CHAPTER I

INTRODUCTION

Industries that deal with paints, plastics, inks, insecticides, drugs, cosmetics, and foods, employ as solvents water, glycols, and alcohols to as great an extent as they do hydrocarbons, ethers and esters, and perhaps even more. Therefore, selection of the suitable solvents is very important. To solve this problem, trial-and-error is the old method which can become time consuming and costly and there is no assurance that the optimal solvents have been found (1, 2).

In the attempt to predict the solubilities of solute in various solvents, the best approach is to construct a theory for liquid mixtures which can be applied under various conditions. Thus, many theories were proposed for prediction of solubilities of solute in various solvents. Most theoretical work has dealt with mixtures of nonpolar spherical molecules and random mixing (e.g. Regular solution theory, Lattice theory, etc.). Among these theories, the theory of solutions is one of the most challenging and least understood branches of physical chemistry (2, 3). The Scatchard-Hildebrand equation of regular solution theory is the pioneer approach in this field (1, 4 - 10).

In recent years, the solubility parameter concepts have found wide and increasing use in many areas of industrial and academic endeavor because of the simplicity with which significant predictions can be obtained. These concepts are generally applied to solvent selection in the industrial community while the calculation of solubilities and thermodynamic properties have concerned the more theoretical

workers (3, 11-13).

Martin and co-workers combined the modification of the Scatchard-Hildebrand equation for solute solubilities in regular solutions with the use of polynomial regression analysis and is referred to as the Extended Hildebrand Solubility Approach (EHS) (3-6, 10, 14-16). This approach is widely used in binary and ternary solvent systems.

Burrell (11) was the first who applied the solubility parameter to practical (polar) systems. He extended the original solubility parameter concept to estimate the solubility of coating materials (mainly polymers) in polar solvents. He classified solvents into low, medium, and high hydrogen-bonding capacity. Together with solubility parameters, this division according to hydrogen-bonding facilitated the selection of solvents for paints, inks, adhesives and related commercial materials (1, 11).

Following Burrell's work, other systems of polar solubility parameters were developed. Among the approaches most widely used is that of Hansen (1, 11, 17), involving three solubility parameters rather than the single δ value of Hildebrand, together with the use of multiple regression analysis; and then referred to as the Extended Hansen Solubility Approach (1, 17-21). The method provides a satisfactorily empirical representation for the solubility of several drugs in individual solvents.

In this study, three approaches based on a regular solution theory, i.e., the Scatchard-Hildebrand equation, the Extended Hildebrand Solubility Approach, and the Extended Hansen solubility Approach were employed to predict the solubilities of phenobarbital

and sulfadiazine in individual solvents ranging from nonpolar hydrocarbons to highly polar solvents. The back-calculating solubilities of these two drugs in individual selected solvents were presented and compared to observed values and among each others.