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A Review on Herbal Medicine.

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Abstract

Due to various benefits, people are becoming more interested in herbal medications nowadays. Formulations made from herbs are now widely accepted as effective treatments for many ailments. Even if the majority of these uses are unconventional, it is a known fact that more than 80% of the world's population relies on herbal products and medicines to maintain a healthy lifestyle. The increased usage of herbal goods has also led to a variety of product abuses and adulterations, which have disappointed consumers and manufacturers and, in some cases, had disastrous results. Scientists face a significant difficulty in developing reliable analytical techniques that can quantitatively analyse marker/bioactive chemicals and other important ingredients and reliably profile the phytochemical makeup. Standardization is a crucial stage in the creation of a standardized chemical profile, or just a quality control approach for growing and producing herbal medicines.

Introduction:

Technology based on herbs is introduced the term "herbal" refers to a botanical or plant-based preparation, whereas "medicine" refers to a material that possesses nutritional, therapeutic, or preventative characteristics. As a result, substances made from plants that have nutritional, curative, or preventative characteristics are referred to as "herbal medicines." As it encompasses 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, herbal medicine is an interdisciplinary branch between herbal medicine and Ayurveda. An herbalist is a person who works with plants, particularly medicinal plants. The use of plants to treat disease is covered in herbal journals. (1)

IDENTIFICATION OF HERBAL MATERIALS:

Raw drug is a material that is used as medicine but has not yet been processed or exposed to analysis. The origin of this material may be organic or inorganic. The majority of Ayurvedic medications are of organic origin, particularly those derived from plants. Organized and unstructured medications are subcategories of organic drugs based on whether or not cellular structure is present. There are over 2, 50,000 plant species, of which 35,000 are employed medically. Over 6,000 plants are utilized for medicinal purposes in India alone, 2,400 of which are used in diverse indigenous medical systems.

Need of Identification:

Identification is the process of recognizing an herbal drug's true identity. Identification becomes crucial when commercial implications are posited. Adulteration, whether intentional or not, has long been a component of the herbal trade. Some of these additives have completely different chemical compositions and therapeutic outcomes from the real thing. Malva rotundifolia and Merremia species have been discovered being sold under the name Brahmi (Bacopa monnieri). These adulterants' leaves only resemble Centellaasiatica, a legally recognized Brahmi alternative. The real Nardostachys jatamansi, also known as Cyperus stoloniferas, is sold in Mumbai markets as "Jatamansi." Similar to adulterants, plant-based medications are available in a variety of forms. Once the monograph identifying each drug is established, consumers can quickly determine if it is adulterated.

Research and Future Directions:

Research and Future Directions Of the top 10 herbs sold in the United States, only four, garlic, G. biloba, saw palmetto, and St. John's wort, are likely to be effective based on systematic reviews of randomized controlled trials. There is likely far less evidence available to evaluate the efficacy of the thousands of other single and multiherb products available in this country. This lack of evidence for efficacy is coupled with recent reports of serious side effects from herbal products [13-17]. and a surveillance system that has been estimated to detect less than 1% of adverse reactions to herbs

Diagnosis Of Herbal Medicine:

The diagnostic methods used by herbalists differ from those of traditional doctors. When treating arthritis, for instance, they can notice "under functioning of a decision that the arthritis is caused by "an accumulation of metabolic waste products" and the patient's systems of disposal." Then, in addition to herbs having anti-inflammatory characteristics, a combination of herbs that is diuretic, choleretic, or laxative may be administered.

Authentication of plant:

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

1. Macroscopic analysis:
   This involves comparing the plant or botanical drug's descriptions in floras or monographs with morphological characteristics that are visible to the unaided eye or under modest magnification. For macroscopic identification, traits like the size, shape, and colour of leaves (or leaf fragments), flowers, or fruits are frequently used.
2. Examining plant material under a microscope focuses on anatomical components that are only visible under a microscope. The shape and structure of trichomes (hair), the arrangement of stomata in the epidermis, the presence or absence of substances like mucilage, starch, or lignin, or the existence of tissues with distinctive cells may all be used to identify herbal medications under the microscope.
3. The separation of chemical substances in a mixture is done using chromatography technologies. There are numerous chromatographic procedures, however they are all founded on the same fundamental ideas. The majority of pharmacopoeial monographs for plants include a TLC identification test since thin-layer chromatography (TLC) is frequently used in the authentication of herbal materials. TLC separates mixtures of substances to leave a silica gel-coated plate with a "fingerprint" of the separated substances. A pure reference compound or an authentic 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 utilized in particular for fatty acids and essential oils.

4. **Phytochemical analysis:**
   Using standardized techniques, the crude powder and/or crude pharmaceuticals extracted using various solvents are analyzed for the presence of various Phyto components. Alkaloids, flavonoids, tannins, phenols, cardiac glycosides, triterpenes, steroids, and saponins are typically tested for in them.
5. **Fluorescence analysis:**
   Under light, the fluorescence microscope shows the fluorescence released by herbal tissues. Due to their chemical makeup or secondary metabolites, many herbal tissues have the capacity to emit light at a certain wavelength after absorbing light with a shorter wavelength and more energy. For instance, it has been discovered that starch grains, calcium oxalate crystals, stone cells, capillaries, and fibers all possess stable and unique polariscopic properties. It involves placing a little amount of dry plant powder on a clean microscope slide, adding a few drops of freshly made reagent solution, gently tilting the slide to mix it, and waiting a short while. Place the slide in the UV chamber after which you can view the colour of short (254 nm) and long (365 nm) wavelength ultra violet radiations in visible light. You can then record the colour you see by using various reagents with various radiations.

6. **Chemical Fingerprinting:**
   A chemical fingerprint is a distinctive pattern that shows the various chemical markers present in a sample. A chemical marker's concentration can serve as a barometer for the potency of a herbal remedy. The study of chemical markers can be used to validate the authenticity of a species, look for new sources of raw materials or substitutes, improve extraction and purification processes, clarify structures, and assess purity.
7. **Molecular markers:**
   In general, the term "molecular markers" refers to biological components including primary and secondary metabolites as well as other large molecules like nucleic acids. DNA markers are trustworthy for revealing polymorphisms since each species' genetic makeup is distinct and unaffected by ageing, physiological changes, or environmental variables. The physiological form of the sample for assessment does not limit detection because DNA can be isolated from live or dried organic tissue of botanical

material. To assess DNA polymorphisms, many DNA-based molecular approaches are used. These include procedures based on hybridization, polymerase chain reaction (PCR), and sequencing.

a. many extraction processes, including cutting-edge ones like supercritical fluid

b. 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 rate at which the solute diffuses through the liquid boundary layer at the interface typically determines the extraction rate. The primary extraction techniques are:

- Maceration
- Percolation
- Digestion
- Infusion
- Decoction.

1. **Solvent removal:**

Menstruum is another name for the extraction solvent used to extract medicinal herbs. The type of plant, the plant component being extracted, the makeup of the bioactive chemicals, and the solvent's accessibility all influence the choice of solvent. In general, non-polar solvents like hexane and dichloromethane are used to extract non-polar chemicals, while polar solvents like water, methanol, and ethanol are used to extract polar compounds.

The traditional method for liquid-liquid extraction is to choose two miscible solvents, such as water-dichloromethane, water-ether, or water-hexane. Water is present in every combination due to its strong polarity and miscibility with organic solvent. To facilitate separation, the substance that will be extracted by liquid-liquid extraction should be soluble in organic solvent but not in water. Additionally, the polarity of the solvents employed in extraction is categorized, with water being the most polar and n-hexane being the least polar.

1. **Extraction with microwave assistance (MAE):**

A household microwave oven system with a maximum power of 800 W and a frequency of 2450 MHz was used for the MAE. A digital control mechanism for microwave power and irradiation time was included into the equipment. Condensing the vapor produced during extraction into the sample required modifying the oven. 20 mL of aqueous ethanol and 1 g of powdered avocado seeds were combined, then the mixture was microwave-irradiated. Microwave power (80–400 W), extraction time (1–5 min), and ethanol concentration (40–80%) were the MAE extraction parameters. After that, the sample was vacuum-pumped through a filter, and the liquid extract was obtained and kept at 4°C for further use.

2. **Supercritical fluid extraction:**

Using non-toxic CO as a solvent, phyto-constituents found in plants can be extracted for medicinal use. Extraction with supercritical fluid is the name of this procedure. Supercritical fluid extraction leaves no hazardous residue behind. Such supercritical fluids have extremely high extraction efficiency and penetration powers.

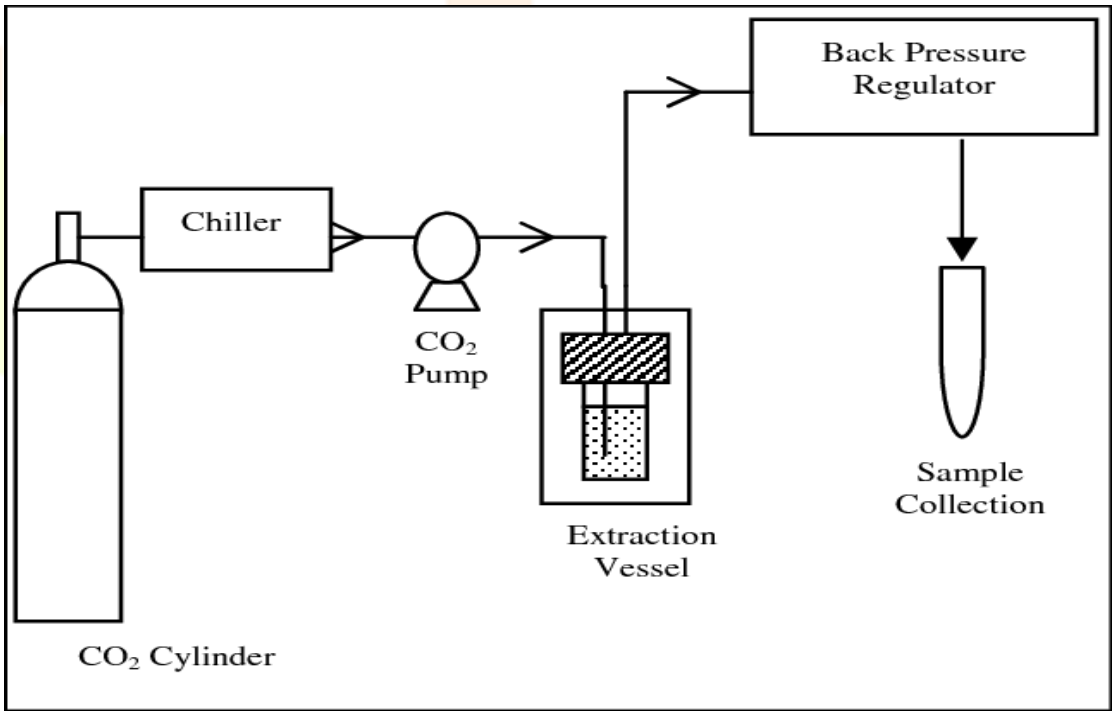

fig1. supercritical fluid extraction

• At the critical point of 73.83 bar pressure and 31.06 °C temperature, gases like carbon dioxide are maintained as supercritical fluid. CO2 functions as a liquefied gas or freely flowing liquid at this crucial juncture, helping to separate the phytochemical components from the crude medicines.

• Supercritical fluids extraction is a Soxhlet extraction method that uses less solvent and operates at lower temperatures. The extraction column's heater is positioned along its length, and the mixture that needs to be fractionated passes through it. The column is used to remove CO2. Drug material becomes saturated in the supercritical fluid that travels along the length of the extraction column once the column is compressed.

- • Pressure and temperature are chosen as the operating conditions. In the pressure-controlled type of extraction, the gas is once more compressed for recycling after the solution is simply enlarged to precipitate the extract during the separation step. When operating under temperature control, the solution is heated to reduce the solvent density and precipitate the extract.
- The three stages of the extraction procedure can be categorized. incorporating the analytes into the supercritical fluid in bulk. gathering the analytes from the depressurized CO2 and sweeping the analytes out of the cell.

In pharmacognosy, supercritical fluid extraction has a wide range of uses, particularly for the extraction and isolation of active components. The method is effective for producing terpene less oils, extracting pyrethrins from coffee, and decaffeinating coffee.

1) Extraction using ultrasound assistance (UAE):

In this investigation, ultrasonic-assisted extraction was used. Alcohol served as the extraction's solvent. The ultrasonic effect was produced with a sonicator (Sonics, 130 W, 20 kHz, Church Hill Road, Newtown, Australia). A water bath, as depicted in Figure, was used to regulate the temperature beneath the extraction setup. A submerged ultrasonic probe was used Enter the solution containing the sample directly. To aid in the extraction process, the ultrasonic device could cause a cavitation with a bubble implosion effect. Utilizing UAE, two experiments—extraction kinetic studies and extraction process optimization—were carried out.

extraction from solids

Compounds that are suspended or dissolved in a liquid mixture can be separated using a procedure called solid-phase extraction (SPE).

sorted out from other mixture components based on their physical and chemical characteristics. Solid phase extraction is used in analytical laboratories to concentrate and purify materials before analysis. Urine, blood, water, drinks, soil, and animal tissue are just a few of the many matrices from which analytes of interest can be extracted using solid phase extraction. SPE divides a mixture into desirable and unwanted components by utilizing the affinity of solutes that are dissolved or suspended in a liquid (known as the mobile phase) for a solid through which the sample is passed (known as the stationary phase). Depending on whether the part that goes through the stationary phase contains the required analytes or undesirable contaminants, it is either collected or discarded. The desired analytes can then be extracted from the stationary phase for collection in a subsequent step in which the stationary phase is washed with the proper eluent, if the part remained on the stationary phase contains them.

Technique for isolation and purification:

a. Standard isolation methods
b. Methods of extraction
c. The separation of natural plant components and their purification depend on the extraction of plant material.
d. Plant matrices naturally contain a variety of chemicals with different physical and chemical properties, making them complicated in nature [8].
e. Therefore, it is essential to thoroughly separate plant matrices from the rest of the organism and generate pure molecules that are of interest to plants in order to characterize them.
f. Extraction techniques
g. 7) can be divided into various categories [9]. They have been divided into groups in this chapter according to the temperatures they operate in.
h. Methods for Low or Room Temperature
i. 9.2.1.1 The cold extraction technique
j. 10) The procedure has been written about in the literature [10, 11]. Specifically, samples of dried plant parts (Cut, crushed or milled).

2) The chromatographic method:

Introduction Since prehistoric times, people on all continents have used hundreds to thousands of native plants for medicinal purposes.

Many plants produce chemicals that are important for maintaining human and animal health. These include aromatic compounds, the majority of which are phenols or their derivatives with oxygen replaced, such as tannins.

Animals that are ill often feed on plants that are high in secondary metabolites like tannins and alkaloids. There is a good case to be made for animals in the wild using these phytochemicals to treat themselves because they frequently have antiviral, antibacterial, antifungal, and anthelminthic activities. Around 80% of people worldwide still utilize herbs and other traditional medicines for their main healthcare requirements, according to a World Health Organization (WHO) estimate. Health-improving dietary supplements known as herbal medicine are available as tablets, capsules, powders, teas, extracts, and fresh or dried plants.

Herbs are generally thought to be safe, and more individuals are consuming them without a prescription.

TECHNIQUES FOR HERBAL DRUGS ANALYSIS USING CHROMATOGRAPHY:

Chromatography is the most flexible and accessible separation technique. Chromatography is a method for separating and identifying constituents, compounds, or combinations of constituents using a stationary phase and a mobile phase.

constituents. Plant components are separated from one another and purified using chromatographic methods. Herbal medicines require a sophisticated system of mixtures to be created.

TLC (Thin Layer Chromatography):

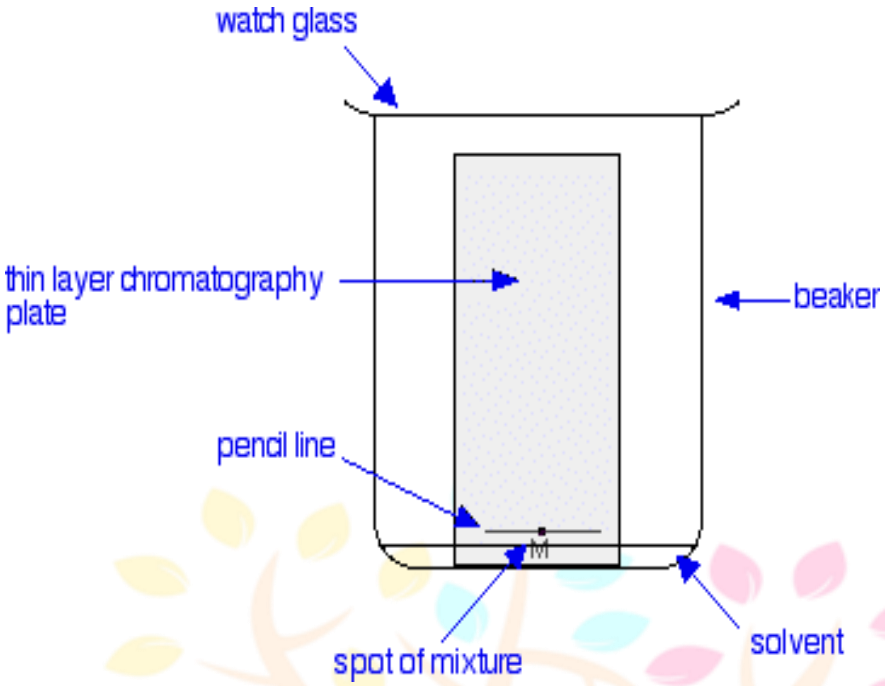

fig2: thin layer chromatography.

TLC is the most popular separation method for practically all classes of phytochemicals due to its ease.
TLC is also referred to as planar chromatography, which involves coating a solid support material, such as a glass plate, plastic, or aluminium sheet, with a thin layer of an adsorbent. The stationary phase is referred to as this. With the use of a capillary tube, the mixture (plant extract) of the components to be separated is applied to the stationary phase in the form of a spot at a distance slightly away from the side and bottom margins of the stationary phase.
The next step is to insert this side of the plate inside a glass chamber that has already been saturated with the mobile phase. Usually, a combination of two or more organic solvents makes up the mobile phase.
The amount of mobile phase used must be such that the spots on the plate do not completely submerge in it. The lid is placed over the plate once it has been inserted into the chamber.
The mobile phase climbs up onto the TLC plate as a result of capillary action.
The solvent and the mixture's components will move along with the ones that have a higher affinity for the mobile phase. Components of the mixture will separate as a result of being adsorbed onto the stationary phase by substances that have a higher affinity for it. The mobile phase can go up to a distance that is around 85% the length of the stationary phase in order to get the best separation. Once this separation has been reached, the plate is taken off, the solvent's top location is indicated, and the solvent is let to evaporate. When it comes to colored components, they are visible to the naked eye. If the component is not colored, it can be seen under UV light or by using different spray reagents.

Column Chromatography:

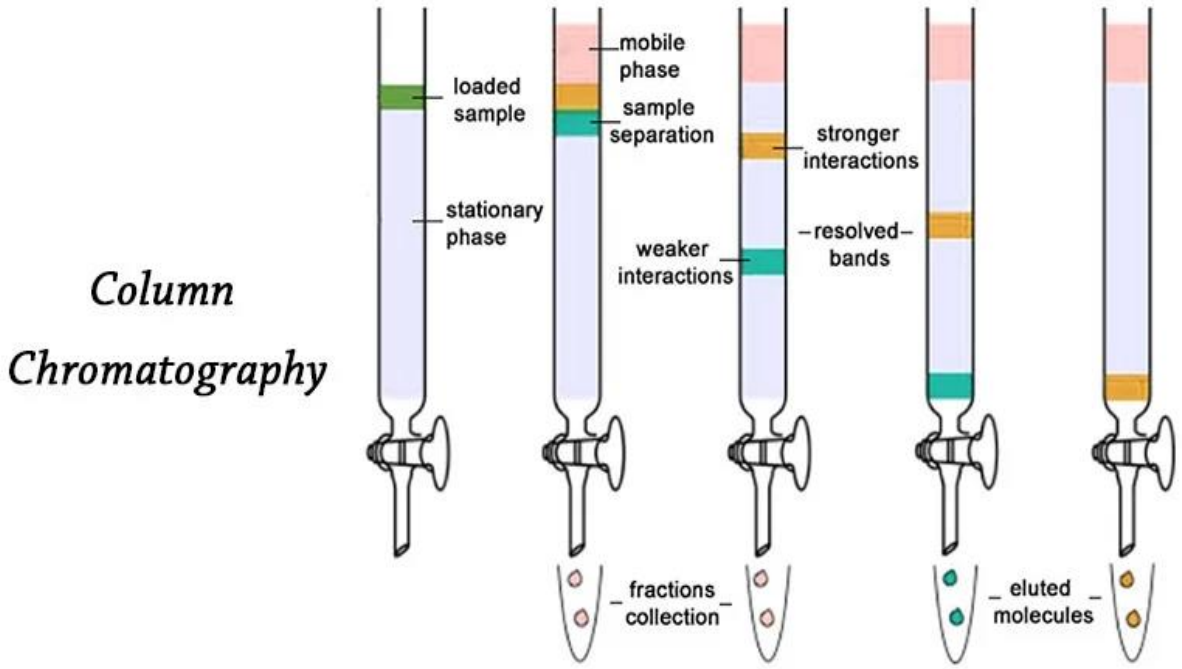

fig3: column chromatography.

With column chromatography (CC), separation is accomplished into a glass column that is filled with solid adsorbent. In CC, a tiny amount of the adsorbent used to fill the column is first used to adsorb the mixture to be separated. The top of the glass column that was previously packed with the adsorbent is then loaded with this adsorbed material.

Following loading, the mobile phase is allowed to flow continuously and slowly through the column as it descends. The adsorption process is the sole separating principle in CC. While the components that are weakly adsorbed are eluted out of the column with the mobile phase, the components that are tightly adsorbed to the stationary phase are eluted first.

Mobile phase enters the column only as a result of gravitational force. In TLC, the mobile phase's progress is stopped at a specific location, whereas in CC, it is permitted to exit the column from the bottom.

High Performance Thin Layer Chromatography (HPTLC):

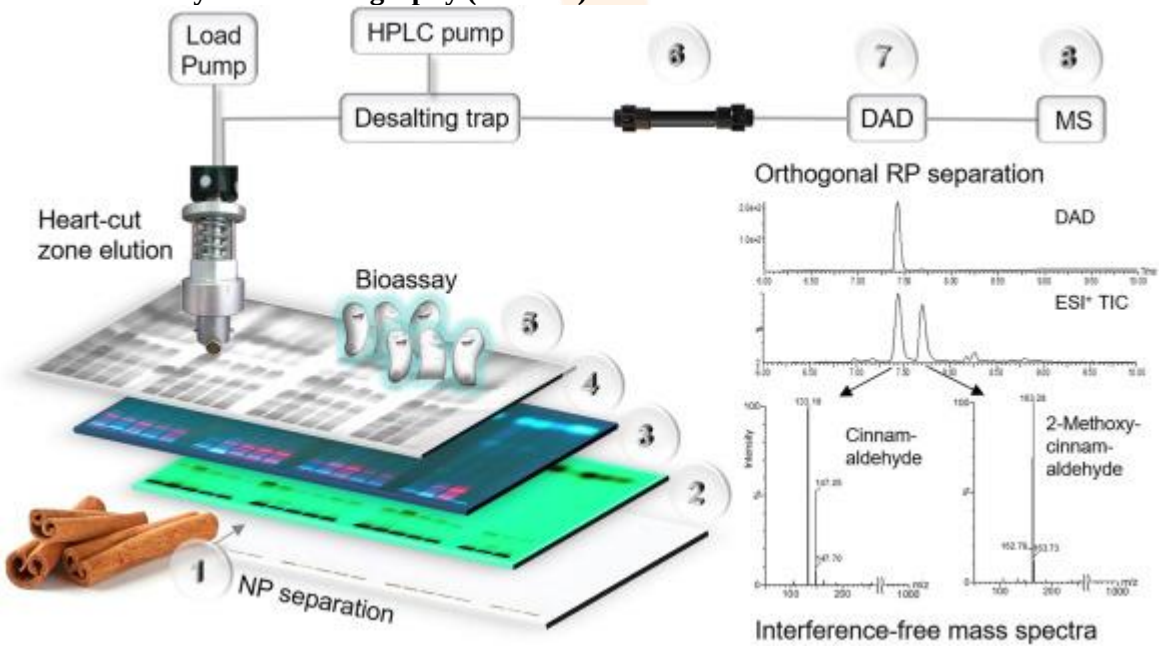

fig4. high performance thin layer chromatography [17]

Because of the lower adsorbent particle size (mean particle size, 5–6 m) and restricted particle size distribution (4–8 m), HPTLC is more effective than TLC.

These adsorbent analytical parameters improve phytoconstituent separation while while providing accurate quantitative data. With the use of a sample applicator, the sample is applied to the adsorbent layer in HPTLC.

This allows for precise sample volume loading onto the plate. Furthermore, the sample is loaded as a band rather than a spot, resulting in analyte homogeneous dispersion and compact diffusion.

High Performance Liquid Chromatography (HPLC):

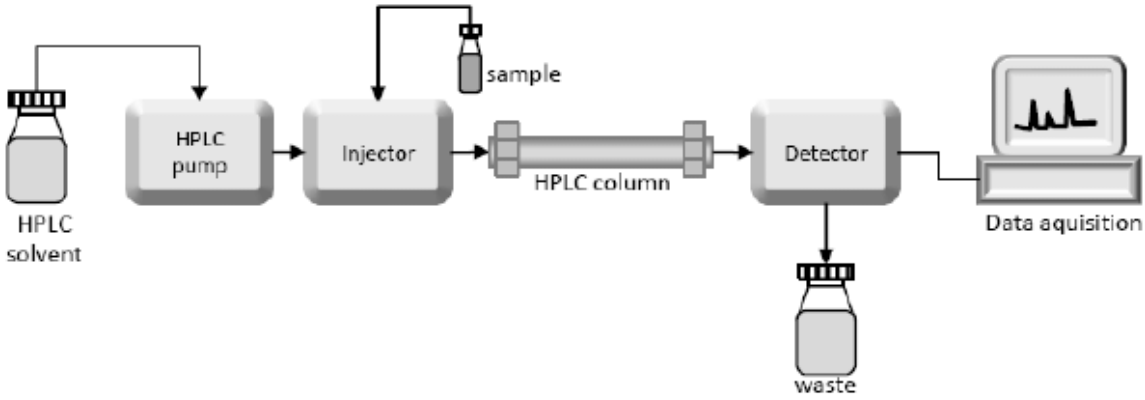

fig5. high performance thin layer chromatography (hptlc)[18]

For the separation, identification, and quantification of mixture components, HPLC is another type of separation technology utilized in analytical chemistry and herbal medication research.
In HPLC, the sample components are separated by passing liquid containing the sample mixture and the mobile phase through a column made of solid adsorbent material under high pressure.

HPLC instrument component:-

- ✓ sample injection port,
- ✓ pump,
- ✓ column
- ✓ oven
- ✓ detector.

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