



A REVIEW ON POLYMORPHS OF MERCURY SULPHIDE

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Article Received on 04/03/2018

Article Revised on 25/03/2018

Article Accepted on 15/04/2018

ABSTRACT

Polymorphism is the property of some chemical compounds to exist in two or more different forms, in same physical state. Mercury sulphide, a compound of mercury and sulphur is known to exist naturally as *hingula-cinnabar* and also to be available in artificial forms as vermilion, *rasa sindura* and *kajjali*. The science of life, *Ayurveda* has described method of preparation and different therapeutic utility of these polymorphic compounds. Texts of *Rasa Shastra*, articles and all internet sources are referred for collection, compilation and classification of the properties and uses of the polymorphs of mercury sulphide. The *hingula* is *kapha hara* in nature; the *kajjali* is an intermittent base for other formulations, its indication and the indication of *rasa sindura* depends on their *anupana*. The vermilion doesn't have any therapeutic description but the method of its preparation matches with methods of preparing artificial *hingula* and *rasa sindura*.

KEYWORDS: Mercury sulphide, Polymorph, *Rasa shastra*.

INTRODUCTION

Polymorphism is the ability of a solid material to exist in more than one form or a crystal structure. It can be potentially be found in any crystalline material including polymers, minerals and metals.^[1] Polymorphs have different stabilities and may spontaneously convert from metastable (unstable) form to stable form at a particular temperature.^[2] Medicine is often administered orally as a crystalline solid and dissolution rates depend on the exact crystal form of a polymorph.^[3] Mercury sulphide, mercuric sulphide or mercury (II) sulphide is a chemical compound composed of the chemical elements mercury and sulphur. It is represented by chemical formula HgS. It is virtually insoluble in water.^[4]

MATERIALS AND METHODS

The combination of mercury and sulphur to make a compound of activity is seen in several texts of *Rasa Shastra* with natural and formulated origin.

1. Hingula: *Hingula*, a *saddharana rasa* is considered as the ore to obtain the best *parada* is chemically called red sulphide of mercury. In natural state it is red as *japa kusuma* (*Hibiscus rosasinensis*), can be easily triturated, shiny and heavy.^[5] The *hingula* with these *lakshana* (properties) is called *hamsapada hingula* and is considered to be best for therapeutics. But when

administered raw/ unprocessed the *hingula* may cause *moha* (psychosis), *prameha* (diabetes), *chitta vibhrama* (delirium), *andhyatwa* (blindness), *klama* (tiredness) and *sharira kshinatwa* (emaciation). Hence, it is made *shuddha* (purified) by triturating it for 7 times with juice of *nimbhu* (*Citrus medica*) or *ardraka* (*Zingiber officinale*) or *lakucha* (*Atrocarpus lacucha*) or in milk of *meshi* (*Ovis aries*).^[6] *Byshodhana* (purification) the *hingula* cures *lochana amaya* (diseases of eyes), *pliha roga* (splenic diseases), *kushta* (skin diseases), *gara visha* (artificial poisoning), *kamala* (jaundice), *meha* (diabetes), *amavata* (arthritis), *jwara* (fever), mitigates *kapha*, diseases of *pitta dosha*, improves *bala* (strength), *varna* (complexion) and *medha* (intellect). Practically, it cures the same diseases it causes when taken raw.^[7]

Hingulottha parada: After purification, it is subjected to *patana yantra* (sublimation apparatus) for extraction of *parada* which is considered more pure doesn't require any method of processing (*samskara*).^[8] The ancient Greeks extracted mercury from same ore. Structurally cinnabar belongs to trigonal crystal system.^[9] In modern the extraction of mercury from cinnabar is dated from Neolithic age. The extraction apparatus with description of methods of obtaining mercury from cinnabar are found in *Alchimia* of 15th century.

2. Kajjali: *Shuddha gandhaka* (purified sulphur) along with metals and minerals is ground with *shuddha parada* (purified mercury) without addition of water till the mixture turns soft and black like kajjali (collyrium). It is called kajjali.^[10] It is a *bandha of parada* and is used in many compound formulations to increase their efficacy.^[11] This *kajjali* is used to prepare several formulations of different types as *kharaliya kalpana* (ground formulations), *pottali kalpana* (steamed formulations), *parpati kalpana* (flakes) and *kupipakwa kalpana* (sublimed formulations).

3. Rasa Sindura And Vermilion: The *rasa sindura* is a *kupipakwa kalpana*, prepared by triturating 1 pala (48g) each of *parada* and *gandhaka* into *kajjali* and again triturate it for 7 times by adding *vata ankura swarasa*; filling it in a *mrit vastra lepita kachakupi* (bottle dressed with mud cloth); heating it for 3 *yama* (12 hours) by 4 hours each in *mrudu*, *madhyama* and *tikshna agni* (mild, moderate and intense flame). The sublimed extract is obtained from neck of the bottle. The same process is done to collect vermilion.

The Chinese were probably the first to make a synthetic vermilion as early as the 4th century BC. The Greek alchemist *Zosimus of Panopolis* (Third–Fourth century AD) wrote that such a method existed. In the early ninth century the process was accurately described by the Persian alchemist *Jabir ibn Hayyan* (722–804) in his book of recipes of colours, and the process began to be widely used in Europe.^[12,13]

The process described by *Jabir ibn Hayyan* was fairly simple. Mercury and sulphur were mixed together, forming a black compound of sulphide of mercury, called *Aethiopes mineralis*. This was then heated in a flask. The compound vaporized, and re-condensed in the top of the flask. The flask was broken, the vermilion was taken out, and it was ground. When first created the pigment was almost black, but as it was ground the red colour appeared. The longer the colour was ground, the finer the colour became. The Italian Renaissance artist *Cennino Cennini* wrote: "if you were to grind it every day even for twenty years it would keep getting better and more perfect."^[14]

During the 17th century a new method of making the pigment was introduced, known as the 'Dutch' method. Mercury and melted sulphur were mashed to make black mercury sulphide then heat in retort, producing vapours condensing as a bright, red mercury sulphide. To remove the sulphur these crystals were treated with a strong alkali, washed and finally ground under water to yield the commercial powder form of pigment.^[15] The pigment is still made today by essentially the same process.

CONCLUSION

The mercury sulphide is available in different forms in solid state. The indication of each form varies. The mode of preparation and their resulted morphology decide their

therapeutic action. Though all the three substances (*hingula*, *kajjali* & *rasa sindura*) contain the same elements, different *samskara* did which change their site of action also in the human body. Thus, polymorphism in drugs can also have direct medical implications. Polymorphic purity of drug samples can be checked using techniques such as powder X-ray diffraction, IR/Raman spectroscopy, and utilizing the differences in their optical properties in some cases.\

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