REFERENCES

1. Lewis, K. J., Irwin, W. J., and Akhtar, S. "Biodegradable Poly(L-lactic acid) Matrices for the Sustained Delivery of Antisense Olignucleotides" *J. of Control. Rel.* **1995**, *37*, 173-183.

2. Coombes, A. G. A., Lavelle, E. C., and Davis, S. S. "Biodegradable Lamellar Particles of Poly(lactide) Induce Sustained Immune Responses to a Single Dose of Adsorbed Protein" *Vaccine* **1999**, *17*, 2410-2422.

3. Welch, W. C., Cornwall, G. B., Toth, J. M., Turner, A. S., Thomas, K. A., Gertszten, P. C., and Nemoto, E. M. "Use of Polylactide Resorbable Film as an Adhesion Barrier" *Orthopedics* **2002**, *25*, (10), S1121-S1130.

4. Tielinen, L., Puolakkainen, P., Pohjonen, T., Rautavuori, J., Törmälä, P., and Rokkanen, P. "The Effect of Transforming Growth Factor-β1, Released from a Bioabsorbable Self-Reinforced Polylactide Pin, on a Bone Defect" *Biomaterials* **2002**, *23*, 3817-3823.

5. Gugala, Z., and Gogolewski, S. "Healing of Critical-Size Segmental Bone Defects in the Sheep Tibiae using Bioresorbable Polylactide Membranes" *Injury. Int. J. Care Injured.* **2002**, *33*, S-B-71-76.

6. Mohan, A. M. "Farmers Lend an Ear to Grocery Packaging" *Packaging Digest* **2002**, October, 30.

7. Viljanmaa, M., Södergård, A., Törmälä, P. "The use of Lactic Acid-Based Hot Melt Adhesive in the Industrial Lamination Process" *Inter. J. of Adhesion & Adhesive* **2003**, *23*, 151-154.

8. Tsuji, H., and Ikada, Y. "Stereocomplex Formation Between Enantiomeric Poly(lactic acid)s. XI. Mechanical Properties and Morphology of Solution-Cast Films" *Polymer* **1999**, *40*, 6699-6708.

9. Toth, J. M., Wang, M., Scifert, J. L., Cornwall, G. B., Estes, B. T., Seim, H. B., and Turner, A. S. "Evaluation of 70/30 D,L-PLA for use as a Resorbable Interbody Fusion Cage" *Orthopedics* **2002**, *25*, (10), S1131-S1140.

10. Lucke, A., Teßmar, J., Schnell, E., Schmeer, G., and Göpferich, A. "Biodegradable Poly(D,L-lactic acid)-poly(ethylene glycol)-monomethyl ether Diblock Copolymers: Structures and Surface Properties Relevant to their use as Biomaterials" *Biomaterials* **2000**, *21*, 2361-2370.

11. Wan, Y., Chen, W., Yang, J., Bei, J., and Wang, S. "Biodegradable Poly(L-lactide)-poly(ethylene glycol) Multiblock Copolymer: Synthesis and evaluation of cell affinity" *Biomaterials* **2003**, *24*, 2195-2203.

12. Tasaka, F., Ohya, Y., and Ouchi, T. "Synthesis of Novel Comb-Type Polylactide and Its Biodegradability" *Macromolecules* **2001**, *34*, 5494-5500.

13. Tasaka, F., Ohya, Y., and Ouchi, T. "One-Pot Synthesis of Novel Branched Polylactide Through the Copolymerization of Lactide with Mevalonolactone" *Macromol Rapid Commun.* **2001**, *22*, (11), 820-824.

14. Ouchi, T., Kontani, T., and Ohya, Y. "Modification of Polylactide Upon Physical Properties by Solution-Cast Blends from Polylactide and Polylactide-Grafted Dextran" *Polymer* **2003**, *44*, 3927-3933.

15. Eguiburu, J. L., Iruin, J. J., Fernandez-Berridi, M. J., and San Ronán, J. "Blends of Amorphous and Crystalline Polylacties with Poly(methyl methacrylate) and Poly(methyl acrylate): A Miscibility Study" *Polymer* **1998**, *39*, (26), 6891-6897.

16. Ryner, M., and Albertsson, A. C. "Resorbable and Highly Elastic Block Copolymers from 1,5-Dioxepan-2-one and L-Lactide with Controlled

Tensile Properties and Hydrophilicity" *Biomacromolecules* **2002**, *3*, 601-608.

17. Fujiwara, T., Miyamolto, M., Kimura, Y., and Sakurai, S. "Intriguing Morphology Transformation due to the Macromolecular Rearrangement of Poly(L-lactid)-block-poly(oxyethylene): from Core-Shell Nanoparticles to Band Structures via Fragments of Unimolecular Size" *Polymer* **2001**, *42*, 1515-1523.

18. Aida, T., Allcock, H. R., Brunelle, D. J., Chujo, Y., Crivello, J. V., Duda, A., Goethals, E. J., Inoue, S., Kim, J., Kobayashi, S., Kubisa, P., Penczek, S., Quirk, R. P., Saegusa, T., Schrock, R. R., and Slomkowski, S. "Ring-Opening Polymerization Mechanisms, Catalysis, Structure, Utility" *Hanser Publishers, Munich Vienna New York Barcelona*: **1993**, pp. 2-6,17-15,88.

19. Maeda, Y. "Ring-Opening Copolymerization of Succinic Anhydride with Ethylene Oxide Initiated by Magnesium Diethoxide" *Polymer* **1997**, *38*, (18), 4719-4725.

20. Takasu, A., Ito, M., Inai, Y., Hirabavashi, T., and Nishimura, Y. "Synthesis of Biodegradable Polyesters by Ring-Opening Copolymerization of Cyclic Anhydrides Containing a Double Bond with 1,2-Epoxybutane and One-Pot Preparation of the Itaconic Acid-Based Polymeric Network" *Polym. J.* **1999**, *31*, (11-1), 961-969.

21. Tokar, R., Kubisa, P., and Penczek, S. "Cationic Polymerization of Glycidol: Coexistance of the Activated Monomer and Active Chain End Mechanism" *Macromolecules* **1994**, *27*, 320-322.

22. Dworak, A., Walach, W., and Trzebicka, B. "Cationic Polymerization of Glycidol. Polymer Structure and Polymerization Mechanism" *Macromol. Chem. Phys*. **1995**, *196*, 1963-1970.

23. Sunder, A., Hanselmann, R., Frey, H., and Mülhaupt, R. "Controlled Synthesis of Hyperbranched Polyglycerols by Ring-Opening Multibranching Polymerization" *Macromolecules* **1999**, *32*, 4240-4246.

24. Taton, D., Leborgne, A., Sepulchre, M., and Spassky, N. "Synthesis of Chiral and Racemic Functional Polymers from Glycidol and Thioglycidol" *Macromol. Chem. Phys*. **1994**, *195*, 139-148.

25. Walach, W., Kowalczuk, A., Trzebicka, B., and Dworak, A. "Synthesis of High-Molar Mass Arborescent-Branched Polyglycidol via Sequential Grafting" *Macromol. Rapid Commun.* **2001**, *22*, (15), 1272-1277.

26. Tsuji, H., and Ikada, Y. "Physical Properties of Polylactides" *Current Trends in Polym. Sci.* **1999**, *4*, 27-46.

27. Abe, A., Albertsson, A. C., Cantow, H. J., Dušek, K., Edwards, S., Höcker, H., Joanny, J. F., Kausch, H. H., Lee, K. S., McGrath, J. E., Monnerie, L., Stupp, S. I., Suter, U. W., Wegner, G., Young, R. J. "Advances in Polymer Science" *Springer-Verlag Berlin Heidelberg*: **2002**, pp. 16-18, 46-47, 59-61, 80-81.

28. Dubois, Ph., Jacobs, C., Jérôme, R., and Teyssié, Ph. "Macromolecular Engineering of Polylactones and Polylactides. 4. Mechanism and Kinetics of Lactide Homopolymerization by Aluminium Isopropoxide" *Macromolecules* **1991**, *24*, 2266-2270.

29. Nakayama, A., Kawasaki, N., Arvanitoyannis, I., Iyoda, J., and Yamamoto, N. "Synthesis and Degradability of a Novel Aliphatic Polyester: Poly(β-methyl-δ-valerolactone-co-L-lactide)" *Polymer* **1995**, *36*, 1295-1301.

30. Maeda, Y., Nakayama, A., Aevanitoyannis, I., Kawasaki, N., Hayashi, K., Yamamoto, N., and Aiba, S. "Synthesis and Characterization of Copoly(succinicanhydride-ethylene oxide)-Poly(L-lactide) Block Copolymer" *Polym. J.* **2000**, *32*, (4), 307-315.

31. Fujiwara, T., Miyamoto, M., and Kimura, Y. "Self-Organization of Diblock and Triblock Copolymers of Poly(L-lactide) and Poly(oxyethylene) into Nanostructured Bands and Their Network System. Proposition of a Doubly Twisted Chain Conformation of Poly(L-lactide)" *Macromolecules* **2001**, *34*, 4043-4050.

32. Chen, X., McCarthy, S. P., and Gross, R. A. "Synthesis and Characterization of [L]-Lactide-Ethylene Oxide Multiblock Copolymers" *Macromolecules* **1997**, *30*, 4295-4301.

33. Arvanitoyannis, I., Nakayama, A., Kawasaki, N., and Yamamoto, N. "Novel Star-Shaped Polylactide with Glycerol using Stannous Octoate or Tetraphenyl Tin as Catalyst: 1. Synthesis, Characterization and Study of Their Biodegradbility" *Polymer* **1995**, *36*, (15), 2947-2956.

34. Arvanitoyannis, I., Nakayama, A., Psomiadou, E., Kawasaki, N., and Yamamoto, N. "Synthesis and Degradability of a Novel Aliphatic Polyester Based on L-Lactide and Sorbitol: 3" *Polymer* **1996**, *37*, (4), 651-660.

35. Arvanitoyannis, I., Nakayama, A., Kawasaki, N., and Yamamoto, N. "Novel Polylactides with Aminopropanediol or Aminohydroxymethylpropanediol using Stannous Octoate as ctalyst; Synthesis, Characterization and Study of their Biodegradabillity: 2" *Polymer* **1995**, *36*, (11), 2271-2279.

36. Korhonen, H., Helminen, A., and Seppälä, J. V. "Synthesis of Polylactides in the Presence of Co-initiators with Different Numbers of Hydroxyl Groups" *Polymer* **2000**, *42*, 7541-7549.

37. Francis, A. U., Venkatachalam, S., Kanakavel, M., Ravindran, P. V., and Ninan, K. N. "Structural Characterization of Hydroxyl Terminated Polyepichlorohydrin Obtained using Boron Trifluoride etherate and Stannic Chloride as Initiators" *Euro. Polym. J.* **2003**, *39*, 831-841.

APPENDIX

APPENDIX

NMR spectra of LLA, G and poly(LLA-co-G)

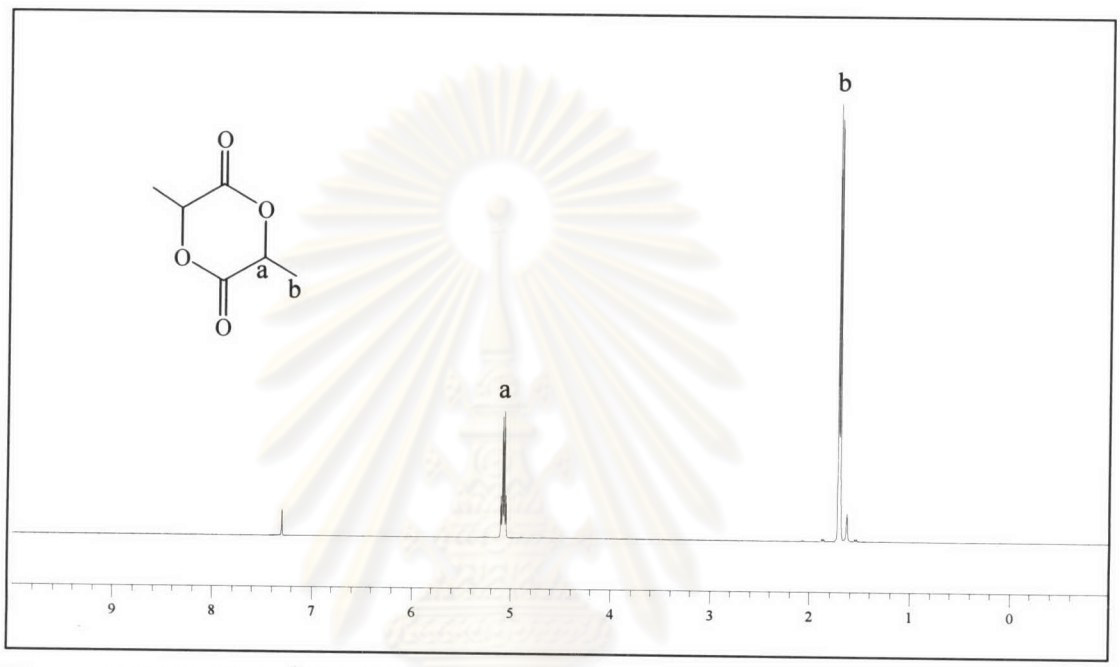

Figure A-1 400 MHz ^{1}H NMR spectra of LLA..

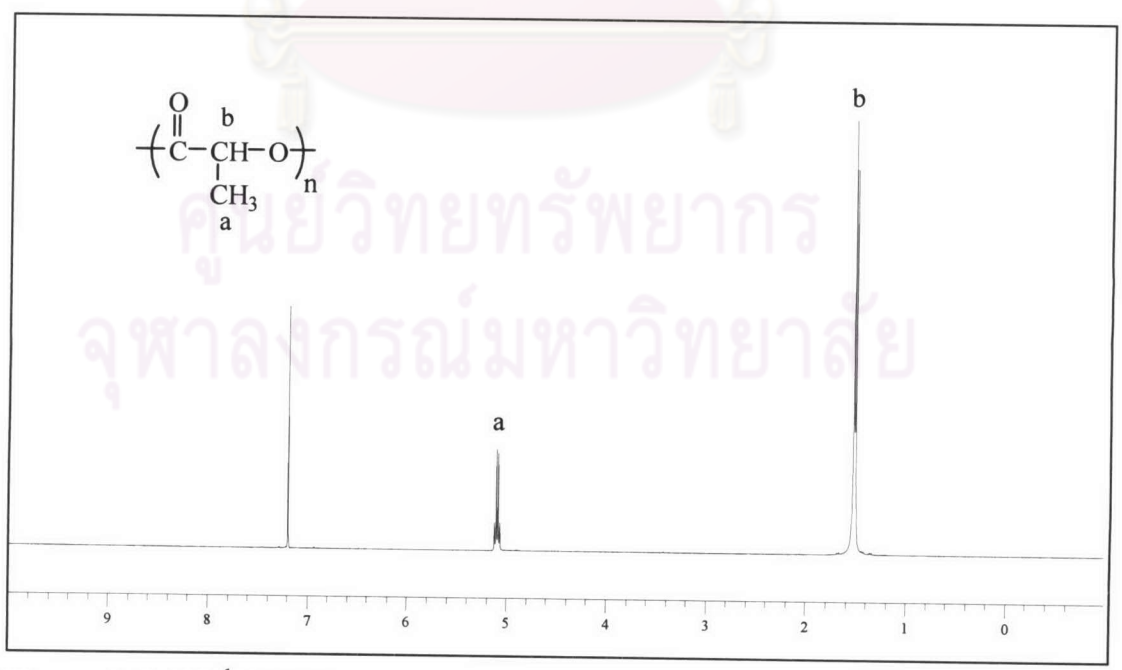

Figure A-2 400 ^{1}H NMR spectra of PLLA (entry 6, table 4.1), 0.3 mol% $Sn(Oct)_2$, 130 °C, 2 days.

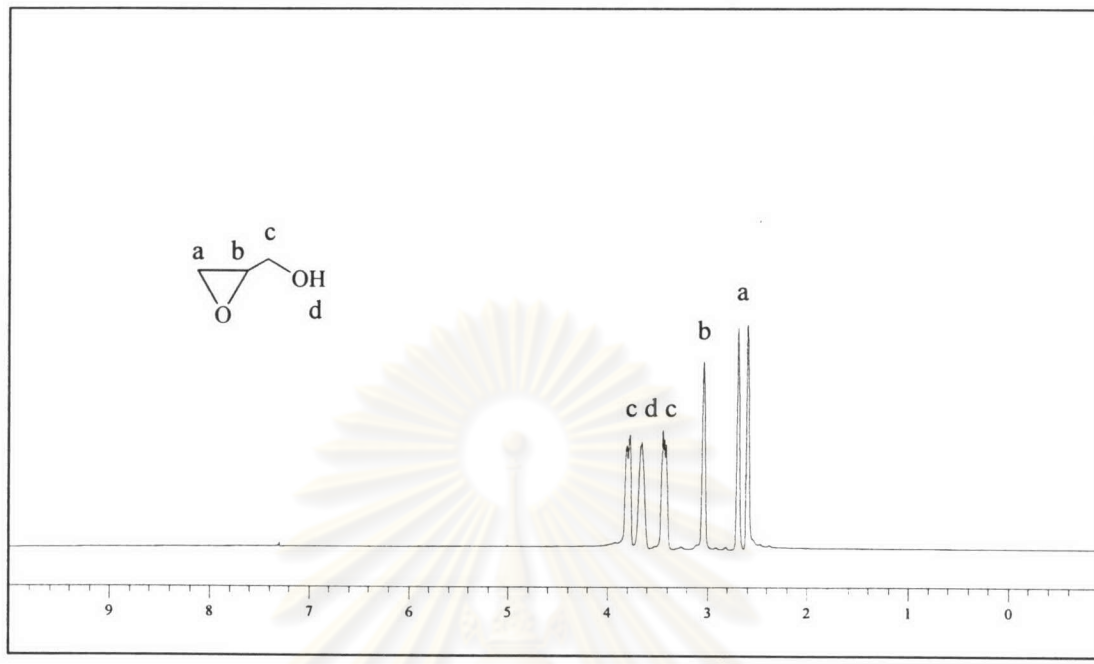

Figure A-3 400 MHz ^{1}H NMR spectra of G.

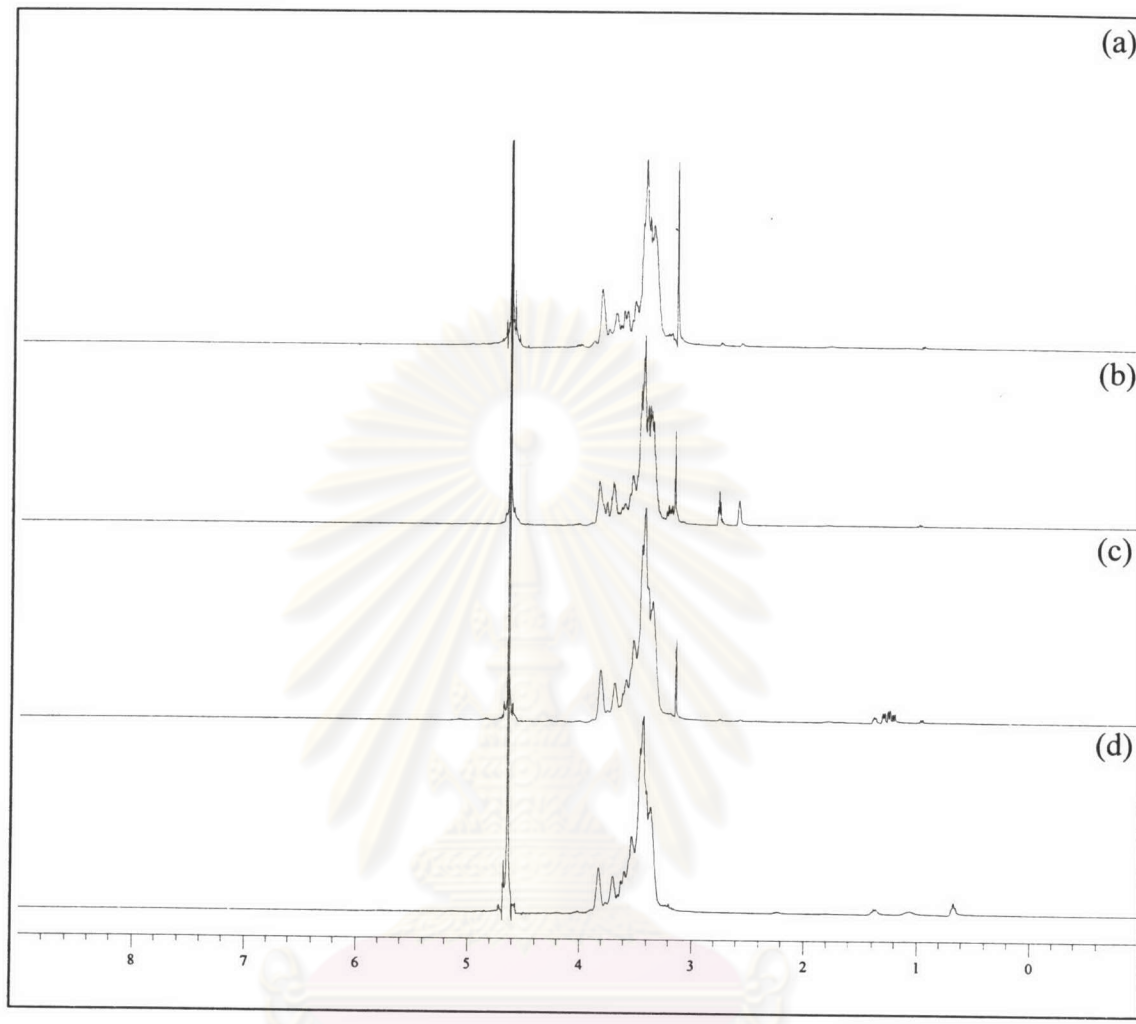

Figure A-4 400 MHz ^{1}H NMR spectra of entries 1-4 from table 4.2, 0.3 mol% initiator ((a) $Mg(OEt)_2$, (b) $Al(O^iPr)_3$, (c) $SnPh_4$, and (d) $Sn(Oct)_2$), 100 °C, 3 days.

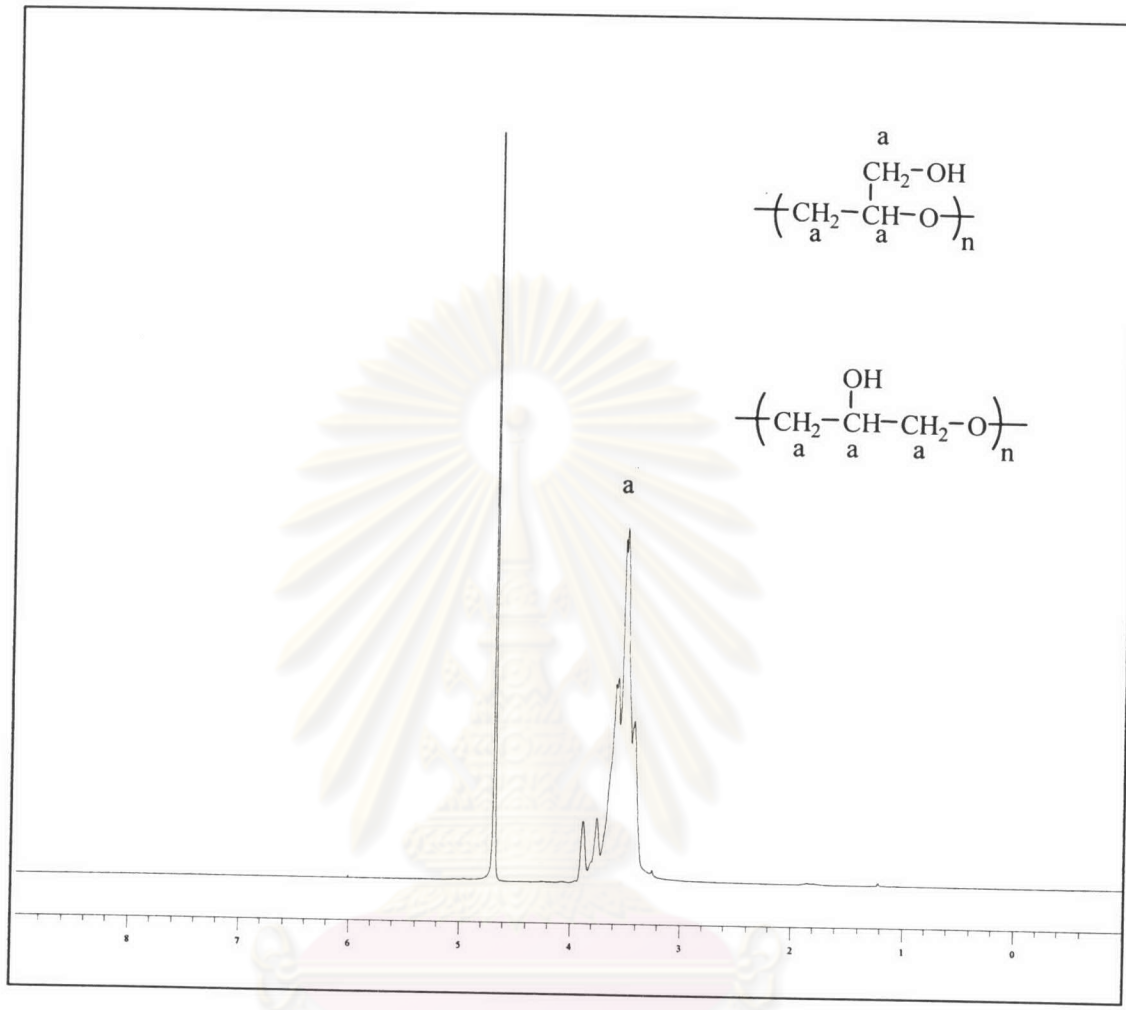

Figure A-5 400 MHz ^{1}H NMR spectra of PG (entry 3, table 4.3), 0.06 mol% $BF_3 \cdot OEt_2$, -11 to –5 °C, 2 days.

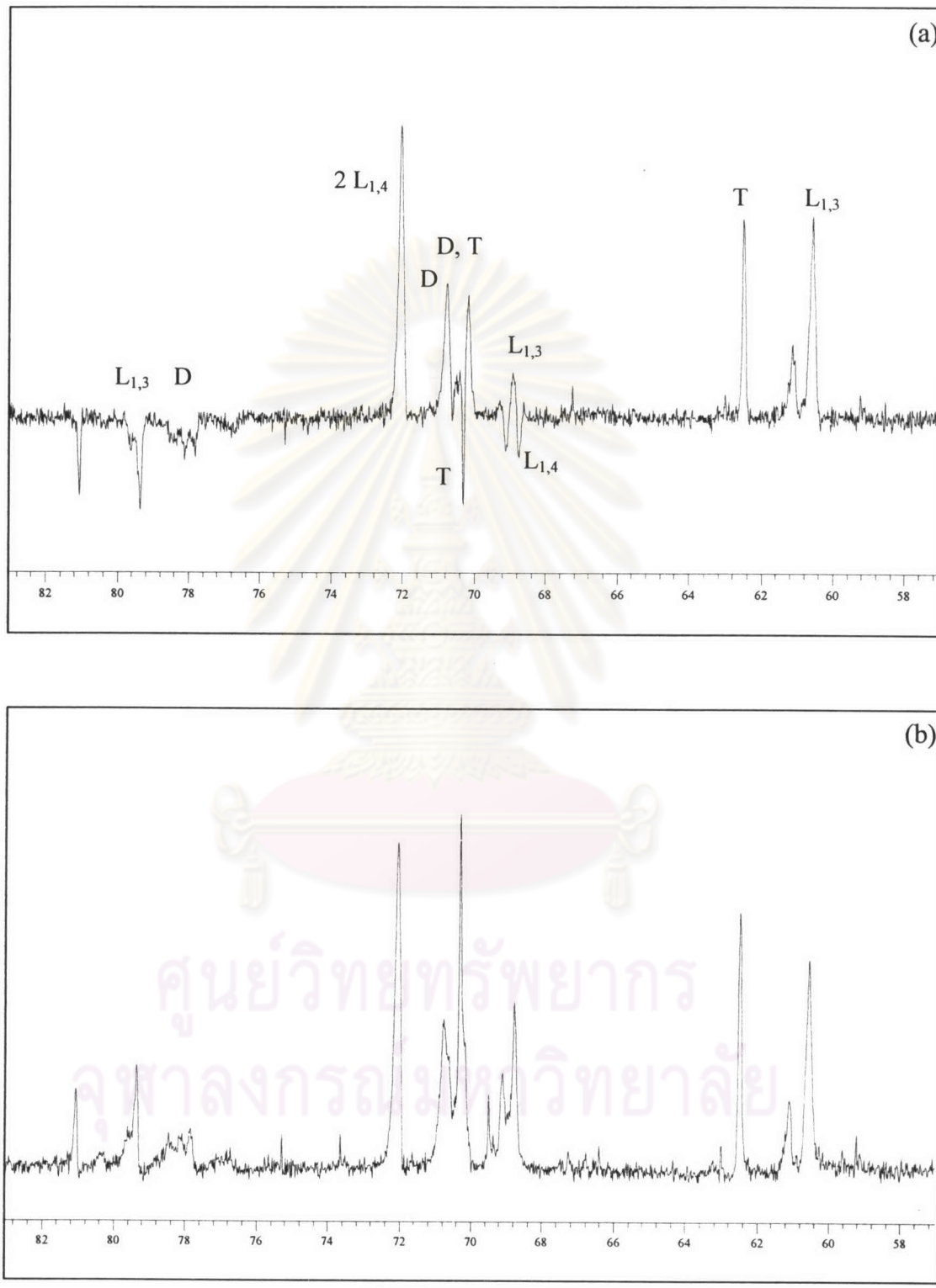

Figure A-6 400 MHz (a) DEPT and (b) ^{13}C NMR spectra of PG (entry 3, table 4.3), 0.06 mol% $BF_3 \cdot OEt_2$, -11 to –5 °C, 2 days.

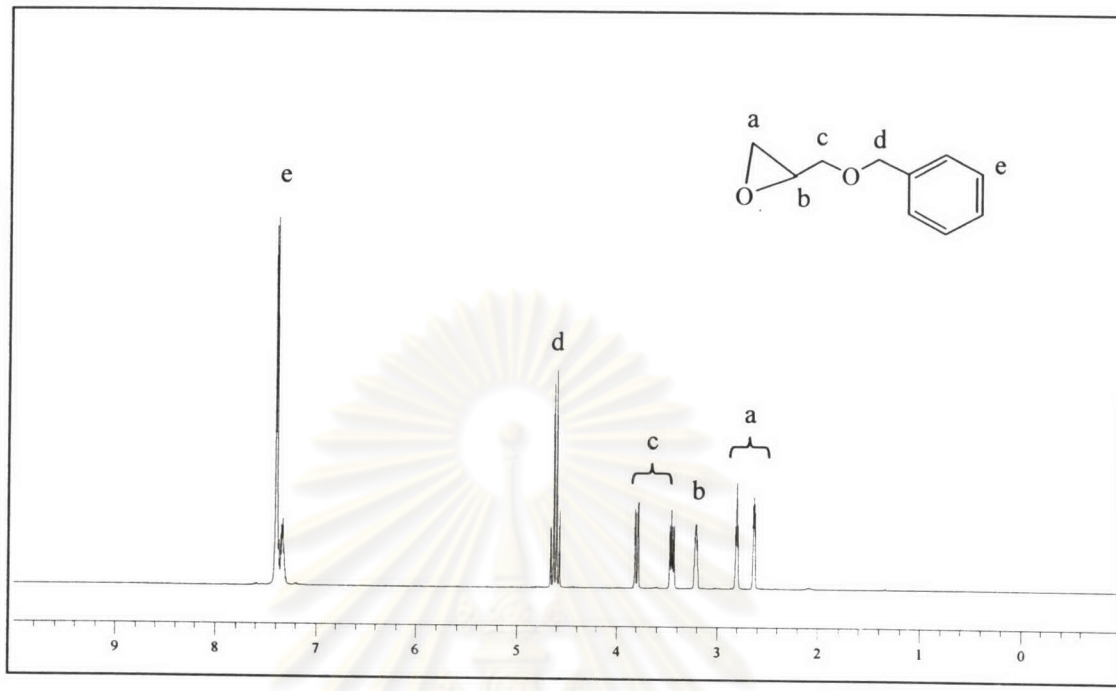

Figure A-7. 400 MHz ^{1}H NMR spectra of GBn.

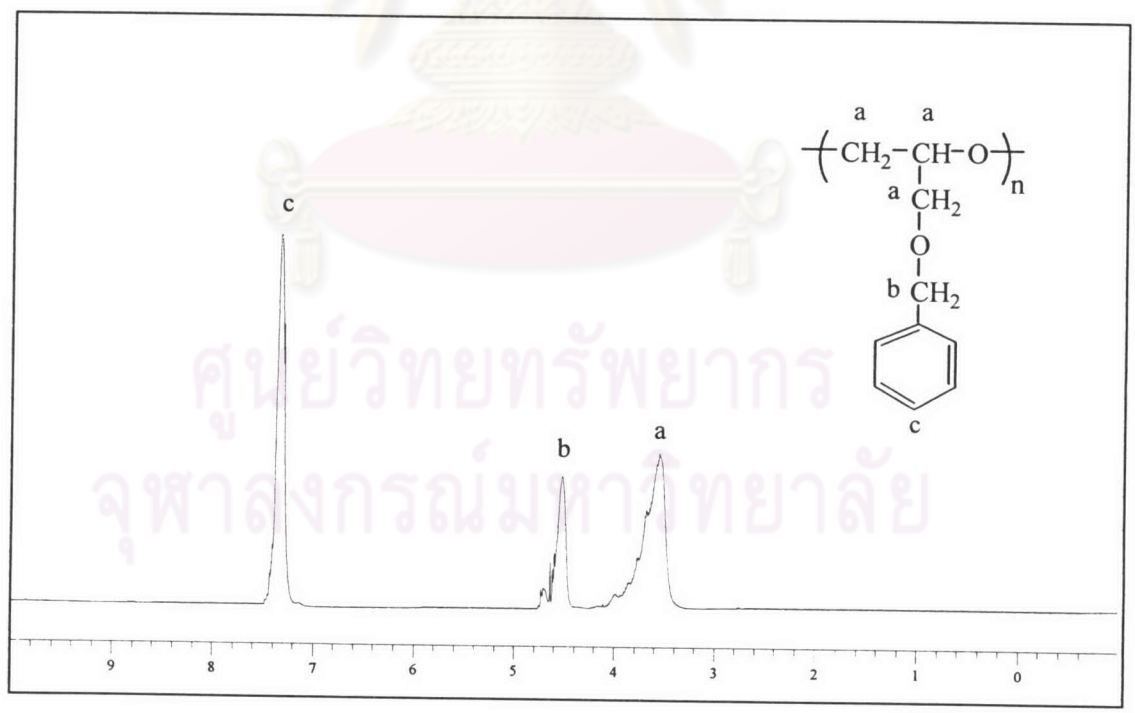

Figure A-8 400 MHz ^{1}H NMR spectra of PGBn (entry 8, table 4.4), 0.8 mol% $SnCl_4$, RT (30 °C), 7 days.

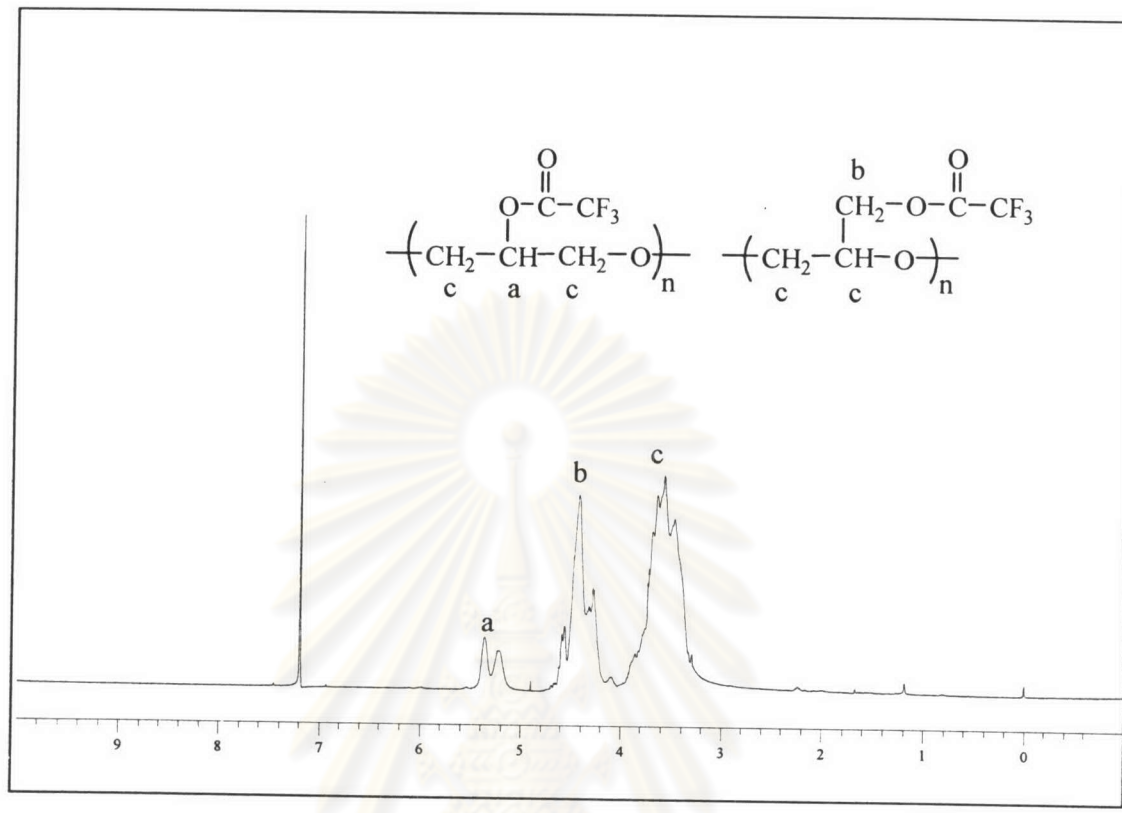

Figure A-9 400 MHz ^{1}H NMR spectra of trifluoro acetyl ester derivative of PG entry 3, table 4.3 ($PG\text{-}OCOCF_3$).

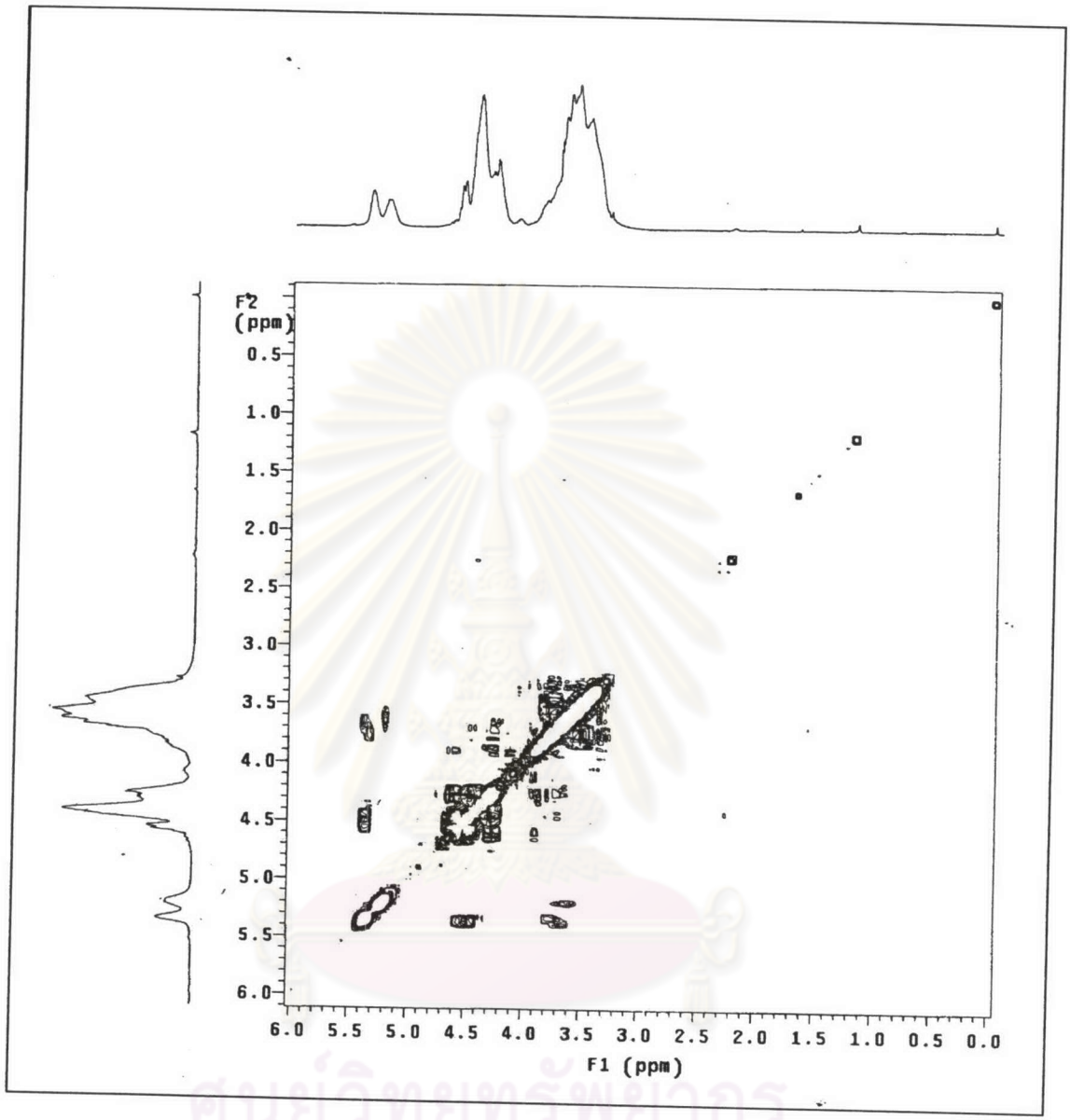

Figure A-10 400 MHz COSY-NMR spectra of trifluoro acetyl ester derivative of PG entry 3, table 4.3 (PG-$OCOCF_3$).

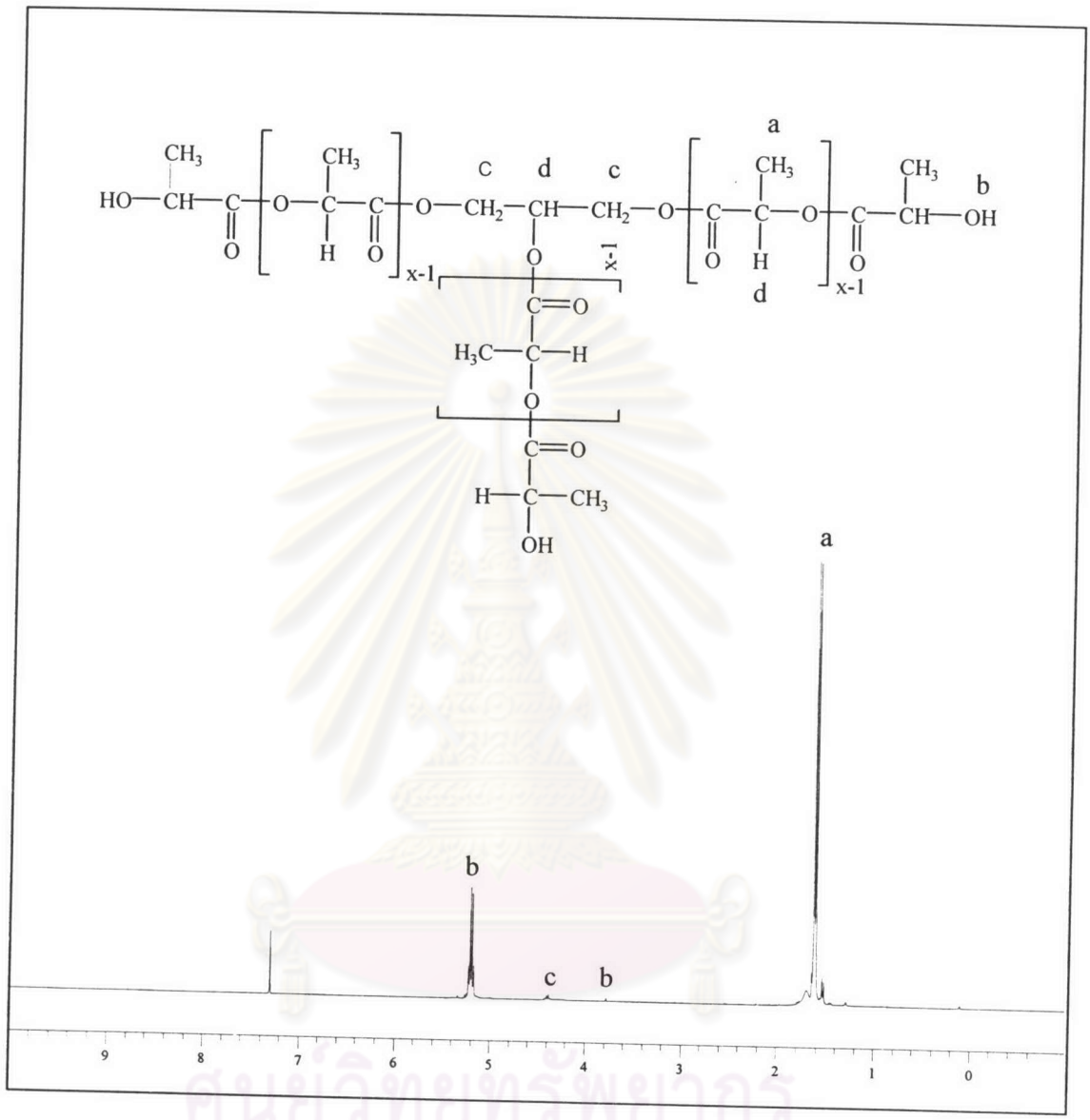

Figure A-11 400 MHz ^{1}H NMR spectra of PLLA-co-GL, 40:1 LLA:GL feed molar ratio, 0.5 mol% $Sn(Oct)_2$, 130 °C, 4 days.

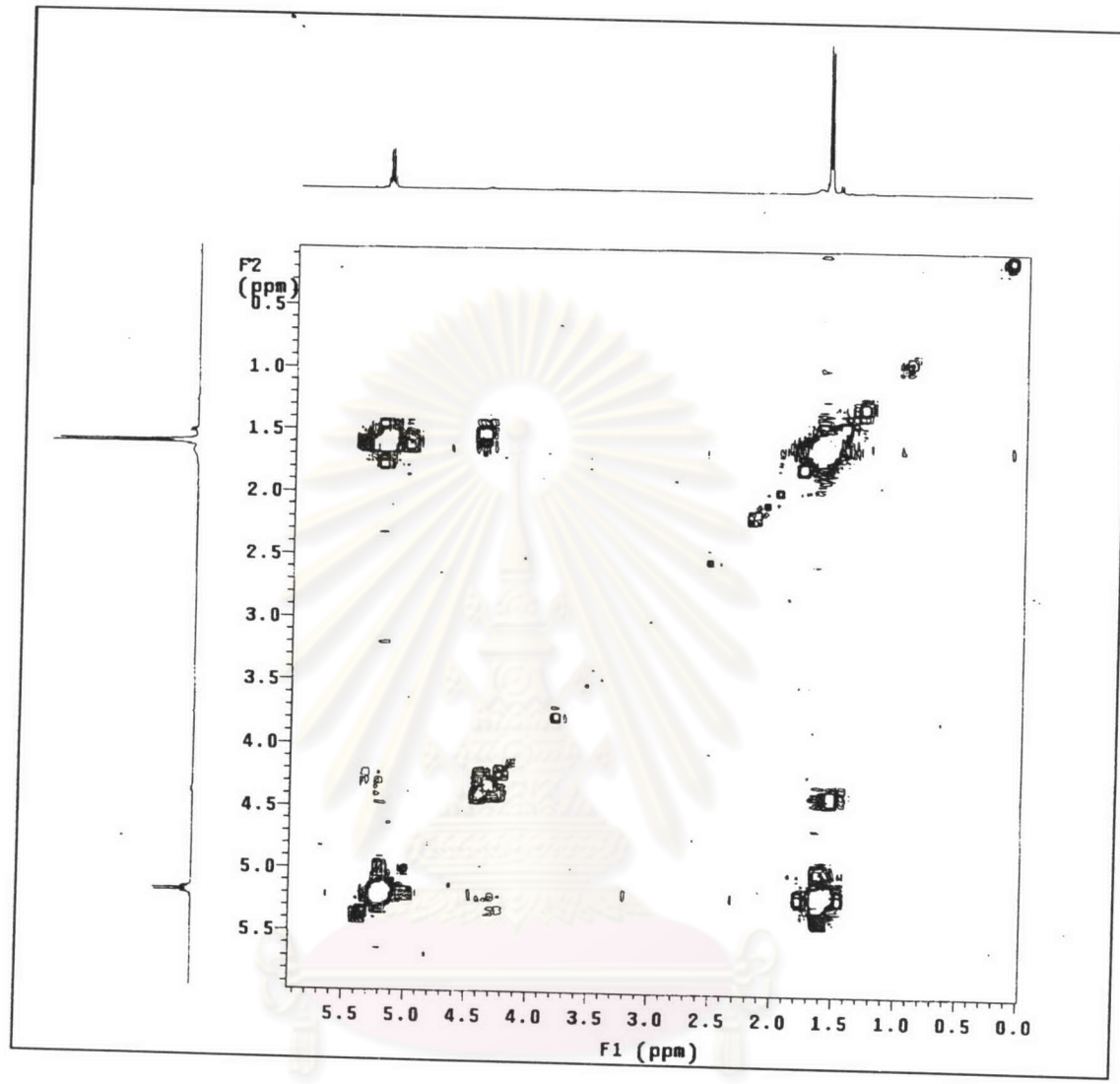

Figure A-12 400 MHz COSY-NMR spectra of PLLA-co-GL, 40:1 LLA:GL feed molar ratio, 0.5 mol% $Sn(Oct)_2$, 130 °C, 4 days.

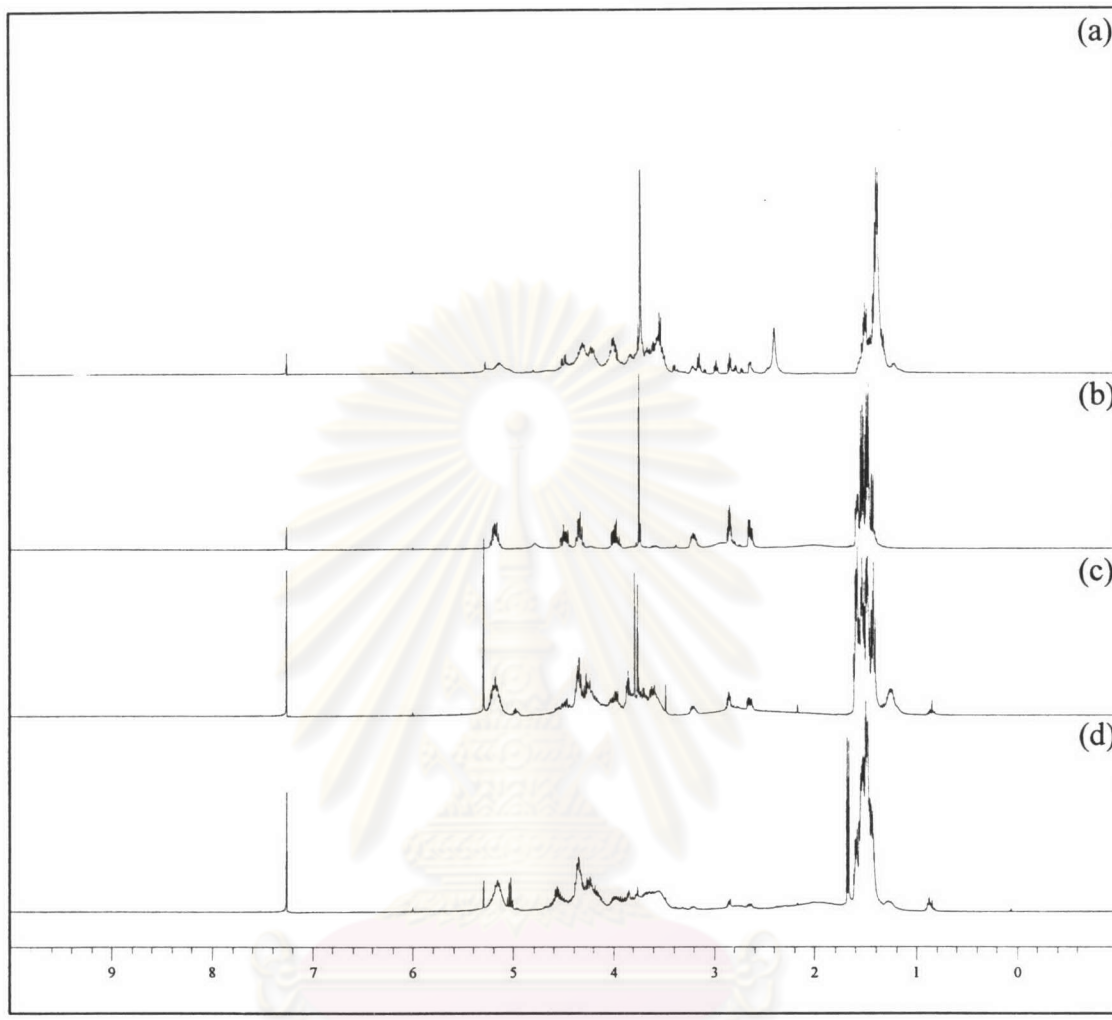

Figure A-13 400 MHz ^{1}H NMR spectra of entries 4, 7, 10, and 11 from table 4.5, 1:1 LLA:G feed molar ratio, 0.3 mol% initiator ((a) entry 4, $Mg(OEt)_2$, (b) entry 7, $Al(O^{i}Pr)_3$, (c) entry 10, $SnPh_4$, and (d) entry 11, $Sn(Oct)_2$), one step addition, 100 °C, 3 days, using a glove box.

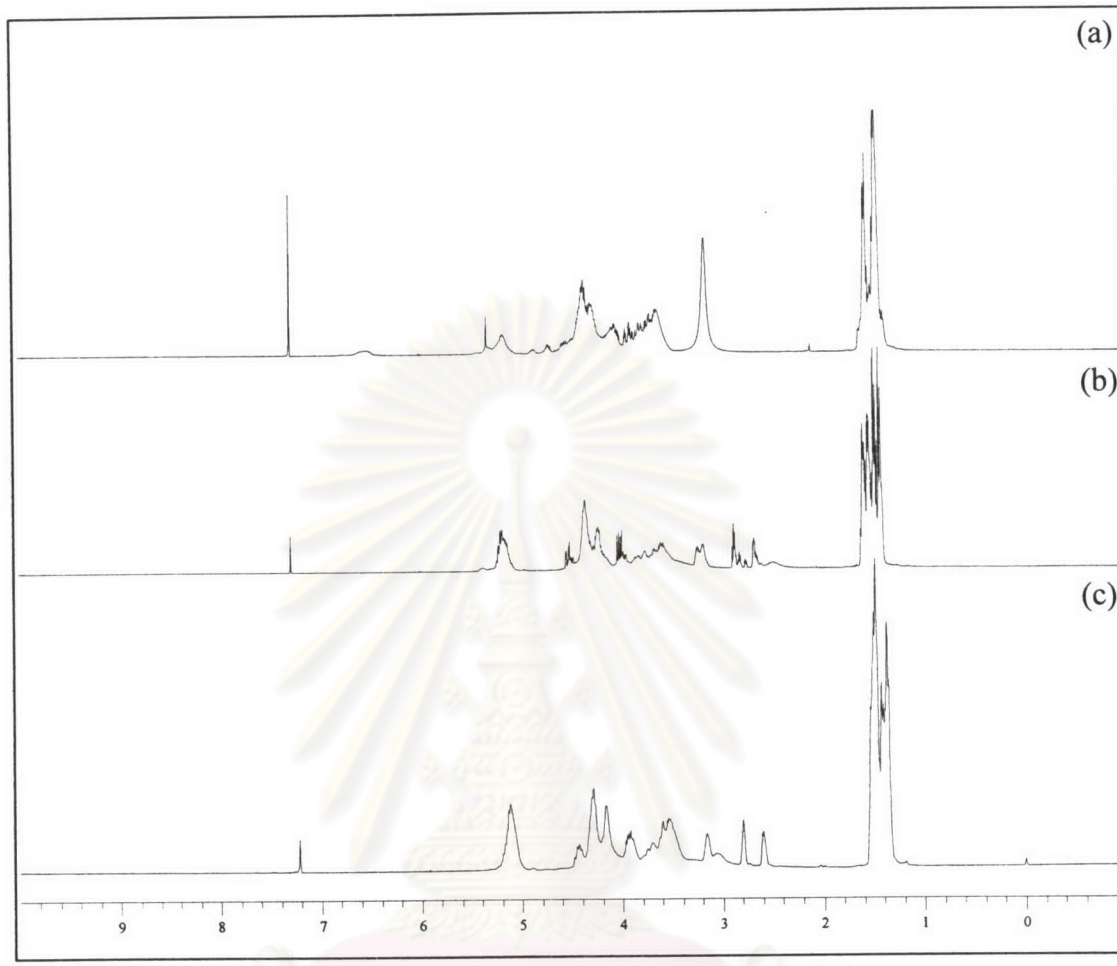

Figure A-14 400 MHz ^{1}H NMR spectra of entry 1, 5, and 8 from table 4.5, 1:1 LLA:G feed molar ratio, 0.3 mol% initiator ((a) entry 1, $Mg(OEt)_2$, (b) entry 5, $Al(O^{i}Pr)_3$, and (c) entry 8, $SnPh_4$), 100 °C, 1 day, using drying tube.

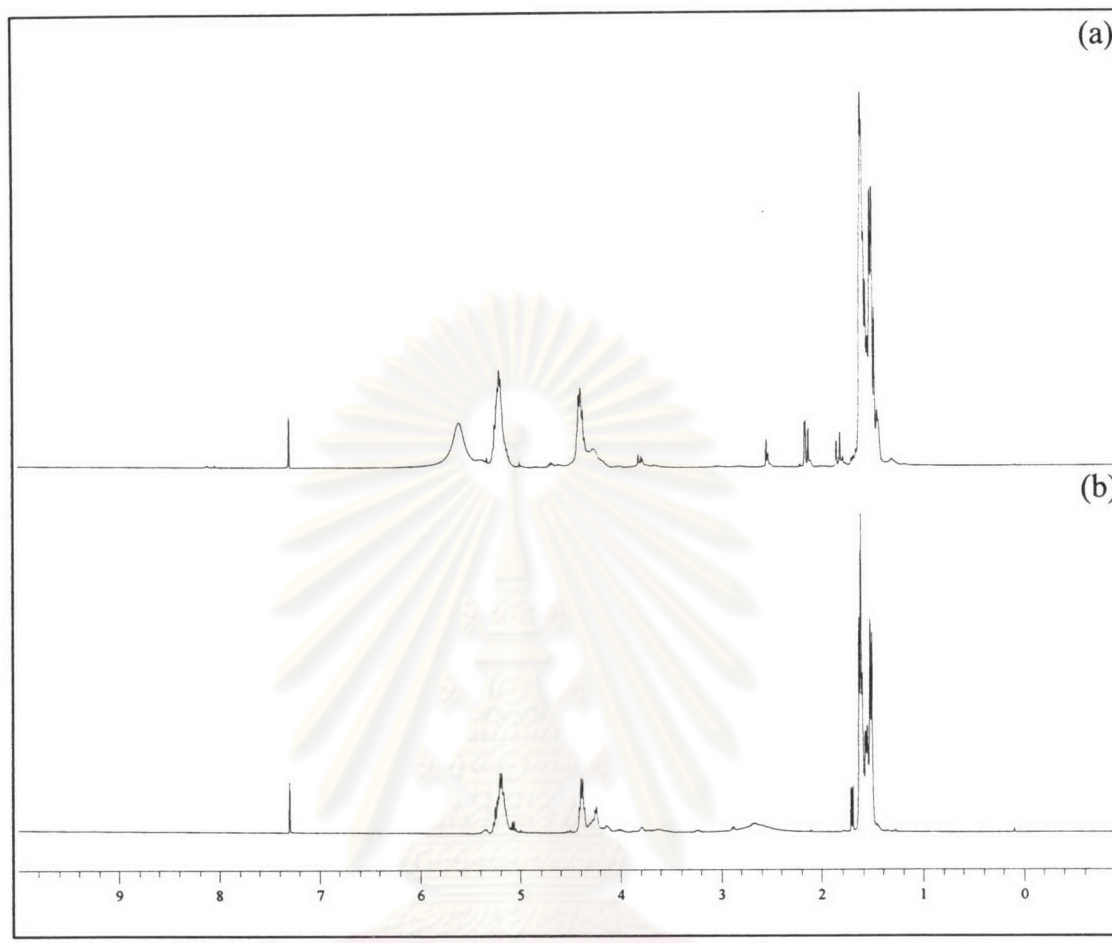

Figure A-15 400 MHz ^{1}H NMR spectra of (a) entry 1 from table 4.6, 5:1 LLA:G feed molar ratio and (b) entry 1 from table 4.7, 9:1 LLA:G feed molar ratio, 0.3 mol% $Mg(OEt)_2$, 120 °C, 7 days, using drying tube.

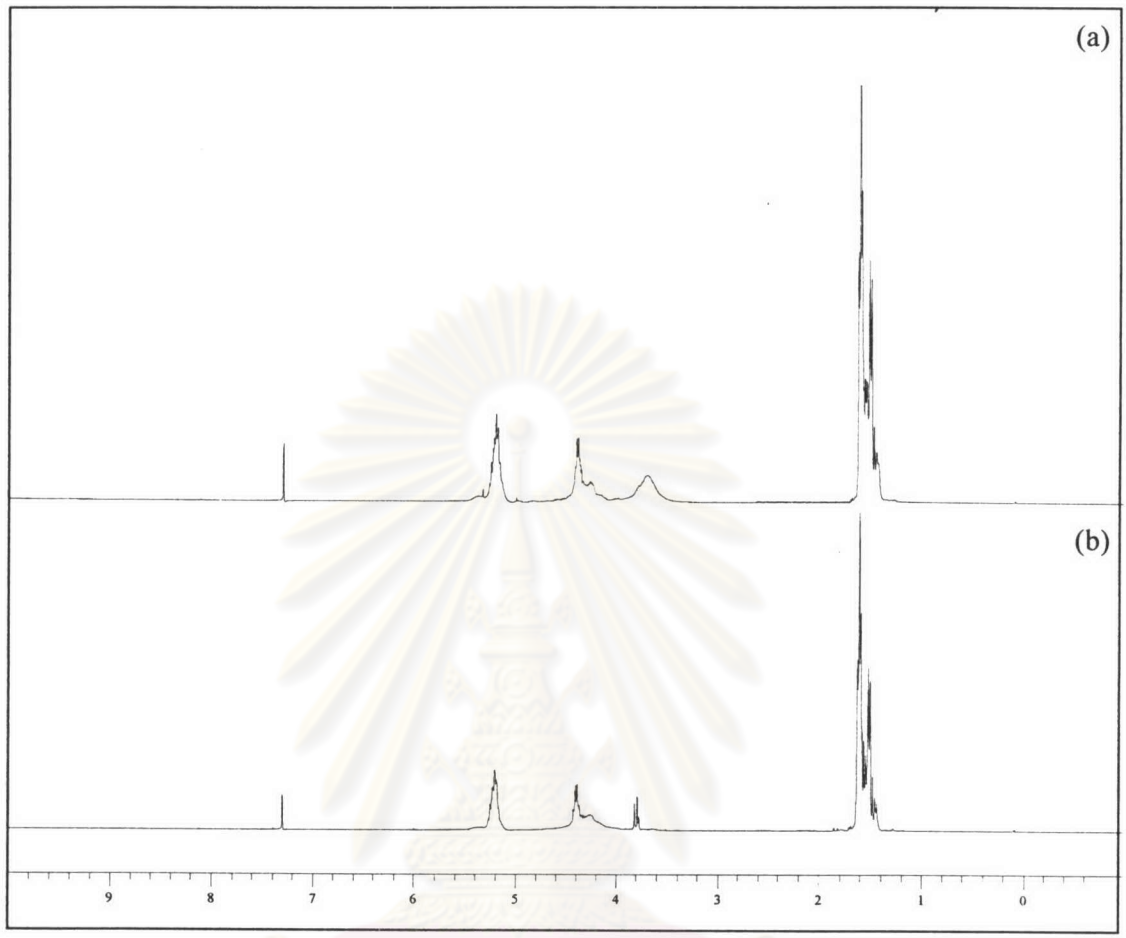

Figure A-16 400 MHz ^{1}H NMR spectra of (a) entry 2 from table 4.6, 5:1 LLA:G feed molar ratio and (b) entry 2 from table 4.7, 9:1 LLA:G feed molar ratio, 0.3 mol% $SnPh_4$, 120 °C, 7 days, using drying tube.

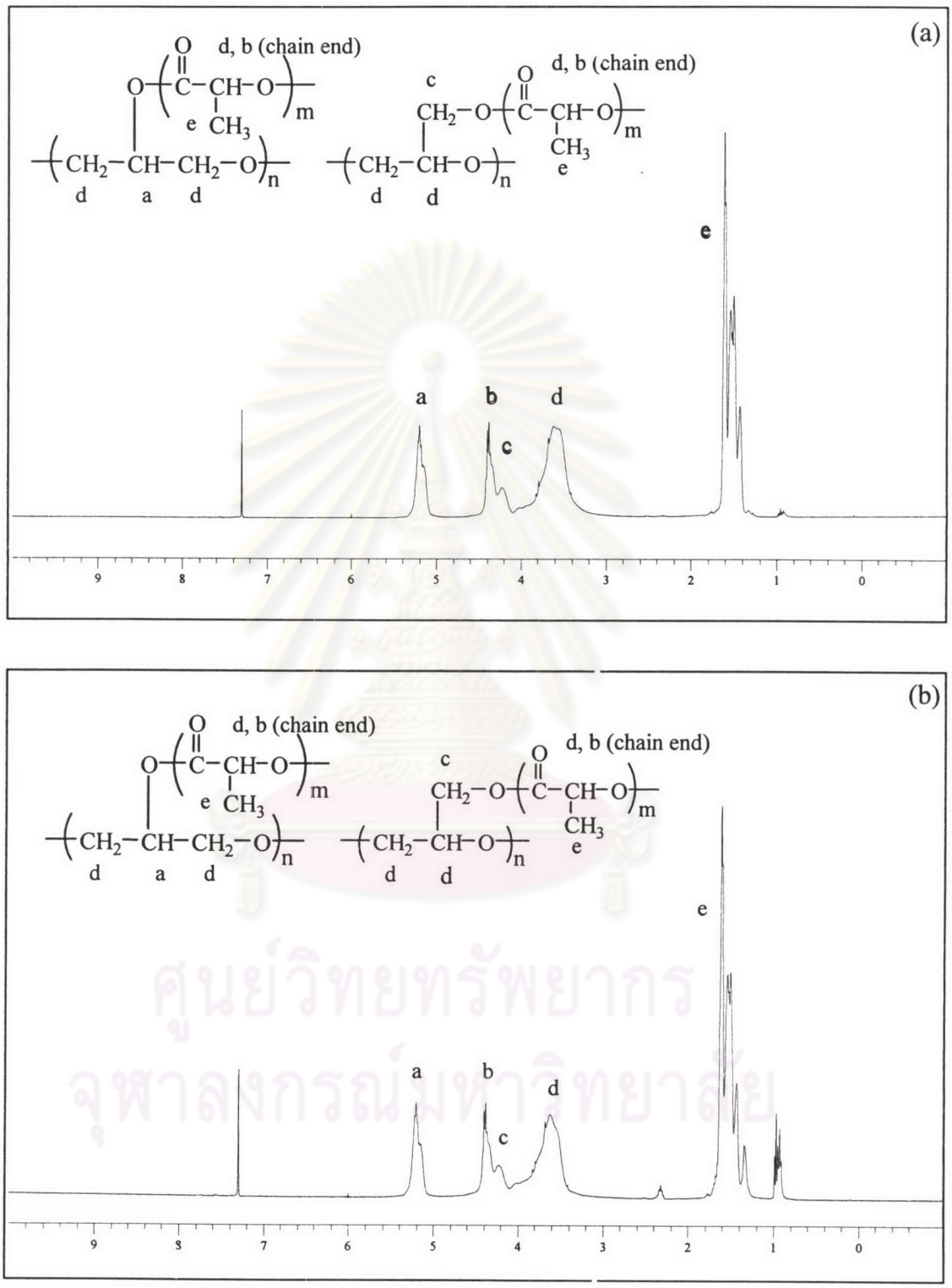

Figure A-17 400 MHz ^{1}H NMR spectra of (a) entry 1, table 4.9, 20:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$ and (b) entry 2, table 4.9, 20:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$, 130 °C, 1 day.

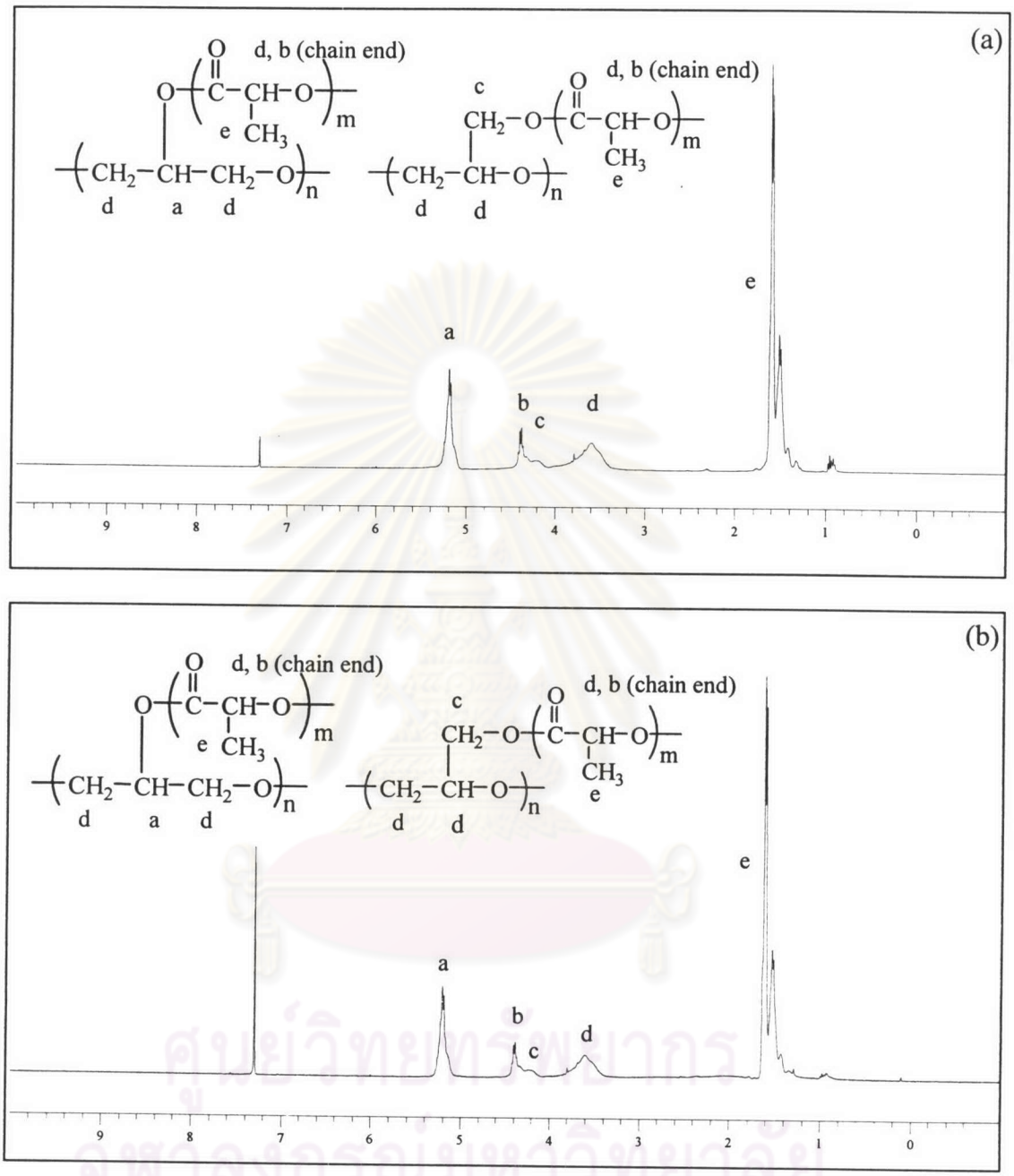

Figure A-18 400 MHz ^{1}H NMR spectra of (a) entry 3, table 4.9, 40:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$ and (b) entry 4, table 4.9, 40:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$, 130 °C, 1 day.

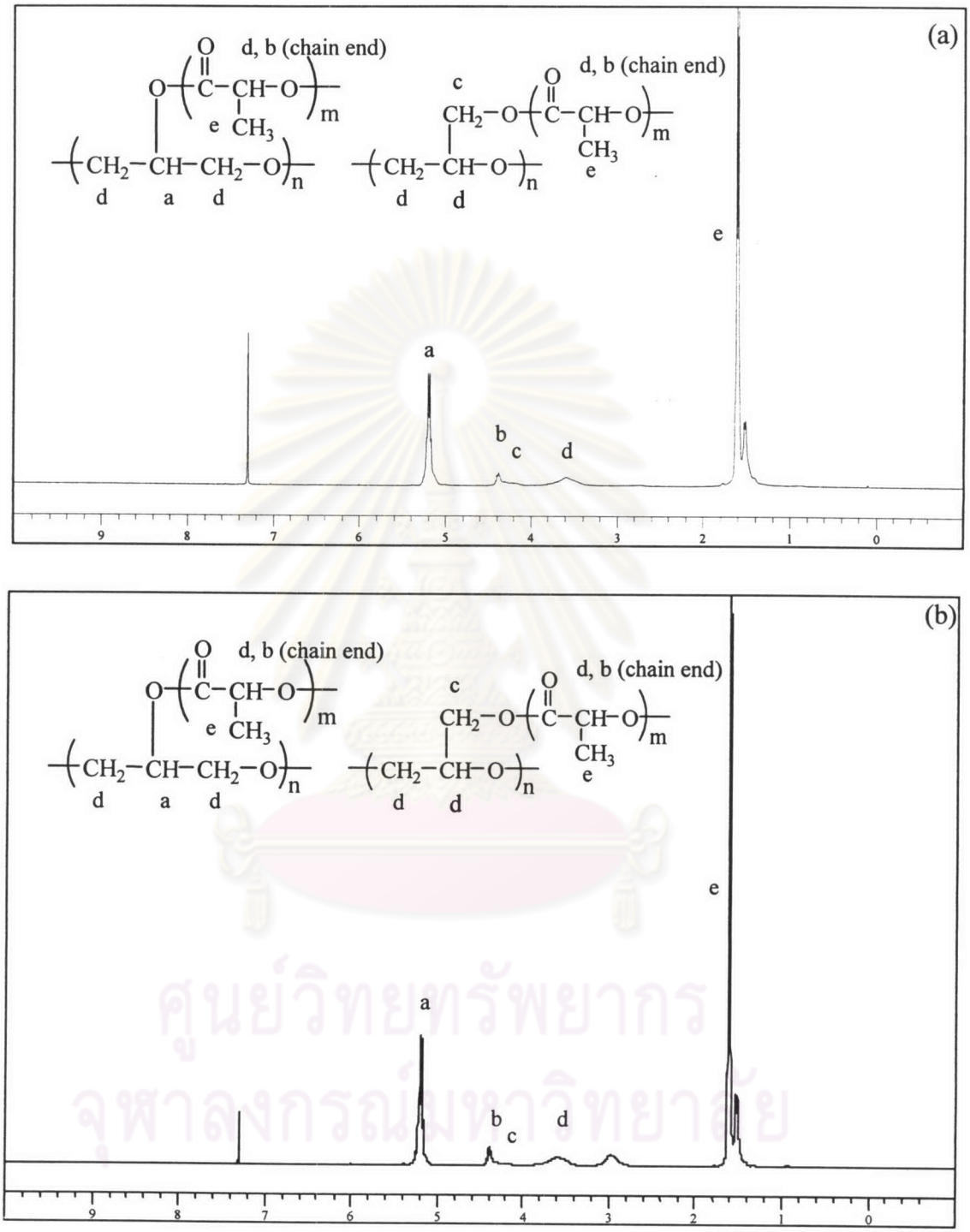

Figure A-19 400 MHz ^{1}H NMR spectra of entry 5, table 4.9, 60:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$, (a) insoluble in MeOH and (b) soluble in MeOH, 130 °C, 1 day.

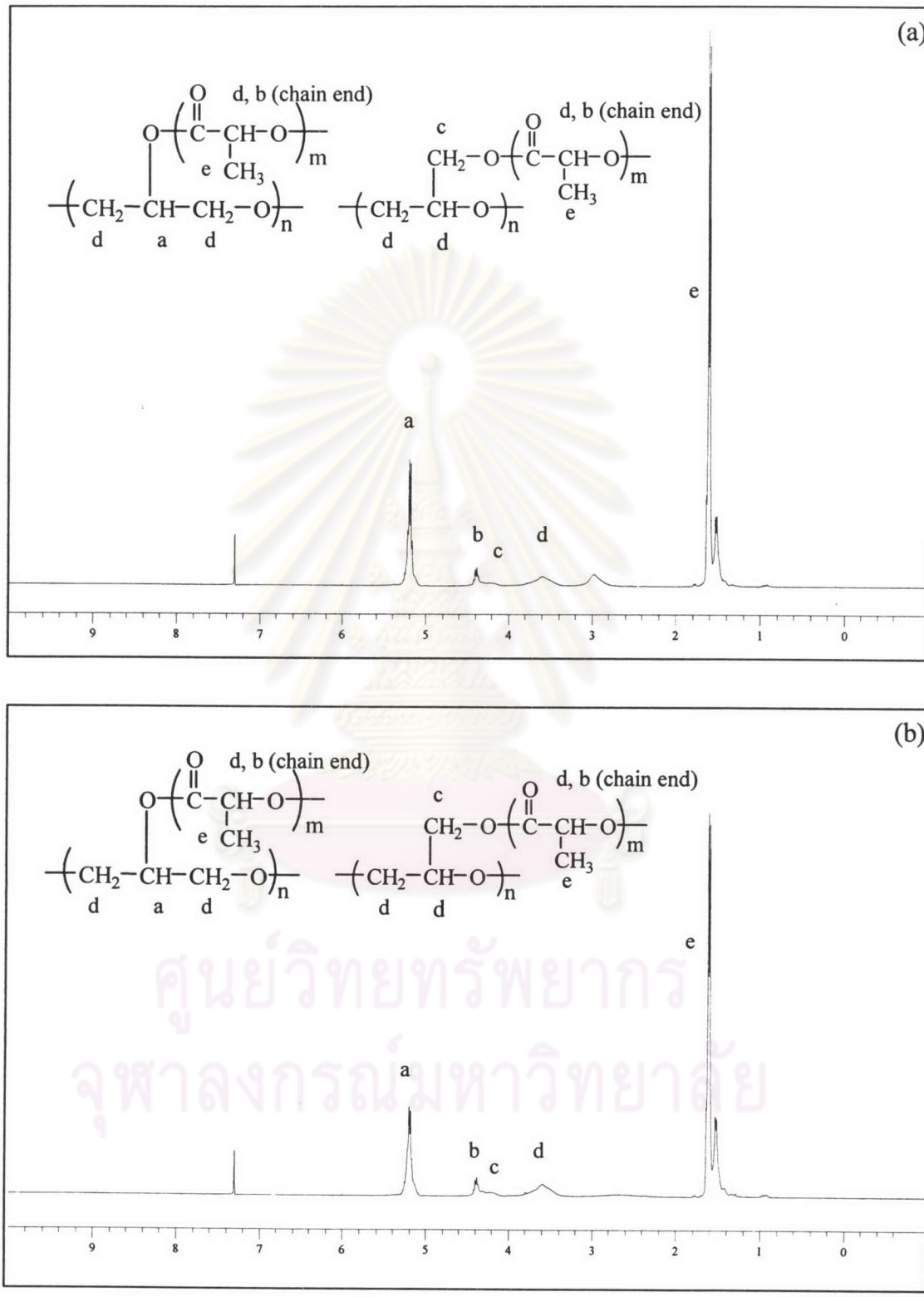

Figure A-20 400 MHz ^{1}H NMR spectra of entry 6, table 4.9, 60:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$, (a) insoluble in MeOH and (b) soluble in MeOH, 130 °C, 1 day.

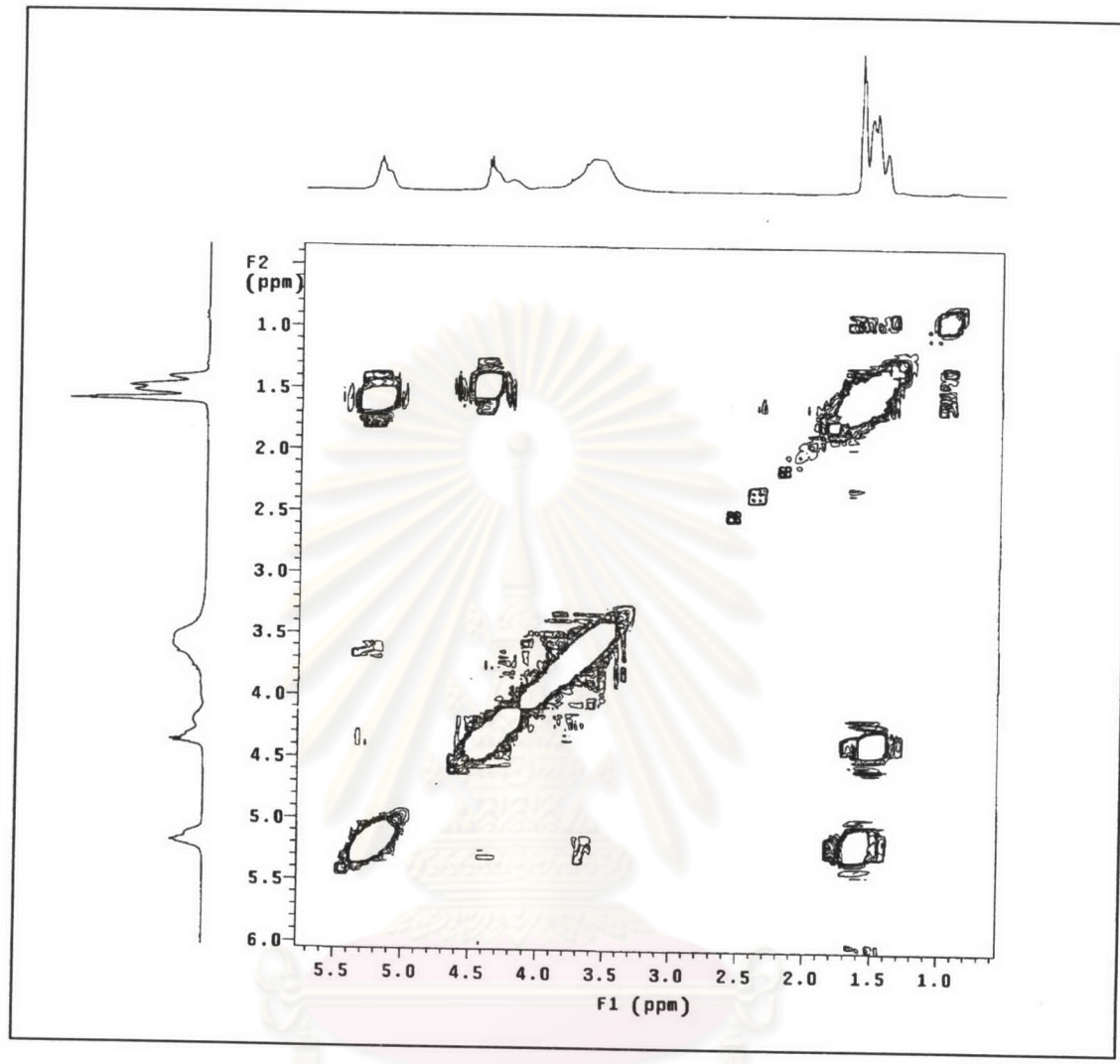

Figure A-21 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 1, table 4.9), 20:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

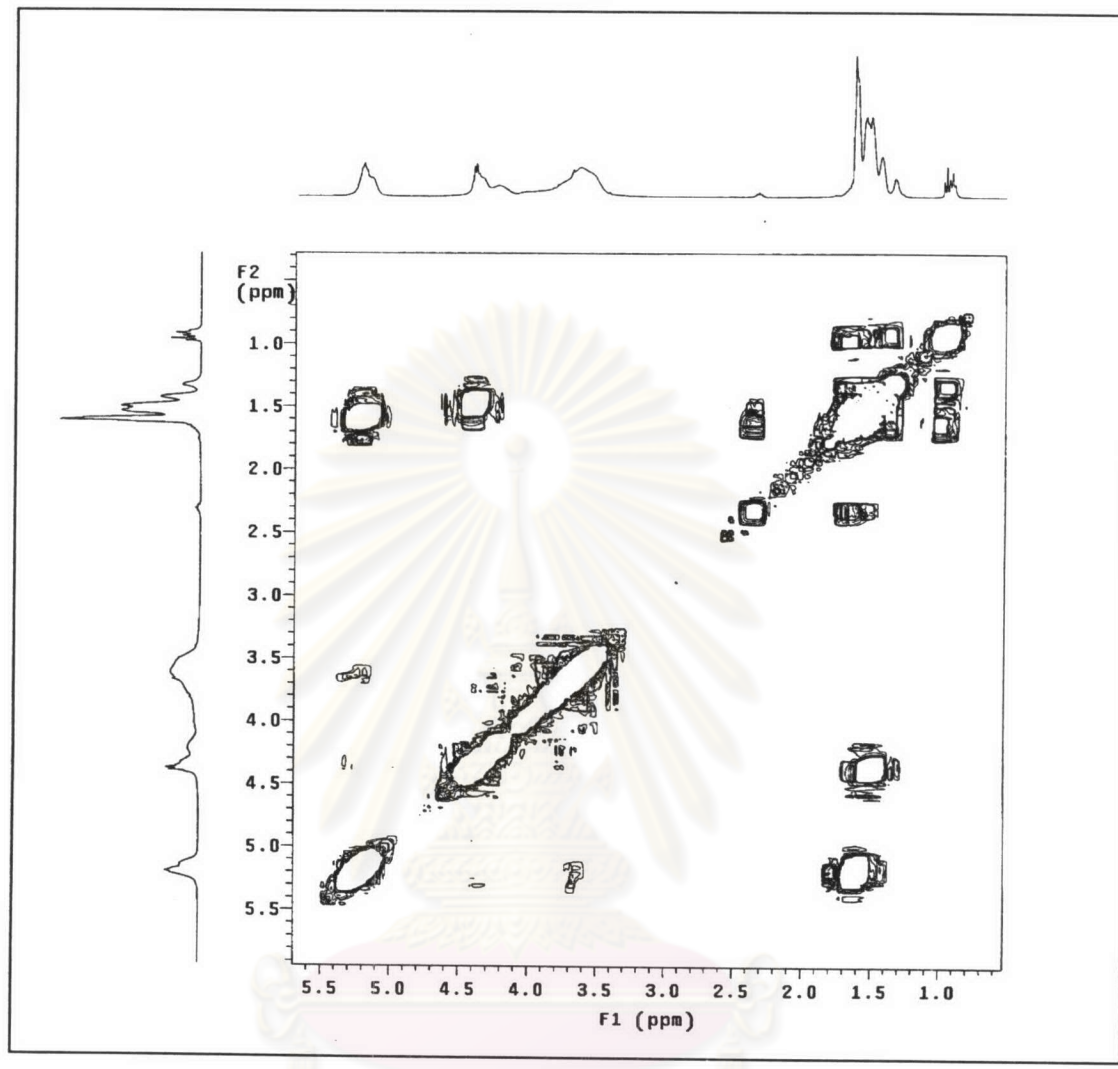

Figure A-22 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 2, table 4.9), 20:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

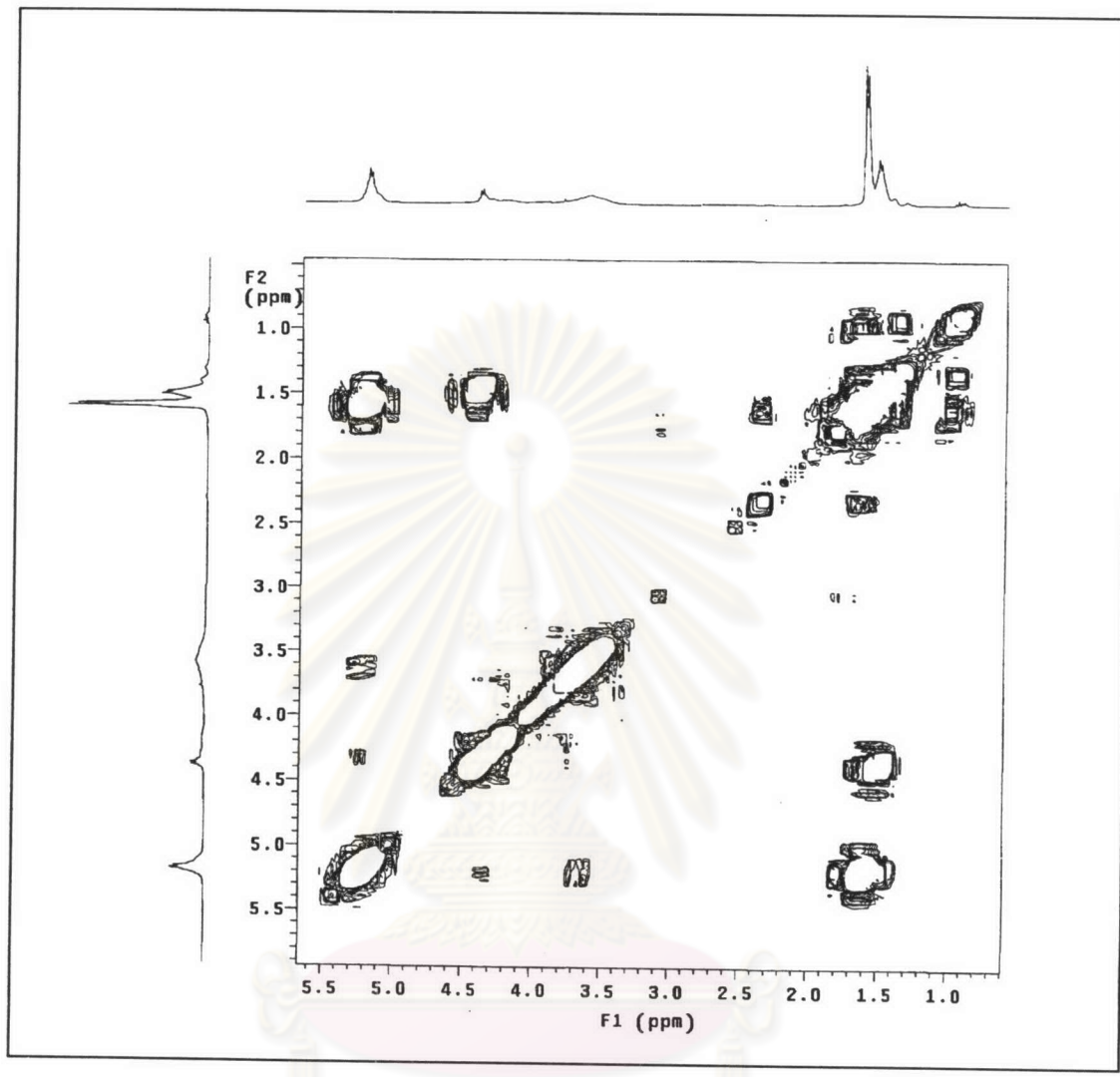

Figure A-23 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 3, table 4.9), 40:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

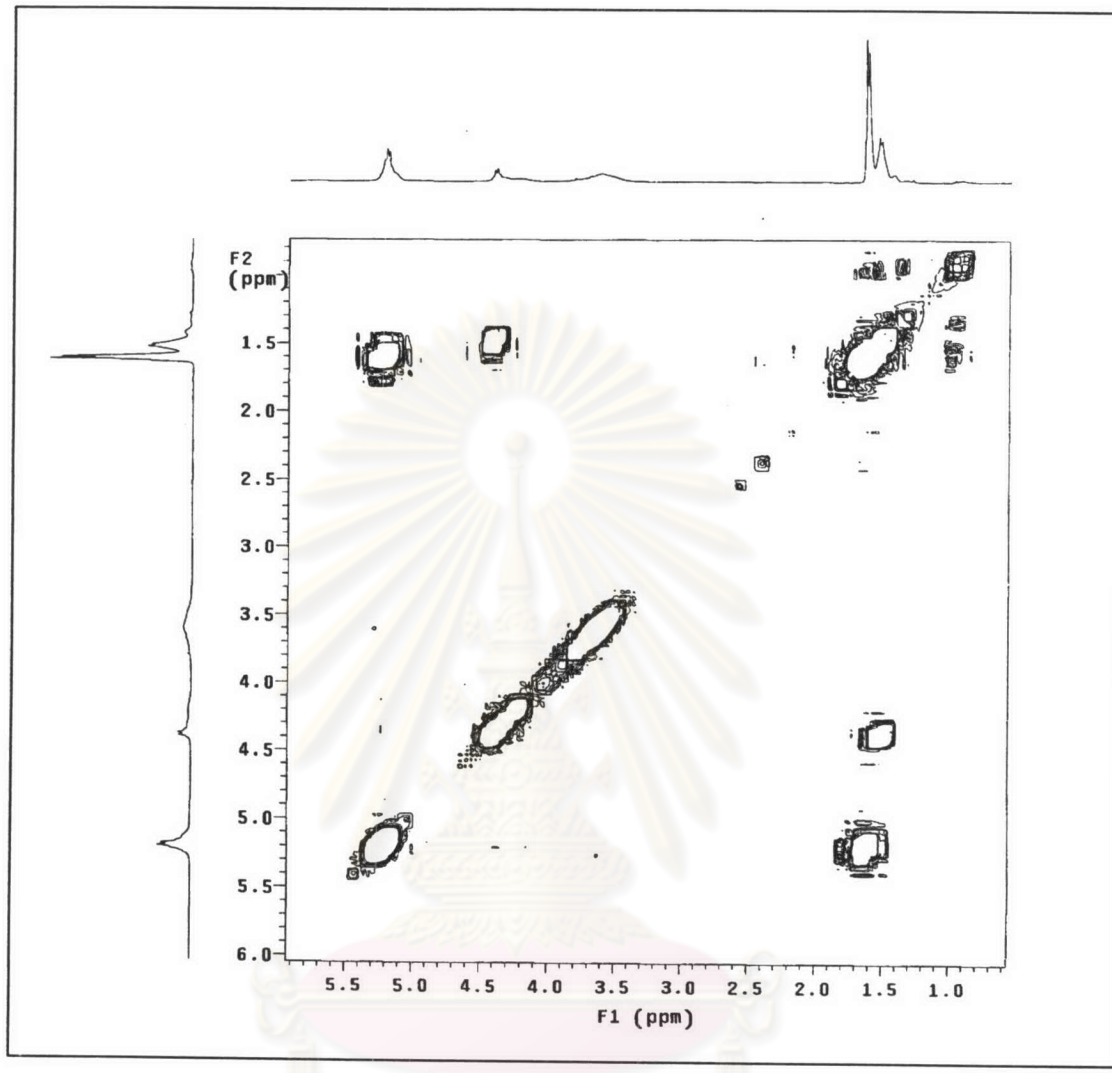

Figure A-24 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 4, table 4.9), 40:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

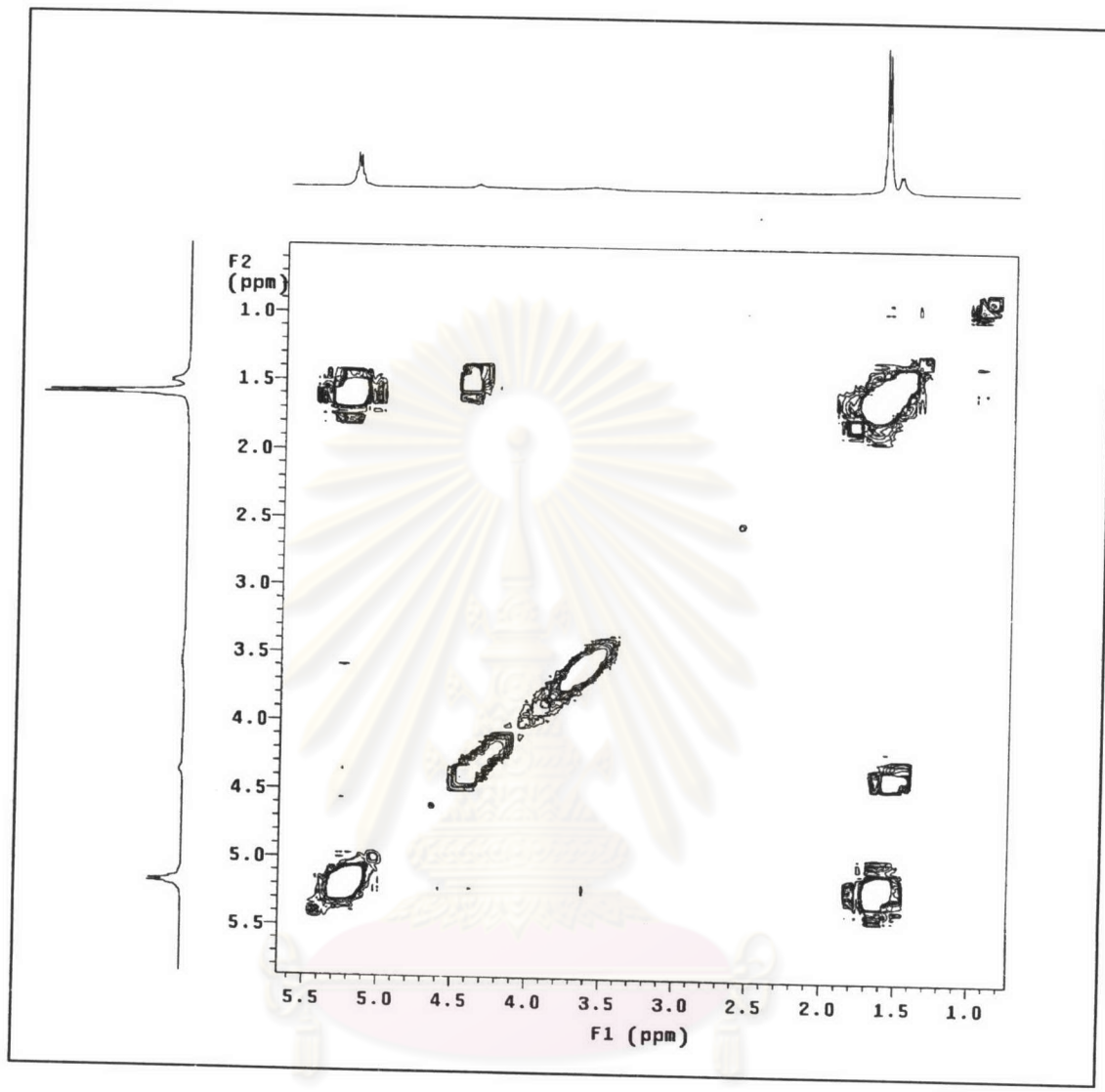

Figure A-25 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 5, insoluble in MeOH, table 4.9), 60:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

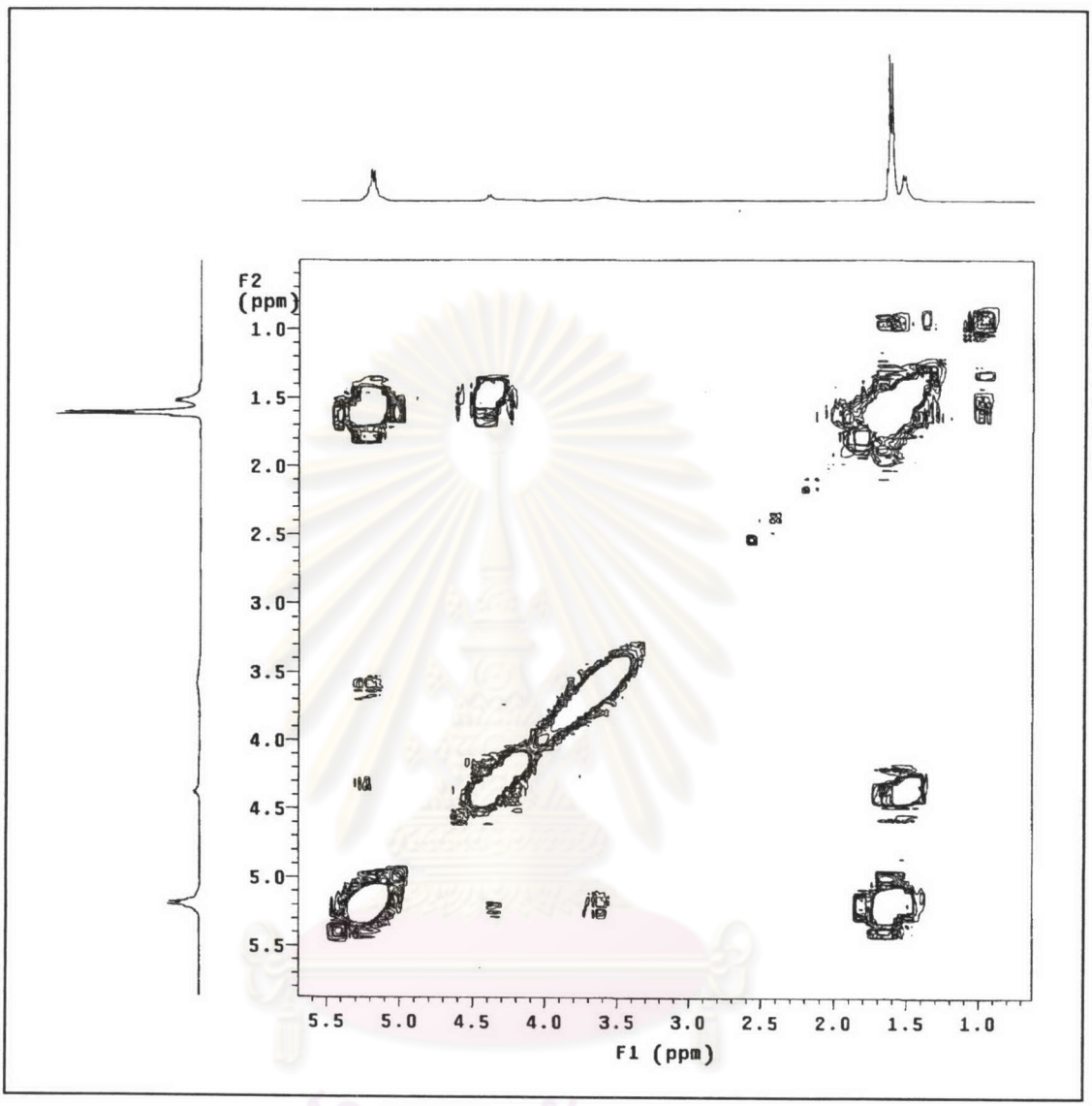

Figure A-26 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 5, soluble in MeOH, table 4.9), 60:1 LLA:PG feed molar ratio, 10 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

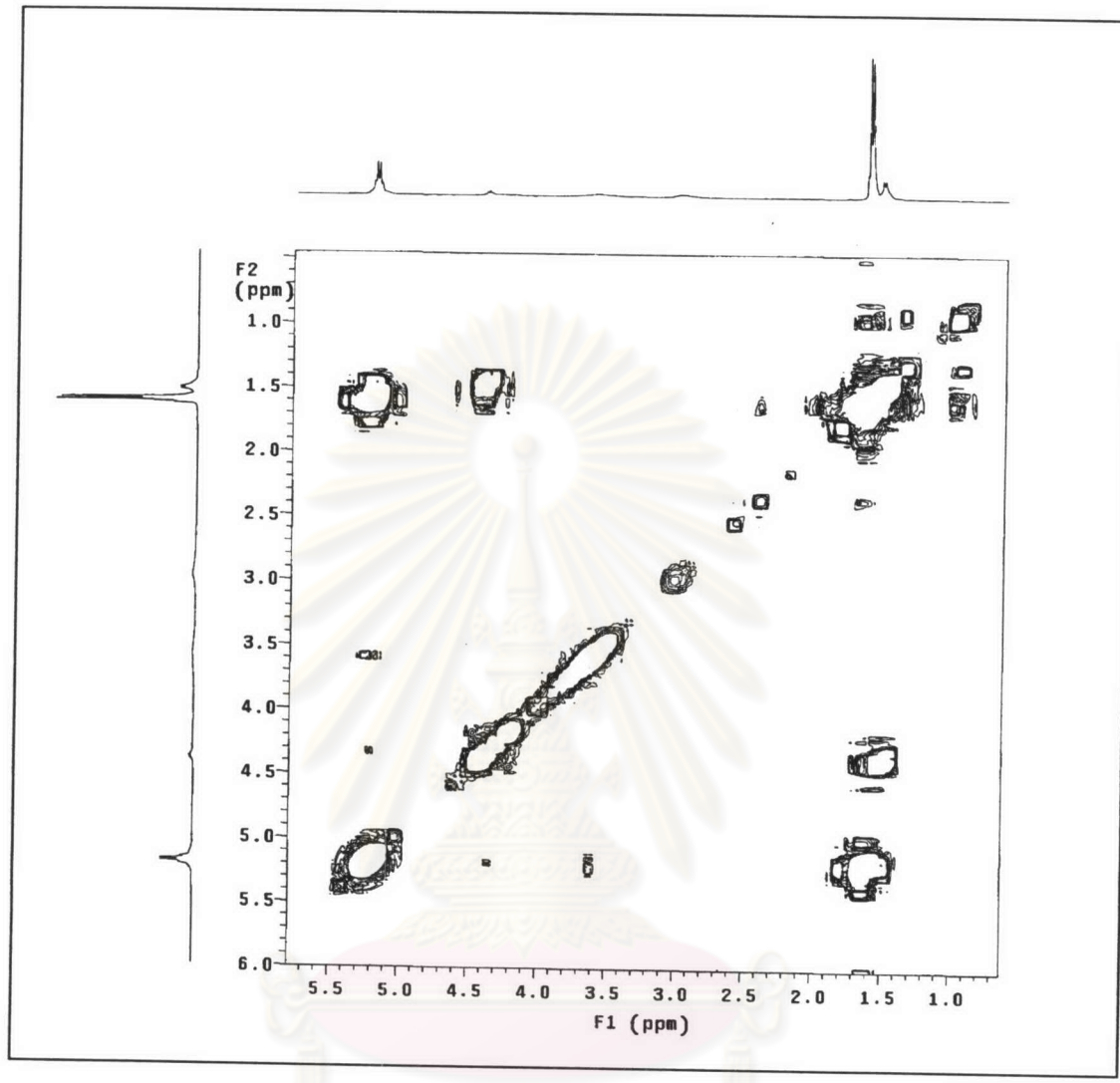

Figure A-27 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 6, insoluble in MeOH, table 4.9), 60:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

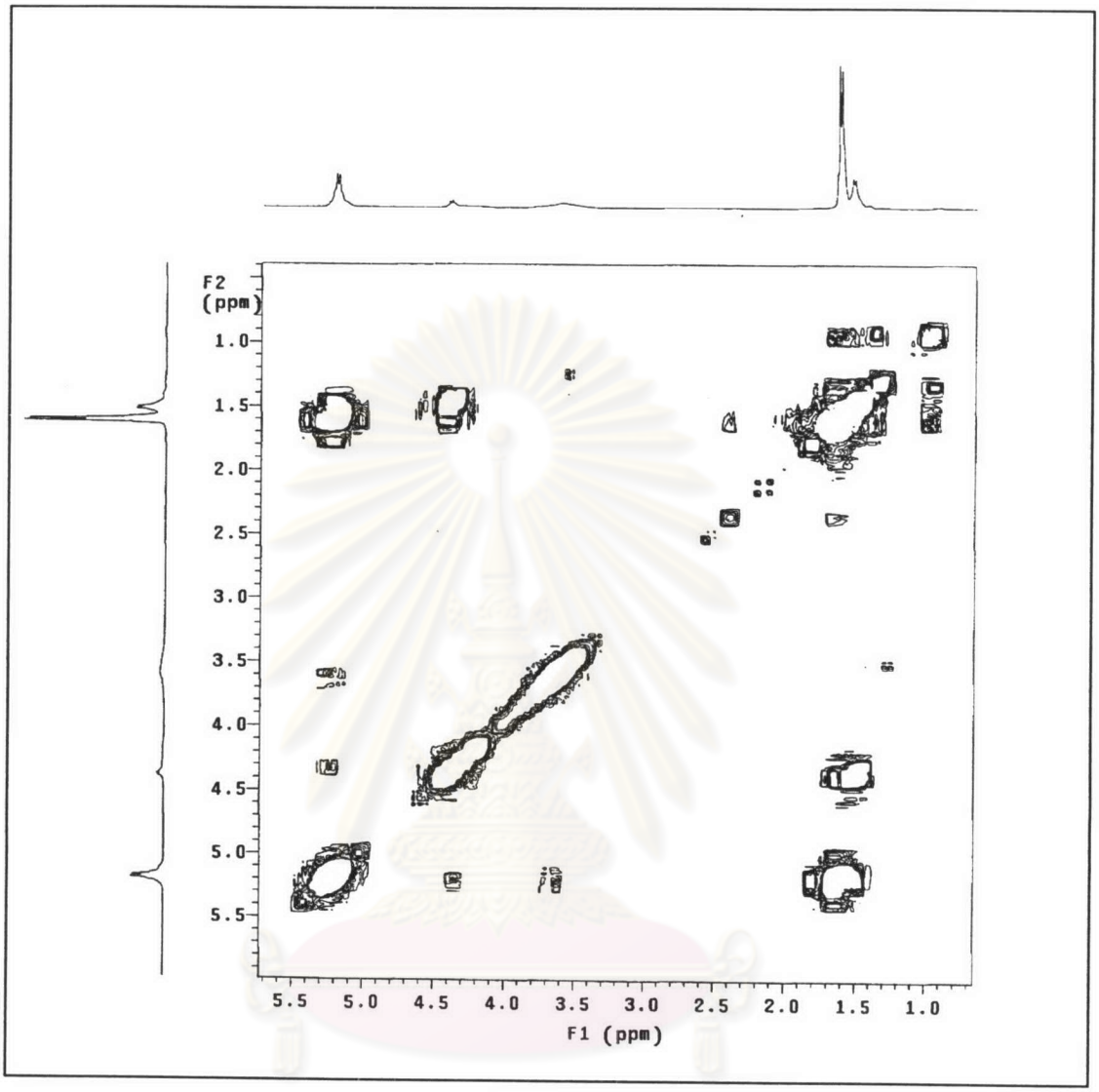

Figure A-28 400 MHz COSY-NMR spectra of PLLA-co-PG (entry 6, soluble in MeOH, table 4.9), 60:1 LLA:PG feed molar ratio, 20 mol% $Sn(Oct)_2$ of total hydroxyl group of PG (entry 3, table 4.3), 130 °C, 1 day.

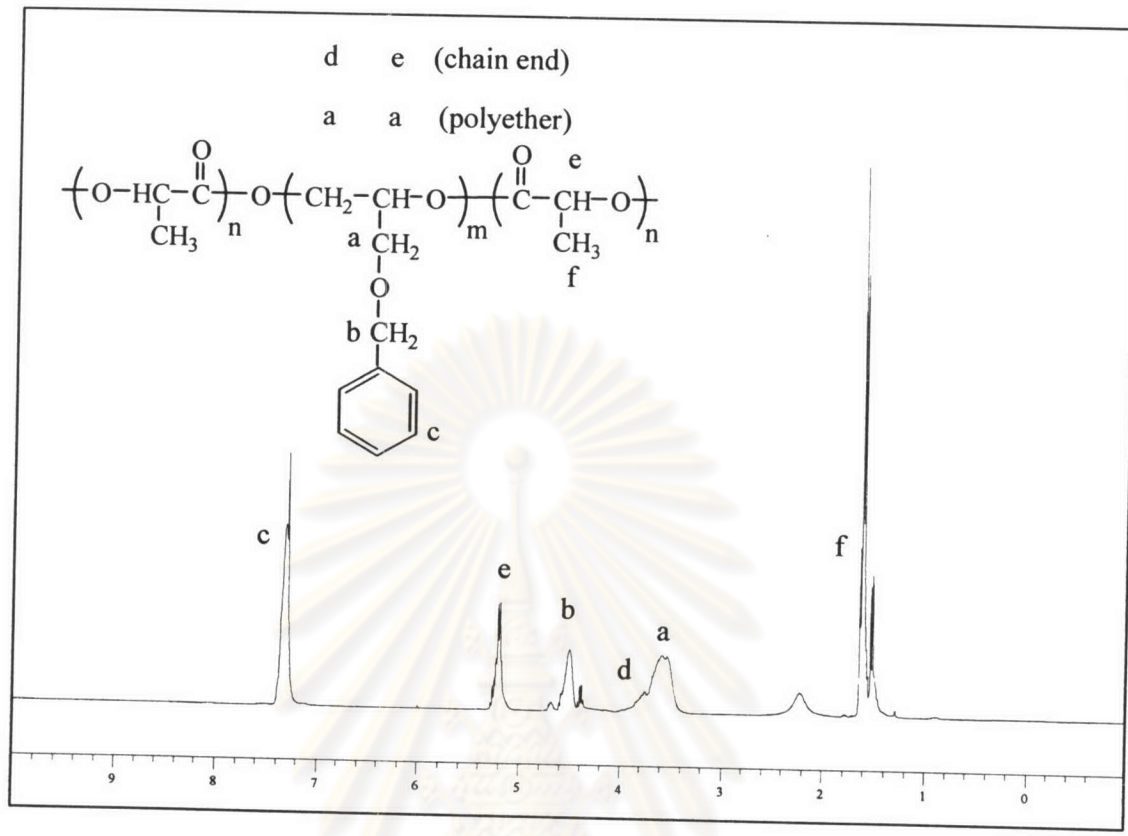

Figure A-29 400 MHz ^{1}H NMR spectra of PLLA-co-PGBn (table 4.11), 1:1 LLA:PGBn (g/g) feed ratio, 10 mol% $Sn(Oct)_2$ of total hydroxyl group of PGBn (entry 9 table 4.4), 130 °C, 1 day.

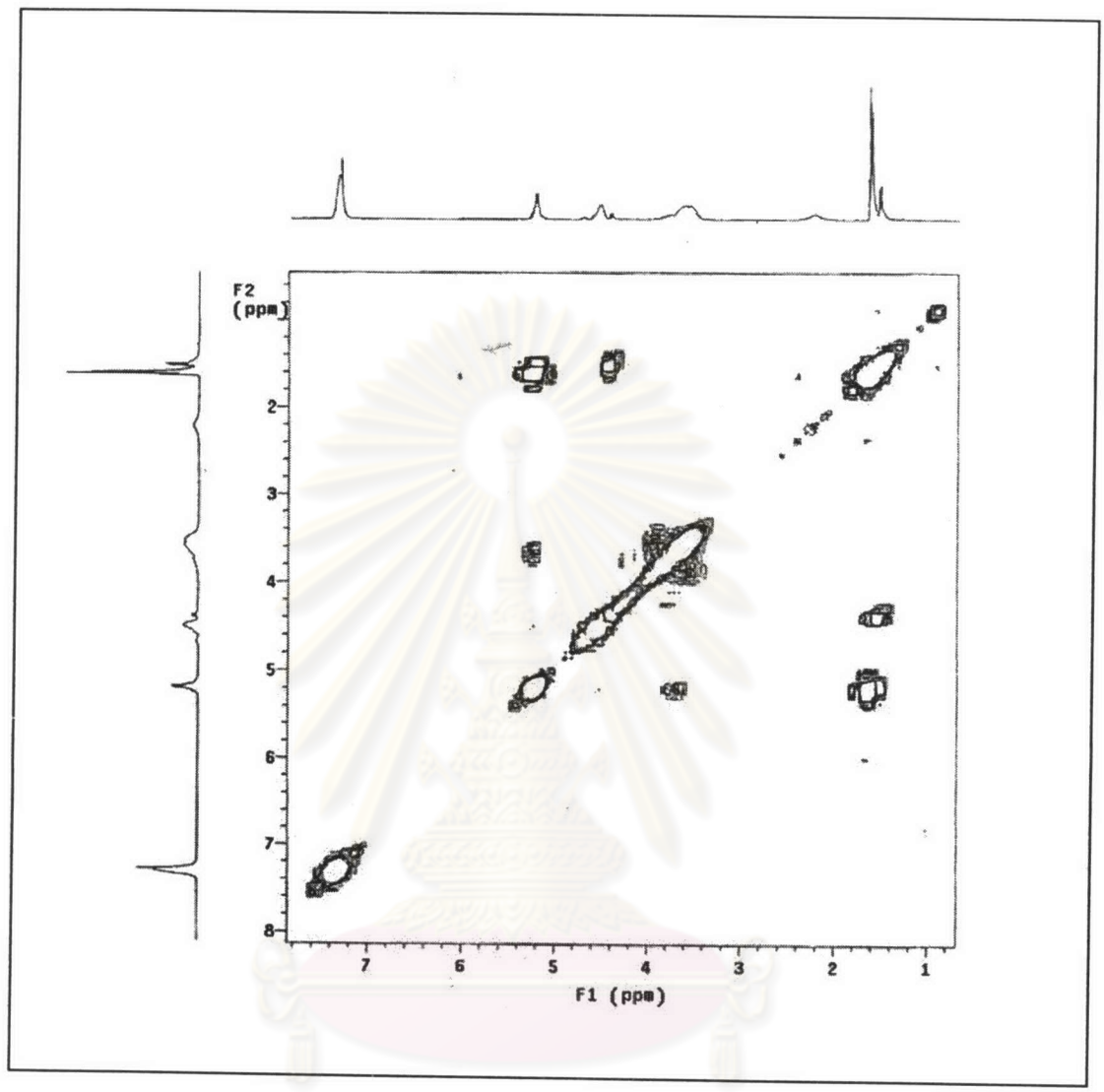

Figure A-30 400 MHz COSY-NMR spectra of PLLA-co-PGBn (table 4.11), 1:1 LLA:PGBn (g/g) feed ratio, 10 mol% $Sn(Oct)_2$ of total hydroxyl group of PGBn (entry 9, table 4.4), 130 °C, 1 day.

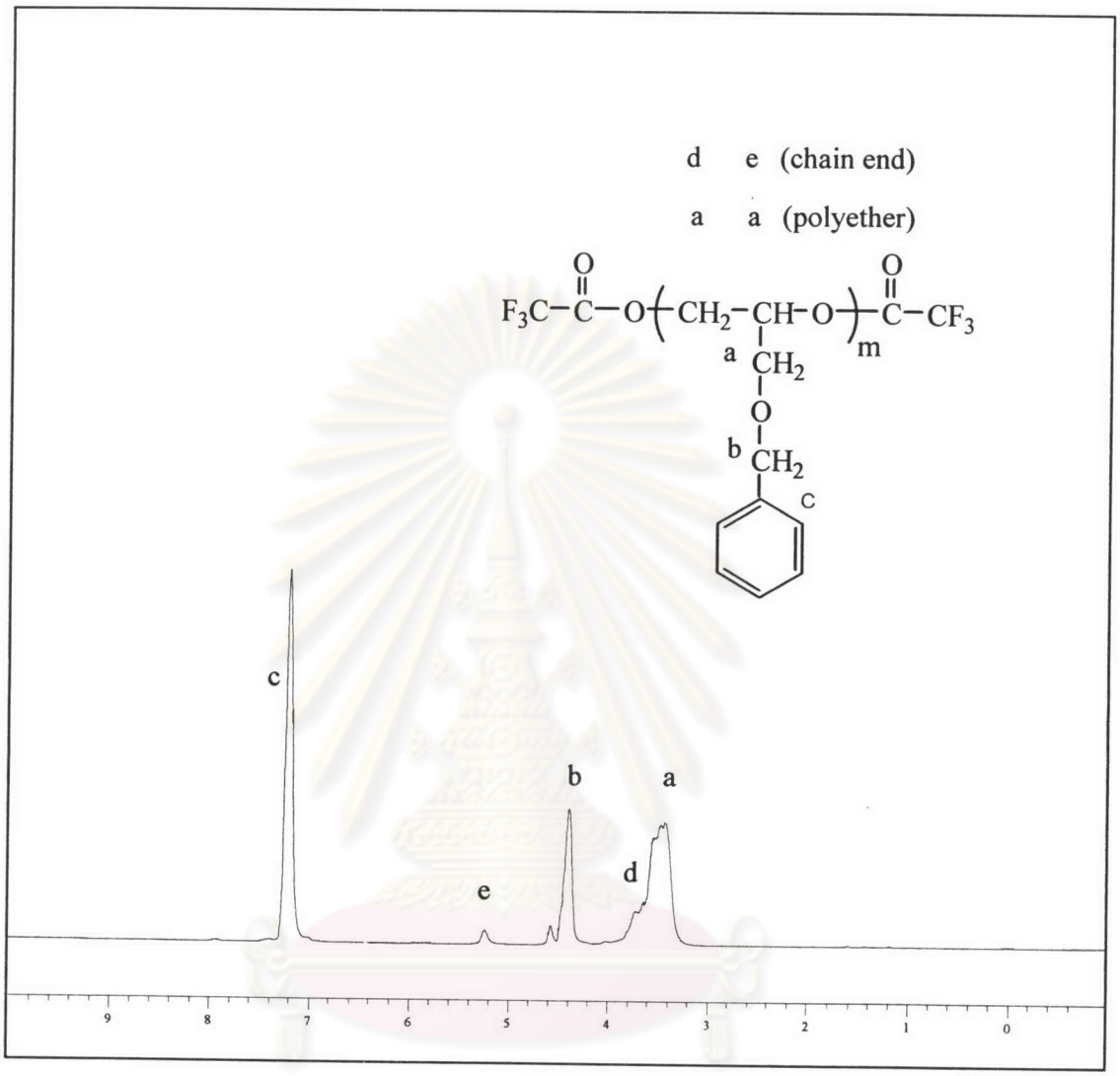

Figure A-31 400 MHz ^{1}H NMR spectra of trifluoro acetyl ester derivative of PGBn entry 9, table 4.4 (PGBn-$OCOCF_3$).

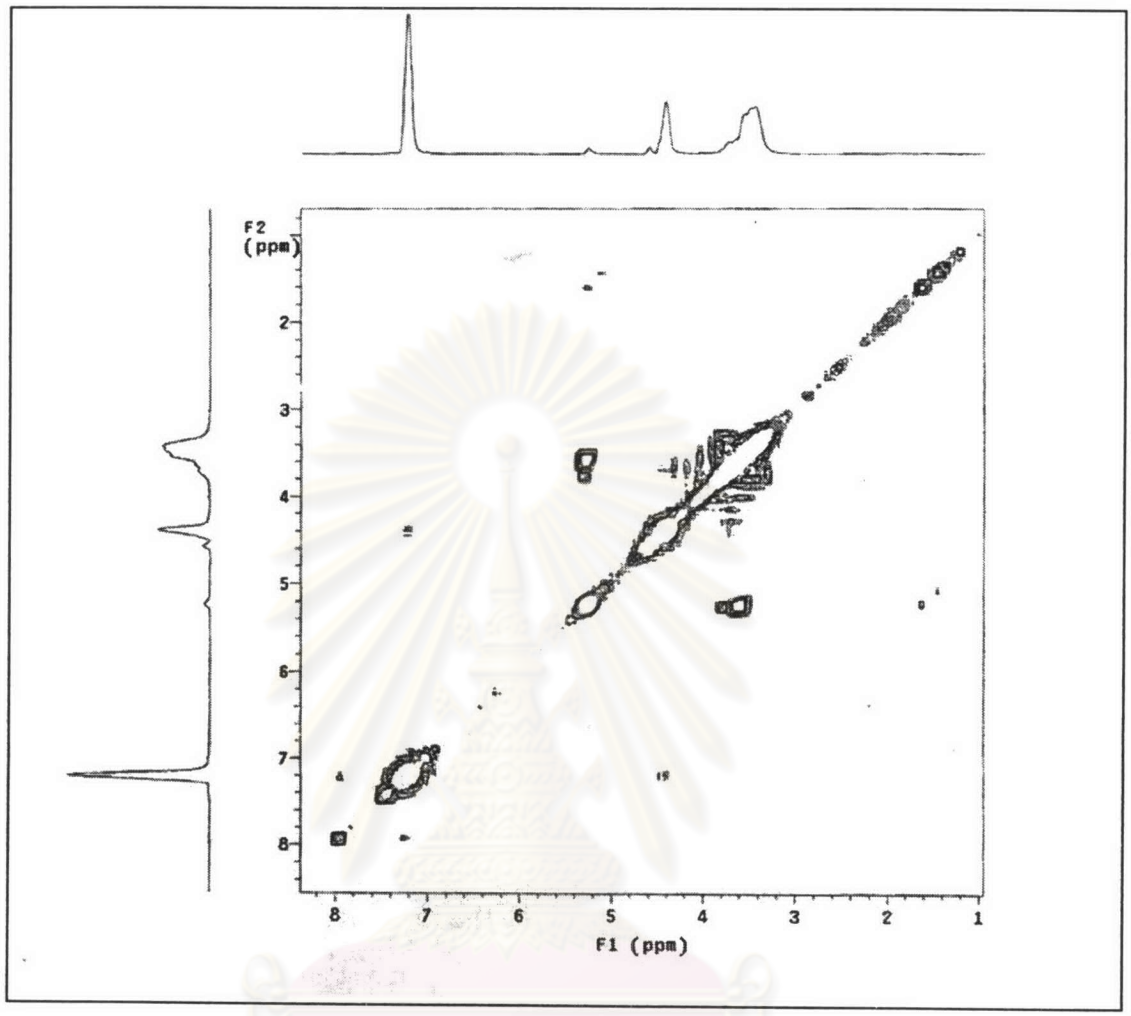

Figure A-32 400 MHz COSY-NMR spectra of trifluoro acetyl ester derivative of PGBn entry 9, table 4.4 (PGBn-$OCOCF_3$).

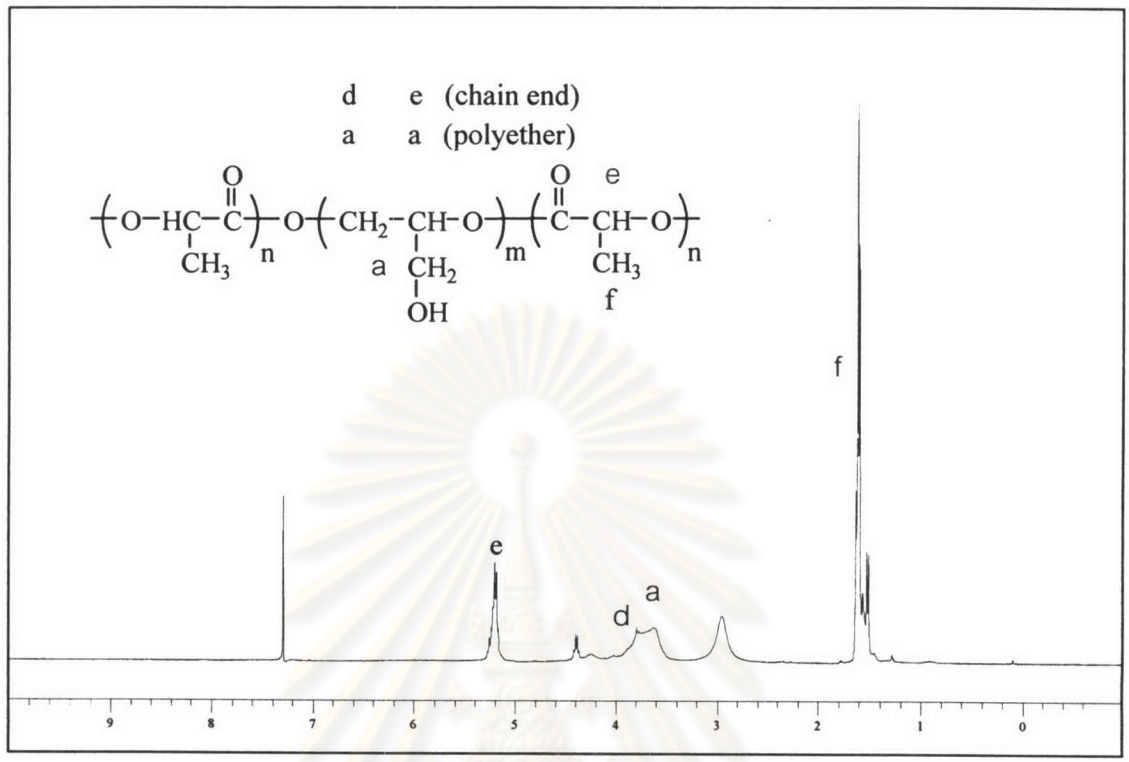

Figure A-33 400 MHz ^{1}H NMR spectra of PLLA-co-PG obtained from hydrogenation of LLA-co-PGBn (table 4.11) using Pd and hydrogen gas.

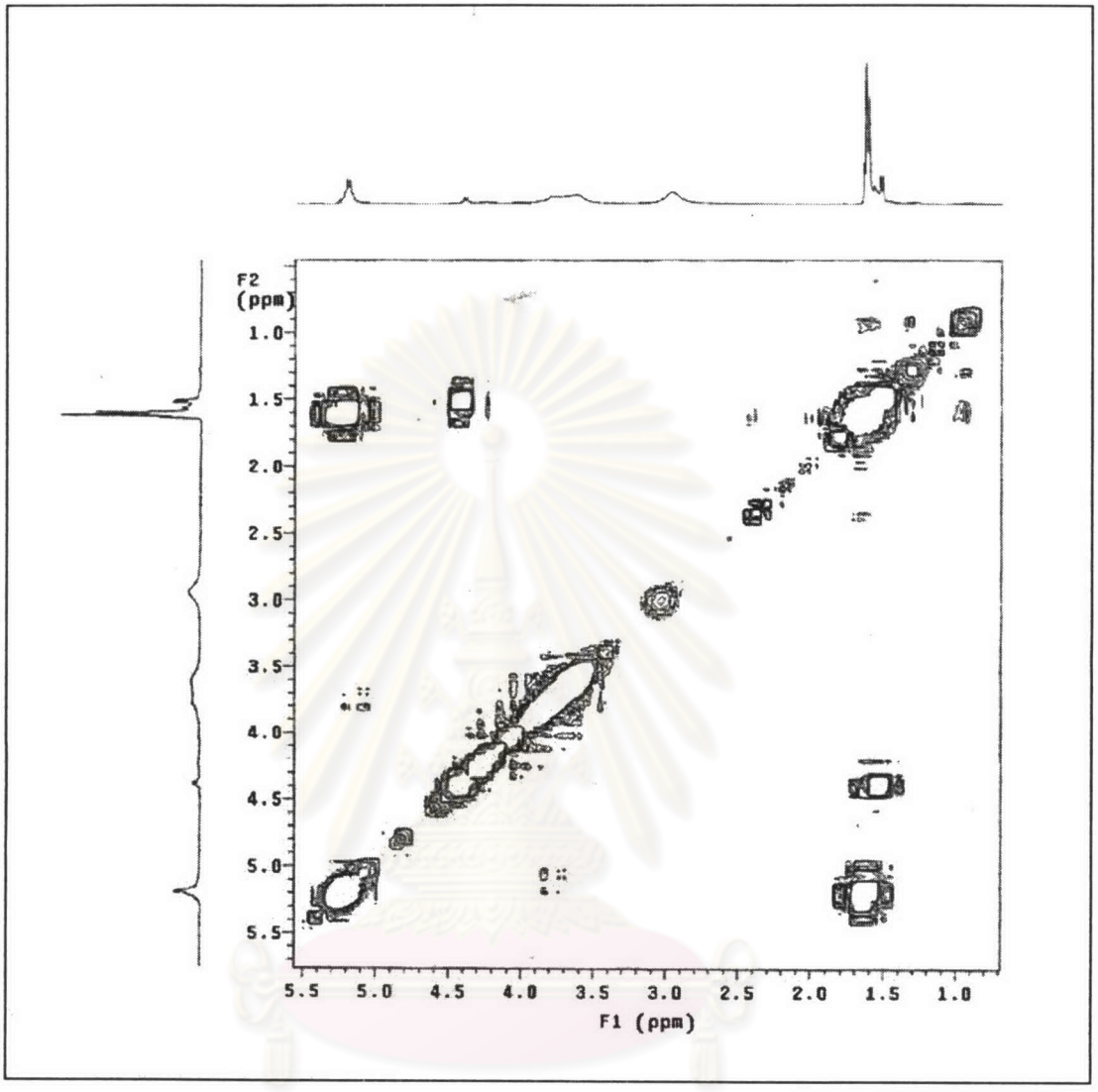

Figure A-34 400 MHz COSY-NMR spectra of PLLA-co-PG obtained from hydrogenation of LLA-co-PGBn (table 4.11) using Pd and hydrogen gas.

VITAE

Miss. Weerawan Sunsaneeyametha was born in Samutsongkram,Thailand, on November 30th, 1977. She received Bachelor degree of science in 1999 from Department of Chemistry, Faculty of Science, Chulalongkorn University. She started as a Master degree student with a major in Petrochemistry, Program of Petrochemistry and Polymer science, Chulalongkorn University in 2000 and completed program in 2003.