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A Critical Review of Standardization of Ayurvedic Dosage Form Kwatha - Part - II: Approaches and Outcome

Review Article

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Abstract

A *Kwatha,* decoction, is one of the most used classical Ayurvedic dosage forms. It is a liquid preparation to be freshly consumed. For this preparation the raw material, mostly herbs or a group of herbs are extracted in water by boiling them for a specific time span. This is second part of the review paper on Ayurvedic *Kwatha* - herbal decoction to review and consider various approaches and their outcomes for the standardization. It provides information and reference data for the standardization of decoction across conventional methods and new techniques and explains how this classical process has evolved within new pharmaceutical developments. Many Ayurvedic production units appear to have adapted to newer manufacturing technologies including fermentation techniques. This paper explores the scope for application of newer technologies for the purpose of better standardization and novel product applications. Application of *Kwatha's* nano-drug delivery systems have a promising potential to enhance operation and resolve issues related to classical dosage forms. In order to tackle further chronic diseases, the incorporation of nano-carriers as NDDS in the conventional medicine system is necessary. This review examines the benefits of the nano-drug delivery system, its properties, its drawbacks, forms of nanoparticles, their preparation methods, and various herbal nano medicines. This review further explores how therapeutic benefits can be improved by reducing toxicity and increasing bioavailability.

Key Words: *Kwatha - Kashayam, Decoction, Standardization, Ayurvedic Pharmacy, QC of Ayurvedic Products, Ayurvedic Technology.*

Introduction

Kwatha is type of Ayurvedic formulation prepared by boiling herbs in water. In modern medicines these are decoctions of water-soluble active principles such as Alkaloids etc. Water is a medium for extracting essential herbal constituents for decoction preparation, which results in rapid absorption and rapid therapeutic action of this type of dosage. Hence it is prescribed in acute conditions like cough, cold, indigestion and chronic conditions such as *amavata* that is compared to rheumatoid arthritis.

Kwatha contains active components soluble in water. These water-soluble components are absorbed readily from the intestine, which makes them act very quickly. Therefore, the decoction is still in demand and marketed as an over the counter medication. Increased demand for a product compromises the quality of the product, which ultimately leads to safety and efficacy issues of the dosage process. Therefore, Standardization of the final dosage form is critical, right from the raw materials used, the processes involved and the product, to ensure quality and safety.

Kwatha should be of standard quality and it is very important to concentrate on the pharmaceutical factors such as temperature, preparation vessels, quantity of water, particle size of the raw drugs used, length of heating to achieve good quality. *Kwatha* is normally one part of raw product that can be boiled with sixteen parts of water that can be reduced to one fourth.

Temperature is the essential element to be considered for preserving the *Kwatha* product thermo-sensitive constituent. Proper particle size of raw drugs leads to the protection of the *Kwatha* nature. Duration of heating is also important in preparing *Kwatha* to get full active principles. There are different variables that need to be weighed in order to get *Kwatha* standardized. There is therefore a crucial need to set up a few parameters in order to achieve the ideal *Kwatha* form.

Approaches to Standardization

Various scientific studies are conducted on *Kwatha* to prove its therapeutic effectiveness for specific diseases as described in the classics. The standardization of this dosage type, composed of various parameters, is made to ensure consistency and safety of decoction efforts. The attempts to standardize can be defined in three respects.

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- Approach to standardization of the raw material
- Approach to process standardization
- Approach to standardization of goods/Product

Approach towards raw material standardization

Raw material is the starting material and is the basis of the finished product. Hence good raw material should produce a product of high quality.

One of the major factors influencing consistency of *Kwatha* is raw material level or fineness. It is expressed with respect to the sieve's nominal mesh aperture size for calculating the powder thickness.

For most *Kwatha* preparations, 60-100 size is preferred. The exact size of the mesh is calculated based on *Kwatha's* pharmaceutical-analytical research. To ensure its quality value, the raw material must be tested against various parameters. Pharmacognosis involves detection, physicochemistry, cultivation, extraction, preparation, quality control, and biological assessment of drugs.

The bioactive chemicals may be extracted using a plant leaf, flower, root, animal or plant extract. This herbal research plays a major role e.g. *Vara-Asanadi Kwatha* (VAK) (1) Pharmacognostic and Phytochemical Analysis.

- Pharmacognostic studies involves the research of crude drugs of plant and animal origin (in the form of tinctures, teas, poultices, powders, and other herbal formulations) and involves the authentication and quality assurance of these drugs based on macroscopic and microscopic analyses.

The first step towards establishing the identity and degree of purity of herbal materials is an analysis to determine these characteristics. They are done before any further testing can be carried out. Visual inspection provides the easiest and fastest means of assessing origin, purity and probabilistic consistency.

- Organoleptic studies: Microscopic examination of herbal materials is necessary for the identification of damaged or powdered material; chemical reagents are used to treat the specimens. An analysis by microscopy alone cannot always provide complete identification, but it can provide invaluable supporting evidence when used in combination with other analytical methods. Comparison with a reference material exposes features not defined in the criteria that could otherwise have been attributed to foreign matter, rather than local constituents. Accounting of both macroscopic and powder raw drug microscopy exposes the consistency and genuineness of all VAK constituents.

- Physico-chemical analysis: Parameter studies include moisture content, drying loss, total ash, acid-insoluble ash, alcohol and water-soluble extractive values, extractive value soluble in petroleum ether, extractive value soluble in ethyl acetate, extractive value soluble in acetone, etc. These physicochemical characterization tests may serve as a valuable source of knowledge and are typically used in assessing the drug's purity and consistency. The extractive principles offer some indication of the drug's chemical structure. The extractive value of alcohol was the highest in the present study followed by water. VAK's TLC and HPTLC with suitable solvent method showed that most of the Rf values were similar, indicating the existence of some definite constituents in *Vara Asanadi Kwatha.*

Approach towards Process standardization

A process is the method of converting the raw material into its final usable form. The process requires several processes, procedures, solutions and needs to be streamlined to ensure that a consistent output is obtained. *Arkadi Kwatha*, *Rasnasaptak Kwatha* and *Phalatrikadi Kwatha* were prepared for process standardization using two sets of methods (2).

- Mass powdering of all ingredients mixed as per yoga (SET I)
- By individual powdering of ingredients and compounding them in the appropriate proportion to obtain the final product (SET II)

They were analyzed for different physico-chemical parameters and particularly for extractive values in various solvents. In the second collection of preparation the study showed higher values in different parameters, i.e. individual powdering, particularly in the solubility values with respect to alcohol and water except in *Phalatrikadi Kwatha*.

These results indicate that it was in the individual powdering process that more active principles were removed. TLC tests, which showed more spots in the second set of preparation than the first set in the same solvent system, further verified this (3). The qualitative organic analysis also found more functional groups were present in the second set.

This study has established, according to the observations, that decoction prepared by individual powdering of ingredients and compounding them in the necessary proportion as per textual method yields a better final product.

Product standardization

The final product must follow the approval requirements for both pharmaceutical and consumer products. Standardization of the product is the need of the hour, and various methods and criteria are employed to meet those needs.

Pharmacognostical study of the end-product

Various groups tried out organoleptic, physico-chemical analysis, TLC and HPTLC methods for quality control and standardization of *Kwatha* Kalpana e.g. *Dashanga Kwatha* (4), *Argwadhadhi Kwatha* (5) and *Gandharvahastadi Kwatha* (6)

- Organoleptic test: Showed the typical characters of the *Kwatha* like color, odor and taste.

- Physicochemical test: Revealed that the *Kwatha* had acidic pH and total solid content was also high, which was due to the extraction process.

Different phytochemical tests were performed for establishing the profile of *Kwatha* for its phytochemical constituents. The phytochemical screening of it for Carbohydrates, Proteins, Amino acids, Steroids, Glycosides, Cardiac glycosides, Anthraquinone glycosides, Saponins, glycosides, Flavonoids, Alkaloids and Tannins was completed. The extract obtained from the methanol, ethanol and water were utilized for the phytochemical screening.

Qualitative analysis of phytochemical constituents (7)

- **Test for Alkaloids**

Take *Kwatha* in a test tube and add 2-3 drops of Dragendorff's reagent (potassium bismuth iodide solution). The formation of a red precipitate indicates the presence of alkaloids.

- **Test for Tannins**

Take samples of some of this *Kwatha* and add a few drops of ferric chloride solution in it. A greenish-brown precipitate indicates the presence of tannins.

- **Test for Flavonoids**

When the sample is shaken, and adds few drops of Lead acetate solution Appearance of yellow precipitate indicates the presence of flavonoids.

- **Test for Sterols and Triterpenoids**

Kwatha is extracted with 2.5 ml of chloroform using a separating funnel. The chloroform extract is evaporated to dryness in a water bath and dissolved in 3 ml of concentrated sulphuric acid and then heated for 10 min in a water bath. A grey color indicates the presence of terpenoids.

- **Test for Reducing sugar**

Kwatha is mixed with equal parts of Fehling's solution A and B which was added to 5 ml of extract and then heated in a water bath for 5 min. Brick red precipitate shows the presence of reducing sugar.

- **Test for Glycosides**

Dilute sulphuric acid solution is added into the sample. The solution is distilled and filtered out. The filtrate is cooled down, then 2-3 drops of benzene are added. The solution is shaken well, and the organic layer is removed. Upon applying equivalent quantities of ammonia solution to the organic layer, the ammonia layer does not turn purple, suggesting the absence of glycosides in the organic layer.

- **Test for Saponins**

Take all the four extracts separately in test tubes and add some water into them and shake well. If no persistent foam is formed it indicates the absence of Saponins.

Table 1: Test for Phyto-constituents for *Kwatha*

Test for various secondary metabolites	***Kwatha (Dashanga Kwatha, Argwadhadhi Kwatha* and *Gandharvahastadi Kwatha)***
Test for alkaloids: (Dragendroff's test)	+ve
Test for tannins: (5% Ferric chloride test)	+ve
Test for flavonoids: (Lead acetate test)	–ve
Test for steroids and terpenoids: (Salkowaski test)	+ve
Test for Reducing sugars: (Fehling's reagent test)	–ve
Test for glycosides: (Borntrager's test)	+ve
Test for saponins	+ve

TLC and HPTLC

Fingerprints for selected solvent system act as a quality of reference for future research. HPLC is used as one of the standardization techniques as defined in the *Pratishyayghna Kwatha* standardization along with the quantitative estimation of the phytoconstituent and validation of the method. Some modern methods such as Supercritical Fluid Chromatography, Capillary Electrophoresis, LC-MS, can also be used to acquire even more stringent quality profile.(8)

As decoctions are water-soluble extractives, extractive values are used as parameters for standardizing *Kwatha kalpana* in different solvent systems.(9) The standard laboratory sample of *Dashamul kashayam* [DMK] was compared with market samples (obtained under similar conditions) for *Dashamul kashayam* standardization.(10) In addition to physico-chemical analysis, the percentage of DMK samples were compared with a selective state of solvents in the-polarity order and TLC trend for a percentage of extractives on successive extraction of *kashayam*.

According to the observations, it was concluded that for most of the samples there was a gross order of similarity of the values for water soluble material. Low ash value of the sample being marketed may indicate its dilute nature. In order of polarity the extract with successive solvent reflects the groups of chemical constituents of that polarity present in decoction. For laboratory samples, the percentage of extractives are somewhat high (especially for alcohol extract and crude aglycones). Testing many authentic samples from multiple pharmacies and different batches of the same pharmacy as well as standard laboratory samples, can help to set variation levels for appropriate final standards.

Estimation of therapeutic efficacy

Decoction can be a single preparation, as well as polyherbal. TLC fingerprinting is performed for comparative analysis of the phytoconstituents and therapeutic efficacy of *Aragwadhadi Kwatham* and its individual drugs.

Aragwadhadi Kwatham is a compound (5) single drug preparation viz. *Cassia fistula* Linn. *Azadirachta indica A.* Juss, *Tinospora cordifolia* Linn. These are highly effective against skin diseases. Specific decoctions of the three herbs were prepared. A study was conducted to equate individual Phyto-constituents with combined decoction.

As the decoctions were prepared under the same conditions, at the combination of the three products, the chemical constituents present in the individual decoction were absent. In the *Aragwadhadi Kwatha,* the essential constituents present in the individual decoction should be present unless the components have undergone other chemical reactions to form new compounds. Results of the clinical trial have shown that *Aragwadhadi Kwatha* is more effective than decoction of individual drugs. The further therapeutic efficacy of the *Aragwadhadi Kwatham* (5) can be due to the formation of new compounds, because the probability of formation of new compounds cannot be ruled out from preliminary studies themselves.

Microbiological studies

Similar approaches to standardization were used to standardize *Nishakatakadi kashayam* (11) and *Varuna Kwatha churna* (12) along with microbiological studies as part of their standardization approach to test the final formulation microbial load.

Alternative forms of Drug Delivery for Decoction

As clearly mentioned in Part-I, decoction has a very short shelf-life giving rise to stability issues. Another point of consideration from the patient's perspective is the issue of palatability. There is a need to think of such a delivery system that fits the pharmaceutical requirements as well as patients' demand.

The probable modifications include *ghanavati* (tablet), *kashaya sookshma churna* (fine powder), *arishta* (fermented infusion) and syrup. Tablets provide a unit dose with ease of administration, portability and long shelf-life. *Kashaya sookshma churna* can also be stored for a very long time without losing the potency. *Arishta*, a fermented oral liquid dosage form, is palatable due to the presence of sweetening agents and alcohol generated during the fermentation process acts a preservative adding shelf life to the product. Syrup finds application, especially in case of pediatrics. (13) *Ghanakalpana* is one of the modified forms of decoction. The preparation method involves preparation of decoction and then reheating with intermittent stirring until semisolid form is obtained. *Guduchi Ghana,* a secondary form of the *Kwatha* with more water-soluble attributes present in them is prepared and reheated as mentioned above. The semisolid mass obtained thereafter is subjected to the oven at 50˚C until completely dried. After five days the dried mass is scrapped as *Guduchi Ghana* (14).

Other modern approaches used are discussed below:

Pravahi Kwatha

This formulation is a secondary form of decoction prepared with the addition of a fermenting and sweetening agent. Direct references of this formulation, are not available, though *Ayurveda Sara Samgraha* makes a mention of it. A concentrated and fermented form of *Brihatpanchmoola* was prepared. Initially, the decoction of the raw materials was prepared as per the traditional method. This filtered decoction was then used to prepare *Pravahi Kwatha*. The decoction could cool up to 40˚C followed by subsequent addition of jaggery and intermittent stirring to ensure proper mixing. It was then filtered and a solution of Woodfordia fruticosa *L. Kurz* flowers was added and kept in a dark place to permit fermentation. After completion of fermentation, it was again subjected to filtration. Comparative phytochemical analysis of the decoction and the fermented decoction revealed that the former showed presence of alkaloids whereas it was absent in the latter one. The reason cited was the lack of extraction of alkaloids in the alcoholic media. Consequently, the HPTLC studies indicated more extraction of constituents from the decoction and less from the fermented one. (15)

Herbal teas / infusions

This is another elegant approach that can serve as a very fruitful alternative to *Kwatha*. Herbal teas can be available as Filter tea bags or Instant teas. Filter tea bags are bags containing the dried botanical on which boiling water is poured and allowed to steep for 5-10 minutes and finally strained off. They offer a number of advantages as they provide proper proportion of the botanical, and the necessary degree of size reduction helps in the packing of the botanicals in the bag and better extraction. In case of instant teas, steeping and straining is ruled out, it only requires the product to be dissolved in water, providing a rapid and uniform composition. Instant teas can be in the form of spray dried extracts or dry granulated teas differing in their method of preparation. Spray dried teas are prepared by spraying the solution of botanical extractive through a nozzle; the fine droplets produced are subjected to a current of warm air to assist in the loss of their moisture. For Granulated teas, the fluid extract is sprayed onto a carrier material (carbohydrates) and dried. It is then crushed in the mill to obtain granules. Comparatively, granulated teas are inferior as they contain more of filler and less of extractive than the spray dried extract.

Granules

In yet another approach to offer a stable form for the decoction, an attempt was made to develop granules for instant use. *Dashmoola Kwatha* was

prepared and was further boiled till it was semi solid. At this stage, *Dashmoola* fine powder was added with continuous stirring to obtain a uniform mass, which was then sieved to prepare granules. The granules so obtained were dried and packed in heat sealed bags. This is a simple and novel approach for ready-to-use granules. The HPTLC profile of the *Dashmoola kwatha* was comparable to that of *Dashmoola* granules, with 3 common spots or R_f values. (16)

Gel

The importance of natural plant derived products is gaining wider importance. There is a need to provide them in a convenient and stable form. One such attempt was made to prepare a wound healing gel comprising of *Kwatha* of *panchvalkala* and *nimba,* and *swarasa* of *kumari. Pancha Valkala* is the combination of the stem barks of five different plants viz. *Vata* (Ficus bengalensis *Linn*.), *Udumbara* (Ficus glomerata *Roxb*.), *Ashwattha* (Ficus religiosa *Linn*.), *Parisha* (Thespesia populnea L*inn Sol. ex Correa*.), *Plaksha* (Ficus lecor *Buch. Ham*.) *Panchvalkala* and *Nimba Kwatha which* were prepared as per the traditional method. *Kumari* leaves were washed, skinned and the pulp was scrapped and filtered to obtain the *swarasa*. 2% Carbopol was added with continuous trituration to the mortar and pestle containing a mixture of *Panchvalkala* and *Nimba Kwatha. Kumari swarasa* was then added and mixed properly. 5% of the above mixture was used to prepare the solution and 0.2% triethanolamine was used to adjust the pH. The HPTLC profile of the raw materials, in-process samples (*Kwatha* and *swarasa*) was comparable to that of the final product i.e. gel showing similar R_f values. Adoption of some modern dosage forms to the conventional age-old forms of the drug delivery may prove beneficial in certain cases. (17)

Approaches to development of Solid Dosage Form

Liquid dosage forms can face physical (agglomeration or Ostwald ripening) or chemical (hydrolysis) stability issues. Solid dosage forms are considered as a better alternative to liquid dosage forms as the stability issues associated with liquid forms are circumvented. The transformation of solid dosage forms can be achieved by operations such as freeze-drying, spray-drying, pelletization and granulation, of which spray-drying is generally employed. The products obtained after conversion to solid form can either be used as such or converted into another convenient mode of delivery, while preserving the potency of the original form. The powders or granules can be used as such in the form of sachets that can be reconstituted when desired. Alternatively, they can be further processed for compaction into a tablet or filled into capsules. Apart from the pharmaceutical hindrances that are overcome, they also have much to offer for patient acceptability, such as portability, accuracy and convenience.

A key point is that the different dosage forms of the same or similar formulation may have different therapeutic applications. Thus, a formula prepared as a decoction may be used for an "organic" disorder, a powder of the same herbs (made as tea or high dosage pill) may be used for a functional disorder, and a small pill or low dosage form may be used as follow-up (preventing relapse) in a patient successfully treated by the other methods. Thus, the indications for a formula might not apply to all the different forms of its preparation.

Packaging is an important consideration in providing physical and chemical stability. The key attributes for selection of a unit dose or a multiple dose primary pack presentation are dose flexibility, ease and convenience of handling, moisture protection, manufacturability, packing and labeling, transportation and storage.

Spray drying technique

The conversion of milk to milk powder is very similar to converting *Kwatha* into a stable form, as milk powders are far more stable than fresh milk. Spray drying technique finds application here. The process involves atomizing the milk concentrate using highly pressurized nozzles into fine droplets using a drying chamber of the hot air flow. The milk droplets are then evaporated to cool off. Final or secondary drying is an accomplished series of fluidized powder beds onto which hot air is blown. The substance, thus obtained has a humidity content of 2-4%. (18)

In the industry spray drying is commonly used to turn a suspension or solution into a dry powder product. The suspension or solution feed is atomised in the spray drying process and the droplets produced are contacted with a hot gas. The contact between the droplets and the heated gas causes the solvent in the droplets to evaporate, leaving a dry powder product. (19)

It is actually one of the Pharmaceutical industry's most interesting technologies. The process shows remarkable ability to control attributes of the powder / particle such as the size, shape, density and residual solvent volume. This versatility has led to its use in a variety of powder formulations and advanced solid forms: from very fine inhalation powders to large direct compression particles, and from solid dispersions for improved bioavailability to drug safety or managed release microcapsules.

In addition, the technique is often applicable to processing materials that are difficult to crystallize and substances that are sensitive to temperature (the relative short temperature exposure makes it a gentle method that is ideal for handling the most sensitive materials. (20) Furthermore, the method must be tailored with respect to various parameters in order to achieve consistent product quality.

The method strongly depends on the properties of the components, the configuration of the equipment and the operating parameters. In terms of residual moisture, particle size and morphology, these variables affect the final product quality. Atomization pressure, feed flow rate, feed viscosity and surface tension have an effect on the final product quality. The ideal temperature difference between the inlet and outlet is the striking outlet temperature which is also critical in the spray drying process. (21)

Pelletization

The pelletization technologies are currently attracting a great deal of attention as they provide an effective route to the manufacture of a new drug delivery system. These granulated dosage forms have gained considerable popularity since then, due to their distinct advantages It has a significant advantage over the traditional method of dosing. These pelletized dosage forms have since gained considerable popularity due to their distinct advantages, such as ease of capsule filling due to better flow properties of the spherical pellets; enhancement of drug dissolution; ease of coating; continuous, regulated or site-specific delivery of the drug from coated pellets; consistent packaging; even distribution in the GI tract; and less GI discomfort. Pelletized dosage forms can be prepared using a range of techniques, including drug layering on nonpareil sugar or microcrystalline cellulose beads, spray drying, congealing water, extrusion of hot-melt and spheronization of low-melting or extrusion-spheronization of wet material. Pellets have numerous therapeutic as well as technological advantages, such as improved drug absorption due to the participation of large GI surfaces in the absorption cycle, less gastric discomfort due to the restriction of localized accumulation and dose dumping good flow ability due to uniform size and shape, high tensile strength, low friability, small particle size distribution and uniform characteristics of packaging.

Development of Novel Drug Delivery System (NDDS)

Most of the biologically active concentrate, *Kwatha* constituents, such as flavonoids, tannins, and terpenoids, are highly soluble in water, but have low intake because they cannot reach the cell's lipid membrane, have excessive molecular size, or are poorly absorbed, resulting in the loss of bioavailability and efficacy. Due to these barriers certain products are not widely used.

Nanotechnology is the improvement of the system for the conveyance of new medicines since natural drugs integrate a nano portion which helps in improving bio-solubility and bioavailability, toxicity safety, sustained delivery etc.

This modern drug delivery system have site-specific action and a fixed rate, at targeted delivery in a cell or tissue, or often in a cross-section of strong epithelial and endothelial barriers, release of large herbal molecules, co-delivery to two or more drugs and identification of drug delivery sites is possible by combining herbal drugs with imaging methods. Consequently, during the entire treatment cycle, new bearers should convey the dynamic substance particle at an appropriate fixation and guide it towards the specific goal, since conventional medicines do not satisfy such necessities.

Therefore, during the entire treatment period, new carriers should deliver the active chemical molecule at an appropriate concentration and direct it towards the particular target; as traditional treatments do not meet these requirements.

This nano-sized delivery has many benefits for herbal medicines, including increased solubility and bioavailability, toxicity prevention, increased biological activity, improved stability, improved distribution of tissue macrophages, controlled transmission, and physical and chemical degradation safety and improvements, improved cellular uptake, increased levels of dissolution, multifunctional nature, improved pharmacological activity which often hides any bad taste, and controls active absorption and biological reaction, etc.

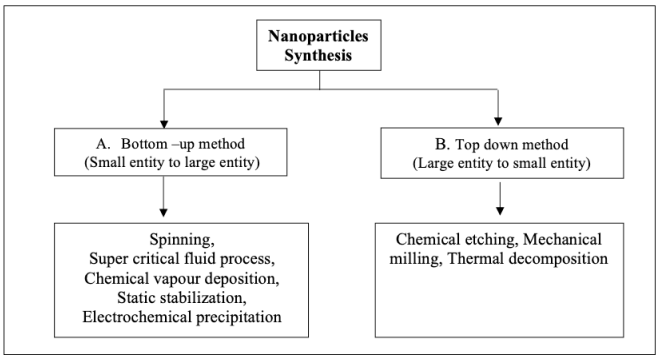
Such constraints can be solved by using materials known as nanomaterials to epitomize or combine them.

Nano-frameworks can provide an adequate emphasis for the dynamic variable across the entire treatment time span, leading to the optimal location of the operation.

Synthesis of nanoparticles

Several chemical and physical methods have been used for the synthesis of nanoparticles. (Figure no 1)

Figure No. 1 Synthesis of nanoparticles



- The classical method (Bottom-up method): The classical method of synthesis of inorganic nanoparticles includes wet-chemical methods. In this method, a chemical reaction is carried out by mixing suitable reagents which lead to a solid phase. Solid particles of 1-2 or less nm are formed. This is known as a nucleation. Through a thermodynamically favored reaction these small crystals grow into larger crystals. The colloidal stability can be due to electrostatic repulsion, or steric stabilization, or both.
- The advanced method (top-down method): The latest researches in nanotechnology are focused on nanosizing herbal extracts and have diversified advantages.

Different methods are used to make nanoparticles by using herbal extracts. The commonly used techniques in the formulation are:

High-pressure homogenization method

In this technique, the lipid is pushed with high pressure (100 to 2000 bar) through a high shear pressure, which results in disturbance of particles down to the sub-micrometer or nanometer extend. High-

weight homogenization strategy is a truly solid and amazing system for the huge scale creation of nanostructured lipid transporters, lipid medication conjugate, SLNs, and parenteral emulsions. (17, 18)

Complex coacervation method

This is an unconstrained stage division procedure of two fluid stages in colloidal frameworks, which results in the cooperation of two oppositely charged polyelectrolytes after blending in a watery solution.

Co-precipitation method

This method is a modification of the complex coacervation strategy for the arrangement of nano-scale center shell particles. This strategy has been accounted for, to give greater scattering solidness to inadequate water-solvent drugs. (18)

Salting-out method

This method is based on the phenomenon that the solubility of a non-electrolyte in water is decreased upon the addition of an electrolyte. (19)

Nano-precipitation method or solvent displacement method

This technique depends on the interfacial statement of a polymer after dislodging of a semi-polar dissolvable miscible with water from a lipophilic arrangement, thus bringing about a decline in the interface pressure between the two stages, which builds the surface territory with an ensuing development of little beads of natural dissolvable even in the absence of mechanical stirring.

Self-assembly methods

Self-gathering is the physical procedure wherein previously scattered segments, iotas, or atoms sort themselves out into direct nano-scale structures by physical or synthetic responses with no commitment from any outer source. (18)

Solvent emulsification–diffusion method

The method involves preparation of an o/w emulsion using oil phase containing polymer and oil in an organic solvent, which is emulsified with the aqueous phase, containing stabilizer, in high shear mixer, followed by addition of water to induce the diffusion of organic solvent, thus resulting in the formation of nanoparticles. (19)

Supercritical fluid methods

This strategy can be utilized to ready sub-micrometer-sized and nano-sized plans. A supercritical liquid (SCFs) can either be a fluid or gas and can be utilized over its thermodynamic basic purpose of temperature and weight. The most normally utilized SCFs are carbon dioxide and water. (20,22)

Outcome

Table 2: Outcome of Standardization: Summary Chart

Parameters	Results	Explanation / Remarks
Specific gravity	Should be more than 1	Denser than water: contains water soluble active constituents
pH	Acidic/Alkaline	Depends upon phytoconstituents of raw material
Total Solid Content	Variation	Varies with method of preparation or extraction process
Total ash	Ash value: More: Presence of inorganic substances	Adulteration / Substitution.
Acid insoluble ash	Presence of inorganic material	Adulteration / Substitution
Extractive values	The extracts with successive solvent in order of polarity: Presence of group of chemical constituents of increasing polarity in *Kashayam.*	Solubility of phytoconstituents in particular solvent refers to its bioavailability
Chromatographic technique	TLC, HPTLC developed with appropriate solvent system and identification of particular phytoconstituents (alkaloids, glycosides etc.) of formulation can be used as a Standard to compare.	Chromatographic fingerprinting of each *Kwatha* formulation can serve as the reference standard for validation of this dosage form.
Microbiological studies	Determination of microbiological load	Susceptibility to microbial growth and deterioration of the product

Discussion

Efforts are made to standardize *Kwatha kalpana* and its general approaches, but certain factors that affect standardization persist.

Standardization of the raw material

The raw material is the key component and thus it is important to define a specific use of the product, whether it is a component of the plant or a whole part of it. Besides this, seasonal and geo-related variations are observed.

Method standardization

Ayurvedic texts have clearly stated the different drug-to-water ratios, no uniformity has been found, in some cases the ratio is said to be based on drug hardness as 1:4, 1:8, 1:16 for mild, medium and hard drugs respectively, if so it needs to be followed in all the cases. Reduction to the optimum amount is another factor that has been found to be different, which again leads to differences, as the degree of reduction is related to the quantity of extractible that is responsible for the therapeutic action. Heat or temperature control is slow, quick, medium and its effect on the final formulation must be calculated. The modern technique of steam jacketed vessels is certainly useful, but serves the function of extraction as used in the traditional method.

Product standardization

A consistent, standardized product can be produced if the raw material and procedure are well defined. There must also be uniformity in the quality of the raw material used, and a standard procedure for *Kwatha* preparation.

This is a difficult process to manufacture powders, the herbs have to be cut into very small parts, dried enough to make them brittle, and then crushed intensively enough to reduce them to a relatively fine powder. In modern times, machine-generated powders are expected to pass through very fine 80-100 mesh screens (such powders almost dissolve in the stomach, and do not merely break up into minute pieces).

Possibly, many of the ancient powders could not pass a 30-mesh panel. However, when the amount of natural materials is decreased in this manner, there are other drawbacks, such as having acceptable quantities of trace minerals from the herbs. This needs to be considered when determining which formulations to use in a lower type of dosage powder and what conditions they should treat. When it comes to herbs, the shelf-life is reduced extensively when herbs are powdered. In the method of powdering leaves much more surface area is exposed to dust, humidity and light. Powdered herbs must therefore be stored in tightly sealed, opaque containers, ideally in temperature- if they are to be held for a prolonged period. Making a tablet or pill eases this issue by eliminating the possibility of the exposed surface again; the encapsulation partially eliminates the issue depending on how firmly the substance is packed into the capsules.

Conclusion

Kwatha is a highly regarded ayurvedic preparation due to its quicker absorption and faster therapeutic action. *Kwatha* standardization was conducted using Pharmacognostic (organoleptic, microscopic, and macroscopic) and analytical methods. The qualitative attributes are described using the physicochemical parameters and their limits. Nevertheless, as discussed above, to bring the highest value to this preparation several parts need to be improved from the pharmaceutical and standardization perspectives.

Using nanotechnology standards, different portion related antagonistic effects can be prevented as there is a choice to decrease the proportion of drug that ought to be stacked. This will moreover help the growing strength and safety issues related to *Kwatha* in addition to build bioavailability and stability. It will similarly reduce the quantity of the product.

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