

PHARMACEUTICO ANALYTICAL STUDY OF VYAGHRYADI KASHAYA AND ITS MODIFICATION IN THE FORM OF ARKA- A COMPARATIVE STUDY

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ABSTRACT

Kwatha, being one among the *Panchavidha Kashaya Kalpanas* is more potent and easily digestible dosage form. As *Panchavidha Kashaya Kalpanas* are usually meant for instantaneous use, its shelf life is prolonged by adding chemical preservatives such as Sodium benzoate, Methyl paraben, Propyl paraben which are said to be carcinogenic when used for longer time. Hence an alternative dosage form, *Arka* which is said to be most potent among *Panchavidha Dravya Kalpana* of *Ravana* in his text *Arka Prakasha* is chosen in the present study. *Arka* form of any drug will have better palatability, higher shelf life & maximum patient compliance. Hence this study intends to evaluate *Vyaghryaadi Kashaya* & *Vyaghryaadi Kashaya dravya Arka* Pharmaceutically, Analytically & compare them.

Keywords: *Panchavidha Kashaya Kalpanas, Kwatha, Arka*

INTRODUCTION

Since pre-historic period man has been using drugs for preservation of health alleviation of several disorders. In Palaeolithic and Neolithic period most probably he might have used these drugs in the form of juice or in the form of powders. After invention of fire these drugs were subjected to heating and different process. The references regarding the use of herbal drugs were seen from *Vedic* period, but pharmaceutical methods for this are not available. Even though we come across the use of *Soma Rasa* in *Rig Veda*, the method of preparation is not available. From *Samhita* period the drugs were converted into different dosage forms depend on the *Roga, Rogi* etc. where dosage forms starts from *Pancha Vidha*

*Kashaya Kalpana*¹ which are considered as primary preparations in *Bhaishajya Kalpana* are the true results of such great thoughts of *Acharyas*. By giving different *Samskara* one can convert the drug into different dosage forms. *Samskara* is the process which turns the raw drug into potent medicine. All the properties contributed to raw drugs, to facilitate treatment have the advantage of *Samskara*. *Acharya Charaka* mention that even the mixing of drugs causes some changes in properties and that also should be considered as *Samskara*.² It should strictly undergo the procedures of *Samskara* to attain bio availability of particular formulation. Modern pharmaceutical industry is appreciating those pharmaceu-

tical forms where there is increased palatability, shelf life and patient compliance. Various dosage forms are designed to provide a medicine in a suitable form for easy consumption, convenience, accuracy and bio availability.

Pancha Vidha Kashaya Kalpana are the primary preparations in *Ayurvedic* pharmaceuticals.³ *Kwatha*, being one among the *Panchavidha Kashaya Kalpanas* is more potent and easily digestible dosage form. As *Panchavidha Kashaya Kalpanas* are usually meant for instantaneous use, its shelf life is prolonged by adding chemical preservatives such as Sodium benzoate, Methyl paraben, Propyl paraben which are said to be carcinogenic when used for longer time.⁴ *Arka Prakasha* describes *Kalka, Churna, Rasa, Taila* and *Arka* as *Panchavidha Kashaya Kalpana*. Among this *Arka* is said to be the most potent.⁵ *Arka* is a unique preparation in which water soluble active principles & essential oils from the herbal drugs are extracted through distillation

method. *Arka* being water distillate, do not undergo putrefaction & remain fresh for 1-2 years. This preparation was introduced to main stream pharmaceutical industry in the recent years. *Arka* form of any drug will have better palatability, higher shelf life & maximum patient compliance.

Vyaghryaadi kashaya is one such formulation mentioned in *Ashtanga Hridaya* in *Jwara chikitsa* which contains *Vyaghri, Guduchi, Shunti & Pippali* which is indicated in *Jwara, Peenasa, Kasa, Shwasa and Shoola*⁶ but less explored or implemented in the clinical practice. The bitter and pungent taste and its shelf life are the hindrance that arises in implementation of this formulation in prescriptions. There arises a need to overcome this drawback with modification of these *Kwatha* ingredients into a form which would render same results as that of the *Kwatha*. Hence this study intends to evaluate *Vyaghryaadi Kashaya & Vyaghryaadi Kashaya dravya Arka* pharmaceutically and analytically.

Materials and Methods

Table 1: Ingredients of *Vyaghryaadi Kashaya* and *Arka*

Sl.No	Ingredients	Latin name	Part used	Quantity	
				For <i>Kashaya</i>	For <i>Arka</i>
1.	<i>Kantakari</i>	<i>Solanum xanthocarpum</i>	<i>Panchanga</i>	37.5 grams	25 grams
2.	<i>Guduchi</i>	<i>Tinospora cordifolia</i>	<i>Kanda (Fresh)</i>	37.5 grams	25 grams
3.	<i>Shunthi</i>	<i>Zingiber officinale</i>	Rhizome (Dried)	37.5 grams	25 grams
4.	<i>Pippali</i>	<i>Piper longum</i>	Fruit (Dried)	37.5 grams	25 grams
5.	Water			1200 ml	800 ml

Source of Drug

Kantakari (*Solanum xanthocarpum*) was collected from Kappalaguddi of Belagavi district *Guduchi* (*Tinospora cordifolia*) from campus of Govt. Ayurveda Medical College, Bengaluru

Pippali (*Piper longum*) & *Shunti* (*Zingiber officinale*) were purchased from Amrut Kesari Depot, Mamulpet, Bengaluru

Preparation of *Vyaghryaadi Kashaya*

Kashaya was prepared as per the general method of preparation mentioned by *Sharangadhara Samhita*⁷. Freshly collected *Panchanga* of *Kantakari* was dried

and powdered by subjecting it into pulveriser using sieve with mesh size 9 to obtain its coarse powder form. Dried rhizome of *Shunthi* and fruit of *Pippali* were taken in crude form and were pounded separately in a clean *Khalva Yantra* to obtain coarse powder form. *Guduchi* stem was collected freshly, cut into small pieces of 4-5cms size approximately; its outer skin was removed and was crushed in a clean *Khalva Yantra*. All the ingredients were taken in specified quantity as mentioned in Table no.1 in a stainless-steel vessel and sufficient quantity of water was added (250 ml) to soak the drug for 3 hours.

Later 1200ml water (8 parts) was added to it and subjected to mild heat with frequent stirring without covering its mouth. Reduction was done until the quantity reduced to 1/4th of its original volume (300ml) and contents were filtered through a clean cotton cloth in to a stainless-steel vessel and the residue was discarded. Temperature was recorded and maintained at 80-90°C throughout the procedure.

Preparation of Vyaghryadi Arka

Arka was prepared as per the general method of preparation mentioned in *Ayurveda Sara Sangraha*⁸. Ingredients used for the preparation of *Vyaghryadi Arka* were taken in the similar way as that used for the preparation of *Vyaghryadi Kashaya*. All the ingredients were taken in specified quantity as mentioned in Table no.1 in a stainless-steel vessel and sufficient quantity of water was added (150 ml) for soaking in the previous night. Next day it was transferred to the distillation apparatus, the remaining quantity of water was added, condenser of the distil-

lation apparatus was attached and was subjected to heating by placing over heating mantle. Apparatus was heated initially at 80°C till the contents in the apparatus started to boil and later the temperature was reduced to 60°C and maintained throughout the procedure. *Arka* started to collect after 80 minutes in the receiver part of the apparatus where initial 5-6 drops were discarded as it may not contain any volatile matter. 2/3rd of the distillate was collected (i.e 660 ml) and heating was stopped and the *Arka* obtained was stored in a clean glass bottle.

Analytical study

The prepared *Vyaghryadi Kashaya* and *Arka* were subjected to evaluate their Organoleptic properties, physico-chemical analysis, qualitative estimation of phytoconstituents, quantitative estimation of detected phytoconstituents by qualitative estimation and HPTLC by following standard protocol in accredited laboratory. The results obtained were depicted in the Table No.2-3

Results

Table 2: Showing results of Pharmaceutical study

Sl.No.	Observations	<i>Vyaghryadi Kashaya</i>	<i>Vyaghryadi Arka</i>
1.	Total quantity of drugs taken	150 grams	100 grams
2.	Quantity of water added	1200 ml	800 ml
3.	Quantity obtained	300 ml	660 ml
4.	Quantity of Reduction	900 ml	340 ml
5.	Total time taken	64 minutes	370 minutes
6.	Total yield	25 %	66 %

Table3: Showing Results of Organoleptic Characters of *Vyaghryadi Kashaya and Arka*

Sl.No.	Organoleptic characters	<i>V.KASHAYA</i>	<i>V.ARKA</i>
1.	Colour	Dark Brown	Colourless
2.	Taste	Bitter	Slightly bitter
3.	Odour	Aromatic	Aromatic
4.	Appearance	Thin Liquid	Clear liquid

Table 4: Showing results of Physico-chemical analysis of *Vyaghryadi Kashaya and Arka*

Sl.No.	Analytical Parameters	<i>V.KASHAYA</i>	<i>V.ARKA</i>
1.	pH	5.77 @ 25°C	7.08 @ 25°C
2.	Specific gravity at 25°C	1.1459	1.0009
3.	Total ash value	0.6186 %	-
4.	Acid insoluble ash	0.3579%	-

5.	Water soluble ash	0.1541%	-
6.	Loss on drying	93.81%	-
7.	Determination of boiling point	-	98 ⁰ C
8.	Refractive index	1.3748	1.3325

Table.5: Showing Results of phytochemical analysis of *Vyaghryaadi Kashaya and Arka*

Sl. No.	Test	Sample	
		<i>V.Arka</i>	<i>V.Kashaya</i>
1.	Alkaloid test (Dragendoff's test)	-	+
2.	Carbohydrate test (Molisch's test)	+	+
3.	Tannin test	-	-
4.	Terpenoids test	+	-
5.	Glycoside test	-	-
6.	Steroid test	-	-
7.	Saponin test	-	+
8.	Phenol test	-	-
9.	Cardiac glycosides	-	-
10.	Flavonoid test	-	-

Determination of Total Alkaloid Contents

Table 6: Showing Concentration of Alkaloid Content in Standard Capsaicin

Sample Name	Conc. (µg/ml)	Abs
	0	0.3145
Standard (Capsaicin)	0.309	0.4034
	0.618	0.5212
	1.236	0.7122
	2.472	1.1645

Figure 1: Graph showing Absorbance of Alkaloid in Standard Capsaicin

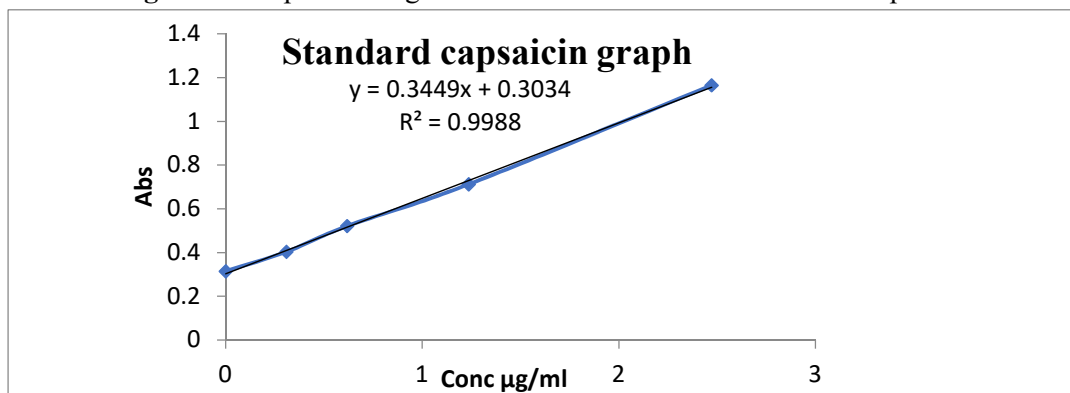


Table 7: Showing Concentration of Alkaloid Content in *Vyaghryadi Kashaya*

Sample Name	Conc. (µl)	Abs	Conc. Alkaloid (ug CE/µl)	Conc. Alkaloid (mg CE/ml)
<i>Vyaghryadi Kashaya</i>	100	0.3406	0.109	1.09

In alkaloid estimation, the sample found to contain 1.09 mg CE/1ml of alkaloid content.

Determination of Total Saponin Contents

Table 8: Showing Concentration of Saponin Content in Standard Diosgenin

Sample Name	Conc. (µg/ml)	Abs
Standard (Diosgenin)	0	0.023
	100	0.057
	200	0.098
	300	0.143
	400	0.18
	500	0.22

Figure 2: Graph showing Absorbance of Saponin in Standard Diosgenin

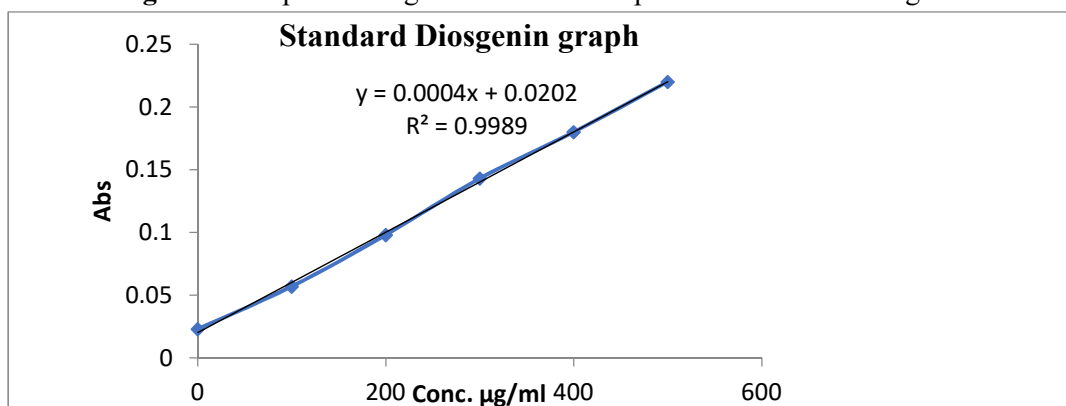


Table 9: Showing Concentration of Saponin Content in *Vyaghryadi Kashaya*

Sample Name	Conc (µl)	Abs	Conc.Saponin (µg DE/µl sample)	Conc. Saponin (mg DE/ml sample)
<i>Vyaghryadi Kashaya</i>	10	0.0541	84.75	8.475

In total Saponin assay, the sample contained 8.475 mg DE/ml of saponin content

Results of HPTLC

Figure 3: TLC Photodocumentation of *Vyaghryadi Kwatha Choorna*, *Vyaghryadi Kashaya* and *Vyaghryadi Arka*

Profile under 254 nm Light source	Profile under 366 nm Light source	Profile After Derivatization
<p>L1 L2 L3</p>	<p>L1 L2 L3</p>	<p>L1 L2 L3</p>

L1- Lane 1 - Vyaghryaadi Arka

L2- Lane 2 - Vyaghryaadi kashaya

L3- Lane 3 - Vyaghryaadi kwatha choorna

Mobile phase - Toluene (55): Ethyl acetate (45): Acetic acid (2)

Spray reagent - Anisaldehyde reagent

Table 10: Rf values of all the samples at 254 nm

<i>Vyaghryaadi Arka</i>	<i>Vyaghryadi Kashaya</i>	<i>Vyaghryaadi Kwatha Choorna</i>
-	-	0.35 (L. Green)
-	-	0.51 (L. Green)
-	0.54 (L. Green)	0.54 (L. Green)
-	0.56 (D. Green)	0.56 (D. Green)
0.59 (L. Green)	0.59 (L. Green)	0.59 (D. Green)
-	0.88 (L. Green)	0.88 (L. Green)
0.95 (L. Green)	0.95 (D. Green)	0.95 (D. Green)

L – Light; D- Dark

Table 11: Rf values of all the samples at 366 nm

<i>Vyaghryaadi Arka</i>	<i>Vyaghryadi Kashaya</i>	<i>Vyaghryaadi Kwatha Choorna</i>
-	-	0.01 (L. Blue)
0.19 (L. Blue)	-	0.19 (L. Blue)
-	-	0.22 (L. Pink)
0.27 (L. Blue)	-	0.27 (L. Blue)
-	0.29 (L. Pink)	0.29 (L. Pink)
-	-	0.33 (L. Pink)
-	-	0.39 (L. Blue)
-	0.44 (L. Blue)	0.44 (L. Blue)
-	0.47 (L. Pink)	0.47 (L. Pink)
-	0.59 (L. Pink)	0.59 (L. Pink)
-	0.65 (L. Blue)	0.65 (L. Blue)
-	0.70 (L. Blue)	0.70 (L. Blue)
-	0.73 (L. Pink)	0.73 (L. Pink)
-	0.82 (L. Pink)	0.82 (L. Pink)
-	0.88 (L. Pink)	0.88 (L. Pink)

L – Light; D- Dark

Table 12: Rf values of all the samples at Post Chromatographic Derivatization

<i>Vyaghryaadi Arka</i>	<i>Vyaghryadi Kashaya</i>	<i>Vyaghryaadi Kashaya Chorna</i>
-	-	0.21 (L.Blue)
-	0.29 (L.Blue)	0.29 (L.Blue)
-	-	0.35 (L. Purple)
-	0.44 (L. Purple)	0.44 (L. Purple)
-	0.47 (L.Blue)	0.47 (L.Blue)
0.59 (L. Purple)	0.59 (L. Purple)	0.59 (L. Purple)
-	0.65 (L.Blue)	0.65 (L.Blue)

-	0.71 (L.Blue)	0.71 (L.Blue)
-	0.73 (L.Pink)	0.73 (D.Pink)
-	0.82 (L.Pink)	0.82 (D.Pink)
-	-	0.86 (L.Blue)
0.88 (L.Blue)	0.88 (L.Blue)	0.88 (L.Blue)
-	-	0.91 (L. Purple)
0.96 (L.Blue)	0.96 (L.Blue)	0.96 (L.Blue)

DISCUSSION

Acharyas have used *Kwatha Kalpana* to cure different diseases as well as to formulate different derivative *Kalpanas* like *Avaleha*, *Sneha*, *Sandhana* etc. The basic principle behind preparation of these *Kashayas* is plant as a whole or any part of the plant, as a whole plant 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.

In *Ayurveda* practice usage of *Arka Kalpana* is uncommon or very rarely used. Some consider it as a part of Unani system of medicine and not *Ayurveda*. They are not described in any of the *Vedas*, *Samhitas* or *Nighantus*. Recent text books have included it as an *Upakalpana* of *Phanta Kalpana*. *Arkas* are elaborately described in the book *Arka Prakasha* written by *Ravana* who lived in the age of *Dwaparayuga*. From this we can conclude that during the period of *Arka Prakasha*, *Arkas* were popular. The description of *Arka Yantra* makes one to think that the sophistication in preparation has lead *Arka Kalpana* to be seldom used. Scientific advancement has made use of distillation apparatus more convenient for the preparation of *Arka*.

The properties of the finished product after processing will be different from the raw drug. Each process will affect the fate of raw drugs. For the quality assurance of any preparation it is important to carry out each process cautiously right from the collection of raw materials, in-process conditions up to storage of finished product.

Preparation of *Kashaya* was carried out in *Mandagni* (80-90⁰C) to avoid destruction of component sensitive to higher temperature. Stirring was done frequently for proper extraction and reducing the chances of degradation of some of the active constituents, which may decompose due to hydrolysis. Thus occasional mechanical stirring is essential to facilitate the evaporation and to avoid the drugs get adhered at the bottom of the vessel.

After the desired reduction was achieved, the mixture was filtered through a clean cotton cloth. This was done to obtain the clear liquid, free from the particles of the drug.

Colour of the *Kwatha* changed from light brown to dark brown with characteristic odour of the ingredients (more of *Shunthi* and *Pippali*) and bitter and astringent in tastes due to extraction of bitter principles from the drug.

Soaking of drugs prior to the preparation increases the duration of contact of drug with water and some constituents of drugs gets released out to water. During the time of soaking the particles of drugs may enter into the water by hydrolysis. By soaking the air will be replaced by the water. It enters into the pores of the drug and penetrates deep into the cells through osmosis. In wet drugs the cell walls (micelle or cellulose molecule) will be surrounded by a film of water. In dry drugs, this water film is lost and the micelle move together to form a continuous membrane. When the dry drug is moistened, the opposite occurs and the micelle takes up liquid or water film and tissue swells up. The amount of swelling varies being greatest in water. This clearly shows that the powdered dry drug must be soaked in water for some

time. In case of a material, which is too hard, soaking may be advocated for longer duration.

Swelling is a result from the distension and bursting of thin-walled cells of the drug. After the entry of water, the soluble matter inside the cell like carbohydrates, proteins, tannins, saponins, glycosides and alkaloids will form a solution of soluble matter. On bursting and boiling of the cells the solution of soluble matter which gets formed inside the cell will be moving to the liquid media.

During the process of heating in the preparation of Arka, when the vapour pressure becomes equal to the surrounding pressure, the liquid starts boiling. This is known as boiling point. On further boiling, the liquid turns to vapour and this vapour formed gets condensed into liquid again through the condenser which is continuously supplied by cold water and gets collected at the receiver which is known as Arka. Only 2/3rd of the distillate has to be extracted as further extraction will not have any active constituents. Clear liquid with oil droplets on the surface is suggestive of volatile oil of the drug has been extracted. After the collection it has to be preserved in a closed clean glass bottle without any contamination so as to preserve its volatile matter, aroma and potency.

pH Value - pH value of *Vyaghryaadi Kashaya* and *Arka* was 5.77 and 7.08 respectively, represents weakly acid nature of *Kashaya* and Alkaline nature of *Arka*. pH is the negative logarithm of Hydrogen. The dissociation of molecules is highly temperature dependent. Any change in the temperature will change the hydrogen ion concentration and therefore its pH value. Drugs that are weak acidic in nature, will be present in their non-ionic form. Since non-ionic species diffuse more readily through cell membranes, weak acids will have a higher absorption in the stomach which has acidic pH.

Specific gravity- The specific gravity of a liquid is the weight of a given volume of the liquid (unless otherwise specified) compared with the weight of an equal volume of water at the same temperature, all kinds of weighing being taken in air. Specific

gravity of *Kashaya* (1.1459) was found to be slightly more than that of *Arka* (1.0009). This may be due to more of the water soluble constituents might have been found in *Kashaya* than that of *Arka*.

Total Ash- The total ash value of *Vyaghryadi Kashaya* was found to be 0.6186%. Total ash value is important in identification and standardization of the drug or the prepared product. A high ash value is indicative of the presence of inorganic matter again which may indicate the contamination, substitution, adulteration of the drug or the prepared product.

Acid insoluble Ash -The presence of acid insoluble ash indicates mainly the presence of silica. The acid insoluble ash of *Vyaghryadi Kashaya* was 0.3579%

Water Soluble Ash- The water soluble ash of the sample was found to be 0.1541%.

Loss on drying- Loss on drying of *Vyaghryadi Kashaya* was 93.81%. Loss on drying of a drug or a formulation indicates the presence of moisture content. This may also indicate the presence of total solid content in the formulation. As the formulation is liquid in nature, the LOD has shown more value. Thus it has been mentioned in our classics for the instant usage of *Kashaya Kalpana* as moisture contents may affect the quality of the drug.

Determination of boiling point - Boiling point refers to the temperature at which the liquids start boiling. The boiling point of the *Arka* determined was 98^oC which is almost equivalent to the boiling point of water. This may be because the *Arka* was prepared from water and no other liquids were added to it.

Refractive index- Refractive index of a substance is a dimensionless number that describes how light, or any other radiation, propagates through that medium. Refractive index of water is 1.33, which means that light travels 1.33 times slower in water than it does in vacuum. Refractive index of *Kashaya* was found to be slightly more than that of *Arka*.

Phyto-chemical Analysis-

- Chemical compounds produced as a result of metabolic reaction during the plant growth are known as Phytochemicals. The medicinal value

of the plant lies in the phytochemical (bioactive) constituents of the plant which shows various physiological effects on human body. Plants contain lots of free radical scavenging molecules some of which include alkaloids, amines, terpenoids, phenolic acids, tanins and other secondary metabolites with high level anti-oxidant activity. Most of the phytochemicals are anti-oxidant agents which essentially reduce the damages caused in tissue during physiological process⁹.

- *Vyaghryaadi Kashaya* showed the presence of Alkaloids, Saponins and Carbohydrates whereas *Vyaghryadi Arka* showed the presence of Triterpenoids and Carbohydrates.
- In alkaloid and saponin estimation, *Vyaghryaadi Kashaya* found to contain 1.09 mg CE/1ml of alkaloid content and 8.475 mg DE/ml of saponin content respectively.
- Non-detection of other constituents like flavonoids tanins, etc is may be due to less concentration of drug in the solution or compounds may be non-polar or thermally labile or it could have been detected by using more sophisticated techniques for identification.

Discussion on HPTLC

HPTLC is the sophisticated analytical parameter for the evaluation of the herbal drugs. HPTLC can also serves as Fingerprinting technique for identification and quantification of the herbal and herbo-mineral formulations. Through HPTLC technique major phytochemical present in the drug or formulation can be estimated. It helps to find out the adulteration in the formulation and is used as a standard for the herbal compounds.

In the present study, HPTLC of *Vyaghryadi Kashaya*, *Arka* and *Vyaghryadi Kwatha Choorna* was carried out.

- At 254 nm- 5 Rf values of *Vyaghryaadi Kashaya* and 2 values of *Arka* corresponds to that of *Kwatha Choorna*.

- At 366 nm- 9 Rf values of *Vyaghryaadi Kashaya* and 3 values of *Arka* corresponds to that of *Choorna*.
- At Post Chromatographic Derivatization- 10 Rf values of *Vyaghryaadi Kashaya* and 3 values of *Arka* corresponds to that of *Choorna*.

This difference is may be due to the constituent present in the *Kwatha Choorna* was water insoluble or might have undergone thermal decomposition while boiling.

As the obtained Rf values of *Kashaya* and *Arka* corresponds with that of *Kwatha Choorna*, it suggests there is no complete degradation of raw drugs in the final product.

CONCLUSION

Kwatha, being one among the *Panchavidha Kashaya Kalpanas* is more potent, easily digestible dosage form and can be prepared easily when compared to *Arka*. The properties of the drug changes when it is brought into a suitable dosage form or when it is subjected to certain *Samskaras* as claimed by our Acharyas and this is evident through the pharmaceutical and analytical study results obtained in the present study. Extensive research is necessary for the modification of *Kashaya* into *Arka* as different ratios for water and drug have been mentioned for its preparation.

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