Effect of Radiation of Moon on the physical property of Jalkhumbhi (Water hyacinth) Bhasma as a functional nanomaterials for its applications as medicine and in other areas of Science & Technology.

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Abstract. Jalkhumbhi Bhasma as Nanomaterials is prepared using ecofriendly green approach in Pushya nakshtra and Rohini nakshtra. The crystal structure was evaluated, using modern scientific tools. X-ray diffraction measurement shows that crystalline size and lattice constant of Jalkhumbhi bhasma prepared in Push and Rohini nakshtra were found, 26.62 nm and 54.55 nm and lattice constant 6.312Å, 6.301Å and respectively. This reveals the effect of radiation of moon alter the crystal structure. The Fourier transform infrared spectroscopy(FTIR) measurement shows functional group present in the materials are of the compound of K, Cl, C-Cl, NH₂, C-O-C, C=O, Ca, and Ca(OH)₂ respectively. The magnitude of force constant between the atoms are 2.51307 N/cm, 4.16005 N/cm and 2.61932 N/cm, 4.20074 N/cm respectively in both the nakshtras, which measure the interatomic strength. The photoluminescence spectra (PL) reveals that the broad emission of radiation spectrum from both the materials lie in the visible region, showing broad blue emission. The energy band gap value for the most significant intense peak corresponding to 481 nm (2.55 eV) corresponding to 350 nm excitation of radiation and 501 nm (2.475 eV) for 370 nm. The optical property shows that prepared Jalkhambhibhasma may be useful as semiconductor electronics nanomaterials, which were prepared using eco-friendly approach. This may open a new window for material science and pharmaceutical sector for the production of such materials for electronic based industries, in addition, to using as an evidence based medicine. The effect of natural radiation of moon changes the crystal structure and properties of materials, which are beneficial for health as well as in other areas of science and technology due to its crystalline size and optical properties.

Keywords: Jalkhubhi, Bhasma, Nanomaterials, Crystal structure, Moon, Physical properties

1. Introduction
Jalkumbhi, an aquatic plant, floating on lakes, streams, and stagnant water ponds is found in the tropical and subtropical regions of Asia, Africa, India, and America. Ayurvedic bhasma are very small sized materials, which are very useful in various diseases [1-5]. Bhasma are nanocrystalline materials, which are confirmed by employing modern scientific techniques [6-10]. Nanocrystalline materials are defined sizes of, which range in between 1-100nm, which can be observed by Electron microscope, X-ray
diffractometer, Nanoparticles tracking analysis system[6-10]. At nanoscale, properties of materials change drastically, because more surfaces are in close contact and their quantum confinement effect[11-12]. Bhasma are ancient Indian wisdom, which are being used from ancient times for the treatment of various diseases. The presence of exact functional groups and determination of crystal structure are still not known to Ayurvedic physicians and pharmaceutical industries. Therefore global scientific communities do not accepted as evidence based medicine of Indian subcontinent. One of this objective of this present research is to determine the Physical properties of this Jalkhumbhi bhasma using modern scientific tools e.g- X-Ray diffractometer(XRD), Fourier Transform infrared spectroscopy(FTIR) and Photoluminescence spectrometer(PL) for its applications. Properties of any materials depend upon the method of synthesis. Generally, chemical methods, Physical method, Biological methods are being used to prepare different materials for its applications in various areas of science and technology [13-14]. But, in this present research we, have used ecofreindly green approach to prepare in the presence of moon Jalkhumbhi Bhasma as nanomaterial, which is another objective of this research. In Indian Ayurvedic text, various techniques are mentioned, which can be used to increase the efficacy of ayurvedic medicine. The efficacy of medicine or properties of materials depends on environmental conditions. Collection of raw materials in Pushya and Ashwinanakshatra was considered very important because moon is the God of drugs and also it is the God of kark rashi (cancer zodiac). In India people consider Sun and Moon as great source of energy for survival of life. That is why in this time period moon is predominant and transmits more ‘rasa’ in drug. Therefore, in this time period, medicinal drugs are considered more effective. On the other hand, accordingly in ayurveda raw fresh materials should be collected either from the East side or North side, it is said that potency and efficacy observed in these direction, because moon is swami of north side and sun of east side that embedded divine energy to drugs [Ref]. In this present research, the effect of nakshatra was also studied on crystal structur using modern scientific tools for its uses, which is also another objective of this present research.

2. Materials and Methods
Jalkumbhi or Water hyacinth (Eichhornia crassipes) plant was taken on 1st January 2021 at 1.15 pm (Pushya nakshatra) in white cloth dress with mantra vibration and saluting divine Cows. This plant was received in north face direction. Plants were cleaned with water and dried in sunlight from 1st January to 26th January 2021. On 27th January, again same plant was cut into pieces and put into soil pitcher and tightly closed with wheat straw and soil. This process was completed at the bank of Ganga of region Munger, Bihar, India at time 1.15 pm. Similar way Jalkhumbhi plant was received on another nakshtra (Rohini) on 27th December 2020 at 2.57 pm. Plants were washed with water and cut into small pieces and dried in sunlight from 28th December 2020 to 26th January 2021. Again, on 27th January 2021, all the materials are taken in soil pitcher and tighten with wheat straw and soil. The Masi Kalpana method was used to prepare Jalkhumbhi bhasma materials on 28th January, 2021. The both soil pitcher were transferred inside pit in earth of 80 x 80 x 80 cm depth and were heated from 28th January 2021 at 1.51 pm to 29th January 2021 at 5.17 pm worshipping lord Shiva and Dhanvantri. The soil pitcher was recovered from patthe materials was obtained as tiny size superfine materials. The materials and methodology used in this research is shown in figure-1 [16]. The materials prepared in Pushyanakshtra is represented by M1, while materials prepared in Rohininakshtra is represented by M2.
3. Results and Discussion

3.1 Crystal Structure Evaluation

The X-ray diffraction pattern of samples M1 and M2 are shown in figure-2 and their structural details are shown in table-1. The XRD diffraction is an advanced tool, which is used for determination of the crystalline size, interplaner distance, interatomic distance and related crystal structure parameters. The figure-2 and table-1 shows that crystalline size of the prepared materials are 26.62 nm and 54.55 nm, using Scherer formula and lattice constant 6.312Å, 6.301Å and respectively [17]. The crystalline size were also determined using Williamson-Hall plots techniques, shown in figure 3, which is special technique to determine crystalline size and using this tools and size were found 26.66nm, 49.51 nm respectively. Both the techniques shows that crystalline size are in between 1-100nm (size of the M1 is about 26 nm and M2 is about 50nm). The major compound present in the materials are KCl and CaCO$_3$. This result shows, crystalline size and lattice constant depends on Pushya naksatra and Rohini naksatra. The efficacy of materials are dependent on crystalline size. The tiny size particles shows more efficacy as compared to bulk size. The detailed structural parameters at atomic and molecular level are shown in figure 5-6. The details of crystal structure was also shown using W-H plot and Reitvelt analysis and shown in figure 3-4 and table-2-3, which reveals that crystalline parameter depends on naksatra.

![Figure 1. Materials preparation at Nano scale from natural product in presence of radiation](image1)

![Figure 2. X-ray diffractograms of sample M1 and M2](image2)
Table 1. Crystallographic Parameters of sample M1 and M2

| Sample Code | 2θ (Degree) | d (Å) | Lattice Constant (Å) | Cell Volume (Å³) | Crystallite size (nm) | X-Ray Density (Dₓ)(g/cm³) |
|-------------|-------------|-------|----------------------|------------------|-----------------------|---------------------------|
| M1          | 28.26       | 3.155 | 6                    | 251.47           | 26.62                 | 3.990                     |
| M2          | 28.31       | 3.150 | 5                    | 250.16           | 54.55                 | 4.011                     |

Figure 3. W-H Plot of sample (a) M1 (b) M2

Table 2. Structural parameters using W-H Plot of sample M1 and M2

| Sample Code | Strain (×10⁻³) | Crystallite size (nm) |
|-------------|----------------|----------------------|
| M1          | -1.630         | 26.66 (±1)           |
| M2          | 0.445          | 49.51 (±5)           |

3.2. Rietveld Refinement Analysis

Table 3. Rietveld refinement crystallographic parameters of KCL Phase

| Parameters | Sample Code |
|------------|-------------|
|            | M1          | M2          |
| 2θ (°)     | 24.48       | 24.47       |
| d(Å)       | 3.6326      | 3.633       |
| Rp (%)     | 36.9        | 22.01       |
| Rb (%)     | 22.6        | 12.61       |
| Rf (%)     | 13.4        | 14.6        |
| Goodness of Fit (GoF) | 6.8        | 3.71        |
| a=b=c (Å)  | 6.2920      | 6.293       |
| V (Å³)     | 249.09      | 249.25      |
| Dₓ(g/cm³)  | 3.975       | 3.972       |
Figure 4. Rietveld refinement graph of sample (a) M1 (b) M2

3.3. Types of structural orientation:

Figure 5. (a-f) Different types of structural orientation of KCL Phase [Source VESTA software, JP Minerals]
XRD and Rietveld analysis of Samples M1 and M2 shows that presence of major two types of compound are KCL and CaCO₃. Moreover, there are various types of structural orientation found which have been identified are shown in Fig 5 and Fig.6 respectively for the sample M1 and M2. Fig 5 (a-e) depicted the polyhedral, wireframe, ball-stick, space-filling and stick orientation respectively, whereas, Fig. 5(f) shows the powder diffraction pattern of KCL phase which matched with F m -3 m (cubic) space group. Similarly, for CaCO₃ phase the structural orientation were identified which matched with R -3 c space group (trigonal). Fig 6(a-e) represented the polyhedral, wireframe, ball-stick, space-filling and stick orientation respectively, whereas, Fig. 6(f) shows the powder diffraction pattern of CaCO₃ phase. The different orientation clearly indicates the internal crystallographic structure of the compound present in samples M1 and M2 which are KCL as well as CaCO₃. The presented detail structural parameters can be considered to determine the physical properties.

3.4. FTIR Spectroscopy measurement

![Figure 7. FTIR spectrum for sample M1 and M2](image)
Table 4. FTIR vibration bands of K⁺ and Cl⁻ for sample M1 and M2

| Sample Code | Vibration Mode      | M1 (Wavenumber (cm⁻¹)) | M2 (Wavenumber (cm⁻¹)) |
|-------------|---------------------|------------------------|------------------------|
|             |                     |                        |                        |
| K⁺ ions     | 478                 | 488                    |                        |
| Cl⁻ ions    | 615                 | 618                    |                        |
| C-Cl Stretching | 710              | 703                    |                        |
| NH₂⁺ Group  | 875                 | 867                    |                        |
| C-O-C Vibration | 1103             | 1055                   |                        |
| CH₃ Molecules | 1438              | 1434                   |                        |
| Ca⁺ Region  | 1590                | 1598                   |                        |
| Carbonyl Group (C=O) | 1795            | 1796                   |                        |
| Ca (OH)₂ Stretching | 3416           | 3406                   |                        |

Table 5. Force constant and bond length of K⁺ and Cl⁻ for sample M1 and M2

| Sample Code | Wavenumber (cm⁻¹) | Site | Effective Mass (×10⁻²⁶) | Force Constant (N/cm) | Bond length (Å) |
|-------------|-------------------|------|------------------------|-----------------------|-----------------|
| M1          | 478               | K⁺ Ions | 3.09561                | 2.513                 | 1.891           |
|             | 615               | Cl⁻ Ions | 3.09561                | 4.160                 | 1.598           |
| M2          | 488               | K⁺ Ions | 3.09561                | 2.619                 | 1.865           |
|             | 618               | Cl⁻ Ions | 3.09561                | 4.200                 | 1.593           |

The Fourier transform infrared spectroscopy (FTIR) measurement, shown in fig-7 and table-4 shows that the presence of functional groups and their vibrational mode of frequency, which are found to differ, which confirm the crystalline structure are different at atomic and molecular level. The functional group present in the materials are of compound of K, Cl, C-Cl, NH₂, C-O-C, C=O, Ca and Ca(OH)₂ respectively. The magnitude of force constant for M1 are 2.51307 N/cm, 4.16005 N/cm and for M2 are 2.61932 N/cm, 4.20074 N/cm respectively. Force constant and bond length are inversely related. Atoms in solid materials are attached like a spring force, which measure the interatomic strength. This result shows that bond length depends on cosmic radiation of moon. Position of wave number of vibration of atoms and compound are found different of materials M1 and M2, which also support the XRD data. This reveals that crystal structure changes at atomic and molecular level. Superfine food materials, which have better bio availability at molecular level for better action on human body, prepared by various milling techniques also have similar changes of crystal structure [18-19]. The superfine powder are nanocrystalline materials of which physico-chemico properties are differ from bulk materials.

3.5. Photoluminescence Measurement (PL)

PL spectra of the samples M1 and M2 are shown in figure 8-9 (a-b) at different excitation radiation of wavelength of 350 nm and 370 nm respectively. The emission spectra reveals that the broad spectrum of both the radiation lies in the visible region, showing broad blue emission. The intensity of M2 sample is more in compared to M1 sample. The energy band gap value for the most significant intense peak corresponding to 481 nm (2.55 eV) corresponding to 350 nm excitation and 501 nm (2.475 eV) for 370 nm. Thus, from this observation we conclude that the band gap decreased with increase in excitation. Such band gap is equivalent to semiconductor materials.
Figure 8 (a-b) Photoluminescence spectra of M1 sample at different excitation radiation of 350 nm.

Figure 9 (a-b). Photoluminescence spectra of M2 sample at excitation radiation of 370 nm.
The present optical property shows that prepared M1 and M2 may be useful as electronics nanomaterials, which was prepared using eco-friendly approach in which no harmful chemicals or gases are emitted. This may open a new window for electronics industries for production of such materials for electronics-based industries. Observation of intense luminescence peaks in visible region may support of its uses in light-based devices, Biological imaging etc [20-25]. Similar luminescence peaks were also observed by chemically synthesized materials [26-27], but in this present research such luminescence are found in natural materials, prepared eco-friendly.

In nutshell, we can highlight of this present research that, till date various research group reported the property of any functional materials, depends on effect magnetic field, electric field, method of synthesis etc [28-29]. But effect of divine energy e.g. radiation of the moon on the drug and their structural behaviour for studies of its efficacy are not reported, to the best of by knowledge. Such studies may highlight the evidence based Indian origin bhasma materials as ayurvedic nanomedicine. Various functional behaviours were measured by modern scientific tools that may support for fill the gap between western science, Indian ancient wisdom and 21st century modern scientific techniques for creating strong scientific human resource for development of society.

4. Conclusions
Jalkhumbhi Bhasma as functional BioNanomaterials have been prepared in presence of radiation of moon using ecofriendly green approach in Pushya nakshtra and Rohini nakshtra. X-ray diffraction measurement shows that crystalline size and lattice constant of Jalkhumbhi bhasma prepared in Pushya and Rohininakshtra was found, 26.62 nm and 54.55 nm and lattice constant 6.312A, 6.301A and respectively. This measurement shows that the prepared materials are nanocrystalline reveal effect of radiation of moon changes the crystal structure. The properties of nanocrystalline materials, therapeatic values are different from bulk size. Therefore, efficacy of materials as medicine as nanoscale will be different. The Fourier transform infrared spectroscopy (FTIR) measurement shows functional group present in the materials are of compound of K, Cl, C-Cl, NH2, C-O-C, C=O, Ca and Ca(OH)2 respectively. The magnitude of force constant for are 2.51307 N/cm, 4.16005 N/cm and 2.61932 N/cm, 4.20074 N/cm respectively. This result shows that bond length depends on radiation of the moon. The photoluminescence spectra (PL) reveals that the broad spectrum of both the spectrum lies in the visible region showing broad blue emission, whereas excitation wavelength are used of wavelength of 350nm and 370nm. The energy band gap value for the most significant intense peak corresponding to 481 nm (2.55 eV) corresponding to 350 nm excitation and 501 nm (2.475 eV) for 370 nm. The optical property shows that prepared jalkhambhi bhasma may be useful as electronics nanomaterials, which was prepared using eco-friendly approach in which no harmful chemicals or gases are emitted. This may open a new window for pharmaceutical industries for production of such materials for electronics based industries. The effect of radiation of moon on structural and physical properties of natural plant Jalkhumbhi bhasma as superfine nanomaterials to increase the efficacy of drug may highlighted the ancient practices by our seers.

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