

PHARMACOLOGICAL & PHYSIOCHEMICAL PROPERTIES OF POTASH ALUM: A COMPREHENSIVE REVIEW

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Abstract:

Sphatika is considered as a very good and useful drug in Ayurveda which is known as alum in English. Its synonyms are Tawas and Potash alum. It is a nontoxic and is commonly used in water treatment plants to clarify drinking water. Alum is useful in cosmetics, perfumes, corporal adornment, and body care. Phitkari (Alum) is a very renowned and useful drug in Unani and Ayurveda system in medicine. It is a drug of mineral origin found in the form of crystal resembling to salt. It is very ancient medicine. It is used as antiseptic, antipyretic, antispasmodic, and heostyptic. It is also used in many compound formulations in various dosage forms.



KEYWORDS: Alum, Phitkari, pharmacological activity, medicine, Ayurveda,

Introduction: Alum is a mineral origin drug named due to its astringent property and action. It is soluble in water and dissolves when heated. It is soluble ten times in normal water and three times in warm water. Potash alum ($\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$) is a naturally occurring inorganic chemical with important uses in both traditional and modern medicine. Alum is utilized to control bleeding, leucorrhoea, Menorrhagia, Diarrhea, vomiting, treat eye diseases, Stomatitis, and for wound cleansing. Additionally, it has a variety of commercial applications, such as tanning and baking cosmetics. Because of its significance and advantageous medical reasons, alum is evaluated in this research for its pharmacological and physiochemical characteristics¹⁵. The astringent impact of protein precipitation at the cell's outer layer causes aluminum potassium sulfate (Alum) to reduce capillary permeability. Alum's ability to block sweat pores is very helpful for its antifungal action. By preventing sweat from escaping, it lowers the moisture content of the site of action, which inhibits the growth of fungal infections. Additionally, alum's antifungal activity also inhibits the growth and development of fungal infections, so it reduces fungal infections in two ways. Wintertime skin cracks are avoided since the alum powder dissolves in water. Because oily skin is more likely to result in pimples and acne, it has the power to dry the skin, which reduces the problem¹¹.

Drug Information:

- **English:** Alum
- **Marathi:** Turti
- **Hindi/Urdu:** Phitkari
- **Arabic:** Yamani

General Description:

- **Common Name:** Potassium alum.
- **Chemical Formula:** $KAl(SO_4)_2 \cdot 12H_2O$
- **Chemical Name:** Potassium aluminium sulphate
- **FIG. :** POWDER OF POTASH ALUM
- **Molar Mass:** 258.192 g/mol.
- **Appearance:** white crystal or powder form
- **Habitat:** Egypt, Italy, England, Germany, and India all have it.

Primarily found in Punjab, Bihar, and Assam, India. In Silajit, alum earths in Nepal, or alum shales in Punjab, Rajputana, Bihar, and Cutch states, alum is primarily found with iron peroxide. With an annual capacity of 36,000 tonnes of ferric alum and 16,000 million tons of non-ferric alum, Ken-Sun Enterprises, located in Mumbai, India, is a significant producer of common alum, which is made as aluminum sulphate.

➤ **Distribution:** In Nepal, Rajputana, Punjab, Cutch States, and Bihar, it is primarily found as shells in shilajeet, or alum earth. After processing, it transforms into salt and an active form.

➤ Phytochemical Screening:

• Evaluation Tests for Alum:

• **Solubility:** Put 1 millilitre of distilled water and 0.5 grams of solid material in a test tube. Stir carefully with a glass rod. Take note of the observation.

• **pH:** Before the pH was measured, the pH meter was calibrated. One gram of prepared alum was dissolved in 100 millilitres of distilled water in a beaker. The pH was measured using a pH meter.

• Identification Test:

• **Flame Test (Test for Potassium):** Potassium was present because a tiny amount of alum was put on a spatula and lit directly in the flame, producing a lavender-coloured flame.

• **Flame Test (Sodium Test):** A small quantity of alum was placed on a spatula and ignited directly in the flame, producing a yellow-colored flame, indicating the presence of sodium.

• **Test for Ammonium:** When 10 mg of ammonium alum was heated with sodium hydroxide solution, ammonia gas was released, which was identified by its characteristic smell and its ability to turn moist red litmus paper blue, indicating the presence of ammonium.

• **Test for Aluminum:** When 20 mg of potash alum was dissolved in 2 ml of water and treated with 0.5 ml of 2M hydrochloric acid and 0.5 ml of thioacetamide reagent, no precipitate formed. Upon the dropwise addition of 2M sodium hydroxide, a gelatinous white precipitate appeared, which dissolved with further addition of sodium hydroxide. The subsequent addition of ammonium chloride solution resulted in the reformation of a gelatinous white precipitate, confirming the presence of aluminum.

• **Sulfate Test:** When 50 mg of soda alum was dissolved in 5 ml of water and 1 ml of dilute hydrochloric acid, followed by the addition of 1 ml of barium chloride solution, a white precipitate was formed, indicating the presence of Sulphate.

• **Analytical Thin Layer Chromatography (TLC):** To find the right solvent solution to create the chromatogram, analytical TLC was used. To generate the chromatogram, different solvent systems were applied to the pre-coated TLC plates (Merck, silica gel 60 F254 plate, 0.25 mm). The most effective solvent system among all of them was chloroform: methanol: distilled water (50:40:10), which was employed for both TLC analysis and TLC bioautography analysis. Rf values were calculated after the TLC plates were examined under visible light to determine which compounds had been separated ⁷.

• **Chemical Composition:**

• The chemical compositions of potash alum are:

• Sulfate range: 38% to 51.06%

• Aluminum: between 9.9% and 28.16%

• Potassium: up to 14.6% of some samples include it.

• Trace quantity of iron: 0.016% to 0.52%

• **Traditional uses of Potash Alum:**

• As a gargle, alum is used to treat mouth ulcers.

• Halitosis and stomatitis can be effectively treated by applying alum with honey or vinegar, or by gargling with alum in honey water.

• Alum is used to treat keratitis and conjunctivitis; it is also used as a tooth powder to ease toothaches.

• Asthma attacks can be avoided by using ten grains of powdered alum over the tongue.

• Powdered alum is applied topically to treat infected wounds and bleeding from cuts or abrasions; it also acts as a stomach and liver tonic and eliminates nausea and vomiting when taken orally.

CHEMICAL FORMULA: $KAl(SO_4)_2 \cdot 12H_2O$

CHEMICAL NAME: POTASSIUM ALUMINUM SULFATE

MOLECULAR MASS: 258.192g/mol.

APPEARANCE: WHITE CRYSTAL OF POWDER FROM

Alum's antifungal activity also inhibit the growth and development od fungal infection so it reduces fungal infection into ways .Wintertime skin cracks are avoided since the alum powder dissolved in water. Because oily skin is more likely to result in pimples and acne , it has the powder to dry the skin which reduce the problem.

1. Classification of Sphatika based on chemical compounds:

1.Potassium Alum : Chemically it is known as $KAl(SO_4)_2$. Its synonyms are Tawas and Potash alum. This variety is easily available in the general stores. It is used as substance after shave and in leather tanning management of textile as fireproof.



2.Soda alum : It is used as acidulate and also used in baking powder. Its chemical formula is $NaAl(SO_4)_2 \cdot 12H_2O$.



3.Ammonium Alum: This is mostly used to dyeing the cloths, in the production of porcelain in purification of water, in deodorants. Its chemical formula is $NH_4Al(SO_4)_2 \cdot 12H_2O$



4.Chrome Alum: This only variety of alum is in deep violet colour. This is used to make crystals of lavender and purple crystal. Its chemical formula is $KCr(SO_4)_2 \cdot 12H_2O$.



5.Selenate Alums This alum is strong oxidizing agent, used as antiseptic because is containing selenium. Its chemical formula is $\text{NH}_4\text{Al}(\text{SeO}_4)_2 \cdot 12\text{H}_2\text{O}$ ■



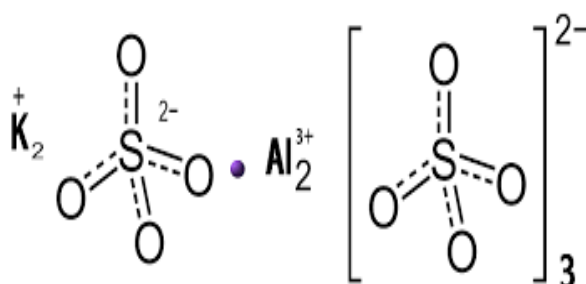
Classification Based On Ayurvedic Literature's:

Phataki Sphatika	Yellowish, heavy, unctuous looking; also known as pitika. It is found as a mineral.
Phullika Sphatika	Snow-white, slightly sour and astringent, unctuous looking. It is also known as phullatuvari (potash alum).

The composition of alum are potassium (8.24%) aluminum(5.69%), hydrogen(5.10%) , sulfur(13.52%) , and oxygen(67.45%).

The density of the alum is $1.757\text{g}/\text{cm}^3$ and bulk density is $1.84\text{gm}/\text{cc}$. Alum occurs naturally in the form of alum shales which are thinly bedded , easily fissile rocks containing varying quantities of small , sometimes microscopic , and well disseminated crystals and grains of iron pyrites. It is an important part of many product created by the pharmaceutical , cosmetic , and food industries because of its astringency property. It is also used in the manufacture of paper , dye , glue , and explosive.

Chemical structure of alum:



➤ **Pharmacological Activites :**

1) **Anti-Hemorrhagic activity:**

In the trial of 45 patients with tonsillectomy, Aluminum potassium sulphate (>99% pure) used as hemostatic agent and gauze pack on the other side in the tonsillar fossae reduced the operation time significantly (28.6%) functioning blood loss by 19.7% and number of ties used reduced by 33.3% in comparison with control . This confirms the anti-hemorrhagic activity with anti -platelet activity mentioned in the classical siddha texts.

2) **Anti -microbial activity:**

Alum exhibits significant , broad- spectrum antimicrobial activity against bacteria (gram -positive/negative) and fungi by damaging cell walls and reducing pH . It effectively inhibits S. aureus , E. coli, and Candida albicans particularly at 20% Concentration , with application in treating mouth ulcer , infection.

3) **Spermicidal activity:**

Spermicidal activity varies with different concentration of potash alum. In case of 15%, the death time is found to be 51.9 sec, in case of 10% it is found to be 87.2 sec and in case of 5% it was 122 sec(11)

4) **Treating aphthous stomatitis:**

Alum is an effective, natural, and inexpensive treatment for aphthous stomatitis (canker sores) to its astringent and antiseptic properties, which help shrink tissues, dry out sores, and speed healing. It works by reducing inflammation in the oral mucosa. It is applied directly as a powder or as a 1%-4% solution.

5) **As adjuvant in vaccines:**

Recent studies reveals that in addition of alum as an adjuvant, the efficacy of the Hepatitis E, influenza, RSV(Respiratory syncytial virus)- Pre F vaccines and several other has been improved by several times(14),(15).

➤ **PROPERTIES OF ALUM**

Most alum tend to have an astringent and acid taste. They are colourless and often found in form of a white crystalline powder. Alum is highly soluble in water. Generally crystalline in the regular octahedral from aqueous solution. The alum crystals can be liquified if heat is applied. Alum generally exist in the from of a white and transparent crystalline form. Its boiling point is around 200 degrees Celsius.

PHYSICAL PROPERTIES	CHEMICAL PROPERTIES
Appearance: colorless, transparent , Crystals or White powder	Acidity: Aqueous solutions are acidic due to the hydrolysis of aluminum ions.
Solubility: Highly soluble in water and insoluble in alcohol.	Dehydration: When heated above 92.5 ⁰ c it melts. Further heating drives off water of crystallization, creating frothy , swollen mask known as burnt alum.
Melting point: 92.5 ⁰ c	Reaction with bases: Reacts with alkalis to from a white precipitate of aluminum hydroxide .
Density: Approximately 1.725g/cm ³	Double salt: It is double sulfate , combing aluminum sulfate and a monovalent metal sulfate.

Pharmacokinetics:

Absorption: Topical alum doesn't absorb much through healthy skin because its molecules are large and don't pass through easily. But when it is used in places like the mouth or open cut, a small amount that gets absorbed depends on the concentration on the alum, the permeability, or whether the alum is healthy for the skin. Although the body doesn't absorb a lot, using too much or for too long might cause irritation or a buildup in the tissue

Distribution: While applying alum on the skin this alum enters the body, and is separated into two parts, which are aluminum and sulfate ions. These are spread into the body with the help of body fluids. Aluminum ions can attach to blood protein like transferrin and may accumulate in the bones, liver, and kidney.

Metabolism: Alum does not break into the body. Instead, when alum enters the body, it is separated into two parts: aluminum and sulfate ions. These ions move around with the body fluids outside the cells. Enzyme does not break the alum.

Excretion: After the process of metabolism, the alum is mainly cleared from the body through kidney by urination.

THERAPEUTIC USES:

Oral ulcer:

Alum products are available in powder and liquid form which also treat the sores by conditions like aphthous stomatitis and injuries. This alum creates a mucosal membrane as a protective layer on the surface of sores, which helps to ease pain and irritation. Alum can tighten skin tissues, help speed up the healing process, and also stop the excess flow of blood from leaking outside. If the alum is in proper use, then the alum can provide relief from the symptoms and promote quicker healing. Some side effects of alum can cause the dryness of skin and also cause irritation which can damage the tissues.

Homeostatic agent:

Alum is a practical solution for stopping minor bleeding. It works by making blood vessels tighten and causing blood to clot, which helps in the control of bleeding. This makes it very useful for dealing with situations like cut, nosebleed, and wound after getting a tooth pulled. Alum also forms a barrier over the wound, which helps prevent additional bleeding and keeps germs away. It's easy to use since it comes in the form of powder, or styptic pencil, making it handy for first aid and minor surgeries. However, using it too much can lead to dry or irritated skin, so it is not good for long term use.

Water Purification: Alum is a chemical compound. Alum is used for cleaning water by removing tiny particles and bacteria. When alum is added to water the small particles of bacteria or dirt stick together through flocculation and create large clumps that settle at the bottom. These processes make filtering the water much easier. It reduces cloudiness, improves clarity, and removes harmful substances like organic matter, and some microorganisms. This alum-treated water goes to the city water purification system, and industrial water goes to the city water treatment plant, home water purification system, and industrial water processing to make sure that water is safe and clean to drink.

Wound Healing: Alum is commonly found in creams and ointments for healing wounds because it tightens the skin, controls bleeding, and fights bacteria. It helps blood vessels narrow and causes proteins to thicken, which helps stop the bleeding. Alum has properties to kill germs and bacteria and also keep away from wounds and reduce the risk of infections. Alum can speed up the process of wound healing and it is also used for minor cuts, scrapes, ulcers, and caring for the wounds after the surgery.

Dermatological Applications: Alum is used for many such as deodorants and antiperspirants and also for wound healing it helps to reduce sweating and body odor because it tightens the sweat glands. It kills the bacteria that cause bad odor from the body and alum keeps away these bacteria from your skin. Many people have used

alum-based products because they are a natural choice compared to chemical products. These deodorants are safer it does not irritate the skin. using them regularly can keep you feeling fresh and dry. If you skin is sensitive, just be sure to check for any irritation or dryness.

ADVERCE EFFECTS:

Aluminum Toxicity:

Alum contains aluminum, and excessive aluminum accumulation may lead to toxicity.

•Possible effects:

- Damage to brain cells.
- Memory problems and cognitive decline.
- Possible link with neurological diseases such as Alzheimer's disease.
- Nervous system disturbances.

•Kidney problem:

- The kidneys remove excess aluminum from the body. If intake is high.
- Kidney stress or damage
- Higher risk for people with existing kidney disease.
- Accumulation of aluminum in blood.

•Digestive Irritation:

Alum is swallowed which sometimes happens in traditional remedies:

- Nausea
- Vomiting
- Stomach irritation
- Abdominal pain
- Large amount can even cause poisoning.

•Skin irritation:

When apply repeatedly to skin

- Dryness and irritation
- Skin peeling
- Burning sensation

Allergic reactions in sensitive individuals

This can happen when using alum as daily deodorant or aftershave.

•Respiratory Irritation

- Inhaling irritation
- Coughing
- Breathing discomfort

Conclusion:

Alum (Sphatika) is an important mineral drug described in Ayurvedic texts with diverse therapeutic properties. Classical literature explains its **Kashaya rasa, Stambhana, Shodhana, and Ropana karma**, which makes it useful in the management of various conditions such as **wound healing, bleeding disorders, oral diseases, skin disorders, and infections**. Traditionally, it has been widely used in formulations for **Pratisarana (local application), Kavala-Gandusha, and external wound management**.

Modern pharmacological studies also support many of these traditional claims, demonstrating **antimicrobial, astringent, hemostatic, and wound-healing activities**. Because of these properties, alum continues to remain a valuable and easily available therapeutic agent in both **Ayurvedic practice and modern medicine**.

However, proper **purification, dosage, and method of administration** are essential to ensure safety and effectiveness. Further **scientific validation and clinical research** can help to explore its full therapeutic potential and integrate its traditional knowledge with contemporary healthcare practices.

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