

LIST OF CONTENTS

Title	Page No.
List of Figures	xiii-xvii
List of Tables	xviii
List of Symbols	xix-xxii
List of Abbreviations	xxiii-xxiv
Preface	xxv
1 Introduction	1-4
1.1 Introduction to the Problem	1
1.2 Aims and Objectives	3
1.3 Organisation of the Thesis	4
2 Literature survey	5-44
2.1 Flow Regime	6
2.1.1 Homogeneous Flow or Bubbly Flow Regime	6
2.1.2 Heterogeneous Flow Regime	7
2.1.3 Slug Flow Regime	7
2.2 Gas Holdup	9
2.3 Bubble diameter	18
2.4 Bubble aspect ratio	23
2.5 Specific Interfacial Area	25
2.6 Gas-Liquid Mass-transfer Coefficient	31
2.7 Measurement Techniques for Bubble Behaviour	38
2.7.1 Photographic Technique	38

2.8	Objective of the present work	43
3	Experimental setup and procedures	45-51
3.1	Experimental Set-Up	45
3.2	Physical Properties of the System	46
3.3	Experimental Procedure	47
3.4	Image Analysis Algorithm	48
3.5	Detection of expanded bed height	51
4	Results and discussion	52-93
4.1	Structure of the Bed	52
4.1.1	Pixel density in vertical direction	53
4.1.2	Fluctuating nature of liquid layer	54
4.1.3	Foam layer thickness	60
4.1.4	Entry Region Width	63
4.2	Gas Holdup	64
4.2.1.	Gas holdup for air-CMC solution system	67
4.3	Bubble Size Distribution (BSD)	69
4.3.1	BSD for Distilled Water	69
4.3.1.1	Effect of U_g	69
4.3.1.2	Effect of H_s	71
4.3.2	BSD for Air-CMC solution	72
4.3.2.1	Effect of U_g	72
4.3.2.2	Effect of Concentration	73
4.4	Sauter-mean bubble diameter	75

4.4.1 Air-distilled water system	75
4.4.1.1 Effect of H_s on d_{32}	75
4.4.2 Air-CMC soln. system	77
4.5 Aspect Ratio	78
4.6 Interfacial area	78
4.6.1 Effect of U_g and H_s on a_i for air-water system	78
4.6.2 Effect of U_g and CMC conc. on a_i for air-CMC soln. system	79
4.7 Volumetric Mass-Transfer Coefficient, ($k_L \cdot a_i$)	81
4.7.1 A model for Volumetric Mass-Transfer Coefficient, $k_L a_i$	82
4.7.2 Estimation of ($k_L a_i$) using Correlations by Akita and Yoshida (1974)	84
4.7.3 Estimation of ($k_L a_i$) using Correlations by Pohorecki et al. (2001)	85
4.7.4 Estimation of ($k_L a_i$) using Correlations by Pohorecki et al. (2005)	85
4.8 Model for apparent viscosity	89
4.9 Gas holdup Correlation for Power Law Fluid	91
5 Conclusions	94-96
References	97-105
Appendix-I	106-115
Appendix-II	116-118
Appendix-III	119-124