

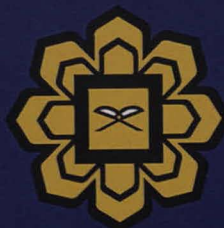
**EXPERIMENTAL METHODS
IN MODERN BIOTECHNOLOGY**

Editors

Ibrahim Ali Noorbacha

Mohamed Ismail Abdul Karim

Hamzah Mohd Salleh

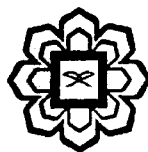


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Ibrahim Ali Noorbatcha
Mohamed Ismail Abdul Karim
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Liquid-Liquid Extraction and its Application for Separation of Organic Acids

Parveen Jamal

1. Introduction

Extraction is a separation process that helps in separating a substance from a matrix or transferring a solute from one phase to another. It is a process in which two phases come into contact with the objective of transferring a solute or particle from one phase to the other. Generally, one phase is liquid and the other phase is solid. Sometimes the phases are immiscible liquids, and the solute is in soluble form.

There are various types of extraction techniques but generally Liquid-liquid extraction and Solid liquid extraction are very common. Other techniques include Supercritical carbon dioxide extraction, ultrasonic extraction, heat reflux extraction or microwave-assisted extraction.

1.1 Liquid-liquid Extraction

Liquid-liquid extraction (LLE) is a basic technique in chemical laboratories, which is commonly performed after a chemical reaction as part of the work-up. It helps in separation/purification of compounds based on their polarity as well as acidic or basic properties. This technique allows extraction of a substance from one liquid phase to another liquid phase. Usually water and an organic solvent immiscible with water are the two phases and extraction is based on the difference in solubility of a compound or mixture of compounds in an aqueous phase compared to organic phase. Another most common example of immiscible solvents is oil and water.

It is a quick way to purify the product(s) of a reaction. Sometimes a complex mixture is obtained upon extraction of natural tissue. When this is the case, additional methods of separation must be used. One such method is the separation of the constituents into three classes: acidic, neutral, and basic by liquid-liquid extraction. In fact virtually every organic reaction requires extraction at some stage in the purification of its products. Most organic reactions involve the use of inorganic reagents. After such a reaction is completed the isolation of the organic product usually involves liquid-liquid extraction.

1.2 Principle of Extraction from Liquids

Liquid-liquid extraction (LLE) is one of the important unit operations that allow the researchers to separate the fluids based on different solutes being soluble to different degrees in different solvents. LLE involves the distribution, or partitioning, of a solute between two different immiscible liquid phases. The term "*partitioning*" is commonly used to refer to the underlying chemical and physical processes involved in liquid-liquid extraction.

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