*Supporting Information for*

# Triconoids A–D, Four Limonoids Possess Two Rearranged Carbon Skeletons from *Trichilia connaroides*

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## S1. Experimental Section

### General Experimental Procedures

Melting point was acquired on a SGM X-4 apparatus (Shanghai Precision & Scientific Instrument Co., Ltd., P.R. China). Optical rotations were measured by a an Autopol Ⅵ polarimeter at 300 K. UV spectra were obtained on a Shimadzu UV-2550 UV-visible spectrophotometer. IR spectra were acquired on a Perkin-Elmer 577 spectrometer with KBr disks. ECD data were carried out on a JASCO 810 Spectrophotometer. NMR data were performed on Bruker AM-500 NMR spectrometers with TMS as internal standard. ESI(+)MS and HRESI(+)MS experiments were recorded on an Esquire 3000 plus LCMS and a Waters Q-TOF Ultima Global mass spectrometers. The X-ray crystallographic data were obtained on a Bruker SMART CCD detector employing graphite monochromated Cu-Kα radiation. Semi-preparative HPLC was carried out on a Waters 1525 pump equipped with a Waters 2489 detector and YMC-Pack ODS-A column (250 × 10 mm, S-5 μm, 12 nm). MCI gel (CHP20P, 75–150 μm, Mitsubishi Chemical Industries Ltd., Japan), Sephadex LH-20 gel (Amersham Biosciences, Sweden), Silica gel (Silica gel H, 100–200 mesh, 200–300 mesh, 300–400 mesh, Qingdao Haiyang Chemical Co., Ltd., Qingdao, P. R. China), and C18 reversed-phase silica gel (150–200 mesh, Merck, Germany) were used for column chromatography. TLC analyses were carried out on pre-coated silica gel GF254 plates (Qingdao Haiyang Chemical Co., Ltd., Qingdao, P. R. China). All solvents used for column chromatography were of analytical grade (ShanghaiChemical Reagents Co., Ltd., Shanghai, P. R. China), and solvents used for HPLC were of HPLC grade (J & K Scientific Ltd., Shanghai, P. R. China).

### Plant Material

The leaves and twigs of *Trichilia connaroides* were collected in August 2013 at Shivapuri Nagarjun National Park, Nepal, and were identified via comparison with the herbarium specimen deposited at the National Herbarium Laboratory, Department of Plant Resources, Godawari, Nepal. A voucher specimen has been deposited in Shanghai Institute of Materia Medica, Chinese Academy of Sciences (Deposition no. TC-2013-1Y).

**Extraction and isolation**

The air-dried powder of the branches of *T. connaroides* (9 Kg) was extracted with 95% EtOH (20 L) three times (for one week each time) at room temperature to obtain a crude extract (250 g). The extract was partitioned between EtOAc (3 × 1.0 L) and $H_2O$ (1.0 L) to afford EtOAc-soluble fraction (50 g), which was then separated into five fractions (A–E) by MCI gel column eluted with MeOH/$H_2O$ (50% to 90%). Fraction D was separated over a silica gel CC eluted with petroleum ether/acetone (15:1 to 1:3) to produce six fractions (D1–D6). Fraction D3 was fractionated by Sephadex LH-20 gel eluted with MeOH to obtain four fractions (D3a–D3d). Fraction D3d was subjected to a silica gel CC eluted with $CH_3Cl$/$CH_3OH$ (200:1 to 50:1) to return a major component, which was further purified by semi-preparative HPLC (3.0 mL/min, 49% $CH_3CN$-$H_2O$) to afford compound **4** (5 mg). Fraction D4 was separated by a column of silica gel eluted with $CH_3Cl$/$CH_3OH$ (200:1 to 50:1) to obtain two fractions (D4a–D4b), and the second fraction was subjected to a C18 reversed-phase silica gel eluted with MeOH/$H_2O$ (50 to 100%) to give three fractions (D4b1–D4b3). Compounds **3** (8 mg) was obtained via semi-preparative HPLC (3.0 mL/min, 45% $CH_3CN$-$H_2O$) from fraction D4b1. Compound **1** (38 mg) was crystallized form the fraction D5 in MeOH at room temperature, and the mother liquor of this fraction was then separated using a silica gel eluted with petroleum ether/acetone(5:1 to 1:1) to obtain two fractions (D5a and D5b). The fraction D5b was subjected to a column of C18 reversed-phase silica gel eluted with MeOH/$H_2O$ (50 to 100%) to afford three components (D5b1–D5b3), and compound **2** (1.4 mg) was obtained from fraction D5b3 via purification on semi-preparative HPLC (3.0 mL/min, 45% $CH_3CN$-$H_2O$).

**X-ray crystallographic analysis**

Triconoid A (**1**) was crystallized from MeOH at room temperature. The X-ray crystallographic data of **1** was obtained on a Bruker SMART CCD detector employing graphite monochromated Cu-Kαradiation ($\lambda$ = 1.54178 Å) at 140(2) K (operated in the $\phi$-$\omega$ scanmode). The structure was solved by direct method using SHELXS-97 (Sheldrick 2008) and refined with full-matrix least-squares calculations on F2 using SHELXL-97 (Sheldrick2008).All

non-hydrogen atoms were refined anisotropically. The hydrogen atom positions were geometrically idealized and allowed to ride on their parent atoms.

Crystallographic data for **1** (Table S1) has been deposited at the Cambridge Crystallographic Data Center (deposition numbers: CCDC 1523294 for **1**). The copy of the data can be acquired free of charge on application to the CCDC, 12 Union Road, Cambridge CB21EZ, UK [tel: (+44) 1223-336-408; fax: (+44) 1223-336-033; e-mail: deposit0@ccdc.cam.ac.uk].

## S2. Physical and Chemical Data

Triconoid A (**1**) : colorless crystals; mp 146−148 °C; $[\alpha]^{27}_{D}$ −66 (*c* 0.15, MeOH); UV (MeOH) $\lambda_{max}$ (log $\varepsilon$) 217 (4.00), 264 (3.40) nm; ECD (MeOH) $\lambda$ ($\Delta\varepsilon$) 194 (−14.9), 213 (6.8), 235 (−3.0), 293 (−3.5) nm; IR (KBr) $\nu_{max}$ 2946, 1789, 1727, 1269, 1212, 1023, 734 $cm^{-1}$; $^{1}H$ and $^{13}C$ NMR data see Table 1; (+)-ESIMS *m/z* 604 $[M + H]^+$, 1229 $[2 M + Na]^+$; (+)-HRESIMS *m/z* 604.2181 $[M + H]^+$ (calcd for $C_{33}H_{34}NO_{10}$ 604.2183).

Triconoid B (**2**) : white powder; $[\alpha]^{27}_{D}$ −64 (*c* 0.2, MeOH); UV (MeOH) $\lambda_{max}$ (log $\varepsilon$) 211 (4.2), 264 (3.70) nm; ECD (MeOH) $\lambda$ ($\Delta\varepsilon$) 196 (−9.8), 213 (13.8), 239 (−2.8), 294 (−6.4) nm; IR (KBr) $\nu_{max}$ 3463, 2923, 1794, 1731, 1273, 1213, 1025, 738 $cm^{-1}$; $^{1}H$ and $^{13}C$ NMR data see Table 1; (+)-ESIMS *m/z* 620 $[M + H]^+$; (−)-ESIMS *m/z*664 $[M + COOH]^-$; (+)-HRESIMS *m/z* 620.2126 $[M + H]^+$ (calcd for $C_{33}H_{34}NO_{11}$ 620.2132).

Triconoid C (**3**): white powders; $[\alpha]^{27}_{D}$ +36 (*c* 0.3, MeOH); UV (MeOH) $\lambda_{max}$ (log $\varepsilon$) 212 (4.1) nm; ECD (MeOH) $\lambda$ ($\Delta\varepsilon$) 193 (−12.4), 216 (10.7), 295 (−2.7) nm; IR (KBr) $\nu_{max}$ 3461, 2946, 1788, 1727, 1220, 1048, 1029, 735 $cm^{-1}$; $^{1}H$ and $^{13}C$ NMR data see Table 1; (+)-ESIMS *m/z*499 $[M + H]^+$, 1019 $[2 M + Na]^+$; (−)-HRESIMS *m/z*497.1814 $[M - H]^-$ (calcd for $C_{27}H_{29}O_9$ 497.1812).

Triconoid D (**4**) : white powder; $[\alpha]^{27}_{D}$ −113 (*c* 0.5, MeOH); UV (MeOH) $\lambda_{max}$ (log $\varepsilon$) 206 (4.4) nm; ECD (MeOH) $\lambda$ ($\Delta\varepsilon$) 201 (−63.5), 230 (17.5) nm; IR (KBr) $\nu_{max}$ 2925, 1781, 1740, 1708, 1262, 1025, 731 $cm^{-1}$; $^{1}H$ and $^{13}C$ NMR data see Table 1; (+)-ESIMS *m/z* 601 $[M +Na]^+$; (+)-HRESIMS *m/z* 601.2039 $[M + Na]^+$ (calcd for $C_{32}H_{34}O_{10}Na$ 601.2050).

**Table S1.** X-ray crystallographic data for triconoid A (**1**)[a]

| | |
|---|---|
| Empirical formula | $C_{33}H_{33}NO_{10}\cdot CH_3OH$ |
| Formula weight | 635.64 |
| Temperature | 296(2) K |
| Wavelength | 1.54178 Å |
| Crystal system | Orthorhombic |
| Space group | P 21 21 21 |
| Unit cell dimensions | *a* = 8.2479(3)Å, α = 90 °<br>*b* = 13.1646(4) Å, β = 90.180(2) °<br>*c* =28.6827(9) Å, γ = 90 ° |
| Volume | 3114.38(18)Å$^3$ |
| Z | 4 |
| Calculated density | 1.356 Mg/m$^3$ |
| Absorption coefficient | 0.847 mm$^{-1}$ |
| F(000) | 1344 |
| Crystal size | 0.230∗0.120∗0.060 mm$^3$ |
| Theta range for data collection | 3.081 to 69.618 ° |
| Index ranges | -8<=h<=9, -15<=k<=15, -34<=l<=28 |
| Reflections collected | 20753 |
| Independent reflections | 5624 [R(int) = 0.0348] |
| Completeness to theta = 67.679 ° | 98.3 % |
| Absorption correction | Semi-empirical from equivalents |
| Max. and min. transmission | 0.7532 and 0.5972 |
| Refinement method | Full-matrix least-squares on F$^2$ |
| Data / restraints / parameters | 5624 / 39 / 417 |
| Goodness-of-fit on F$^2$ | 1.092 |
| Final R indices [I>2σ(I)] | R1 = 0.0500, wR2 = 0.1471 |
| R indices (all data) | R1 = 0.0526, wR2 = 0.1505 |
| Absolute structure parameter | 0.09(6) |
| Extinction coefficient | n/a |
| Largest diff. peak and hole | 0.477 and –0.647 e. Å$^{-3}$ |

[a] Colorless crystals of triconoid A (**1**) were obtained in methanol solvent.

**Figure S1.** $^{1}H$ NMR spectrum of triconoid A (**1**) in $CDCl_3$

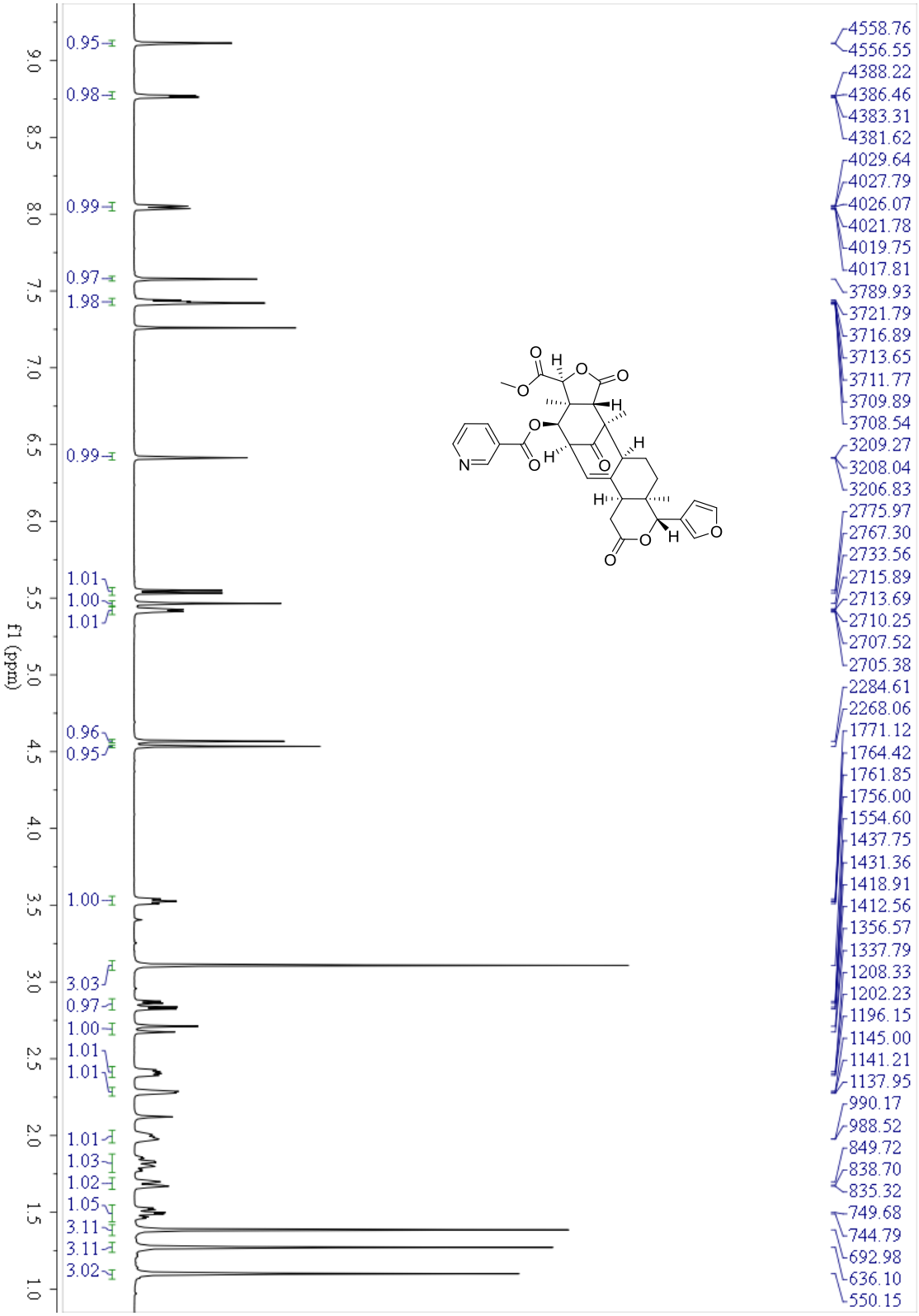

**Figure S2.** $^{13}C$ NMR spectrum of triconoid A (**1**) in $CDCl_3$

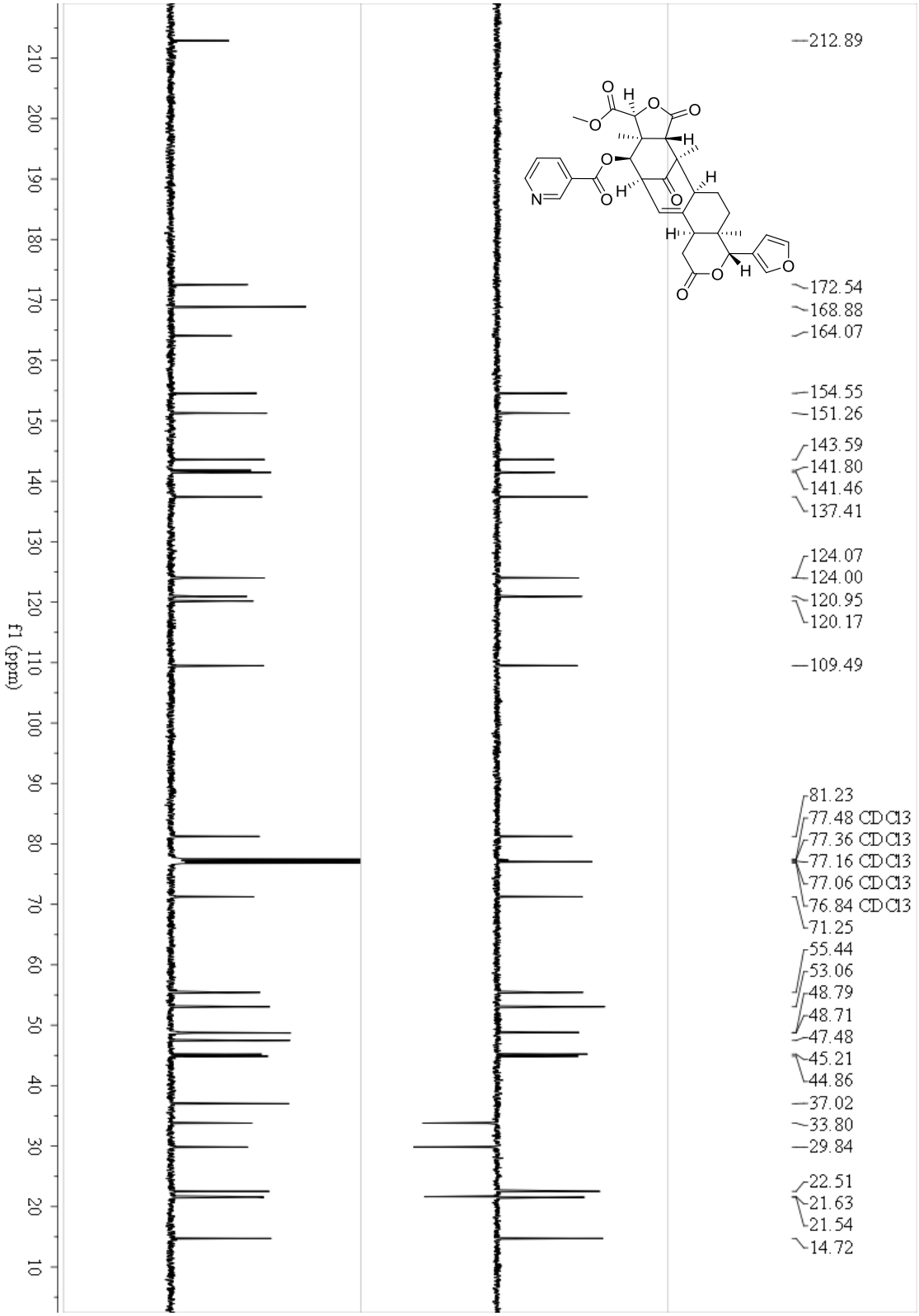

**Figure S3.** HSQC spectrum of triconoid A (**1**) in $CDCl_3$

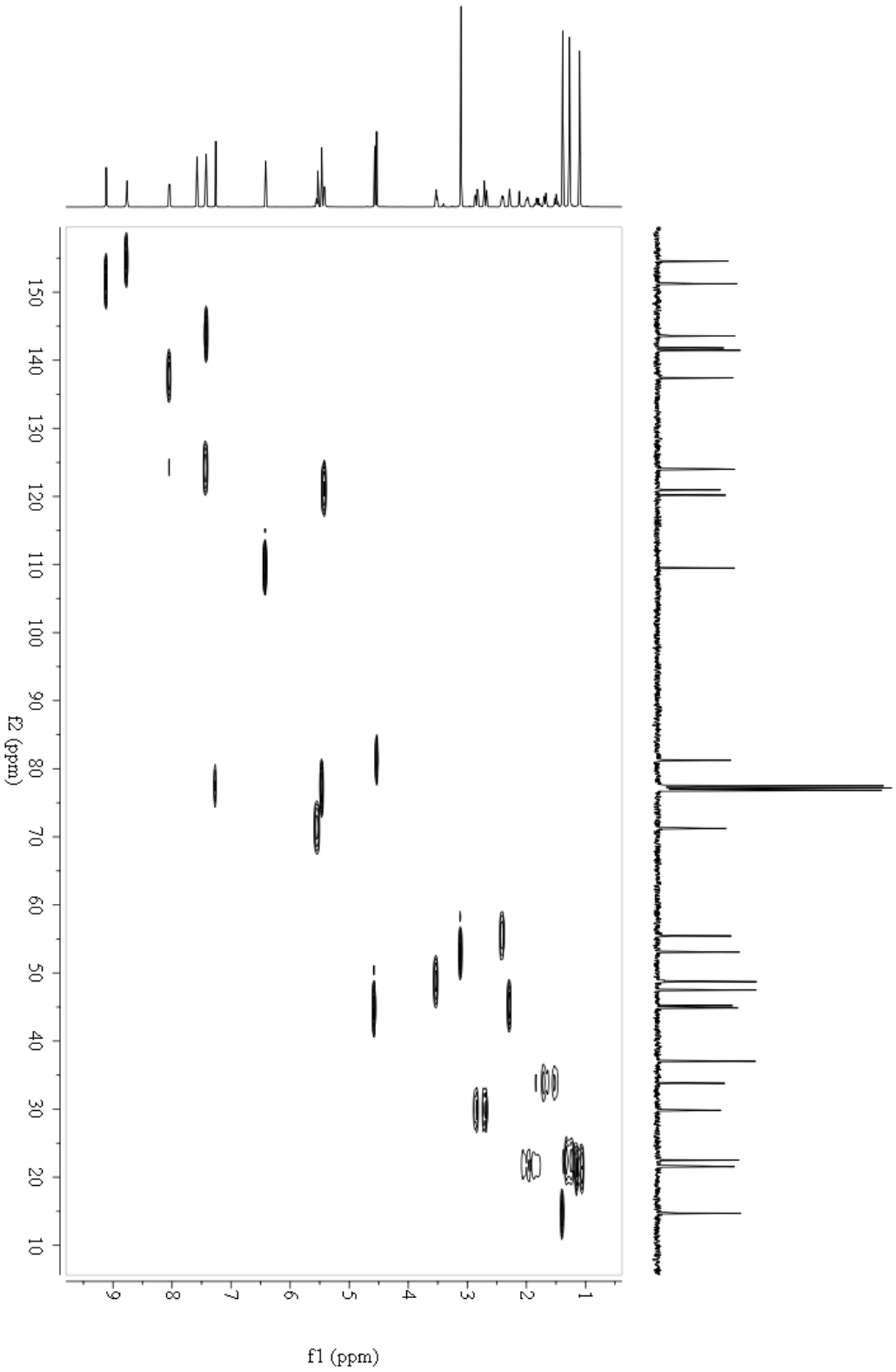

**Figure S4.** HMBC spectrum of triconoid A (**1**) in $CDCl_3$

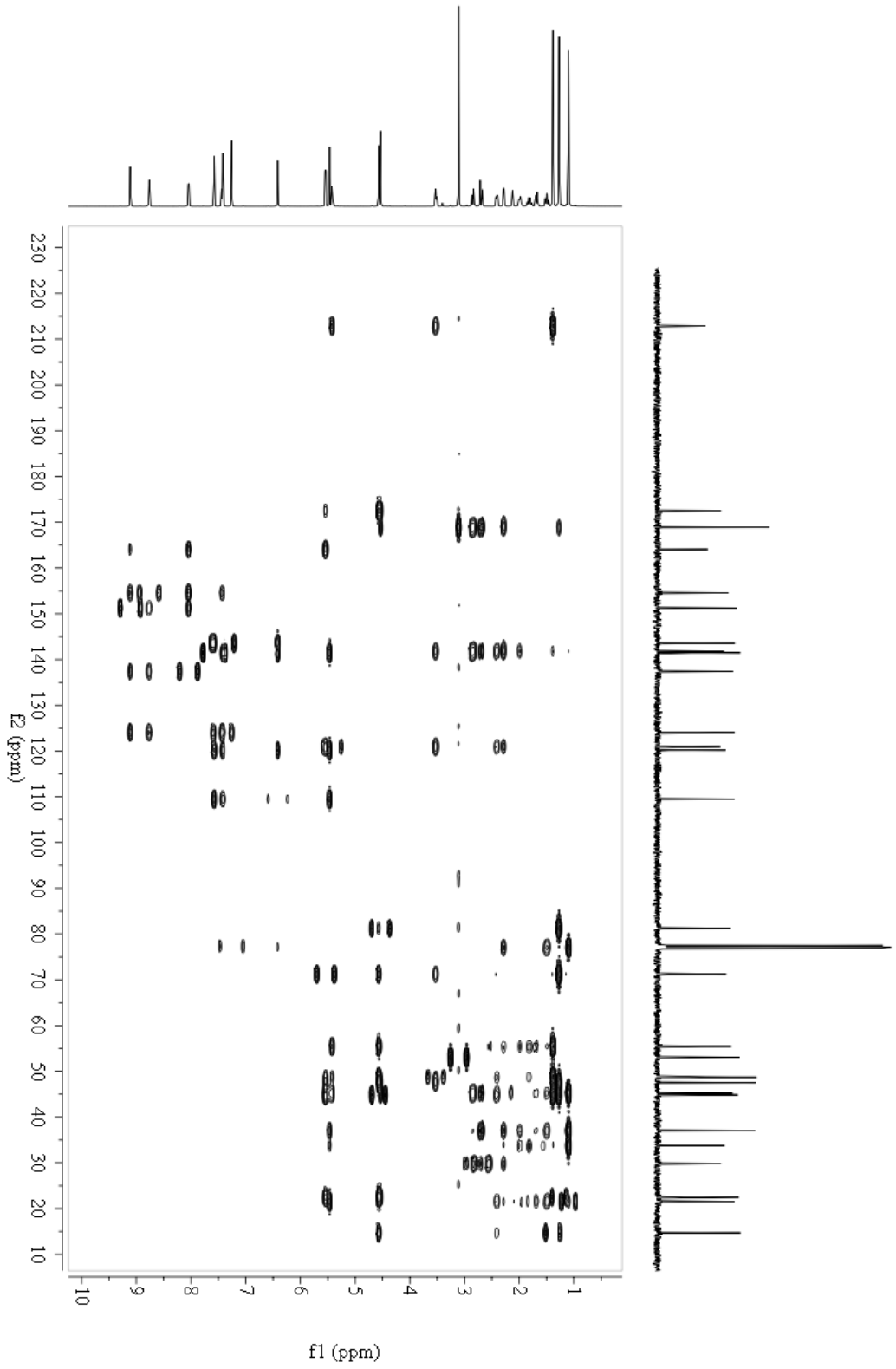

**Figure S5.** $^{1}H$-$^{1}H$ COSY spectrum of walsunoid A (**1**) in $CDCl_3$

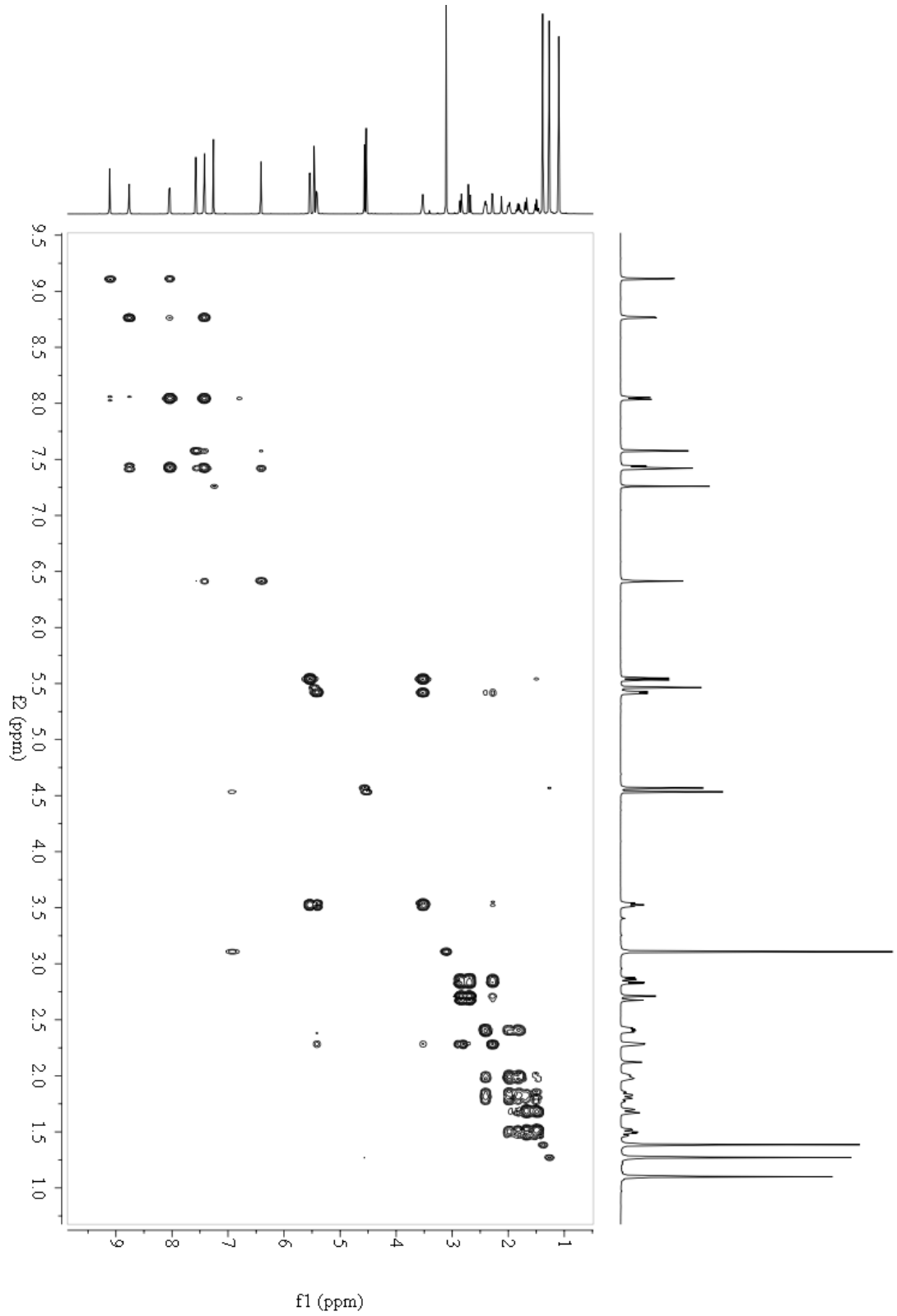

**Figure S6.** NOESY spectrum of triconoid A (**1**) in $CDCl_3$

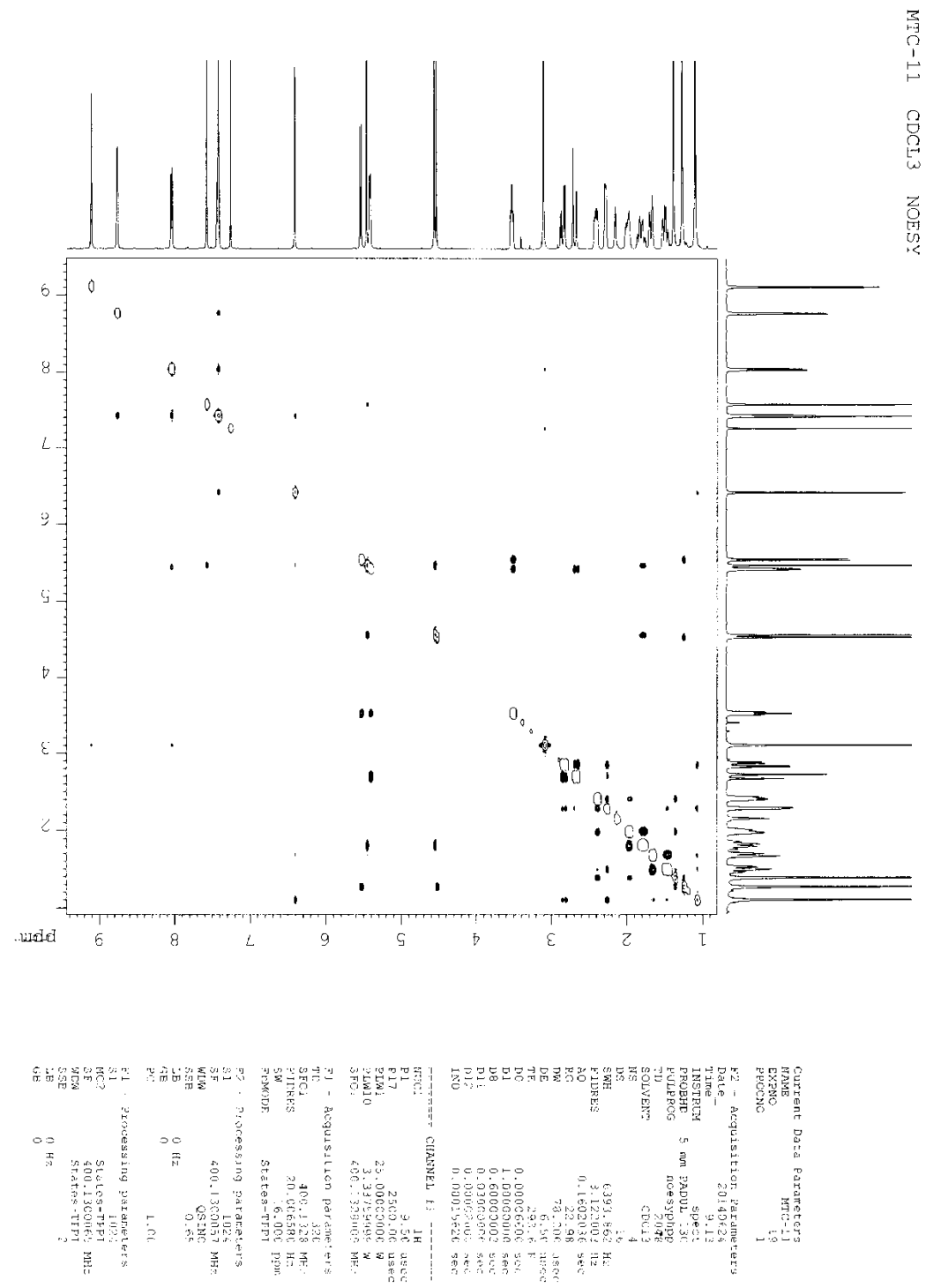

**Figure S7.** ESI(+)MS spectrum of triconoid A (**1**)

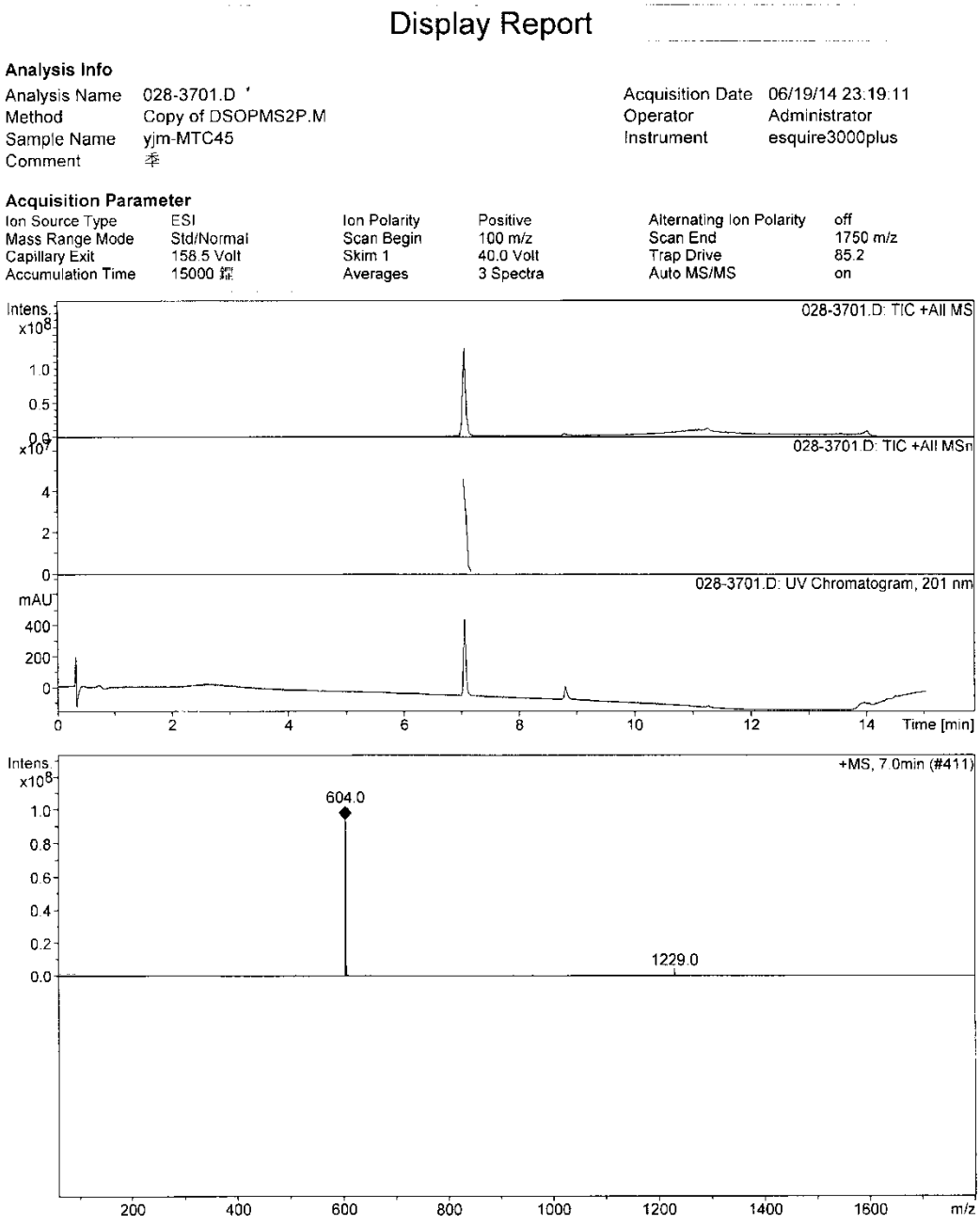

**Figure S8.** HRESI(+)MS spectrum of triconoid A (**1**)

**Elemental Composition Report** **Page 1**

**Single Mass Analysis**
Tolerance = 3.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off
Number of isotope peaks used for i-FIT = 3

Monoisotopic Mass, Even Electron Ions
727 formula(e) evaluated with 1 results within limits (up to 50 closest results for each mass)
Elements Used:
C: 5-80 H: 2-120 N: 0-2 O: 0-20 Na: 0-1

MTC-11 LCT PXE KE324 01-Jul-2014 15:47:41
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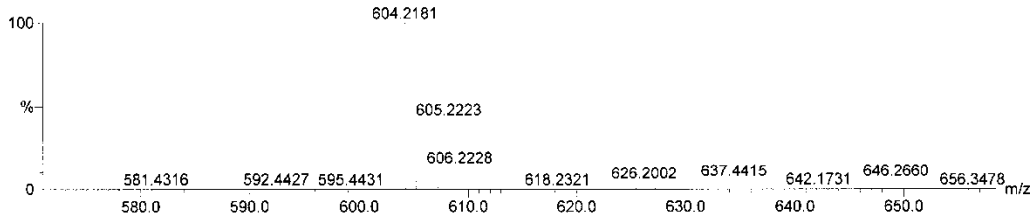



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Minimum: | | | | -1.5 | | | |
| Maximum: | | 5.0 | 3.0 | 50.0 | | | |
| Mass | Calc. Mass | mDa | PPM | DBE | i-FIT | i-FIT (Norm) | Formula |
| 604.2181 | 604.2183 | -0.2 | -0.3 | 17.5 | 125.9 | 0.0 | C33 H34 N O10 |

**Figure S9.** IR spectrum of triconoid A (**1**)

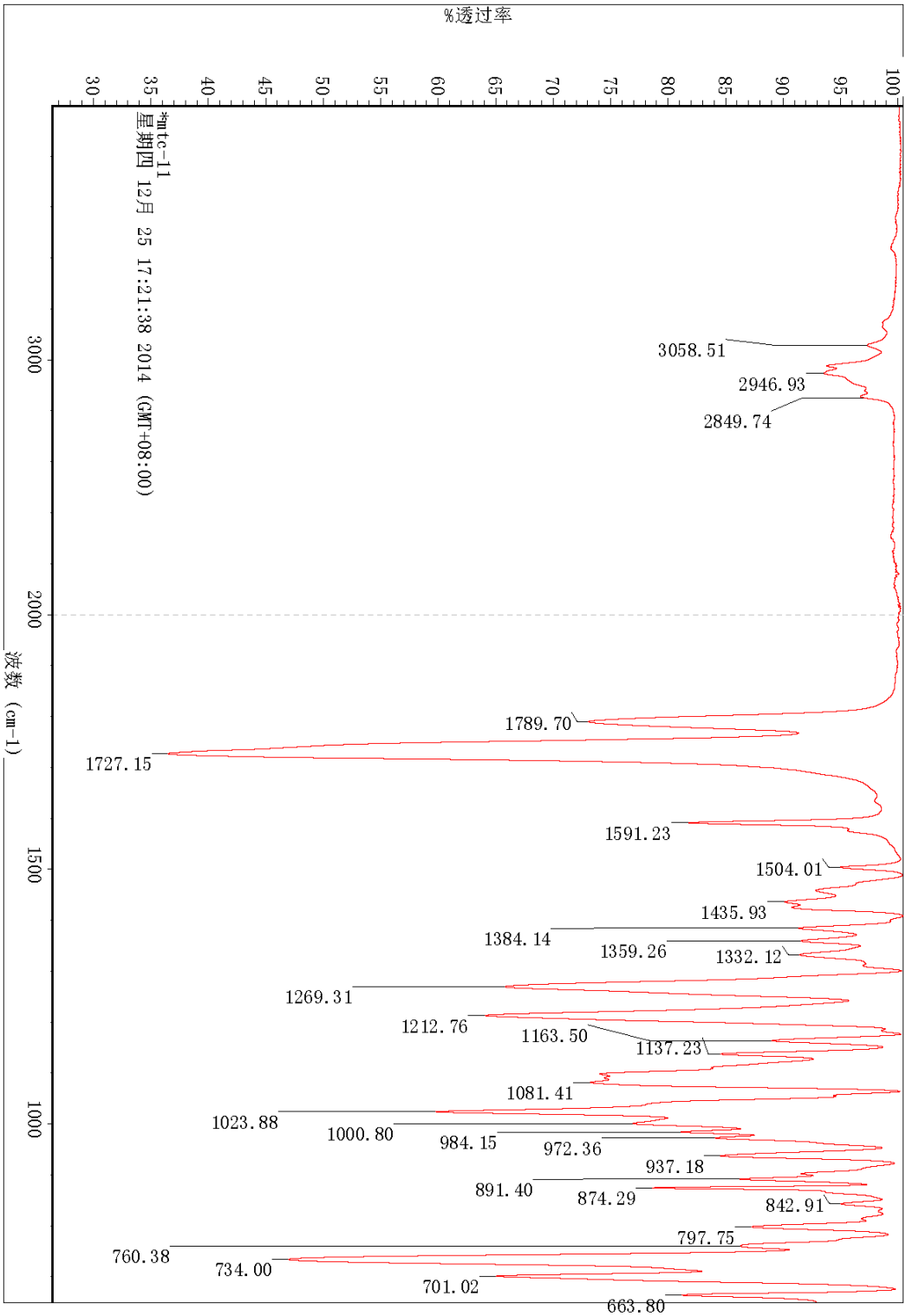


**Figure S10.** $^{1}$H NMR spectrum of triconoid B (**2**) in $CDCl_3$

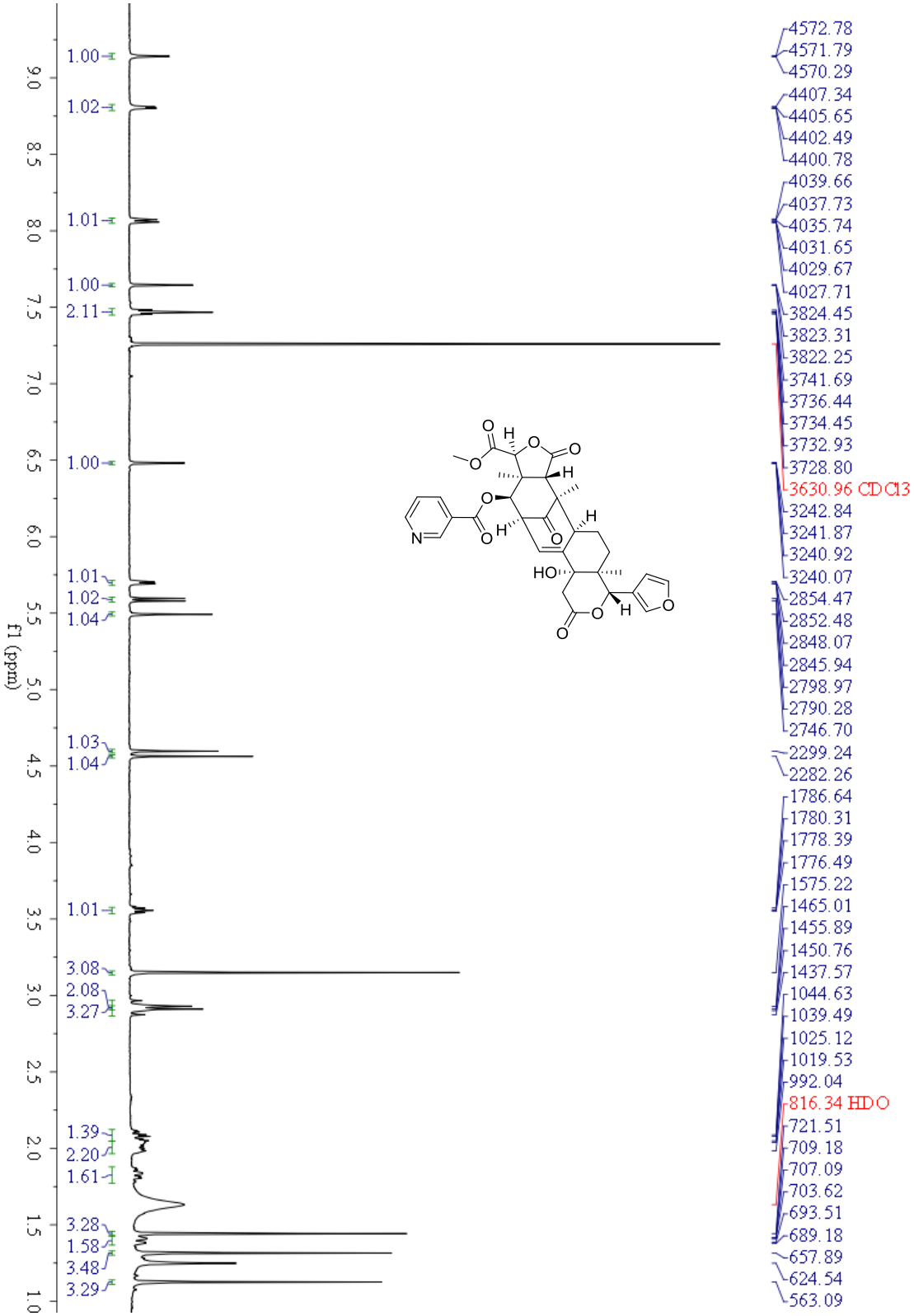


**Figure S11.** $^{13}C$ NMR spectrum of triconoid B (**2**) in $CDCl_3$

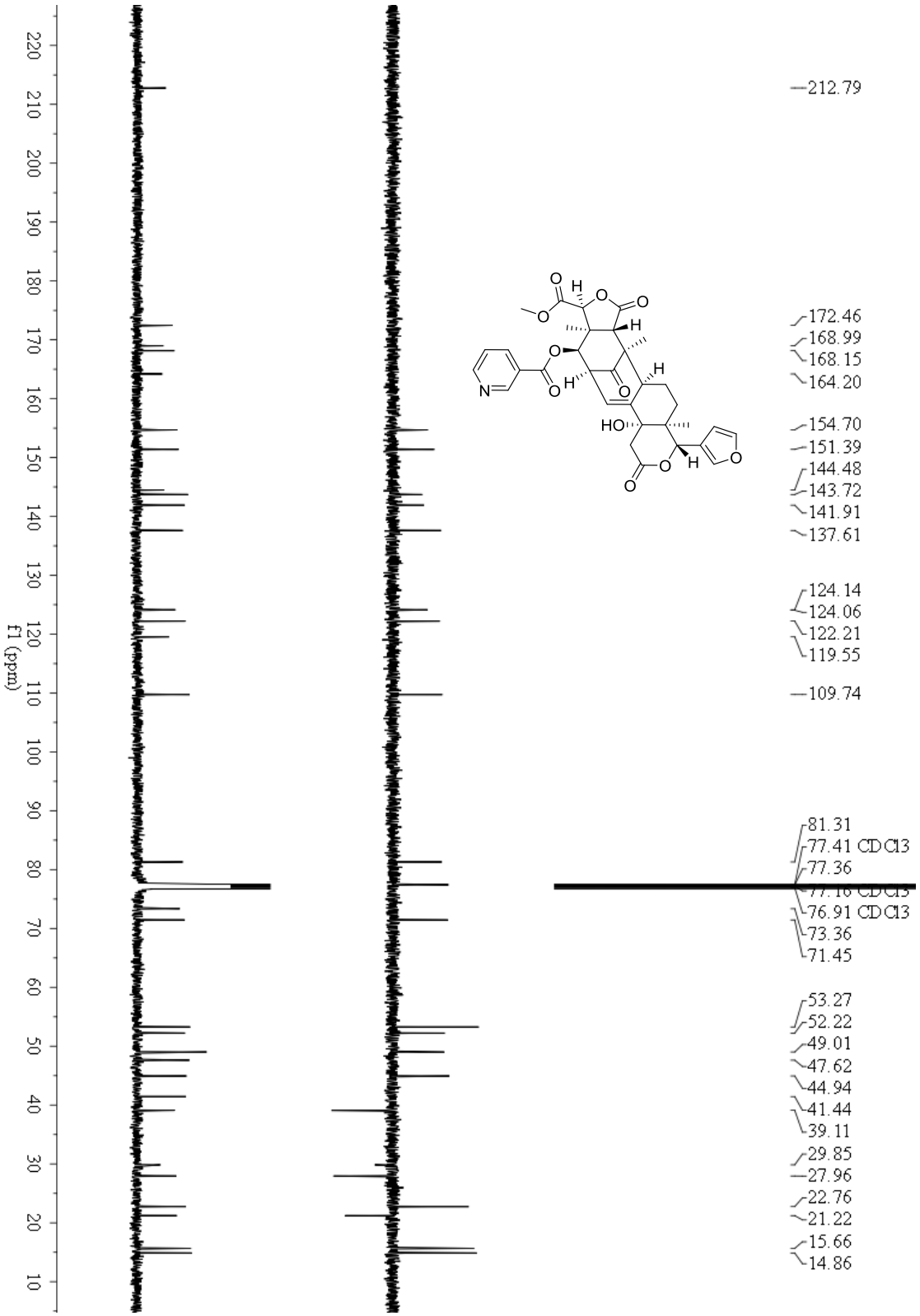


**Figure S12.** HSQC spectrum of triconoid B (**2**) in $CDCl_3$

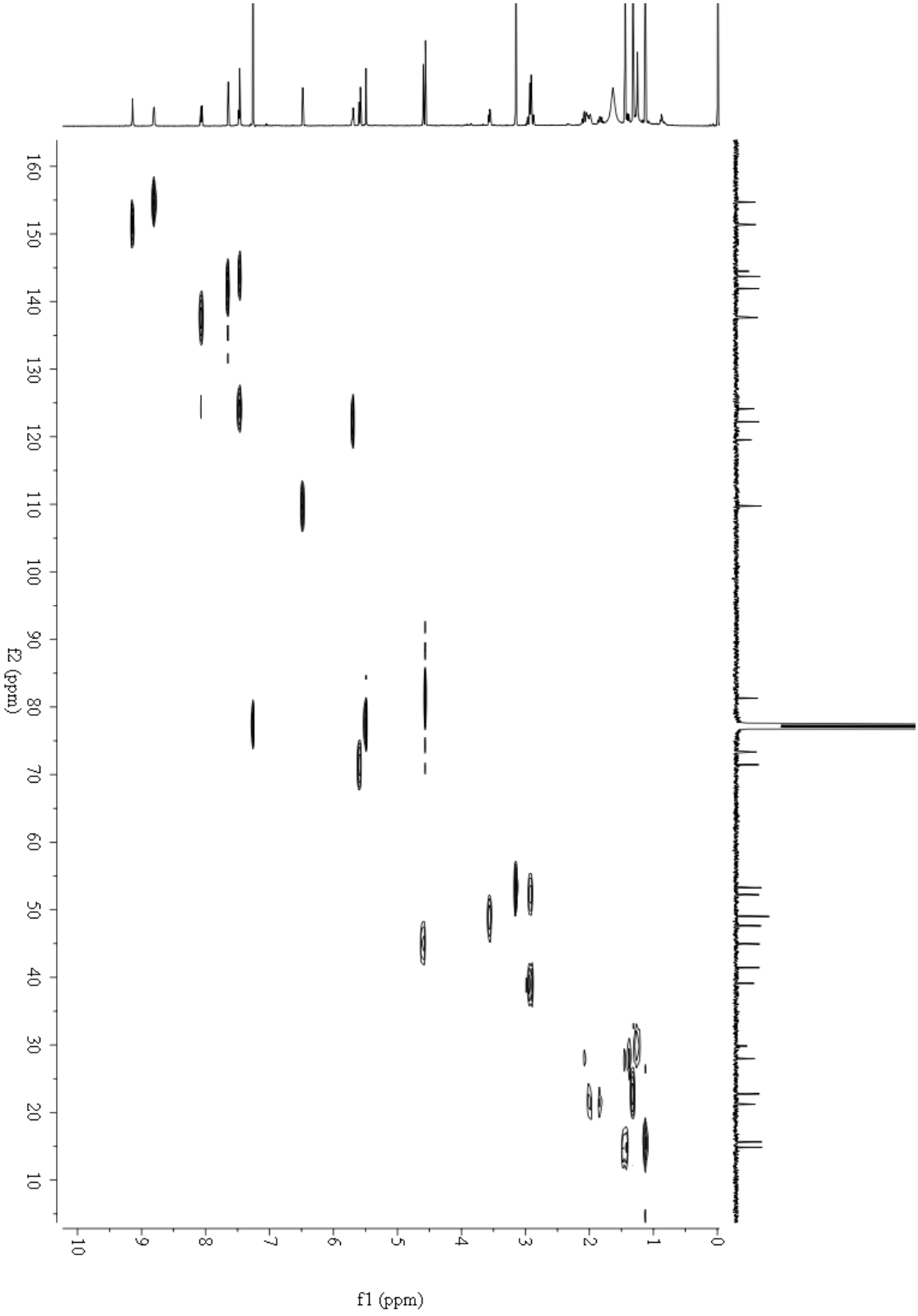


**Figure S13.** HMBC spectrum of triconoid B (**2**) in $CDCl_3$

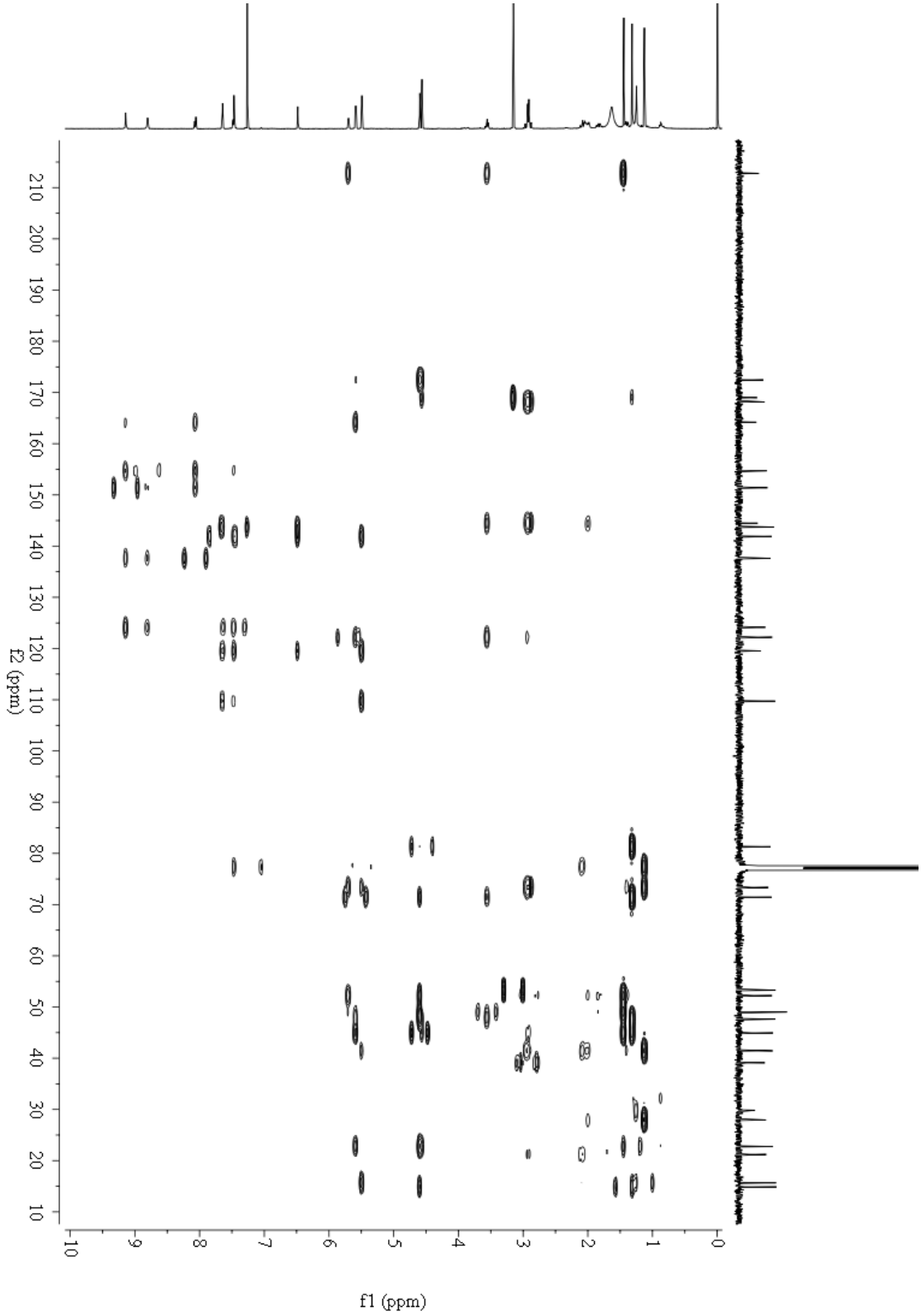


**Figure S14.** $^{1}H$-$^{1}H$ COSY spectrum of triconoid B (**2**) in $CDCl_3$

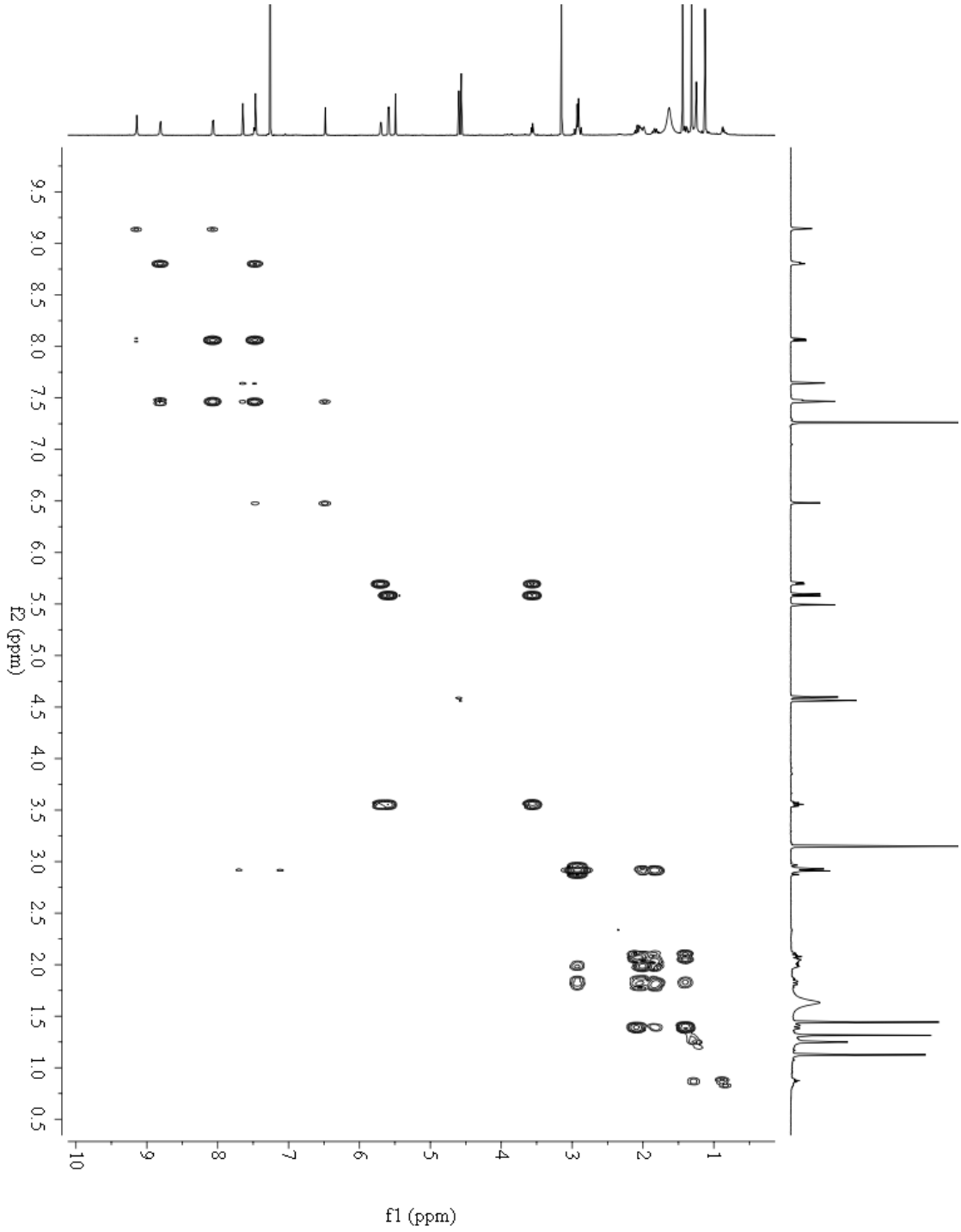


**Figure S15.** NOESY spectrum of triconoid B (**2**) in $CDCl_3$

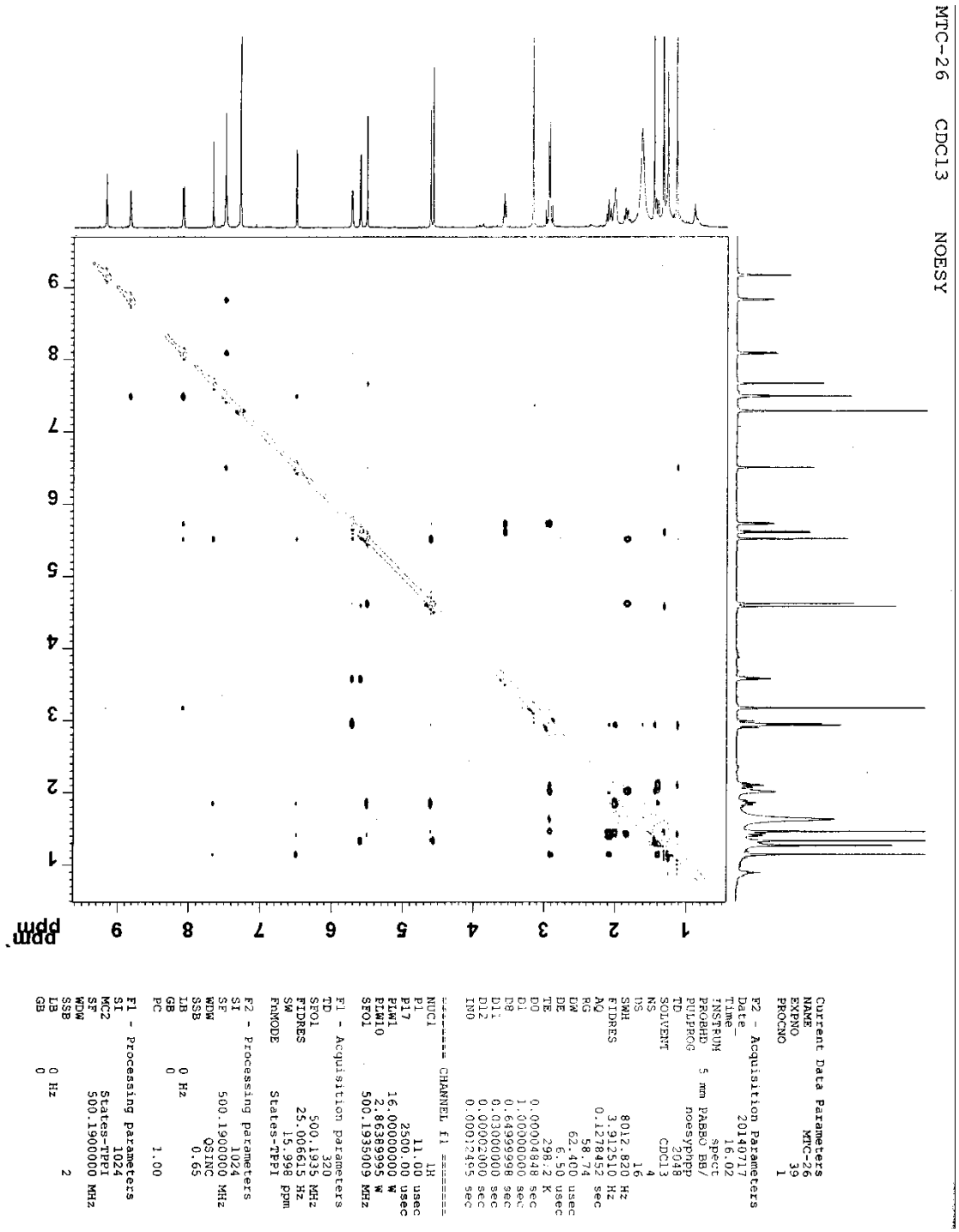


**Figure S16.** ESI(+)MS spectrum of triconoid B (**2**)

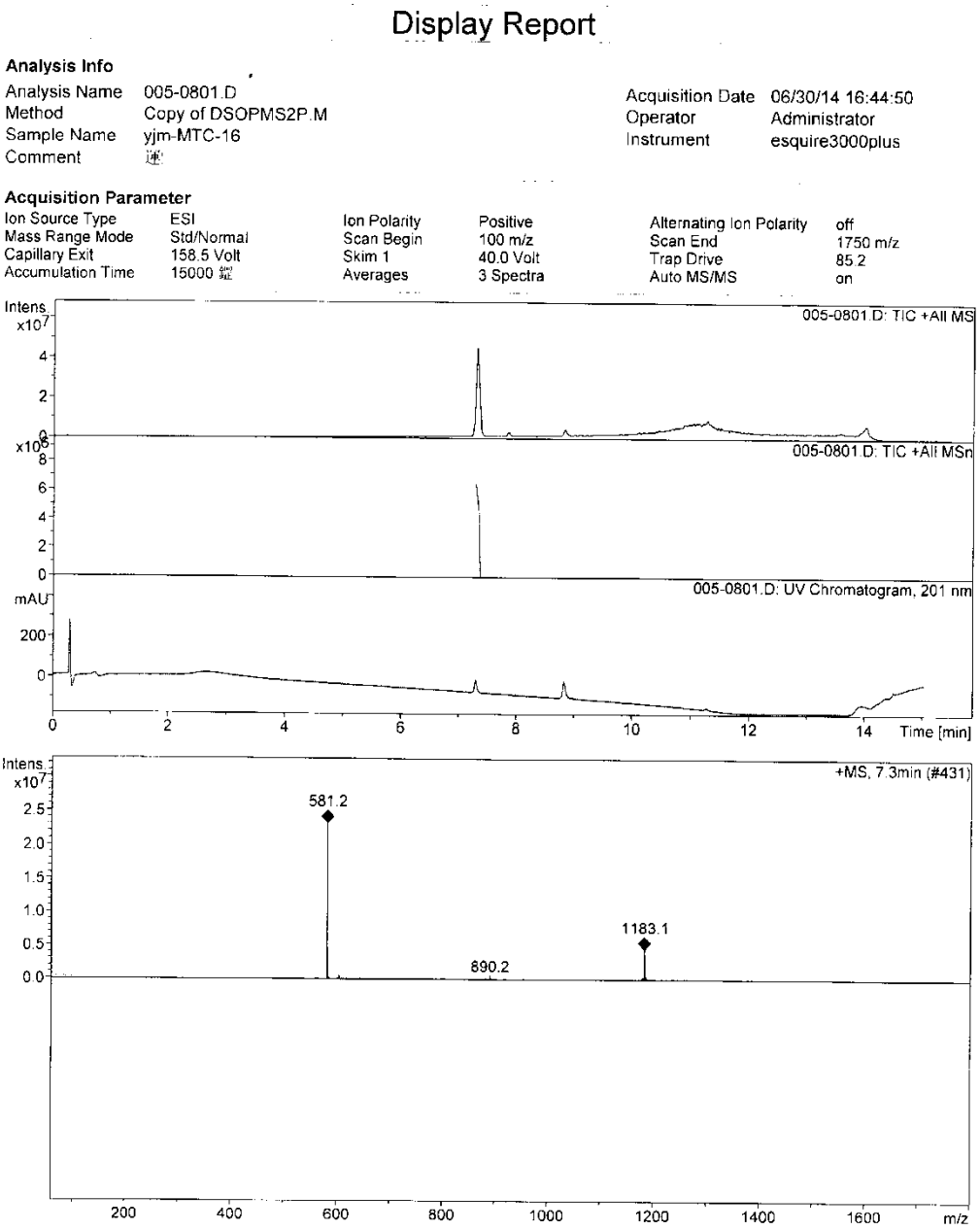


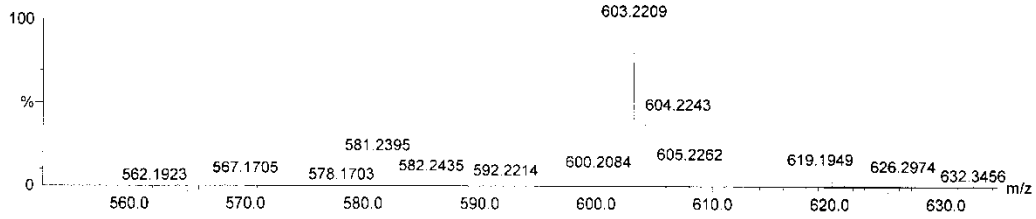
**Figure S17.** HRESI(+)MS spectrum of triconoid B (**2**)

**Elemental Composition Report** **Page 1**

**Single Mass Analysis**
Tolerance = 3.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off
Number of isotope peaks used for i-FIT = 3

Monoisotopic Mass, Even Electron Ions
245 formula(e) evaluated with 1 results within limits (up to 50 closest results for each mass)
Elements Used:
C: 5-80 H: 2-120 O: 0-20 Na: 0-1

MTC-16 LCT PXE KE324 01-Jul-2014 16:05:57
MTC-16_0701 33 (0.725) AM2 (Ar,10000.0,0.00,1.00); ABS; Cm (29:44) 1: TOF MS ES+ 2.11e+004




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Minimum: | | | | -1.5 | | | |
| Maximum: | | 5.0 | 3.0 | 50.0 | | | |
| Mass | Calc. Mass | mDa | PPM | DBE | i-FIT | i-FIT (Norm) | Formula |
| 603.2209 | 603.2206 | 0.3 | 0.5 | 14.5 | 97.6 | 0.0 | C32 H36 O10 Na |

**Figure S18.** IR spectrum of triconoid B (**2**)

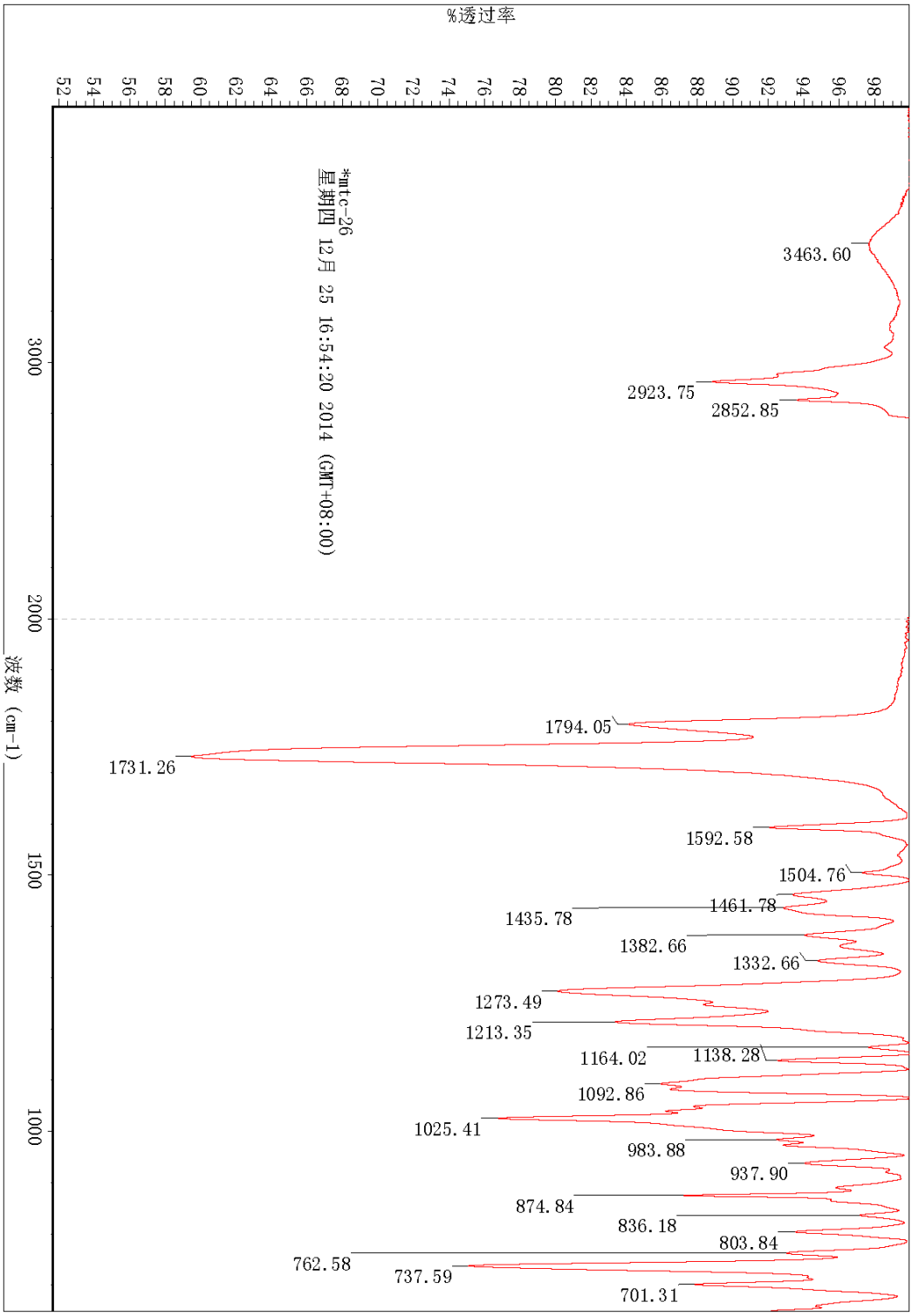


**Figure S19.** $^{1}$H NMR spectrum of triconoid C (**3**) in $CDCl_3$

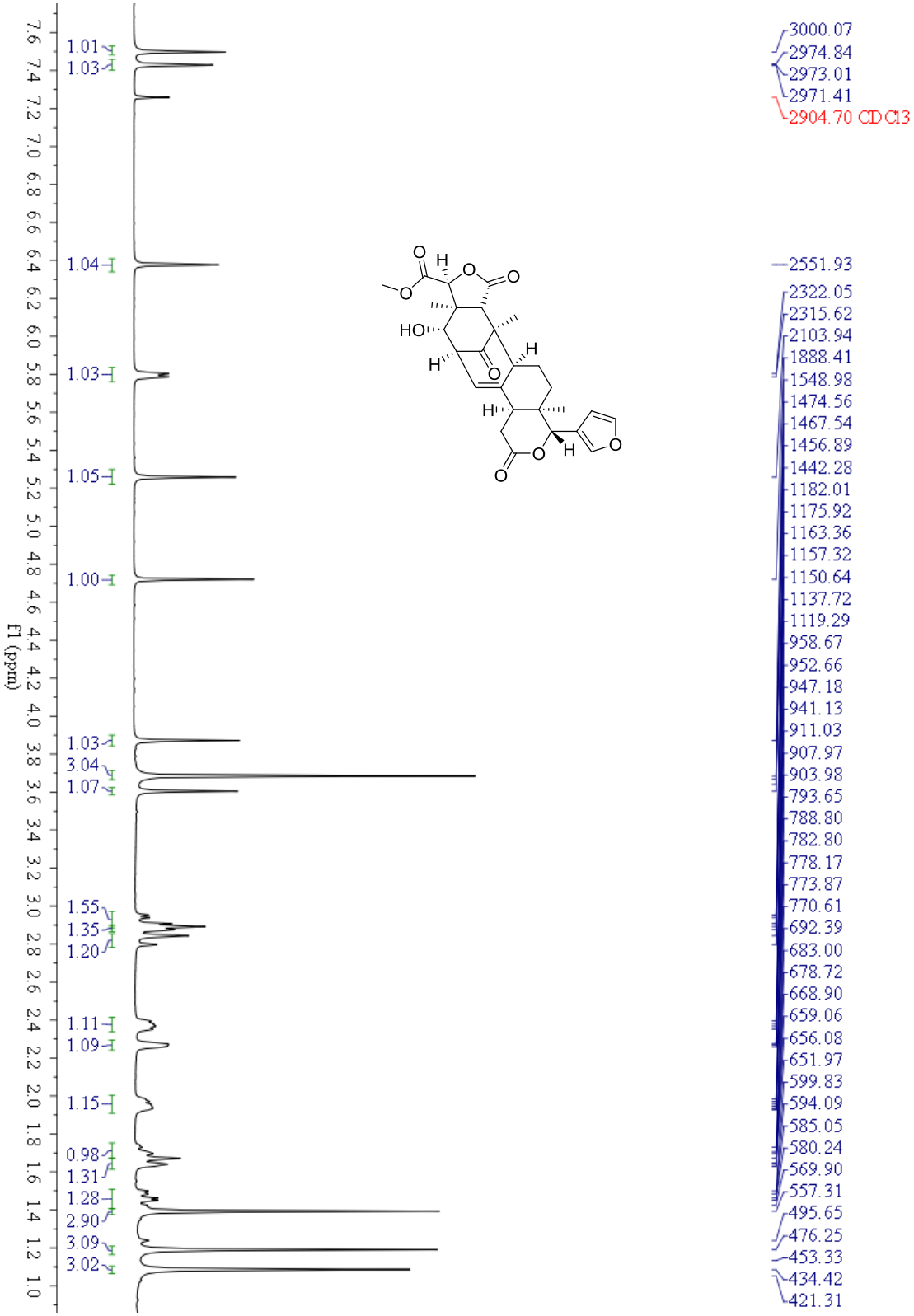


**Figure S20.** $^{13}C$ NMR spectrum of triconoid C (**3**) in $CDCl_3$

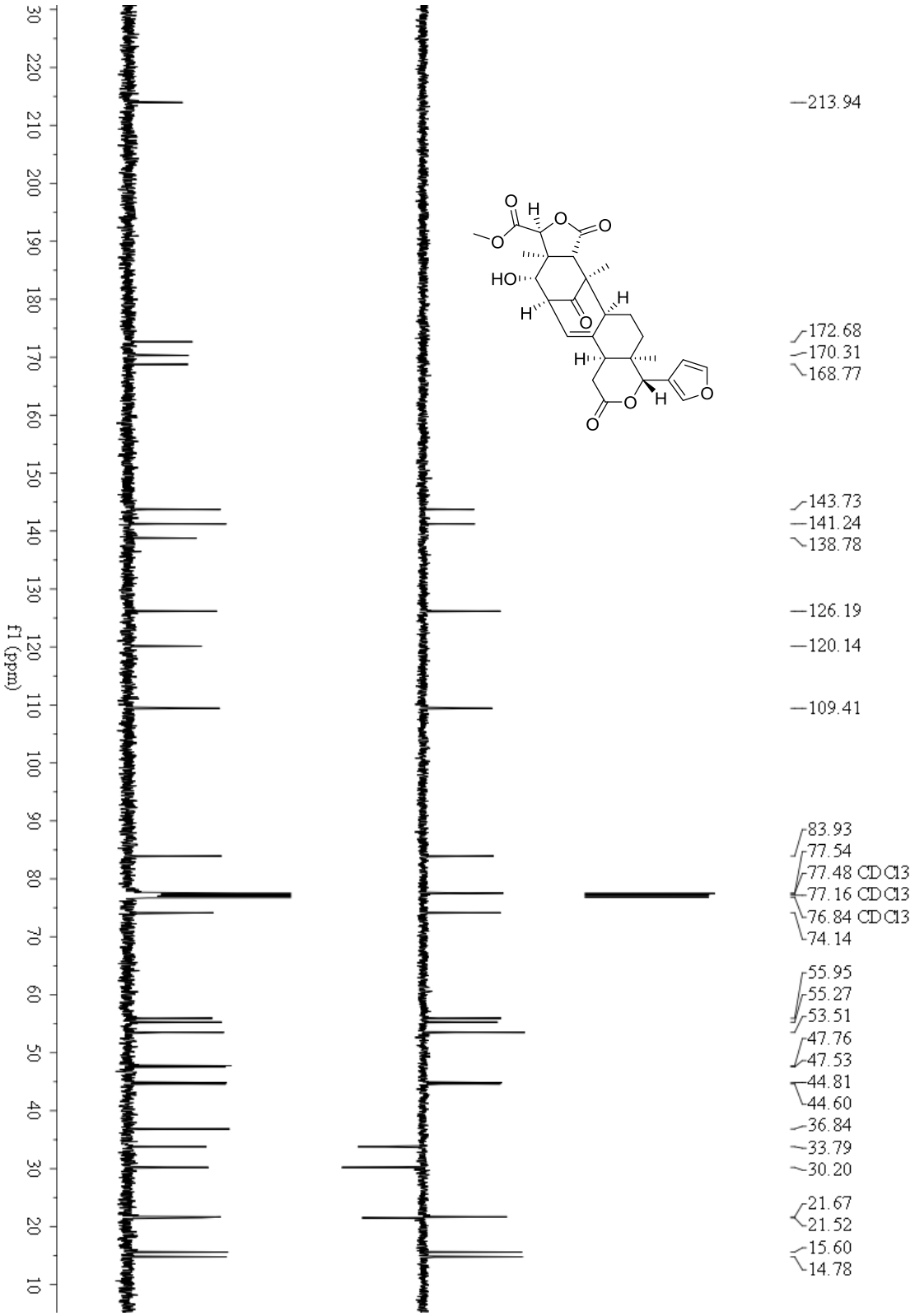


**Figure S21.** HSQC spectrum of triconoid C (**3**) in $CDCl_3$

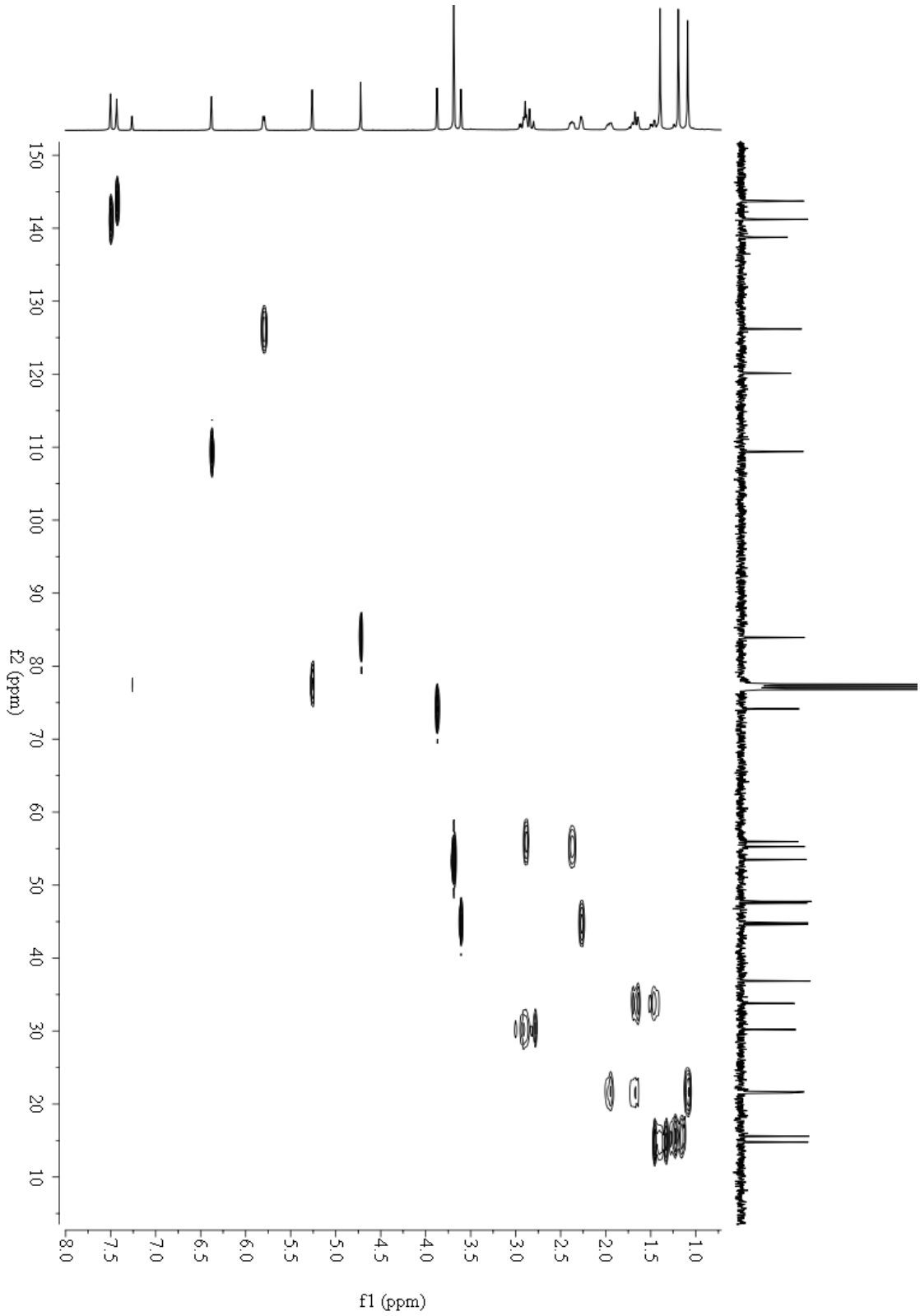


**Figure S22.** HMBC spectrum of triconoid C (**3**) in $CDCl_3$

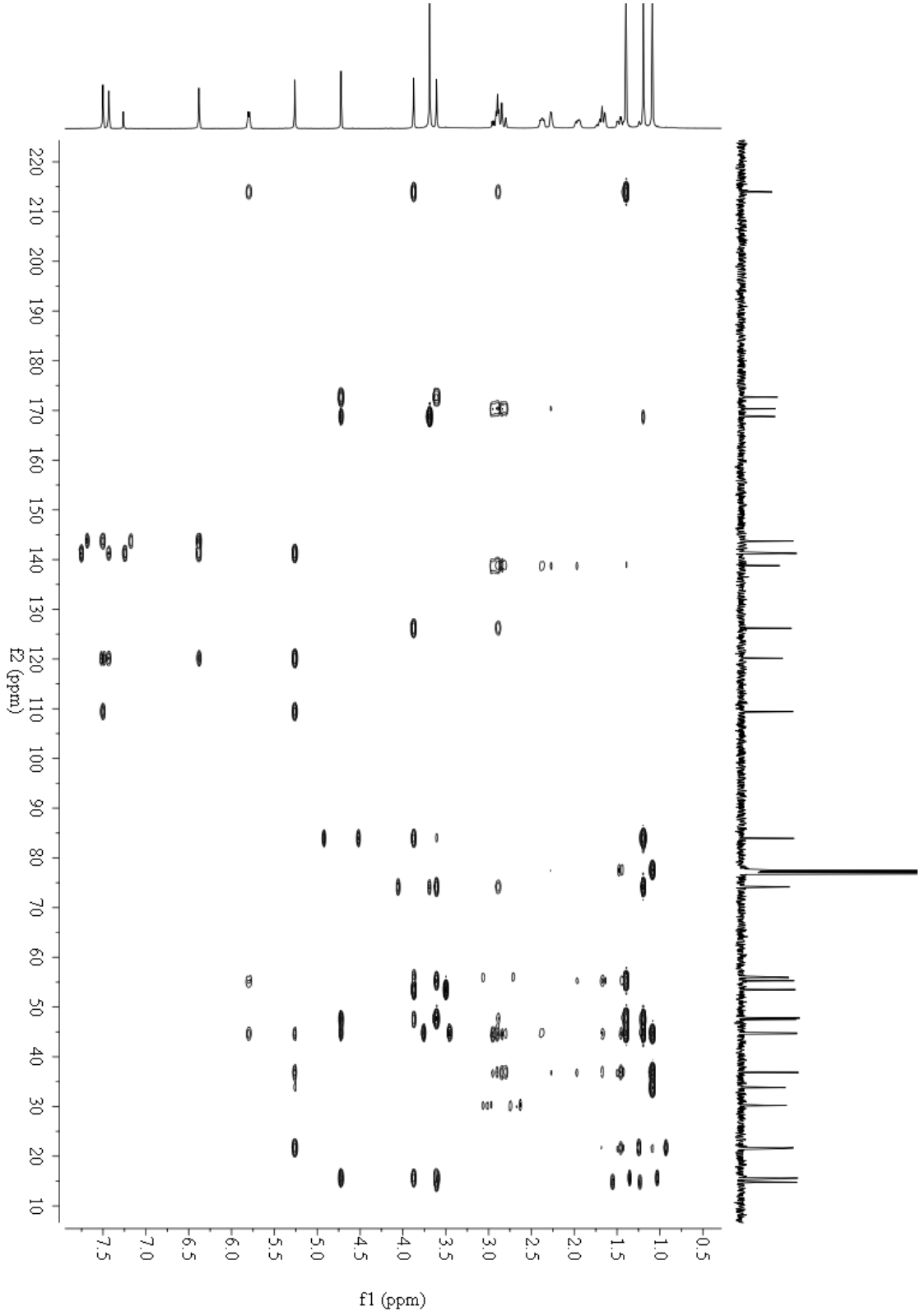


**Figure S23.** $^{1}H$-$^{1}H$ COSY spectrum of triconoid C (**3**) in $CDCl_3$

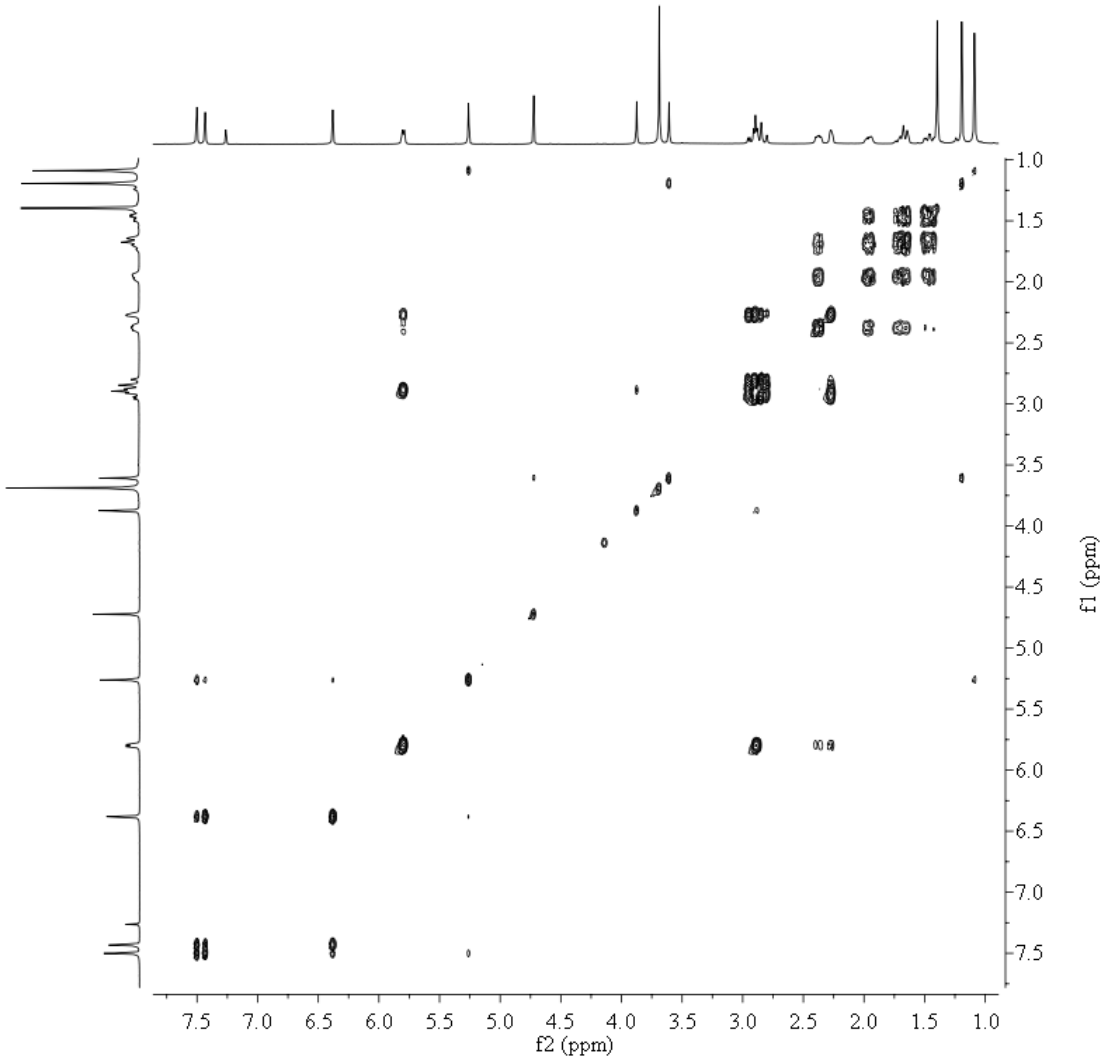


**Figure S24.** NOESY spectrum of triconoid C (**3**) in $CDCl_3$

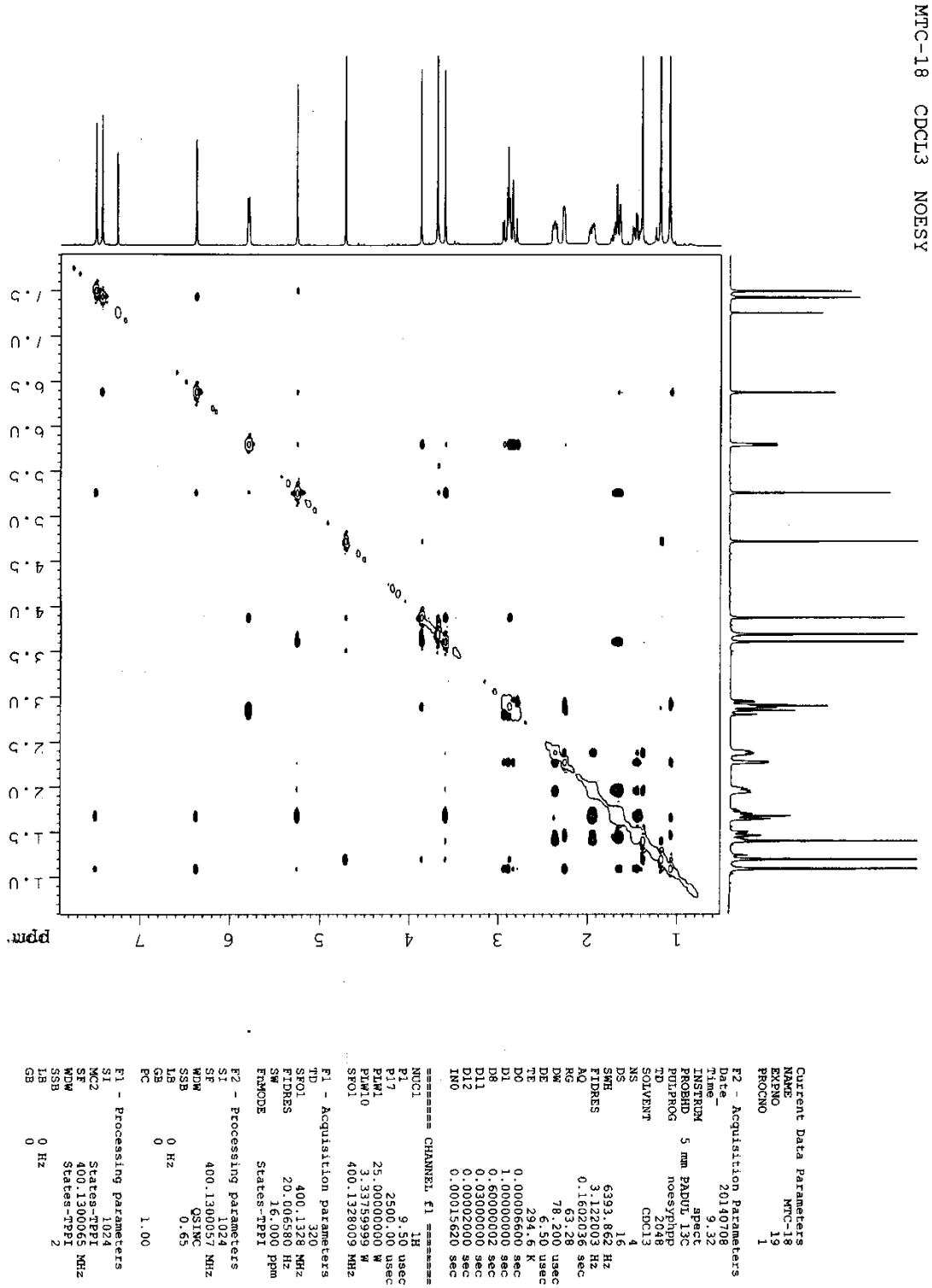


**Figure S25.** ESI(+)MS spectrum of triconoid C (**3**)

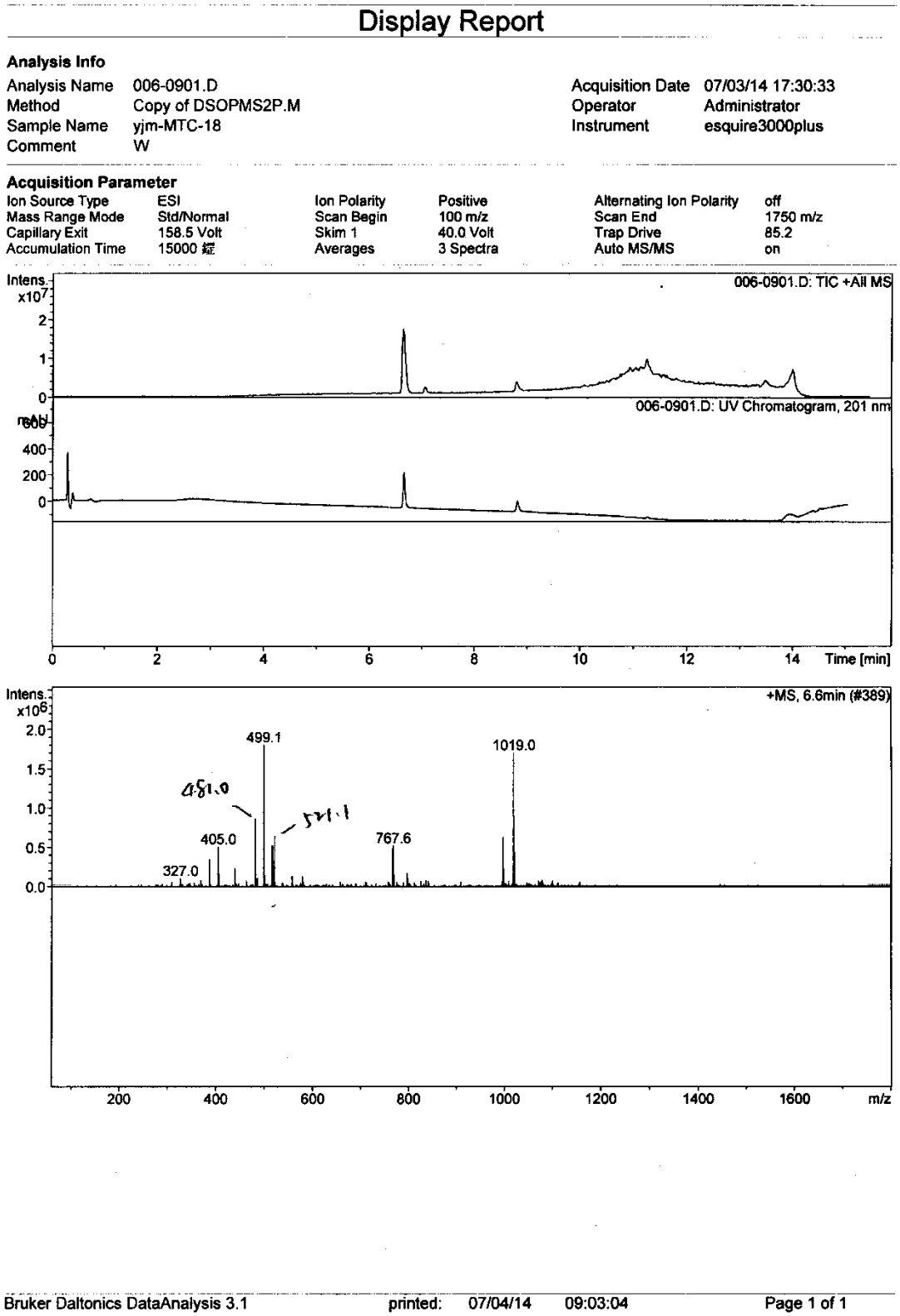


**Figure S26.** ESI(–)MS spectrum of triconoid C (**3**)

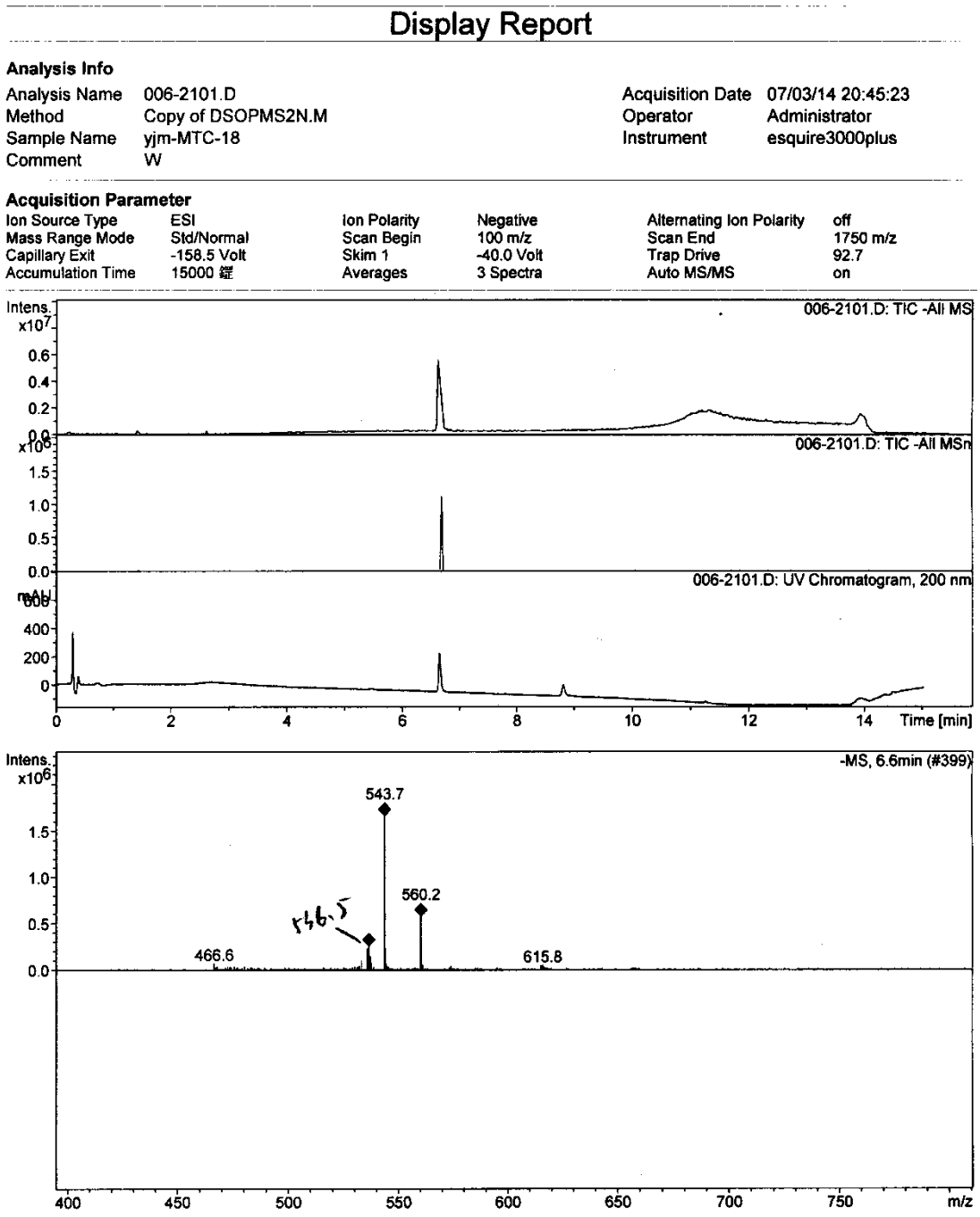


**Figure S27.** HRESI(–)MS spectrum of triconoid C (**3**)

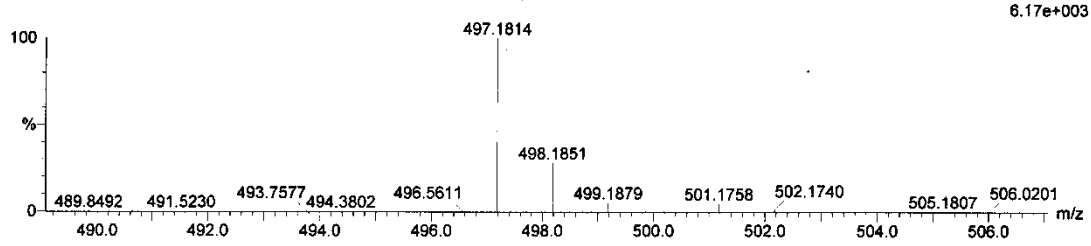
**Elemental Composition Report** **Page 1**

**Single Mass Analysis**
Tolerance = 3.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off
Number of isotope peaks used for i-FIT = 3

Monoisotopic Mass, Even Electron Ions
97 formula(e) evaluated with 1 results within limits (up to 50 closest results for each mass)
Elements Used:
C: 5-80 H: 2-120 O: 0-20

MTC-18 LCT PXE KE324 27-Aug-2014 10:27:46

MTC-18_0827 13 (0.284) AM2 (Ar,10000.0,0.00,1.00); ABS; Cm (7:13) 1: TOF MS ES- 6.17e+003




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Minimum: | | | | -1.5 | | | |
| Maximum: | | 5.0 | 3.0 | 50.0 | | | |
| Mass | Calc. Mass | mDa | PPM | DBE | i-FIT | i-FIT (Norm) | Formula |
| 497.1814 | 497.1812 | 0.2 | 0.4 | 13.5 | 85.3 | 0.0 | C27 H29 O9 |

**Figure S28.** IR spectrum of triconoid C (**3**)

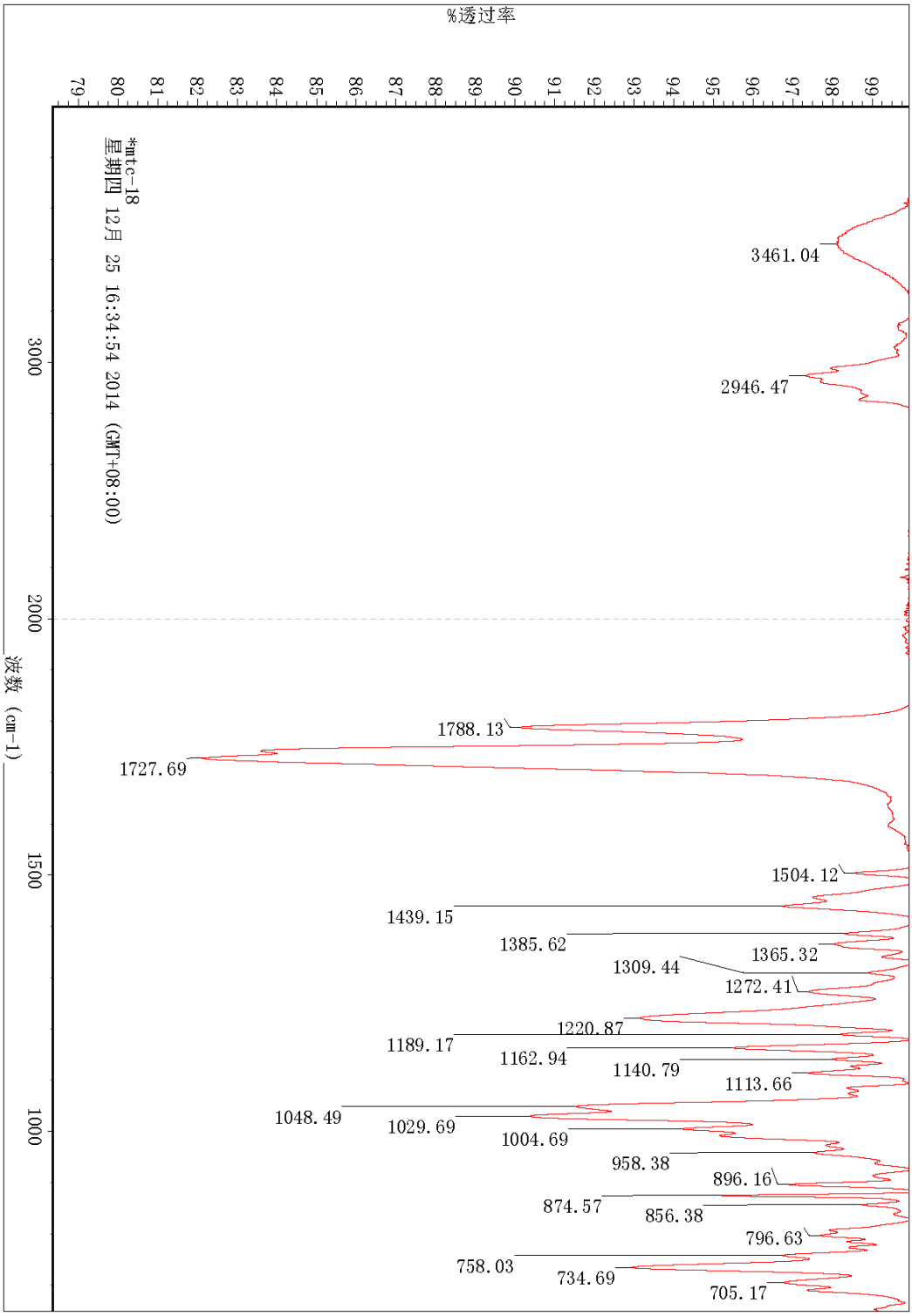


**Figure S29.** $^{1}$H NMR spectrum of triconoid D (**4**) in $CDCl_3$

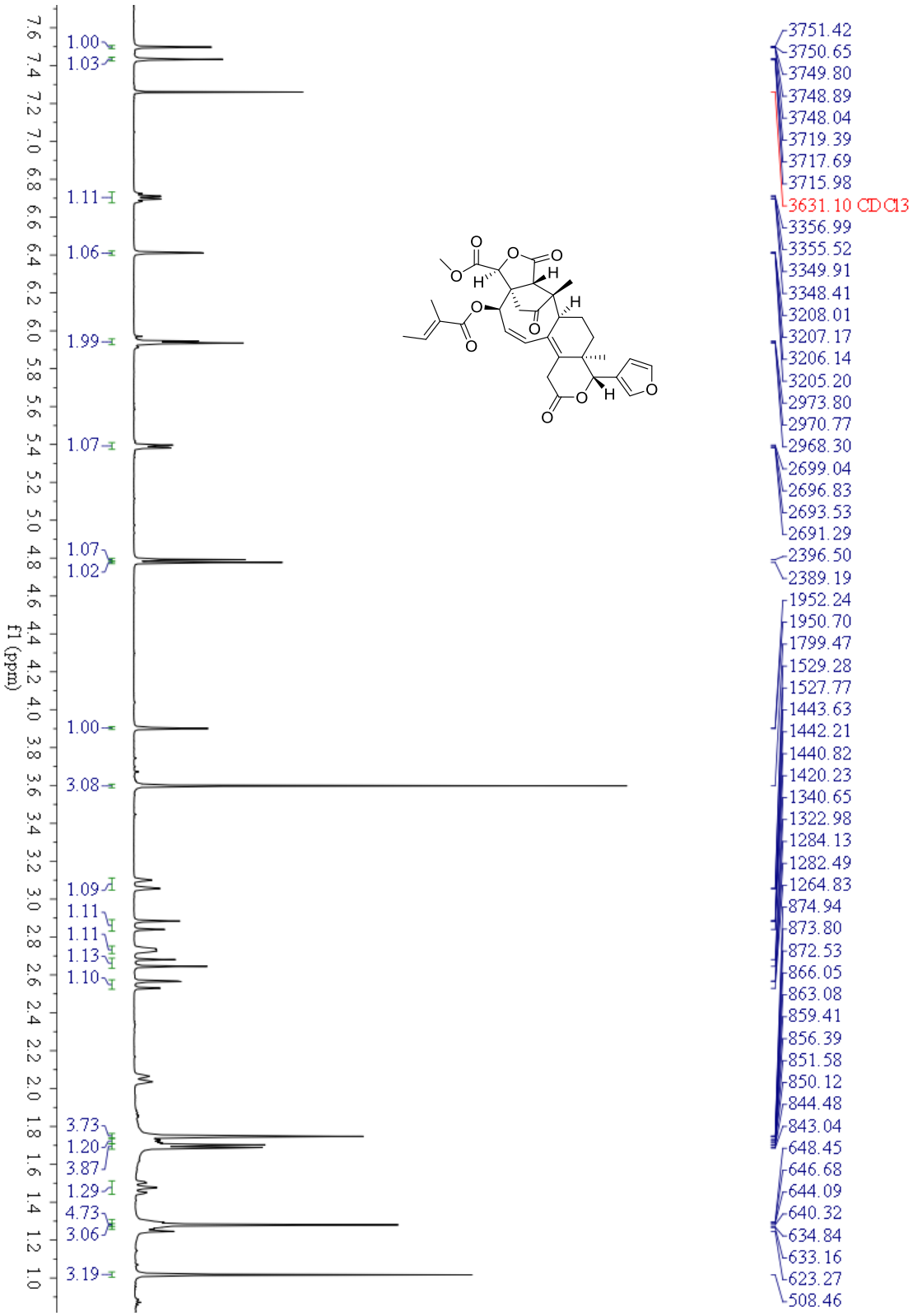


**Figure S30.** $^{13}C$ NMR spectrum of triconoid D (**4**) in $CDCl_3$

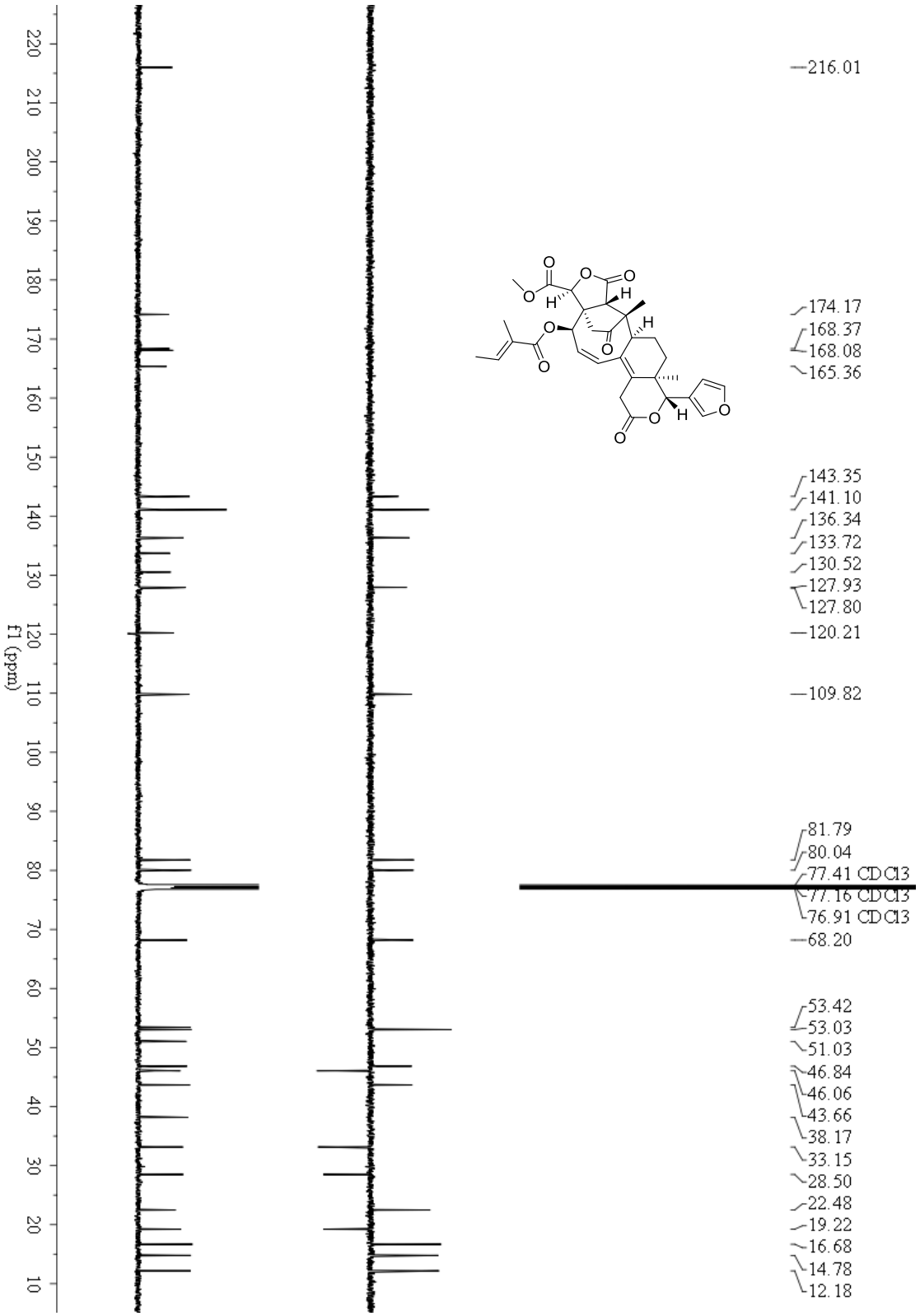


**Figure S31.** HSQC spectrum of triconoid D (**4**) in $CDCl_3$

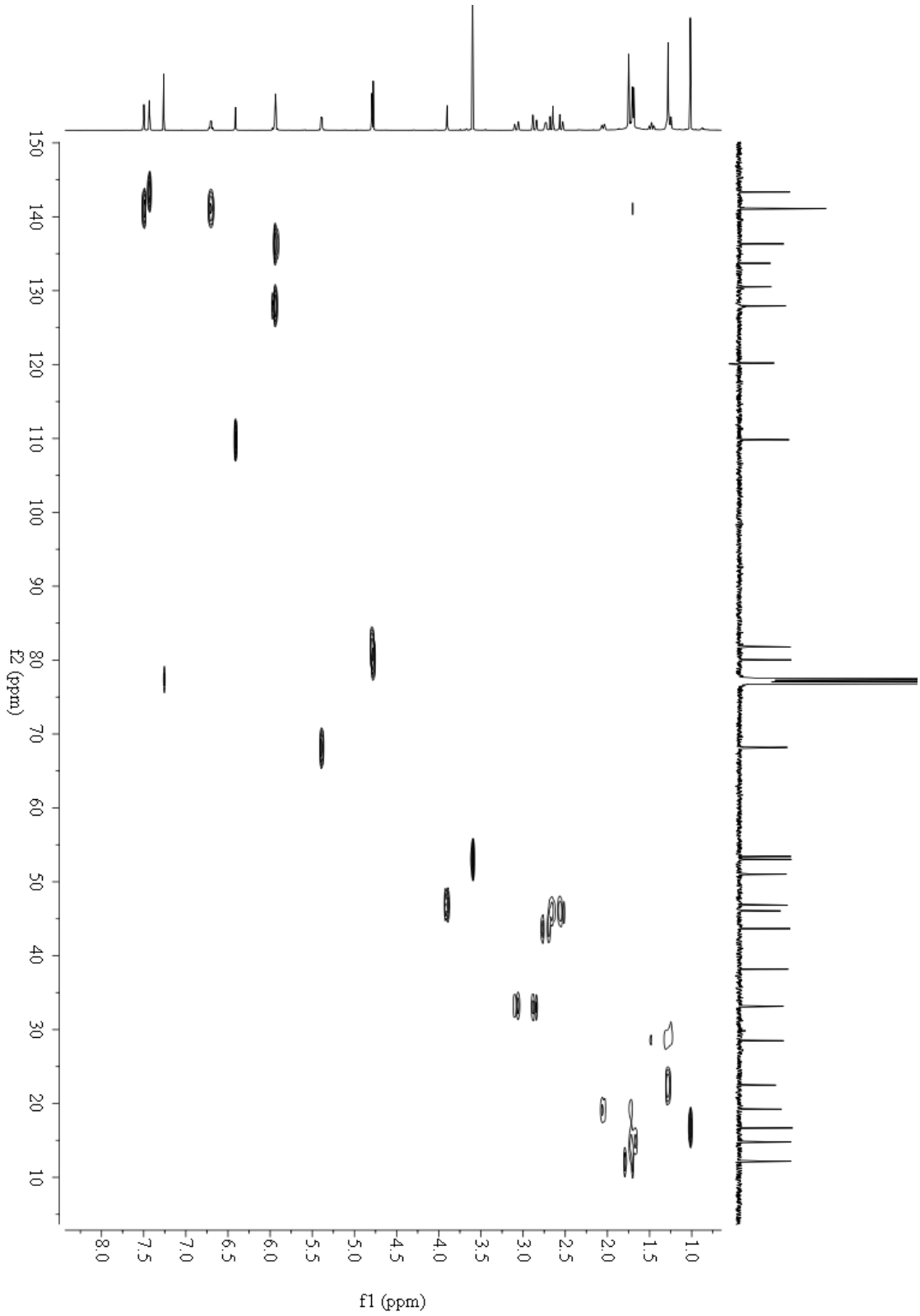


**Figure S32.** HMBC spectrum of triconoid D (**4**) in $CDCl_3$

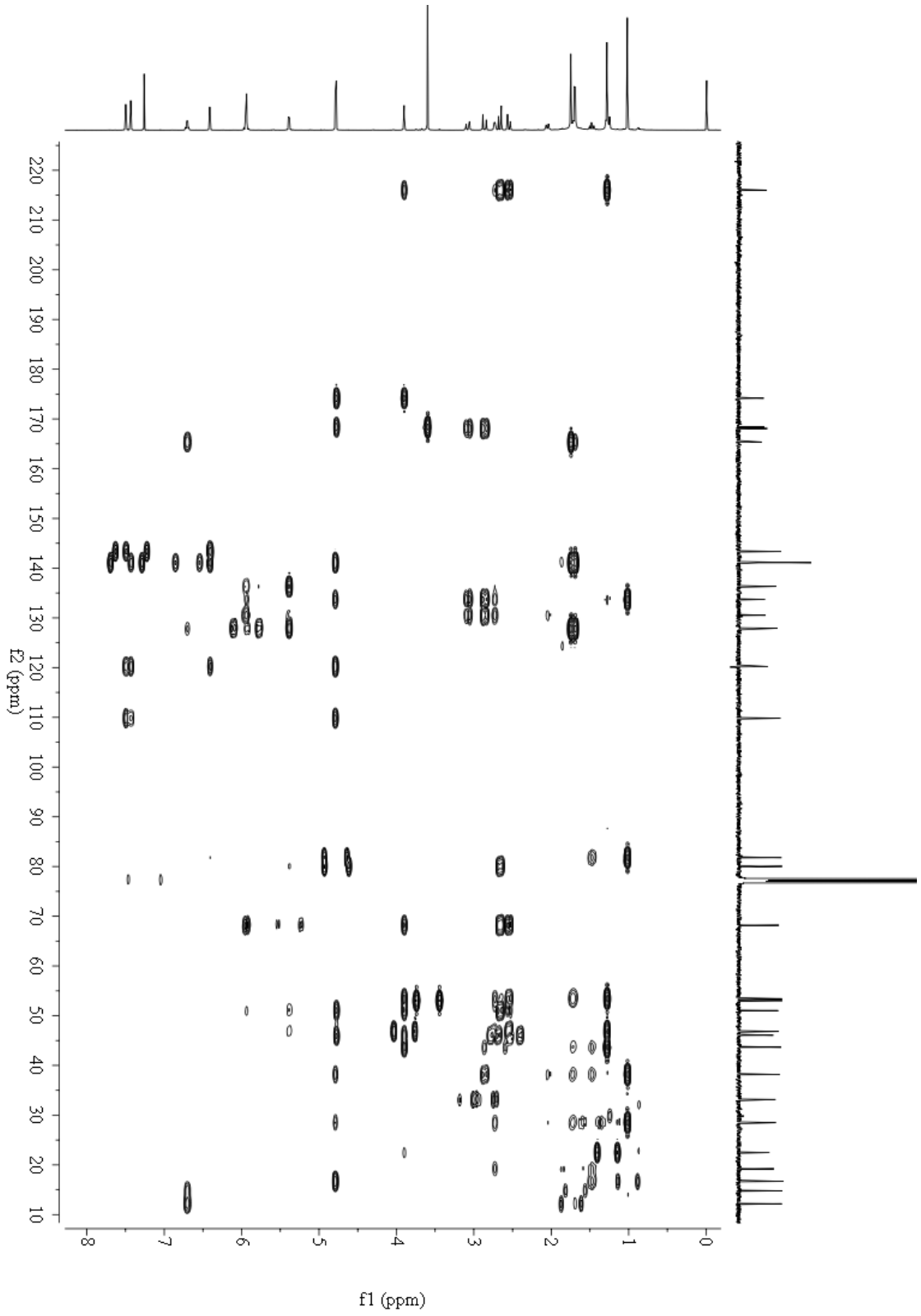


**Figure S33.** $^{1}H$-$^{1}H$ COSY spectrum of triconoid D (**4**) in $CDCl_3$

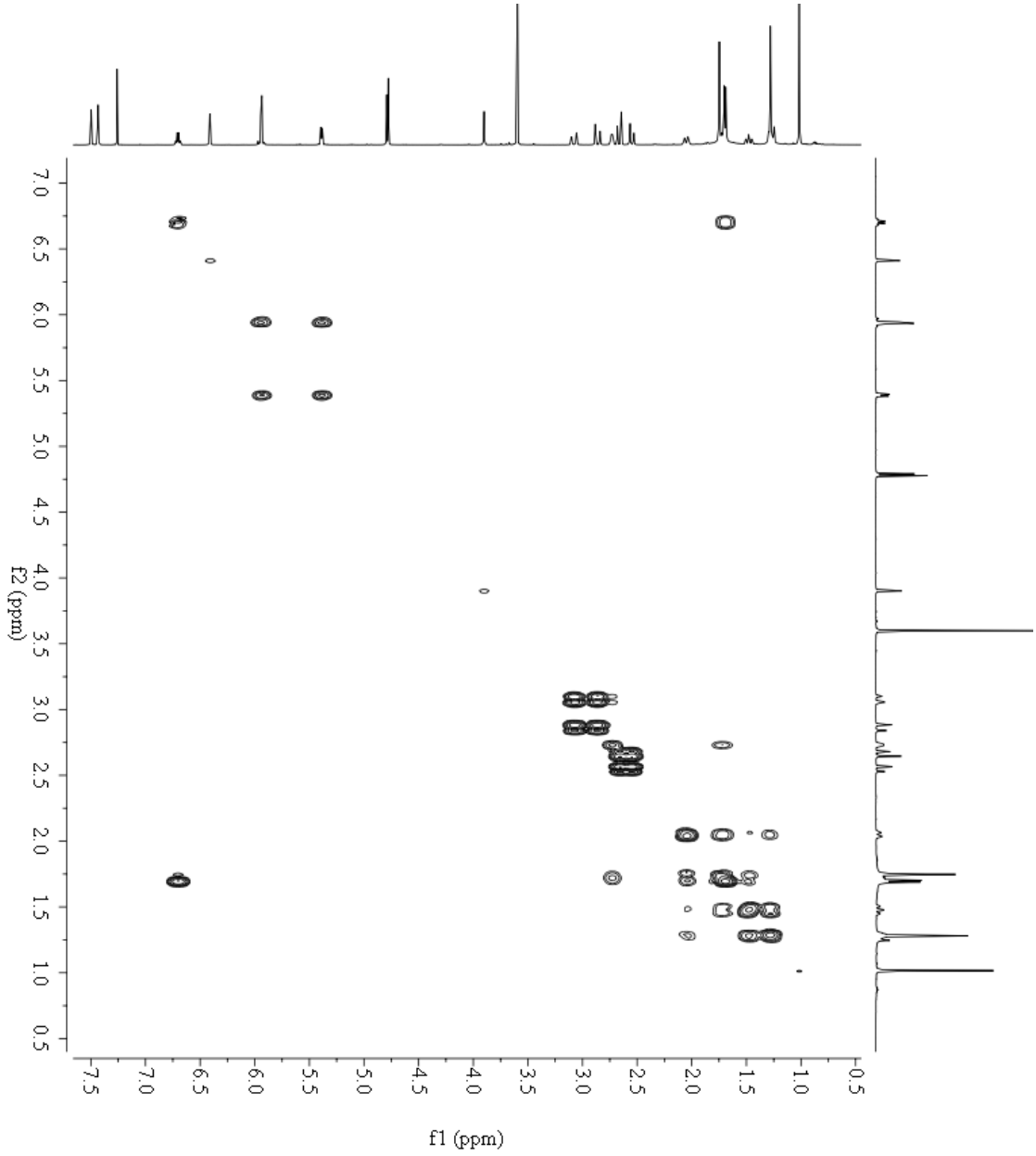


**Figure S34.** NOESY spectrum of triconoid D (**4**) in $CDCl_3$

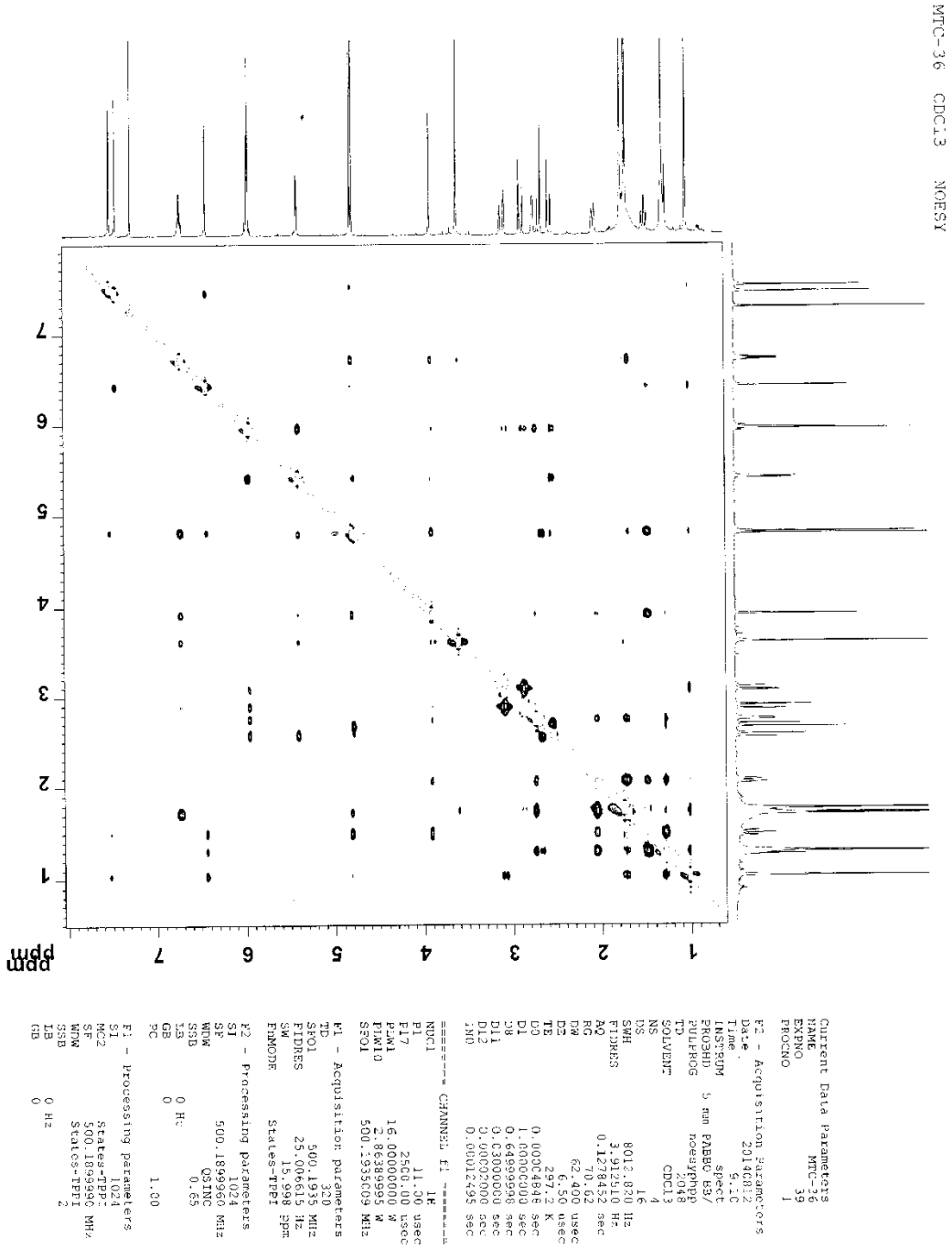


**Figure S35.** ESI(+)MS spectrum of triconoid D (**4**)

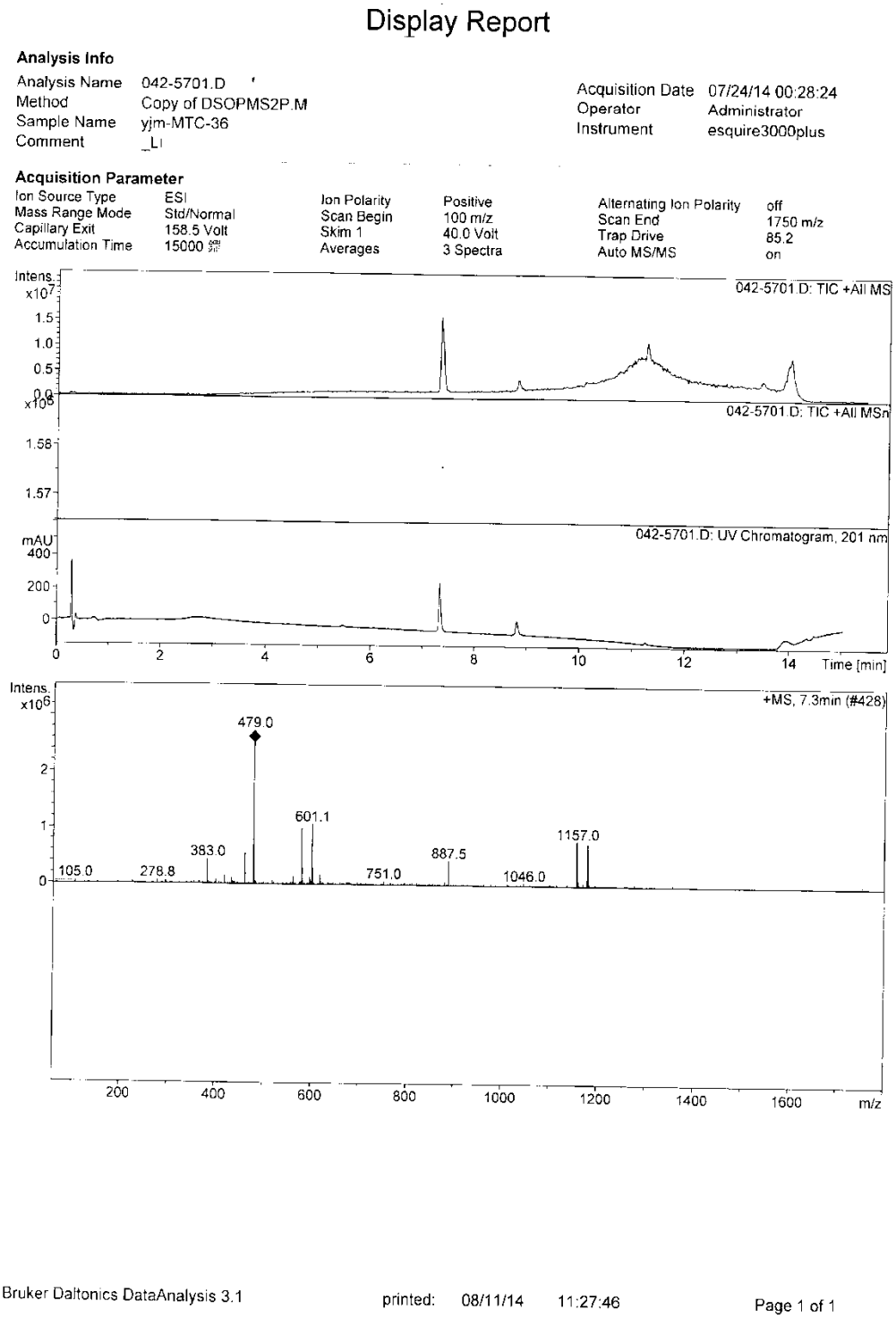


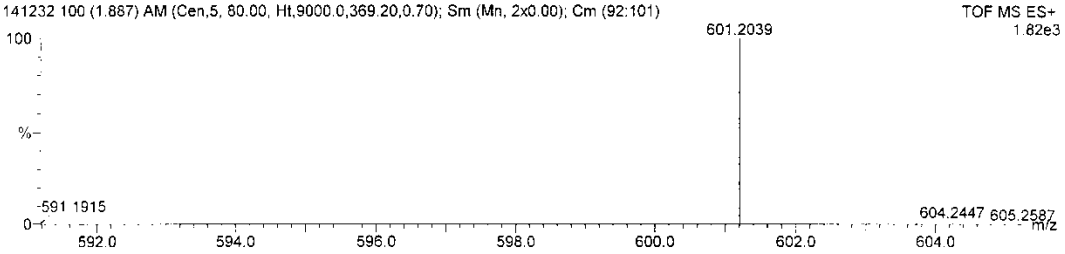
**Figure S36.** HRESI(+)MS spectrum of triconoid D (**4**)

**Elemental Composition Report** **Page 1**

Tolerance = 10.0 PPM / DBE: min = -1.5, max = 50.0
Isotope cluster parameters: Separation = 1.0 Abundance = 1.0%

Monoisotopic Mass, Odd and Even Electron Ions
11 formula(e) evaluated with 1 results within limits (up to 20 closest results for each mass)

SIMM-Mass Spec Q-Tof Ultima 17-Sep-201412:33.27
MTC-36
141232 100 (1.887) AM (Cen,5, 80.00, Ht,9000.0,369.20,0.70); Sm (Mn, 2x0.00); Cm (92:101) TOF MS ES+
1.82e3




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Minimum: | 50.00 | | | | -1.5 | | |
| Maximum: | 100.00 | | 200.0 | 10.0 | 50.0 | | |
| Mass | RA | Calc. Mass | mDa | PPM | DBE | Score | Formula |
| 601.2039 | 100.00 | 601.2050 | -1.1 | -1.8 | 15.5 | 1 | C32 H34 O10 Na |

**Figure S37.** IR spectrum of triconoid D (**4**)