REFERENCES

1 Cordell, G. A., Angerhofer, C. K. and Pezzuto, J. M.1994. Recent studies on cytotoxic, anti-HIV and antimalarial agents from plants. *Pure&Appl.Chem.* 66: 2283-2286.

2 De Pasquale. A., 1984. Pharmacognosy : the oldest modern sceince. *J. of Ethnopharm.* 11: 1-16.

3 Yue-Zhong S., 1998. Recent natural products based drug development: a pharmaceutical industry perspective. *J. Nat. Prod.* 61: 1053-1071.

4 Goldfrank, L. 1982. The Pernicious Panacea: Herbal Medicine. *Hospital Physician* 10: 64-86.

5 Vulto, A. G. and Smet, P.A.G.M. 1988. *In* Meyler's Side Effects of Drugs, 11 th Ed. Elsevier, Amsterdam, pp. 999-1005.

6 Pezzuto, J. M. 1997. Plant–derived anticancer agent. *Biochem. Pharm.*. 53: 121–33.

7 Kitazawa, E., Sato, A., Takahashi, S., Kuwano, H.and Ogiso, A. 1980. Novel diterpenelactones with anti-peptic ulcer activity from *Croton sublyratus. Chem. Pharm. Bull.* 28: 227-231.

8 เต็ม สมิตินันท์. 2523.ชื่อพรรณไม้แห่งประเทศไทย (ชื่อพฤกษศาสตร์-ชื่อพื้นเมือง). พิมพ์ครั้งที่ 2. สำนักพิมพ์ฟันนี่พับลิชชิ่ง, กทม.

9 สมภพ ประธานธุรารักษ์. 2539. อนุกรมวิธานพืชสมุนไพร. สำนักพิมพ์โอเดียนสโตร์, กทม.

10 เสงี่ยม พงษ์บุญรอด. 2502. ไม้เทศเมืองไทย. สำนักพิมพ์เขษมบรรณกิจ, กทม.

11 Blatter, E., Caius, J. F. and Mhaskar , K. S. 1975. Indian Medicinal Plants. Vol III. 2nd ed. Jayyed Press, Delhi. p 751.

12 Kitazawa, E., Ogiso, A.,Takahashi, S., Sato, A., Kurabayashi, M., Kuwano, H., Hata, T., and Tamura, C. 1979. Plaunol A and B, new anti-ulcer diterpenelactones from *Croton sublyratus. Tetrahedron Letter.* 13: 1117-1120

13 Kitazawa, E. and Ogiso, A. 1981. Two diterpene alcohols from *Croton sublyratus. Phytochemistry.*. 20: 1915-1918.

14 Silveria, E. R. and Craverio, A. A. 1982. Two cleistanthane type diterpenes from *Croton sonderianus*. . *Phytochemistry.* 21: 2571–2575.

15 McChesney, J. D. and Silveria, E. R. 1989. 12–Hydroxyhardwikiic acid and sonderianial, neo-clerodane from *Croton sonderianus. Phytochemistry.* 28: 3411–3416.

16 McChesney, J. D. and Clark, A. M. 1991. Antimicrobial diterpenes of *Croton sonderianus*, hardwikiic and 3,4-secotrachylobanoic acids. *J. Nat. Prod.* 54(6): 1625-1633.

17 Cai, Y., Chen, Z.P. and Phillipson, J. D. 1993. Diterpenes from *Croton lachleri*. . *Phytochemistry*.. 32: 755–759.

18 Chen, Z. P., Cai, Y. and Phillipson, J. D. 1994. Studies on the anti-tumor, anti-bacterial, and wound-healing properties of dragon blood. *Planta Med.*. 60:541-545.

19 Peres, M.T.L.P., Monache, F. D., Cruz, A. B., Pizzolatti, M. G. and Yunes, R. A. 1997. Chemical composition and antimicrobial activity of *Croton urucurana* Baillon (Euphorbiaceae). *J. of Ethnopharm.*. 56: 223-226.

20 Piacente, S., Belisaro, M. A., Castillo, H.D., Pizza, C. and Feo, V. D. 1998. *Croton ruizianus*: Platelet proaggregating activity of two new pregnane glycosides. *J. Nat. Prod.* 61: 318-322.

21 Ngadjui, B. T., Folefoc, G. G., Keumedijo, F., Dongo, E., Sondengam, B. L. and Connolly, J. D. 1999. Crotonadiol, a labdane diterpenoid from the stem bark of *Croton zambesicus*. . *Phytochemistry.* 51: 171–174.

22 Maciel, M. A. M., Pinto, A. C., Arruda, A. C., Pamplona, S. G. S. R., Vanderlinde, F. A., Lapa, A. J., Echevarria, A., Grynberg, N. F, Colus, I.M.S., Farias, R. A. F., Costa, A. M. L. and Rao, V. S. N. 2000. Ethnopharmacology, phytochremistry and pharmadology: a successful combination in study of *Croton cajucara. J. of Ethnopharm.*. 70: 41–55.

23 Vigor, C., Fabre, N., Fouraste, I. and Moulis, C. 2001. Three clerodane diterpenoids from *Croton eluteria* Bennett. . *Phytochemistry*.. 57: 1209-1212.

24 Rao, P. S., Sachdev, T. R., and Singh, H. B.1968. Isolation and constitution of oblongifolol, a new diterpene of Croton oblongifolius. *Tetrahedron lette*r. 45: 4685-4688

25 Aiyar, V. N., Rao, P. S., Sachdev, T. R. and Seshadri, T. R. 1969. Isolation and constitution of deoxyoblongifoliol. *Indian J. Chem.* 7: 838–839.

26 Aiyar, V. N. and Seshadri, T. R. 1970. Component of *Croton oblongifolius.* Roxb. III. Constitution of oblongifolic acid. *Tetrahedron.* 26: 5275–5279.

27 Aiyar, V. N. and Seshadri, T. R.1971. Chemical components of *Croton oblongifolius.* Roxb: part IV constitution of oblongifoliol and deoxyoblongifoliol. *Indian J. Chem.* 9: 1055–1059.

28 Aiyar, V. N. and Seshadri, T. R.1971. Chemical components of *Croton oblongifolius.* Roxb: part V *Indian J. Chem.* 9: 613–614.

29 Aiyar, V. N. and Seshadri, T. R. 1971. Isolation of acetyl aleuritolic acid from *Croton oblongifolius.* Roxb. *Indian J. Chem.* 9: 1028–1029.

30 Aiyar, V. N. and Seshadri, T. R. 1972. 11-dehydro-hardwikiic acid from *Croton oblongifolius.* Roxb. . *Phytochemistry.* 11: 1473- 1476

31 Aiyar, V. N. and Seshadri, T. R. 1972. Chemical components of *Croton oblongifolius.* Roxb. *Curr. Sci.* 41: 839–840.

32 Roengsumran, S. Achayindee, S., Petsom, A., Pudhom, K., Singtotong, P., Surachetapan, C. and Vilaivan, T. 1998. Two new cembranoids from *Croton oblongifolius. J. Nat. Prod.* 61: 652-654.

33 Roengsumran, S., Singtotong, P., Pudhom, K., Ngamrojnavanich, N., Petsom, A., and Chaichantipyuth, C. 1999. Neocrotocembranal from *Croton oblongifolius. . J. Nat. Prod.* 62: 1163-1164.

34 Roengsumran, S., Petsom, A, Sommit, D. and Vilaivan, T. 1999. Labdane diterpenoids from *Croton oblongifolius. . Phytochemistry.* 50: 449–453.

35 Roengsumran, S., Petsom, A., Kuptiyanuwat, N., Vilaivan, T., Ngamrojnavanich, N., Chaichantipyuth, C. and Phutong, S. 2001. Cytotoxic labdane diterpenoids from *Croton oblongifolius. Phytochemistry.* 56: 103-107.

36 Sommit, D. 1996. Structure analysis of diterpenoid compounds from stem barks of *Croton oblongifolius* Roxb. Master's Thesis, Graduate School, Chulalongkorn University.

37 Singtothong, P. 1999. Chemistry and biological activity of diterpenoid from *Croton oblongifolius* Roxb. Ph. D. Dissertation, Graduate School, Chulalongkorn University.

38 Kutiyanuwat, N. Chemical constituents of stem barks of *Croton oblongifolius* Roxb and their biological activity from Amphoe Wangsupung Loei province. Master's Thesis, Graduate School, Chulalongkorn University.

39 Baingern, S. 1999. Chemical constituents and biological activity from the stem barks of *Croton oblongifolius* Roxb from Amphoe Muang Udonthani province. Master's Thesis, Graduate School, Chulalongkorn University.

40 Tanwattanakun, T. 1999. Chemical constituents and their biological activity of stem barks of *Croton oblongifolius* Roxb from Amphoe Muang Uttaradit province. Master's Thesis, Graduate School, Chulalongkorn University.

41 Sirimongkhon, S. 2000. Kaurane diterpenes from stem bark of *Croton oblongifolius* Roxb from Kuiburi, Prachuabkhirikhan province. Master's Thesis, Graduate School, Chulalongkorn University.

42 Siriwat, K. 1999. Chemical constituents and biological activity from the stem bark of *Croton oblongifolius* Roxb from Amphoe Dan Sai, Loei province. Master's Thesis, Graduate School, Chulalongkorn University.

43 Sriyangnok, S. 2000. Chemical constituents and biological activity from the stem bark of *Croton oblongifolius* Roxb from Amphoe Muang, Udonthani province. Master's Thesis, Graduate School, Chulalongkorn University.

44 Bunyamanee, P. 2000. Cytotoxicity to cancer cell lines of diterpenoid compounds from stem barks of *Croton oblongifolius* Roxb. from Chachoengsao province. Master's Thesis, Graduate School, Chulalongkorn University.

45 Dixon, R. A., Chen, F., Guo, D. and Parvathi, K. 2001. The biosynthesis of monolignols: a "metabolic grid" or independent pathways to guaiacyl and syringyl units. *Phytochemistry.* 57: 1069–1084.

46 Rustaiyan, A., Saberi, M., Hababi, Z. and Jakupovic, J. 1991. Melampolides and other constituents from *Jurinea leptoloba. Phytochemistry.* 30: 1929–1932.

47 Mossman, T. 1983. Rapid colorimetric assay for cellular growth and survival: application to proliferation and cytotoxicity assays. *J. of Immunological method.* 65: 55–63.

48 Rowland, R. L. and Roberts, D. L., 1963. Macrocyclic diterpenes isolated from tobacco. α- and β-3,8,13-duvatriene-1,5-diols. *J. Org. Chem.* 28: 1165-1169.

49 Berh, D., Wahlberg, I., Aasen, A. J., Nishida, T., Enzell, C. R., Berg, J. and Pilotti, A., 1978. Tobacco chemistry.44.(1S,2E,4R,6E,8R,11S,12R)-and (1S,2E,4S,6E,8R,11S, 12R) -8,11-epoxy-2,6-thunbergadiene-4,12-diol. Two new diterpenoids of Greek tobacco. *Acta. Chem. Scand. B* 32: 221-227.

50 Wahlberg, I., Behr, D., Eklund, A., Nishida, T., Enzell, C. and Berg, J., 1982. Tobacco chemistry.54.(1S,2E,4S,6E,8S,11R,12S)-8,11-epoxy-2,6-cembradiene-4,12-diol, a new constituent of Greek tobacco. *Acta. Chem. Scand.* 36: 37-41

51 Wahlberg, I., Forsblom, I., Eklund, A. and Nishida, T., 1985. Tobacco chemistry 62, five new cembranoids from Tobacco. *J. Org. Chem.* 50: 4527-4538.

52 Dauben, W. G., Thiessen, W. E. and Resnick, P. R., 1965. Cembrene, a fourteen-membered ring diterpene hydrocarbon. *J. Org. Chem.* 30: 1693-1698.

53 Corsano, S. and Nicoletti, R., 1967. The structure of incensole. *Tetrahedron.* 23: 1977-1984.

54 Wiemer, D. F. and Meinwald, J., 1979. Cembrene A: diterpenes from a Termite soldier (*Isoptera termitidae* Termitinae*). J. Org. Chem.* 22: 3950-3952.

55 Kosela, S., Ghisalberti, E. L., Jefferies, P. R., Skelton, B. W. E. and White, A. H., 1985. Unsaturated cembrene acids from *Cleome viscosa* L. (Capparidaceae). *Aust. J. Chem.* 38: 1365-1370.

56 Tanaka, C. M. A., Sarragiotto, M. H., Schpector, J. Z. and Marsaioi, A. J., 1997. A cembrane from *Echinodaurus grandiflorus. Phytochemistry.* 44: 1547-1549.

57 Sato, A., Kurabayashi, M., Ogiso, A. and Kuwano, H., 1981. Poilaneic acid, a cembranoid diterpene from *Croton poilanei. Phytochemistry.* 20: 1915-1918.

58 Urones, J. G., Teresa, J. P., Marcos, I. S., Martin, D. D., Garrido, N. M. and Alfayate, R., 1987. Diterpenoids from *Halimium viscosum. Phytochemistry.* 26(4): 1077-1079.

59 Urones, J. G., Marcos, I. S., Cuadrado, M. J. S., Basabe, P. and Lithgow, A. M., 1990. *Ent*-halimane diterpenes from *Halimium viscosum. Phytochemistry.* 29(4): 1247-1251.

60 Urones, J. G., Marcos, I. S., Cuadrado, M. J. S., Basabe, P. and Lithgow, A. M., 1990. *Nor-ent*-halimanes from *Halimium viscosum. Phytochemistry.* 29 (11): 3597-3600.

61 Urones, J. G., Marcos, I. S., Basabe, P, Sexmero, M. J., Carillo, H. and Melchor, M. J., 1994. Minor diterpenoids from *Halimium viscosum. Phytochemistry.* 37(5): 1359-1361.

62 Mendonica, D. I. M., Rodilla, J. M. L., Lithgow, A. M. and Marcos, I. S., 1997. Hydrohalimic acids from *Halimium viscosum. Phytochemistry.* 44(7): 1301-1307.

63 Rodilla, J. M. L., Mendonica, D. I. M., Urones, J. G. and Moro, R. F., 1998. Hydroxylated diterpenoids from *Halimium viscosum. Phytochemistry.* 49 (3): 817-822.

64 Favier, L. S., Nieto, M., Giordano, O. S. and Tonn, C. E., 1997. Diterpenoids and flavonoids from *Ophrysporus charrua. Phytochemistry.* 45(7): 1469-1474.

65 Nagashima, F., Suzuki, M. and Asakawa, Y., 2001. A new halimane type diterpenoid from the liverworth (*Jungermannia infusca). Fitoterapia.* 72 (1): 83-85.

66 Hara, N., Asaki, H., Fujimoto, Y., Gupta, Y. K., Singh, A. K. and Sahai, M., 1995. Clerodane and *ent*-halimane diterpenes from *Polyalthia longifolia. Phytochemistry.* 38(1): 189-194.

67 Chen, C. Y., Chang, F. R., Shih, Y. C., Hsieh, T. J., Chia, Y. C., Tseng, H. Y. Chen, H. C., Chen, S. J., Hsu, M. C. and Wu, Y. C., 2000. Cytotoxicity constituents of *Polyalthia longifolia var. pendula. J. Nat. Prod.* 63: 1475-1478.

68 Bohlmann, F., Chen, Z. L. and Schuster, A., 1981. Aromatic esters from *Solidago decurrens. Phytochemistry* 20(11): 2601-2602.

69 Sugiyama, M., Nagayama, E. and Kikuchi, M., 1993. Lignan and phenyl propanoid glycosides from *Osmanthus asiaticus. Phytochemistry.* 33(5): 1215-1219.

70 Greca, M. D., Ferrara, M., Fiorentino, A., Monaco, P. and Previtera, L., 1998. Antialgal compounds from *Zantadeschia aethiopica. Phytochemistry.* 49 (5): 1299-1304.

71 Ma, B., Gao, K., Shi, Y. P. and Jia, Z. J., 1997. Phenols derivatives from *Ligularia intermedia. Phytochemistry.* 46(5): 915-919.

72 Jin, C., Micetich, R. G. and Daneshstalab, M., 1999. Phenyl propanoid glycosides from *Stellera chamaejasme. Phytochemistry.* 50: 677-680.

73 Bohlmann, F., Gupta, R. K. and Jakupovic, J. 1981. An acylpyrrole derivative and further constituents from Jamaiciam representatives of the tribe senecioneae. *Phytochemistry.* 20(4): 831-832.

74 Lin, R. C., Skaltsounis, A. L., Seguin, E., Tillequin, F. and Koch, M., 1993. Phenolic constituents of *Selaginella doederleinii. Planta Med.* 60: 168-170.

75 Wen, L., Wrolstad, R. E. and Hsu, V., 1999. Characterization of sinapyl derivatives in pineapple (*Ananus comosus* [L.] Merill) juice. *J. Agric. Food. Chem.* 47(3): 850-853.

APPENDIX

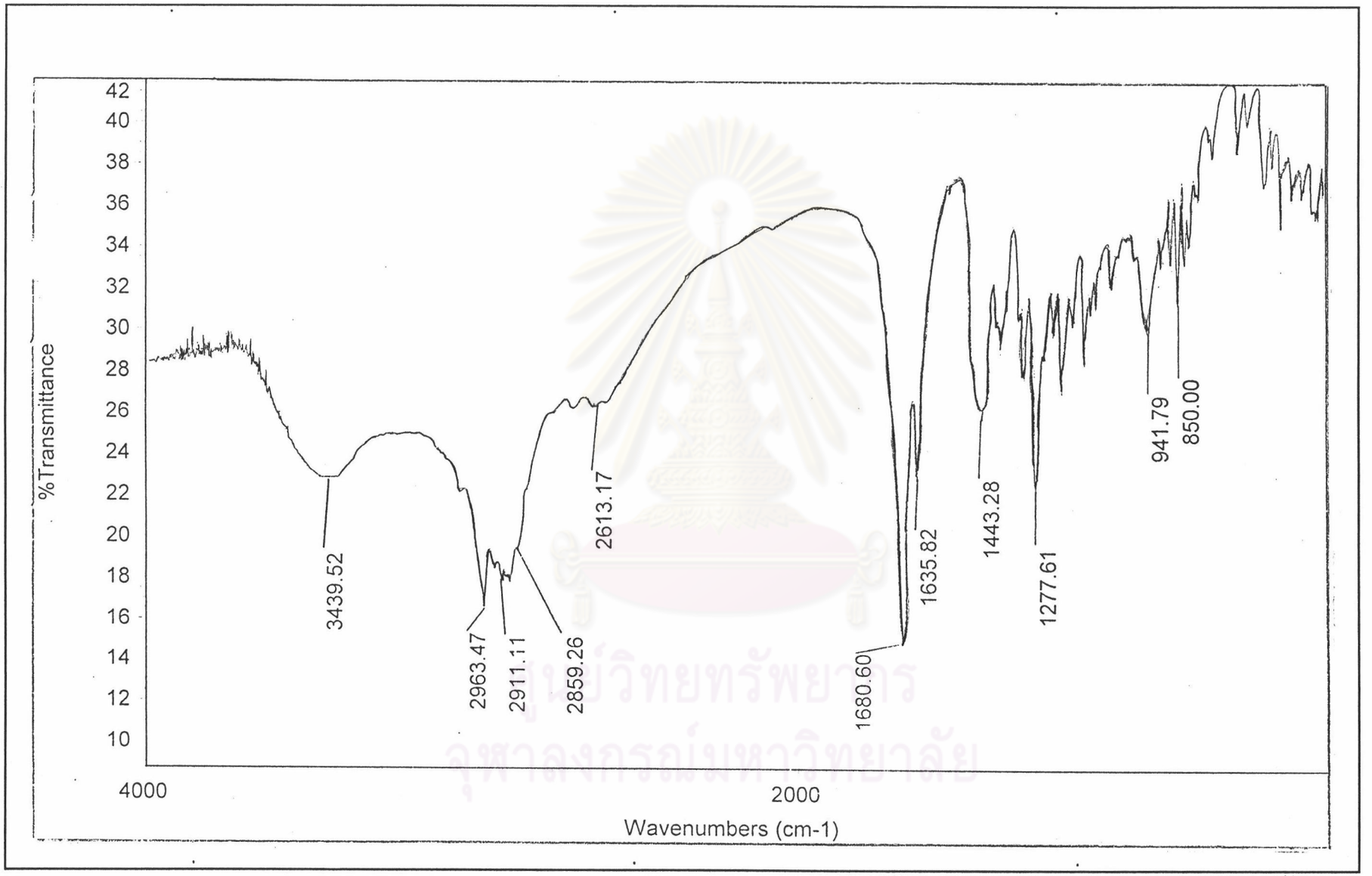

Figure 9 IR spectrum of compound 1

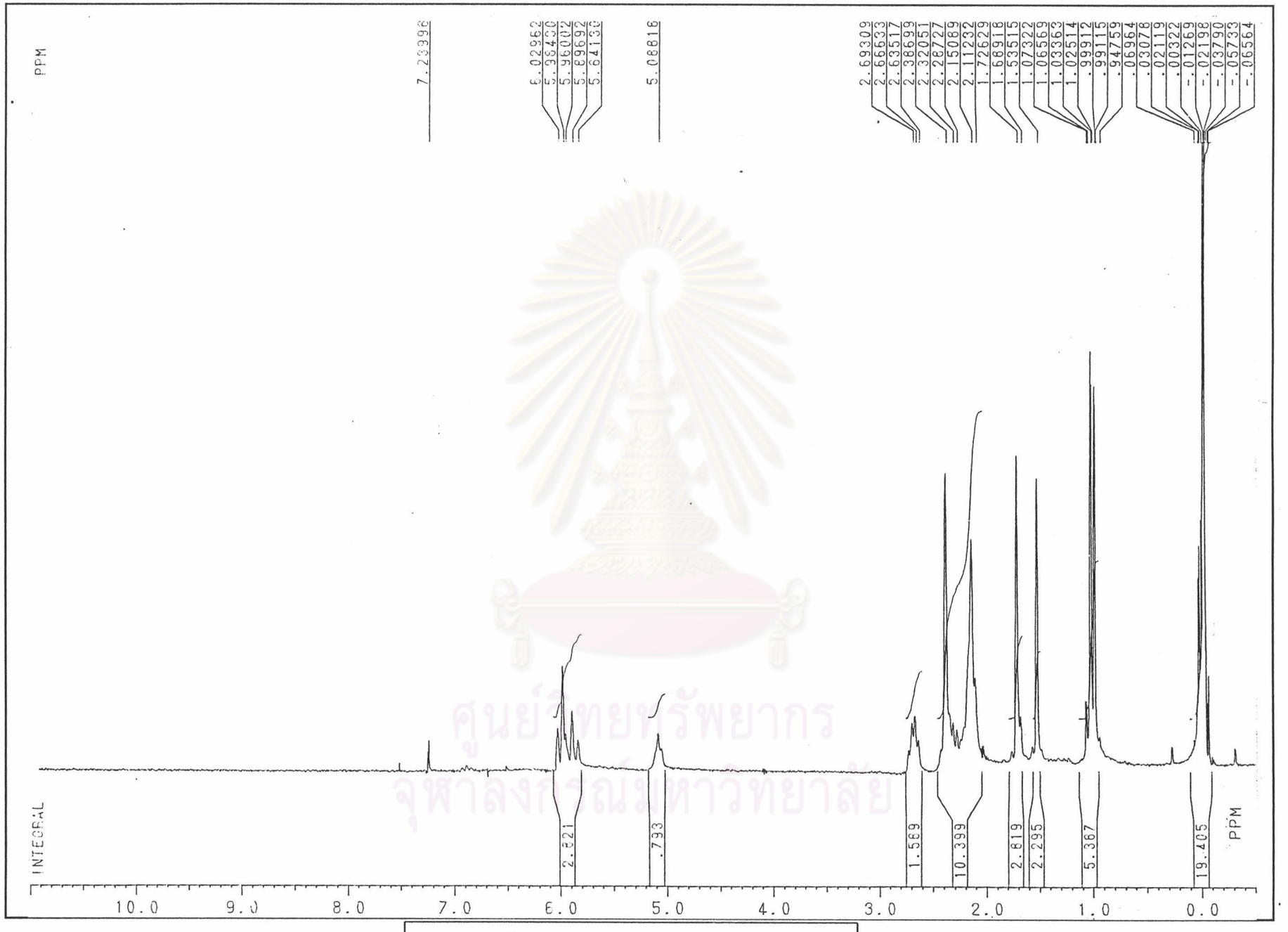

Fig.10 ^{1}H-NMR spectrum of compound 1

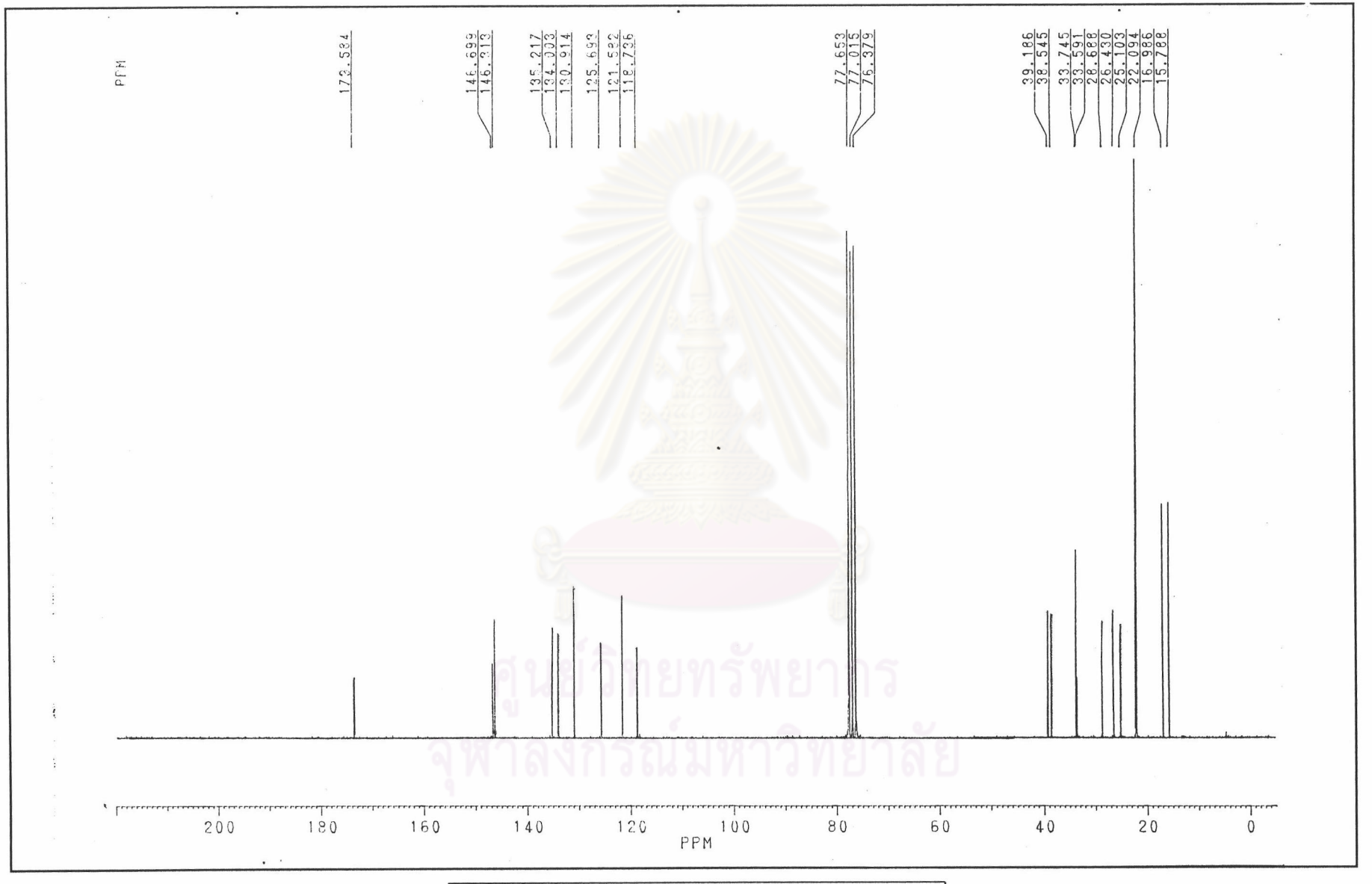

Fig.11 ^{13}C-NMR spectrum of compound 1

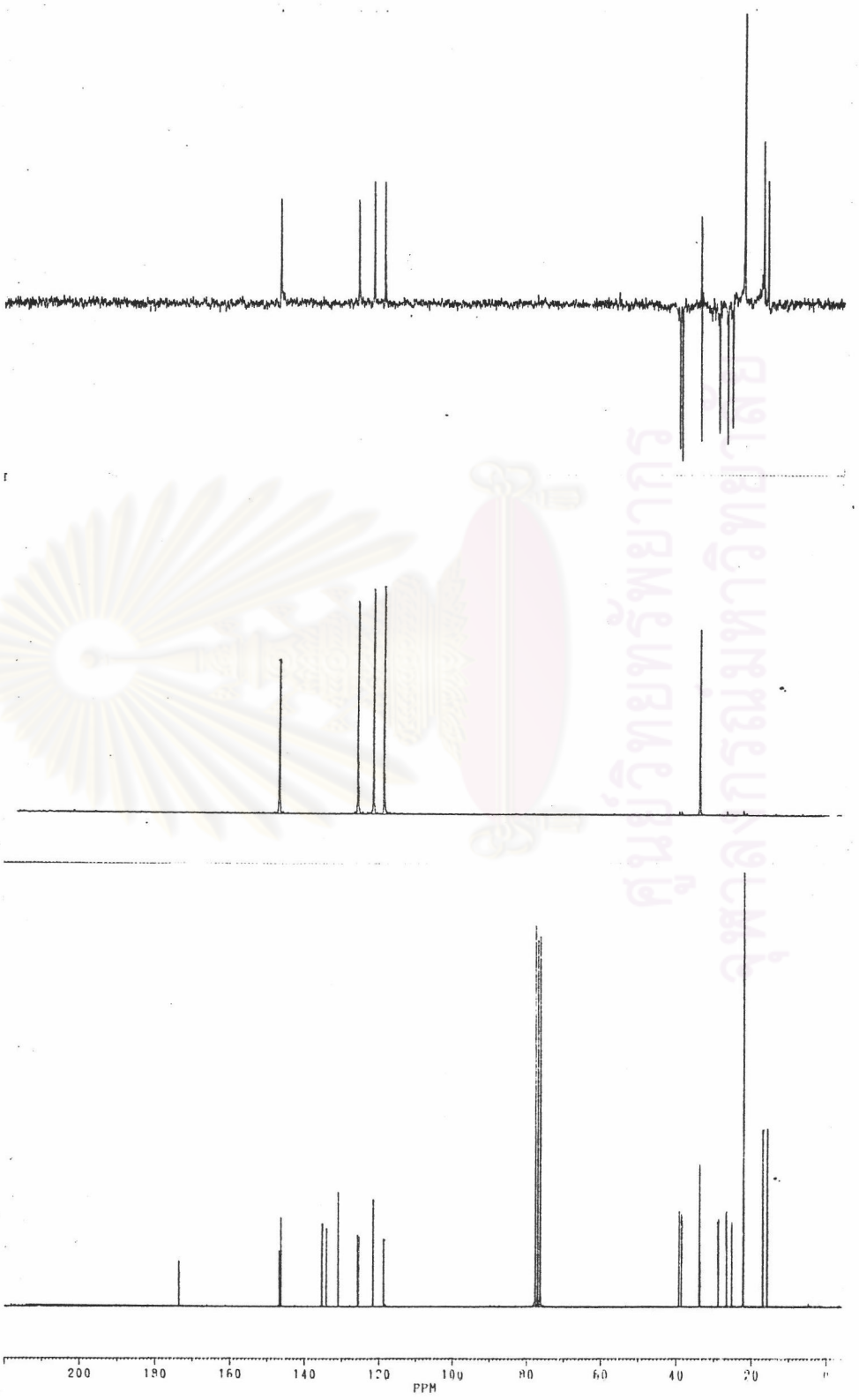

Fig. 12 DEPT-135,90 and ^{13}C-NMR spectrum of compound 1

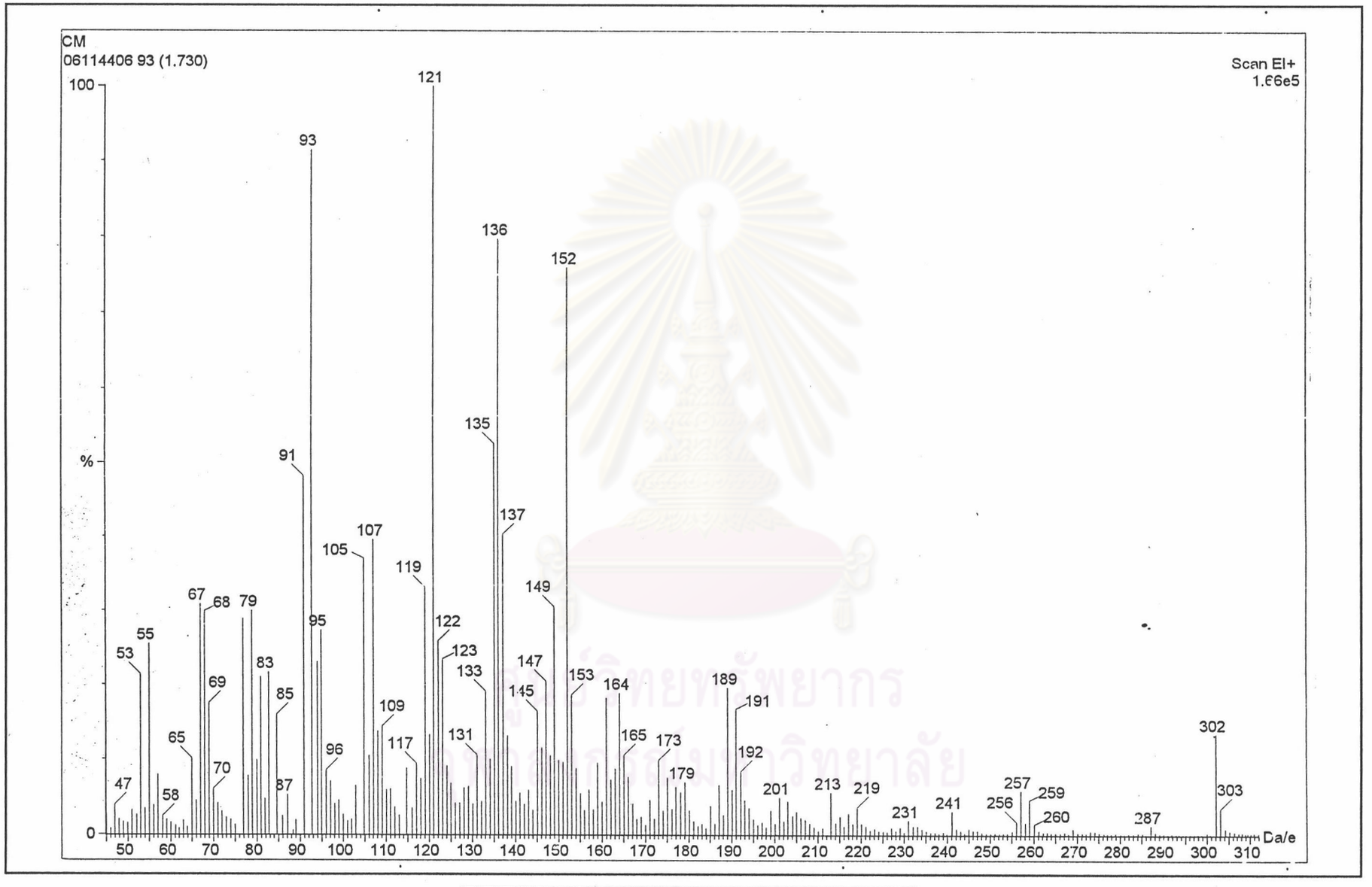

Fig.13 EIMS spectrum of compound 1

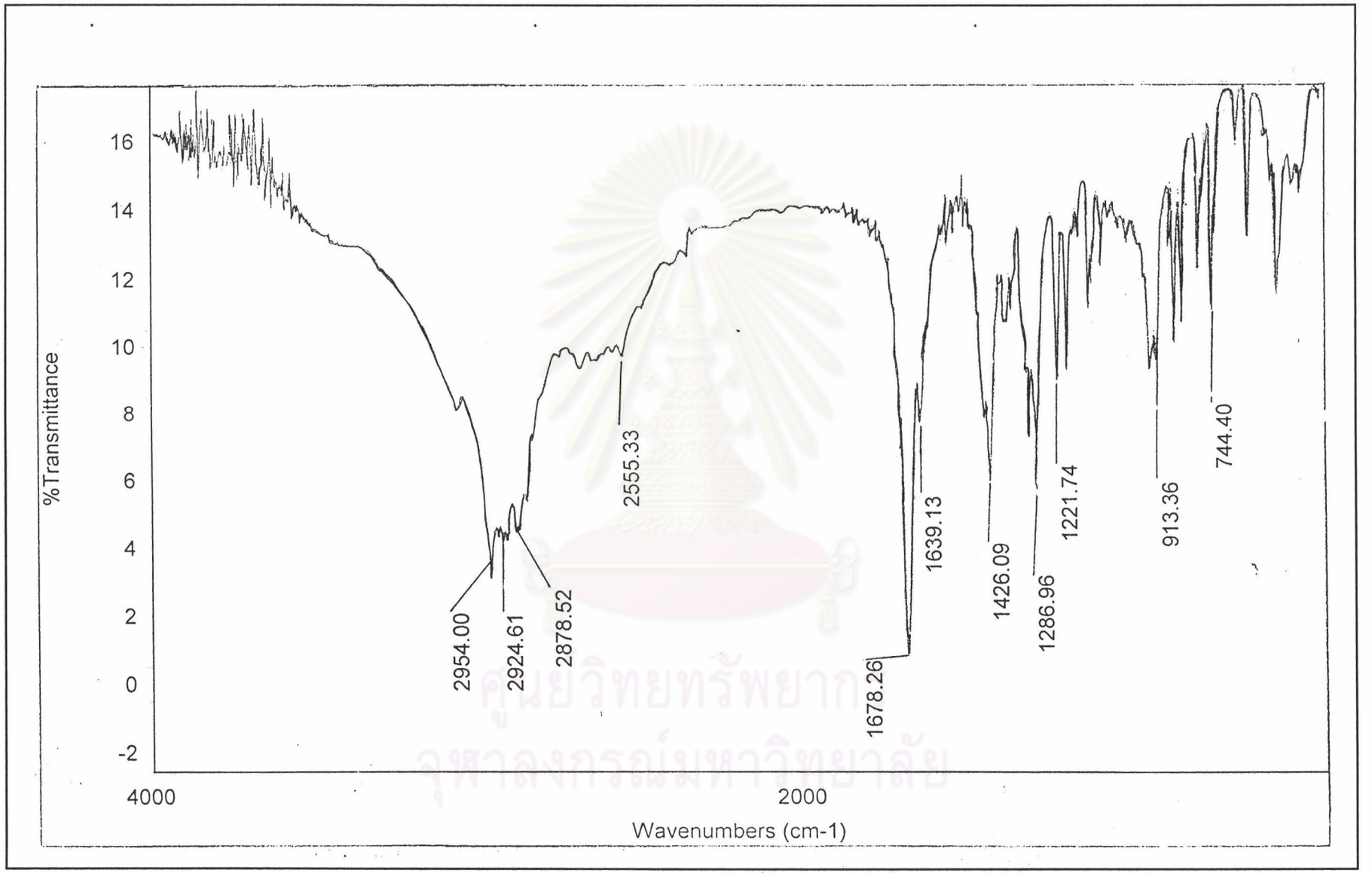

Fig.14 IR-spectrum of compound 2

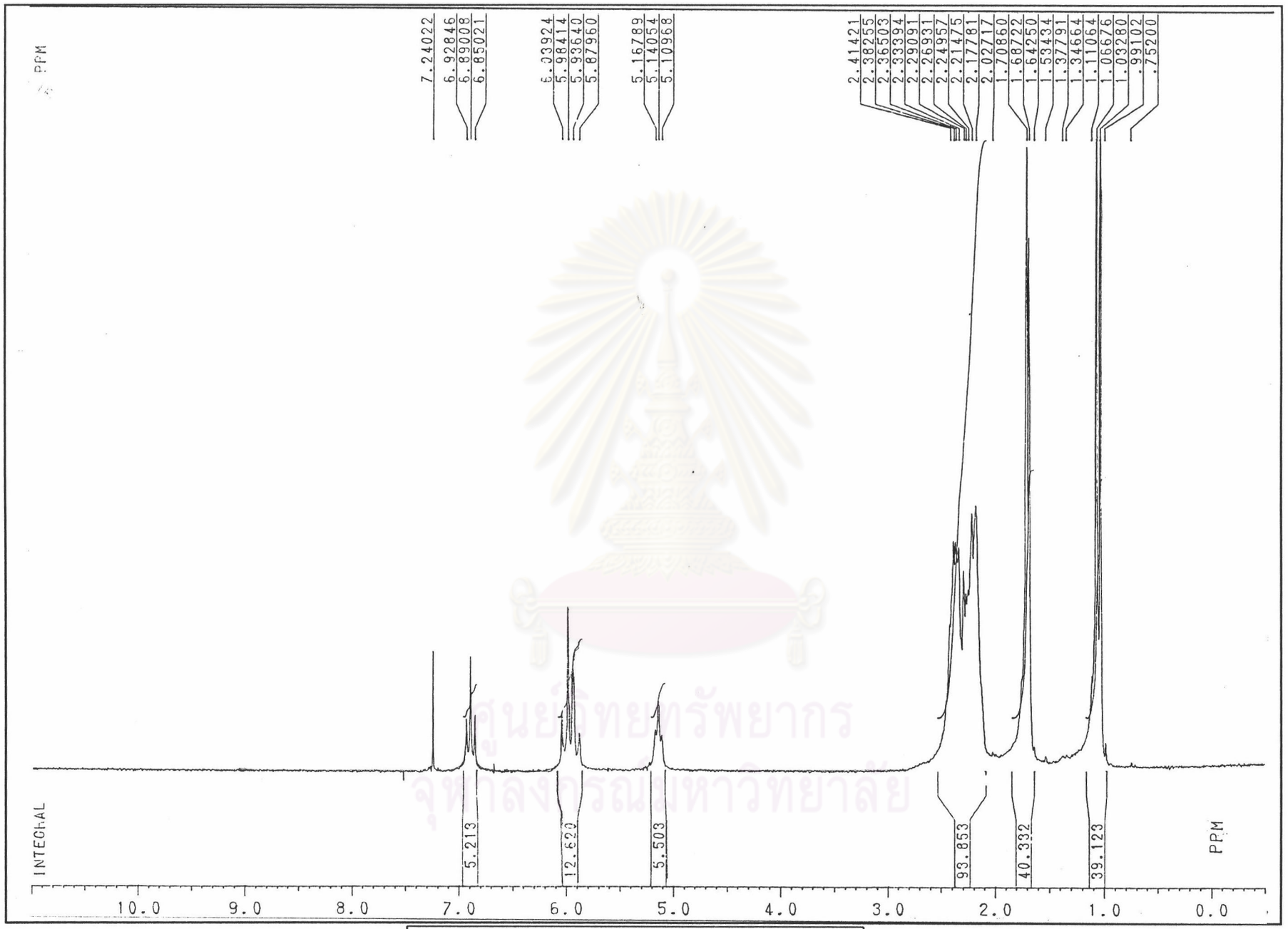

Fig.15 ^{1}H-NMR spectrum of compound 2

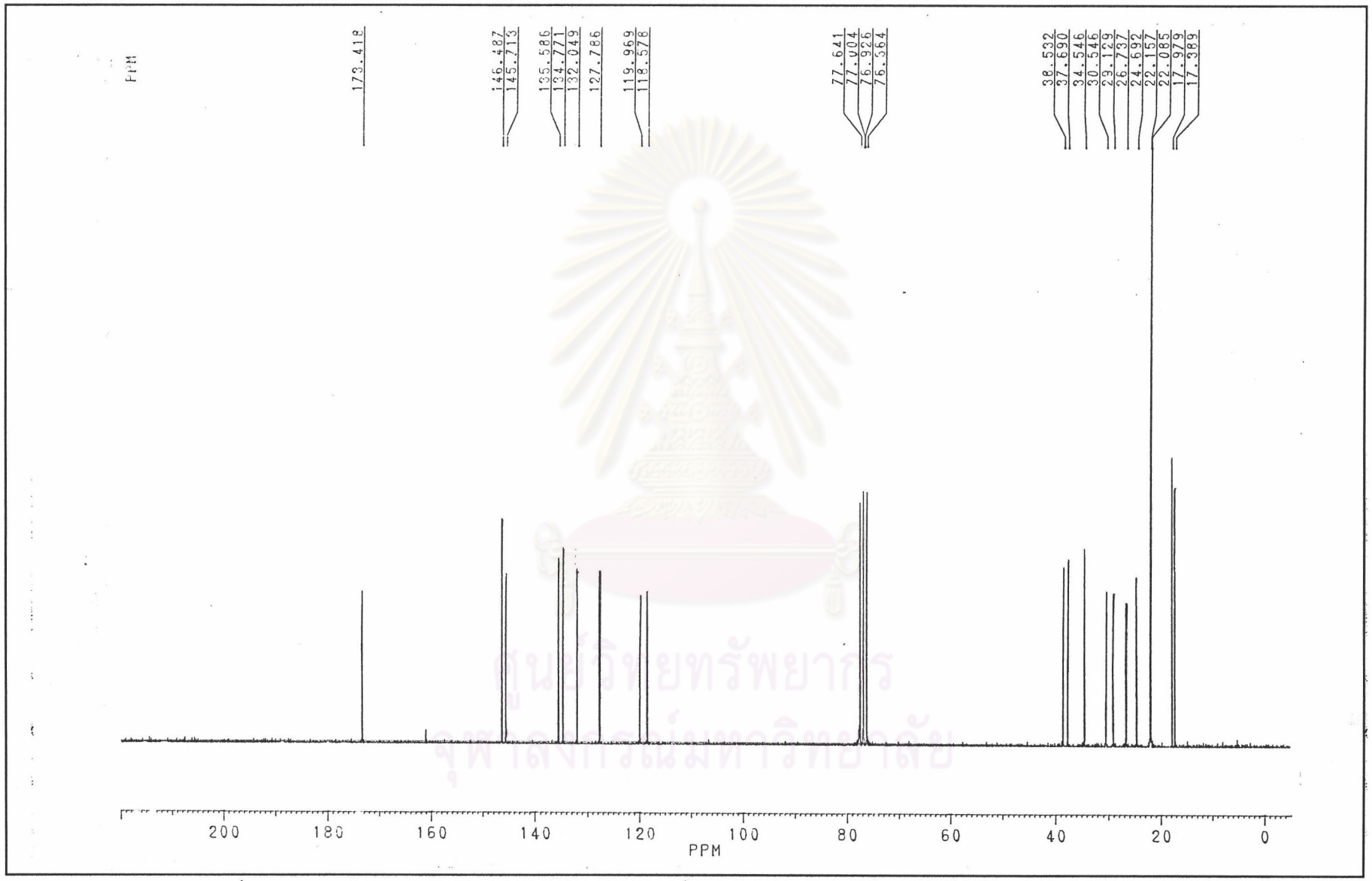

Fig.16 ^{13}C-NMR spectrum of compound 2

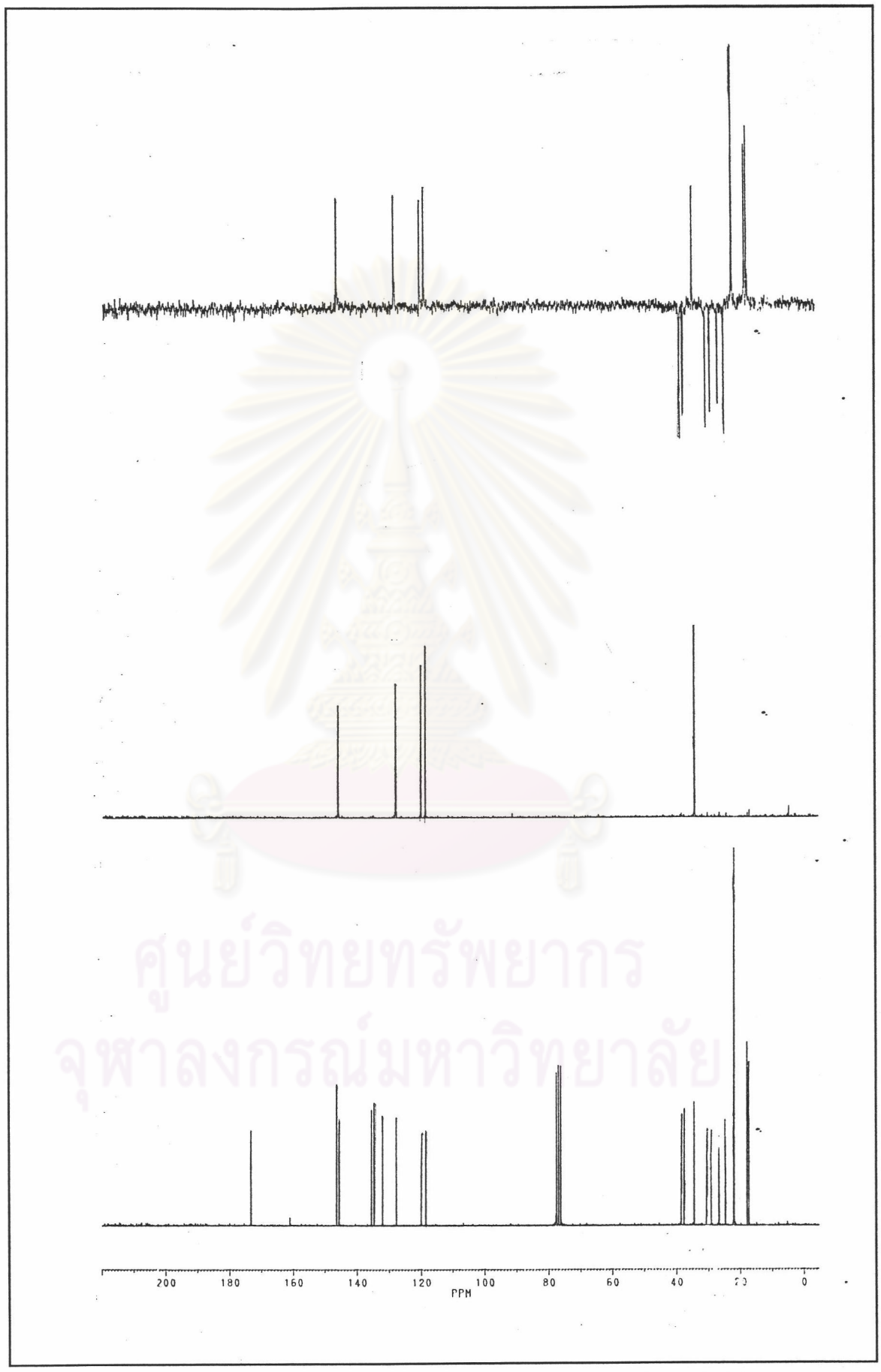

Fig. 17 DEPT-135,90 and ^{13}C-NMR spectrum of compound 2

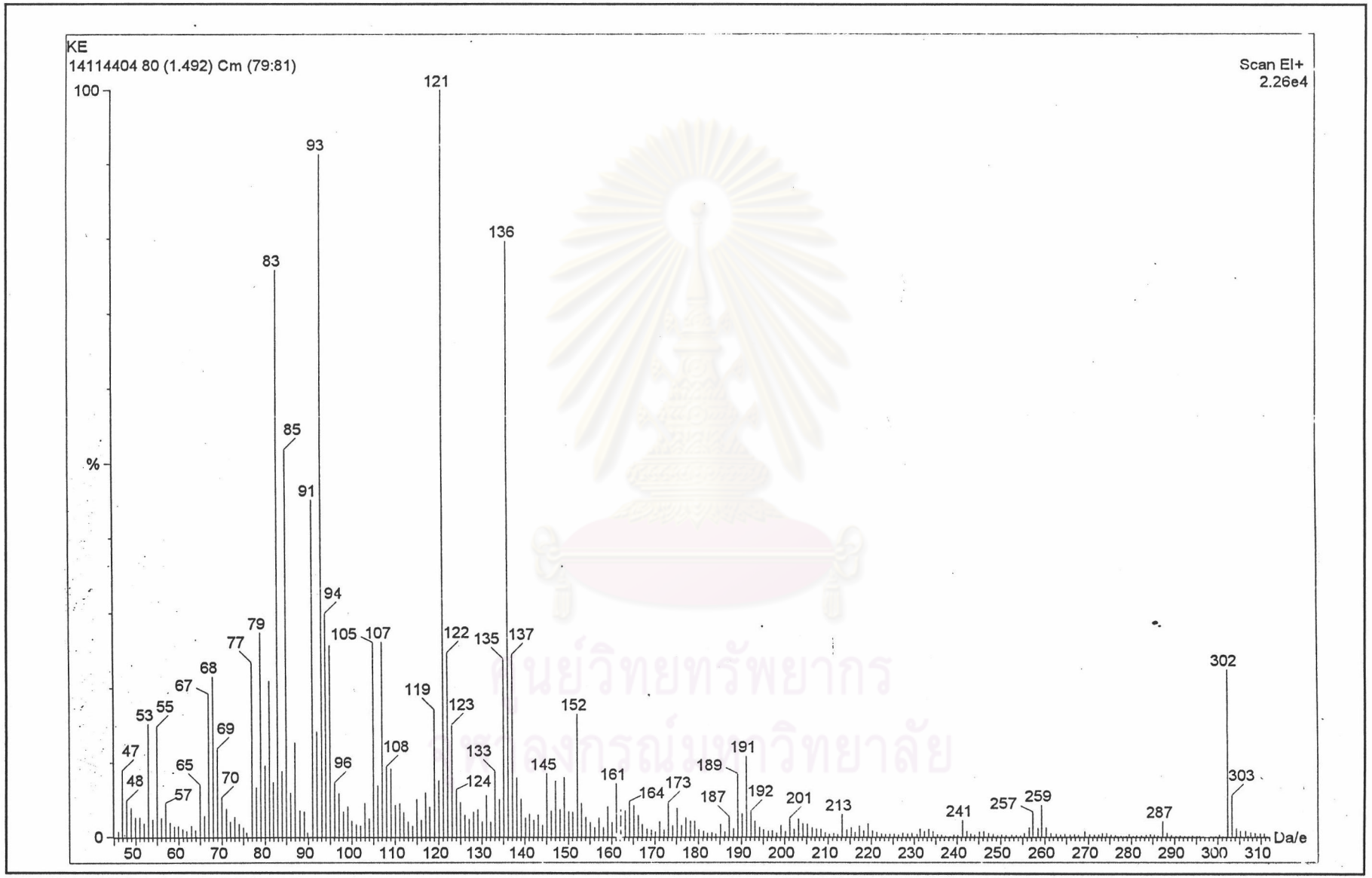

Fig.18 EIMS spectrum of compound 2

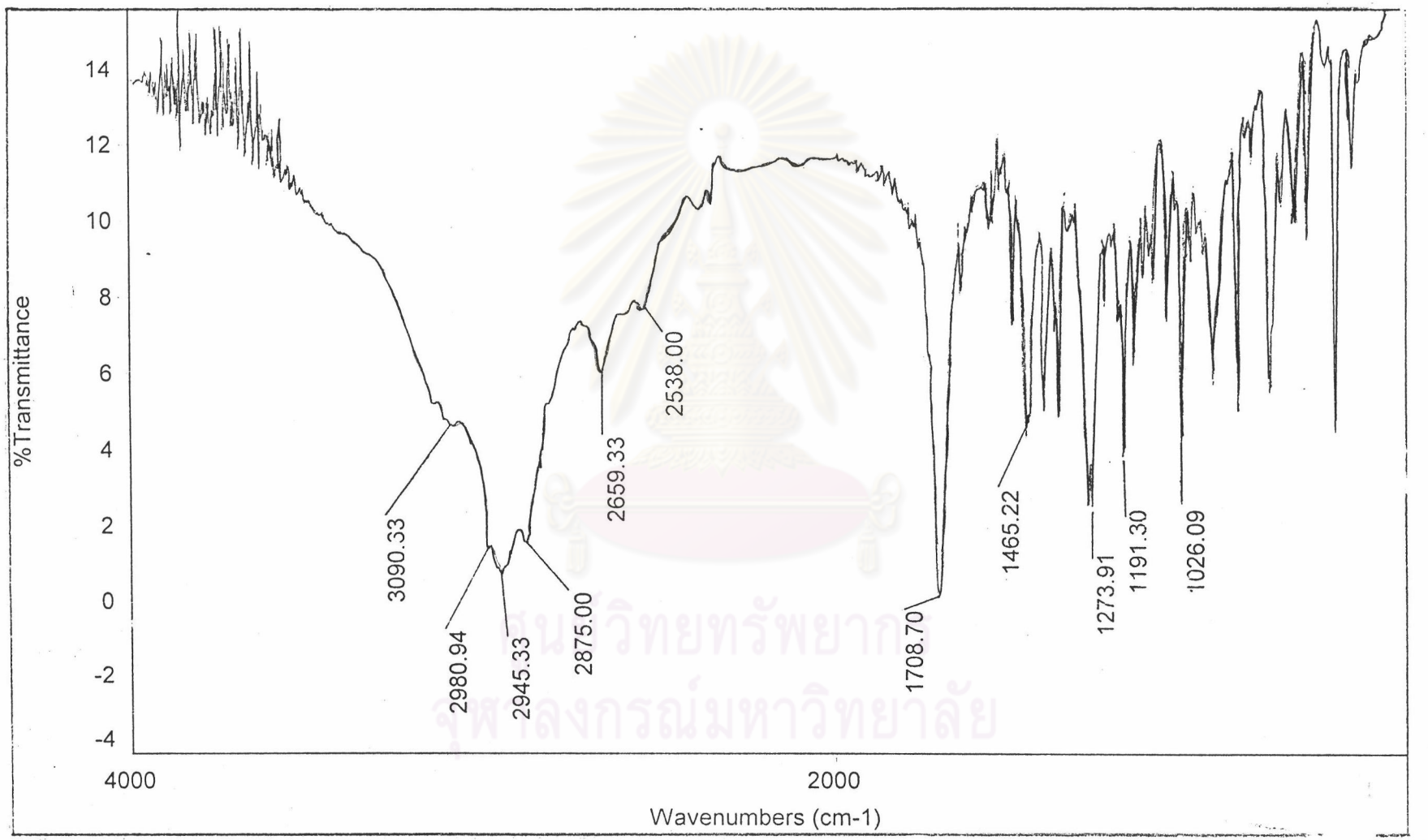

Fig.19 IR-spectrum of compound 3

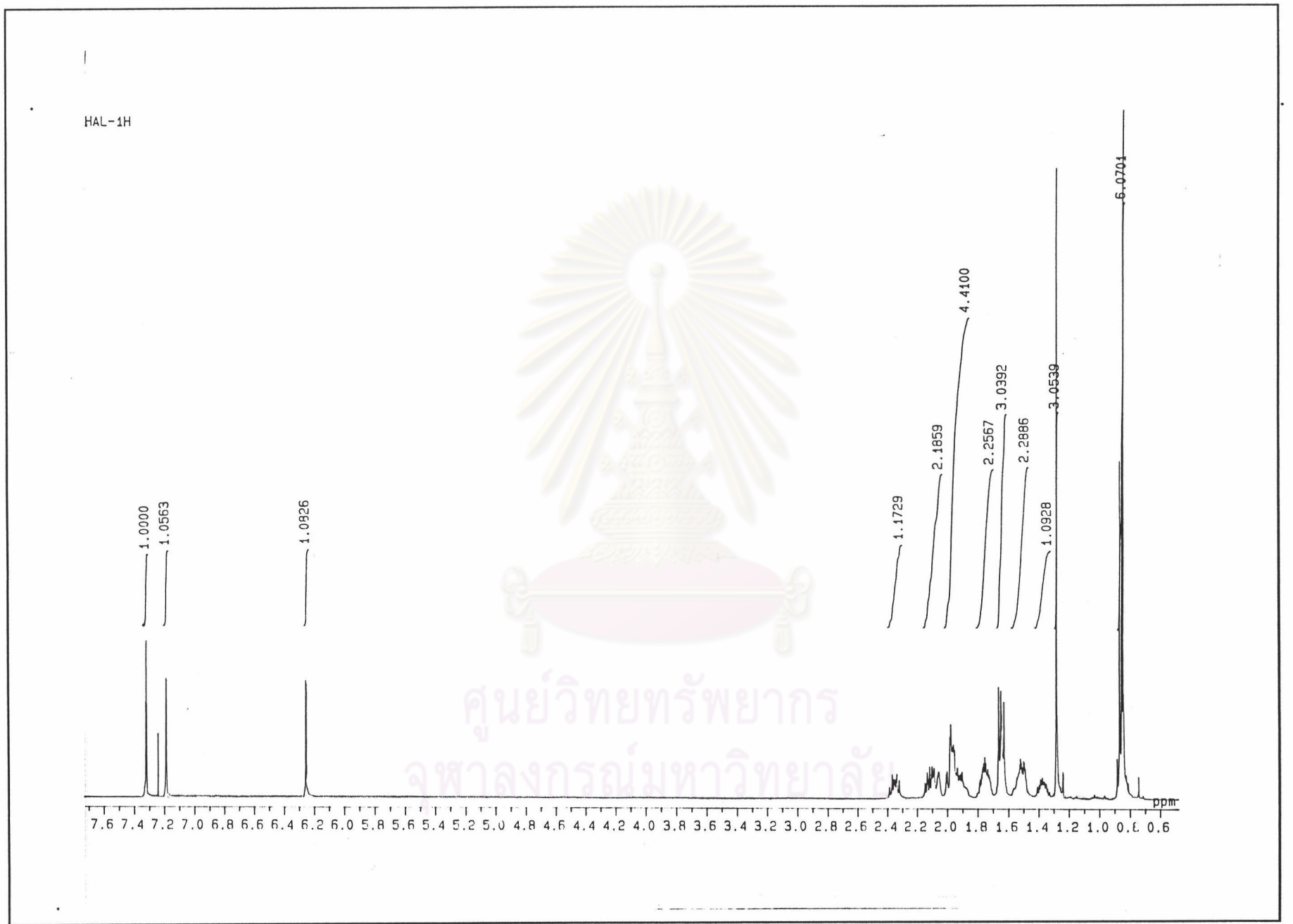

Fig.20 ^{1}H-NMR spectrum of compound 3

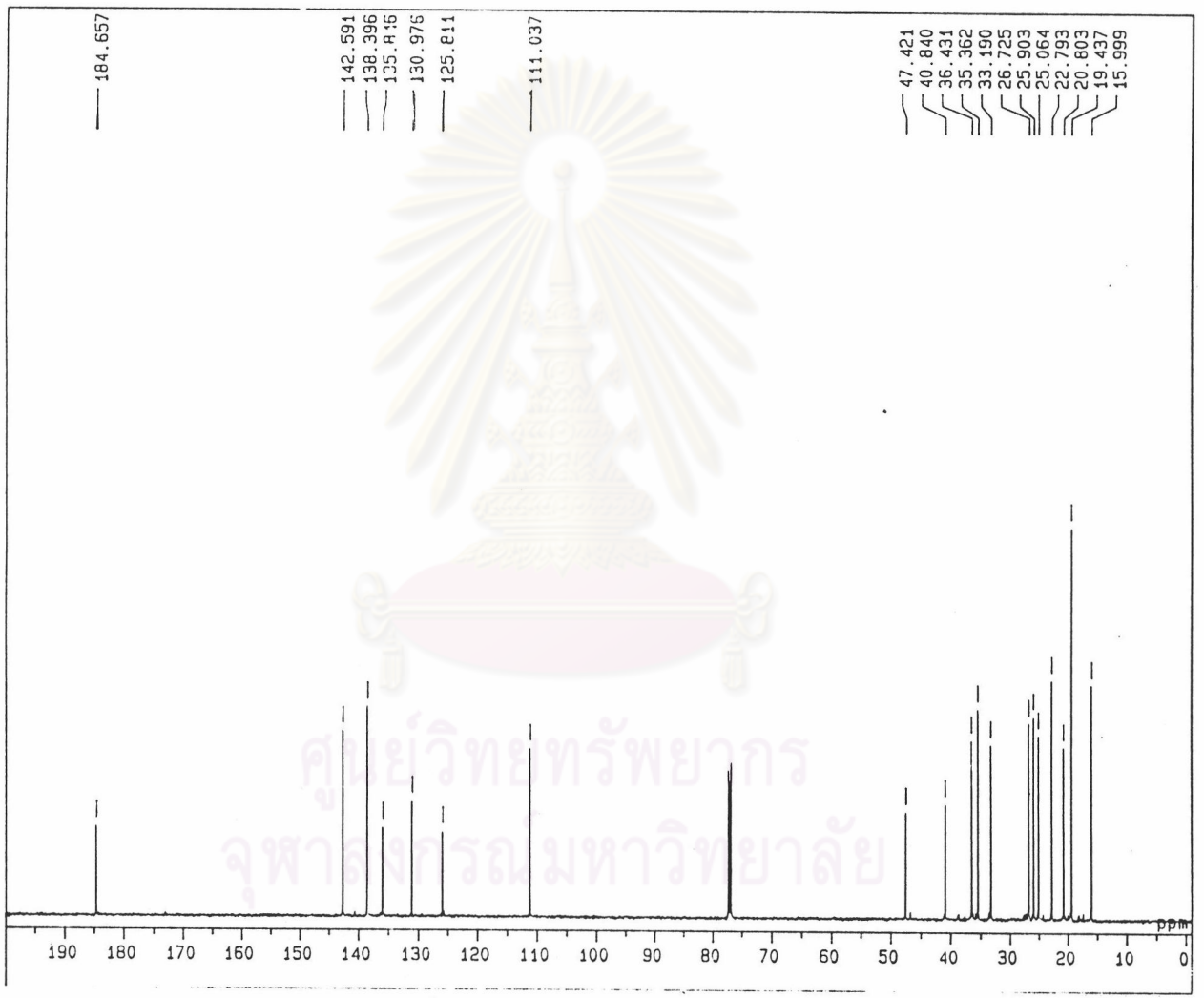

Fig.21 ^{13}C-NMR spectrum of compound 3

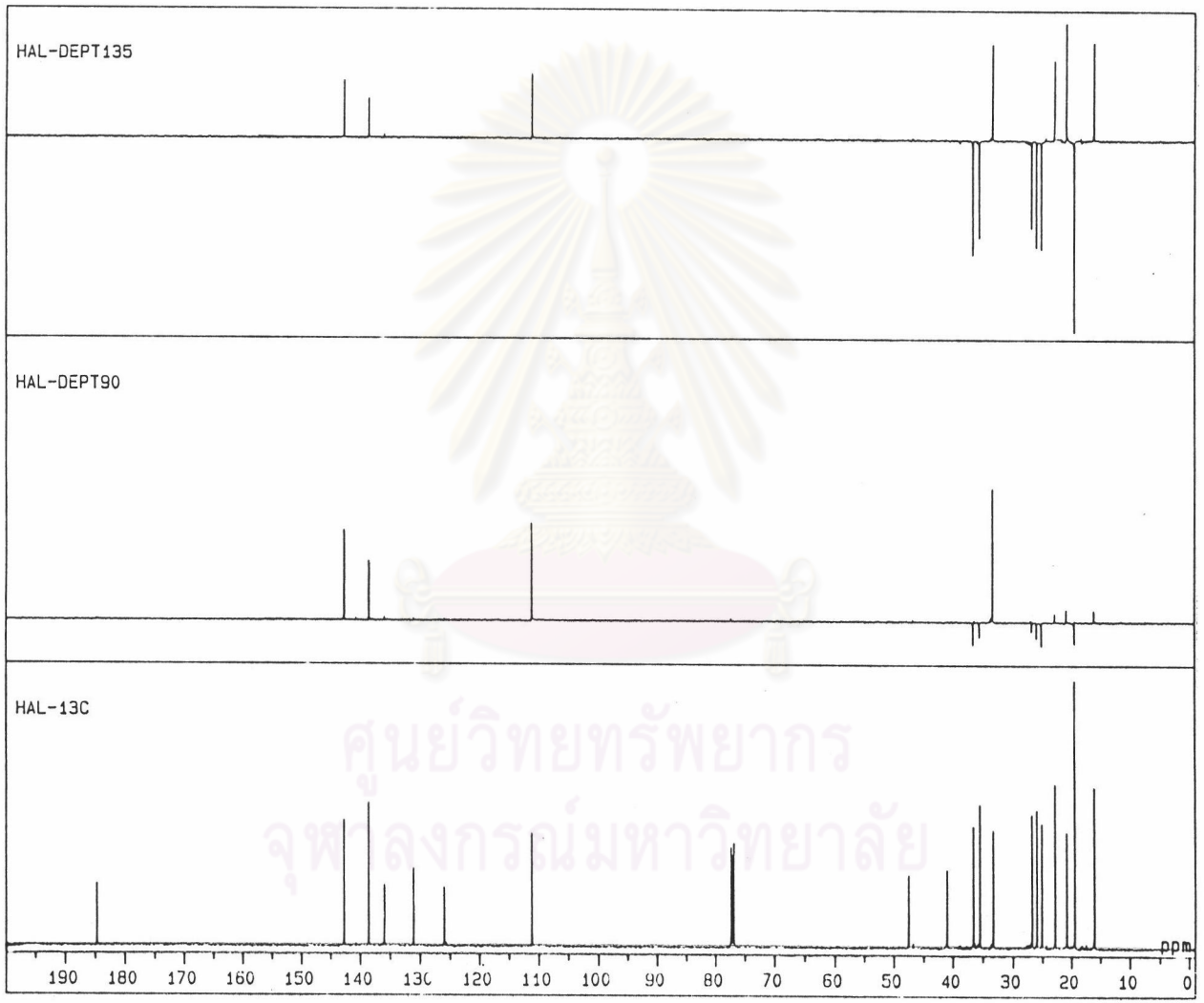

Fig. 22 DEPT-135,90 and ^{13}C-NMR spectrum of compound 3

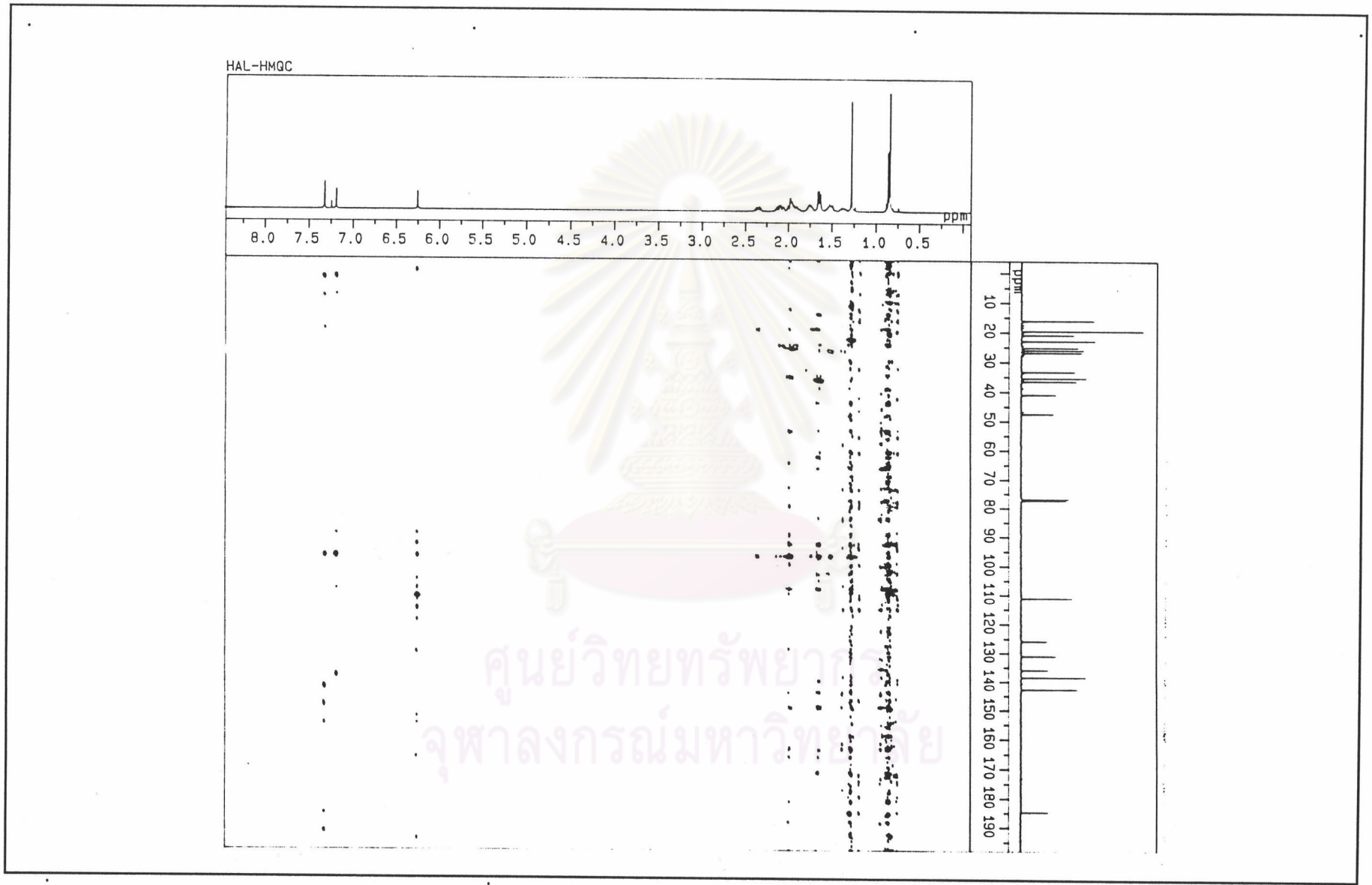

Fig. 23 HMQC spectrum of compound 3

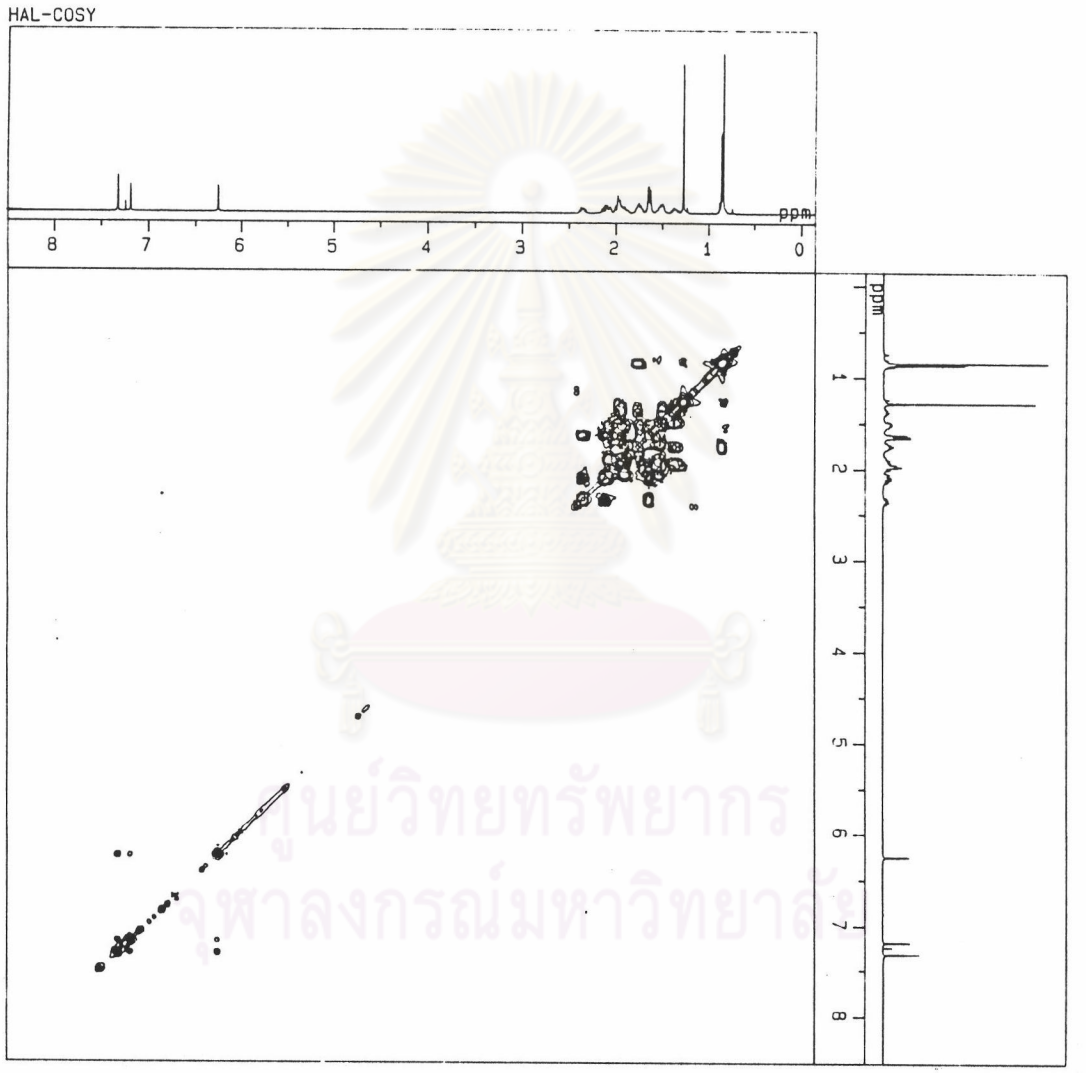

Fig. 24 COSY spectrum of compound 3

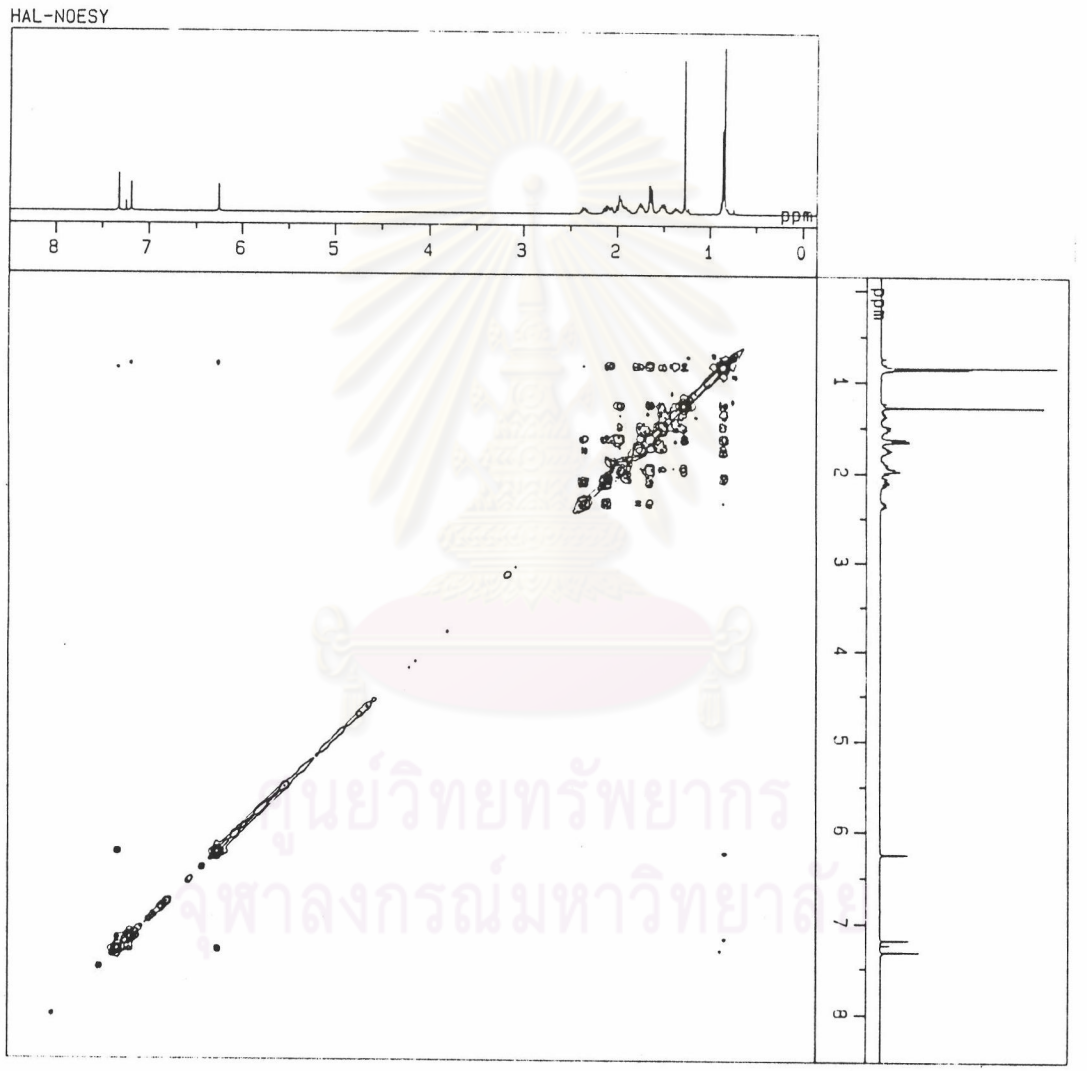

Fig. 25 NOESY spectrum of compound 3

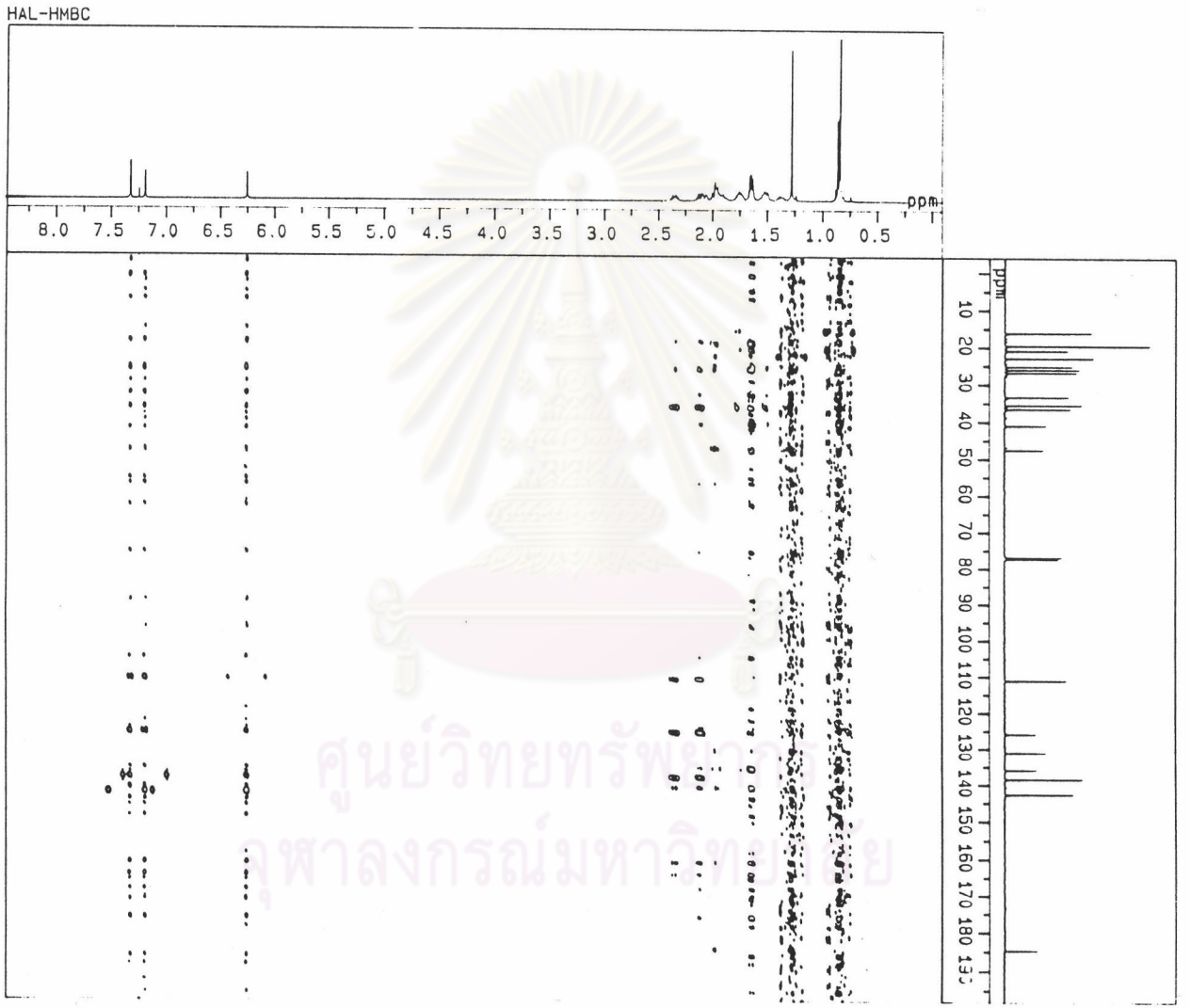

Fig. 26 HMBC spectrum of compound 3

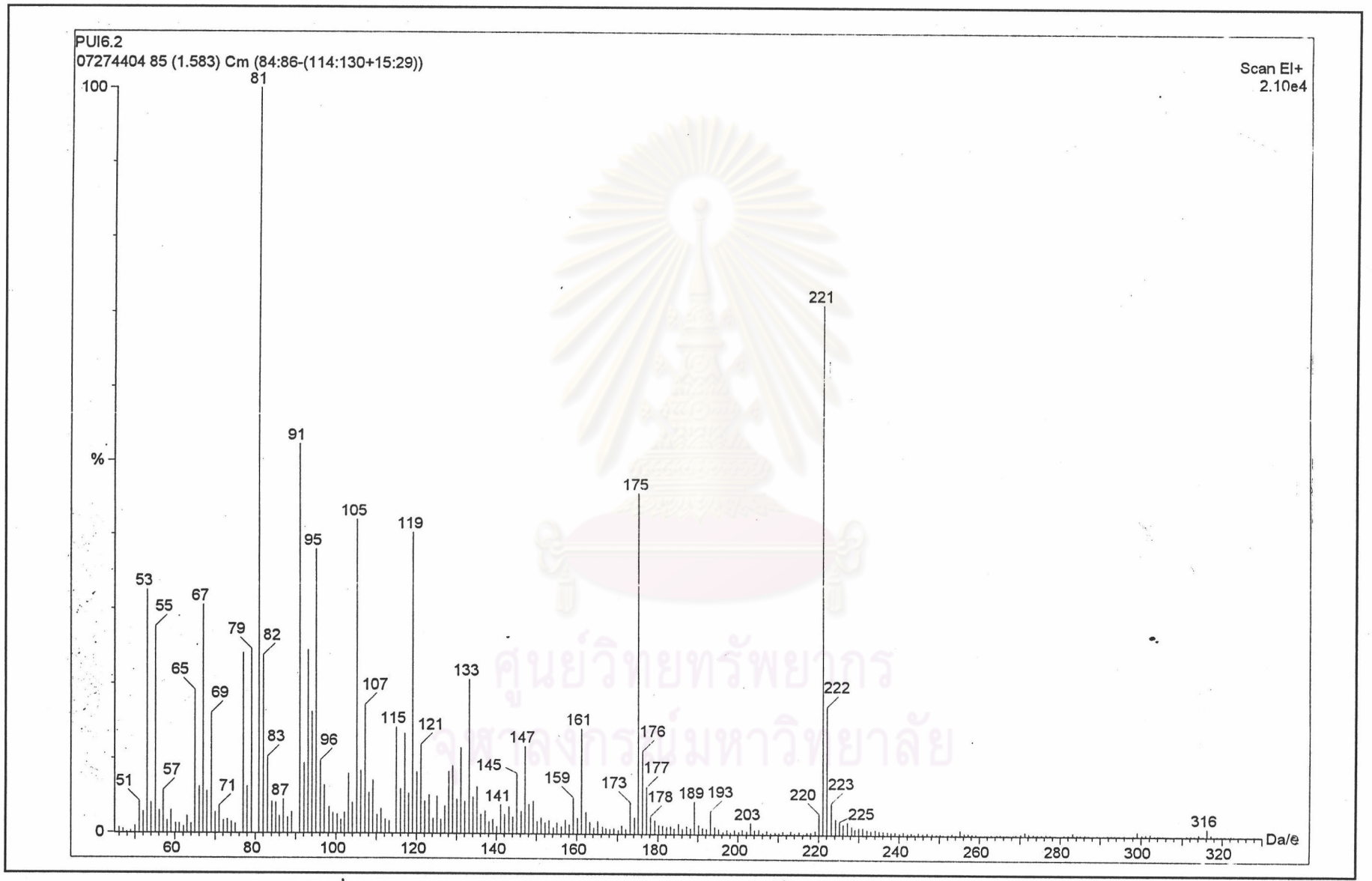

Fig.27 EIMS spectrum of compound 3

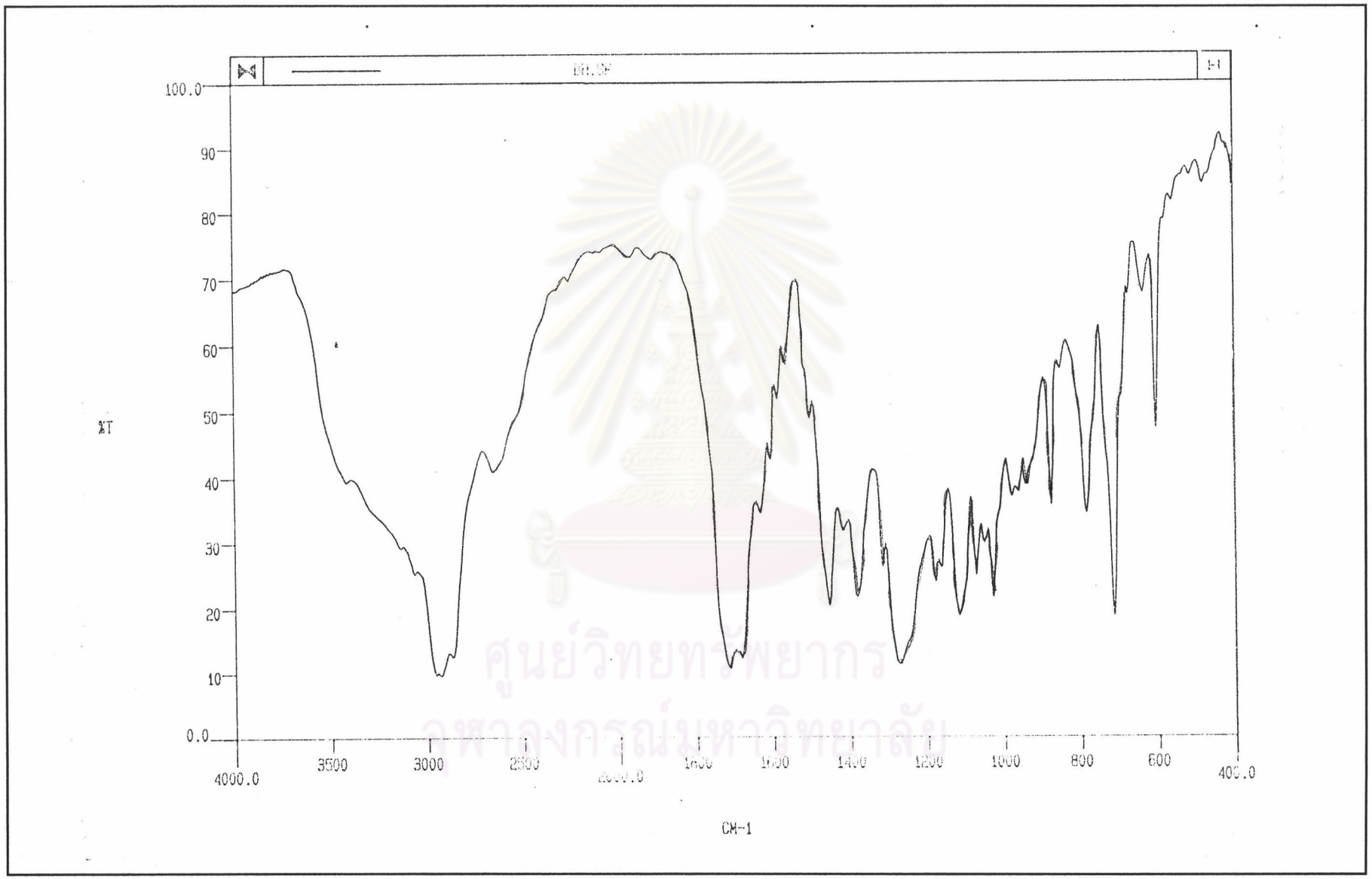

Fig.28 IR-spectrum of compound 4

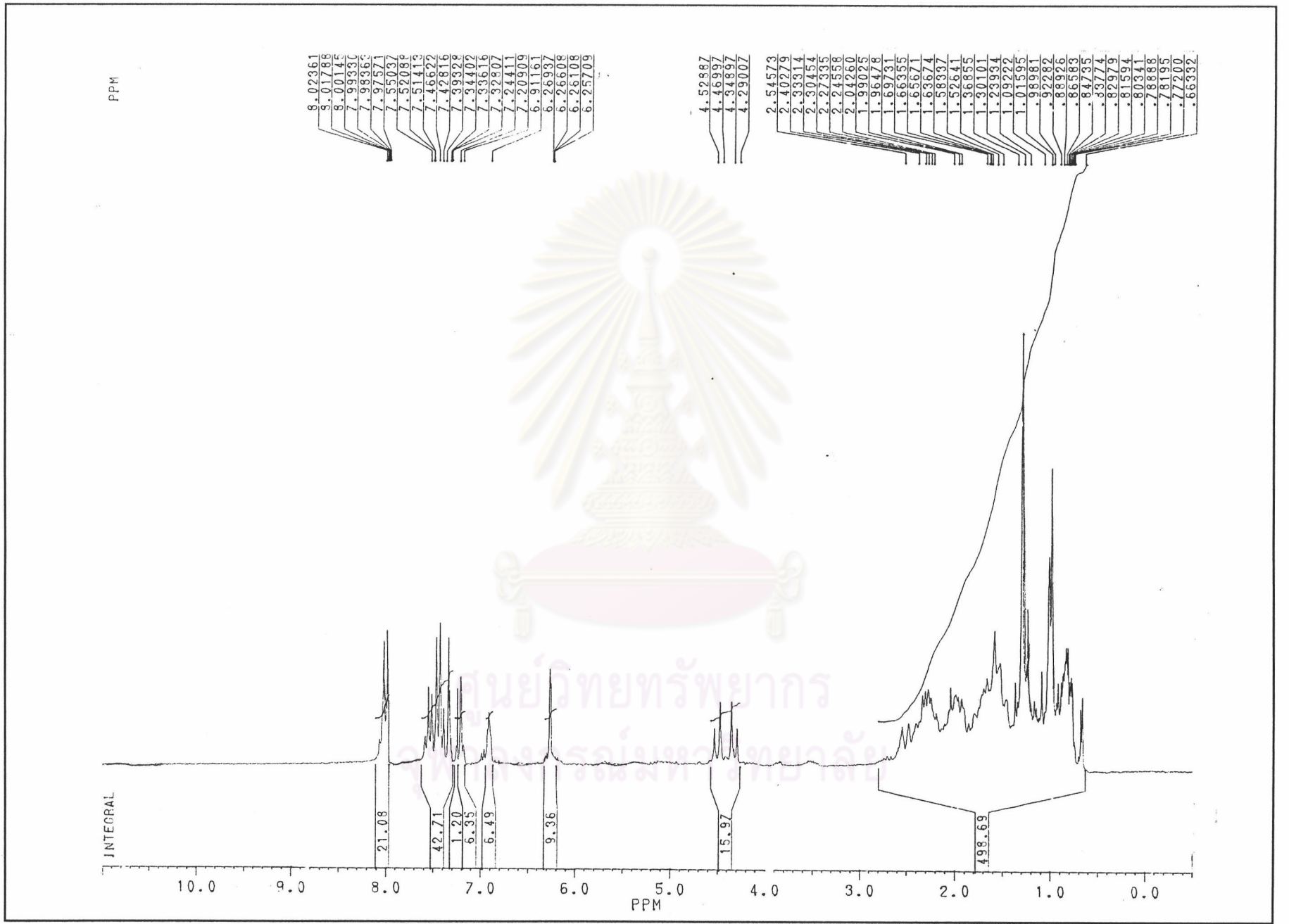

Fig.29 ^{1}H-NMR spectrum of compound 4

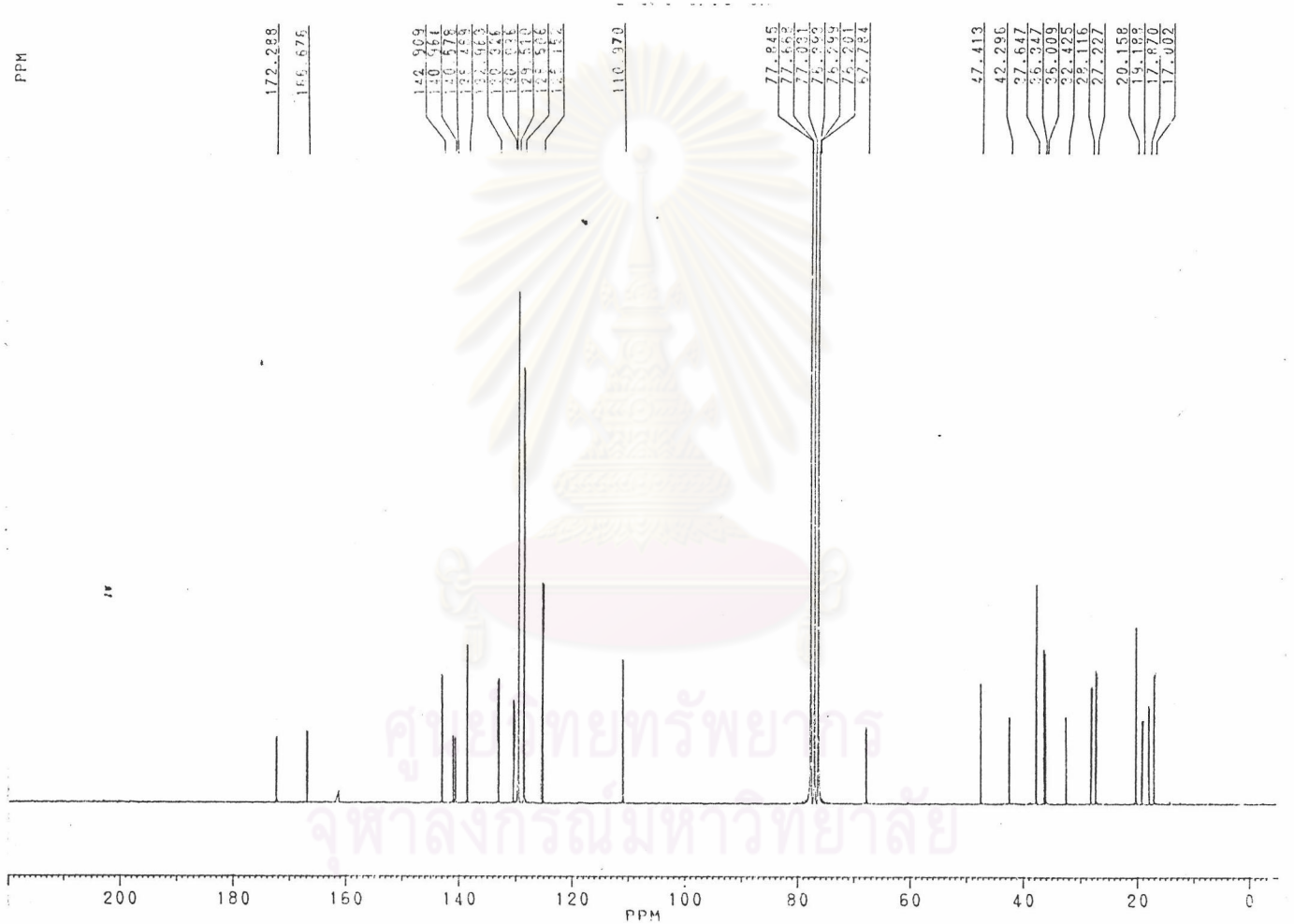

Fig.30 ^{13}C-NMR spectrum of compound 4

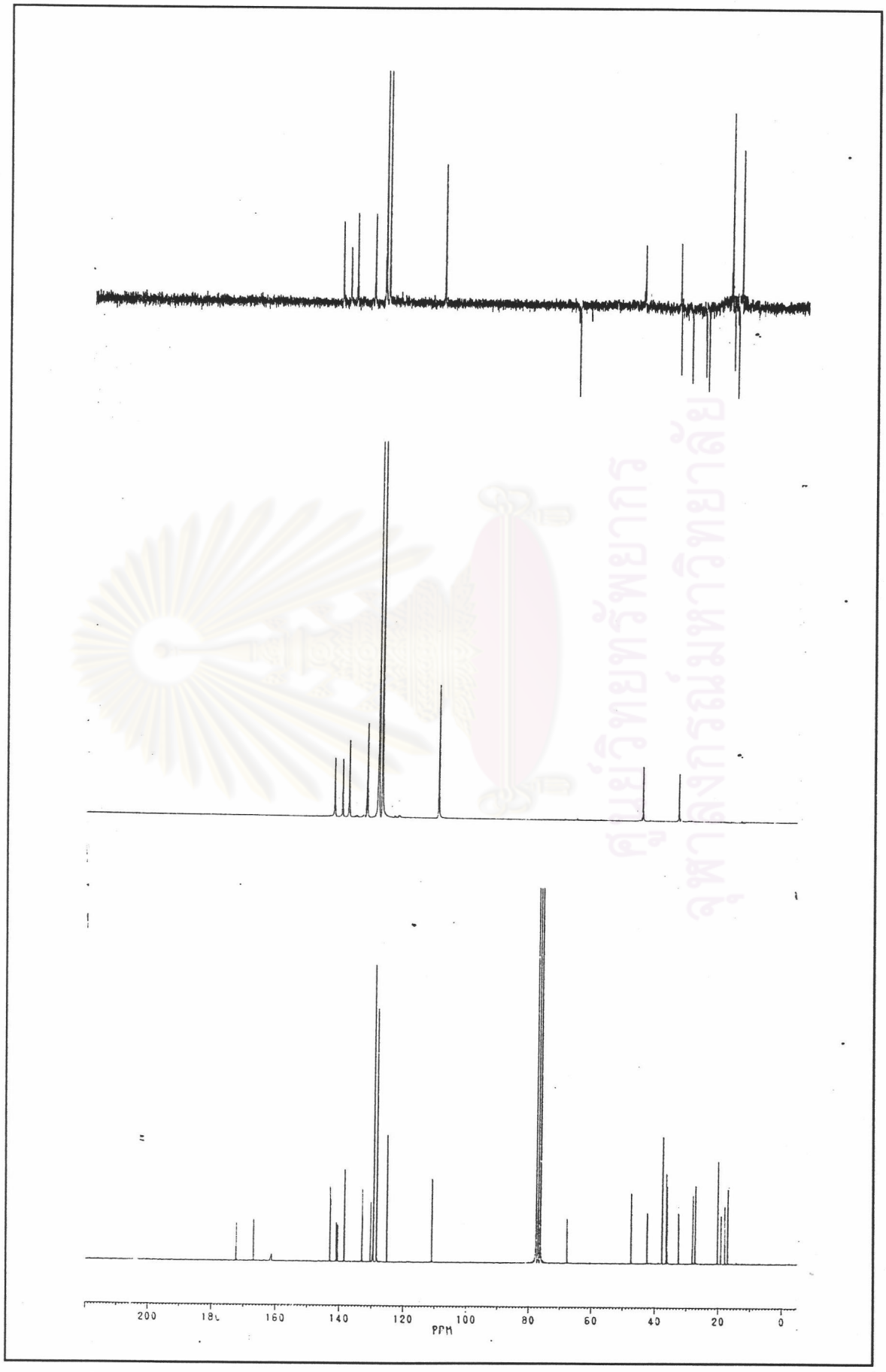

Fig. 31 DEPT-135,90 and ^{13}C-NMR spectrum of compound 4

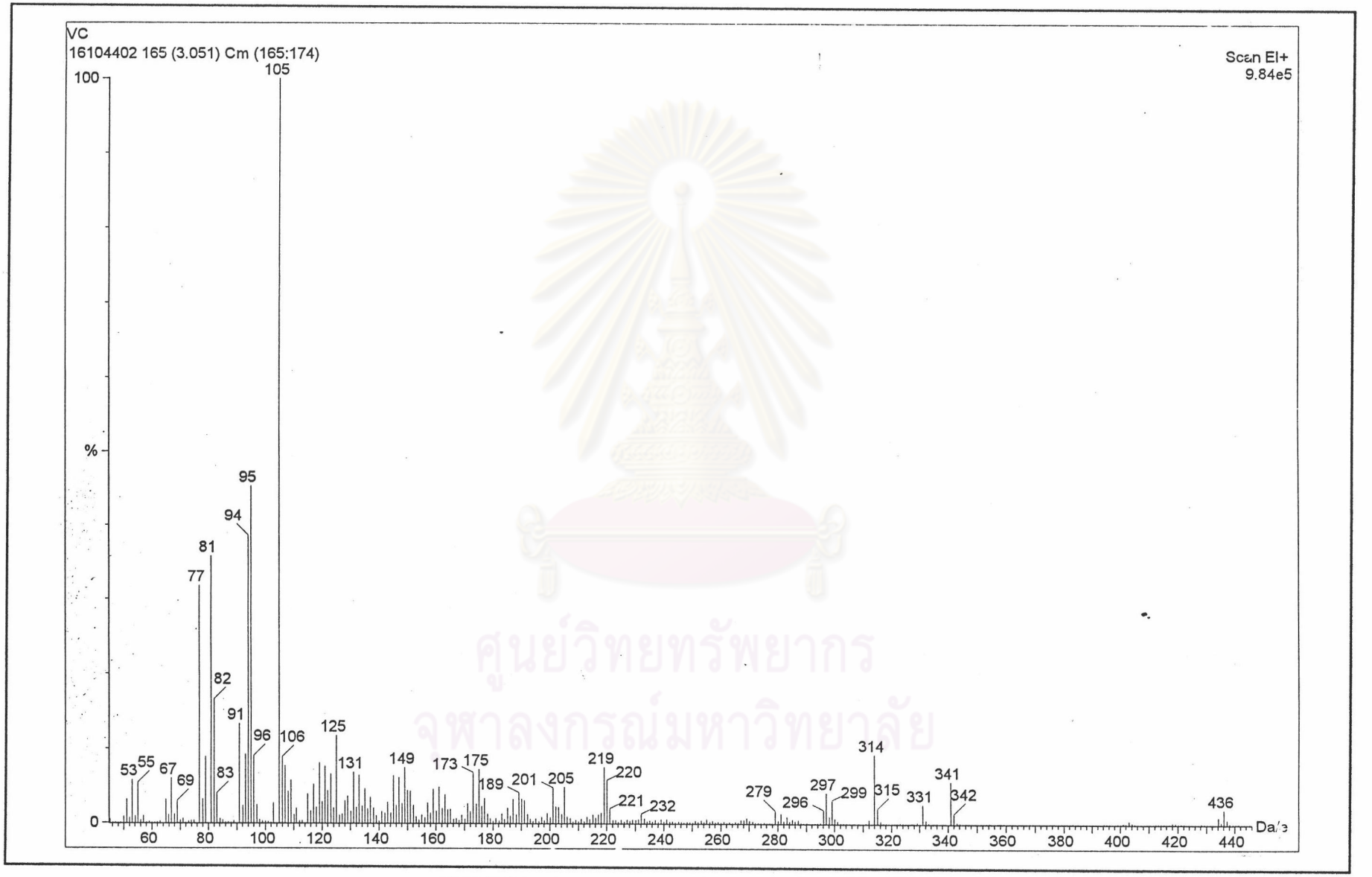

Fig.32 EIMS spectrum of compound 4

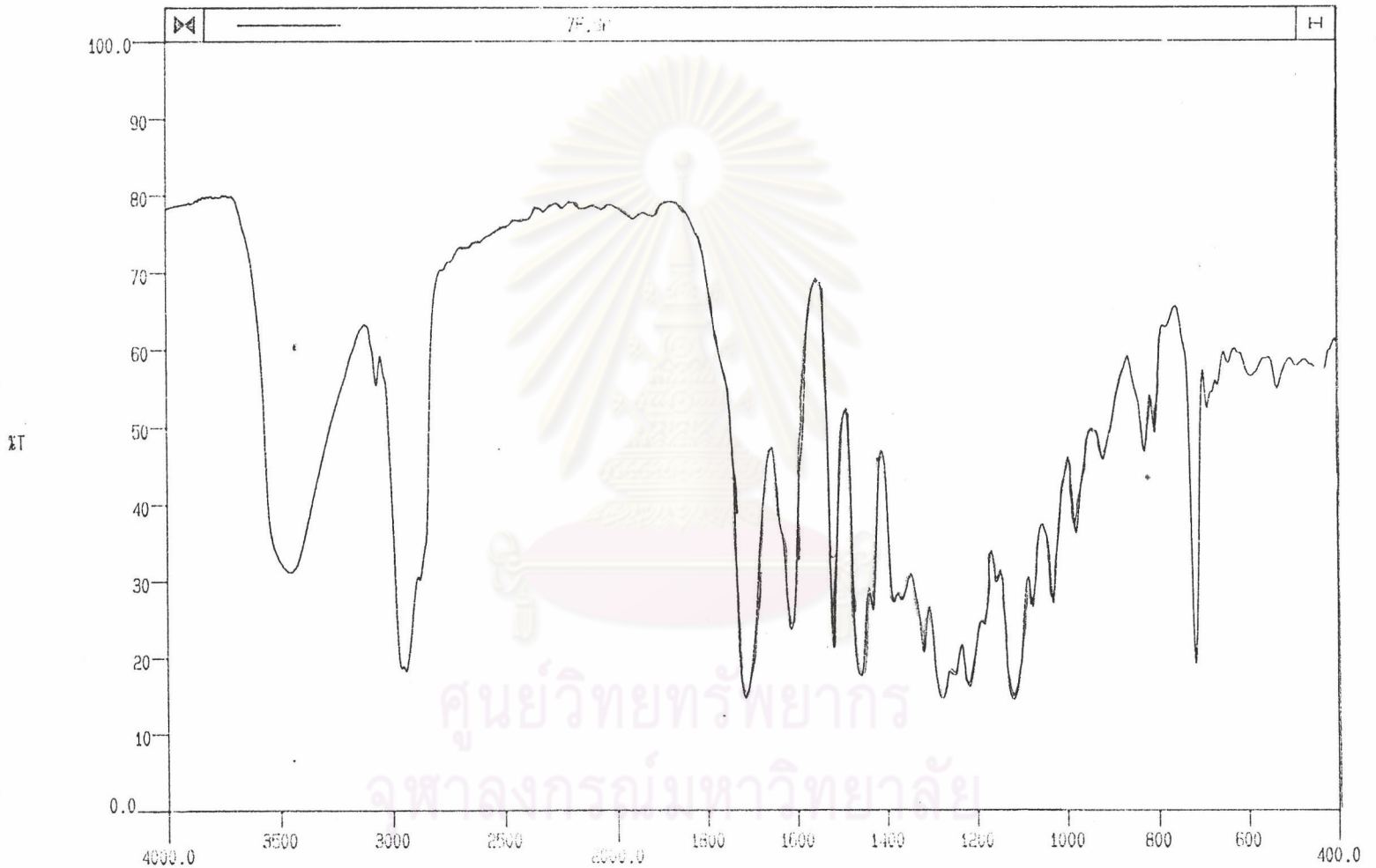

Fig.33 IR-spectrum of compound 5

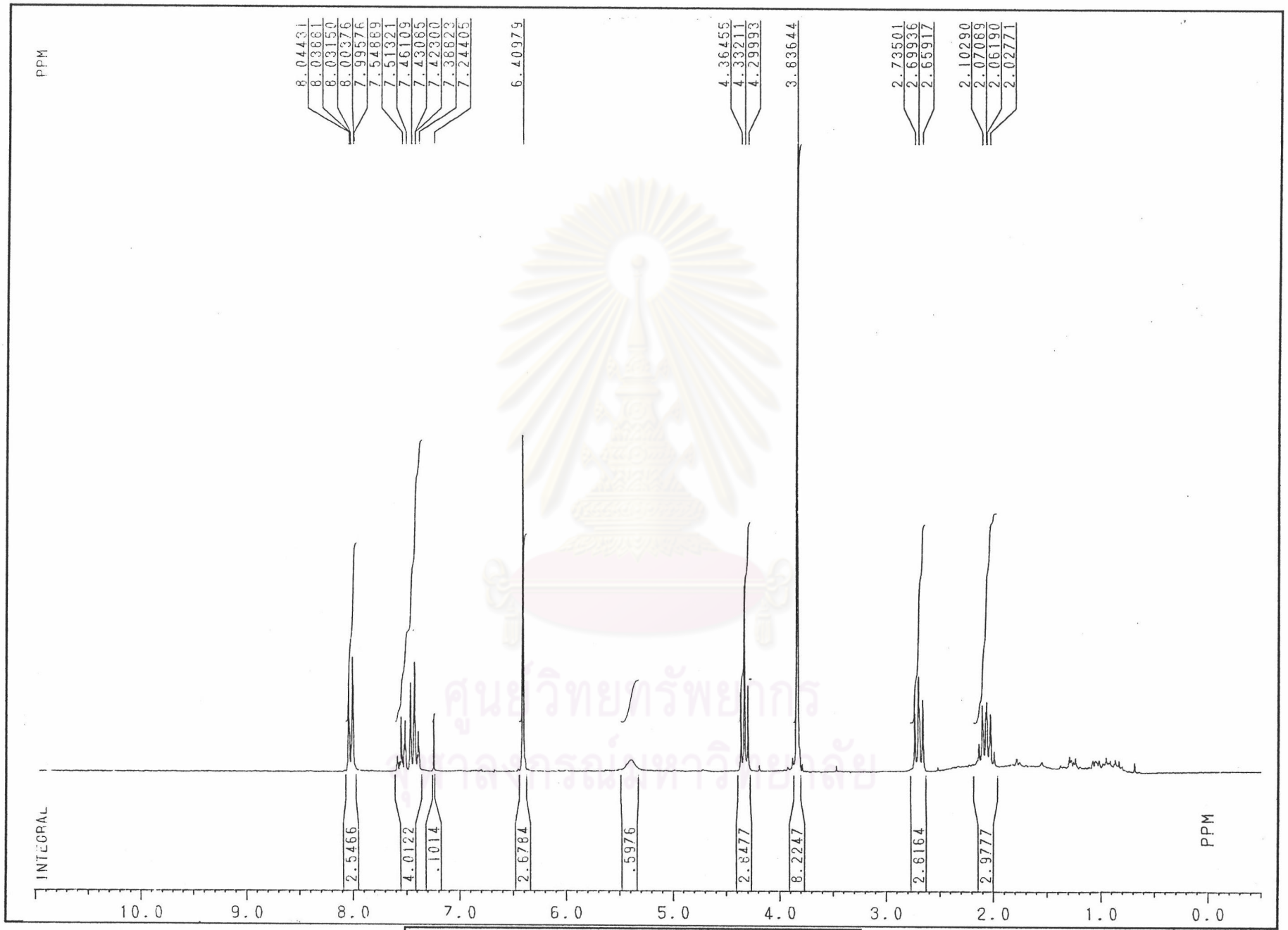

Fig.34 ^{1}H-NMR spectrum of compound 5

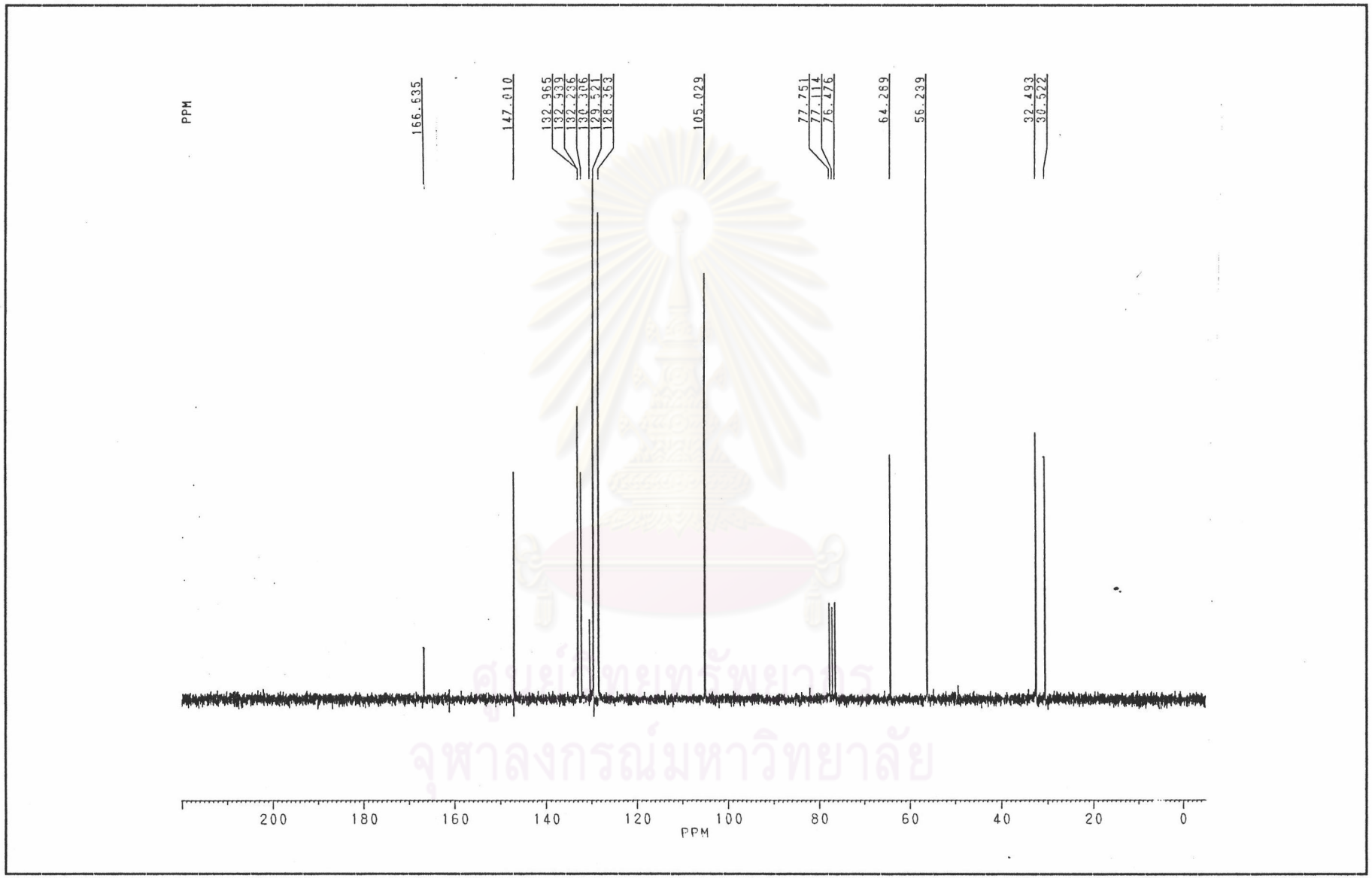

Fig.35 ^{13}C-NMR spectrum of compound 5

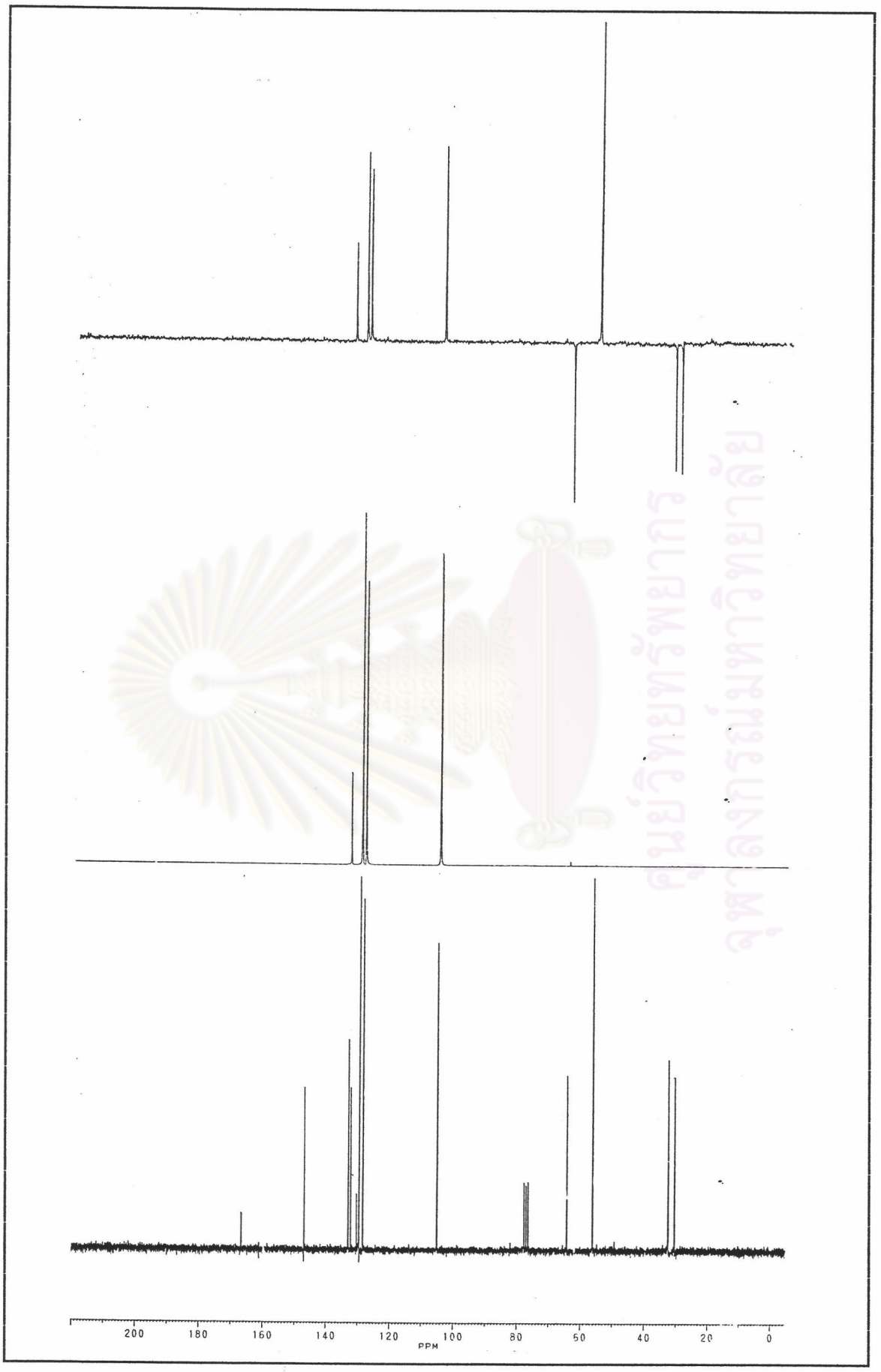

Fig. 36 DEPT-135,90 and ^{13}C-NMR spectrum of compound 5

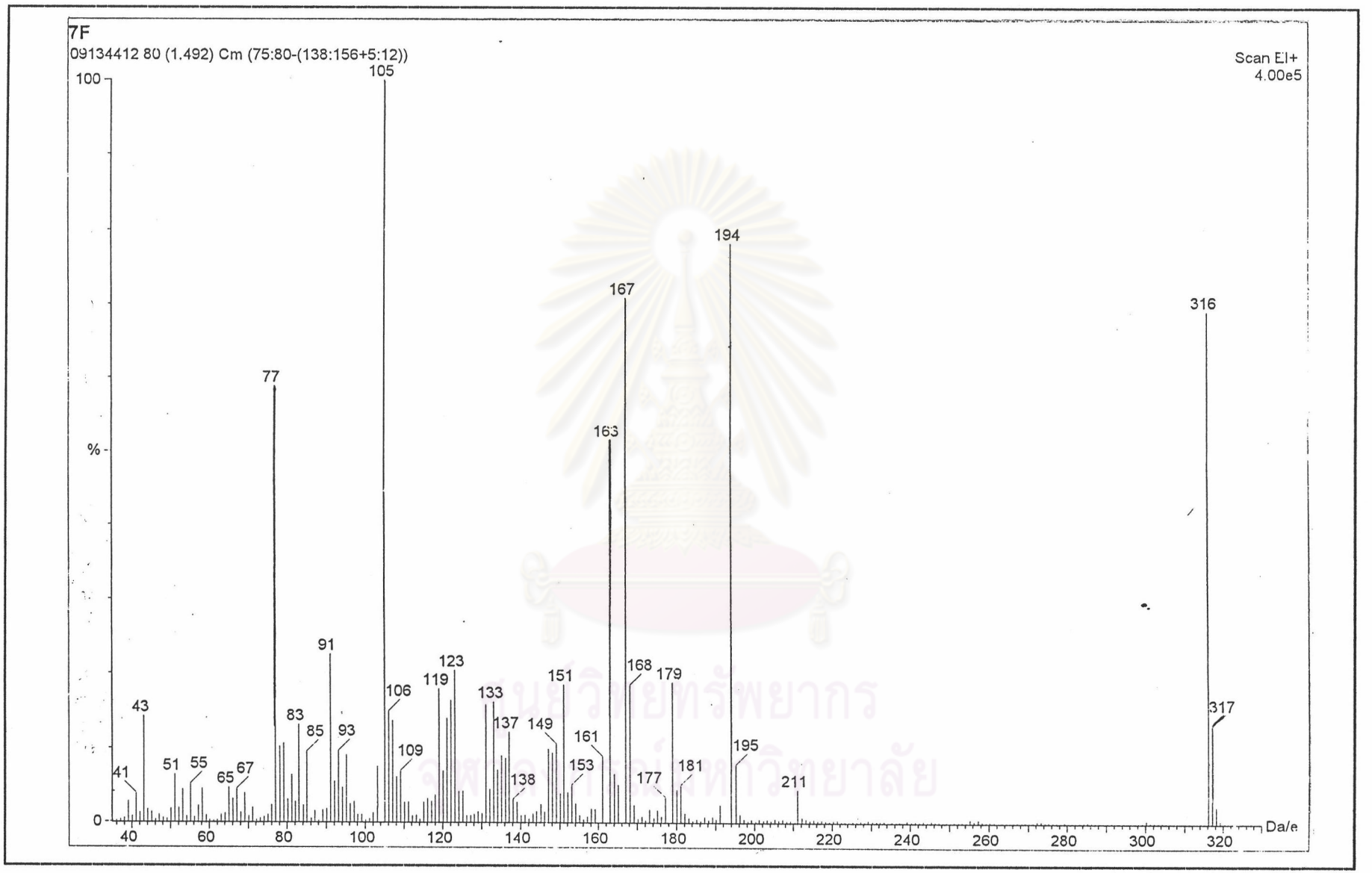

Fig.37 EIMS spectrum of compound 5

VITA

Miss Wirongrorong Teprugsa was born on December 17, 1978 in Bangkok, Thailand. She graduated with a Bachelor's Degree of Science in Biology from Kasetsart University in 1999. She was admitted into a Master's Degree Program in Biotechnology at Chulalongkorn University in 1999 and complete the program in 2002.