

HINGULA (RED SULPHIDE OF MERCURY): A CONCEPTUAL REVIEWJolly Saxena¹, Vinita^{2*} and Ankur Saxena³¹Professor, PG Department of Rasa Shastra & Bhaishjya Kalpana.²Lecturer, PG Department of Dravyaguna.³Lecturer, PG Department of Rog Nidan & Vikriti Vigyan, Major S. D. Singh PG Ayurvedic Medical College and Hospital Farrukhabad (UP).***Corresponding Author: Dr. Vinita**

Lecturer, PG Department of Dravyaguna.

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ABSTRACT

Hingula is described as the cheapest and easiest source of *Parada* (Mercury). It is classified under both *Maharasa* and *Sadharanarasa Varga*. In ancient time it was used in the incineration procedures of gold, silver and other metals. Best quality of *Hingula* colour is like *Japa-pushpa* or *Gudhal pushpa* (shoe flower). Chemically it is Red sulphide of mercury (HgS) and called Cinnabar. It is considered as the most popular mineral for obtaining mercury across the world. Purified *Hingula* is useful in the treatment of all types of eye diseases (*Netra Roga*). It is therapeutically used in various disease conditions of liver, pancreas, skin and rheumatoid arthritis (*Amavata*), diabetes mellitus (*Prameha*), fever (*Jwara*), spermatorrhoea (*Sukrameha*) and leprosy (*Kustha*). *Hingula* has been used in many formulations.

KEYWORDS: Ayurveda, *Hingula*, Cinnabar, Red sulphide of mercury (HgS).**INTRODUCTION**

Hingula is one of the most important compound minerals of *Rasa-Sashatra*. It is also called *Rasodbhava* means precursor of *Rasa (Parada)*, and described as the cheapest and easily available source of *Parada* (mercury). It is classified under both *Maharasa* and *Sadharanarasa Varga*. Best quality of *Hingula* colour is like *Japa-pushpa* or *Gudhal pushpa* (shoe flower). In the classical age, the native form was procured from *Darada Desha* and *Malechha Desha*. It is a combination of *Parada* (Mercury) and *Gandhaka* (Sulphur). Chemically it is Red sulphide of mercury (HgS) and called Cinnabar. Cinnabar contains about 86% of mercury and 14% of sulphur. It is considered as the most popular mineral for obtaining mercury across the world. It is heavy, soft in grinding and bright red in appearance. Purified *Hingula* is therapeutically used in various disease conditions because *Hingulottha Parada* (*Parada* extracted from *Hingula*) is considered as equally potential as *Ashta samskarita Parada*. It is also used in the extraction procedures of gold, silver and other metals.^[1-2]

Classical Description**Synonyms of *Hingula***^[3-5]

Rasagarbha, *Chitranga*, *Churnaparada*, *Daityaraktaka*, *Rakta*, *Raktaparada*, *Shukatundaka*, *Hansapad*, *Maraka*, *Ranjaka*, *Ranjana*, *Lohaghna*, *Charmara*, *Uru*, *Rasagandhka sambhuta*, *Rasodbhava*, *Malechchha*,

Darada, *Kapishirshaka*, *Rasasthana* etc are the synonyms of *Hingula* mentioned in various texts.

1. ***Rasagarbha***- precursor of *Rasa (Parada)*.
2. ***Rasodbhava***- precursor of *Rasa (Parada)*.
3. ***Chitranga***- outer surface looks like red and white mixture shades.
4. ***Churnaparada***- its powder contains *Parada*.
5. ***Daityaraktaka***- blackish red colour.
6. ***Rakta***- Red Colour.
7. ***Raktaparada***- red ore of *Parada*
8. ***Shukatundaka***- look like the colour of the beak of Parrot.
9. ***Hansapad***- appear like the colour of feet of swan.
10. ***Maraka***- used for *marana* of *Parada*.
11. ***Ranjaka***- used as a colouring agent.
12. ***Ranjana***- used as a colouring agent.
13. ***Lohaghna***- incineration for metals.
14. ***Rasagandhka sambhuta***- a combination of *Parada* and *Gandhak*.
15. ***Malechchha***- It was imported from other countries (Greek)
16. ***Darada***- found in '*Darada Desha*' near Kashmir.
17. ***Kapishirshaka***- Colour looks like the head of a monkey.

REVIEW OF LITERATURE

Vedic Literature

No references regarding *Hingula* are available in any of the Vedas. In *Garuda Purana Hingula* has been used in ear diseases.^[6]

Classical literature

Parad has been mentioned in classical texts but, there are no any references regarding *Hingula* in these texts.

Ancient literature

In *Kautilya Arthasashtra*, *Hingula* has been first ever described as the natural ore which was used for testing of gold metal. But the medicinal use was not described in this text. In *Brihat Samhita*, *Hingula* has been described for the preparation of 84 types of *Gandhyukti* (perfumes).^[7]

Chikitsa Grantha

The pharmaceutical use of *Hingula* started from *Chakradatta* and after onward all *chikitsa granthas* have used in their formulations.

Rasa Grantha

Rasendramangala (6 to 8 Cent. A.D) described for the first time about the therapeutic uses by the synonyms as *Darada*. Then after almost all texts of *Rasashastra* have described *Hingula* in their texts.

Nighantu

Abhidhan manjari, *Kaidev ni ghantu*, *Dhanwantari nighantu*, *Bhaprakash nighantu*, *Madanpal nighantu*, *Raja nighantu*, *Laghunighantu*, these all have described *Hingula*.^[8]

Origin of Hingula

A mythological origin of *Hingula* has been mentioned in *Rasaratna Samucchya*. It is originated from the mouth of *Agni Deva*. Due to its heaviness, it fell in the area of *Darad Desha* and mixed with soil and situated underground. That's why it is called *Darad Hingula*. By the procedure of *Urdhvapatan*, mercury can be obtained from *Hingula*.^[9]

Classification of Hingula^[10-11]

Various *Rasa* texts have classified *Hingula* under the different groups.

1. **Rasa-** *Rasahridaya Tantra*
2. **Maharasa-** *Goraksh Samhita*, *Rasarnava*, *Rasakamdhenu*, *Rasa Kalpa*, *Hridaya mala Tantra*
3. **Uparasa-** *Rasendrasar Samgrah*, *Rasamanjari*, *Anandkand*, *Rasa Ratnakara*, *Rasa Prakash Sudhakar*, *Rasendra Chintamani*, *Ayurvedaparakasha*, *Brahadyoga Tarangini*, *Rasendra Bhaskara*, *Brihat Rasaraj Sunder*.
4. **Sadharanrasa-** *Rasaratna Samucchya*, *Ayurveda Prakasha*, *Rasa Chandanshu*, *Ras Jala Nidhi*, *Rasa Dhatu Prakasha*, *Bharatiya Rasa Shastra*

Types of Hingula^[10-12]

Rasa Tarangini, *Ayurveda Sar Sangraha* and *Rasa Dhatu Prakasha* have described 2 types of *Hingula* based on its origin-

1. **Khanija**
2. **Kritrim**

Anand Kanda, *Rasa Kamdhenu*, *Parada Sanhita*, *Rasa Jalandhi*, *Brihat Rasarajsunder*, *Ayurveda Praksha*, *Rasa Chandanshu* and *Purandararahasya* have mentioned 3 types of *Hingula*. These are also considered as *Khanija* origin.

1. **Charmara**
2. **Shuka Tunda**
3. **Hansa Pada**

Rasaratna Samucchaya, *Rasa Prakashasudhakara* and *Rasendrachudamani* have mentioned only 2 types of *Hingula* as-

1. **Shuka tunda**
2. **Hansa pada**

In these texts, the term *Charmara* has been also used as a synonym of *Shuka tunda*.

In *Rasarnava* 2 types of *Hingula* are described as-

1. **Churna Rupa** (Powder form)
2. **Parada Rupa** (Mercury Form)

Rasamritum has mentioned 2 types of *Hingula* as-

1. **Hansa pada**
2. **Malecchaka**

Khanij Hingula (mineral)

It is a compound element of *Parada* (mercury) and *Gandhaka* (sulphur). In which 86.2% mercury and 13.8% sulphur are found.

Kritim Hingula (artificial)

Parada (mercury) and *Gandhaka* (sulphur) are taken in 6:1 ratio and the mixture put and packed in an iron vessel of the iron lid or *Mridanga Yantra*. Then the pot heated in high fire and then a red compound found stuck on iron lid. This red compound has been used as *Hingula*.

Charmara Hingula

Purandar Rahasya has mentioned that it is black. Rubbing on a hard surface it produces a black line. *Rasaratna Samucchya* has called it *Charmar* and colour resemble like *Shuktunda*. In *Ayurved Prakash* it is mentioned as *Shukvarna* in colour.

Shuka Tunda Hingula

Purandar Rahasya has mentioned that it is *Pitavarna* (yellow) *Hingul*. *Rasaratna Samucchya* has also called it *Charmar*.

Hansa Pada Hingula

Rasaratna Samucchya has called it *Pravalabh Hingul*. *Purandar Rahasya* and *Ayurveda Prakash* have mentioned that it is red like a shoe flower. Rubbing on a

hard surface it produces a red line with a white tinge. It is the main ore of mercury.

Hansapada variety is considered to be the best, *Shukatunda* is medium and *Charmara* is having least qualities.

Characteristics of Best Hingula

Best quality of *Hingula* should be like *Pravala* (coral), *Japakusuma* (shoe flower) in colour. It should possess white lines or *salaka* like structure on its surface. On grinding of *Hingula*, it appears firm soft and looks like shiny red colour. It is heavy in weight.^[13-14]

Need of Purification of Hingula

Intake of *Hingula* without purification causes *Moha* (psychosis), *Prameharoga* (diabetes mellitus), *Chitta-*

vibhrama (delirium), *Andhatwa* (darkness before eyes), *Klama* (tiredness), *Kustha* (skin diseases), *Klaibya* (impotence), *Bhrama* (giddiness) and *Sarirakshinatva* (emaciation). So, it should be properly purified before the therapeutic use.^[15-16]

Prativish (antidote) of effects of unpurified Hingula:

A mixture of *Suddha Gandhaka* (purified sulphur) with cow ghee should be taken internally.^[17]

Shodhana (Purification) of Hingula

Rasa-ausadhi is obtained from mineral ore, compound with earthen impurities and contamination. So there is a need for proper purification before their use. Some most important procedures are described below-.

Table 1: Purification procedure of Hingula.

S.N.	Procedures	Ref.
1.	Fine powder of <i>Hingula</i> , given <i>Bhawana</i> with <i>Ardraka Swarasa/ Lakucha Swarasa</i> , alternately for 7 times.	[18]
2.	<i>Bhavana</i> with <i>Kamala Patra Rasa</i> (lotus petal juice) for 3 hours.	[19]
3.	7 times <i>Bhawana</i> with Lemon juice (<i>Nimbuka swarasa</i>) and washed with water and drying in sunlight.	[20]
4.	Pieces of <i>Hingula</i> are kept in a centre of <i>Kushmanda Phala majja</i> and boiled in a <i>Dolayantra</i> , with <i>Lakuch Swarasa</i> for 3 days.	[21]
5.	<i>Hingula</i> are boiled in a <i>Dolayantra</i> with <i>Jayanti swarasa</i> or <i>Gomootra</i> or <i>Kanji</i> or <i>Nimbu swarasa</i> for 3 then <i>Bhavana</i> with <i>Beejapoorak Rasa</i> for 3 times.	[22]
6.	<i>Bhawana</i> with the <i>Meshi Dugdha</i> (sheep's milk) for 7 times and then 7 times with <i>Amlavarga dravya</i> ..	[23]

Shuddha Hingula lakshana

Normally unpurified *Hingula* is red but after *Shodhana* the redness increases and looks like ripened *Bimbiphala*.^[24]

Rasapanchaka (Pharmacological properties)^[24-26]

Rasa- Tikta, Kashaya, Katu (*Rasarnava, Dhanvantari Nighantu –Madhura- Tikta Rasa*)

Guna- Ushna, Laghu

Virya- Ushna (*Dhanvantari Nighantu*)

Vipaka- Katu (*Dhanvantari Nighantu*).^[27]

Dosh-karma- Kapha-Pitta nasak, *Tridoshaghna*

Karma - Rasayana, Sarvadoshaghna, Vrishya, Vishahar
Amayeek prayog (Therapeutic uses)- *Deepana, Netraroghar, Plihahar, Kamalahar, Jwarahar, Kusthahar, Amavatahar, Pramehahar*

Therapeutic Dose - ½ -1 Ratti (62.5 mg – 125 mg).^[28]

Anupana - Maricha, Guda, Pippali, Guduchi swarasa, Madhu.^[29]

Marana of Hingula

The procedure of *marana* is used for the preparation of *bhasma*. Accordingly prepared *bhasma* has to become ready for the use.

Table 2: Extraction procedure of mercury from Hingula.




S.N.	Procedure	Yantra/ place of collection of Parada
1.	Seven <i>Bhavana</i> of <i>Nimbu Swarasa</i> or <i>Lakucha Swarasa</i> or <i>Aardraka Swarasa</i> .	<i>Urdhwa Paatana Yantra/</i> collected from inner surface of upper pot.
2.	Triturated with <i>Aardraka Swarasa</i> or <i>Lakucha Swarasa</i> or <i>Nimbuka Swarasa</i> and paste is prepared.	<i>Adha Paatana Yantra/</i> collected at the base of the lower pot.

Other important uses of Hingula

Hingula is given *Bhavana* with *Meshi Dugdha/ Aamla Varga* for seven times and the *Shodhita Hingula* is used marana (incineration procedures) of gold, silver and iron etc. metals. It is useful in *Parada Jarana* (increasing the therapeutic potency of mercury).

Modern Description

Cinnabar ore is a vibrant red mineral that contains a mixture of mercury and sulphur. It is widely used as a colouring agent since the sixth century BC.

<p>Category – Mineral Class - Sulphide and Sulpho Salts English Name – Cinnabar Scientific Name – Red Sulphide of Mercury Latin Name – Sulfuratum Hydrargyrum Chemical formula–Mercury (II) Sulphide (HgS) Molecular Weight – 232.66 gm.</p>			
	Fig.1. Unpurified Hingula	Fig.2. Purification process of Hingula	Fig.3. Purified Hingula

Source of cinnabar

There are two available sources as native or natural and artificial form. Presently it has been sourcing from many mines over the world. Natural ore has been mined from Spain, Italy, France, Germany, China, Japan, Russia, America, Iran, South Africa, Kenya etc. An oldest one Almaden mines in Spain have fulfilling one-third requirement of mercury.

Natural ore is also divided into two subtypes- *Disseminated ore*, which is fine-grained impregnated with mineral and *Deposited ore* which is found in fissures or cracks of rock.^[33]

Unfortunately, *Hingula* is not found in India, so that it has been artificially manufactured from *Rasa-sashtra* period. Now it has been manufactured in Surat, Kolkata and part of the country.

Varieties of Cinnabar^[34]

There are following varieties of Cinnabar-

- 1. Ordinary** –Cinnabar crystallizes in Rhombohedral or Trapezohedral Crystals.
- 2. Hepatic cinnabar** – It is liver brown coloured, mixed with Bitumen content and structurally in granular.
- 3. Meta cinnabar-** It is black and HgS crystallizes in cubic form.
- 4. Hypercinnabar-** It crystallizes in the hexagonal form. It may be *Hanspada*.
- 5. Synthetic Cinnabar-** It is produced by treatment of Hg(II) salts with hydrogen sulphide to precipitate black.

It is synthetic meta Cinnabarite, which is then heated in water. This conversion is promoted by the presence of sodium sulphide.

Physical characteristics

- **Colour** – Brownish- red / Vermilion

- **Crystal Habit** – Rhombohedral to tubular Granular to massive
- **Crystal System** – Trigonal, Hexagonal
- **Cleavage** – Prismatic, Perfect (Perfect in three directions)
- **Fracture** – Sub – conchoidal to uneven some what sectile
- **Hardness** – 2-2.5 (Mons scale) Gypsum Finger Nail
- **Lustre** – Adamantine to dull inclining to metallic
- **Refractive index** – Transparent to Opaque
- **Streak** – Scarlet
- **Density-** 8.1
- **Specific gravity** – 8- 8.2 gm/cm³
- **Solubility** – 3×10⁻²⁶g per 100 ml of water
- **Not reacted-** to acids like HNO₃ or HCl
- **Indices of Refraction** – W= 2.91, E+27, with strong by refraction shows strong circular polarization.

Structure of Cinnabar

Cinnabar (HgS) has two structures-

1. *Dimorphous Structure*
2. *Zinc blende structure*

Dimorphous is the more stable form of Cinnabar. The Black form of HgS has zinc blended structure.^[33-35]

Industrial Uses of Cinnabar

Cinnabar is the primary ore of mercury. It was mined by the Roman Empire for its mercury content and mercury was a crucial ingredient used in the extraction of gold and silver. It is also used as a pigment and as a mineral specimen.

Medicinal Uses of Cinnabar

Cinnabar is known to be highly toxic. It is used in very small quantity. Used internally cinnabar is believed to clear away 'heat' and tranquillize the mind. It is used as a tonic and for heart palpitation, restlessness, insomnia, sore throats and mouth sores. Also, Cinnabar is applied externally to treat some skin disorders and infections.

Extraction of Mercury from Cinnabar

Mercury is extracted by heating cinnabar ore in a current of air and condensing the vapour. The equation for this extraction is: $HgS + O_2 (6000C) \rightarrow Hg \text{ (liquid)} + SO_2 \text{ (gas)}$. To produce liquid (quicksilver) mercury, crushed cinnabar ore is roasted in rotary furnaces. Pure mercury separates from Sulphur in this process and easily evaporates. A condensing column is used to collect the liquid mercury.^[36]

Special precaution as Heavy metal toxicity

The heavy metals most commonly associated with poisoning of lead, mercury, arsenic and cadmium. A heavy metal, a dense metal that is usually toxic at low concentrations. Most heavy metals have a high atomic number, atomic weight and a specific gravity greater than 5.0. Because of the high toxicity of mercury, both the mining of Cinnabar and refining of mercury are the hazardous and historic cause of mercury poisoning.^[37]

Some Preparations of Hingula:

There are some frequently used *Hingula* preparations are mentioned in various *Rasa* text.

Table 3: Important classical preparations of Hingula

1. <i>Shreesiddha hinguleshwara Rasa</i>	2. <i>Mritunjaya Rasa</i>
3. <i>Mritsanjeevan Rasa</i>	4. <i>Amritmanjari Rasa</i>
5. <i>Anandbhairav Rasa</i>	6. <i>Kanaksunder Rasa</i>
7. <i>Jwaramurari Rasa</i>	8. <i>Jwaradhuketu Rasa</i>
9. <i>Vasantmalti Rasa</i>	10. <i>Rasagarbha Pottali</i>
11. <i>Tribhuvankirti Rasa</i>	12. <i>Kasturibhairav Rasa</i>
13. <i>Kamagnisandeepan Rasa</i>	14. <i>Kshetrapal Rasa</i>
15. <i>Atisarahari Vati</i>	16. <i>Hinguladhya Malahara</i>
17. <i>Hingula Maanikya Rasa</i>	18. <i>Shreesiddha daradaamruta</i>
19. <i>Darad Vati</i>	20. <i>Hingula Amruta Malahara</i>

CONCLUSION

It may be concluded that Indians were aware of *Hingula* since 200 years B.C. *Hingula* was prepared artificially by the author of *Rasa Ratnakar* in 13th Century A.D. It was also used in the extraction procedures of gold, silver and other metals. So, the knowledge regarding the *Hingula* had been increased step by step. Therapeutically it has been used for *Deepana*, *Netrarog*, *Pliharog*, *Kamala*, *Jwara*, *Kustha*, *Amavata*, *Prameha* and other diseases also. Due to the high toxicity of mercury, it must be purified and perfectly incinerated. There is a need for further studies to reduce or keep free from toxicities for global acceptance of *Rasa-aushadhis*.

Conflict-of-Interest: No.

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