## REFERENCES


1. Poporich, M., and Carl, H. Fuel and lubricants. New York: John Wiley & Sons. 1959, pp. 135-136.
2. William, K. Diesel fundamental. South Holland: The goodheart-willcox company. 1988, pp. 25-31.
3. Robert, W. Lubricants and their applications. 3 rd ed. New York: McGraw-Hill, 1988, pp. 144-150.
4. Richard, B. Marker for petroleum fuels. US 4,209,302. 1980.
5. Richard, B. Colored petroleum markers. US 4,735,631. 1988.
6. Hallisy, M. J. Base extractable petroleum markers. US 5,252,106. 1993.
7. Smith, M. J. Fluorescent petroleum markers. US 5,498,808. 1996.
8. Swern, D. Beiley's industrial oil and fat products. Vol. 1. New York: Eric Jungerman. 1979, pp. 374-382.
9. องอาจ ธเนศนิตย์. การศึกษาองค์ประกอบทางเคมีของน้ำมันปาล์ม.วิทยาศาตร บัณฑิต ภาควิชาเคมี คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, 2538.
10. Barton, O. Comprehensive organic chemistry. Vol. 2. Sutherland: Butterworth & Co. 1979, pp.871-889.
11. Zimmerman, I. , and Zimmerman, H. Elementals of organic chemistry. 2nd ed. New York: Macmillan Publishing. 1983, pp. 328-337.
12. March, J. Advanced organic chemistry. 3rd ed. USA: Willey & Sons. 1985, pp. 351-352, 691-699.
13. Liener, I. E. Organic and biological chemistry. New York: The Ronald Press Company. 1966, pp. 120-123.
14. Mark, H. F. Encyclopedia of chemical technology. Vol. 8, 2 nd ed. New York: Interscience Publishers. 1965, pp.45-47.

15. Robert, L. A. Oxidation. Vol. 1. New York: Marcel Dekker. 1969, pp 259-337.

16. Smith, M. B. Organic Synthesis. New York: McGrill-Hill international. 1994, pp. 306-308.

17. Furniss, B. S. , Hanasagord, A. J. , and Roger. V. Vogel's textbook of practical organic chemistry. 4 th ed. New York: Longman Group. 1978, pp. 82-86.

18. Beiley, P. S. Adipic acid by ozonolysis of clyclohexene. Ind. Eng. Chem. 50 (1958): 993-996.

19. Fremery, I. , and Ellis, K. Emulsion ozonization of clycloolefin in aqueous alkaline hydrogen peroxide. J. Org. chem. 48 (1963): 2537-2541.

20. Albert, L. , and Philip, H. The preparation of aldehydes, ketones, and acid by ozone oxidation. J. Am. Chem. Soc. 68 (1943): 752-754.

21. Mitchll, J. , and Kolthoff, I. M. Organic analysis. Vol. 2., New York: Interscience Publishers. 1954, pp. 20.

22. Feigl, F. Spot tests in organic analysis., New York: Elesevier Publishing. 1966, pp. 212-214.

# APPENDIX

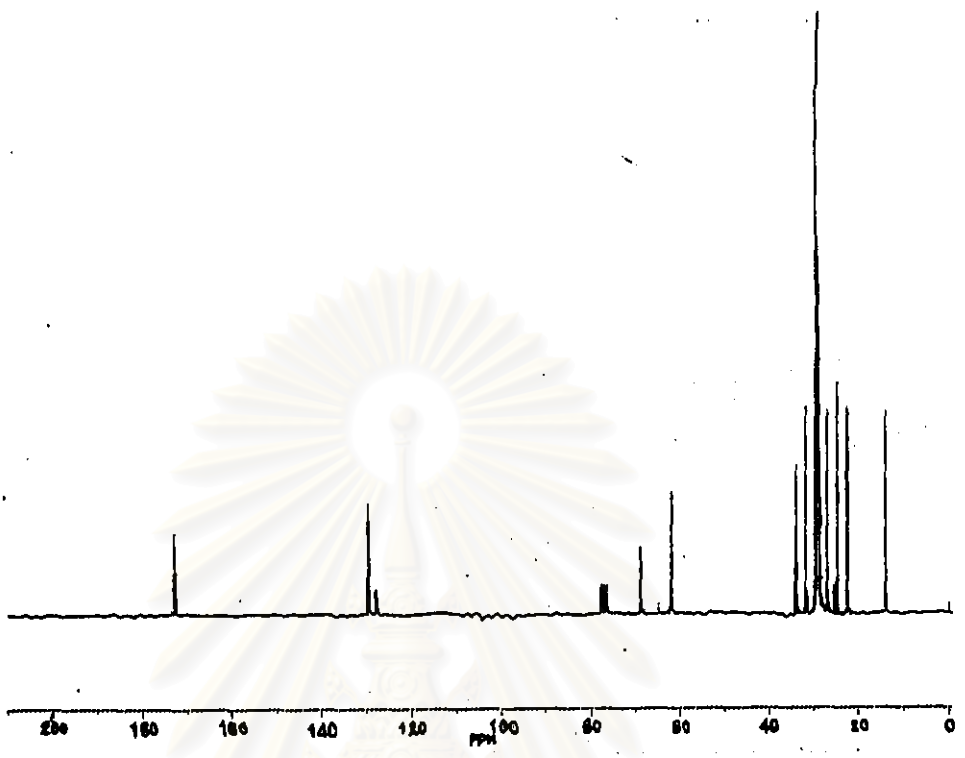



Fig. 1 The $^{13}$C-NMR spectrum of palm oil in $CDCl_3$

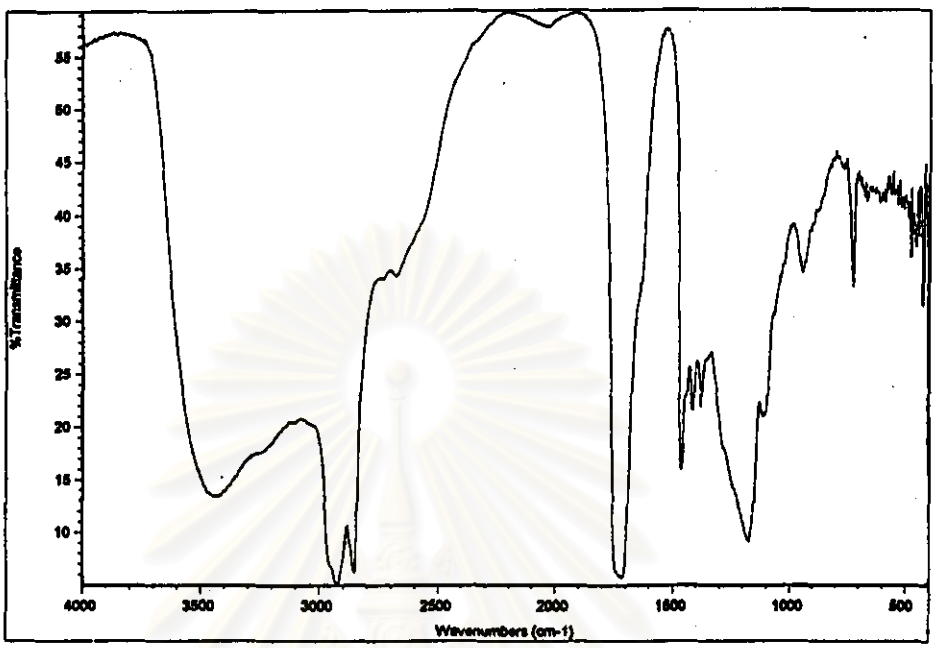



Fig. 2 The FT-IR spectrum of crude acid in KBr disc

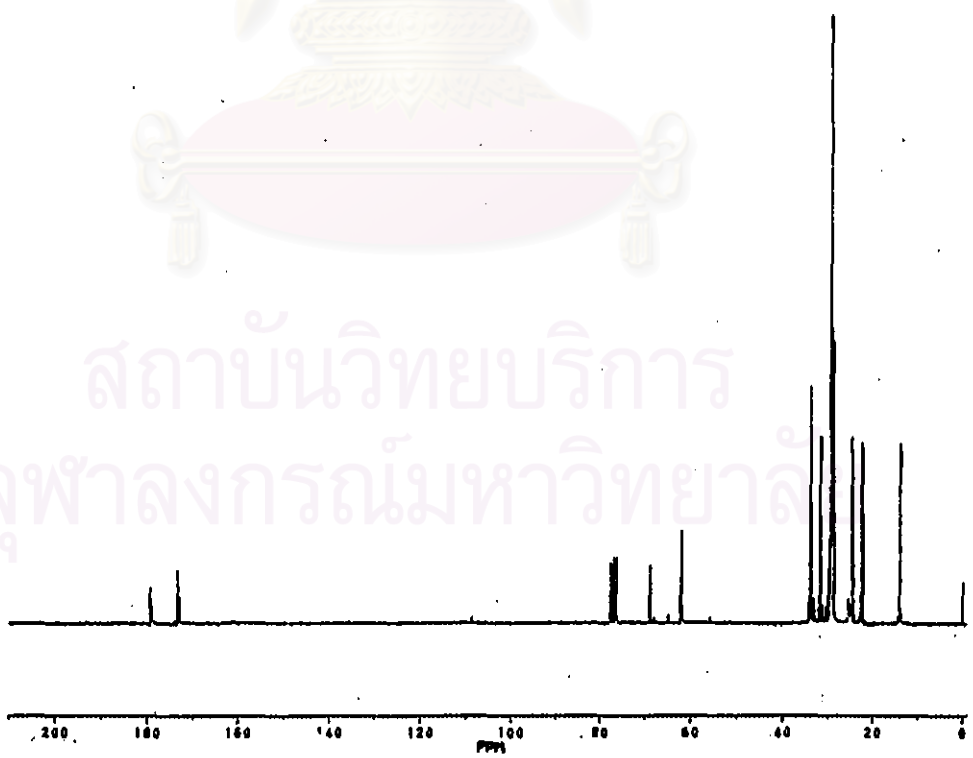



Fig. 3 The $^{13}$C-NMR spectrum of crude acid in $CDCl_3$

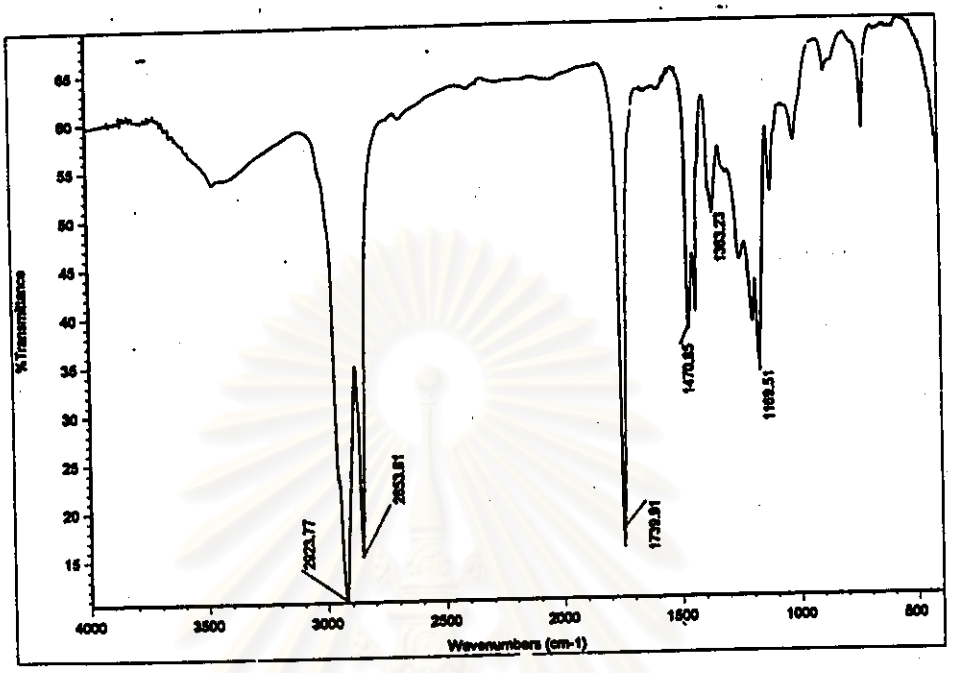



Fig. 4 The FT- IR spectrum of compound 1 in KBr disc

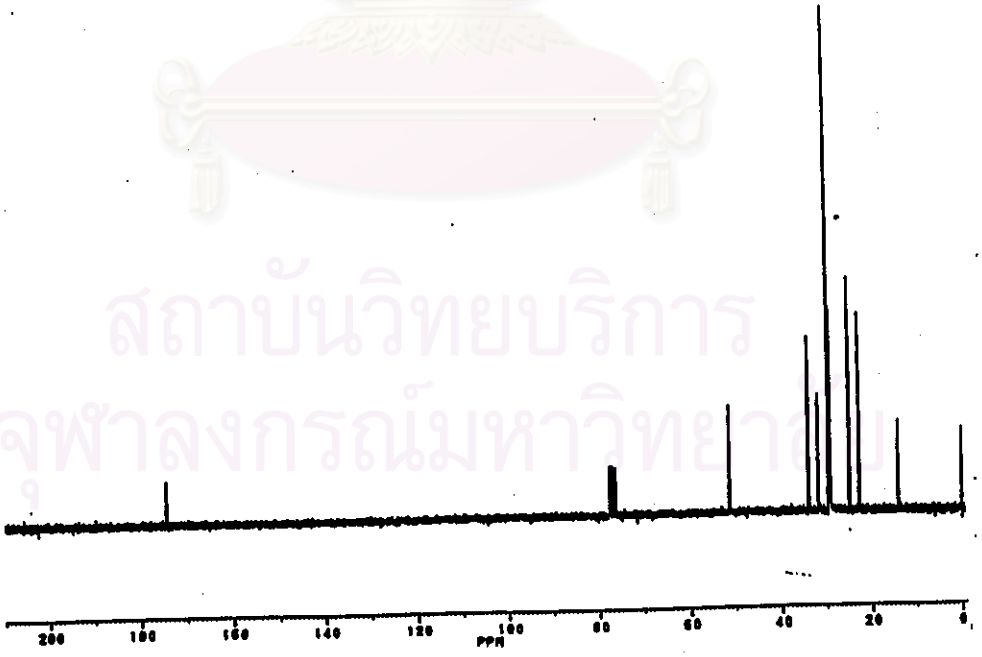



Fig.5 The $^{13}C$-NMR spectrum of compound 1 in $CDCl_3$

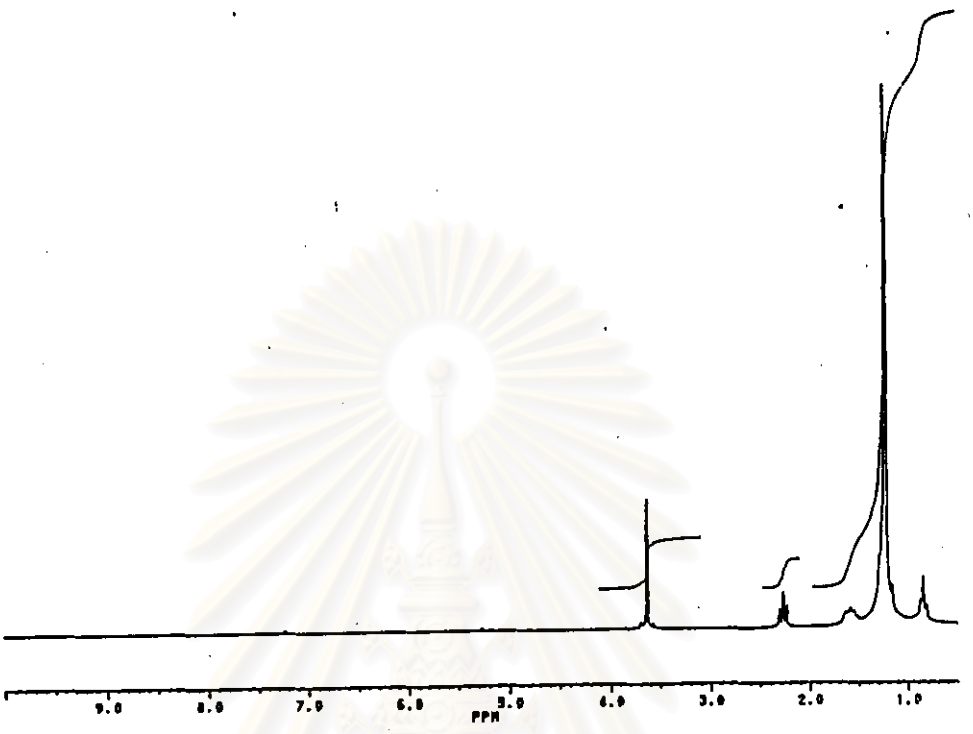



Fig. 6 The $^{1}$H-NMR spectrum of compound **1** in $CDCl_3$

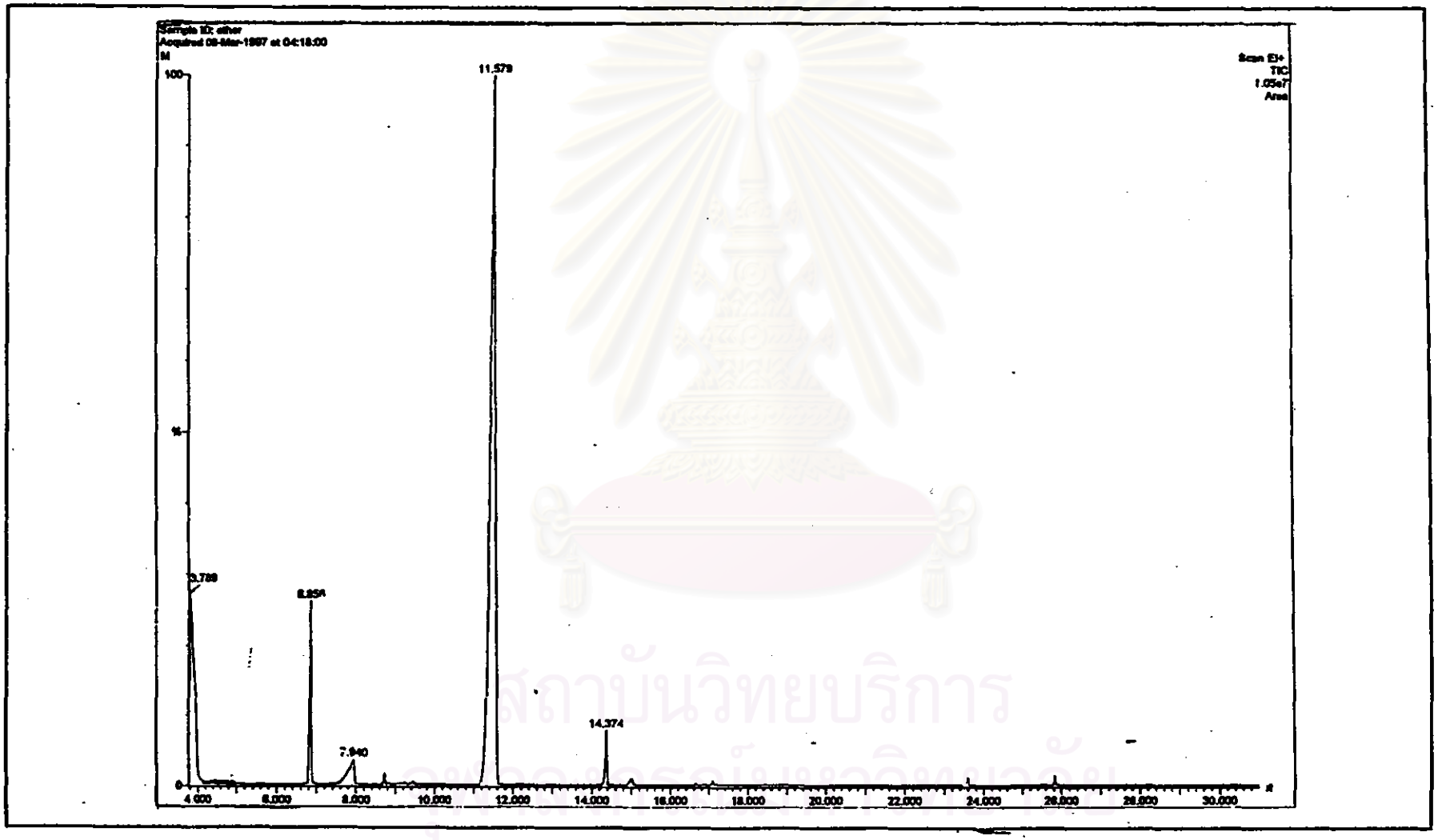



Fig. 7 The GC chromotogram of mixed methyl ester

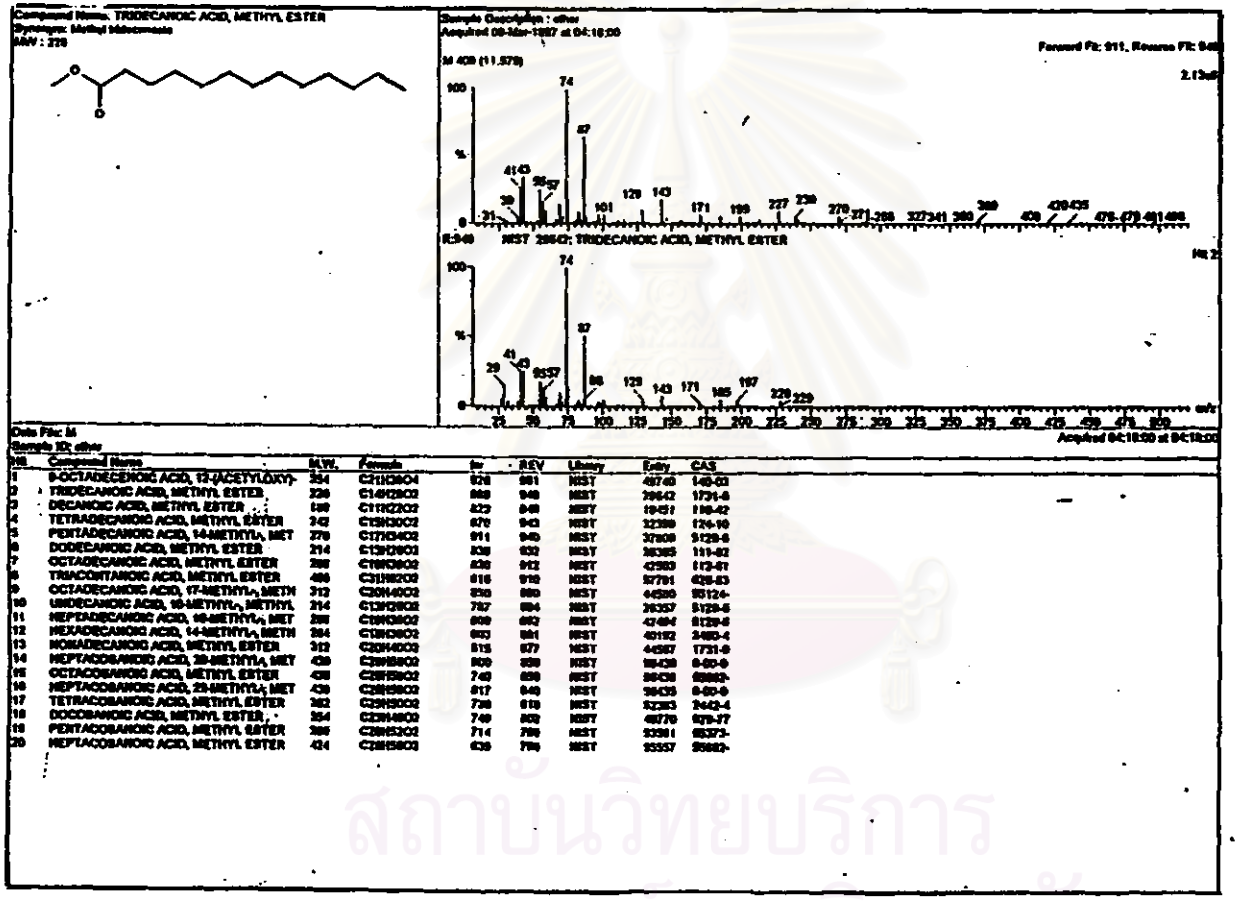



Fig. 8 The MS spectrum of compound 1

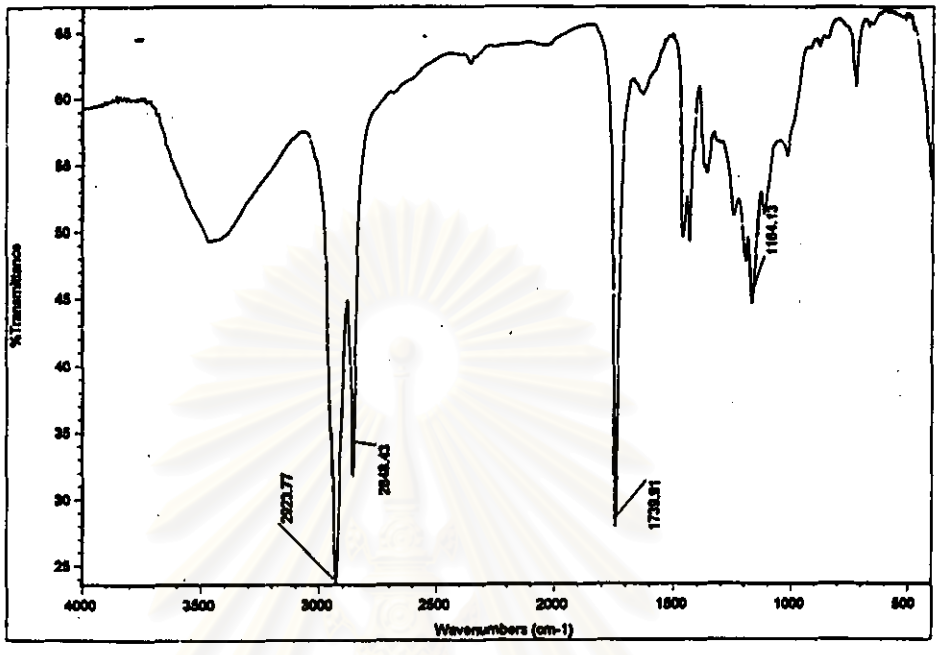



Fig. 9 The FT- IR spectrum of compound 2 in KBr disc

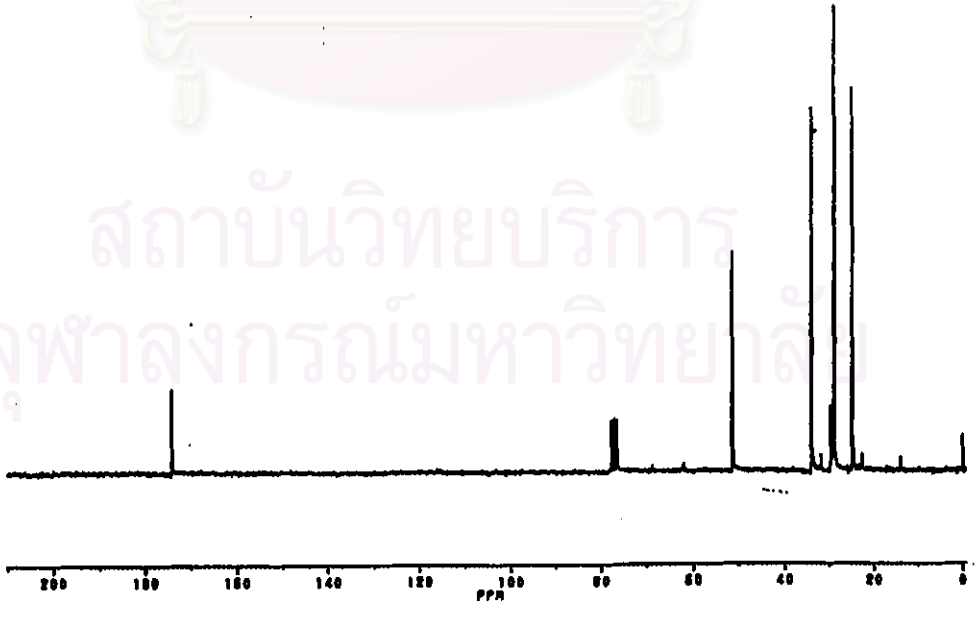



Fig. 10 The $^{13}C$-NMR spectrum of compound 2 in $CDCl_3$

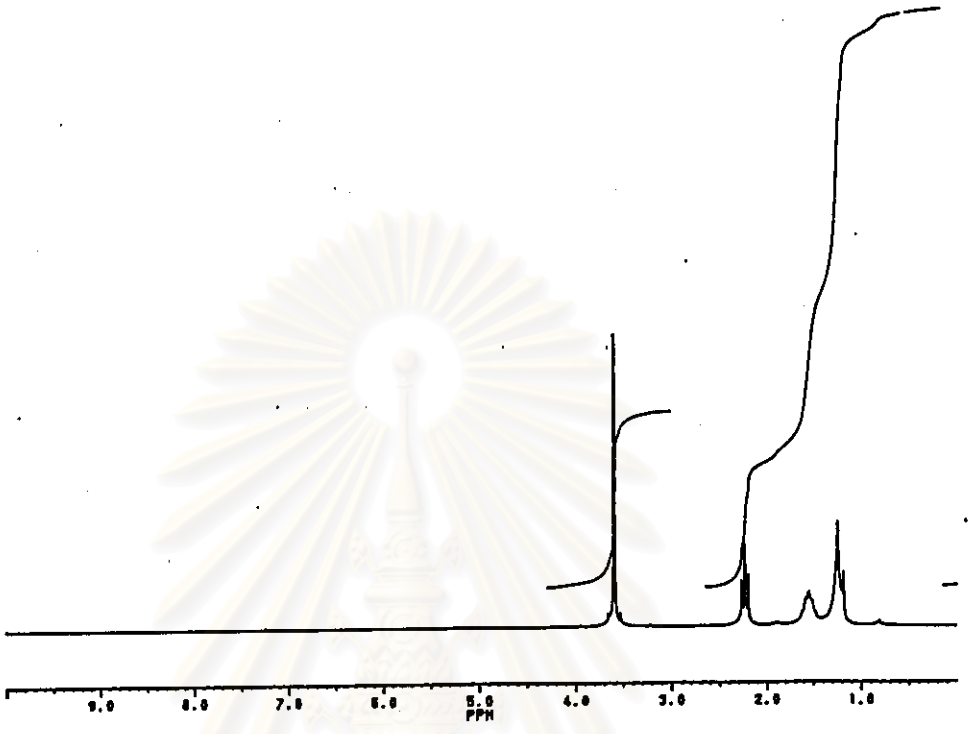
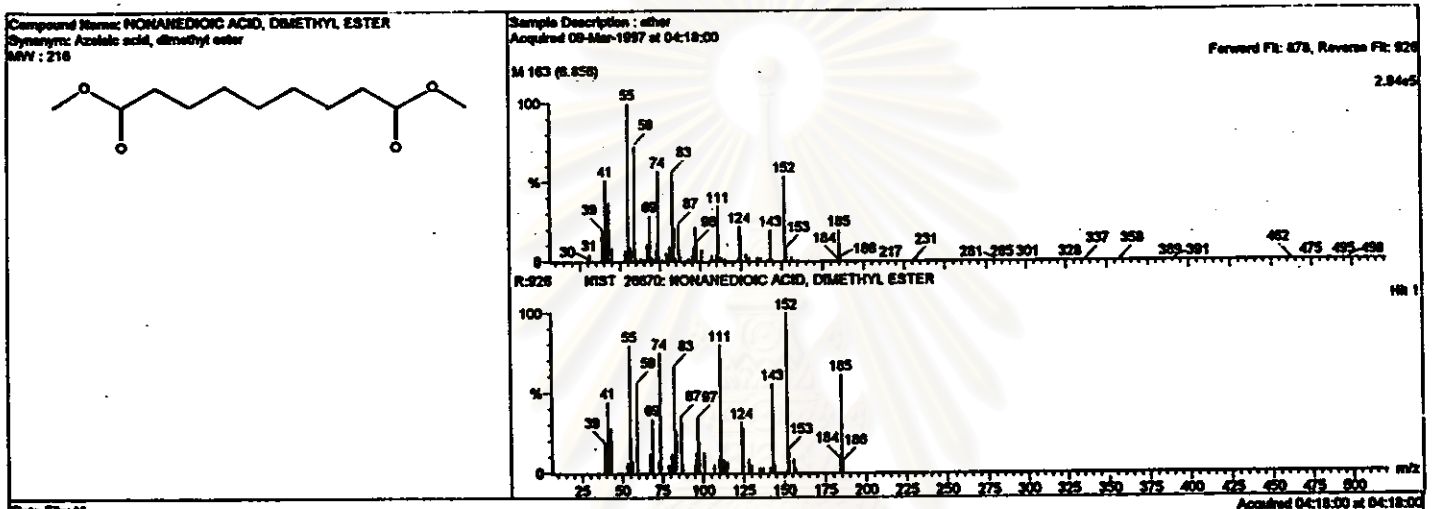



Fig. 11 The $^{1}$H-NMR spectrum of compound 2 in $CDCl_3$




Data File: M
Sample ID: ether

| NR | Compound Name | M.W. | Formula | for | REV | Library | Entry | CAS |
|---|---|---|---|---|---|---|---|---|
| 1 | NONANEDIOIC ACID, DIMETHYL ESTER | 216 | C11H20O4 | 879 | 926 | NIST | 28670 | 1732-1 |
| 2 | 3-OCTENOIC ACID, METHYL ESTER, (E)- | 156 | C9H16O2 | 520 | 857 | NIST | 11448 | 35234- |
| 3 | 10-UNDECENOIC ACID, METHYL ESTER | 198 | C12H22O2 | 684 | 840 | NIST | 22425 | 111-81 |
| 4 | MONOMETHYL PIMELATE | 174 | C8H14O4 | 518 | 822 | NIST | 18114 | 20291- |
| 5 | DIMETHYL 4-METHYLOCTANE-1,8-DIOATE | 216 | C11H20O4 | 744 | 820 | NIST | 28669 | 0-00-0 |
| 6 | NONANOIC ACID, 9-OXO-, METHYL ESTER | 188 | C10H18O3 | 644 | 820 | NIST | 19365 | 1931-6 |
| 7 | NONANEDIOIC ACID, MONOMETHYL ESTE | 202 | C10H18O4 | 755 | 819 | NIST | 23284 | 2104-1 |
| 8 | 3-TETRADECANOL | 214 | C14H30O | 573 | 809 | NIST | 28418 | 1653-3 |
| 9 | 4-OCTENOIC ACID, METHYL ESTER | 156 | C9H16O2 | 551 | 780 | NIST | 11460 | 1732-9 |
| 10 | AZELAIC ACID | 188 | C9H16O4 | 678 | 784 | NIST | 18788 | 123-99 |
| 11 | DODECANENITRILE, 2-METHYL- | 195 | C13H25N | 317 | 783 | NIST | 21810 | 85844- |
| 12 | OCTANEDIOIC ACID, 3-METHYL-, DIMETHY | 216 | C11H20O4 | 682 | 781 | NIST | 28671 | 5-6576- |
| 13 | DECANEDIOIC ACID, 3,8-DIMETHYL-, DIME | 258 | C14H26O4 | 633 | 769 | NIST | 35498 | 97224-2 |
| 14 | 3-OCTENOIC ACID, METHYL ESTER, (Z)- | 156 | C9H16O2 | 606 | 766 | NIST | 11478 | 69668- |
| 15 | 4-OCTENOIC ACID, METHYL ESTER, (Z)- | 156 | C9H16O2 | 580 | 758 | NIST | 11428 | 21063- |
| 16 | DECANEDIOIC ACID, 4,7-DIMETHYL-, DIME | 258 | C14H26O4 | 623 | 751 | NIST | 35495 | 5024-2 |
| 17 | DECANEDIOIC ACID, 3,7-DIMETHYL-, DIME | 258 | C14H26O4 | 658 | 749 | NIST | 35508 | 5131-4 |
| 18 | HEXANEDIOIC ACID, MONOMETHYL ESTE | 160 | C7H12O4 | 439 | 740 | NIST | 12310 | 627-91 |
| 19 | TRIDECANENITRILE | 195 | C13H25N | 485 | 733 | NIST | 21811 | 629-60 |
| 20 | HEXANEDIOIC ACID, DIMETHYL ESTER | 174 | C8H14O4 | 531 | 733 | NIST | 18128 | 627-93 |

Fig. 12 The MS spectrum of compound 2

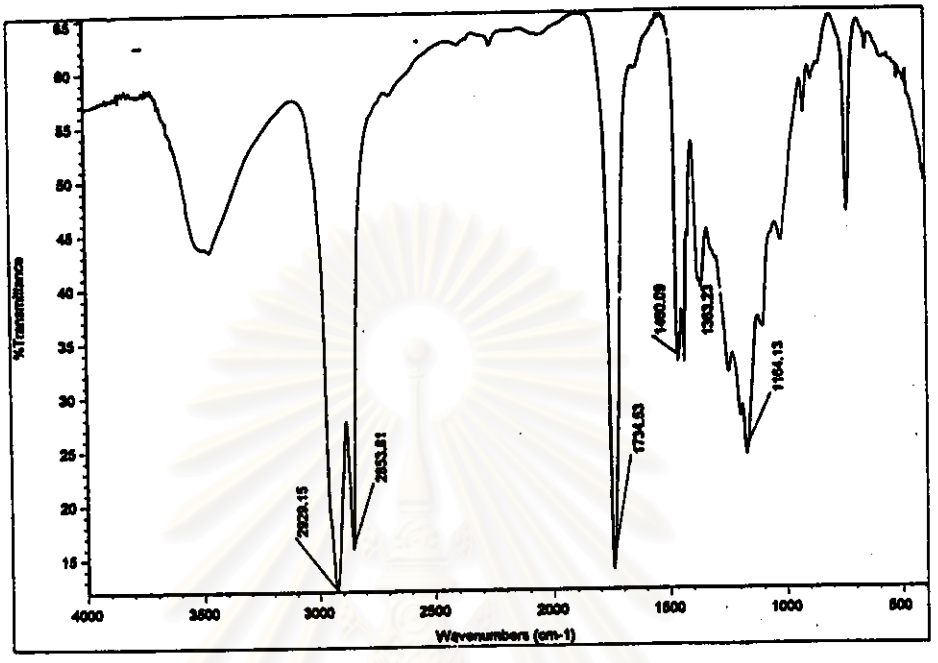



Fig.13 The FT- IR spectrum of compound 3 in KBr disc

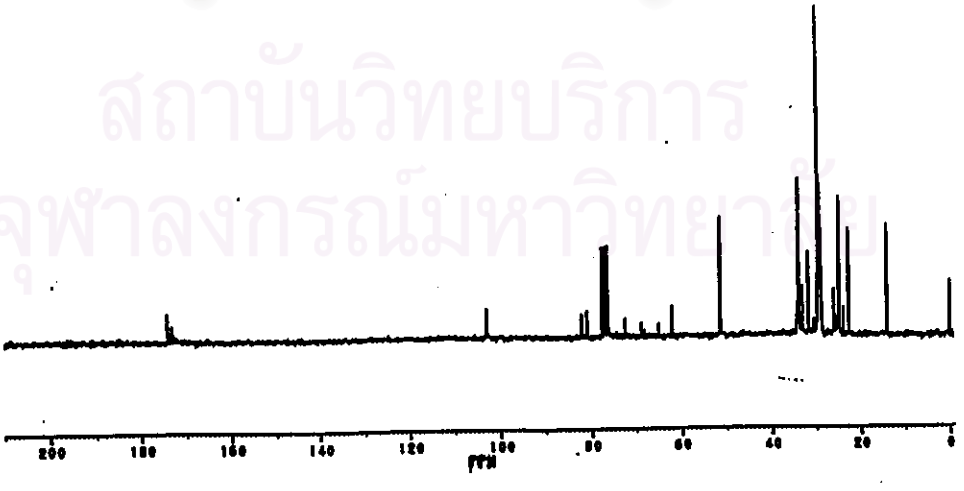


Fig. 14 The $^{13}$C-NMR spectrum of compound 3 in $CDCl_3$

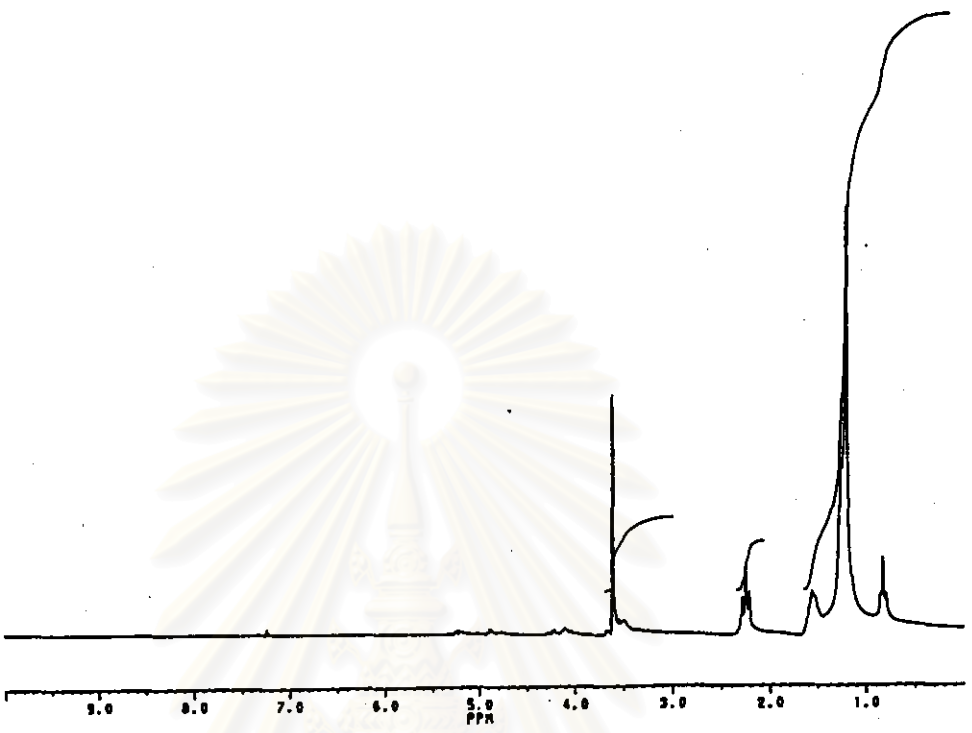
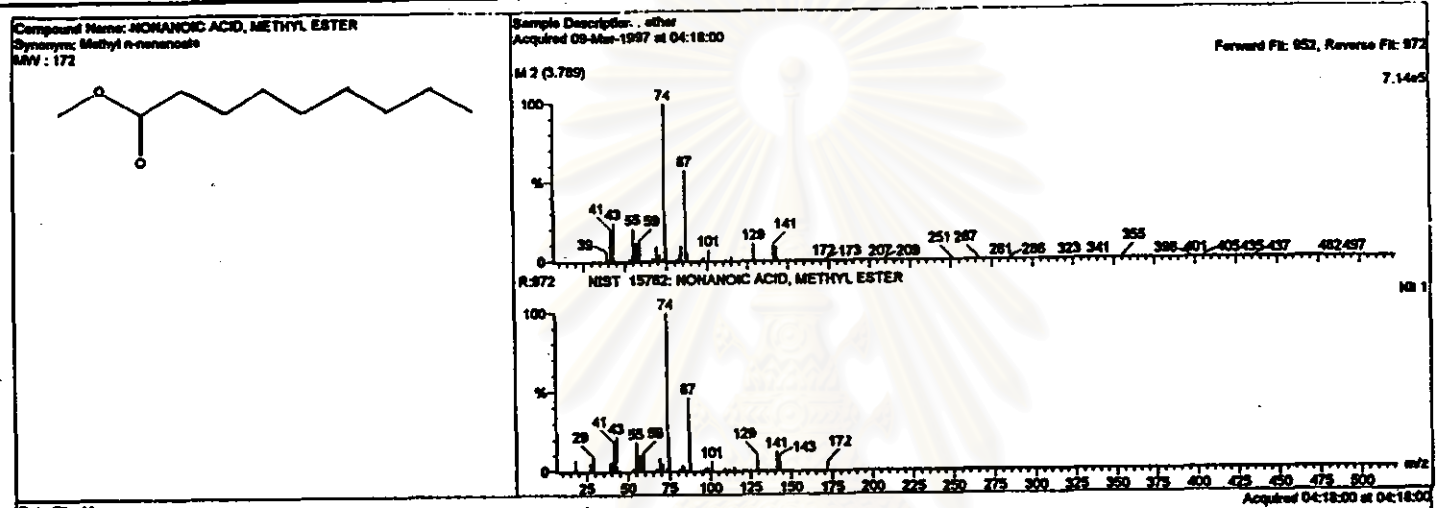



Fig. 15 The $^{1}$H-NMR spectrum of compound 3 in $CDCl_3$




| Nb | Compound Name | M.W. | Formula | for | REV | Library | Entry | CAS |
|---|---|---|---|---|---|---|---|---|
| 1 | NONANOIC ACID, METHYL ESTER | 172 | C10H20O2 | 952 | 972 | NIST | 15762 | 1731-8 |
| 2 | DECANOIC ACID, 2-METHYL- | 186 | C11H22O2 | 843 | 852 | NIST | 19462 | 24323- |
| 3 | DECANOIC ACID, METHYL ESTER | 186 | C11H22O2 | 805 | 847 | NIST | 19451 | 110-42 |
| 4 | UNDECANOIC ACID, 2-METHYL- | 200 | C12H24O2 | 677 | 827 | NIST | 22950 | 24323- |
| 5 | DODECANOIC ACID, 2-METHYL- | 214 | C13H26O2 | 618 | 821 | NIST | 26358 | 2874-7 |
| 6 | 2-NAPHTHALENOL, 6-AMINO- | 159 | C10H9ON | 651 | 880 | NIST | 13217 | 116-48 |
| 7 | 9-OCTADECENOIC ACID, 12-(ACETYLOXY)- | 354 | C21H38O4 | 826 | 867 | NIST | 49746 | 140-03 |
| 8 | OCTANOIC ACID, METHYL ESTER | 158 | C9H18O2 | 821 | 874 | NIST | 11832 | 111-11 |
| 9 | HEPTANOIC ACID, METHYL ESTER | 144 | C8H16O2 | 783 | 859 | NIST | 8433 | 106-73 |
| 10 | METHYL 8-OXOOCTANOATE | 172 | C9H16O3 | 628 | 832 | NIST | 15890 | 4316-4 |
| 11 | TETRADECANOIC ACID, 10,13-DIMETHYL-, | 270 | C17H34O2 | 553 | 628 | NIST | 37801 | 0-00-0 |
| 12 | HEXADECANOIC ACID, 9-METHYL-, METHY | 284 | C18H36O2 | 570 | 800 | NIST | 40187 | 0-00-0 |
| 13 | PENTADECANOIC ACID, METHYL ESTER | 256 | C16H32O2 | 737 | 798 | NIST | 35199 | 7132-6 |
| 14 | OCTADECANOIC ACID, 11-METHYL-, METH | 312 | C20H40O2 | 657 | 775 | NIST | 44950 | 0-00-0 |
| 15 | NONANOIC ACID, 9-OXO-, METHYL ESTER | 186 | C10H18O3 | 690 | 744 | NIST | 18385 | 1931-8 |
| 16 | HEPTANOIC ACID, 3,5-DIMETHYL-, METHY | 172 | C10H20O2 | 694 | 740 | NIST | 15789 | 2490-5 |
| 17 | TRIDECANOIC ACID, 12-METHYL-, METHYL | 242 | C15H30O2 | 640 | 702 | NIST | 32397 | 5129-5 |
| 18 | 10-UNDECENOIC ACID, METHYL ESTER | 198 | C12H22O2 | 605 | 690 | NIST | 22425 | 111-81 |
| 19 | 7-NONENOIC ACID, METHYL ESTER | 170 | C10H18O2 | 586 | 670 | NIST | 15217 | 20731- |
| 20 | CYCLOPROPANENONANOIC ACID, METHY | 212 | C13H24O2 | 602 | 651 | NIST | 25801 | 10152- |

Fig. 16 The MS spectrum of compound 3

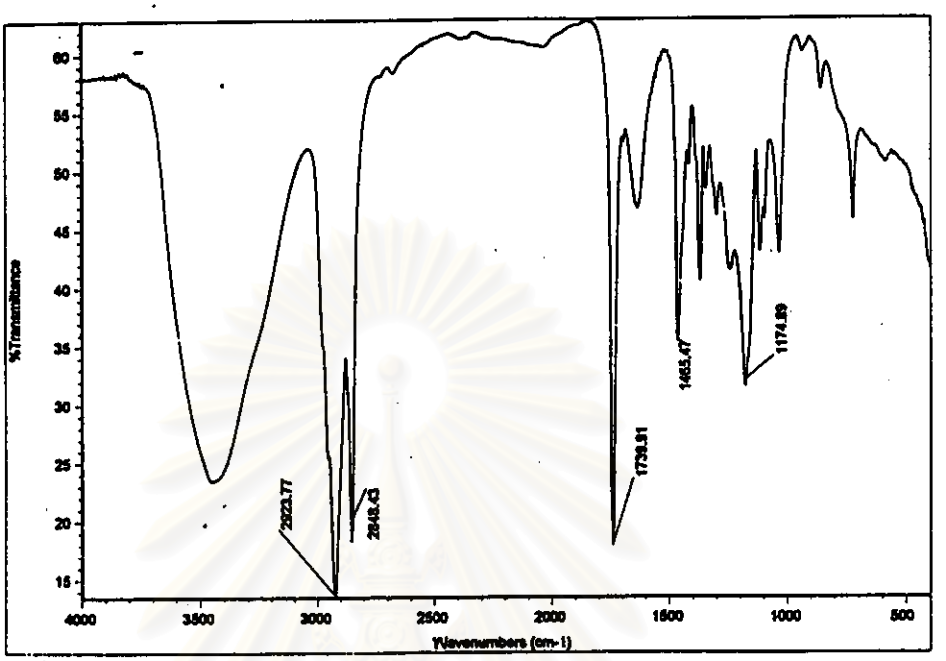



Fig. 17 The FT- IR spectrum of compound 4 in KBr disc

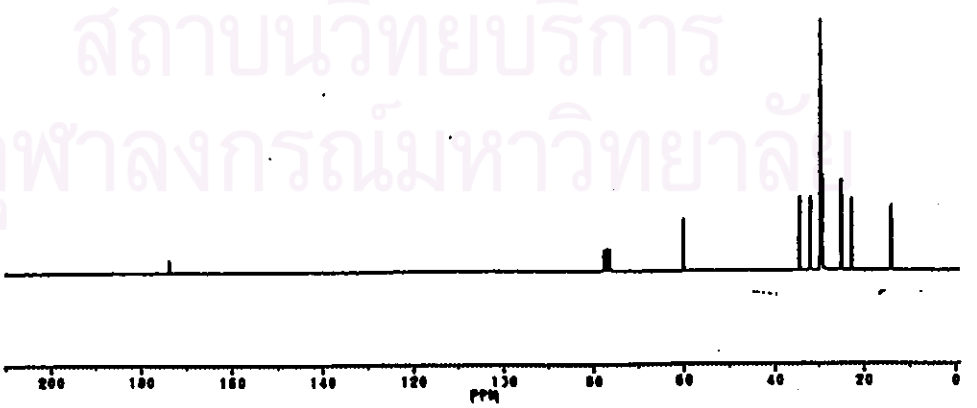



Fig. 18 The $^{13}$C-NMR spectrum of compound 4 in $CDCl_3$

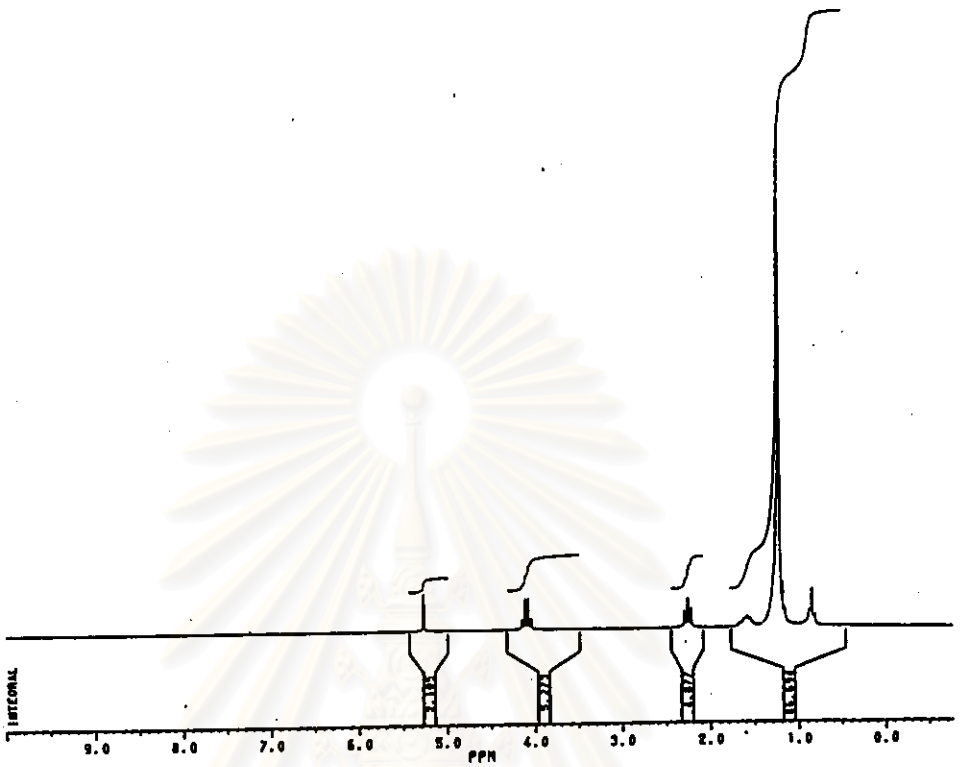



Fig. 19 The $^{1}$H-NMR spectrum of compound 4 in $CDCl_3$

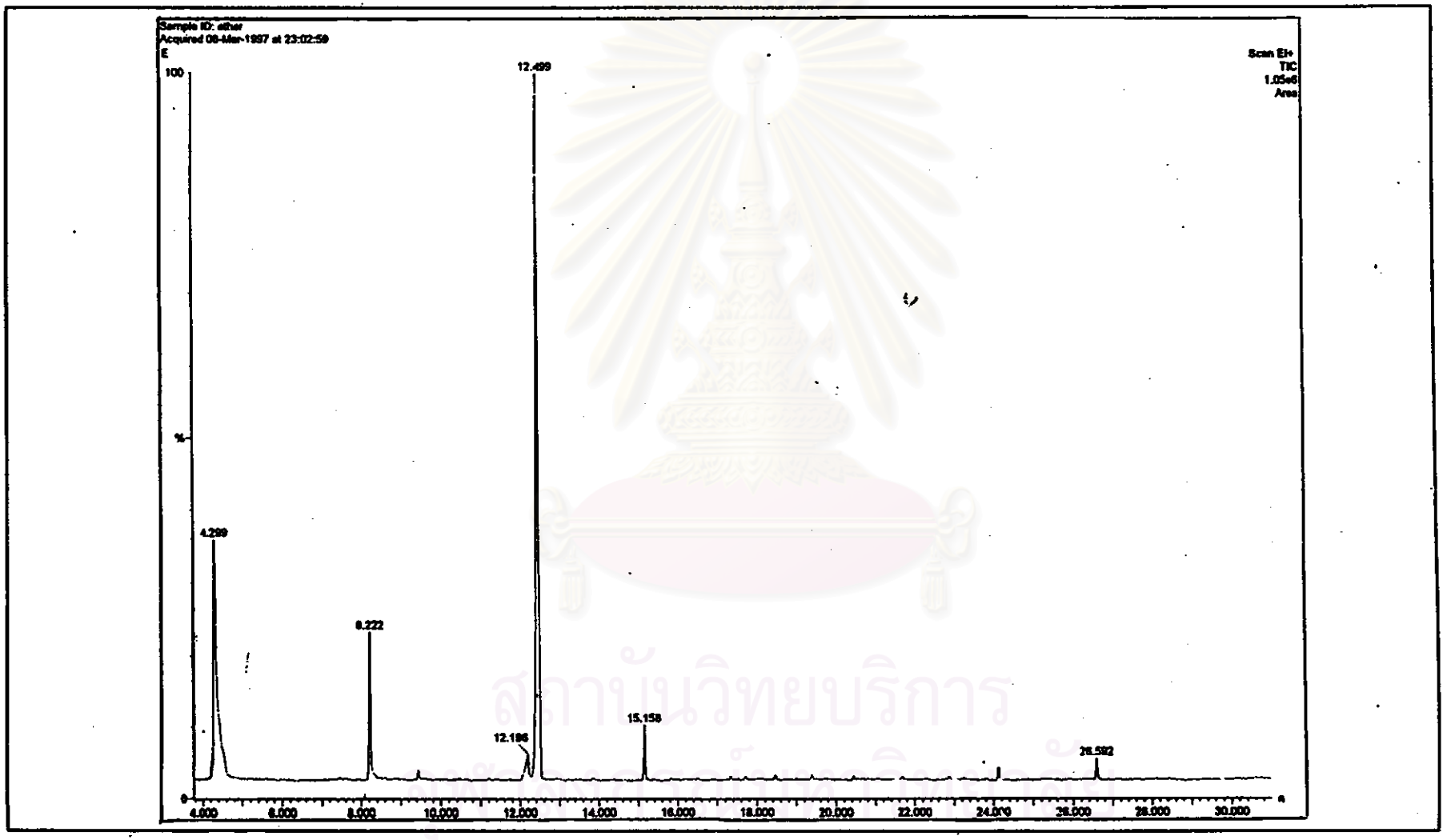
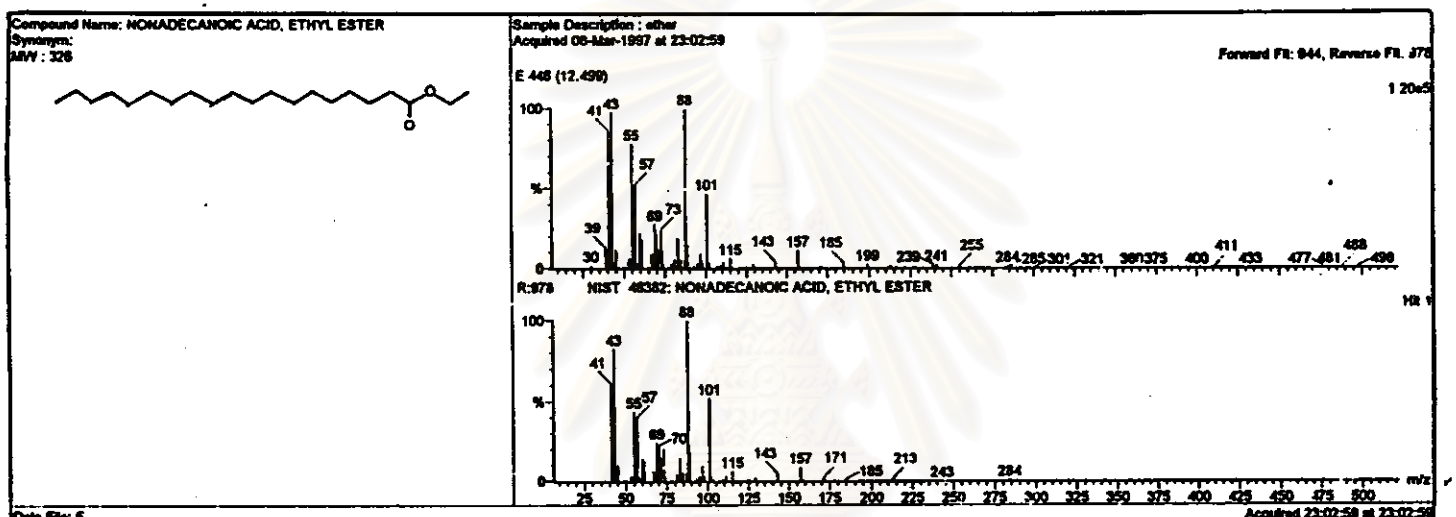



Fig. 20 The GC chromotogram of mixed ethyl ester




| Hit | Compound Name | M.W. | Formula | for | REV | Library | Entry | CAS |
|---|---|---|---|---|---|---|---|---|
| 1 | NONADECANOIC ACID, ETHYL ESTER | 326 | C21H42O2 | 944 | 978 | NIST | 46382 | 18281- |
| 2 | PENTADECANOIC ACID, ETHYL ESTER | 270 | C17H34O2 | 912 | 950 | NIST | 37809 | 41114- |
| 3 | UNDECANOIC ACID, ETHYL ESTER | 214 | C13H26O2 | 879 | 921 | NIST | 26363 | 627-90 |
| 4 | DECANOIC ACID, ETHYL ESTER | 200 | C12H24O2 | 858 | 902 | NIST | 22936 | 110-38 |
| 5 | NONANOIC ACID, ETHYL ESTER | 186 | C11H22O2 | 846 | 891 | NIST | 19480 | 123-29 |
| 6 | HEXADECANOIC ACID, ETHYL ESTER | 284 | C18H36O2 | 783 | 855 | NIST | 40201 | 628-97 |
| 7 | OCTANOIC ACID, ETHYL ESTER | 172 | C10H20O2 | 788 | 848 | NIST | 15774 | 106-32 |
| 8 | TETRADECANOIC ACID, ETHYL ESTER | 256 | C16H32O2 | 779 | 838 | NIST | 35195 | 124-06 |
| 9 | CYCLOHEXANOL, 1,1'-DIOXYBIS- | 230 | C12H22O4 | 388 | 828 | NIST | 29907 | 2407-9 |
| 10 | HEPTANOIC ACID, 2,4-DIMETHYL-, METHY | 172 | C10H20O2 | 711 | 810 | NIST | 15778 | 18450- |
| 11 | HEXANOIC ACID, 2,4-DIMETHYL-, METHYL | 158 | C9H18O2 | 707 | 808 | NIST | 11983 | 14251- |
| 12 | 9-DECENOIC ACID, 2,4-DIMETHYL-, METHY | 212 | C13H24O2 | 665 | 802 | NIST | 25897 | 31183- |
| 13 | HEPTANOIC ACID, 2-ETHYL- | 158 | C9H18O2 | 668 | 800 | NIST | 11944 | 3274-2 |
| 14 | PENTANOIC ACID, ETHYL ESTER | 130 | C7H14O2 | 580 | 787 | NIST | 5447 | 539-82 |
| 15 | HEPTANOIC ACID, ETHYL ESTER | 158 | C9H18O2 | 715 | 781 | NIST | 11952 | 106-30 |
| 16 | HEXANOIC ACID, 2,4-DIMETHYL-, METHYL | 158 | C9H18O2 | 683 | 775 | NIST | 11980 | 14251- |
| 17 | OLEIC ACID | 282 | C18H34O2 | 640 | 760 | NIST | 38820 | 112-80 |
| 18 | (R)-(-)-4-METHYLHEXANOIC ACID | 130 | C7H14O2 | 505 | 760 | NIST | 9458 | 52745- |
| 19 | 3,3-DIMETHYL-4-HEPTANOL | 144 | C9H20O | 467 | 750 | NIST | 8511 | 3-00-0 |
| 20 | 3-ETHYLHEPTANOIC ACID | 158 | C9H18O2 | 637 | 738 | NIST | 11969 | 14272- |

Fig. 21 The MS spectrum of compound 4

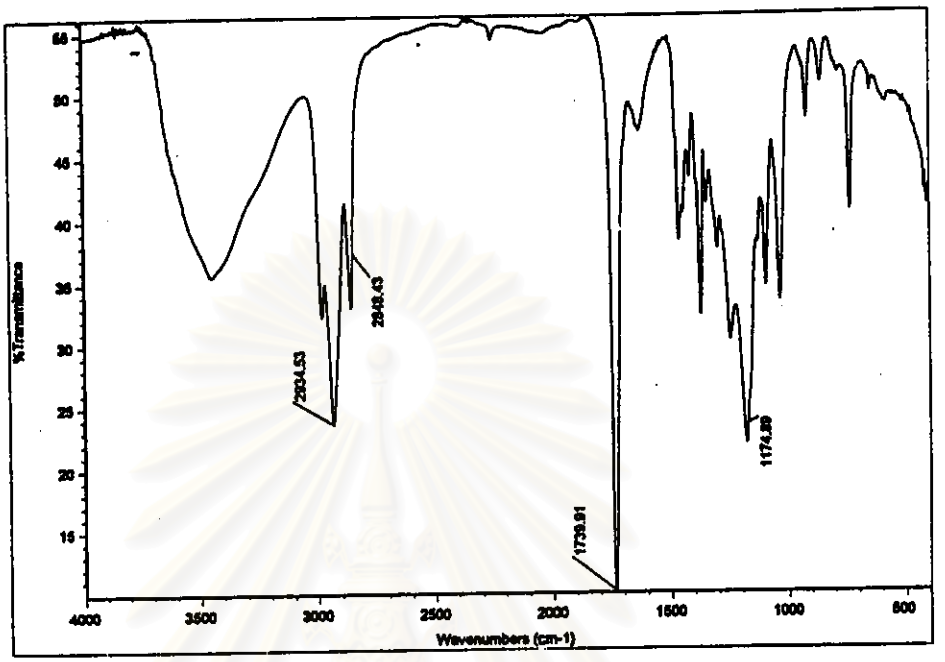



Fig. 22 The FT- IR spectrum of compound 5 in KBr disc

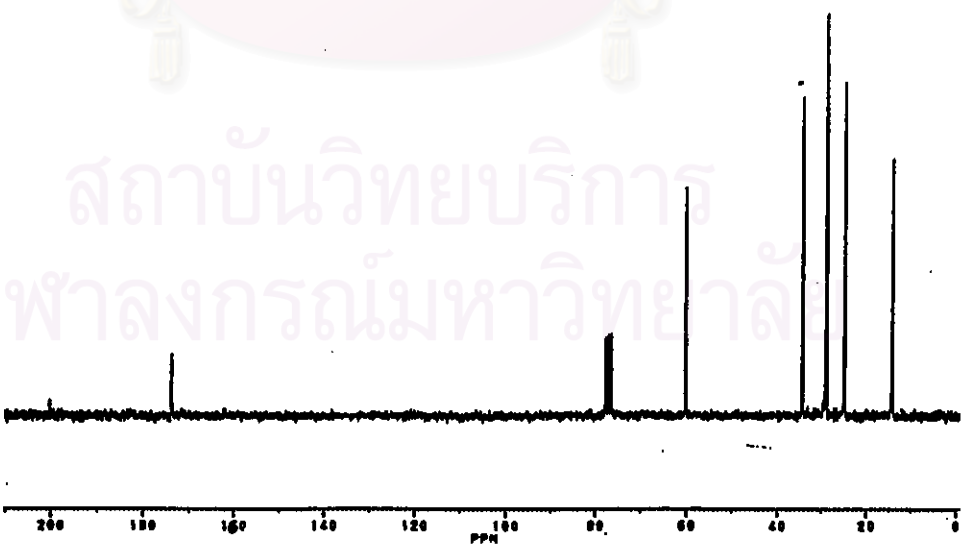



Fig. 23 The $^{13}C$-NMR spectrum of compound 5 in $CDCl_3$

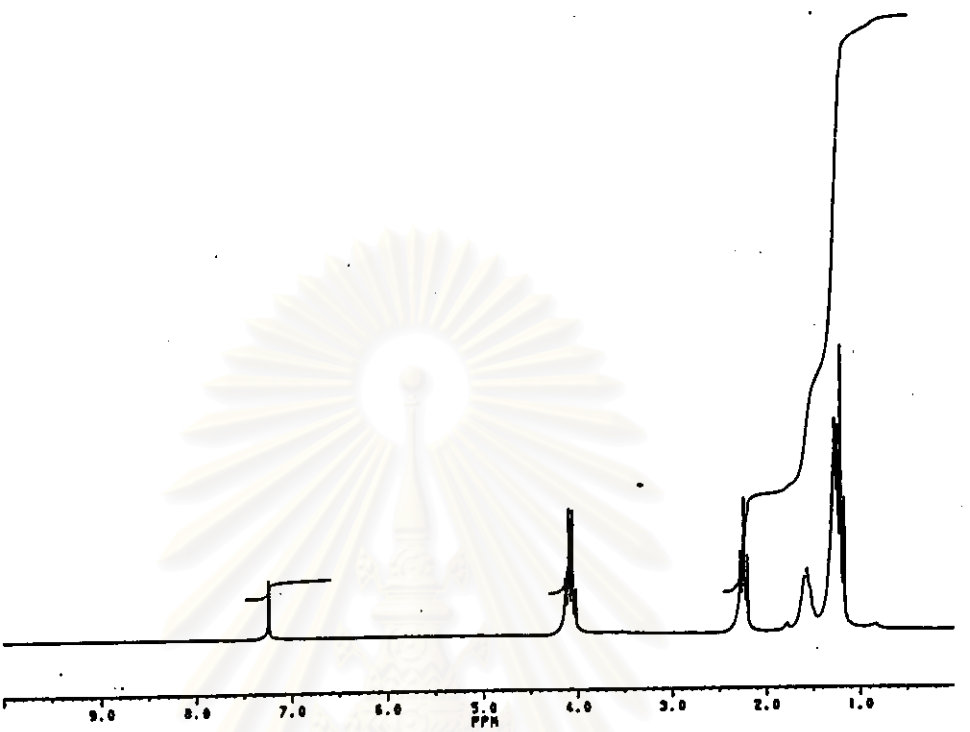



Fig. 24 The $^{1}$H-NMR spectrum of compound 5 in $CDCl_3$

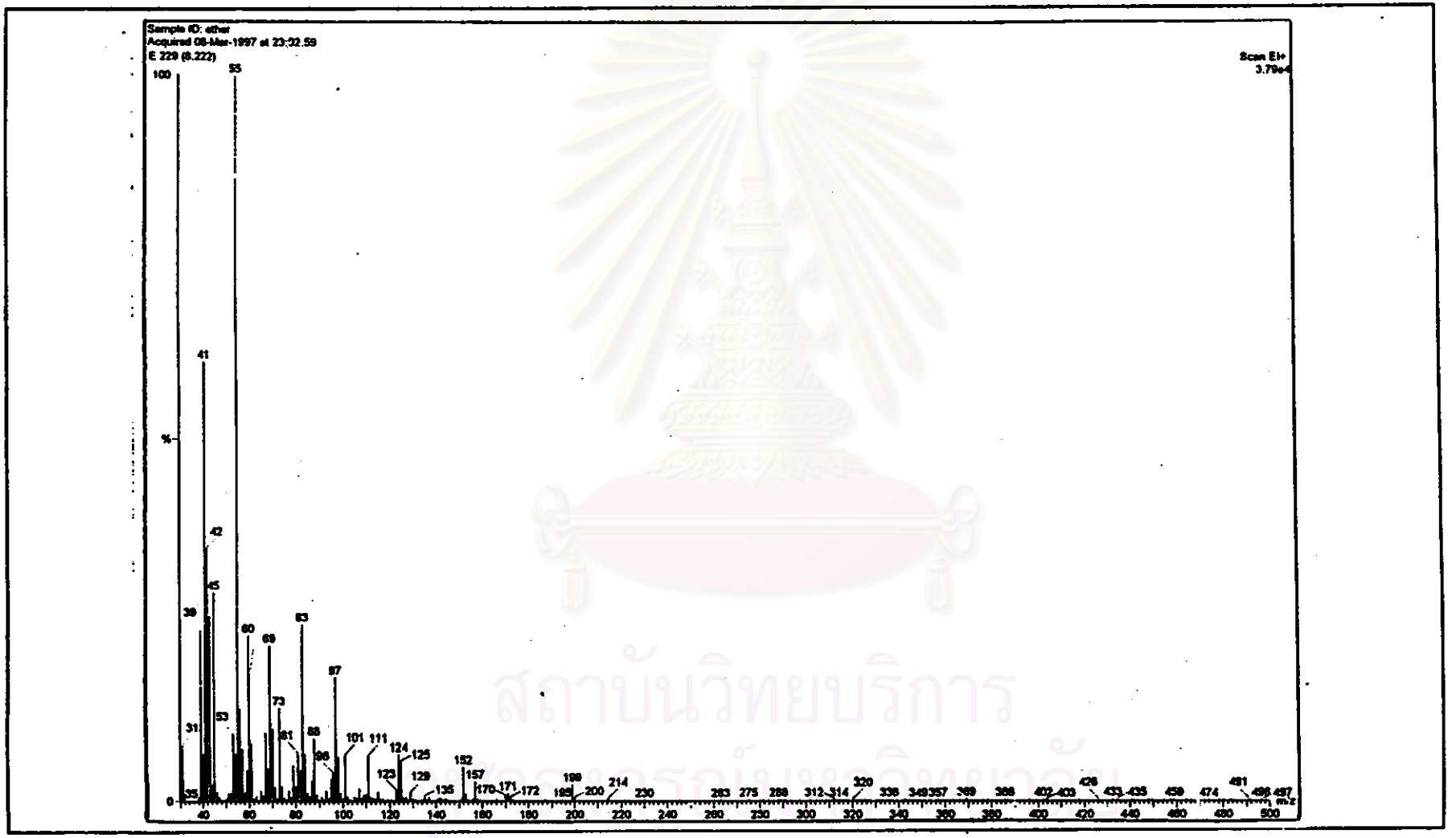



Fig. 25 The MS spectrum of compound 5

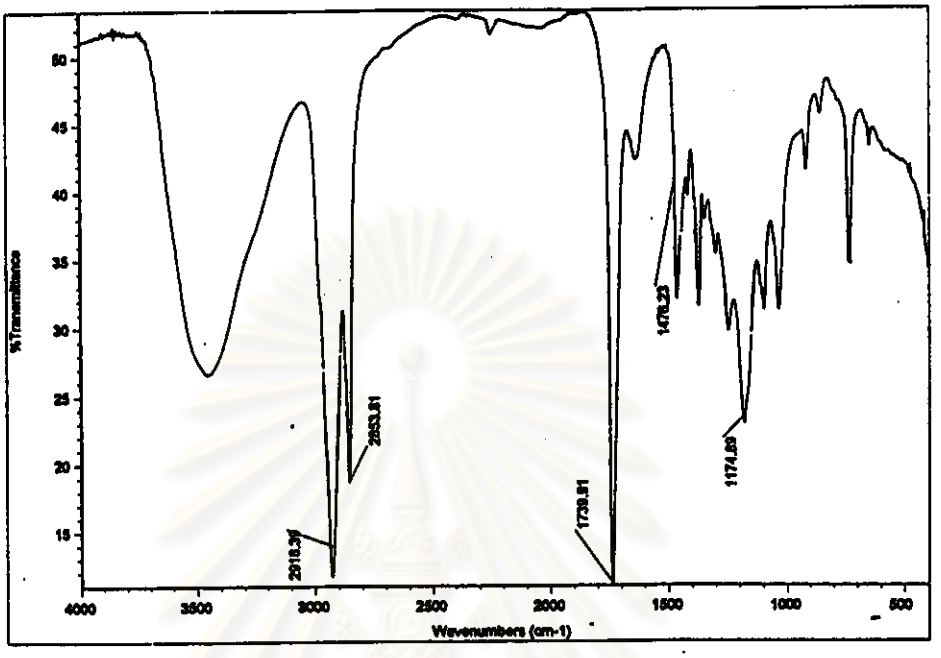



Fig. 26 The FT- IR spectrum of compound 6 in KBr disc

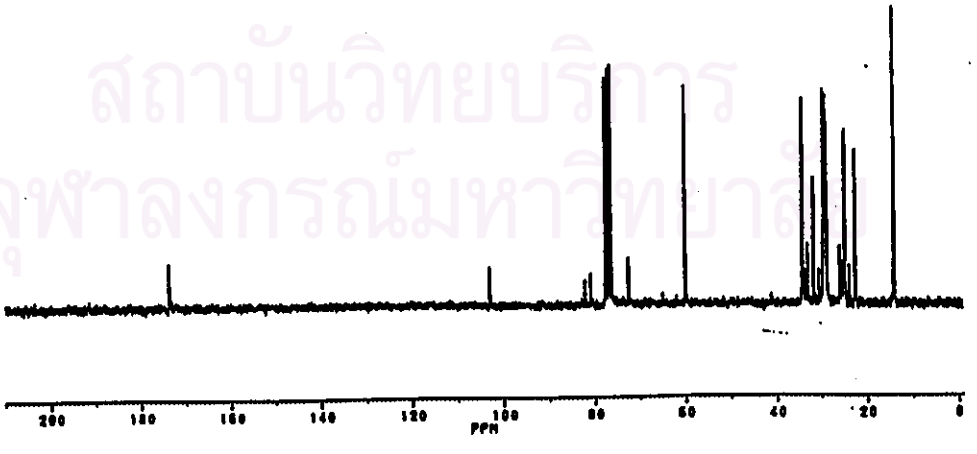



Fig. 27 The $^{13}$C-NMR spectrum of compound 6 in $CDCl_3$

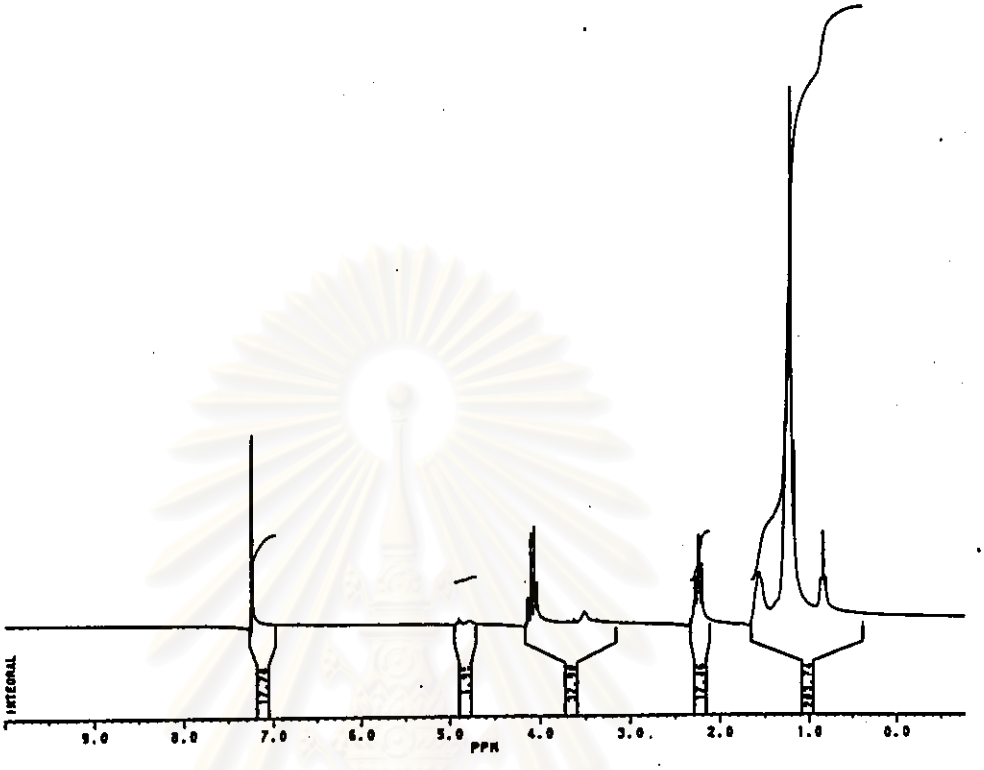



Fig. 28 The $^{1}$H-NMR spectrum of compound 6 in $CDCl_3$

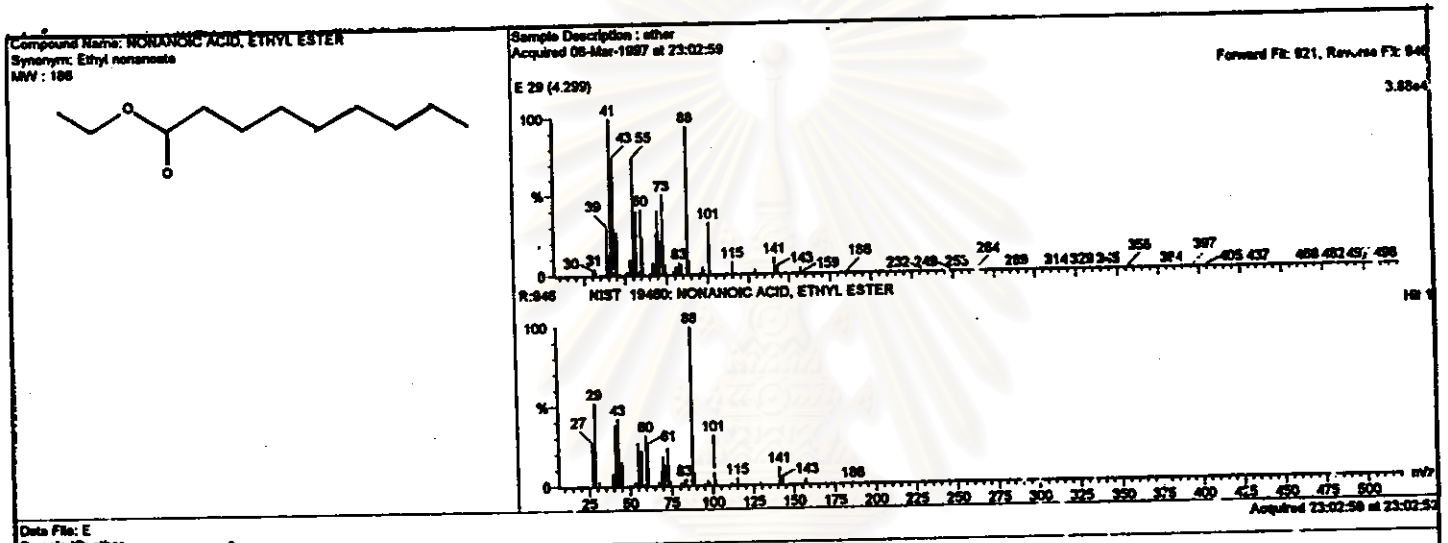



Fig. 29 The MS spectrum of compound 6

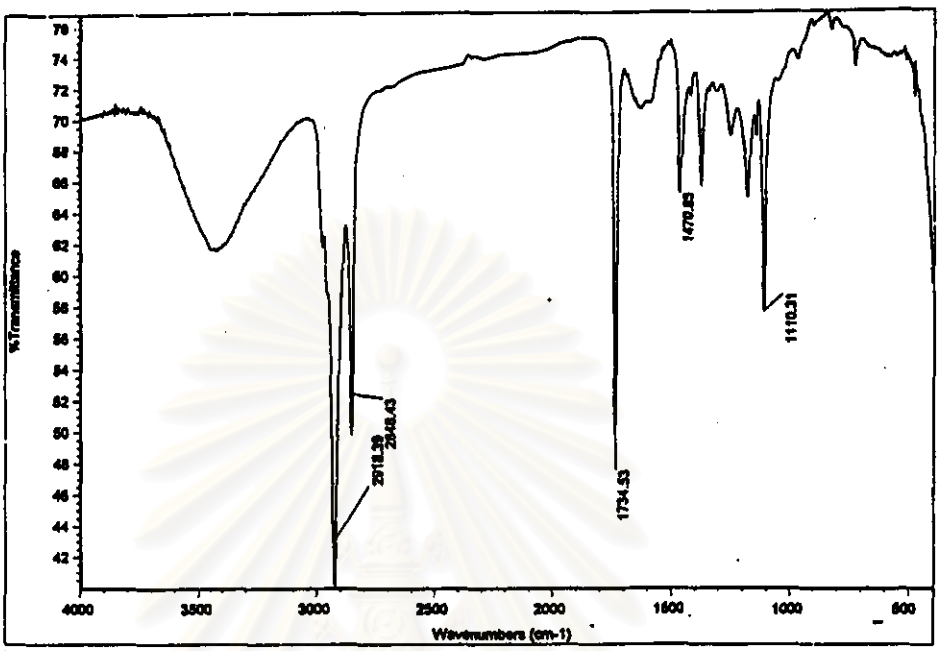



Fig. 30 The FT- IR spectrum of compound 7 in KBr disc

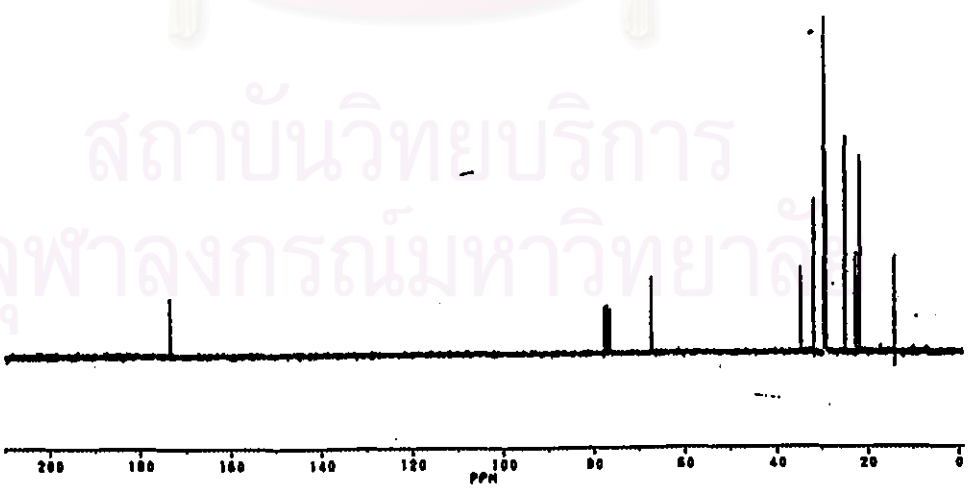



Fig. 31 The $^{13}$C-NMR spectrum of compound 7 in $CDCl_3$

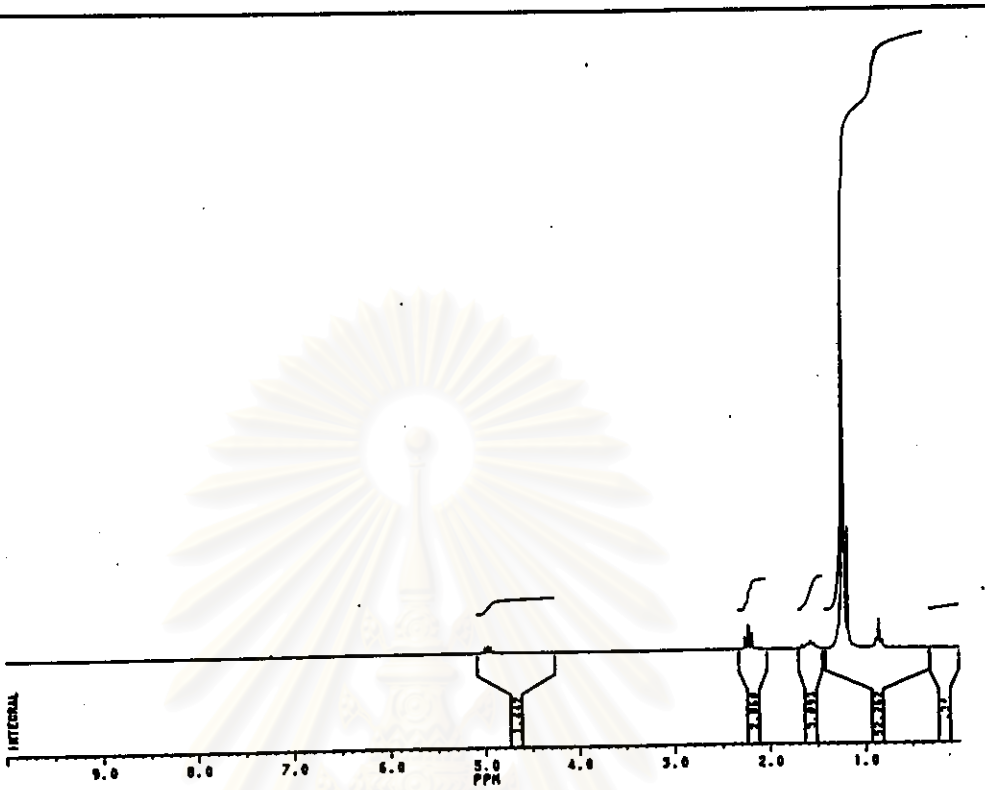



Fig. 32 The $^{1}$H-NMR spectrum of compound 7 in $CDCl_3$

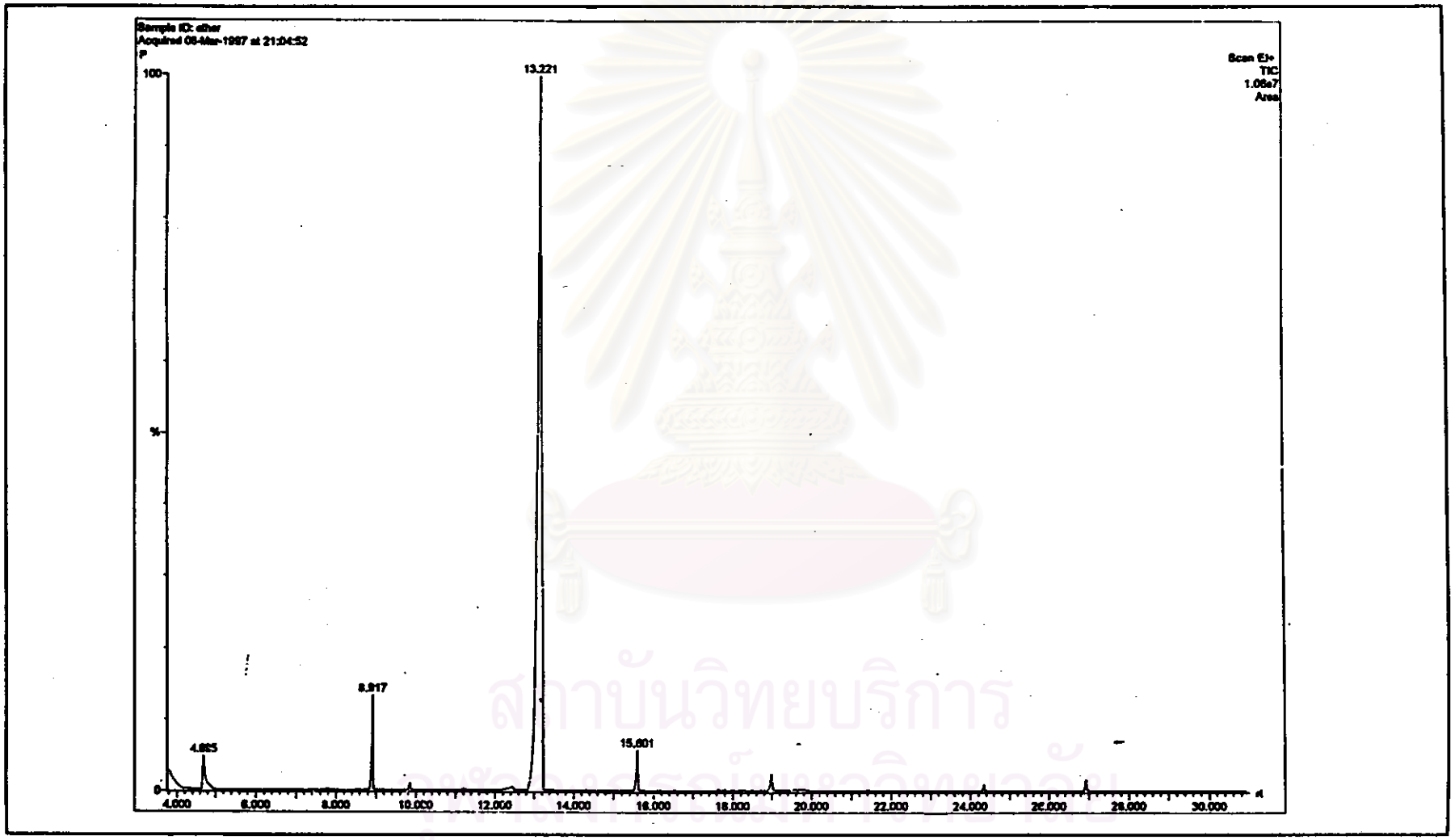



Fig. 33 The GC chromotogram of mixed isopropyl ester

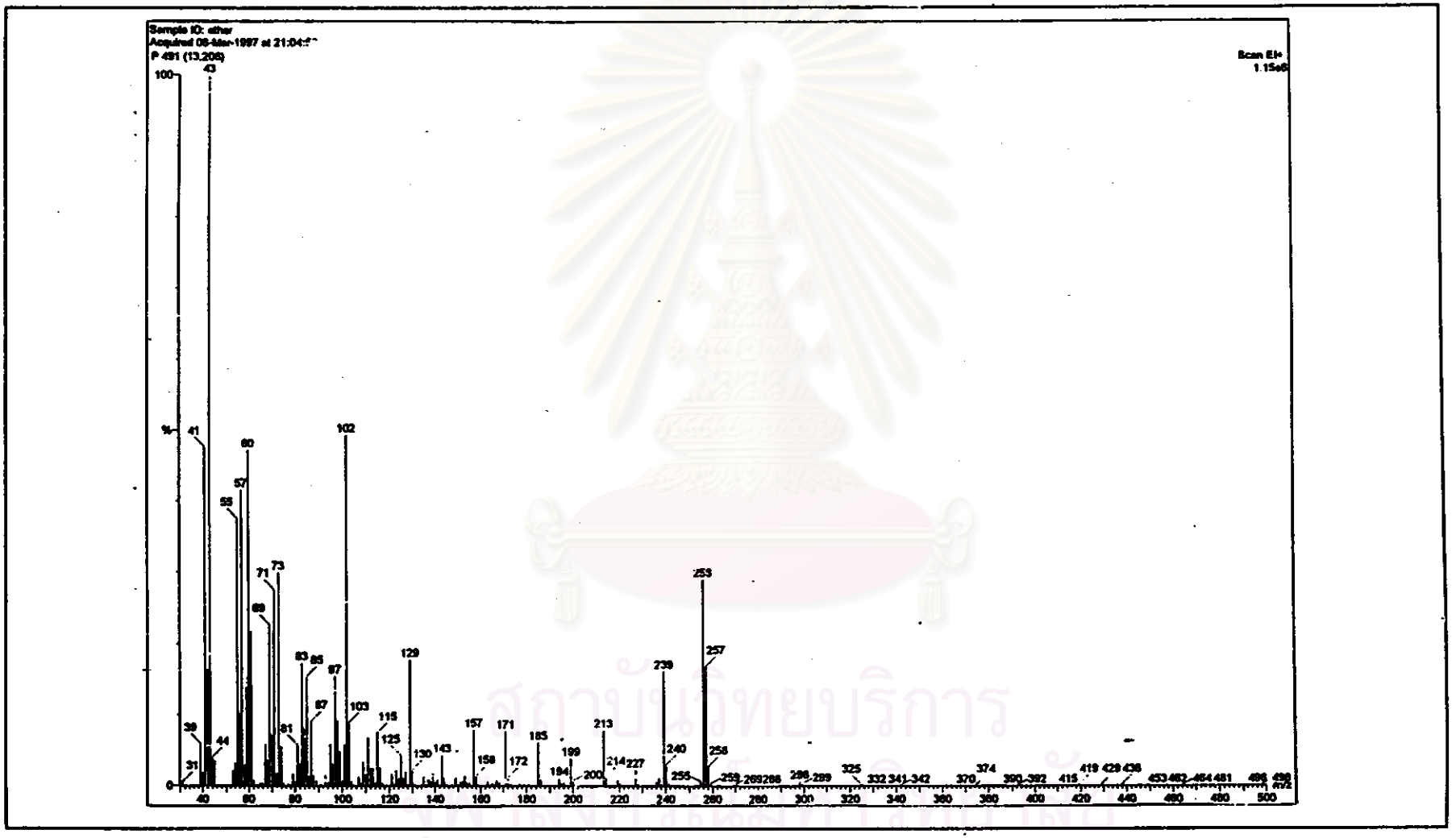



Fig. 34 The MS spectrum of compound 7

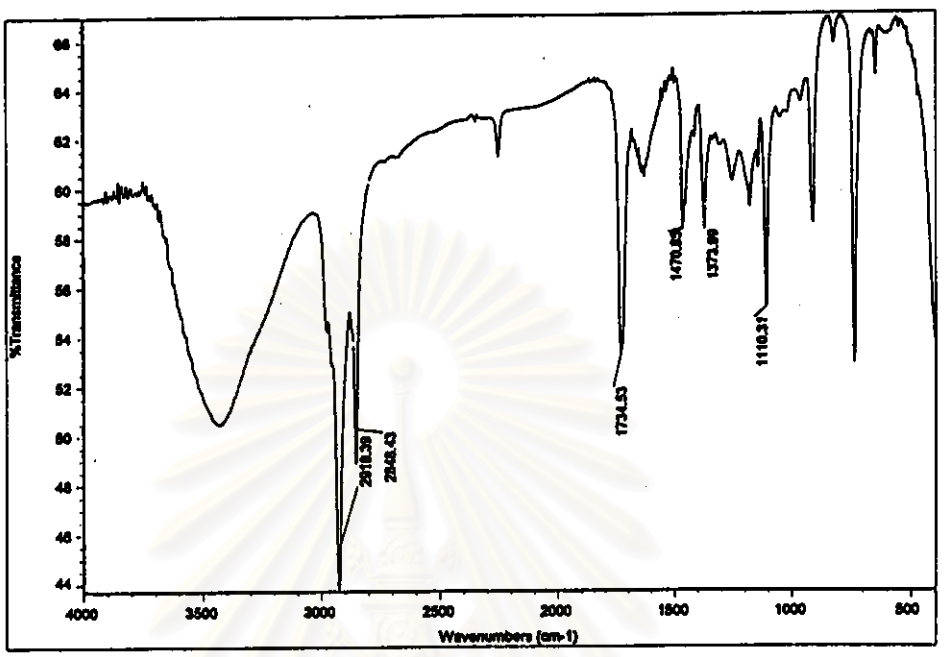



Fig. 35 The FT- IR spectrum of compound 8 in KBr disc

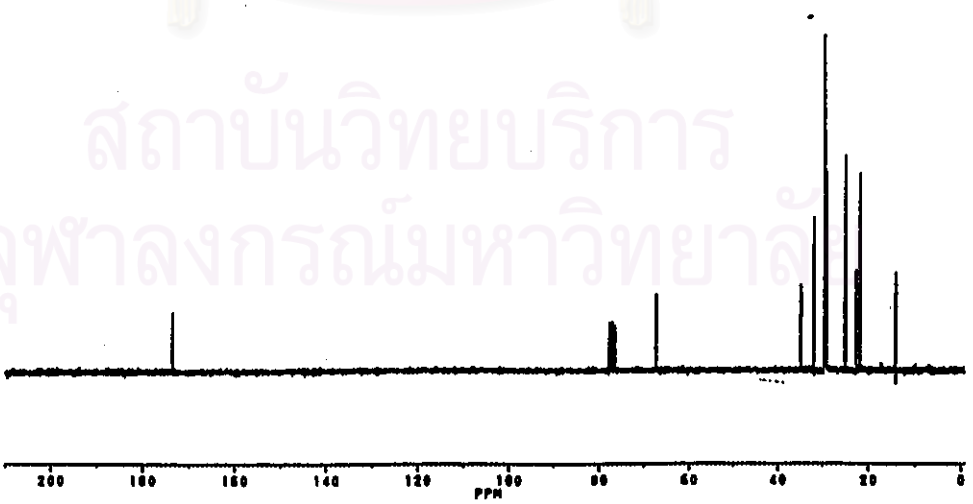



Fig. 36 The $^{13}$C-NMR spectrum of compound 8 in $CDCl_3$

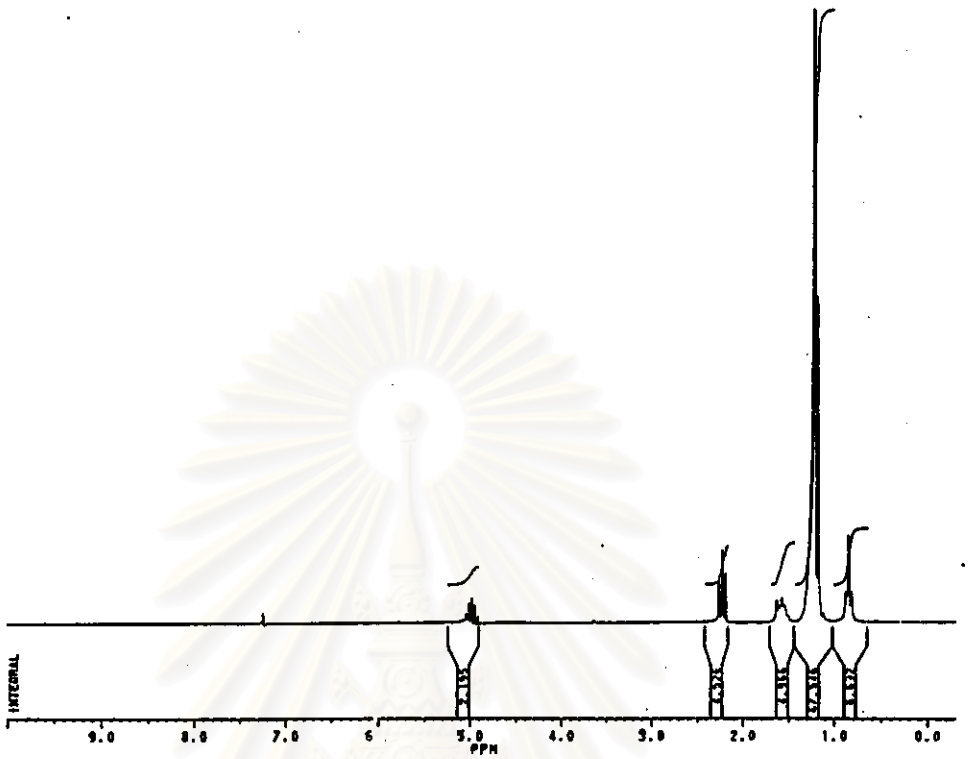



Fig. 37 The $^{1}$H-NMR spectrum of compound **8** in $CDCl_3$

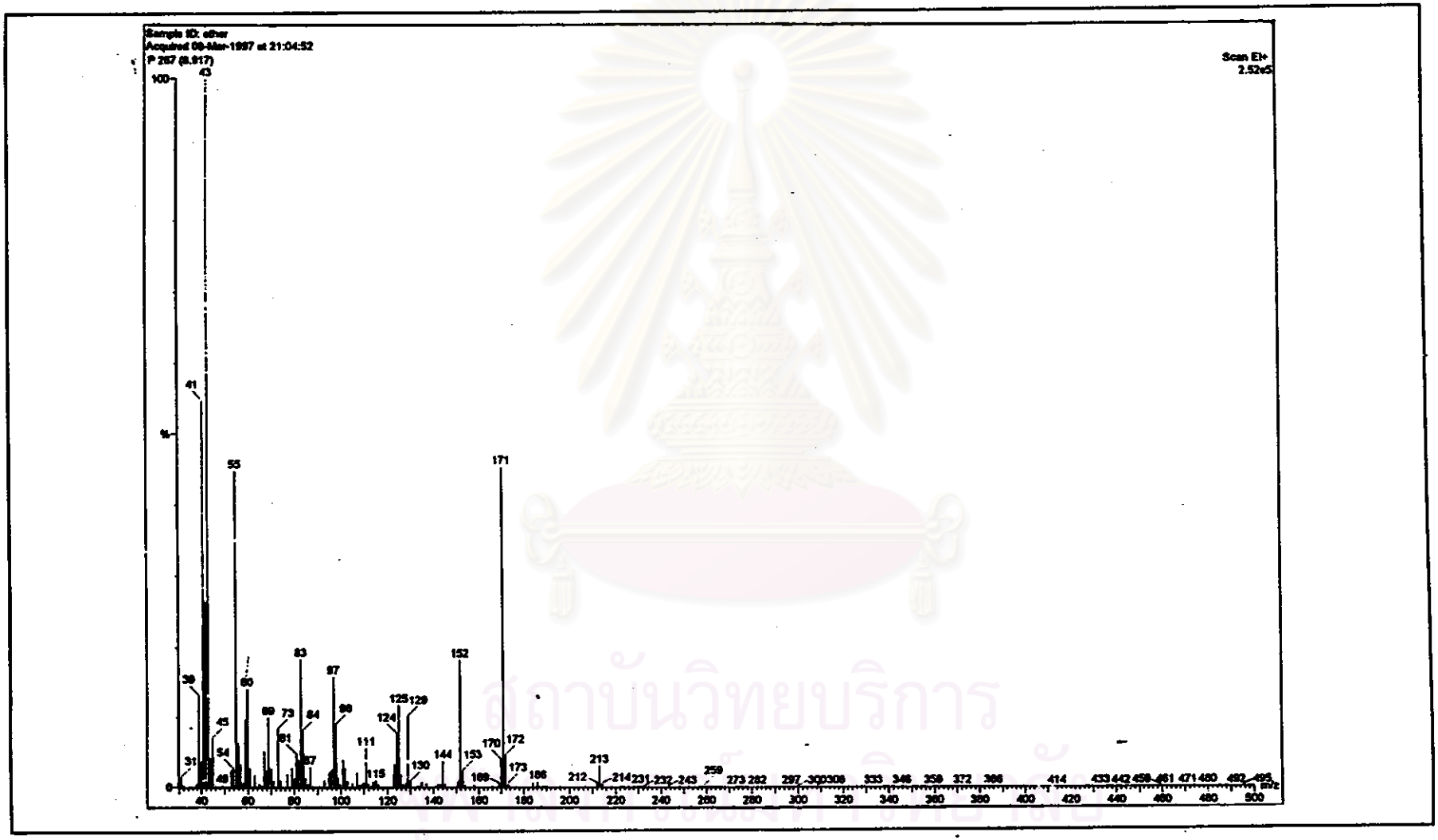



Fig. 38 The MS spectrum of compound 8

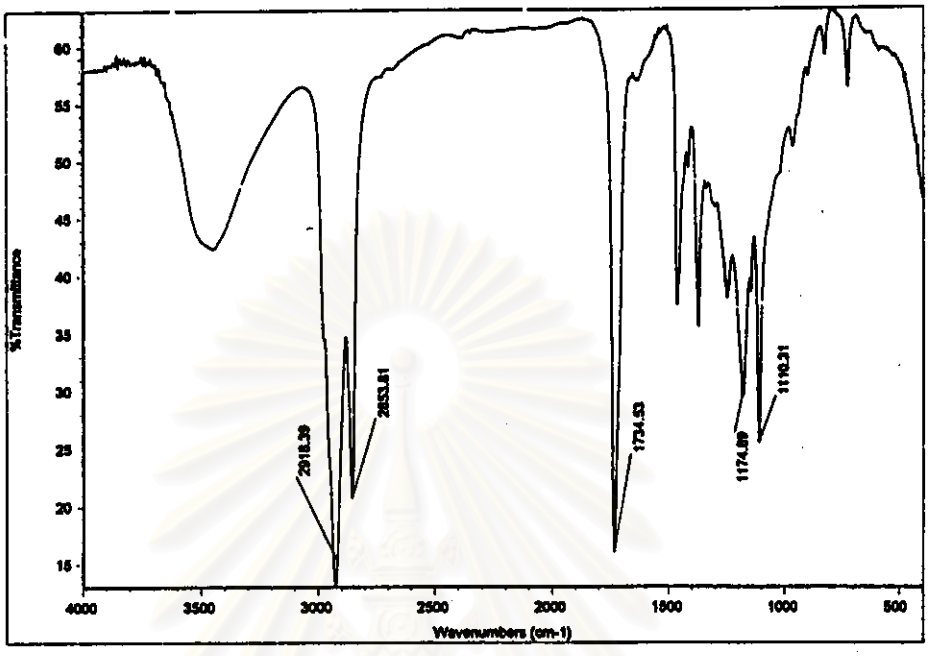



Fig. 39 The FT- IR spectrum of compound 9 in KBr disc

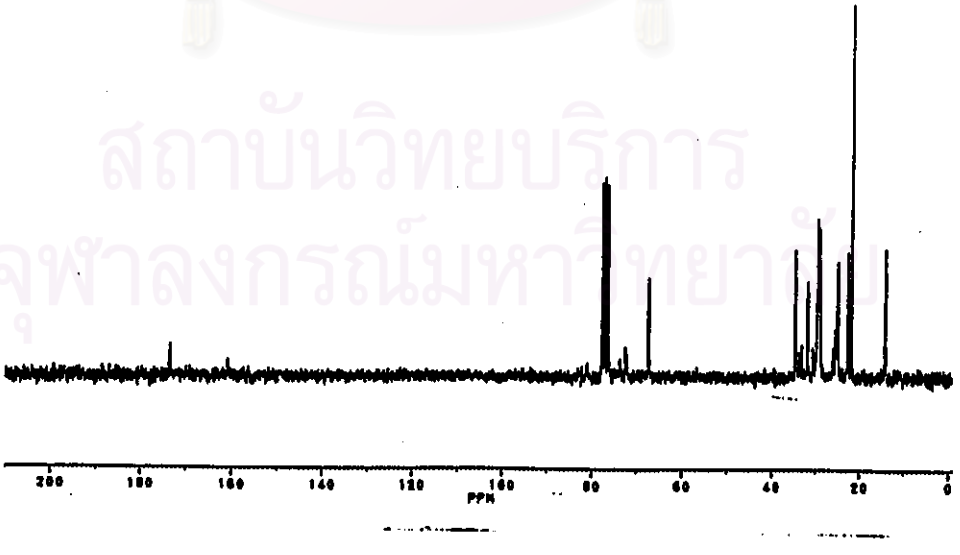



Fig. 40 The $^{13}$C-NMR spectrum of compound 9 in $CDCl_3$

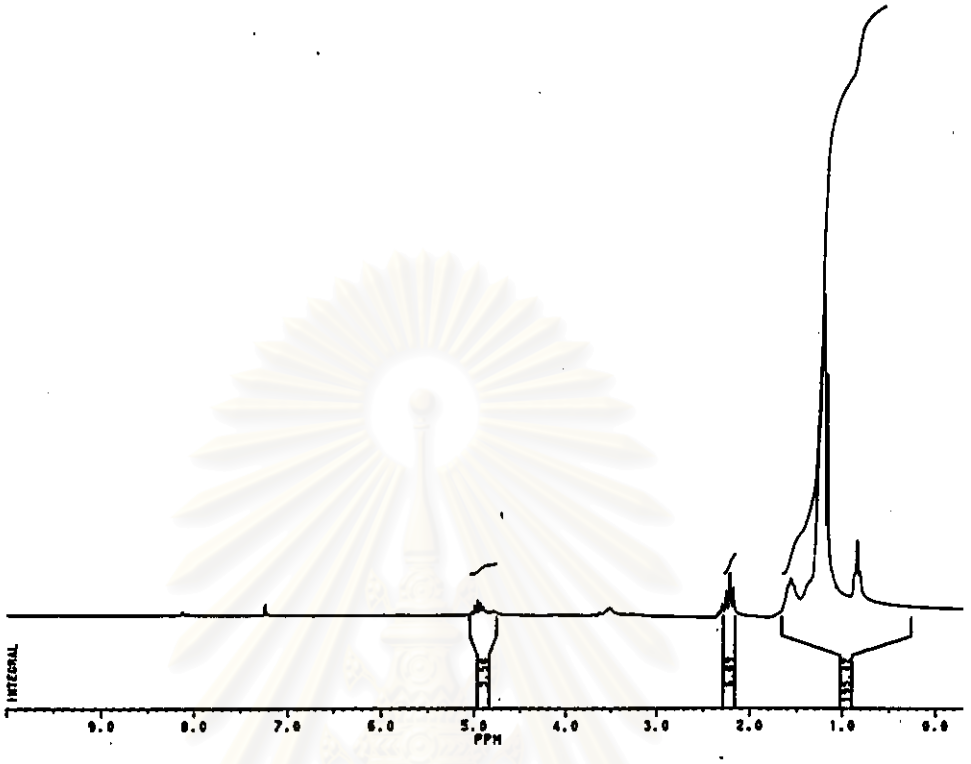



Fig. 41 The $^{1}$H-NMR spectrum of compound 9 in $CDCl_3$

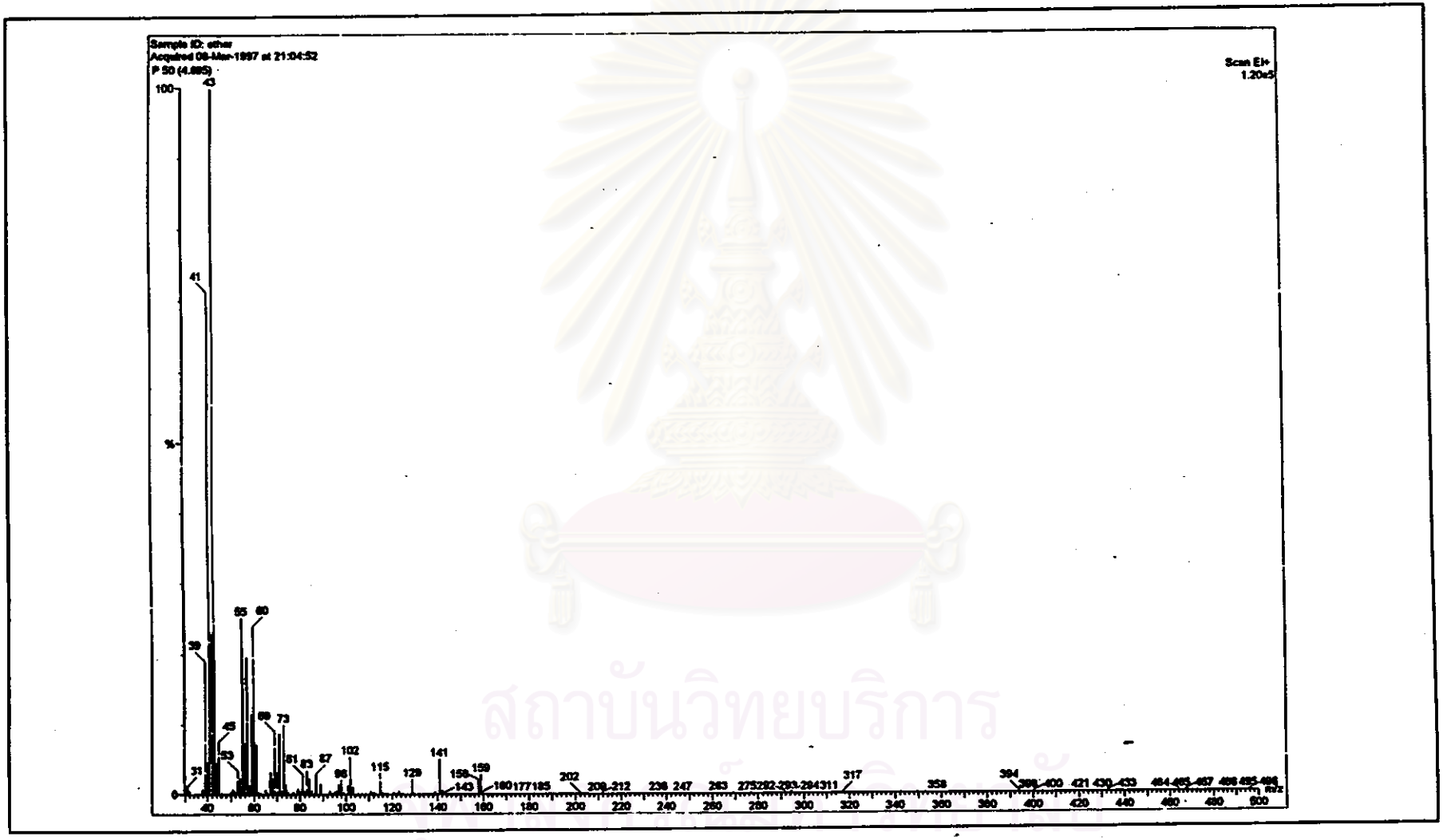



Fig. 42 The MS spectrum of compound 9

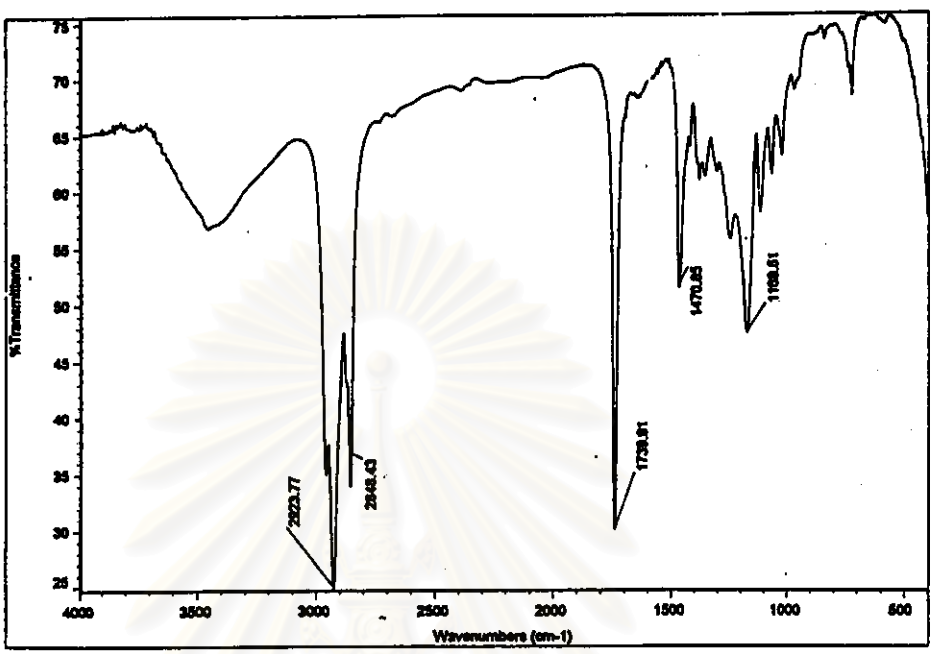



Fig. 43 The FT- IR spectrum of compound 10 in KBr disc

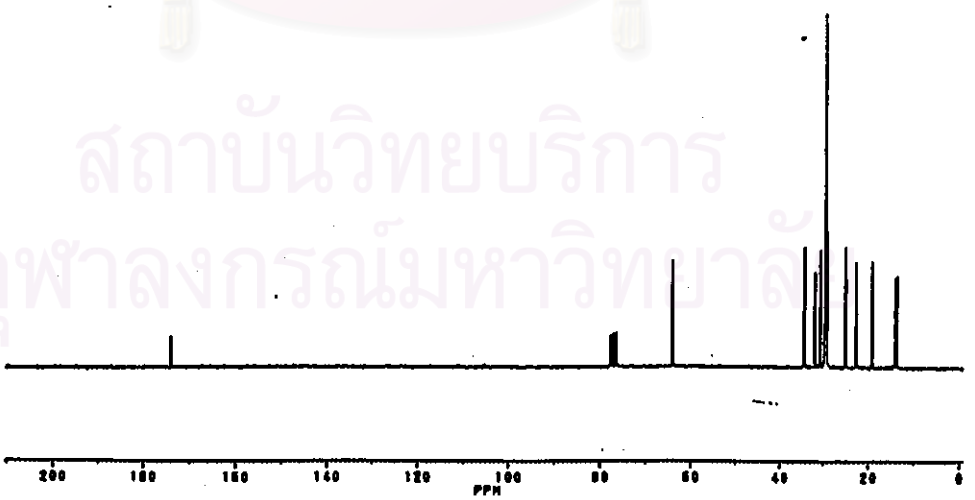



Fig. 44 The $^{13}$C-NMR spectrum of compound 10 in $CDCl_3$

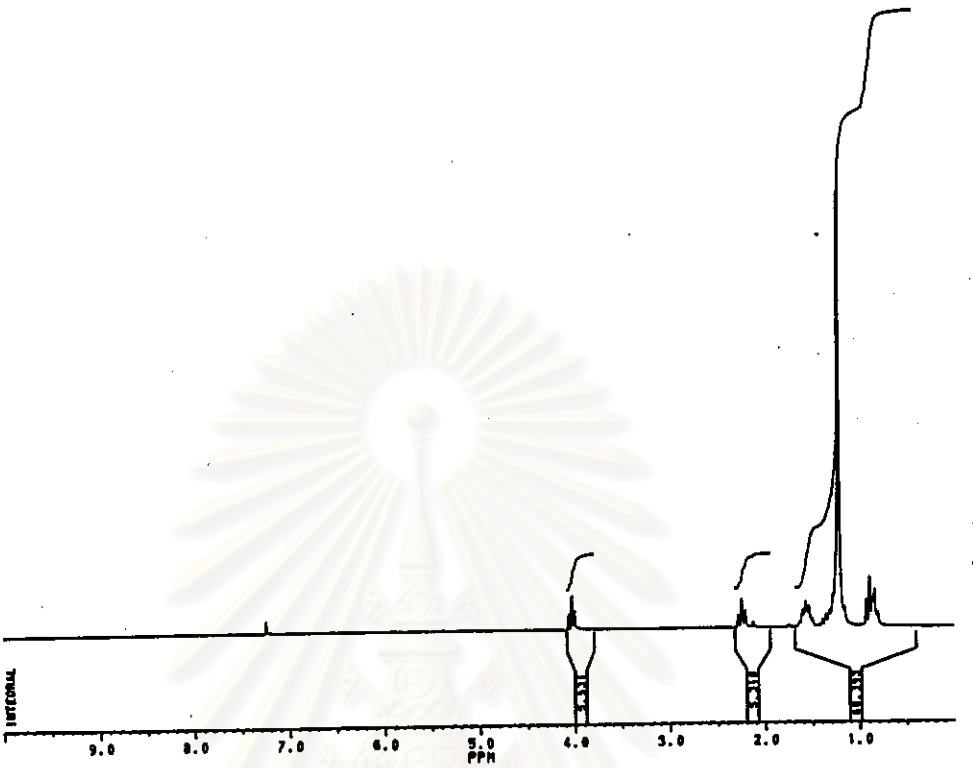



Fig. 45 The $^{1}$H-NMR spectrum of compound 10 in $CDCl_3$

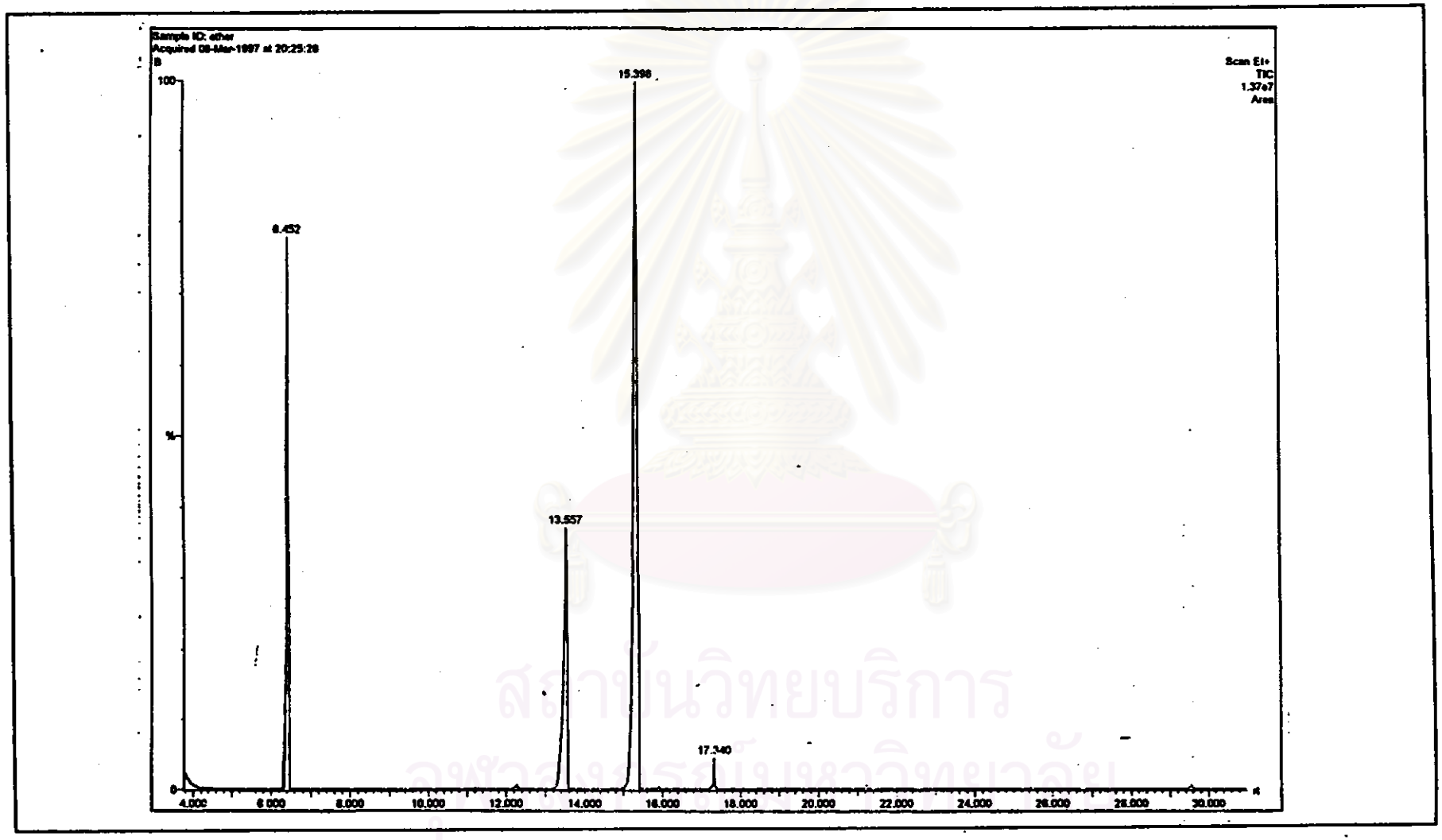



Fig. 46 The GC chromotogram of mixed butyl ester

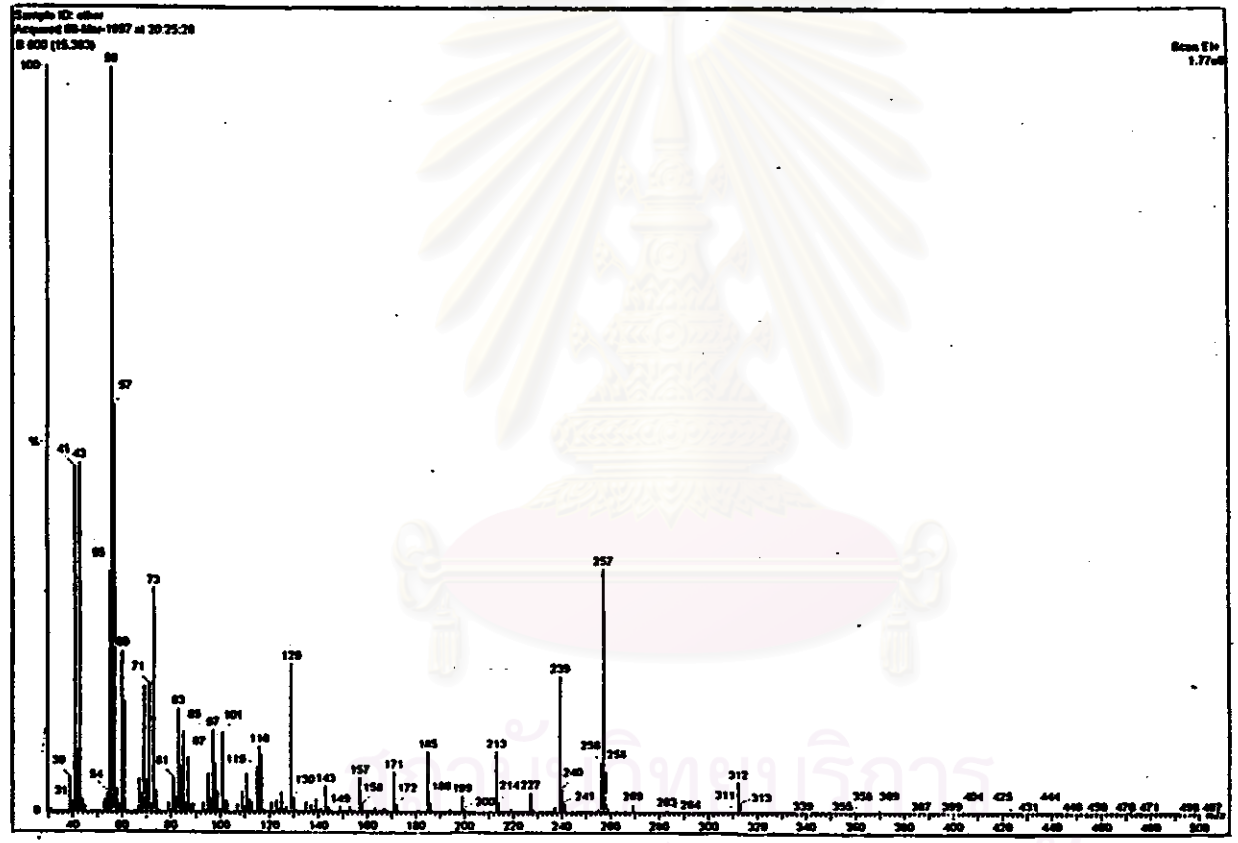


Fig. 47 The MS spectrum of compound 10

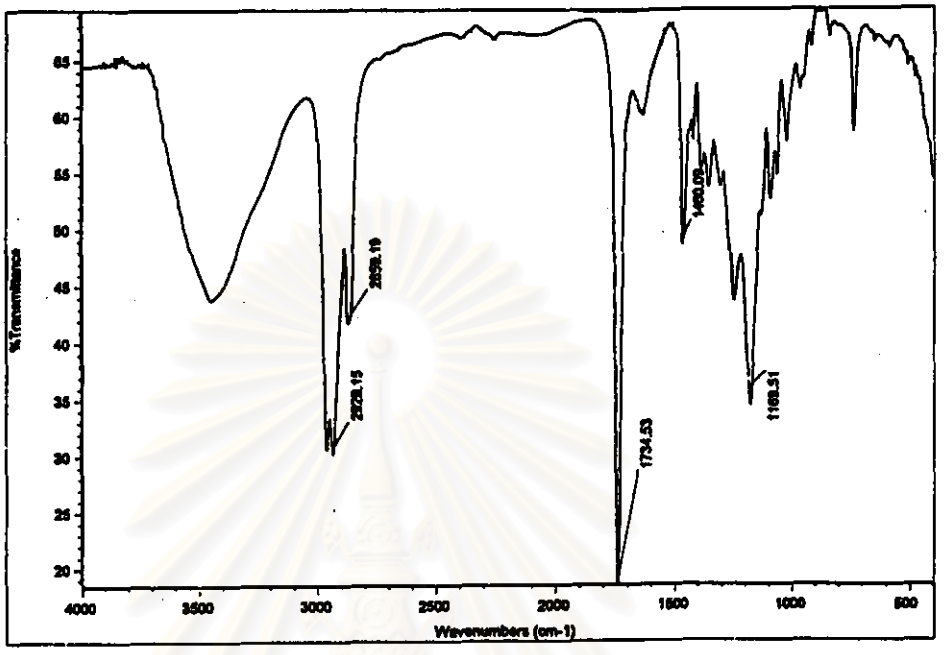



Fig. 48 The FT- IR spectrum of compound 11 in KBr disc

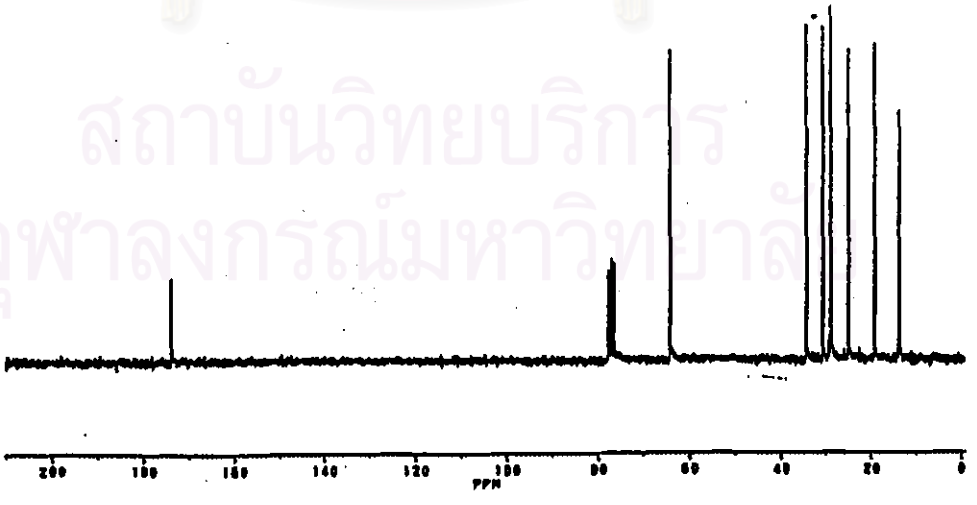



Fig. 49 The $^{13}$C-NMR spectrum of compound 11 in $CDCl_3$

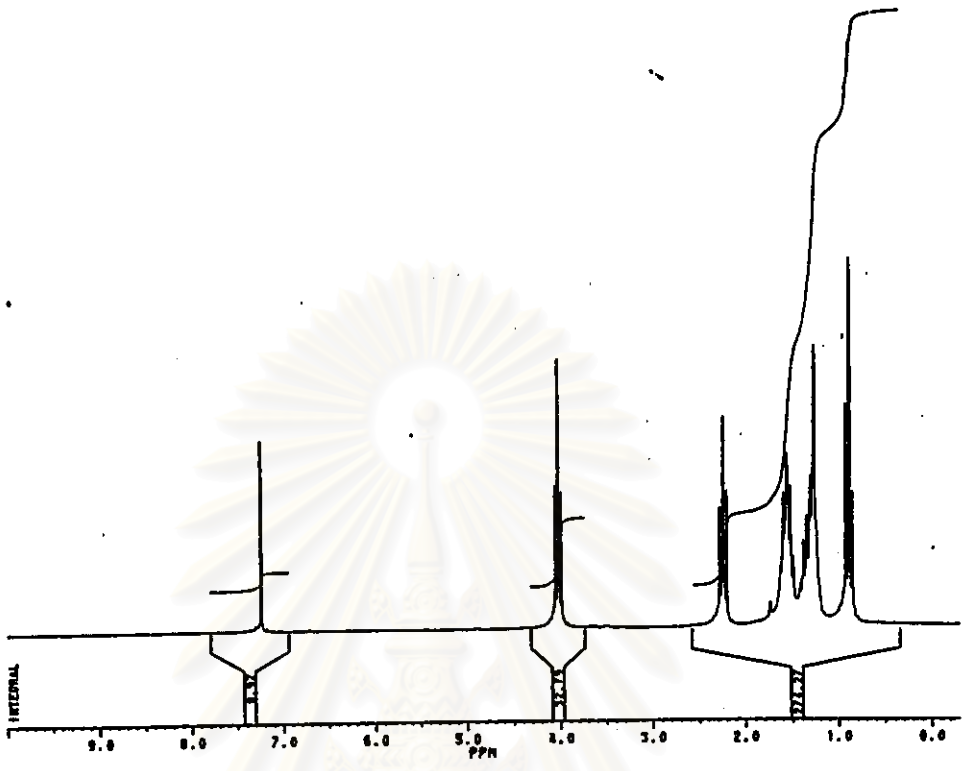
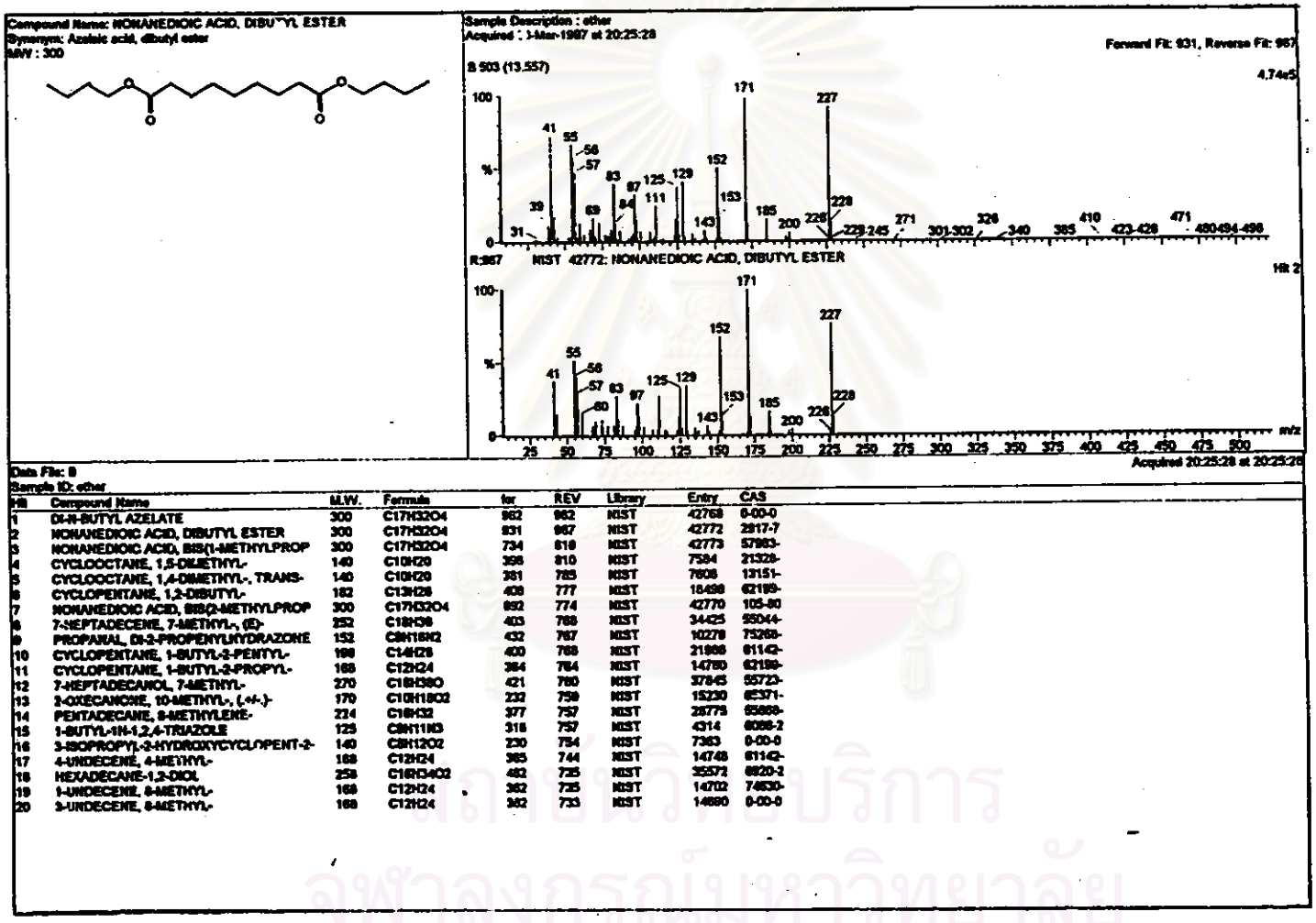



Fig. 50 The $^{1}$H-NMR spectrum of compound **11** in $CDCl_3$




| Hit | Compound Name | M.W. | Formula | for | REV | Library | Entry | CAS |
|---|---|---|---|---|---|---|---|---|
| 1 | DI-N-BUTYL AZELATE | 300 | C17H32O4 | 962 | 962 | NIST | 42768 | 0-00-0 |
| 2 | NONANEDIOIC ACID, DIBUTYL ESTER | 300 | C17H32O4 | 931 | 967 | NIST | 42772 | 2917-7 |
| 3 | NONANEDIOIC ACID, BIS(1-METHYLPROP | 300 | C17H32O4 | 734 | 818 | NIST | 42773 | 57983- |
| 4 | CYCLOOCTANE, 1,5-DIMETHYL- | 140 | C10H20 | 398 | 810 | NIST | 7584 | 21328- |
| 5 | CYCLOOCTANE, 1,4-DIMETHYL-, TRANS- | 140 | C10H20 | 381 | 785 | NIST | 7608 | 13151- |
| 6 | CYCLOPENTANE, 1,2-DIBUTYL- | 182 | C13H26 | 408 | 777 | NIST | 18498 | 62199- |
| 7 | NONANEDIOIC ACID, BIS(2-METHYLPROP | 300 | C17H32O4 | 892 | 774 | NIST | 42770 | 105-80 |
| 8 | 7-HEPTADECENE, 7-METHYL-, (E)- | 252 | C18H36 | 403 | 768 | NIST | 34425 | 55044- |
| 9 | PROPANAL, DI-2-PROPENYLHYDRAZONE | 152 | C9H16N2 | 432 | 767 | NIST | 10278 | 75268- |
| 10 | CYCLOPENTANE, 1-BUTYL-2-PENTYL- | 196 | C14H28 | 400 | 768 | NIST | 21986 | 61142- |
| 11 | CYCLOPENTANE, 1-BUTYL-2-PROPYL- | 168 | C12H24 | 384 | 764 | NIST | 14780 | 62199- |
| 12 | 7-HEPTADECANOL, 7-METHYL- | 270 | C18H38O | 421 | 760 | NIST | 37845 | 55723- |
| 13 | 2-OXECANONE, 10-METHYL-, (+/-)- | 170 | C10H18O2 | 232 | 759 | NIST | 15230 | 6E371- |
| 14 | PENTADECANE, 8-METHYLENE- | 224 | C16H32 | 377 | 757 | NIST | 28775 | 65866- |
| 15 | 1-BUTYL-1H-1,2,4-TRIAZOLE | 125 | C6H11N3 | 318 | 757 | NIST | 4314 | 6086-2 |
| 16 | 3-ISOPROPYL-2-HYDROXYCYCLOPENT-2- | 140 | C8H12O2 | 230 | 754 | NIST | 7363 | 0-00-0 |
| 17 | 4-UNDECENE, 4-METHYL- | 168 | C12H24 | 365 | 744 | NIST | 14748 | 6114-2- |
| 18 | HEXADECANE-1,2-DIOL | 258 | C16H34O2 | 482 | 735 | NIST | 35572 | 6920-2 |
| 19 | 1-UNDECENE, 8-METHYL- | 168 | C12H24 | 362 | 735 | NIST | 14702 | 74630- |
| 20 | 3-UNDECENE, 8-METHYL- | 168 | C12H24 | 362 | 733 | NIST | 14690 | 0-00-0 |

Fig. 51 The MS spectrum of compound 11

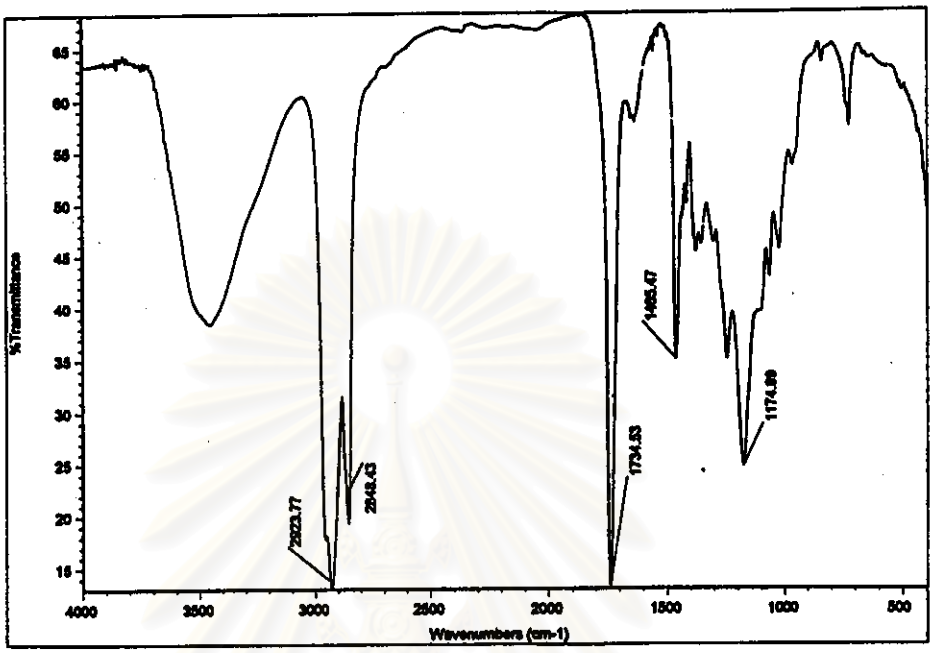



Fig. 52 The FT- IR spectrum of compound 12 in KBr disc

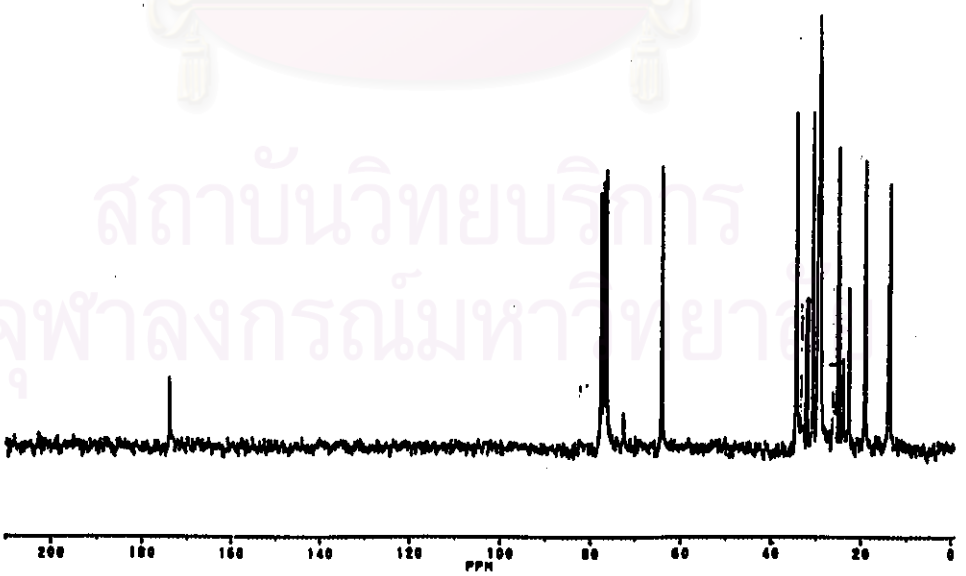



Fig. 53 The $^{13}$C-NMR spectrum of compound 12 in $CDCl_3$

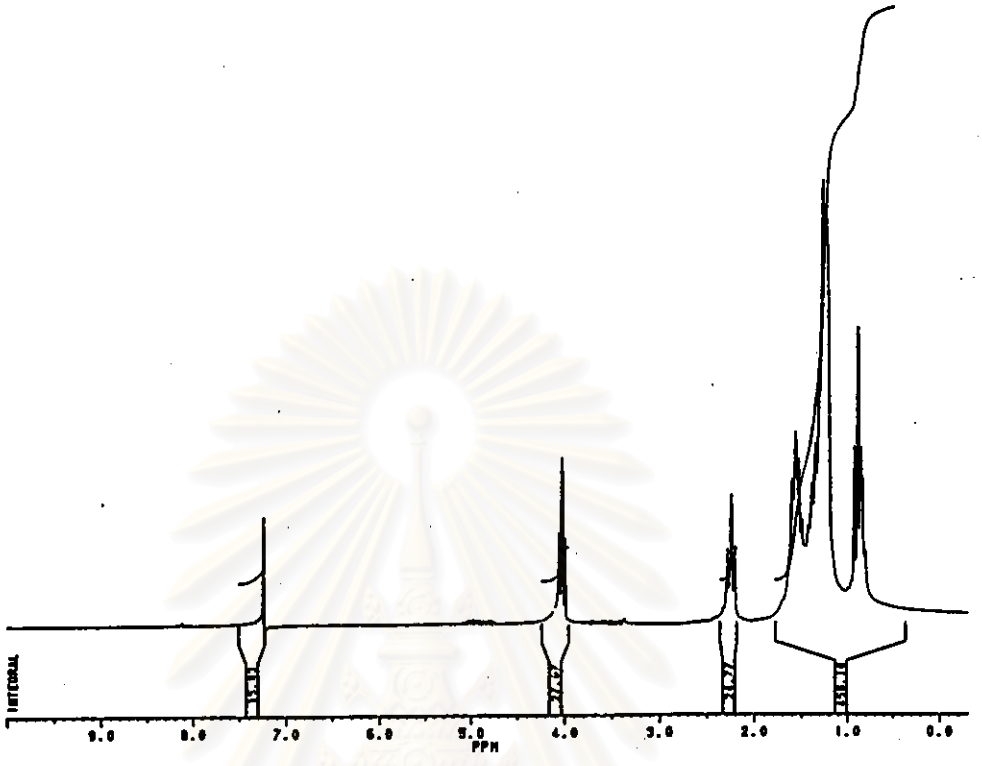
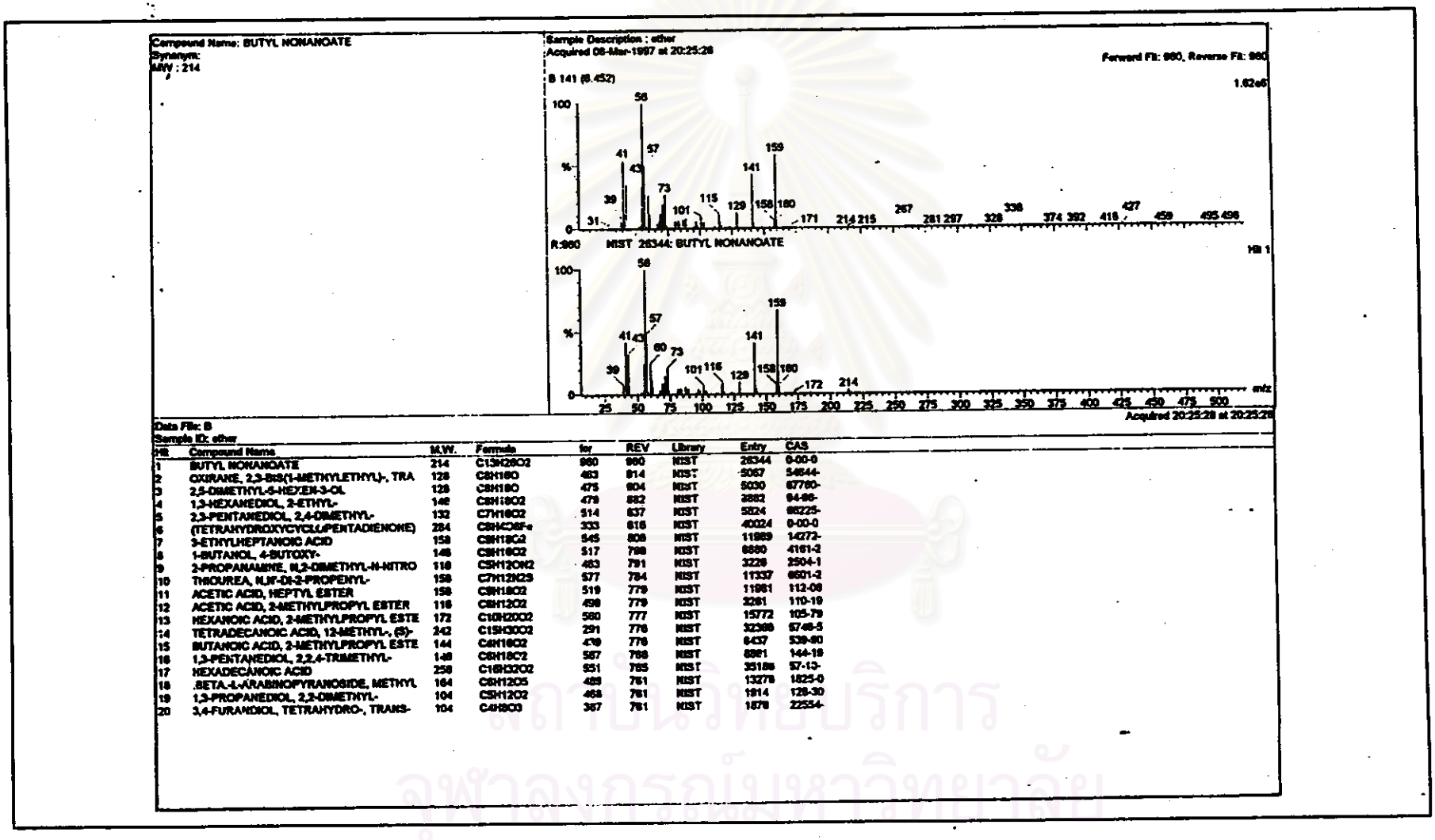



Fig. 54 The $^1$H-NMR spectrum of compound 12 in $CDCl_3$




| Hit | Compound Name | M.W. | Formula | for | REV | Library | Entry | CAS |
|---|---|---|---|---|---|---|---|---|
| 1 | BUTYL NONANOATE | 214 | C13H26O2 | 980 | 980 | NIST | 26344 | 0-00-0 |
| 2 | OXIRANE, 2,3-BIS(1-METHYLETHYL)-, TRA | 128 | C8H16O | 463 | 814 | NIST | 5057 | 54644- |
| 3 | 2,5-DIMETHYL-5-HEXEN-3-OL | 128 | C8H16O | 475 | 804 | NIST | 5030 | 67760- |
| 4 | 1,3-HEXANEDIOL, 2-ETHYL- | 146 | C8H18O2 | 479 | 882 | NIST | 2892 | 94-96- |
| 5 | 2,3-PENTANEDIOL, 2,4-DIMETHYL- | 132 | C7H16O2 | 514 | 837 | NIST | 5824 | 66225- |
| 6 | (TETRAHYDROXYCYCLO)PENTADIENONE) | 284 | C8HC8Fe | 333 | 816 | NIST | 40024 | 0-00-0 |
| 7 | 3-ETHYLHEPTANOIC ACID | 158 | C9H18O2 | 545 | 808 | NIST | 11989 | 14272- |
| 8 | 1-BUTANOL, 4-BUTOXY- | 146 | C8H18O2 | 517 | 798 | NIST | 6880 | 4161-2 |
| 9 | 2-PROPANAMINE, N,2-DIMETHYL-N-NITRO | 118 | C5H12ON2 | 463 | 791 | NIST | 3228 | 2504-1 |
| 10 | THIOUREA, N,N'-DI-2-PROPENYL- | 158 | C7H12N2S | 577 | 784 | NIST | 11337 | 6501-2 |
| 11 | ACETIC ACID, HEPTYL ESTER | 158 | C9H18O2 | 519 | 779 | NIST | 11981 | 112-06 |
| 12 | ACETIC ACID, 2-METHYLPROPYL ESTER | 116 | C6H12O2 | 498 | 779 | NIST | 3281 | 110-19 |
| 13 | HEXANOIC ACID, 2-METHYLPROPYL ESTE | 172 | C10H20O2 | 580 | 777 | NIST | 15772 | 105-79 |
| 14 | TETRADECANOIC ACID, 12-METHYL-, (S)- | 242 | C15H30O2 | 291 | 776 | NIST | 32388 | 5749-5 |
| 15 | BUTANOIC ACID, 2-METHYLPROPYL ESTE | 144 | C8H16O2 | 479 | 776 | NIST | 6437 | 539-90 |
| 16 | 1,3-PENTANEDIOL, 2,2,4-TRIMETHYL- | 146 | C8H18O2 | 567 | 768 | NIST | 8981 | 144-19 |
| 17 | HEXADECANOIC ACID | 256 | C16H32O2 | 551 | 765 | NIST | 35189 | 57-10- |
| 18 | .BETA.-L-ARABINOPYRANOSIDE, METHYL | 164 | C6H12O5 | 489 | 761 | NIST | 13278 | 1825-0 |
| 19 | 1,3-PROPANEDIOL, 2,2-DIMETHYL- | 104 | C5H12O2 | 468 | 761 | NIST | 1914 | 126-30 |
| 20 | 3,4-FURANDIOL, TETRAHYDRO-, TRANS- | 104 | C4H8O3 | 367 | 761 | NIST | 1878 | 22554- |

Fig. 55 The MS spectrum of compound 12

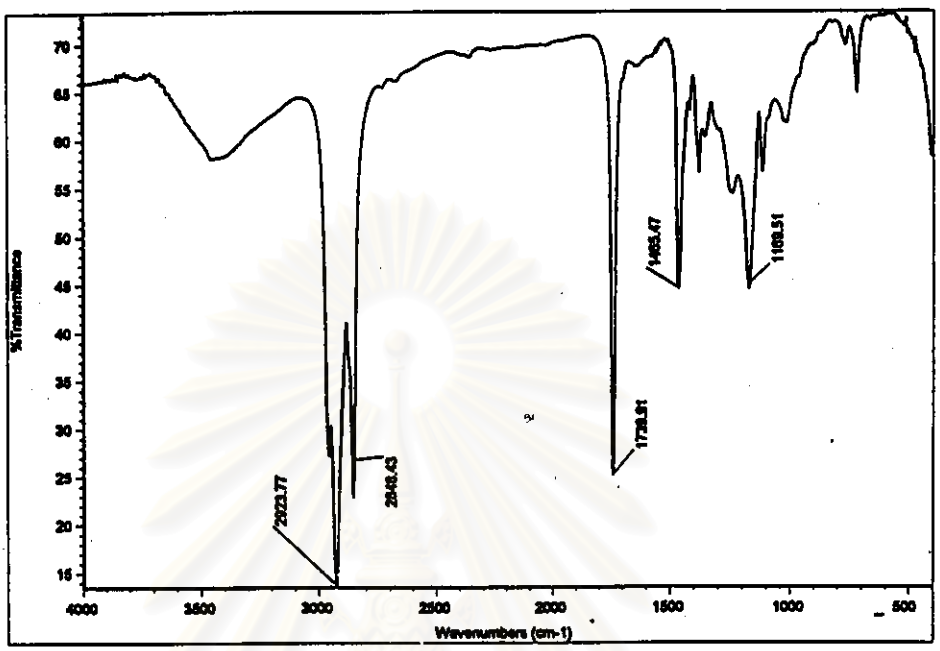



Fig. 56 The FT- IR spectrum of compound 13 in KBr disc

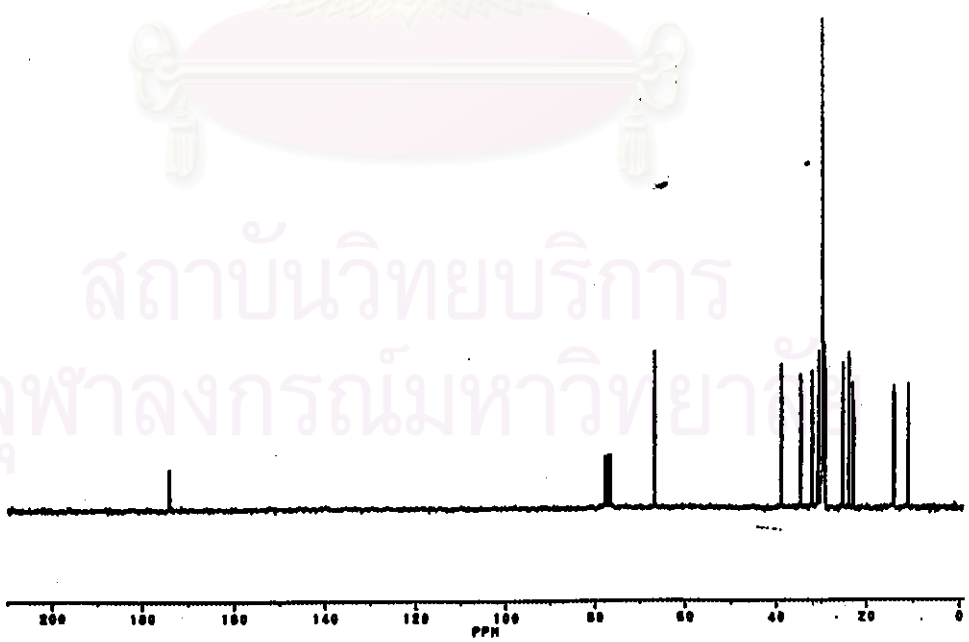



Fig. 57 The $^{13}$C-NMR spectrum of compound 13 in $CDCl_3$

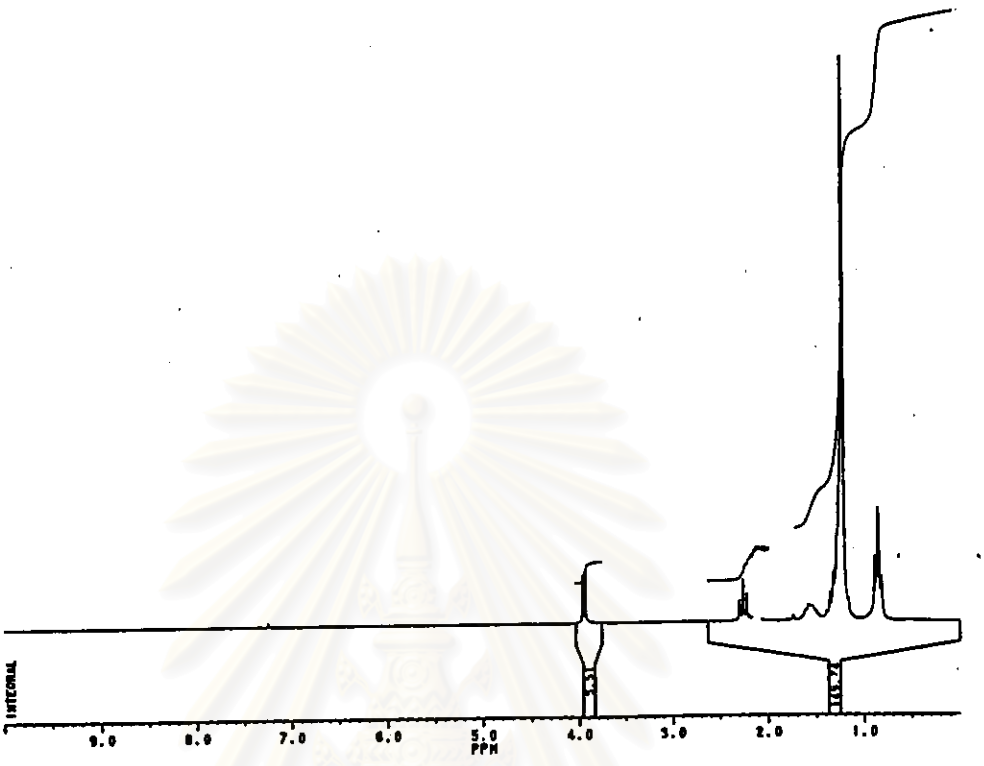



Fig. 58 The $^{1}$H-NMR spectrum of compound 13 in $CDCl_3$

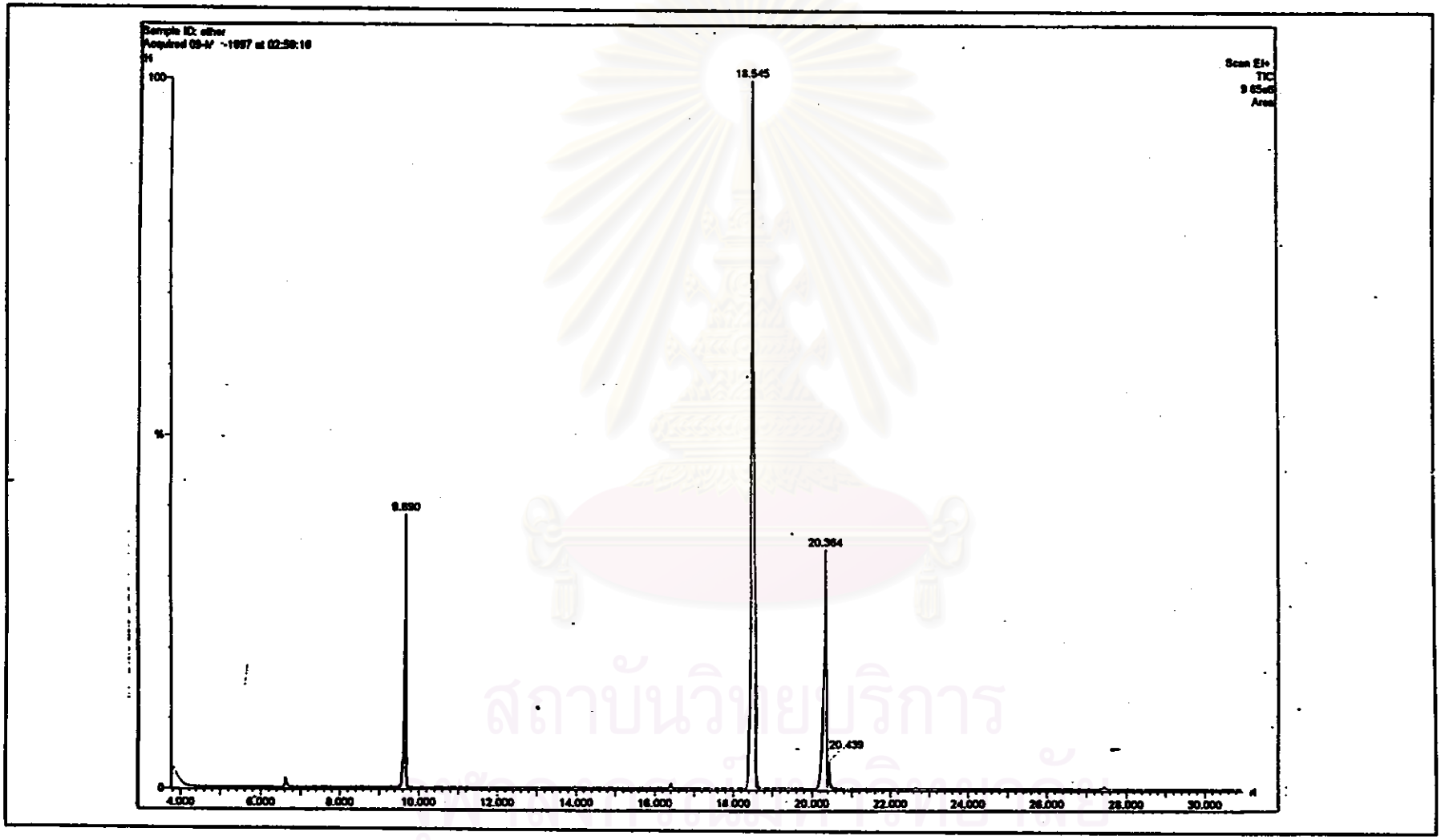
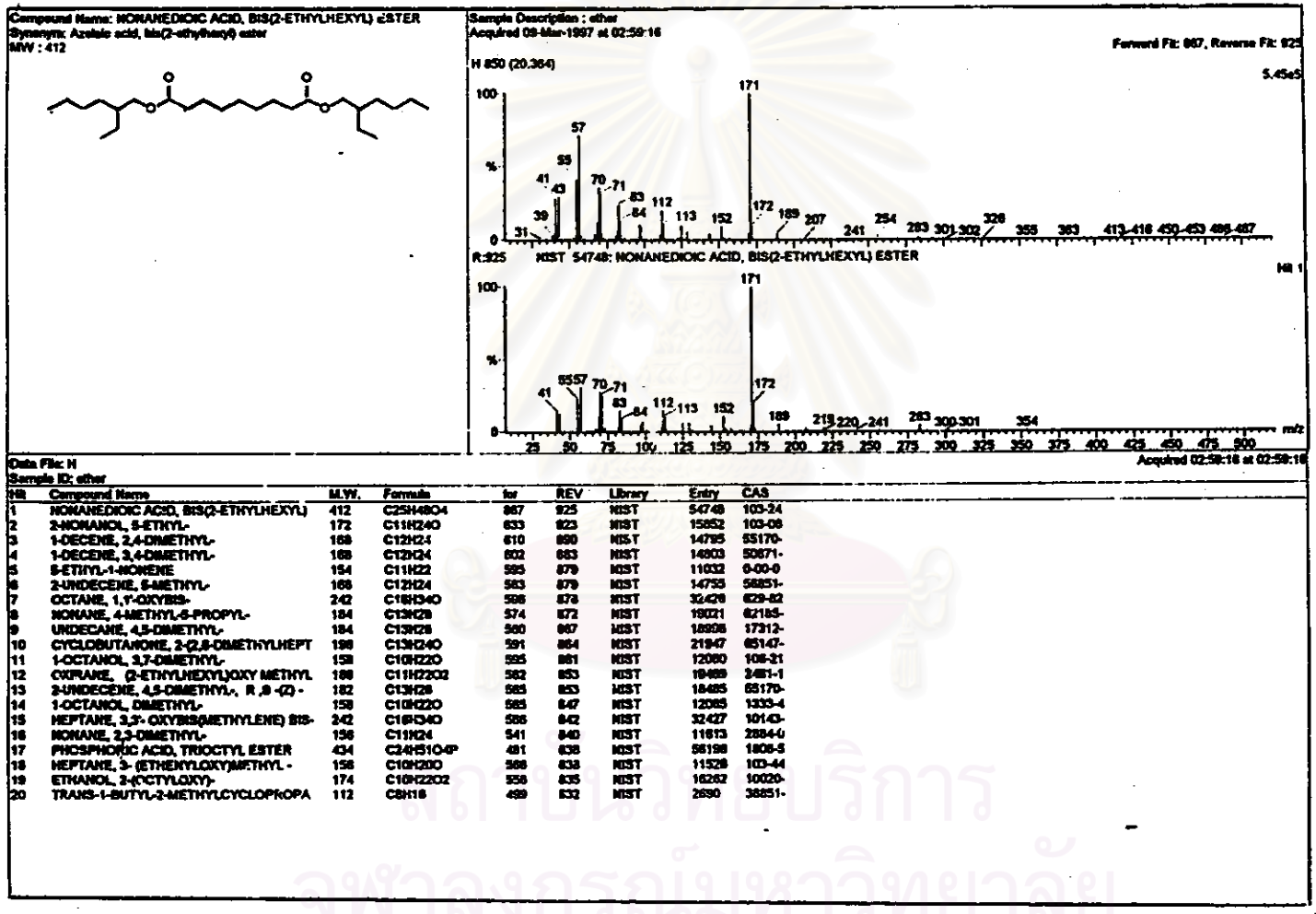



Fig. 59 The GC chromotogram of mixed 2-ethyl-1-hexyl ester




| Hit | Compound Name | M.W. | Formula | for | REV | Library | Entry | CAS |
|---|---|---|---|---|---|---|---|---|
| 1 | NONANEDIOIC ACID, BIS(2-ETHYLHEXYL) | 412 | C25H48O4 | 867 | 925 | NIST | 54748 | 103-24 |
| 2 | 2-NONANOL, 5-ETHYL- | 172 | C11H24O | 633 | 823 | NIST | 15852 | 103-08 |
| 3 | 1-DECENE, 2,4-DIMETHYL- | 168 | C12H24 | 610 | 890 | NIST | 14795 | 55170- |
| 4 | 1-DECENE, 3,4-DIMETHYL- | 168 | C12H24 | 602 | 883 | NIST | 14803 | 50871- |
| 5 | 5-ETHYL-1-NONENE | 154 | C11H22 | 595 | 879 | NIST | 11032 | 0-00-0 |
| 6 | 2-UNDECENE, 5-METHYL- | 168 | C12H24 | 583 | 879 | NIST | 14755 | 56851- |
| 7 | OCTANE, 1,1'-OXYBIS- | 242 | C16H34O | 526 | 878 | NIST | 32426 | 629-82 |
| 8 | NONANE, 4-METHYL-5-PROPYL- | 184 | C13H28 | 574 | 872 | NIST | 19021 | 62185- |
| 9 | UNDECANE, 4,5-DIMETHYL- | 184 | C13H28 | 560 | 867 | NIST | 18998 | 17312- |
| 10 | CYCLOBUTANONE, 2-(2,6-DIMETHYLHEPT | 196 | C13H24O | 591 | 864 | NIST | 21947 | 65147- |
| 11 | 1-OCTANOL, 3,7-DIMETHYL- | 158 | C10H22O | 595 | 861 | NIST | 12080 | 106-21 |
| 12 | OXIRANE, (2-ETHYLHEXYL)OXY METHYL | 186 | C11H22O2 | 582 | 853 | NIST | 19489 | 2461-1 |
| 13 | 2-UNDECENE, 4,5-DIMETHYL-, R ,S -(Z) - | 182 | C13H26 | 585 | 853 | NIST | 18485 | 55170- |
| 14 | 1-OCTANOL, DIMETHYL- | 158 | C10H22O | 585 | 847 | NIST | 12085 | 1333-4 |
| 15 | HEPTANE, 3,3'- OXYBIS(METHYLENE) BIS- | 242 | C16H34O | 586 | 842 | NIST | 32427 | 1014- |
| 16 | NONANE, 2,3-DIMETHYL- | 156 | C11H24 | 541 | 840 | NIST | 11613 | 2884-0 |
| 17 | PHOSPHORIC ACID, TRIOCTYL ESTER | 434 | C24H51O4P | 491 | 838 | NIST | 56198 | 1806-5 |
| 18 | HEPTANE, 3- (ETHENYLOXY)METHYL - | 156 | C10H20O | 566 | 838 | NIST | 11528 | 103-44 |
| 19 | ETHANOL, 2-(OCTYLOXY)- | 174 | C10H22O2 | 556 | 835 | NIST | 16262 | 10020- |
| 20 | TRANS-1-BUTYL-2-METHYLCYCLOPROPA | 112 | C8H16 | 499 | 832 | NIST | 2690 | 38851- |

Fig. 60 The MS spectrum of compound 13

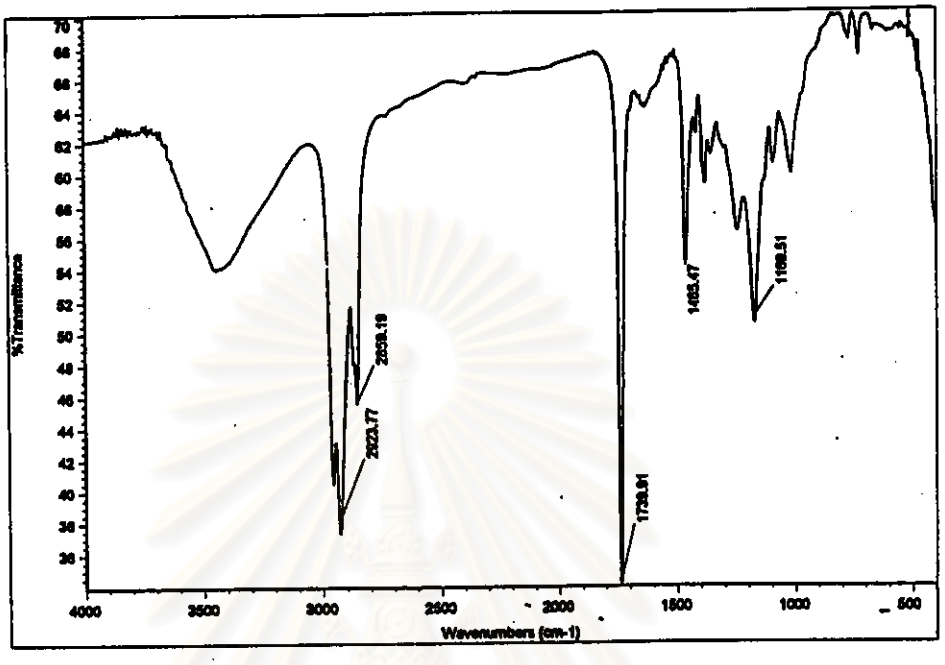



Fig. 61 The FT- IR spectrum of compound 14 in KBr disc

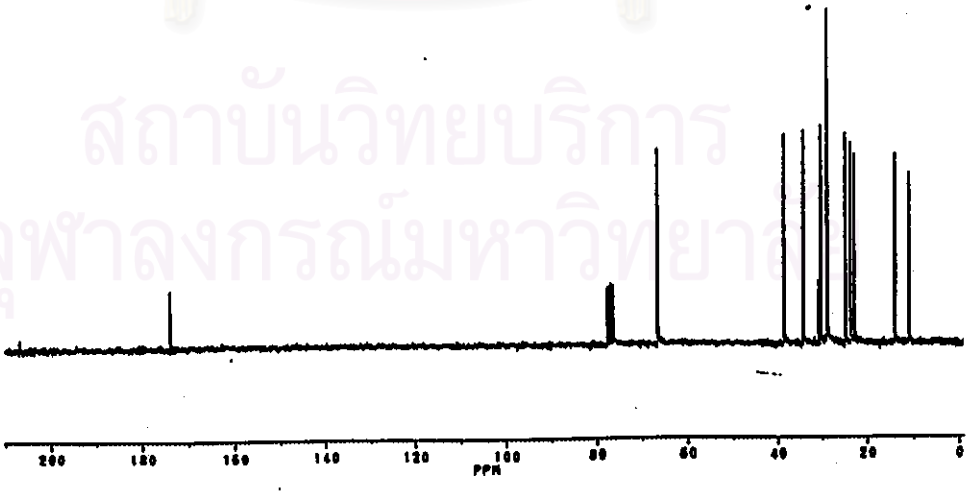



Fig. 62 The $^{13}$C-NMR spectrum of compound 14 in $CDCl_3$

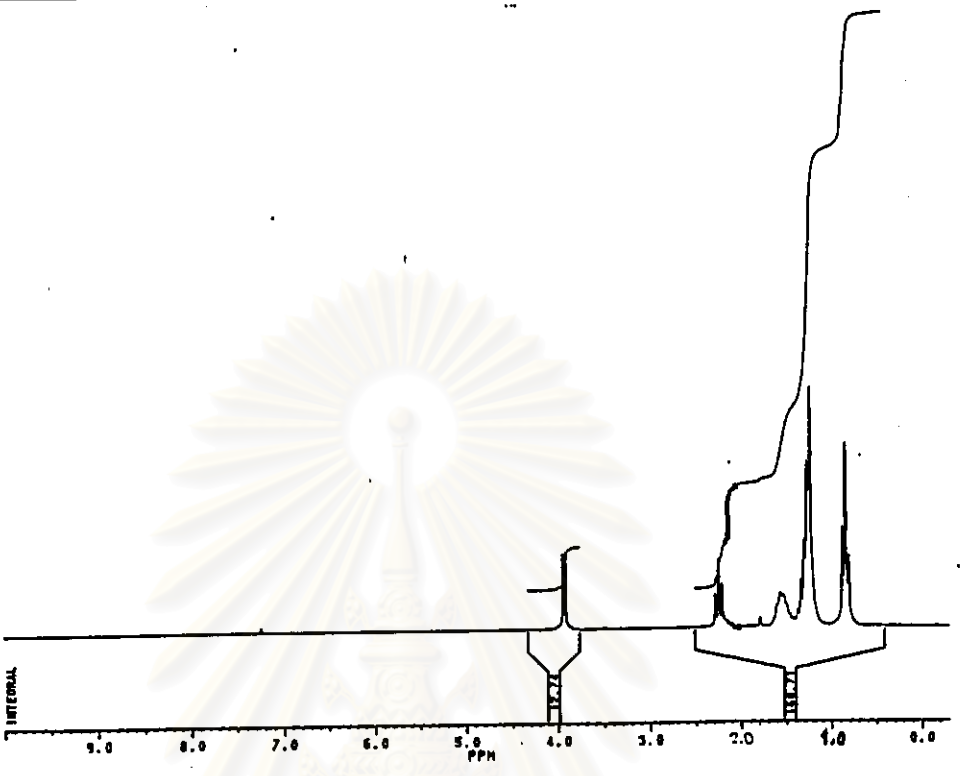



Fig. 63 The $^{1}$H-NMR spectrum of compound 14 in $CDCl_3$

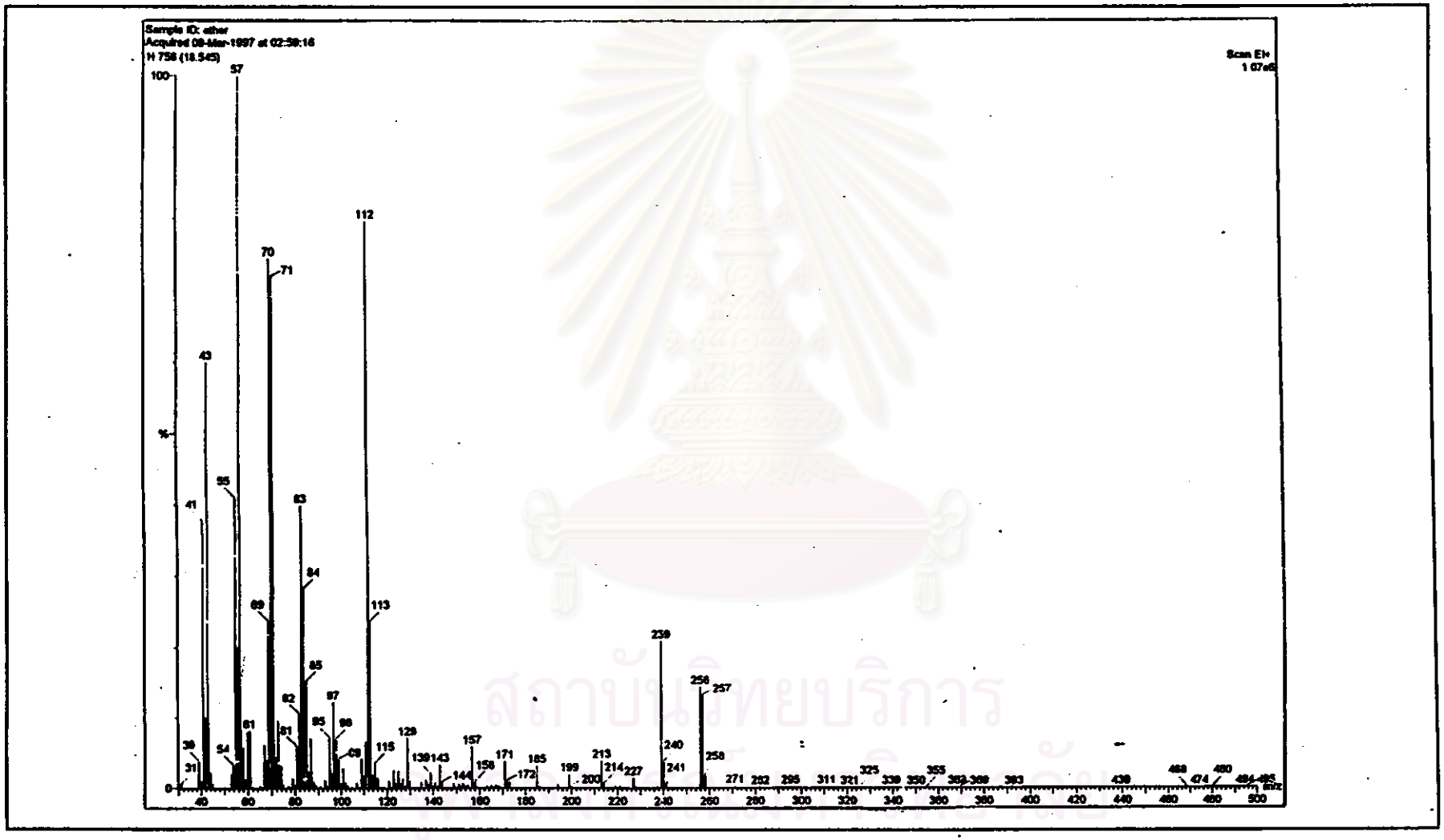



Fig. 64 The MS spectrum of compound 14

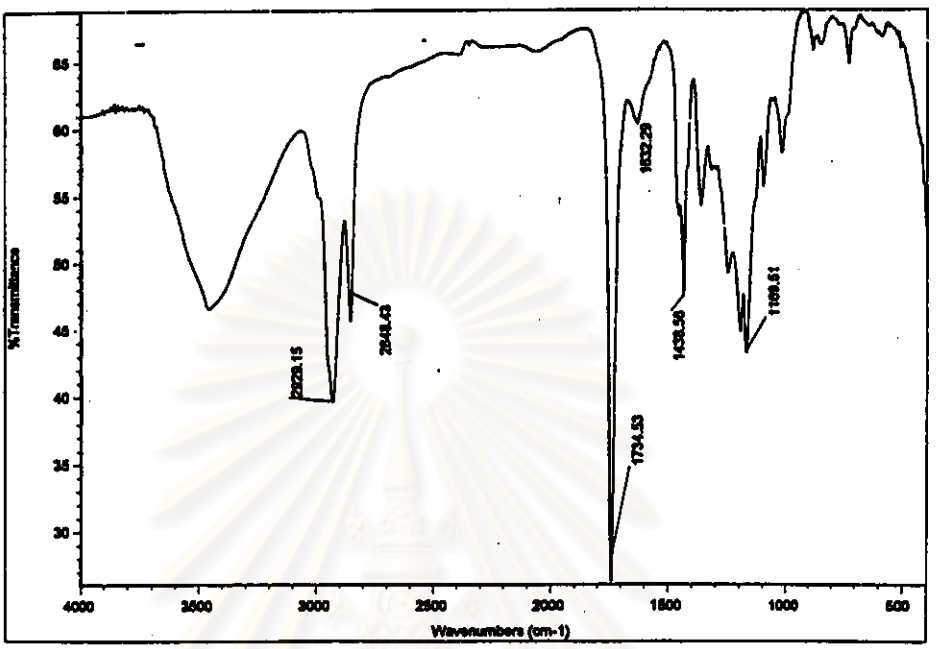



Fig. 65 The FT- IR spectrum of compound 15 in KBr disc

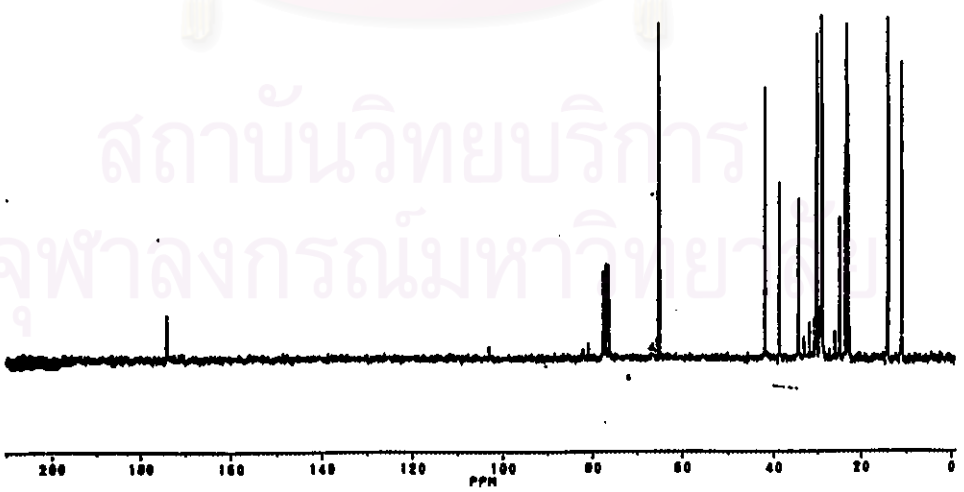



Fig. 66 The $^{13}$C-NMR spectrum of compound 15 in $CDCl_3$

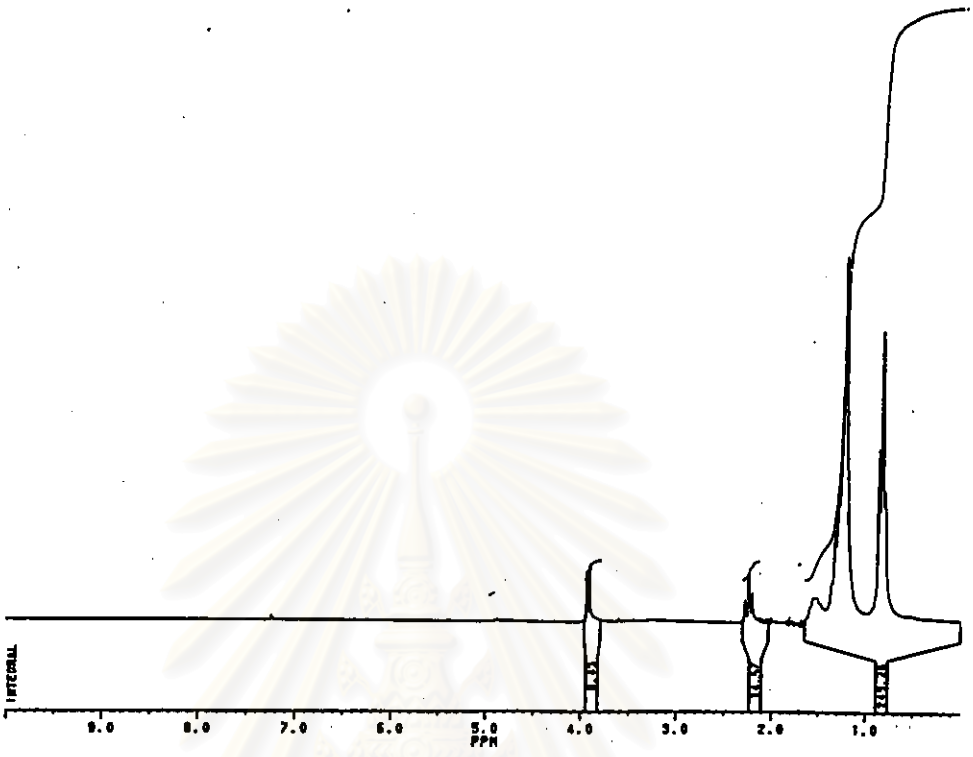



Fig. 67 The $^{1}$H-NMR spectrum of compound **15** in $CDCl_3$

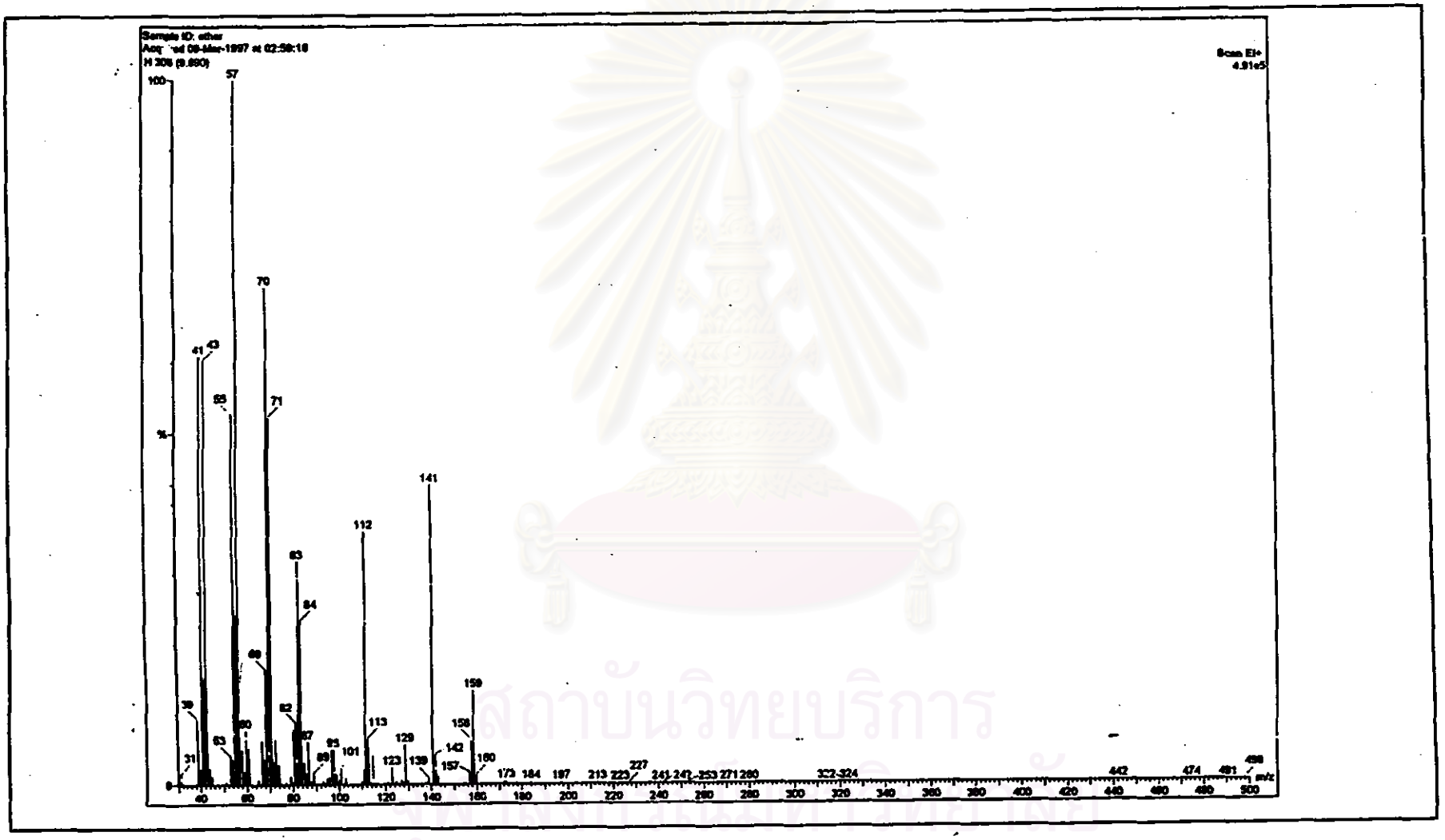



Fig. 68 The MS spectrum of compound 15

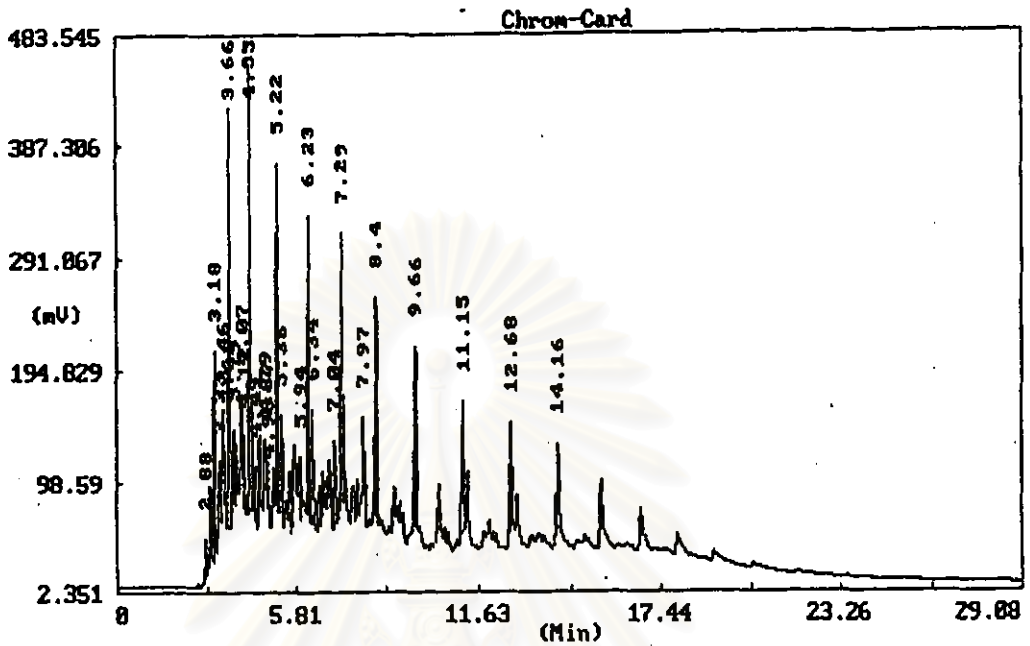



Fig. 69 The GC chromatogram of diesel fuel

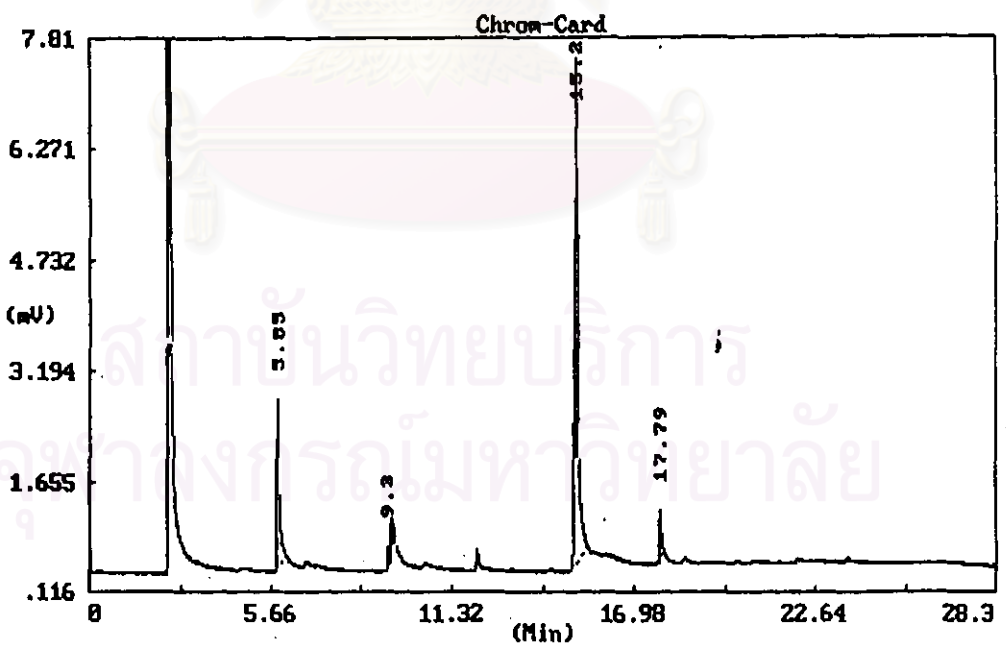



Fig. 70 The GC chromatogram of mixed methyl ester

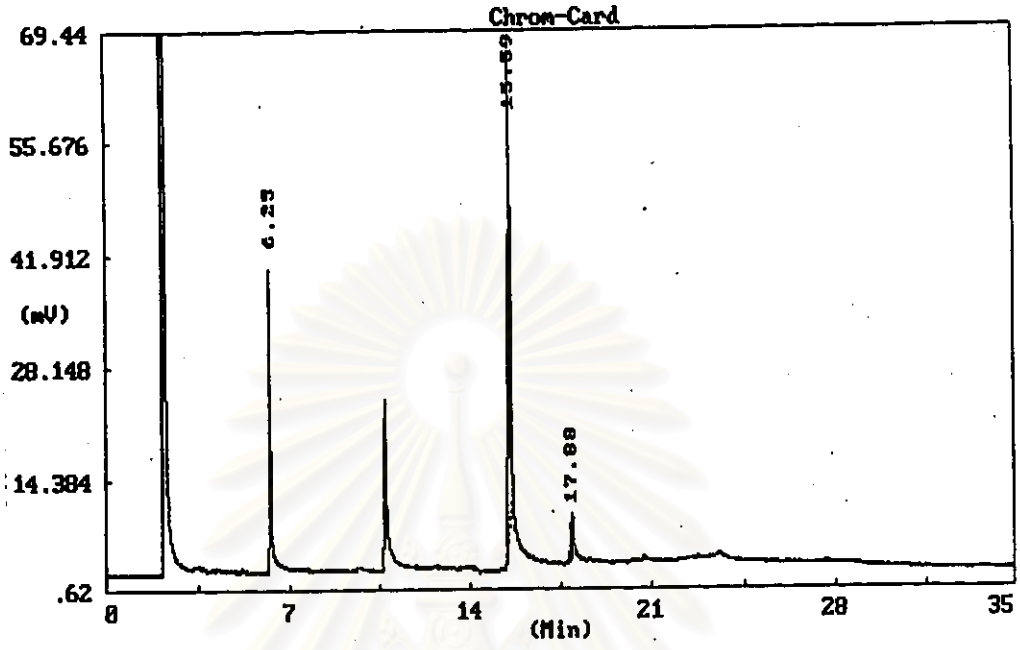



Fig. 71 The GC chromatogram of mixed ethyl ester

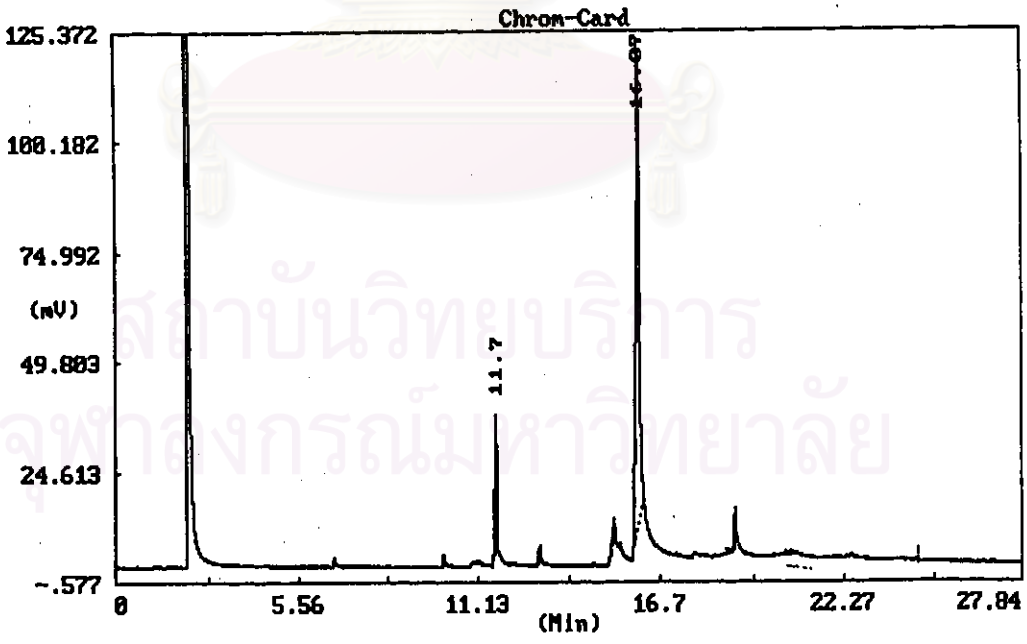



Fig. 72 The GC chromatogram of mixed isopropyl ester

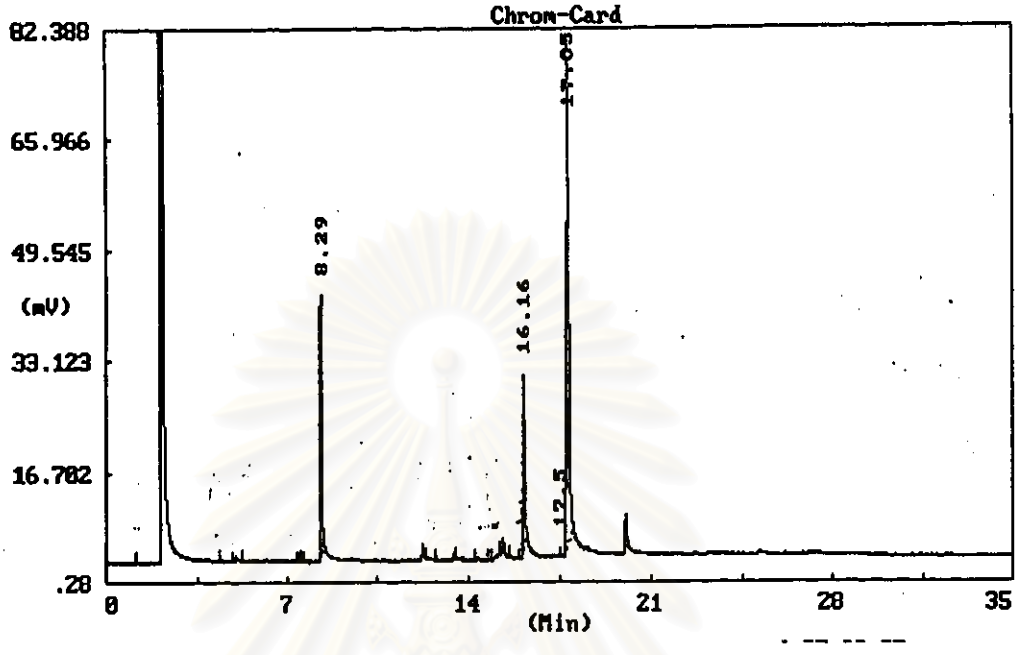



Fig. 73 The GC chromatogram of mixed butyl ester

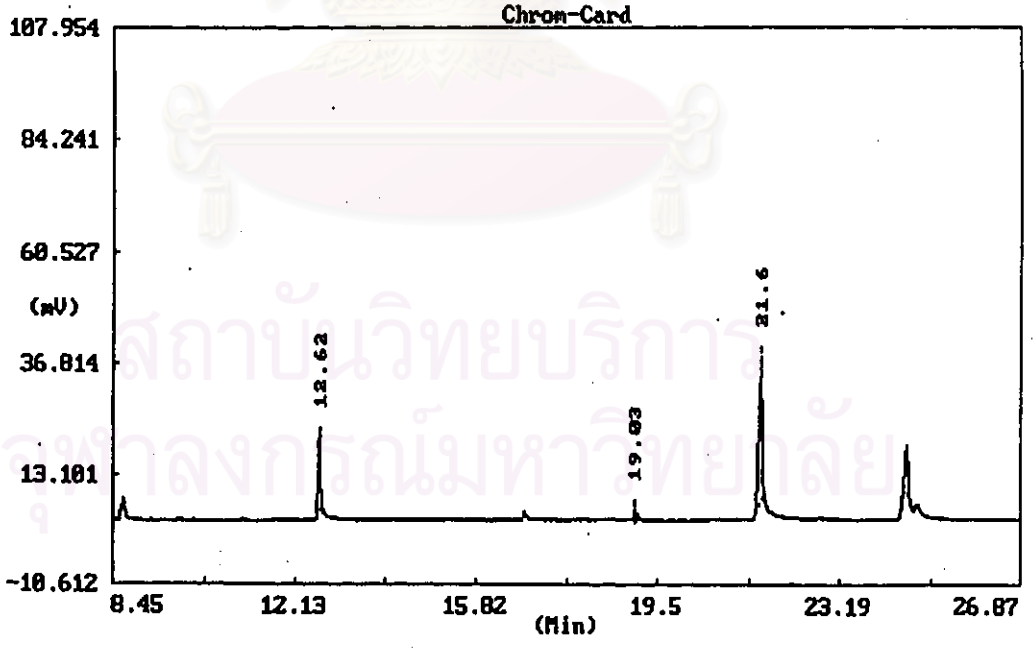



Fig. 74 The GC chromatogram of mixed 2-ethyl-1-hexyl ester

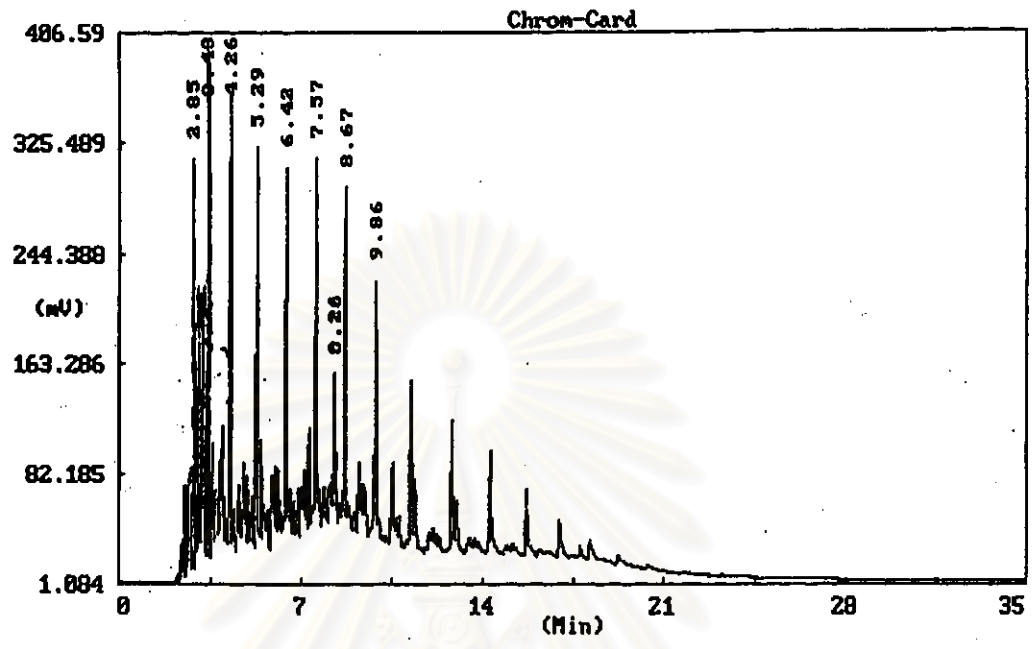



Fig. 75 The GC chromatogram of mixed butyl ester at concentration 10000 ppm

# VITA

Waraporn Wongchantra was born on April 19, 1971 in Prachinburi, Thailand. She recieved her Bachelor Degree of Science in the field of Chemistry from Burapha University in 1994. She continuted her graduate study in organic chemistry at Chulalongkorn University in 1994 and finished in 1998.