

**UNIVERSITI TEKNOLOGI MARA**

**STUDIES ON THE POLYMER SOLVENT  
INTERACTIONS IN PRESENCE OF THE DRUG  
ACECLOFENAC**

**SITI SYAMIMI BT AMBO MASE**

**Dissertation submitted in partial fulfillment of the requirement for the  
degree of Bachelor of Pharmacy (Hons.)**

Faculty of Pharmacy

November 2009

## ACKNOWLEDGMENT

Foremost, I would like to express my sincere gratitude to my supervisor DR. Minaketan Tripathy for the continuous support of my research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better supervisor and mentor for my research paper.

Besides my supervisor, I would like to thank the coordinator for this subject, Dr. Kala for her encouragement, insightful comments, and for enlightening me the first glance of research.

I thank my fellow labmates Norazura Che Hamid, Qairul Azhani and Kamal Rashid for the stimulating discussions, for the sleepless nights we were working together before deadlines, and for all the fun we have had in the last four months. Last but not the least, I would like to thank my family, my parents Ambo Mase bin Patola and Siti Maryam binti Mohd Badawie for giving birth to me at the first place and supporting me spiritually throughout my life.

## TABLE OF CONTENTS

	<b>Pages</b>
TITLE PAGE	
ACKNOWLEDGMENT	ii
TABLE OF CONTENT	iii
LIST OF TABLES	v
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	viii
ABSTRACT	xi
CHAPTER ONE (INTRODUCTION)	
1.1 Introduction	1
1.2 Background of study	2
1.3 Objective of study	3
1.4 Scope and limitation	4
CHAPTER TWO (LITERATURE REVIEW)	
2.1 Cellulose derivatives property	5
2.2 Polymer and drug diffusion	6
2.3 Effect of polymer content on the release of drug	7
2.4 Effect of different polymer on the release of drug	7
2.5 Insoluble drug (Aceclofenac)	9
2.6 Ultrasonic velocity study	9
2.6.1 Adiabatic compressibility ( $K_s$ or $\beta_{ad}$ )	10
2.6.2 Inter-molecular free length ( $L_f$ )	10
2.6.3 Apparent isentropic molar compressibility ( $K_s, \theta$ )	11
2.6.4 Limiting isentropic molar compressibility	11
2.6.5 Molar sound velocity ( $R_m$ )	11
2.6.6 Molar compressibility ( $W$ ) and Acoustic impedance ( $Z$ )	12
2.6.7 Theory	13
CHAPTER THREE (MATERIAL AND METHOD)	
3.1 Chemicals	15
3.2 Preparation of aqueous solution of methylcellulose bases	15
3.3 Preparation of aqueous solution of methylcellulose bases with addition of Aceclofenac	16
3.4 Measurement of ultrasonic velocity	19
3.4.1 Working principle	19
3.4.2 Description	20
3.4.3 Measurement	20
3.5 Measurement of compressibility	21
3.5.1 Density of liquid	21
3.5.1.1 Measurement	22

## ABSTRACT

The ultrasonic velocity and density of different proportion of polymeric aqueous solution - 9:1, 8:2 and 6:4 mixture (Methylcellulose (MC) and polyethylene glycol (PEG)) and (MC and hydroxylpropyl methylcellulose(HPMC)) beside 9:0.5:0.5, 8:1:1 and 6:2:2 mixture (MC, PEG and HPMC) at 298.15 K in the absence as well as in the presence of drug have been measured. The ultrasonic velocity data are used to estimate various acoustic parameters such as Molar sound velocity ( $R_m$ ), Acoustic impedance ( $z$ ), Intermolecular free length ( $L_f$ ), Relative association ( $R_a$ ), Internal pressure ( $\pi_i$ ) and free volume ( $V_f$ ). From the experimental density and molar sound velocity data, the apparent isentropic molar compressibility ( $K_s, \theta$ ) and isentropic compressibility ( $\beta_{ad}$ ), have been evaluated. The result shows a negative value in apparent isentropic molar compressibility ( $K_s, \theta$ ) and in both the internal pressure and the free volume. The ultrasonic properties in mixtures exhibit a maximum in ultrasonic velocity and a minimum in isentropic compressibility, relative association and intermolecular free length.

# **CHAPTER ONE**

## **INTRODUCTION**

### 1.1 Introduction

The ultrasonic velocity data are used to estimate various acoustic parameters such as isentropic compressibility, intermolecular free length, acoustic impedance, molar sound velocity and molar compressibility. The ultrasonic studies provide information about the type of interaction taking place in some systems. The density data on the whole can provide an insight into the state of association of the solute and the extent of its interaction with the solvent. Moreover, ultrasonic studies leading to several acoustic parameters provide necessary information regarding structural effects of the solute and solvent in solution. Nomoto and coworkers made successful attempts to evaluate sound velocity in binary liquid mixtures. The nature and degree of molecular interactions in different solutions depend upon several factors such as the nature of the solvent, the structure of the solute and also the extent of the solvation taking place in the solution.