



KIBRIT (SULPHUR): MEDICINAL IMPORTANCE IN PERSPECTIVE OF UNANI MEDICINE AND PHARMACOLOGICAL STUDIES

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ABSTRACT

Kibrit (Sulphur) is the non-metal mineral drug of Unani Medicine used for the treatment of skin disorders. It is also known as *Gandhak*. Sulphur, due to its high reactivity, readily participates in a multitude of chemical reactions, leading to the creation of compounds with a vast array of properties. Throughout history, the reactions involving Sulphur and the resulting compounds have fascinated and inspired people. Sulphur has long been linked with volcanoes, flames, and pungent odours, evoking a sense of intrigue and awe. It has anti-inflammatory, blood purifier, laxative, antiseptic, germicidal and expectorant action. It is used to treat arthritis, skin disorders, constipation, piles, cough due to above-mentioned actions. This drug has been used for a long for treating skin disorders in the Unani system of medicine. Its temperament is hot and dry.

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Keywords: Gandhak, germicidal, Kibrit, Unani medicine.

Introduction:

Unani System of Medicine (USM) is the most ancient healing heritage of the world, serving the ailing society with indigenous medicines of herbal, mineral and metallic origin. The medicines used in Unani for various diseases are time-tested concerning their efficacy and safety. Sulphur was known in ancient times. A Sulphur ointment used in ancient Egypt is evident from Ebers Papyrus. It was used for fumigation in pre-classical Greece. Java, Indonesia, Chile, Japan,

Mexico, Sicily, Europe, Asia¹. *Gandhak* or Sulphur is an element obtained from mineral source. It is one of the important elements which are necessary for all forms of life because it is also widely used in metabolic processes. The human body contains approximately 140g of Sulphur, mainly in the form of proteins. Although it is not much essential like other minerals because its deficiency doesn't cause any visible symptoms². Sulphur molecules operate as fuels and respiratory components in metabolic reactions.

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The vitamins, biotin and thiamine, the latter of which is called after the Greek word for Sulphur, both include Sulphur in organic form. The protein keratin, which is present in the outer skin, hair, and feathers, is predominantly supported by disulfide bonds, which also contribute to the element's strong odor when burned. Apart from its necessity for metabolism process, it has been also used as a potent medicine in USM for various kinds of skin manifestations of different bacterial origin. Gandhak can be used internally or topically in different forms. Gandhak has fungicidal, bactericidal, anti-parasitic effect and mainly used in various skin diseases like dermatitis, psoriasis, eczema, internally-arthritis and chronic cough. Gandhak is used as a broad spectrum medicine for curing the skin diseases of the body parts irrespective of origin of microbes¹.

They are effective within smallest dose of 60 mg to maximum dose of 250 mg, having properties like tasteless, easily absorbed and assimilated². The discovery of sulphonamide (organo-sulphur compounds) as an antibacterial drug by a German scientist, Gerhard Domgk, marks an important milestone in the development of medicinal chemistry³. According to Unani physician, *Gandhak* is formed after mixing of light and dry vapors from soil when naturally heated up then it becomes hot, lubricant, lightweight, in this way Sulphur produced and due to its hot nature it catches fire suddenly when heat is provided. In European country it is mainly found in compound form along with other matters, its compounds known as sulphide e.g. lead sulphide, zinc sulphide, iron sulphide, copper sulphide, calcium sulphide etc. From these compounds Sulphur can be separated only

Mutarādifāt (vernacular names)

Arabic:	Kibrīt ^{4,5,6} ,
Bengali:	Gandrak, Gandhak ⁷
English:	Sulphur ^{6,8} , Sublimed Sulphur, brimstone,
Gujrati:	Gandhak ⁷
Hindi:	Gandak ⁷ , Gandhak ⁶
Kashmiri:	Gandhak ⁷

Kannad:	Gandhak ⁷
Malayalam:	Gendkam ⁷
Marathi:	Gandhak ⁷
Panjabi:	Gandhak, <i>Kibrīt</i> Anwalasar, Gogird ⁷
Persian:	Gogird ^{5,6}
Sanskrit:	Gandhaka ⁷ , Gandh Pashan ⁷
Sinhalese:	Gandhak ⁷
Tamil:	Gandkam ⁷
Telugu:	Gandhakam ⁷
Ayurvedic:	Gandhaka ⁷

Identification, description and collection:

Sulphur is a non-metal element which is commonly known as Gandhak. It is an abundant, multivalent non-metal element, in its native form it is bright yellow crystalline solid. In nature, it can be found as the pure element and as sulfide and sulfate minerals. At room temperature, sulphur is a soft; bright-yellow solid with only a faint odor, similar to that of matches, the strong smell of Sulphur usually refers to the odour of hydrogen sulfide or organ Sulphur compounds. It occurs in the nature in the form of pure Sulphur, sulphides and sulphates⁹. In India it is of 2 types: One is called "*Gandhak Anwalāsar*" and other one is "*Gandhak Muthiya*". *Gandhak Amalāsar* looks greenish and shining, *Gandhak Muthiya* is available in the form of *Batti/Sahyyaf* about 2-3 inch long and one inch in diameter. This is also called "role Sulphur". Pure Sulphur is tasteless, odourless. It can't dissolve in alcohol and water but it often melts in ghee and oil when put on fire. Pure sulphur gives nothing if burnt. According to colour it classified in 5 types 1. Red Sulphur, 2. Yellow Sulphur, 3. Greenish white Sulphur 4. Bluish Sulphur, 5. Blackish sulphur. Some says that bright red, clear and heavy one is good quality and some considered yellow which is odourable and clear is of good quality. *Arastu* (Aristotle) said red Sulphur which is mention in its type has not been seen but others said its relationship with Sulphur is famous. According to Unani physicians Sulphur is found in various forms, first one is in powdered form which is formed when Sulphur's vapors received coldness then it became cold and fine crystals which is made into powder form; this type is known as

flower of Sulphur (*Gandhak ka Phūl*). Its powder is mild coarse, beautiful, greenish yellow, tasteless without odour. It burns with a blue flame and produces sulphuric acid, and converts totally into vapors form. Second is found in suppository form about 2-3 inch long and one inch in diameter. This is also called “role Sulphur”. 3rd one is available in the form of crystals which is known as *Āmlasār Gandhak* (annulus of Sulphur). Sublimated Sulphur can precipitate by slaked lime, acids of salts and water. This Sulphur is known as precipitation Sulphur, milk sulphur and milk of Sulphur. Precipitated Sulphur is mainly used in skin disease. Sulphur oil on dissolve Sulphur with yolk and made tablet form put tablets into fire proof bottle and extract oil after put the fire proof bottle over the coal.⁶

Taba'i Khusūsiyāt

(morphological characteristics)

- **Rang** (Colour): Before purification its colour is bright yellow, on heating it becomes Reddish brown and after purification, its colour becomes dark yellow.

- **Bu** (odour): Sharp and unpleasant⁹
- **Qiwām** (Consistency): Hard, easy to break
- **Maza** (taste): Before purification its taste is bitter and after purification it becomes tasteless⁹.

Tahlīl (Dissolution) and reaction to heat: It is not dissolved in alcohol and water but dissolved in Ghee, turpentine oil and other oils. On heating at 239 °F it melts like water and gives dull greyish colour. As the temperature increases it becomes grimy. On heating at 430-480 °F, thick and mucilaginous Sulphur is obtained which is not able to pour due to its thick consistency but when it is put in water then it becomes soft like wax but can't maintain this structure and after some time it returns to original form. On heating at 480°F. It becomes thin and at 750°F it boils and changes into red vapours. Sulphur gives fire with blue flame after heating. Sublimation sulphur can precipitate by slaked lime, Acids of salts and water⁶.



Fig: Showing various forms of Gandhak (Sulphur)

Mizaj (temperament): Its temperament is hot and dry in the 3rd degree but according to Ibn Sina, Hot and dry in the 4th degree^{6,8}.

Afal (action): Sulphur has been used as medicament since antiquity for its activities like, *Dāfi'-i-Jarab* (scabidical), *Dāfi'-i-Huwām*

(insecticidal), *Qātil-i-Jarāthīm* (germicidal), *Dāfi'-i-Qūbā* (fungicidal), *Mushil* (purgative), *Musaffi-i-Khūn* (blood purifier), *Mukhrij-i-Balgham* (expectorant), *Mujaffif* (siccative), *Dāfi'-i-Quruh* (wound healer), *Dāfi'-i-Ufūnat* (antiseptic), *Muhallil-i-Awaram* (anti-inflammatory), *Jādhīb-i-Rutūbat* (absorbent), *Musakhkhin* (calorific),

Mulattif (demulcent), *Mudirr-i-Hayd* (emmenagogue), *Musqit-i-Janin* (abortifacient), *Muqawwi-i-Bah* (aphrodisiac), *Kasir-i-Riyāh* (carminative), *Jāli* (detergent), *Mushil-i-Safra'* (cholagogue), *Mudir* (diuretics), *Mulayyin* (laxatives), *Mushil* (purgative) in large dose, *Mu'arriq* (diaphoretic), *Dāfi'-i-Humma* (antipyretics) properties^{6,8,4,5}.

Iste'mālāt (uses): It is used to treat various diseases like *Jarab* (scabies), *Kalaf* (melasma), *Nazla* (catarrh), *Zukām* (cold), *Ribu* (asthma), *Su'āl-i-Martūb* (productive cough), *Yaraqān* (jaundice), *Ihtibas-i-Hayd* (amenorrhea), *Sara'* (epilepsy), *Shaqīqa* (migraine), *Waja' al-Mafāsīl* (arthralgia), *Irq al-Nasa* (sciatica), *Sakta* (stroke), *Du'f-i-Bah* (sexual weakness), *Ātashak* (syphilis), *Suzak* (gonorrhea), *Juzam* (leprosy), *Amrād-i-Tihāl* (splenic diseases), *Fālij* (paralysis), *Tashannuj* (convulsion), *Sil wa Diq* (tuberculosis), *Bawāsīr* (piles)^{6,8}.

Tarkīb-i-Iste'mal (mode of administration):

Head and brain diseases

1. According to Unani physicians Jālīnūs (Galen). He saw a man having melancholic jaundice for 5 years. When he used *Gandhak* with *Badam Talkh*, his health condition was improved⁶.

Skin diseases and cosmetic uses

1. White inferior to yellow variety is preferred for external application. Red and black sublime Sulphur is also used externally as a deodorant and disinfectant fumigant⁴
2. Topical applications of Sulphur as ointments or creams might provides benefits for various skin conditions such as acne, eczema or psoriasis.¹
3. It reduces to reduce wet pruritus by killing bacteria present on the skin which causes itching⁶.
4. When applied to the wounds, it leads to profuse itching and kills microorganisms⁶.

5. Mostly Sulphur is said to be effective in scabies and used in the form of compound formulation *Marham-i-Gandhak*.⁶
6. In the case of Acne vulgaris Sulphur ointment is applied on the face, and it absorbs easily without any stain on the face⁶.
7. Taking a bath in natural springs having Sulphur is useful in skin disease⁶.
8. The fine powder of Sulphur dissolved in Ghee is used as a face pack to cure itching, melasma, chloasma, boil, and carbuncle⁶.

Diseases of the Ear, Nose, Throat

In the case of epidemic diphtheria Sulphur is said to be beneficial when used as dusting powder⁶.

Lung diseases

1. In a healthy person, Sulphur provides moisture to the mucous membrane of the trachea⁶.
2. Sulphur is excreted out through urine in the form of sulphates and through lungs, milk & skin in the form of sulphuric hydrogen, that's why its smell comes in breathing⁶.

Gastrointestinal Diseases

2. It can't dissolve in the mouth so there is no effect in the stomach but after reaching to the intestines some parts of the Sulphur change into sulphide and hydrogen sulphide which causes abrasion to the intestines and further causes 1-2 loose motion by increasing peristaltic movement⁶
3. In the case of piles and anal fissures the use of Sulphur orally as a tablet form is effective because of its purgative and analgesic effect⁶.
4. In case of mild constipation *Qurs-e-Gogard* 2 tablets are used at bed time⁶.
5. Water from natural springs in which Sulphur is already present is used in liver dysfunction⁶

6. In case of prolapsed rectum the fumigation of Sulphur is used for health improvement⁶.

Joint Disorders

1. Water from natural springs in which Sulphur is already present is used in arthritis, by taking a bath in this water⁶.
2. In the case of arthritis and sciatica application of *Marham-i-Gogard* over the joints is useful in reducing the pain⁶.
7. To reduce the thickness of viscous and sticky sputum that appears in chronic cough Sulphur is used in the form of a tablet⁶.
8. For fungal infection which occurs at the time of menopausal stage of women, it is used for analgesic purposes and reduces itching.⁶
9. It reduces the factors that produce pus in the stomach and intestines and provides strength to the mucous membranes.⁶
10. In case of infectious diseases Sulphur is used as fumigating agent to detoxify the room⁶.
11. The mixing of *Gandhak* with *Gumakkiya* and curd is useful in, boil, carbuncle and wet itching.
12. The use of Sulphur by mixing with honey, vinegar, *Anacylus pyrethrum* D.C., is beneficial for leprosy and melancholic diseases⁶.
13. The use of Sulphur with vinegar is beneficial for Melasma and Chloasma.⁶
14. Soaked cotton in the Sulphur oil is applied to the affected teeth but excessive use of this oil causes weakness in teeth⁶.
15. Sulphur oil helps to reduce pharyngeal and laryngeal infections⁶.
16. Soaked cotton in the Sulphur oil is applied over the scorpion bite, it acts as an antidote⁶.

17. The use of a few drops of Sulphur oil with water helps decrease the size of the spleen⁶.
18. A few drops of Sulphur oil with water are taken to induce appetite.⁶
19. Clove, Cinnamon bark is soaked in distilled water of Sulphur and then dried to make powder, which is used to increase libido⁶.
20. A fine powder prepared with 750 mg of Sulphur with 75 mg of Terminalia is used with lubricant Brinjal oil seed after 4 hours of light diet; it is beneficial to reduce paralysis, tuberculosis, chronic cough and piles.

Miqdar Khurak (dose): ½-1 gm^{5,6}.

Madarrat (adverse effects): Sulphur is harmful to the stomach and brain.^{5,6} Excessive use can cause nerve palsy, indigestion, constipation and also decreases RBC production. Excessive use of *Ma'jun-i-Gogard* and *Ma'jun-i-Sana* causes indigestion and inflammatory bowel diseases so it always is used in the therapeutic dose and time duration which is mentioned in classic books that are 1-1.5 g⁶.

Muslih (correctives) and Tadbir-i-Advia (Detoxification):

It is detoxified by a specific method, one part of *Gandhak Amalsar* and two parts of Roghan (Ghee) are taken in a ladle and kept on low fire. When *Gandhak* is melted, four parts of the milk are added. This process is repeated at least three times changing the fresh Ghee and Milk each time to obtain *Gandhak Mudabbar*^{1,5,6}.

The metal is melted in equal quantities of Ghee (clarified butter) in a stainless steel pot and cooked on mild fire. Another stainless steel pot is filled up to 2/3 of its capacity with cow's milk. Melted Sulphur is poured into the second pot through a clean cloth. Sulphur gets solidified in milk. It is removed from milk, washed with warm water and dried. The process should be repeated three times⁴.

Badal (substitute): *Hartāl* (Orpiment)⁴

Ḍimād-i-Jarb, Dimad-i-Niqris, Dimad-i-Ātashak, Roghan-i-Gandhak, Habb-i-Kibrīt, Marham-i-Kibrīt, Safūf-i-Māmīrān.

Murakkabat (compound formulation): *Marham Ushaq, Habb-i-Quba, Dawa-i-Siyāh Mushil,*

Table 01: Compound formulations having Gandhak as one of the important ingredients mentioned with mode of administration and uses.

S. No.	Compound formulation	Mode of Administration	Uses
1.	Marham-i-Ushaq	Locally	It is useful in Peritonsillar abscess (Quincy), Benign hypertrophy, and is used as a pain killer ^{9,11}
2.	Habb-i-Qūba	Locally with lemon juice	Ringworms ^{4,9,11}
3.	Habb-i-Kibrīt	1-4 pieces Orally	As a carminative use in Indigestion, piles ¹¹
4.	Habb-i-Siyāh	Locally	Conjunctivitis ^{4,9}
5.	Dawā-i-Siyāh Mushil	Orally, locally	Syphilis ¹¹ , Leprosy, Syphilis, Arthritis ⁹
6.	Dawā-i-Kibrīt	3-5g Orally	Loss of libido, paralysis, tremors, facial palsy ⁹
7.	Ḍimād-i-Jarb	Locally	Pruritus, Rashes, Scabies ^{9,11}
8.	Ḍimād-i-Ushaq	Locally	Inflammation ⁹
9.	Ḍimād Kibrīt	Locally	Splenomegaly ^{9,11}
10.	Roghan-i-Gandhak	Locally	Arthritis especially heel bone pain ⁶
11.	Marham-i-Ushaq	Locally	Splenomegaly, Inflammation, scrofula ⁶
12.	Safūf-i-Gandhak	Locally	Skin diseases ⁶
13.	Gandhak Ṭilā	Locally	Skin diseases like eczema, dermatitis ¹¹ .
14.	Marham-i-Khārish Jadīd	As a local (paste)	Itchy rashes, healing ¹¹
15.	Kushta Tila Marwaridi	30mg orally with <i>Dawa al-Misk Mu'tadil</i>	Tuberculosis ^{9,11}
16.	Kushta Fawlad	Orally 60 mg with <i>Jawarish Jalinus</i>	Anaemia, generalized weakness, loss of libido ¹¹ .
17.	Kuhsta Mirgang	Orally 60 mg with <i>Jawarish Jalinus</i>	Liver and stomach ailments because of restorative effects Haemorrhagic disorder ¹¹
18.	Ma'jun Murawwah al-Arwah	5g orally	Brain tonic, cardiac tonic, hepatic tonic ⁹ .

Sulphur toxicity

Sulphur generally has low toxicity for humans, but excessive ingestion can lead to diarrhea or a burning sensation in the gastrointestinal tract.

Inhaling sulfur dust can irritate the airways and cause coughing. It may also cause skin and eye irritation, and in some cases, blurred vision¹⁴.

Pharmacological Studies:**Antimicrobial Activity**

Sulphur has an antimicrobial activity. It exhibits strong anti-bacterial activity mostly against *E.coli* (gram-negative bacteria) and *staphylococcus aureus* rod shaped monoclinic, Sulphur nanoparticles inhibited growth of *staphylococcus aureus* while as the micro-

sized particles of sulphur has shown no anti-microbial activity Sulphur has been recognized for its antimicrobial properties for centuries, often used in traditional medicine and as a preservative. Its antimicrobial activity primarily arises from its ability to interfere with the metabolic processes of bacteria, fungi, and other microorganisms. Here's a detailed look into the antimicrobial activity of Sulphur (Table 2):

Table 2: Mechanism of action of Sulphur on microorganisms.

S. No.		
A.	Mechanism of Action:	
1.	Disruption of Microbial Metabolism	By inhibiting the activity of certain enzymes and can prevent the synthesis of essential cellular components like proteins, nucleic acids, and cell walls.
2.	Production of Reactive Sulfur Species (RSS)	It can damage cellular components, leading to the death of the microorganism.
3.	Disruption of Membrane Integrity	Some sulfur compounds can integrate into microbial cell membranes, disrupting their integrity and leading to cell lysis.
B.	Types of Sulfur Compounds with Antimicrobial Activity	
1.	Elemental Sulphur	Often used in topical preparations, elemental sulfur can treat various skin infections, including those caused by fungi and bacteria
2.	Sulfur Dioxide (SO ₂)	Organic sulfur compounds containing the -SH group, such as allicin from garlic, exhibit potent antimicrobial effects, particularly against bacteria.
3.	Thiols and Thioesters	Organic sulfur compounds containing the -SH group, such as allicin from garlic, exhibit potent antimicrobial effects, particularly against bacteria.
4.	Spectrum of Activity:	
1.	Antibacterial Activity	Sulphur and its compounds are effective against a range of bacteria, including Gram-positive and Gram-negative species. They are particularly active against acne-causing bacteria like <i>Propionibacterium acnes</i> .

2.	Antifungal Activity	Sulphur has been shown to be effective against several types of fungi, including those causing superficial and systemic infections.
3.	Antiparasitic Activity	Sulphur has been used to treat parasitic infections like scabies and other mite-related skin conditions.
D.	Spectrum of Activity	
1.	Antifungal Activity	Sulphur has been shown to be effective against several types of fungi, including those causing superficial and systemic infections.
2.	Antifungal Activity	Sulphur is effective against several types of fungi, including those causing superficial and systemic infections.
3.	Antiparasitic Activity	Sulfur has been used to treat parasitic infections like scabies and other mite-related skin conditions
E.	Challenges and Considerations	
1.	Resistance Development	While Sulphur is generally effective, there is always a concern about the development of microbial resistance, particularly with prolonged use.
2.	Toxicity and Irritation	High concentrations of Sulphur, especially in topical applications, can cause skin irritation or toxicity. Proper dosing and formulation are essential to minimize side effects
3.	Environmental Impact	The use of Sulphur compounds, particularly in agriculture, can have environmental repercussions, such as soil acidification or harm to non-target organisms ¹⁵

Conclusion:

Kibrit, or sulphur, has a long medicinal history, especially for treating skin disorders. Historically, sulphur has been used topically to manage conditions like acne, eczema, and psoriasis due to its antimicrobial and keratolytic properties, which help reduce inflammation and promote dead skin cell shedding. Ancient physicians such as Dioscorides and Galen also recommended sulphur for respiratory issues, using it both through inhalation and orally for its expectorant, anti-inflammatory, and antiseptic effects. Inhalation of sulphur fumes was believed

to clear respiratory passages and alleviate symptoms of colds and cough. In earlier times, sulphur was burned for fumigation to disinfect homes and prevent disease spread by releasing sulphur dioxide, a potent disinfectant gas. Today, while sulphur's internal and fumigation uses have largely been replaced by more modern treatments, it remains significant in dermatology. Sulphur is still utilized in creams and ointments, emphasizing its enduring role in skin care.

Consent and ethical approval:

It is not applicable.

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