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COMPARATIVE ANALYTICAL EVALUATION OF HARIDRA CHURNA PREPARED BY LYOPHILIZATION AND TRADITIONAL METHOD

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ABSTRACT

Introduction: Haridra (*Curcuma longa* Linn.) offers extensive health benefits and is utilized globally as a food, flavoring agent, dye, and medicine. India, the world's largest producer, consumer, and exporter of turmeric, accounts for 70% of the annual global production of 1.1–1.15 million tons. The conventional preparation of *Churna* (powder) involves prolonged drying, which results in significant loss of active principles due to retained moisture and the effects of *Kalaprabhava* (factors such as time, temperature, moisture, and seasonal variations). **Aim and Objectives:** This study aims to employ lyophilization technology to minimize the impact of *Kalaprabhava* on turmeric during storage. **Materials and Methods:** A qualitative and quantitative comparison was conducted between classically prepared *Haridra* powder and lyophilized *Haridra* powder in accordance with the *Ayurvedic* Pharmacopoeia of India. **Results:** The findings confirm the advantages of lyophilization for turmeric samples. **Conclusion:** This study is unique in demonstrating the potency and efficacy of lyophilized powder, supporting its potential for future development of dosage forms in Ayurveda.

Keywords: *Ayurveda*, Analytical Study, *Churna kalpana, Haridra*, Lyophilization

INTRODUCTION:

The *Trisutra*-the three fundamental pillars of Ayurveda, includes *Aushadha* (drugs) **[1]**. A physician's success depends on accurate diagnosis and the prescription of effective drugs. Herbs, minerals, and metals have been used medicinally since antiquity, as evidenced in the Vedas. The use of single drugs and compound formulations gained

prominence during the *Samhita* period. *Bhaishajya Kalpana* is founded on the *Panchavidha kashayakalpana*, comprising *Swarasa* (juice), *Kalka* (paste), *Kwatha* (decoction), *Hima* (cold infusion), and *Phanta* (hot infusion). These primary dosage forms are further developed into various *Upkalpana* to enhance absorption, stability, and shelf life.

Churna (powder), *Mantha* and *Avaleha* (co nfections) are among these sub-types *Churna Kalpana* is considered an *Upakalpana* of *Kalka Kalpana*. It is widely regarded as a commonly used and preferred dosage form due to its ease of preparation and administration. However, its primary limitation is the loss of volatile constituents during drying and powdering, along with a short shelf life.

Lyophilization, or freeze-drying technology, is a modern method for preparing, preserving, and storing powder formulations. In contemporary medicine, it is used to preserve antibiotics and biological products such as proteins and plasma in vials for parenteral use. Powder formulations produced via lyophilization offer significant advantages over traditionally prepared powders, including retention of active principles and phytochemicals, enhanced shelf life and stability, reduced moisture content with minimal heat exposure, and improved solubility, which increases bioavailability and allows for lower therapeutic doses. Lyophilization is effectively employed across various disciplines to overcome the limitations of conventional drying and powdering methods, particularly in minimizing the loss of volatile compounds.

Haridra **[2]** (turmeric) has long been extensively used in India as a home remedy for cuts and bruises. High domestic and international demand for raw and processed turmeric necessitates a scientific approach to expedited drying and powdering. Turmeric is widely utilized by *Ayurvedic* physicians and the pharmaceutical industry, both as a single drug and in formulations, for conditions such as inflammation, as a galactagogue, stomachic, spasmolytic, and in *Vishavikara*, *Prameha*, *Tvakvikara*, *Shos ha*, *Pandu* **[3]**, among others. Fresh turmeric rhizomes are not available year-round, limiting the production of compound drugs requiring fresh material. Lyophilization offers a method for longer-term preservation. Given the absence of studies comparing traditionally prepared turmeric powder with lyophilized turmeric powder, this trial was undertaken.

Aim and Objectives:

The aim is to utilize the technology i.e., lyophilization, to minimize the *Kalaprabhava* on turmeric storage and to establish the efficacy of the thus obtained

Haridra Churna through the analytical parameters.

MATERIALS AND METHODS:

Sample collection & identification:

Raw, fresh *Haridra* (Turmeric) rhizome was purchased from local market of Vadodara and authenticated by P.G. Dept. of Dravyaguna Govt. Ayurved College, Vadodara.

The identification of the species and its family were confirmed by studying its morphological characters and authenticated by comparing them with the characters mentioned in various floras and the textbook of botany by a subject expert in the Pharmacognosy Division of Food and Drugs Laboratory, Vadodara.

Preparation of drug:

First, the manual sorting of *Haridra* (Turmeric) was done to separate it from foreign unwanted materials, and subsequently washed thoroughly with lukewarm water.

Further, the *Haridra* was kept over a porous tumbler for water to drain out. Once the water was drained off, after cleaning, 9.6 kilograms of *Haridra* were separated for Lyophilization, and three kilograms were separated for simple *Churna* preparation. The skin of *Haridra* was peeled off using a knife.

After peeling the skin, 8.2 kilograms of *Haridra* were put in a grinder for size reduction, and 2.6 kilograms were cut into small pieces using a knife.

After grinding, the *Haridra* was like a paste (*Kalka)*, very similar to *Haridra Kalka*. This *Haridra Kalka* was finally subjected to Lyophilization in the Freeze Dry Machine and another 2.6 kilogram cut pieces were dried in the Sun.

After the drying, both Simple and Lyophilized *Haridra* were subjected to grinding in a suitable grinder. Thus, the pulverized powders obtained were sieved over 85 no. sieve to obtain fine powder.

Both powders (Lyophilized and simple *Haridra churna)* were then packed in a quantity of 50 gms in low-density polyethylene containers. These finished containers were finally labeled Lyophilized *Haridra* and Simple *Haridra churna* and stored under controlled temperature (30 $\pm$ 5 ^{o}C) for analytical procedures.

Table 1: Results of Lyophilized *Haridra* powder

Total time taken for preparation of Lyophilized Haridra powder – 4 days
Total time taken for freeze drying of *Haridra* Rhizome pieces – 6 hours
Weight of fresh *Haridra* Rhizome – 9.600 kg
Weight of *Haridra* before the skin is peeled - 9.600 kg
Weight of peeled Haridra - 8.200 kg
Weight of small pieces before freeze drying - 8.000 kg
Weight of Lyophilized *Haridra* powder obtained- 1.175 kg
Total weight loss (in kg) – 8.425
Total weight loss (in %) - 87.75
Total yield (in %)-12.25

Table 2: Results of simple *Haridra* powder

Total time taken for preparation of Simple Haridra Churna - 13 days
Total time taken for drying of Haridra Rhizome pieces- 12 days
Weight of fresh Haridra Rhizome – 3.000 kg
Weight of Haridra After the skin is peeled - 2.600 kg
Weight of Haridra (without outer skin) - 2.600 kg
Weight of small pieces after drying- 1.060 kg
Weight of Haridra Churna obtained – 1.015 kg
Total weight loss (in kg) - 1.985
Total weight loss (in %) - 66.20
Total yield (in %) – 33.80

Analytical study

Analytical study was carried out at Vasu Research Center, Makarpura, Vadodara.

Development of specifications for the validation of *Haridra* powder with Specific and General Test Procedures are as follows:

(A) Organoleptic evaluation: Organoleptic evaluation refers to evaluating the drug by appearance, colour, odour, taste, etc. The organoleptic characteristics of the preparations were evaluated **[4]**.

(B) Physicochemical parameters:

1. pH **[5]**
2. Loss On Drying **[6]**
3. Water-Soluble Extractives **[7]**
4. Alcohol-Soluble Extractives **[8]**
5. Total Ash **[9]**
6. Acid-Insoluble Ash **[10]**
7. Limit Test For Heavy Metals **[11]**
8. Microbial Limit Test **[12]**
9. Assay Of Curcumin By HPLC **[13]**

Table 3: Result of analytical study

S. No.	Organoleptic Parameters	Lyophilized *Haridra Churna* (LH)	Simple *Haridra Churna* (SH)
1	Colour	Yellow colour	Yellow colour
2	Odour	Characteristics	Characteristics
3	Taste	Astringent	Astringent

Table 4: Physico-Chemical Parameters of Lyophilized and Simple Haridra Churna

S. No.	Physico-Chemical Parameters	Limits According to API	Lyophilized *Haridra Churna* (LH)	Simple *Haridra Churna* (SH)
1	pH	-	5.25	6.25
2	Loss On Drying (% w/w)	-	4.49	9.71
3	Water Soluble Extractive (% w/w)	Not less than 12.0	18.14	14.60
4	Alcohol Soluble Extractive (% w/w)	Not less than 8.0	11.80	7.54
5	Total ash (% w/w)	Not more than 9.0	7.21	7.23
6	Acid insoluble ash (% w/w)	Not more than 1.0	0.21	0.15
	HPTLC Result			
7	Assay of curcumin by HPTLC (% w/w)	Not less than 1.5 (Acc. To IP)	1.660	0.910
	Microbial Limit Test			
1	Total Plate Count	1000 cfu/gm	118 cfu/gm	540 cfu/gm
2	Total Yeast & Mould Count	100 cfu/gm	16 cfu/gm	14 cfu/gm
3	E. coli	Absent	Absent	Absent
4	Salmonella	Absent	Absent	Absent
5	S. aureus	Absent	Absent	Absent
6	P. aeruginosa	Absent	Absent	Absent
	Heavy Metal Analysis	Permissible limits		
1	Lead	10 ppm	Not Detected	Not Detected
2	Cadmium	0.30 ppm	Not Detected	Not Detected
3	Mercury	1 ppm	Not Detected	Not Detected
4	Arsenic	3 ppm	Not Detected	Not Detected

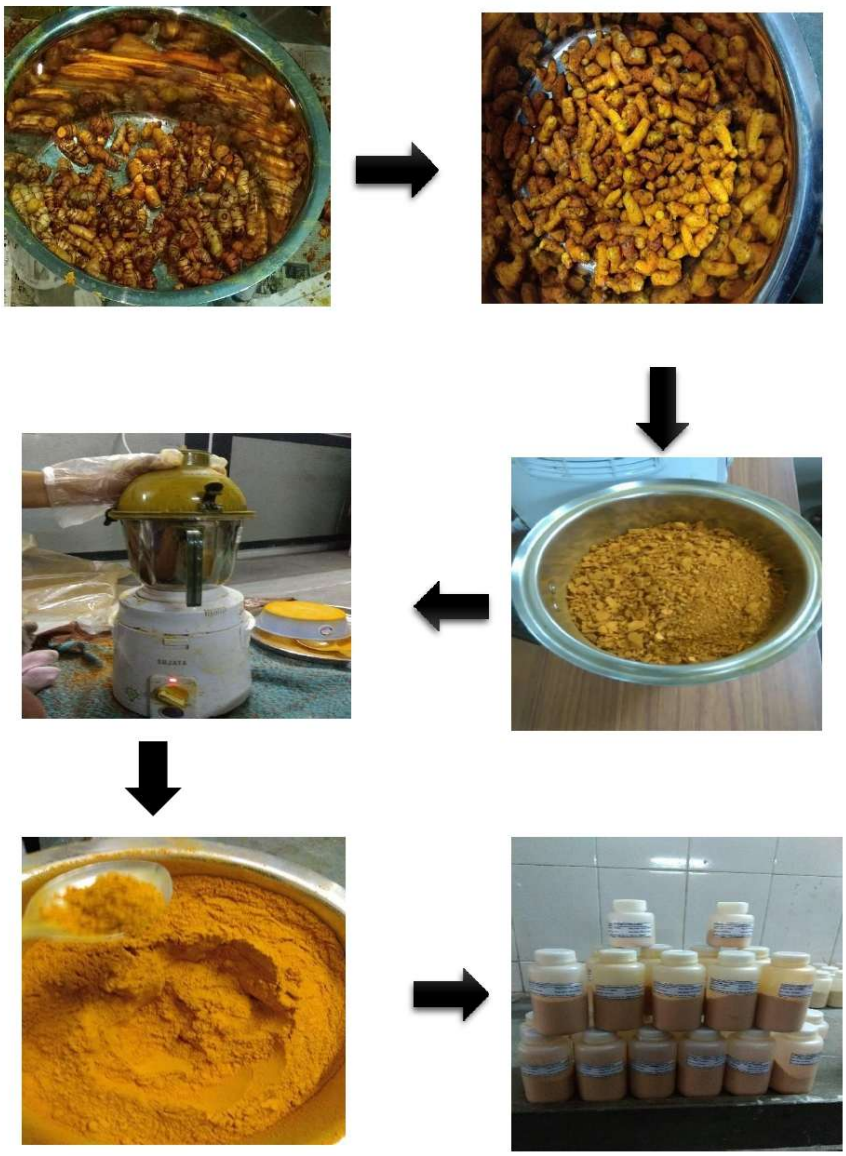


Fig.No.1.Preparation of Simple *Haridra Churna*

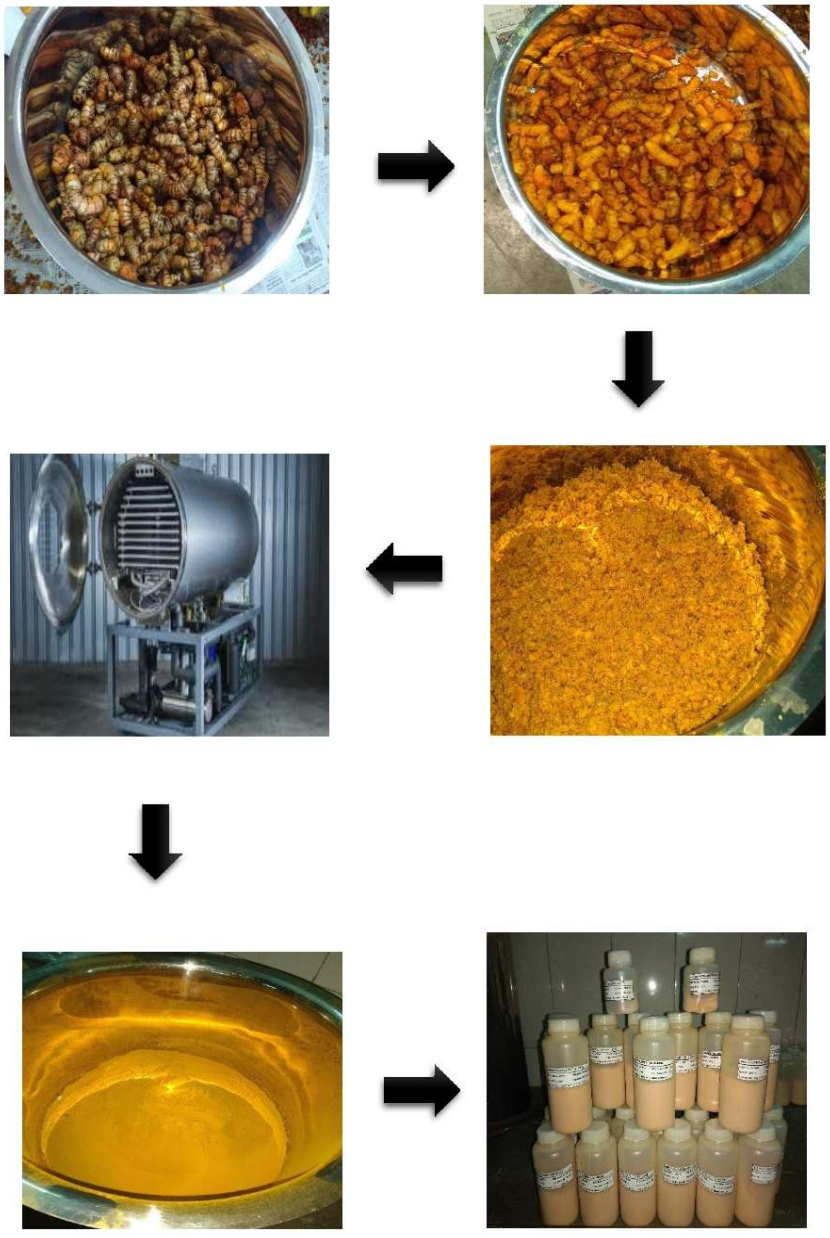


Fig.No.2. Preparation of Lyophilized *Haridra* powder

DISCUSSION

Result shows that the LH *Churna's* LOD was 4.49% and SH *Churna'*s LOD was 9.71%, shows that SH *Churna* may get spoiled earlier than LH *Churna* due to the moisture content. So, LH *Churna*'s Shelf life is going to be longer than SH *Churna*. In API *Haridra Churna*'s WSE is not less than 12%, and ASE is not less than 8%. SH *Churna*'s WSE is 14.60 %, ASE is 7.54% and LH *Churna's* WSE is 18.14%, ASE is11.80%, which shows LH *Churna* has a better extractive value, so we can make effective *Kalpanas* (formulation) from it. LH *Churna*'s total ash is 7.21% and the Acid insoluble ash is 0.20% whereas SH *Churna*'s total ash is 7.23% and Acid-insoluble ash is 0.15%, which indicate that there are no more inorganic impurities in both samples. Assay of curcumin by HPTLC shows that SH *Churna*'s result (0.910%) is under limit, so it is unproductive when LH *Churna* has good amount (1.660%) compared to IP standard (Not less than 1.5%). In LH *Churna* Total Plate Count is 118 cfu/gm and Total Yeast & Mould Count is 16 cfu/gm when in SH *churna* Total Plate Count is 540 cfu/gm and Total Yeast and Mould Count is 14 cfu/gm. So, according to this data, SH *Churna* crossed the standard limit and became useless due to microbial growth. In this test, heavy metals like Cadmium, Mercury, Lead and Arsenic were not detected in both Lyophilized and Simple *Haridra* powder. Only by Lyophilization natural values of the herbs were retained. It preserves all the ingredients of the herb in full, rather than any other preservation process like sun drying, spray drying, tray drying, extracts etc. which eliminates active ingredients partially or completely. Through this study Lyophilized *Haridra*'s analytical data is generated so we can use it for further study and also use this technology for other drugs to get more productive medicines.

CONCLUSION:

Simple *Haridra* powder is prepared by the classical method, whereas Lyophilized *Haridra* powder is prepared by a mechanized method by the use of freeze-drying machine.

The active ingredient *Curcumin* was found at 1.660% (w/w) in Lyophilized *Haridra* powder, whereas 0.910 % (w/w) in simple *Haridra* powder. That means Lyophilized *Haridra* powder is more potent than Simple *Haridra* powder. So, even by taking in less quantity, it shows more efficacy.

According to IP, the permissible limit of Curcumin is not less than 1.5% (w/w), whereas in simple *Haridra* powder it is 0.910 % (w/w), so according to IP, it was not able to fulfil the criteria for preparation of medicine.

Extractive values were higher in Lyophilized *Haridra* powder than in simple

Haridra powder. The microbial limit test showed values under the limit, but higher in Simple *Haridra* powder than in lyophilized powder, so it may get spoiled earlier. Heavy metal test shows that there was no trace of metal in it

So, it can be concluded through the Analytical parameters that, through lyophilization, more potential drugs can be obtained.

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