



## Sulphur (*Kanthakam*) in Siddha Medicine: its toxicological, Medicinal and Modern aspects.

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### ABSTRACT

*Kanthakam* so called Sulphur(S), more effective and unavoidable *Padanam* in Siddha Medicine, deferent types of *Kanthakam* uses for deferent purposes because of its peculiarity of general properties. Naturally Sulphur possesses fire element, and hot potency thus many literatures mentioned as brimstone or burning stone. This review aims to explore the importance of Sulphur in the aspect of medicine and non-medicine, there for the siddha Literatures, text books, Paper articles, Traditional information, Publications, Journals and relevant web sides were followed and studied. The review revealed that, unpurified or irregular manifestation of medicine with Prolonged or over usage causes the toxic effect on human. The toxic effects are yellowish discoloration of the eye and skin, Pallor of face, blackish teeth, Bad breath (Halitosis), Dyspepsia, abdominal pain with distension and pimples etc. Even though Sulphur possesses the toxic effect the sulphur used to prepare the medicines with structured purification processes. The skin diseases, Chronic venereal disorders, Infectious diseases, respiratory diseases, eye diseases, Asities, poisonous bites and other poisonous conditions etc. were managed by siddha and modern medical preparations. in addition, specific antidotes also available for Sulphur toxicity in Siddha Medicine. further Sulphur dominates the industries because of Sulfuric acid, fertilizer, fungicide, pesticide, winemaking and food preservation. The review concluded as Siddhar statement the primary mineral of sulphur essential substance to maintain the healthy life with siddha medicinal preparation vs Pharmaceuticals and industrial. If siddha statements regarding sulphur undergone with reverse pharmacology it will be remarkable mile stone for the science.

### Keywords:

*Kanthakam, Sulphur, Literature, Siddha Medicine*

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## INTRODUCTION

The *Kanthakam* (Sulphur) is one of important, more effective and easily available *Padanam* in Siddha Medicine. As Sulphur, a chemical element with the symbol S and atomic number 16, is a vital element in the periodic table. Elemental Sulphur is a bright yellow, crystalline solid at room temperature as well as in literature Sulphur called as brimstone, which means "burning stone" (Earnshaw A, 1997). Sulphur, also spelled Sulfur (S) (Brasted, 10 Nov 2020).

In Siddha Medicine the *Kanthakam* is the Mother *Pashanam* (*Thaai sarakku*) and superior among 64 *Pashanam*: Water soluble inorganic substance that emit vapour on heating (Thiyagarajan.R, 2009).

The *Kanthakam* mentioned in deferent texts with deferent name as *Kenthokam*, *Kenthakam*, *Thanam*, *Kanthi*, *Ponvarni*, *Kaarilaiyin Naatham*, *Kavi*, *Kiruntham*, *Kanthira*, *Satharonitham*, *Thanthi* and *Thanthiran* (Mohan R. C, 2019). In addition The text of Agathiyar Panchakaviya Nigandu 3<sup>rd</sup> part mentioned the names of *Kedari*, *Kevunam*, *Piranitham*, *Viththu*, *Asuli*, *Arukokam*, *Kenthi* and *Nathapeesa kenthi* (S.P.Ramachanthiran, 1997) and also its variety and effects in its colour, appearance, character, properties and uses mentined in deferent siddha medical texts. On the other hand the Sulphur is indispensable in the fields of chemistry, medicine, industry, and biology, and its significance extends to environmental and energy-related matters.

As for its biological relevance, sulfur is a crucial component of amino acids, which are the building blocks of proteins. Thus, sulfur plays a fundamental role in the structure and function of living organisms.

Sulfur's importance in industry is exemplified by its use in the production of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), a fundamental chemical compound used in various industrial processes, from metal extraction to fertilizer production. Additionally, sulfur finds applications in the synthesis of numerous organic compounds, including pharmaceuticals and plastics.

## AIM AND OBJECTIVE

The aims of this study were to explore the importance of Sulphur in the aspect of medicine, non-medicine and toxicology to get the more beneficial effect on healthy life. Easily available cost effective sulphur need to utilized in the medical aspect with proper purification methods.

## METHODOLOGY

Information regarding the sulphur Systematically search via Siddha texts books, E- books, published journals, Website, Traditional information, Toxicological view also included toxicological importance etc. This review expresses the sulphur in various perspective

### Types of *Kanthakam*

Deferent types of *Kanthakam* available in the world as well as in the texts, each and every type of *Kanthakam* uses for deferent purposes because of its peculiarity of general properties. Example, Bohar was mentioned the four types of *Kanthakam* (Mohan. R. C, 2017) The Sampasivam pillai mentioned in the book of Bohar aharathi which there are 16 types of *Kanthakam* available Such as *Vana Kanthakam*, *Kuzhai Kanthakam*, *Nellikai Kanthakam*, *Pachchai Kanthakam*, *Naaduk Kanthakam*, *Paruppuk Kanthakam*, *Kozhithalai Kanthakam* in addition to that *Amarsilai Kanthakam* and additionally *Karaddu Kanthakam*, *Sivappu Kanthakam*, *Suraikai Kanthakam*, *Neelak Kanthakam*, *Thulliyya Kanthakam*, *Karuppu Kanthakam*, *Pook Kanthakam*, *Pathangitha Kanthakam* (pillai, 1998). Gooseberry (Nellikai) *Kanthakam* is the one which is often used in Medicinal preparations. In additionally Vaipumurai *Kanthakam* also mentioned,

### General character of *Kanthakam*

The book of Anupava Vaithiya Thevarakasiyam mentioned that "The pure *Kanthakam* improves the digestive fire and strength as well as it cure the *Kasam*, *Suvasa Kasam*, *Sayarogangal*, *Kutta rogam*, *Kelathamnai* "The book of Sarpentthira vaithiyamurai kunmaroga sikisai 2<sup>nd</sup> part mentioned that "The *Nellikai Kanthakam* cure the *Arippu*,

*Kuttam, Sirangu, Sori, Aamathodam, Visham, Kirumi* and improves the digestive fire and strength and also cure all type of Skin disorder and pacify the *Kapam and Vatham* with increases the *Pitham*”

The book of Anupoka vaithiya noai nithanam mentioned that “ Naturally *Kanthakam* possess the Fire property and hot potency with pure *Kanthakam* cures the *kuttam, Kelathanmai*, prevent from *Akalamaranam*, increase the sperm count and improve the *Jadarakkini*” *Nellikai Kanthakam*, Cure the 18 types of *Kuttam, Mantham*, Swelling in the spleen and liver, *Kavisai* (one type of ascites), *Kunma vayu*, disease in the eye, Poisonous bites, Chronic venereal disorders, Fever due to *Vatham*, Diarrhea, *Kirakani*, In the Text book of Theran Porut panpu nool the quotation mentioned “The mother care about their child like wise the Sulphur cares the body” and the smell of the Sulphur cure the infection in the blood and body, skin diseases and deformity disorders.

#### **Taste and action of *Kanthakam***

*Kanthakam* possess the bitter and astringent taste. In the text of Sarabentra vaithiyamurai mentioned that “*Nellikai kanthakam* possess the bitter, salt, sweet taste and hot potency with pungent inherent property” It has the pharmacological actions of Laxative, tonic, antiseptic, diaphoretic, *vidapethakari*, increase the bile secretion, and reduce the swelling.

#### **Poisonous aspect of *Kanthakam***

The *Kanthakam* is mild toxic substance; poisonous effect arises in the body due to unpurified and improper purified *Kanthakam* and improper and irregular manifestation of medicine. Prolonged and over usage of *Kanthakam* will causes the poisonous effect. Toxic features are yellowish discoloration of the eye, Pallor of face, loss of natural brightness of body then discoloration of the skin, Disfigured and blackish teeth, Profuse hyperhidrosis with yellow colour, , urine appear as goats urine, Dark yellow feases, Bad breath(Halitosis), Dyspepsia-psodo appetite, Flatulence abdominal pain with distension and pimples also appear(Macules).

#### **Antidote for *Kanthakam***

A decoction prepared with the root of *Cassia auriculata*, *Cleome feline*, *Indigofera tinctoria*, dried rhizome of *Zingiber officinale*, Leaves of *Gossypium herbaceum* and *Messua ferrea* can be given as an antidote for Sulphur toxicity. Paste of seeds of lotus in tender coconut water is also used as an antidote. A decoction of equal parts of *Piper nigrum*, *Indigofera tinctoria* and *cuminum cyminum* is also used as an antidote.

A decoction is prepared with *Piper longum* (small variety) *Glycyrrhiza glabra* and the root bark of *Solanum nigrum* taking 10g each and given for 40 days in the morning and evening or till the poisonous effects are neutralized

#### ***Kanthaka* preparation with Indication**

Medicine prepared with *Kanthakam* were used for different kind of disorder. Here mentioned some important diseases with indication such as *Kanthaka parpam, Kanthaka senthooram, Kanthaka Mezhuku, Sarva vida rhodari kuzhikai, Kanthak Mathirai, Kanthak thailam, Kanthaka VAdqakm, Kanthaka rasayanam, Kanthak kattu*.

#### **The Sources of Sulphur**

The world production of Sulphur in 2011 amounted to 69 million tonnes (Mt), with more than 15 countries contributing more than 1 Mt each. Countries producing more than 5 Mt are China (9.6), US (8.8), Canada (7.1) and Russia (7.1) (Apodaca, 2012) Production has been slowly increasing from 1900 to 2010; the price was unstable in the 1980s and around 2010.

#### **Natural occurrence of Sulphur**

Sulphur is the fifth most common element by mass in the Earth. Elemental Sulphur can be found near hot springs and volcanic regions in many parts of the world, These deposits are polycrystalline, with the largest documented single crystal measuring 22×16×11 cm (P.C, 1981) Historically, Sicily was a major source of Sulphur in the Industrial Revolution (Kutney, 2007)

### Physical properties of sulphur

Symbol -S, atomic number- 16, Atomic weight- 32.06, Standard state- Solid at 298 °K, Group in periodic table- 16, Color- Lemon yellow, Classification- Nonmetallic, Melting point- 115.21 °C, Boiling point- 444.72 °C, Thermal conductivity- 0.205 W/(m·K), Electrical resistivity-  $>10^{23} \times 10^8 \Omega\text{m}$ , Density of solid- 1.96 g/cm<sup>3</sup>. Ionic radii- 0.37 Å for S<sup>4+</sup> (coordination number 6) and S<sup>6+</sup> (coordination number 4); 0.29 Å for hexacoordinated S<sup>6+</sup> in crystals, Oxidation states- +2, +4, +6 (Sulfur-s, www.isoflex.com) (Earnshaw A, 1997).

### Chemical properties of Sulphur

Sulfur burns with a blue flame with formation of Sulphur dioxide, which has a suffocating and irritating odor. Sulphur is insoluble in water but soluble in carbon disulfide and, to a lesser extent, in other nonpolar organic solvents, such as benzene and toluene.

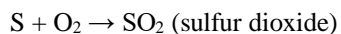
Sulfur reacts with nearly all other elements with the exception of the noble gases, even with the notoriously unreactive metal iridium (yielding iridium disulfide) (Munson, February 1968). Some of those reactions need elevated temperatures (Egon Wiberg, 2001).

Sulfides



### Oxides, Oxoacids, and Oxoanions

The principal Sulphur oxides are obtained by burning sulfur:



Multiple Sulphuroxides are known; the sulfur-rich oxides include Sulphurmonoxide, disulfur monoxide, disulfur dioxides, and higher oxides containing peroxy groups.

Sulfur forms Sulphuroxoacids, some of which cannot be isolated and are only known through the salts. Sulphurdioxide and sulfites (SO<sup>2-</sup><sub>3</sub>) are related to the unstable sulfurous acid (H<sub>2</sub>SO<sub>3</sub>). Sulphur trioxide and sulfates (SO<sup>2-</sup><sub>4</sub>) are related to sulfuric acid (H<sub>2</sub>SO<sub>4</sub>).

Sulfuric acid and SO<sub>3</sub> combine to give oleum, a solution of pyrosulfuric acid (H<sub>2</sub>S<sub>2</sub>O<sub>7</sub>) in sulfuric acid.

Metal sulfides

The principal ores of copper, zinc, nickel, cobalt, molybdenum, and other metals are sulfides. These materials tend to be dark-colored semiconductors. They are formed by the reaction of hydrogen sulfide with metal salts. The mineral galena (PbS) was the first demonstrated semiconductor. The iron sulfide called pyrite, the so-called "fool's gold", has the formula FeS<sub>2</sub>. (Vaughan, et al., 1978)

### Environmental toxic Effect of Sulphur

Sulfur can be found in the air in many different forms. It can cause irritations of the eyes and the throat with animals, when the uptake takes place through inhalation of Sulphur in the gaseous phase. Sulphur is applied in industries widely and emitted to air, due to the limited possibilities of destruction of the Sulphur bonds that are applied.

The damaging effects of Sulphur with animals are mostly brain damage, through malfunctioning of the hypothalamus, and damage to the nervous system. Laboratory tests with test animals have indicated that Sulphur can cause serious vascular damage in veins of the brains, the heart and the kidneys. These tests have also indicated that certain forms of Sulphur can cause foetal damage and congenital effects. Mothers can even carry Sulphur poisoning over to their children through mother milk. Finally, Sulphur can damage the internal enzyme systems of animals.

### Industrial importance of Sulphur

#### Sulfuric acid

Elemental Sulphur is used mainly as a precursor to other chemicals. Approximately 85% is converted to sulfuric acid (H<sub>2</sub>SO<sub>4</sub>):



The principal use for the acid is the extraction of phosphate ores for the production of fertilizer manufacturing. Other applications

of sulfuric acid include oil refining, wastewater processing, and mineral extraction. (Nehb, et al., 2006)

### **Fertilizer**

Sulfur is increasingly used as a component of fertilizers. The most important form of Sulphur for fertilizer is the mineral calcium sulfate. Elemental Sulphur is hydrophobic (not soluble in water) and cannot be used directly by plants.

### **Fungicide and pesticide**

Elemental Sulphur is one of the oldest fungicides and pesticides. "Dusting sulfur", elemental Sulphur in powdered form, is a common fungicide for grapes, strawberry, many vegetables and several other crops. Biosulfur (biologically produced elemental Sulphur with hydrophilic characteristics) can also be used for these applications.

Standard-formulation dusting Sulphur is applied to crops with a Sulphur duster or from a dusting plane. Wettable Sulphur is the commercial name for dusting Sulphur formulated with additional ingredients to make it water miscible (Mohamed, et al., 13 July 2010).

A diluted solution of lime Sulphur (made by combining calcium hydroxide with elemental Sulphur in water) is used as a dip for pets to destroy ringworm (fungus), mange, and other dermatoses and parasites. Sulphur candles of almost pure Sulphur were burned to fumigate structures and wine barrels, but are now considered too toxic for residences (Every, et al., 20 August 1968)

### **Bactericide in Winemaking and food preservation**

Small amounts of Sulphur dioxide gas addition (or equivalent potassium meta bisulfite addition) to fermented wine to produce traces of sulfurous acid (produced when  $\text{SO}_2$  reacts with water) and its sulfite salts in the mixture, has been called "the most powerful tool in winemaking" (Spencer, Retrieved 26 October 2011.)

### **Medical importance of Sulphur:**

All living things need Sulphur. It is either the seventh or eighth most abundant element in the human body by weight, about equal in abundance to potassium, and slightly greater than sodium and chlorine. A 70 kg (150 lb) human body contains about 140 grams of sulfur. It is especially humans because it is important part of the amino acid methionine, which is an absolute dietary requirement for us. The amino acid cysteine also contains Sulphur. The average person takes in around 900 mg of Sulphur per day, mainly in the form of protein. Methionine contains most of the sulfur, and the element is present in all polypeptides, proteins, and enzymes that contain these amino acids save for the vitamins biotin and thiamine. Disulfide bonds (S-S bonds) between cysteine residues in peptide chains are very important in protein assembly and structure. These covalent bonds between peptide chains confer extra toughness and rigidity.  $\text{M, CH}_3\text{SCH}_2\text{CH}_2\text{SO}_3^-$ , the immediate precursor to methionine (Thauer, 1998)

### **Sulfur metabolism and the Sulphur cycle**

The Sulphur cycle was the first of the biogeochemical cycles to be discovered. In the 1880s, while studying Beggiatoa (a bacterium living in a Sulphur rich environment), it oxidized hydrogen sulfide ( $\text{H}_2\text{S}$ ) as an energy source, forming intracellular Sulphur droplets.

Sulfur oxidizers can use as energy sources reduced Sulphur compounds, including hydrogen sulfide, elemental sulfur, sulfite, thiosulfate, and various polythionates (e.g., Tetrathionate) (JT, et al., 1990).

They depend on enzymes such as Sulphur oxygenase and sulfite oxidase to oxidize Sulphur to sulfate. Some lithotrophs can even use the energy contained in Sulphur compounds to produce sugars, a process known as chemosynthesis. Some bacteria and archaea use hydrogen sulfide in place of water as the electron donor in chemosynthesis, a process similar to photosynthesis that produces sugars and utilizes oxygen as the electron acceptor.

The photosynthetic green Sulphur bacteria and purple Sulphur bacteria and some lithotrophs use elemental oxygen to carry out such oxidization of hydrogen sulfide to produce elemental Sulphur(S<sup>0</sup>), oxidation state= 0. Primitive bacteria that live around deep ocean volcanic vents oxidize hydrogen sulfide in this way with oxygen; the giant tube worm is an example of a large organism that uses hydrogen sulfide (via bacteria) as food to be oxidized (Pepper IL, 1978).

Sulfur is absorbed by plants roots from soil as sulfate and transported as a phosphate ester. Sulfate is reduced to sulfide via sulfite before it is incorporated into cysteine and other organosulfur compounds (Heldt, 1996).

### Clinical aspect

Pure powdered Sulphur was used as a medicinal tonic and laxative (Nehb, et al., 2006) The Skin disorders of Eczema, dry scalp, rashes, burns and abrasions can be cured and the digestive disorders and poor liver detoxification including food allergies and indigestion. Arthritis – Rheumatoid and osteoarthritis also cured.

### Medicines

Organo sulfur compounds are used in pharmaceuticals, dyestuffs, and agrochemicals. Many drugs contain sulfur; early examples being antibacterial sulfonamides, known as sulfa drugs. Sulphur is a part of many bacterial defense molecules. Most  $\beta$ -lactam antibiotics, including the Penicillins, Cephalosporins and Monolactams contain sulfur (J., 1996).

### Actions

Its bile secretion, Acts as laxative, Its preparations also act alternative, laxative, diuretic and insecticide. It is stimulant to the secreting organs such as skin and the bronchial mucous membranes

### Pharmaceuticals

Sulfur (specifically octa sulfur, S<sub>8</sub>) is used in pharmaceutical skin preparations for the treatment of acne and other conditions.

It acts as a keratolytic agent and also kills bacteria, fungi, scabies mites, and other parasites (Springer., 1978). Precipitated Sulphur and colloidal Sulphur are used, in form of lotions, creams, powders, soaps, and bath additives, for the treatment of acne vulgaris, acne rosacea, and seborrhoeic dermatitis. Common adverse effects include irritation of the skin at the application site, such as dryness, stinging, itching and peeling.

### Dietary source of Sulphur

Sulfur is found in a large variety of foods. The biggest categories include, **Meat and poultry:** beef, ham, chicken, duck, turkey, and organ meats like heart and liver, **Fish and seafood:** most types of fish, as well as shrimp, scallops, mussels, and prawns, **Legumes:** soybeans, black beans, kidney beans, split peas, and white beans, **Nuts and seeds:** almonds, Brazil nuts, peanuts, walnuts, and pumpkin and sesame seeds, **Eggs and dairy:** whole eggs, cheddar, Parmesan and gorgonzola cheese, and cow's milk, Dried fruit: dried peaches, apricots, sultanas, and figs, Certain vegetables: asparagus, broccoli, Brussels sprouts, red cabbage, leeks, onion, radishes, turnip tops, and watercress, Certain grains: pearl barley, oats, wheat, and flour made from these grains, Certain beverages: beer, cider, wine, coconut milk, and grape and tomato juice, **Condiments and spices:** horseradish, mustard, marmite, curry powder, and ground ginger, Drinking water can also contain significant amounts of Sulphur depending on where you live.

This may be especially true if you source your water from a well. Moreover, sulfites — a food preservative derived from Sulphur— are commonly added to packaged foods like jams, pickles, and dried fruit to extend their shelf life. Sulfites can also develop naturally in fermented foods and beverages including beer, wine, and cider (Yves Ingenbleek, 2013 Jul) Sulphur in the body, approximately 850 mg / day of dietary

intake is considered necessary. The generally recommended dosage range for arthritis is upto 1000 mg per day.

### **Sulphur in blood**

The total Sulphur in blood (plasma) averages to about 3.1 mg % ,This is present in 3 distinct form one is Inorganic sulphate 0.5 – 1.1 mg/100ml , second is Neutral sulphate 1.7 – 3.5 mg / 100 ml and third is Ethereal sulphate 0.1 – 1.0 mg/100 ml.

### **Absorption**

Sulphur in food is ingested in 2 forms.one is As inorganic sulphate of sodium, potassium and magnesium and as organic sulphate from Sulphur containing amino acids, sulpholipids, glycoproteins, chondroitin sulphate. They are absorbed from the intestine into portal blood and reach the liver (koyal, .2011, jul-dec5).

### **Metabolism of Sulphur**

Most of the organic Sulphur is oxidised to inorganic sulphates. Unoxidised Sulphur is utilized for the formation of Sulphur containing substances like insulin, anterior pituitary hormone, taurocholic acid and glutathione and the rest is excreted in the urine as neutral Sulphur.

### **Detoxification**

Inorganic sulphate combines in the liver with various phenolic substances produced by purification to form ethereal sulphate, which is excreted in urine.

### **Excretion**

Sulphur is excreted in the urine in three forms. The total amount of Sulphur excreted in urine is about 1 gm per day under normal condition. The excretion of Sulphur varies with the intake of Sulphur containing protein and the rate of tissue catabolism. The Inorganic sulphate – 85% of total excretion includes sulphates of sodium, potassium, calcium and magnesium, Ethereal sulphate – 10 % of total excretion of this is sulphate of phenol, indoxyl and skatol. And Neutral sulphate – 5% of total excretion. This is unoxidised Sulphur. It includes cysteine, taurine, cysteine taurine, cyanides and thiocyanates.

### **Sulphur Toxicity**

Elemental Sulphur is non-toxic, as are most of the soluble sulfate salts, such as Epsom salts. Soluble sulfate salts are poorly absorbed and laxative. When injected parenterally, they are freely filtered by the kidneys and eliminated with very little toxicity in multi-gram amounts.

When Sulphur burns in air, it produces Sulphur dioxide. In water, this gas produces sulfurous acid and sulfites; sulfites are antioxidants that inhibit growth of aerobic bacteria and a useful food additive in small amounts. At high concentrations these acids harm the lungs, eyes, or other tissues. In organisms without lungs such as insects or plants, sulfite in high concentration prevents respiration.

Sulfur trioxide (made by catalysis from Sulphurdioxide) and sulfuric acid are similarly highly acidic and corrosive in the presence of water. Sulfuric acid is a strong dehydrating agent that can strip available water molecules and water components from sugar and organic tissue (Baker, Retrieved 14 June 2018.)The burning of coal and/or petroleum by industry and power plants generates Sulphur dioxide (SO<sub>2</sub>) that reacts with atmospheric water and oxygen to produce sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and sulfurous acid (H<sub>2</sub>SO<sub>3</sub>). These acids are components of acid rain, lowering the pH of soil and freshwater bodies, sometimes resulting in substantial damage to the environment and chemical weathering of statues and structures. Fuel standards increasingly require that fuel producers extract Sulphur from fossil fuels to prevent acid rain formation. This extracted and refined Sulphur represents a large portion of Sulphur production. In coal-fired power plants, flue gases are sometimes purified. More modern power plants that use synthesis gas extract the Sulphur before they burn the gas (P. Rajalakshmi, 2010).

Hydrogen sulfide is as toxic as hydrogen cyanide and kills by the same mechanism (inhibition of the respiratory enzyme cytochrome oxidase) (Medscape., 30 March 2017 ) though hydrogen sulfide is less likely to cause surprise poisonings from small inhaled amounts because of its disagreeable odor.

Hydrogen sulfide quickly deadens the sense of smell and a victim may breathe increasing quantities without noticing the increase until severe symptoms cause death. Dissolved sulfide and hydrosulfide salts are toxic by the same mechanism. Low emicity and poses very little if any risk to human health. Sulfa drug ie sulphonamides can cause adverse drug reactions. The most common adverse reaction is ranging from various benign rashes to life threatening “stevens – Johnson syndrome”. “Sulfa allergy” is approximately only 3%.

Sulfhemoglobinemia is a rare condition in which there is excess sulfhemoglobin (SulfHb) in the blood. The pigment is a greenish derivative of hemoglobin which cannot be converted back to normal, functional hemoglobin. It causes cyanosis even at low blood levels. This condition in which the hemoglobin molecule has the ability to bind irreversibly to any substance containing a sulfur atom. When hydrogen sulfide (H<sub>2</sub>S) (or sulfide ions) and ferric ions combine in the blood, the blood is incapable of carrying oxygen (Gharahbaghian, et al., August 2009).

Sulphur toxicity causes various physiological effects in livestock such as diarrhoea, reduced growth, reproduction and location problems, blind staggers and death.

Some of these effects have been produced experimentally by adding Sulphate salt to the water supply. However, these physiological effects have occurred over a wide range of sulphate concentration in water. The serum sulphate concentration is increased in presence renal functional impairment, pyloric and intestinal obstruction and leukomia. Marked sulphate retention in adavanced glomerulonephritis came the development of acidosis.

The Sulphur content important for toxicological aspect such as, Sulphuric acid (oil of vitriol battery acid) H<sub>2</sub>SO<sub>4</sub>, Sulphonamide (P- amino Benzene sulphonamide) and Hydrogen Sulphide (Sulphuretted hydrogen) H<sub>2</sub>S. As example the Sulphuric acid Colourless, heavy, hydropscopic, oily liquid, which emits fumes, when exposed to the air, a stronger form of

acid is known as phyro Sulphuric acid which is a brown, oily, fuming liquid and is represented by the formula H<sub>2</sub>S<sub>2</sub>O<sub>7</sub>. Symptoms are Burning pain in the mouth, throat oesophagus and stomach with brownish (or) blood stained vomit, Tongue is swollen, lips are usually swollen and excoriated. Occasionally hypersalivation has been observed on the second (or) third day. Fatal Dose 5 – 10 ml, Fatal Period 18 – 24 hours

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## CONCLUSION

The sulphur abundantly available in the world which possess the medicinal and non-medicinal effect even though it possess mild toxic effect. The sulphur used in siddha and modern medical aspects. Especially siddha medical preparations mentioned with purification methods. If siddha statements regarding sulphur undergone with reverse pharmacology it will be remarkable mile stone for the science.

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