Supporting Information

Epiandrosterone-Derived Prolinamide as Efficient Asymmetric Catalyst for Michael Addition Reactions of Aldehydes to Nitroalkenes

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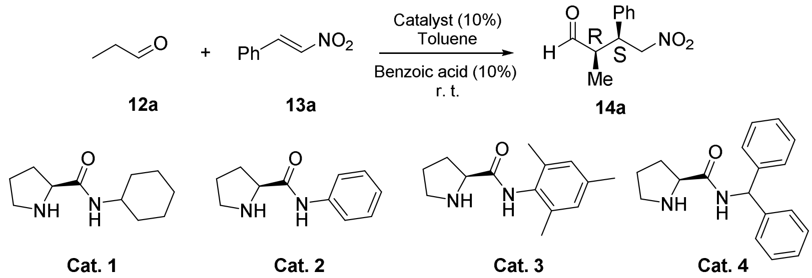
1. General Information:

The NMR spectra were recorded on a Bruker DRX400 (^{1}H: 400 MHz, ^{13}C: 100 MHz) and DRX500 (^{1}H: 500 MHz, ^{13}C: 125 MHz) with TMS as the internal standard, chemical shifts (δ) are expressed in *ppm*, and *J* values are given in Hz, and deuterated $CDCl_3$ and was used as solvent. Highresolution mass spectrometry(HRMS) was recorded on a VG Auto Spec-3000 spectrometer. Optical rotations were measured on a JASCO DIP-370polarimeter. IR spectra were recorded on a FT-IR Thermo Nicolet Avatar 360 using KBr pellet. The mass spectroscopic data were obtained at the Agilent 1100 LC/MSD Trap LC-mass spectrometer. HPLC analysis was performed with a Shimadzu LC-10A instrument equipped with Daicel HPLC columns.Reagents and Materials were of the highest commercially available grade and used without further purification. Solvents were purified by standard procedures and distilled before use. The reactions were monitored by thin layer chromatography(TLC) using silica gel GF_{254}. Column chromatography was performed on silica gel (200–300 mesh). Compounds were visualized by UV and spraying with H_2SO_4(10%) in ethanol and followed by heating.

2. Screening of non-chiral prolinamidecatalysts

In order to evaluate the importance of the big chiral structure of epiandrosterone for the efficiency of the catalyst, as supplementary, several smaller non-chiral prolinamide derivatives has been tested in the model Michael reaction (Table 1). As shown in Table 1, although excellent yields were obtained, the diastereoselectivities and enantioselectivity were unsatisfactory. Significantly, when changed the steric hindrance of the catalysts from Cat.1 to Cat.4,it was observed that also led to the incresing of diastereoselectivities and enantioselectivities. The experimental results shown that the bulky epiandrosterone group is considered to be important to the high catalytic activity of the catalyzed reactions.

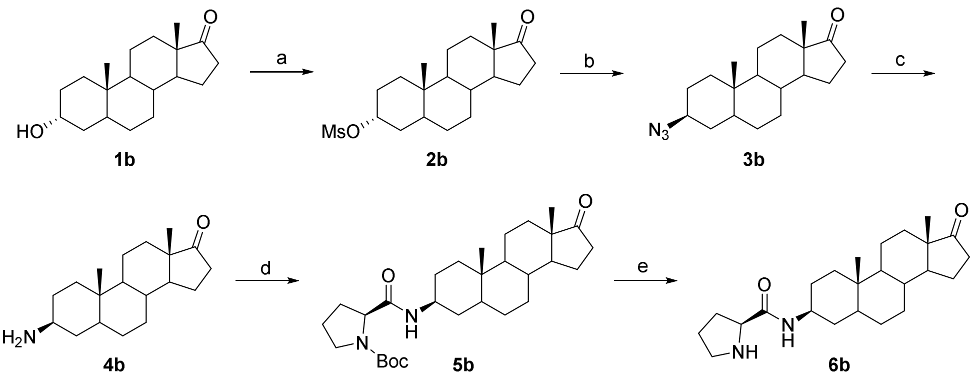
Table 1. Screening of non-chiral prolinamidecatalysts:[a]



Entry	Catalyst (mol%)	Time (h)	Yield [b](%)	*syn/anti* [c]	*ee*(*syn*) [d](%)
1	**Cat.1**	12	91	58:42	21
2	**Cat.2**	12	89	55:45	24
3	**Cat.3**	12	87	62:38	41
4	**Cat.4**	12	88	64:36	65

[a]Allreactionswerecarriedoutusing**12a**(3.0 mmol)and**13a**(1.0 mmol)inthepresenceofcatalystsinsolvent(1.0mL). [b]Yieldoftheisolatedproduct.[c]Determinedby ^{1}HNMRanalysisoftheproducts.[d]DeterminedbychiralHPLC,the absolute configurationwas established by comparison with literature data.

3. Procedure for the synthesis of catalysts 6b



(3R,10S,13S)-10,13-dimethyl-17-oxohexadecahydro-1H-cyclopenta[a]phenanthren-3-yl methanesulfonate (2b). The method for the synthesis of **2b** was similar to that of **2a**. **2b** is white solid, 92 % yield. $[\alpha]_D^{20}$ = -56.7 (c 1.0, $CDCl_3$); IR (KBr) 510, 910, 964, 1276, 1450, 1748, 2897, 2972, 3488 cm^{-1}; m.p. 157-150℃; HRMS (EI) calcd for $C_{20}H_{32}O_4S$ $[M+Na]^+$ 391.1913, found 391.1911.^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.99 (1H, m), 3.02 (3H, s), 2.48 (1H, dd, J = 19, 8.8 Hz), 2.08 (1H, dt, J = 19, 9 Hz), 2.13-2.05 (2H, m), 1.98-1.34 (10H, m), 1.31-1.22 (6H, m), 1.73 (1H, m), 1.07-1.02 (1H, m), 0.87 (3H, s), 0.83 (3H, s); ^{13}C-NMR (125 MHz, $CDCl_3$) δ 221.6, 80., 0, 54.5, 51.8, 48.2, 39.8, 39.1, 36.2, 35.4, 34.3, 32.6, 31.9, 31.0, 28.2, 27.7, 22.1, 20.4, 14.2, 11.8.

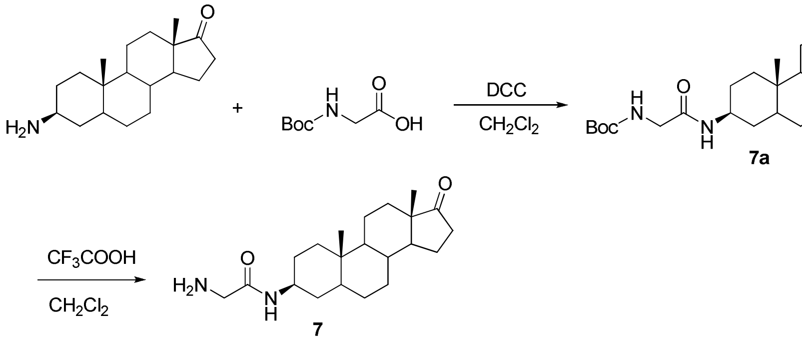
(3S,10S,13S)-3-azido-10,13-dimethylhexadecahydro-17H-cyclopenta[a]phenanthren-17-one (3b). The method for the synthesis of **3b** was similar to that of **3a**. **3b** is white solid, 94 % yield. $[\alpha]_D^{20}$ = -51.6 (c 1.0, $CDCl_3$); IR (KBr) 787, 1021, 1143, 1298, 1749, 2093, 2945 cm^{-1}; m.p. 114-116℃; HRMS (EI) calcd for $C_{19}H_{29}N_3O$ $[M+Na]^+$ 338.2202, found 338.2206.^{1}H-NMR (500 MHz, $CDCl_3$) δ 3.30(1H, m), 2.28 (1H, dd, J = 19, 8.8 Hz), 2.08 (1H, dd, J = 19, 9.4 Hz), 1.96-1.93 (3H, m),1.84-1.47 (5H, m), 1.42-1.24 (7H, m), 1.19-1.00 (2H, m), 0.86 (3H, s), 0.84 (3H, s); ^{13}C-NMR (125 MHz, $CDCl_3$) δ221.5, 60.8, 54.7, 51.8, 48.2, 45.6, 37.5, 36.2, 36.1, 35.4, 34.7, 31.9, 31.2, 28.7, 27.9, 22.2, 20.8, 14.2, 12.6.

(3S,10S,13S)-3-amino-10,13-dimethylhexadecahydro-17H-cyclopenta[a]phenanthren-17-one (4b). The method for the synthesis of **4b** was similar to that of **4a**. **4b** is white solid, 90 % yield. $[\alpha]_D^{20}$ = -96.8 (c 1.0, $CDCl_3$); IR (KBr) 868, 1021, 1395, 1471, 1602, 1773, 2859, 3387 cm^{-1}; m.p. 125-127℃; HRMS (EI) calcd for $C_{19}H_{31}NO$ $[M+H]^+$ 290.2478, found 290.2480. ^{1}H-NMR (500 MHz, CD_3OD) δ 3.42 (1H, m), 2.51(1H, m), 2.38-2.32 (2H, m), 2.25 (1H, dd, J = 19, 8.8 Hz), 2.15 (1H, dt, J = 19, 9 Hz), 1.98 (3H, m), 1.97-1.93(2H, m), 1.85-1.37 (22H, m), 1.25-0.71 (31H, m), 0.85 (3H, s), 0.82 (3H, s); ^{13}C-NMR (125 MHz, CD_3OD) δ220.4, 54.8, 51.7, 51.4, 47.9, 45.9, 41.0, 38.1, 36.1, 35.4, 32.9, 32.2, 31.3, 28.9, 22.2, 20.8, 14.3, 12.9.

tert-butyl (2S)-2-(((3S,10S,13S)-10,13-dimethyl-17-oxohexadecahydro-1H-cyclopenta[a]phenanthren-3-yl)carbamoyl)pyrrolidine-1-carboxylate (5b). The method for the synthesis of **4b** was similar to that of **4a**. **4b** is white solid, 93 % yield. $[\alpha]_D^{20}$= -15.2 (c 1.0, $CHCl_3$); IR (KBr) 932, 1171, 1283, 1394, 1601, 1764, 2890, 2944, 3347 cm^{-1}; HRMS (EI) calcd for $C_{29}H_{46}N_2O_4$ $[M+Na]^+$ 509.3385, found 509.3388. ^{1}H-NMR (500 MHz, $CDCl_3$) δ 4.15 (1H, m), 3.79-3.74 (2H, m), 3.46 (2H, m), 2.46-2.40 (1H, m), 2.10-2.03 (2H, m), 1.95-1.31 (20H, m), 1.29-0.96 (20H, m), 0.86 (3H, s), 0.82 (3H, s); ^{13}C-NMR (125 MHz, $CDCl_3$) δ 221.6, 172.5, 125.3, 80.9, 54.7, 51.8, 49.0, 48.8, 48.2, 47.5, 45.7, 42.9, 37.7, 36.2, 35.9, 35.7, 31.9, 31.2, 29.1, 28.8, 28.6, 22.5, 22.2, 20.8, 14.2, 12.6.

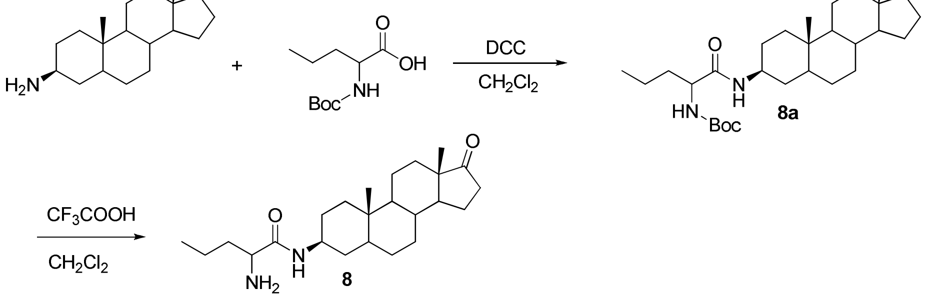
(2S)-N-((3S,10S,13S)-10,13-dimethyl-17-oxohexadecahydro-1H-cyclopenta[a]phenanthren-3-yl)pyrrolidine-2-carboxamide (6b). The method for the synthesis of **6b** was similar to that of **6a**. **6b** is white solid, 92 % yield.$[\alpha]_D^{20}$ = -43.0 (c 1.0, $CHCl_3$);IR (KBr) 773, 959, 1247, 1262, 1427, 1538, 1848, 2831, 3001, 3364 cm^{-1}; HRMS (EI) calcd $C_{24}H_{38}N_2O_2$, $[M+H]^+$ 387.3006, found for 387.3004. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (1H, d, J = 7.3 Hz), 3.79-3.75 (3H, m), 3.70-3.68 (1H, m), 3.03-2.98 (2H, m), 2.46-2.41 (1H, m), 2.15-2.04 (3H, m), 1.96-1.30 (16H, m), 1.27-1.07 (22H, m), 0.88 (3H, s), 0.86 (3H, s); ^{13}C NMR (100 MHz, $CDCl_3$) δ221.6, 174.6, 61.4, 54.8, 51.8, 48.8, 48.2, 47.7, 45.8, 42.9, 37.8, 36.3, 35.8, 35.5, 31.9, 31.2, 29.3, 29.1, 28.7, 26.5, 22.5, 22.2, 20.8, 14.2, 12.7.

4. Procedure for the synthesis of catalysts 7-10.



3α-*N*-(Boc-2-amino-acetyl)-5α-androstan-17-one (7a).The method for the synthesis of **7a** was similar to that of **5**. **7a** is white solid, 89% yield. $[\alpha]_D^{20}$=+36.8 (c 1.0, $CHCl_3$); IR (KBr) 1041, 1164, 1241, 1528, 1663, 1732, 2852, 2921, 3326 cm^{-1}; m.p. 91-94 ℃; HRMS (EI) calcd for $C_{26}H_{42}N_2O_4$, $[M+Na]^+$ 469.3036, found 469.3031.^{1}H NMR (500 MHz, $CDCl_3$): δ 6.71 (s, 1H), 5.06 (d, J = 8.1 Hz, 1H), 4.13-4.05 (m, 2H), 2.89-2.87 (d, J = 10.0 Hz, 1H), 3.65-3.62 (m, 1H), 2.98-2.94 (m, 1H), 2.88-2.82 (m, 1H), 2.08-2.06 (m, 1H), 2.05-1.85 (m, 7H), 2.49-2.44 (m, 1H), 2.09-2.04 (m, 1H), 1.94-1.91 (m, 1H), 1.82-1.49 (m, 10H), 1.41 (s, 9H), 1.38-1.25 (m, 6H), 1.38-1.22 (m, 6H), 0.95-0.93 (m, 3H), 0.87 (s, 3H), 0.83 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.7, 172.0, 156.3, 80.3, 60.8, 54.9, 53.6, 52.0, 48.8, 48.2, 45.0, 41.2, 36.9, 36.5, 36.2, 35.3, 33.5, 33.1, 32.0, 31.6, 31.1, 28.8, 28.5, 26.4, 25.2, 23.3, 22.5, 22.1, 21.4, 20.4, 14.6, 14.2, 11.8.

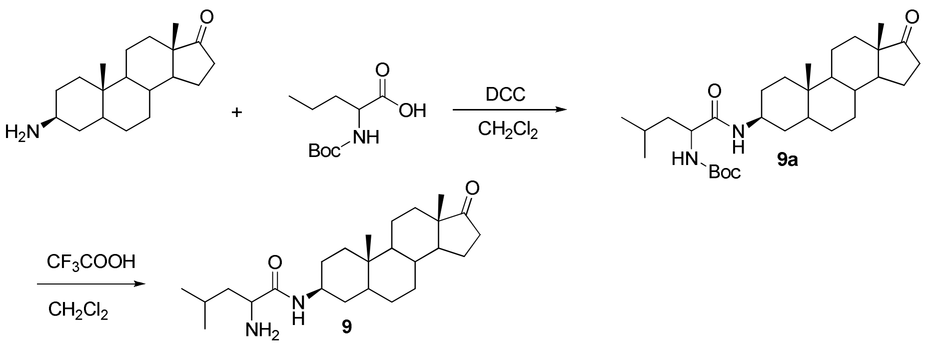
3α-*N*-(2-amino-acetyl)-5α-androstan-17-one (7). The method for the synthesis of **7** was similar to that of **6**. **7** iswhite solid, 93% yield. $[\alpha]_D^{20}$=+69.8 (c 1.0, $CHCl_3$); IR (KBr) 747, 1119, 1364, 1446, 1511, 1674, 1740, 2855, 2929, 3374 cm^{-1}; m.p. 88-90 ℃; HRMS (EI) calcd for $C_{21}H_{34}N_2O_2$, $[M+H]^+$ 347.2693, found 347.2693.^{1}H NMR (500 MHz, $CDCl_3$): δ 7.66 (d, J = 7.0 Hz, 1H), 4.10-4.09 (m, 1H), 3.38-3.36 (m, 1H), 2.47-2.41 (m, 1H), 2.08-1.48 (m, 22H), 1.38-1.20 (m, 12H), 1.08-0.77 (m, 16H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.8, 174.5, 55.0, 54.0, 51.9, 48.2, 44.5, 44.3, 41.5, 36.6, 36.2, 35.4, 33.7, 33.3, 31.9, 31.2, 28.6, 26.4, 25.3, 23.7, 22.5, 22.1, 21.8, 20.5, 14.2, 11.9.



3α-*N*-(Boc-2-amino-pentanoyl)-5α-androstan-17-one (8a).The method for the synthesis of **8a** was similar to that of **5**.**8a** iswhite solid, 86% yield. $[\alpha]_D^{20}$=+50.2 (c

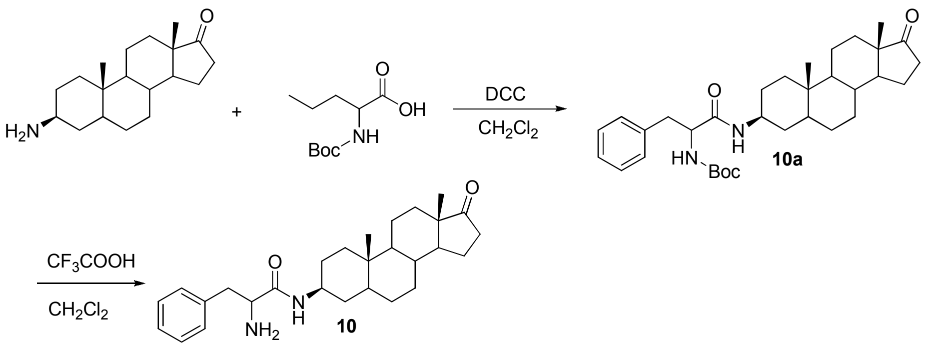
1.0, $CHCl_3$); IR (KBr) 1052, 1168, 1241, 1588, 1674, 1792, 2842, 2971, 3332 cm^{-1}; m.p. 93-95 ℃; HRMS (EI) calcd for $C_{29}H_{48}N_2O_4$, $[M+Na]^+$ 511.3506, found 511.3503.^1H NMR (500 MHz, $CDCl_3$): δ 6.66 (s, 1H), 5.17 (s, 1H), 4.12 (s, 1H), 4.00 (d, J = 6.0 Hz, 1H), 2.49-2.44 (m, 1H), 2.09-2.04 (m, 1H), 1.96-1.91 (m, 1H), 1.79-1.74 (m, 3H), 1.67-1.22 (m, 32H),0.94-0.91 (m, 6H), 0.87 (s, 3H), 0.83 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.7, 171.7, 156.3, 80.3, 54.9, 51.9, 48.8, 48.2, 45.0, 41.2, 36.6, 36.2, 35.3, 34.8, 33.5, 33.1, 28.8, 28.2, 26.4, 22.5, 22.1, 20.4, 19.4, 14.2, 11.8.

3α-*N*-(2-amino-pentanoyl)-5α-androstan-17-one (8).The method for the synthesis of **8** was similar to that of **6**.**8** isamorphous powder, 96% yield. $[\alpha]_D^{20}$=+50.8 (c 1.0, $CHCl_3$); IR(KBr) 976, 1123, 1319, 1376,1446, 1519, 1675, 1740, 2852, 2925, 3354 cm^{-1}; HRMS (EI) calcd for $C_{24}H_{40}N_2O_2$, $[M+H]^+$ 389.3162, found 389.3166.^1H NMR (500 MHz, $CDCl_3$): δ 7.61 (d, J = 7.6 Hz, 1H), 3.99 (s, 1H), 3.24 (t, J = 7.8 Hz, 1H), 2.37-2.32 (m, 1H), 1.98-1.94 (m, 1H), 1.87-1.82 (m, 1H), 1.71-1.16 (m, 22H), 1.00-0.79 (m, 5H) , 0.79 (s, 3H) , 0.75 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.4, 174.5, 55.4, 54.9, 51.8, 48.7, 48.1, 46.2, 44.3, 41.3, 37.6, 37.0, 36.5, 35.3, 35.0, 33.6, 33.2, 31.9, 31.6, 31.3, 31.1, 28.5, 26.4, 23.5, 22.4, 22.0, 20.8, 19.5, 19.3, 17.2, 14.5, 14.1, 11.8.



3α-*N*-(Boc-2-amino-4-methylpentanoyl)-5α-androstan-17-one (9a).The method for the synthesis of **9a** was similar to that of **5**.**9a** iswhite solid, 87% yield. $[\alpha]_D^{20}$=+42.8 (c 1.0, $CHCl_3$); IR (KBr) 587, 645, 767, 1041, 1160, 1236, 1524, 1654, 1724, 2929, 3326 cm^{-1}; m.p. 111-114 ℃; HRMS (EI) calcdfor $C_{30}H_{50}N_2O_4$, $[M+Na]^+$ 525.3684, found 525.3680.^1H NMR (500 MHz, $CDCl_3$): δ 6.85 (s, 1H), 5.48 (s, 1H), 4.12 (s, 1H), 3.74 (t, J = 5.4 Hz, 2H), 2.48-2.45 (m, 1H), 2.11-2.04 (m, 1H), 1.94-1.91 (m, 1H), 1.82-1.51 (m, 8H), 1.48 (s, 9H), 1.41-1.18 (m, 8H), 1.08-0.96 (m, 1H), 0.87 (s, 3H), 0.83 (s, 3H), 0.77-0.73 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.8, 169.2, 156.9, 80.6, 54.9, 52.0, 48.2, 45.3, 45.1, 36.6, 36.2, 35.3, 33.4, 33.1, 31.9, 31.2, 28.8, 26.3, 22.1, 20.4, 14.2, 11.8.

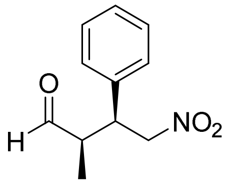
3α-*N*-(2-amino-4-methylpentanoyl)-5α-androstan-17-one (9).The method for the synthesis of **9** was similar to that of **6**.**9** isamorphous powder, 88% yield. $[\alpha]_D^{20}$=+78.9 (c 1.0, $CHCl_3$); IR (KBr) 588, 669, 751, 1442, 1516, 1675, 1736, 2848, 2925, 3338 cm^{-1}; HRMS (EI) calcdfor $C_{25}H_{42}N_2O_2$, $[M+H]^+$ 403.3319, found 403.3316.^1H NMR (500 MHz, $CDCl_3$): δ 8.02 (s, 1H), 7.66 (s, 1H), 4.15-4.04 (m, 1H), 3.80-3.77 (m, 1H), 3.35 (s, 1H), 2.96-2.87 (m, 1H), 2.47-2.42 (m, 2H), 2.08-1.25 (m, 23H), 1.07-1.02 (m, 3H), 0.86 (s, 6H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.6, 171.9, 56.2, 55.8, 55.4, 55.0, 53.7, 53.4, 52.4, 51.9, 48.8, 48.2, 46.7, 46.3, 45.3, 44.4, 44.0, 41.4, 36.6, 36.2, 35.4, 34.9, 33.8, 33.4, 33.3, 32.2, 32.0, 31.6, 31.2, 28.6, 27.8, 26.5, 26.0, 23.6, 22.5, 22.1, 20.9, 20.5, 16.8, 14.2, 12.0.



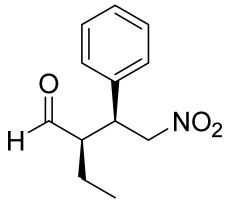
3α-*N*-(Boc-2-amino-3-phenylpropanoyl)-5α-androstan-17-one (10a).The method for the synthesis of **10a** was similar to that of **5.10a** iswhite solid, 85% yield. $[\alpha]_D^{20}$=+50.4 (c 1.0, $CHCl_3$); IR (KBr) 588, 645, 768, 1042, 1160, 1238, 1372, 1524, 1654, 1724, 2929, 3326 cm^{-1}; m.p. 172-174℃; HRMS (EI) calcdfor $C_{33}H_{48}N_2O_4$, $[M+Na]^+$559.3541, found 559.3542.^{1}H NMR (500 MHz, $CDCl_3$): δ 7.33-7.25 (m, 5H), 5.95 (s, 1H), 5.30 (s, 1H), 4.29 (s, 1H), 4.03 (s, 1H), 3.17-3.12 (m, 1H), 3.00-2.96 (m, 1H), 2.49-2.43 (m, 1H), 2.12-2.06 (m, 1H), 1.98-1.93 (m, 1H), 1.82-1.77 (m, 2H),1.64-1.14 (m, 23H), 0.95-0.92 (m, 2H), 0.86 (s, 3H), 0.77 (s, 3H), 0.76-0.60 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 221.6, 170.3, 156.2, 155.9, 137.6, 129.6, 129.4, 129.1, 127.3, 80.4, 56.5, 54.7, 52.0, 48.2, 45.2, 45.0, 41.1, 40.9, 39.4, 39.1, 36.4, 36.2, 35.3, 33.3, 33.1, 32.9, 31.9, 31.1, 30.1, 30.1, 28.8, 28.4, 26.2, 26.1, 22.1, 20.4, 14.2, 11.8.

3α-*N*-(2-amino-3-phenylpropanoyl)-5α-androstan-17-one (10).The method for the synthesis of **10** was similar to that of **6.10** iswhite solid, 95% yield. $[\alpha]_D^{20}$=+43.8 (c 1.0, $CHCl_3$); IR (KBr) 694, 751, 1319, 1446, 1511, 1671, 1732, 2848, 2929, 3346 cm^{-1}; m.p. 98-111℃; HRMS (EI) calcdfor $C_{28}H_{40}N_2O_2$, $[M+H]^+$437.3162, found 437.3164.^{1}H NMR (500 MHz, $CDCl_3$): δ 7.34-7.16 (m, 5H), 4.14-4.13 (m, 1H), 3.63-3.60 (m, 1H), 3.27-3.20 (m, 1H), 2.89-2.73 (m, 1H), 2.48-2.43 (m, 1H), 2.11-1.23 (m, 29H), 1.07-0.63 (m, 16H), 0.95-0.92 (m, 2H), 0.86 (s, 3H), 0.77 (s, 3H), 0.76-0.60 (m, 1H); δ 221.6, 173.5, 138.4, 138.3, 130.5, 129.7, 129.1, 128.4, 128.3, 127.2, 126.7, 57.0, 56.8, 55.5, 54.9, 53.0, 52.5, 51.9, 48.2, 44.5, 44.3, 41.7, 41.5, 41.4, 40.9, 36.6, 36.2, 36.0, 35.4, 33.8, 33.6, 33.2, 32.2, 31.9, 31.6, 31.3, 31.1, 28.6, 26.5, 23.5, 22.1, 20.9, 20.5, 16.9, 14.2.

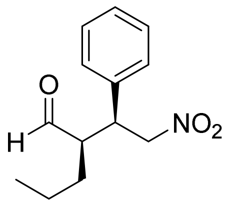
5. Characterization Data of Michael Adducts



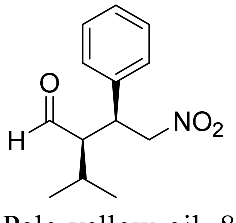
Pale yellow oil, 88% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.63 (d, J = 1.0 Hz, 1H), 9.60 ((d, J = 1.0 Hz), 7.28-7.19 (m, 6H), 7.14-7.08 (m, 4H), 4.76-4.70 (m, 3H), 4.63-4.58 (m, 1H), 3.78-3.71 (m, 2H), 2.77-2.66 (m, 2H), 1.13 (d, J = 7.2 Hz, 2H), 0.92 (d, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 201.3, 201.2, 135.9, 135.6, 128.1, 128.1, 127.1, 127.1, 771, 47.7, 47.4, 43.8, 43.0, 11.1, 10.7; HPLC (Chiralcel OD-H, Hexane: *i*-PrOH=90:10, flow rate: 1.0 mL/min, λ=254 nm),T_{major}=34.4, T_{minor}= 25.6, 94% ee.



Pale yellow oil, 91% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.71 (d, J = 2.8 Hz, 1H), 9.48 (d, J = 2.8 Hz), 7.36-7.27 (m, 4H), 7.18 (d, J=7.2, 2H), 4.82-4.70 (m, 2H), 4.65-4.60 (m, 1H), 3.85-3.76 (m, 1H), 2.71-2.65 (m, 1H), 1.73-1.64 (m, 1H), 1.54-1.00 (m, 1H), 0.97 (t, J=7.2 Hz, 1H), 0.82 (t, J=7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 203.2, 203.1, 136.8, 136.3, 129.1, 128.2, 128.1, 128.0, 78.5, 77.9, 55.0, 54.9, 44.1, 42.7, 20.6, 20.4, 11.5, 10.7; HPLC (Chiralcel AD-H, Hexane: i-PrOH= 99: 1, flow rate: 0.8 mL/min, λ=254 nm), T_{major}=27.3, T_{minor}=32.7, 98% ee.

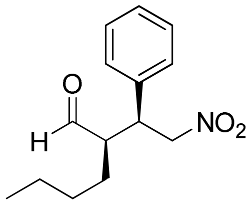


Pale yellow oil, 85% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.71 (s, 1H), δ 9.70 (s), 7.36-7.26 (m, 4H), 7.17 (d, J=7.2, 3H), 4.73-4.62 (m, 3H), 3.81-3.75 (m, 2H), 2.74-2.67 (m, 1H), 1.62-0.94(m, 5H), 0.90 (t, J=10.8 Hz, 1H), 0.80 (t, J=14.0 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 203.2, 136.8, 129.1, 128.1, 128.0, 78.4, 53.8, 43.2, 29.5, 19.8, 13.9; HPLC (Chiralcel OD-H, Hexane: i-PrOH=96:4, flow rate: 1.0 mL/min, λ=254 nm), T_{major}=34.9, T_{minor}=28.0, 95% ee.

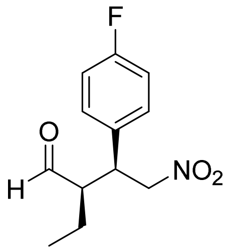


Pale yellow oil, 83% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.92 (d, J=2.0 Hz, 1H), 9.47 (d, J=4.4 Hz), 7.36-7.27 (m, 3H), 7.19 (d, J=7.2, 2H), 4.69-4.65 (m, 1H), 4.60-4.54 (m, 1H), 3.93-3.87 (m, 1H), 2.80-2.75 (m, 1H), 1.74-1.67 (m, 1H), 1.09 (d,

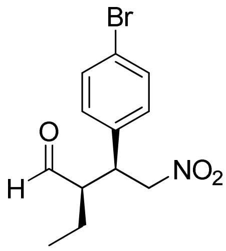
J=7.2 Hz, 3H), 0.87 (d, J=7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 204.4, 137.1, 129.2, 128.1, 128.0, 79.0, 58.7, 41.9, 27.9, 21.7, 16.7; HPLC (Chiralcel AD-H, Hexane: i-PrOH= 97: 3, flow rate: 0.5 mL/min, λ=254 nm), T_{major}=23.7, T_{minor}= 28.1, 99% ee.



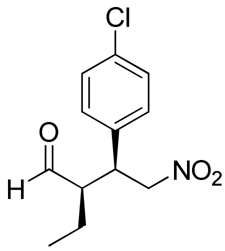
Pale yellow oil, 88% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.70 (s, 1H), 9.47 (s), 7.36-7.27 (m, 3H), 7.17 (d, J=7.2, 2H), 4.73-4.61 (m, 2H), 3.81-3.75 (m, 1H), 2.73-2.67 (m, 1H), 1.53-1.28 (m, 9H), 1.21 (t, J=10.4 Hz, 1H), 1.17 (t, J=17.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 203.3, 136.8, 129.1, 128.1, 128.0, 78.4, 53.9, 43.1, 28.5, 27.0, 22.5, 13.6; HPLC (Chiralcel OD-H, Hexane: i-PrOH= 97: 3, flow rate: 1.0 mL/min, λ=254 nm), T_{major}=35.7, T_{minor}= 26.2, 96% ee.



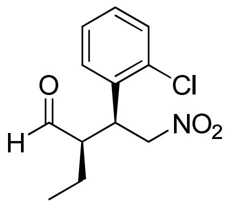
Pale yellow oil, 93% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.72 (d, J=2.4 Hz), 9.49 (d, J=2.8 Hz, 1H), 7.19-7.15 (m, 2H), 7.07-6.99 (m, 2H), 4.82-4.70 (m, 2H), 3.84-3.79 (m, 2H), 2.61-2.55 (m, 1H), 1.78-1.57 (m, 3H),1.00 (t, J=15.2 Hz, 3H), 0.84 (d, J=15.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.8, 163.6, 161.1, 132.1, 129.9, 116.2, 116.0, 78.0, 55.0, 43.3, 41.8, 20.6, 11.4; HPLC (Chiralcel AD-H, Hexane: i-PrOH= 99:1, flow rate: 1.0 mL/min, λ=254 nm), T_{major}=25.0, T_{minor}= 33.3, 99% ee.



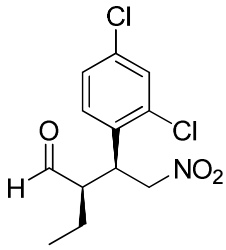
Pale yellow oil, 94% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.72 (d, J=2.4 Hz, 1H), 9.49 (d, J=2.0 Hz), 7.50-7.45 (m, 3H), 7.08 (d, J=2.4, 3H), 4.78-4.70 (m, 2H), 4.62-4.57 (m, 1H), 3.80-3.74 (m, 2H), 2.70-2.64 (m, 1H), 1.72-1.46 (m, 3H), 0.98 (t, J=14.8 Hz, 2H), 0.84 (d, J=14.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.6, 135.9, 135.5, 132.3, 132.3, 130.0, 129.7, 122.3, 122.2, 78.2, 54.8, 54.7, 43.4, 42.1, 20.5, 20.3, 11.4, 10.5; HPLC (Chiralcel AD-H, Hexane: i-PrOH= 98.5:1.5, flow rate: 1.0 mL/min, λ=254 nm),T_{major}=32.0, T_{minor}= 50.4, 98% ee.



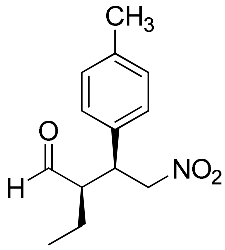
Pale yellow oil, 92% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.71 (d, J=2.4 Hz, 1H), 9.49 (d, J=2.4 Hz), 7.32-7.15 (m,2H), 7.13 (d, J=8.4, 2H), 4.78-4.70 (m, 1H), 4.63-4.57 (m, 1H), 3.82-3.76 (m, 1H), 2.70-2.64 (m, 1H), 1.00 (t, J=14.4 Hz), 0.95 (d, J=15.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.7, 135.4, 134.1, 130.2, 129.6, 129.4, 128.5, 78.3, 54.7, 42.0, 20.3, 10.5; HPLC (Chiralcel AD-H, Hexane: i-PrOH= 98.5:1.5, flow rate: 1.0 mL/min, λ=254 nm),T_{major}=27.9, T_{minor}= 42.0, 97% ee.



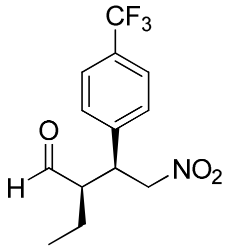
Pale yellow oil, 88% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.73 (d, J=2.0 Hz, 1H), 9.56 (d, J=2.8 Hz), 7.42-7.28 (m, 1H), 7.26-7.20 (m, 4H), 4.89-4.76 (m, 2H), 4.72-4.67 (m, 1H), 4.38-4.33 (m, 1H), 2.95 (s, 1H), 1.78-1.70 (m, 1H), 1.65-1.50 (m, 2H), 0.97 (t, J=15.2 Hz, 1H), 0.87 (d, J=15.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.8, 202.3, 134.5, 134.4, 130.6, 129.3, 128.7, 127.5, 76.2, 54.5, 54.0, 39.2, 20.4, 19.8, 11.6, 10.7; HPLC (Chiralcel AD-H, Hexane: i-PrOH= 98.5:1.5, flow rate: 1.0 mL/min, λ=254 nm), T_{major}=16.7, T_{minor}= 18.7, 96% ee.



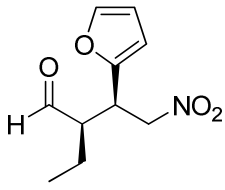
Pale yellow oil, 84% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.72 (d, J=2.0 Hz, 1H), 9.56 (d, J=2.8 Hz), 7.44 (s, 1H), 7.27 (d, J=2.0 Hz, 1H), 7.25 (d, J=2.0 Hz, 1H), 4.88-4.82 (m, 1H), 4.70-4.66 (m, 1H), 4.38-4.27 (m, 1H), 2.30-2.80 (m, 1H), 1.62-1.55 (m, 2H), 1.53 (t, J=14.8 Hz, 1H), 0.99 (d, J=14.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.4, 201.9, 135.1, 134.5, 133.2, 130.4, 130.1, 129.6, 128.5, 127.8, 76.0, 54.3, 53.8, 38.7, 20.4, 19.9, 11.5, 10.6; HPLC (Chiralcel AD-H, Hexane: i-PrOH=99:1, flow rate: 1.0 mL/min, λ=254 nm), T_{major}=19.2, T_{minor}= 21.8, 98% ee.



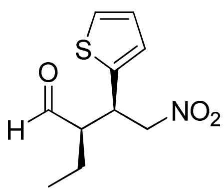
Pale yellow oil, 95% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.71 (d, *J*=2.4 Hz, 1H), 9.47 (d, *J*=3.2 Hz), 7.15-7.12 (m, 2H), 7.06 (d, *J*=8.0 Hz, 2H), 4.78-4.38 (m, 1H), 4.60-4.57 (m, 1H), 3.78-3.72 (m, 1H), 2.68-2.62 (m, 1H), 2.31 (d, *J*=6.0 Hz, 3H), 1.51-1.47 (m, 2H), 0.98 (t, *J*=14.8 Hz, 1H), 0.83 (d, *J*=14.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 203.4, 203.3, 137.9, 133.6, 129.8, 128.1, 127.8, 78.7, 55.1, 55.0, 43.9, 42.4, 21.1, 20.7, 20.4, 11.5, 10.7; HPLC (Chiralcel OD-H, Hexane: i-PrOH= 92:8, flow rate: 0.5 mL/min, λ=254 nm), T_{major}=39.8, T_{minor}= 34.6, 97% ee.



Pale yellow oil, 92% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.72 (d, *J*=2.0 Hz, 1H), 9.51 (d, *J*=2.4 Hz), 7.63-7.51 (m, 3H), 7.48-7.35 (m, 2H), 4.83-4.75 (m, 1H), 4.69-4.63 (m, 1H), 3.92-3.86 (m, 1H), 2.77-2.70 (m, 1H), 1.58-1.44 (m, 2H), 1.01 (t, *J*=14.8 Hz, 1H), 0.84 (d, *J*=14.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.5, 141.1, 133.7, 130.6, 130.3, 128.8, 128.5, 126.1, 126.0, 125.2, 122.5, 78.1, 54.8, 54.5, 43.5, 42.3, 20.4, 20.3, 11.3, 10.5; HPLC (Chiralcel AS-H, Hexane: i-PrOH= 93:7, flow rate: 0.5 mL/min, λ=254 nm), T_{major}=26.7, T_{minor}= 29.2, 99% ee.

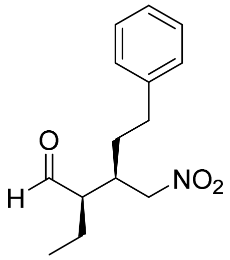


Pale yellow oil, 83% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.71 (d, *J*=1.6 Hz, 1H), 9.60 (d, *J*=2.4 Hz, 1H), 7.36 (d, *J*=1.2 Hz, 2H), 7.36 (d, *J*=0.4 Hz, 2H), 7.35 (d, *J*=0.8 Hz, 2H), 4.74-4.65 (m, 4H), 4.04-3.97 (m, 2H), 2.77-2.75 (m, 1H), 2.56-2.53 (m, 1H), 1.75-1.73 (m, 1H), 1.63-1.55 (m, 4H), 1.00 (t, *J*=14.8 Hz, 2H),0.90 (d, *J*=14.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 202.8, 202.3, 150.1, 149.7, 142.7, 110.5, 110.4, 109.0, 108.8, 76.0, 53.6, 53.4, 37.7, 36.6, 20.5, 20.0, 11.5, 10.9; HPLC (Chiralcel AS-H, Hexane: i-PrOH= 96:4, flow rate: 0.5 mL/min, λ=254 nm), T_{major}=38.1, T_{minor}= 34.3, 93% ee.



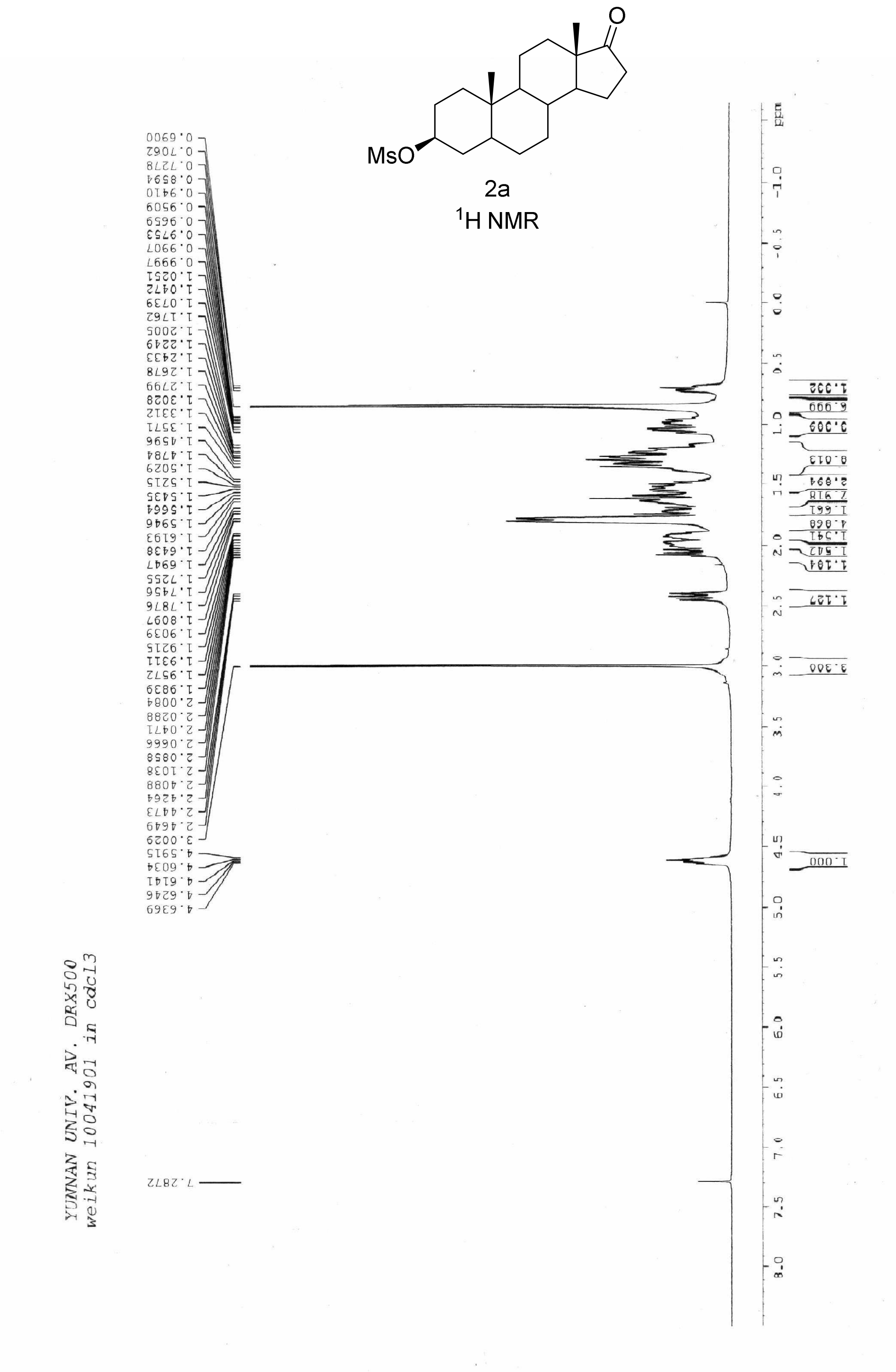
Pale yellow oil, 89% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.70 (d, *J*=1.6 Hz, 1H), 9.52 (d, *J*=2.4 Hz, 1H), 7.35-7.31 (m, 2H), 7.10 (d, *J*=4.8 Hz, 2H), 6.93 (d, *J*=4.8 Hz, 2H), 4.81-4.59 (m, 5H), 4.02-3.95 (m, 2H), 2.67-2.65 (m, 1H), 2.64-2.52 (m, 1H), 1.78-1.72 (m, 1H), 1.64-1.54 (m, 4H), 1.00 (t, *J*=14.8 Hz, 3H), 0.88 (t, *J*=14.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 203.3, 202.9, 137.2, 136.6, 127.0, 126.9, 126.1, 123.4, 123.3, 78.3, 77.9, 55.0, 54.6, 39.4, 38.2, 20.6, 20.3, 11.6, 10.9; HPLC

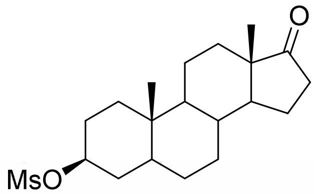
(Chiralcel AD-H, Hexane: i-PrOH= 98:2, flow rate: 0.7 mL/min, λ=254 nm), T_{major}=36.2, T_{minor}= 46.8, 97% ee.



Pale yellow oil, 94% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.71 (1H,s), 7.35-7.18 (1H,m), 4.58-4.49 (2H, m), 2.74-2.64 (3H,m), 2.51-2.47 (2H,m), 1.86-1.69 (3H, m), 1.61-1.54 (2H, m); ^{13}C NMR (100 MHz, $CDCl_3$): δ 203.4, 140.9, 129.1, 128.7, 126.8, 54.2, 36.6, 33.4, 31.4, 19.1, 12.3; HPLC (ChiralcelOD-H, Hexane: i-PrOH= 90:10, flow rate: 0.4 mL/min, λ=210 nm), T_{major}=37.4, T_{minor}= 40.1, 95% ee.

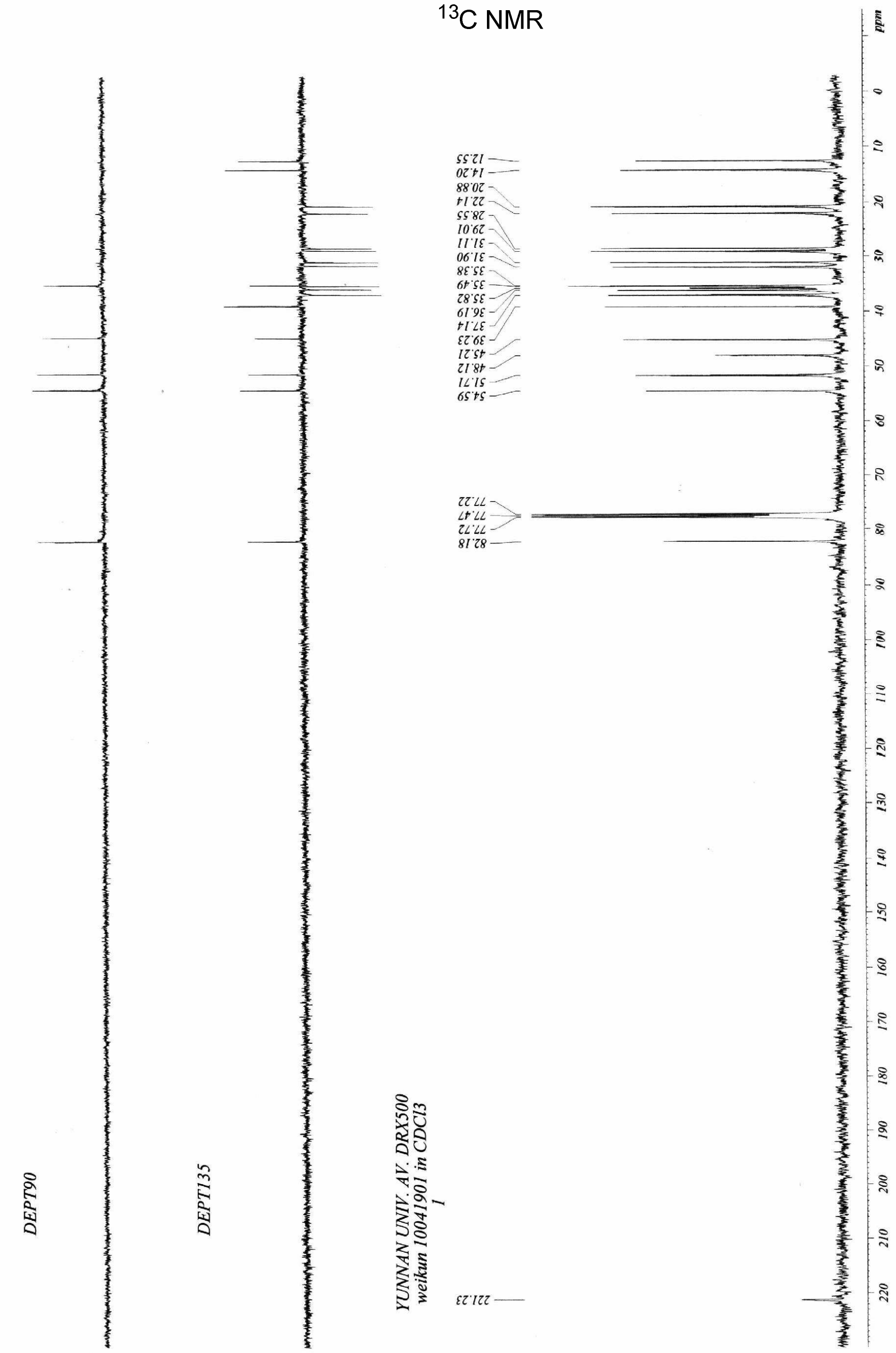
Spectra of Catalysts





2a

^{13}C NMR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weikun 10041901 in CDCl3
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14.20
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28.55
29.01
31.11
31.90
35.38
35.49
35.82
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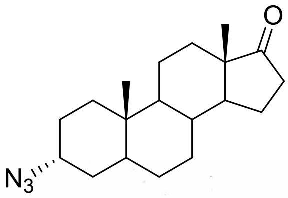
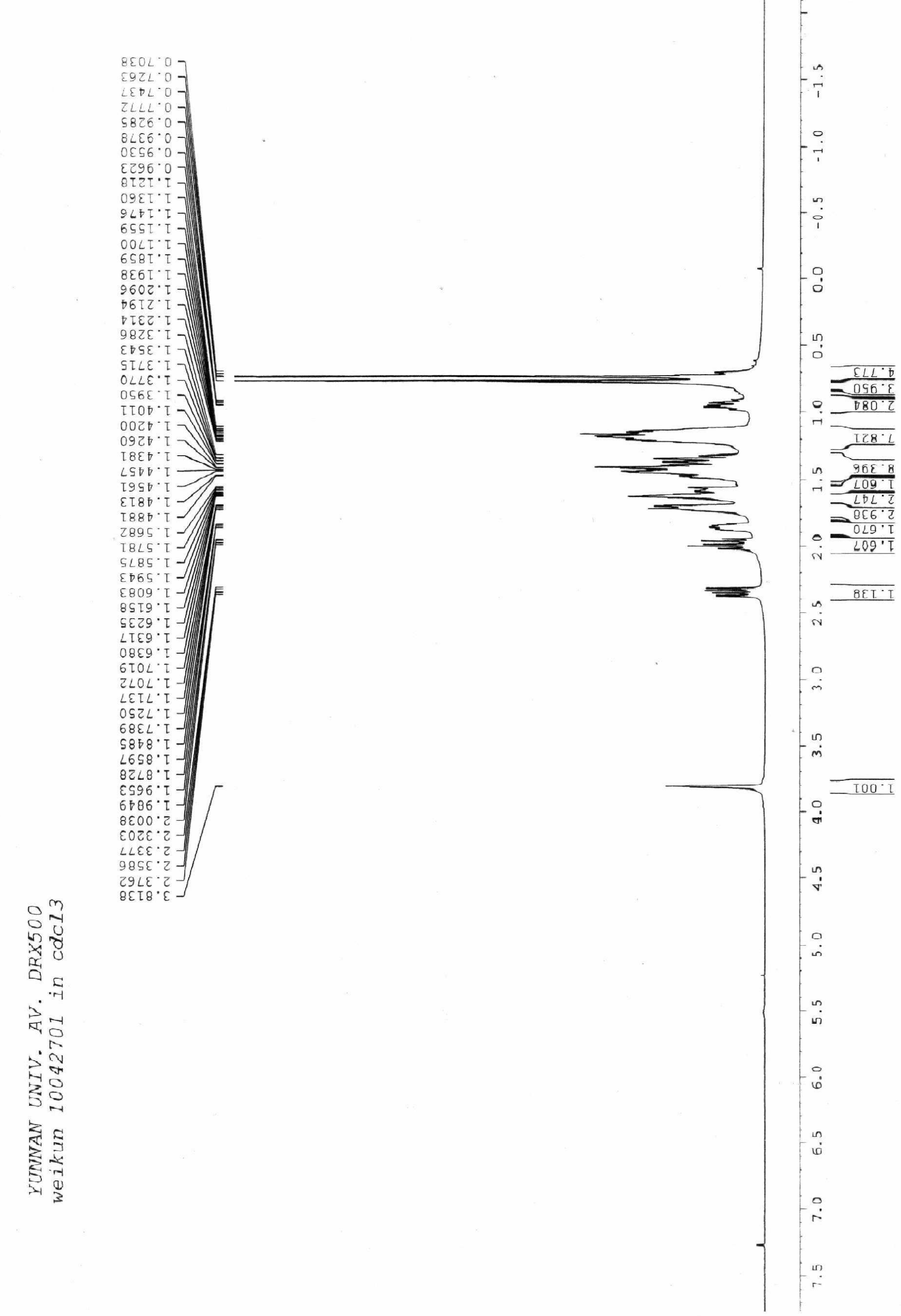
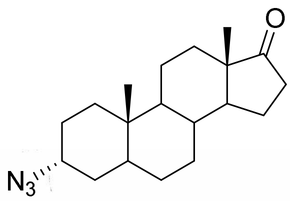


3a

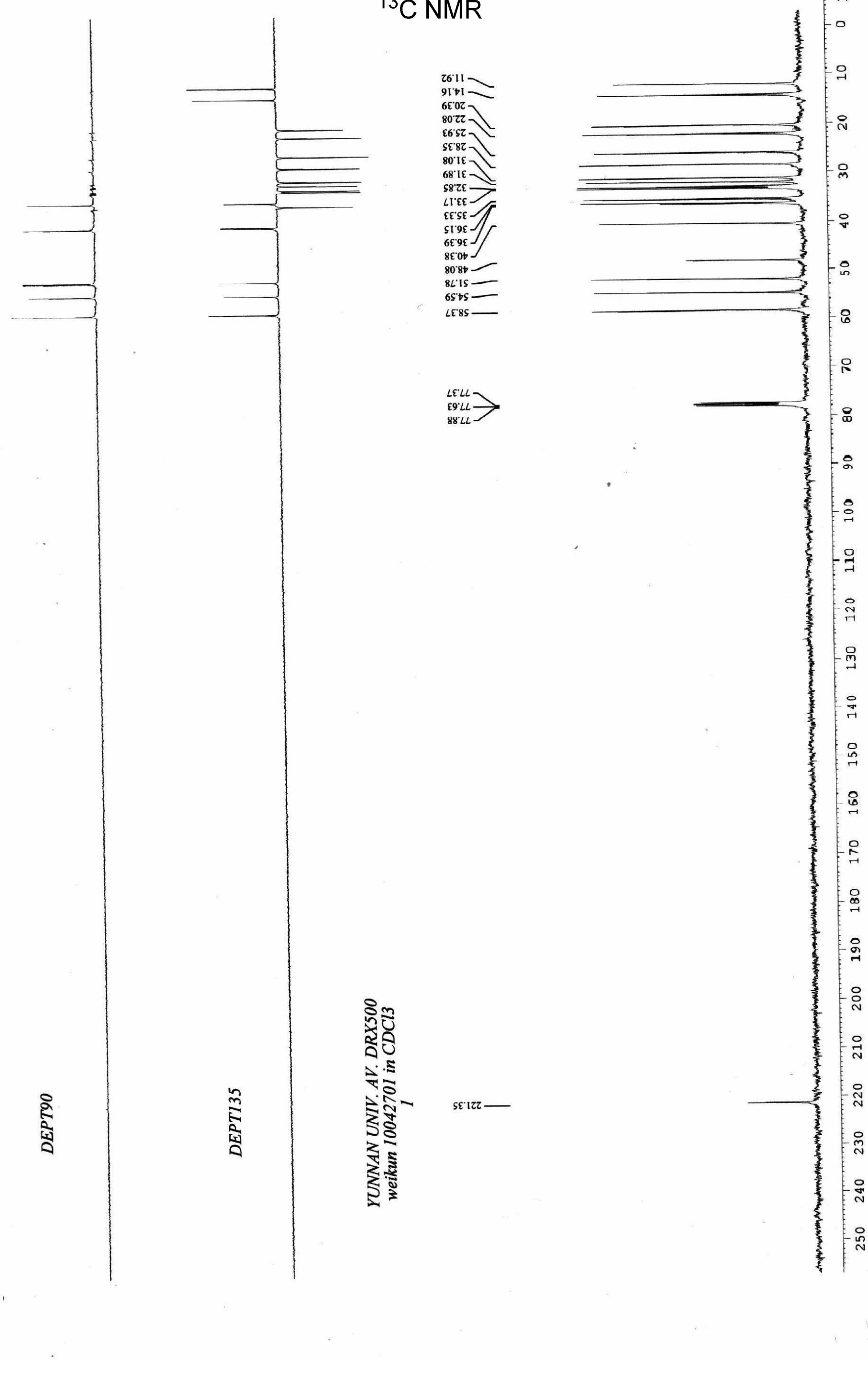
^{1}H NMR





3a

^{13}C NMR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DEPT135
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25.93
28.35
31.08
31.89
32.85
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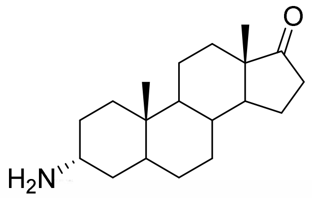
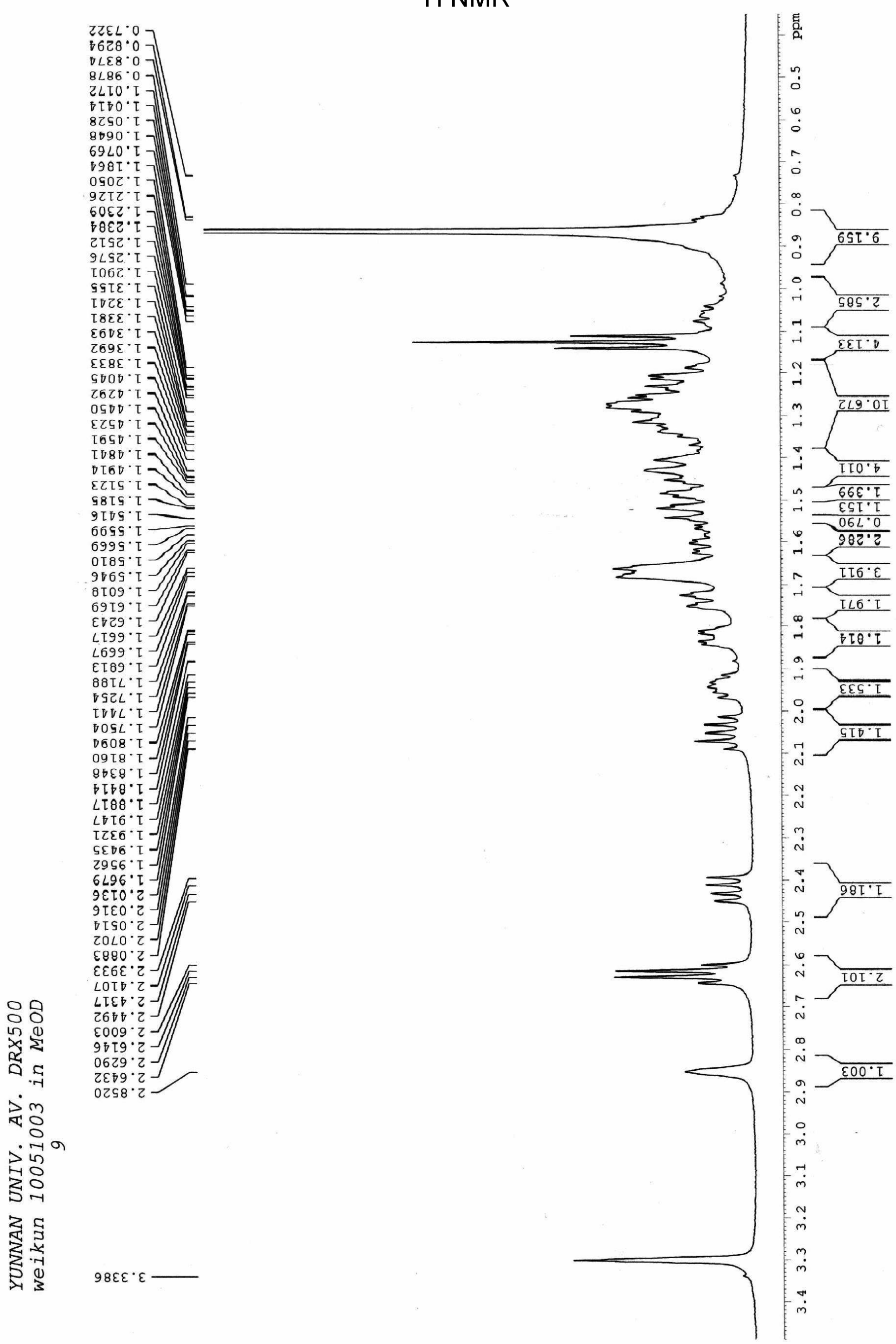
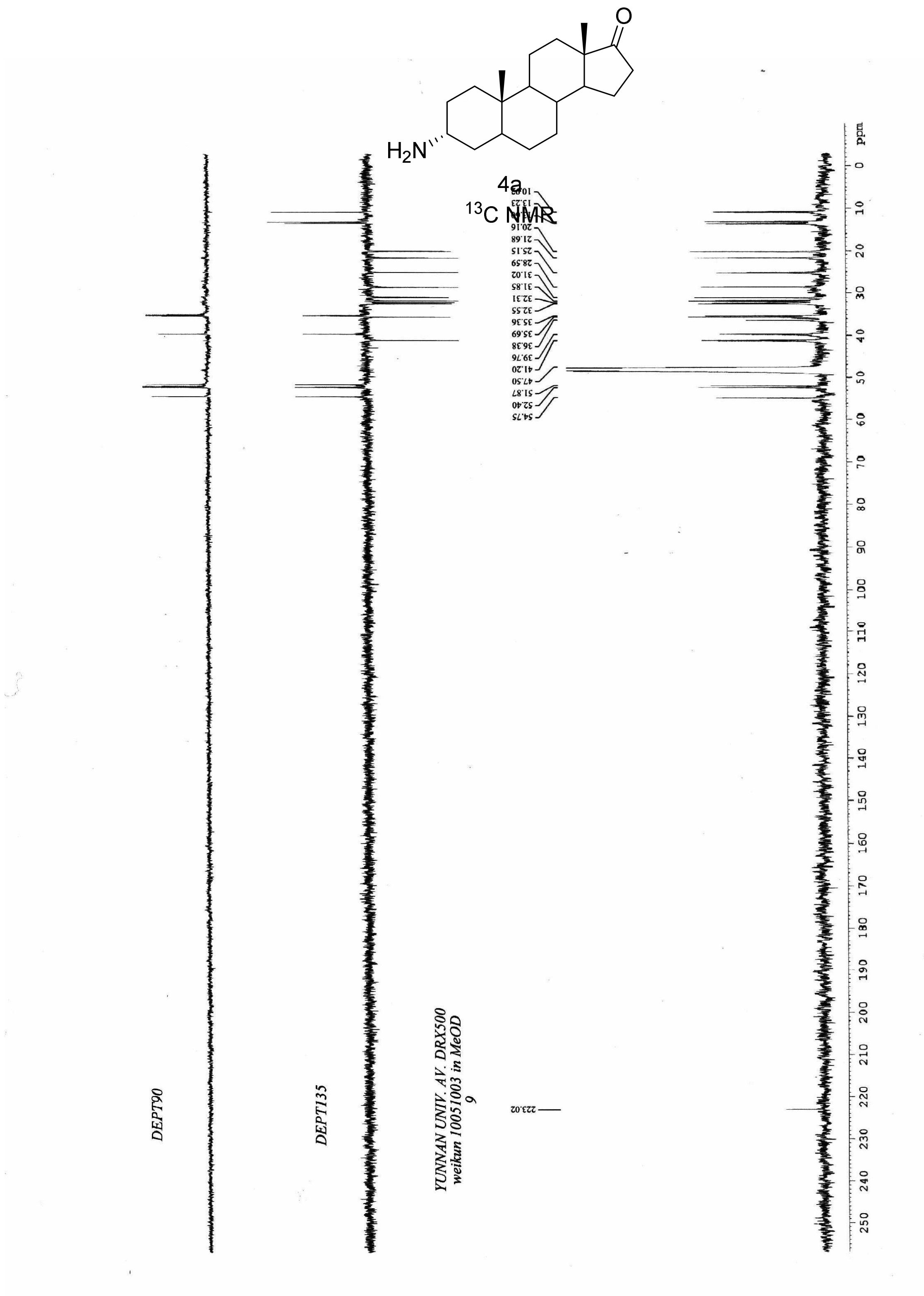


4a

^{1}H NMR




4a
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9
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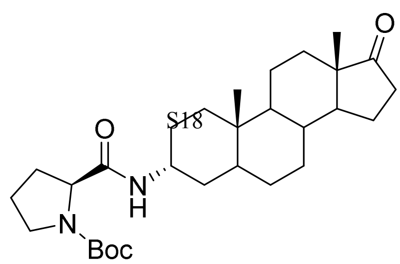
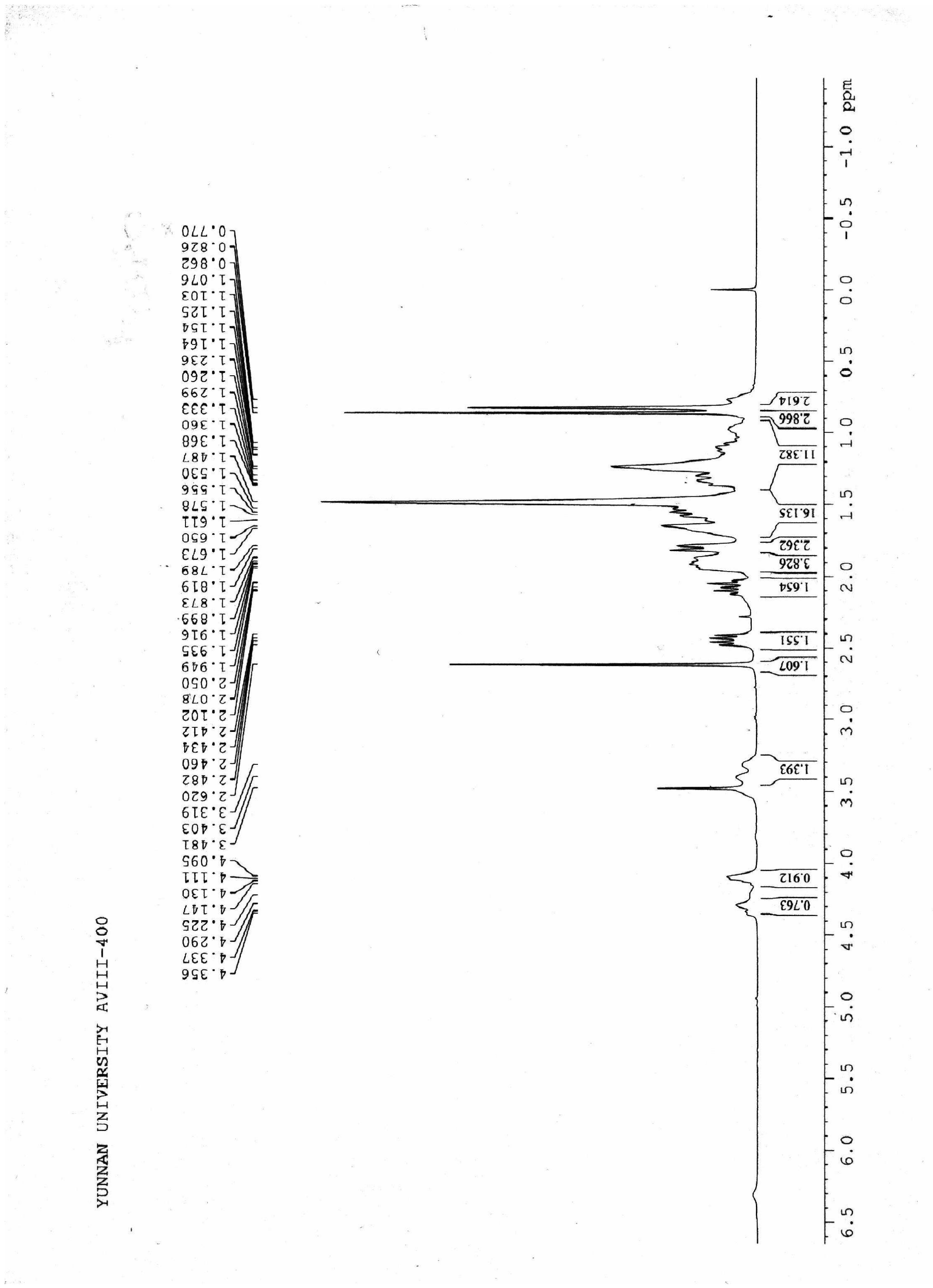
ppm

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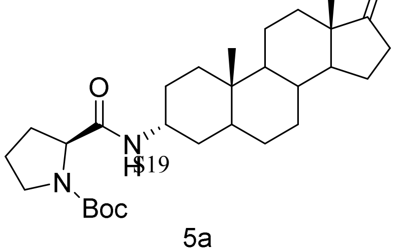
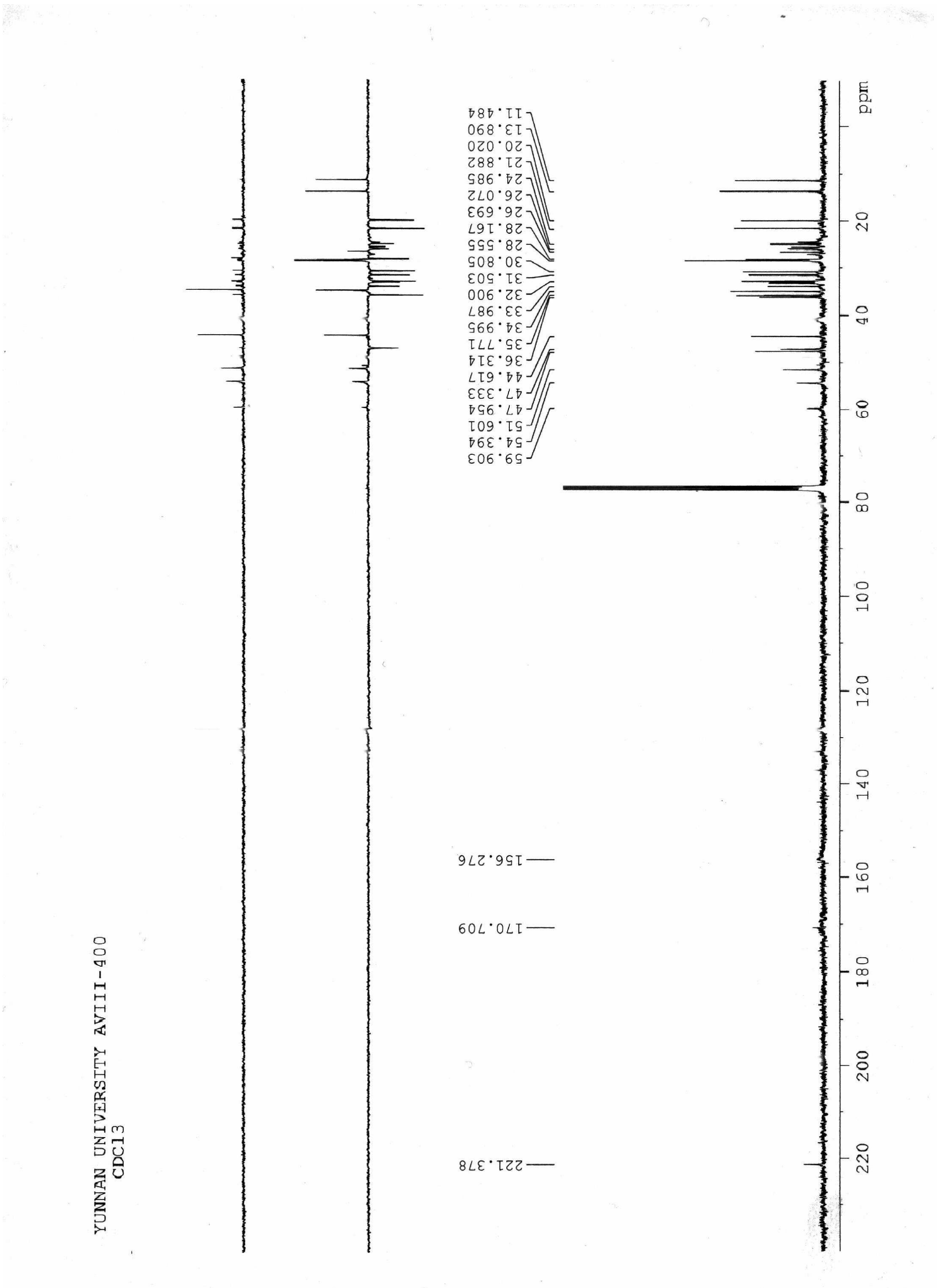
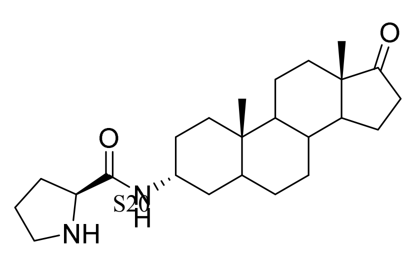
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
ppm


O
O
N
H
N
Boc

5a

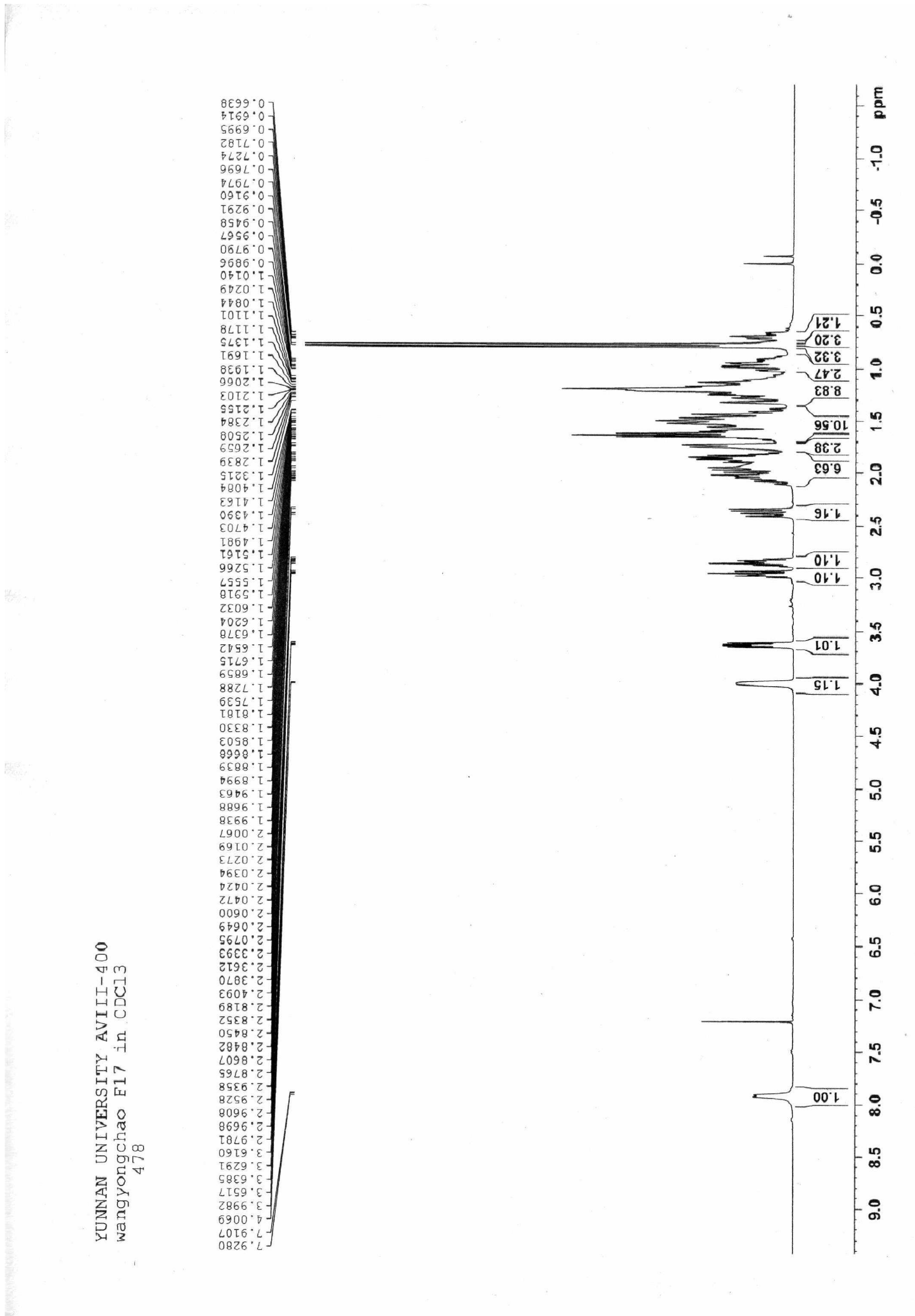
^{13}C NMR

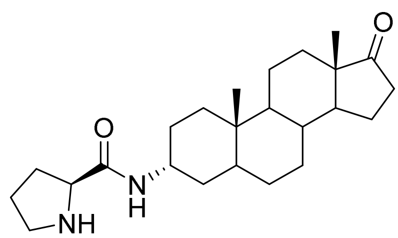

YUNNAN UNIVERSITY AVIII-400
CDCl3
11.484
13.890
20.020
21.882
24.985
26.072
26.693
28.167
28.555
30.805
31.503
32.900
33.987
34.995
35.771
36.314
44.617
47.333
47.954
51.601
54.394
59.903
156.276
170.709
221.378
ppm
20
40
60
80
100
120
140
160
180
200
220


O
O
N
H
NH

6a

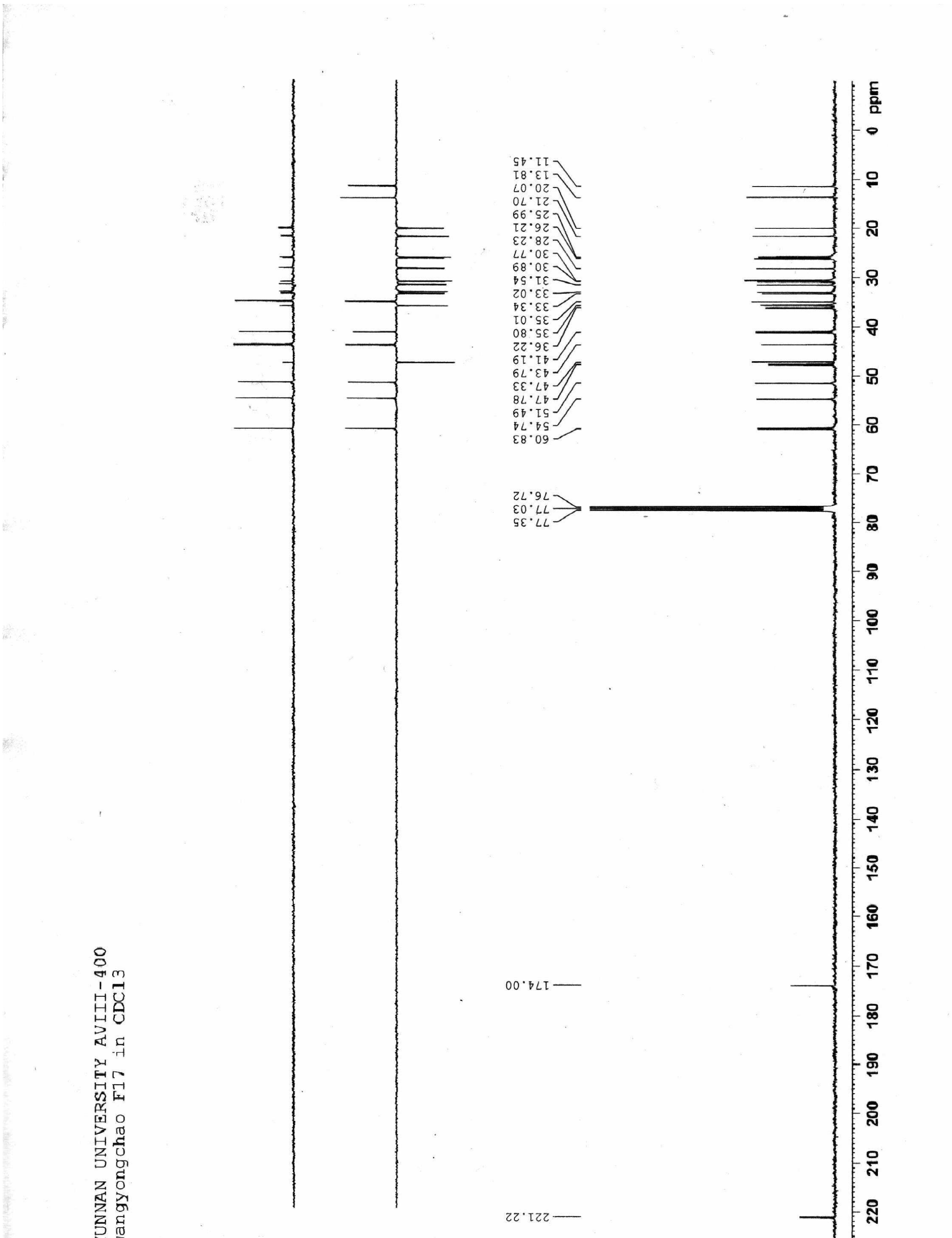
^{1}H NMR

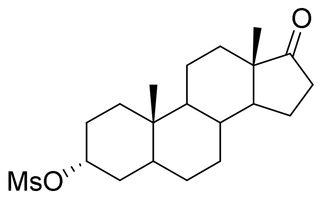




6a

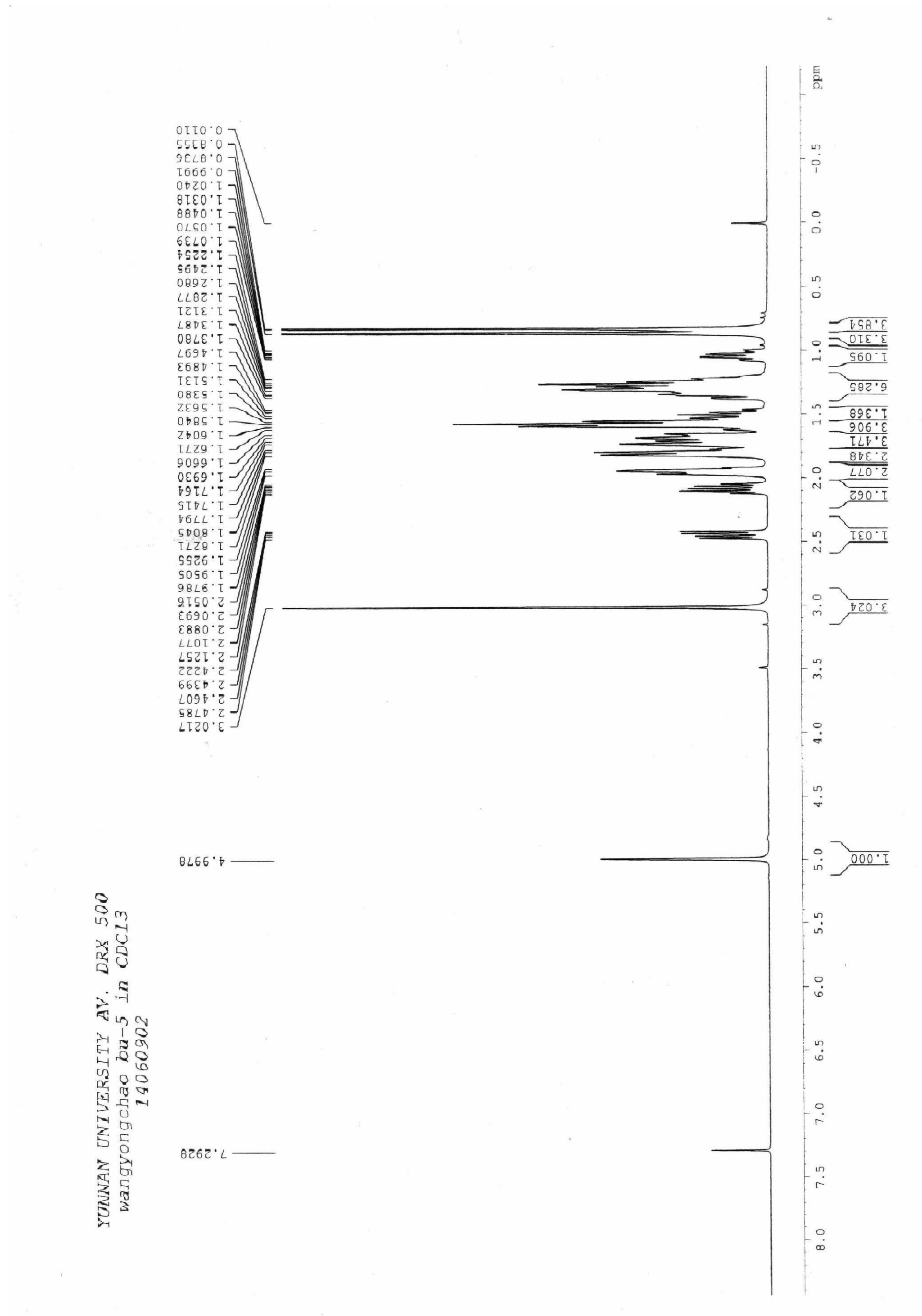
S21 ^{13}C NMR

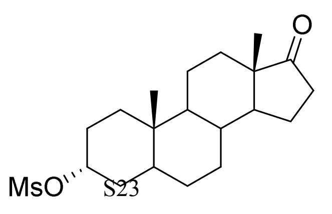

YUNNAN UNIVERSITY AVIII-400
wangyongchao F17 in CDCl3
11.45
13.81
20.07
21.70
25.99
26.21
28.23
30.77
30.89
31.54
33.02
33.34
35.01
35.80
36.22
41.19
43.79
47.33
47.78
51.49
54.74
60.83
76.72
77.03
77.35
174.00
221.22
ppm


O
MsO

2b

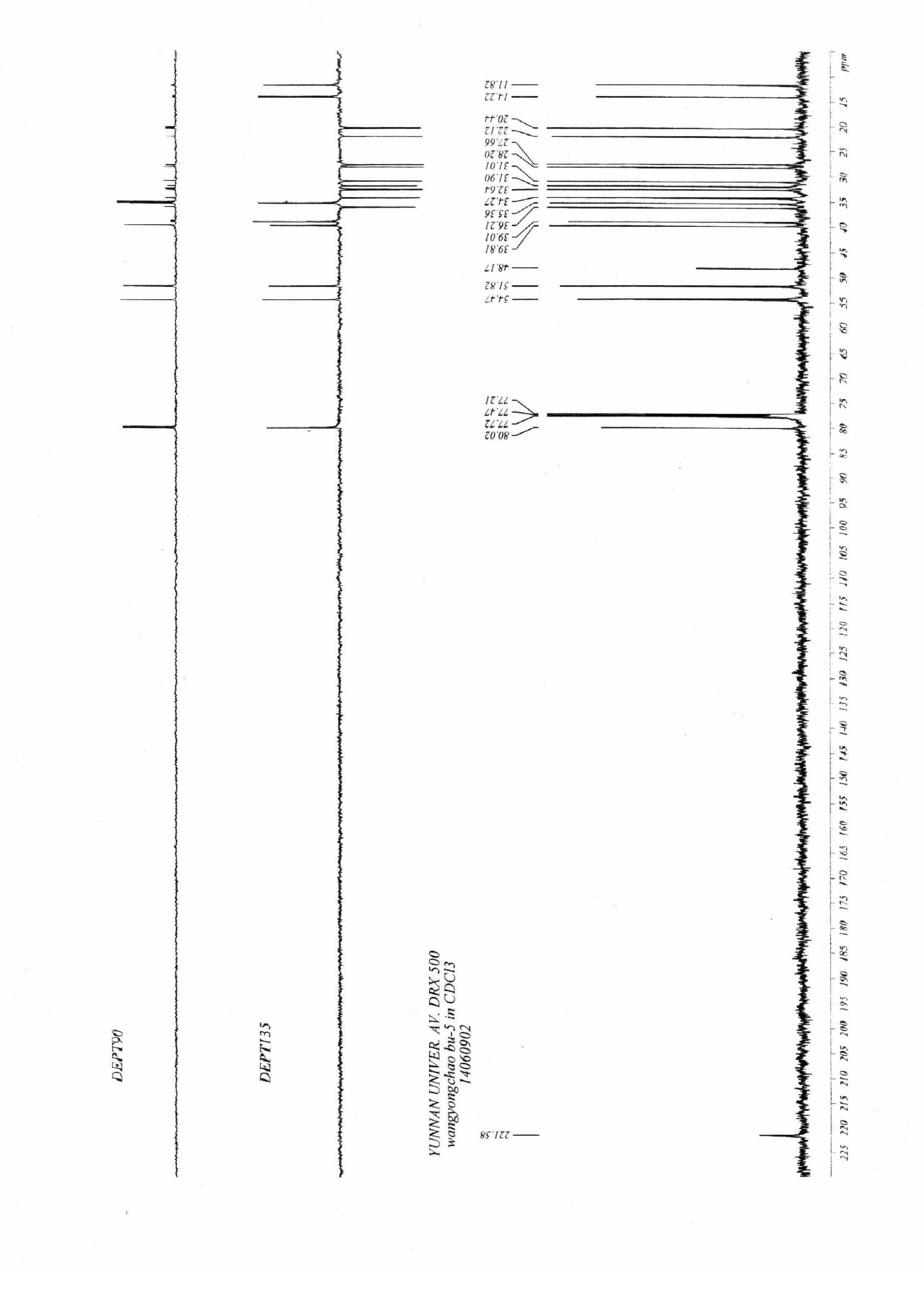
^{1}H NMR

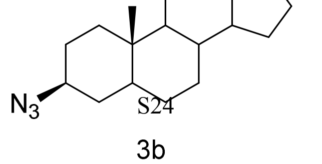

YUNNAN UNIVERSITY AV. DRX 500
wangyongchao bu-5 in CDCl3
14060902
ppm


O
MsO

2b

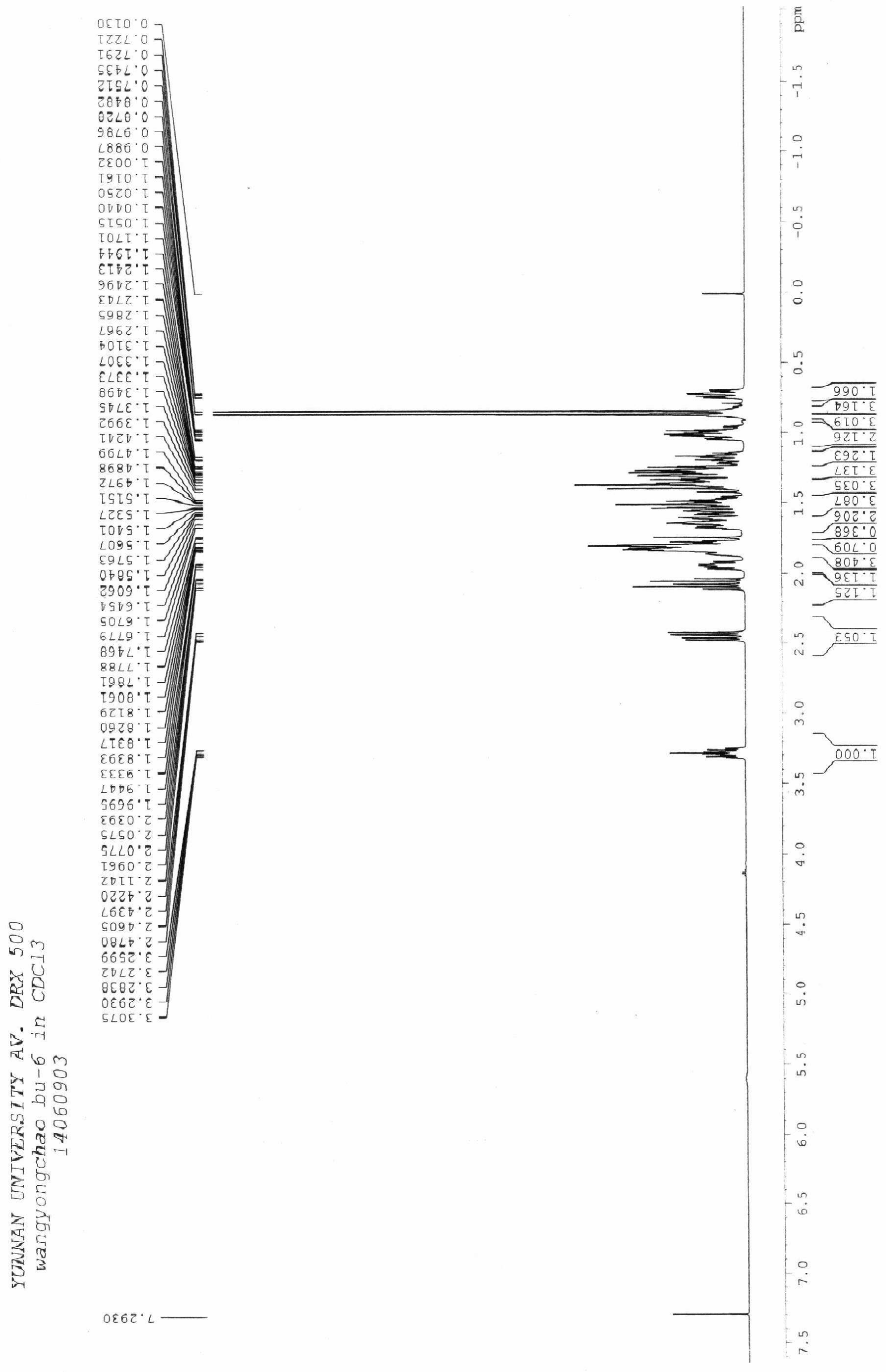
^{13}C-NMR

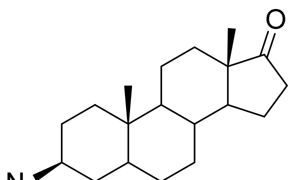

DEPT90
DEPT135
YUNNAN UNIVER AV. DRX 500
wangyongchao bu-5 in CDCl3
14060902
11.82
14.22
20.44
22.12
27.66
28.20
31.01
31.90
32.64
34.27
35.36
36.21
39.01
39.81
48.17
51.82
54.47
77.21
77.47
77.72
80.02
221.58
ppm


O
N3

3b

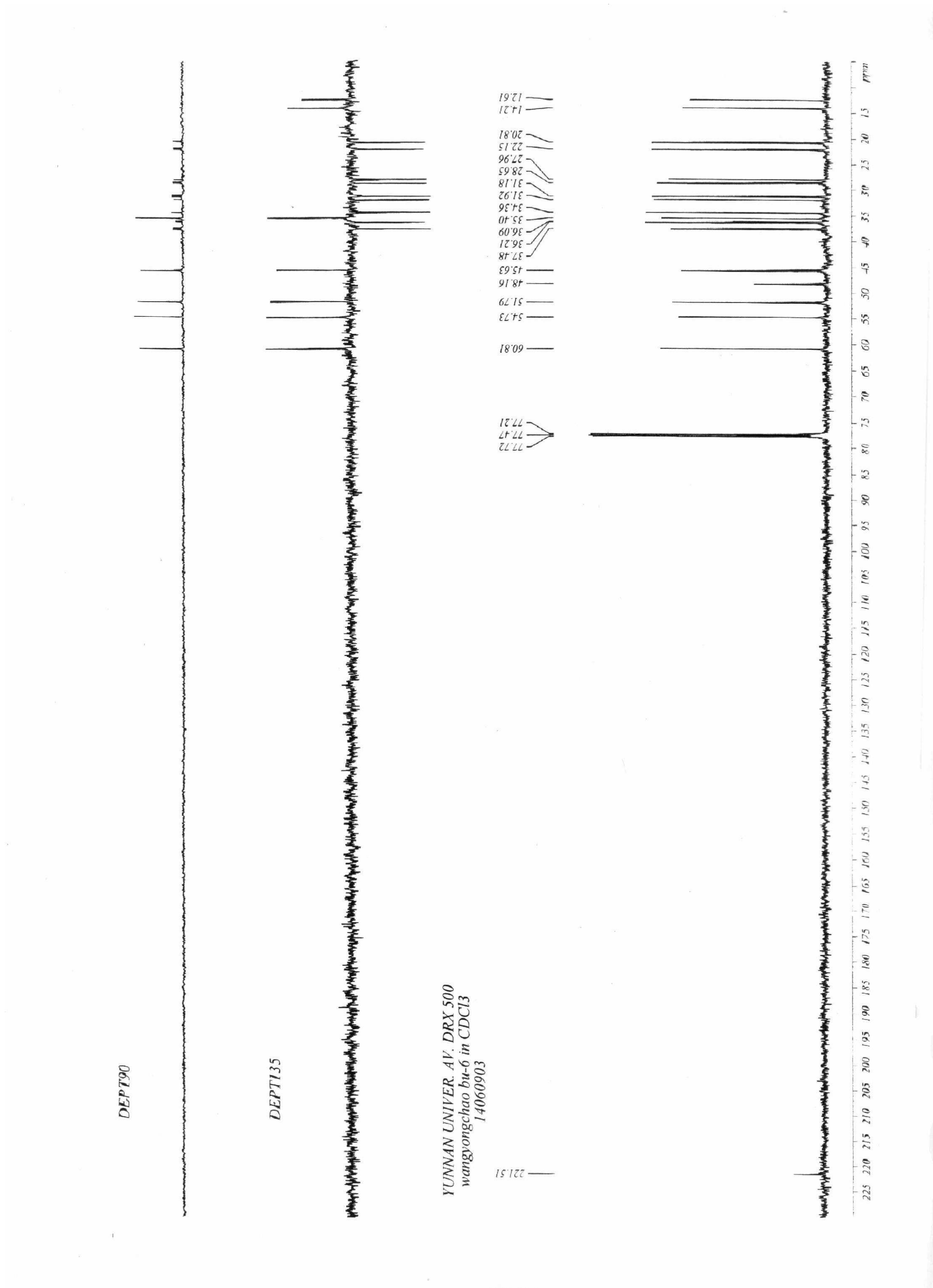
^{1}H-NMR

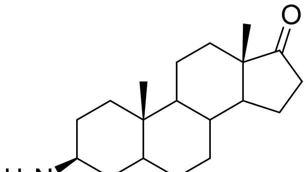

YUNNAN UNIVERSITY AV. DRX 500
wangyongchao bu-6 in CDCl13
14060903
ppm



3b

^{13}C-NMR

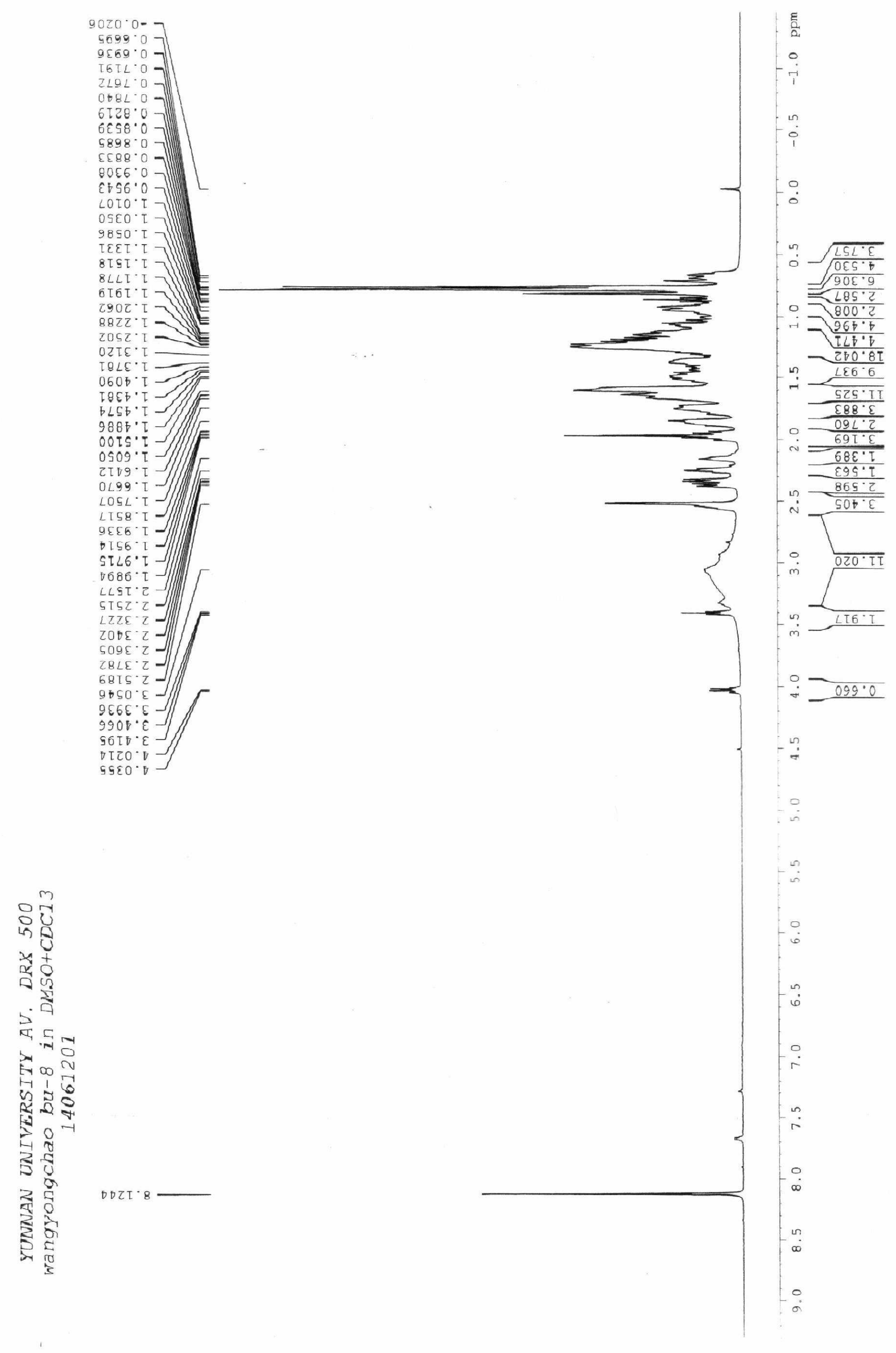

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao bu-6 in CDCl3
14060903
12.61
14.21
20.81
22.15
27.96
28.65
31.18
31.92
34.36
35.40
36.09
36.21
37.48
45.63
48.16
51.79
54.73
60.81
77.21
77.47
77.72
221.51
ppm

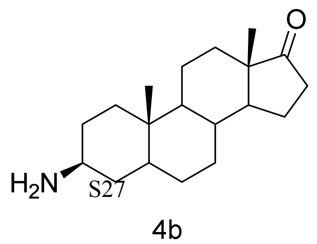

O
H_2N

S26

4b

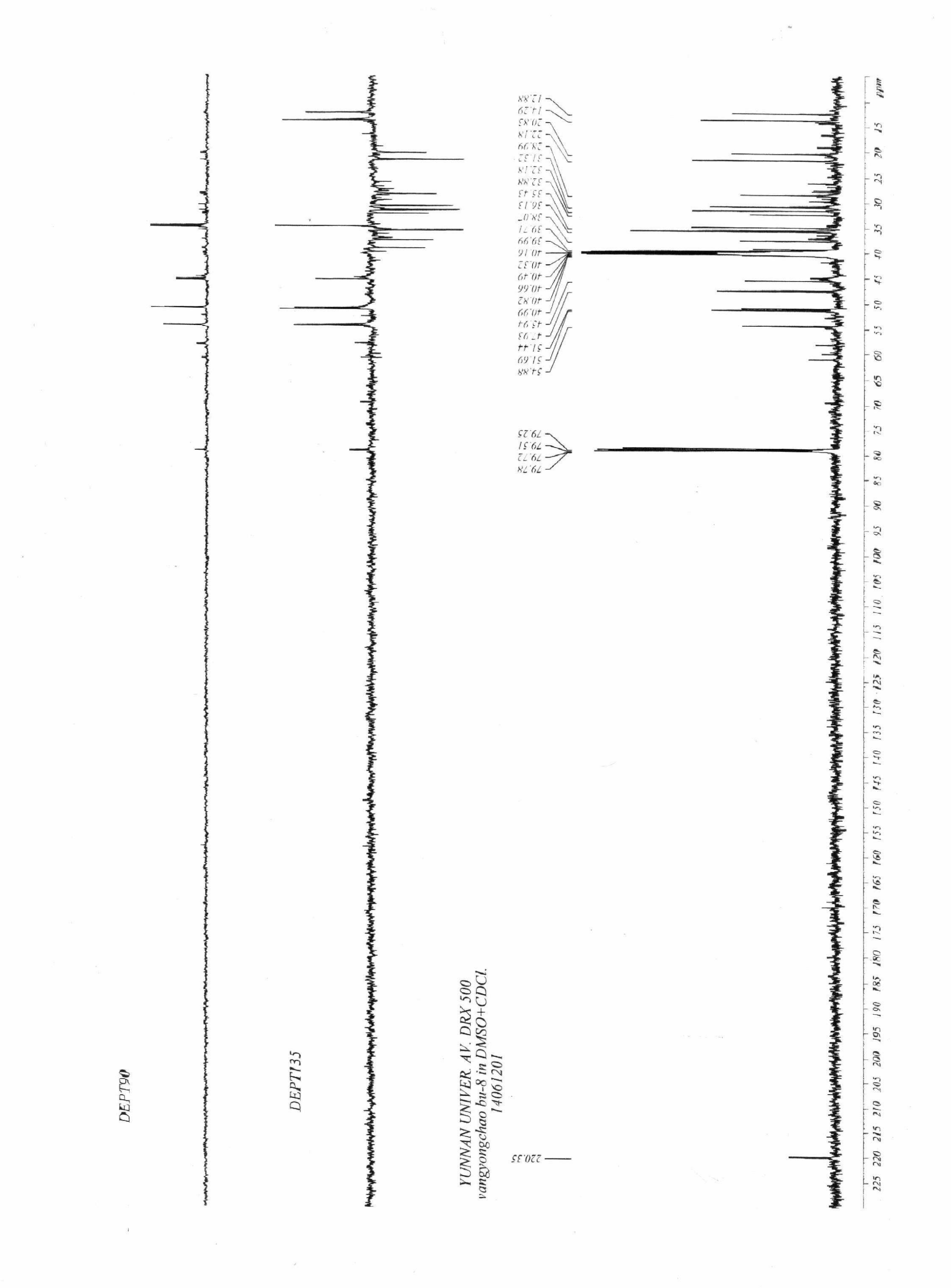
^{1}H-NMR

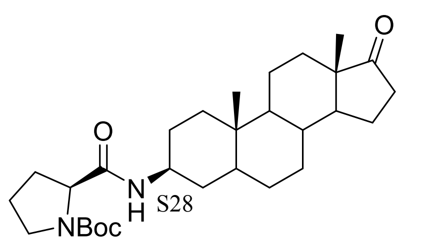

YUNNAN UNIVERSITY AV. DRX 500
wangyongchao bu-8 in DMSO+CDCl3
14061201


H2N

4b

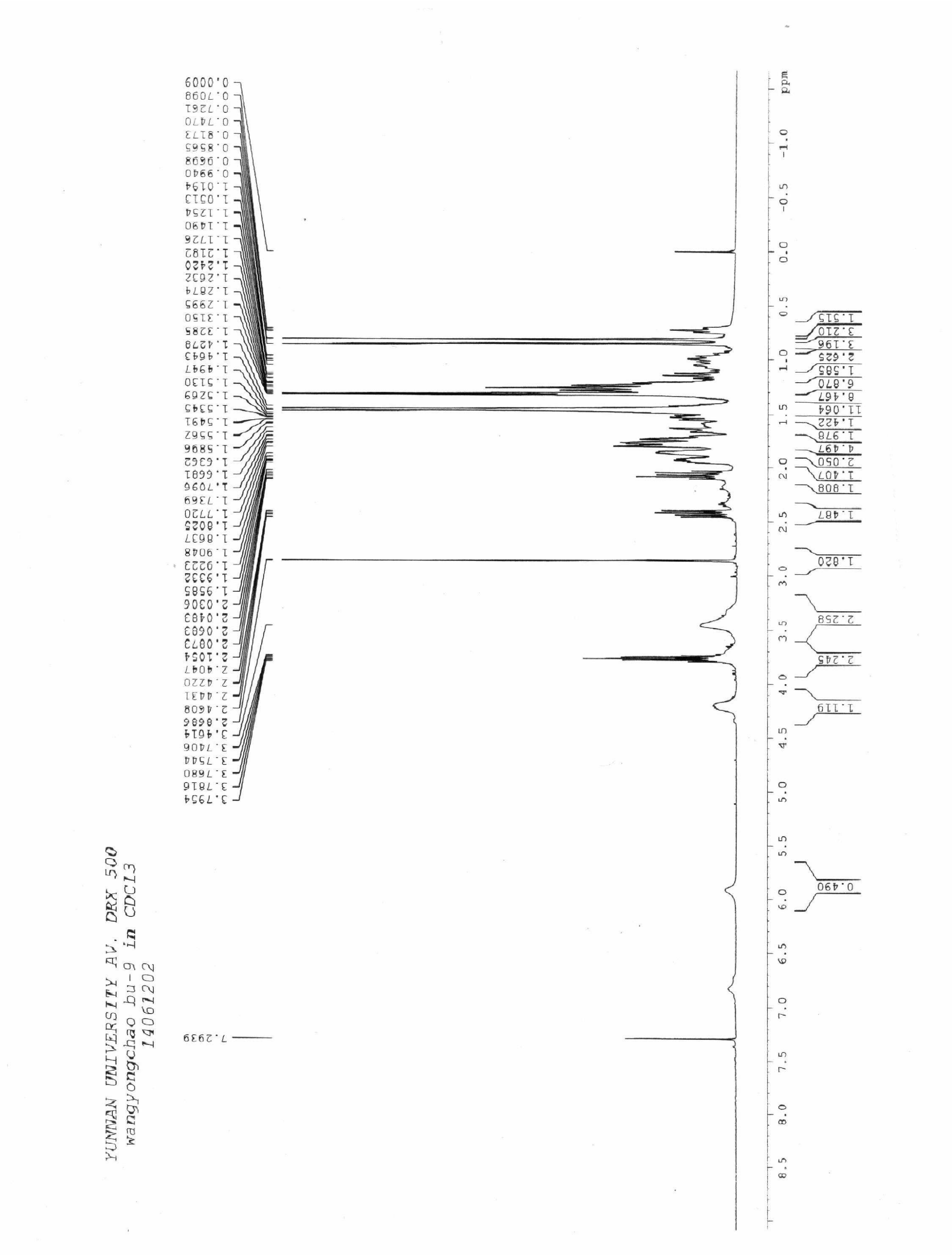
^{13}C-NMR

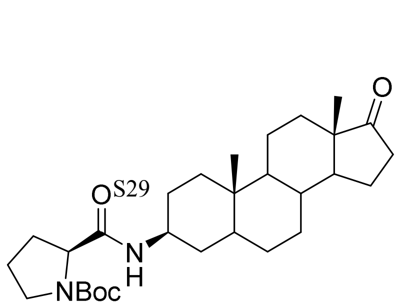

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
vangyongchao bu-8 in DMSO+CDCl3
14061201

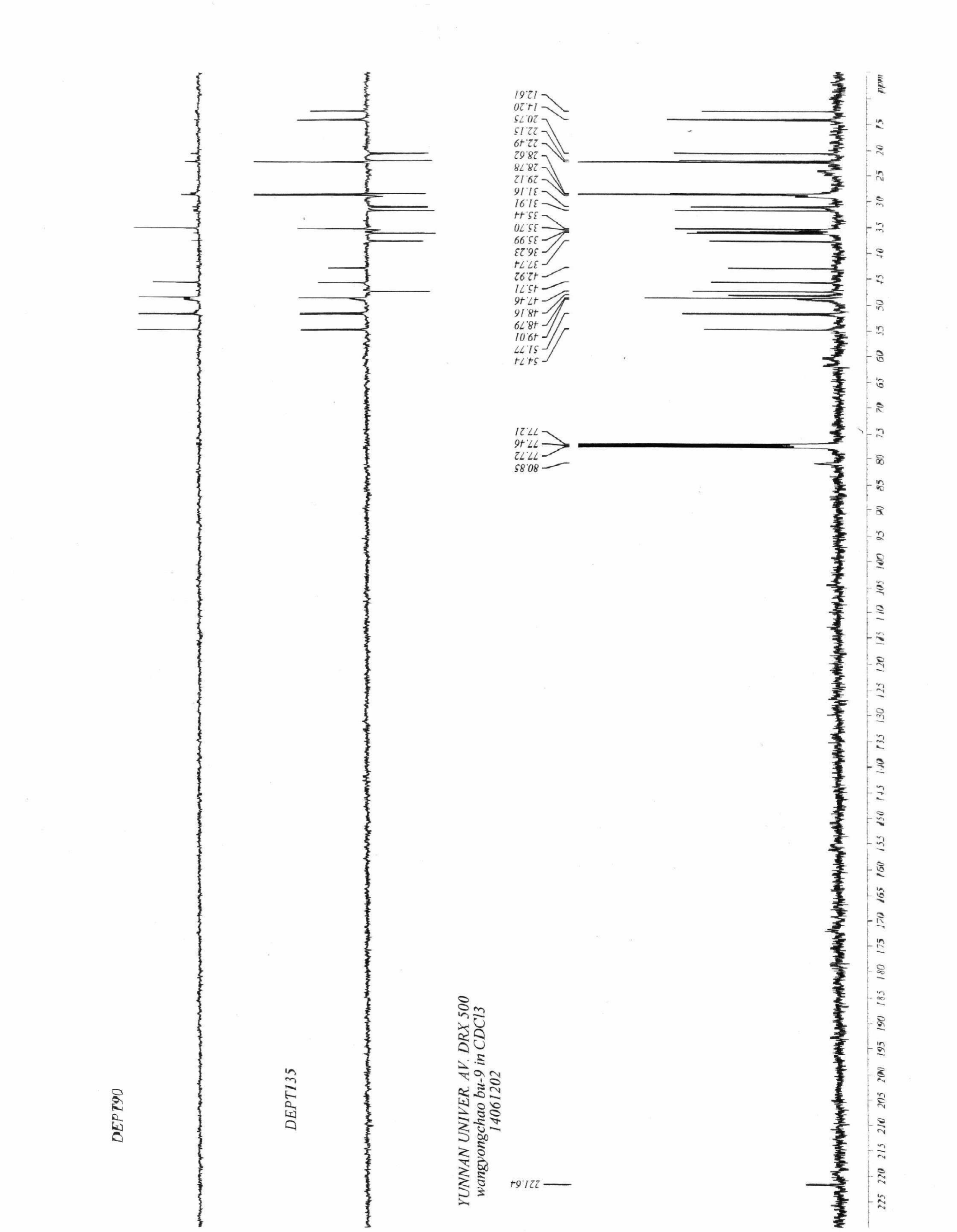

O
N
H
NBoc
O

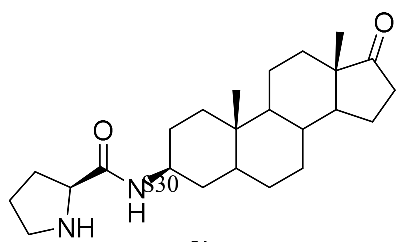
5b

^{1}H-NMR


YUNNAN UNIVERSITY AV. DRX 500
wangyongchao bu-9 in CDCl3
14061202
ppm

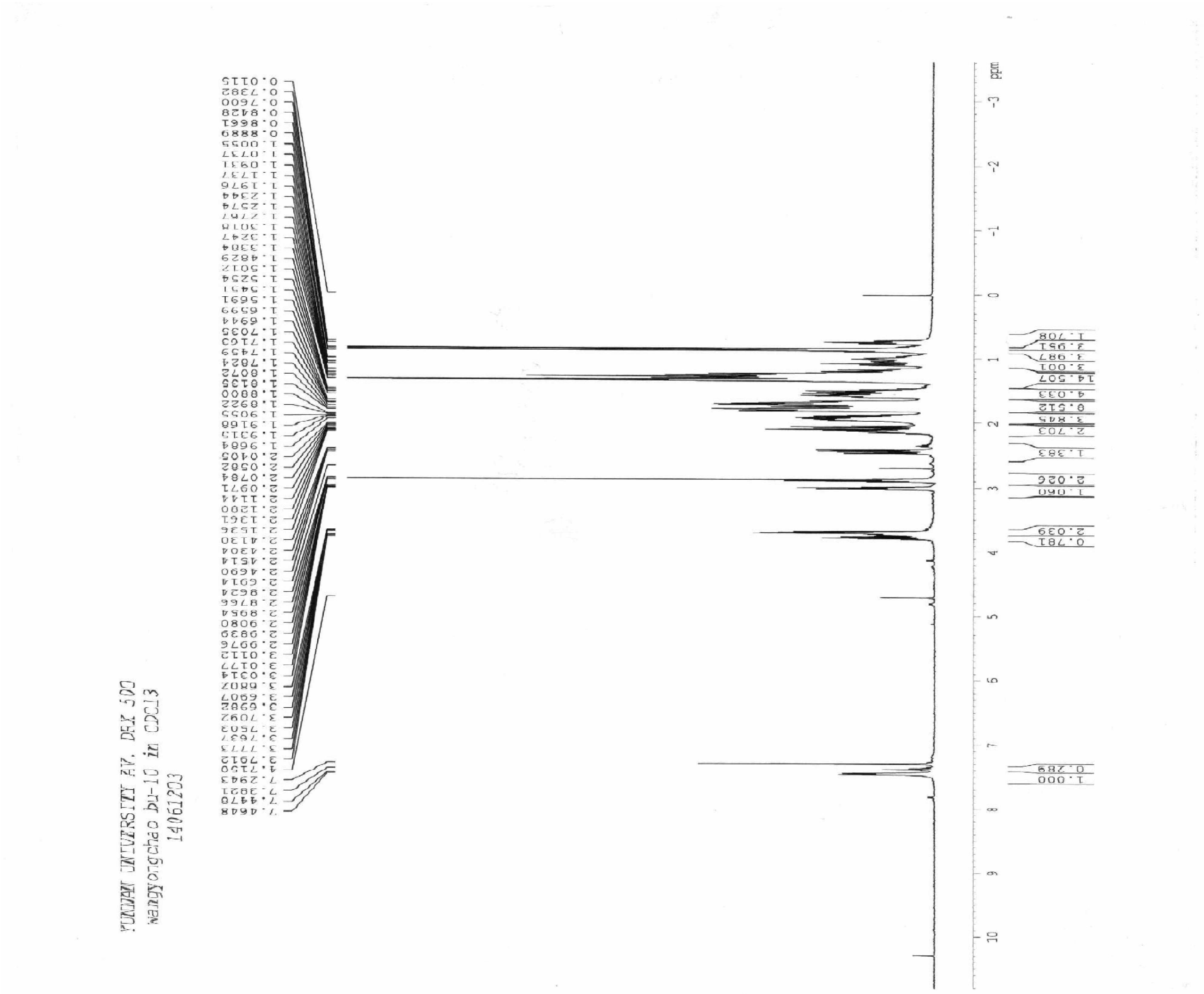

S29

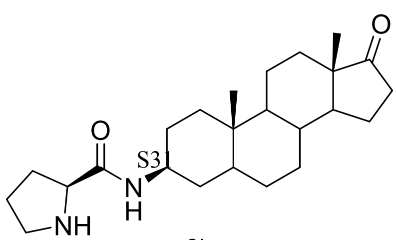

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao bu-9 in CDCl3
14061202
ppm



6b

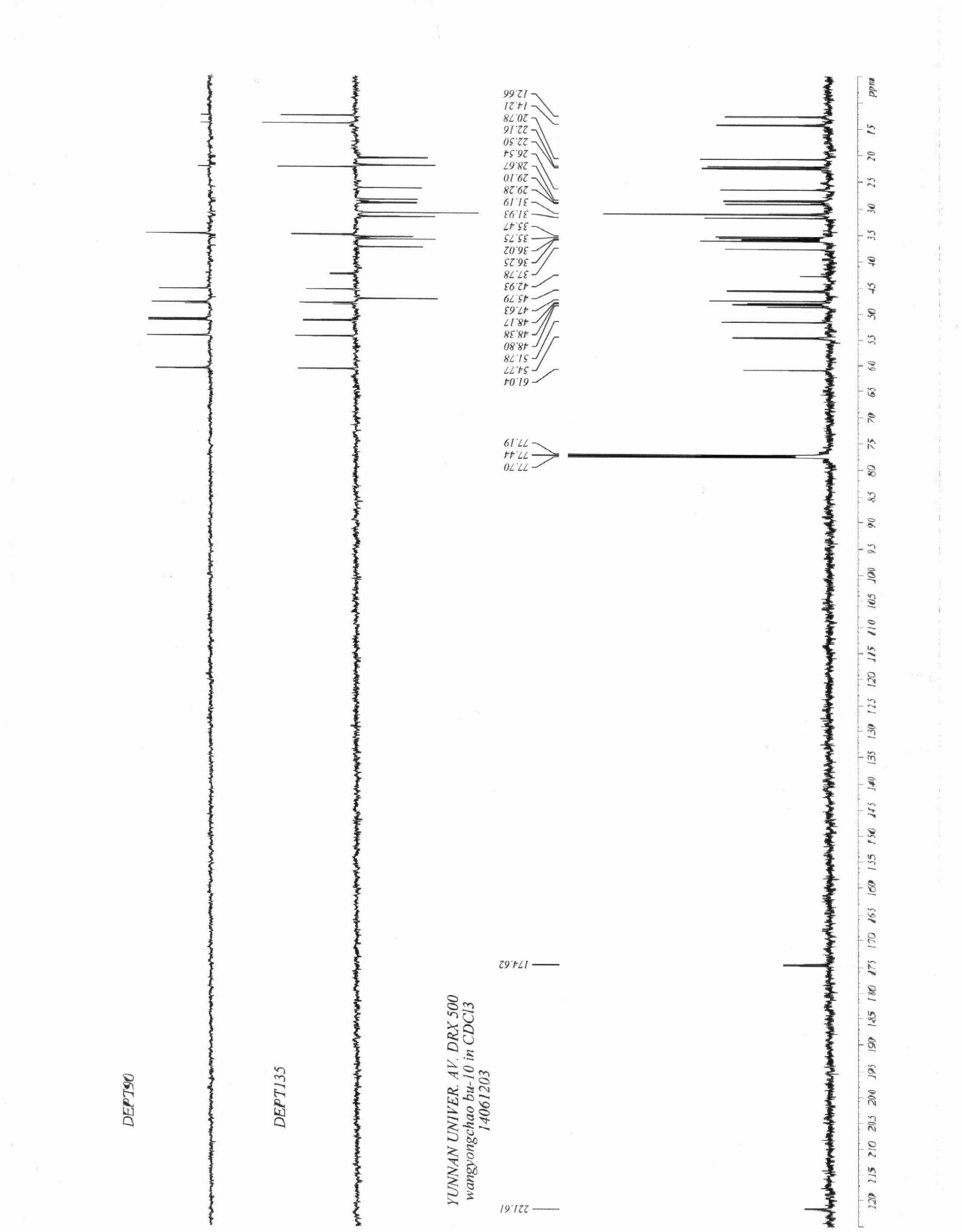
^{1}H-NMR

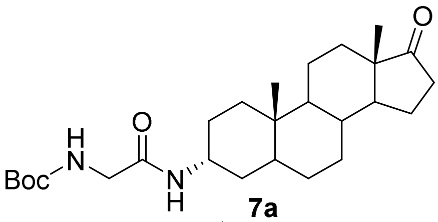

YUNNAN UNIVERSITY AV. DRX 500
wangyongchao bu-10 in CDCl3
14061203
ppm


O
O
S3
N
H
NH

6b

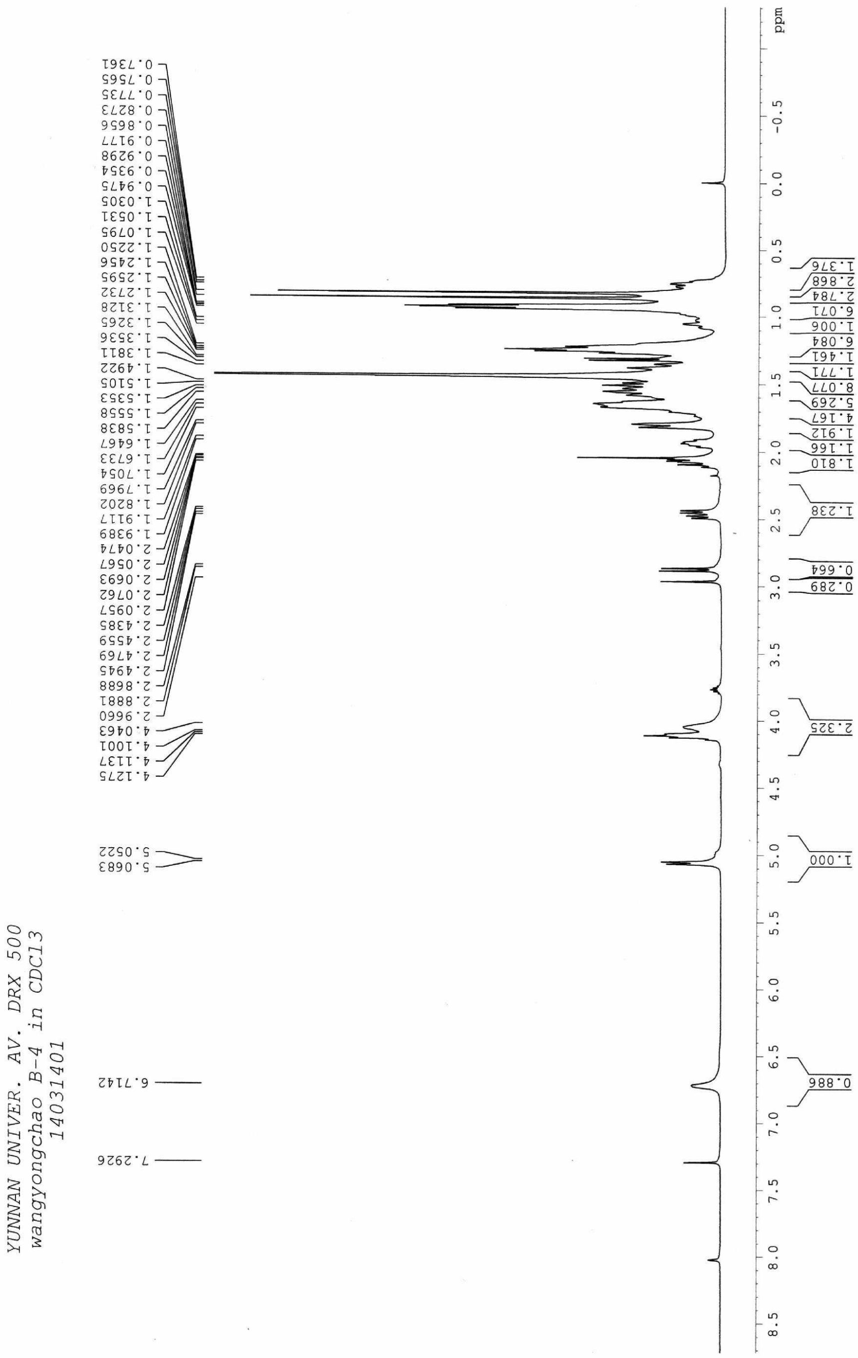
^{13}C-NMR

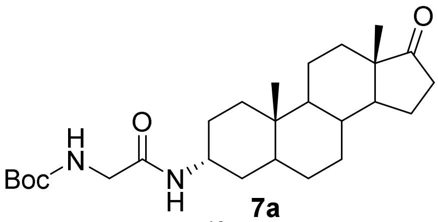

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao bu-10 in CDCl3
14061203
12.66
14.21
20.78
22.16
22.50
26.54
28.67
29.10
29.28
31.19
31.93
35.47
35.75
36.02
36.25
37.28
42.93
45.79
47.63
48.17
48.38
48.80
51.28
54.72
61.04
77.19
77.44
77.70
174.62
221.61
ppm


Boc
N
H
O
N
H
O

7a

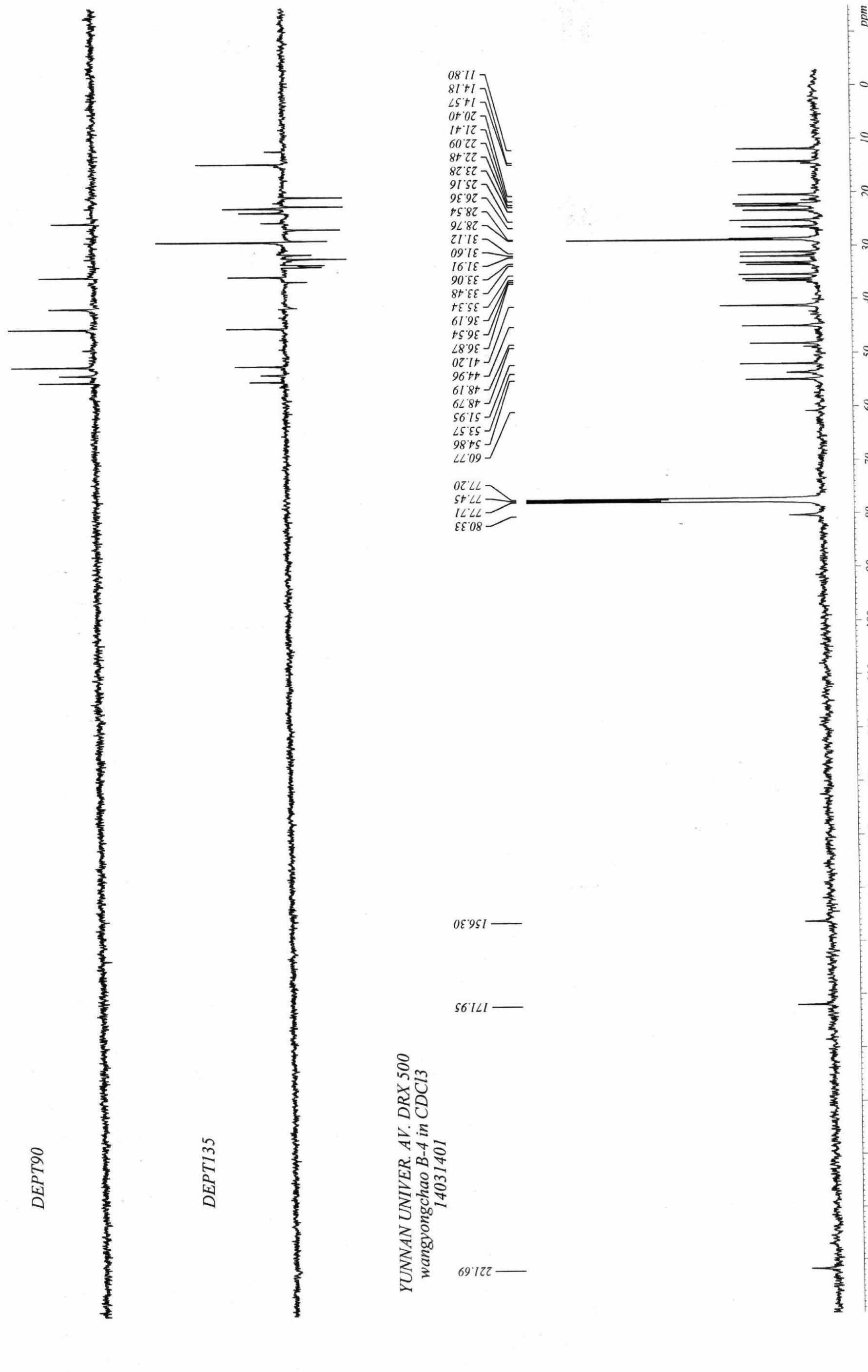
^{1}H NMR

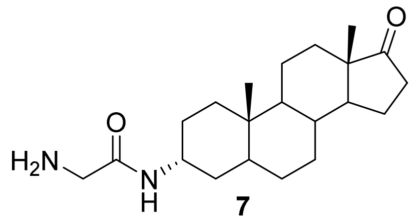

YUNNAN UNIVER. AV. DRX 500
wangyongchao B-4 in CDCl3
14031401
0.7361
0.7565
0.7735
0.8273
0.8656
0.9177
0.9298
0.9354
0.9475
1.0305
1.0531
1.0795
1.2250
1.2456
1.2595
1.2732
1.3128
1.3265
1.3536
1.3811
1.4922
1.5105
1.5353
1.5558
1.5838
1.6467
1.6733
1.7054
1.7969
1.8202
1.9117
1.9389
2.0474
2.0567
2.0693
2.0762
2.0957
2.4385
2.4559
2.4769
2.4945
2.8688
2.8881
2.9660
4.0463
4.1001
4.1137
4.1275
5.0522
5.0683
6.7142
7.2926
1.376
2.868
2.784
6.071
1.006
6.084
1.461
1.771
8.077
5.269
4.167
1.912
1.166
1.810
1.238
0.664
0.289
2.325
1.000
0.886
ppm


O
H
N
Boc
O
N
H

7a

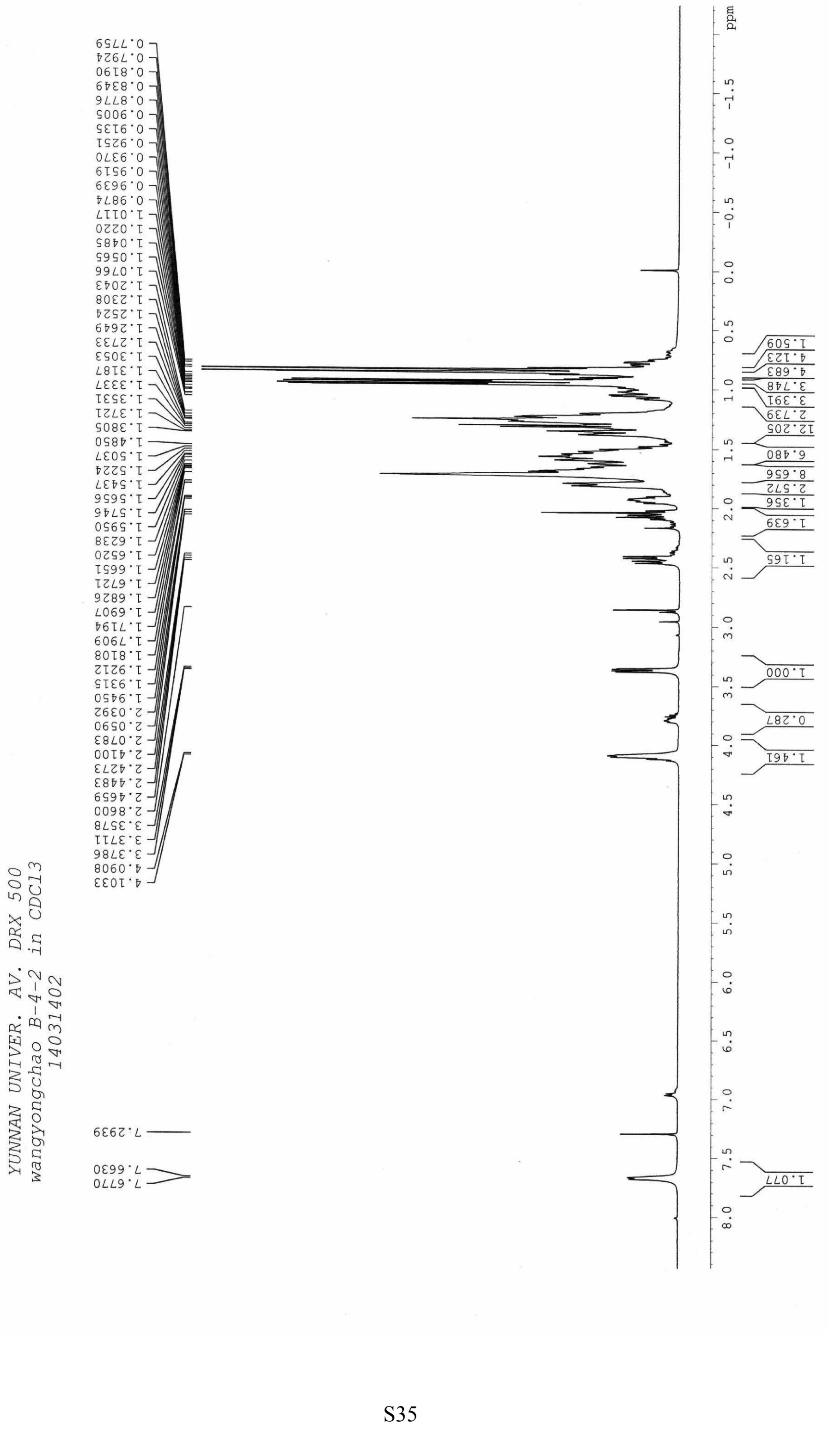
^{13}C NMR

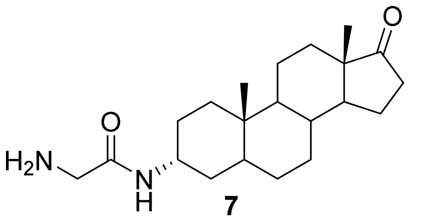

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-4 in CDCl3
14031401
11.80
14.18
14.57
20.40
21.41
22.09
22.48
23.28
25.16
26.36
28.54
28.76
31.12
31.60
31.91
33.06
33.48
35.34
36.19
36.54
36.87
41.20
44.96
48.19
48.79
51.95
53.57
54.86
60.77
77.20
77.45
77.71
80.33
156.30
171.95
221.69
ppm


H2N
O
N
H
O

7

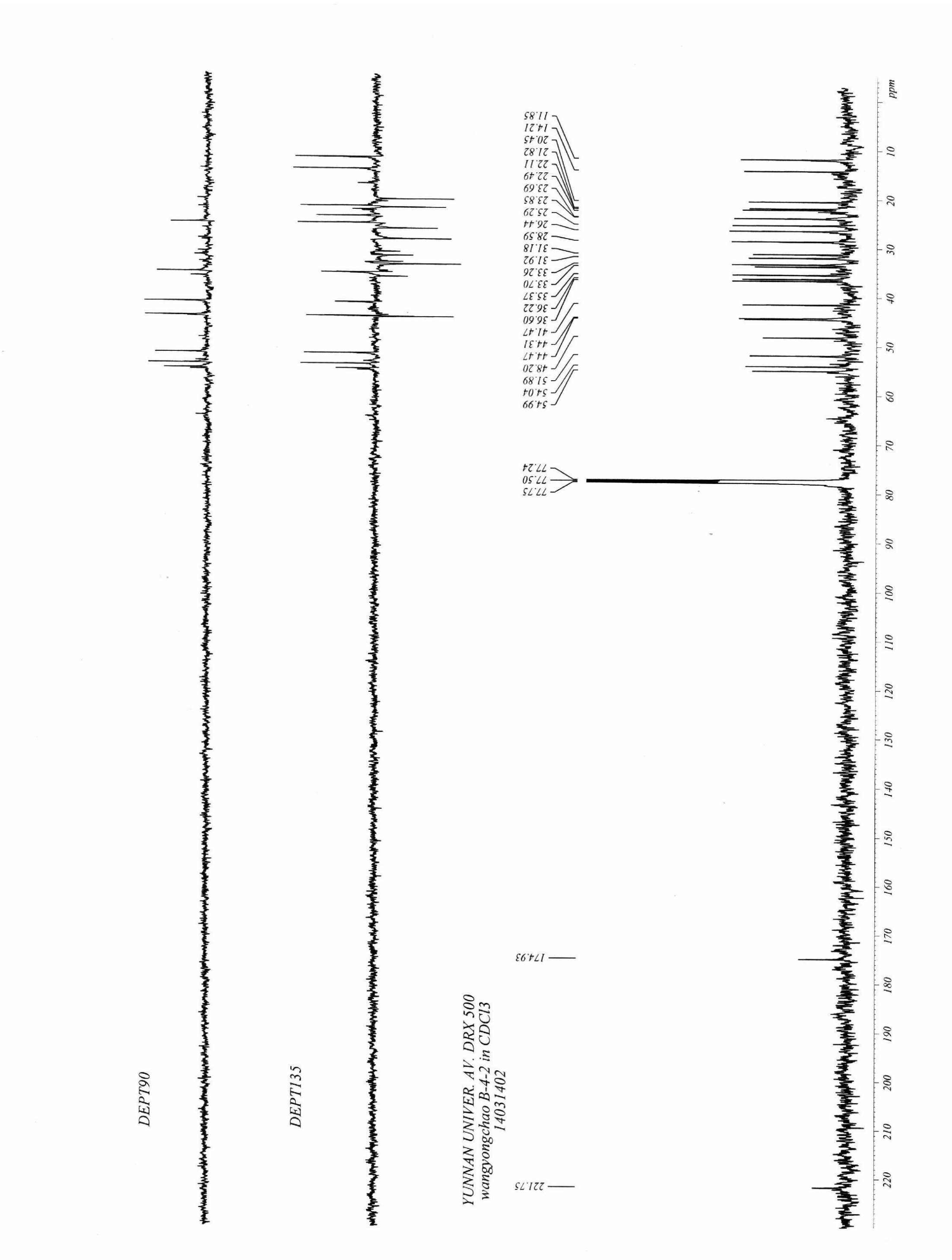
^{1}H NMR

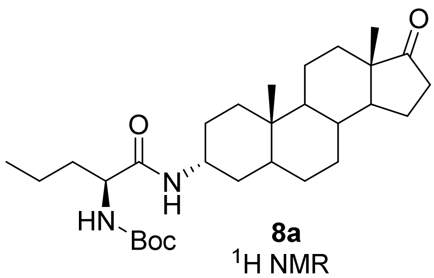

YUNNAN UNIVER. AV. DRX 500
wangyongchao B-4-2 in CDCl3
14031402
0.7759
0.7924
0.8190
0.8349
0.8776
0.9005
0.9135
0.9251
0.9370
0.9519
0.9639
0.9874
1.0117
1.0220
1.0485
1.0565
1.0766
1.2043
1.2308
1.2524
1.2649
1.2733
1.3053
1.3187
1.3337
1.3531
1.3721
1.3805
1.4850
1.5037
1.5224
1.5437
1.5656
1.5746
1.5950
1.6238
1.6520
1.6651
1.6721
1.6826
1.6907
1.7194
1.7909
1.8108
1.9212
1.9315
1.9450
2.0392
2.0590
2.0783
2.4100
2.4273
2.4483
2.4659
2.8600
3.3578
3.3711
3.3786
4.0908
4.1033
7.2939
7.6630
7.6770
1.509
4.123
4.683
3.748
3.391
2.739
12.205
6.480
8.656
2.572
1.356
1.639
1.165
1.000
0.287
1.461
1.077
ppm


H2N
O
N
H
O

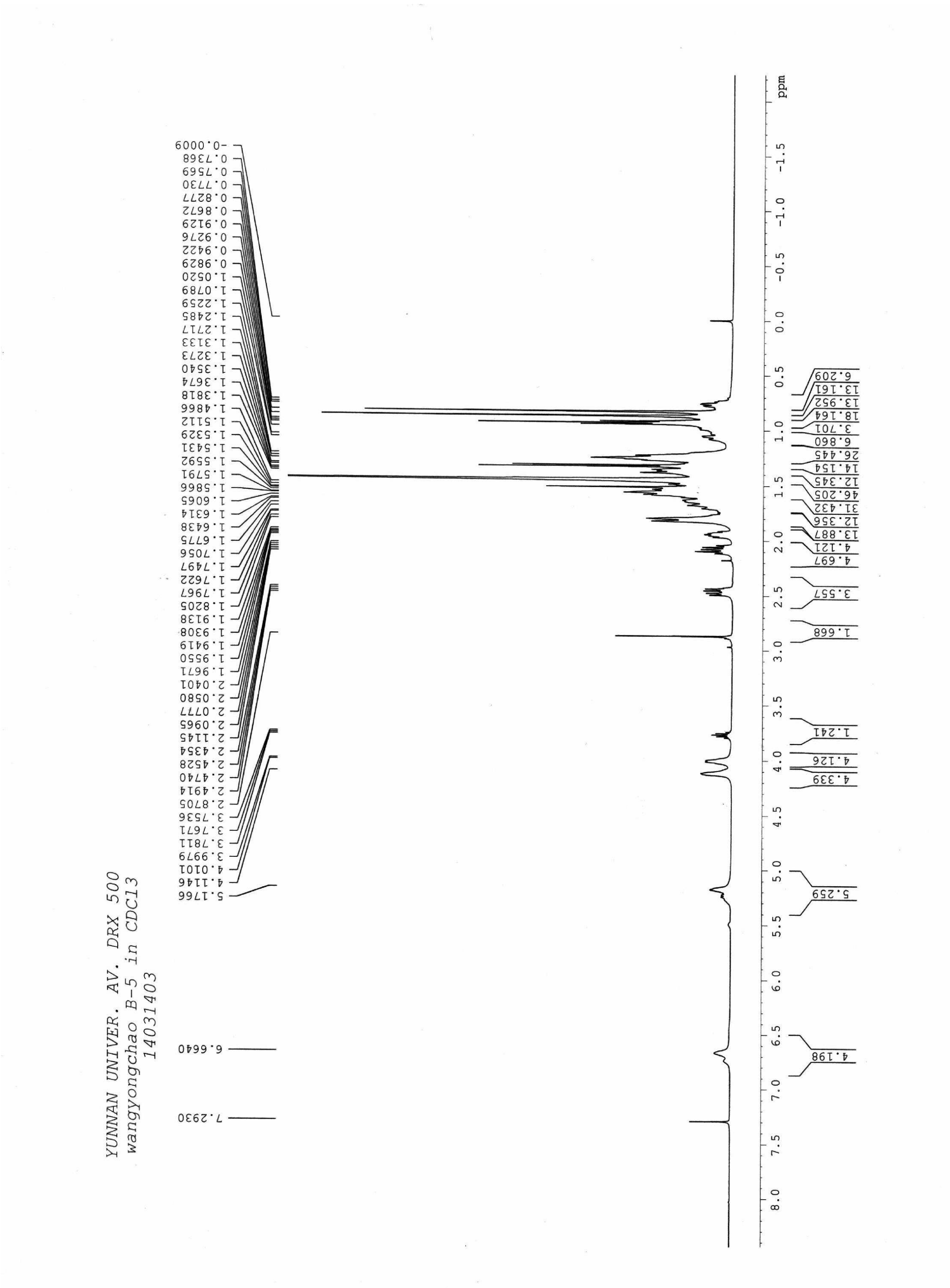
7

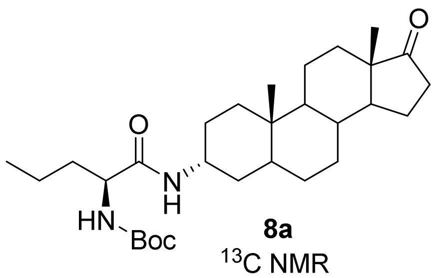
^{13}C NMR


DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-4-2 in CDCl3
14031402
11.85
14.21
20.45
21.82
22.11
22.49
23.69
23.85
25.29
26.44
28.59
31.18
31.92
33.26
33.70
35.37
36.22
36.60
41.47
44.31
44.47
48.20
51.89
54.04
54.99
77.24
77.50
77.75
174.93
221.75
ppm



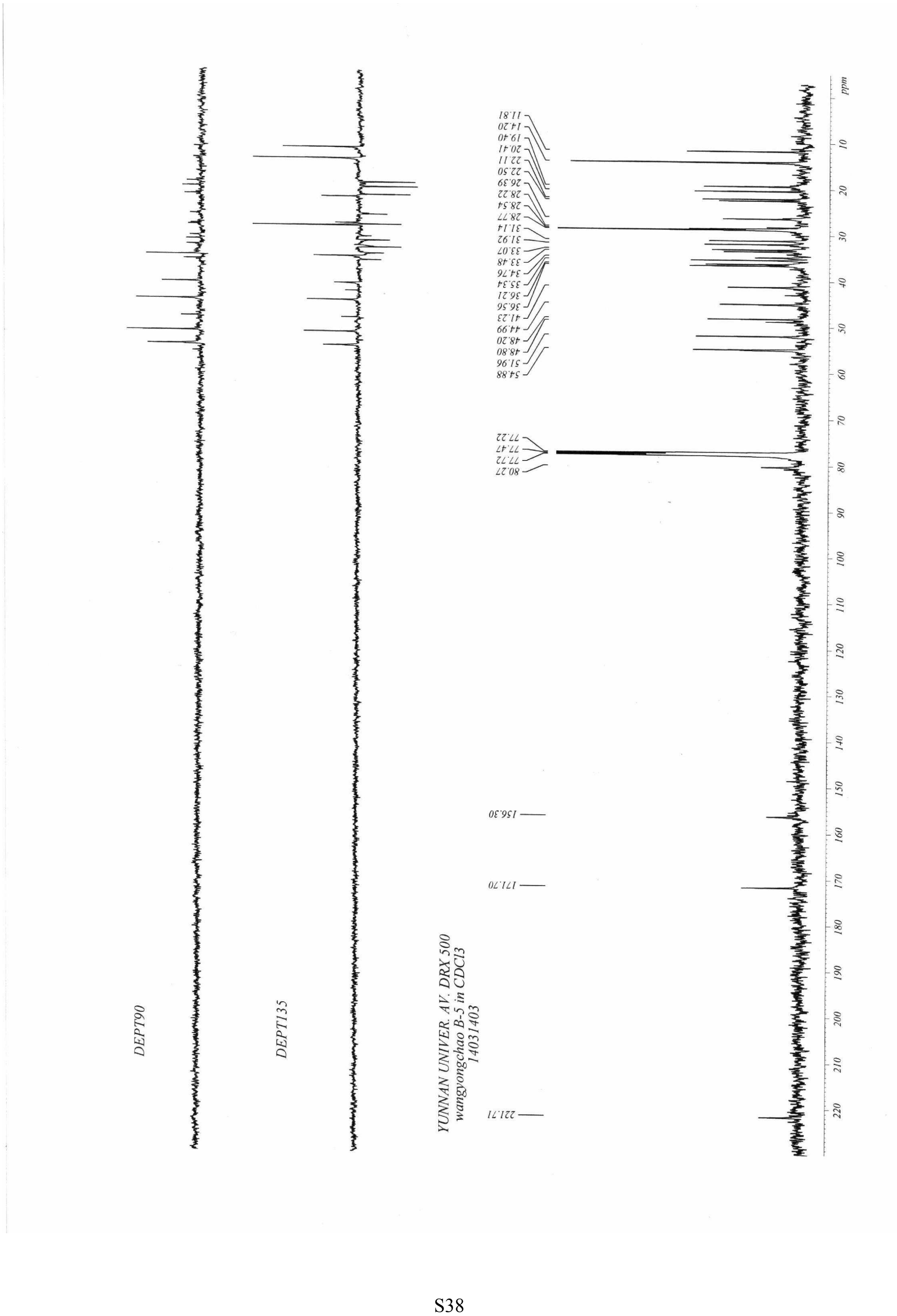
8a
^{1}H NMR

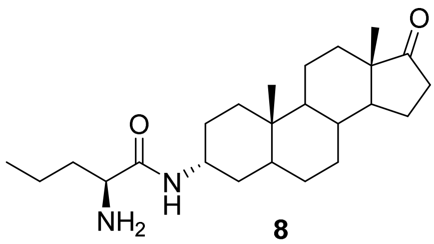

YUNNAN UNIVER. AV. DRX 500
wangyongchao B-5 in CDC13
14031403
-0.0009
0.7368
0.7569
0.7730
0.8277
0.8672
0.9129
0.9276
0.9422
0.9829
1.0520
1.0789
1.2259
1.2485
1.2717
1.3133
1.3273
1.3540
1.3674
1.3818
1.4866
1.5112
1.5329
1.5431
1.5592
1.5791
1.5866
1.6065
1.6314
1.6438
1.6775
1.7056
1.7497
1.7622
1.7967
1.8205
1.9138
1.9308
1.9419
1.9550
1.9671
2.0401
2.0580
2.0777
2.0965
2.1145
2.4354
2.4528
2.4740
2.4914
2.8705
3.7536
3.7671
3.7811
3.9979
4.0101
4.1146
5.1766
6.6640
7.2930
6.209
13.161
13.952
18.164
3.701
6.860
26.445
14.154
12.345
46.205
31.432
12.356
13.887
4.121
4.697
3.557
1.668
1.241
4.126
4.339
5.259
4.198
ppm



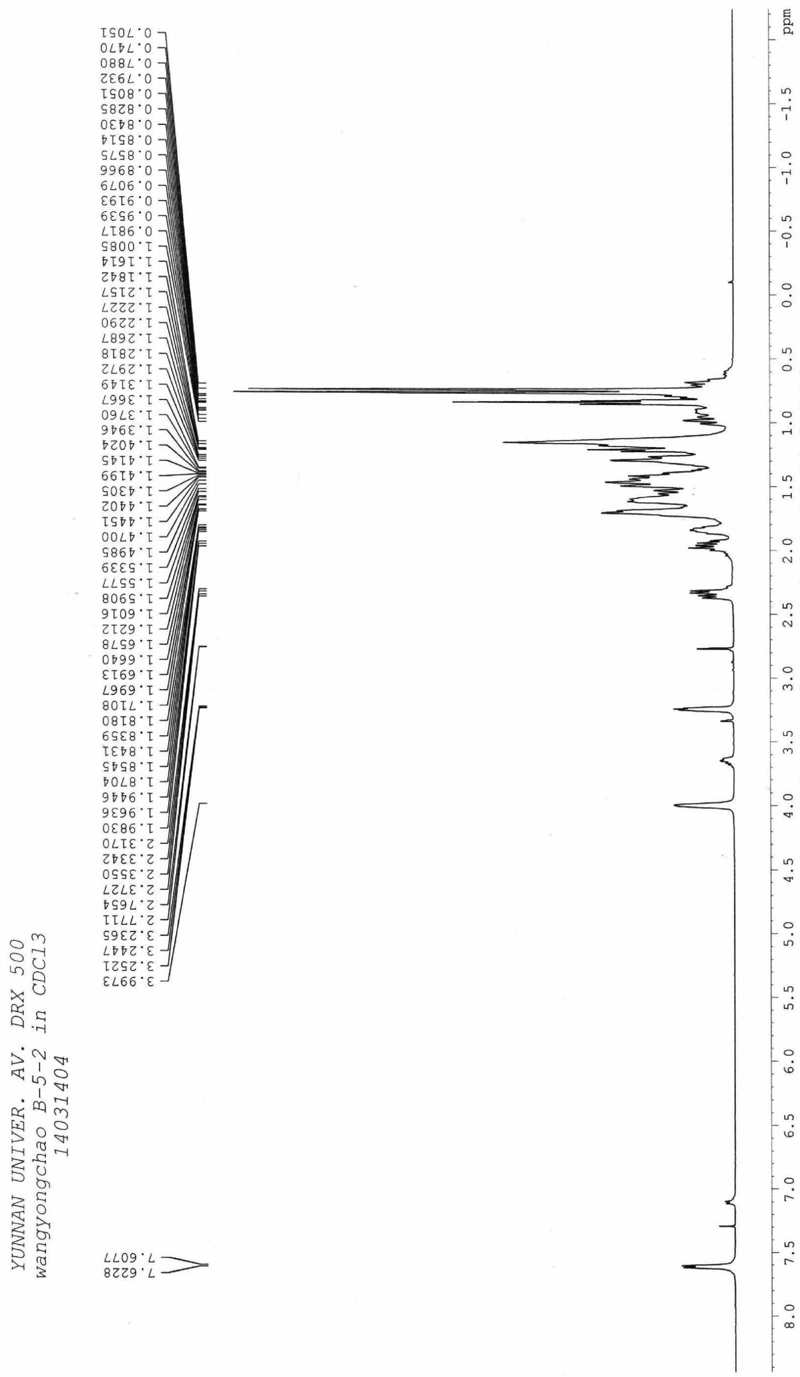
8a

^{13}C NMR

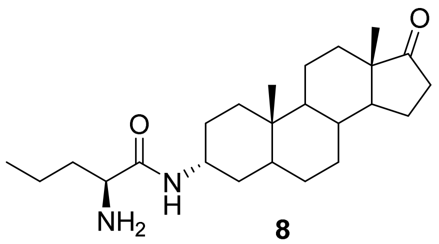

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-5 in CDCl3
14031403
11.81
14.20
19.40
20.41
22.11
22.50
26.39
28.22
28.54
28.77
31.14
31.92
33.07
33.48
34.76
35.34
36.21
36.56
41.23
44.99
48.20
48.80
51.96
54.88
77.22
77.47
77.72
80.27
156.30
171.70
221.71
ppm



8
^{1}H NMR

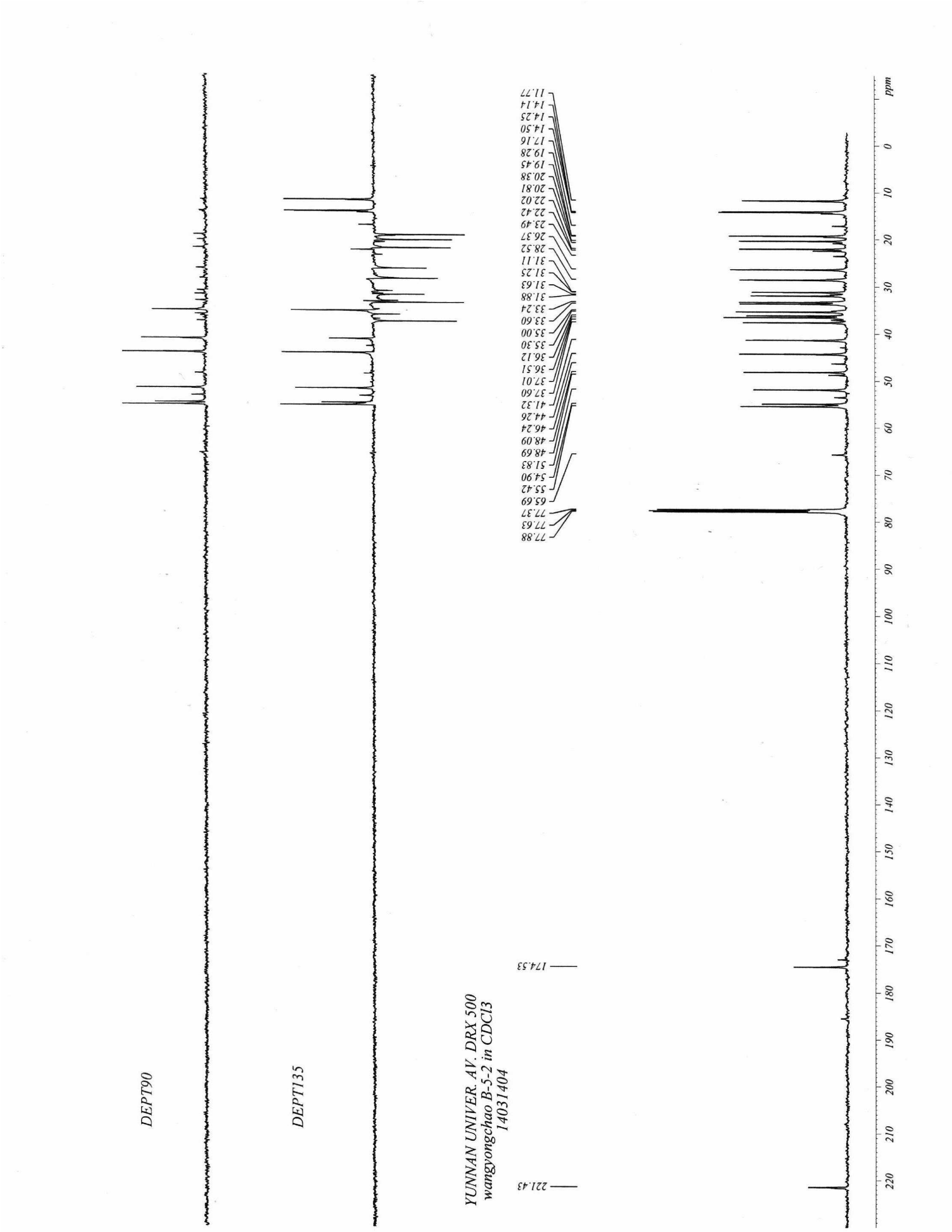


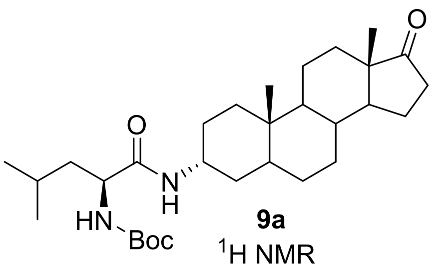
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-5-2 in CDCl3
14031404
0.7051
0.7470
0.7880
0.7932
0.8051
0.8285
0.8430
0.8514
0.8575
0.8966
0.9079
0.9193
0.9539
0.9817
1.0085
1.1614
1.1842
1.2157
1.2227
1.2290
1.2687
1.2818
1.2972
1.3149
1.3667
1.3760
1.3946
1.4024
1.4145
1.4199
1.4305
1.4402
1.4451
1.4700
1.4985
1.5339
1.5577
1.5908
1.6016
1.6212
1.6578
1.6640
1.6913
1.6967
1.7108
1.8180
1.8359
1.8431
1.8545
1.8704
1.9446
1.9636
1.9830
2.3170
2.3342
2.3550
2.3727
2.7654
2.7711
3.2365
3.2447
3.2521
3.9973
7.6077
7.6228
1.147
6.259
2.570
1.952
6.961
2.808
5.191
4.180
3.046
1.055
1.073
1.000
0.171
0.888
0.267
1.000
0.824
ppm



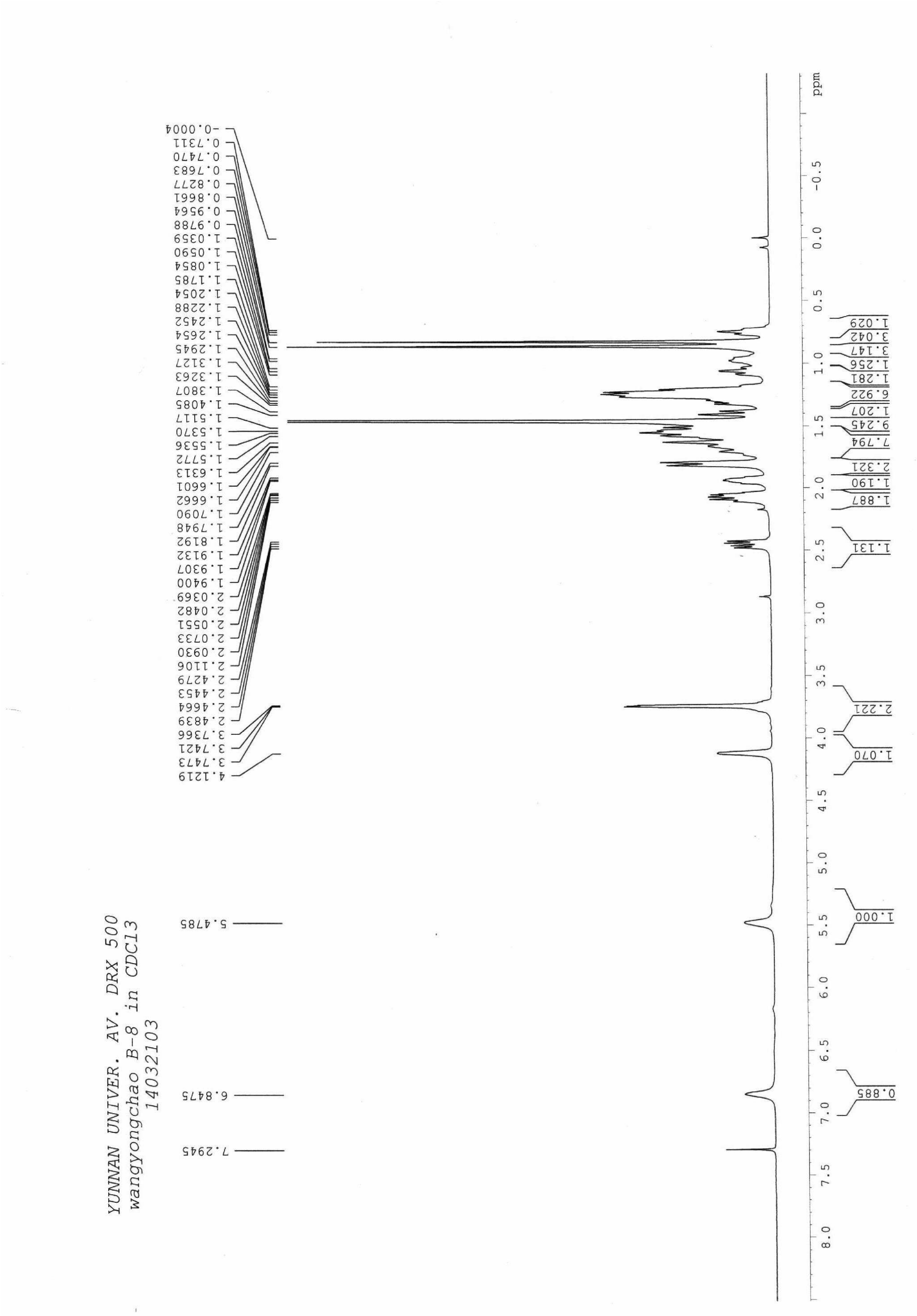
8

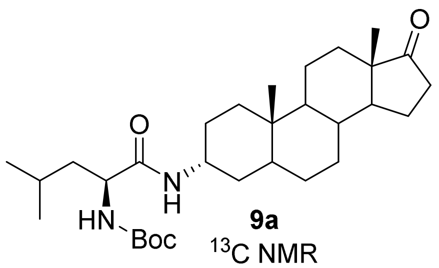
^{13}C NMR


DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-5-2 in CDCl3
14031404
11.77
14.14
14.25
14.50
17.16
19.28
19.45
20.38
20.81
22.02
22.42
23.49
26.37
28.52
31.11
31.25
31.63
31.88
33.24
33.60
35.00
35.30
36.12
36.51
37.01
37.60
41.32
44.26
46.24
48.09
48.69
51.83
54.90
55.42
65.69
77.37
77.63
77.88
174.53
221.43
ppm



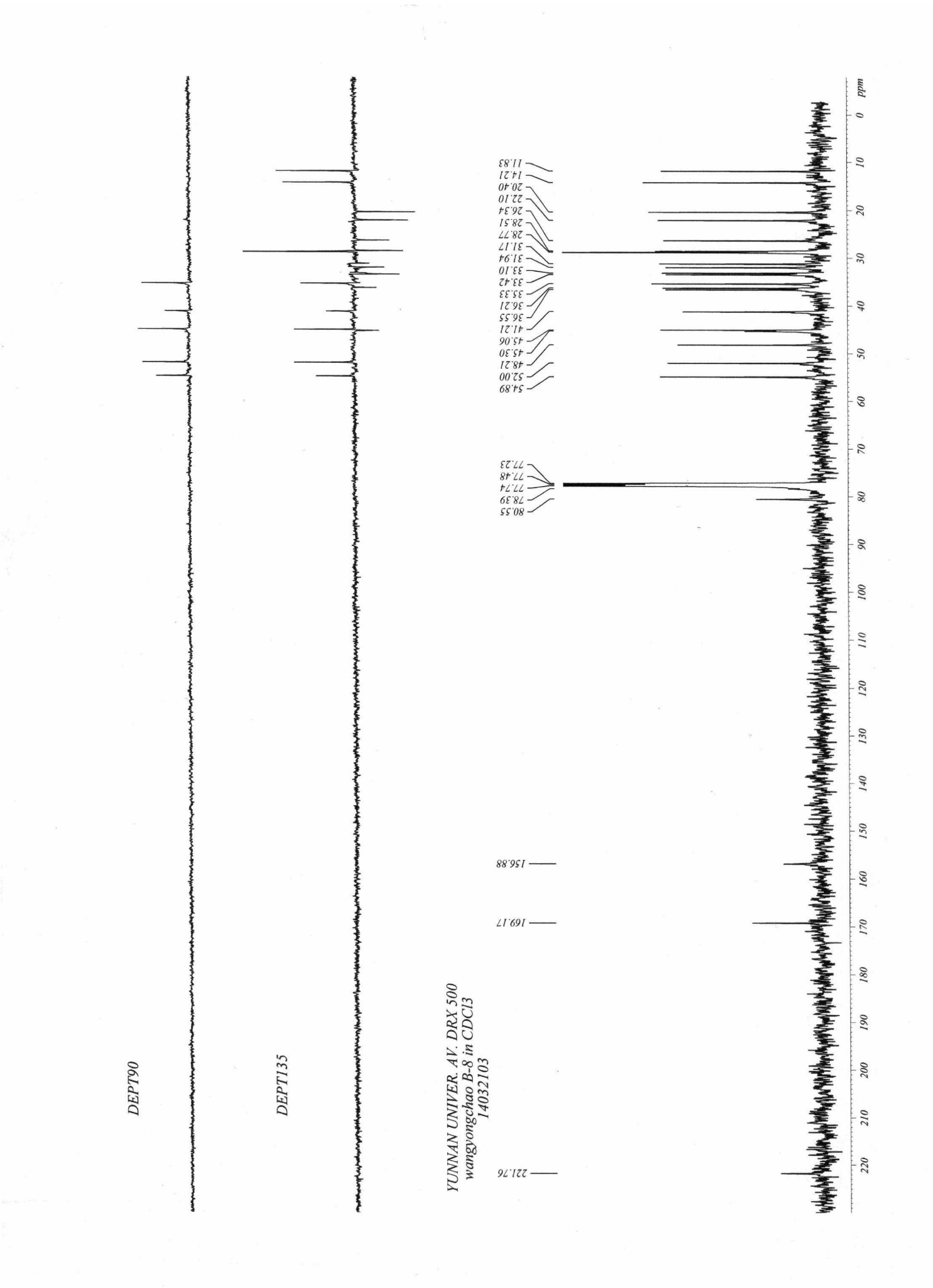
9a
^1H NMR

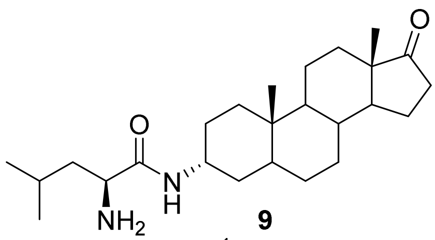

YUNNAN UNIVER. AV. DRX 500
wangyongchao B-8 in CDCl3
14032103
ppm



9a

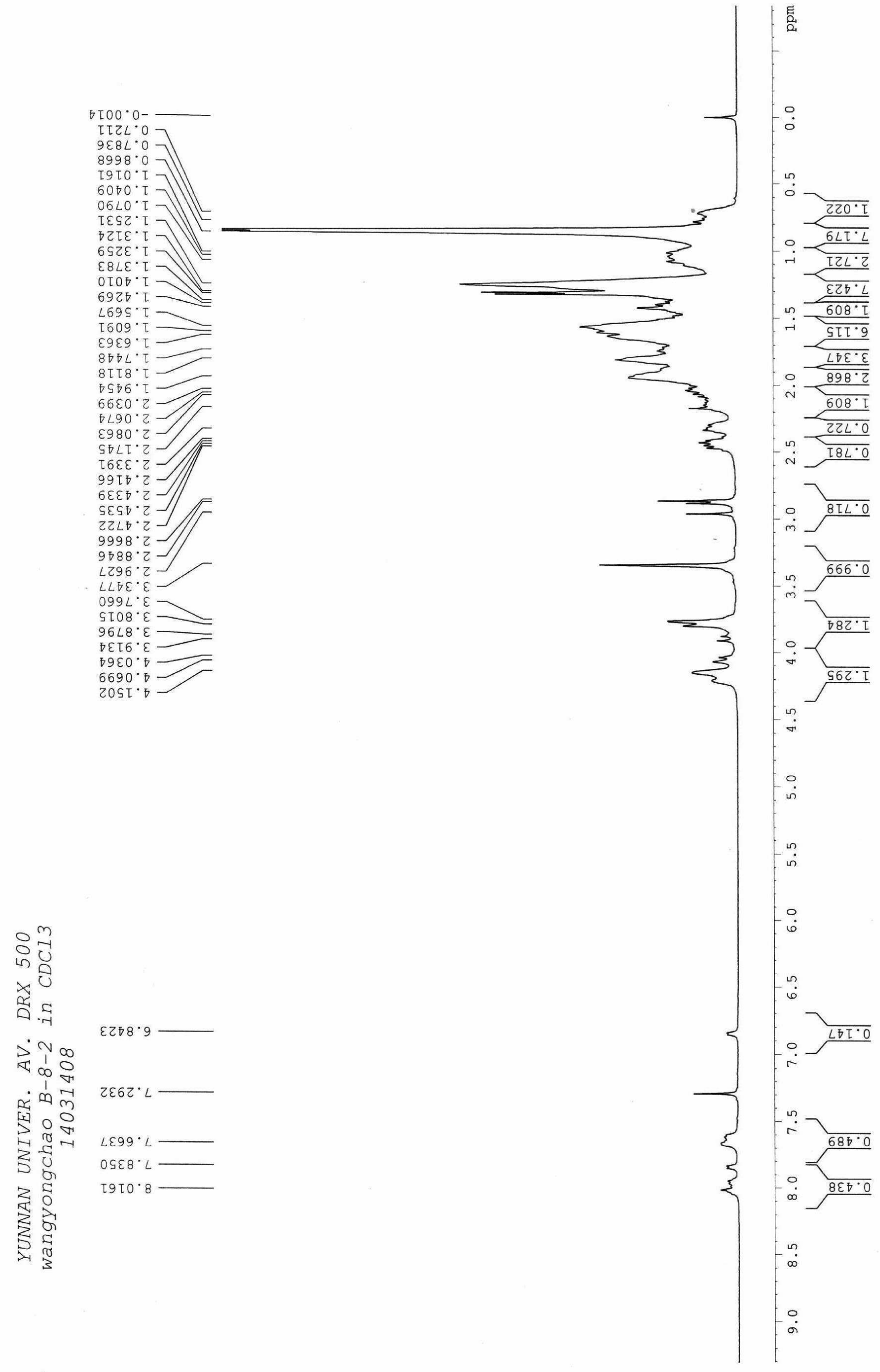
^{13}C NMR

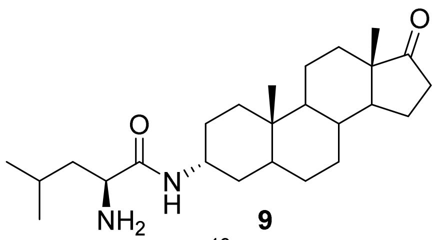

DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-8 in CDCl3
14032103
11.83
14.21
20.40
22.10
26.34
28.51
28.77
31.17
31.94
33.10
33.42
35.33
36.21
36.55
41.21
45.06
45.30
48.21
52.00
54.89
77.23
77.48
77.74
78.39
80.55
156.88
169.17
221.76
ppm


O
O
N
H
NH2

9

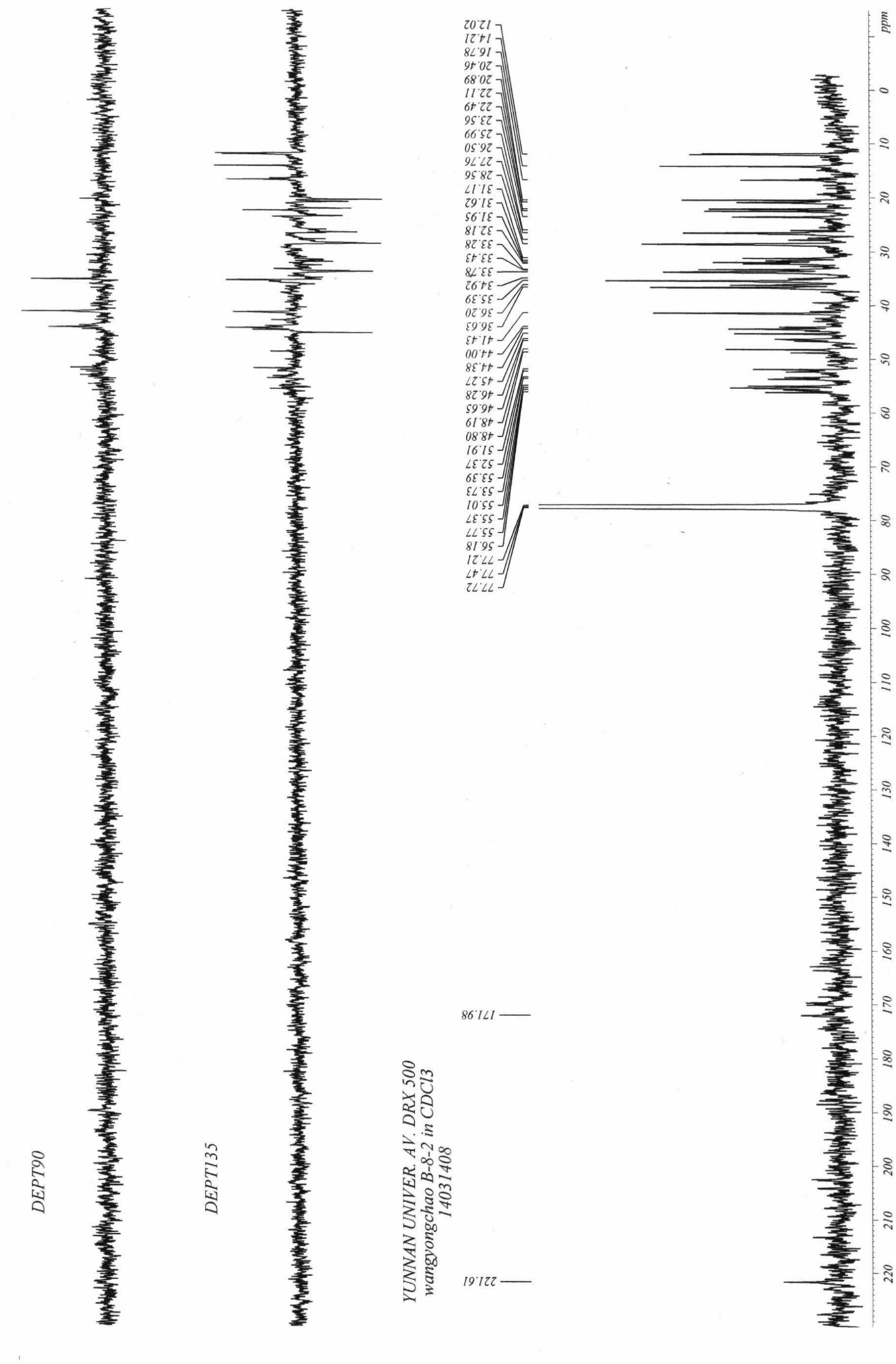
^{1}H NMR

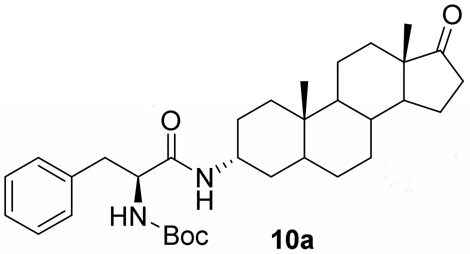

YUNNAN UNIVER. AV. DRX 500
wangyongchao B-8-2 in CDC13
14031408
-0.0014
0.7211
0.7836
0.8668
1.0161
1.0409
1.0790
1.2531
1.3124
1.3259
1.3783
1.4010
1.4269
1.5697
1.6091
1.6363
1.7448
1.8118
1.9454
2.0399
2.0674
2.0863
2.1745
2.3391
2.4166
2.4339
2.4535
2.4722
2.8666
2.8846
2.9627
3.3477
3.7660
3.8015
3.8796
3.9134
4.0364
4.0699
4.1502
6.8423
7.2932
7.6637
7.8350
8.0161
1.022
7.179
2.721
7.423
1.809
6.115
3.347
2.868
1.809
0.722
0.781
0.718
0.999
1.284
1.295
0.147
0.489
0.438
ppm


O
O
N
H
NH2

9

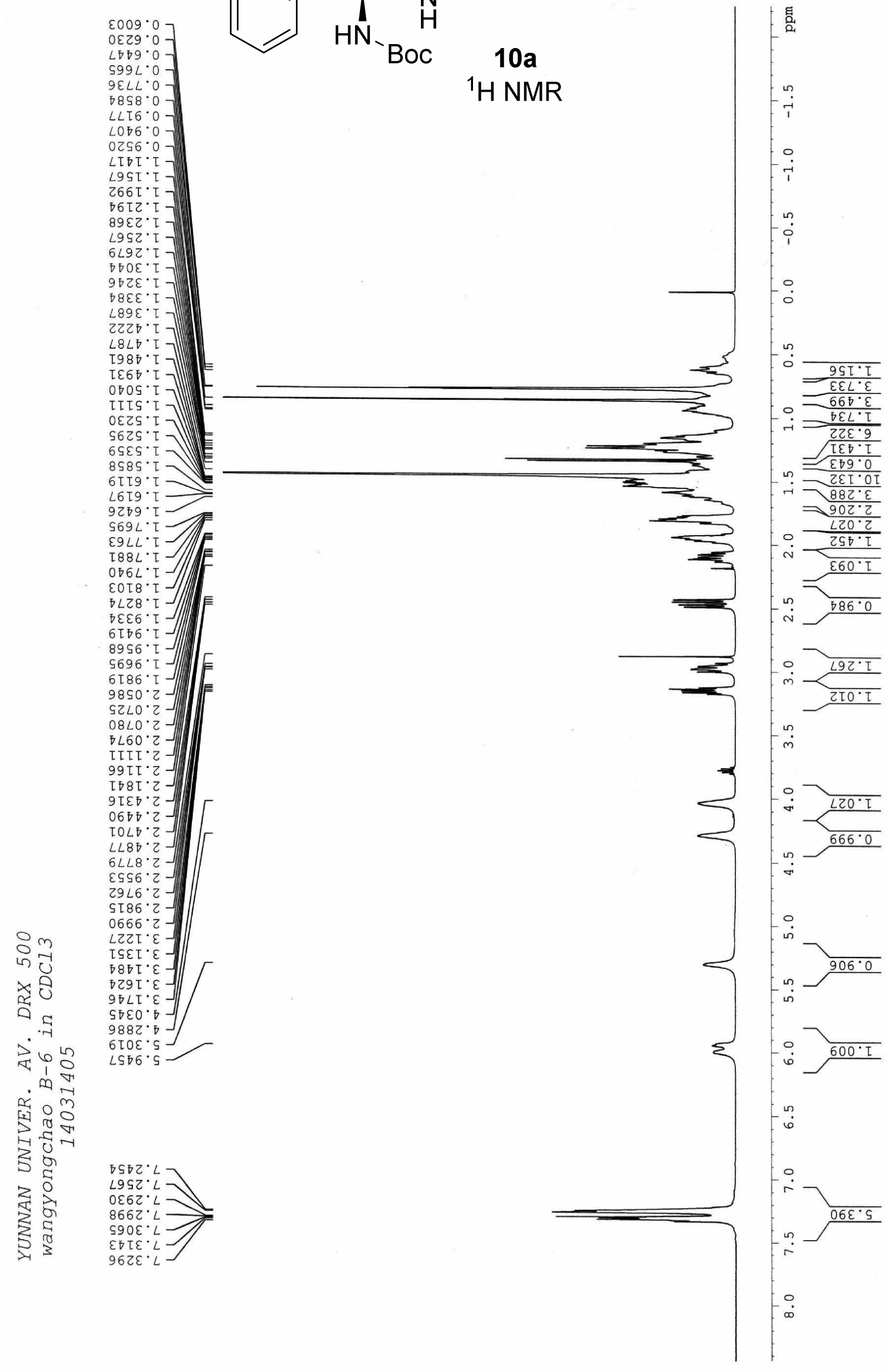
^{13}C NMR

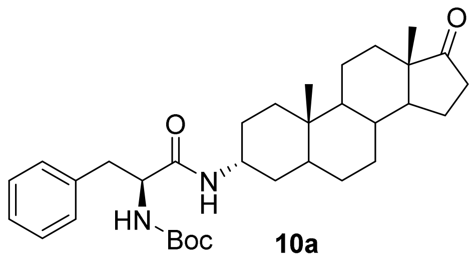

DEPT90
DEPT135
YUNNAN UNIVER AV. DRX 500
wangyongchao B-8-2 in CDCl3
14031408
12.02
14.21
16.78
20.46
20.89
22.11
22.49
23.56
25.99
26.50
27.76
28.56
31.17
31.62
31.95
32.18
33.28
33.43
33.78
34.92
35.39
36.20
36.63
41.43
44.00
44.38
45.27
46.28
46.65
48.19
48.80
51.91
52.37
53.39
53.73
55.01
55.37
55.77
56.18
77.21
77.47
77.72
171.98
221.61
ppm



10a

^{1}H NMR

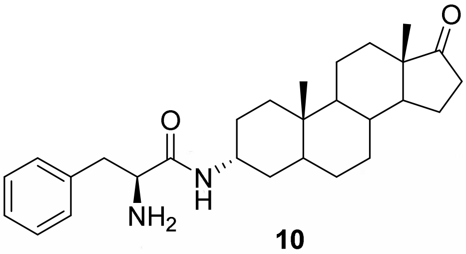

YUNNAN UNIVER. AV. DRX 500
wangyongchao B-6 in CDCl3
14031405
ppm


O
O
N
H
HN
Boc

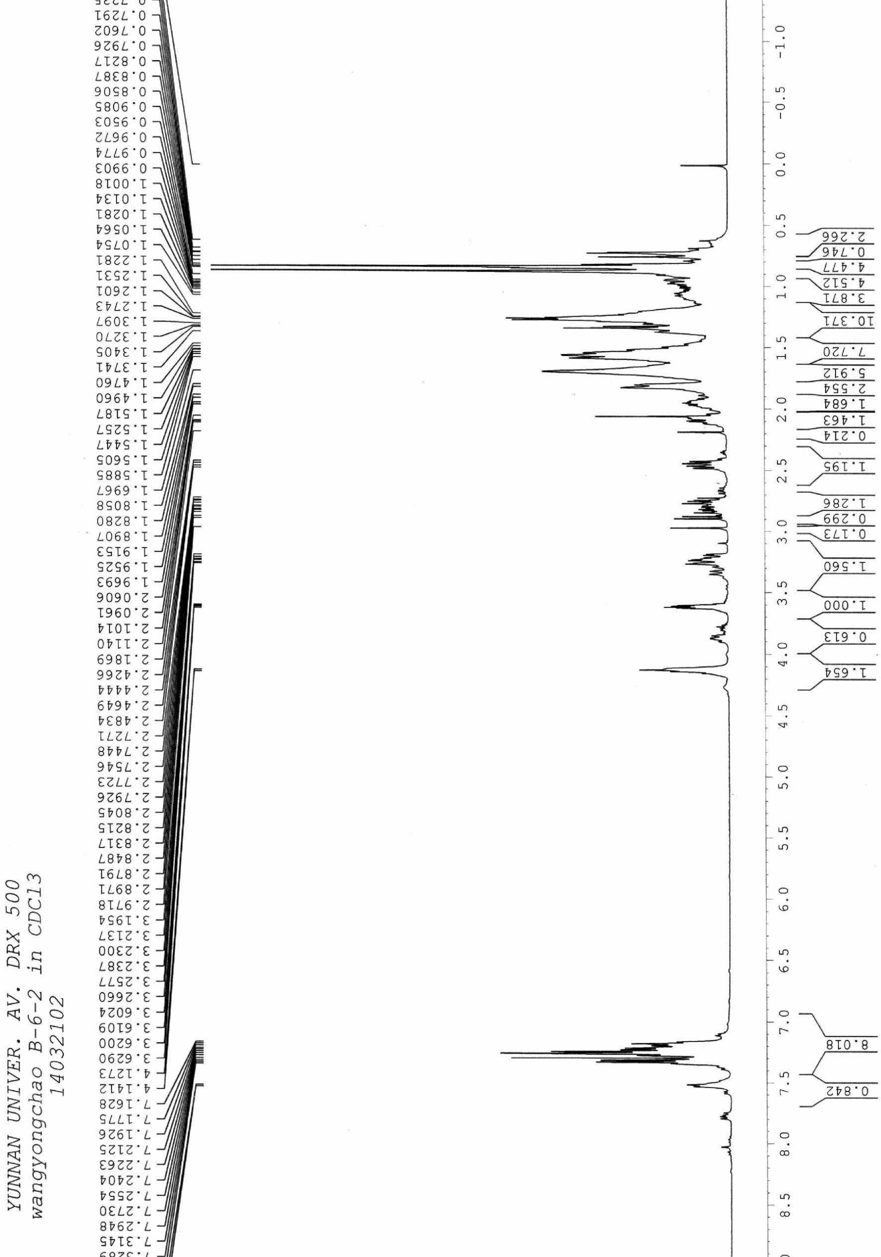
10a

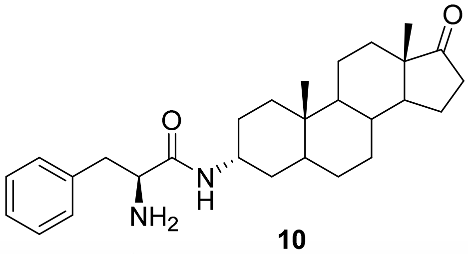
^{13}C NMR


DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-6 in CDCl3
14032101
-0.43
11.75
14.20
20.35
22.11
26.11
26.24
28.42
28.76
30.98
31.09
31.94
32.94
33.14
33.30
35.27
36.20
36.39
39.12
39.40
40.95
41.09
44.97
45.16
48.18
51.95
54.73
56.49
77.23
77.49
77.74
80.39
127.28
129.07
129.14
129.40
129.64
137.60
155.89
156.19
170.32
221.59
ppm



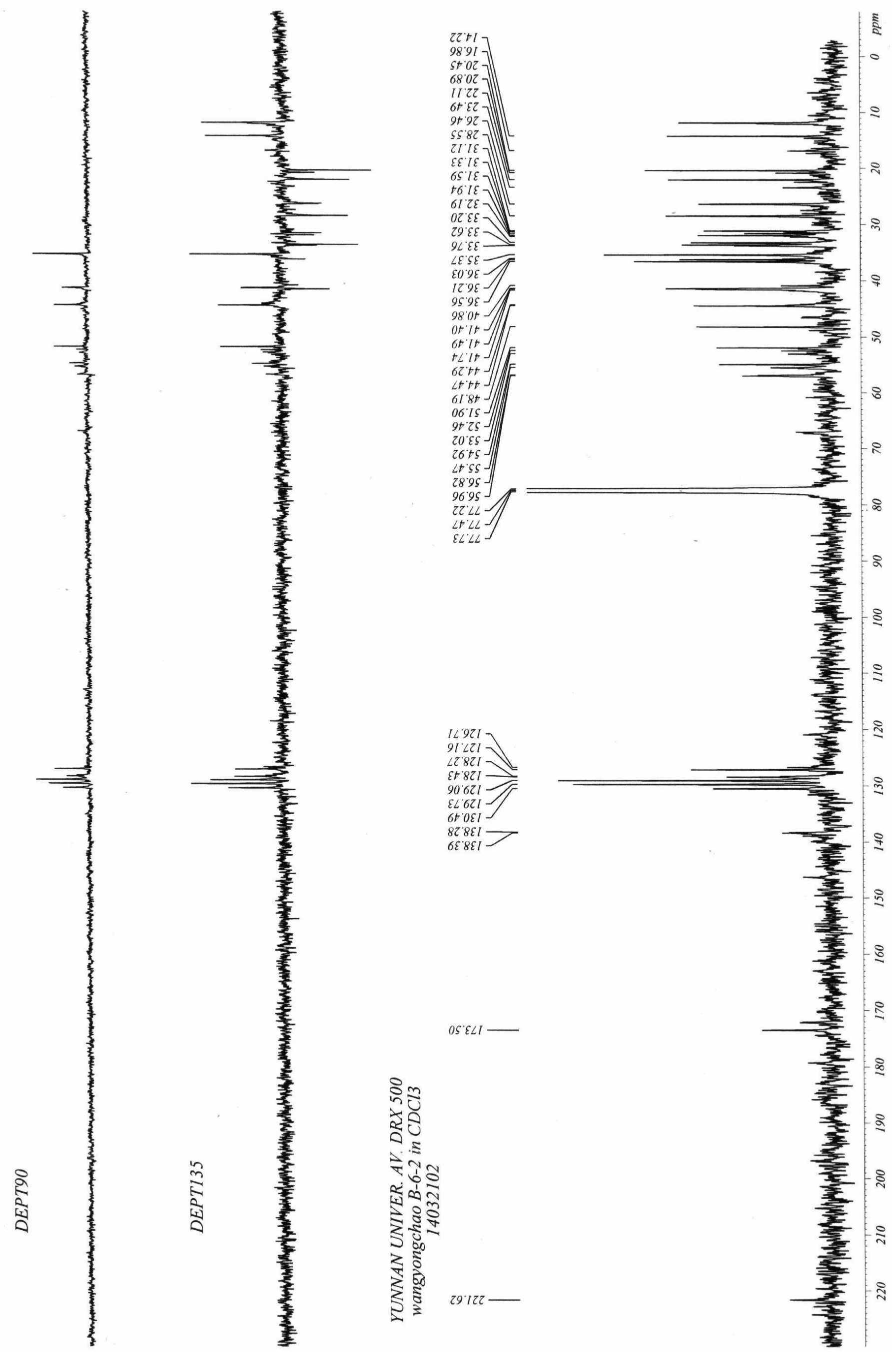
10
^{1}H NMR


YUNNAN UNIVER. AV. DRX 500
wangyongchao B-6-2 in CDCl3
14032102
ppm

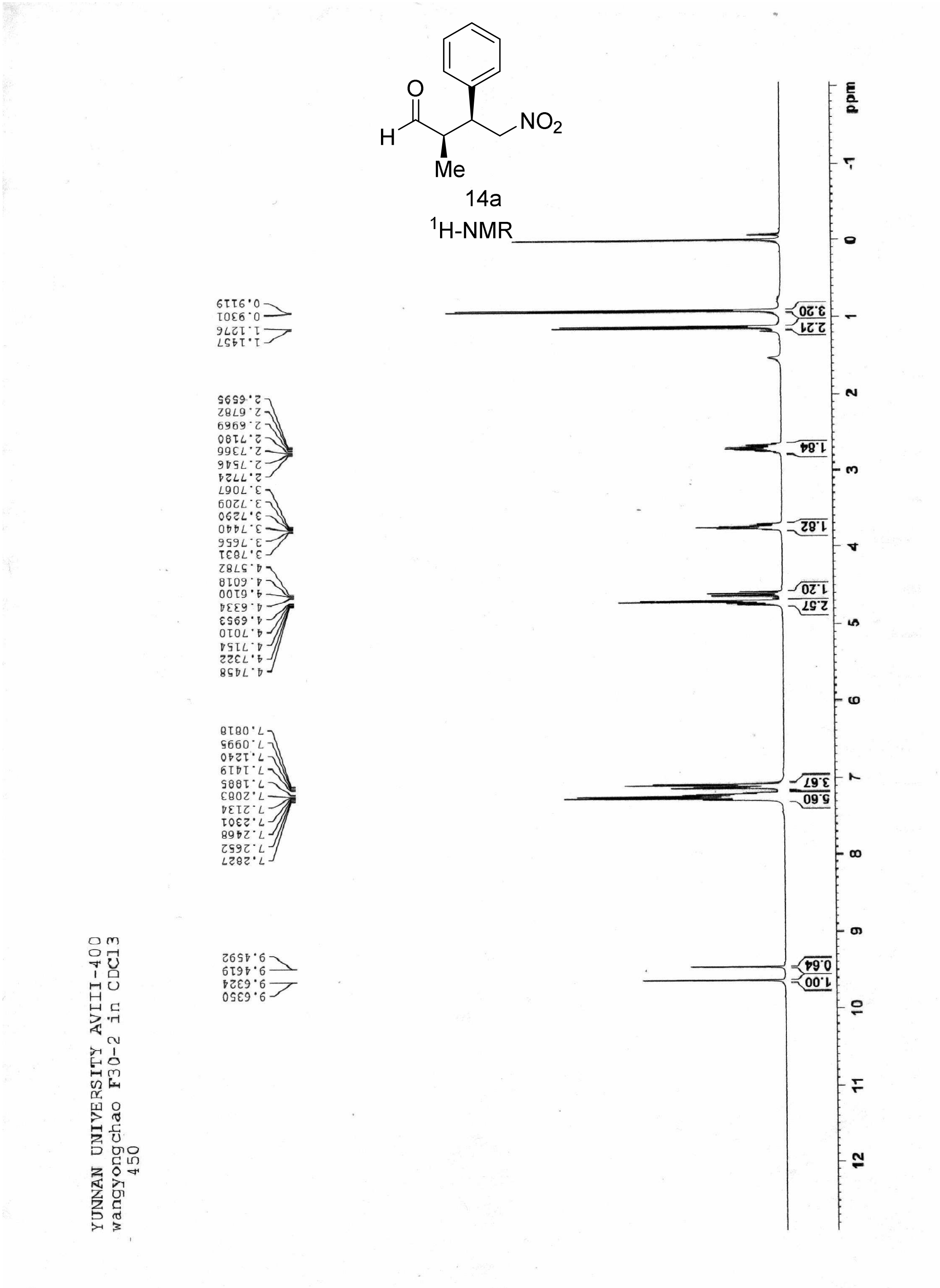

O
O
N
H
NH2

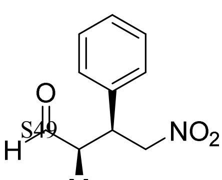
10

^{13}C NMR


DEPT90
DEPT135
YUNNAN UNIVER. AV. DRX 500
wangyongchao B-6-2 in CDCl3
14032102
ppm

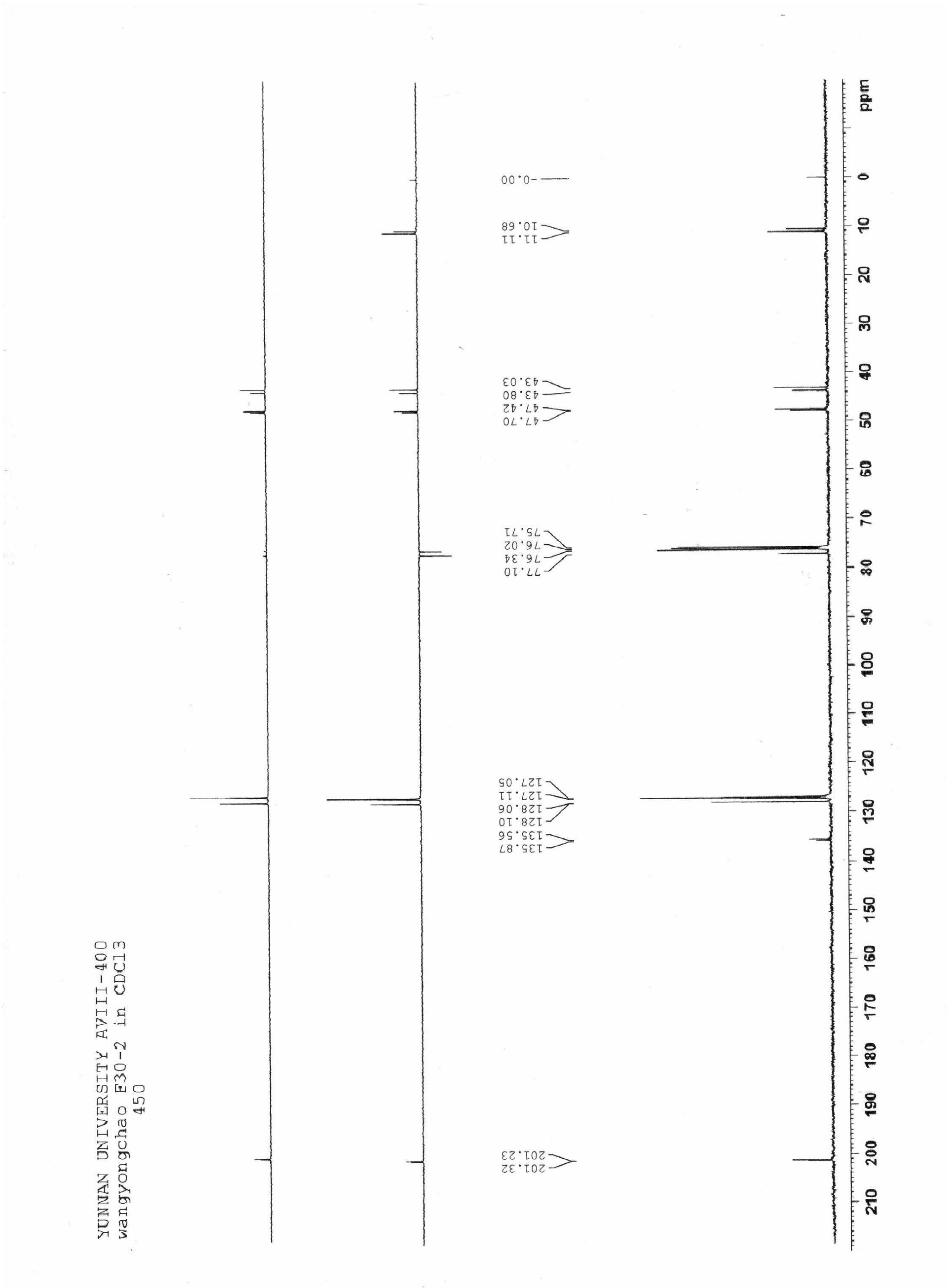
Spectra of Michael Adducts

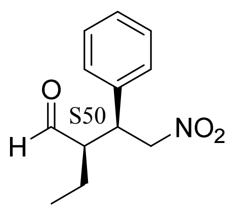




14a

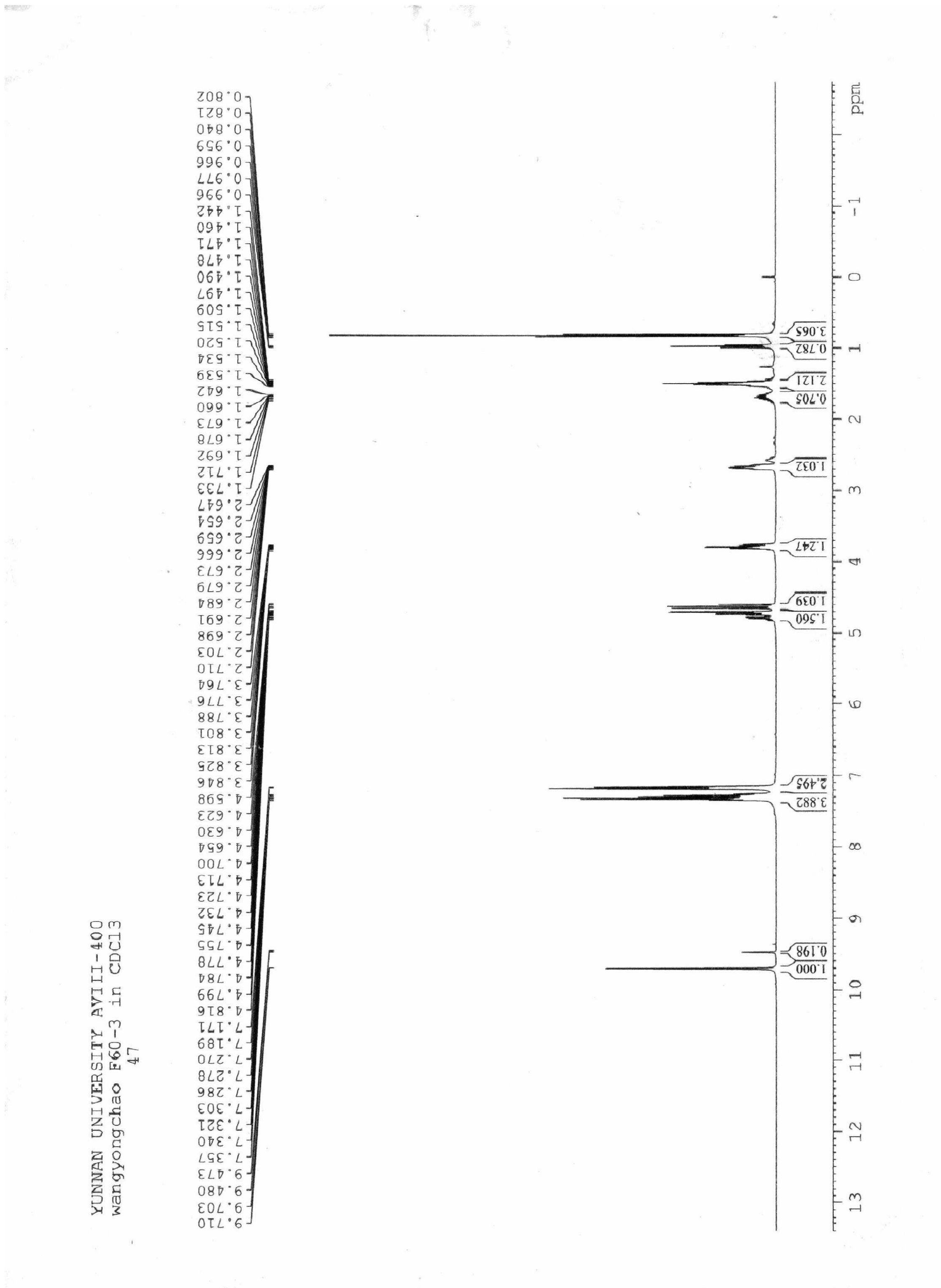
^{13}C-NMR

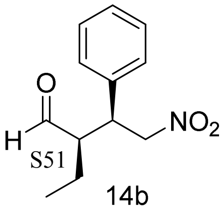

YUNNAN UNIVERSITY AVIII-400
wangyongchao E30-2 in CDCl3
450
-0.00
10.68
11.11
43.03
43.80
47.42
47.70
75.71
76.02
76.34
77.10
127.05
127.11
128.06
128.10
135.56
135.87
201.23
201.32
ppm

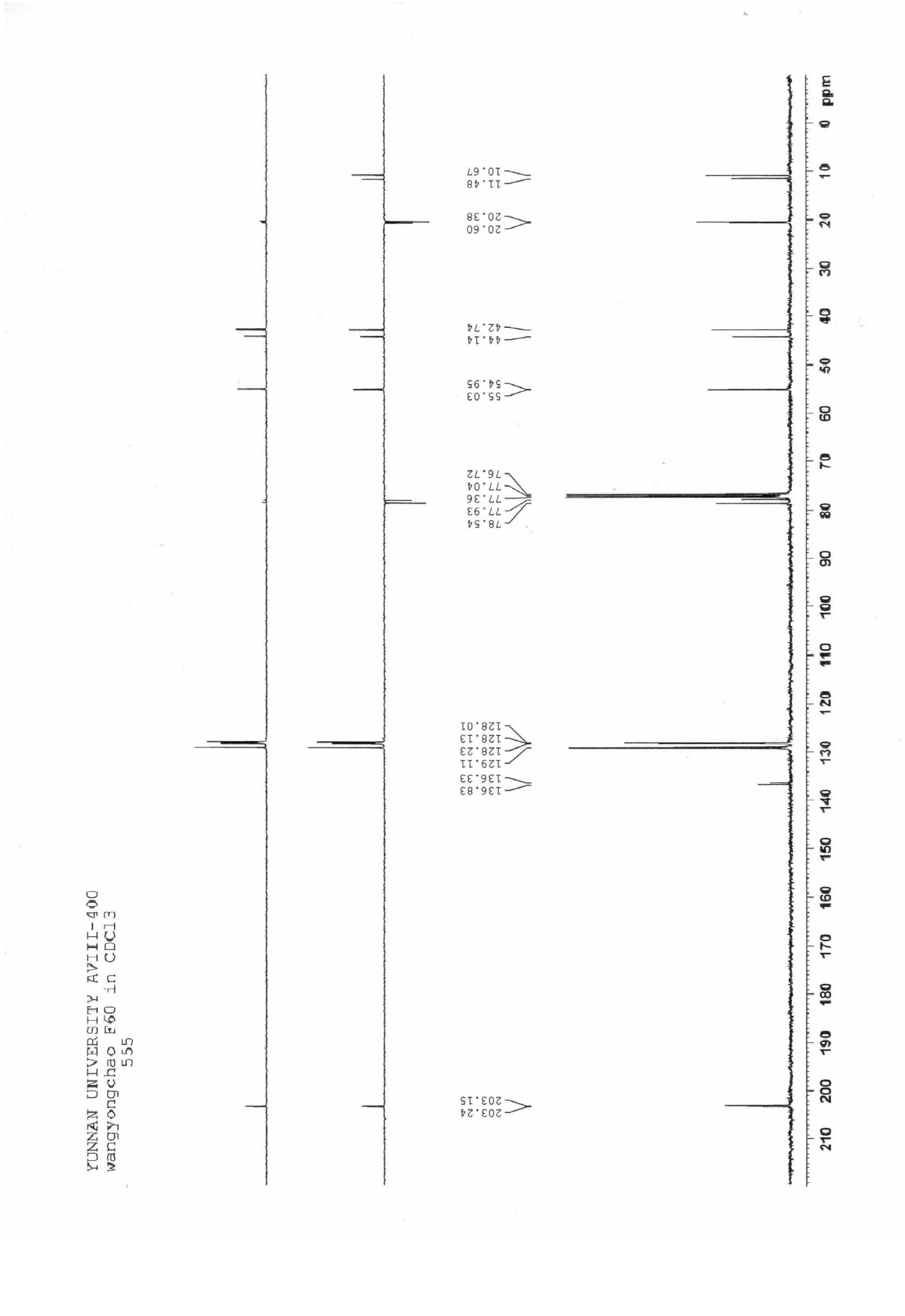

O
H
NO_2

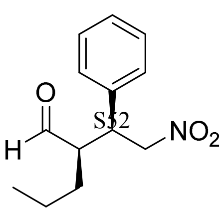
14b

^1H NMR


YUNNAN UNIVERSITY AVIII-400
wangyongchao F60-3 in CDCl3
47
ppm

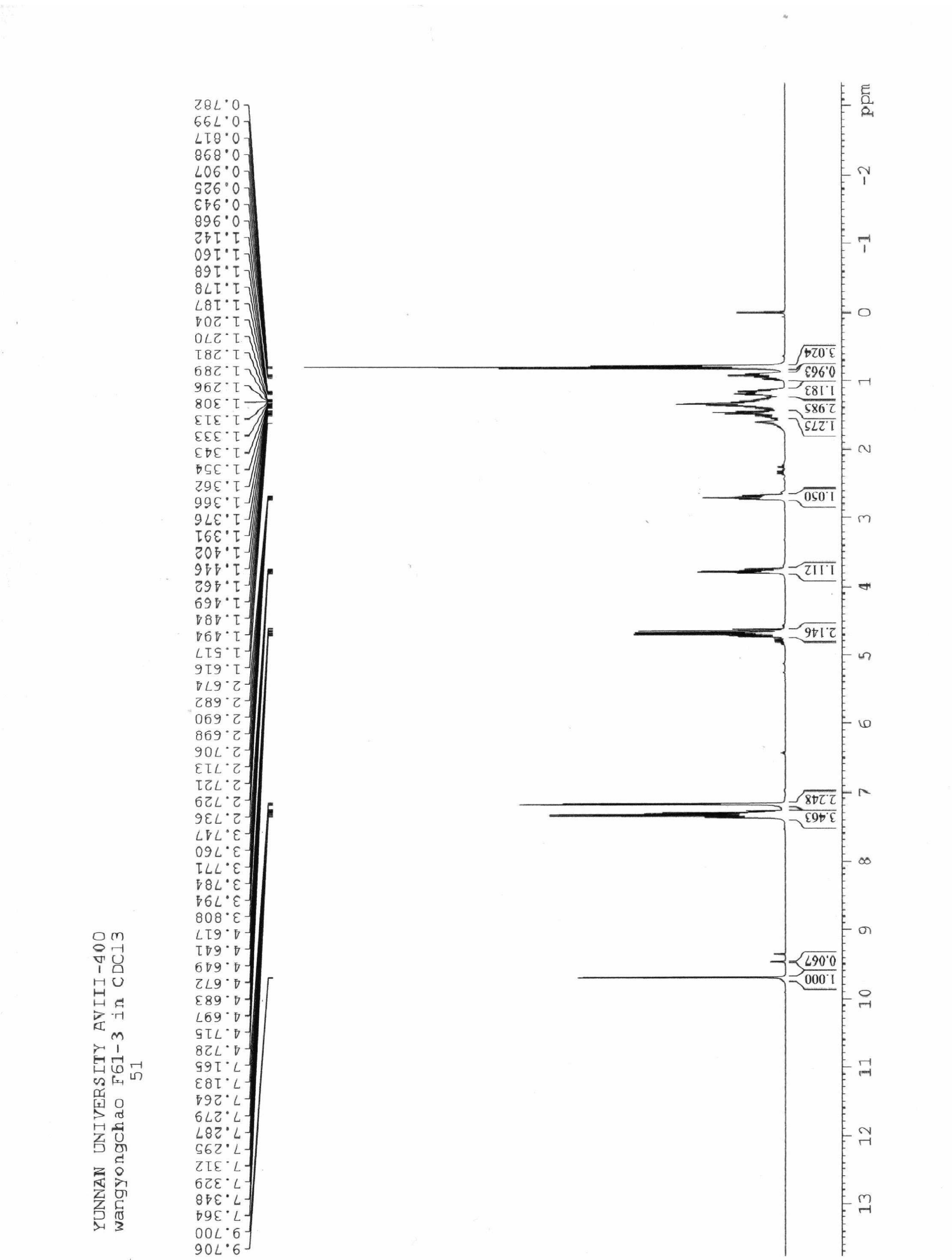

14b
^{13}C-NMR

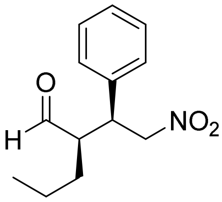

YUNNAN UNIVERSITY AVIII-400
wangyongchao F60 in CDCl13
555
10.67
11.48
20.38
20.60
42.74
44.14
54.95
55.03
76.72
77.04
77.36
77.93
78.54
128.01
128.13
128.23
129.11
136.33
136.83
203.15
203.24
ppm


O
H
NO_2

14c

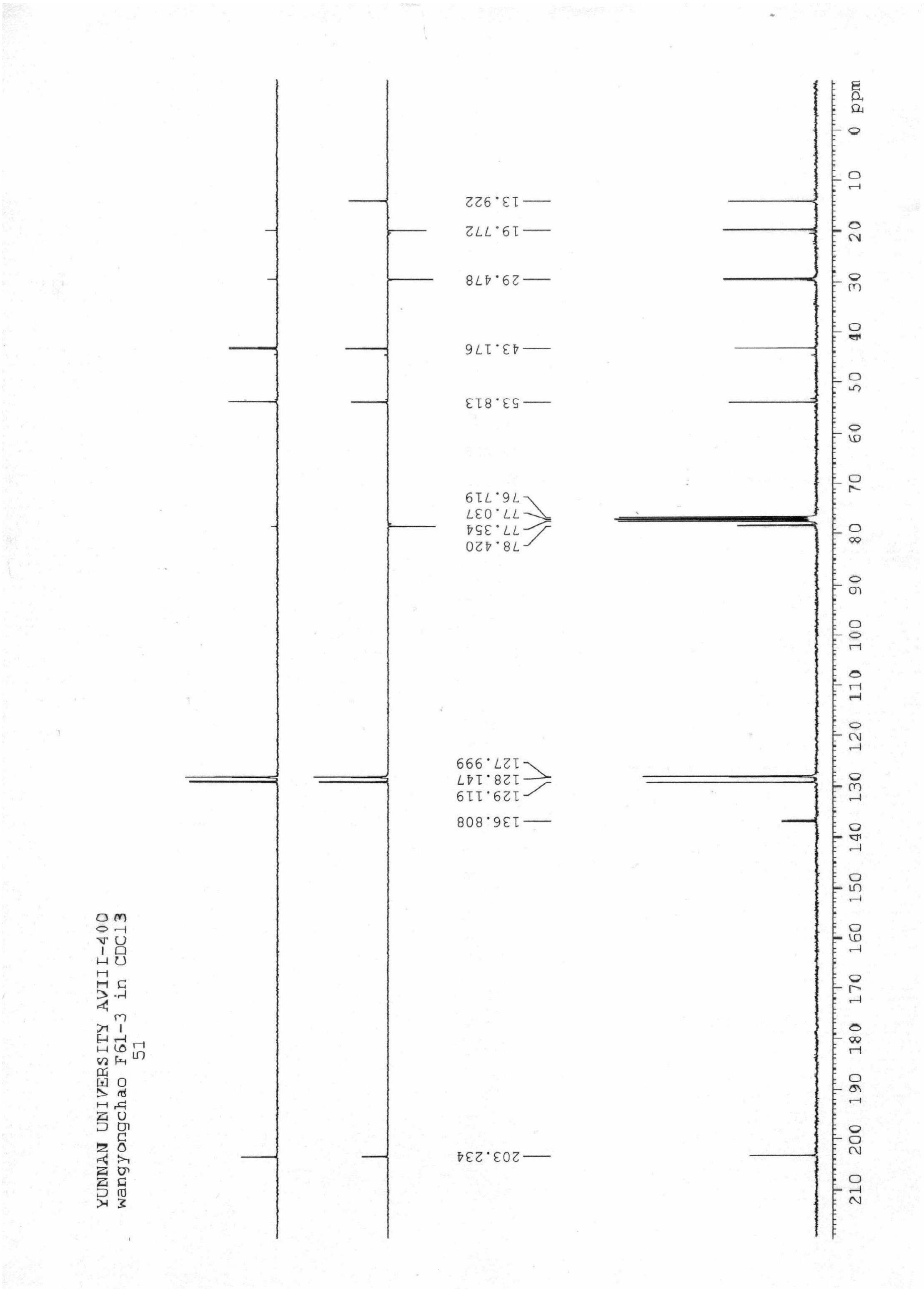
^{1}H NMR

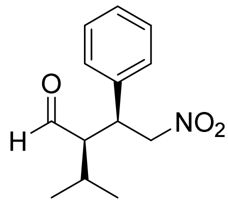

YUNNAN UNIVERSITY AVIII-400
wangyongchao F61-3 in CDCl3
51
0.782 0.799 0.817 0.898 0.907 0.925 0.943 0.968 1.142 1.160 1.168 1.178 1.187 1.204 1.270 1.281 1.289 1.296 1.308 1.313 1.333 1.343 1.354 1.362 1.366 1.376 1.391 1.402 1.446 1.462 1.469 1.484 1.494 1.517 1.616 2.674 2.682 2.690 2.698 2.706 2.713 2.721 2.729 2.736 3.747 3.760 3.771 3.784 3.794 3.808 4.617 4.641 4.649 4.672 4.683 4.697 4.715 4.728 7.165 7.183 7.264 7.279 7.287 7.295 7.312 7.329 7.348 7.364 9.700 9.706
3.024 0.963 1.183 2.985 1.275 1.050 1.112 2.146 2.248 3.463 0.067 1.000
ppm


O
H
NO2

14c

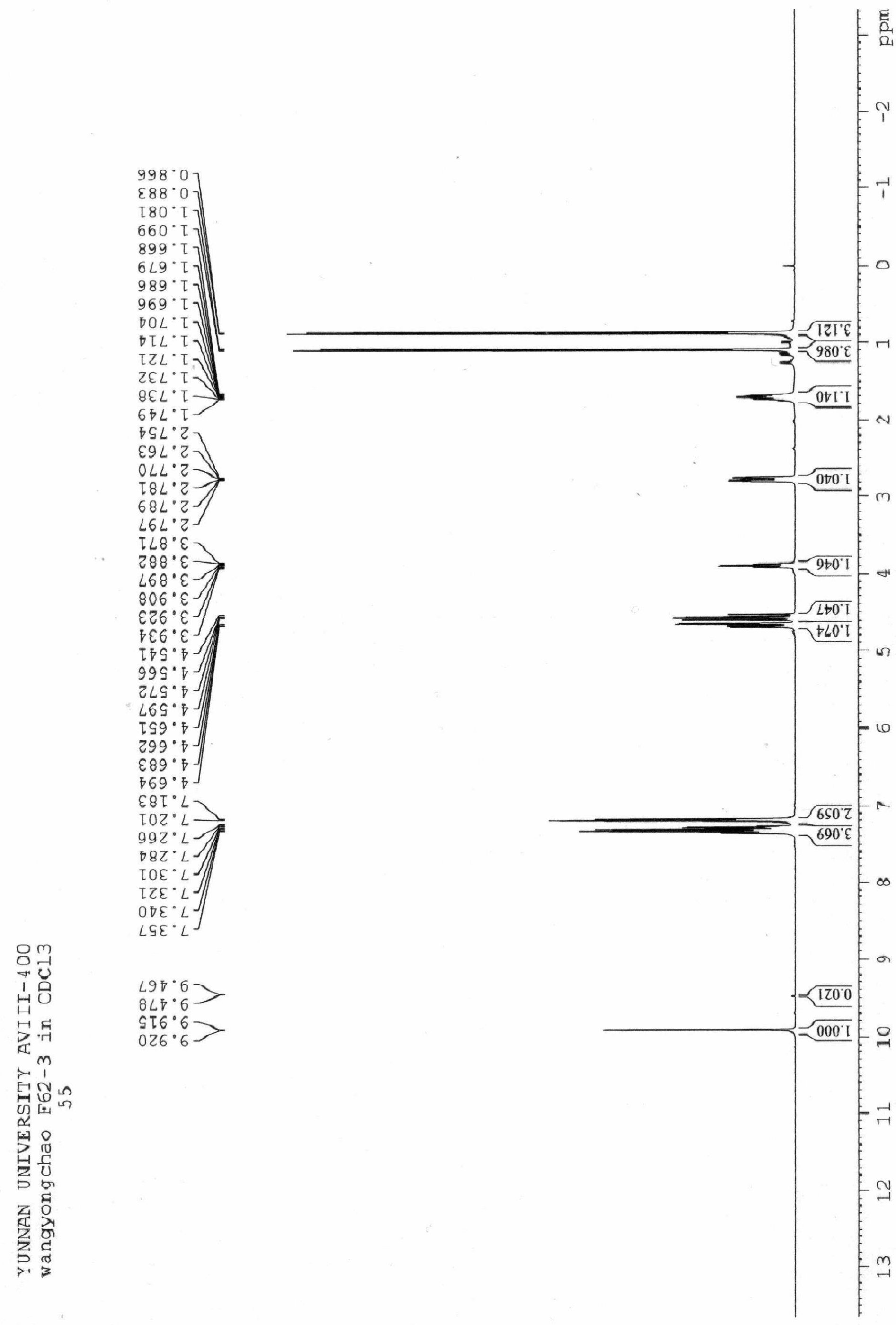
^{13}C-NMR

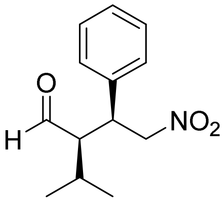

YUNNAN UNIVERSITY AVIII-400
wangyongchao F61-3 in CDCl3
51
13.922
19.772
29.478
43.176
53.813
76.719
77.037
77.354
78.420
127.999
128.147
129.119
136.808
203.234
ppm



14d

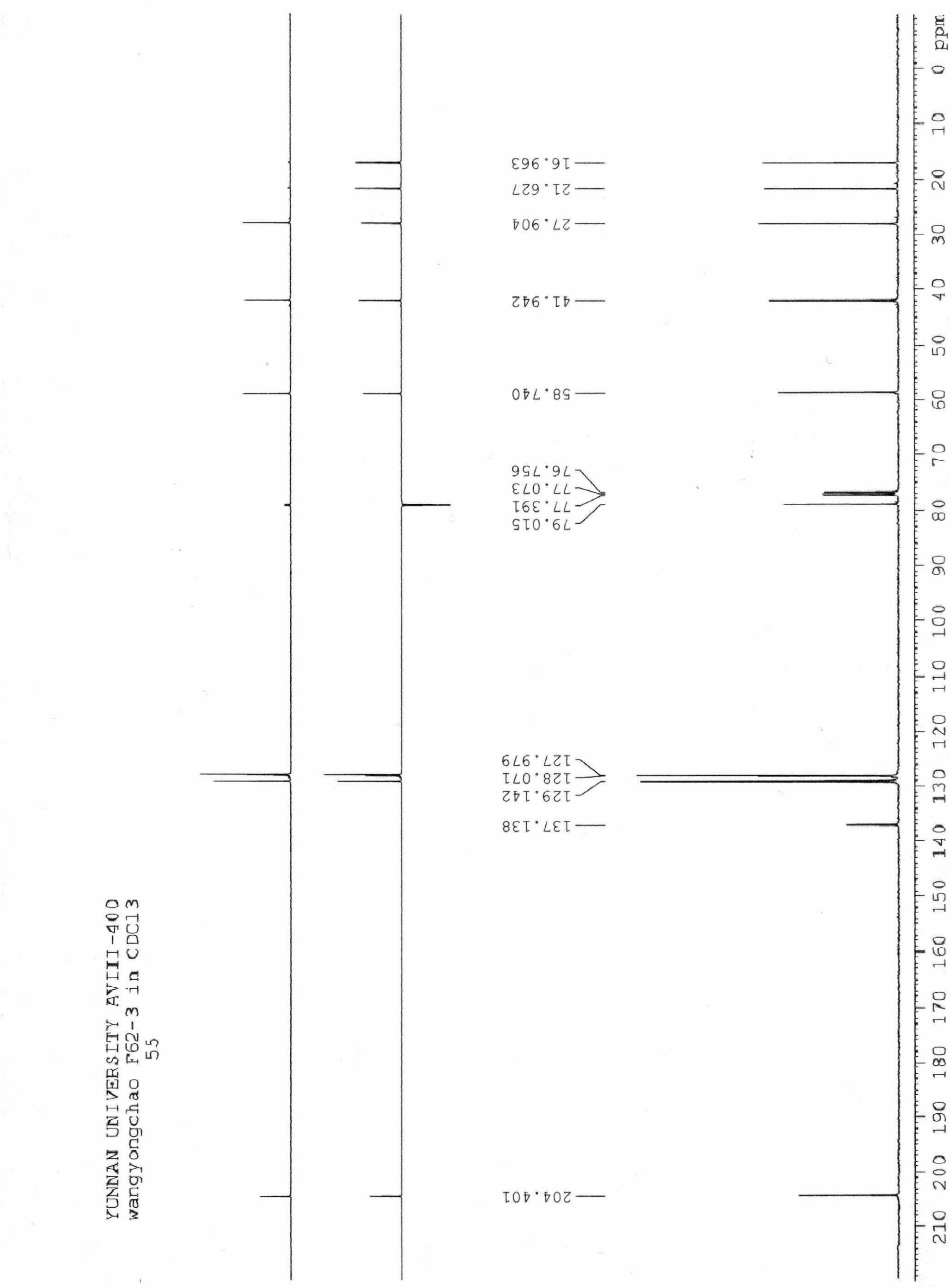
^{1}H-NMR


YUNNAN UNIVERSITY AVIII-400
wangyongchao F62-3 in CDCl3
55
ppm

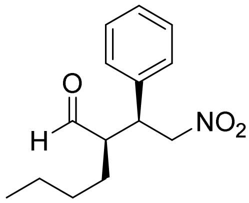


14d

^{13}C-NMR

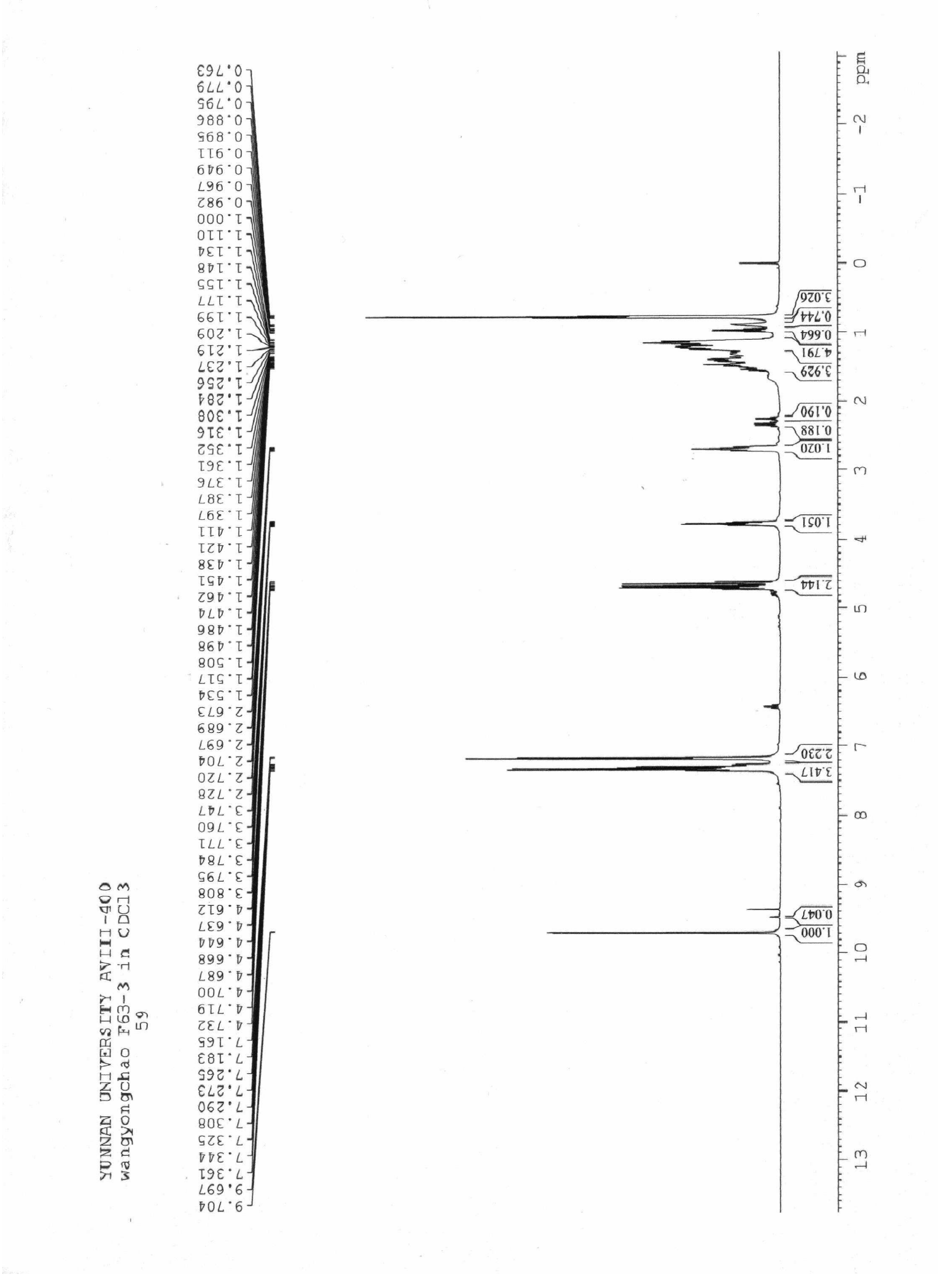


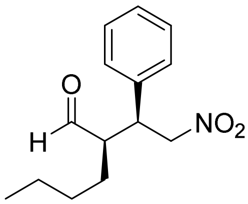
YUNNAN UNIVERSITY AVIII-400
wangyongchao F62-3 in CDCl3
55
16.963
21.627
27.904
41.942
58.740
76.756
77.073
77.391
79.015
127.979
128.071
129.142
137.138
204.401
ppm



14e

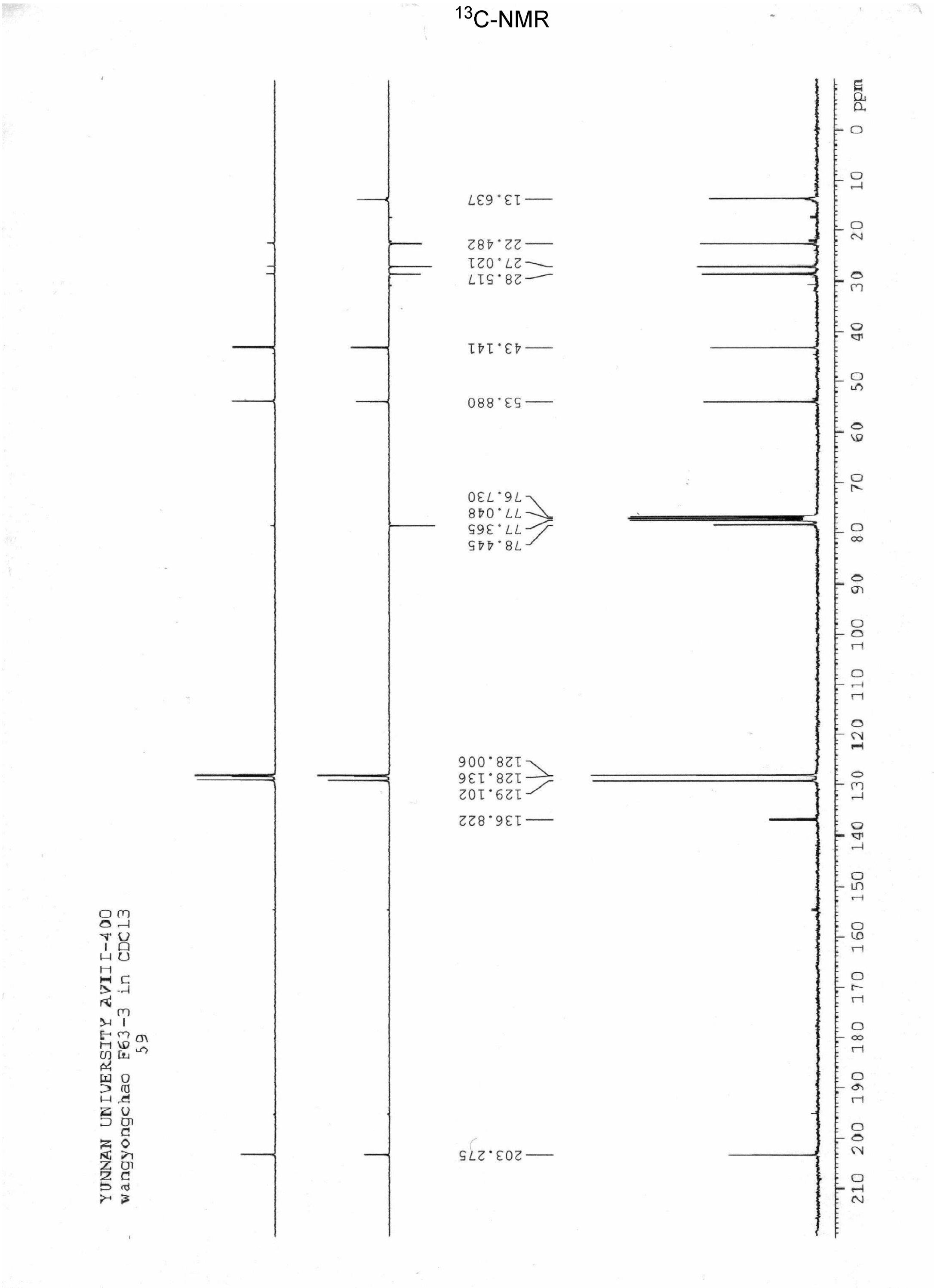
^{1}H-NMR

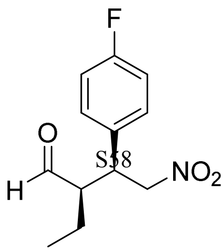

YUNNAN UNIVERSITY AVIII-400
wangyongchao F63-3 in CDCl3
59
ppm



14e

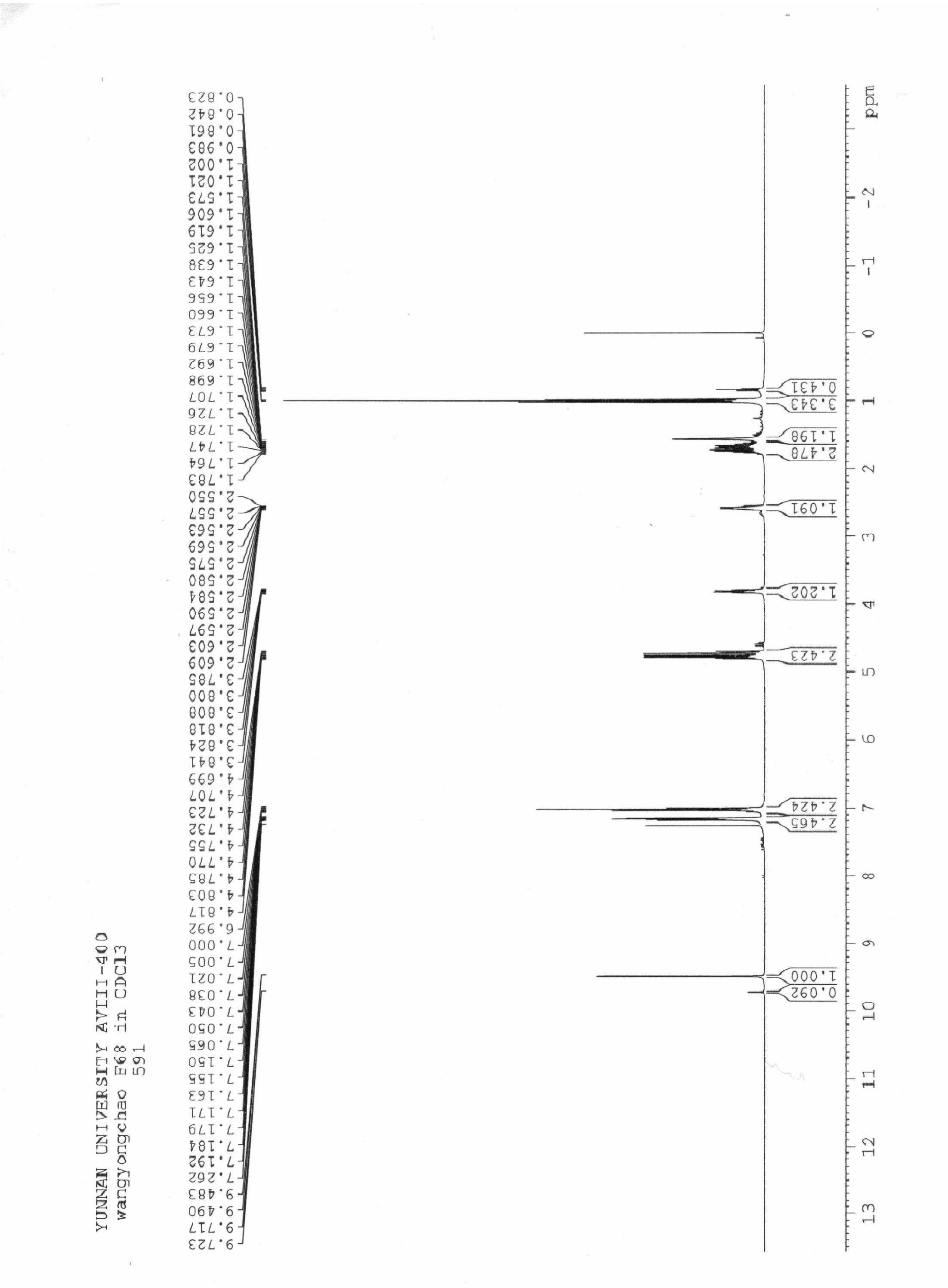
^{13}C-NMR

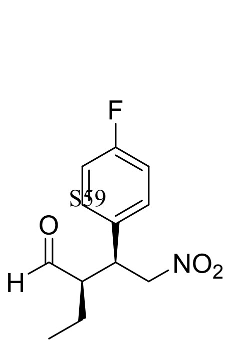


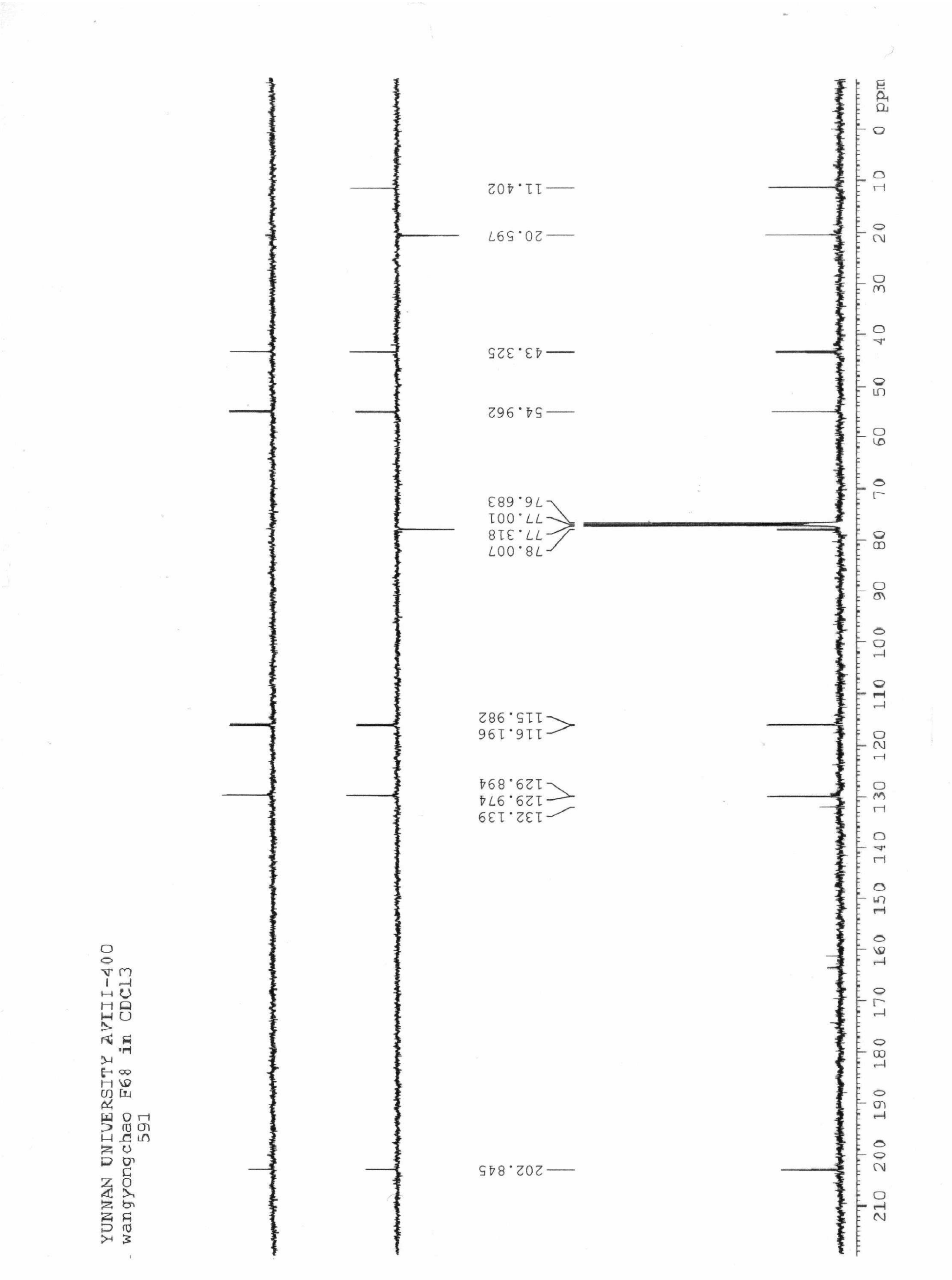


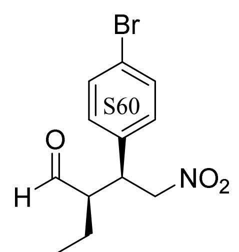
14f

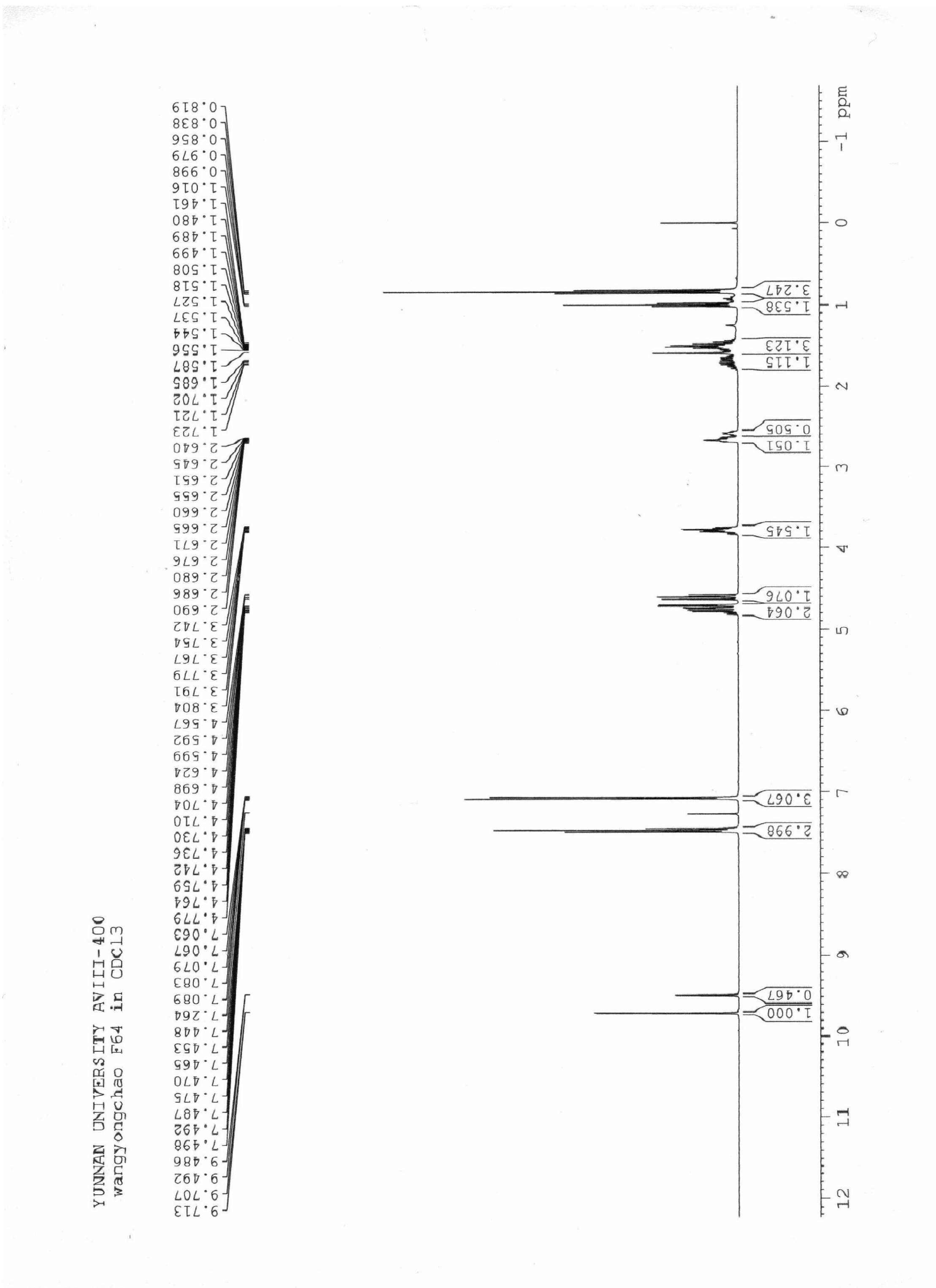
^{1}H-NMR


YUNNAN UNIVERSITY AVIII-400
wangyongchao E68 in CDCl3
591
0.823 0.842 0.861 0.983 1.002 1.021 1.573 1.606 1.619 1.625 1.638 1.643 1.656 1.660 1.673 1.679 1.692 1.698 1.707 1.726 1.728 1.747 1.764 1.783 2.550 2.557 2.563 2.569 2.575 2.580 2.584 2.590 2.597 2.603 2.609 3.785 3.800 3.808 3.818 3.824 3.841 4.699 4.707 4.723 4.732 4.755 4.770 4.785 4.803 4.817 6.992 7.000 7.005 7.021 7.038 7.043 7.050 7.065 7.150 7.155 7.163 7.171 7.179 7.184 7.192 7.262 9.483 9.490 9.717 9.723
0.431
3.343
1.198
2.478
1.091
1.202
2.423
2.424
2.465
1.000
0.092
ppm


F
O
H
NO2

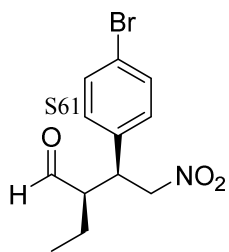

YUNNAN UNIVERSITY AVIII-400
wangyongchao F68 in CDCl3
591
11.402
20.597
43.325
54.962
76.683
77.001
77.318
78.007
115.982
116.196
129.894
129.974
132.139
202.845
ppm


Br
O
H
NO_2

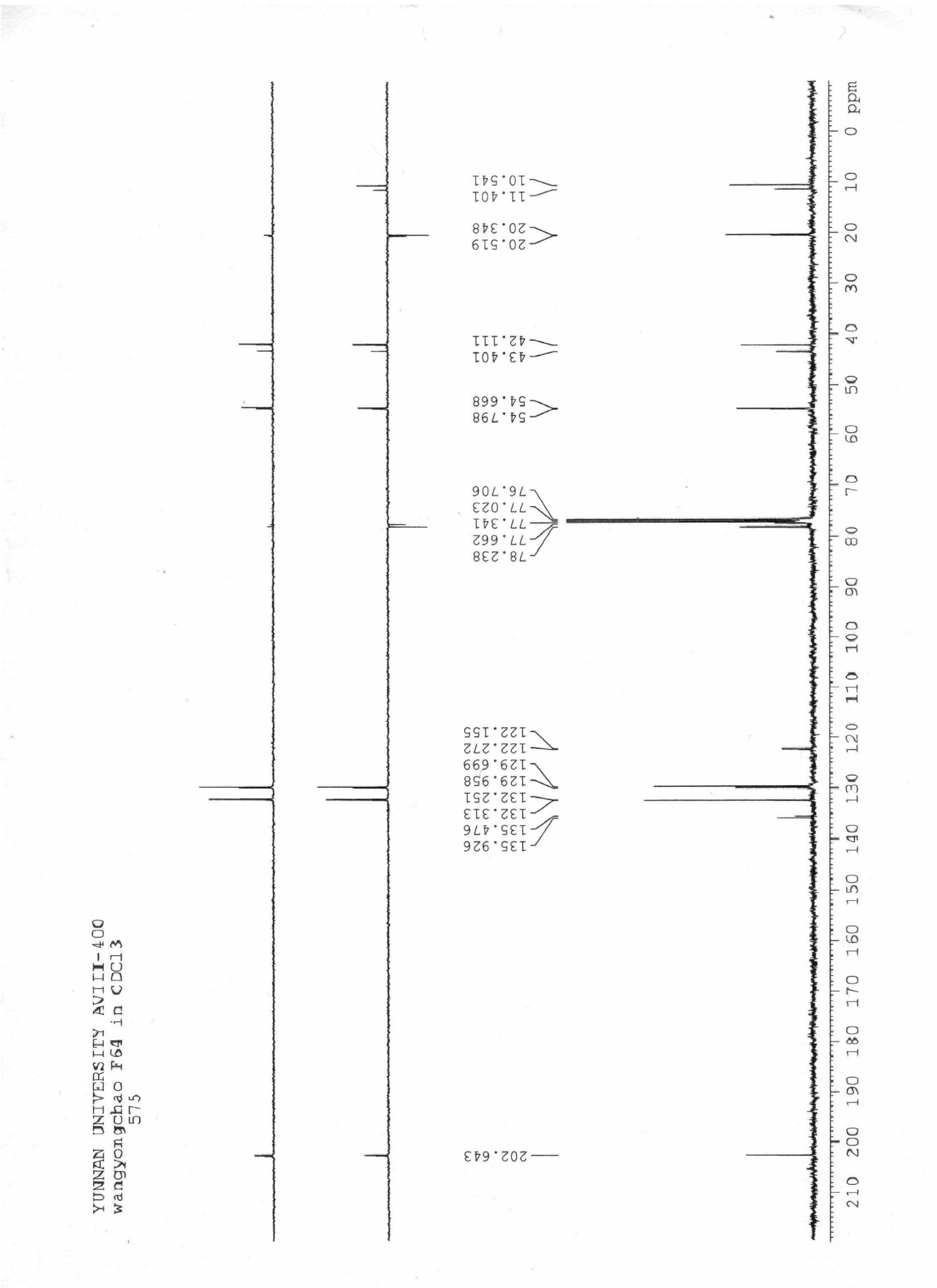


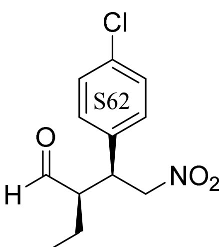
YUNNAN UNIVERSITY AVIII-400
wangyongchao F64 in CDCl3
9.713
9.707
9.492
9.486
7.498
7.492
7.487
7.475
7.470
7.465
7.453
7.448
7.264
7.089
7.083
7.079
7.067
7.063
4.779
4.764
4.759
4.742
4.736
4.730
4.710
4.704
4.698
4.624
4.599
4.592
4.567
3.804
3.791
3.779
3.767
3.754
3.742
2.690
2.686
2.680
2.676
2.671
2.665
2.660
2.655
2.651
2.645
2.640
1.723
1.721
1.702
1.685
1.587
1.556
1.544
1.537
1.527
1.518
1.508
1.499
1.489
1.480
1.461
1.016
0.998
0.979
0.856
0.838
0.819
1.000
0.467
2.998
3.067
2.064
1.076
1.545
1.051
0.505
1.115
3.123
1.538
3.247
12
11
10
9
8
7
6
5
4
3
2
1
0
-1 ppm

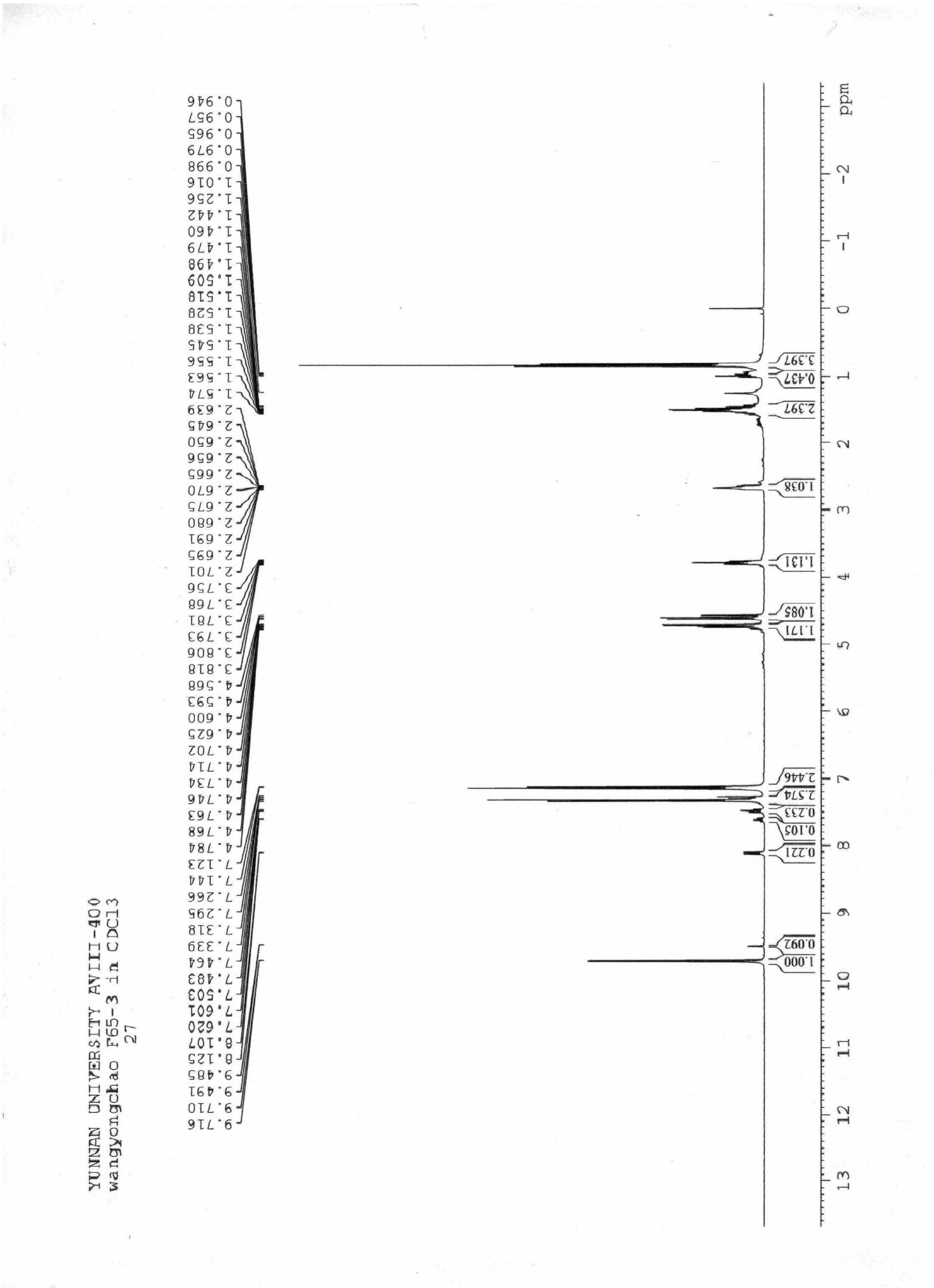
S61

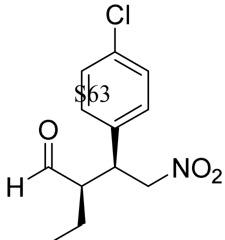


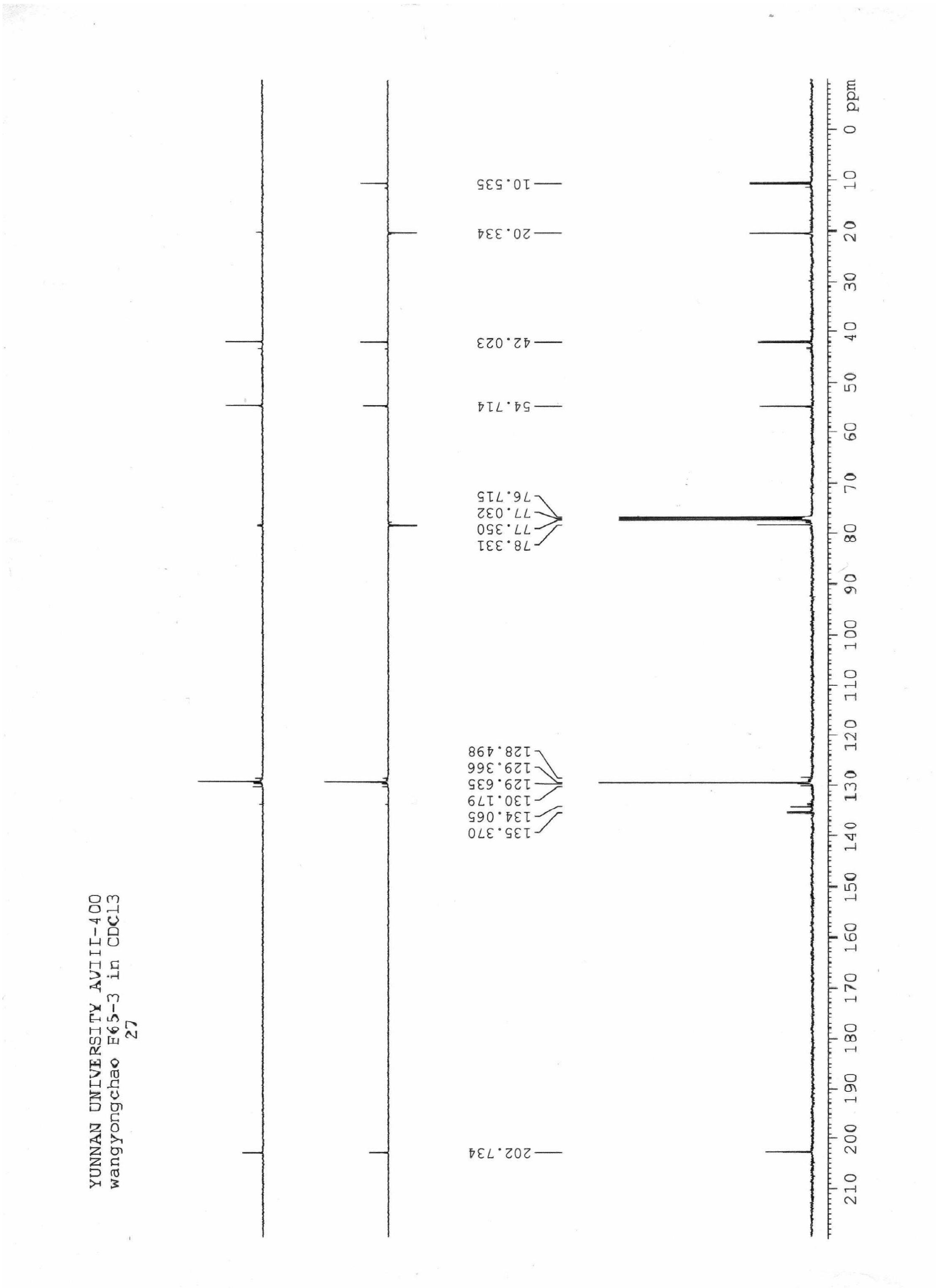
Br
O
H
NO2

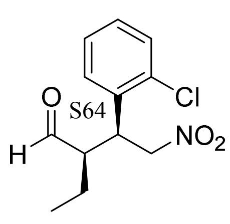

YUNNAN UNIVERSITY AVIII-400
wangyongchao F64 in CDCl3
575
10.541
11.401
20.348
20.519
42.111
43.401
54.668
54.798
76.706
77.023
77.341
77.662
78.238
122.155
122.272
129.699
129.958
132.251
132.313
135.476
135.926
202.643
ppm


Cl
O
H
NO2

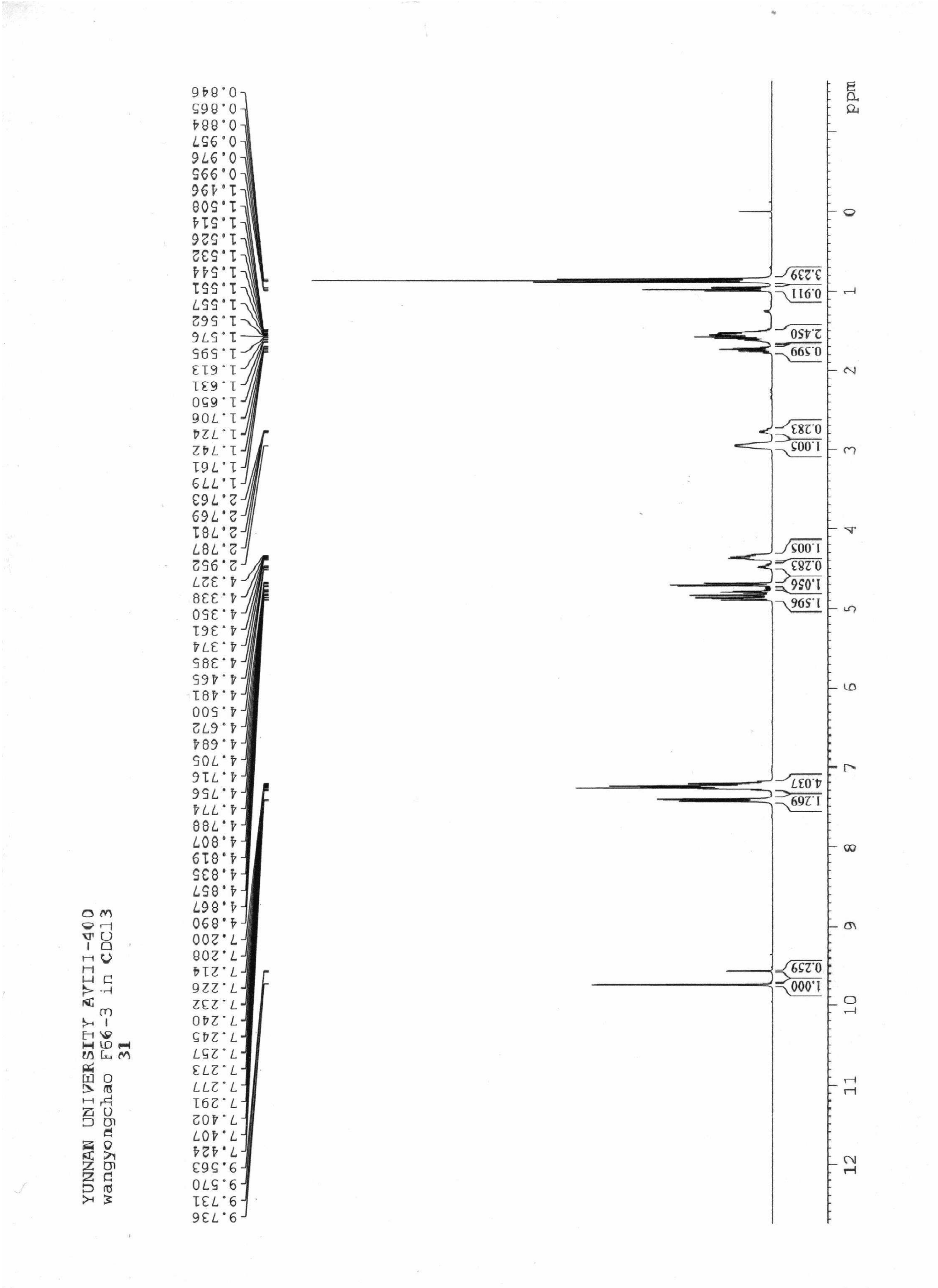

YUNNAN UNIVERSITY AVIII-400
wangyongchao F65-3 in CDCl3
27
9.716
9.710
9.491
9.485
8.125
8.107
7.620
7.601
7.503
7.483
7.464
7.339
7.318
7.296
7.266
7.144
7.123
4.784
4.768
4.763
4.746
4.734
4.714
4.702
4.625
4.600
4.593
4.568
3.818
3.806
3.793
3.781
3.768
3.756
2.701
2.695
2.691
2.680
2.675
2.670
2.665
2.656
2.650
2.645
2.639
1.574
1.563
1.556
1.545
1.538
1.528
1.518
1.509
1.498
1.479
1.460
1.442
1.256
1.016
0.998
0.979
0.965
0.957
0.946
1.000
0.092
0.221
0.105
0.233
2.574
2.446
1.171
1.085
1.131
1.038
2.397
0.437
3.397
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
ppm

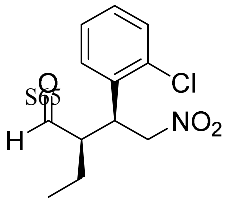

Cl
O
H
NO2


YUNNAN UNIVERSITY AVIII-400
wangyongchao E65-3 in CDCl3
27
10.535
20.334
42.023
54.714
76.715
77.032
77.350
78.331
128.498
129.366
129.635
130.179
134.065
135.370
202.734
ppm

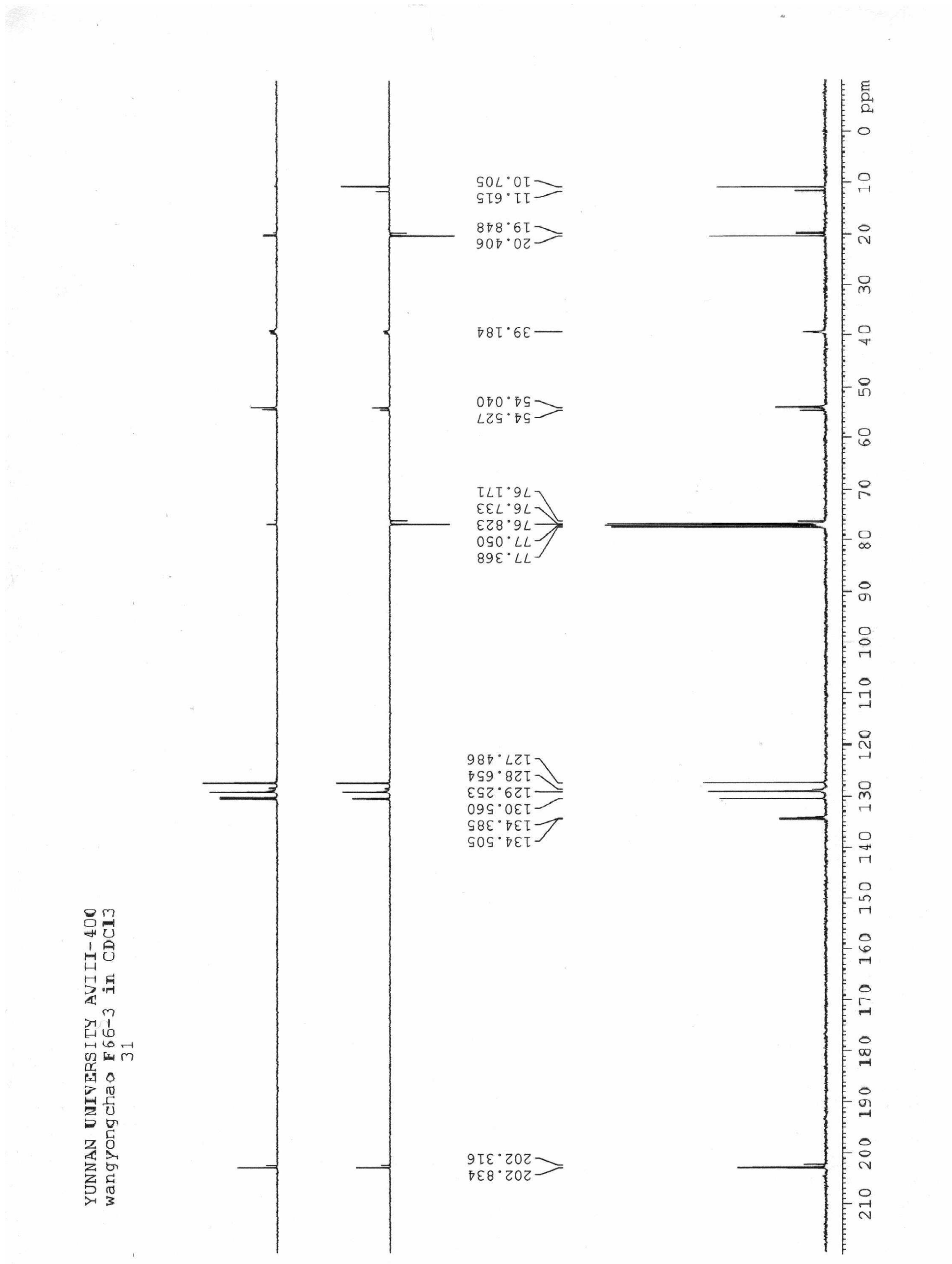

O
H
Cl
NO_2

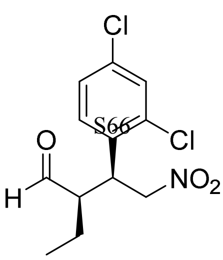
14i


YUNNAN UNIVERSITY AVIII-400
wangyongchao F66-3 in CDCl3
31
0.846
0.865
0.884
0.957
0.976
0.995
1.496
1.508
1.514
1.526
1.532
1.544
1.551
1.557
1.562
1.576
1.595
1.613
1.631
1.650
1.706
1.724
1.742
1.761
1.779
2.763
2.769
2.781
2.787
2.952
4.327
4.338
4.350
4.361
4.374
4.385
4.465
4.481
4.500
4.672
4.684
4.705
4.716
4.756
4.774
4.788
4.807
4.819
4.835
4.857
4.867
4.890
7.200
7.208
7.214
7.226
7.232
7.240
7.245
7.257
7.273
7.277
7.291
7.402
7.407
7.424
9.563
9.570
9.731
9.736
3.239
0.911
2.450
0.599
0.283
1.005
1.005
0.283
1.056
1.596
4.037
1.269
0.259
1.000
ppm
0
1
2
3
4
5
6
7
8
9
10
11
12

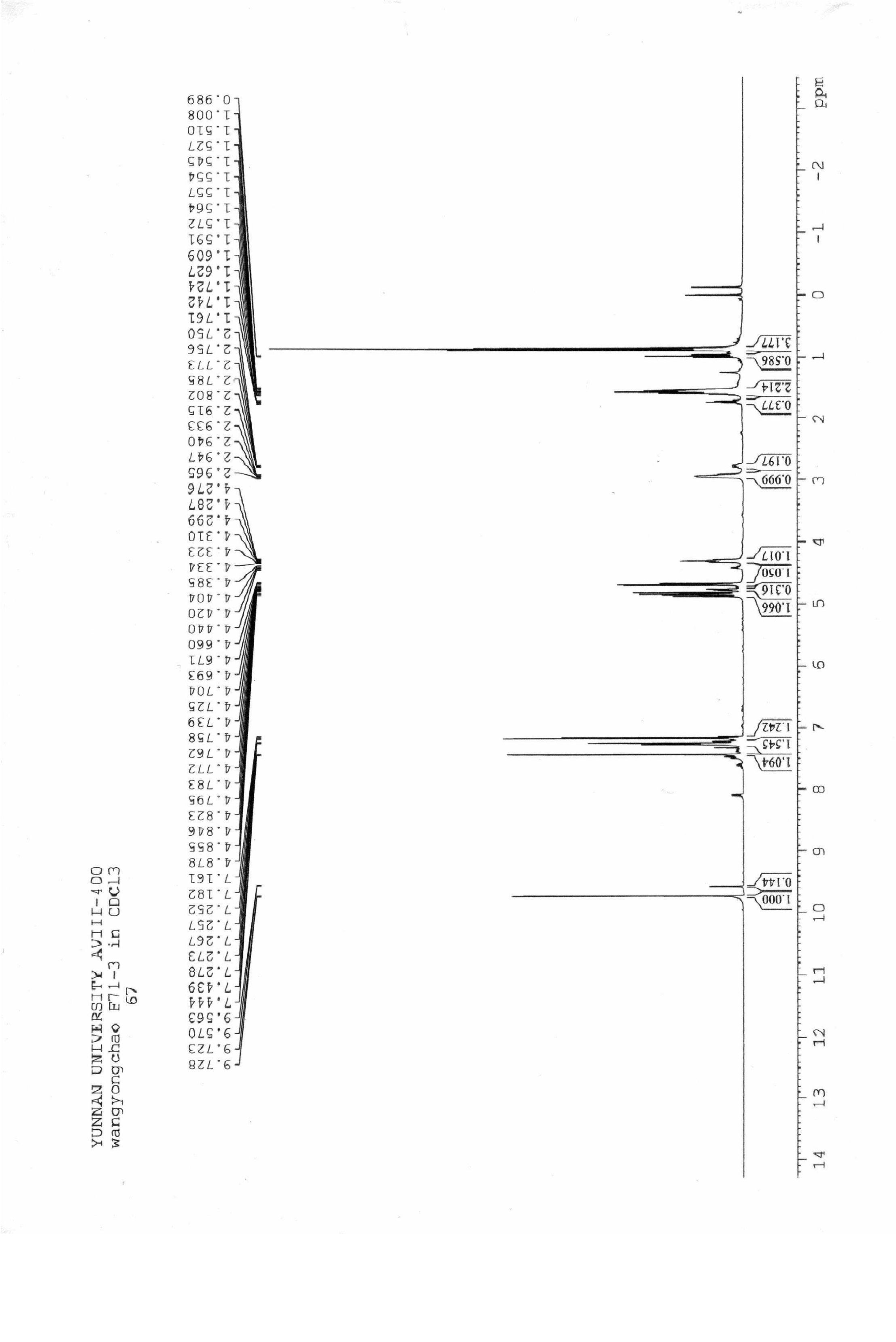

S65
O
Cl
H
NO2

14i

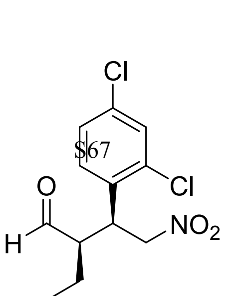

YUNNAN UNIVERSITY AVIII-400
wangyongchao F66-3 in CDCl3
31
10.705
11.615
19.848
20.406
39.184
54.040
54.527
76.171
76.733
76.823
77.050
77.368
127.486
128.654
129.253
130.560
134.385
134.505
202.316
202.834
ppm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210

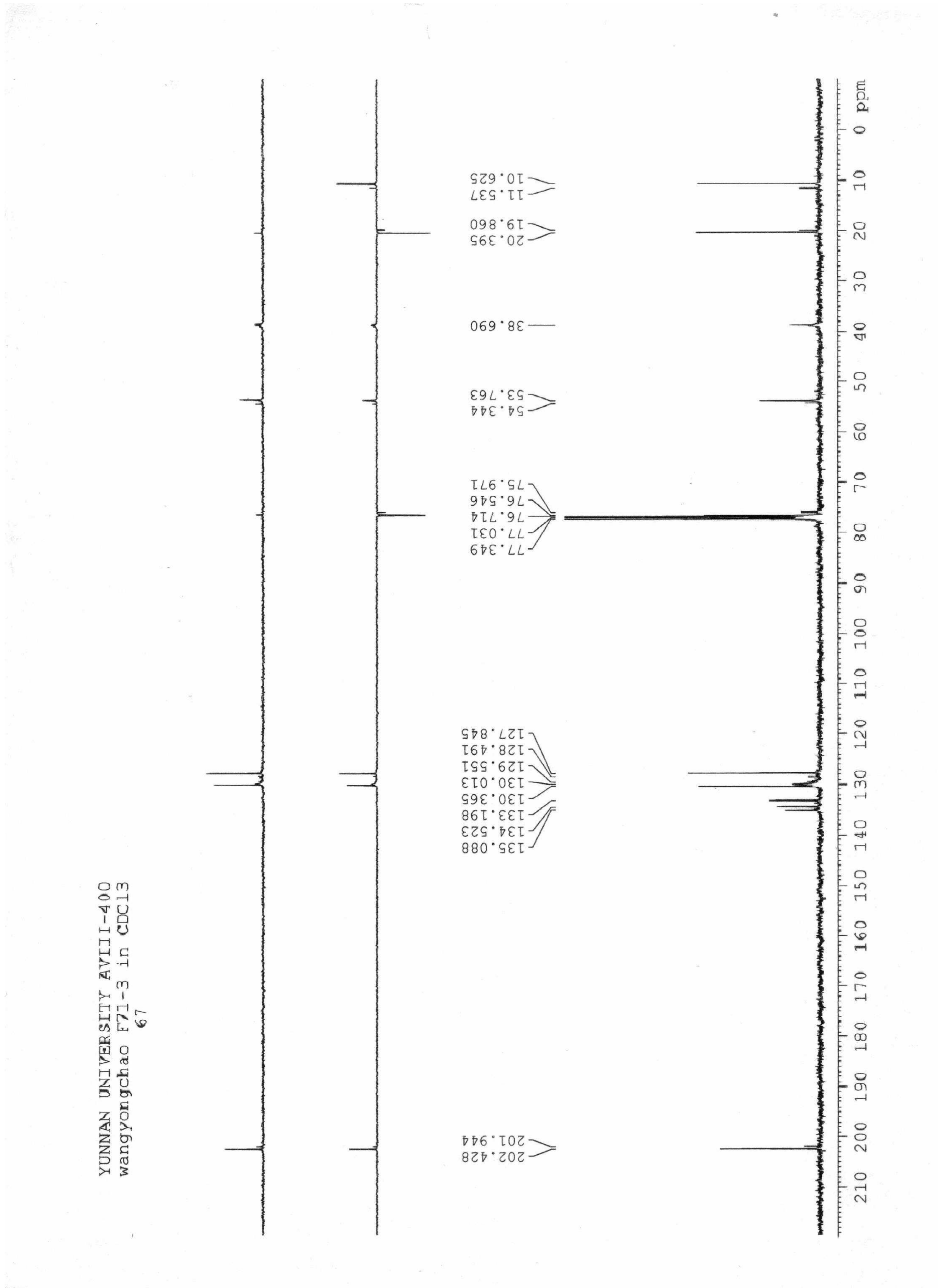

Cl
Cl
O
H
NO2

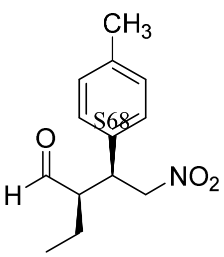
14i


YUNNAN UNIVERSITY AVIII-400
wangyongchao E71-3 in CDCl3
67
0.989
1.008
1.510
1.527
1.545
1.554
1.557
1.564
1.572
1.591
1.609
1.627
1.724
1.742
1.761
2.750
2.756
2.773
2.785
2.802
2.915
2.933
2.940
2.947
2.965
4.276
4.287
4.299
4.310
4.323
4.334
4.385
4.404
4.420
4.440
4.660
4.671
4.693
4.704
4.725
4.739
4.758
4.762
4.772
4.783
4.795
4.823
4.846
4.855
4.878
7.161
7.182
7.252
7.257
7.267
7.273
7.278
7.439
7.444
9.563
9.570
9.723
9.728
3.177
0.586
2.214
0.377
0.197
0.999
1.017
1.050
0.316
1.066
1.242
1.545
1.094
0.144
1.000
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
ppm

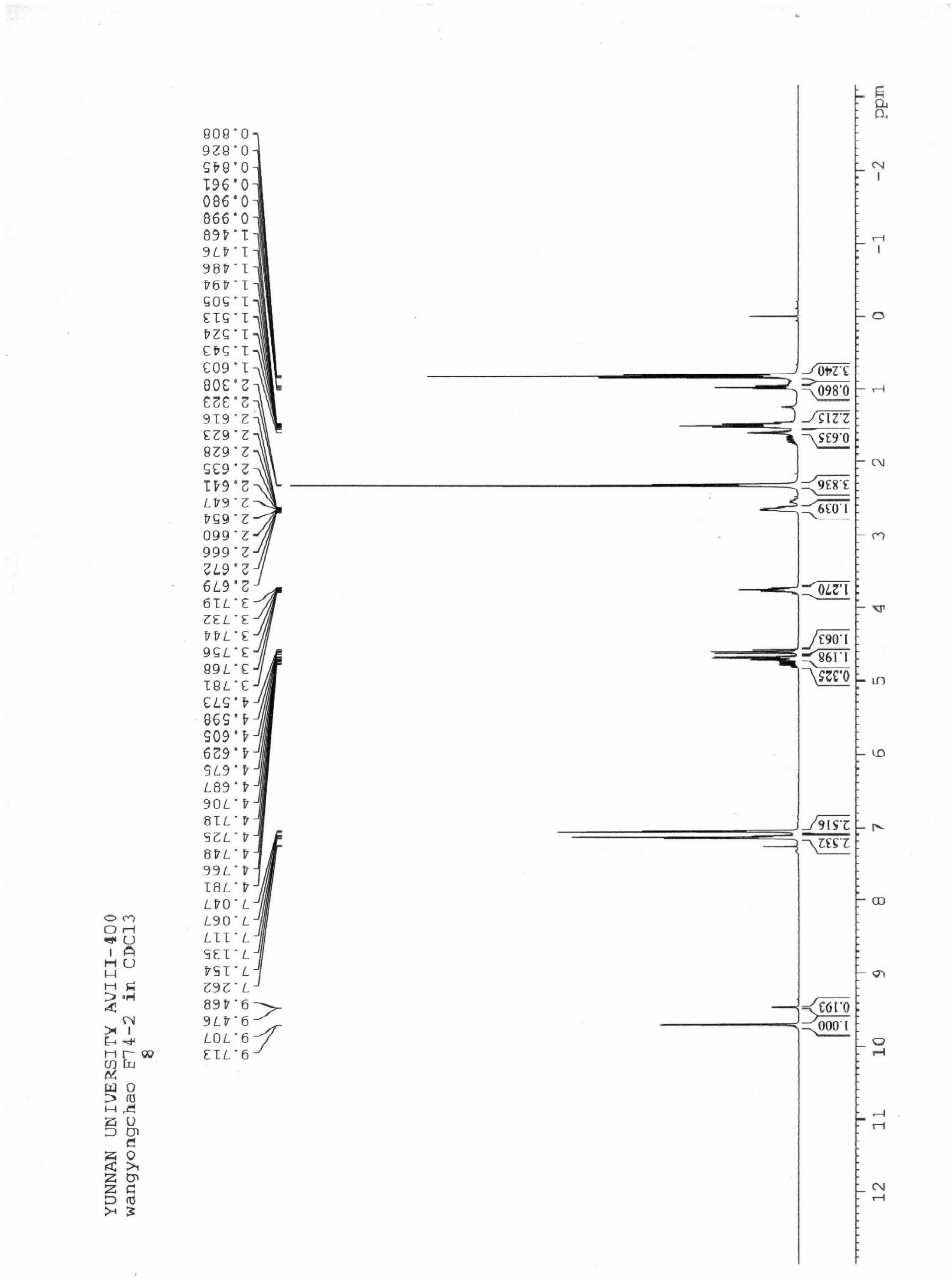
S67


Cl
Cl
O
H
NO2

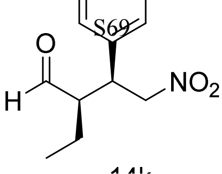

YUNNAN UNIVERSITY AVIII-400
wangyongchao F71-3 in CDCl3
67
10.625
11.537
19.860
20.395
38.690
53.763
54.344
75.971
76.546
76.714
77.031
77.349
127.845
128.491
129.551
130.013
130.365
133.198
134.523
135.088
201.944
202.428
ppm


CH3
O
H
NO2

14l

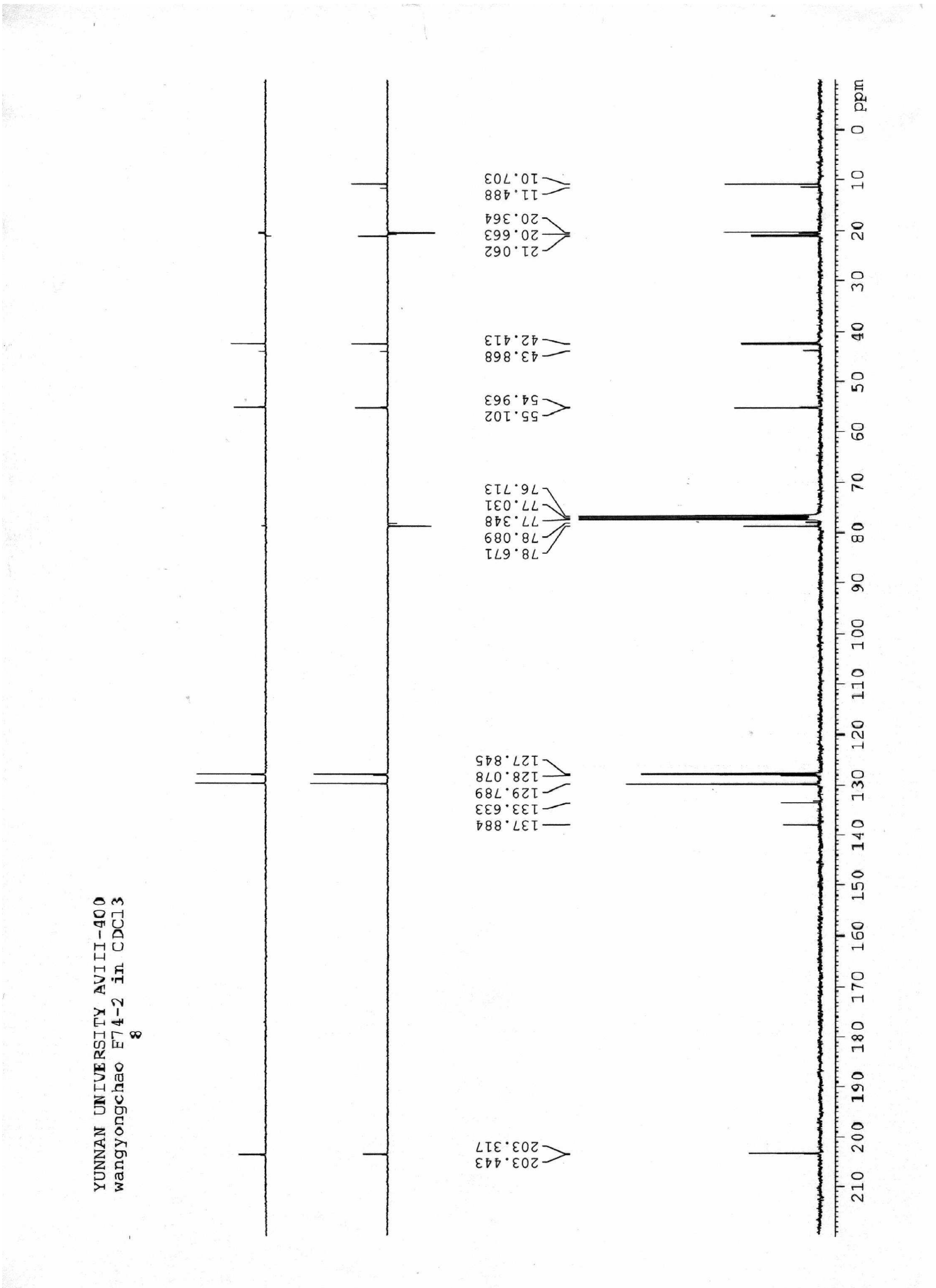


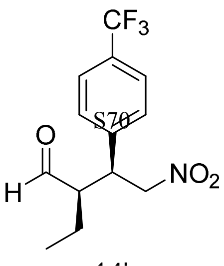
YUNNAN UNIVERSITY AVIII-400
wangyongchao E74-2 in CDCl3
8
0.808
0.826
0.845
0.961
0.980
0.998
1.468
1.476
1.486
1.494
1.505
1.513
1.524
1.543
1.603
2.308
2.323
2.616
2.623
2.628
2.635
2.641
2.647
2.654
2.660
2.666
2.672
2.679
3.719
3.732
3.744
3.756
3.768
3.781
4.573
4.598
4.605
4.629
4.675
4.687
4.706
4.718
4.725
4.748
4.766
4.781
7.047
7.067
7.117
7.135
7.154
7.262
9.468
9.476
9.707
9.713
3.240
0.860
2.215
0.635
3.836
1.039
1.270
1.063
1.198
0.325
2.516
2.532
0.193
1.000
ppm

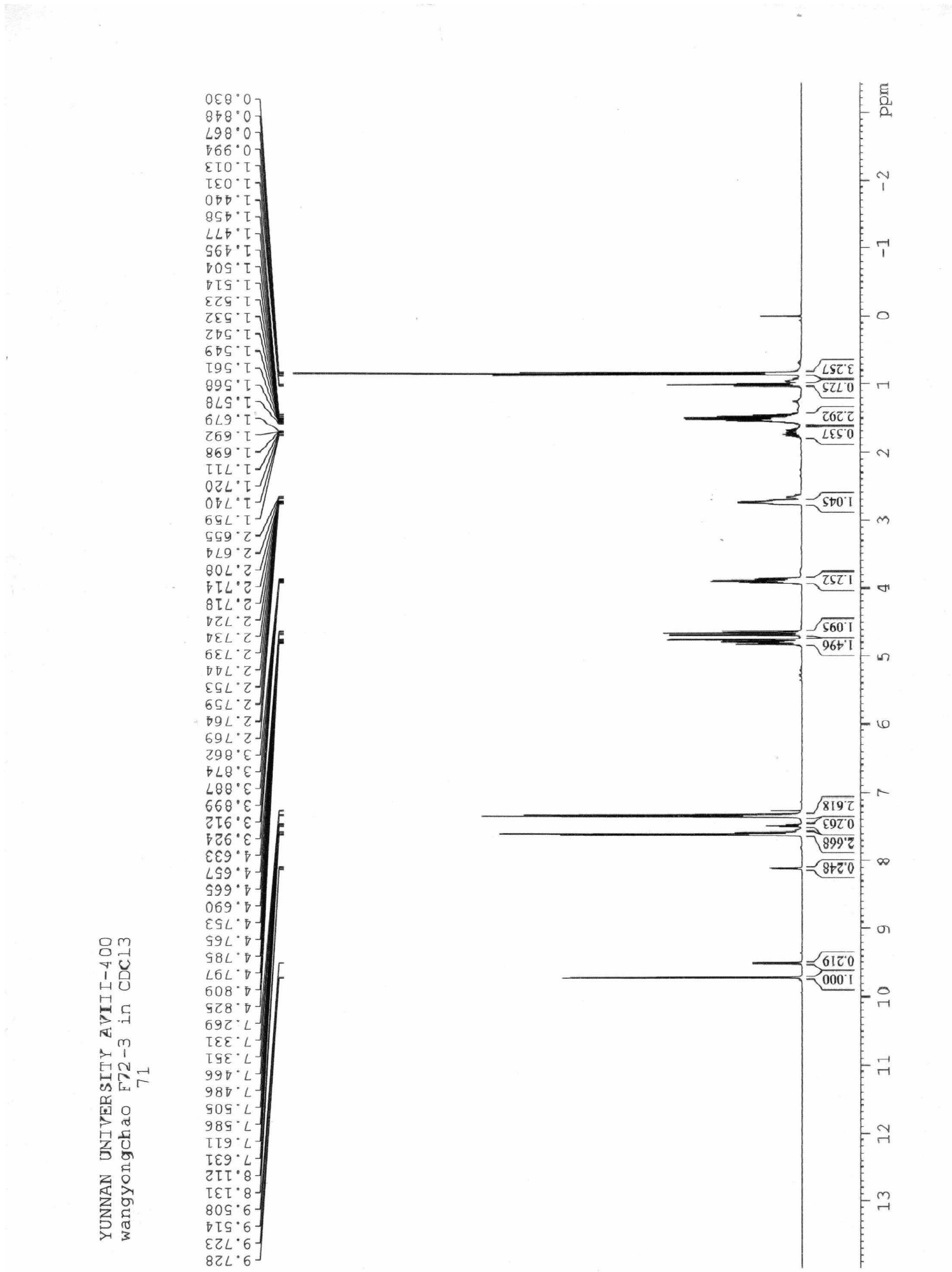


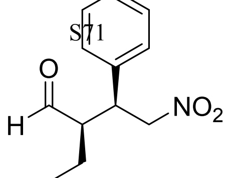
CH3
O
H
NO2

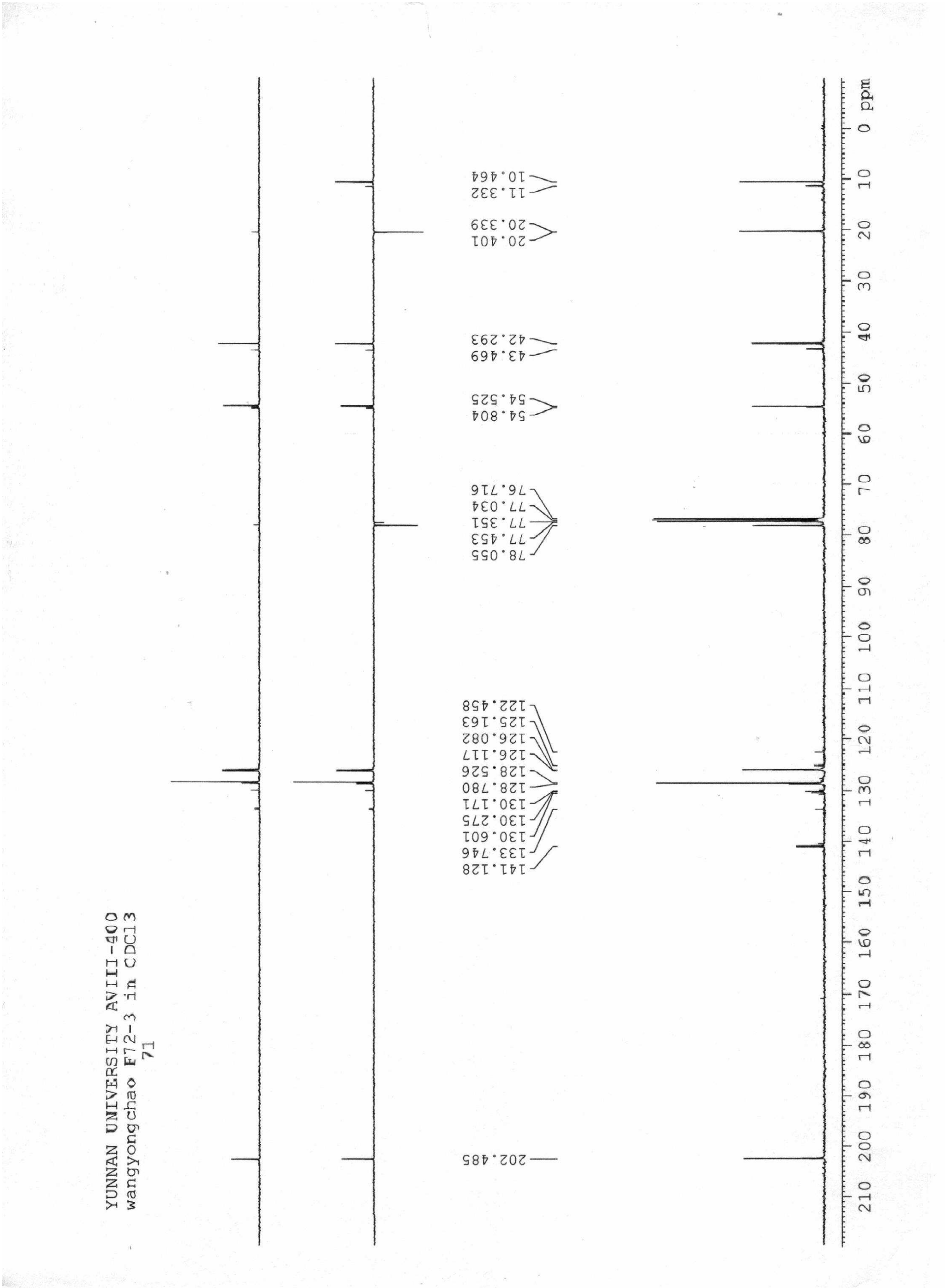
14k

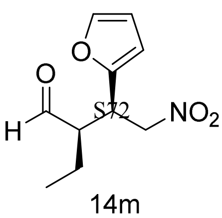

YUNNAN UNIVERSITY AVIII-400
wangyongchao E74-2 in CDCl3
10.703
11.488
20.364
20.663
21.062
42.413
43.868
54.963
55.102
76.713
77.031
77.348
78.089
78.671
127.845
128.078
129.789
133.633
137.884
203.317
203.443
ppm
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210


CF3
O
H
NO2


YUNNAN UNIVERSITY AVIII-400
wangyongchao F72-3 in CDCl3
71
0.830
0.848
0.867
0.994
1.013
1.031
1.440
1.458
1.477
1.495
1.504
1.514
1.523
1.532
1.542
1.549
1.561
1.568
1.578
1.679
1.692
1.698
1.711
1.720
1.740
1.759
2.655
2.674
2.708
2.714
2.718
2.724
2.734
2.739
2.744
2.753
2.759
2.764
2.769
3.862
3.874
3.887
3.899
3.912
3.924
4.633
4.657
4.665
4.690
4.753
4.765
4.785
4.797
4.809
4.825
7.269
7.331
7.351
7.466
7.486
7.505
7.586
7.611
7.631
8.112
8.131
9.508
9.514
9.723
9.728
3.257
0.725
2.292
0.537
1.045
1.252
1.095
1.496
2.618
0.263
2.668
0.248
0.219
1.000
ppm

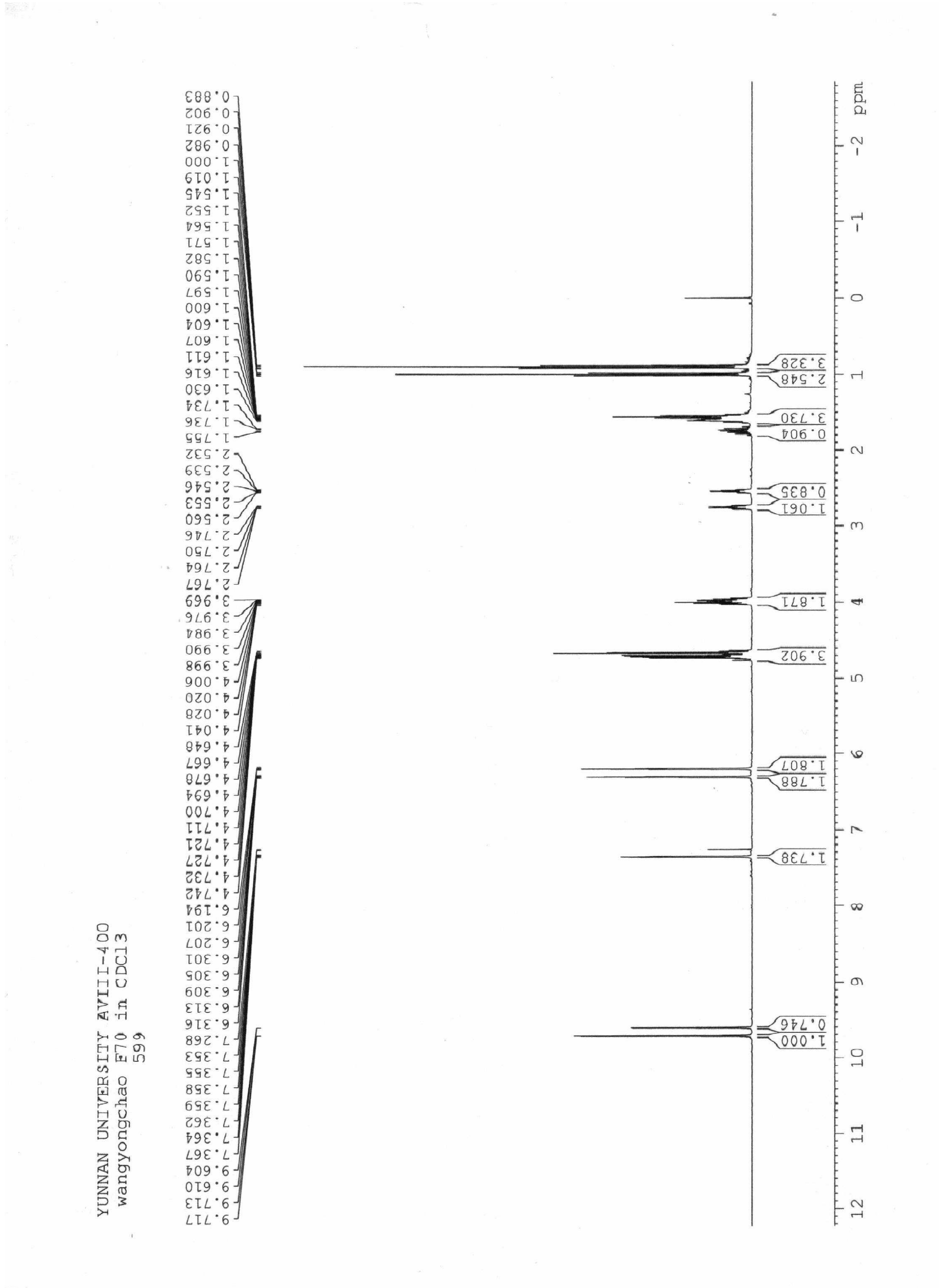

CF3
O
H
NO2

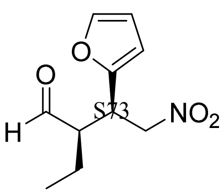

YUNNAN UNIVERSITY AVIII-400
wangyongchao F72-3 in CDCl3
71
10.464
11.332
20.339
20.401
42.293
43.469
54.525
54.804
76.716
77.034
77.351
77.453
78.055
122.458
125.163
126.082
126.117
128.526
128.780
130.171
130.275
130.601
133.746
141.128
202.485
ppm


O
O
H
NO2

14m

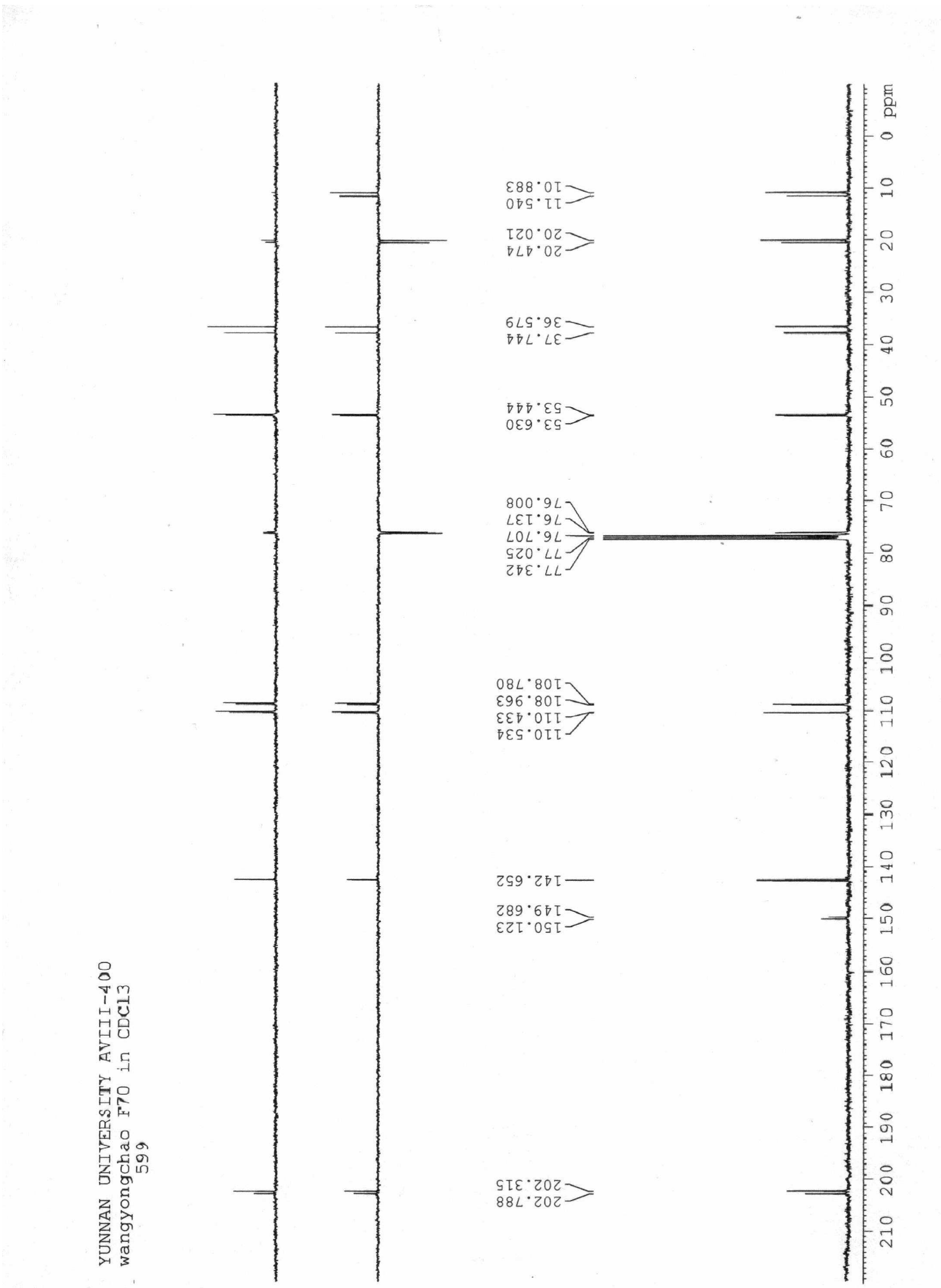
^{1}H-NMR

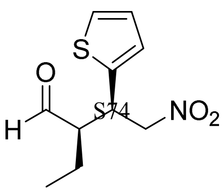

YUNNAN UNIVERSITY AVIII-400
wangyongchao E70 in CDCl3
599
0.883
0.902
0.921
0.982
1.000
1.019
1.545
1.552
1.564
1.571
1.582
1.590
1.597
1.600
1.604
1.607
1.611
1.618
1.630
1.734
1.736
1.755
2.532
2.539
2.546
2.553
2.560
2.746
2.750
2.764
2.767
3.969
3.976
3.984
3.990
3.998
4.006
4.020
4.028
4.041
4.648
4.667
4.678
4.694
4.700
4.711
4.721
4.727
4.732
4.742
6.194
6.201
6.207
6.301
6.305
6.309
6.313
6.316
7.268
7.353
7.355
7.358
7.359
7.362
7.364
7.367
9.604
9.610
9.713
9.717
3.328
2.548
3.730
0.904
0.835
1.061
1.871
3.902
1.807
1.788
1.739
0.746
1.000
ppm
-2
-1
0
1
2
3
4
5
6
7
8
9
10
11
12


O
O
H
NO_2

14m

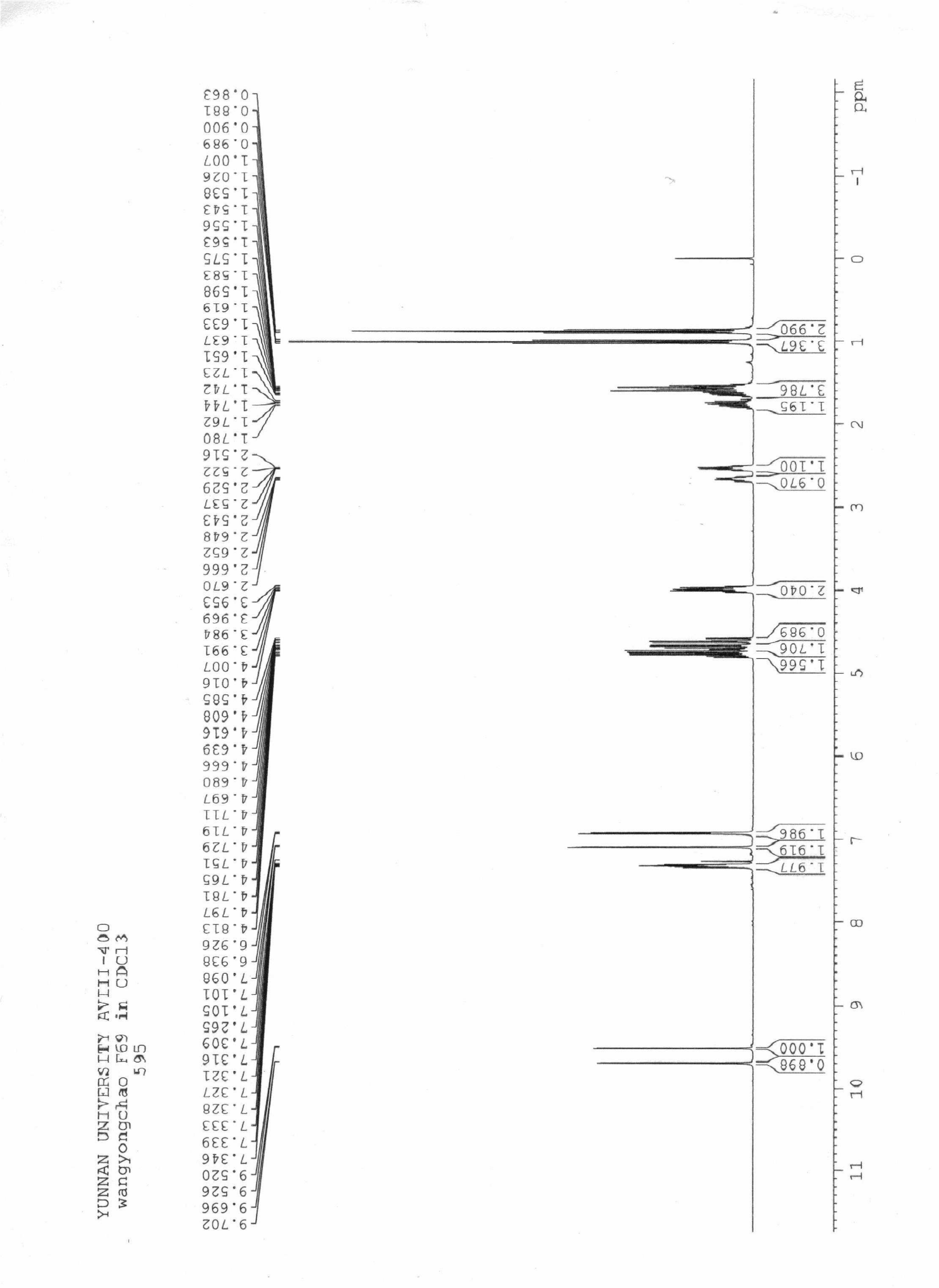
^{13}C-NMR

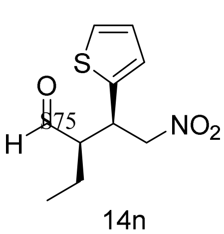

YUNNAN UNIVERSITY AVIII-400
wangyongchao F70 in CDCl3
599
10.883
11.540
20.021
20.474
36.579
37.744
53.444
53.630
76.008
76.137
76.707
77.025
77.342
108.780
108.963
110.433
110.534
142.652
149.682
150.123
202.315
202.788
ppm
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210


S
O
H
NO2

14n

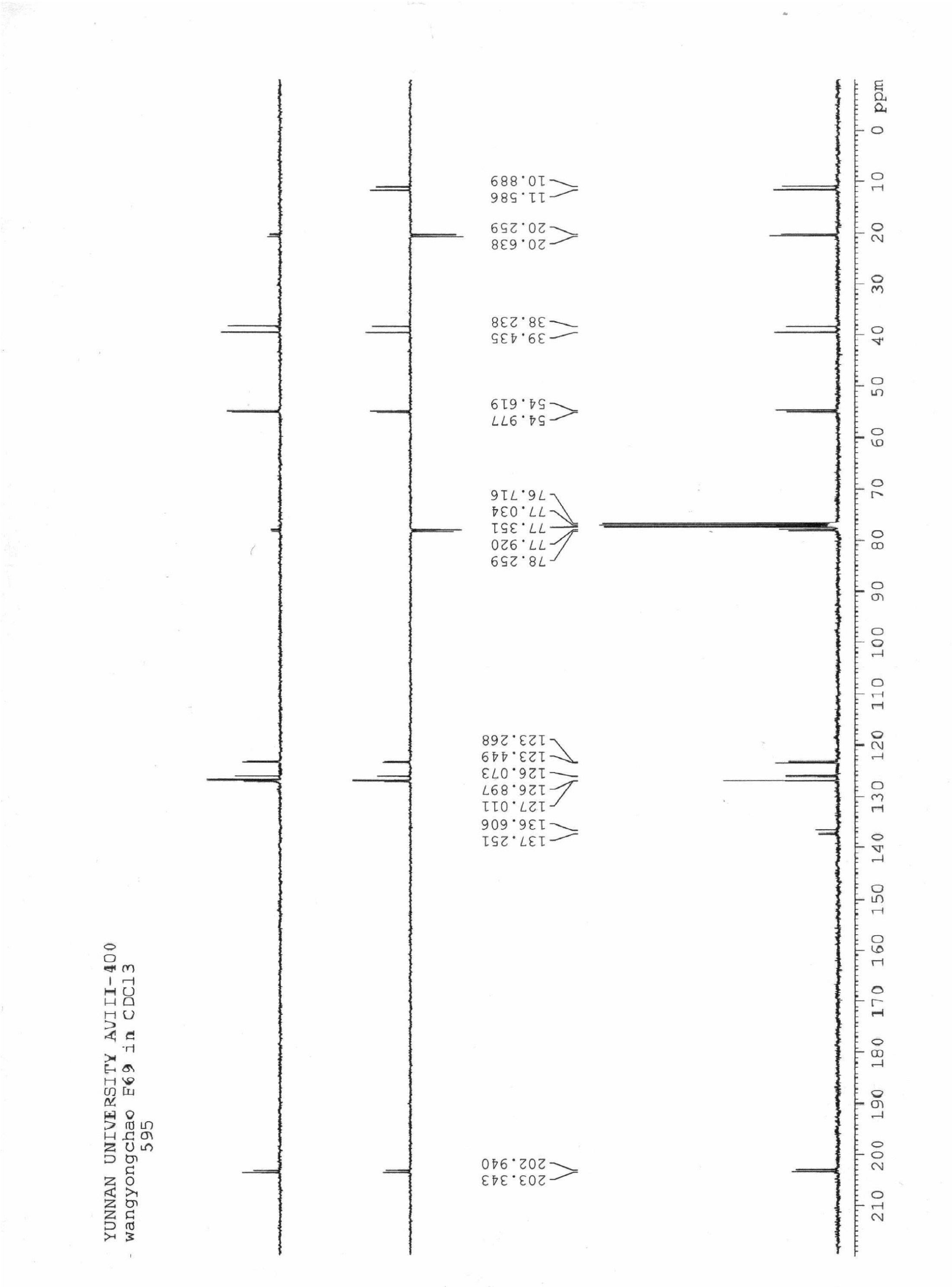
^{1}H-NMR

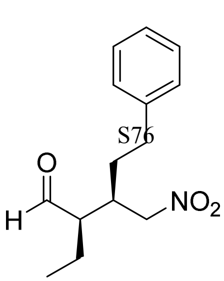

YUNNAN UNIVERSITY AVIII-400
wangyongchao F69 in CDCl3
595
ppm



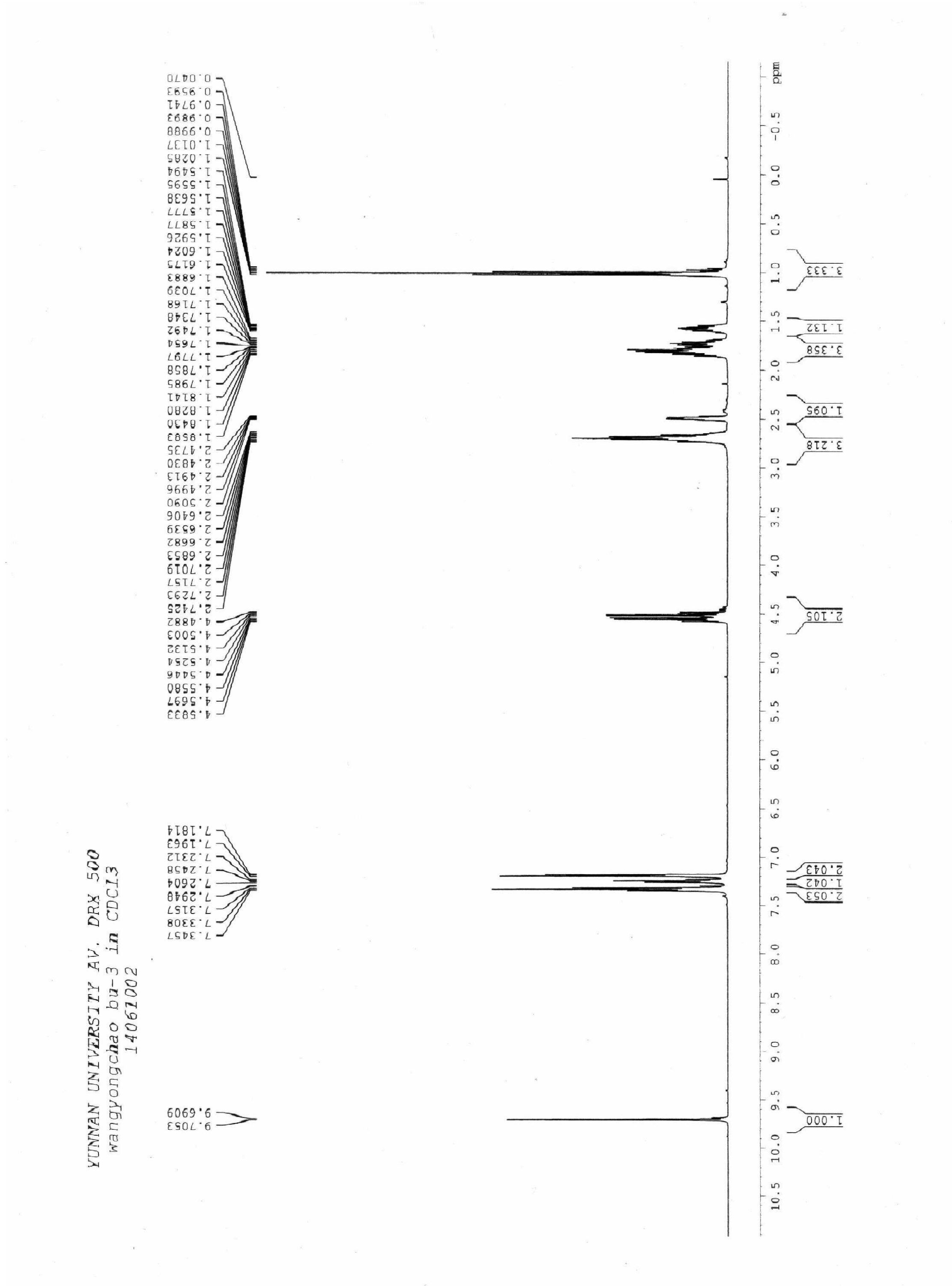
14n

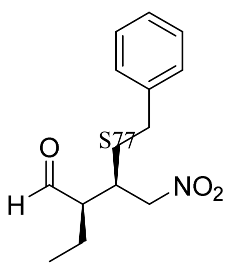
^{13}C-NMR


YUNNAN UNIVERSITY AVIII-400
wangyongchao E69 in CDCl3
595
10.889
11.586
20.259
20.638
38.238
39.435
54.619
54.977
76.716
77.034
77.351
77.920
78.259
123.268
123.449
126.073
126.897
127.011
136.606
137.251
202.940
203.343
ppm

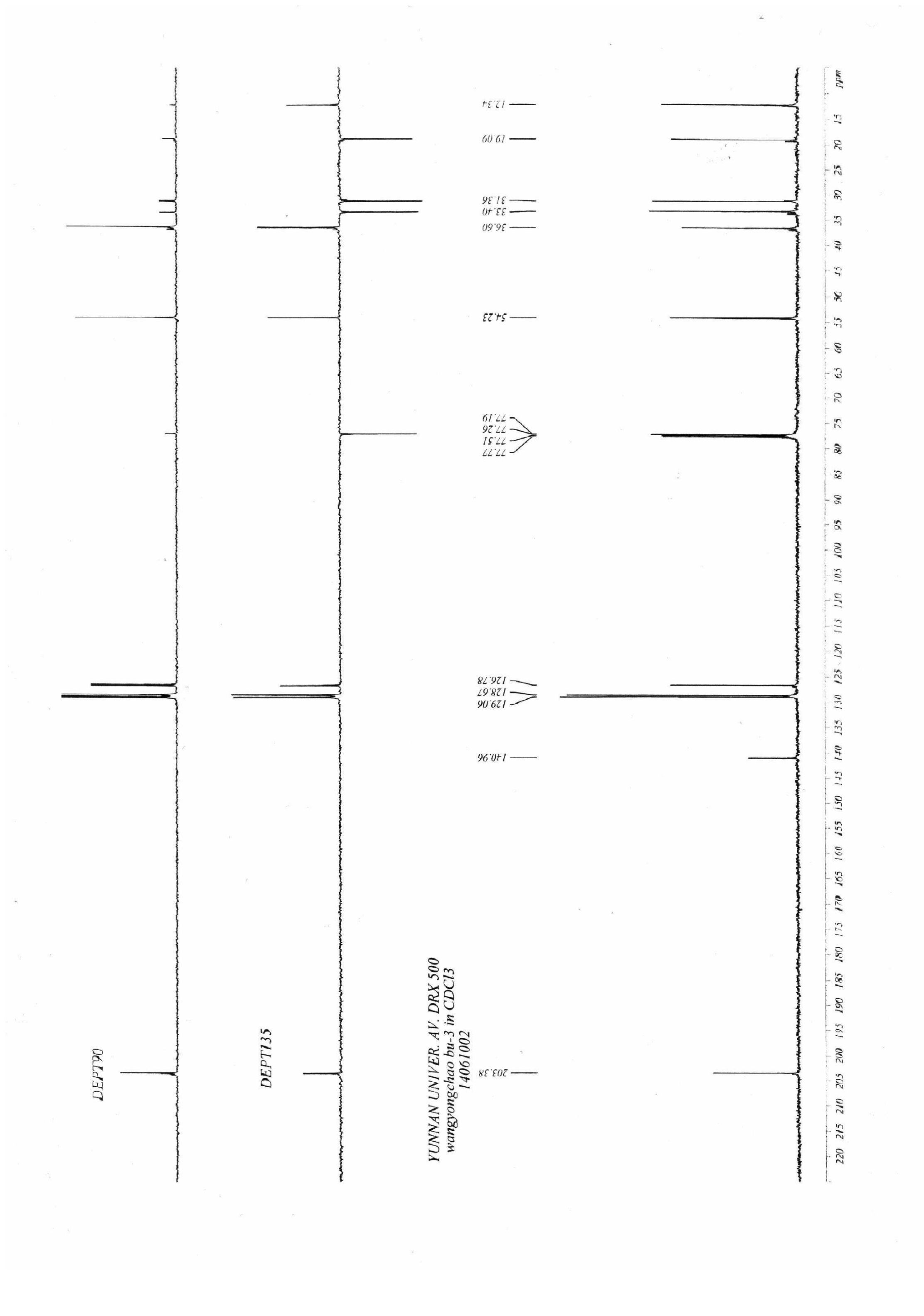

O
H
NO2

S76


YUNNAN UNIVERSITY AV. DRX 500
wangyongchao bu-3 in CDCl3
14061002
ppm

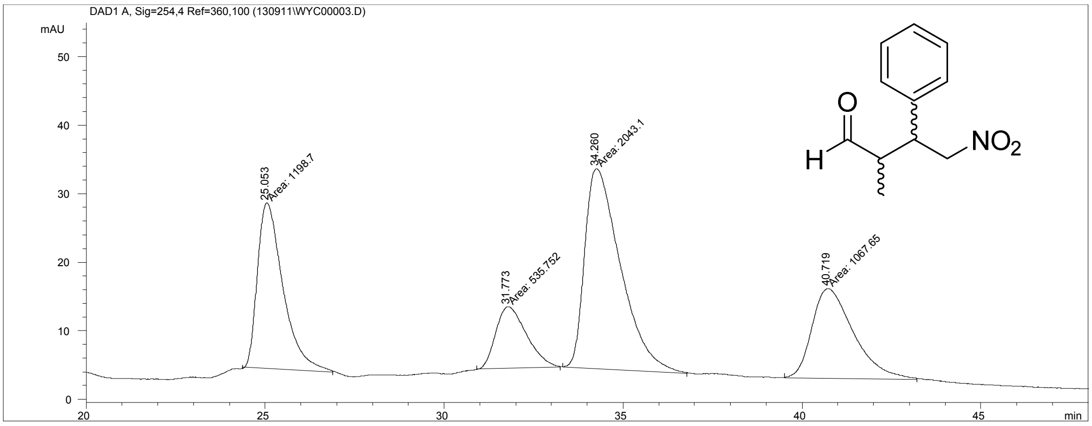

S77
O
H
NO2

14



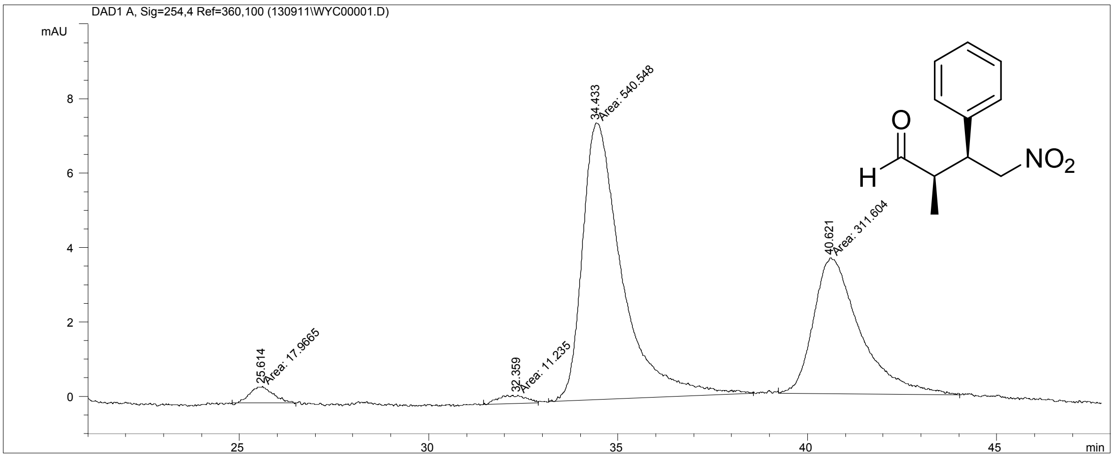
Spectra of chiralHPLC

14a:OD-H n-hexane:2-propanol=90:10 1.0 mL/min



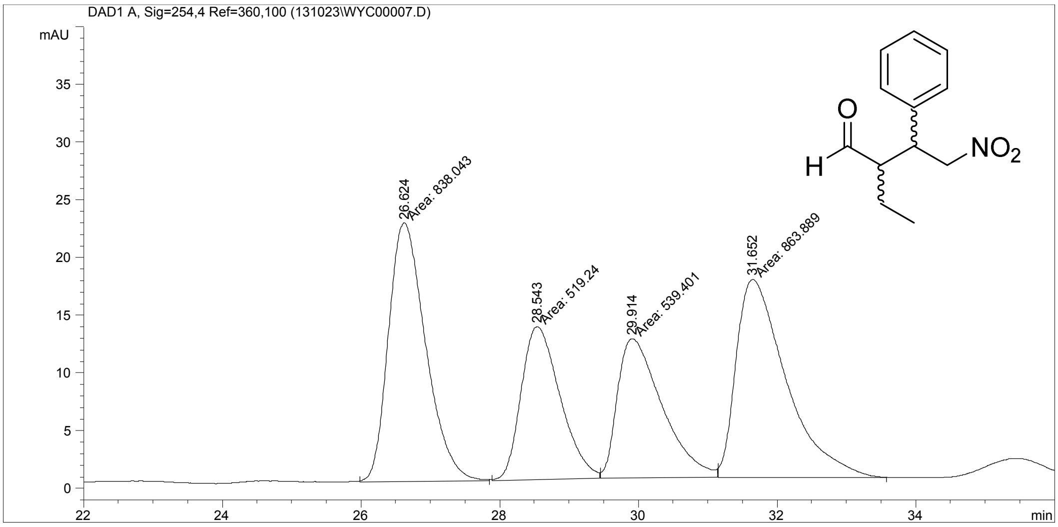
Peak	RetTime	Type	Width	Area	Height	Area
1	25.053	MM	0.8266	1198.7042	24.17069	24.7400
2	31.773	MM	0.9982	535.75201	8.94521	11.0574
3	34.260	MM	1.1657	2043.09766	29.21243	42.1674
4	40.719	MM	1.3525	1067.65210	13.15644	22.0352

OD-H n-hexane:2-propanol=90:10 1.0 mL/min ee=94%



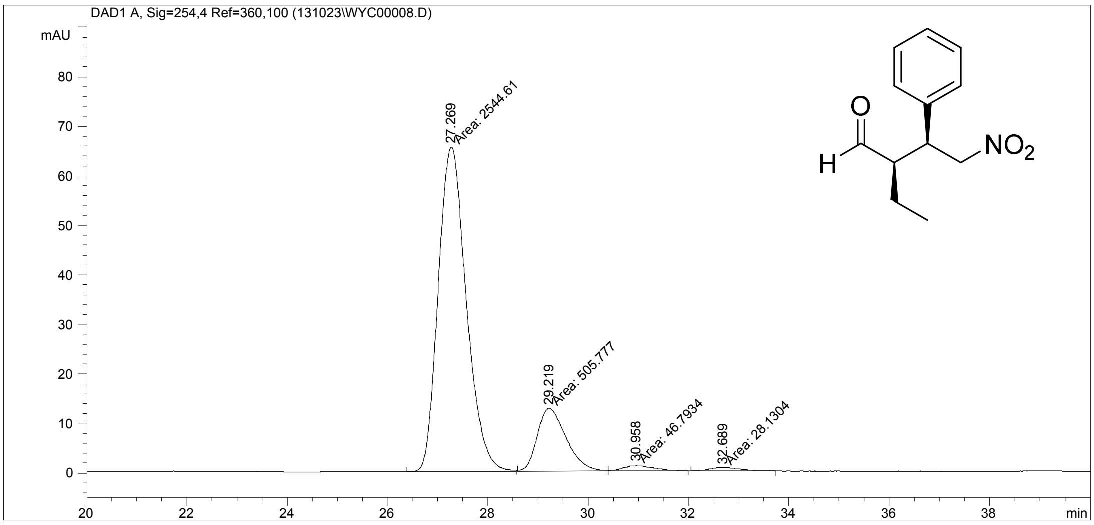
Peak	RetTime	Type	Width	Area	Height	Area
1	25.614	MM	0.6916	17.96647	4.32994	2.0385
2	32.359	MM	0.8468	11.23500	2.21128	1.2747
3	34.433	MM	1.2118	540.54779	7.43431	61.3315
4	40.621	MM	1.4245	311.60434	3.64568	35.3552

14b: AD-H n-hexane:2-propanol=99:1 0.8 mL/min



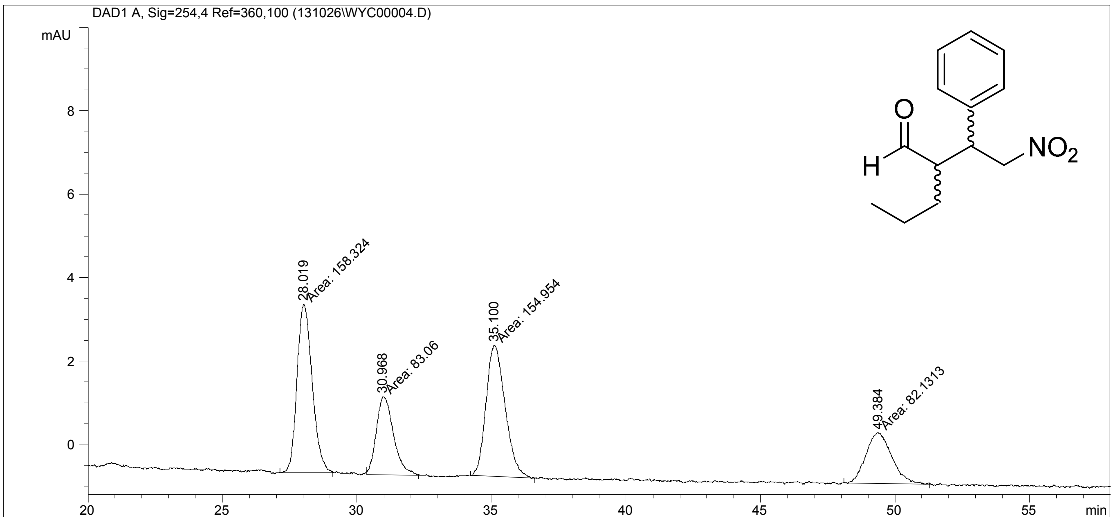
Peak	RetTime	Type	Width	Area	Height	Area
1	26.624	MM	0.6226	838.04266	22.43385	30.3576
2	28.543	MM	0.6525	519.24017	13.26336	18.8091
3	29.914	MM	0.7455	539.40118	12.05854	19.5395
4	31.652	MM	0.8387	863.88879	17.16640	31.2938

AD-H n-hexane:2-propanol=99:1 0.8 mL/min ee=98%



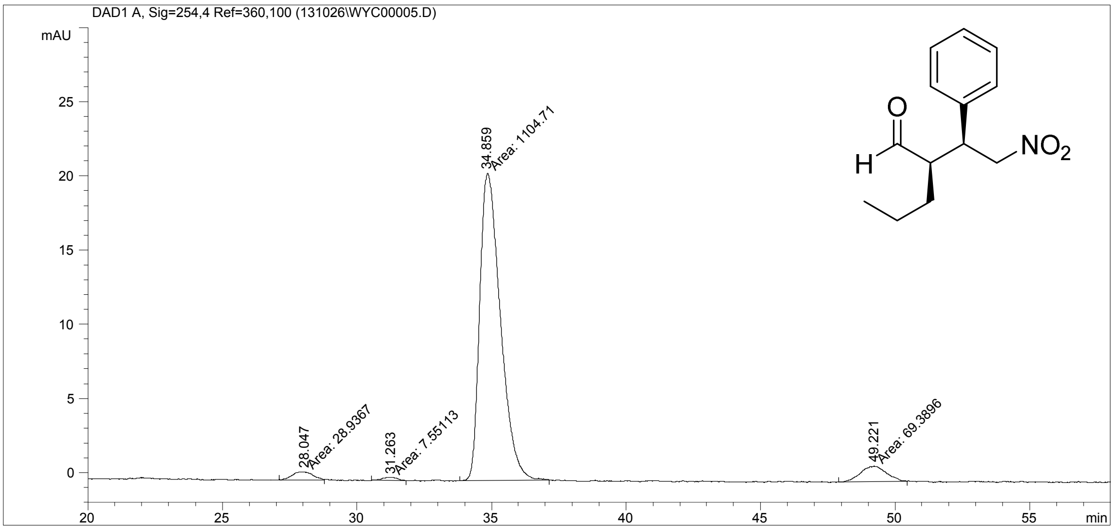
Peak	RetTime	Type	Width	Area	Height	Area
1	27.269	MM	0.6473	2544.60693	65.51886	81.4194
2	29.219	MM	0.6657	505.77750	12.66341	16.1833
3	30.958	MM	0.7146	46.79339	1.09133	1.4972
4	32.689	MM	0.7087	28.13035	6.61547e-1	0.9001

14c: OD-H n-hexane:2-propanol=96:4 1.0 mL/min



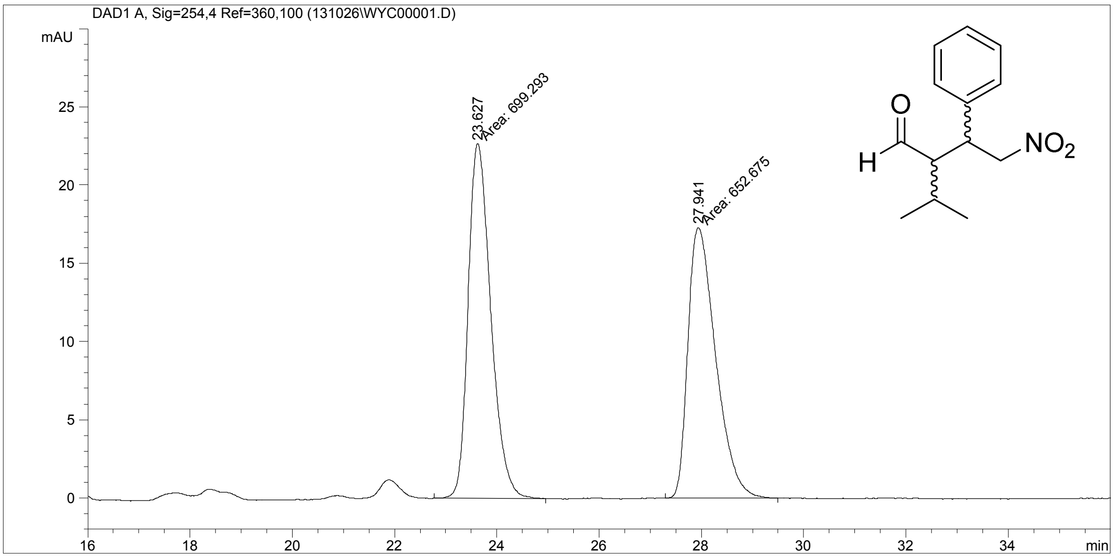
Peak	RetTime	Type	Width	Area	Height	Area
1	28.019	MM	0.6541	158.32413	4.03435	33.0897
2	30.968	MM	0.7410	83.06001	1.86823	17.3595
3	35.100	MM	0.8221	154.95360	3.14125	32.3853
4	49.384	MM	1.1226	82.13135	1.21935	17.1654

OD-H n-hexane:2-propanol=96:4 1.0 mL/min ee=95%



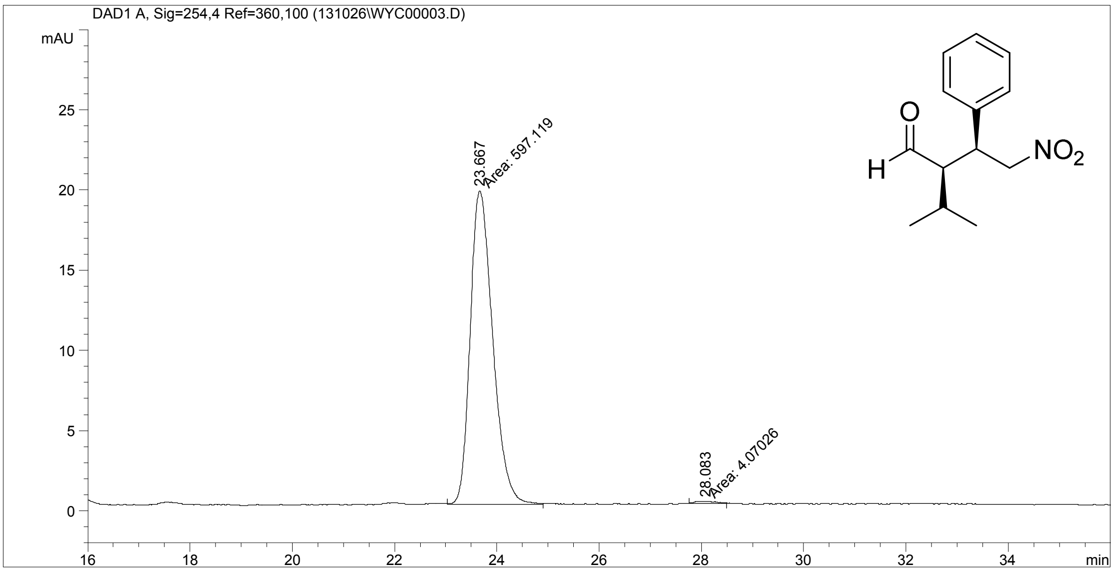
Peak	RetTime	Type	Width	Area	Height	Area
1	28.047	MM	0.8710	28.93668	5.53724e-1	2.3903
2	31.263	MM	0.5965	7.55113	2.10995e-1	0.6238
3	34.859	MM	0.8898	1104.70825	20.69282	91.2540
4	49.221	MM	1.1052	69.38958	1.04642	5.7319

14d: AD-H n-hexane:2-propanol=97:3 0.5 mL/min



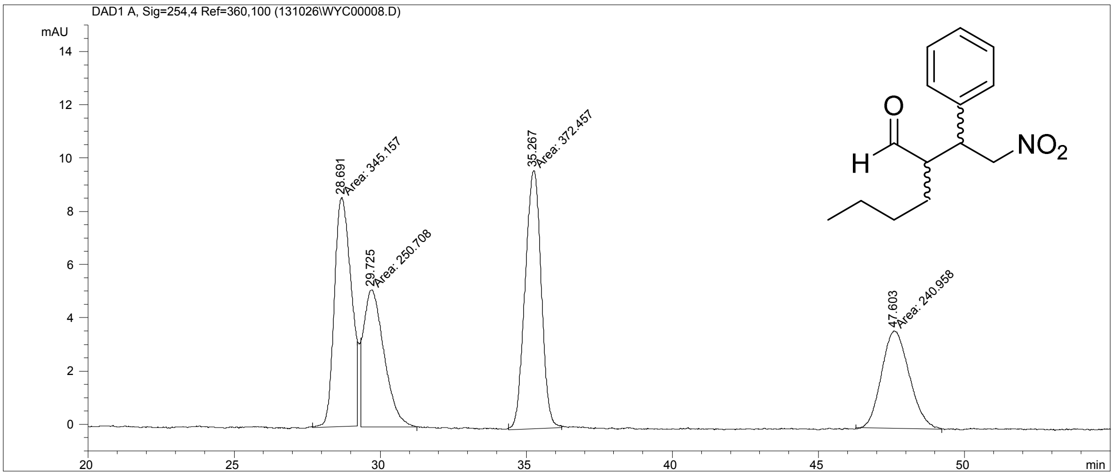
Peak	RetTime	Type	Width	Area	Height	Area
1	23.627	MM	0.5143	699.29346	22.66385	51.7241
2	27.941	MM	0.6288	652.67542	17.30001	48.2759

AD-H n-hexane:2-propanol=97:3 0.5 mL/min ee=99%



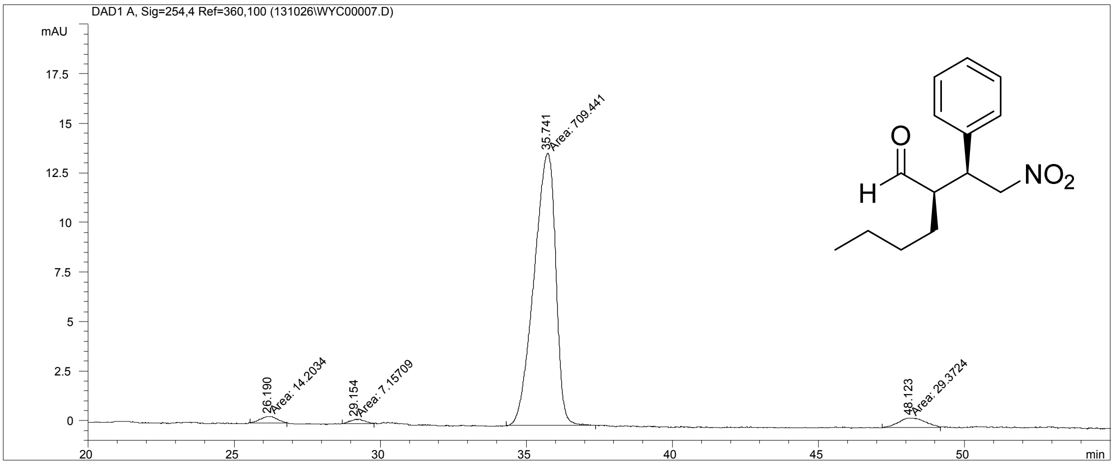
Peak	RetTime	Type	Width	Area	Height	Area
1	23.667	MM	0.5094	597.11914	19.53519	99.3230
2	28.083	MM	0.4521	4.07026	1.50051e-1	0.6770

14e: OD-H n-hexane:2-propanol=97:3 1.0 mL/min



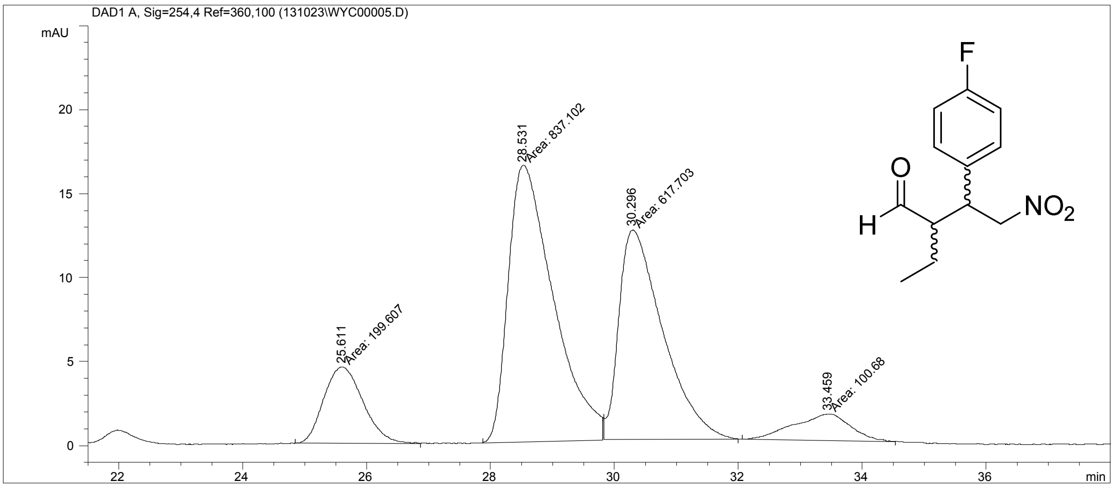
Peak	RetTime	Type	Width	Area	Height	Area
1	28.691	MM	0.6689	345.15674	8.60073	28.5424
2	29.725	MM	0.8116	250.70798	5.14862	20.7320
3	35.267	MM	0.6397	372.45657	9.70463	30.7999
4	47.603	MM	1.0966	240.95757	3.66232	19.9257

OD-H n-hexane:2-propanol=97:3 1.0 mL/min ee=96%



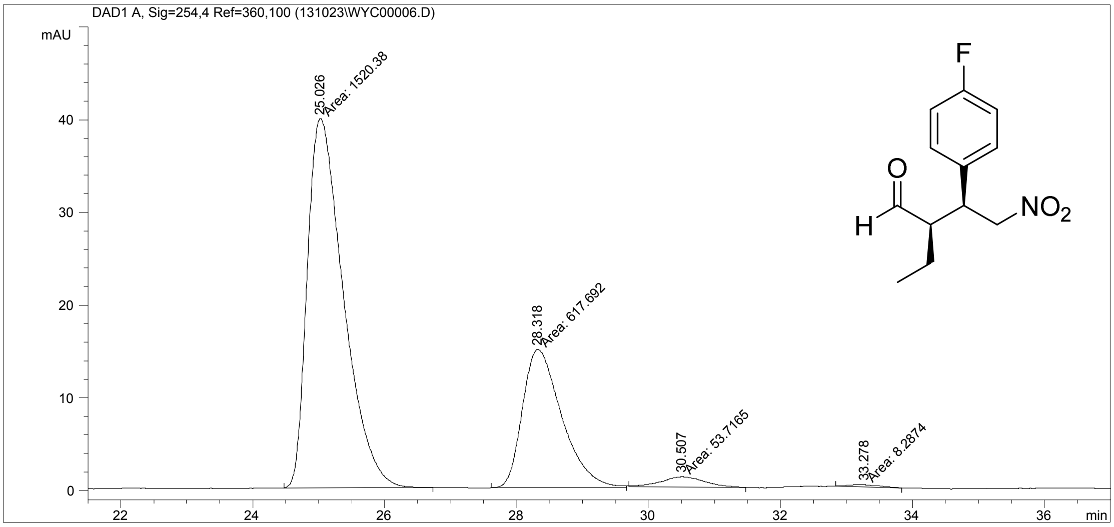
Peak	RetTime	Type	Width	Area	Height	Area
1	26.190	MM	0.6851	14.20342	3.45522	1.8684
2	29.154	MM	0.5448	7.15709	2.18970	0.9415
3	35.741	MM	0.8598	709.44061	13.75233	93.3261
4	48.123	MM	1.0290	29.37243	4.75746	3.8639

14f: AD-H n-hexane:2-propanol=99:1 1.0 mL/min



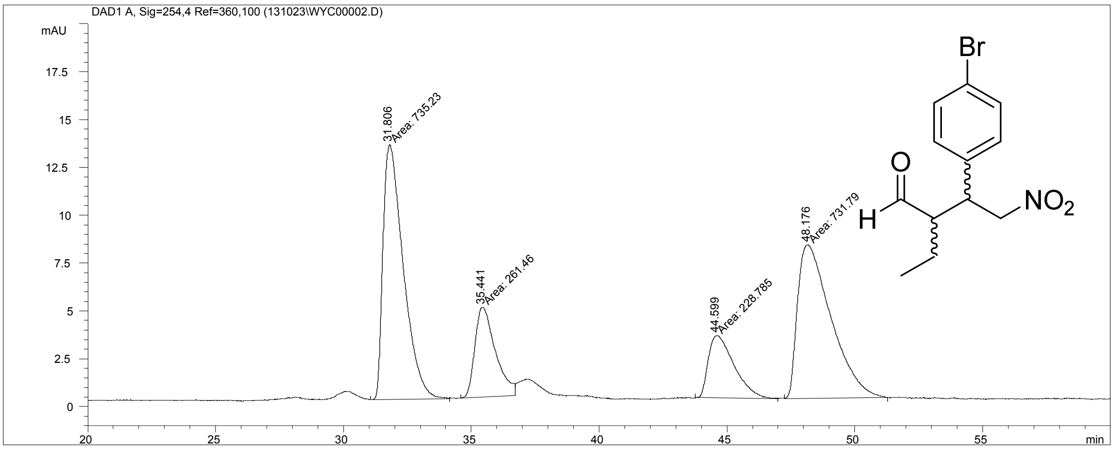
Peak	RetTime	Type	Width	Area	Height	Area
1	25.611	MM	0.7317	199.60738	4.54670	11.3730
2	28.531	MM	0.8465	837.10156	16.48241	47.6956
3	30.296	MM	0.8255	617.70337	12.47155	35.1949
4	33.459	MM	1.0562	100.67973	1.58866	5.7364

AD-H n-hexane:2-propanol=99:1 1.0 mL/min ee=99%



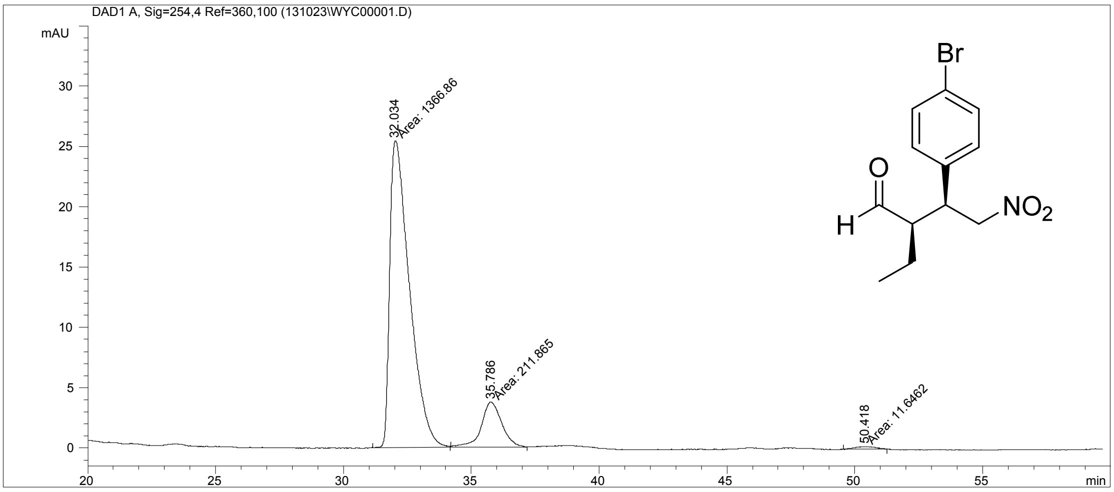
Peak	RetTime	Type	Width	Area	Height	Area
1	25.026	MM	0.6356	1520.37537	39.87033	69.1057
2	28.318	MM	0.6911	617.69189	14.89722	28.0760
3	30.507	MM	0.7821	53.71649	1.14471	2.4416
4	33.278	MM	0.5461	8.28740	2.52918e-1	0.3767

14g: AD-H n-hexane:2-propanol=98.5:1.5 1.0 mL/min



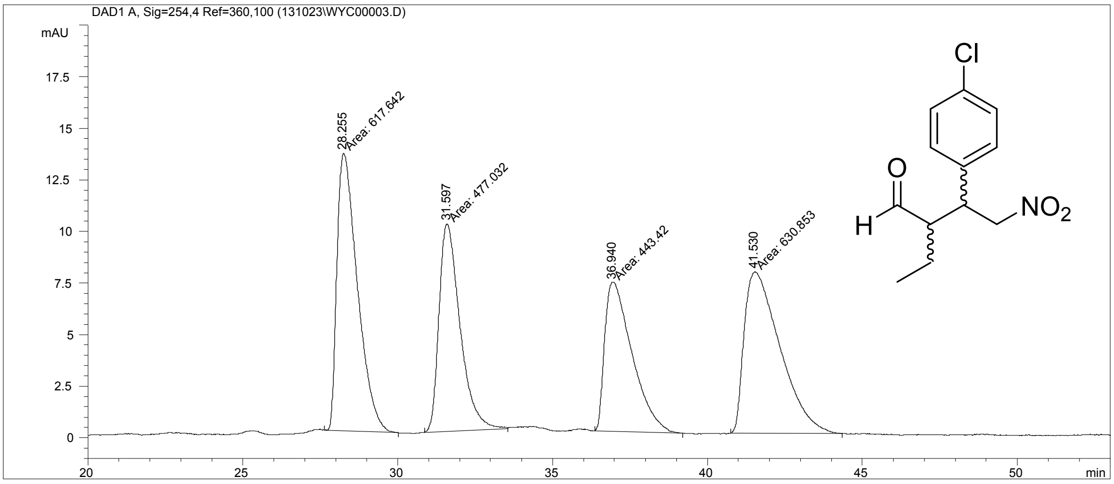
Peak	RetTime	Type	Width	Area	Height	Area
1	31.806	MM	0.9205	735.23010	13.31213	37.5642
2	35.441	MM	0.9287	261.46024	4.69229	13.3584
3	44.599	MM	1.1700	228.78531	3.25898	11.6890
4	48.176	MM	1.5213	731.78961	8.01691	37.3884

AD-H n-hexane:2-propanol=98.5:1.5 1.0 mL/min ee=98%



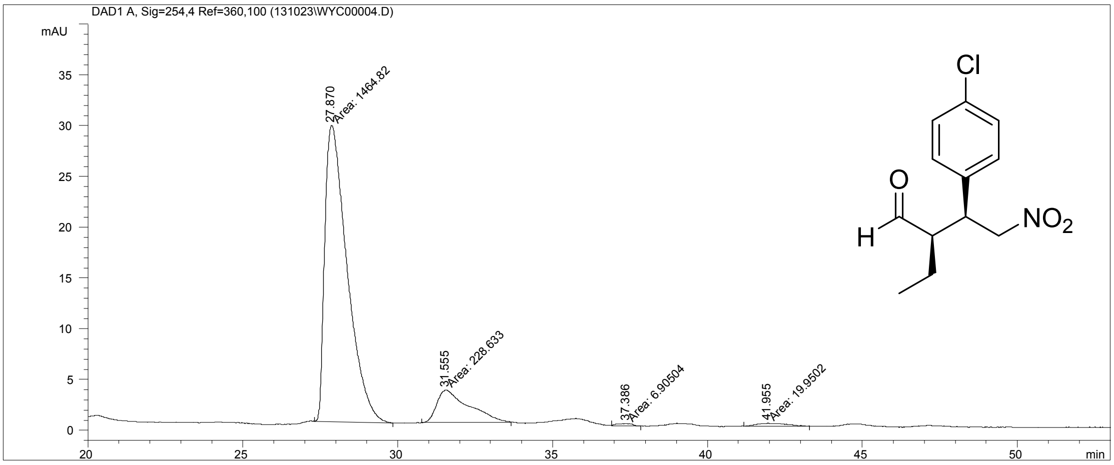
Peak	RetTime	Type	Width	Area	Height	Area
1	32.034	MM	0.8954	1366.86145	25.44221	85.9460
2	35.786	MM	0.9417	211.86499	3.74969	13.3217
3	50.418	MM	0.8921	11.64620	2.17569e-1	0.7323

14h: AD-H n-hexane:2-propanol=98.5:1.5 1.0 mL/min



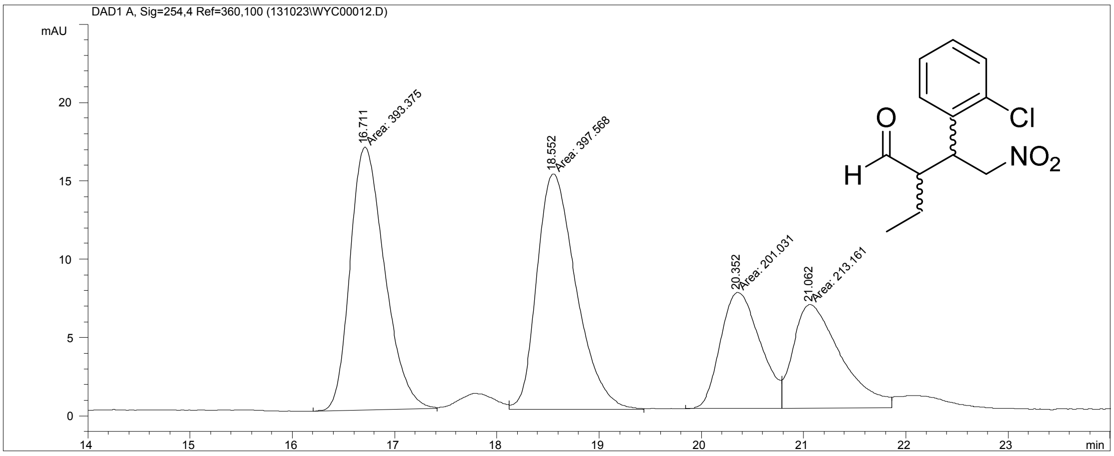
Peak	RetTime	Type	Width	Area	Height	Area
1	28.255	MM	0.7647	617.64178	13.46114	28.4766
2	31.597	MM	0.7902	477.03207	10.06172	21.9937
3	36.940	MM	1.0233	443.41980	7.22227	20.4440
4	41.530	MM	1.3439	630.85272	7.82346	29.0857

AD-H n-hexane:2-propanol=98.5:1.5 1.0 mL/min   ee=97%



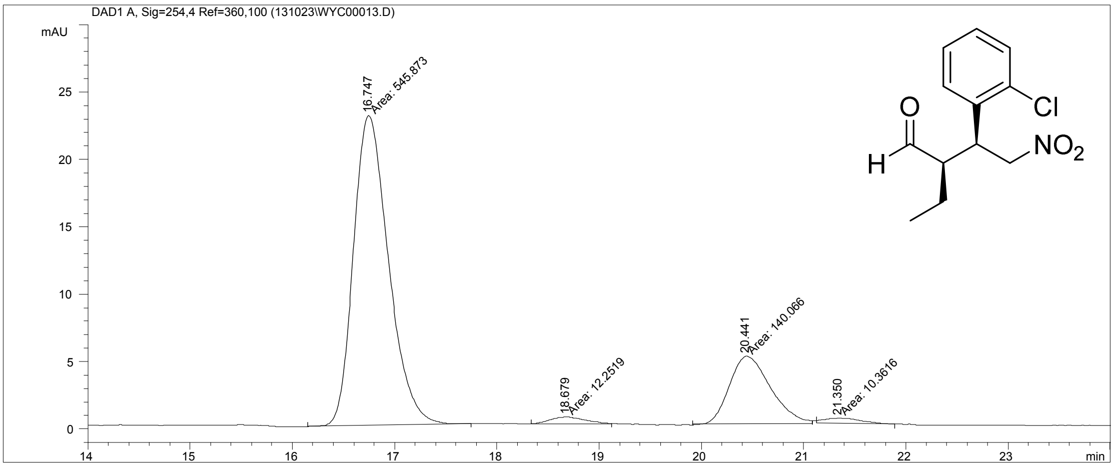
Peak	RetTime	Type	Width	Area	Height	Area
1	27.870	MM	0.8362	1464.81958	29.19622	85.1487
2	31.555	MM	1.1912	228.63293	3.19886	13.2902
3	37.386	MM	0.5867	6.90504	1.96170	0.4014
4	41.955	MM	1.1098	19.95020	2.99620	1.1597

14i: AD-H n-hexane:2-propanol=99:1 1.0 mL/min



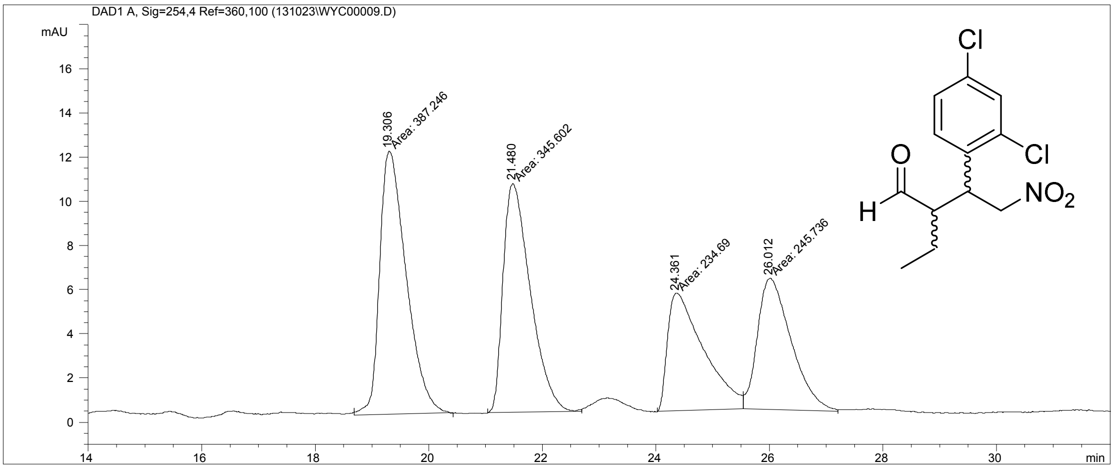
Peak	RetTime	Type	Width	Area	Height	Area
1	16.711	MM	0.3910	393.37469	16.76834	32.6416
2	18.552	MM	0.4415	397.56821	15.00797	32.9895
3	20.352	MM	0.4530	201.03058	7.39608	16.6812
4	21.062	MM	0.5374	213.16089	6.61054	17.6877

AD-H n-hexane:2-propanol=99:1 1.0 mL/min ee=96%



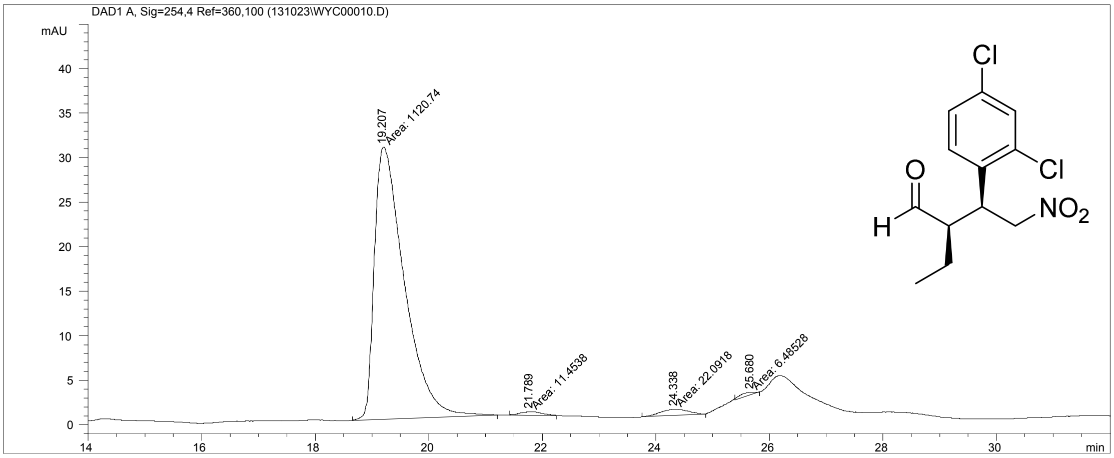
Peak	RetTime	Type	Width	Area	Height	Area
1	16.747	MM	0.3960	545.87335	22.97521	77.0406
2	18.679	MM	0.3943	12.25194	5.17894	1.7292
3	20.441	MM	0.4655	140.06561	5.01491	19.7679
4	21.350	MM	0.4213	10.36161	4.09883	1.4624

14j: AD-H n-hexane:2-propanol=99:1 1.0 mL/min



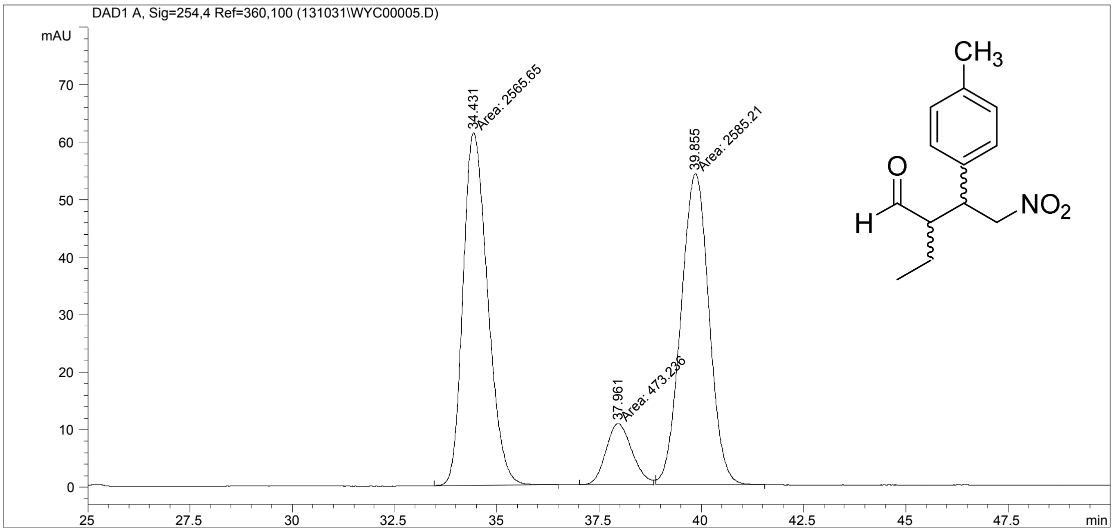
Peak	RetTime	Type	Width	Area	Height	Area
1	19.306	MM	0.5415	387.24628	11.91827	31.9175
2	21.480	MM	0.5562	345.60205	10.35623	28.4851
3	24.361	MM	0.7339	234.68988	5.32954	19.3435
4	26.012	MM	0.6884	245.73569	5.94955	20.2539

AD-H n-hexane:2-propanol=99:1 1.0 mL/min ee=98%



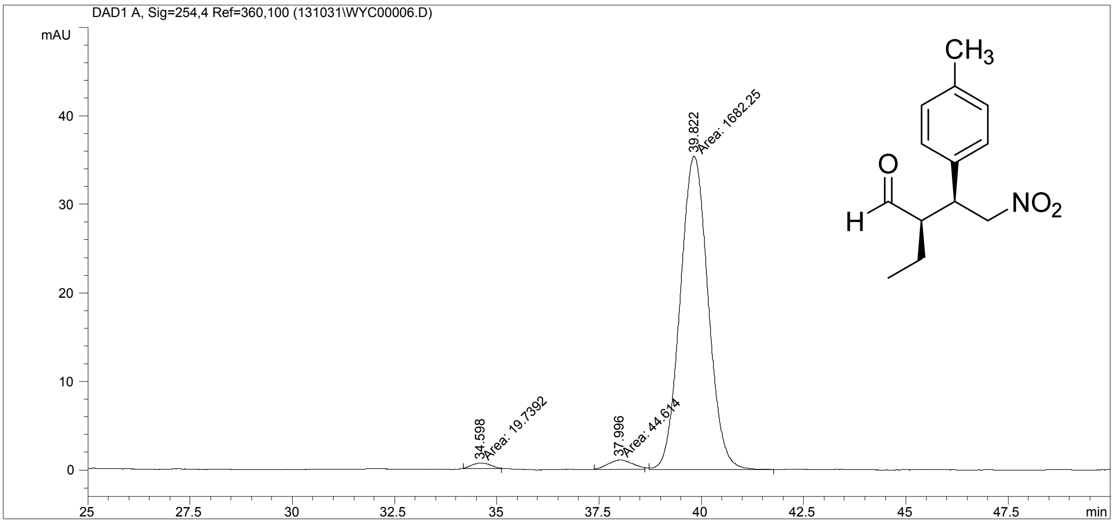
Peak	RetTime	Type	Width	Area	Height	Area
1	19.207	MM	0.6112	1120.73547	30.56152	96.5513
2	21.789	MM	0.4458	11.45382	4.28246e-1	0.9867
3	24.338	MM	0.5501	22.09179	6.69319e-1	1.9032
4	25.680	MM	0.2794	6.48528	2.80238e-1	0.5587

14k: OD-H n-hexane:2-propanol=92:8 0.5 mL/min



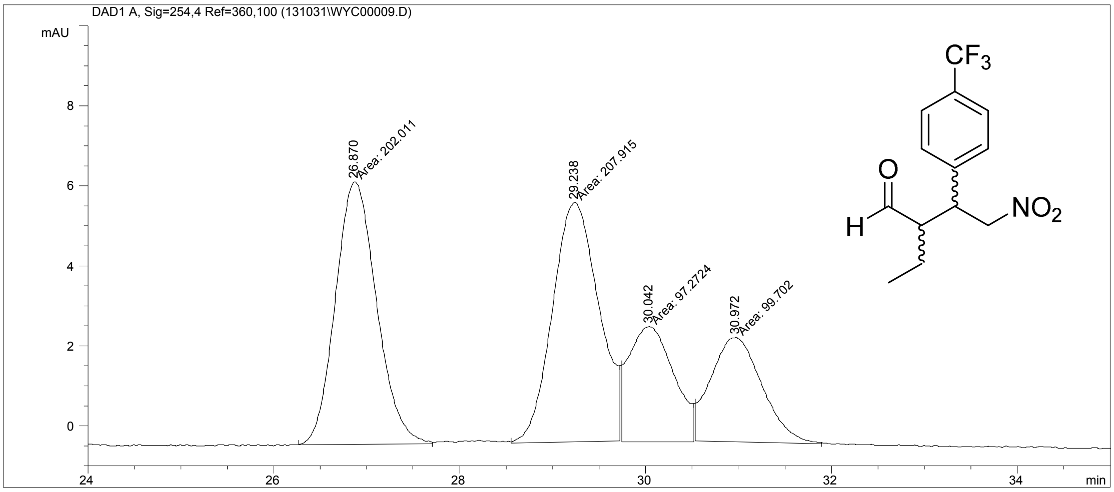
Peak	RetTime	Type	Width	Area	Height	Area
1	34.431	MM	0.6975	2565.65088	61.30646	45.6189
2	37.961	MM	0.7426	473.23550	10.62051	8.4144
2	39.855	MM	0.7971	2585.20898	54.05658	45.9667

OD-H n-hexane:2-propanol=92:8 0.5 mL/min ee=98%



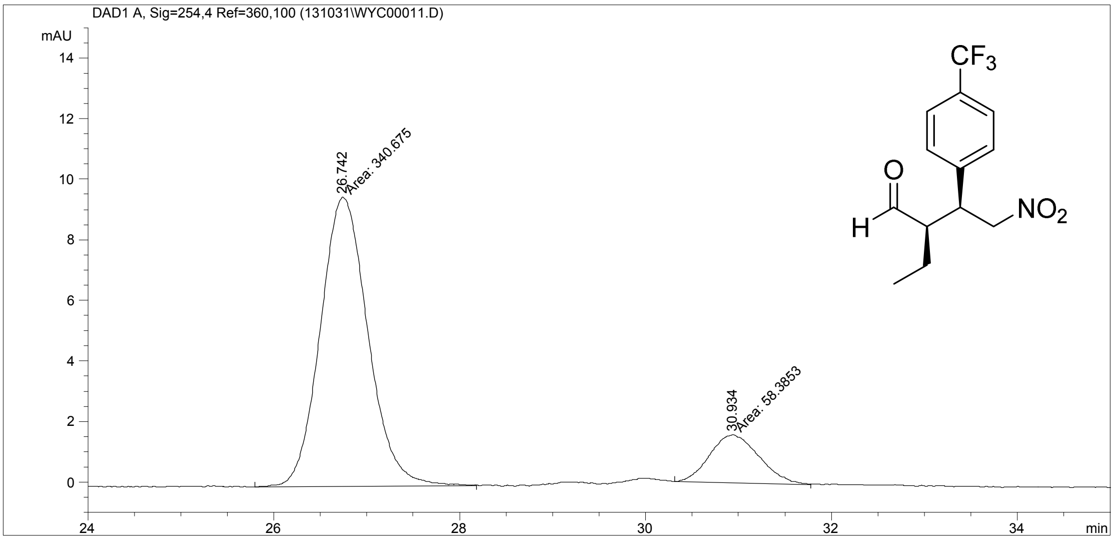
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	34.598	MM	0.5198	19.73922	6.32884	1.1301
2	37.996	MM	0.6940	44.61398	1.07139	2.5543
2	39.822	MM	0.7927	1682.25146	35.36762	96.3155

14l: AS-H n-hexane:2-propanol=93:7 0.5 mL/min



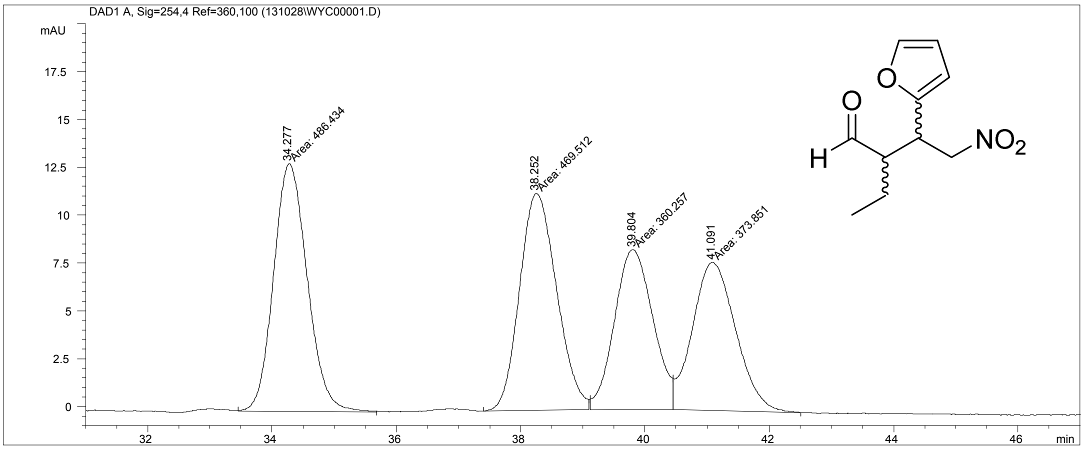
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	26.870	MM	0.5132	202.01059	6.56055	33.2856
2	29.238	MM	0.5802	207.91518	5.97265	34.2585
3	30.042	MM	0.5641	97.27235	2.87403	16.0277
4	30.972	MM	0.6385	99.70204	2.60251	16.4281

AS-H n-hexane:2-propanol=93:7 0.5 mL/min ee=99%



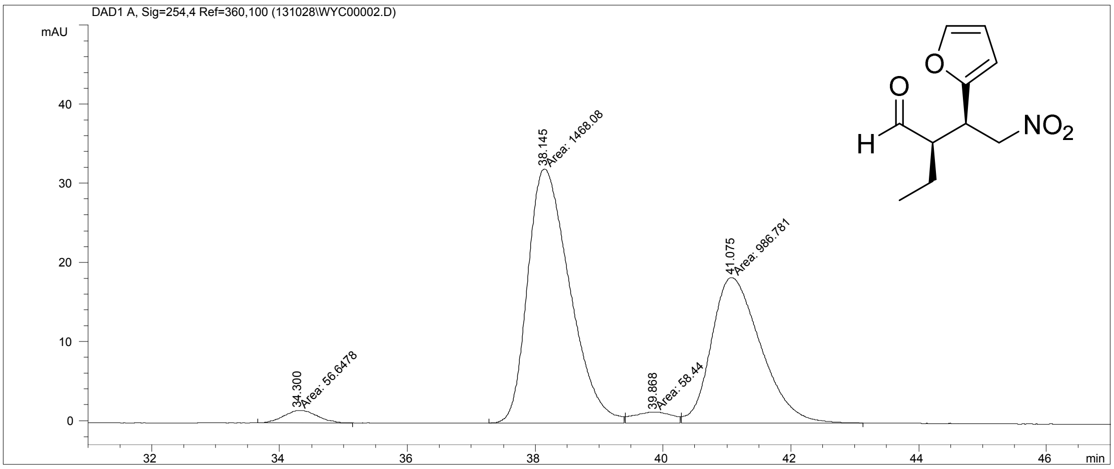
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	26.742	MM	0.5947	340.67493	9.54781	85.3693
2	30.934	MM	0.6154	58.38535	1.58128	14.6307

14m: AS-H n-hexane:2-propanol=96:4 0.5 mL/min



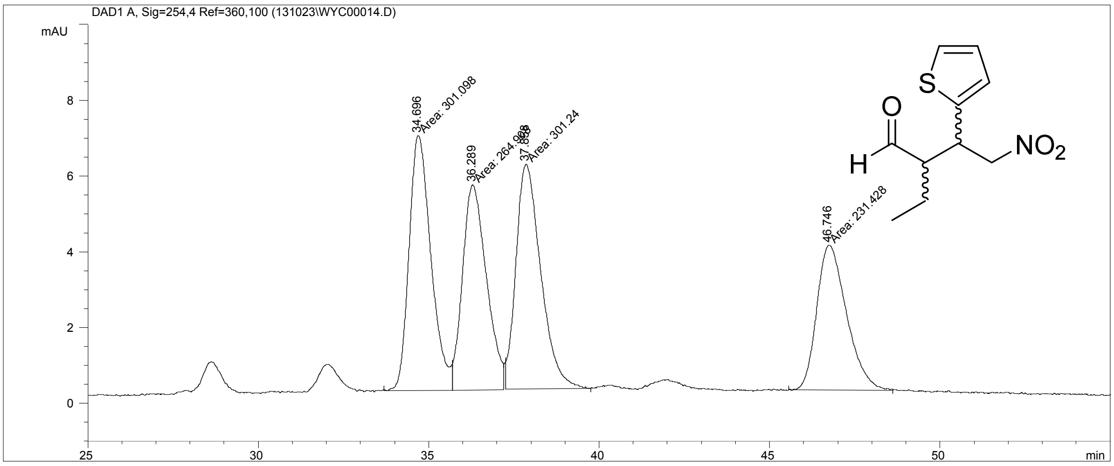
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	34.277	MM	0.6267	486.43433	12.93736	28.7822
2	38.252	MM	0.6916	469.51236	11.31427	27.7809
3	39.804	MM	0.7187	360.25729	8.35455	21.3163
4	41.091	MM	0.8057	373.85095	7.73391	22.1206

AS-H n-hexane:2-propanol=96:4 0.5 mL/min   ee=93%



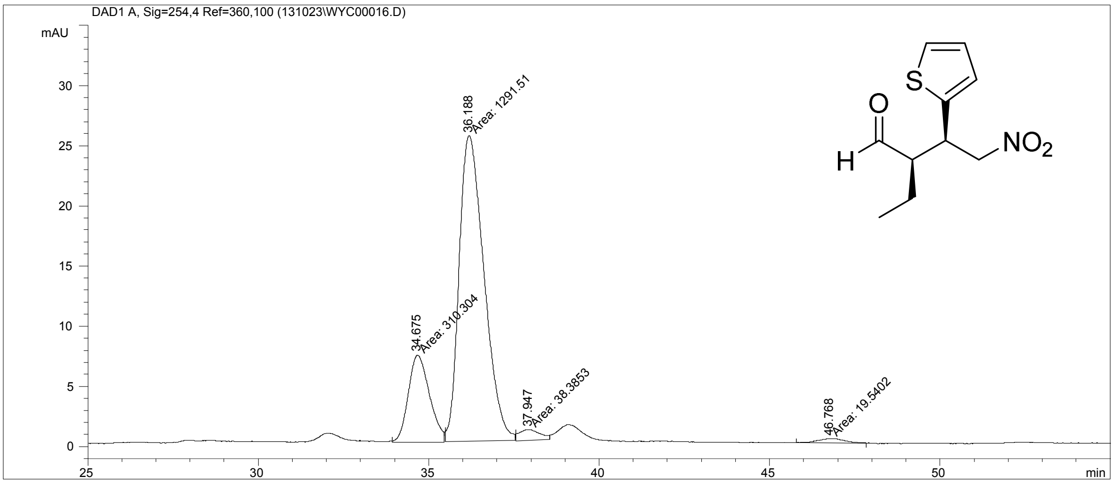
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	34.300	MM	0.6009	56.64780	1.57118	2.2042
2	38.145	MM	0.7626	1468.08423	32.08387	57.1249
3	39.868	MM	0.6944	58.44001	1.40256	2.2740
4	41.075	MM	0.8940	986.78094	18.39577	38.3968

14n: AD-H n-hexane:2-propanol=98:2 0.7 mL/min



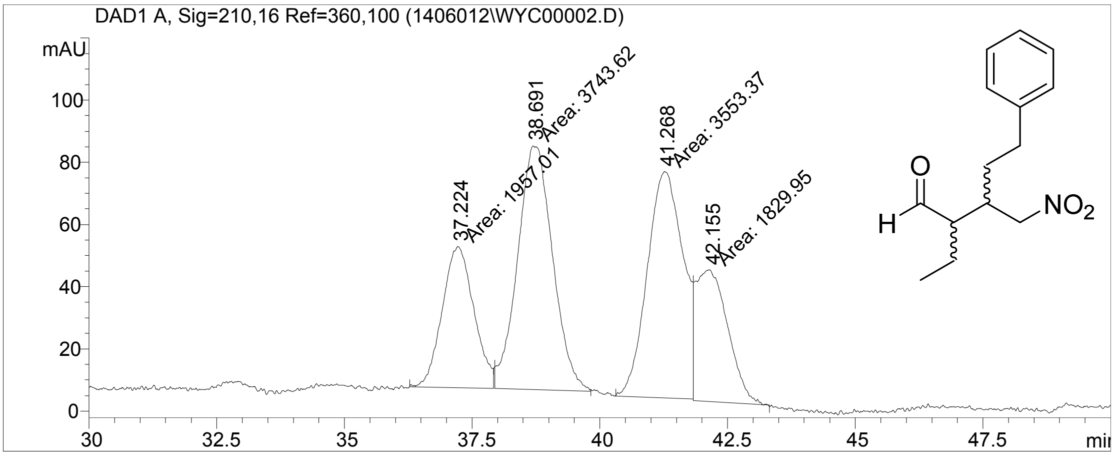
Peak	RetTime	Type	Width	Area	Height	Area
1	34.696	MM	0.7452	301.09787	6.73444	27.4056
2	36.289	MM	0.8161	264.90787	5.40991	24.1116
3	37.858	MM	0.8454	301.23978	5.93888	27.4185
4	46.746	MM	1.0105	231.42755	3.81700	21.0643

AD-H n-hexane:2-propanol=98:2 0.7 mL/min   ee=97%



Peak	RetTime	Type	Width	Area	Height	Area
1	34.675	MM	0.7171	310.30368	7.21190	18.6960
2	36.187	MM	0.8485	1291.50806	25.36931	77.8140
3	37.947	MM	0.7115	38.38526	8.99133	2.3127
4	46.768	MM	0.9039	19.54017	3.60299	1.1773

14o: OD-H n-hexane:2-propanol=90:10 0.4 mL/min



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Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	37.224MM	0.69891957.01		44.3717.55		
2	38.691MM	0.78483743.62		34.4134.42		
3	41.268	MM	0.83233553.37 33.88		33.88	
4	42.155MM	0.62841829.9539.77		14.14		

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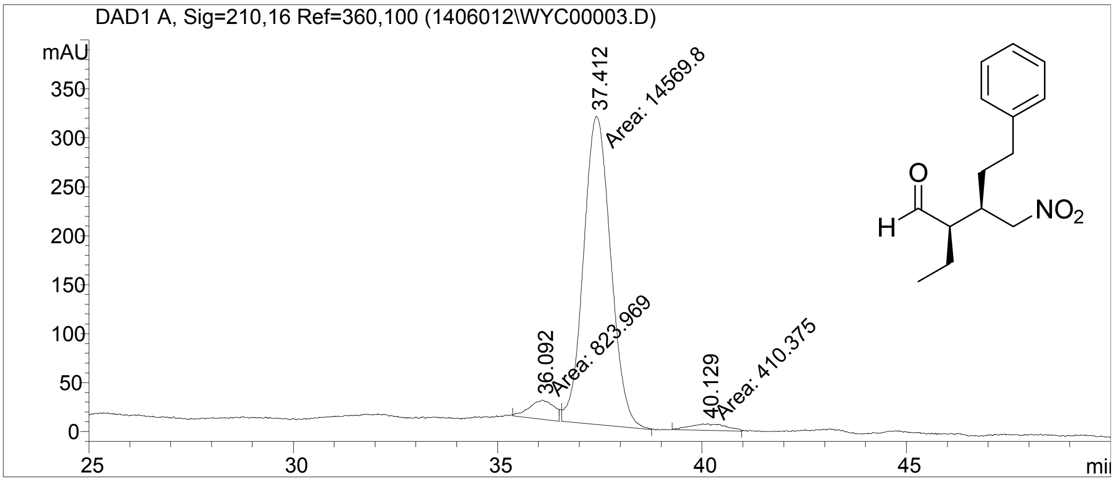
OD-H n-hexane:2-propanol=90:10 0.4 mL/min ee=95%



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Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	36.092MM	0.6960823.96		19.325.2136		
2	37.412MM	0.771014589.8		314.9592.189		
340.129MM	1.0101410.3756.77		2.5966			

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