Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 9s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Pharmaceutical Standardization and Comparative Analysis of Gandhaka Shodhana Methods as Per Rasatarangini

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Cite this paper as: Niteen Mukesh, Ajay Kumar Singh, (2025) Pharmaceutical Standardization and Comparative Analysis of Gandhaka Shodhana Methods as Per Rasatarangini. *Journal of Neonatal Surgery*, 14 (9s), 990-1000.

Accepted: 05-03-2025 **Published: 17-03-2025**

ABSTRACT

Gandhaka (Sulphur) is a significant mineral drug extensively used in Rasashastra for its therapeutic applications. However, raw *Gandhaka* (Ashuddha Gandhaka) often contains impurities such as clay, sand, visha (*Haratala*, and *Manahshila*), necessitating purification (Shodhana) prior to medicinal use. Classical Ayurvedic texts, including Rasatarangini, recommend different media for the Shodhana process. This study aims to compare three traditional media—Godugdha (cow's milk), Bhringraja Swarasa (Eclipta alba juice), and *Churnodaka* (lime water)—to determine their efficacy in purifying Gandhaka. **Materials and Methods:** Pharmaceutical processing was carried out using the traditional seven-stage Shodhana procedure. Each medium was evaluated for its ability to remove physical and chemical impurities, and comparative weight loss was documented. Organoleptic properties and physico-chemical analyses, including sulphur content (gravimetric method) and heavy metal analysis (with a focus on arsenic), were performed as per standards outlined in the Ayurvedic Pharmacopoeia of India (API). **Results:** *Godugdha* Shodhana resulted in highest sulphur content (99.47% w/w) and lowest arsenic content (2.03 ppm) among the three. Bhringraja Swarasa Shodhana achieved 98.66% w/w sulphur purity and 2.10 ppm arsenic. Churnodaka Shodhana was least effective, yielding 96.20% w/w sulphur and 2.24 ppm arsenic, though it showed practical feasibility due to easy preparation. **Conclusion:** The study concludes that Godugdha is the most effective and reliable medium for Gandhaka Shodhana, offering superior purification outcomes with significant reduction in arsenic content. Bhringraja Swarasa is effective but limited by seasonal availability, while Churnodaka, although accessible and cost-effective, shows lower purification efficacy. These findings support the classical view that the choice of media in Rasa Shastra profoundly influences drug quality and safety. Further clinical evaluation is recommended to substantiate these in vitro results.

Keywords: *Gandhaka,Shodhana,Churnodaka,Dhalana,Prakshalana,Swedana,Galana.*

1. INTRODUCTION

Gandhaka is one of the drugs used in many pharmaceutical procedures in *Ayurveda*. As we know earlier *Ashuddha Gandhaka* has got many physical & chemical impurities like clay, sand particles, small stones, *Haratala, Manahshila*[1] etc. Internal administration of Ashodhita Gandhaka will produces many unwanted effects and disorders in the human body. It may cause twaga vikara (skin disease), hyperthermia, giddiness, pittajavikara. It adversely affects the kanti, abha, overall health and virility[2] . Hence these impurities need to be eliminated before using Gandhaka for further processes. There are different methods of *Gandhaka Shodhana* explained in the classical text of *Rasashastra*. Pharmaceutical companies/Vaidyas are always confused about adopting an appropriate method of *Gandhaka shodhana* prior to, using it for therapeutic purposes. Hence there is a need to ascertain the most appropriate media for the process for *Shodhana* (purification) of *Gandhaka.* This study is being conducted to fetch the knowledge of *Gandhaka Shodhana* mentioned in the classical textbook of Rasa Shastra i.e., *Rastarangni*. Different methods of *shodhana* have been mentioned in *Rastarangini*. Three different media like, *Go-Dugdha, Bhringraj Swarasa* and *Churnodaka*, are chosen here for the process of *shodhana* of Gandhaka, which are obtained from three different sources viz- **animal, plant, and mineral origin** respectively. Media plays a very important role in the processing of *Rasa-Aushadhi*. The notifiable effect of media can be seen in Marana.

लोहानां मारणं श्रेष्ठं सर्वेषां रसभस्मना ।

मुलीभिर्मध्यमं प्राहुः कनिष्ठं गन्धकदिभिः ।

अरिलोहेन लोहस्य मारणं दुर्गुणप्रदम् ।। र०र०स०-५/१४।।

Bhasma is prepared by the addition of ***Parada*** *(Rasa bhasma),* ***Mulibhih*** *(padap dravyas),* ***Gandhakadibhih*** *(Gandhaka* etc.) and ***Arilohas*** are considered to be of uttama (superior), madhyama (medium), kanishtha (inferior) and *durgunapradam* (antagonist) respectively. Hence during *shodhana* of *Gandhaka*, media seems to play an important role in therapeutic value. So, here for the process of *Gandhaka shodhana*, three different medias have been selected to know their comparative efficacy and cost-effectiveness.

2. MATERIAL AND METHOD

Drug Review-

Gandhaka is described in Samhitas, also showing knowledge of its medicinal value from a very early period. It is the next most important drug of Rasashastra after Parada. It is described in *Uparasa Varga* of *Ras dravyas*. It is used for neutralizing the toxicity of Parada and enhancing its therapeutic effect. It is used for the preparation of *Kajjali*, *Rasa Parpati*, *Rasa Sindura* etc. It is being given prime importance in Rasashastra because of its Rasayana properties. It is also considered as one of the essential ingredients for the various processes of *Parada samskara* such as *Murcchana* & *Jarana* etc. It is believed that when Parada treated with *Gandhaka* many desirable properties are come into existence and toxic effects are reduced. Probably due to this peculiar nature of *Gandhaka, Parada* is mostly administered internally after *Samskarit* with *Gandhaka*. *Ras Aushadhi* prepared from *Parada* without treated with *Gandhaka* are more toxic. In addition to its value *Parada* is employed not only for its medicinal benefits but also in the process of *Parada Bandha*.

Pharmaceutical Study-

Pharmaceutical study includes mainly purification of *Gandhaka*, and its process of standardization in which drug ratio, *dravya* quantity, and duration etc. The practical study of purification of *Gandhaka* with different medias comprised of following steps: -

1. Gandhaka Shodhana with Godugdha [3]
2. Bhringaraja Swarasa Nirmana [4]
3. Gandhaka Shodhana with Bhringaraja Swarasa [5].
4. Churnodaka Nirmana [6].
5. Gandhaka Shodhana with Churnodaka [7].

1.Gandhaka Shodhana with Godugdha

Sodhana of Gandhaka was carried out according to the method given in *Rastarangini* (8/7-12). Initially when *Gandhaka* and *Goghrita* heated together fine powder of *Gandhaka* becomes adhere each other. Further after uniform heating and stirring it finally totally melted. A change in color from dark yellow to orange-yellow is observed during the liquefaction of *Gandhaka*. When melted *Gandhaka* was poured into the vessel through white coloured *Goghrita lipta* muslin cloth containing *Godugdha*, Physical impurities, including stones and sand, were removed by filtration through muslin cloth. Granular purified *Gandhaka* was collected at the bottom of the vessel. Washing with hot water caused the water to appear milky. After drying, the final color of the Śuddha *Gandhaka* was yellow, and its strong characteristic odor was notably diminished through the subsequent purification steps. The brittleness of *Gandhaka* increased progressively with each stapes of the process. Initially 250 gm Raw *Gandhaka* was taken and ***69 gm*** of Shuddha *Gandhaka* was obtained.

Table No. 1.1 1st batch Shodhana of Gandhaka by Godugdha

Amlasara Gandhaka shodhan.	Qty.before shodhan	Qty. after shodhan (in gms)	Loss in gms	Loss in %
1-st	125	104	21	16.8
2-nd	104	90	14	13.5
3-th	90	75	15	16.7

4-th	75	62	13	17.3
5-th	62	52	10	16.1
6-th	52	41	11	21.2
7-th	41	31	10	24.4

Table No. 1.2: 2nd batch Shodhana of Gandhaka by Godugdha

Amlasara Gandhaka shodhaan.	**Qty.before shodhana in gms**	**Qty. after shodhana (in gms)**	**Loss in gms**	**Loss in %**
1-st Shodhana	**125**	**110**	**15**	**12**
2-nd Shodhana	**110**	**97**	**13**	**11.8**
3-rd Shodhana	**97**	**82**	**15**	**15.5**
4-th Shodhana	**82**	**70**	**12**	**14.6**
5-th Shodhana	**70**	**58**	**12**	**17.1**
6-th Shodhana	**58**	**48**	**10**	**17.2**
7-th Shodhana	**48**	**38**	**10**	**20.8**

A total of 69 gm (31 gm + 38 gm) of Shuddha Gandhaka was obtained.

Precautions: *Gandhaka* should be heated over mild heat. The mixture was constantly stirred while heating. The unfiltered part should be again melted and filtered through cloth to avoid greater loss. While meting process, *Gandhaka* should not bring in contact with heat flames as it burns immediately with bluish flame. Muslin cloth should be properly coated with *Goghrita* to avoid sticking of the *Gandhaka* in it. *Gandhaka* must melted on slow fire. Otherwise, on further heating it turns to reddish thick consistency which made it difficult to filter through the cloth. The purified Gandhaka should be thoroughly washed with hot water approximately ten times to ensure complete removal of Go-ghrita. This entire purification process must be repeated seven times. In each cycle, fresh *Godugdha* and *Goghrita* should be used, and the mortar and pestle must be properly cleaned before reuse.

Fig 1.1-
Ashuddha Gandhaka

Fig 1.2-
Melting of Gandhaka with Goghrita

Fig 1.3-
Filteration of Melted Gandhaka

Fig 1.4-
Suddha Gandhaka in Godugdha

Fig 1.5-
Gandhaka (After 1st Shodhan)

Fig 1.6-
Gandhaka (After 7th Shodhan)

1. **Bhringaraja Swarasa Nirmana.**

There is no reference of Bhringaraja Swarasa nirmana described in Rasatarangni. Hence general method of Swarasa nirmana described in Sarangdhara Samhita, Madhyama Khanda, Prathama adhyaya is used to prepare of Bhringaraja Swarasa. Initially 2.5 kg of Bhringraja Plant was taken and **1.150 lit** of Swarasa was obtained.

Fig 2.7-Bhringaraja plant

Fig 2.8-Bhringaraja Swarasa

2. Gandhaka Shodhana With Bhringaraja Swarasa.

When Gandhaka is melted alone in a *lauha darvi*, it becomes sticks in the bottom. To overcome this problem Gandhaka was melted with Goghrita which was not mentioned in the Reference. Initially when Gandhaka and Goghrita heated together fine powder of Gandhaka becomes adhere each other. Further after uniform heating and stirring it totally melted. When the melted Gandhaka was poured into a vessel through white muslin cloth containing Bhringaraja Swarasa, physical impurities such as stones and sand were filtered out by the cloth. The purified Gandhaka settled at the bottom of the vessel in the form of granules. The Bhringaraja Swarasa became hot after contact with the molten Gandhaka. Upon washing the Gandhaka with hot water, the water turned greenish in color. After drying, the final color of the Śuddha Gandhaka appeared greenish-yellow. With each purification cycle, the Gandhaka became progressively more brittle. Initially 250 gm raw Gandhaka was taken and **71 gm** of pure Gandhaka was obtained.

Table No. 1.3: 1st batch Bhringaraja Swarasa Shodhita Gandhaka: -

Amlasara Gandhaka shodhan.	Qty.before shodhan	Qty. after shodhan (in gms)	Loss in gms	Loss in %
1-st Shodhana	125	107	18	14.4
2-nd Shodhana	107	92	15	14.02
3-rd Shodhana	92	78	14	15.22
4-th Shodhana	78	63	15	19.23
5-th Shodhana	63	50	13	20.63
6-th Shodhana	50	40	10	20
7-th Shodhana	40	32	8	20

Table No. 1.4: 2nd batch Shodhana of Gandhaka by Bhringaraja swarasa

Amlasara Gandhaka shodhaan.	Qty.before shodhana in gms	Qty. after shodhana (in gms)	Loss in gms	Loss in %
1-st Shodhana	125	105	20	16
2-nd Shodhana	105	91	14	13.33
3-rd Shodhana	91	78	15	16.48
4-th Shodhana	78	66	13	16.66
5-th Shodhana	66	56	12	18.18
6-th Shodhana	56	46	10	17.85
7-th Shodhana	46	39	7	15.21

RESULT:

- Weight of impure Gandhaka**: 250 gm.**
- Weight of pure Gandhaka obtained after Sodhana**: 71 gm.**
- Total Weight loss during purification **179 gm.**

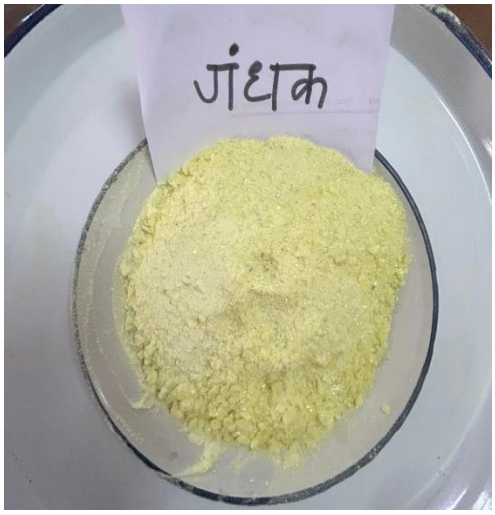

Fig 2.7-Raw Gandhaka

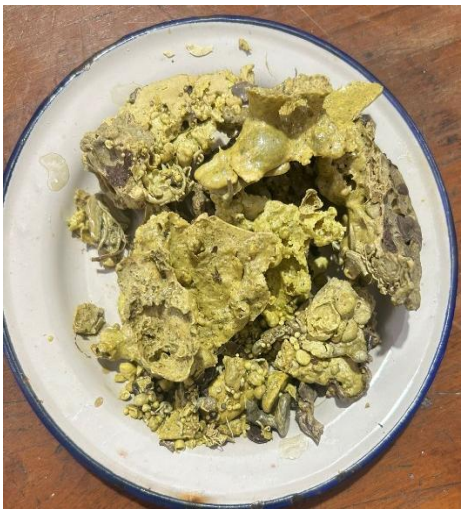

Fig 2.8-Bhringaraja Swarasa Shodhita Gandhaka

3. Churnodaka Nirmana.

When water added to the Churna in a vessel, initially there is no reaction was measured. Gradually vessel became heated, shows starting of exothermic reaction. Evaporation of water seen easily. At a time, vessel became too hot to touch. Churnodaka will attain milky white appearance in the beginning. After keeping it undisturbed for 09 hours, the Churna settled down and the supernatant fluid will be transparent very light milky in colour. Initially 2.25 lit of water was taken and **1.4 lit** of Churnodaka was obtained.

Fig 2.9- Chuna

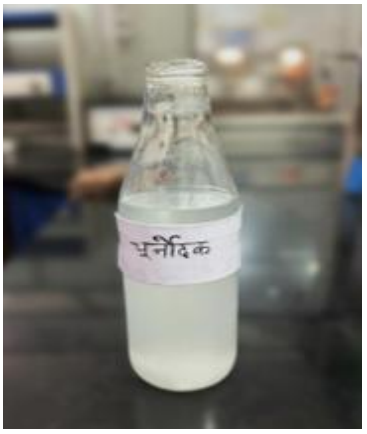

Fig 2.10-Churnodaka

RESULT:

- **Measurement of Water: 2.25 lt.**
- **Measurement of Churnodaka obtained: 1.4 lt.**

4. Gandhaka Shodhana With Churnodaka.

When both *Gandhaka* and *Churnodaka* was strongly heated together, they did not melt as described in the reference. To overcome this problem Gandhaka was melted with *Goghrita* and poured through *Goghrita* lipta muslin cloth in churnodaka. Then strongly heated this mixture until ***kapil varna*** appeared. When the melted *Gandhaka* was poured into the vessel containing Churnodaka, physical impurities such as stones and sand were filtered out by the cloth. Black colour Slug of impurities were also shown with Gandhaka during washing. Colour of *churnodaka* after *dhalana* of melted Gandhaka and strongly heated was deep yellow. After drying, the final color of Śuddha Gandhaka became light yellow. Initially, 250 grams of raw *Gandhaka* was taken, and **209 grams** of Śuddha *Gandhaka* was obtained.

Fig 2.11- Boiling of Gandhaka with Churnodaka

Fig 2.12- Gandhaka without Churnodak

Fig 2.13- Churnodaka after Gandhaka Shodhana

3. OBSERVATIONS AND RESULT

Table No.1.5: OVER ALL RESULTS OF ALL PRACTICAL

PRACRICAL NO.	NAME OF PRACTICAL	TAKEN	RESULT
1	Gandhaka Shodhana by Godugdha media	250 gm	115 gm

2	Gandhaka Shodhana by Bhringaraja Swarasa media	250 gm	117 gm
3	Gandhaka Shodhana by Churnodaka media	250 gm	209 gm

ANALYTICAL STUDY-

In this section, a broad analysis of samples of Raw as well as Shodhita *Gandhaka* for Standardization was planned. For this, Various organoleptic and qualitative physico-chemical parameters were mentioned as per API/AFI/General Guidelines for Drug Development of Ayurvedic Formulations/another standard guideline. The analytical study of drug was carried out by *S.R LABS & RESEARCH CENTRE*, Jagatpura, Jaipur, Rajasthan, which is AYUSH approved Laboratory & ISO-9001 Certified.

Organoleptic examination:

Organoleptic examination refers to the sensory evaluation of samples using our senses, particularly taste, smell, sight, touch, and hearing.

Table No. 1.6: Organoleptic Examinations of all samples.

Samples	1	2	3	4
Properties	Raw Gandhaka	Godugdha Shodhita Gandhaka	Bhringraja Swarasa Shodhita Gandhaka	Churnodaka Shodhita Gandhaka
Colour	Dull Yellow	Yellow	Greenish Yellow	Light Yellow
Appearance	Stony	Granules	Granules	Granules
Odour	Sulphurous smell	Sulphurous smell	Sulphurous smell	Sulphurous smell
Touch	Hard	Smooth	smooth	Smooth

SULPHUR PURITY TEST

Determining sulphur purity by the gravimetric method involves precipitating sulphur as *barium sulfate* (BaSO4) and measuring the mass of the formed precipitate.

Table No.1.7 : Purity of Gandhaka in all the samples.

Sulphur Content in samples				
Standard as per A.P. I	Raw Gandhaka	Godugadh Shodhita Gandhka	Bhringraja Swarasa Shodhita Gandhka	Churnodaka Shodhita Gandhka
90 % w/w	93.45 %w/w	99.47 % w/w	98.66 % w/w	96.20 % w/w

Determining Sulphur Purity test of all the samples shows that the Raw Gandhaka Heavy that the limit is 93.45 w/w w/w. After purification by different medias purity increased. **Godugdha shodhita Gandhaka purity increased upto 99.45 % w/w** which is most purify form of Gandhaka among all the four samples.

HEAVY METALS ANALYSIS

- **Heavy metals analysis** of Raw Gandhaka shows that the limit of Arsenic metal is 5.37 ppm which is over the standard limit (3 ppm) as per A.P.I. Rest all three heavy metals, Lead, Cadmium & mercury are present in the sample within the limit described by A.P.I. Therefore, presence of Lead, Cadmium & mercury was not analysed in rest three samples of Purified Gandhaka. Only Arsenic analysis was done for rest three samples of purified

Gandhaka.

- Arsenic metals analysis of all purified samples of Gandhaka shows that the limit of Arsenic metal is reduced to under permissible limit slandered set by A.P.I. Godugdha Shodhita Gandhaka shows least Arsenic i.e. 2.03 ppm among all the samples.

Table 1.8 - Permissible Limits of Heavy Metals

S.No.	Heavy Metal contents	Permissible limits
1.	Lead	10 ppm
2.	Arsenic	03 ppm
3.	Cadmium	0.3 ppm
4.	Mercury	1 ppm

Table No.1.9: Heavy Metal Analysis of Raw Gandhaka.

Heavy Mental Analysis of Raw Gundhaka		
Metals	Standard as per A.P. I	Finding
Lead (Pb)	10 ppm	4.02 ppm
Cadmimum (Cd)	0.3 ppm	0.01 ppm
Mercury (Hg)	1 ppm	0.47 ppm
Arsenic (As)	3 ppm	**5.37 ppm**

- Heavy metals analysis of Raw Gandhaka shows that the limit of Arsenic metal is **5.37 ppm** which is over the standard limit (3 ppm) as per A.P.I. Rest all three heavy metals, Lead, Cadmium & mercury are present in the sample within the limit described by A.P.I. Therefore, presence of Lead, Cadmium & mercury was not analized in rest three samples of Purified Gandhaka. Only Arsenic analysis was done for rest three samples of purified Gandhaka.

Table No.1.10: Arsenic Analysis of all samples of Gandhaka.

Arsenic (As) Analysis of Samples				
Standard as per A.P.I	Sample 1	Sample 2	Sample 3	Sample 4
	Raw Gandhaka	Godugadh Gandhka	Bhringraja Gandhka	Churnodaka Gandhka
3 ppm	**5.37 ppm**	2.03 ppm	2.10 ppm	2.24 ppm

Arsenic metals analysis of all purified samples of Gandhaka shows that the limit of Arsenic metal is reduced to under permissible limit slandered set by A.P.I. Godugdha Shodhita Gandhaka shows least Arsenic i.e. 2.03 ppm among all the samples.

4. DISCUSSION & CONCLUSION

In this chapter, all the data obtained after analytical test is discussed carefully, rationally and scientifically.

After corelating all the analytical study it is concluded that –

- Matter content in Raw Gandhaka is 93.45 % w/w which is above the purity parameter according to API guideline which is 90 % w/w. Hence in external uses like ointment, raw Gandhaka may be used without purification. which will confirm further clinical trial.
- Based on analytical study, this is clearly stated that ***media plays a vital role in 'Shodhana'*** which is also shown in '*Marana'*.
- Purity of Churnodaka Shodhita Gandhaka is **96.20 w/w,** which is least among all three medias. And finding of Arsenic metal in it is **2.24 ppm** which is also highest among all the three medias. Therefore, it shows that ***Churnodaka is not better choice as a media for purification of Gandhaka***.
- Purity of Bhringraja Swarasa Shodhita Gandhaka is **98.66 w/w,** its value lies in between Godugdha and Churnodaka. And finding of Arsenic metal in it is **2.10 ppm** which is also lies between these two medias. Therefore, it shows that *Bhringraja Swarasa may be used as a purification media, but its green plant is not available in every season.*
- Purity of Godugdha Shodhita Gandhaka is **99.47 w/w** which is best among all three medias. And finding of Arsenic metal in it is 2.24 ppm which is least among all the three medias. Therefore, it shows that ***Godugdha is the best media for purification of Gandhaka. It is also*** very easily available, and ready to use.
- Further clinical trial may fetch the deep knowledge related to this study.

DISCUSSION

The analytical evaluation of Gandhaka processed with three different Shodhana media—Churnodaka, Bhringraja Swarasa, and Godugdha—demonstrates that the choice of purification medium markedly influences both the chemical purity and residual toxic element profile of the final product. Raw Gandhaka already meets the Ayurvedic Pharmacopoeia of India (API) purity threshold (93.45% w/w vs. 90% w/w), suggesting potential for certain external formulations without further processing. However, when subjected to Shodhana:

- **Churnodaka Shodhita Gandhaka** yielded the lowest increase in purity (96.20% w/w) and the highest residual arsenic (2.24 ppm), indicating incomplete removal of toxic elements and suboptimal refinement.
- **Bhringraja Swarasa Shodhita Gandhaka** improved purity to 98.66% w/w with arsenic reduced to 2.10 ppm. While more effective than Churnodaka, its reliance on seasonally available plant juice limits consistent application.
- **Godugdha Shodhita Gandhaka** achieved the highest purity (99.47% w/w) and the lowest arsenic content (2.02 ppm), confirming its superior capacity to dissolve and remove impurities. Its universal availability and ease of handling further reinforce its practical advantage in Shodhana procedures.

These findings underscore that aqueous media with complex organic constituents (e.g., proteins and lipids in milk) facilitate more efficient binding and extraction of sulfur-bound impurities than simple aqueous solutions. The reduction in arsenic and enhancement in matter content correlate directly with the nature of the Shodhana dravya, reflecting both its physicochemical interactions and its biological matrix.

CONCLUSION

The present study concludes that Raw Gandhaka, with a purity of 93.45% w/w, surpasses the API standard and may be suitable for external applications, subject to clinical validation. Among the three Shodhana media evaluated, Godugdha proved to be the most effective and practical, yielding the highest purity and the lowest arsenic residue. Bhringraja Swarasa showed moderate improvement in both parameters but poses limitations due to its seasonal unavailability. Churnodaka, on the other hand, demonstrated the least effectiveness in purification and retained the highest arsenic content, making it unsuitable as a Shodhana medium. These findings emphasize the significance of the purification medium in enhancing the safety and quality of Gandhaka. Further in vivo and clinical research is essential to substantiate these analytical outcomes and support the evidence-based application of Shodhita Gandhaka in Ayurvedic therapeutics.

ACKNOWLEDGEMENT

The author is thankful to Prof. (Dr). Prabhat Dwivedi, Professor, Dept. of Rasashastra and Bhaishajya Kalpana for his valuable guidance, inspiration, and co-operation during the study.

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