CHAPTER I

INTRODUCTION

1.1 Definition of Liquid-Liquid Extraction

Liquid-liquid extraction is a mean of mass-transfer operation, sometimes called solvents extraction. It may be defined as the separation of the constituents of a liquid solution by contact with another insoluble liquid. The mixture under treatment is called the raffinate and the solvent rich phase is called the extract. The component transferred from raffinate to extract is the solute. The solvent in the extract leaving the extractor is usually recovered and reused.

Liquid-liquid extraction carried out in several ways, all involving the distribution of a substance between two immiscible liquids for purpose of mass-transfer of constituents from one liquid phase to other, followed by physical separation of two immiscible liquids.

1.2 Controlled Cycling and Controlled Cycling Extraction.

The concept of controlled cycling was introduced by Cannon in 1952. He defined controlled cycling as a cyclic process in which the time for each part of the cycle, or amount of material moved in each part of the cycle, or both, is controlled by automatic equipment. Althrough controlled cycling has been proved to be a very effective method of operation by laboratory experiments, it still has not been applied extensively to industrial plants. It is a new field of research,

and a few informations. However, it is a very interesting field. Therefore, further study is required inorder to get more information.

All previous applications of controlled cycling in the field of masstransfer have involved the flow of only one phase at a time. Some processes have a short pause with no flow between flow periods to permit phase separation. The directions of the flows during their respective periods are opposite. When phase contacting is done with controlled cycling, the major advantages of this alternate one phase flow are: First, it prevents channeling of phases and therefore improved the contact between phases. Second, it increases greatly the average driving force (average concentration difference in the case of mass transfer). For these reasons, efficiency and capacity with controlled cycling should be higher than the conventional operation.

The application of controlled cycling to liquid extraction can best be explained with referrence to Figure 1.1. A complete cycle has four parts consisting of:-

1. a light phase flow period during which both light phase valves are open and those on the heavy phase lines are closed;

2. a coalescing period during which all valves are closed and the phases separate at each stage;

3. flow of the heavy phase with valves in the heavy phase line open; and

4. another coalescing period to permit phase separation before the cycle repeats.

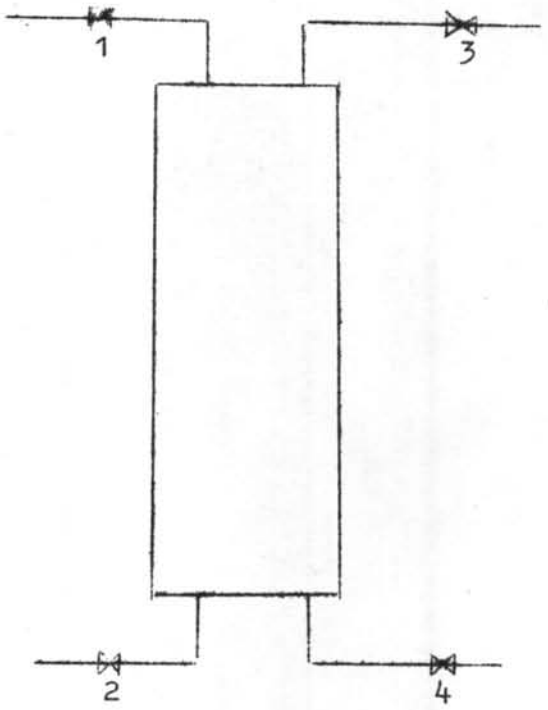

Figure 1.1 A cyclic extractor. Light phase input period, 1 and 2 open; relaxation period, all valves are closed: Heavy phase input period, 3 and 4 open; relaxation period, all valves are closed.

1.3 Field of Usefulness

There are major fields of application for liquid-liquid extraction as follow:-

1. As a substitute for distillation or evaporation particularly when the substances to be separated are chemically differrent. For example, distillation of a dilute solution of acetic in water involves the evaporation of large amount of water as high reflux ratio is expensive, because of high latent heat of vaporization of water. Extraction of acetic acid with organic solvent, followed by distillation of the new solution provided a cheaper process. Since the heat of vaporization of most organic solvents is substantially less than that of water. Extraction may also be attractive as an alternative to distillation or evaporation when very low temperature would be required to avoid thermal decomposition. For example, long-chain fatty acids may be separated from vegetable oils by high-vaccum distillation but mor economically by extraction with liquid propane.

2. For separations not readily done by other methods. For example, aromatic and paraffin hydrocarbons of nearly the same molecular weight can be separated readily by extraction with any of a number of solvents, eq. diethyleneglycol and sulfonate, but are impossible to separate by distillation. Many phamaceutical products, eq. penicillin, occur naturally in mixtures which are so complex that only liquid extraction is a feasible separation device. Many metal separations, particularly those which are expensive by chemical methods, such as uranium-vanadium, tantalum-columbium, and halfnium-zirconium, are economically done by extraction. Even low cost organic chemicals such

as phosphoric acid, boric acid, and the like, can be economically purified by liquid-extraction means, despite the fact that the cost of solvent recovery must be included in the final operation.

1.4 Purpose and Scope of Study

Experimental work concerning the application of controlled cycling to a seive plate liquid-liquid extraction column on the system of M.I.B.K., Acetic acid, Water system to determine the efficiency and capacity of each run on the effects of the following.

1. The effect of varying through put rate on column efficiency
2. The effect of varying the period of flow and coalescing
3. The effect of varying the light phase to heavy phase flow ratio
4. The effect of varying total cycle time.