WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.453
Volume 15, Issue 3, 980-996. Research Article ISSN 2277–7105

DEVELOPMENT OF PHYSICOCHEMICAL PARAMETERS AND PROBABLE CHEMICAL REACTION MECHANISM IN THE PREPARATION OF *SHANKHADRAVAKA*

Vikas Mishra[1]*, Ashish Kumar[2], Puneeth Raj R. M.[3], Sakhitha K. S.[4], Reetesh Ramanai[5], Anupam Srivastava[6]

[1,2,3]MD Scholar, Department of RS and BK, Deemed to be University (De NoVo), Jaipur, Rajasthan, India.
[4,5]Assistant Professor, Department of RS and BK, Deemed to be University (De NoVo), Jaipur, Rajasthan, India.
[6]Professor, Head of the Department, Department of RS and BK, Deemed to be University (De NoVo), Jaipur, Rajasthan, India.

Article Received on 01 Jan. 2026,
Article Revised on 22 Jan. 2026,
Article Published on 01 Feb. 2026,

https://doi.org/10.5281/zenodo.18430983

***Corresponding Author**
Vikas Mishra
MD Scholar, Department of RS and BK, Deemed to be University (De NoVo), Jaipur, Rajasthan, India.

How to cite this Article: Vikas Mishra[1]*, Ashish Kumar[2], Puneeth Raj R. M.[3], Sakhitha K. S.[4], Reetesh Ramanai[5], Anupam Srivastava[6] (2026). Development Of Physicochemical Parameters And Probable Chemical Reaction Mechanism In The Preparation Of Shankhadravaka. World Journal of Pharmaceutical Research, 15(3), 980–996.

ABSTRACT

Introduction: *Shankhadravaka* is a classical Ayurvedic formulation prepared through distillation and traditionally used in the management of gastrointestinal disorders such as *Annadrava Shoola* (gastritis) and *Udara Shoola* (abdominal colic). Despite its therapeutic significance, standard physicochemical parameters and a validated analytical profile for this formulation remain insufficiently documented. This study was undertaken to develop physicochemical parameters, document pharmaceutical procedures, and propose a probable chemical reaction mechanism involved in the preparation of *Shankhadravaka*. **Methods:** Authenticated raw materials were procured from a GMP-certified pharmacy and verified by experts at the National Institute of Ayurveda, Jaipur. Classical *Shodhana* (purification) procedures were performed on each ingredient, and observations were recorded. *Shankhadravaka*was then prepared using traditional distillation apparatus, and organoleptic as well as physicochemical analyses—including pH, specific gravity, refractive index and total solid content—were carried out. The probable chemical mechanism was deduced based on observed results, classical Ayurvedic descriptions, and modern chemical interpretations. **Results:** During purification, significant weight reduction in *Shankha* confirmed effective impurity removal. The distillation yielded 12.5 ml (11.90%) of *Shankhadravaka* in 3 hours. Organoleptic examination revealed a sharp, ammonia-like odor, saline taste, and light yellow appearance. The physicochemical parameters obtained were: pH 9.72, specific gravity 1.1215 refractive index 1.3903and total solid content 1.3805%. The proposed chemical mechanism indicated the liberation of ammonia gas via interaction of Ammonium Chloride with alkaline carbonates, which subsequently dissolved in water vapor to form Ammonium Hydroxide (NH_4OH) in the distillate. **Conclusion:** The study substantiates the classical *Shodhana* and distillation practices described in Ayurvedic texts through modern analytical parameters. The physicochemical properties confirm the alkaline and stable nature of *Shankhadravaka*, supporting its traditional applications. The proposed reaction mechanism provides a scientific rationale for its therapeutic properties. These findings contribute to establishing quality control standards and analytical benchmarks for *Shankhadravaka* and similar distillate preparations in Ayurveda.

KEYWORDS: *Shankhadravaka*, Ayurvedic distillation, physicochemical analysis, ammonia liberation, ammonium hydroxide, classical pharmaceutical validation.

INTRODUCTION

Rasashastra and *Bhaishajya Kalpana*, integral branches of Ayurveda, specialize in the preparation, purification, and therapeutic application of herbo-mineral formulations, renowned for their potent efficacy and rapid therapeutic action. Among these, *Rasoushadhis* and *Kashtoushadhis* occupy a significant place in Ayurvedic pharmaceutics due to their wide therapeutic applications and unique pharmaceutical techniques. One such distinctive formulation is *Shankhadravaka. a* classical distillate preparation described in *Rasa Tarangini*[1], raditionally indicated for the management of various gastrointestinal disorders including *Agnimandya* (digestive impairment), *UdaraShoola* (colicky abdominal pain), *Grahani* (malabsorption syndrome), and *Annadrava Shoola* (gastritis). Shanka *dravaka* has more than one reference in classical books. In ‘Rasa yoga sagara (14 formulations)[2], in Bhaishajyaratnavali (3 formulations)[3], and in Rasa tarangini (3 formulations)[4] of *Shankhadravaka* are described.

Despite its therapeutic potential, *Shankhadravaka* remains underutilized in contemporary clinical practice, largely due to its limited commercial availability and the absence of standardized pharmaceutical and analytical profiles. Its formulation process, involving meticulous *Shodhana* (purification) procedures and a classical distillation technique, has not been extensively validated through modern physicochemical and analytical studies. Moreover, its liquid dosage form and minimal dose requirement (5–16 drops) offer distinct advantages in terms of ease of administration and patient compliance, particularly in conditions requiring prompt relief and sustained management, such as acid-peptic disorders. Study by Sperber AD et.al (2020) on Worldwide Prevalence and Burden of Functional Gastrointestinal Disorders found that more than 40% of persons worldwide have functional gastrointestinal disorders (FGIDs),[5] This highlights the necessity for effective, accessible, and evidence-based therapeutic options. Traditional formulations like *Shankhadravaka* warrant renewed attention, not only for their clinical utility but also for scientific validation and potential reintegration into conventional practice.

The present study was thus undertaken with the primary aim of developing a comprehensive pharmaceutical and analytical profile of *Shankhadravaka p*repared as per Rasatarangini.[6] the research specifically focused on documenting pharmaceutical observations during *Shodhana* and distillation processes, and establishing key physicochemical parameters of the final product. Additionally, a probable chemical reaction mechanism underlying the preparation and distillation process was proposed, based on classical references and modern chemical principles.

The aim of this study is to develop and establish the physicochemical parameters of *Shankhadravaka* prepared according to the classical preparation methods described in *Rasa Tarangini*, and to explore its probable chemical reaction mechanisms during the preparation process for scientific validation.

MATERIALS AND METHODS

Procurement and identification of raw materials

The raw drugs, including *AshuddhaShankha* (conch shell), *Tankana* (borax), *Sphatika* (potash alum), *yavakshara* (potassium carbonate), *svarjikshara* (sodium bicarbonate), *Navasadara* (ammonium chloride), *saindhavalavana*(rock salt), *samudralavana*(sea salt), *vidalavana* (black salt), *souvarchalalavana (*Black salt), and *romakalavana*(Earthen salt), were procured from the GMP-certified NIA Pharmacy ,Jaipur and authenticated by the experts from the department of Rasashastra and Bhaishajya Kalpana NIA jaipur. All pharmaceutical processes, such as the *Shodhana* (purification) of the selected ingredients, were carried out systematically according to classical guidelines, with meticulous care, in the practical laboratory of the PG Department of Rasashastra and Bhaishajya Kalpana, National Institute of Ayurveda, Jaipur.

Preparation of *Shankhadravaka*

Preparation of *Shankhadravaka* involved intermediate steps like *Kanji* preparation, *Shodhana* of shanka, *Tankana*, *Sphatika* and *Navasadara*. The steps are detailed as below.

1) Preparation of *Kanji*[7]

*F*or preparation of *Kanji* 500g of rice was cooked in 2.4 litres of RO water. The cooked rice was then transferred to a vessel and 6 litres of boiled and cooled RO water was added, mixed well and the whole mixture was transferred to a large porcelain jar, filling it up to three-quarters of its 12-liter capacity. On the third day, the Bubbling sound was heard, indicating that the fermentation process had begun. The jar was then sealed with *kappadmitti* (a cloth wrapped in mud) and placed in a designated location with a temperature range of 25°C to 35°C for 25 days for fermentation. On the 26th day, the *Kanji* was opened, filtered into another vessel, and allowed to rest for an additional 3 to 4 days to complete the process.

2) *Shodhana* of *AshuddhaShankha*[8]

To purify the conch, 100 grams of '*AshuddhaShankhaNabhi*(the base part of the conch shell) and 1.5 litresof '*Kanji*' were used. As part of the process, the *ShankhaNabhi*was subjected to swedana using the Dolayantra in a stainlesssteel vessel for a duration of one *praharakala*(3 hrs.). Afterward, the *ShankhaNabhi* was removed from the vessel, washed with warm water, thoroughly dried, and stored in an airtight container as '*ShuddhaShankha*'.

3) *Shodhana* of *AshuddhaTankana*[9]

Tankan (Borax), in its crude form, appeared as transparent, crystalline lumps. For the purpose of purification, 100 grams of *Ashuddha* Tankan (impure borax) was initially taken. The impure Tankan was powdered and placed in an iron pan (Loha Patra) and then heated over a moderate flame. Upon heating, the Tankan began to swell, froth, and the crystalline water present in it started to evaporate. Tankan is known to contain approximately 10 molecules of water in crystalline form, which converted into vapor under the influence of heat. Throughout the process, the substance was stirred continuously to ensure even heating. Heating was continued until all the moisture had evaporated and the hissing sound ceased. After this, the Tankan became light, dry, and friable (khara), and this purified Tankan was considered suitable for use in Ayurvedic medicine and was stored in a clean glass container.

4) *Shodhana* of *AshuddhaSphatika*[10]

In the purification process, *AshuddhaSphatika* (impure potashalum) was taken as the raw drug material. The *AshuddhaSphatika* was pounded into a fine powder and placed in an iron pan, where it was heated over a moderate flame. The heating was continued until the material became completely dry and free from water molecules. During this procedure, the evaporation of water content present in the *Sphatika* was observed. As the heat was applied, the *Sphatika* gradually transformed into a semi-liquid form, indicating that the twenty-four water molecules originally present in its crystalline structure were converted into liquid form and subsequently evaporated. After the completion of the heating process, the *Sphatika* was allowed to cool naturally and was then stored in an airtight container as *ShuddhaSphatika* (purified potash alum).

5) *Shodhana* of *AshuddhaNavasadara*[11]

For the purification (*Shodhana*) of *AshuddhaNavasadara* (impure ammonium chloride), 100 grams of the crude drug was taken as the raw material. It was dissolved in 300 ml of potable water (three times its quantity) and filtered several times through a clean cotton cloth to remove insoluble impurities. During this process, blackish impurities were visibly retained on the cloth. Despite thorough filtration, some impurities remained suspended in the solution and became noticeable upon subsequent heating. The filtrate was transferred into a stainlesssteel vessel and boiled to evaporate all water content andFollowing the completion of the *Shodhana* process, the final product appeared as a fine white powder.

6) Preparation of *Shankhadravaka*[12]

Table no. 1: Ingredients Used in the Preparation of *Shankhadravaka*.

S.No.	Name of Ingredient	Latin/English Name	Quantity
1.	*ShuddhaShankha*	Conch shell	15g
2.	*ShuddhaTankana*	Borax	15g
3.	*ShuddhaSphatika*	Potash alum	15g
4.	*Yava kshara*	Potassium carbonate	15g
5.	*Svarjikshara*	Sodium bicarbonate	15g
6.	*ShuddhaNavasadara*	Ammonium chloride	15g
7.	*Saindhava lavana*	Rock salt	3g
8.	*Samudra lavana*	Sea salt	3g

9.	*Vida lavana*	Black salt	3g
10.	*Souvarchalalavana*	Black salt	3g
11.	*Romakalavana*	Earthen salt	3g

Procedure

All the ingredients were individually taken in a clean circular iron *Khalva Yantra* (mortar and pestle) and triturated thoroughly to obtain a uniform and homogenous mixture. This mixture was then carefully transferred into a 500ml Capacity *Round Bottom Flask (RBF)*, which had been previously coated externally with a clay layer (three successive applications) and dried. The RBF was then assembled onto a distillation unit, with the other end of the distillation assembly connected to a receiver.

Initially, moderate heat (350-400°C) as applied to the RBF using a stove. After approximately 45 minutes, the appearance of vapors was observed along the inner walls of the distillation unit, and after about 1 hour and 15 minutes, the first drop of the final product was collected in the receiver.

At the beginning, the distillation process was rapid, but after 2 hours from the start of heating, the distillation rate gradually slowed down. By 2 hours and 15 minutes, the distillation process had completely ceased. The stove was kept on for a total duration of 3 hours before switching it off.

ANALYTICAL STUDY

Organoleptic evaluation of *Shankhadravaka*was carried out based on its colour, odour, and taste. Physicochemical evaluation of *Shankhadravaka*samples was carried out at the Drug Testing Laboratory, National Institute of Ayurveda (NIA), Jaipur, using standard methods for determining pH specific gravity at 25 °C, total solid content, and refractive index.

OBSERVATION AND RESULTS

The *Kanji* used for the purification (*Shodhana*) of *Shankha* was prepared through a traditional fermentation process, and its pH was measured at 3.51 upon completion. During the *ShankhaShodhana*, significant frothing and effervescence were observed due to the reaction between the alkaline *Shankha Nabhi* and the acidic *Kanji* medium, necessitating the use of a larger vessel to prevent overflow. Following this process, the color of *Shankha Nabhi* changed from a dirty brown to a smooth, pure white, accompanied by a reduction in weight from 100 grams to 92 grams, indicating effective removal of impurities and partial corrosion of the outer layer.

Similarly, *TankanaShodhana* resulted in a weight reduction from 100 grams to 96 grams, attributed to the loss of inherent water molecules through vaporization. In the case of *SphatikaShodhana*, a notable decrease in weight from 100 grams to 66.5 grams was recorded, confirming the removal of moisture and volatile impurities. *NavasadaraShodhana* led to a weight reduction of 3 grams per 100 grams, with visible insoluble blackish impurities retained on the filtration cloth. It was noted that soluble impurities like sodium chloride could not be removed by this process, as they remained dissolved in the filtrate.

Table no. 2: Showing the total reduction in weight of the drug material after the *Shodhana* process.

S.no.	Drug	Quantity taken	Weight after *Shodhana*	Net loss
1.	*Shankha*	100g	92g	8g
2.	*Tankana*	100g	96g	4g
3.	*Sphatika*	100g	66.5g	33.4g
4.	*Navasadara*	100g	97g	3g

The distillation process for the preparation of *Shankhadravaka* was successfully executed using a classical distillation apparatus. Vapors appeared after approximately 45 minutes of heating, and the first distillate drop was collected at 1 hour 15 minutes. The process was completed within 3 hours, yielding 12.5 ml of *Shankhadravaka*, corresponding to an average yield of 11.90%.

Organoleptic analysis of the final distillate revealed a sharp, pungent odor, a saline taste, and a light yellowcolor, in accordance with classical Ayurvedic descriptions. The physicochemical evaluation demonstrated a pH of 9.72, indicating pronounced alkalinity. The specific gravity was recorded as 1.1215 at 25°C, while the refractive index was measured as 1.3903. The total solid content was found to be 1.3805%, collectively confirming the formulation’s alkaline, stable, and distinctive physicochemical profile.

Table no. 3: Organoleptic analysis of *Shankha* Drava.

S.NO.	Organoleptic test	Result
1.	Smell	Sharp pungent
2.	Taste	Saline
3.	Colour	Light yellow

Table no. 4: Physicochemical analysis of *Shankhadravaka*.

S.NO.	Physicochemical Test	Result
1.	Ph	9.72
2.	Specific gravity at 25 °C	1.1215
3.	Total solid content	1.3805%
4.	Refractive index	1.3903

DISCUSSION

The outcomes of the present study substantiate the classical significance of *Shodhana* (purification) procedures in Ayurvedic pharmaceutics, particularly within the context of *Rasa Shastra* formulations such as *Shankhadravaka***.** The physicochemical changes observed during the *Shodhana* processes align well with the descriptions documented in classical Ayurvedic texts, reinforcing their pharmacological rationale.

The classical process of *ShankhaShodhana* holds significant pharmaceutical and therapeutic importance in Ayurveda. Traditionally performed using acidic media such as lemon juice, *Kanji*, or buttermilk, this procedure aims to remove surface impurities and enhance the pharmaceutical quality of the raw material. The underlying principle involves an acid-base reaction between the acidic medium and calcium carbonate ($CaCO_3$), the chief constituent of *Shankha*. Upon contact, the acid reacts with surface-bound calcium carbonate, liberating carbon dioxide (CO_2) and forming soluble calcium salts. This reaction induces mild surface corrosion and partial decalcification, contributing to increased porosity, reduction in particle size, and improved bioavailability of the material. Notably, during the *Shodhana* process, a measurable reduction in the weight of *Shankha* was recorded, indicating effective removal of impurities and partial erosion of its outer layers. This transformation not only enhances the digestibility and therapeutic assimilation of the material upon internal use but also ensures its safety by eliminating adhering organic matter, microbial contaminants, and undesirable mineral residues. Thus, *ShankhaShodhana* serves as a critical preparatory step to standardize and potentiate the material for subsequent pharmaceutical processing and therapeutic applications.

In the context of *TankanaShodhan***,** *Tankana*($Na_2B_4O_7 \cdot 10H_2O$) is a crystalline compound containing ten molecules of water of crystallization, which must be removed to render it pharmaceutically suitable for therapeutic use in *Rasashastra* formulations. The classical process of *Utphullikarana* involves heating *Tankana* within a specific temperature range of 320°C to 400°C, facilitating the release of these water molecules as vapor. This dehydration occurs due to the disruption of weak hydrogen bonds and lattice forces within the crystal structure. The process transforms *Tankana* into a light, porous, and anhydrous form, enhancing its pharmaceutical utility. Heating below the prescribed range results in incomplete dehydration, while exceeding it may lead to melting and undesirable alteration of texture. Notably, a consistent reduction in weight observed during *TankanaShodhana* validated the effective removal of inherent water content, reaffirming the necessity and therapeutic importance of this classical purification step in ensuring the quality, safety, and efficacy of the final medicinal product.

A notable weight decrease during *SphatikaShodhana* reaffirmed its hygroscopic nature and underscored the importance of purification prior to its pharmaceutical application to ensure stability and efficacy.

In the process of *NavasadaraShodhana*, crude *Navasadara* is dissolved in potable water, exploiting its high solubility, while insoluble impurities such as sand, dust, and carbonaceous matter remain undissolved. These are removed by repeated filtration through a clean cotton cloth, visibly separating blackish impurities. Despite thorough filtration, certain colloidal or fine organic impurities persist in suspension, which become apparent upon subsequent heating. Boiling the filtrate serves a dual purpose: it facilitates the coagulation and volatilization of residual impurities and ensures complete evaporation of water, leading to the recrystallization of pure ammonium chloride. The final product appears as a fine, white, crystalline powder, indicating the successful elimination of physical, organic, and thermolabile impurities.

The preparation of ***Shankhadravaka*** using a classical distillation apparatus (*Tiryakapatana yantra*) successfully yielded a clear, light yellow, and transparent distillate. The yield percentage and the time required for the first appearance of vapors corresponded closely with descriptions in classical treatises and findings from contemporary pharmaceutico-analytical studies. This highlights the practical applicability and reliability of traditional equipment and techniques when employed under controlled experimental conditions.

The organoleptic and physicochemical attributes recorded for the formulation, including its sharp, ammonia-like odor and alkaline pH, are characteristic of *Shankhadravaka*. The major ingredients like shankha, tankana, yavakshara and sarjika kshara being alkaline in nature may have contributed to the alkalinity in the finished product. It was also observed that the finished product exhibited properties closely resembling that of Ammonium hydroxide which is basic in nature. Both specific gravity and Refractive index of a sample is expected to alter due to the presence of dissolved substances in the sample. In the present study *Shankhadravaka* recorded a specific gravity of 1.1215 and RI 1.3903. The pH value of 9.72**,** along with other parameters such as specific gravity and refractive index, established a distinctive chemical profile essential for the identification, quality assurance, and therapeutic applicability of the formulation.

Probable Chemical Reaction Mechanism in the Preparation and Distillation Process of *Shankhadravaka*

The successful preparation of *Shankhadravaka* involves a carefully controlled thermal environment, wherein specific thermochemical properties of the ingredients play a crucial role in facilitating the desired reactions. Ammonium chloride (NH_4Cl), a key ingredient, sublimes at approximately 338°C[13], aligning perfectly with the target heating range of 350–400°C prescribed in the classical method. The presence of calcium carbonate ($CaCO_3$) and alkali carbonates (such as sodium carbonate or potassium carbonate) creates a strongly basic and reactive medium, which promotes the displacement and liberation of ammonia (NH_3) gas from NH_4Cl through thermally induced reactions. Additionally, borax (sodium borate), known for its glassy, flux-like behavior upon gradual softening above 300°C and complete melting at around 743°C, contributes to maintaining a uniform thermal environment within the apparatus and prevents localized overheating that could hinder the distillation process.

Alum (potassium aluminumsulfate) undergoes dehydration upon heating, releasing water vapor in a controlled manner. This steam generation supports the principles of *Tiryakapatana yantra* described in Ayurvedic pharmaceutics, facilitating efficient distillation and transfer of volatile components. Common salt (NaCl), although chemically inert under these conditions, plays a supportive role by modifying the eutectic behavior of the mixture, thereby contributing to the formation of a semi-molten, homogeneous matrix which ensures smooth heat distribution and reaction progression.

Upon organoleptic evaluation, the final *Shankhadravaka* distillate exhibited properties closely resembling Ammonium Hydroxide (NH_4OH), characterized by a sharp ammonia-like odor.[14], alkaline taste, colorless.[15] and transparent appearance, and a basic pH. These features indicate that during distillation, ammonia (NH_3) may have liberated through thermal decomposition and chemical reactions within the mixture and subsequently dissolved in the distillate water to form NH_4OH as the principal active constituent. The pharmaceutical preparation involved the controlled heating of a mixture containing Calcium Carbonate ($CaCO_3$)[16], Sodium Tetraborate ($Na_2B_4O_7 \cdot xH_2O$)[17], Potash Alum ($K_2SO_4 \cdot Al_2(SO_4)_3 \cdot xH_2O$), Potassium Carbonate ($K_2CO_3$)[18], Sodium Bicarbonate ($NaHCO_3$)[19], Ammonium Chloride (NH_4Cl)[20], and Sodium Chloride (NaCl).[21] These hygroscopic constituents released water vapor upon heating within a *Tiryakapatana yantra* (distillation apparatus), facilitating the effective distillation and absorption of ammonia into the condensate. On the basis of the initial ingredients used and the nature of the final product obtained, the probable chemical reactions occurring during the preparation of *Shankhadravaka* are depicted below.

1. **Reaction between NH_4Cl and alkaline carbonates ($CaCO_3$ / K_2CO_3 / Na_2CO_3)**

Ammonium chloride reacts with $CaCO_3$

$2NH_4Cl + CaCO_3 \rightarrow 2NH_3\uparrow + CaCl_2 + CO_2\uparrow + H_2O$

With K_2CO_3:

$2NH_4Cl + \mathbf{K_2CO_3} \rightarrow 2NH_3\uparrow + 2KCl + CO_2\uparrow + H_2O$

With Na_2CO_3 (from $NaHCO_3$ decomposition)

$2NH_4Cl + Na_2CO_3 \rightarrow 2NH_3\uparrow + 2NaCl + CO_2\uparrow + H_2O$

2. **Supporting Thermal decomposition of NH_4Cl**

$NH_4Cl \rightarrow NH_3\uparrow + HCl$

3. **Neutralization of liberated HCl by $CaCO_3$**

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2\uparrow + H_2O$

4. **Decomposition of $NaHCO_3$ to Na_2CO_3** (which further reacts similarly):

$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2\uparrow + H_2O$

The key reactions responsible for ammonia liberation include Thermal Decomposition and Interaction. Due to High solubility of NH_3 in water (up to 700 volumes per 1 volume water at 0°C) and According to Brönsted-Lowry theory.[22] the liberated NH_3 passed along with water vapor into the condenser and subsequently dissolved in the aqueous phase to form Ammonium Hydroxide (NH_4OH) This is reversible, weakly basic as per modern chemistry (supported by your Kirk-Othmer ref: *LeBlanc et al., 1978*).[23] Although the proposed reactions are based on the initial ingredients and the final product obtained, it is too early to confirm their exact occurrence during the preparation process. Further research is necessary to substantiate these findings.

Thermochemical factors, including the continuous removal of liberated gases, positive entropy changes, and the high solubility of ammonia in water, collectively favored the complete conversion and stabilization of the final product. These findings not only validate the classical pharmaceutical procedures but also provide a scientifically grounded analytical profile for the standardization, quality assurance, and broader clinical application of *Shankhadravaka* in contemporary Ayurvedic practice.

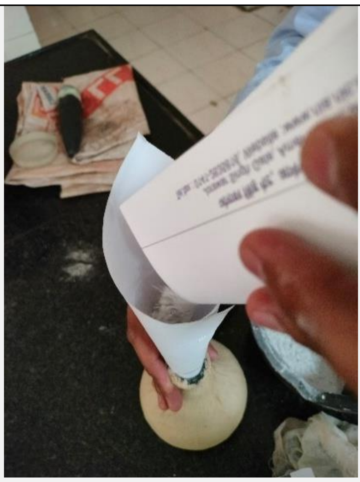
From a therapeutic perspective, the presence of *Kshariya* (alkaline) and *Lavaniya* (saline) ingredients imparts classical properties such as Ushna (hot), Tikshna (sharp), Deepana (digestive stimulant), *Pachana* (digestant), and *Shoolaghna* (pain-relieving) to the formulation. These pharmacological attributes justify the classical therapeutic indications of *Shankhadravaka*, particularly in the management of conditions like *Annadrava Shoola* (gastritis) and *Udara Shoola* (abdominal colic).[24] The findings of this study validate the classical descriptions of *Shankhadravaka* while establishing a scientifically grounded framework for its standardization, quality assurance, and contemporary clinical application.

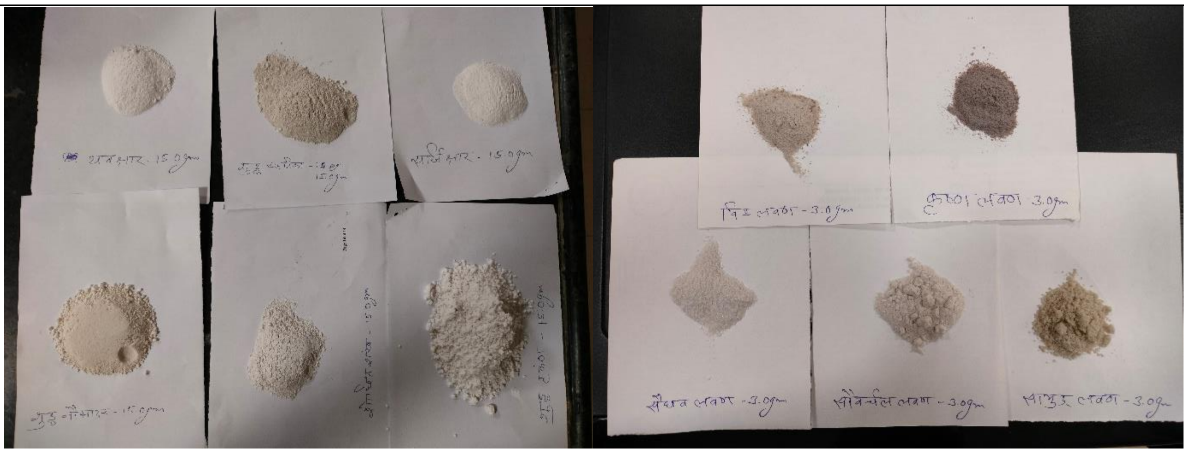
Table no. 5: Functional Roles of Other Ingredients.

Compound	**Thermal Decomposition Behavior (350–400°C)**	**Function in Reaction**
NH_4Cl	Sublimes & decomposes, releasing NH_3 and HCl around 338–350°C[25]	Primary NH_3 source
$CaCO_3$	Stable up to ~825°C, but reacts with NH_4Cl releasing NH_3, forming $CaCl_2$ and CO_2	Base; reacts with NH_4Cl
K_2CO_3 / Na_2CO_3 (from $NaHCO_3$)	React with NH_4Cl, liberating NH_3 and forming KCl/NaCl and CO_2	Alkali displacers of NH_3 from NH_4Cl
$NaHCO_3$	Decomposes to $Na_2CO_3 + CO_2 + H_2O$ at ~100°C	Forms Na_2CO_3 for further reaction
$Na_2B_4O_7{\cdot}xH_2O$ (Borax)	Dehydrates and melts; acts as flux; stabilizes temperature gradients	Acts as a flux, stabilizing the reaction temperature and pH; releases water vapor aiding distillation.
$K_2SO_4{\cdot}Al_2(SO_4)_3{\cdot}xH_2O$ (Alum)	Potash Alum decomposes around 200–400°C to give K_2SO_4, Al_2O_3 and water vapors.	carbonates/bicarbonates thus facilitate ammonia liberation via thermal decomposition and displacement reactions; releases water vapor upon dehydration,

		enhancing distillation.
NaCl	Inert but modifies melting points and phase behavior	Hygroscopic and thermally stable, releases water vapor at elevated temperatures, and modulates melting behavior, preventing localized overheating.

IMAGES

 ***AshuddhaShankha***	 **Shodhan of *Shankha* in *Kanji***
 **Filling The Round Bottom Flask**	 **Preparation Of *Shankha*Dravak**



Ingredients Used in the Preparation of *Shankha dravaka*

Shankhadravaka

CONCLUSION

The present study successfully revivedand scientifically validated the classical Ayurvedic formulation *Shankhadravaka*as described in *Rasa Tarangini*, integrating traditional pharmaceutics with modern analytical approaches. Through methodical *Shodhana* and distillation processes, a reproducible pharmaceutical protocol was established, yielding a distillate consistently exhibiting characteristic organoleptic and physicochemical properties. Analytical evaluation confirmed the presence of Ammonium Hydroxide (NH_4OH) as the principal active constituent, formed via thermal decomposition and displacement reactions of Ammonium Chloride with alkaline carbonates under controlled heat, substantiating the classical therapeutic claims of the formulation. The findings elucidate a clear, scientifically justified chemical mechanism behind *Shankhadravaka's* preparation and action, supporting its traditional indications in digestive and gastrointestinal disorders. This work not only reinforces the relevance of classical Ayurvedic processes but also provides a standardized framework for its pharmaceutical quality assurance and sets the groundwork for future pharmacological, toxicological, and clinical investigations, promoting its evidence-based integration within modern healthcare systems.

REFERENCES

1. Sharma S. *Prasadini Hindi commentary by Haridatta Shastri*, edited by Kashinatha Shastri. In: *Rasa Tarangini*. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 12, verse 35-39, p. 290-291.
2. Sharma Hariprapanna, Rasayogasagara; Vol II, 1st edition reprint, Satippana Hindi Commentary by Hariprasanna sharma, Shankhadravarasa prakarana; Yoga 14-27; Verse 107 to 203, Varanasi, Chowkhamba Krishnadas Academy series, 2004; p 418-423.
3. Das Govind, Bhaishajya Ratnavali; 1st edition; Siddhiprada Hindi Commentary by Sidhinanadana Mishra; Chapter 41; Plihayakritrogadhikara; Verse 162-188; Varanasi, Chowkhamba Surbharati Prakasha, 2007; p -760, 761.
4. Sharma S. *Prasadini Hindi commentary by Haridatta Shastri*, edited by Kashinatha Shastri. In: *Rasa Tarangini*. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 12, verse 35-39, p. 290-291.
5. Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, Simren M, Tack J, Whitehead WE, Dumitrascu DL, Fang X, Fukudo S, Kellow J, Okeke E, Quigley EMM, Schmulson M, Whorwell P, Archampong T, Adibi P, Andresen V, Benninga MA, Bonaz B, Bor S, Fernandez LB, Choi SC, Corazziari ES, Francisconi C, Hani A, Lazebnik L, Lee YY, Mulak A, Rahman MM, Santos J, Setshedi M, Syam AF, Vanner S, Wong RK, Lopez-Colombo A, Costa V, Dickman R, Kanazawa M, Keshteli AH, Khatun R, Maleki I, Poitras P, Pratap N, Stefanyuk O, Thomson S, Zeevenhooven J, Palsson OS. Worldwide Prevalence and Burden of Functional Gastrointestinal Disorders, Results of Rome Foundation Global Study. Gastroenterology, 2021 Jan; 160(1): 99-114.e3. doi: 10.1053/j.gastro.2020.04.014. Epub 2020 Apr 12. PMID: 32294476.
6. Sharma S. Prasadini Hindi commentary by Haridatta Shastri, edited by Kashinatha Shastri. In: Rasa Tarangini. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 12, verse 35-39, p. 290-291.
7. Anonymous. Ayurvedic Formulary of India, 2nd ed. Part 1. New Delhi, India: Government of India: Ministry of Health and Family Welfare, 2000; p.159.
8. Sharma S. *Prasadini Hindi commentary by Haridatta Shastri*, edited by Kashinatha Shastri. In: *Rasa Tarangini*. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 12, verse 10, p. 286.

9. Sharma S. *Prasadini Hindi commentary by Haridatta Shastri*, edited by Kashinatha Shastri. In: *Rasa Tarangini*. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 13, verse 77-78, p. 318.
10. Madhav Upadhyay. *Ayurved Prakash*. Varanasi: Chaukhambha Bharati Academy; Chapter 2, Shloka 258. Commentary: Arthavidyotini-Sushpashtarthaprakashini by Shri Gulraj Mishra.
11. Sharma S. *Prasadini Hindi commentary by Haridatta Shastri*, edited by Kashinatha Shastri. In: *Rasa Tarangini*. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 14, verse 3-4, p. 326.
12. Sharma S. *Prasadini Hindi commentary by Haridatta Shastri*, edited by Kashinatha Shastri. In: *Rasa Tarangini*. 11th ed. Varanasi: Motilal Banarasidass Publishing House, 2021; Taranga 12, verse 35-39, p. 290-291.
13. *Haynes, W.M. (ed.). CRC Handbook of Chemistry and Physics. 95th Edition. CRC Press LLC, Boca Raton: FL 2014-2015, p. 4-46.*
14. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 222, Ammonia; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Ammonia
15. *Haynes, W.M. (ed.). CRC Handbook of Chemistry and Physics. 95th Edition. CRC Press LLC, Boca Raton: FL 2014-2015, p. 4-46.*
16. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 10112, Calcium Carbonate; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Calcium-Carbonate
17. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 10219853, Sodium Borate; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Sodium-Borate
18. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 11430, Potassium Carbonate; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Potassium-Carbonate
19. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 516892,

Sodium Bicarbonate; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Sodium-Bicarbonate
20. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 25517, Ammonium Chloride; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Ammonium-Chloride
21. PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 5234, Sodium Chloride; [cited 2025 May 30]. Available from: https://pubchem.ncbi.nlm.nih.gov/compound/Sodium-Chloride
22. NCERT. Chemistry Part II: Textbook for Class XI. New Delhi: National Council of Educational Research and Training, 2006; UNIT 6, p. 190.
23. LeBlanc JR, Madhavan S, Porter RE. Ammonia. In: Grayson M, Eckroth D, editors. *Kirk-Othmer Encyclopedia of Chemical Technology*. 3rd ed. Vol. 2. New York: John Wiley & Sons, 1978; p. 470–516.
24. N. K. Parthipan and Ravindra Angadi. Pharmaceutical study of ‘Shankha draavaka’ and the hands-on impediments. J Biol Sci Opin, 2018; 6(2): 23-29. http://dx.doi.org/10.7897/2321-6328.06277
25. *Pohanish, R.P. (ed). Sittig's Handbook of Toxic and Hazardous Chemical Carcinogens 6th Edition Volume 1: A-K,Volume 2: L-Z. William Andrew, Waltham, MA, 2012; p. 174.*