

Padikaram (Alum)- A Unique drug and its Utilization in Siddha Medicine: A Pharmacological review

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Abstract

Siddha system is one of the ancient medicinal practices, laid down by various Siddhars. This Siddha system has various unique properties which can't be compensated by any of the currently available treatment methods. This superlative nature of this system is due to the extra-ordinary diagnostic methods, treatment regimes, various methods of medications as well as in preventive care. Padikaram (Seenakaram, Alum), which is an unique mineral found in various parts of India as well as in other countries has been used routinely by common people with adequate knowledge like arresting bleeding etc., This article aims to give an deep insight of scientific knowledge of Padikaram, its pharmacological activities, therapeutic potential in Siddha texts and in current modern medicines, which has been mentioned in Traditional texts. It is used as an antipyretic, antiseptic, antispasmodic, hemostyptic in several medicinal systems. It is also used in many compound formulations in various dosage forms. In this paper, Alum is reviewed for its various pharmacological and physiochemical properties due to its importance and beneficent medical indications.

Keywords

Alum, mineral, Siddha, Medicine, Pharmacology, Literature.

Introduction

India's soil is enriched with several minerals with its ores. Besides its country economic wealth for commercial use, it has high medicinal values in curing ailments. On knowing this, the Siddhar's with their immense knowledge, found the separation of these minerals from its ore, their astonishing purification methods and formulated medicinal preparation procedures with their indications of various diseases. Minerals are the inorganic compounds that occur in nature in pure or impure state. One among them is Alum. Alum is extracted from its ore of Alumen, which is a Mineral salt. Alum is extracted from the soil ore present in Nepal, Bihar, Punjab and around Kathiawar⁽²⁾. In Siddha literatures, Alum is used to arrest bleeding, leucorrhoea and menorrhagia, diarrhoea, vomiting, washing eyes in case of eye diseases, stomatitis and in washing wounds. It is used as an antipyretic, antiseptic, antispasmodic, haemostatic in several medicinal systems. It is also used in many compound formulations in various dosage forms. It also has various commercial uses like tanning, baking cosmetics etc. In this paper, Alum is reviewed for its pharmacological and physiochemical properties due to its importance and beneficent medical indications.

Vernacular Names

Tamil: Padikaram, Shinacarum

English: Alum, Sulphate of alumina and potash or of aluminum and ammonium, Ammonious Sulphate.

Persia: Shab-i-Yemeni, Zake Bilor, Zake sagefed.

Arab: Shabb-zaje-abyaz

Hindi: Phitikhari, phithkari

Gujarathi: Phatkari

Telugu: Pattikaramu

General Properties

According to Siddha Literature, Aluminium and its oxides are found almost everywhere in form of clay combined with metal irons, ammonium etc as a compound called Alumina from which the metal is isolated resembling Silver. It is white with bluish tinge and available in lumps and it is

sour and astringent in taste. It contains water and so boils when heated. It is a double sulphate of aluminium and potassium. It has long been produced artificially from different ores. It is brittle, inodorous and crystalizes as transparent containing acid which is sweetish astringent taste. It forms the principle constituent cocoined with the oxides or iron of Silajet⁽²⁾.

Types of Alum and it's Uses

1. Potassium alum

a) Physical and chemical properties

- Chemical formula- $KAL(SO_4)_2 \cdot 12 H_2O$
- Molecular weight- 474.39gm
- Color - colorless, white.
- Luster - vitreous
- Specific gravity- 1.757
- Crystal system- Isometric
- Hardness – 2 on mohs` scale or 2 gypsum
- Type – Isotropic
- Density-1.757 g/cm³ or 1.753 g /cm³
- Cell parameter = 12.157(3)Å
- Streak-white
- Electron density – bulk density=1. 84 gm/cc
- Fermion index-0.0013552227
- Photoelectric; PE alum (k) =1.89 barns/electron
- $V=PE ALUM(K) \times electron=3.47$ barns/electron

b) COMPOSITION

Potassium	8.24% k	9.93% k ₂ o
Aluminium	5.69% Al	10.75% Al ₂ o ₃
Hydrogen	5.10% H	45.57% H ₂ O
Sulfur	13.52% S	33.75% So ₃
Oxygen	67.45% O	
	100%	100% TOTAL oxide

Table1: Composition of Alum

c) Morphology

If Crystal Octahedral is precipitated from pure water solution, Cubic from alkaline solutions commonly massive with columnar or granules, structure, stalactitic, merely coating.

d) Uses

It is aluminium potassium sulfate also known as “tawas” or potash alum. It mainly used as astringent and antiseptic. It is also used in water purification, tanning, dying, fire proof textile and baking powder as E number E522. It also has cosmetic effects as deodorant, to arrest bleeding in minor cut and abrasion, epistaxis, and hemorrhoids and to relieve pain from stings and bites. Potassium alum was also used topically to remove pimples and acne and to cauterize aphthous ulcers. It has been used to stop bleeding in cases of hemorrhagic cystitis in children and help to cure for hyperhidrosis. It is used in dentistry especially in original retraction cords, because of its astringent and hemostatic properties. Potassium and ammonium alum are the active ingredient in some antiperspirants⁽⁴⁾ and deodorants, acting by inhibiting the growth of bacteria responsible for body odour.

Potassium alum was the major adjuvant used to increase the efficacy of vaccines but it has almost completely replaced by aluminium hydroxide and aluminium phosphate in commercial vaccines. Alum may be used in depilatory waxes used for the removal of body hair or applied to freshly waxed skin and serves as a demulcent. Potassium alum may be the acidic ingredients of baking powder to provide a second leavening phase at high temperature. Preservatives, brad whites fire retardant to under cloth, wood and paper materials less flammables. Leather tanning is done in order to remove moisture from the hide and prevent rotting. It is used as mordant to form a permanent bond between dye and natural textile fibers. It is a base of lake pigment. It is used to remote antiquity purification of turbid liquid. Between 30 and 40 ppm of alum for household wastewater often more in industrial waste water, is added to the water so that the negativity changed colloidal particles dump together into flocs. Like other similar salts, it works by neutralizing the electrical double layer surrounding very fine suspended particles, allowing them to join into flocs. This same principle is exploited when using alum to increase the viscosity of ceramic glaze more readily adherent and slows its rate of sedimentation. Alum solution has the property of dissolving steels bits that have become lodged in machined castings. Alum and animal glue were dissolved in water, forming a liquid known as dousa and used as an unclucout for paper sizing. Potassium alum was formerly used as a hardness of photographic emulsions, usually as part of fixer.

It usually dissociates in an alkaline solution, combining with OH of water to form insoluble aluminium hydroxide. In the presence of excess acid, aluminium hydroxide cannot be formed, thus causing failure of aluminium haematoxylin dye lake to form, due to lack of OH ions. Hence acid solution of alum haematoxylin becomes red. During staining alum haematoxylin –stained section are usually passed on to a neutral or alkaline solution in moles to neutralize the acid and form an insoluble blue aluminium haematin complex this procedure is known as blueing.

e) Toxicology

Weak irritant to skin.

f) Radioactivity

- GR api (gamma ray American petroleum institute units) = 124.32
- Concentration of alum(k) per GR api unit = 0.80%
- Estimated radioactivity from alum (K) – barely detertable.

g) Adverse effects while using alum

Common adverse effect - Stinging of skin

Infrequent adverse effect

- Dry skin
- Skin irritant
- Stinging of skin

Rare adverse effect

- Burn
- Feeling faint
- Feeling of throat tightness
- Fluid accumulation around the eye
- Hives
- Hypersensitivity drug reaction
- Life threatening allergic reaction
- Puffy face from water retention
- Shallow skin ulcer
- Skin ulcer
- Throat swelling
- Trouble breathing

- Itching

2. Sodium alum

- **Physical and chemical properties:**

- Chemical formula: $\text{Na Al (SO}_4)_2 \cdot 12(\text{H}_2\text{O})$
- Molecular weight : 458.28gm
- Cell dimension; a =12.214
- X ray diffraction; by intensity (I/O)=4.314(3)₂,2.962(O.35),3.526(0.14)
- Color - colorless
- Density-1.67
- Habit-Fibrous- crystal made up of fibers
- Hardness – 3 –calite
- Luminescence – non florescent
- Luster-vitreous (glassy)
- Magnetism- non magnetic
- Electron density- bulk density=1.75gm/cc
- Specific gravity of alum (Na)=1.67 gm /cc
- Photoelectric PE alum (Na)=1.22 barns/electron
- Radioactivity-GRapi=0 (gamma ray American petroleum institute unit)
- Alum(Na) is Non-radioactive.

Morphology

Like its potassium analog, sodium Aluminium sulfate crystallizes are dodecahydrate in the classical cubical alum structure. Sodium alum is very soluble in water and extremely difficult to purify.

Uses

Sodium aluminium sulphate is produced by combing sodium sulfate and aluminium sulfate. An estimated 3000 ton/year are produced worldwide. Baking powder-sodium alum act as an acid which is activated at baking temperature. Mordant for the preparation of hematoxylin solutions for staining cell nuclei.

Two other rare mineral forms are

Mendozite

Tamarugite

3. *Ammonium alum*

a) **Physical and chemical properties**

- Chemical formula: $(\text{NH}_4)\text{Al}(\text{SO}_4)_2$
- Molar mass: 237.15g/mole (anhydrous), 453.33g/mole(dodecahydrate)
- Appearance –white crystal
- Density -2.45g/cm³(anhydrous)
- Melting point -93.5°C
- Boiling point-120°C
- Solubility in water -15g/100ml
- Crystal structures-hexagonal (anhydrous), Cubic(dodecahydrate)
- Coordination geometry: octahedral (Al^{3+})
- Flash boin-non flammable

b) **Uses**

Ammonium alum is made from aluminium hydroxide ,sulfuric acid and ammonium sulfate.It form a solid solution with potassium alum.Pyrolysis cause alumina such alumina is used in the production of grinding powder and as precursor of synthetic gums.Used in water purification in vegetable glue,in porcelain cement in deodorants and in tanning,dying and in fire proofing textiles.The PH of solution resulting from the topical application of ammonium alum with perspiration is typically in slightly acid range from 3 to 5.It is common ingredients in animal repellent sprays.

c) ***Adverse effects while using alum:***

It causes Alzheimer's disease

d) ***Potential health effect***

This material hydrolyses in water to form sulfuric acid which is responsible for the irritating effects.

Inhalation

- Irritating respiratory tract
- Symptoms: coughing, Shortness of breath

Ingestion

Irritation, nausea, vomiting, and diarrhoea .thus have been two cases of fatal human poisoning from ingestion of 30g of alum.

Skin contact

Irritation, redness, itching, pain

Eye contact

Irritation redness, pain

e) Hazards identification

- Harmful if swallowed or inhaled causes irritation to skin ,eyes and respiratory tract
- Health rating –slight
- Flammable rating-none
- Reactivity rating-none
- Contact rating-slight
- Lab protective equip-goggles, lab coat
- Storage color code-orange

f) First aid measures

- Inhalation
- Move to fresh air.
- If not breathing, give artificial respiration.

g) Chrome Alum

It is also known as Chromium Alum. It has the formula $KCr(SO_4)_2 \cdot 12 H_2O$. It is an deep violet compound used in tanning and can be added in other alum for coloring.

h) Selenate Alum

Like chrome Alum it is replaced by Selenate $[SeO_4^{2-}]$. The selenate compound is an strong oxidizing agents, so it can be used as an Antiseptics.

i) Aluminum Sulfate

It is also called as “Papermaker`s Alum” still rendered use in Medical purposes.

j) Alumen exsiccatum (Dried Alum)

In Siddha Text`s it denoted in the name of “Padigapori”⁽²⁾. It is used as an mild escharotics⁽⁵⁾.

Purification Method in Siddha Literatures

Crystallization: Dissolve alum in water and the saturated salt solution is filtered by using a filter. The solution is poured in a china clay container and covered by a cloth to prevent dust. then it is exposed to sunlight and allowed to evaporated, the purified crystals are obtained^{(1),(6)(8)}.

Pharmacological actions in Siddha Literature

Internal uses

- Alum, Catechu (kaichukatti) and Cinnamomun are taken in equal quantity and powdered . 975 gms of this powder is given with honey with diarrhoea proceeding cholera.
- Administration of 65 mg of padikaram relieves vomiting.
- Administration of 195 mg padikaram with 14ml of rose water twice a day relieves asthma and cough.
- 260 mg of padikaram is mixed with juice of Adathoda vasica and administered thrice a day for leucorrhoea and menorrhagia.
- To extract Aloe Vera juice, padikaram powder is used⁽¹⁾ .

It is also an ingredient in various compound preparations like padikara parpam, padikara cheendoram, Padikalinga thuvar etc..

Reported Pharmacological activities

- 1) Anti- Hemorrhagic activity:
In the trial of 45 patients with tonsillectomy, Aluminium 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⁽⁷⁾. This confirms the anti-hemorrhagic activity with anti-platelet activity⁽⁹⁾ mentioned in the Classical Siddha texts⁽¹⁾.
- 2) Anti-microbial activity:
Different concentrations of Alum were examined against *Proteus mirabilis*, that causes urinary tract infections. The results with loss of motility in semi-solid media and minimum inhibitory concentrations were found to prove the adequate anti-microbial activity⁽¹⁰⁾.

- 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:
Recurrent aphthous stomatitis, which is caused by recurrent usage of several medications like antibiotics, analgesics etc. This ulcer can be cured by topical application of allum⁽¹³⁾.
- 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 others has been improved by several times^{(14),(15)}.
- 6) Management of post-operative wounds:
Alum shows a better prognosis in post-operative wound care⁽¹⁶⁾.

It also has other activities like antiseptic, albuminuria, antispasmodic, anti-emetic, anti- cancer, aphonia, arrest excessive menstrual bleeding, in asthma, astringent, atonic diarrhea, atony in bed sores, Gum bleedings, bleeding piles, chronic conjunctivities,etc⁽¹²⁾

External uses⁽¹⁾⁽³⁾

1. 130 mg of padikaram is dissolved in 28 ml of water and used for washing eyes in case of eye diseases.
2. 35 gm of padikaram is dissolved in 28ml of water and used for mouth wash in stomatitis and in washing wounds.
3. To arrest bleeding, gauze pieces is dipped into padikaram dissolved water and used as a bandage.
4. Padikara patru: Powdered peel of Kadukai(*Terminalia chebula*) is grounded with lime water and placed in a iron vessel. Powdered padikaram and kariyapolam is added and heated. It is applied over the eye and shedding of tears.

It is also an ingredient in various compound preparations like Padikara neer, vellai mathirai etc..

Conclusion

To conclude, besides several activities Padikaram can be promoted for its usefulness in emergencies to arrest various types of bleeding in Siddha system owing reported pharmacological activity. Further efforts are needed to evaluate these activities for better efficacy which will promote the physicians to handle bleeding emergencies which will lay a milestone for the development of Siddha system.

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