

**DEVELOPMENT OF SEQUENTIAL INJECTION
ANALYSIS WITH ELECTROCHEMICAL
IMMUNOSENSOR FOR SENSITIVE
DETERMINATION OF HUMAN
IMMUNOGLOBULIN G**



**MASTER OF SCIENCE
IN CHEMISTRY**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

**GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
MAY 2017**

**DEVELOPMENT OF SEQUENTIAL INJECTION ANALYSIS
WITH ELECTROCHEMICAL IMMUNOSENSOR FOR
SENSITIVE DETERMINATION OF HUMAN
IMMUNOGLOBULIN G**

CHIDKAMON THUNKHAMRAK

**A THESIS SUBMITTED TO CHIANG MAI UNIVERSITY IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN CHEMISTRY**

**GRADUATE SCHOOL, CHIANG MAI UNIVERSITY
MAY 2017**

**DEVELOPMENT OF SEQUENTIAL INJECTION ANALYSIS
WITH ELECTROCHEMICAL IMMUNOSENSOR FOR
SENSITIVE DETERMINATION OF HUMAN
IMMUNOGLOBULIN G**

CHIDKAMON THUNKHAMRAK

THIS THESIS HAS BEEN APPROVED TO BE A PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN CHEMISTRY

Examination Committee:

Advisor:

Sarawut Somnam
..... Chairperson
(Asst. Prof. Dr. Sarawut Somnam)

Jaroon Jakmunee
.....
(Assoc. Prof. Dr. Jaroon Jakmunee)

Jaroon Jakmunee
..... Member
(Assoc. Prof. Dr. Jaroon Jakmunee)

Surin Saipanya
..... Member
(Asst. Prof. Dr. Surin Saipanya)

3 May 2017

Copyright © by Chiang Mai University

ACKNOWLEDGEMENTS

The author would like to express her sincere gratitude and is greatly indebted to her thesis advisor, Assoc. Prof. Dr. Jaroon Jakmune, for his kind supervision, suggestion, invaluable guidance, comments, and consistent motivation, constant encouragement and financial support throughout this research.

The author is truly grateful to Asst. Prof. Dr. Sarawut Somnam and Asst. Prof. Dr. Surin Saipanya for their valuable comments, suggestion and discussion, and she also thanks to Asst. Prof. Dr. Kontad Ounnunkad and Dr. Kritsana Jitmanee for their valuable advice, assistance and providing reagents.

The author gratefully acknowledges Human Resource Development in Science Project (Science Achievement Scholarship of Thailand, SAST) for granting and sponsoring a full scholarship for her graduate study. The author thanks Department of Chemistry, Faculty of Science, Chiang Mai University, the Graduate School, and Chiang Mai University for all supports.

Her acknowledgements are extended to all her friends at the Research Laboratory on Development of Analytical Instrument and Electrochemistry (AIE) group for their kind assistances, suggestions and encouragements.

The author expresses her greatest gratitude to her parents and everyone whom may concern to her success for their endless love and continual encouragement throughout the study. Finally, the author would like to thank those whose names are not listed here, who have contributed to the success of this study.

Chidkamon Thunkhamrak