

Study On Effect of Classical Shodhana on Pharmaceutical Properties and Quality Attributes of Tankana

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Abstract

Background-In Ayurveda, Tankan (Borax) is extensively utilized for therapeutic purpose. But Indian Alchemist (Rasa Vaidya) have mentioned about pharmaceutical process like Shodhana (purification) that must be performed over Tankan before incorporating it for therapeutic use to improve its quality and safety. Although this procedure is followed since long period still there is insufficient analytical evidence documenting regarding physico-chemical changes induced by Shodhana.

Aim-This study focused to compare the physico-chemical characteristics of raw and Shodhita (purified) Tankana and to provide laboratory based validation for the traditional purification process.

Material and Method-Raw Tankana was purified by controlled heating as per the procedure in Rasa Shastra text. Colour, texture, pH, solubility, hygroscopicity, angle of repose, bulk density, and loss on drying were examined for both raw and purified samples of Tankan in a certified laboratory.

Result-Features like alkaline nature, white colour and water solubility were maintained in purified sample, but changes were observed in its texture from slightly granular to a fine form, free-flowing powder consistency. Loss on drying dropped significantly from 22.0% to 0.66% indicating effective removal of moisture and water of crystallization while bulk density decreased from 0.64 g/mL to 0.35 g/mL Altered powder flow behaviour were observed which was reflected from the angle of repose that increased from 42.93° to 53.67° following purification.

Conclusion-These numerical confirms that that traditional shodhana substantially preserved its intrinsic alkaline properties while modifying the physico-chemical profile of Tankana. Thus the outcomes supported the pharmaceutical rationale for purifying Tankana prior to its incorporation into Ayurvedic formulations and furnish a core for its analytical standardization.

Keywords: Tankana, Borax, Shodhana, Physicochemical Evaluation, Pharmaceutical Standardization, Ayurveda.

Introduction

In Indian Alchemy, Tankana is categorized under Kshara Varga (alkaline group) and chemically it is recognized as “Borax” or Sodium tetraborate decahydrate. It is broadly used in Ayurvedic formulations.¹ Traditional descriptions regarding properties of Tankan such as Katu Rasa (pungent), Ushna, (Hot) Tikshna, (Sharp) Ruksha (Dry), and Saraka, (laxative property) are associated with its application in respiratory ailments, digestive disorders, and conditions involving impaired menstruation. It is also used externally in preparations intended for wound cleansing and topical application.²

Tankana is incorporated into several classical formulations, including Rajapravartini Vati,³ Amrutamanjari Rasa⁴ and Anandabhairava Rasa.⁵ However, raw Tankana is generally not administered directly in medicinal preparations. In Ayurvedic pharmaceuticals, Shodhana is an important pharmaceutical procedure performed before the therapeutic use of many drugs belonging to the metallic, mineral, and alkaline categories. Therefore Tankan is also subjected to Shodhana, involving controlled heating until it swells and loses its moisture. The resulting product is known as Shodhita Tankana (purified borax) and is considered more suitable for pharmaceutical use.⁶ Published physico-chemical studies have reported changes in the crystalline form and chemical composition of Tankana after purification, including the predominance of a pentahydrate phase in the processed material compared with the decahydrate and mixed hydrate phases observed in the raw sample.

From a contemporary pharmaceutical perspective, heating sodium tetraborate decahydrate causes the removal of water of crystallization. Thus there may be alteration in material's crystal structure, density, moisture content, particle morphology, flow behaviour, and storage characteristics due to dehydration.⁶ Previously analytical research activities have been published by focusing on certain parameters like particle arrangement and boron content of

Tankan by discriminating it in raw and purified form. Nevertheless, to establish the relationship between the traditional purification procedure and measurable physico-chemical changes further systematic evaluation is vital. Accordingly, the present study compares raw and Shodhita Tankana using selected pharmaceutical parameters, including organoleptic characteristics, pH, solubility, hygroscopicity, angle of repose, bulk density, and loss on drying. Assessment of these properties may help clarify the effects of the traditional Shodhana process and contribute to the standardization, quality control, and scientific validation of Tankana-based Ayurvedic formulations.

Aim

To investigate the physicochemical changes occurring in Tankana following the traditional Shodhana process and assess their pharmaceutical significance.

Objectives

1. To prepare Shodhita Tankana from Ashodhita Tankana using the traditional heating procedure described in Rasa Tarangini.
2. To evaluate and compare selected physicochemical properties of Ashodhita and Shodhita Tankana.

Materials and Methods

Study Design

The study comprised two components: pharmaceutical processing and comparative physicochemical evaluation. The pharmaceutical processing of Tankana was performed at the Teaching Pharmacy, Department of Rasa Shastra and Bhaishajya Kalpana, Sri Sri College of Ayurvedic Science and Research Hospital.

Physicochemical analysis of the processed and unprocessed samples was carried out at the Department of Pharmaceutical Sciences, Siksha 'O' Anusandhan University, Bhubaneswar.

Two samples were designated for comparative evaluation:

- Sample A: Ashodhita Tankana (unprocessed Tankana)
- Sample B: Shodhita Tankana (processed Tankana)

Materials and Equipment

Ashodhita Tankana was used as the starting material. The equipment required for pharmaceutical processing included an iron frying pan, weighing balance, gas stove, spoon, and Khalwa Yantra.

Pharmaceutical Processing of Tankana

The Shodhana procedure was performed according to the method described in Rasa Tarangini. The process consisted of three stages.

1. Preliminary preparation

An initial quantity of 100 g of Ashodhita Tankana was weighed. Visible extraneous materials were manually separated, and the remaining crystalline material was reduced to powder using a Khalwa Yantra.

2. Heating procedure

The powdered material was transferred to an iron pan and heated over a gas stove. Heating was initially carried out at a high intensity and subsequently maintained at a moderate level. During heating, the material underwent visible physical changes associated with the release of water of crystallization. Heating was continued until the characteristic changes associated with the completion of the process were observed. The material was then allowed to cool naturally.

3. Collection and storage

Following cooling, the processed material was powdered and weighed. The final quantity of Shodhita Tankana obtained was 50 g. The sample was transferred to a clean, dry, airtight container for subsequent physicochemical analysis.

Observations During Shodhana

The changes observed during the heating process are presented in Table 1.

Table 1. Physical changes observed during Tankana Shodhana

Stage	Observations
Before heating	The unprocessed material consisted of transparent to translucent crystals with a glossy appearance.
Initial heating	A crackling sound was observed during the early stage of heating.
During heating	Steam was released, and the crystalline material gradually became opaque and expanded.
Continued heating	The material developed a porous, lightweight, and puffed appearance, accompanied by an increase in volume.
Completion of heating	Crackling and visible steam release ceased, leaving a white, dry, brittle mass.
After cooling	The processed material could be readily reduced to a fine white powder.

Physicochemical Evaluation

Ashodhita and Shodhita Tankana were subjected to comparative physicochemical examination at the Department of Pharmaceutical Sciences, Siksha 'O' Anusandhan University, Bhubaneswar.

The evaluated characteristics included colour, texture, pH, solubility, hygroscopicity, angle of repose, bulk density, and loss on drying. The measurements were used to document differences between the unprocessed and processed samples.

Results

Table 2. Comparative physicochemical characteristics of Ashodhita and Shodhita Tankana

Parameter	Ashodhita Tankana	Shodhita Tankana
Colour	White	White
Texture	Slightly granular	Fine powder
pH	9.25	9.27
Solubility	Soluble	Soluble
Hygroscopicity	Slightly hygroscopic	Slightly hygroscopic

Interpretation of Results

The changes in the physical parameters of Tankana were noticeable in the Shodhana process. The processed material had a finer texture and lower bulk density compared to the unprocessed material. This reduction in bulk density, from 0.64 g/mL to 0.35 g/mL, agrees with the appearance of the sample upon heating, which seems to be porous and expanded. Loss on drying was reduced to 1.66% in Shodhita Tankana from 22.0% in Ashodhita Tankana which shows that there is significant reduction of volatile matter under the test condition. This observation is in line with the water release when heated. Both samples had comparable pH values (9.25 and 9.27); this indicates that the alkalinity measured under the conditions of the analysis was not greatly affected. After processing the angle of repose has increased from 42.93° to 53.67° which is a change in the powder flow behaviour. The greater the value, the less flowable the processed powder is under the test conditions. The two samples were found to be soluble and slightly hygroscopic. The results indicate that the overall results show measurable changes that occurred after traditional Tankana Shodhana. Further analytical work, however, would be needed to determine chemical transformations and to investigate whether or not these changes enhance the safety or pharmaceutical quality of Tankana.

Discussion

The comparative physicochemical evaluation demonstrated that the traditional Shodhana procedure performed on Tankana preserved its identity, aqueous solubility and alkaline nature but considerably changes in the physical characteristics occurred. Initially Raw Tankana which appeared as a coarse, crystalline material, but following purification by controlled heating Shodhita Tankana got converted into a finer and more porous powder. This transformation may be due to thermal treatment which was associated with the disruption of the original crystal arrangement and the progressive removal of water of crystallization. On heating Sodium tetraborate it gradually dehydrated forming lower hydrates and under suitable conditions, anhydrous sodium tetraborate.¹⁻⁴

It was observed that the pH values of Raw Tankana and Shodhita Tankana were 9.25 and 9.27, respectively thus demonstrated its alkaline nature which was maintained after thermal processing. This negligible difference indicates that the heating procedure did not substantially alter the basic reaction of the aqueous solution. As the traditional use and several functional properties of Tankana are associated with its alkaline character so persistence of alkalinity is pharmaceutically becomes relevant..²⁻⁵

After Shodhan a marked reduction in bulk density was observed i.e. 0.64 g/mL in Raw Tankana to 0.35 g/mL in Shodhita Tankana. This depletion in values may be related to dehydration, the development of a lighter, more porous structure and particle expansion. Thus the transformation of a relatively porous powder from dense crystalline form can increase the occupied volume per unit mass. ^{3, 6}

The angle of repose suggested that the treated powder exhibited greater resistance to free flow which was significantly observed from increased value of 42.93° in Raw Tankana to 53.67° after Shodhana. Although Shodhita Tankana became more porous, lighter with the formation of finer particles and due to increased interparticle cohesion may have promoted the occurrence of a more stable powder heap.^{6,7}

The most significant difference was seen in the loss on drying which fell from 22.0% of Raw Tankana to 0.66% of Shodhita Tankana. This decrease is consistent with the removal of the physically retained moisture and water of crystallisation from the sample during controlled heating. Borax decahydrate is a water-complexed form of sodium tetraborate which starts to effloresce at 170°C, and may be dried, by further heating, to yield anhydrous sodium tetraborate. The significant decrease in loss on drying value is a clear sign that the Shodhana process was successful in reducing the moisture associated content of the raw material. This can enhance the storage stability and minimize the risk of moisture-induced changes during storage. These properties plays a vital role for the efficacy of the conventional purification technique.^{2, 3, 8}

The Shodhana process described in the classical ayurvedic texts is an important pharmaceutical process prior to its use as a medicine in the case of Tankana. The present study has focused on these aspects and the physicochemical changes involved in this traditional method. After Shodhana, the bulk density of Tankana decreased from 0.64 to 0.35 g/mL and loss on drying from 22.0% to 0.66% with changes in physical appearance and powder characteristics. The two pH values, on the other hand, were almost the same (9.25 and 9.27) and both samples were determined to be soluble. These observations suggest that the physical properties of Tankana mostly affected by the heating procedure under the experiment condition. The results offer some preliminary experimental information which can prove to be helpful in the formulation of physicochemical specifications for Shodhita Tankana. The extended significance on the pharmaceutical field of these changes needs to be further investigated with advanced analytical methods and safety evaluations.^{1,2,8-10.}

Conclusion

This investigation has compared and assessed the physico-chemical qualities and therapeutic value of raw Tankana and traditionally purified Tankana (Shodhita Tankana). All above lab testing parameters proved that Shodana produced noticeable transformed its texture, bulk density, moisture level and other powder related characteristics. Measurable change was also seen in loss on drying which indicated that water had been removed corresponding to the crystallization and this may be reflected in the increase in physico-chemical stability and handling in the pharmaceutical preparation. But one important fact is to be noted the whole process retained the substance's basic alkaline character and ability to dissolve in water. Thus, the conclusions stressed the importance of traditional purification for standardizing and quality assurance of mineral based Ayurvedic formulations and this led to the preference of the use of Shodhita Tankana over the unprocessed one. However, detailed structural analysis by advanced instrumental techniques along with pharmaceutical studies is required to understand the molecular transformation of Shodhana and understanding their effect on therapeutic activity of Tankana.

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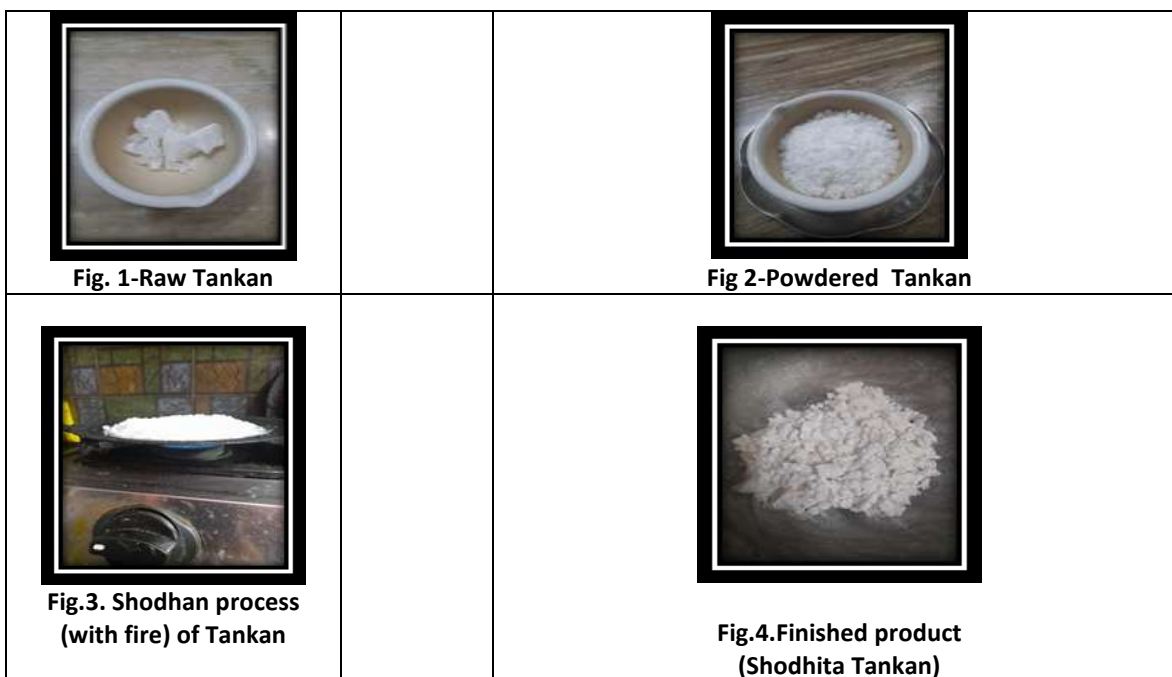


Fig. 3.P