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Review Article

Rasashastra

Fundamental Principles of Rasashastra: An Overview of Iatrochemistry in Ayurveda

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Basic principles of iatrochemistry are those concepts that have been tried and tested in various ways and which are required to be known in connected science. Rasashastra, Indian alchemy, is the unique branch of Ayurveda that is considered to be Indian pharmaceutics of herbo-mineral remedies. The fundamental principles connected to the foundation and evolution of Rasashastra are not clearly defined and are scattered in various ancient classical texts. Therefore, an attempt has been made to review these fundamental principles systematically and explanatorily. Therefore, in the present work, an attempt has been made to set up a full-fledged review of basic principles of Rasashastra and elucidate their distinguishing features. Lohavada and Dehavada, eighteen ways of treating mercury, Rasashastra terminology, instruments, crucibles, blowers, the pit of incineration of metals/minerals purification, incineration, Amrutikarana, Lohitikaran, Satvapatan, the test of incinerated material, and levigation are the basic principles of Rasashastra. The aim of this article is to combine the understanding of these principles with regard to both Ayurvedic and contemporary science as the foundation for research and development in Rasashastra.

Keywords: fundamental principles, basic principles, iatrochemistry, Indian alchemy, Indian pharmaceutics

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Introduction

Rasashastra is made up of two words; *Rasa* refers to mercury, and *Shastra* refers to science; thus, *Rasashastra* together refers to the science of mercury. *Rasashastra* is a specialized branch of Ayurveda that deals with the production and therapeutic application of minerals, metals, and herbo-mineral products. Based on ancient Indian alchemy, *Rasashastra* seeks to improve the effectiveness of Ayurvedic medicine through detoxifying and transmuting processes that convert materials such as mercury (*Rasa*), gold, silver, and other minerals into active medicines. Medicine is the core of nearly all medical sciences, other than some treatments such as physiotherapy, acupressure, acupuncture, etc. Finding out various medicines is a long history and result of genuine efforts put in by intelligent researchers. It is known that these findings were established on the basis of experience, numerous experiments, keen observations, frequent assessment of results, and the best logical conclusions of all these. Such studies have led to the creation of various principles that later became the basis of some medical sciences. *Rasashastra*, being a department of Ayurveda, is one such evolved branch that can now be considered the Indian pharmacology of herbo-mineral drugs. The final objective is not only to cure ailments but also lead to longevity, energy, and spiritual progress. Potentization by repetitive grinding with juices of herbs or decoctions. *Rasashastra* combines strict processes with a philosophic basis upon the *Tridosha* theory and alchemical transformation principles. It dictates balance, accuracy, and strict adherence to ancient processes to unleash the curative potential of otherwise poisonous compounds. Through its scientific process, *Rasashastra* remains an integral part of ancient Ayurvedic therapeutics. *Rasashastra*, being a department of Ayurveda, is one such evolved branch that can now be considered the Indian pharmacology of herbo-mineral drugs. According to the available literature, *Rasashastra* indicates that mercury is the basic reason for the origin of this science, though the metallic-mineral substance for treatment through various processes for numerous diseases is the primary objective of *Rasashastra*. The description of these concepts is not very clear and scattered in various ancient classical texts.

It is need of hour to make a review of these fundamental principles in systemic and explanatory way. Therefore, in present work an attempt has been made to make a comprehensive review of basic principles of *Rasashastra* and to elucidate their distinguishing features. Available classical texts have been studied basic principles has been collected from texts of *Rasashastra* such as *Rasendramangala* (8th century AD) *Rasendra-chuḍamani* (12th century AD), *Anandakanda* (12th century AD), *Rasaratnasamuchchaya* (13th century AD), *Rasendrachintamani* (13th century AD), *Rasendrasarasamgraha* (14th century AD), *Rasakama-dhenu* (17th century AD) and *Rasatarangini* (20th century AD) etc. These basic principles have been interpreted according to their rationality, importance and application in view of current era.**[1]**

The critical overview of classical works of *Rasashastra* revealed the fundamental principles of *Rasashastra* are as follows:

1. Concept of *Lohavada* and *Dehavada*

Transformation of non-precious metals into valuable metals like gold by using specially processed mercury is referred to as *Lohavada* or *Dhatuvada*. Employment of such powerful mercury for attaining longevity of life, and vitality is known as *Dehavada*.**[2]** *Rasashastra* was formed on the basis of this *Lohavada* concept of attaining healthy long life through means of processed mercury, which has the ability to transform lower metals into gold. As per ancient classical books, both *Dehavada* and *Lohavada* were well in books written in the 9th century onwards up to the 13th and 14th centuries AD, but this science was secret and known to very few seers. Now, there are many references available connected with the conversion of copper and lead into silver and gold, but the precise knowledge to attain successes is lost in the timeline.

2. Concept of *Parada Ashtadasha Sanskara* (Eighteen processing methods of mercury)**[3]**

The word *Samskara* signifies different meanings in various classical texts. In *Rasashastra*, *Samskara* can be defined as addition or alteration of new qualities that already exist in drugs by doing various pharmaceutical processes such as *Mardana*, *Swed-ana*, *Patana*, etc. *Shodhana* is used for removal of impurities from drugs, whereas *Samskara* specifically aims to increase *Bala* and *Teja*, meaning potentiation of drug by mentioned processes.**[4]**

There are 18 processing methods of mercury, which make mercury so powerful that it can be utilized to attain the objective of *Dehavada* and *Lohavada*. Out of the 18 processing methods, the first five are explained for erasing blemishes from mercury; the next three are spoken for enhancing the strength of mercury; the next 8 techniques are connected with deploying transformation power in mercury to transform any metal to gold; the 17th processing technique is the trial of the transformation power of mercury, and the last one is the administration of mercury in human beings.**[5]**

3. Concept of *Paribhasha* (technical terminology in *Rasashastra*)

A statement of the precise meaning of a word or phrase is known as *Paribhasha* (technical terminology).**[6]** Many times, the words used have specific meanings pertaining to that science only. For example, the Sanskrit word '*Rasa*' has various meanings like taste, juice, essence, sap, aesthetic appreciation, liquid, artistic delight, potion, nectar, melodious sound, the element mercury, etc. In *Dravya Guna*, i.e., Materia Medica of Ayurvedic drugs, it represents the taste, whereas in *Rasashastra* it denotes the mercury. Hence, it is important to understand the technical terms of that particular science.**[7]** *Paribhasha* highlighted the things by throwing light on those that are not expressed clearly or articulated, not mentioned anywhere, or said not as much of and controversial things.**[8]** There are 78 different terms referred to in *Rasaratnasamuchchaya* in chapter 8.**[9]** The words that are cryptic and ambiguous are better understood with the assistance of *Paribhasha*. The study of *Paribhasha* inspires a better understanding regarding the science of *Rasashastra*.

4. Concept of *Yantra, Musha, Koshthi*, and *Puta* (Instruments, crucibles, blowers, and pit for incineration of metals/minerals)

In ancient times, acharyas of *Rasashastra* invented various instruments, crucibles, blowers, and pits for the incineration of metals/minerals. The author of *Rasaratnasamuchchaya* has described 31 instruments, 17 types of crucibles, 4 types of blowers, and 10 types of pits in the 9th and 10th chapters of his treatise.**[10]** This idea gives guidelines for the need for different apparatus in pharmacy for the treatment of mercury, metals, minerals, and herbal drugs.

Apparatus is one of fundamental need for medicine making and therefore in order to understand *Rasashastra* and for the purpose of research and development in *Rasashastra*, it is necessary to know all such apparatus. Equipment is used for performing and preparing various formulations, the incineration process, and *Saṭva* extraction and is also used for the elimination of blemishes.

5. Concept of *Shodhana* (Purification)

Shodhana is a process by which *Mala* (physical and chemical impurities) get separated from the substances by *Peshanadi Karma* (different treatment) with mentioned drugs. These impurities are separated from the substance by various processes like *Bhavana*, *Mardana*, and *Swedana* with specific drugs.**[11]**

Acharyas explained two types of purification: *Samanya* and *Vishesh Shodhana*. In *Rasashastra*, typically the minerals/metal and sometimes a few medicines of poisonous origin are encountered, which are prone to possessing some toxic effect as well. Hence, with an intention to eradicate or reduce their toxicity and to make them fit for further treatment, a variety of purification procedures have been discovered and evolved, which is referred to as *Shodhana*.**[12,13]** Here it must be pointed out that Ayurvedic purification does not imply rendering metal 100% in its original elemental form; actually, this process is associated with impregnation of organic molecules in inorganic substances and enhancing their bio-accessibility as well as minimizing unwanted effects. The metallic preparations are utilized in the form of *Bhasma* (incinerated powder), and *Shodhana* is the first and most crucial step prior to the preparation of their *Bhasma*. *Shodhana* of metals is conducted in two steps, viz. *Samanya Shodhana* (general purification) and *Vishesha Shodhana* (special purification). *Samanya Shodhana* is primarily done by heating the metal up to the red-hot stage or up to complete melting, then quenching for either three or seven times in each liquid media, viz., *Til Taila* (sesame oil), *Takra* (clarified butter), *Gomutra* (cow urine), *Kanji* (sour gruel), and *Kulattha Kwatha* (decoction of Dolichos biflorus Linn), respectively.**[14]** *Samanya Shodhana*, however, is used only for metals but not for minerals and deadly herbs. *Vishesha Shodhana* consists of the same procedure of heating or quenching, but the liquid media are different for different metals.

6. Concept of *Marana* (Incineration)

The metals and minerals are not bio-assimilable in their natural states. They had to be brought into such refined form, which can easily become assimilable in the human body, capable of curing several diseases, and did not leave any ill effect. To meet this end, the idea of *Marana* (incineration) was unearthed by ancient seers of *Rasashastra*. *Marana* is a process in which the purified metals and minerals are converted into bhasma, subjecting them to levigation and incineration.**[15]** Briefly, *Marana* refers to the conversion of metal/mineral into fine nanoparticles, which have a herbo-mineral, organo-metallic nature and therapeutic potency. In classical texts, different methods of incineration are discussed for each metal. These processes can be classified in some categories based on the principle, such as incinerated metal prepared after the *Jarana* (open pan frying) process, prepared from *Pishti* (amalgam), prepared by the *Lepa* (application of layer upon metal) method, and prepared after the open pan-frying process followed by *Bhavana* (levigation) and *Puta* (incineration cycles), etc. Ancient seers of *Rasashastra* many times used more than one procedure. A detailed understanding of the incinerated preparation of any metal by a process explains the preparative procedure of other metals.

7. Concept of *Bhavana* (Trituration and Levigation)[16]

Bhavana is one significant *Samskara* referred to in classics by virtue of which even a very small quantity of a drug may be caused to yield a high response, i.e., to enhance potency. *Bhavana* is wet trituration. The *Shodhita* minerals and metals in stated liquid medium for stated time duration and transform them into a finer, assimilable form. Liquid media facilitate conversion of coarse powder into a finer state. Impregnation of *Bhavana dravya* of media into material, causing characteristic and appropriate physiochemical change, facilitating incorporation of organic properties into inorganic. *Bhavana* applies continuous pressure and frictional force. The toxic effects and undesirable properties can be neutralized due to effect of *Bhavana dravya*. Hence, knowledge of *Bhavana Dravya* referred During different *Bhasma* and formulation preparations, plays a key role. By virtue of which it loses and reduces soluble impurities/toxic character of material and leads to impartation of favourable therapeutic effects.

8. Concept of *Amrutikarana* (Removal of remaining blemishes)

The process of *Amrutikaran* is advised after process of marana. Some Bhasmas are holding their doshas (poisons) after being given proper *Putas*; for those particular Bhasmas, process that is being done to destroy doshas is known as *Amrutikaran*; it is needed for some *Dhatu* Bhasmas like *Abhraka, Loha, Tamra, and Swarna Makshika*.**[17]** If it is found that *Bhasma* made, when taken by patients internally, shows some unwanted effects, then only this process is undertaken. Instead of wasting such a precious product earned after hard work, it is processed in this manner in an attempt to destroy property of producing ill effects. The side effects, which are mostly expressed, are in form of manifestations of excessive *Pitta,* and therefore simplest process is roasting the *Bhasma* on fire with a small amount of Ghee (*Goghrita*).**[18]**

9. Concept of *Lohitikaran* (Induce red colour to the *Bhasma*)[19]

The pharmaceutical procedures carried out on prepared *Bhasma* to induce *Rakta varna* in it are called *Lohitikarana*. The only reference available regarding *Lohitikarana* is in *Rasatarangini,* while explaining *Abhraka Bhasma Lohitikarana*. The quantity of *Putas* provided, the heat it is exposed to, and the liquid media used for trituration of the bhasma for the purpose of incineration most likely result in a black-coloured *Abhraka Bhasma*. In order to transfer the red colour to it, *Lohitikarana* has been proposed. And an interesting point that is noticed is the employment of *Rakta Varga Dravya* to transfer the colour to the *Bhasma*. The colour of the bhasma is a criterion for identification of the bhasma and also a test of the *Bhasmas* perfectness; the colour of the bhasma of various metals and minerals has been defined in *Rasashastra* literature.

10. Concept of *Satvapatan* (Essence Extraction Technique)[20]

Satvapatan consists of two different words, viz. *Satva* and *Patana.* The former refers to an active principle or fundamental substance, and the latter refers to separation or extraction. are a compound substance, and the latter refers to separation or extraction. During the formation age of *Rasashastra*, it was believed that the medicinal qualities of different minerals result from an active material present within it.

Different efforts were made to isolate this active principle from the minerals, and thus the process is referred to as *Satvapatna*. It is primarily comprised of heating the mineral in a crucible using instant heat. The material to be blended in this process is from *Amlavarga* (acidic material), *Ksharvarga* (alkaline/acidic salts), and *Dravaka Gana* (primarily substances of plant & animal origin that are intended to be used for melting metals). The combined action of this process is the minerals converted to original metals in element form. It is intended to possess all the medicinal qualities of the original mineral substance. The *Satva* thus obtained, particularly *Satva* of Mica, is said to be highly effective in experiments of the *Dhatuvada* branch of *Rasashastra*, but its medicinal applications have also been explained. Prior to its application to such an end, it needs to undergo processes like softening, purification, incineration, etc.

11. Concept of *Bhasma Pariksha* (Examination) [21]

Classical literature clearly mentions that the *Rasashastra* scholars of ancient times were well versed with inappropriately processed and partially prepared incinerated preparations. Thus, they have recommended performing a number of tests to ensure proper formation of the product referred to as *Bhasma Pariksha*. A particular colour is described for each *Bhasma*. Change in some colour indicates that *Bhasma* is not properly prepared since some specific metallic compound is developed while making *Bhasma*, and each chemical compound will have a certain colour. *Bhasma* should be *Nischandra* (dull) prior to after proper incineration, metals lustre should not be left behind; if metal lustre remains, then there is a need for further incineration.**[22]** The test of *Varitara (*Floating), when used to test the lightness and fineness of *Bhasma*, is the floating nature of *Bhasma* on an immobile surface of water.**[23]** It is a law of surface tension-based test. The *Unama* (Floating grain) test is another testing of the *Varitara* test. One grain of rice is to be placed cautiously upon the floated *Bhasma* layer. See whether grain floats or sinks. If grain becomes like that and stays on the layer, then *Bhasma* can be used. *Rekhapurnata* test is such that *Bhasma* must be finer so that it can fill up furrows of fingertips. Some small quantity of *Bhasma* is rubbed in between index finger and thumb to see if the particles can occupy furrows of fingertips.

This test is used to examine the fineness of *Bhasma*. *Bhasma* particles should be of smallest size so that they can easily get absorbed and assimilated in the body.**[24]** *Apunarbhava* refers to inability to regain original metallic form. For this test, *Bhasma* is blended with an equal amount of *Mitra Panchaka* (seeds of *Abrus precatorius*, honey, ghee, borax, and jaggery), and it is sealed in *Sarava Samputa* (earthen pots); then, a similar grade of heat employed for the preparation of the specific *Bhasma* is used, and on self-cooling, the product is seen.**[25]** Shining particles present in it indicate the presence of free metal, which is an indication of inadequate incineration. *Niruttha* is to test the non-reversibility to the metallic state of metallic Bhasmas. In this test, *Bhasma* is mixed with a definite weight of silver leaf, placed in earthen pots, and the same grade of heat is applied, and after self-cooling, the weight of silver is measured. Weight gain of silver leaf is sign of poorly made *Bhasma*.**[26]**

Discussion

It is a proven fact that all science has experienced variations and modifications done by researchers in the research area. Evolution in technologies and new research according to contemporary needs can be considered the basis of changes in any branch of science. *Rasashastra* also needs changes and modifications in the field of research. Salvation was the main aim of ancient Indians, and longevity and preservation of health and life for permanent meditation was the primary requirement. Therefore, central importance was given to the concept of *Lohavada* and *Dehavada* between the 9th and 13th-14th centuries AD. It is believable that some seers were successful in converting copper and lead into gold with the help of processed mercury. But the technique of processing mercury was kept very confidential and hardly passed on to later generations, which resulted in the complete vanishing of such marvellous knowledge. It requires a high facility and financial support to research the topic of *Lohavada* and *Dehavada.* A similar situation applies to eighteen procedures of processing mercury. Now these procedures are considered time-consuming, and expensive. First eight processing procedures are feasible to perform & are employed to a certain extent. Therefore, acquaintance with at least first eight processing procedures is required for acquaintance with *Rasashastra*.

Using a precise term for a particular process, for a group, or for defining a particular concept is one of the best ways of making a science precise as well as systematic. The *Paribhasha,* i.e., the technical terminology employed in *Rasashastra*, is extremely well explained by Acharya Rasa Vagbhata in the 8th chapter of his treatise *Rasaratnasamuchchaya*.

The conventional terminology of instruments, crucibles, blowers, and pits for metal/mineral incineration is from the point of view of the ancient availability of materials. Much progress has been made in this section in recent years, and this has been incorporated in Ayurvedic drug production, such as the utilization of distillation apparatus, electric muffle furnace, and utilization of liquid petroleum gas, etc. All these changes are acceptable and are required in order to suit large-scale production, minimum labour costs and minimum time. It is worth noting that none of the concepts of *Rasashastra*, like the concept of purification, the concept of incineration, the concept of *Amrutikarana*, the concept of a test for incinerated material, and the concept of *Bhavana* (levigation) retains their singular worth and must be followed in strict adherence to the classical directive in order to produce desired effects.

Existing literature on *Rasashastra* is a reservoir of abundant information for the formulation of new combinations since there are numerous techniques described for purification, calcination, levigation, etc., and modification in a single drug/media in any of these procedures may change the therapeutic potential of the final product. Though it is certain that acquaintance with rudimentary principles of *Rasashastra* is necessary to comprehend the investigation and development of this pharmacotherapeutic science. In current work, the dispersed fundamental principles have been discussed briefly, and this knowledge will be found helpful for overall comprehension of *Rasashastra*.

Conclusion

The fundamental concepts of *Rasashastra*, such as *Lohavada* and Dehavada, eighteen mercury processing methods, terminology, instruments, crucibles, blowpipes, and metal/mineral incineration pits, purification, incineration, *Amrutikarana, Lohitikaran, Satvapatan*, incinerated material tests, and levigation. These principles are the key points for this science.

A clear understanding of these principles, keeping in mind Ayurvedic and modern science, is the groundwork to comprehend as well as for research and development in *Rasashastra*.

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