



## PHARMACEUTICAL DEVELOPMENT OF ARJUNA KSHEERAPAKA POWDER PREPARED FROM DIFFERENT METHODS & ITS ANALYTICAL EVALUATION

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### ABSTRACT

**Introduction:** Ksheerapaka is an extraction method in which both aqueous and lipid soluble extractives are extricated from the pungent and astringent drugs, where milk will perform as chirality compound. Ksheerapaka is prepared by four different methods and it has to be consumed instantly. Hence the Ksheerapaka is developed into powder form by drier method to increase its shelf life.

**Methodology:** The present study is done to realise suitable method for preparation of Arjuna Ksheerapaka and the Ksheerapaka powder, by quantitative and qualitative estimation.

#### Aims & Objectives:

1. To prepare Arjuna Ksheerapaka by using four different methods.
2. To convert Ksheerapaka into powder form by spray drier method.
3. To find out the qualitative analysis for the resultant product.

**Results:** The percentages of powder obtained by the methods are: Method 1 – 5%, Method 2 – 2.39%, Method 3 – 4.025% and Method 4 – 5.66%. High Performance Thin Layer Chromatography (HPTLC) finger printing at 540nm refraction was done to estimate the numbers of chemical constituents obtained unaltered from methods and the results are: Method 1 – 2, Method 2 – 3, Method 3 – 6 & Method 4 – 5.

**Discussion:** Ksheerapaka is preferred for pungent and astringent drugs, to counter their attributes and make them palatable and there are different methods for its preparation. The Ksheerapaka prepared by different methods are converted into powder form and analysed by Physico-chemical parameters and HPTLC. Sharangdhara's method has higher relevance at 540nm refraction where, 6 chemical constituents from the raw drug were found intact in ksheerapaka powder.

### KEYWORDS : Arjuna, Ksheerapaka, Spray drier

#### INTRODUCTION:

*Ksheerapaka* is an *Upakalpana* (sub formulation) of *kwatha kalpana* (decoction). It is a unique preparation found in *Ayurvedic pharmacopeia*, where milk is the media of administration. Usually the *Tikshna* (pungent) & *Kashaya Pradhana* (astringent dominant) drugs are selected here. The intention is to bring down the *Tikshnata* (pungency) and the *Kashayata* (astringency) of the drug, with the help of *Madhura Rasa* (sweet taste) and *Madura Vipaka* (sweet metabolic end effect) of *ksheera* (milk). We find 4 different methods of *Ksheerapaka* preparation in *Ayurveda* texts each prepared with different proportions of water and milk. Still which method is to be preferred or more yielding is not been indicated. Though *Ksheerapaka* is extensively used, very low shelf life is still a concern for its preparation and it has to be used immediately after its preparation. *Arjuna* (*Terminalia arjun*), commonly administered as *Ksheerapaka*, is been known for its mild diuretic and fairly potent cardiac stimulant and cardio-tonic activity. Today this *Arjuna Ksheerapaka* can also be converted into powder form by using drying techniques. The value in the final powder form will give an insight for converting such low shelf life preparations into a stable dosage form like powder. The *Ksheerapaka Kalpana* is mentioned only by a few *Samhitakaara* (authors of Ayurvedic classical texts). There are more than one methods of its preparation and no reference can be ignored, as every procedure being considered as *Aptavachana* (verbal testimony). *Ksheerapaka Kalpana* is hard to prepare every time especially in outdoor. By converting into powder form, we are making an attempt to make this preparation patient friendly. Hence, this study is done to determine the ideal procedure to prepare *Arjuna Ksheerapaka* and to develop it into powder form.

#### MATERIALS AND METHODS:

Raw materials like *Arjuna* bark was collected from market and necessary drugs were authenticated by Department of Pharmacognosy, Parul Institute of Ayurveda, Parul University, Gujarat. Cow's milk was

procured from FSSAI (Food Safety and Standards Authority of India) approved milk Product Company. Pharmaceutical preparation of *Arjuna ksheerapaka* was done at GMP (Good Manufacturing Practice) certified Ayurveda pharmacy, Parul Institute of Ayurved, Parul University, Gujarat.

#### PREPARATION OF ARJUNA KSHEERAPAKA:

*Arjuna ksheerapaka* was prepared by four different references *Ashtanga Sangraham*, *Chakradatta*, *Sharangdhara* and *Yadavji Trikamji*. *Ksheerapaka* of *Arjuna* was prepared by 4 different methods, in 3 batches.

- 75g of *Arjuna twak* (Arjuna bark) is boiled in 600ml of *jala* and reduced to 150ml and *kwatha* (decoction) of *Arjuna* is obtained. Equal quantity of *ksheera* (milk) is added to obtained *kwatha* (decoction) and boiled till milk portion remains.
- 320ml of *ksheera* (milk) and 320ml of *jala* (water) are taken to 40g of *Arjuna twak* (Arjuna bark) and this is boiled till milk portion remains.
- 240ml of *ksheera* (milk) and 960ml of *jala* (water) are taken to 40g of *Arjuna twak* (Arjuna bark) and this is boiled till milk portion remains.
- 300ml of *ksheera* (milk) and 300ml of *jala* (water) are taken to 20g of *Arjuna twak* (Arjuna bark) and this is boiled till milk portion remains.

**Table-1: Preparation of Arjuna Ksheerapaka**

Methods	Amount of Arjuna bark (in g)	Quantity of milk (in ml)	Quantity of water (in ml)	Max temp (in °C)	Yield obtained (in ml)
<i>Ashtanga Sangraham</i>	75	150	150 (decoction)	105-107	150
<i>Chakradatta</i>	40	320	320	105-107	320

<i>Sharangdhara Samhita</i>	30	240	960	107-108	240
<i>Dravyaguna Vijnanam</i>	20	300	300	107-108	300

### POWDERING OF ARJUNA KSHEERAPAKA:

*Arjuna ksheerapaka* is converted into the dried powder by using Lab Ultima, lab spray dryer, LU 222 advanced at department of Pharmaceutics, Parul Institute of Pharmacy and Parul Institute of Pharmacy and Research, Parul University, Vadodara, Gujarat. *Ksheerapaka* was kept in spray drying unit with standard setting of atomizer on temperature controlled mode at 90-95°C.

**Table- 2: Preparation of *Arjuna Ksheerapaka* powder**

Method	Quantity of <i>ksheerapaka</i> in (ml)	Inlet temp. in (°C)	Outlet temp. in (°C)	Aspirator rate (m <sup>3</sup> n/hr)	Feed pump rate in (ml/min)	Time duration in (minutes)	Quantity of dried powder obtained in (g)
<i>Ashtanga Sangraha</i>	150	90	40	60	1	60	7.5
<i>Chakradatta</i>	320	90	40	60	1	205	8
<i>Sharangdhara Samhita</i>	240	90	40	60	1	140	10
<i>Dravyaguna Vijnanam</i>	300	90	40	60	1	165	18

### RESULTS:

Analysis of samples was conducted at quality control lab of Parul Institute of Ayurved as per API standards. Parameters such as colour, odour, taste, touch, pH, Specific gravity, Total solid content, Particle size distribution, Ash value, Loss on drying, Acid insoluble ash, Water soluble extractive and Methanol soluble extractive.

HPTLC was done by adopting solvent system of Toluene: Ethyl Acetate: Formic Acid in proportion of 5:5:2 over MERCK-TLC/HPTLC silica gel 60 F254 on aluminium sheets. Spots of *Arjuna Ksheerapaka*, Raw *Arjuna* powder and *Arjuna Ksheerapaka Churna* (spray dried powder) were placed on HPTLC plate and observed under 254nm, 366nm, 540nm frequency wavelength of UV light. Derivation was done by Anisaldehyde Sulphuric acid reagent.

**Table- 3: Organoleptic parameters of *Arjuna Ksheerapaka* & Spray dried powder Method - 1**

Properties	<i>Arjuna Ksheerapaka</i>	Spray dried powder
Colour	Dark brown	Dark brown
Odour	Milky	Milky
Taste	Astringent, sweet	Sweet, astringent
Touch	Unctuous	Fine smooth
Form	Liquid	Solid (powder)

**Table- 4: Organoleptic parameters of *Ksheerapaka* & Spray dried powder Method - 2, 3 & 4**

Properties	<i>Arjuna Ksheerapaka</i>	Spray dried powder
Colour	Light brown	Light brown
Odour	Milky	Milky
Taste	Astringent, sweet	Sweet, astringent
Touch	Unctuous	Fine smooth
Form	Liquid	Solid (powder)

**Table- 5: Physicochemical parameters of *Arjuna Ksheerapaka*:**

Observations	Method 1	Method 2	Method 3	Method 4
pH Value	5	5	5	6
Specific gravity (in g/ml)	1.44	1.0239	1.0249	1.0237
Total Solid Content (in %)	2.933	2.696	2.256	2.883

**Table- 6: Physicochemical parameters of *Ksheerapaka* powder:**

Observations	Method 1	Method 2	Method 3	Method 4
Ash value (in %)	8	6	5.9	4
Loss on Drying (in %)	1.8	4	4.5	3.5
Acidic insoluble ash (in %)	1	1	0	1
Water soluble extractives (in %)	1.68	1.6	1.29	1.152
Methanol soluble extractives (in %)	2.22	0.53	0.69	0.476

**Table- 7: HPTLC RF values at 540nm method 1:**

Sample	No of spots	Refraction value at 540 nm
<i>Arjuna Ksheerapaka</i>	10	0.05, 0.17, 0.22, <b>0.37</b> , 0.41, 0.51, <b>0.56</b> , 0.68, 0.82, 0.91
Raw <i>Arjuna</i> powder	6	0.06, 0.16, <b>0.37</b> , <b>0.56</b> , 0.61, 0.69
<i>Arjuna Ksheerapaka</i> powder	10	0.05, 0.18, 0.23, <b>0.37</b> , 0.51, <b>0.56</b> , 0.61, 0.68, 0.82, 0.91

**Table- 8: HPTLC RF values at 540nm method 2:**

Sample	No of spots	Refraction value at 540 nm
<i>Arjuna Ksheerapaka</i>	11	0.06, 0.11, 0.20, 0.26, <b>0.40</b> , 0.43, 0.54, <b>0.60</b> , <b>0.73</b> , 0.86, 0.94
Raw <i>Arjuna</i> powder	6	0.07, 0.19, <b>0.40</b> , <b>0.60</b> , 0.65, <b>0.73</b>
<i>Arjuna Ksheerapaka</i> powder	10	0.06, 0.20, 0.26, <b>0.40</b> , 0.54, <b>0.60</b> , 0.65, <b>0.73</b> , 0.86, 0.94

**Table- 9: HPTLC RF values at 540nm method 3:**

Sample	No of spots	Refraction value at 540 nm
<i>Arjuna Ksheerapaka</i>	11	<b>0.07</b> , 0.19, 0.23, <b>0.37</b> , 0.40, 0.50, <b>0.55</b> , <b>0.60</b> , <b>0.67</b> , <b>0.79</b> , 0.87
Raw <i>Arjuna</i> powder	6	<b>0.07</b> , 0.16, <b>0.37</b> , <b>0.55</b> , <b>0.60</b> , <b>0.67</b> , <b>0.79</b>
<i>Arjuna Ksheerapaka</i> powder	10	<b>0.07</b> , 0.19, 0.23, <b>0.37</b> , 0.50, <b>0.55</b> , <b>0.60</b> , <b>0.67</b> , <b>0.79</b> , 0.87

**Table- 10: HPTLC RF values at 540nm method 4:**

Sample	No of spots	Refraction value at 540 nm
<i>Arjuna Ksheerapaka</i>	12	<b>0.06</b> , 0.09, 0.13, 0.18, <b>0.36</b> , 0.39, 0.49, <b>0.54</b> , <b>0.58</b> , <b>0.66</b> , 0.80, 0.87
Raw <i>Arjuna</i> powder	6	<b>0.06</b> , 0.16, <b>0.36</b> , <b>0.54</b> , <b>0.58</b> , <b>0.66</b>
<i>Arjuna Ksheerapaka</i> powder	9	<b>0.06</b> , 0.17, <b>0.36</b> , 0.49, <b>0.54</b> , <b>0.58</b> , <b>0.66</b> , 0.80, 0.87

### DISCUSSION:

*Ksheerapaka* is a sub formulation of *Kashaya* (decoction), in which aqueous and lipid soluble principles are extracted for consumption. This formulation is preferred for pungent and astringent drugs, aiming to reduce their attributes and make them palatable and this is prepared by 4 different methods. When it comes to astringent drugs, the use of milk is chirality. The choking effects of the natural astringent drugs are counteracted by the sweetness of milk.

Spray drying is one among the method of producing dry powder from a liquid or slurry material by rapidly drying with hot gas. This is the ideal method of drying of various thermal-sensitive materials like foods and pharmaceuticals.

The percentages of yield of powder obtained by the methods are,

Method 1 – 5%

Method 2 – 2.39%

Method 3 – 4.025%

Method 4 – 5.66%

The details of organoleptic studies are recorded by direct perception. The physico-chemical parameters are recorded separately for *Ksheerapaka* and *Ksheerapaka* powder. The recordings are as follows, pH- It is acidic on all *Ksheerapaka* and is neutral in all *Ksheerapaka* powders. Specific gravity- The method according to *Ashtanga Sangraha* has more specific gravity, as the other methods lost a considerable portion of their milk solids with the waste. Total solid content- By the same reason above, the *Ksheerapaka* of *Ashtanga Sangraha* method has more solids. Ash Value- Once again the higher milk solids of *Ksheerapaka* of *Ashtanga Sangraha* lead to lightly more solids. Loss on Drying- The powder prepared according to *Sharangdhara Samhita* has higher loss, obviously as it is the method conducted with higher ratio of water. Water Soluble Extractives- are more in *Ksheerapaka* powder of *Ashtanga Sangraha* method because of the preparation pattern. Methanol Soluble Extractives are also high in *Ksheerapaka* powder of *Ashtanga Sangraha* method because of the above same reason. Particle Size Distribution: Irrespective of the methods, every sample has higher quantity of moderately coarse powders.

Instrumental Analysis: *Sharangdhara Samhita* method has higher relevance at 540nm refraction where, 6 chemical constituents of the raw drug got carried unaltered to *Ksheerapaka* powder.

**CONCLUSION:**

The alternate hypothesis is accepted as there is significant qualitative difference in *Arjuna Ksheerapaka* powder prepared by different methods. The *Ksheerapaka Churna* (*Ksheerapaka* powder) developed with *Ksheerapaka* powder prepared by *Dravyaguna Vijnanam* method, yields higher quantity. The *Ksheerapaka Churna* (*Ksheerapaka* powder) developed with *Ksheerapaka* prepared by *Sharangdhara Samhita* method yields higher unaltered concentration of chemical constituents.

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**PICTURES:**



**1. Measurement of Arjuna Twak**



**2. Pounding of Arjuna Twak**



**3. Arjuna Twak put in vessel**



**4. Measurement of milk**



**5. Measurement of water**



**6. Arjuna Twak, milk and water in vessel**



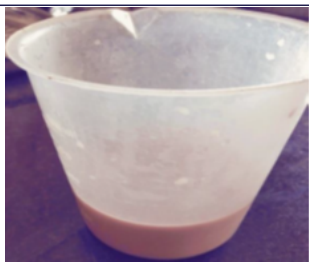
**7. Boiled Arjuna Ksheerapaka**



**8. Temperature assessment by thermometer**



**9. Filtration of Ksheerapaka**



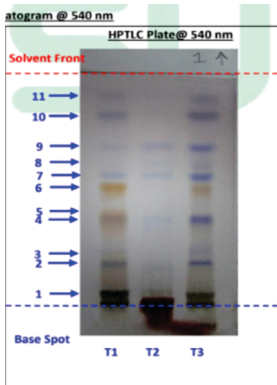
10. Obtained Ksheerapaka



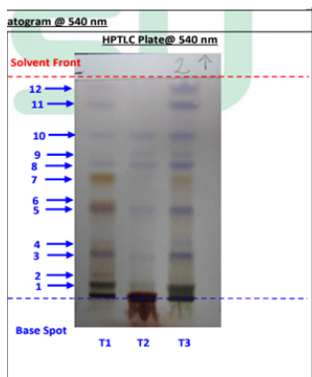
11. Spray Drier



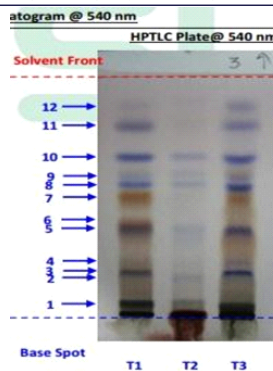
12. The Obtained Powders



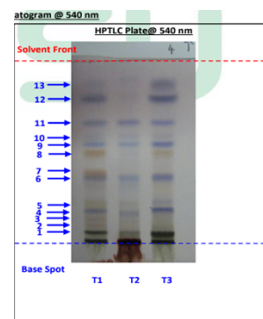
13. HPTLC RF values at 540nm: method 1



14. HPTLC RF values at 540nm: method 2



15. HPTLC RF values at 540nm: method 3



16. HPTLC RF values at 540nm: method 4

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