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LATEST REVIEWS ON ADVANCED HERBAL TECHNIQUES

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Abstract :
Nowadays, people are getting increasingly interested in herbal remedies due to their many benefits. Herbal formulas are now commonly recognized as efficient therapies for a wide range of illnesses. It is known that more than 80% of the world's population relies on herbal products and medicines to maintain their health, but they are often abused. The increased use of herbs has also led to misuse and adulteration of many products, leading to dissatisfaction of both consumers and producers, and in some cases leading to major disasters. Developing reliable analytical methods that can improve the identification of phytochemicals and identify markers/bioactive compounds and other important compounds is a challenge for researchers. Standardization is the first important step in design.

Keywords :

Authentication, Chromatography, Extraction, Purification, Standardization, Herbal Technology, Herbal Medicine

Objective :

Recognize the various approaches utilised in advanced herbal medication technology.

INTRODUCTION :

This article covers the basic concepts of the popular herbal technology. The market for natural products and conventional medical procedures have grown in response to the need for alternative medicine. When utilizing herbal medication technology to transform plant materials into medications, It is important to combine current research and traditional knowledge with appropriate standards and quality control. Substances thought to provide therapeutic, preventive or nutritional benefits are called "medicines", and plants or herbal preparations are called "herbs". "Herbs" therefore refer to plants that have medicinal, preventive or curative properties. Plants with these characteristics are called by this name. The field of herbal medicine encompasses many disciplines such as pharmacognosy, botany, natural chemistry, phytotherapy, Ayurveda, agriculture, Unani medicine, biotechnology and biochemistry. Medicine and Ayurveda. A healer is someone who works with plants, especially herbs. Herbal medicine is a common term in herbal medicine. Anyway to start. [1]

Different techniques for plant identification :

Recognition :

Dependability-wise, it's similar to professional judgment. Based on the identifier's extensive previous Fantasticality in determining the plant group.

Professional Determination:

Expert opinion is the most accurate method of analysis. Generally speaking, specialists have Revealed treatments (revisions, summaries, and monographs) of the relevance in one's deve Expert taxa can be found in more current manuals or floras. In herbaria, botanical gardens, and museums,Experts can usually be found at colleges, universities, etc. Despite being incredibly dependable, this approach has Disadvantages in that it delays identification and takes up important professional time.

COMPARISON :

Comparing an unknown to known specimens, images, drawings, or descriptive text is the third technique. Even if it's a dependable process, there may not be enough identical materials, therefore it could be Laborious or even unfeasible.[4]

The use of key and similar device :

A list of inquiries or assertions regarding a feature of a plant is called a key. You have to decide if they are "true" (the description in the key corresponds with the plant's physical appearance) or "false" (the description does not correspond with the plant's physical appearance).This method is the most widely used since it doesn't require the knowledge or experience necessary for Contrasting and acknowledging. [4]

How to identify plant :

1) Pay close attention to the area and weather conditions. For example, coniferous forests in cold climates are mostly evergreen forests. In desert areas with low moisture content and sandy soil, succulents and cacti are more prevalent. Humid, damp settings are ideal for the growth of algae, ferns, and tropical flowers.

2) Examine the branches and stems. Examine the plant's branches and stalks for any unique features that can reveal something about its nature. Hardwood-containing stems and branches are typically found in woody plants, whereas herbaceous plants—which are typically annuals or perennials—have supple, soft branches. Some examples of plants having trailing or climbing vines are climbing members of the broad bean family (Fabaceae), fruit shrubs, and ivy.

3) Observe the size and form of the leaf. The species of a plant can be inferred from the size and form of its leaves. Unless you're dealing with a broad-leafed evergreen plant, leafy leaves may be a sign of a tropical plant, while sharp pines may be a sign of an evergreen plant. Succulents may be represented by thick, waxy leaves, while herbs may be represented by triangular leaves.

4) Examine how the leaves are arranged. You can learn a lot about a plant's species by observing how its leaves are formed and structured. (Leaves are not limited to the time of flowering; they are present during the entire growth season of the plant.) Determine the number of lobes on the plant's leaves and whether or not the margins are notched or smooth. Poison oak is indicated by rounded lobes, whereas clusters of three blunt-toothed leaflets may indicate poison ivy. When combined, these characteristics can help identify the species you see and indicate if the plant is safe to handle.

5) Pay attention to flowers and fruits. Fruits and berries of flowering plants can be used to identify species. Green, white, and yellow berries are probably poisonous, but fruits with blue, black, or purple skin are frequently edible. (Always do an edibility test before consuming any plant's berries.) Figuring out the plant's toxicity is another key stage for identification. Check the flower color and number of petals to identify if you're dealing with weeds or wildflowers, some of which may be edible (like dandelions or chicory, which have many petals). But you should stay away from most umbrella-clumping flowering plants because they are highly hazardous.

6) Search for thorns, hairs, or barbs. Look for defense-related features on the plant, such as hairs, thorns, or barbs on the stems or leaves. The stems of stinging nettle have hairs that resemble needles. Certain deadly mushrooms release a milky fluid from their epidermis. If you see these plants outside, it's advisable to stay away from them because touching them can irritate your skin.

7) Take note of the fragrance. Certain herbs, such as basil, rosemary, and parsley, have pleasant aromas, whereas other herbs have unpleasant ones. Certain plants, like female ginkgo trees or crown imperials, have inherent sulfurous or fecal scents that can also indicate the kind of plant species you are interacting with.

8) Examine the roots. Examine the plant's roots to see how it grows—from rooted stems, rhizomes, bulbs, or tubers—if you are able to handle it safely. Subterranean rhizomes grow horizontally, producing new shoots from nodes and new root systems. Ginger, asparagus, and lily of the valley are examples of common rhizomes. Bulbs differ from tubers in their growth habits, although they share comparable inflated underground stems. Bulb plants include tulips, daffodils, and hyacinths. From the base of the original bulb, new bulbs grow, and from surface buds on tubers, new stems emerge. Tuberous roots are found in many flowering plants, including dahlias, daylilies, and peonies.

9) Call. It is important to remember that it is impossible to identify a plant based on its appearance alone, as many have deadly relatives in the wild. Before growing or eating exotic plants outdoors, study their bodies and structures before trusting your intuition and vision. Explore research and information collected by renowned botanists. To prevent ingestion of invasive plants, learn about potentially invasive plants before cutting down trees and planting them in your garden.

10) Try a plant report. Use a smartphone app to identify plants rather than using your own instructions. Using intelligence, we can determine common names, scientific names, and general characteristics from just a photograph of a plant. Most apps have a built-in camera that allows you to take photos of your plants and access certain information. The app compares the plant's characteristics and appearance to species listed in the plant database to help determine plant identity. [14]

DIFFERENT EXTRACTION METHOD :

Extracting technique:

The process of extracting soluble substances by treating insoluble residues (liquid or solid) with a heavy liquid is called extraction. Therefore, it is based on the phenomenon of mass transfer and is a solution.

The primary techniques for extraction are as follows :

1. The maceration process.
2. Incorporation
3. Disintegration
4. Infusion
5. Seepage
6. Extraction of Soxhlet
7. Extraction with microwave assistance
8. Sonography-assisted extraction
9. Supercritical fluid extraction

Maceration :

One of most common methods is to digest plant material in methanol, ethanol, ethyl acetate, acetone, hexane, etc. It is a maceration in which it is roughly immersed in solvents such as. This is a popular and inexpensive way to extract many bioactive substances from plants. However, the maceration process also has some disadvantages such as limited efficiency, low yield and the use of large amounts of solvents that may be harmful to consumption. It is also important to choose the right solvent for the extraction process of a particular botanical extract. As part of the maceration process, the plant material is ground into small particles, making the surface area easier for the solvent to mix and use the drug effectively. The mixture of plant material and the solvent is then stored for a long time, constantly stirred and filtered through filter media. The weight and type of plant material determines how much bioactive substances are extracted from the product. The most important factor affecting extraction performance is the polarity of the solvent. For this method to be effective, various solvents and mixing times are used. By dissolving the cell structure and allowing the chemical compounds to react with the solvent, the maceration procedure eliminates plant components. This method is frequently used in lab settings to extract a variety of bioactive compounds. Maceration was one of the simplest ways to

produce flower extracts from Papaver rhoeas L., leaf extracts from Morus, kinnow peel extract and fruit extract. This approach may be applied locally or widely and finds usage in the industrial sector. [6]

Infusion:

A fluid solvent is used to bring one or more components of a solid combination into a desired solution. This technique is known as infusion extraction, but it is also known as leaching, washing extraction, diffusional extraction, or solvent extraction. Infusion, often termed steeping, is the technique of suspending plant material in a solvent for a long time with the goal of extracting flavors or chemical components (a process frequently called steeping). The infusion procedure is distinct from decoction, an extraction method that boils the plant material, and percolation, which includes running water through the material (as in a coffee machine). The botanical substances (usually dried herbs, flowers, or fruits) used in the medicinal process of infusion are volatile and readily release their medicine in water, oil, or alcohol. Usually the liquid is heated to a high temperature (such as boiling) and poured over the plant. After the herbs have steeped for the appropriate amount of time, they are removed from the liquid (usually filtered), leaving the infusion. If not used immediately, infusions are packaged and stored for later use. The length of time the herb remains in the liquid depends on the type of infusion. The brewing time for liqueurs such as Sloe gin can vary from seconds to hours, days or even months, depending on the type of tea. Some of the tools and techniques used to extract herbal or botanical ingredients into liquids are metal infusers (similar to tongs), French presses (often used for ice along with various teas and coffees), and tea infusers (which double as tea makers). Filter. The most commonly used equipment is tea bags, which are small bags made of filter paper that contain tea leaves of various flavors. Infusion is a tea. Most require the leaves to be steeped in hot water, although some, such as Moroccan mint tea, require boiling. Many herbal teas are also produced by brewing. You can use one or more herbs alone or in combination, such as rooibos, lemon, chamomile, senna, apple, and ginger. [13]

Decoction:

. Boiling is a proven extraction technique, especially for water-soluble and heat-stable ingredients. In this case, an open extractor containing a set of water boils the raw herbs for a predetermined period of time. Crude samples are usually initially diluted one to sixteen (1:16) or one to four (1:4). At the end of the extraction process, it reduces the volume to a quarter of its original volume through boiling and evaporation After the decoction is extracted, the concentrated extract is filtered and used directly or after further processing. Decoction is the process of boiling herbal or plant material to dissolve the drug in the product. This is the most common scheme in many herbal systems. Once dried, the plant material is chopped, crushed or sliced to maximize its solubility. They are boiled in water to remove oil, organic compounds and other substances. [7]

Percolation:

Ancient extraction technique used to prepare traditional Chinese medicines is called percolation extraction. The extraction solvent is continually introduced to a percolation tank filled with powdered pharmaceutical material while the percolation extract is simultaneously collected. Simple percolation apparatus is used. The process of percolation is simple. It is possible to remove components that are unstable at temperatures with effectiveness. However, it has disadvantages such as using too much solvent, long removal time and energy consumption in the next step.[14]

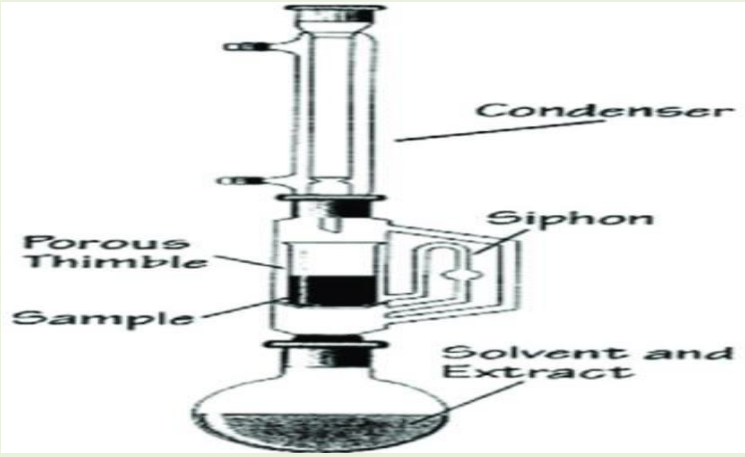

Fig. 2 Percolation

SOXHLET EXTRACTION:

An effective and user-friendly method is soxhlet extraction. He used many materials such as soil, sediment, tissue and animals. Other solvents can also be used, including acetone-hexane mixture and pure dichloromethane (DCM). Using nonpolar solvents only isn't suggested. About eight hours are usually needed for a normal Soxhlet extraction. Sulfur is another substance obtained from soil and sediment samples that must be removed during post-cleaning processing. Soxhlet extraction has long been used when there are insoluble impurities in the sample that have little solubility in the solvent. The main chamber of the Soxhlet extractor contains a space filled with sample material. The extraction cycle typically repeats the process several times using a concentrator and siphon to return the solvent through the nozzles.[7]

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SUPER CRITICAL FLUID METHOD:

The method of using supercritical fluid as the extraction solvent to separate one part (extractant) from another part (matrix) is called supercritical fluid extraction, or SFE. Extraction is usually performed on solid matrices, but can also be performed in liquids. SFE can be used on a larger scale to collect desired products (e.g. essential oils) or to remove unwanted products from products (e.g. decaffeinated products). It can also be used as a standard pre-analysis step. These essential oils may contain direct solvents such as limonene. The most common solvent is carbon dioxide (CO2), sometimes replaced by solvents such as methanol or ethanol. Supercritical carbon dioxide extraction conditions are above 74 bar and 31°C. Modifie

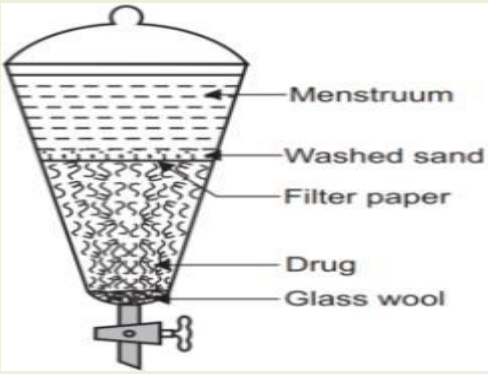

Fig. 3Soxhlet Extraction

rs can change this to some extent. Unless otherwise specified, the following topics are primarily related to CO2 mining. The system requires a CO2 pump, a power cell to store the sample, a method to maintain constant system pressure, and a storage vessel. The liquid is fed into the heating zone and heated to supercritical temperature. The extracted product is quickly absorbed and dissolved in the product matrix of the extraction vessel. The product moves from the extraction machine to a separator operating at low speed and then recovered. Carbon dioxide can be released into space, cooled, or recompressed. [8]

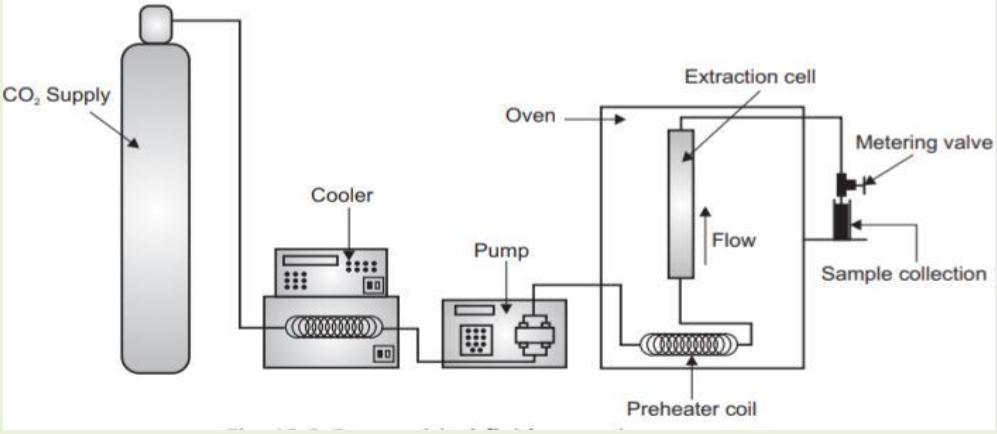

Fig.4 Supercritical Fluid Method

MICROWAVE ASSISTED EXTRACTION:

An environmentally friendly method called “microwave-assisted extraction” uses microwave energy in the range of 0.915 to 2.45 GHz to extract chemical molecules specifically from plant materials. This method has become a new tool for analyzing chemical matrix extraction and organic synthesis during modeling. This technique, called “microwave-assisted extraction,” involves using microwave energy to heat the solvent in contact with the sample to remove analytes from the sample matrix and shift the weight. Use this method to extract organic compounds from materials. Previously, samples were digested in a microwave oven for metal analysis. Although microwave region actually occurs at frequencies from 100 GHz to 300 MHz all microwaves, whether in homes or laboratories, operate at the same frequency of 2.45 GHz. Works

Selection of solvent :

When using microwave-assisted extraction (MAE), the choice of organic solvent is important because the solvent must be able to absorb microwave radiation and therefore heat. The suitability of an organic solvent for MAE can be measured by its dielectric constant; The higher the dielectric constant value, the greater the heat capacity of the organic solvent. Hexane, methanol, dichloromethane, acetone and acetonitrile are organic solvents commonly used in MAE.

Principal Of MAE :

The principle of microwave extraction (MAE) differs from traditional methods (liquid-liquid or simple extraction) in that electromagnetic waves cause changes in the cell structure, resulting in extraction. As microwaves pass through the material, the molecules interact with the waves. As a result, thermal energy produced by the conversion of microwave energy aids in the mass transfer of plant cells from their interior to their exterior. In this manner, microwave energy can be used to extract bioactive chemicals. Conventional techniques for extracting plant components using solvents depend on choosing the right solvents and applying heat or agitation to enhance mass transfer and make the target chemicals more soluble. This is why there has been interest in the novel extraction technique known as microwave-assisted extraction, which has shorter extraction times, uses less solvent, prevents pollution better, and takes additional care with thermolabile ingredients.

MAE Procedure :

For devices for MAE, two methods are employed

1. Atmospheric MAE system (Open system)
2. Pressurized MAE system (Close system)

Atmospheric MAE system

The sample in the open MAE system is kept in an open tank and is mixed with the proper organic solvent. The solvent boils and rises to the top of the vessel when the magnetron's microwave energy is focused onto the sample and solvent system via the waveguide. A water-cooled reflux condenser then comes into contact with the heated solvent. The solvent condenses as a result and goes back into the vessel. In order to allow for the desorption of organic molecules from the sample into organic solvent, this process is repeated briefly.

- Operating conditions

1. Temperature that reaches the solvent's boiling point.
2. Time of extraction 5-20min.
3. Set the power 100% at 300W

Pressurized MAE system

Microwaves enter the cavity (the oven) of the closed MAE system and are distributed by a mode stirrer. An equal distribution of microwaves inside the cavity is made possible by the mode stirrer. The sample and solvent are contained within the sealed vessel, which is often constructed of materials that are microwave-transparent, such as poly(ether imide) or trifluoromethoxy polymers, which is another significant distinction in the pressurized MAE system.

- Operating conditions

1. Pressure less than 200psi Temperature range between 100-140°c
2. Set the power 100% at 900W. [13]

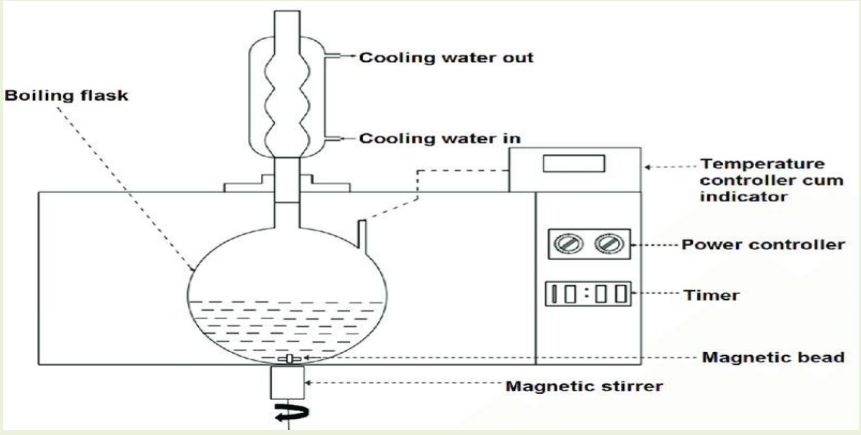

Fig. 5 MAE

ULTRASONIC EXTRACTION PUB :

Ultrasound-assisted extraction (UAE) involves applying the energy produced by ultrasound to the sample. Due to the cavitation caused by the ultrasonic process, small bubbles or holes in the liquid burst in the solid structure, producing local high pressures and temperatures of approximately 50 MPa and 4500 °C, respectively. These forces can cause events such as removal of material from the body, disruption of cell membranes, and sonic fragmentation. The UAE is generally divided into direct UAE and indirect UAE. In UAE, direct ultrasonic radiation is used directly following immersion of an ultrasonic generator (an inert acoustic instrument) into the sample-liquid mixture. BAE ultrasonic energy is applied directly to the sample-liquid mixture using an ultrasonic bath that can be applied to multiple samples simultaneously. Both techniques require an additional cleaning step. Temperature, sonication cycle, granulation/homogenization step, and extraction time are all negative factors for the development of UAE .[9]

Benefits :

- In addition to increasing extraction yield, ultrasound extraction also involves quicker kinetics and a drop in operating temperature, which enables the extraction of chemicals that are thermolabile.
- The modest number of effective materials utilized reduces the amount of solvents used while increasing sample throughput.
- The process of Ultrasound Extraction is also effective in recovering and purifying active compound.

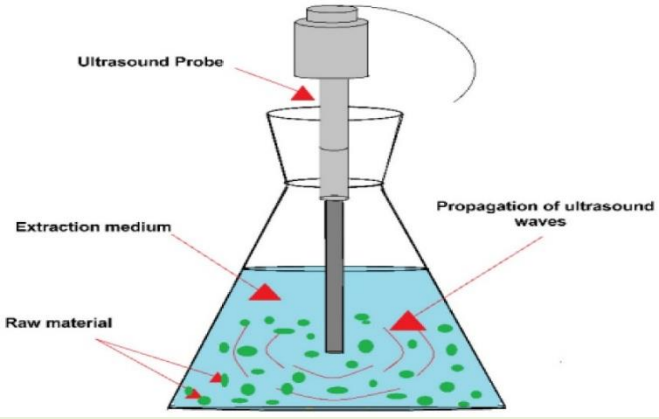

Fig. 6 Ultrasonic Extraction

SOLID PHASE EXTRACTION:

Clinical laboratories often use standard extraction (SPE) methods to extract analytes from complex matrices. This sample preparation can be used to extract, purify and concentrate previously analyzed samples for quantitative analysis. Solid phase extraction eliminates many of

the problems of liquid-liquid extraction, which also helps recover value. This method can be automated, easy to use, and can remove a lot of material in 30 minutes. Additionally, this method can be used for urine, blood, food samples, water, etc. It is also suitable for pretreatment of complex matrices, such as handling small amounts of solvent. Solid phase extraction exploits the difference in affinity between analytes and interactions with the solid phase (adsorbent) in the liquid matrix. Due to their affinity, target analytes can be separated from interfering substances.

In general, the product extraction phase consists of four processes.

1. The filter material must first be cooled or equilibrated with solvent to wet the adsorbent.
2. After this, the cargo containing the analyte penetrates into the solid phase. Ideally, analytes and some bacteria should remain on the sorbent.
3. Then, contaminants are eliminated by washing the sorbent.
4. This elution phase involves collecting the analyte.

Phase importance for high selectivity

There are various levels for SPE. Most are based on polar, hydrophobic or ionic interactions. Options are limited and display plans are often shared with glitchy products. The most selective phase currently on the market is called molecularly imprinted polymers. Using this technique, interference during elution can be minimized and recovery (even at low levels) in chromatographic analysis can be achieved. AFFINISEP, a leader in the development of molecularly imprinted polymers, has developed a line of solid phase extraction sorbents called AFFINIMIP® SPE that use molecularly imprinted techniques to clean samples prior to analysis .

The process of separating and purifying phytochemicals. :

The process of using physical and chemical techniques to extract substances or active substances from a plant extract and purify them into a compound is called phytochemical isolation. Today, traditional separation techniques such as solvent removal, precipitation, crystallization, fractionation, salting and filtration continue to be used in practice. However, modern separation techniques such as high-performance liquid chromatography, ultrafiltration, column chromatography and high-performance reaction chromatography are also important in the process. The common techniques and their particular uses in phytochemical isolation are covered in this section. A wide variety of chromatographic techniques can be used to improve fractionation and purify final nanoparticles. Generally speaking, the decision is based on the extract or fraction’s purity level and the separated NPs’ primary function.

TECHNIQUES FOR ISOLATION AND PURIFICATION:

- Crystalization
- Sublimation
- Distillation
- Liquid liquid partition extraction

- Chromatography methods

Crystalization :

One method of material purification is crystallization. The process of removing solids from solution. Crystallization is the process by which material atoms or molecules arrange themselves in a three-dimensional lattice structure, reducing the total energy of the system. When a substance crystallizes, its atoms or molecules are bonded to each other at perfect angles. When added and mixed, the ingredients will dissolve in the liquid. However, as more and more solids are added, a point is reached where they cannot dissolve in the liquid. This point is called the saturation point and the liquid is called the saturated solution

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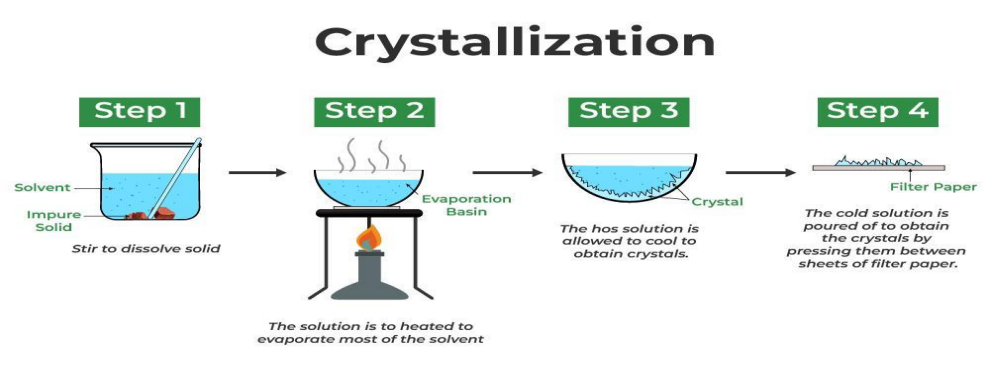


Fig. 7 Crystallization

. **Crystallization process:**

1. Heat the solution using an open container
2. When the solvent molecules begin to evaporate, solvent is left behind.
3. As the solution cools, a viscous liquid begins to form on the surface of the solution.
4. Crystal collection and drying process is carried out according to the demand of the product.
5. Filtration is a method of removing undissolved particles from a liquid.
6. The cooling rate determines the size of crystals formed during operation.

7. The size of the crystals formed during this process depends on the cooling rate.
8. Large crystals form slowly upon cooling.

Use of Crystallization:

- seawater purification.
- Crystallization of alum from impure materials separated.

Sublimation :

Some solids can pass directly from the liquid phase into the gaseous state. Sublimation is the name given to the purification process that uses this technology. It can be used to distinguish substances that can and cannot sublimate. The product is heated in a porcelain vessel above and an inverted funnel is used to collect the sublimable solution. To speed up the process, the funnel is kept cold. The vapor of the product condenses on the funnel. Sublimation is the transition of a solid into a gas. During this transition, the drug does not pass into the liquid phase; instead it turns into a phase change. Instead it varies directly from product to fuel. Since the molecules are being released into the air by breaking their chemical connections, the sublimation process is an endothermic reaction. As a result, energy is released during the formation of chemical bonds and must be supplied during their breakage. As such, the process is endothermic. The enthalpy of sublimation is the energy that is computed. Only pressures and temperatures lower than a substance's triple point can cause sublimation. The triple point of a substance refers to the pressure and temperature at which the substance exists in three phases (solid, gas, and liquid).. Below the triple point, solid water sublimates when its temperature rises and turns into a gas. Examples of sublimation include the transformation of dry ice into gaseous carbon dioxide at normal temperature and pressure. Naphthalene, an organic chemical, sublimes readily at room temperature and normal pressure.

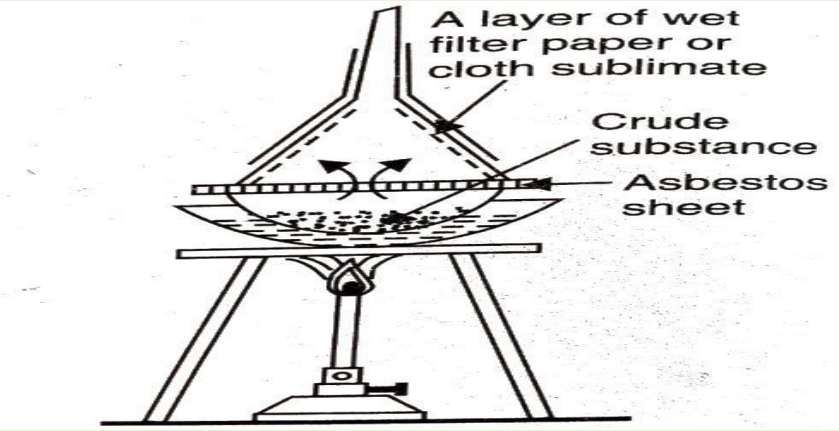


Fig . 8 Sublimation

Distillation :

The process of selectively boiling and then concentrating a portion of a liquid mixture is called distillation. A separation process that can be used to obtain (nearly) pure substances through mixing or to increase the concentration of mixed substances. The distillation process utilizes temperature differences between substances to convert part of a liquid mixture into a gas. It is important to remember that distillation is a physical separation process rather than a chemical separation process. The diagram below shows the laboratory setup used to perform this procedure. While industrial distillation methods are often continuous and necessitate maintaining a constant mixture composition, laboratory distillation frequently employs batches of the liquid mixture.

Distillation Types :

- Useim distillation
- Steam distillation
- Fraction distillation
- Nqus distillation
- Zone distillation
- Short path distillation

Simple Distillation :

In the distillation process, the liquid mixture is heated to boiling point and then the vapor condenses very quickly.

This process is best for mixing liquids with temperatures varying up to 25oC.

Raoult's law regulates the distillate's purity, or the liquid that has been purified.

Fractional distillation

A common technique for separating mixtures of liquids with comparable boiling points is fractional distillation. It goes through multiple phases of vaporization and condensation (in a fractioning column). Another name for this process is therapy. Below is a list of ingredients that should be used to break the mixture into pieces.

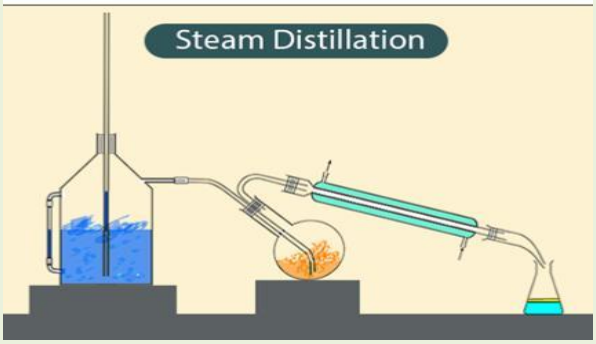
- Distillation flask or glass base
- A hot source such as a hot shower or fire.
- obtaining a flask to hold the condensed fumes.
- Column of fractions
- A thermometer to gauge the distillation flask's temperature
- The condenser
- Glassware standard.

The liquid combination turns into vapors when heated, and the fumes ascend into the fractioning column. During this time, the steam cools and condenses on the condenser walls. The condensed

steam is now heated with hot air coming from the distillation vessel to obtain new steam. This evaporation-condensation cycle occurs multiple times, with each cycle increasing the purity of the distillate. The photo below shows the proportions. Liebig and Graham condensers are two types of condensers that are frequently used in laboratories.

STEAM DISTILLATION

Steam distillation is a method is mainly used for the isolate heat-sensitive chemicals. Another way is to classify miscible liquids according to their volatility. Let's think about nostalgia. This is necessary in some industrialized areas. Because most organic molecules decompose at high temperatures, they are difficult to separate at their boiling point using simple distillation methods. The evaporated water vapor and the necessary chemicals are in condensed liquid phase and placed somewhere near the glass. Distillation is now done at low temperatures. If the product



is heat sensitive, steam distillation may be an option. After distillation, the steam is condensed.

Fig. 9 Steam Distillation

Application :

Essential oils, such as those used in perfumes, are produced through steam distillation. Herbal products containing essential oils are used in this process. This process is only used by companies to extract orange oil. Both the production of consumer goods and the oil industry use steam distillation. Use them to extract fatty acids from the mixture

Vacuum Distillation

- The best method for separating boiling liquids is vacuum distillation.
- Heating these chemicals to high temperatures is not the only way to boil them. Therefore, the pressure in the environment decreases.
- This may cause overheating due to component depletion. This material becomes vapor when the vapor pressure reaches ambient pressure.
- After that, the vapors condense and are gathered as the distillate. High-purity samples of chemicals that break down at high temperatures can also be obtained by the vacuum distillation process.

Zone Distillation:

Zone distillation is a process in which matter is partially dissolved and the resulting vapor is condensed to produce a pure distillate. This is done on a longboat with the help of a heating zone.

Application:

- A key component of several methods of purifying water is distillation. This technique is used by several desalination plants to produce potable water from seawater.
- Distillation is a common method used to extract flavorings and perfumes from herbs and plants.
- Several fermented goods, including alcoholic beverages, can be cleansed using this technique.[22]

Chromatography :

Chromatography is an important separation technique used to control the purity of organic compounds and to separate the elements of a mixture of substances in order to purify the compounds. This method uses a mixture of chemicals in a stationary phase (solid or liquid). In the stationary phase, the oil mixture or pure solvent is allowed to move slowly. Therefore, the components of the mixture begin to separate from each other. Three elements form the basis of the chromatographic process based on this method. [7]

- Stationary: The “solid” phase, often referred to as the “liquid layer adsorbed on the support surface”, always forms this phase.
- Mobile phase: This phase always contains “liquid” or “vapours components”.
- divided molecules

The most important factor in effectively separating of the molecules from each other is the interfere between the stationary phase, mobile phase and the mixture. Fraction-based chromatography techniques are particularly suitable for the separation and analysis of small molecules such as fatty acids, carbohydrates and amino acids. Proteins and other large molecules (such as nucleic acids) can be better separated using affinity chromatography (also known as ion exchange chromatography). Gas-liquid chromatography is used to separate alcohols, esters, lipids, and amino groups and to monitor enzyme interactions. Molecular sieve chromatography is used specifically to determine the molecular weight of proteins. The Paper chromatography is technique used in the separate the proteins and study of the protein synthesis. Bacterial, DNA and RNA fragments can be purified using agarose gel chromatography. Stationary phase is the liquid or solid phase that covers the solid phase in chromatography. Liquid chromatography (LC) refers to the use of a liquid mobile phase; Gas chromatography (GC) refers to the use of the gas phase. Gas chromatography is widely used for mixtures of solids, gases and liquids. Liquid chromatography is particularly suitable for non-volatile and thermally unstable substances. In addition to being used in separation, chromatography is also used in quantitative measurements

where the aim is to achieve separation in a reasonable time. Various chromatographic applications have been developed to achieve this goal. Some of these techniques are gel permeation chromatography. [7]

Types of chromatography:

- Chromatography using thin layers
- Chromatography in columns
- Chromatography using Ion Exchange
- Chromatographic affinity
- Chromatography of gas
- Chromatography using gel permeation
- The liquid chromatography under high pressure

CHROMATOGRAPHY USING THIN LAYER

Chromatography by thin layer is techniques are the technique used for the separation of the non-electrolyte compounds. The test is performed on a piece of glass, plastic or aluminum foil lightly coated with adsorbent material. Usually silicone, cellulose or alumina materials are used. Once the separation process is complete, all objects appear vertically separated. Each element has a retention factor (Rf), which indicates: Rf is proportional to the distance traveled by the solvent and the sample. RF = Distance Traveled from Sample / Distance Traveled by Solvent . Temperature, adsorbent, surface area and weight all affect the retarding effect.

Principle :

Thin layer chromatography (TLC), like other chromatographic techniques, is based on separation. The relative affinity of the drug to the two phases determines the separation. The drug in the mobile phase moves towards the surface of the station. Compounds with better affinity for the stationary phase move slower than other compounds and the movement occurs in this way. Therefore the mixture is separated. When the separation process is completed, the composite material appears as a ball on the appropriately sized plate. Appropriate measurement techniques can identify their nature and properties.

Procedure :

- Thin layer chromatography plates: Use weak metal and chemically inert ready-to-use plates. Its surface is covered with a thin layer of stationary phase. The stationary phase of the plate has small shape and thickness.
- TLC chamber for plate formation. Responsible for managing the internal environment to support the development of facilities. It also keeps the entire process dust-free and stops the evaporation of the solvent.

- Chromatography by thin layer Mobile Phase: The mobile phase contains and moves a solvent or solvent mixture. In this case there should be no particles. The higher the quality purity, the better the growth of the stone.
- A thin layer chromatography filter should be installed in the chamber. It gets wet in the mobile phase.

Application :

- TLC does qualitative testing on a range of medications, including steroids, hypnotics, analgesics, anticonvulsant tranquilizers, sedatives, and local anesthetics.
- It is frequently employed in the division of complex medicinal compositions.
- It is frequently employed in the division of complex medicinal compositions.[10]

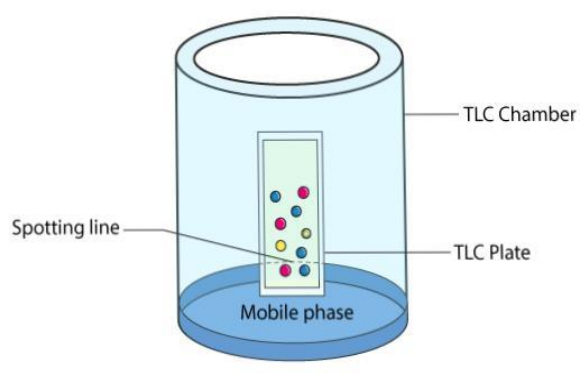


Fig. 10 TLC

The Paper chromatography :

Paper chromatography is a chromatographic method that uses a paper or strip as a stationary or adsorbent passing through the solution. Composites can be easily separated using a low-cost method by using their different forms. It is the high diagnostic tool that requires so small equipment. Paper chromatography was invented by Singer and The Martin in 1943.

Theory :

Adsorption chromatography may be the principle. Partition chromatography is a technique in which substances are dispersed or dispersed in the liquid phase. The two phases are the mobile phase passing through the filter paper and the water contained in the pores of the filter paper. During the moving action the mixture separates. Due to the capillary action of the pores of the paper, the substances in the mixture are separated according to their different affinities for solvents in the stationary and mobile phases. Adsorption chromatography is a technique that uses the liquid phase as mobile phase and the paper surface as the stationary phase.

Procedure :

1. Selection of suitable devlopment type
2. Selection of suitable solvent
3. Selection of suitable filter paper
4. Preparation of the sample
5. Sample spot on the paper
6. Development of chromatogram
7. Drying of the filter paper And detection of sample

Application :

- To verify the safety of medications
- To research the ripening and fermentation processes.
- To inspect the reaction mixtures in labs doing biochemistry.

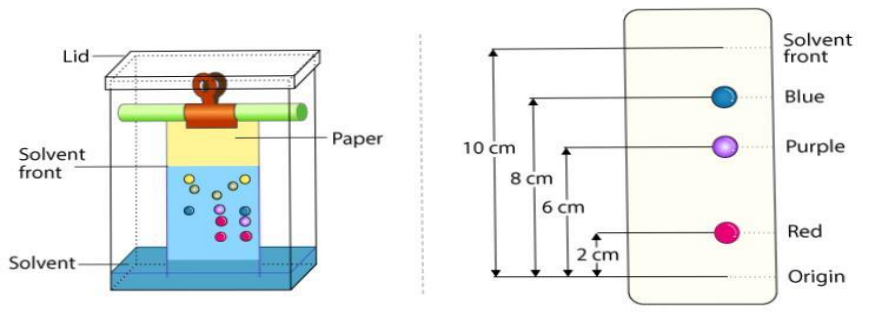


Fig. 11 Paper Chromatography

Column Chromatography .

The method used in chemistry to extract a compound from a mixture in liquid is called column chromatography. Column chromatography can separate substances into different fractions by allowing compounds to pass through the column at different rates and then adsorb on the adsorbent. Both small and large objects to be used in future research can be purified using this method. This technique falls under the category of adsorption chromatography.

Theory :

When it is mobile and the mixture leaves the top of the column, the particles of the mixture move at different speeds. Faster components are eluted first, while slower components are eluted last.

Application :

- One method of separation of the active components is the column chromatography.
- It is employed in the estimate of drug dosage based on drug compositions.

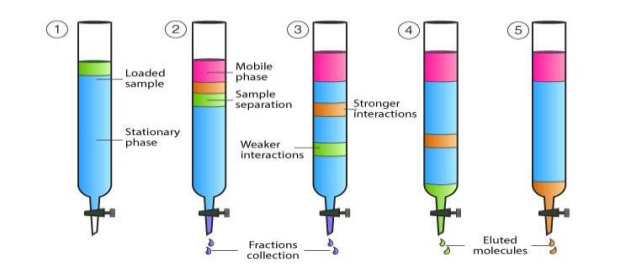


Fig. 12 Column Chromatography

HPLC :

An analytical method called high-performance liquid chromatography is used to separate, identify, or quantify of each compound. The mixture is separated using the principles of column chromatography and then spectroscopy is used to analyze and evaluate the results. Therefore, HPLC is the most important column liquid chromatography method.[8]

Application :

- Drug analysis
- Separation of valueable product
- Purification of water
- Isolation and purification of enzymes

Standardization Of Herbal Drug :

Quality control for herbal medicines is a difficult and time-consuming task. Due mostly to a lack of suitable medical regulations, the commercialization of these medications' production to satisfy the rising demand has resulted in a decline in their quality. It is imperative to establish a clear approach and implement well-planned strategies for the normalization of unrefined natural components and locally produced formulations. India has the potential to become a major country and take the lead in establishing the powerful, mainstream Ayurvedic treatment plan. India has to research useful plants for medicine. Only by assessing and testing herbal goods utilizing advanced, contemporary standardized procedures like UV-Visible, TLC, HPLC, HPTLC, GC-MS, and others can this be achieved. [12]

Parameters of evaluation for the herbal drugs :

- Morphological evaluation
- Microscopical evaluation
- Chemical evaluation
- Biological evaluate
- Physical evaluation

Morphological evaluation :

This method examines morphological or external traits. The flavor and scent in this color are referred to as organoleptic character. These characters have been altered from plant parts.[10]

- Colour
- Size
- Shape
- Odur
- Taste

Microscopical evaluation :

This method makes it possible to thoroughly examine tiny features. Using a compound microscope, histological analysis is required for this method. It also involves studying other cell components such calcium oxalate crystals, lignin starch grains, and aleuronic grains (a kind of plant protein) that are present in crude medicines. This method offers a comprehension of both disordered and ordered systems that microscopic study is unable to offer. This method analyzes cell walls, starch, lignin, calcium oxalate crystals, trachoma, stoma, fiber, etc. can be used to describe their content. Contains the following characters [11]

- Number of stomata
- Stoma index
- Palisade ratio
- Number of vascular islets
- Number of vascular endings
- Lycopodium method

Number of Stomata :

Number of the stomata is described as the mean number of stomata per square millimeter of the leaf's epidermis.

Stoma index :

The ratio of the number of stomata in epidermal cells to all stomata is called the stomatal index of the leaf.

Palisade ratio :

Based on the average number of palisade cells per epidermal cell. Dust decides that.

number Of vascular islets :

The average number of square millimeters of Pex between the midrib and the edge of the leaf is called vascular islets number

Number of vascular endings :

The average number of square millimeters of pex between the midrib and the edge of the leaf is called vascular endings number.

Lycopodium method :

Lycopodium method is the made up of Lycopodium clavatum spores. Every spore has a tetrahedral form. The Lycopodium Spores have a uniform size of 25 mm and a highly distinctive shape. For those crude drug powder samples, the Lyospores technique is applied, with an average of 94000 spores per milligram of powdered Lycopodium present.[12]

Physical evaluation :

Qualitative physical evaluation involves following

- Refractive index
- Melting point
- Boiling point
- Density
- Viscosity

Quantitative evaluation consists following

- Ash value
- Moisture content
- Extractive value

Ash value :

By utilizing the powder-drug interaction as a result of the interaction between the crude and ash drugs, one may determine the composition of the powder. To incinerate all living things. When it comes to identifying or assessing the purity of powdered medications, Ash Value is crucial. Depending on the solids, it fluctuates within prescribed prescription limits. The ash is composed of silicates, carbonate, phosphate, and silica.

Types of ash values:

- Total ash
- Acid insoluble ash
- Water soluble ash
- Dry Ash
- Wet Ash

Moisture content :

Microbial growth will reveal the surplus water content of a medicinal plant. There is an ideal watering schedule for each type of plant.

Types :

- Loss of drying
- Azeotropic method
- Karl fisher reaction.

Chemical evaluation :

In qualitative chemical evaluation , which uses a variety of compounds to detect distinct phytochemicals, may be run on both crude drug powder samples. For instance, alcohol, protein, glycosides, and alkaloids acid Value, iodine Value, saponification Value, ester Value, RM Value and acetyl value of the oil , fats are all included in this quantitative evaluation assay of the Radio Immunoassay Enzyme, which includes the immunosorbent assay. Value of White Ester Value of Acetyl Content of aldehyde in volatile oil. [12]

CONCLUSION :

Since the beginning of human history, people around the world have used plants, herbs, and ethnobotany to improve health and treat disease. The basis of today's medicine is obtained from plants and other natural sources, which play an important role in production of pharmaceutical products. Approximately 25% of the world's medicines come from plants. Plants can also be used as medicine instead of medicine. For some people, herbs are a recommended treatment option. Some people use herbs as treatments in addition to traditional medicine. However, in many poor countries, the only effective and affordable treatment is traditional medicine, whose main ingredients are medicinal plants. Whatever the reason, herbal users should ensure that the products they purchase are safe and cover their use as they may not contain certain herbs or herbal ingredients. In addition, consumers should be provided with scientific information about the use, contraindications and effectiveness of the drug. To achieve this goal and ensure the responsible production and sale of medicinal herbs, it is necessary to comply with international laws. These laws should allow for the appropriate use of plants where there is sufficient scientific evidence of their benefits, with the aim of encouraging their use and recognizing their therapeutic benefits and promoting public health

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