International Research Journal of Management and Commerce
ISSN: (2348-9766)
Impact Factor 5.564 Volume 7, Issue 2, February 2020
©Association of Academic Researchers and Faculties (AARF)
www.aarf.asia, **Email** : editor@aarf.asia, editoraarf@gmail.com

A REVIEW ON EXTRACTION TECHNIQUES FOR MEDICINAL PLANTS

Asst. Prof. Shruti Pawar
Ashoka College of Education, Nasik.

Abstract:

Medicinal plants are mostly used in ethno medicine treating common disease such as cold, fever and other medicinal claims are now supported with sound scientific evidences. The study on medicinal plants started with extraction procedures that play a critical role to the extraction outcomes and also to the consequent assays performed. A wide range of technologies with different methods of extraction is available nowadays. Public awareness on the adverse effects of synthetic chemical products also increased the demand for herbal products. Hence, this paper reviews the state-of-the-art development in medicinal plants processing and extraction methods from the year 1991 until 2017.

Keywords: Methods; Maceration; Soxhlet extraction, Ultrasound-assisted extraction, Accelerated solvent extraction, Supercritical-fluid extraction, Medicinal plants.

Introduction:

The term "**medicinal plant**" include various types of plants used in herbalism ("herbology" or "herbal medicine"). It is the use of plants for medicinal purposes, and the study of such uses.

The word "**herb**" has been derived from the Latin word, *"herba"* and an old French word *"herbe"*.

Asia is the largest continent of the world's population. It has abundant medicinal and aromatic plant species, well documented traditional knowledge, a long-standing practice of traditional medicine, and the potential for social and economic development of

medicinal and aromatic plants. Asia is one of the largest biodiversity regions in the world, containing some of the richest countries in plant resources. Six of the world's 18 biodiversity hot spots, namely eastern Himalaya, North Borneo, Peninsular Malaysia, Sri Lanka, Philippines and the Western Ghats of South India, lie in Asia. The total numbers of plant species and the endemics in the region are given below: Region Species Endemics South East Asia 42-50,000 40,000 China and East Asia 45,000 18,650 Indian Subcontinent 25,000 12,000 South West Asia 23,000 7,100 Sustainable industrial exploitation of such a valuable bioresource, through use of appropriate technologies, can substantially contribute to the socio-economic growth of Asian countries. Medicinal plants are currently in considerable significance view due to their special attributes as a large source of therapeutic phytochemicals that may lead to the development of 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 of medicinal plants starts with the pre-extraction and the extraction procedures, which is an important step in the processing of the bioactive constituents from plant materials.

Pre-extraction preparation of plant samples

The initial stage in studying medicinal plants is the preparation of plant samples to preserve the biomolecules in the plants prior to extraction. Plants samples such as leaves, barks, roots, fruits and flowers can be extracted from fresh or dried plants material.

Fresh vs. dried samples: Both fresh and dried sample is used in medicinal plants studies. In most cases, dried sample is preferred considering the time needed for experimental design.

Grinded vs. powdered samples: Lowering particle size increases surface contact between samples and extraction solvents. Grinding resulted in coarse smaller samples; meanwhile, powdered samples have a more homogenized and smaller particle, leading to better surface contact with extraction solvents.

Air-drying, microwave-drying, oven-drying and freeze-drying (lyophilisation) of plants samples: Air-drying usually takes from 3-7 days to months and up to a year depending on the types of samples dried (e.g. leaves or seed). Plant samples, usually plants leaves with stem were tied together and hang to expose the plant to air at ambient temperature. This drying method does not force dried plant materials using high temperature; hence, heat-labile compounds is preserved.

Microwave-drying uses electromagnetic radiation that possesses both electric and magnetic fields. The electric field causes simultaneous heating through dipolar rotation.

Oven-drying at 44.5°C for 4 hours using 80% methanol resulted in highest antioxidants activities in Cosmos caudatus extracts is another pre-extraction method that uses thermal energy to remove moisture from the samples.

Freeze-drying is a method base on the principle of sublimation. Sublimation is a process when a solid is changed into gas phase without entering the liquid phase. Sample is frozen at -80°C to -20°C prior to lyophilisation to solidify any liquid (eg. solvent, moisture) in the samples.

Extraction methods:

Extraction, as the term involves the separation of medicinally active portions of plant or animal tissues from the inactive or inert components by using selective solvents in standard extraction procedures. The products so obtained from plants are relatively impure liquids, semisolids or powders intended only for oral or external use. These include classes of preparations known as decoctions, infusions, fl uid extracts, tinctures, pilular (semisolid) extracts and powdered extracts. Such preparations popularly have been called galenicals, named after Galen, the second century Greek physician.

General Methods of Extraction of Medicinal Plants

1 Maceration: In this process, the whole or coarsely powdered crude drug is placed in a stoppered container with the solvent and allowed to stand at room temperature for a period of at least 3 days with frequent agitation until the soluble matter has dissolved. The mixture then is strained, the marc (the damp solid material) is pressed, and the combined liquids are clarifi ed by filtration or decantation after standing.

2 Infusion: Fresh infusions are prepared by macerating the crude drug for a short period of time with cold or boiling water. These are dilute solutions of the readily soluble constituents of crudedrugs.

3 Digestion This is a form of maceration in which gentle heat is used during the process of extraction. It is used when moderately elevated temperature is not objectionable. The solvent effi ciency of the menstruum is thereby increased.

4 Decoction In this process, the crude drug is boiled in a specifi ed volume of water for a defi ned time; it is then cooled and strained or fi ltered. This procedure is suitable for extracting water-soluble, heat-stable constituents. This process is typically used in

preparation of Ayurvedic extracts called “quath” or “kawath”. The starting ratio of crude drug to water is fi xed, e.g. 1:4 or 1:16; the volume is then brought down to one-fourth its original volume by boiling during the extraction procedure. Then, the concentrated extract is filtered and used as such or processed further.

5 Percolation: This is the procedure used most frequently to extract active ingredients in the preparation of tinctures and fluid extracts. A percolator (a narrow, cone-shaped vessel open at both ends) is generally used. The solid ingredients are moistened with an appropriate amount of the specified menstruum and allowed to stand for approximately 4 h in a well closed container, after which the mass is packed and the top of the percolator is closed. Additional menstruum is added to form a shallow layer above the mass, and the mixture is allowed to macerate in the closed percolator for 24 h. The outlet of the percolator then is opened and the liquid contained therein is allowed to drip slowly. Additional menstruum is added as required, until the percolate measures about three-quarters of the required volume of the finished product. The marc is then pressed and the expressed liquid is added to the percolate. Sufficient menstruum is added to produce the required volume, and the mixed liquid is clarified by filtration or by standing followed by decanting.

Strength and limitation: This method requires a smaller quantity of solvent compared to maceration. However, the Soxhlet extraction comes with disadvantage such as exposure to hazardous and flammable liquid organic solvents, with potential toxic emissions during extraction. Solvents used in the extraction system need to be of high-purity that might add to cost. This procedure is considered not environmental friendly and may contribute to pollution problem compared to advance extraction method such as supercritical fluid extraction (SFE).

6 Hot Continuous Extraction (Soxhlet) In this method, the finely ground crude drug is placed in a porous bag or “thimble” made of strong filter paper, which is placed in chamber E of the Soxhlet apparatus (Figure 2). The extracting solvent in fl ask A is heated, and its vapors condense in condenser D. The condensed extractant drips into the thimble containing the crude drug, and extracts it by contact. When the level of liquid in chamber E rises to the top of siphon tube C, the liquid contents of chamber E siphon into fl ask A. This process is continuous and is carried out until a drop of solvent from the siphon tube does not leave residue when evaporated. The advantage of this method, compared to previously described methods, is that large amounts of drug can be extracted with a much smaller quantity of solvent. This effects tremendous economy in terms of

time, energy and consequently fi nancial inputs. At small scale, it is employed as a batch process only, but it becomes much more economical and viable when converted into a continuous extraction procedure on medium or large scale.

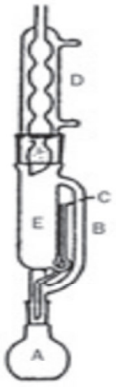

Figure 2: Soxhlet apparatus

Strength and limitation: This technique is the easiest and simple method. However, organic waste come into an issue as large volume of solvents is used and proper management of the waste is needed. Alteration in temperature and choice of solvents enhance the extraction process, reduce the volume needed for extraction and can be introduced in the maceration technique, when such alteration is not objectionable. Boiling Centella asiatica at 90° C showed to increase phenolics content and antioxidant activities, but jeopardized the pH of the extracts with increase extraction time [13]. In this method, solvents used in the soaking process play a critical role.

7 **Aqueous Alcoholic**: Extraction by Fermentation Some medicinal preparations of Ayurveda (like asava and arista) adopt the technique of fermentation for extracting the active principles. The extraction procedure involves soaking the crude drug, in the form of either a powder or a decoction (kasaya), for a specifi ed period of time, during which it undergoes fermentation and generates alcohol in situ; this facilitates the extraction of the active constituents contained in the plant material. The alcohol thus generated also serves as a preservative. If the fermentation is to be carried out in an earthen vessel, it should not be new: water should fi rst be boiled in the vessel. In large-scale manufacture, wooden vats, porcelain jars or metal vessels are used in place of earthen vessels. Some examples of such preparations are karpurasava, kanakasava, dasmularista. In Ayurveda, this method is not yet standardized but, with the extraordinarily high degree of advancement in fermentation technology, it should not be diffi cult to standardize this technique of extraction for the production of herbal drug extracts.

8 Counter-current Extraction: In counter-current extraction (CCE), wet raw material is pulverized using toothed disc disintegrators to produce a fi ne slurry. In this process, the material to be extracted is moved in one direction (generally in the form of a fi ne slurry) within a cylindrical extractor where it comes in contact with extraction solvent. The further the starting material moves, the more concentrated the extract becomes. Complete extraction is thus possible when the quantities of solvent and material and their fl ow rates are optimized. The process is highly effi cient, requiring little time and posing no risk from high temperature. Finally, suffi ciently concentrated extract comes out at one end of the extractor while the marc (practically free of visible solvent) falls out from the other end. This extraction process has signifi cant advantages:

i) A unit quantity of the plant material can be extracted with much smaller volume of solvent as compared to other methods like maceration, decoction, percolation.

ii) CCE is commonly done at room temperature, which spares the thermolabile constituents from exposure to heat which is employed in most other techniques.

iii) As the pulverization of the drug is done under wet conditions, the heat generated during commination is neutralized by water. This again spares the thermolabile constituents from exposure to heat.

iv) The extraction procedure has been rated to be more effi - cient and effective than continuous hot extraction.

9 Ultrasound Extraction (Sonication): The procedure involves the use of ultrasound with frequencies ranging from 20 kHz to 2000 kHz; this increases the permeability of cell walls and produces cavitation. Although the process is useful in some cases, like extraction of rauwolfi a root, its large-scale application is limited due to the higher costs. One disadvantage of the procedure is the occasional but known deleterious effect of ultrasound energy (more than 20 kHz) on the active constituents of medicinal plants through formation of free radicals and consequently undesirable changes in the drug molecule.

Strength and limitation: The benefits of UAE is mainly due reduction in extraction time and solvent consumption. However, use of ultrasound energy more than 20 kHz may have an effect on the active phytochemicals through the formation of free radicals.

10 Supercritical Fluid Extraction: Supercritical fl uid extraction (SFE) is an alternative sample preparation method with general goals of reduced use of organic solvents and increased sample throughput. The factors to consider include temperature, pressure, sample volume, analyte collection, modifi er (cosolvent) addition.

11 Phytonics Process: A new solvent based on hydrofl uorocarbon-134a and a new technology to optimize its remarkable properties in the extraction of plant materials offer signifi cant environmental advantages and health and safety benefi ts over traditional processes for the production of high quality natural fragrant oils, fl avors and biological extracts. Advanced Phytonics Limited (Manchester, UK) has developed this patented technology termed "phytonics process".

Advantages of the Process • Unlike other processes that employ high temperatures, the phytonics process is cool and gentle and its products are never damaged by exposure to temperatures in excess of ambient.

- The solvents used in the technique are not fl ammable, toxic or ozone depleting
- The technique is highly selective, offering a choice of operating conditions and hence a choice of end products.
- It is less threatening to the environment.
- The solvents are completely recycled within the system.

Conclusion :

All stages of extractions, from the pre-extraction and extraction are equally important in the study of medicinal plants. The sample preparation such as grinding and drying affected the efficiency and phytochemical constituents of the final extractions; that eventually have an effect on the final extracts. It can be concluded that, no universal extraction methods is the ideal method and each extraction procedures is unique to the plants. Previously optimized methods can be used to lead in the selection of suitable methods. However, evaluation and selection of pre-extraction preparation and extraction methods are depending on the study objectives, samples, and target compounds.

REFERENCES:

1. Mukherjee PK, Maity N, Nema NK, Sarkar BK (2011) Bioactive compounds from natural resources against skin aging. Phytomedicine 19: 64-73.
2. Methods Optimization in Accelerated Solvent Extraction in Technical note (2013) 208: 1-4.
3. Arya V, Thakur NM, Kashyap C (2012) Preliminary Phytochemical Analysis of the Extracts of Psidium Leaves. J Pharmacogn Phytochem 1: 1-5.

4. Anuradha M, Pragyandip PD, Richa K, Murthy PN (2010) Evaluation of Neuropharmacological Effects of Ethanolic Extract of Clitorea Ternatea Flowers. Pharmacologyonline 1: 284-292.
5. Patil, Sachin BS, Wakte PS, Shinde DB (2013) Optimization of supercritical fluid extraction and HPLC identification of wedelolactone from Wedelia calendulacea by orthogonal array design. J Adv Res 5: 629-635.
6. S. S. Handa, S.P.S. Khanuja, G. Longo and D..D. Rakesh. (2008).
7. Extraction Technologies for Medicinal and Aromatic Plants, 1st edn, no. 66. United Nations Industrial Development Organization and the International Centre for Science and High Technology. Italy.
8. A.Pandey and S. Tripathi. (2001, January). Concept of standardization, extraction and pre phytochemical screening strategies for herbal drug, Journal of Pharmacognosy and Phytochemistry. 2(5),
1. https://www.researchgate.net/publication/324136585
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4293910/