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Short Communication

Exploration of Rasashastra's process of mercury detoxification using Garlic

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Abstract

Rasashastra is the ancient iatrochemistry which mainly elaborates mercury processing and its formulations for medicinal purpose. Minerals or metals can be toxic to human body in raw untreated forms. However; to achieve the medicinal benefits these can be converted into fine *bhasma* form which are therapeutic and safe. Rasashastra is ancient and it elaborates the mineral drugs in detail. Medicinal plants are used for conversion of minerals into medicines by use of complex processes. The processes include effects of heat, water, air, various plants and minerals, by use of complex methods. It us believed that Mercury [*parada*] acts as a catalyst in conversion of metals in bhasma form. However there is no much primary evidence regarding actual chemical changes occurring in the substances. Mercury is used after *shuddhi* process ie detoxification by specific method of *rasashastra*. The most commonly used process detoxification involves mixing and continuous pounding of mercury with paste of garlic [*Allium sativum*] and rock salt. Important sulfur-containing compounds in garlic includes allicin, which is produced from alliin when garlic is crushed; ajoene, various disulfides and trisulfides (like diallyl disulfide and diallyl trisulfide), vinyldithiins, and S-allyl-L-cysteine. Reaction of garlic and mercury may alter the chemical configuration of mercury. After separation of mercury from this mixture, the mercury is said to be detoxified. Rasashastra medicines such as rasasindura are comprised of mercury sulfur bound together. This report gives insights into the facts related to garlic and mercury.

Keywords: Parad, Mercury, Shuddhi, Samskara, Rasashastra, Rason, Garlic.

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1. Introduction

Mercury [*Parad*] is the prime ingredient in *Rasashastra*, the ancient Indian iatrochemistry. In modern era; mercury is regarded as one of the most hazardous heavy metals and is capable of biomagnification, thereby posing severe risks to ecosystems and human health.[1] Rasashastra's Mercurial preparations are manufactured and used therapeutically in India. This includes *kupipakva, parpati, pottali* and *kharaliya* type of formulations. Bhasma of metals are also sometimes prepared with the help of mercury. However, there is no adequate research related to various methods involved in mercury processing elaborated in *rasashastra*. It is necessary to understand chemical changes by Rasashatra based processes carried out on mercury. These processes involve medicinal plants and other minerals such as sulfur. After *parad samskara* [special processing of mercury] it is supposed to have enhanced reactivity with sulfur, mica, gold etc.

It is well recognized and noted in literature of *Rasashastra* that mercury has toxic properties [natural, adulterated and compounded due to contact of ores etc].[2] Process to remove the toxicity are also elaborated. The natural toxic nature of mercury can result in death. It is understood/interpreted as neurotoxicity of vapors of mercury which can result in death, if inhaled by any person. In all processes of *rasashastra* involving heating above the boiling point of mercury [356.7%], there is a tightly closed assembly, and vapors of mercury cannot escape. Such heating at high temperatures overhead mercury's boiling point takes place in a closed assembly in *damaru yantra*,[3] *vidyadhar yantra*,[4] *urdhvapatan yantra*,[5] *adhapatan yantra*,[6] *tiryak patan yantra*,[7] all of these *yantras* involve leak proof sealing by adhesive paste known as *toyamruttika*, prepared by mixing of powdered iron oxide mineral, lime and jaggery, triturated

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with the decoction of bark of *Acasia arabica*[8] and *vanhimrutsna*, prepared by mixing of calcium carbonate, iron oxide, triturated with buffelo milk.[9] These sealing materials sustain very high heat and seal the instruments very firmly, so that mercury vapors cannot escape, and get condensed/chemically react within the assembly. Wherever there is a heating in open *kharal* [mortar and pestle] during any processes, the heat is mild [40 to 60 degree C], much below the boiling temperature of mercury. Eg –heating using rice husk or dried *ajapurish* ie goats excreta [dried] for mild heating of iron kharal [*taptakhalvayantra*].

With an intension to purify mercury and also to make it more reactive, eighteen processes of *parad samskara* had been elaborated which were a gateway to medicinal benefits as well as alchemy.[10] Out of 18 processes only the first 8 are practiced and the further ones are rare/extinct in recent time. Processes of '*Samskaras'* remove toxic part and it may induce changes at chemical level which makes mercury more reactive. *Rasaratnasamucchay* text of 13th century does not state any separate processes for *shuddhi* i.e. purification of mercury, apart from *samskaras*.

In the texts of *rasashastra* after 13th century, various methods for *shuddhi* ie detoxification of mercury have been described. It invariably makes use of medicinal plants. Detoxication process from *Ayurved Prakash* text is most commonly practiced all over India.[11,12] This process involves garlic [*Allium sativum*], and rock salt. Garlic is one of world's oldest medicinal herb. Ayurveda regards garlic as a drug for rejuvenation. Purification of mercury is carried out by pounding mercury with paste of fresh garlic bulbs [*Allium sativum*] rock salt for 7 days in a warm mortar pestle of iron [11]. Some of the texts mention a month's duration for pounding. Slight warm iron mortar pestle [*tapta kharal*] is used for this pounding process. Garlic may have a role in safe and effective medicinal use of mercury.

Garlic has affinity to mercury and also there is drug -herb interaction after consuming these two substances.

1.1. Known facts regarding pharmacology of garlic and mercury

The phytoconstituents of garlic are chelators for certain metals. Garlic contains methionine and cysteine, two amino acids known to act as chelators for arsenic, lead, mercury and cadmium.[13] Some research based on methyl mercury toxicity have reported the use of garlic as a protecting drug from mercury toxicity. Garlic is a chelating agent for mercury and it has an affinity towards it. Methyl mercury is the toxic form of mercury. Garlic consumption is known to have a protective effect in rats when it is administered with cadmium, methylmercury and phenylmercury. Hence it is indicated that consumed garlic reacts with consumed mercury and curbs the harmful effects of toxic forms of mercury [methyl mercury]. In the study it was evident that accumulation of heavy metals in liver, kidneys, bone and testes were decreased, and histopathological damages and the inhibition of serum alkaline phosphatase activities by heavy metals were reduced. This shows that there is some chemical phenomenon which facilitates excretion of mercury, when garlic is fed to experimental rats.[14]

It may be hypothesized that during the process of *Parad shuddhi* when garlic is pounded with mercury, there is a chemical reaction, which alters the electronic configuration of mercury.

Another study in wistar rats showed protective effect of garlic when administered orally. The results suggested that garlic offered hepatoprotective effect to mercury through the processes of uptake, assimilation and elimination of these metals.[15]

Garlic in different forms has antioxidant properties. These properties are shown to be due to the existence of compounds such as water soluble organosulfur compounds, S-allylcysteine and lipid soluble compounds like diallyl sulfide. Recent supportive evidence indicates that garlic contains compounds capable of detoxifying lead, cadmium, methlymercury, phenylmercury and arsenic. The pounding of mercury with garlic paste and rock salt leads to chemical reaction of its phyto-constituents with mercury.[16]

Garlic contains approximately 33 sulfur compounds (aliin, allicin, ajoene, allylpropyl disulfide, diallyl trisulfide, sallylcysteine, vinyldithiines, S-allylmercaptocystein, and others).[17] Interestingly most of formulations of mercury in Rasashastra, involve the use of sulfur with mercury. Hence along with garlic, sulfur too has a role in nullifying the toxic effects of mercury. Mercury is first detoxified by pounding with garlic. Mercury and sulfur are then pounded to get kajjali. This forms base of most formulations of Rasashastra.

The living body is full of chelates; metals bound with two or more coordination bonds. Metals of oxidation state greater than one (i.e., a charge of +2 or more) are predominantly bound in tissues by ionic (in skeletal minerals) or coordination bonds (e.g., bound to albumin, enzymes, small peptides, and amino acids such as cysteine, methionine, and selenomethionine).[18]

With the knowledge of modern chemistry and *Rasashastra* [iatrochemistry] it is possible to understand the science behind traditional processes used in *Rasashastra*.

Mercury, after garlic processing is most of the times pounded with sulfur to form black powder known as '*kajjali'* and then further with special drugs/ processes [*parpati /pottali /kupipakwa /kharaliya formulations*] for being used as medicine. While consuming mercury medicines there are strict rules for diet and lifestyle for patients. The eatables like *bruhati* (*Solanum indicum*), *bilva* (*Aegle marmelos*), *kushmanda* (*Benincasa hispida*), *vetagra* (*Bambusa arundinacea*), *karavellaka* (*Momordica charantia*), *masha* ie black gram (*Vigna mungo*), *masura* ie lentils (*Lens culinaris*),

nishpava [green pea] (*Pisum sativum*), *kulattha* ie horse gram (*Macrotyloma uniflorum*), *sarshapa* [mustard seeds], *tila* [sesame seeds], fasting, *udvartan*, chicken, meat, *sura* [alcoholic drink prepared by fermentation of grains] are to be refrained from by the patient. These may interfere or are related with pharmacokinetics of mercury, though unexplored by research.[19]

Rasashastra has been termed as iatrochemistry. There are interesting terms used for describing different processes. Especially in mercurial processing, some terms are used which are generally used a living person. It includes *murchhan* [being unconscious], *jaran* [digesting], *bhakshan* [engulfing or eating], *dipan* [appetizing], *grasasamartha* [ready to engulf or eat]. These terminologies indicate various states of mercury after or during various *samskara* processes. The chemistry of mercury changes supposedly, and it reportedly becomes more reactive [*grasasamartha*] to further processes.

Role of mercury in Rasashastra medicines as a vehicle or catalyst,[20] apart from an active ingredient also requires more exploration. The specific chemical nature of garlic and sulfur may be responsible for safe medicinal use of mercury formulations,[21] which needs scientific exploration. There are certain dos and donts in rasashastra while consuming mercurial preparations, which may have a role in its pharmacokinetics.

2. Source of Funding

None.

3. Conflict of Interest

None.

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