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Extraction Techniques for Herbal Drugs

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ABSTRACT: In recent times medicinal plants are gaining much attention due to their special attributes as a large source of therapeutic phytochemicals that may lead to the development of various novel drugs. Most of the phytochemicals from plant sources such as phenolics and flavonoids have been reported to have positive impact on health and cancer prevention. The study on these phytochemicals starts with extraction procedures; there are different types of extraction procedures which play an important role to the extraction outcomes e.g. yield and phytochemicals content. Therefore extraction strep is a critical step in the processing of the bioactive constituents from plant materials. Traditional methods such as maceration and soxhlet extraction are commonly used at the small research setting or at Small Manufacturing Enterprise (SME) level. At larger level wide range of technologies with different methods of extraction is available nowadays. Hence, this review aim to describe and compare the most commonly used methods for extraction of herbal drugs.

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INTRODUCTIONS:

In recent years, plant derived products are gradually more being required out as medicinal products, nutraceuticals and cosmetics and are available in various health food shops and pharmacies over the counter as self-medication or also as drugs prescribed in the non-allopathic systems. These herbal medicines or nutraceuticals are in large demand for health-care in both developed and developing countries. According to an estimate of the World Health Organization (WHO), about 80% of the world inhabitants still use herbs and other conventional medicines for their primary health care needs. Herbal formulations have reached

widespread acceptability as therapeutic agents for diabetics, arthritics, liver diseases, cough remedies, memory enhancers and adoptogens. These formulations are complex chemical mixtures containing phytochemicals prepared from plants extracts [1,2]. High content of phenolic and flavonoids in medicinal plants have been associated with their antioxidant activities that play a role in the prevention of the development of age-related disease, particularly cause by oxidative stress. With regards to the beneficial phytochemicals in medicinal plants and the shift towards natural products in pharmaceuticals and cosmeceuticals industry, the research on medicinal plants particularly are as important as the research on conventional drugs [3].

Extraction:

Extraction is the crucial first step in the analysis of medicinal plants, because it is necessary to extract the desired chemical components from the plant materials for further separation and characterization. The basic operation included steps, such as pre-washing, drying of plant materials or freeze drying, grinding to obtain a homogenous sample and often improving the kinetics of analytic extraction and also increasing the contact of sample surface with the solvent system. Proper actions must be taken to assure that potential active constituents are not lost, distorted or destroyed during the preparation of the extract from plant samples [4,5].

Such extraction techniques separate the soluble plant metabolites and leave behind the insoluble cellular marc. The products so obtained from plants are relatively complex mixtures of metabolites, in liquid or semisolid state or (after removing the solvent) in dry powder form, and are intended for oral or external use. These include classes of preparations known as decoctions, infusions, fluid extracts, tinctures, pilular (semisolid) extracts or powdered extracts.

Such preparations have been popularly called galenicals, named after Galen, the second century Greek physician. The purpose of standardized extraction procedures for crude drugs (medicinal plant parts) is to attain the therapeutically desired portions and to eliminate unwanted material by treatment with a selective solvent known as menstruum. The extract thus obtained, after standardization, may be used as medicinal agent as such in the form of tinctures or fluid extracts or further processed to be incorporated in any dosage form such as powder, tablets, suppository, paste and capsules [4].

SOLVENTS USED FOR EXTRACTING DRUGS (MENSTRUUM) [6,7]:

Various types of solvents are used for extraction; some of the properties of solvent are described as follows:

Ideal properties of the solvent are:

- It should display low toxicity to higher life forms.
- It should be cheap and selective (dissolve only the required constituents).
- It should not cause the extract to complex or dissociate.
- It should be preservative in action.
- It should promote rapid physiologic absorption of the extract.
- It should be easily evaporated at a low heat.

Water (Aqua):

Water 'the universal solvent', or mother of life. It is used for extraction of proteins, gums, colouring agents, alkaloidal salts, glycosides, sugars, tannins, enzymes, organic salts & acids etc. but cannot dissolve fatty acids like waxes, fats, fixed oils & alkaloids(as free base). As a solvent, it has many advantages like nontoxic, Non-inflammable and cheap.

Its main disadvantages are;

- Because of its wide solvent powers, it is not selective and many organic substances will decompose, grow or ferment when in contact with it.
- Hydrolysis of glycosides is common with subsequent enzyme action, which is undesirable.
- Water promotes the growth of micro-organisms, many of which, aside from assisting spoilage, can be extremely toxic.
- Because of it high boiling point, concentration of preparations made from it, can only be achieved at a temperature that decomposes most bio-active substances (requires more heat).

Alcohol:

Alcohol is used for extraction of alkaloids, alkaloidal salts, glycosides, tannins, volatile oils, anthraquinone derivatives and resins but cannot dissolve albumin, gums, waxes, most fixed oils and sucrose. Alcohol as solvent for plant materials has many advantages;

- It is miscible with water in all proportions and also reasonably selective.
- In medicinal doses it is non toxic to higher life forms. An average adult medicinal dose is 2.5 ml.
- The plant extractive does not complex or dissociate (compound breakdown), when in contact with it.

- At strength of 20% by volume, it is preservative and prevents attack by spoilage organisms.
- Its low boiling point temperature (78.4°C), allows easy evaporation at reduced temperatures, so that concentration to dry or soft extracts may be achieved without damage to the plant metabolites.
- Extracts and tinctures prepared from alcohol, when correctly stored, have a long shelf life, usually in excess of 10 years, without any great loss of potency.

Combination Solvents:

The most widely used menstruum, is a combination of alcohol and water. The hydro-alcoholic menstruum. The proportion of each depends on the nature and constituents of the plant that is being operated on. For example, high strength alcohol, when used as a solvent, would fail to extract those principles that are more easily dissolved by water, a diluted alcohol would prove to be more efficient. Whereas for such substances as resins the high strength alcohol is required. The correct proportions of alcohol and water have been determined experimentally for the different plant preparations, and correspond to the official dilute alcohols [1]. Other solvents used in extraction are Ether, Chloroform, Light petroleum, Glycerin, Acetic acid, Tannic acid and Propylene glycol.

TYPES OF EXTRACTION [8-10]:

Liquid - Liquid extraction:

A solution of the substance desired to extract is bought into contact with another solvent for the substance that is immiscible with the first solvent but rest solution is soluble. A concentration gradient is set up between the phases, and the mass transfer will occur until equilibrium is established.

Podbielniak extractor:

The Pod operates on two principles: separation and extraction. A solvent-extraction device in which centrifugal action enhances liquid-liquid contact and increases resultant separation efficiency. The Podbielniak extractor is a horizontally mounted centrifuge. The Pod has perforated concentric cylindrical bands that fit into grooves on the rotor at one end and the endplate at the other. The rigid inner shaft supports the rotor, and also provides the ports that serve as process liquid inlets and outlets. The shaft is drilled almost to the center from each side, but not through. There is a central channel and an annular channel on both the sides. This provides the four channels needed for process liquid flow [15]. The heavy liquid (HLI) is introduced near the shaft, and the light liquid (LLI) is introduced near the rim of the rotor. As a result of the centrifugal force and density difference, the heavy liquid is forced out to the rim. As the heavy liquid propagates through the perforations, it displaces an equal volume of light liquid towards the shaft. The two liquids flowing counter currently are forced to pass each other through the perforations on each band, leading to intense contact. The light liquid is collected at the shaft (LLO), and the heavy liquid is collected at the rim (HLO). This countercurrent series of dispersion and coalescence allows multi-stage extraction. The Pod has been used to extract antibiotics such as penicillin, erythromycin, and tylosin. The Pod has also been used in biological applications, including hormone and vitamin extraction and food processes like edible oil processing and citrus flavor extraction.

Solid - Liquid extraction:

The extraction of a soluble constituent from a solid by means of a solvent is commonly referred to as leaching but extraction mostly used. Different extraction steps are Authentication of origin and nature of cultivation regimes, Sampling and organoleptic assessment of the drug, Size reduction (comminuting) of the drug, Extraction by appropriate means, Clarification by sedimentation and/or filtration and Adjustment of extract to a defined strength. All the process operations described are carried out on single substances. To combine two or more crude drugs is to destroy the natural synergy of them all. The chemical groups of each plant, when reacting with each other, produce unpredictable results. The infusions and decoctions are no longer official, they are not considered reliable for some very good reasons, which are; the extraction is incomplete. The water and heat involved promote hydrolysis and prone to contamination by microorganism.

PROCESSES USED FOR EXTRACTION [11-16]:

Infusion:

Infusions are dilute solutions containing the readily soluble constituents of crude drugs. It's of two types such are fresh – recentinum infusion and concentrated infusion. Preparation of Fresh Infusions (just like making a cup of tea), which include following specifications;

- Strength – 5 %, i.e., 1:20 = 5 g per 100 ml.
- Solvent - Hot or cold distilled water.
- Degree of comminution - 18 or 25 meshes.
- Length of infusion - 15-30 min, depending on substance.
- Length of storage - Maximum 12 h.

The infusion should be prepared in a heat resistant glass, porcelain or stainless steel vessel. It should have a close-fitting lid to prevent the escape of volatile principles such as essential oils. For convenience and ease of handling, enclose the comminutated drug in a muslin bag.

Procedure for recentinum infusion:

- Scald the vessel with boiling water; rinse and quarter fill the vessel with boiling water and allow to stand for 2 or 3 min or until the vessel is thoroughly warmed through.
- Empty the vessel then add the comminutated drug and pour on the requisite amount of boiling water. Cover the vessel tightly and allow infusing for an appropriate time. Agitate the vessel 2 or 3 times during the infusion process.
- On termination of infusion, remove the drug and lightly express the liquid it contains. Pour the liquid into a clean graduated container and adjust to the requisite volume with distilled water.
- The preparation should be kept covered and used within 12 h. If smaller or larger quantities than 1 L are required then any adjustments should be made on the basis that the preparation conforms to a 1:20 strength.

Concentrated Infusions:

Infusions in which 25 % alcohol is added during or after the infusion process and then diluted as per Pharmacopoeial (Official) requirement. The extraction was achieved by dilute alcohol at strength of 25 %. Concentrated infusions are especially prepared in cases in which the active and desirable principles of drug are equally soluble in water and in the menstruum used for both concentrates and infusions. Even this was not really a satisfactory answer because invariably the dilution with water required to produce a standard infusion produced precipitation and/or turbidity due to the change in menstruum strength. So not surprisingly such preparations were slowly displaced as 'official' standards were changed i.e., tacit acknowledgment that such preparations were lacking in efficacy. Applications are used for soft drugs (delicate herbs, leaves and fresh tender plants) with water soluble active constituents. Examples**:** Infusion of senna**,** Infusion of quassia**,** Concentrated compound infusion of chirata and concentrated compound infusion of gentian.

Decoction:

Decoctions are water based preparations, in which the herbal material, that is usually a root or a bark, is simmered in boiling water for 10 to 15 minutes. The resulting liquid is allowed to cool and then filtered.

Preparation of decoction: Drug cut in small pieces, boiled with menstruum for some time (10 to 15 min). After boiling, the liquid is cooled and filter. More water is passed through the marc to produce the required volume. In this final volume is adjusted because different workers use different type of vessels and different sources of heat resulting in varying losses of water by evaporation.

Digestion:

Digestion was carried out at a constant low heat i.e. a temperature not below 25°C or exceeding 35°C. Earlier there was no thermometer, and judging the fire too fierce, would embed the digesting flask and its contents in horse dung.

To ensure a constant and even gentle heat which is produced by fermentation of the manure. At night fall the Spagyrist would remove the flask from the dung and allow it to cool in the night air. At sunrise the flask would be replaced in the dung. We simply turn off the heat. The process of digestion was continued for either a lunar month of 28 days (4 × 7) or a philosophical month of 40 days. The precise period was judged according to the work to be accomplished.

Maceration:

In a chemical sense the term 'maceration' means to 'soften and separate the constituent parts of a substance in a liquid'. Place the solid materials with the whole of the menstruum in a closed vessel and allow standing for 7 days, shaking occasionally. Strain, press the marc, and mix the liquids obtained. Clarify by subsidence or filtration.

The Organized Drug maceration:

The marc of an organized drug will hold around 1.5 times its dry weight of menstruum, e.g., 500 g of dry crude drug when saturated with menstruum would weigh circa 2 kg. That is the equivalent of

a drug/menstruum ratio of 1:3. Obviously there is insufficient menstruum to extract the drug by maceration. Therefore, a standard tincture is 1:4.

- Comminute the crude drug as appropriate and place it in a wide neck jar or flask. Pour in the total menstruum and seal the flask. Leave to macerate in a warm dark place.
- Shake the maceration 2 or 3 times daily for 7 days.
- After the 7 days, separate the menstruum from the marc by filtration. Press the marc and add the expressed liquid to the separated portion. Seal the flask, shake and leave to settle for 24 h.
- Clarify the tincture by a single filtration. Seal the flask and store in a cool place until required. Do not adjust the volume.

Note: Filtration should not be done soon after extraction, the liquid should be allowed to stand for some time to settle any colloidal material and then filter otherwise the liquid again become cloudy due to coagulation of colloidal particles.

The Unorganized Drug maceration:

The major differences in procedures for unorganized drugs are as follows;

- Crush the material and macerate the substance in 80% of the menstruum specified.
- Shake the maceration 2 or 3 times daily for 3 days or until solution is complete.
- Separate the marc from the extraction by filtration. Wash the marc across the filter with the reserved 20% of menstruum. Do not press the marc.
- Finally adjust the tincture to the required volume by the addition of further menstruum. Uniformity is achieved because extraction of the unorganized substance is almost total.

Note: Marc is not pressed because unorganized drugs marc forms a compact mass as it does not retain any appreciable amount of menstruum therefore pressing the gummy residue is not practicable.

Multiple Maceration (Modified maceration):

It is of two types such as double Maceration and triple Maceration. Repeated maceration may be more efficient than a single maceration, since an appreciable amount of active principle may be left behind in the first pressing of the marc. The repeated maceration is more efficient in cases where active constituents are more valuable. Double maceration is used for concentrated infusions which contain volatile oil. Where the marc cannot be pressed, a process of triple maceration is sometimes employed.

Double Maceration - Total volume of the menstruum is divided in two parts: First maceration – weighed amount of the drug is allowed to remain in contact with the specified amount of menstruum with occasional shaking for a definite time. Then liquid is strained and marc pressed. Combine the strained and expressed liquid. Second maceration – second part of menstruum added to the marc and allowed to stand for some time. The clear liquid is strained, marc pressed. Liquids obtained from first and second maceration are combined together, filtered and evaporated to get a product of required concentration.

Triple Maceration - Menstruum is divided into three parts: First maceration - weighed amount of the drug is allowed to remain in contact with the specified amount of menstruum with occasional shaking for a definite time. Then liquid is strained and reserved. Second maceration – second part of menstruum added to the marc and allowed to stand for some time. The liquid is strained. Third maceration – third part of the menstruum added to the marc and allowed to stand for some time. The liquid is strained and marc is pressed. Expressed liquid is mixed with liquids obtained from the second & third maceration and then evaporated. The liquid obtained in the first maceration is quite concentrated therefore earlier obtained evaporated liquid is mixed with first macerate. 90% alcohol (equal to ¼ of the final volume) is added to prevent microorganism's growth. Final volume is making up.

Large Scale Extraction Procedures [14-17]:

Large scale operation demands modification of many extraction processes. For industrial batch where a large amount of solvent and the vessels having the huge weight, diameter and height, there will be a considerable difficulty in shaking the vessels. In addition, economics become increasingly important and one of the most important objectives is to improve the efficiency of extraction so that less solvent is needed and evaporation requirements for concentrated products are reduced.

Modified Large Scale Maceration Processes:

Circulatory Extraction - The efficiency of extraction in a maceration process can be improved by arranging for the solvent to be continuously circulated through the drug as indicated in the Fig 1, given below.

- Solvent is pumped from the bottom of the vessel to the inlet where it is distributed through spray nozzles over the surface of the drug.
- The movement of the solvent reduces boundary layers, and the uniform distribution minimizes local concentration in a shorter time.

Multiple Stage Extraction:

Like the normal maceration process, however, extraction is incomplete, since mass transfer will cease when equilibrium is set up. This problem can be overcome by using a multistage process.

- The equipment needed for this method is a vessel for the drug, together with a circulating pump and spray distributors, and a number of tanks to receive the extracted solution.

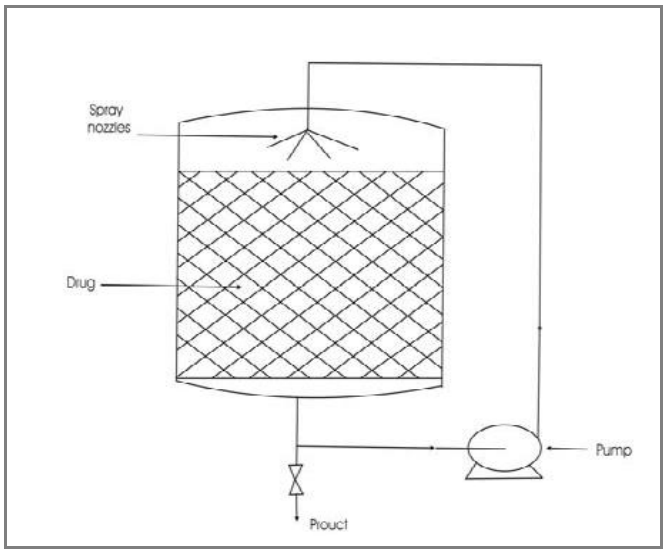

Fig 1. Circulatory Extraction.

- The extractor and tanks are connected with piping and valves as shown in Fig. so that anyone of the tank may be connected to the extractor for the transfer of solution.
- Examination of these procedures showed that each batch of drug is treated several times with solvent and that, once a cycle is in process, the receivers contain solution with the strongest in receiver 1 and the weakest in receiver 3 as shown in Fig 2.

Advantages:

- The drug is extracted as many times as there are receivers – in this case, three. If more extraction stages are required, it is only necessary to have more receivers.
- The last treatment of the drug before it is discharged is with fresh solvent, giving maximum extraction.
- The solution is in contact with fresh drug before removal for evaporation, giving the highest possible concentration [17].

Procedure:

- Fill extractor with drug, add solvent and circulate. Run off to receiver 1.
- Refill extractor with solvent and circulate. Run off to receiver 2.
- Refill extractor with solvent and circulate. Run off to receiver 3.
- Remove drug from extractor and recharge. Return solution from 1 to extractor. Remove for evaporation.
- Return solution from 2 to extractor and circulate. Run off to receiver 1.

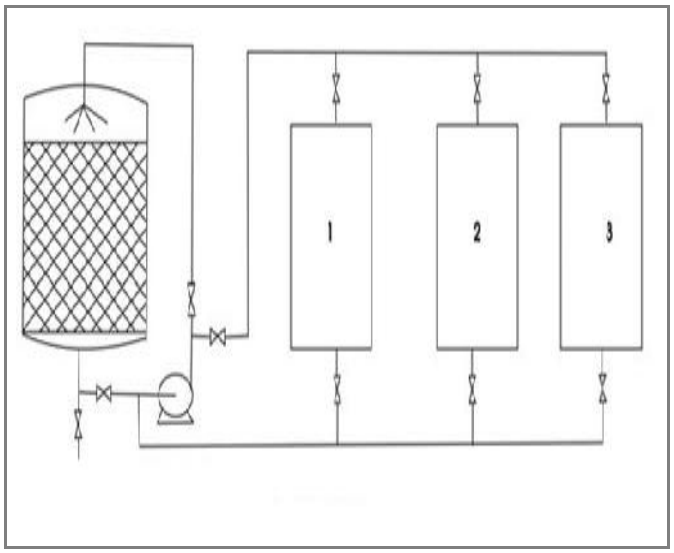

Fig 2. Multiple stage extraction.

- Return solution from 3 to extractor and circulate. Run off to receiver 2.
- Add fresh solvent to extractor and circulate. Run off to receiver 3.
- Remove drug from extractor and recharge. Repeat cycle.

Extraction Battery:

In the normal percolation process, the percolate is not of maximum concentration and as such very dilute. The ideal situation would be to have maximum concentration.

- Continuous extraction devices of this type are used where large amounts of single material are handled.
- It can be achieved by treating it as a stage wise process.

- In this process a series of vessels are used and extraction is semi –continuous.

Equipment - Equipment is described as an extraction battery and consists of a number vessels with inter connecting pipe work.

- Vessels are so arranged that solvent can be added to and the product taken from any vessel.
- These vessels can, therefore, be made into a series with any of vessels as the first of the series.
- The use of extraction battery is illustrated in Fig. given below, where simplest arrangement of three vessels is shown.

Percolation (Exhaustive extraction):

Percolation is a method of extraction achieved by the downward displacement of soluble extractive by a suitable solvent through a suitably comminuted drug plant (The process is a combination of maceration and percolation and is sometimes referred to as a process of 'Macero-Percolation'). Not all plant drugs are suitable for the process. There are 7 distinct operations involved; they are in order of operation [16,17];

Comminution:

Size of the drug is reduced from coarse powder to fine powder. Remember if the particles are too fine a solid cake may occur, this will affect the downward flow of menstruum and will most certainly lead to the formation of 'dry pockets' within the body of the material which will escape extraction. It the material is too coarse then interstices are formed through which there is a speedy percolation of menstruum which produces an incomplete extraction and will require excessive volumes of menstruum to exhaust the marc.

Imbibitions:

The word is derived from the Latin meaning 'to drink in'. The comminuted drug thoroughly moistened with a portion of the menstruum. This is best done in a lidded container of a suitable size. The moistened drug is allowed to stand for a period of four hours to allow the drug to imbibe the menstruum and thereby swell to its maximum capacity. The container used should be large enough to accommodate the expansion of the drug.

Preliminary moistening is required because;

- If drug is packed in the dry condition, subsequent swelling due to menstruum will reduce the porosity of the material and choke the percolator.
- The air present in the interstices is removed by menstruum, which will otherwise disturb the packing of the percolator.
- It does not allow the fine particles to be washed out of the percolator during percolation.

Packing:

On completion of imbibitions the drug should be passed through a number 10 sieve to break up any lumps that may have formed. The drug is then transferred to the percolation vessel in portions [8].

The Percolator - It is a conical vessel having a lid at the top and is provided with a false bottom on which filter paper or cotton wool is placed to support the column of the drug and help in escape of percolate. Base of percolate is fitted with a tap from which percolate is collected.

Two types of percolator:

a. Open percolator (for water of dilute alcohol menstruum).
b. Closed percolator (for volatile menstruum).

Packing procedure -

- A piece of cotton wool, fibers of flax, hemp etc. previously moistened with menstruum is placed on the false bottom.
- A small amount (10%) of the moistened drug is introduced in the percolator and is pressed lightly with a rod.
- Similarly more of moistened drug is introduced and pressed till drug occupy 2/3 rd capacity of the percolator (Each portion should be firmly packed but not so firmly that liquid is forced from the drug but sufficient to exclude any air pockets).
- The packed drug is covered with a filter paper and a layer of clean sand to maintain the packing without disturbance and the cotton wool plug is to prevent the packed drug from being washed into the receiver.

Where possible the percolator and ancillary equipment should be of sufficient size to contain all of the menstruum plus the drug. If this is not possible then the bulk of the menstruum may be contained in a reservoir as follows; The level of menstruum will be maintained at the neck of the bottle until it is empty, where upon it should be removed and replaced with the percolator lid.

To minimize loss of solvent by evaporation the opening of the receiver/collector should be kept as small as possible; a graduated flat bottomed boiling flask of a suitable size will serve the purpose well.

Maceration:

Open the stop cock on the bottom of the percolator and pour in the menstruum in portions and allow percolating through the packed drug. If the menstruum drips through the stop cock in less than 10 minutes, the drug is too loosely packed. If the first drop takes 25 minutes or more then the drug is too tightly packed. If all is well, then close the stop cock and pour in sufficient menstruum to leave a layer 1 or 2 cm deep over the drug. Cover the percolator and leave to macerate for 24 to 48 h in a warm dark place at a temperature not exceeding 25°C [18].

Percolation:

On completion of maceration the percolation procedure is commenced. Slowly open the stop cock and adjust the flow of saturated menstruum to 10 ml/min for the first 10% of the total menstruum, thereafter adjust the flow to 10 drops per/min.

Adjustment:

When the first 85 % of the percolate has been collected, the receiver is changed and the first portion is reserved. The percolation into the fresh receiver is continued until the drug is exhausted. The marc is pressed and the expressed menstruum is mixed with the contents of the second receiver. That fluid is then reduced to a soft extract and then dissolved into the reserved 85 % in the first receiver. The total is then adjusted to volume with a matching strength menstruum.

Clarification:

The extract is sealed and allowed to stand in a cool dark place for a minimum of 48 h (a week if times allow) after which it is filtered to remove any sedimentation and may then be considered ready for use. Correctly prepared and correctly stored the product will have a shelf life of 10 years [7].

Modifications of the General Process of Percolation:

In general process of percolation, particularly in the manufacture of concentrated preparations like liquid extracts, the following problems may arise: a) If the active substances are thermo-labile, evaporation of large volume of dilute percolate may result in partial loss of the active constituents. b) In the case of alcohol- water mixture, evaporation results in preferential vaporization of alcohol leaving behind an almost aqueous concentrate which may not be able to retain the extracted matter in solution and hence get precipitated [17]. In such cases the modification in general process of percolation is required as given below:

Reserved Percolation:

In this case the extraction is done through the general percolation procedure. First step include percolation process is done, in which first portion of the percolate which contains the maximum amount of active ingredients is reserved. Second step include subsequent percolation is done and completed until the drug is exhausted. At the last, the evaporation is done under reduced pressure in equipment like a Climbing evaporator to the consistency of a soft extract (semi solid) such that all the water is removed.

This is then dissolved in the reserved portion which is strongly alcoholic and easily dissolves the evaporated portion with any risk of precipitation [23].

Percolators:

Different types of percolators are used for small and large scale extraction. In small scale or laboratory scale extraction, the processes for the manufacture of concentrated preparations by maceration and percolations are involved in extraction followed by the evaporation of solvents. The two operations are combined in continuous extraction process.

Soxhlet Apparatus:

The piece of equipment used is a standard to most laboratories and is known as the 'Soxhlet Extractor', named after a German agricultural chemist Franz von Soxhlet. It is made from a very high grade of glass and consists of the following parts like Reflux condenser, Hot vapor tube, Percolate return tube (by siphon), Soxhlet Extractor (Body), Extraction Thimble, Boiling flask.

The raw material is usually placed in a thimble made of filter paper and inserted into the wide central tube of the extractor (Alternatively the drug, after imbibition with the *menstruum* may be packed into the extractor taking care to see that the bottom outlet for the extract is not blocked). Solvent is placed in the flask and brought to its boiling point. Its vapour passes up the larger right hand tube into the upper part of the drug and then to the condenser where it condenses and drops back on to the drug. During its percolation, it extracts the soluble constituents. When the level of the extracts reaches the top level of syphon tube, the whole of the percolates syphon over into the flask. The process is continued

until the drug is completely extracted and the extract in the flask is then processed. This extraction is series of short maceration [17,18].

The limitations of this process are:

- It is not useful when the raw materials contain thermo-labile active constituents because the extraction is carried out at an elevated temperature, and the extract in the flask is also maintained in the hot condition until the process is complete.
- It can be used only with pure solvents or with solvent mixtures forming azeotropes.
- If an ordinary binary mixture is used as the *menstruum*, the composition of the vapour will be different from the liquid composition [22].

FACTORS AFFECTING CHOICE OF EXTRACTION PROCESS [20-22]:

The final choice of the process to be used for the extraction of a drug will depend on a number of factors, including:

Characters of Drug:

- If hard and tough (such as nux vomica) use percolation.
- If soft and parenchymatous (such as gentian) use maceration.
- If 'unpowderable' (such as squill) use maceration.
- If an 'unorganized drug (such as benzoin) use maceration.
- If preferable to avoid powdering (such as senna fruits) use maceration.

Thus, knowledge of the pharmacognosy of the drug is essential to selection of the extraction process.

Therapeutic value of the drug:

When the drug has considerable therapeutic value, the maximum extraction is required, so that percolation is used, as in belladonna. If the drug has little therapeutic value, however, the efficiency of extraction is unimportant and maceration is adequate; for example, "flavours" (lemon), or "bitters", (gentian) [21].

Stability of drug:

Continuous extraction should be avoided when the constituents of the drug are thermo-labile.

Cost of drug:

- From the economic point of view, it is desirable to obtain complete extraction of an expensive drug, so that percolation should be used.
- For cheap drugs, the reduced efficiency of maceration is acceptable in view of the lower cost of the process. In particular, the cost of size reduction to a powdered state is avoided.

Solvent:

If the desired constituents demand a solvent other than a pure boiling solvent or an azeotrope, continuous extraction should be used.

Concentration of product:

- Dilute products such as tincture can be made by maceration or percolation, depending on the previous factors.
- For semi-concentrated preparations the more efficient percolation process is used) unless the drug cannot be powdered or is not worth powdering, when double or triple maceration is chosen.
- Concentrated preparations, of which liquid extracts or dry extracts are example, are made exclusively by percolation, with the exception that continuous extraction can be used if the solvent is suitable and the constituents are thermo-stable [20].

Recovery of solvent from the marc:

The residue of the drug after extraction (often known as the marc) is saturated with solvent and if economic the latter is recovered.

EXTRACTS:

Extracts are concentrated preparations of vegetable or animal drugs obtained by extracting the active constituent of the respective drugs with suitable menstruum. Depending upon the consistency of the extracts are made in three forms such are liquid, soft and dry extracts [22,23].

Liquid extracts:

The Liquid Extract is the strongest type of plant liquid made, its ratio of the plant material to solvent is 1:1, i.e., 1 gram crude drug represents 1 ml of the liquid extract. For technical reasons it may only be further concentrated by evaporation of the solvent. They are still commonly used in extemporaneous compounding. Example – Liquid Liquorice Extract B.P.

Soft extracts:

They are semi-solid preparations obtained by evaporation of the solvent. They have demerits like:

- It was difficult to standardize the degree of softness and therefore their consistency with any degree of accuracy.
- Soft extracts hardened on storage, providing a tough mass difficult to handle.

- Strength of a soft extract varies significantly depending on preparation, menstrum used and storage.

Dry extracts:

They are solid preparations obtained by evaporation of the solvent used for their production. Dry extracts usually have water content of not greater than 5 % m/m. They can be standardizing as they varied less in strength and generally easier to handle.

Storage less likely to cause significant problems, although granular dried extracts were preferred to those that were powders, as powdered varieties were more likely to absorb moisture from the air and become solid black.

CONCLUSION:

All stages of extractions, from the pre-extraction, extraction to collection of extract are equally important in the study of herbal drugs. As starting from the first step of the sample preparation such as cutting, grinding and drying affected the efficiency and content of phytochemicals in the final extracts. It can be concluded that, no common extraction method is the perfect method for every herbal drug so each extraction procedure should be exclusive for the specific plant. Formerly optimized methods can be used to guide in the selection of appropriate methods. Nevertheless, estimation and assortment of pre-extraction preparation and extraction methods are dependent on the work objectives, part of plant / drug, and intention compounds.

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REFERENCES:

1. Indian Pharmacopoeia Committee. The Indian Pharmacopoeia. New Delhi: Manager of Publications; 1966. pp. 947-950.
2. Bimakr M. Comparison of different extraction methods for the extraction of major bioactive flavonoid compounds from spearmint (*Mentha spicata* L.) leaves. Food Bioprod Process, 2010; 1-6.
3. Cowan MM. Plant products as antimicrobial agents. Clinical microbiology reviews 1999; 12(4):564-582.
4. Das K, Tiwari RKS, Shrivastava DK. Techniques for evaluation of medicinal plant products as antimicrobial agent: Current methods and future trends. J Med Plants Res, 2010; 4(2): 104-111.
5. Eloff JN. Which extractant should be used for the screening and isolation of antimicrobial components from plants. J Ethnopharmacol, 1998; 60: 1-8
6. Evans WC. Treas and Evans Pharmacognosy. 14th ed. London: WB Saunders company Ltd; 2002.
7. Handa SS, Khanuja SPS, Longo G, Rakesh DD. Extraction Technologies for Medicinal and Aromatic Plants. Italy: Int Centre Sci High Tech; 2008. pp. 21-25.
8. Johansen DA. Plant Micro technique. New York: McGraw Hill Book Co; 1940. pp. 182-197.
9. Kokate CK. Practical Pharmacognosy. New Delhi: Vallabh Prakashan; 1991. pp. 107-111.
10. Kumar R, Sharma RJ, Bairwa K, Roy RK, Kumar A. Pharmacological review on natural antidiarrhoel agents. Der Pharma Chemica, 2010; 2(2): 66-93.
11. Lapornik B, Prosek M, Wondra AG. Comparison of extracts prepared from plant by-products using different solvents and extraction time. J Food Eng, 2005; 71: 214-222.
12. Mali RG, Mahajan SG, Mehta AA. *In-vitro* anthelmintic activity of stem bark of *Mimusops elengi* Linn. Pharmacogn Mag, 2007; 3(10): 73-76.
13. Mute VM. Anthelmintic effect of Tamarind indica linn leaves juice extract on *Pheretima posthuma*. Int J Pharma Res Dev, 2009; 7: 1-6.
14. Ncube NS, Afolayan AJ, Okoh AI. Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods and future trends. Afr J Biotechnol, 2008; 7(12): 1797-1806.
15. Parekh J, Karathia N, Chanda S. Evaluation of antibacterial activity and phytochemical analysis of *Bauhinia variegata* L. bark. Afr J Biomed Res, 2006; 9: 53-56.
16. Remington JP. Remington: The science and practice of pharmacy. 21th ed. London: Lippincott Williams & Wilkins, 2011. pp. 773- 774.
17. Roopashree TS, Dang R, Rani SRH, Narendra C. Antibacterial activity of anti- psoriatic herbs: *Cassia tora*, *Momordica charantia* and *Calendula officinalis*. Int J Appl Res Nat Prod, 2008; 1(3): 20-28.
18. Sutar N, Garai R, Sharma US, Sharma UK. Anthelmintic activity of *Platycladus orientalis* leaves extract. Int J Parasitol Res, 2010; 2(2): 1-3.

19. Sharma US, Sharma UK, Singh A, Sutar N, Singh PJ. *In vitro* anthelmintic activity of *Murraya koenigii* linn. Leaves extracts. Int J Pharma Bio Sci, 2010; 1(3): 1-4.
20. Vidyadhar S, Saidulu M, Gopal TK, Chamundeeswari D, Rao U, Banji D. *In vitro* anthelmintic activity of the whole plant of *Enicostemma littorale* by using various extracts. Int J Appl Biol Pharm Tech, 2010; 1(3): 1119-1125.
21. Wallis TE. Text Book of Pharmacognosy. New Delhi: CBS publishers and Distributors; 1989. pp. 356-549.
22. Wang GS, Han J, Zhao LW, Jiang DX, Liu YT, Liu XL. Anthelmintic activity of steroidal saponins from *Paris polyphylla*. Phytomed, 2010; 17: 1102-1105.
23. Wang GX. *In vivo* anthelmintic activity of five alkaloids from *Macleaya microcarpa* (Maxim) Fedde against *Dactylogyrus intermedius* in *Carassius auratus*. Veterinary Parasitol, 2010; 171: 305-313.

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