Review Article

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HYPOTHETICAL APPROACH ON EXTRACTION PROCESSES IN AYURVEDA: A COMPREHENSIVE REVIEW

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ABSTRACT

Extraction is the first and foremost step towards the preparation of any herbal formulation and plant-based medicines are being used from the Stone Age to date for alleviation and mitigation from various ailments. In Ayurvedic therapeutics under the roof of Bhaishajya Kalpana extraction techniques have been employed since time immemorial. In the present scenario Extraction of herbal drugs is recognized by modern science due to its huge therapeutic utility in a number of disorders and the field of cosmetics and so many techniques have been invented and developed to separate extracts from plant materials. In Ayurveda, various Kalpanas were offered by our acharyas to extract out the active principle of herbs or plant materials in the form of medicines e.g. kwatha, hima, Phanta, ksheera paka, Sandhana, and Sneha Kalpana, etc. The present paper aims to highlight the significance of ancient extraction techniques so that the basic concept behind these formulations is understood, explaining their possible correlations with modern pharmaceutics alongside.

Keywords: Ayurveda, Bhaishajya Kalpana, Extraction, Kalpana, Extraction techniques.

INTRODUCTION

Since the beginning of human civilization mankind has always searched for getting the best of their resources, this led to various inventions in different fields of science. In ancient medical science (Ayurveda) to combat diseases our acharyas also have invented various ways of extracting the active part of medicines for better outcomes of drug keeping the active principle intact during the procedure. Not all the herbs are the same by the virtue of their active components therefore; our great intellects used different methods of extraction for drugs, keeping their pancha Mahabhautika Sangathan, absorption, strength, palatability, and shelf life in concern. In Vedic kala traces of extraction techniques are not found as such, though the usage of Sura, Madya and Somarasa etc. were quite prevalent back in time. The extraction of raw drugs became popular since the advent of Panchavidha kashaya kalpana (five basic formulations) in Samhita kala, Swarasa, Kalka, kwatha, hima and Phanta are the five primary dosage forms, secondary dosage forms were later developed by using different heating pattern for extraction of pharmacologically active ingredients. Administration of these dosage forms chiefly depends on bala (strength) of vyadhi (disease) and Atura (patient).[1] Acharyas have mentioned pancha Kashaya yoni as sources of five basic formulations namely-

1. Madhura Kashaya
2. Amla Kashaya
3. Katu Kashaya
4. Tikta Kashaya
5. Kashaya Kashaya

Among the Shad Rasas (Madhura, Amla, Lavana, Katu, Tikta, Kashaya) except lavana rasa all five Rasas are included in the pancha Kashaya yoni because in kashaya kalpana water is used as media and the main objective here is to extract the active principles (evidently water-soluble) into the water by heating or without heating, by doing so, sara bhaga (active principle) of dravya will be dissolved in menstruum (water) and kitta bhaga (marc) is thrown out after filtration. By this method, from lavana, it is not possible to extract active principles into water media as lavana gets completely dissolved into water forming a homogenous solution hence it is not possible to separate marc and menstruum in this case, therefore lavana is not included in Panchavidha kashaya yoni.

The word Kashaya is attributed with different meanings but in the context of Bhaishajya kalpana it means to scrape, to rub, to injure, or to kill. “Kasha himsa karoti iti kashaya” means that which irritates the throat is ‘kashaya’ and Kashaya Kalpana here is what irritates the disease and drive them away from the body, in other words - which prevents the body from destruction is Kashaya Kalpana. Well, there are quite dissimilarities in the opinions of acharyas regarding the Kashaya Kalpana. Arka Prakash mentions Kalka, churna, rasa, taila, arka as five basic formulations. Acharya Sharangadhara enlisted Panchavidha Kashaya Kalpana as- Swarasa Kalka, kwatha, Hima, Phanta. According to Acharya Sushruta- ksheera, Swarasa, Kalka, Srita, Sheeta, Phanta are six Kashaya Kalpanas. There are seven (Saptavidha) Kashaya Kalpanas according to acharya Kashyapa wiz. Churna, sheeta, Swarasa, Abhishava, Phanta, Kalka, Kwatha.[2]

In modern pharmaceutics, extraction is performed using several solvents like water alcohol, ether, acetone, chloroform, benzene, toluene, etc. Water is a universal solvent; it has wide solvent action, non-toxic, non-inflammable, and easily available. For the extraction of herbs, water is the most commonly used solvent in Ayurvedic pharmaceutics, in some cases ksheera (milk), Sneha (fat), and alcohol are also used.

In modern pharmacology, the preparations prepared by the process of extraction get the general term as galenical. It is named so after Galen- Greek physician. These medicinal preparations comprise of herbal and vegetable matter using a suitable solvent.[3]

'Extraction' may be defined as the treatment of the plant or animal tissues with specific solvents, whereby the medicinally active constituents are dissolved and most of the inert matter remains undissolved. The solvent used for extraction is known as 'menstruum' and the inert insoluble material that remains after extraction is called 'marc'. The various processes used for extraction are:

1. Infusion
2. Maceration
3. Percolation
4. Decoction
5. Digestion

Infusion
Infusion consists of pouring water over the drugs and then allowing it to keep in contact with water for the stated period, usually 15 minutes, with occasional stirring and finally filtering off the liquid.

Decoction
In this process water is used as menstruum and the drug is boiled with water for a stated period usually 10-15 minutes. After boiling, the liquid is strained, and more water is passed through the marc to produce the required volume.

Maceration
In this process, the drug is placed with the whole of the menstruum in a closed vessel for seven days. During this period shaking is done occasionally. After seven days, the liquid is strained, and marc is pressed. The expressed liquid is mixed with strained liquid. It is then filtered to make a clear liquid e.g. tinctures are made by this process.

Percolation
Percolation is another procedure to extract the active principle from the drugs used in the preparation of tinctures and liquid extracts. Here the suitably comminuted drugs are moistened with a sufficient quantity of menstruum which is then packed in a percolator. The drug is allowed to remain in contact with the menstruum for 24 hours. The required volume is collected, marc is pressed, and expressed liquid is added to the percolate e.g. tincture of belladonna, ginger etc. is prepared by this process.

Digestion

In the process digestion, the drug is extracted by heating at a particular pressure. This will increase the penetration power of the menstruum so that there is complete extraction of the drug. The apparatus used is known as "digestor" for the extraction of a drug by this method.

The various preparations obtained via the process of extraction include decoction, cold and hot infusions, spirits, elixirs, tinctures, extracts, etc. all these preparations are commonly known as 'Galenicals'[4]

The present paper aims to discuss the ancient methods of extraction, their properties, significance, rationality, therapeutic value, shelf life, alongside their modern equivalents for a better understanding of the concept.

Swarasa (Expressed juice)

'Rasa' or 'Swarasa' is something that is obtained from herbal ingredients (fresh and free from insects) are crushed and obtained matter is then expressed through a fine cotton cloth. Swarasa Kalpana has been included in Brihattrayi classics. It has been considered as the guru or highly concentrated than the other four Kalpanas. This is why it has been placed in the first place.

In modern pharmaceutical science, it is known as 'expressed juice'. The expression is the process in which the liquid is separated from the solid by force, this juice may be plant juice, fruit juice, and the oils separated from seeds, nuts, and other oil-containing materials.[5]

Kwatha (Decoction)

Kwatha sits at the third position in the sequence if Panchavidha Kashaya Kalpana, Term Kwatha is derived from the root term 'kwathana' which means 'process of boiling'.

When the coarse powder of the drug is boiled with an adequate amount of water and water is reduced to quarter of the original amount then obtained liquid is called decoction or kwatha.[6]

Quantity of water depending on nature of drug

- If the drug is soft (Mridu) then water is taken is 4 times than drug.
- If drug is of medium consistency (Madhyam) then water is taken 8 times than the drug.
- If a drug is of hard (Kathina) nature then water is kept 16 times than drug.

Whether the drugs are in dry or fresh state, the decoction is prepared by the same method i.e. adding water and boiling it to reduce to one- fourth.

Kwatha or decoction is among the most prevalently used in Ayurveda along with powder (Churnas).

The modern concept of kwatha (Decoction)

A decoction is the process in which the water-soluble and thermostable constituents of hard woody crude drugs are extracted out. In this process, the drug is boiled with water for a stated period usually 10-15 minutes. After boiling, the liquid is strained, and water is passed through the content of the strainer to make the required volume. A freshly prepared decoction is should be consumed within 24 hours.[7]

Hima Kalpana (Cold infusion)

It is included in Panchavidha kashaya Kalpana and occupies fourth place, it is less guru than the former three Kalpanas (preparations). Hima Kalpana is a liquid preparation where the selected drug in coarse powder form is soaked in water (six times) and kept overnight to facilitate the transfer of water-soluble active principles from the drug into the liquid media and the obtained

liquid is filtered and used as hima kalpana. These preparations usually possess sheeta virya and mridu guna here the drugs with Madhura, amla rasa, and the drugs with volatile principles are preferred. These preparations in general mitigate pitta dosha (pitta shamaka) and are cardiotonic (Hridya) and satisfying (Sadhya Santarpana).[8]

Phanta Kalpana (Hot infusion)

Phanta Kalpana is the last preparation included in the Panchavidha kashaya Kalpana, it is a liquid preparation where the selected drugs in coarse powder form are soaked in hot water (four times), after some time it is rubbed and strained. The liquid so obtained is Phanta which is also known as churna Drava.

This process is performed on drugs that are light in structure and free from dense tissues. Their virya (active principles) might not be thermostable therefore giving high temperature or boiling is avoided.

The line of difference between hima kalpana and Phanta kalpana is thin, in hima cold water is used whereas in Phanta hot water. In hima the drug is soaked overnight but in Phanta it is soaked until the hot water cools down.[9]

Modern concept of hima/Phanta Kalpana (Infusion)

Hima and Phanta are co-related with cold and hot infusions respectively, an infusion consists of pouring water over the drugs and then allowing it to keep in contact with water for the stated period, usually 15 minutes, with occasional stirring and finally filtering off the liquid. The marc is not pressed. The boiling water is commonly used as a solvent since it has a greater solvent action than water. The temperature of hot water poured into the drug helps in better extraction of the principles into liquid media (hot infusion). However, the use of drugs with volatile principles may not be a suitable choice here. Thus, cold water is used for such medicines and the preparation is known as a cold infusion. Special pots known as 'infusion pots' are used to prepare infusions.[10]

Sandhana kalpana (Fermentative procedures)

'Sandhana' the term itself means the 'union' or 'combination'. Here medicines are combined and are allowed to be in the same state for a specific period. Sandhana Kalpana or fermentative procedures are classified into two main categories wiz. Madya preparation (Alcoholic fermentation) and Sukta preparation (acidic fermentation)

In madya preparation Asava, Arista, Sura, Sidu, etc. are included and in Sukta preparations Sauviraka, Kanji, Tushodaka, Dhanyamla etc. are included. Madya group of preparations (alcoholic liquors) are those in which alcohol is produced and Sukta group of preparations (acidic liquids) are those which are prepared by the fermentation process and are acidic in nature. Generally, Madyas are claimed to possess five Rasas but Sukta group of preparations contains only amla rasa.

Sandhana is the process of fermentation where the 'Dravadraya' (kwatha, Swarasa or any other liquid preparation), Madhura dravya (jaggery, honey or sugar), 'Prakshepa dravya' (fine powders of medicinal drugs), and 'Sandhana dravya' (Dhataki Pushpa, Madhuka Pushpa as fermentation initiators) are put together in an inert vessel (mud pot) and sealed for a specific period of time to facilitate the process of fermentation. Asava and arishta are the two major products of this process.[12]

All the preparations resulting from 'fermentation procedure' come under the heading Sandhana Kalpana. These are also called spirituous liquids. Usually, herbal medicines lose their potency after some time; hence ancient scholars propounded this Kalpana to preserve the medicinal drugs for a prolonged duration in alcoholic and acidic media.

This fermentation process facilitates the chemical and biochemical reactions with breakage and reunion of bonds in the preparation to form a new compound.[11]

Significance of fermentative preparations

This Kalpana contains self-generated alcohol, thus facilitating the extraction of the active principle of herbs into the liquid media. Water and alcohol soluble extractives are easily extracted through this extraction process. The alcohol so generated, also serves as a preservative for the formulae. It is a process that is mediated by microbes; they enhance the therapeutic properties of the preparation, which may be due to microbial biotransformation of the initial ingredients. These preparations on account of their very long shelf life, quick absorption properties are considered highly effective in therapeutic uses.[13]

Sneha kalpana (Medicated oil /ghee)

Sneha kalpana can be defined as "A pharmaceutical process to prepare oleaginous medicament by the combination of Kalka, kwatha and other dravya in specific proportion by subjecting to a unique heating pattern and duration to fulfill certain pharmaceutical parameters according to the needs of therapeutics." The process ensures that active principles of Kalka and kwatha dravya are easily extracted out in water-soluble media i.e. kwatha and rest through fat-soluble media (Sneha dravya).[14]

Advantages of Sneha Kalpana

Sneha kalpana is considered to be superior to other Kalpanas due to their advantages like increased absorption, bioavailability and extraction of fat-soluble as well as water-soluble active principals at the same time in a single formulation. It also has added benefits like increased palatability, provides strength and unction to the body when used externally. Fats like ghrita is rich in antioxidants like beta-carotene and vitamin-E and sesame contains large quantities of essential polyunsaturated fatty acids (PUFA), linoleic acid in the form of triglycerides, the anti-neoplastic properties of many PUFAs such as linoleic acid and their metabolites are known.[15,16]

Arka kalpana (Distilled formulations)

Arka is a unique preparation in which essential oils from herbal drugs are extracted through the distillation method using special equipment called Arka Yantra. Arka is a highly potent herbal medicine because of its lightness (laghu guna) in nature hence its action is really fast and gets absorbed easily in the body. The only historical reference book available for all arka preparations is 'Arka Prakasha' written by 'Ravana' whose period and identity is vaguely known.[17]

General method of arka preparation

The drug is coarsely powdered if dry and crushed if wet, soaked into a sufficient quantity of water for 2 to 4 hours.

The well-soaked drug is transferred to the distillation apparatus and 10 parts of water is added to it. The mixture is continuously heated till 60% of the distillate is collected. After cooling, the

distillate (collected arka) is preserved in airtight containers as arka.[18]

Arka characteristics

Volatile active constituents of a medicinal drug are extracted in a medium of water through this process (kalpana). Arka is prepared by a process of distillation of water-soaked-raw drugs. The volatile principles which are evolved admixed with water vapor are condensed and taken. A good arka must be clear and transparent and possess the odor and taste of the ingredients.[19]

Distillation

Traditional Arka can be compared to the distillation of modern science. Distillation is a process of separating the components from a liquid mixture by using selective boiling and condensation.

In the process of distillation, the condenser is mounted on the neck of the flask containing the material to be treated. As vaporization occurs, the vapor enters the condenser; the pressure of the vapor causes the distillate to spurt out from it. At the same time, a certain amount of back pressure is produced by the presence of liquid retained in the condenser and this interrupts the smooth process of distillation.

Ksheera paka (Milk decoction)

Ksheera paka is one of the unique preparations of Ayurvedic pharmaceutics. Here milk is used as a medium for the formulation because milk is an emulsion, having the capability to dissolve mainly water-soluble, protein soluble and fat-soluble ingredients, from the drugs used for Ksheera paka preparation. Besides this, milk also has antacid activity due to its alkalinity. Because of the more dietic value of milk, it is used as a dietic regimen as well as medicine. Because of its palatability, it can be used easily for therapeutic purposes. Because of the alkalinity of milk and its antidote activity ksheera paka can be used in wide range of disorders. Usually, Kashaya rasa dravyas are used for the preparation of ksheera paka e.g. Arjuna ksheera paka. The reason is, because of the irritability of Kashaya rasa, acceptance of these drugs in raw form is less. Therefore, ancient scholars took a step forward to make the administration of these drugs easier by formulating ksheera paka kalpana.[20]

Rationality

Medicinal herbs which are used for Ksheera paka contains various alkaloids, phytochemicals, fatty acids, vitamins, and minerals. Milk acts as a carrier that delivers such phytochemicals to targeted cells. Ksheera paka Kalpana is mostly useful for geriatric and paediatric cases as they can easily take such a dosage form and it also provides nourishment.

DISCUSSION

The extraction of a soluble constituent from a solid through a solvent is commonly known as ‘leaching’, but the general term ‘extraction’ is most frequently used in pharmaceutical practice. The extraction of active constituents holds a great concern in the traditional system of medicine because it is necessary to extract the desired chemical components from the plant material for better results due to the rapid action of active constituents rather than crude form. Extraction is affected by various factors such as the character of the drug, nature of the solvent, stability, and solubility of the drug, etc. In ancient pharmaceutics, Panchavidha kashaya Kalpanas were the basic extraction procedures introduced by our great ancestors among which Kwatha is the most prevalent and common method of extraction to date due to its easy method of preparation and readily available solvent i.e. water. Hima, Phanta (hot and cold infusions) are used for substances that have a higher affinity towards the water and quickly shed active principles into the solvent which as a result is less time-consuming. Arkas are distilled essences, which contain volatile constituents of the drugs used in the preparation, in a medium of water and they are equivalent to the 'aquae’ or ‘waters’ of western pharmacopeia. Stability of Arka is comparatively more than Swarasa, Kalka, Kwatha, Hima, Phanta, Churna, etc. and it also owns good palatability and attractive colour, thus its acceptance is more as compared to other formulations. In ksheera paka, milk is used as medium for the formulation. Because milk is an emulsion having the ability to dissolve mainly water-soluble, protein soluble and fat-soluble ingredients to some extent from the drugs, besides milk also possesses antacid activity due to its alkalinity and has dietic utility as well as medicinal properties.

Asava arista (Sandhana Kalpana) preparations have occupied a unique place amongst all other Kalpanas mentioned in Ayurveda. This Kalpana said by acharyas is solely dedicated to the separation of the alcohol and water-soluble extracts from the plant materials. These preparations are more recognized and appreciated because of their quick action, high preserving qualities. These preparations on account of their very long shelf-life, quick absorption properties are considered highly effective in therapeutic uses.

Sneha Kalpana is where the Sneha wiz. fat or fatty material used as a base for the preparation of medicaments fat-soluble active components are separated via this technique. It is the only Kalpana that is used for external (abhyanga, Shiro basti, shirodhara etc.) as well as internal application (nasya, basti, Pana, Bhojana) hence it possesses great importance in the treatment of numerous disorders especially those originated from vata-pitta. It also nourishes the body and provides strength and unction.

According to the details of extraction presented here above, various solvents used in Ayurvedic preparations are as follows:

S. No.	Kalpana	Menstruum
1.	Decoction	Water
2.	Hima	Water
3	Phanta	Water
4.	Sneha Kalpana	Fatty materials (ghrita/taila) etc.
5.	Madya kalpana	Water (Alcohol)
6.	Arka	Water
7.	Ksheera paka	Milk + Water
8.	Shukta	Water (acidic)

CONCLUSION

Extraction is a modern concept though it is important to note that greater minds of our science have developed many extraction procedures to separate active principles using a number of solvents (water, milk, fat, alcohol). Extraction depends on various factors like the nature of the drug, solubility into the media, the hardness of the drug, temperature, etc. keeping these in mind acharyas have developed different Kalpanas so as to achieve better extraction of phytochemicals.

REFERENCES

1. Satya Narayana Shastri, Charaka Samhita Vidyotini Teeka, Vol.-1, Chaukhambha Bharati Academy Varanasi, chapter-4, verse no. 7; 2013. p. 69.
2. Dr. Ravindrda Angadi. A textbook of Bhaishajya kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, Chapter-5; 2016. p. 60.
3. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter-10; 2016. p. 83.
4. Vidya Sagar Parshuram Shastri, Sharangadhar Samhita, Madhyam Khanda, Chaukhambha Orientalia Varanasi, chapter 1 verse no. 1. p. 137.
5. Ashok K. Gupta/S.S. Bajaj, Introduction to pharmaceutics- 1, 3rd edition, CBS publishers and Distributers, chapter-9; 2000. p. 145.
6. Devendra Joshi/Geeta Joshi, Introduction to Ayurvedic Pharmaceutics, Chaukhambha Orientalia Varanasi, chapter 4; 2014. p. 51.
7. Ashok K. Gupta/S.S. Bajaj, Introduction to pharmaceutics- 1, 3rd edition, CBS publishers and Distributers, chapter-9; 2000. p. 149.
8. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter-9; 2016. p. 78.
9. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter-10; 2016. p. 81.
10. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter-10; 2016. p. 84.
11. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter 30; 2016. p. 287.
12. K.R.C Reddy, Bhaishajya Kalpana Vigyana, Chaukhambha Sanskrit Bhavan, Part-B chapter-2; 2008. p. 353.
13. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter 30; 2016. p. 288.
14. Thesis on "Pharmaceutical, analytical and antimicrobial study of Sindooradi taila (Maha) taila." by Ritendra Dohary, Madhya Pradesh medical science university Jabalpur (M.P); 2016.
15. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, chapter 29; 2016. p. 250.
16. K.R.C Reddy, Bhaishajya Kalpana Vigyana, Chaukhambha Sanskrit Bhavan, Part-B Sneha Kalpana; 2008. p. 320, 325.
17. Dr. Indradev Tripathi, Arka Prakash Hindi commentary, Chaukhambha Krishnadas Academy, Varanasi; 2015 p. 20.
18. Dr. Ravindrda Angadi. A textbook of Bhaishajya Kalpana Vigyan Pharmaceutical Science, Chaukhambha Surbharati Prakashan Varanasi, Arka Kalpana; 2016. p. 115.
19. K.R.C Reddy, Bhaishajya Kalpana Vigyana, Chaukhambha Sanskrit Bhavan, Part-A Kashaya yoni; 2008. p. 194.
20. K.R.C Reddy, Bhaishajya Kalpana Vigyana, Chaukhambha Sanskrit Bhavan, Part-A chapter 7, Kashaya yoni; 2008. p. 211.

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