Absorption of Carbon Dioxide into Piperazine Activated Alkanolamines

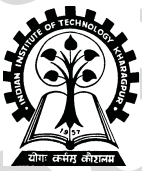
A Thesis Submitted for the Award of the Degree

of

DOCTOR OF PHILOSOPHY

By

Arunkumar Samanta



Separation Science Laboratory
Cryogenic Engineering Centre
Indian Institute of Technology
Kharagpur – 721302

May 2008

Dedication

To My Family Members

Cryogenic Engineering Centre
Indian Institute of Technology Kharagpur
Kharagpur 721302, India

CERTIFICATE

This is to certify that the thesis entitled **"*Absorption of Carbon Dioxide into Piperazine Activated Alkanolamines*"**, being submitted by **Mr. Arunkumar Samanta** for the award of Ph.D. degree, is a record of bonafide research carried out by him at the Cryogenic Engineering Centre, Indian Institute of Technology, Kharagpur, under my guidance and supervision. The work documented in this thesis has not been submitted to any other University or Institute for the award of any other degree or diploma.

(Dr. Syamalendu S. Bandyopadhyay)
Professor
Cryogenic Engineering Centre
Separation Science Laboratory
Indian Institute of Technology
Kharagpur 721302

Acknowledgement

I take this opportunity to express my deep sense of respect and sincere gratitude to my thesis supervisor, Professor Syamalendu Sekhar Bandyopadhyay, for giving me an opportunity to work under his supervision for my doctoral program at the Indian Institute of Technology Kharagpur. I am indebted to Professor Bandyopadhyay for his valuable guidance and encouragement throughout this research program and for instilling in me a relentless quest for perfection. The experience of working with him, I strongly believe, will have far-reaching influence in my future life.

I express my gratitude and indebtedness to Professor V.V. Rao, Head, Cryogenic Engineering Centre for providing me with the necessary laboratory and departmental facilities. I am thankful to Professor S. K. Sarangi, Professor T.K. Dey, Professor K. Chowdhury, Professor P. Sandilya, Professor T.K. Nandi, Professor P. Ghosh, Professor I. Ghosh and Professor V. Adyam of the Cryogenic Engineering Centre for their support during my research work.

I am also thankful to Professor S. Ray, Professor S. DasGupta and Professor S. De of the Department of Chemical Engineering for serving on my Doctoral Scrutiny Committee and for their valuable suggestions and instructions at various stages of this research program.

I am grateful for the financial support from G H Patel College of Engineering and Technology, Vallabh Vidyanagar, Gujarat, for the research work. I am very much thankful to the Principal, GCET, and the Head, Department of Chemical Engineering, GCET, for necessary means of support.

I am thankful to Mr. B. Keshav Rao of the Cryogenic Engineering Centre for his assistance and help in my experimental work. I am also thankful to Mr. S. Bose, Mr. M. C. Dey, Mr. M.L. Ghosh, Mr. S. Das, Mr. U Pal and all other staff members of Cryogenic Engineering Centre for their sincere help and cooperation during this work.

I would like to extend special thanks to Mr. Tanmay Dutta, one of my co-workers in the Separation Science Laboratory (SSL), for his immense help and co-operation all these years during my doctoral program. I have had the pleasure of interacting professionally and personally with number of students at the SSL, including Sudipta Naskar, S. Roy and B. Jayaprakash. I am thankful to my other research colleagues and former colleagues at the SSL, Mr. B.P. Mandal, Mrs. M Kundu for their cooperation and assistance. Thanks are due to Mr. Puvvala Taraka Narayana Rao (Kumar) for his assistance and preparation of manuscript of my Ph.D thesis. I am thankful to my friends, Mr. Tathagata Ray, Mr. Pritam Nasipuri, Mr. Biswajit Sarkar and for their friendship and support.

I express my humble regards and respect for my parents. I will always be grateful to them for the opportunities they have provided to me. Heartfelt thanks are also due to other friends and family members of mine, whom I could not mention here, for their encouragement and moral support.

Finally, I would like to thank my wife, Madhumita, for her immense support, sacrifice and patience at all stages of this work all these years. She is not only a wonderful wife and mother to our son, Shreyas, she is an exceptionally understanding and caring person. Her contributions to our home have made my time at work easier and her companionship has made me a better person.

Indian Institute of Technology *Arunkumar Samanta*

Kharagpur

May 2008