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Review Article

A REVIEW ON GEOLOGICAL ASPECT OF RASA DRAVYA WITH SPECIAL REFERENCE TO MINERALS

Saroch Vikas[1]*, Verma Sachin[2], Kundailia Nitika[3]

[1]Lecturer, Department of Rasashastra and Bhaishajya Kalpana, Institute of Ayurveda, Desh Bhagat University Mandi gobindgarh, Punjab, India

[2]PhD Scholar, Department of Rasashastra and Bhaishajya Kalpana, Institute of Ayurveda, Desh Bhagat University Mandi gobindgarh, Punjab, India

[3]PG Scholar, Department of Rasashastra and Bhaishajya Kalpana, Institute of Ayurveda, Desh Bhagat University Mandi gobindgarh, Punjab, India

***Correspondence**

Saroch Vikas

Lecturer, Department of Rasashastra and Bhaishajya Kalpana, Institute of Ayurveda, Desh Bhagat University Mandi gobindgarh, Punjab, India

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Abstract

Rasa dravyas (Mercurical, mineral, metal preparations) are broadly classified under the headings of Maharasa, Uprasa, Sadharanrasa (Minerals), Ratan (Precious stones), Upratan (Semi Precious stones), Dhatu (Metals) etc. intended to increase the therapeutic efficacy. As majority of minerals available today are not from natural sources and prepared artificially. To evaluate their Grahyalakshna (acceptable characters) those mentioned in classical literature of Ayurveda are not enough so the geological aspect can help in this facet. Geological aspect of Rasa dravya's are essential to evaluate their internal structure to highlight the mechanism of changes that are occurring. It is the need of hour to integrate such up gradations. Considering the Geological aspect of metals and minerals the following parameters are to be evaluated; Nature/Form, Colour, Streak, Cleavage, Fracture, Lustre, Tenacity, Transparency, Magnetism, Crystal Habit, Hardness, Specific Gravity, Taste. A proper understanding and evaluation of the above parameters could reveal the originality of the Rasa dravyas intended to be used for medicinal purpose. Geological aspect of Rasa dravya's are essential to evaluate their internal structure to highlight the mechanism of changes that are occurring. It is the need of hour to integrate such up gradations.

Keywords: Geological study, Minerals, Petrology, Rasadravya

INTRODUCTION

The study of Rasadravyas (alchemy) has been vastly documented in Ayurvedic science under the branch of Rasashastra. Ancient Acharya's have mentioned about the best variety of minerals and gems based on certain physical and physiological characteristics including its emphasis on their appearance which are coined in ancient literature as Grahya lakshanas (Acceptable characters). Now modern era is an era of continuous development and synchronisation of technologies. Minerals found today are rarely obtained from the natural sources but still classical preparations are available in the market and yielding valuable results. So, the classical preparations are being modified in a bid to serve the market interest. Thus minerals are now being prepared artificially and naturally the classical parameters are not enough to determine the originality of the drug. Thus geological parameters should be included to determine standard quality of minerals. Grahya lakshanas are very important in identifying the originality of the drug in raw form that eases human understanding and if the geological parameters are coupled with it, then it would provide flawless selection of raw materials and would contribute in producing quality medicines. Geology is a wide range of science which also deals with the study of rocks and minerals. Modern geological techniques include different physical parameters (e.g. streak, fracture, cleavage etc).

Methodology

For proper understanding of Geological aspects of the rasa dravyas the methodology is divided as follows:

Nature, Crystal, Habit, Colour, Streak, Cleavage, Fracture, Lustre, Tenacity, Transparency, Magnetism, Hardness, Specific gravity, Fluorescence, XRD

Nature

Being natural chemical compounds, minerals may occur in any aggregation state, though most of them are known to belong to solid crystalline substances. Amorphous minerals are scare[1]. As such, natural occurrence of minerals may be in the following forms:-

State of Aggregation

Under favourable conditions, minerals assume a definite crystal form. The following crystal forms are known:-

a) Crystallised: A term denoting that the mineral occurs as well developed crystals. Most of the beautiful mineral specimens in museums are of crystallized minerals.
b) Crystalline: A term denoting that no definite crystals are developed, but that a confused aggregate of imperfect

crystals grains have formed interfering with one another during their growth.

c) Crypto-crystalline: A term denoting that the mineral possesses traces of crystalline structure.
d) Amorphous: A term used to describe the complete absence of crystalline structure, a condition common in natural rock glasses, but rare in minerals.

Crystal Habit

The development of an individual crystal or an aggregate of crystals to produce a particular external shape is described as its Habit and this depends upon the conditions during formation[2].

Individual crystals

a) Acicular: Fine needle like crystals
b) Bladed: Shaped like a knife blade or lath like
c) Fibrous: Consisting of fine thread like strands
d) Foliated: Consisting of thin and separate lamellae or leaves as is shown by mica group of minerals.
e) Lamellar: Consisting of separate plates or leaves as in wollastonite
f) Prismatic: Elongation of crystals in one direction.
g) Reticulated: Crystals in a cross- mesh pattern, like a net
h) Scaly: In small plates
i) Tabular: Broad, flat, thin crystals

Crystal Aggregates

There may be aggregates of the crystals of which individuals can be seen with the naked eye or massive aggregates of minerals in which individual crystals are too small to be seen with the naked eye.

a) Botryoidal: Spherical aggregates resembling a bunch of grapes
b) Columnar: Massive aggregations in selender columns
c) Granular: Coarse or fine grains
d) Lenticular: Flattened balls or pellets shown by many concretionary and nodular minerals.
e) Radiating: Fibres are arranged around a central point
f) Lump: An uneven mass / piece of mineral / ore / rock

Colour

A mineral gives a constant distinctive colour, when observed on freshly broken surface. Though this property is not clear in many minerals, commercial minerals, by and large, are distinguished by their typical colour[3].

Streak

The fine powder of a mineral shows more constant colouration than the same mineral in a massive specimen. This phenomenon is used for identification of a mineral by rubbing the mineral on a rough surface. A white unglazed porcelain plate commonly known as streak plate is generally used to see the colour of the powder of a mineral. Streak is a more reliable distinguishing feature of minerals with a semi-metallic lusture[4].

Cleavage or Parting

Cleavage or parting is the tendency of minerals to split along certain definite planes. The cleavage plane is closely related crystalline form and internal atomic structure and therefore is generally parallel to crystal faces. Minerals may show several cleavages, which are described by stating the crystallographic directions of each cleavage and also the degree of perfection of each cleavage plane[5]. Cleavage may be described in order of quality as under:

a) Perfect or Eminent: Cleavage planes are seen perfectly in the minerals
b) Good or Distinct: Cleavage planes can be seen with little effort.
c) Poor or indistinct: Cleavage planes indistinctly visible

Fracture

The character of the fracture displayed on the broken or chipped surfaces of a mineral is an important property. The fracture surface is not the smooth surface of a cleavage plane but is an irregular surface, usually totally independent of cleavage[6]. The types of fractures, known are given here.

a) Conchoidal: The mineral breaks with a curved concave or convex fracture. This often shows concentric and gradually diminishing undulations towards the point of impact, somewhat resemble the growth lines a seashell.
b) Even: The fracture surface is flat.
c) Uneven: The fractured surface is rough by reason of minute elevations and depressions. Most minerals have an uneven fracture.
d) Hackly: The broken edge shows sharp and jagged projections / elevations like serrations.
e) Earthy: The dull fractured surface of chalk or clay minerals.

Lustre

Lustre is one of the most regular and easily observable properties of a mineral. As a rule, a mineral reveals, at first glance, its lustre which is produced by the light reflected or refracted from the faces of the crystals, cleavage planes and from freshly fractured faces of the mineral. Lustre is directly dependent on the light reflected from the surface[7].

a) Splendent: reflects objects distinctly like a mirror
b) Shining: objects are reflected indistinctly
c) Dull: when the surface has no reflection or refraction.

Various types of lustre are

a) Metallic: This is the ordinary lustre of metals. When feebly displayed, this type of lustre is termed sub-metallic and when not displayed at all, is termed as dull. Based on the intensity and degree of reflection / refraction, metallic lustre is termed as Metallic, Sub-metallic, Dull and Non-metallic.
b) Vitreous: The lustre of broken glass. When less well developed, it is termed sub- vitreous and when not developed at all is dull.
c) Resinous: The lustre of resin.
d) Pearly: The lustre of Pearl. It is shown by the surfaces parallel to which the mineral is separated in to thin plates, similar to the condition of a pile of thin glass sheets such as cover glasses on microscopic slides.
e) Adamantine: The lustre of Diamond
f) Silky: The lustre of silk. This lustre is peculiar to minerals possessing a fibrous structure.
g) Iridescence: Play of colours of rainbow, as those formed in soap bubbles due to interference of light waves.

Tenacity

This is a measure of how a mineral deforms when it is crushed or bent. In fact, tenacity or tensile strength is the resistance that a mineral offers to mechanical deformation. In other words, it is the resistance that a mineral offers a

mechanical deformation. In other words, it is the resistance that the atoms or ions of a substance offer to being subjected to processes that tend to cause bending, breaking, crushing or cutting[8]. Tenacity is termed as follows:-

a) Sectile: The mineral can be cut with a knife and the resulting slice breaks up under a hammer.
b) Melleable: A slice cut from the mineral/metal can be hammered into thin film sheets.
c) Brittle: The mineral crumbles or shatters easily.
d) Flexible: The mineral or thin plates or laminae of the mineral can be bent, remains bent and does not return to its original position even if that pressure is removed.
e) Ductile: The mineral can be drawn out into thin wires.

Transparency (Light Transmission)

Transparency is a property of the substance to transmit light. In other words, the ability of a substance, to allow light to pass through it, is called transparency[9]. Based on their capability and varying degrees of Transparency, the materials are said:

a) Transparent: The materials are capable of transmitting light and through which an object can see easily with its sharp, Clear and distinct outlines.
b) Translucent: materials are capable of transmitting light but through which an object can be seen, except an outline, generally distorted and blurred.
c) Opaque: The materials that is incapable of transmitting light.

Magnetism

A few minerals in their natural stage are capable of being attracting by a hand magnet. They are called magnetic. In other orders if minerals gets attracted by horse-shoe magnet or deflects the needle of compass, it is said to posses' magnetism. A substance may be strongly magnetic, weekly magnetic and nonmagnetic[10].

Hardness

Hardness of a mineral is its resistance to starching. It is relative parameters. In mineralogy, relative hardness is always by determining by using a set of mineral known as the moh's scale of hardness. This scale is consisting of ten references, mineral, each of which is assigned a number in order of increasing hardness from 1 to 10. The Moh's Scale of Hardness, with reference minerals, is given here[11].

Specific Gravity (Density)

Specific gravity is relative weight of a mineral compare to that of the weight of an equal volume of purified water. The weight of an equal volume of purified water is the same as the loss of weight of the mineral in purified water specific gravity is calculating by dividing the weight in an air by the loss of weight in purified water. The specific gravity of natural mineral is known to vary from 0.8 to 21[12].

Fluorescence

This is the property of substances which emit light when subjected to irradiation with ultra-violet (UV), cathode or other short wave race. Such luminescence remains only till the substance is kept under irradiation. It is characteristic feature of some minerals. Ultra-violet radiation has a range of wavelength of 400 nm to 200 nm. The range from 200 nm to 400 nm is called short wave (far UV rays) and from 300 nm to 400 nm called longed wave (or near UV rays). Short wave UV lamp has been used in present determination[13].

XRD Analysis

X-ray diffraction is one of the methods which can be employed to identify the crystalline matters such as minerals and inorganic/organic compounds. It is more useful in mixture or intergrowth of minerals including species identification by identifying its crystal structure and cell size[14].

Taste

Only the soluble minerals have a property of taste. It a perceived by the tongue it is the nerve ending reaction in the tongue to different chemicals[15].

Electricity

Development of a positive and negative charge on different part of same crystal by altering in temperature, by applying pressure and exposed to radiation. Conduction in mineral terms is defined as the ability of a mineral to conduct electricity. Only a very small number of minerals are good conductors; they are the metallic elements and the mineral Graphite. These conductors can be placed between wire carrying electricity, and the electricity will pass through. Conduction is an important property that can distinguish true metals from metallic looking sulfides and oxides[16].

Pyro electricity

Pyro electricity describes the ability of a mineral to develop electrical charges when exposed to temperature changes. Some minerals develop an electrical charge when heated, others when cooled, e.g., Quartz

Piezoelectricity

Piezoelectricity describes the ability of a mineral to develop electrical charges when put under stress. Piezoelectric minerals will develop charges when rubbed or struck repeatedly, e.g., Quartz, Tourmaline

Photo electricity

When some minerals are exposed to radiation they produce electricity, e.g. Fluorite

Radioactivity

Minerals containing elements of high atomic weights are called Radioactive, because of their emissions[16].

DISCUSSION AND CONCLUSION

Geological techniques also include chemical parameters like assays, the effect of heat to determine the threshold temperature, to evaluate the purity of the desired products. Global approach towards Ayurveda is at its greatest height and its need of hour to standardize such thing to omit errors. In this regards even Govt. of India has published another volume of Ayurvedic Pharmacopeia of India which include mineralogical concept of Rasadravyas (Metals and minerals) used in various formulation. The concept behind evaluating the source of minerals obtained from rocks is to analyse the molecular structures, and to evaluate the purity of its source. And some analytical measures are informal while few need expert hands. The tradition of Ayurveda necessitates multidimensional approach of research for validation of classical things with classical as well as modern parameter.

The methods of mineral identification are the most important ways to tell what a mineral is.

Table 1: Mohs scale of Hardness

Hardness	Reference Mineral
1	Talc
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Corundum
10	Diamond

Figure 1: Nature

Figure 2: Crystal Habit

Figure 3: Colour

Figure 4: Streak

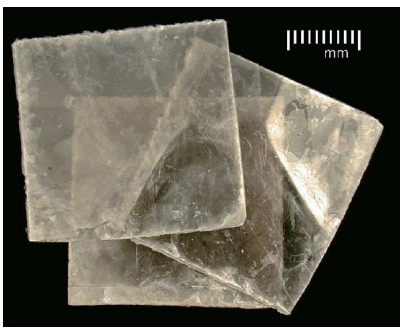

Figure 5: Cleavage

Figure 6: Fracture

Figure 7: Lusture

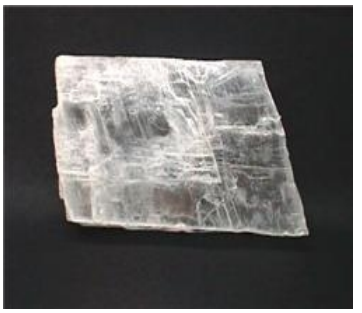

Figure 8: Tenacity

Figure 9: Transparency

Figure 10: Magnetism

Figure 11: Moh's scale of Hardness

Figure 12: Specific Graity

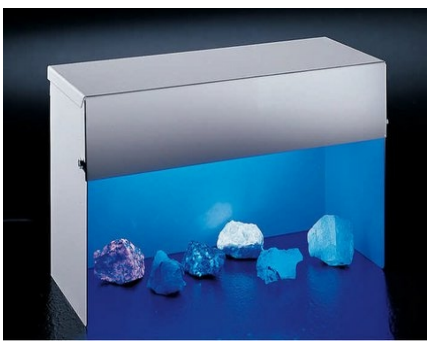

Figure 13: Fluorescence

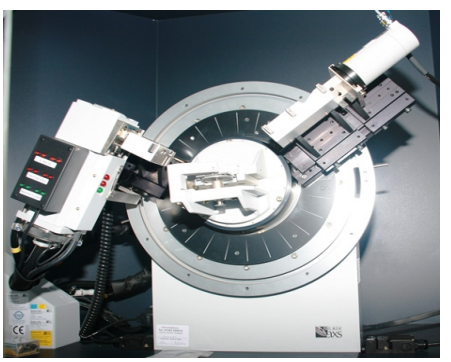

Figure 14: XRD Analysis

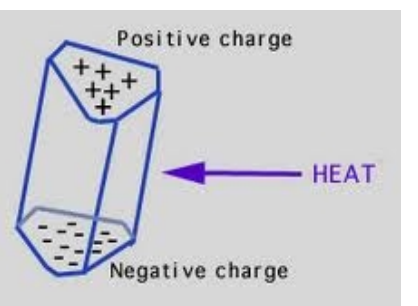

Figure 14: Conduction

Figure 15: Greiger Counter

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