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## Pharmaceutical and XRF Study of *Yashada Pushpa* Prepared using Electric Muffle Furnace

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### ABSTRACT

*Yashada pushpa* is a type of *Yashada bhasma*, which is an ingredient of local (topical) applicants indicated in skin disorders. The classical method of preparation of this type of *Yashada bhasma* is given in *Rasatarangini*. In the present study, *Yashada pushpa* was prepared according to the pharmaceutical processes given in *Rasatarangini* except, during the *marana* procedure, the classical heating equipment and method were replaced by Electric Muffle Furnace (EMF). Samples were taken before and after *shodhana* and finally after *Yashada pushpa* preparation and were subjected to XRF (X-ray Fluorescence) analysis. The results have been tabulated for this study. pH of 1% solution of *Yashada pushpa* was 7.11 at 30°C. Considering the *siddhi lakshanas* (end point observations) and the ease of preparation, this study has concluded that the use of EMF is an effective as well as an efficient method for preparation of *Yashada pushpa*.

### KEYWORDS

*Yashada Pushpa*, *Yashada bhasma*, XRF, Electric Muffle furnace



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## INTRODUCTION

*Rasashastra*, a branch of Ayurveda, deals with the conversion of metals and minerals into therapeutic drugs for internal as well as external use. *Yashada bhasma* is one such *ayurvedic* formulation prepared from *Yashada* which has been identified today as Zinc by authoritative Ayurveda literature. *Rasatarangini* has given four methods of preparing *Yashada bhasma*, out of which the *chaturtha marana prakara* (fourth method) involves direct heating of *shuddha yashada* in an iron vessel kept on a high flame, thus melting and vaporizing it<sup>1</sup>. The endpoint of this procedure is *Kundendudhawla* (flower like, moon white) *bhasma* (calcined ash)<sup>1</sup>. The swollen-up appearance and colour of this type of *yashada bhasma* has given it the name '*Yashada pushpa*' or 'Flowers of Zinc'. In the present study, *ashuddha* (raw) *yashada* was subjected to *shodhana* according to *Rasatarangini* but for *marana* procedure, instead of classical heating apparatus and method, EMF was used. XRF analysis was done for *ashuddha yashada*, *shudhha yashada* and *Yashada pushpa* to identify the elements in it qualitatively as well as quantitatively. As it is used for external application, its pH was also checked.

## MATERIALS AND METHODS

### Equipment

Gas stove, iron ladle, stainless steel vessels, *pithara yantra*, silica crucibles, EMF

### Ingredients

Limestones, *Ashuddha yashada* (Zinc plates) were procured from the local market.

### Preparation of *choornodaka*

Preparation of *choornodaka* was also done according to the reference in *Rasatarangini*. Lime powder, 19.2 gm was added to 4liters of water, thoroughly stirred and kept still for 12 hrs after which the clear water at the top was decanted by siphon (Figure 1) and stored in green coloured glass bottles<sup>2</sup>.



Figure 1 Decanting clear *choornodaka* by siphon

### *Yashadashodhana*

*Ashuddha yashada* (zinc) 50gm was procured from local market (Figure 2). A sample of 5gm was taken out for XRF analysis and the remaining was subjected to *shodhana*. *Yashada shodhana* was done by seven times *dhalana* (melting and quenching) in *choornodaka*<sup>3</sup>.



**Figure 2** Ashuddha yashada

*Choornodaka* (300 ml) was taken in a stainless steel vessel and covered with a *pithara yantra*. *Ashuddha yashada* (30 gm) was taken in an iron ladle and heated over high flame. Molten *yashada* was immediately quenched in *choornodaka* through *pithara yantra* (Figure 3).



**Figure 3** Process of *dhalana* through *pithara yantra*

After cooling, *yashada* was removed from *choornodaka*, thoroughly washed and again melted and quenched. The above procedure was done seven times in total and at each time, the *choornodaka* from the previous *dhalana* was discarded and fresh 300 ml *choornodaka* was taken.

After seven times *dhalana*, the *yashada* was thoroughly cleaned and dried and a sample was taken and labeled as *Shuddha yashada* (Figure 4).



**Figure 4** *Ashuddha yashada* (flat chip like) and *Shuddha yashada* (Solid chunk)

#### ***Yashada pushpa* preparation by EMF**

In this, same principle was used as given under *chaturtha marana prakara* (fourth method) of *yashada bhasma* in *Rasatarangini*<sup>1</sup> but instead of classical heating in iron vessel over high flame, EMF was used. *Shuddha yashada*, 10 gm was taken in a silica crucible which was kept in the EMF. Temperature was set at 900°C. The temperature was allowed to rise up to 900°C and then kept at 900°C for 30 mins (Figure 5).



**Figure 5** EMF at 900°C



The temperature recording was done every 5 mins (Table 1). After maintaining 900°C for 30 mins, the switch was turned off and the furnace was allowed to self-cool. After this, the EMF was opened and *Yashada pushpa* was extracted, weighed, sample was taken out and stored.

**Table 1** Temperature recorded during preparation of *Yashada pushpa* in EMF

Time	Temperature in °C
9:10	0
9:15	123
9:20	195
9:25	250
9:30	263
9:35	312
9:40	377
9:45	437
9:50	498
9:55	550
10:00	586
10:05	630
10:10	664
10:15	700
10:20	728
10:25	754
10:30	776
10:35	798
10:40	821
10:45	843
10:50	869
10:55	878
11:00	881
11:05	893
11:08	900
11:08 to 11:38	900

## OBSERVATIONS AND RESULTS

*Choornodaka* prepared by *Rasatarangini* method was clear and transparent but compared to water, it was very slightly turbid in appearance. Its pH was 12.46 at 30°C. During *dhalana* procedure, there was a crackling sound and few droplets of *choornodaka* had flown out of the opening

of *pithara yantra*. Weight of *shuddha yashada* obtained after seven times *dhalana* was 28.5 gm (ie. a loss of 1.5 gm). After heating *shuddha yashada* in EMF, it had swollen up to approximately 10 times its original size (by volume) and its dense metallic structure was converted to white fluffy flowers (Figure 6) which when grinded in a mortar and pestle, were reduced to white coloured fine powder.



**Figure 6** *Yashada pushpa* prepared in EMF

When removed from the crucible, the top part of *Yashada pushpa* was pure white coloured whereas a small part of *Yashadha pushpa* near the base of the crucible was light brownish in colour. This small discoloured part was separated from the white *Yashada pushpa* and discarded. The initial weight of *shuddha yashada* taken in the crucible was 10 gm. The total weight of contents in the crucible after heating in EMF was 11.296 gm (ie. a gain of 1.296 gm). However when the discoloured part was removed, the final weight was 9.173 gm (ie. a loss of 0.827 gm) Comparative organoleptic tests for *ashuddha yashada*,





*shuddha yashada* and *Yashada pushpa* are as given in Table 2.

**Table 2** Comparative organoleptic tests for *Ashuddha yashada*, *shuddha yashada* and *Yashada pushpa*

Sr. No.	Organoleptic Test	<i>Ashuddha yashada</i>	<i>Shuddha yashada</i>	<i>Yashada pushpa</i>
1.	Colour	Grey	Grey	White
2.	Odour	Metallic	Metallic	Odorless
3.	Taste	Not done	Not done	Not done
4.	Appearance	Plates with metallic lusture	Irregular chunks with a slight metallic lusture	Fluffy and light. Very fine and smooth powder when grounded.

The final product showed *Nischandratva*, *Rekha-poornatva* (Figure 7), *Vaaritaratva* and *Unnama* (Figure 8) which are classical tests mentioned for quality analysis of *bhasmas*<sup>4</sup>. For pH, 1% solution was prepared in distilled water which showed

that *Yashada pushpa* was insoluble in water. pH of 1% solution of *Yashada pushpa* was 7.11 at 30°C The results of XRF analysis of *ashuddha* (Raw) *yashada*, *shuddha yashada* and *Yashada pushpa* are as given in Table 3 and Table 4.

**Table 3** XRF analysis (Qualitative and Quantitative) of Elements present in *ashuddha yashada*, *shuddha yashada* and *Yashada pushpa*

Sr. No	Element	<i>Ashuddha yashada</i> (mass %)	<i>Shuddha yashada</i> (mass %)	<i>Yashada pushpa</i> (mass %)
1.	Zn	99.17	98.46	80.337
2.	Si	0.53	-	-
3.	S	0.30	0.11	-
4.	Ca	-	1.43	-
5.	O	-	-	19.663

**Table 4** XRF analysis (Qualitative and Quantitative) of oxides present in *ashuddha yashada*, *shuddha yashada* and *Yashada pushpa*

Sr. No	Sample	Oxides
1.	<i>Ashuddha yashada</i>	No any oxides present
2.	<i>Shuddha yashada</i>	No any oxides present
3.	<i>Yashada pushpa</i>	Zinc Oxide- 100 mass%



**Figure 7** *Rekha-poornatva*



**Figure 8** *Unnama*



## DISCUSSION

pH revealed that *choornodaka* is alkaline in nature. Observations during *yashada shodhana* explain the importance of using *pithara yantra* during *dhalana* procedure. Using *pithara yantra* makes the *dhalana* procedure safe thus avoiding chances of getting burnt while quenching the molten *yashada*. X-ray fluorescence (XRF) spectrometry is an elemental analysis technique. XRF is based on the principle that individual atoms, when excited by an external energy source, emit X-ray photons of a characteristic energy or wavelength. By counting the number of photons of each energy emitted from a sample, the elements present may be identified and quantitated<sup>5</sup>. The XRF reports of *ashuddha yashada* and *shuddha yashada* reveal that, Silicon (Si) which was present in *ashuddha yashada* had disappeared after *shodhana* suggesting that it was removed during the *shodhana* procedure. Calcium (Ca) was seen to be added during *shodhana* in *choornodaka* however that too was absent in the final *Yashada pushpa*. The observation that the top part of *Yashada pushpa* is pure white, while the small part near the base of crucible is brownish indicates that the constituents other than zinc which were present is *shuddha yashada* might have remained at the bottom and did not rise up when the

*Yashada pushpa* had swollen-up with heat. XRF analysis of *Yashada pushpa* is consistent with this hypothesis, as it is an oxide of zinc with absolutely no other elements present in it other than zinc and oxygen.

## CONCLUSION

*Yashada pushpa* can be successfully prepared using the above (Table 1) temperature settings. The colour and appearance of the final product is consistent with the description in *Rasatarangini* and its appropriateness in terms of *bhasma pariksha* proves that EMF can be effectively used in the preparation of *Yashada pushpa*. Its pH being 7.11 at 30°C indicates that it is non-corrosive for external application. Although *Yashada pushpa* prepared by this method shows *Nischandratva*, *Rekhapoornatva*, *Vaaritaratva* and *Unnama*, *Rasatarangini* clearly mentions that it is meant for external use only. For internal use, *yashada bhasma* should be prepared according to the other appropriate references given in *Rasatarngini*. This study can be used as a guideline for in-process and final product standardization of *Yashada pushpa* prepared by EMF.

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