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PHARMACEUTICAL PREPARATION AND PHYSICOCHEMICAL ANALYSIS OF KHADIRARISHTA

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ABSTRACT

Ayurveda, the ancient Indian system of medicine, emphasizes holistic healing through natural remedies. Rasashastra and Bhaishajya Kalpana play an important role in this healing with natural remedies or medicines. Sandhan Kalpana is one such specialized branch that comes under Bhaishajya Kalpana that deals with the fermentation process to prepare various medicinal formulations. These formulations contain self-generated alcohol, which acts as a natural preservative and enhances the absorption of active ingredients. It has various benefits including ease of administration, long shelf life, palatability, and faster action in less dosage. Asava are prepared using fresh juices of herbs and Arishta are prepared using Decoction of Herbs. Khadirarishta is one such classical Ayurvedic formulation, which has been traditionally employed to manage all kinds of Skin disorders, gastrointestinal ailments like krumi, gulma etc and heart conditions. Khadirarishta is mentioned in many Ayurvedic Granths, but for the current study the reference is taken from Bhaishajya Ratnavali In this study Khadirarishta is prepared and fermented for one month period and then it is analyzed for its physicochemical properties.

KEYWORDS: *Ayurveda, Khadirarishta, Arishta, Sandhan kalpana, Kushta*

INTRODUCTION

Ayurveda is a traditional healthcare system originated thousands year back. The medicine system of Ayurveda comprises of plant base, mineral base and animal base system of medicine that meets more than 50% of the healthcare needs of India. It comprises various types of dosage forms according to the modalities. Sandhana Kalpana is one of the dosage forms practiced since Vedic period. The basic pharmaceutical principle in Sandhana kalpana is to extract active constituents of drug through a biochemical process of fermentation in a mildly self-generated alcoholic medium. This ensures extraction of both water and alcohol soluble constituents.[1]

Asava and arishta are most popular dosage forms prepared using herbal juices and decoctions which undergo fermentation in favourable conditions to achieve long shelf life, quick action, and high therapeutic effectiveness. Alcoholic preparations and their actions are innumerable depending upon the ingredients, their combinations and method of preparation.[1] Asava are prepared using cold juices, extracts, infusions and Arishta are prepared from herbal decoctions(kwath). These preparations are advocated for their medicinal and nutritive value, ease of ingestion across various age groups, and enhanced bioavailability compared to other forms.

Khadirarishta is one such potent formulation used in various ailments. It is mentioned in various Ayurvedic Samhitas Granths like Bhaishajya Ratnavali, Sharangdhar Samhita, Gadanigraha etc. In the present study the reference is taken from Bhaishajya Ratnavali *Kushtha Rogadhikar*. In Ayurveda all the skin disease are broadly classified under the concept of Kushta. And Khadirarishta is beneficial for curing Skin disorders under the name of Kushta (like Eczema, Psoriasis, Vitiligo etc.), Urticaria, Wounds, Splenomegaly, Intestinal worms etc. as per Ayurvedic literature.

MATERIALS AND METHODS

Collection, identification, authentication of herbal drug

All ingredients like Khadira, Triphala, Bakuchi, etc. were procured in whole (Akhanda) dry form. They were collected from well-known authentic source and authenticated from renowned pharmacy of Mumbai. Khanda Sharkara and Honey were also procured from authentic source.

Preparation before fermentation

All the dry whole drugs were pounded using mortar pestle. The Prakshepaka drugs were powdered using grinder and sieved

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through 80 Mesh. The khanda Sharkara (compound sugar) was pounded, converted into powder and sieved.
The fermentation pots, instruments and other equipment's were rinsed using hot water, dried in sunlight. Then Lepana was done by Ghrit and it was fumigated using Dhoopana drugs (Guggulu, Triphala churna, raal, Nimba churna).

Preparation of Khadirarishta
For Khadirarishta kwath preparation all the pounded and chopped drugs were added in thick bottom steel vessel and soaked in water overnight. Next morning Potable water in 4 Litres quantity was added and level was marked in the vessel. The remaining 28 litres of water was taken along with soaked kwath dravya. The mixture was allowed to heat on medium flame. The kwath was reduced until 1/8th part was obtained i.e. 4 litres of kwath was obtained and filtered using a clean cotton cloth in a clean fumigated stainless-steel vessel.

The powdered sugar was mixed in the warm kwatha, mixture was stirred till the sugar dissolved completely. Once the kwath was cooled down Honey was added to the kwath. It was filtered to remove the physical impurities observed in the mixture. This mixture was filled in the Sandhan pot. Prakshepa Dravya and Dhataki pushpa were added into the mixture in pot. The mixture was stirred using stirrer.

The fermentation pot was sealed using cotton cloth smeared with multani mitti (fuller's earth clay) and kept in a clean, dry, dark place for the duration of thirty days.

On 31st day, the pot was opened to check the status of the fermentation process. The confirmatory tests like lime water test, sound test, matchstick test were performed interpreting completion of the process. The formulation was filtered using clean cotton cloth in separate vessels. The formulation was stored separately in amber coloured bottles for further use.

ANALYTICAL PARAMETERS

The prepared sample of Khadirarishta was analysed for organoleptic tests (colour, odour, taste, texture) followed by physico-chemical tests i.e. pH, specific gravity, alcohol percentage, total phenolic content, total solids, total sugar content, microbial load.

- **pH**

The pH of formulation was measured using digital pH meter. It is the measure of hydrogen ion concentration, a measure of the acidity or alkalinity of a solution. The pH scale usually ranges from 0 to 14. Arishta formulations are acidic in nature as its normal value ranges between 3-5.

  - Result: 4.4

- **Specific gravity**

It is the ratio of density of substance to the density of a reference substance (water). The specific gravity of Khadirarishta was measured using pycnometer. The specific gravity was calculated by weight of pycnometer with distilled water over the weight of pycnometer with sample

  - Result: 1.081 gm/ml

- **Alcohol content**

The ethanol content of a liquid is expressed as the number of volumes of ethanol contained in 100 volumes of the liquid, the volumes being measured at 24.9° C. The alcohol content was calibrated using specific gravity method.

  - Result: 6.25 %

- **Loss on Drying**

At first 100 mL Khadirarishta was taken in a beaker and was weighed. Then Khadirarishta with beaker was put in a water bath for completing evaporation. The residue was weighed after cooling.
LOD = Weight test sample before evaporation - weight test sample after evaporation.

  - Result: 8.05

- **Thin Layer Chromatographic Analysis**

Khadirarishta comprises active and inactive compounds, therefore, to identify these compounds thin layer chromatographic (TLC) technique was used with chloroform and ethyl acetate at different ratios as solvent systems.

  - Result: Gallic acid identified in the Khadirarishta Sample

- **Total Sugar, Reducing sugar and non-reducing sugar**

The total sugar content in a liquid is commonly estimated using Fehling's method, a classical chemical titration technique. Reducing and non-reducing sugar is also calculated in the given Khadirarishta Sample.

  - Result: Total Sugar is 32 %, reducing sugar is 22.5%, non-reducing sugar is 7.01%

- **Microbial contamination**

Total Bacterial Count and Total Yeast and Mould Count are used to determine microbial contamination of the Khadirarishta sample.

  - Result: Total bacterial count is 5.72×10^3 cfu/ml
    Total yeast and mold count is 1218 cfu/ml

- **Total Solid content**

The total solids content includes both the suspended and dissolved salts. To determine the percentage of solid matter present in a liquid preparation. The liquid sample is evaporated and dried to constant weight. The residue left represents the solid content present in the formulation.

  - Result: 9.21 %

RESULTS

The time required to prepare 4 L kwatha was 3 hours. The addition of Sharkara and honey in kwatha resulted in increased volume of the mixture. Hence the total quantity of Khadirarishta obtained was 5L after filteration.

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The completion of the fermentation process was confirmed on day thirty one by observing the bubbles on the top layer of the formulations and lighted candle placed on the surface of fermentation pot did not burn out. Also, the absence of sound of bubbles and a negative lime water test confirmed completion of fermentation. The pH noted on day thirty was 4.4 i.e. it was acidic. Other Values for organoleptic parameters and physico-chemical constants of Khadirarishta are mentioned in table 2.

DISCUSSION

Khadirarishta, mentioned in *Bhaishajya Ratnavali* under *Kushtha Rogadhikara*, has been considered in the present study. It is widely used in the management of various skin disorders, and its ingredients possess pharmacological activities that are also relevant in the context of skin disorders.

Khadira (Acacia catechu) exhibits *Rasayana* properties. Owing to its *Tikta* and *Kashaya Rasa* along with *Raktapradoshaka Karma*, it has been traditionally indicated in different types of *Kushtha*. Daruharidra (Berberis aristata) possesses significant anti-inflammatory activity. It is beneficial in *Dushtavrana*, *Kandu*, and *Kushtha*. Experimental studies suggest that the aqueous extract of *B. aristata* is effective in the management of skin disorders when used both internally and externally. Bakuchi (Psoralea corylifolia) has been employed since antiquity in the treatment of *Kushtha* and *Shwitra*. Its efficacy is attributed to its *Tikta* and *Katu Rasa*, *Ushna Guna*, and the presence of essential oils, which contribute to its therapeutic potential in skin diseases.

It has been studied that the flowers of dhataki pushpa contain high percentage of tannins (22%) and these tannins (phenolic compounds) bring enzymatic conversion to simple phenols and alcohol during anaerobic fermentation.[3] At initiation of fermentation process 40% of the sugar is utilized. As the fermentation progresses, the growing yeasts use up the total reducing sugars.[4] It is known that sugar content decreases during fermentation with subsequent increase in the alcohol content and reduction in density of the fermenting medium resulting decrease in the pH and specific gravity.[5]

Analytical evaluation is an essential step in determining the quality, safety, and standardization of any Ayurvedic formulation. The analytical studies of *Khadirarishta* were carried out as per the standards prescribed in verified laboratories. Organoleptically, *Khadirarishta* is a dark brown, sticky and flowy liquid with a characteristic fermented alcoholic odour, and it has a sweet and astringent taste. The pH of the formulation was found to be 4.4, indicating its acidic nature. The moisture content was 8.05%, while the solid content was 9.21%, suggesting a significant presence of extractive matter derived from the herbal ingredients. The alcohol content was estimated at 6.25%, which is self-generated through natural fermentation; a value between 5–10% is considered ideal according to API standards.

The sugar profile revealed that the formulation contains 32% total sugar, of which 22.5% is reducing sugar and 7.01% is non-reducing sugar. This indicates that a considerable proportion of sugars remains even after fermentation, contributing to both the sweet taste and the calorific value of the preparation. Microbial load studies showed a total bacterial count of 5.72×10^3 cfu/ml and a yeast and mold count of 1218 cfu/ml. Both values are well within the permissible limits of API standards, confirming that the formulation was prepared and stored under hygienic conditions, ensuring its safety and suitability for therapeutic use.

CONCLUSION

The Khadirarishta sample prepared in this study is as per API standards. The study successfully demonstrated the preparation of Khadirarishta according to classical Ayurvedic text of Bhaishajya Ratnavali and validated its quality through modern analytical tools. Organoleptic, physico-chemical tests like pH, Total alcohol content, thin layer chromatography etc.

Thus, the pharmaceutical methods employed were effective in producing a standardized Khadirarishta. The integration of traditional techniques with modern analytical evaluation establishes a scientific basis for its therapeutic use and enhances confidence in its safety and efficacy.

Table 1

Sr No	Ingredients	Latin Name	Parts Used	Quantity
1	Khadira	*Acacia Catechu*	Heartwood	800gm
2	Devdaru	*Cedrus Deodara*	Heartwood	800gm
3	Bakuchi	*Psoralea Corylifolia*	Seeds	192gm
4	Daruharidra	*Berberis Aristata*	Root, stem	320gm
5	Haritaki	*Terminalia Chebula*	Fruit	106gm
6	Bibhitaki	*Terminalia Bellirica*	Fruit	106gm
7	Amalaki	*Emblica Officinalis*	Fruit	106gm
8	Dhataki	*Woodfordia Fruticosa*	Flowers	320gm
9	Kankola	*Piper Cubeba*	Raw fruit	16gm
10	Nagakeshar	*Mesua Ferrea*	Stamens	16gm
11	Jatiphala	*Myristica Fragrans*	Fruit	16gm

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12	Lavanga	*Syzygium Aromaticum*	Flower bud	16gm
13	Elaichi	*Elettaria Cardamomum*	Fruits, seeds	16gm
14	Dalchini	*Cinnamomum Zeylanicum*	Bark	16gm
15	Tejpatta	*Cinnamomum Tamala*	Leaf	16gm
16	Pippali	*Piper Longum*	Fruit	64gm
17	Madhu	Honey	—	3.2kg
18	Sharkara	Sugar	—	1.6kg
19	Jala	Water	—	32 litres

Table 2

Test	Result
Appearance (Sparsh)	Sticky Liquid
Colour (Rupa)	Dark Brown
Odour (Gandha)	Fermented
Taste (Rasa)	Sweet & Astringent
pH	4.4
Specific Gravity	1.081 gm/ml
Loss on Drying	8.05%
Total Solid Content	9.21%
Alcohol Content	6.25%
Total Sugar	32%
Reducing Sugar	22.5%
Non-reducing Sugar	7.01%

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