
TABLE OF CONTENTS

List of Figures	xi
List of Tables	xvi
Nomenclature	xvii
Preface	xxi
CHAPTER 1 INTRODUCTION	1
1.1 Global environmental issues and CO ₂ emission	1
1.2 CO ₂ reduction techniques	3
1.3 Amine-based absorption technology	6
1.4 Amine solvent	7
CHAPTER 2 LITERATURE REVIEW AND OBJECTIVES	9
2.1 Amine-based solvent for CO ₂ capture	9
2.2 Screening of tertiary amine-based solvent for CO ₂ capture	10
2.3 Screening of DEEA-based amine blend solvent for CO ₂ capture	20
2.4 Scope of present research work / research gap	25
2.5 Objectives of present research work	26
CHAPTER 3 SELECTION OF EFFICIENT ABSORBENT FOR CO₂ CAPTURE FROM GASES CONTAINING LOW CO₂	27
Abstract	27
3.1 Introduction	28
3.2 Experimental	31
3.2.1 Chemicals and materials	31
3.2.2. Experimental set-up and procedure	34
3.2.2.1 CO ₂ absorption experiment	34
3.2.2.2 CO ₂ desorption experiment	36
3.3 Calculations of performance parameters	38
3.3.1 CO ₂ loading	38
3.3.2 Absorption and desorption rate	38
3.3.3 Cyclic capacity and regeneration efficiency	39
3.4 Results and discussion	39

	3.4.1 Validation of experimental setup and procedures	39
	3.4.2 CO ₂ loading	41
	3.4.3 Absorption rate	43
	3.4.4 Desorption rate	47
	3.4.5 Cyclic capacity and regeneration efficiency	50
	3.5 Conclusions	53
CHAPTER 4	EQUILIBRIUM SOLUBILITY MEASUREMENT AND MODELING OF CO₂ ABSORPTION IN AQUEOUS BLEND OF 2-(DIETHYLAMINO) ETHANOL AND 2-(2-AMINOETHYLAMINE)ETHANOL	55
	Abstract	55
	4.1 Introduction	56
	4.2 Experimental	59
	4.2.1 Chemicals and materials	59
	4.2.2 Experimental setup and procedures	60
	4.2.3 Reaction chemistry of CO ₂ -DEEA-AEEA system	61
	4.3 Results and discussion	63
	4.3.1 Solubility of CO ₂ in DEEA+AEEA solution	63
	4.3.1.1 Effect of concentration	63
	4.3.1.2 Effect of partial pressure	66
	4.3.1.3 Effect of temperature	68
	4.3.1.4 Comparison of CO ₂ solubility data in various aqueous mixtures of amines	71
	4.3.2 Development of CO ₂ solubility model	72
	4.4 Conclusions	75
CHAPTER 5	EQUILIBRIUM SOLUBILITY MEASUREMENT AND MODELING OF CO₂ ABSORPTION IN AQUEOUS BINARY MIXTURE OF 2-(DIETHYLAMINO) ETHANOL AND 1,6-HEXAMETHYLDIAMINE	77
	Abstract	77
	5.1 Introduction	78
	5.2 Experimental	81
	5.2.1 Chemicals and materials	81

	5.2.2 Experimental set-up and procedure	81
	5.2.3 Reaction chemistry of CO ₂ -DEEA-HMDA system	83
	5.3 Results and discussion	83
	5.3.1 Solubility of CO ₂ in DEEA+HMDA aqueous mixture	83
	5.3.1.1 Effect of concentration	85
	5.3.1.2 Effect of CO ₂ partial pressure	88
	5.3.1.3 Effect of temperature	90
	5.3.1.4 Comparison of the CO ₂ solubility in various aqueous mixtures of amines	92
	5.3.2 Development of CO ₂ solubility model	93
	5.3.3 Estimation of heat of absorption of CO ₂	97
	5.4 Conclusions	100
CHAPTER 6	EQUILIBRIUM SOLUBILITY MEASUREMENT AND MODELING OF CO₂ ABSORPTION IN AQUEOUS BLEND OF 2-(DIETHYLAMINO)ETHANOL AND ETHYLENEDIAMINE	101
	Abstract	101
	6.1 Introduction	102
	6.2 Experimental	105
	6.2.1 Chemicals and materials	105
	6.2.2 Experimental apparatus and procedure	107
	6.2.3 Reaction chemistry of CO ₂ -DEEA-EDA system	108
	6.3 Results and Discussion	109
	6.3.1 Solubility of CO ₂ in DEEA+EDA solution	109
	6.3.1.1 Validation of experimental setup and method	109
	6.3.1.2 Effect of concentration	110
	6.3.1.3 Effect of CO ₂ partial pressure	112
	6.3.1.4 Effect of temperature	113
	6.3.1.5 Comparison of CO ₂ solubility in different DEEA-based amine blends	114
	6.3.2 Development of CO ₂ solubility model	116

6.3.3 Estimation of heat of absorption of CO ₂	121
6.4 Conclusions	124
CHAPTER 7	
OVERALL CONCLUSIONS AND RECOMMENDATIONS	125
7.1 Overall conclusions	125
7.2 Recommendations for future work	126
References	127
Appendix A	147
Appendix B	149
Publications	151