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RESEARCH ARTICLE

ARKA KALPANA - A REVIEW W.S.R. TO DISTILLATION.

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Abstract

Arka Kalpana is now days famous Kalpana among the Ayurvedic procedures. It is introduced in pharmacy of Ayurveda in later part of development, which is very specific in its mode of preparation and due to virtue of this particularity; it may have all volatile active substances in effective form in its final product. It is more palatable form of Ayurvedic dosage forms in comparison to Swarasa, kalka, kwath etc. In Arka Prakash various kinds of Procedures and heating are mentioned for preparing Arka from different type of Dravya. Arka Kalpana is correlated with Distillation in modern pharmaceuticals practices.

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Introduction:-

As a science of Life and Health, the different branches of Ayurveda have evolved over the long period as health being mainly concerned with keeping the body fit and preventing as well as curing the diseases, which were its main objective. Logically therefore, there has been a constant research on therapeutic agents that keep the body fit, increase its capacity to combat a disease and bring it back to normal. These therapeutic agents are termed as Drugs. Every dravya can be a medicine but some pharmaceutical procedures are done to change or potentiate its original properties. The basic idea behind the administration of drug is to make it more suitable to the body elements. To achieve this, many processes were invented in a sense of manufacturing process, these are termed as Kalpanas. And our Acharyas describe elaborately all required properties of a Dravya i.e. Bhaishaja (Ausadha) for enormous effect in our classics.

Bahukalpam bahugunam sampannam yogyamaushadham

Arka-Kalpana introduced in pharmacy of Ayurveda in later part of development, which is very specific in its mode of preparation and due to virtue of this particularity, it may have all volatile active substances in effective form in its final product.

ARk :(Shabdakalpa drum):-

Definition:-

The method by which the volatile oil and active principles of the drug are collected is called as Arka-kalpana and the compound prepared through this procedure is called as Arka.

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Historical Review:-

The word Arka is not mentioned in Vedic literature as well as in Samhita Granthas and even Sangraha Granthas. First of all, Shodhal in 12th cent. described the 'Arka-Kalpana' After words it was adopted by many workers and so many books were written on it. The main reference book of Arka-Kalpana is 'Arka-Prakash' but there is no any explanation about the author of this text. This text is present in the form of conversation between Ravana and Mandodari,

In the 14th Century, Unani Chikitsa was flourishing and Arkas were used frequently in that period by Unani Hakims. Therefore some people say that Arka-Kalpana, is not derived from our Panchavidha-Kashaya Kalpana, but it is originated from Unani system of medicines.

No reference about Arka-Kalpana is found in Rasa-Shastriya texts, only in Rasa-tarangini there is one shloka about it² -

Parishrutasalilam

Yantren nadikakhyena vahinsantapa yogatah

Bindusho yatstrutam niram tatparistrutamucyate. (r.t.2/59)

Classification:-

We can classified the Arkas into following types (according to description of Arka Prakasha)

A) Classification according to contents:

- 1 *sthirarka* - Arka-patan from the drugs in which there is No volatile oil. eg. Triphala, Dasamula etc.
- 2 *gandharka* - Arka-patan from the drugs with fragrance or Volatile oil. eg. Jiraka, Ajmoda, etc.
- 3 *dravarka* - Arka extraction from the liquid drugs.

B) Classification according to duration of preparation.

- 1 *nyun* - Prepared in 1 p\hr
- 2 *madhyarka* - Prepared in 2 p\hr
- 3 *shreshthark* - Prepared in 3 p\hr

Again in Arka-prakash Arkas are classified according to the diseases and also according to the actions.

C) Classification according to part used:

- | | |
|---------------------------|----------------------------|
| 1 <i>pushparka</i> | 2 <i>kshiri vruksharka</i> |
| 3 <i>taildhanyarka</i> | 4 <i>tandularka</i> |
| 5 <i>sattu dhanyarka</i> | 6 <i>vip vargarka</i> |
| 7 <i>sugandha ganarka</i> | |

Classification according to Modern Science³:

- a. Simple distillation.
- b. Vacuum distillation
- c. Fractional distillation
- d. Steam distillation
- e. Destructive distillation (Dry distillation)

Importance of the Arkas⁴:

dravya kalpah panchdhasyat kalka churna rasastatha

tailamarka kramatgneyam yathottargunam priye {a. p\ 1/46}

According to the above reference the efficacy of Kalka, Churna, Swarasa, Taila and Arka is gradually increasing in descending order. This efficacy of individual formulation is may be due to various degrees in the concentration of active principle. This implies that the author of Arka-Prakash has said this on the basis of concentration of drug in formulations.

Other importances of this Kalpana are as follows:

1. It can be preserved for longer time than other Kalpanas like Swarasa, Kwath etc.

2. This Kalpana is easy to administer in the patients of Mridu Prakriti and one who hesitate to take medicines like Churna, Kwath etc.
3. Arka is prepared by the combination of Jala and with the help of Agni, hence Arkas are Laghupaki, Vyavayi and Vikasi & thus assimilates quickly in the body.
4. Arkas have good palatability.
5. Arka Kalpana acquires highest position in obtaining the potentially active volatile oils as the condensation takes place during the process of distillation.

Method of Arka Preparation:-

In preparation of Arka, we should consider following points,

- 1) Apparatus used in Arka preparation.
- 2) Process of Arka preparation (Methodology)
- 3) Role of Agni in Arka preparation.

Ayurvedic approach⁵ which is described in Arka – Prakash

Apparatus:-

In this classical review is described.

Mud used for preparing of Arka – Patan Yantra:-

Before invention of modern technique the apparatus for distillation was being prepared.

Iron powder, geru, alum, black clay, red clay, bone powder, glass powder etc. should be taken in equal quantities and clay should be mixed in equal quantity. Urine of cow, horse, goat, buffalo and elephant. The clay should be added there after dried in sunlight, till the smell of urine gets completely removed. In this way clay for manufacturing distillation apparatus is prepared.

Method of manufacturing apparatus:-

Round shaped vessel should be manufactured by pot maker from the above clay. The mouth of the pot should not be less than 3 angula (3 cm.) For covering again same size of lid should be prepared and there should be lips of 3 angula by which it is jointed with the vessel. Powder of old bones should be used to seal the joint to make it airtight. One small hole should be made in the lid. In this hole the tube of Bamboo (One is small and another one is double the size of first one) is inserted and clay should be applied on the joints. So that fumes may not escape out. The small tube is inserted measuring 4-5 Angula inside the pot. Arka-patra should be kept below the large tube. The fume that comes out from the pot is collected in that vessel and this vessel should be kept in cold water. In this way the fumes gets condensed & again collected in the form of Arka.

Method of Arka Preparation:-

(i) General Method:

In 2nd chapter of Arka-Prakash, it is mentioned that for preparing Arka first of all, the drugs are to be coarsely powdered and ten times water should be added to it and it should be soaked for 24 hrs. Then Arka should be extracted by using Arka – Yantra.

(ii) Special Method:

Apart from general method some special methods are also mentioned by Ar. P. According to 5 types of Dravyas, which are used in the preparation of Arka, (1) Very hard drug (2) Hard drug (3) Fresh drug (4) Twig (5) Liquid drug.

Though the method of Arka preparation is same as mentioned in general method, here water should be added according to the hardness of the drug.

(1) Very hard drug -

The drugs which are one year old and very hard like Sandal wood etc. are considered as very hard drug. General method is applied for preparing Arka of such drugs.

(2) Hard drug -

Ajamoda, Trikatu, Kirata etc. drugs are considered as hard drug. While preparing the Arka from such drugs two times water is to be added and kept for 12 hrs. After that Arka is to be prepared by using Arka-Patan Yantra.

(3) Fresh drug -

These drugs are divided into two Groups

- | | | |
|-----------------|-----------------|------------------|
| Juicy drugs | 1) Leaves | 2) Fruits |
| Juiceless drugs | 1) Fleshy drugs | 2) Fibrous drugs |

Fresh drugs, which contain milk, are again divided into two groups.

Milky 1) Mild 2) Strong

Part used for Arka preparation	Amount of Water	Heating Duration
Leaves	1/100 th part	24 hrs.
Fruits	Without adding water	-
Green & Juiceless drugs	1/20 th part	3 hrs
Flowers	1/16 th part	3 hrs
Mridmilky drugs(Arka)	Kept in hot water for 3 days, then fresh water are added & crushed till milk secretion stops. Then 1/10 th part of water is added	-
Tikshna milky(Snuhi)		

According to Modern Science:-

Apparatus –

Distillation is the process by which liquid is vaporized and recollected by cooling and condensing the vapor.

The apparatus required for distillation

- 1) Boiler (Heating mantle) - which provides heat and maintain the heat.
- 2) Vessel, in which vapors are produced by heating the liquid up to its boiling point.
- 3) Condenser - This functions as a cooling device of vapor either by circulation of water or air at atmospheric temperature.

e.g.: Liebig Condenser, Worm Condenser, Hallock block - tincoil condenser, Reflux condenser (Return – flow condenser), Soxhlet extraction apparatus

- 4) Receiver - It is used for the collection of the condensed liquid.

Process of Distillation:-

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

Distillation consists of two steps (A) Evaporation (B) Condensation

A) Evaporation:-

Evaporation may be defined as the free escape of vapors from the surface of a liquid. It should be distinguished from boiling or ebullition, which takes place at one temperature only for a given pressure.

The Kinetic theory of matter assist us to understand how evaporation takes place at any temperature and from the surface of a liquid only. It is presumed that the molecules of a liquid are always in motion, moving hither and hither at enormous speeds, frequently colliding. The molecules of a liquid are believed to exert an attractive force upon each other.

It will be seen that the Kinetic theory affords an explanation of the fact that when a liquid is allowed to evaporate without being heated it gradually becomes cooler. This is because the molecules with the highest velocity are escaping from the liquid.

Latent heat of Vaporization:-

It will be seen, therefore, that if it is desired to change a liquid into a vapor without fall in temperature, heat must be supplied. This heat is called latent heat of vaporization and when the vapor returns to the liquid state the latent heat is evolved as sensible heat. 1 gm. of water at 100°C may be converted in to water vapor (at normal atmospheric pressure) of the same temperature, the expenditure of 537 Cal. of the heat energy is required.

B) Condensation:

Condensation is the reverse process of evaporation or vaporization. It will be recalled that, in order that 1 gm. of water at 100°C may be converted into water vapor (at normal atmospheric pressure) of the same temperature, the expenditure of 537 cal. of heat energy is required. Accordingly, when water vapor is condensed by cooling, this

same quantity of heat (the latent heat of vaporization) is liberated. Unless adequate provision is made to carry away the heat that is released, the condenser soon becomes too hot to condense the vapor at all and permits it to escape into the atmosphere.

The condensation of water vapor requires a more rapid heat exchange that required for any of the other vapors produced from the common solvents. According to Cook and Lawall - "Remington's practice of pharmacy", it has been calculated that steam at 100° C requires about twenty-five times its weight of water at 20°C. to condense it. In most of cases, water is used as the cooling media and is most effective when supplied as a stream from a constant source, rather than when used by simply surrounding the condensing tube with a relatively large volume of water that is not in motion. The constant motion provides for the continuous replacement of the water as it becomes heated. The condenser should be designed so as to have a relatively large cooling surface, since the rate of condensation is proportional to the area of surface exposed. The condensing surface should be made of substance, which is a reasonably good conductor of heat, for the rapidity of condensation is proportioned to the speed with which the heat is carried away. For this reason, metallic condensers are more efficient than those made of glass.

Distribution of Agni in Arka preparation:-

In Arka Prakash for the preparation of Arka 6 grades of Agni are given on gradual increase of fire⁶ – Ar.P. 1/80.

Name of Agni	Definition of different Agni	Reference	Duration of heating
Dhumagni	Without any flame only huge amount of fumes	Ar.P. 1/81	1½ prahara (4½ hrs.)
Dipagni	flame of Dhumagni is increased to four times	Ar.P. 1/82	1 Prahara (3 hrs)
Mandagni	flame of Dipagni is increased to four times	Ar.P.1/82	½ Prahara (1½hrs.)
Madhyamagni	The Agni in which the flame is in between Dipagni & Mandagani	Ar.P.1/83	1 Muhuruta (45 minutes)
Kharagni	complete Agni	Ar.P.1/83	1 Muhuruta (45 minutes)
Bhattagni	The Agni in which the flame spreads all over the bottom of the vessel	Ar.P.1/84	-

Test of Arka:-

- Taste and odour of the drug from which, Arka Patan is done must be present.
- When Arka is filled in different Patra, the colour of Arka should be similar to Shankha, Kundan and moon rays. Colour should not change if it is filled in Jirnasthi Mrutika Patra. General Dose of Arka – 12-24 ml⁷. Anupan – Tambulbhakshana /Lavanga.

Durgandhanashan Vidhi:-

- If Arka is having bad smell then it has to be fumigate with Dhum produced by powder of Hingu, Methika, Rajika etc. mixed in Ghrita and then it should be kept in Navin Handi.

Storage:-

Arka should be stored in airtight glass bottles – Any Arka if kept open and exposed to air will lose its volatile medicinal principles.

Conclusion:-

Arka Kalpana has its roots in Hima and Phanta Kalpana. The main reference book of Arka Kalpana is "Arka Prakash" but there is no explanation about the author of this text and also about time period of this text. Regarding the distillation process we can give some points for the Arka extraction i.e. Separation of components via distillation depends on the differences in boiling points of the individual components. Also, depending on the concentration of the components present, the liquid mixture will have different boiling point characteristics. Therefore, distillation process depends on the vapor pressure characteristics of liquid mixtures.

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