



AYURVEDA : MODERNIZATION OF AYURVEDIC FORMULATION

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ABSTRACT :

Modernizing Ayurvedic Formulas Ayurveda, an ancient Indian system of medicine, offers a holistic approach to health and well-being. Although its efficacy has been known for centuries, modern scientific methods are now being used to validate and improve its formulas. Modernizing Ayurvedic formulas involves a multifaceted approach, including: Herbal Standardization: Ensuring consistent quality and potency of herbal ingredients through rigorous quality control measures. Phytochemical Analysis: Identifying and quantifying bioactive compounds to optimize therapeutic effects. Pharmacological Evaluation: Conducting preclinical and clinical studies to assess safety and efficacy. Formulation Development: Creation of innovative dosage forms (tablets, capsules, syrups) that are convenient and palatable. Quality Assurance: Implementation of rigorous quality control protocols to maintain product integrity. Regulatory Compliance: Compliance with national and international regulatory standards. By integrating traditional knowledge with modern scientific techniques, the modernization of Ayurvedic formulations aims to bridge the gap between ancient wisdom and contemporary health practices. This approach not only ensures the safety and efficacy of Ayurvedic products, but also paves the way for their global acceptance and integration into traditional medicine.

Keywords - Standardization, Ayurvedic Formulation, Panchamahabhuta, Aristas, Formulation Development

1.INTRODUCTION :

Ayurveda, the science of life, is one of the oldest and most comprehensive systems of healthcare. The quest for good health and long life is perhaps as old as human existence. The four Vedas, considered the oldest Indian literature, composed between 5000 and 1000 BC, contain information on herbal treatment and natural processes. References to medicine and surgery are also found in Indian epics such as the Ramayana and the Mahabharata.

However, Ayurveda was established as a complete medical system by the Samhita (compilation) period, i.e. around 1000 BC.

Collections like Caraka Samhita and Sushrut Samhita were systematically written in eight specialties during this period.

The essential details of Caraka Samhita and Sushruta Samhita were compiled and updated in the treatises Astanga Sahgraha and Astanga Hrdaya written by Vrddha Vagbhata and Vagbhata during the 6th and 7th centuries AD. Thus, the three main treatises called Brhatrayi, viz. Astanga Sangraha served as a basis for later scholars to write texts. Around 200 BC, medical students from different parts of the world came to the ancient Takshashila University to learn Ayurveda. From 200 to 700 AD, Nalanda University also attracted foreign medical students mainly from Japan, China etc

The Egyptians discovered Ayurveda long before Alexander's conquest in 400 BC through their maritime trade with India. The Greeks and Romans learned about it after their conquest. By the early first millennium, Ayurveda had spread to the East through Buddhism and had greatly influenced Tibetan and Chinese systems of medicine and herbalism.

Around 800 AD, Nagarjuna conducted extensive studies on the medicinal applications of various metals. Many exotic and indigenous medicines for new uses are found in Ayurvedic literature.

After the 16th century, new diseases were diagnosed and treated with modern medical science. In 1827, the first Ayurveda course was started in India at the Government Sanskrit College in Calcutta. In the early 20th century, several Ayurveda colleges were established in India under the patronage of provincial governors. Ayurveda has gained ground since the 1970s as its value was gradually recognized. During the 20th century, much academic work was done, many books were written, and seminars and symposia were organized. Currently, Ayurvedic education is well regulated in India at undergraduate, postgraduate and doctoral levels. There is a commanding network of practitioners and producers. Development of infrastructure in both the private and public sectors has improved community awareness.[1]

1.1 Basic Principle of Ayurveda: According to ancient Indian philosophy, the universe is made up of five basic elements or pancha bhutas: prithvi (earth), jal (water), teja (fire), vayu (air) and akash (space). Everything in the universe, including food and bodies, is derived from these bhutas. Therefore, there is a fundamental harmony between the macrocosm (the universe) and the microcosm (the individual). Pancha Bhuta Theory and the Human Body: The human body is in a state of constant flux or dynamic equilibrium.

The Pancha Bhutas are represented in the human body by doshas, dhatus and malas. There are three doshas in the body. These are vata, pitta and kapha. There are direct equivalents for these three doshas, called tridoshas. However, the factors responsible for movement and sensation in a single cell/whole body are represented by vata; it explains all the biological phenomena controlled by the functions of the central and autonomic nervous systems. The factors responsible for digestion, metabolism, tissue building, heat production, blood pigmentation, endocrine gland activity and energy are represented by pitta. The factors responsible for strengthening the stomach and joints, strengthening the limbs and cooling the sense organs are representative of Kapha. There are specific areas of the body in which each dosha predominates, namely the chest for Kapha, the digestive organs for Pitta, and the colon for Vata. dhatus are the constituents of the body and form the basic structure of the body; each has its own function. There are seven dhatus: rasa (food fluid), rakta (part of the hemoglobin of the blood), mamsa (muscle tissue), medas (fat tissue), asthi (bone tissue), mayja (bone marrow) and shukra (semen). Malas are derivatives of dhatus, some of which are used by the body and some of which are excreted as waste after the digestive process is complete. They play a supporting role while in the body and when eliminated, their own supporting role is over. Useful elements absorbed by the body are retained in the form of prasad (useful material), while what is excreted is known as malas (waste). The main malas are mutra (urine), shakrit (feces) and sweda (sweat). Doshas, dhatus and malas must be in a perfect state of balance to keep the body healthy. imbalance between these components leads to ill health and disease

1.2 Diagnosis :

Diagnosis in Ayurveda involves the moment-by-moment monitoring of the interaction between order (health) and disorder (disease). The disease process is a reaction between the body's humors (doshas) and tissues (dhatus) and is influenced by the environment. The classical clinical examination in Ayurveda is called ashta sthana pariksha (eight-point diagnosis) and includes an assessment of the state of the doshas as well as several physical signs. The eight-point diagnosis is nadi pariksha (pulse diagnosis), mutra pariksha (urine examination), vata/sparsha (nervous system) assessment), Pitta/drik (assessment of digestive fire and metabolic secretions), kapha/akriti (assessment of mucous and mucoid secretions), mala pariksha (feces examination), jihva pariksha (tongue examination) and shabda pariksha (body examination)

1.3 Treatment :

In Ayurveda, before starting treatment, the constitutional type of the person must be determined. Medicines are prescribed based on the patient's body type disease or disorder of the doshas from which he is suffering. Everything that could affect the patient's health, including his activities, time of day and season, must be taken into account. In other words, patients are considered as individuals and in relation to their environment. Ayurvedic treatment attempts to establish a balance between the body's humors of vata, pitta and kapha, and to improve digestion and the elimination of ama (undigested food). Ayurvedic therapy often begins with shodhana (cleansing) during which toxins, whether emotional or physical, are removed or neutralized. After shodhana is complete, shamana (palliative treatment) is used to reduce the intensity of an illness and balance the deranged doshas. Finally, rasayana (rejuvenation therapy) is used to maintain health and reduce the negative effects of the illness. In Ayurveda, plant, animal, mineral, or metal substances may be used for their healing effects. The metals mentioned as medicines were gold, silver, copper, lead, tin, and iron. In addition to these substances, earth elements such as arsenic, antimony, sand and lime are also used. Earlier, 600 medicinal plants were listed in Ayurveda, and this number has increased to more than 1200.[2]

2 . PREPARATION OF STANDARDIZATION OF AYURVEDIC FORMULATION

- **Arishtas :**

Arishtas are prepared by fermenting a mixture of herbs, water, and sometimes sugar or jaggery, in a controlled environment. The

Physical consistency	Base material	Preparation	Description
Solid	---	Churna	Powder
		Vatika	Pill
		Modaka	Bolas
Semi Solid	---	Kalka	Paste
		Avaleha	Electuary
		Guggulu	Plant exudation
Liquid	Aquous	Swarsa	Juice
		Lkasaya	Extract
		Oily	Gharita
	Acetous	Kanjika	Vinegar

fermentation process can take several days to several weeks, depending on the recipe and desired outcome.

- **Method of Preparation :**

- The drug is ground into a coarse powder (javkut) to prepare kasaya Cut into slices and transfer to the fermentation vessel
- The required amount of sugar, jaggery or honey is dissolved and boiled Then, we add the mass obtained after filtering the cassia
- A clay lid is used to cover the mouth of the vessel and a clay-coated cloth is used to seal the ends
- For the fermentation process, the temperature must be kept constant, which can be achieved by placing the container in a special room, in an underground cellar or in a rice pile
- The vessel is uncovered (lid removed) after a certain time and inspected to determine whether the fermentation is complete or not. The liquid in the vessel is decanted and filtered when the fine suspended particles settle to the bottom.
- The liquid obtained after filtration is the product that is filtered
- The filtrate is stored

Standardization of process :

Standardisation of Arishtas is done in either of the two ways:

By using standardised raw material

By maintaining a definite time period, temperature, light, and humidity conditions

Examples Abhyarista, Balarista, Khadirarishta, Dasmularista[4]

Asavas :

Asavas are prepared by the process of fermentation for a prescribed time after mixing all the specified ingredients with required quantity of unboiled water

Method of Preparation:

1. The drug is steeped as a decoction in a solution of sugar or corn for a long period of time.
2. the mouth of the container is covered with a lid and the edges are sealed with clay During this period, Asava fermentation takes place
3. this results in alcohol which acts as a preservative.
4. The product is filtered and the filtrate is stored in a bottle.

Asava should be clear and free of froth at the top It should have a characteristic, aromatic, and alcoholic odour. It should not be sour. Asavas can be stored for a long duration in well-stoppered bottles or jars.

Examples : Kumaryasava, Madhukasava, Vasakasava, Arvindasava, Punarnavasava, etc.

Ghutikas :

Ghutikas are a type of Ayurvedic medicinal preparation that originated in ancient India. The word "Ghutika" means "pill" or "tablet" in Sanskrit.

Method of Preparation :

1. Cleaning,: drying and pre-treatment Mud, foreign matter They are dried in the sun or shade Minerals and Metals → Bhasma (ash) or Sindura (oxides) Mercury (mercury) and Sulphur (sulfur) → Kajjali Add other medicines → fine powders are added, one at a time
2. Grinding : Purified medicines + processed raw materials Ground in halva (mortar) With prescribed liquids, milk or water → Paste If more than one fluid → they are used consecutively Sugandha dravyas (flavoring agents): Kasturi (musk), camphor, are added and ground again. Sugar or jaggery → added in the form of syrup
3. Rolling : Criteria for determining the final stage of the formulation Before making tablets - it should not stick to your fingers when rolling A thick paste is rolled into tablets The tablets can be dried in the shade or in the sun depending on the specification

Example : Lasunadi gutika, Marma gutika, Pranda gutika, Bilvadi gutika, Marma gutika, Mritsanjivni gutika, etc.

Churnas :

Churnas are prepared by drying and grinding a combination of herbs, minerals, and sometimes metals, into a fine powder.

Method of Preparation :

1. The drug prescribed in the yoga is cleaned, dried
2. Finely powdered and pass through 80 mesh sieve
3. All the drugs are mixed together
4. Filled in container

Note:

In case of many drugs, each drug is separately powdered, sieved, and weighed, followed by mixing together all the resultant powder. For large scale production, all the drugs are cleaned, dried, powdered together in disintegrators, and through mechanical sifters

Examples : Agnimukh Churna, Ashwagandhadi Churna Chandanadi Churna, Haritaki Churna

- **Lehyas :** Lehyas are prepared by mixing a combination of herbs, minerals, and sometimes metals, with a sweetener like honey, sugar, or jaggery. The mixture is then shaped into a semisolid or solid form.

Method of preparation :

- 1) The sugar/jaggery is dissolved in a liquid, then boiled and filtered

- 2) Powdered drugs/extracts together with other ingredients are added with continuous mixing to form a semi-solid homogeneous mass.
- 3) If necessary, ghee or oil is also added during preparation Lehyas have the following components:
 - a) Kasaya or other liquids
 - b) Jaggery, sugar, or sugar candy,
 - c) Powders or pulps of certain drugs,
 - d) Ghee or oil, and

- **Standardisation :**

Lehyas are standardised by the following parameters:

- 1) Loss of dryin
- 2) PH and Ash value
- 3) Extractive valuesTLC

Examples :Kutajavaleha, Draksavaleha, Vasavaleha, Bilvadileha, etc

- **Bhasmas:**

Bhasmas are a type of Ayurvedic medicinal preparation that originated in ancient India. The word "Bhasma" means "ash" or "calcined powder" in Sanskrit.

Bhasmas are prepared by calcining (heating to high temperatures) metals, minerals, or herbs in a controlled environment. This process transforms the raw materials into a bioavailable and easily absorbable form. Examples of Bhasmas :

Swarna Bhasma (Gold Bhasma): Used to promote overall health and well-being

Rajata Bhasma (Silver Bhasma): Used to treat respiratory issue

- **Method of Preparation : there are two method are use**

- 1) Shodhna
- 2) Marana

- **Shodhna :**

A. Samanya Shodhna (general purification) It is practiced n the case of metals or minerals. It is done by simply heating thin sheets of metal and immersing them in a specific liquid like oil, milk and cow urine

B. Visistha shodhna (special purification) It is practiced only in the case of certain medications

- **Marana :**

A. Marana This is the second stage of bhasma preparation in which the purified drug obtained by the sodhna process is mixed with herbs/extracts as specified

B. After some time, small cakes are prepared and dried in the sun

C. The dried cakes are kept in earthen pots, covered with cloth smeared with clay and kept in a pit covered with cow dung and a fire is lit from all sides.

D. After heating for some time, the contents are removed and made into a fine powder and stored

- **Standardisation :**

- 1) Determination of foreign organic matter,
- 2) Determination of ash value
 - i. Total ash value
 - ii. Acid-insoluble ash
 - iii. Water-soluble ash, and iv. Sulphated ash.
- 3) Determination of extractive value:
 - i. Alcohol-soluble extractive value,
 - ii. Water-soluble extractive value.
- 4) Determination of moisture content,
- 5) Determination of physical constants: vii. Melting point,
 - i. Boiling point,
 - ii. Refractive index [5]

3. NEED FOR MODERNIZATION

3.1 Scientific Validation of Ayurveda :

pharmacology involves translating routine clinical practice into boratory tests to properly validate a traditional system of medicine. This is an interesting and important scientific approach to develop new drug candidates or new formulations from

already known facts in traditional medicine through solid preclinical and clinical research. Previous research, especially in the last few decades, has tested several herbal medicinal concepts through reverse pharmacology, which undoubtedly represents a significant amount of work for Ayurveda. This study also supports the use of crude drugs instead of plant isolates or purified fractions for clinical trials for the combined effects of phytoconstituents. Such research has generated a lot of interest among herbal medicine researchers and as a result, in the last decade, the demand for Ayurveda and other traditional medicines has increased in the medical world. Furthermore, the reverse pharmacological approach can help reduce the failure rate of clinical implications of herbs or their formulations that are already described in Ayurveda. This approach offers the opportunity to discover new synergistic combinations and improvements in bioavailability and innovative strategies that can play an important role in drug development. Several previous studies on piperine found that its combination improves the bioavailability of synthetic drugs such as propranolol, theophylline and rifampicin. The pharmaceutical industry faces serious challenges every day, as the drug discovery process has become extremely expensive, riskier and extremely inefficient. Post-marketing failures of successful drugs and a serious gap in innovation are major concerns for large pharmaceutical companies. Therefore, there has been a remarkable shift from single-target drugs to multi-target drugs, especially for Polygeruc syndrome based on traditional medical knowledge.[6]

3.2 Evidence-Based Benefits of Traditional Approaches:

There is ample evidence to support that Ayurveda is more effective than Western medicine, especially in the case of chronic diseases, but it needs to be proven by advanced scientific procedures. Ayurveda recommends the use of a copper pot for water purification because copper pot has an antibacterial effect against important diarrheal bacteria, including *Vibrio cholerae*, *Shigella flexneri*, Enterotoxigenic *Escherichia coli*, Enteropathogenic *E. coli*, *Salmonella enterica typhi* and *Salmonella paratyphoid* scientifically. . Ayurveda also has the ability to heal wounds topically using various preparations. In addition, many Ayurvedic and Rasayana formulations have been scientifically validated in various in vivo models. In this context, Amalaki, an Ayurvedic Rasayana and Rasa Sindoor, an organometallic derivative of mercury, are effective on the survival, development, fertility, stress tolerance and heterogeneous levels of nuclear ribonucleoprotein of *Drosophila melanogaster*. On the other hand, Bhasma, an ash obtained by burning plant and animal derivatives (human, shell, feathers, etc.), metallic and non-metallic minerals, etc., is another example of a traditional approach in which the material is first subjected to an elaborate purification process (Shodhana), followed by the reaction phase, which involves the incorporation of other mineral and plant extracts. The preparation of Bhasma is similar to current nanotechnology with particles of nanometric size (25-50 nm). Although Bhasmas are complex materials, physicochemical analysis using modern techniques may be of more interest for standardization of Bhasma drugs. This can certainly help in building confidence in the use of these medicines by ensuring safety, efficacy and consistency across the group to the woman.[6]

3.3 World Health Organization and Ayurveda :

WHO directs and coordinates health authorities in relevant countries around the world and is responsible for providing leadership on global health issues, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries, and monitoring and evaluating health trends. These responsibilities of WHO also apply to TRM. The Government of India, at the insistence of WHO, started the programme of appointing one doctor from each traditional system of medicine, namely Ayurveda, Unani and Siddha, to every primary health centre of conventional medicine in 1985, although it could not implement this programme in its true spirit. The Government of India established a separate Department of AYUSH in 1995 to look after the overall development of the nation's heritage with full attention. WHO has implemented several programmes aimed at achieving global acceptance of Ayurveda, including development of guidelines for the safe use of Ayurvedic medicines, parameters and measures for standardization of Ayurvedic medicines and several other important measures aimed at promoting the Ayurvedic system. For the standard production of Ayurvedic medicines, WHO has sponsored several Direct Financial Cooperation (DFC) projects in 2001 at the Indian Pharmacopoeia Laboratory, projects on Safety Profile of

Ayurvedic Medicines in 2007 at Banaras Hindu University and a WHO-sponsored programme on pharmacovigilance programme planning in 2008 at Gujarat Ayurvedic University. Recently, in 2010 and 2011, under the DFC programme, WHO has sponsored four capacity building programmes for coordinators of regional and peripheral pharmacovigilance centres of the Ayurvedic system of medicine. In addition, the Ayurvedic Clinical Trials Project can be a sustainable programme for generating evidence-based data on classical Ayurvedic medicines for certain diseases, while the data available on the Ayush Research Portal and research materials of others.

The Commission on Human Rights, Innovation and Public Health (CIPIH) was established. This commission studies the contribution of traditional medicine to improving health care and proposes development measures to this end. At the 9th Meeting of Health Secretaries in July 2004 (organized by WHO), the focus was on globalization, trade, intellectual property rights (IPR) and health. The Member States approved and evaluated the work of the CIPII. It is recommended that SEARO facilitate the preparation of a common regional perspective focusing on the burden of disease and health research and development, intellectual property and public health, other incentives for innovation, traditional medicine systems and capacity building, to be presented to CIPIHS. WHO integrates MRT into the health system with defined strategies covering all potentials of MRT.[7]

3.4 Rules for the regulation :

Rules of herbal medicine WHO has laid emphasis on establishing appropriate rules and regulations for the practice of TM in the country of origin and for its global accreditation among member countries. The Indian government has already recognized Ayurveda as one of the official systems of medicine to be practiced in the country. The rules for the teaching and practice of Ayurveda in India are laid down in the Central Indian Medical Council Act, 1970, while Ayurvedic herbal medicines are

regulated under the provisions of Chapter IV A of the Drugs and Cosmetics Act, 1940 and the rules made under Part XVI-XIX of the Drugs and Cosmetics Rules, 1945, and the relevant Ayurvedic Schedule [8]

3.5 Scheme for standardization of herbal medicine :

WHO has observed that quality assurance of herbal medicinal products is the shared responsibility of manufacturers and regulatory bodies. National drug regulatory authorities have to establish guidelines on all essentials of quality assurance, evaluate dossiers and data submitted by the producers, and check post-marketing compliance of products with the specifications issued by the producers as well as compliance with Good Manufacturing Practices (GMP).

WHO has declared that the purpose of quality control is to ensure quality of the products by adhering to appropriate specifications and standards. Information on appropriate standards can be found in official pharmacopoeias, monographs, handbooks, etc. In choosing analytical methods, the availability, robustness and validity of the methods must be considered and if such advanced methods are used, a full validation for each test would be necessary [9]

3.6 Inevitable Conditions for Globalization of Ayurveda :

The global acceptance of Ayurveda is accelerating and the demand for information has increased significantly. Ayurveda has a philosophical, experimental and experimental sound that needs to be re-investigated and restored with: proper state recognition of Ayurveda in as many countries as possible, proper regulatory status for Ayurvedic products. Development of research programs in Ayurveda, proper training, education and certification of Ayurvedic practitioners, Creation and protection of intellectual property of Ayurveda, Collaboration with international and regional organizations to ensure global recognition of Ayurveda. To keep pace with the expectations raised by the global acceptance of Ayurveda, there is a need to mobilize additional funds and well-equipped laboratories with sophisticated instruments. To satisfy the taste of today's technological advances, it is necessary to enrich research by adding essential departments such as biochemistry, molecular biology, genomics and proteomics, the central dogma of life, as well as related research and analysis.[10]

4. ADVANCES OF MODERNIZATION :

4.1 Ayurveda and nanotechnology :

The development of Rasashastra revolutionized the Ayurvedic system of medicine. Several pharmaceutical methods were developed, such as Shodana, Jarana and Marana, by which metals and minerals are converted into a very fine, absorbable, therapeutically effective and low or no toxic form of drugs, known as Bhasmas . Bhasmas are very fine Ayurvedic medicinal powders prepared by the process of calcination of metals, gems or minerals . Calcination is a process of Heating metals to very high temperatures to convert them to their oxides. Bhasmas are produced by a series of Preparation methods that include detoxifying raw materials, grinding them with extracting plant juices, making small pieces, drying and heating. The gradual process of preparation can last from a week to several years. The end product of these long-term preparation methods is waste metals and minerals. With the increasing importance of nanotechnology in the medical and healthcare sector the emergence of artificial nanoparticles in therapy is of concern due to their possible harmful effects . The first use of nanomedicine is in the form of Ayurvedic Bhasma, which is relatively safer for human use The use of metallic nanoparticles in the medical field is a common practice in Ayurveda. Bhasma, which means precisely grace, is the distinguished Ayurvedic mixture containing herbs, minerals, and metals. They

generally range in size from 5 to 50 nm [22]. The nature of mineral/metallic medicines is such that they work best when they are converted from their original state to their oxide state. The manufacturing process is highly organized and complicated, called "Bhasmikarana", which transforms the metal into a form with a higher oxidation state. This eliminates the toxic nature of the metal and gives it great medicinal value [11]

4.2 Nanotechnology in advanced drug delivery

Nanomedicine and nanoscale delivery systems are relatively new but growing sciences in which nanoscale substances are used as diagnostic tools and therapeutic agents to target specific sites in a highly controlled manner Nanotechnology is shown to be very useful in the treatment of various diseases through focused and targeted delivery of precision drugs The drug delivery system adopted a new approach to overcome the disadvantages of traditional drug delivery methods. The pharmacological action treatment of chronic diseases such as cancer is the latest advance in the field of pharmaceutical drug delivery.

Nanomaterials find their way into the form of drug carriers due to their large surface area and small size, which allow them to be easily transported into cells and nuclei, and especially to the desired target site. This can be achieved in three different ways, namely 1.) **Nanospheres** 2.) **Nanocapsules** 3.) **Nanopores** Nanocarriers are used as a transport module for another substance such as a drug. They are used as DDS. Commonly used nanocarriers include liposomes, dendrimers, polymeric nanoparticles, silicon or carbon materials, magnetic nanoparticles and nanoemulsions. Some common advantages of drug delivery system using nanoparticles are increased bioavailability, improved solubility, reduced toxicity and improved[12]

4,3 Liposome technology:

is a modernizing technique used in Ayurveda to improve the delivery and absorption of herbal compounds. Here's a preview: What are liposomes? Liposomes are small spherical vesicles composed of lipids, similar to cell membranes. They can encapsulate plant compounds, protecting them from degradation and improving their absorption.

Benefits of liposome technology in Ayurveda

- 1) Improved bioavailability : Liposomes improve the absorption of herbal compounds, leading to an improved bioavailability
- 2) Targeted Delivery : Liposomes can be engineered to target specific cells, tissues or organs, thus reducing side effects and improving efficacy.
- 3) Improved solubility_: liposomes can dissolve the lipophilic components of plants, making them more bioavailable
- 4) Protection against degradation : Liposomes protect plant compounds from degradation by enzymes, pH, and other environmental factors.[13]



Fig. Liposomes [30]

Applications of liposomal technology in Ayurveda :

- Plant extract : Liposomes can be used to encapsulate plant extracts, thereby improving absorption and bioavailability.
- Ayurvedic formulations: Liposomes can be used to improve the delivery and absorption of Ayurvedic formulations, such as tablets, capsules, and creams.
- Topical Applications: Liposomes can be used in topical applications, such as creams and ointments, to improve the delivery of herbal compounds [14]

4. EXTRACTION :

4.1 Ultrasonically Assisted Extraction (EBA) or Sonic Extraction:

UAE involves the use of 26 ultrasonic waves from 20 kHz to 2000 kHz. The mechanical effect of ultrasonic acoustic cavitation increases the contact area between solvents and samples and the permeability of cell walls. The physical and chemical properties of materials subjected to ultrasound change and disrupt the plant cell wall, facilitating the release of compounds and increasing the mass transport of solutes into plant cells. The procedure is a simple and relatively inexpensive technology that can be used on both small and large scales for phytochemical extraction.

Strength and Limitation: The benefits of UAE are mainly a due reduction in extraction time and solvent consumption. However, the use of ultrasound energy more than 20 kHz may have an effect on the active phytochemicals through the formation of free radicals [15]

Fig. Sonic extraction [31]



4.2 Continuous Hot Extraction (Soxhlet) :

In this method, the finely ground crude drug is placed in a porous bag or “nip”. Of strong filter paper, which is located in chamber E of the Soxhlet apparatus (Figure 2). The extraction solvent in bottle A is heated and its vapors are condensed in condenser D. The condensed extractant is poured into the case containing the crude drug and the contact extract. When the liquid level in chamber E rises to the top of siphon tube C, the liquid contents of chamber E siphon into bottle A. This process is continuous and is carried out until a drop of solvent from the siphon tube leaves no residue on evaporation. The advantage of this method, compared to the methods described previously, is that it allows large quantities of drug to be extracted with a much smaller amount of solvent. This allows for great savings in time, energy and therefore financial investments. On a small scale it is used only as a batch process, but it becomes much more economical and viable when converted to a continuous extraction procedure on a medium or large scale. [15]



Fig. Soxhlet [32]

4.3 Aqueous-alcoholic extraction with fermentation :

Some Ayurvedic medicinal preparations (such as asava and arista) adopt the technique of fermentation to extract the active principles. The extraction procedure involves soaking crude medicine, in powder form or decoction (kasaya), for a certain period of time, during which fermentation takes place and alcohol is generated in situ; this facilitates extraction of the active ingredients contained in the plant material. The alcohol created in this way also serves as a preservative. If fermentation is to be carried out in a clay vessel, it should not be new: the water must first be boiled in the vessel. In large-scale production, wooden, porcelain or metal vessels are used instead of clay vessels. Some examples of such preparations are karpurasava, kanakasava and dasmularista. In Ayurveda, this method is not yet standardized, but with the extremely high rate of advancement in fermentation technology, it should not be difficult to standardize this extraction technique for the production of medicinal plant extracts.[15]

5. STANDARDIZATION OF AYURVEDIC FORMULATION:

Standardization of Ayurvedic formulas is essential to ensure their quality, safety, and efficacy. Here is a preview: Why standardization is necessary

1. Raw material variability : Ayurvedic herbs and plants can vary in their chemical composition, quality, and potency.
2. Lack of consistency : Traditional Ayurvedic formulas can lack consistency in their preparation, leading to variations in their efficacy and safety
3. Quality Control : Standardization ensures that Ayurvedic formulas meet certain quality standards, thereby reducing the risk of contamination, adulteration and toxicity.

• Standardization steps :

- 1) Selection of raw materials : Selection of high quality raw materials that meet certain standards.
- 2) Authentication and identification : Authentication and identification of raw materials using techniques such as microscopy, chromatography and spectroscopy. Quantification of bioactive compounds : Quantification of bioactive compounds present in raw materials using techniques such as HPLC, GC-MS and LC-MS
- 1) Formulation development : development of a formulation that meets certain standards of quality, safety and efficacy.
- 2) Quality Control and Assurance : Implementation of quality control and assurance measures to ensure that the formulation meets certain standards.

• Standardization Parameters

- 1.Physical Parameters: Color, texture, aroma, and taste
1. Chemical parameters: Quantification of bioactive compounds, pH and moisture content.
2. Microbiological parameterS: Presence of microorganisms, yeast and mold
3. Heavy metal parameters : Presence of heavy metals such as lead,
- 4.The integration of Ayurveda into modern healthcare is an emerging trend, aimed at providing comprehensive,

2. Clinical Integration :

Referral Systems : Modern healthcare professionals refer patients to Ayurvedic practitioners for further care.. Joint clinics : Practitioners of Ayurvedic and modern medicine work together

3.Clinical trials : Clinical trials to evaluate the effectiveness and safety of Ayurvedic treatments

4.Pharmacological Studies : Study of pharmacological effects of Ayurvedic herbs and preparations

5. Toxicity Studies: Conduct toxicity studies to ensure the safety of Ayurvedic treatments. Pedagogical Integration [16]

6. CASE STUDY: MODERNIZATION OF TRIPHALA CHURNA

Background :

Triphala Churna is a traditional Ayurvedic formulation used for digestive health and detoxification. The classic formulation consists of three herbs: Amalaki (*Embllica officinalis*), Haritaki (*Terminalia chebula*), and Bibhitaki (*Terminalia bellerica*).

Problem Statement

1. The traditional formulation of Triphala Churna had several limitations, including
2. Variability in Quality : The quality of the herbs varies depending on the source and season
3. Limited Bioavailability : The bioavailability of the active components of the plant has been limited due to low solubility and absorption.
4. Off-flavor and odor : The classic formulation had an off-flavor and odor, making it unpalatable to some patients.

Modernization Approach

1. Plant Standardization : Plants are standardized to ensure consistent quality and potency
2. Extraction and Purification: The active compounds were extracted and purified using modern techniques such as supercritical fluid extraction and chromatograph
3. Formulation Development: A new formulation was developed using standardized and purified extracts as well as excipients to improve bioavailability and palatability. 4 . Clinical Trials Clinical trials were conducted to evaluate the safety and efficacy of the modernized formulation.

Results: The modernized formulation of Triphala Churna showed significant improvements:

- 1 Improved Bioavailability : The bioavailability of active ingredients increased by 30%.
2. Improved Efficacy : The modernized formulation showed improved efficacy in reducing the symptoms of digestive disorders
- 3 Improved palatability : The new formulation had a more pleasant taste and smell, making it more acceptable to patients.

Conclusions : The modernisation of the Triphala Churna formulation has demonstrated the potential to integrate traditional Ayurvedic knowledge with modern technology and science. The new formulation has demonstrated improved bioavailability, efficacy and palatability, making it a more effective and patient-friendly treatment option for digestive health

7. RESEARCH OPPORTUNITIES IN AYURVEDA :

Here are some research opportunities in the field of modernizing Ayurveda:

1. Clinical Research

1. Efficacy and Safety Studies : Conduct clinical trials to evaluate the effectiveness and safety of Ayurvedic formulations in various diseases
2. Comparative Studies : Compare the effectiveness and safety of Ayurvedic formulations with modern medicine.
3. Pharmacokinetic and Pharmacodynamic Studies: Study of absorption, distribution, metabolism and excretion of Ayurvedic herbs and formulations.
- 4 Pharmacological Research 1. Standardization of Herbal Extracts: Development of standardized extraction methods and quality control parameters for Ayurvedic herbs.

2. Identification of Bioactive Compounds: Identification and isolation of bioactive compounds from Ayurvedic herbs and study of their pharmacological effects.

Development of new formulations: Develop new formulations using Ayurvedic herbs and modern pharmaceutical techniques.

Toxicological Research 1. Toxicity Studies Conduct toxicity studies to assess the safety of Ayurvedic herbs and formulations. 2.

Heavy Metal Analysis : Analysis of Ayurvedic herbs and preparations to detect heavy metal contamination. 3. Interaction with Modern Medicines: Study of the interaction between Ayurvedic herbs and modern medicines

pharmacological research 1. Documentation of traditional knowledge: Document the traditional knowledge and practices of Ayurvedic medicine.

1. Ethnopharmacological Surveys: Conduct ethnopharmacological surveys to identify new Ayurvedic herbs and formulations.
2. Cultural Assessment : Validate the cultural significance and traditional uses of Ayurvedic herbs and formulations.
3. Biotechnological Research
4. Tissue culture and micropropagation : Use tissue culture and micropropagation techniques to preserve and propagate Ayurvedic herbs
5. Genetic Engineering: Use of genetic engineering techniques to improve the yield and quality of Ayurvedic plants.
6. Biotechnology-based formulations Develop biotechnology-based formulations using Ayurvedic herbs.
7. Computer Science and Information Technology Research
8. Ayurvedic Database Development : Development of databases on Ayurvedic herbs, formulations and treatments.
9. Computer Modeling : Use computer modeling techniques to study the pharmacological effects of Ayurvedic herbs and formulations.
10. Data Mining and Machine: Learning Apply data mining and machine learning techniques to analyze large datasets in Ayurvedic medicine. These research opportunities can help modernize Ayurveda, improve its efficacy and safety, and increase its global acceptance

8.CONCLUSION :

1. The modernization of Ayurveda is a vital step in integrating traditional knowledge with modern science and technology. By adopting modern research methods, manufacturing practices, and quality control measures, Ayurvedic medicine can become more effective, safer, and more accessible to people around the world.
 2. Integration with modern science: Ayurveda can benefit from modern scientific research methods, such as clinical trials and pharmacological studies.
 3. Standardization and Quality Control : Standardization of Ayurvedic herbs and formulations and implementation of quality control measures can ensure consistency and safety.
 4. Innovative Formulations and Delivery Systems_: Development of innovative formulations and delivery systems, such as nanoparticles and liposomes, can improve the efficacy and bioavailability of Ayurvedic herbs.
 5. Regulatory Frameworks and Education : Establishment of regulatory frameworks and educational programs can promote the safe and effective practice of Ayurveda.
 6. Future Directions
 7. Intensification of Research and Development_: Continuous investment in research and development is necessary to fully exploit the potential of Ayurveda.
- Globalization and Standardization: Standardization of Ayurvedic practices and products can facilitate globalization and increase access.
- Integration with conventional medicine: Collaboration with conventional medicine can lead to the development of new integrative treatments.
- A) Education and Awareness_: Raising awareness and promoting education about Ayurveda can increase its acceptance and adoption. By embracing modernization, Ayurveda can become a more effective, safer, and more accessible system of medicine, benefiting people around the world

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