



AN OVERVIEW ON UTILIZATION OF ADVANCED HERBAL TECHNOLOGIES IN PHARMACEUTICAL SCIENCE

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Abstract: Nowadays herbal medicine play important role in our life and have many advantages .Due to various benefits, people are becoming more interested in herbal medications these days. Herbal medicines have fewer side effects so widely accepted as effective treatment option in various diseases. Identification of the plant done by observing specific morphological characters such as size, leaf shape, Flower colour and odour etc. Plant authentication is the process of confirming a plant identity. Several method that can be used to authenticate a plant are DNA testing, Morphological analysis and chemical analysis. Different extraction techniques including advanced extraction techniques such as ultrasound Assisted Extraction action, supercritical Fluid Extraction, Microwave Assisted Extraction etc.

Keyword: Standardization, Pharmacognostic studies, chromatography technique, Extraction techniques, etc.

I. INTRODUCTION:

Medicine is a substance that has nutritive, curative, or preventive properties, while the term “herbal” refers to a botanical or plant-based preparation. Hence, the term “herbal medicine” is used for plant-based substances that consist of nutritive, curative, or preventive properties. Herbal medicine is an interdisciplinary branch between herbal medicine and Ayurveda as it covers all fields of herbal medicine related to botany, medicinal plant research, pharmacognosy, phytochemistry, physiotherapy, botanical medicines, Ayurveda, natural chemistry, agriculture science, Unani medicine, biotechnology, and biochemistry. A person who deals with herbs, especially medicinal herbs, is known as an herbalist. ^[1]

Importance:

- Plant identification using a traditional key is difficult and time-consuming.
- Understanding species is crucial to preserving biodiversity.
- This presents a challenge for beginners who wish to learn about species.

Different Method of Identification of Plant:

- Expert Determination
 - Recognition
 - Comparison
 - The use of key and similar devices
- a. Expert Determination:** In terms of accuracy or dependability, expert determination is the best identifying technique. Despite its high level of reliability, this approach has drawbacks, such as consuming experts' valuable time and delaying identification.

- b. Recognition:** It gets close to professional assessment in terms of dependability. This is predicated on the identifier's vast prior familiarity with the relevant plant group.
- c. Comparison:** Comparing an unknown to identified specimens, pictures, drawings, or descriptions is the third technique.
- d. Using Keys and Similar Devices (Synopses, Outlines):** This approach is the most popular. Since it doesn't require the knowledge, resources, or time that go into comparison and recognition.^[2]
- 1. Authentication of Plant:** Plant authentication is the process of verifying the identity of a plant. Herb (plant) authentication is a quality assurance process which ensures that the correct plant species and plant parts are used as raw materials for herbal medicines.
- 2. Macroscopic Examination:** In Macroscopic Examination Involved Study of Shape, Size, Colour, Taste of Leaves, Flower and Fruit are evaluated.

Sr. No	Parameter	Characteristics
1.	Size	Ruler in millimetre was used for measurement of the length and width of crude drug .
2.	Colour	Untreated sample was examined under diffused daylight Untreated sample was examined under diffused daylight
3.	Surface Characteristics, Texture	The material is touched to determine if it is soft or hard either it is bended and ruptured to obtain information on brittleness and the plant material were fractured to observe whether material is fibrous , smooth , rough and granular.
4.	Odour	The material was powdered and the strength of the odour was determined.
5.	Taste	The small amount of plant materials was tasted and observed

Table No.1: Macroscopic Examination^[3]

- 3. Microscope Examination:** Examination focuses on anatomical structures in the plant material that are visible only with the help of a microscope. There are two type if microscopy:
- Quantitative microscopy:** it involved study of stomatal number, stomatal index, vein islet number, vein termination, palisade ratio.
 - Qualitative microscopy:** stomata, trichomes, starch grains, calcium oxalate crystals, xylem vessels.^[4]
- 4. Chromatography Evaluations:**
- Chromatography is the separation of chemical compounds in a mixture. Chromatography is derived from the Greek words “chroma” meaning “colour” and “graphien” meaning to “write”. The technique was originally developed by Russian Botanist M. S. Tswett in 1903. It is analyte technique utilized for the separation, purification and identification of constituents from the mixture. It works on the principle of differential interaction of solutes with two different phases viz. The stationary phase and the mobile phase. Many modifications were made to the techniques of chromatography to overcome the shortcomings like analysis time and the range of compounds that could be detected. Technologies like spectroscopy and electrochemical methods were added to enhance detection.^[5]
- 5. Different extraction methods including advanced extraction techniques**

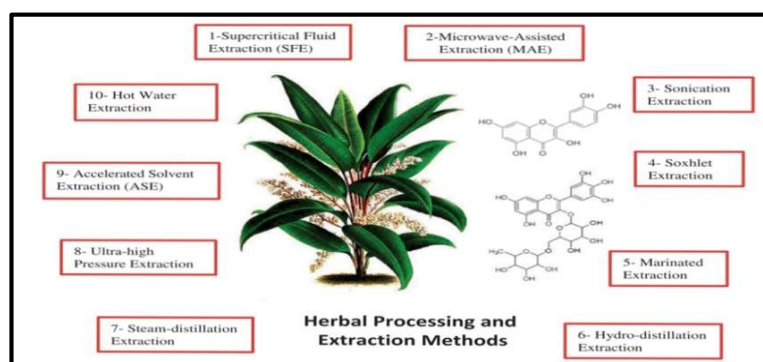


Fig. No. 1: Different Extraction Methods

- **Extraction:**

Definition: The process of separating medicinally active constituents of plant and animal tissue with the help of selective solvent and standard procedures is termed extraction. The drug extraction process is divided into the following four steps:

1. The solvent penetrates the drug.
2. The drug constituents dissolved in the solvent.^[6]

- **Advanced Extraction Techniques:**

- a) Supercritical Fluid Extraction:
- b) Microwave Assisted Extraction:
- c) Ultrasound Assisted Extraction:
- d) Solid-phase Extraction:

a. Supercritical Fluid Extraction: Supercritical fluids are used in the separation of components during the SFE process. In most cases, liquids or solid matrices are used for extraction.^[7]

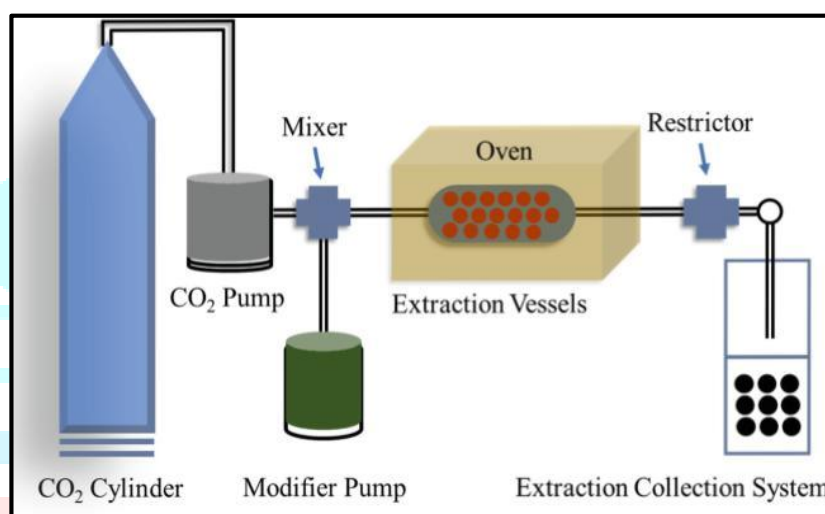


Fig. No. 2: Supercritical Fluid Extraction

b. Microwave Assisted Extraction: Non-ionizing electromagnetic waves that fall between X-rays and infrared rays are known as microwaves.

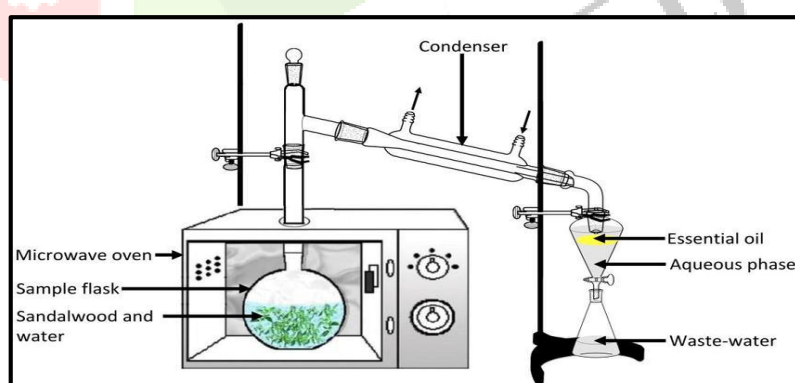


Fig. No. 3: Microwave Assisted Extraction

- **Principle:**

Microwaves are part of electromagnetic spectrum of light with a range of 300 MHz to 300 GHz and wavelengths of these waves range from 1cm to 1m. These waves are made up of two perpendicular oscillating fields which are used as energy and information carriers. First application of microwaves includes its interaction with the specific materials which can absorb a part of its electromagnetic energy and can convert it into heat. Commercial microwaves use 2450 MHz of energy for this purpose which is almost equivalent to 600-700W. Practically, microwaves induce dipole rotation in organic molecules along with heating which causes the destruction of hydrogen bonding.

Due to increased kinetic energies of ions as well as friction between ions due to their continuous movements and change in direction. This cause the traffic of ions which results in heating effect due to increased in kinetic energy of ions as well as between ions due to their continuous movements and change in direction.^[8]

c. Ultrasonic Assisted Extraction: Ultrasonic-assisted extraction is a quick and efficient extraction method that increases mass transfer speed and accelerates extraction by using ultrasonic to create quick solvent movement. When compared to other cutting-edge extraction methods, UAE is more affordable, environmentally benign, and practical.

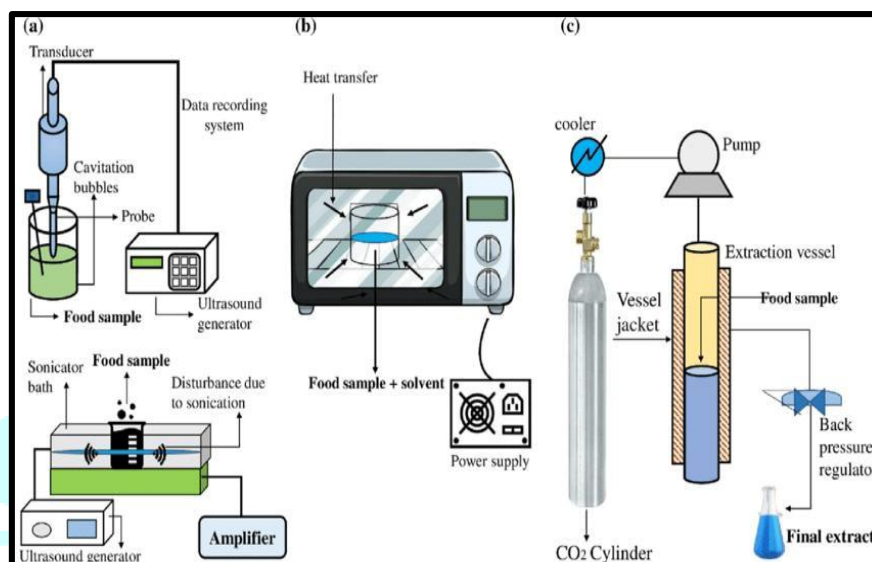


Fig. No. 4: Ultrasound Assisted Extraction.

Boateng and Lee (2013) provided evidence to back the statement, reporting that UAE is a quick and easy procedure that uses less energy, time, and material to produce more pure product at higher yields. UAE is viewed as an ideal solution for the edible oil industry because it can be carried out at low operation temperatures, protecting the extract from thermal damage while preserving the structure and molecular properties of the bioactive compounds. In addition to preventing thermal damage to the bioactive compounds, UAE also avoids damaging plant material.^[9]

6. Isolation and Purification Technique:

Isolation: An isolation technique is a method of separation that allows us to receive a compound that has been purified.^[10]

• General Method of Isolation

- Methods of extraction.
- Plant matrices are inherently complex, including a wide range of chemicals with different physical and chemical properties.
- Plant material extraction is an essential step in the isolation of natural plant components and their purification.
- For the purpose of characterizing plants, it is crucial to carefully separate chemicals of interest from the rest of the plant and creates pure versions of them.
- There are several ways extraction method can be categorized.
- The temperatures have been used to categorize them.
- Methods using low or room temperature.
- The cold extraction approach.^[11]

Chromatography Techniques:

The term chromatography (Greek kromatos – colour and Graphos – written) meaning colour writing. Chromatography is a laboratory technique for the separation of a mixture. The mixture is dissolved in a fluid called the mobile phase, which carries it through a structure holding another material called the stationary phase. The various constituents of the mixture travel at different speeds, causing them to separate. The separation is based on differential partitioning between the mobile and stationary phases. Chromatography is a physical method of separation in which the components to be separated are distributed between two phases, one of which is stationary phase while the other is mobile phase which is movable. Chromatography is a scientific procedure for the separation of a mixture. The phrase comes from the Greek words kromatos, which means color, and graphos, which means written. The mixture is dissolved in a liquid known as the mobile phase, which then passes through a structure containing the stationary phase, which is another substance. The mixture separates because the different components move at different speeds. Differential partitioning between the mobile and stationary phases serves as the basis for the separation. Chromatography is a physical separation technique in which the components to be separated are divided into two phases: a mobile phase that is movable, and a stationary phase.^[12]

- a) **Thin Layer Chromatography:** This method of chromatography uses a solid-liquid adsorption for the purpose of isolating non-volatile mixtures. In this method, the mobile phase is a liquid but the stationary phase is a silica gel coated glass plate. The polarity of the particles towards these phases (mobile and stationary) helps in their separation from one another. The technique of chromatography was discovered in the year 1906 by M. Tswettin. The procedure of thin layer chromatography for the most part utilizes a sheet of plastic, glass or aluminium foil, which is covered with a thin layer of adsorbent material, typically cellulose, silica gel, aluminium oxide.^[13]
- b) **Column Chromatography:** One method for separating a single chemical compound from a mixture dissolved in a fluid is column chromatography. Column chromatography is a technique that allows substances to be separated into fractions by using the differential absorption of the chemical to the adsorbent as the molecule moves through the column at varying rates both small- and large-scale materials that will be employed in upcoming research can be purified using this method. One kind of adsorption chromatography technology is this one.^[14]
- c) **High Performance Thin Layer Chromatography:** A more complex and automated version of thin-layer chromatography (TLC) with improved and enhanced separation efficiency and detection limits is called high performance thin-layer chromatography (HPTLC). HPTLC is a well-known and adaptable separation technology that has many advantages when compared to other separation techniques. It is also known as Flat-bed chromatography, Planar chromatography, and High Performance Thin Layer Chromatography. The only real distinction between HPTLC and traditional TLC is the sorbents' pore and particle sizes. It is an effective analytical technique that works well for tasks requiring quantitative analysis. Depending on the type of adsorbents utilized on the plates and the solvent system used for development, separation may be caused by either partitioning or adsorption, or by both phenomena.^[15]
- d) **High Performance Liquid Chromatography:** High-performance liquid chromatography, sometimes referred to as high pressure liquid chromatography, or HPLC, is a specific kind of column chromatography that is used to separate, identify, and quantify the active compounds. A stationary phase (column containing packing material), a pump that moves one or more mobile phases through the column, and a detector that shows the molecules' retention times are the main parts of an HPLC system. Retention time is influenced by the interactions that occur between the stationary phase, the molecules under investigation, and the solvent or solvents being used. Specific chemical or physical interactions with the stationary phase cause the sample for analysis to be delayed when it is added in modest quantities to the stream of mobile phase.^[16]

II. RESULT AND CONCLUSION:

Advanced herbal technology convert biological material into medicine .These herbal medicine has fewer side effects and it is less expensive. Various advanced technology is used to covert botanical material into medicine such as supercritical fluid extraction , microwave assisted extraction ,ultrasound assisted extraction etc. These extraction give pure product which is safe , non-toxic and economical and do not cause major adverse drug effect .HPTLC technique is better used as compared to TLC help to detect compound and chromatography major role is to separate the components mixture.

III. REFERENCES:

1. <https://copbela.org>.
2. Mr. Karande Sankalp, Santosh, Ms. Adsul P. S, Advanced herbal drug technology. International Journal of Research Publication and Reviews: 2023; 4(3), 2482 – 2487.
3. Ashwani kumar, Darshika sharma , studies on Macroscopic, Microscopic and TLC Based phytoconstituents Analysis of Boerhavia diffuse. International Research Journal of Management Science and Technology: 2019; 10(6), 2250 -1959.
4. Maitri .T. Patel, Krupa Purohit, Microscopic Evaluation: An essential tool for authentication of crude drugs. World Journal of Pharmaceutical Research: 2017; 6 (17), 334-343.
5. Rekha Priyadarshini, Gerard Marshall Raj, chromatography: The essence of bioanalysis. European Journal of Biomedical and Pharmaceutical Sciences: 2016; 3(1), 366-377.
6. Dr. K prabhu, Dr. G Arunachalam, Pharmacognocny and Phytochemistry-2, Thakur publication (2019), page no. 256-257.
7. Tariq Ahmad, F.A .Masoodi, supercritical Fluid Extraction: A Review, Received: 2019 ,Page no.114-122
8. Iqra Akhtar , Sumera Javade , Microwave Assisted Extraction of phytochemicals an efficient and modern approach for botanicals and pharmaceutical :2019 ;32 (1),Page no.223-230.
9. Archana .A. Bele, Anubha Khale, An Overview on Thin Layer Chromatography, International Journal of Pharmaceutical Sciences and Research: 2011; 2(22); 256-267 <https://www.differencebetween.com/difference-between-extraction-and-isolation>
10. Gavali Pratiksha Suresh, Garute Komal Somnath, Advanced herbal technology, International Journal of Creative Research Thoughts: 2022; 10(1), 2320-2882.
11. Mimansha Patel, Review article: chromatography principles and applications, International Journal of Pharmacy and Pharmaceutical Research: 2018; 13(4), 2349-7203
12. Archana .A. Bele, Anubha Khale, An Overview on Thin Layer Chromatography, International Journal of Pharmaceutical Sciences and Research: 2011; 2(22); 256-267.
13. Dr. Tushar P. Dukre, Sager S. Sangale, Akash .K.Shelke, Nilesh .M. Chattar,Dhananjay. D. Narsale, A Review on: Column Chromatography Techniques As Separation Method, IRE Journal: 202; 6(7), Page no.118-119.
14. Puskuri Divya, Dr. M Sathish kumar, Dr. A Malik, Dr. N Jyothi, A Review on high performance thin layer chromatography, 2021; 6(10),Page no.245-247
15. Archana A. Bele and Anubha Khale, An Overview on: Thin layer chromatography, vol-2, ISSN-0975 8232,Page no.256-267.