

Supplementary Materials for

[20(22)*E*]-Lanostane Triterpenes from the Fungus *Ganoderma australe*

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References:	Error! Bookmark not defined.

1. Supplementary Figures

Figure S1. ^1H NMR spectrum of **1** (600 MHz, CD_3OD).

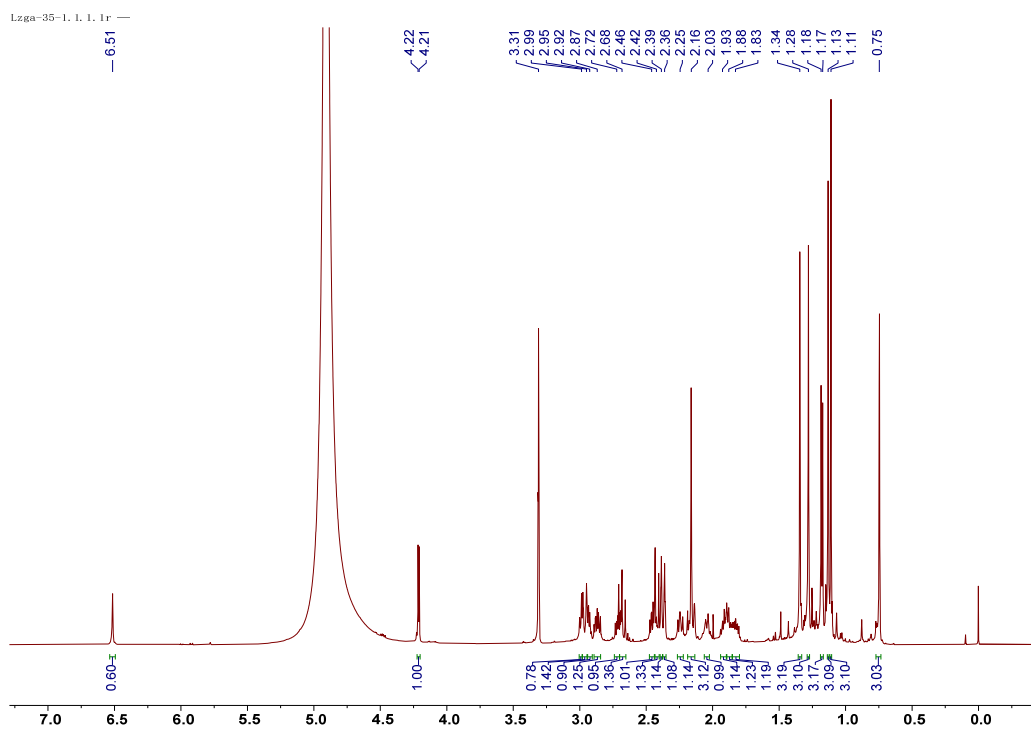


Figure S2. ^{13}C and DEPT NMR spectra of **1** (150 MHz, CD_3OD).

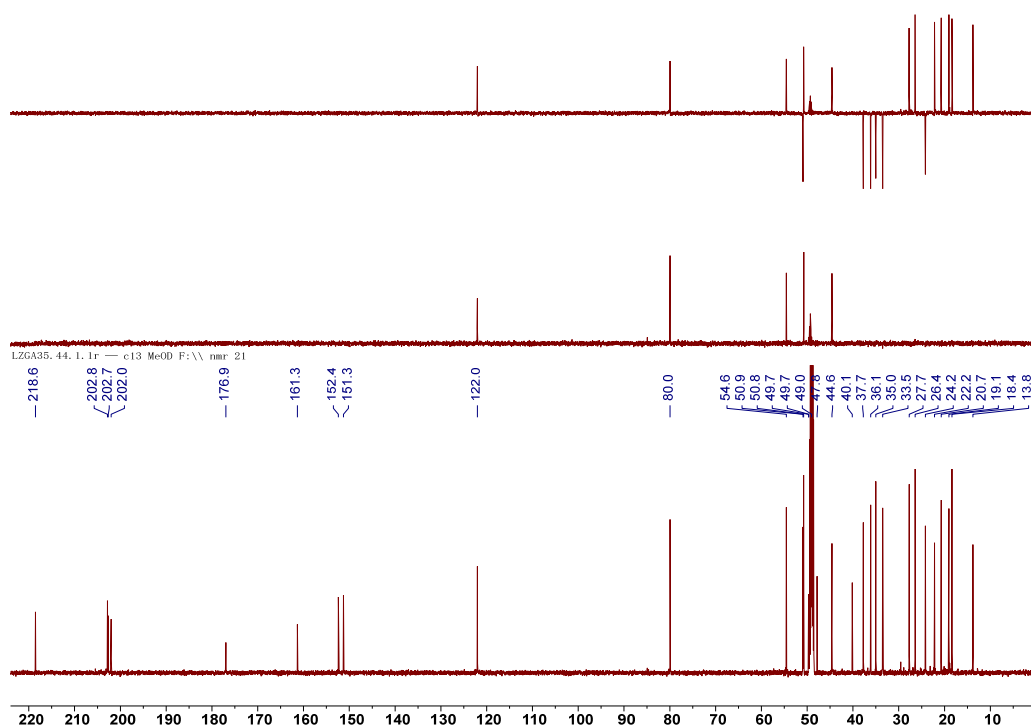


Figure S3. HSQC spectrum of **1**.

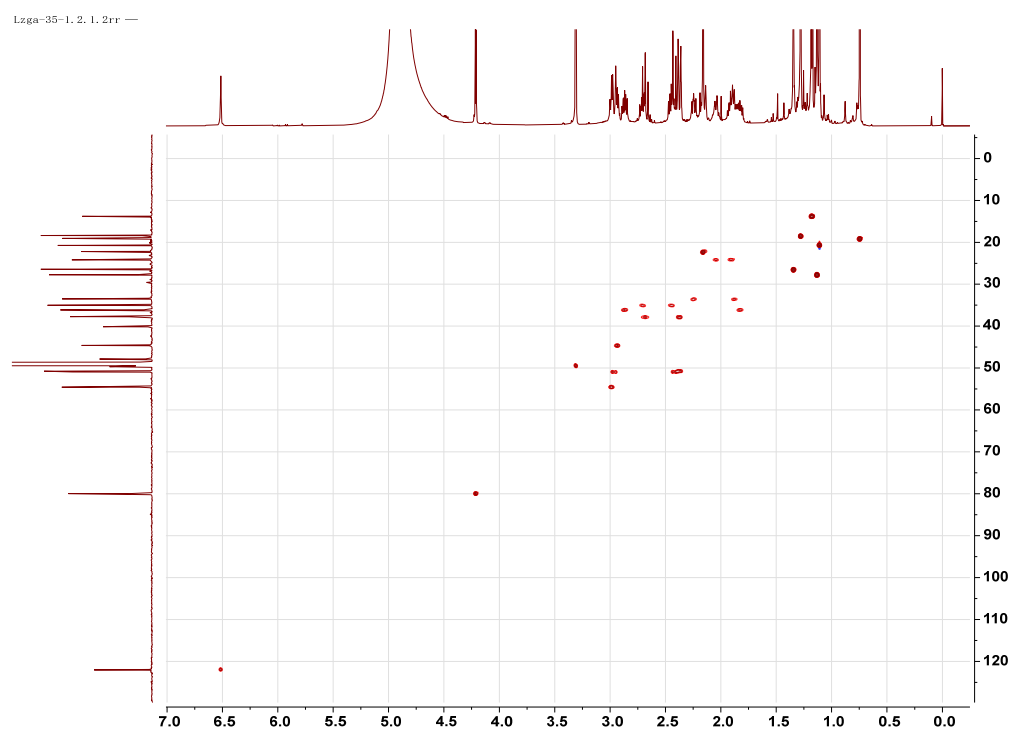
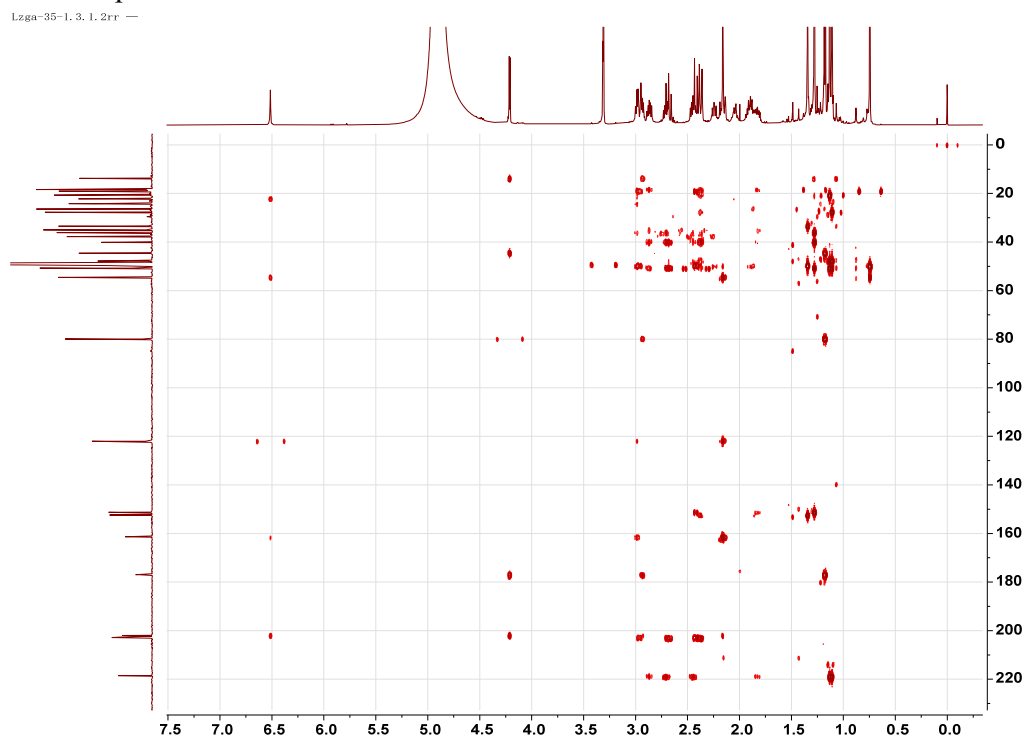
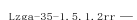


Figure S4. HMBC spectrum of **1**.



Lzga-35-1.4.1.2rr —



Lzga-35-1.5.1.2rr —

Figure S7. HRESIMS of **1**.

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T: FTMS + p ESI Full ms [300.0000-1300.0000]

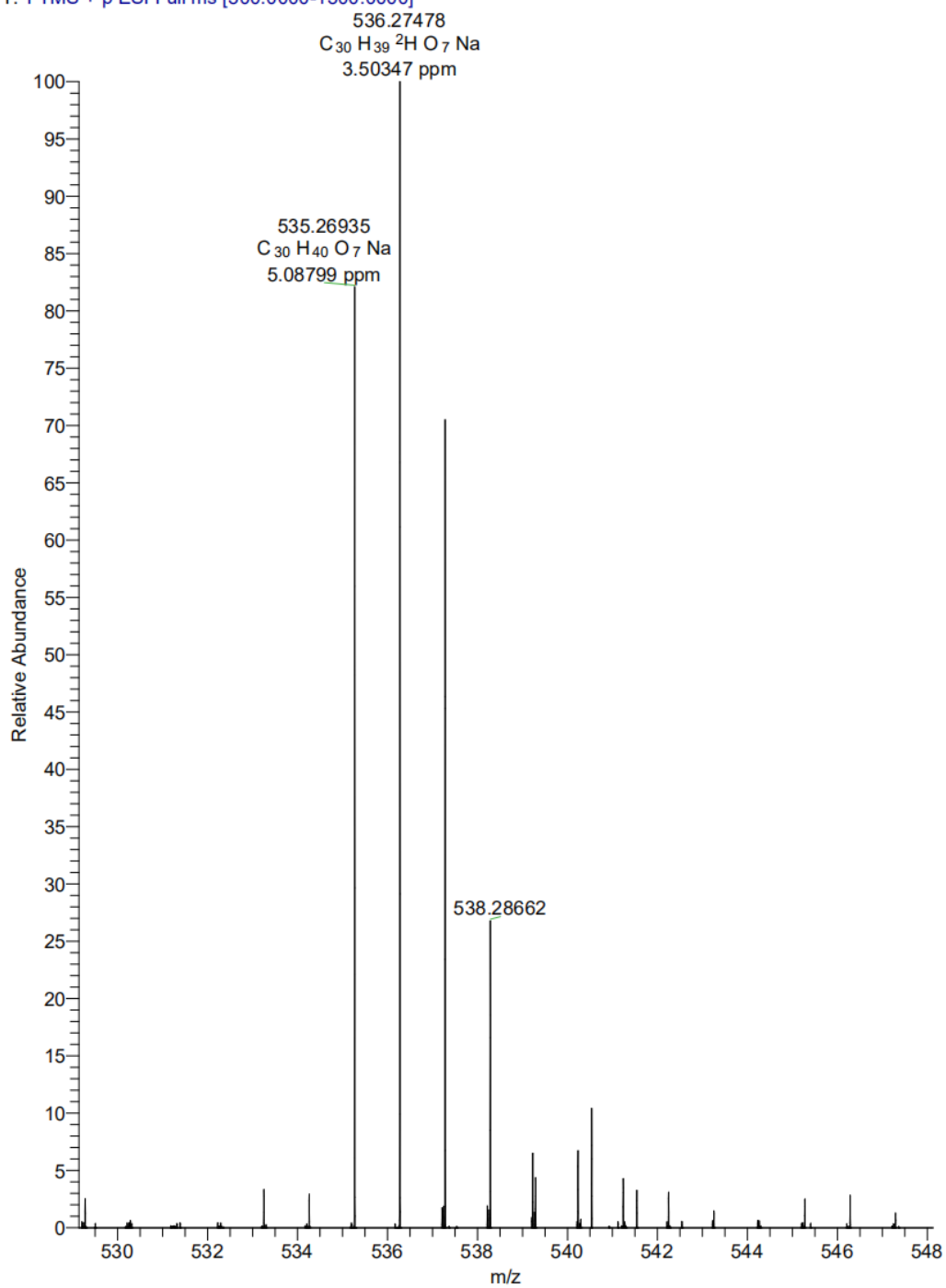


Figure S8. ^1H NMR spectrum of **2** (600 MHz, CDCl_3).

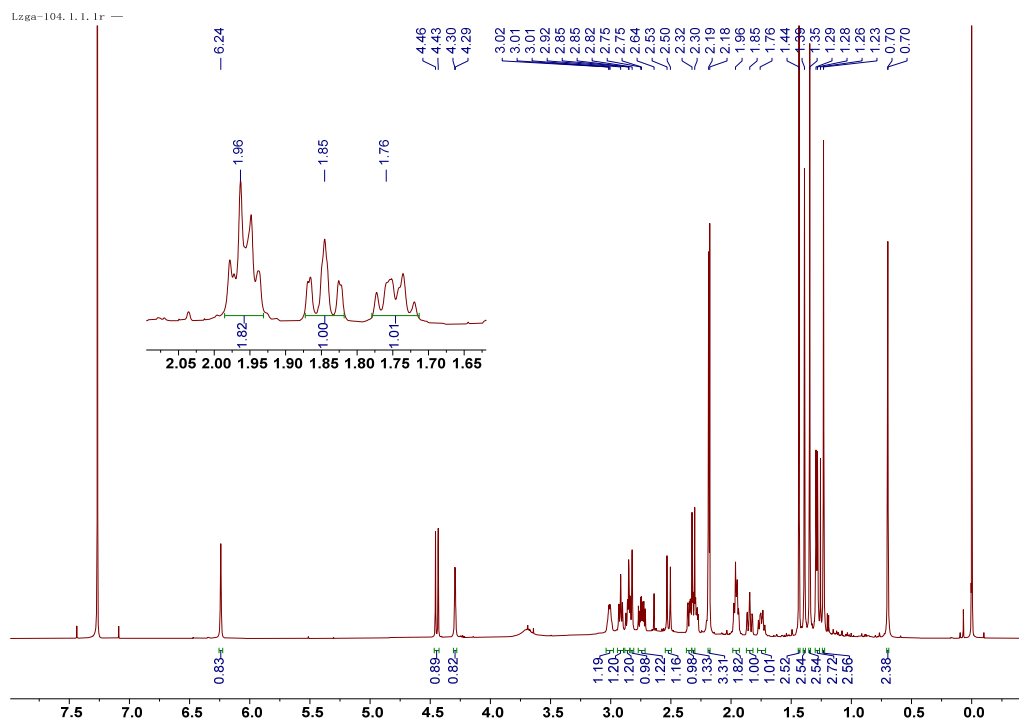


Figure S9. ^{13}C and DEPT NMR spectra of **2** (150 MHz, CDCl_3).

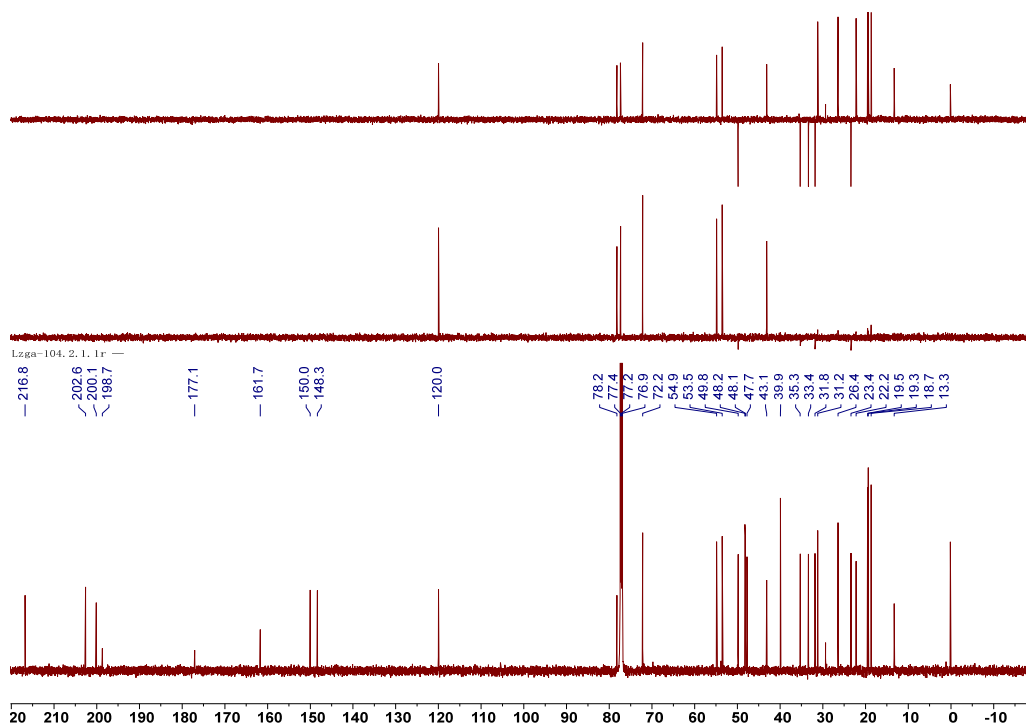


Figure S10. HSQC spectrum of **2**.

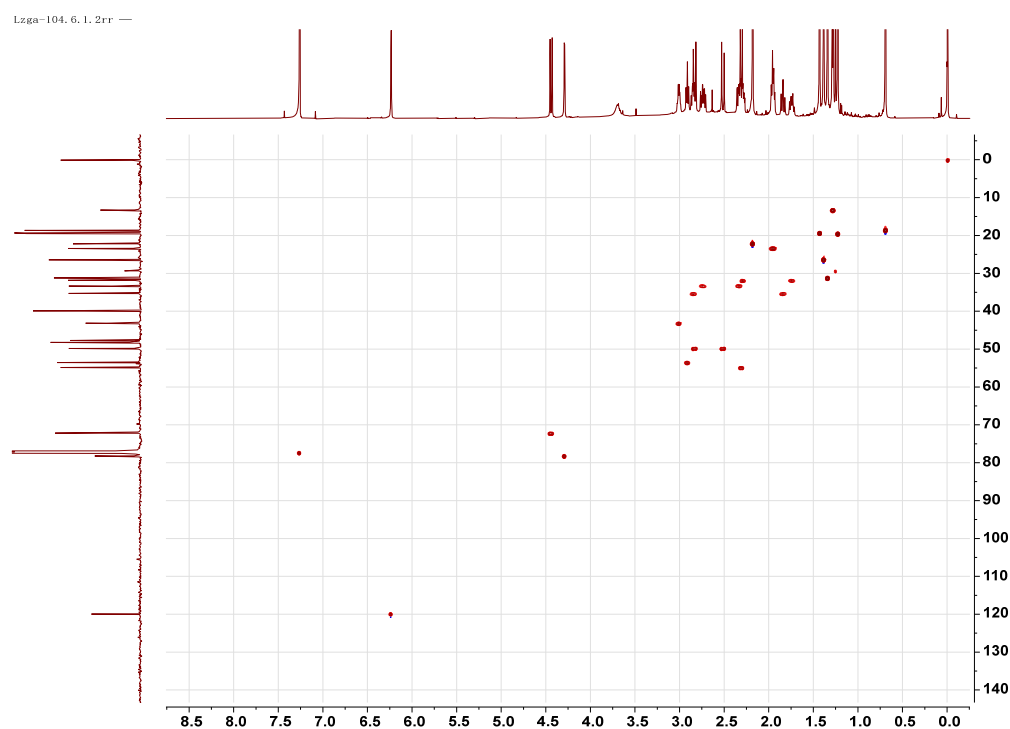


Figure S11. HMBC spectrum of **2**.

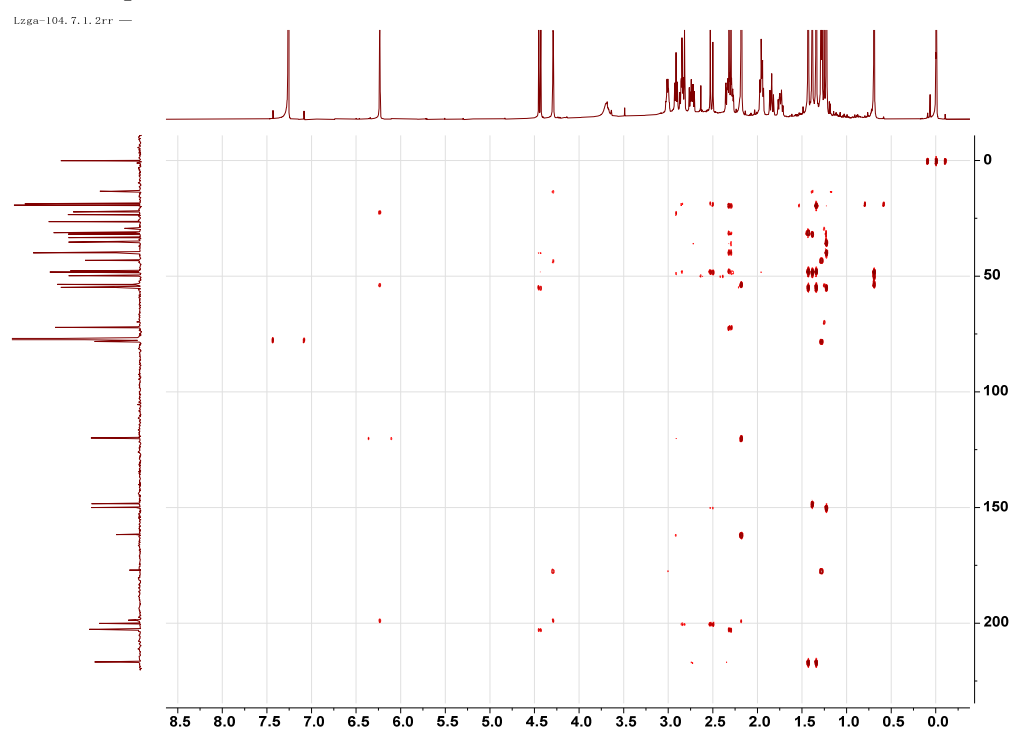


Figure S12. ^1H - ^1H COSY spectrum of **2**.

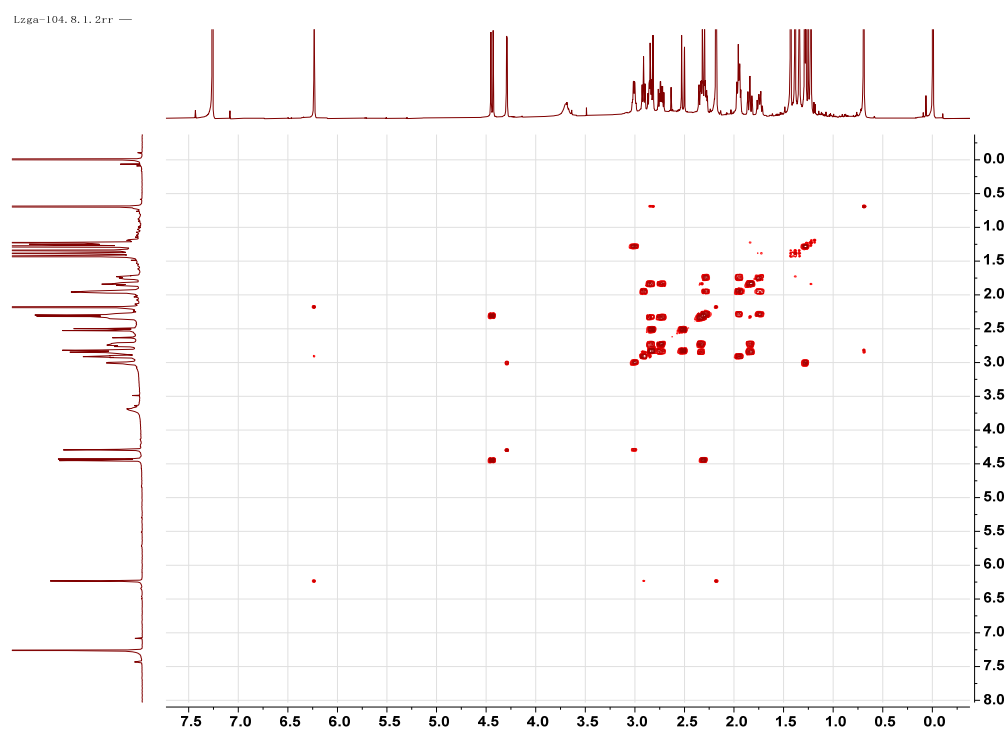


Figure S13. ROESY spectrum of **2**.

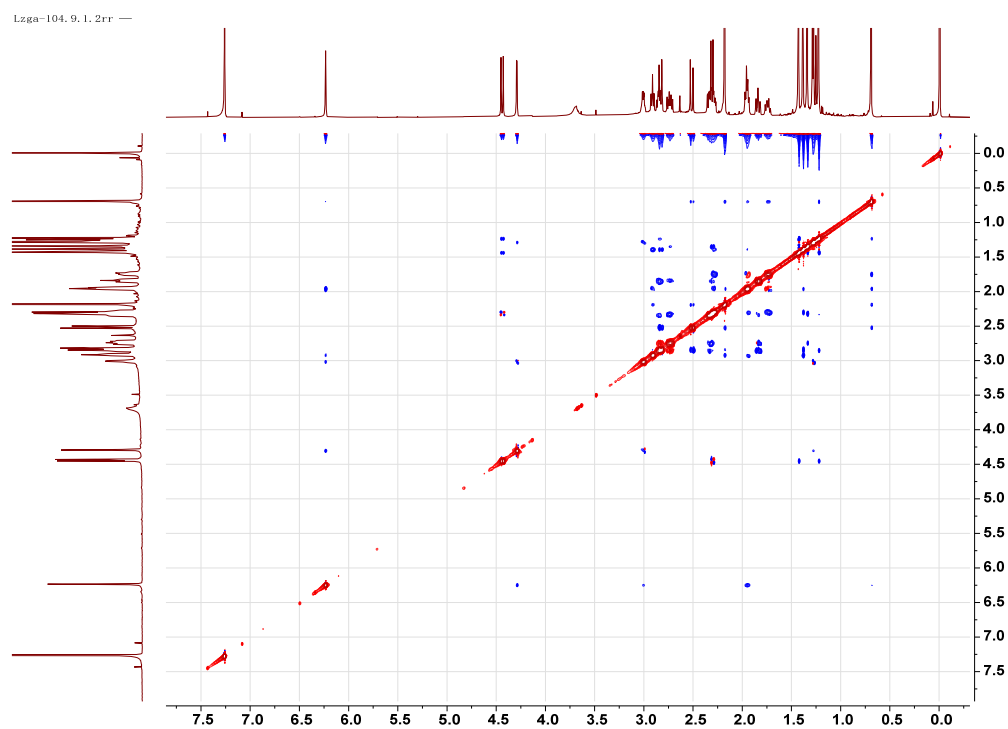


Figure S14. HRESIMS of **2**.

D:\spectrum\lzga\Zga-104\ZGA-104

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ZGA-104 #13 RT: 0.17 AV: 1 NL: 2.48E8

T: FTMS + p ESI Full ms [300.0000-1300.0000]

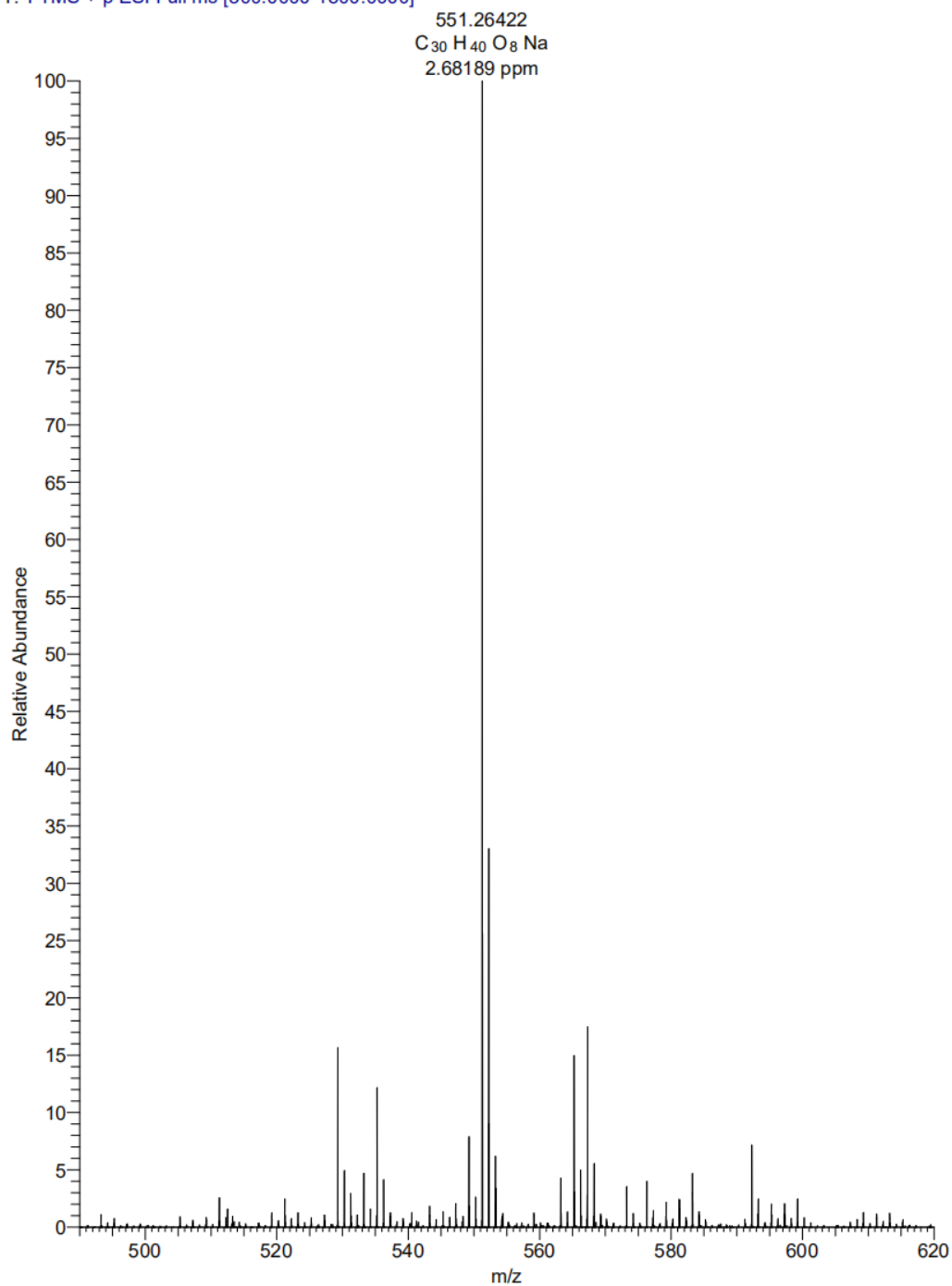


Figure S15. ^1H NMR spectrum of **3** (500 MHz, CDCl_3).

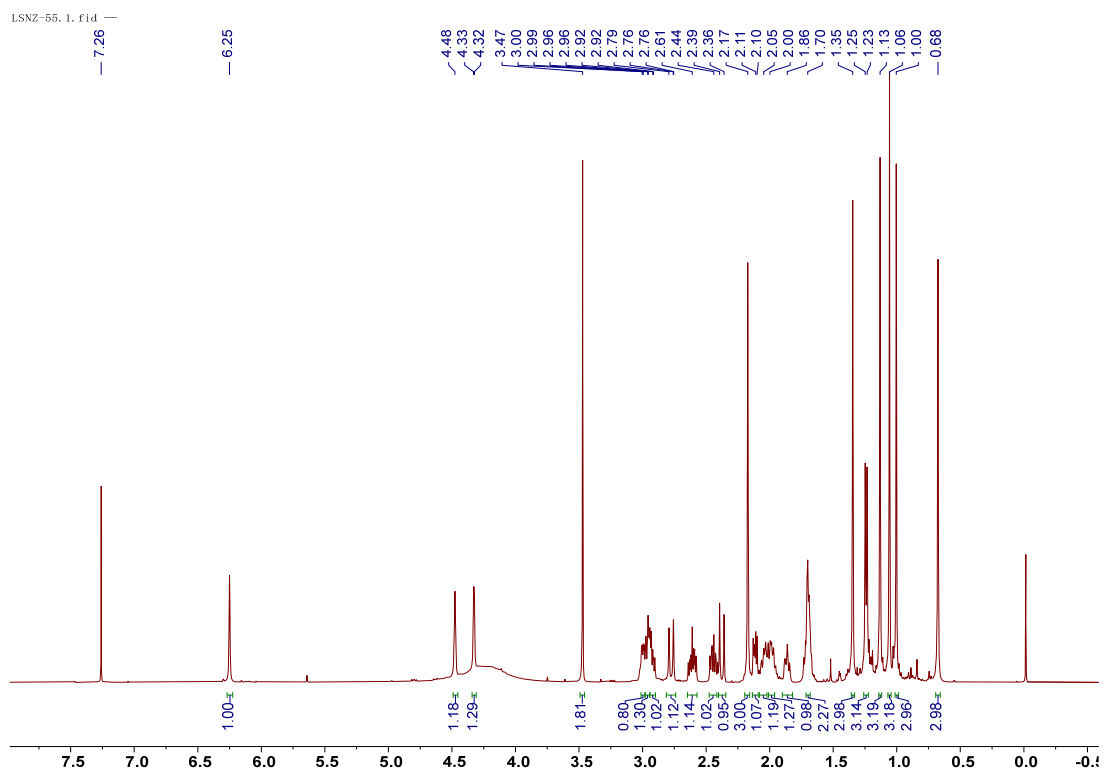


Figure S16. ^{13}C and DEPT NMR spectra of **3** (125 MHz, CDCl_3).

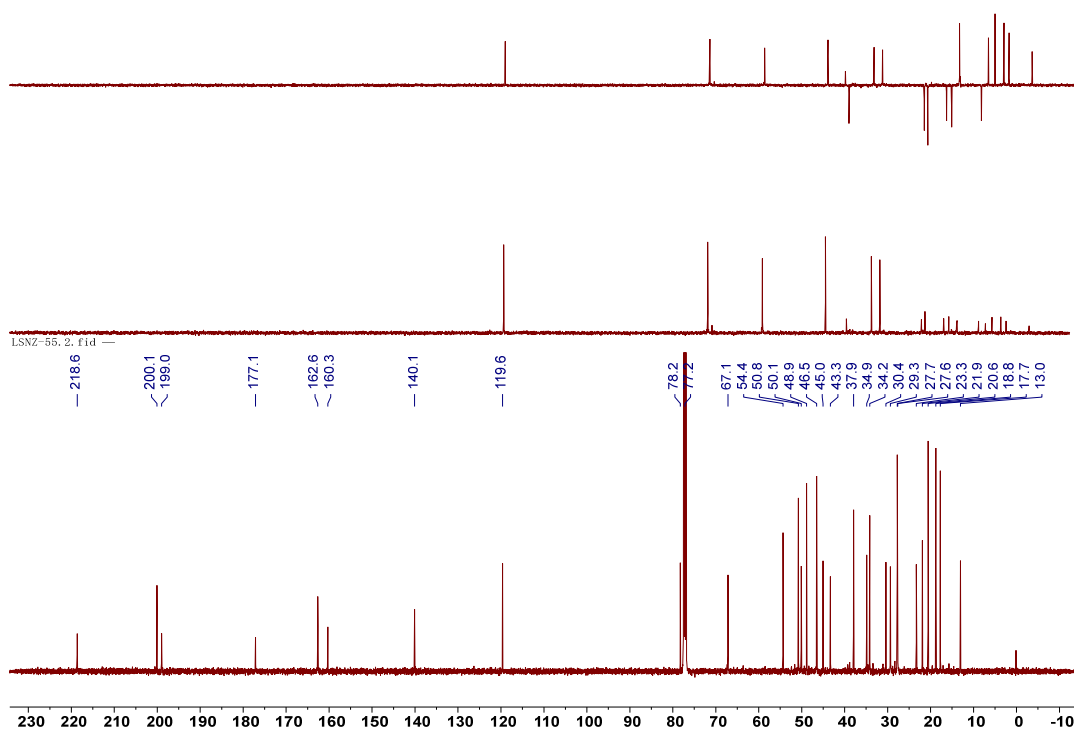


Figure S17. HSQC spectrum of **3**.

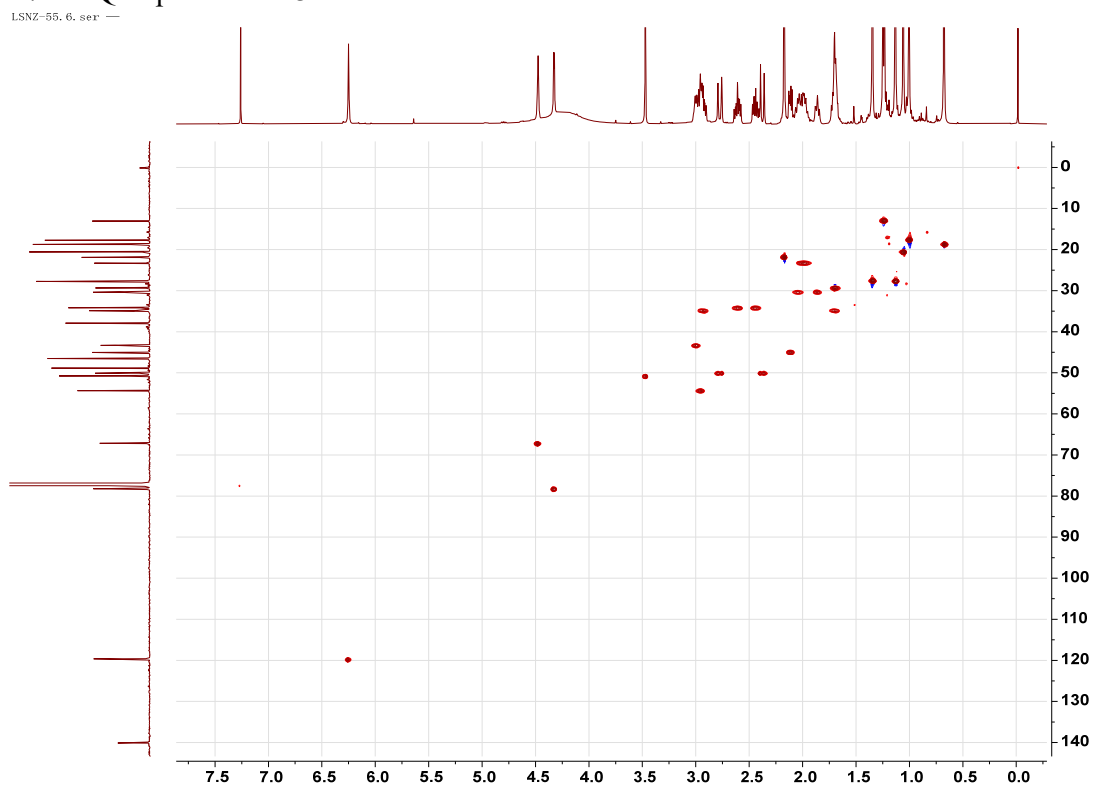


Figure S18. HMBC spectrum of **3**.

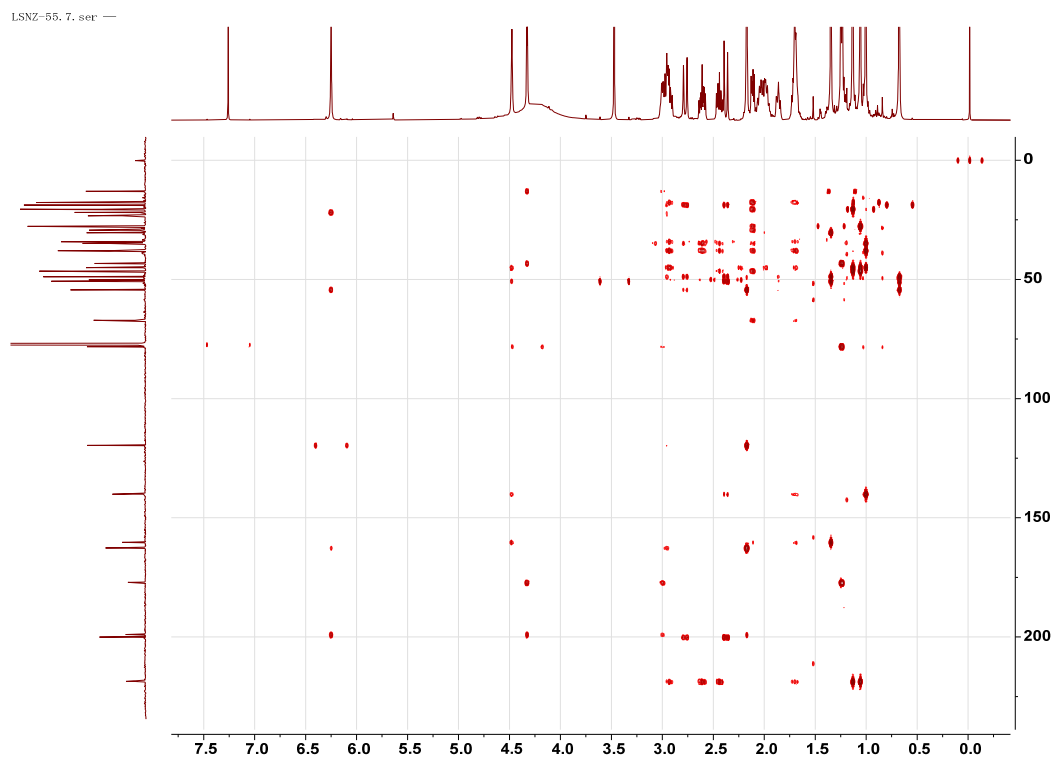


Figure S19. ^1H - ^1H COSY spectrum of **3**.

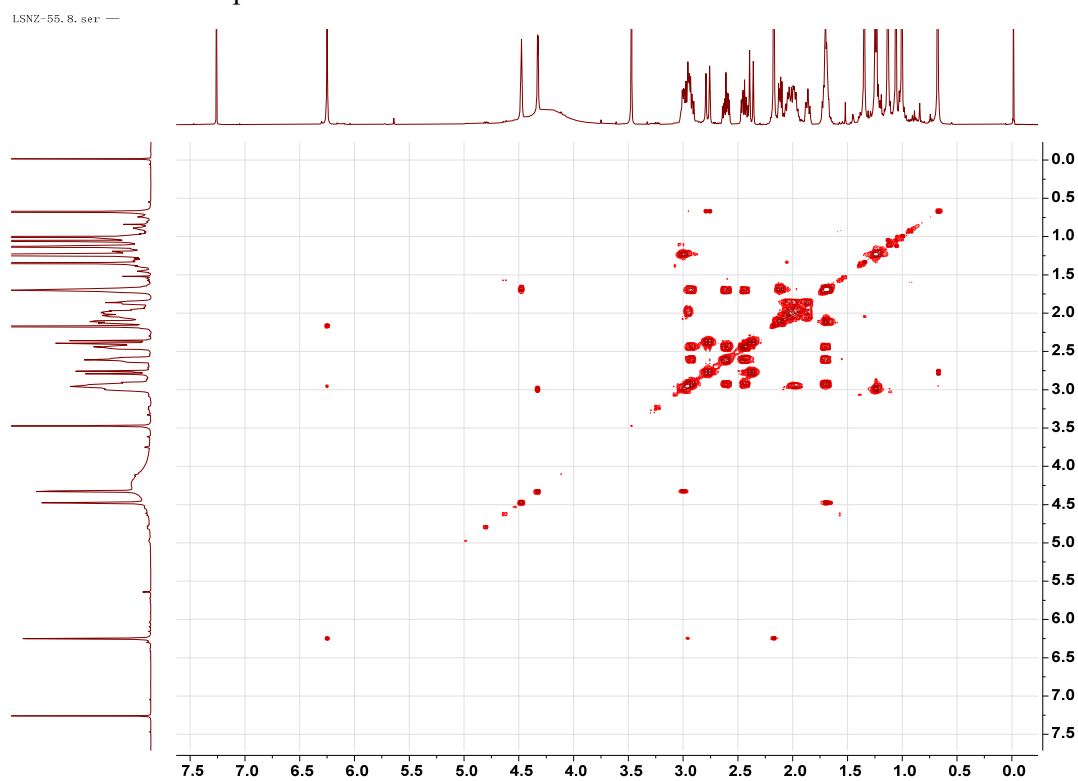


Figure S20. ROESY spectrum of **3**.

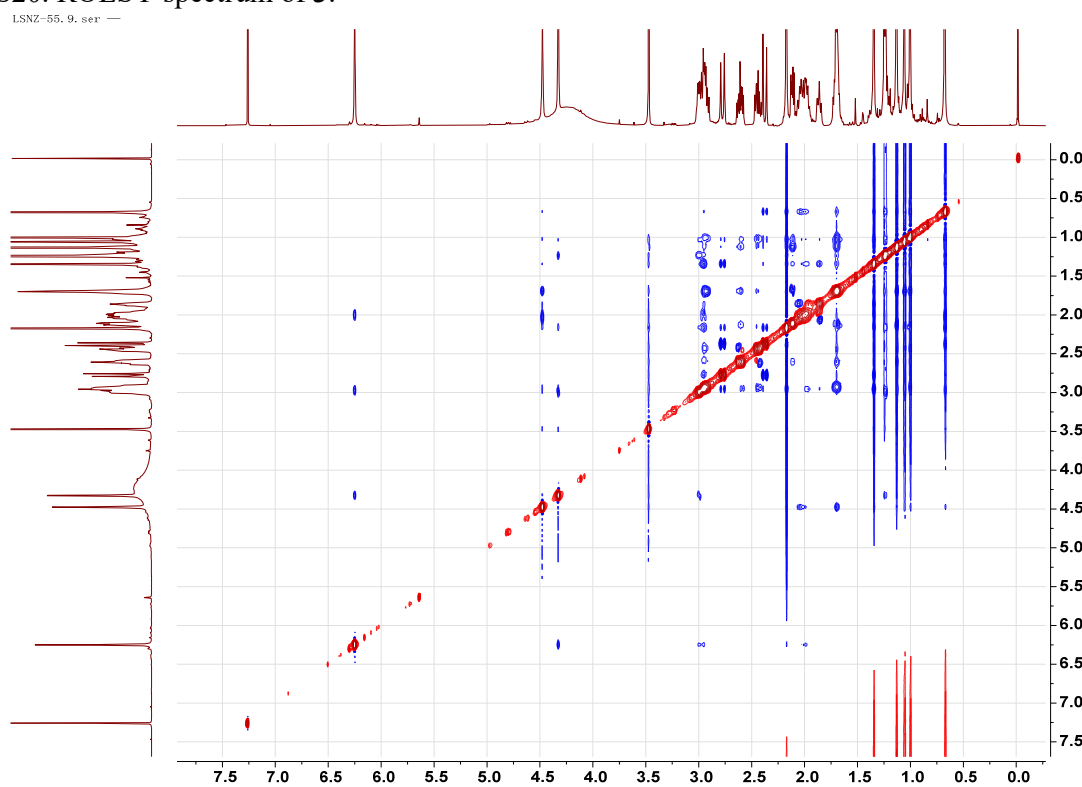


Figure S21. HRESIMS of **3**.

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T: FTMS + p ESI Full lock ms [100.0000-1500.0000]

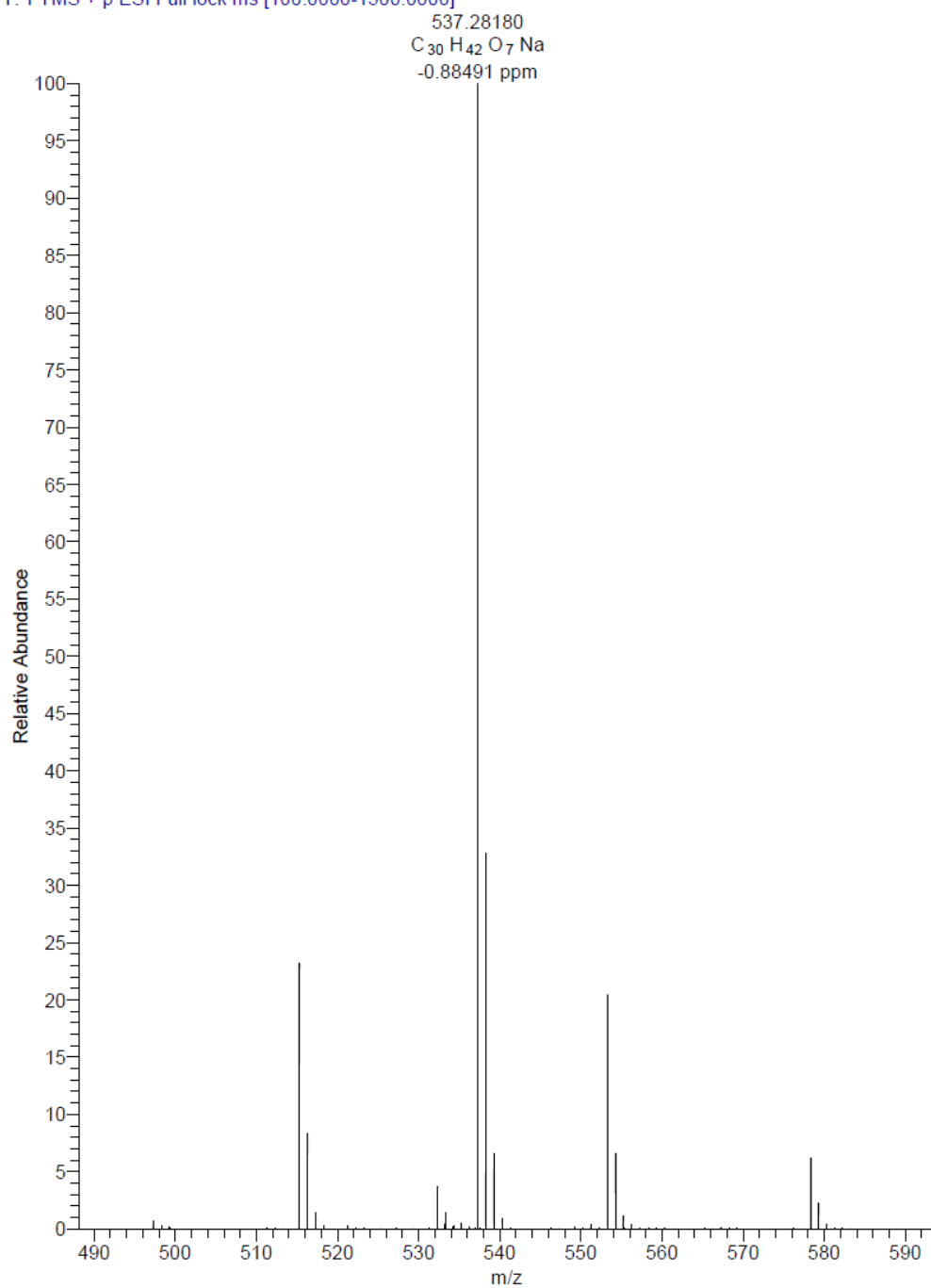


Figure S22. ^1H NMR spectrum of **4** (600 MHz, CD_3COCD_3).

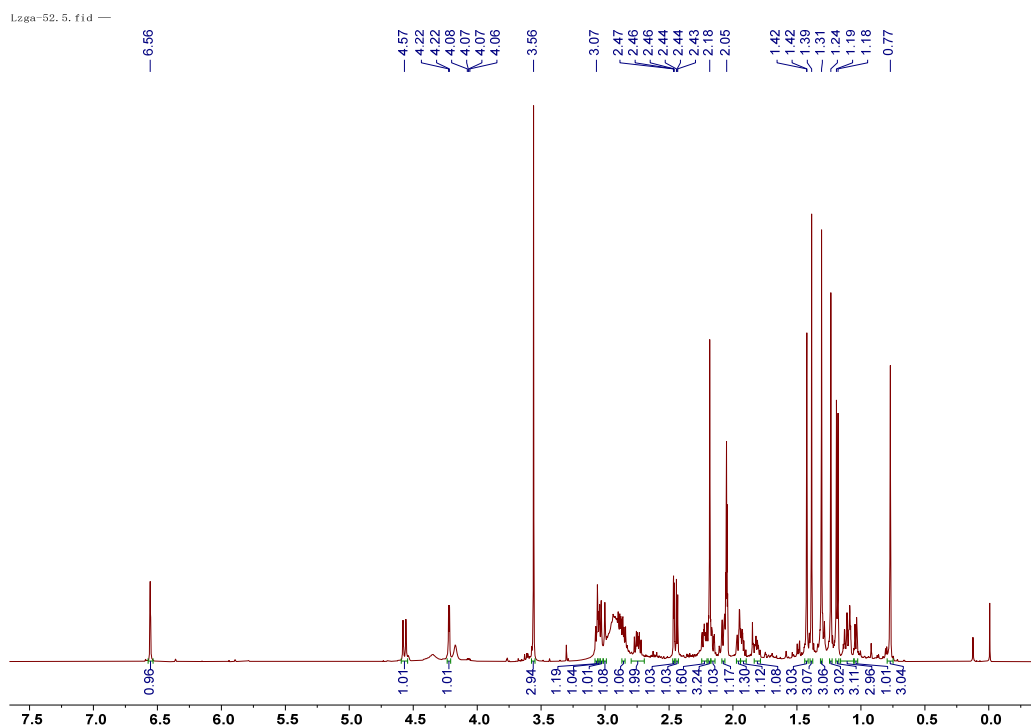


Figure S23. ^{13}C and DEPT NMR spectra of **4** (150 MHz, CD_3COCD_3).

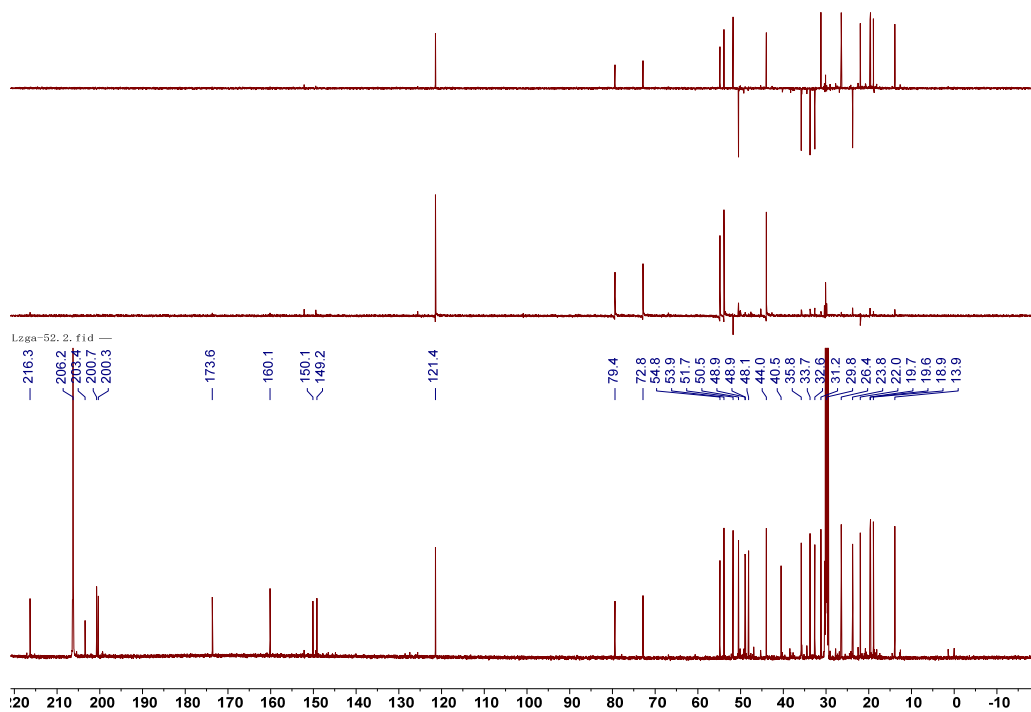


Figure S24. HSQC spectrum of **4**.

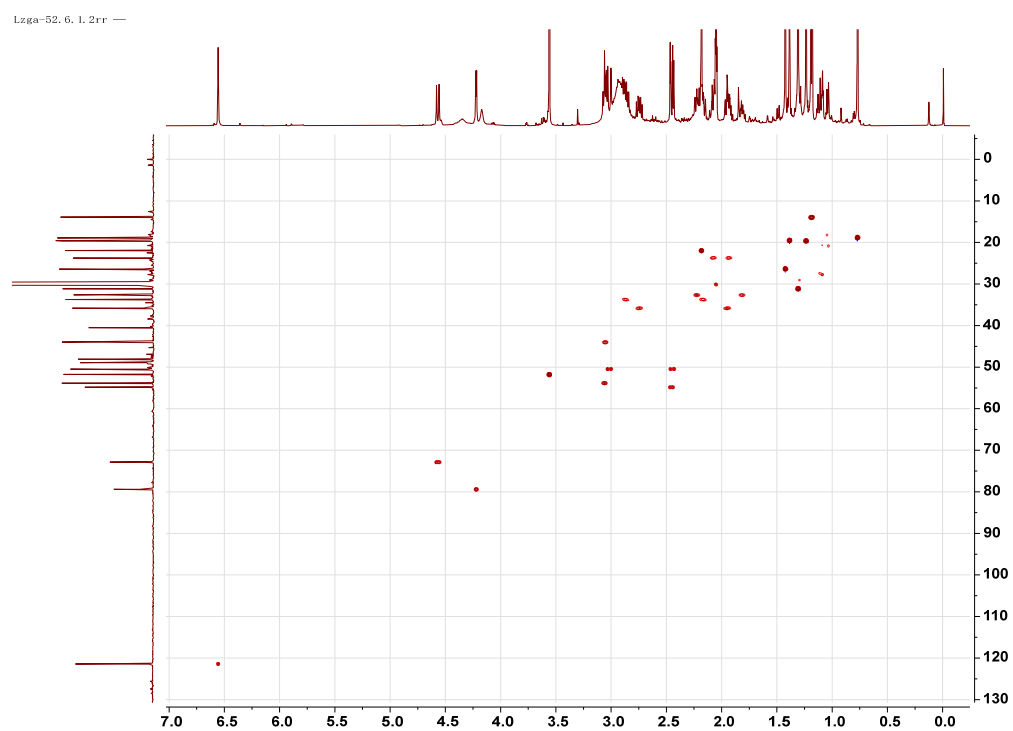


Figure S25. HMBC spectrum of **4**.

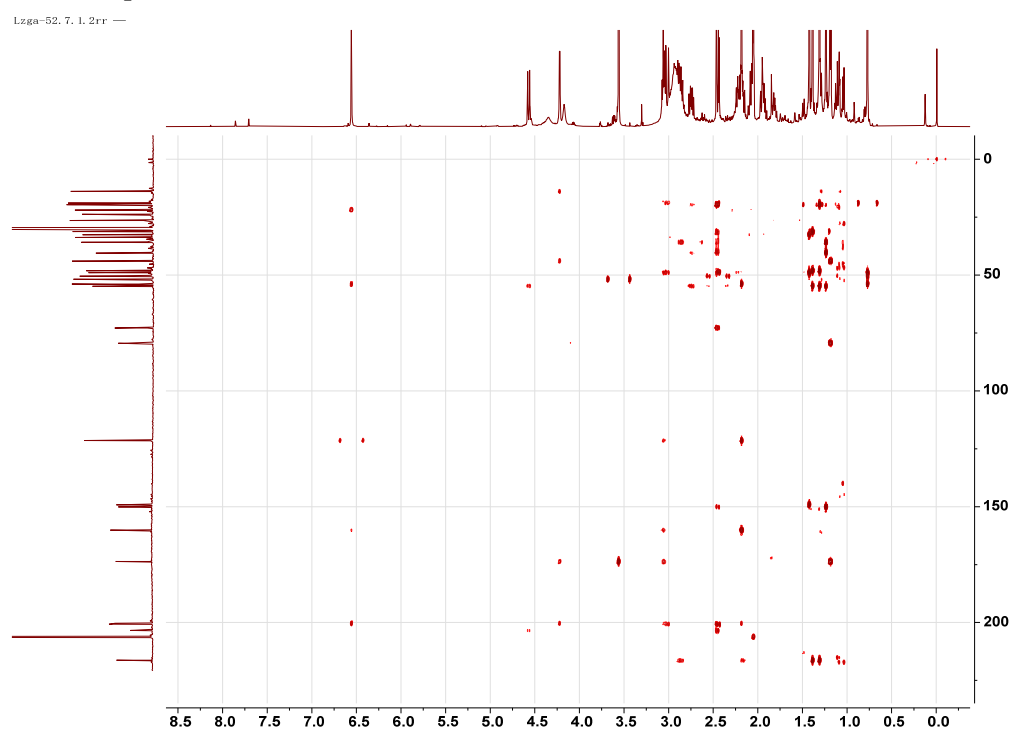


Figure S26. ^1H - ^1H COSY spectrum of **4**.

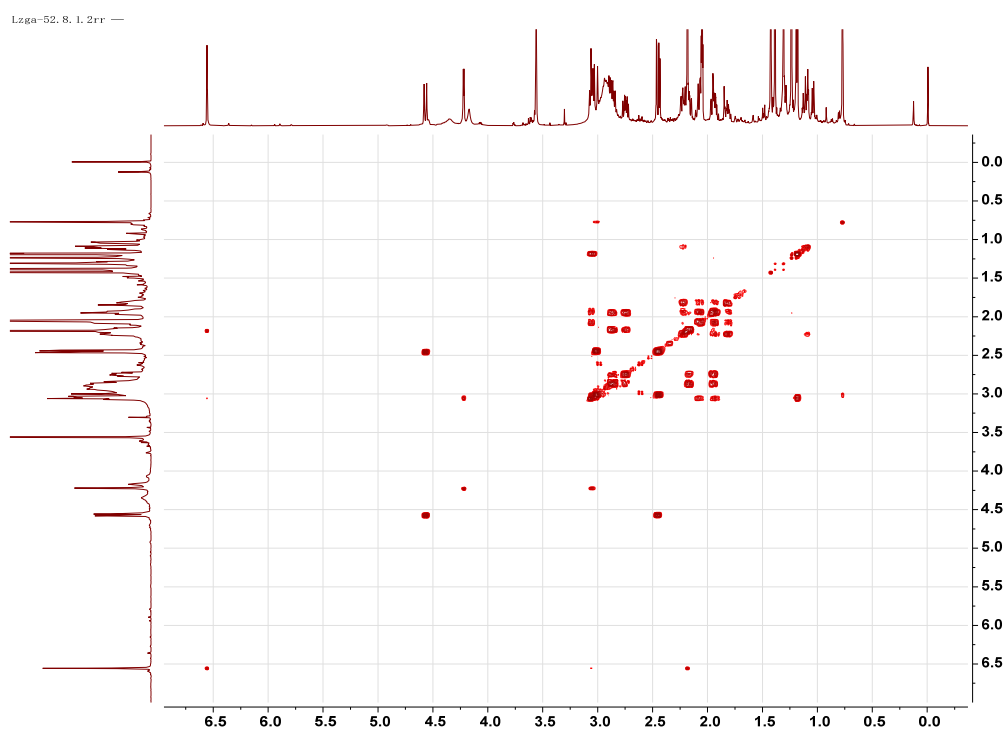


Figure S27. ROESY spectrum of **4**.

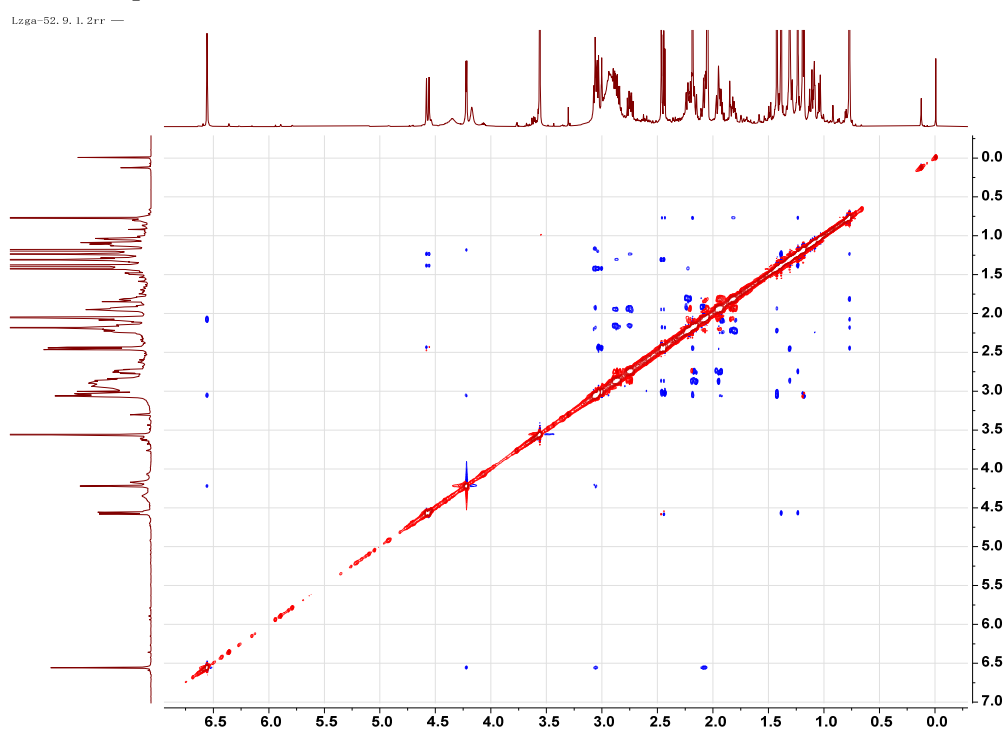


Figure S28. HRESIMS of **4**.

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T: FTMS + p ESI Full lock ms [150.0000-1100.0000]

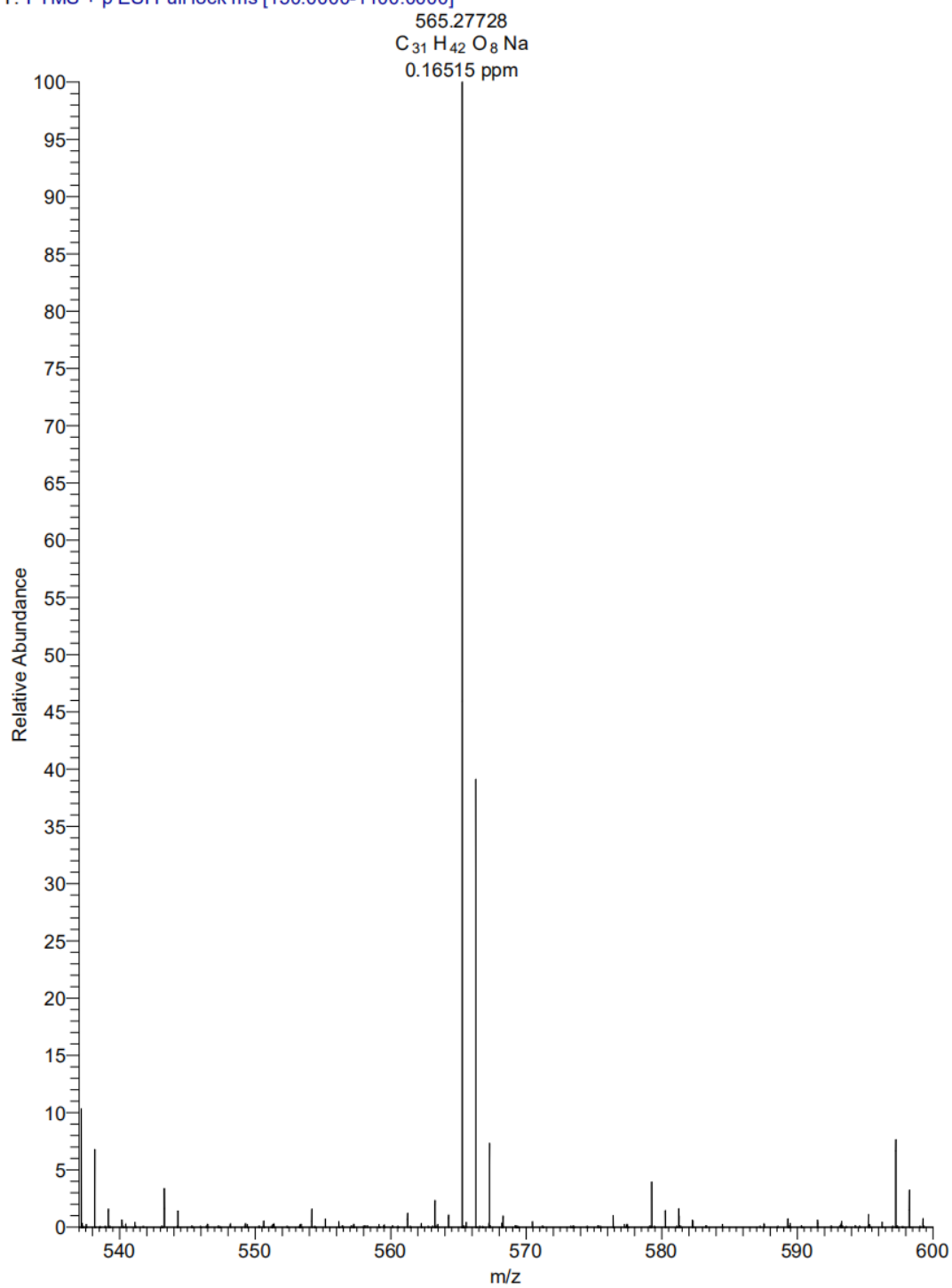


Figure S29. ^1H NMR spectrum of **5** (600 MHz, CDCl_3).

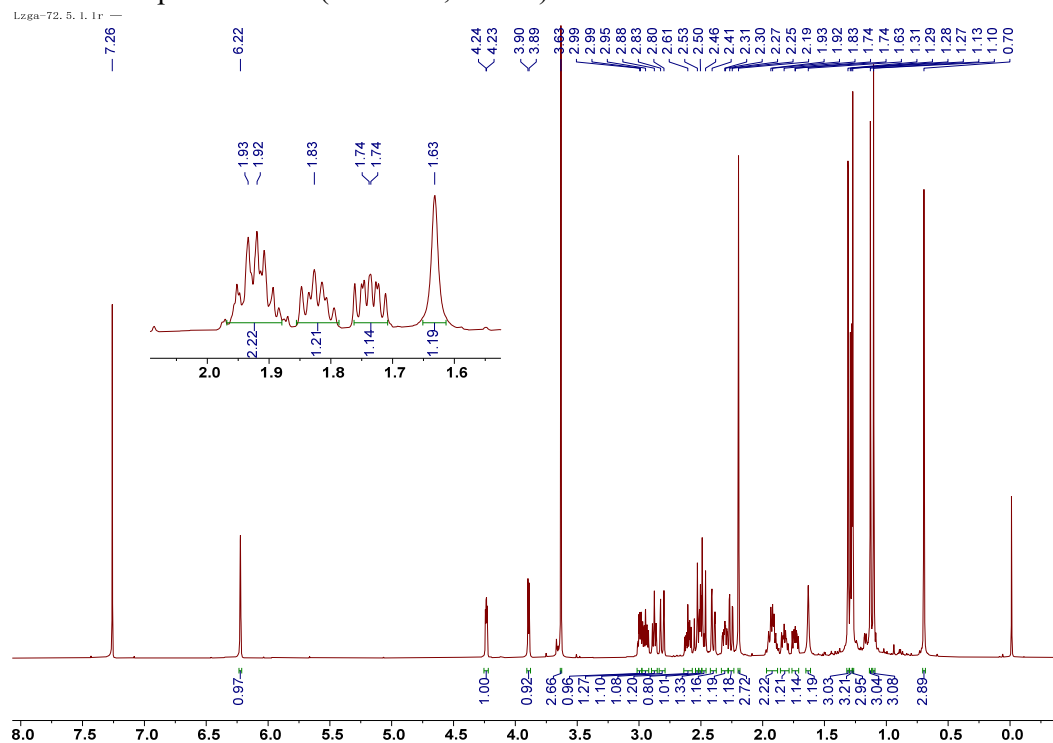


Figure S30. ^{13}C and DEPT NMR spectra of **5** (150 MHz, CDCl_3).

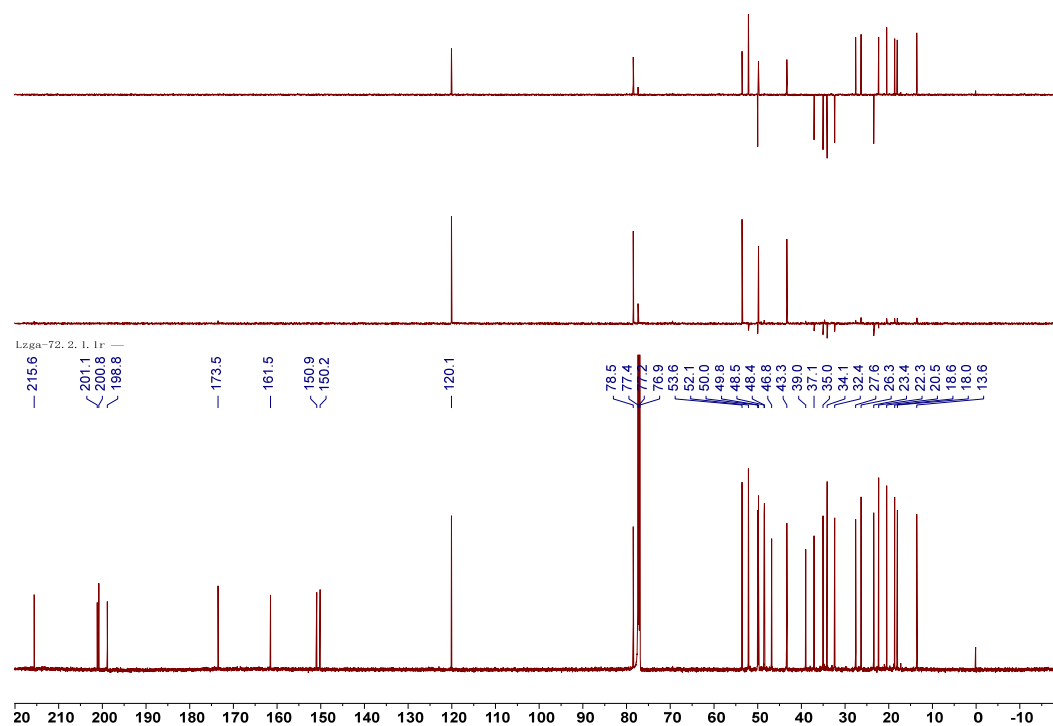


Figure S31. HSQC spectrum of **5**.

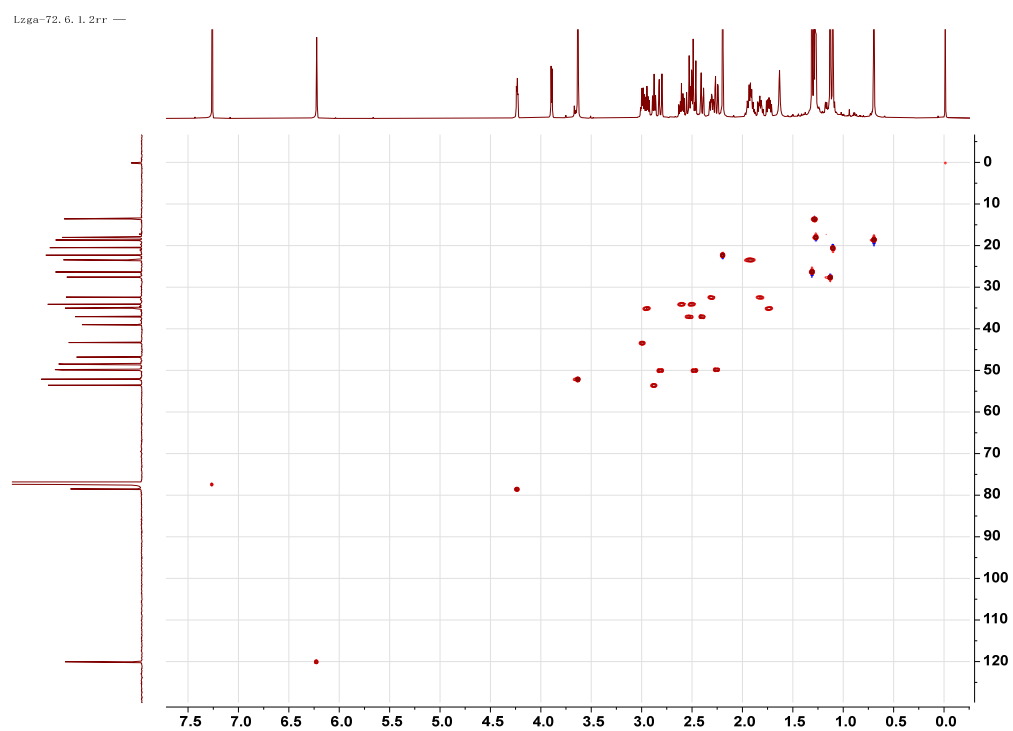


Figure S32. HMBC spectrum of **5**.

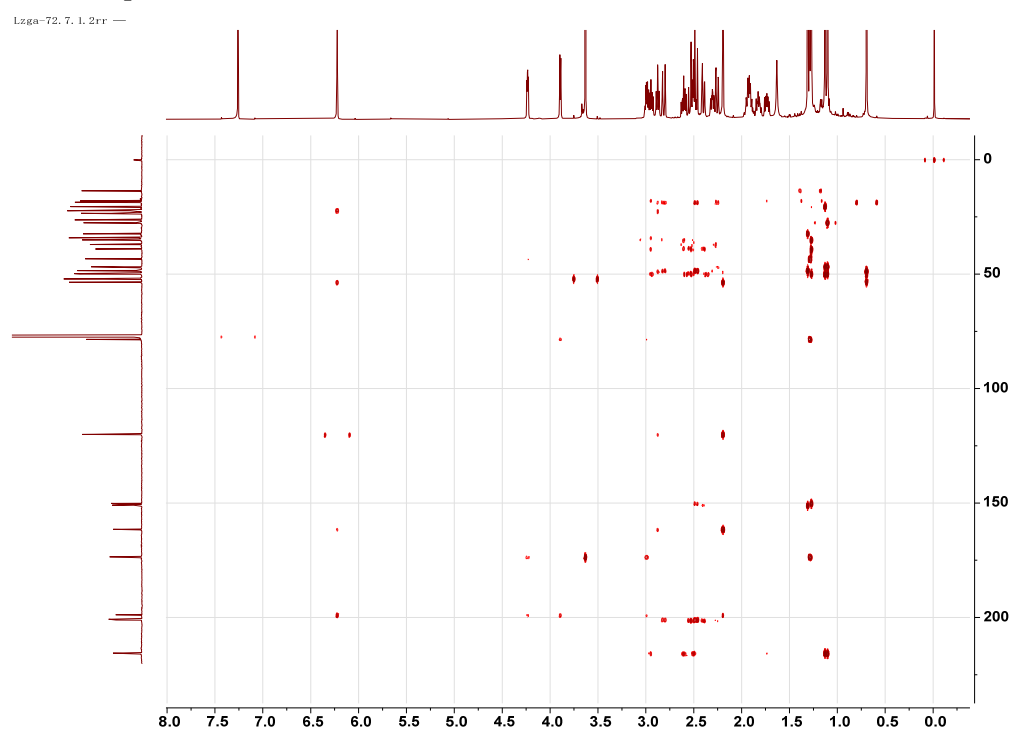


Figure S33. ^1H - ^1H COSY spectrum of **5**.

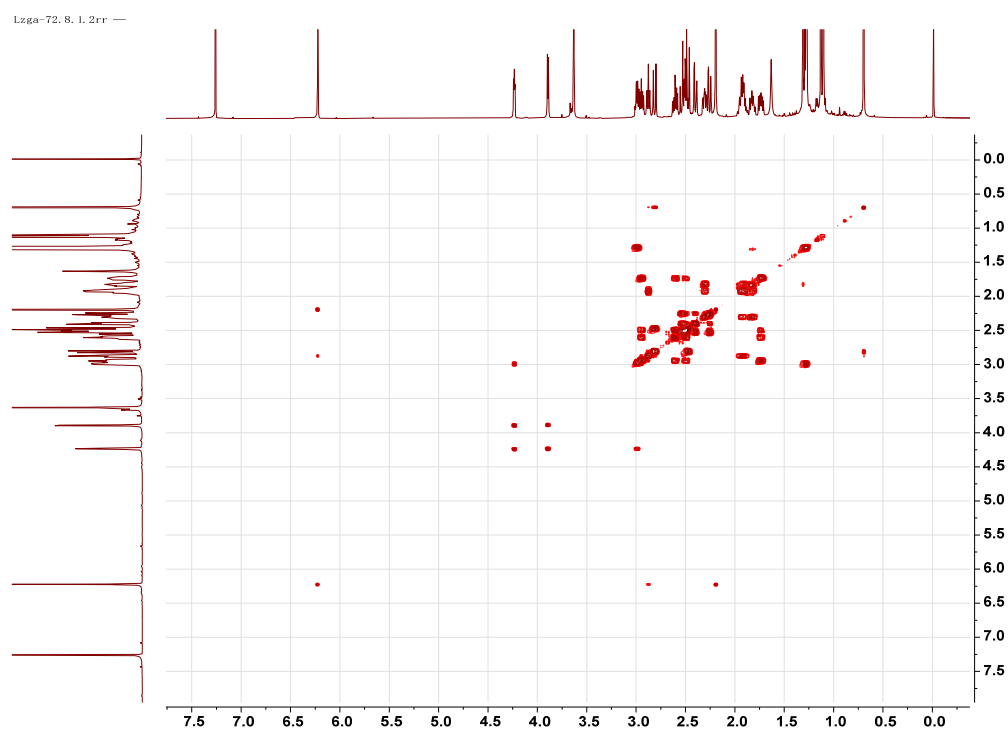


Figure S34. ROESY spectrum of **5**.

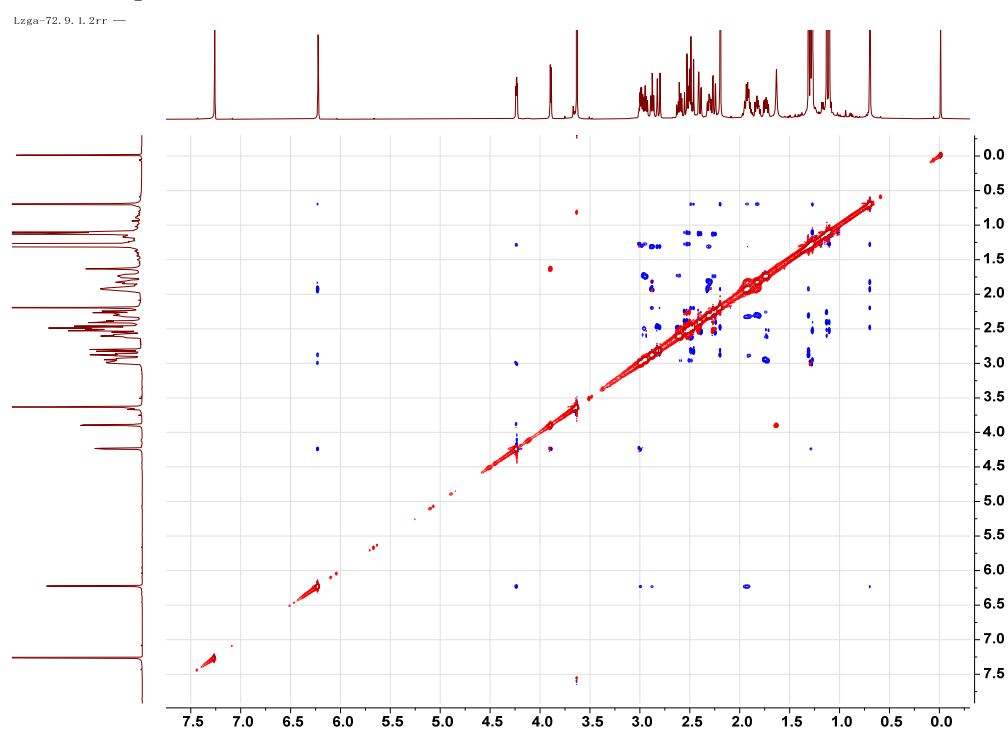


Figure S35. HRESIMS of **5**.

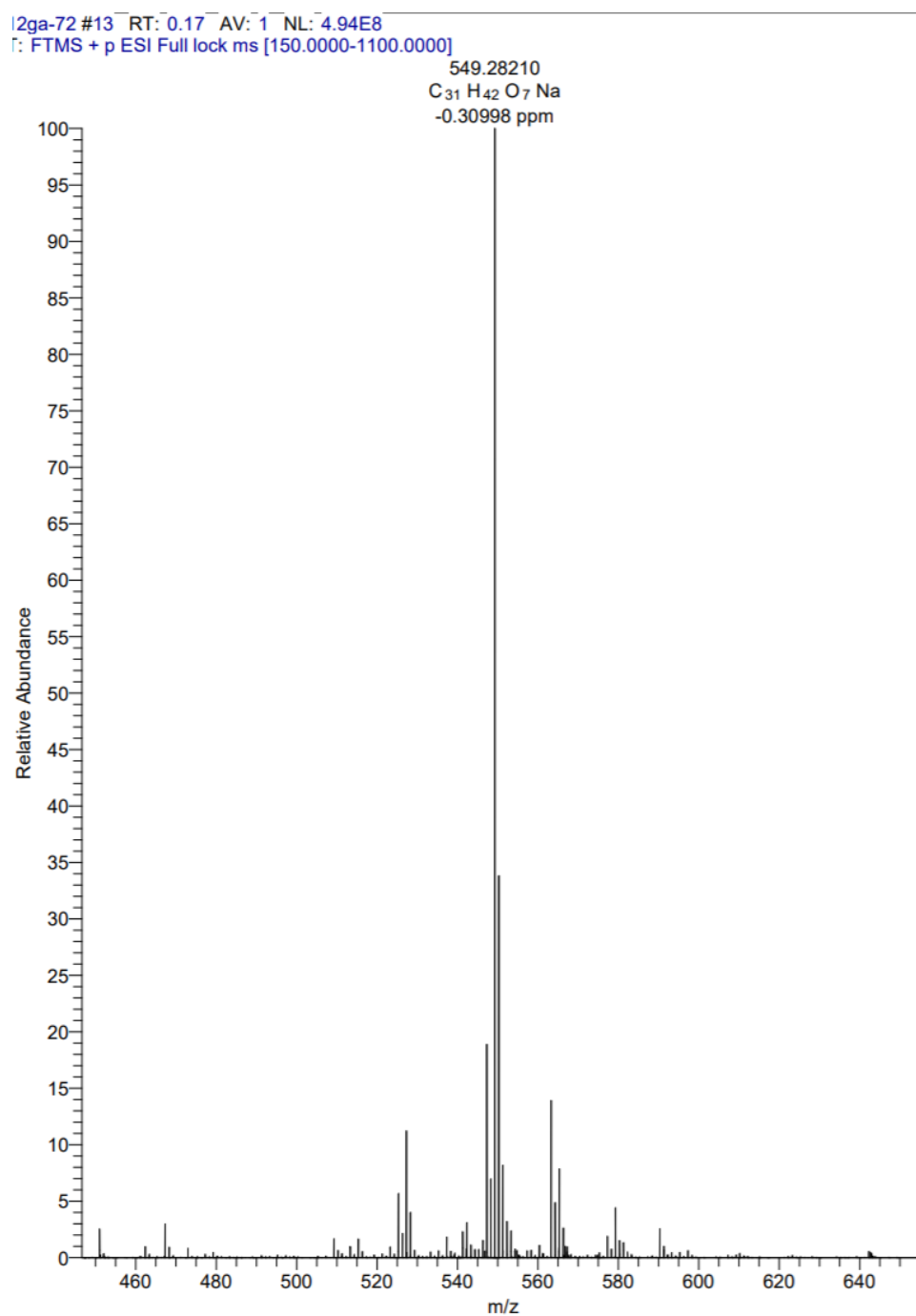


Figure S36. ^1H NMR spectrum of **6** (600 MHz, CDCl_3).

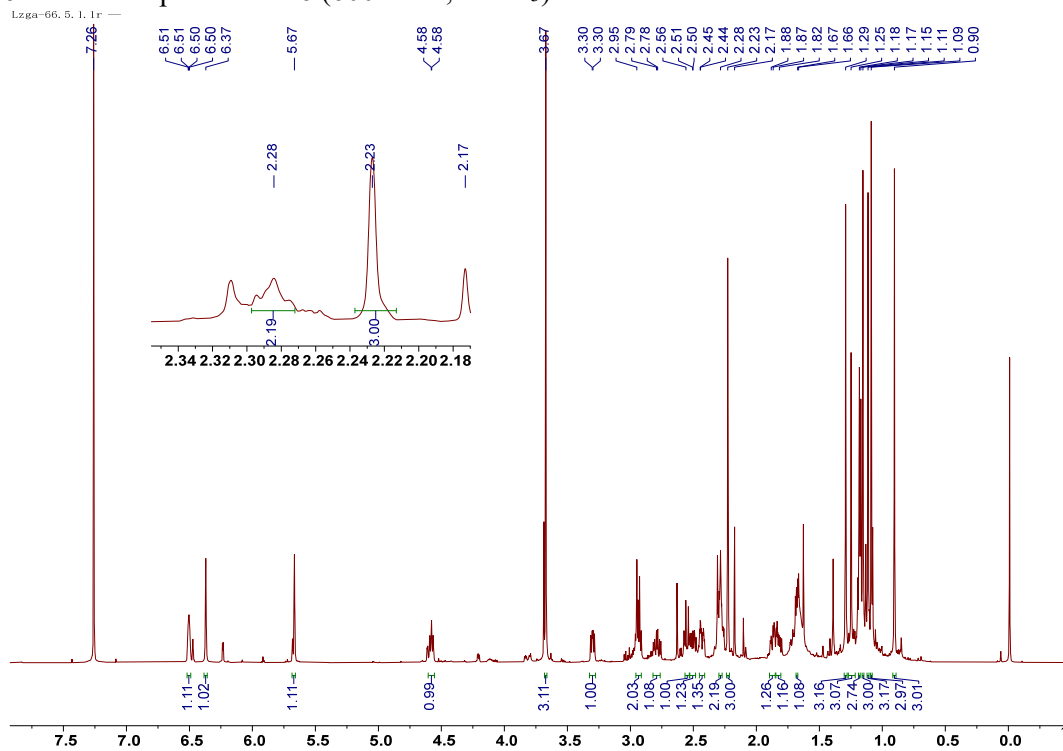


Figure S37. ^{13}C and DEPT NMR spectra of **6** (150 MHz, CDCl_3).

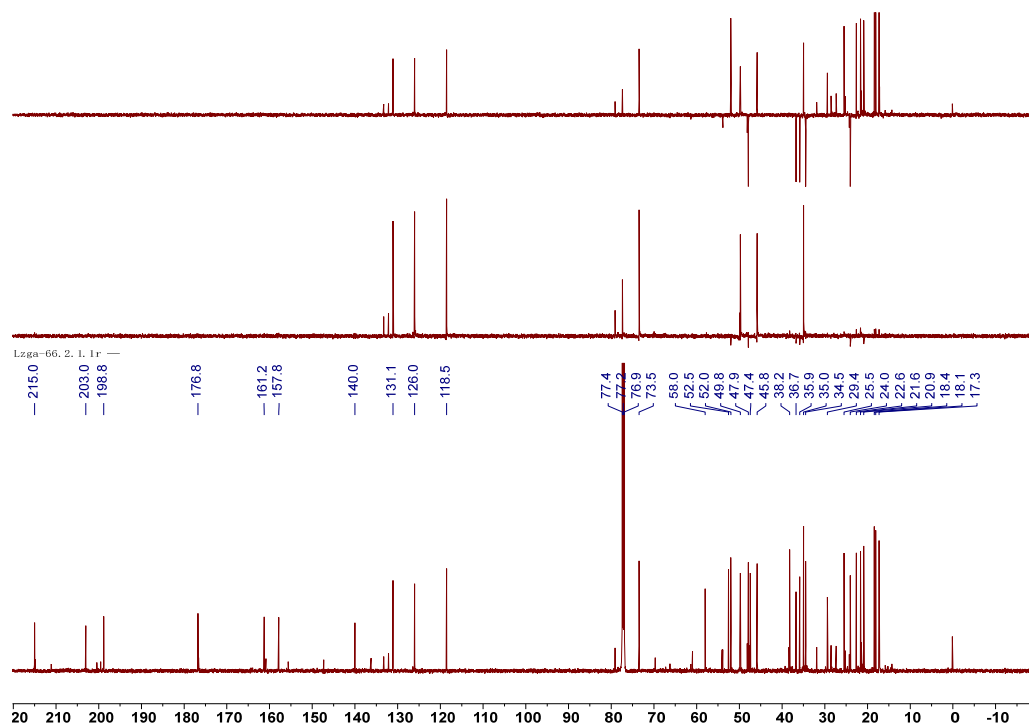


Figure S38. HSQC spectrum of **6**.

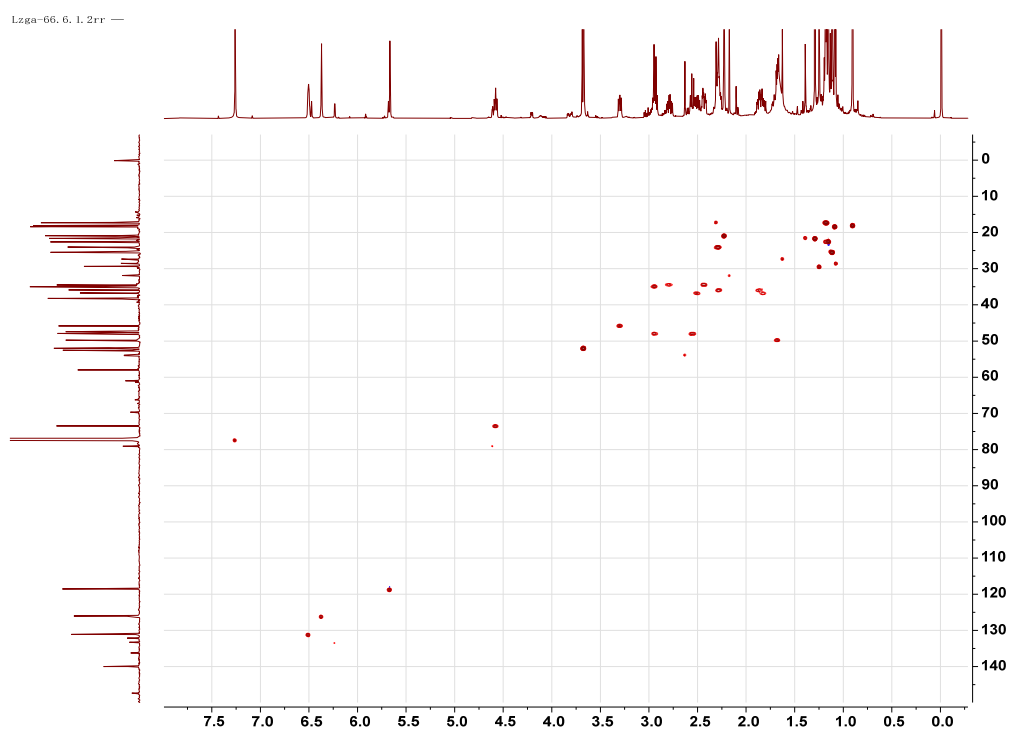


Figure S39. HMBC spectrum of **6**.

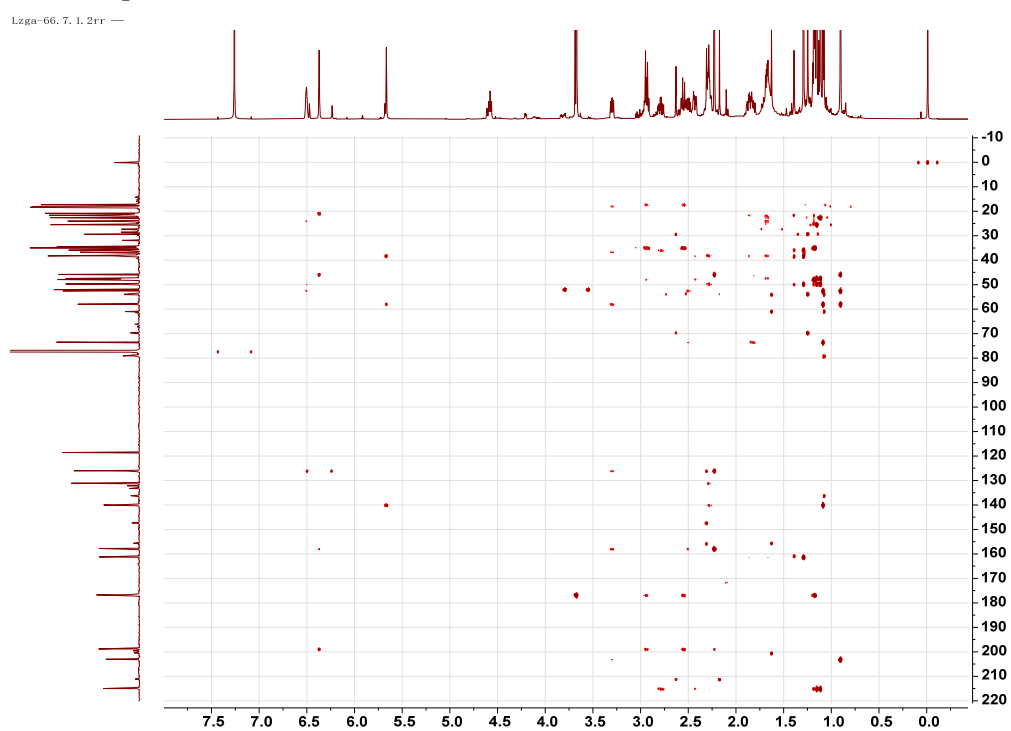


Figure S40. ^1H - ^1H COSY spectrum of **6**.

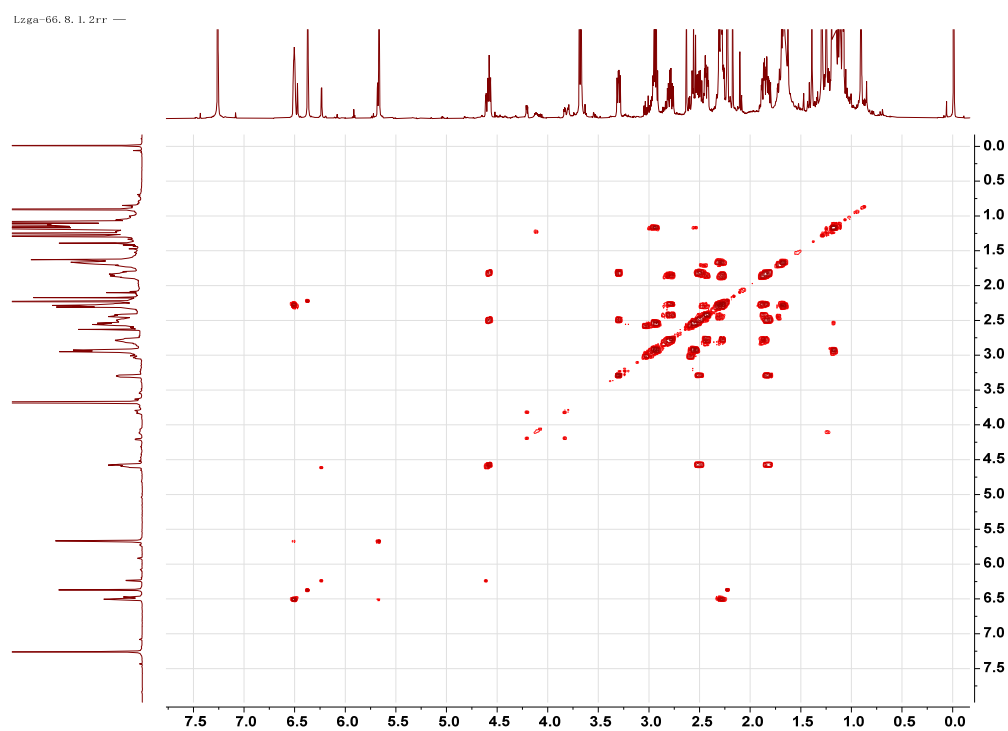


Figure S41. ROESY spectrum of **6**.

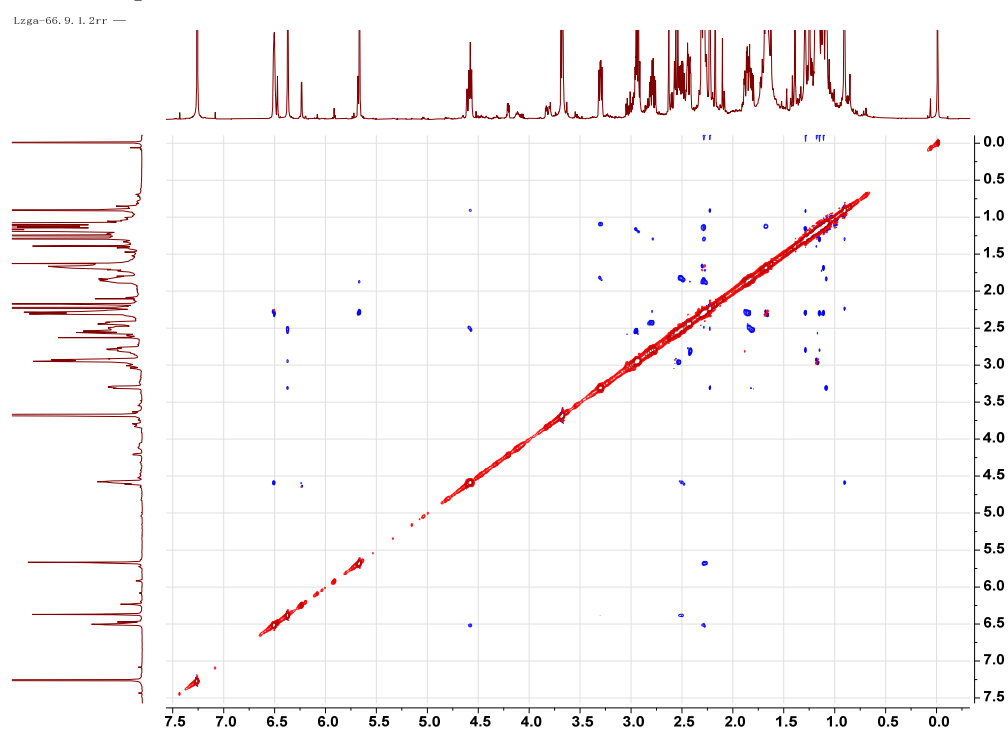


Figure S42. HRESIMS of **6**.

D:\spectrum\lzga\Lzga-66\LZGA-66

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T: FTMS + p ESI Full lock ms [150.0000-1100.0000]

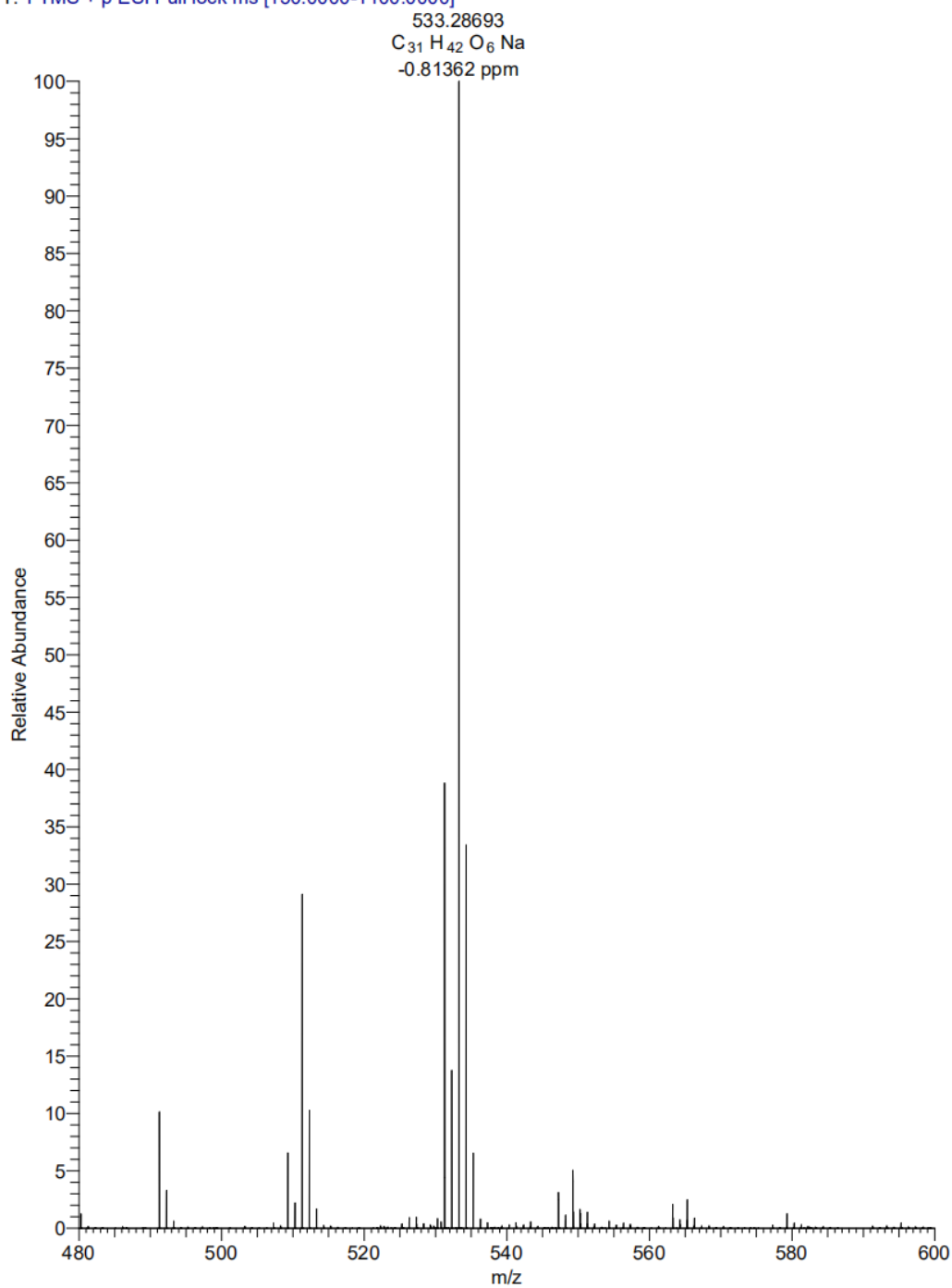


Figure S43. ^1H NMR spectrum of **7** (800 MHz, CDCl_3).

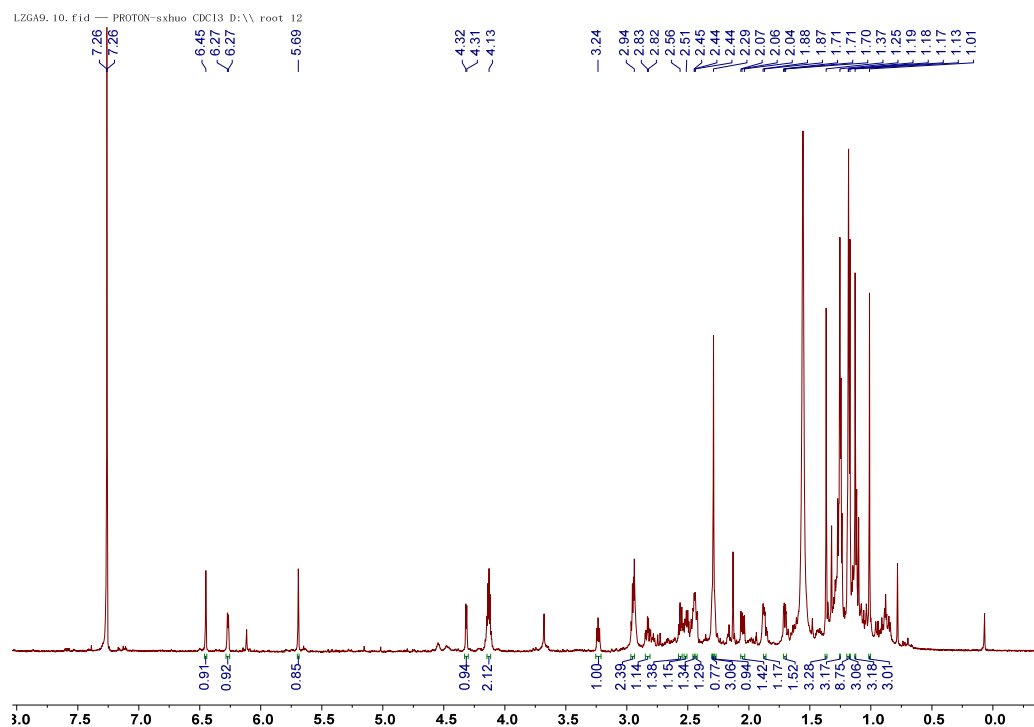


Figure S44. ^{13}C NMR spectra of **7** (200 MHz, CDCl_3).

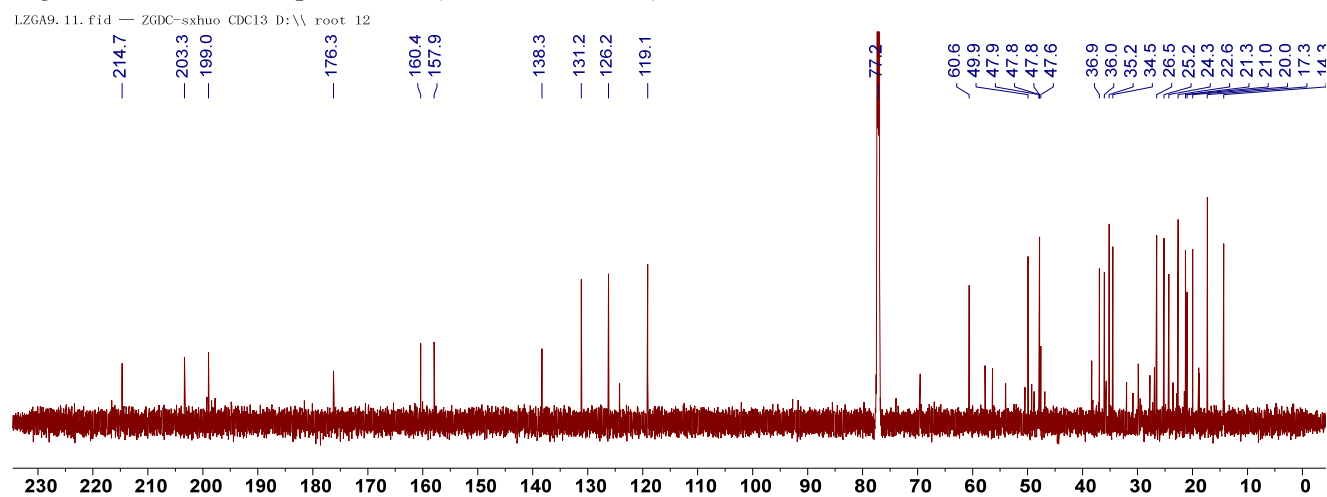


Figure S45. HSQC spectrum of 7.

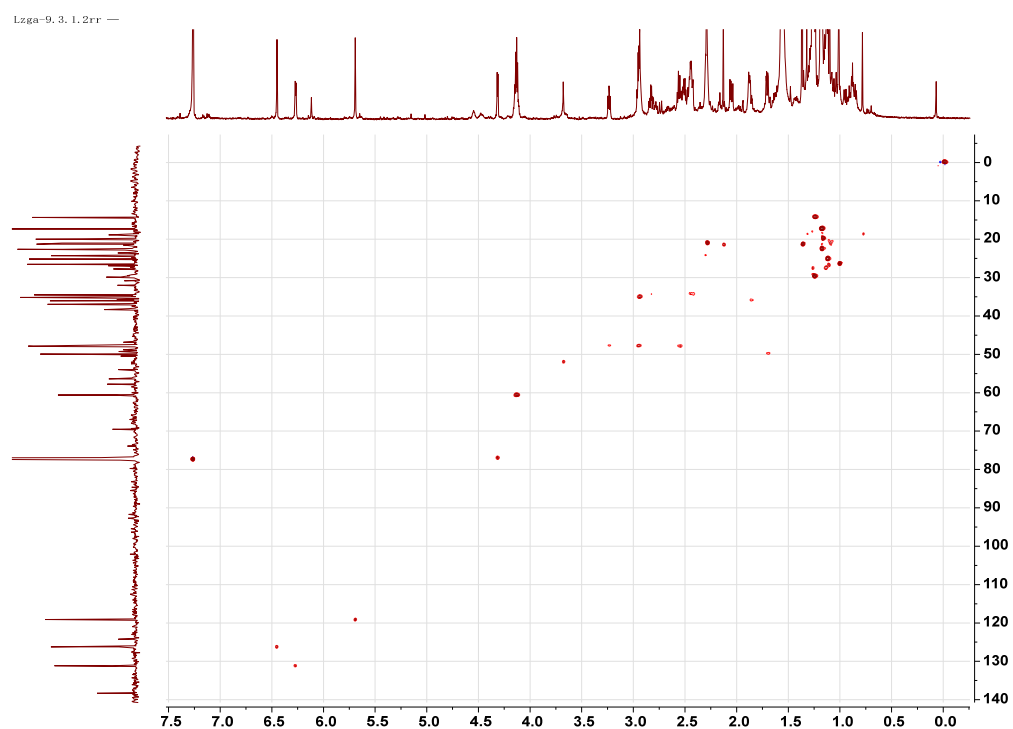


Figure S46. HMBC spectrum of 7.

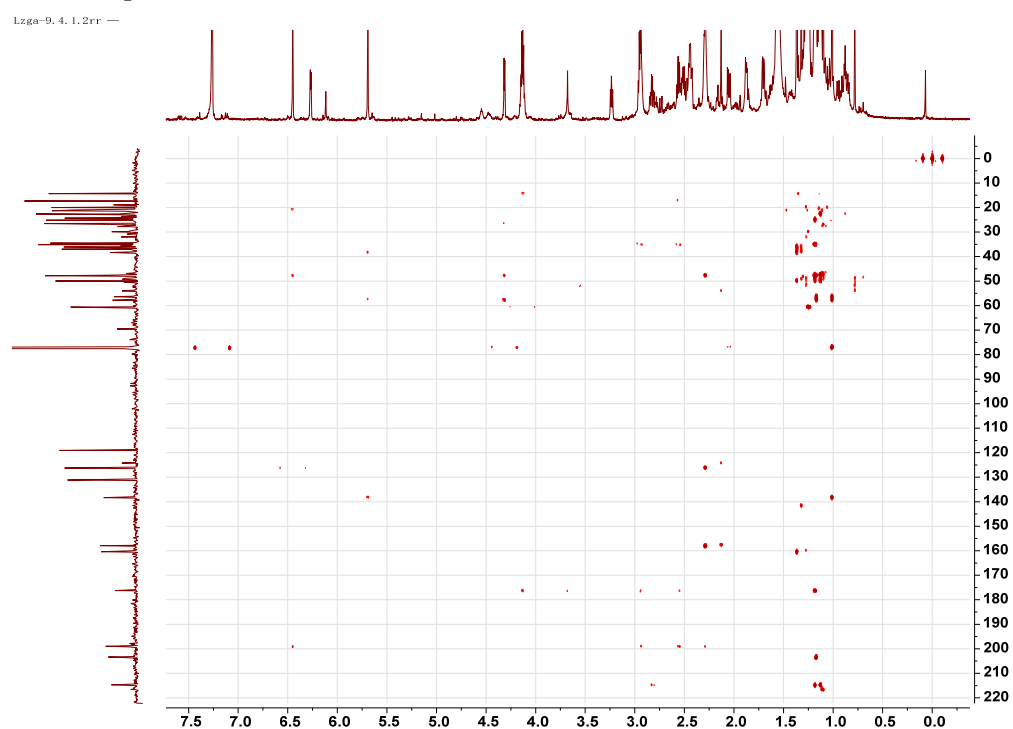


Figure S47. ^1H - ^1H COSY spectrum of 7.

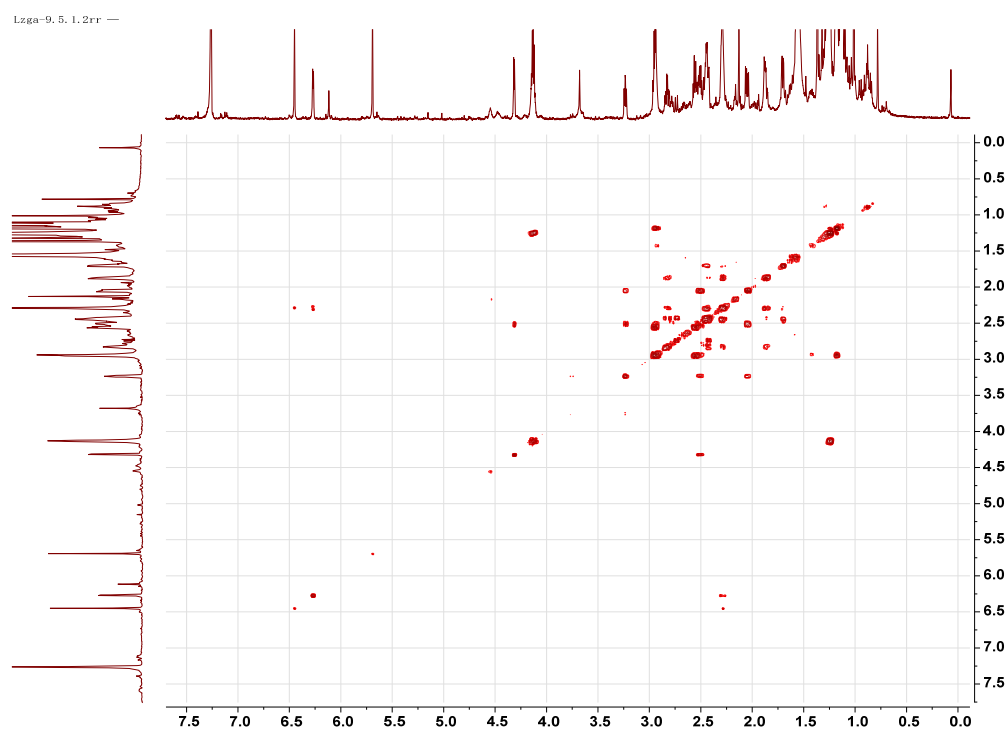


Figure S48. ROESY spectrum of 7.

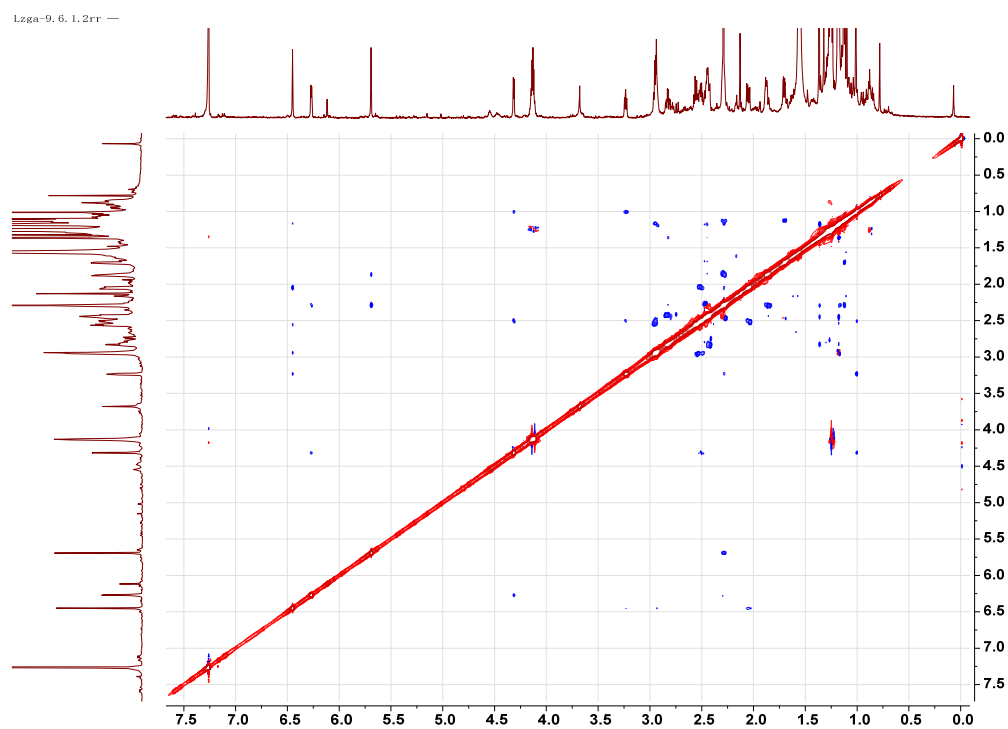


Figure S49. HRESIMS of 7.

D:\spectrum\zga\Lzga-9\LZGA-9

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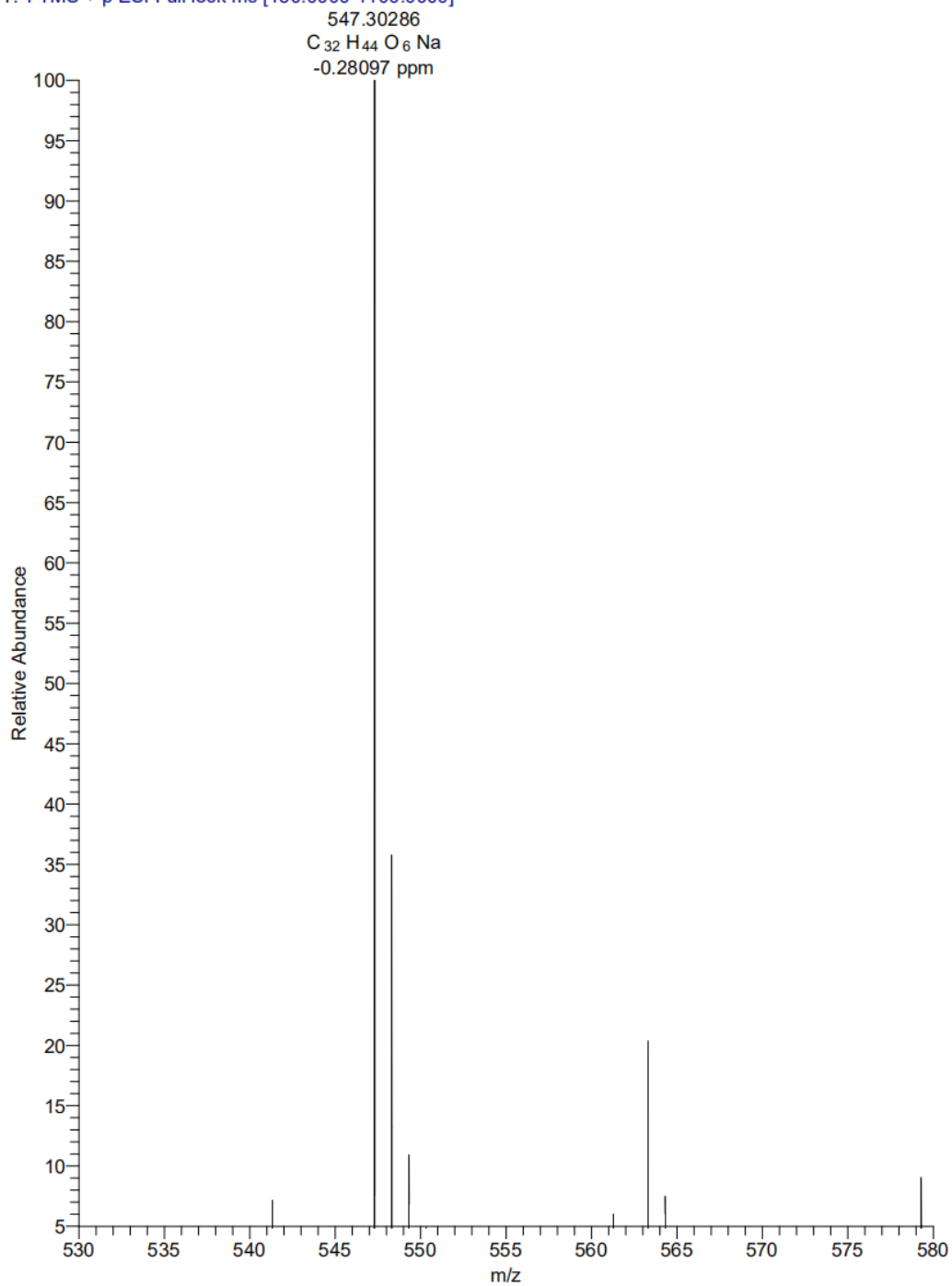


Figure S50. ^1H NMR spectrum of **8** (600 MHz, CDCl_3).

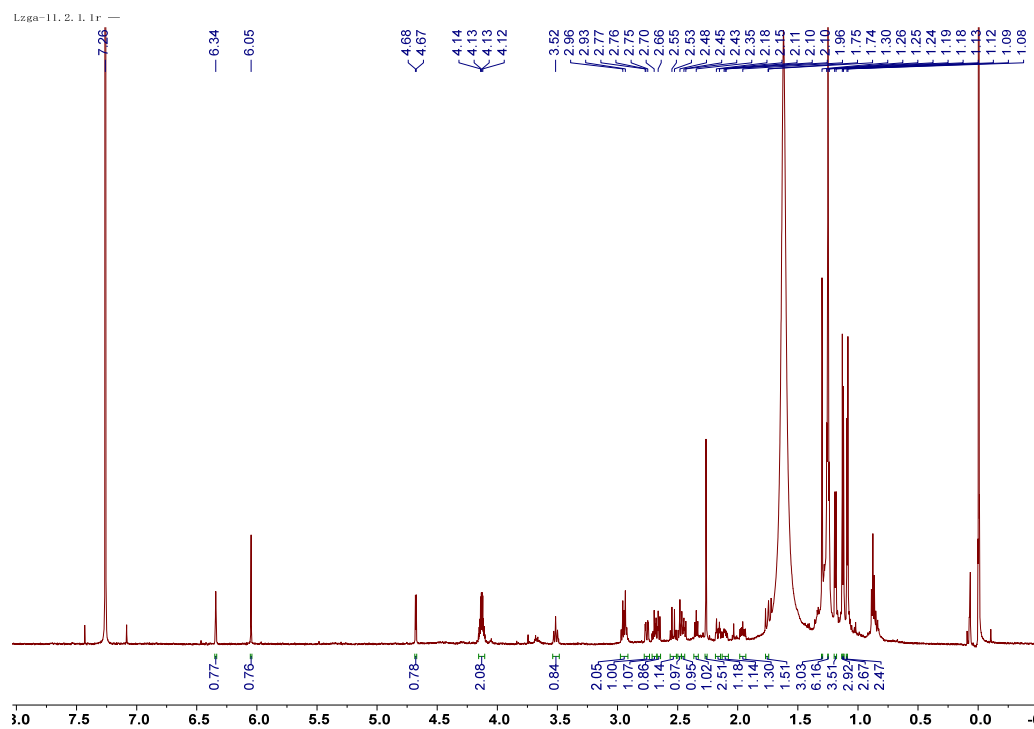


Figure S51. ^{13}C NMR spectra of **8** (150 MHz, CDCl_3).

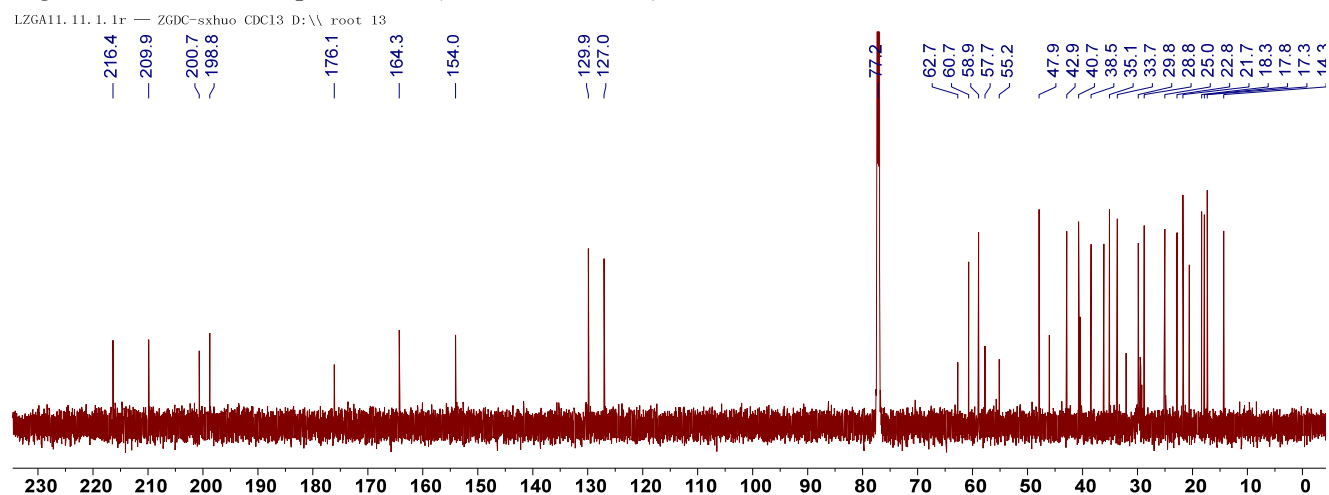


Figure S52. HSQC spectrum of **8**.

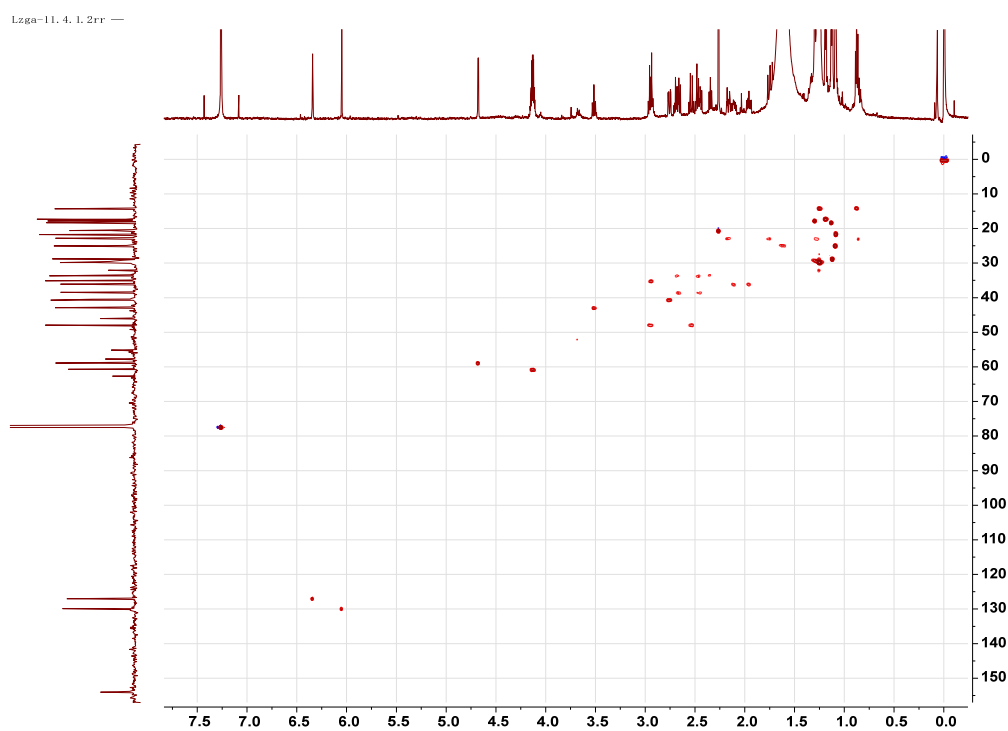


Figure S53. HMBC spectrum of **8**.

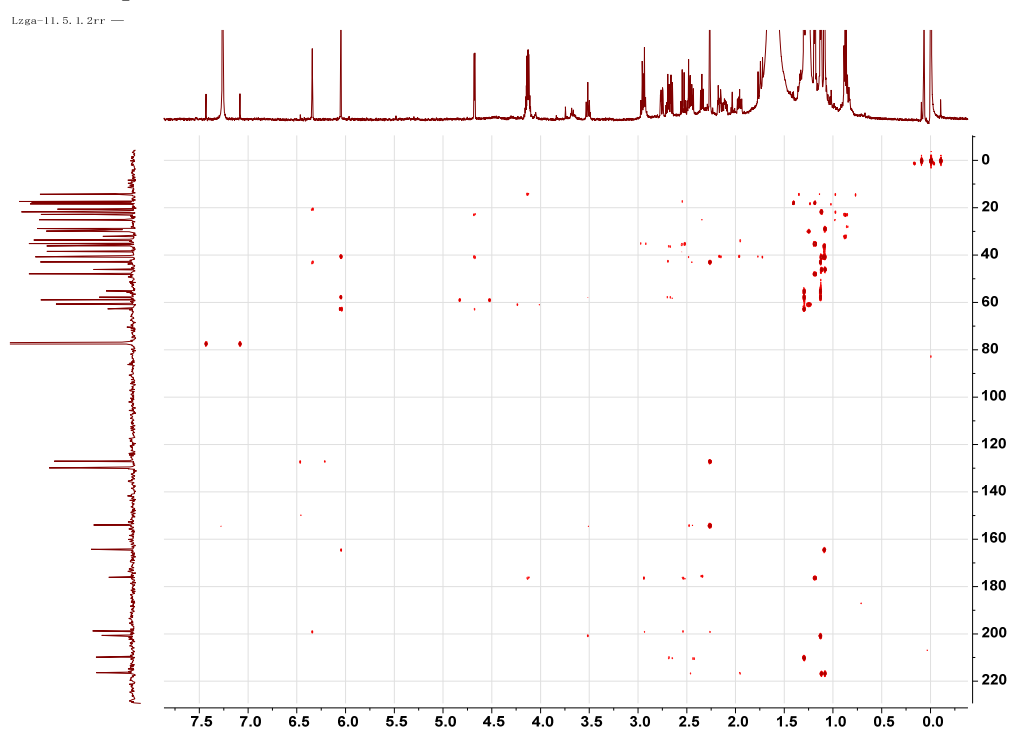


Figure S54. ^1H - ^1H COSY spectrum of **8**.



Figure S55. ROESY spectrum of **8**.

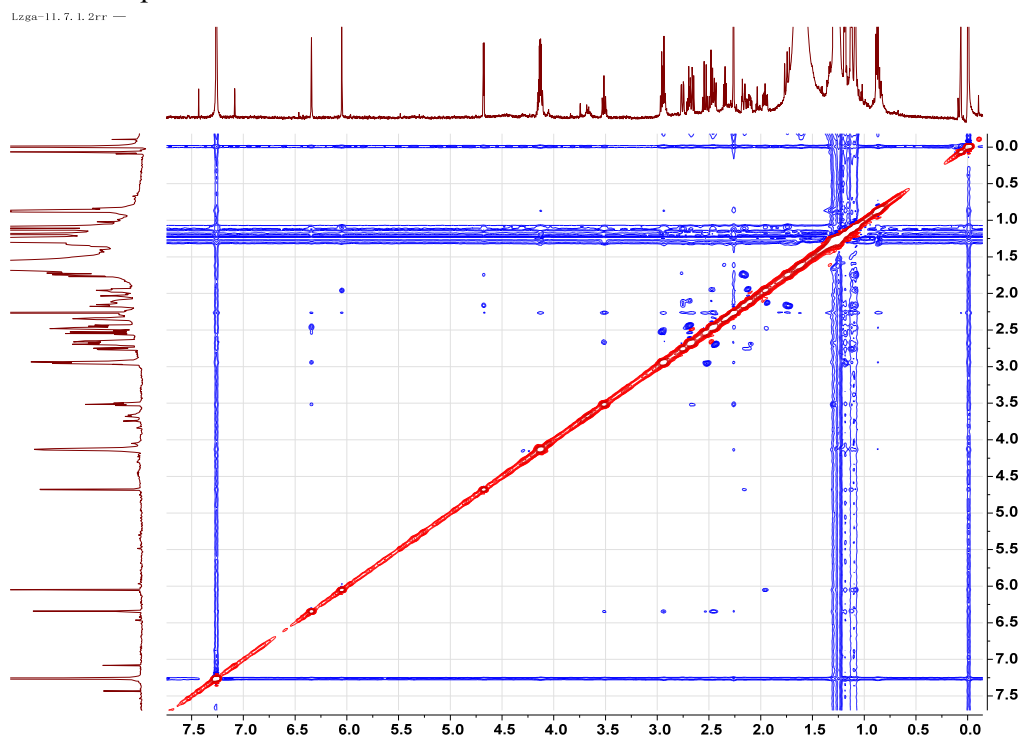


Figure S56. HRESIMS of **8**.

D:\spectrum\zga\7Lzga-11\LZGA-11

2021/6/18 10:09:02

LZGA-11 #13 RT: 0.17 AV: 1 NL: 3.88E7

T: FTMS + p ESI Full lock ms [150.0000-1100.0000]

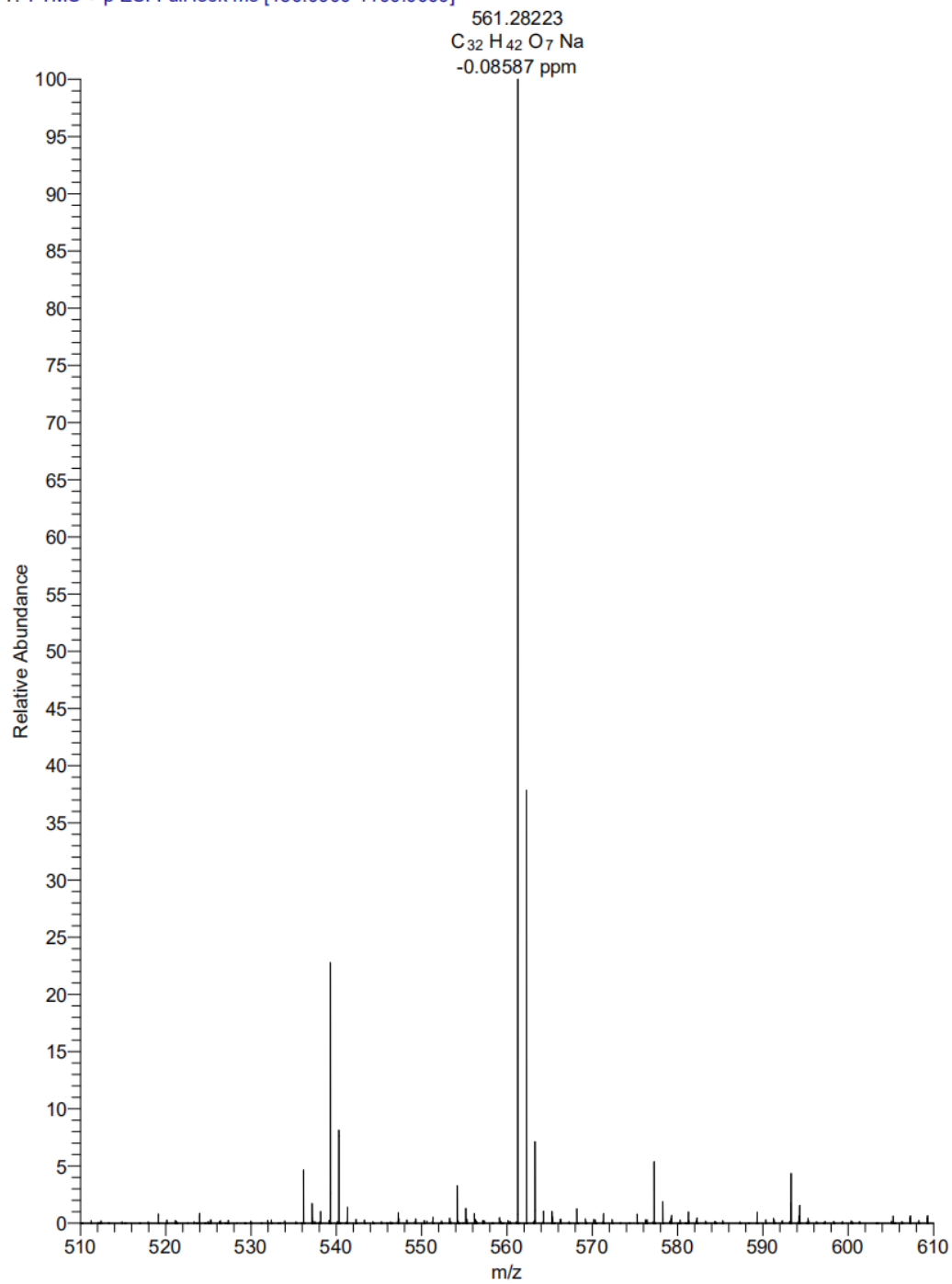


Figure S57. ^1H NMR spectrum of **9** (600 MHz, CDCl_3).

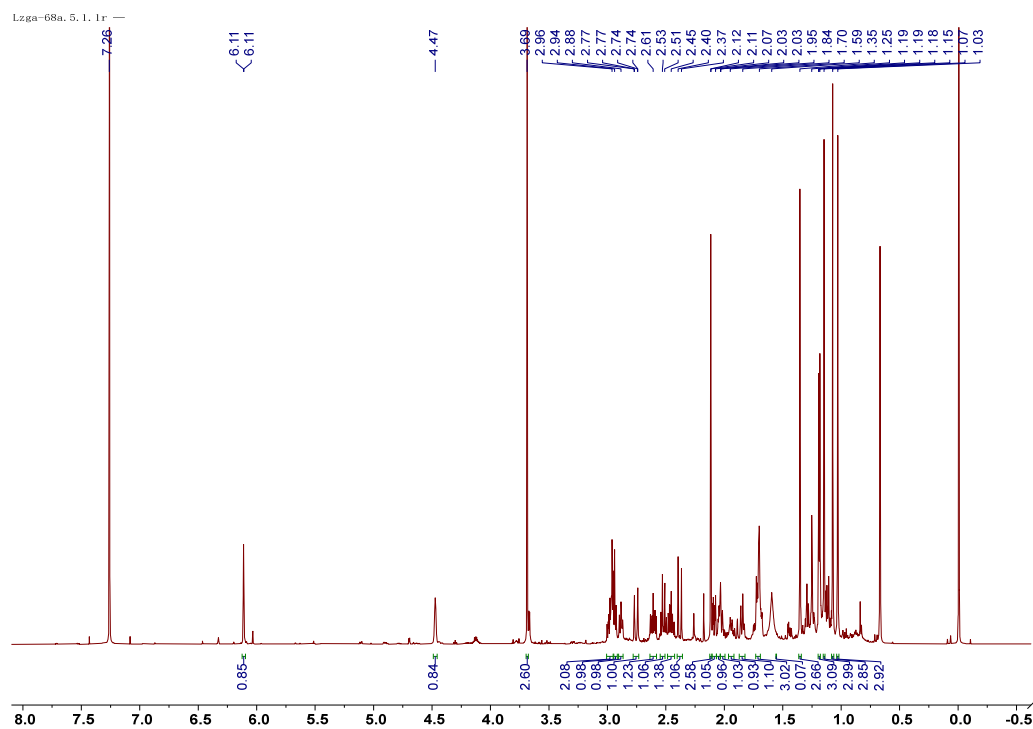


Figure S58. ^{13}C and DEPT NMR spectra of **9** (150 MHz, CDCl_3).

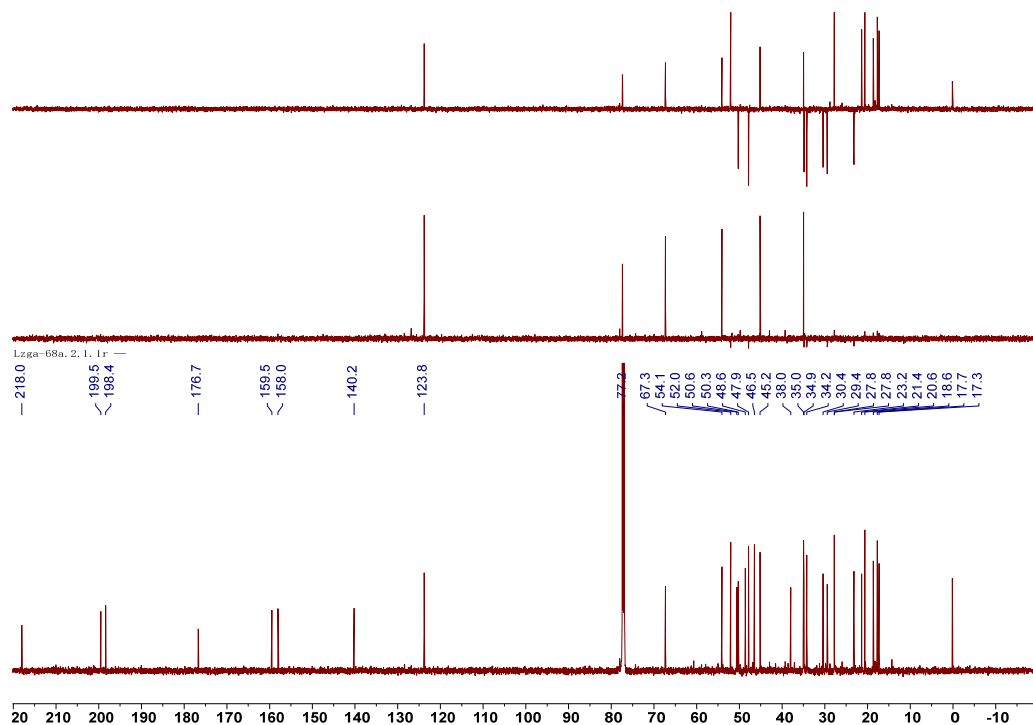


Figure S59. HSQC spectrum of **9**.

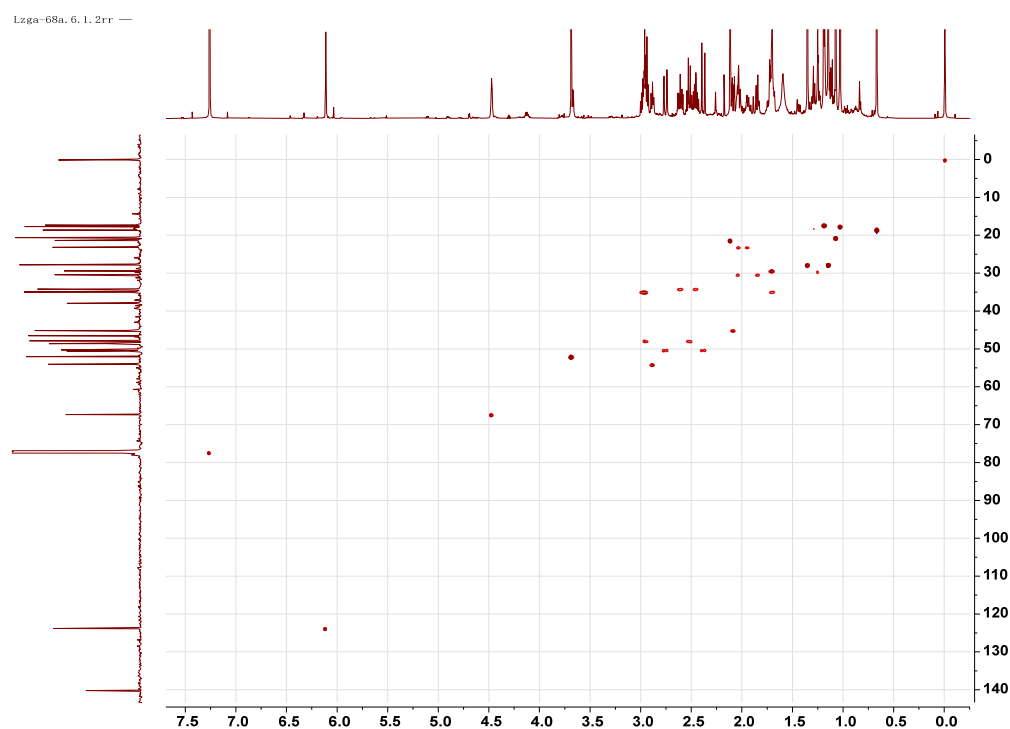


Figure S60. HMBC spectrum of **9**.

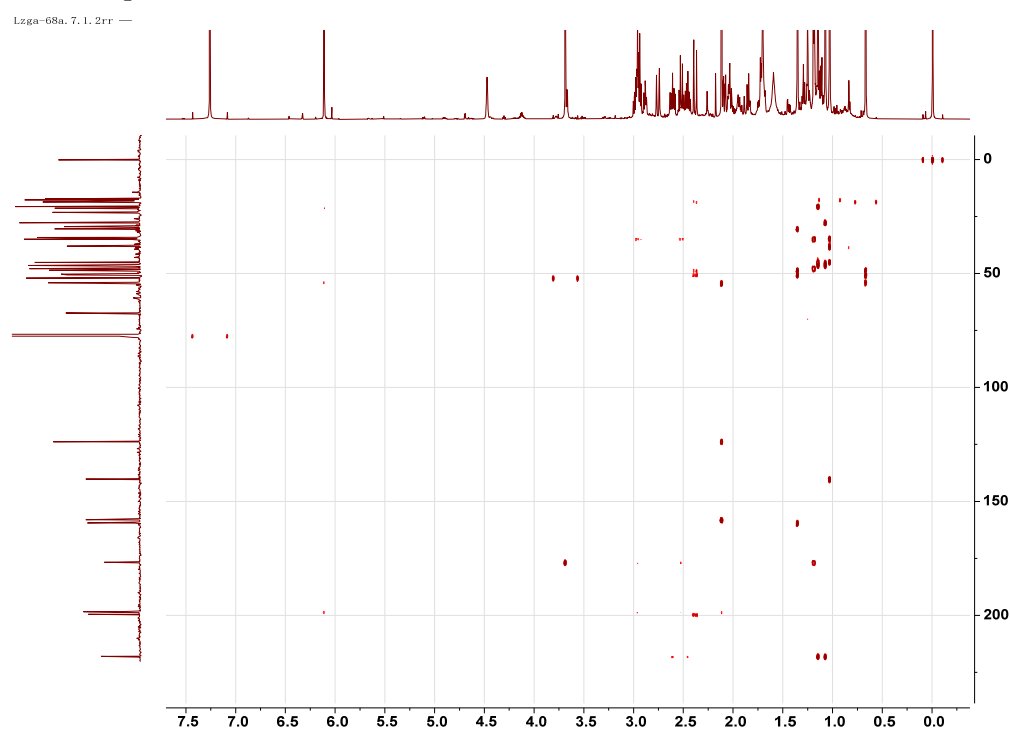


Figure S61. ^1H - ^1H COSY spectrum of **9**.

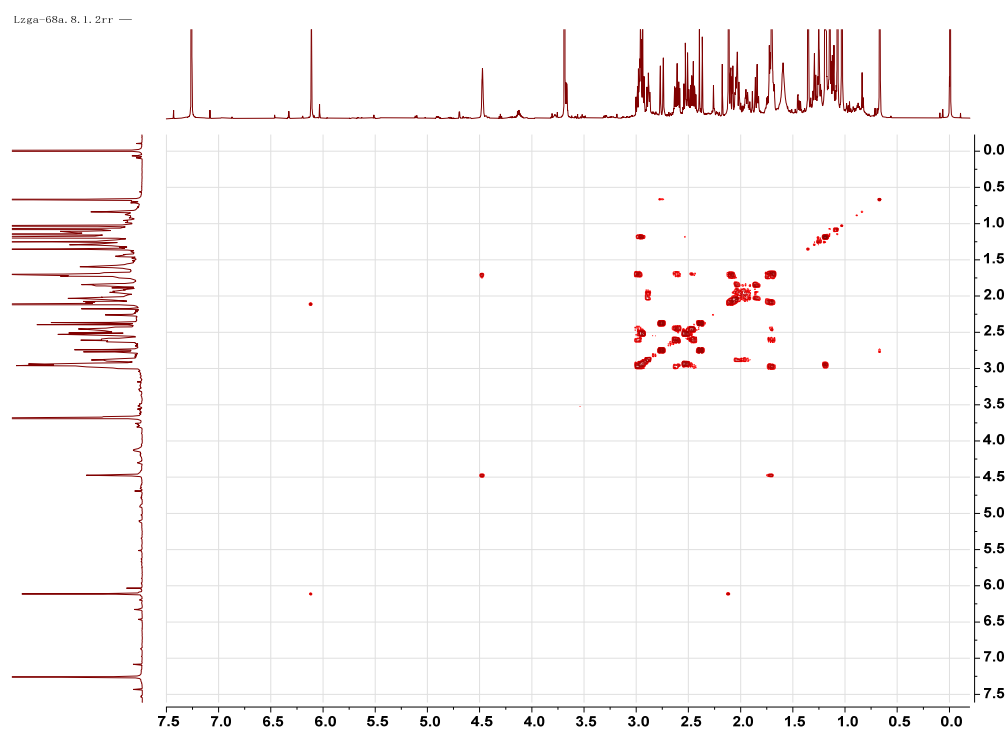


Figure S62. ROESY spectrum of **9**.

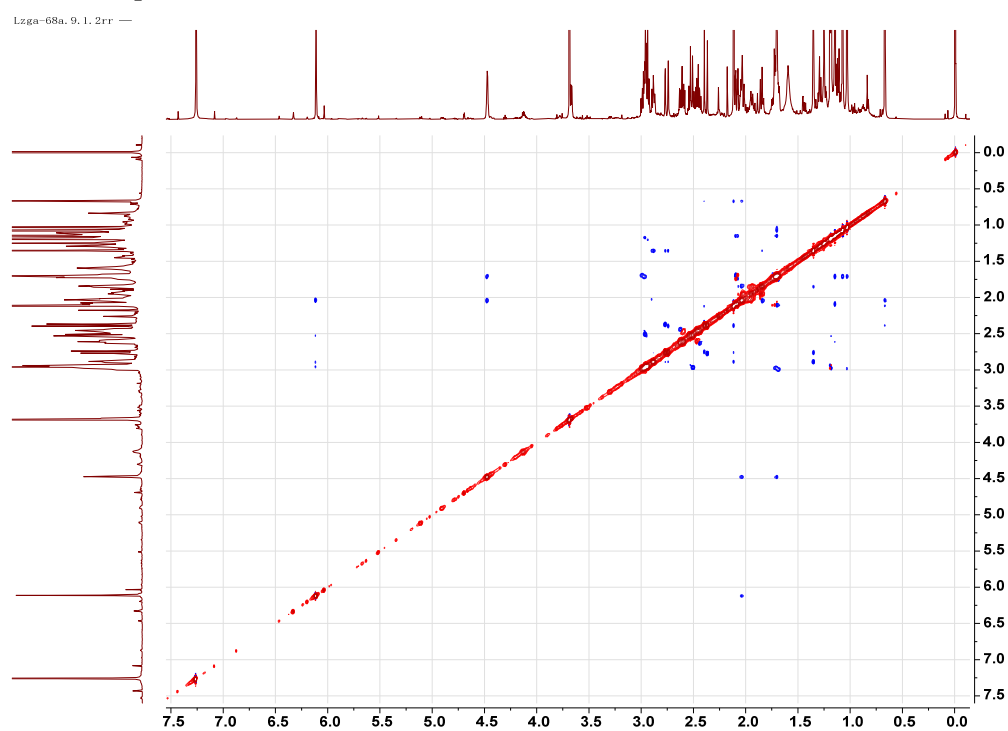


Figure S63. HRESIMS of 9.

lzga-68a #13 RT: 0.17 AV: 1 NL: 1.11E9

T: FTMS + p ESI Full lock ms [200.0000-1000.0000]

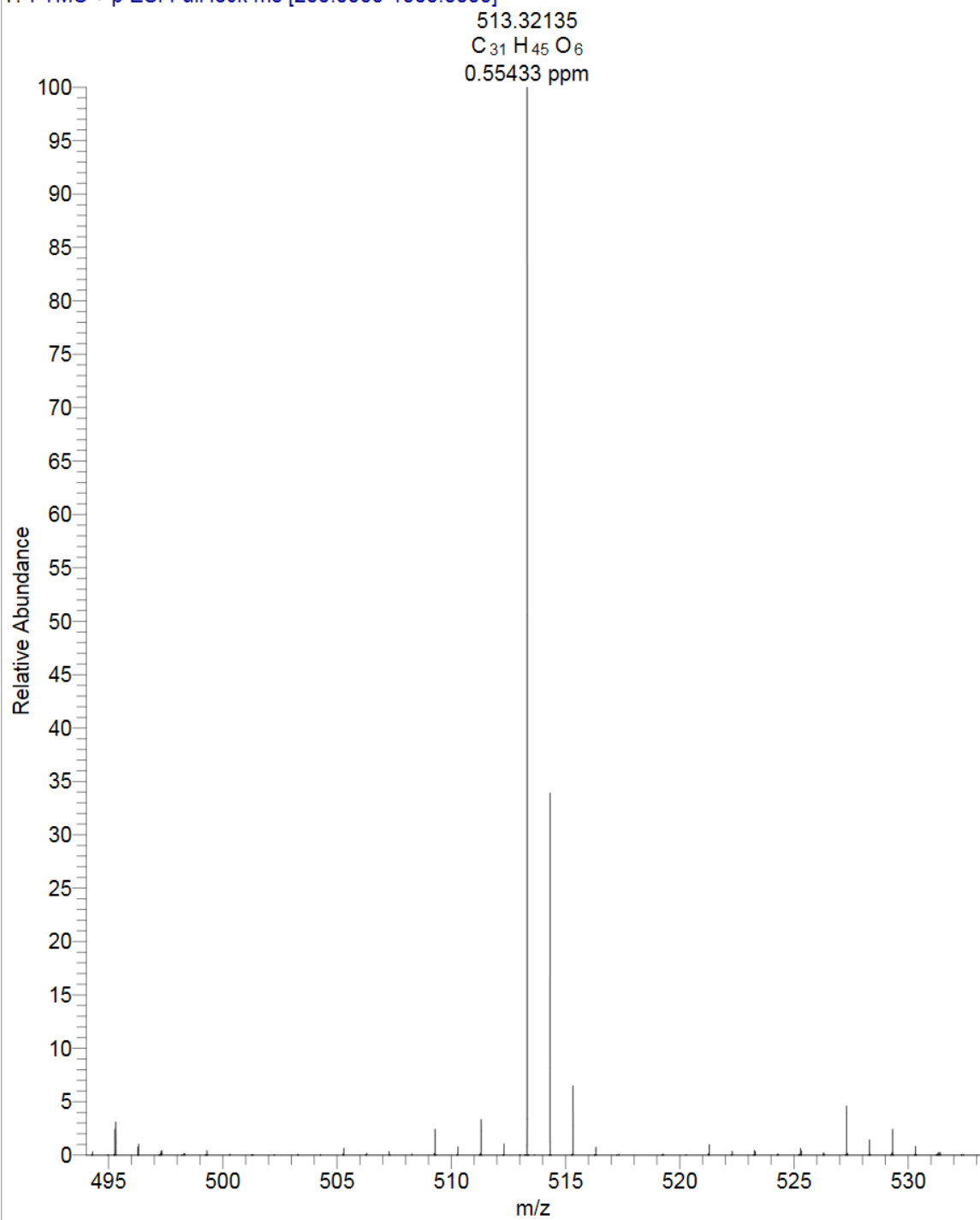


Figure S64. ^1H NMR spectrum of **10** (600 MHz, CDCl_3).

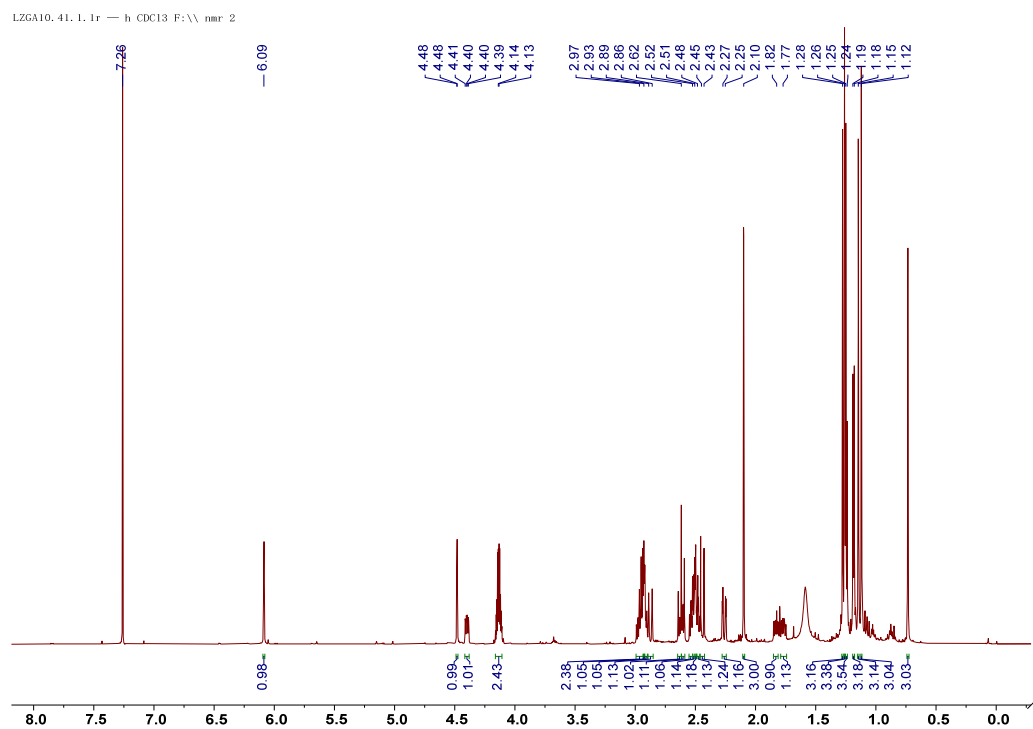


Figure S65. ^{13}C and DEPT NMR spectra of **10** (150 MHz, CDCl_3).

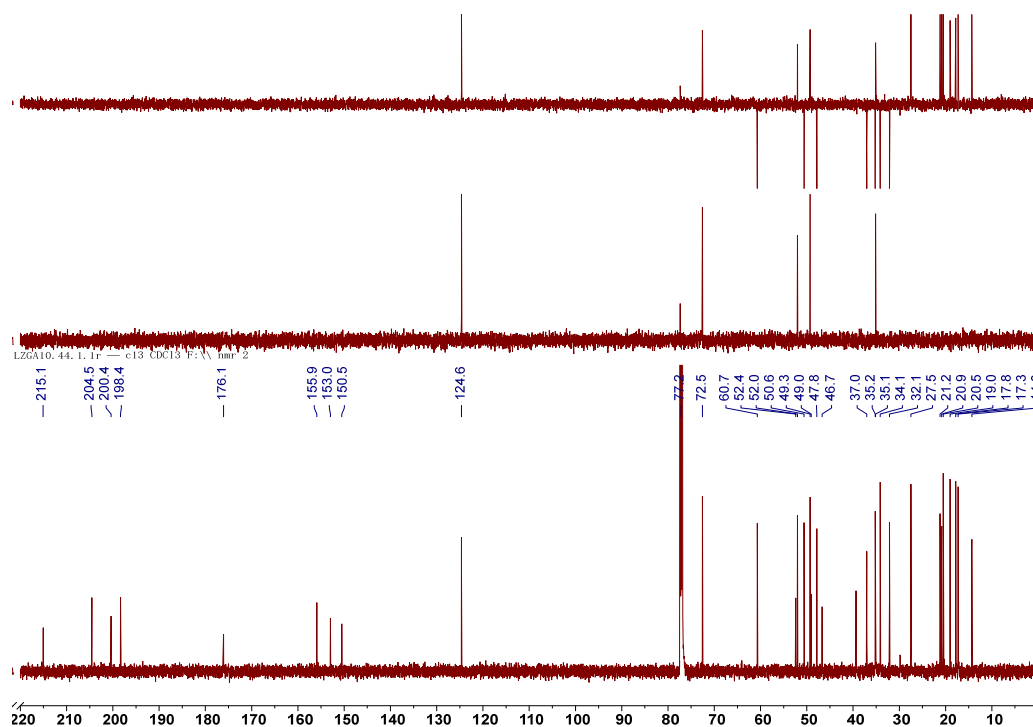


Figure S66. HSQC spectrum of **10**.

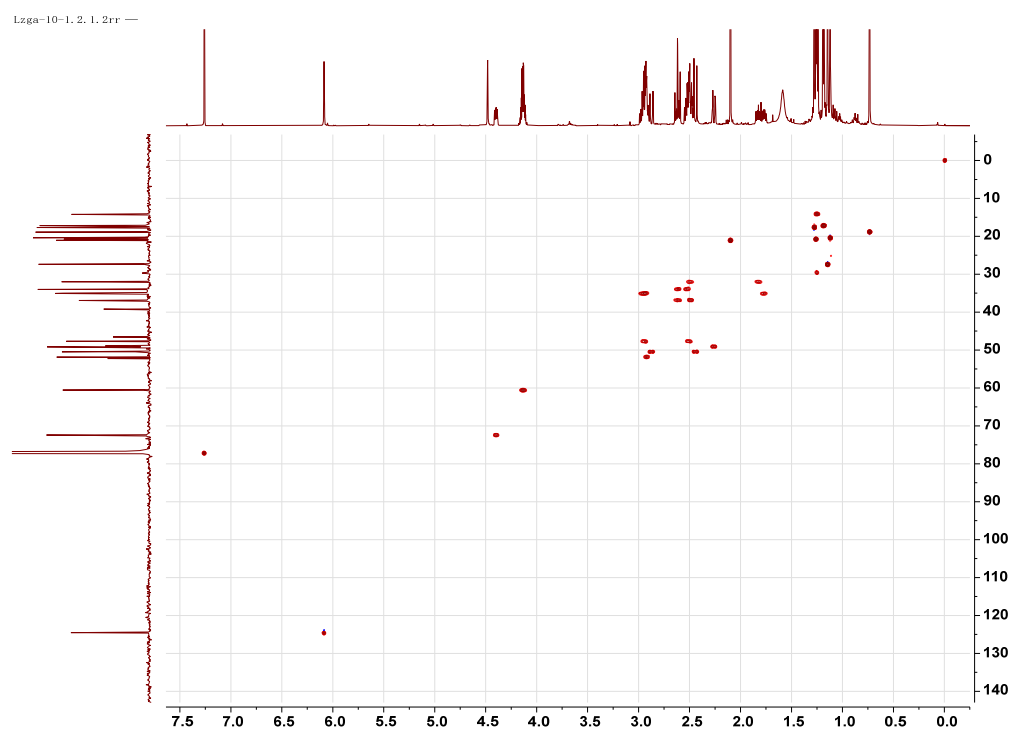


Figure S67. HMBC spectrum of **10**.

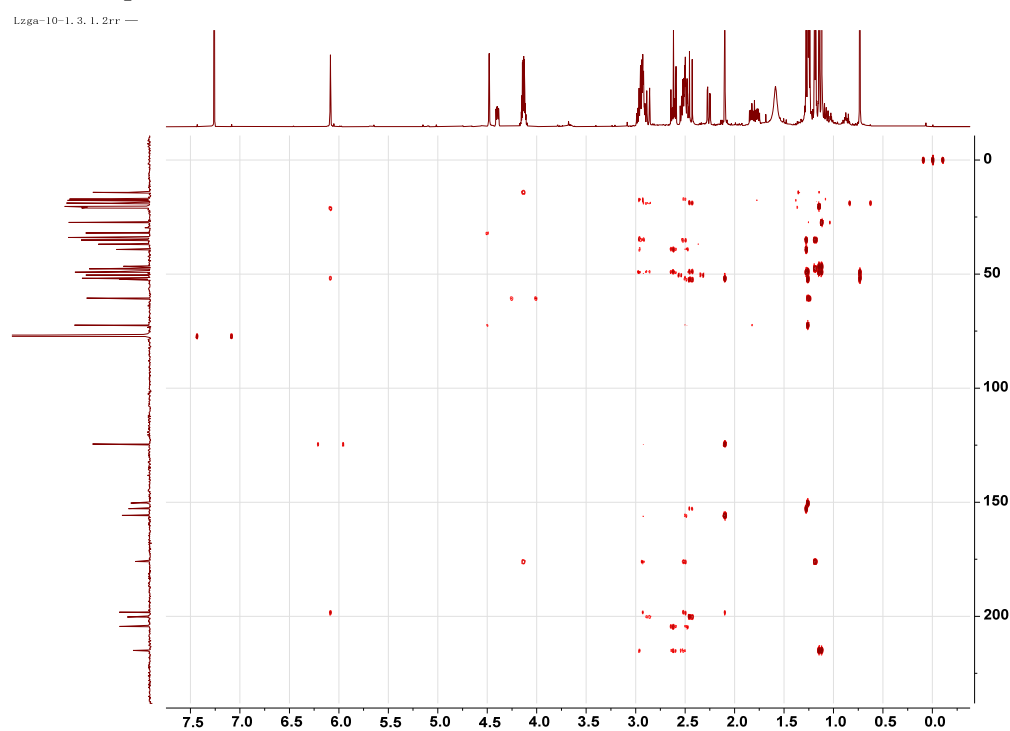


Figure S68. ^1H - ^1H COSY spectrum of **10**.

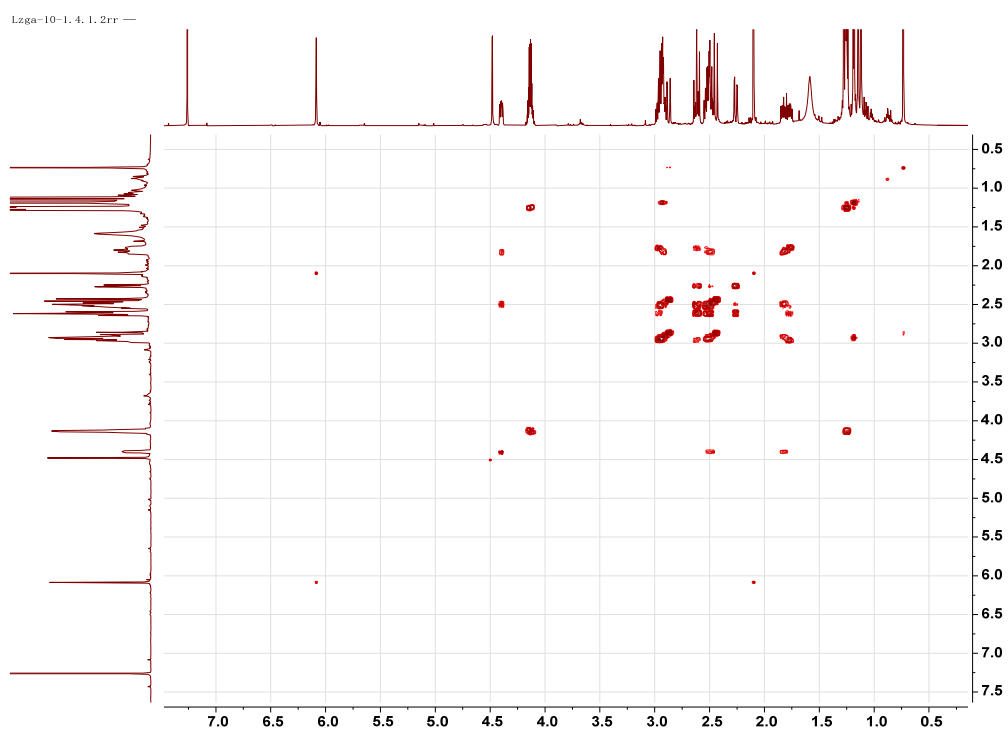


Figure S69. ROESY spectrum of **10**.

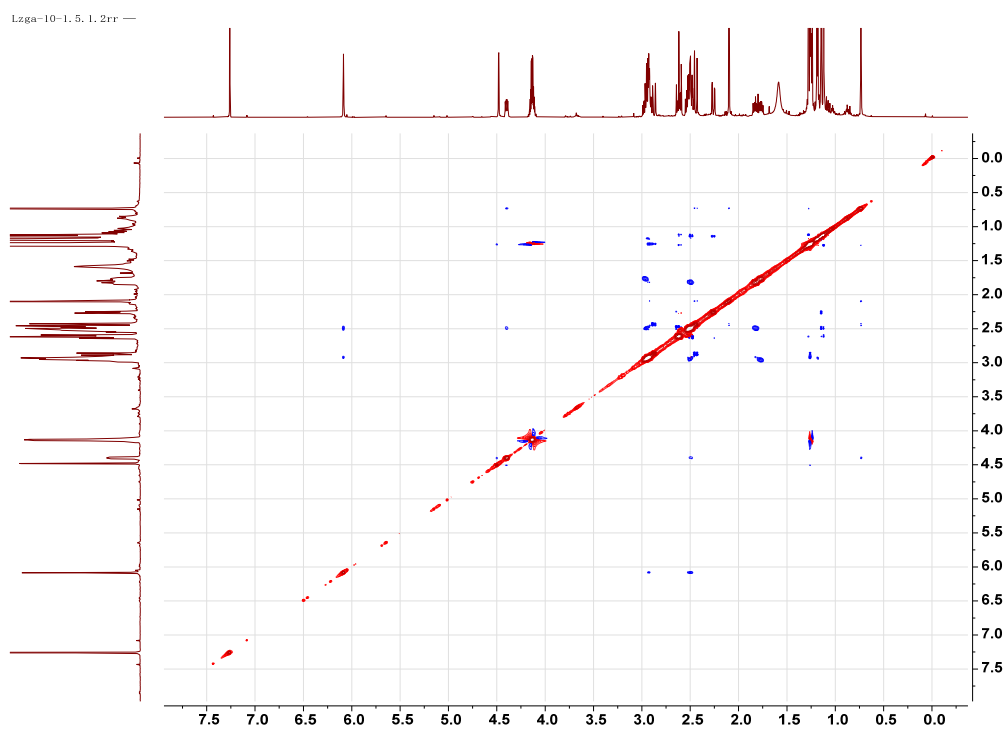


Figure S70. HRESIMS of **10**.

LZGA-10 #15 RT: 0.20 AV: 1 NL: 1.30E8
T: FTMS + p ESI Full lock ms [150.0000-1100.0000]

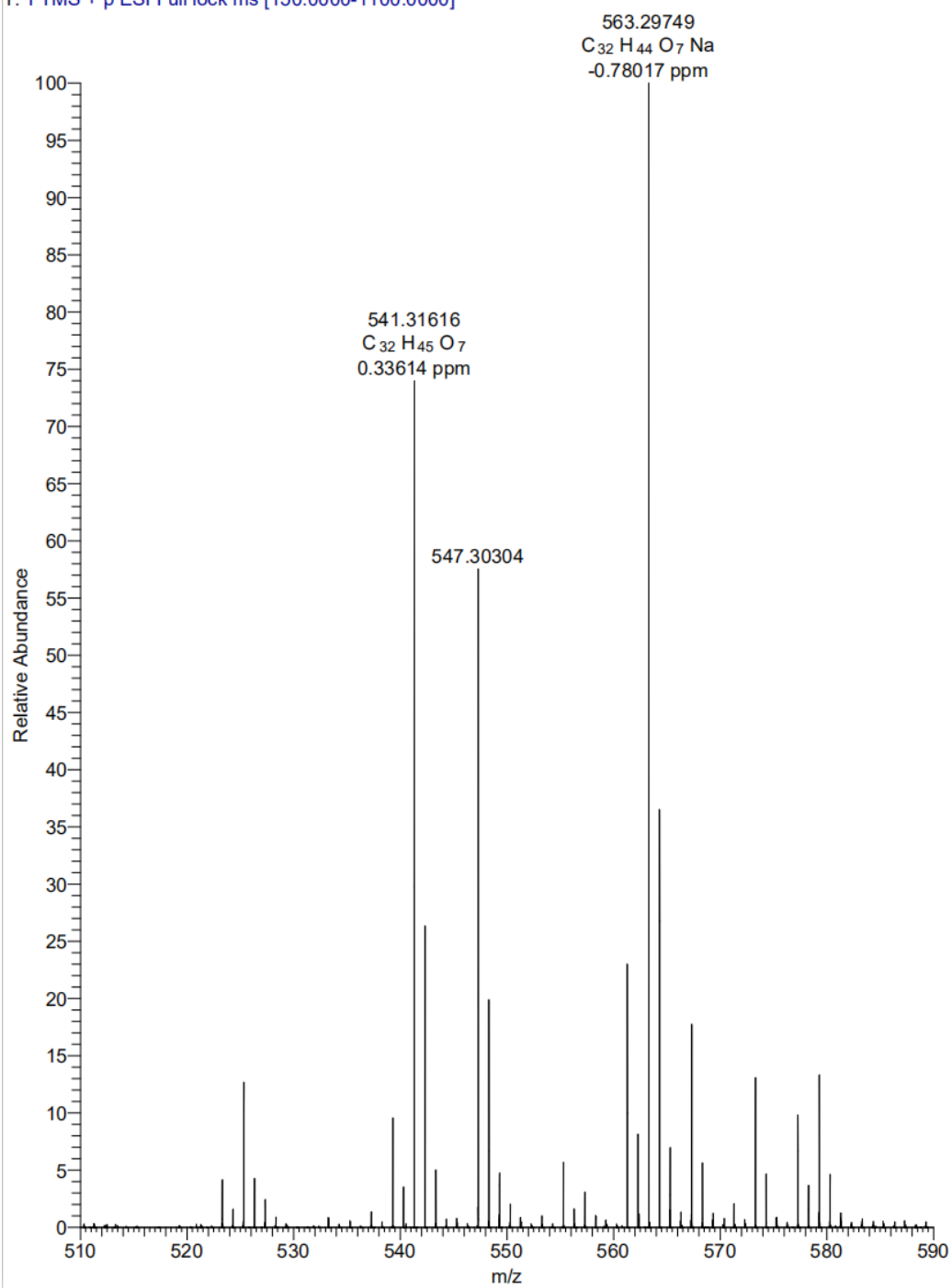


Figure S71. ^1H NMR spectrum of **11** (600 MHz, CDCl_3).

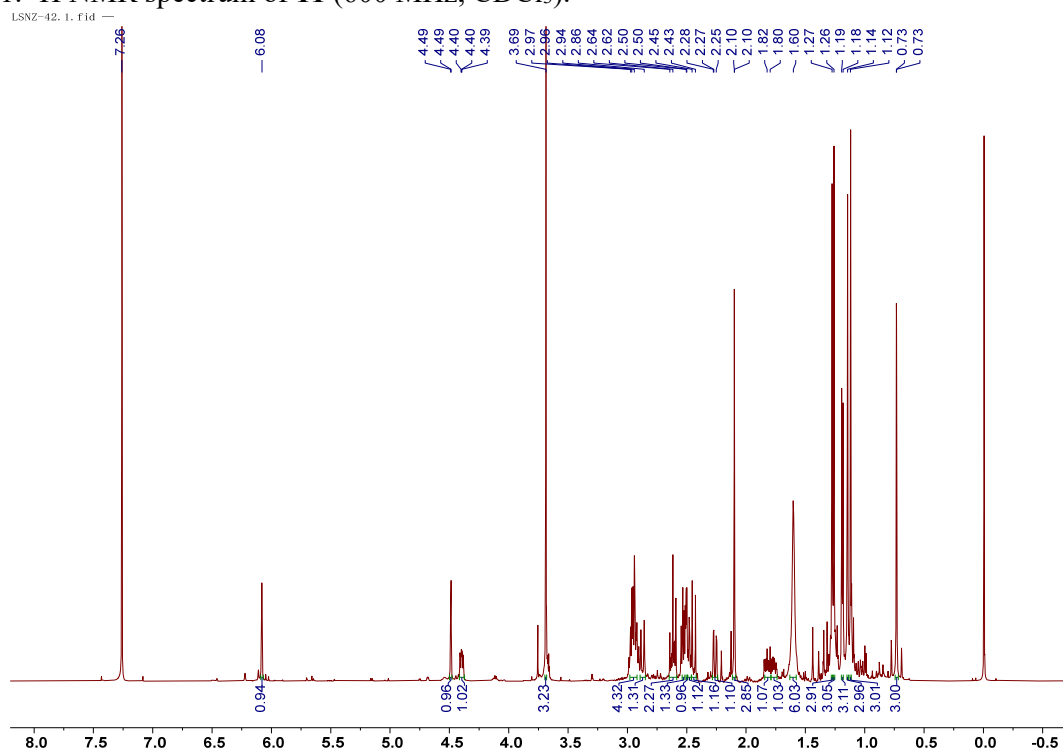


Figure S72. ^{13}C and DEPT NMR spectra of **11** (150 MHz, CDCl_3).

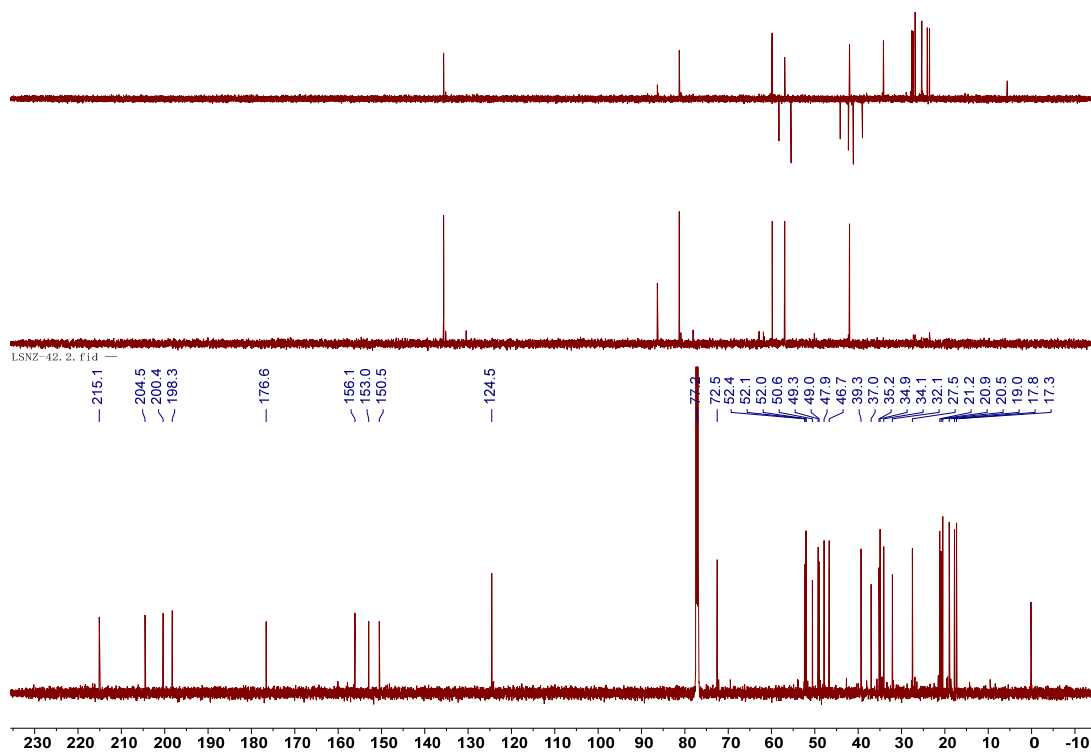


Figure S73. HSQC spectrum of **11**.

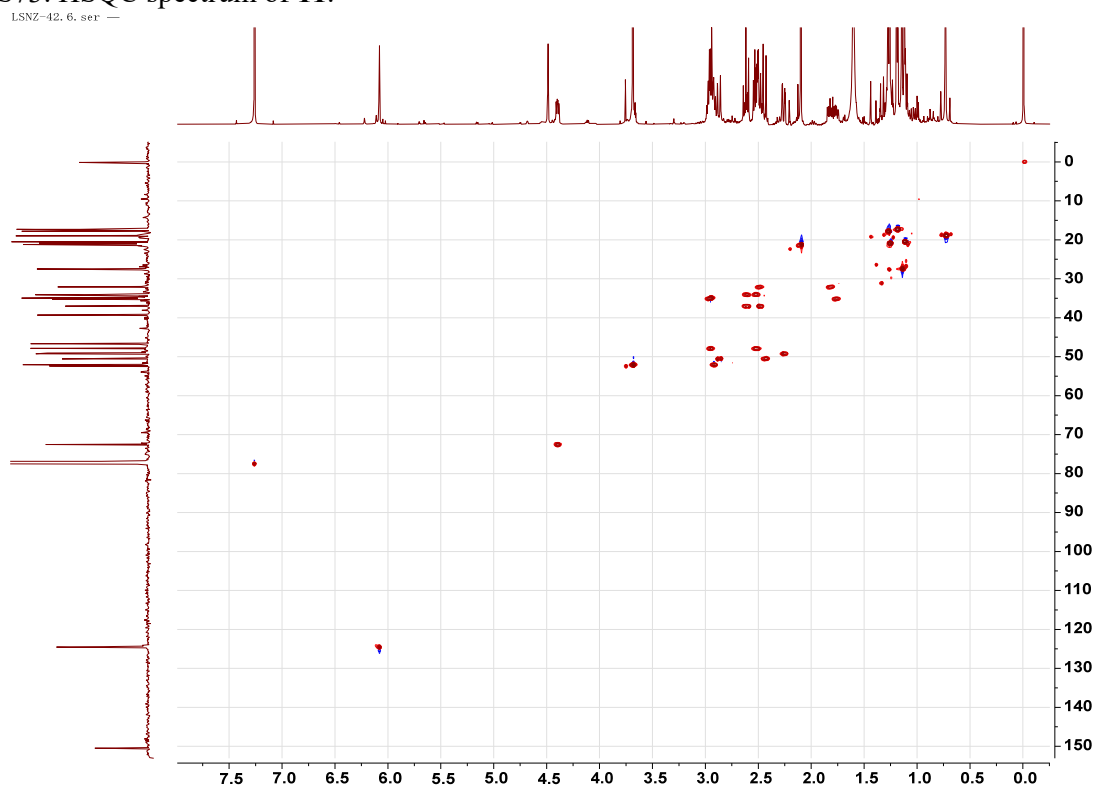


Figure S74. HMBC spectrum of **11**.

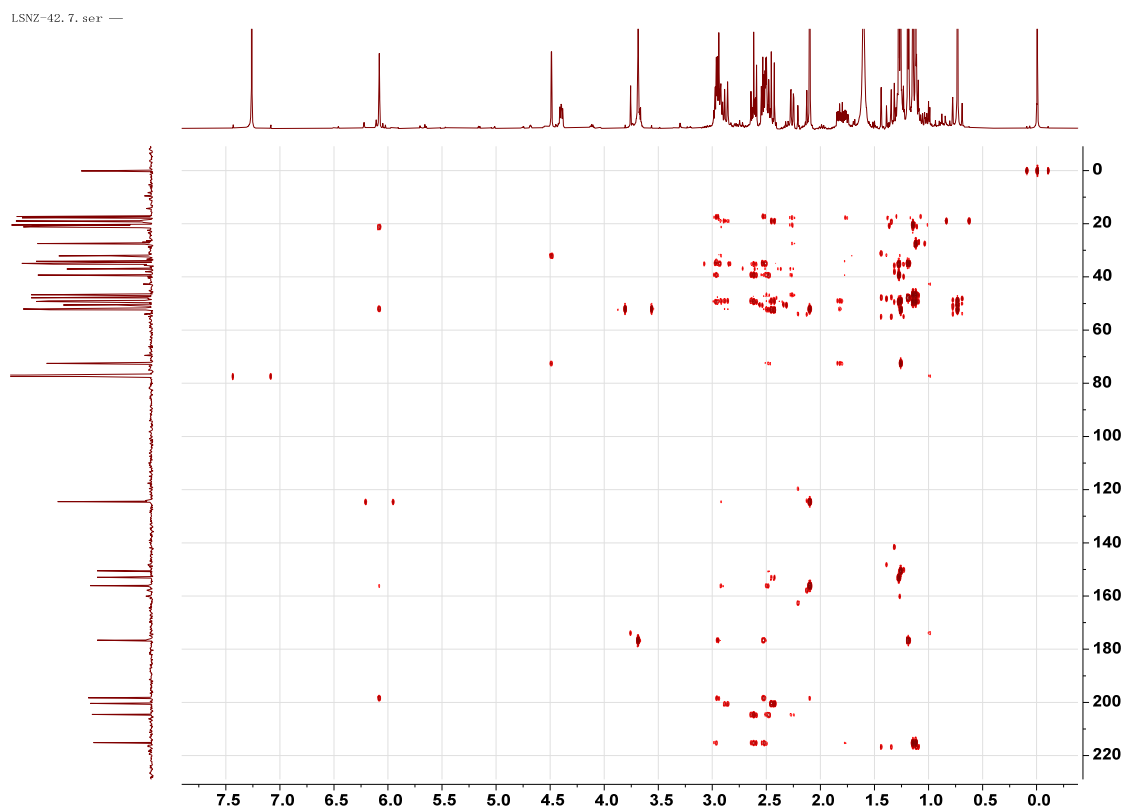


Figure S75. ^1H - ^1H COSY spectrum of **11**.

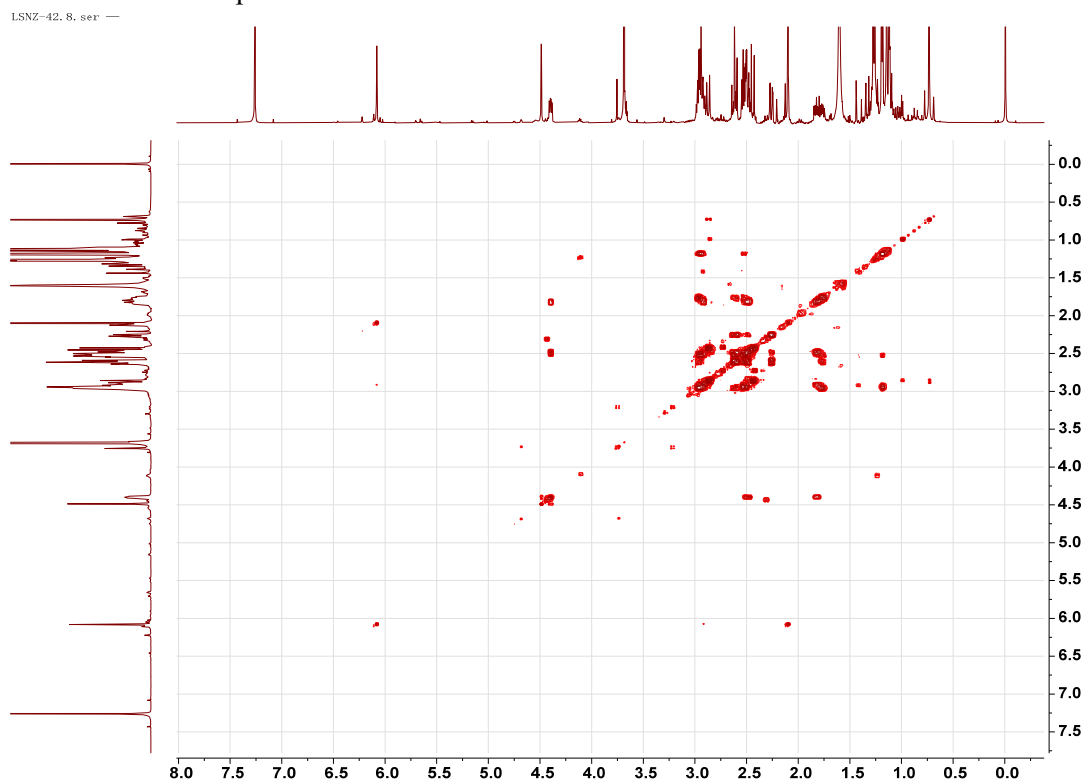


Figure S76. ROESY spectrum of **11**.

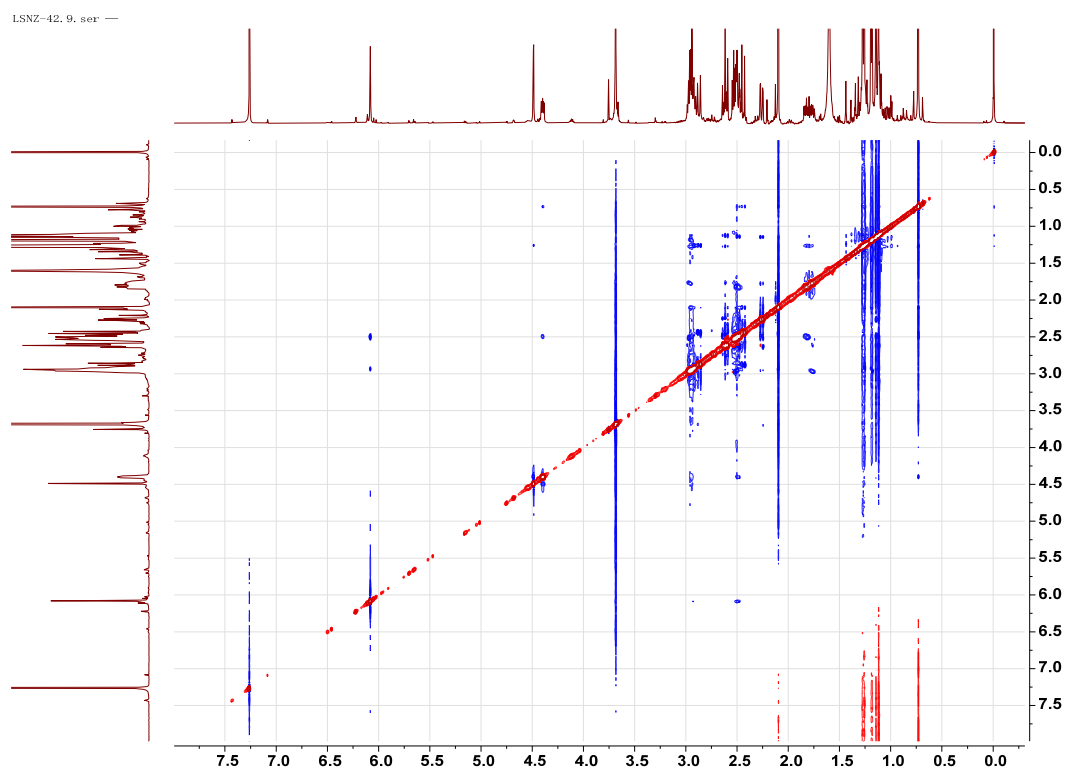


Figure S77. HRESIMS of **11**.

_SN2-42 #649 RT: 9.13 AV: 1 NL: 1.80E8
f: FTMS + p ESI Full lock ms [100.0000-1500.0000]

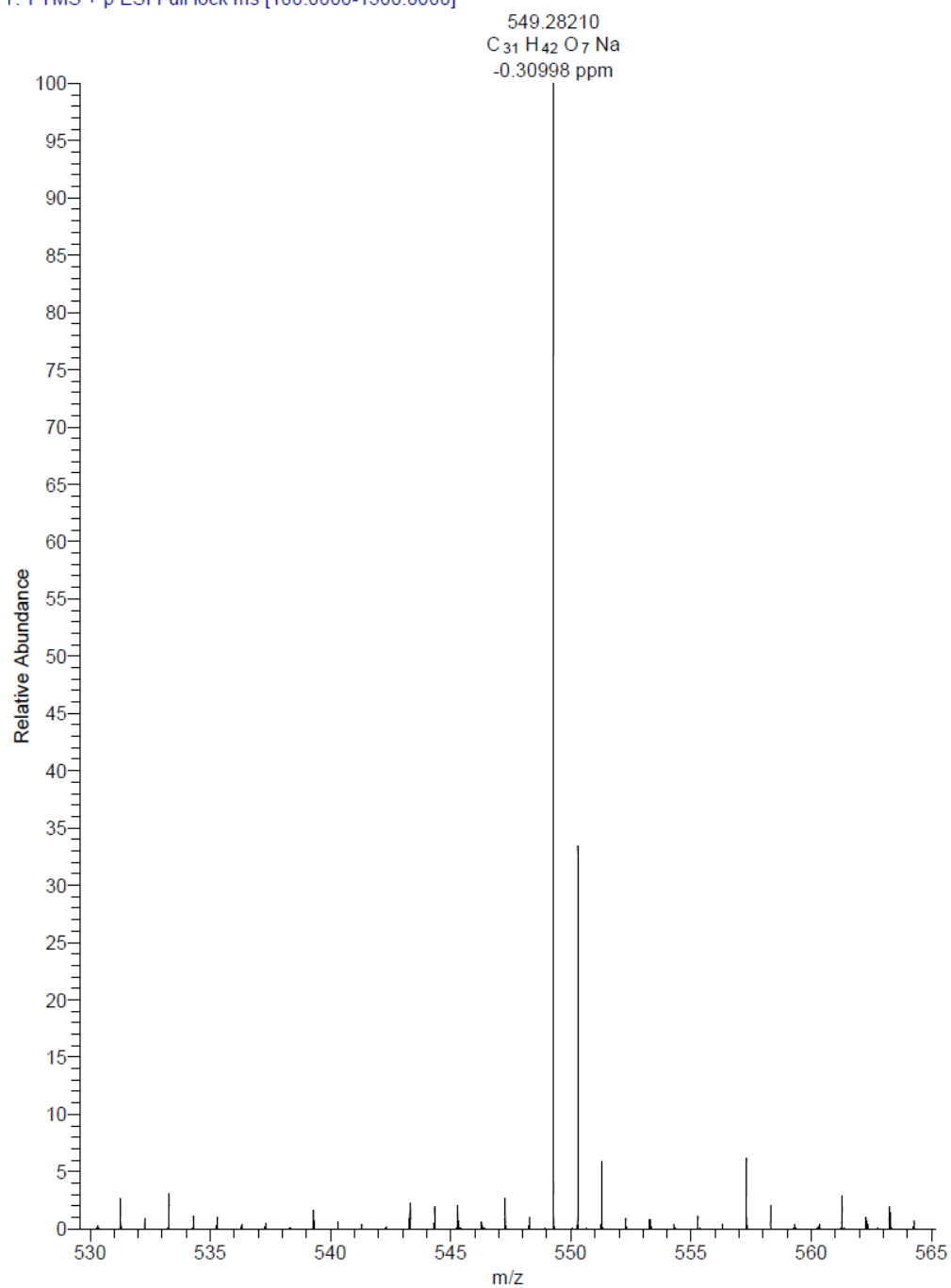


Figure S78. ^1H NMR spectrum of **12** (600 MHz, CDCl_3).

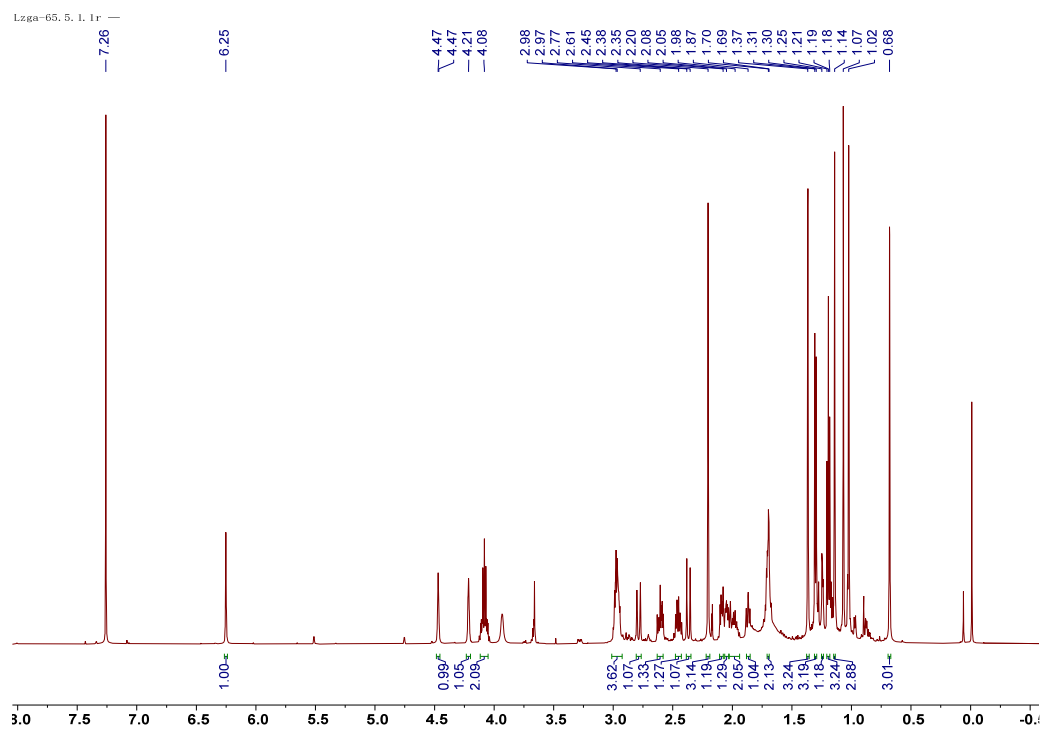


Figure S79. ^{13}C and DEPT NMR spectra of **12** (150 MHz, CDCl_3).

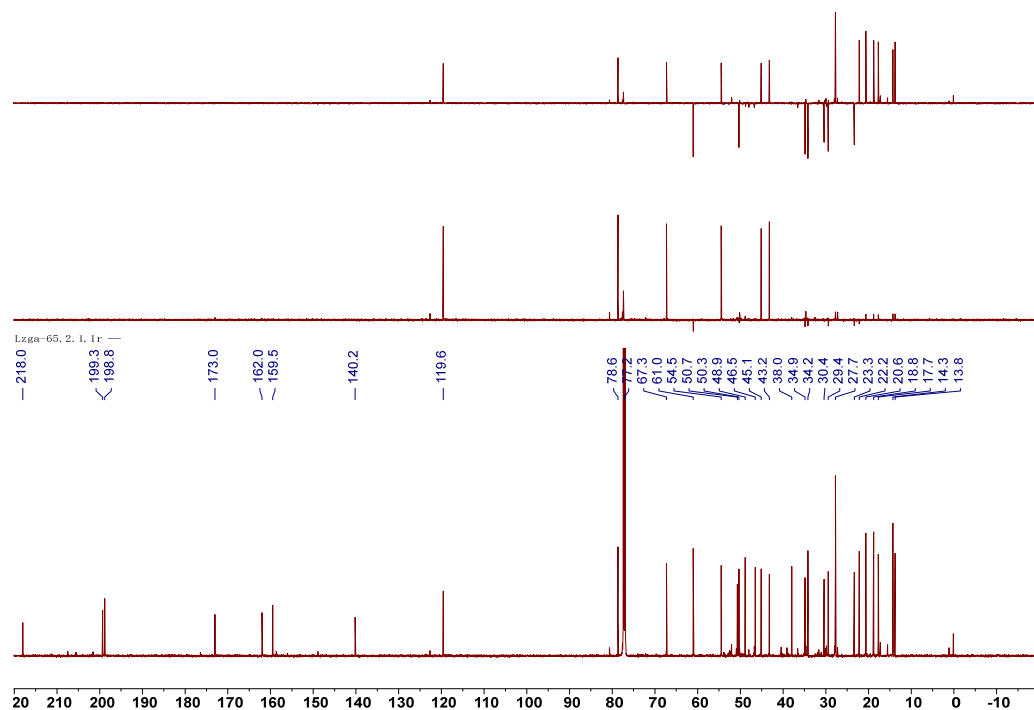


Figure S80. HSQC spectrum of **12**.

Lzga-65.6.1.2rr —

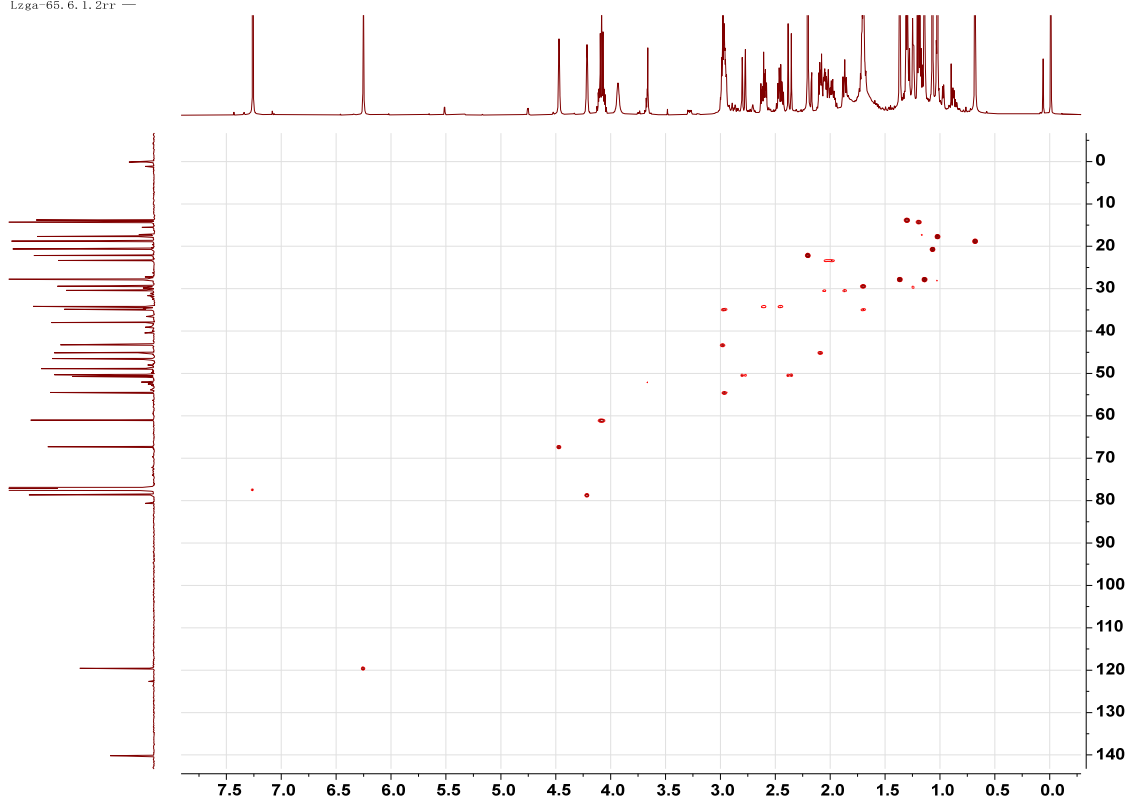


Figure S81. HMBC spectrum of **12**.

Lzga-65.7.1.2rr —

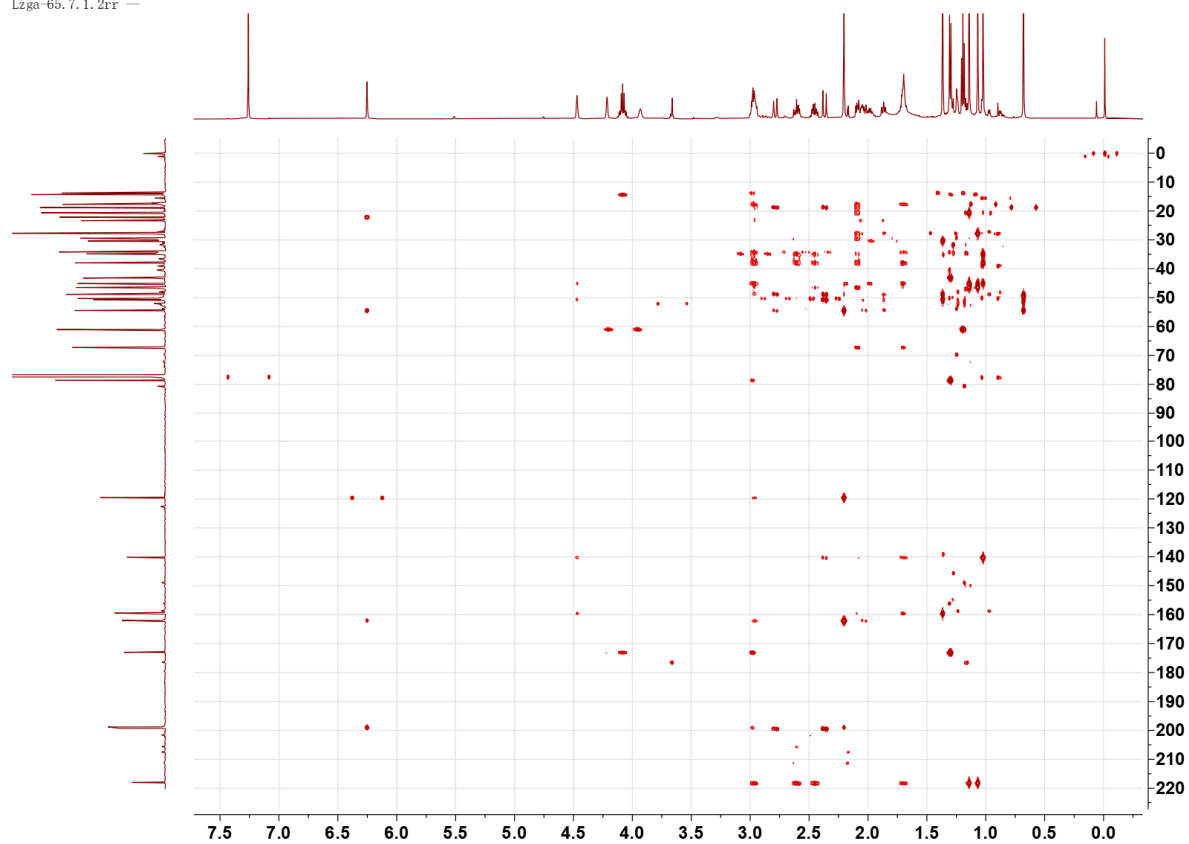


Figure S82. ^1H - ^1H COSY spectrum of **12**.

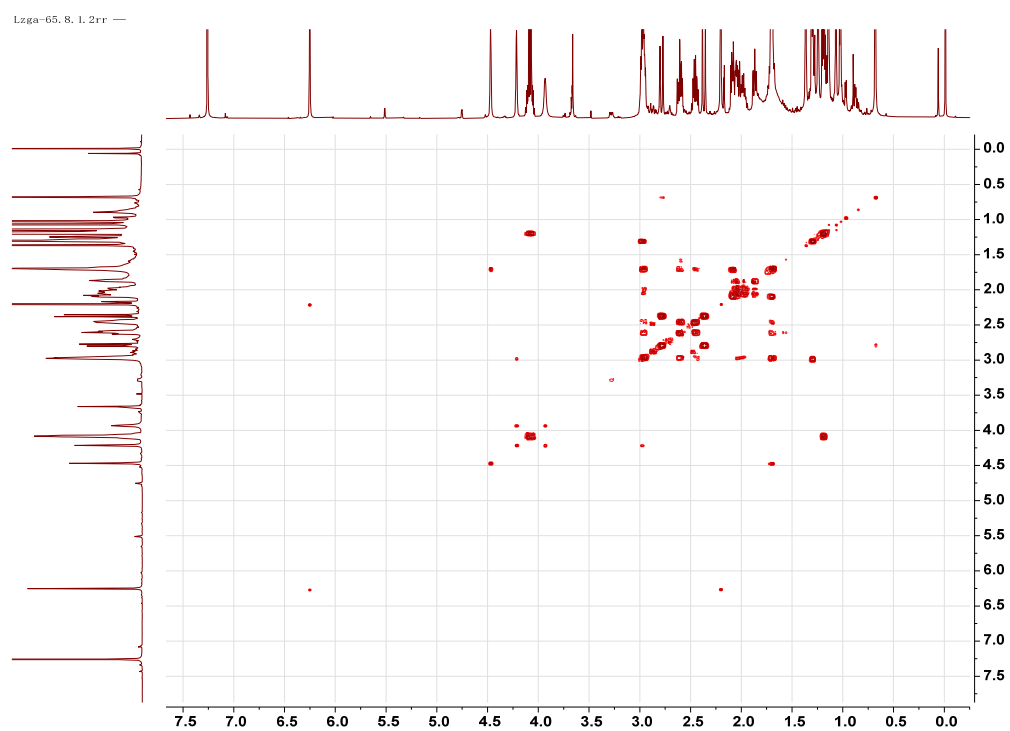


Figure S83. ROESY spectrum of **12**.

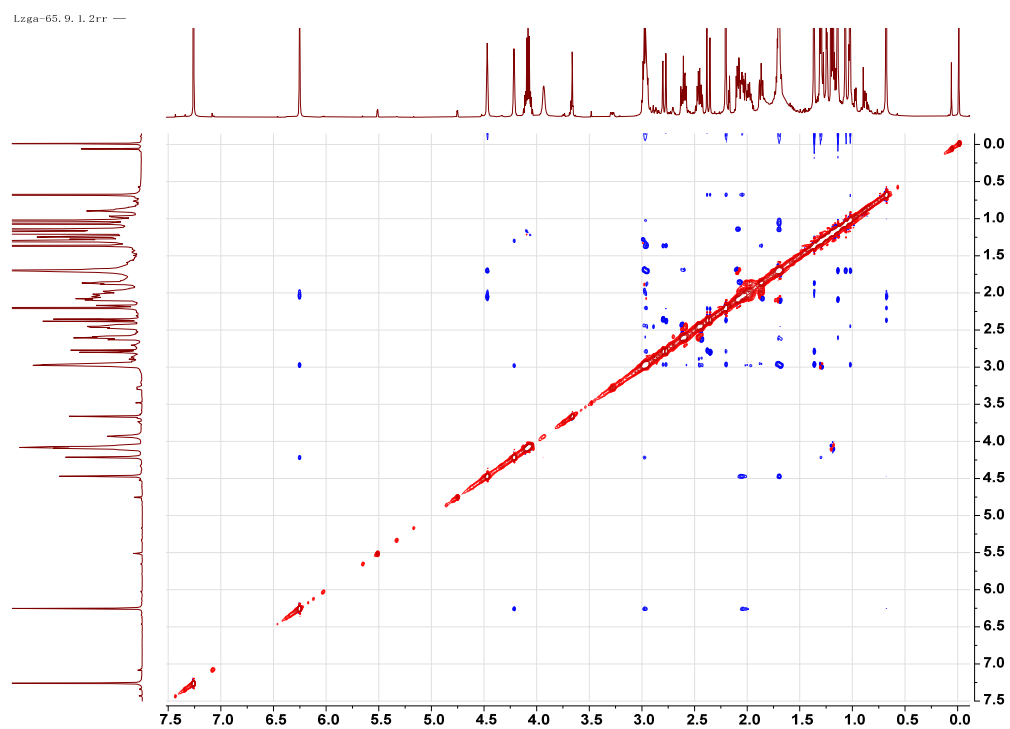


Figure S84. HRESIMS of **12**.

LZGA-65 #15 RT: 0.20 AV: 1 NL: 3.49E8
T: FTMS + p ESI Full lock ms [150.0000-1100.0000]

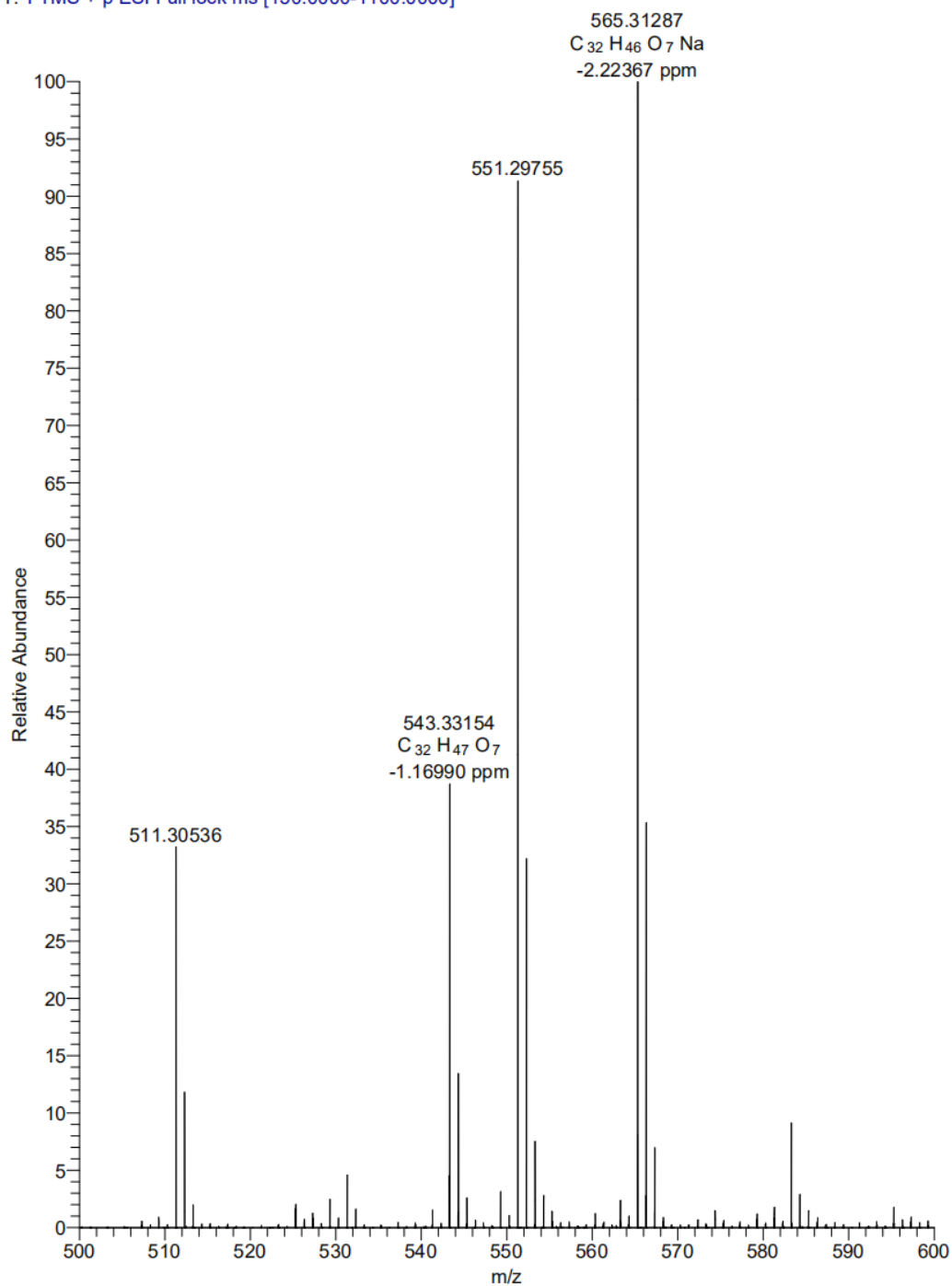


Figure S85. ^1H NMR spectrum of **13** (600 MHz, CDCl_3).

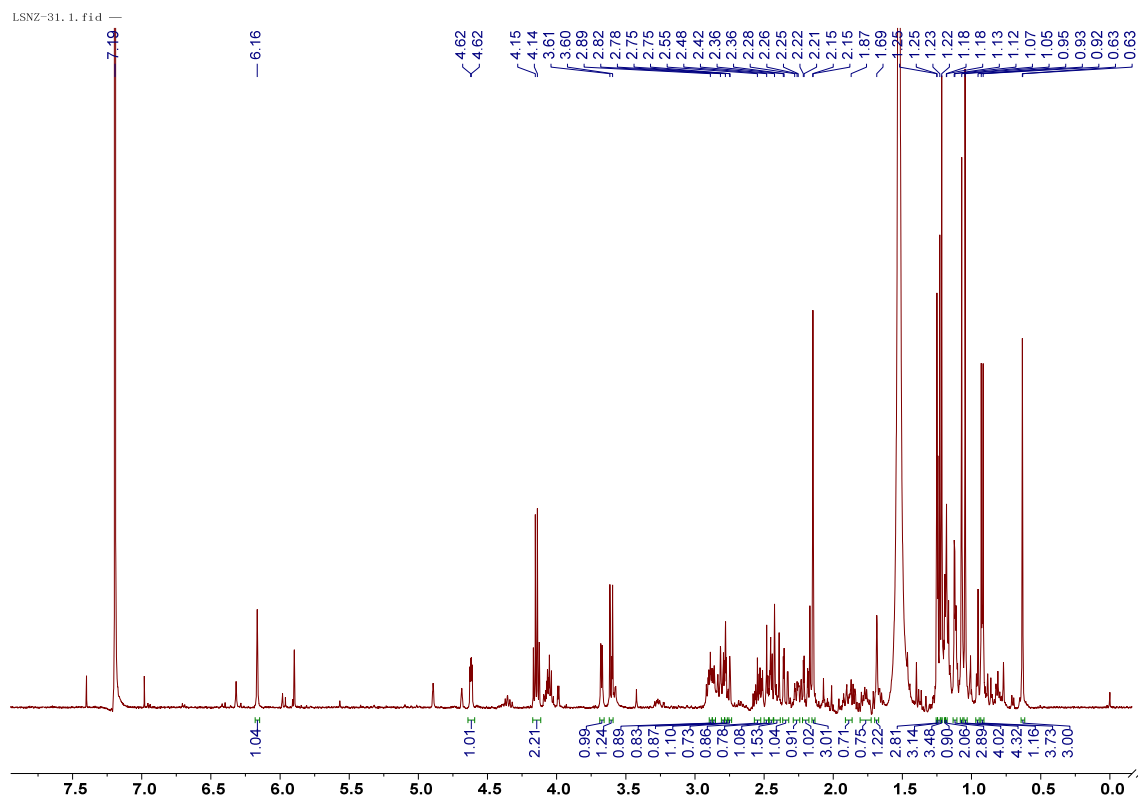


Figure S86. ^{13}C and DEPT NMR spectra of **13** (150 MHz, CDCl_3).

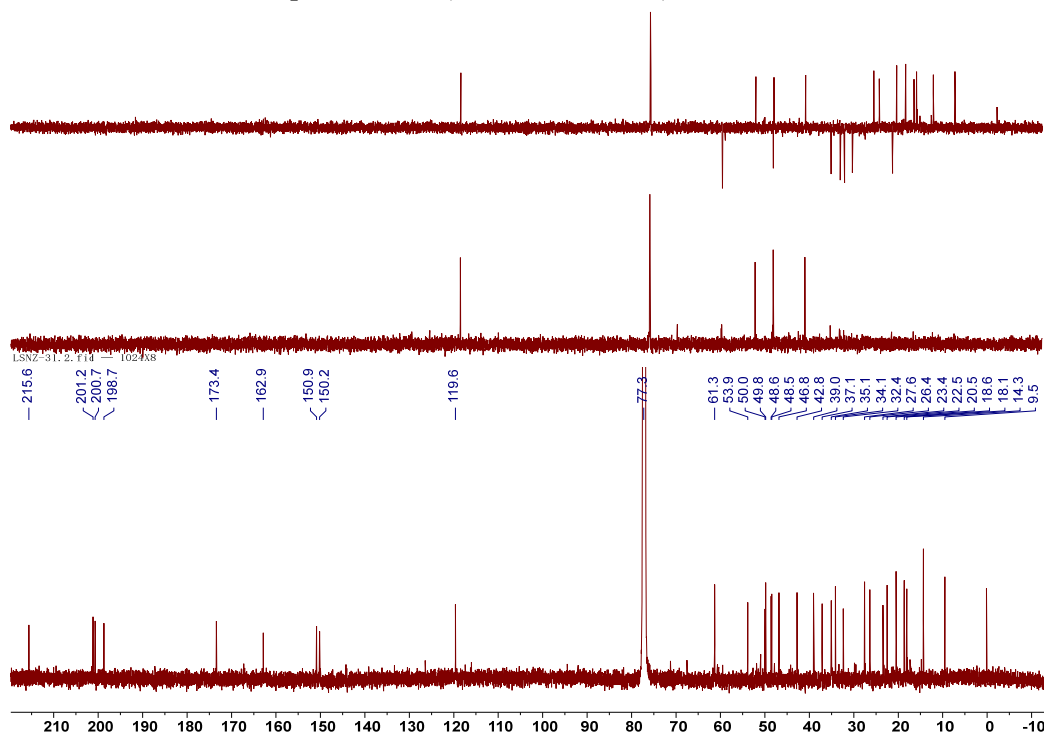


Figure S87. HSQC spectrum of **13**.

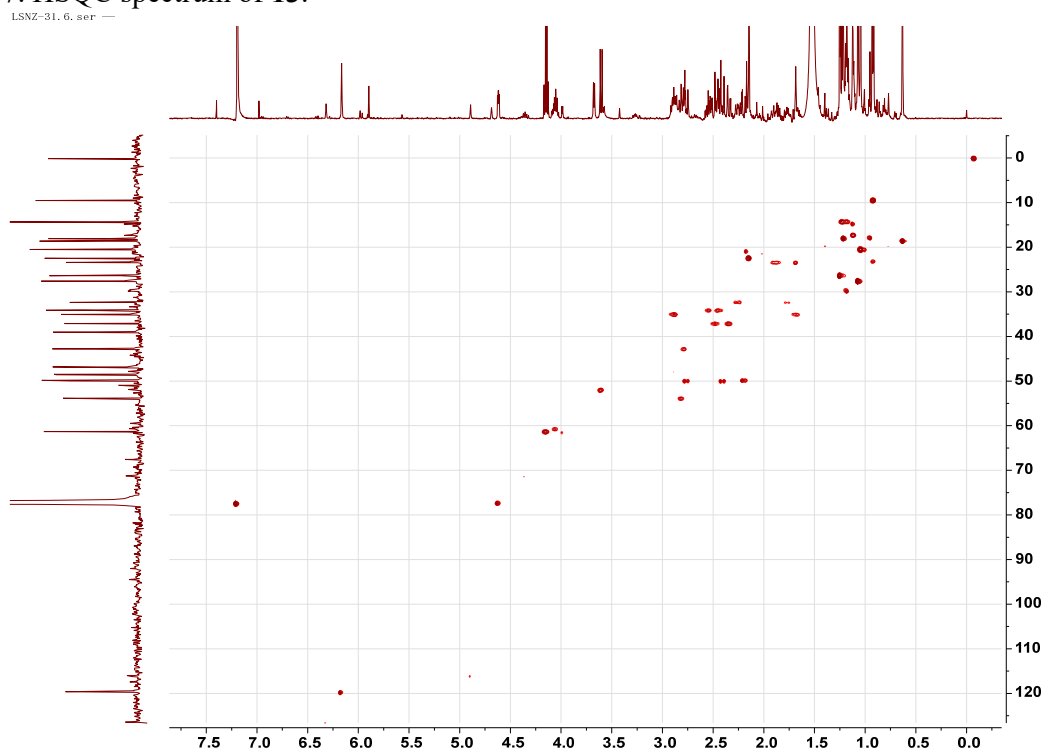


Figure S88. HMBC spectrum of **13**.

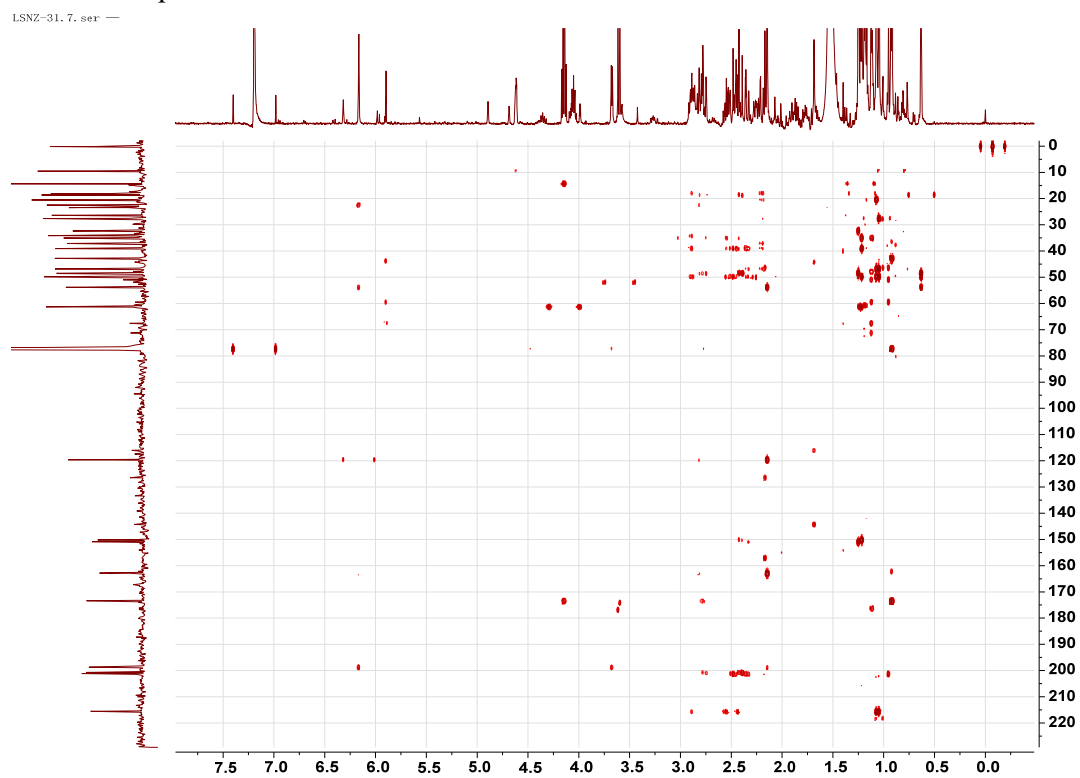


Figure S89. ^1H - ^1H COSY spectrum of **13**.

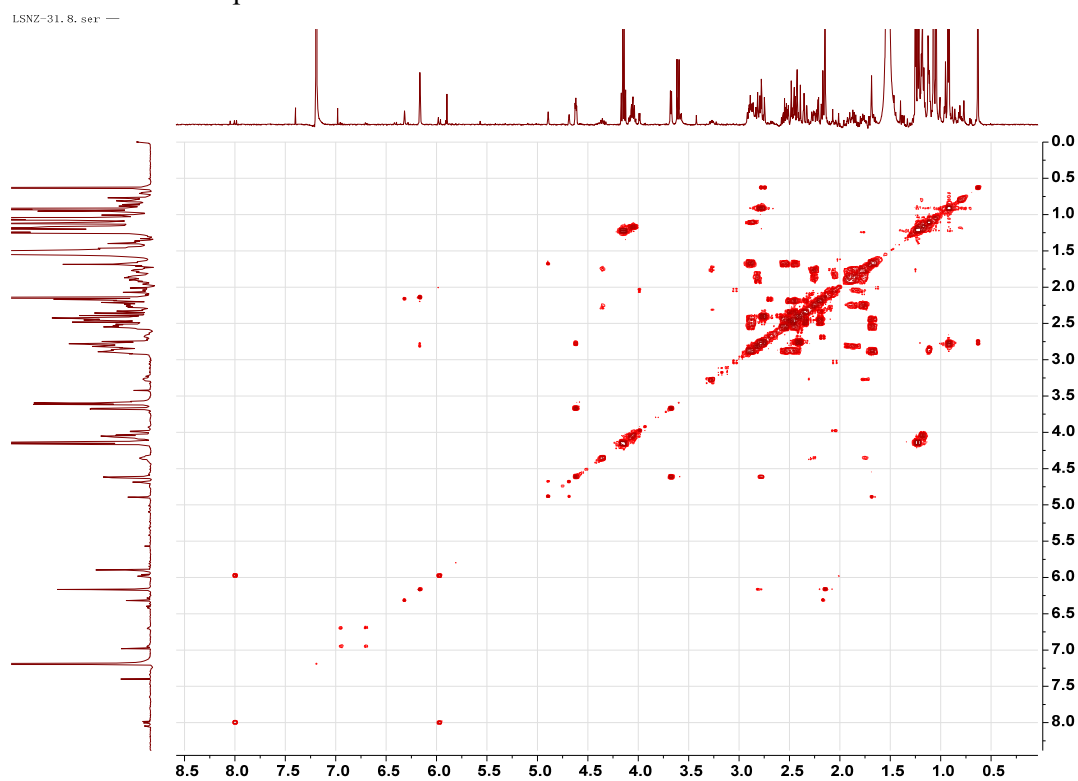


Figure S90. ROESY spectrum of **13**.

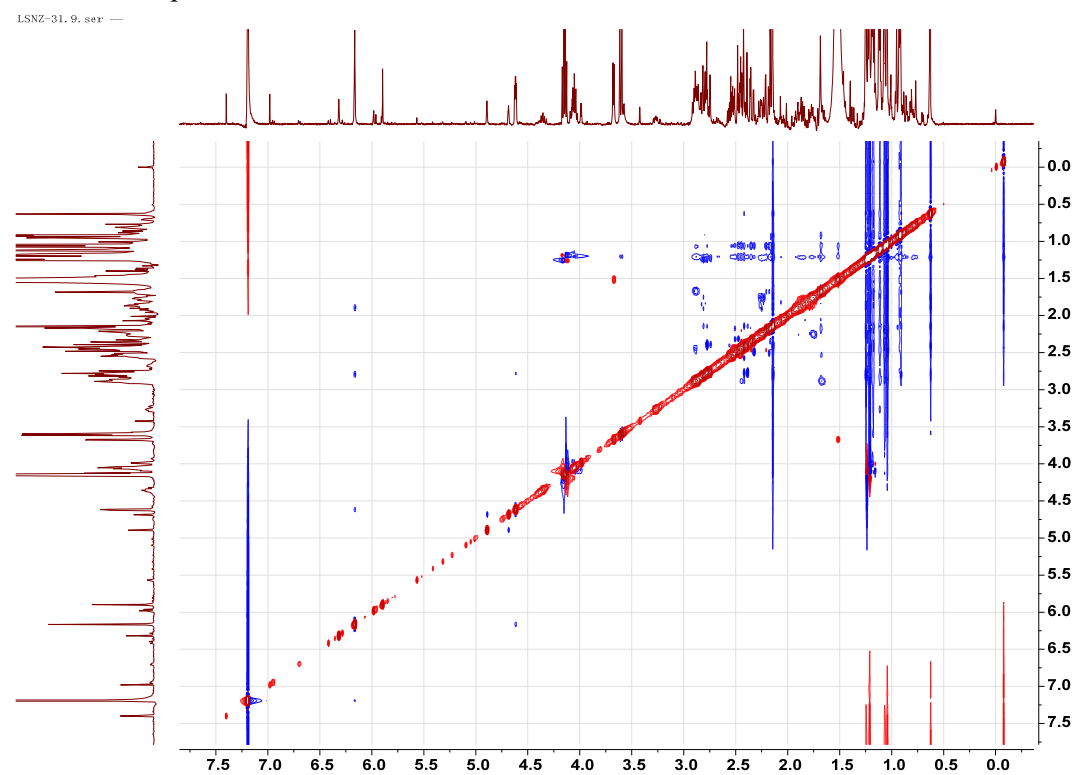


Figure S91. HRESIMS of **13**.

LSN2-31 #705 RT: 9.91 AV: 1 NL: 9.27E7

T: FTMS + p ESI Full lock ms [100.0000-1500.0000]

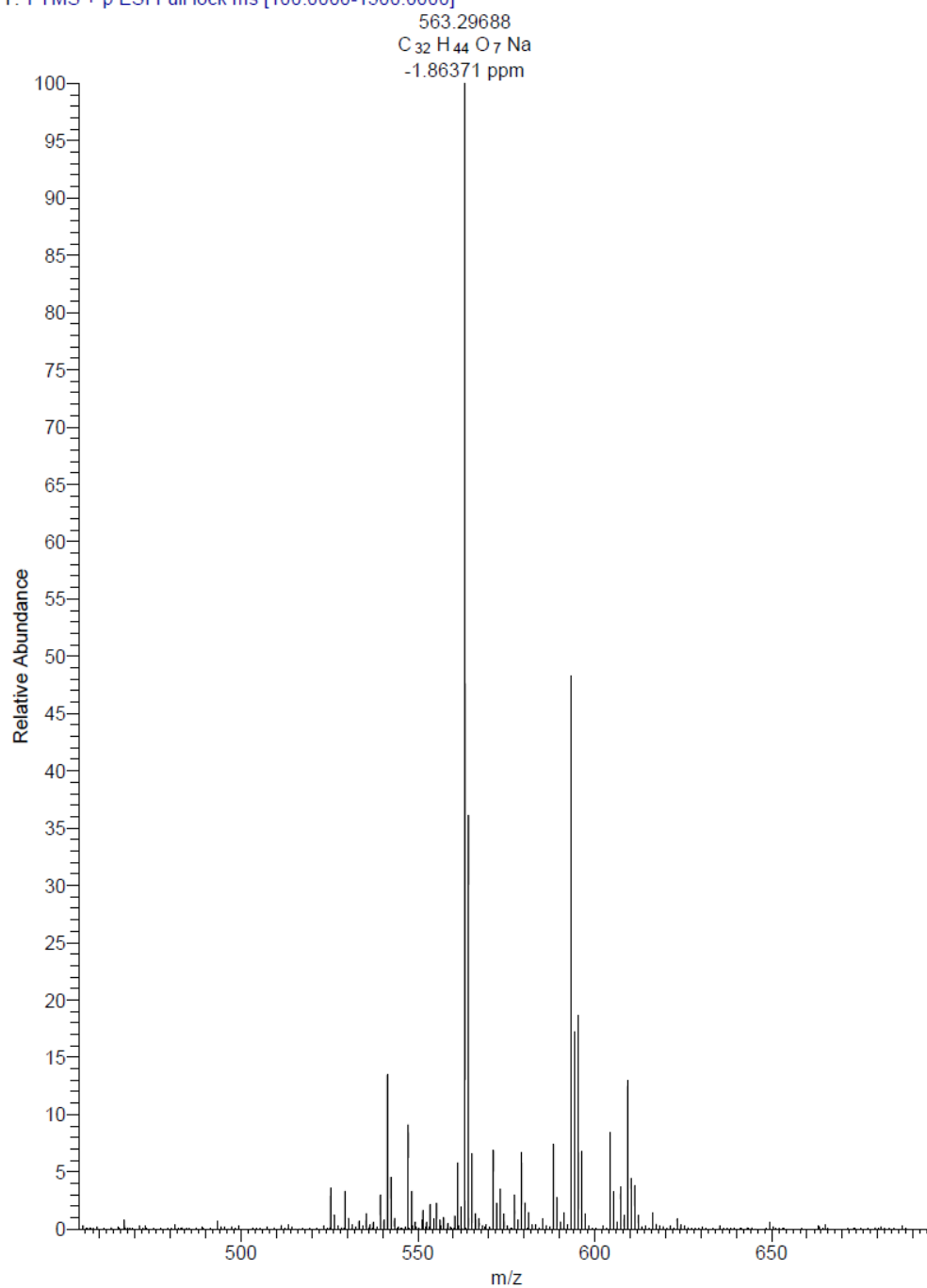


Figure S92. ^1H NMR spectrum of **1a** (600 MHz, CDCl_3).

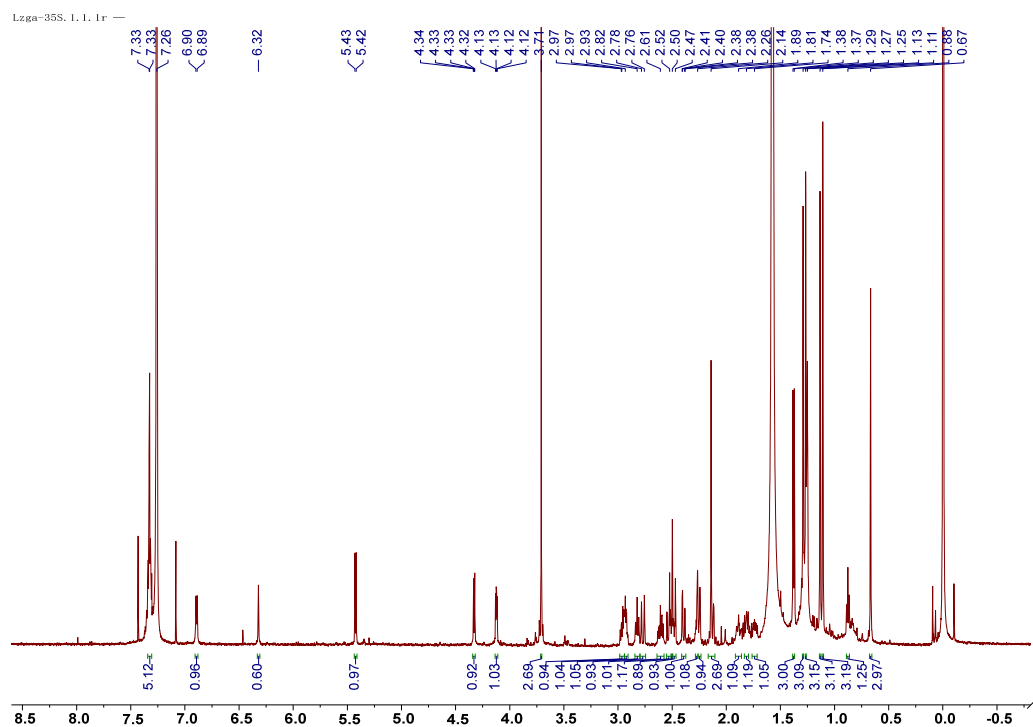


Figure S93. ^1H - ^1H COSY spectrum of **1a**.

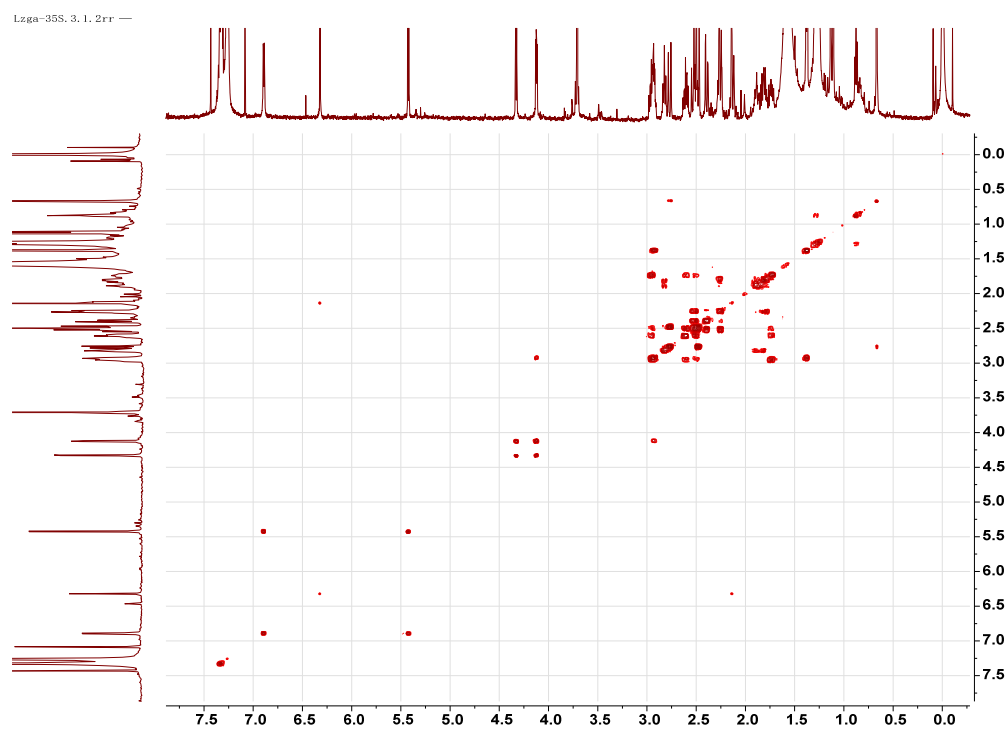


Figure S94. ^1H NMR spectrum of **1b** (600 MHz, CDCl_3).

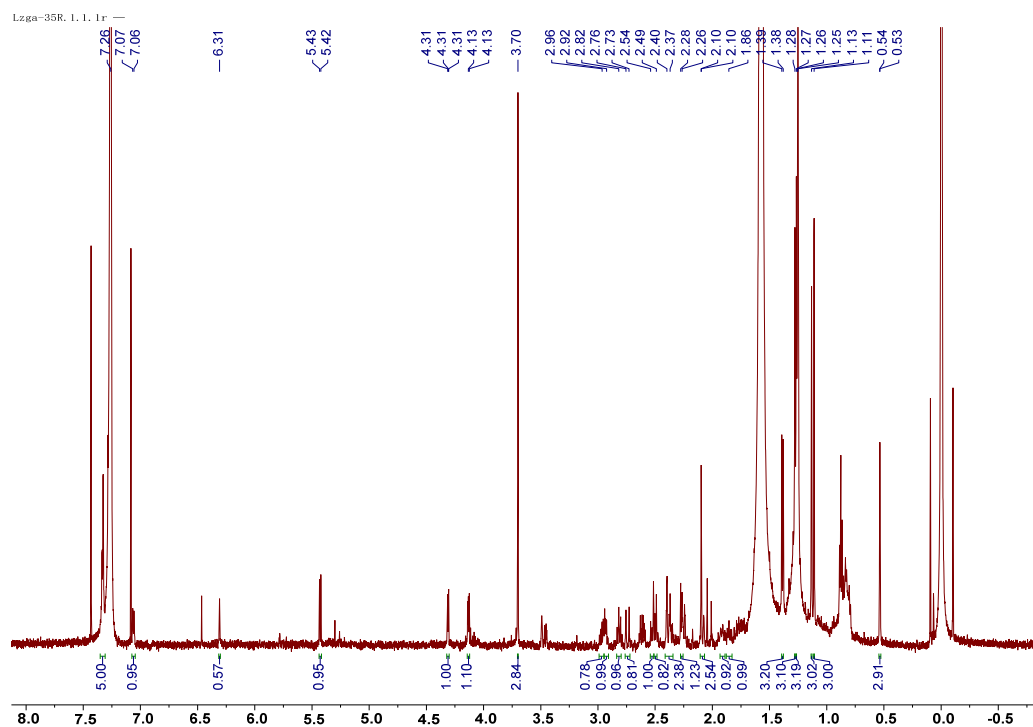


Figure S95. ^1H - ^1H COSY spectrum of **1b**.

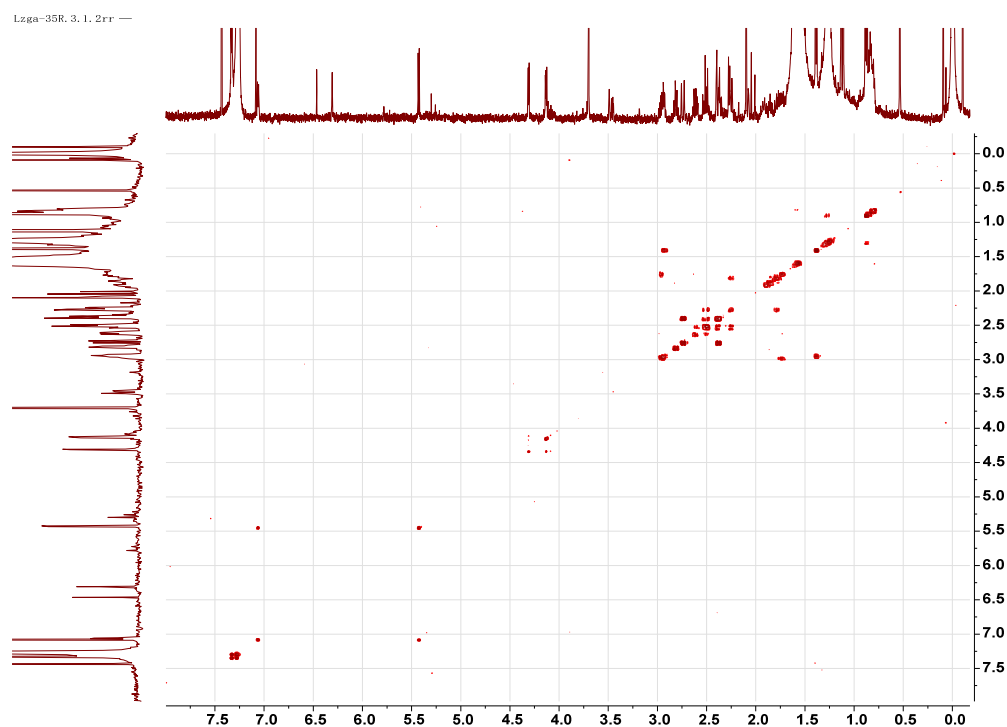


Figure S96. HRESIMS of **1a**.

ZGA-35S-2 #13 RT: 0.17 AV: 1 NL: 8.77E7

FTMS + p ESI Full ms [400.0000-1300.0000]

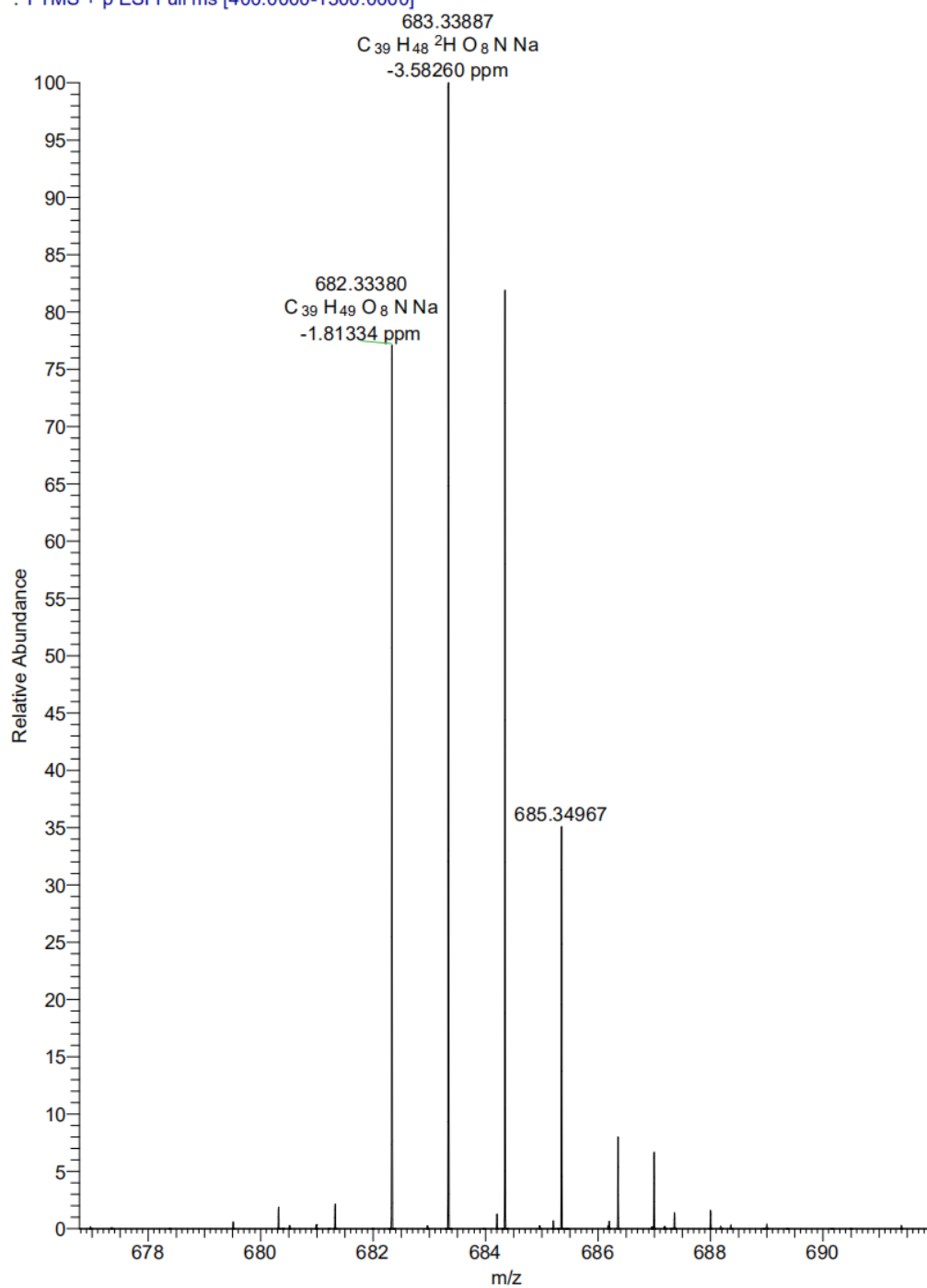


Figure S97. HRESIMS of **1b**.

LZGA-35R-2 #13 RT: 0.17 AV: 1 NL: 3.77E7
T: FTMS + p ESI Full ms [400.0000-1300.0000]

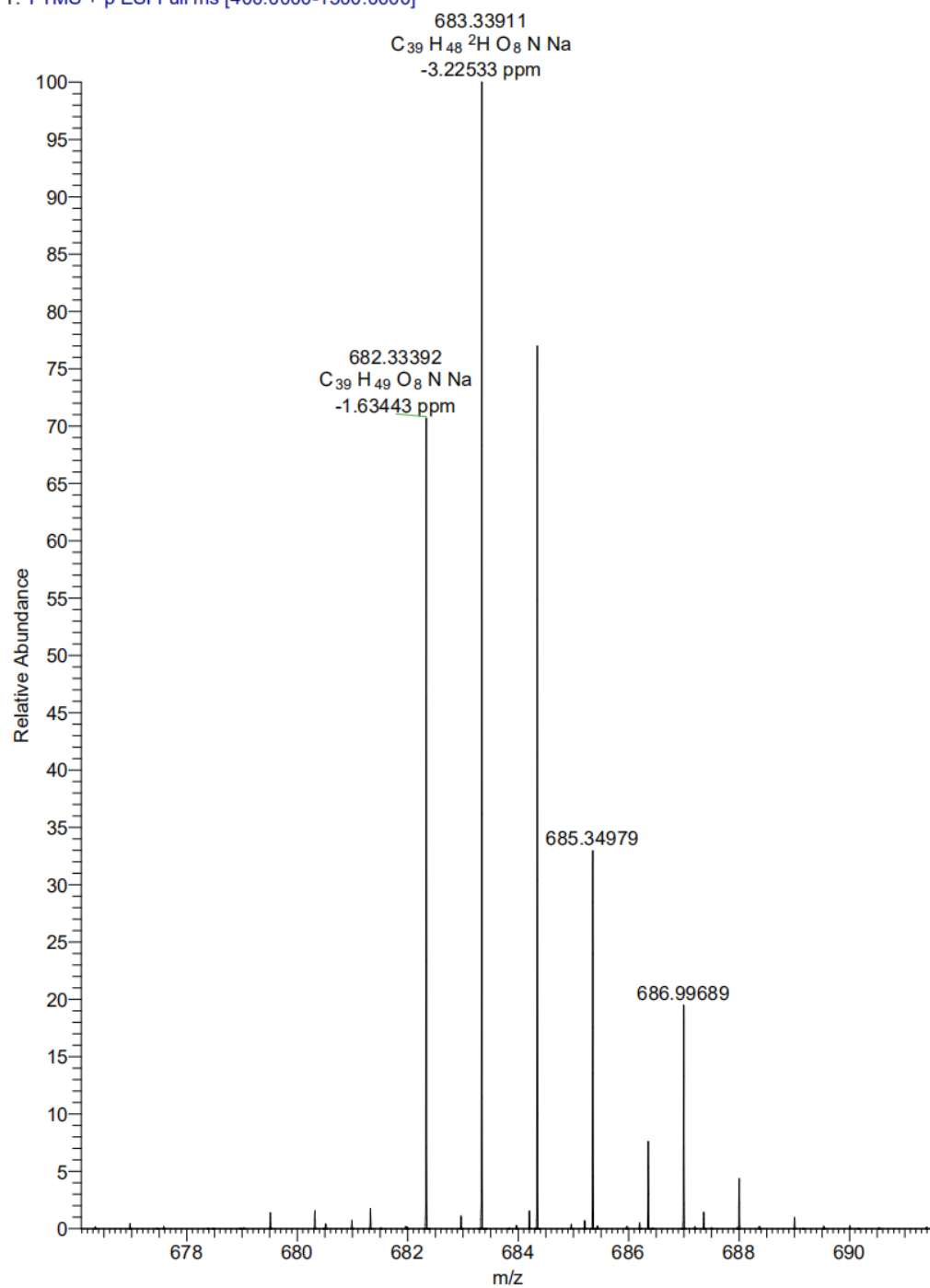


Figure S98. ^1H NMR spectrum of **2a** (600 MHz, CDCl_3).

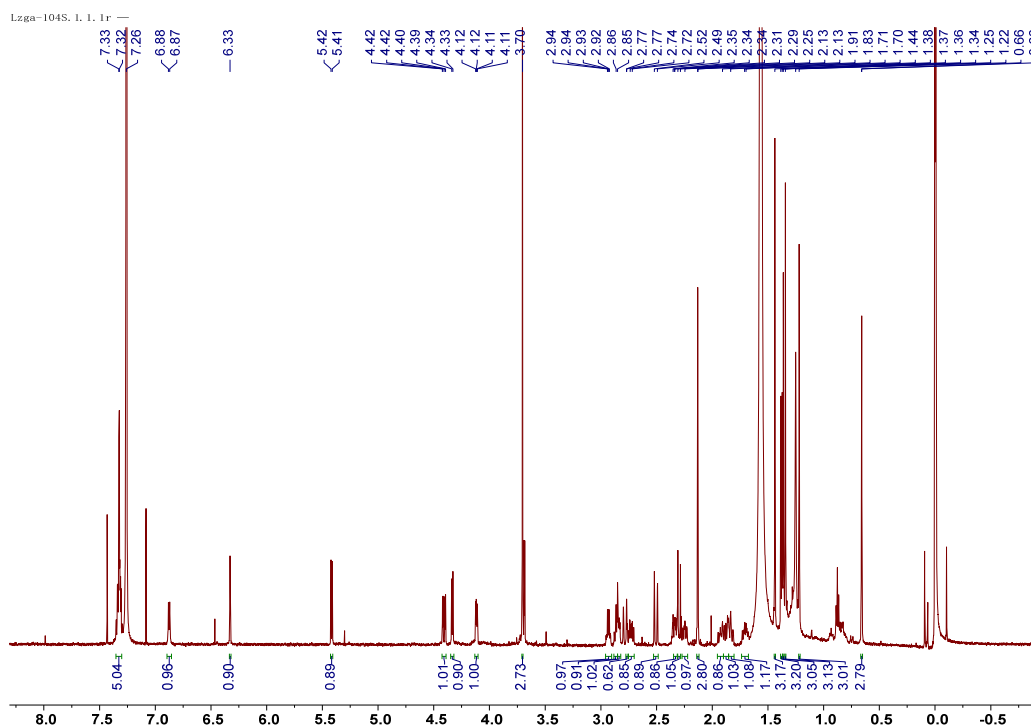


Figure S99. ^1H - ^1H COSY spectrum of **2a**.

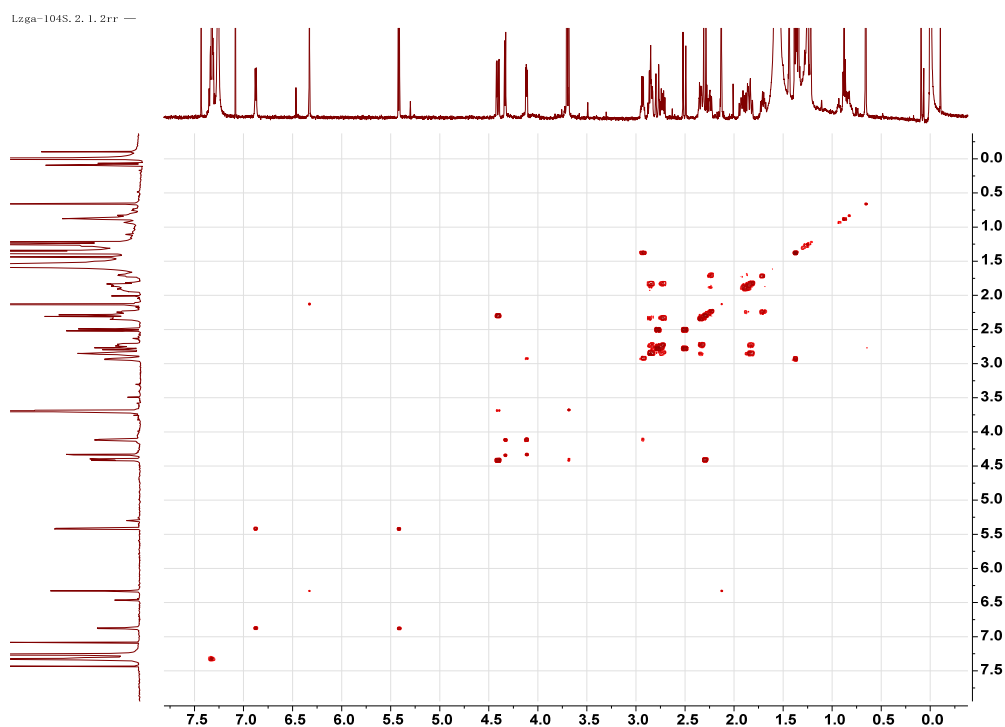


Figure S100. ^1H NMR spectrum of **2b** (600 MHz, CDCl_3).

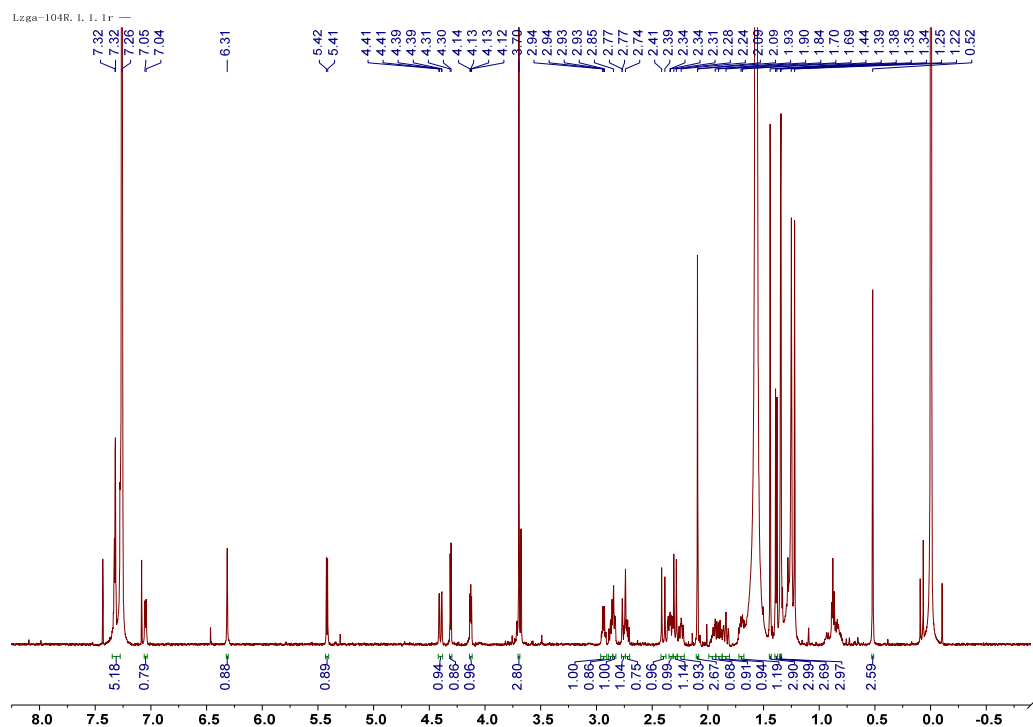


Figure S101. ^1H - ^1H COSY spectrum of **2b**.

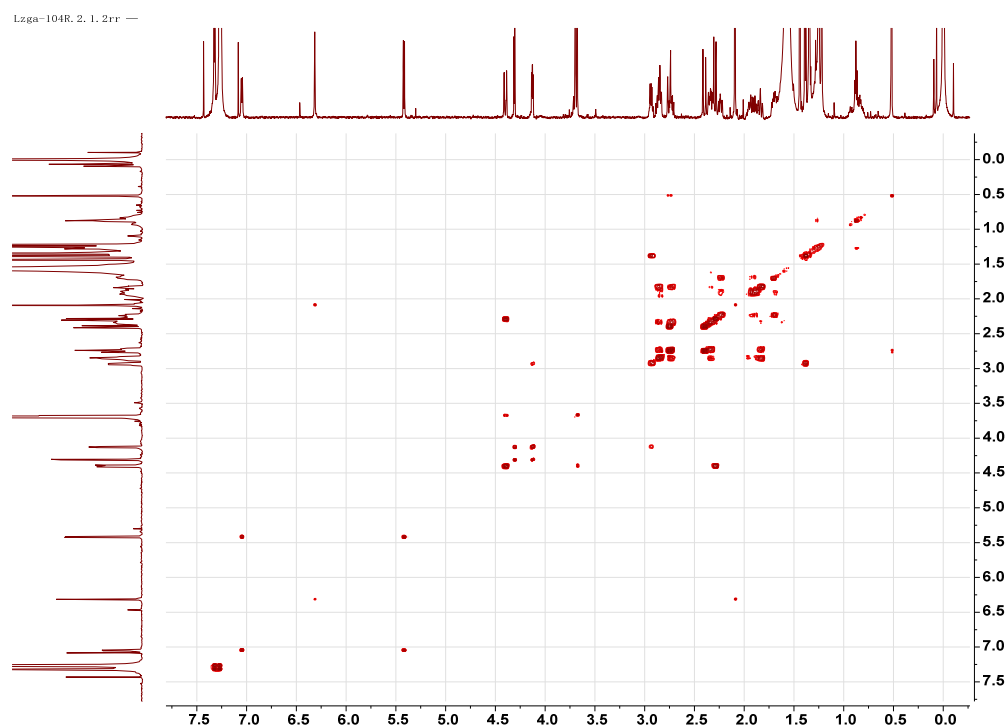


Figure S102. HRESIMS of **2a**.

D:\spectrum\...lzga-104\lzga-104s-2

2021/6/3 16:05:44

lzga-104s-2 #13 RT: 0.17 AV: 1 NL: 2.12E8

T: FTMS + p ESI Full ms [400.0000-1500.0000]

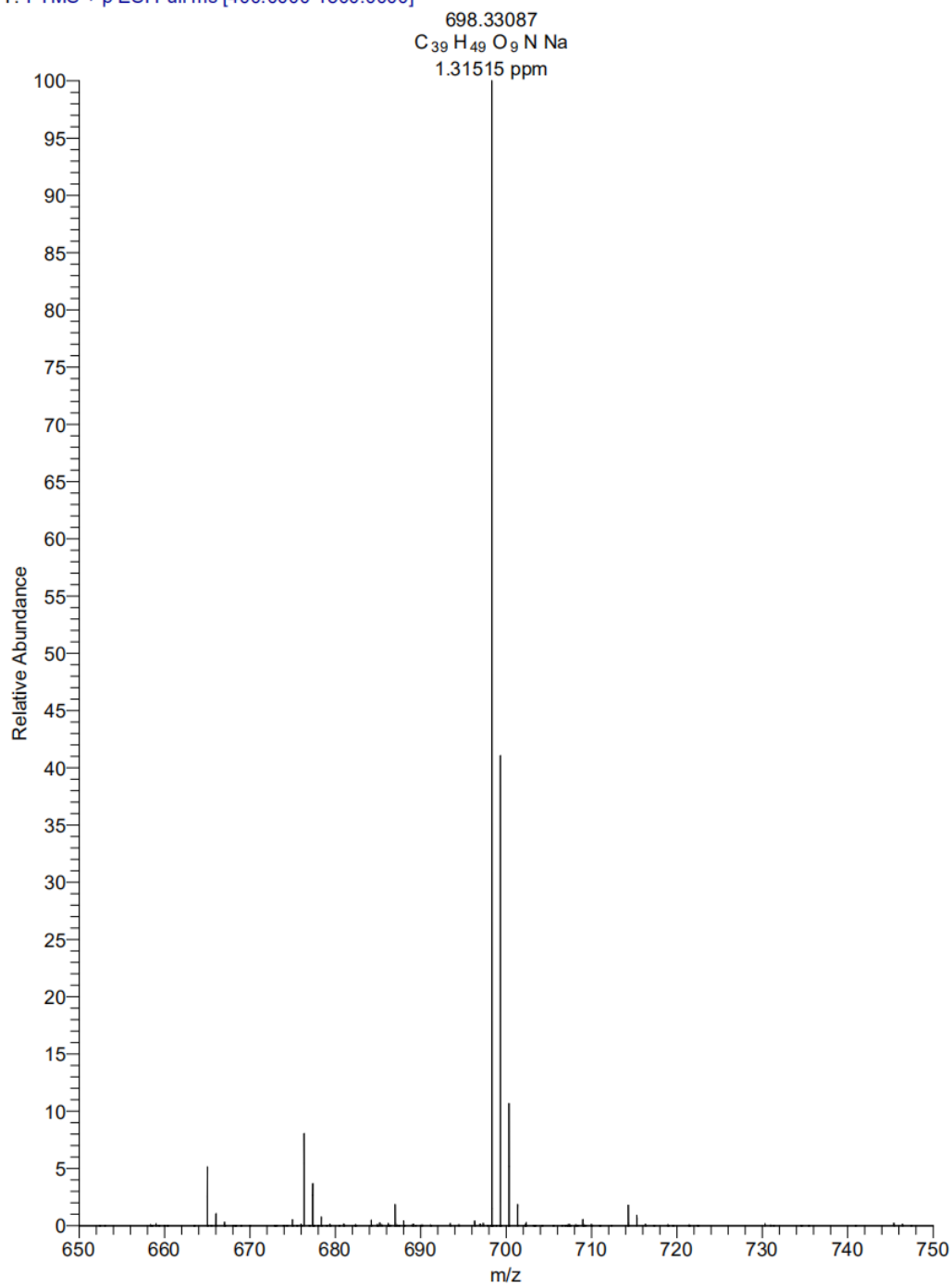


Figure S103. HRESIMS of **2b**.

LZGA-104R-2-1_210826165528 #19 RT: 0.25 AV: 1 NL: 4.13E7
T: FTMS + p ESI Full lock ms [150.0000-1100.0000]

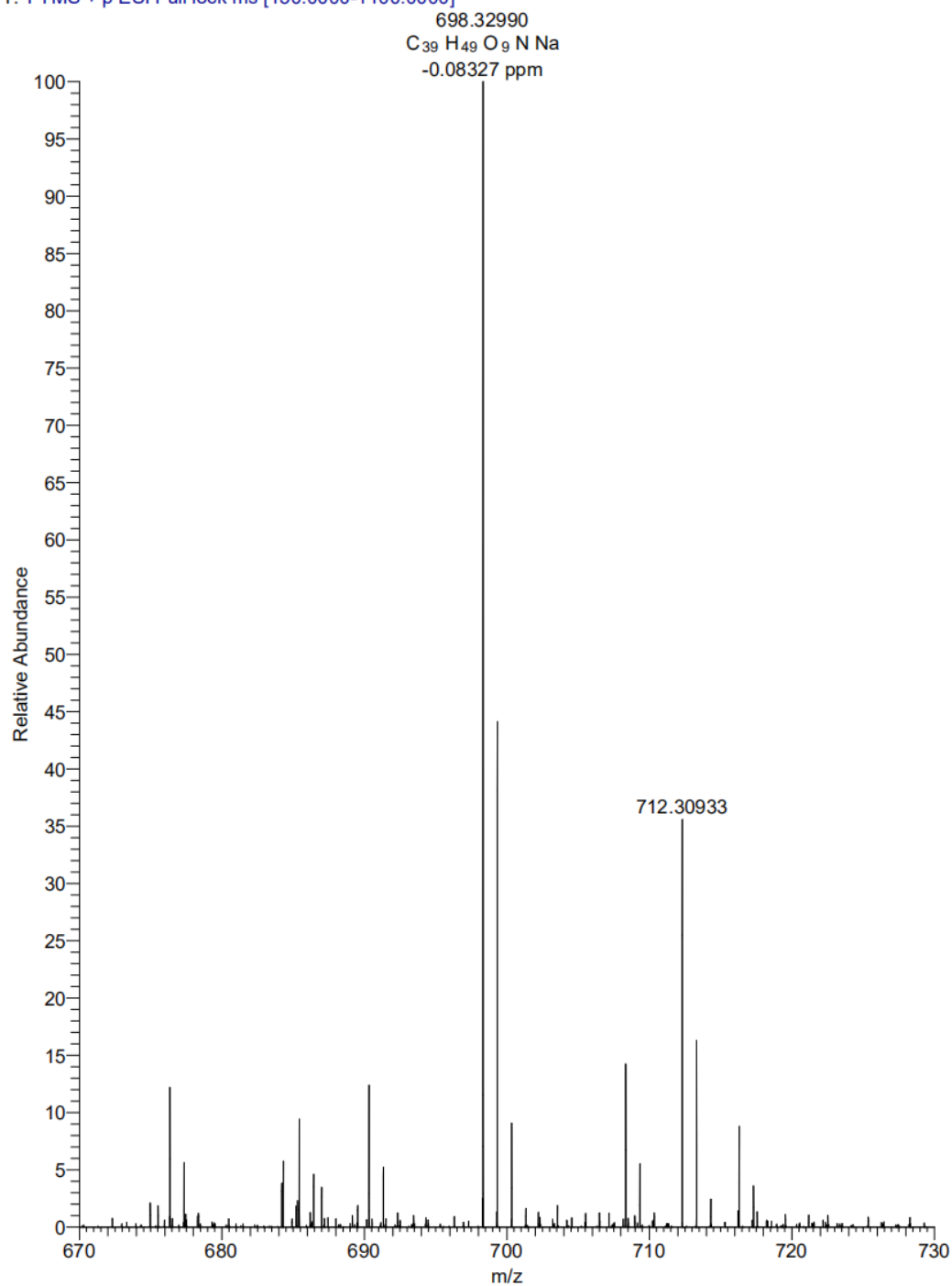


Figure S104. ^1H NMR spectrum of **3a** (600 MHz, CDCl_3).

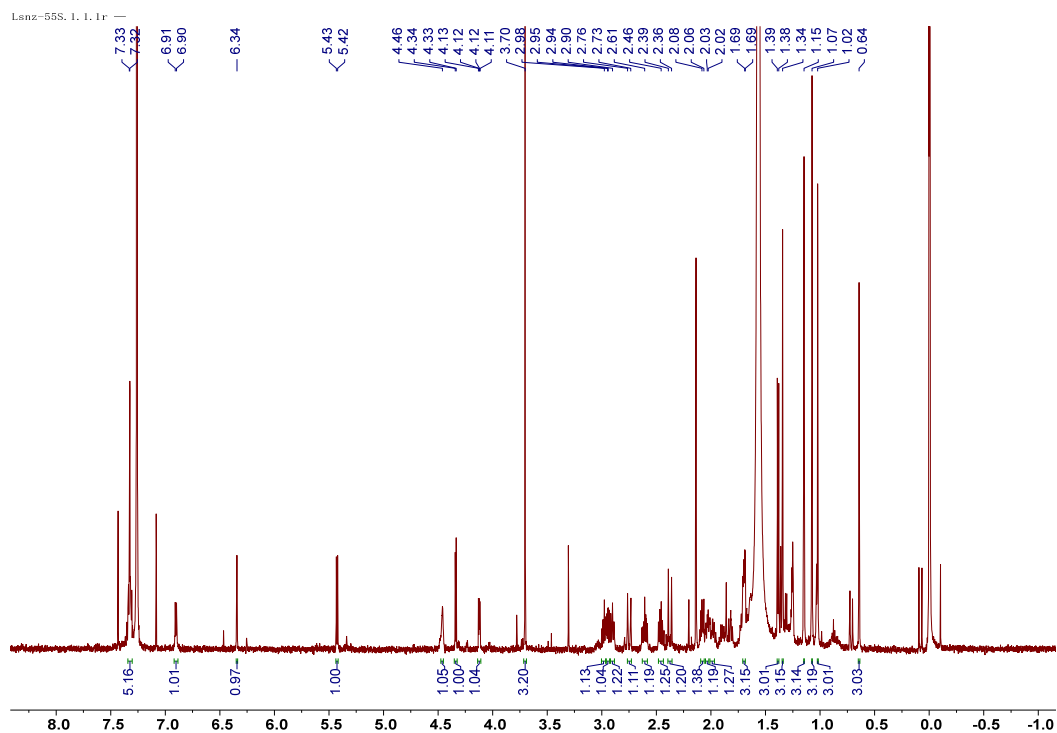


Figure S105. ^1H - ^1H COSY spectrum of **3a**.

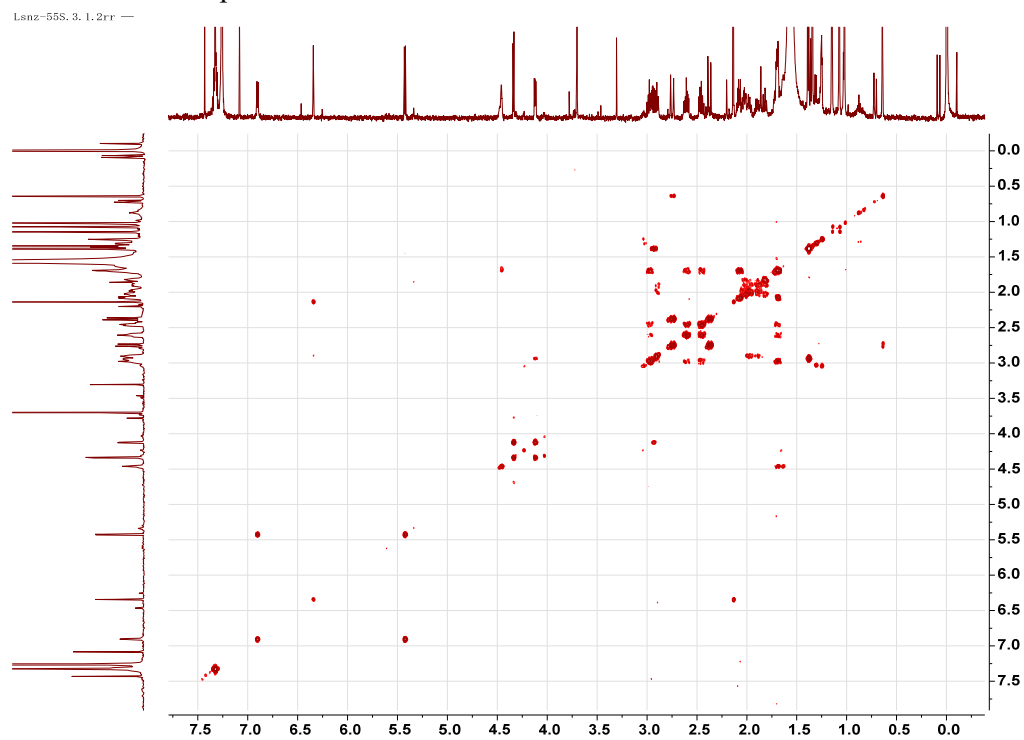


Figure S106. ^1H NMR spectrum of **3b** (600 MHz, CDCl_3).

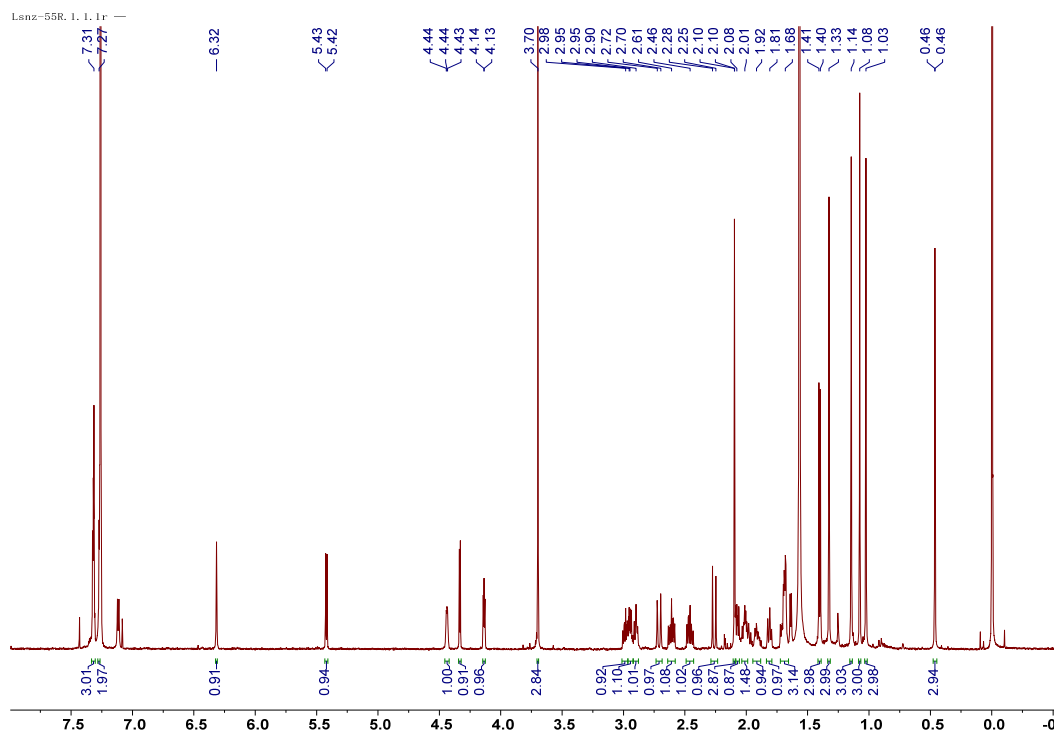


Figure S107. ^1H - ^1H COSY spectrum of **3b**.

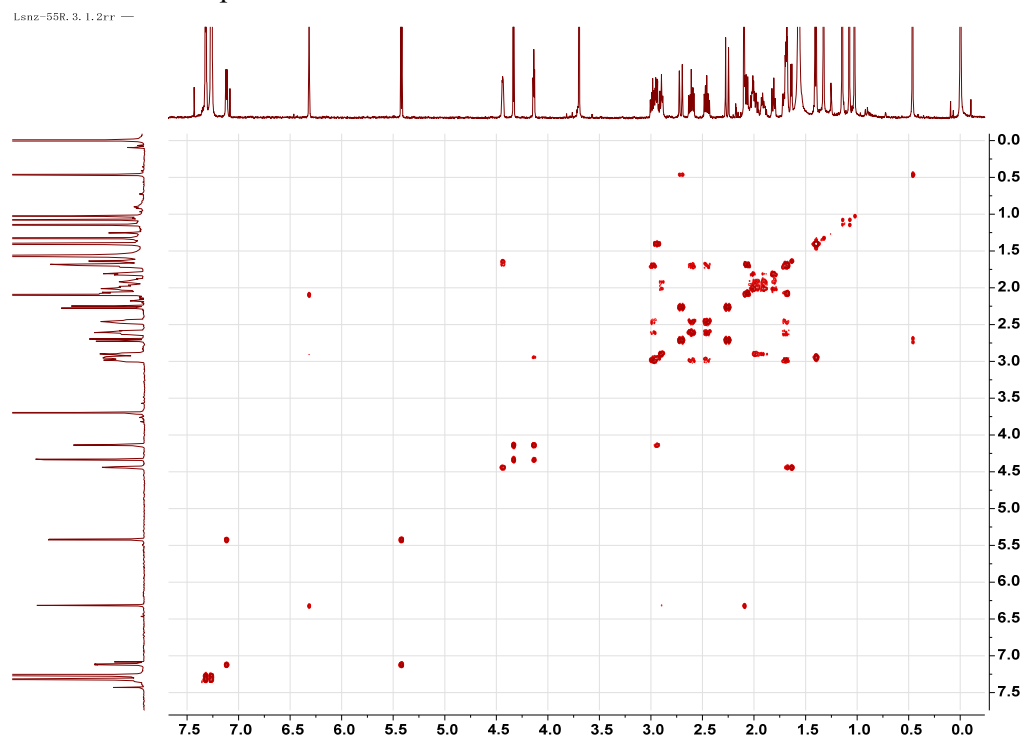


Figure S108. HRESIMS of **3a**.

LZGA-55S-2 #13 RT: 0.17 AV: 1 NL: 1.60E8
T: FTMS + p ESI Full lock ms [100.0000-1000.0000]

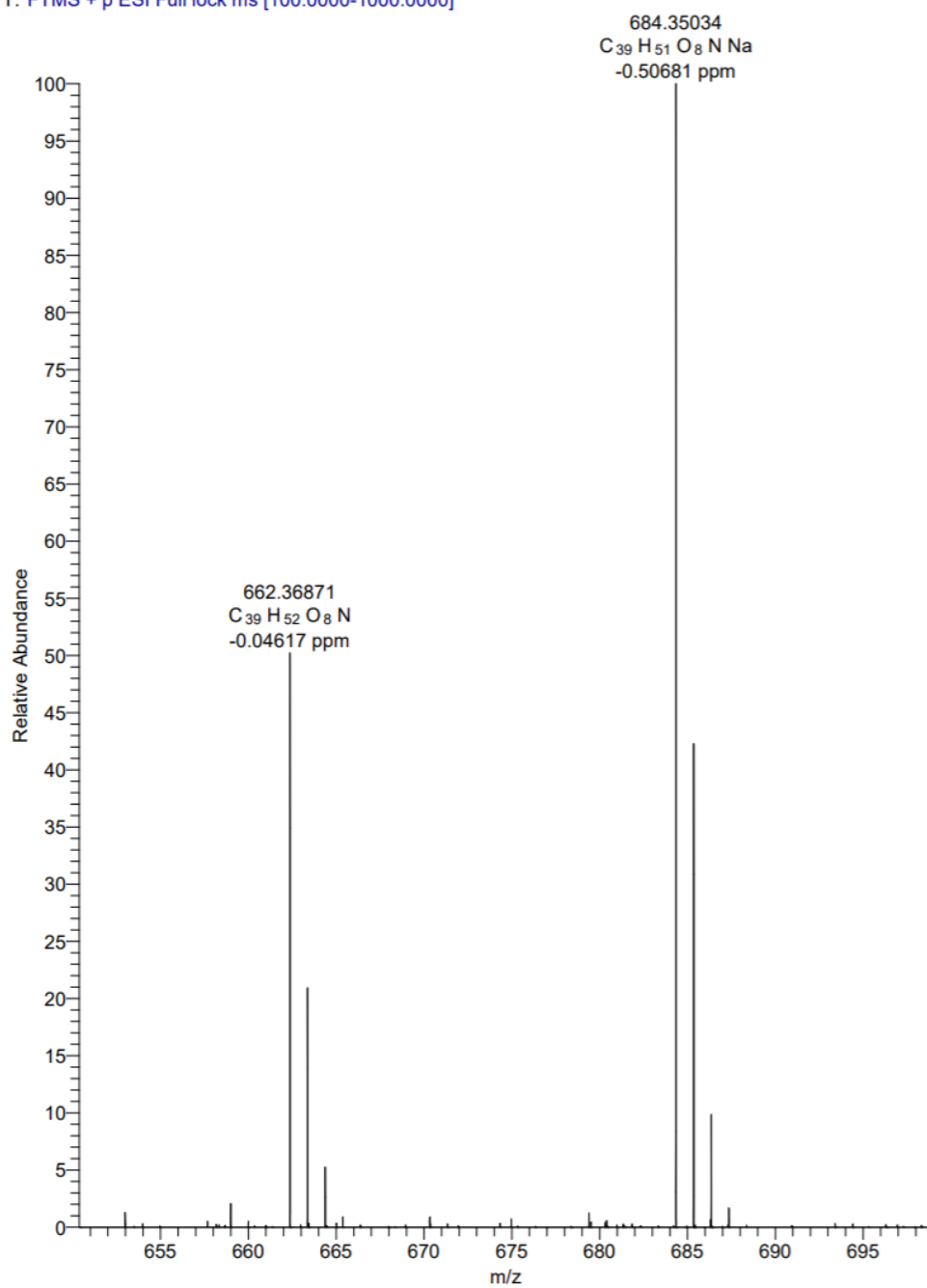


Figure S109. HRESIMS of **3b**.

LZGA-55R-2 #13 RT: 0.17 AV: 1 NL: 2.10E8
T: FTMS + p ESI Full lock ms [100.0000-1000.0000]

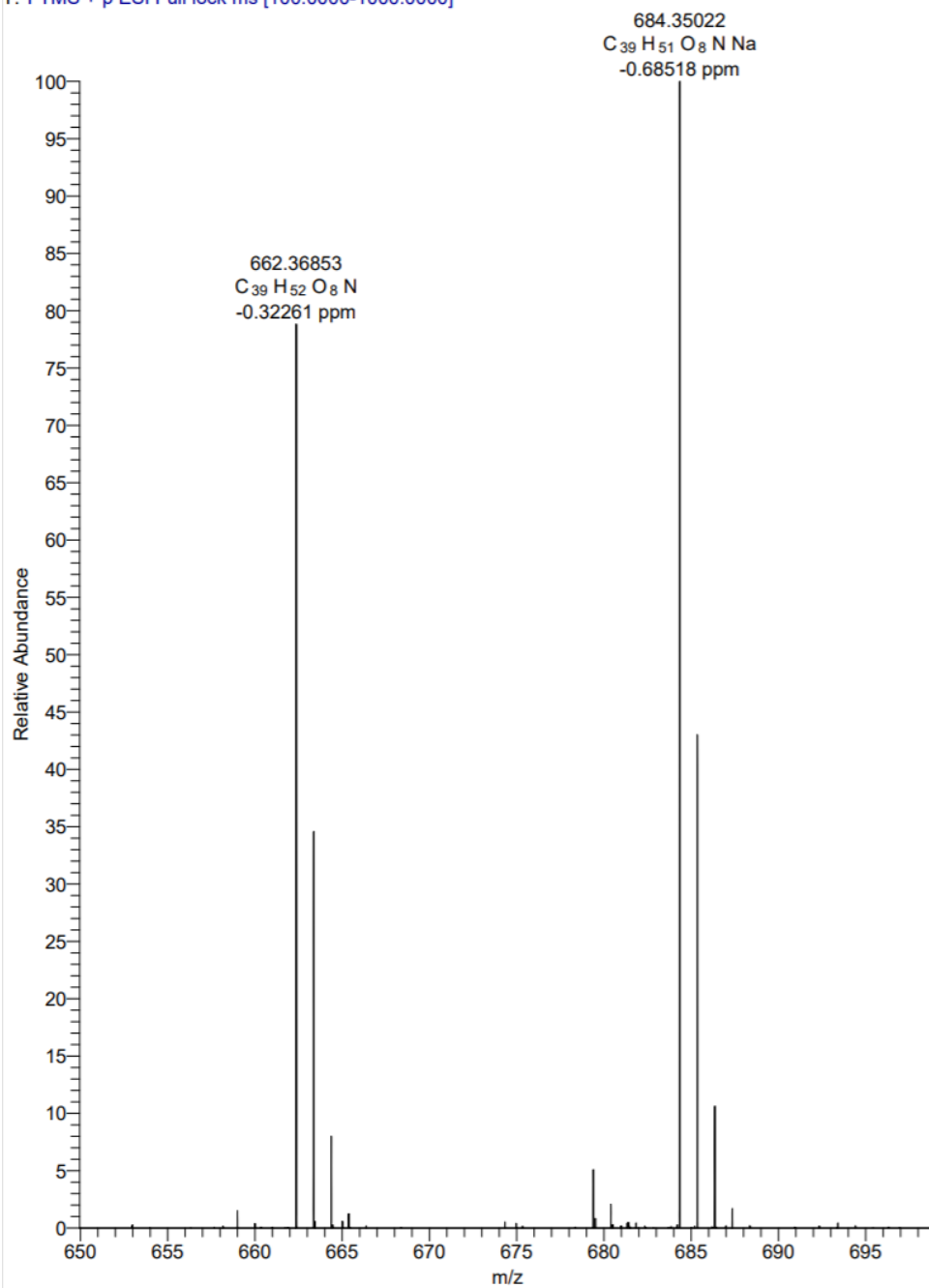


Figure S110. ^1H NMR spectrum of **6H** (600 MHz, CDCl_3).

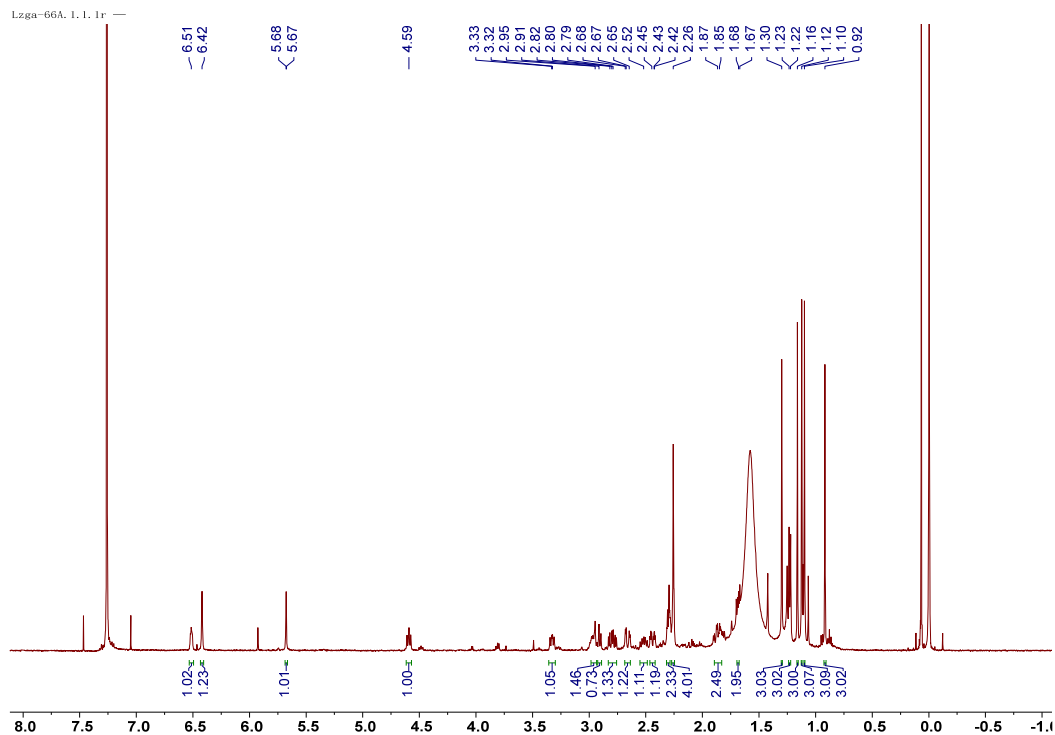


Figure S111. ^{13}C NMR spectrum of **6H** (600 MHz, CDCl_3).

Number of scans= 18000

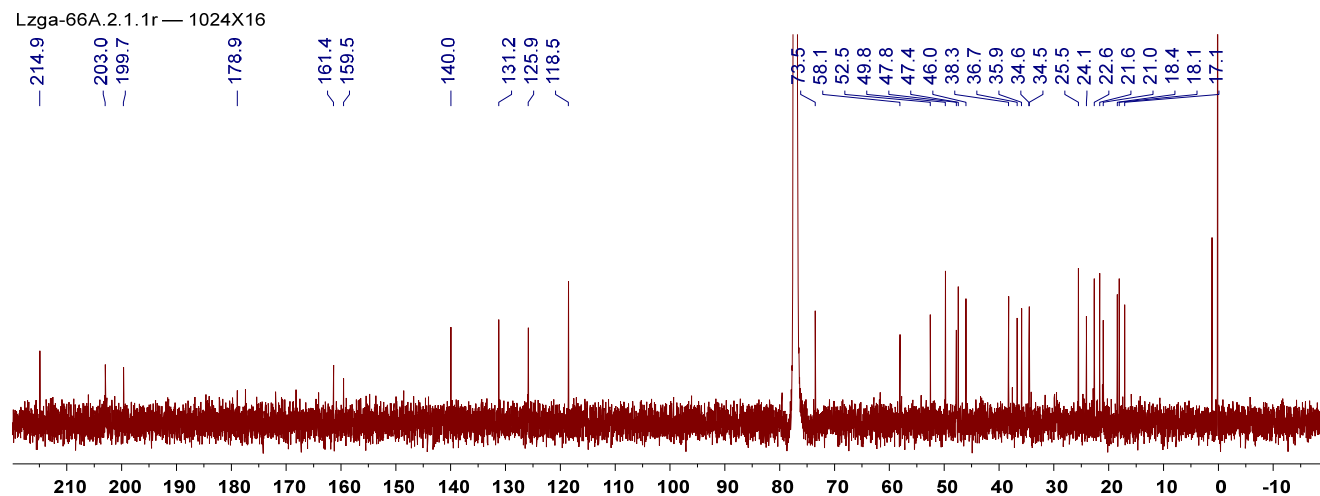


Figure S112. ^1H NMR spectrum of **6Ha** (600 MHz, CDCl_3).

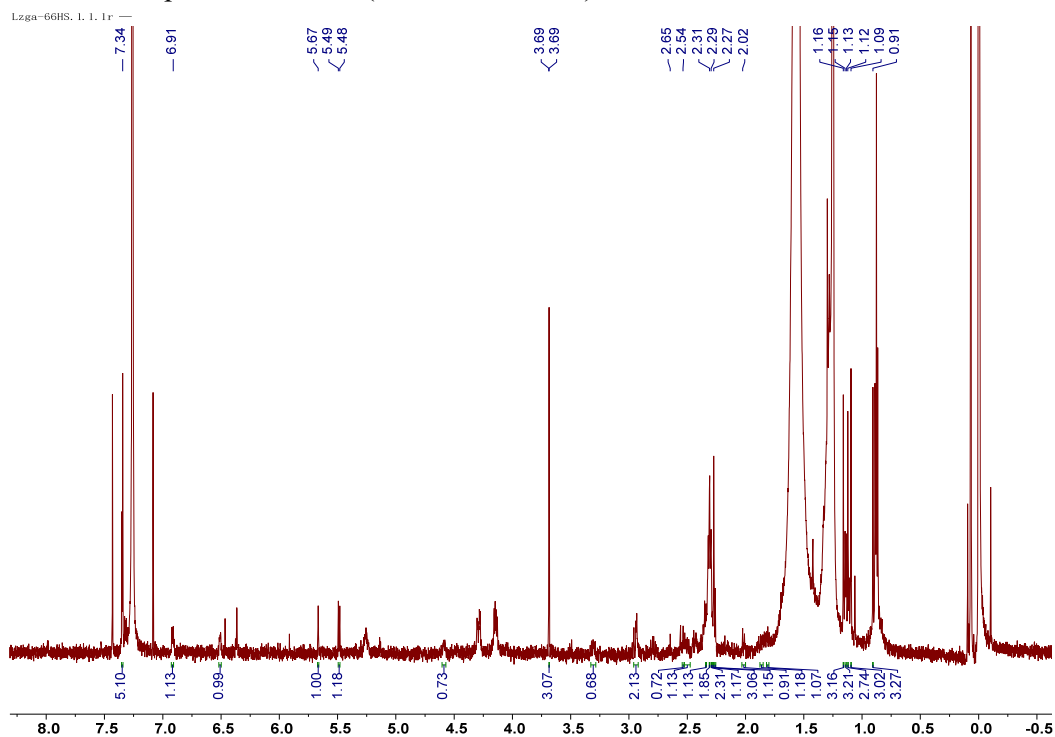


Figure S113. ^1H - ^1H COSY spectrum of **6Ha**.

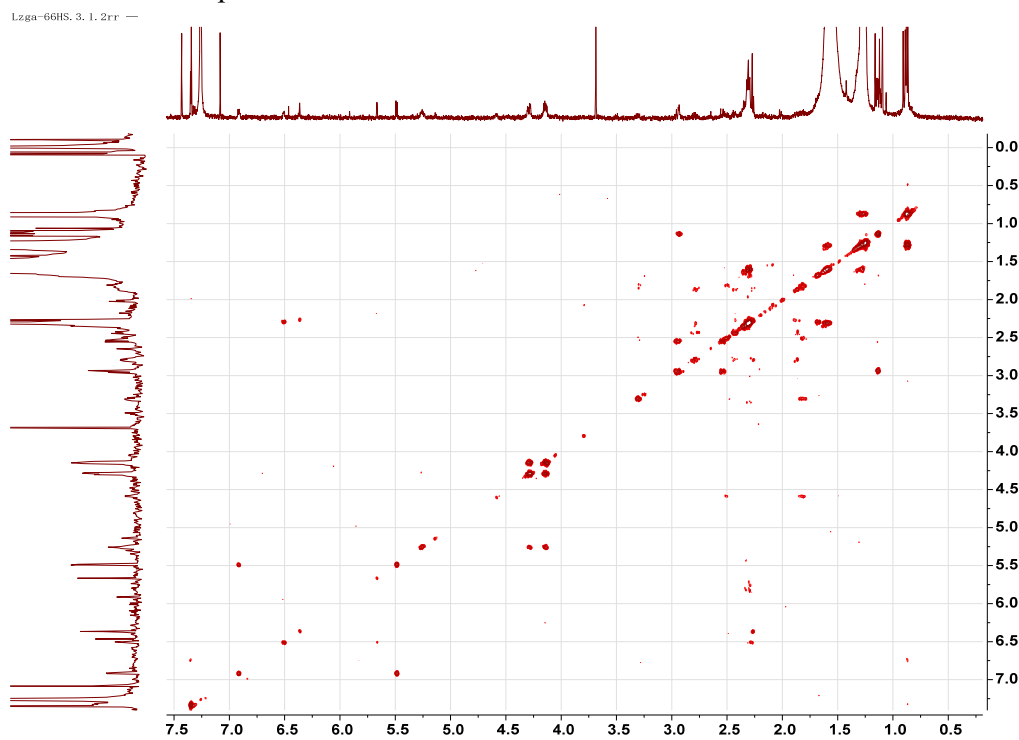


Figure S114. ^1H NMR spectrum of **6Hb** (600 MHz, CDCl_3).

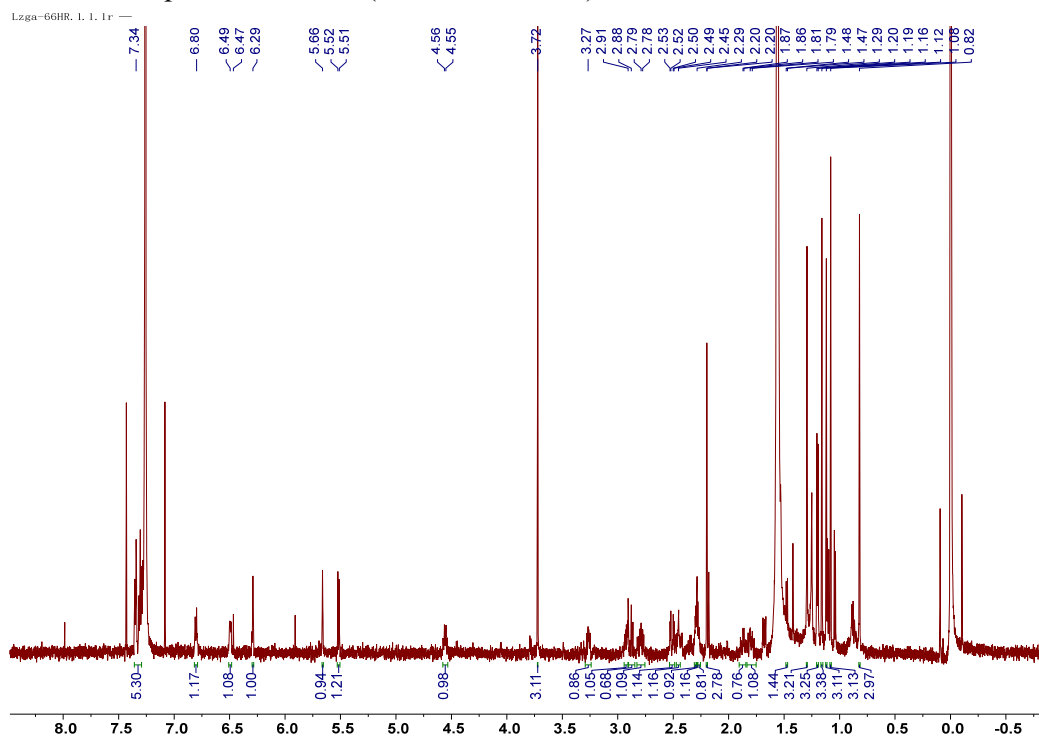


Figure S115. ^1H - ^1H COSY spectrum of **6Hb**.

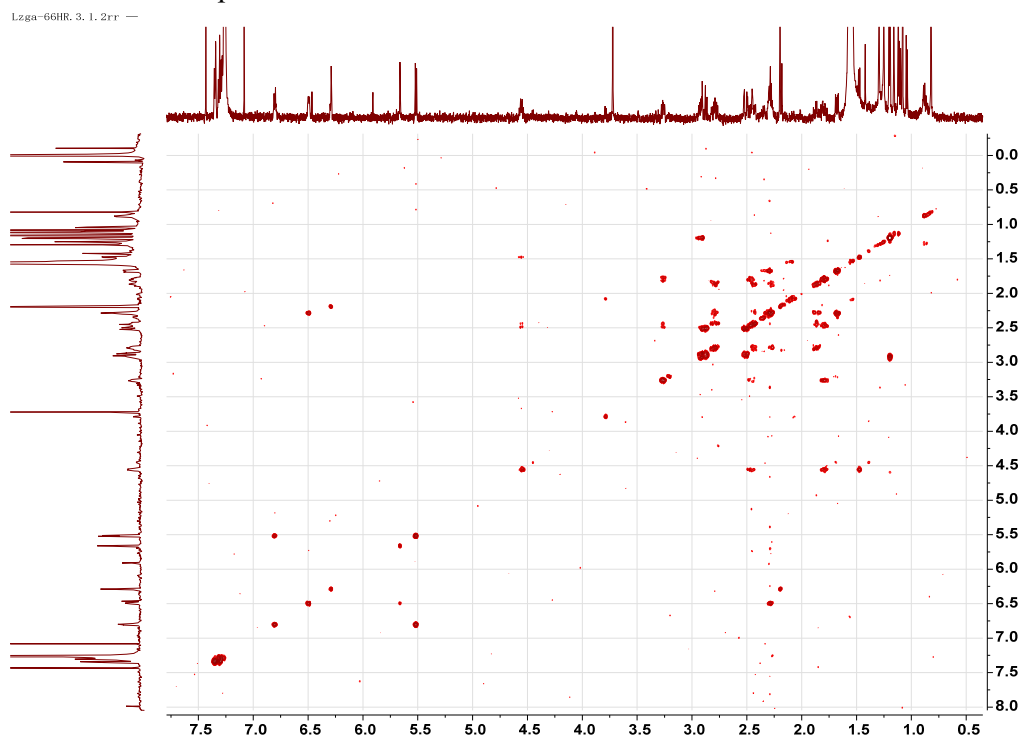


Figure S116. HRESIMS of **6Ha**.

ZGA-66HS #13 RT: 0.17 AV: 1 NL: 5.28E7
: FTMS + p ESI Full lock ms [100.0000-1000.0000]

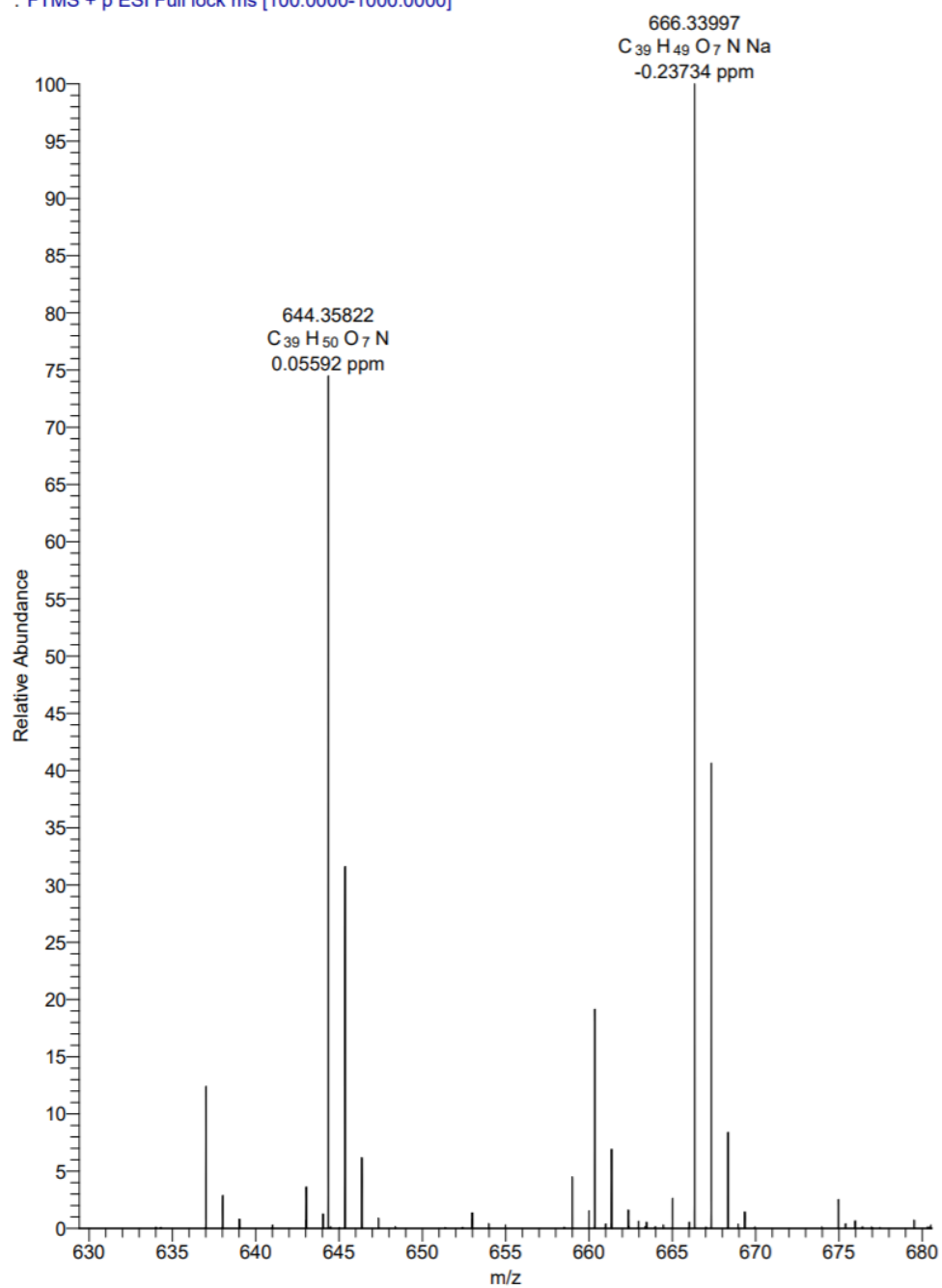
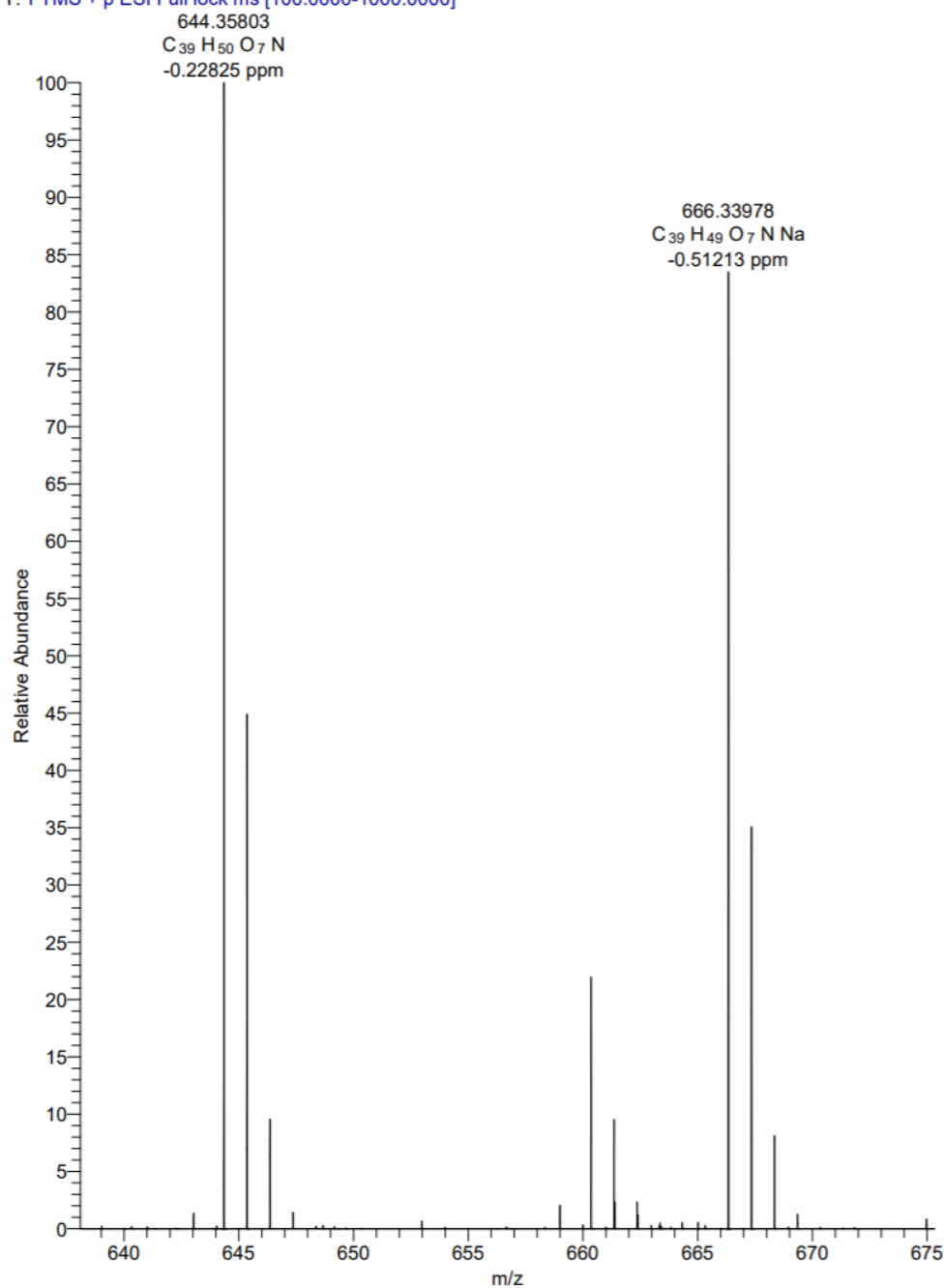


Figure S117. HRESIMS of **6Hb**.

LZGA-66HR #13 RT: 0.17 AV: 1 NL: 1.78E8
T: FTMS + p ESI Full lock ms [100.0000-1000.0000]



2. Spectroscopic data of compound 6.

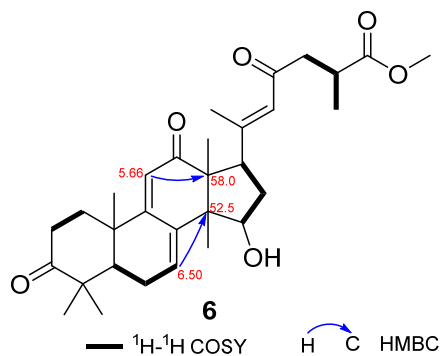


Figure S118 The key HMBC and ^1H - ^1H COSY correlations of **6**.

Methyl gibbosate O (**6**): pale-yellow oil. $[\alpha]_{\text{D}}^{24} +51.4$ (c 0.05, MeOH); UV (MeOH) λ_{max} (log ϵ) 245.0 (4.16); HRESIMS m/z 533.28693 $[\text{M} + \text{Na}]^+$ (calcd for $\text{C}_{31}\text{H}_{42}\text{O}_6\text{Na}$, 533.28791).

No.	6 (600/150 MHz, CDCl_3)	
1	2.27, ddd (13.8, 6.1, 3.0) 1.87, td (13.8, 4.7)	35.9, CH_2
2	2.78, ddd (14.8, 13.8, 6.1) 2.43, ddd (14.8, 4.7, 3.0)	34.5, CH_2
3		215.0, C
4		47.4, C
5	1.68, dd (10.6, 5.6)	49.8, CH
6	2.29, overlapped, 2H	24.0, CH_2
7	6.50, m	131.1, CH
8		140.0, C
9		161.2, C
10		38.2, C
11	5.66, s	118.5, CH
12		203.0, C
13		58.0, C
14		52.5, C
15	4.58, t (8.4)	73.5, CH
16	2.51, dd (8.4, 7.2) 1.83, dd (10.9, 8.4)	36.7, CH_2
17	3.30, dd (10.9, 7.2)	45.8, CH
18	0.90, s	18.1, CH_3
19	1.29, s	21.6, CH_3
20		157.8, C
21	2.22, s	20.9, CH_3
22	6.37, s	126.0, CH
23		198.8, C
24	2.94, overlapped 2.55, dd (20.4, 8.6)	47.9, CH_2
25	2.95, overlapped	35.0, CH
26		176.8, C
27	1.18, d (7.0)	17.3, CH_3
28	1.11, s	25.5, CH_3
29	1.15, s	22.6, CH_3
30	1.08, s	18.4, CH_3
-OCH ₃	3.67, s	52.0, CH_3

3. Biological assays

3.1 Cytotoxicity assays

The cytotoxicity assay procedures were same as previously reported [24]. The following human tumor cell lines were used: HL-60, SMMC-7721, A-549, MCF-7, and SW-480. All cells were cultured in RPMI-1640 medium (Hyclone, Logan, UT, USA), supplemented with 10% fetal bovine serum (FBS, Hyclone) at 37 °C in a humidified atmosphere with 5% CO₂. Cell viability was assessed by conducting colorimetric measurements of the amount of insoluble formazan formed in living cells based on the reduction of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) (Sigma, St. Louis, MO, USA). Briefly, 100 µL of adherent cells was seeded into each well of a 96-well cell culture plate and allowed to adhere for 12 h before test compound addition, while suspended cells were seeded just before test compound addition, both with an initial density of 1×10^5 cells/mL in 100 µL of medium. Each tumor cell line was exposed to the test compound at various concentrations in triplicate for 48 h, with *cis*-platin and paclitaxel (Sigma) as positive control. After the incubation, MTT (100 µg) was added to each well, and the incubation continued for 4 h at 37 °C. The cells were lysed with 100 µL of 20% SDS-50% DMF after removal of 100 µL of medium. The optical density of the lysate was measured at 595 nm in a 96-well microtiter plate reader (Bio-Rad 680). The IC₅₀ value of each compound was calculated by Reed and Muench's method.

3.2 α -Glucosidase inhibition assays

The α -glucosidase inhibition assay procedures were same as previously reported [25]. A mixture containing 25 µL of different compounds (final concentrations of 0.78, 1.56, 3.13, 6.25, 12.50, 25.00, 50.00 µM), 25 µL of α -glucosidase (0.2 U/mL, from *Saccharomyces cerevisiae*, Sigma), and 175 µL of phosphate buffer (100 mM, pH 6.8) was pre-incubated for 10 min at room temperature. Then the reaction was started by the addition of 25 µL of 25 mM *p*-nitrophenyl- α -D-glucopyranoside (Sigma) and incubated for 15 min at 37 °C. The assay was conducted in a 96-well plate, and the absorbance was determined at 405 nm using a Spark™ 10 M microplate reader (Tecan). The control was prepared by adding phosphate buffer instead of the compound. The blank was prepared by adding phosphate buffer instead of α -glucosidase using the same method. The α -glucosidase inhibition rate (%) = $[(OD_{\text{control}} - OD_{\text{control blank}}) - (OD_{\text{sample}} - OD_{\text{sample blank}})] / (OD_{\text{control}} - OD_{\text{control blank}}) \times 100\%$. IC₅₀ values were calculated through non-linear regression using GraphPad Prism5 Software. Acarbose was utilized as the positive control with an IC₅₀ value of 793.79 ± 0.41 µM.

3.3 Protein tyrosine phosphate 1 β (PTP1B) inhibition assays

The PTP1B inhibition assay procedures were same as previously reported [26].

3.2 Dipeptidyl peptidase 4 (DDP4) inhibition assays

The DDP4 inhibition assay procedures were same as previously reported [27].

3.3 Angiotensin converting enzyme 2 (ACE2) inhibition assays

The ACE2 inhibition assay procedures were same as previously reported [28].