

ACKNOWLEDGEMENTS

I would like to express my gratitude to Assoc. Prof. Dr. Suwimol Asavapisit, my advisor, who gave a chance to work under her guidance, support and discussions as well as assistance in writing the report throughout my thesis. Also, I would like to thank to Asst. Prof. Dr. Kwannate Sombatsompop, my co-advisor, and including Asst. Prof. Dr. Apichat Imyim, Dr. Pipat Chaiwiwatworakul and Prof. Dr. Chai Jaturapitakkul, my committee members, who gave me the valuable knowledge, great advice, motivation and encouragement. Moreover, I am very grateful to my family who provided and encouraged me to study for the Ph.D. I recognize that this research would not have been possible without the financial assistance of the Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi, Center of Excellence on Energy Technology and Environment, Ministry of Education Thailand, and the National Research University Project of Thailand, The Office of the Higher Education Commission (Thailand).