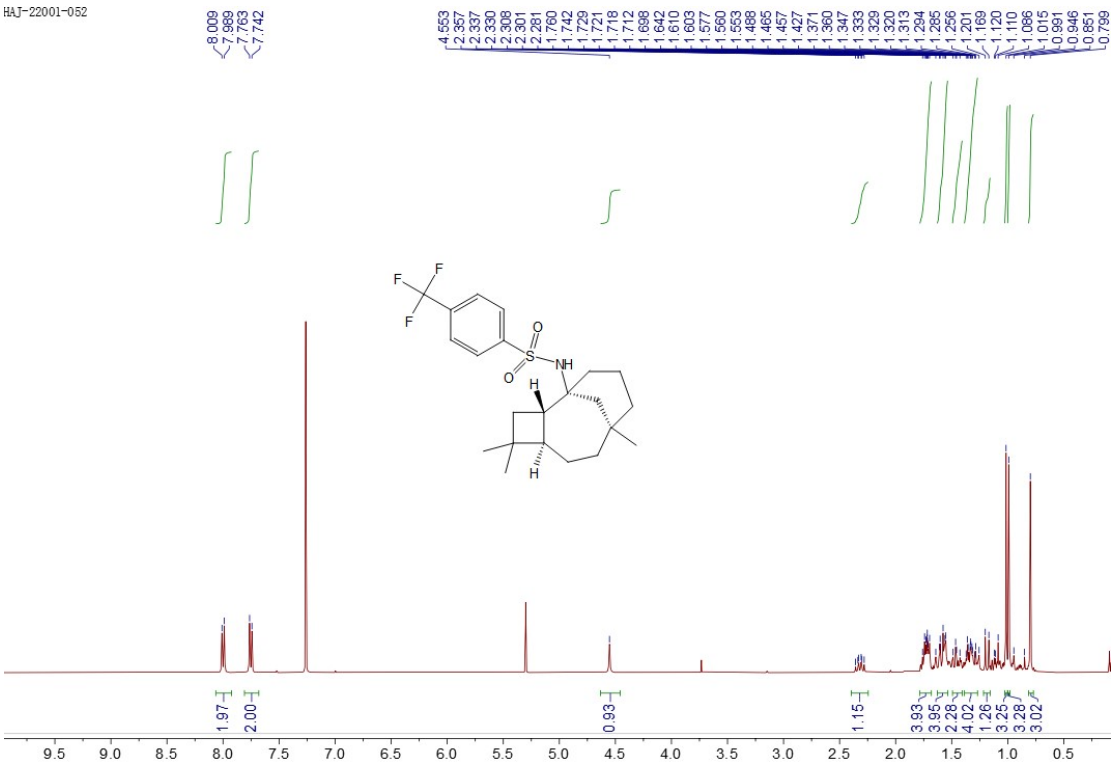


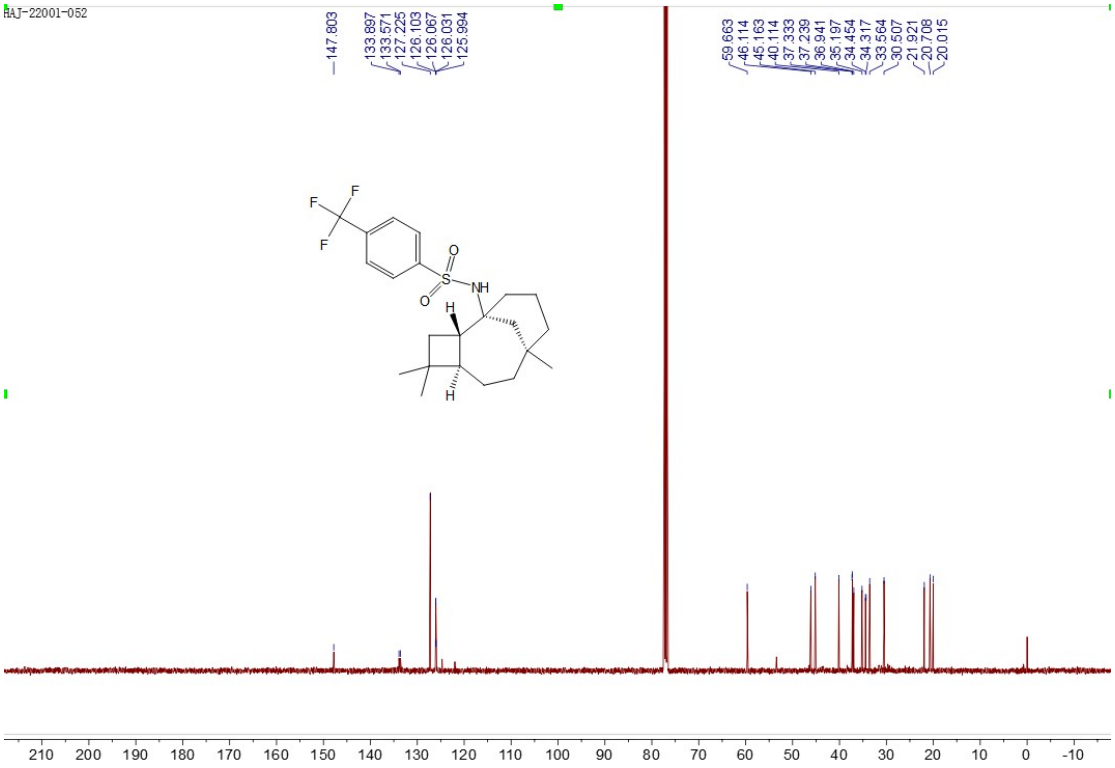
Compound SA-11





Compound SA-12





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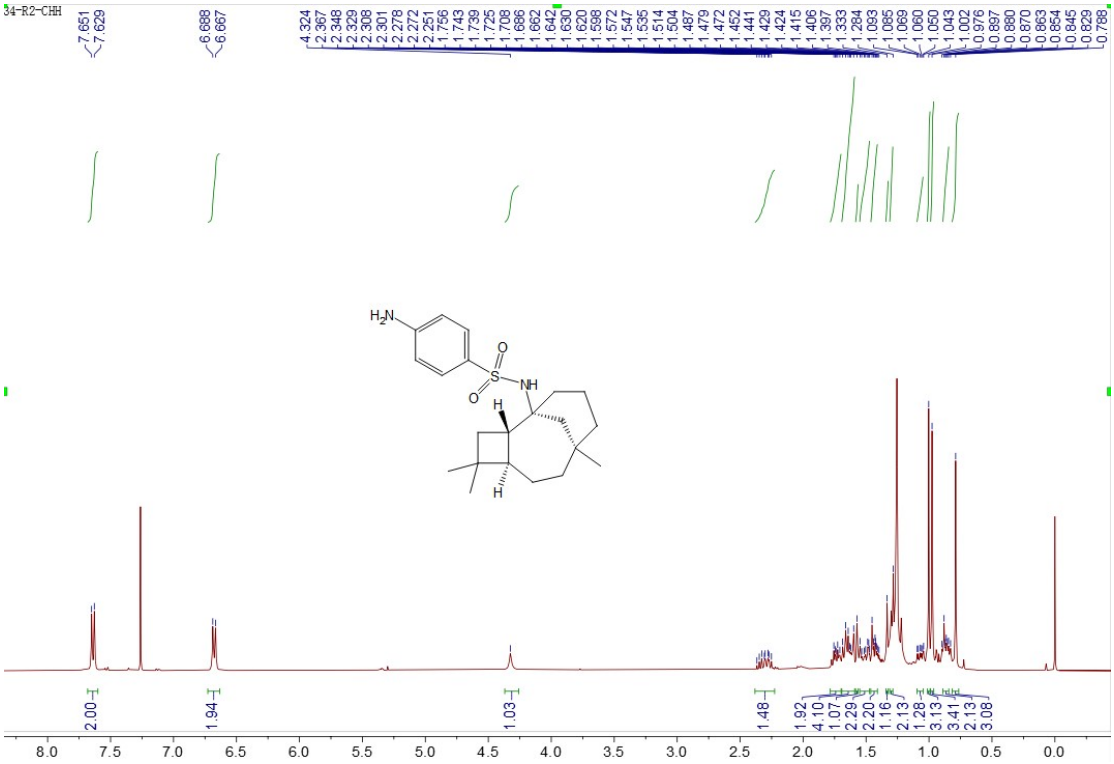

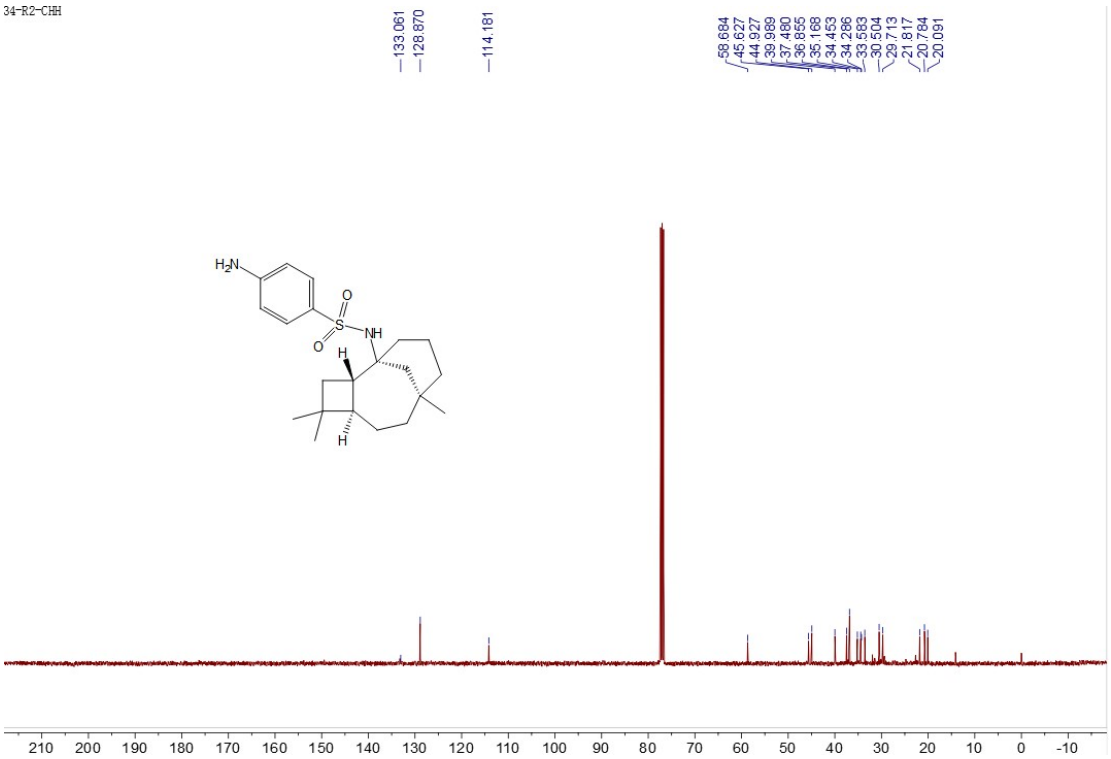

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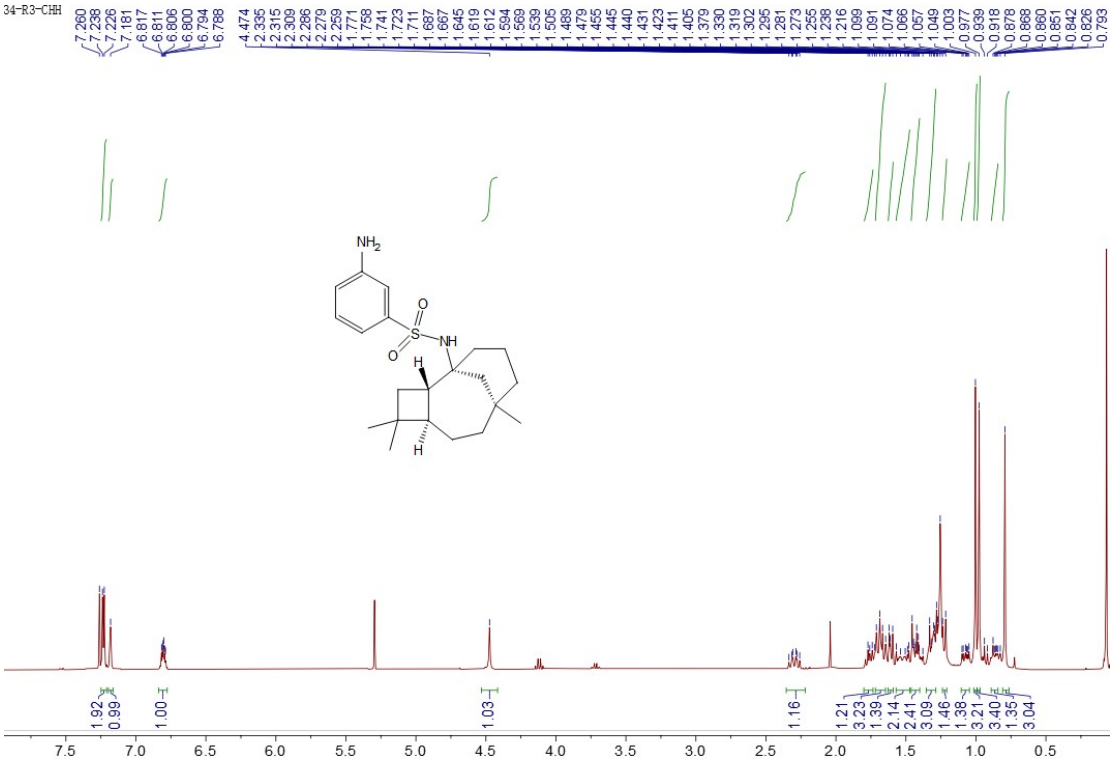
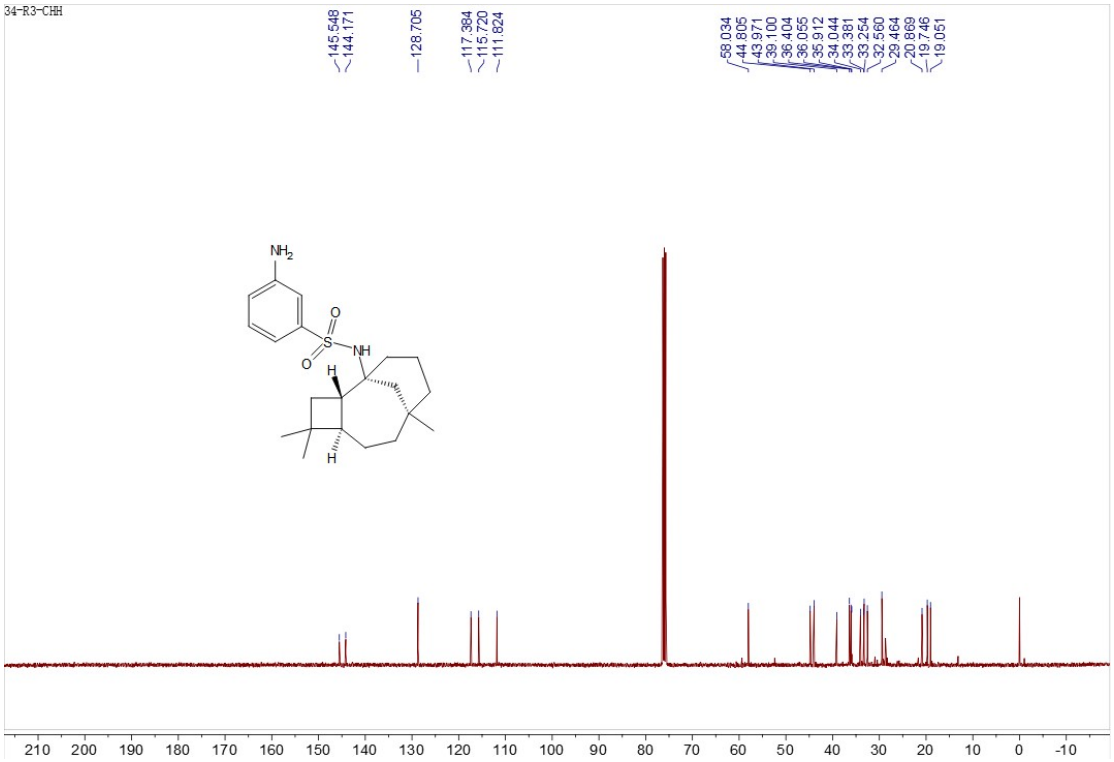
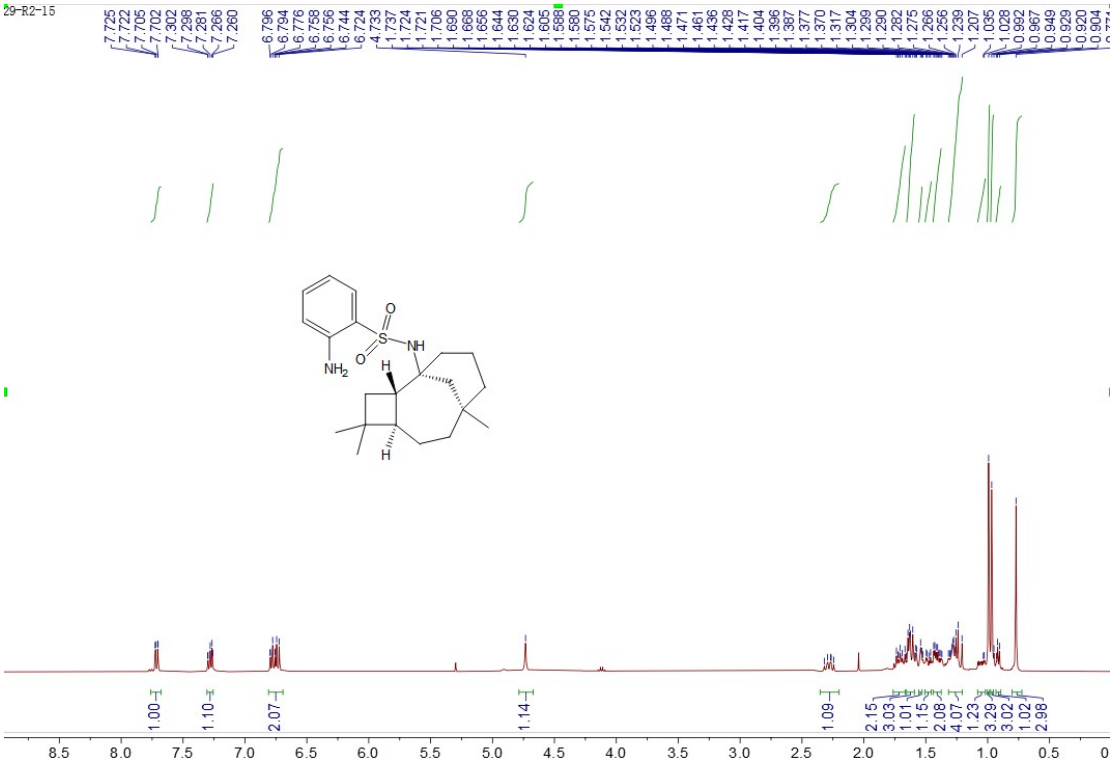
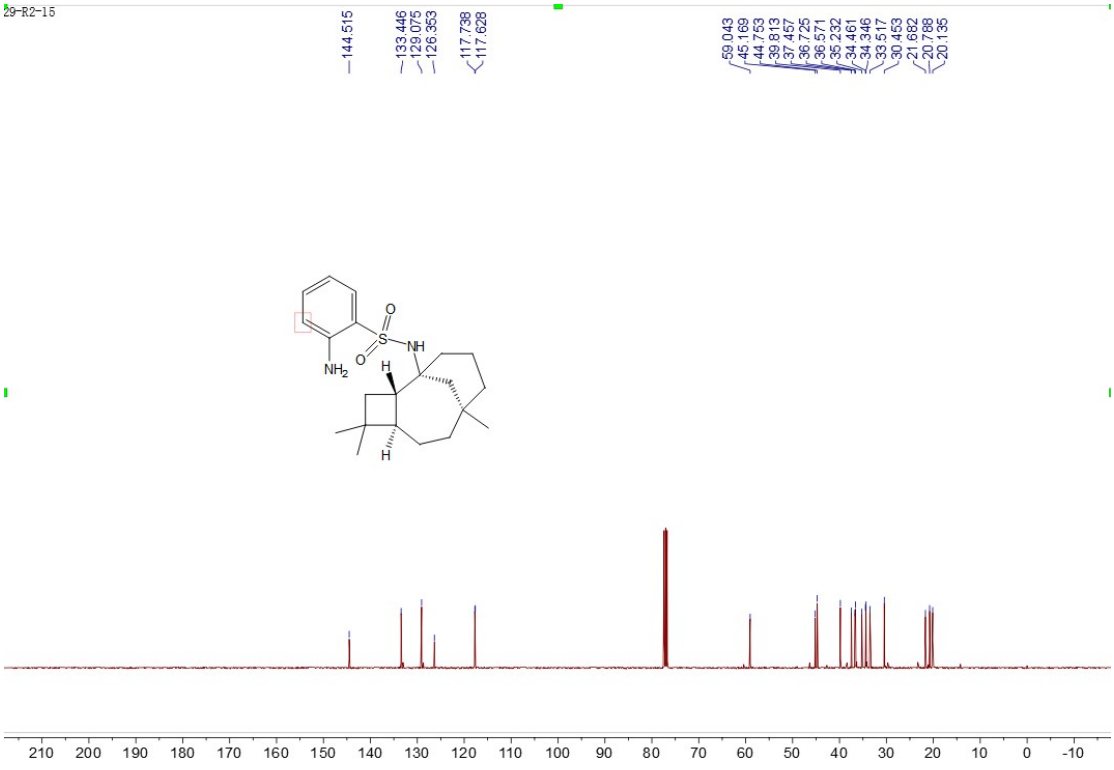


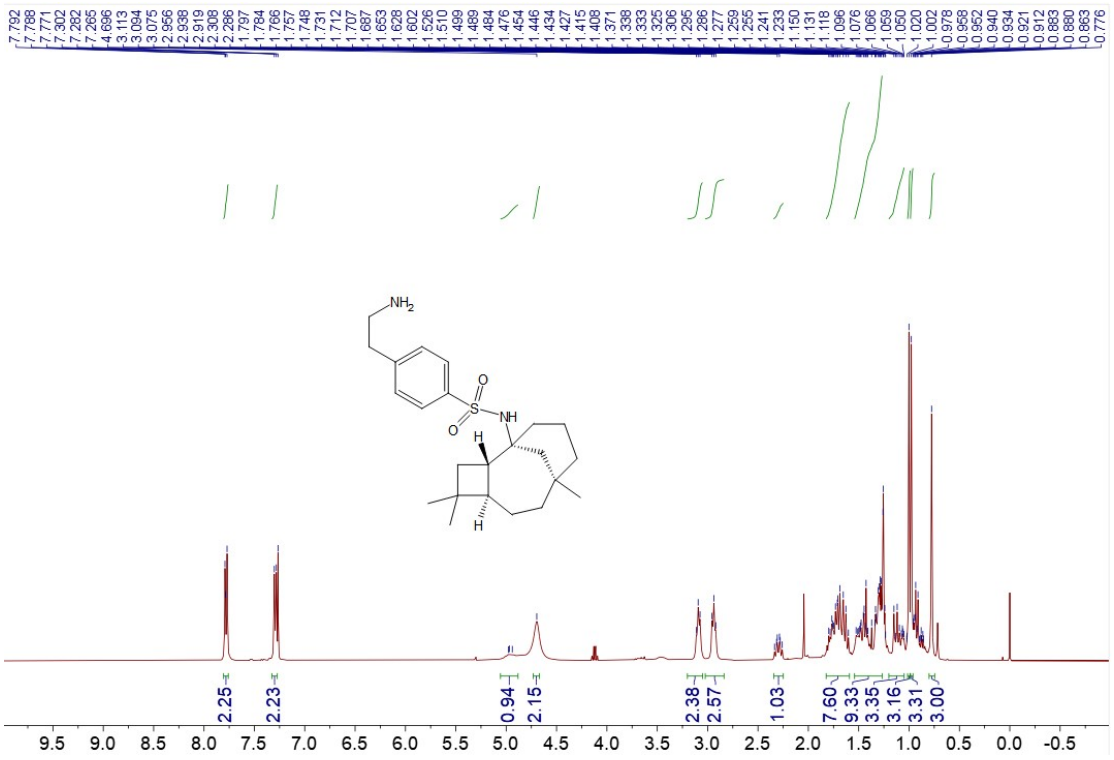


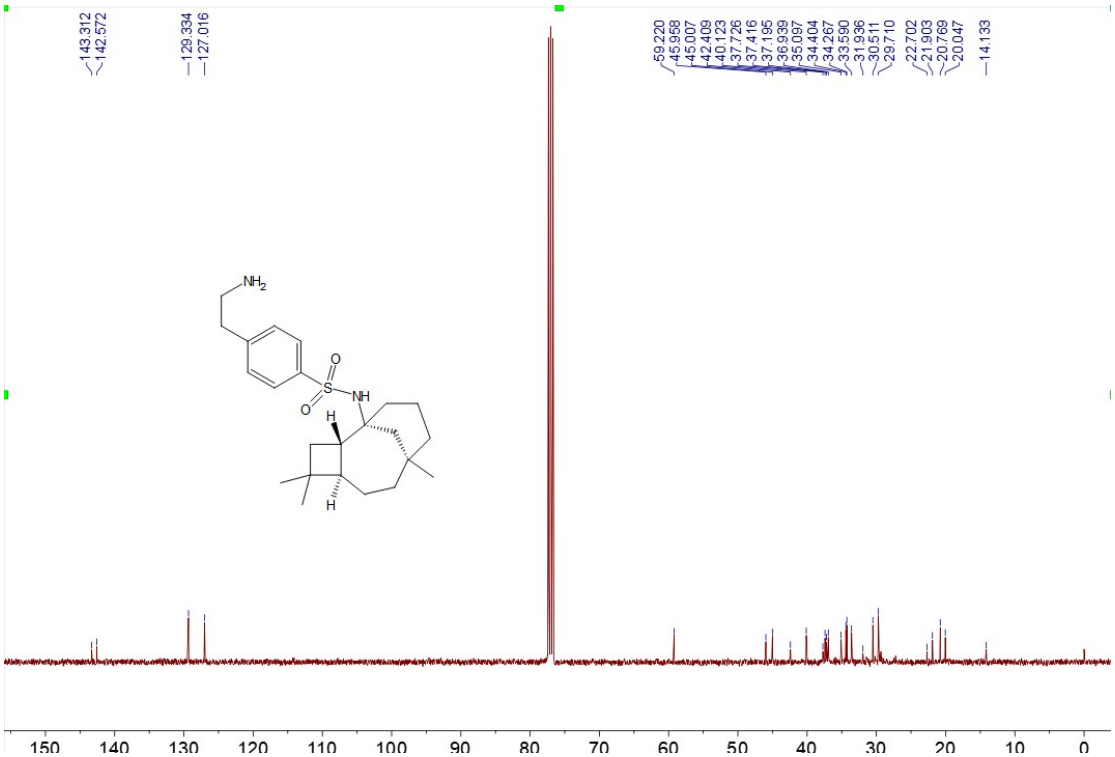
Compound SA-15



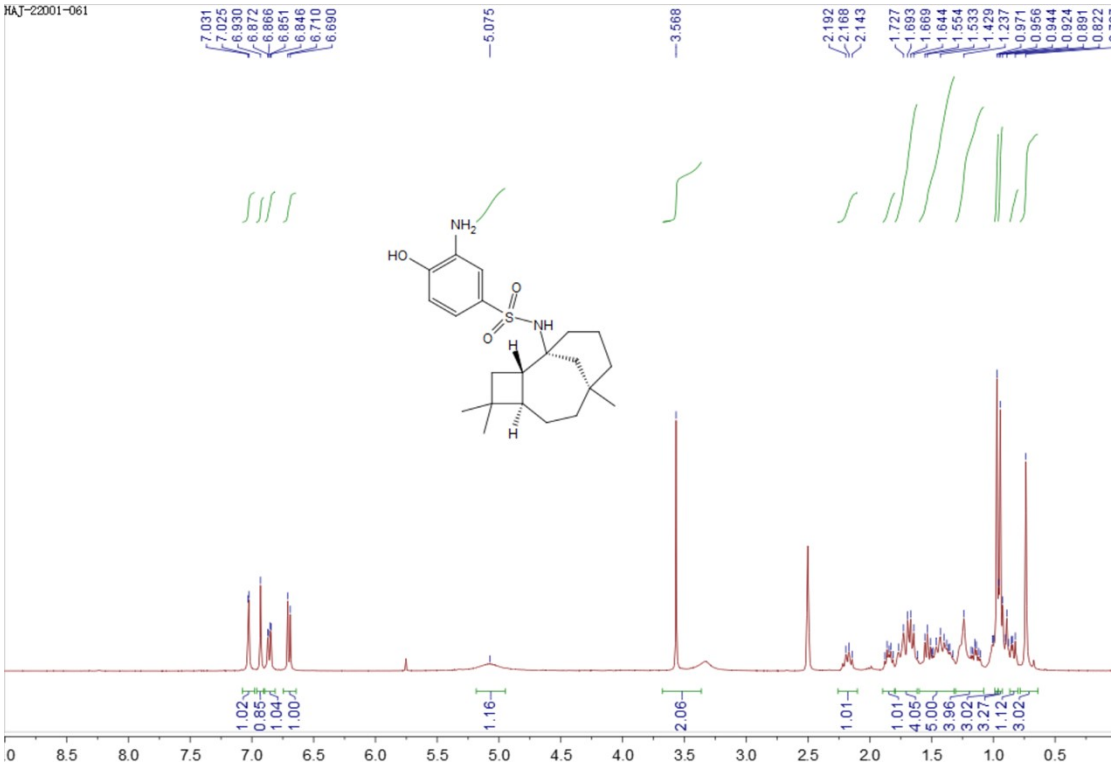


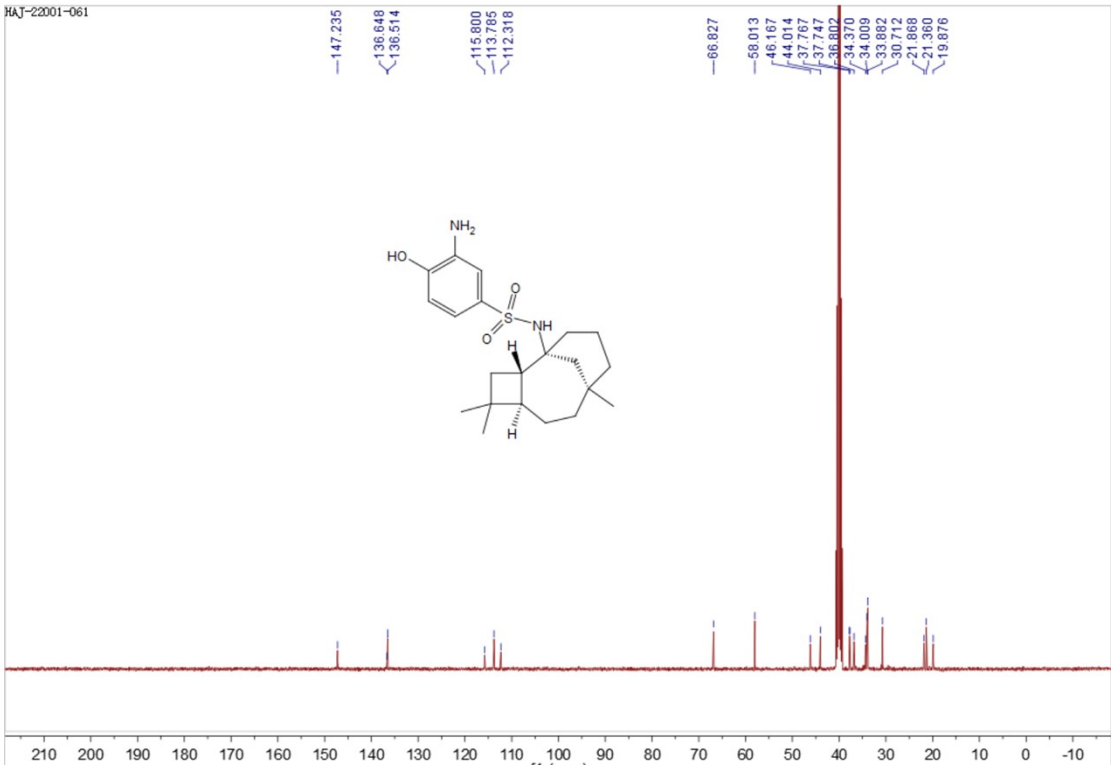
Compound SA-16





Compound SA-17





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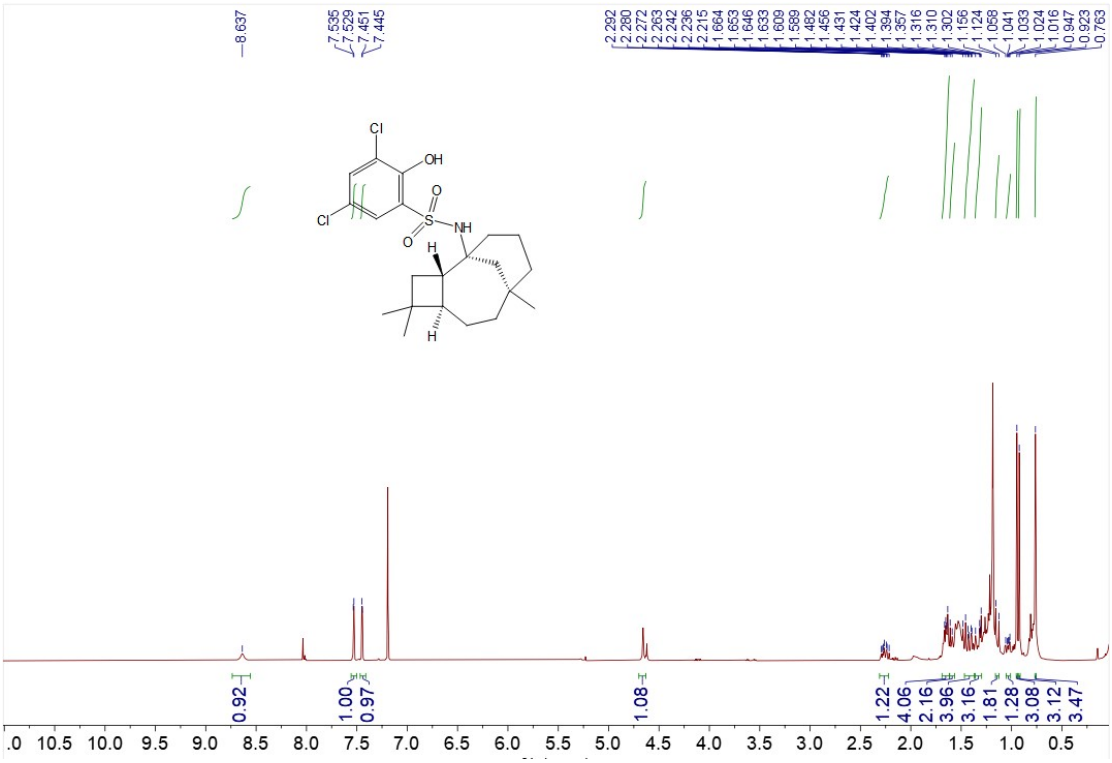
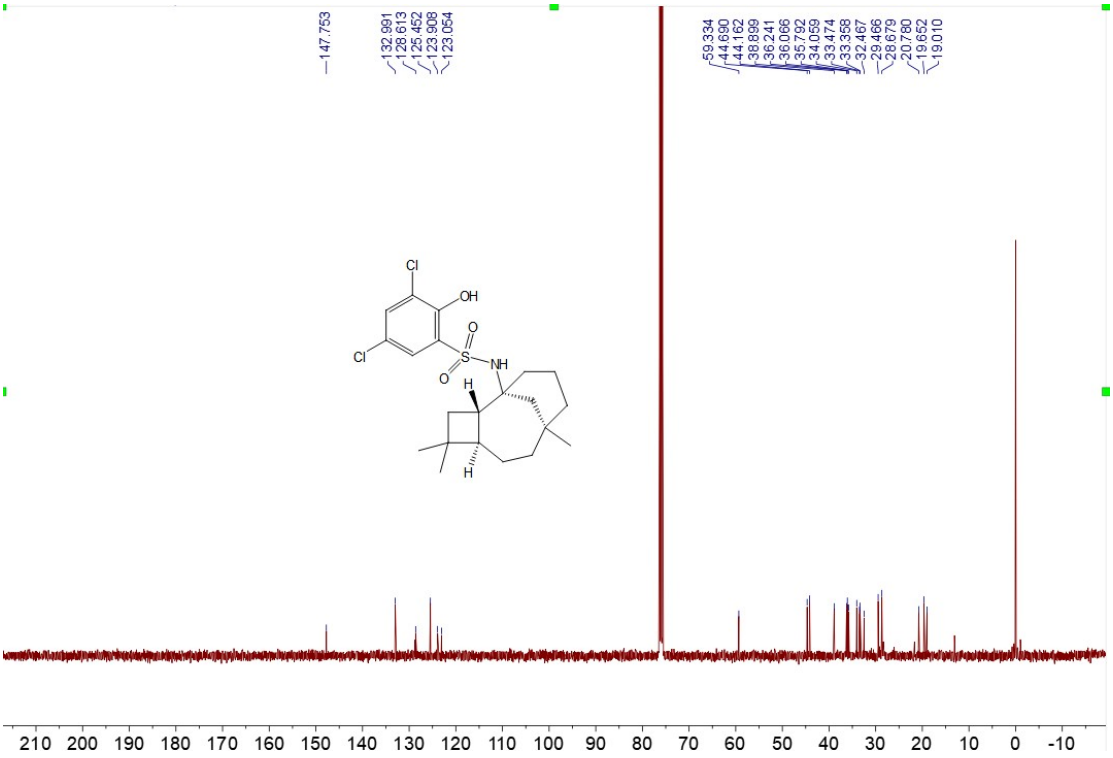
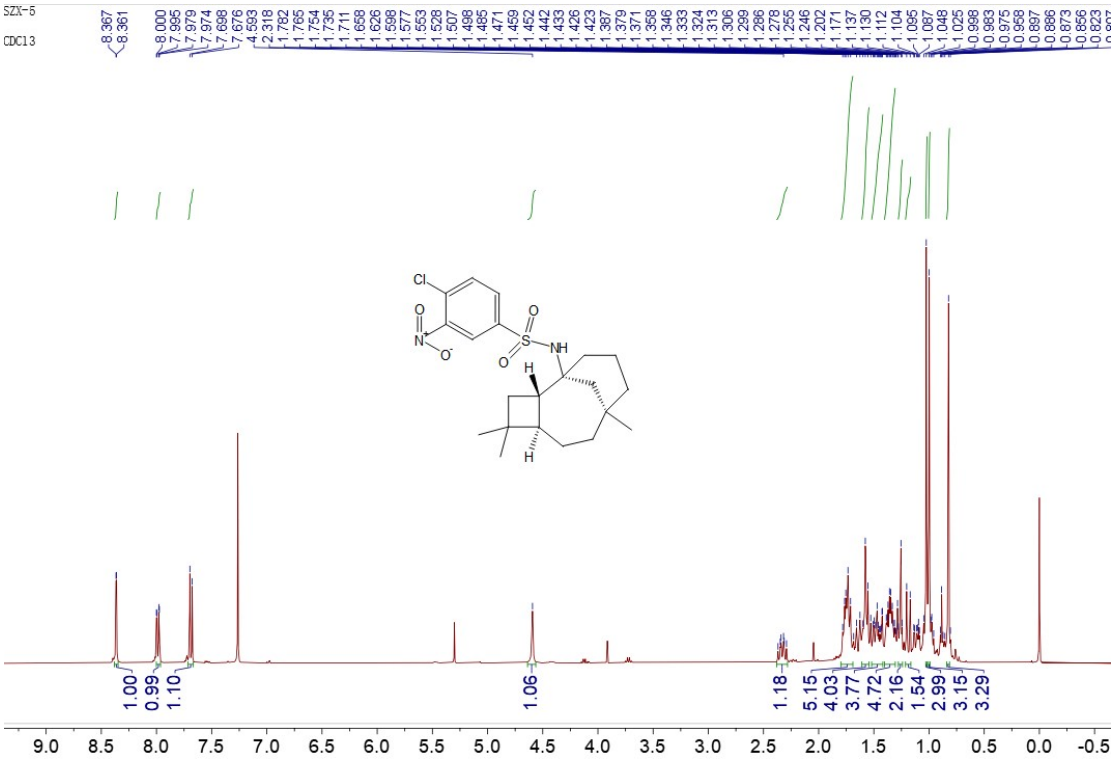
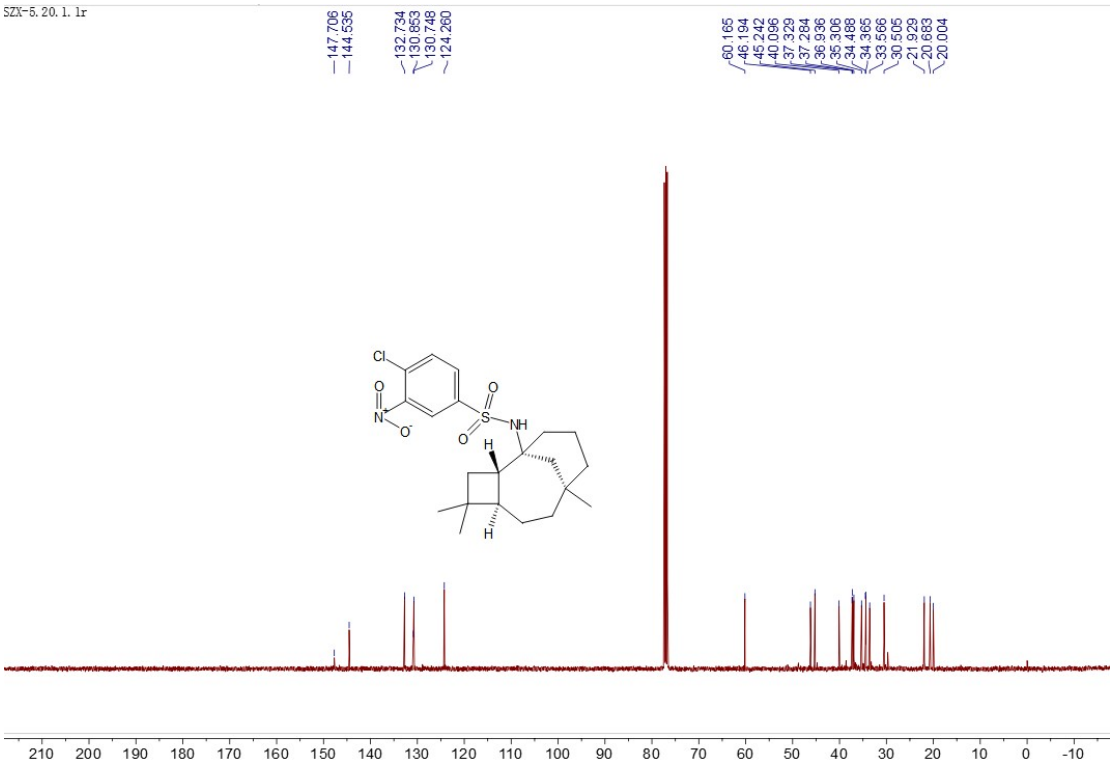




Compoun SA-19





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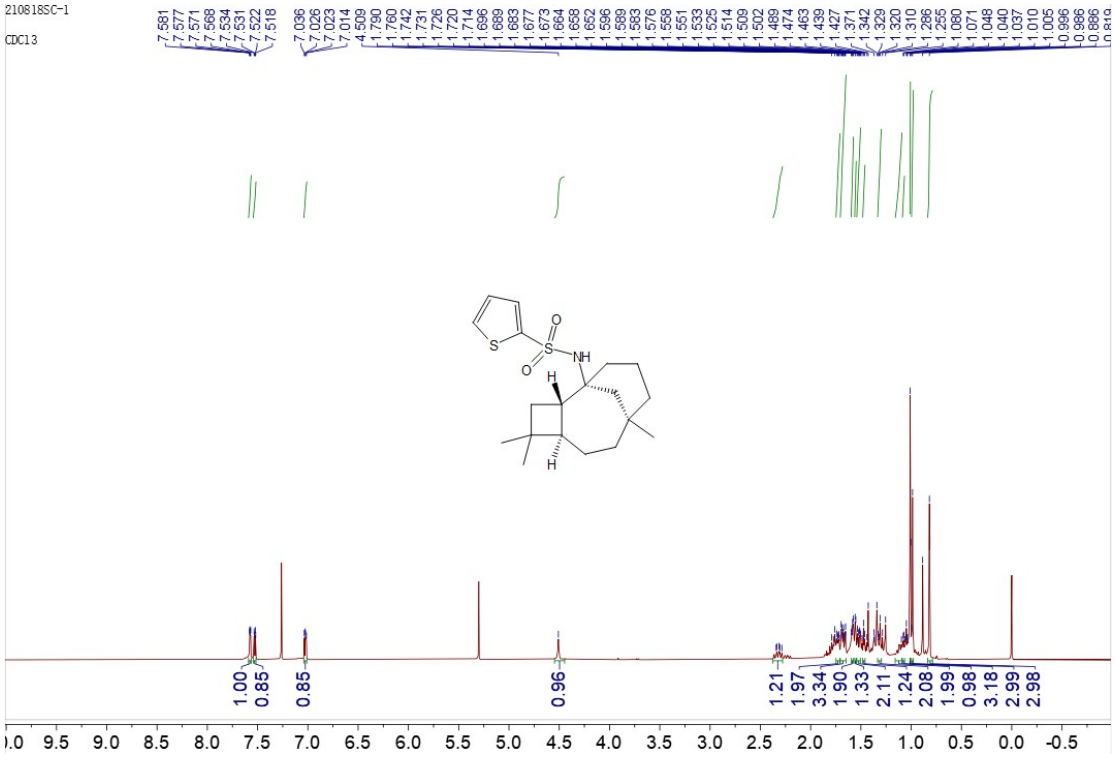
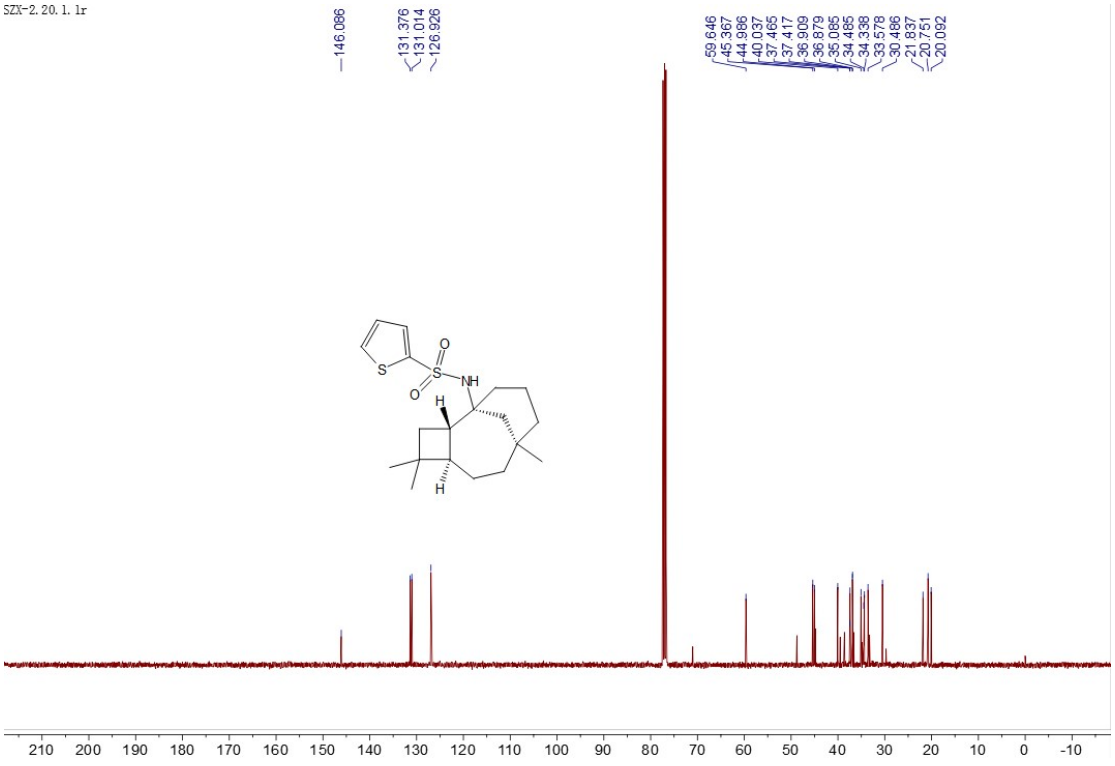
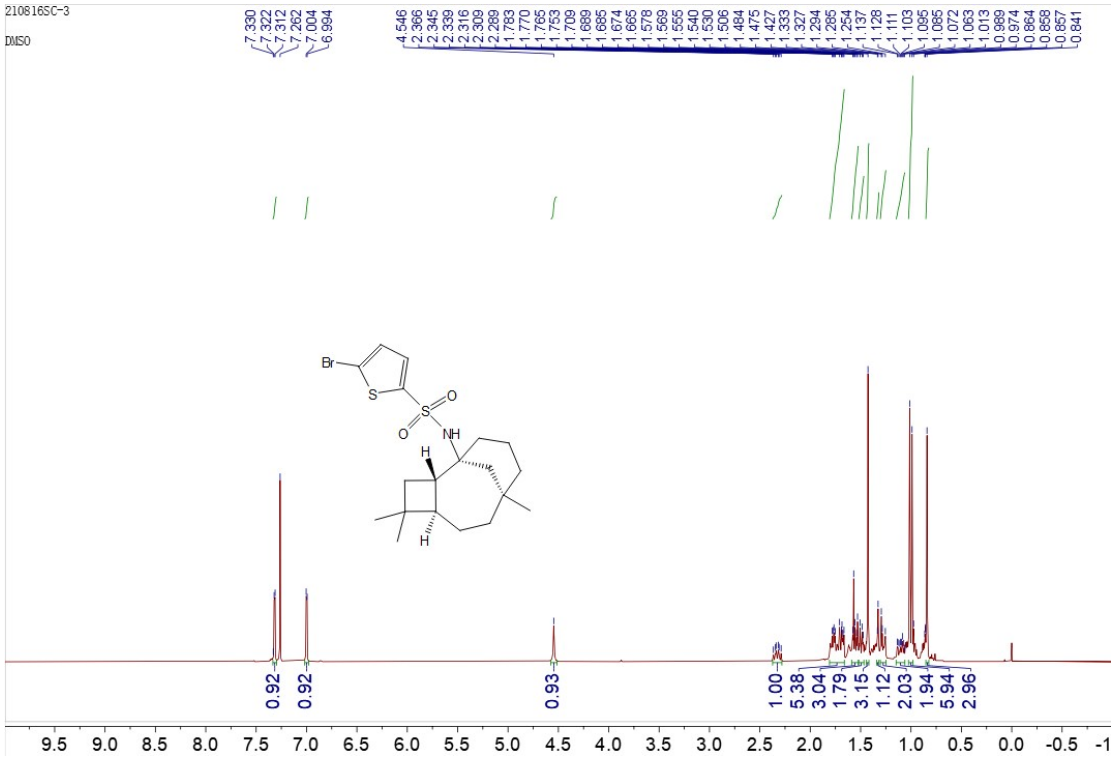
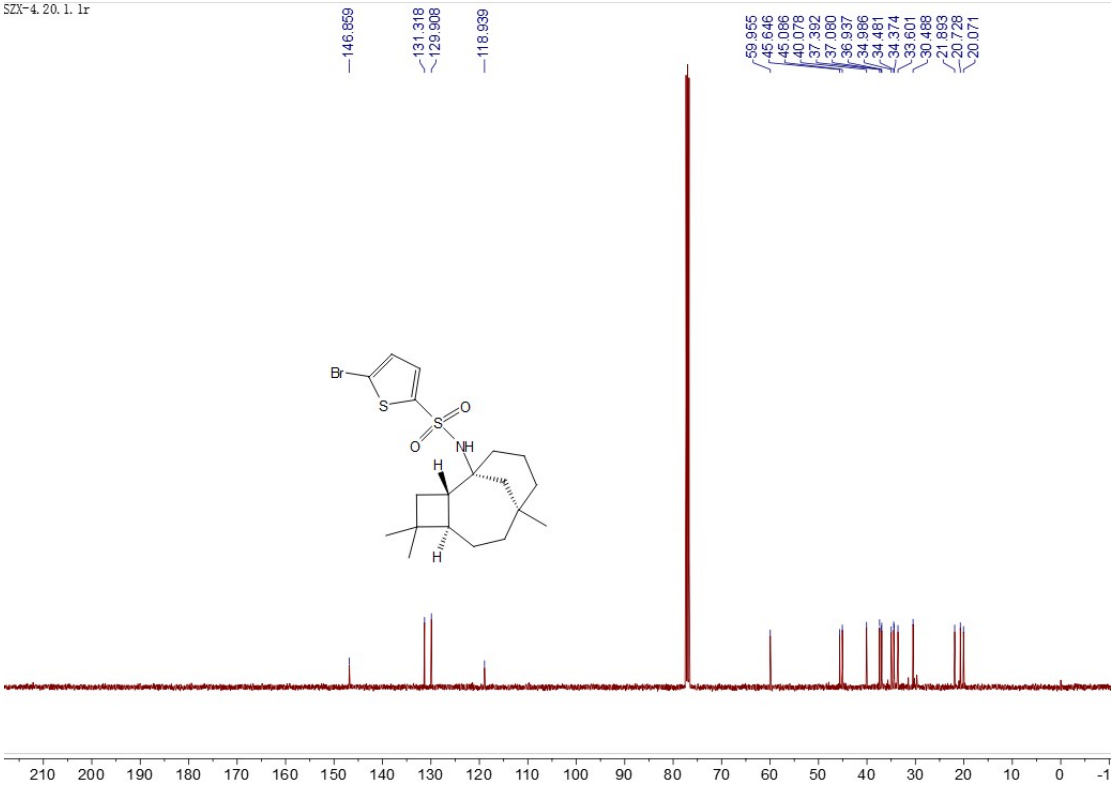




Compound SA-21





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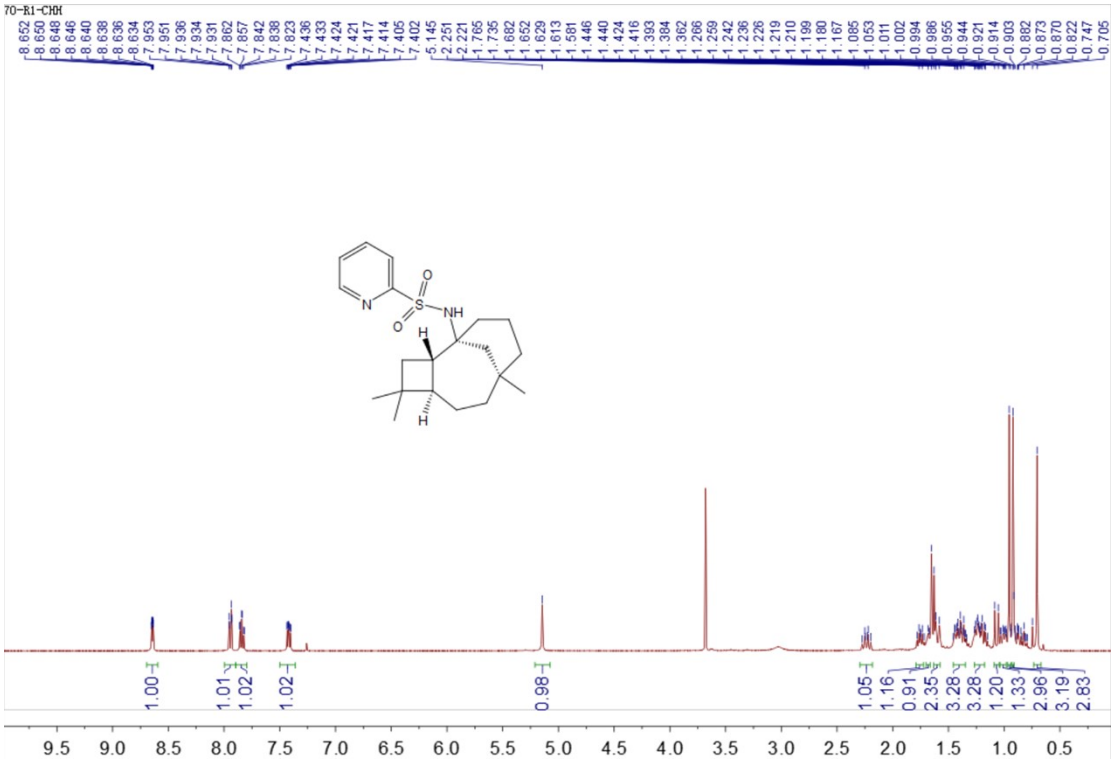

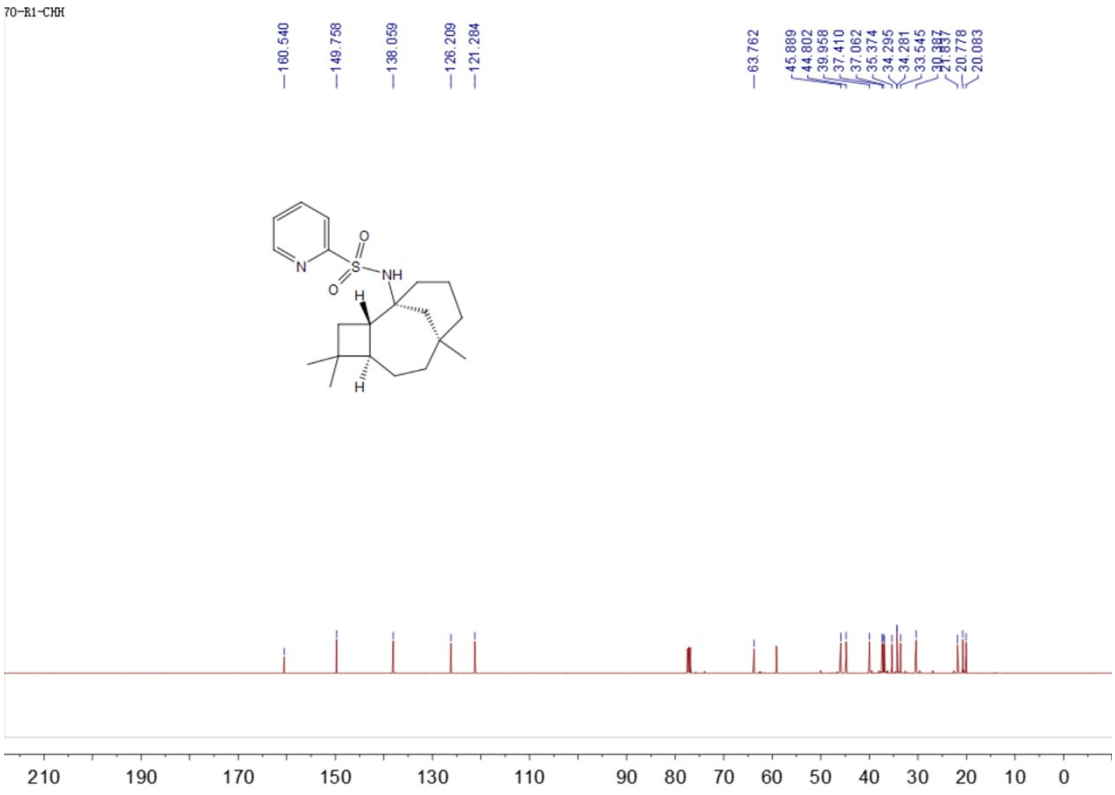

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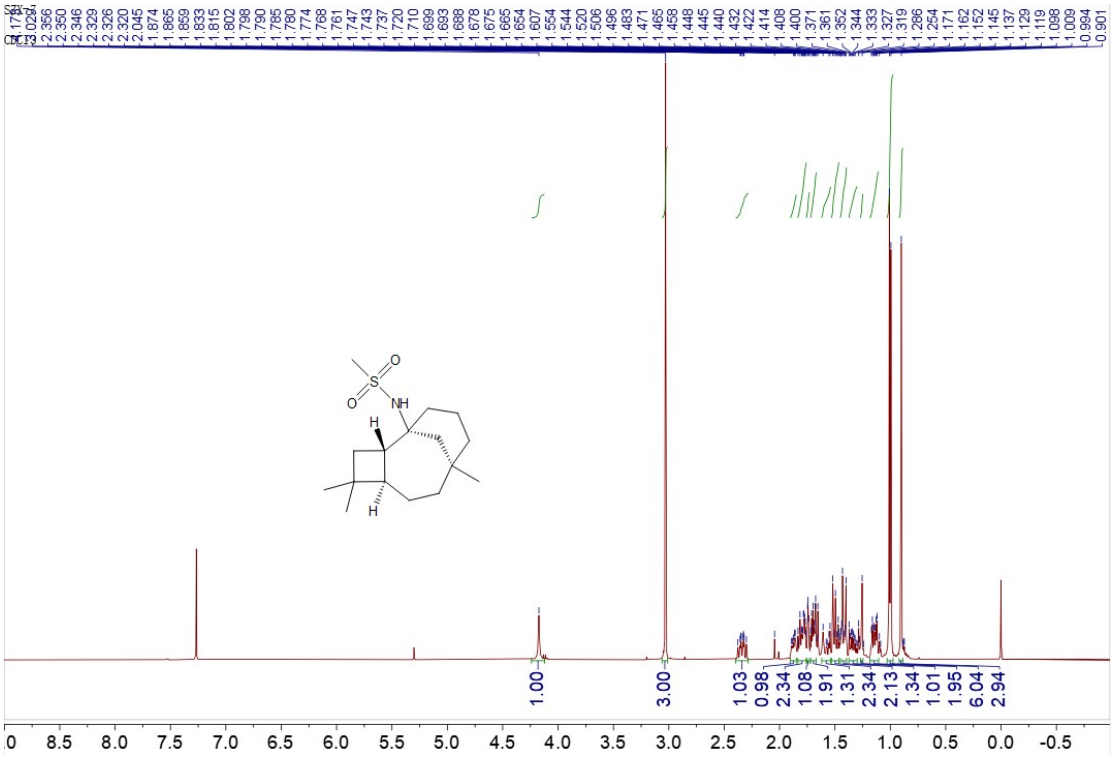

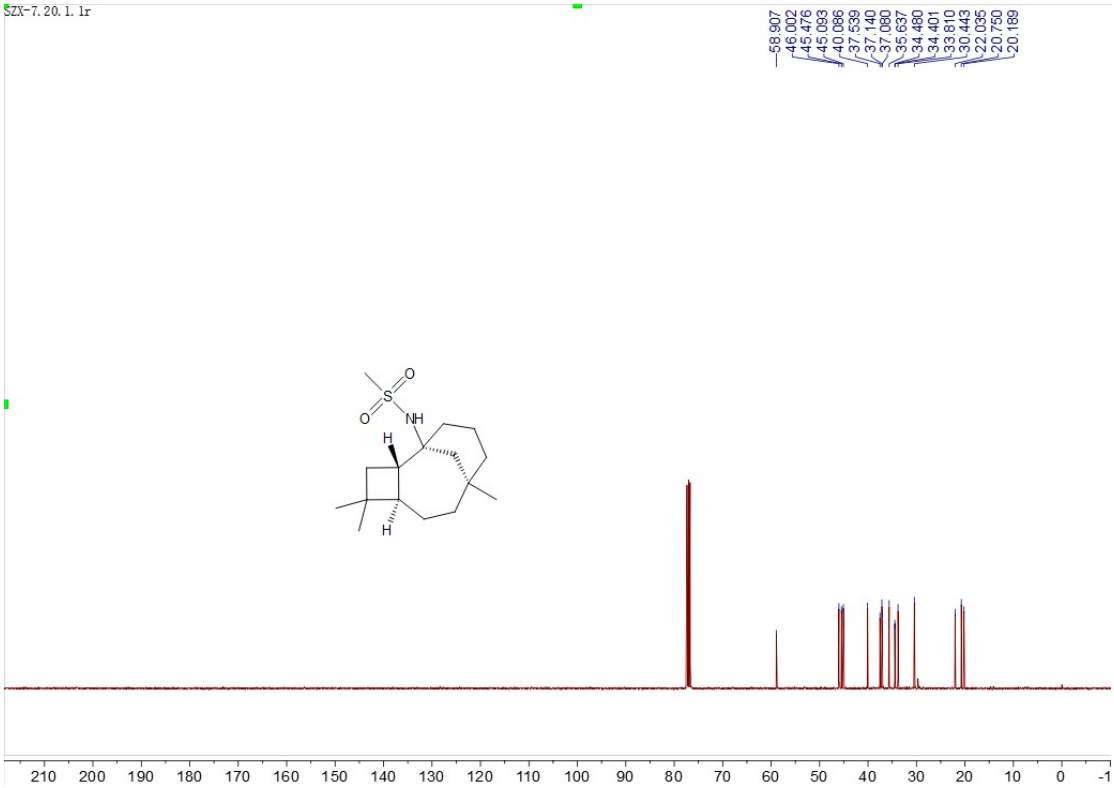

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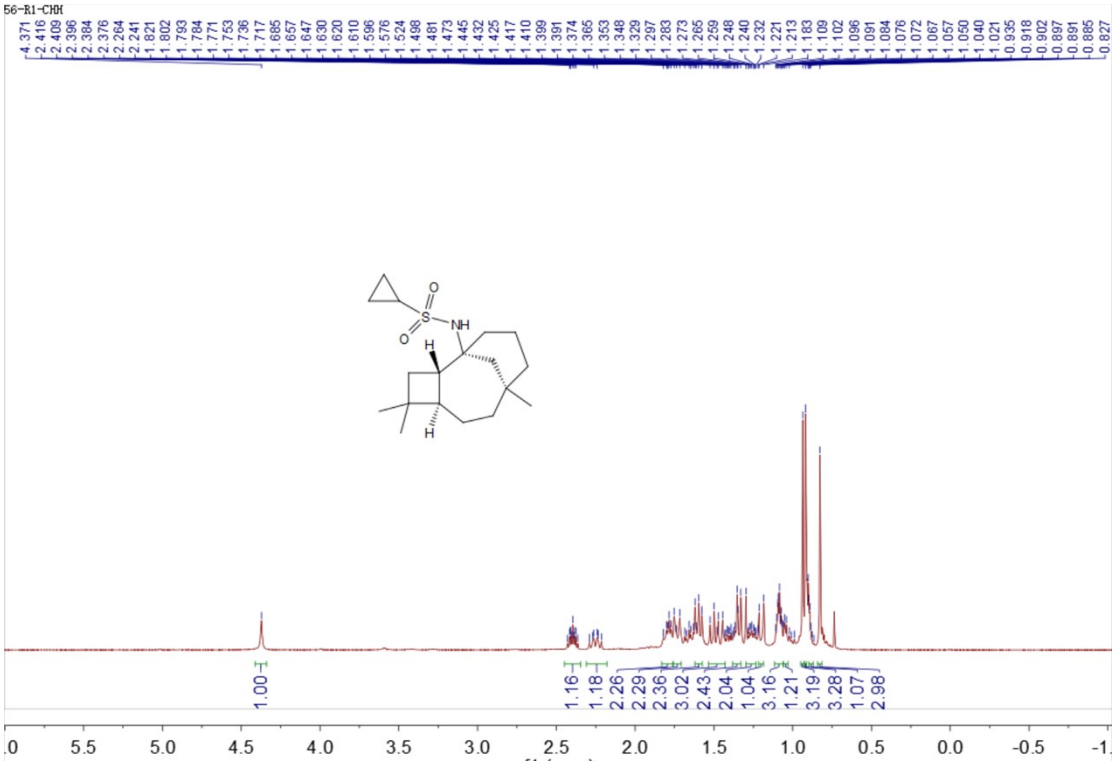

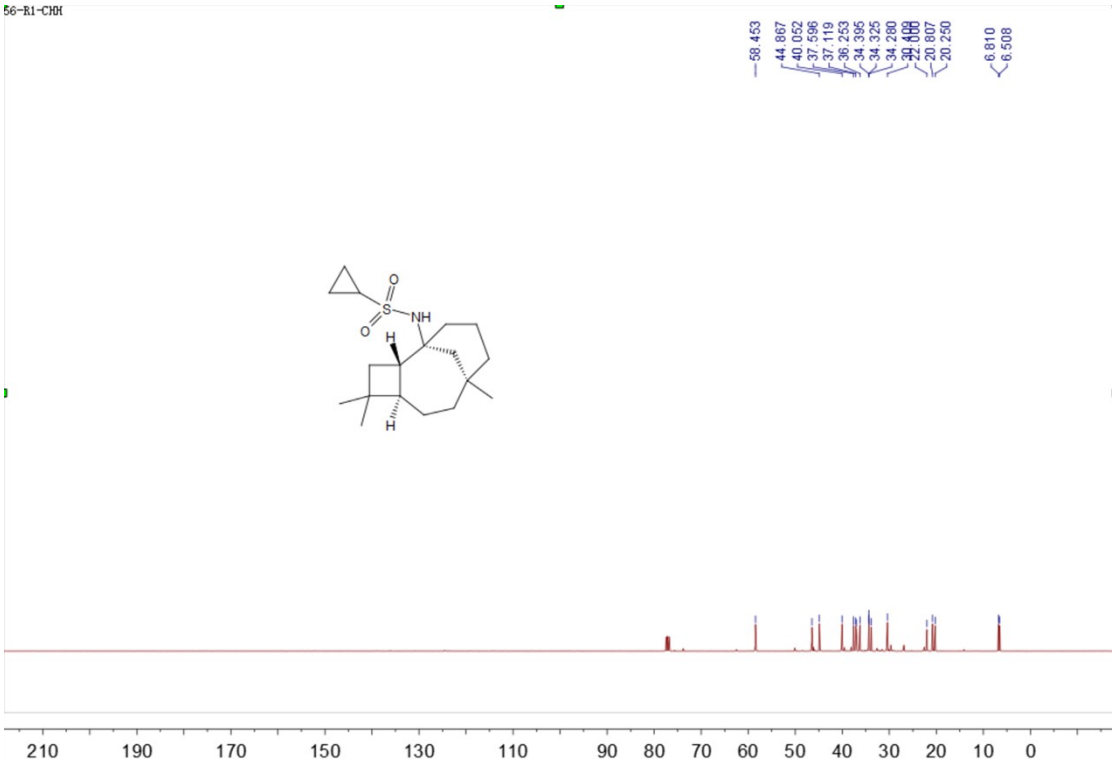

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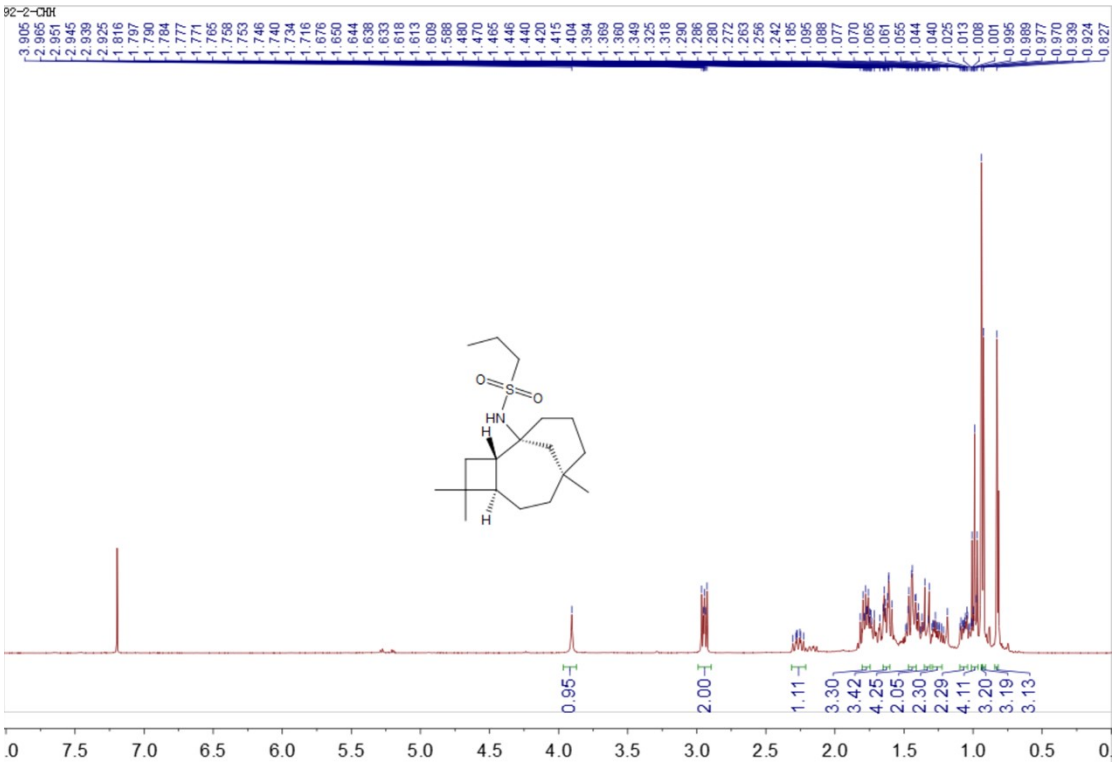

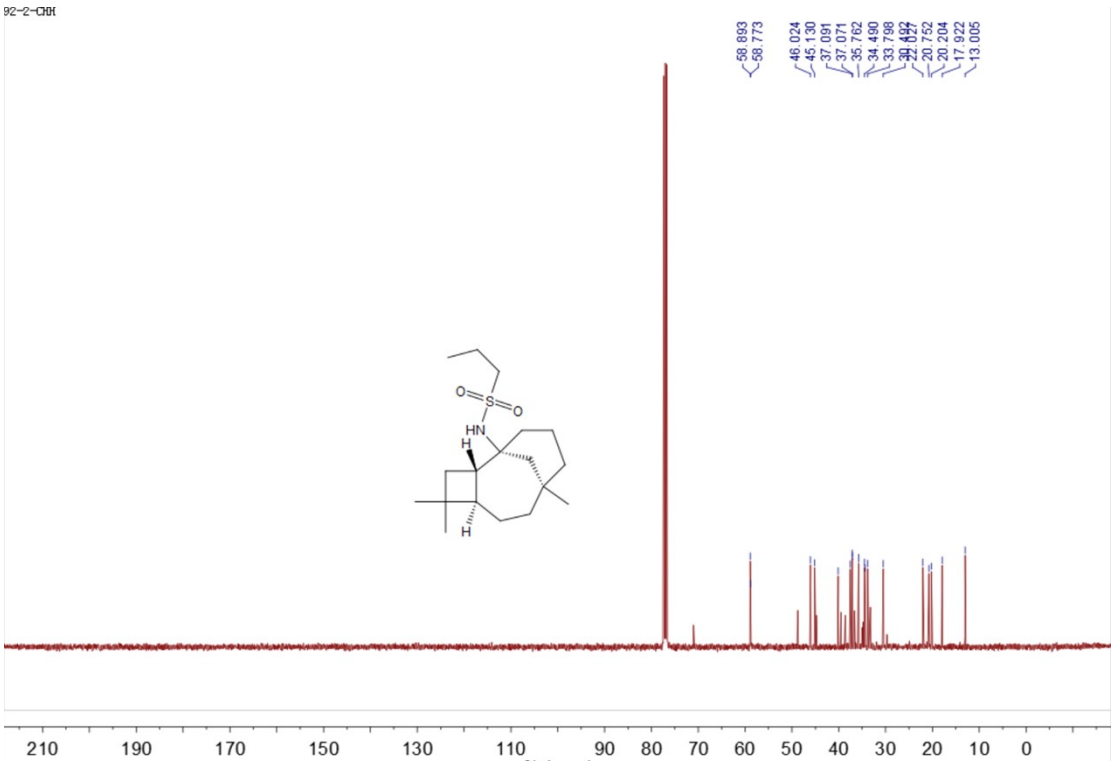

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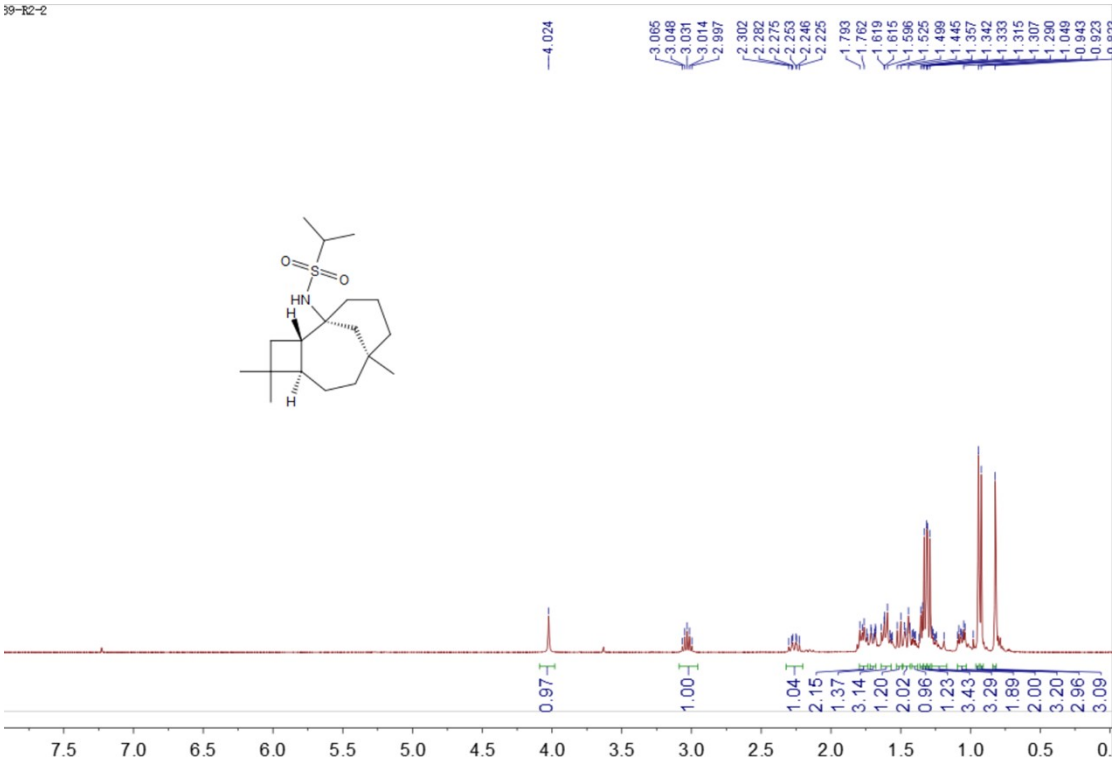

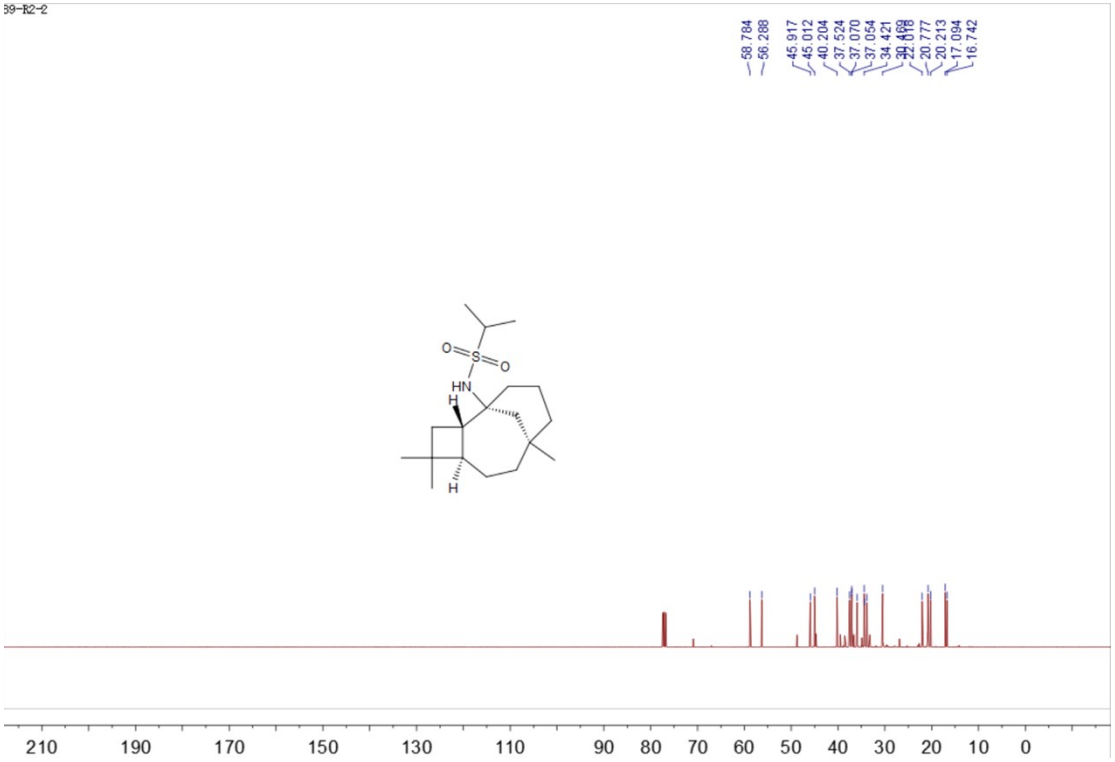

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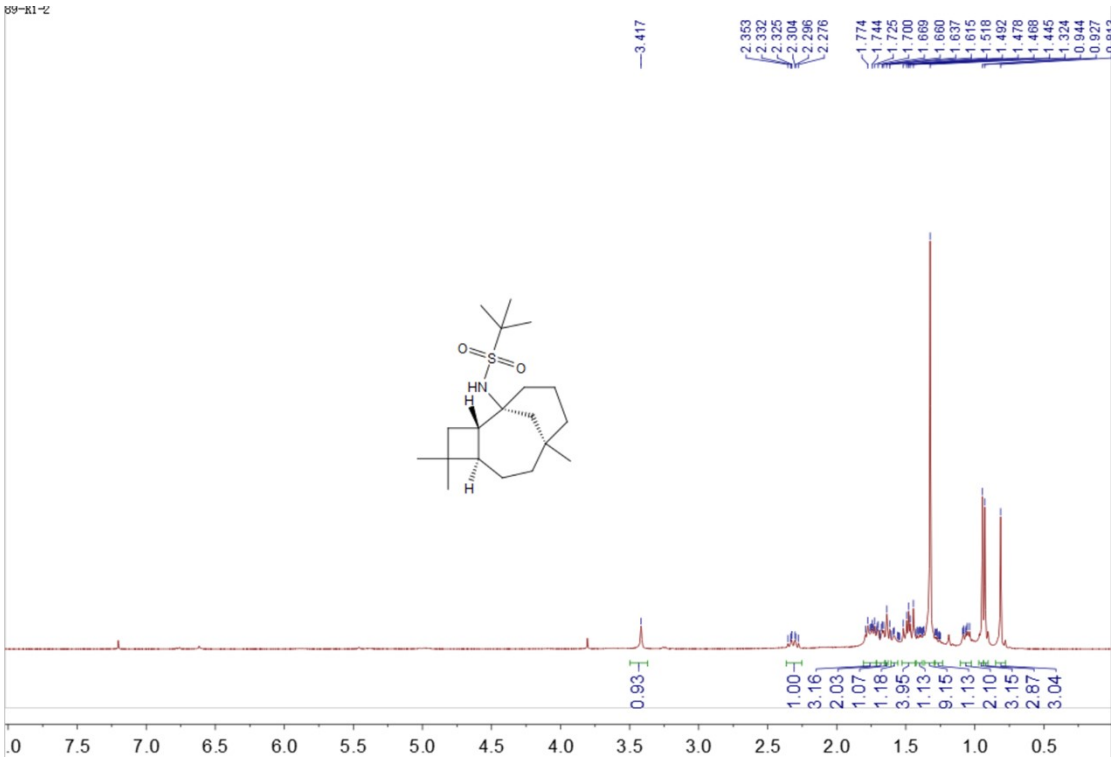
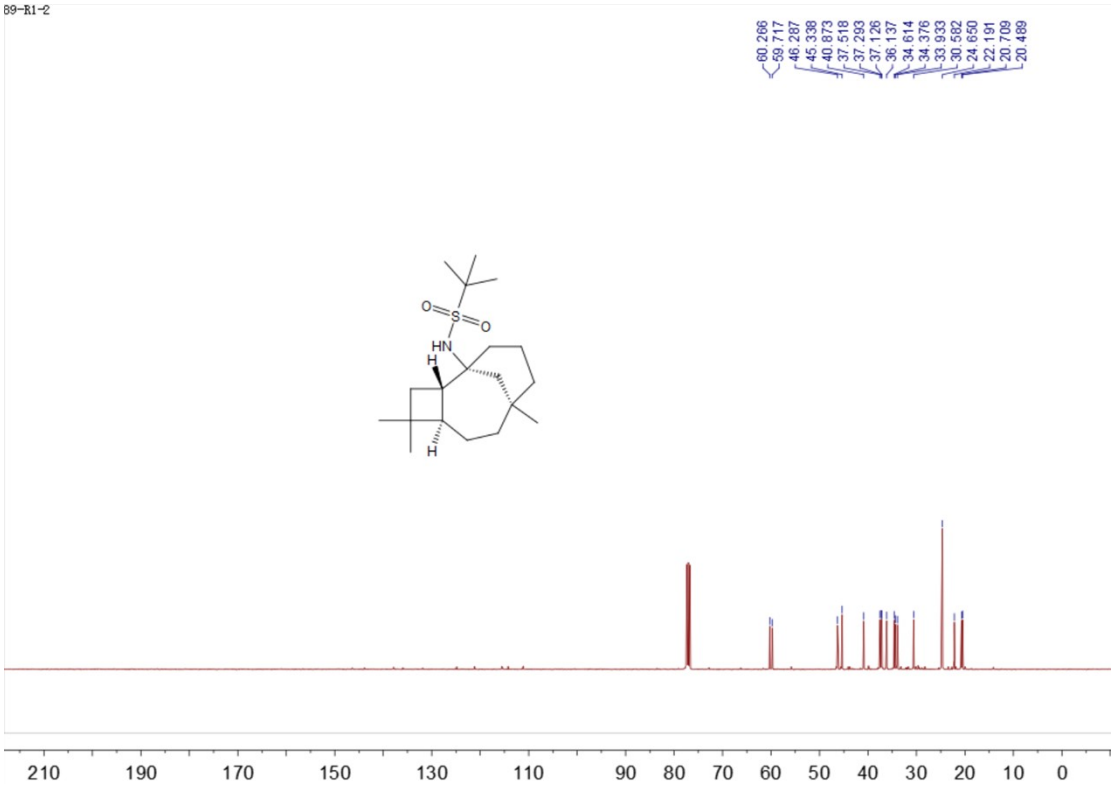
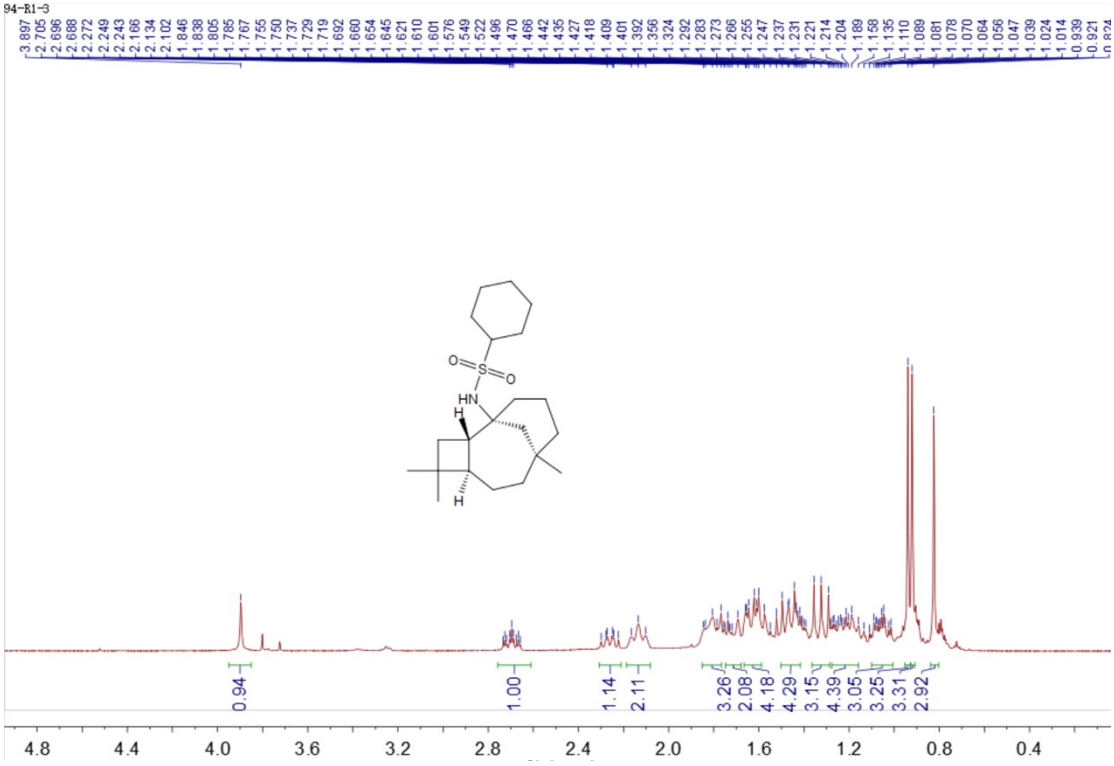
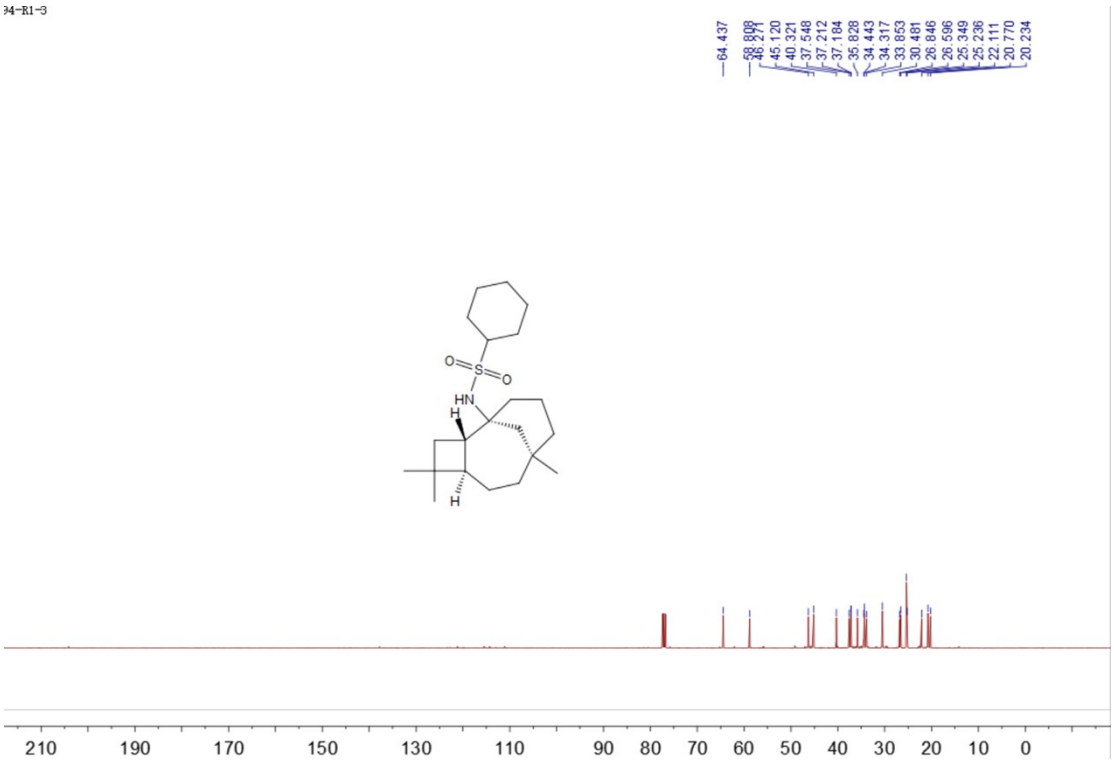




Compound SA-28





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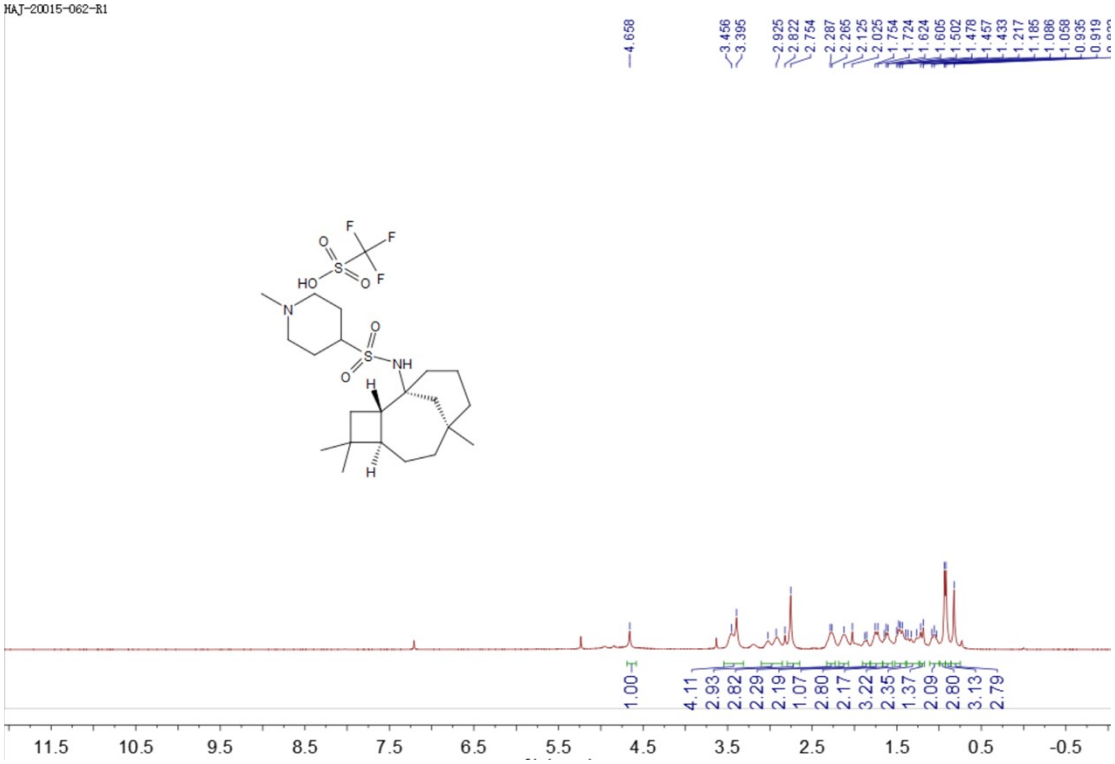
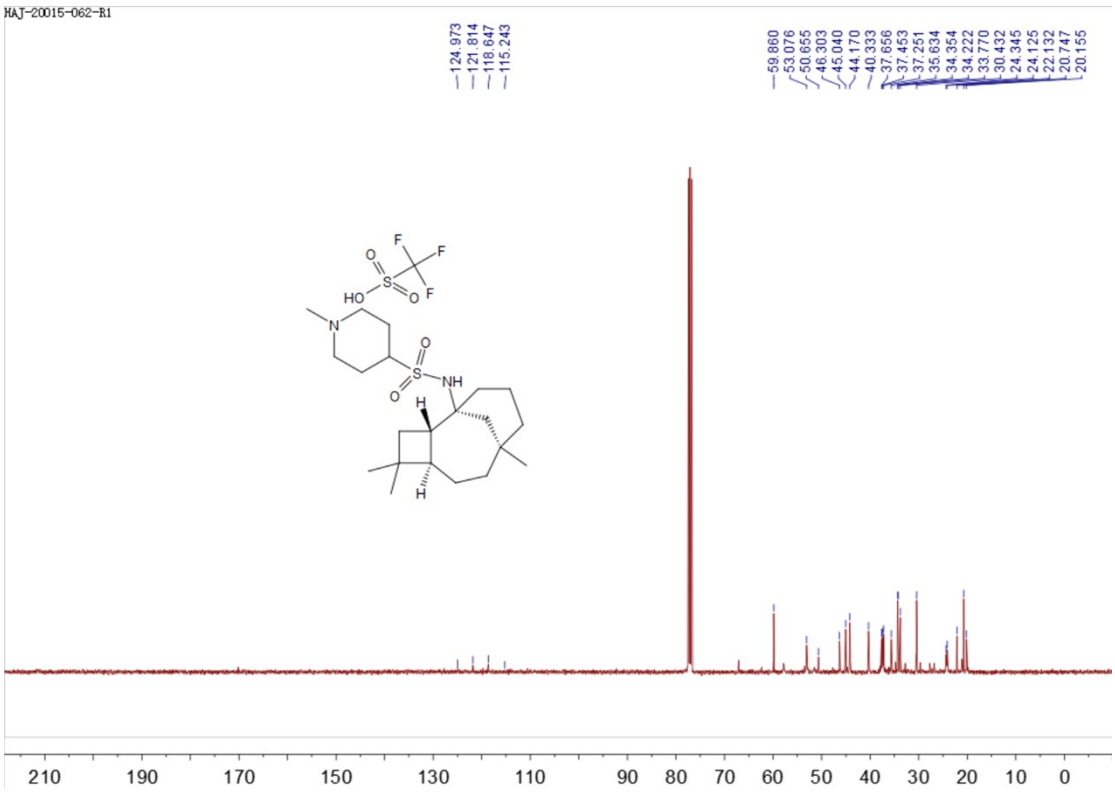
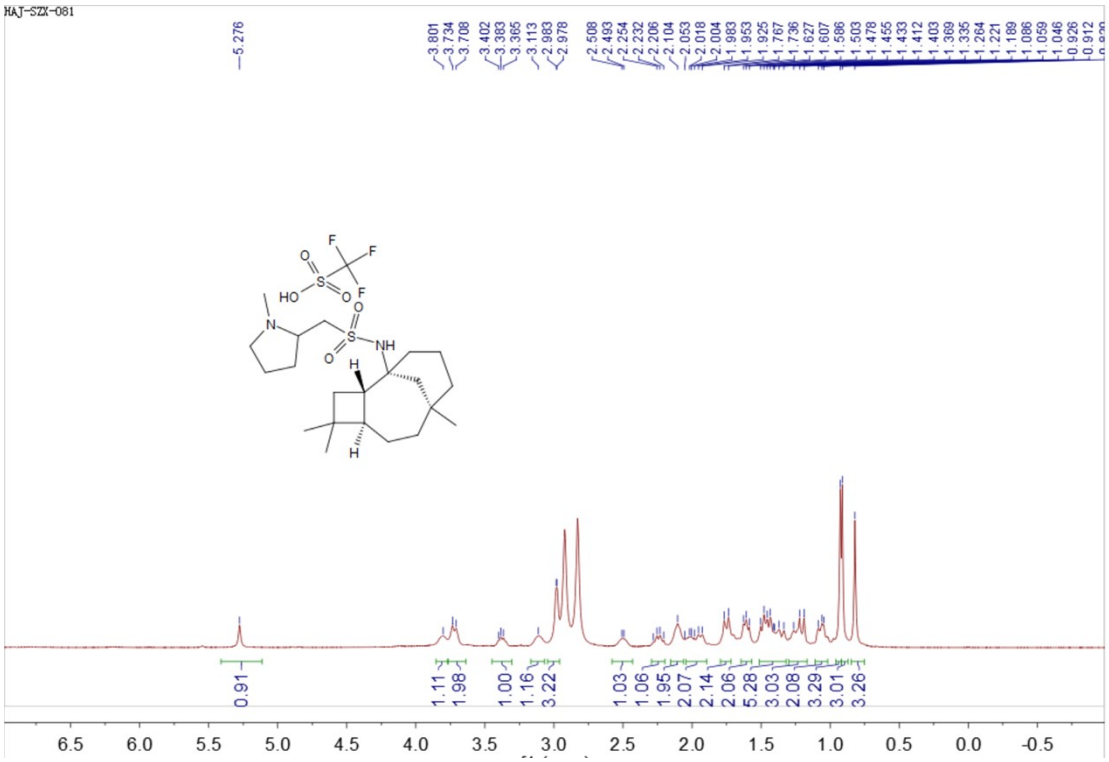
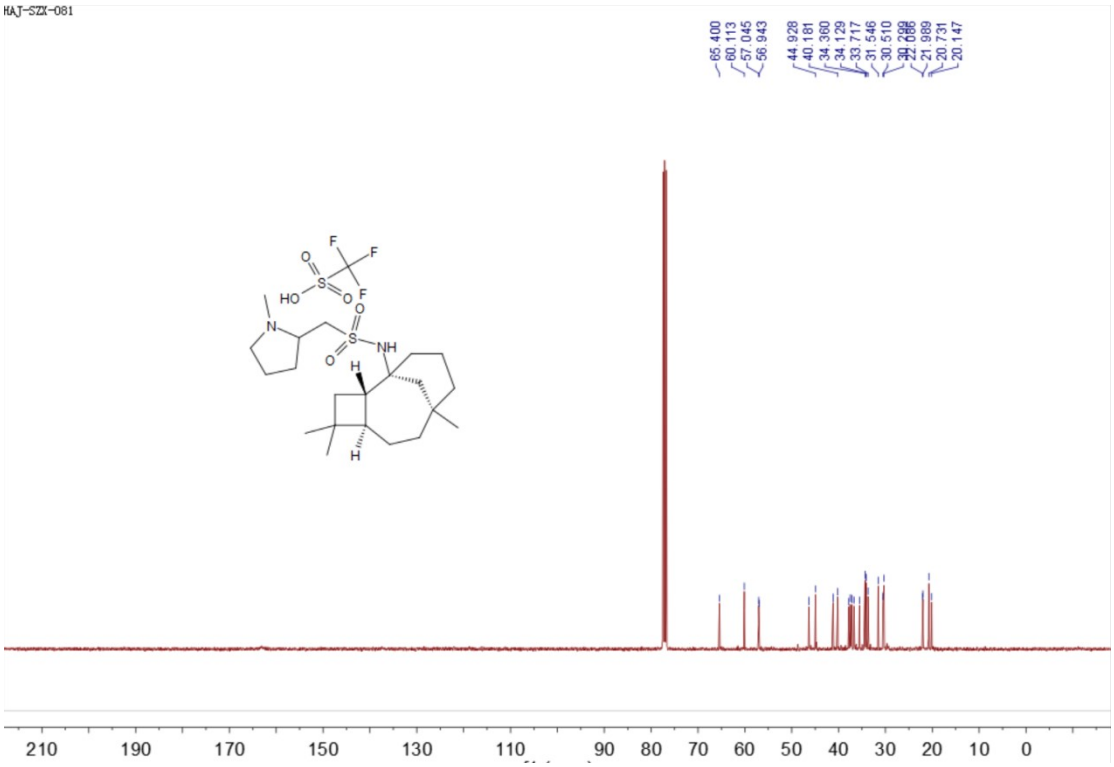


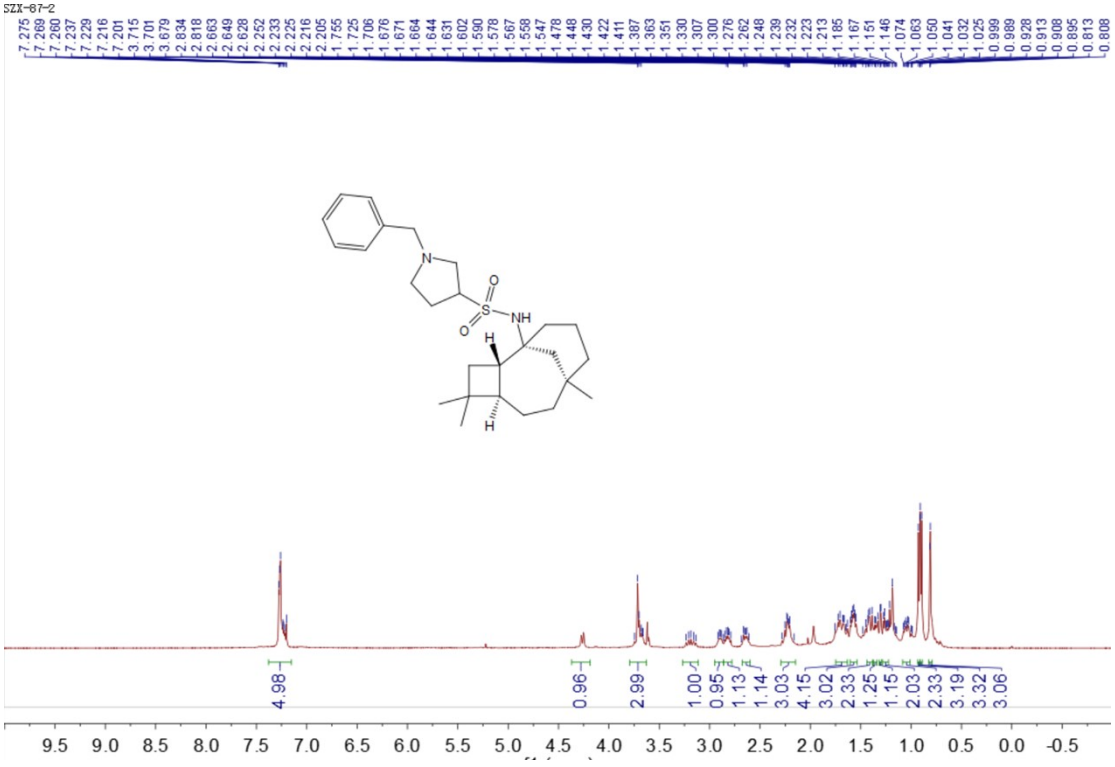


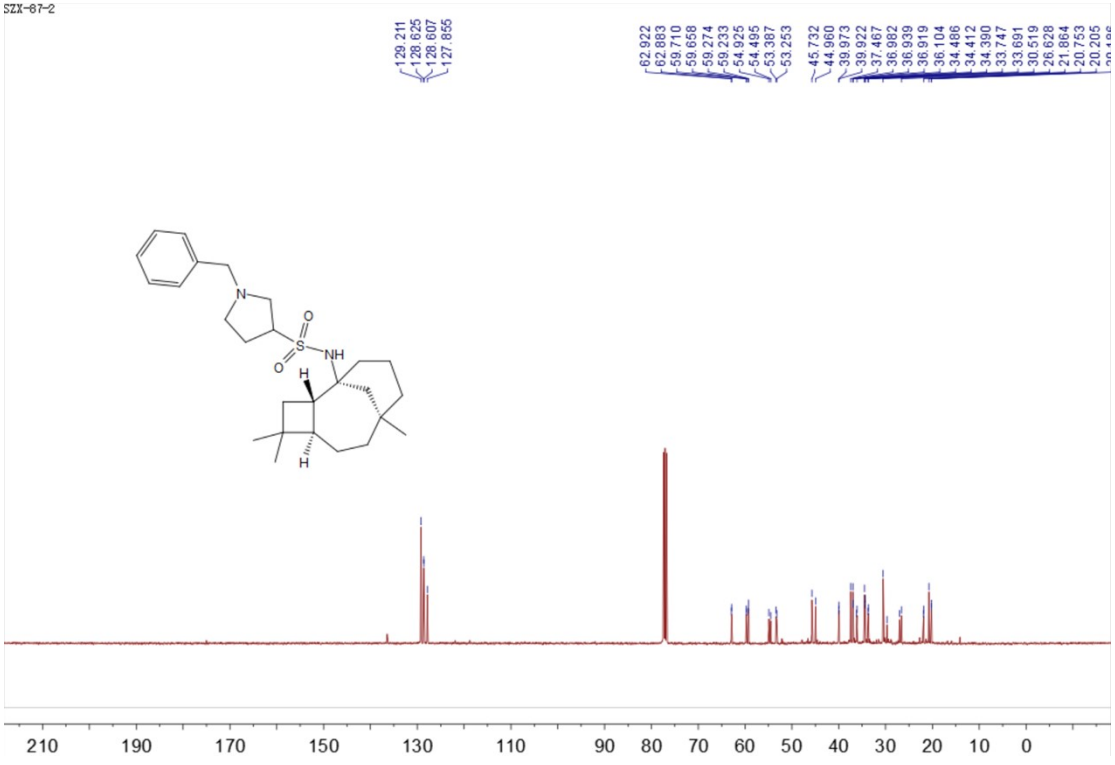
Compound SA-30





Compound SA-31





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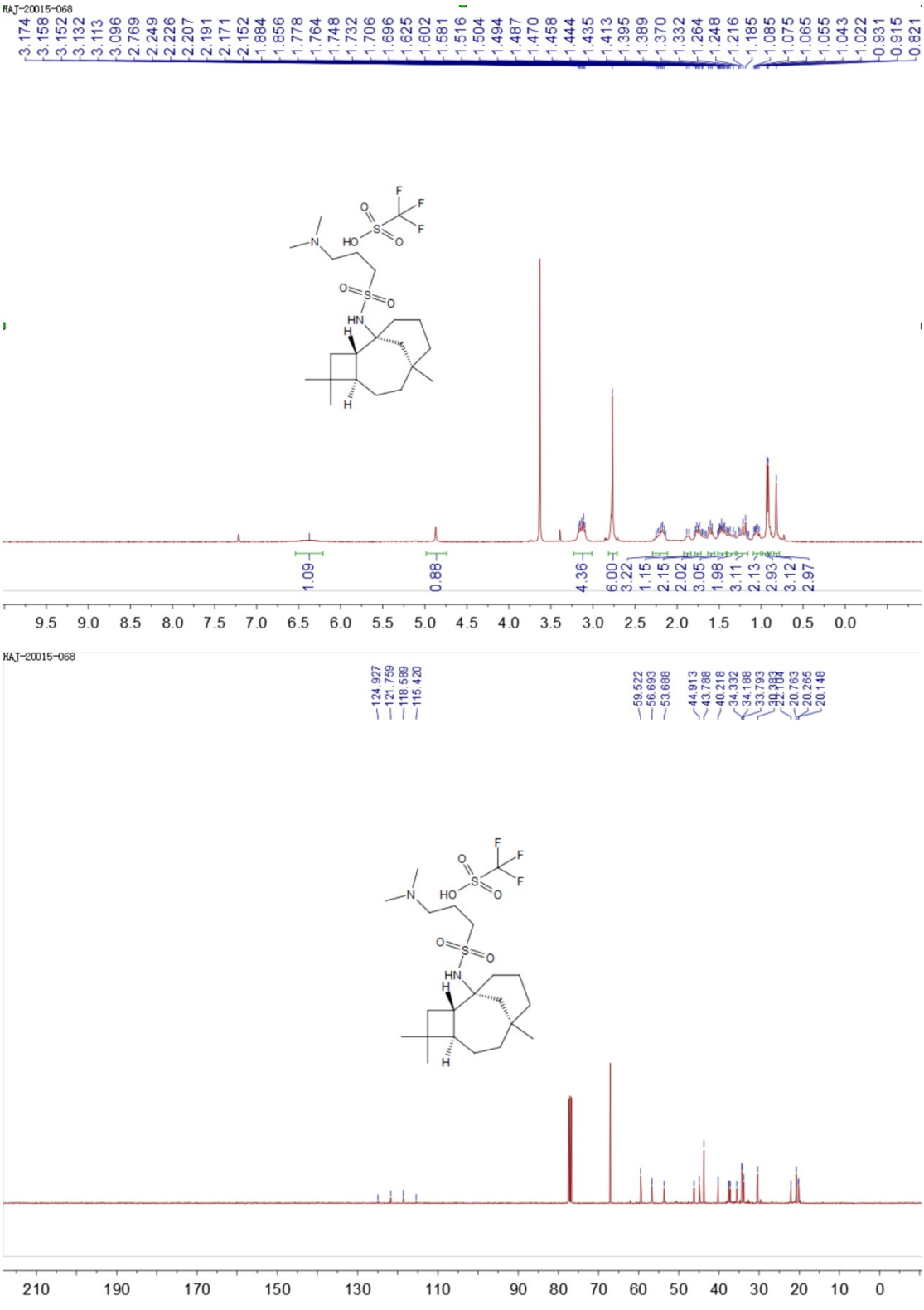

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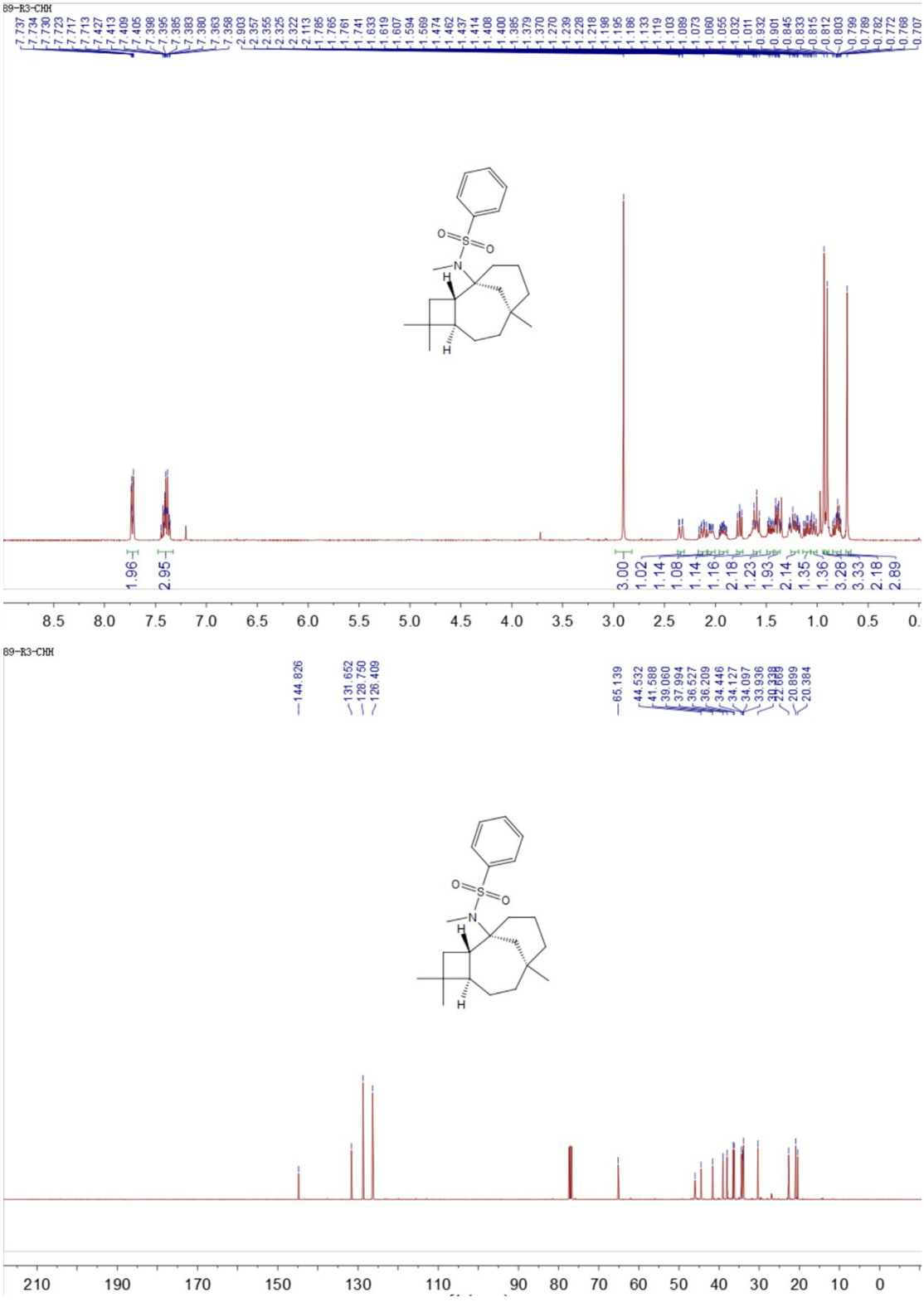
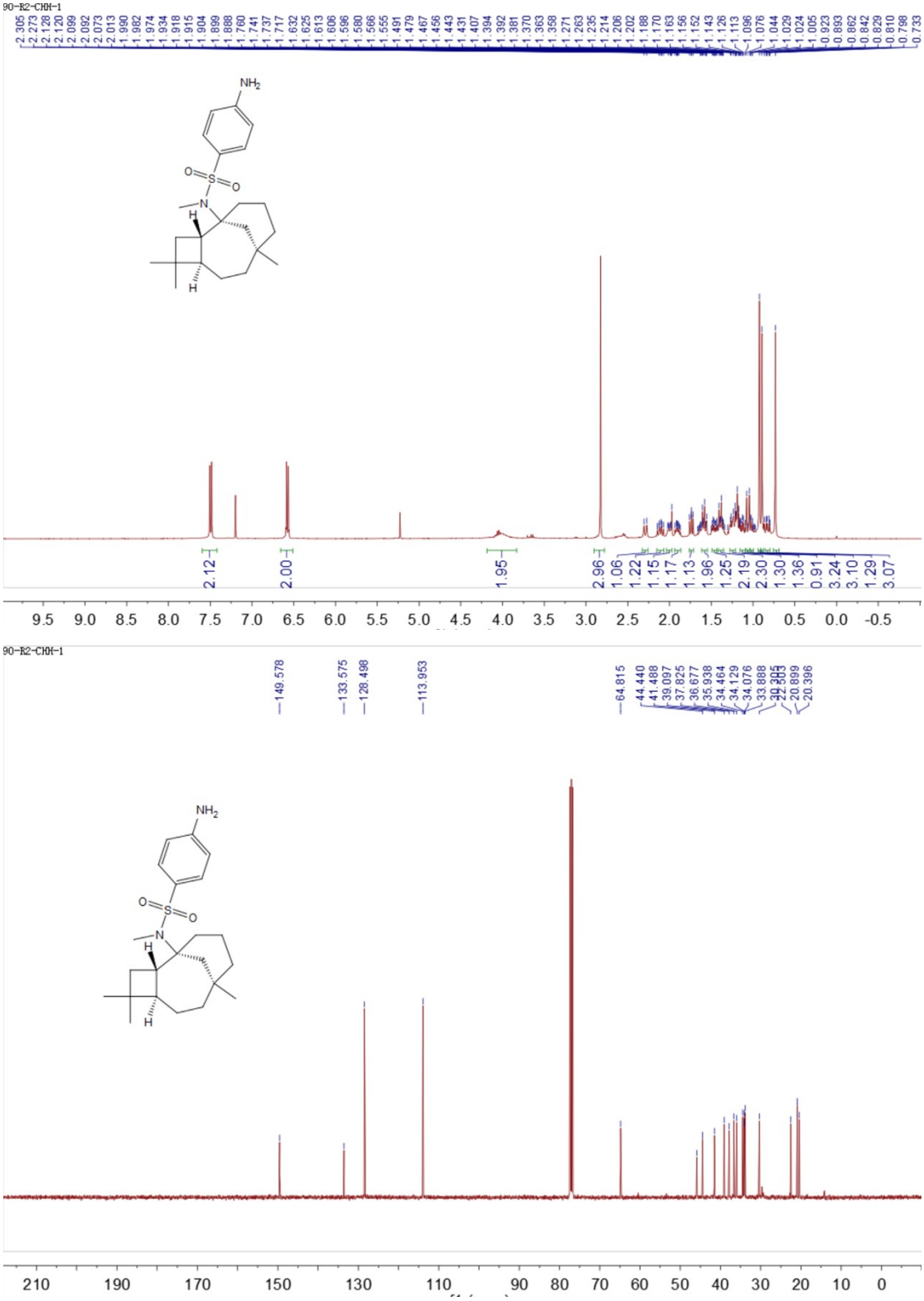
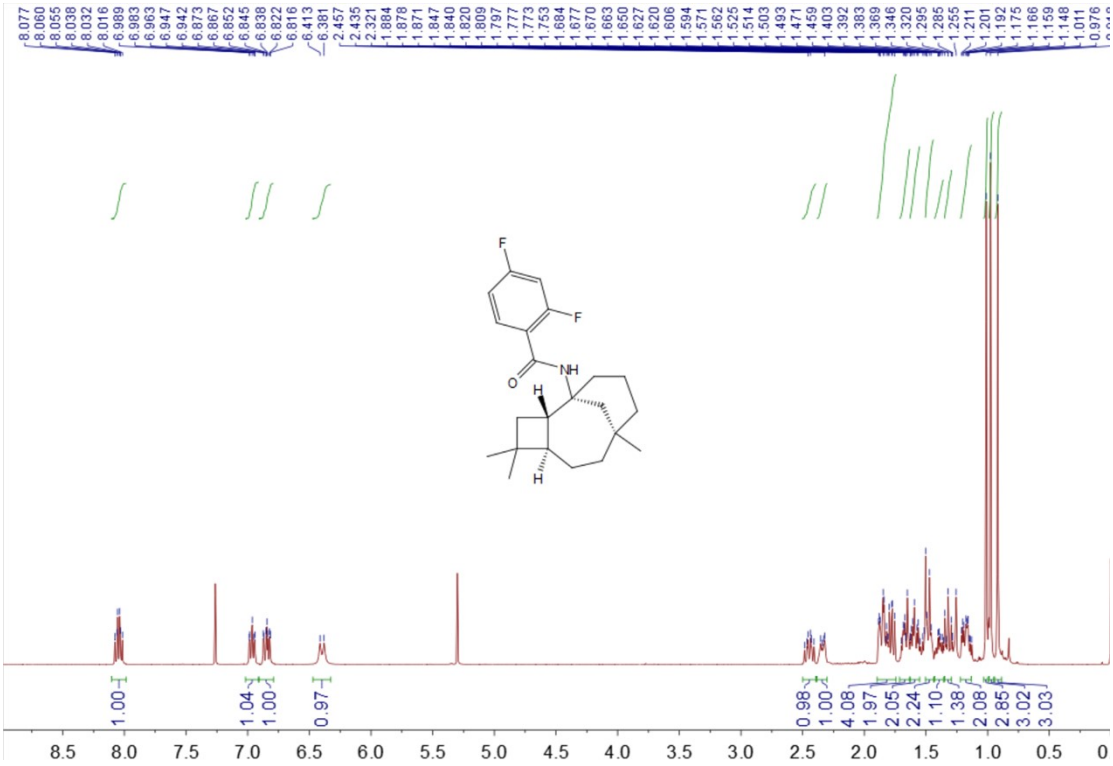
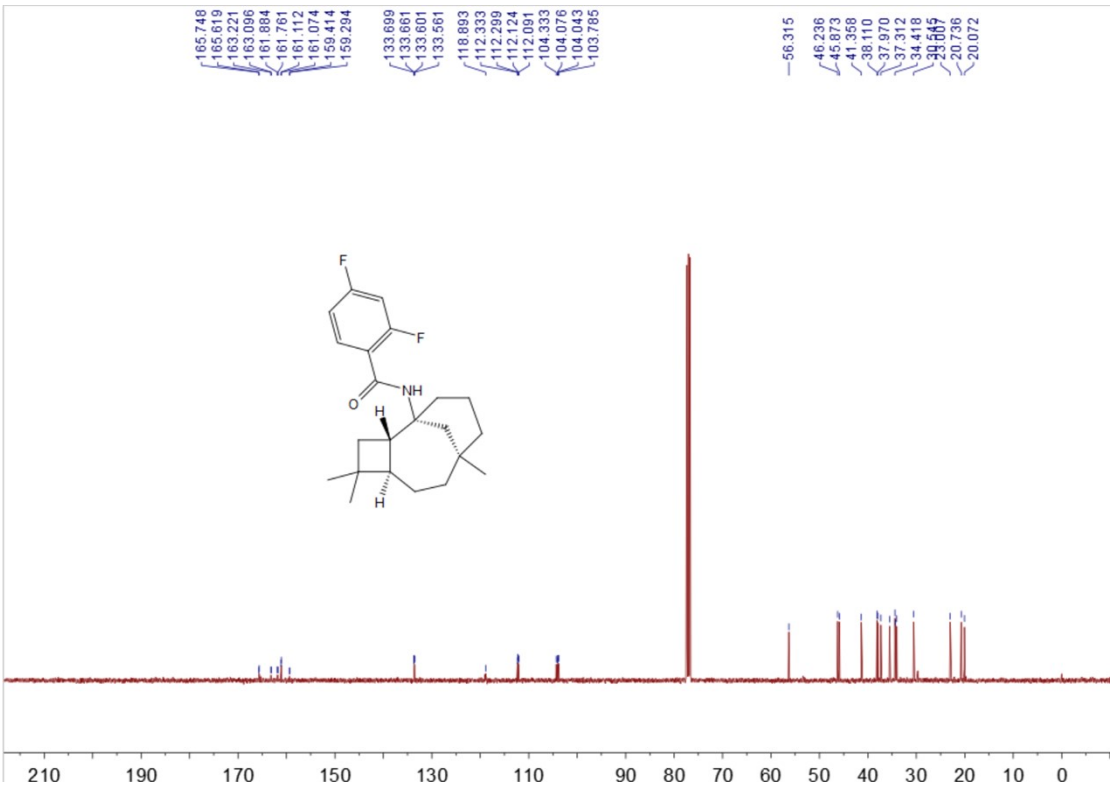


Compound SA-34

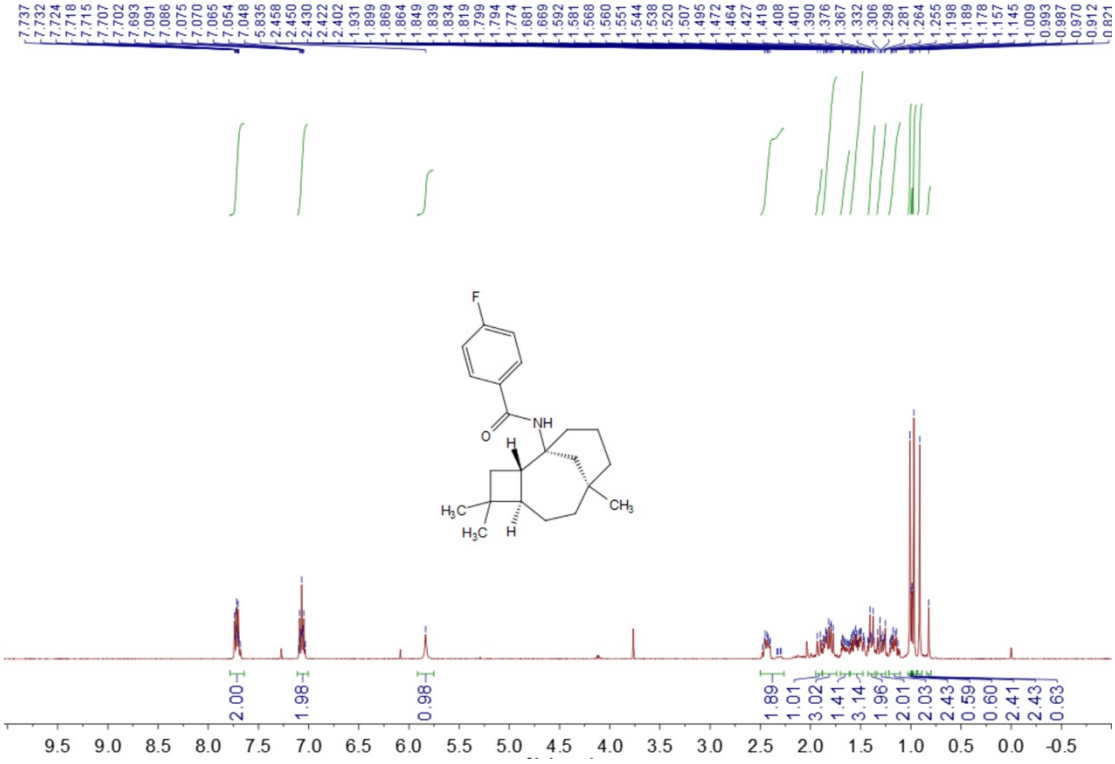


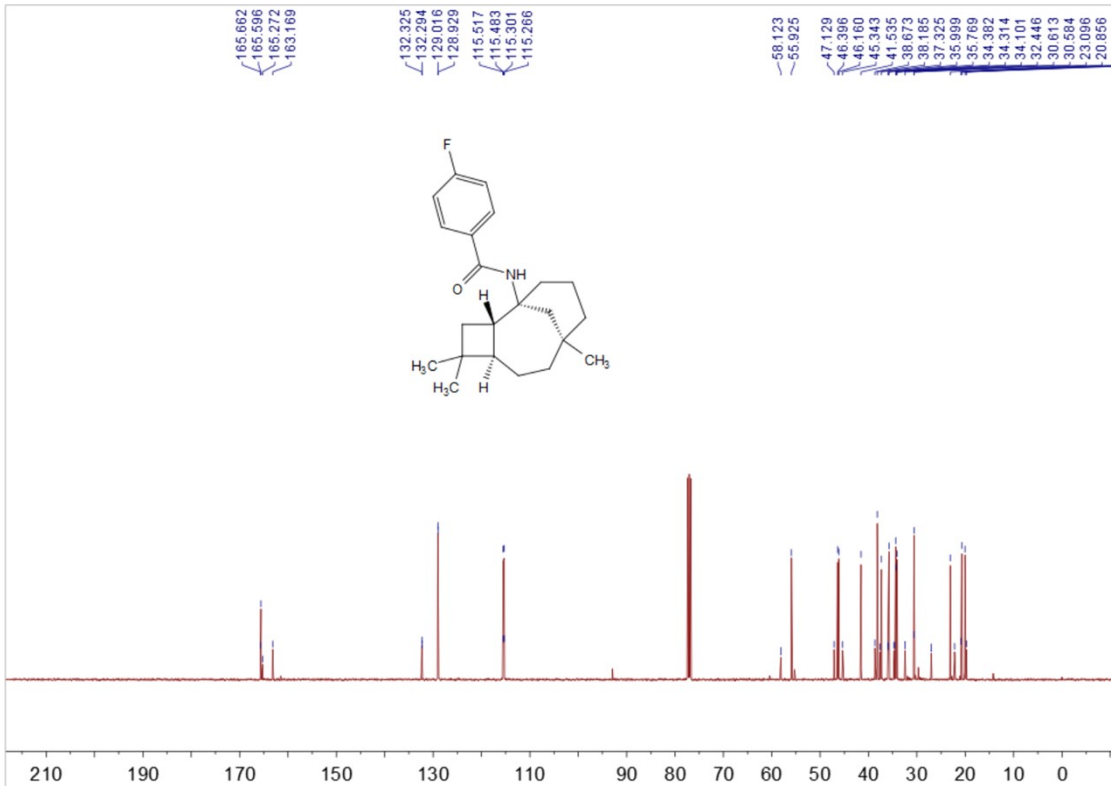
Compound CA-1



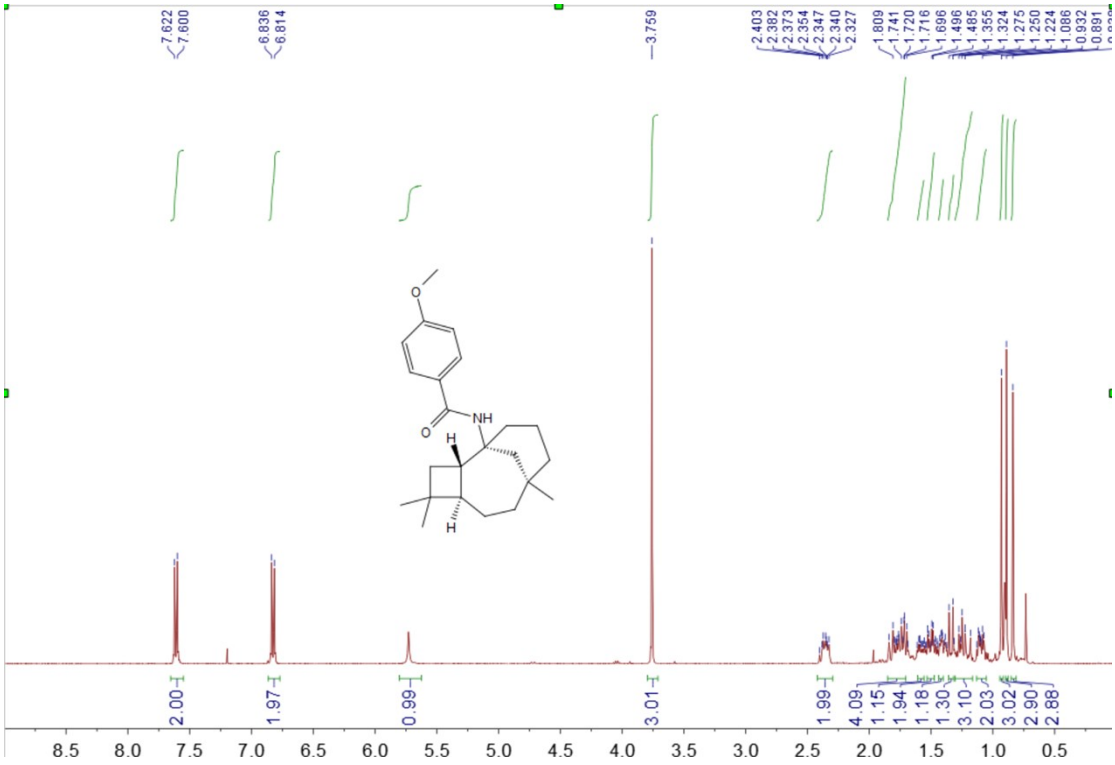


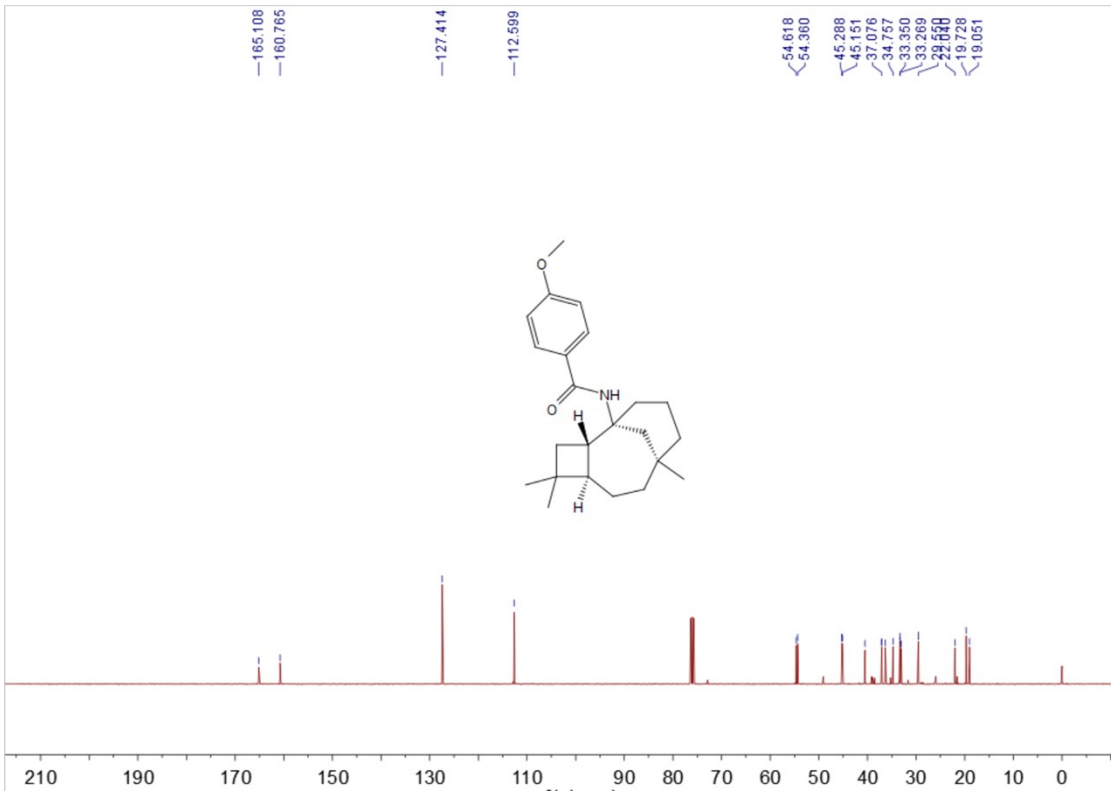
Compound CA-2



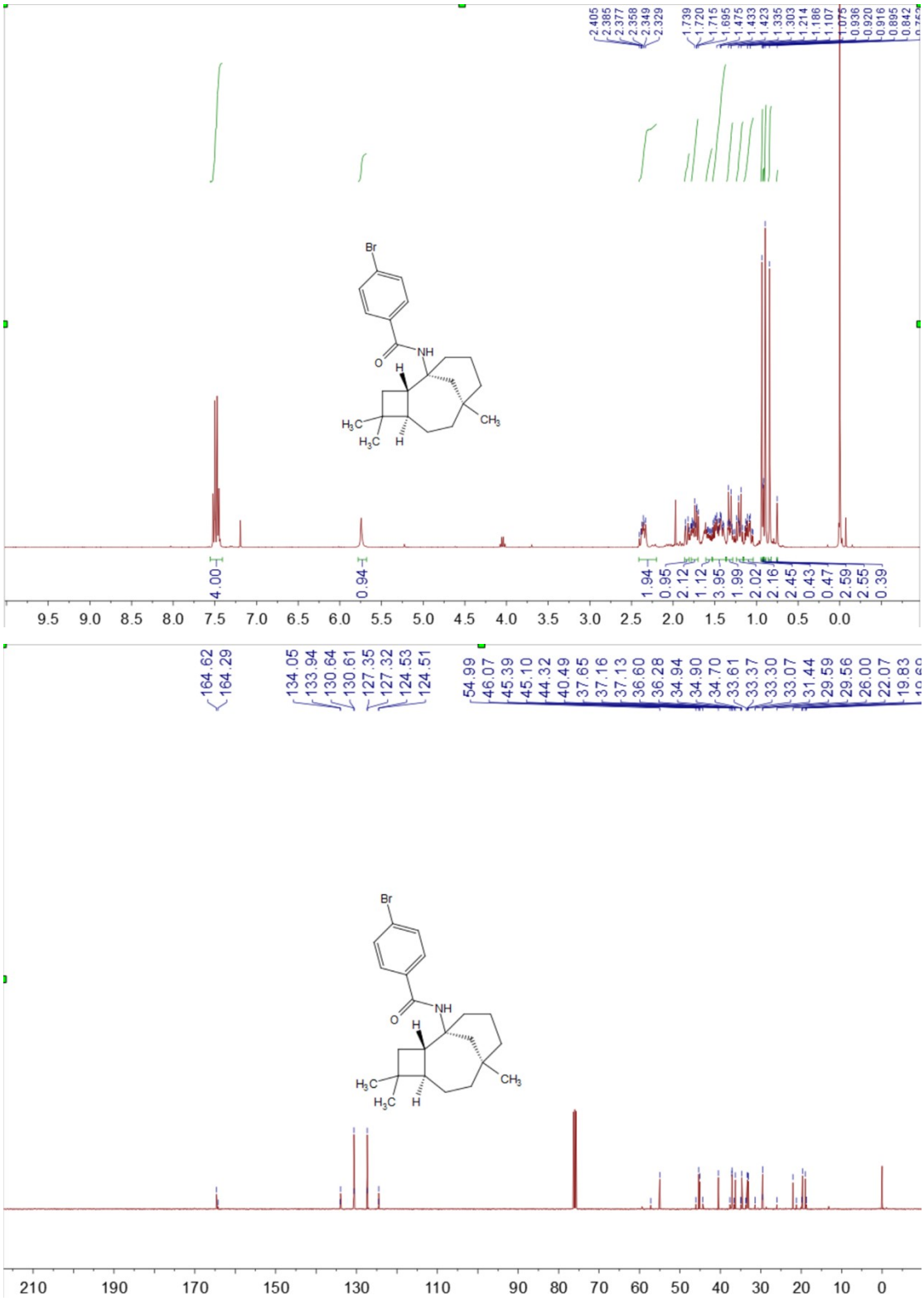


Compound CA-3

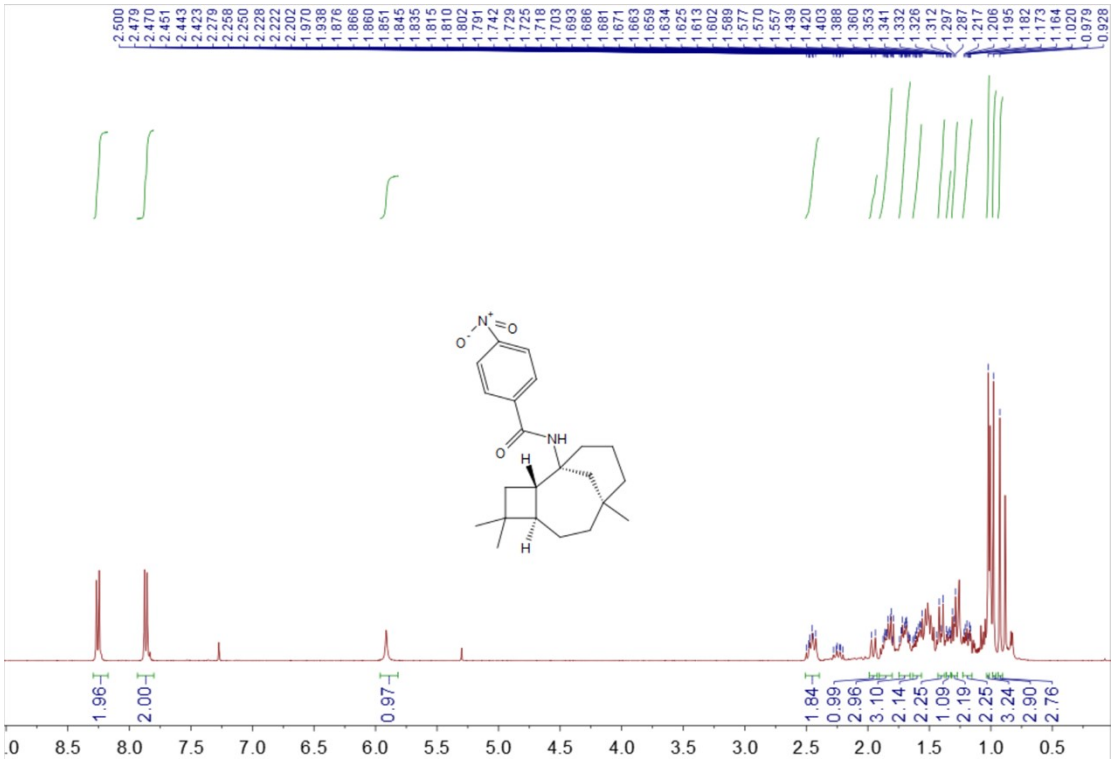


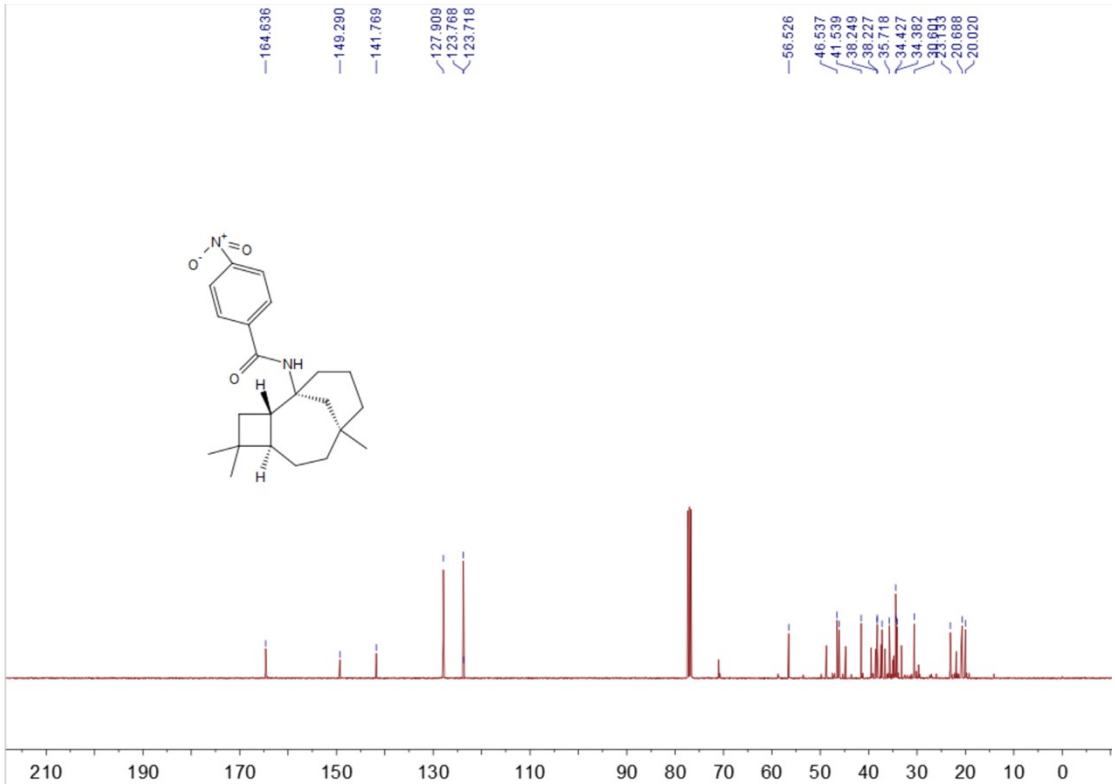


Compound CA-7

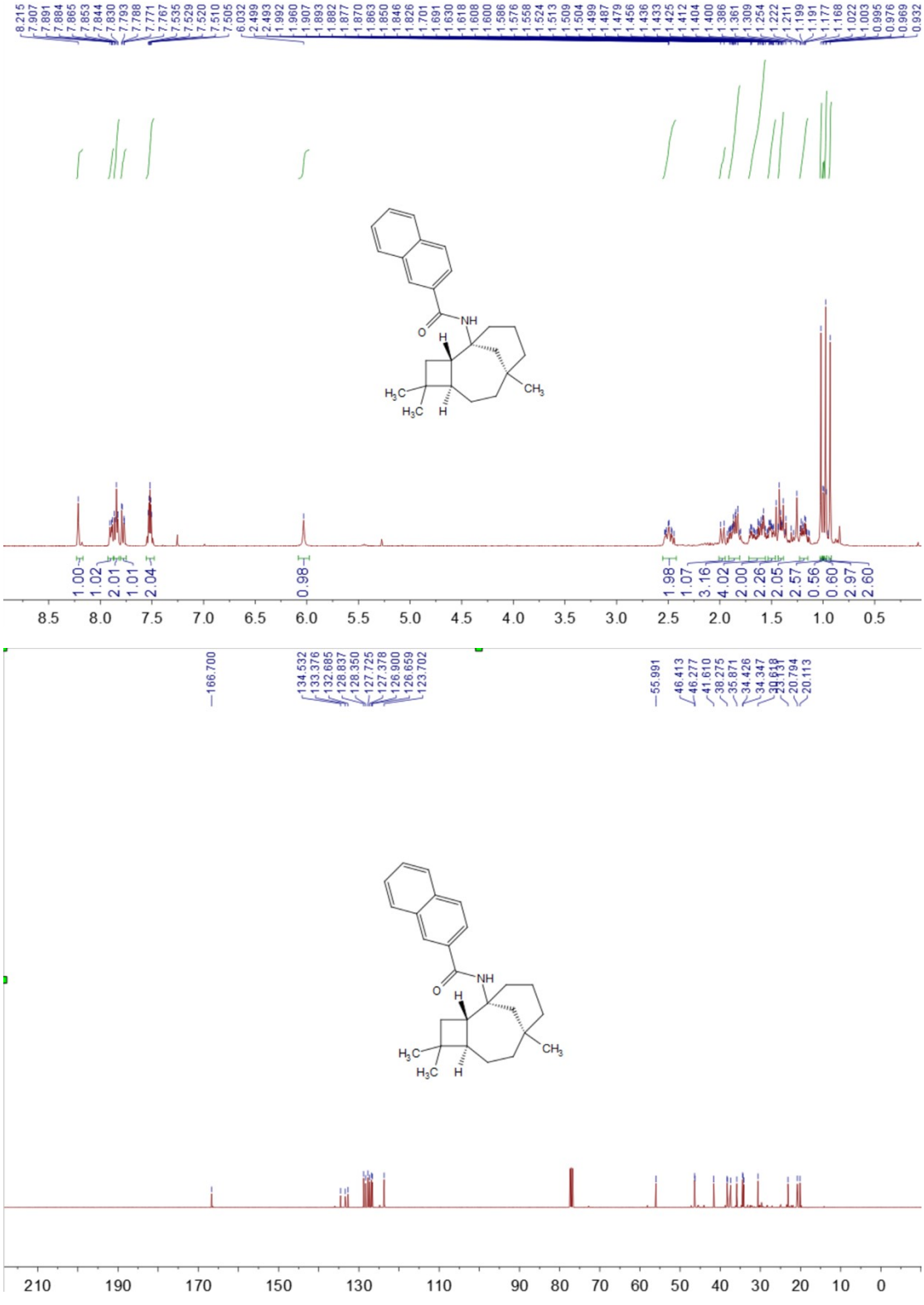


Compound CA-8

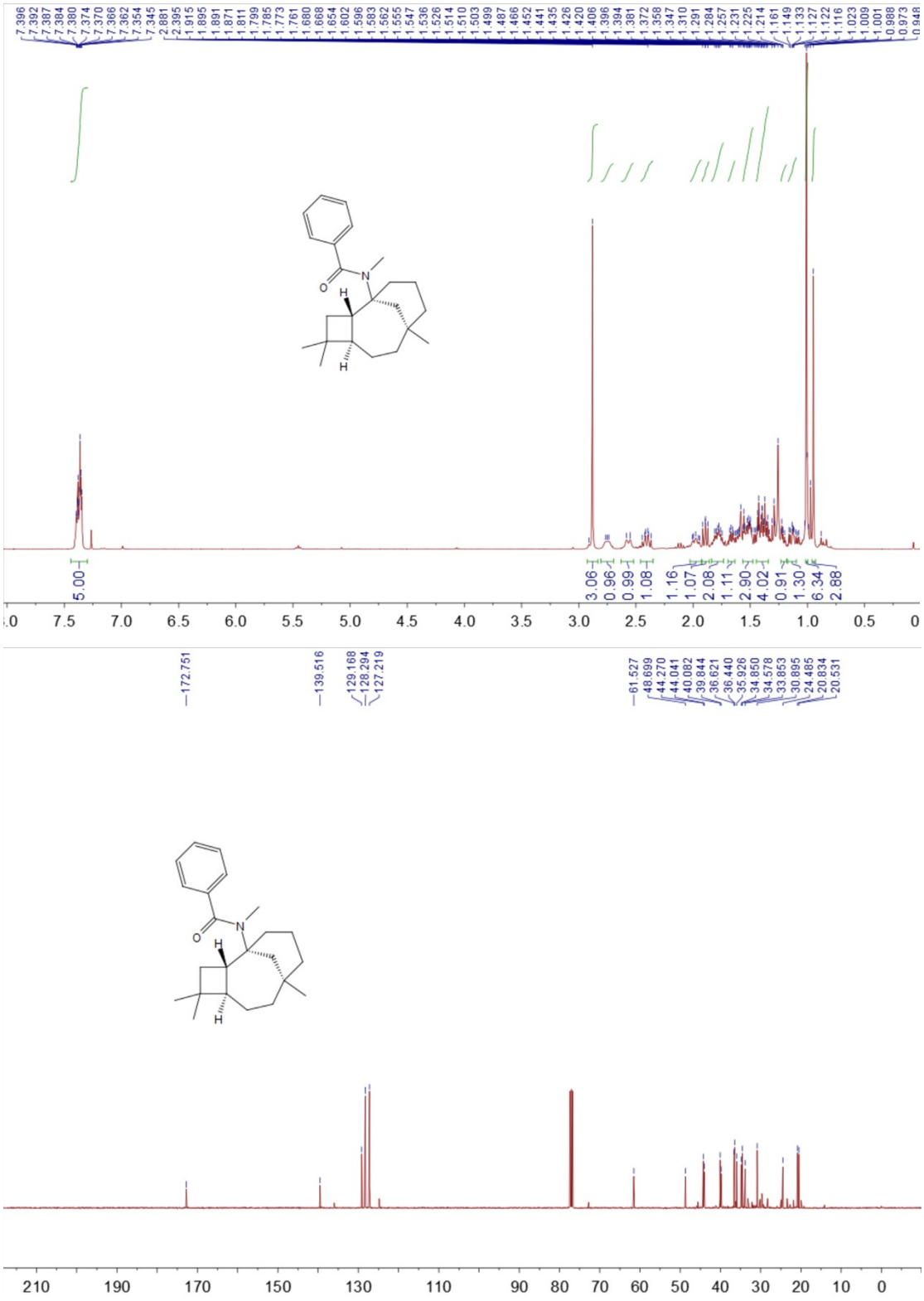




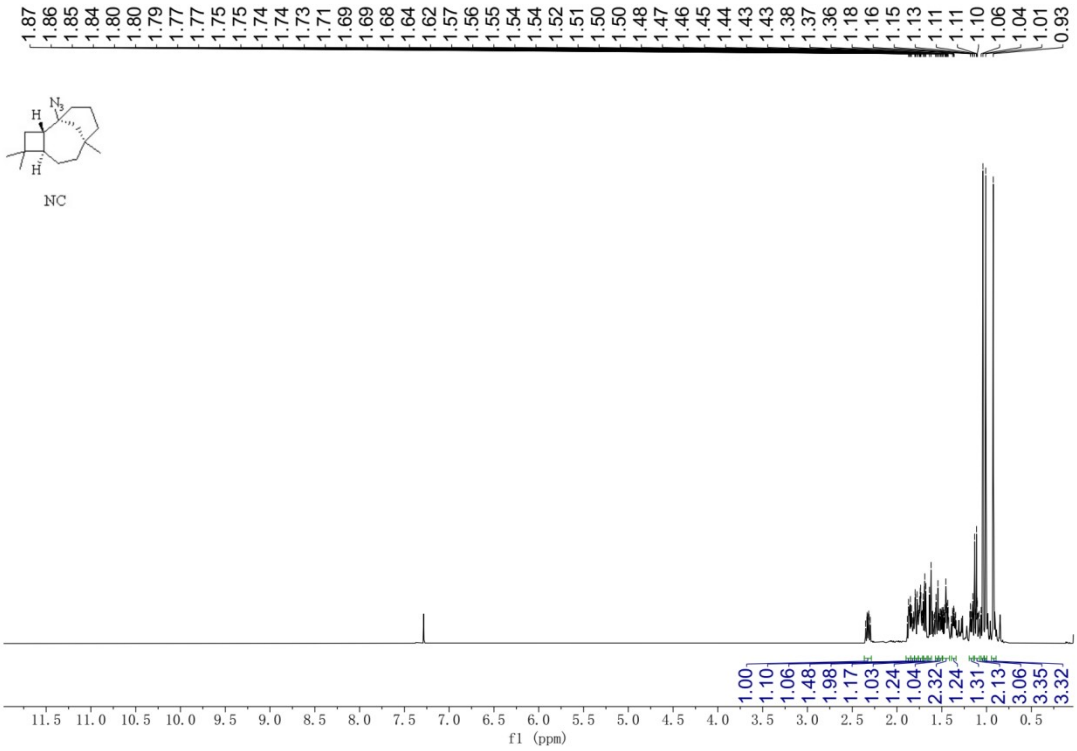
Compound CA-9



Compound CA-11



Compound NC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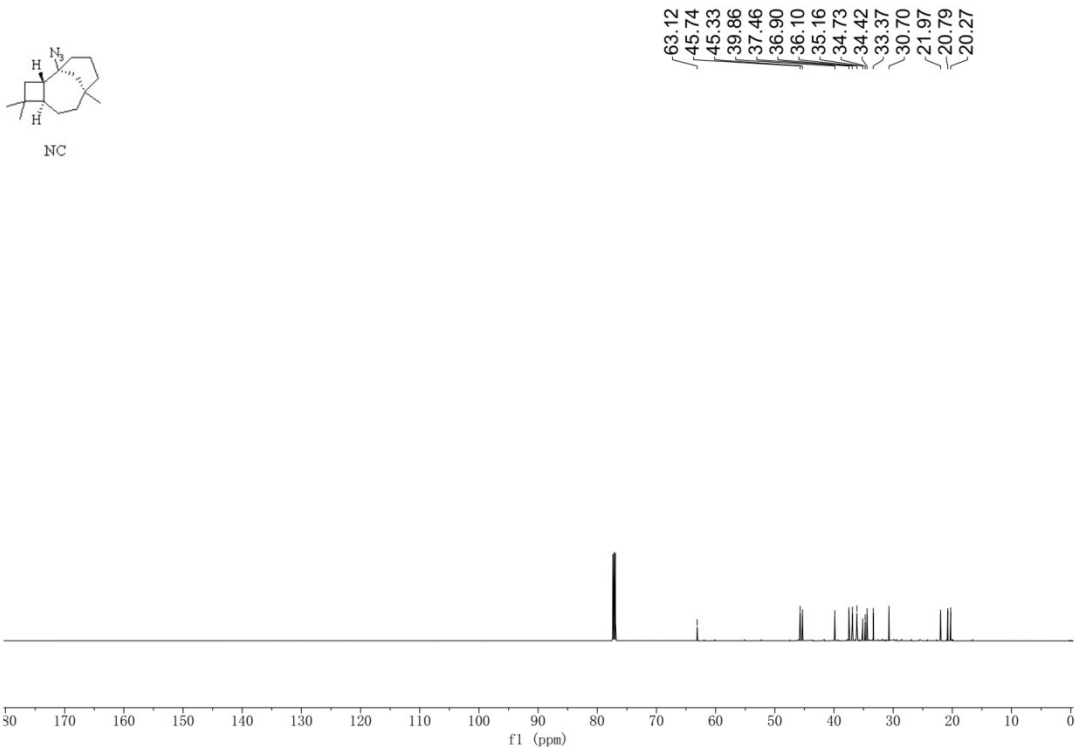
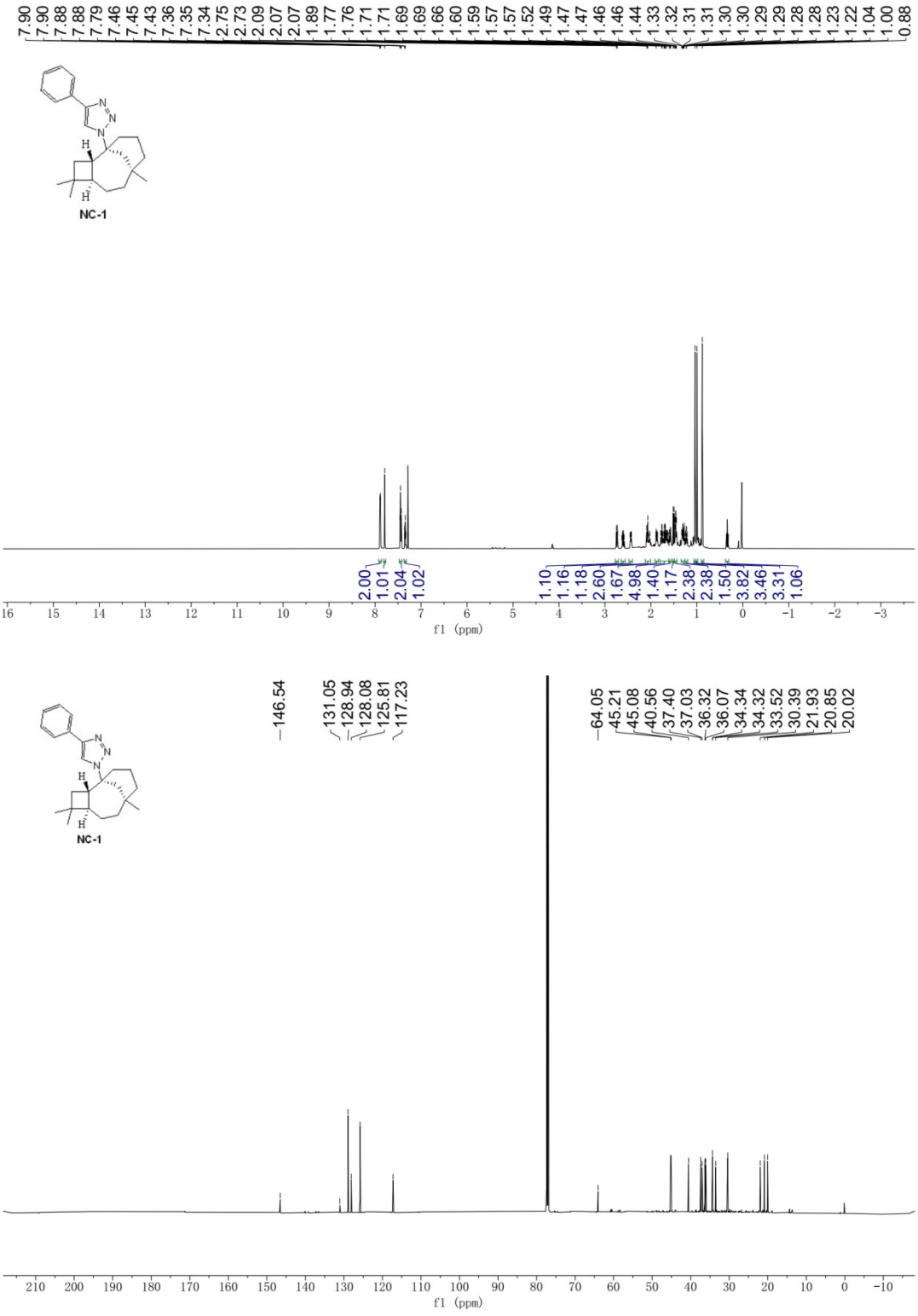

63.12 45.74 45.33 39.86 37.46 36.90 36.10 35.16 34.73 34.42 33.37 30.70 21.97 20.79 20.27
NC
f1 (ppm)

Compound NC-1



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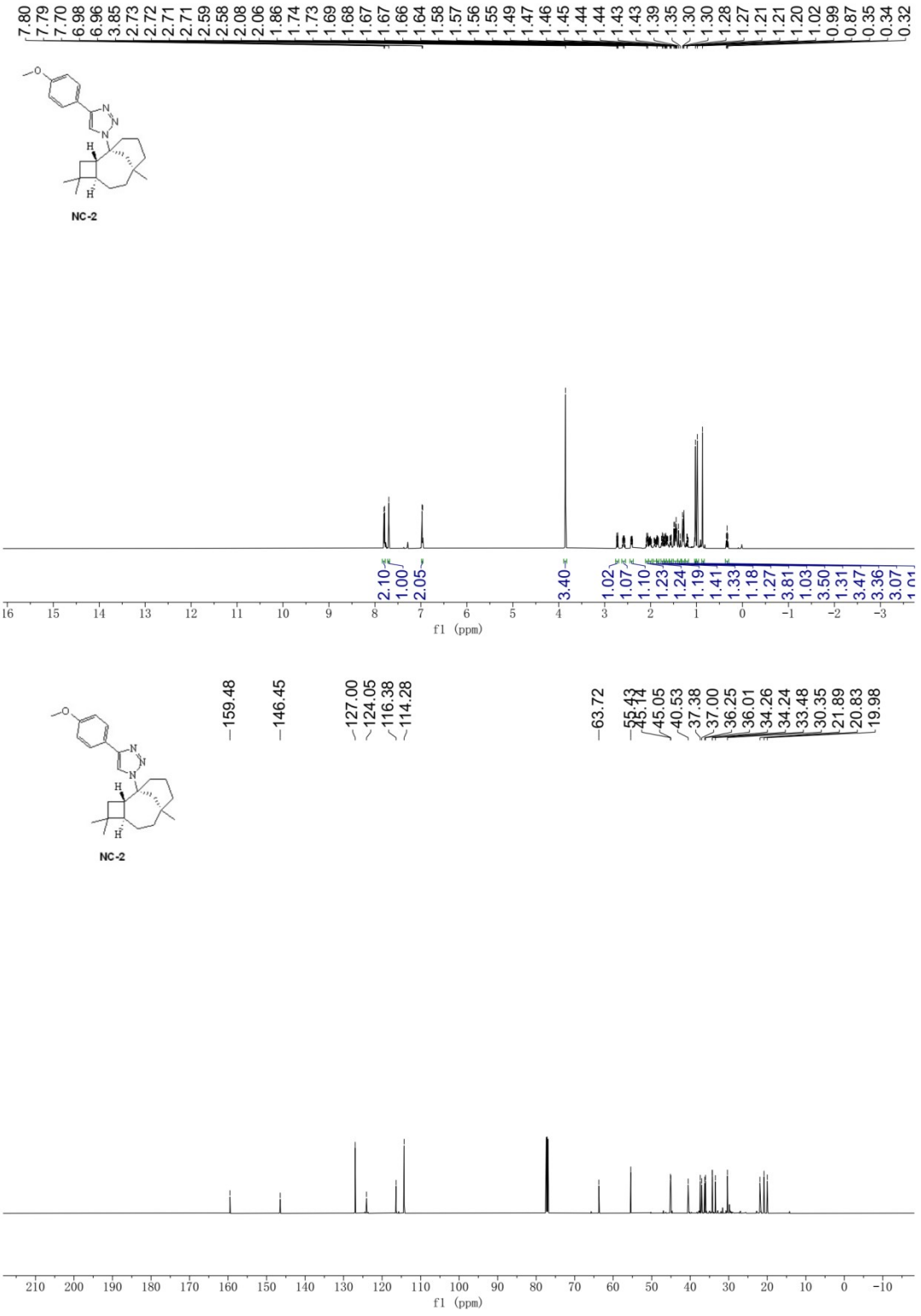

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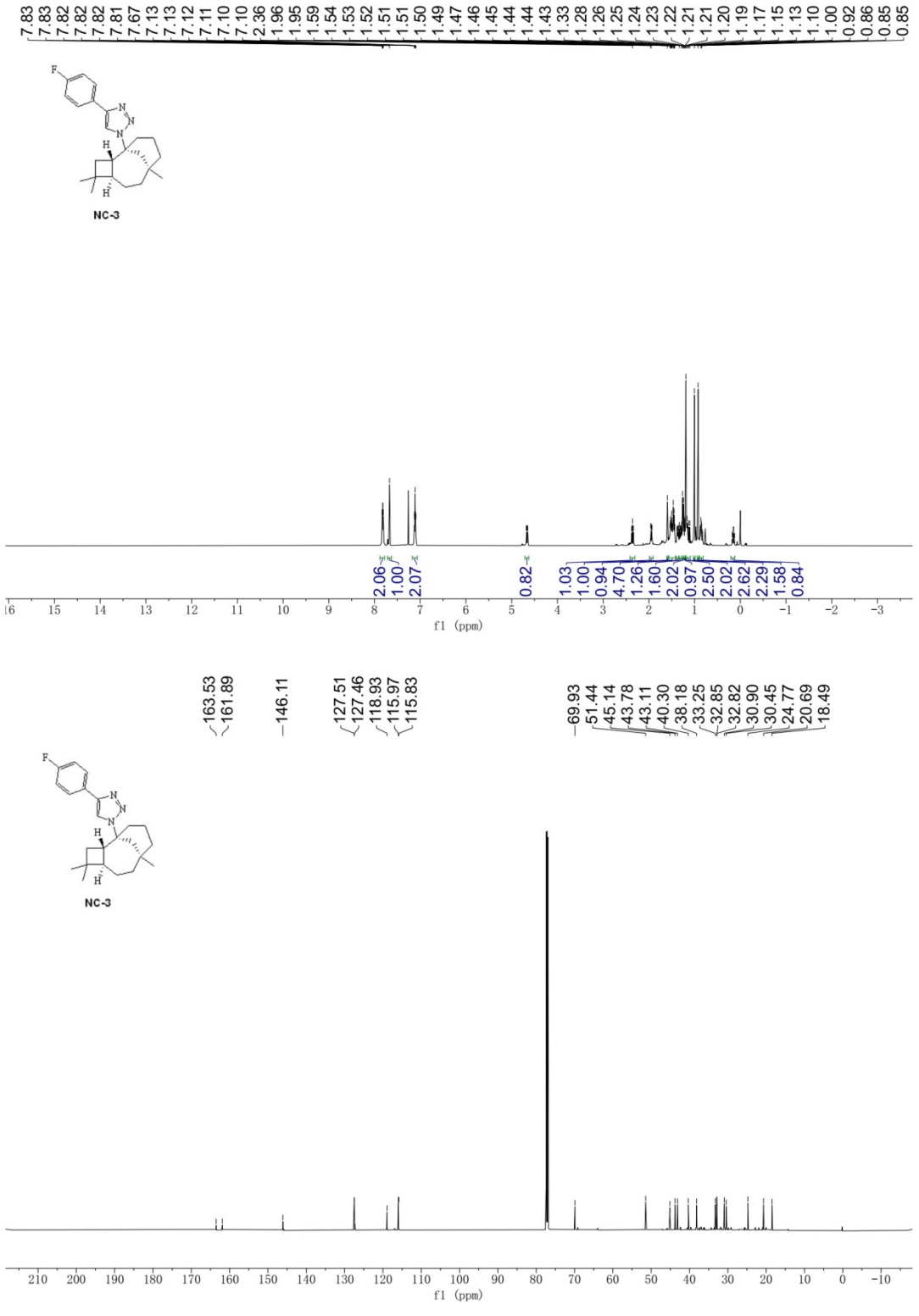

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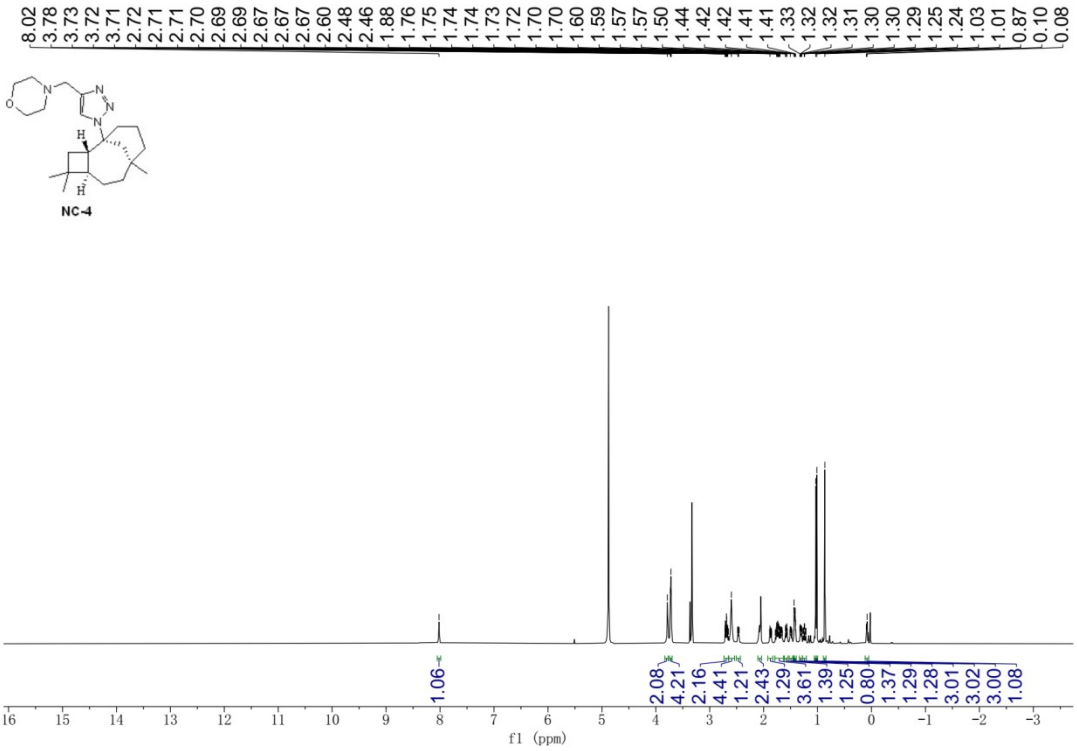

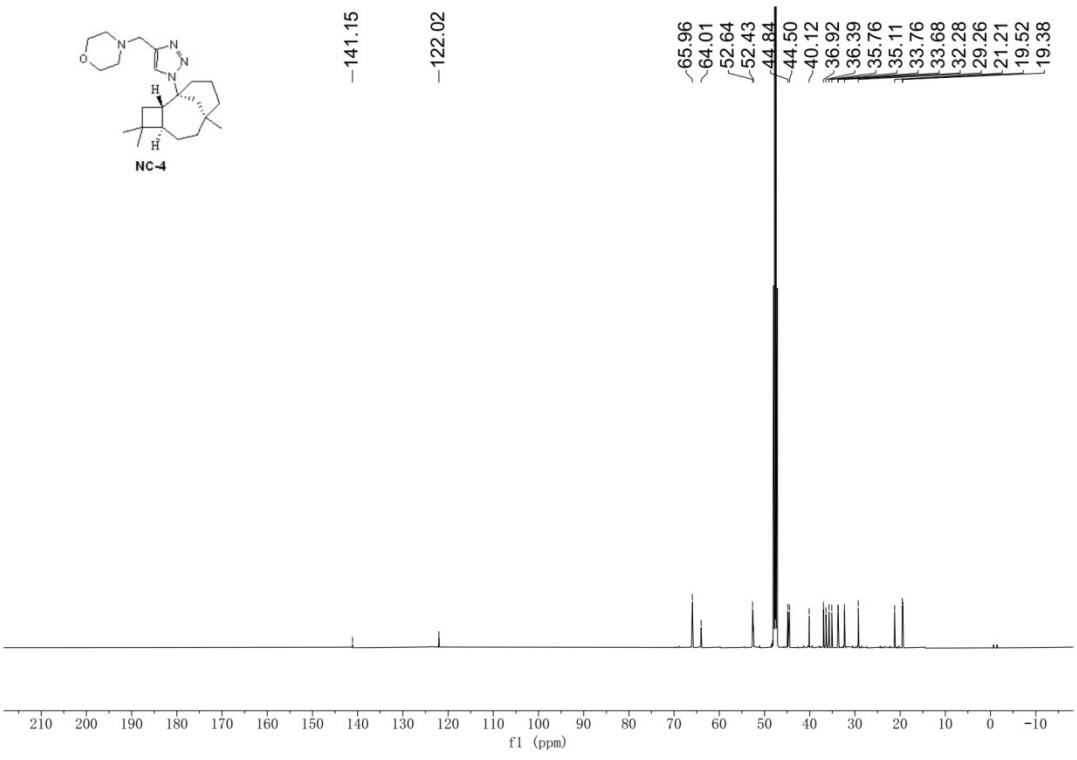

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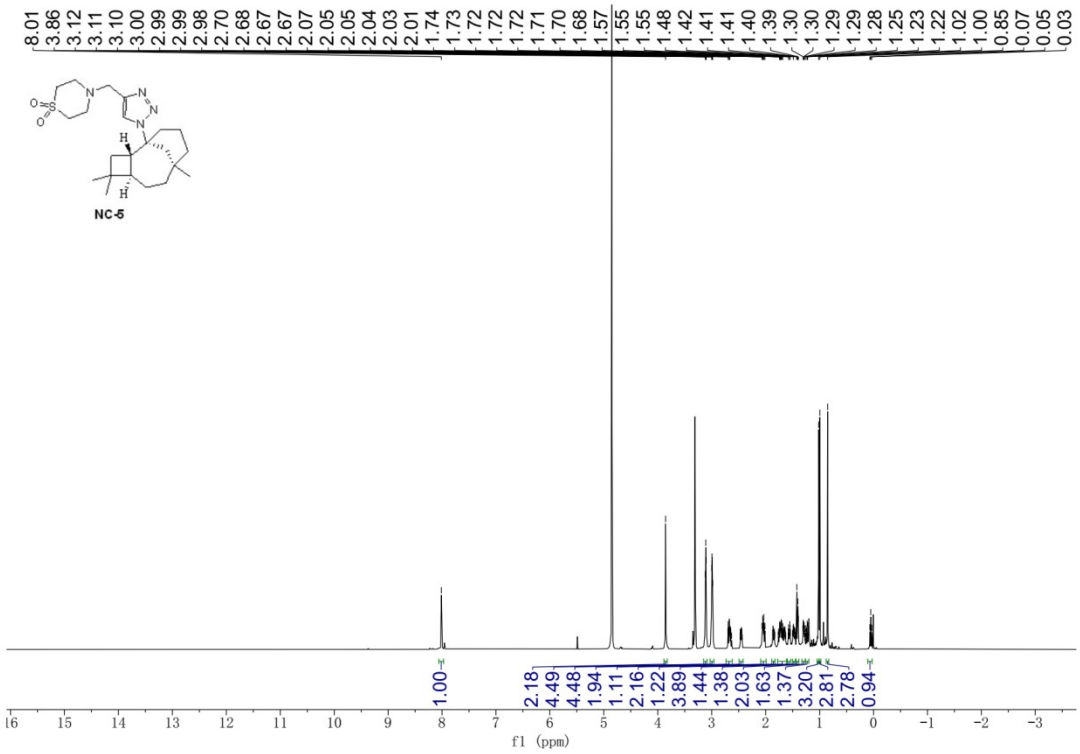
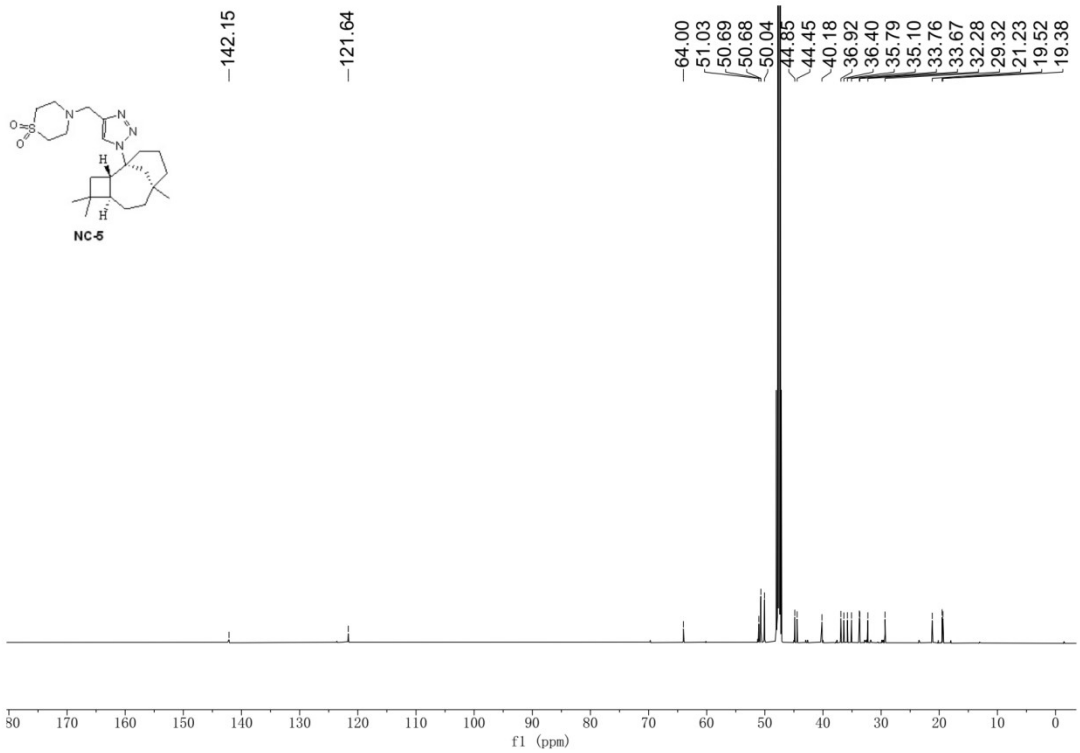
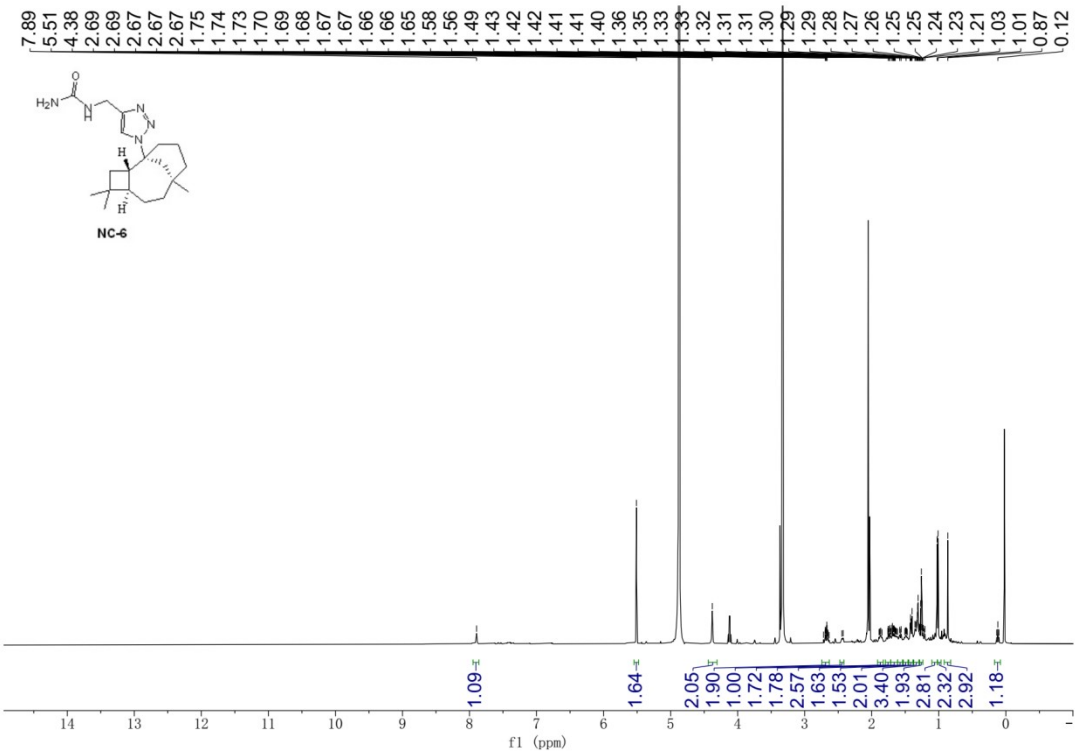
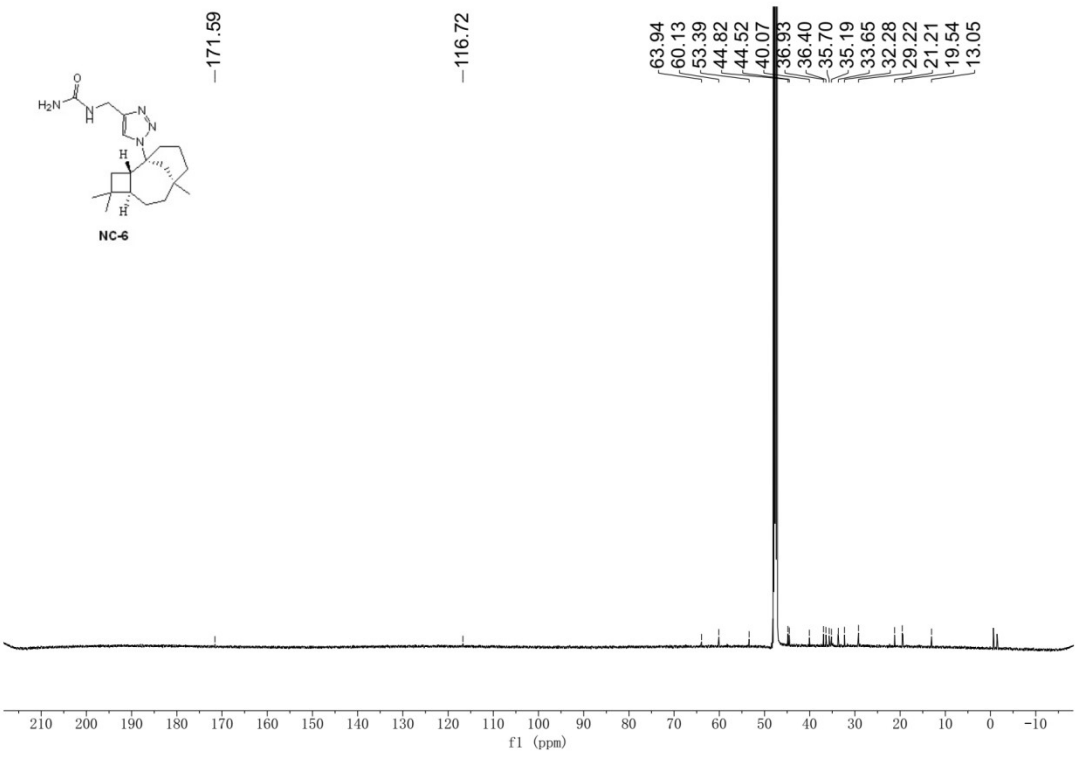




Compound NC-6





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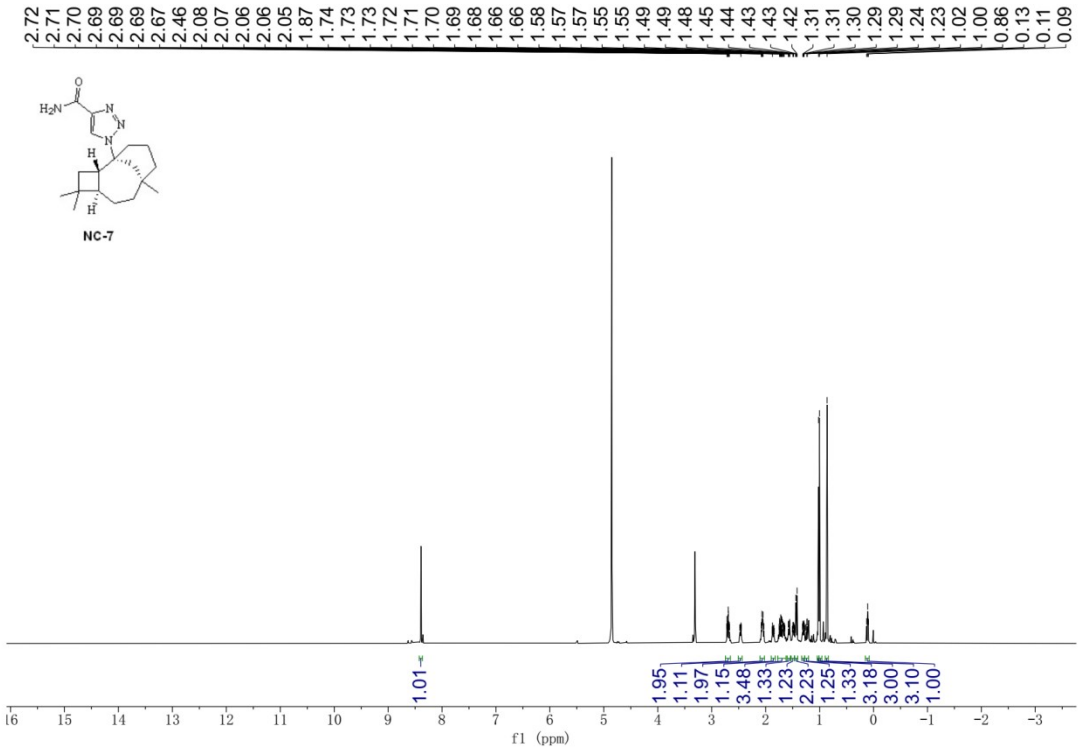

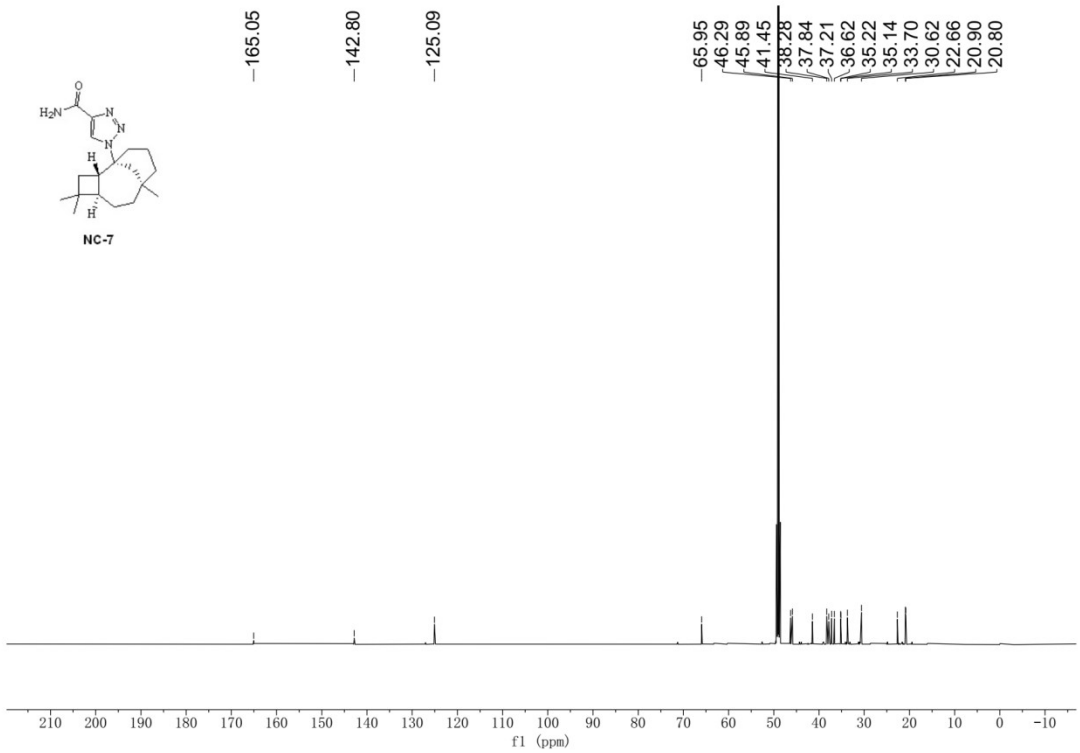

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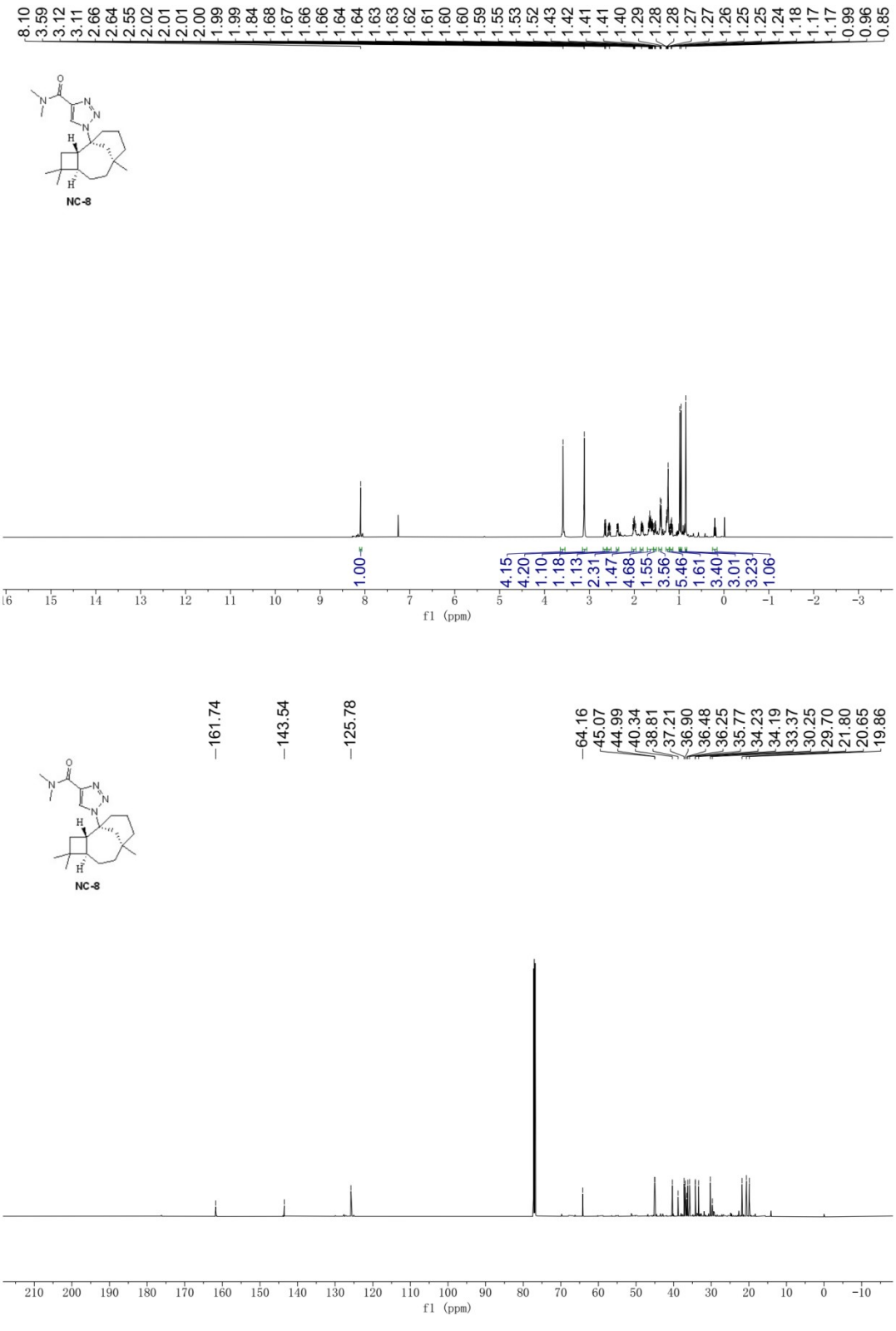

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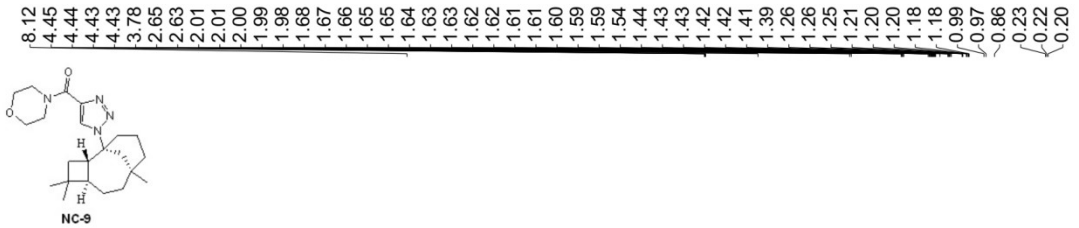

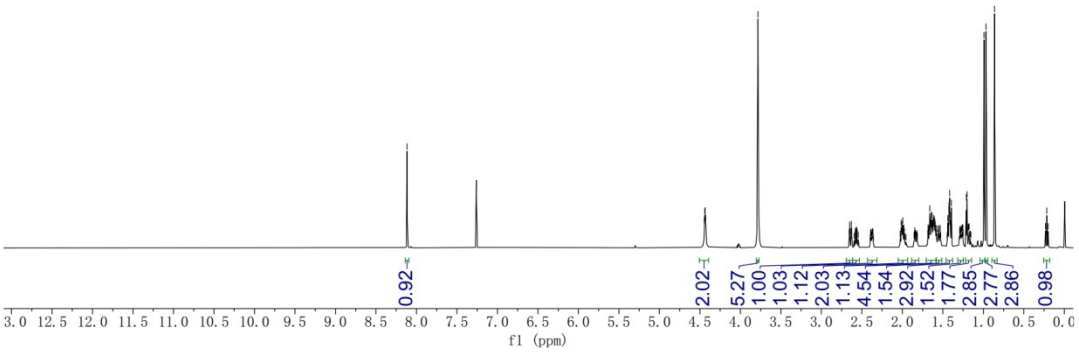

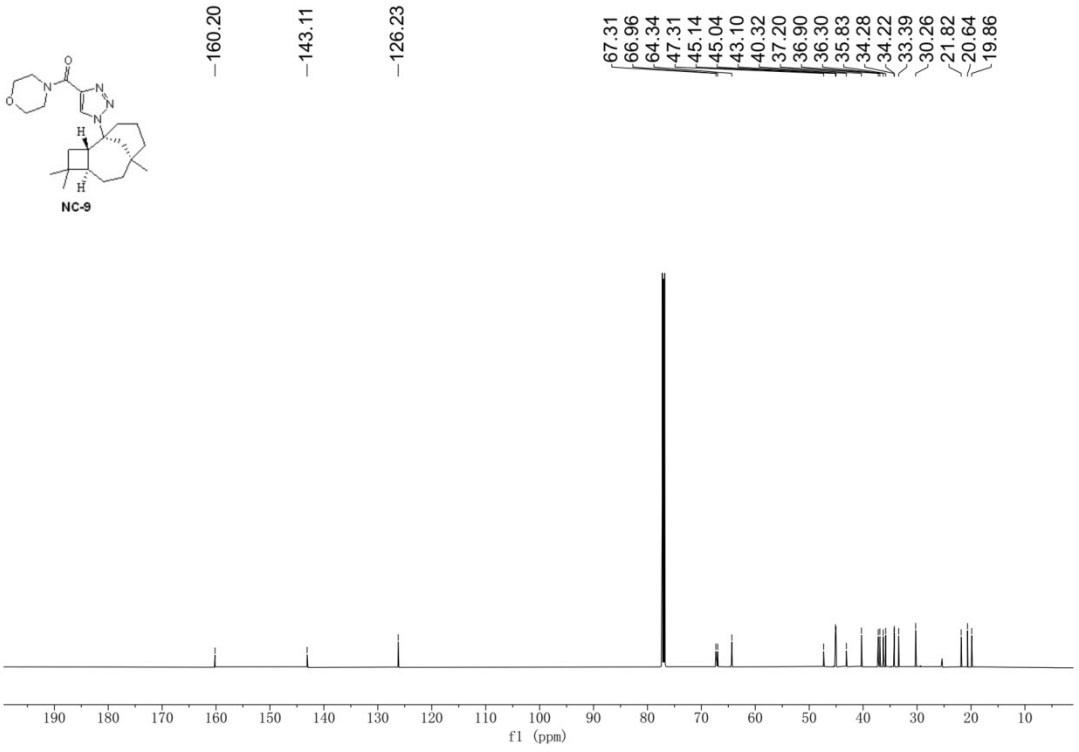

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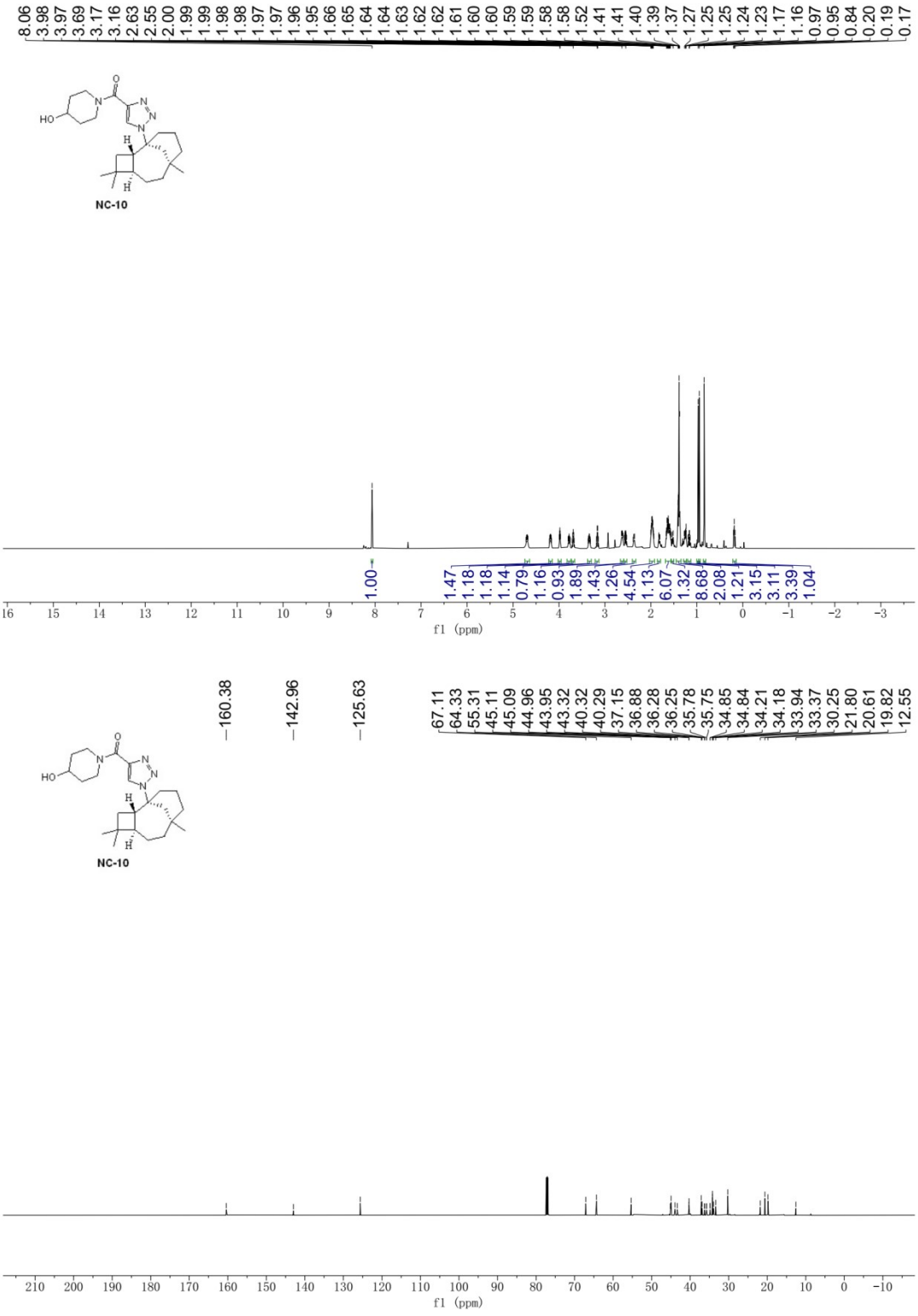

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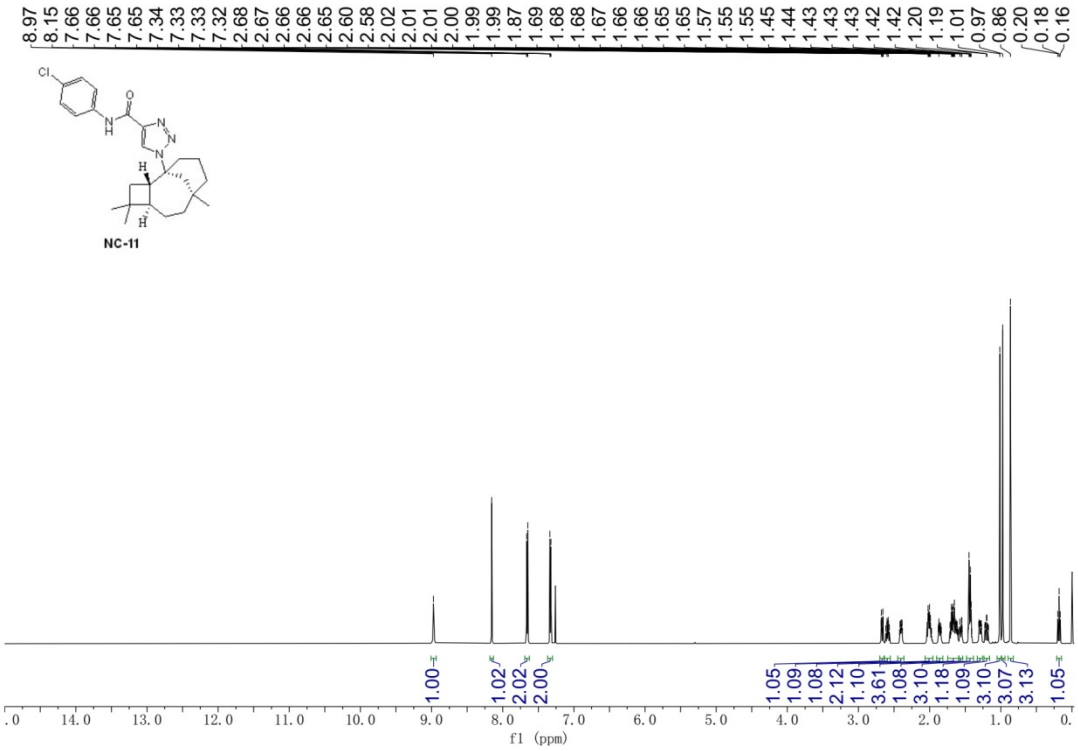

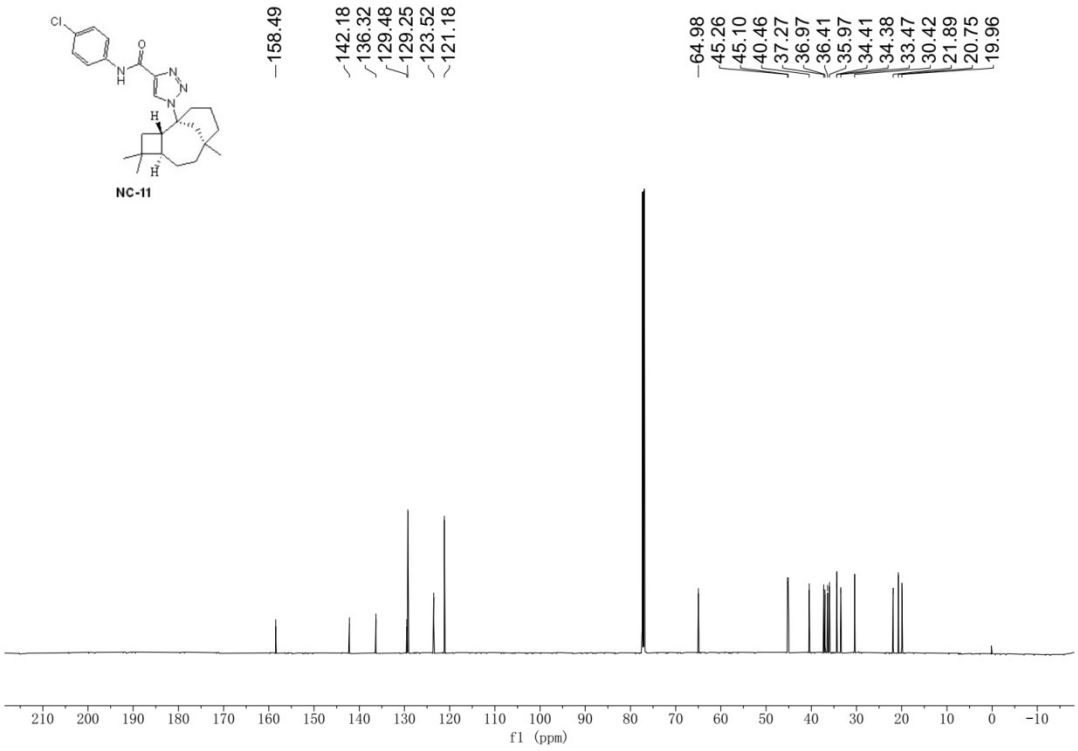

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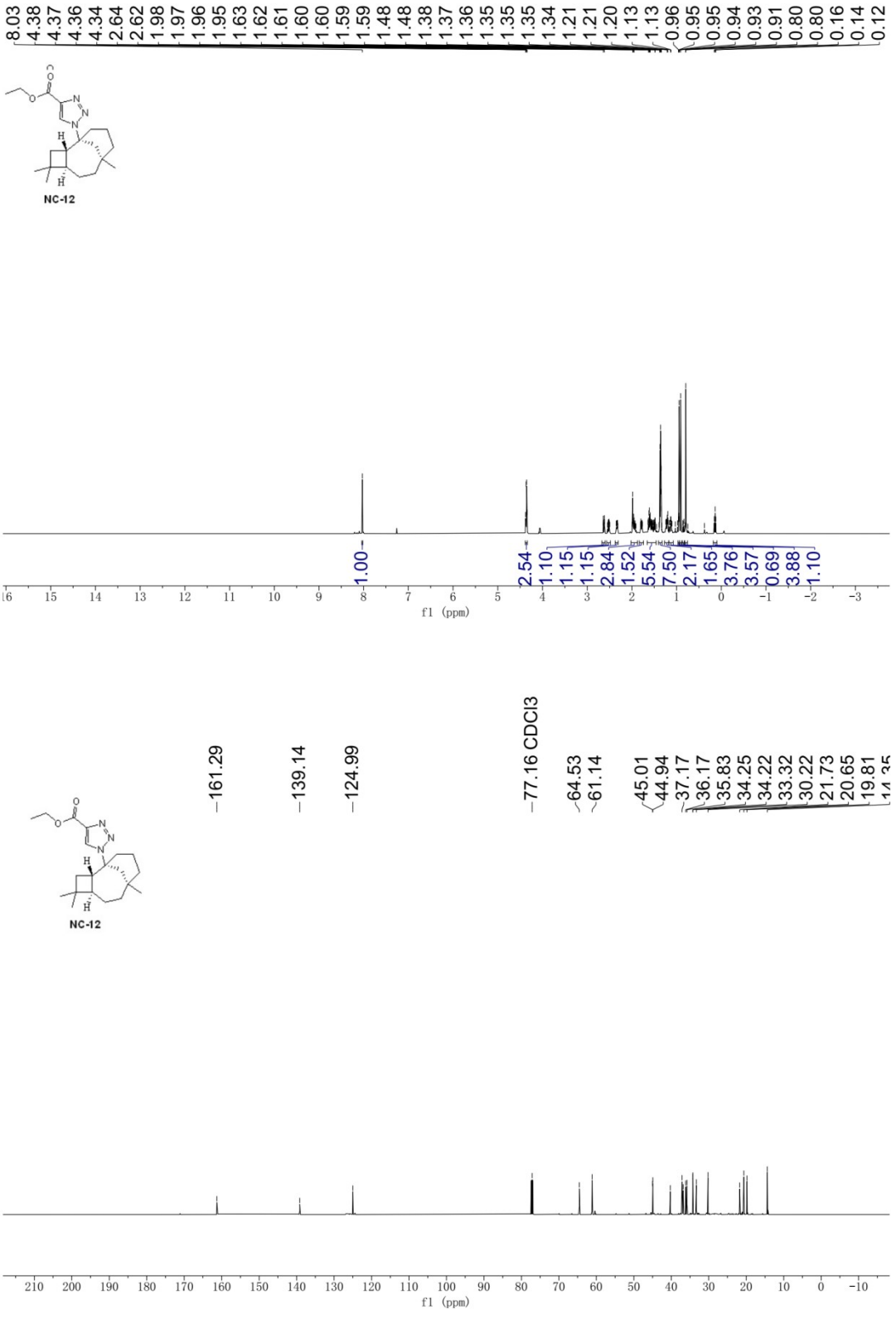
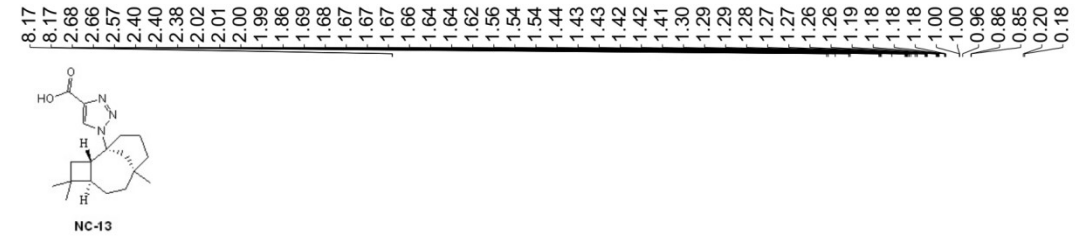
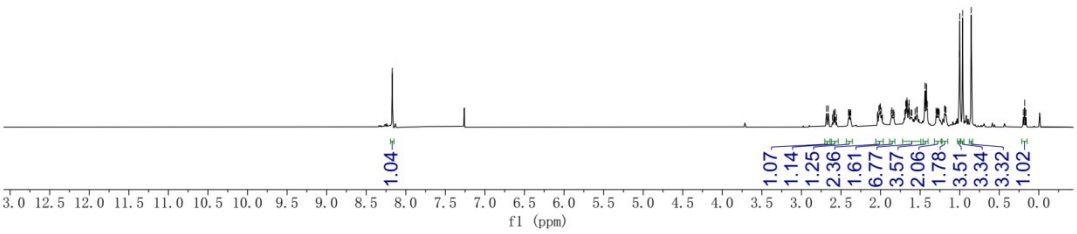
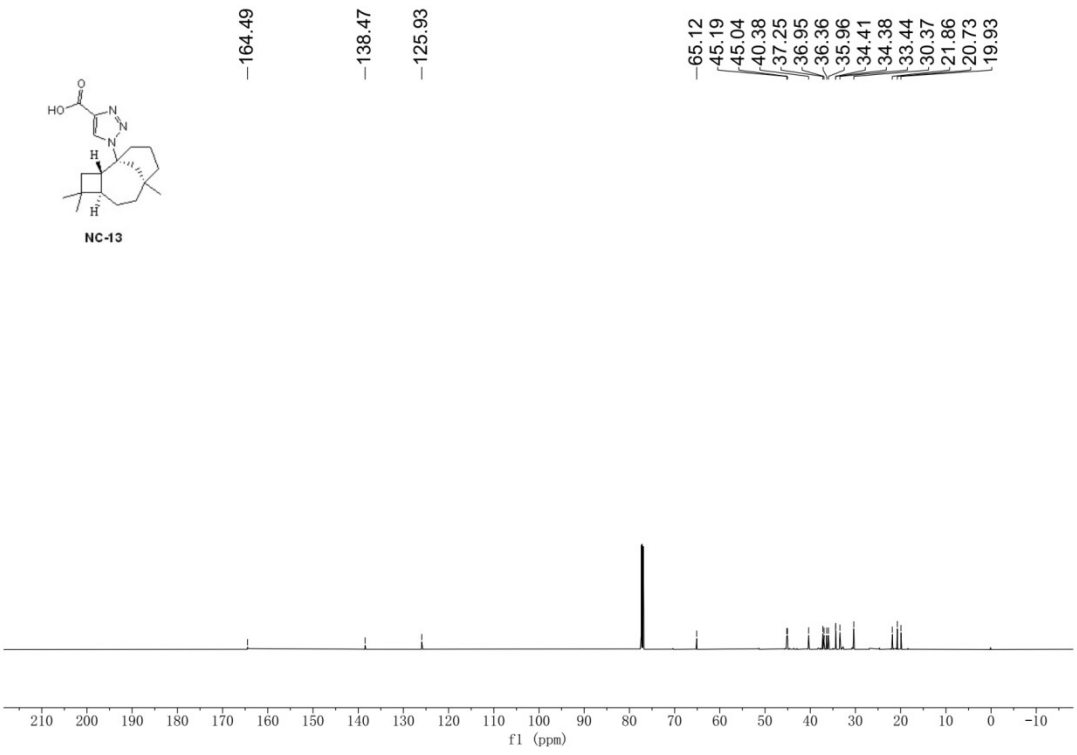


Compound NC-13







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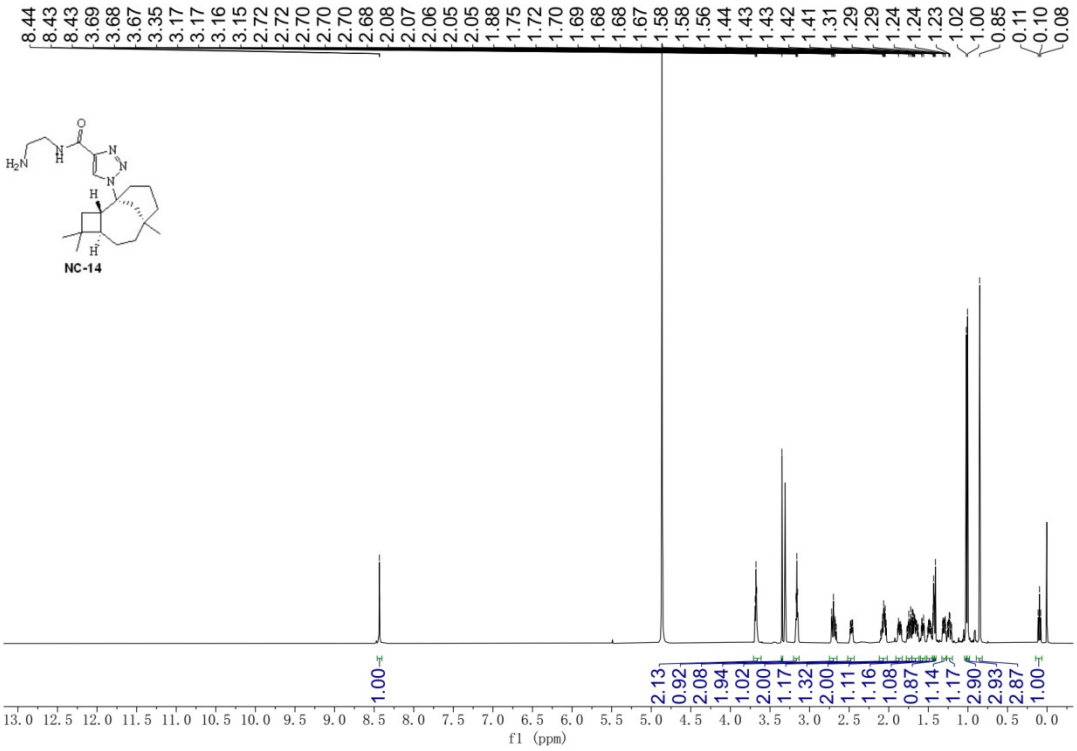

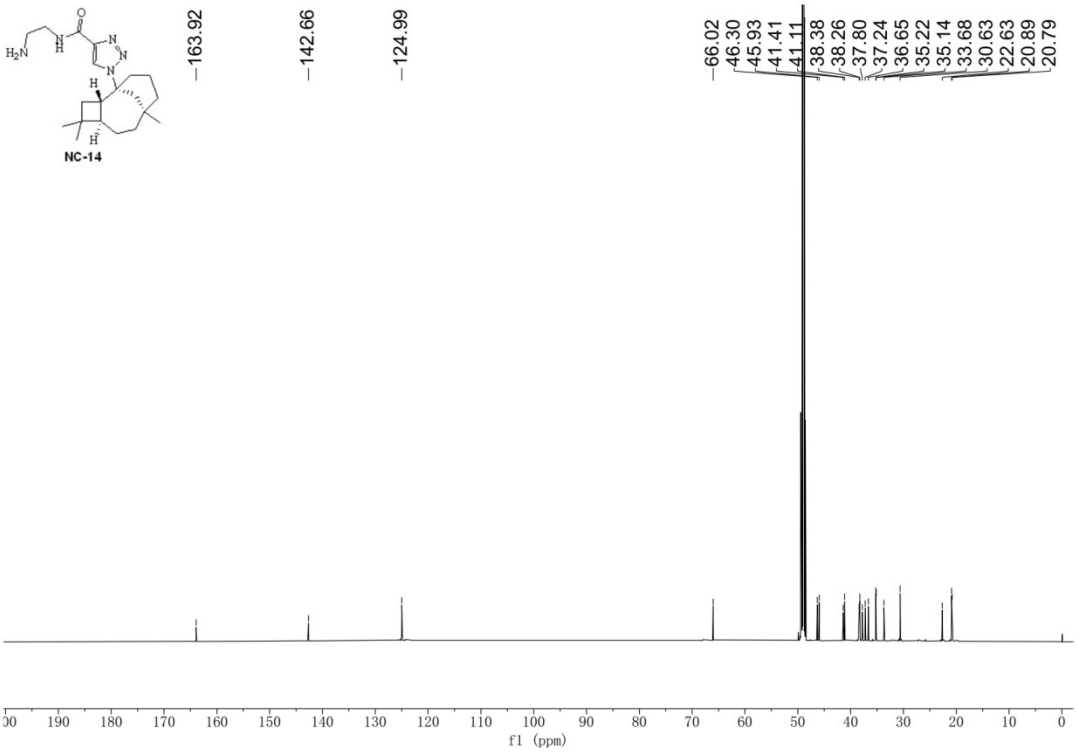

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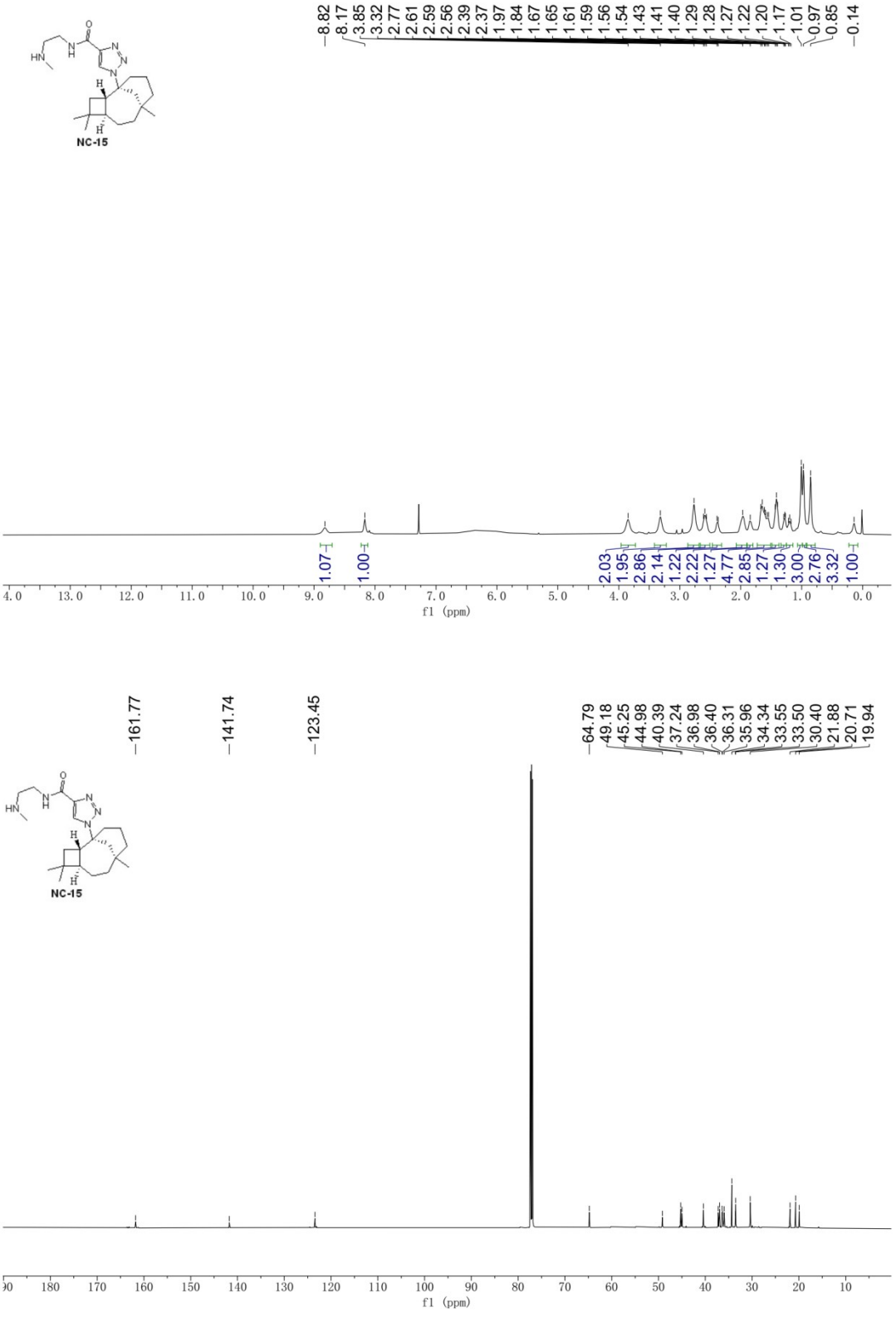

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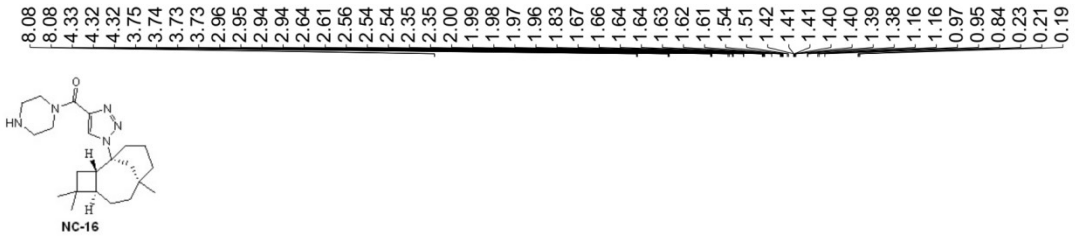
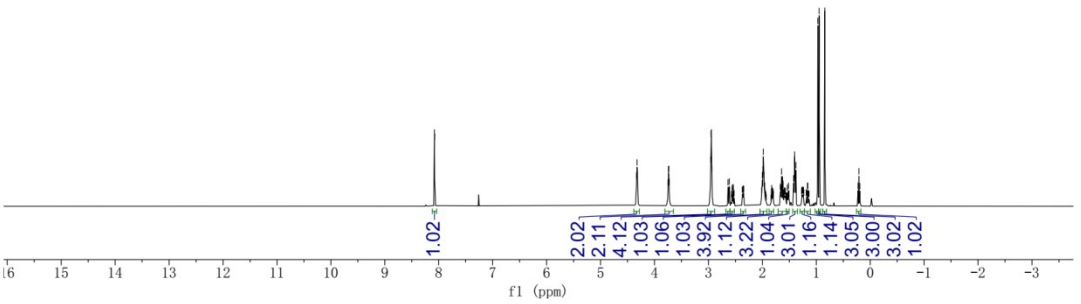
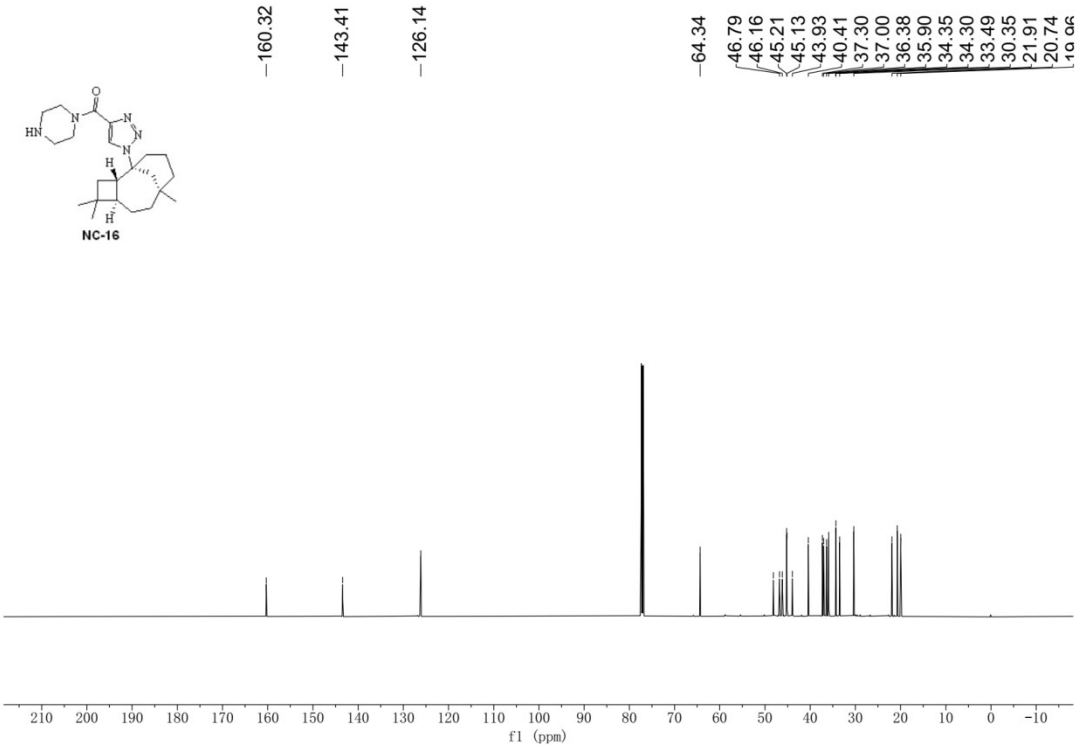
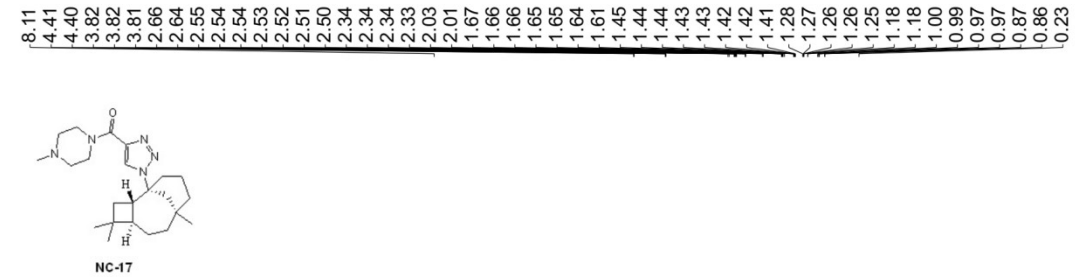
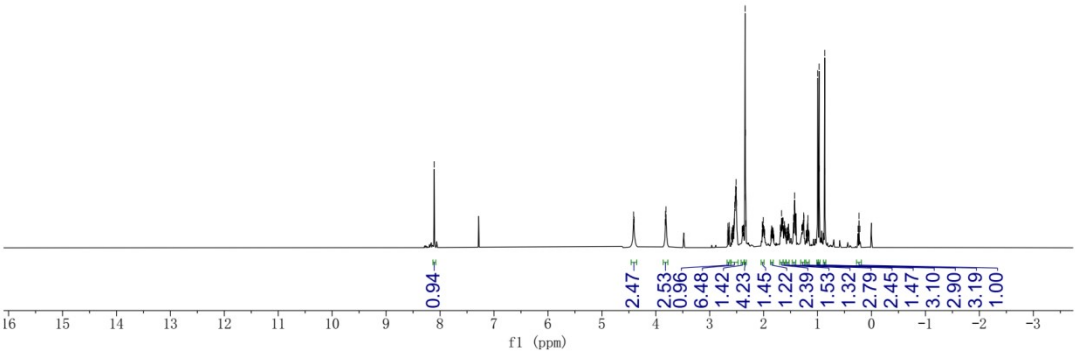


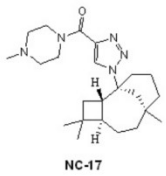


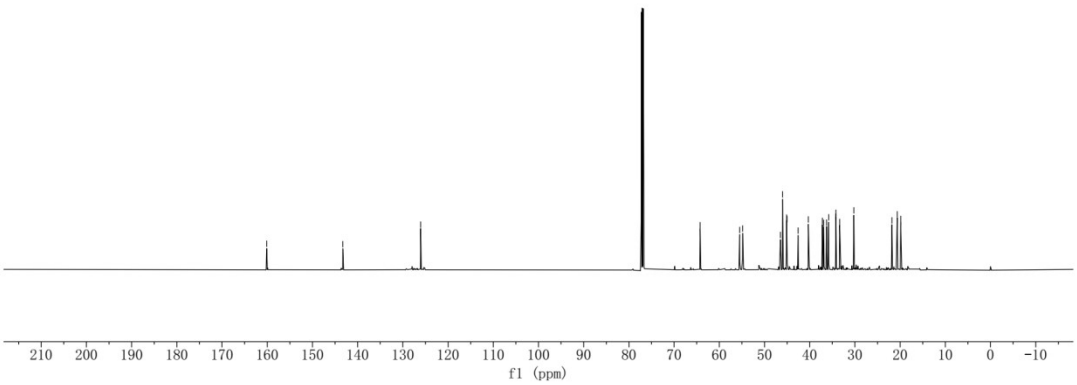


Compound NC-17









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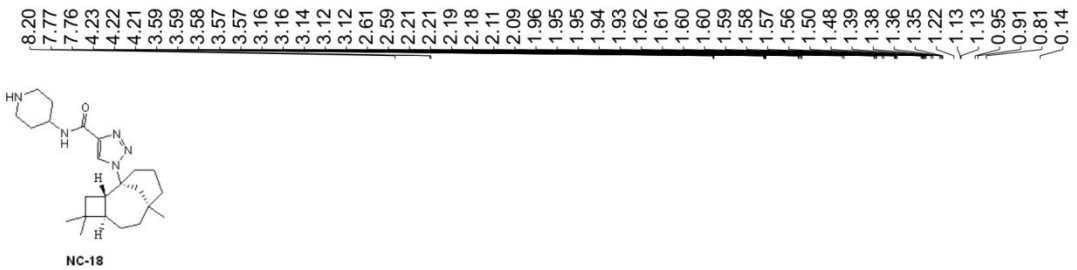

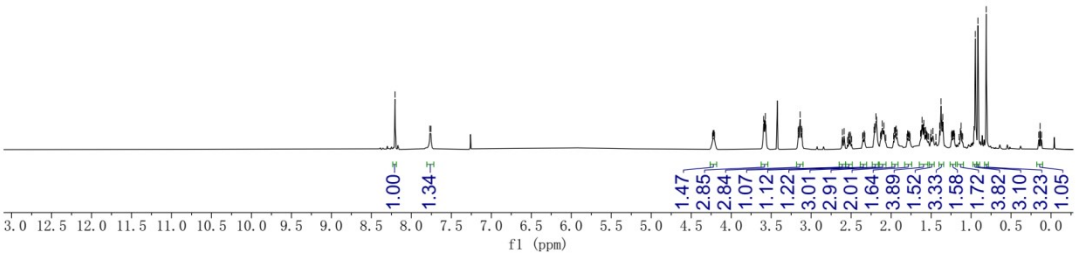

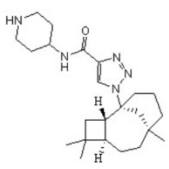

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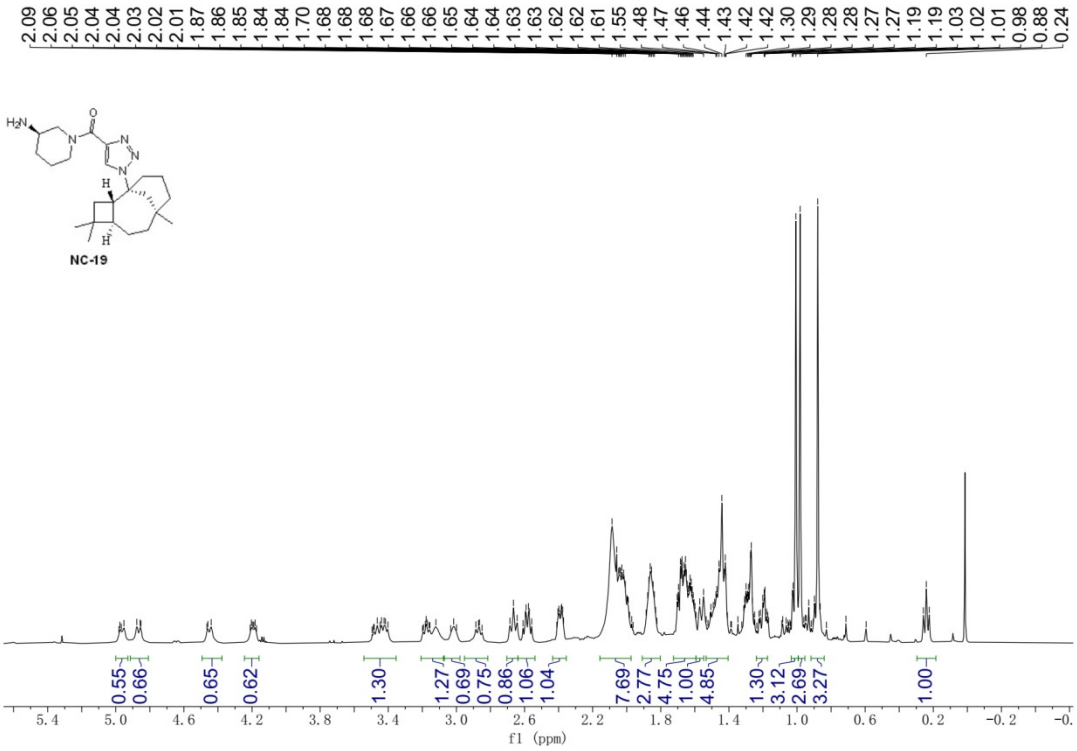

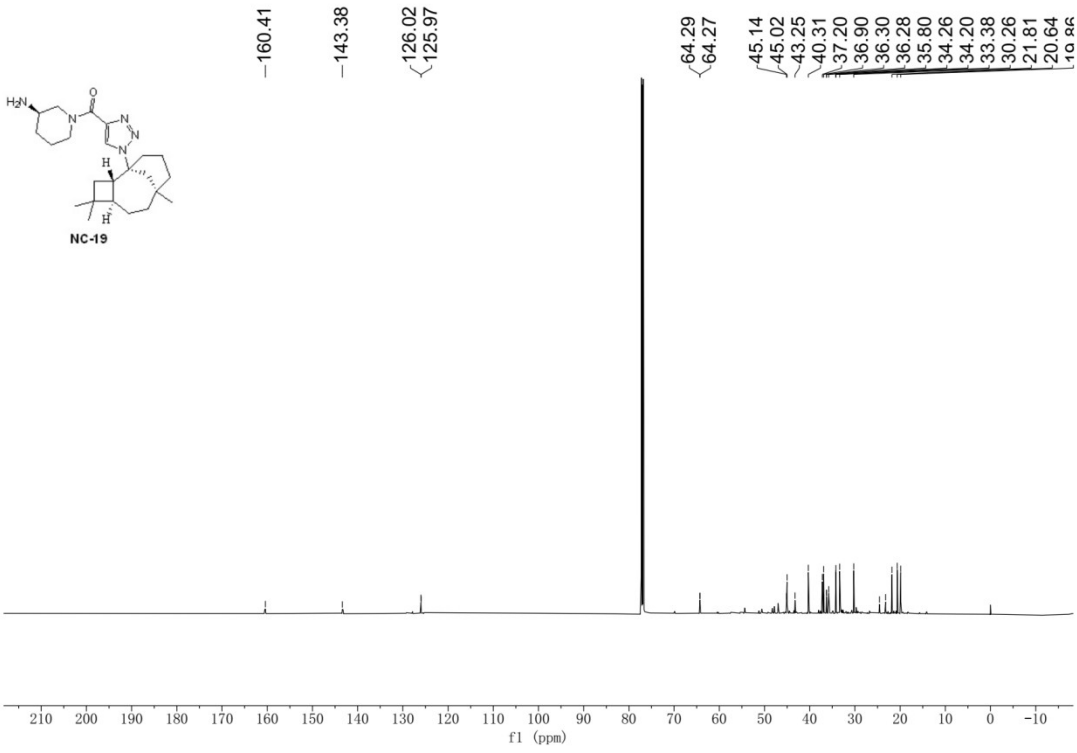

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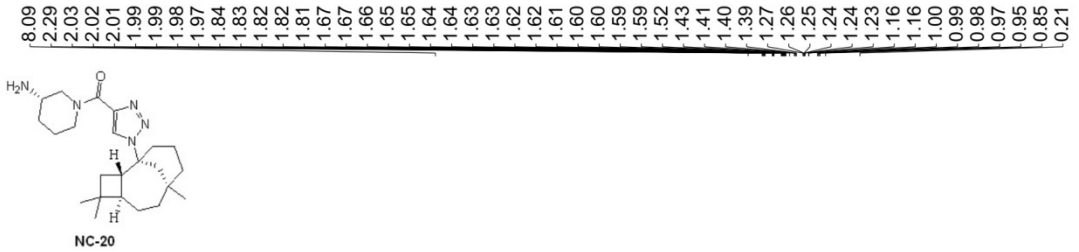
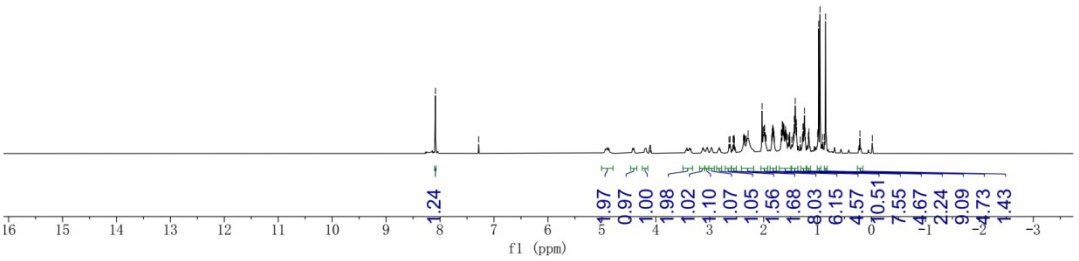
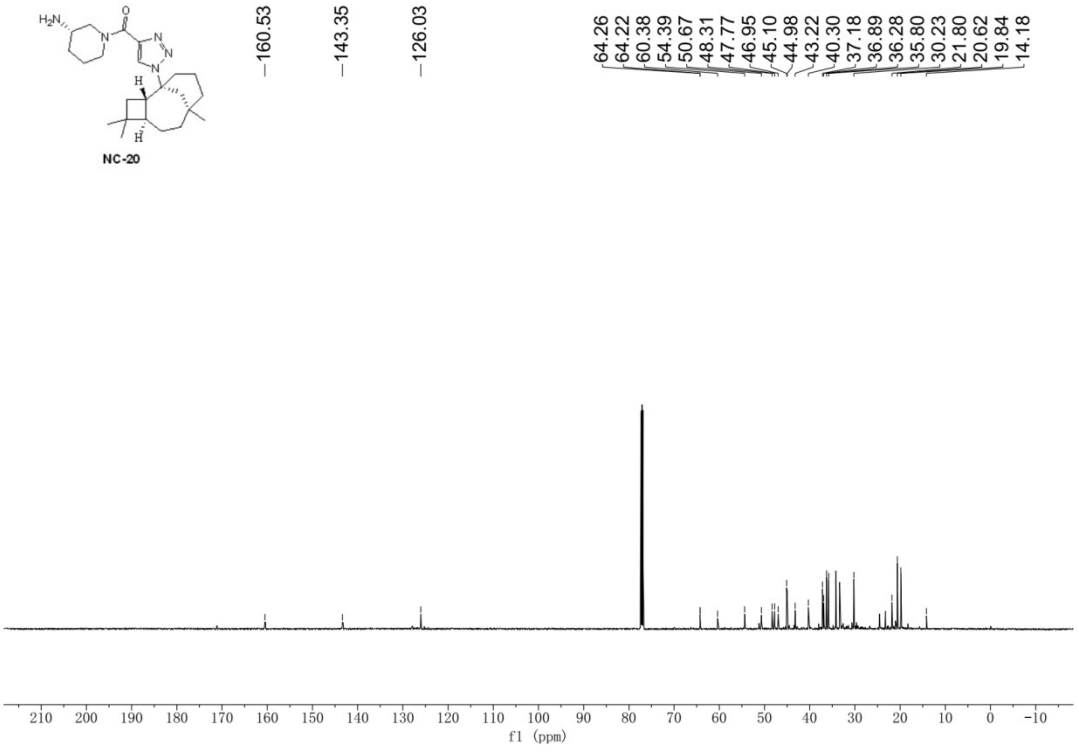
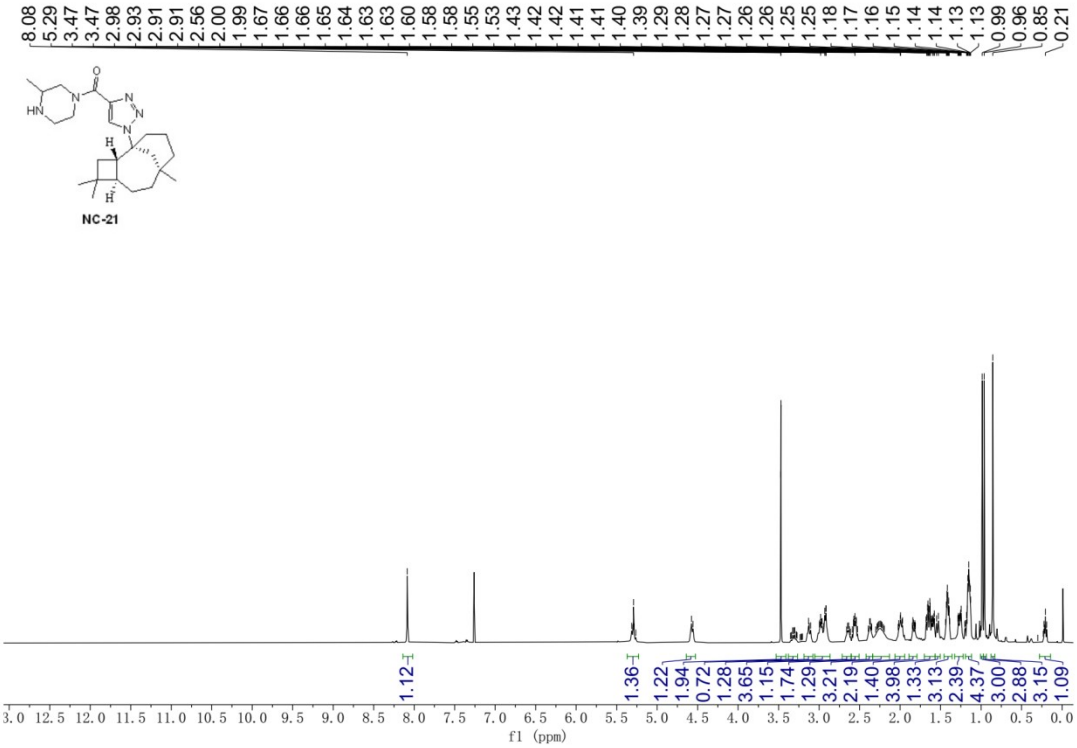
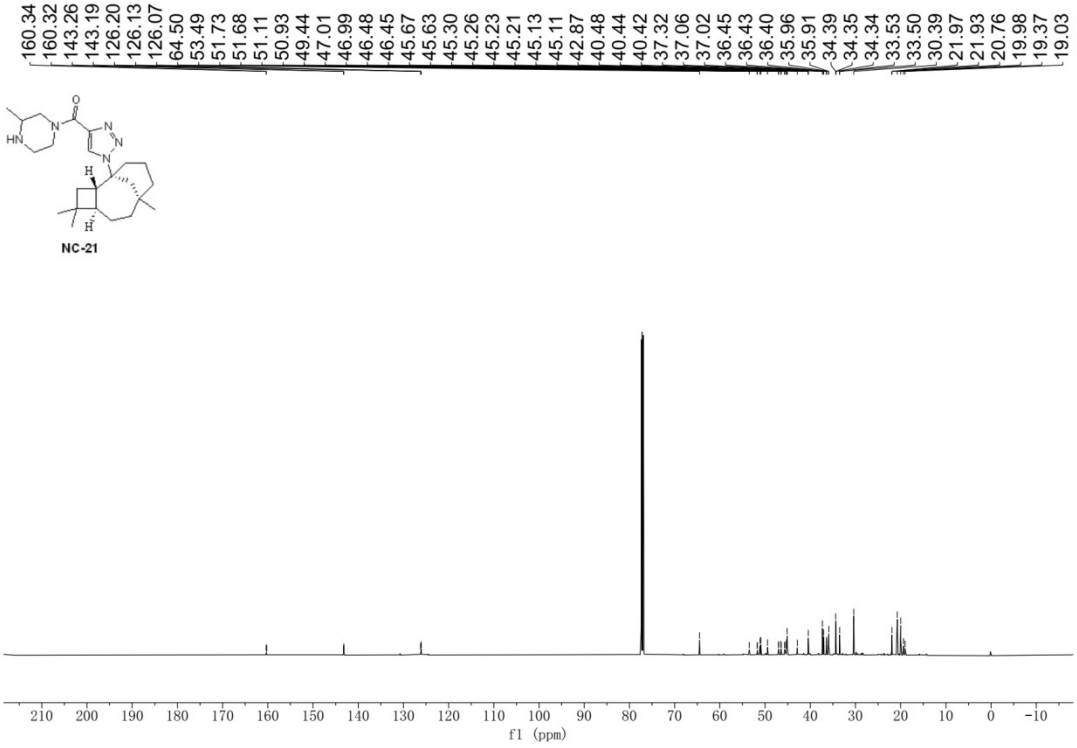




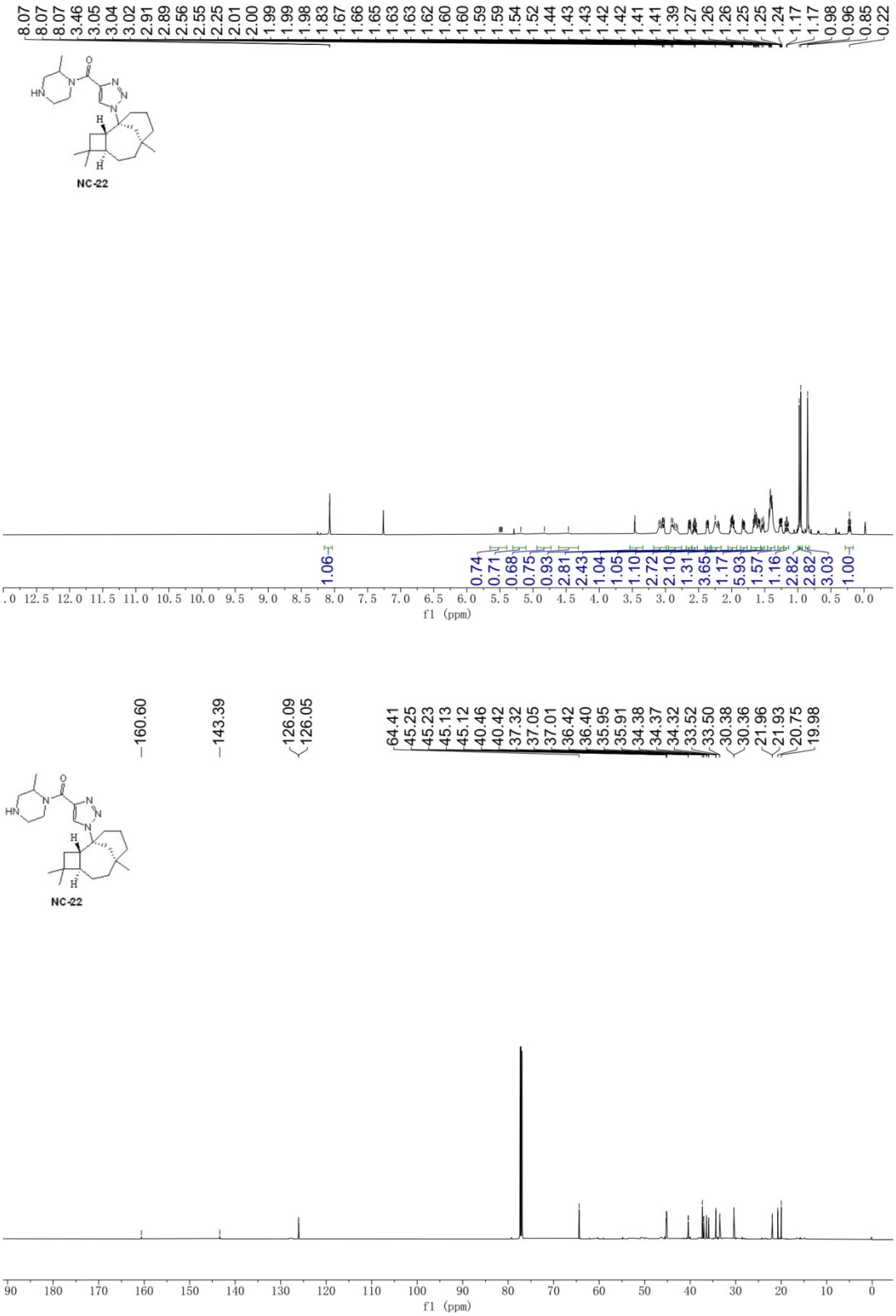


Compound NC-21

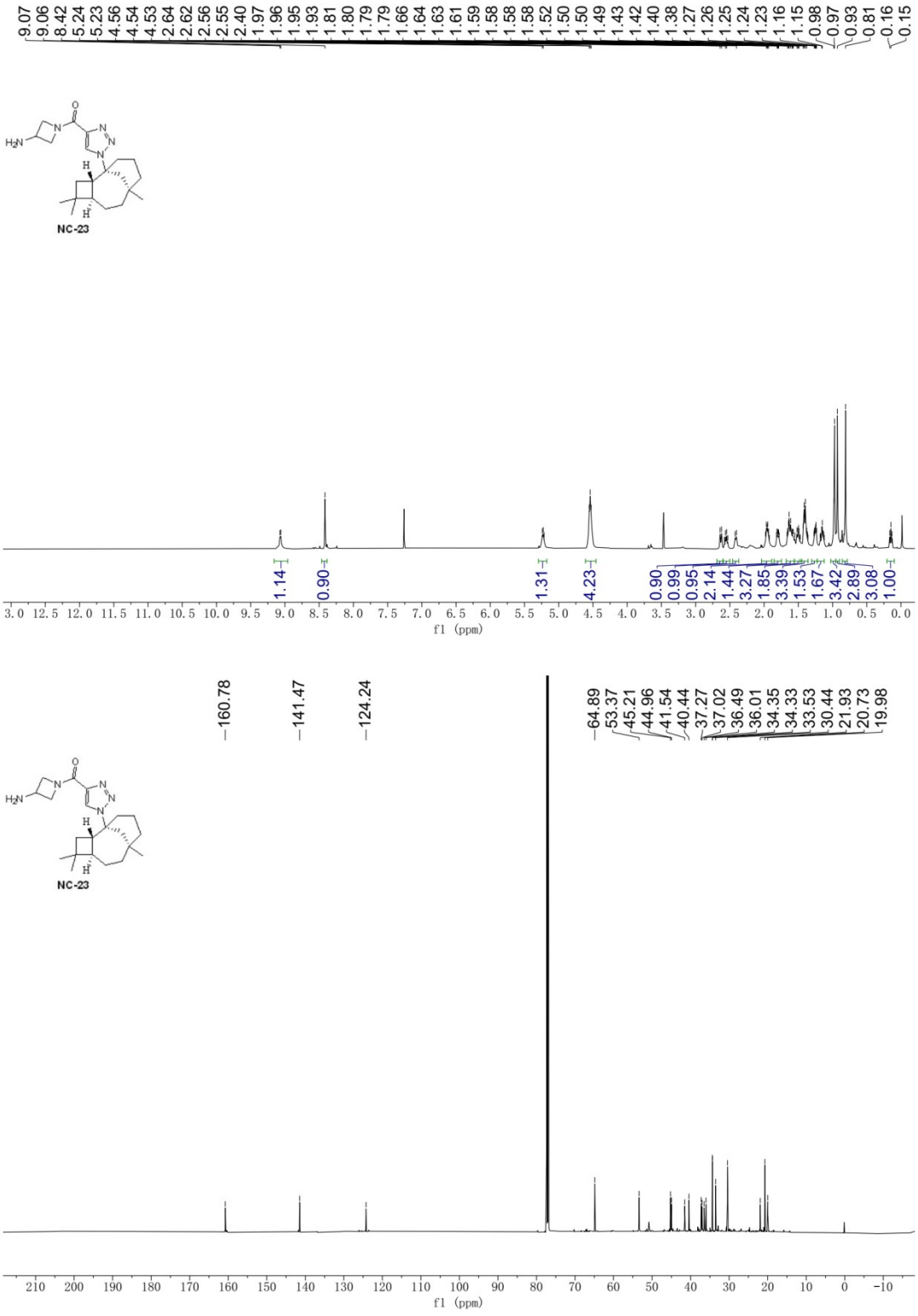




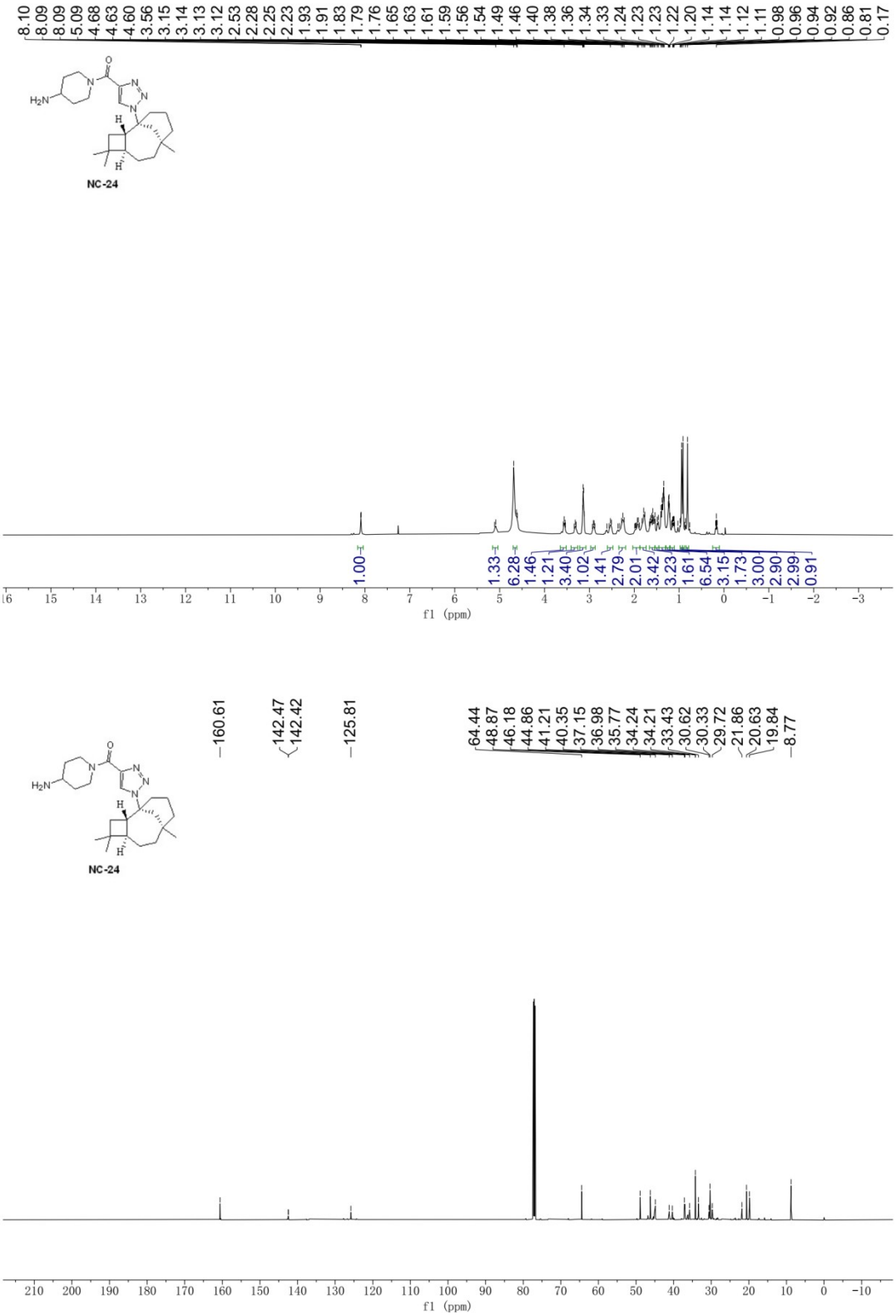
Compound NC-22



Compound NC-23

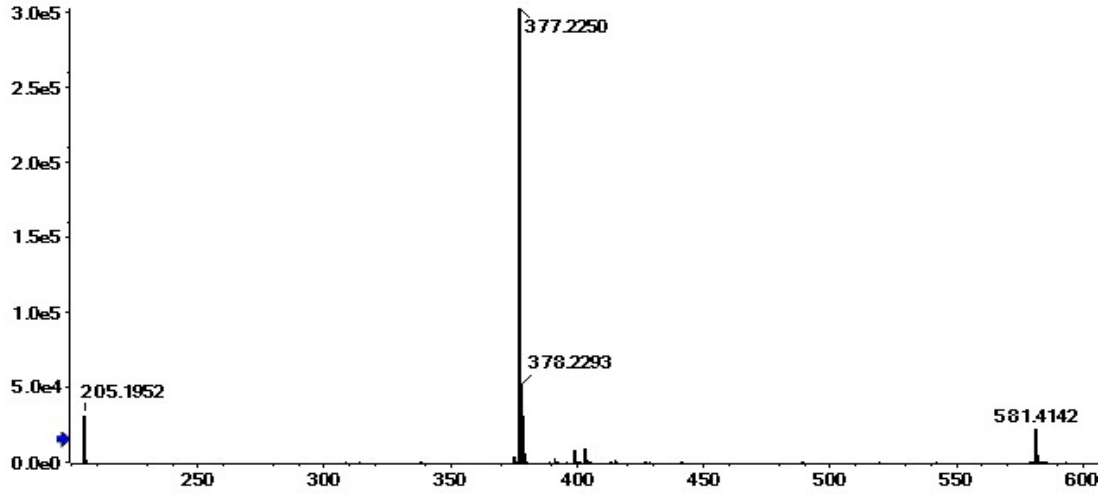


Compound NC-24

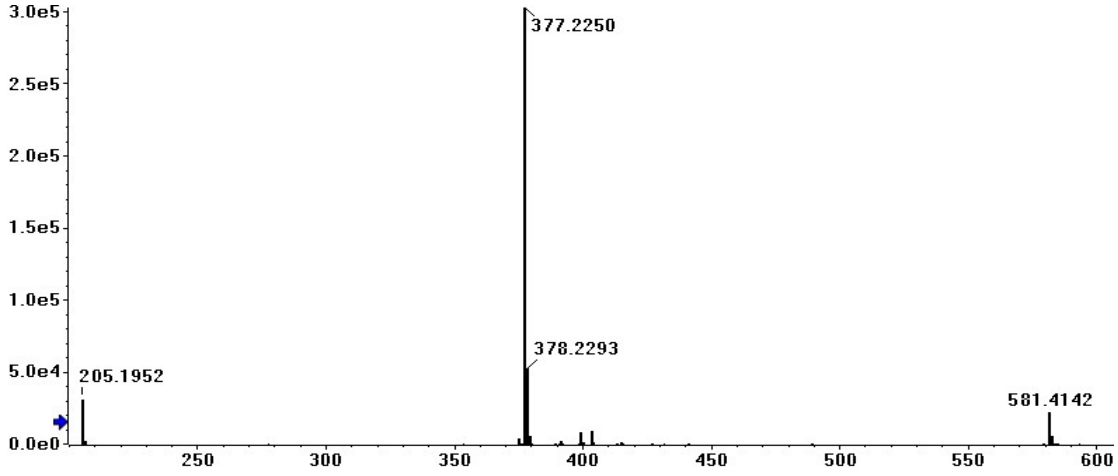


3. HRMS-ESI spectra of β-caryolane derivatives

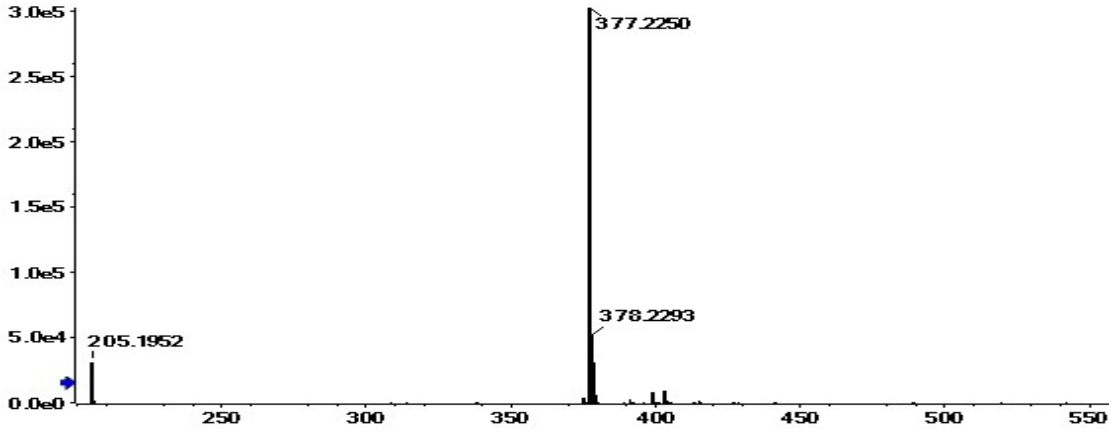
SA-13



SA-14



SA-15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2.0e5
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0.0e0
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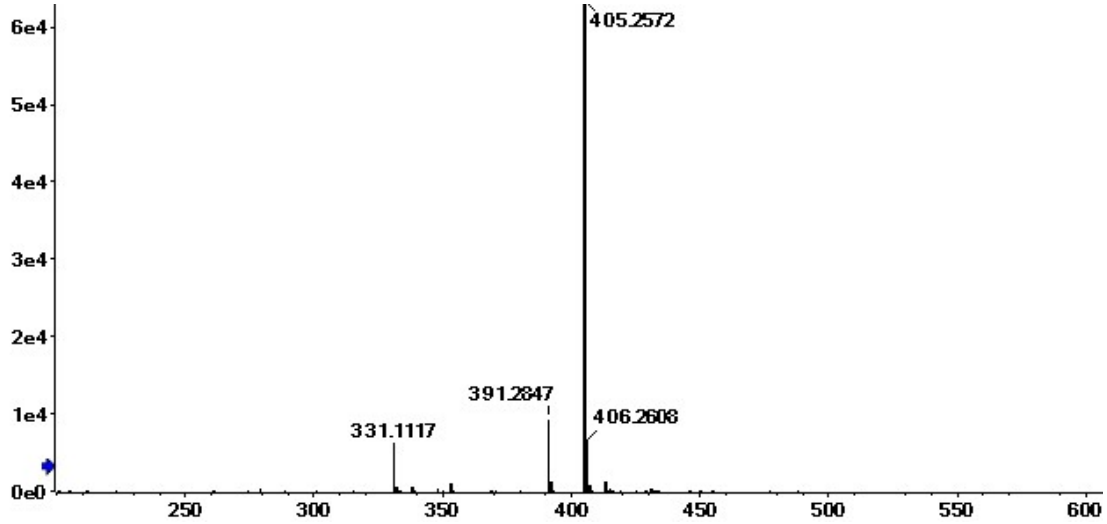
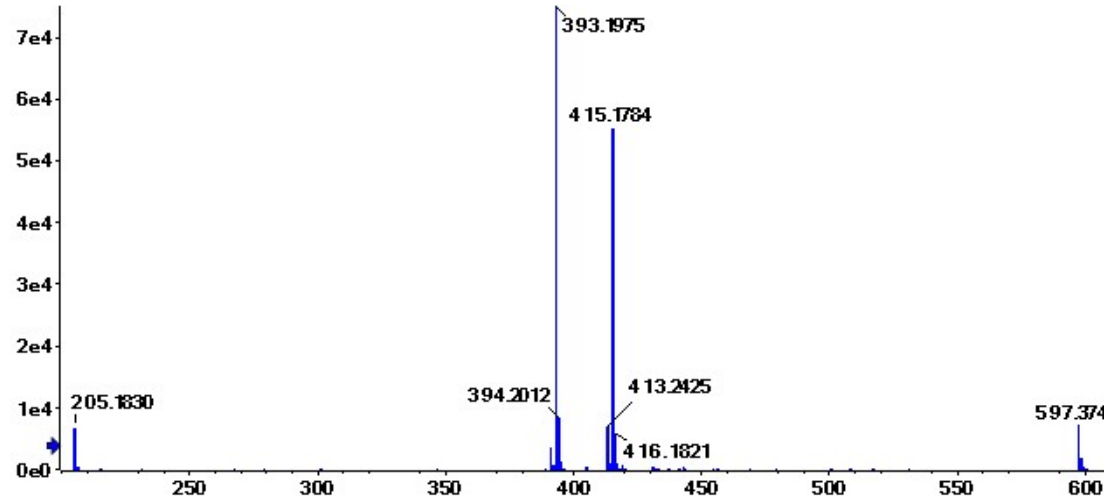
378.2293
205.1952
250
300
350
400
450
500
550

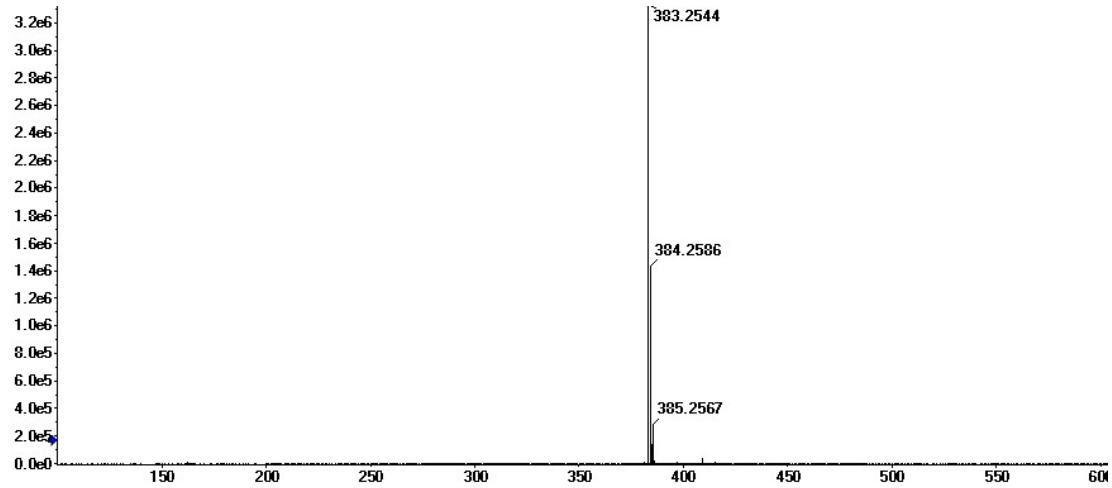
SA-16



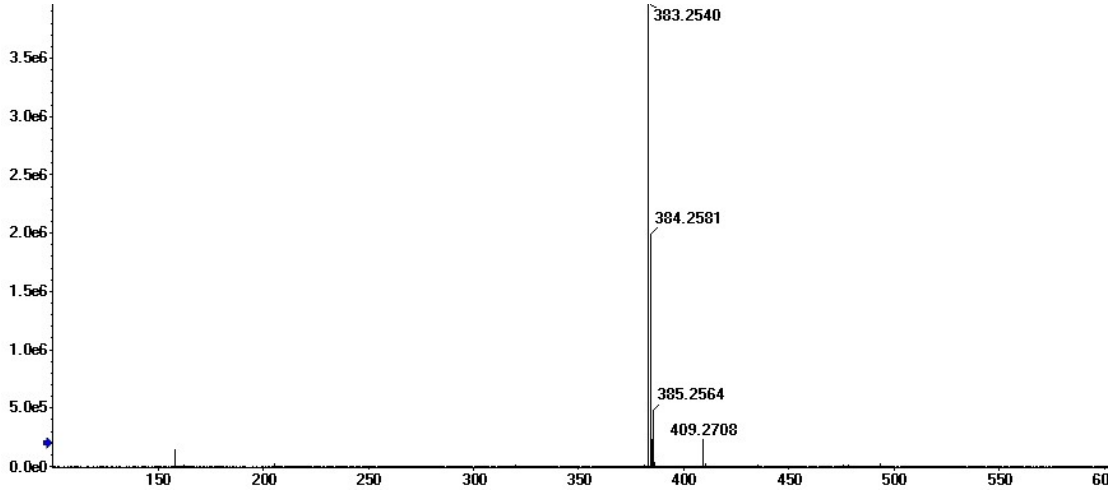
SA-17



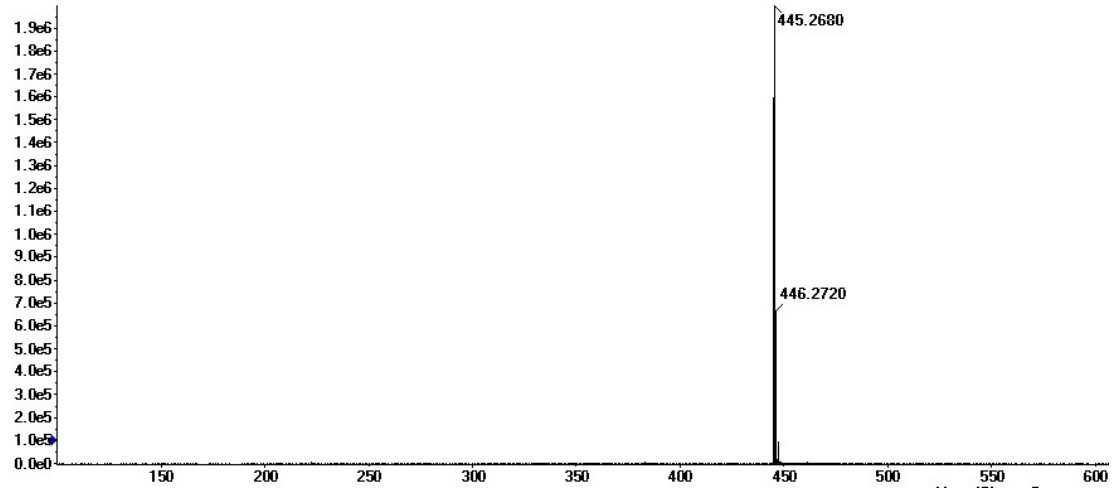
SA-29



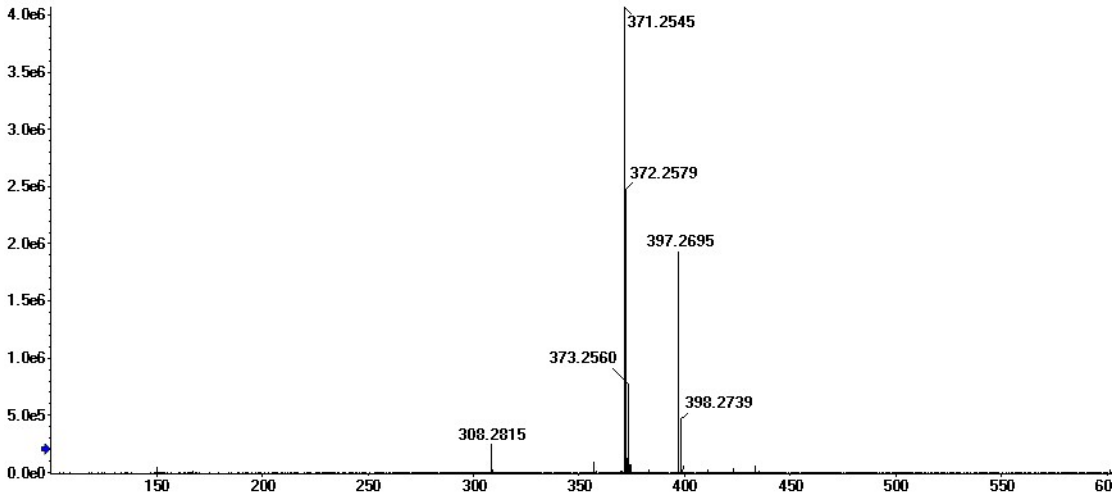
SA-30



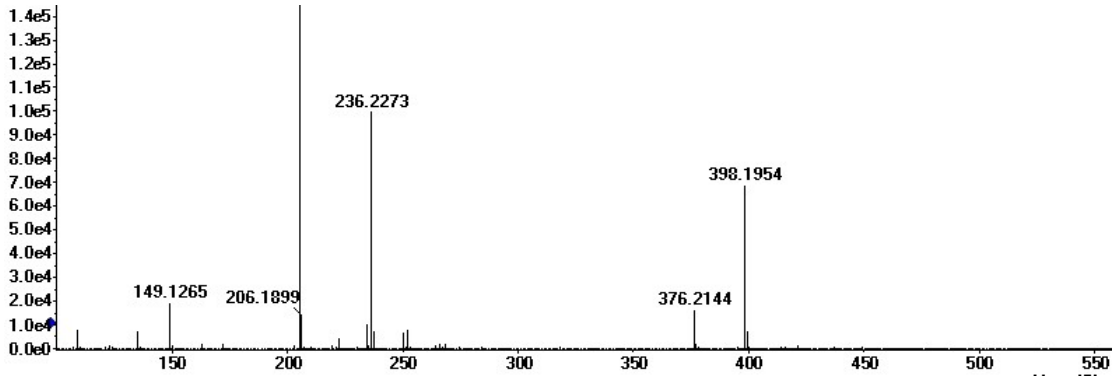
SA-31



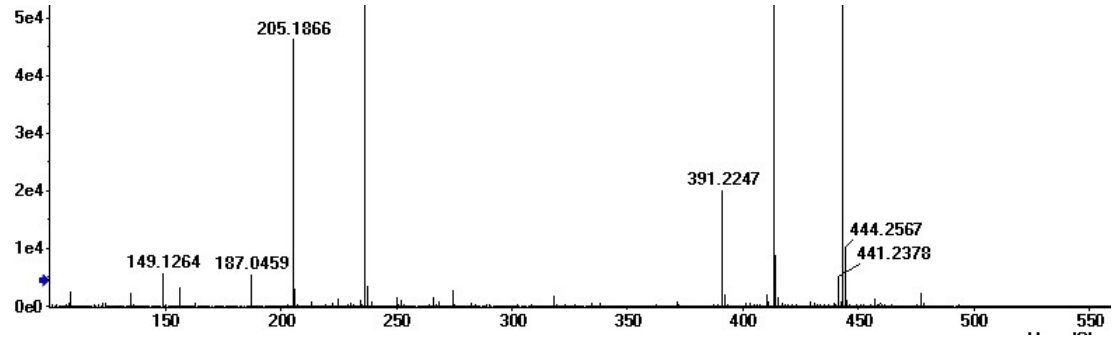
SA-32



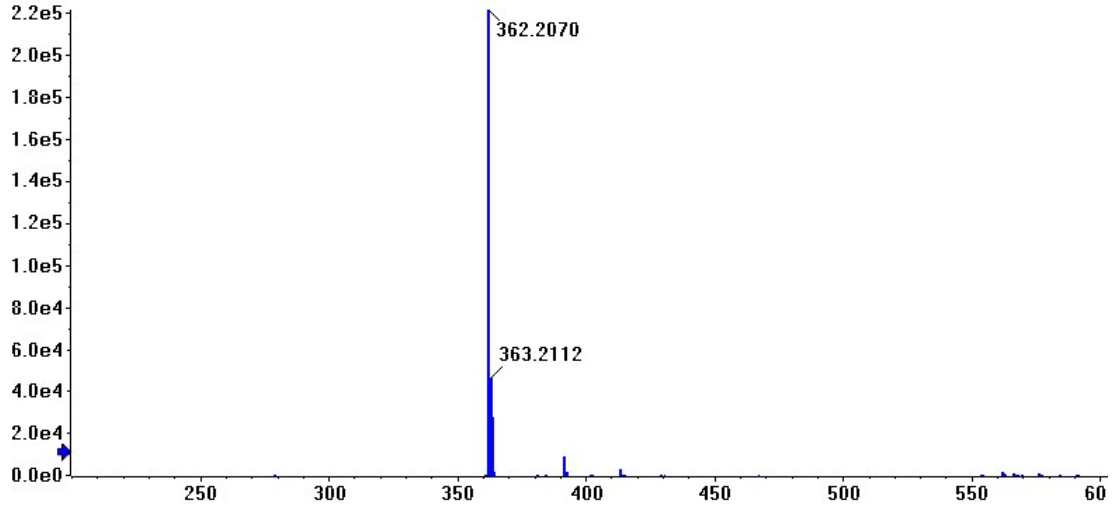
SA-33



SA-34



CA-1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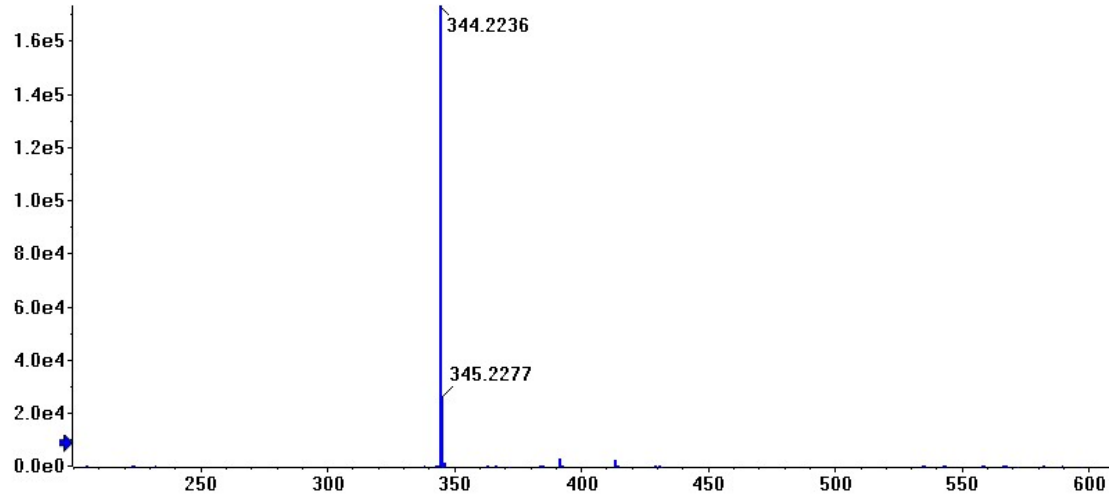
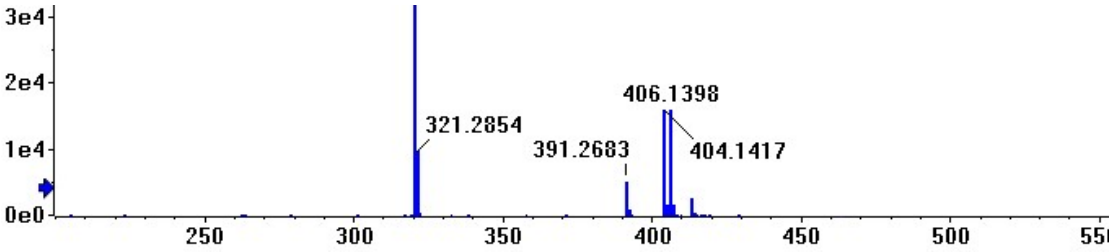
4.0e4
2.0e4
0.0e0
362.2070
363.2112
250
300
350
400
450
500
550
60

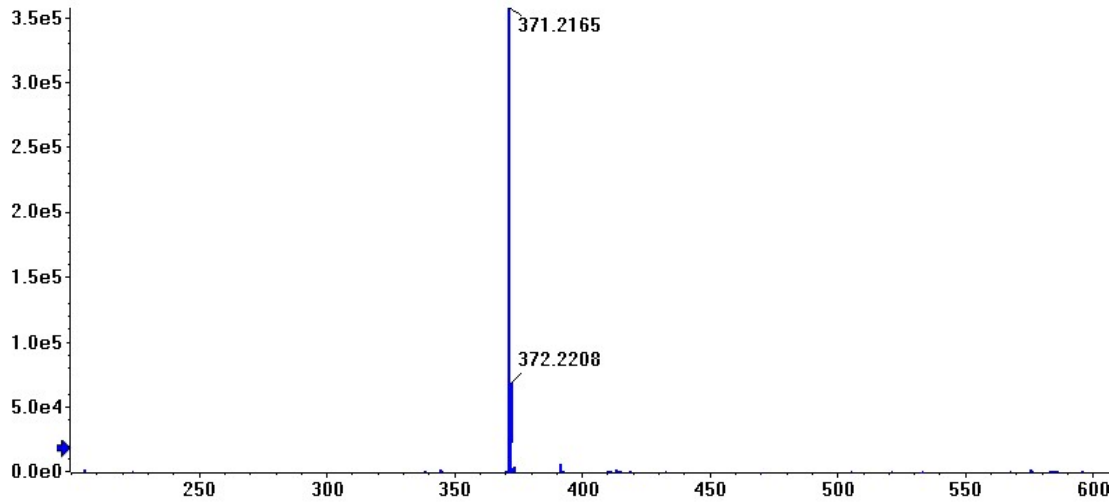
CA-2


344.2236
345.2277
1.6e5
1.4e5
1.2e5
1.0e5
8.0e4
6.0e4
4.0e4
2.0e4
0.0e0
250
300
350
400
450
500
550
600

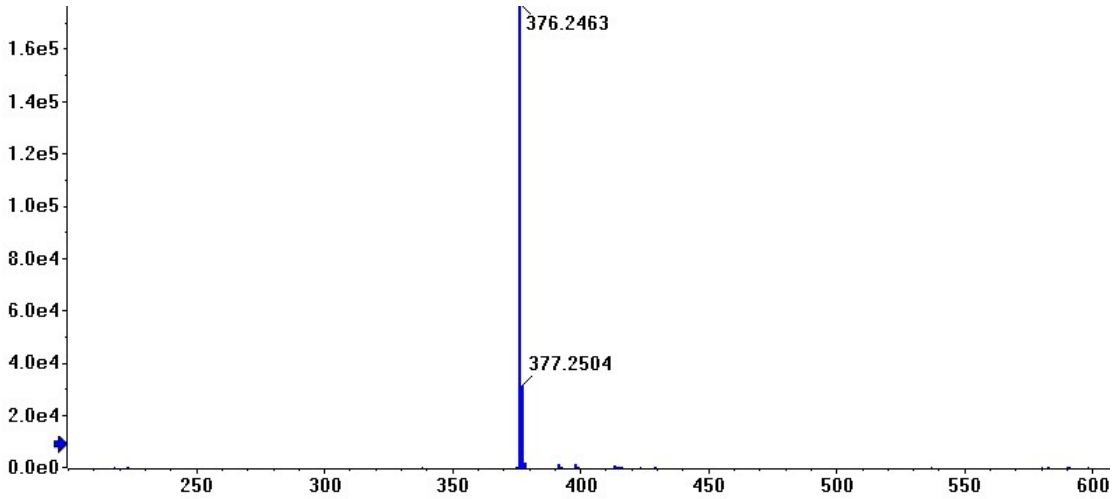
CA-7


406.1398
321.2854
391.2683
404.1417
3e4
2e4
1e4
0e0
250
300
350
400
450
500

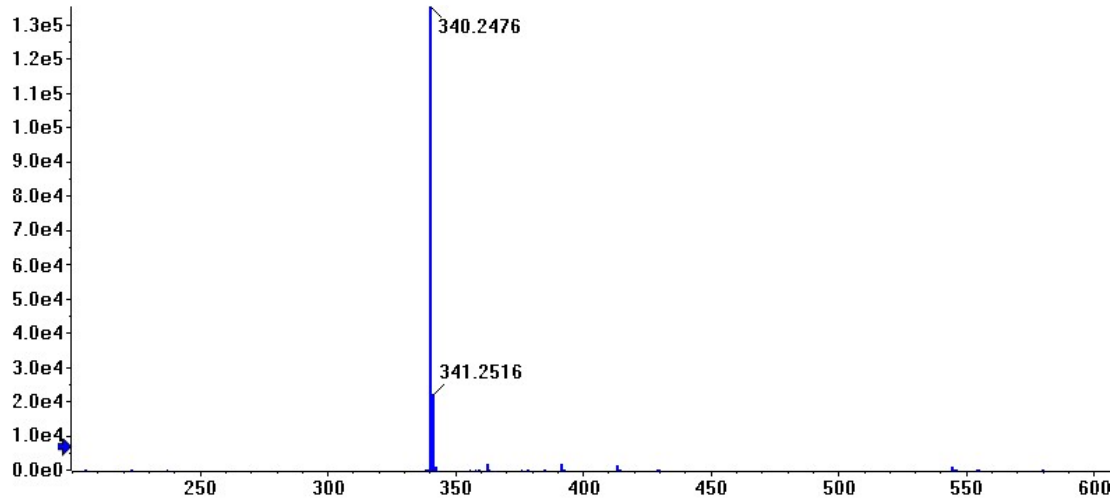
CA-8


371.2165
372.2208
3.5e5
3.0e5
2.5e5
2.0e5
1.5e5
1.0e5
5.0e4
0.0e0
250
300
350
400
450
500
550
600

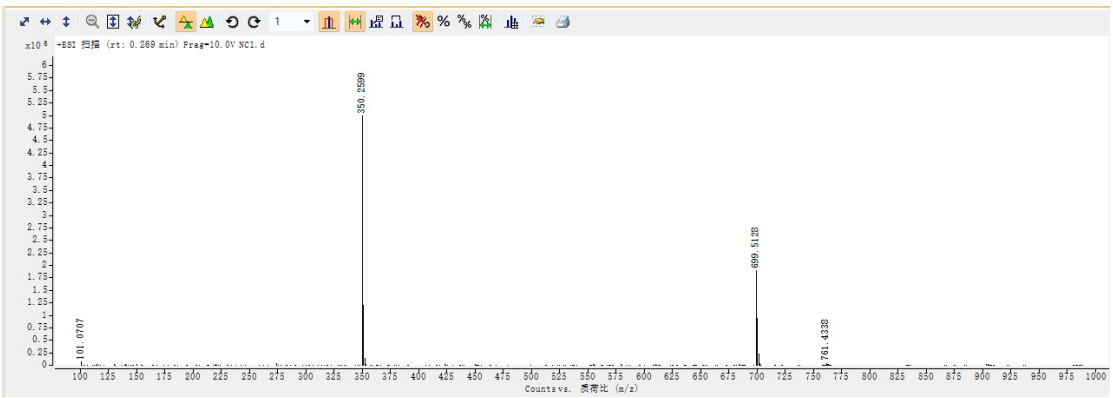
CA-9



CA-10

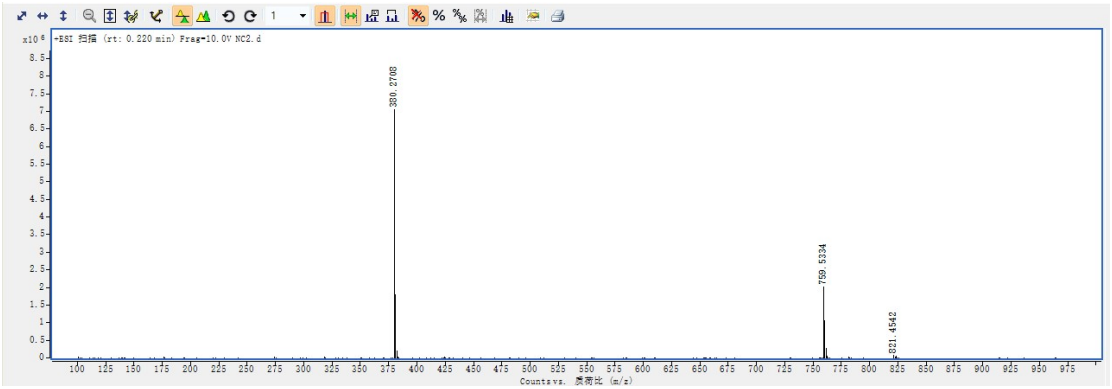


NC-1

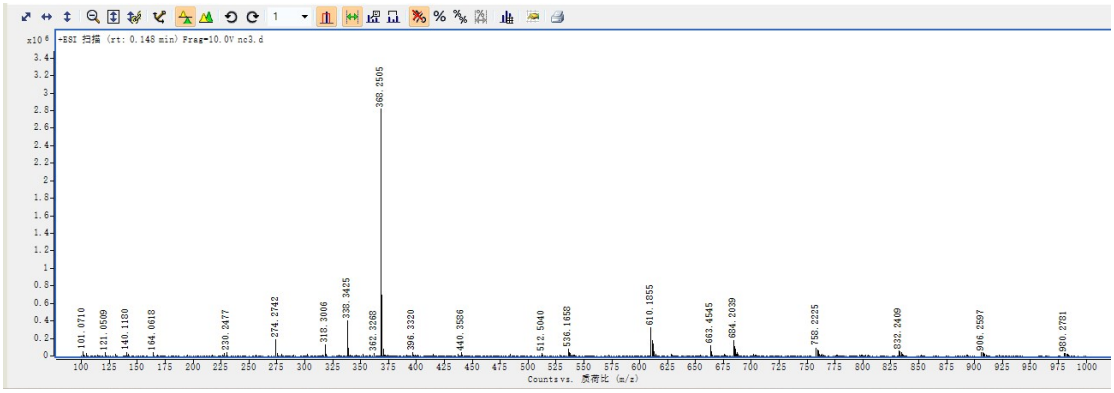


NC-2

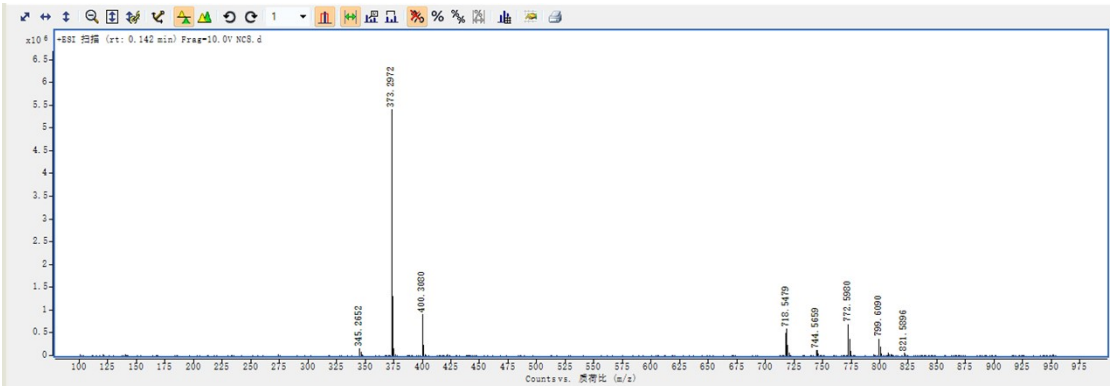
S113


+ESI 扫描 (rt: 0.220 min) Frag=10.0V NC2.d
380.2708
759.5334
821.4542
Counts vs. 质荷比 (m/z)

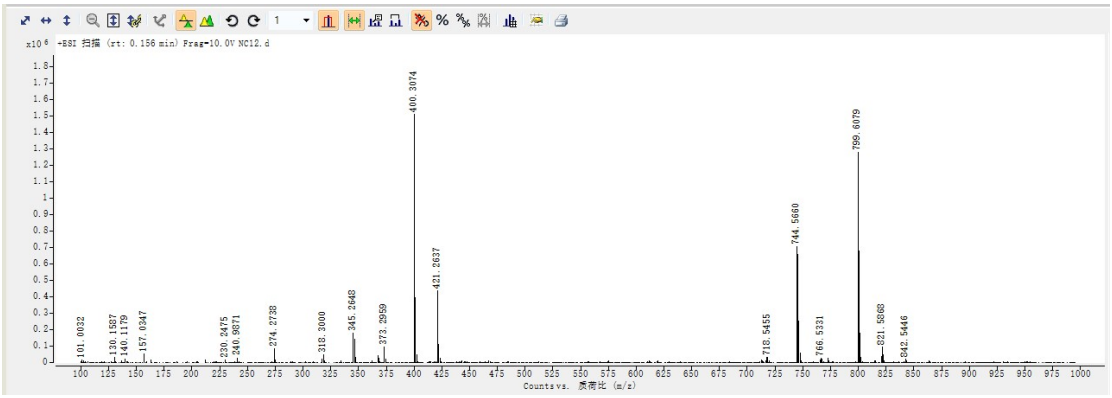
NC-3


+ESI 扫描 (rt: 0.148 min) Frag=10.0V nc3.d
360.2565
101.0710
121.0509
140.1180
164.0618
230.2477
274.2742
318.3006
330.3425
382.3268
396.3320
440.3586
512.5040
536.1658
610.1855
683.4545
694.2039
758.2225
832.2469
906.2597
980.2781
Counts vs. 质荷比 (m/z)

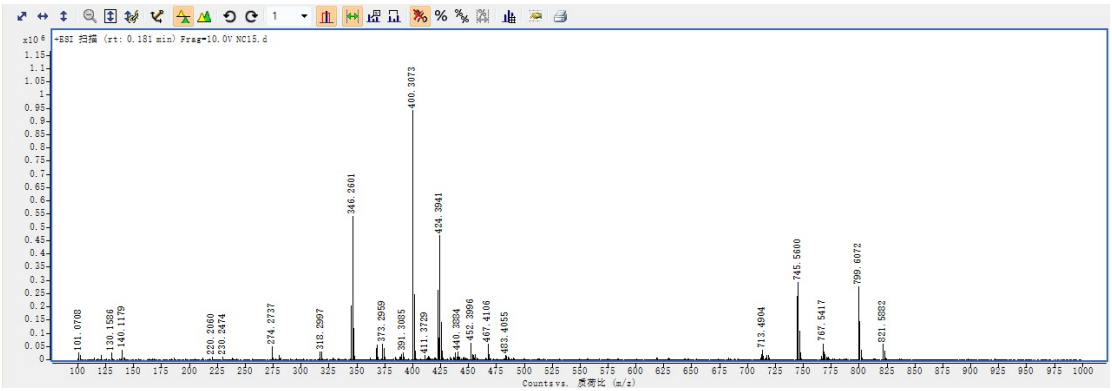
NC-4


+ESI 扫描 (rt: 0.142 min) Frag=10.0V NC8.d
373.2972
345.2652
400.3600
710.5479
744.5659
772.5980
799.6090
821.5896
Counts vs. 质荷比 (m/z)

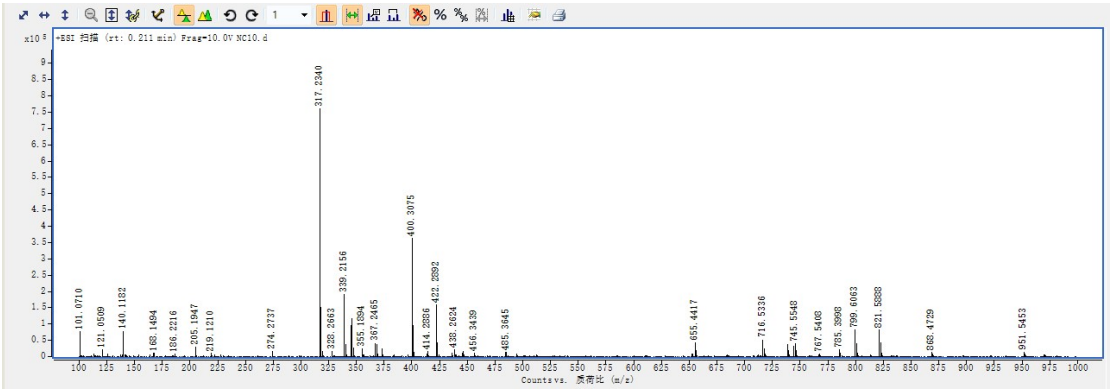
NC-5


x10 6 +ESI 扫描 (rt: 0.156 min) Frag=10.0V NC12.d
101.0032
130.1587
140.1179
157.0347
220.2475
240.9871
274.2738
318.3000
345.2648
373.2959
400.3074
421.2637
710.5455
744.5669
766.5331
799.6079
821.5868
842.5446
Counts vs. 质荷比 (m/z)

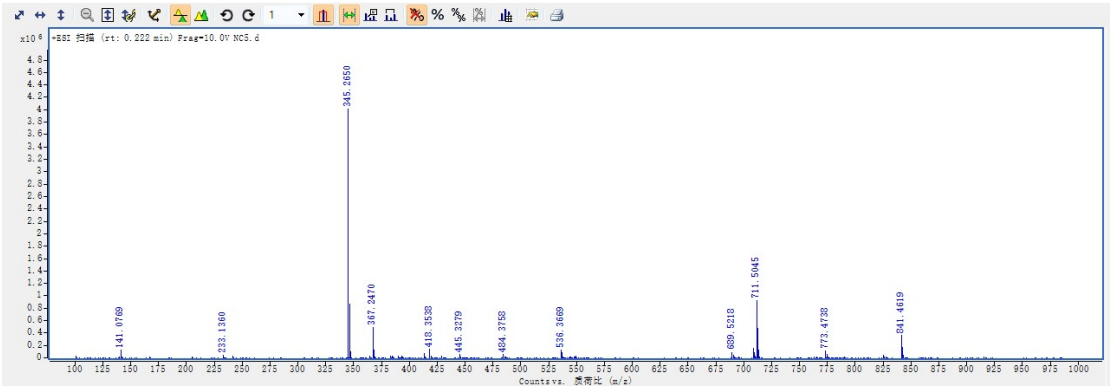
NC-6


x10 6 +ESI 扫描 (rt: 0.181 min) Frag=10.0V NC15.d
101.0708
130.1586
140.1179
220.2060
230.2474
274.2737
318.2997
346.2601
373.2959
391.3085
400.3073
411.3729
424.3941
440.3854
452.3996
467.4106
483.4055
713.4904
745.5600
767.5417
799.6072
821.5882
Counts vs. 质荷比 (m/z)

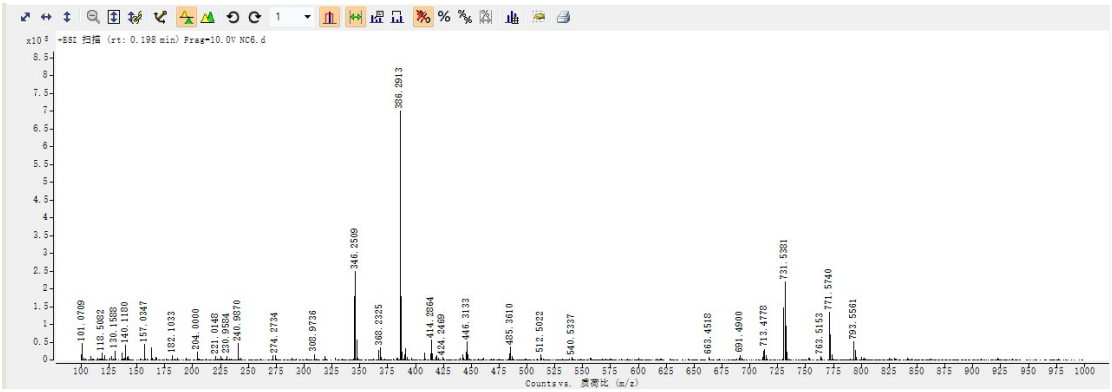
NC-7


x10 6 +ESI 扫描 (rt: 0.211 min) Frag=10.0V NC10.d
101.0710
121.0509
140.1182
168.1494
186.2216
205.1947
219.1210
274.2737
317.2340
338.2663
339.2156
355.1894
367.2465
400.3075
414.2836
422.2892
438.2624
456.3439
485.3645
655.4417
716.5336
745.5548
767.5408
785.3998
799.6063
821.5888
868.4729
951.5453
Counts vs. 质荷比 (m/z)

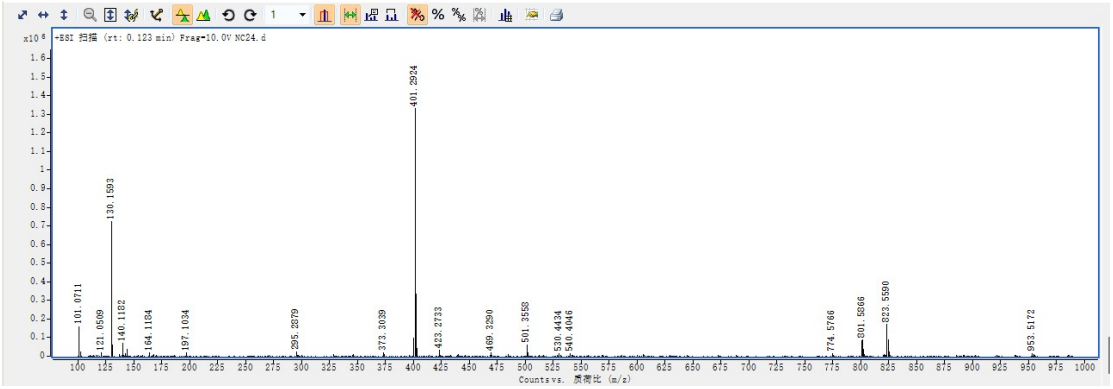
NC-8



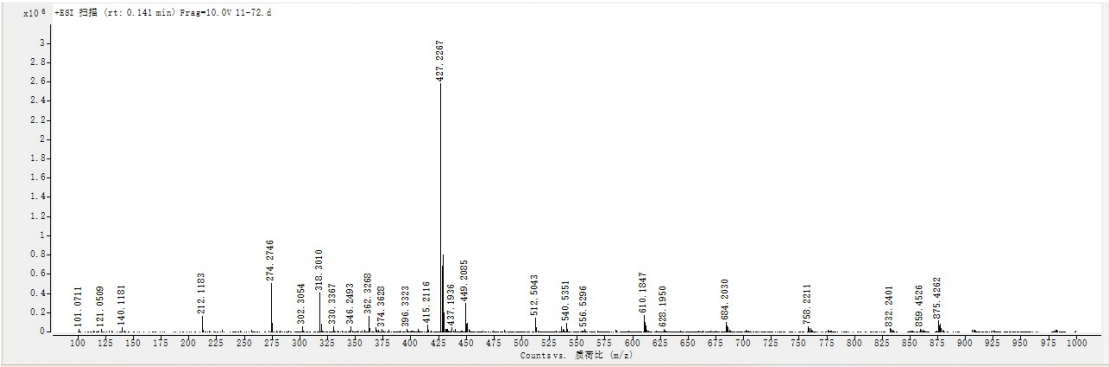
NC-9



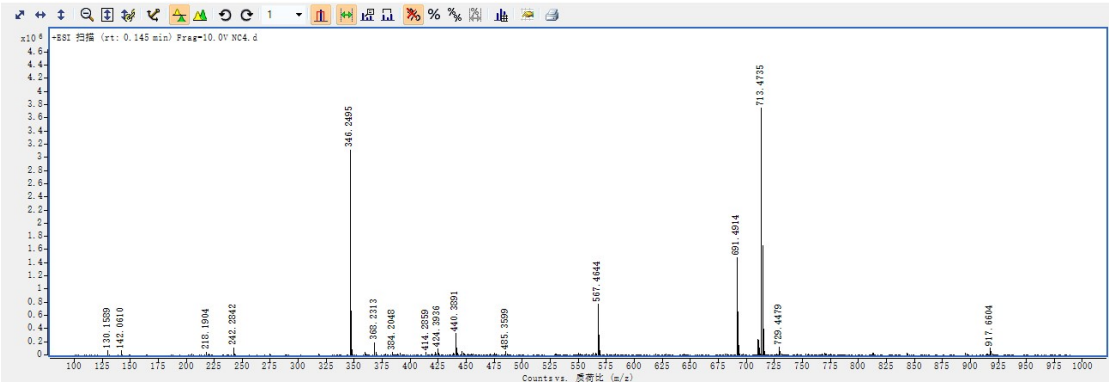
NC-10



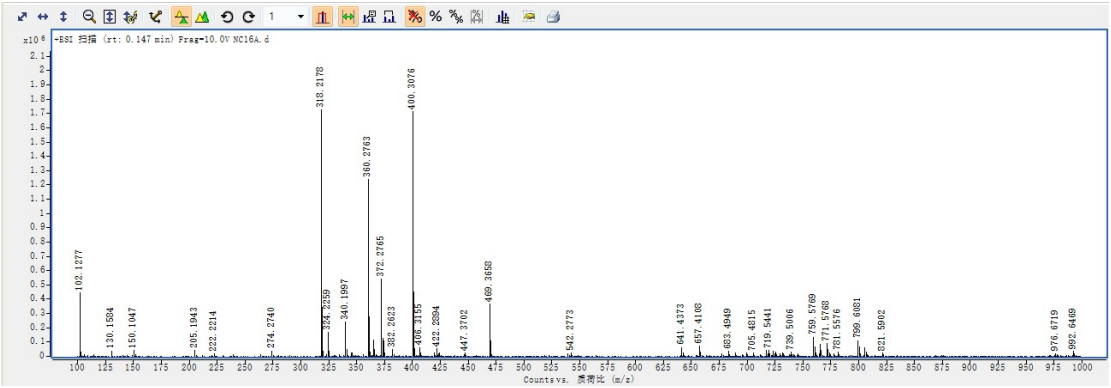
NC-11



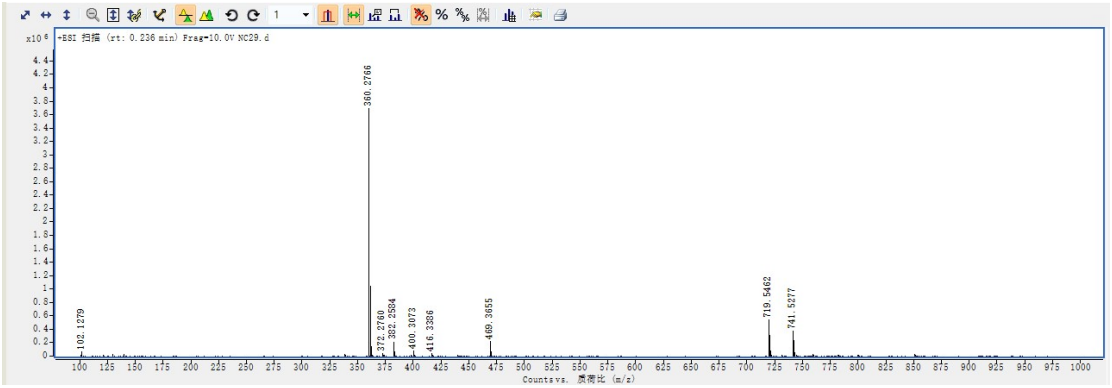
NC-12



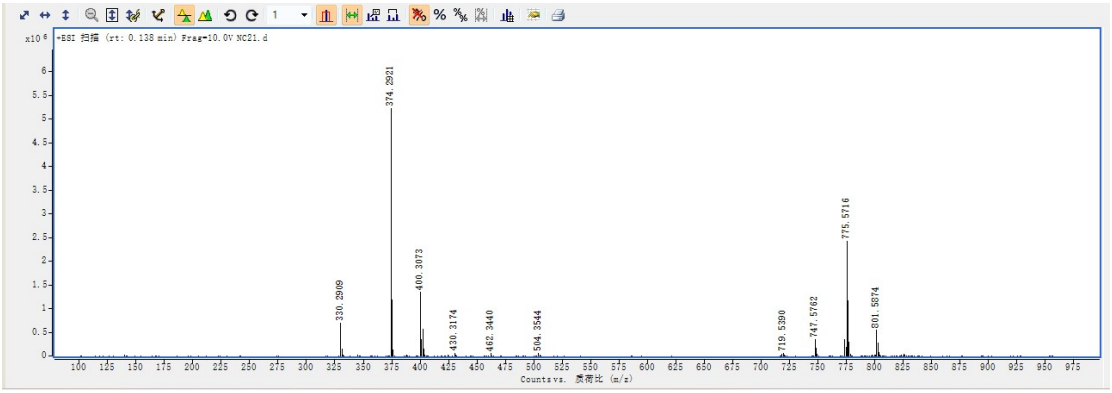
NC-13



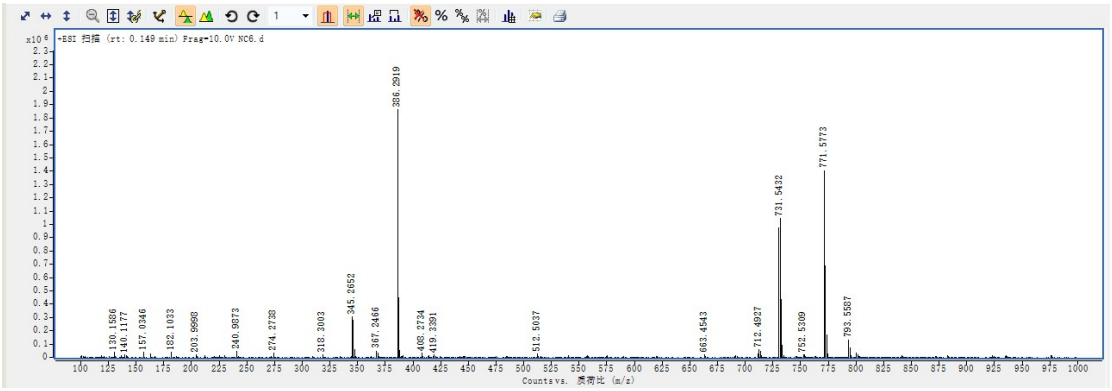
NC-14



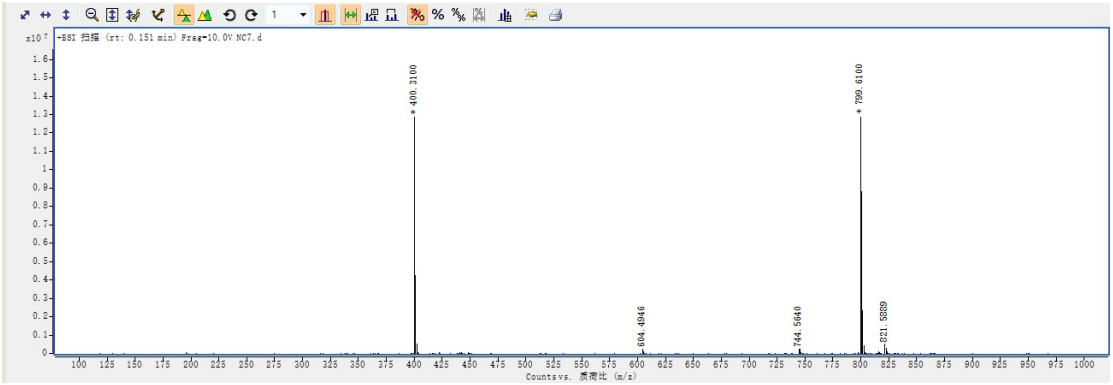
NC-15



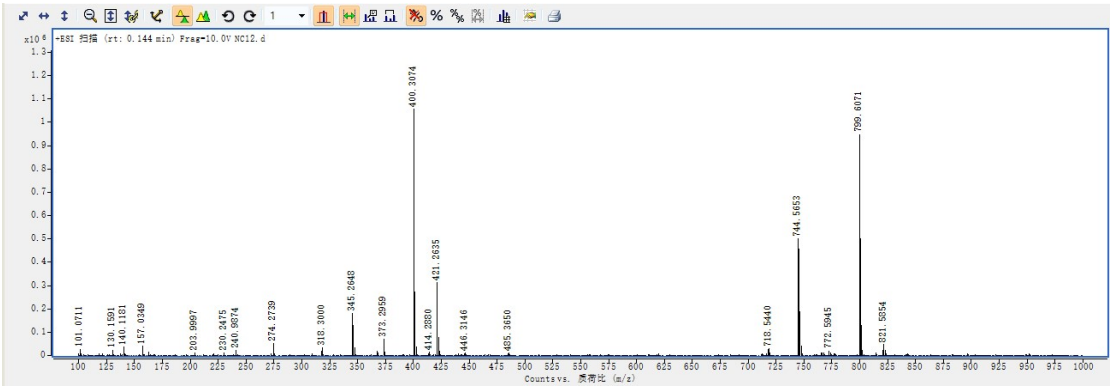
NC-16



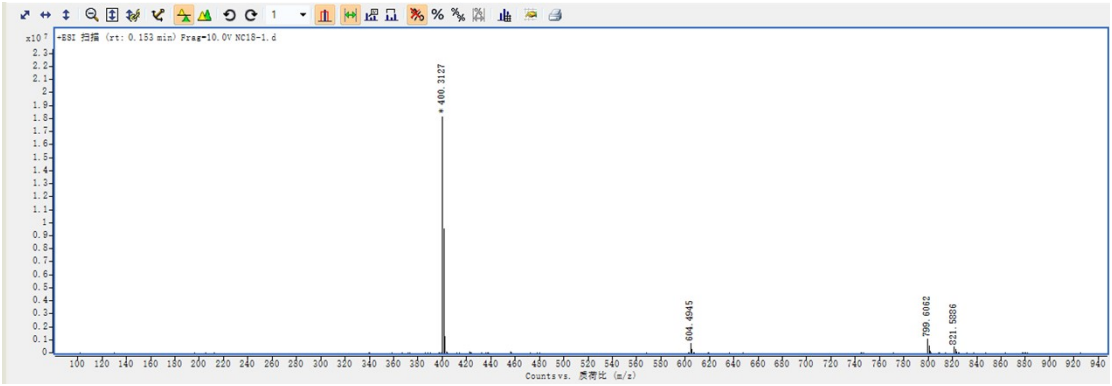
NC-17



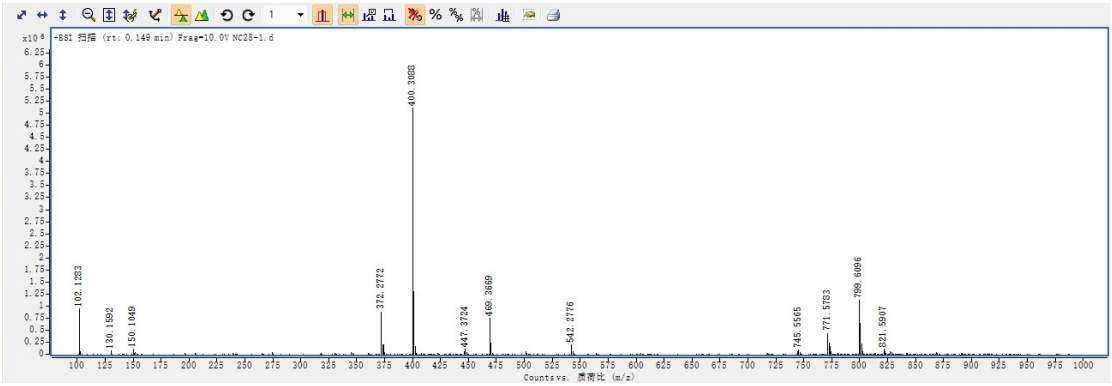
NC-18



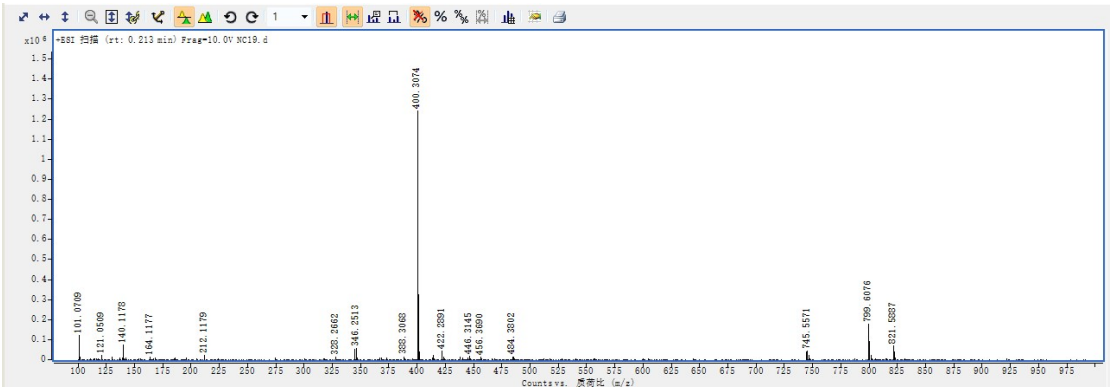
NC-19



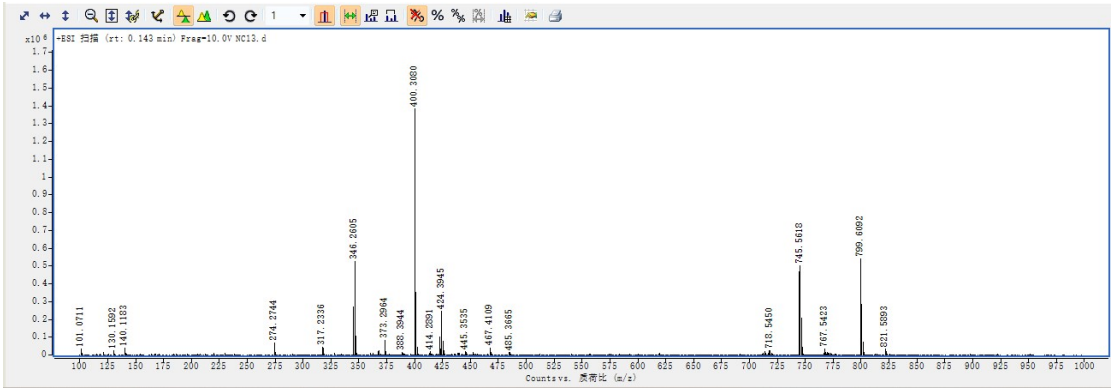
NC-20



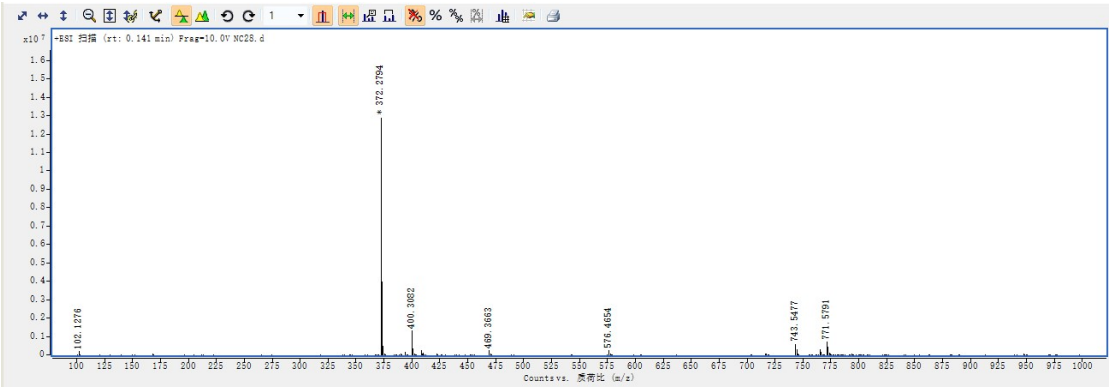
NC-21



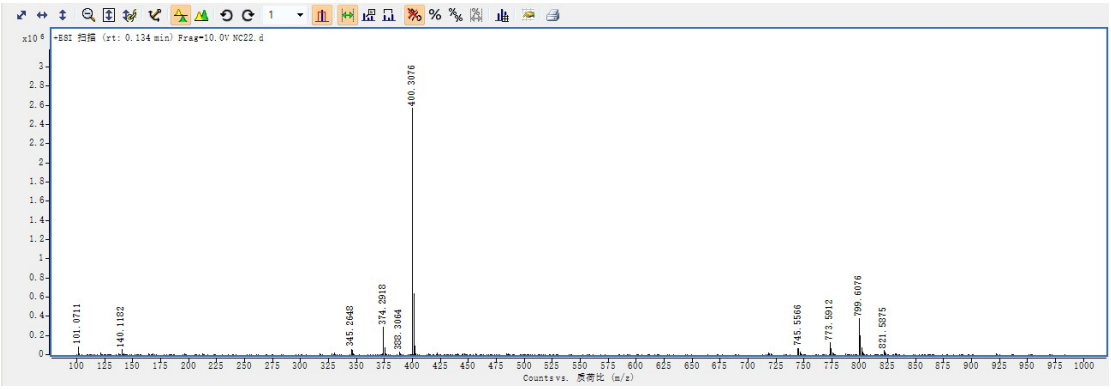
NC-22



NC-23


+ESI 扫描 (rt: 0.141 min) Frag=10.0V NC28.d
x10 7
* 372.2794
102.1276
400.3082
489.3663
576.4654
743.5477
771.5791
Counts vs. 质荷比 (m/z)

NC-24


+ESI 扫描 (rt: 0.134 min) Frag=10.0V NC22.d
x10 6
400.3076
101.0711
140.1182
345.2648
374.2918
388.3064
745.5566
773.5912
799.6076
821.5875
Counts vs. 质荷比 (m/z)