Supplementary Data

First synthesis and characterization of new impurities in obeticholic acid

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Mass Spectrum SmartFormula Report

Analysis Info

Analysis Name	D:\Data\SHUJVFENXI\ZHANGFL-group\14238-06-1_RA6_01_12938.d	Acquisition Date	7/27/2018 7:11:32 AM
Method	20150915.m	Operator	BDAL@DE
Sample Name	14238-06-1	Instrument / Ser#	maXis 4G 21240
Comment			

Acquisition Parameter

Source Type	ESI	Ion Polarity	Positive	Set Nebulizer	1.0 Bar
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Scan End	1500 m/z	Set Collision Cell RF	600.0 Vpp	Set Divert Valve	Waste

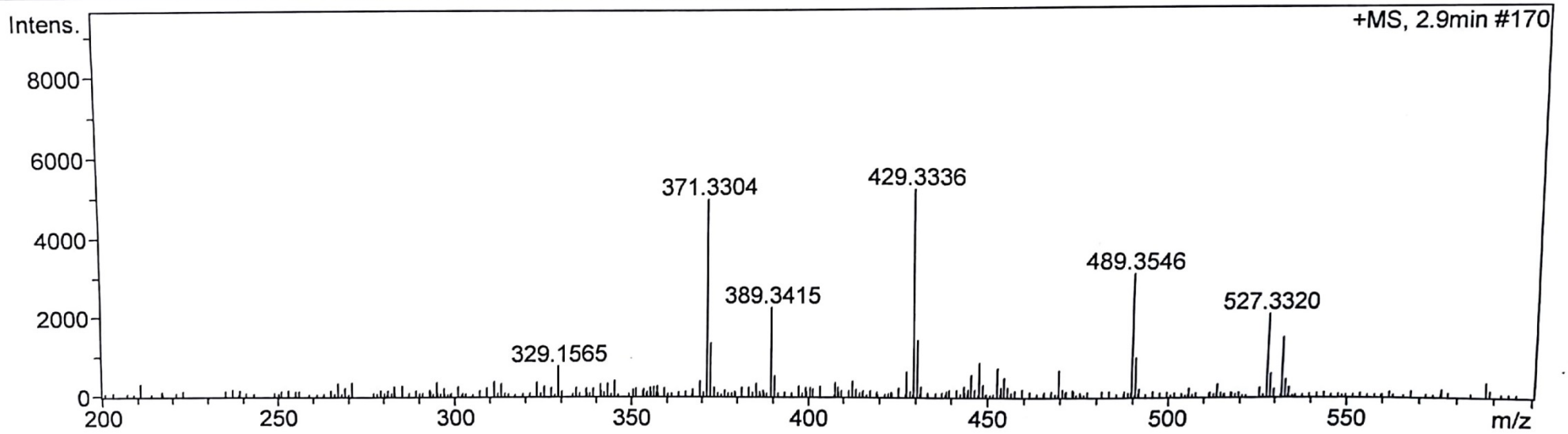

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Figure S1. HRMS spectrum of compound **8**.

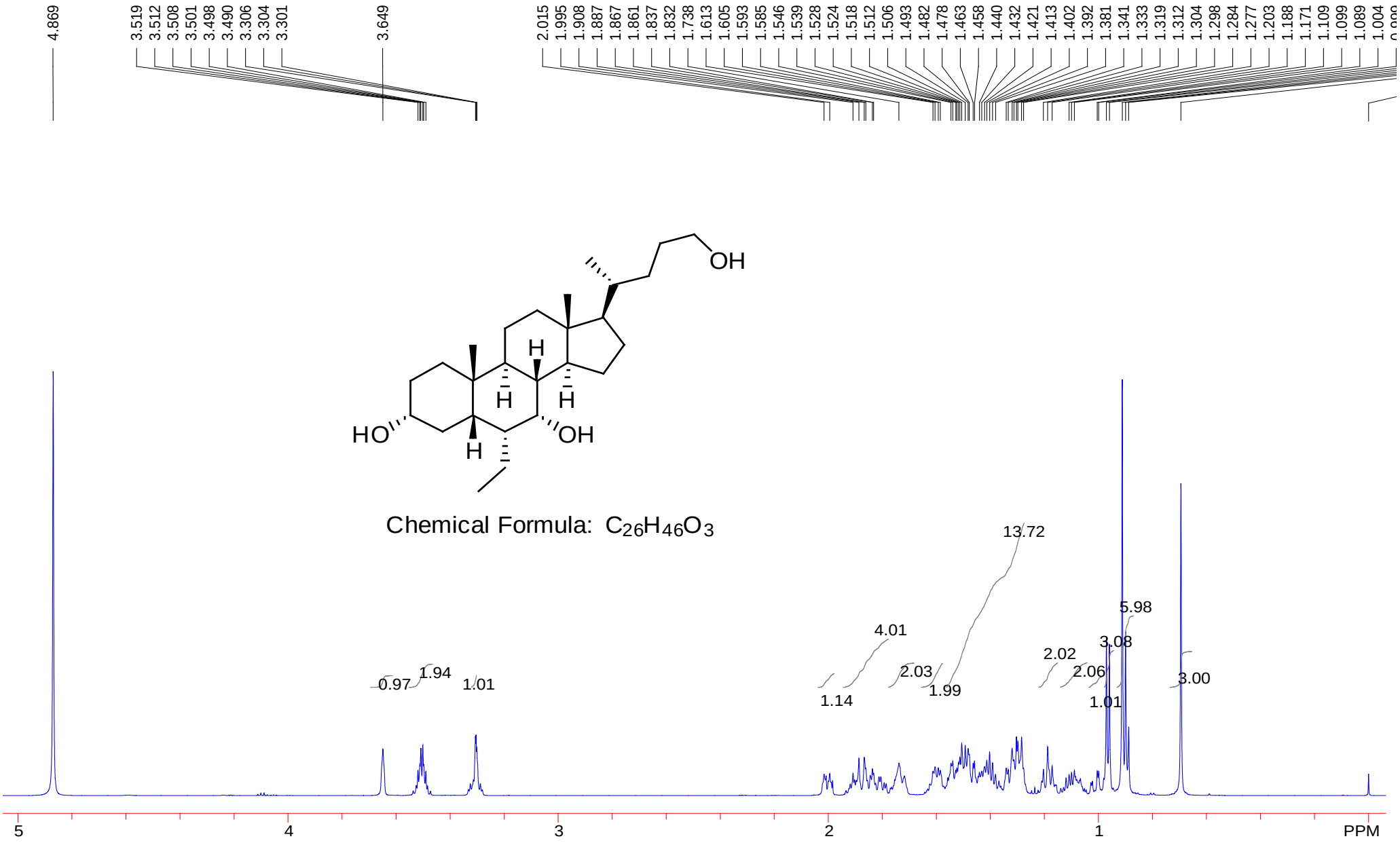

Figure S2. ^{1}H NMR spectrum of compound **8**.

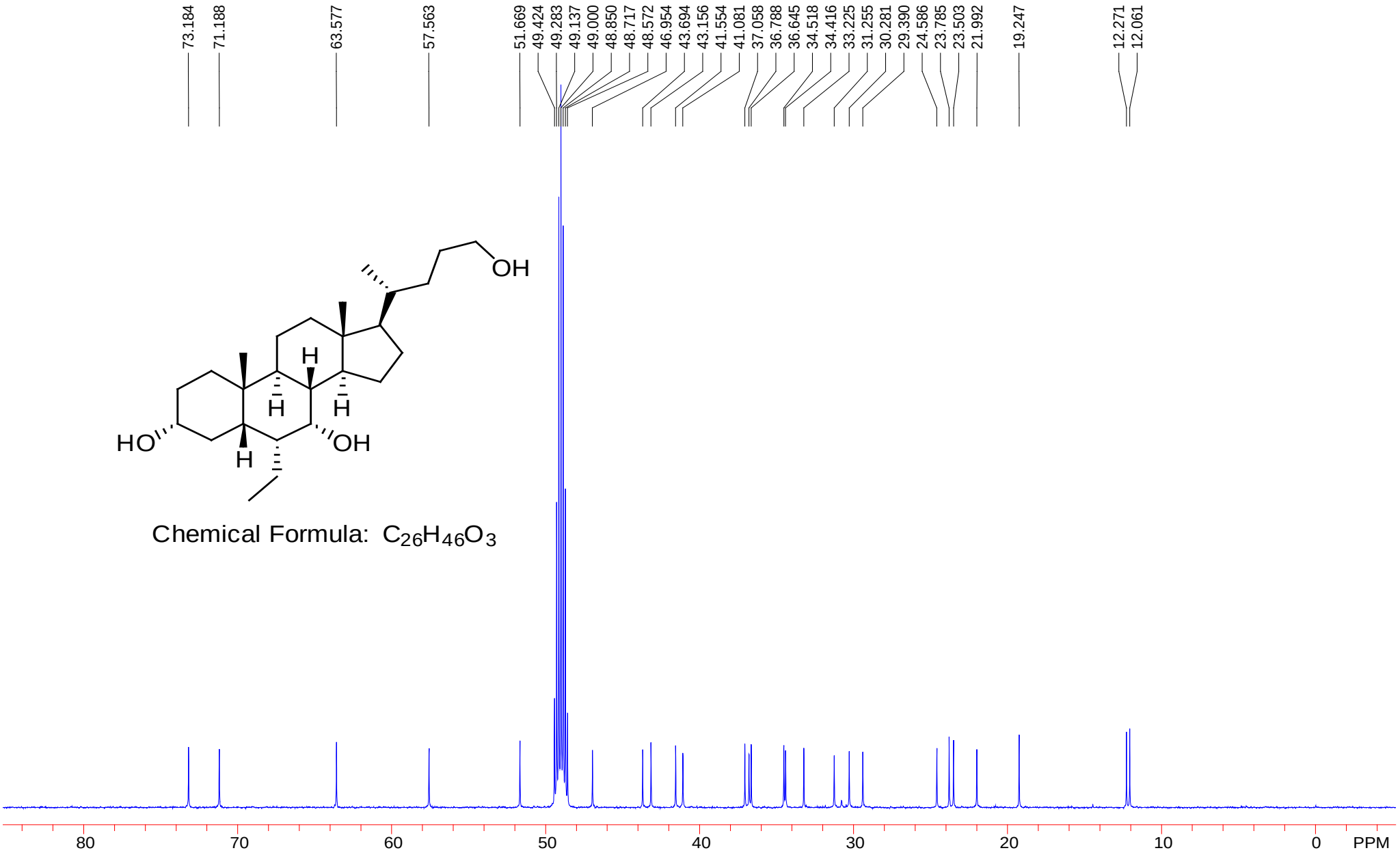

Figure S3. ^{13}C NMR spectrum of compound **8**.

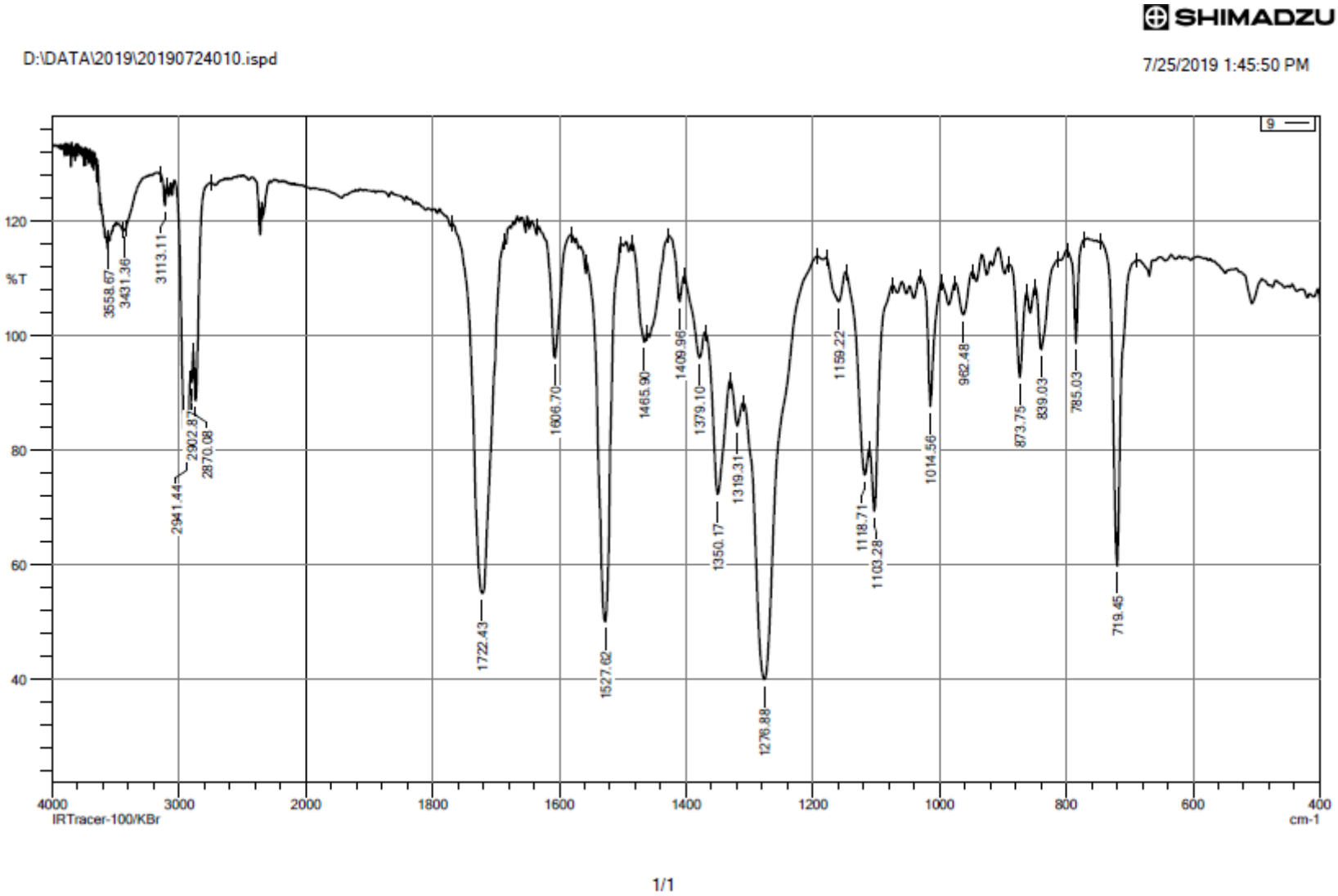

Figure S4. FT-IR spectrum of compound **9**.

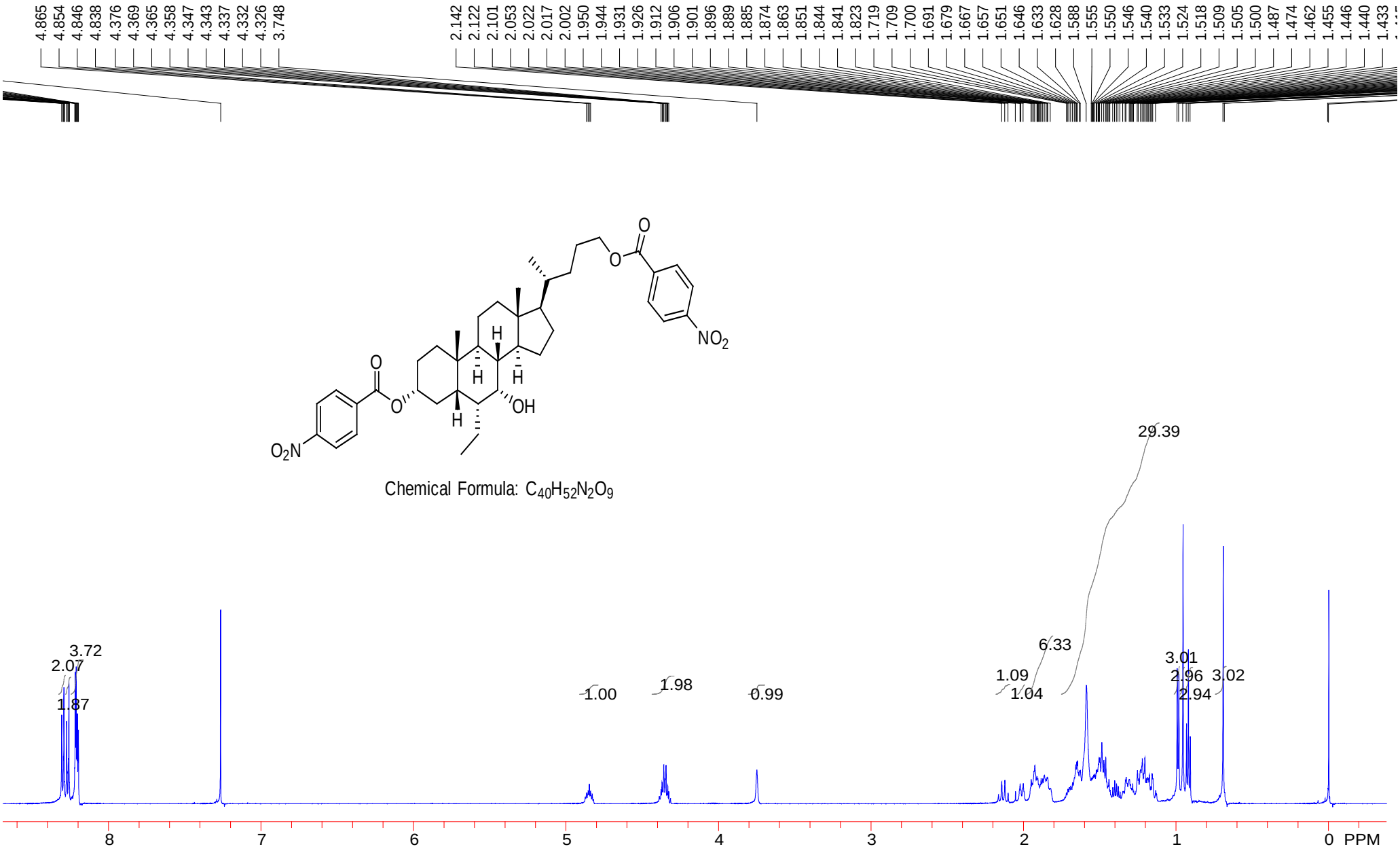

Figure S5. ^{1}H NMR spectrum of compound **9**.

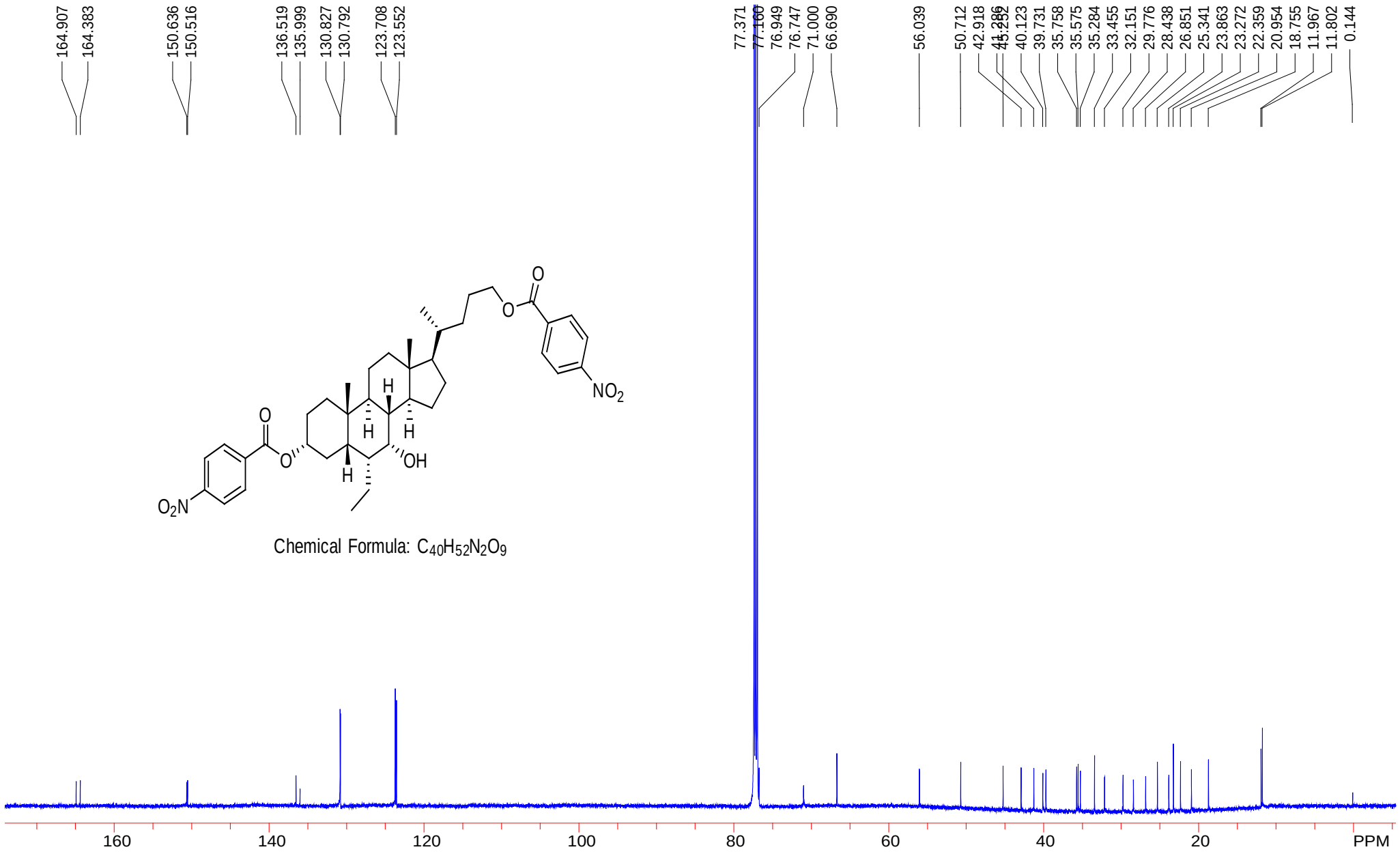

Figure S6. ^{13}C NMR spectrum of compound **9**.

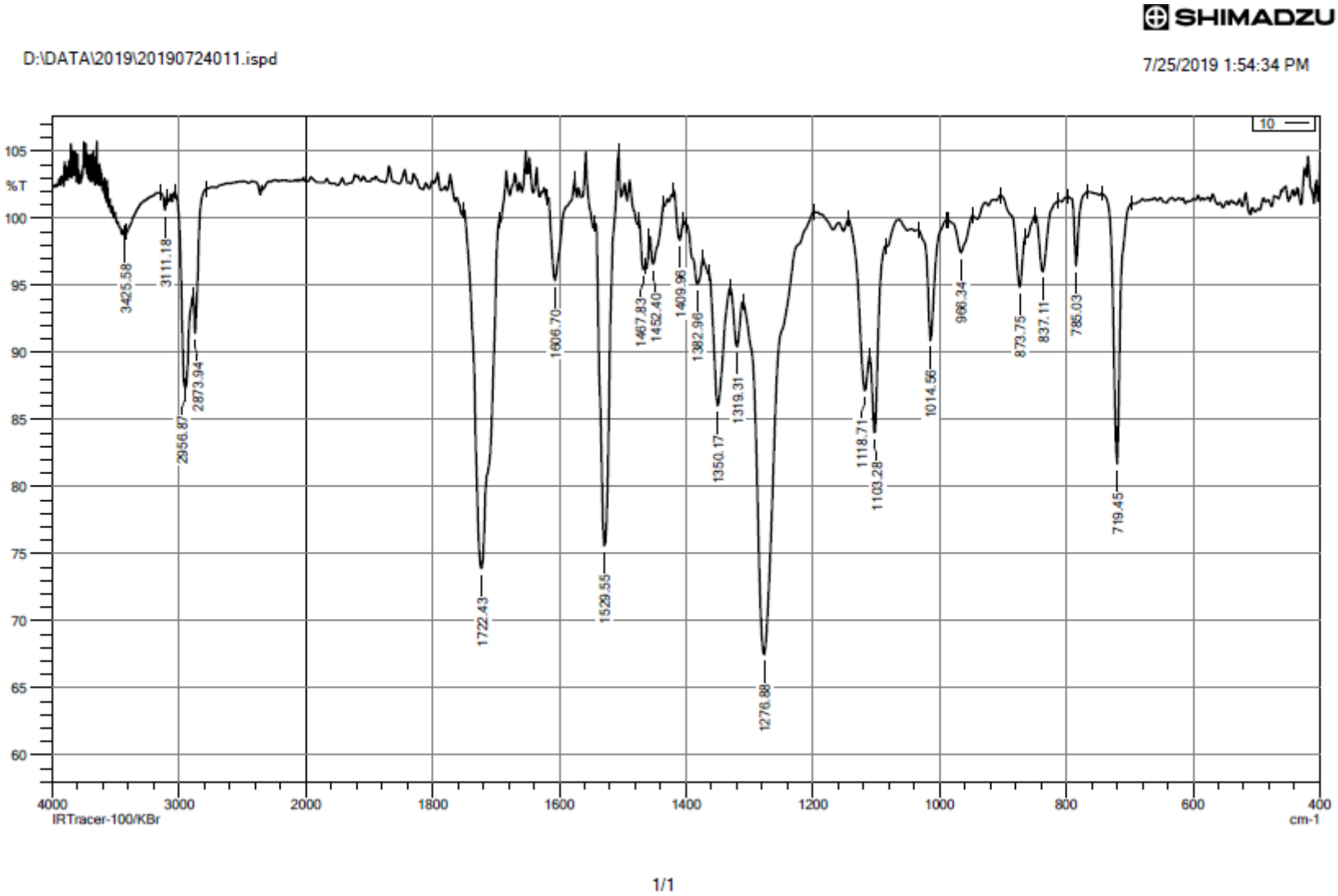

Figure S7. FT-IR spectrum of compound **10**.

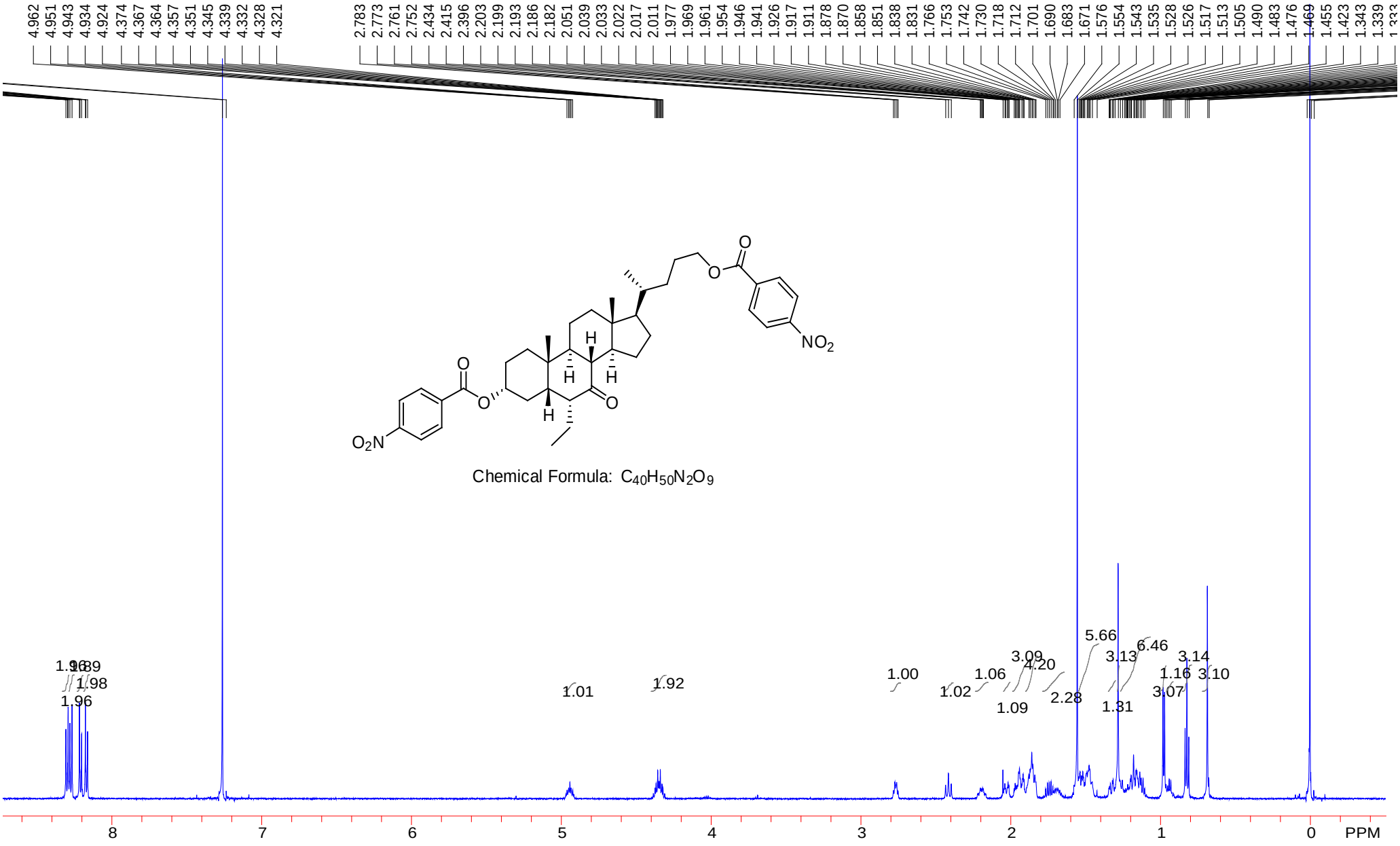

Figure S8. ^{1}H NMR spectrum of compound **10**.

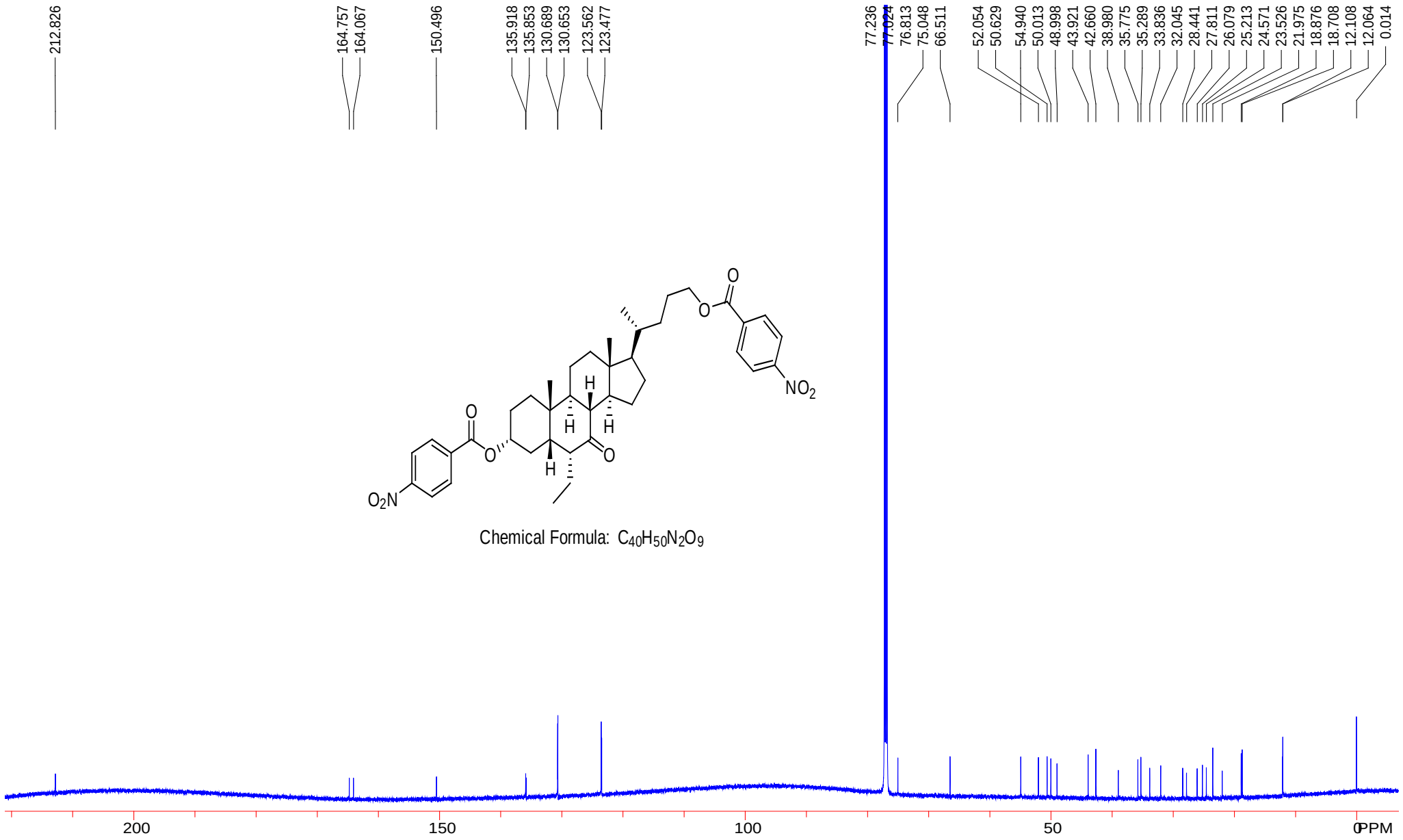

Figure S9. ^{13}C NMR spectrum of compound **10**.

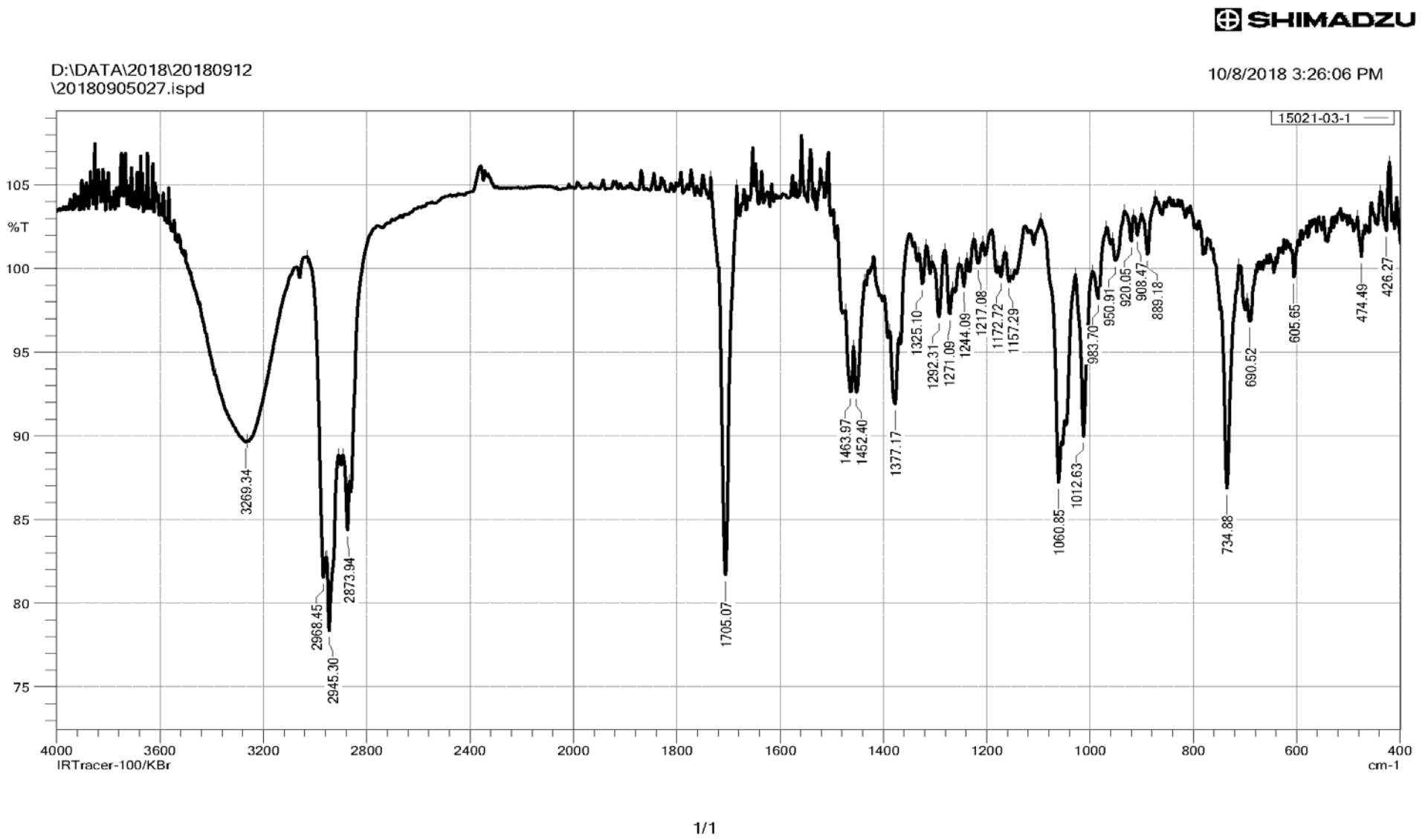

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Figure S10. FT-IR spectrum of impurity **1**.

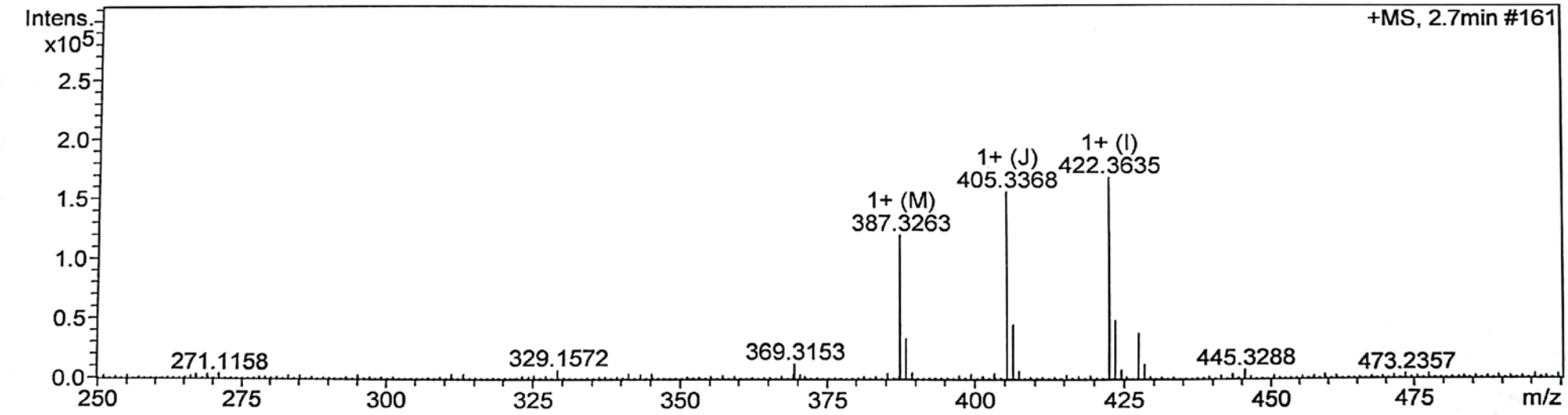
Mass Spectrum SmartFormula Report

Analysis Info

Analysis Name	D:\Data\SHUJVFENXI\ZHANGFL-group\15021-03-1_RC4_01_13042.d	Acquisition Date	9/15/2018 1:21:48 AM
Method	20150915.m	Operator	BDAL@DE
Sample Name	15021-03-1	Instrument / Ser#	maXis 4G 21240
Comment			

Acquisition Parameter

Source Type	ESI	Ion Polarity	Positive	Set Nebulizer	1.0 Bar
Focus	Not active	Set Capillary	4000 V	Set Dry Heater	220 °C
Scan Begin	50 m/z	Set End Plate Offset	-500 V	Set Dry Gas	6.0 l/min
Scan End	1500 m/z	Set Collision Cell RF	600.0 Vpp	Set Divert Valve	Waste



Meas. m/z	#	Formula	Score	m/z	err [ppm]	Mean err [ppm]	mSigma	rdb	e⁻ Conf	N-Rule
405.3368	1	C 26 H 45 O 3	100.00	405.3363	-1.3	-1.1	2.0	4.5	even	ok
422.3635	1	C 26 H 48 N O 3	100.00	422.3629	-1.5	-1.2	0.8	3.5	even	ok
427.3184	1	C 26 H 44 Na O 3	100.00	427.3183	-0.3	-0.3	25.5	4.5	even	ok

Figure S11. HRMS spectrum of impurity **1**.

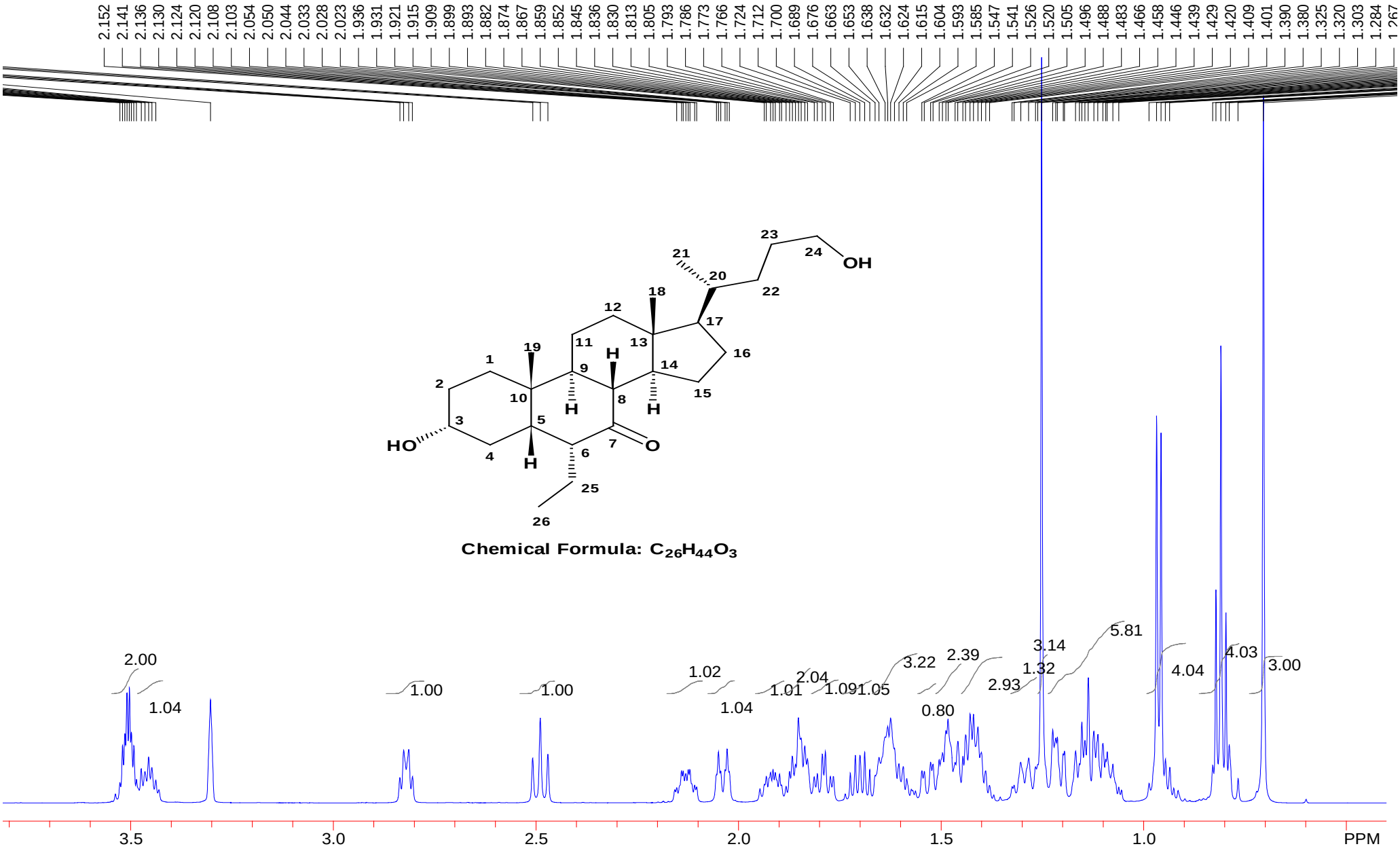


Figure S12. ^{1}H NMR spectrum of impurity **1**.

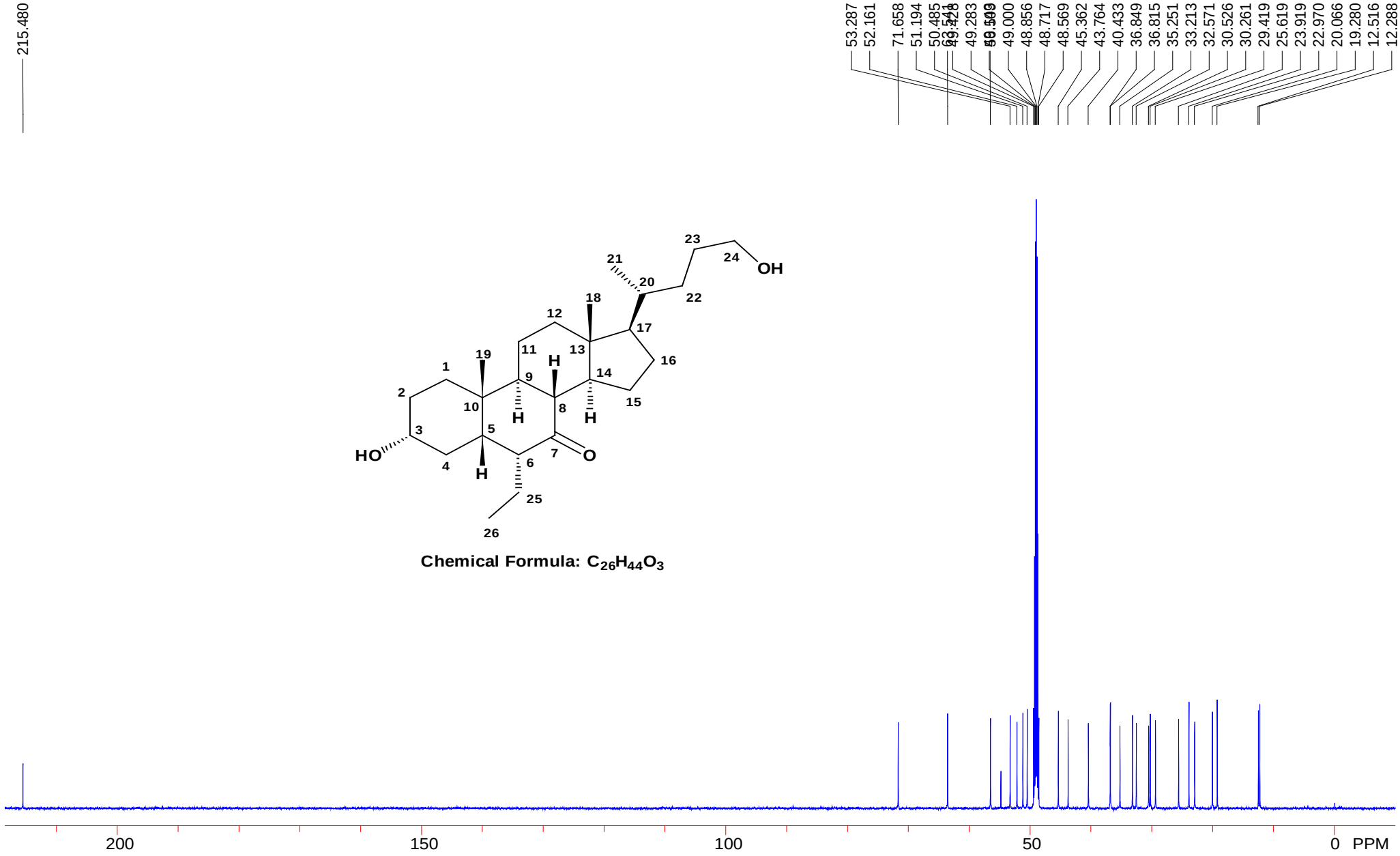


Figure S13. ^{13}C NMR spectrum of impurity **1**.

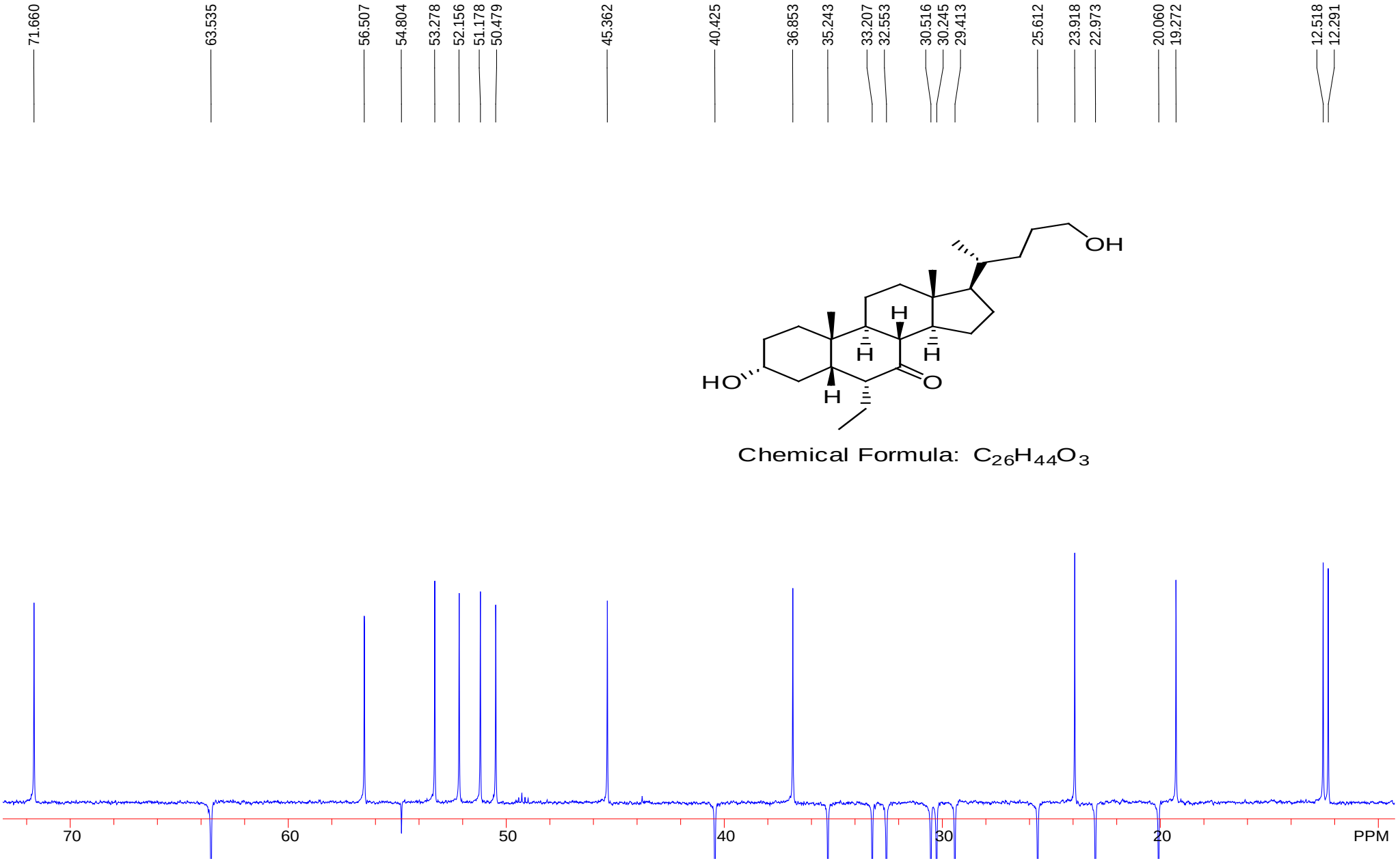


Figure S14. DEPT 135 spectrum of impurity **1**.

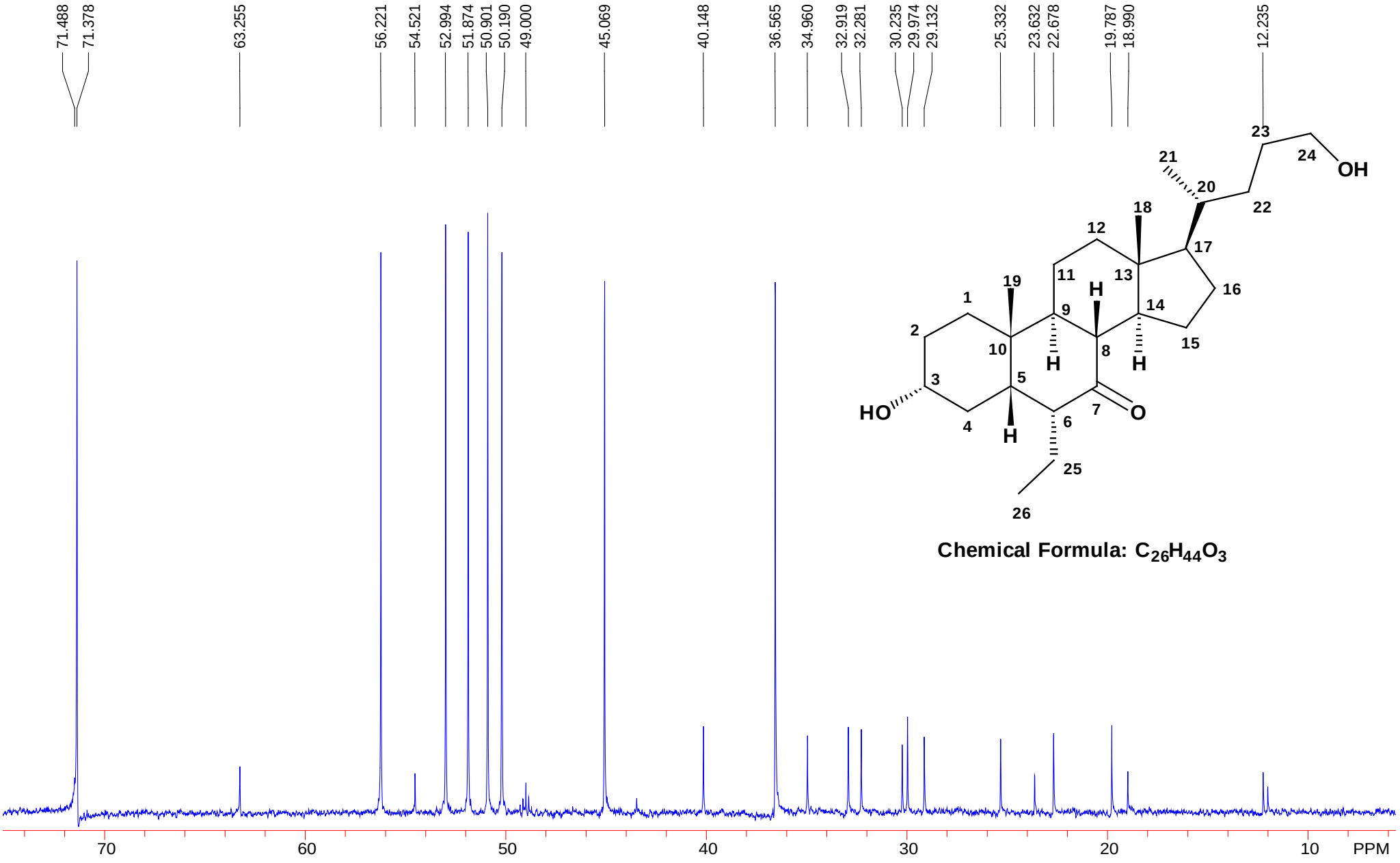


Figure S15. DEPT 90 spectrum of impurity **1**.

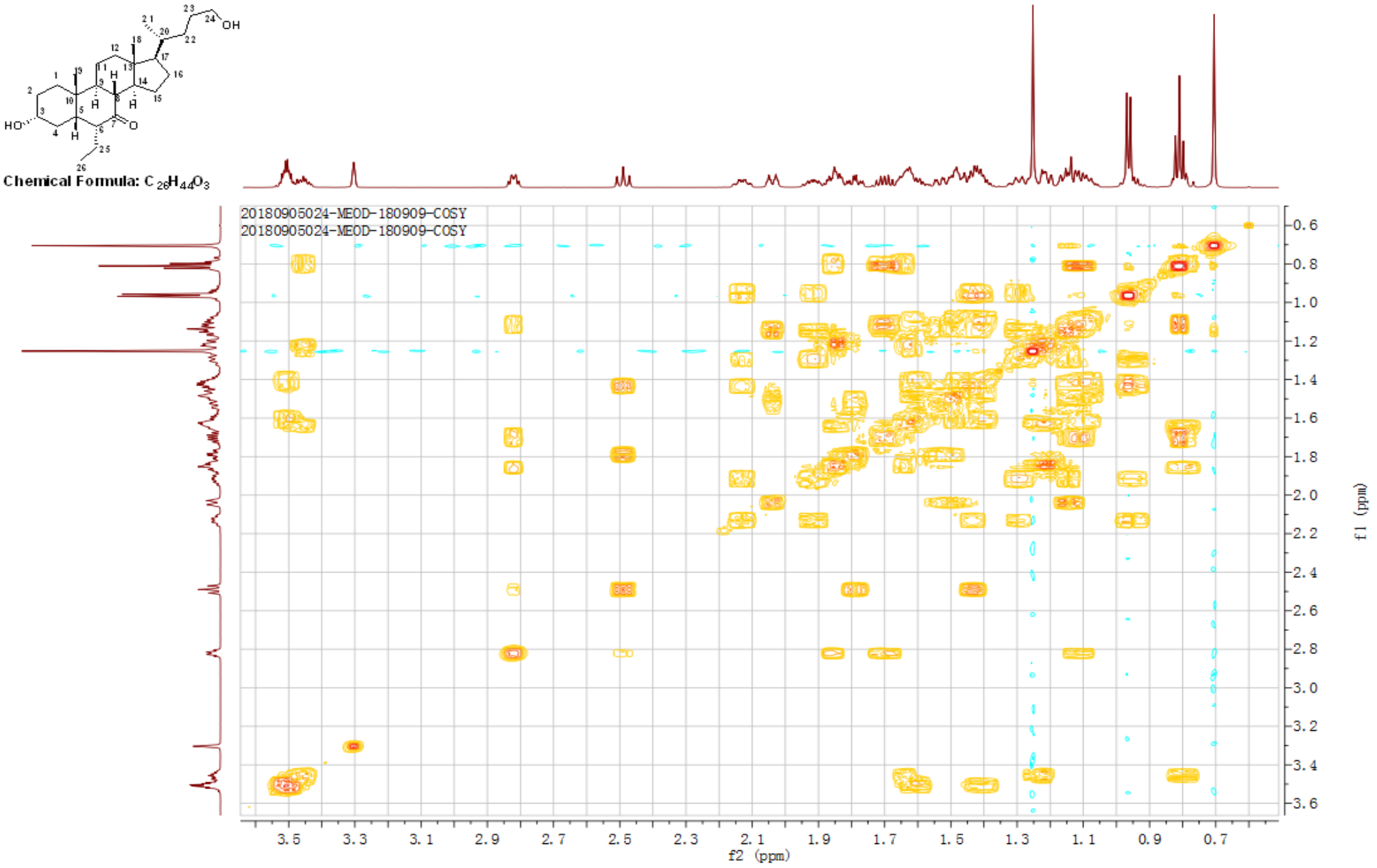


Figure S16. H-H COSY spectrum of impurity **1**.

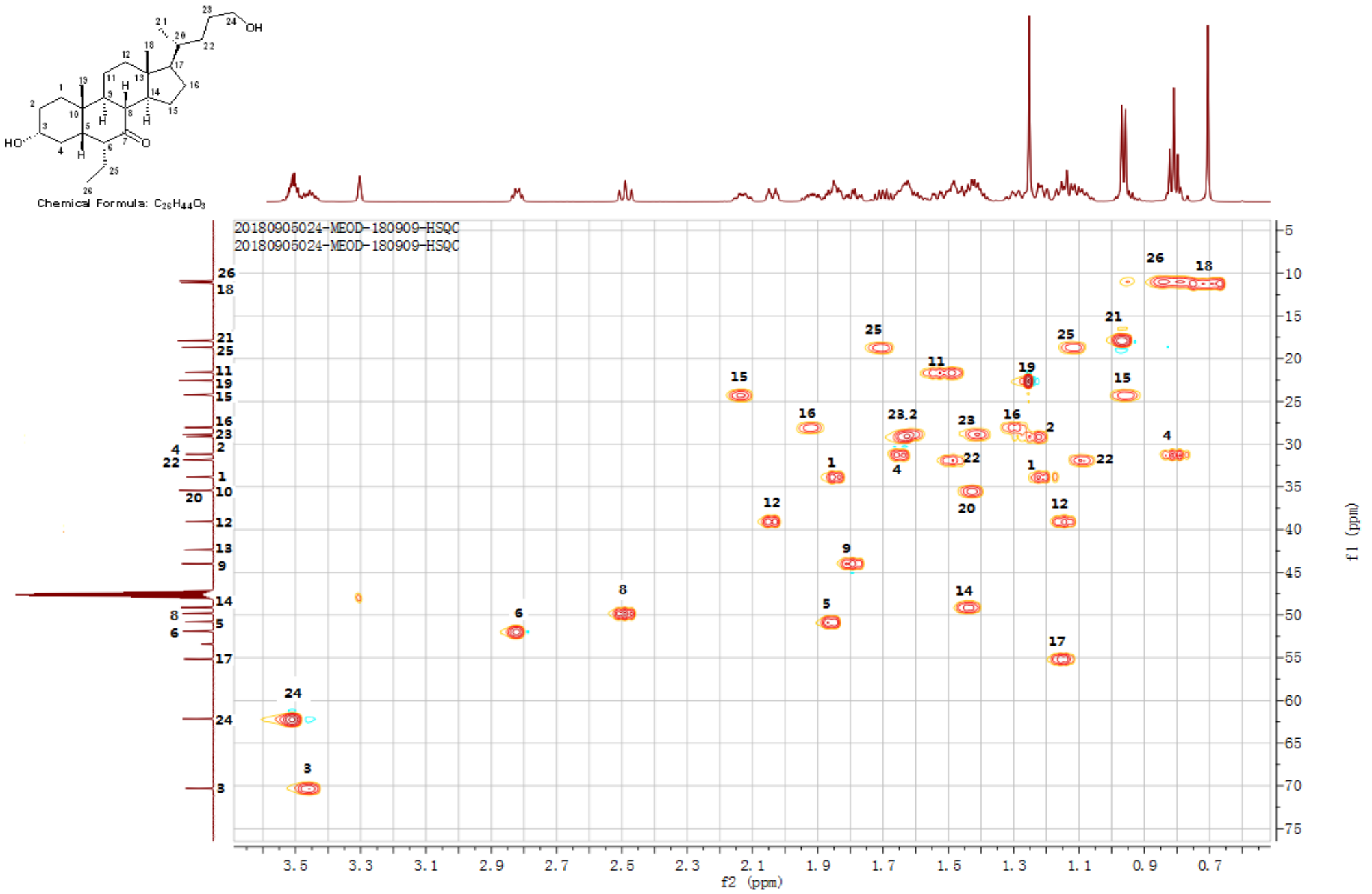


Figure S17. HSQC spectrum of impurity **1**.

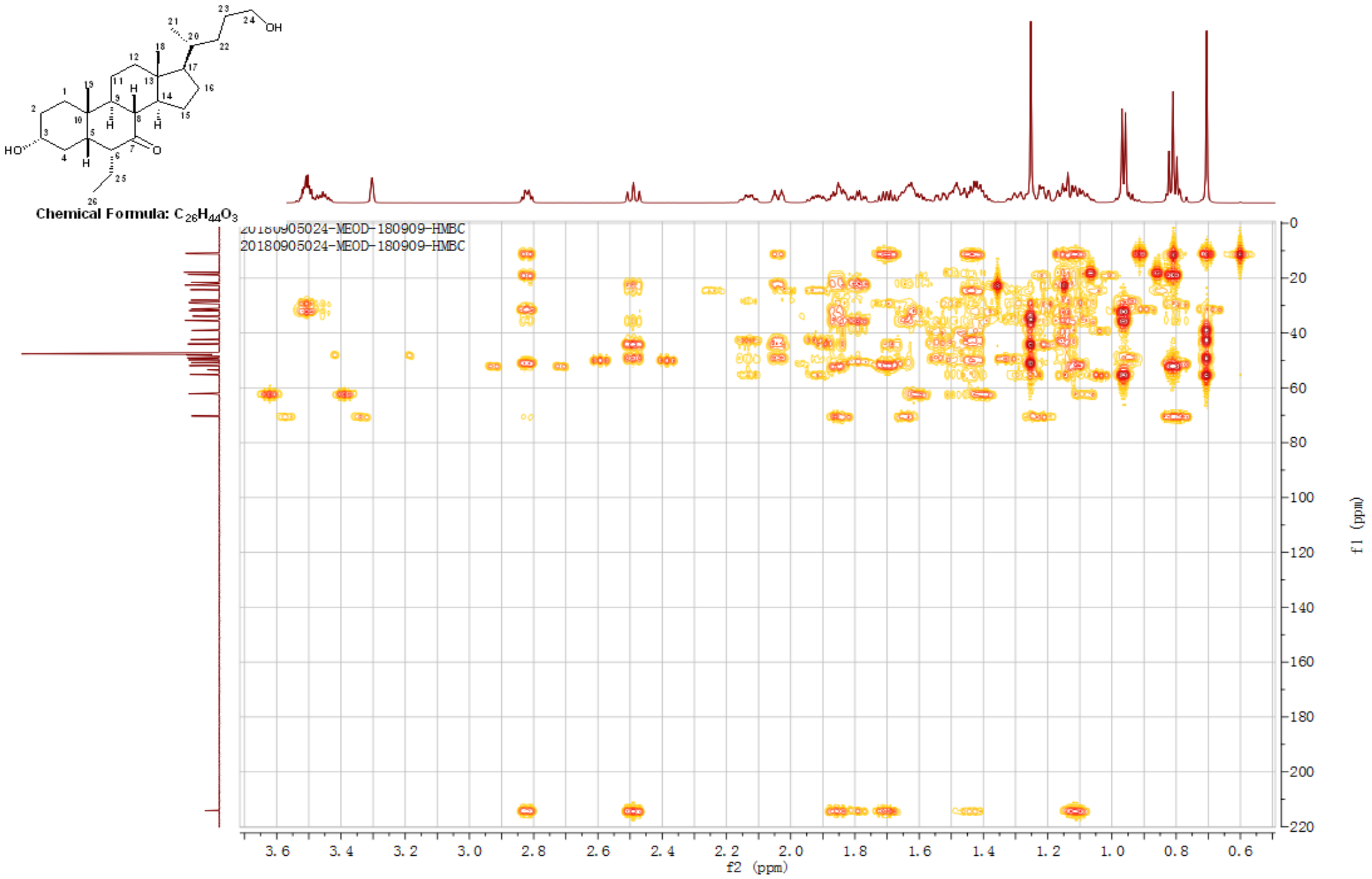


Figure S18. HMBC spectrum of impurity **1**.

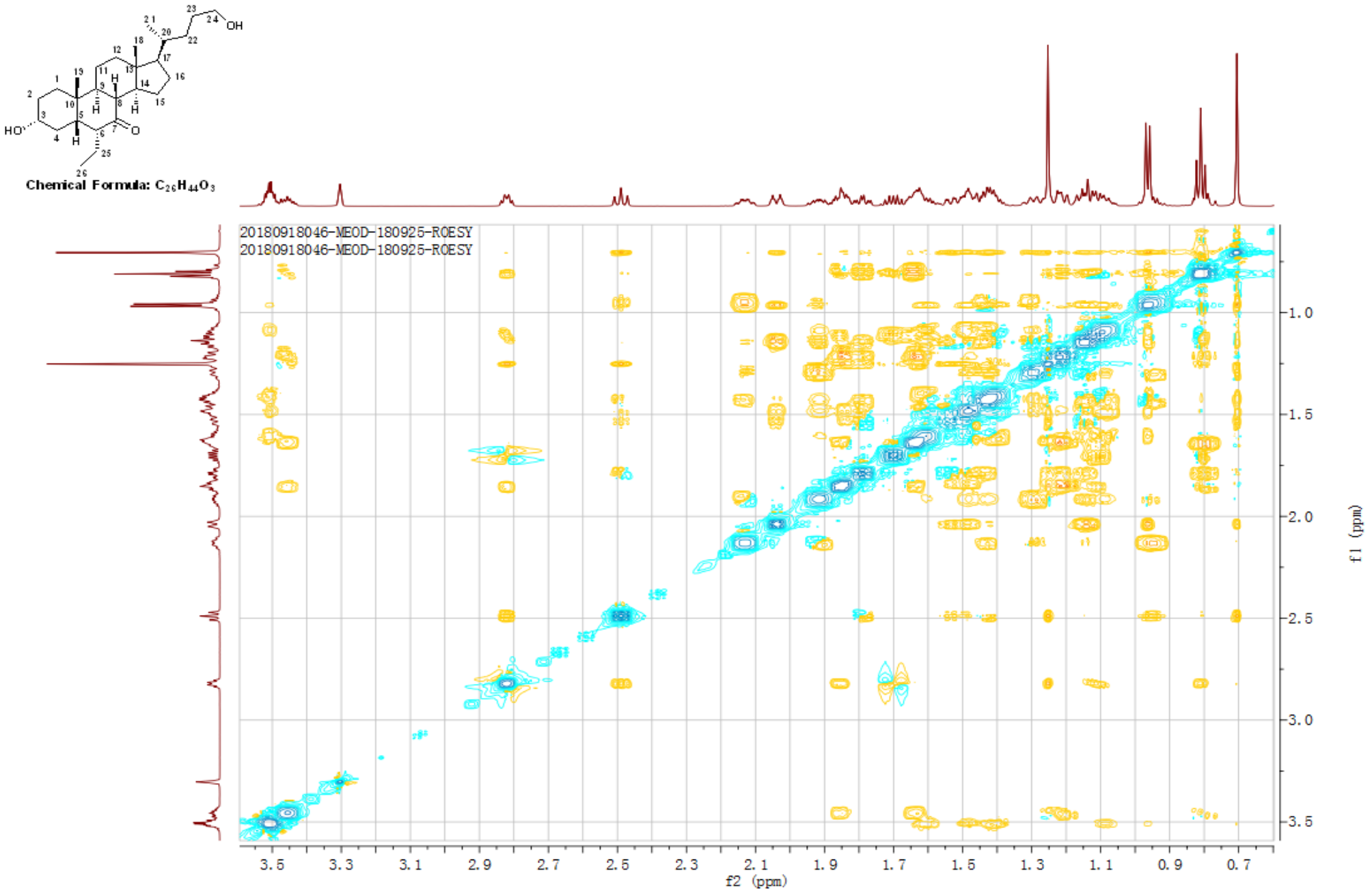


Figure S19. ROESY spectrum of impurity **1**.

Mass Spectrum SmartFormula Report

Analysis Info

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Method	20150915.m	Operator	BDAL@DE
Sample Name	14237-91-1	Instrument / Ser#	maXis 4G 21240
Comment			

Acquisition Parameter

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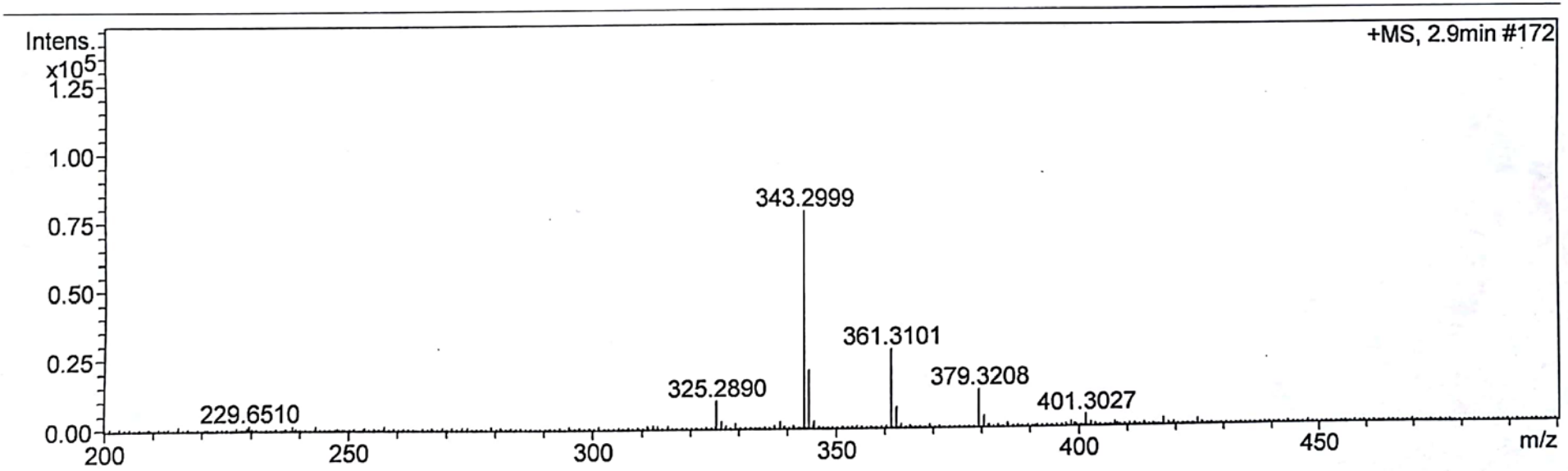
Focus	Not active	Set Capillary	4000 V	Set Dry Heater	220 °C
Scan Begin	50 m/z	Set End Plate Offset	-500 V	Set Dry Gas	6.0 l/min
Scan End	1500 m/z	Set Collision Cell RF	600.0 Vpp	Set Divert Valve	Waste



Meas. m/z	#	Formula	Score	m/z	err [ppm]	Mean err [ppm]	mSigma	rdb	e⁻ Conf	N-Rule
379.3208	1	C 24 H 43 O 3	100.00	379.3207	-0.4	-0.5	10.4	3.5	even	ok

Figure S20. HRMS spectrum of compound **11**.

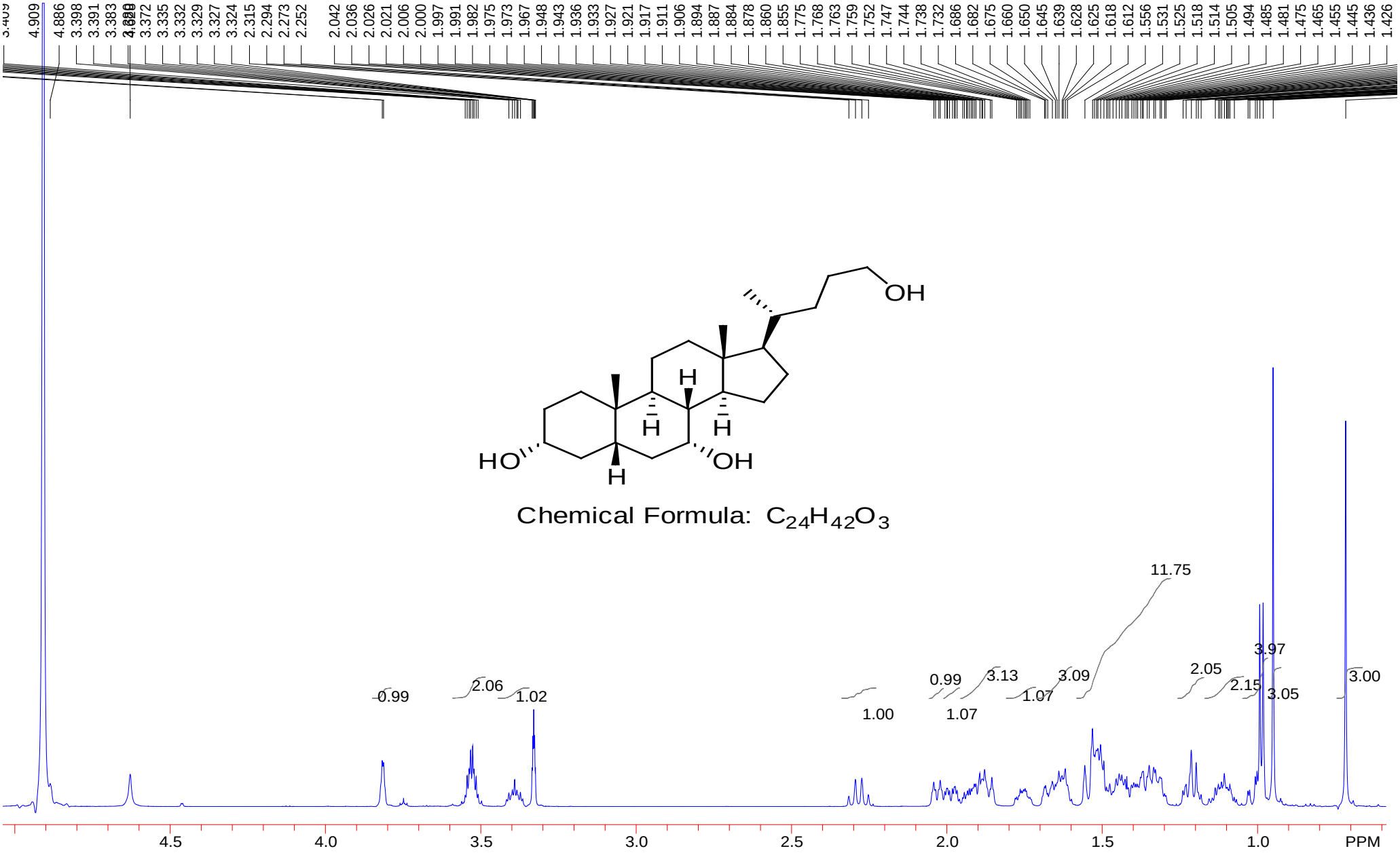


Figure S21. ^{1}H NMR spectrum of compound **11**.

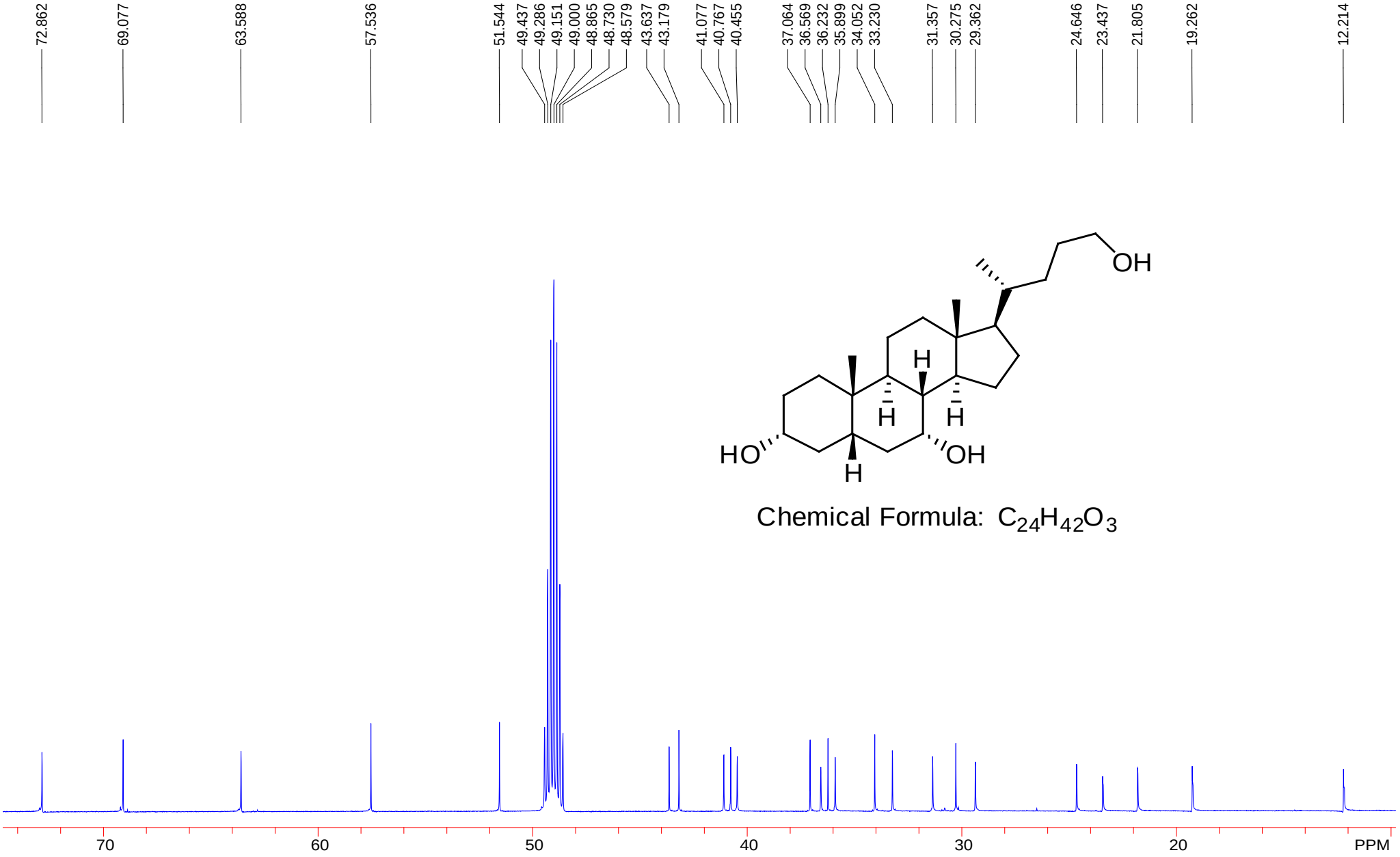


Figure S22. ^{13}C NMR spectrum of compound **11**.

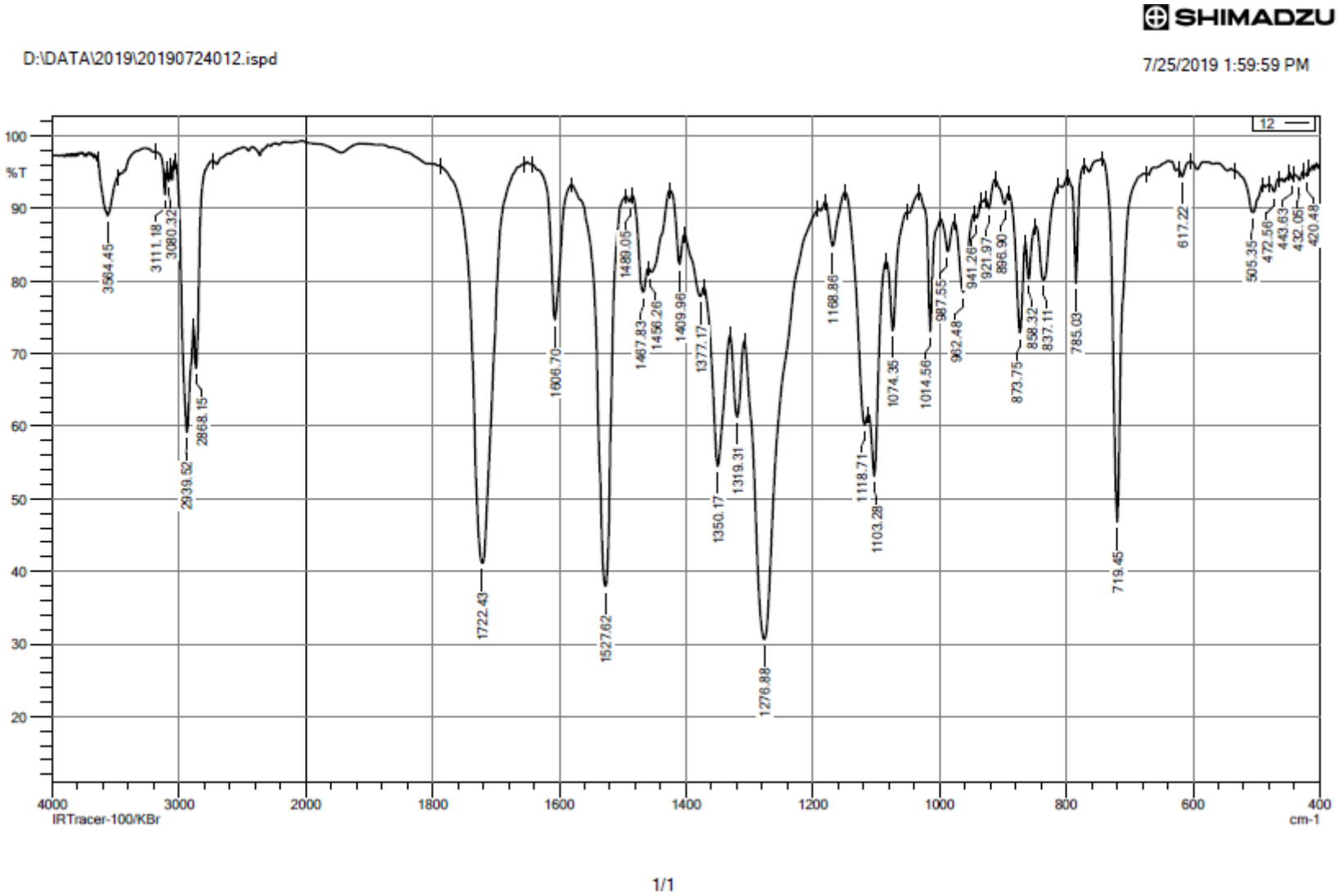


Figure S23. FT-IR spectrum of compound **11**.

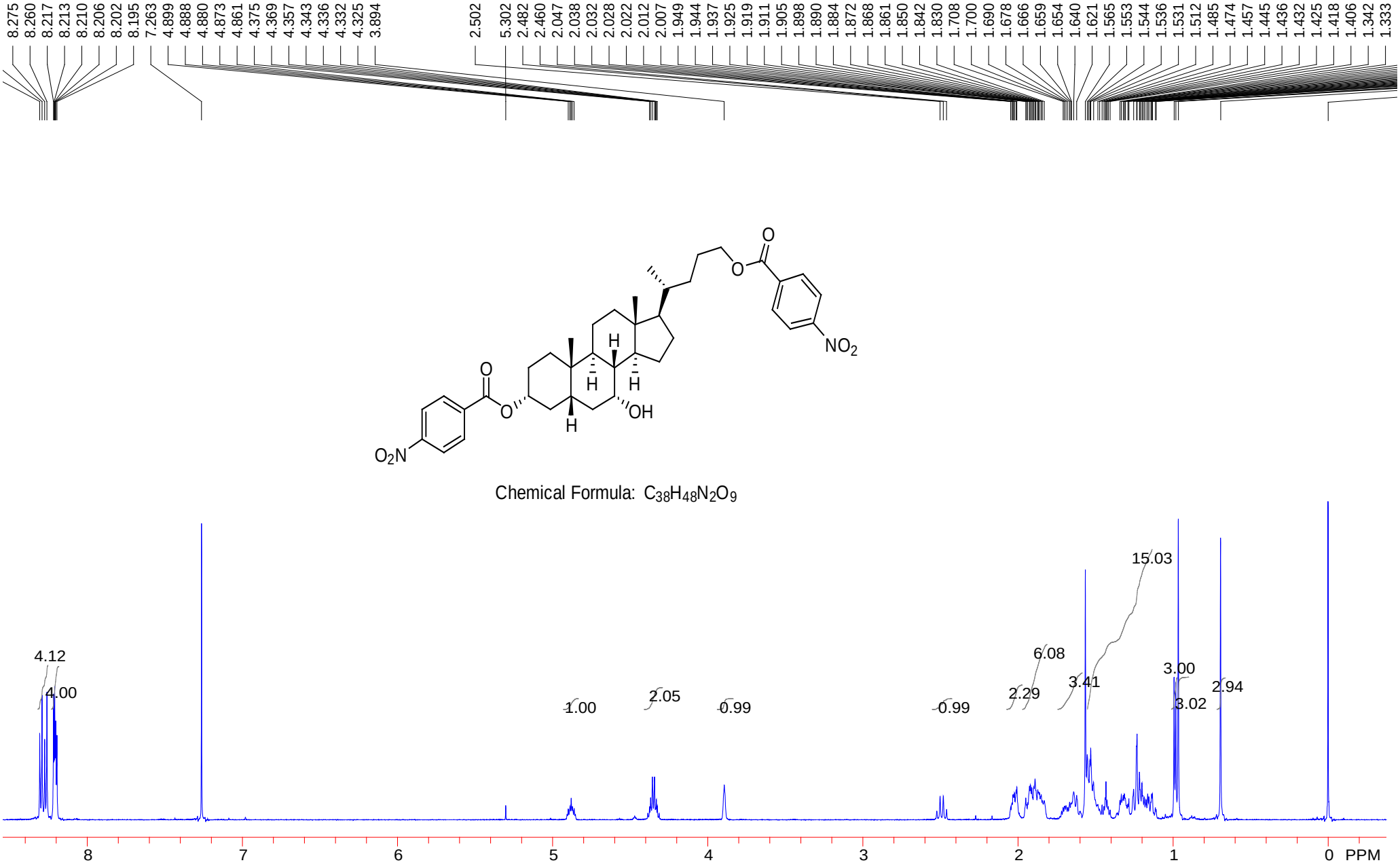


Figure S24. ^{1}H NMR spectrum of compound **12**.

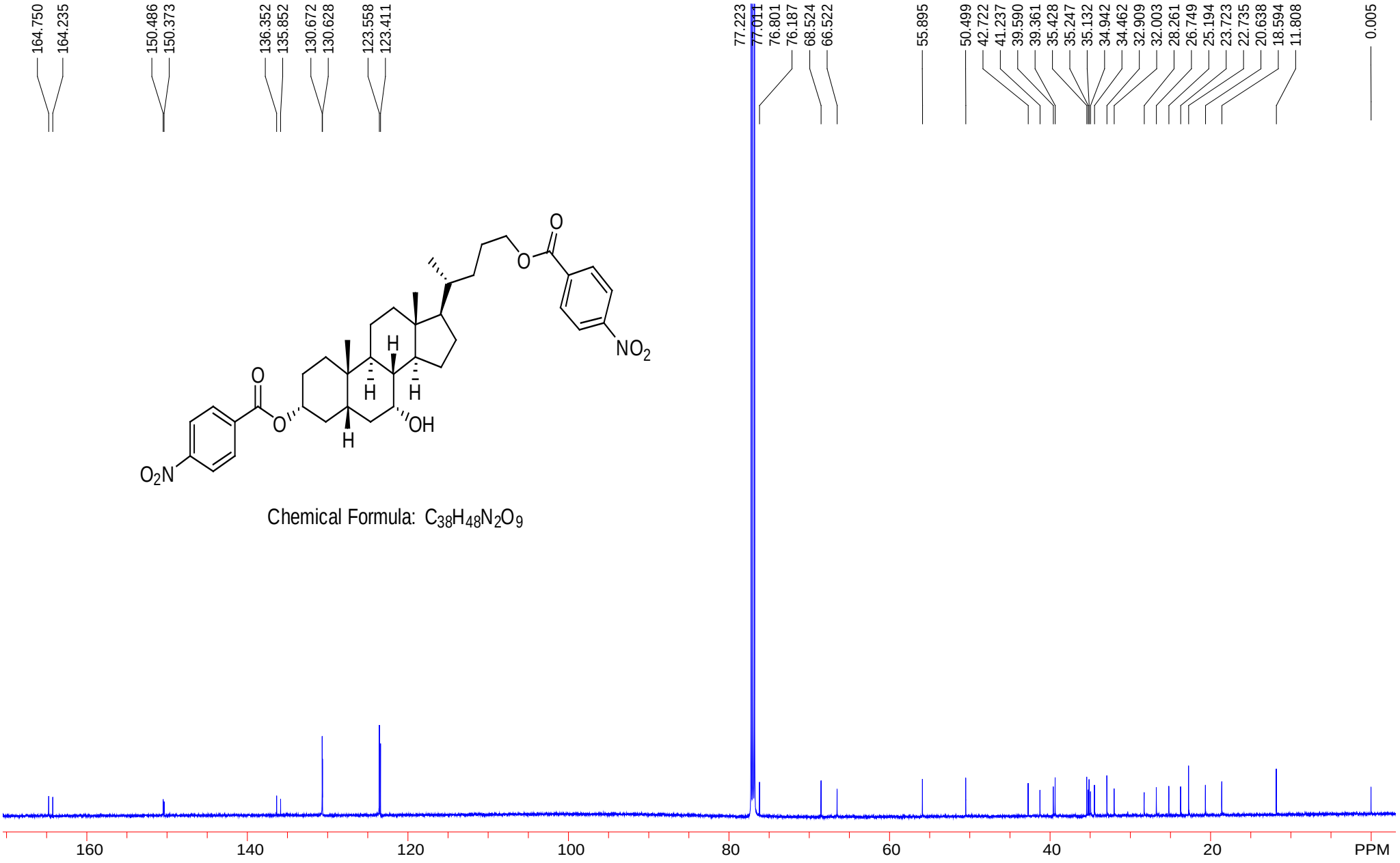


Figure S25. ^{13}C NMR spectrum of compound **12**.

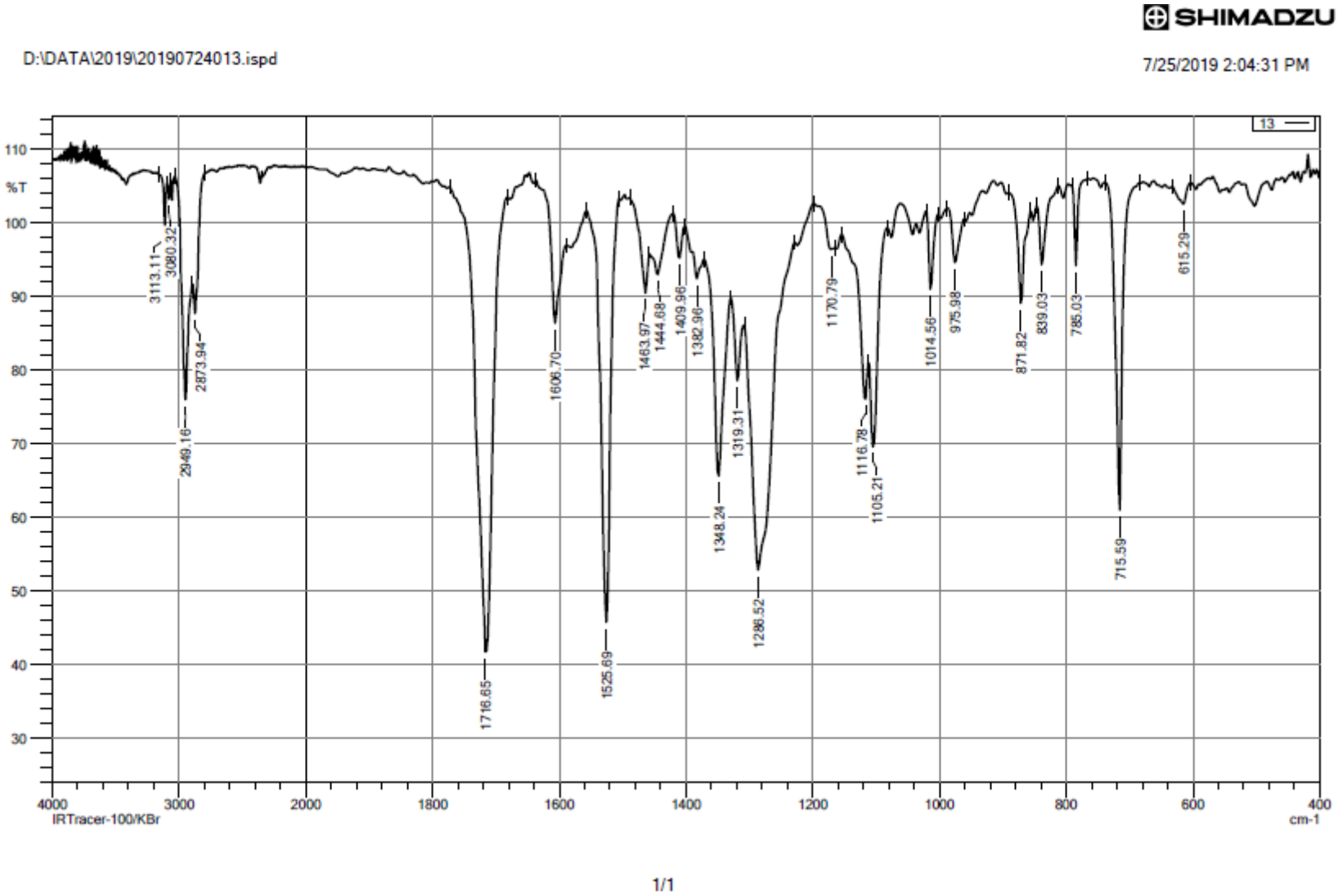


Figure S26. FT-IR spectrum of compound **13**.

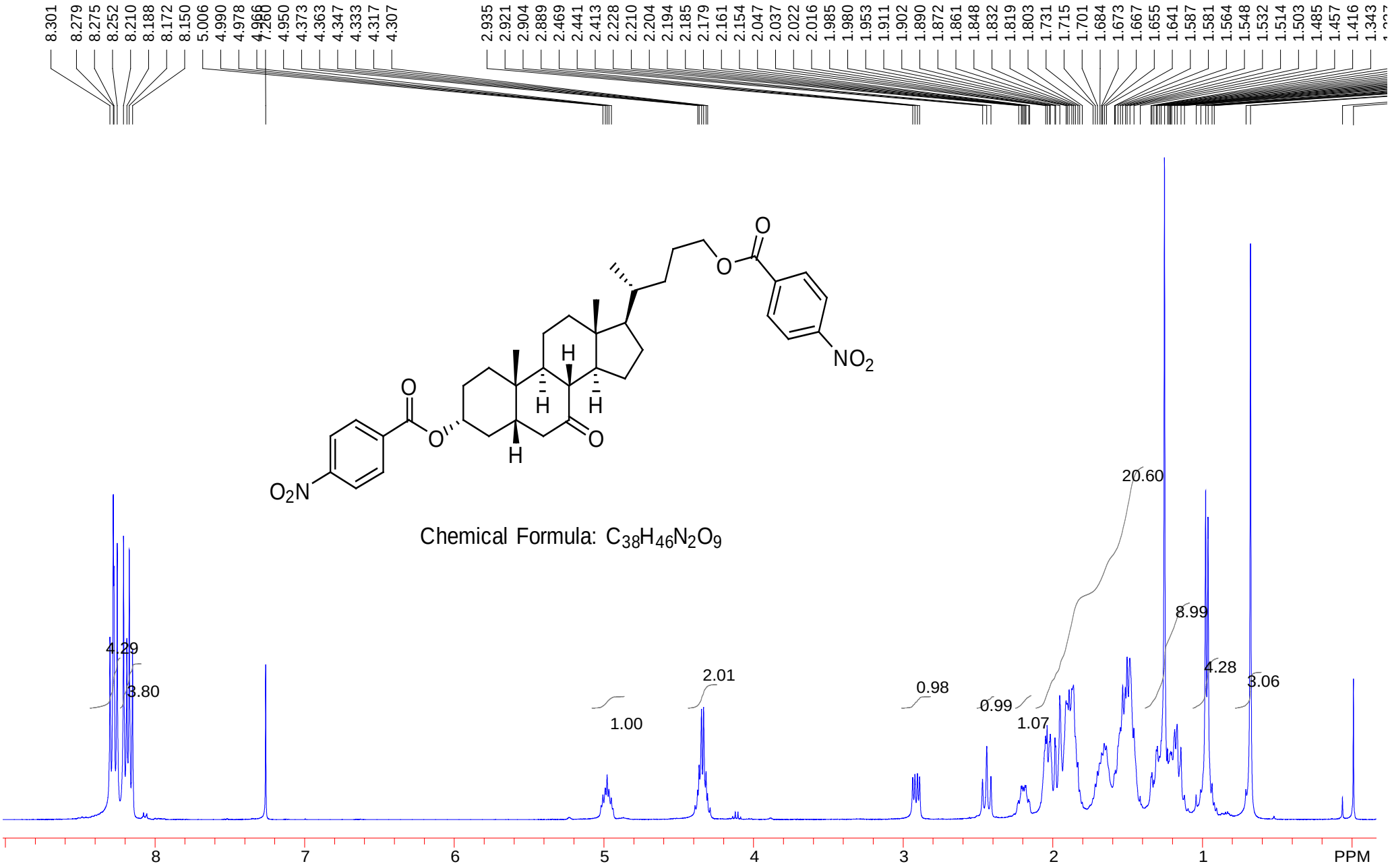


Figure S27. ^{1}H NMR spectrum of compound **13**.

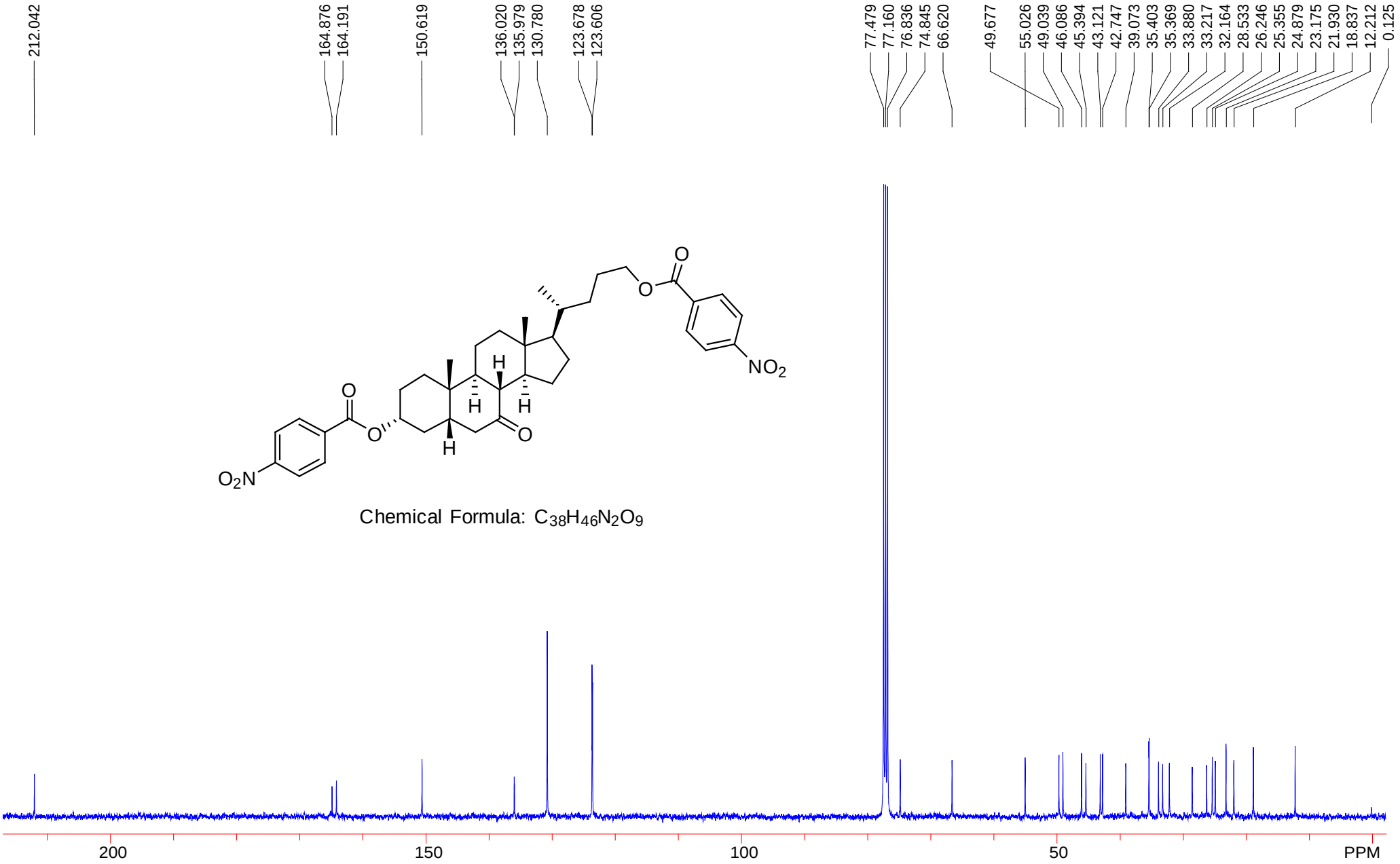


Figure S28. ^{13}C NMR spectrum of compound **13**.

Mass Spectrum SmartFormula Report

Analysis Info

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Method	20150915.m	Operator	BDAL@DE
Sample Name	14237-68-1	Instrument / Ser#	maXis 4G 21240
Comment			

Acquisition Parameter

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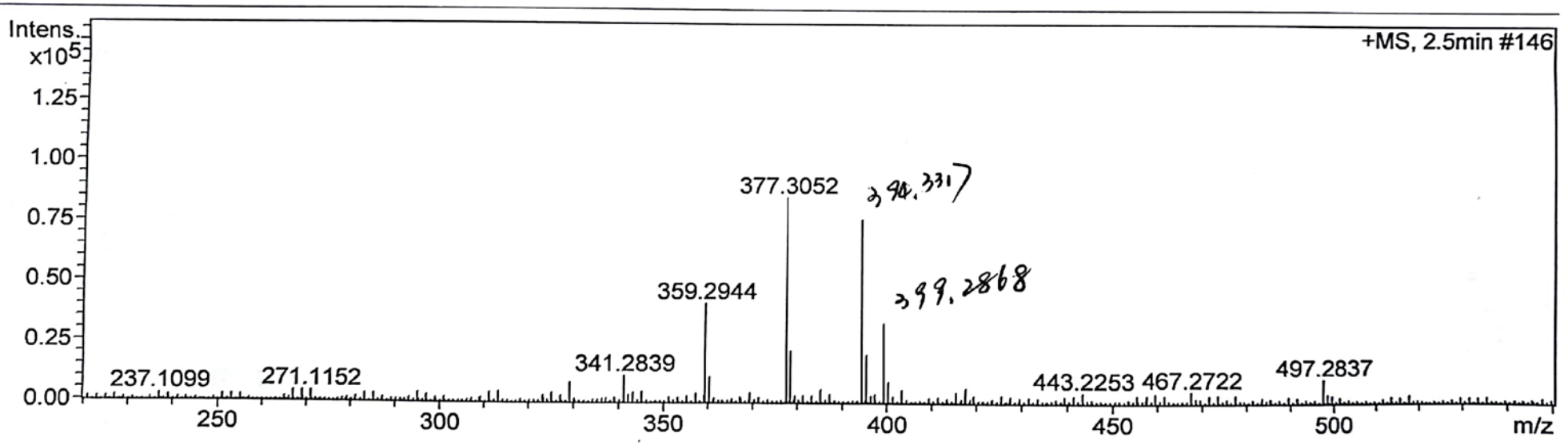
Focus	Not active	Set Capillary	4000 V	Set Dry Heater	220 °C
Scan Begin	50 m/z	Set End Plate Offset	-500 V	Set Dry Gas	6.0 l/min
Scan End	1500 m/z	Set Collision Cell RF	600.0 Vpp	Set Divert Valve	Waste



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377.3052	1	C 24 H 41 O 3	100.00	377.3050	-0.5	-0.4	8.4	4.5	even	ok
394.3317	1	C 24 H 44 N O 3	100.00	394.3316	-0.3	-0.2	5.6	3.5	even	ok
399.2868	1	C 24 H 40 Na O 3	100.00	399.2870	0.4	0.4	4.5	4.5	even	ok

Figure S29. HRMS spectrum of compound **14**.

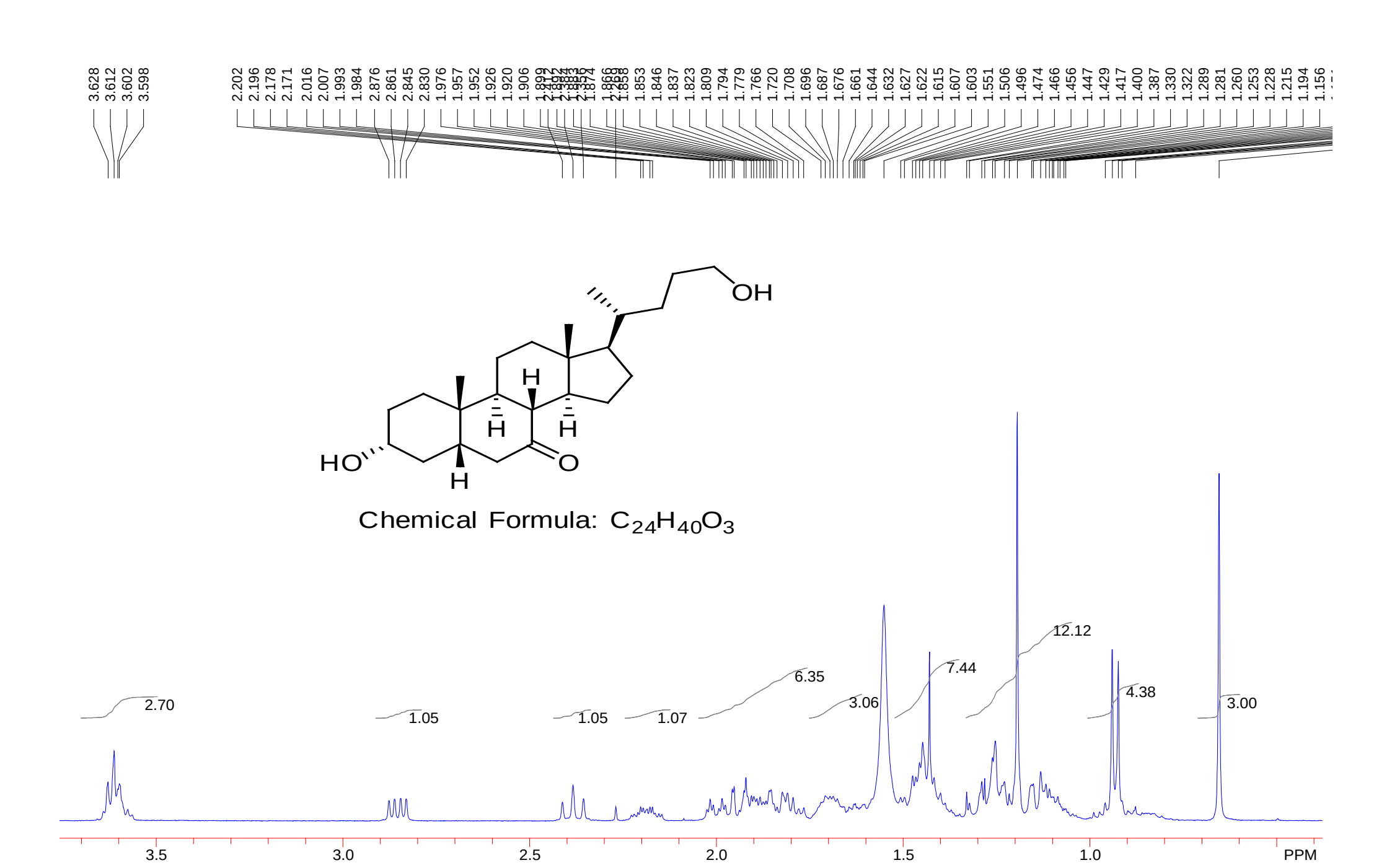


Figure S30. ^{1}H NMR spectrum of compound **14**.

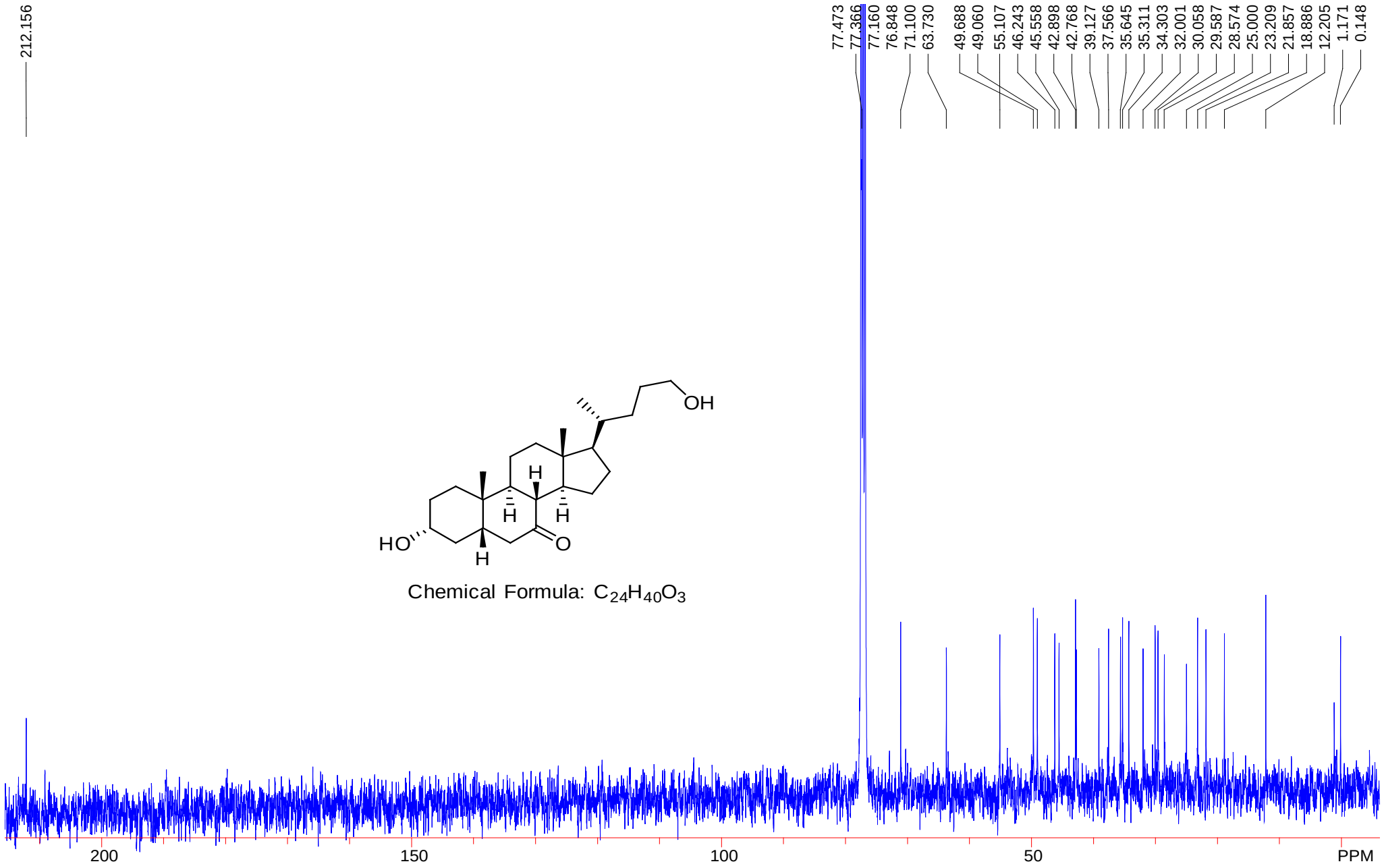
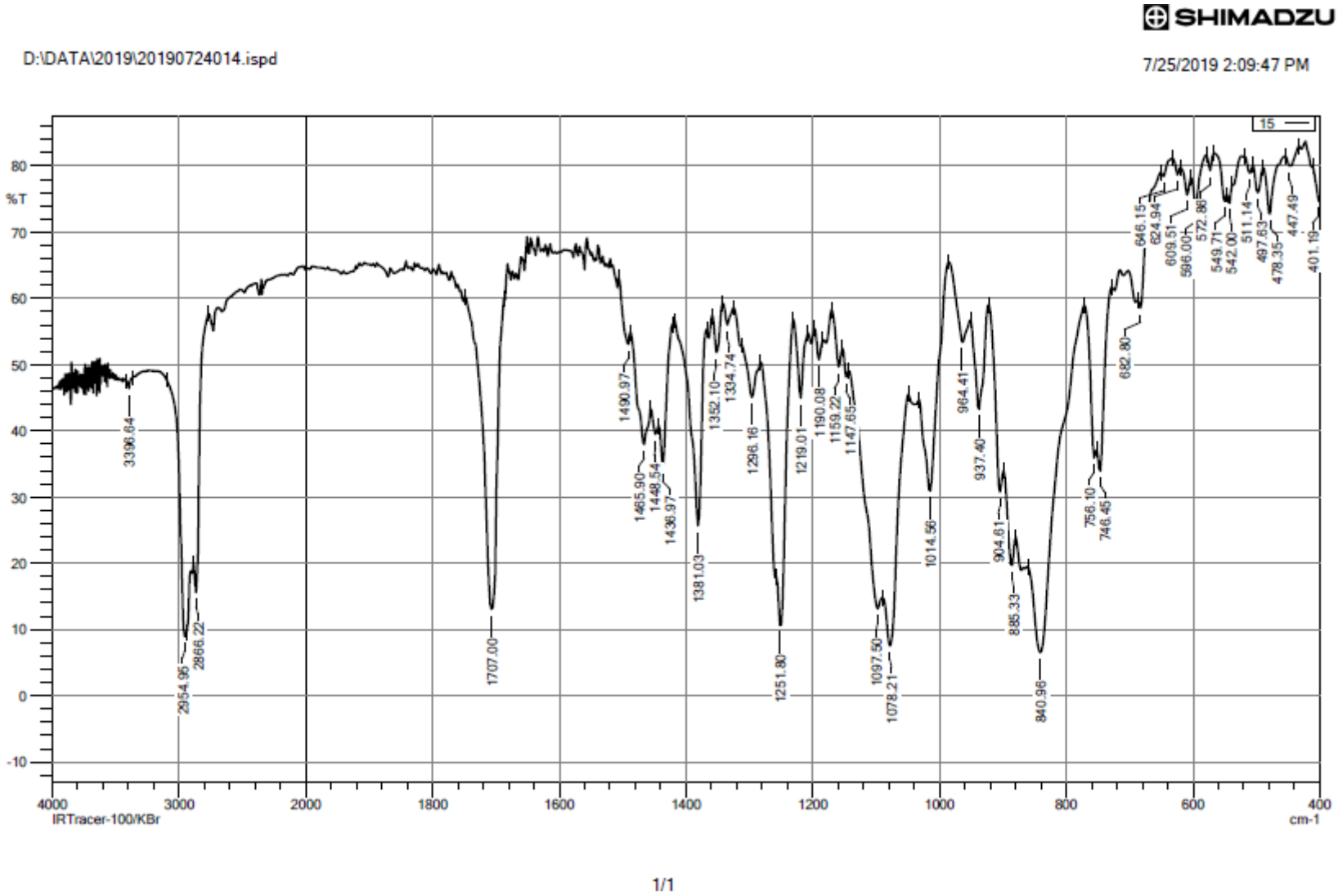


Figure S31. ^{13}C NMR spectrum of compound **14**.



1/1

Figure S32. FT-IR spectrum of compound **15**.

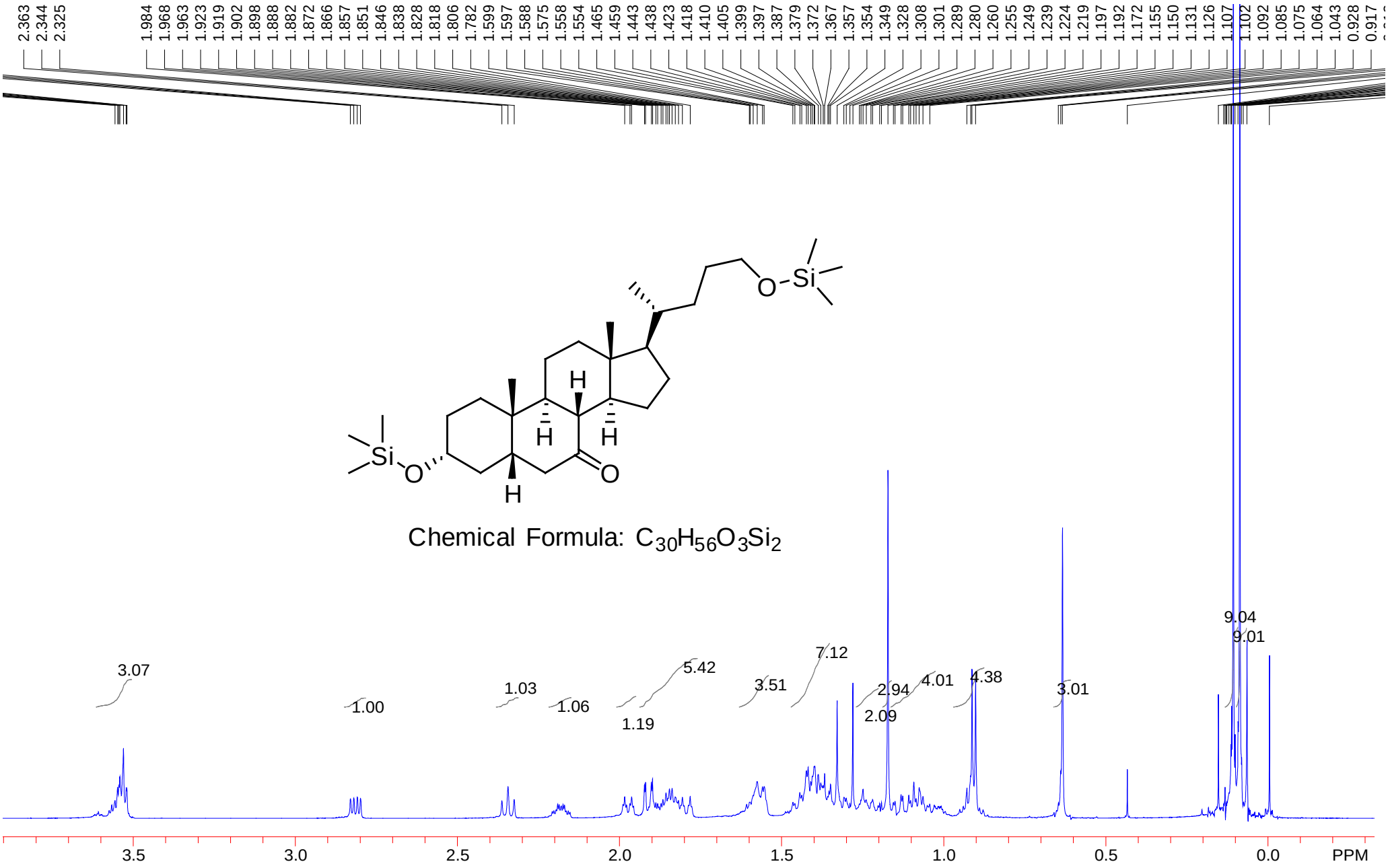


Figure S33. ^{1}H NMR spectrum of compound **15**.

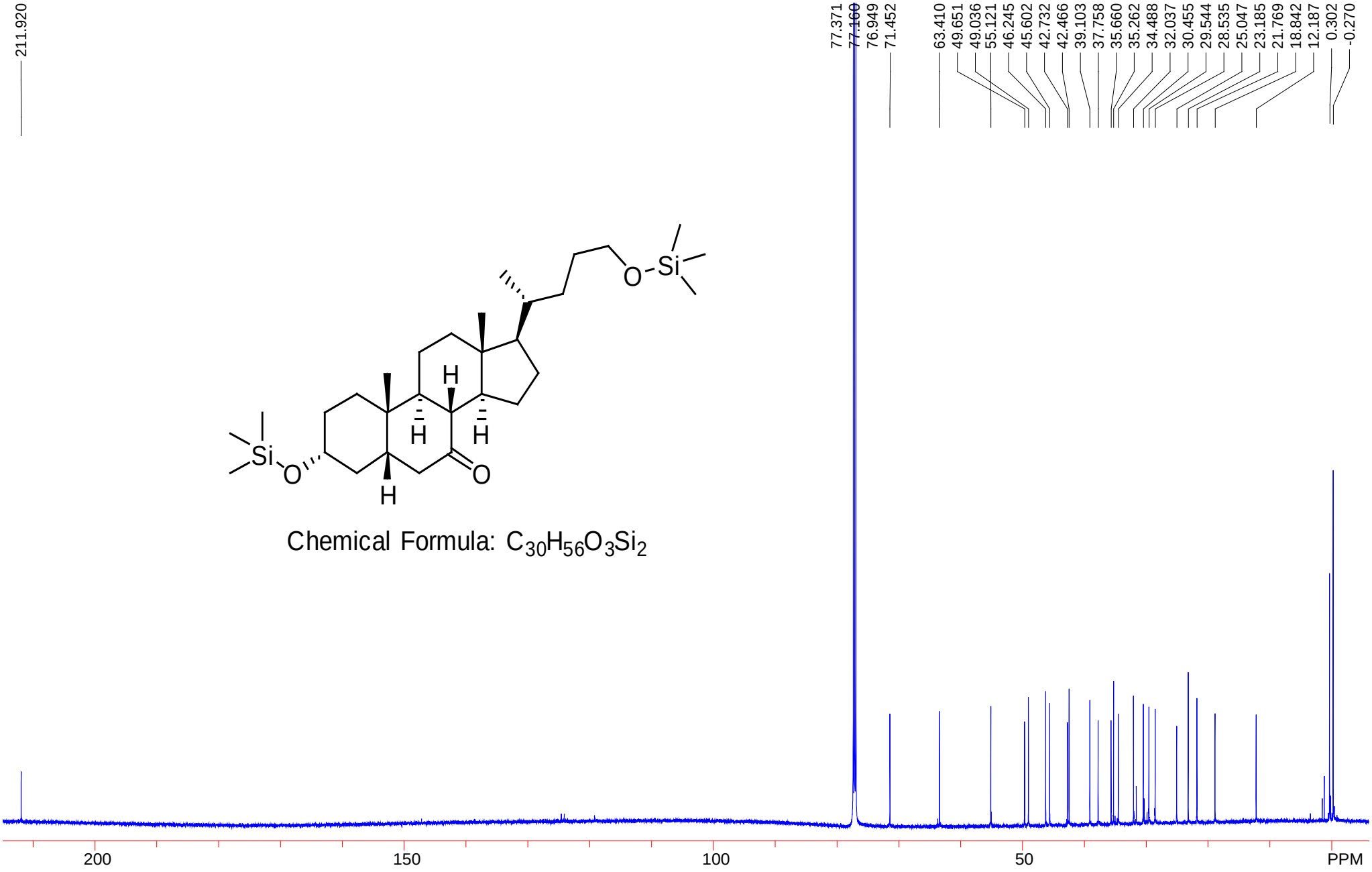
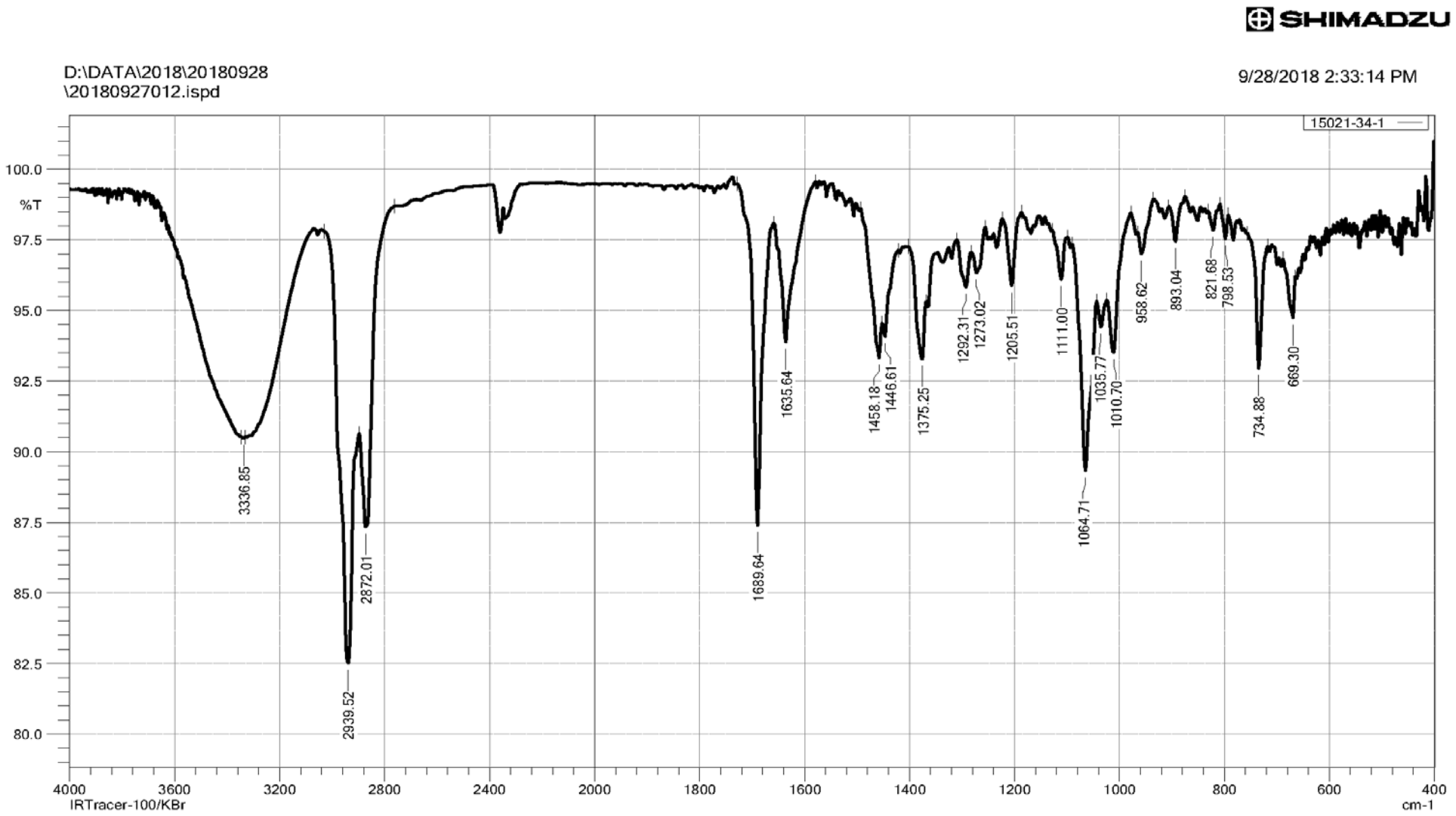


Figure S34. ^{13}C NMR spectrum of compound **15**.



1/1

Figure S35. FT-IR spectrum of impurity **2**.

Mass Spectrum SmartFormula Report

Analysis Info

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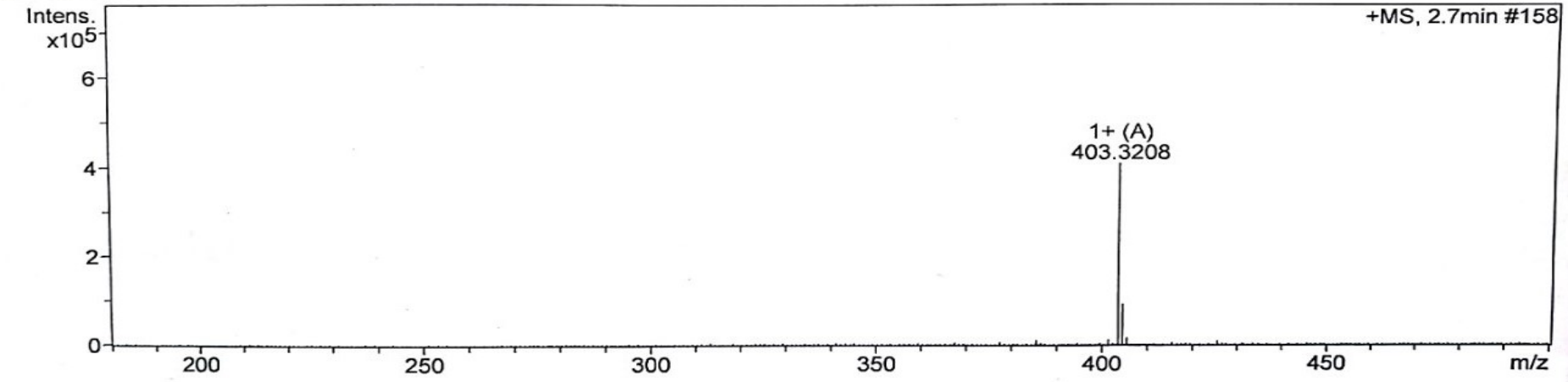
Method	20150915.m	Operator	BDAL@DE
Sample Name	15021-34-1	Instrument / Ser#	maXis 4G 21240
Comment			

Acquisition Parameter

Source Type	ESI	Ion Polarity	Positive	Set Nebulizer	1.0 Bar
Focus	Not active	Set Capillary	4000 V	Set Dry Heater	220 °C
Scan Begin	50 m/z	Set End Plate Offset	-500 V	Set Dry Gas	6.0 l/min
Scan End	1500 m/z	Set Collision Cell RF	600.0 Vpp	Set Divert Valve	Waste



Meas. m/z	#	Formula	Score	m/z	err [ppm]	Mean err [ppm]	mSigma	rdb	e⁻ Conf	N-Rule
403.3208	1	C 14 H 40 N 10 Na O 2	100.00	403.3228	5.0	5.1	19.6	-0.5	even	ok

Figure S36. HRMS spectrum of impurity **2**.

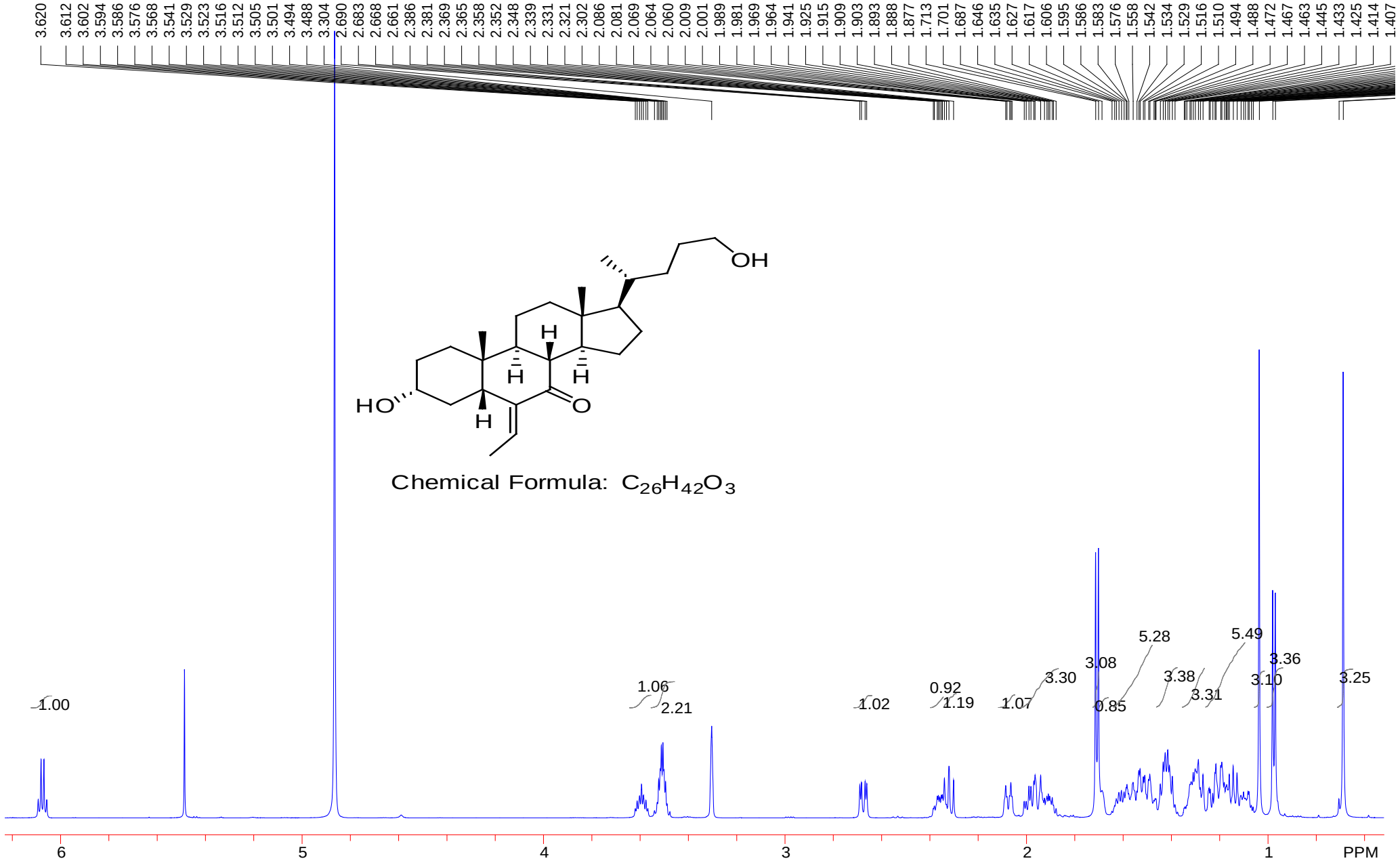


Figure S37. ^{1}H NMR spectrum of impurity **2**.

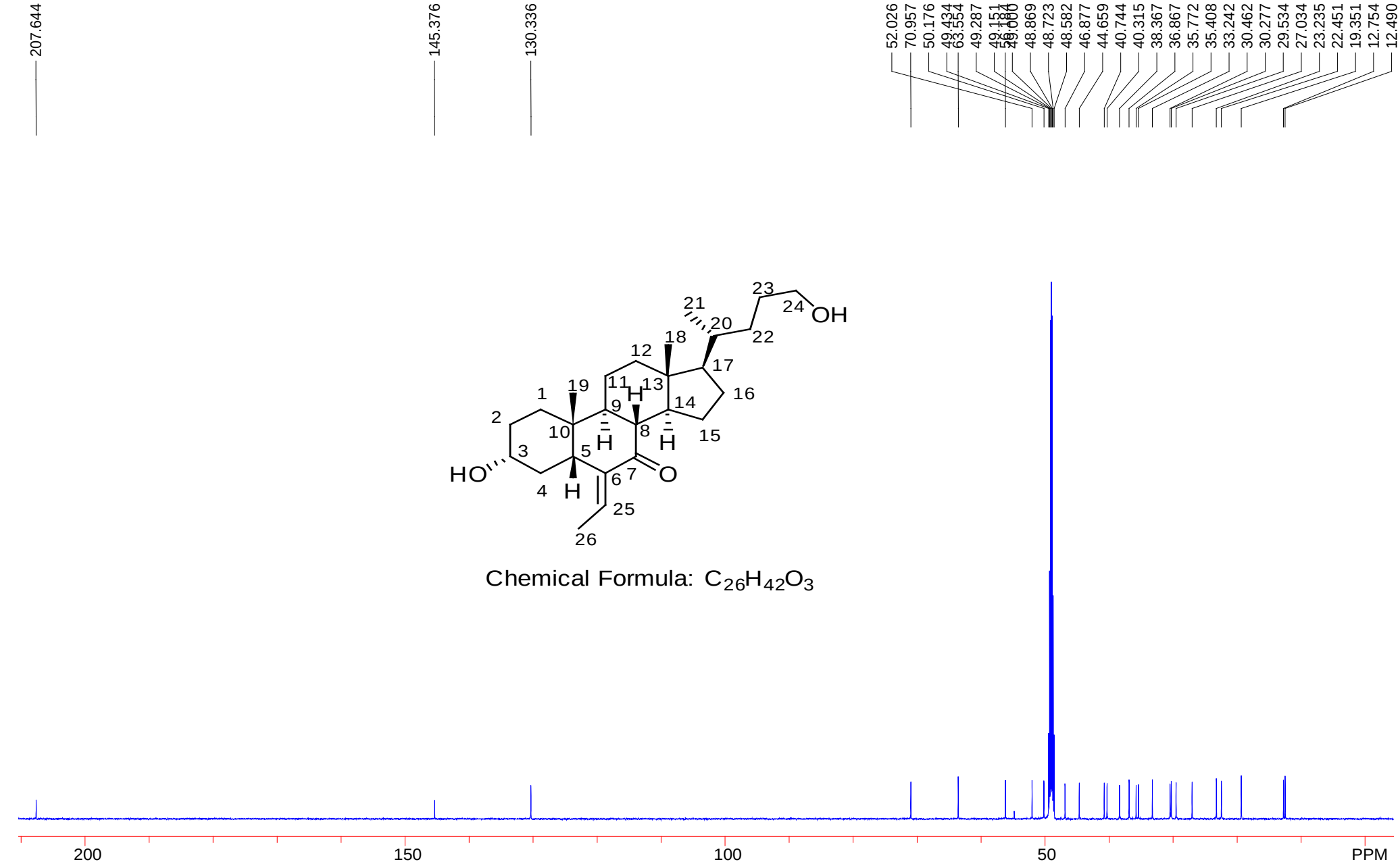


Figure S38. ^{13}C NMR spectrum of impurity **2**.

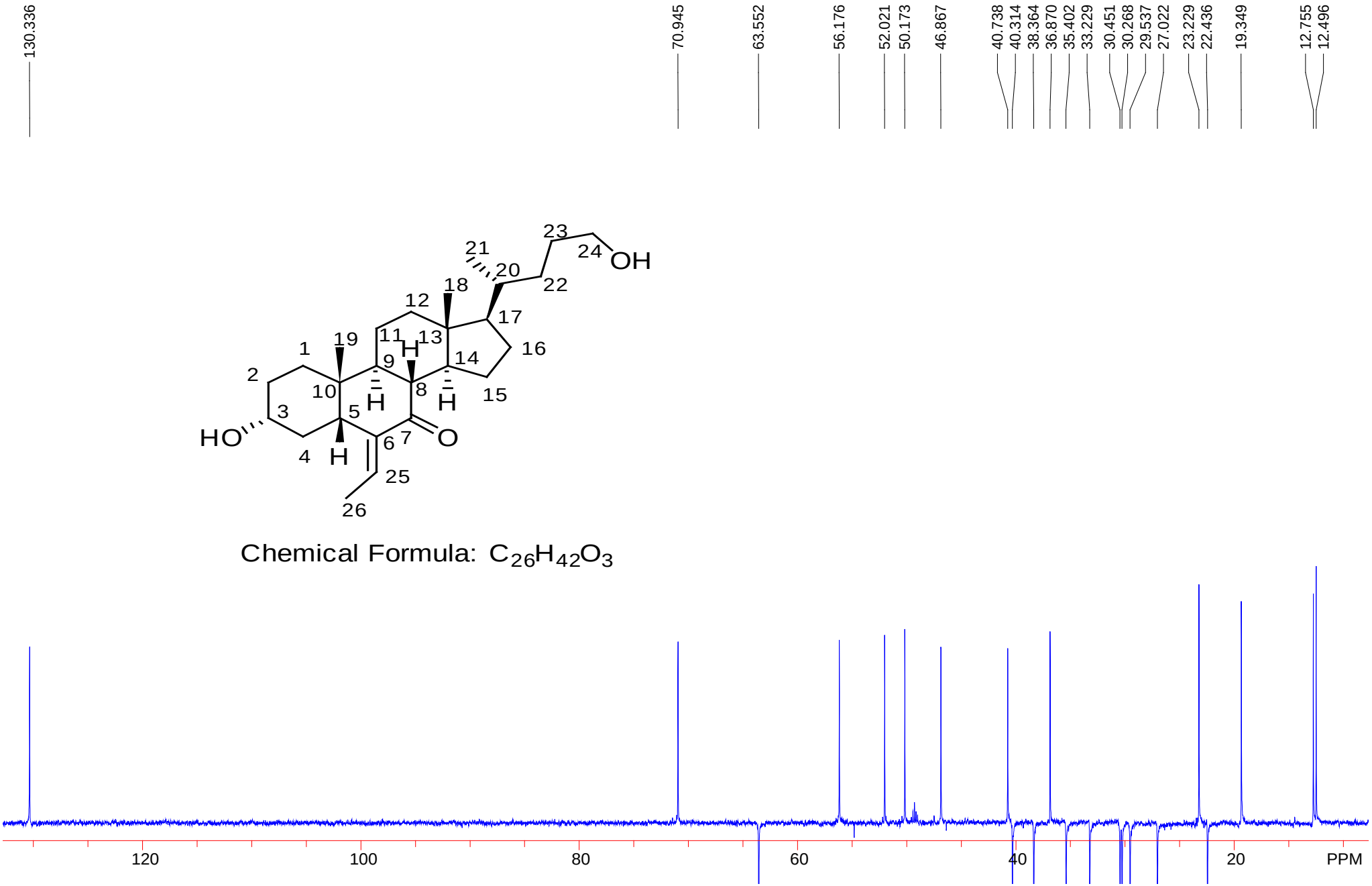


Figure S39. DEPT 135 spectrum of impurity **2**.

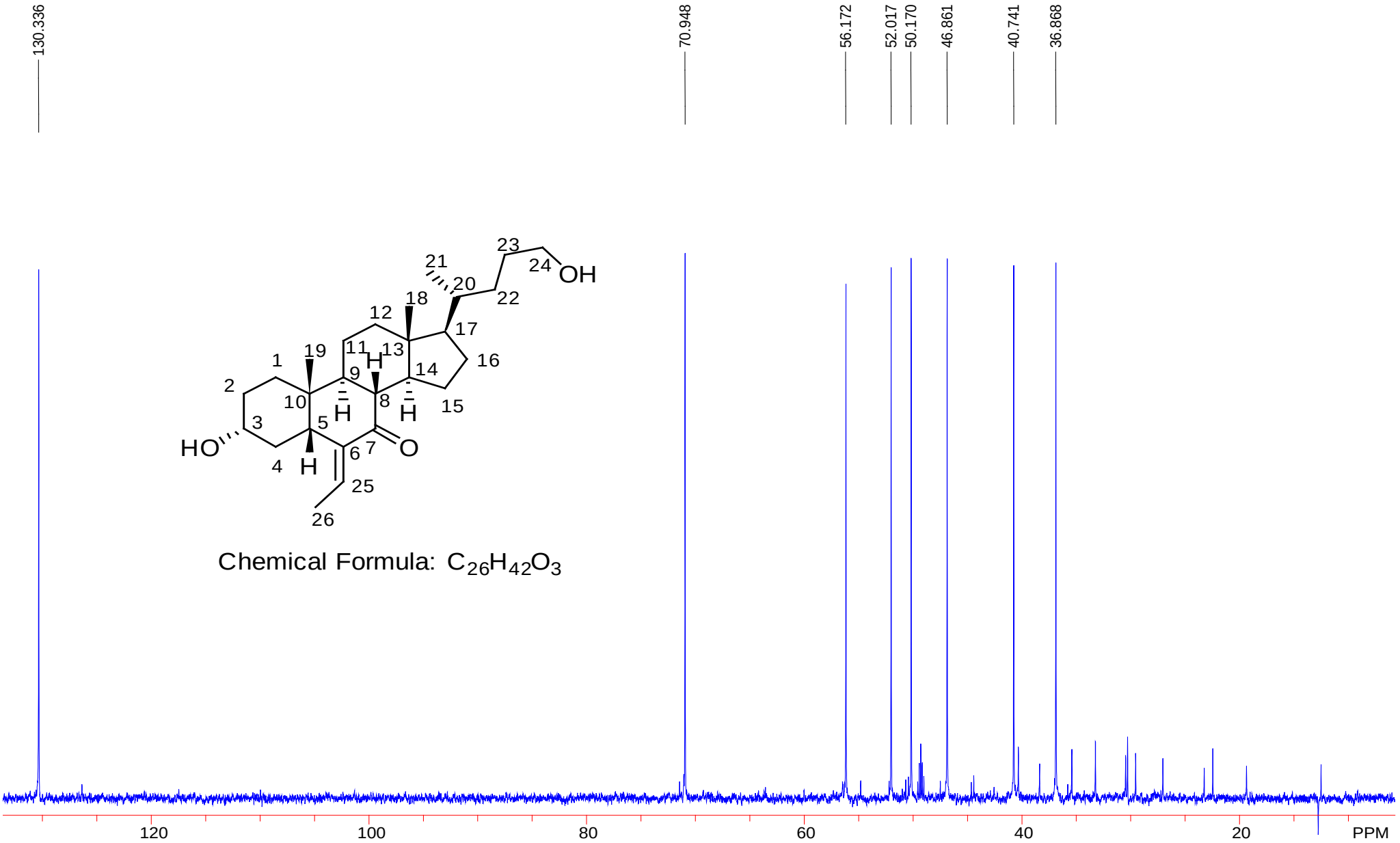


Figure S40. DEPT 90 spectrum of impurity **2**.

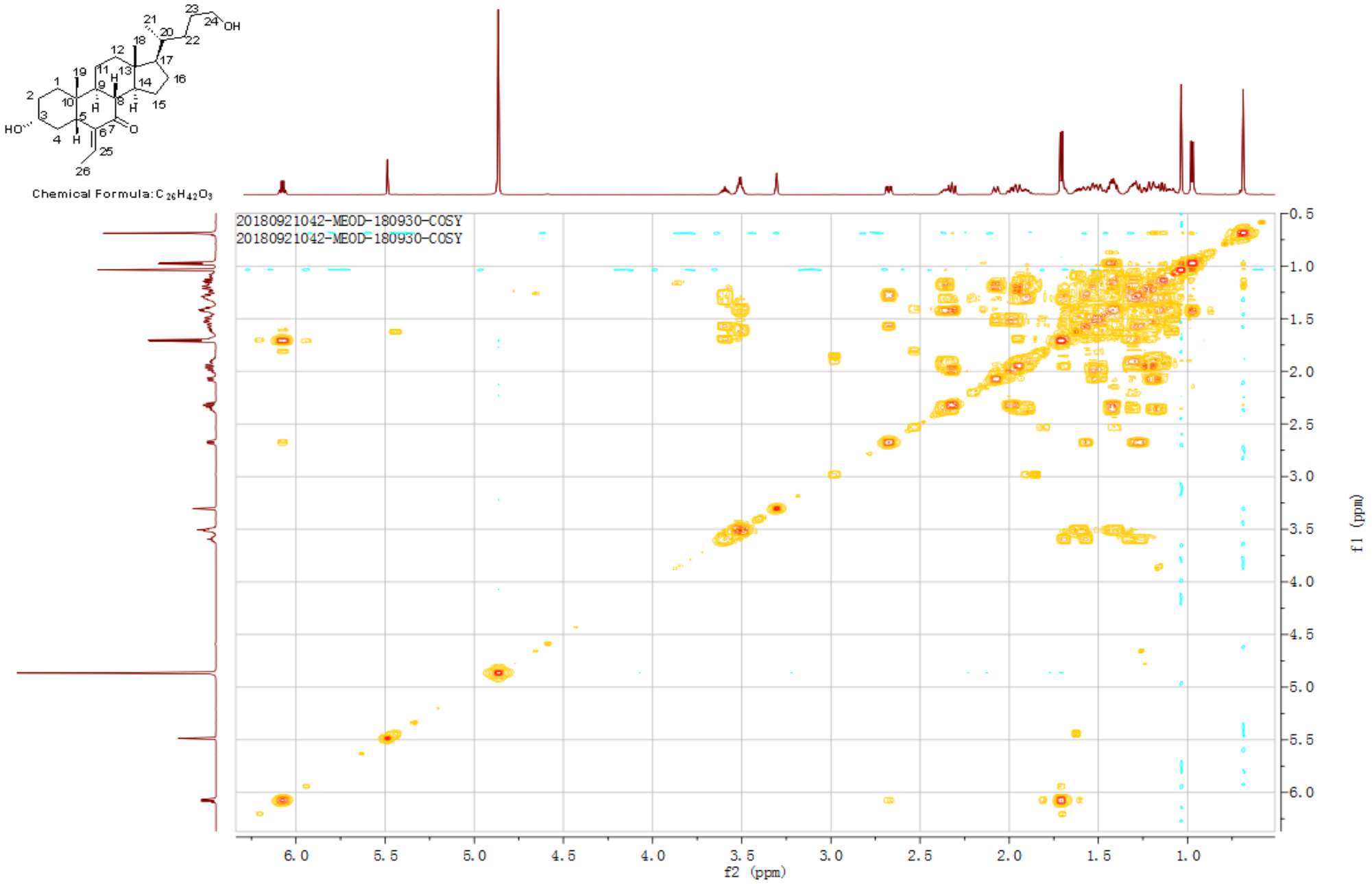


Figure S41. H-H COSY spectrum of impurity **2**.

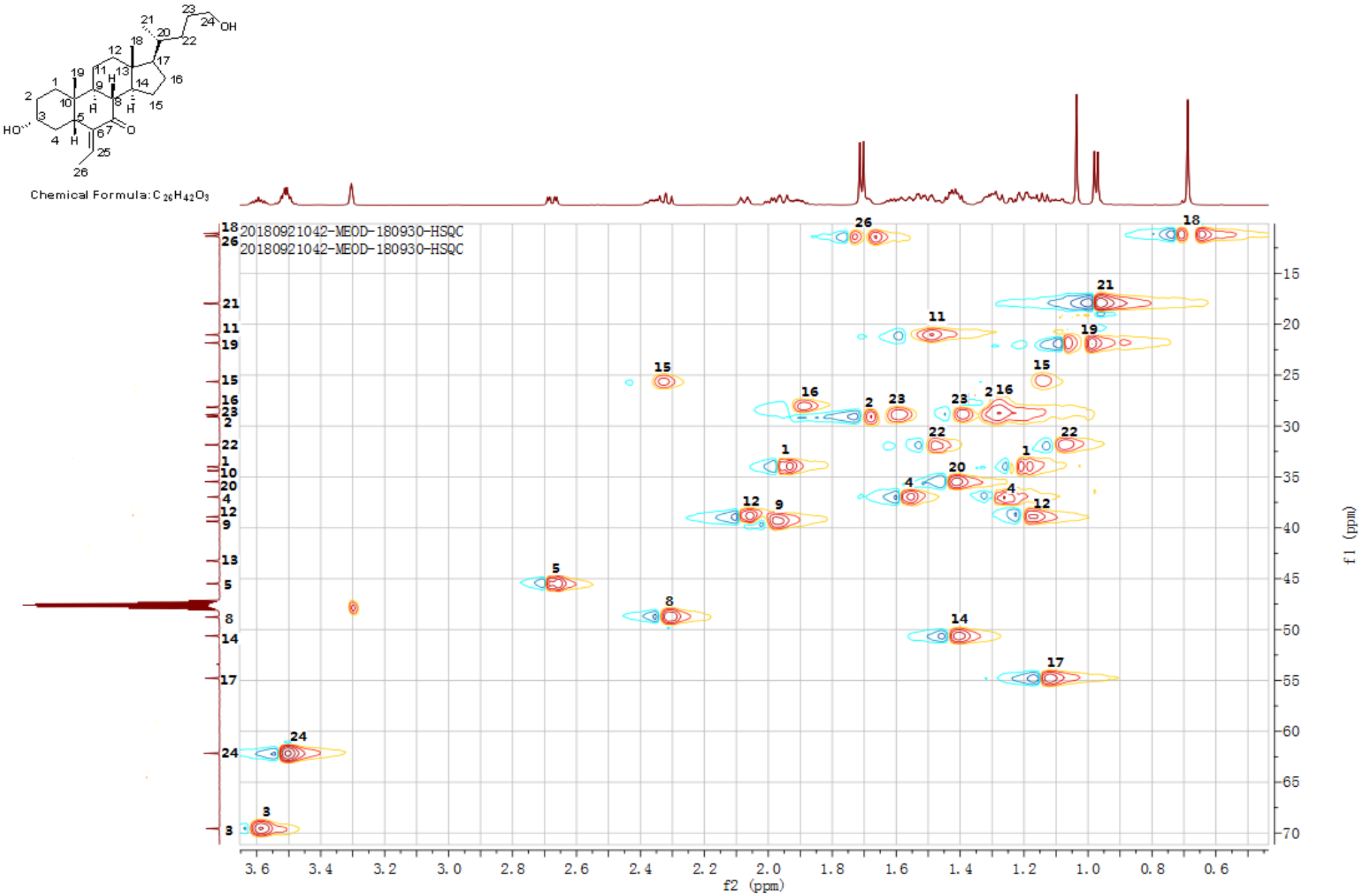


Figure S42. HSQC-1 spectrum of impurity **2**.

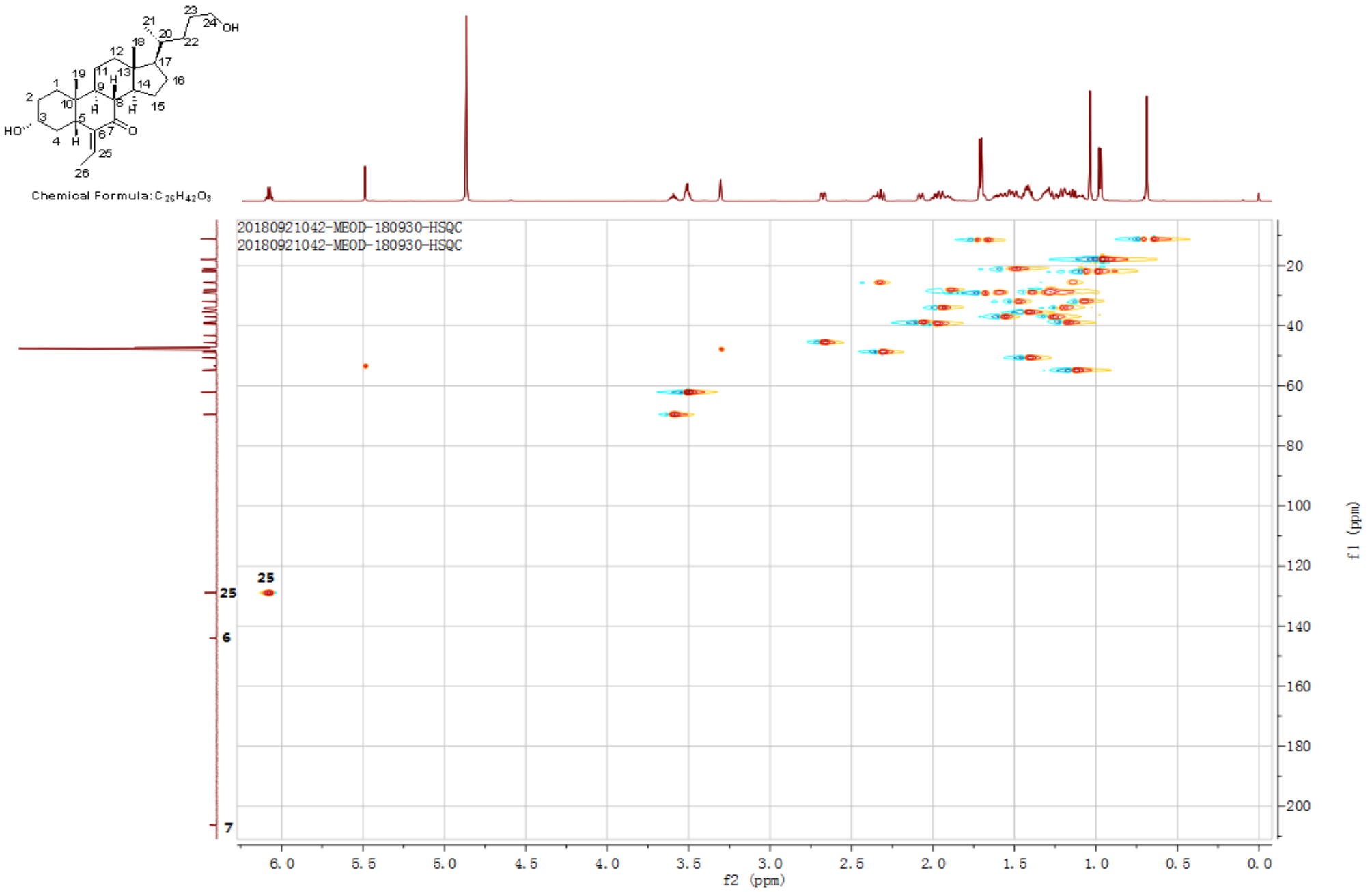


Figure S43. HSQC-2 spectrum of impurity **2**.

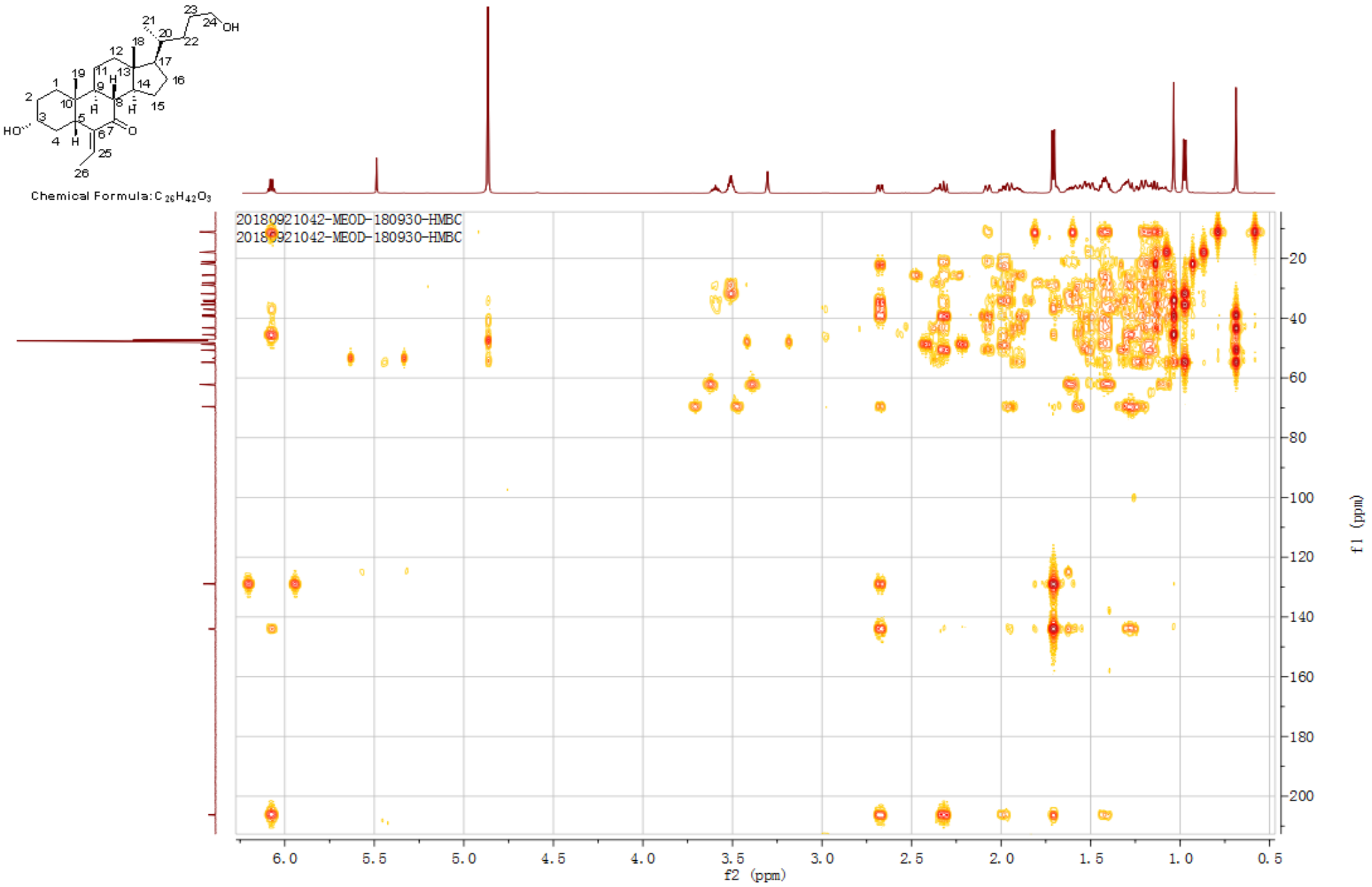


Figure S44. HMBC spectrum of impurity **2**.