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## RESEARCH ARTICLE

### REVIEW ARTICLE ON MERCURY CONTAINING COMPOUNDS AND ITS TOXICITY

**Anuja Hari Gholap<sup>1</sup>, Madhavi P.Mahajan<sup>2</sup>, Rashmi Kakade<sup>3</sup>, Sagar Rokade<sup>4</sup>  
and Mahesh K.Gupta<sup>5</sup>**

<sup>1,3,4</sup>Department of Kayachikitsa, Bharati Vidyapeeth Deemed University College And Hospital of Ayurveda, Katraj-Dhankawadi, Pune-43

<sup>4</sup>Department of Swasthavritta, Bharati Vidyapeeth Deemed University College And Hospital of Ayurveda, Katraj-Dhankawadi, Pune-43

<sup>5</sup>Private Practitioner, Pune

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#### ABSTRACT

Rasashastra has been using herbo-mineral metallic preparations in therapeutics since decades. Rasashastra texts does not advise single use of Mercury because of its two prime properties namely quickness & liquid state. The fine black powder obtained from trituration of mercury with metals, sulphur & other substances, without addition of any liquid substance is known as Kajjali. Most Rasashastra formulations use Kajjali as a basic ingredient. Different Khalvi Rasayana (drugs prepared in mortar & pestle) has been reviewed to identify percentage of Kajjali in single dose. Article consists of manufacturing, analysis, therapeutics & toxicological aspect of Kajjali. Mercury is a major toxic metal.

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#### INTRODUCTION

All rasa kalpas contain mercury and sulphur. For example, Cinnabar as a compound (contains mercury sulfide) has been used in traditional medicines for thousands years as an ingredient in various remedies. Such traditional medicines are still in use today. Absorbed mercury from cinnabar is mainly accumulated in kidney. Heating cinnabar results in release of mercury vapor, which in turn can produce toxicity similar to inhalation of these vapors. The doses of cinnabar required to produce neurotoxicity are thousands times higher than methyl mercury. Renal dysfunction may occur after its long term use. Dimercaprol and succimer are effective chelation therapies for general mercury intoxication including cinnabar. Pharmacology studies of cinnabar suggest sedative and hypnotic actions. In brief, cinnabar and other compounds containing mercury are chemically inert with a relatively low toxic potential when taken orally.

Mercury is the most crucial ingredient of Rasa kalpas. Ayurveda has used mineral and herbo-mineral preparations. It has properties like quickness, since times immemorial. It is the only metal in liquid state which made it crucial but is

unsuitable to use it in natural form [2]. To international market, it is now reaching to each parameter overcome such difficulties scholars of and every part of world are coming together. About 80% of the Rasashastra mentioned the procedures to Rasa Kalpas used are Khalvi Rasayana in control the unsteadiness of mercury are known which Kajjali is key ingredient. Kajjali is also used as a Mercurial Bond. They are used in multiple preparation of different dosage forms total 25 types of Parada Bandha (Mercury like Parpati, Kupipakwa Rasayana & Pottali bonding procedures) mentioned in Rasa Ratna. So importance of Kajjali being basic Samucchaya [3]; one of them is Kajjali ingredient is which is untouched. Trituration of purified Mercury is known since ancient period & used in Sulphur till formation of black powder (Kajal) Rasashastra from decades. Description of such a product is called Kajjalika. Kajjali was firstly used and was given by Nagarjuna in 8th century [1]. Though Kajjali (Black Sulphide of Mercury) is familiar to European countries since 10th century but they were and are not well versed about its medicinal properties.

##### Various definitions of Kajjali

The fine black powder obtained from triturating mercury with metals, sulphur & other substances, without addition of any

\*Corresponding author: **Anuja Hari Gholap**

Department of Kayachikitsa, Bharati Vidyapeeth Deemed University College And Hospital of Ayurveda, Katraj-Dhankawadi, Pune-43

other liquid substance is known as Kajjali [5]. Sulphur can be added to mercury either in equal quantity or half quantity [6]. (i.e.1:1, 1/2, 2, 3, 4, 5, 6, 8, 16 parts i.e.in various proportions). [7]. Through this process mercury & mercurial compounds develop definite disease curing capacity & after Murcchana mercury doesn't return to its original form. Kajjali is Sagandha (with Sulphur) & Niragni (without fire) Murcchana. Sagandha Murchana of Mercury doesn't create any untoward effect on body even if its intake is continued after the disease is cured [8]. When Kajjali is consumed especially with anupana (Vehicle) it cures all types of diseases. It normalizes the Tridosha and has Vrishya (aphrodisiac) property. countless formulations, small drug dose, rapid action, desired results, long lasting effects, palatability are specialties of Kajjali. [9]. Rasachandanshu has mentioned its therapeutic use in Upadansha (Syphilis).

For any drug containing heavy metals (for example mercury), such structural information is an absolute necessity<sup>24</sup>. *Ras-Sindoor* is a well known mercury based *bhasma* prescribed for certain diseases, viz. syphilis, genital disorders and also for rejuvenation purposes<sup>25</sup>. The combination of sulphur is believed to have neutralized the toxicity of mercury<sup>26</sup>. Some researchers utilized Hg as tracer to study the pharmaco-kinetics and bio-distribution of *Kajjali* (a sulphur and mercury preparation)<sup>27</sup>. Several others have also worked on the efficacy and safety aspects of mercurial preparations in such traditional drugs<sup>28,29</sup>.

Use and Role of Kajjali as a Rasayana drug (rejuvenative)-Kajjali is prepared from 1 part purified Mercury and 1 Part purified Sulphur. Honey, Ghee, Shilajeet and Amaltas powder should be taken in equal quantity. The mixture is advised in dose of 2 g. per day. When taken for a period of one month, it acts as an anti-ageing agent.[10].Kajjali own properties like Rasayana (antiageing) & Yogavahi (as catalyst) [11], Jantughnata (anti-microbial), Sarvaamayahara (broad spectrum) [11]. These properties of Kajjali are essential to enhance efficacy & potency in prepared drug. Yogvahitwa property has importance in pharmacokinetics of drug as it drags whatever is mixed with it towards the target tissue down in to the deeper and most inaccessible parts of the system. When mixed with other medicines they become more potent and act in low doses. Kajjali increases the bio-availability of drug which helps to obtain greater efficiency of drug. The ancient authors described Rasa-Chikitsa as the best treatment.[12] Rasashastra, the pharmaceutical science, deals mainly with the processing and therapeutic utilization of Mercury, metals and minerals.[13] It aims at designing novel drugs with better curative attributes at minimal doses.[14] There are two classes of thoughts as far as the pharmacology of Kajjali is concerned.[15] One is by considering the proposals that Mercury and mercurial compounds such as Kajjali are not absorbed through the GI tract and the other line of thought considers mercurial absorption. When the theories stipulate that Kajjali is not absorbed in the GI tract, it is postulated that it eventually acts as GI stimulant, locally also as neuro-chemical irritant for the intestinal mucosa.[16] It also acts as catalyst and hence through its catalytic activity, better absorption of herbal pharmacological molecules is achieved. Hence, the net activity of Kajjali is that it eventually increases the bioavailability of

ingested drugs. Internal administration of Kajjali pacifies the Tridosha (disorder of the three humours of the body) and acts as Vrushya (an aphrodisiac). Furthermore, it is also used as Sahapana (taking together with the medicine) and Anupana (as a vehicle taken after the medicine).

### **Mercuric sulphide and toxicity**

For example, Cinnabar as a compound contains mercury sulfide has been used for over 2000 years in traditional Chinese medicines and in Indian Ayurvedic medicines (17,18,19). Mercury is a well-known toxic heavy metal, having a high score on the CDC Toxic Substances List. Mercury content found in traditional medicines genuinely scares the layman (20,21,22,23), and so many mercury-containing traditional medicines have been banned for the same reason. However, some are still in use today (17,18). Mercuric Sulphide is a recognized developmental toxicant and exposure to it has the high potential to negatively affect a developing baby in utero. The severity and range of negative effects experienced can vary greatly depending on the chemical, the stage of pregnancy at which the exposure occurred and the duration, level and nature (e.g. inhalation, skin exposure, ingestion) of the exposure. Developmental toxicity can include such things as low birth weight, birth defects, foetal death and behavioral and psychological problems. Sometimes the effects may not manifest until the baby becomes older. At room temperature the mercury as a metal is in liquid form. The toxicity of mercury depends on its chemical form and route of exposure. It affects the immune system, alters genetic and enzyme systems, and damages the nervous system, including incoordination and the tactile, gustatory and visual hallucinations. Clinical features of mercury poisoning along with differential diagnosis have been seen at many places.

### **Various research works carried out having mercury as a component in the trial drug wherein no toxicity effects have been noted**

- A pilot study to clinically evaluate the role of herbomineral compound "*Rakatchap Har*" in the management of essential hypertension<sup>30</sup>
- Preparation and Evaluation of Amavatvidhvansa rasa- A Herbomineral Formulation<sup>31</sup>
- Antiepileptic activity of unmadagajakesari-a herbomineral formulation:an experimental evaluation<sup>32</sup>
- Assessment of Genotoxic Potential of *Hridayarnava Rasa* (A Herbo-Mineralo-Metallic Ayurvedic Formulation) Using Chromosomal Aberration and Sperm Abnormality Assays<sup>33</sup>
- Effect of Amavatavidhvansa rasa: A herbo-mineral formulation on carrageenan - Induced inflammation in rats<sup>34</sup>
- Likewise many more and multiple such research works have been carried out wherein drugs containing mercury have shown no toxic effects after their consumption

### **CONCLUSION**

Ayurveda encompasses the use of multiple alchemy compounds known as rasa kalpas to provide a near immediate

effect and relief to the patient. rasa kalpas containing mercury and sulphur used in impure forms are bound to produce a negative health effect after long term consumption. But such can be averted with the standard process of prior purification of these two substances hence providing us with an overall positive efficacy and outlook. However, a detailed biochemical analytical study needs to be done in human models after the consumption of rasa kalpas containing purified mercury and sulphur in order to understand its role on the organs and genetic susceptibility

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