

# Pharmaceutical processing and standardization of modified dosage form of *Lodhradi Kashaya* as spray dried powder

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## Abstract

**Introduction:** *Lodhradi Kashaya* is a classical formulation mentioned in *Vaidya Chintamani* under *Kaphaj Prameha* and in *Basavarajiyam* under *Prameha Prakarana*. The therapeutic efficacy of the *Lodhradi Kashaya* was described as “*Madhumehajeet*,” i.e., win over diabetes mellitus. *Lodhradi Kashaya* was selected for research study, and formulation was modified as instant dissolving powder because classical *kwath* (decoction) had shorter shelf life, and it is difficult to prepare fresh *kwath* each time while administration. **Aim:** Pharmaceutical preparation and standardization of *Lodhradi Kashaya* spray dried powder. **Materials and Methods:** *Lodhradi Kashaya* spray dried powder was prepared by complete aqueous extraction of ingredients followed by drying with spray drier. Physicochemical testing, and standardization of finished formulation was done by following standard protocol. **Results:** Finished spray dried *Kashaya* powder was evaluated for different standardization parameter which showed limit of detection (5.86%), pH of 1% w/v solution (3.55) and 5% w/v solution (3.42), total ash value (10.68%), acid insoluble ash (0.47%), extractive value in water (84.95%), and methanol and ethyl acetate (51.21% and 0.86%, respectively). Spray dried powder was fine (pass through 80# mesh) in nature. *Lodhradi Kashaya* spray dried extract requires time span to get soluble as 15 s (30°C), 11 s (40°C), and 8 s (60°C) on gentle stirring. It was also evaluated for heavy metal, and microbial load that was found are within limit. **Conclusion:** *Lodhradi Kashaya* decoction powder dosage form is very convenient to prepare *Kashaya* dosage form while administration whenever and wherever it is required in busy life schedule. This study and approach will be helpful to revitalize the *Kashaya* dosage form as it has better exposure and probably better efficacy in the human body.

**Key words:** *Kashaya*, instant dissolving *Kashaya* extract, *Madhumeha*

## INTRODUCTION

Approximately, 347 million people are diabetic worldwide, among which 90% are suffering from Type 2 diabetes mellitus.<sup>[1]</sup> India's embrace of the worst of both eastern and western ways is sending lifestyle illnesses such as obesity and diabetes skyrocketing. In 2011, India had 62.4 million people with Type 2 diabetes, compared with 50.8 million the previous year, according to the International Diabetes Federation and the Madras Diabetes Research Foundation.<sup>[2]</sup> Ayurvedic medicines are attracting global population to treat and prevent various diseases and disease complications by their holistic approach to heal since antiquity. Ayurvedic literature having various references for the treatments of *Madhumeha* (diabetes), there are many

formulations and lifestyle procedures were mentioned for its regulation and treatment. In *Vaidya Chintamani* many decoction formulations were mentioned for treatment of *Madhumeha*, *Lodhradi Kashaya* is one of them mentioned for the treatment of *Kaphaj prameha*.<sup>[3]</sup> *Basavarajiyam* also mentioned one formulation containing the decoction of *Lodhra*, *Haritaki*, *Musta* and *Katphala* for the management of *Madhumeha* and effect of this formulation is mentioned as “*Madhumehajeet*.”<sup>[4]</sup> This formulation is containing four ingredients *Lodhra* (stem bark), *Haritaki*

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(fruit pulp), *Musta* (rhizome) and *Katphala* (stem bark) [Table 1]. Since in classical text suggested dosage form was *kwath* (decoction) for *prameha* but in present busy life schedule it became difficult to prepare fresh *kwath* at each administration. So in present study, an approach was made to prepare instant *Kashaya* powder with spray drier technology with the *kwath* prepared by classical methods. Shelf life of the *kwath* is 24 h as classical text.<sup>[5]</sup> Hence by preparing instant dissolving *Kashaya* extract (dried powder dosage form), shelf life also increased so that one may take *kwath* just by dissolving the suitable quantity of *Kashaya* powder in warm water. Therefore in the present study, step is made to develop spray dried *Lodhradi Kashaya* extract which will facilitate quick dissolving in gentle warm water and further helps inconvenient and easy for administration in busy life whenever and wherever it is required.

## MATERIALS AND METHODS

### Procurement of Drugs

Raw drug ingredients<sup>[4]</sup> were collected from “raw drug supplier” Sikandrabad, Noida India. The raw drugs sample were collected in jute bags and labeled with name, place and date of collection. Raw drugs were authenticated by an eminent scholar of Department of Dravyaguna, Institute of Medical Sciences, Banaras Hindu University, Varanasi and further screened by the quality control unit at Sanath Product Ltd. and best precaution were taken to purchase the drugs. Physical impurities like soils, stones, and foreign material were manually removed from the raw material.

### Preparation of *Kwath Churna*

Each ingredient of the formulation is taken in 35 kg of each and made into *kwath churna* by milling of raw drugs. The raw drugs first inspected for foreign matter then milled to make them into coarse powder form.

### Aqueous Extraction (*Kwath* Preparation)

The concept of *kwath* (decoction) preparation was modified with the concept of complete aqueous extraction. These *kwath churna* (140 kg) are soaked 6 h in distilled water on 1<sup>st</sup> day in stainless steel container having 500 L water and 700 L water were added to the *kwath churna* when heating started on mild heat over steam jacketed pot [Table 2]. Heating was done for complete aqueous extraction in three successive steps using same raw material. This complete extraction was done in three batches with same *kwath churna* to get complete extract. The decoction was observed for total solid content (TS) and collected in vessel then refiltered to ensure complete removing of sediments and larger particles. The first batch extraction gives 3 TS filtrate, the second batch gives 2 TS filtrate, whereas the third batch gives 0.5 TS

filtrate indicating complete aqueous extraction [Table 2]. All the *kwath* was stored in stainless steel pot.

### Optimization of Dilute Aqueous *Kwath* for Spray Drying

*Kwath* from all the batches were taken in steel pot collectively and reheated on vertical multiple effect evaporator under controlled condition (temperature VS 1-75°C, temperature VS 2-65°C, vacuum 540, heater - 76°C, steam pressure - 8 kg, cooling tower temperature - 30°C) to concentrate the *kwath*. Evaporation done until *kwath* turns into thicker (36 TS) concentrate [Table 3]. Now, the concentrated *kwath* was ready for spray drying thus it again collected in the stainless steel.

### Preparation of Spray Dried Powder

*Kwath* (TS - 36%, approximately 100 L) was subjected to drying by spray drier method. Spray drier is the technology where liquid were dried by aspirating it in the hot air under controlled environment (inlet temperature 182°C, outlet temperature 108°C, feed pressure 50 kg), where particle were dried and converted into dried fine powder [Table 3]. This fine powder was weighted and stored in air tight sealed plastic packet.

### Standardization

Standardization of *Lodhradi Kashaya* powder were done immediately after preparation, with analytical grade chemical following the standard procedure mention in The Ayurvedic Pharmacopoeia of India and testing protocol for Ayurveda,

**Table 1: Ingredients of *Lodhradi Kashaya***

Plant	Botanical name	Family	Part used
<i>Lodhra</i>	<i>S. racemosa</i> Roxb	Symplocaceae	Stem bark
<i>Hareetaki</i>	<i>T. chebula</i> Retz	Combretaceae	Fruit pulp
<i>Musta</i>	<i>C. rotundus</i> Linn	Cyperaceae	Rhizome
<i>Katphala</i>	<i>M. esculenta</i>	Myricaceae	Stem bark

*S. racemosa*: *Symplocos racemosa*, *T. chebula*: *Terminalia chebula*, *C. rotundus*: *Cyperus rotundus*, *M. esculenta*: *Myrica esculenta*

**Table 2: Complete aqueous extraction of raw materials**

Processes	Raw material	Water	Time	<i>Kwath</i>	TS (%)
First	140 kg	1200 L	4 h	890 L	3
Second	Successively with same raw material	Add 800 L	4 h	860 L	2
Third	Same material	Add 600 L	4 h	620 L	0.5

TS: Total solid

**Table 3:** Concentration of *Kwath* and its spray drying

Raw material (35 kg each)	Total quantity	Water added	Aqueous extract	Total aqueous extract	Final extract after evaporation	Dried spray dried powder
Lodhra	140 kg	Batch 1 (1000 L)	Batch 1 (890 L/3 TS)	2370 L/2 TS	100 L/38 TS	37 kg
Musta		Batch 2 (800 L)	Batch 2 (860 L/2 TS)			
Katphala		Batch 3 (600 L)	Batch 3 (620 L/0.5 TS)			
Haritaki						

TS: Total solid

Siddha and Unani drugs. The sample was evaluated for different organoleptic characteristics, as well as for standardization parameters like determination of ash value<sup>[6]</sup> (total ash and acid insoluble ash), determination of extractive values<sup>[7]</sup> (in water, methanol, ethyl acetate), solubility in water at a different temperature and its fineness.<sup>[8]</sup>

### Moisture Content<sup>[7]</sup>

Moisture analysis has been done by using Shimadzu moisture analyzer MOC-120H at room temperature.

### Determination of pH<sup>[9]</sup>

Sample was dissolve in water to prepare 1% and 5% strength solution, and then pH was measured by digital pH meter using glass membrane electrode at room temperature.

### Heavy Metal Analysis<sup>[10]</sup>

Heavy metal is analyzed by atomic absorption spectroscopy. Sample was dissolved in 50% HNO<sub>3</sub> for the digestion that was further diluted with distilled water.

### Microbial Load<sup>[11]</sup>

The formulation was subjected for the microbial contamination. Sample was collected immediately after the processing of the formulation (After 48 hr of the spray drying).

## RESULTS

Organoleptic characteristic of the drug shows that formulation is dark brown, smooth, astringent, and bitter and possesses specific aromatic odor [Table 4]. Physicochemical study of the *Lodhradi Kashaya* was done, and the results are summarized in Table 5. The formulation was evaluated for the time period required to get dissolve in water at different temperature on gentle stirring, and results are summarized in Table 6. The *Lodhradi Kashaya* was evaluated for their microbial load and heavy metal (As, Pb, Hg, Cd) and the results are summarized in Tables 7 and 8 respectively.

**Table 4:** Organoleptic properties of *Lodhradi Kashaya* extract

Organoleptic properties	Observations
Appearance	Soft and smooth fine powder
Odor	Aromatic
Taste	Astringent and bitter
Color	Dark brown
Touch	Smooth

**Table 5:** Physico-chemical properties of *Lodhradi Kashaya* extract

Parameter	Result
Loss on drying (%)	5.86
Water soluble extractive value (%)	84.95
Methanol soluble extractive value (%)	51.21
Ethyl acetate soluble extractive value (%)	0.86
Total ash value (%)	10.68
Acid insoluble ash value (%)	0.47
pH (1% solution)	3.55
pH (5% solution)	3.42
Sieve analysis (80# size)	100% pass

**Table 6:** Time required for dissolution of spray dried extract

Weight of sample	Water	Solubility time at 30°C	Solubility time at 40°C	Solubility time at 60°C
2 g	100 ml	15 s	11 s	8 s
3 g	100 ml	15 s	11 s	8 s
5 g	100 ml	18 s	11 s	7 s

## DISCUSSION

The approach of presented research work is to make *kwath* (*Kashaya*) available to the common people with least hurdle of preparation and for this purpose *Kashaya* dosage form was modified to water dissolving powder dosage form, keeping the focus that final administration will be in the *Kashaya* form (dissolving the appropriate quantity of dissolving dosage form in gentle warm water). Since Ayurvedic pharmacological action is due to the *rasa, guna,*

**Table 7:** Microbial load of *Lodhradi Kashaya* spray dried extract

Testing parameter	Observation	Limit
Total bacterial count	60 CFU/g	1×10 <sup>5</sup> CFU/g
Total fungal count	27 CFU/g	1×10 <sup>3</sup> CFU/g
<i>E. coli</i>	Absent	Absent
<i>Salmonella</i> sp.	Absent	Absent
<i>P. aeruginosa</i>	Absent	Absent
<i>S. aureus</i>	Absent	Absent

*E. coli*: *Escherichia coli*, *P. aeruginosa*: *Pseudomonas aeruginosa*,  
*S. aureus*: *Staphylococcus aureus*

**Table 8:** Estimation of heavy metal in *Lodhradi Kashaya*

Element	Wavelength	Concentration (ppm)	Limit (ppm)
Cadmium	228.802	0.020	0.3
Lead	220.353	0.416	10 ppm
Mercury	253.652	Not detected	1 ppm
Arsenic	193.696	Not detected	3 ppm

*veerya*, *vipaka*, and *prabhava* so approach was made such that dosage form modification leads to administration as *Kashaya* as a final dosage form. *Rasa* is perceived especially through tongue and buccal cavity and senses from mouth, nose and eyes directly goes to brain and its action get started. This dried powder dosage form ensures enhanced shelf life than *Kashaya* and reproducibility. For this purpose, complete aqueous extraction was done to get maximum yield and complete phytoconstituent in the *kwath*. This concept was adopted to enhance phytoconstituent extraction. As more yield value may tends to the cost effectiveness of final drug. Drying was done by spray drier (Inlet temperature 182°C, outlet temperature 108°C, feed pressure 50 kg) to ensure very fine powder. Spray drier is the technology that convert liquid *kwath* into dried powder so this technology was adopted here as it enhance flow properties and ensure better handling, as well as dose uniformity. The dried sample was evaluated for their quality following standard parameter mentioned in active pharmaceutical ingredients and other reference standards. Organoleptic characteristic of the drug shows that formulation is dark brown, smooth, astringent, and bitter and possesses specific aromatic odor [Table 4]. Aromatic odor may be due to the mixed constituents of four plants. Bitter and astringent test is due to the *tikta*, *katu*, and *Kashaya rasa* present in ingredients.<sup>[12]</sup> Analytical evaluation of the *Lodhradi Kashaya* powder shows that moisture content of the *Lodhradi Kashaya* are 5.86% [Table 5]. Moisture content denote the presence of water content in the sample which was responsible for stability period and intactness of the products.<sup>[13]</sup> The presence of excess moisture is conducive to the promotion of mold and bacterial growth, and subsequently to deterioration and spoilage of the drug.<sup>[14]</sup> Ash value is the

common method to know the adulteration of the inorganic materials, and it has greater importance in the quality control and standardization. Higher the inorganic material higher will be the ash value.<sup>[15]</sup> Total ash value of the *Lodhradi Kashaya* was 10.68% which denotes that there are some inorganic material present in the product that may be due to plant constituent and physical impurities [Table 5]. Acid insoluble ash value was 0.47% which represent the siliceous content in the sample.<sup>[14]</sup> Extractive value represents the quantity of the phytoconstituent and materials that are soluble in the respective solvent. It is also related to the availability of drugs in a different medium in body through different solvent carriers. Any change in the extractive value refers the change in the constituents thus it help in the standardization and reproducibility of the drugs. Methanol soluble, water soluble, and ether soluble extractive value were evaluated to know the percentage of product soluble in the respective solvent and was found 51.21%, 84.95%, and 0.86% [Table 5] that reflect that *Lodhradi Kashaya* dissolving powder have greater solubility on water in comparison to alcohol and ether, which depicts its more bioavailability in water medium.<sup>[15]</sup> Water soluble extractive value (10.52%) is due to the presence of sugars, acids, polar constituents, glycosides of steroid, alkaloids, and coumarins.<sup>[16]</sup> Alcohol soluble extractive value shows the presence of fewer amounts of polar substances like phenols, tannins, glycosides and flavonoids.<sup>[16]</sup> pH of 1% and 5 % solution of the *Lodhradi Kashaya* are found 3.55 and 3.42, respectively, which denotes that solution of the formulation is acidic in nature [Table 5]. All the powder drug was passed through 80# mesh size that refers that powder is fine in nature and having good flow property.<sup>[8]</sup> Solubility study was done to know the effect of temperature and quantity of the drugs over time required for dissolving the formulation in water. It was observed that more the temperature, better the dissolving while amount of the drug also affects the time required for dissolving. Heavy metal estimation were done for cadmium, lead, mercury and arsenic, and the result shows that lead and cadmium were found to be 0.416 and 0.020 ppm respectively [Table 8] while other heavy metals were not detected, and the value found here complies within limit.<sup>[17]</sup> The microbial load was calculated based on Agar media was found within limit [Table 7]<sup>[17]</sup> and it reflect that proper hygiene norms followed during the preparation of formulation and packing.<sup>[15]</sup> It shows that finished product is safe for use, and all the data are complies within the prescribed limit while physicochemical data support that product is safe and stable.

## CONCLUSION

*Lodhradi Kashaya* mentioned in the *Vaidya Chintamani* and *Basavrajyam* clearly indicate its therapeutic efficacy in diabetes mellitus, especially in *Basavrajyam* it was denoted as *Madhumehajeet* (win over diabetes). In fast living style, it is hectic to prepare *Kashaya* (decoction) every time for administration. Since *Kashaya* also have shorter shelf life so here an approach is made to modify the dosage form to

ensure better shelf life and to make it available as *Kashaya* by dissolving in a suitable quantity of water whenever and where ever it is required. Analytical standardization was done to ensure quality in medicine and reproducibility at the same time.

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