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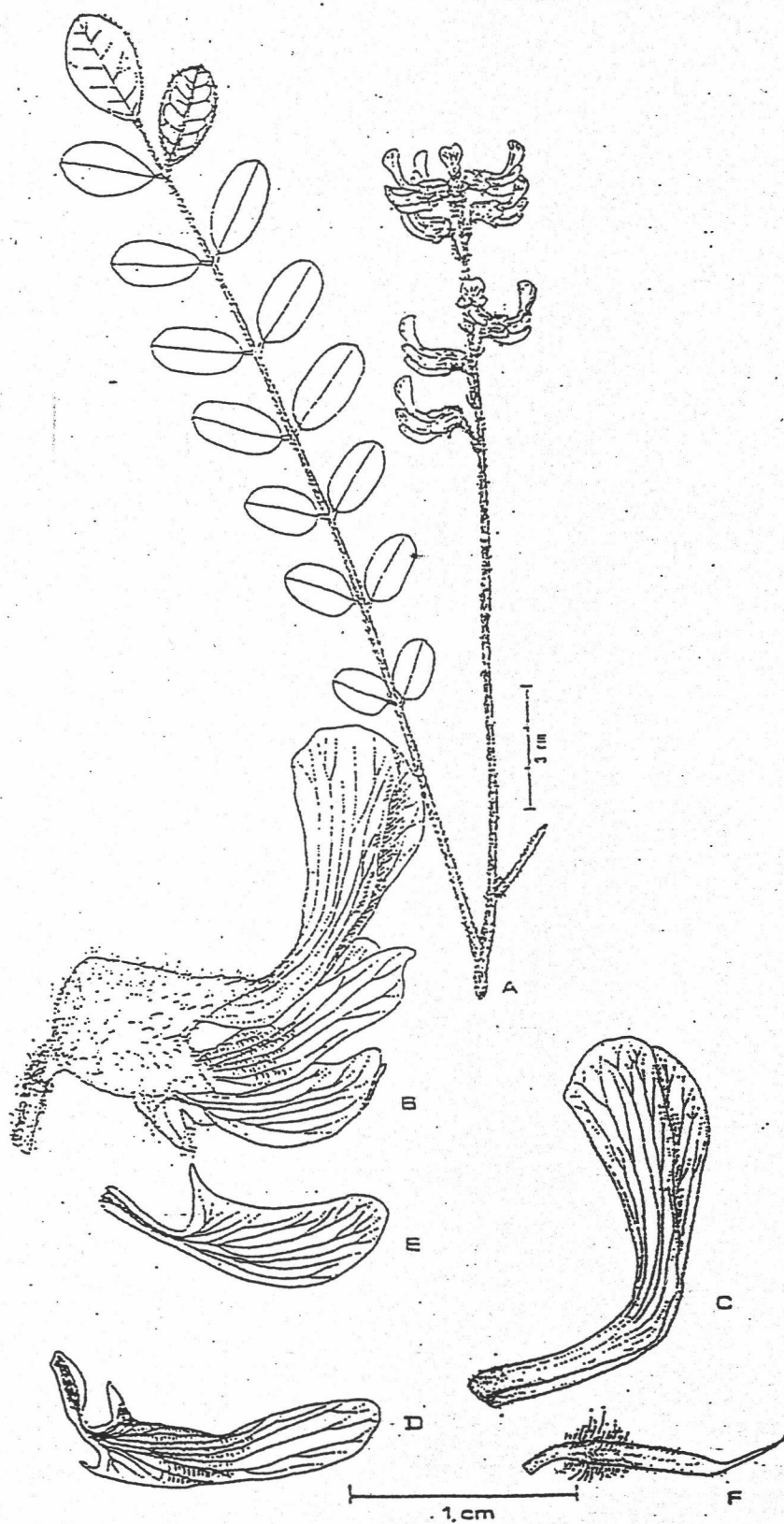
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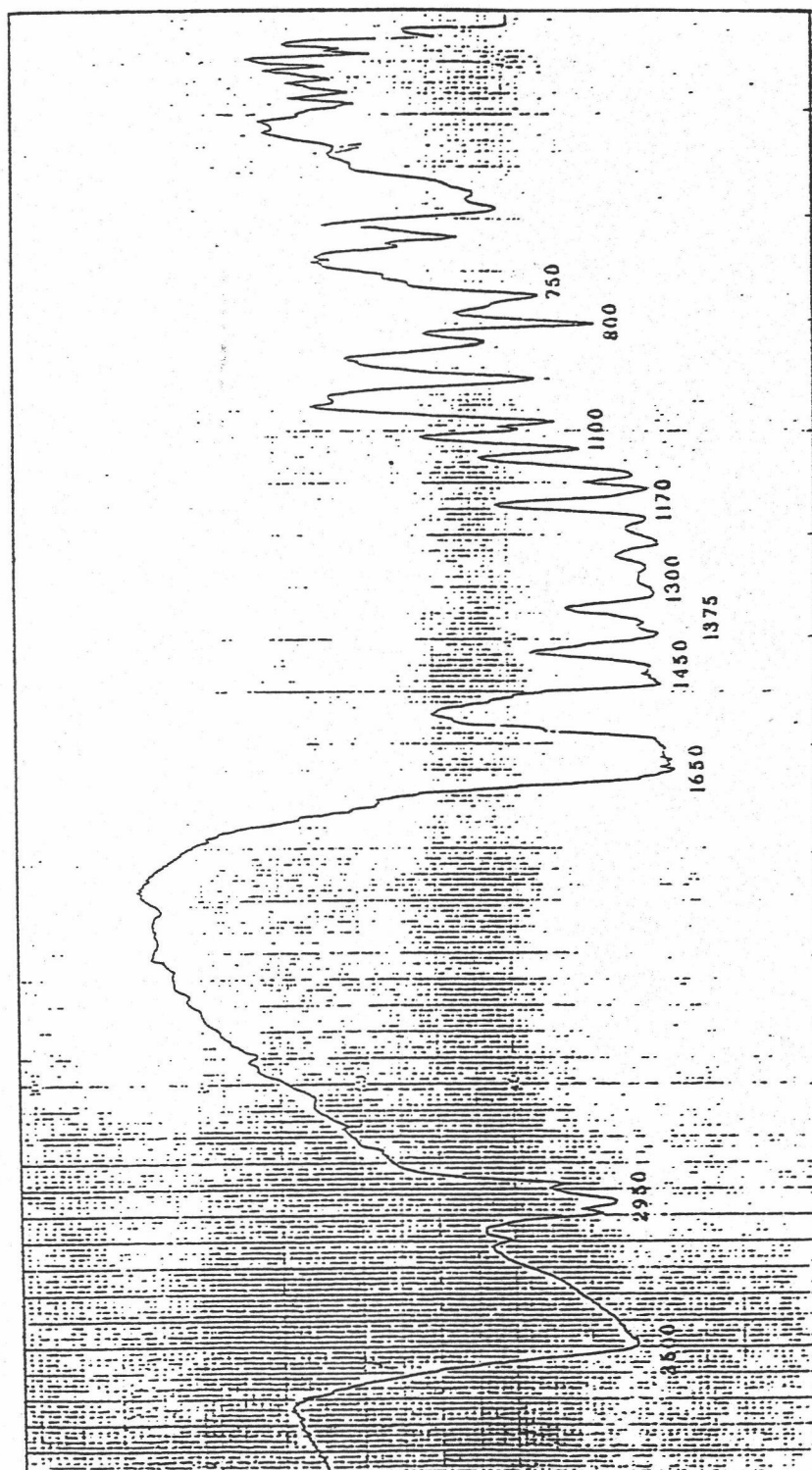
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ภาคผนวก



*Sophora exigua* Craib : A = flowering branch ; B = flower ;  
 C = standard ; D = wing ; E = keel ; F = ovary.

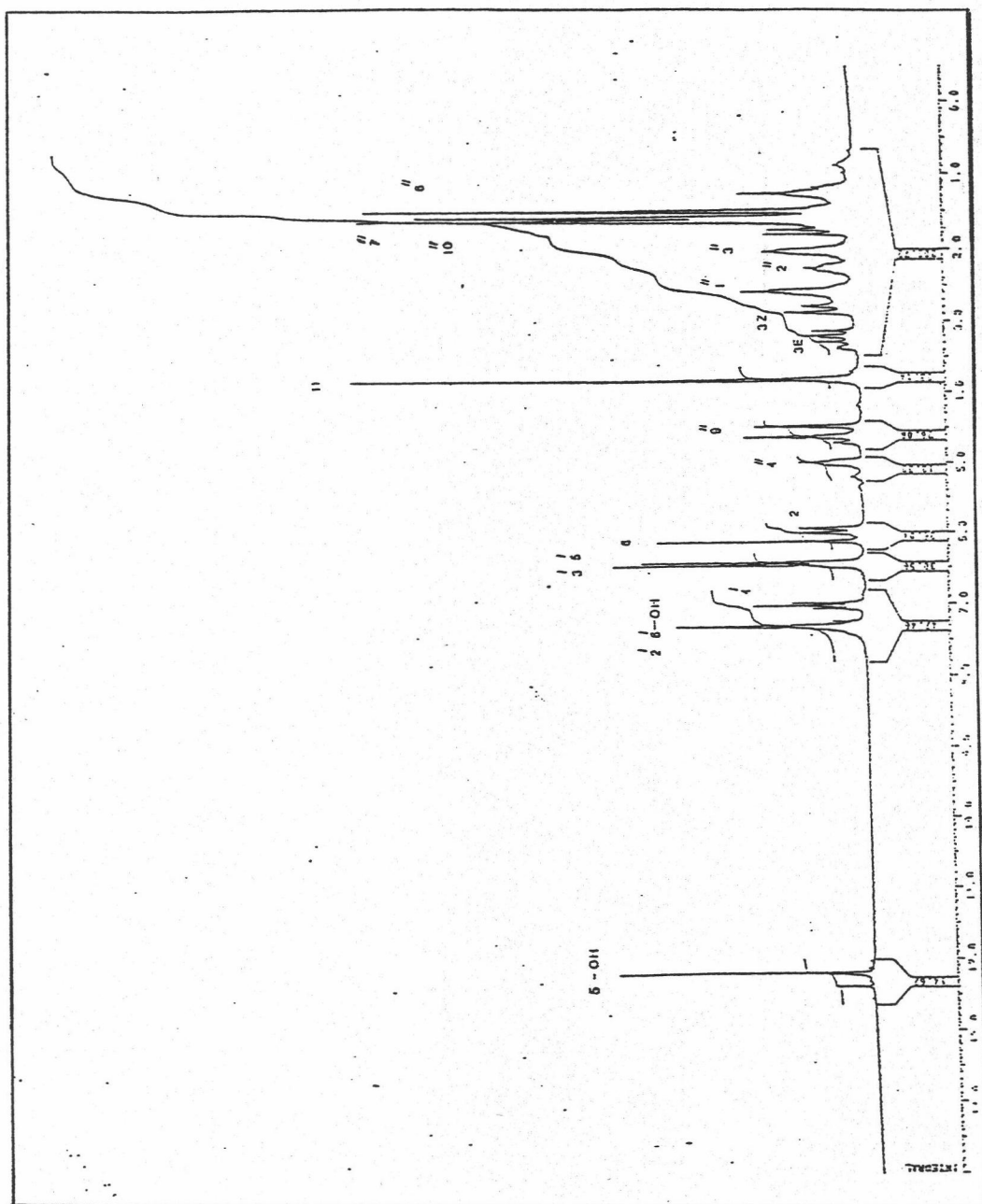
รูปที่ 1 แสดงลักษณะกิ่ง ก้าน ใบ และดอก ของพืชนา



รูปที่ 2 อินฟราเรดสเปกตรัมของสาร 1

| BTC1H                      |        | MIN. INTENSITY = 1.209 |         | MAXY = 25.00000      |  | FP CONSTANT = .50000   |  |
|----------------------------|--------|------------------------|---------|----------------------|--|------------------------|--|
| INTENG. LEVEL = 3002.10 HZ |        | 1.209                  |         | NOISE = 15.00006 PPM |  | SENS. LEVEL = .02294   |  |
| F1 =                       |        | 15.00006 PPM           |         | F2 =                 |  | -99.70 HZ = -.4982 PPM |  |
| #                          | CURSOR | FREQUENCY              | PPM     | INTENSITY            |  |                        |  |
| 1                          | 1384   | 2479.001               | 12.3860 | 1.214                |  |                        |  |
| 2                          | 1481   | 2412.141               | 12.2026 | 7.901                |  |                        |  |
| 3                          | 4055   | 1466.437               | 7.3273  | 5.901                |  |                        |  |
| 4                          | 4184   | 1417.326               | 7.0820  | 1.664                |  |                        |  |
| 5                          | 4206   | 1409.051               | 7.0406  | 3.500                |  |                        |  |
| 6                          | 4227   | 1401.197               | 7.0014  | 2.321                |  |                        |  |
| 7                          | 4500   | 1297.614               | 6.4838  | 7.894                |  |                        |  |
| 8                          | 4521   | 1289.539               | 6.4434  | 7.083                |  |                        |  |
| 9                          | 4679   | 1229.721               | 6.1445  | 6.484                |  |                        |  |
| 10                         | 4749   | 1203.322               | 6.0126  | 2.297                |  |                        |  |
| 11                         | 4784   | 1189.994               | 5.9460  | 2.074                |  |                        |  |
| 12                         | 5267   | 1006.781               | 5.0306  | 1.322                |  |                        |  |
| 13                         | 5283   | 1000.086               | 5.0011  | 2.039                |  |                        |  |
| 14                         | 5475   | 928.117                | 4.6375  | 3.687                |  |                        |  |
| 15                         | 5554   | 890.046                | 4.4874  | 3.355                |  |                        |  |
| 16                         | 5898   | 767.670                | 3.8359  | 15.071               |  |                        |  |
| 17                         | 6183   | 459.565                | 3.2956  | 1.332                |  |                        |  |
| 18                         | 6219   | 445.838                | 3.2271  | 1.384                |  |                        |  |
| 19                         | 4229   | 642.031                | 3.2080  | 1.777                |  |                        |  |
| 20                         | 6266   | 628.356                | 3.1397  | 1.554                |  |                        |  |
| 21                         | 6449   | 576.300                | 2.8796  | 2.100                |  |                        |  |
| 22                         | 6449   | 558.873                | 2.7925  | 1.861                |  |                        |  |
| 23                         | 6530   | 525.007                | 2.6237  | 2.403                |  |                        |  |
| 24                         | 6556   | 518.051                | 2.5886  | 3.724                |  |                        |  |
| 25                         | 6567   | 513.916                | 2.5679  | 2.861                |  |                        |  |
| 26                         | 6711   | 459.439                | 2.2957  | 1.511                |  |                        |  |
| 27                         | 6729   | 452.811                | 2.2626  | 1.770                |  |                        |  |
| 28                         | 6746   | 446.113                | 2.2291  | 1.266                |  |                        |  |
| 29                         | 6846   | 408.170                | 2.0395  | 3.049                |  |                        |  |
| 30                         | 6961   | 364.771                | 1.8226  | 2.980                |  |                        |  |
| 31                         | 6995   | 351.887                | 1.7583  | 2.869                |  |                        |  |
| 32                         | 7058   | 328.102                | 1.6394  | 15.934               |  |                        |  |
| 33                         | 7083   | 318.560                | 1.5917  | 14.114               |  |                        |  |
| 34                         | 7129   | 300.968                | 1.5038  | 15.643               |  |                        |  |
| 35                         | 7253   | 253.843                | 1.2684  | 3.766                |  |                        |  |
| 36                         | 7272   | 246.828                | 1.2333  | 2.071                |  |                        |  |
| 37                         | 7296   | 237.573                | 1.1871  | 1.502                |  |                        |  |

ข้อมูลปรตอนเป็นเอ็มอาร์สเปคตรัมของสาร 1



รูปที่ 3 ปรอทอนเอ็มเออาร์สเปกตรัมของสาร 1

DATA IS PROTECTED  
DATA IS PROTECTED

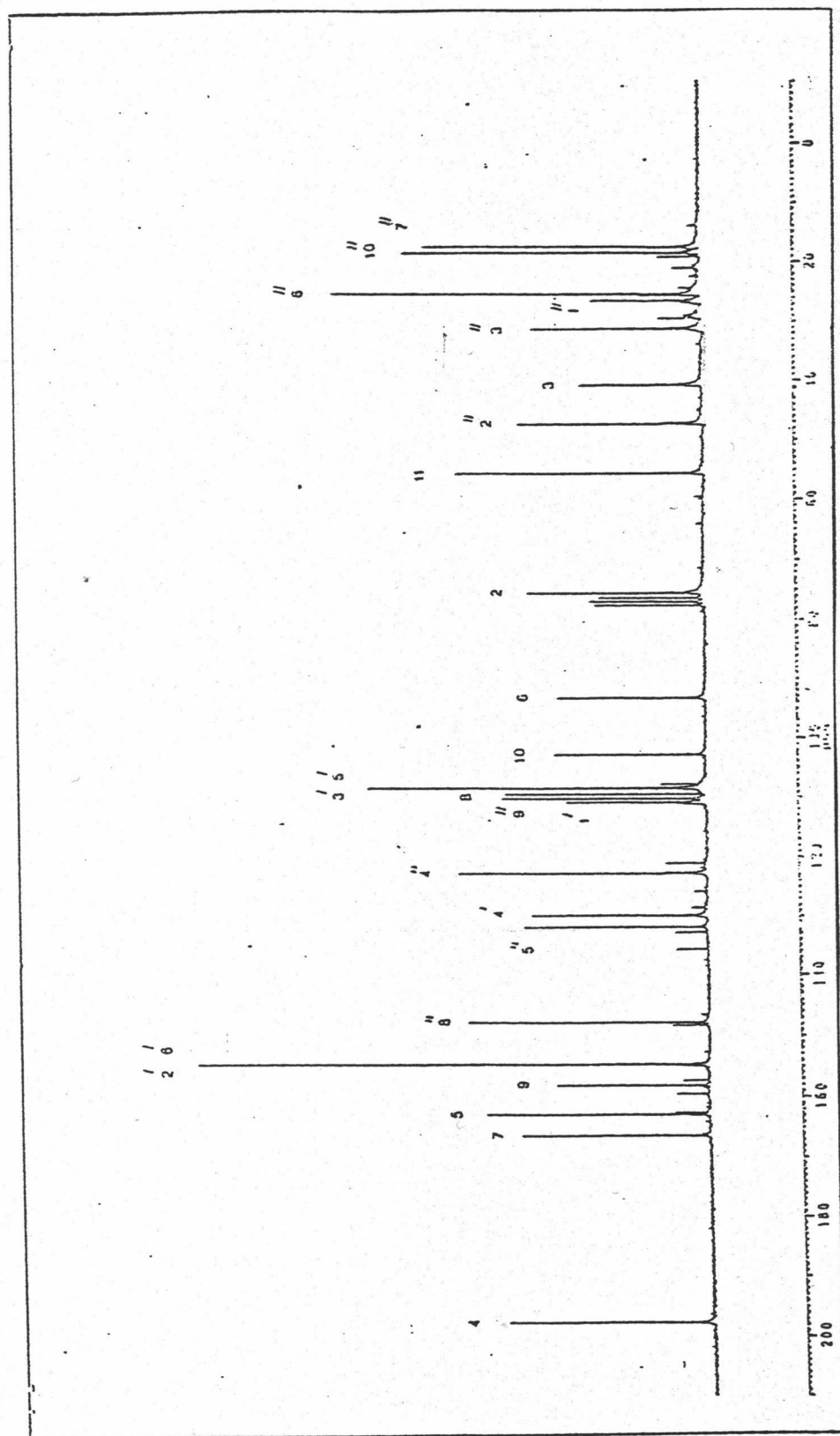
SUM. 020  
MIN. INTENSITY = 1.245 MAXY = 25.00000 PF CONSTANT = .50000  
INTENS. LEVEL = 1.245 NOISE = .01905 SENS. LEVEL = .03810  
F1 = 10567.79 HZ F2 = -503.31 HZ FPM = -10.0015 PPM

| #  | CURSOR | FREQUENCY | PPM      | INTENSITY |
|----|--------|-----------|----------|-----------|
| 1  | 928    | 9952.185  | 197.7649 | 5.745     |
| 2  | 3256   | 8373.213  | 166.3889 | 5.161     |
| 3  | 3511   | 8200.289  | 162.9505 | 6.153     |
| 4  | 3865   | 7950.309  | 158.1833 | 4.223     |
| 5  | 4116   | 7789.971  | 154.7964 | 14.020    |
| 6  | 4626   | 7441.159  | 147.9266 | 6.554     |
| 7  | 5608   | 6642.357  | 131.9936 | 9.180     |
| 8  | 5955   | 6542.750  | 130.0143 | 4.831     |
| 9  | 6484   | 6184.443  | 122.8942 | 7.126     |
| 10 | 7369   | 5583.592  | 110.9511 | 3.929     |
| 11 | 7416   | 5551.923  | 110.3250 | 5.639     |
| 12 | 7471   | 5514.622  | 109.5838 | 9.569     |
| 13 | 7545   | 5464.786  | 108.5935 | 9.335     |
| 14 | 7598   | 5428.566  | 107.8738 | 1.248     |
| 15 | 7965   | 5179.591  | 102.9263 | 4.203     |
| 16 | 8671   | 4701.250  | 93.4211  | 4.114     |
| 17 | 9836   | 3910.895  | 77.7154  | 2.973     |
| 18 | 9883   | 3878.912  | 77.0798  | 3.143     |
| 19 | 9930   | 3846.886  | 76.4431  | 2.957     |
| 20 | 9989   | 3807.071  | 75.6523  | 4.815     |
| 21 | 11461  | 2808.471  | 55.8125  | 5.874     |
| 22 | 12077  | 2391.145  | 47.5156  | 9.039     |
| 23 | 12565  | 2050.182  | 40.9309  | 3.332     |
| 24 | 13270  | 1581.810  | 31.4329  | 4.741     |
| 25 | 13624  | 1341.659  | 26.6608  | 3.057     |
| 26 | 13690  | 1297.178  | 25.7769  | 1.683     |
| 27 | 13706  | 1285.427  | 25.5632  | 10.116    |
| 28 | 14212  | 943.195   | 18.7427  | 8.154     |
| 29 | 14277  | 898.881   | 17.8621  | 1.526     |
| 30 | 14284  | 894.523   | 17.7755  | 1.545     |
| 31 | 14291  | 889.685   | 17.6794  | 7.585     |

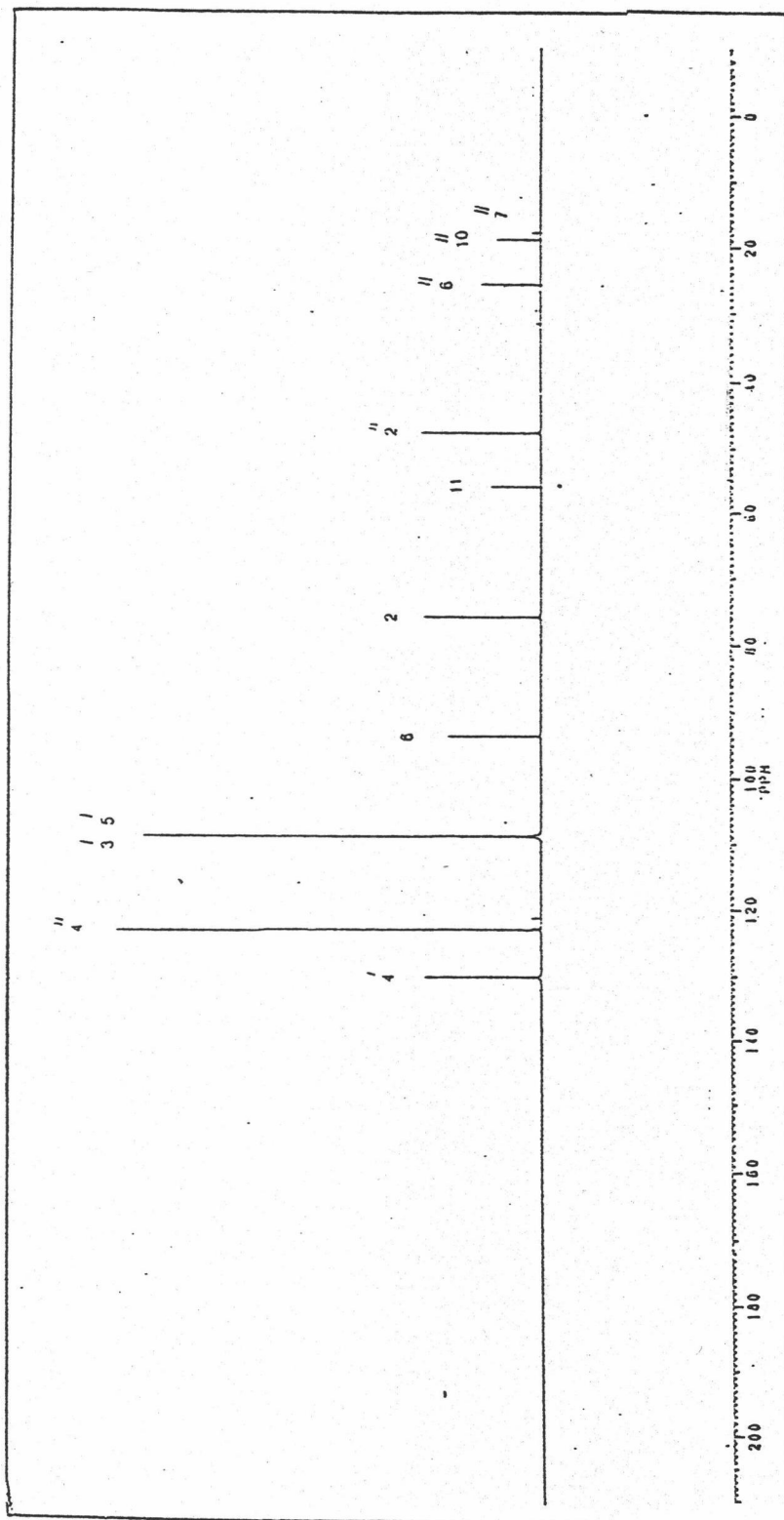
B = 96.4481 77

ข้อมูลคาร์บอน-13 เอ็มเอ็มอาร์สเปกตรัมของสาร 1

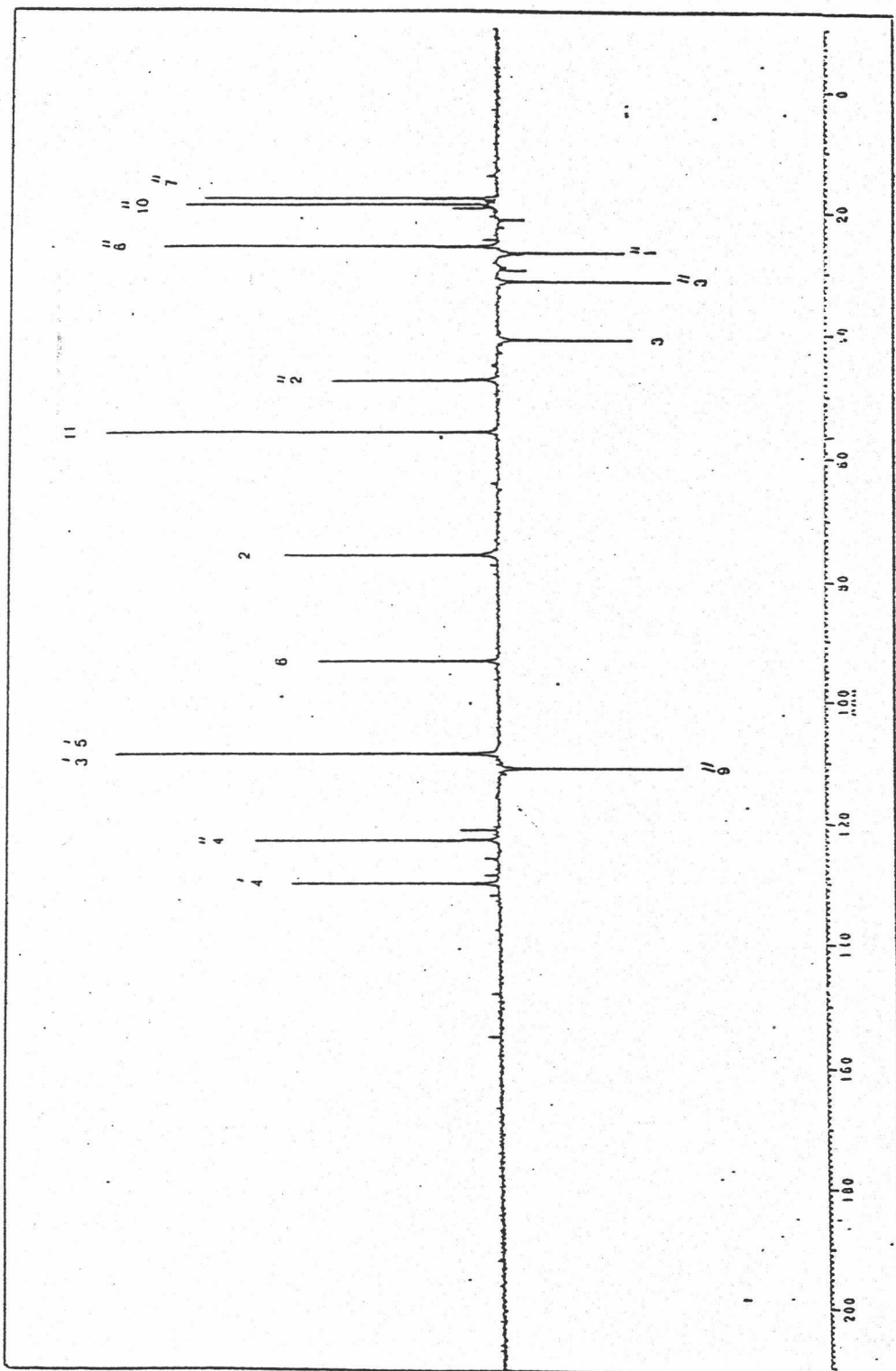




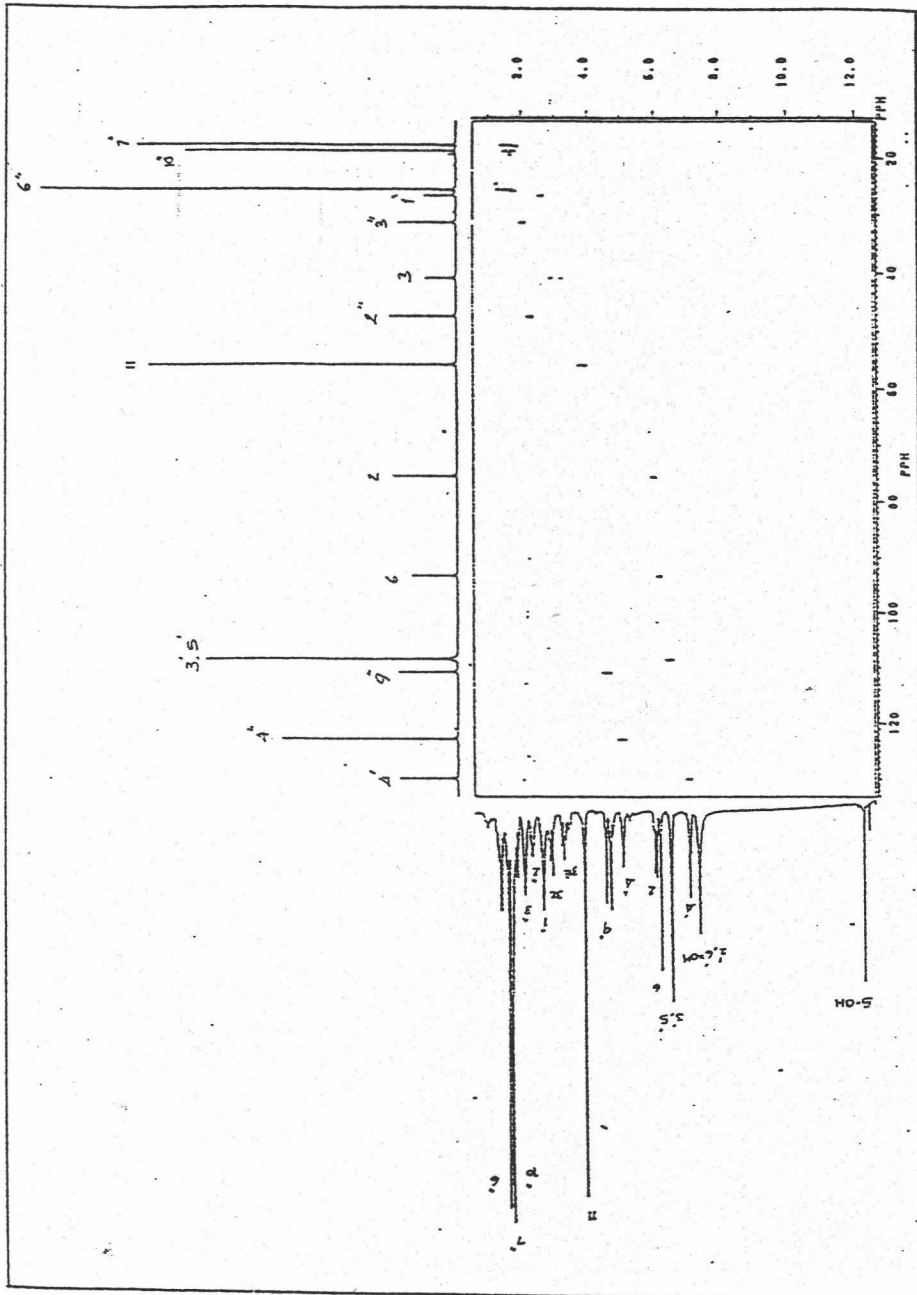
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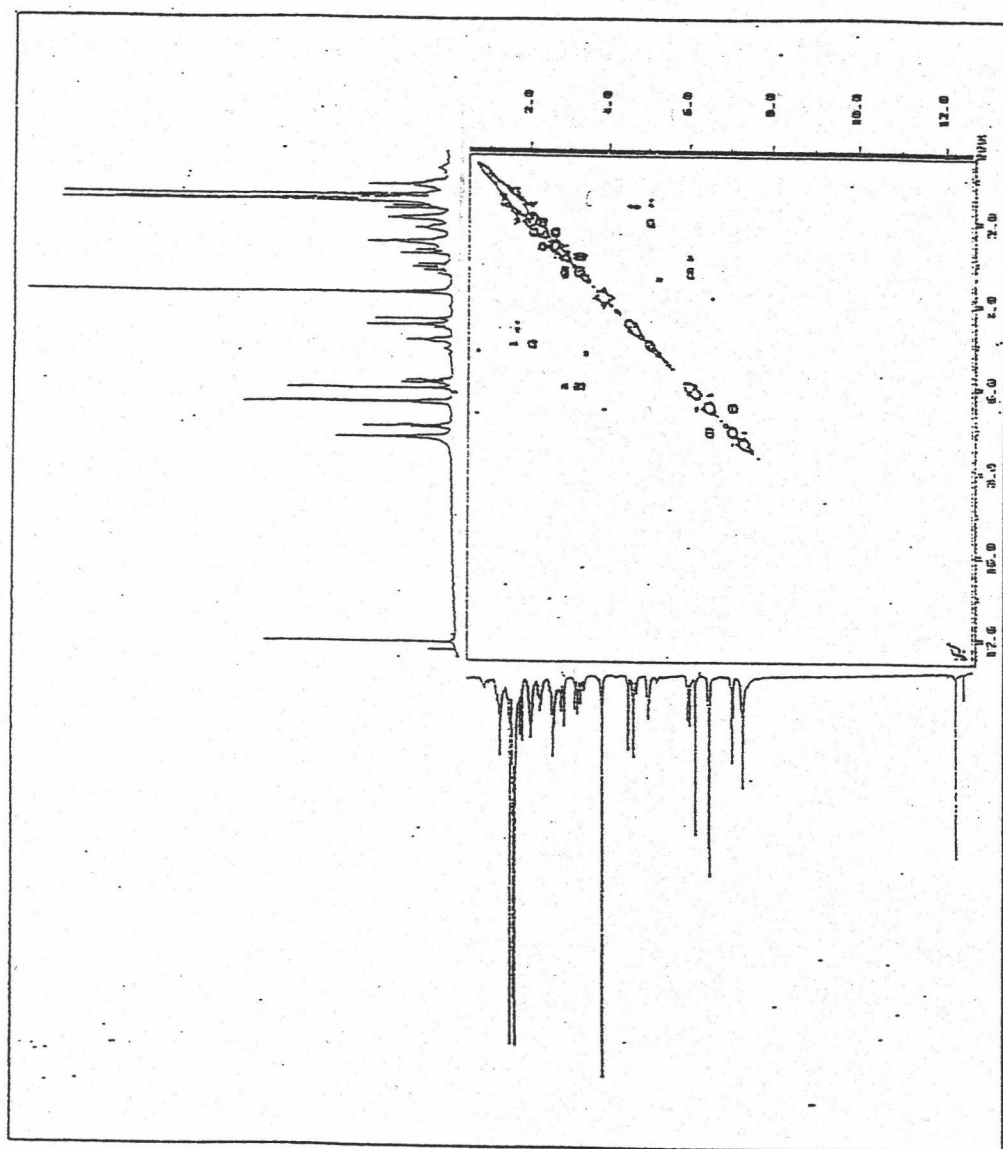
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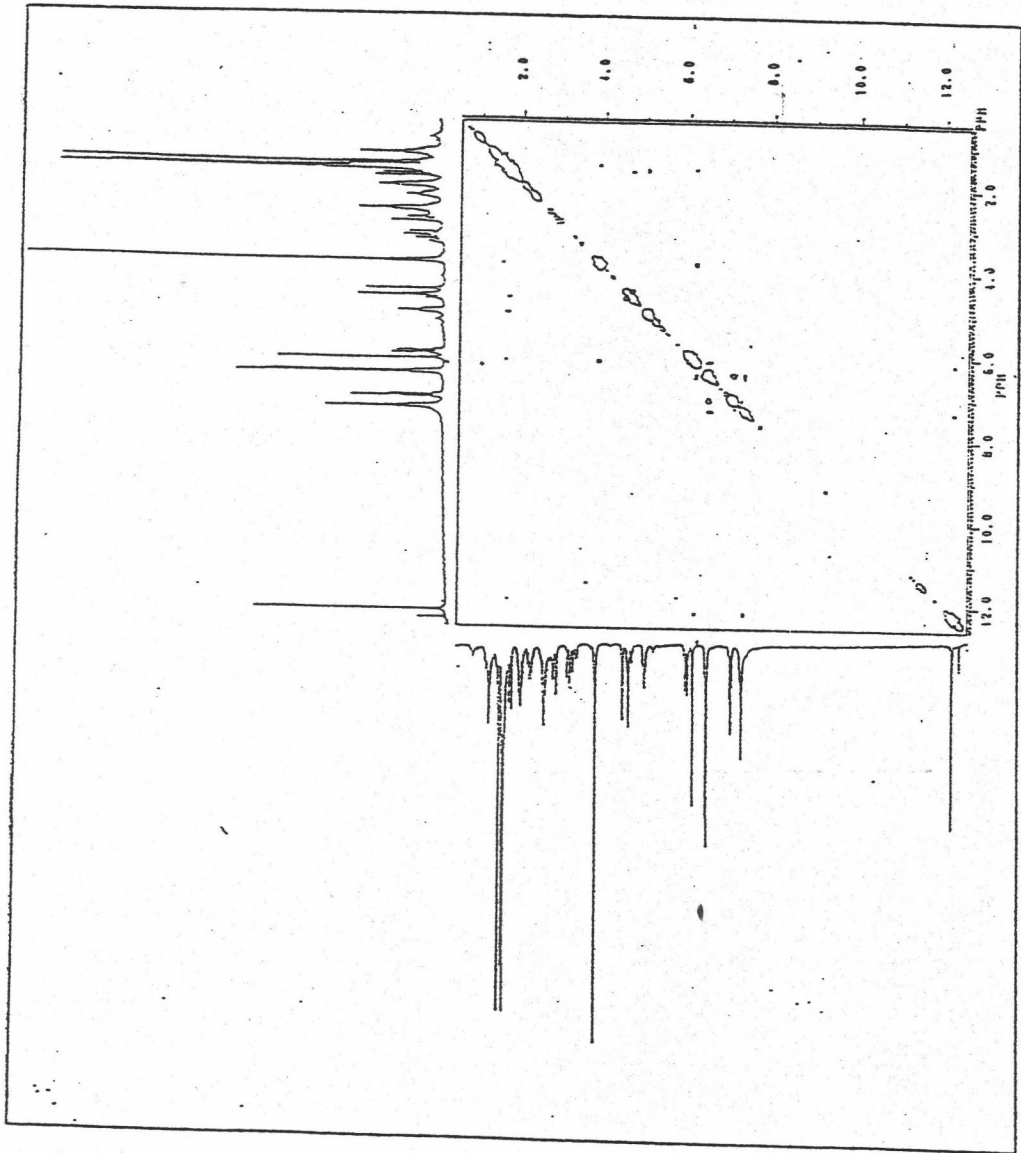
รูปที่ 6 DEPT 135 เอ็มเอ็มอาร์สเปกตรัมของสาร 1



รูปที่ 7 C-H CORRELATION ของสาร 1



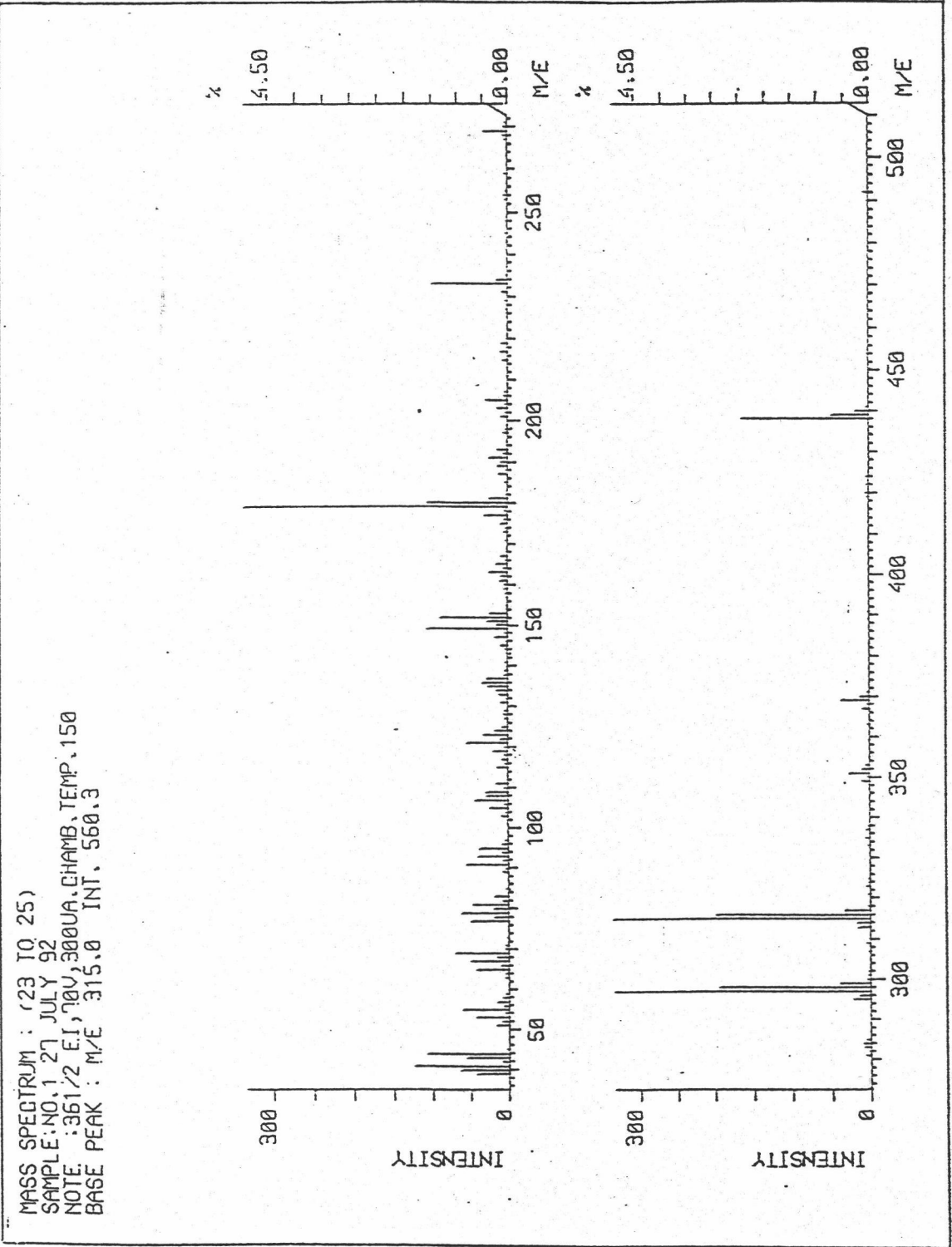
รูปที่ 8 1H-1H COSY ของสาร 1



รูปที่ 9  $^1\text{H}$ - $^1\text{H}$  NOESY ของสาร 1

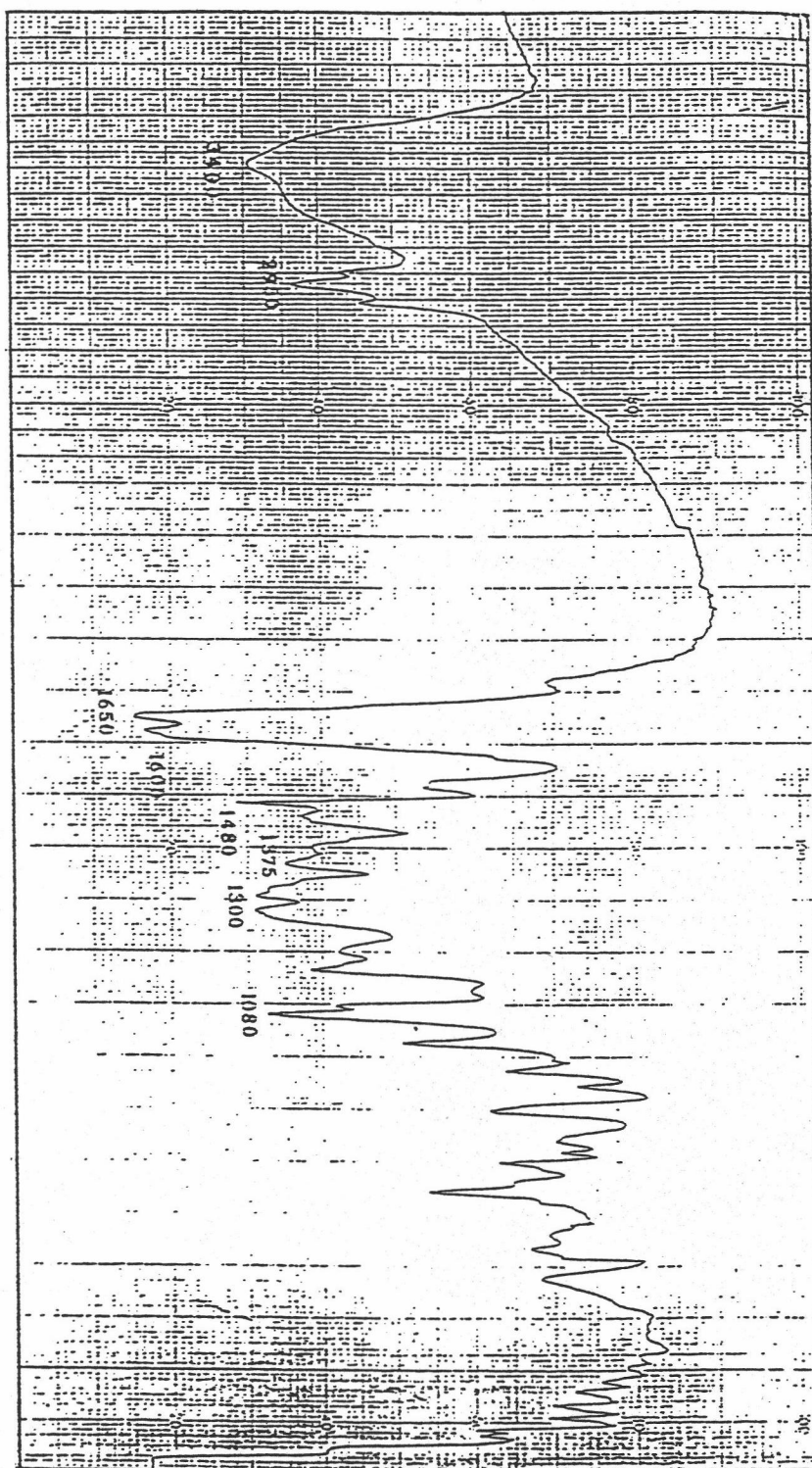
| MASS SPECTRUM : (23 TO 25)              |          |        |          | MASS SPECTRUM : (23 TO 25)              |          |        |          | MASS SPECTRUM : (23 TO 25)              |          |        |          |
|---|----------|--------|----------|---|----------|--------|----------|---|----------|--------|----------|
| SAMPLE:NO.1 27 JULY 92                  |          |        |          | SAMPLE:NO.1 27 JULY 92                  |          |        |          | SAMPLE:NO.1 27 JULY 92                  |          |        |          |
| NOTE :361/2 EI,70V,300UA,CHAMB,TEMP,150 |          |        |          | NOTE :361/2 EI,70V,300UA,CHAMB,TEMP,150 |          |        |          | NOTE :361/2 EI,70V,300UA,CHAMB,TEMP,150 |          |        |          |
| BASE PEAK : M/E 315.0 INT. 560.3        |          |        |          | BASE PEAK : M/E 315.0 INT. 560.3        |          |        |          | BASE PEAK : M/E 315.0 INT. 560.3        |          |        |          |
| M/E                                     | RAW INT. | R.INT. | SIGMA(%) | M/E                                     | RAW INT. | R.INT. | SIGMA(%) | M/E                                     | RAW INT. | R.INT. | SIGMA(%) |
| 40.0                                    | 36.1     | 64.5   | 5.18     | 163.0                                   | 13.9     | 24.9   | 0.67     | 440.0                                   | 10.3     | 18.5   | 38.94    |
| 41.0                                    | 70.3     | 125.4  | 10.08    | 177.0                                   | 17.2     | 30.7   | 0.83     | 441.0                                   | 2.5      | 4.5    | 9.62     |
| 43.0                                    | 31.8     | 56.9   | 4.57     | 179.0                                   | 318.6    | 568.5  | 15.46    | 442.0                                   | 0.5      | 1.0    | 2.17     |
| 44.0                                    | 60.7     | 108.3  | 8.71     | 180.0                                   | 59.8     | 106.7  | 2.90     | 448.0                                   | 0.5      | 1.0    | 2.17     |
| 53.0                                    | 24.0     | 44.3   | 3.56     | 181.0                                   | 13.7     | 24.6   | 0.66     | 454.0                                   | 2.2      | 4.0    | 8.47     |
| 55.0                                    | 34.0     | 60.8   | 4.09     | 191.0                                   | 13.9     | 24.0   | 0.67     | 455.0                                   | 0.0      | 1.4    | 3.09     |
| 67.0                                    | 23.9     | 42.0   | 3.44     | 205.0                                   | 16.2     | 28.9   | 0.78     | 456.0                                   | 0.6      | 1.1    | 2.40     |
| 69.0                                    | 28.5     | 50.9   | 4.09     | 233.0                                   | 55.0     | 99.7   | 2.71     | 490.0                                   | 1.2      | 2.1    | 4.58     |
| 77.0                                    | 39.7     | 70.8   | 5.69     | 269.0                                   | 17.6     | 31.4   | 0.85     | 491.0                                   | 0.6      | 1.1    | 2.40     |
| 79.0                                    | 28.0     | 49.3   | 4.07     | 297.0                                   | .14.7    | 26.2   | 0.71     | 492.0                                   | 4.1      | 7.4    | 15.57    |
| 81.0                                    | 26.0     | 60.6   | 4.05     | 299.0                                   | 597.7    | 959.6  | 26.09    | 493.0                                   | 1.4      | 2.6    | 5.61     |
| 91.0                                    | 30.9     | 47.9   | 3.43     | 299.0                                   | 109.8    | 196.0  | 5.33     | 494.0                                   | 1.3      | 2.3    | 4.92     |
| 93.0                                    | 22.0     | 55.1   | 4.43     | 315.0                                   | 22.9     | 41.0   | 1.11     |   |          |        |          |
| 95.0                                    | 21.0     | 39.6   | 3.13     | 316.0                                   | 560.3    | 1000.0 | 27.19    |   |          |        |          |
| 107.0                                   | 24.7     | 38.9   | 3.55     | 317.0                                   | 111.5    | 198.9  | 5.41     |   |          |        |          |
| 121.0                                   | 30.1     | 44.2   | 4.32     | 351.0                                   | 18.7     | 33.4   | 0.90     |   |          |        |          |
| 136.0                                   | 18.0     | 33.6   | 2.70     | 359.0                                   | 15.6     | 27.9   | 0.76     |   |          |        |          |
| 149.0                                   | 59.2     | 105.6  | 8.50     | 430.0                                   | 92.7     | 38.0   | 1.03     |   |          |        |          |
| 152.0                                   | 49.0     | 88.9   | 7.14     | 439.0                                   | 27.7     | 155.5  | 4.50     |   |          |        |          |
|   |          |        |          |   | 27.7     | 49.4   | 1.34     |   |          |        |          |
|   |          |        |          |   |          |        |          |   |          |        | END      |

ข้อมูลแมสสเปกตรัมของสาร 1



รูปที่ 10 แมสสเปคตรัมของสาร 1



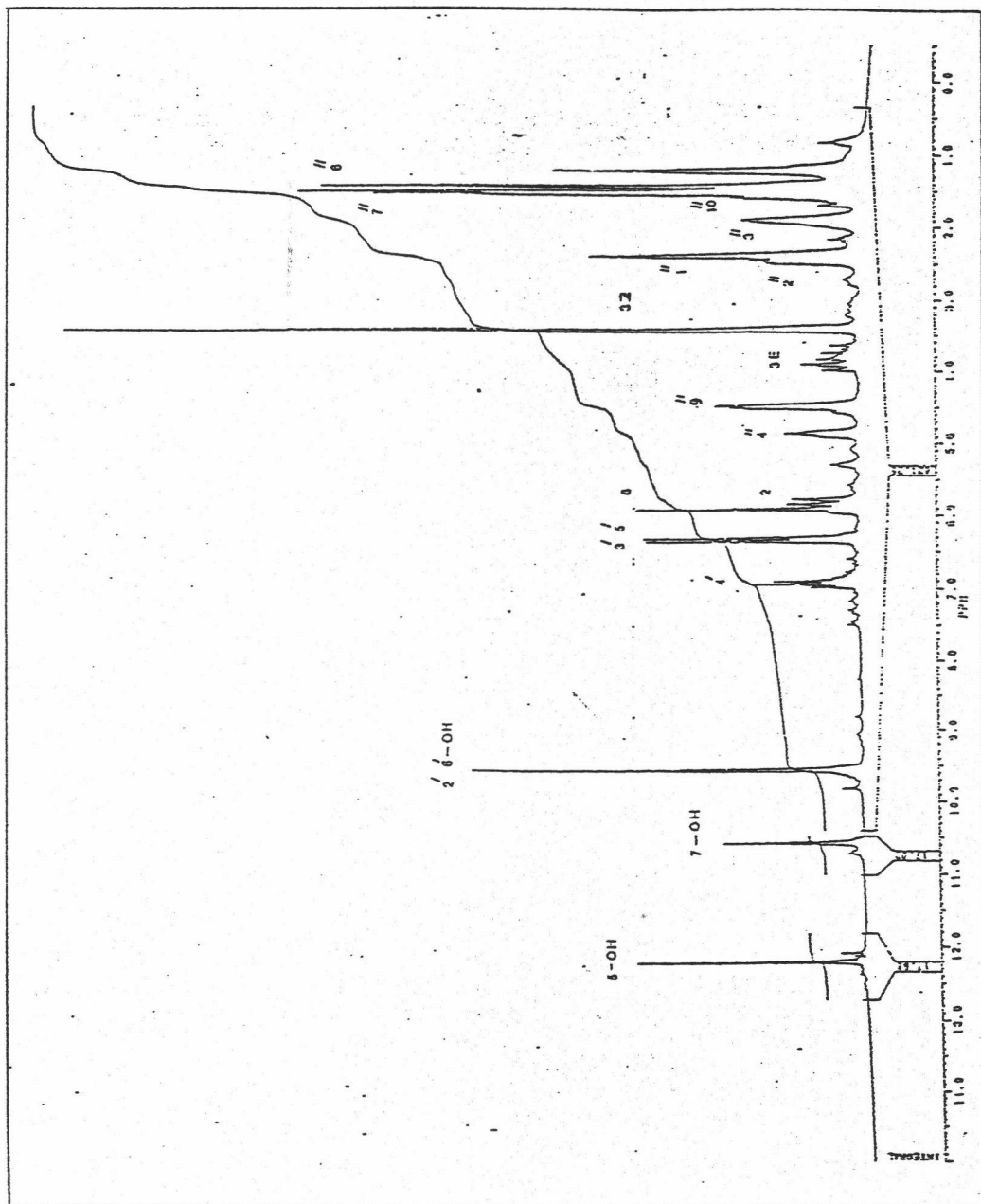


รูปที่ 11 อินฟราเรดสเปกตรัมของสาร 2

| #  | CURSOR | FREQUENCY | PPM     | INTENSITY |
|----|--------|-----------|---------|-----------|
| 1  | 1425   | 2146.630  | 12.2250 | 7.036     |
| 2  | 1431   | 2144.072  | 12.2122 | 2.058     |
| 3  | 2262   | 2118.825  | 10.5871 | 4.176     |
| 4  | 2779   | 1916.901  | 9.5781  | 12.235    |
| 5  | 4100   | 1399.748  | 6.9941  | 1.377     |
| 6  | 4121   | 1391.601  | 6.9534  | 3.082     |
| 7  | 4142   | 1383.487  | 6.9128  | 2.472     |
| 8  | 4163   | 1375.175  | 6.8713  | .732      |
| 9  | 4119   | 1275.006  | 6.3708  | 6.515     |
| 10 | 4140   | 1256.893  | 6.3302  | 6.552     |
| 11 | 4418   | 1197.255  | 5.9823  | .737      |
| 12 | 4631   | 1191.962  | 5.9558  | .862      |
| 13 | 4644   | 1187.155  | 5.9318  | 6.849     |
| 14 | 4685   | 1171.099  | 5.8516  | 2.081     |
| 15 | 4713   | 1159.874  | 5.7955  | 1.635     |
| 16 | 4721   | 1157.105  | 5.7817  | 1.944     |
| 17 | 4965   | 1061.434  | 5.3036  | .727      |
| 18 | 5174   | 979.730   | 4.8954  | 1.181     |
| 19 | 5188   | 974.227   | 4.8679  | 2.125     |
| 20 | 5370   | 903.152   | 4.5128  | 3.843     |
| 21 | 5382   | 898.371   | 4.4869  | 4.272     |
| 22 | 5387   | 896.439   | 4.4772  | 4.232     |
| 23 | 5434   | 799.529   | 3.9950  | .989      |
| 24 | 5471   | 785.382   | 3.9243  | 1.103     |
| 25 | 5678   | 752.323   | 3.9090  | 1.610     |
| 26 | 5715   | 748.207   | 3.8385  | 1.133     |
| 27 | 5758   | 751.140   | 3.7532  | .997      |
| 28 | 5919   | 688.210   | 3.4389  | 21.001    |
| 29 | 6100   | 499.878   | 2.4977  | 2.392     |
| 30 | 6104   | 498.332   | 2.4900  | 2.598     |
| 31 | 6414   | 494.701   | 2.4719  | 2.706     |
| 32 | 6421   | 491.663   | 2.4567  | 3.205     |
| 33 | 6452   | 479.759   | 2.3972  | 8.234     |
| 34 | 6566   | 434.963   | 2.1734  | .766      |
| 35 | 6706   | 380.315   | 1.9003  | 3.402     |
| 36 | 6809   | 340.134   | 1.6995  | 1.054     |
| 37 | 6864   | 318.613   | 1.5920  | 3.784     |
| 38 | 6889   | 308.611   | 1.5420  | 14.947    |
| 39 | 6907   | 301.846   | 1.5082  | 17.165    |
| 40 | 6945   | 286.660   | 1.4323  | 16.485    |
| 41 | 7059   | 242.287   | 1.2106  | 9.376     |
| 42 | 7251   | 167.028   | .8346   | 1.003     |

6TDM601H  
 MIN. INTENSITY = .727  
 INTENS. LEVEL = .727  
 F1 = 15.00004 PPM  
 MAXY = 25.00000  
 NOISE = .01041  
 F2 = -100.16 HZ  
 PP CONSTANT = .50000  
 SENS. LEVEL = .02081  
 = .50005 PPM

ข้อมูลปรอทอนไลน์เอ็นอาร์สเปคตรัมของสาร 2

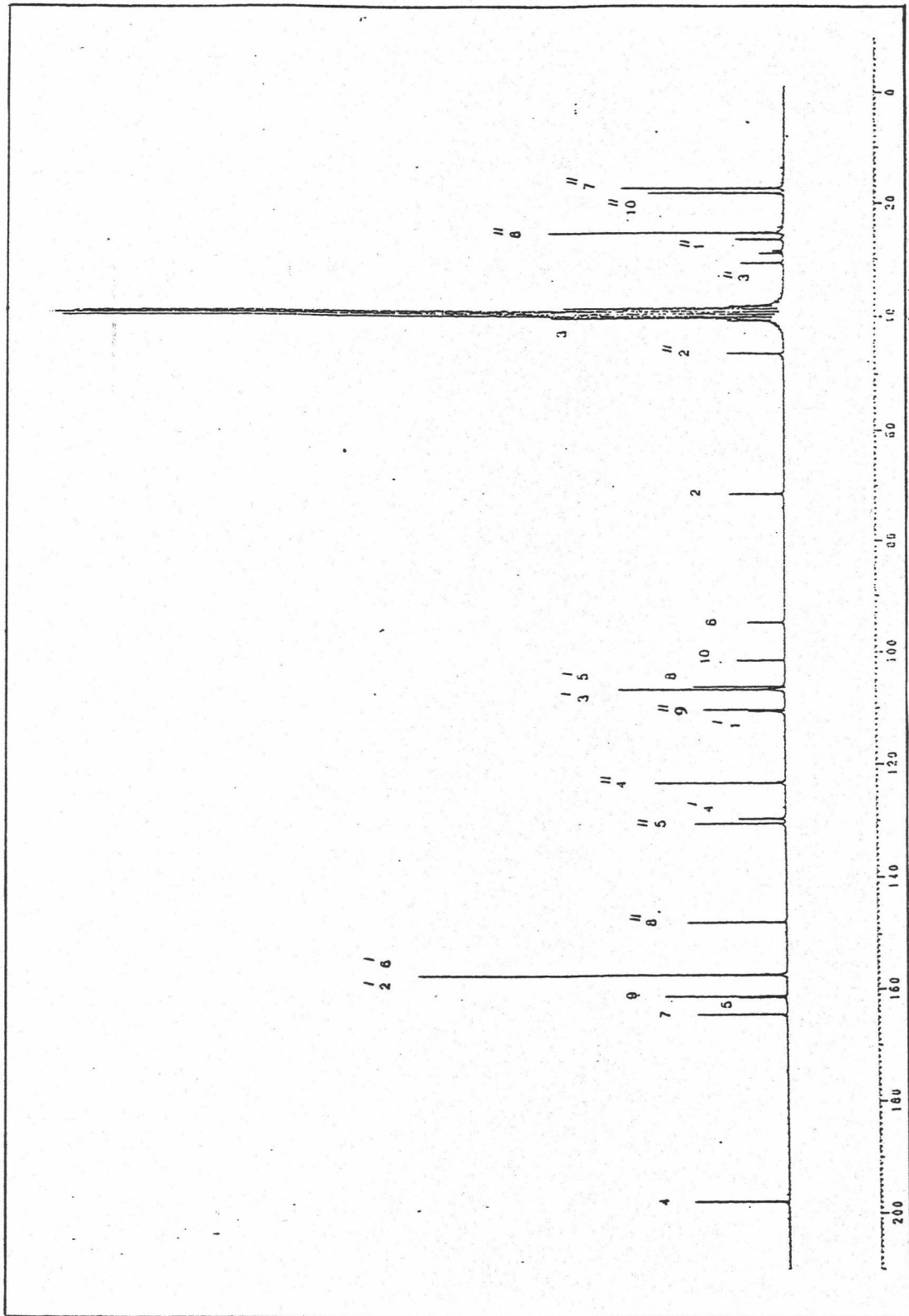


รูปที่ 12 ปรอทอนเอ็นเอ็มอาร์สเปกตรัมของสาร 2

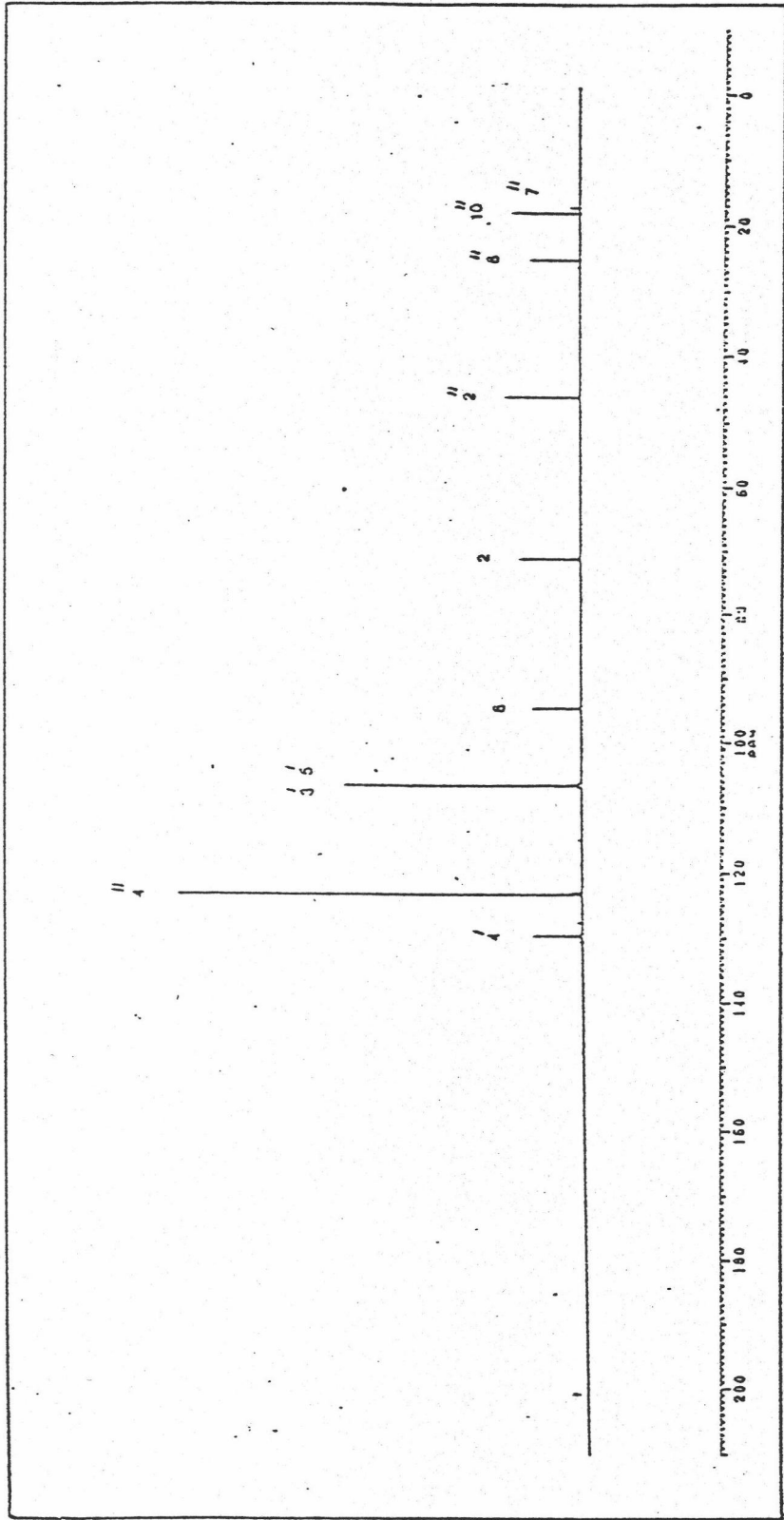
| #  | CURSOR | FREQUENCY | PPM      | INTENSITY |
|----|--------|-----------|----------|-----------|
| 1  | 2280   | 9963.500  | 197.9887 | 2.724     |
| 2  | 4653   | 8279.216  | 164.5196 | 2.671     |
| 3  | 4866   | 8128.628  | 161.5272 | 1.451     |
| 4  | 4884   | 8115.530  | 161.2670 | 3.451     |
| 5  | 5158   | 7921.163  | 157.4046 | 10.429    |
| 6  | 5831   | 7413.826  | 147.9193 | 2.950     |
| 7  | 7058   | 6572.518  | 130.6052 | 2.638     |
| 8  | 7116   | 6531.503  | 129.7901 | 1.313     |
| 9  | 7564   | 6213.496  | 123.4709 | 3.699     |
| 10 | 8167   | 5572.612  | 110.7356 | 1.057     |
| 11 | 8492   | 5554.887  | 110.3834 | 2.315     |
| 12 | 8750   | 5372.172  | 106.7526 | 4.809     |
| 13 | 8785   | 5346.853  | 106.2495 | 2.634     |
| 14 | 9116   | 5112.093  | 101.5845 | 1.353     |
| 15 | 9593   | 4773.289  | 94.8520  | 1.074     |
| 16 | 11251  | 3596.716  | 71.4724  | 1.566     |
| 17 | 13020  | 2335.378  | 46.4072  | 1.659     |
| 18 | 13129  | 2051.261  | 40.7614  | 1.639     |
| 19 | 13418  | 2037.511  | 40.4882  | 1.098     |
| 20 | 13459  | 2029.705  | 40.3331  | 6.635     |
| 21 | 13489  | 2008.379  | 39.9093  | 20.450    |
| 22 | 13519  | 1987.148  | 39.4874  | 26.019    |
| 23 | 13549  | 1965.692  | 39.0611  | 23.947    |
| 24 | 13579  | 1944.309  | 38.6361  | 6.412     |
| 25 | 13590  | 1936.932  | 38.4896  | 1.451     |
| 26 | 13610  | 1922.453  | 38.2018  | 1.577     |
| 27 | 14137  | 1548.880  | 30.7784  | 1.247     |
| 28 | 14431  | 1339.630  | 26.6203  | 1.389     |
| 29 | 14508  | 1285.055  | 25.5359  | 6.946     |
| 30 | 15012  | 927.456   | 18.4299  | 3.920     |
| 31 | 15072  | 885.064   | 17.5875  | 4.623     |

MI = .055 U  
 6TDM5013  
 MIN. INTENSITY = 1.052 MAXY = 25.00000 PP CONSTANT = .50000  
 INTENS. LEVEL = 1.052 NOISE = .01510 SENS. LEVEL = -.03020  
 F1 = 10567.64 HZ = 209.9938 PPM F2 = -503.14 HZ = -9.9981 PPM

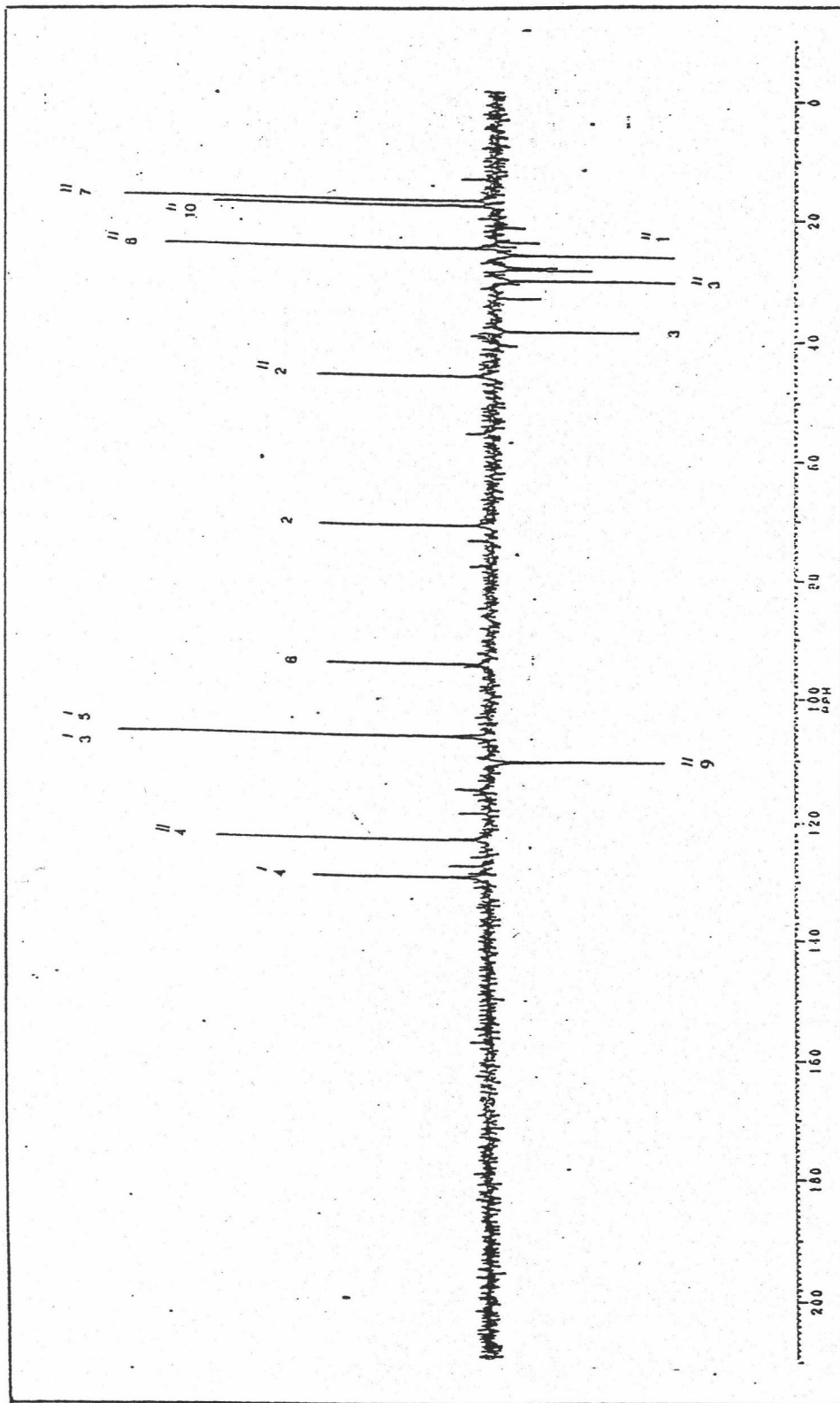
ข้อมูลคาร์บอน-13 เอ็นเอ็มอาร์สเปกตรัมของสาร 2



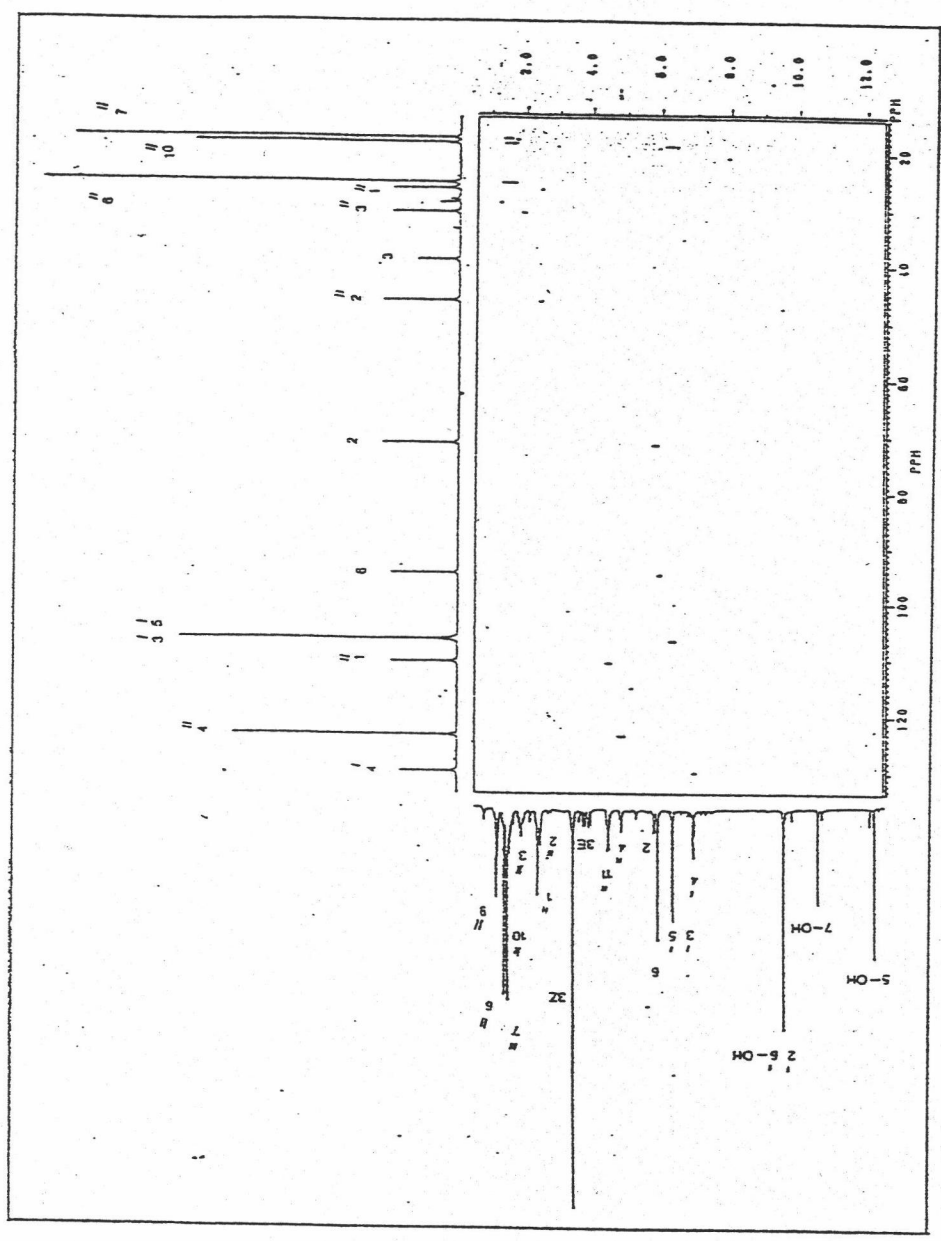
รูปที่ 13 คาร์บอน-13 เอ็มเอ็มอาร์สเปกตรัมของสาร 2



รูปที่ 14 DEPT 90 เอ็มอาร์สเปคตรัมของสาร 2

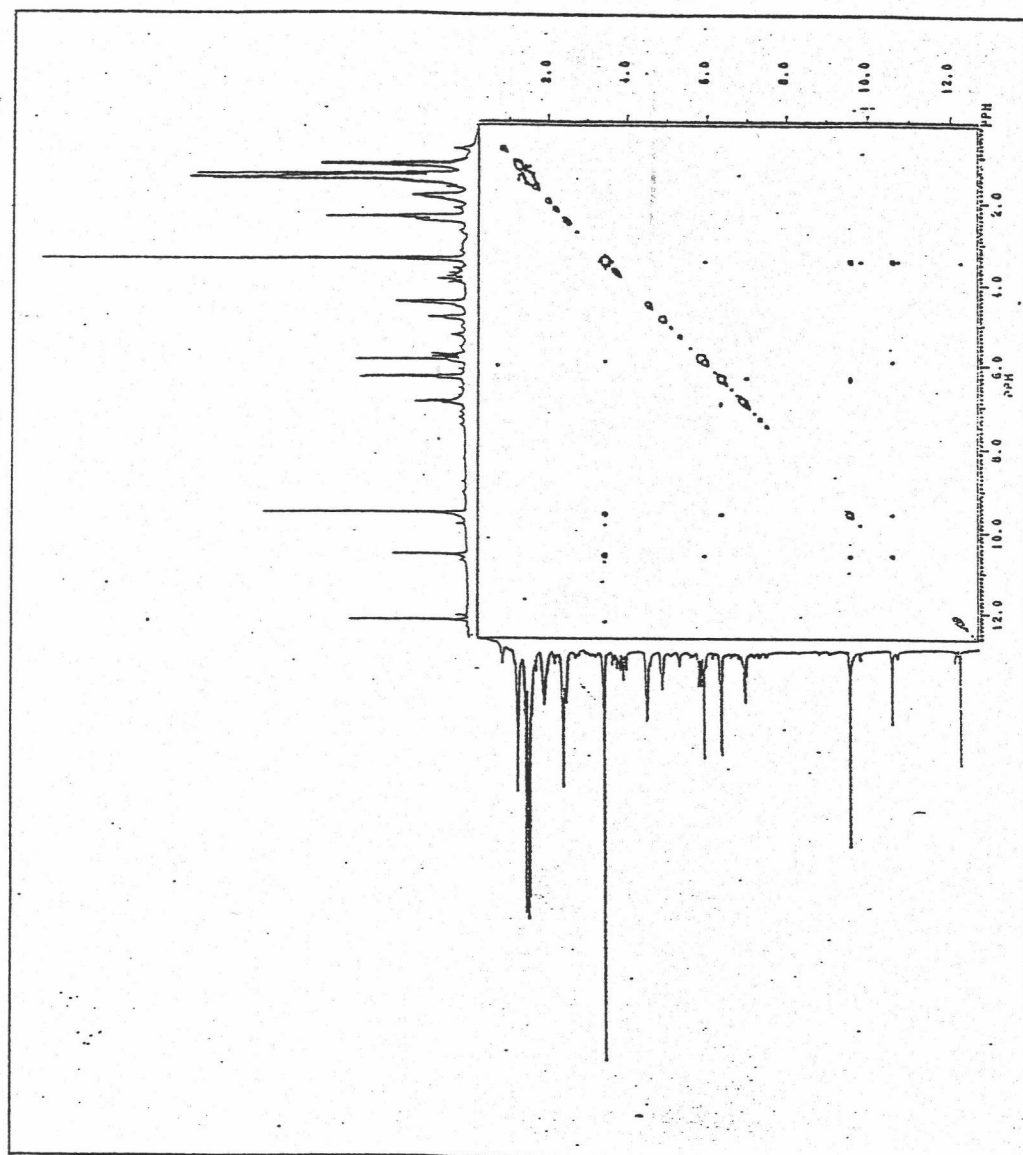


รูปที่ 15 DEPT 135 เอ็นเอ็มอาร์สเปกตรัมของสาร 2



รูปที่ 16 C-H CORRELATION ของสาร 2





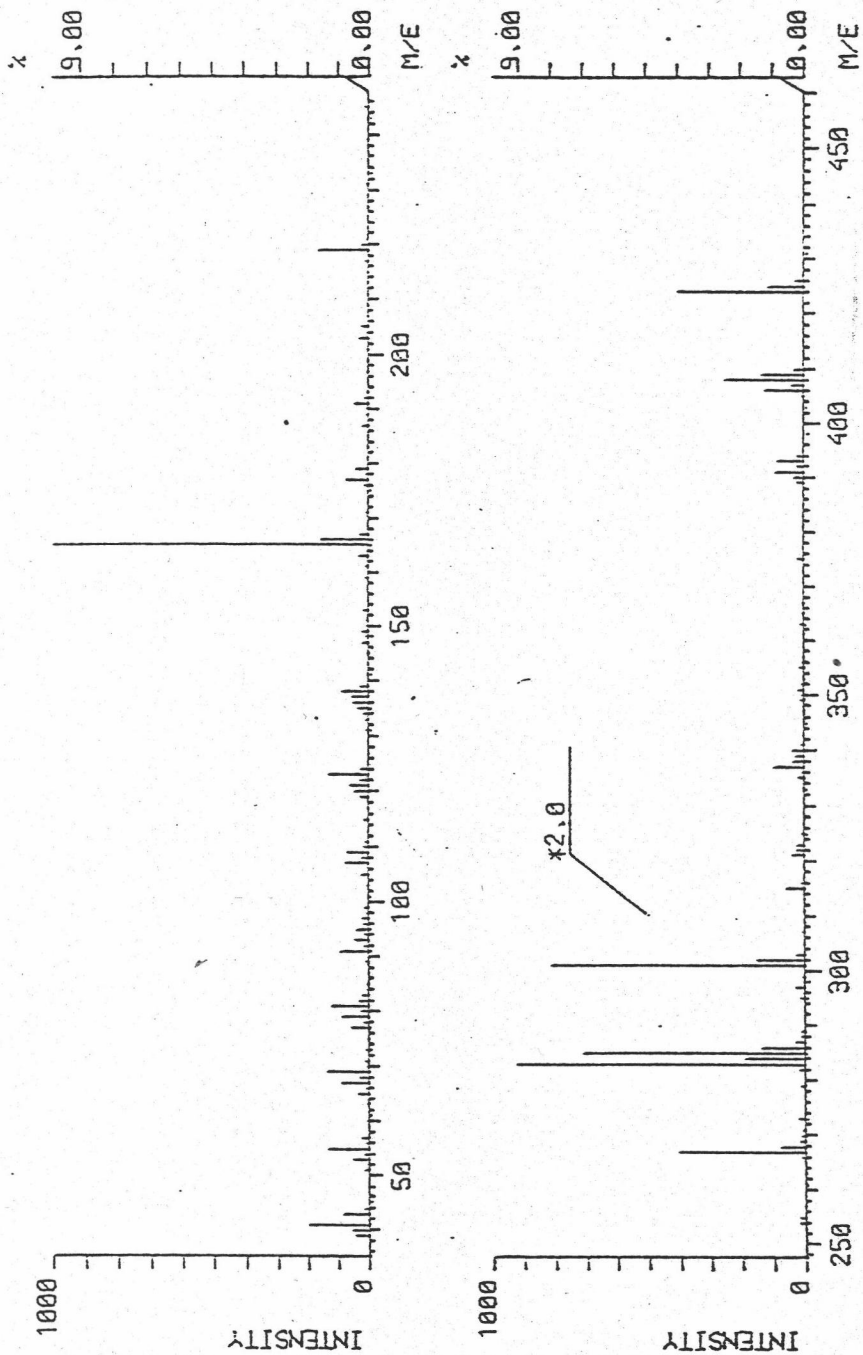
รูปที่ 17 <sup>1</sup>H-<sup>1</sup>H NOESY ของสาร 2

MASS SPECTRUM : (8 TO 10) ,      MASS SPECTRUM : (8 TO 10) ,  
 SAMPLE:NO.9 30 JUL 92      SAMPLE:NO.9 30 JUL 92  
 NOTE :370/2 EI, 70V, 300UA, CHAMB. TEMP.150      TEMP.150  
 BASE PEAK : M/E 165.0 INT. 600.4      BASE PEAK : M/E 165.0 INT. 600.4

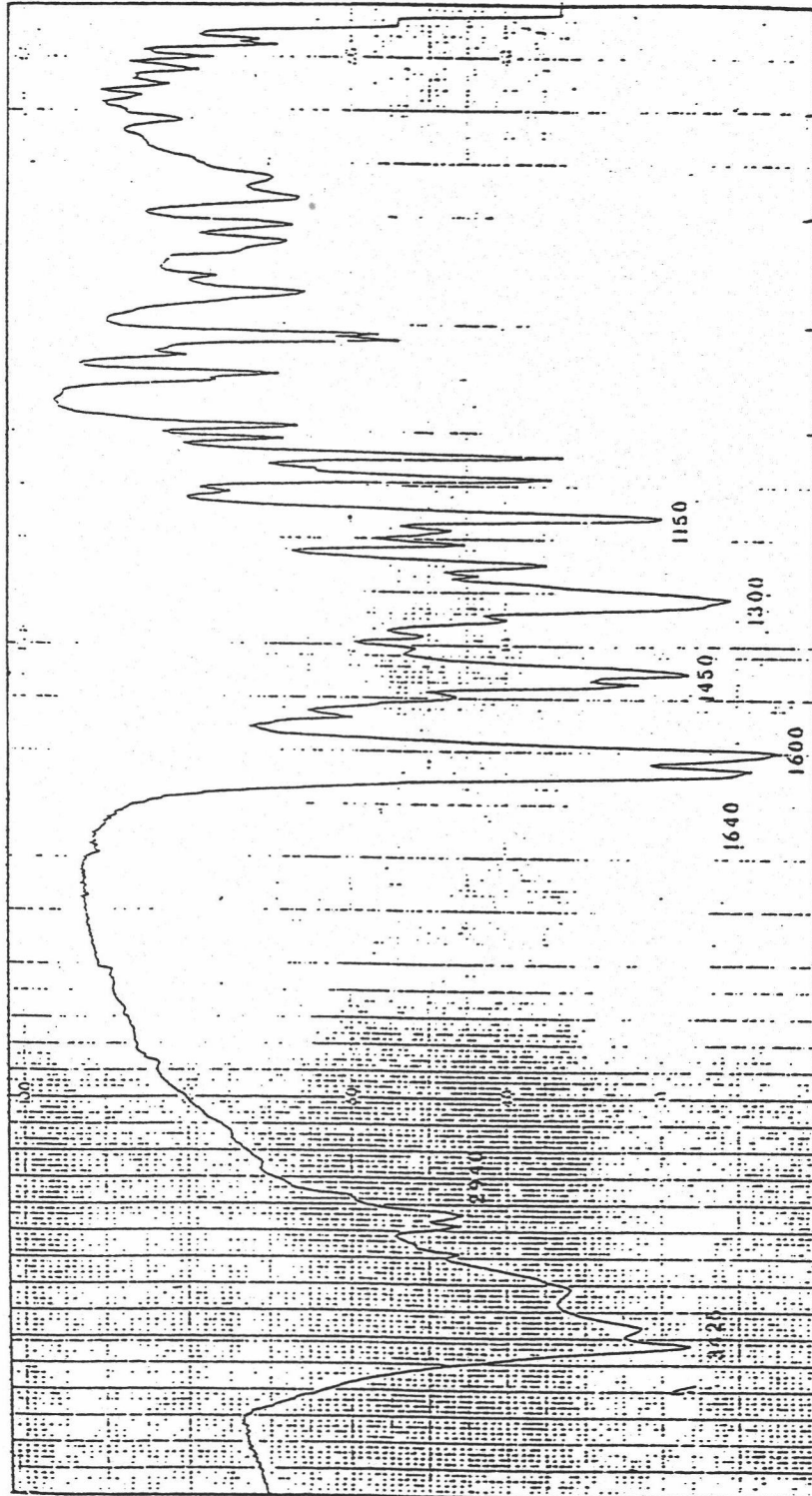
| M/E   | RAW INT. | R. INT. | SIGMA(%) | M/E   | RAW INT. | R. INT. | SIGMA(%) | M/E   | RAW INT. | R. INT. | SIGMA(%) |
|-------|----------|---------|----------|-------|----------|---------|----------|-------|----------|---------|----------|
| 41.0  | 120.7    | 201.0   | 15.09    | 147.0 | 16.1     | 26.0    | 0.44     | 425.0 | 9.3      | 15.6    | 55.89    |
| 43.0  | 52.1     | 86.9    | 6.32     | 149.0 | 14.2     | 23.6    | 0.39     | 427.0 | 1.7      | 2.0     | 10.34    |
| 55.0  | 81.5     | 135.7   | 10.19    | 163.0 | 19.4     | 32.3    | 0.54     | 428.0 | 0.4      | 0.0     | 2.90     |
| 57.0  | 57.2     | 95.3    | 7.15     | 165.0 | 600.4    | 1000.0  | 16.74    | 436.0 | 0.4      | 0.0     | 2.90     |
| 59.0  | 84.6     | 140.9   | 10.58    | 166.0 | 96.6     | 160.9   | 2.69     | 430.0 | 2.5      | 4.2     | 15.24    |
| 79.0  | 53.1     | 88.5    | 6.64     | 177.0 | 18.3     | 31.5    | 0.52     | 439.0 | 0.6      | 1.0     | 3.01     |
| 81.0  | 72.6     | 120.9   | 9.07     | 179.0 | 44.3     | 73.0    | 1.23     | 440.0 | 1.4      | 2.4     | 8.09     |
| 91.0  | 57.2     | 95.3    | 7.15     | 179.0 | 26.1     | 43.6    | 0.73     |       |          |         |          |
| 107.0 | 46.6     | 77.7    | 5.03     | 187.0 | 15.4     | 25.7    | 0.43     |       |          |         |          |
| 109.0 | 43.2     | 72.0    | 5.41     | 191.0 | 30.2     | 50.4    | 0.84     |       |          |         |          |
| 123.0 | 77.4     | 129.0   | 9.68     | 203.0 | 10.2     | 30.3    | 0.50     |       |          |         |          |
| 130.0 | 52.9     | 88.2    | 6.62     | 205.0 | 14.2     | 23.6    | 0.39     |       |          |         |          |
|       |          |         |          | 219.0 | 100.4    | 167.3   | 2.00     |       |          |         |          |
|       |          |         |          | 220.0 | 15.1     | 25.3    | 0.42     |       |          |         |          |
|       |          |         |          | 254.0 | 16.1     | 26.0    | 0.45     |       |          |         |          |
|       |          |         |          | 267.0 | 246.5    | 410.6   | 6.07     |       |          |         |          |
|       |          |         |          | 268.0 | 49.0     | 81.7    | 1.36     |       |          |         |          |
|       |          |         |          | 273.0 | 14.3     | 23.0    | 0.40     |       |          |         |          |
|       |          |         |          | 283.0 | 554.5    | 923.5   | 15.46    |       |          |         |          |
|       |          |         |          | 284.0 | 115.0    | 191.6   | 3.20     |       |          |         |          |
|       |          |         |          | 285.0 | 428.5    | 713.7   | 11.35    |       |          |         |          |
|       |          |         |          | 286.0 | 83.0     | 130.2   | 2.31     |       |          |         |          |
|       |          |         |          | 287.0 | 10.0     | 30.1    | 0.50     |       |          |         |          |
|       |          |         |          | 297.0 | 17.3     | 28.0    | 0.48     |       |          |         |          |
|       |          |         |          | 301.0 | 489.5    | 815.3   | 13.65    |       |          |         |          |
|       |          |         |          | 302.0 | 92.4     | 153.9   | 2.57     |       |          |         |          |
|       |          |         |          | 303.0 | 15.9     | 26.5    | 0.44     |       |          |         |          |
|       |          |         |          | 315.0 | 18.5     | 30.9    | 0.51     |       |          |         |          |
|       |          |         |          | 337.0 | 29.4     | 49.1    | 0.82     |       |          |         |          |
|       |          |         |          | 351.0 | 27.5     | 45.9    | 0.76     |       |          |         |          |
|       |          |         |          | 393.0 | 25.2     | 42.0    | 0.70     |       |          |         |          |
|       |          |         |          | 406.0 | 37.9     | 63.1    | 1.05     |       |          |         |          |
|       |          |         |          | 408.0 | 76.0     | 126.6   | 2.12     |       |          |         |          |
|       |          |         |          | 409.0 | 40.9     | 68.2    | 1.14     |       |          |         |          |
|       |          |         |          | 424.0 | 123.0    | 204.9   | 3.43     |       |          |         |          |
|       |          |         |          | 425.0 | 35.2     | 58.7    | 0.98     |       |          |         |          |

ข้อมูลแบบสเปกตรัมของสาร 2

MASS SPECTRUM : (8 TO 10)  
SAMPLE NO. 9 30 JUL 92  
NOTE : 370/2 EI, 70V, 300UA, CHAMB, TEMP, 160  
BASE PEAK : M/E 165.0 INT, 600.4



รูปที่ 18 แมสสเปคตรัมของสาร 2

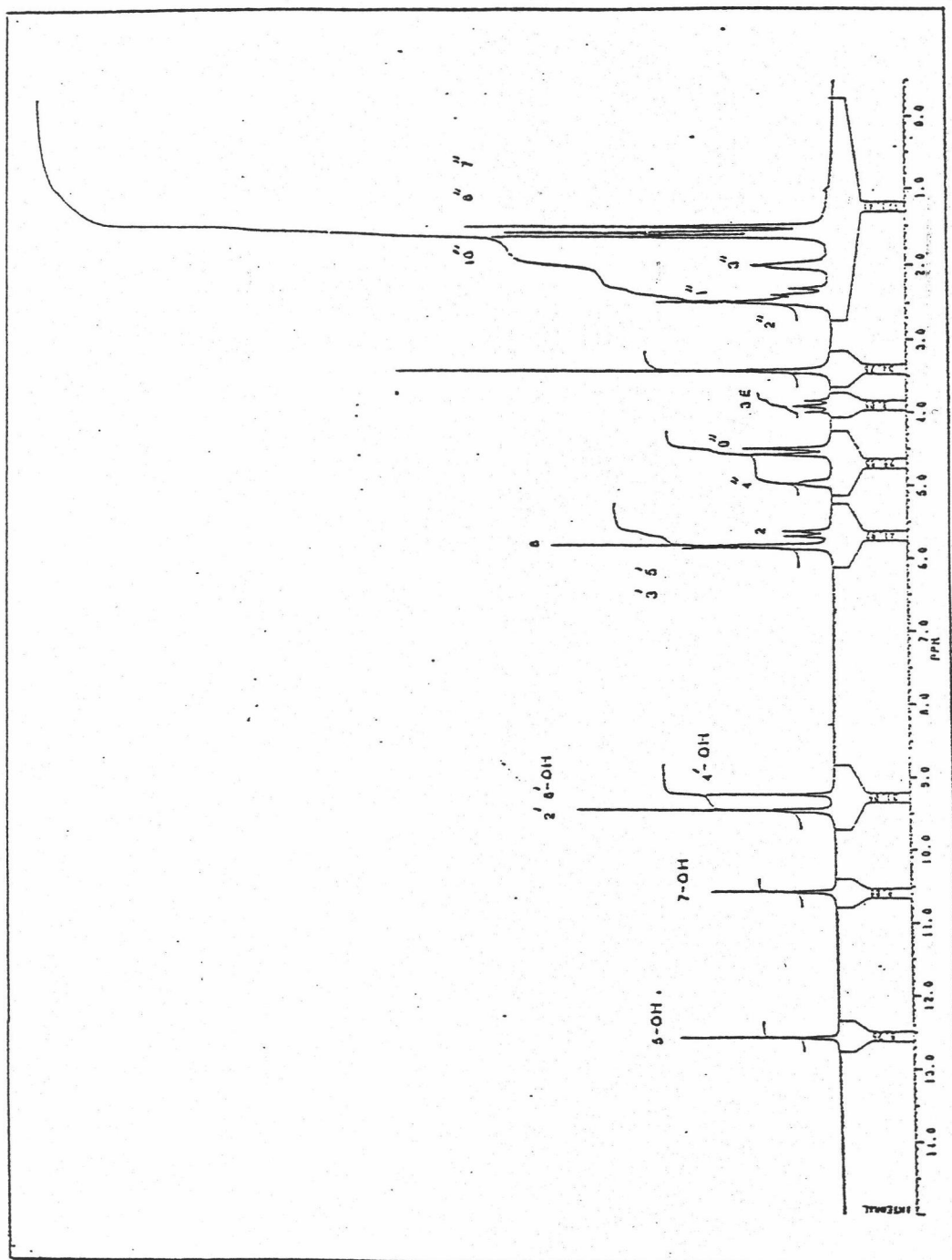


รูปที่ 19 อินฟราเรดสเปกตรัมของสาร 3

STDMBOIH  
 MIN. INTENSITY = .74B  
 INTENS. LEVEL = .74B  
 F1 = 3002.07 HZ = 15.00004 PPM  
 MAXY = 25.00000  
 NOISE = .00807  
 F2 = -100.16 HZ = -.50005 PPM  
 PP CONSTANT = .50000  
 SENS. LEVEL = .01614

| #  | CURSOR | FREQUENCY | PPM     | INTENSITY |
|----|--------|-----------|---------|-----------|
| 1  | 1241   | 2518.376  | 12.5835 | 5.017     |
| 2  | 1246   | 2516.154  | 12.5739 | 4.083     |
| 3  | 2265   | 2117.805  | 10.5820 | 3.859     |
| 4  | 2832   | 1896.197  | 9.4747  | 8.188     |
| 5  | 2944   | 1852.076  | 9.2542  | 3.996     |
| 6  | 4672   | 1175.977  | 5.8760  | 4.747     |
| 7  | 4677   | 1174.302  | 5.8676  | 4.414     |
| 8  | 4691   | 1168.507  | 5.8386  | 9.050     |
| 9  | 4695   | 1166.952  | 5.8309  | 7.984     |
| 10 | 4761   | 1141.441  | 5.7034  | 1.481     |
| 11 | 4796   | 1127.776  | 5.6351  | 1.530     |
| 12 | 5132   | 996.280   | 4.9781  | 1.555     |
| 13 | 5333   | 917.310   | 4.5835  | 2.678     |
| 14 | 5374   | 901.548   | 4.5047  | 2.771     |
| 15 | 5631   | 800.783   | 4.0012  | .749      |
| 16 | 5674   | 784.039   | 3.9176  | 1.143     |
| 17 | 5712   | 769.235   | 3.8436  | .796      |
| 18 | 5915   | 689.692   | 3.4462  | 14.221    |
| 19 | 5919   | 688.387   | 3.4396  | 13.243    |
| 20 | 6406   | 497.753   | 2.4871  | 5.481     |
| 21 | 6455   | 478.534   | 2.3911  | 1.833     |
| 22 | 6499   | 461.433   | 2.3056  | 1.266     |
| 23 | 6650   | 402.064   | 2.0090  | 2.489     |
| 24 | 6836   | 329.492   | 1.6464  | 10.428    |
| 25 | 6863   | 319.023   | 1.5941  | 10.534    |
| 26 | 6904   | 302.935   | 1.5137  | 11.903    |

ข้อมูลปรตอนเอ็นเอ็นเออาร์สเปคตรัมของสาร 3



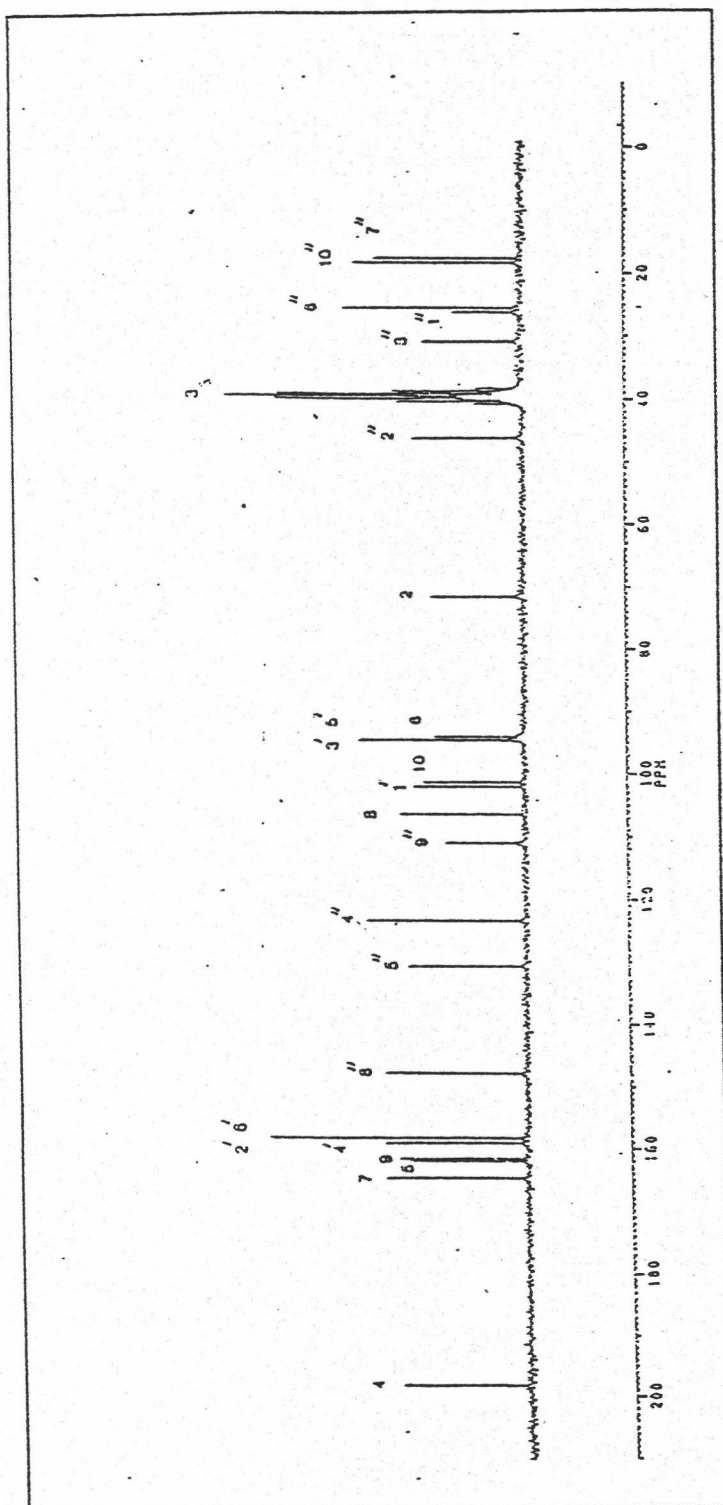
รูปที่ 20 ปรอทอนเอ็มอาร์สเปคตรัมของสาร 3

MI = 2.100 U

SUM. 002  
 MIN. INTENSITY = 2.100 MAXY = 25.00000 PP CONSTANT = -50000  
 INTENS. LEVEL = 2.100 NOISE = .06233 SENS. LEVEL = .12465  
 F1 = 10568.35 HZ F2 = -502.43 HZ FPM -9.9840 PPM

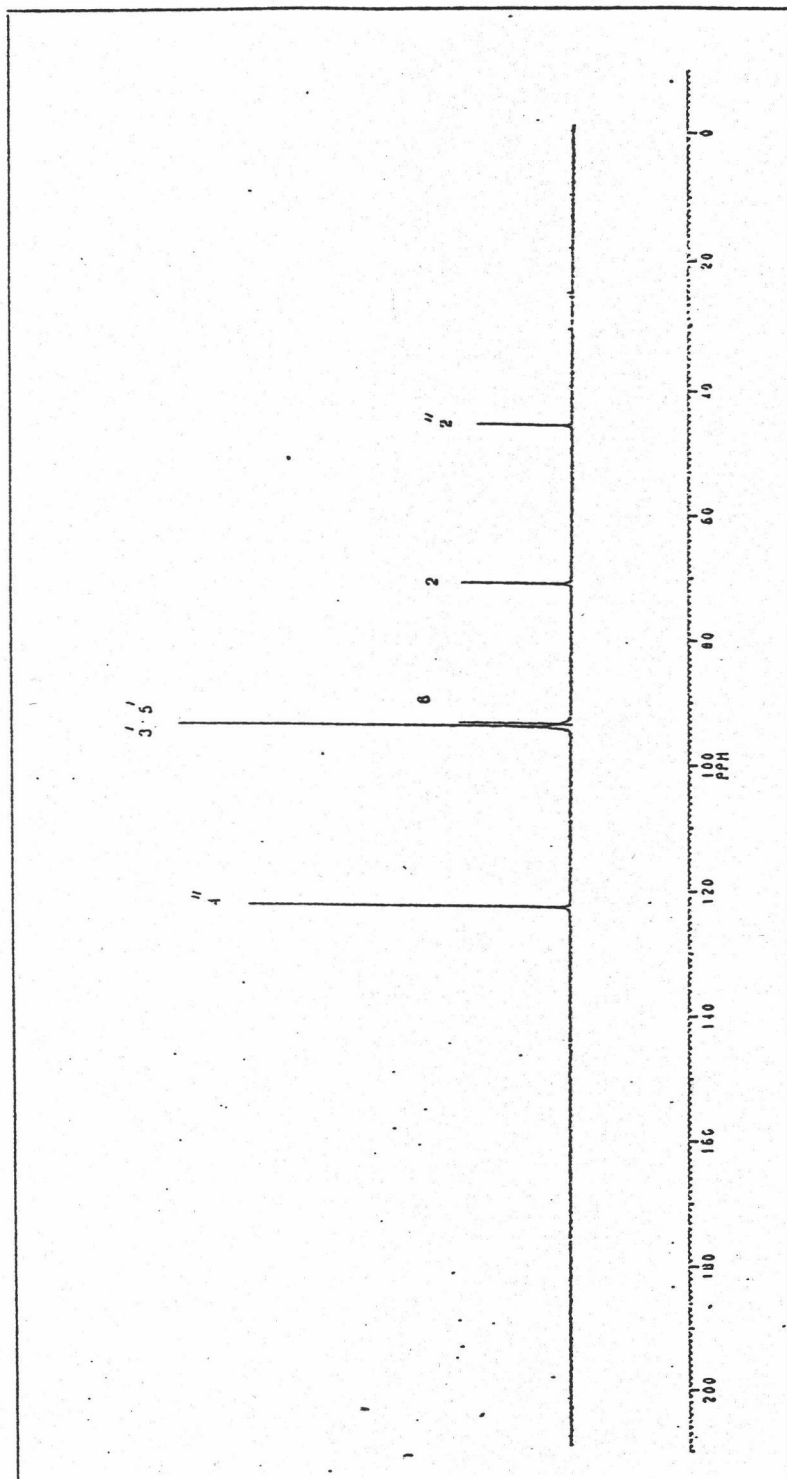
| #  | CURSOR | FREQUENCY | PPM      | INTENSITY |
|----|--------|-----------|----------|-----------|
| 1  | 2275   | 9967.483  | 198.0679 | 3.674     |
| 2  | 4650   | 8281.715  | 164.5693 | 3.953     |
| 3  | 4842   | 8145.449  | 161.8615 | 3.286     |
| 4  | 4872   | 8123.817  | 161.4316 | 3.713     |
| 5  | 5050   | 7997.745  | 158.9264 | 4.005     |
| 6  | 5108   | 7956.853  | 158.1138 | 7.447     |
| 7  | 5845   | 7433.738  | 147.7188 | 4.010     |
| 8  | 7057   | 6573.653  | 130.6277 | 3.429     |
| 9  | 7570   | 6209.079  | 123.3831 | 4.575     |
| 10 | 8448   | 5585.873  | 110.9991 | 2.149     |
| 11 | 8773   | 5388.825  | 106.4278 | 3.664     |
| 12 | 9086   | 5133.728  | 102.0144 | 3.236     |
| 13 | 9138   | 5096.511  | 101.2748 | 2.808     |
| 14 | 9613   | 4758.300  | 94.5541  | 4.754     |
| 15 | 9653   | 4730.773  | 94.0071  | 2.483     |
| 16 | 11244  | 3601.835  | 71.5735  | 2.526     |
| 17 | 13041  | 2326.613  | 46.2331  | 3.054     |
| 18 | 13159  | 2029.477  | 40.3286  | 3.562     |
| 19 | 13489  | 2008.517  | 39.9120  | 7.001     |
| 20 | 13505  | 1997.518  | 39.6935  | 2.569     |
| 21 | 13519  | 1987.509  | 39.4946  | 8.312     |
| 22 | 13548  | 1966.526  | 39.0776  | 6.956     |
| 23 | 13578  | 1945.474  | 38.6593  | 3.639     |
| 24 | 14123  | 1558.485  | 30.9693  | 2.706     |
| 25 | 14503  | 1288.886  | 25.6120  | 5.059     |
| 26 | 15010  | 929.053   | 18.4618  | 4.742     |
| 27 | 15043  | 891.760   | 17.7205  | 4.325     |

ข้อมูลคาร์บอน-13 เอ็นเอ็มอาร์สเปกตรัมของสาร 3

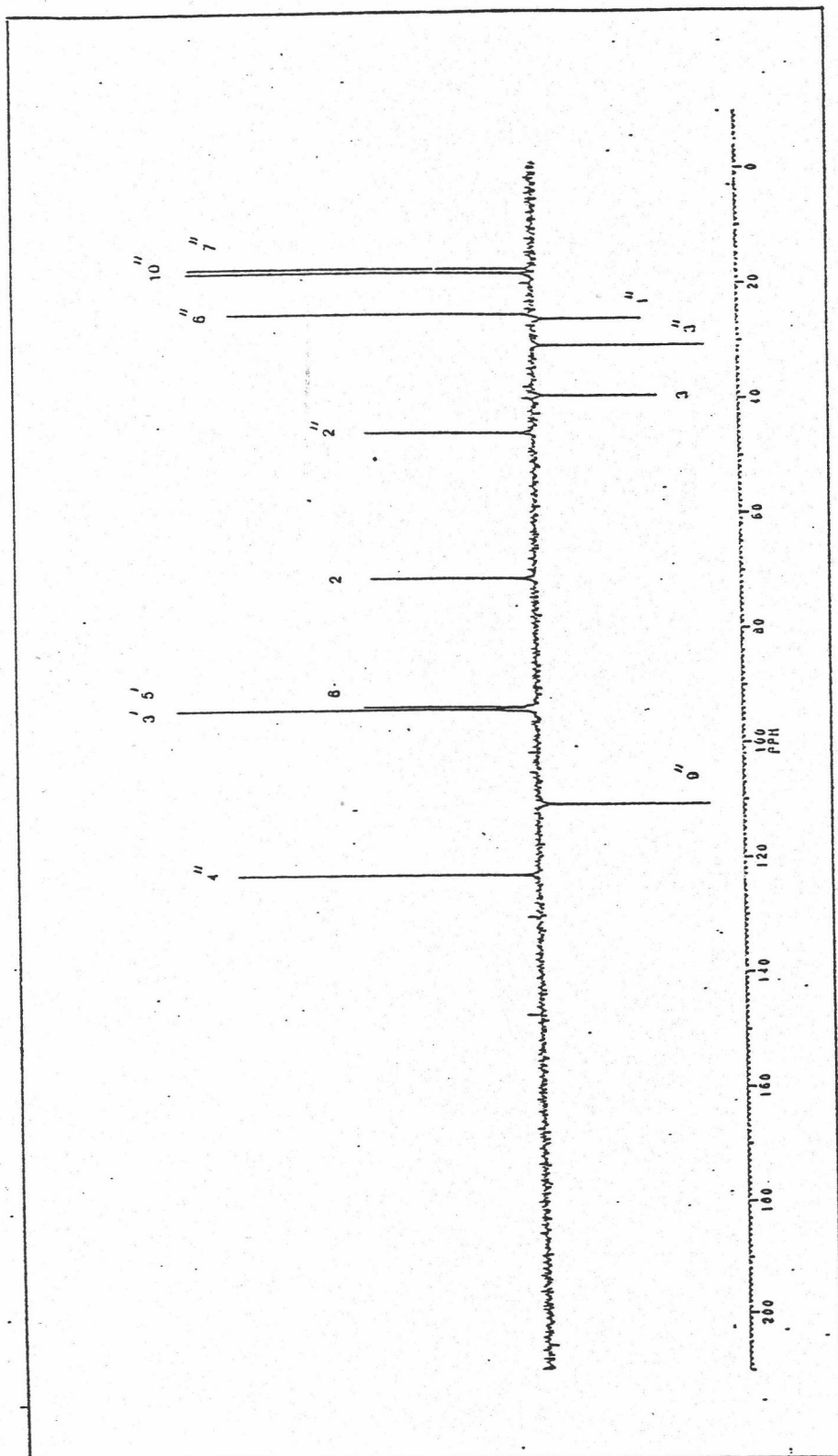


รูปที่ 21 คาร์บอน-13 เอ็นเอ็มอาร์สเปกตรัมของสาร 3

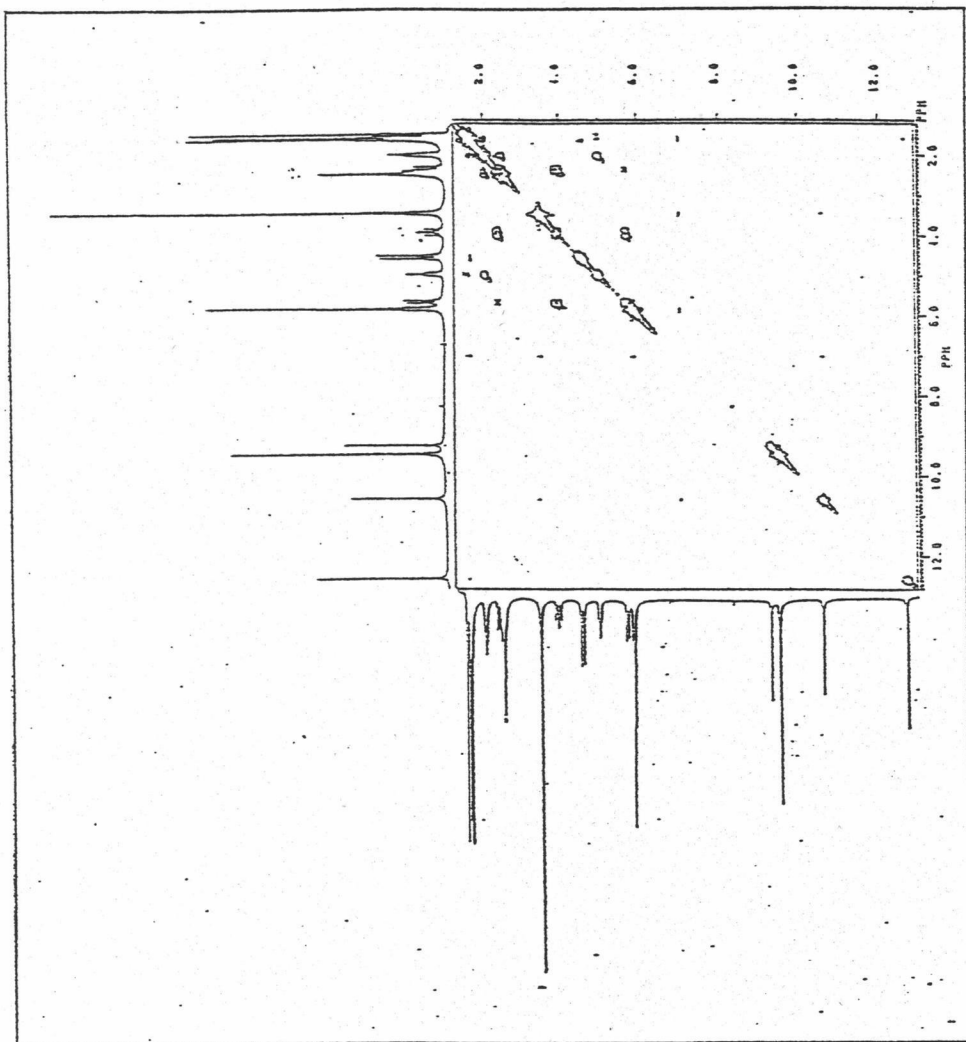




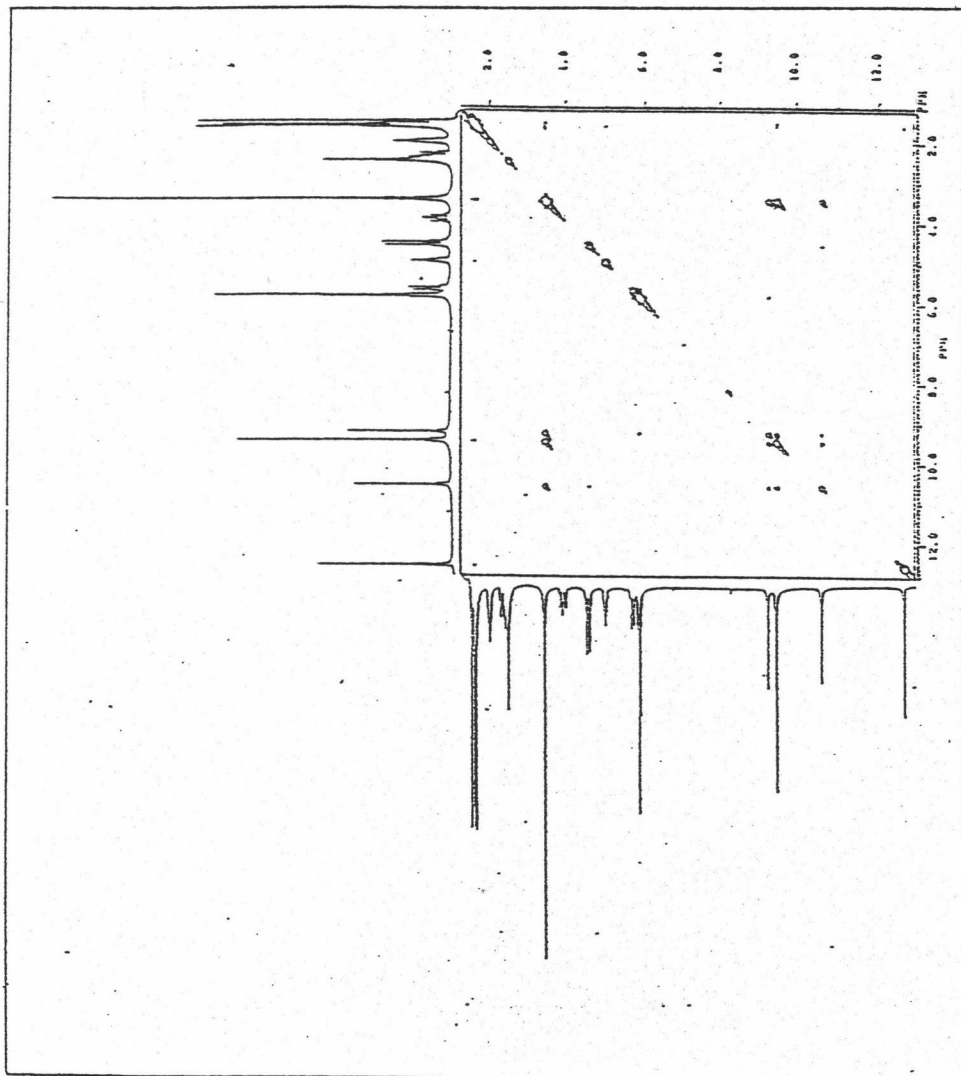
รูปที่ 22 DEPT 90 เอ็มเอ็มอาร์สเปกตรัมของสาร 3



รูปที่ 23 DEPT 135 เอ็นเอ็มอาร์สเปกตรัมของสาร 3



รูปที่ 24  $^1\text{H}$ - $^1\text{H}$  COSY ของสาร 3



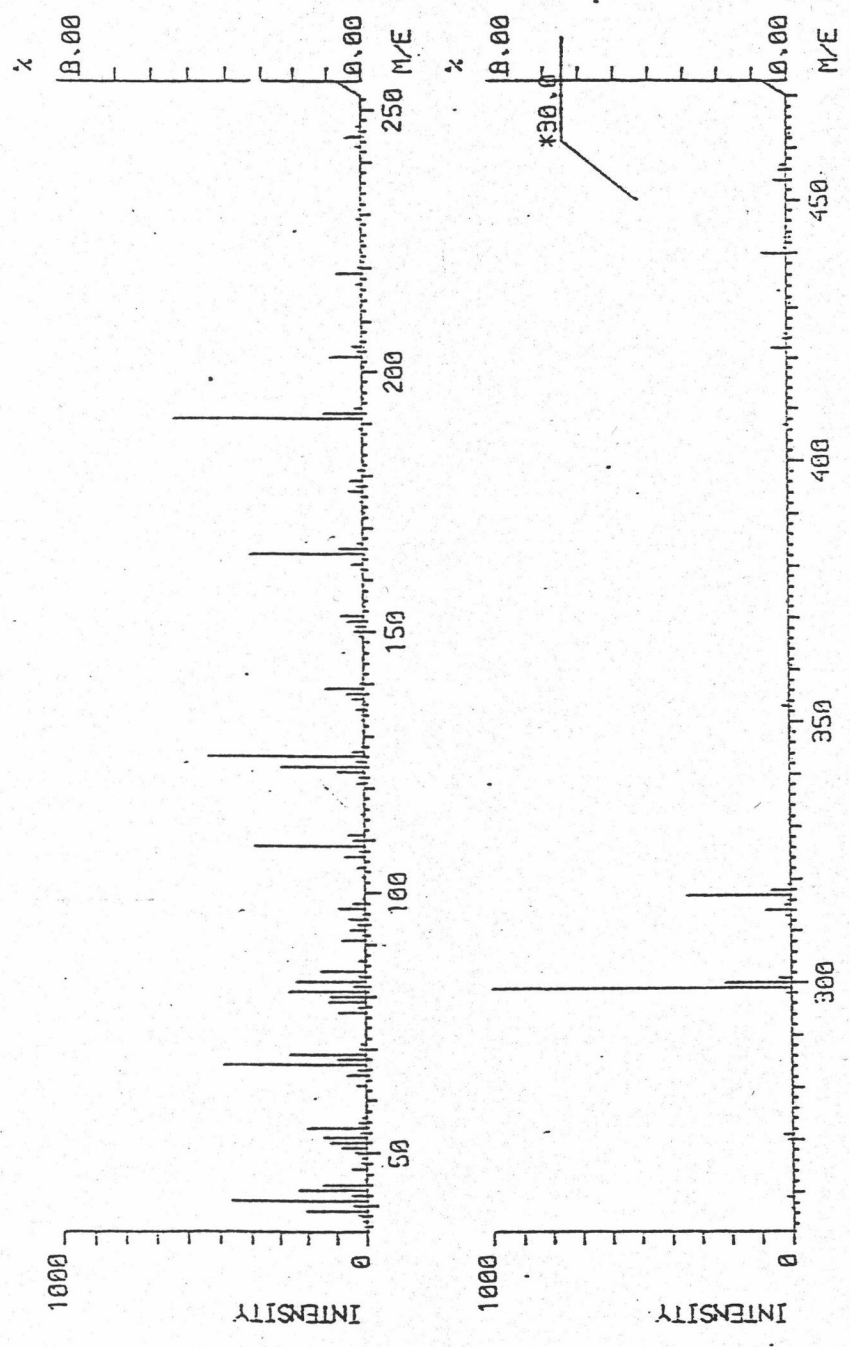
รูปที่ 25 <sup>1</sup>H-<sup>1</sup>H NOESY ของสาร 3

MASS SPECTRUM : (10 TO 11)  
 SAMPLE:NO.3 20 JUL 92  
 NOTE : 366/2 E.I., 70V, 300UA, CHAMB, TEMPE:160  
 BASE PEAK : M/E 299.0 INT. 428.0 BASE PEAK : M/E 299.0 INT. 428.0

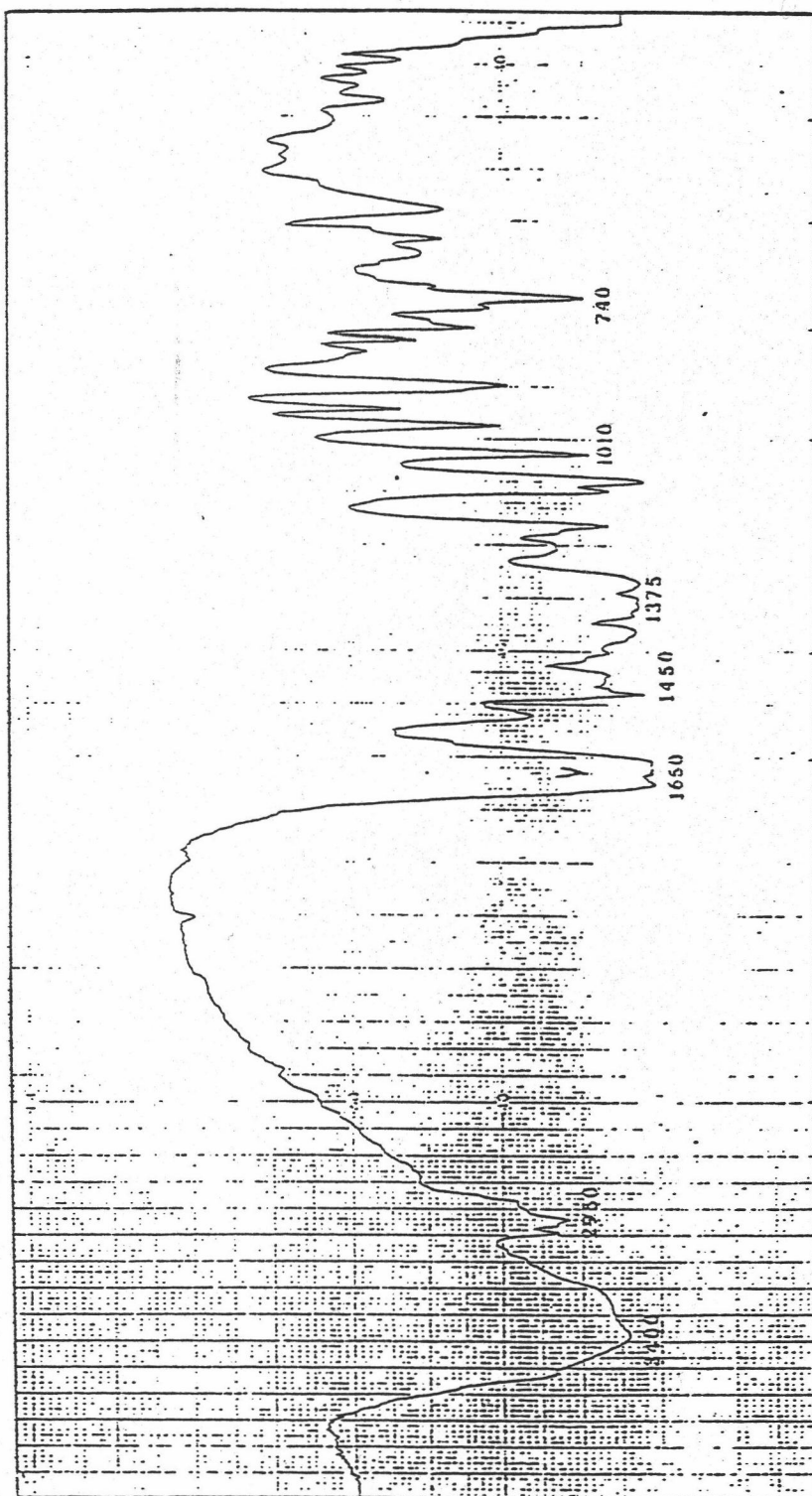
| M/E   | RAW INT. | R.INT. | SIGMA(%) | M/E   | RAW INT. | R.INT. | SIGMA(%) | M/E   | RAW INT. | R.INT. | SIGMA(%) |
|-------|----------|--------|----------|-------|----------|--------|----------|-------|----------|--------|----------|
| 39.0  | 89.0     | 208.3  | 3.71     | 177.0 | 20.2     | 47.3   | 1.49     | 441.0 | 5.3      | 12.4   | 30.48    |
| 41.0  | 199.0    | 466.1  | 0.31     | 178.0 | 11.0     | 25.6   | 0.01     | 442.0 | 4.5      | 10.5   | 25.78    |
| 43.0  | 100.9    | 235.4  | 4.19     | 179.0 | 10.0     | 42.0   | 1.32     | 443.0 | 4.0      | 11.2   | 27.52    |
| 44.0  | 63.5     | 148.2  | 2.64     | 191.0 | 272.3    | 635.0  | 20.07    | 444.0 | 1.1      | 2.7    | 6.79     |
| 51.0  | 36.0     | 86.0   | 1.53     | 192.0 | 56.5     | 131.0  | 4.16     | 454.0 | 0.6      | 1.5    | 3.03     |
| 52.0  | 53.0     | 123.6  | 2.20     | 193.0 | 11.5     | 26.9   | 0.05     | 455.0 | 0.3      | 0.9    | 2.26     |
| 53.0  | 62.1     | 145.0  | 2.58     | 203.0 | 45.1     | 105.3  | 3.32     | 457.0 | 0.3      | 0.7    | 1.91     |
| 55.0  | 86.2     | 201.0  | 3.58     | 205.0 | 15.9     | 37.1   | 1.17     | 590.0 | 0.2      | 0.5    | 1.39     |
| 67.0  | 200.5    | 486.3  | 0.67     | 219.0 | 36.3     | 86.1   | 2.72     |       |          |        |          |
| 69.0  | 42.6     | 93.3   | 1.77     | 245.0 | 23.2     | 54.2   | 1.71     |       |          |        |          |
| 69.0  | 112.3    | 262.0  | 4.67     | 271.0 | 13.1     | 30.6   | 0.06     |       |          |        |          |
| 79.0  | 42.2     | 98.4   | 1.75     | 279.0 | 428.0    | 1000.0 | 31.60    |       |          |        |          |
| 80.0  | 54.2     | 126.6  | 2.25     | 300.0 | 93.7     | 210.6  | 6.91     |       |          |        |          |
| 80.0  | 52.3     | 122.1  | 2.17     | 301.0 | 17.6     | 41.0   | 1.29     |       |          |        |          |
| 81.0  | 112.2    | 261.6  | 4.66     | 314.0 | 35.7     | 83.3   | 2.63     |       |          |        |          |
| 83.0  | 100.3    | 235.3  | 4.19     | 315.0 | 10.0     | 23.4   | 0.74     |       |          |        |          |
| 85.0  | 65.2     | 152.0  | 2.71     | 317.0 | 150.7    | 350.0  | 11.08    |       |          |        |          |
| 91.0  | 37.6     | 86.3   | 1.55     | 318.0 | 28.7     | 66.3   | 2.11     |       |          |        |          |
| 109.0 | 154.1    | 302.0  | 6.02     | 353.0 | 9.0      | 23.0   | 0.72     |       |          |        |          |
| 123.0 | 39.5     | 91.5   | 1.63     | 422.0 | 21.4     | 49.9   | 1.57     |       |          |        |          |
| 124.0 | 123.5    | 280.1  | 5.13     | 440.0 | 36.0     | 84.0   | 2.65     |       |          |        |          |
| 126.0 | 226.6    | 528.6  | 9.42     |       |          |        |          |       |          |        |          |
| 139.0 | 55.4     | 123.2  | 2.30     |       |          |        |          |       |          |        |          |
| 153.0 | 32.6     | 76.0   | 1.35     |       |          |        |          |       |          |        |          |
| 165.0 | 160.0    | 391.0  | 6.98     |       |          |        |          |       |          |        |          |
| 166.0 | 35.6     | 83.0   | 1.48     |       |          |        |          |       |          |        |          |

ข้อมูลแมสสเปกตรัมของสาร 3

MASS SPECTRUM : (10 TO 11)  
SAMPLE: NO.3 28 JUL 92  
NOTE : 366/2 E.I, 300UA, CHAMB, TEMP. 160  
BASE PEAK : M/E 299.0 INT, 428.0



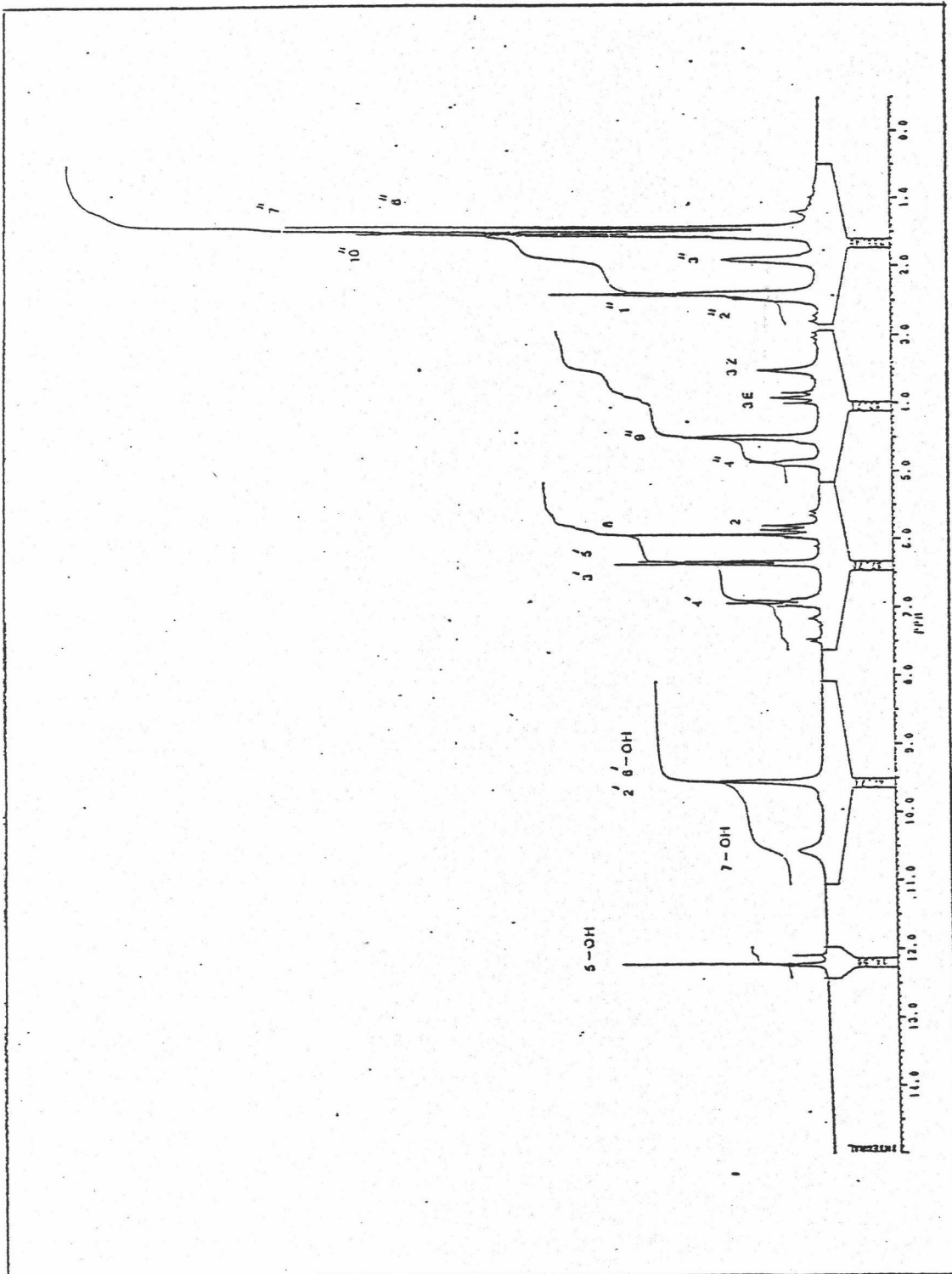
รูปที่ 26 แมสสเปคตรัมของสาร 3



รูปที่ 27 อินฟราเรดสเปกตรัมของสาร 4

| STDM501H          |        | .731         |         | 25.000000         |  | PP CONSTANT = .500000 |  |
|-------------------|--------|--------------|---------|-------------------|--|-----------------------|--|
| MIN. INTENSITY =  |        | .731         |         | NOISE =           |  | SENS. LEVEL = .01525  |  |
| INTENS. LEVEL =   |        | 15.00001 PPM |         | F2 = -100.16 HZ = |  | -.50005 PPM           |  |
| F1 = 3002.07 HZ = |        |              |         |                   |  |                       |  |
| #                 | CURSOR | FREQUENCY    | PPM     | INTENSITY         |  |                       |  |
| 1                 | 1421   | 2447.989     | 12.2318 | 6.708             |  |                       |  |
| 2                 | 1489   | 2421.370     | 12.0988 | .949              |  |                       |  |
| 3                 | 2274   | 3114.334     | 10.5646 | .737              |  |                       |  |
| 4                 | 2789   | 1412.655     | 9.5569  | 4.502             |  |                       |  |
| 5                 | 4102   | 1359.238     | 6.9915  | 1.397             |  |                       |  |
| 6                 | 4122   | 1391.212     | 6.9514  | 3.089             |  |                       |  |
| 7                 | 4144   | 1382.726     | 6.9090  | 2.628             |  |                       |  |
| 8                 | 4166   | 1374.247     | 6.8667  | .908              |  |                       |  |
| 9                 | 4115   | 1276.640     | 6.3789  | 6.805             |  |                       |  |
| 10                | 4436   | 1268.615     | 6.3388  | 6.093             |  |                       |  |
| 11                | 4613   | 1199.274     | 5.9924  | 1.129             |  |                       |  |
| 12                | 4638   | 1189.473     | 5.9434  | 6.773             |  |                       |  |
| 13                | 4676   | 1174.455     | 5.8684  | 1.954             |  |                       |  |
| 14                | 4708   | 1162.026     | 5.8063  | 1.897             |  |                       |  |
| 15                | 5168   | 981.953      | 4.9065  | 1.393             |  |                       |  |
| 16                | 5183   | 976.250      | 4.8780  | 2.319             |  |                       |  |
| 17                | 5366   | 984.470      | 4.5193  | 4.525             |  |                       |  |
| 18                | 5377   | 980.291      | 4.4985  | 4.589             |  |                       |  |
| 19                | 5630   | 881.471      | 4.0047  | 1.115             |  |                       |  |
| 20                | 5673   | 784.476      | 3.9198  | 1.574             |  |                       |  |
| 21                | 5710   | 770.116      | 3.8480  | 1.184             |  |                       |  |
| 22                | 5877   | 704.543      | 3.5204  | 2.014             |  |                       |  |
| 23                | 6415   | 493.968      | 2.4682  | 3.029             |  |                       |  |
| 24                | 6444   | 482.876      | 2.4138  | 8.989             |  |                       |  |
| 25                | 6700   | 382.735      | 1.9124  | 3.174             |  |                       |  |
| 26                | 6862   | 319.139      | 1.5946  | 3.485             |  |                       |  |
| 27                | 6886   | 310.033      | 1.5491  | 15.815            |  |                       |  |
| 28                | 6907   | 301.687      | 1.5074  | 16.466            |  |                       |  |
| 29                | 6945   | 286.727      | 1.4327  | 18.047            |  |                       |  |
| 30                | 7066   | 259.376      | 1.1951  | .002              |  |                       |  |

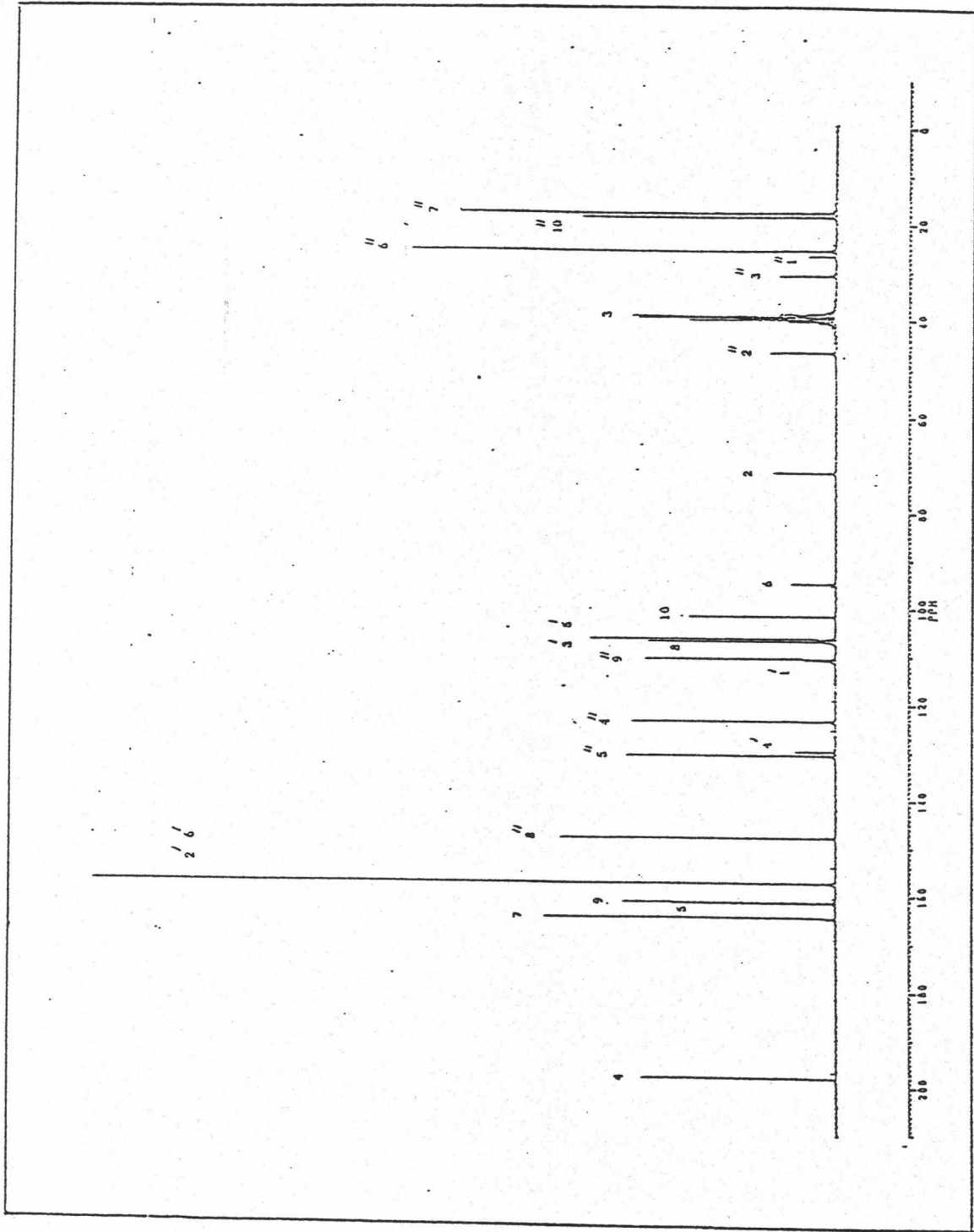




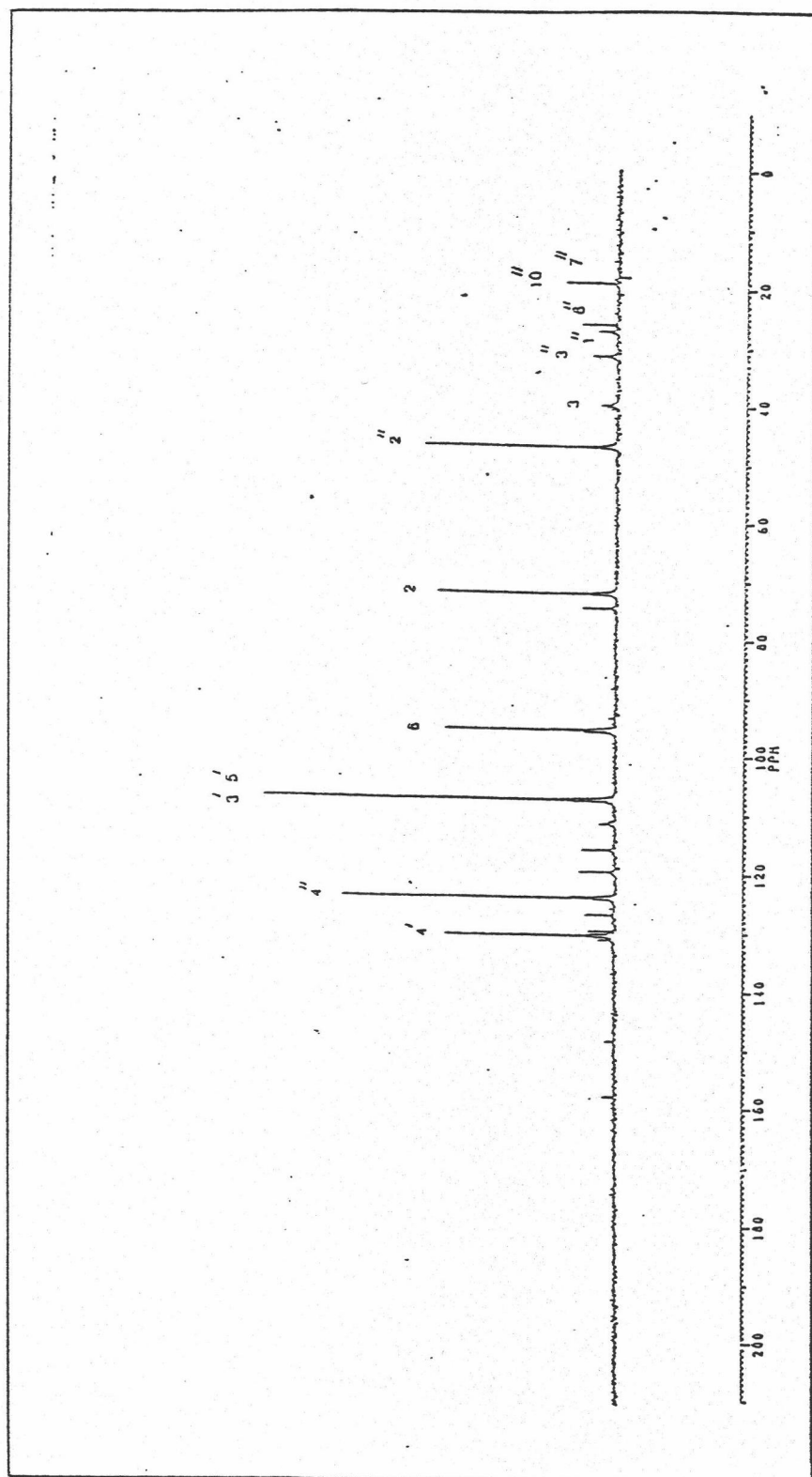
รูปที่ 28 ปรตอนเน็นเอ็มอาร์สเปคตรัมของสาร 4

| SUM.004          |        | MIN. INTENSITY = .980 |          | MAXY = 25.00000 |  | PP CONSTANT = 1.00000 |  |
|------------------|--------|-----------------------|----------|-----------------|--|-----------------------|--|
| INTENS. LEVEL =  |        | .980                  |          | NOISE =         |  | SENS. LEVEL =         |  |
| F1 = 10568.35 HZ |        | 210.0000 PPM          |          | F2 = -502.43 HZ |  | -9.9840 PPM           |  |
| #                | CURSOR | FREQUENCY             | PPM      | INTENSITY       |  |                       |  |
| 1                | 2283   | 9961.650              | 197.9519 | 6.884           |  |                       |  |
| 2                | 4655   | 8278.159              | 164.4986 | 10.180          |  |                       |  |
| 3                | 4867   | 8127.694              | 161.5087 | 5.778           |  |                       |  |
| 4                | 4884   | 8115.485              | 161.2661 | 7.521           |  |                       |  |
| 5                | 5160   | 7914.798              | 157.3775 | 28.040          |  |                       |  |
| 6                | 5831   | 7443.507              | 147.9129 | 9.555           |  |                       |  |
| 7                | 7041   | 6570.677              | 130.5686 | 7.447           |  |                       |  |
| 8                | 7118   | 6530.062              | 129.7615 | 1.406           |  |                       |  |
| 9                | 7565   | 6213.075              | 123.4625 | 7.380           |  |                       |  |
| 10               | 8468   | 5571.993              | 110.7233 | 1.171           |  |                       |  |
| 11               | 8491   | 5555.640              | 110.3983 | 6.666           |  |                       |  |
| 12               | 8748   | 5373.143              | 106.7719 | 6.597           |  |                       |  |
| 13               | 8785   | 5346.972              | 106.2518 | 8.513           |  |                       |  |
| 14               | 9116   | 5112.123              | 101.5850 | 5.158           |  |                       |  |
| 15               | 9593   | 4773.719              | 94.8605  | 1.553           |  |                       |  |
| 16               | 11251  | 3596.861              | 71.4747  | 2.176           |  |                       |  |
| 17               | 13024  | 2338.408              | 46.4675  | 1.115           |  |                       |  |
| 18               | 13029  | 2335.201              | 46.4037  | 2.339           |  |                       |  |
| 19               | 13462  | 2027.370              | 40.2867  | 1.746           |  |                       |  |
| 20               | 13487  | 2009.865              | 39.9388  | 1.806           |  |                       |  |
| 21               | 13492  | 2006.284              | 39.8677  | 5.211           |  |                       |  |
| 22               | 13523  | 1984.642              | 39.4376  | 7.035           |  |                       |  |
| 23               | 13547  | 1967.265              | 39.0923  | 2.598           |  |                       |  |
| 24               | 13552  | 1963.543              | 39.0184  | 7.260           |  |                       |  |
| 25               | 13559  | 1958.868              | 38.9255  | 1.620           |  |                       |  |
| 26               | 13583  | 1941.764              | 38.5856  | 2.008           |  |                       |  |
| 27               | 14137  | 1548.810              | 30.7770  | 1.991           |  |                       |  |
| 28               | 14131  | 1310.302              | 26.6337  | 1.002           |  |                       |  |
| 29               | 14511  | 1283.226              | 25.4995  | 14.883          |  |                       |  |
| 30               | 14515  | 1280.541              | 25.4462  | 1.977           |  |                       |  |
| 31               | 15013  | 926.909               | 18.4190  | 8.833           |  |                       |  |
| 32               | 15074  | 883.567               | 17.5577  | 13.365          |  |                       |  |

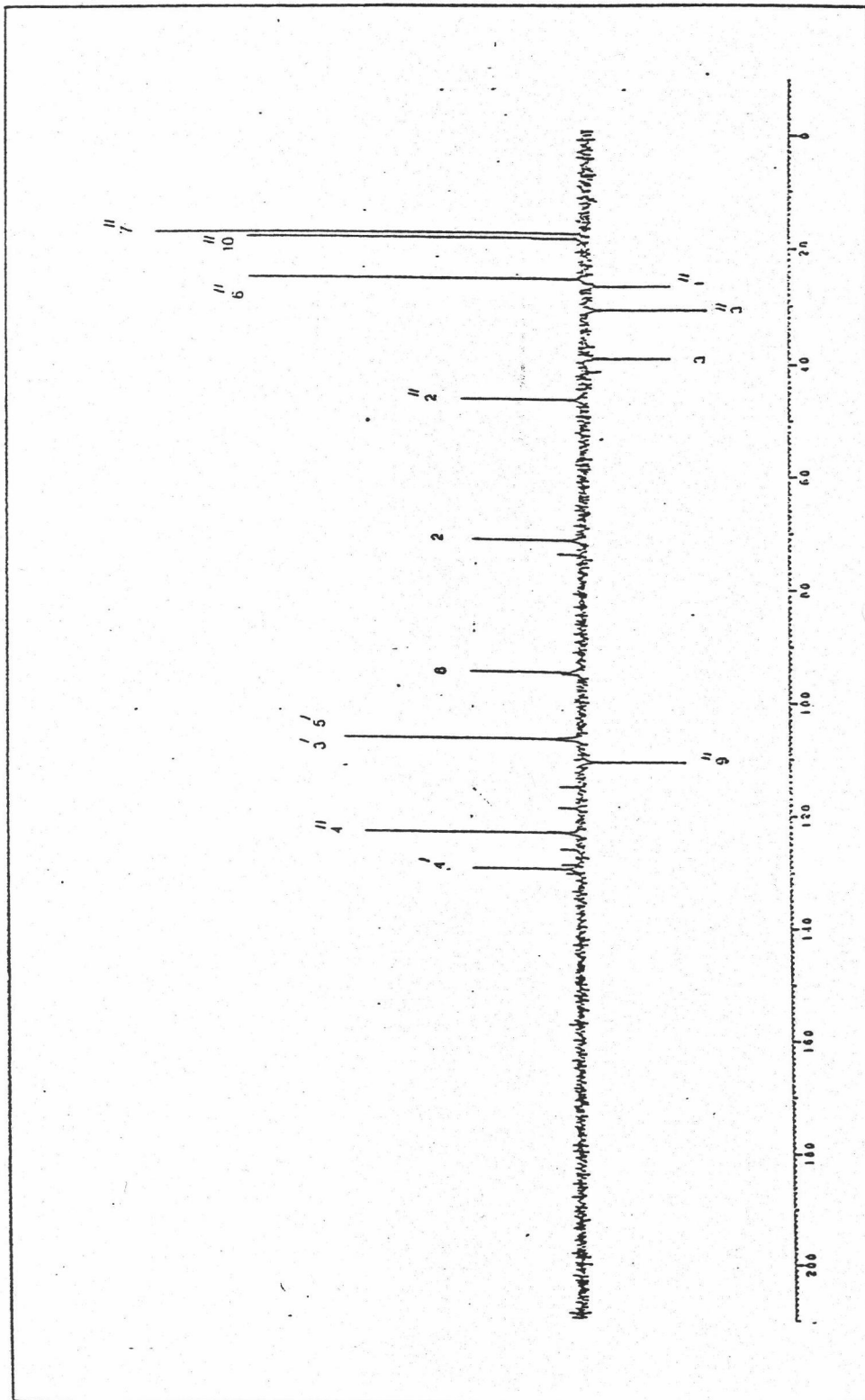
ข้อมูลคาร์บอน-13 เอ็มอาร์สเปกตรัมของสาร 4



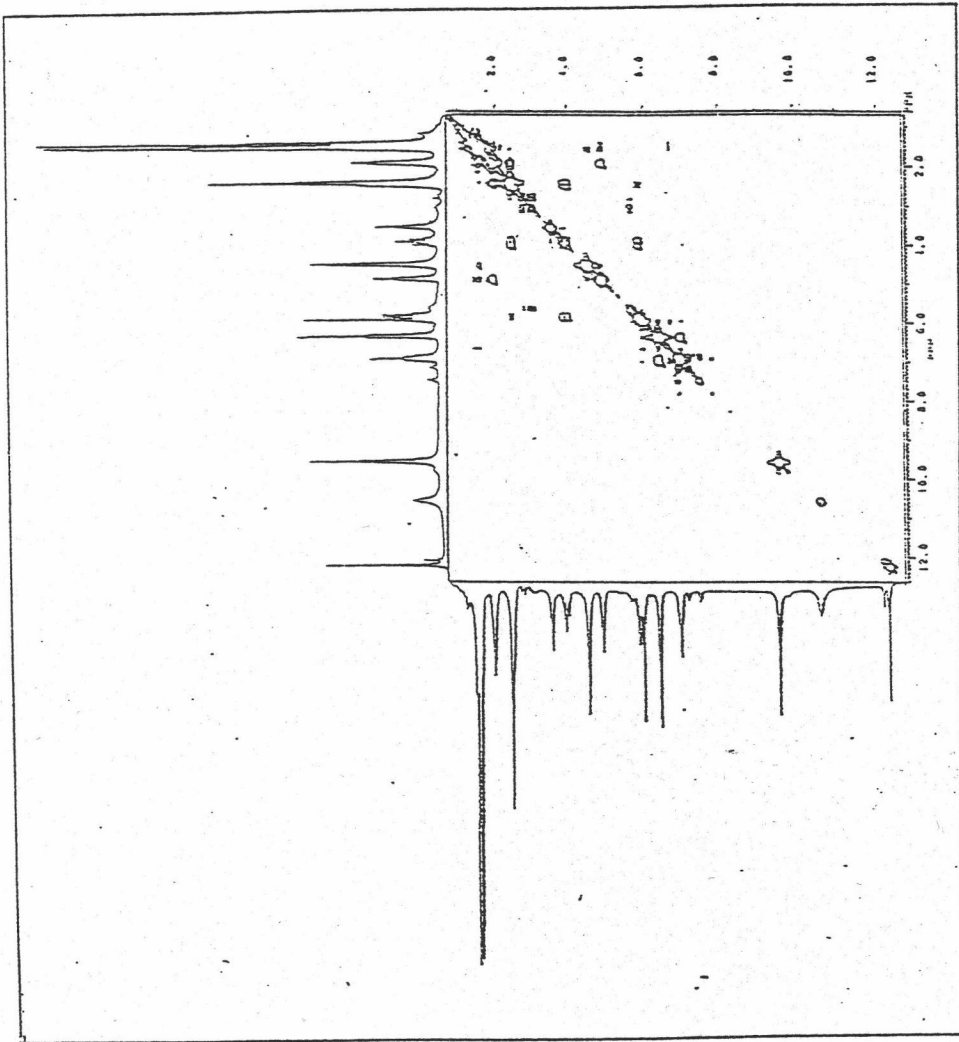
รูปที่ 29 คาร์บอน-13 เอ็นเอ็มอาร์สเปกตรัมของสาร 4



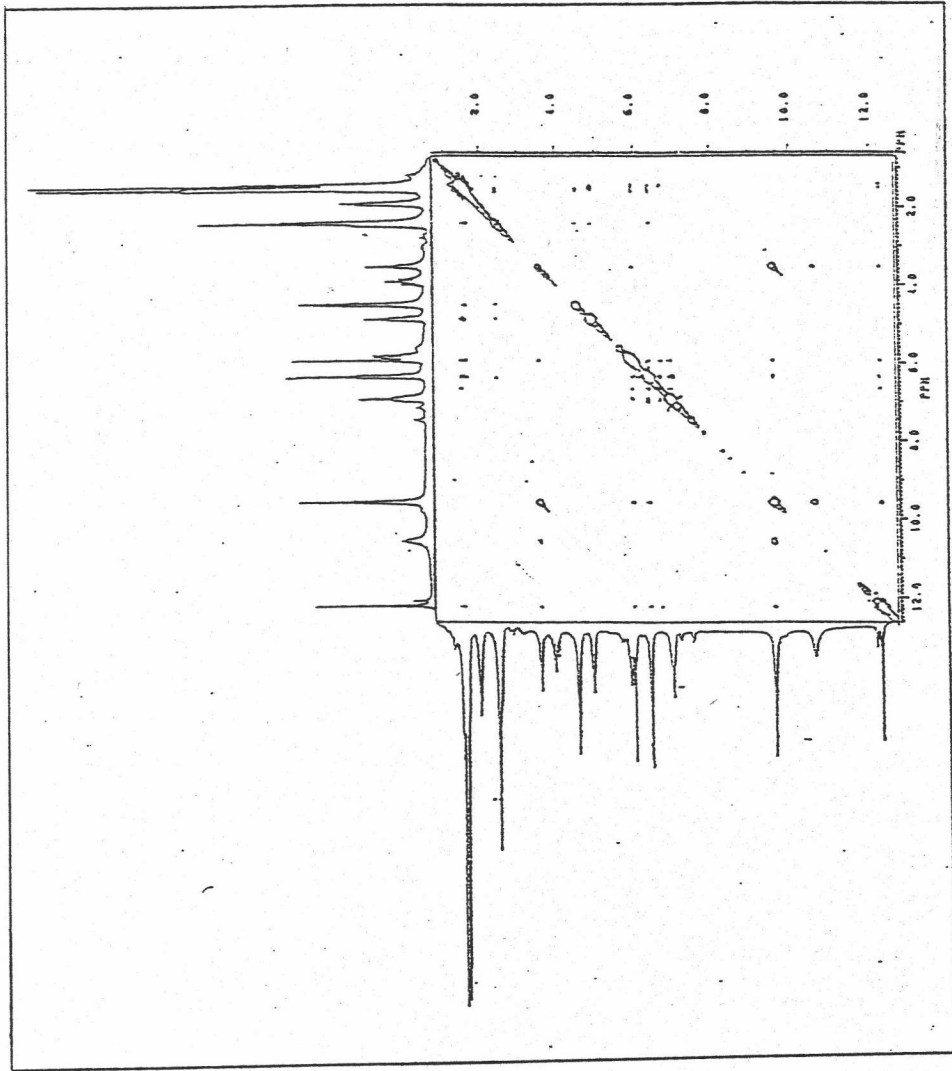
รูปที่ 30 DEPT 90 เอ็มเอ็มอาร์สเปกตรัมของสาร 4



รูปที่ 31 DEPT 135 เอ็มเอ็มอาร์สเปคตรัมของสาร 4



รูปที่ 32  $^1\text{H}$ - $^1\text{H}$  COSY ของสาร 4



รูปที่ 33  $^1\text{H}$ - $^1\text{H}$  NOESY ของสาร 4

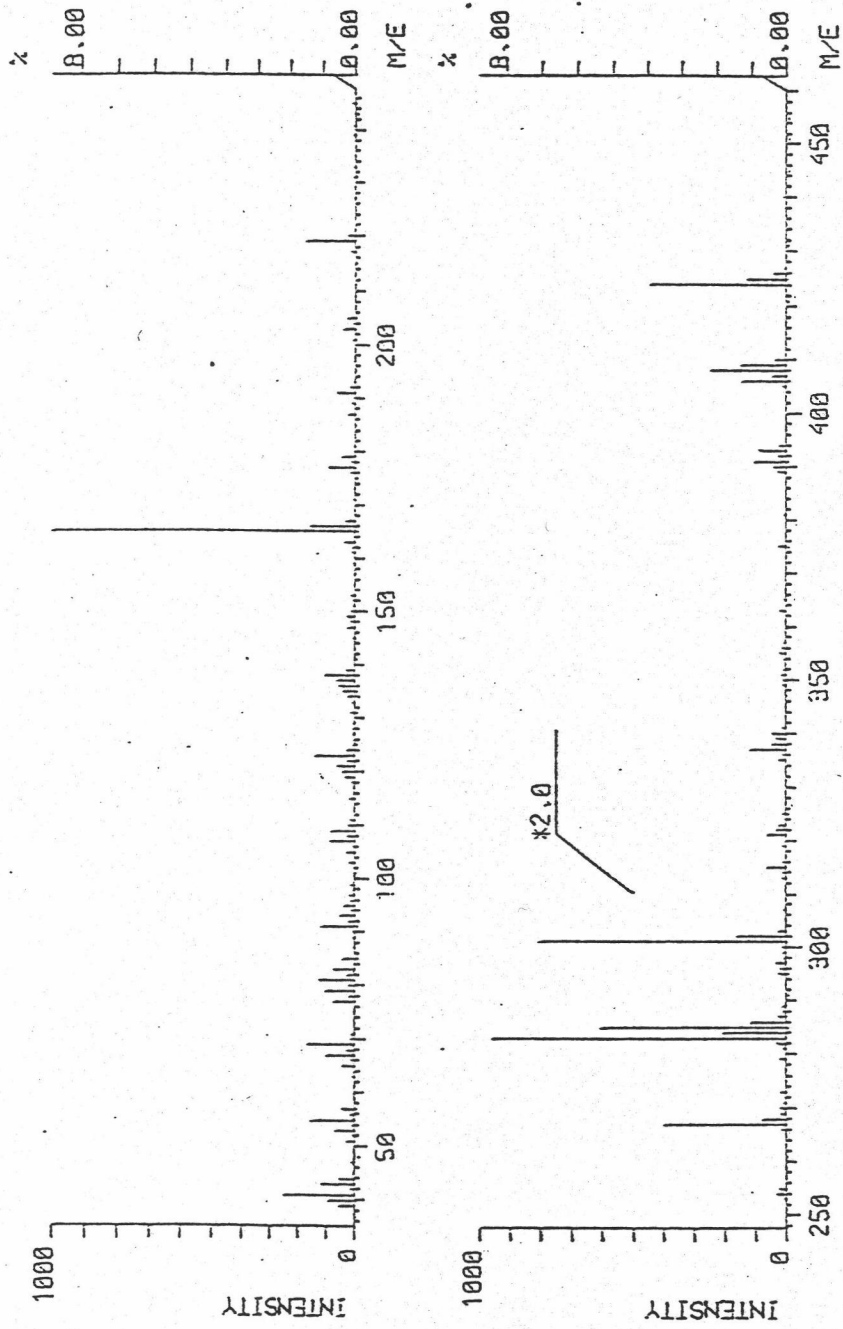
MASS SPECTRUM : (5 TO 7) : MASS SPECTRUM : (5 TO 7) :  
 SAMPLE:NO.4 29 JUL 92 SAMPLE:NO.4 29 JUL 92  
 NOTE : 371/2 EI, 70V, 300UA, CHAMB, TEMPT.160 TEMPT.160  
 BASE PEAK : M/E 165.0 INT. 537.6 BASE PEAK : M/E 165.0 INT. 537.6

| M/E   | RAW INT. | R. INT. | SIGMA(%) | M/E   | RAW INT. | R. INT. | SIGMA(%) | M/E   | RAW INT. | R. INT. | SIGMA(%) |
|-------|----------|---------|----------|-------|----------|---------|----------|-------|----------|---------|----------|
| 41.0  | 134.0    | 250.7   | 15.91    | 149.0 | 17.0     | 33.2    | 0.55     | 426.0 | 11.0     | 22.0    | 55.73    |
| 43.0  | 63.7     | 110.5   | 8.00     | 163.0 | 20.6     | 30.4    | 0.64     | 427.0 | 2.4      | 4.5     | 11.46    |
| 55.0  | 83.7     | 155.7   | 10.50    | 165.0 | 537.6    | 1000.0  | 16.78    | 430.0 | 2.6      | 4.0     | 12.32    |
| 67.0  | 54.9     | 102.2   | 6.09     | 166.0 | 87.6     | 163.0   | 2.73     | 439.0 | 0.9      | 1.0     | 4.58     |
| 69.0  | 90.0     | 167.5   | 11.30    | 167.0 | 19.0     | 37.0    | 0.62     | 440.0 | 2.5      | 4.0     | 12.17    |
| 79.0  | 56.5     | 105.2   | 7.10     | 177.0 | 49.9     | 92.9    | 1.56     | 441.0 | 0.7      | 1.4     | 3.72     |
| 81.0  | 68.3     | 127.0   | 8.57     | 179.0 | 26.0     | 49.0    | 0.83     |       |          |         |          |
| 91.0  | 64.2     | 119.4   | 8.05     | 177.3 | 17.3     | 32.3    | 0.54     |       |          |         |          |
| 107.0 | 49.4     | 91.9    | 6.20     | 186.1 | 36.1     | 67.2    | 1.12     |       |          |         |          |
| 123.0 | 75.2     | 139.9   | 9.44     | 203.0 | 22.4     | 41.7    | 0.70     |       |          |         |          |
| 130.0 | 55.7     | 103.7   | 6.99     | 219.0 | 94.1     | 175.0   | 2.93     |       |          |         |          |
|       |          |         |          | 254.0 | 17.5     | 32.6    | 0.54     |       |          |         |          |
|       |          |         |          | 267.0 | 216.5    | 402.0   | 6.76     |       |          |         |          |
|       |          |         |          | 268.0 | 43.0     | 80.0    | 1.34     |       |          |         |          |
|       |          |         |          | 282.0 | 18.0     | 33.6    | 0.56     |       |          |         |          |
|       |          |         |          | 283.0 | 517.1    | 961.0   | 16.14    |       |          |         |          |
|       |          |         |          | 284.0 | 111.2    | 206.9   | 3.47     |       |          |         |          |
|       |          |         |          | 285.0 | 323.2    | 603.0   | 10.15    |       |          |         |          |
|       |          |         |          | 286.0 | 63.2     | 117.6   | 1.97     |       |          |         |          |
|       |          |         |          | 297.0 | 19.7     | 36.7    | 0.61     |       |          |         |          |
|       |          |         |          | 301.0 | 433.2    | 805.9   | 13.52    |       |          |         |          |
|       |          |         |          | 302.0 | 86.1     | 160.3   | 2.69     |       |          |         |          |
|       |          |         |          | 315.0 | 17.4     | 32.4    | 0.54     |       |          |         |          |
|       |          |         |          | 321.0 | 17.3     | 32.1    | 0.54     |       |          |         |          |
|       |          |         |          | 337.0 | 32.2     | 60.0    | 1.00     |       |          |         |          |
|       |          |         |          | 391.0 | 28.4     | 52.0    | 0.80     |       |          |         |          |
|       |          |         |          | 393.0 | 23.9     | 44.5    | 0.74     |       |          |         |          |
|       |          |         |          | 406.0 | 39.0     | 74.1    | 1.24     |       |          |         |          |
|       |          |         |          | 408.0 | 66.7     | 124.2   | 2.08     |       |          |         |          |
|       |          |         |          | 409.0 | 39.9     | 74.3    | 1.24     |       |          |         |          |
|       |          |         |          | 424.0 | 120.7    | 224.5   | 3.76     |       |          |         |          |
|       |          |         |          | 425.0 | 34.9     | 64.9    | 1.00     |       |          |         |          |

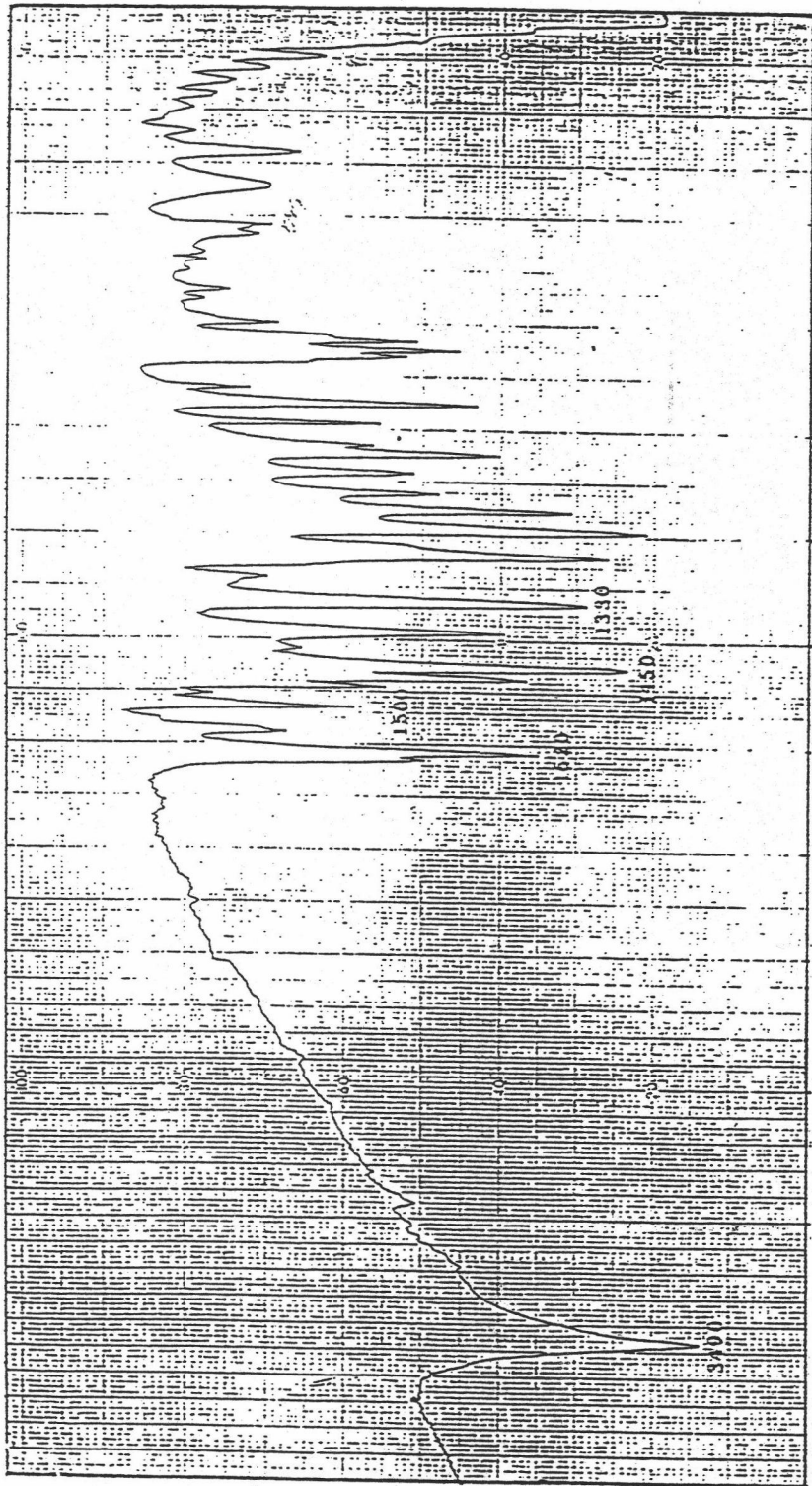
ข้อมูลแม่สเปกตรัมของสาร 4



MASS SPECTRUM : (5 TO 7)  
SAMPLE NO: 4 29 JUL 92  
NOTE : 3711/2 E.I, 10V, 3000VA, CHAMB, TEMP, 160  
BASE PEAK : M/E 165.0 INT, 537.6



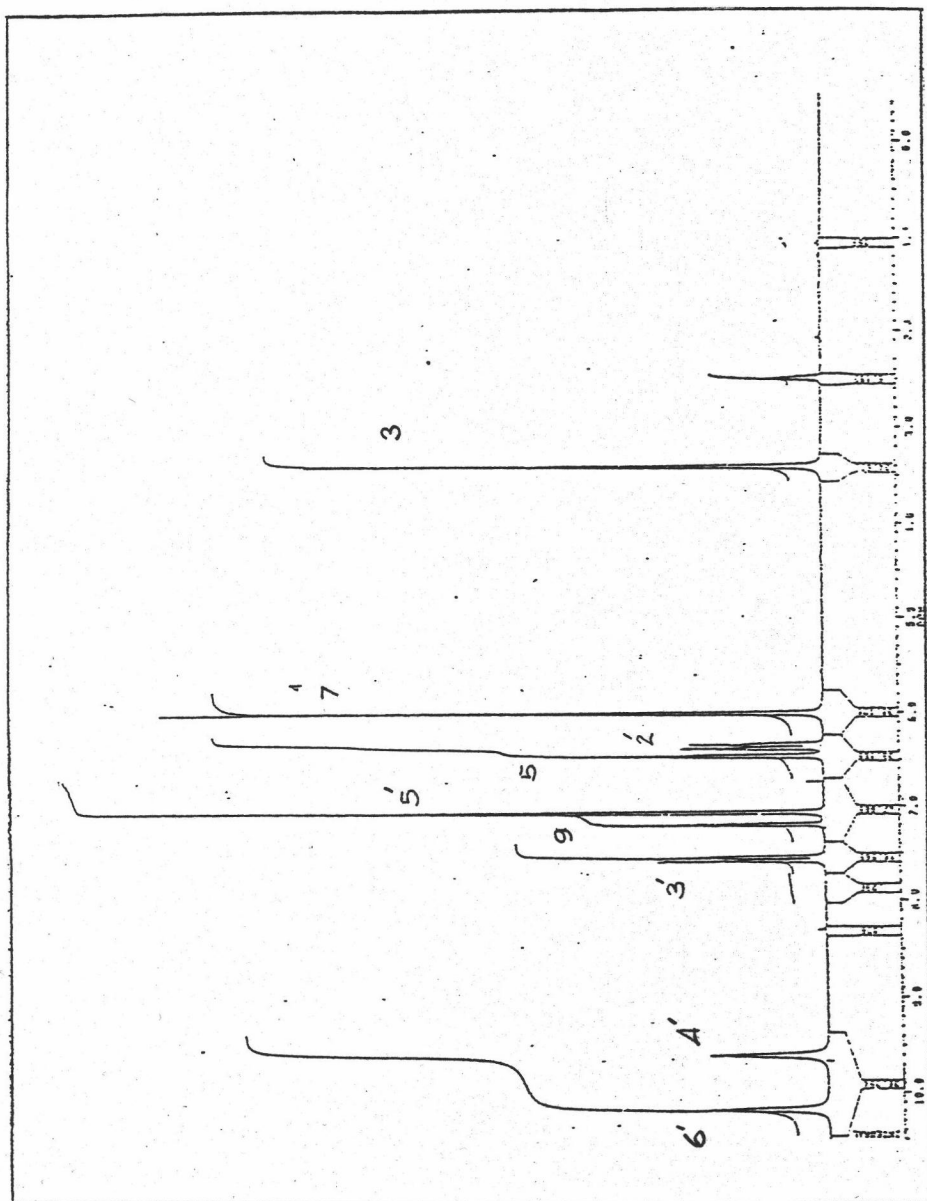
รูปที่ 34 แมสสเปคตรัมของสาร 4



รูปที่ 35 อินฟราเรดสเปกตรัมของสาร 5

| STMSOIH                    |        | MIN. INTENSITY = 1.675 |         | MAXY = 25.00000 |  | FP CONSTANT = .50000 |  |
|----------------------------|--------|------------------------|---------|-----------------|--|----------------------|--|
| INTENS. LEVEL = 2101.41 HZ |        | 1.675                  |         | 1016E = 7.59509 |  | SENS. LEVEL = .02635 |  |
| F1 = 2101.41 HZ            |        | 10.5001 PPM            |         | F2 = -99.77 HZ  |  | - .4VBS PPM          |  |
| #                          | CURSOR | FREQUENCY              | PPM     | INTENSITY       |  |                      |  |
| 1                          | 2470   | 2037.801               | 10.1822 | 3.954           |  |                      |  |
| 2                          | 2766   | 1921.810               | 9.6026  | 3.955           |  |                      |  |
| 3                          | 3793   | 1520.010               | 7.59509 | 5.572           |  |                      |  |
| 4                          | 3800   | 1517.437               | 7.5821  | 3.451           |  |                      |  |
| 5                          | 3815   | 1511.474               | 7.5523  | 5.968           |  |                      |  |
| 6                          | 3993   | 1411.865               | 7.2005  | 7.498           |  |                      |  |
| 7                          | 4058   | 1416.210               | 7.0763  | 16.895          |  |                      |  |
| 8                          | 4061   | 1415.149               | 7.0710  | 17.510          |  |                      |  |
| 9                          | 4345   | 1296.049               | 6.4759  | 5.345           |  |                      |  |
| 10                         | 4371   | 1293.781               | 6.4616  | 9.401           |  |                      |  |
| 11                         | 4409   | 1278.943               | 6.3905  | 3.520           |  |                      |  |
| 12                         | 4415   | 1275.579               | 6.3791  | 4.685           |  |                      |  |
| 13                         | 4431   | 1270.400               | 6.3478  | 3.128           |  |                      |  |
| 14                         | 4437   | 1268.172               | 6.3366  | 4.429           |  |                      |  |
| 15                         | 4601   | 1203.847               | 6.0153  | 21.919          |  |                      |  |
| 16                         | 5933   | 682.557                | 3.4105  | 17.564          |  |                      |  |
| 17                         | 6403   | 499.003                | 2.4934  | 1.714           |  |                      |  |

ข้อมูลปรตอนเป็นเส้นอาร์สเปคตรัมของสาร 5



รูปที่ 36 ปรอทอนเน็มอาร์สเปคตรัมของสาร 5

MI= 2.634 U

SUM.010  
 MIN. INTENSITY = 2.634  
 INTENS. LEVEL = 2.634  
 F1 = 10568.35 HZ = 210.0000 PPM

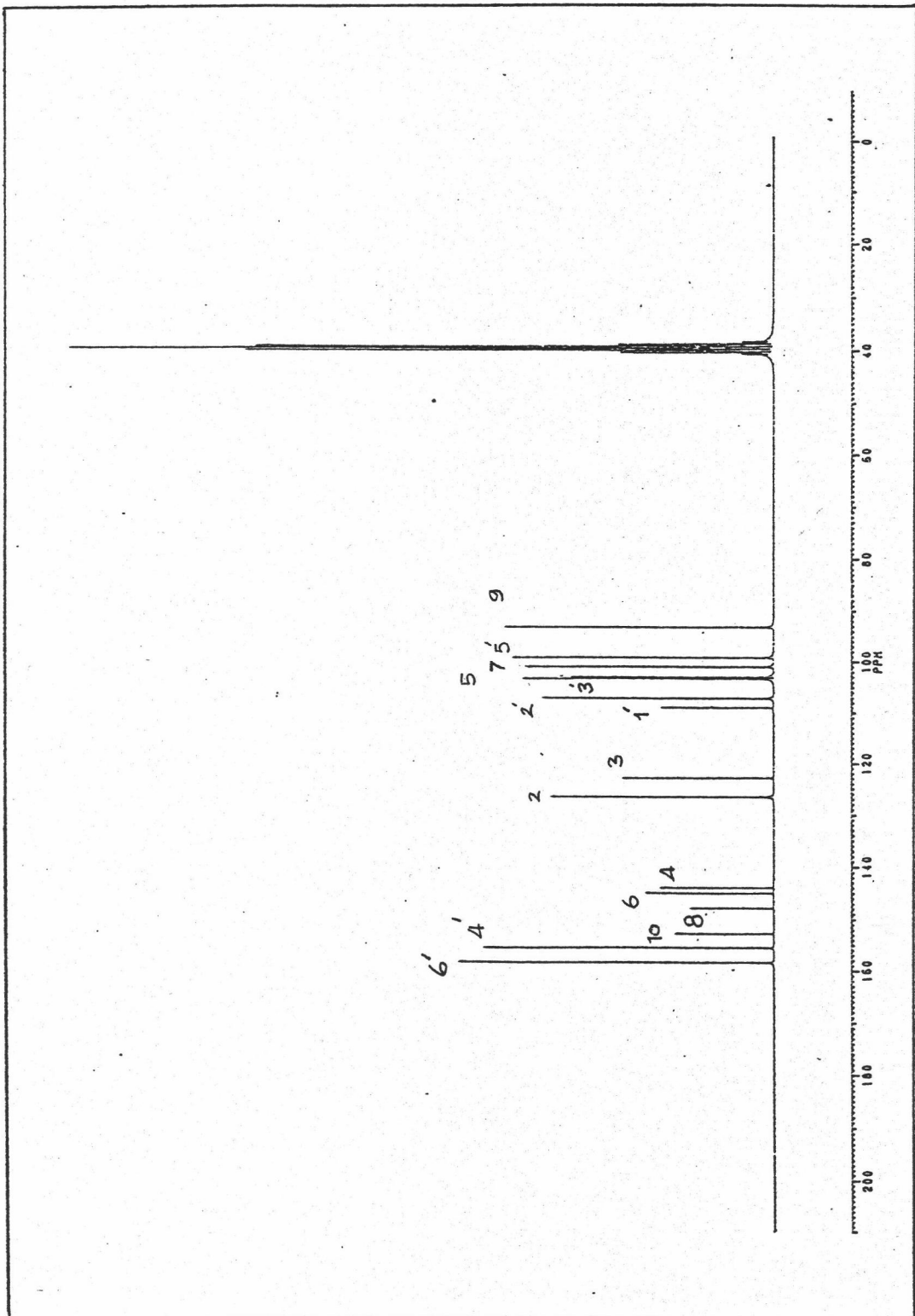
MAXY = 25.00000  
 NOISE = .00390  
 F2 = -502.43 HZ = -9.9840 PPM

PP CONSTANT = .50000  
 SENS. LEVEL = .00796

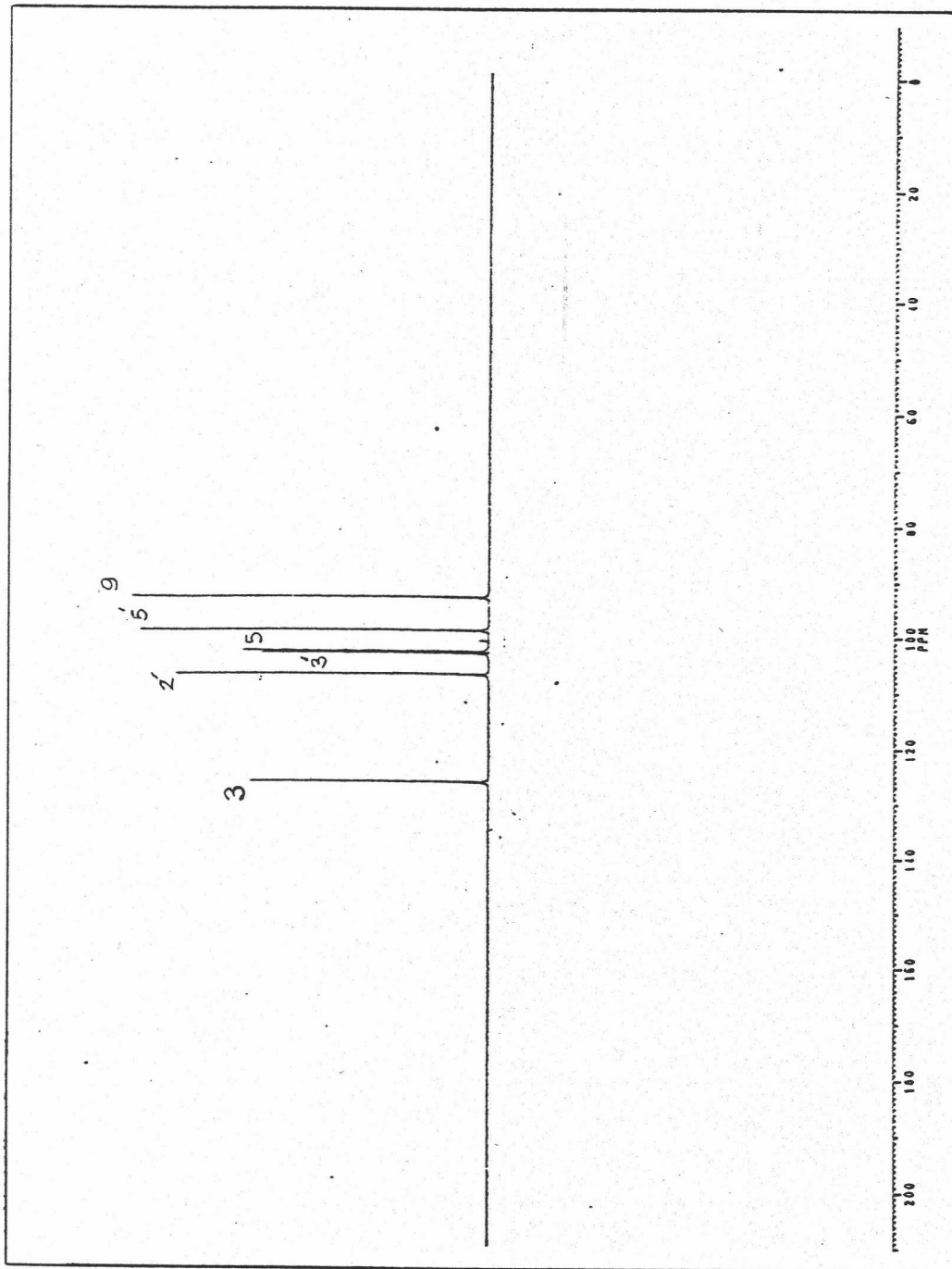
| #  | CURSOR | FREQUENCY | PPM      | INTENSITY |
|----|--------|-----------|----------|-----------|
| 1  | 5088   | 7970.918  | 158.3933 | 10.108    |
| 2  | 5292   | 7825.959  | 155.5128 | 9.261     |
| 3  | 5486   | 7688.512  | 152.7815 | 3.170     |
| 4  | 5834   | 7441.651  | 147.8760 | 2.748     |
| 5  | 6037   | 7297.235  | 145.0053 | 4.070     |
| 6  | 6112   | 7244.393  | 143.9563 | 3.772     |
| 7  | 7344   | 6369.583  | 126.5726 | 7.149     |
| 8  | 7604   | 6184.992  | 122.9045 | 4.911     |
| 9  | 8592   | 5484.208  | 108.9789 | 3.647     |
| 10 | 8720   | 5392.985  | 107.1652 | 7.436     |
| 11 | 8990   | 5201.758  | 103.3662 | 8.183     |
| 12 | 9017   | 5182.223  | 102.9780 | 6.501     |
| 13 | 9155   | 5084.662  | 101.0394 | 8.007     |
| 14 | 9284   | 4992.864  | 99.2152  | 8.311     |
| 15 | 9710   | 4690.699  | 93.2109  | 8.672     |
| 16 | 13457  | 2031.040  | 40.3558  | 4.922     |
| 17 | 13488  | 2009.490  | 39.9316  | 16.821    |
| 18 | 13518  | 1989.153  | 39.5096  | 22.342    |
| 19 | 13540  | 1967.000  | 39.0890  | 16.647    |
| 20 | 13578  | 1945.590  | 38.6618  | 5.026     |

MI= 1.675 U

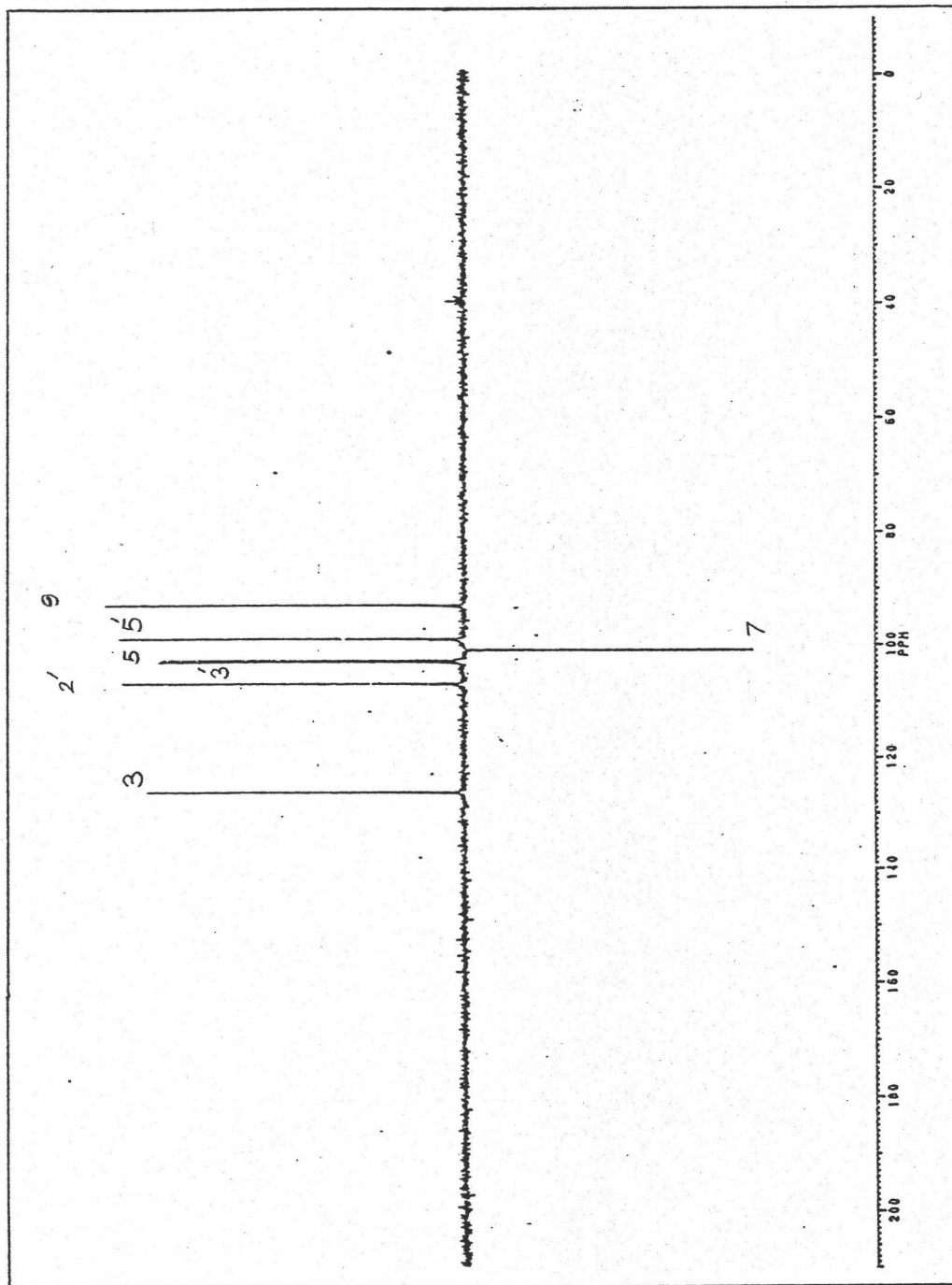
ข้อมูลคาร์บอน-13 เอ็มเอ็มอาร์สเปกตรัมของสาร 5



รูปที่ 37 คาร์บอน-13 เอ็นเอ็มอาร์สเปกตรัมของสาร 5

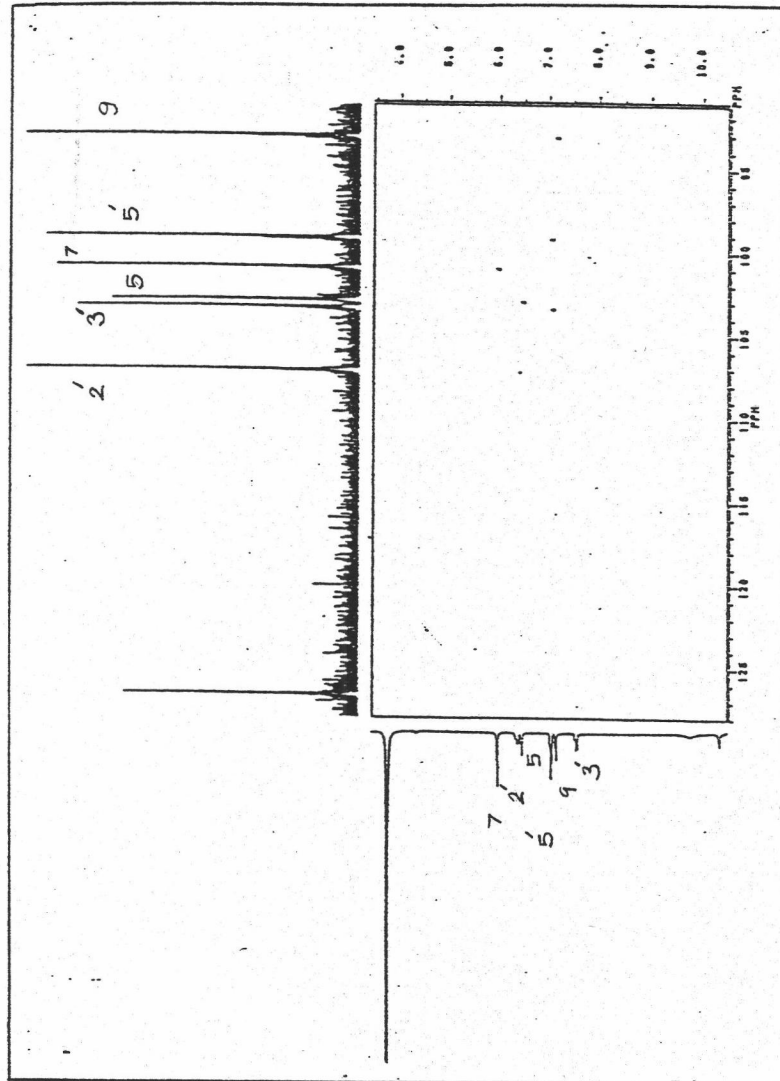


รูปที่ 38 DEPT 90 เอ็มเอ็มอาร์สเปกตรัมของสาร 5

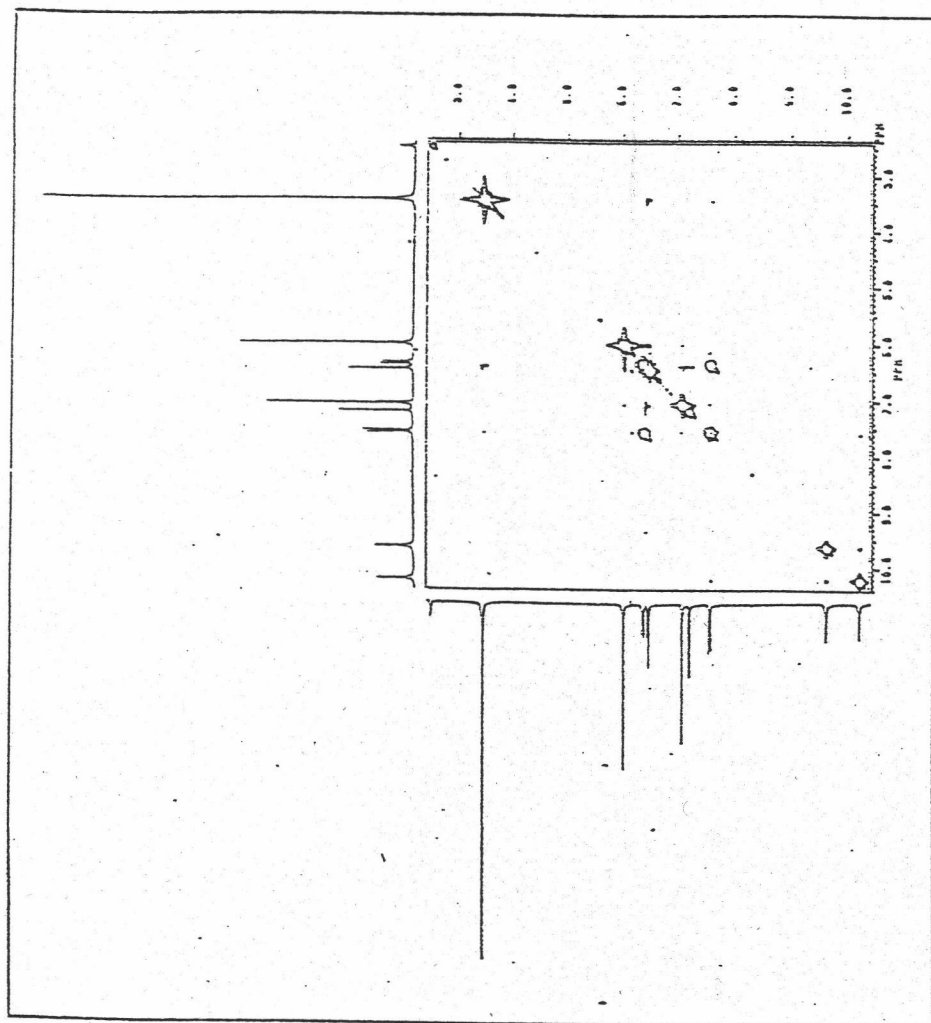


รูปที่ 39 DEPT 135 เอ็มเออาร์สเปคตรัมของสาร 5

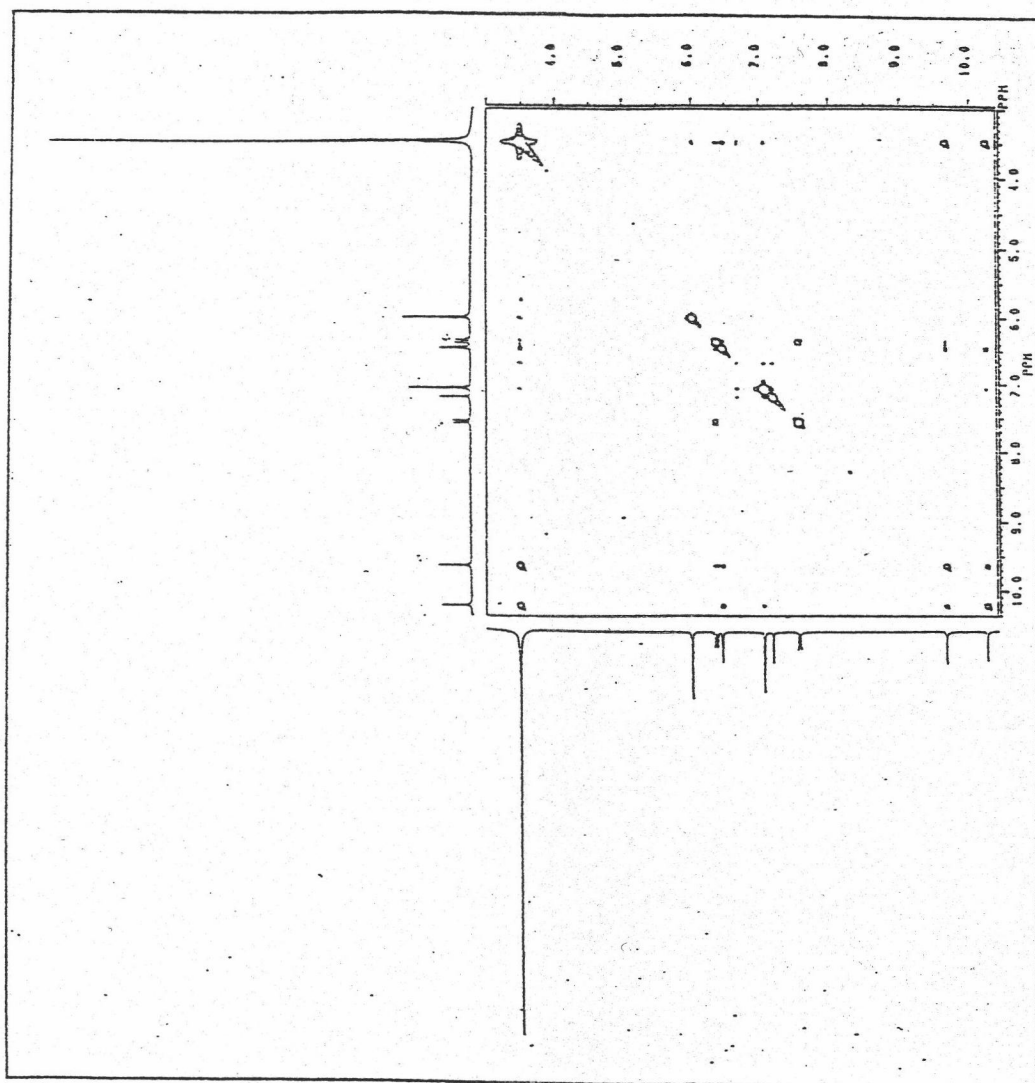




รูปที่ 40 C-H CORRELATION ของสาร 5



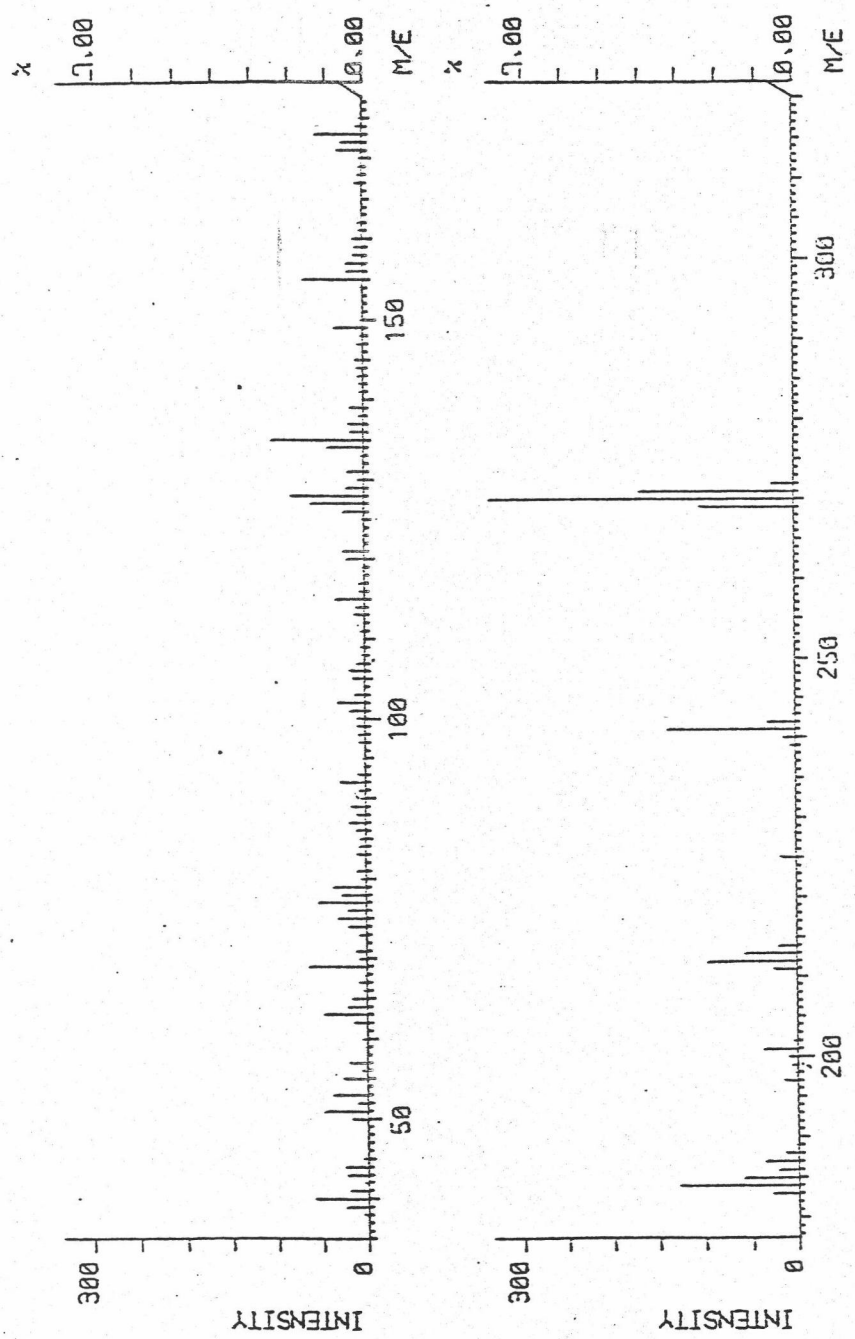
รูปที่ 41  $^1\text{H}$ - $^1\text{H}$  Cosy ของสาร 5



รูปที่ 42  $^1\text{H}$ - $^1\text{H}$  NOESY ของสาร 5

| MASS SPECTRUM : (5 TO 8)                      |          |         |          | MASS SPECTRUM : (5 TO 8)                      |          |         |          |
|---|----------|---------|----------|---|----------|---------|----------|
| SAMPLE NO.5 29 JUL 92                         |          |         |          | SAMPLE NO.5 29 JUL 92                         |          |         |          |
| NOTE : 372/2 EI, 10V, 300UA, CIAMB, TEMP. 140 |          |         |          | NOTE : 372/2 EI, 10V, 300UA, CIAMB, TEMP. 140 |          |         |          |
| BASE PEAK : M/E 270.0 INT. 652.1              |          |         |          | BASE PEAK : M/E 270.0 INT. 652.1              |          |         |          |
| M/E   | RAW INT. | R. INT. | SIGMA(x) | M/E   | RAW INT. | R. INT. | SIGMA(x) |
| 40.0  | 39.7     | 60.1    | 11.06    | 120.0   | 13.0     | 20.9    | 0.78     |
| 51.0  | 32.0     | 48.3    | 9.55     | 124.4   | 16.2     | 25.6    | 0.96     |
| 53.0  | 25.9     | 39.1    | 7.72     | 126.0   | 16.9     | 25.6    | 0.96     |
| 63.0  | 32.3     | 48.0    | 9.63     | 127.0   | 39.9     | 60.3    | 2.26     |
| 69.0  | 42.9     | 64.0    | 12.79    | 129.0   | 54.5     | 82.4    | 3.09     |
| 75.0  | 21.2     | 32.0    | 6.32     | 137.0   | 13.7     | 20.7    | 0.70     |
| 77.0  | 36.1     | 54.5    | 10.77    | 131.0   | 13.1     | 19.9    | 0.74     |
| 78.0  | 10.0     | 28.5    | 5.63     | 140.0   | 27.1     | 40.9    | 1.53     |
| 79.0  | 10.5     | 37.0    | 7.31     | 135.0   | 69.2     | 104.6   | 3.52     |
| 92.0  | 10.7     | 28.3    | 5.59     | 139.0   | 11.9     | 10.0    | 0.67     |
| 102.0   | 20.3     | 30.7    | 6.07     | 149.0   | 22.0     | 33.3    | 1.25     |
| 115.0   | 22.4     | 33.0    | 6.68     | 155.0   | 45.1     | 68.2    | 2.56     |
|   |          |         |          | 156.0   | 12.7     | 19.2    | 0.72     |
|   |          |         |          | 157.0   | 13.0     | 19.7    | 0.74     |
|   |          |         |          | 171.0   | 19.3     | 29.2    | 1.09     |
|   |          |         |          | 172.0   | 16.0     | 24.1    | 0.90     |
|   |          |         |          | 173.0   | 34.9     | 52.0    | 1.90     |
|   |          |         |          | 183.0   | 20.1     | 30.4    | 1.14     |
|   |          |         |          | 184.0   | 85.3     | 128.9   | 4.04     |
|   |          |         |          | 185.0   | 39.5     | 59.7    | 2.24     |
|   |          |         |          | 186.0   | 14.9     | 22.0    | 0.82     |
|   |          |         |          | 187.0   | 24.9     | 36.7    | 1.37     |
|   |          |         |          | 201.0   | 24.5     | 37.1    | 1.39     |
|   |          |         |          | 211.0   | 16.9     | 25.5    | 0.96     |
|   |          |         |          | 212.0   | 63.5     | 95.9    | 3.60     |
|   |          |         |          | 213.0   | 30.1     | 57.5    | 2.16     |
|   |          |         |          | 214.0   | 13.3     | 20.1    | 0.75     |
|   |          |         |          | 225.0   | 11.5     | 17.5    | 0.65     |
|   |          |         |          | 241.0   | 91.6     | 130.3   | 5.19     |
|   |          |         |          | 242.0   | 21.1     | 31.0    | 1.19     |
|   |          |         |          | 269.0   | 66.9     | 101.0   | 3.79     |
|   |          |         |          | 270.0   | 652.1    | 1000.0  | 37.54    |
|   |          |         |          | 271.0   | 112.7    | 170.3   | 6.39     |
|   |          |         |          | 272.0   | 16.3     | 24.6    | 0.92     |
|   |          |         |          |   |          |         | END      |

MASS SPECTRUM : (5 TO 8)  
SAMPLE NO. 5 29 JUL 92  
NOTE : 372/2 EI, 70V, 300UA, CHAMB, TEMP, 140  
BASE PEAK : M/E 270.0 INT, 562.1



รูปที่ 43 แมสสเปคตรัมของสาร 5

## ประวัติผู้เขียน

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เมื่อปีการศึกษา 2529 เข้ารับการศึกษาในระดับปริญญาโทบัณฑิต สาขาอินทรีย์เคมี ภาควิชาเคมี  
คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย เมื่อปีการศึกษา 2533.

๕๑๖๐