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REVIEW ON CHARACTERIZATION OF MINERALS

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ABSTRACT

As Rasashastra deals with the use of metals and minerals for processing and making them into a palatable form for the alleviation of the disease so there is a importance of defining a mineral with its particular characters. The characterization of the drug comes under raw drug standardization for selecting particular and appropriated drug in order to give an exact result which is needed after preparing medicines. Availability of the drug has been reduced compared to previous days, so the artificial preparation of some materials has come up which does not possess the required qualities or the properties, thus characterization helps at this level for selection of drug. In olden days the Rasa vaidyas were selecting the minerals with the help of Grahya lakshans, the science has advanced we can explain those characters of a mineral under the heading characterization for worldwide acceptance in object parameter.

KEYWORDS: Rasashastra, mineral, characterization, mineralogical identification, streak, Grahyalakshanas.

INTRODUCTION

Every mineral[1] possess its own characteristic properties and the review of it is called as characterization[3]. A mineral is a body produced by the process of inorganic nature, having usually a definite chemical composition and, it found under favourable conditions a certain characteristic atomic structure which is expressed in its crystalline form and other physical properties. A mineral must be a homogenous substance, even when minutely examined under the microscope, further it must have a chemical composition which commonly is definite and can be expressed by a chemical formulae in some cases the chemical composition is variable but only with certain limits and then usually according to a definite law thus much basalt appears to be homogenous to the eye but when expressed under the microscope it is seen to be made up of different substances each having characters of its own.

A mineral has in most cases a definite atomic structure. This atomic structure manifests itself in the physical characters and especially in the crystalline form. A mineral in the majority of cases possess both general properties such as specific gravity, melting point etc,. And directional properties such as its atomic structure, crystal symmetry, optical characters etc. The combination of these two kinds of characters serves to define a mineral species.

THE PHYSICAL PROPERTIES FOR CHARACTERIZATION[4]

A. PHYSCIAL EXAMINATION OF THE MINERAL

Nature of the crystal[4]

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 scarce. As such natural occurrence of minerals may be in the following forms:

a. Crystalline
b. Amorphous
c. Opaque, transparent and translucent
d. Aggregate

Crystal Structure

A crystal structure is the orderly geometric spatial arrangement of atoms in the internal structure of a mineral. Depending on the symmetry we can find six types of crystal structure:

1. Isometric

The isometric system is referred to three axes of equal lengths and at right angle to each other. Ex: Iron Pyrite

2. Tetragonal

The tetragonal system are referred to Three axis at right angle to each other of which two horizontal axis are equal in length the vertical axis is either shorter or longer. Ex: Calcite

3. Orthorhombic

The orthorhombic system is referred to three axes at right angles to each other, all of different length. Ex: Adamite

4. Monoclinic

The monoclinic system is referred to three unequal axes, having one of their axial inclination oblique. Ex: Gypsum

5. Hexagonal

The hexagonal system is referred to four axes, three equal horizontal axes in a common plane intersecting at 60 degree, and a fourth vertical axes at right angle to them. Ex: Beryl

6. Triclinic

The Triclinic system is referred to three unequal axes, with all their intersections oblique. Ex: Labradorite

7. Amorphous

There's other type of crystals called amorphous in which crystals have no symmetry, this means that crystal system is absent. Ex: Amber and Opal are a good:

Crystal form[4] (Habit)

Crystal form indicates Shape of crystal.Based on shape crystal can be can classified as

Cubic - ex: Pyrite

Colour

Colour can be explained in two ways that is

→Metallic

→Non metallic

Examples for Metallic

Peacock feather colour – Peacock Ore o Copper colour- Copper

Examples for non-metallic

Deep blue colour – Lapis Lazuli o White colour – Gypsum

Streak[5]

Streak is the colour of the mineral in powdered form. Streak shows the true colour of the mineral. In large solid form, trace minerals can change the colour appearance of a mineral by reflecting the light in a certain way. Trace minerals have little influence on the reflection of the small powdery particles of the streak. The streak of metallic minerals tends to appear dark

because the small particles of the streak absorb the light hitting them. Non-metallic particles tend to reflect most of the light so they appear lighter in colour or almost white. Because streak is a more accurate illustration of the mineral's colour, streak is a more reliable property of minerals than colour for identification.

Hardness[6]

Hardness is one of the better properties of minerals to use for identifying a mineral. Hardness is a measure of the mineral's resistance to scratching. The Mohs scale is a set of 10 minerals whose hardness is known. The softest mineral, talc, has a Mohs scale rating of one. Diamond is the hardest mineral and has a rating of ten. Softer minerals can be scratched by harder minerals because the forces that hold the crystals together are weaker and can be broken by the harder mineral

The following is a listing of the minerals of the Moh's scale and their rating:

1.Talc,2.Gypsum,3.Calcite,4.Fluorite,5.Apatite,6.Orthoclase Feldspar,7.Quartz,8.Topaz, 9.Corundum,10.Diamond.

Cleavage[7]

Cleavage or parting is the tendency of minerals to split along certain definite planes. The cleavage plane is closely related to crystalline form and internal atomic structure and therefore is generally parallel to crystal faces. Minerals may show several cleavages and also the degree of perfection of each cleavage plane.

Fracture[8]

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.

Transparency or Diaphaneity[8]

Diaphaneity is a mineral's degree of transparency or ability to allow light to pass through it. The degree of transparency may also depend on the thickness of the mineral.

Tenacity[8]**-**

Tenacity is the characteristic that describes how the particles of a mineral hold together or resist separation. The chart below gives the list of terms used to describe tenacity and a description of each term.

Magnetism[8]

Magnetism is the characteristic that allows a mineral to attract or repel other magnetic materials. It can be difficult to determine the differences between the various types of magnetism, but it is worth knowing that there are distinctions made.

Example: Kantaloha

Luster[8]

Luster is the property of minerals that indicates how much the surface of a mineral reflects light. The luster of a mineral is affected by the brilliance of the light used to observe the mineral surface. Luster of a mineral is described in the Following terms:

Metallic the mineral is opaque and reflects light as a metal would. Submetallic the mineral is opaque and dull. The mineral is dark colored. Nonmetallic the mineral does not reflect light like a metal. Nonmetallic minerals are described using modifiers that refer to commonly known qualities. Waxy the mineral looks like paraffin or wax. Vitreous the mineral looks like broken glass. Pearly the mineral appears iridescent, like a pearl. Silky the mineral looks fibrous, like silk. Greasy the mineral looks like oil on

water.Resinous the mineral looks like hardened tree sap (resin).Adamantine the mineral looks brilliant, like a diamond.

Odor[9]

Most minerals have no odor unless they are acted upon in one of the following ways: moistened, heated, breathed upon, or rubbed.

Example: Lashuna gandha of Ghandhaka

Taste[9]

Only soluble minerals have a taste, but it is very important that minerals not be placed in the mouth or on the tongue

Specific Gravity[10]

Specific Gravity of a mineral is a comparison or ratio of the weight of the mineral to the weight of an equal amount of water. The weight of the equal amount of water is found by finding the difference between the weight of the mineral in air and the weight of the mineral in water

Fluorescence[10]

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

Twinning[10]

A twinned crystal contains two or more single crystals with identical packing but in different orientations. They are interringringgrown in such a way that at least some of their lattice directions are parallel.

Simple twinned crystals may be contact twins or penetration twins. Contact twins share a single composition surface often appearing as mirror images across the boundary. In penetration twins the individual crystals have the appearance of passing through each other in a symmetrical manner. If several twin crystal parts share aligned by the same twin law they are referred to as multiple or repeated twins.

If these multiple twins are aligned in parallel they are called polysynthetic twins.

When the multiple twins are not parallel they are cyclic twins.

Conductivity[10]

Conductivity is the measure of the ease at which an electric charge or heat can pass through a material. A conductor is a material which gives very little resistance to the flow of an electric current or thermal energy. Materials are classified as metals, semiconductors, and insulators. Metals are the most conductive and insulators (wood, plastic) the least conductive.

Acid test (fizz test)[11]

In this test you can test chemical properties for some minerals. For example, a few drops of hydrochloric acid (dilute or concentrated) can be used to see bubbles form the mineral.

Ex: iron pyrite

Flame test[11]

In flam test when mineral subjected to flame, the color of flame will change.

Ex: gold-yellow color flame.

Raman spectroscopy[12]

Raman spectroscopy (named after Sir C. V. Raman) is a spectroscopic

technique used to observe vibrational, rotational and other low-frequency modes in a system. It relies on inelastic scattering, or Raman scattering, of monochromatic light, usually from a laser in the visible, near infrared, or near ultraviolet range. The laser light interacts with molecular vibrations, phonons or other excitations in the system, resulting in the energy of the laser photons being shifted up or down. The shift in energy gives information about the vibrational modes in the system. Infrared spectroscopy yields similar, but complementary, information.Typically, a sample is illuminated with a laser beam. Light from the illuminated spot is collected with a lens and sent through a monochromatic. Wavelengths close to the laser line due to elastic Rayleigh scattering are filtered out while the rest of the collected light is dispersed on to a detector.

Energy Dispersive X-ray Fluorescence (EDXRF)[12]

Energy Dispersive X-ray Fluorescence (EDXRF) is one of two general types of X-ray Fluorescence techniques used for elemental analysis applications. In EDXRF spectrometers, all of the elements in the sample are excited simultaneously, and an energy dispersive detector in combination with a multi-channel analyzer is used to simultaneously collect the fluorescence radiation emitted from the sample and then separate the different energies of the characteristic radiation from each of the different sample elements.

Resolution of EDXRF systems is dependent upon the detector, and typically ranges from 150 eV – 600 eV. The principal advantages of EDXRF systems are their simplicity, fast operation, lack of moving parts, and high source efficiency. X-ray optics can be used to enhance EDXRF instrumentation.

CHEMICAL EXAMINATION OF A MINERAL

Closed tube[13]

A small fragment is inserted or a small amount of powdered mineral and heat is applied by means of ordinary Bunsen flame, the presence of a volatile ingredient is ordinarily shown by the deposit or sublimate upon the tube at some distance above the assay where the tube is relatively cool.

Open tube[13]

A small fragment is placed in the tube about an inch from the lower end, the tube being slightly inclined but not enough to cause the mineral to slip out, and heat applied beneath.

Roasting[13]

Sample is taken in Iron pan and heated to observe the odor, fumes and changes occurring while roasting. The mineral is powdered and spread out the points to be noted are the a) odor given, b) fusion, c) The sublimate.

TABLE NO.1- CHARACTERIZATION FOUND IN RASA CLASSICS[19]

Rasadravyas	Nature	Colour	Luster	Wt. of mineral
Abhraka	snigdha	varasamyuktanilajanopam	mahajwalam	Bharatodhikam
Vaikratha	Masruna	Shuddhamishritavarna		guru

Makshika	Snigdha, shuddha	Suvarnavarnas ahashanvavarna samaprabha	harshlilacchavi	guru
Vimala	Vartula, Phalakavinta			
Shilajatu	Mrudu	mrutsna	Achajapapu shapanibha	
Sasyaka	-		mayurakaanta	bharudhaya
Chapala	snigdha	sphatikashubha		guru
Gandhaka	Snigdha, Masruna, Katina		shukapichasamacc ham	
Gairika	Masruna Snigdha	Atyanta shonitha		
Haratala	Snigdha	swarnavarna	bhasura	guru
Manashila	Kandapurvika	atiraktangi		
Kampillaka	-	Ishtikachurna sankasha	chandikadayo	
Kaparda	Dirgavruta	pithabha		
Hingula	-	shukavarna	japakusumambu	
Swarna	Mrudu, nirdala	Shodhasavarnadaya raktapitakam	swacha	guru
Rajata	Ghana, snigdha,mrudu	Chandravaswacha shankhabha	swacha	guru
Tamra	Dhatukshama ghana	shonam	snigdham	guru
Mandura	Hada	krushna		guru
Vanga	Mruladrutadra vasagara	Shubhravarna dhavala		
Naga	-			Maha bharam
Yashada	Mruduvi, snigdhatva		nirmala	Maha bharam
Pittala	Mruduvi, snigdhatva	pitabha		guru
Kamsya	Susnigdha	Ishcchamalashu bhakam	nirmala	
Manikya	Sphutamvrutha ya tasamagaatra	Kusheshayadala ghayam	Swacha snigdham	guru

Mukta	Vrutha, susnigdha	Nakshathabhakhetanivarna	nirmala	Sthula,gaurava
Pravala	Vrutha, susnigdha	Pakvabimbapha lachaya		sthula
Trakshya	Masruna	haridavarna	Rashmichayabas Uram,snigdham	guru
Pushparaga	Mruduvi, susnigdha	Karnikaaraprasu nabha	swacha	Sthula guru
Vajra	Astasrastaphal aka shadkhona		atibhasuram	
Neela	mrudhumadhy eshindita	nilabham	ekacchtaswacha	sabharam
Vaidurya	Snigdha	Vidaleksha-nasaprasha	shubra	guru
Suryakantha	Masruna	nivarna	shuddha	
Chandrakantha	Snigdha	pithavarna	swacha	
Rajavarta	Sumasruna	Alparatha-shikikantasamaprakasha	Nilikamishritaprabha nirmala	guru
Sphatikamani			Gangatoya binduswachavi	

DISCUSSION AND CONCLUSION

The Physical properties and chemical properties of minerals are used by Mineralogists to help determine the Identity of a specimen. Some of the tests can be performed easily in the field, while others require laboratory equipment. For the beginning student of geology, there are a number of simple tests that can be used with a good degree of accuracy. The list of tests is in a suggested order, progressing from simple experimentation and observation to more complicate either in procedure or concept. Possibly almost all the minerals which are dealt in Rasa shastra can be characterized with the help of modern mineralogy for the proper understanding of structure of the mineral. Generally we get the references in our classics regarding the selection of the mineral for the purpose of preparing Aushadhies and the drugs which are to be discarded dealt with the heading Grahya and Agrahyalakshana's. Therefore above mentioned points will clearly shows us Characterization of the minerals used in the formulation will help in the drug action of the Formulation in which it is used.

REFERENCE

1. A text book of mineralogy by Edward Salisbury Dana, 4th edition 2006, CBS Publishers and distributors Pvt ltd. New Delhi.

2. The Ayurvedic pharmacopoeia of India, Part-1, Volume-2, 1st edition, 2008, Published by Govt. of India, Ministry of

Health and Family welfare, Dept.ofAyush, New Delhi.
3. Mineralogy, American Heritage Dictionary. Houghton Mifflin harcourt publishing company. 2017.retrieved 19 october 2017.
4. Dyar and Gunter 2008 .
5. Bishop, A.C Wolley, A.R. Hamilton,WR.Cambridge guide to minerals, rocks and fossils.2nd edition , Cambridge university press pp 12-13.
6. Mohs hardness in encyclopedia Britannica online.
7. Hurlbut, Cornelius S.klein, cornelis, 1985, Manual of Mineralogy 20th edition.
8. A text book of mineralogy by Edward Salisbury Dana, 4th edition 2006, CBS Publishers and distributors Pvt ltd. New Delhi.
9. History of chemistry in Ancient and medieval India incorporating the history Of Hindu chemistry by Acharya Prafulla Ray Edited by P.C.Ray Chaukambha Krishna das academy, Varanasi, 2004.
10. Alchemy and metallic medicine in Ayurveda by Brahma shakara 2nd edition 2000,11th chapter,100
11. Intro-chemistry of Ayurveda by parafful 1st edition Chakumbha orintalis Varanasi 1999 5thchapter, 89
12. Sadananda Sharma, Rasatarangini, 11th Edition, Edited by Kashinath Shasthri, Motilal Banarasidas, Delhi, 2009, 10th chapter, 13th sloka.
13. V.N.Sharma, R.S. Singh, A.V.Ulabhaje, S.P.Sen, studies on Identification of vaikrantha Used in Ayurveda science of Life, vol no.1, pages 146-154.
14. Rasavagbhata, Rasa Ratna Samucchaya, Edited by Kaviraja Sri Ambikadatta Shasthri, 9th Edition, Chaukambha Amara Bharathi Prakashana, 2nd chapter,126pp
15.Acharya Madhava, Ayurveda Prakasha, Edited by Gulraj Sharma Mishra, Chaukambha Bharati Academy, Varanasi, 1st edition, 2007, 4th chapter, 8th pp.
16. Prof. Siddi Nandan Mishra, Ayurvedeeya Rasashastra, Chaukambha orientalia Varanasi, revised edition 2011, pp-392.
17. Rasavagbhata, Rasa Ratna Samucchaya, Edited by Kaviraja Sri AmbikadattaShasthri, 9th Edition, Chaukambha Amara Bharathi Prakashana, 3rd chapter,137pp.
18. Sadananda Sharma, Rasatarangini, 11th Edition, Edited by Kashinath Shasthri, Motilal Banarasidas, Delhi, 2009, 20th chapter, 126 pp.
19.Acharya Madhava, Ayurveda Prakasha, Edited by Gulraj Sharma Mishra, Chaukambha Bharati Academy, Varanasi, 1st edition, 2007, 5th chapter, 95 pp.

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