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ADVANCED HERBAL DRUGS TECHNOGY

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Abstract:

People started turning to herbal treatments recently because of its numerous advantages. Even if the majority of these applications for herbal formulations are orthodoxy, it is a known fact that 80% of the world's population relies on herbal medicines and products for a healthy lifestyle. Due to the increased usage of herbal goods, there have also been an increase in product abuse and adulteration, which has resulted in flaws for both customers and manufacturers and, in some cases, fatal consequences. Scientists face a significant problem in evaluating reliable analytical techniques that can quantitatively analyse marker/bioactive chemicals and other important ingredients and reliably profile the phytochemical makeup. For the manufacture and manufacturing of herbal medications, standardisation is a crucial step in establishing an uniform biological activity, consistent chemical profile, or even just a Quality Assurance programme. The numerous conventional approaches and more recent advancements are covered in the current review article. Recent developments have been noted in areas such as DNA fingerprinting, metabolomics, differential pulse polarography, chemometrics, X-ray diffraction, etc. Contributions of chromatographic and capillary electrophoresis techniques to the standardisation of herbal medicines are also reported.

Key Words: Standardization, herbal drug, DNA fingerprinting, chromatographic

Introduction

A few fresh herbs that are most frequently used in recipes have names that are well-known to many people. It's simple to remember what basil, thyme, and rosemary are because they have quite



tentative appearance

Since the middle of the 1990s, a lot of people have been using DNA technology to identify herbal medicinal components, which have been used for ages to preserve health and treat sickness. Medicines' primary sources are found in nature. they have been used as medicines for centuries.





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Identification of herbal drugs technology

Crude Plant Material: The botanical term, which includes the genus, species, and authority of the plant, as well as the description of the part of the plant, active and It is important to establish the features of the elements and, if at all possible, the content restrictions. The presence of foreign substances, contaminants, and microbes should be specified or constrained. Each lot of processed plant material should be represented by a voucher specimen, which should be validated by an expert botanist and kept for at least ten years. It is necessary to assign a lot number, which should be displayed on the product label.

• Plant prepping:

The production process needs to be thoroughly explained. Other compounds should be stated in the production methods if they are added during manufacture to change the plant preparation to a specific level of active or distinctive ingredients or for any other reason. It should also include a procedure for identifying the plant preparation and, if practical, for assaying it. To guarantee constant quality of the prepsubsta, it should be sufficient to identify a characteristic ingredient or mixture of chemicals if identification of an active principle is not achievable.

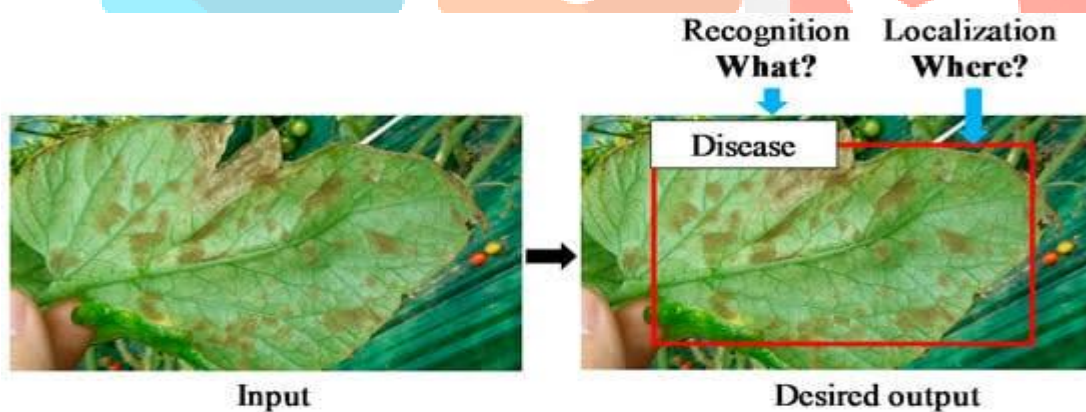
• Different methods Of identification of plant:

- 1) expert determination
- 2) Recognition
- 3) Comparison
- 4) The use of key and similar devices

A vital task is identification.. is the primary objective of systematics. Despite the fact that identification is a separation procedure, in reality it also incorporates nomenclature and classification. Identification is simply determining whether two items are the same or different by comparing their similarities or differences. When a person properly judges that an unidentified plant is a member of the same group as a recognised specimen (species, genus, family, etc.), the knowledge stored in classification systems becomes accessible and applicable to the material at hand. This comparison of an unknown plant with a named specimen and the determination that the two elements are the same also involves classification.

Identification is thus a fundamental step in classification, and nomenclature is crucial to information retrieval as well as communication. Identification is "best defined as the recovery side of taxonomy," according to Blackwelder (1967), and "enables us to obtain the necessary data from the system (classification) to be connected with some specimen at hand." In actuality, a plant is typically named after being identified by direct comparison or the use of keys. This chapter discusses the methods and practical aspects of plant identification and system identification. See *How to Identify Plants* by Harrington and Durrell for further details

1] Recognition: The most reliable and accurate form of identification is expert determination. In general, experts have published treatments (monographs, revisions, synopses) of the group in question, and it's likely that more recent floras, florulas, or manuals include the expert idea of taxonomy.



Example:

Peppermint leaf:

Synonyms : peppermint ,mentha pepertia.

- **Biological source:**

menthol, menthofuran, cineol, and limonene are all components of peppermint oil.

By steam distillation, menthone is produced from fresh mentha peppermint leaves.

Family: Lamiaceae



- **Geographical source:**

It is mainly found in Europe, United States
And also in damp places of England.

- **Chemical constituents :**

Menthol (C₁₀H₂₀O), Eucalyptus C₁₀H₁₈O,
Menthone C₁₀H₁₈O, Caryophyllene C₁₅H₂₄.

- **Health and benefits :**

- Peppermint is promoted for irritable bowel Syndrome, other digestive problems, the common cold Sinus infection, headaches & other conditions.
- Peppermint oil is promoted to topical use (application to skin for problems like muscle aches, Joint pain, itching.

Fenugreek leaf:

- Synonyms: methi, metha
- **Biological source:** It consists of herb of trigonella Foenum graeun
- **Family:** fabaceae
- **Geographical source:**

It can be cultivated in Asia Europe, Africa, America some parts of Australia in India 80% of fenugreek occurs in Rajasthan.

- **Description:**

- Fenugreek herb is aromatic 30-60cm tall, annual herb
- It has roots bearing nodules, leaflets are 2- 2.5cm long
- Flowers are 1-2 numbers axillary, sensible and white yellow coloured

- **Chemical constituents:**

Fresh Fenugreek contains ascorbic acid ,

B- carotene fiber's ,galctonamanund, calcium.

- **Health benefits:**
- Fenugreek has benefits for lowering blood sugar ,levels ,boosting testosterone.
- - And increasing milk production in breast feeding mothers .
- - Fenugreek may also reduce chloestrol level lower inflammation

Authentication of plant

Introduction:

Introduction:

terms of prevention and treatment, conventional medical practises are catching up to modern medical practises. Traditional medical practises are catching up to modern medical practises in terms of prevention and treatment. Herbalists can make money from the growing commerce in medicinal plants, but end users are misled when expensive constituents are replaced with species that are less expensive and more commonly available. The complicated chemical makeup of herbal remedies utilised as entire plants, plant parts, or extracts is the primary contributor to the issues with

standardising medicinal herbs. It is difficult to distinguish between real resources since intentional adulteration of desired elements occurs. For the industries that make herbal medicines, researchers, and academia, the authentication of medicinal plants using modern molecular techniques is inevitable. Recent advances in herbal genomics, molecular research on medicinal plants, and potent next-generation sequencing tools have the potential to revolutionise our understanding. order to accurately authenticate herbal drugs, this study looked at the efficiency of numerous molecular markers in barcoding.

The efficacy of various molecular markers in barcoding for the precise verification of herbal medications has been attempted in this work. Data were gathered from earlier works of literature and online databases like NCBI, Pubmed, etc. There are numerous molecular methods that can be used to verify the authenticity of medicinal plants, including DNA barcoding, Restriction Fragment Length Polymorphism (RFLP), Random Amplified Polymorphic DNA (RAPD), Amplified Fragment Length Polymorphism (AFLP), Sequence Characterized Amplified Region (SCAR), Selective Amplification of Microsatellite Polymorphic Loci (SAMPL), Simple Sequence Repeats (S Several of the therapeutic herbs were, The genetic information of multi-herbal mixtures aids in their broad acceptance .

- **Authentication of medicinal plant using molecular biology techniques**

As botanical supplements, herbal remedies, and sources of lead chemicals for pharmaceutical development, medicinal plants have gained enormous popularity in the United States. According to estimates, Americans took or ingested herbal medications worth 5.1 billion US dollars in 1997. Authentication of medicinal plants is a crucial problem for consumer safety. From the time the plant material is harvested until it is turned into the finished product, authentication is ideal. Unfortunately, no one approach can guarantee complete authentication throughout the process, but the objective can be reached by using a variety of diverse methodologies. Good voucher specimens that serve as reference materials and demonstrate chain of custody serve as the foundation of the entire procedure. Examinations at the microscopic and macroscopic levels can be employed as quick and affordable identification methods. The most effective method for contaminant detection and a great way to identify plants is chemical analysis. Each of these strategies has flaws, so other analytical techniques are required to help with authenticity. A variety of methods offered by molecular biology can be very helpful in authenticating therapeutic plants. The different facets of authentication procedures are covered in this overview, with a focus on molecular biology methods.

1) The easiest technique to confirm the identification and purity of botanicals may be to generate DNA markers (DNA sequences) using the polymerase chain reaction (PCR), which is becoming more and more common.

- The use of DNA markers has shown to be a beneficial addition to the use of morphological/anatomical and chemical markers (see Shaw et al., 2002; Joshi et al., 2004; Techen et al., 2004; Weising et al., 2005). One explanation is because DNA is the clearest sign of genetic identity.

2) The first is that competition for primer sites and low annealing temperatures may result in uneven amplification of different DNAs (Wising et al., 2005).

- The lack of reproducibility between labs, which is partly caused by differences in PCR settings, is another important issue (Itchen et al., 2004).

3) Authentication of plant resources is a risky issue for the therapeutic or botanically complementary uses of plants, especially medicinal plants. A single approach cannot provide an accurate identification of plants, hence authentication must occur throughout the many processes for the safety confirmation of plant products. These include molecular analysis, physicochemical techniques including TLC, HPLC, NMR, and X-ray, as well as outer morphological and microscopic identification approaches.

- **Authentication of medicinal plant by DNA markers**

Since ancient times, medicinal plants have been utilised all across the world to promote health and treat illnesses, particularly chronic ones. The issue is resolved by distinguishing the real substance from adulterants, replacements, and fake medications using DNA, morphological, anatomical, and chemical indicators. DNA markers, which have a stronger discriminatory power than the other two markers since they are not age- or tissue-dependent. In order to identify medicinal plant species and populations/varieties of the same species, characterisation of plants using such markers is an ideal method. Availability

Since DNA markers are independent of age or tissue, they have a better discriminatory ability than the other two markers. The best method for identifying medicinal plant species, populations, and variants is through the characterization of plants using such markers.

Availability

-Medicinal plant species are known to be in use since time immemorial for the treatment and cure of human and animal ailments. Though their use and practice registered a decline with the advent of antibiotics and sulfa-drugs, the toxicity and harmful effects associated with synthetic drugs and antibiotics have brought the herbal systems of medicines again

Extraction of Herbs

For thousands of years, the only remedy available for both the prevention and treatment of human ailments was natural medicine. For the creation of new drugs, natural ingredients are essential sources. Natural remedies always contain relatively small levels of bioactive natural ingredients. The creation of efficient and specific extraction a



nd isolation techniques for those bioactive natural compounds is now absolutely essential. In order to provide readers a complete picture of the many techniques used to extract and isolate natural compounds, this paper will cover them all. The advantages, disadvantages, and real-world applications of both traditional and contemporary approaches used in natural product research are also discussed in this work

Extraction is the initial step in extracting the suitable natural products from the base materials.

Further extraction processes include solvent extraction, distillation, pressing, and sublimation, in accordance with the extraction principle.

Solvent extraction is the method that is most frequently used.

The process of extracting natural products includes the following steps: (1) allowing the solvent to permeate the solid matrix; (2) allowing the solvent to dissolve the solute; (3) allowing the solute to diffuse out of the solid matrix; and (4) collecting the extracted solutes. The extraction will be made easier by any component that increases the solubility and diffusivity in the aforementioned phases. The extraction efficiency is influenced by the solvent's characteristics, the raw materials' particle size, the solvent-to-solid ratio, the extraction temperature, and the extraction time [6–10].

The properties of the extraction solvent, the particle size of the raw materials, the solvent-to-solid ration, the extraction temperature and the extraction duration will affect the extraction efficiency [6–10]. Separating the appropriate natural products from the raw materials is the first stage in the extraction process. According to the extraction principle, further extraction procedures include the use of solvents, distillation, pressing, and sublimation. The most often employed technique is solvent extraction. The processes of natural product extraction are as follows: (1) the solvent enters the solid matrix; (2) the solute . The solute that is soluble in the solvents diffuses out of the solid matrix first, then the solvent permeates the solid matrix, and finally the extracted solutes are collected. Any element that boosts the solubility and diffusivity in the aforementioned phases will make extraction simpler.

The solvent's properties, the size of the raw materials, the solvent-to-solid ratio, the extraction temperature, and the extraction time all have an impact on how effectively materials are extracted [6–10]. The choice of solvent is important for solvent extraction. Considerations for choosing solvents should include selectivity, solubility, price, and safety. Similarity and intermiscibility (like dissolves like) theory states that solvents having polarity values near to the solute's polarity will likely perform better. likewise the inverse.

In solvent extraction for phytochemical investigations, two popular solvents are EtOH and MeOH. Usually, the extraction functions better when the particle size is smaller. The small particle size will improve extraction effectiveness due to better solvent absorption and absolute dispersion. However, too fine of a particle size will cause issues with later filtering and excessive solute absorption by the solid. At high temperatures, solubility and diffusion both rise. The loss of solvents, however, can lead to the extraction of unwanted impurities and the destruction of thermolabile components. Excessively high temperatures can have this effect. Extraction efficiency increases with longer extraction times within a given time range. following the equilibrium

use.

- The extracted preparations include decoctions, infusions, fluid extracts, tinctures, pilular (semisolid) extracts, or powdered extracts; these preparations are named as galenicals after Galen (a Greek physician of 2nd century).
- The extract obtained by this process, after standardization is either used as a medicinal agent in the form of tinctures or fluid extracts, or is further processed for incorporation in tablet and capsule forms.

The drug extraction process is divided into the following four steps:

- The solvent penetrates the drug.
- The drug constituents dissolve in the solvent.
- The solution within the cells diffuses out.
- The dissolved portion separates from the exhausted drug.
- In the extraction process there is a mass transfer process in which transfer of mass occur from soluble material like solid to a fluid.
- The different factor which effect the process of mass transfer are temperature, agitation, size reduction and others

Types of extraction.

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Properties of extraction:

- It should be non-toxic.
- It should be stable, i.e., physically and chemically inert.
- It should not be too volatile or inflammable.
- It should be selective in nature, i.e., the desired amount of active ingredient can be extracted using minimum amount of inert material.
- Be safe for both people and the environment.
- Facilitating the extract's quick physiologic absorption.
- Preventative measures.
- Possess a large extraction capacity.

❖ Methods of extraction:

- Traditional methods:
 - Maceration.
 - Digestion.
 - Decoction.
 - Infusion.
 - Percolation.
 - Continuous hot extraction (Soxhlet extraction).
 - Expression.
 - Enfleurage.
- Modern Methods
 - Supercritical fluid extraction.

- Counter current extraction.
- Microwave assisted extraction.
- Ultrasonic assisted extraction.
- Accelerated Solvent Extraction (ASE).

1] Maceration:

The word maceration denotes softening.

- The maceration process is used for producing tinctures, extracts, and concentrated infusions.
- It is the simplest method of crude drug extraction, which was official in I.P., 1966.
- In maceration, solid ingredients and the solvent are taken in a stoppered container, and left undisturbed for at least 3-7 days of persistent agitation.
- The resulting mixture is put through sieves or nets after the soluble material dissolves in the solvent. The liquids are combined, the marc that was caught in the sieves is crushed, and then they are filtered or decanted after standing.

Maceration refers to softening.

The tinctures, extracts, and concentrated infusions are made by the maceration process. It is the most basic technique for extracting crude drugs, and it was made legal in I.P., 1966.

- In the process of maceration, the solvent and solid ingredients are placed in a container with a cork and allowed to stand still for at least 3 to 7 days while being frequently stirred. The resulting mixture is put through sieves or nets after the soluble material dissolves in the solvent.
- The liquids are combined, the marc that was caught in the sieves is crushed, and then they are filtered or decanted after standing.

2] Decoction :



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The word decoction means to concentrate by boiling.

- In this method, the drug powder can be boiled with water for a few minutes and then filtered.
- This method is suitable for drugs that are hard in nature such as roots, wood, seeds etc. containing water soluble constituents and are not affected by prolonged heating.
- These are mainly useful for making “Herbal Tea”.

● Advanced extraction methods like advanced techniques:

- 1) Extraction of supercritical fluid:
- 2) Extraction with microwave assistance
- 3) Extraction using ultrasound assistance
- 4) Microwave-assisted solid phase extraction

Supercritical fluid extraction:



The critical point of a pure substance is defined as the highest temperature and pressure at which the substance can exist in vapour-liquid equilibrium i.e. physical and thermal properties that are between those of pure liquid and gas.

- SCF's offers liquid like densities, gas like viscosities, gas like compressibility properties and higher diffusivities than liquid.
- Supercritical fluid is a substance at temperature and pressure above its critical point.
- It can diffuse through solids like a gas and dissolve materials like a liquid.
- The most commonly used supercritical fluids are carbon dioxide (CO₂) and

water, which are used for decaffeination and power generation, respective

- The greatest temperature and pressure at which a pure substance can exist in vapour-liquid equilibrium, i.e., with physical and thermal properties halfway between those of a pure liquid and a gas, is known as the critical point of the pure substance.
- SCFs are substances that are at temperatures and pressures above their critical points and have properties that are similar to those of gases, including liquid-like densities, gas-like viscosities, gas-like compressibility properties, and higher diffusivities than liquid.
- Carbon dioxide (CO₂) and water are the two most often employed supercritical fluids, and they are used to produce power and decaffeinate coffee, respectively.

The highest temperature and pressure at which a pure substance can achieve vapour-liquid equilibrium or exhibit properties between

Advantages:

SCF's volatility makes it simple to recover from the extract, and pressure and/or temperature can alter how quickly SCF dissolves. • Toxic solvents don't leave behind any damaging residue.

High-boiling components are extracted at comparatively low temperatures, and in some circumstances separations that are not possible using more traditional methods can be accomplished.

- By using low temperatures for the extraction, thermally labile chemicals can be extracted with little risk of harm.

Disadvantages:

Increased pressure is necessary.

Complex recycling procedures are needed for solvent compression in order to save money on electricity.

- High equipment capital expenditure.

Applications:

- Oil shale organics recovered.

- The division of bodily fluids.

Biological segregation
Recovering oil.

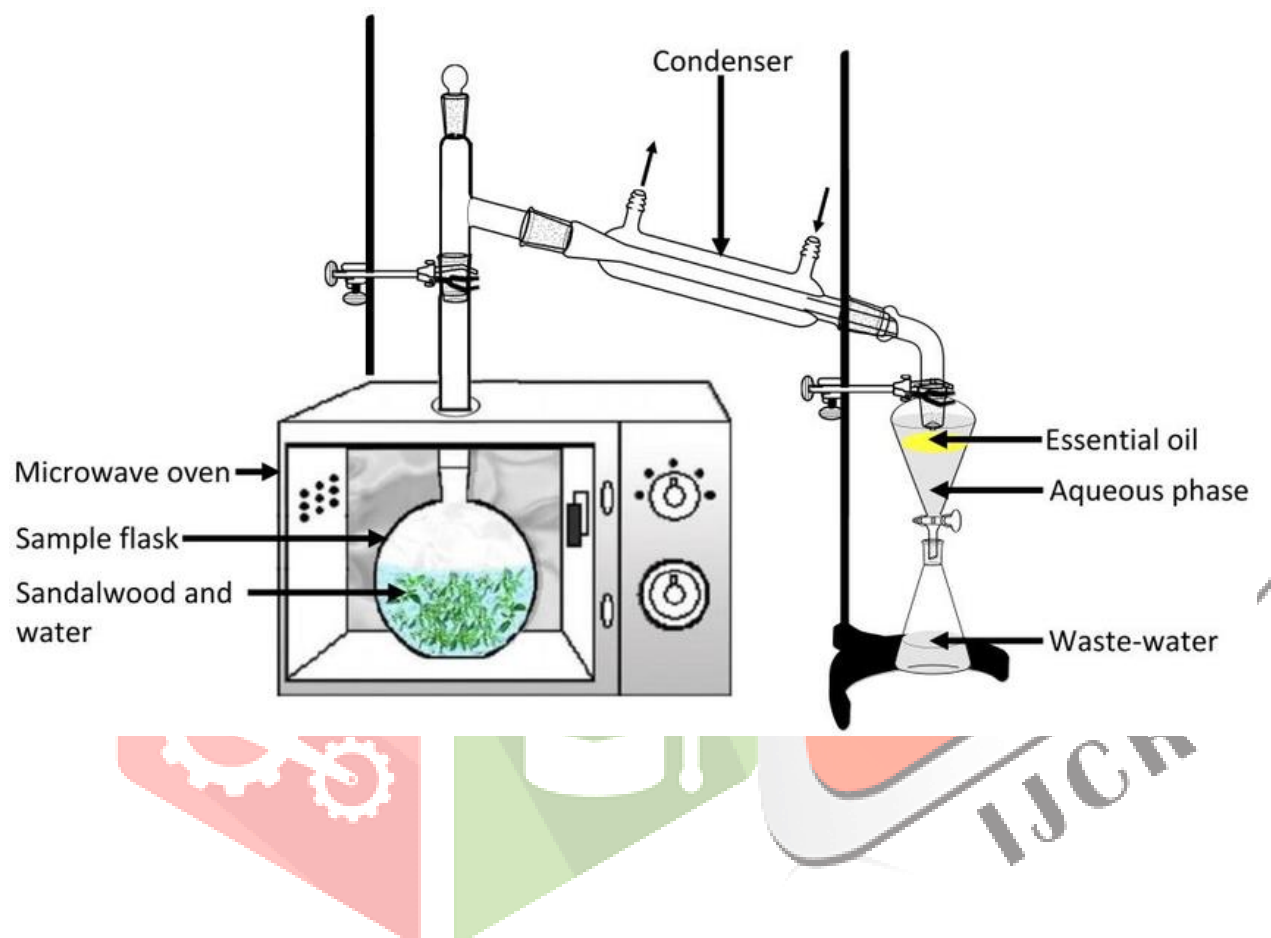
- Rude wax removal.
- Coal exploitation (reactive extraction and liquefaction).

Choosing which scents, oils, and contaminants to remove from food and agricultural products

pollution prevention.

Combustion and numerous other

2) microwave assisted extraction:



Nonionizing electromagnetic waves with a frequency of 300MHz to 300GHz make up microwaves, which are found in the electromagnetic spectrum between

They are composed of the electric and magnetic fields (two oscillating perpendicular fields), the former of which is responsible for heating. X-rays and infrared rays.

- For extraction, dried plant materials are typically utilised; however, microwave heating can also be used on plant cells that still retain minute amounts of moisture.
- The moisture inside these plant cells heats up and evaporates when they are subjected to microwave heat.

Plant cells expand up as a result, applying pressure to the cell wall, which causes the cells to stretch and eventually break, releasing the active ingredients into the solvent around them and increasing yield.

Advantages

Since the extraction process only needs a few seconds to a few minutes (15–20 minutes), it is less time-consuming.

- Less solvent is needed (only a few milliliters).
- The extraction yield is increased.
- It offers more accuracy and precision because it is an automatic procedure.
- The extraction of thermolabile components is possible.
- From a few milligrammes of plant sample, it is possible to extract trace amounts of components, such as heavy metals and pesticide residues.
- By agitating the extraction process, it enhances the mass transfer phenomena.
- Since its instrumentation (like Soxwave) combines Soxhlet's capabilities with the advantages of microwave technology, extraction is made more easier.

It takes less time to extract data because it simply takes a few seconds to a few minutes (15–20 minutes).

- There is less need for solvent (only a few milliliters).
- There is an increase in extraction yield.
- Because it follows an automatic process, it delivers more accuracy and precision.
- It is feasible to extract thermolabile components.
- It is able to isolate trace levels of substances, such as heavy metals and pesticide residues, from a few milligrammes of plant sample.
- It improves the mass transfer phenomenon by stirring up the extraction process.
- Extraction is made simpler because its instrumentation (like Soxwave) blends Soxhlet's capabilities with the benefits of microwave technology.

- attractive.
- The extraction procedure only needs a few seconds to a few minutes (15–20 minutes), therefore it requires less time.
- Less solvent is needed (only a few milliliters).
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- It offers more accuracy and precision because it is an automatic procedure.
- The extraction of thermolabile components is possible.
- From a few milligrammes of plant sample, it is possible to extract trace amounts of components, such as heavy metals and pesticide residues.
- By agitating the extraction process, it enhances the mass transfer phenomena.
- Since its instrumental setup (like Soxwave) combines the advantages of microwave and Soxhlet, extraction is much more alluring.

Disadvantages:

When the solvents or target chemicals are non-polar or volatile, the efficiency of microwaves can be drastically reduced. In addition, additional filtration or centrifugation may be required to get rid of the solid waste product left behind by MAE.

Applications:

Compounds that are biologically active that are extracted with microwave assistance.

- Taxanes are extracted from the needles of *T. brevifolia*

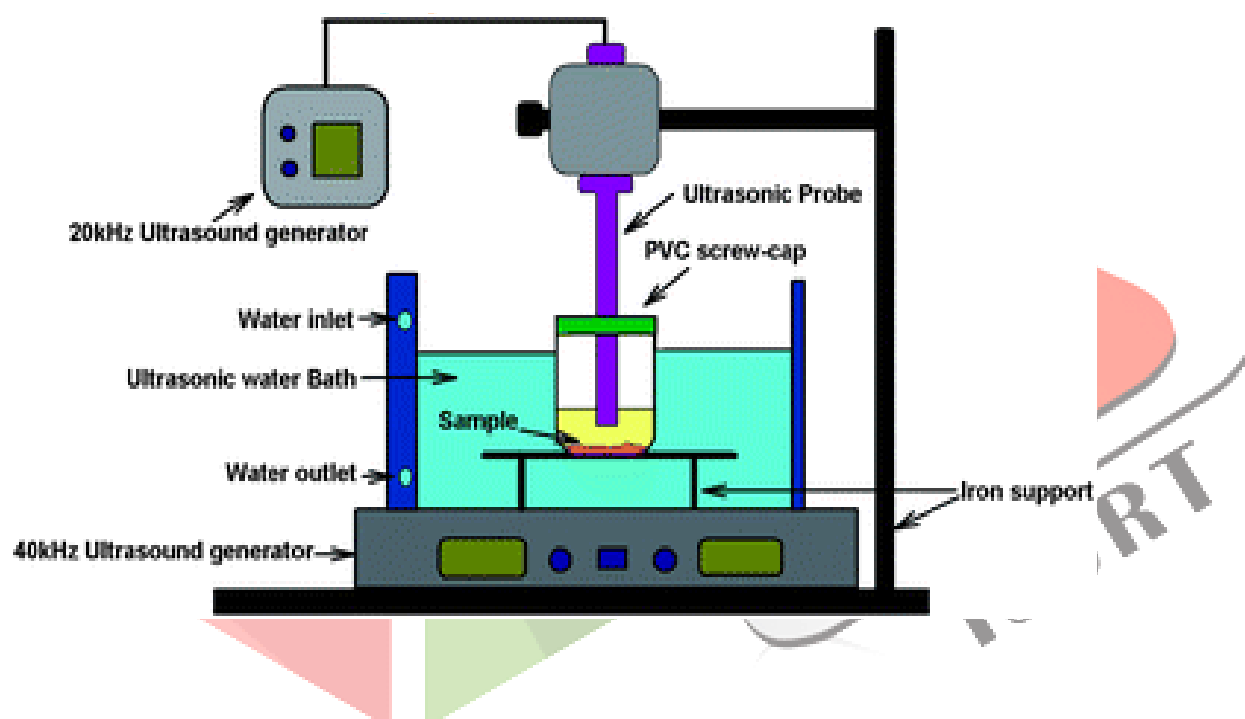
Azadirachta indica seed kernel limonoids that are related to azdiractin.

- Extracting glycyrrhizin acid from the roots of Glycyrrhizia glabra.
- Artemisinin is extracted from Artemisia annua.
- When employing MAE to extract anti-oxidative phenolic compounds from tomatoes, a higher microwave temperature and a shorter extraction period are more efficient. MAE has been shown to be a viable substitute for conventional techniques for extracting phenols from green coffee beans, such as chlorogenic acids.

3) ultrasound assisted extraction:

Ultrasound refers to frequencies above 20,000 Hz.

- Ultrasonic extraction uses ultrasonic waves.
- These waves have a cavitation impact on dry cells, destroy cell walls, and liberate contents that are active.



- When ultrasonic waves flow through a liquid medium, the liquid media is compressed (producing a high pressure) and rarefied (producing a low pressure).

Small gaps or vacuum bubbles are created in the solvent as a result of this procedure.

- After a given amount of time, these bubbles were unable to absorb any more microwave energy and burst.
- They cavitated, or burst, during the high pressure cycle.

Cell walls are destroyed and active chemical components are removed as a result of this cavitation.

Advantages:

- It offers a low-cost, easy-to-use alternative to traditional extraction techniques.
- It also includes a higher extractive output and quicker kinetics.
- It lowers the working temperature, allowing thermolabile chemicals to be extracted.
- The ultrasound device is more user-friendly and less expensive when compared to other cutting-edge extraction methods, such as microwave assisted extraction.
- The time, polarity, amount of solvent, amount, and kind of sample can all be optimised when it comes to UAE extraction conditions.
- UAE has faster kinetics and a comparably shorter operating time.

Disadvantages:

The production of free radicals can lead to unwanted alterations in the medication molecules, which can affect the active ingredients of medicinal plants.

Applications:

utilised to extract plant lipids such as rice bran, almond, and apricot oils as well as essential oils and dietary supplements.

Following ginseng saponin extraction, the measured total yield and saponin yield increased by 15 and 30%, respectively. It was found that using high-intensity ultrasound and either hexane or a simple aqueous solution, rice bran oil extraction could be successfully finished in 30 minutes.

Depending on the temperature, ultrasound-assisted extraction with hexane enhanced the rates of extraction of carvone and limonene by 3-2 times compared to conventional extraction.

use to extract lipids and nutraceuticals from plants, such as essential oils and rice bran, almond, and apricot oils.

We measured ginseng saponin extraction, observed total yield, and saponin concentration.

Conclusion :

Plants, herbs, and ethnobotanicals have been used for illness prevention and treatment since the dawn of human history. Plants and other natural resources provide the basis of modern medicine, and they also greatly contribute to the creation of commercially available pharmaceutical products. Worldwide, over 25% of medications are manufactured from plants. However, as opposed to pharmaceuticals, plants are commonly used in the healthcare industry. Some people prefer simply taking herbal medicines as a kind of treatment. Some people use herbal remedies in addition to conventional medicine. However, in many undeveloped countries, traditional medicine, of which herbal medicine is an essential part, is the only available or affordable type of healthcare. People who take herbal medicine, whatever the cause

Consumers should also obtain scientifically

accomplish this, international legal harmonisation is required to direct the ethical manufacturing and distribution of herbal medicines. If there is accepted scientific proof that a herb has benefits, then such legislation should enable for this to be

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