



The Scientific Basis of Traditional Extraction Techniques Employed in Ayurvedic Pharmaceuticals

Author: Priya Darshani Koul¹,

Co Authors: Yadavendra Yadav², Usha Sharma³, Shuchi Mitra⁴, and Khem Chand Sharma⁵

¹⁻⁵P.G. Dept. of Rasa Shastra & Bhaishajya Kalpana, Rishikul Campus UAU, Haridwar (Uttarakhand) India

ABSTRACT

Bhaishajya Kalpana is the branch of Ayurvedic medicine that deals with the collection, selection, purification of drugs, study of their nature and combination as well as preparation, preservation and posology. Ancient extraction techniques had been in practice under this branch. Herbs show pharmacological action by means of their active ingredients. Depending upon the type of active constituent of the drug, different extraction techniques are being used. With the evolution of *Panchvidha Kashaya Kalpana* in *Samhita kala*, the extraction of crude drugs came into light. In modern pharmaceutical science, there are many advanced and refined techniques for the extraction of active ingredient(s)/principle of a drug. And various researches are being done to extract the active ingredient(s) of a drug to increase its potency and decrease its dose. Although new extraction technologies are on the rise, having both advantages and limitations, conventional extraction methods have their own edge. The present paper is aimed to focus on the chemistry of these conventional methods.

Key Words: *Bhaishajya Kalpana, Panchvid kashaya Kalpana, Arka, Fermentation*

INTRODUCTION

In Ayurveda, mainly four factors are responsible for the success of *Chikitsa*, which are known as *Chikitsa Chatushpada*. *Dravya* is one of the important components of this *Chatushpada* (Pt.Kashinath et (al) 2013). While discussing the properties of *Dravya*, *Acharya Vagbhatta* has said that the *Dravya* should have the ability to formulate in multiple forms like *Kwath*, *Churna*, *Taila* etc(Dr.Brahmanand Tripathi et (al). Five fundamental preparations are mentioned in *Sharanghdar Samhita* viz. *Swarasa*, *Kalka*, *Kwath*,

Hima and *Phaant*, the rest of all preparations are derived from these basic formulations(Pandurang jawaji, 1993). *Dravya* shows pharmacological action employing their active ingredients. The quantity of active ingredients in these herbs is always relatively low. Extraction is the process of separating medicinally active constituents of a plant or animal tissues from the inert or inactive components by using selective solvents in standard extraction procedures(Sukhdev swami handa et (al). The purpose of standardized extraction procedures is to attain the



therapeutically desired portion and to remove the inert substance by treatment with a selective solvent known as the menstruum.

Kwath Kalpana (Decoction): *Kwath* is the filtered decoction obtained by boiling coarse powder of drug in the proportion of 4 and 8 times for *Mridu and Madhyama Dravyas* respectively of water and reduced to one-fourth and 16 times of water for *Kathina Dravyas* and reduced to one eighth (API). The aim of preparing the *Kwath* is to extract very systematically the active principles from the raw drugs. When heated with water, two types of changes take place in the raw drug components i.e. hydrolytic and pyrolytic changes. The change made by hydrolysis comprises the conversion of esters into alcohols and acids, rearrangement in the chemical structure of the components, removal of the volatile components with steam, better dispersion in the water, imbibition of the starchy materials, isomerization, decomposition of the proteins into peptides and structural modification in the active principles like chlorophylls, carotenes, vitamins etc. Each chemical transformation is directly influenced by temperature/ duration of heating/water/alkaline & acidic materials etc. isomerization, decomposition, polymerization, etc can take place depending upon the nature of heating (DR G.S Kumar). The diffusion of water and hydrogen ions into the source herbal materials also takes place. It shows Sterilizing action by eliminating common contaminating organisms, thus preventing unwanted growth at the expense of beneficial organisms (Dileep Singh Bhagel 2006).

Hima: It is prepared by putting one part of the drug in 6 parts of cold water and kept overnight in an earthen pot. The next day the drug is then macerated and filtered through a clean cloth (Sharanghdar Acharya, 1931). It is also called as cold infusion. Infusion is a method employed to extract the active principles from soft natured drugs having water-soluble active constituents¹. If the drug contains volatile and thermolabile content, extraction methods like *Hima* are preferred. These drugs may lose active principles by heating; hence for such types of drugs, *Hima Kalpana* helps in collecting the active ingredient in cold infusion form (Dr. Prasad Krishna Padekar).

Water is used as the extracting media for *Hima*, while in the modern pharmacy, different chemicals are employed during the maceration and percolation process. Thereby in *Hima*, only the water-soluble plant principles could be extracted. Whereas in macerating and percolation different plant principles soluble in the respective solvent are extracted (Dr. Shobhah Hiremath).

Phaant (Hot Infusion): To prepare phaant one part coarse powder of a drug is put into four parts of hot water. After it cools down to the environmental temperature, it should be rubbed with hands and filtered using a clean cloth (Sharanghdar Acharya Pandu Jawaji, 1931). By this softening of the drugs takes place as the extraction of all the volatile principles from the drug to water. *Phaant* is considered to be the least potent, among the *Panchavidha Kashaya Kalpanas*. *Phaant* is the hot infusion of those



herbs, which are proposed to be used for *Kapha* and *Vata Dosa*(Dr Kavita (et) al).

Those plants that requires low-grade temperature for extraction of water-soluble ingredients and are likely to be sensitive to high temperature in that case *Phaant* is prepared(Savrikar, S.S (et) al).

Asava/Arishta: *Sandhana Kalpana*' is a unique form in which acidic and alcoholic fermented formulations are prepared(Acarya Shri Yadava Ji Trikamji,2002). *Asavas* and *Arishtas* are medicinal formulations made by soaking the drugs, either in the form of coarse powder or in form of decoction, in a solution of sugar or jaggery, and is kept for a specific period of time, during which it undergoes a process of fermentation producing alcohol, thus aiding the extraction of the active principles contained in the drugs. The alcohol, so formed, also acts as a preservative(AFI). In *Arishta* preparations, the alcohol produced during the process of fermentation gradually but steadily extracts the active constituents from the powdered drug. Enough time is available for the concentration of the active principles in the solution, as the duration of fermentation is too long. The drugs should have the required level of fineness so that an alcoholic solvent can penetrate the cells breaking and opening the cellular membranes to extract the active principles.

(i) Fermentation eliminates most of the undesirable sugars from plant material, making the product more bio-available and removing side effects such as gas and bloating.

(ii) A wide range of active ingredients from the herb are extracted than any other method, since the menstruum undergoes a gradient of increasing alcohol levels during fermentation.

(iii) Yeast act as a natural cleansing system because its cell wall naturally bind heavy metals and pesticide residues (Chaudhary A. Singh (et) al)

(iv) Fermentation not only eliminates impurities but also lowers the toxicity of some of the toxic components in plants.

(v) Fermentation ruptures the cells of the herbs, exposing them to the solvent, and bacterial enzymes break down cell walls to further assist in the leaching process. Fermentation also creates an active transport system that moves the dissolved contents from the herbal material to the solvent system.

(vi) In a comparative phytochemical study between Arjun-arishta and its decoction, it was seen that the amount of gallic acid and ellagic acid increased substantially during the fermentation, which can be ascribed to possible hydrolysis of ellagitannins and gallotannins during fermentation. Additional peaks for ethyl gallate and two flavonoids, quercetin and kaempferol, were identified in the formulation. Ethyl gallate that are enhanced in final processed formulation exhibit high antioxidant activity. The flavonoids (4-oxoflavonoids), quercetin and kaempferol, which are introduced into the formulation during fermentation, are known to show membrane stabilizing properties(Tanaka T (et) al), (Mullen W (et) al), vasodilation capacity (by inhibiting



protein kinase C)(Takao K (et) al) and are found to prevent deposition of low-density lipoproteins which are the major cause of atherosclerosis (Nakagawa K (et) al).

Sneha Kalpana: It is a process to produce an oleaginous medicament from the substances such as *Kalka*, *Kwatha*, and *Drava Dravyas*, in a specific amount by subjecting them to a specified heating pattern and duration. By this process, one can ensure the transformation of the active therapeutic properties of the ingredients to the solvents, and hence, one can recover fat-soluble as well as water-soluble chemical constituent simultaneously(Karande MN (et) al).

The Sneha, which is basically a glyceride of fatty acid, interacts with the *Drava* and will form fatty acid. This fatty acid will interact with *Kalka*. Water-soluble part of the *Kalka* gets attached to the hydrophilic end and fatty acid along with the soluble oil part attaches to the hydrophobic end leading to micelles formation.

The driving force for micelles formation is hydrophobic since the oil end cannot break the hydrogen bonds of the water molecules and, as a result, cluster together in close proximity. The continuous agitation and heating during *Sneha Paka* enhance the extraction process by weakening the bonds, thereby isolating the hydrophobic substance from hydrophilic. This hydrophobic matter will act as a surface-active agent that gets solubilized in fatty material after evaporation of water. Hence due to micelle formation, the finished Sneha may contain both oil

and water-soluble active principles(Amees S Amrutia (et) al).

The plant oils do have tocopherols, carotenoids, etc as antioxidants for preservation. Polyunsaturated fatty acid content in the sesame oil is very high and is commonly used for the *Taila* preparations. Also, it contains sesamol, sesamine etc which act as antioxidants for the protection of the oil preparations. Ghee doesn't have much antioxidants by itself(Dileep Singh Bhagel 2006).

Ksheerpaka Kalpana: According to Acharya Sharangadhara, *Ksheerapaka* (medicated milk) is prepared with one part of the prescribed drug, eight parts of milk and 32 parts of water (1:8:32). The mixture is heated on moderate heat and boiled till only the milk part remains in the vessel(Vd Gangadhar Shastri). Milk reduces *Ushna*, *Tikshna* properties of the drug and improves efficacy and specific target actions of drugs. Medicinal herbs which are used for *Ksheerapaka* contain various alkaloids, phytochemicals, fatty acids, vitamins and minerals. Milk act as a carrier that delivers such phytochemicals to targeted cells. *Ksheerapaka Kalpana* is mostly useful for aged people and children as they can easily take such a dosage form and it also provides nourishment(Dr. Pooja V. Shaha (et) al). Interaction among the biomolecules of milk and bioactive compounds in herbs occurs during the preparation of *Ksheerpaka Kalpana* due to heat(Dr. Kavita (et) al).

Arka Kalpana: The process by which the volatile active principles of the volatile oil containing drugs are collected after separation and cooling up to a congealing point is called *Arka Kalpana* and



the compound prepared through this procedure is called as *Arka*. It is a liquid formulation obtained by hydro-distillation of certain drugs soaked in water using *Arka Yantra*, *Bhabhka* or any distillation apparatus. *Arka* is a distilled essence in a medium of water, which contains the volatile constituents of the drugs used in its preparation. It can be compared to distillation.

Two processes take place in distillation i.e., evaporation and condensation

A. Evaporation: The Kinetic theory of matter supports us in understanding how evaporation takes place at any temperature and from the surface of a liquid only. Evaporation may be explained as the free escape of vapor from the surface of a liquid.

B. Condensation: it is the reverse process of vaporization or evaporation. It will be recalled in order that 1gm of water at 100o c may be transformed into water vapor (at 1 atmospheric pressure) of a similar temperature, the expenditure of 537 calories of heat energy is required. Accordingly, when water vapor is condensed by cooling, same amount of heat i.e. the latent heat of vaporization, is generated. Unless adequate mode is made to carry away the thermal energy is released, the condenser soon becomes too hot to condense the vapors and permits it to escape into the atmosphere(Dr.Ravindra Angadi,2011).

DISCUSSION

Ethnobotanical and Herbal Ayurvedic preparations for medicinal usage contain various types of bioactive compounds. Extraction is the

isolation of active principles of a drug for target and disease-specific use. A drug may provide different phytoconstituents from different extraction techniques. Thus, it can be seen that the modification of the extraction technique can affect the desired result in the patient. This makes the proper assessment of the extraction technique of a drug a prime factor in treating diseases.

Ayurveda acharyas were aware of this concept and has explained it beautifully in various contexts. In the context of *Pippali Rasayana*, Acharya has advised to use *Pippali* in *Kalka* form in *Balavan*, in *Kwatha* form in *Madya Bala* and as *churna* form in *Heena Bala*(Vagabhatta Acharya,1939). Thus, it depends on the *Yukti* of the physician to use the suitable form of extraction to the most suitable patient and disease. The different *Kalpanas*, on detailed inspection, unfolds before us a much broader concept and possibilities than just different extraction techniques. Critical analysis of each formulation is essential for the target and disease-specific results in patients.

Extraction is the first key step in the preparation of herbal medicine and modern medicine. The ancient extraction methodologies used in the separation of active ingredients of the single and poly-herbal medicine of classical and proprietary preparations are used in Ayurvedic preparations are still valuable due to its convenient and economic reason. Advancement extraction and isolation techniques are mere modernization of traditional methods.

CONCLUSION



The extraction of crude drugs progressed from *Panchvidha Kashaya Kalpana* in Samhita Kala. Depending upon the nature of the active constituents of a drug, different extraction techniques are employed. For water-soluble extracts, *Kwath* is prepared. *Ksheerpaka* and *Sneha Kalpana* are prepared to get both the fat soluble and water-soluble active principles. In order to extract the volatile content of a drug *Arka*, *Hima and Phaant Kalpana* are prepared.



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