“STUDIES ON IDENTIFICATION OF ‘VAIKRANTA’ USED IN AYURVEDA”

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ABSTRACT: Of the several of minerals used in Ayurveda practice as Vaikranta, the most commonly used were procured from reputed Ayurveda pharmacies all over India and those responding to physical characteristics of Vaikranta as mentioned in Ayurveda texts were subjected to physical, chemical and spectral analysis. X-ray diffraction study of Schorlrite was undertaken to conform mineral constitutions of the materials.

Introduction:

The use of previous stones in the treatment of diseases has been in vogue in Indian system of medicinal from very early period in the history of civilization. These precious stones also from important constituents of Unani medicine. However there is no reference available in the literatures about the use of these materials in modern system of medicine.

In Indian system of medicine, particularly in Ayurveda, the therapeutic use of precious stones falls under Rasacikitsa². The precious stones are used by oral route only after some preliminary pharmaceutical treatment, known as sodhana and marana³.

Of several precious stones, used in Indian system of medicine, Vaikranta occupies a very important position. According to Rasa Text Vaikranta is distributed mostly in mountainous regions along the border of Vindhya ranges. Rasa-Ratna-Saamuccaya⁴ includes Vaikranta in the group of Maharasa and chapter on Vaikranta follows that of Abhraka (Mica), which presumably indicate the association of Vaikranta to that of Abhraka in its natural distribution.

The mineral identity of Vaikranta has unfortunately been a matter of controversy and many minerals, differing widely in nature from one another, are recommended by different schools of Ayurveda physicians to be used as Vaikaranta in therapeutics. It is worth mentioning that at present at least four items viz. Tourmaline, Flourspar, Feldspar and Quartz are being used for Vaikranta by different pharmacies and physicians. The physical and chemical characteristics of the four materials as mentioned above have been fully established by modern scientific discipline⁹.

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The present study has been undertaken to identify the material or materials, which conform to the physical characteristics and elemental composition of Vaikranta, as described in Ayurveda texts. Study of the forms and habits have been done by spectral and chemical examination of the four materials viz. Tourmaline Feldspar, Flourspar and Quartz.

According to Ayurveda Rasa Text “Vaikranta” may either have eight angles and eight surfaces or six angles and six surfaces. The material is smooth, heavy and may be of a single colour or of a combination of colours. The term smooth may refer to glossy surface of the grains and term heavy indicates its high specific gravity. Some authorities have suggested that Vaikranta can be of seven colours while others have suggested that these may be of eight colours. The Acaryas of Rasa or exponents of Rasa-Sastra have started that Variance in colour of Vaikranta is due to the deposition of various mineral elements on the basic stone, which forms the nucleus. These mineral elements originated from the mountain summits and are carried with the streams and torrents to be mixed with the stones on mountainous regions. Most of the authorities believe that Vaikranta may be of seven colours. White (Sveta), Red (Rakta), Yellow (pita), Blue (Nila), Dove coloured (Ash-colored) or (Parabatechavi), Greenish (Syamala), Black (Krsna). In some texts, syamala is replaced either by markata (emerald colour) or tarksy and krsna is replaced by Mayur-vala or Mayurkantha. Those who accept eight colours, mention ‘Karbura’ (Varie-gated) as separate entity. ‘Karbura’ presumably represents, (Indradhanucchavi). The physical and Chemical characteristics of the four minerals used as Vaikranta have been sufficiently studied by modern scientific workers and review of literature show the following characteristics. (Table X).

In view of the controversy about the true identify of vaikranta, difficulty is after experienced improcuring the right varieties. As such, a primilary study has been undertaken to find out the physic-chemico characteristics or materials sold in the market as vaikranta.

**EXPERIMENTAL**

I. Test sample:

Samples of materials, being used as Vaikranta in Indian Pharmacies, were obtained from different reputed Ayurvedic Pharmaceuticals organizations.

II. Method of examination:

The gross physical characters of these were examined and compared with the descriptions given in Ayurvedic texts. Such samples which conformed to the physical characters of Vaikaranta, as mentioned in Ayurvedic literature, were selected for detailed study. Out of eight samples, six were found to respond to the characteristics mentioned in Ayurvedic texts.
Physical examination:

Studies regarding form, colour, streak, lusture Fracture, Cleavage, Hardness, Specific gravity (by walkar’s steel yard method) and inclusion and alteration of the samples was done according to Geological examination methods for preliminary identification. The samples responding to the physical characteristics of Vaikranta were than subjected to microscopic examination and late Chemical analysis and X-Ray studies were done to establish their identities.

(B) Microscopic examination:
The microscopic examination was done under the petrological microscopic, wherein the sections were examined under ordinary light, polarized light, crossed nicols.

(C) Chemical analysis:
The rock Chips were washed with distilled water and crushed in diamond-steel mortar. The crushed material was further ground in Agate mortar to 200 mesh fineness. The analytical procedure included preparation of two solutions one for determination of $\text{SiO}_2$ and $\text{Al}_2\text{O}_3$ and other for determination of $\text{TiO}_2$, $\text{Fe}_2\text{O}_3$, Mn0, Mgo, Cao, $\text{P}_2\text{O}_5$, $\text{Na}_2\text{O}$ and $\text{K}_2\text{O}$. Solution No.1 was prepared by fusing the rock material with NaOH pellets, diluting with water and then boiling with dil HCl solution. Solution No.2 was prepared by triturating the samples with a mixture of hydro-flouric (HF) acid and HNO$_3$ ACID (3:1) IN A PLATINUM CRUCIBLE UNDER FUMING CHAMBER, which was then heated on water bath till rock powder was completely digested and solution became transparent. This was next heated on hot plate till dense white sulphurous fumes were produced. Contents of the crucible were diluted with water in a beaker, heated and a mixture of HClO4-HnO$_3$ WAS ADDED. Heated again and then cooled to room temperature. To the solution cone, HNO$_3$and Hydrazine sulphate solution were added and again boiled on hot plate. The percentage compositions of the elements were estimated in the solutions (1) and (2) by approved analytical methods for rock analysis.
| Sl. No. | Name      | Form / Crystal Form                                                                 | Variety / Colour                                                                 | Chemical Composition                                                                 | Specific Gravity | Hardness |
|--------|-----------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------|----------|
| 1      | Tourmaline| Prismatic Crystals three sited hexagonal and trigonal prisms                          | **RUBELLITE (RED)**<br>Indecollite (indigoblue)  
Brasillian sapphire (Blue) | RUBELLITE  
Mn gives pink-colours,  
Others contain its No. (Al, Fee + Mn, Li) 3 B₃, Al₃,  
(Al, SiO₂ O₆) 3 (OH, F )₄<br>Indigolite green tint due to Cu, Cr. Na, Mg, B₃,  
Al₃ (OH)₄ (Al₃) Si₆ O₂₇  
Scholite – Na Fe₃ B₃ Al₃ (OH)₄ (Al₃ Si₆ O₇)<br>KAlSi₃O₈ also constants little percentage of Na, Al Si₃ O₈ | 3.0 – 3.2      | 7.0 – 7.5  |
| 2      | Feldspar  | Orthoclase, hylophane selsian and soda-orthoclase crystalise in mono clinic system and micro clinic | Aluminous silicates of K, Na, Ca or Ba | Blue Johnpur pil or blue variety form derbisor  
CaF₂ | 2 – 0 – 3 - 0 | 6.0      |
| 3      | Flourspar | Common form crystal of cubes more rarely octahedral or tetrahedra                     | Blue Johnpur pil or blue variety form derbisor  
CaF₂ | 3.0 – 3.25    | 4.0      |
| 4      | Quartz    | Hexagonal prisms turbinated by positive and negative rombohedra                      | i) Rose Quartz pale pink or rose colour fades on exposure  
i) Sairngorm fine smoky yellow or smoky brown colour | SiO₂ | 2.7      | 7.0      |
|   |   | iii) Morian – nearly black variety |
|---|---|----------------------------------|
|   |   | iv) Milky quartz                  |
|   |   | v) Cat’s eye                      |
|   |   | vi) Aventurin                     |
|   |   | vii) Ferruginous – contain Ironoude which imparts a raddish or brownish colour |
X-RAY ANALYSIS

X-Ray analysis was done by powder photographic method (Dubey and Schewer) and the different mineral constituents of the samples were estimated by the calculation of the reflected ray from the equations.

\[ 2d \sin \theta = n \] (1)
\[ n = \text{some integer} \]

\[ = \text{wave length of x-ray and reflected planes,} \]

\[ d = \text{distance between parallel reflected planes} \]
\[ = s/S \times 90^\circ \] (2) \[ (s = \text{distance of particular line for centre}) \]

(S= distance between two centres) from the observed value the value of \( d \) can be calculated, which in its turn helps in identifying the mineral by consolation of the tables showing \( d \) values and the corresponding mineral.

RESULTS AND OBSERVATION

The results obtained in the various studies mentioned above are presented in the following tables:-

MICROSCOPIC EXAMINATION:

Microscopic Examination of the samples revealed the characteristics of the samples according to which materials were finally characterized as Tourmaline, Feldspar, Flourspar and Quartz.
| Sl. No. | Properties                  | Samples Numbers                  |
|-------|-----------------------------|----------------------------------|
|       |                             | I      | II      | V      | VI     | VII    | VIII   |
| 1     | Colour                      | Pink Colour | Pale green colour | Colourless slightly smoky | Black | Pink colour | Pale green transparent |
| 2     | Streak                      | None, transparent | White transparent | None | White | White | Vitreous |
| 3     | Lustre                      | Vitreous | Vitreous | Vitreous | Vitreous | Peerly on cleavage faces. | Perfect octahedral (this cannot be checked in the actual specimen) |
| 4     | Cleavage                    | None Irregular | No Cleavage | Absent | Absent | Perfect in 2 sets at about right angle |
| 5     | Fracture                    | Conchoidal | Conchoidal irregular fracture present | Conchoidal | Uneven | Uneven | Conchoidal |
| 6     | Habit                       | Columnner with prism from vertically striated | Columnner prism faces striated vertically | Massive | Prismatic columnner crystals with prism faces vertically striated | Tabular crystallized | Crystalline Massive |
| 7     | Hardness                    | 7.5    | 7.5    | 7.0    | 7.5   | 6.0   | 4.0   |
| 8     | Specific gravity            | 3.3    | 3.2    | 2.61   | 3.1   | 2.57  | 3.18  |
| 9     | Inference probable (Identity) | Tourmaline (Rubellite) | Tourmalin (Indicollite) | Quartz | Tourmaline (Schorlrite) | Microcline (Perthite) | Fluorite |
### TABLE NO. II

Table Showing Microscopic Characteristics of the Different Samples of Vaikrant from Different Agencies

| Sl. No. | Minerological | Sample No.1                  | Sample No.2                              | Sample No.5                  | Sample No.6                         | Sample No.7                      | Sample No.8                  |
|---------|---------------|------------------------------|------------------------------------------|------------------------------|--------------------------------------|----------------------------------|-----------------------------|
| 1       | Form          | Irregular Anhedral           | Irregular Anhedral                       | Irregular Anhedral           | Irregular Anhedral                   | Irregular Anhedral               | Subhedral                   |
| 2       | Cleavage      | Absent, Irregular fracture   | Absent, Irregular fracture               | Absent, Irregular fracture   | Absent, Irregular fracture            | Present but not clear           | Clear                       |
| 3       | Colour        | Pale pink                    | Colourless gaingran                      | High Pale green to pale blue faint pleochroism | Colourless                     | Slate blue                      | Transparent colourless       |
| 4       | Relief        | High, Twinkling effect seen due to charge of relief | Low Pleaochroism                         | Low strongly pleaochroic yellowish green blue | Absent                         | Absent                          | Colourless                   |
| 5       | Pleaohroic Halves | Absent                     | Absent                                   | Absent                       | Absent                              | Absent                          | Absent                      |
| 6       | Isotropic / Anisotropic | Anisotropic                  | Anisotropic                             | Anisotropic                  | Anisotropic                        | Anisotropic                     | Isotropic                   |
| 7       | Isotropic / Interference | Masked by strong body colour | White with grey and streous yellow       | Masked strong body colour    | Grey all white interference in colour | Absent                          | Absent                      |
| 8       | Extinction    | Nil                          | Straight                                 | Interminable                 | Straight                           | Angle small about 5º            | Absent                      |
|   |         |         |         |         |         |         |         |
|---|---------|---------|---------|---------|---------|---------|---------|
| 9 | Twinning | Absent  | Absent  | Absent  | Absent  | Cross hatchca twinning | Absent  |
| 10| Others   | Spinaly proper | Nil     | Minute unidentible inclusions present | Occasional Minute inclusion | Shows inter growth with albite | Nil     |

Samples 1, 2 and 6 respond to characteristics of three varieties of Tourmaline i.e. Rubellite, Indicolite, Schorlite respectively.

Samples 5 is Quartz white samples 7 & 7 seem to be microline perthite and Flourite respectively.
### TABLE NO. III

Table Showing Chemical Composition of Minerals as Oxide Weight (Percentage)

| ELEMENTS | SAMPLES  | I   | II  | V   | VI  | VII | VIII |
|----------|----------|-----|-----|-----|-----|-----|------|
| SiO₂     |          | 39.86 | 38.01 | 98.05 | 36.78 | 63.02 |
| TiO₂     |          | 10.50 | 9.92  | 8.01  |
| B₂O₃     |          | 42.10 | 40.69 | 0.66  | 31.14 | 18.73 |
| Al₂O₃    |          | 1.27  | 4.57  | 0.48  | 8.55  | 0.92  |
| Fe₂O₃    |          | 0.91  | 0.90  |
| FeO      |          | 0.09  | 0.96  | 6.66  | 0.10  |
| MnO      |          | 0.05  | 0.41  | 0.97  | 1.20  | 2.13  |
| MgO      |          | 1.55  | 1.98  | 0.20  | 1.49  | 9.49  |
| CaO      |          | 0.30  | 0.37  | 0.10  | 6.33  |
| Na₂O     |          | 1.63  | 3.02  | 4.59  | 0.54  |
| K₂O      |          | 98.05 | 0.66  |
| H₂O      |          | 36.78 | 8.01  |
| CaF₂     |          | 63.02 | 18.73 |

| Sample No. | SERIES   |
|------------|----------|
| I          | Rubellite |
| II         | Indocollite |
| V          | Quartz |
| VI         | Schorlite |
| VII        | Feldspar (Microline – Perthite) |
| VIII       | Flourite Sample |

**Result of x-ray diffraction analysis of bhasma**

(Photograph in 1 showing the x-ray diffraction kaltan of the varieties & Vaikranta)

‘*d values*’ (as per famy & D ondo Bhoss method)

1. Tourmaline- 6.55, 5.31, 4.05, 3.33, 2.85, 2.57, 2.20, 2.05, 1.72, 1.67.
2. Feldspar- 3.88, 2.18, 1.81, 1.52, 1.46, 1.44, 1.42, 1.19.
3. Quartz-
   4.23,2.30,1.95,1.76,1.62,1.42,1.30.

4. Flurspar-1.71,1.39,1.12,0.92.

The results indicate that the physical characteristics of Schorlite, Indiocollite and Rubellite are similar to those of Vaikranta although the chemical composition of the three materials differ appreciably. The absence of B₂O₃, Feo, Mgo in Schorlite is quite significant. Further this materials contain a higher proportion of SiO₂, Na₂O and K₂O as compared to Indicollite and Rubellite which accounts for allowed specific gravity and hardness of this material. It is also pertinent to mentioned that all three materials mentioned above, are the different forms of Tourmaline, which indicate that, ‘Vaikrant of Ayurveda is essentially a form of Tourmaline.

The ayurveda literature is not very clear about the Chemical composition of Vaikranta but from descriptions about its colour, hardness, cleavage as expressed in allegorical terms, it is presumed to be of the nature of schorelite.

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