

A Comprehensive Review of the Pharmacological and Physicochemical Properties of Potash Alum

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ABSTRACT

Potash alum (*Sphatika/Phitkari*), chemically known as potassium aluminum sulfate dodecahydrate ($KAl(SO_4)_2 \cdot 12H_2O$), is a traditional mineral-based therapeutic agent widely used in Ayurvedic and conventional medicine for its astringent, hemostatic, and antimicrobial properties. It has been extensively employed in the management of mucocutaneous disorders, minor bleeding, oral diseases, and dermatological conditions. The therapeutic effects of potash alum are primarily attributed to its ability to induce protein precipitation, leading to tissue contraction, reduced capillary permeability, and formation of a protective barrier, along with antimicrobial action mediated through an acidic pH and disruption of microbial cell integrity. Collectively, these mechanisms contribute to their hemostatic, wound-healing, and antiseptic effects.

Classical Ayurvedic attributes such as *Raktastambhana*, *Vrana ropana*, and *Krimighana* show strong correlation with these modern pharmacological actions, indicating significant translational relevance. Overall, potash alum is a accessible, and pharmacologically active agent with promising clinical utility; however, its integration into evidence-based practice requires further validation through well-designed studies and standardized therapeutic protocols.

KEYWORDS - Potash alum, Sphatika, Phitkari, Kankshi, Ayurved

INTRODUCTION

Potash alum, commonly referred to as Sphatika in Ayurved and Phitkari in traditional Indian systems of medicine, is a naturally occurring inorganic compound with long-standing therapeutic and industrial applications. Chemically, it is defined as potassium aluminum sulfate dodecahydrate with the molecular formula $KAl(SO_4)_2 \cdot 12H_2O$, belonging to the class of double sulfates known as alums^(1,2). It exists predominantly as a hydrated crystalline solid composed of potassium, aluminum, sulfate ions, and 12 molecules of crystallization water, which contribute to its structural stability and physicochemical characteristics. In contemporary chemistry, it is represented as $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$, reflecting its double-salt nature⁽²⁾. Potash alum is widely recognized for its acidic nature, high water solubility, and characteristic astringent taste, which are directly responsible for its biological and clinical effects.

It is a colorless, transparent, crystalline compound that has been utilized for centuries due to its remarkable physicochemical and pharmacological properties. Potash alum occurs naturally as mineral alunite and can also be synthesized through industrial processes. Owing to its unique characteristics such as high-water solubility, astringency, stability, and antimicrobial activity, it has found widespread applications in medicine, pharmaceuticals, cosmetics, water purification, food processing, textiles, leather tanning, and various industrial sectors⁽³⁾. It has played a crucial role in both ancient and modern medical practices, particularly in the Siddha, Ayurved, and Unani systems of medicine, where it is commonly referred to as Padikaram. The compound's remarkable solubility, crystalline stability, and biocompatibility make it a valuable excipient in several dosage forms such as lotions, gels, creams, sprays, and toners⁽⁴⁾. In pharmaceutical formulations, alum serves as a coagulant, preservative, and stabilizing agent while exhibiting notable pharmacological actions such as anti-obesity, antifungal, antineoplastic, antimicrobial, and hemostatic activities^(1,2,4). Its use in topical preparations has been proven to accelerate wound healing, minimize infections, and promote tissue regeneration. Moreover, its traditional applications extend to dental care, deodorants, water purification, and dermatological treatments. Despite its extensive therapeutic advantages,

excessive or unprocessed alum can cause irritation or toxicity; therefore, controlled processing and dosage standardization are essential for safety^(3,4).

सौराष्ट्राश्मनि सम्भूता मृत्सा सा तुवरी मता।

वस्त्रेषु लिप्यते यासौ मंजिष्ठारागबन्धिनी॥

कांक्षी कषायं कटुकम्लकंथा केश्या व्रणघ्नी विषनाशिनीच्।

श्वित्रापहा नेत्रहिता त्रिदोषशान्तिप्रदा पारद जारणी च ॥६३॥

(र.र.स ३ / ६३)^(१४)

- **Sanskrit:** Kankshi, Sphatika, Tuvari, Sourastri
- **English:** Alum, Potash Alum, Double sulphate of Aluminium & Potassium
- **Hindi:** Phitkari
- **Marathi:** Phataki
- **Other regional names:** Patika (Telugu), Padigaram (Tamil/Malayalam), Patike (Kannada), Phatkari (Bengali), Phatakadi (Gujarati), Sibba (Arabic)

In traditional Ayurvedic literature, Sphatika (also known as Kankshi, Tuvari, and Sourastri) is classified under mineral-origin drugs (Rasadravya) and is described as a substance with potent Raktastambhana (hemostatic), Vrana ropana (wound healing), and Krimighna (antimicrobial) properties⁽⁵⁾. Classical texts describe its origin from mineral-rich soils, particularly in regions such as Saurashtra, followed by purification processes before therapeutic application. These traditional attributes have facilitated their widespread use in managing bleeding disorders, skin conditions, oral diseases, and infections over the centuries.

Table 1 :- Physical Properties of Kankshi

Sr. No.	Property	Description
1	Colour	White when pure; may appear grey, yellow, red, or reddish-brown due to impurities
2	Habit	Small crystals are rare; usually occurs in massive, granular to dense forms
3	Crystallization	Hexagonal system; ditrigonal dipyramidal form
4	Specific Gravity	2.6 – 2.9
5	Hardness	3.5 – 4 (Mohs scale)
6	Luster & Optical Properties	Luster: Vitreous to dull; Streak: White; Diaphaneity: Transparent to translucent; Cleavage: Basal
7	Solubility	Soluble in water; insoluble in acetone
8	Density	1.725 gm/cm ³
9	Boiling Point	Decomposes at ~200 °C
10	Melting Point	92 – 95 °C

Structurally, potash alum crystallizes in an octahedral geometry in its hydrated form, with water molecules coordinated around metal ions, although variations in environmental conditions may alter its crystal symmetry. Upon heating, it undergoes stepwise dehydration, releasing water molecules and eventually forming anhydrous residues composed of alumina and potassium sulfate. Such transformations are not only relevant from a pharmaceutical standpoint but also influence the therapeutic efficacy and formulation of traditional preparations, such as Sphatika Bhasma⁽⁶⁾.

Given this background, a systematic evaluation of the available clinical evidence is warranted to critically assess the therapeutic potential, safety profile, and translational relevance of potash alum in modern medicine. This review aims to bridge the gap between traditional knowledge and modern scientific validation by systematically analyzing the existing literature on the clinical efficacy and safety of Sphatika.

MATERIALS AND METHODS

The present review was conducted using information collected from classical Ayurvedic texts, standard Rasashastra literature, pharmacopoeias, modern scientific textbooks, and published research articles. The classical references on Sphatika (Potash Alum) were obtained from the following sources: -Rasatarangini , Ayurveda Sara Sangraha , Bhaishajya Ratnavali , Rasa Ratna Samuccaya , The Ayurvedic Pharmacopoeia of India (API) .

Modern information regarding the physicochemical characteristics, pharmacological activities, safety profile, and therapeutic applications of potash alum was collected from- PubMed, Scopus, Web of Science, Google Scholar, articles etc.

OBSERVATIONS

Potash alum (Sphatika/Phitkari), chemically potassium aluminum sulfate dodecahydrate ($KAl(SO_4)_2 \cdot 12H_2O$), was consistently identified in the reviewed literature as a crystalline, water-soluble inorganic compound possessing significant astringent and antimicrobial properties^(8,9). It typically occurs as colorless to white, transparent, or translucent octahedral crystals with a characteristic astringent taste and absence of odor. The aqueous solution of alum is acidic, which contributes to its biological activity, particularly in protein precipitation and microbial inhibition. Upon heating, alum undergoes dehydration, losing its water of crystallization and forming a porous, amorphous substance commonly referred to as “burnt alum,” which exhibits enhanced adsorptive and styptic properties. These physicochemical characteristics are central to its therapeutic applications in both traditional and modern medical systems⁽¹⁰⁾.

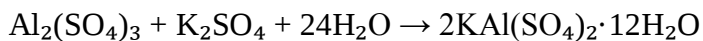
Table 2 :- Classical Ayurvedic Properties of Kankshi

Parameter	Rasa Ratna Samuchaya / Rasa Jala Nidhi	Rasa Tarangini	Rasamritam
Rasa (Taste)	Kashaya	Katu, Amla	Madhura, Kashaya, Ishat Amla
Virya (Potency)	Ushna	Ushna	Ushna
Guna (Qualities)	Kantya, Keshya, Vranaghni,	Vishadoshahanti, Keshya, Visarpagna, Kanduhara,	Vranaropani, Switrapaha, Grahani, Rudhirasravarodhaka, Mukharogahara,

	Vishanashini, Shvitrapaha, Netrahita, Tridoshahara	Switapaha, Vranaropana, Netrya, Vishamajwaranashini, Rati-manda-sankochakarini	Switranashaka
Karma (Actions)	Used in Parada Jarana; Tridosha balancing	Grahi, Lekhana, Snigdha, Rudhirastrava-rodhini, Mukharogahara, Dantadardyakara	Haemostatic, wound healing, anti- leucoderma, GI stabilizing
Special Indications	Skin diseases, wound care, detoxification	Visarpa, Kandu, Jwara, Mukharoga	Grahani, bleeding disorders, oral diseases

Artificial Preparation (Modern Method)

The artificial preparation of potash alum involves a controlled chemical reaction between aluminum sulfate and potassium sulfate. Industrially, aluminum sulfate is first prepared by treating bauxite ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$) with sulfuric acid. This was followed by the addition of potassium sulfate solution, leading to the crystallization of potash alum upon cooling. The reaction can be represented as follows:



The resulting crystals were purified through recrystallization to obtain high-grade alum suitable for pharmaceutical and industrial use. This method ensures a standardized composition and higher purity, which are essential for reproducibility in clinical applications ⁽¹²⁾.

Shodhana (Purification Process in Ayurved)

In Ayurvedic pharmaceuticals, Shodhana (purification) of Sphatika is an essential step to enhance its therapeutic efficacy and remove physical and chemical impurities from it. The commonly described method involves dissolving crude alum in water, followed by filtration and recrystallization, yielding purified transparent crystals. In some traditional practices, heating (to form Sphatika bhasma or burnt alum) is performed to modify its properties, particularly to enhance its Raktastambhana (hemostatic) and Stambhana (astringent) effects ⁽¹³⁾.

Mechanism of Action ^(1,2,4,5)

The therapeutic efficacy of potash alum can be explained by multiple mechanisms.

- **Protein precipitation:** Alum causes coagulation of surface proteins, forming a protective layer → reduces bleeding and exudation
- **Astringent effect:** Tissue contraction leads to decreased capillary permeability and fluid loss
- **Antimicrobial activity:** Acidic pH and ionic interactions disrupt microbial cell membranes and enzyme systems
- **Moisture reduction:** Limits bacterial growth (basis for deodorant use)
- **Wound healing:** Combines antimicrobial + tissue contraction + reduced inflammation

These mechanisms are non-specific but clinically effective, particularly for minor conditions.

DISCUSSION

Potash alum (*Sphatika/Phitkari*) represents a unique intersection between traditional therapeutic relevance and modern pharmacological potential. However, despite its widespread empirical use, the level of clinical evidence remains limited and heterogeneous, necessitating a cautious interpretation.

Clinical Uses in Modern Medicine ^(1,8,9,12)**1. Wound Care and Hemostasis**

स्फटिकः कषायो रुक्षः शीतलो रक्तपित्तजित्।

ब्रणशोथविषार्शसि मुखदन्तामयान् जयेत्॥ (Rastarangini)

Alum is widely used as a topical styptic agent to control minor bleeding (e.g., cuts and shaving injuries). The protein coagulation mechanism rapidly seals the capillaries.

2. Oral Conditions

- Recurrent aphthous ulcers
- Gingivitis
- Dental plaque control

Provides symptomatic relief through astringent + antimicrobial action

3. Dermatological Conditions

कषायो रुक्षः शीतश्च स्फटिको रक्तपित्तजित्।

ब्रणदोषहरो हृद्यः कृमिघ्नो मुखरोगजित्॥ (Bhavprakash)

- Acne
- Minor infections

- Hyperhidrosis (excess sweating)

Acts by reducing sebum, tightening pores, and inhibiting bacteria

4. ENT Uses

स्फटिकः कषायः शीतो लेखनो रोपणः स्मृतः।

रक्तस्तम्भकरः श्रेष्ठो मुखरोगविनाशनः॥ (Ayurved sara sangraha)

- Gargles for sore throat
- Tonsillitis (traditional use)

5. Gynecological Uses

- Vaginal tightening
- Leucorrhea

Clinical evidence here is weak and largely anecdotal

Ayurvedic Perspective (Amayik Prayog)

In Ayurved, *Sphatika* is described with properties such as:

- Kashaya rasa (astringent taste)
- Sheeta veerya (cool potency)
- Stambhana (checking secretion/bleeding)

Table 3: Amayik Prayog

Disease (Vyadhi)	Ayurvedic Indication	Form Used	Probable Modern Correlation
Mukha roga	Oral ulcers, stomatitis	Powder / gargle	Aphthous ulcers
Vrana	Wounds	Local application	Wound healing
Raktapitta	Bleeding disorders	Topical	Hemostatic use
Kandu	Itching	External application	Dermatitis
Swedadhikya	Excess sweating	External	Hyperhidrosis
Yoniroga	Vaginal discharge	Local wash	Leucorrhea

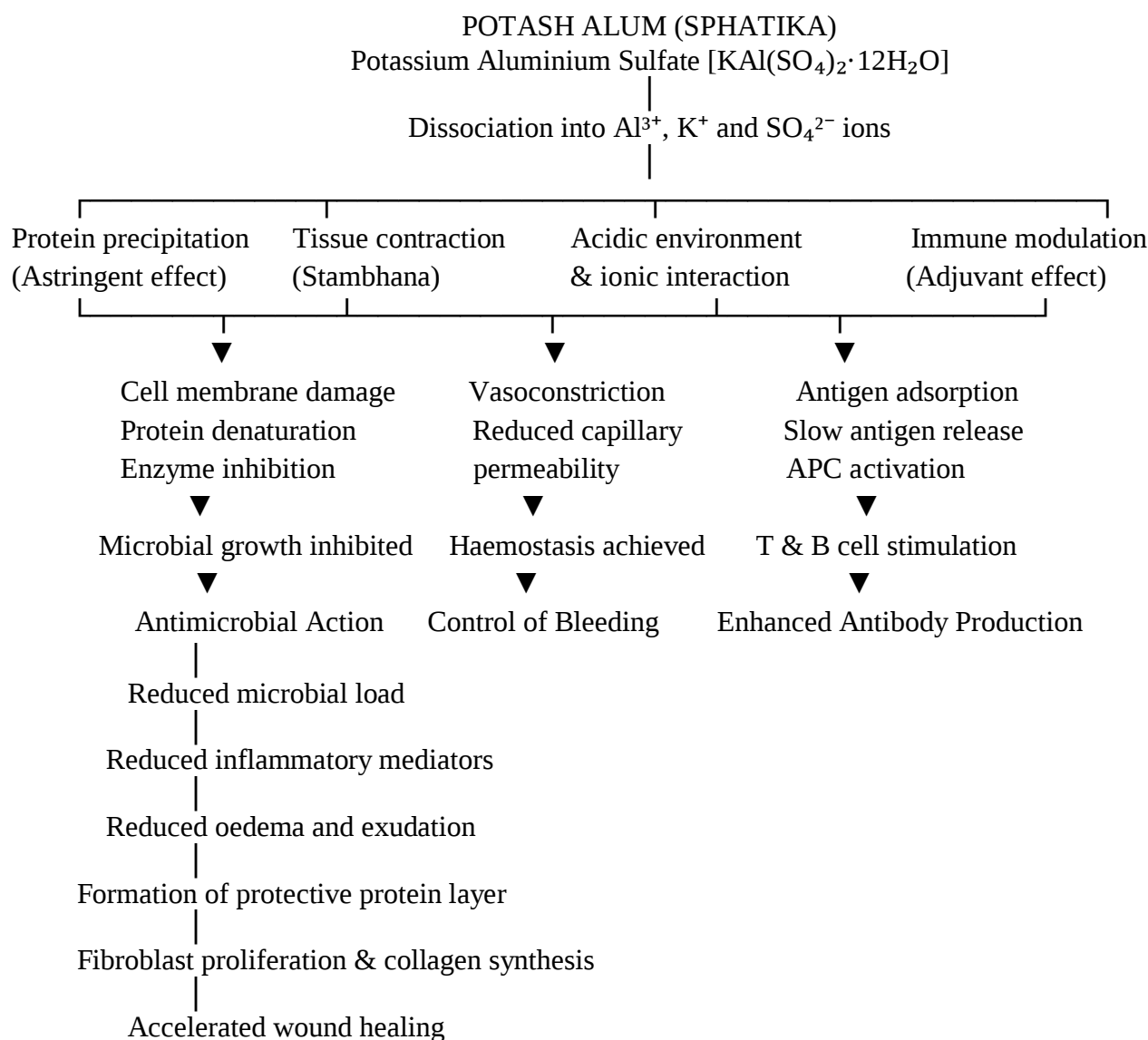
Overall Assessment

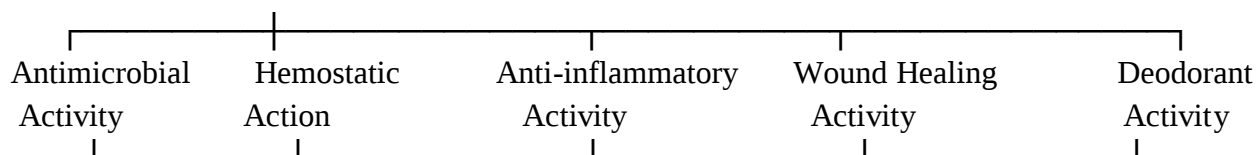
This review highlights Potash Alum (*Sphatika*) as a versatile mineral drug with significant therapeutic and industrial importance. Evidence from classical Ayurvedic literature and modern scientific research demonstrates that its traditional uses are supported by diverse pharmacological activities, including antimicrobial, anti-inflammatory, hemostatic, wound-healing, antioxidant, antifungal, and astringent effects.

Its favorable physicochemical properties, such as crystalline structure, high water solubility, thermal stability, and protein-precipitating ability, contribute to its efficacy in pharmaceutical formulations and various industrial applications.

The integration of traditional knowledge with contemporary evidence suggests that potash alum has considerable potential as a safe and effective therapeutic agent when used appropriately. However, further well-designed experimental studies, clinical trials, toxicological evaluations, and standardization of formulations are necessary to establish its long-term safety, optimize therapeutic applications, and strengthen the scientific evidence supporting its use.

❖ Comprehensive Mechanism of Action (MOA) of Potash Alum (Sphatika)





THERAPEUTIC APPLICATIONS

- Wounds and ulcers
- Minor bleeding & epistaxis
- Haemorrhoids
- Water purification
- Vaccine adjuvant
- Oral diseases (stomatitis, gingivitis)
- Skin infections
- Excessive sweating & body odour
- Pharmaceutical preparations
- Cosmetic formulations

CONCLUSION

Potash Alum (Sphatika) is a valuable mineral drug with a long history of use in both traditional and modern medicine. Classical Ayurvedic texts describe its therapeutic importance in the management of wounds, bleeding disorders, oral diseases, skin conditions, and inflammatory disorders, while contemporary scientific studies have validated many of these traditional claims. Its diverse pharmacological activities, including antimicrobial, anti-inflammatory, hemostatic, wound-healing, antioxidant, and astringent effects, are closely associated with its unique physicochemical properties such as high-water solubility, crystalline structure, stability, and protein-precipitating ability.

The extensive applications of potash alum in pharmaceuticals, cosmetics, water purification, food processing, and other industrial sectors further emphasize its multifunctional significance. Although topical use is generally considered safe, appropriate dosage and duration of use should be ensured to minimize potential risks associated with excessive aluminum exposure.

In conclusion, the integration of classical Ayurvedic knowledge with modern scientific evidence highlights the therapeutic potential of potash alum as an effective and versatile mineral drug. Further experimental studies, clinical trials, and standardization of formulations are warranted to strengthen the evidence base and expand its applications in evidence-based healthcare.

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