The investigations presented in this thesis were carried out by the author during 2007 – 2010 in the Department of Physics, Periyar University, Salem, Tamilnadu, INDIA.

The specific drugs, the antibiotics exhibit biological activity. Thereafter they produce adverse effects which tamper the natural physiological phenomena in the system and they develop antibiotic resistance. These interactions basically are of specific in nature. Hence these specific interactions can be investigated through physical parameters by employing suitable techniques. It will be an interpretation of physiological phenomena of thermodynamical conditions and expected to give more insight to understand the drug interactions through simple sophisticated physical techniques.

The behavioral interaction places the doxycycline hyclate as a special and significant drug. Its interference with insulin and fatty acids is of considerable importance. These interactions are of great interest. Here it is an attempt to identify the specific interactions of doxycycline hyclate in different environmental condition with biomolecules.

The present investigation consists of seven chapters. In the first chapter, the importance of molecular interactions was outlined. The molecular interactions that exist between liquid mixtures, polymer solutions, polymer blends and drug-receptors are described. The basis of investigations of liquid mixtures is adopted to investigate the polymer solutions and hence the basis of polymer solution is
justified to investigate the drug interactions. The approach to the present investigation on the basis of molecular interactions and the probable techniques of investigation are discussed.

In the Chapter II, There is a need to analyze the basic theories of the preferred techniques of investigation. Therefore the theories of investigation techniques viscometric, ultrasonics and the conformational techniques Refractometric, FTIR and UV are elaborated.

In the chapter III, An appropriate first task here is briefly to review the characters of molecules of solutes and solvent which have been selected for present investigations. The structure, physical and chemical properties of the molecules taken for investigations are outlined. The procedure adopted for the preparations of solutions and blends and the experimental procedures of the techniques are provided.

In the chapter IV, the viscometric, the ultrasonics, the refractometric and the FTIR techniques were employed to investigate the polymer solutions of Poly (methyl methacrylate) (PMMA) and Nitrocellulose (NC) and the blends of PMMA/NC in the presence of solvent ethyl methyl ketone at compositions and at temperature 303K. The miscibility among the polymers is established. The effectiveness of the techniques is appreciated and it is preferred to employ these techniques for the investigation of physiological phenomena of drug interactions.

In the chapter V, An attempt has been made to identify the molecular interactions in the aqueous solutions of doxycycline hyclate, Human insulin
actrapid and the blends of doxycycline/insulin at compositions and at
temperatures 303K, 310K and 313K through dilute solution viscometric and
ultrasonic techniques. The conformational technique of refractometric and UV
spectrometry were also employed. The doxycycline hyclate deviates from its
bioactivity and involves in interaction with insulin. Thus the social relevance
problem of interaction of doxycycline with exogenous insulin to increase the
tissue sensitivity is proved.

The chapter VI deals with the investigation of molecular interaction of
doxycycline hyclate with unsaturated fatty acids at different compositions and at
temperatures 303, 310 and 313K through dilute solution viscometric, ultrasonics
and refractometric techniques. The affinity of doxycycline hyclate towards fatty
acids is proved and which may leads to toxic side effects, the antibiotic resistance.

Chapter VII also identifies the molecular interaction of doxycycline
hyclate with saturated fatty acids through viscometric, ultrasonic and
refractometric techniques at ambient temperature 303K and physiological
temperatures 310 and 313K to show the preferential interaction of fatty acid with
lipophilic doxycycline hyclate. This antibiotic interaction with fatty acids, the
energy reserves is significant for antibiotic resistance.

Thus in this thesis an attempt has been made to prove the social
relevance problems that causes from the drug interactions. The investigation is
successfully carried out through the simple and sophisticated techniques. The
effectiveness of the techniques was also identified.