
**وزارة التعليم العالي والبحث العلمي**
**الجامعة الاسلامية / النجف الاشرف**
**كلية التقنيات الطبية**
**قسم تقنيات المختبرات الطبية**
**الكيمياء العامة / العملي**

# Lecture (6) / extraction

**لطلبة تقنيات المختبرات الطبية**

**المرحلة الاولى**

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**Extraction** : is a separation process consisting in the separation of a substance from a matrix. The distribution of a solute between two phases is an equilibrium condition described by partition theory.

**Rules of extraction: -**

1- You must have tow insoluble liquid layers to perform of extraction.
2- In solid extraction, solid must be dissolved in a solvent, and must be insoluble in the other extracting or washing liquid.
3- If you washing or extracting an organic liquid, dissolve it into the another liquid, just like a solid, before extracting or washing it.

This lab. focuses on three widely used techniques for extraction:

1- **Liquid–liquid extraction (LLE),** also known as **solvent extraction** : is a method to separate compounds or metal complexes, based on their relative solubility in two different immiscible liquids, usually water (polar) and an organic solvent (non-polar). There is a net transfer of one or more species from one liquid into another liquid phase, generally from aqueous to organic. The solvent that is enriched in solute(s) is called extract.
   -LLE is also widely used in the production of fine organic compounds, the processing of perfumes, the production of vegetable oils and biodiesel, and other industries ,It is among the most common initial separation techniques.
2- **Solid - phase extraction (SPE)** : is an extraction method that uses a solid phase and a liquid phase to isolate one (or one type of) analyte from a solution. The analyte is selectively adsorbed on the surface of the solid phase . Other solvent added to remove possible adsorbed matrix components (washing). Eluting solvent added to desorb analyte selectively.

Principle of SPE Distribution of Sample components between two phases, i.e liquid phase and solid phase. Solid phase must have greater affinity for analyte than the sample matrix. Compounds retained on the solid phase can be removed by eluting solvent having greater affinity for the analyte . pH changes can be useful.

3- **Solid –Liquid Extraction (SLE)** : is similar to liquid-liquid extraction, except that the solute is dispersed in a solid matrix, rather than in a carrier liquid. The solid phase, containing the solute, is dispersed in the solvent and mixed. The solute is extracted from the solid phase to the solvent, and the solid phase is then removed by filtration.

- There are many techniques that work within this phase, we will touch on a system:

**Soxhlet extractor** : is a piece of laboratory apparatus invented in 1879 by Franz von Soxhlet. It was originally designed for the extraction of a lipid & liquids from a solid material. Typically, a Soxhlet extraction is used when the desired compound has a limited solubility in a solvent, and the impurity is insoluble in that solvent. It allows for unmonitored and unmanaged operation while efficiently recycling a small amount of solvent to dissolve a larger amount of material.

## Equipment & materials:

| | | |
|---|---|---|
| 1- Condenser | 2- Thimble | 3- round flask |
| 4-hot plate or mental heat | 5- orange peel | 6- solvent |

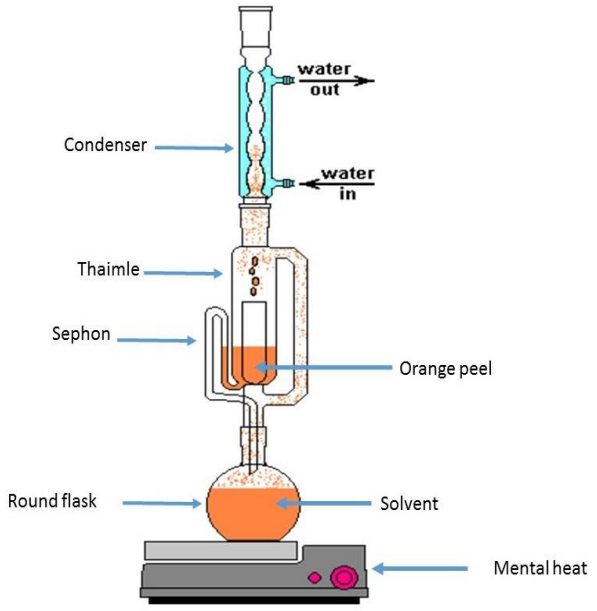
## Assembly

1. The source material containing the compound to be extracted is placed inside the thimble.
2. The thimble is loaded into the main chamber of the Soxhlet extractor.
3. The extraction solvent to be used is placed in a distillation flask.
4. The flask is placed on the heating element.
5. The Soxhlet extractor is placed atop the flask.
6. A reflux condenser is placed atop the extractor.

## Operation

The solvent is heated to reflux. The solvent vapour travels up a distillation arm, and floods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapour cools, and drips back down into the chamber housing the solid material. The chamber containing the solid material slowly fills with warm solvent. Some of the desired compound dissolves in the warm solvent. When the Soxhlet chamber is almost full, the chamber is emptied by the siphon. The solvent is returned to the distillation flask. The thimble ensures that the rapid motion of the solvent does not transport any solid material to the still pot. This cycle may be allowed to repeat many times, over hours or days.

During each cycle, a portion of the non-volatile compound dissolves in the solvent. After many cycles the desired compound is concentrated in the distillation flask. After extraction the solvent is removed, typically by means of a rotary evaporator or simple distillation.




**-Extraction of limonene from orange peel -**