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Advanced Herbal Technology

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Abstract: *Lately peoples are getting attracted towards herbal medicines due to many benefits. Herbal formulations have achieved extensive acceptability as medicinal agents for several diseases. It is a well-known fact that over 80% of individuals worldwide rely on herbal remedies and products to keep up a wholesome way of life, even though most of these applications are unconventional. This is a development in the use of herbal product has again given height to various forms of misuse and impurity of the products leading to consumers' and the manufacturers' dissatisfaction and in some instances fatal effects. Herbal medicine having significant chemical constituents that having tendency toward treat the disease conditions. Mainly when there is no Allopathic drug Herbal drugs are used. The development of original analytical methods which can reliably profile the phytochemical arrangement, including quantitative analyses of marker/bioactive compounds and other major components, is a major challenged to scientists. Standardization is an important step for the organization of a consistent biological activity, a consistent chemical profile, or just a quality confirmation program for exposition and manufacturing of herbal drugs Recent advancements includes DNA fingerprinting, metabolomics method, differential vibration polarography, chemo metric, X-ray diffraction…etc. are practical. Capillary electrophoresis and chromatographic methods contributions towards standardization of herbal drugs is also documented. Nowadays, seasoning blends are acknowledged as variable therapies for a range of ailments. More than 80%of people on the planet rely on medication and flavouring products to lead healthy lives, even though the majority of those uses are unorthodox..*

Keywords: Herbal Technology, Herbal medicine, Standardization, Chromatographic, DNA fingerprinting, Extraction, Purification

Objective

1. Acknowledge the different methods used in modern herbal medicine technology.
2. Gain an understanding of the raw materials used in the production of herbal medications.
3. Be familiar with the ICH and WHO criteria for herbal medication evaluation.
4. Be familiar with natural sweeteners, herbal cosmetics, and nutraceuticals.
5. Appreciate GMP and herbal medicine patents

I. INTRODUCTION

The demand for alternative medicine has led to an increase in the markets for conventional medical procedures and natural products. Herbal drug referred as plants materials or called herbalism in this use whole plant or part of plant to treat injuries or disease condition or maintain health and healing purpose. Herbal drugs are oldest form of health care known to mankind. There are various type of herbal preparation available in market to treat mild to severe cases of disease. Exceptionally in some countries herbal drug may also enclose by tradition, natural organic, inorganic active constituents which are not of plant source. When using herbal medication technology to transform plant ingredients into pharmaceutical, Standardization, quality control, and a sufficient it's significant for integrating ancient wisdom in today methodologies in science. The term "health care" designates a material with therapeutic preventive, or nutrition qualities; the term "herbal" designates a preparation composed of plants or botanicals. Therefore, any plant based substance that has therapeutic, preventive, or nutritional properties is referred to as "herbal medicines". Herbs are generally safe due to they obtain from Natural sources. The use of herbal drug in the world day to day increase due to higher the side effects and toxicity associated with Allopathic drug its lead to rapid increases in the number of herbal

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drug manufacturers. All emerging technological frontiers aimed at gaining access to the wild range of plant manipulation techniques available in America are circumscribed by herbal technology which encompasses every aspect of herbal medicine related to botany and research on medicinal plants, except genes. A vast array of technologies has been developed to harvest the abundant goods produced by the plants, as well as to produce natural dyes, biofertilizers, biopesticides, and biofuel. Flavorer Technology was the first step towards codifying the scientific procedure and guiding principles of this novel approach to successful managing plants across America. For over two decades Herb Technology has led the way in the advancement of botanical medicines. Our team of doctors – western, Chinese, and Ayurvedic-has preferred the age-old art of flavour formulation. Ayurvedic medicine, biological science medicines, medicinal plant analysis, phytochemistry, botanical medicine, natural chemistry, agriculture science, Unani drugs, biotechnology, and organic chemistry are all covered by herbal drugs.[1]

Fig no. 1

Identification of herb–what is this herbs?

Fresh herbs are most frequently used in recipes, and most people are familiar with their names. It's simple to identify basil, thyme, and rosemary because of their different appearances. Throughout history, herbal remedies have been utilised to treat illnesses and preserve health. DNA technology for the identification of herbal medicinal ingredients has been in widespread use since the mid-1990s. Nature is the primary source of medicinal materials. They're employed ancient medicines. People are becoming more interested in herbal remedies these days because of their many benefits. Formulations with herbs have achieved widespread acceptance as medicines for a number of illnesses.[2]

Different methods of identification of plant

1)Expert determination: In terms of accuracy or dependability, this is the most reliable identification approach. It is likely that the more recent floras or manuals incorporate the expert's definition of taxonomy, as experts have generally published treatments (monographs, revisions, and synopses) of the group in question.

2)Recognition: this is predicated on the identifier's comprehensive prior expertise with the relevant plant group.

3)Comparison: A third technique involves contrasting an unknown with identified specimens, images, drawings, or descriptions.

4)The use of keys and similar devices: The most popular technique, which doesn't involve any time, materials, or experience, is the use of keys and similar devices participating in recognition and comparison.

Authentication of plant

Formal medical systems are moving to the position of Swiss drugs in treatment and preventative factors. The increased exchange in medicinal shops delivers profit citation for herbalists while negotiation of occasional constituents with cheaper and further readily functional species is deluding the end drugs. The outstanding cause of the problems associated With the standardisation of medicinal shops is the complex arrangement of herbal medicines used in the form of whole shops. factory corridor or excerpts. Purposeful contamination of deliberate factors is posing problems in distinguishing the genuine aids. Authentication of medicinal shops by recent molecular styles is ineluctable for herbal medicine enterprises. experimenters and academia. Of late, herbal genomics, molecular studies of medicinal shops, and important coming generation Sequencing ways have been passed to transfigure the recent knowledge. [3]

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Authentication techniques are followed below

1)Morphological Identification

Description: Involves the observation of external features like leaf shape, size, flower structure, stem type, and root morphology.

Advantages: Quick and simple for distinguishing numerous plants, especially those with egregious differences.

Limitations: Can be unreliable due to phenotypic variations, hybridization, and environmental influences.

2. Microscopic Analysis

Description: Examining plant tissues under a microscope can help identify species grounded on cellular structures similar as epidermal cells, trichomes(hairs), vascular tissue, and stomata.

Advantage: Provides detailed, species-specific structural features.

Limitations: Requires technical knowledge and outfit, and it can be time- consuming.[4]

3. DNA Barcoding

Description: Uses short, standardized DNA sequences(generally in regions like rbcL or matK) to identify factory species. This is done by comparing the DNA sequence of an unknown factory sample to a reference database of given species.

Advantages: largely accurate and dependable; effective for relating indeed fractured factory material(e.g., dried leaves or mucilage's).

Limitations: Requires technical outfit(e.g., PCR machine), and a reference database must be available for comparison.

4. inheritable characteristic

Description: ways like AFLP(Amplified Fragment Length Polymorphism), SSR(Simple Sequence Repeats), or RAPD(Random Amplified Polymorphic DNA) induce unique inheritable labels that can be used to distinguish species or indeed kinds within a species.

Advantages: largely accurate and effective for relating inheritable differences.

Limitations: Requires moxie and laboratory outfit.

5. Chemical Profiling(Phytochemical Analysis)

Description: Analyses the chemical composition of shops using styles like HPLC(High- Performance Liquid Chromatography), GC- MS(Gas Chromatography- Mass Spectrometry), or NMR(Nuclear glamorous Resonance) spectroscopy. This is especially useful for medicinal or sweet plants, where specific composites serve as labels.

Advantages: Reliable, especially for shops used in herbal drug.

Limitations: Requires technical outfit and may be expensive.

6. High- Performance Liquid Chromatography(HPLC)

Description: Used to separate, identify, and quantify factory composites grounded on their chemical parcels.

Advantages: largely accurate for relating factory-specific composites and detecting contamination.

Limitations: Time- consuming and requires professed drivers.

7. Gas Chromatography- Mass Spectrometry(GC- MS)

Description: GC- MS separates unpredictable composites from factory material and identifies them grounded on their mass gamut's.

Advantages: Excellent for analysing unpredictable canvases and secondary metabolites set up in medicinal plants.

Limitations: Requires precious equipment and expertise.[5]

8. Herbarium and Taxonomic Reference Collections

Description: Involves comparing a factory sample to samples in herbarium collections or reference databases, where plants are proved with detailed taxonomic information.

Advantages: Direct comparison with vindicated samples.

Limitations: Requires access to a well- maintained herbarium and may not be doable for field identification.

9. Ethnobotanical styles

Description: Involves original knowledge of factory use, particularly in traditional or indigenous communities. Ethnobotanical studies can help in vindicating the identity of plants used for medicinal, culinary, or artistic purposes.

Advantages: Provides sapience into factory uses that might not be fluently captured through scientific styles.

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Limitations: private and may not always align with scientific taxonomy.

10. Fourier Transform Infrared Spectroscopy(FTIR)

Description: FTIR is a fashion used to gain an infrared diapason of immersion or emigration of a factory sample. This helps to identify functional groups within the factory's chemical composites.

Advantages: Non-destructive and fairly quick.

Limitations: May bear careful estimation and moxie for interpretation.

11. Radioactive Isotope Tracing(for specific purposes)

Description: In some advanced exploration scripts, radioactive isotopes can be used to trace factory growth or commerce with the terrain, although this is a rare system for routine authentication.

Advantages: Can offer perceptivity into plant behaviour and composition over time.

Limitations: Expensive and not generally used for routine factory authentication.

Extraction of herbs

Extraction methods are to isolate compounds from raw materials, typically for purposes such as analysing active ingredients, creating concentrates, or separating valuable substances. These techniques can be classified into basic and advanced methods, depending on their complexity and the type of materials they are used to extract.[6]

Methods of extraction

1)Traditional methods

a. Maceration

b. Digestion

c. Decoction

d.Infusion

e. Percolation

f. Continuous hot extraction (Soxhlet extraction)

g. Expression

h. Enfleurage

2)Advanced methods

a. Supercritical fluid extraction

b. Counter current extraction

c. Microwave assisted extraction

d. Ultrasonic assisted extraction

e. Solid phase extraction

f. Accelerated Solvent Extraction (ASE)

Supercritical fluid extraction:

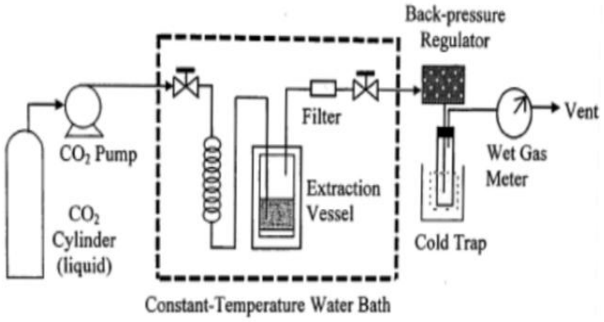

Fig no. 2

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The maximum temperature and pressure at which a pure substance can remain in vapour-liquid equilibrium that is, within the range of its physical and thermal characteristics between those of a pure liquid and a gas is known as its critical point.In this particular extract, a solvent is used to help remove a element from a matrix. still, supercritical fluid is the detergent in this case. Supercritical fluid birth, or SCF, is substantially used to extract materials from solids, though it can also be used to extract materials from liquids. In logical laboratories, this kind of birth is used to prepare samples. More generally, it's employed in the process of decaffeination(oil painting) to remove undesirable materials from the product stream. In this birth process, the separated materials or composites are combined with the supercritical fluids to form a mobile phase.[7]

Advantages

1)Pressure governs the dissolving power of the SCF and/or temperature.
2)Due to its easy recovery of SCF from the extract, volatility.
3) Residue-Free; Non-Toxic Solvents
4)Only high boiling components are fractionated at medium low temperatures.
5)Ultimately, high resolution by more classical processes infeasible separations.can sometimes be effected.
6)It is used to extract thermally labile compounds withonly low temperatures can be used for little damageby the extraction.

Disadvantages

1)Elevated pressure required.
2)Compressing solvent by dehumidifying the ambient gas means multiple, complex steps of recyclingsteps to get energy prices down
3)Equipment requires substantial capital investment.[8]

Application

1) Organics are recovered from oil shale.
2) Fluid separations in biology.
3) Bioseparation.
4) Recovery of petroleum.
5) Raw dewaxing.
6) Coal processing (liquefaction and reactive extraction).
7) Extracting perfumes, oils, and contaminants selectively from food and agricultural goods control of pollution.
8) Combustion, along with numerous other

Microwave assisted extraction (MAE):

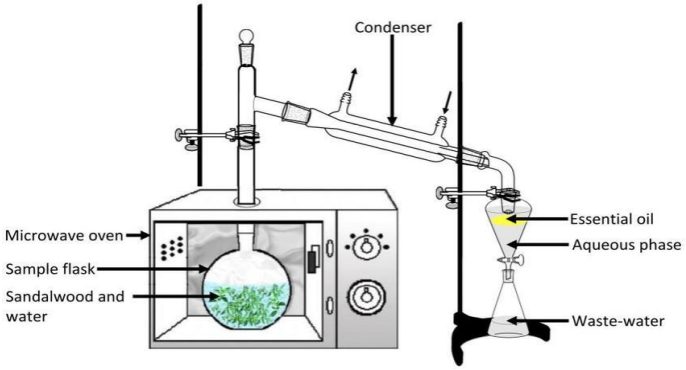

Fig no. 3

Microwaves (frequency 300MHz to 300GHz) are non-of the electromagnetic waves they were ionizing appearing in the electromagnetic spectrum between X rays and infrared rays.

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1.They consist of an oscillating electric field and magnetic field(Two orthogonal oscillating fields), of which the former heats.
2.Extraction is carried out mainly from dried plant materials; But the plant cells that have traces of this in themof moisture that they become the target of microwaveheating.
3.These plant cells when microwave heated,the moisture inside heats up and goes away.
4.That causes the plant cells are swollen and apply pressureon the cell wall.
5.Cells expand due to this mechanical stress and finally explode, thereby dissolving the active solvent to the outside between its constituent and enhancing the phytoconstituents yield
6.Similar solvent mixture is hexane acetone.[9]
Microwave assisted extraction process:
Two approaches are used for devices for MAE
1.Open MAE system (Atmospheric)
2.Closed MAE system (pressurized)

Open MAE system

The sample is located in an open vessel to which an appropriate organic solvent is added. The microwave generated from the magnetron is directed by the waveguide onto the sample/solvent system, thus causing solvent to boil and rise up within the vessel. The hot solvent then comes into contact with a water cooled reflux condenser. This causes the solvent to condense and return to the vessel. This process is repeated for a short period of time so enabling organic compound to be desorbed from the sample matrix into the organic solvent.[10]
Typical operating conditions for open MAE are as follows:
1) Temperature up to the boiling point of the solvent.
2)Extraction times5-20 min.
3) Power setting of 100% at 300 W.

Closed MAE System

Microwave enter the cavity (the oven), and are dispersed by a mode stirrer. The mode stirrer allows an even distribution of microwaves within the cavity. The other major difference in the pressurized MAE system is that the sample and solvent are located within the sealed vessel which is usually made of microwave-transparent material such as poly (ether imide) or trifluoromethoxy polymers.
Operating conditions for closed MAE are as follows
1) pressure <200 psi.
2) The temperature is within the range of 110-145°C .
3) power setting of 100% at 900 W.

Advantages

1) In MAE, extract multiple samples simultaneously using a minimal organic solvent.
2) Reduction extraction time.
3) Improved yield.
4) Better accuracy.
5) suitable for thermolabile substance.

Disadvantages

1) Remove the solid remains during MAE, further filtration or centrifugation is required.
2)Additionally, microwave efficiency can be terribly inadequate when the mark compounds or the solvents are either volatile or non-polar.

Application

1)Texans extraction from Taxus brevifolia needles.
2)Luminescence associated with azadiractin from Azadirachta indica seed kernels.
3)Mycorrhizal acid extraction from Glycyrrhizia glabra beginnings.
4)Artemisinin is extracted from Artemisia annual.

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5) MAE was confirmed to be a viable substitute for traditional techniques for phenol extraction, including green coffee beans' chlorogenic acids.[11]

Ultrasound-assisted extraction

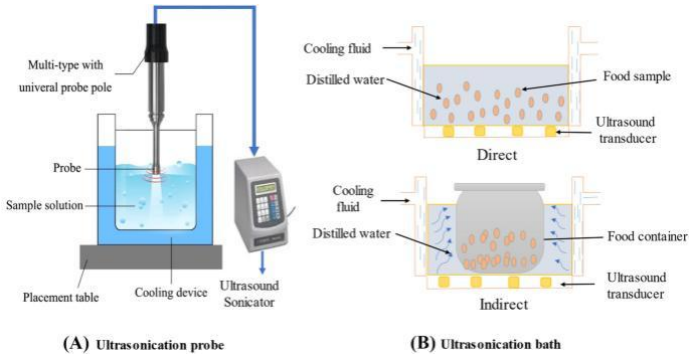

Fig no. 4

The commonness above the 20,000 Hz is known as ultrasound. Ultrasonic swells are used in ultrasonic birth. These swells reason cavitation's consequence on the dry cell and destruct the cell wall and release the active members. When ultrasonic swells are passed through the liquid media, it compresses (produces high pressure) and responds (low pressure) to the liquid media. Due to this process, small holes or vacuum globules are formed in the detergent. After a specific duration, these bubbles aren't suitable to soak further power yield by microwave oven, and they burst. At the high pressure cycle, they burst, which is known as cavitation. Due to this cavitation, cell walls are destroyed and functional chemical elements are uprooted.[12]

Advantages

1) It's a reasonable, easy, and effective choice to traditional line fashion.
2) It contains the increase in extraction result and hastily kinetics.
3) It drops the operating temperature, permitting the extraction of thermolabile composites.
4) Compared with different new extraction methods, such as broiler-supported extraction, the ultrasound machine is cheaper and its process is easier.
5) The extraction situations of UAE can be optimised with regard to time, the contradiction quantum of detergent, and the volume and variety of sample.
6) The operating time of UAE is comparatively shorter with faster kinetics.

Disadvantages

1) The active ingredients of medicinal shops through the conformation of free revolutionaries and accordingly unwelcome changes in the medicine molecules.
2) The free revolutionaries may have undesirable side effects.

Applications

1) prize nutraceuticals from shops similar to essential canvases and lipids as salutary complements. e.g, canvases, almond, apricot, and rice bran.
2) Extraction of saponins from ginseng, the experimental total result and saponin yield increased by 15 and 30 independently.

Solid-phase extraction

It is a sample medication fashion used for constituent separation, enrichment, and sanctification from waterless results, depending on the physical and chemical properties of the ingredients. A solid phase, sometimes referred to as a sorbent, comes into contact with waterless samples during this process.[13]

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Isolation and Purification Techniques

General isolation techniques

1. Maceration: This involves soaking the plant material in a solvent (like ethanol or water) to dissolve the desired compounds.
2. Percolation: A more controlled version of maceration, where the solvent is continuously passed through the plant material.
3. Steam distillation: Used for extracting essential oils from aromatic plants. Steam is passed through the plant material, carrying away the volatile compound
4. Solvent extraction: Using Solvent like ethanol, methanol, or hexane to dissolve the desired compound, then evaporating the solvent to obtain the extract.
5. Supercritical fluid extraction: Utilizes a supercritical fluid (like carbon dioxide) to extract the compound. This method is efficient and leaves no solvent residues.
6. Fractional distillation: For separating different compounds based on their boiling points.
7. Chromatography (column, Thin layer, HPLC): used for further Purification and separation of compounds.
8. Crystallization: Allowing the extract to slowly evaporate, causing the compounds to crystallize.
9. Precipitation: Adding a solvent to the extract, causing the desired compounds to precipitate out.
10. Filtration: Used to remove solid impurities from the extract.
11. Centrifugation: separates particles based on their density using centrifugal force chromatographic techniques.[14]

Types of chromatography techniques are:

1. column chromatography
2. Thin Layer Column Chromatography
3. Paper chromatography
4. Gas chromatography
5. High Performance Liquid Chromatography
6. High Performance Thin Layer Chromatography

Thin Layer Chromatography (TLC) :

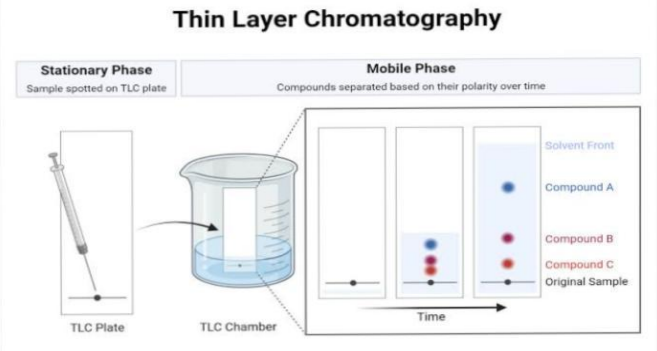

Fig no. 5

Procedure

1. Preparing the TLC plate: Take a TLC plate, which is a flat sheet of glass, plastic, or aluminium coated with a thin layer of a stationary phase(usually silica gel or alumina). Mark a baseline near the bottom edge of the plate using a pencil or marker. This is where you'll spot or apply your sample .
2. Preparing the sample: Dissolve or suspend the mixture of compounds you want to in a suitable solvent. This forms the sample solution. If the sample contains solids, it may need to be dissolved or diluted in a suitable solvent,
3. Applying the sample: Using a capillary tube, micropipette, or a thin applicator spot small amount of the sample solution onto the baseline you marked on the TLC plate. Bee careful not to overload the plate.

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4. Developing the chromatogram: Place the TLC plate in a developing chamber containing a solvent mixture (the mobile phase). Ensure that the solvent level is below the baseline on the TLC plate to allow capillary action to occur. Cover the chamber to prevent evaporation of the solvent and allow the chromatogram to develop. This might take several minutes to an hour depending on the compounds being separated.

5. Visualizing the separation: Remove the TLC plate from the chamber once the solvent front (solvent migration) is close to the top of the plate. Allow the plate to air dry or use a gentle stream of air to speed up the process. Visualize the separated compounds. Initially, they might be invisible or faint. You can use a UV lamp or a chemical reagent to Visualize specific types of compounds.

6. Analysing the TLC plate: Measures the distance traveled by each compound(Rf value) by dividing the distance traveled by the compound by the total distance traveled by the solvent. Compare the Rf values obtained for each compound with known standards or literature values to identify the components.

7. Recording results: Recording the Rf values, any visual observation, and any additional relevant data in your lab notebook or report.[14]

Advantages

1. An easy method of separation of the components.
2. In this technique, fewer types of equipment are used...
3. All components of UV light is achievable to Visualize.

Disadvantages

1. Applicable for soluble mixture components only.
2. Qualitative analysis, not quantitative analysis.
3. Not an automatic process.

Column Chromatography:

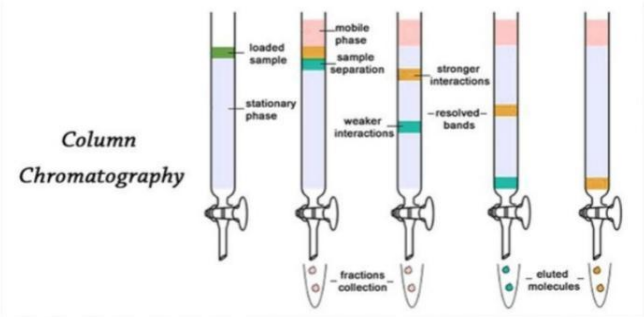

Fig no. 6

Column chromatography is widely used technique for separating and purifying compounds based on their differential and elution propertied. Here are the steps involved:

1. Packing the column: A glass column is filled with a stationary phase (usually a solid material like silica gel or alumina) which acts as the adsorbent. The solid is packed evenly to ensure efficient separation.

2. Sample loading: The mixture to be separated (sample) is dissolved in a suitable solvent and then appli3d at the top of the column. This is called the sample loading step.

3. Elution: A mobile phase (solvent or solvent mixture) is added to the top of the column and allowed to flow down through the stationary phase.

4. Collection of fraction: As different components reach the bottom of the column, they are collected in separate fractions. This is done by collecting drops or small volumes at regular intervals.[15]

Advantages

1.Versatility: It can separate a wide range of compounds based on their chemical properties.

2. Ease of operation: It's relatively straightforward to set up and perform, making it accessible to many researchers.

3. Scalability: It can be scaled up for lager scale Purification processes.

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Disadvantages

1. Time consuming process.
2. Limited Resolution.
3. Sample size requirements.

High Performance Thin Layer Chromatography

It is an analytical technique used for the separation, identification, and qualifications of components in a mixture. Here are the steps, advantages, and disadvantages of the HPTLC process:

Steps:

1. Sample application: A small amount of the sample is applied as a spot near the bottom of a TLC plate. This can he done using a microsyringe, capillary tube, or automatic sample applicator.
2. Development: The TLC plate is placed in a developing chamber containing a mobile phase (solvent system). The sample component separate as the mobile phase moves up the plate by capillary action.
3. Drying: After development, the plate is dried to remove any remaining solvent.
4. Detection: The separated components are visualized using various detection methods, such as UV light, fluorescence, or by using specific chemical reagents.
5. Documentation and analysis: The plate is typically scanned or photographed for documentation. The Rf(Retention factor) values are calculated to identify and quantify the components.[16]

Advantages

1. It has high sensitivity.
2. It has resolution.
3. Quick analysis.

Disadvantages

1. Cost: HPTLC plate and equipment can be expensive, especially for high quality systems.
2. Skills and Expertise: Proper training and expertise are required to perform HPTLC effectively and interpret the results accurately.
3. Limited compound identification

High Performance Liquid Chromatography

It is a technique used for separating and analysing components in a mixture. Here are the steps involved in the HPLC system.

1.Sample injection: The sample is injected into the HPLC system.
2. Mobile phase: A liquid solvent (mobile phase) is pumped through a column containing the stationary phase. The mobile phase carries the sample components through column.
3. Column separation: The sample components interact with the stationary phase inside the column, this interaction causes different components to move at different speeds through the column.
4. Detection: As the components elute (exit) from the column, they pass through a defector. The detector measures the concentration of the components and generates a chromatogram.
5. Data analysis: The chromatogram is analysed to determine the quantity and identify the components in the sample.[17]

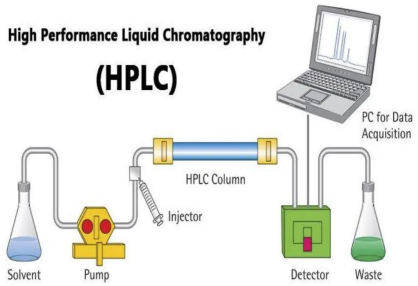

Fig no 7

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Advantages

1.High sensitivity: HPLC can detect and quantify components in very small concentration, making it useful in analytical chemistry.

2. Wide range of applications: It is versatile and can be used to analyse a wide range of compounds, from small organic molecules to large bio molecules like proteins and DNA.[18]

Disadvantage

1.High equipment and operating cost.

2. Limited compatibility with volatile compounds.

3. Time consuming process.

Purification Techniques for isolated phytoconstituents

A Soxhlet apparatus is a common tool used to extract and purify phytoconstituents from plant materials: The apparatus consists of a round bottom flask, condenser, siphon tube, extraction chamber, and thimble. The plant material is finely ground and placed in the thimble, which is then put in the extraction chamber. The solvent is heated in the flask, vaporizes, and condenses in the condenser.The condensate drips back into the thimble, extracting the phytoconstituents. When the solvent level reaches the siphon tube, the extracted material and solvent are siphoned back into the flask. The process continues until the solvent runs clear.[19]

Introduction to different techniques of characterization of bioactive constituents

1.Spectroscopy:

a)UV visible spectroscopy.

b)Infrared Spectroscopy.

c)Nuclear Magnetic Resonance.

2. Chromatography:

a)High Performance Liquid Chromatography.

b)Gas chromatography.

c)Thin Layer Chromatography.[20]

3. Mass Spectrometry

a)Electrospray Ionization and Matrix-Assisted Laser Desorption.

b)Gas chromatography- Mass Spectrometry.

3. Microscopy:

a)Scanning Electron Microscopy.

b)Transmission Electron Microscopy.

4. Bioassay:

a) Cell based assay.[21]

Methods For Standardization Of Herbal Drugs

Importance of Standardization

1.Interoperability: Standards ensure that products, processes, and systems are compatible and can work together seamlessly. This is particularly vital in technology, where diverse systems need a communicate effectively.

2. Quality Assurance: Standards provide a benchmark for quality, ensuring that products or services meet certain established criteria. This helps in building trust among consumers.

3. Safety and Reliability: Standardized processes and products are often designed with safety in mind. This reduces risks associated with using or implementing them.

4. Cost Efficiency: Standardization can lead to economies of scale. When products are Standardized, it becomes more efficient to produce them in large quantities, which can lead to cost savings.

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5. Consumer Protection: Standards protect consumers by ensuring that products meet certain safety, quality, and performance requirements.[22]

Problems involved in the Standardization of herbs standardization of single drugs and compound formulations

1. Variability in natural sources: Herbs are derived from plants, and their potency can vary due to factors like soil quality, climate, and harvesting methods. This natural Variability makes it difficult to establish consistent potency levels.
2. Complex chemical composition: Herbs often contain a multitude of compounds, and it can be challenging to identify and quantify all active ingredients. Some compounds may be more therapeutically relevant than others.
3. Extraction methods: The process of extracting active compounds from herbs can influence the final product's composition. Different extraction methods may yield different concentration and profiles of active ingredients.
4. Lack of Standardized analytical techniques: There may not be universally accepted methods for analysing herbal products. This can lead to discrepancies in reported potency levels across different studies of manufacturers.
5. Absence of quality control standards: Unlike pharmaceuticals, herbal products are not always subject to rigorous quality control measures. This can lead to inconsistencies in the composition and quality of herbal preparations.[23]

WHO guidelines for quality standardized herbal formulation

1. Botanical identity: Ensuring that the correct plant species and plant part are used.
2. Good agricultural and collection practices: providing guidance on the cultivation, harvesting, and collection of medicinal plants.
3. Good manufacturing practices: outlining the standards and procedures for the manufacturing of herbal medicines.
4. Quality control and testing: Describing the methods for evaluating the quality, purity, and potency of herbal products.[24]
5. Stability studies: providing guidelines for assessing the stability of herbal formulations under different storage conditions.
6. Documentation and labelling: Recommending what information should be included on labels and in product documentation.
7. Safety and efficiency: Assessing the safety and effectiveness of herbal medicines through scientific studies.
8. Regulatory requirements: providing guidance for regulatory authorities on the registration and licensing of herbal medicines.[25]

Parameters to be assessed for standardization

1. Macro and Microscopic examination: For identification of right variety and search of adulterants.
2. Foreign organic matter: This involves removal of matter other than source plant to get the drug in pure form.
3. Ash value: Helpful in determining the quality and purity of crude drugs , especially powder form. The objective of ashing vegetable drugs is to remove all traces of organic matter, which may otherwise interfere in an analytical determination.
4. Moisture content: checking moisture content helps reduce errors in the estimation of the actual weight of drug material.
5. Crude fibre: This helps to determine the woody material component, and it is a criterion for judging purity.
6. Toxicological studies: This helps to determine the pesticide residues, potentially toxic elements, safety studies in animals like LD50 and microbial assay to establish the absence or presence of potentially harmful microorganisms.[26]

II. CONCLUSION

Plants, herbs and ethnobotanicals have been used since the before days of humankind and are always used throughout the world for fitness creation and treatment of infection. Plants and natural sources form the provocation of moment's ultramodern drug and contribute greatly to the marke table medicine trials manufactured moment. About 25% of medicines specified worldwide are deduced from plants. The "Advanced Herbal Technology" review underscores the

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significance of systemic approach that includes authentication, identification, extraction, various isolation and purification techniques, standardization. By using this approaches we enhance the quality and safety. This comprehensive methodology not only enhances the quality and safety of herbal products but also paves the way for their acceptance in modern healthcare, bridging the gap between traditional practices and contemporary scientific standards.

Future potential: With ongoing research and advancement, herbal technology holds the promise of addressing global challenges, such as antimicrobial resistance, chronic diseases, and climate change.

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