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APPENDIX

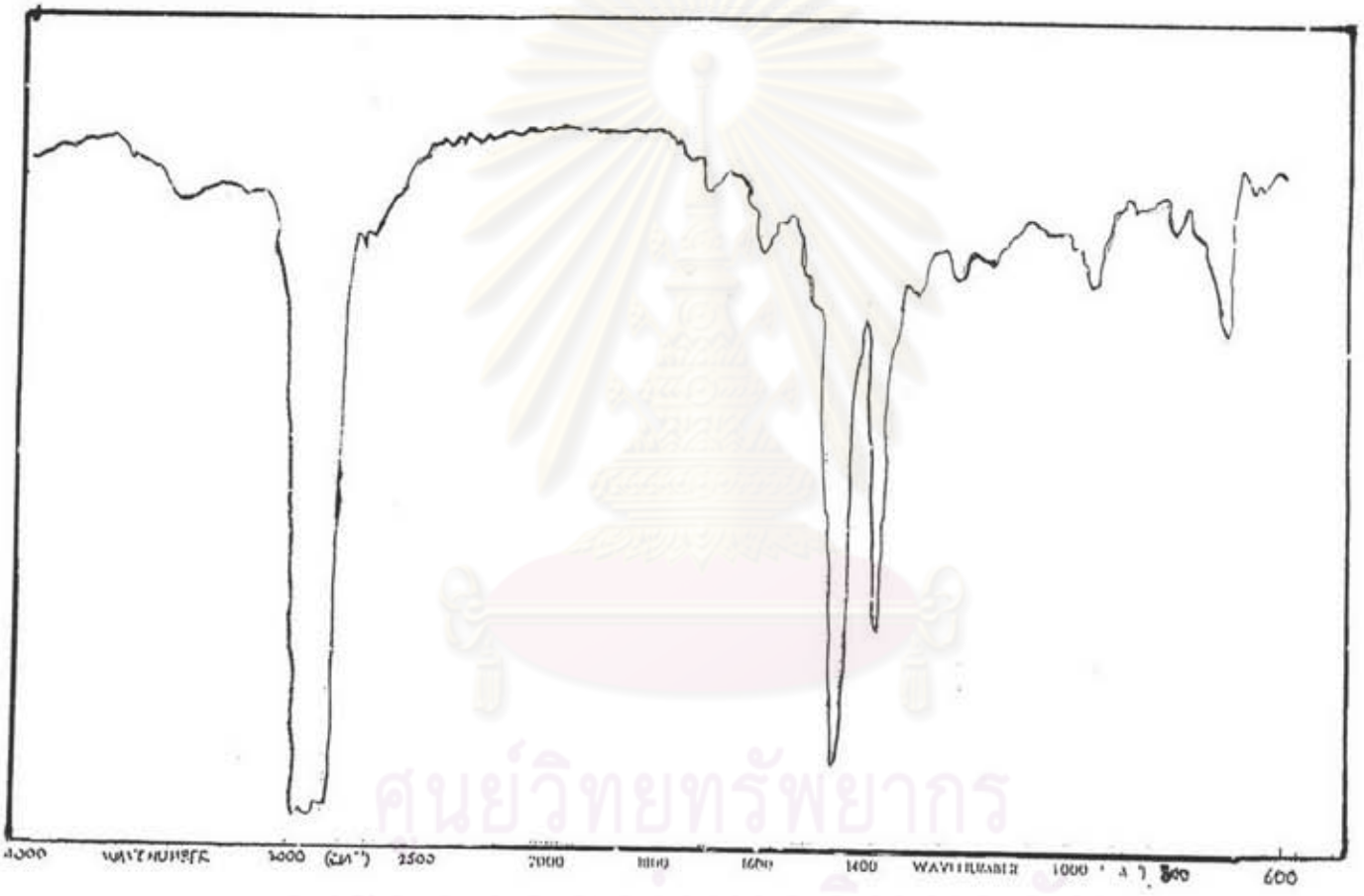

Figure A-1 IR Spectrum of Havoline-A

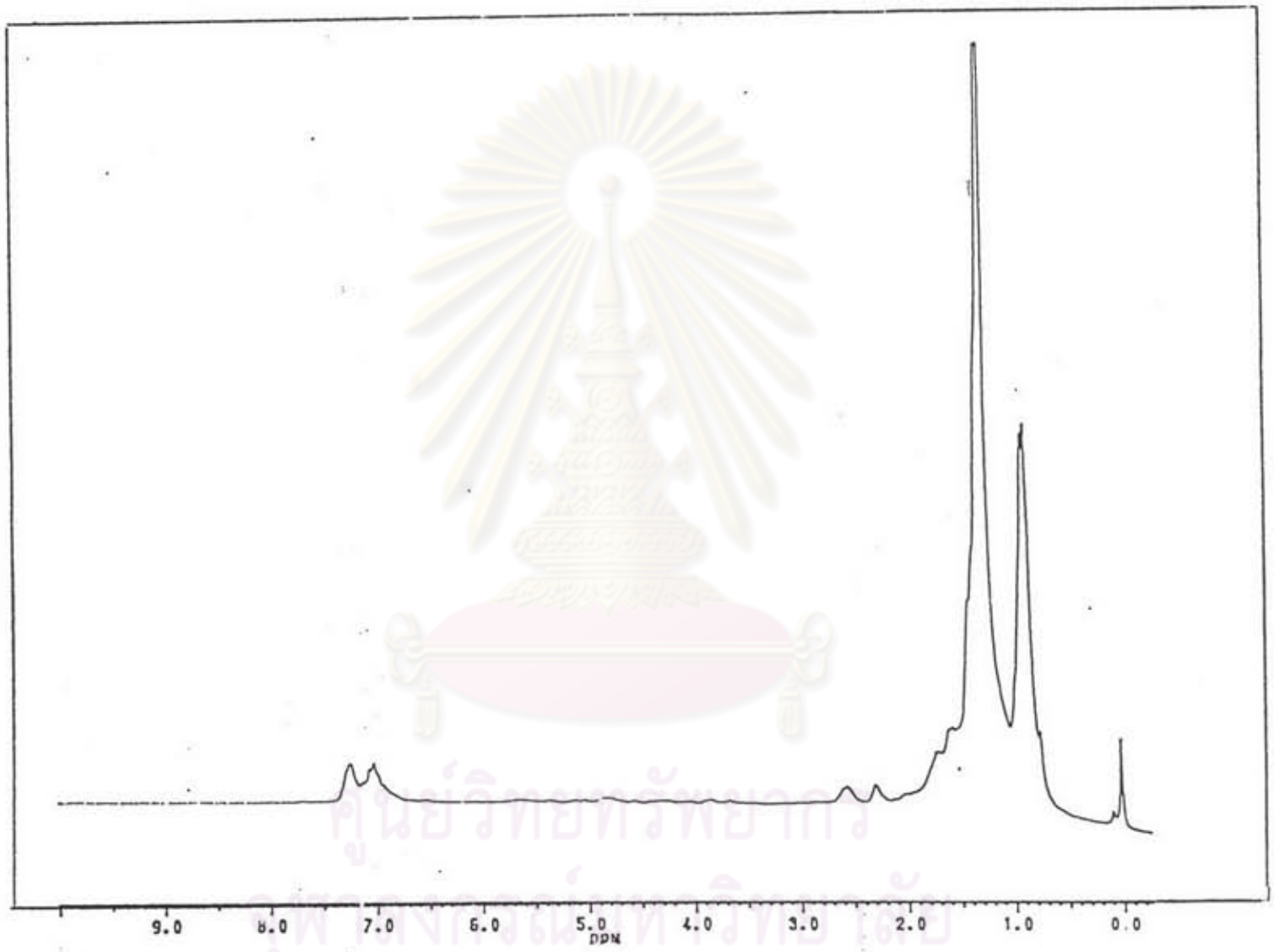

Figure A-2 ^{1}H-NMR Spectrum of Havoline-A : ($CDCl_3$)

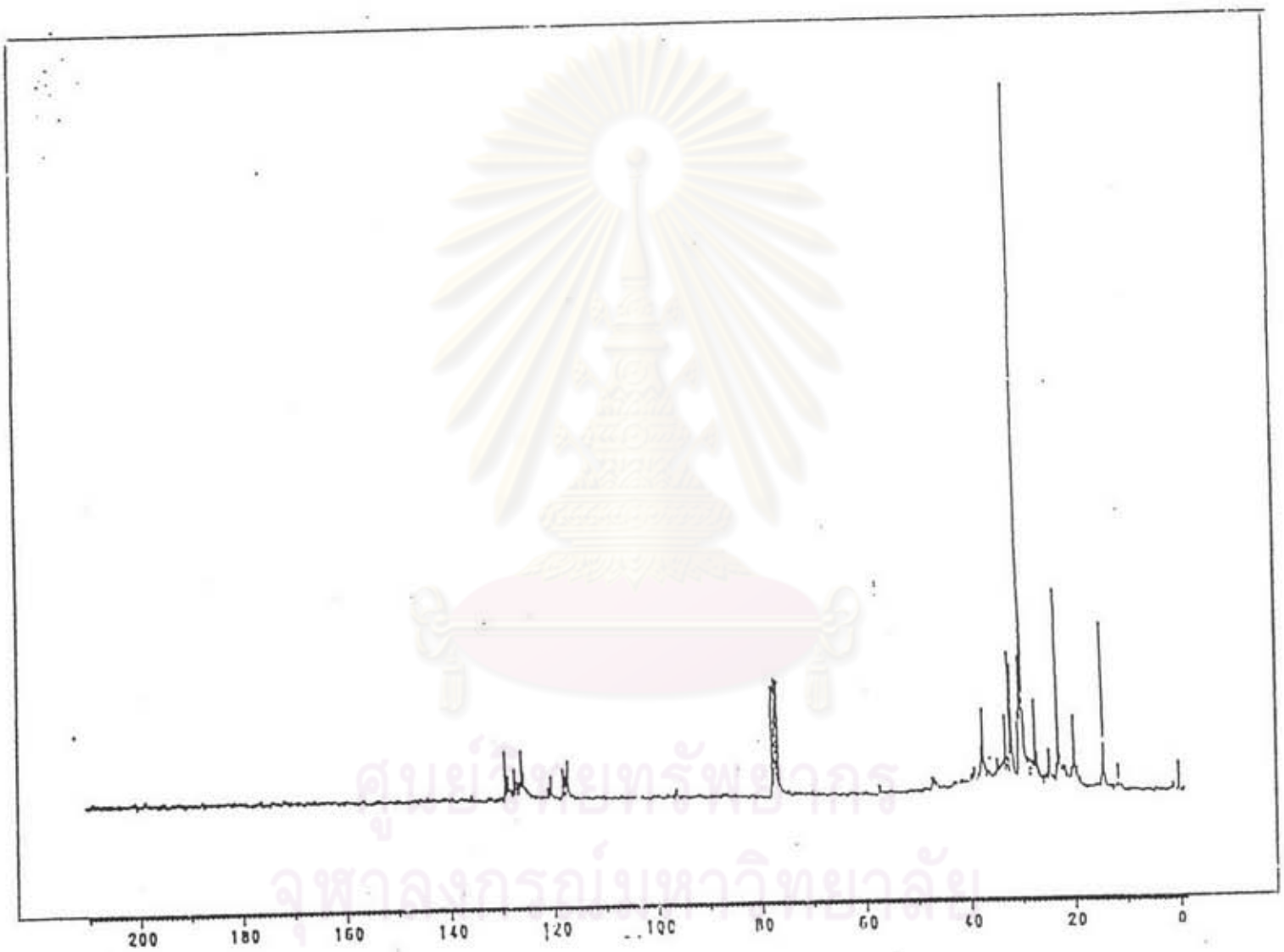

Figure A-3 ^{13}C-NMR Spectrum of Havoline-A : ($CDCl_3$)

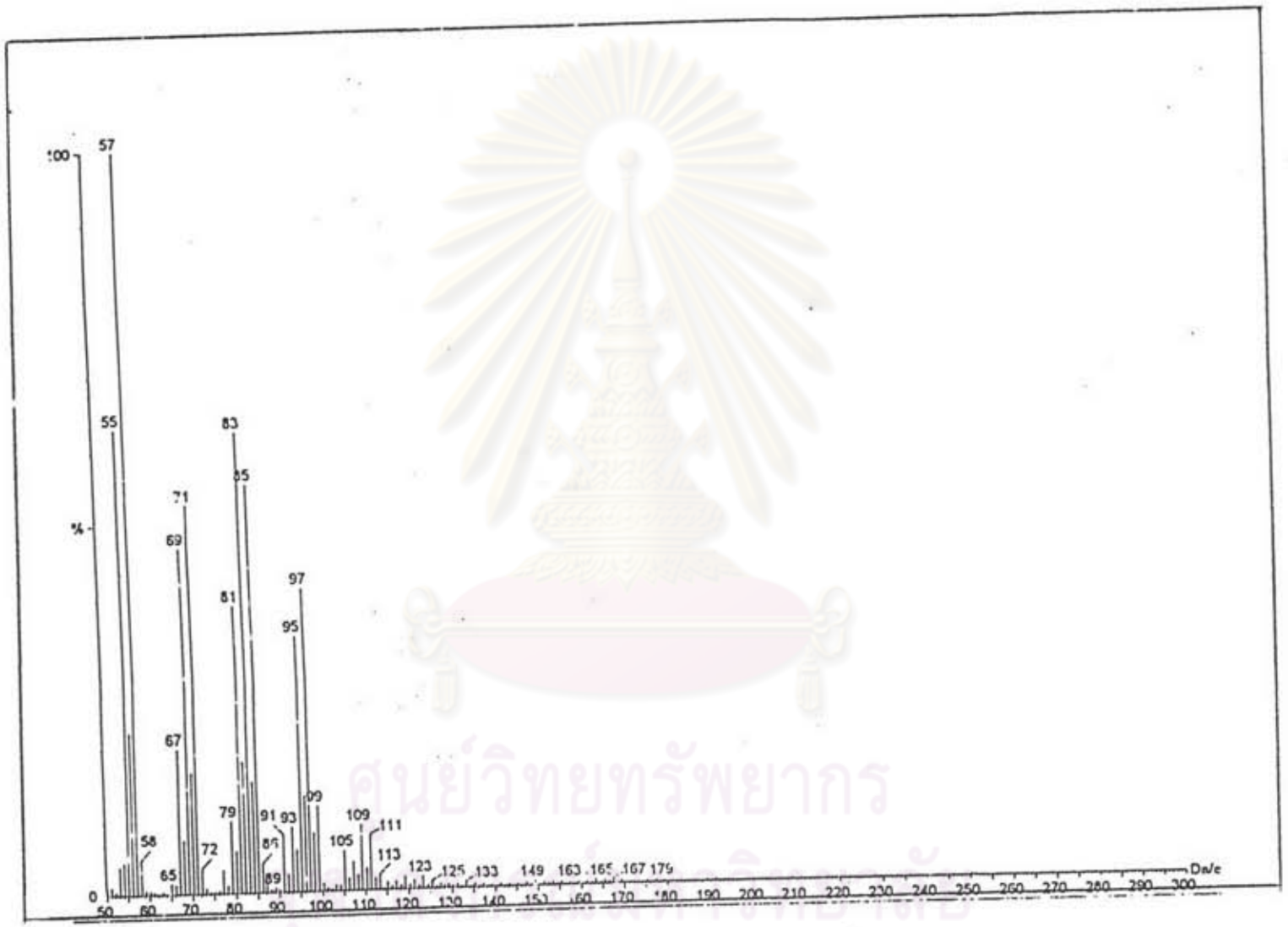

Figure A-4 MS-Spectrum of Havoline-A

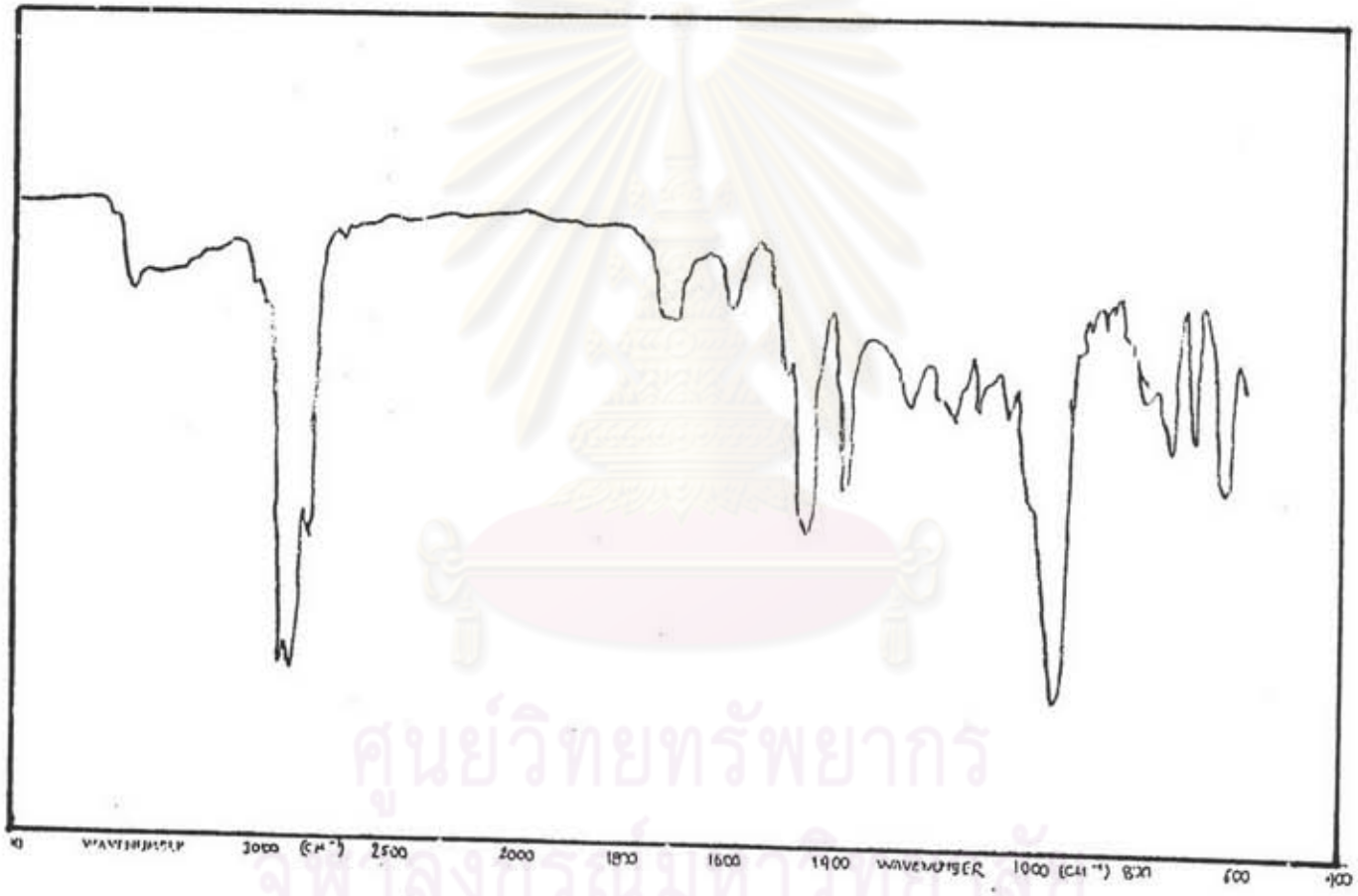

Figure A-5 IR Spectrum of Havoline-B

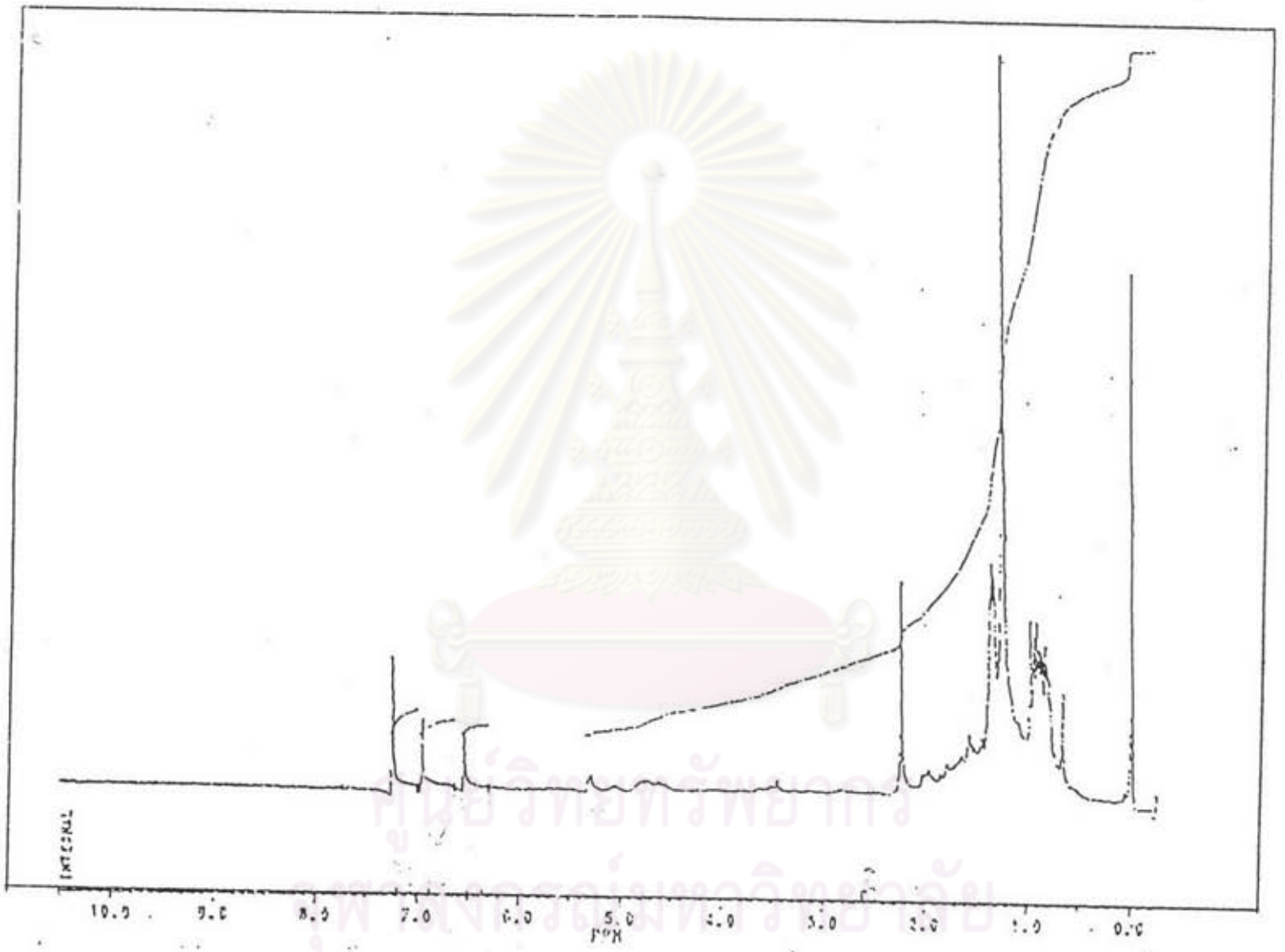

Figure A-6 ^{1}H-NMR Spectrum of Havoline-B : ($CDCl_3$)

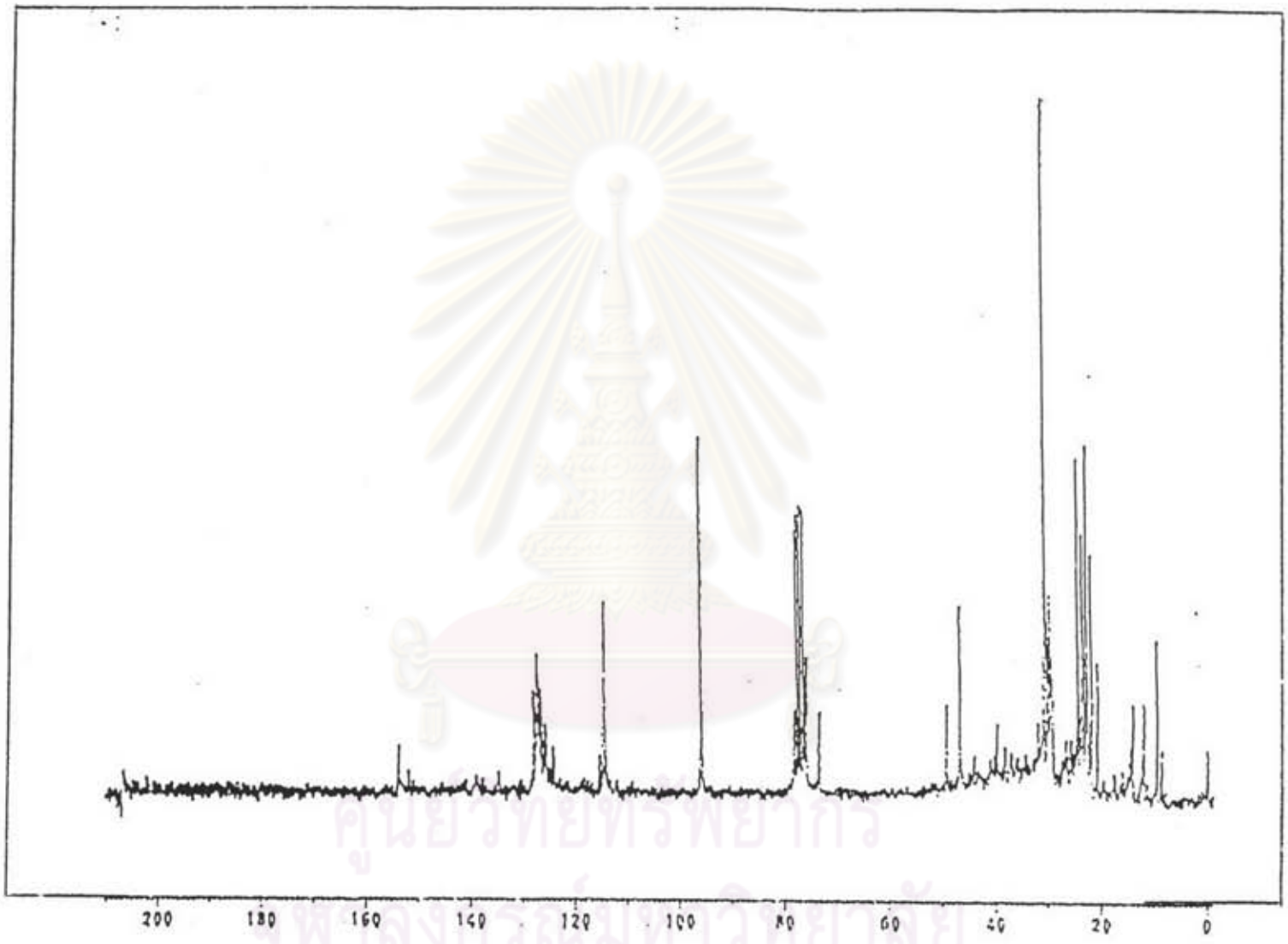

Figure A-7 ^{13}C-NMR Spectrum of Havoline-B : ($CDCl_3$ + CCl_4)

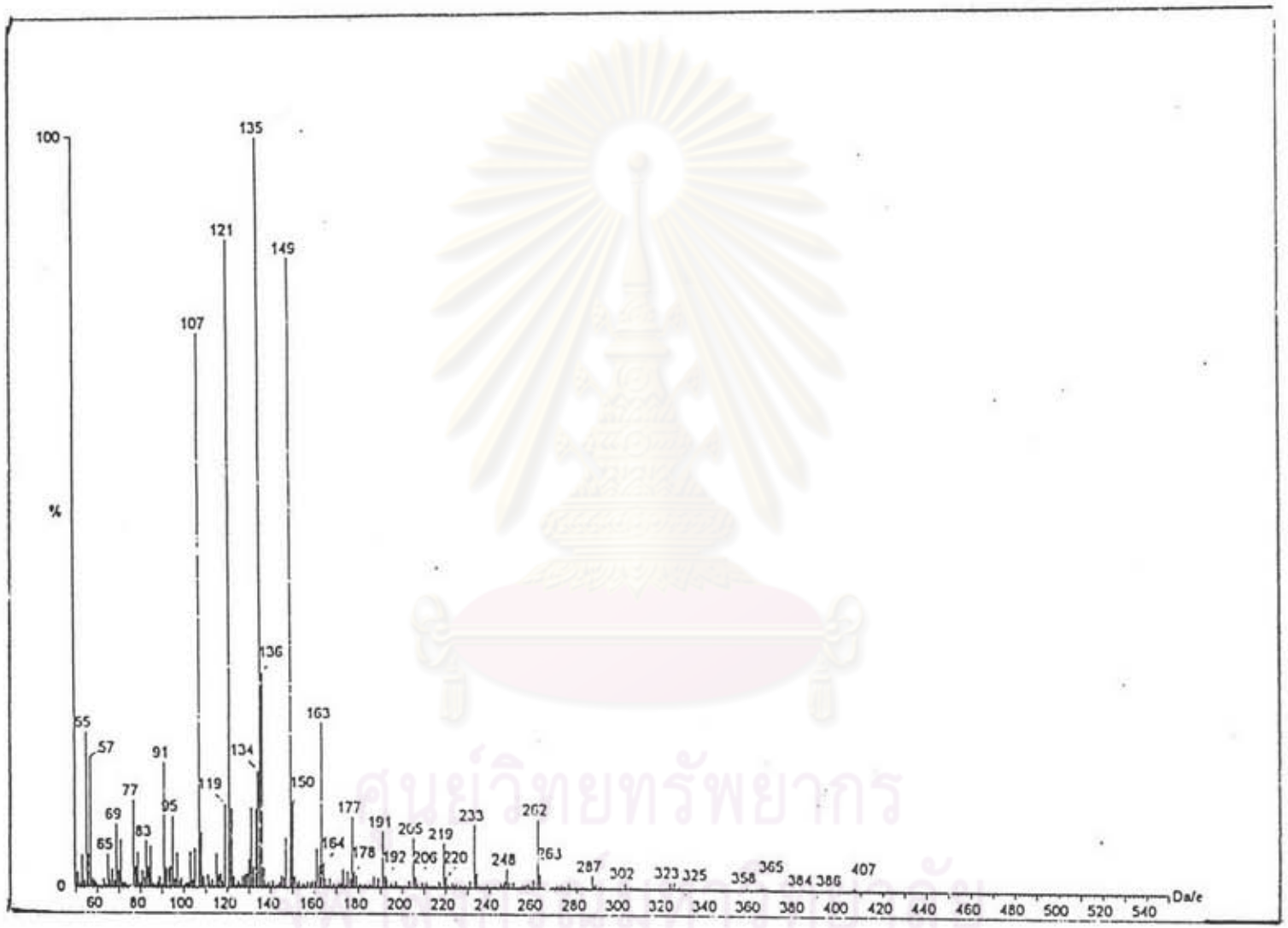

Figure A-8 MS Spectrum of Havoline-B

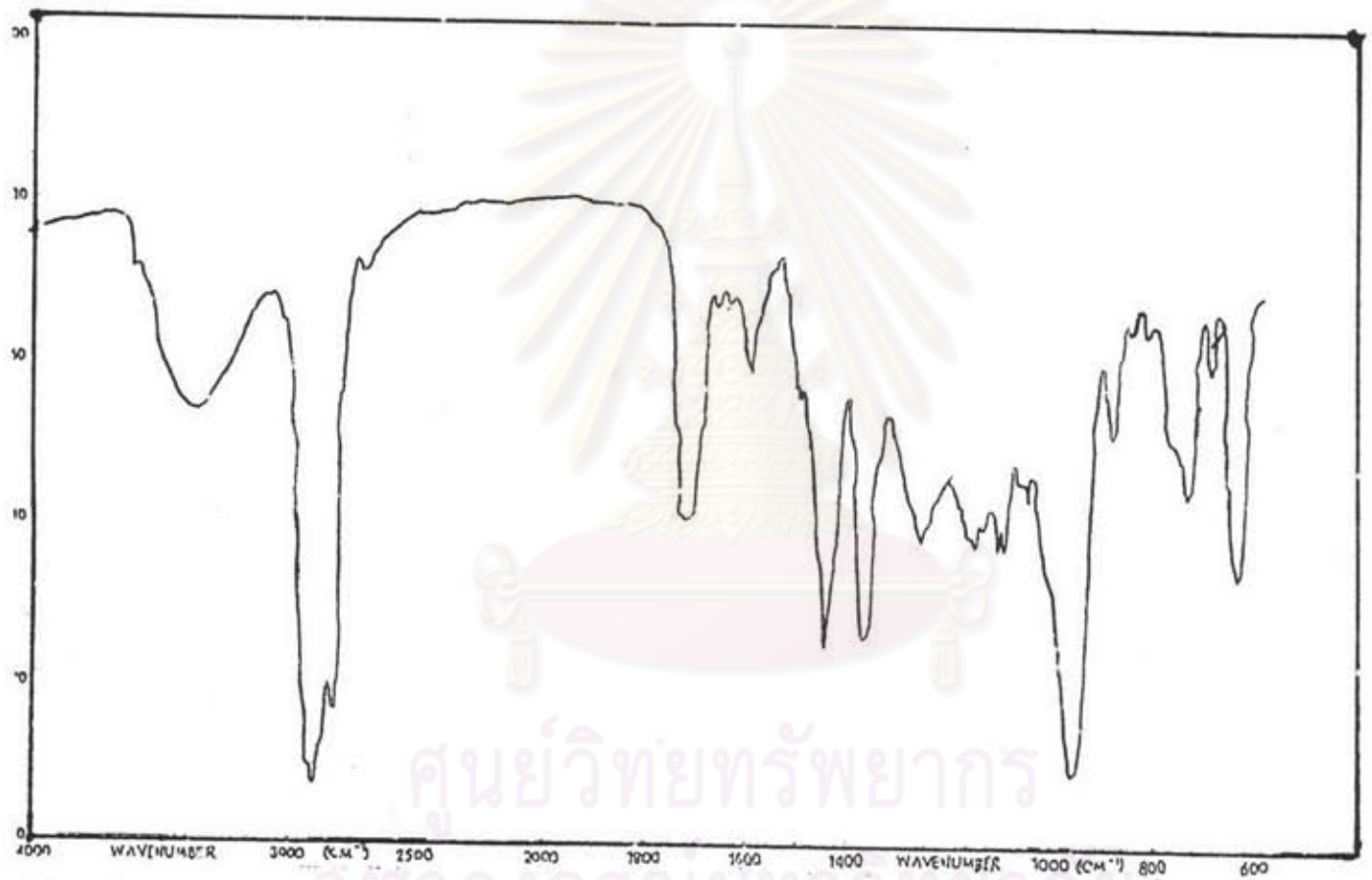

Figure A-9 IR Spectrum of Havoline-C

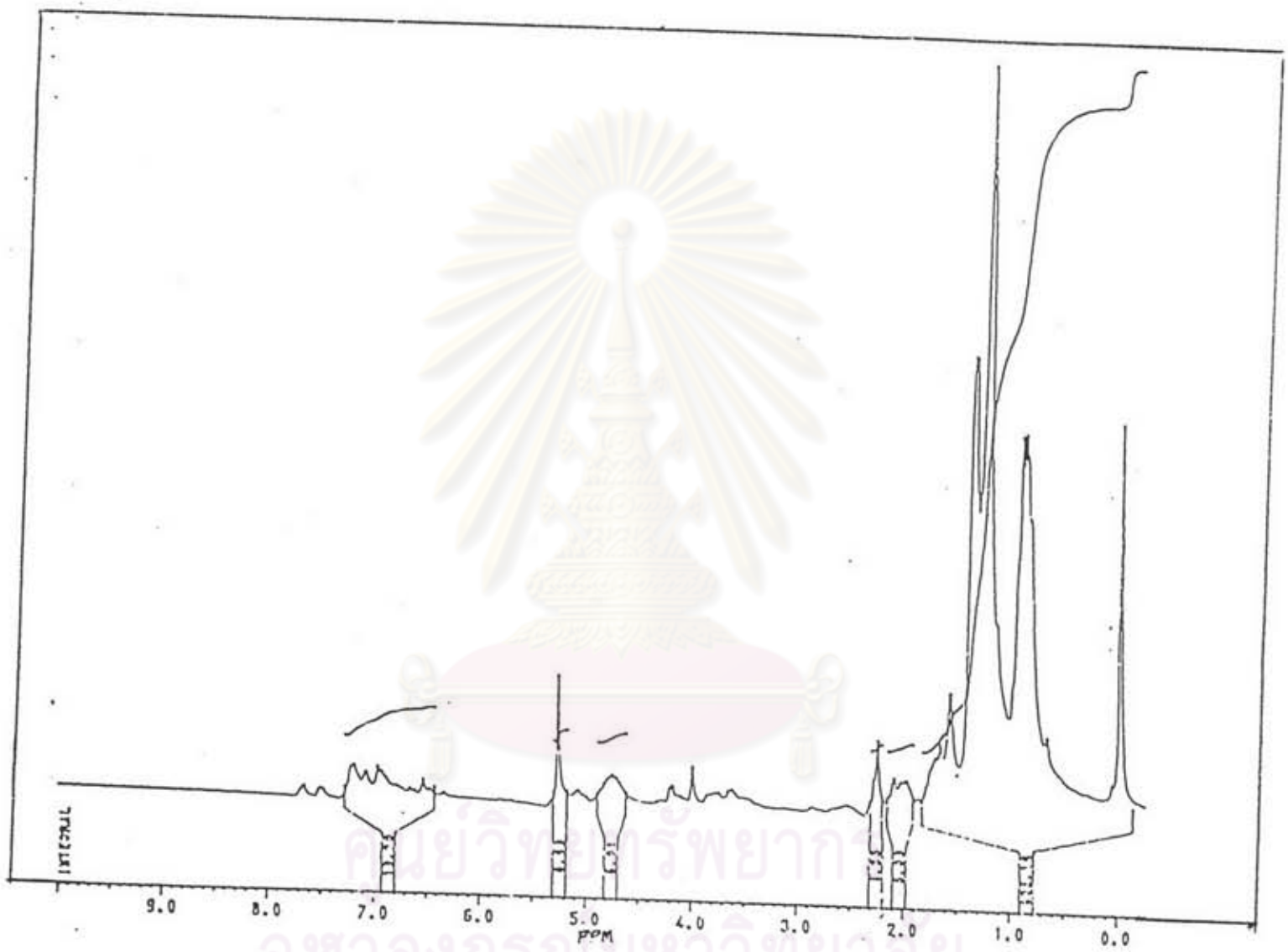

Figure A-10 ^{1}H-NMR Spectrum of Havoline-C : ($CDCl_3$)

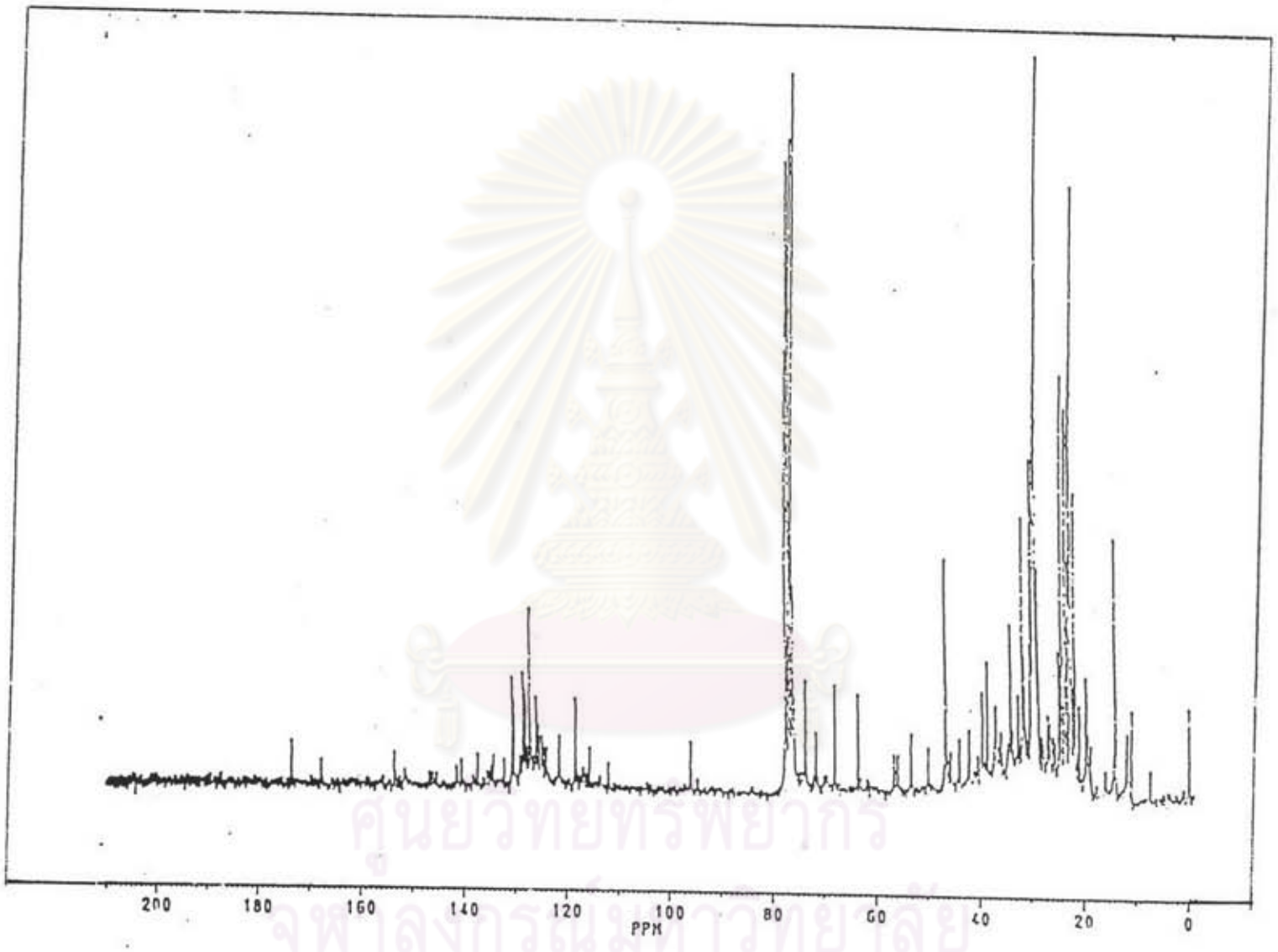

Figure A-11 ^{13}C-NMR Spectrum of Havoline-C : ($CDCl_3$)

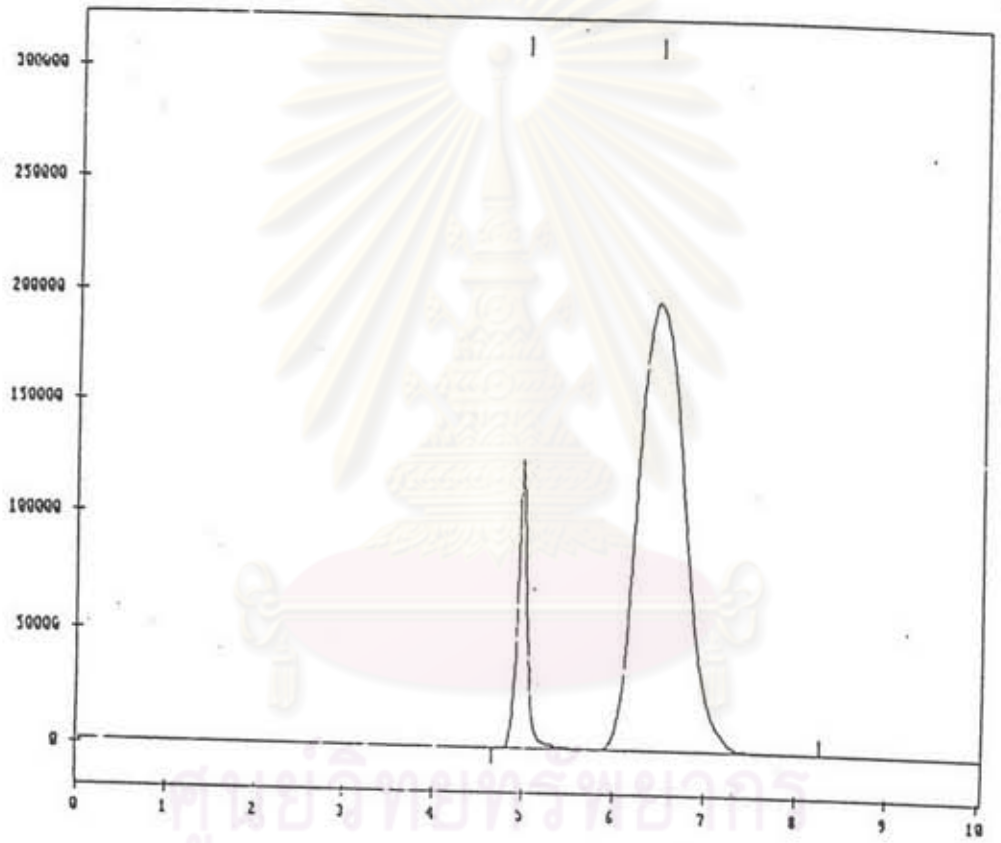

Figure A-13 GPC Chromatogram of dialysis residue of Havoline

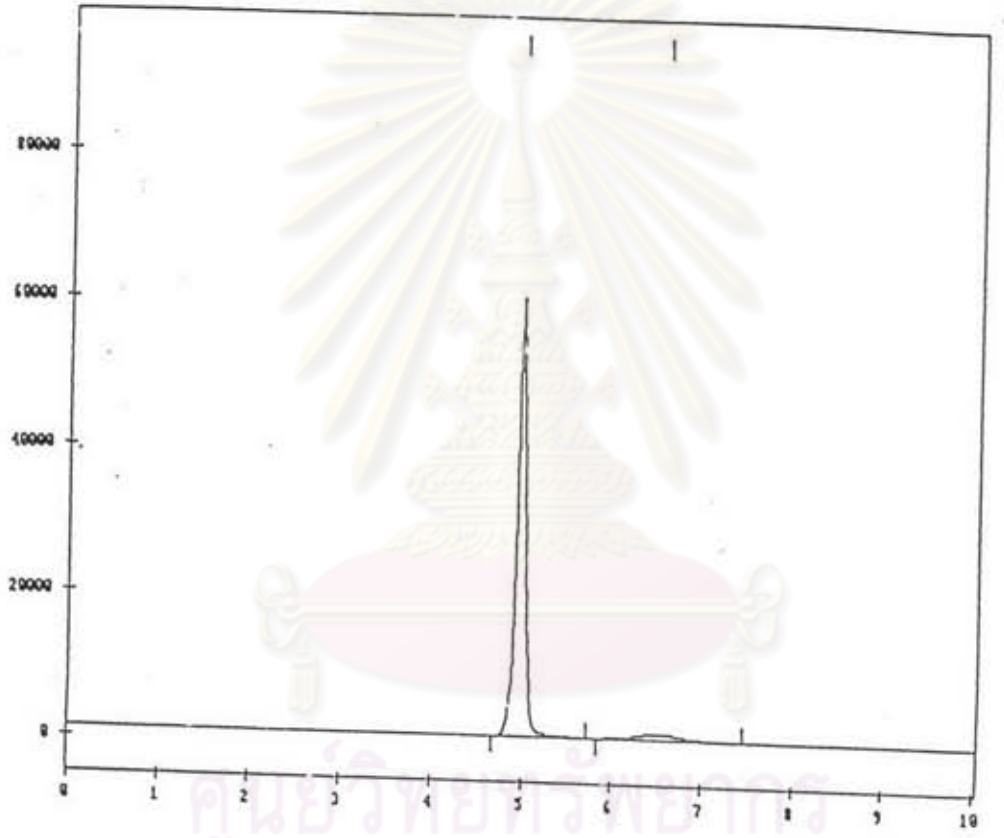

Figure A-14 GPC Chromatogram of the purified polymer of Havoline

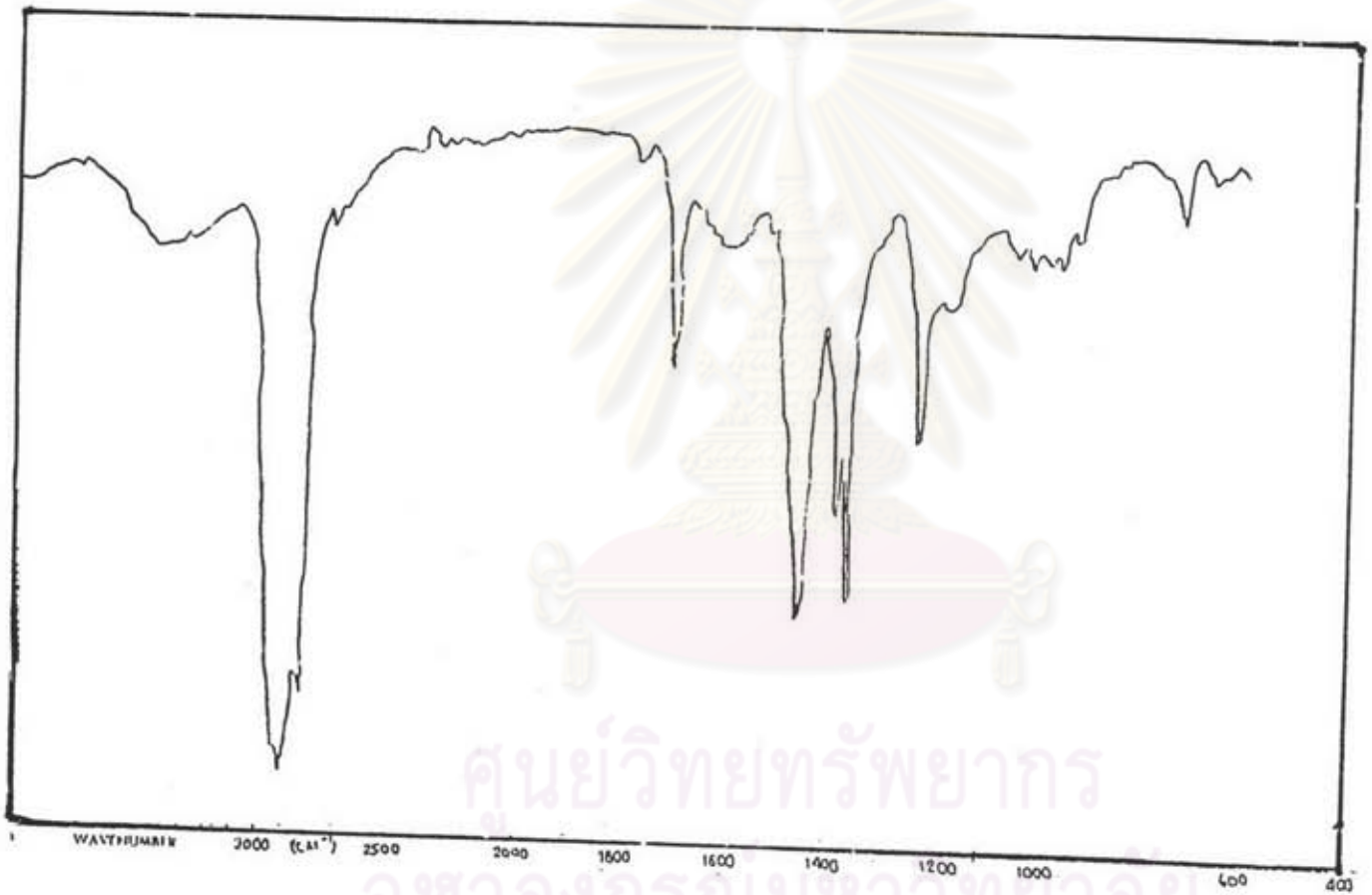

Figure A-15 IR Spectrum of polymer of Havoline

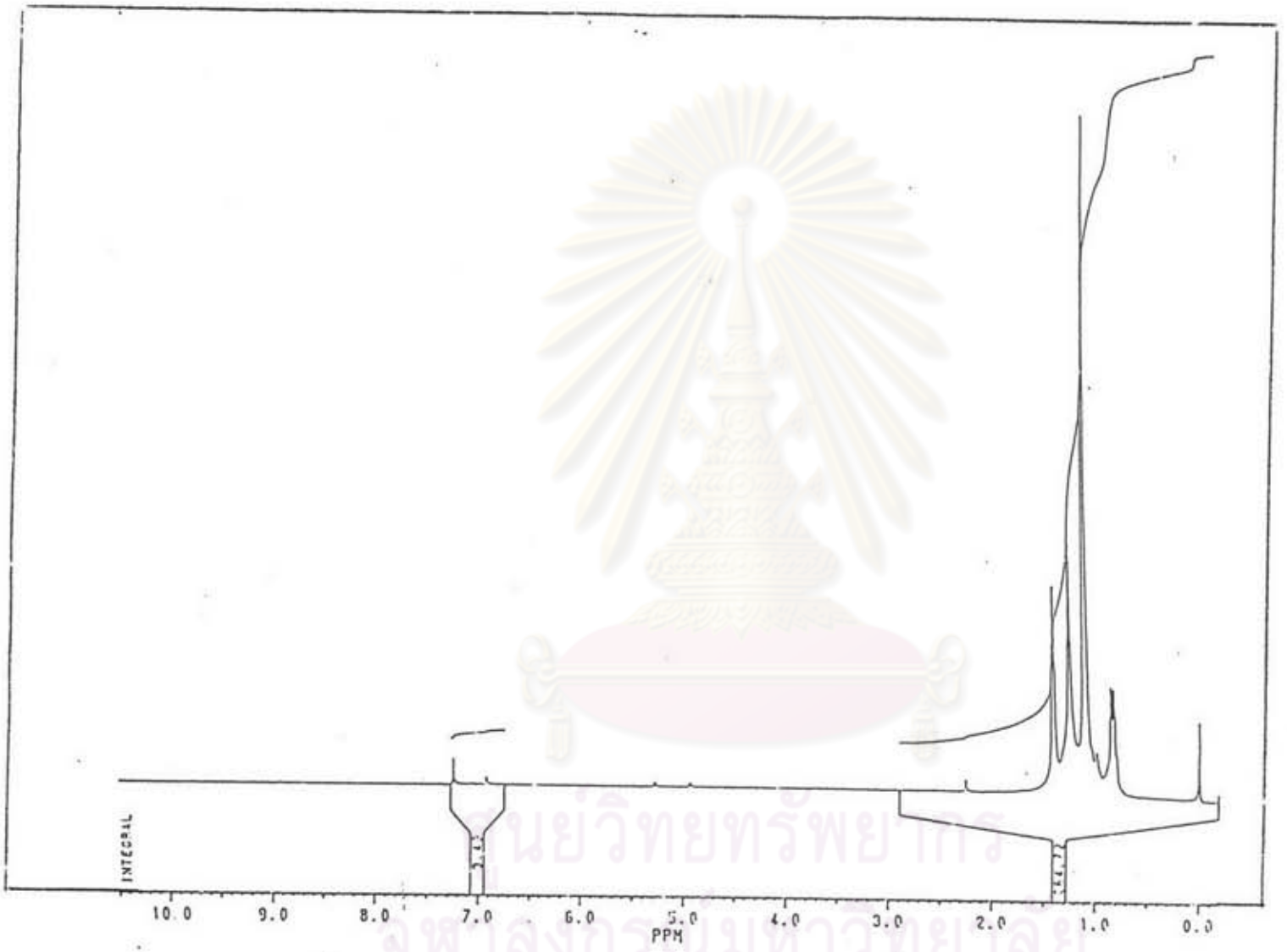

Figure A-16 ^{1}H-NMR Spectrum of polymer of Havoline : ($CDCl_3$ + CCl_4)

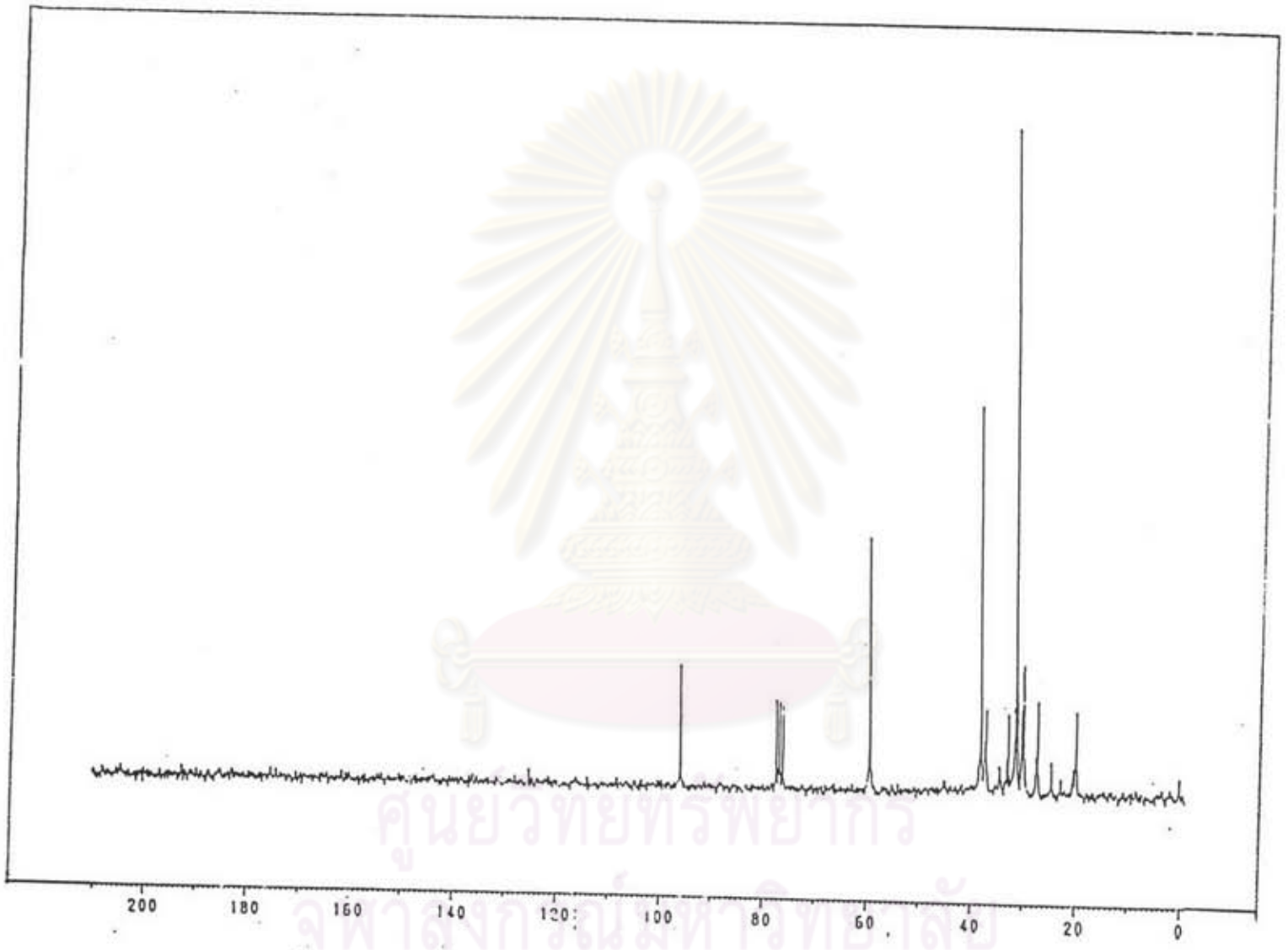

Figure A-17 ^{13}C-NMR Spectrum of polymer of Havoline : ($CDCl_3$ + CCl_4)

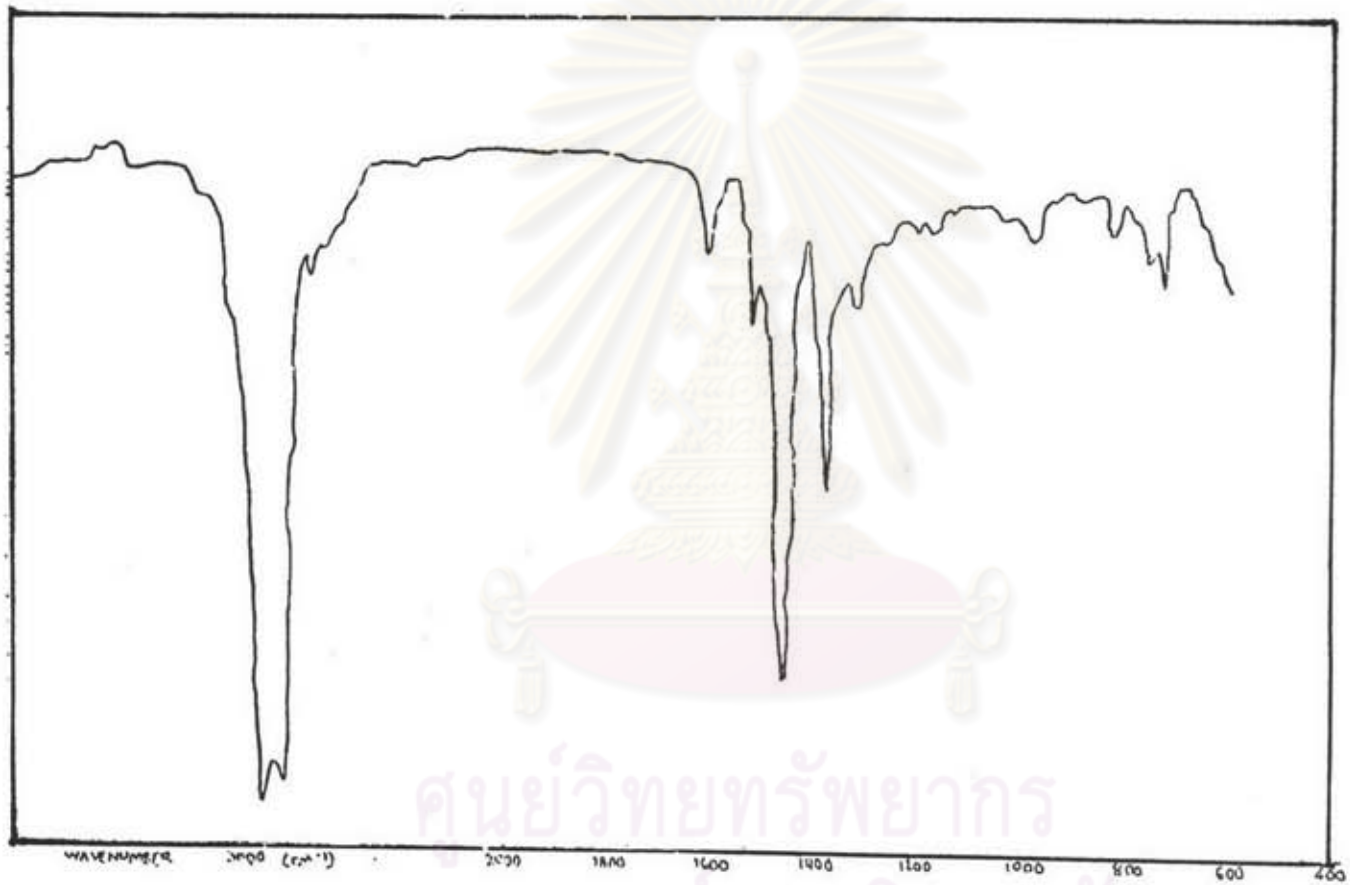

Figure A-18 IR Spectrum of Shell-A

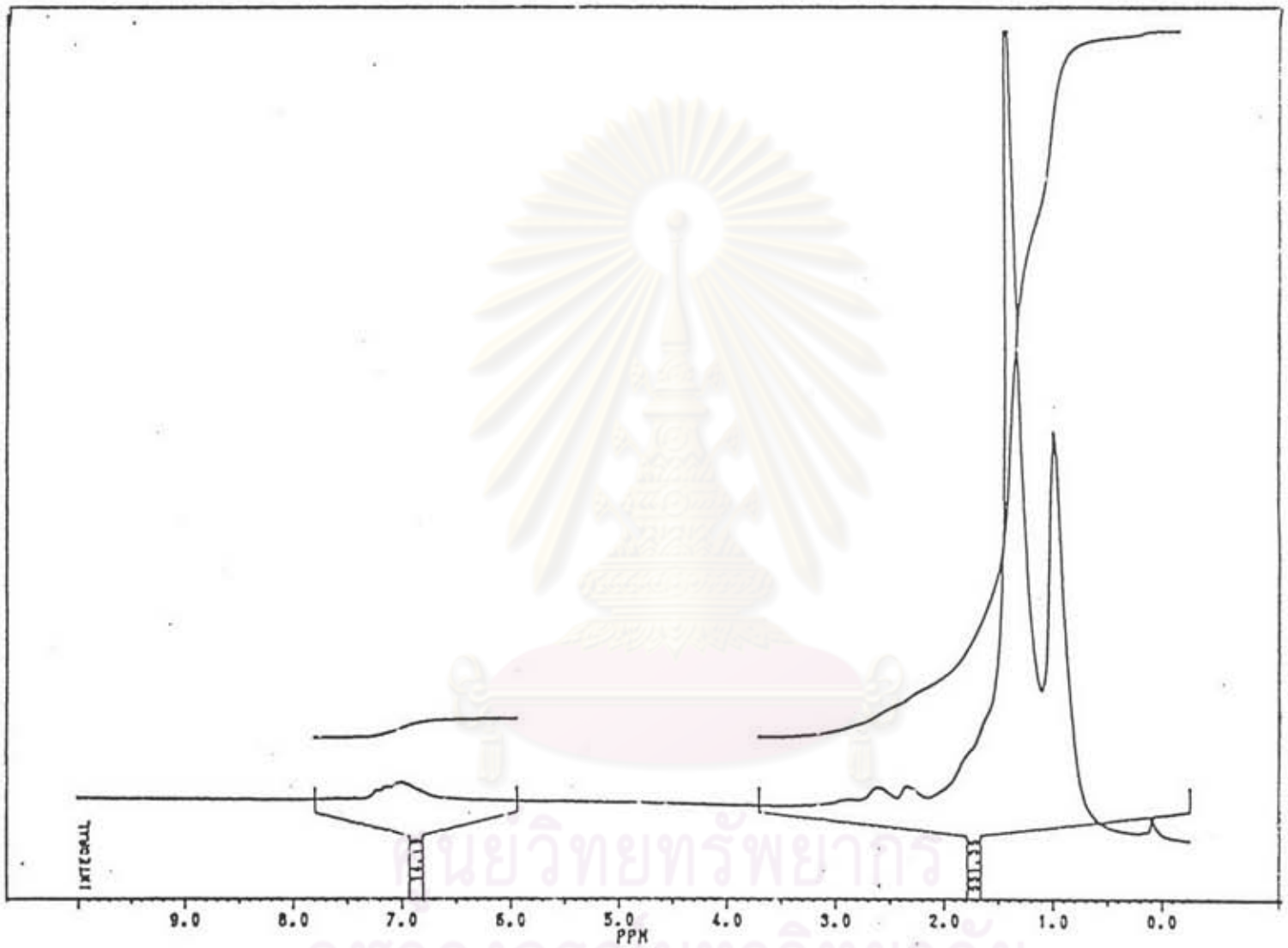

Figure A-19 ^{1}H-NMR Spectrum of Shell-A : ($CDCl_3$ + CCl_4)

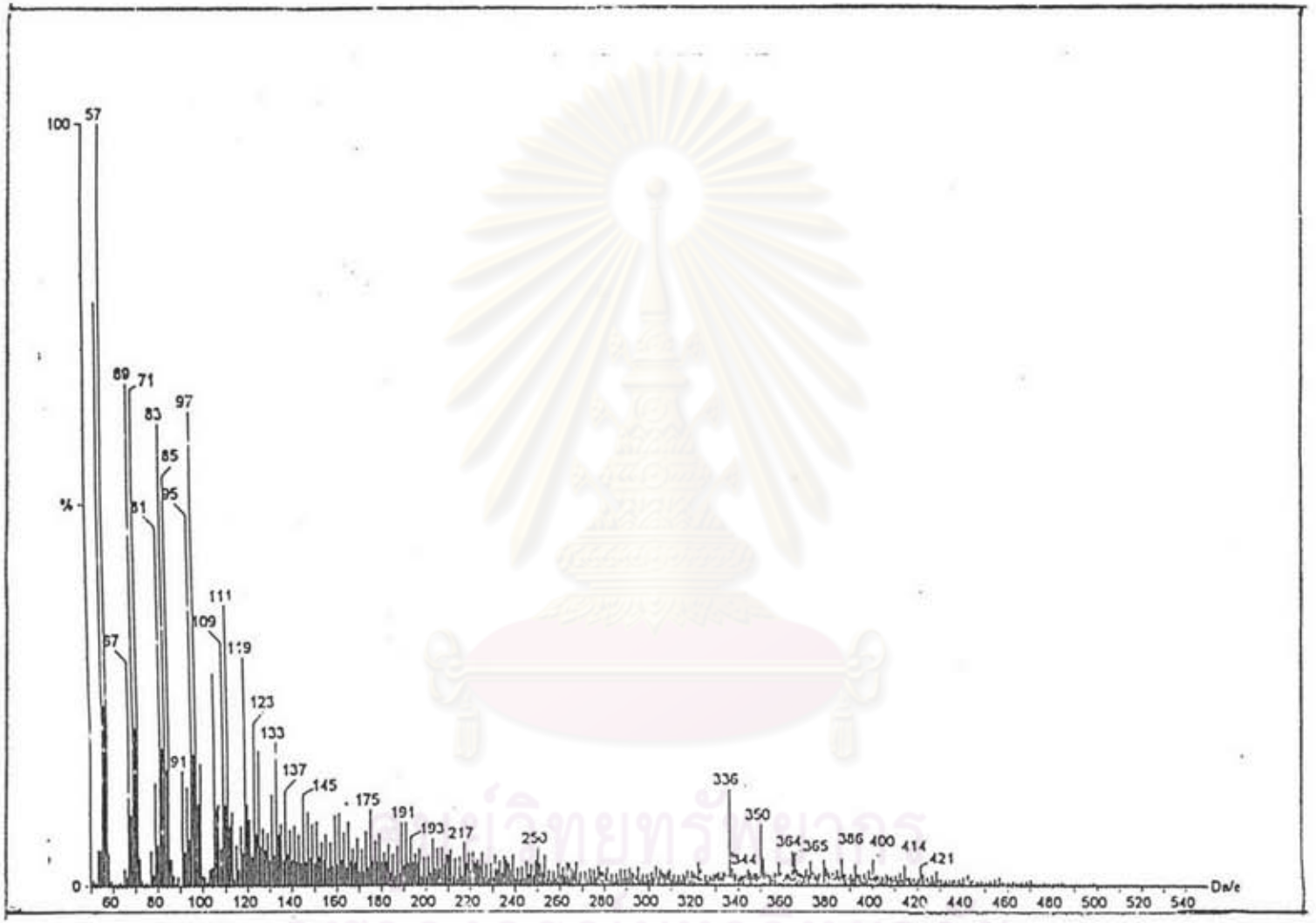

Figure A-21 MS-Spectrum of Shell-A

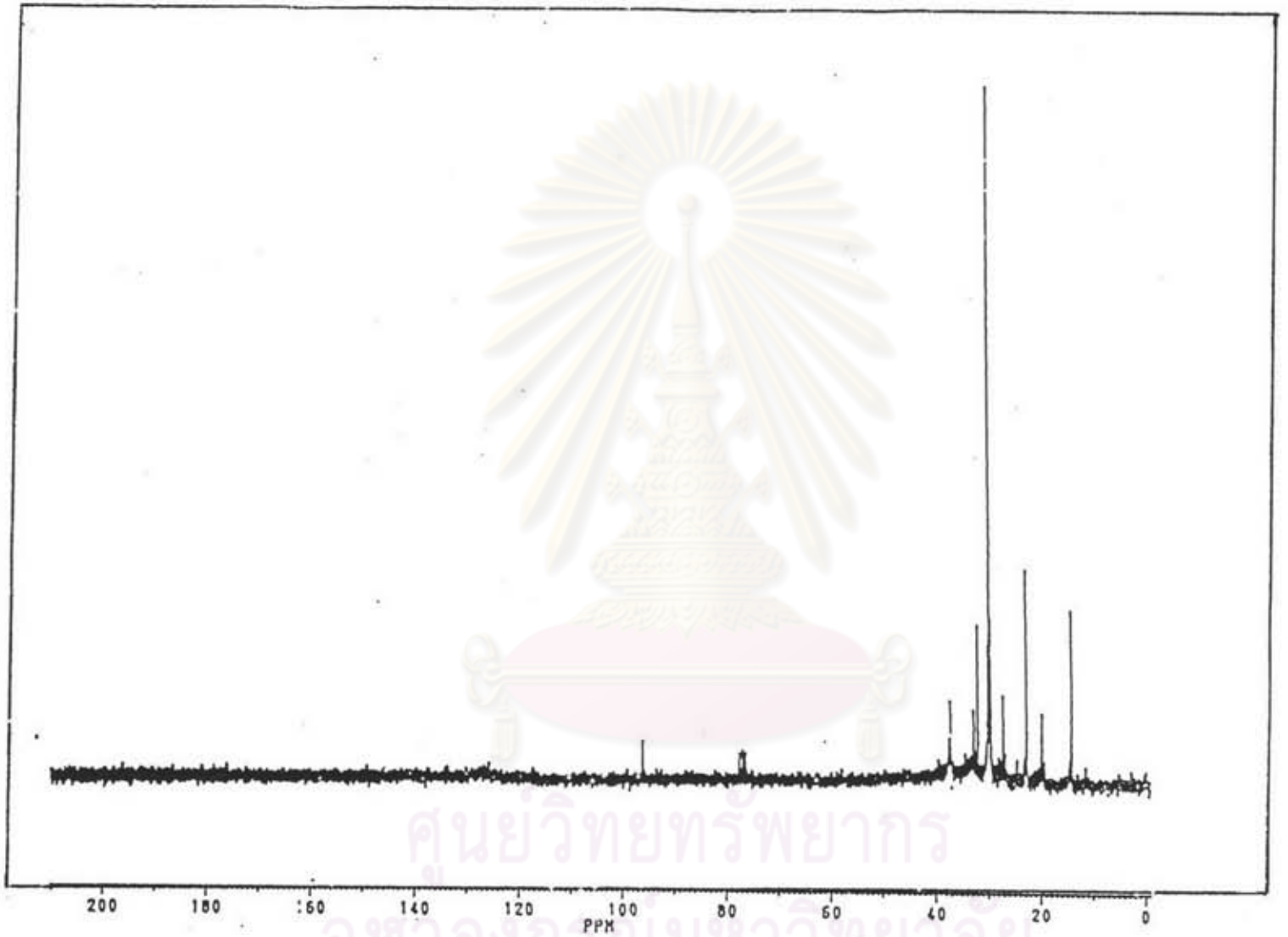

Figure A-20 ^{13}C-NMR Spectrum of Shell-A : ($CDCl_3$ + CCl_4)

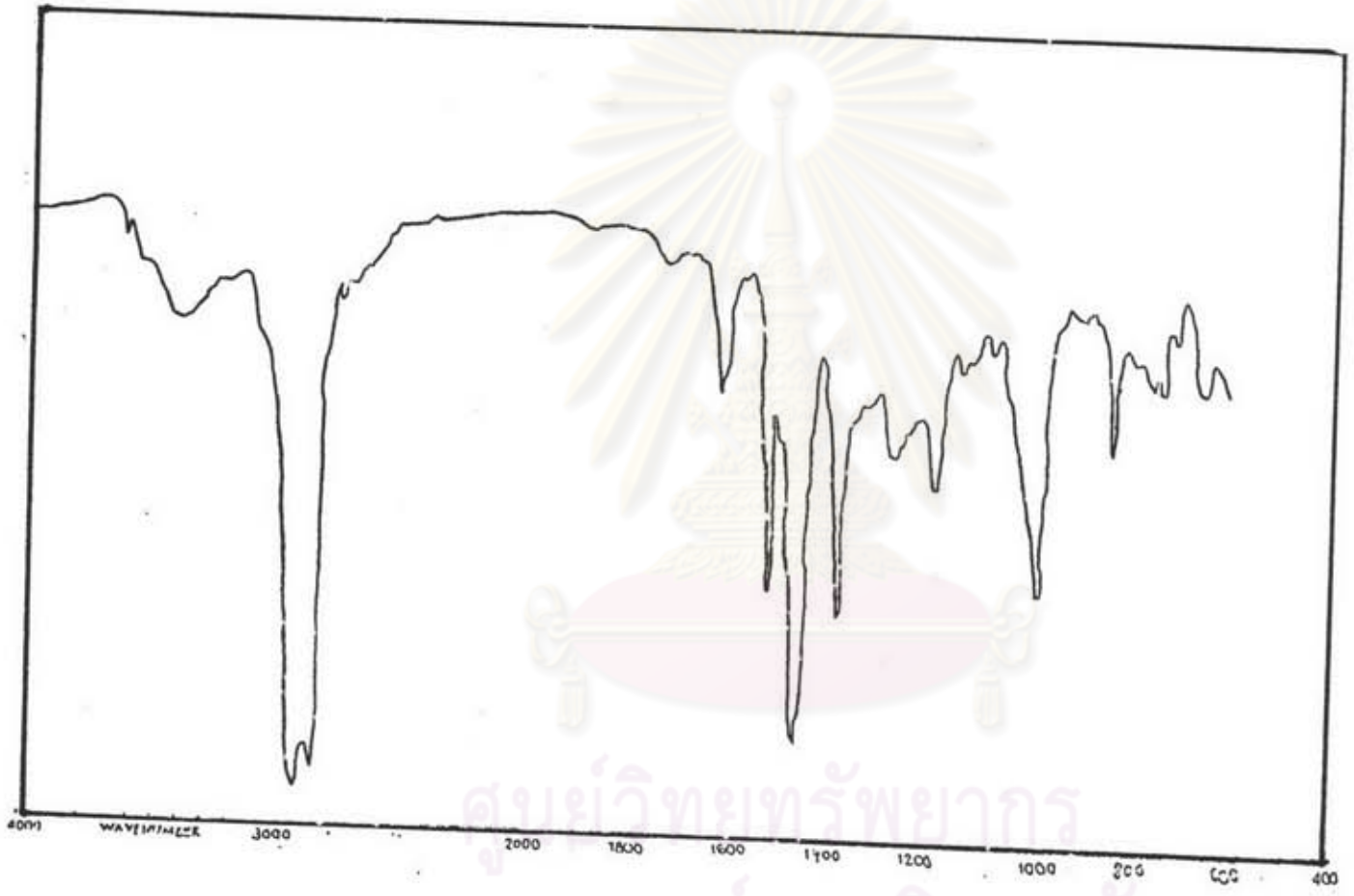

Figure A-22 IR Spectrum of Shell-B

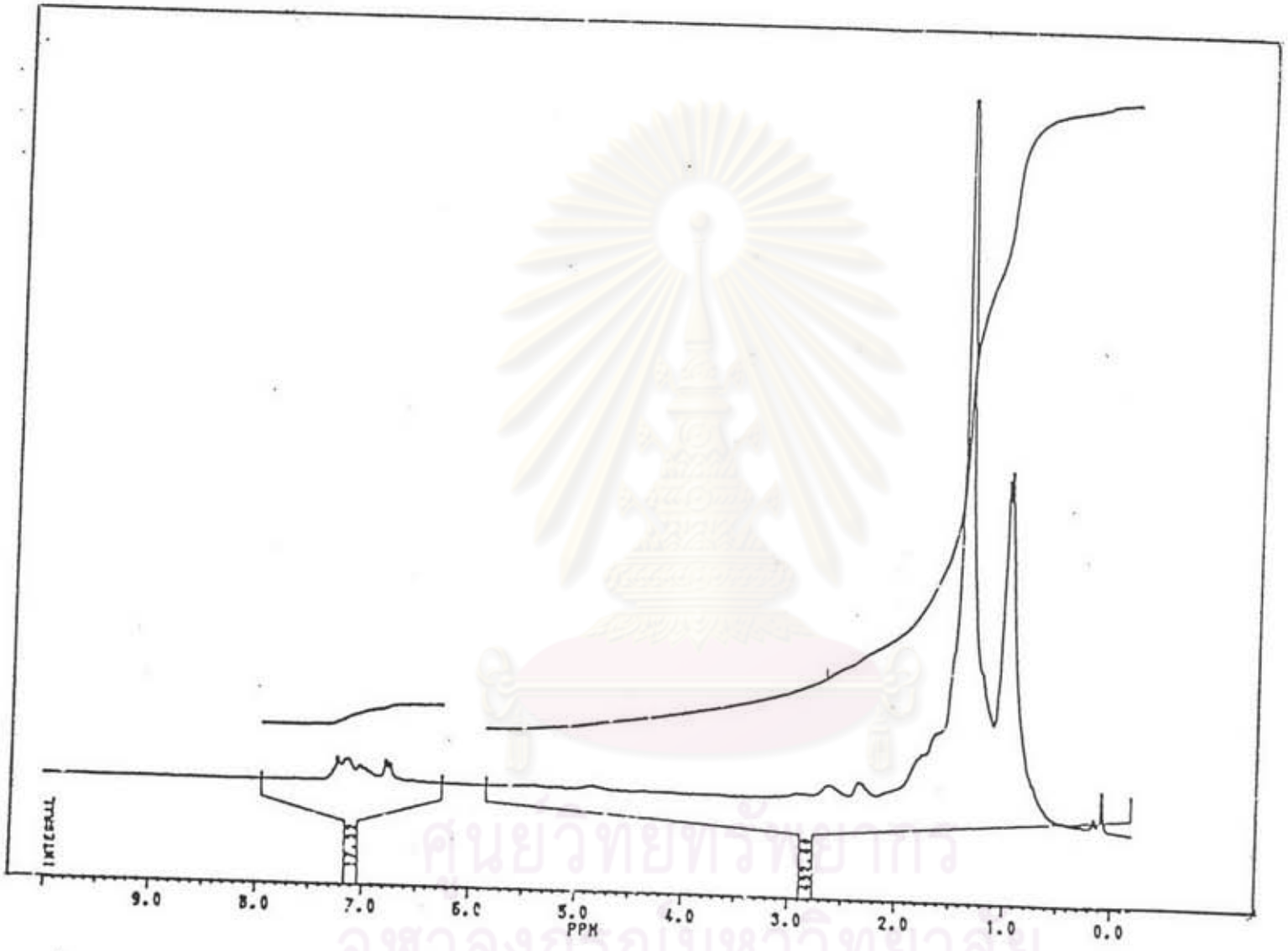

Figure A-23 : ^{1}H-NMR Spectrum of Shell-B : ($CDCl_3$ + CCl_4)

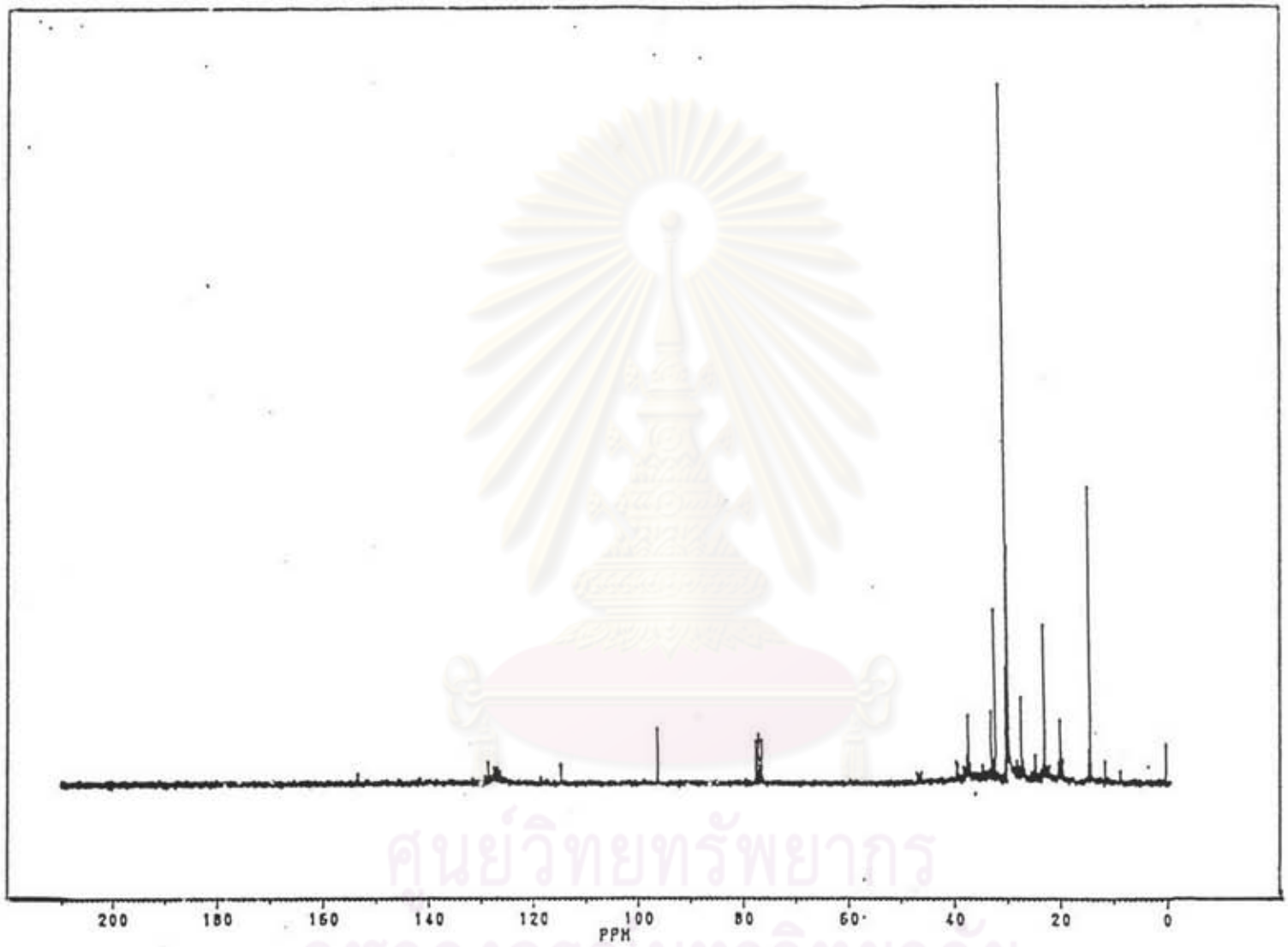

Figure A-24 ^{13}C-NMR Spectrum of Shell-B : ($CDCl_3$ + CCl_4)

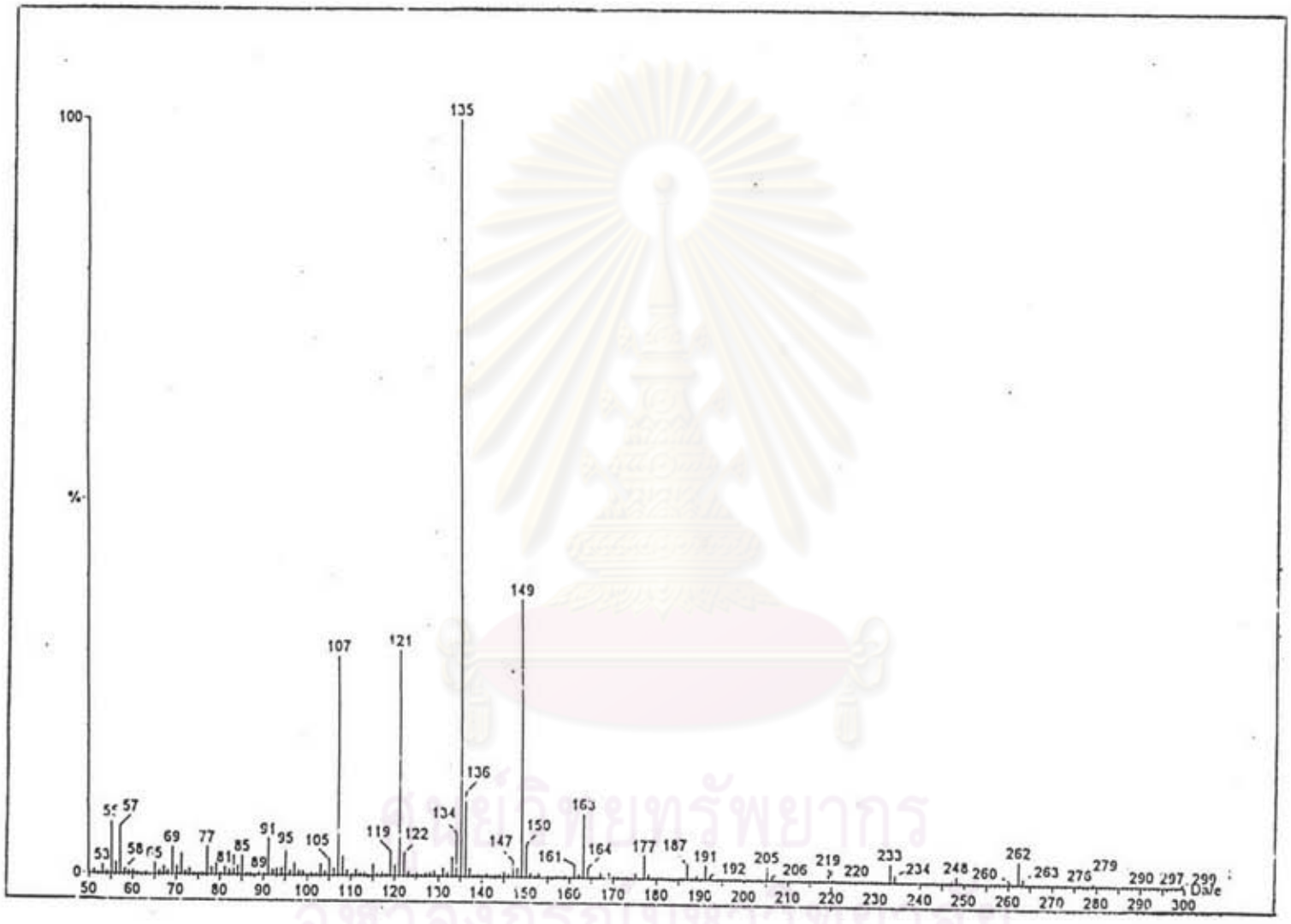

Figure A-25 MS Spectrum of Shell-B

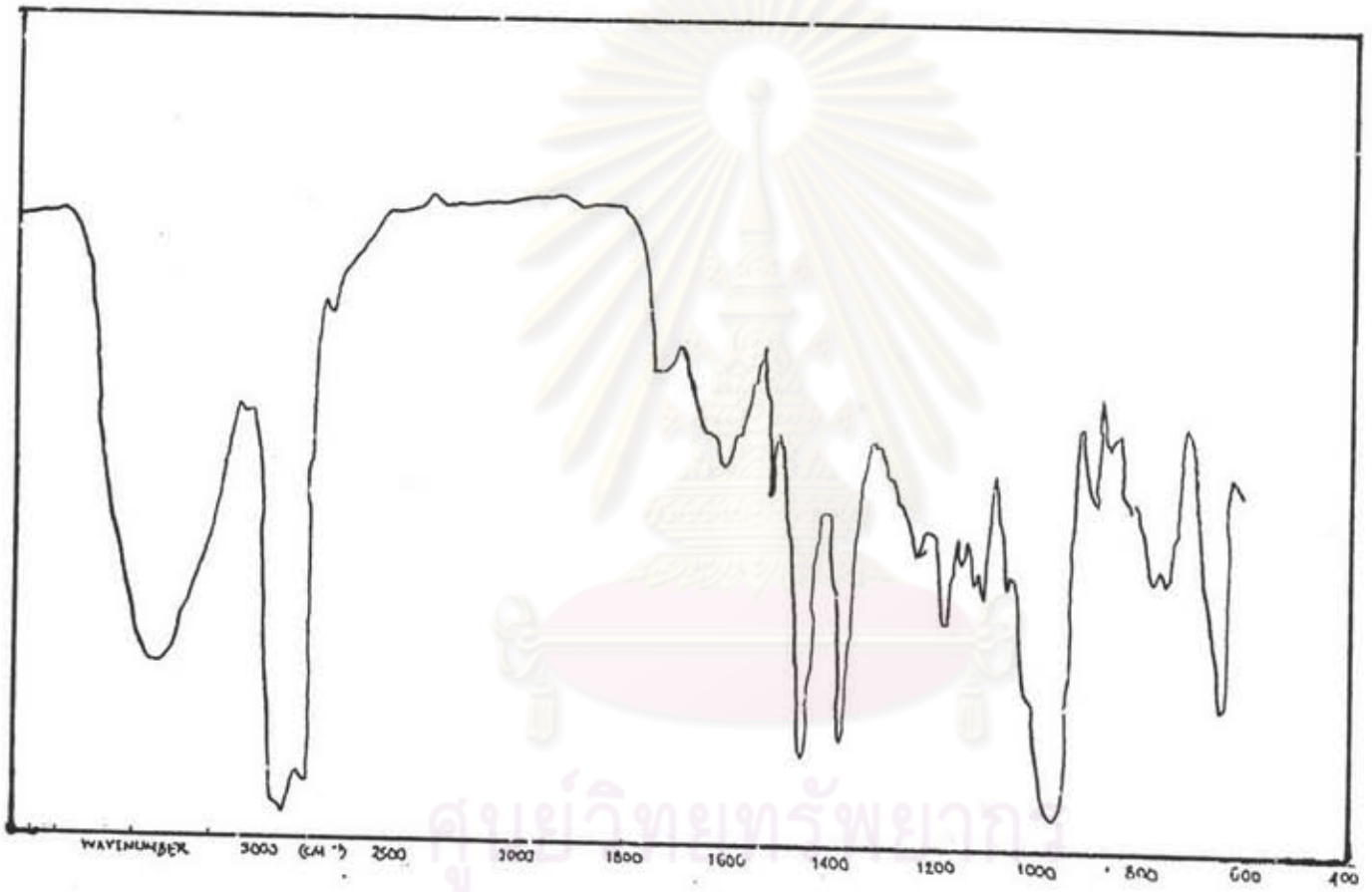

Figure A-26 IR Spectrum of Shell-C

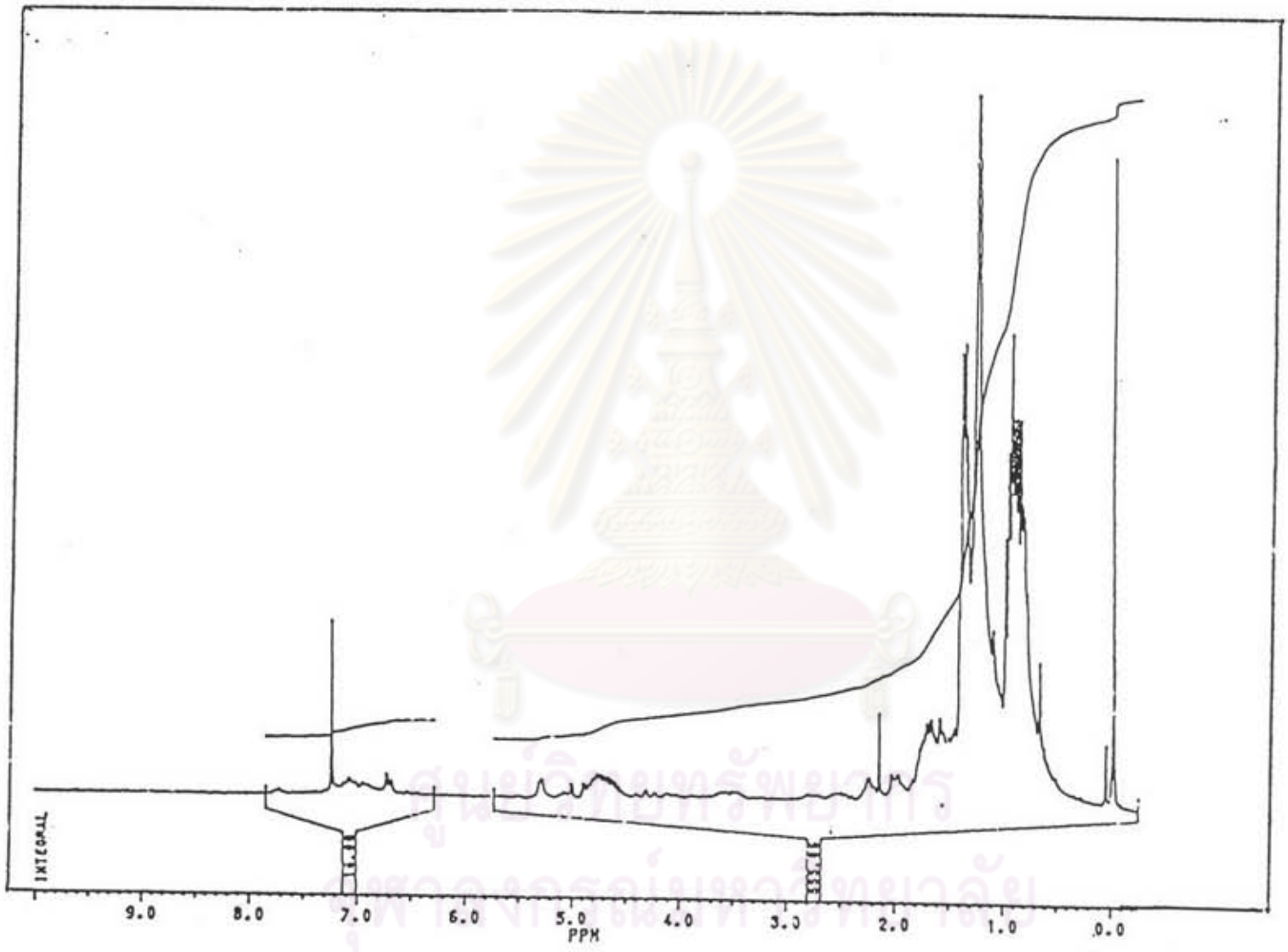

Figure A-27 ^{1}H-NMR Spectrum of Shell-C : ($CDCl_3$ + CCl_4)

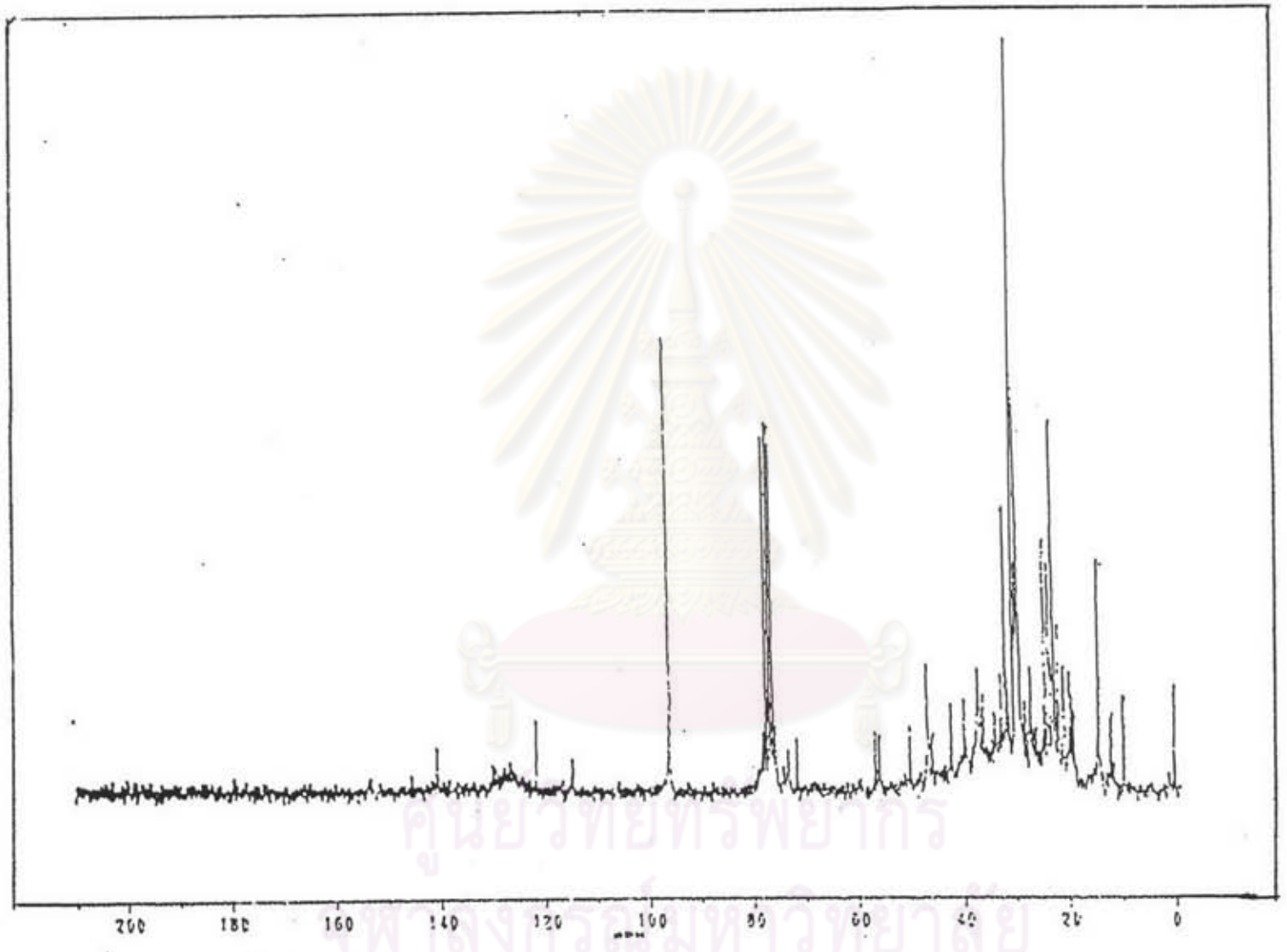

Figure A-28 ^{13}C-NMR Spectrum of Shell-C : ($CDCl_3$ + CCl_4)

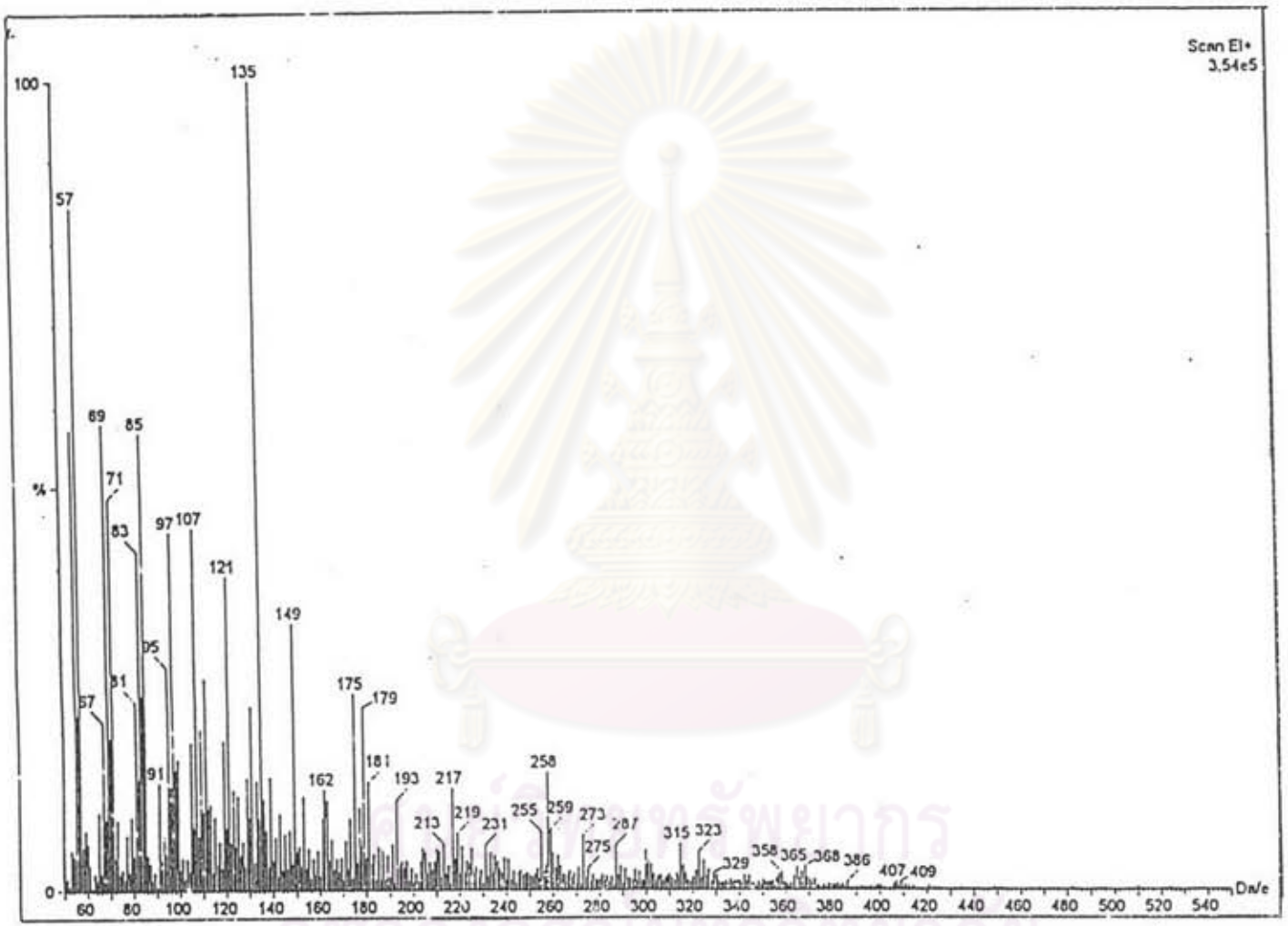

Figure A-29 MS Spectrum of Shell-C

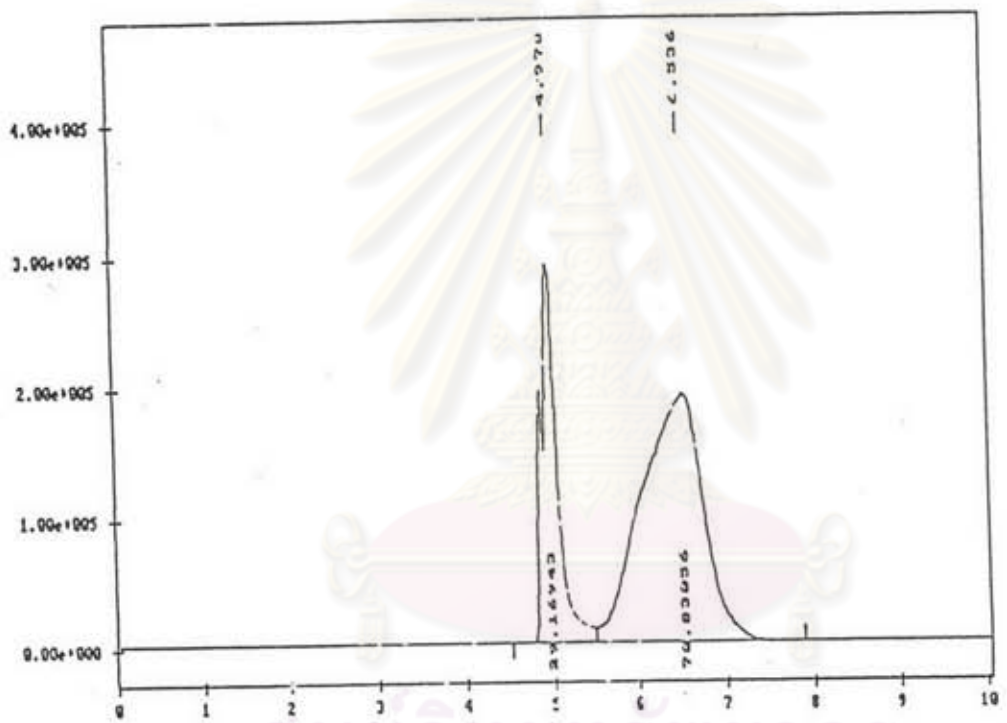

Figure A-30 GPC Chromatogram of dialysis residue of Shell

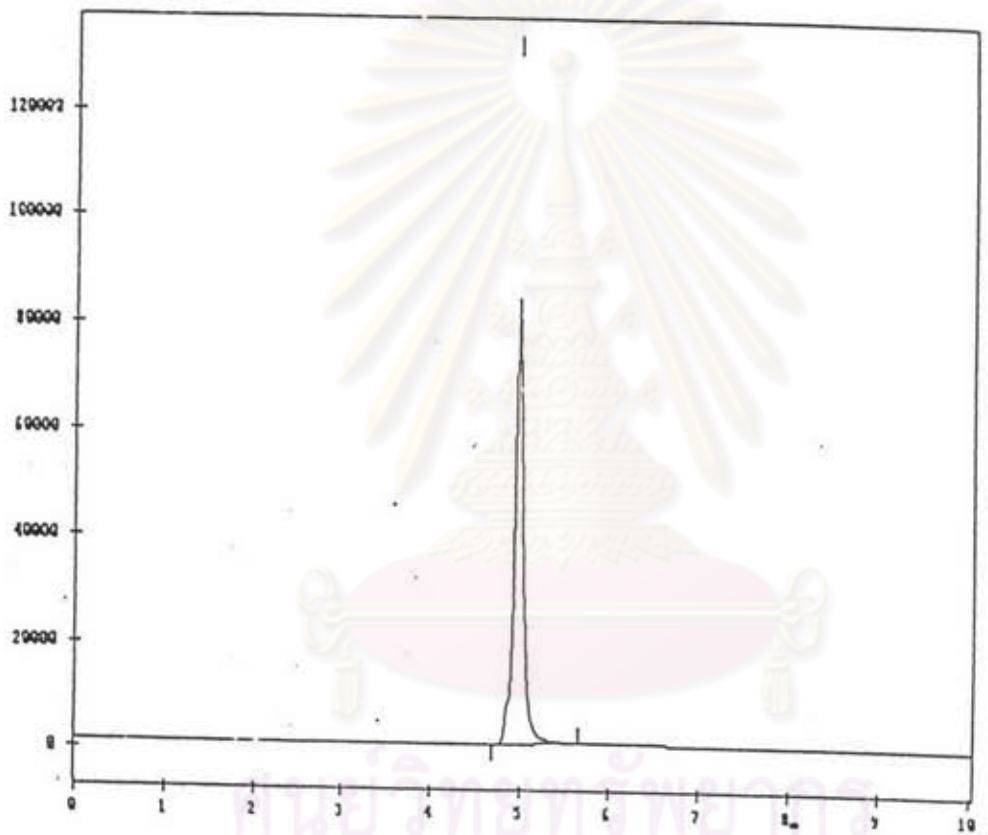

Figure A-31 GPC Chromatogram of the purified polymer of Shell

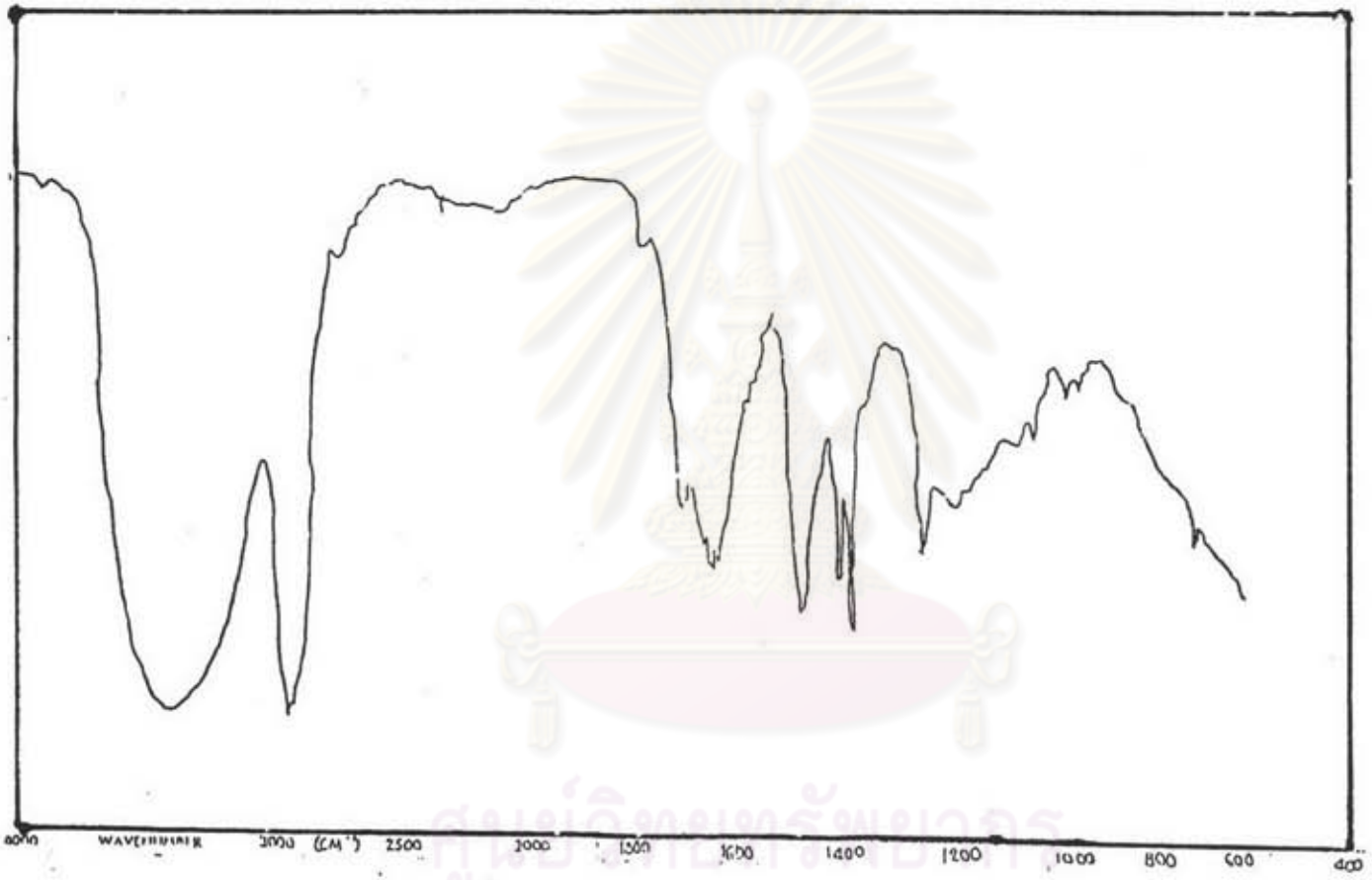

Figure A-32 IR Spectrum of polymer of Shell

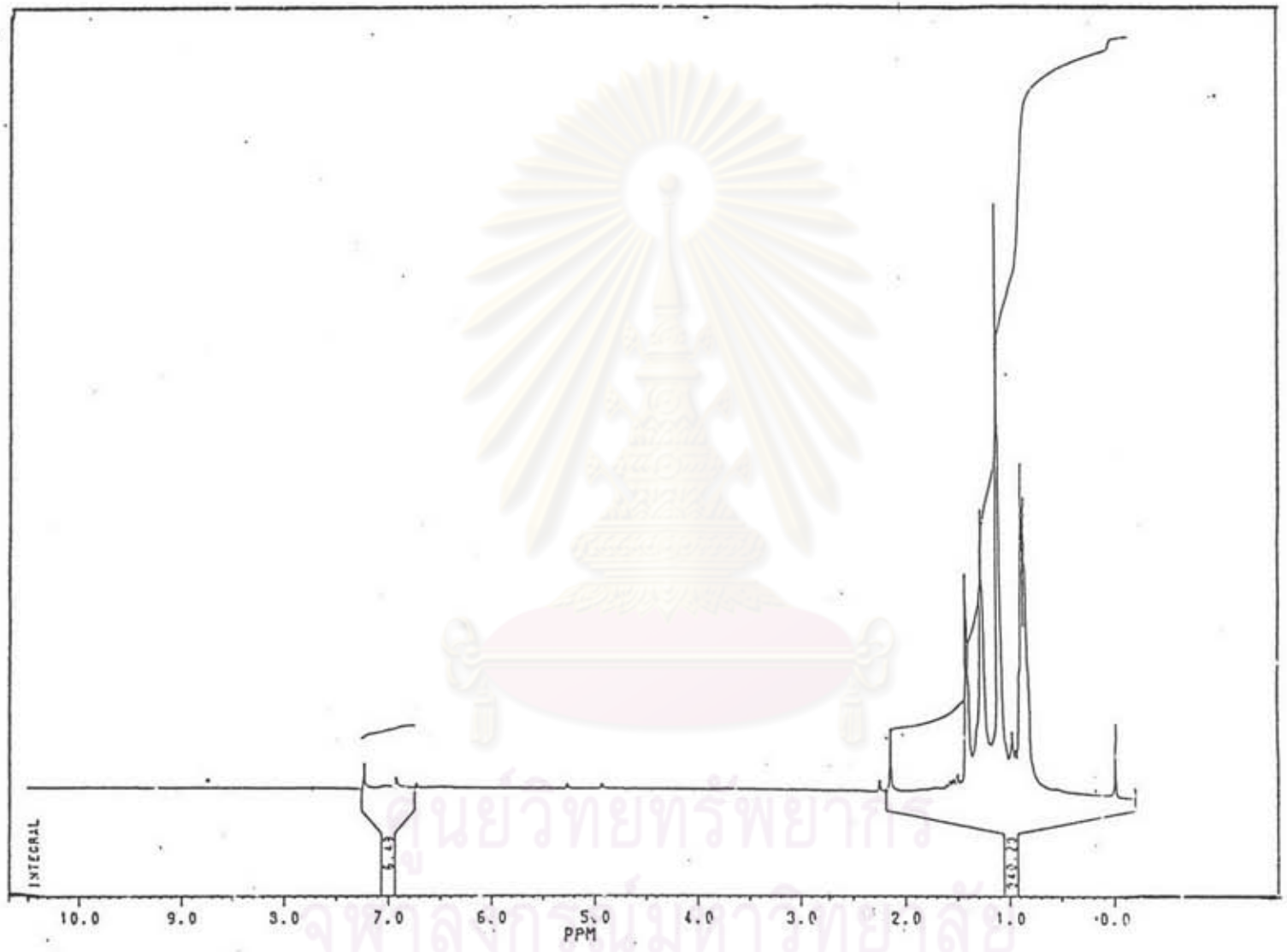

Figure A-33 : ^{1}H-NMR Spectrum of polymer of Shell : ($CDCl_3$ + CCl_4)

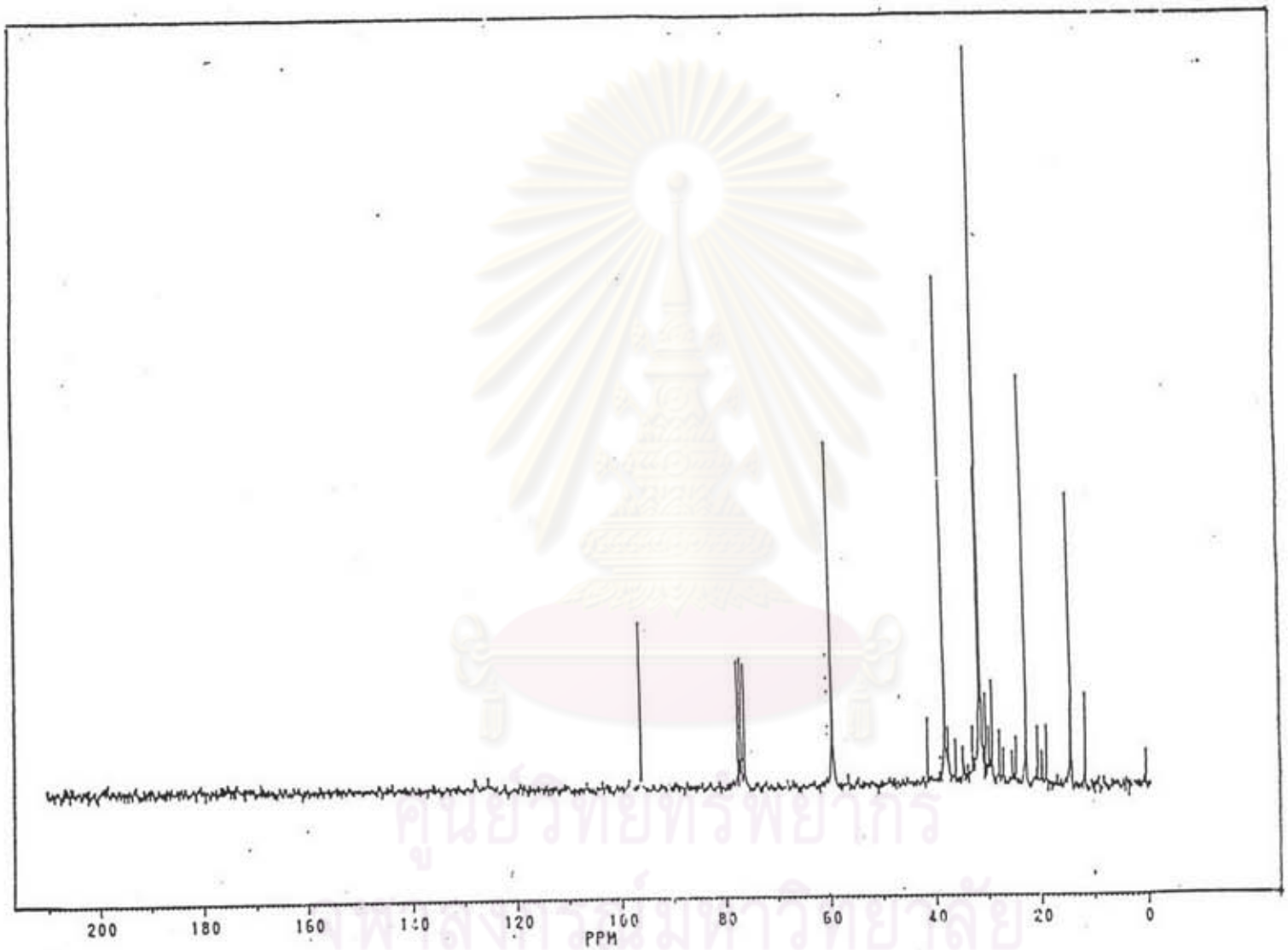

Figure A-34 ^{13}C-NMR Spectrum of polymer of Shell : ($CDCl_3$ + CCl_4)

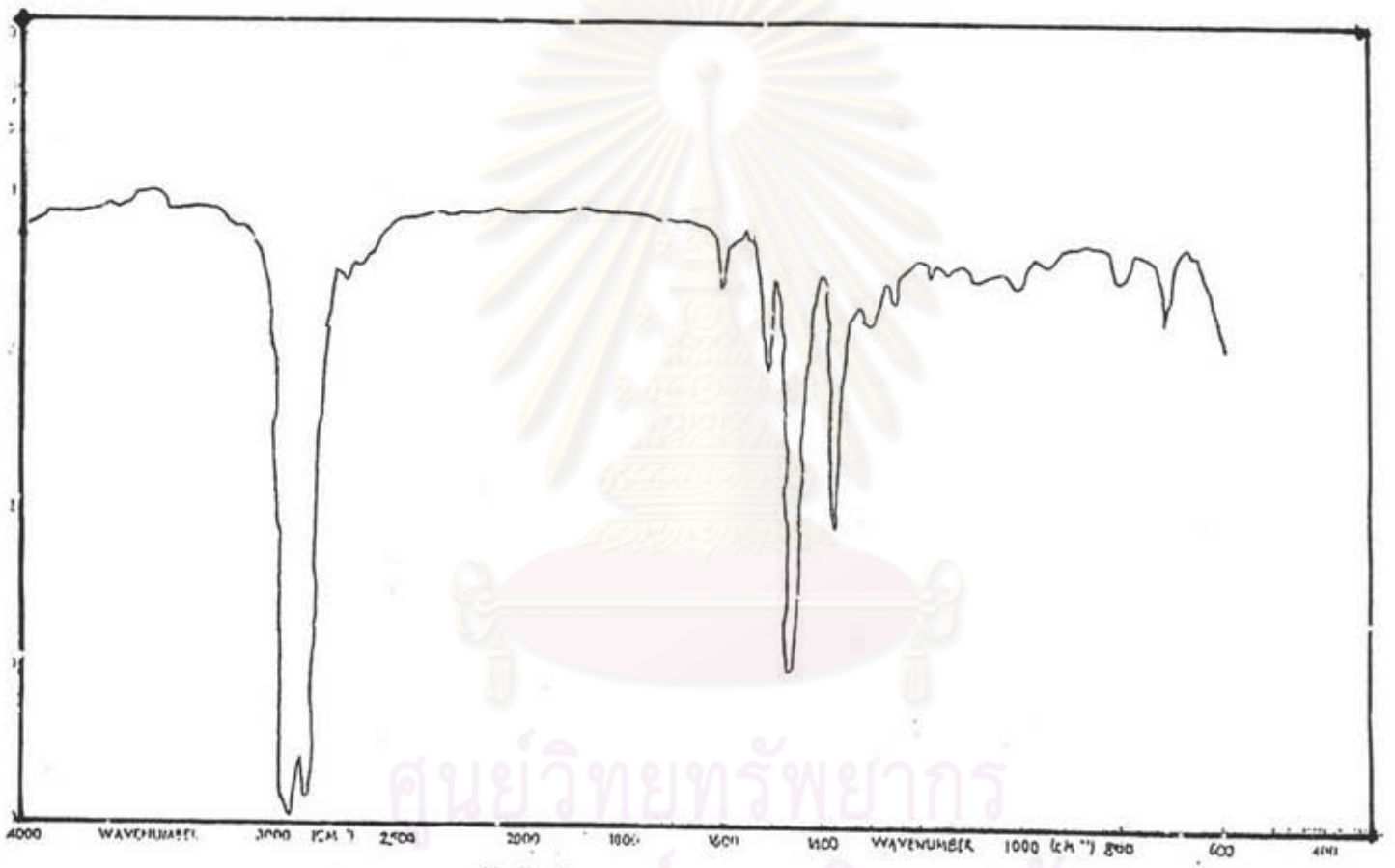

Figure A-35 IR Spectrum of Superflo-A

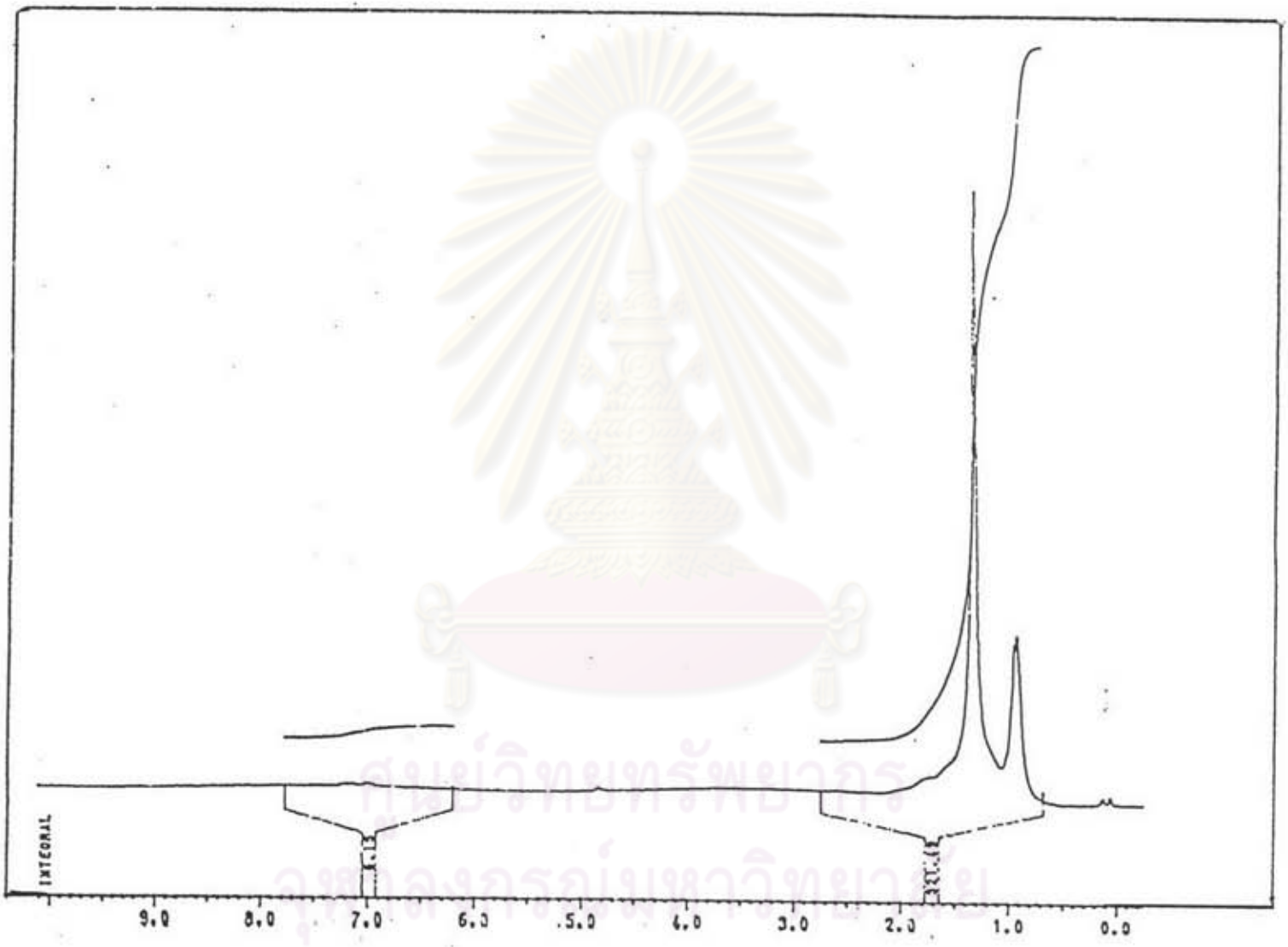

Figure A-36 ^{1}H-NMR Spectrum of Superflo-A : ($CDCl_3$ + CCl_4)

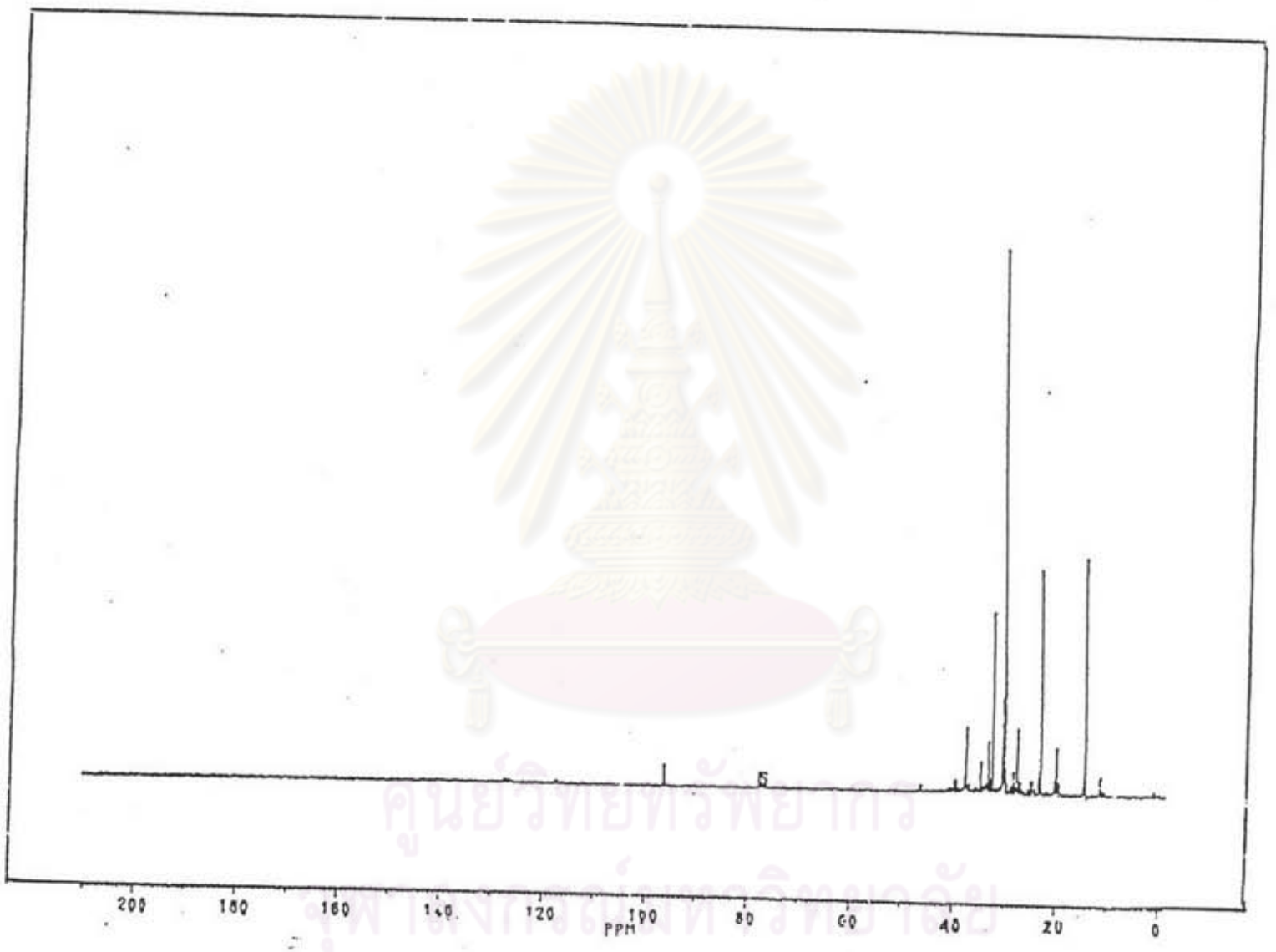

Figure A-37 ^{13}C-NMR Spectrum of Superflo-A : ($CDCl_3$ + CCl_4)

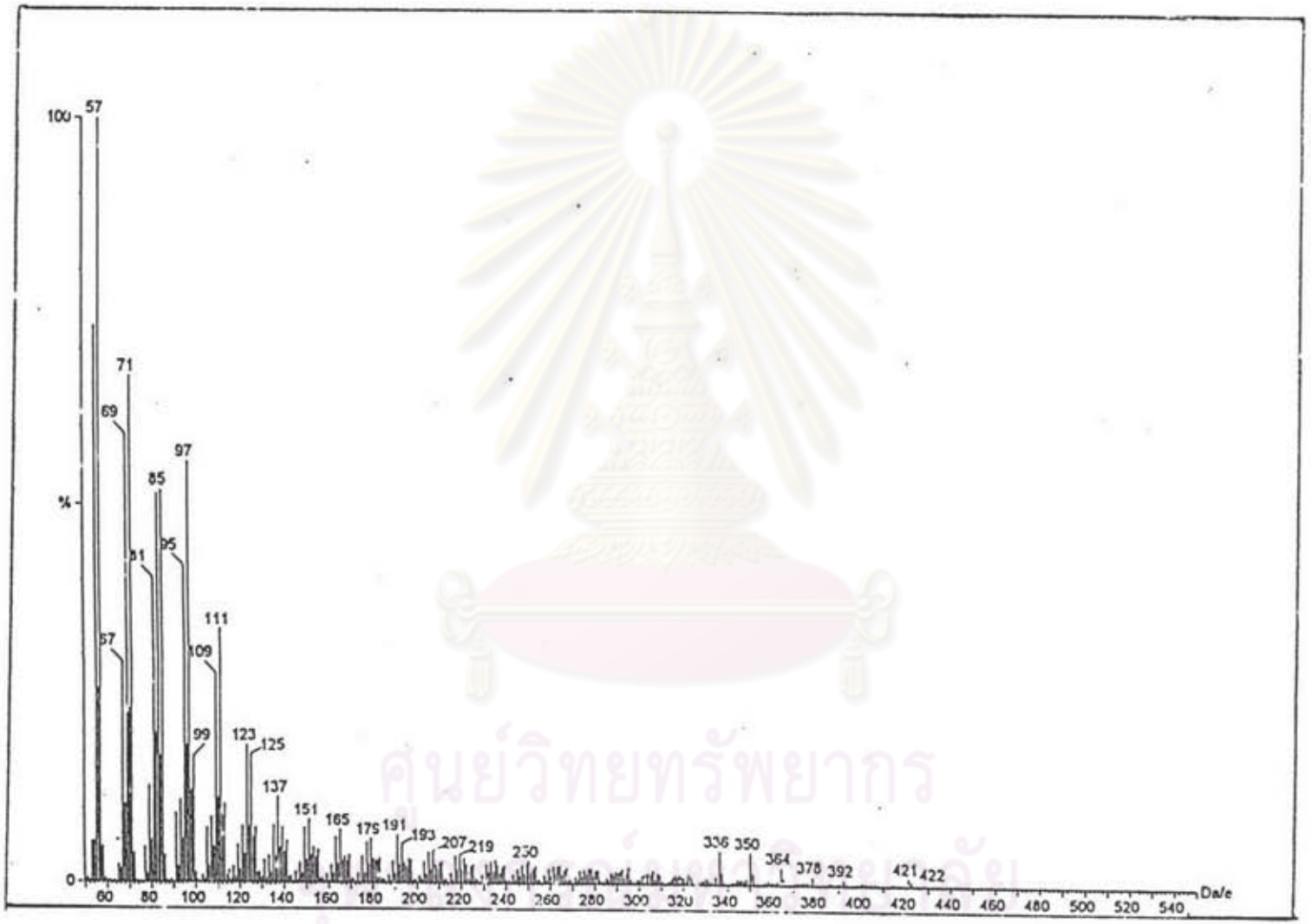

Figure A-38 MS-Spectrum of Superflo-A

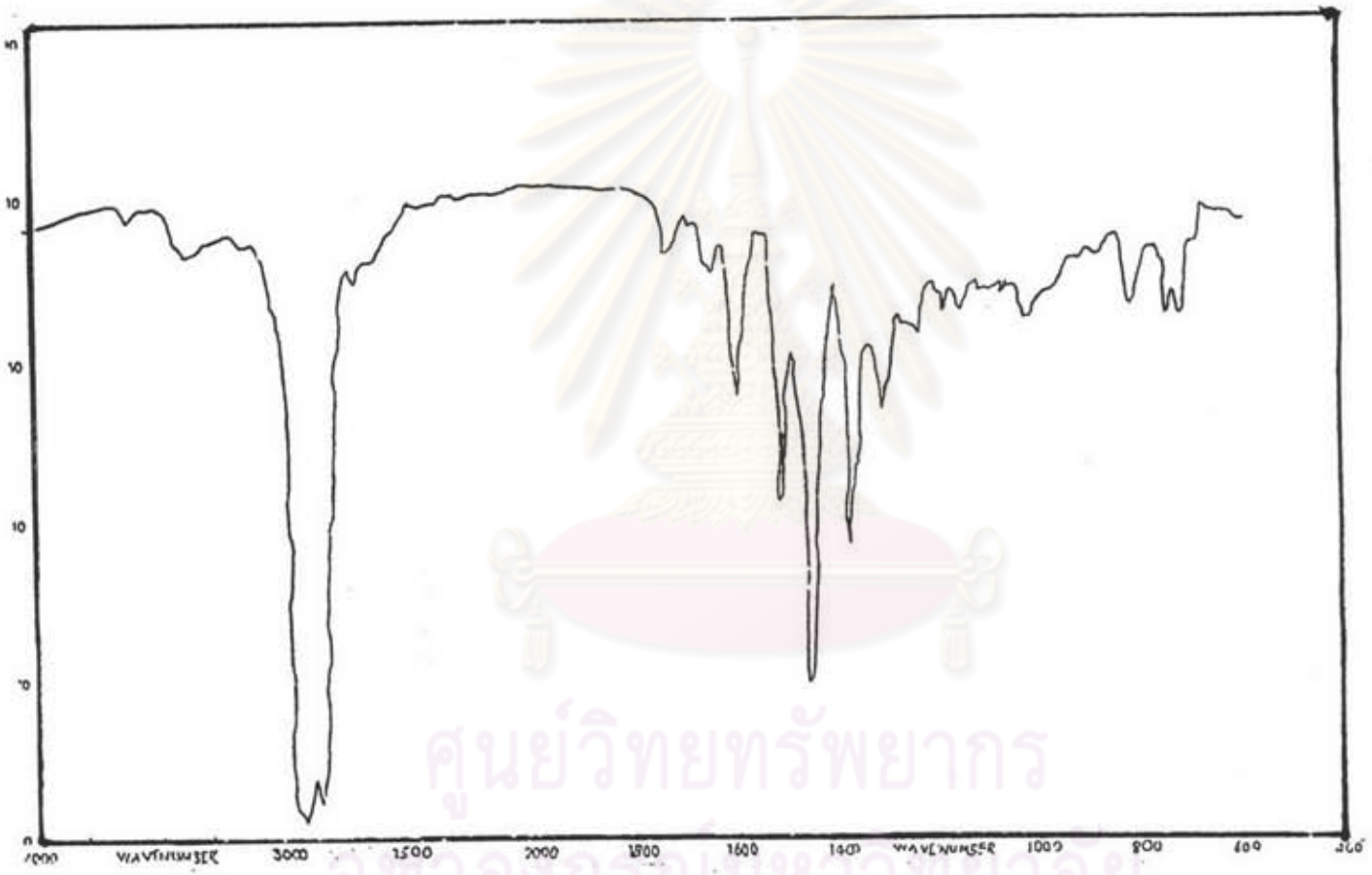

Figure A-39 IR Spectrum of Superflo-B

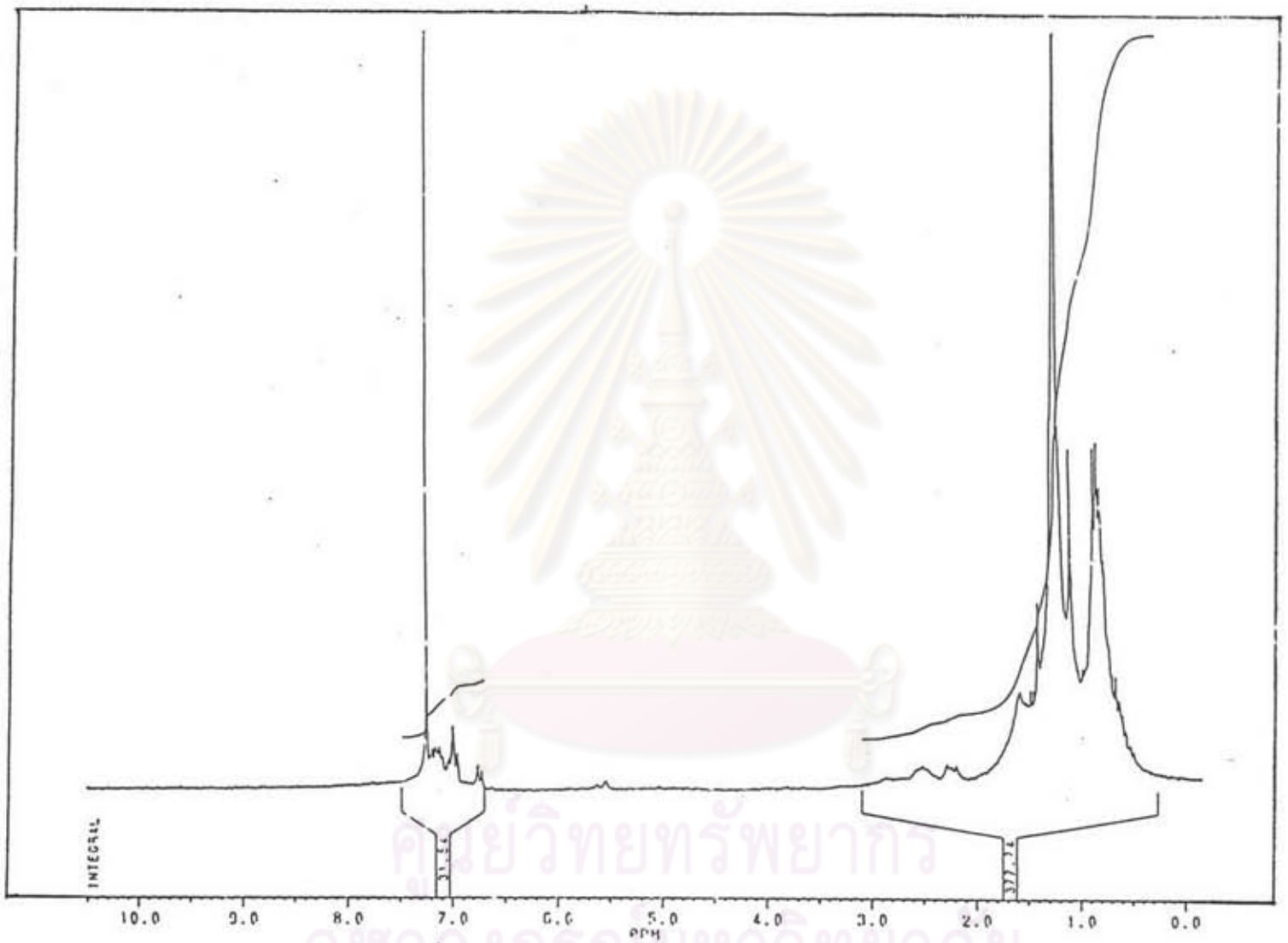

Figure A-40 ^{1}H-NMR Spectrum of Superflo-B : ($CDCl_3$ + CCl_4)

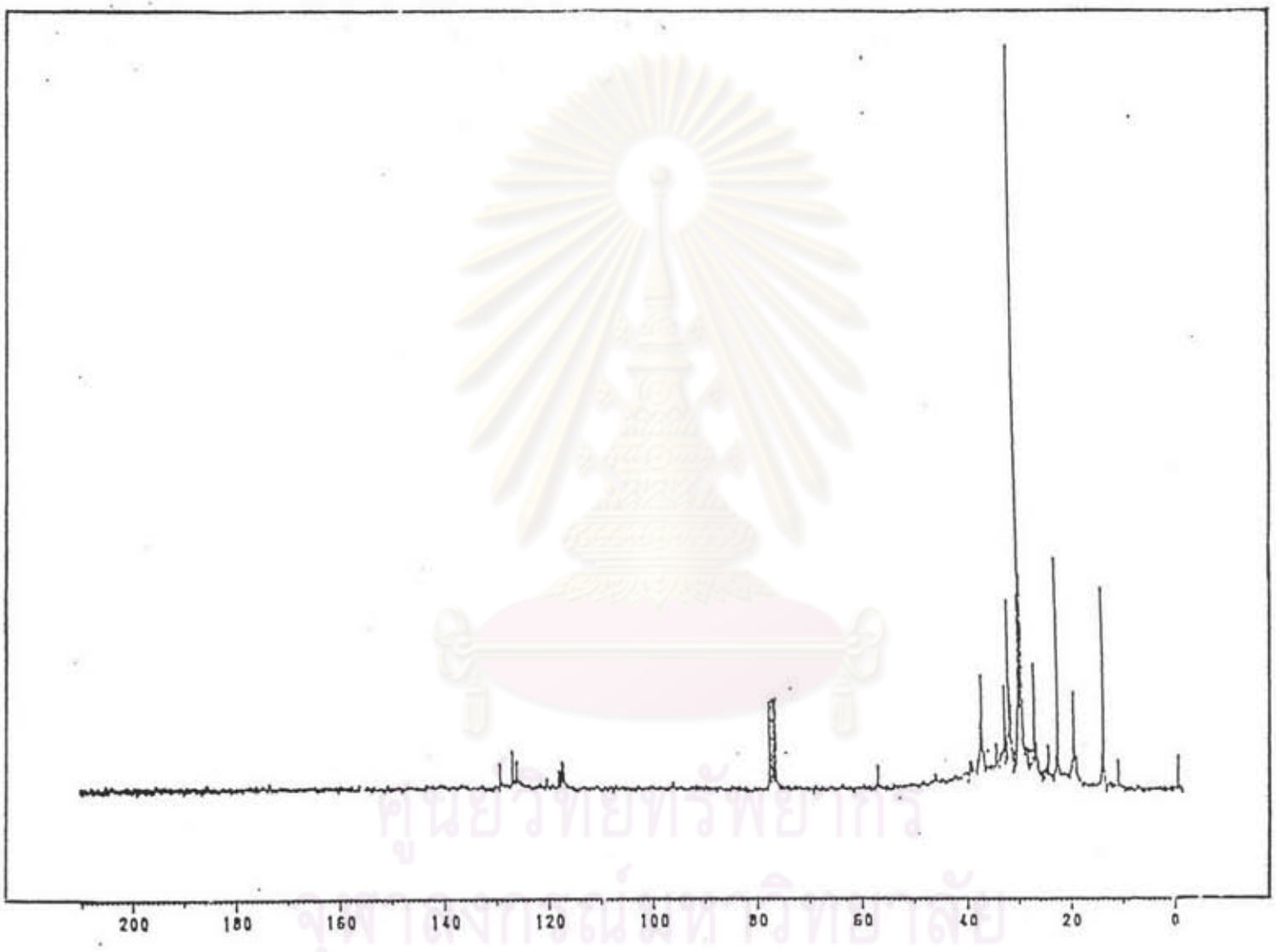

Figure A-41 ^{13}C-NMR Spectrum of Superflo-B : ($CDCl_3$ + CCl_4)

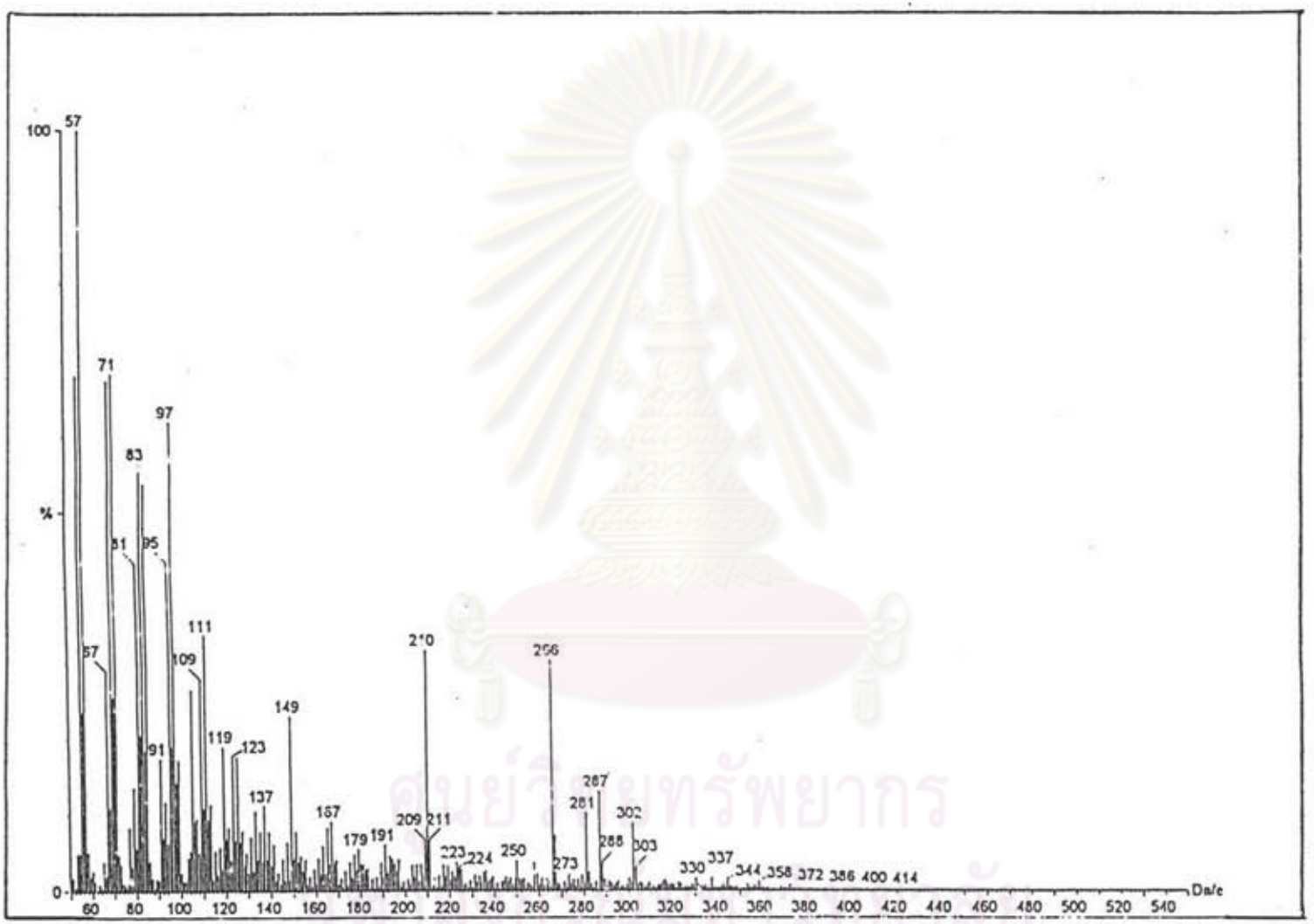

Figure A-42 MS Spectrum of Superflo-B

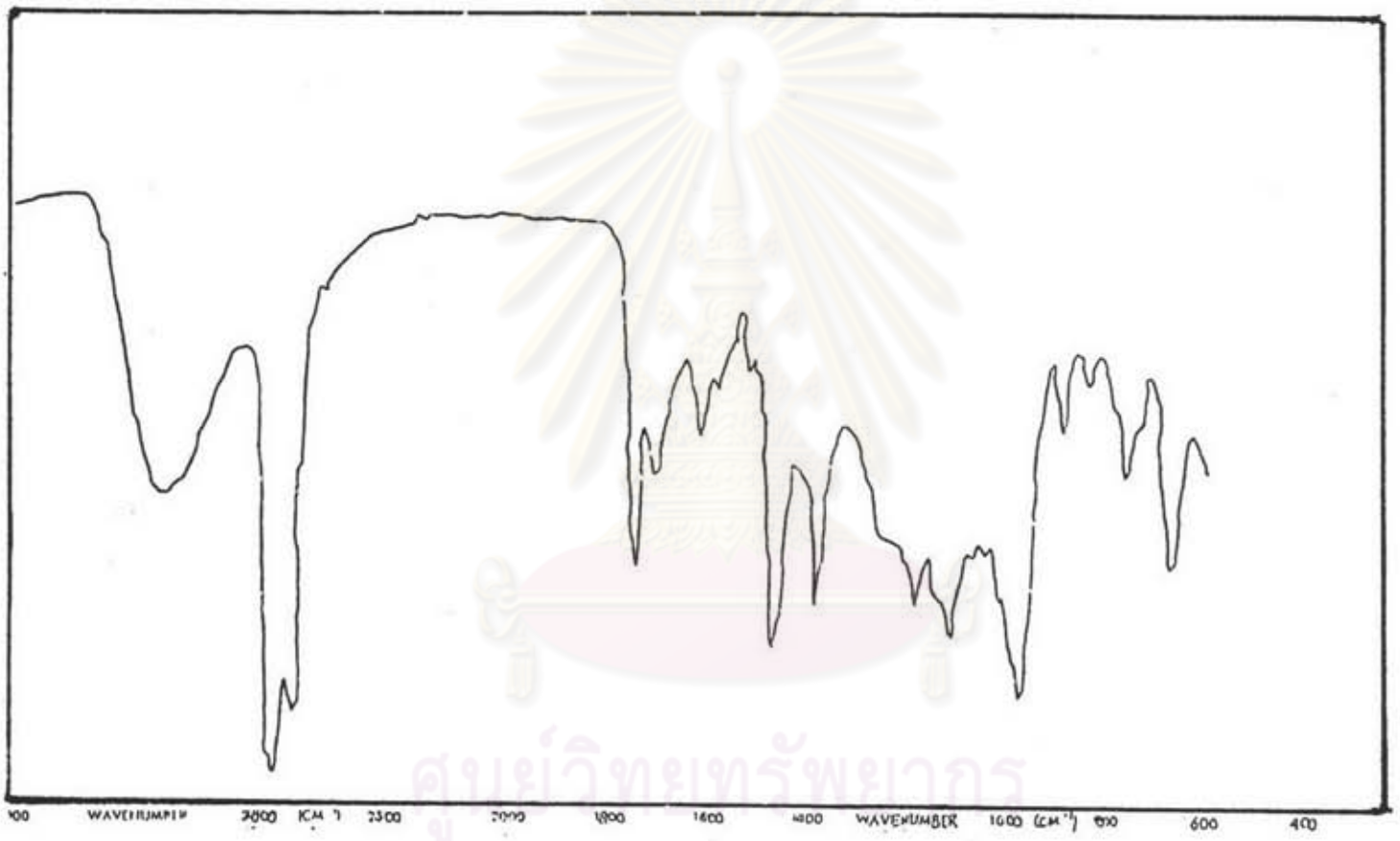

Figure A-43 IR Spectrum of Superflo-C

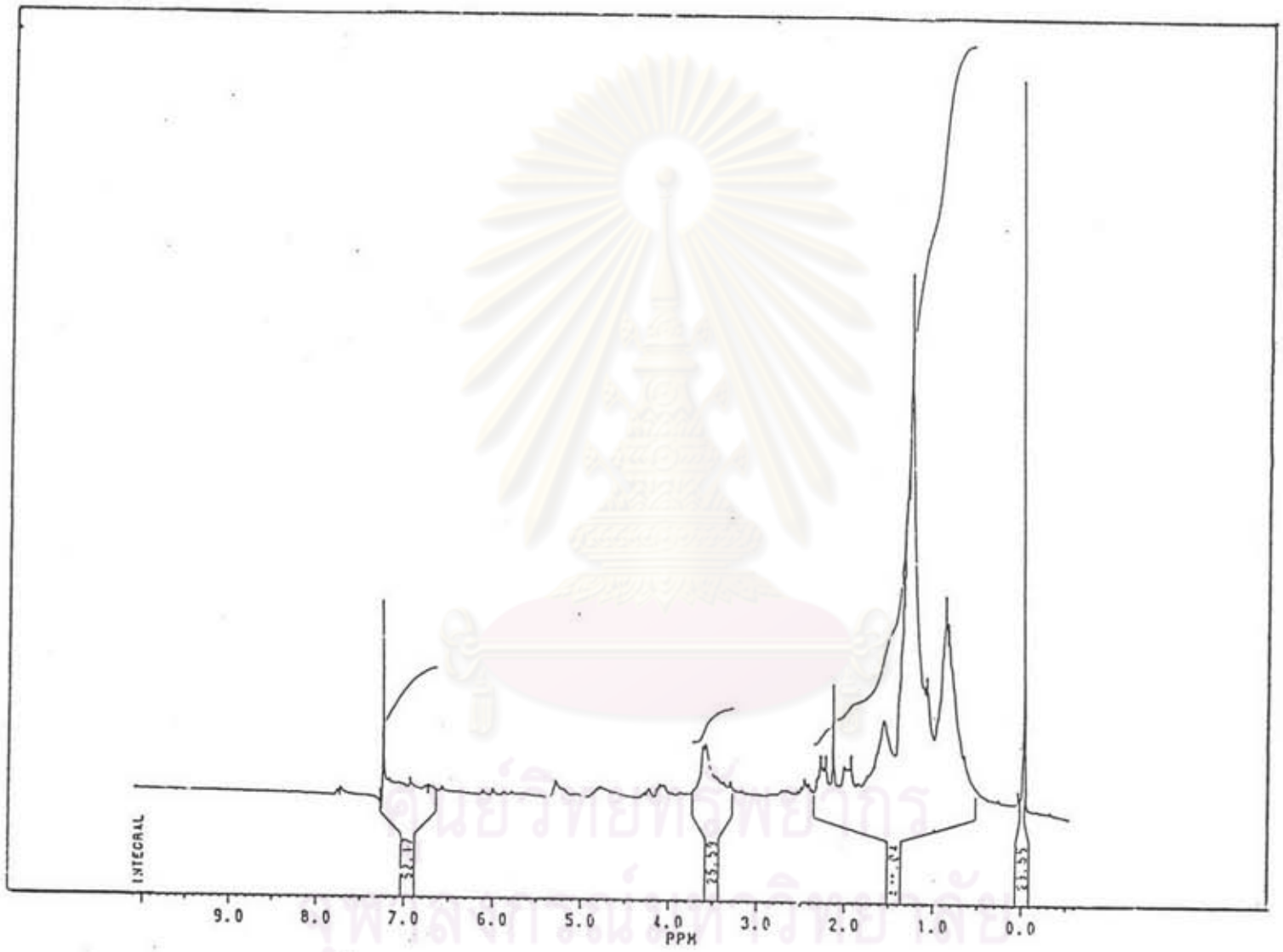

Figure A-44 ^{1}H-NMR Spectrum of Superflo-C : ($CDCl_3$+CCl_4)

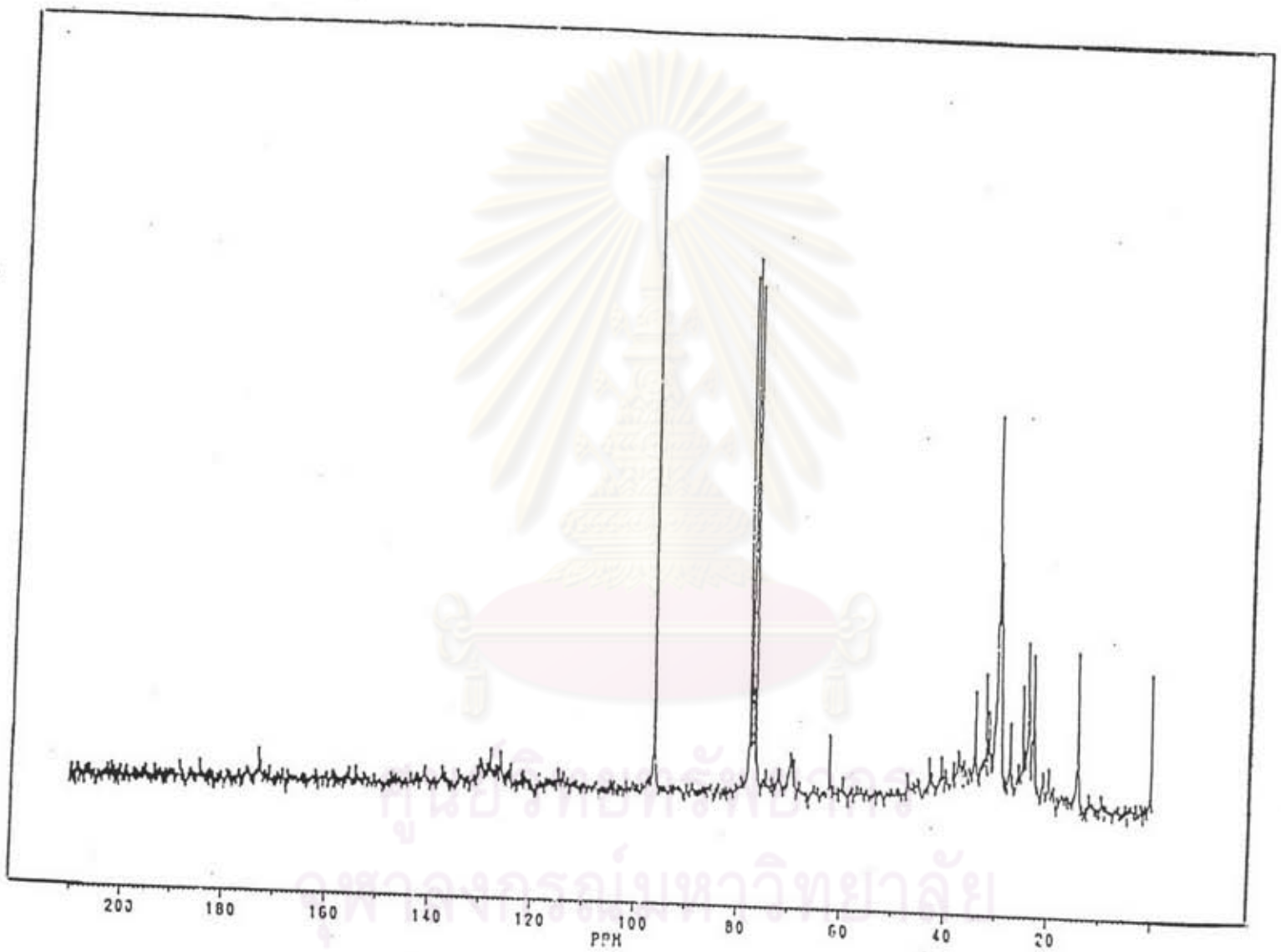

Figure A-45 ^{13}C-NMR Spectrum of Superflo-C : ($CDCl_3$ + CCl_4)

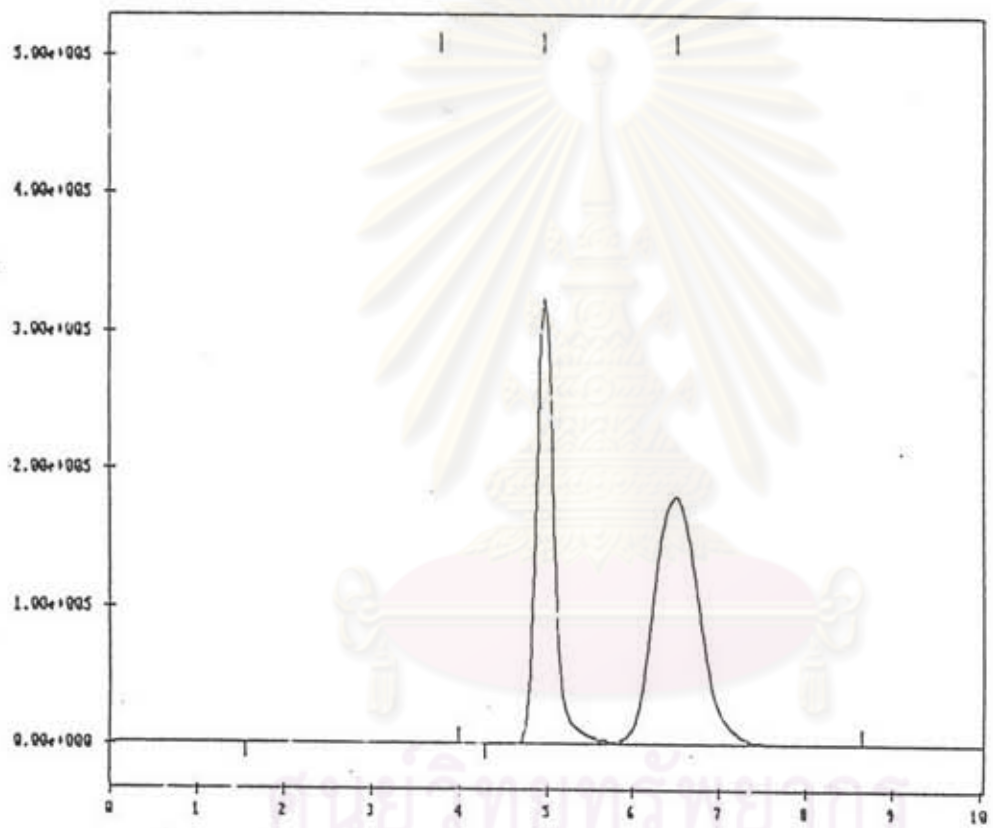

Figure A-47 GPC Chromatogram of dialysis residue of Superflo

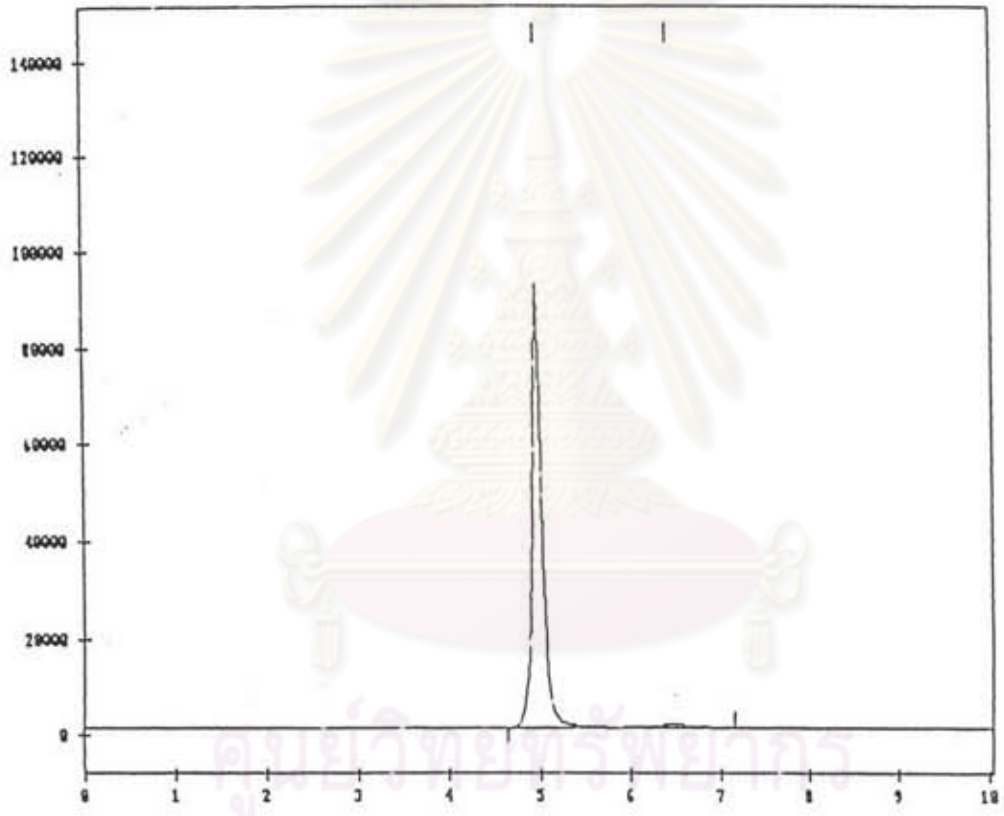

Figure A-48 GPC Chromatogram of the purified polymer of Superflo

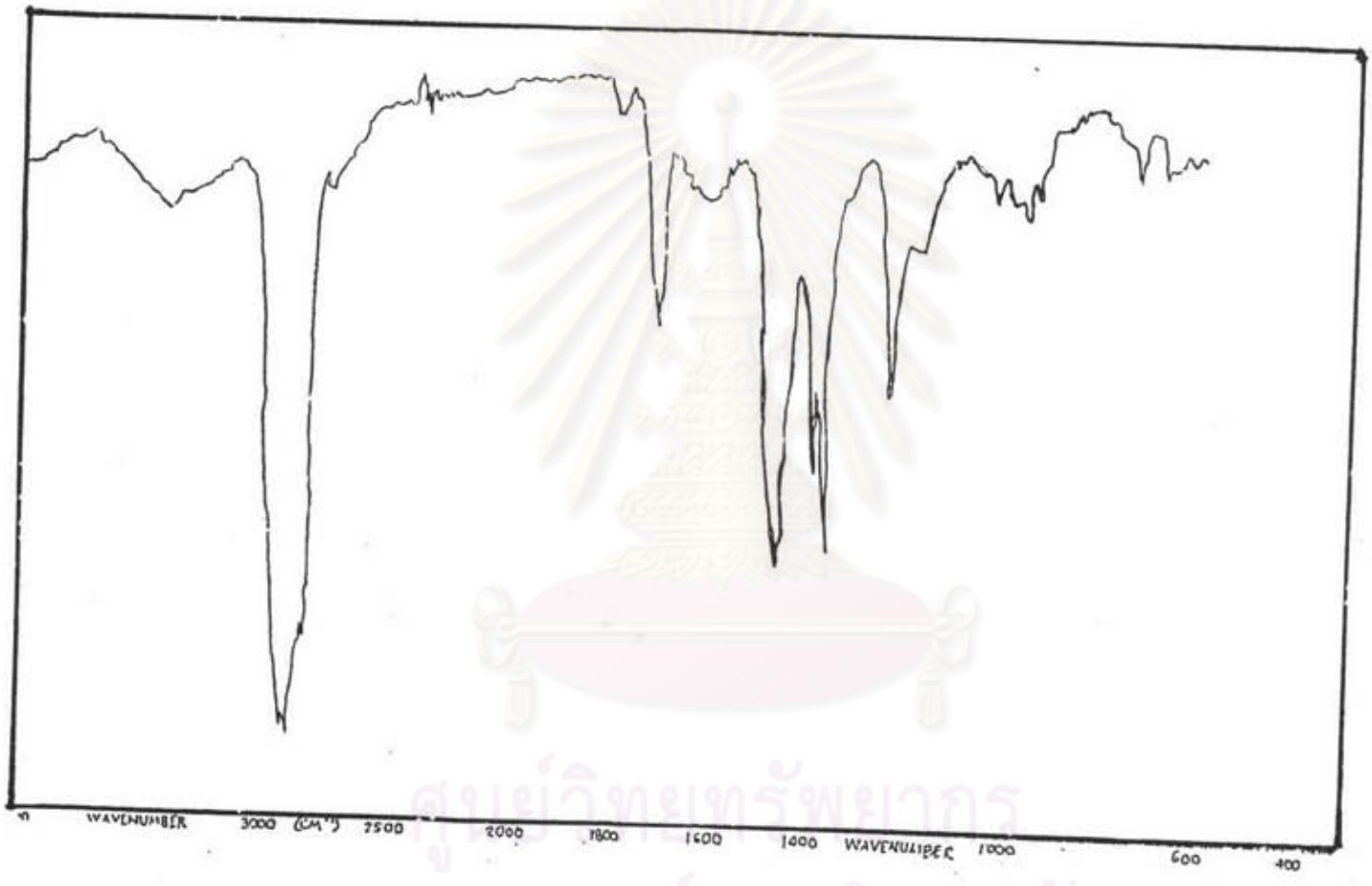

Figure A-49 IR Spectrum of polymer of Superflo

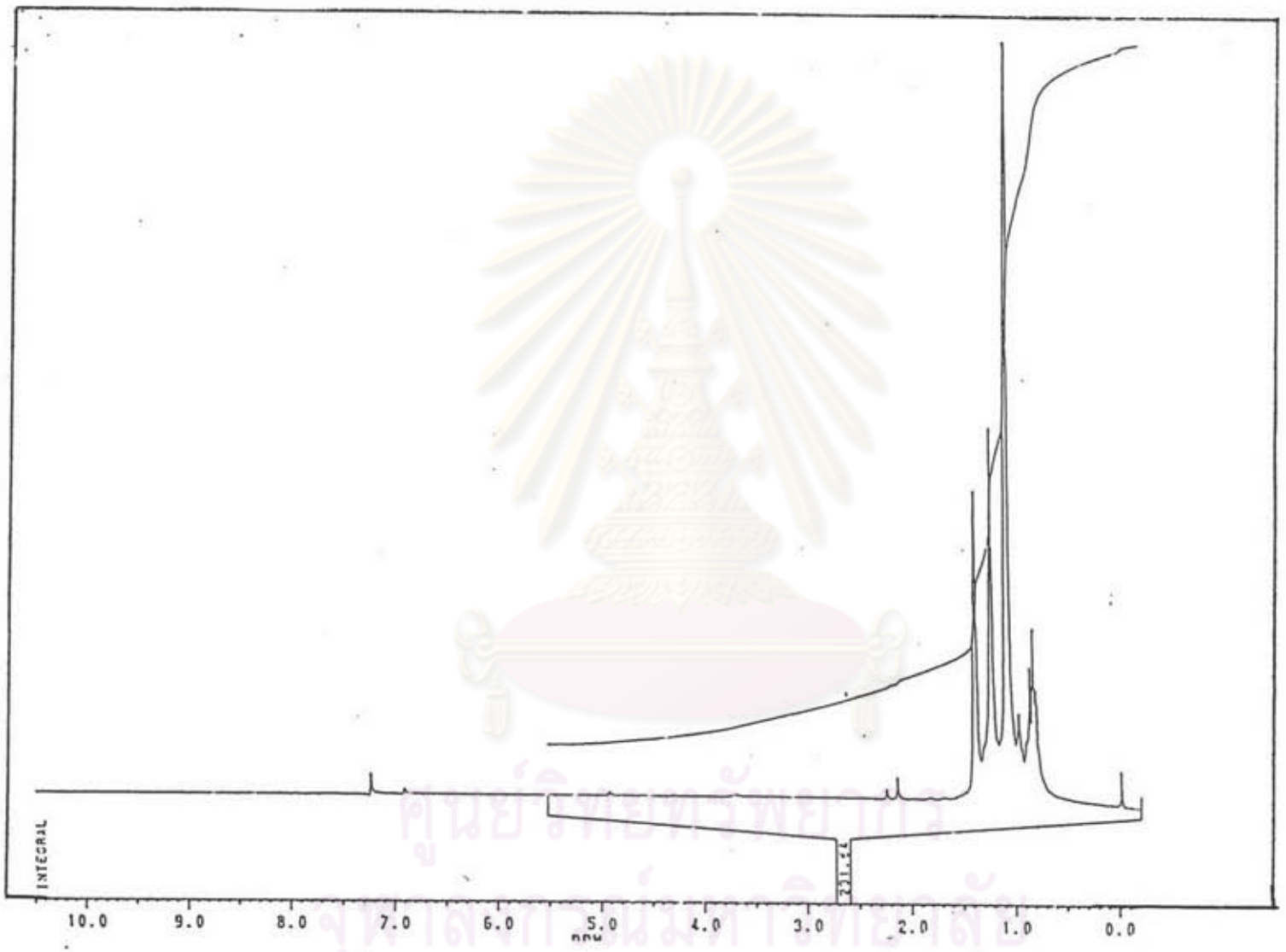

Figure A-50 ^{1}H-NMR Spectrum of polymer of Superflo : ($CDCl_3$+CCl_4)

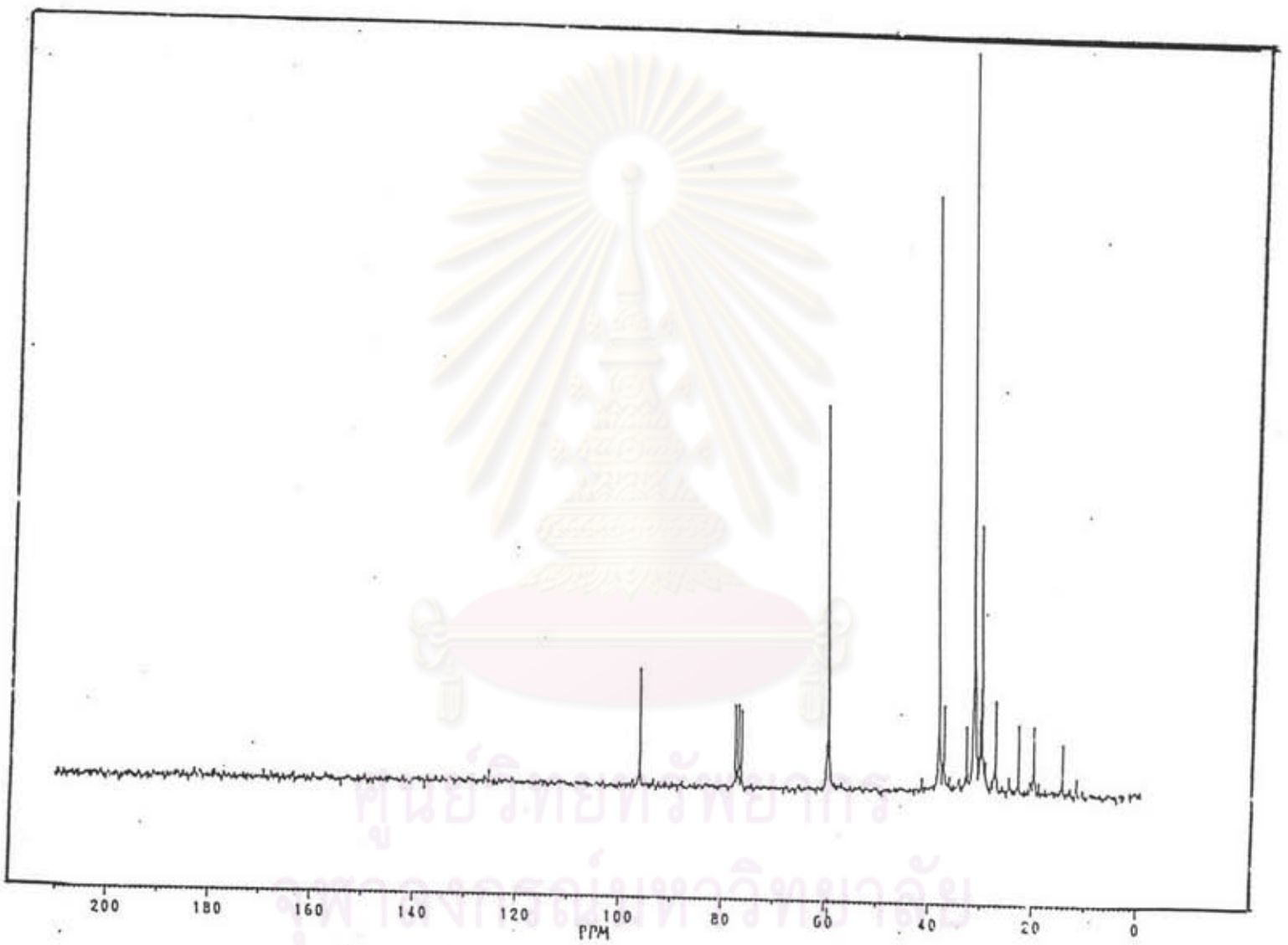

Figure A-51 ^{13}C-NMR Spectrum of polymer of Superflo : ($CDCl_3$ + CCl_4)

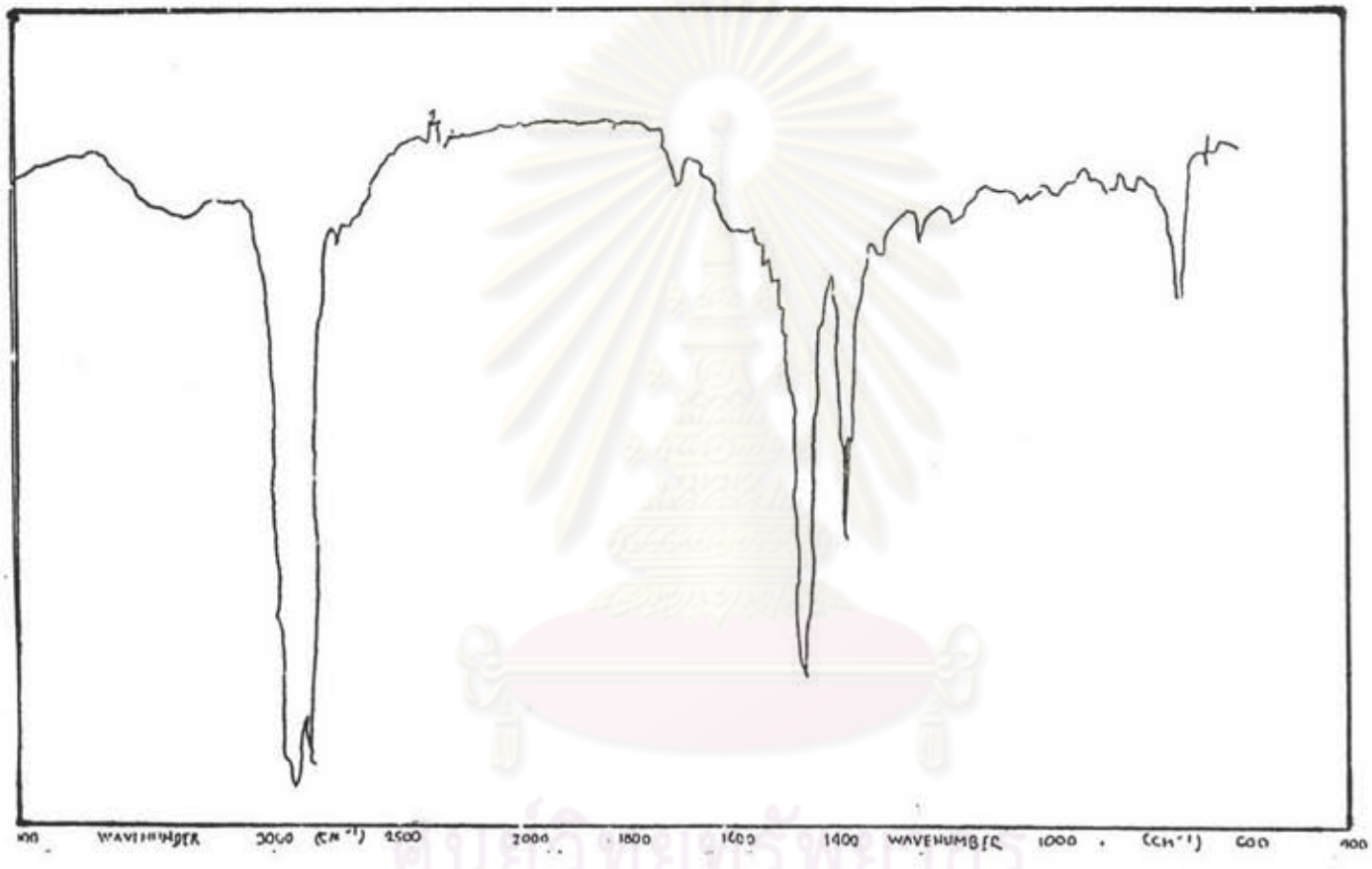

Figure A-52 IR Spectrum of PTT-A

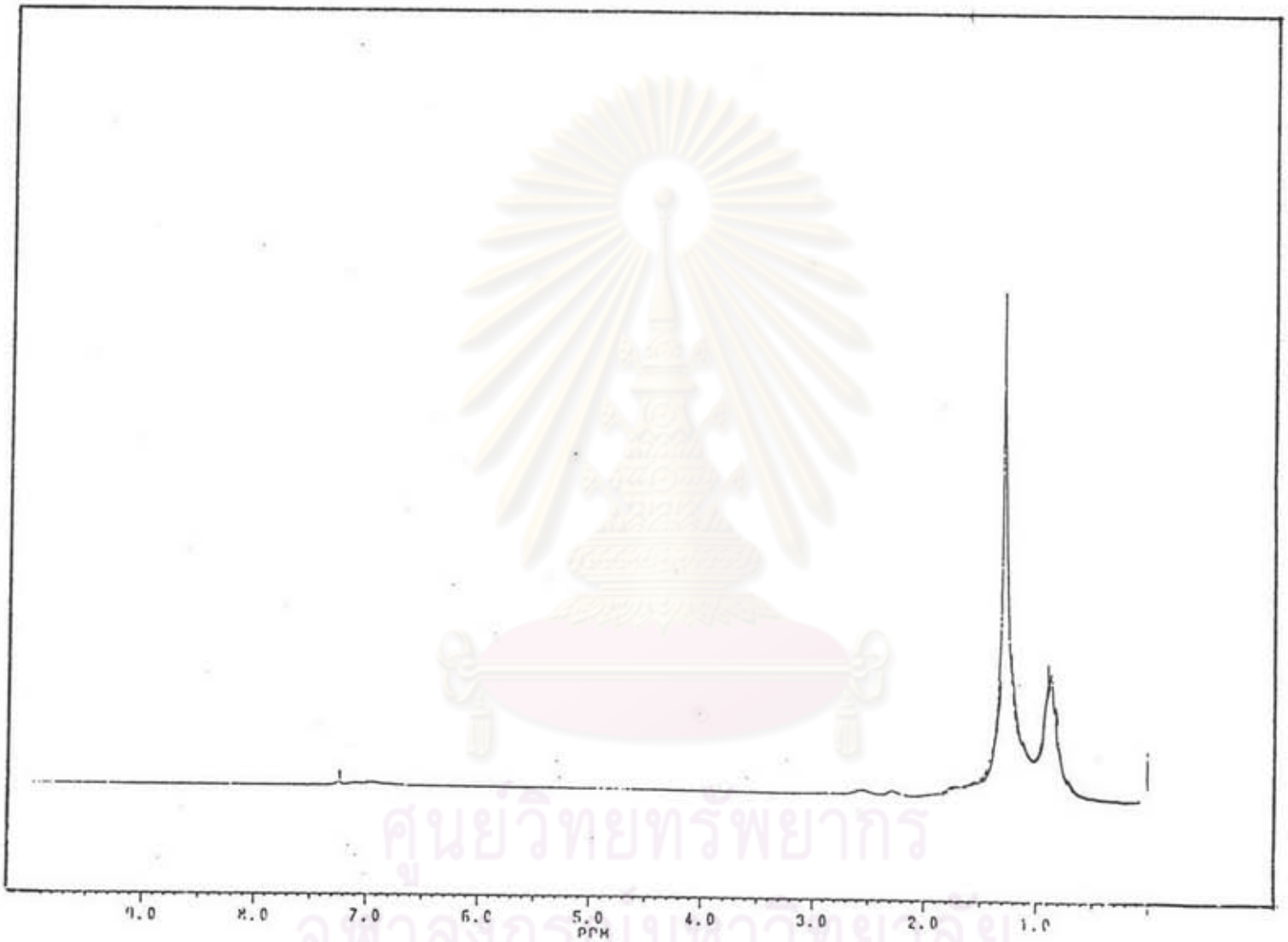

Figure A-53 ^{1}H-NMR Spectrum of PTT-A : ($CDCl_3$ + CCl_4)

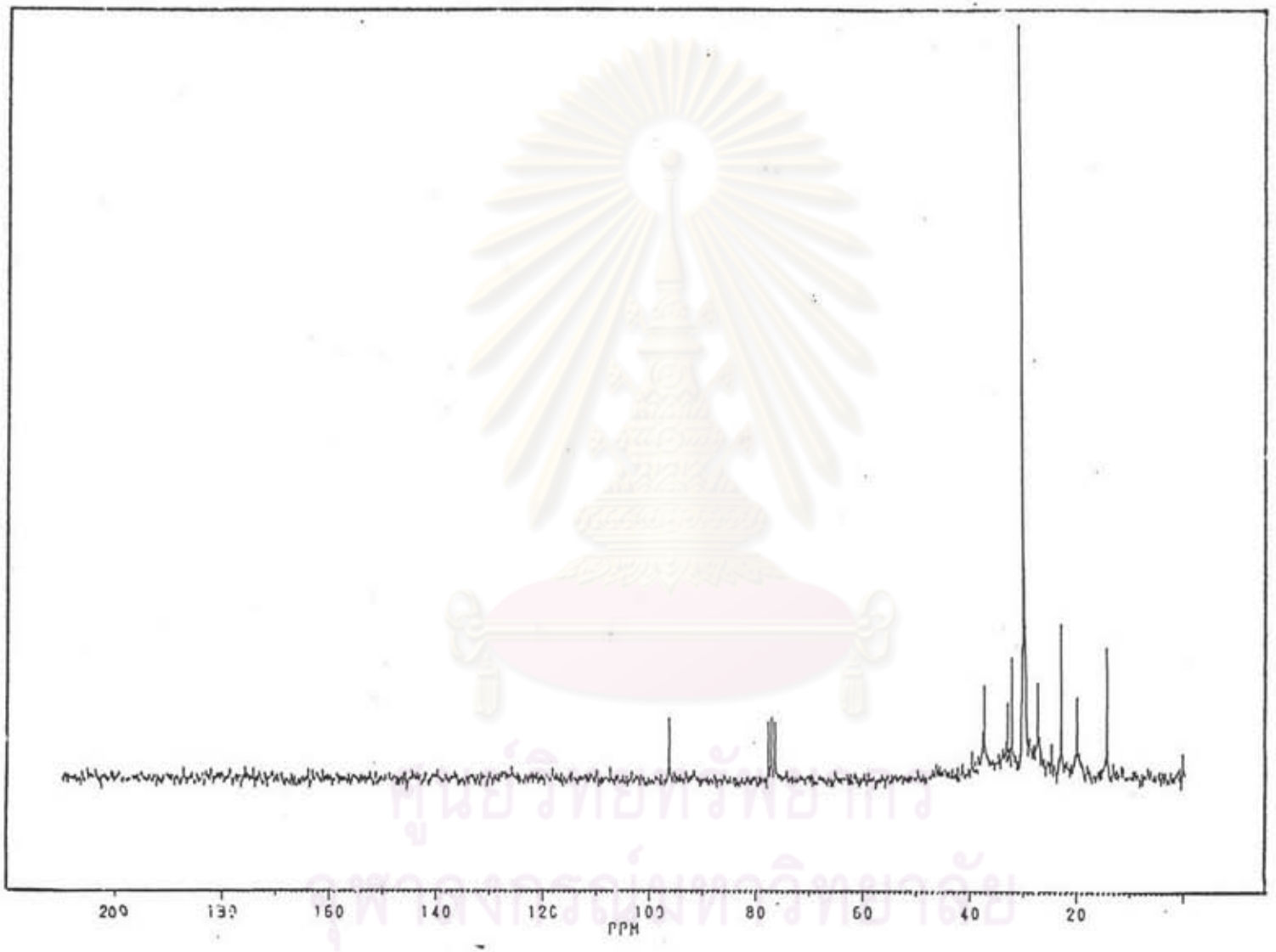

Figure A-54 ^{13}C-NMR Spectrum of PTT-A : ($CDCl_3$+CCl_4)

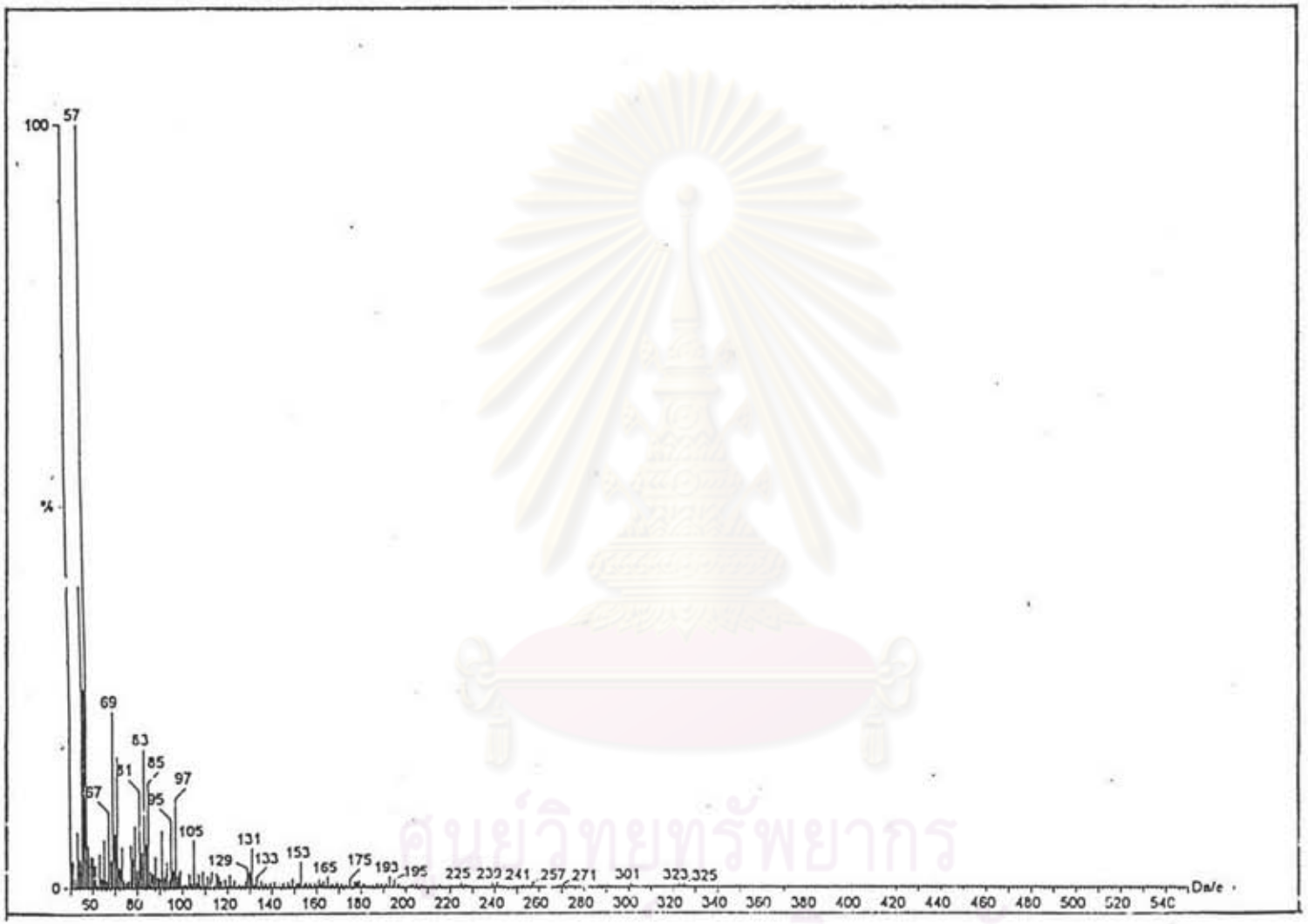

Figure A-55 MS-Spectrum of PTT-A

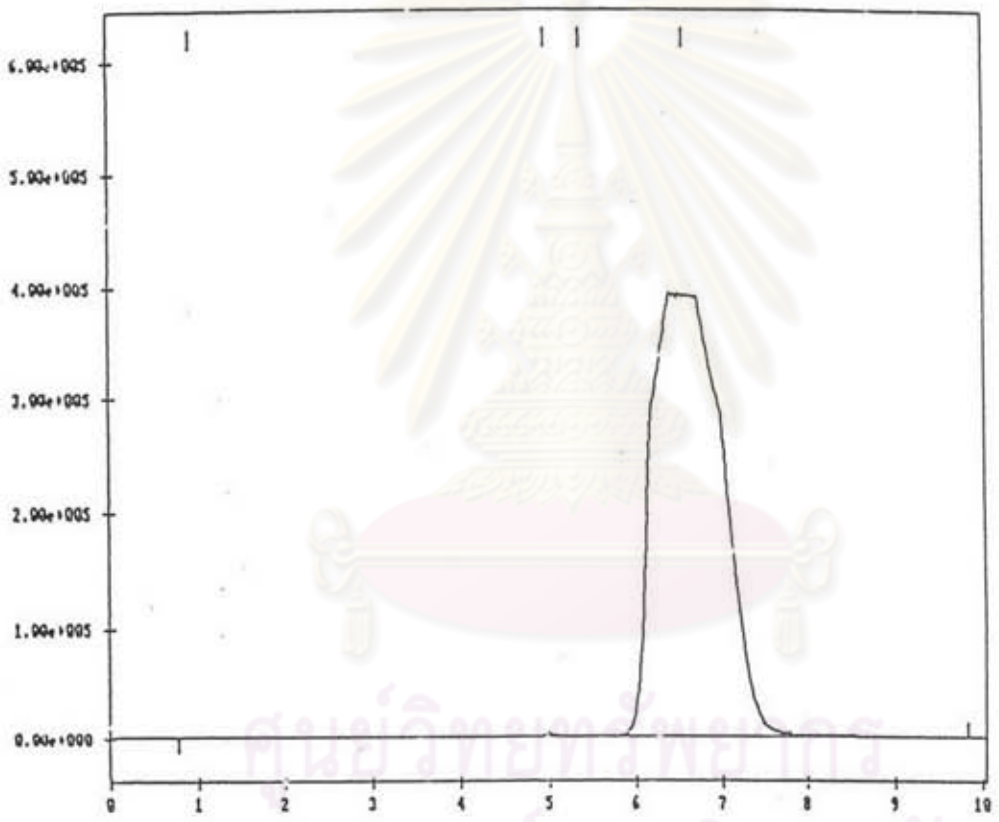

Figure A-57 GPC Chromatogram of dialysis residue of PTT

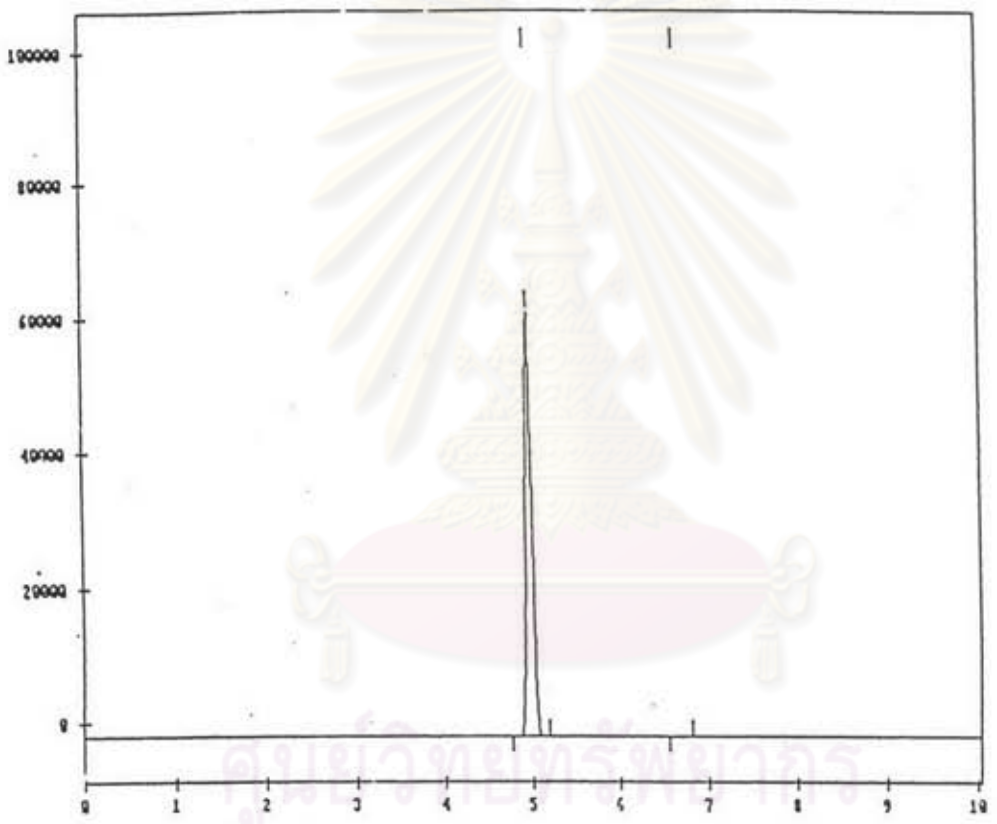

Figure A-58 GPC Chromatogram of the purified polymer of PTT

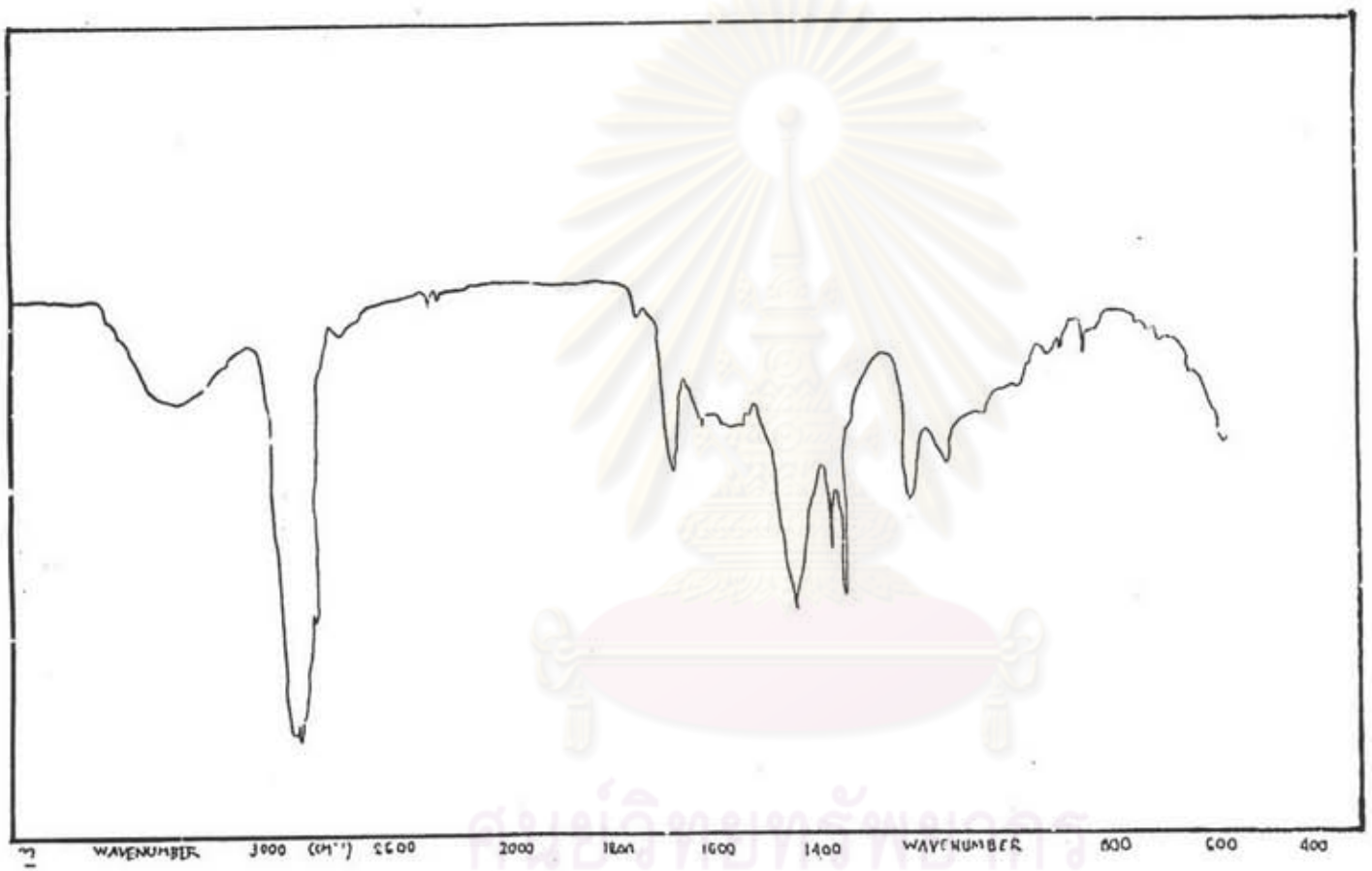

Figure A-59 IR Spectrum of polymer of PTT

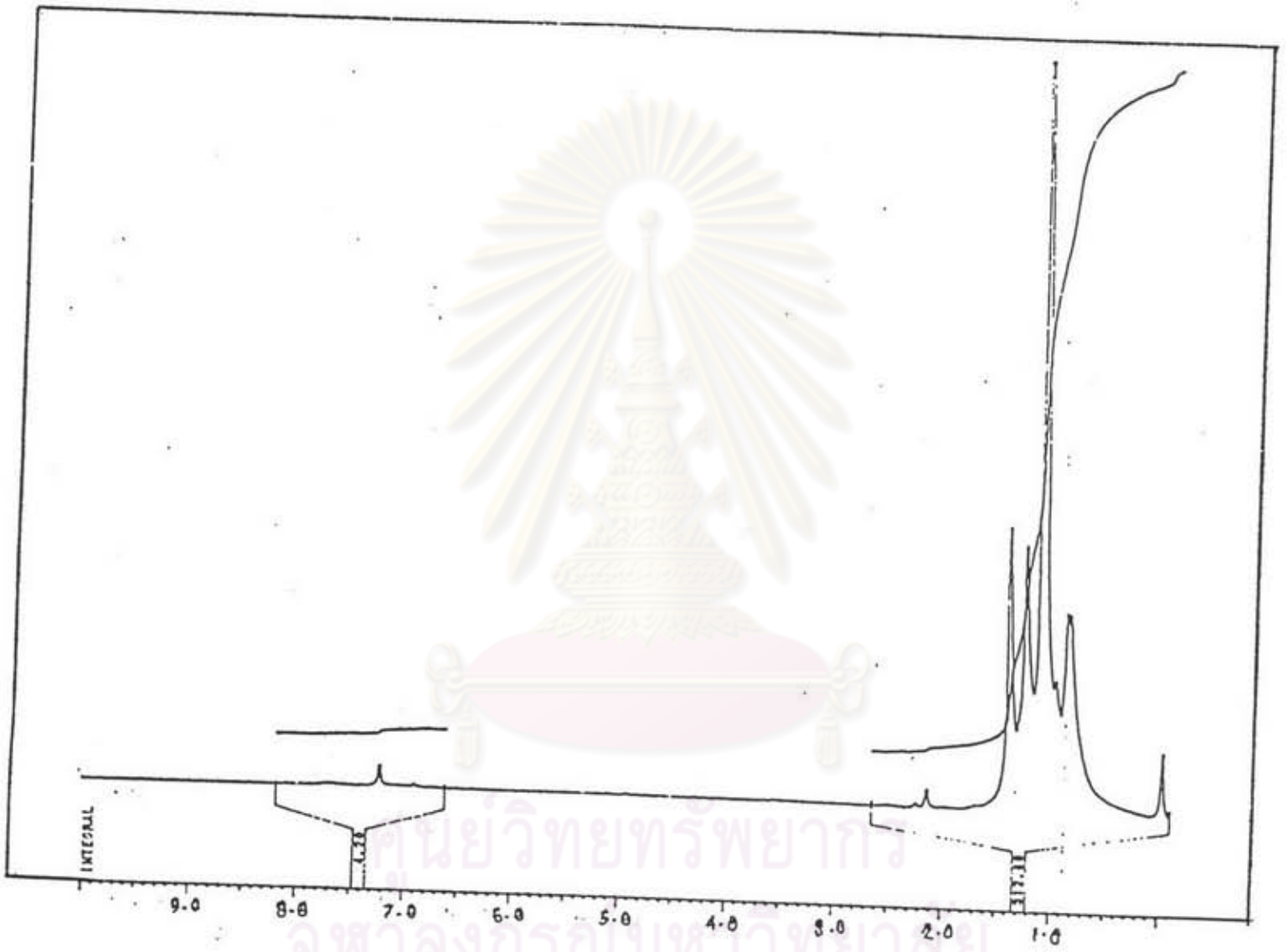

Figure A-60 ^{1}H-NMR Spectrum of polymer of PTT : ($CDCl_3$ + CCl_4)

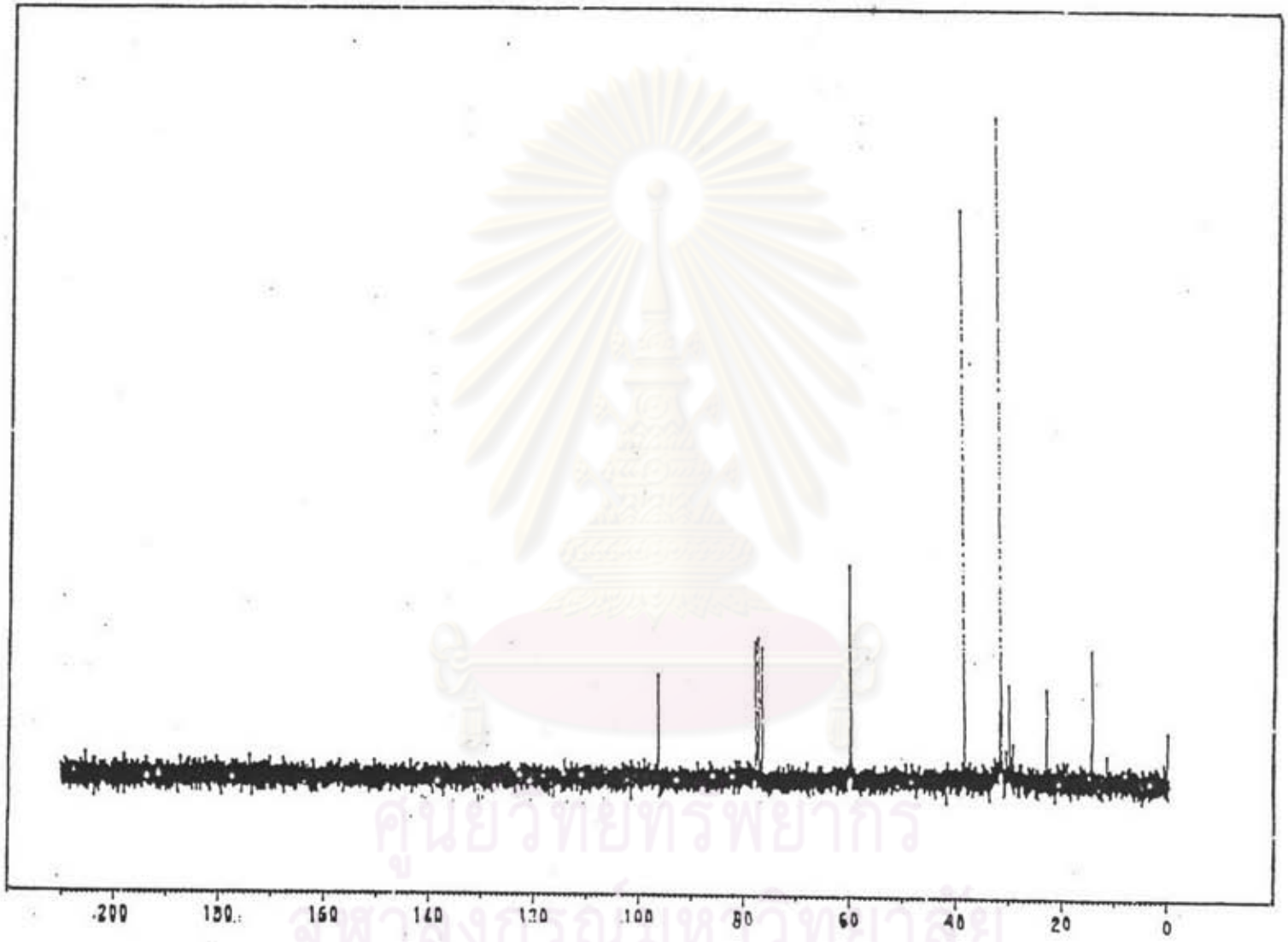

Figure A-61 ^{13}C-NMR Spectrum of polymer of PTT : ($CDCl_3$ + CCl_4)

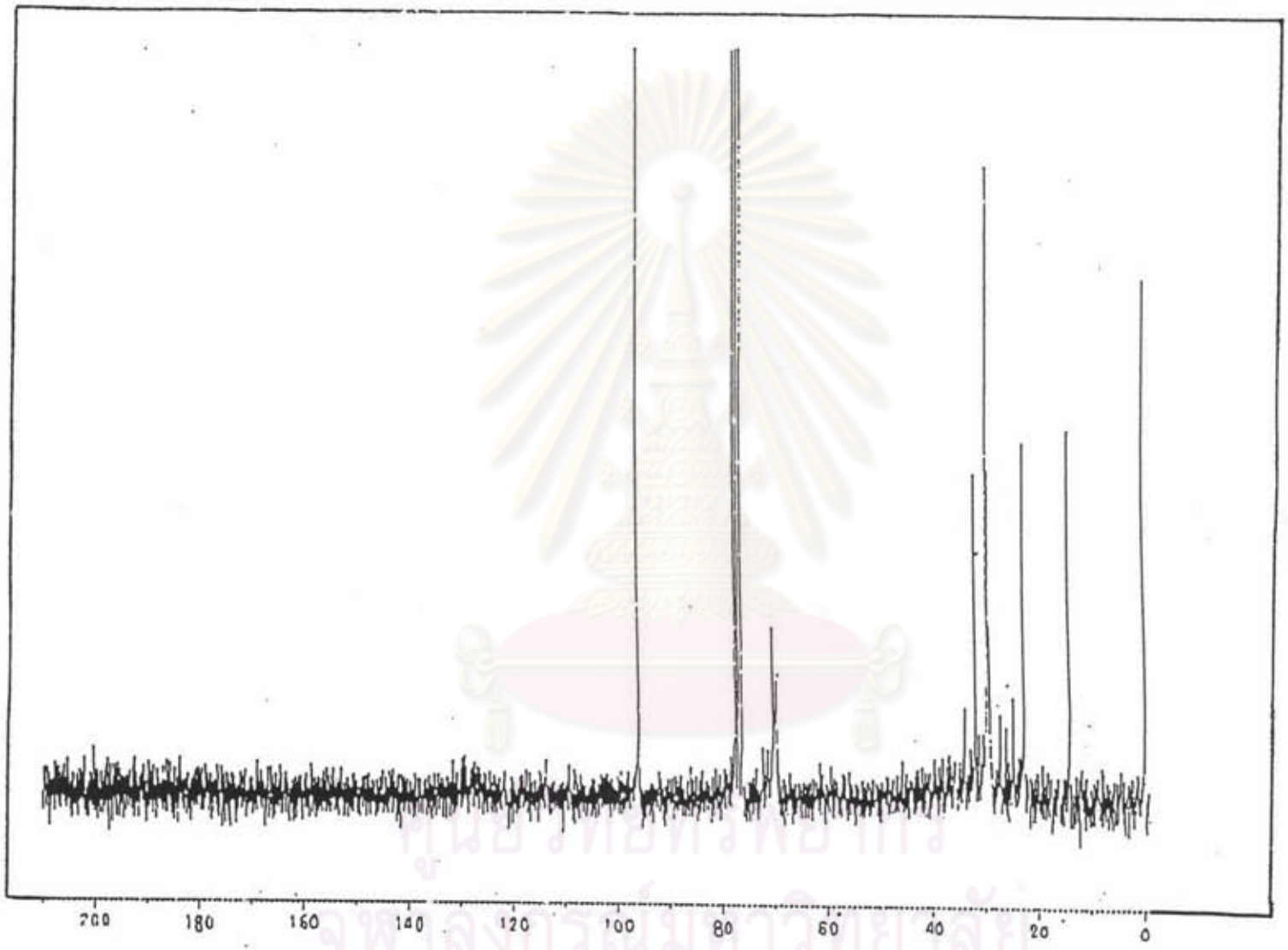

Figure A-62 ^{13}C-NMR of ZDDP in Havoline : ($CDCl_3$ + CCl_4)

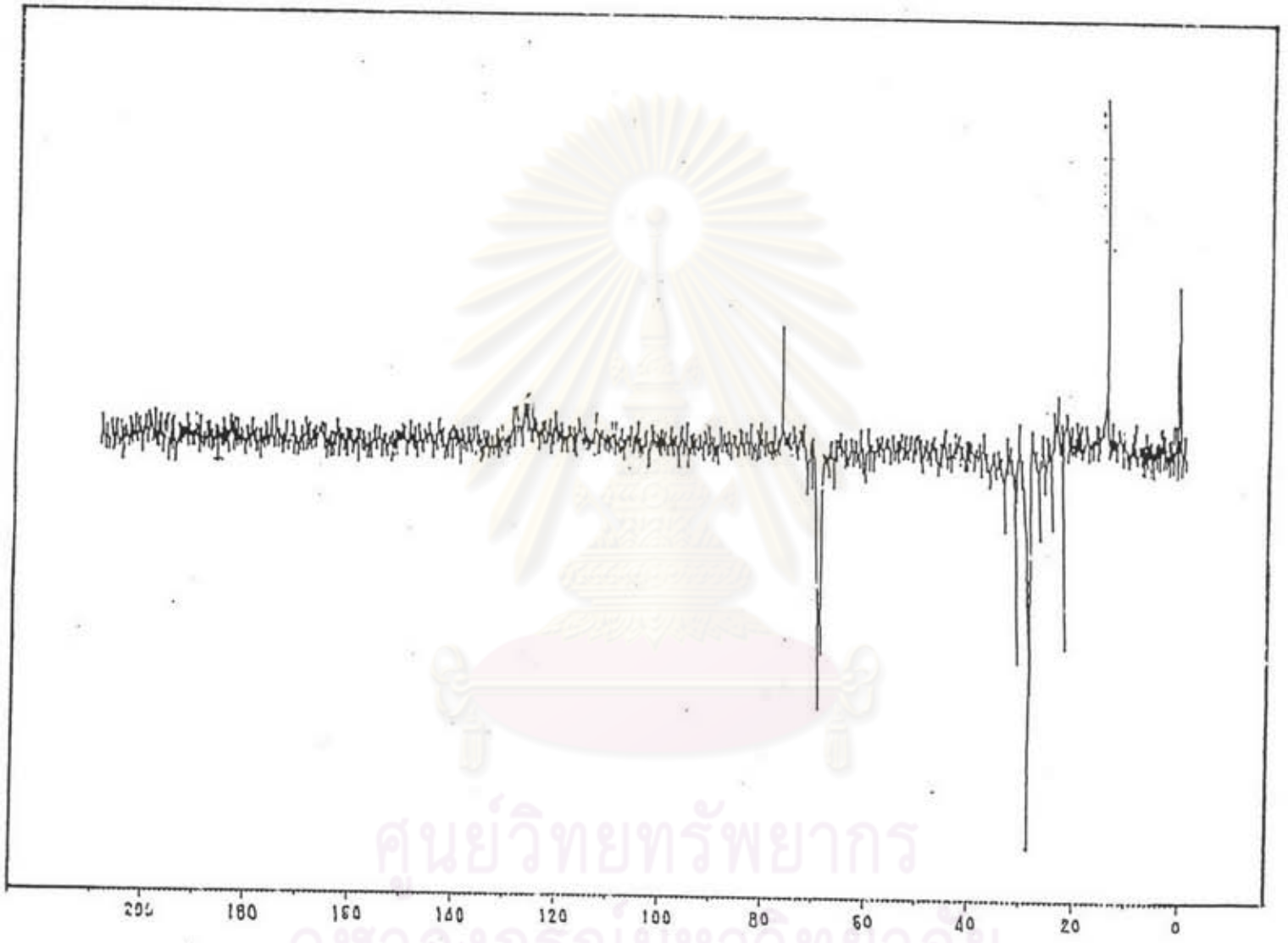

Figure A-63 DEPT-135 ^{13}C-NMR of ZDDP in Havoline : ($CDCl_3$ + CCl_4)

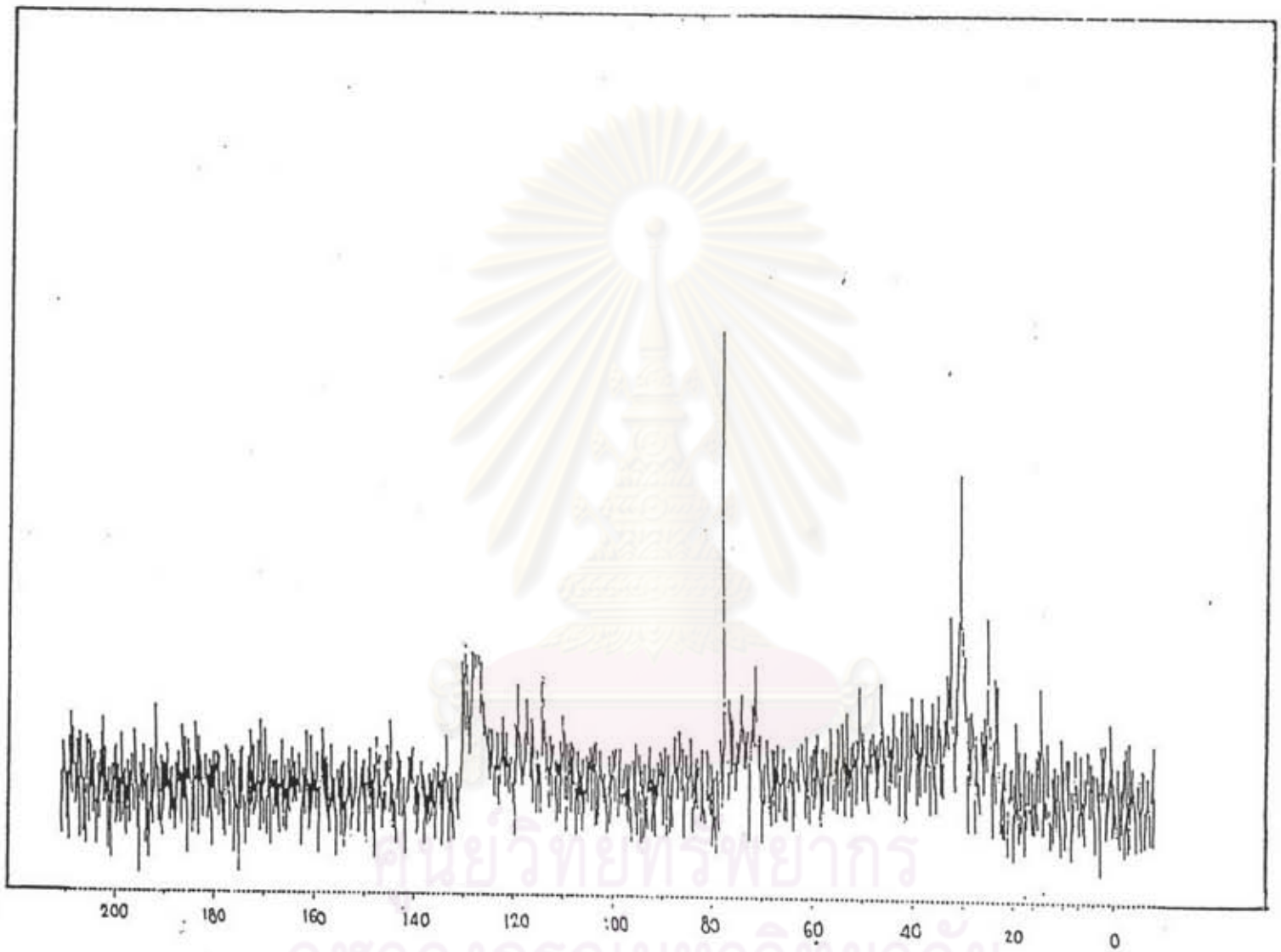

Figure A-64 DEPT-90 ^{13}C-NMR of ZDDP in Havoline : ($CDCl_3$ + CCl_4)

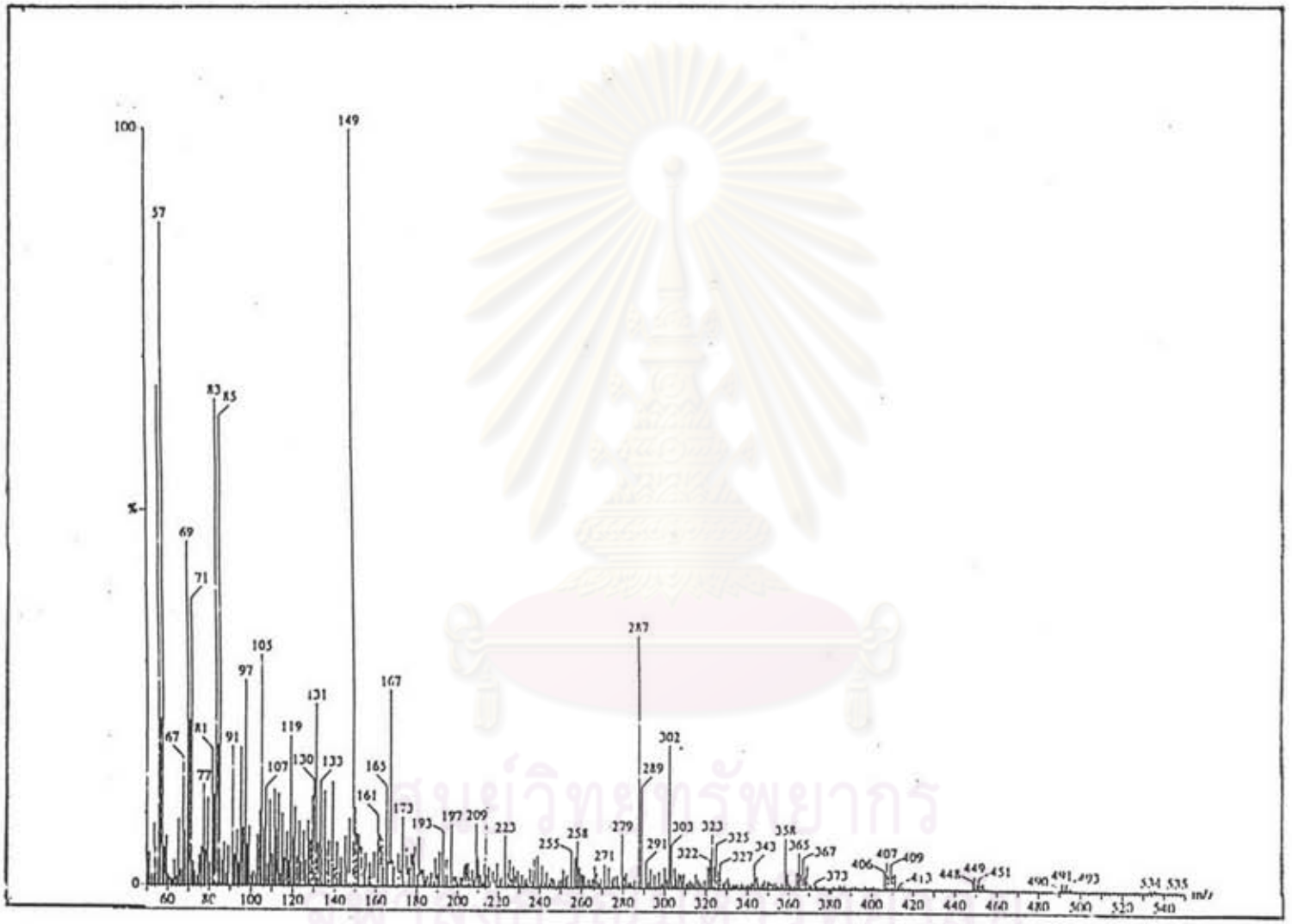

Figure A-65 MS spectrum of ZDDP in Havoline

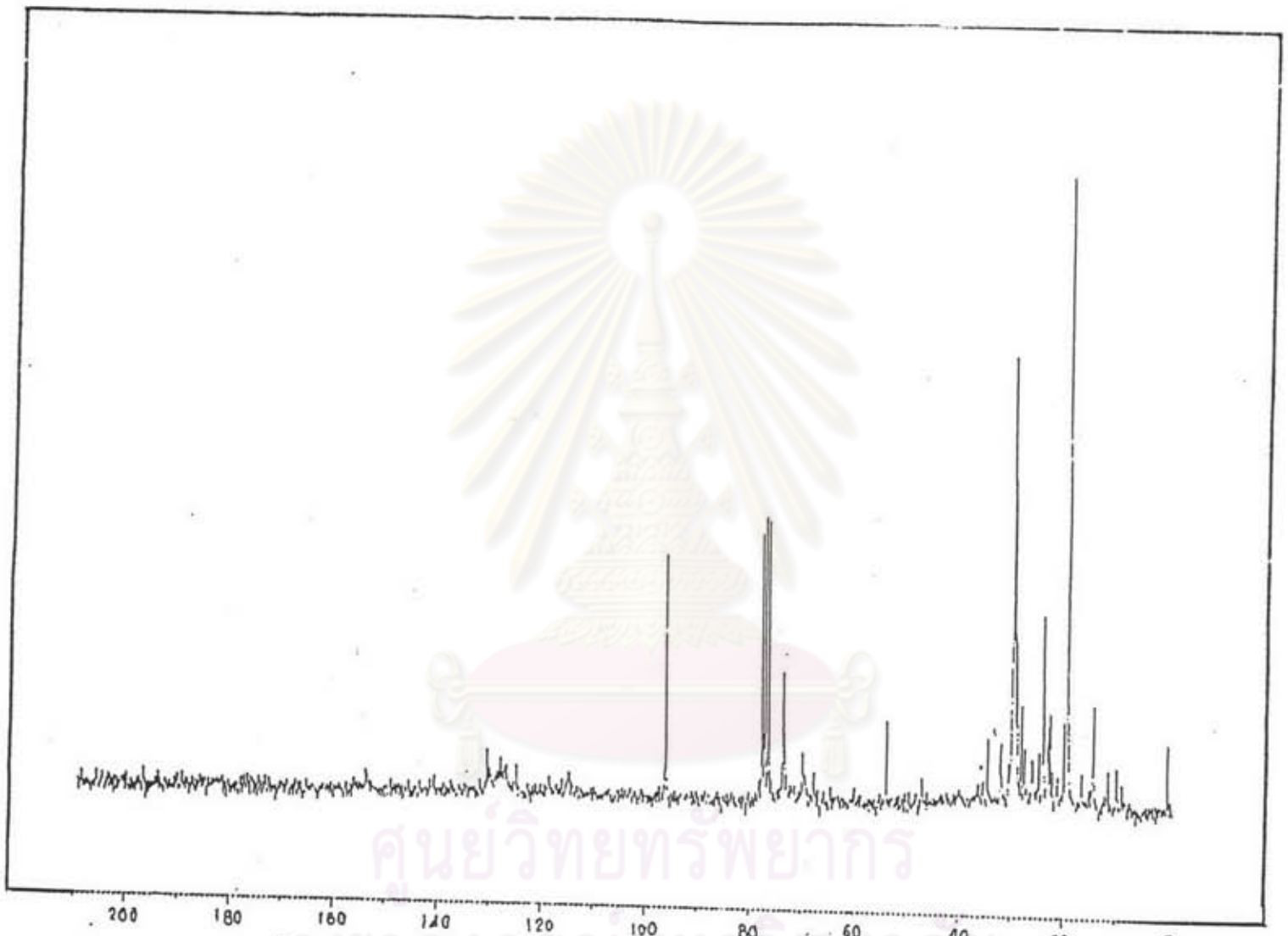

Figure A-66 ^{13}C-NMR of ZDDP in Helix : ($CDCl_3$ + CCl_4)

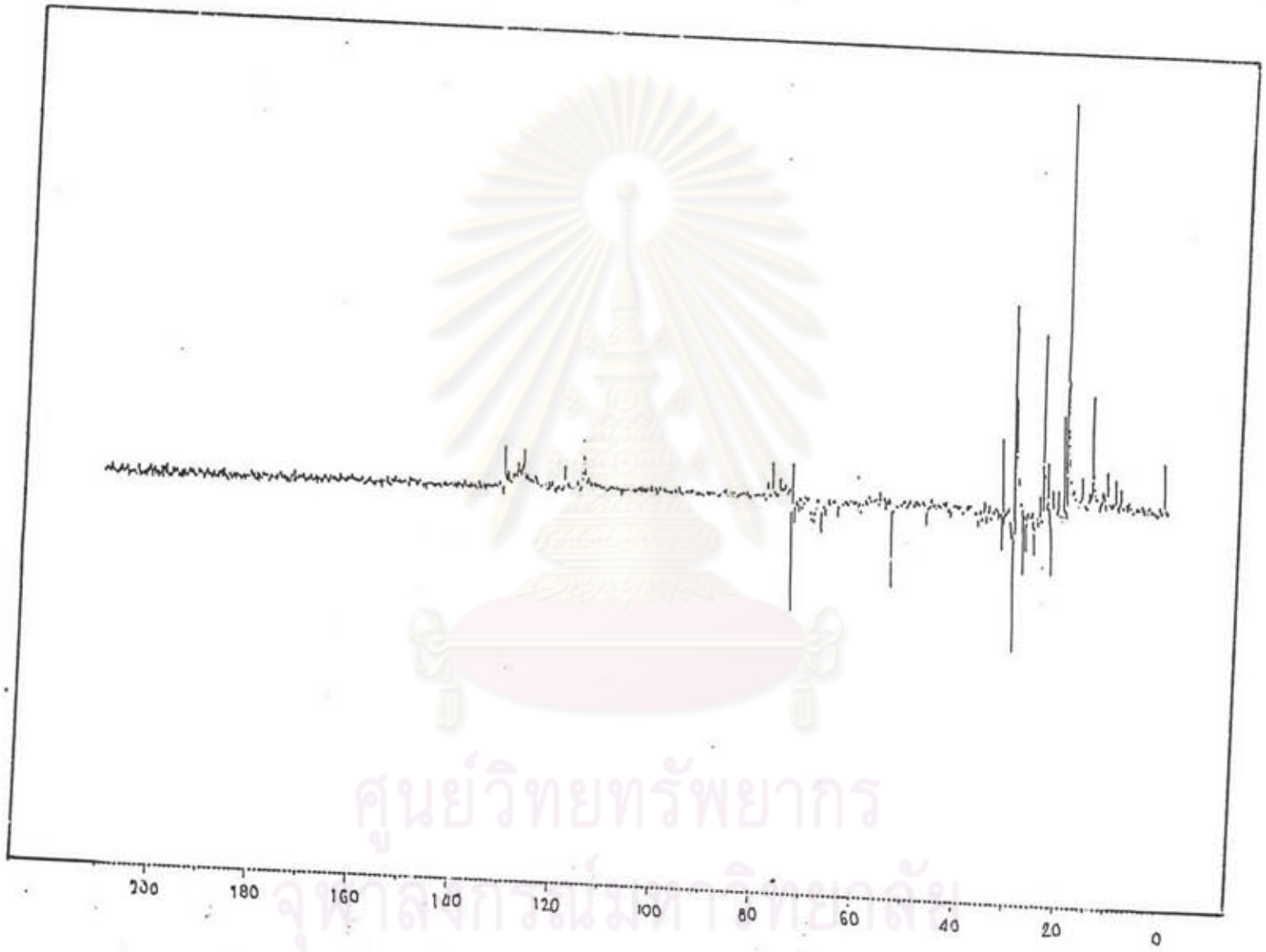

Figure A-67 DEPT-135 ^{13}C-NMR of ZDDP in Helix : ($CDCl_3$ + CCl_4)

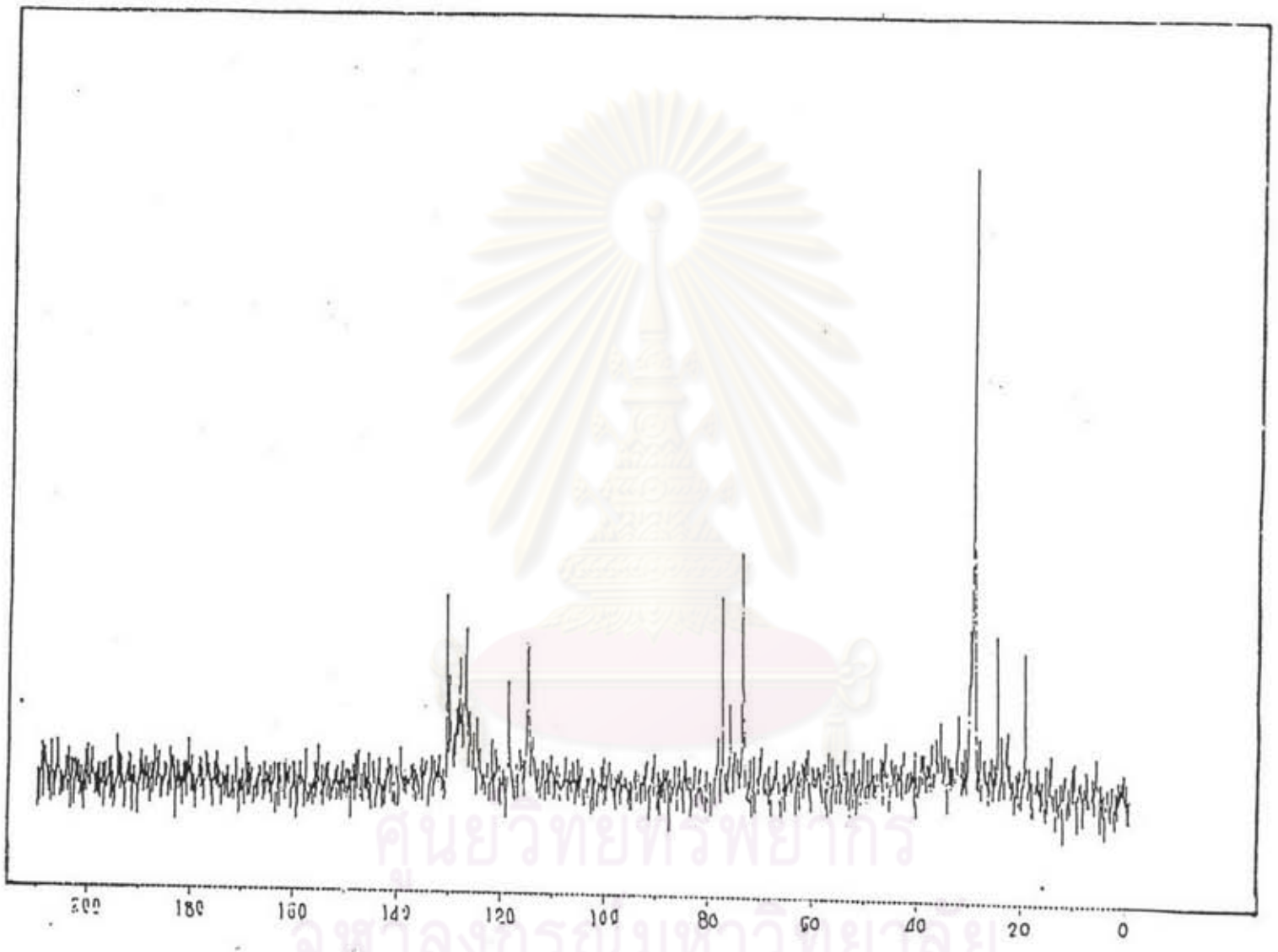

Figure A-68 DEPT-90 ^{13}C-NMR of ZDDP in Helix : ($CDCl_3$ + CCl_4)

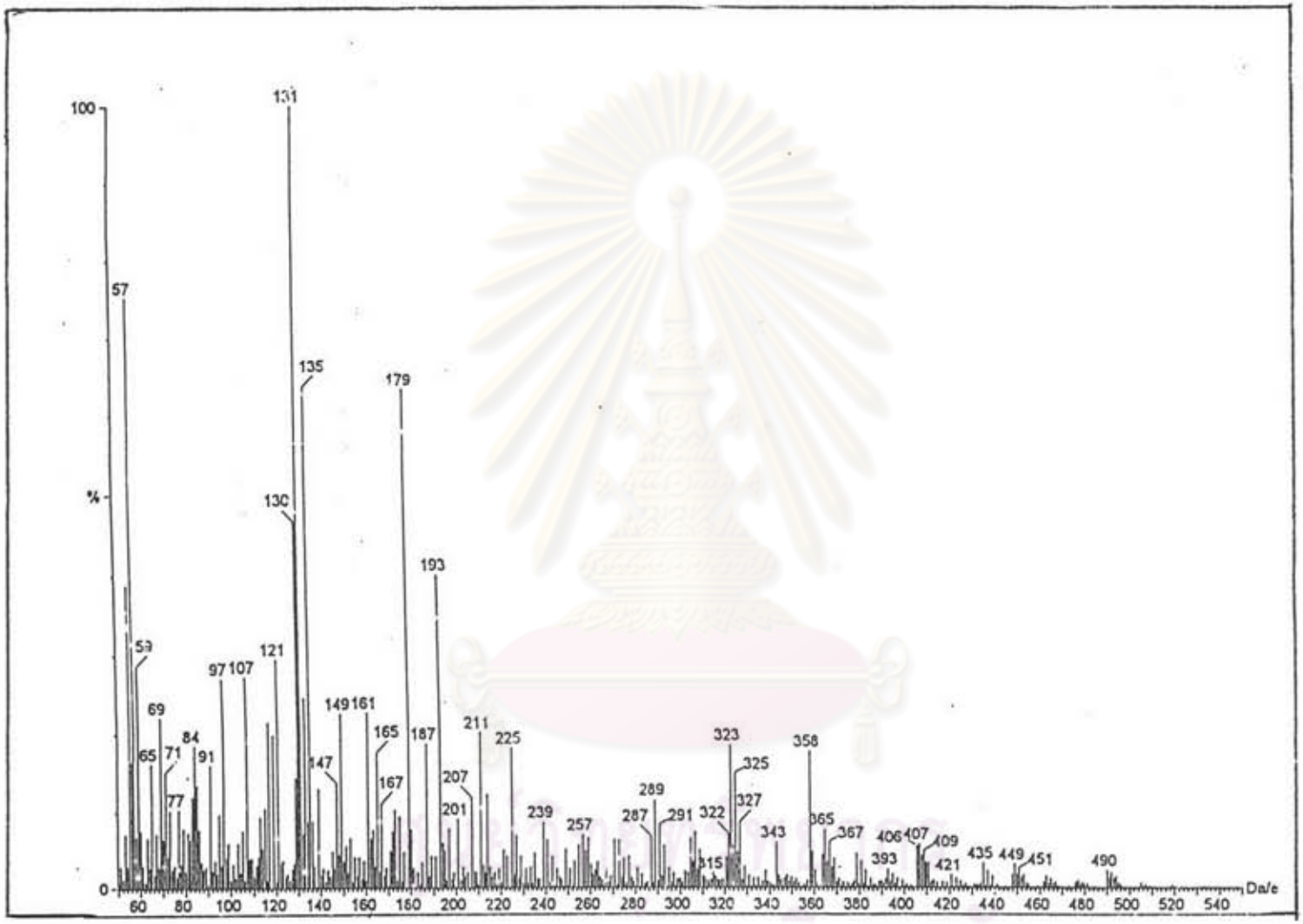

Figure A-69 MS spectrum of ZDDP in Helix

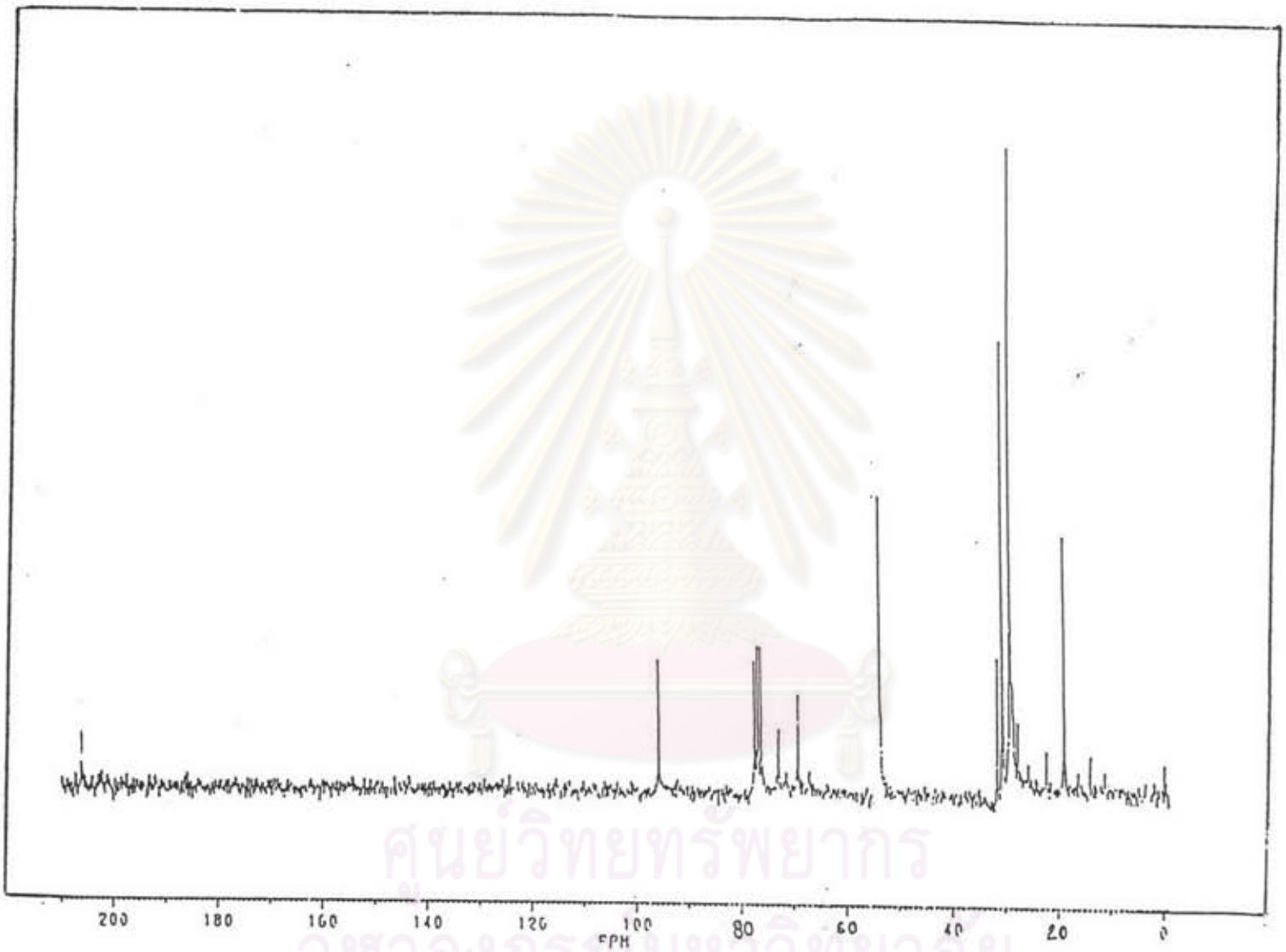

Figure A-70 ^{13}C-NMR of ZDDP in Superflo : ($CDCl_3$ + CCl_4)

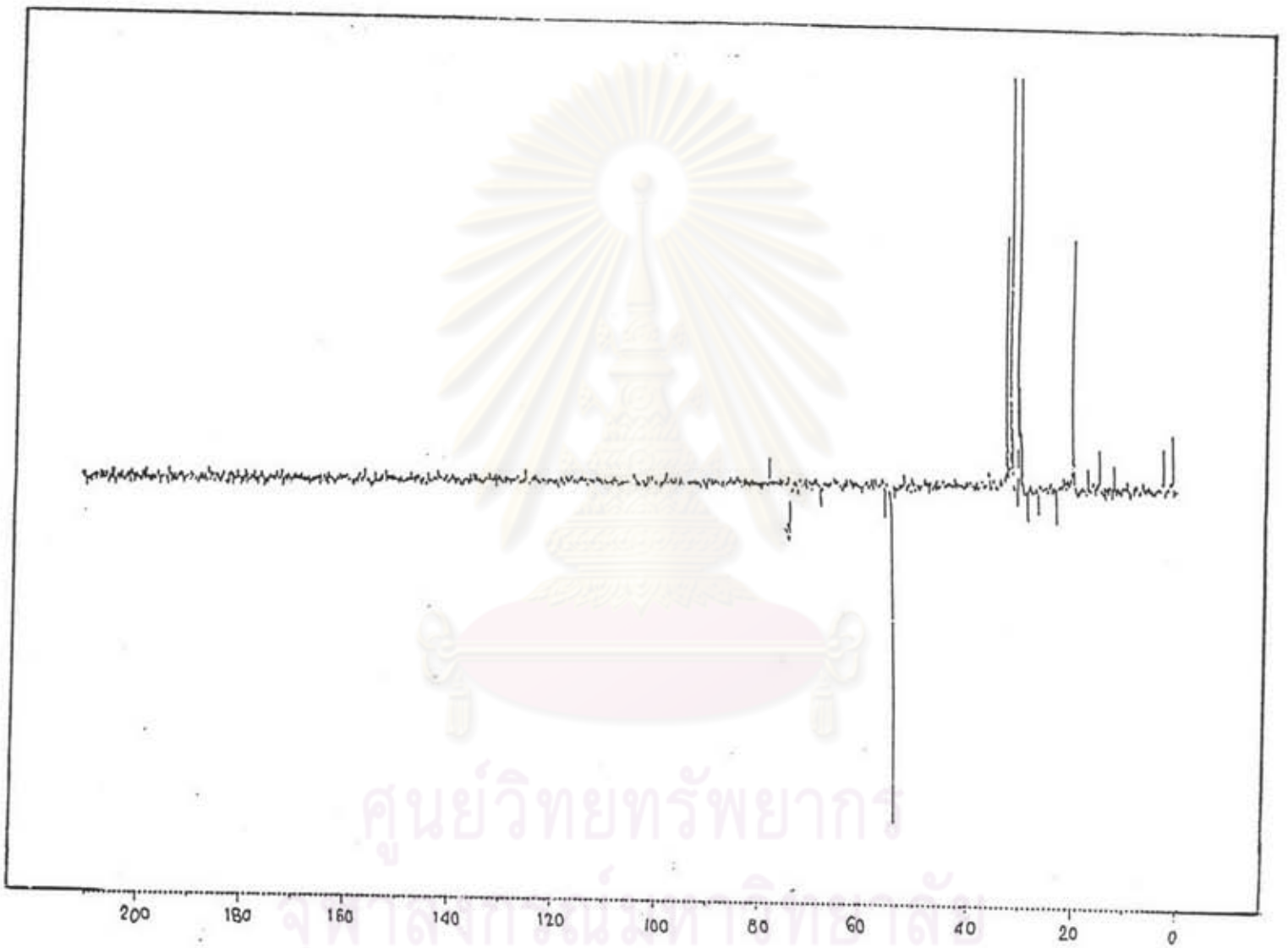

Figure A-71 DEPT-135 ^{13}C-NMR of ZDDP in Superflo : ($CDCl_3$ + CCl_4)

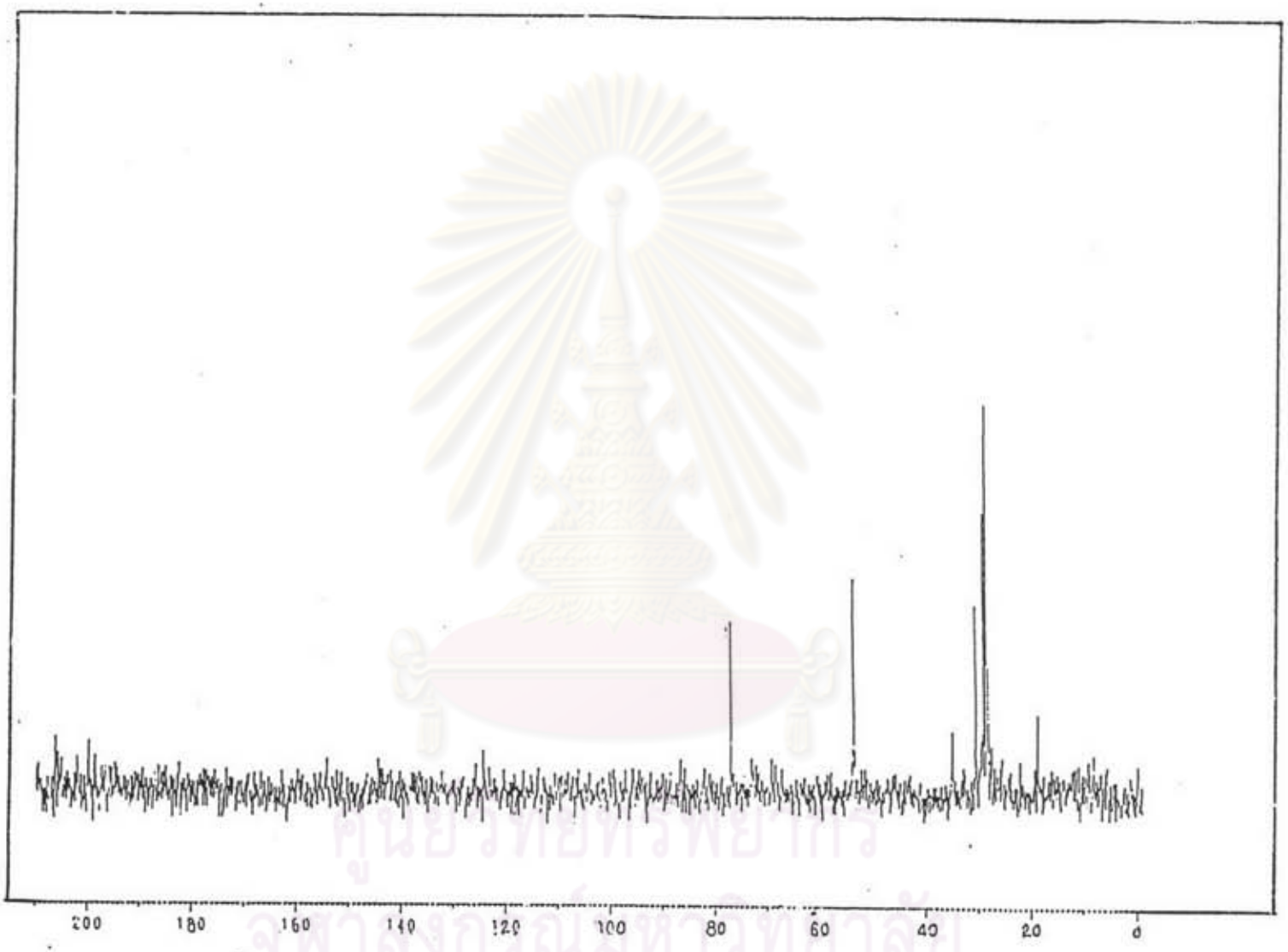

Figure A-72 DEPT-90 ^{13}C-NMR of ZDDP in Superflo : ($CDCl_3$ + CCl_4)

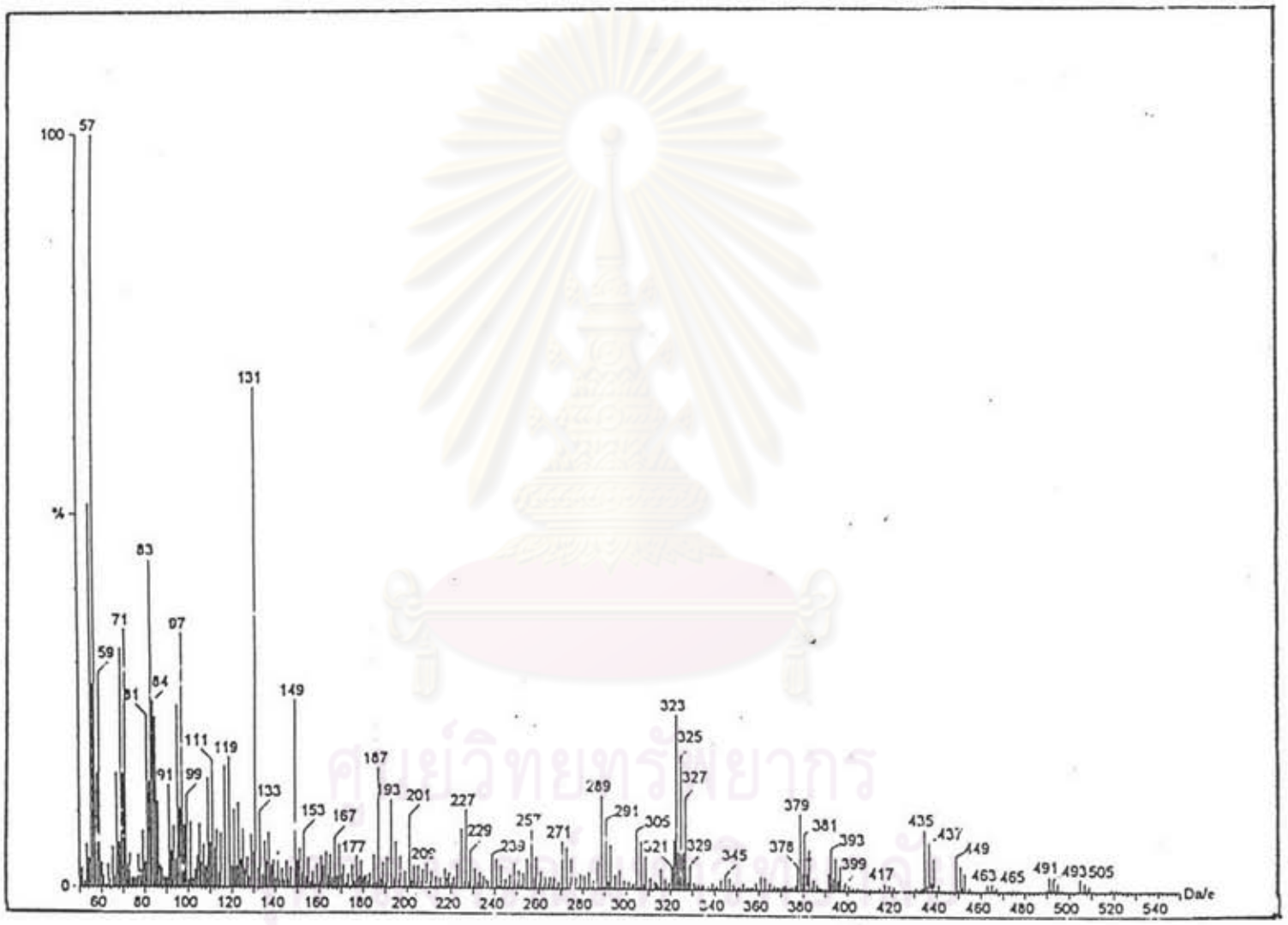

Figure A-73 MS spectrum of ZDDP in Superflo

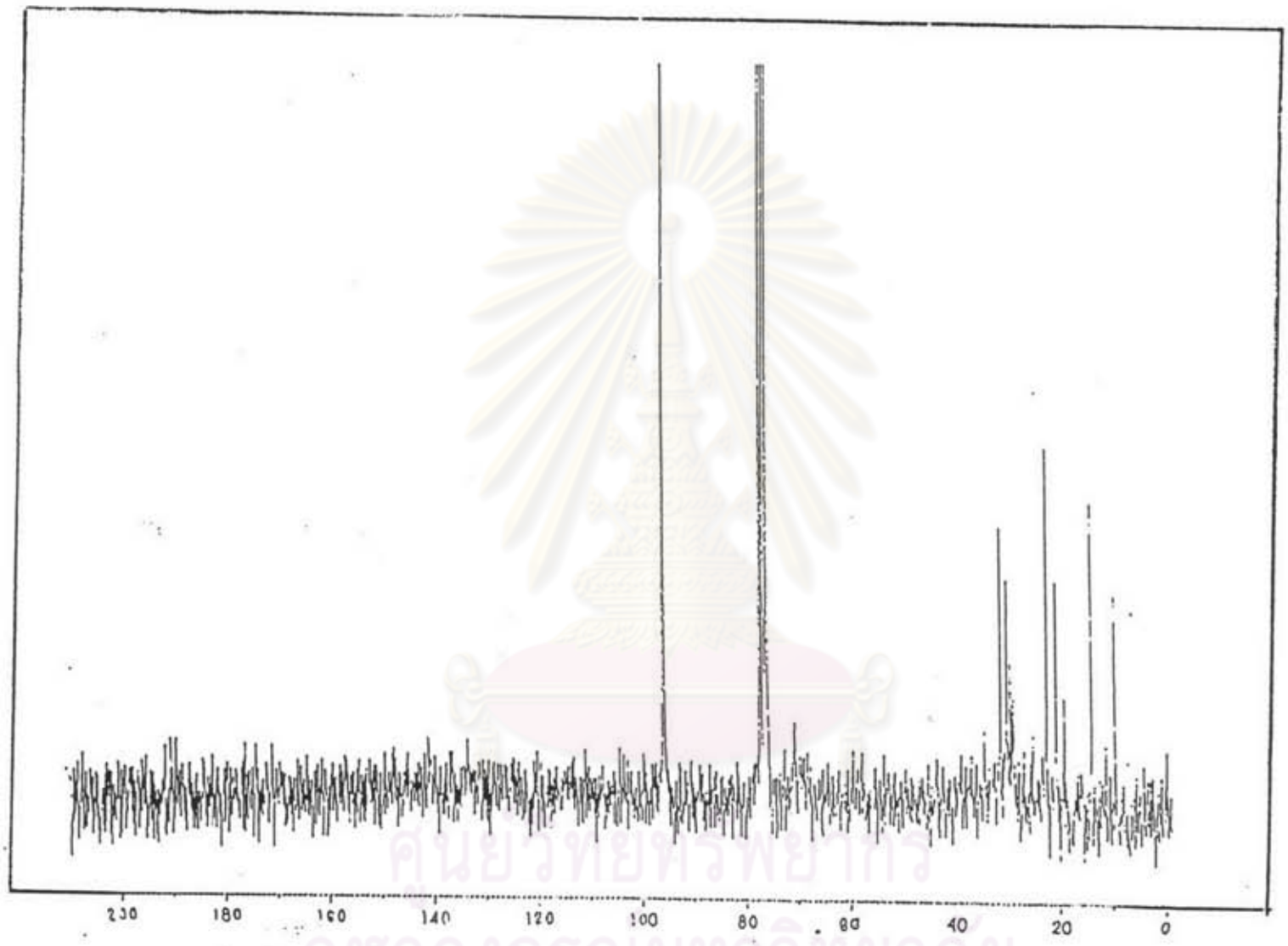

Figure A-74 ^{13}C-NMR of ZDDP in PTT : ($CDCl_3$ + CCl_4)

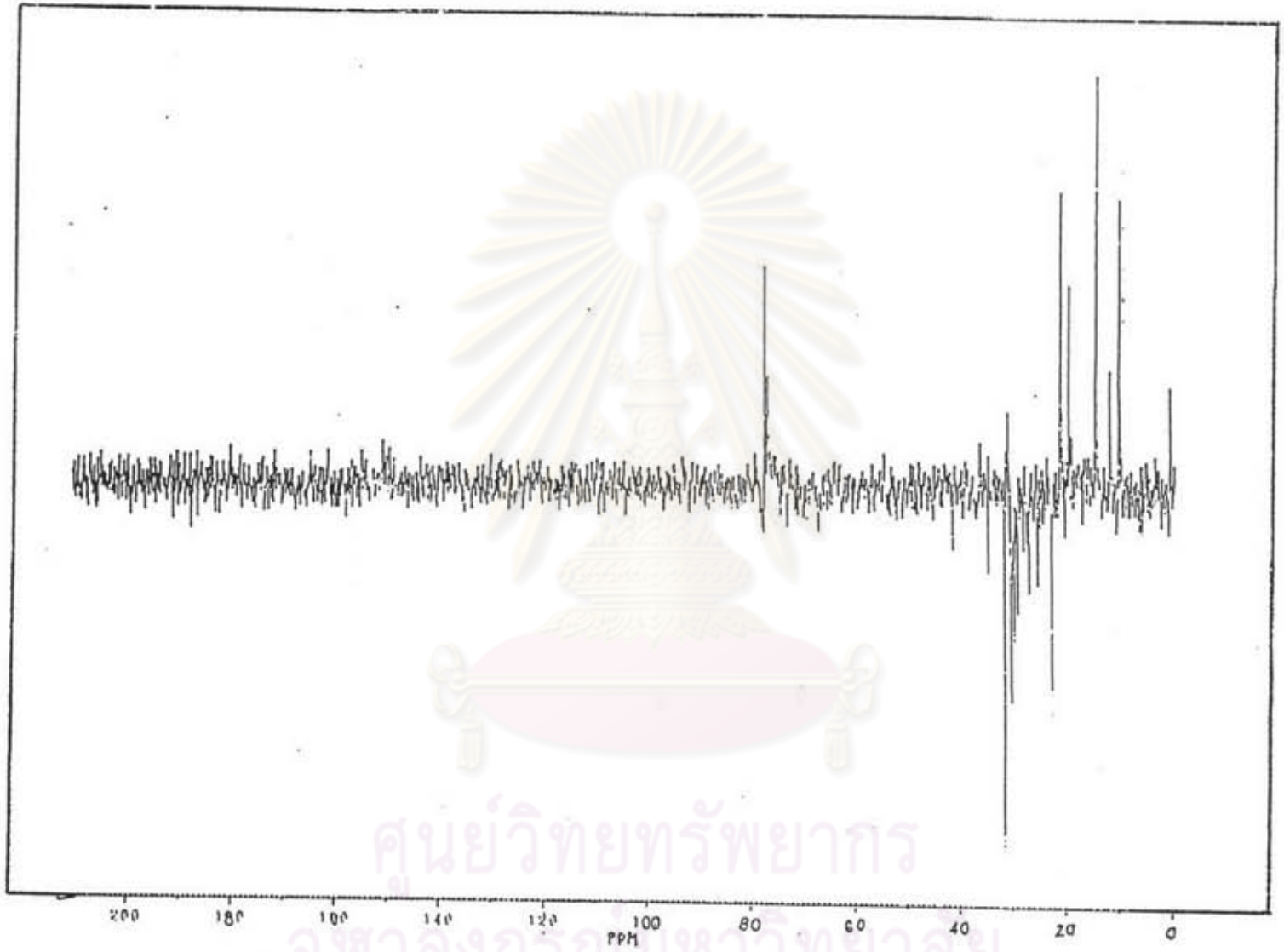

Figure A-75 DEPT-135 ^{13}C-NMR of ZDDP in PTT : ($CDCl_3$ + CCl_4)

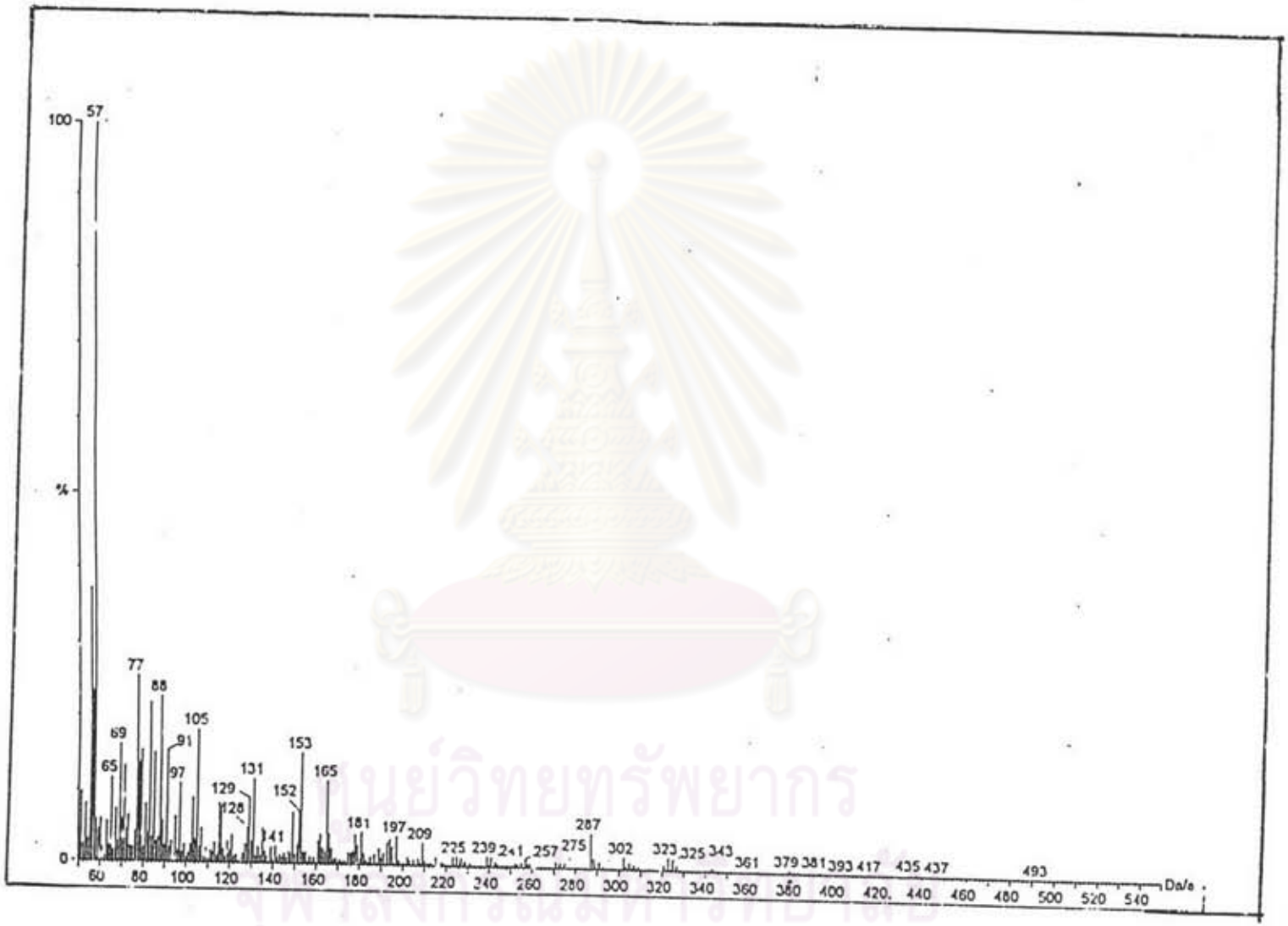

Figure A-76 MS spectrum of ZDDP in PTT

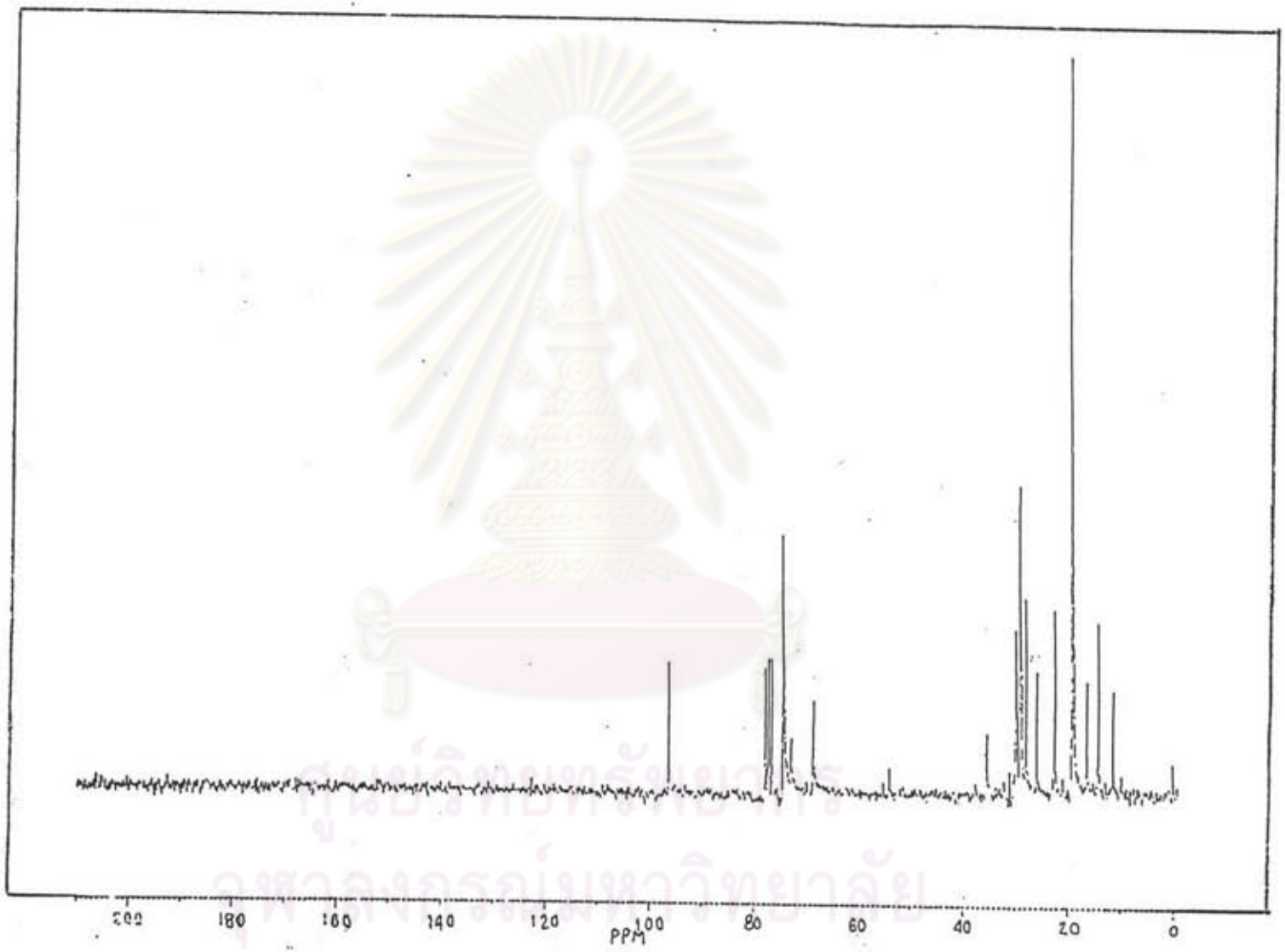

Figure A-77 ^{13}C-NMR of ZDDP in PX-15 : ($CDCl_3$ + CCl_4)

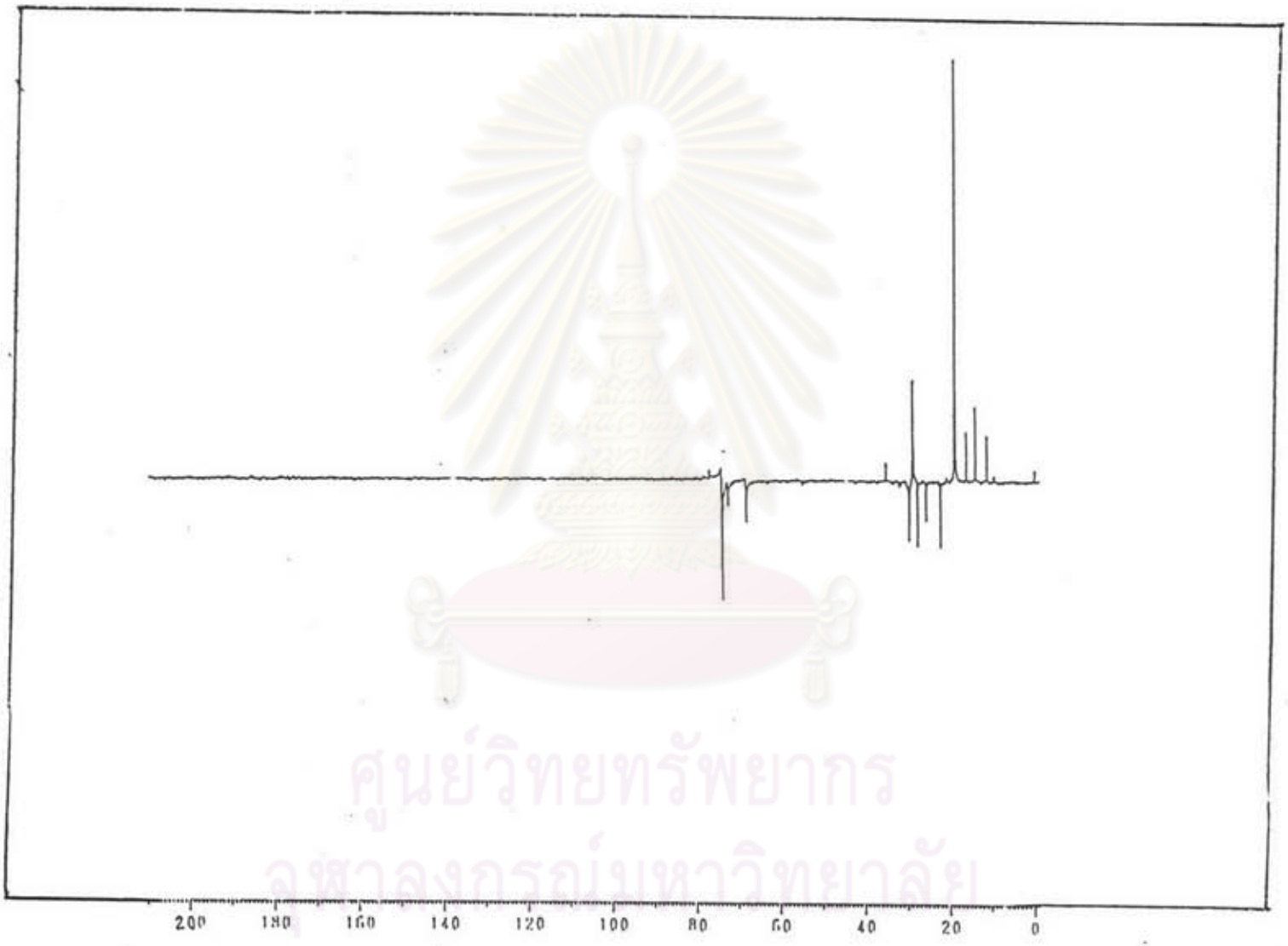

Figure A-78 DEPT-135 ^{13}C-NMR of ZDDP in PX-15 : ($CDCl_3$ + CCl_4)

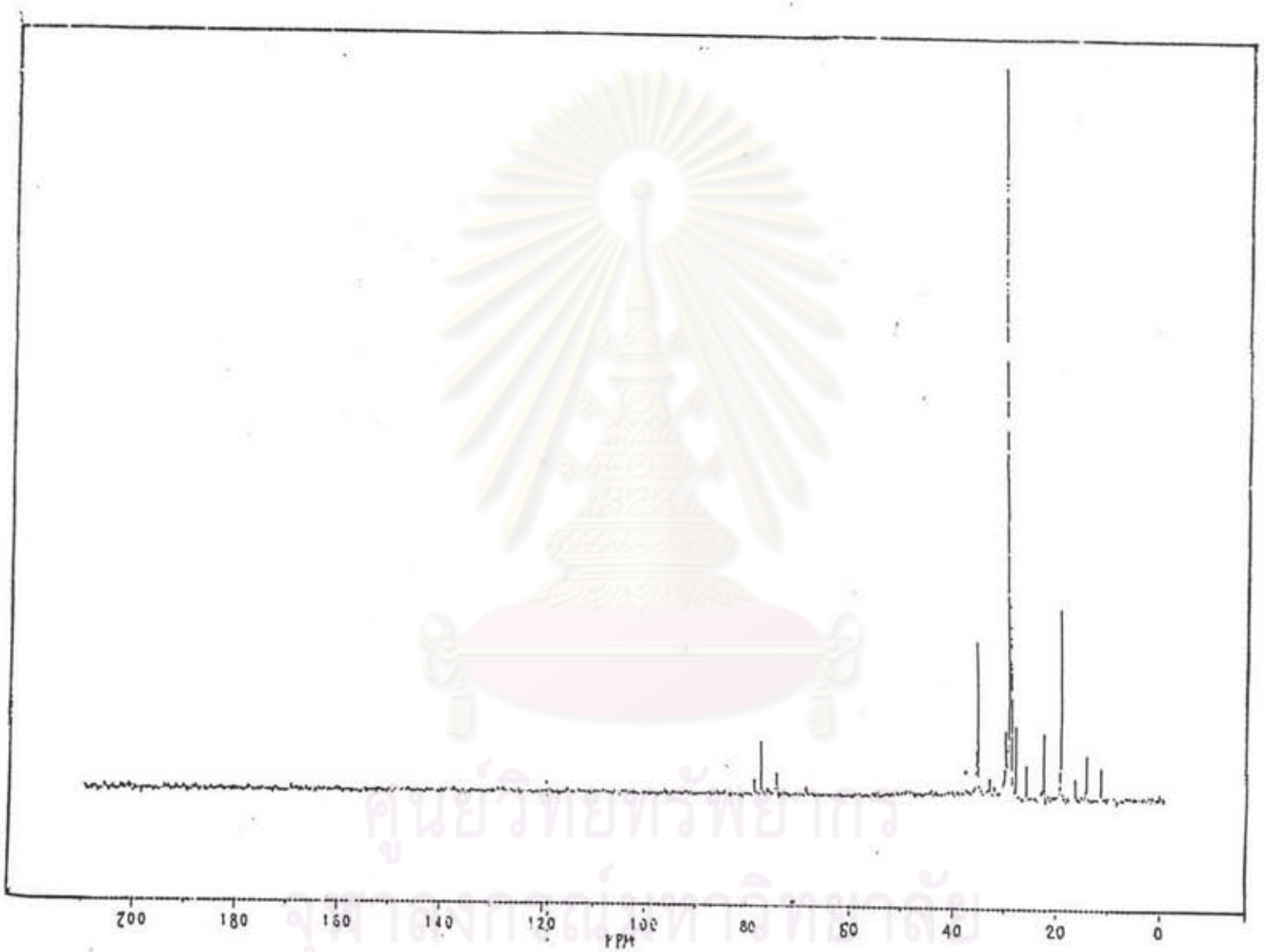

Figure A-79 DEPT-90 ^{13}C-NMR of ZDDP in PX-15 : ($CDCl_3$ + CCl_4)

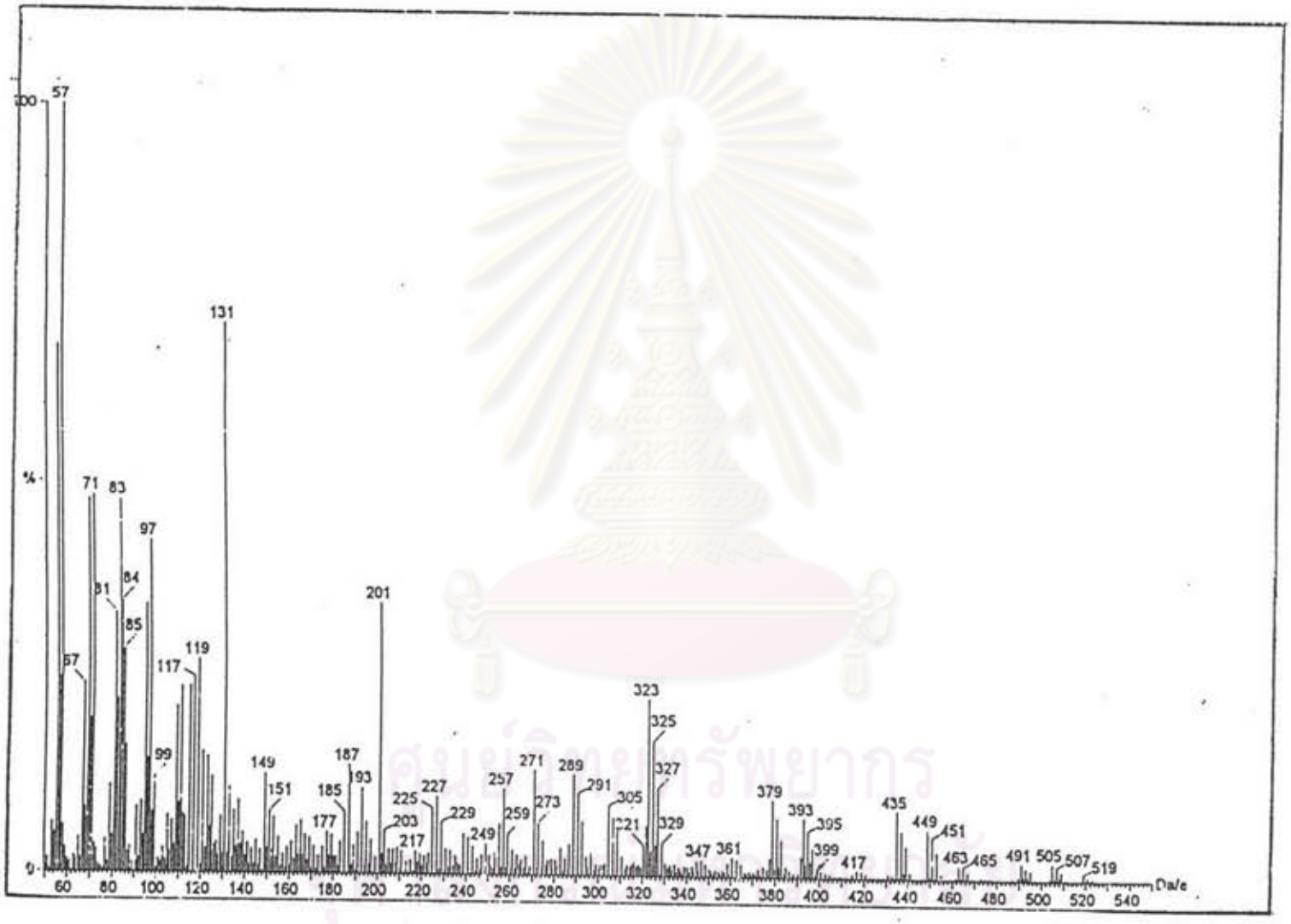

Figure A-80 MS spectrum of ZDDP in PX-15

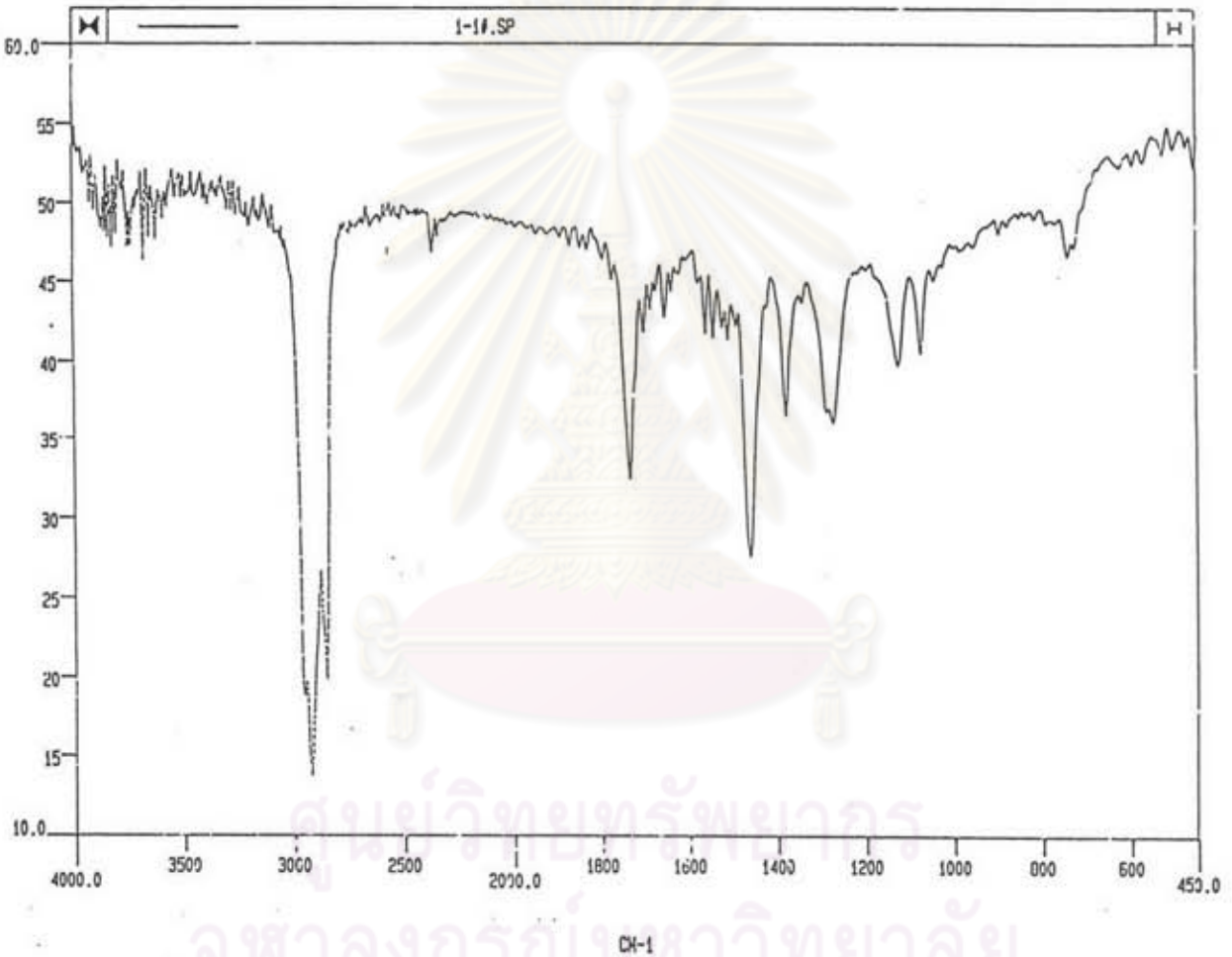

Figure A-81 FT-IR spectra of 1st spot from Shell Helix

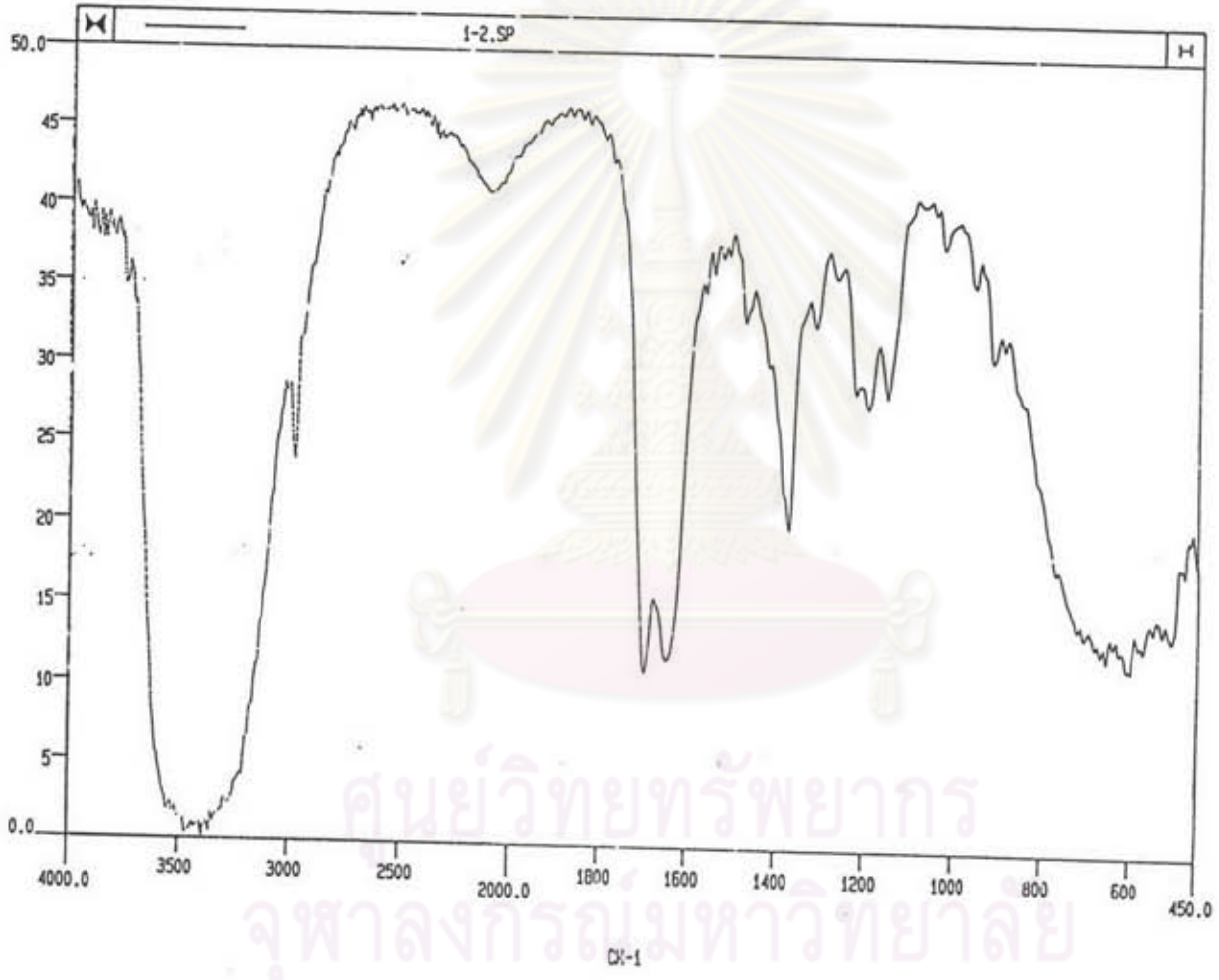

Figure . A-82 FT-IR spectra of 2nd spot from Shell Helix

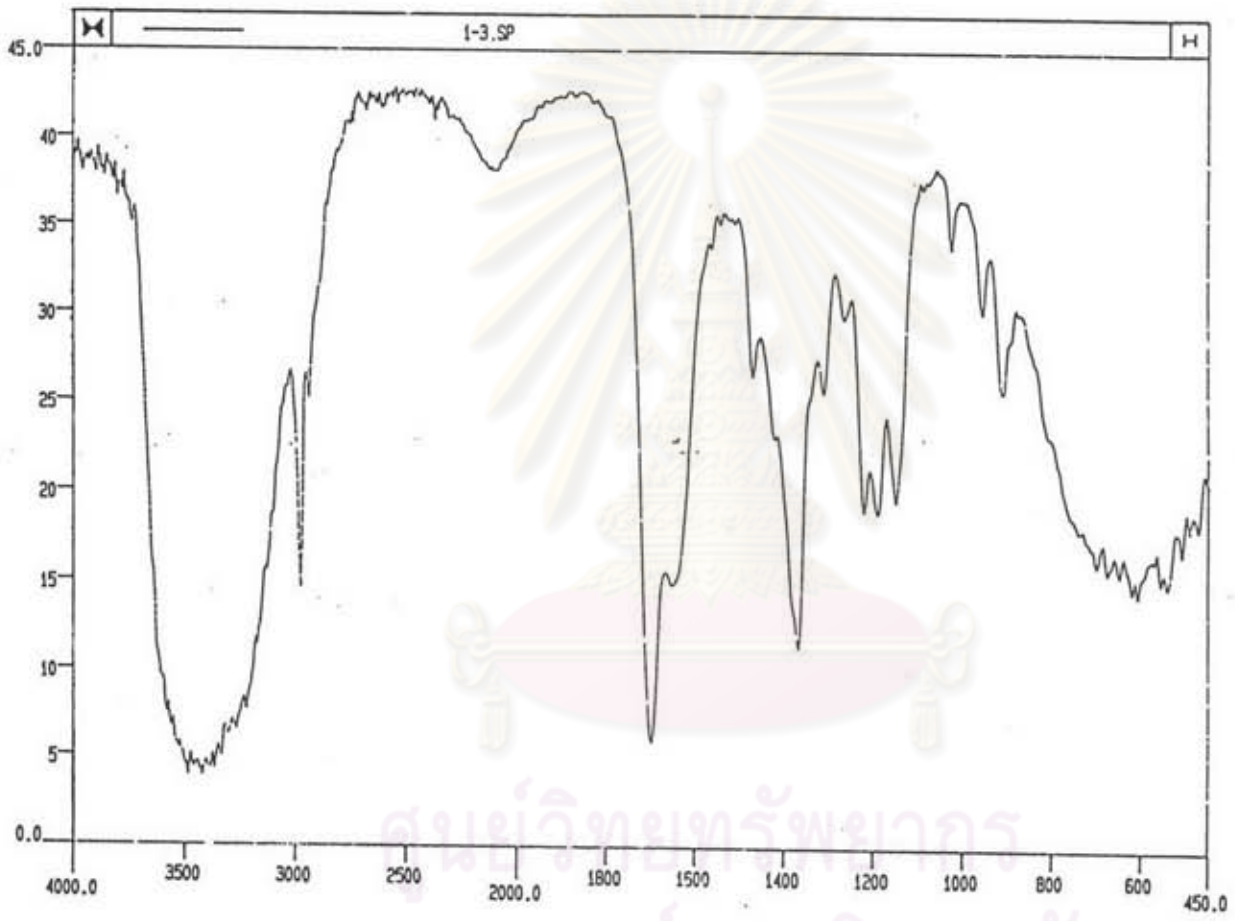

Figure A-83 FT-IR spectrum of 3rd TLC spot from Shell Helix

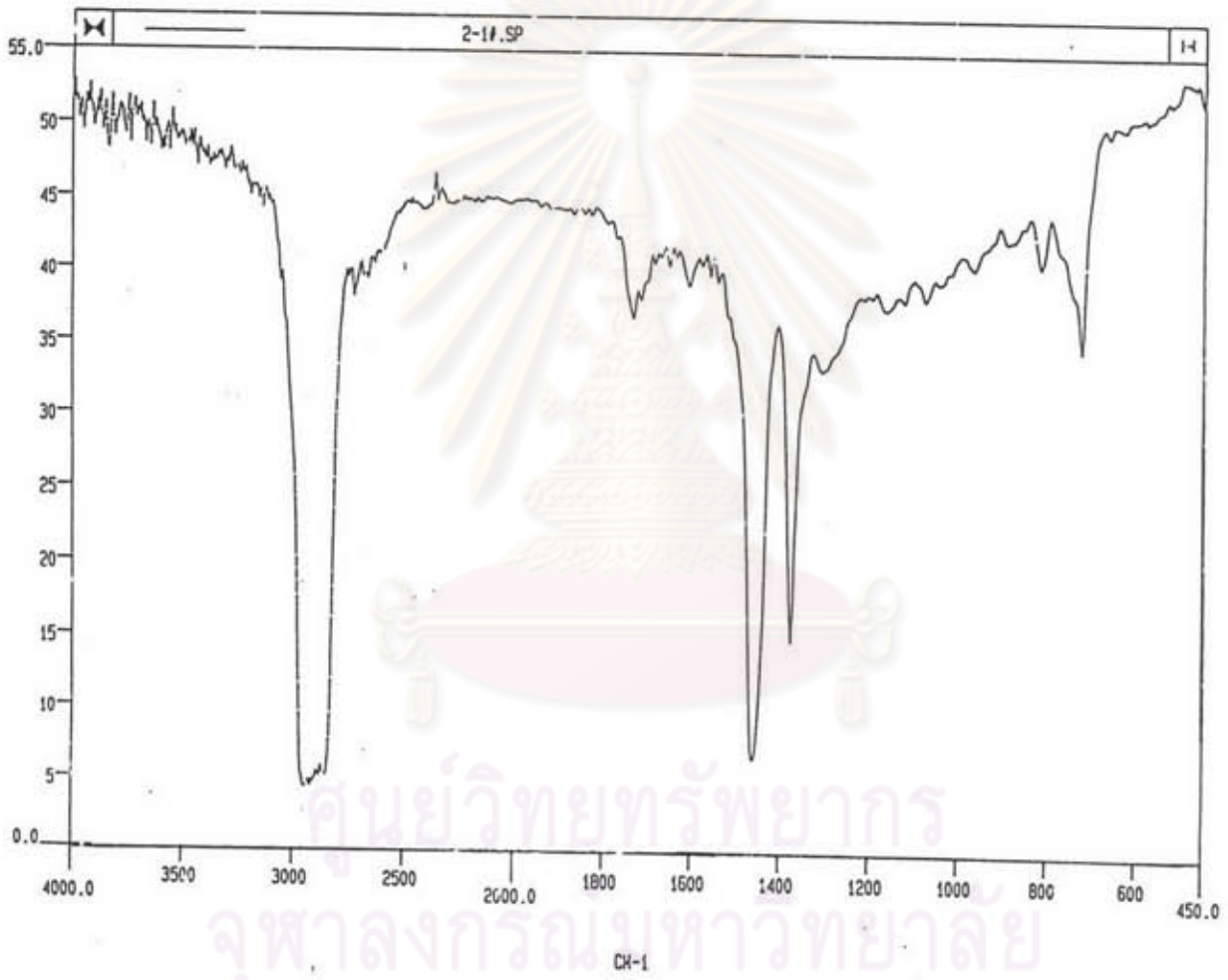

Figure A- 84 FT-IR spectra of 1st spot from Esso Superflo

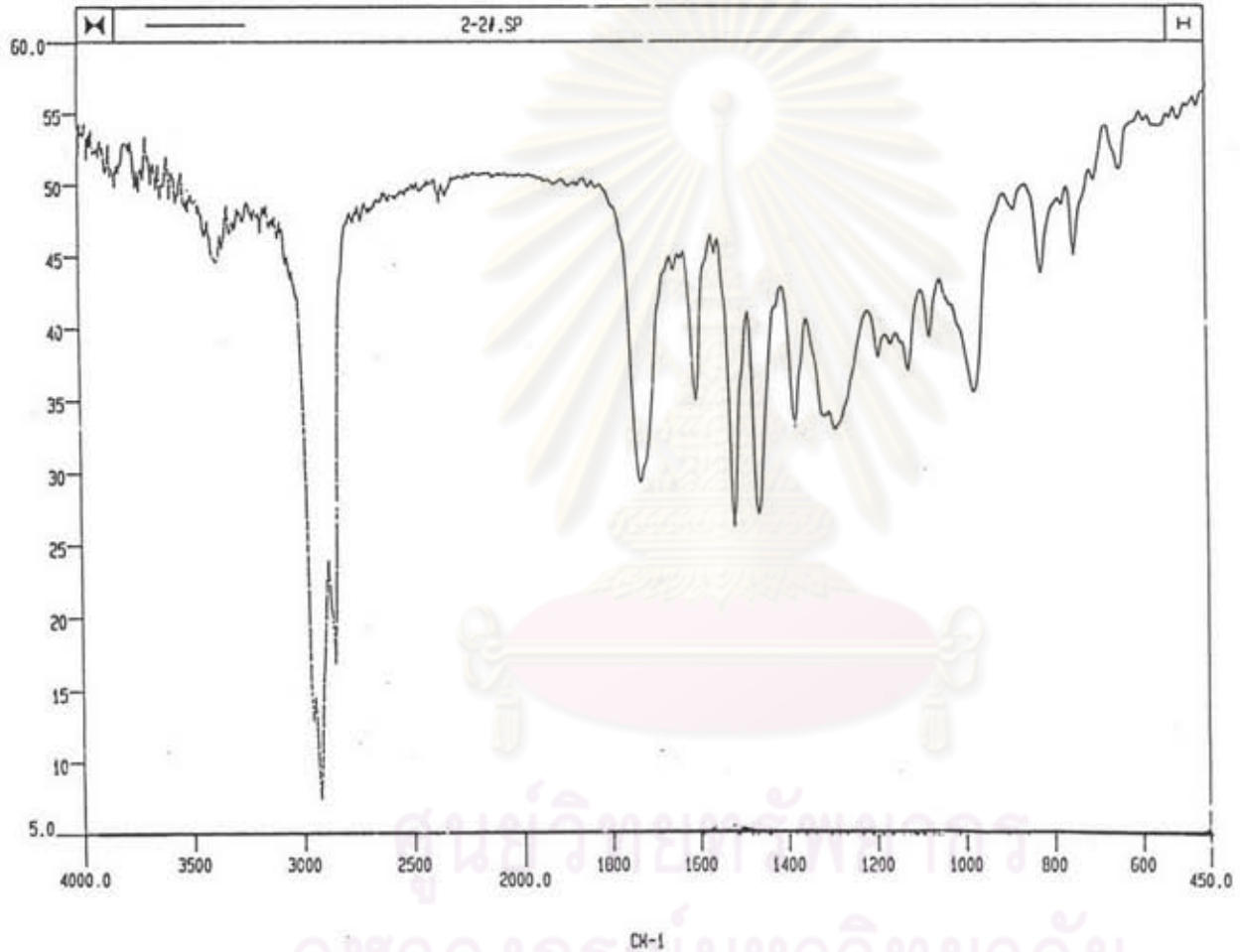

Figure A-85 FT-IR spectra of 2nd spot from Esso Superflo

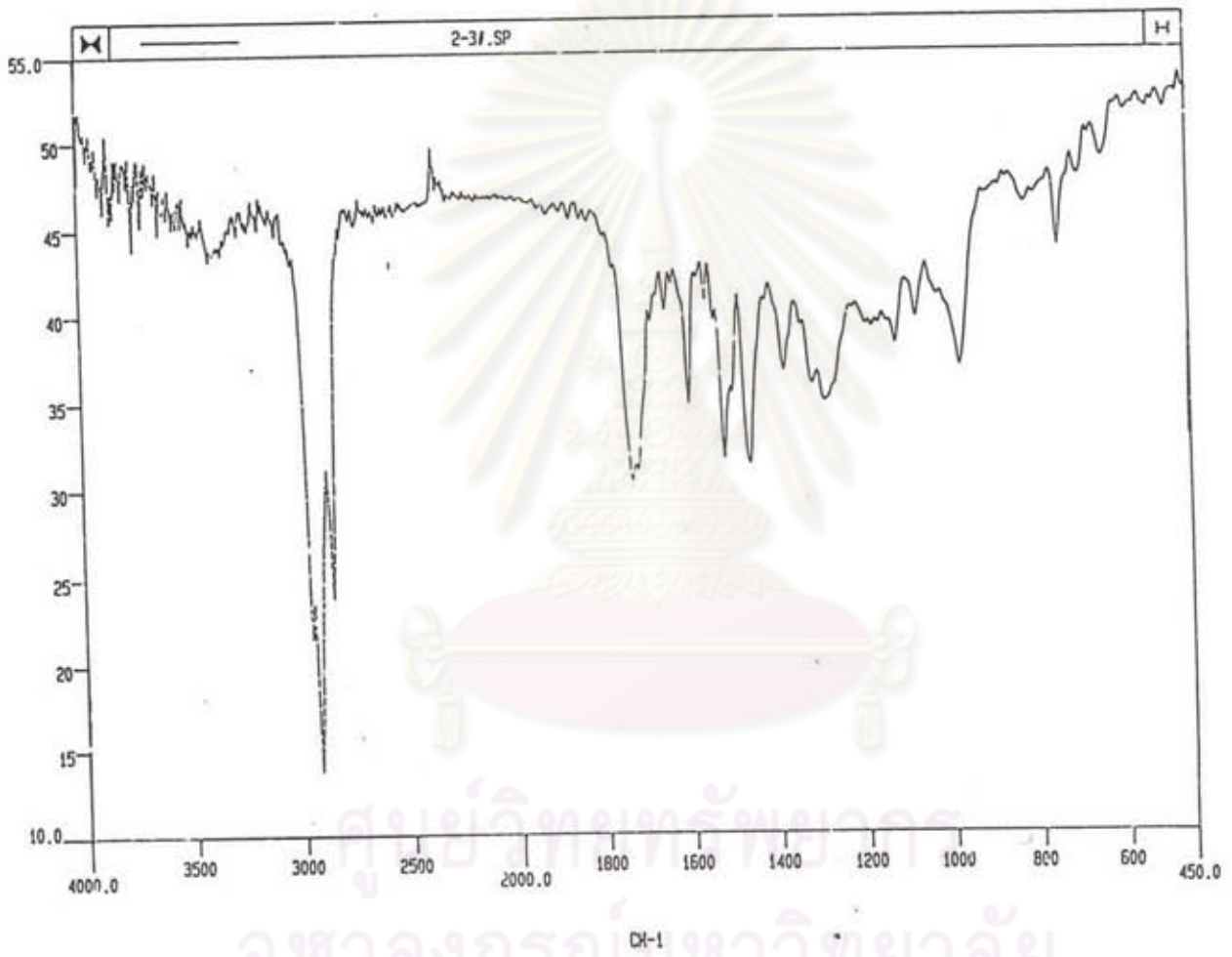

Figure A-86 FT-IR spectra of 3rd spot from Esso Superflo

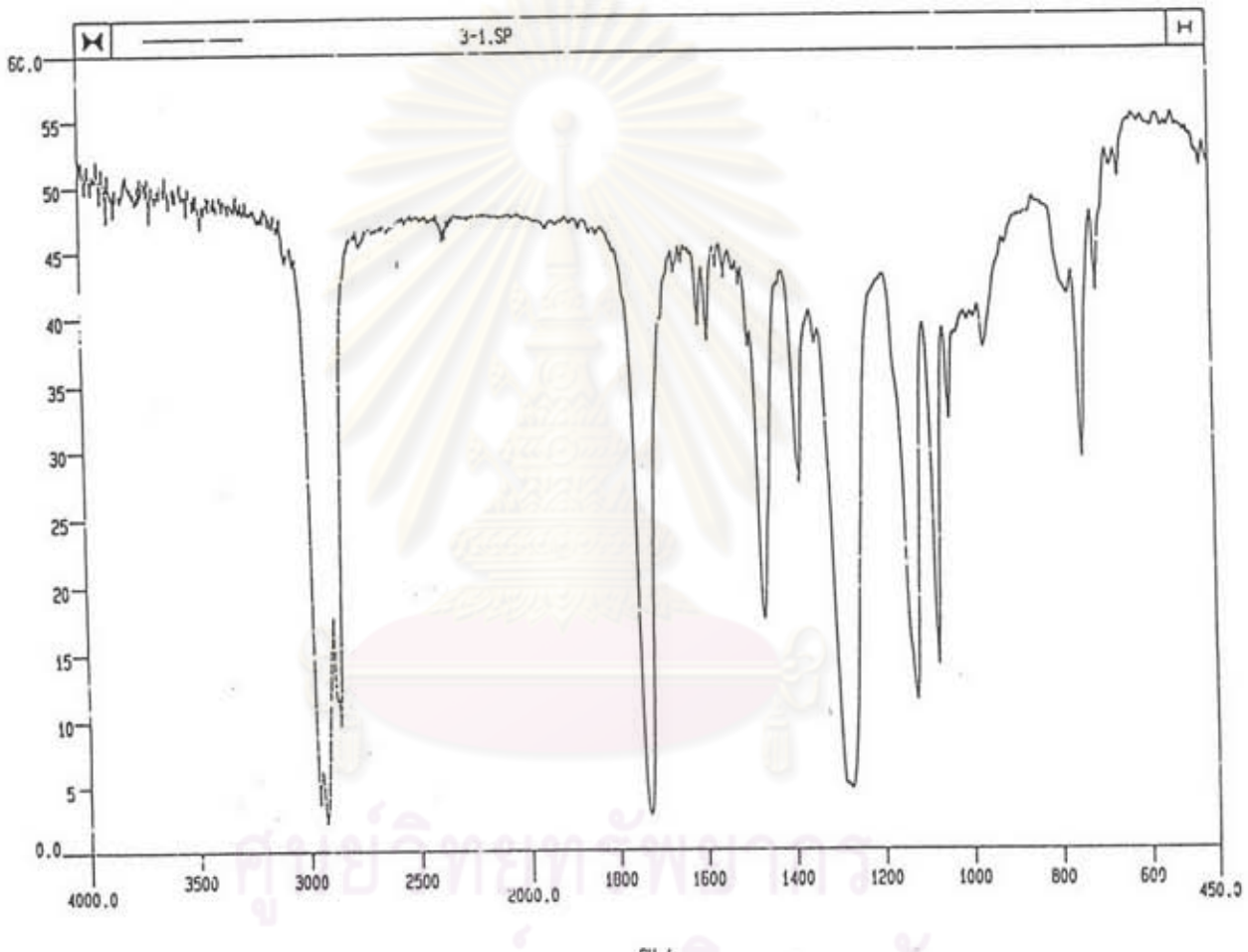

Figure A-87 FT-IR spectrum of 1st TLC spot from PTT

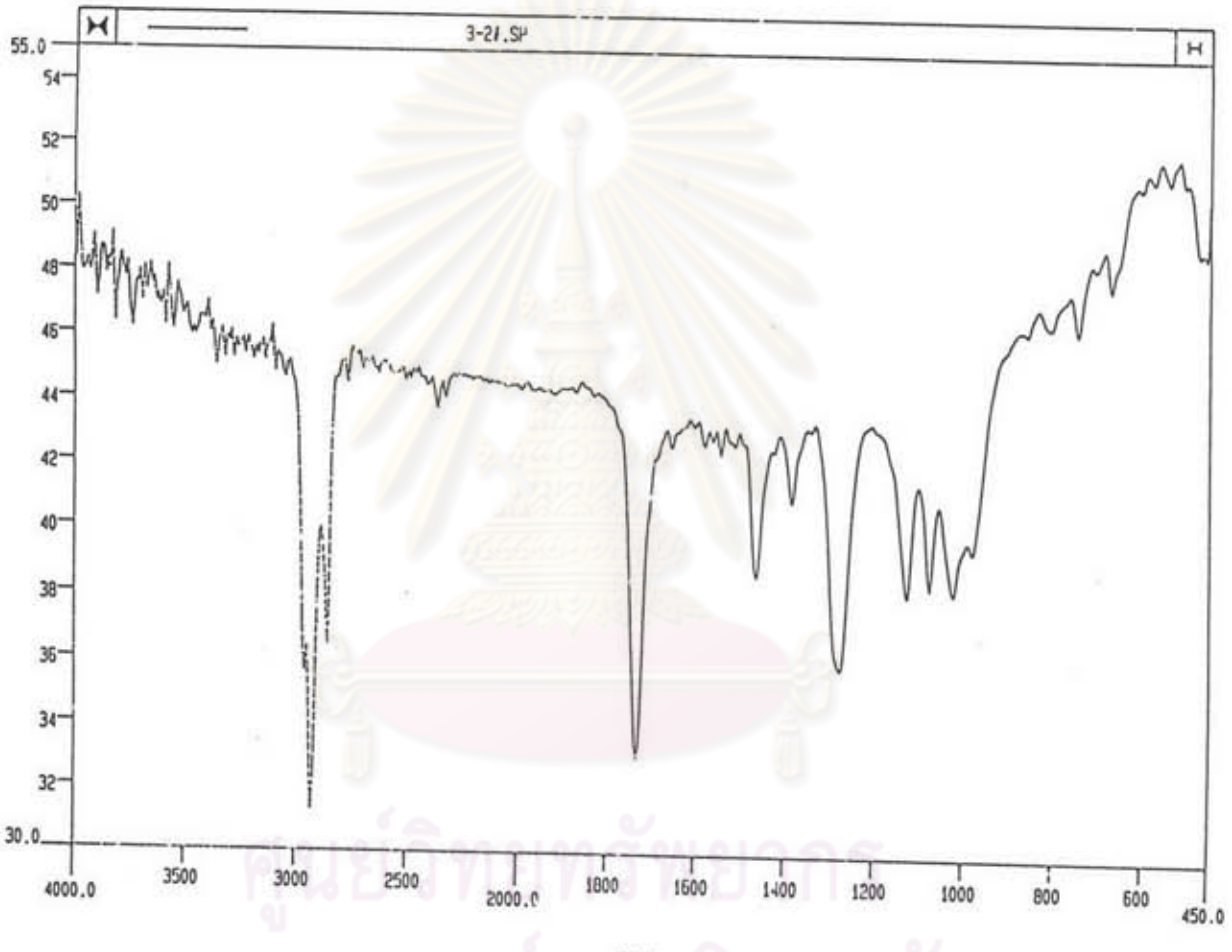

Figure A-88 FT-IR spectra of 2nd spot from PTT V100

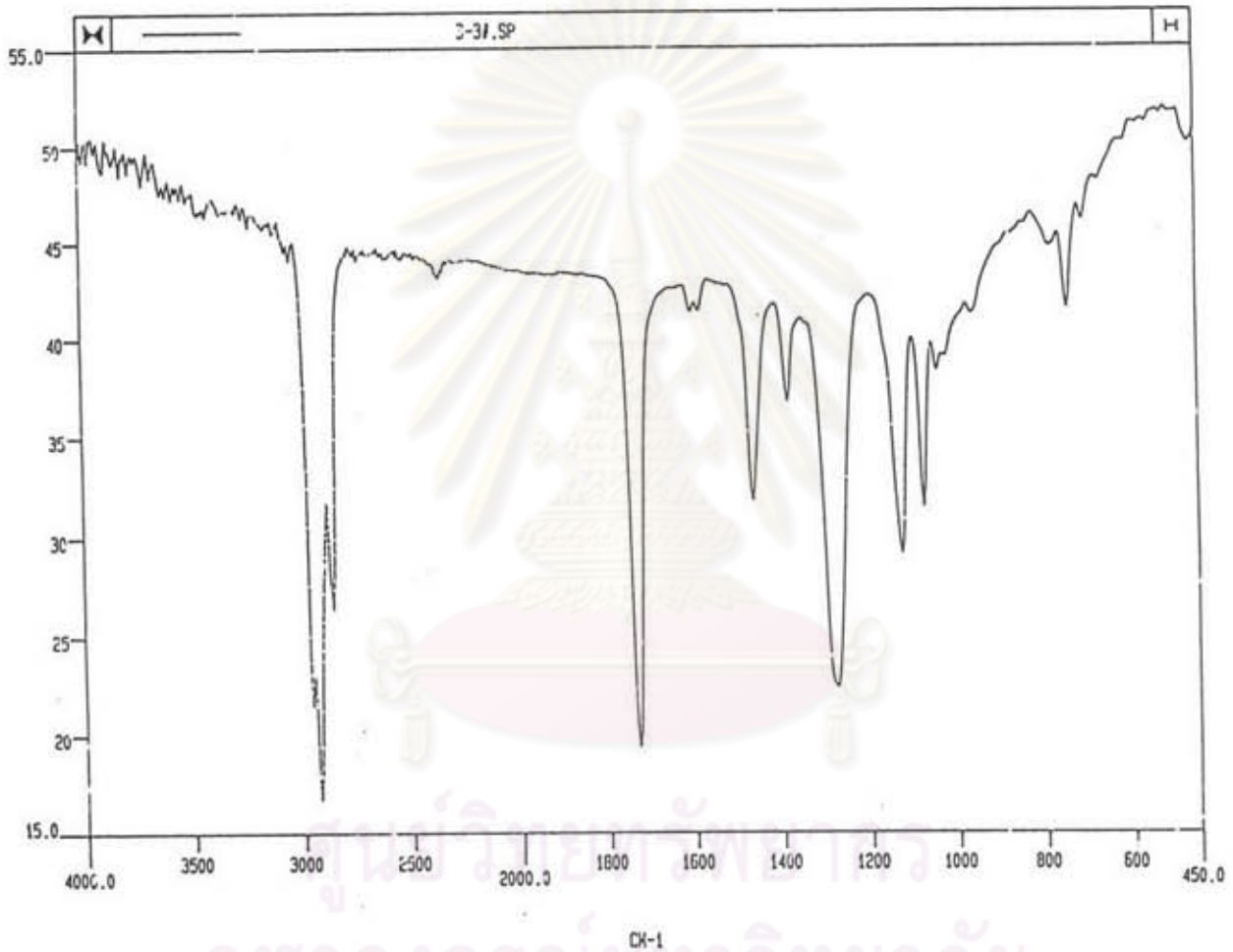

Figure A-89 FT-IR spectra of 3rd spot from PTT V100

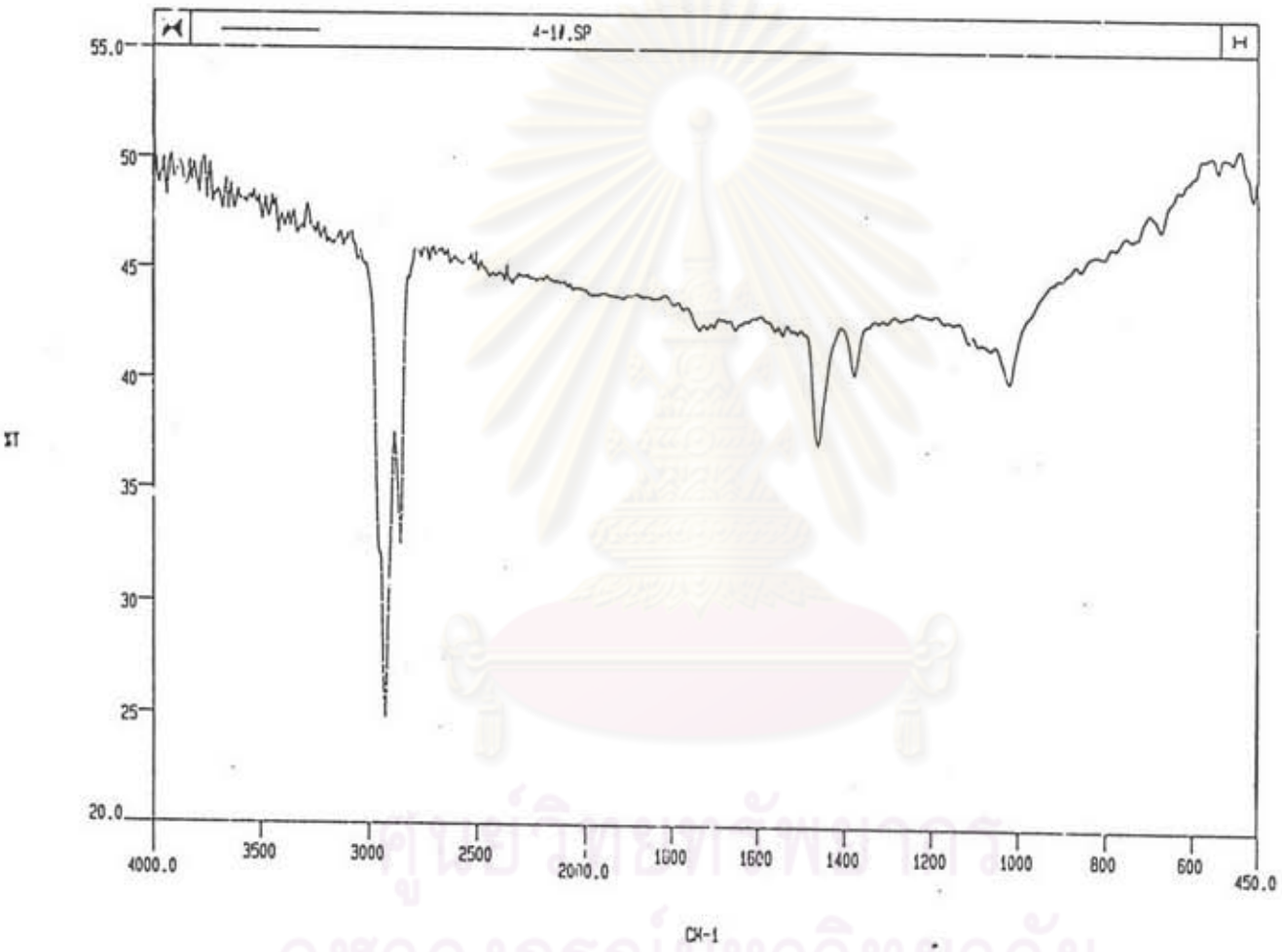

Figure A-90 FT-IR spectrum of 1st TLC spot from Caltex Havoline

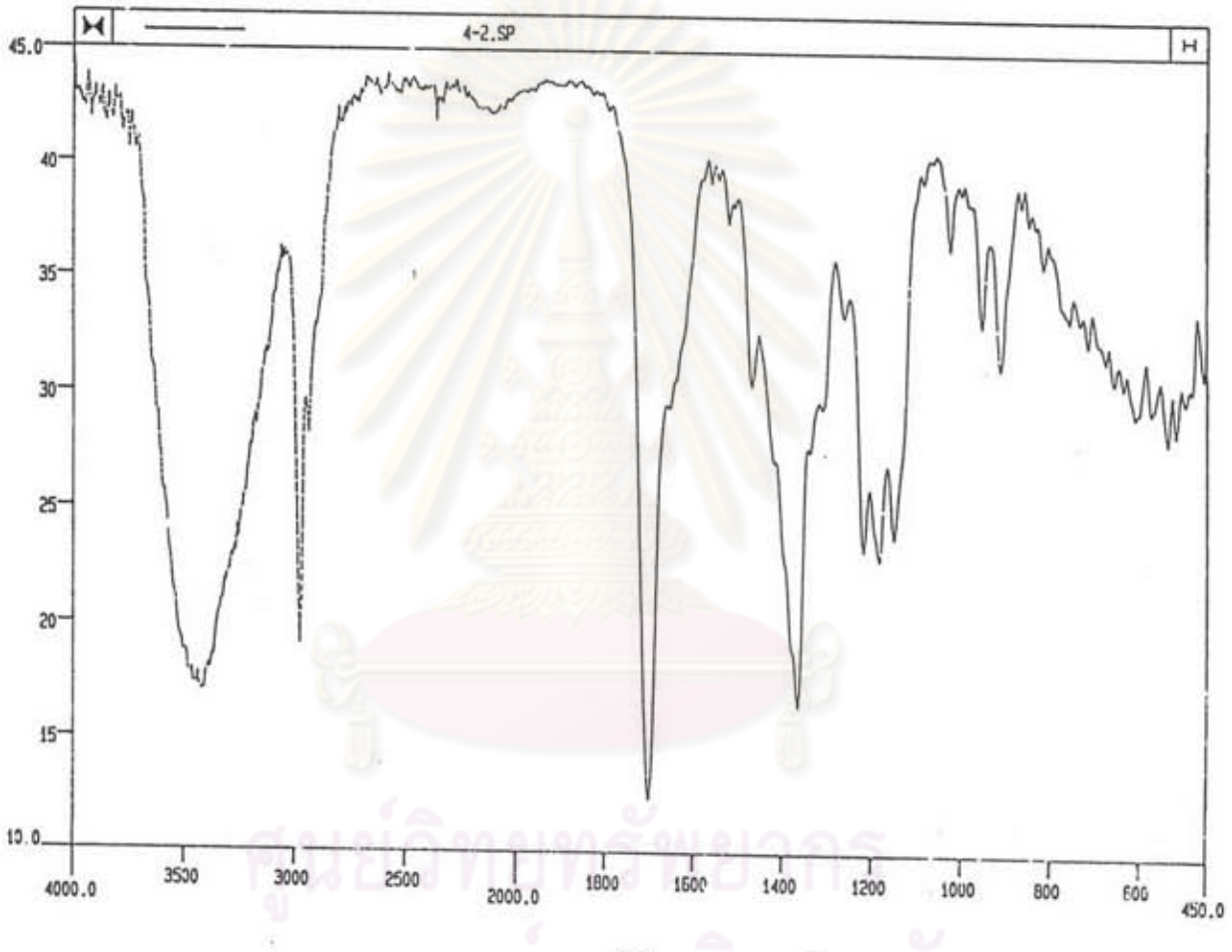

Figure A-91 FT-IR spectrum of 2nd TLC spot from Caltex Havoline

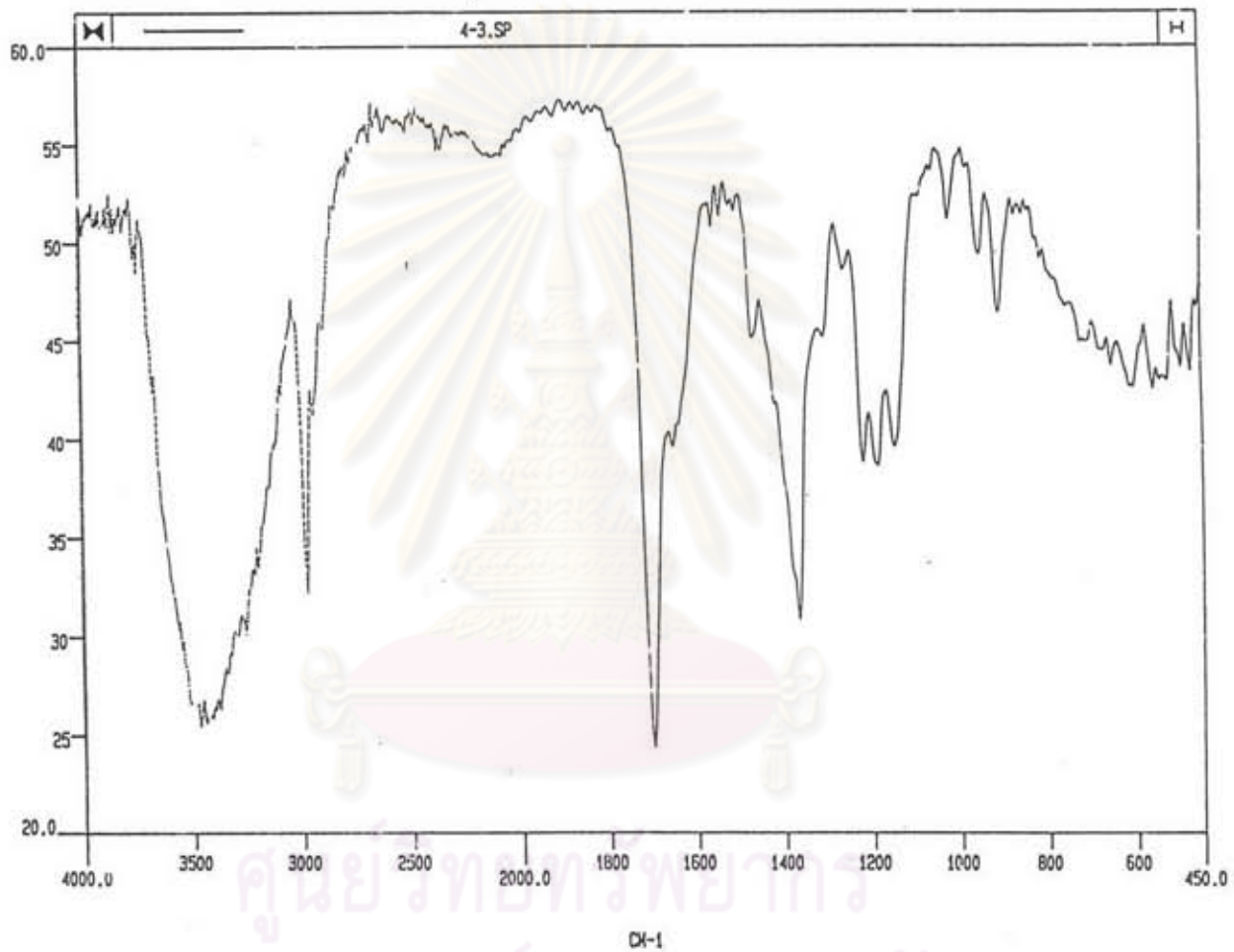

Figure A- 92 FT-IR spectrum of 3rd TLC spot from Caltex Havoline

VITA

Mr. Nopporn Wichailak was born on September 6, 1971 in Bangkok, Thailand. He graduated with a Bachelor Degree of Science majoring in Industrial Chemistry from King Mongkut's Institute of Technology North Bangkok in 1993. He has been a graduate student in graduate school at Chulalongkorn University majoring in Multidisciplinary Petrochemistry and Polymer. He graduated with a Master Degree of Science (Petrochemistry) in 1996.