

Techno-Herbal Renaissance: Looking As We Leap

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Abstract: Herbal medicine is one of the most primitive and publically accepted systems of medical sciences at every nook and corner of the world. Men make use of natural resources for cure and care of health, prevention and mitigation of diseases since times immemorial. Such a system of materia-medica played a key role in human civilization with a dependency of huge number of human populations mostly in developing countries. Globalization of the local-folk knowledge concerning the use of aboriginal medicinal plants by traditional healers and localization of globally advanced technology not only boosted the expansion and advancement of herbal industry but also have created global dench towards herbal medicines. New technology greatly helped the developed countries to copyleft this ancient and enriched natural product inspired system of medicine for future drug development. An upgrading in each step of herbal manufacture of medicines has hopefully been possible with modern technological advancements. Growing demand and desirability of masses towards droolworthy herbal medicinal drugs in the past few years has been increased considerably is an apparent indication of herbal renaissance. The present review throws light on some of the current trends and aspects in the utilization of these formulas and facts in view of modern scientific researches so as to look upon uber-technological aid for growth and development of herbal medicinal industry.

Keywords: Aboriginal, herbal, materia-medica.

1.0 INTRODUCTION

Plants have provided man to fulfill all his necessities of food, clothing, shelter and medicines as well. Plants have formed the base of long-established medicinal systems among which are Ayurvedic, Unani and Chinese form the base of the peak. These systems of medicine have given some important drugs that are in use still today. The less recognized systems of medicine are the African and Australian, Central and South American as tabulated in Table-1, [1, 2].

Medicinal plants are fast gaining wide attention in recent times because of their use in ethnomedicine, treating and mitigating regular diseases such as cold, fever etc. with other medicinal claims currently supported by sound scientifically approved evidences which gives a sense of global resurgence [3].

In the later part of last decade, the Western world has realized the importance of herbal medicines with minimum side-effects

and thus accepted the medication which mostly depends upon the processes and procedures applied to plants containing active constituents of medicinal importance. It is also often called as phytomedicine or ethnomedicine and is a component of alternative or complementary medicine [4].

Table- 1 Traditional medicinal systems of the world

Country	Traditional medicine
India	Ayurveda
Middle-East	Unani
Japan	Kampo
Europe	Homeopathy
USA, Australia	Western herbal
Africa	Tribal herbal

One of the surprising success stories of contemporary research has been the evolution of a system that is increasingly more efficient at directly translating knowledge into technology and class commercial products offering a net advantage in terms of productivity, yield and selectivity with better processing time, enhanced quality, reduced chemical and physical hazards assuring indemnity of environmental suitability with sustainability [5].

The extraction procedures, isolation and identification techniques, bioassay methods for efficacy testing, dosage form and study of pharmacokinetic, pharmacodynamic, toxicological and pharmacological mode of action crawls competition with present typical modes of health care. Forensic studies in regulatory aspects and global marketing are other areas of herbal medicine industry gaining prominent importance [6].

2.0 CULTIVATION, HARVESTING, COLLECTION AND STORAGE OF MEDICINAL HERBS USING MODERN TECHNOLOGY

Modern technology has greatly helped to reduce the old farm practices and procedures that were performed earlier in pre-modern times after harvesting of particular plant so as to use it as herbal drug. Before advent of technologically sophisticated instruments environmental factors largely affect the cultivation as well as plant growth. Improper farm practices were carried out during cultivation and harvesting. Malpractices occurred at the time of drying and storage. Now-a-days conditioned drying, availability of machines for processing, proper storage facilities and change in production procedures right from extraction to

final processing, packaging and transportation reduced the chances of loss in active secondary metabolite which lay down any change in composition, yield of bioactive components and biological activities of medicinal plants. Amount of active compounds may vary in each extraction step. Therefore the extract should be checked for respective biological activity in an experimental animal model which is sometimes not likely to be possible [7, 8]. Today technological advancement *per se* provides information for batch to batch variation of active components by therapeutic index values and is utilized to judge best time for harvest so as to avoid the unnecessary loss of active agents [9].

3.0 PLANT EXTRACTION, IDENTIFICATION OF BIOACTIVE COMPONENTS, ISOLATION METHODOLOGY, CHARACTERIZATION AND DRUG DISCOVERY USING MODERN TECHNOLOGY

Genomics, gene manipulation as well as metabolic engineering techniques serves to develop new drugs from natural products. Drugs are developed mostly by high throughput screening (HTS) but high cost incurred for this method made this technique less notorious. Therefore role of conventional herbal formulations are worth gaining importance as safe to use without side-effects [10, 11].

Now novel techno-modern methods such as virtual software based screening and filtering experiments by pharmacophore models, computational docking of molecules and artificial neural networking for novel lead identification from natural products receiving more and more popularity [12].

Automated NMR method is newly adopted tool to separate the bioactive components from a mixture of crude plant extracts by way of generation of NMR spectral library of pure components [13].

DNA, protein, and cell chip based HTS are part of research as mini version of HTS method. DNA microarray technique is also valuable for pharmacognostic, pharmacogenomic, and pharmacodynamic studies of herbal drugs [14].

Fluorescence resonance energy transfer (FRET) based High Throughput Screening is a modern tool for anticancer drug designing. Construction of natural product library through high throughput screening is another method to reduce the complexity of component identification without any difficulty. Chromatographic fingerprinting profiling of each medicinal plant solves the problem of presence numbers of metabolites in natural plant sources and their wide range without loss in bio-active components [15].

Chemo-bioinformatics in its nascent stage helps to detect specifically bio-molecular targets that are expected to have effects for particular diseases so that screening and formulation of novel herbal drugs for chronic diseases is likely to be possible [16, 17].

Solvent extraction of active secondary metabolites from medicinal plants is one of the decisive steps in herbal drug development. Extractions are still done using the steps like distillation, decoction, maceration, etc. but recent technological inventions made us available the modified techniques like Micro-distillation, Thermal Micro-distillation and Molecular Distillation Techniques, Solid Phase Micro-extraction and Headspace Trapping Extraction, Super-critical Fluid Extraction, Flash Chromatography and Low Pressure Chromatography, Counter-current Chromatography, High performance Thin Layer Chromatography (HPTLC), Process-scale HPLC. Few newly designed modern techniques with usefulness of each are tabulated in Table-2, [18-20].

Table 2- Novel extraction methods and their individual uses medicinal

Novel Extraction Method	Efficient Use
Supercritical Fluid extraction (SFE)	Efficient extraction & pesticide residues analysis is possible
Ultrasonic extraction (UE)	Increased extraction efficiency with reduced time
Microwave assisted extraction (MAE) technique	Extracts can directly used for HPLC
Pressurized Liquid Extraction (PLE) & PLE combined ultrasound-assisted extraction and solid phase extraction	High yield, decreased time, less solvent consumption and protects sensitive compounds

Other such methods for analysis of active principles as well as adulteration include thin layer chromatography (TLC), high performance liquid chromatography (HPLC) and capillary electrophoresis (CE) etc. Tandem techniques such as Gas chromatography (GC) & Mass spectroscopy (MS), Liquid chromatography (LCMS) and CEMS provide high specificity and are mostly used for confirmation of molecules. Liquid chromatography-selected reaction monitoring mass spectrometry (LC-SRM/MS) is one such new technique [21, 22].

From the last few years, electromigration methods like capillary electrophoresis, capillary electro-chromatography (CEC) is proving useful in the identification and quality control of herbal drugs. In thin layer chromatography enhancements like forced-flow planar chromatography (FFPC), rotation planar chromatography (RPC), over-pressured-layer chromatography (OPLC) and electro-planar chromatography (EPC) etc. are worth notable [23].

Techniques to analyze and remove toxic pesticide includes GC, HPLC or Column switching high-performance liquid chromatography (CSHPLC), GC/MS, HPLC/MS, super-critical fluid extraction (SFE), capillary electrophoresis (CE), and enzyme linked immunosorbent assay (ELISA). Pesticide residue

detection is often done using SFE. Advances in HPLC includes HPLC analysis coupled with evaporative light scattering detection (ELSD), strong anion-exchange HPLC (SAX-HPLC), micellar electro-kinetic capillary chromatography (MECC), high-speed counter-current chromatography (HSCCC), low-pressure size-exclusion chromatography (SEC), reversed-phase ion-pairing HPLC (RP-IPC-HPLC) etc. [24].

4.0 TOXICITY CHECK OF HERBAL DRUGS USING MODERN TECHNOLOGY

Pesticides regulate plant growth as well as secondary metabolite production in growing herbs, but monitoring of residue levels of such hazardous chemicals so far have not been possible. Nowadays such testing facilities are available to measure pesticide residue which have considerably reduced the chances of toxicity in these plant based drugs [25].

There are some other factors which adversely affect the plant quality like adulteration, substitution, contamination and misidentification. Lack of standardization, incorrect preparation and dosage, inappropriate labelling or advertisement is also need to be checked. Toxic heavy metals like arsenic, lead, mercury, cadmium, etc. have been found in few Chinese and Indian herbal products. Forensic identification, regulations and following strict toxicity check by modern methods can only solve such problems [26, 27].

5.0 FORMULATION, DISPENSING AND PACKAGING USING MODERN TECHNOLOGY

Market dispersal of herbal preparations is in the form of pills, decoction, syrups, tablet, capsule etc. So stability studies of herbal drugs are important before dispersal. The physical instability of herbal formulations or their raw materials are due to heavy moisture, bacterial and fungal contamination, chemical instability, improper harvesting and storage conditions etc. High moisture content often causes bio-degradation of active molecules. Stability can be achieved by maintaining proper drying conditions considering decomposition behaviour of active metabolites, nanoparticle coating of drug, use of chelating agent, formulation of emulsion and suspension etc. It is found that water soluble phytoconstituents have limited bio-availability due to poor absorption *in-vivo* and thus stabilization of the bio-active extract with minimum shelf-life of a year atleast with further improvement of techniques to increase bio-availability of phytochemicals is important. Biological activity of herbal molecule is also a function of drug delivery system so that new discoveries of drug delivery system like polymeric nanoparticles, nanocapsules, nanoemulsions, microsphere, liposomes, phytosomes, transferosomes, and ethosomes are proving useful and elegant ways of modern system of traditional healing [29-31].

Necessary packaging technology is needed so as to maintain batch to batch product uniformity. Appropriate label is to be pasted not to cause ambiguity of herbal made drugs. Unless good manufacturing practices are not maintained and concentration of each active agent is not properly indicated, it may result in toxicity when used for children. Sub-standardized processing, packaging and storage are of great concerns for underdeveloped countries. So adoption of novel technology and its implementation is the need of the hour [32, 33].

6.0 CONCLUSION

Technology has paved way for the global harmonization of herbal system of medicine but still due to dearth of capital investment poor countries lacking in such modern screening methodologies, extraction and isolation techniques for separation of bioactive components and detection of toxic contaminants. Technology-based herbal drug development with scientific backing following necessary legislative norms for possessing and production will predominantly promote herbal pharmaceuticals for public health and treatment of diseases. Thus it is not a hyperbole to say that an era has begun with labyrinth of fortunate future which appropriately be described as 'techno-herbal renaissance' and can only be realized and recognized when consumers are assured for the safety, efficacy and effectiveness with sound scientific support data concerning such herbal drugs and their dosages which we look when we leap the ladder of traditional medicines trusting trends of ethnic authenticity with prop-up from easy availability of modern technological applicability, associability and accessibility.

7.0 REFERENCES

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