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A Review on Modern Herbal Technology

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ABSTRACT:

Due to their many benefits, herbal medications are becoming more and more popular today. Nowadays, herbal preparations are widely acknowledged as effective treatments for a number of ailments. Even if the majority of these uses are atypical, more than 80% of people use herbal products and medications to maintain a healthy lifestyle. The increased usage of herbal goods has also resulted in a number of product abuses and adulterations that have disappointed consumers and manufacturers and, in some cases, had devastating results. It is highly difficult for scientists to establish reliable analytical techniques that can quantitatively analyse marker/bioactive chemicals, other crucial components, and precisely profile the phytochemical composition. For the manufacture and manufacturing of herbal medicines, standardisation is a crucial step in developing a uniform biological activity, consistent chemical profile, or even just a quality assurance programme. A variety of traditional techniques are discussed in the current review article along with more contemporary innovations. Recent developments have been noted in a number of disciplines, including DNA fingerprinting, metabolomics, differential pulse polarography, chemometrics, X-ray diffraction, and others. The advantages of chromatographic and capillary electrophoresis techniques for standardising herbal treatments are also discussed.

Keywords: Chromatographic Methods, DNA Fingerprinting, Herbal Drugs, and Standardisation

Objective:

1. Recognize the origin of herbal drugs in their raw materials, from their cultivation to their finished products.
2. Be familiar with the WHO and ICH guidelines for evaluating herbal medications.
3. Understand natural sweeteners, nutraceuticals, and herbal cosmetics.
4. Value GMP and the patenting of herbal remedies

1. INTRODUCTION

The term "medicine" refers to a substance that has nutritional, medicinal, or preventative properties, whereas the term "herbal" refers to a botanical or plant-based preparation. So-called "herbal medicines" are substances derived from plants that have nutritive, therapeutic, or preventive properties. Herbal medicine is an interdisciplinary branch of herbal medicine and Ayurveda because it includes all areas of herbal medicine related to botany, medicinal plant research, pharmacognosy, phytochemistry, phytotherapy, botanical medicines, Ayurveda, natural chemistry, agriculture science, Unani medicine, biotechnology, and biochemistry. A person who works with plants, especially therapeutic herbs, is known as an herbalist. Herbal journals discuss the use of plants to treat illness. [1, 25]

1.1 Several Techniques for Plant Identification

(1) Expert Determination:

The most accurate and trustworthy identification procedure is expert determination. The relevant group has typically been treated by professionals (monographs, revisions, synopses), and it is likely that the taxa used by specialists are included in more recent floras or manuals. Experts are frequently found in botanical gardens, herbaria, museums, colleges, and universities, among other places. Although very effective, this method has limitations in that it delays identification and takes up professionals' important time.

(2) Recognition: Its reliability is on par with that of professional opinion. Based on the identifier's extensive prior acquaintance with the relevant plant group, this is said to be the case.

(3) Comparison: A third method entails contrasting something unknown with samples, images, drawings, or descriptions that are already known. Despite being a dependable process, it could be extremely time-consuming or even impossible because there aren't enough equivalent materials.

(4) Using Keys and Other Comparable Instruments (Synopses, Outlines, etc.)

It is by far the most popular choice because it doesn't require the time, resources, or knowledge necessary for comparison and recognition. [2]

1.2 Authentication of Plant

Herb authentication is a quality control procedure that makes sure the right kinds of plants and plant components are utilised as the foundation for herbal medications. For herbal medications to be safe and effective, herbal raw materials must be properly authenticated. [3]

- **Macroscopic:** the comparison of morphological characteristics that can be seen with the unaided eye or at low magnification with descriptions of the plant or botanical medicine in floras or monographs is known as a macroscopic inspection. For macroscopic identification, traits like the size, shape, and colour of leaves (or leaf fragments), flowers, or fruits are frequently utilised.
- **Microscopic:** Anatomical characteristics of plant material that can only be observed with a microscope are the subject of a microscopic inquiry. Under a microscope, it may be possible to distinguish between different herbal medications based on the shape and structure of trichomes (hair), the placement of stomata in the epidermis, the presence or absence of substances like mucilage, starch, or lignin, or the existence of tissues with distinctive cell types.[3]
- **Chromatography** is the process of separating the various chemical elements in a mixture. There are numerous chromatographic techniques, however they are all based on the same core concepts.

Thin-layer chromatography (TLC) is frequently used to authenticate herbs, and most pharmacopeial monographs for plants include a TLC identification test. TLC separates mixtures of materials to produce a plate coated in silica gel that bears the "fingerprint" of the materials that were separated. A pure reference chemical or a genuine sample can be used to compare this fingerprint to.

Another type of chromatography that is frequently employed in the identification and examination of herbal compounds is high-performance liquid chromatography (HPLC). Gas chromatography is yet another form that is utilised in particular for fatty acids and essential oils. [2,3]

1.3 Different Extraction Methods

Extraction is the process of using a liquid solvent to separate soluble material from an insoluble residue, which can be either a liquid or a solid. Therefore, it is a process for finding a solution that depends on the mass transfer phenomenon. The pace at which the solute diffuses through the liquid boundary layer at the interface often determines the rate of extraction.

The primary extraction techniques are:

- Maceration
- Percolation
- Digestion
- Infusion
- Decoction

A. **Maceration**

This is an extraction procedure in which coarsely powdered drug material, either leaves or stem bark or root bark, is placed inside a container; the menstruum is poured on top until completely covered the drug material. The container is then closed and kept for at least three days. [20, 21, 22, 23, 24] The content is stirred periodically, and if placed inside bottle it should be shaken time to time to ensure complete extraction. At the end of extraction, the micelle is separated from mare by filtration or decantation. Subsequently. The micelle is then separated from the menstruum by evaporation in an oven or on top of water bath [20, 21, 23, 24] this method is convenient and very suitable for thermolabile plant material.

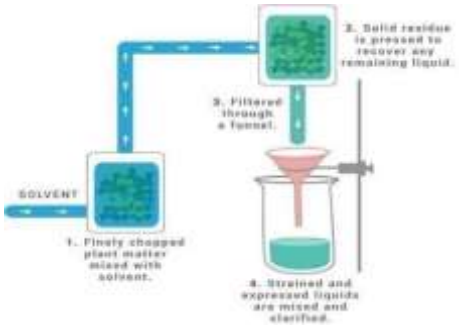

Figure 1: Maceration

Types of maceration

1. Simple maceration
2. Unorganized maceration
3. Multiple maceration

B. Percolation

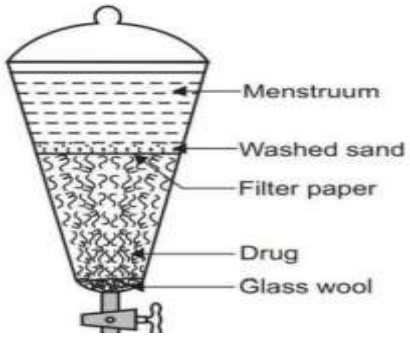

Figure 2: Percolation

The apparatus used in this process is called percolator. It is a narrow-cone-shaped glass vessel with opening at both ends. A dried, grinded. and finely powdered plant material is moistened with the solvent of extraction in a clean container. More quantity of solvent is added, and the mixture is kept for a period of 4h. Subsequently, the content is then transferred into percolator with the lower end closed and allow to stand for a period of 24h. The solvent of extraction is then poured from the top until the drug material is completely saturated. The extract is separated by filtration followed by decantation. The mare is then expressed and final amount of solvent added to get required volume.[21,22]

C. Decoction

This is a process that involves continuous hot extraction using specified volume of water as a solvent. A dried, grinded, and powdered plant material is placed into a clean container. Water is then poured and stirred. Heat is then applied throughout the process to hasten the extraction. The process is lasted for a short duration usually about 15min. The ratio of solvent to crude drug is usually 4:1 or 16:1. It is used for extraction of water soluble and heat stable plant material.[20,21,22]

D. Solvent Extraction

Sometimes referred to as liquid-liquid extraction or partitioning, is a technique for separating substances depending on how well they dissolve in two different immiscible liquids, typically water and an organic solvent. It is the extraction of a material. From one liquid phase, into another liquid phase. Chemical laboratories use a separatory funnel as the primary tool for this process. In order to separate a substance from a mixture, it is typically preferred to dissolve the material in a suitable solvent. Solvent extraction can be applied analytically to concentrate, reject, or separate mixtures. This process frequently separates soluble from insoluble substances. Solvent extraction is necessary for manufacturing, mining processing, and nuclear processing. [4]

E. Supercritical Fluid Extraction

As an initial stage in the analysis of complex materials, it is frequently necessary to separate the analyte or analytes from a sample matrix. In a perfect world, an analytical separation method would be quick, simple, and inexpensive, allow for the quantitative recovery of analytes without loss or degradation, produce an analyte solution that is sufficiently concentrated to forgo concentration during the final measurement, and produce little to no waste that needs to be disposed of. For a long time, the extraction of bulk samples using a Soxhlet extractor and hydrocarbon or chlorinated organic solvents was one of the most widely used methods for performing analytical separations on difficult environmental, pharmaceutical, food, and petroleum samples. However, liquid extraction frequently fails to [5]

F. Supercritical Fluid

Anything more than critical A supercritical fluid is one that exists at a certain temperature and pressure. It is capable of diffusing through solids like a gas and dissolving things like a liquid. Since even small variations in temperature or pressure have a significant effect on density, a supercritical fluid's many properties may also be "fine-tuned" close to the critical point. Supercritical fluids can take the place of organic solvents in a variety of industrial and laboratory processes. The most well-known Water and carbon dioxide are supercritical fluids that are used to produce electricity and decaffeinate coffee, respectively. CO2 is the type of solvent utilised for plant extraction. There are no unfavourable traces left behind. Its extraction qualities may be broadly regulated by making small temperature and pressure modifications.

G. Extraction

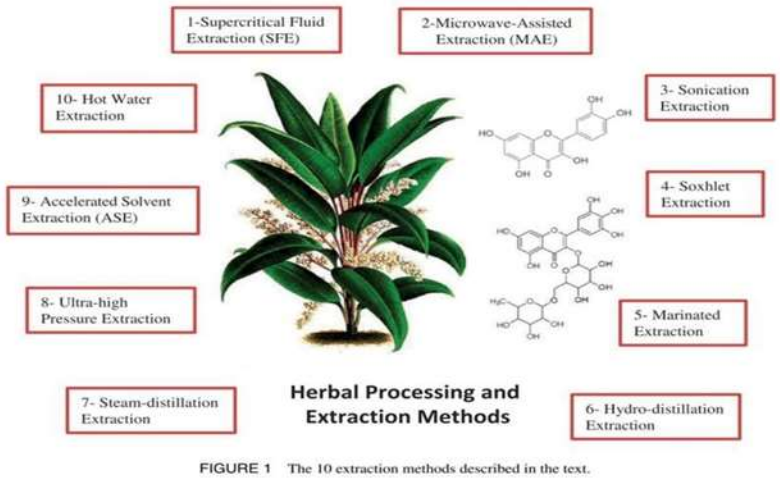

FIGURE 1 The 10 extraction methods described in the text.

Figure 3: Extraction methods

Microwave Assisted Extraction

Microwavable extraction aids the fundamentals of microwave-aided extraction. A portion of the electromagnetic spectrum of light, microwaves have wavelengths between 1 cm and 1 m and frequencies between 300 MHz and 300 GHz. (Mandal and others, 2007) These waves consist of two parallel oscillating fields that carry information and energy. Their main application is the interaction of microwaves with specific materials that may partially absorb their electromagnetic energy and convert it to heat. Commercial microwaves use 2450 MHz of energy, which is roughly equivalent to 600–700W, for this function. (2012) Afoakwah et al. [5]

Ultrasound Assisted Extraction

Unquestionably, extraction has been practised since the discovery of fire. The Egyptians, the Phoenicians, the Jews, the Arabs, the Indians, the Chinese, the Greeks, and the Romans all used novel extraction and distillation methods for food, cosmetics, and even fragrances.

It is now impossible to find a production line in the food, pharmaceutical, cosmetic, nutraceutical, or bioenergy industries that doesn't involve extraction methods like maceration, solvent extraction, steam or hydrodistillation, cold pressing, or squeezing. Increasing energy costs and initiatives to cut greenhouse gas emissions provide difficulties for the food and plant-based chemical sectors. In order to save energy, abide by emission regulations, guarantee the safety and control of their goods and processes, and cut costs while raising functionality and quality, these industries must create new technologies. For instance, there are substantial scientific and technological obstacles to be overcome in current extraction processes, which can require up to 50% of a new facility's capital costs and more than 70% of all process energy used in the food sector [1]. These drawbacks have led to the development of more efficient automated extraction techniques during the past 20 years, including ultrasound-assisted extraction. The main objectives were to reduce the use of organic solvents, lengthen extraction times, and conserve resources like money and energy. These goals have propelled developments in ultrasound-assisted extraction, leading to a number of cutting-edge techniques such as ultrasound assisted Soxhlet extraction, ultrasound-assisted Clevenger distillation, continuous ultrasound assisted extraction, and ultrasound-assisted extraction combined with microwave, extrusion, and supercritical fluid extraction.

Isolation and Purification Technique

- General isolation strategies
- Methods of extraction

The extraction of plant material entails the isolation of natural plant components and their purification. Because they contain a variety of compounds with distinctive physical and chemical properties, plant matrices are naturally complex [8]. In order to produce pure molecules for their characterization, it is crucial to completely isolate the matrixes of interest in plants from the rest of the plant. For extraction techniques, there are numerous classification schemes [9]. In this chapter, they have been categorised into classes based on the low or space temperature ranges in which they function.

2. CHROMATOGRAPHIC APPROACH

2.1 Introduction

On every continent since the beginning of time, people have used hundreds to thousands of local plants to treat illness. Chemicals that are vital for preserving both human and animal health are produced by numerous plants. These include aromatic substances, the most majority of which are phenols or their oxygen-substituted derivatives, such as tannins [1]. Animals in poor health frequently consume food from plants rich in secondary metabolites like tannins and alkaloids. Due to the frequent antiviral, antibacterial, antifungal, and anthelminthic actions of these phytochemicals, it is feasible that

wild animals self-medicate [2]. A World Health Organization (WHO) estimate is that over 80% of people still use herbs and other traditional medicines for their primary healthcare needs. Health-improving Tablets, capsules, powders, teas, extracts, and fresh or dried plants are all forms of nutritional supplements referred to as herbal medicine. Herbs are increasingly being used by people without a prescription since they are usually regarded as safe.[3]. since they are usually regarded as safe. [3]

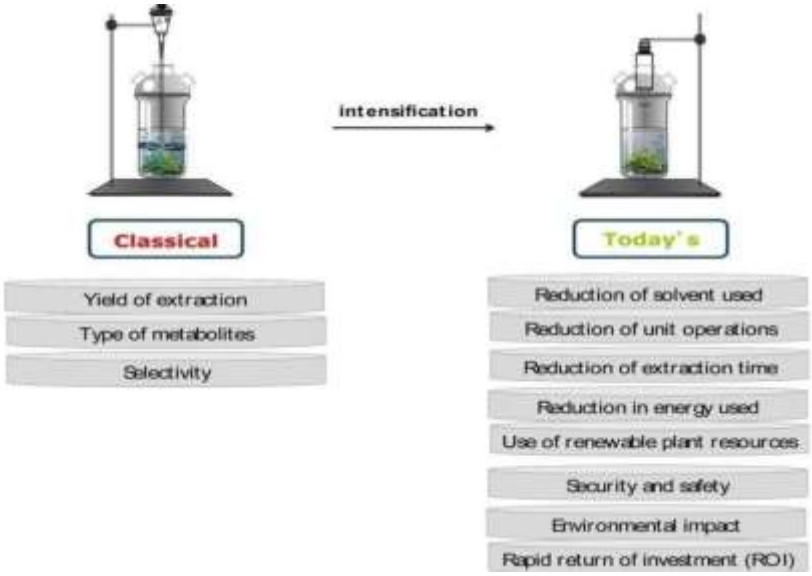

Figure 4: Chromatographic technique

3. HERBAL DRUGS ANALYSIS USING CHROMATOGRAPHICAL TECHNIQUES

Chromatography is the most flexible and accessible separation technique. Chromatography is a technique used to isolate and separate components, compounds, or combinations of them into their individual components. Plant components are separated from one another and purified using chromatographic methods. To manufacture herbal medicine, a sophisticated system of mixtures is required. As a result, the recommended techniques for detecting "botanical pharmaceuticals" are primarily made to identify a certain plant's unique fingerprint, which denotes the presence of a particular quality-defining chemical constituent.Chemicalfingerprints made using chromatographic methods, especially hyphenated chromatography, are strongly advised for the purpose of quality control of herbal medicines because they may accurately represent the "chemical integrities" of the herbal medicines and can be used for product identification and authentication. Thin layer chromatography (TLC) and high performance thin layer chromatography (HPTLC) [7]

3.1 Thin Layer Chromatography

TLC is a shorthand acronym for thin layer chromatography. One of the most popular and simple chromatographic methods for chemical separation, it is. For the following reasons, TLC is frequently employed in the phytochemical assessment of herbal remedies. It offers two key advantages:

1. It provides qualitative and semi-quantitative information on the identified components.
2. It enables fast analysis of herbal extracts with minimal sample preparation.
3. It enables the quantification of chemical constituents. HPLC and GLC fingerprinting are also used in some situations. [9]

For TLC fingerprinting, information such as the chromatogram, retardation factor (Rf) values, colour of the separated bands, their absorption spectra, and the maximum and shoulder inflections of all resolved bands can be recorded using a high-performance TLC (HPTLC) scanner. The profiles on derivatization with various reagents are all shown, along with the TLC fingerprint profile for the sample. By using this method, data can be generated that can be utilised to distinguish between genuine pharmaceutical items, screen out adulterants, and maintain the consistency and potency of the drug. TLC was the method of choice for herbal evaluation before the invention of instrumental chromatography techniques like GC and HPLC.TLC is still widely used for the analysis of herbal medicines today because many pharmacopoeias, including the American Herbal Pharmacopoeia (AHP), Chinese drug monographs and analyses, and Pharmacopoeia of the People's Republic of China, still use it to provide the initial characteristic fingerprints of herbs. Instead, TLC is used as a more straightforward way to perform a preliminary screening followed by a semi quantitative analysis with other chromatographic techniques.

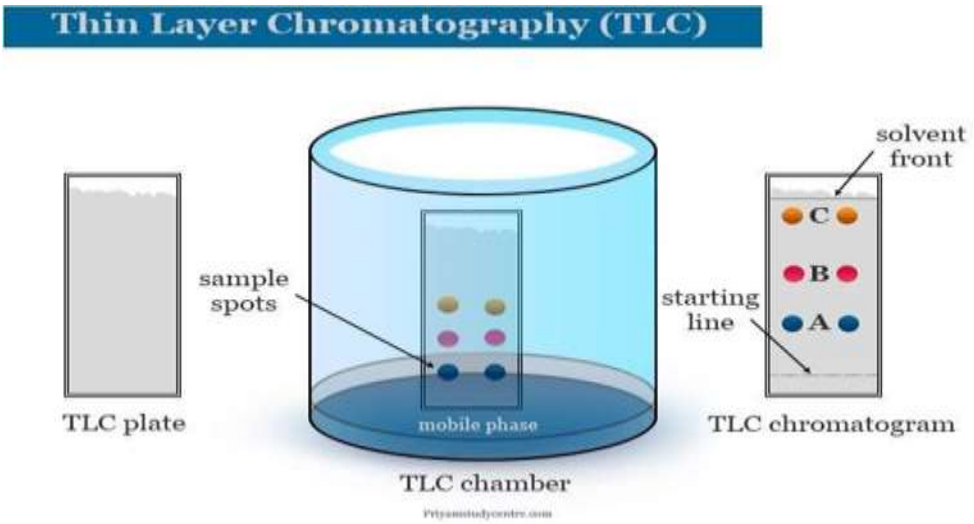

Figure 5: Thin Layer Chromatography

3.2 Column Chromatography

Column chromatography is a method used in chemistry to separate a single chemical compound from a mixture. Chromatography can separate substances into fractions because different chemicals bind to the adsorbent in different ways and move through the column at different rates. The technique is highly versatile and can be used with a wide range of adsorbents (normal phase, reversed phase, or other) and solvents. The technique can be used with scales from micrograms to kg. The stationary phase, which is cheap and simple to discard after use, is the primary advantage of column chromatography. The latter prevents cross-contamination and stationary phase degradation brought on by recycling. Column chromatography can use both gravity and pressurised gas to push the solvent through the column. [14]

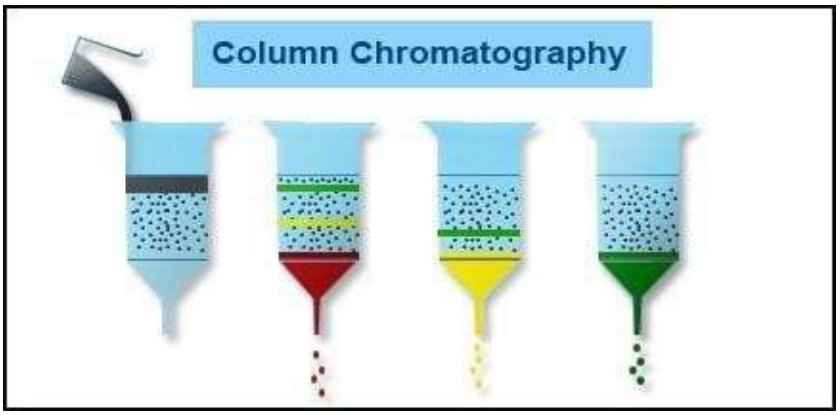

Figure 6: Column Chromatography

3.3 High Performance Thin Layer Chromatography (HPTLC)

The pharmaceutical industry regularly uses the HPTLC technique for process development, adulterant detection in herbal goods, determining the pesticide content, determining the presence of mycotoxin, and ensuring the quality of therapeutic foods and plants. Well-reported results show that numerous samples can be run simultaneously with less mobile phase than in HPLC. For HPTLC, mobile phases with a pH of 8 or higher may also be used. Another advantage of HPTLC is the capability of repeated detection (scanning) of the chromatogram under identical or dissimilar conditions. HPTLC has been studied in order to simultaneously test numerous components in a multicomponent composition. With the aid of this technique, various plant species may be confirmed, and the uniformity and stability of their preparations from different manufacturers can be evaluated. Numerous researchers have created an HPTLC method to analyse phytoconstituents such bergen in, catechine, and gallic acid that are present in Bergeniacilliata and Bergenialingulata [13].

Figure 7: HPTLC

3.4 High Performance Liquid Chromatography (HPLC)

The distribution of the analyte (sample) between a mobile phase (eluent) and a stationary phase is the foundation of the HPLC separation principle (packing material of the column). The molecules travel through the stationary phase more slowly depending on the chemical makeup of the analyte. The duration of a sample's "on-column" time is determined by the specific intermolecular interactions between the sample's molecules and the packing material. As a result, different components of a sample elute at various periods. Thus, the sample ingredients are successfully separated. [11] Afterthe analytes have exited the column, a detection unit, such as a UV detector, can identify them. A data management system (computer software) converts and records the signals, which are subsequently shown in a chromatogram. The mobile phase may then be subjected to further detector units, a fraction collecting unit, or the waste after passing the detection unit. A solvent reservoir, a pump, an injection valve, a column, a detector unit, and a data processing unit are the typical components of an HPLC system. The pump circulates the solvent (eluent) throughout the system at a high pressure and steady speed. A continuous and pulseless flow from the pump is essential to minimise the drift and noise of the detector signal. The injection valve delivers the analyte (sample) to the eluent. [16]

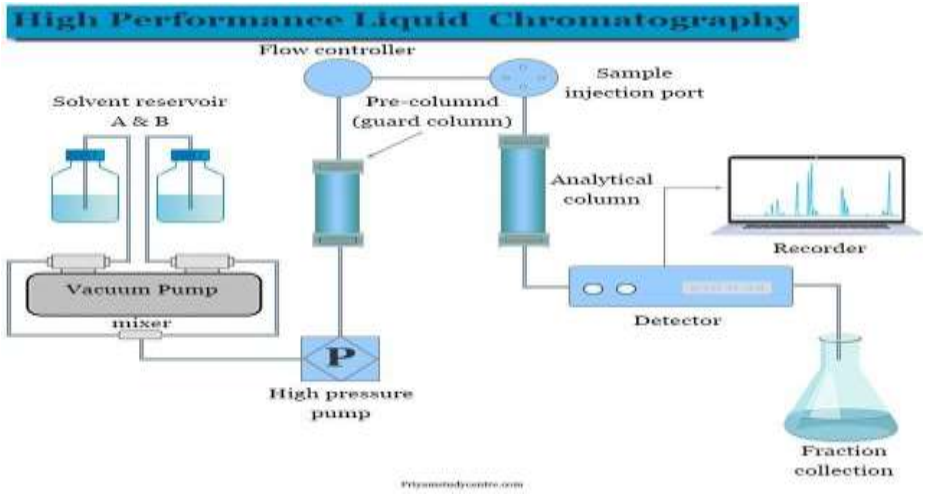

Figure 8: HPLC

3.5 Purification Techniques for Isolated Phytoconstituents

The process of isolating the components of plant extracts or useful sections one at a time and purifying them into monomer compounds using physical and chemical processes is known as the separation of phytochemicals. Current isolation techniques still frequently include solvent extraction, precipitation, crystallisation, fractional distillation, salting out, and dialysis. The separation of phytochemicals, however, also benefits from the use of contemporary separation techniques such high performance liquid chromatography, ultrafiltration, and high-performance liquid drop counter current chromatography. The common techniques and their unique applications for isolating phytochemicals are described in this section. [13]

3.6 Solvent Method Acid and Basic Solvent Method

It is done in accordance with the various levels of acidity and alkalinity present in each component of the mixture. Alkaline organic substances that are insoluble in water, like alkaloids, may react with inorganic acids to generate salts that can be used to distinguish no alkaline and water-insoluble substances. Bases can salt acid components with carboxyl or phenolic hydroxyl groups and dissolve them in water. [11] It is possible to saponify and

dissolve in water components having lactone or lactam substructures before isolating them from other water-insoluble components. The entire extract can be split into acidic, alkaline, and neutral components by dissolving it in lipophilic organic solvents (ethyl acetate is frequently employed as a solvent) and extracting it with acid water and alkali water, respectively. Of course, after adjusting the pH, the entire extract can also be dissolved in water and extracted with organic solvents. The fractions can be further separated by using a pH gradient extraction due to differences in the alkalinity or acidity of the fractions. [18]

By dissolving the extract in lipophilic organic solvents (ethyl acetate is usually used as a solvent) and then extracting it with acid water and alkali water, respectively, the complete extract can be divided into acidic, alkaline, and neutral components. Of course, the complete extract can also be diluted in water and extracted using organic solvents after correcting the pH. Due to variations in the alkalinity or acidity of the fractions, the fractions can be further separated by utilising a pH gradient extraction. [18]

Polarity Gradient Extraction Method

Using this technique, the separation goal is accomplished based on the various polarities of the various plant extract constituents and the various partition coefficients in two-phase solvents. The polarity of the components in plant extracts is typically taken into account when choosing between different two-phase solvent systems. For instance, nbutanol and water can be used to separate components with strong polarity, ethyl acetate and water can be used to separate components with medium polarity, and chloroform (or ether) and water can be used to separate components with weak polarity. [10]

The plant extract must first be dissolved in water before the extraction process can begin. The solution or suspension is then extracted in a separating funnel using a separate organic solvent that is not miscible with water due to polarity differences. As illustrated in Figure 1, the extract was typically extracted using petroleum ether (or cyclohexane) first, followed by ethyl acetate (or chloroform), and then water-saturated n-butanol. Low polarity, lipid soluble molecules can be found in the petroleum ether layer. Medium polar substances such monoglycerides, flavonoids, and substances with more polar functional groups are present in the ethyl acetate layer. Strongly polar substances, such as oligoglycosides and other water-soluble elements, are present in the n-butanol layer. The strongest polarity is seen in chemicals in the water layer, including glycosides with more glycosyl groups, carbohydrates, amino acids, proteins, and other water soluble substances. [5]

Precipitation Method

It is a technique that relies on the creation of some phytochemicals as precipitates through reactions with reagents, or the precipitation of some components from solutions through the addition of particular reagents, which can lessen the solubility of some components in solutions. If the target components are necessary for the formation of precipitation, the precipitation process must be reversible. The precipitation reaction can be irreversible if the components are nontarget since they will cause the precipitation to be eliminated. The following categories could be applied to this approach depending on the addition of chemicals or solvents: A specific solvent that is mutually soluble with the solution can be used to modify the constituents in the mixed component solution, allowing them to precipitate out of the solution. Fractional precipitation is the progressive precipitation caused by varying the polarity or amount of solvent supplied. For instance, ethanol is added to the water extracting concentrate to increase its alcohol content to more than 80%, which causes polysaccharides, proteins, starch, gum, and other substances to precipitate and be removed after filtration when using water as an extracting solvent to extract phytochemicals. The previous process is known as ethanol precipitation and water extraction. This technique is frequently used to isolate crude plant polysaccharides [17].

4. IMPORTANCE OF STANDARDIZATION

4.1 Standardization of Herbal Formulation

Application of Good Manufacturing Practices is required for standardising herbal formulation (GMP). Additionally, it is deemed crucial to research a number of parameters, including pharmacodynamics, pharmacokinetics, dose, stability, selflife, toxicity evaluation, and chemical profiling of herbal formulations. Aflatoxine level, heavy metal contamination, and Good Agricultural Practices (GAP) in herbal medication standardisation are a few additional criteria that are equally significant.

4.2 Standardization of Polyherbal Formulation

As polyherbal formulations combine more than one herb to achieve the desired therapeutic effect, standardisation is crucial for maintaining and evaluating the product's quality and safety. Standardization reduces batch-to-batch variation and ensures the polyherbal formulations' acceptability, safety, efficacy, and quality. The standardisation of different herbal and polyherbal products that are sold, such as MadhumehariChurna (Baidynath), which has a blend of eight herbs. Traditional remedy Dashamularishta is used to restore physiological function following childbirth. The identity, purity, and potency of the polyherbal formulation, as well as setting standards for this Ayurvedic formulation, were determined using TLC and HPTLC fingerprint profiles. [12]

4.3 Standardization and Quality Control of Herbal Crude Drugs – Parameters

Standardization and quality control of herbals is the process involved in the physicochemical evaluation of crude drugs, according to WHO (1996a and b, 1992), and it includes activities like the selection and handling of raw materials, the evaluation of the finished product's safety, efficacy, and stability,

the documentation of safety and risk based on experience, the dissemination of product information to consumers, and product promotion. Attention is normally paid to such quality indices such as:[15]

- **Morphology and Organoleptic Evaluation:** Morphological characteristics are crucial for discriminating in the case of the entire medication. It mostly covers things like colour, smell, taste, form, and size. Detail Fractures, texture, venation, and other characteristics are among them.
- **Microscopic and Histologic Evaluation:** These are beneficial in both whole and powdered form. It focuses mostly on the examination of features including trichomes, calcium oxalate crystals, vascular bundle patterns, stomata, and fibres, among others.
- **Quantitative Microscopic Study:** Microscopic measurements such as fibre size, palisade ratio, stomatal index, stomatal number, and vein termination number. Such research aids in separating closely related species.
- **Physical Evaluation:** Investigation of a number of physical parameters, including moisture content, solubility, viscosity, refractive index, melting point, optical rotation, ash values, extractives, and foreign organic matter. Fibre size and palisade ratio such research aids in separating closely related species.
- **Physical Evaluation:** Study of numerous physical properties such as ash values, extractives, solubility, viscosity, refractive index, melting point, and foreign organic materials.
- **Qualitative Chemical Evaluation:** This includes identifying and classifying crude drugs according to their phytochemical components. It uses various analytical methods to find and isolate the active ingredients. Identification of the botanical species, solvent extraction, purification, and characterisation of the active medicinal ingredients are all steps in photochemical screening approaches.
- **Quantitative Chemical Evaluation:** To calculate the concentrations of the main component classes.
- **Toxicological Studies:** This assists in determining the presence or absence of potentially dangerous bacteria, pesticide residues, possibly poisonous ingredients, safety tests in animals like LD50, and microbial assay.[15]
- **Microbiological Parameters:** It contains the entire amount of viable, the entire count of mould, and the entire count of coliforms. Limiters are a quantitative or semi-quantitative tool that can be used to measure and limit the amount of impurities, such as solvents, reagents used in the extraction of various herbs, and impurities shipped directly from the factory.[15]

4.4 Problem of Advance Herbal Technology

Although herbal medicine has a very strong history of traditional applications and a global restructuring, there are still many obstacles to its promotion, particularly in wealthy countries. The following issues must be resolved before traditional herbal knowledge is promoted globally.[18]

- Quality Issues: The main issues that diminish the effectiveness of herbal preparations and can be viewed as important variables impacting the quality and purity of herbal medications include adulteration, misidentification of plants, poor collecting and preparation, and inappropriate formulation procedures.
- Processing and Harvesting Issues: The low quality of herbal medications is a result of a variety of factors, including inadequate pre- and post-harvest practises, indiscriminate harvesting, poor agricultural and propagation techniques, and a lack of processing processes.
- Quality Control Related Issues: The biggest obstacles to maintaining the quality of herbal pharmaceuticals include standardisation, poor quality control practises, and a lack of Good Manufacturing Practices (GMP). In small and medium-sized companies, it is also common for farmers and manufacturers to be unaware of the guideline, and for the guideline to not be implemented or regulated.

Administrative issues: The herbal industry lacks effective monitoring and supervision, which is absolutely necessary for the quality of pharmaceuticals. [9]

- Infrastructure Related Issue: The main issues are a lack of processing technology, trained personnel, advanced equipment, application of contemporary techniques, and local instrument fabrication facility.
- Pharmaco Vigilance: In order to discover toxicological information and adverse drug reactions of herbal medications, proper pharmacovigilance in the herbal sector is currently required. It's important to thoroughly monitor adverse responses, contraindications, combinations with other medications, foods, and traditional drugs.[19]
- Clinical Trial: Clinical trials are required to establish the safety and efficacy of these treatments before introducing them in the worldwide market because safety is still a major concern when using herbal remedies.
- IPR and Bio Piracy: The main obstacle to the advancement of herbal traditional medicine is bio piracy. Thus, recording traditional knowledge is crucial for the future.
- Irrational Use: Unfortunately, contrary to popular belief, herbal products do have negative effects and interactions. Therefore, the inappropriate use of these pharmaceuticals can result in a number of issues that could impede their promotion.

- R&D: The primary necessity for any drug is research and development on dose, processing, and procedures, although compared to allopathic medicine, it is far less in the herbal business. Nevertheless, the tendency has changed in recent years. Research is required to comprehend the mode of action and pharmacokinetics phenomena, as well as to improve/create monographs and reference standards for marker-based analysis. Another issue for a sustainable, socio-culturally equitable, and safe supply of herbal medicines is the significant gap in current ethno pharmacological and contemporary medicinal plant research.
- Other Issues: Unreliable and inaccurate information, a lack of qualified doctors, a lack of funding, a lack of targeted marketing and branding, and a lack of knowledge exchange are other factors impeding the global promotion of herbal medicine. Another significant concern is failing to protect biodiversity and traditional medicinal plants. [16]

4.5 Selection criteria for substance of herbal origin relevant for standardization and quality control of herbal medicine

The standardisation and quality control of herbal resources, herbal preparations, herbal medications, and final herbal goods involve a number of general factors that are quite complex. This can make it exceedingly difficult to identify and quantify herbal medicines and make it very difficult to detect adulteration. It should be made clear that utilising markers to identify herbal medicines and measuring the amount of marker compounds present in herbal medicines do not, by themselves, ensure the quality of herbal medicines. Good agriculture and collection procedures (GACP) and good manufacturing practises (GMP), when necessary, must be used in conjunction with quality control to cover all stages of production. The selection of reference materials and the control of quality criteria It is important to consider that different constituents in herbal medicines may have varying degrees of influence on their final quality, safety, and efficacy. This calls for the following principles to be followed when choosing the chemicals for identification and quantification. Components that have been recognised as having therapeutic activityshould be used as indicators. If this is not the case, but a substance or constituents with known pharmacological activity should be utilised as markers. If the aforementioned scenarios don't apply, the production process and analysis of marker substancecontaining other distinguishing constituents can be used to determine the identity and quantity of herbal materials, preparations, and medications. Be aware that identification of herbal materials, as well as, to some extent, completed herbal products, can be accomplished or supplemented by microscopic, macroscopic, or DNA analytical procedures when appropriate reference sources and descriptions are used. [2]

4.6 Drugs for Advance Technology

A. Jasmine (Jasminum)

Body receives information from the limbic system, which controls the neurological system, when you breathe in the molecules of jasmine. You can keep a jasmine plant in your room to help with anxiety and depression, or you can use the essential oil to fill a diffuser with the fragrance. Jasmine can aid with anxiety, depression, focus, sleep, hormone balance, and infection risk reduction in addition to anxiety and depression. This demonstrates the jasmine plant's versatility and its potential to enhance your

Figure 9: Jasmine

4.7 Golden Shower Tree

These are yellow flowers that hang from their tree in long drooping chains. It is useful in the treatment of skin diseases, cardiac diseases, jaundice, constipation, indigestion, and even ear ache.

Figure 10: Golden Shower Tree

4.8 Shankpushpi (Convolvulus Pluricaulis)

The powerful memory enhancer and brain tonic known as Shankhpushpi—also known by the names Shankhini, Kambumalini, Samkhapushpi, Sadaphuli, and Sankhaphuli—actively works to increase intelligence and brain function. The plant was given the name shankhpushpi because of its shankh or conch-shaped blooms. Additionally, it aids in improving focus, learning capacities, mental tiredness, sleeplessness, tension, anxiety, and depression, among other things. Due to its antidepressant effect, it enhances mental wellness and could assist in controlling depression. According to Ayurveda, Shankhpushpi relieves tension and anxiety while calming the brain. Its Medhya (improves intelligence) characteristic also helps memory by functioning as a brain tonic.TakeShankhpushpipowder with warm milk or water to assist improve focus and memory. Additionally, sankhpushpi pills and capsules can enhance cognitive abilities. AyurvedicShankhpushpi Syrup is a memory and mental acuity enhancer. It helps with mental acuity issues, forgetfulness, memory loss, poor recall, etc. However, medications or supplements can only enhance alertness, attention span, brain functioning, nerve coordination, and the capacity of the brain to retain information; they may not be able to alter your procrastinating patterns. Daily brain exercises are therefore necessary to improve brain capacities. Shankhpushpi has the status of a nerve tonic in Ayurveda. It contains substances including tryptanoids, flavonol glycosides, anthocyanins, and steroids, for example. [3]

Figure 11: Shankpushpi

5. CONCLUSION

This subject is focused on mainly Herbal Extraction Techniques, Plants, herbs, and ethnobotanicals have been used since the early days of humankind and are still used throughout the world for health promotion and treatment of disease. Plants and natural sources form the basis of today's modern medicine and contribute largely to the commercial drug preparations manufactured today. About 25% of drugs prescribed worldwide are derived from plants. Still, herbs, rather than drugs, are often used in health care. For some, herbal medicine is their preferred method of treatment. For others. Herbs are used as adjunct therapy to conventional pharmaceuticals. However, in many developing societies, traditional medicine of which herbal medicine is a core part is the only system of health care available or affordable. Regardless of the reason, those using herbal medicines should be assured that the products they are buying are safe and contain what they are supposed to, whether this is a particular herb or a particular amount of a specific herbal component for the good end product various extraction process like TLC, HPLC, and Coloumn Chromatography. Consumers should also be given science-based information on dosage, contraindications, and efficacy. To achieve this, global harmonization of legislation is needed to guide the responsible production and marketing of herbal medicines. If sufficient scientific evidence of benefit is available for an herb, then such legislation should allow for this to be used appropriately to promote the use of that herb so that these benefits can be realized for the promotion of public health and treatment of disease.

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