ACKNOWLEDGEMENTS

I would like to gratefully acknowledge the National Research Council of Thailand (NRCT) under the program Research Scholarships for Graduate Students 2013 for the Ph.D. Program Thai Doctoral Degree. The French Embassy (Bangkok, Thailand) and The INPT, France under the program "Franco-Thai Cooperation Program in Higher Education and Research Year 2012" Scholarship. The Mahasarakham University under the program Graduates Research in 2013 for their kind grant support.

I would like to express my sincere thanks to my advisor, Assist. Prof. Dr. Pariyaporn Itsaranuwat for her guidance, valuable suggestions, generosity, friendship and helps me at all stages throughout my study. I also deep appreciation to my coadvisor, Prof. Dr. Annie Pfohl-Leszkowicz, Department Bioprocess & Microbial System, ENSAT/INPT for her constructive comments, supervision and providing the laboratory facilities to conduct my research. Also, wish to express my gratitude to the thesis committee, Assist. Prof. Dr. Supatra Porasuphatana, Dr. Sujira Maneerat, and Dr. Vijittra Luang-In, examiner, Dr. Sumonwan Chumchuere, Asst. Prof. Dr. Rumpai Gaensakoo, and Dr. Luchai Butkhup in Department of Biotechnology for their generosity, valuable advice and guidance which enable me to carry out this study successfully.

Many thanks are expressed to Dr. Virginie Faucet-Marquis and Dr. Nicolas Mater in Laboratory Chemical engineering, ENSAT/INPT, Mr. Threeraphan, Mr. Yutthachai, for their cooperation, technical help, support and friendships. Thanks are also express to; Department of Biotechnology, Central laboratory MSU, and Laboratory Chemical engineering, ENSAT/INPT for providing facilities during my research.

My sincere thanks to all those who rendered support, generosity, friendships and help provided me during my study here, particularly Dr. Piyanard Junlek, Mrs. Nittaya in Ag. Ed. KMITL, Mrs. Sujittra, Miss Praveena in Biotech MSU.

My sincere admiration goes to Assoc. Prof. Dr. Pakkapong Poungsuk in Ag. Ed. KMITL who inspired me and financial support during my study. He always encouraged me to gain this doctorate degree if without his greater love, constant encouragement, and support this would not have been possible.

Finally, my profound thanks goes to my father, my sister, my brother and their family for their love, understanding, encouragement and everything throughout from the beginning.