PREFACE

In liquid state physics, the study of relation between micro and macro parameters has been one of the most difficult but attractive topics. Evaluation of acoustical and optical properties of a liquid provides a good understanding of the physical structure of it. The purpose of this work is to make an attempt to relate acoustical properties with optical properties of liquids and liquid mixtures.

Chapter 1 of this thesis begins with a brief description of liquids and their mixture rules, followed by a discussion on optical and acoustical properties of liquids. It ends with a brief survey of the works done on the study of properties of liquids using a thermodynamic property, adiabatic compressibility. Chapter 2 deals with an account of theories, specially about the acoustic properties. Two new liquid parameters, molar opto-acoustic velocity $H$ and molar optical volume $N$ are deduced empirically in chapter 3. It relates the sound velocity in a liquid with the index of refraction of it and $N$ relates the index of refraction of a liquid with the density of it. These parameters are useful to gauge micro information through macroscopic optical and acoustic properties. The structure dependence of these parameters are also studied. In chapter 4, a new optical parameter, 'molar light velocity', $M$, for a liquid is proposed which is an optical counterpart of the acoustical parameter 'molar sound velocity', $R$. An empirical relation for $M$ is also deduced. In chapter 5, all the new opto-acoustic parameters $H$, $N$ and $M$ developed in chapter 3 and 4 are used with their specific values $\gamma$, $\nu$, and $\mu$, respectively, to evaluate the sound velocities, densities and indices of refraction in binary and ternary liquid mixtures. The linear and additive properties of the molar refraction $R$, of a liquid are used in conjunction with molar sound velocity $R$ to predict sound velocities in binary and ternary liquid mixtures. In chapter 6, an elementary attempt is made to study the molecular interactions using the opto-acoustic parameters as well as using the excess light velocity. Major conclusions of this study are presented briefly in chapter 7.