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BHAISHAJYA KALPANAA - THE AYURVEDIC PHARMACEUTICS - AN OVERVIEW

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**Abstract**

In Ayurvedic therapeutics, drug therapy is given prime importance. There is a very well developed sub-discipline entirely devoted to drug formulations known as “Bhaisajya Kalpanaa”. Considering its importance, different aspects of this discipline have been presented in this review to familiarize the readers, especially those who have just started studying Ayurveda, with concept of ayurvedic pharmaceuticals. The Ayurvedic drug formulation is based on what is known as “Pancavidha Kasaaya” concept. According to this concept there are five basic forms of formulation known as 1- ‘Swarasa’ the expressed juice, 2- ‘Kalka’, a fine paste obtained by grinding fresh or wet grinding dried plant material 3- ‘Kwaatha’, the decoction, 4- ‘Sheeta’ or ‘Hima’, the cold water infusion and 5- ‘Faanta’, the hot water infusion. Different aspects of their preparation and use have been discussed. Further from the above basic forms, a number of other formulations are derived; a brief description of each of them has been given along with brief outlines of drug formulations meant for specific routes. The third part of the review is devoted to discussion of influence of different factors on the expression of pharmacological activity.

**Key words:** Ayurvedic pharmaceuticals, Bhaisajya Kalpanaa, Pancavidha Kasaaya, Ayurvedic formulations  
Traditional systems of medicine

**Introduction**

Patient treatment methods according to Ayurveda are broadly classified as ‘Daiva Vyapaasraya’ (psychotherapy) and ‘Yukti Vyapaasraya’ (physical interventions) treatments (Caraka Samhitaa and Sutra Sthaana 1/58, 1984). The psychotherapy includes chanting of condition specific mantras (religious chanting), worshipping specific Gods, performing rituals like ‘Yagna’ (sacrifice based ritual in which oblations are offered to the sacrificial fire) or wearing sacred beads and threads. The second treatment method includes use of drug therapy or non-drug therapeutic measures such as regulation of life style, diet management, fasting etc.

Ayurvedic classics consider ‘drug’ a very important patient management tool in the hands of a physician or a therapist. This tool needs to be handled judiciously, if not done so it is likely to prove injurious or sometimes fatal to the life of the patient who is receiving it. The information related to drugs and formulations along with diagnosis and management of disease accompanied with techniques of health maintenance through observance of proper daily and seasonal routines can be found in large number of

classical and other literary works. The authors of such works have categorized the drugs in different manners. Groups of classics known as Greater triad (Brihat trayee) and Lesser triad (Laghu trayee) are noteworthy among them. Greater triad comprises three books namely Caraka Samhita by Carakaacaarya, Susruta Samhita by Susrutaacaarya and Astaanga Hridaya by Waagbhataacaarya, whereas lesser triad comprises of Bhaava Prakaasa by Bhaava Misra, Saarangdhara Samhita by Saarangdhara and Maadhav Nidaan by Maadhav Upaadhyaaaya . Apart from this lexicons and compilations authored by different scholars from different parts of the country written in sanskrita and regional languages have contributed enormously in this regard.

Carakaacaarya (Caraka Samhitaa - Sutra Sthaana 1/126, 1984) while discussing different aspects of drugs and drug therapy says even a poison is an effective drug if used judiciously, whereas injudicious use of even an elixir can prove harmful. Similarly, use of an unknown drug may also prove injurious to the health of the patient. Carakaacaarya (Caraka Samhitaa ' Sutra Sthaana 1/124, 1984) issues a caution in this regard with following words "An unknown drug is just like a poison or a weapon or a fire or the Vajra, the famous weapon of Indra (the king of Gods as per Hindu mythology) ". Drugs usually are known to possess destructive potential and hence need to be used carefully. He further elaborates the concept by saying that not a single substance in the Universe is devoid of therapeutic potential and hence is a potential drug source, provided it is used judiciously at appropriate indications. Substances distributed in the Universe are derived from plants, animals or minerals, which also serve as the drug sources and hence are considered as basic drug classes. Plant, animal or mineral product in whatever nature they may be they can be hardly used as a drug in their natural form. Hence almost every substance has to undergo a specific processing to acquire a form of palatable drug. Such processing is termed as pharmaceutics i.e. 'Bhaisajya Kalpanaa' in terms of Ayurveda. The form which ultimately comes into use by the patient is termed as a drug delivery system or drug dosage form. Safety, Efficacy, Stability and Palatability are the four basic requirements of a good drug dosage form. Ayurveda also gives prime importance to these four basic requirements. The different aspects related to drug formulation, preparation, storage etc., are dealt in a sub-division known as Bhaisajya Kalpanaa. The word Bhaisajya Kalpanaa is derived from the word 'Bhaisajya' meaning a drug. Bhaisajya is in turn derived from 'Bhisag' meaning a physician, a vaidya. Etymologically 'Bhaisajya' is a substance used by a 'Bhisag' the physician as a means of treating a patient. 'Bhaisajya' is also known as 'Ausadha' meaning a substance imparting health. Concept of 'Drug' is principally based on the type of activity of a substance on the human body. In this respect edible substances are broadly divided in two categories: 1. 'Aahaara Dravya' food substance and 2. 'Ausadhi Dravya' substance used as drug. Aahaara dravya is supposed to be 'Rasa pradhaana' meaning containing ingredients essentially providing nourishment to the body, where as a drug is supposed to be 'Veerya Pradhaana' meaning principally therapeutically active.

In Ayurvedic therapeutics, drugs in both forms are used, crude as well as processed and converted into different formulations. It is necessary that the form of the drugs or formulations when ready for ingestion, should be not only effective but also easy to administer and agreeable to patient. The main emphasis is on removing the physical and chemical impurities from the crude drugs. Further, Ayurvedic classics also give emphasis to the elimination of inherent constituents of the drug which are inappropriate in specific clinical condition and toxic in nature and which enter into the formulation if not removed. To meet this requirement basic materials are sometimes subjected to purifying process known as "sodhana". There are elaborate descriptions for employing different types of sodhanas for different kinds of materials. In this regard the procedures involved in mineral and metal based preparations are quite elaborate and will be dealt in a detailed manner in another review which is under preparation.

## Historical Background

Historically the Ayurvedic Pharmaceutics can be divided in two distinct streams - namely 'Aarsa' and 'Siddha', however the two streams merged into one, making the distinction invisible with the passage of time. History of the 'Aarsa' stream dates back to period of Vedas (5000 B.C.) whereas the 'Siddha' stream was considered to have been active around 8<sup>th</sup> century A.D., the period of second 'Naagaarjuna' although the period of first 'Naagaarjuna' can be traced back to 100 B.C. (Siddhinandan Misra-1990). The

'Aarsa' stream followers although used minerals and metals for their drug requirements; such use was very rare. They prepared their drugs principally from plants whereas 'Siddhas' not only initiated use of minerals in combination with plants but also instituted drugs prepared solely from minerals. Thus they were instrumental in opening a new generation of mineral and metal based drugs giving birth to a new branch of Ayurvedic discipline termed as 'Rasa shastra'. The word 'Bhaisajya Kalpanaa' is specifically used in relation to preparation of plant based drugs although literally it encompasses preparation of any type of drug. An independent article is being prepared on Rasa Saastra hence this article will only deal with Ayurvedic pharmaceuticals of plant based drugs.

### Principles of Ayurvedic Pharmaceuticals

The pharmaceutical procedures for any drug involve various steps starting from identification and collection of authentic raw material, application of standardized processing techniques, and production of quality drug to packaging and storage of the produced drug. Ayurvedic pharmaceuticals is not an exception to this. A quote from Caraka Samhitaa (Caraka Samhitaa Vimana Sthaana 8/87, 1984) says raw material of specified type having specific characteristics and therapeutic action, grown on a specific soil in a specific geographical area in specific atmospheric conditions should be collected in a specific season. Only such raw material will produce the expected therapeutic effect provided it is used judiciously in proper dose.

Sarangadhara-states (Sarangadhara Samhitaa Purvakhanda 1/6, 1983) that the plant material should never be collected from dirty, marshy and gravel filled places. The plants growing in a graveyard or on a footpath should also not be collected. Raw material which is infected, burnt or chilled also is not likely to produce the expected therapeutic effect and hence should not be collected. He further adds that autumn, the 'Sarada Ritu', the first two months succeeding the rains as per the Indian calendar being ripening time for most of the plants, is supposed to be the best season for collection of all types of plant material, whereas plants specifically used for induction of purgation and emesis should be collected at the end of spring.

As described above every substance in the Universe possesses a potential to become a drug. But not all the parts of the substance are always therapeutically useful in view of the specific diseased state. In such a situation the therapeutically useful part of the substance needs to be separated out and put to therapeutic use. The therapeutically useful part is termed as 'Saara Bhaaga' in the terminology of Ayurveda (Cakrapaanidatta 'Ayurveda Dipikaa'-1984). This can be achieved through specific processing. Many a times the substance may contain more than one therapeutically useful constituent. Different procedures may be required to separate out such useful constituent. The components soluble in water are extracted in water whereas solvents like fat, oil or alcohol are required to extract ingredients soluble in those solvents. A combined solvent system is also used sometimes. Depending on the requirement, different procedures are adopted to extract therapeutically useful ingredients. Water being universal solvent is used for majority of extractions. Since the plant material used for drug preparation is very similar to food material the cooking practices such as heating, boiling, frying etc. are used in pharmaceutical procedures as well.

Fresh as well as dried plant material is used for processing- depending on availability and necessity. Different procedures are adopted to prepare a dosage form, which is stable for a longer period. Thus the type of pharmaceutical processing depends on following factors:

1. Nature of the raw material : fresh or dry
2. Required concentration of the dosage form
3. Solubility of therapeutically useful component of the plant
4. Heat stability of therapeutically useful component of the plant
5. Route of administration
6. Shelf life of prepared dosage form

The Ayurvedic formulations range widely from freshly extracted plant juice to eye drops, ointments, surgical threads etc. However there are five basic classical forms termed as 'Pancavidha kasaaya' (Sarangadhara Samhitaa - Madhyama Khanda 1/1, 1983) from which all other drug

formulations or forms are derived or developed. The five basic forms are : 'Swarasa' the expressed juice, 'Kalka', a fine paste obtained by grinding fresh or wet grinding dried plant material, 'Kwaatha', the decoction, 'Sheeta' or 'Hima', the cold water infusion and 'Faanta', the hot water infusion. The first two forms are prepared from freshly collected plant material and are directly put to patient use, whereas the last three forms 'Kwaatha', 'Sheeta' and 'Faanta' are aqueous extracts prepared from the dried plant material.

The basic principle behind preparation of these 'kasaayaas' is that the plant as a whole or any part of the plant as a whole may not be useful for the expected therapeutic action. Not all but some of the plant ingredients are therapeutically active. These ingredients have to be extracted from the plant and put to therapeutic use. Water being comparatively inert universal solvent is used as a media for extraction of such active ingredients from the plant. Three types of extraction techniques, depending on the heat sensitivity of the plant material, are used. The extracts so obtained are termed as 'Kwaatha', 'Faanta' for extraction with hot water and 'Hima' for extraction with cold water. The water insoluble plant material is separated and thrown out as a waste material at the end of all these extraction processes. According to some authorities (Cakrapaanidatta 'Ayurveda Dipikaa'- Caraka Samhitaa Sutra 4/7 - 1984 ) use of specific extraction system depends on the target disease condition, the target patient and the source substance. Some of the plants require specific extraction technique for obtaining expected therapeutic action e.g. (Caraka Samhitaa Cikitsaa Sthaana 1/3/31- 1984 ) *Centella asiatica* (Linn) 'Mandookparni' and *Tinospora cordifolia* (Thunb) Miers 'Guduci' should be used only in the form of expressed juice for their 'Rasayana' effect and *Convolvulus pleuricaulis* Chois- 'Shankhpushpi' should only be used in the form of paste (kalka). It is apparent that the expected plant ingredients having specific therapeutic action of above mentioned plants will be destroyed if other procedures of extraction are utilized because of the sensitive nature of the related plant ingredients.

In all these extraction methods water soluble active ingredients of the plant are extracted. The concentration of the active ingredient extracted in the solvent water differs in each of the methods (Cakrapaanidatta 'Ayurveda Dipikaa'- Caraka Samhitaa Sutra 4/7 - 1984 ). The concentration declines in descending order with reference to 'Swarasa', Kalka, 'Kwaatha', 'Hima' and 'Faanta'. 'Swarasa' possesses highest concentration where as 'Faanta' possesses the lowest. They are put to use depending upon the condition of the patient with respect to his digestive capability e.g. 'Swarasa' should only be used when the general condition of the patient is good otherwise the drug is likely to be harmful. Children and elderly may not be suitable for receiving the 'Swarasa', the expressed juice, whereas for a robust individual- 'Faantaa', the hot water infusion may fall short of yielding the expected effect. The disease status also plays an important role in deciding the form of the drug. Severity of the disease invites use of concentrated drug forms.

#### Method of Preparation of 'Pancavidha Kasaaya' (Five basic drug forms) Swarasa - the expressed juice

It is obtained from freshly collected plants. The useful plant parts leaf, stem, fruit or whole plant etc. are cut to pieces and ground to prepare a bolus. The finely ground bolus is then collected and is mechanically squeezed to extract as much juice as possible. The juice so obtained termed as 'swarasa' - is collected and put to use immediately. Sometimes the plant parts may not be containing enough moisture to obtain the juice by applying mechanical pressure. In such cases two parts of water is added to the ground plant material and it is left to soak overnight. The soaked material is then squeezed to extract all the juice from it by applying mechanical pressure. Alternatively if the plant material is dry it is pulverized to yield fine powder. Eight parts of water is then added to the powder. The contents are then subjected to heating to retain one fourth of the water. In fact this is nothing but a type of decoction since the concentration of active ingredients in this decoction is similar to 'swarasa' it is classified as 'swarasa' (Ramachandra Rao, 1997).

The general advocated dose of 'swarasa' obtained from freshly collected plants is 20 ml whereas that of 'swarasa' prepared from dried plant is 40 ml. If any additives such as honey, sugar, jaggery (normally refers to unrefined sugar prepared from palm sap but also includes the one prepared from sugarcane juice) caustic, corrosive or acrid substances, jeeraka (cumin seeds), salt, ghee (butter oil) , oil

and any powdered plant material need to be added in 'swarasa' they should be added in the measure of 10 g (Saarangdhara Samhitaa purvkhanda 1/6, 1983). In some cases the plant material requires steaming to facilitate extraction of juice. This is achieved through a procedure called 'Putapaaka' wherein the plant material is ground to prepare a fine paste. The paste is then rolled into a bolus which is wrapped in the coverings of leaves. Two finger thick layer of mud is then applied on the covering of leaves. The bolus is then kept in an open hearth where it is subjected to intensive heat till it becomes red hot. It is then removed from the hearth and allowed to cool. The coverings of mud and leaves are then removed and the bolus is taken out. It is then mechanically squeezed to produce the expressed juice. The dose of this expressed juice is 40 ml (Savrikar, 2006).

#### **Kwaatha- the decoction**

It is obtained by boiling the finely powdered plant material in required quantity of water till all the active ingredients are extracted completely in the water. The retained liquid after boiling is then filtered through a muslin cloth. The filtrate so obtained is termed as 'kwaatha'- the decoction. The reason for boiling the plant material in water is to extract the entire water soluble ingredients. The quantity of water required to be added and to be retained after boiling varies from plant to plant. According to some experts whatever quantity of water is added, three- fourth part of water needs to be evaporated and the fourth part retained to achieve this objective (Cakrapaanidatta 'Ayurveda Dipikaa'- Cikitsa 3/197-199, 1984). According to 'Saarngadharaacaarya' - a fixed quantity of sixteen parts of water in proportion to powdered plant material needs to be added and eighth part retained after boiling when the decoction is to be used for consumption by the patient (Saarangadhara Samhitaa Madhyama Khanda 2/1- 1983) . The above proportion of plant material and water to be added initially and retained after boiling is prescribed for the decoction used for patient as a drug dosage form. But four, eight and sixteen parts of water is added to soft, hard and very hard plant material respectively for the decoction to be used as base material for preparation of medicated oil or ghee. In all these cases one fourth part of water is retained after boiling.

The suggested dose of 'kwaatha' is 80 ml. Additives such as cumin seeds, gum guggulu, caustic substances, salt, asphalt, asafoetida, mixture of ginger, black and long pepper in the measure of 3 g each are added as per requirement. If required liquids like milk, ghee (butter oil), oil, cow urine in the measure of 10 ml. and jaggery 10 g are added to one dose of decoction. Fourth, eighth and sixteenth part of sugar is added to one dose of decoction respectively for the diseases caused by derangement or vitiation of 'Vaata, Pitta' and 'Kapha' respectively, whereas honey is added in sixteenth, eighth and fourth part to the decoction in the diseases caused by derangement or vitiation of 'Kapha, Pitta' and 'Vaata' respectively. This clearly indicates that the ancient masters were aware of the existence of individual differences in the manifestation of disease and response to therapy. This was taken care by devising appropriate dosage forms.

#### **Faanta - The hot water infusion**

'Faanta' is prepared from the plant material requiring low grade temperature for extraction of water soluble ingredients- which are likely to be sensitive to high temperature. Finely powdered plant material is soaked in hot water and thoroughly mixed. The mixture is then filtered through a four layered muslin cloth. The filtrate so obtained is termed as 'Faanta'. The dose of 'Faanta' is 80 ml. The proportion of additive if required is similar as prescribed for 'kwaatha'.

#### **'Sheeta' or 'Hima'- the cold water infusion**

Heat sensitive plant material is subjected to cold water infusion and the product so obtained is termed as 'Sheeta' or Hima. Finely powdered plant material is soaked overnight in six parts of water. The contents are then filtered through a four layered muslin cloth. The filtrate so obtained is 'Sheeta'. The dose of 'Sheeta' is 80 ml and the proportion of additives if required is as prescribed for 'Kwaatha'.

The above described 'Pancavidha kasaayaas' are perishable dosage forms. They have to be consumed by the patient as and when they are prepared. Drug dosage forms having a longer stability are required by the patient and the health care provider. Sensing this need Ayurvedic classics have described many stable dosage forms. The stability period or shelf life of these dosage forms although in a generalized way has also been described by the classics. The stability period of different dosage forms according to Saarangadhara (Saarangadhara Samhitaa - Prathamaa Khanda 1/51-52, 1983) is shown in Table 1.

Table 1: Shelf life of different types of drug forms

Drug form	Shelf Life
Unprocessed dried plant material	One year
Powder	Two months
Tablet, Pills, Syrups	One year
Medicated oil and ghee	Sixteen months
Low potency drugs	One year
Alcoholic preparations, Mineral and Metallic drugs	More than a year

#### Period of utilization

According to 'Saarangadharaachaarya' for all purposes in therapeutics all plant material should be utilized within one year of its collection except *Embelia ribes* Burn.f., *Piper longum* Linn, Jaggery, coriander, ghee and honey. These plants and substances should be used only after one year after their collection, since till that time they are not ready for therapeutic use. Apart from this the following plants should be used only till they retain their natural moisture : *Tinospora cordifolia* (Thunb) Miers. (Guduci), *Holarrhena antidysenterica* (Linn.) Wall.ex DC (Kutaj), *Adhatoda vasica* Nees (Vaasaa), *Benincasa hispida* (Thunb.) Coga (Kusmaand), *Asparagus racemosus* Willd.(Sataavarii), *Withania somnifera* (Linn.) Dunal (Asvagandhaa), *Barleria prionitis* Linn. (Sahacara), *Anethum foeniculum* Linn (Satapuspa), *Paederia foetida* Linn.(Prasaarini) (Saarangadhara Samhitaa - Prathamaa Khanda 1/45, 1983).

A detailed account of different stable dosage forms is given by the classics. Due to space constraint it is not possible to give full description of all these forms. However a concise description of selected dosage forms is provided below for familiarization, further details can be obtained from source books or by referring to Ayurvedic Formulary of India (Anonymous, 1978). In Ayurvedic Formulary of India which can be considered as an authentic source book- twenty one type of drug formulations have been mentioned. Out of them sixteen are mainly for plant based products and rest are mineral and metal product based formulations.

Arka is a liquid preparation obtained by distillation of certain liquids or drugs soaked in water using the Arkayantra (a type of steam distillation apparatus) or any convenient modern distillation apparatus. It is a suspension of the distillate in water having slight turbidity and colour according to the nature of the drugs used and smell of the predominant drug.

Aasava or Aristas- these are fermented preparations of medicinal plants. The fermentation procedure adopted to prepare these preparations is termed as 'Sandhaana kalpanaa' and the ferment used to stimulate fermentation is termed as 'Sandhaana dravya'. Aasavas are usually prepared by fermenting expressed juice ('swarasa'), whereas 'Aasavas' are prepared from fermentation of decoction (Kwaatha). Sugar or jaggery and powders (choorna) of other medicinal plants as required along with a natural ferment are added to these two liquids and they are left in a closed container till the fermentation is completed. Aasava and Aristas can be prepared from 'swarasa' or 'kwaatha' (as the case may be) of single plant or from a mixture of 'swarasa' or 'kwaatha' from multiple plants. This facilitates the extraction of the active principles contained in the drugs. The alcohol generated in this process serves as a self preservative. Both function as weak wines but rich and fortified with active principles (Ramachandra Rao, 1987).

Avaleha- it is a semi-solid preparation of the drugs meant for licking. It acquires the consistency of a thick paste. After strained decoctions (Kwaatha) are boiled down, sugar or jiggery is added to it. The other similar forms are known as Modaka, Guda, Khanda, Lehya, Praasa etc.

Coorna is a fine powder of drug or drugs. Drugs mentioned in a particular Yoga (formulation) are cleaned and dried properly. They are finely powdered and sieved. Where there are a number of drugs in yoga, the drugs are separately powdered and sieved. Powder of each drug is weighed separately and mixed thoroughly. This will ensure proper mixing in comparison to mixing the drugs and preparing the powder of the drug-mix. In industry, however, all the drugs are cleaned, dried and powdered together by disintegrators. Mechanical sifters are also used. Salt, sugar, camphor- the material with water content, when mentioned are separately powdered and mixed with the rest at the end. Asafoetida and salt may also be roasted, powdered and then added. Sometimes it is necessary to use plant ingredients in fresh form in such a case drug paste is prepared, dried, and then added. The powder should be fine at least of 80 mesh sieves. It should not adhere together or become moist. The finer the powder, the better is its therapeutic value. They retain potency for two months as per the classical reference Saarangadhara Samhitaa Prathama khanda 1/51-53.

Ghana is a dried aqueous extract. It is the solidified mass prepared by evaporating all the aqueous portion from 'kwaaha'. The water content of the 'kwaatha' is evaporated by subjecting it to slow heating. The 'kwaatha' passes through various stages as it solidifies from clear liquid to semi-solid and then solid form through the process of heating. These dosage forms are grouped as 'Rasakriyaa' and are broadly classified as Avaleha and Ghana. Avaleha is the one which is semi-solid and can be licked whereas 'Ghana' is the one which is solid (Saarangadhara Samhitaa - Madhyma Khanda 8/1, 1983).

Siddha Tailas (Medicated oils) and Siddha Ghritas (Medicated Ghee)- are preparations in which oil or ghee is boiled with prescribed kasaayas (decoction) and kalkas (fine paste) of drugs according to the formula. This process ensures absorption of the active therapeutic properties of the ingredients used, into the oil base. In these preparations three ingredients are essential- sneha (ghee or oil), drava (liquid)- which may be decoctions, expressed juice etc., and kalka- the fine paste of the ingredients. The ratio of the ingredients, unless specified otherwise, is oil four part, kalka- one part and liquid sixteen parts (however, there are several exceptions). During preparation the fine paste and liquids are mixed together and then oil or ghee is added and boiled on mild fire and continuously stirred to ensure that the fine paste does not stick to the vessel. The boiling is continued till the liquid portion gets evaporated, at this stage the moisture of the fine paste starts evaporating. This is tested with the help of a ladle to determine the paaka (cooking stage). The paaka is categorized into mridu (soft)- if the paste is waxy when rolled between fingers, madhyama (moderate) if the paste is hard and fires without cracking noise when put in to fire and khara (hard) if it burns with cracking sound when placed in fire. The ideal condition of the medicated oil is attained when uniform froth comes out and subsides in case of medicated ghee. This is the general procedure- depending upon the ingredients used, different modifications have been mentioned.

Oil prepared with mridu paaka (mild cooked) is used for nasal insufflations (Nasya) 'madhyama paaka'. Medium cooking stage oil is used for enema and oral administration. Khara paaka (rough consistency) oil is used for bathing. The medicated oil generally will have the colour, odor and taste of the ingredients used. They are preserved in glass, polythene or aluminum containers. Preparations for internal use keep their potency for about sixteen months. Medicated oils when used for internal purpose are administered along with adjuvants known as anupana. When no Anupana is specified such oil should be taken with warm water or warm milk (Anonymous, 1978).

Guggulu is an exudate (Niryasa) obtained from the plant *Commiphora mukul* (Hook ex Stocks) Engl. Preparations having this exudate as main effective ingredient are known as Guggulu. There are five different varieties of Guggulu described in the texts. However, two of the varieties, namely Mahisaksha and Kanaka Guggulu are usually preferred for medicinal preparations. Mahisaksha Guggulu is dark greenish brown and Kanaka Guggulu is yellowish brown in color. They are purified by boiling the raw material with different liquid materials till a soft mass is obtained and repeatedly processed to obtain its purified form known as sodhita guggulu. Its potency is supposed to be retained for two years when used

as ingredient with products of plant origin and indefinitely when prepared with metal and mineral based products (Anonymous, 1978).

Lepa- drug formulation in the form of a paste used for external application are called lepas. The drugs are made into a fine powder. Before use on the body part, the powder is mixed with some liquid or other medium indicated for each preparation and made into a soft paste. Water, Cow's urine, oil, and ghee are some of the media used for mixing. Vegetable lepa coorna (powder) will preserve their potency for 30 days if kept in air tight containers. Mineral and metallic preparations last indefinitely.

Sattva- is the water extractable solid substance collected from a plant. The plant is cut into small pieces, macerated in water and kept overnight. Then it is strained through cloth and the solid matter is allowed to settle. The supernatant liquid is decanted and the remaining Sattva is washed with water and decanted and the process is repeated several times. The Sattva so sedimented is allowed to dry and is powdered. This can be preserved in a closed container.

Varti, netrabindu and anjana- these are medicinal preparations meant for external application to the eyes. Vartis are made by grinding the fine powders of the drugs with the fluids in the formula to form a soft paste. This is then made into thin sticks of about 2 centimeters in length and dried in shade. Netrabindu is prepared by dissolving the semisolids of drugs to be applied with Netra-salaka (type of drug applicator to the eye). These can be preserved for one year if kept in air tight container. In case of formulations in which minerals are used, the drugs are preserved for indefinite period.

Vati and Gutikas- drug forms prepared in the form of tablet or pills. They are made of one or more drugs of plant, animal or mineral origin. The plant ingredients are dried and made into fine powders, separately and ground to soft pastes before they are rolled in to pills with the help of fingers. Sometimes minerals are also used as ingredients in such cases the mineral is converted to Bhasmas (calcined metallic compounds) and used as ingredients. When more than one liquid is mentioned for grinding, they are used in succession. When the mass is properly ground and is in a condition to be made into pills- flavoring agents are added and ground again. The criterion to determine the final stage of the formulation before making pills is that it should not stick to the fingers when rolled. Pills may be dried in shade or under direct sunlight as specified in the texts. In cases where sugar or jaggery is mentioned, paaka (consistency) should be made on mild fire and removed from the oven. The powders of the ingredients are added to the Paaka and briskly mixed. When still warm, vatis should be rolled and dried in shade. Pills made of plant drugs when kept in air tight containers can be used for two years. Pills containing minerals can be used for an indefinite period.

In addition to the above discussed formulation types there are other purely mineral based formulations like kupipakwa rasaayana, parpati, pisti, bhasma etc., these are also used in therapeutics. Information related to these preparations would be discussed in another review which is under preparation. Apart from oral dosage forms, drugs administered through other routes of administration such as per-rectal, per urethral, per vaginal, nasal etc., are also described by classics. These are shown in Table 2. Creams, ointments, lotions, dusting powders etc., are also described for external application. Thus 'Ayurvedic Bhaisajya Kalpanaa' encompasses a wide range of drug dosage forms which can be used by the health care provider in accordance with the patient requirements. Each of the above dosage forms is a subject that would require writing an independent article to do justice.

Table 2: Preparations meant for routes other than oral routes

Dosage form	Brief description
Basti	Per rectal administration of medicated oils and emulsions
Guda varti	Per rectal insertion of suppository
Uttar Basti	Per-urethral, per-vaginal administration of medicated oils and emulsions
Nasya	Nasal instillation and inhalations (nasal insufflations)
Aschyotana	Eye drops
Anjana	Eye creams and ointments
Karnapurana	Ear drops
Ksaara a sutra	Surgical thread coated with caustic or acrid drug material



### Formulation factors influencing expression of pharmacological activity

Though it is generally accepted among the ayurvedic fraternity that drug formulation is very important for ensuring therapeutic efficacy, not much importance is being given to assess or ascertain the impact of changes made in formulation factors on the expression of pharmacological activity. The classical formulation techniques and preparatory methods exhibit high degree of sophistication. However, unfortunately many improvisations and changes are being affected in the name of modernization without assessing the impact of such modifications. This may have great adverse impact on their therapeutic efficacy. Thus great research and development efforts are required to optimize the formulation aspects to ensure constant availability of standardized products with constancy of composition and efficacy. A great many varieties of factors related to raw drug selection, processing, formulation, preparation, use of purification processes and use of adjuvants have been observed to have strong influence on the expression of pharmacological activity thus possibly on therapeutic effect.

### Influence of season and place of collection

In one of the studies it has been shown that season of collection of raw drugs can influence the expression of pharmacological activity (Sridhara Bairy, 1997). Paarijaata (*Nyctanthes arbor-tristis* Linn) leaves collected in different seasons (six samples) were subjected to pharmacological evaluation. It was observed that samples collected during September produced better anti-inflammatory activity in comparison to samples collected during other seasons. The leaves collected during November and July were almost inactive. The raw materials are collected from different regions of the country. It is possible that because of the ecological conditions prevailing in different parts from where the material is procured the same material collected from different regions may not have same activity profile. In a study carried out by Saxena 1995, Silajatu (a rock exudate) samples obtained from five different places were evaluated for different types of pharmacological activities. Differences in the activity profile was observed. Anti-depressant activity evaluation employing behavioral 'despair' test showed that among the five samples studied only Nepal and Gopeshwar samples showed significant activity while in other samples the activity was not significant.

### Influence of formulation type

In a study carried out by Sudhir Joshi (1997) - Yastimadhu (*Glycyrrhiza glabra* Linn) was administered in three formulation forms and subjected to comparative evaluation. Yasti corona, Yasti ghrita and Yasti Sarkaraa - each containing same quantity of the Yasti were evaluated for anti-ulcer activity against forced swimming induced stress ulcers. Significant decrease in ulcer index was observed in Yasti ghrita administered group; in other two groups only moderate and statistically non-significant decrease was observed. This clearly indicates that for attenuating the stress ulcers test drug given in the form of ghrita is good.

### Influence of drug processing during preparation

A study carried out by Rajesh Barvaliya (2000) on A-Pancatikta ghrita (literally translates as medicated ghee prepared from five drugs having bitter taste principles containing ghee) involved preparation of the formulation by three methods and subjecting them to comparative study. The samples were : A-Pancatikta ghrita (PG-A) prepared after ghrita murchanaa (a purificatory process) and using triphala kalka; PG-B prepared by using ghrita subjected to murchanaa without kalka ; PG-C prepared only with plain ghrita without subjecting it to murchanaa and without using kalka. Samples B and C produced significant potentiation of anti-body formation against Sheep Red Blood Cells (SRBC) in rats, where as Sample-A produced only a weak and non-significant effect. This indicates drug preparation and processing methods can influence expression of pharmacological activity.

### Influence of adjuvant on the pharmacological activity

A study was carried out (Rajagopala, 2004) by noting the effect of the test preparations on cyclophosphamide induced immuno and myelosuppression. The test drug Vacaadhaatryaadi Avaleha (VDAV) containing vacaa (*Acorus calamus* Linn.), dhatri (*Emblca officinalis* Gaertn), musta (*Cyperus rotundus* Linn), Puskaramoola (*Inula racemosa* Hook.f.), jeeraka (*Cuminum cyminum* L.), Sankhapuspi (*Convolvulus pluricaulis* Chois.), pippali (*Piper longum* Linn ), sita (sugar), kshaudra (honey), sarpi (ghee) and trikatu was evaluated for immunopotential effect at the dose of 900mg/kg. As one of the control group avaleha prepared with ghee, honey and sharkaraa (1:2:4) (ADJ) - 900mg/kg was used. The observed effect was compared against a water control group. Administration of cyclophosphamide caused significant suppression in anti-body formation. This immunosuppressant activity was reversed by both VDAV and ADJ. However, only the effect observed with VDAV was found to be statistically significant. The myelosuppression produced by the toxicant was also reversed by both ADJ groups and VDAV. The results obtained indicate in many cases adjuvant used may not be inert but per se may produce significant pharmacological activities. Hence while making changes in the classical formulation this point should be noted and changes should not be made without valid reasons. If the changes are made the impact of such changes should be assessed by undertaking comparative pharmacological studies.

### Influence of source of adjuvant or vehicle on the expression of pharmacological activity

Many a times the place or source of materials especially of adjuvants and vehicles is not specified. The investigators tend to ignore this aspect. It is certainly possible that the quality of the adjuvant and other ingredients may influence the expression of biological activity. In one of the studies carried out in our lab (Savrikar, 2006) three samples of guduchi ghritas were prepared using cow ghee (ghrita) obtained from three different regions- Wardha, Nanded and Solapur and the samples were evaluated for different pharmacological activities. Evaluation for adaptogenic property using forced swimming test showed that only the sample prepared by using Solapur go-ghrita produced significant anti-stress activity while other two samples did not produce similar effect. This shows that source of adjuvant itself may influence the expression of pharmacological activity.

The above illustrations are just few examples of a vast array of factors that may influence expression of pharmacological activity. Studies carried out in our Institute have shown that many other factors like use of cultivated raw material or naturally collected material, processing methods like murchanaa, sodhana, avartana, number of putas (method of heating) while preparing a bhasma all have influence over expression of pharmacological activity. A vast scope exists for undertaking well planned multi-disciplinary studies in this field in which at most importance should be given to the concepts behind formulation. This endeavor along with rigorous standardization of all aspects of drug manufacturing would be a great help in ensuring availability of standardized, efficacy and safety proven ayurvedic formulation in the market. That would serve as the most important step in the globalization of Ayurvedic practice.

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