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REVIEW ARTICLE

CONCEPT OF HARATALA DRUG

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ABSTRACT

Haratala, Manahshila and *Somala* are important arsenic compounds which are used in *Ayurveda*. *Haratala* is most popular among them. *Haratala* is commonly used in treating the diseases like *Sleshmaroga, Raktapitta, Vatarakta, Kustha* etc. *Haratala* is called orpiment of yellow arsenic with two molecules of Arsenic and three molecules of Sulphur (AS_2S_3). *Haratala* consumed without proper *Shodhana* shortens the life span, causes diseases of *Kapha* and *Vata, Prameha, Santapa, Spotha, Snayu Sankocha*. Hence *Shodhana* of *Haratala* is essential. *Shodhana* is the process of removal of physical, chemical impurities and potentiating of the drugs. Generally *Shuddha Haratala* is not given alone. It is administered along with herbal drugs or in the form of *Rasamanikya* or also as a main ingredient in most of the popular formulations like *Samirapannaga Rasa, Vatagajankusha Rasa, Kasturibhairava Rasa, Talakeshwara Rasa* etc. There are various *Shodhana* procedures explained for *Haratala* in *Rasa Granthas* like *Rasa Ratna Samuchaya*, *Ayurveda Prakasha* and *Rasa Tarangini.*

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INTRODUCTION

Haratala is said in *Vedas* that it is the first step in regard of knowledge which was complied for the welfare of the humanity all over the world. Ancient importance of any reference is rooted in Vedas. In the subject of orpiment, a stanza in *Rigveda* is available, showing its importance. In *Charaka Samhita* fourteen references of *Haratala* in different places with different aspects are available. Out of fourteen, five references can be seen in *Sutrasthana*, such as in counting of *Parthiva Dravyas*, an external application in various skin disorders and in the subject of *Sirovirecana* as an ingredient of *Dhumapana*. In *Chikitsasthana* also *Haratala* is indicated for skin diseases apart from *Unmada* (insanity), *Hikka* (Hiccups), *Shwasa* (Dyspnoea), *Kasa* (Cough) and in *Visa Chikitsa* (Toxicosis) in the form of oil and *Sura* etc. it is used for *Pradeha Pralepa* (the external aplications) *Dhumapana* (smoking) *Anjana* (collrium) and in the form of powder and *Agada* for internal uses. In *Sushruta Samhita*, orpiment has been counted in *Sthavara Vishas*. Moreover, he has described arsenic and orpiment as two *Dhatuvishas*. In the age of *Sangraha Granthas*, *Vagbhata* has applied *Haratala* mainly on *Nasa Rogas*, (Nasal, diseases), *Sotha* (oedema), *Vriscika Dansa* (scorpion sting), for *Vidarana* action i.e. self opening of the abscess and as per the actions and uses given by *Charaka* and *Sushruta*. In *Bhela Samhita*, *Kashyapa Samhita* etc. have described the indications of *Haratala*. The development of *Rasa* therapy and *Nagarjuna* are the two sides of a coin. From the age of *Nagarjuna*, the description of orpiment regarding properties, indications, contraindication, *Sodhana*, *Marana* and *Satva Patana* etc. are more elaborately described. He has utilized this drug for various alchemical processes for converting basic metal into noble one. In the texts of *Rasa Sastra* and *Nighantus* the literature of *Haratala* is available in details. Most of the texts of *Rasa Shastra* have described *Haratala* with its synonyms, properties, *Shodhana, Marana, Satva Patana* etc. the texts of 12th and 13th centuries as *Rasa Prakasa Sudhakara, Rasendra Sarasangraha, Rasa Sara*, *Rasachintamani, Rasa Ratna Kara* (By *Nityanatha*). Have described alchemical and pharmaceutical processes and the pharmacology of *Haratala* thoroughly. In 13th century the author of *Rasakamadhenu* compiled the uses of *Haratala* and remedies according to diseases and systems. *Rasatarangini, Rasacandamshu*, *Rasajalanidhi* etc. texts are considered to be of 20th century. In these texts, the description of *Haratala* has been modified.

Origin of Haratala

In ancient literature there are various stories regarding the origin of *Haratala* (orpiment). One of those is in *Shatapatha Brahmana* (Sri Sadananda Sharma *et al*., 1989). Here it is described that when in the circles of *Parama Ojas, Ap* and *Vayu Tatvas* are prominent, the sun, and *Agni* producing *Tatva* is hidden in the embryo like formation. At that time due to

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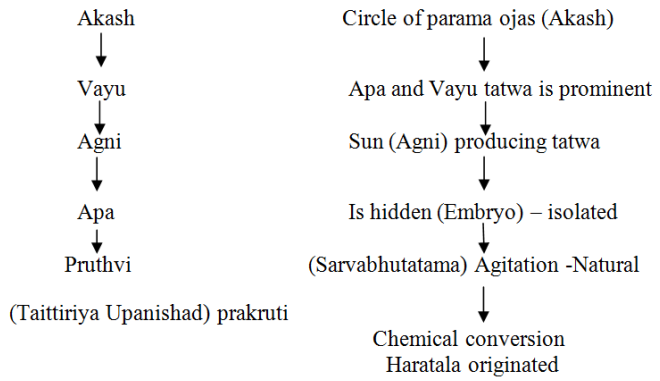
those extreme pure *Tatvas*, intermingling together an agitation takes place. It is actually an intercourse of Lord with *Prakriti* which is known as *Sarvabhutamayi*, described in a mythological way with this agitation, orpiment is being originated (Acharya Yashodharas *et al*., 2014).

Chart showing Haratala – Origin (Shatapathabrahman)



It is also mentioned that when the earth is being separated from the sun, some poisons are released in the formation under the earth. Because the arsenic is concerned with *Somatatva*, it is known as *Somala* and when *Somala* is combined with *Parthiva Dravyas* like *Gandhaka*, *Haratala* is being originated with such combination, so it is available in mines as a mineral. In the light of knowledge of modern chemistry, it is clear that orpiment is a native sulphide of arsenic. Two atoms of arsenic are combined with three atoms of sulphur to form AS_2S_3 (orpiment). The mineral shows a relation to stibnite in is crystalline structure and perfect cleavage in one direction. The color is bright, lemon yellow smooth and cleavage surface have a pearly appearance The name orpiment is a corruption of the latin name "Auripigmentam" which means gold coin. The pigment known as king's yellow is however prepared artificially. Despite of orpiment has long been known and worked in Citrala (N.W.F.P.) where they are found at altitudes of 11,000 to 16,000 feet. During recent years, however, only small quantities of orpiment have been obtained from this area and there are no records of production. In the *Kumaun* areas of the united provinces orpiment has been reported from near *Eunsyri* occur on the surface *Murangana* of the *Shanlmlpali* glacier. Now a days it is available in all over the world particularly, it is obtained from Italy, Turk, Iran, China, Russia, U.S.A., Germany and Spain. In India, it is not available in major quantity. In India, it is available in Bihar in small quantity.

Haritala ayurvedic review

Artificial preparation of *Haratala* is mentioned in *Rasatarangini*[1] as follows: 49 parts of purified arsenic oxide (*Somala*) and 24 parts of purified sulphur (*Gandhaka*) are mixed in a mortar. And this mixture is rubbed well. After proper mixing it is taken in *Damaru Yantra* and heated on mild heat. The time limit and the range of temperature is not described in this reference. When is becomes self-cooled, this *Yantra* should be put off carefully and *Haratala* is collected from the inner part of above pot of *Damaru Yantra*. It should be carefully separated and collected. (RT 11/9-12. pp – 245). If purified *Somala* and purified *Gandhaka* is used then it is not necessary to purify *Haratala*

In modern chemistry, it is said that arsenic trisulphide is formed when powdered arsenic and sulphur are heated together in the proportion indicated by the formula.

$$3AS_2O_3 + 9S \longrightarrow 2\ AS_2S_3 + 3\ SO_2$$

Synonyms of Haratala[2]

1. **Alam** : The material which is ornament for artists is *Alama*
2. **Alama :** The material which is ornament for artists is *Alama*
3. **Kanaka Prabham**: The material which has gold like luster is *Kanaka Prabham*.
4. **Kanaka Rasah** : Golden color or the *Rasa* gained by *Kanaka* (Gold) is *Kanaka Rasah*.
5. **Karburam** : Which destroys the diseases or the mineral which has a matter of proud of its color property in comparison of other minerals is *Karburam*.
6. **Kancanakam** : means which is partially having gold like form is or, which is used in the artificial preparation of gold is *Kancanakam*.
7. **Kancana Rasah** : which has gold like *Rasah* is *Kancana Rasah*.
8. **Kharjuram :** which produces itching is *Kharjuram*.
9. **Godantam** : teeth of cow like glazy is there so it is *Godantam*.
10. **Gauram** : which is beautiful in colour.
11. **Gaurilalitam :** ornamental for a beautiful lady.
12. **Citragandha** : which possesses strange smell as *Citragandham*.
13. **Chatrangam** : which is formed with overlapped layers is *Chatrangam*.
14. **Citrangam** : which has peculiar form or body is *Citrangam*.
15. **Talam :** Which establishes taste, *Kanti* and health is *Talam*.
16. **Talakam** : Which establishes taste, *Kanti* and health is *Talam*.
17. **Natabhusanam** : Which is the ornamental for actors is *Natabhusanam*.
18. **Natamandanam** : *Nata* is a cast living in India, which wears various designs of ornaments prepared by *Haratala.*
19. **Natasanjnam** : Which is related with the word *Nata*, means actors. Actors are using ornaments for their makeup. So, it is known from their name.
20. **Pingam** : Which has the coloring property of lemon yellow (*Pingam*) is *Pingam*.
21. **Pingasara** : Which has the abstract of yellow color is *Pinga Sara*.
22. **Pinjakam** :Which has particular type of colouring property is *Pinjakam*.
23. **Pinjaram** :Which has particular type of coloring property is *Pinjaram*.
24. **Pinjarakam** :Which has particular type of coloring property is *Pinjarakam*.
25. **Pinjalakam** : Which has particular type of coloring property is *Pinjalakam*.
26. **Pindalakam** : Which is formed in the shape of *Pinda* (mass) is *Pindalakam*.
27. **Pittalam**: Which produces yellow color is *Pittalam*. Previously used for making alloys.

28. **Mallagandhajam**: Which is formed with the combination of arsenic (*Malla*) and sulphur (*Gandhaka*) is *Malla Gandhajam*.
29. **Malam** : Which is for the purpose of respect is *Malam*.
30. **Romanasanam** : Which removes hair.
31. **Romapatanam** : Which removes hair.
32. **Romaharanam** : Which removes hair.
33. **Vansapatrakam**: Which has layer like form of bamboo is *Vansapatrakam*.
34. **Vansapatra**: Which possesses the layers like the layers of bamboo is *Vansapatra*.
35. **Lomahrit** : Hair remover.
36. **Vangari** : The *Bhasma* of *Vanga* can be easily prepared with it so it is *Vangari*. It reduces tin therefore enemy of tin.
37. **Varnakam :** Which has precious color is *Varnakam*.
38. **Vidalakam** : Cat's eye like color is called *Vidalakam*.
39. **Visragandham** : Which has strange smell like dead body is *Visragandham*.
40. **Visragandhih** : Which has strange smell like dead body is *Visragandhih*.
41. **Vaidalah** : Which is formed with the help of layers is *Vaidalah*.
42. **Siddha Dhatu** : With which, gold can be produced, is *Siddhadhatu* or which has been proved a drug for many diseases is *Siddhadhatu*.
43. **Haritalam** : Which possesses lemon yellow color property is *Haritalam*.
44. **Haritalakam**: Which possesses lemon yellow color is called *Haritalakam*.
45. **Harerbijam** : Which is known as semen of God *Vishnu* is *Harerbijam*.

Names of Haratala in Indian languages (Rasamanjari)

1. Hindi -*Haritala*
2. Gujarati -*Haratala*
3. Marathi-*Haratala*
4. Bengali-*Haratala*
5. Punjabi -*Haratala*
6. Oriya -*Haratala*
7. Tamil-*Ardidaram, Vellikuo Pasanam*
8. Telugu-*Haritala, Pasanam*
9. Kannada-*Haridala, Haratala, Aradala*
10. Assamese-*Haritala*.

Synonyms of Haritala in Foreign languages

1. Arabic -Ursanigam, Janikhe – Asfar
2. English-yellow arsenic, king's yellow orpiment.
3. Latin -yellow arsenic sulphide.
4. Burmese-Hayasadana Shyeva.
5. Old Europe-Auri pigmentum.
6. Persian-Janikhe-Jarda.

Color and types of Haritala (Sri Sadananda Sharma *et al*., 1989; Sri Vagbhatacharya *et al*., 1990)

Haratala is a solid, yellowish, lustrous, material. Most of the texts have described its two types. However the number for the types varies two to four. It is clarified in Table –3.1.2.

Types of orpiment have been classified on the basis of color. Majority of *Acharyas* are in favour of two types.

Table 3.1.2. The types of *Haratala*

Haratala two types	*Haratala* four types
1. Patra Haratala	*1. Patra Haratala*
2. Pinda Haratala	*2. Panda Haratala*
	3. Godanti haritala
	4. Bagdadi
A. Rasendra Chudamani	*A. Siddhamata* (given in *Ayurveda Prakasha)*
B. Rasaratna Sammuchaya	
C. Ayurveda Prakasa	
D. Rasendra Sara Sangraha	
E. Rasarnava	
F. Rasa Prakasha Sudhakara	
G. Rasa Paddhati	
H. Basavarajiyam	
I. Rasakamadhenu	
J. Dhanwantari Nighantu	
K. Bhavaprakasa	
L. Rasa Chandansu	
M. Rasatarangini	

1. Patra Haratala (Sri Sadananda Sharma *et al*., 1989; Sri Vagbhatacharya *et al*., 1990; Rasendra Purana and Khemraj Shrikrishnadas, 2000): Haratala is usually preferred and practiced for the therapeutically purposes. According to the classics of *Rasashastra* this is the best quality of orpiment. **Figure-1** Following properties are there in according to various texts:

1. Better in qualities. *Patra Haratala*
2. It is formed with mica-like thin layers.
3. It is seemed like gold in color.
4. *Snigdha*
5. *Guru*
6. *Bhasuram*
7. *Sukshma Patras*
8. Having *Rasayana* properties
9. Lustrous
10. Beautiful
11. *Tridoshagna*
12. *Kusthagna*

For the present study *Patra Haratala* is selected.(Figure-1)

2. Pinda Haratala (Sri Sadananda Sharma *et al*., 1989; Sri Vagbhatacharya *et al*., 1990; Rasendra Purana and Khemraj Shrikrishnadas, 2000)

This type of *Haratala* is not preferred for the oral use because the portion of clay has not mixed with it. Generally it is preferred for the external applications like ointments etc. according to classics it possess following properties:

1. Lesser qualities
2. Yellowish in color
3. Without layers
4. Without luster
5. Stone like form
6. Low weight (*Abharavahi*)
7. Not good in appearance
8. *Bhrusam*
9. *Svalpasatva*
10. *Stripushpa Haranam*

3. Godanti haritala (Rasendra Purana and Khemraj Shrikrishnadas, 2000)

It is not actually orpiment, so it has not been counted in the types of *Haratala* by *Rasacharyas*. Only in *Ayurveda Prakasha*, according to *Siddhamata* it is noted. According to the text *Rasa Jala Nidhi* this orpiment possesses the shape of teeth of cow, and it has a long portion in its form. It is

yellowish in color but in the middle of the specimen, there is al bluish lining, it is smooth in touch. Only if it is yellowish in color and smooth in touch it has been counted in the types of orpiment. Actually, it does not possess arsenic in its chemical form. It is formed chemically with Ca, S and O and properties are also different. Therapeutically also it is different. Only in shape there are some similarities.

Properties of haratala (Sri Sadananda Sharma *et al*., 1989; Acharya Yashodharas and Rasa Prakasha Sudhakara, 2004)

4. Bagdadi or Tabaki or Varki haritala (Rasendra Purana and Khemraj Shrikrishnadas, 2000)

It is the fourth type of orpiment which is prepared artificially in modern age. It has been described in Rasa Jala Nidhi. It is very much smooth in touch. It possesses the layers and marked weight too. It is prepared with previously said ratio of arsenic and sulphur. It is of course, chemically pure and seems beautiful in physical appearance too.

Indications of *Haratala* according to system (Sri Sadananda Sharma *et al*., 1989)

Systemic action:

External

1. *Lekhana*
2. *Jantughna*
3. *Romashatana*

Internal

Nadi Sansthana-Nadi Balya
Pacana Sansthana-Dipana, Pachana ,Anulomana
Raktavaha Sansthana-Shothahara, Raktashodhaka
ûPrajanana Sansthana-Artavajanana
Twacha-Kushtaghna
Tapakrama- Jwaraghna
Satmikarana-varjya

Table 3.1.3. The properties of *Haratala* from different classics

Name. of Texts	*RASA*	*GUNA*			*VIRYA*	*VIPAKA*
		Snigdha	*Usna*	*Guru*		
A.S.	*Kasaya, Katu*	+			*Ushna*	
A.P.	*Katu, Kashaya*	+	+		*Ushna*	*Katu*
Bh.P.	*Katu, Kashaya*	+	+		*Ushna*	*Katu*
D.N.	*Katu*	+	+		*Ushna*	*Katu*
M.N.P.	*Katu , Kashaya*	+	+		*Ushna*	*Katu*
R.N.	*Katu*	+	+		*Ushna*	*Katu*
R.Cha.	*Katu*	+	+		*Ushna*	*Katu*
R.K.D.	*Katu, Kashaya, Tikta*	+	+	+	*Ushna*	*Katu*
R.J.	*Katu*	+	+		*Ushna*	*Katu*
R.M.	-					*Katu*
R.A.	-				*Ushna*	
R.P.S.	*Katu*	+	+		*Ushna*	*Katu*
R.R.S.	*Katu*	+	+		*Ushna*	*Katu*
R.T.	-	+			*Ushna*	*Katu*
R. Chi.	-					*Katu*
R. Chu.	*Katu*	+	+		*Ushna*	*Katu*
Ra sa sa.	*Katu, Kashaya*	+	+			*Katu*
S.N.					*Ushna*	
S.B.M.	*Katu, Kashaya*	+	+			*Katu*
Ba. R.	*Katu*	+	+		*Ushna*	*Katu*
Y.R.	*Katu, Kashaya*	+	+			*Katu*

Table 3.1.4. The toxic effects of Ashuddha Haritala (Sri Sadananda Sharma and Rasa Tarangini, 1989; http://www.scescape.net/-woods/elements/arsenic.html)

Name of the Text → / Toxic symptom ↓	A.P.	Bh..P.	D.N.	R.Cha.	R.J.	R.K.D.	R.M.	R.R.	R.R.S.	R.T.	R.sa.sa	S.N.	Ba.R.	Y.R.
Anga diptihara						+								
Anga sankocakara	+	+	+	+	+		+	+	+		+	+		+
Arucikara						+								
Asmakara			+			+								
Atughnam			+	+			+	+	+		+	+	+	+
Balahanikara						+								
Dahakara										+				
Dehanasaka												+		
Kampakara										+				
Kapharogakara	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ksobhakara										+				
Kusthakara	+	+			+					+		+		
Mehakara	+		+	+	+		+	+	+		+	+	+	+
Murchakara			+			+								
Malinikaroti angam										+				
Pangutva kara												+		
Pidika kara	+	+	+		+									
Sphotakara			+	+			+	+	+		+	+	+	+
Tapakara	+	+	+	+	+	+	+	+	+		+	+	+	+
Todakara										+				
Vatarogakara	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Dohsa prayoga (Sri Sadananda Sharma *et al*., 1989)

It is used in the diseases of ***Vata*** and ***Kapha***

Uses (Sri Sadananda Sharma *et al*., 1989; Sri Vagbhatacharya *et al*., 1990)

External Uses

Nadi Vrana, Bhagandara, Shotha etc. with *Shankha* ($CaCO_3$) as a hair remover.

Internal Uses

Nadi Sansthana-Nadi Daurbalya ,Vata Vyadhi
Pacana Sansthana-Agnimandya, Shula, Gulma, Pleeharoga
Raktavaha Sansthana-Vatarakta, Phiranga
Swasana Sansthana-Kasa, Swasa

Ashuddha Haratala Guna (Sri Sadananda Sharma and Rasa Tarangini, 1989; http://www.scescape.net/-woods/ elements/arsenic.html)

When the *Ashuddha Haratala* is consumed it shows the below symptoms as tabulated in table-3.1.4 from various classics.

Management of poisonous effect of Haratala (http:// www.scescape.net/-woods/elements/arsenic.html.©Fabre Minerals)

As it is clear that *Haratala* is a poisonous drug containing arsenic. It has been given in almost all the classics for purification of *Haratala*. Purified *Haratala* is used therapeutically. If the purification is not conducted properly or accidentally the *Haratala* is taken orally in impure form it is harmful as mentioned in Table-3.1.4.

Acharyas have mentioned various management of *Haratala* poisoning. These are as follows:

1) In *Rasendra Purana* and in Rasa Tarangini it is mentioned that for the management of the poisoning of *Haratala, Jeeraka* (seed of the powder of Carum carvi) with sugar should be given for three days.
2) Kusmanda Svarasa can also be given.
3) According to *Rasendra Chudamani*, Hansaraja Swarasa is given internally.
4) In *Rasayana Sara,* six times exhausted mercury with sulphur is advised for seven days to manage the complications of impure orpiment.

Modern review (The Merck Index: An Encyclopedia of Chemicals, 1989)

History

L. arsenicum, Gr. arsenikon, yellow orpiment, identified with arenikos, male, from the belief that metals were different sexes. Arabic, Az-zernikh, the orpiment from Persian zerni-zar, gold. Elemental arsenic occurs in two solid modifications: yellow, and gray or metallic, with specific gravities of 1.97, and 5.73, respectively. It is believed that Albertus Magnus obtained the element in 1250 A.D. In 1649 Schroeder published two methods of preparing the element. Mispickel, arsenopyrite, (FeSAs) is the most common mineral from which, on heating, the arsenic sublimes leaving ferrous sulfide.

The element is a steel gray, very brittle, crystalline, semimetallic solid; it tarnishes in air, and when heated is rapidly oxidized to arsenous oxide with the odor of garlic. Arsenic and its compounds are poisonous. Arsenic is used in bronzing, pyrotechny, and for hardening and improving the sphericity of shot. The most important compounds are white arsenic, the sulfide, Paris green, calcium arsenate, and lead arsenate; the last three have been used as agricultural insecticides and poisons. Marsh's test makes use of the formation and ready decomposition of arsine. Arsenic is finding increasing uses as a doping agent in solid-state devices such as transistors. Gallium arsenide is used as a laser material to convert electricity directly into coherent light. Arsenic was used more than 2400 years ago, in Greece and Rome as a therapeutic agent and poison. Indeed, It is the foundation of many modern concepts of chemotherapy derive from Ehrlich's early work with organic arsenicals and such drugs were once a mainstay of chemotherapy. In current therapeutics arsenicals are important only in the treatment of certain tropical diseases.

Orpiment in chemistry (Essentials of forensic medicine 456 pp) (Figure-11 and 12)

Orpiment is a common monoclinic arsenic sulfide mineral with formula: As_2S_3. It has a Mohs hardness of 1.5 to 2 and a specific gravity of 3.46. It melts at 300 °C to 325 ° C . Optically it is biaxial (-) with refractive indices of a=2.4, b=2.81, g=3.02.

Compounds of arsenic (Acharya Bhavamishra *et al*., 1995)

Arsenic (III) sulphide

- **Formula as commonly written:** As_2S_3
- **Hill system formula:** As_2S_3
- **CAS registry number:** [1303-33-9]
- **Formula weight:** 246.041
- **Class:** sulphide

Synonyms

- Arsenic (III) sulphide
- Arsenic sulphide
- Arsenic trisulphide
- Diarsenic trisulphide

Physical properties

- **Colour:** yellow-orange
- **Appearance:** crystalline solid
- **Melting point:** 310°C
- **Boiling point:** 707°C
- **Density:** 3460 kg m^{-3}

Element analysis and oxidation numbers (Acharya Bhavamishra *et al*., 1995)

For each compound, and where possible, a formal oxidation number for each element is given, but the usefulness of this number is limited, especially so for p-block elements in particular. Based upon that oxidation number, an electronic configuration is also given but note that for more exotic compounds you should view this as a guide only.

General information of Orpiment:	
Chemical formula:	As_2S_3
Molecular Weight:	246.04 gm
Composition:	Arsenic 60.90 % As Sulfur 39.10 % S
Empirical Formula:	As_2S_3
Environment:	Low temperature hydrothermal veins, hot springs, and fumaroles; also commony as an alteration product of arsenic minerals, especially realgar.
IMA Status:	Valid Species (Pre-IMA) 1747
Locality:	Common world wide. Link to MinDat.org Location Data.
Name Origin:	From the Latin, auripigmentum, in allusion to the vivid golden hue.
Synonym:	ICSD 15239 PDF 24-75
Orpiment Figure	 Comments: Deep orange-colored orpiment crystal aggregate. Location: Twin Creeks mine, 62 bench, north of Winnemucca, Humboldt County, Nevada. USA. Scale: 6.5 x 5.5 cm.
Orpiment Crystallography	
Axial Ratios:	a:b:c =1.1981:1:0.4431
Cell Dimensions:	a = 11.49, b = 9.59, c = 4.25, Z = 4; beta = 90.45° V = 468.29 Den(Calc)= 3.49
Crystal System:	Monoclinic - Prismatic H-M Symbol (2/m) Space Group: P $2_1/n$
X Ray Diffraction:	By Intensity(I/I_o): 4.82(1), 2.7(0.53), 4(0.47),
Physical Properties of Orpiment	
Cleavage:	[010] Perfect
Color:	Lemon yellow, Brownish yellow, Orange yellow.
Density:	3.49 - 3.56, Average = 3.52
Diaphaniety:	Transparent to translucent
Fracture:	Sectile - Curved shavings or scrapings produced by a knife blade, (e.g. graphite).
Habit:	Foliated - Two dimensional platy forms.
Habit:	Massive - Fibrous - Distinctly fibrous fine-grained forms.
Habit:	Prismatic - Crystals Shaped like Slender Prisms (e.g. tourmaline).
Hardness:	1.5-2 - Talc-Gypsum
Luminescence:	None.
Luster:	Pearly
Calculated Properties of Orpiment	
Electron Density:	$\rho_{electron}$=3.23 gm/cc note: $\rho_{Orpiment}$ =3.49 gm/cc.
Fermion Index	Fermion Index = 0.00293 Boson Index = 0.99707
Photoelectric:	$PE_{Orpiment}$ = 44.66 barns/electron U=$PE_{Orpiment}$ x $\rho_{electron}$= 144.44 barns/cc.
Radioactivity:	GRapi = 0 (Gamma Ray American Petroleum Institute Units) Orpiment is Not Radioactive

Element	%	Formal oxidation state	Formal electronic configuration
As	60.90	3	$[Ar].3d^{10}.4s^2$
S	39.10	-2	$[Ne].3s^2.3p^6$

Isotope pattern

What follows is the calculated isotope pattern for the As_2S_3 unit with the most intense ion set to 100%.

Formula: As_2S_3

Chemical form of arsenic

The arsenic atoms exists in the elemental form and in trivalent and pentavalent oxidation states. The toxicity of a given arsenical is released to the rate of its clearance to the body and therefore to its degree of accumulation in tissues. In general, toxicity increases in the sequence of organic arsenicals (organic arsenicals AS^{+5}arsenic). The organic arsenicals are usually excreted more rapidly then are in the inorganic forms. The pentavalent arsenicals have very low effinity for thiod groups in control to the trivalent compounds and are much less toxic.

Mechanism of action

Arsenate is a well-known up-coupler of mitochondrial oxidative phosphorylation. The mechanism is thought to be related to competitive substitution of arsenite. For inorganic phosphate with subsequent formation of an unstable arsenite ester that is rapidly hydrolyzed. This process is termed arsenolysis. Trivalent arsenicals including inorganic arsenite are regarded primarily as sulfhydral reagents. As such,

trivalent arsenicals inhibit many enzymes by reacting with biological ligands containing available – SH groups.

Absorption, distribution & excreation (Acharya Bhavamishra *et al*., 1995)

The absorption of poorly water soluble arsenicals such as AS_2O_3 greatly depends upon the physical state of the compound. coarse powdered material is less toxic because it can be eliminated in faeces before it dissolves, experimental evidence has shown a high degree of gastro-intestinal absorption of both trivalent and pentavalent forms of arsenic. Medicinal organic arsenicals vary in their extent of gastrointestinal absorption. Some are well absorbed and are given orally in the treatment of systemic infections. Others, those are poorly absorbed are used effectively against intra-intestinal parasites. The distribution of arsenic depends upon the duration of administration and the particular arsenicals involved. Arsenic is stored mainly in liver, kidney heart and lungs. Much smaller amounts are found in muscles and neural tissues. Because of the high sulphydryl content of keratin high concentration of arsenic are found in hairs and nails. Deposition in hairs and starts within two weeks after administration and arsenic stays fixed at this site for years. it is also deposited in bones and teeth and is retained there for long period. The low toxicity and high recovery of pentavalent arsenicals in urine and excreta indicate that very little reduction takes place. It appears that both trivalent and pentavalent forms are methylated in man. Because dimethyl Arsenic acid is a major form of arsenic excreted in urine. Arsenic is eliminated by many routes (feces, urine, sweat, hair, skin, lungs). Although most is excreted in urine in man. The half life for the urinary excretion of arsenic is 3 to 5 days.

Pharmacological & toxicological effects of arsenic (Acharya Bhavamishra *et al*., 1995)

Arsenicals have carried effects on many organs and systems. The effect on skin is as under: Actually, many arsenicals have vesicant effect on the skin that results in necrosis and sloughing. Chronic ingestion of low doses of inorganic arsenicals causes cutaneous. Vasodilatation prolonged use of arsenic however also chronic.

Chronic arsenic poisoning (Acharya Bhavamishra *et al*., 1995)

The most common early sign of common arsenic poisoning is muscle of the neck, eyelids, nipples and axillae. Hyperkeratosis weaknesses and aching, skin pigmentation specially. Gastro - intestinal involvement is less prominent in chronic exposures. Other signs and symptoms that should arose suspicion of arsenic poisoning include garlic odour of the breath and perspiration. Excessive salivation and sweating stomatitis. Generalized itching, sore, throat, coryza, lacrimation, numbness, burning or tingling of the extremities. Dermatitis, vitiligo and alopecia, poisoning may begin insidiously within symptoms of weakness, longer anorexia, occasional nausea and vomiting, diarrhoea or constipation. Subsequent symptoms may stimulate acute coryza. Dermatitis and keratosis of the palms and soles are the common features. Eventually the cirrhosis of liver may occur form the hepato toxic action. Peripheral neuritis results in motor and sensory paralysis of the extremities usually the legs are more severely affected than the arms. The bone marrow is seriously injured by arsenic by which severe explosion of all hematological pathways may be affected .and causes of hyperkeratosis. Particularly of the palms and soles are effected and hyper pigmentation over the trunk and extremities also can occur. Eventually those actions proceed to atrophy and degeneration and possibly to cancer. Skin eruptions are common in patients who received inorganic arsenic medication.

Acute arsenic poisoning (Acharya Bhavamishra *et al*., 1995)

Arsenic, in the form of AS_2O_3 used to be a common cause of poisoning because it is readily available. Particular it is test less and has the appearance of sugar. Fatal dose of Arsenic is 100 to 200 mg. Gastrointestinal discomfort is usually experienced within an hout after intake of the arsenicals. Although it may be delayed as much as12 hours, after oral ingestion, if food is in stomach. Burning lips, constriction of the throat and difficulty in swallowed may be the first symptoms followed by excruciating gastric pain projectile vomiting and severe diarrhea. Oliguria with proteinuria and haematuria is usually present. Eventually anuria may occur. The patient often complains marked skeletal muscle cramps and severe thirst. As the loss of fluids proceeds symptoms of shock appear. Hypoxic convulsion may occur terminally and coma, after death can occur within an hour. But usual interval is 24 hours.

DISCUSSION

Haratala

It is said in *Vedas* that it is the first step in regard of knowledge which was complied for the welfare of the humanity all over the world. Ancient importance of any reference is rooted in Vedas. In the subject of *Haratala*, a stanza in *Rigveda* (Rasendra Purana and Khemraj Shrikrishnadas, 2000) is available, showing its importance. According to this stanza, an arrow whose above part is prepared with a part of the Horne of deer named *Ruru* is coated with *Haratala*. Moreover, the front part of this arrow is made of iron and is prepared with different chemical procedures. Such type of arrow is it is to be released in the sky, the very good rain can be obtained with its influence. This type of specific arrow, who prepares and possesses, we are bowing to that goddess. However, here there is no any reference of medicinal application of *Haratala* in this incantation. But, for the sake of human welfare an experiment of artificial raining is indicated here. At that time when treatises of *Ayurveda* were written the prosperity of *Ayurveda* was at its peak. It was the starting phase but the golden age of *Ayurveda* due to the basic principles established at this stage itself. These two treatises of *Ayurveda* are considered as authentic texts even up to this time viz. *Charaka Samhita* and *Sushruta Samhita*. These are dealing with medical and surgical aspects respectively. In *Charaka Samhita* fourteen references of *Haratala* in different places with different aspects are available. Out of fourteen, five references can be seen in *Sutrasthana*, such as in counting of *Parthiva Dravyas*, an external application in various skin disorders and in the subject of *Sirovirecana* as an ingredient of *Dhumapana*. In *Chikitsasthana* also *Haratala* is indicated for skin diseases apart form *Unmada* (insanity), *Hikka* (Hiccups), *Shwasa* (Dyspnoea), *Kasa* (Cough) and in *Visa Chikitsa* (Toxicosis) in the form of oil and *Sura* etc. it is used for *Pradeha Pralepa* (the external aplications) *Dhumapana* (smoking) *Anjana* (collrium)

and in the form of powder and *Agada* for internal uses. In *Sushruta Samhita*, orpiment has been counted in *Sthavara Vishas*. Moreover, he has described arsenic and orpiment as two *Dhatuvishas*. Totally 29 times orpiment is quoted for various points of views as follows. In *Sutrasthana* only two references are there which are in the subject of *Vranas Odhana Dravyas* (for cleansing wounds). In *Chikitsasthana*, is references are available. They are mainly in the subject of *Varana Sodhana* (wound cleaning), *Pandu Karma* (Coloring the skin after scars of wounds) *Arsha* (Piles), various skin disorders, *Granthi* (nodules) *Upadamsa* (Syphletic pimples) *Visarpa* (spreading poisonous wounds) and as a hair remover in different *Yogas*. In *Kalpasthana* two references are available in the counting of *Dhatuvishas* and *Lutadansa Chikitsa*. Simultaneously in *Uttara Tantram*, seven references are available in the subject of warms, eye diseases, skin diseases and several paediatric disorders in the form of oil, powder, and *Dhumapana*. In the texts of *Rasa Sastra* and *Nighantus* the literature of *Haratala* is available in details. Most of the texts of *Rasa Shastra* have described *Haratala* with its synonyms, properties, *Shodhana, Marana, Satva Patana* etc. the texts of 12^{th} and 13^{th} centuries as *Rasa Prakasa Sudhakara, Rasendra Sarasangraha, Rasa Sara*, *Rasachintamani, Rasa Ratna Kara* (By *Nityanatha*). Have described alchemical and pharmaceutical processes and the pharmacology of *Haratala* thoroughly. In 13^{th} century the author of *Rasakamadhenu* compiled the uses of *Haratala* and remedies according to diseases and systems. *Rasatarangini, Rasacandamshu*, *Rasajalanidhi* etc. texts are considered to be of 20^{th} century. In these texts, the description of *Haratala* has been modified.

Conclusion

- *Haratala* is a well-known drug from the *Vedic* period and described in many legend *Ayurvedic* classics and *Rasa Granthas.*
- *Haratala* is used both internally and externally.
- According to various literatures *Patra Haratala* is therapeutically used.
- *Shuddha Haratala* is not used alone. It is administered along with herbal drugs or in the form of *Rasamanikya.*
- *Haratala* can be artificially prepared by 49 parts of purified arsenic oxide (*Somala*) and 24 parts of purified sulphur (*Gandhaka*) are mixed in a mortar.
- *Ashuddha Patra Haratala* is having yellowish with brown tinge with shiny, peculiar odor with crystalline smooth surface.

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