Scholars Academic Journal of Pharmacy (SAJP) **ISSN 2320-4206 (Online)**
Sch. Acad. J. Pharm., 2015; 4(1): 51-53 **ISSN 2347-9531 (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublisher.com

Research Article

A facile method of Synthesizing Ayurvedic medicine: Lauha bhasma (iron oxide nanoparticles) & its Characterization

Tambur Pavani, K. Venkateswara Rao*, CH.Shilpa Chakra, Y.T.Prabhu
Centre for Nano Science and Technology, Institute of Science and Technology, Jawaharlal Nehru Technological University Hyderabad, Hyderabad-500085, Telangana State, India

***Corresponding author**
K.Venkateswara Rao.
Email: kalagadda2003@gmail.com

Abstract: Iron oxide nano particles can be synthesized by various physical and chemical methods which are toxic and harmful for the environment. Ayurveda is a holistic and divine science; a modern method of synthesizing ayurvedic medicine reported for iron oxide nano particles which is cost effective and eco friendly technique. Lauha (Iron) is used extensively in Ayurvedic literature for management of various diseases like anemia, jaundice etc., as iron is very hard metal, it should be converted into bhasma (herbo metallic preparation) for medicinal use. Since 7^{th} century BC twenty bhasmas were analyzed and widely recommended for various chronic ailments. The synthesis of iron oxide nano particles using iron filings as a precursor material, subjected to purification process to obtain the final product as Lauha bhasma. The iron oxide nano particles thus obtained were characterized by various characterization techniques like X-ray diffraction, UV-Visible Spectroscopy, thermo gravimetric and differential thermal analysis, average particle size, atomic force microscopy.
Keywords: Ayurveda, herbo-metallic preparation, lauha bhasma, XRD, AFM.

INTRODUCTION

In recent years, iron oxide nano particles were widely applied in various streams which include terabit magnetic storage devices, fenton's reagents, catalysis, sensors and high-sensitivity biomolecular magnetic resonance imaging (MRI) for medical diagnosis and therapeutics. By synthesizing iron oxide using ayurvedic method results in the product for treatment of anemia [1] which is major health problem in India and in few developing countries. The metal is converted into ash (bhasma) that is easy way to enter intravenously into the human body. The human body contains about 3-5% of iron, which exists in two forms heme iron (Fe_2O_3) and non heme iron (Fe_3O_4).There are different types of bhasmas existing since 7^{th} century BC, Naga bhasma (lead), Swarna bhasma (gold), Abhrak bhasma (mica) etc., Different types of lauha bhasma are munda bhasma, type of cast iron used in the preparation of iron vessels, tiksna lauha is a type of steel used to prepare swords, weapons. Kanta lauha which is considered as best one.

Present work deals with lauha bhasma synthesized by modern method using ayurvedic ingredients and studied different characterization techniques.

EXPERIMENTAL PROCEDURE

Synthesis of iron oxide nano particles:

Iron filings were taken as precursor material, then sesame oil, panchgavya, butter milk, horse gram decoction, triphala, rice gruel solution were treated as purifying agents in consecutive steps. To obtain the final product, purification steps were conducted, in the first purification step sesame oil was added to the precursor material to transfer greasy matter from iron fillings to oil and also to remove dirt and fine rust. Secondly, the treatment with rice gruel solution and horse gram decoction involves the removal of Fe^{3+} and few coordination compounds. Panchgavya is considered as anti-bacterial agent so it is used to remove microbial organisms. Finally, triphala comprises of three components Emblica Officinalis, Terminalia Bellerica and Terminalia Chebula. It is used as highly digestive ingredient. As it contains ascorbic acid, it increases the bioavailability of iron by converting Fe^{3+} to Fe^{2+}.

The synthesis involves quenching with herbal ingredients mentioned above and heat treated at 530^0C-560^0C. Purification steps were repeated for seven times to remove the impurities.

RESULTS AND DISCUSSION

X-ray diffraction analysis:

Bruker D8 advanced X-ray diffractometer using Cu*kα* radiation was used for the crystallite size analysis of iron oxide nano particles.

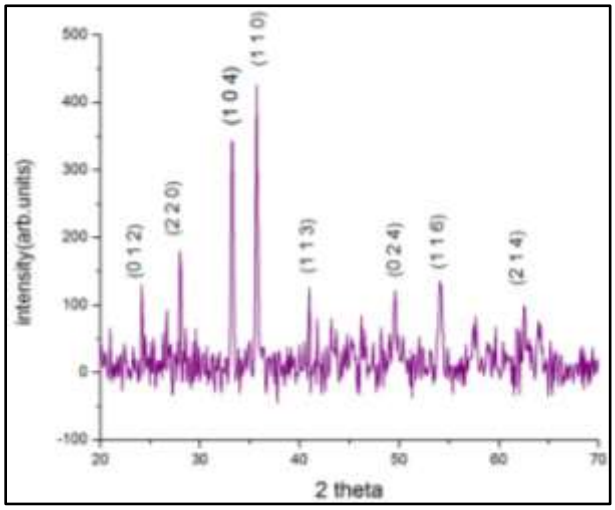

Fig-1: **XRD pattern of iron oxide nano particles**

The XRD pattern of the nano particles were studied with the diffraction angle 20-70 .The hkl values of the peaks are (0 1 2) (2 2 0) (1 0 4) (1 1 0) (1 1 3) (0 2 4) (1 1 6) (2 1 4) respectively. All the peaks are in phase matching with the Fe_2O_3 rhombohedral phase of JCPDS [33-0664]. As the figure depicts that no other characteristic impurity peaks are present in the sample which also confirms that the product obtained is in the pure form. The average crystallite size of iron oxide nano particles is estimated by Debye-Scherrer's equation [2].

$$D = \frac{0.9\lambda}{\beta.Cos\theta} \qquad (1)$$

Where D is the average crystallite size λ is the X-ray wavelength of 1.54A°, θ is the Bragg diffraction angle and β is the FWHM. The average crystallite size obtained is 25.2 nm. The lattice parameters of sample a=5.0286A°, c=13.619A° are in good agreement with the standard values (a=5.035 A° and c=13.748 A°). The c/a ratio and volume of the cell are 2.708 and 298.26 A° respectively.

Particle size analyzer:

Particle Size Analyzer by HORIBA SZ-100 is used to measure the average size of the particle.

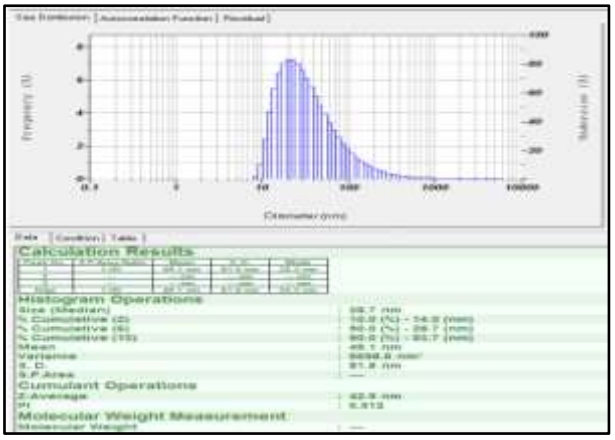

Fig- 2: Histogram representation of particle size analyzer

The average particle size of lauha bhasma is shown in figure 2. The particle size obtained is 28.7 nm. The results obtained from particle analyzer are in good agreement with the XRD results of crystallite sizes

UV-Visible Spectroscopy:

The optical properties of the materials determined by using Systronics UV – Visible Spectrophotometer 2202 with the wavelength range from 200 - 1100 nm.

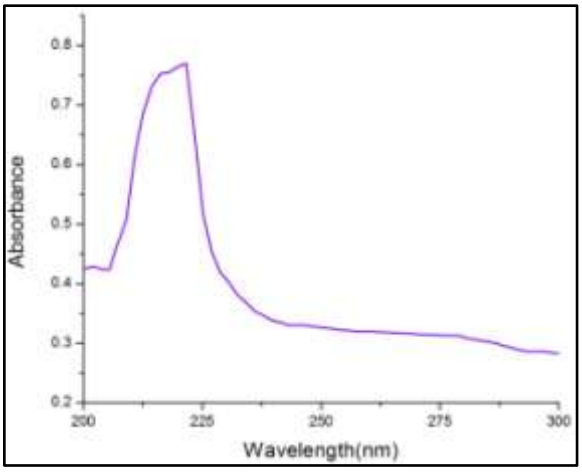

Fig- 3: Absorption spectra of UV-Vis

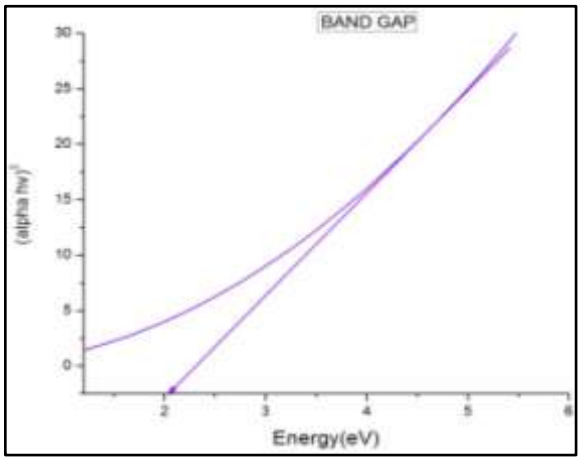

Fig-3.1: Band gap of UV-Vis

The absorbance curves and band gap are shown in the Figure: 3 and 3.1.The optical transition and band gap are calculated using the equation (2)

$$\alpha h\nu = C.\ (h\nu - E_g)^n \qquad (2)$$

Where $h\nu$ is the photon energy, α is the absorption coefficient, Eg is the band gap and C is a characteristic parameter dependent of photon energy. Nanocrystalline sample has the absorption at wavelength 220-230nm. The band gap E_g (for direct transition) values are obtained from the intercept of the extrapolation of the $(\alpha h\nu)^2$ versus $h\nu$. The band gap for iron oxide nano particles obtained is 2-2.2 eV.

TG/DTA analysis:

The figure 4 depicts thermo gravimetric analysis of the sample prepared. The thermal analysis and weight loss of the sample are observed by EXSTAR-6000.

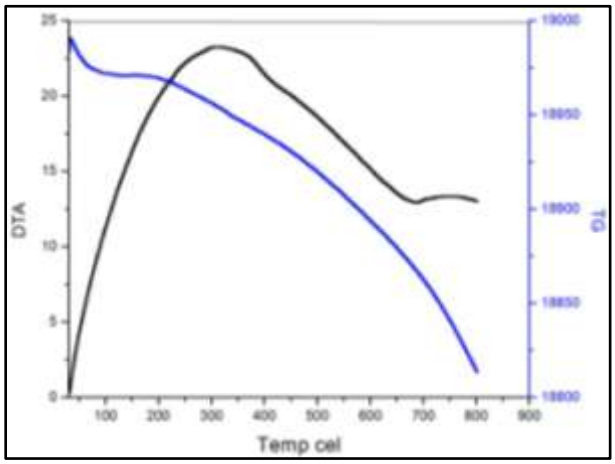

Fig-4: Thermo gravimetric analysis of Fe_2O_3 nano particles

From the figure typical TG and DTA curves of the lauha bhasma sample is subjected to 800°C. TG analysis shows the total weight loss percentage at 0.89797%. This clearly indicates that the obtained sample has extreme purity and very small weight loss. Analysis showed that there is weight loss below 200°C due to liberation of moisture content from the sample. At range of temperature 300-500°C, the weight loss is 0.2939%. It corresponds to the elimination of carbon group compounds. The increase in the curve from 700 - 800°C represents the phase transformation from metal to metal oxide. In the DTA analysis there is an exothermic peak at 300°C indicates existence of organic material in small amounts.

Atomic force microscopy:

Using APE research, Atomic Force Spectroscopy is performed.

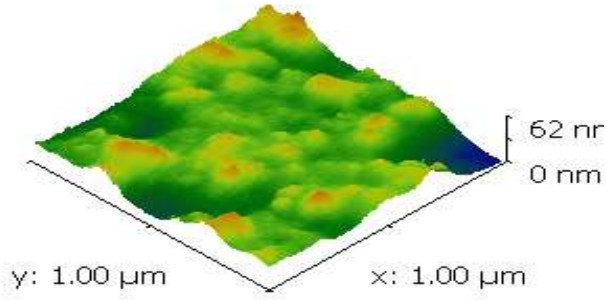

Fig-5: Iron oxide nanoparticles sample representation of Atomic force microscope

AFM represents the 3D visualization of the sample; surface morphology is observed [3]. We can also calculate the roughness of the sample. From the figure the size of the iron nano particles is with in nano range i.e, 62 nm.

CONCLUSIONS

In summary, we have synthesized lauha bhasma by modern method by an ecofriendly technique. The crystallite size obtained is 25.2 nm and mean particle size is 28.7 nm which is in good agreement with XRD result. From UV-Vis analysis represents quantum confinement and very low band gap of 2 ev. From TG/DTA clearly indicates that the obtained sample has extreme purity and very small weight loss AFM represents morphology and particle size with in nano range. This is unique synthesis process, cost effective and nontoxic process as it purely contains herbal ingredients.

Acknowledgements

My special thanks to *Ms.CH. Shilpa Chakra, Head, CNST* and *Dr. K. Venkateswara Rao* Associate Professor of Nanotechnology, Centre for Nano Science and Technology, Institute of Science and Technology for their rewardable guidance through out my work.

REFERENCES

1. Singh N, Reddy KRC; Particle size estimation and elemental analysis of Lauha bhasma. International Journal of Research in Ayurveda & Pharmacy, 2011; 2(1): 30-35.
2. Cullity BD; Elements of X-Ray Diffraction, Addison-Wesley publishing Company, Inc, Philippines, 1978.
3. Wang C, Chen Z, He Y, Li L, Zhang D; Structure, morphology and properties of Fe-doped ZnO films prepared by facing-target magnetron sputtering system. Applied Surface Science, 2009; 255(15): 6881-6887.