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GREEN SYNTHESIS AND CHARACTERIZATION OF ZNO USING VASA EXTRACT

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ABSTRACT:

NPs or bio inorganic nanoparticles, Ayurvedic medicinal preparations, are prepared using herbs and minerals following long iterative procedures. Jasad NPs are prepared by basic solution conditions. Methods: The ZnO NPs and its in-process intermediate are characterized for their physicochemical properties using electron microscopy, x-ray diffraction and CHNS(O) analysis. The bioaccumulation of zinc, effect on liver antioxidant status, liver and kidney function (by conventional tests as well as SPECT: Single Photon Emission Computed Tomography), effect on blood cells and effect on immune system are studied in mice model, Swiss albino. Since NPs is given with an accompaniment (anupan), all the bioactivity studies were carried out by administering the preparation with and without Amala powder (Phyllanthus emblica L., fruit, dry powder) as anupan.

KEYWORDS:

NANOPARTICLES (NPS), XRD, RIETVELD, UV PL, AFM, GREEN SYNTHESIS.

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INTRODUCTION

Nano-micro Zinc oxide nanocrystals are promising luminescence electronic materials because of dual emission and wide emission wavelength [1]. ZnO NPs is a II-VI nanocrystal with self-activated hexagonal wurtzite structures. The important properties of ZnO NPs are wide band gap of 3.36eV at room temperature and large exciton binding energy of 60 meV which is much higher than other semiconductor nano micro crystals [2]. Owing to these properties, ZnO NPs is a versatile material that has achieved application in photo catalysis [3], solar cell [4], transparent electrode [5], uv laser diode[6], transducers.

The key interest for the research for the ZnO NPs nanocrystal is the high quality material with a controllable size and fine dispersion. Numerous experimental efforts have been made to fulfill the highly stable ZnO NPs quantum dot with quantum confinement effect. Optical properties of nanoparticles strongly depend on inter granular distance and granular aggregation. Spanhel et al reported that aggregation of ZnO NPs colloids is possible to red shift in the absorption onset as well as photo luminescence peak [7].

In this paper we reported that high intensity green emission is possible in the solution synthesized ZnO NPs nano micro wires. The cauterization due to aging of the sample is caused for the continuous variation in the optical and morphological characteristics.

MATERIAL AND METHOD

XRD patterns of the as grown ZnO NPs microwires were recorded in thin film grazing angle mode of powder diffractometer using Cu K_α . Optical absorptions were carried out with a UV-Vis spectrometer (model UVPC 1601supplied by SHIMADZU corp.JAPAN) with slit width 2nm. Photo luminescence emission spectra of the sample were recorded using the luminescence spectrometer LS55 (Perkin-Elmer instrument UK). The majority carrier's type in the semiconductor film was checked with a hot probe measurement technique.

RESULTS & DISCUSSION

The XRD results accompanied with Rietveld analysis indicate that the final NPs is mainly oxide of zinc, whereas the intermediate is mainly sulphide of zinc. The animal

studies show that the NPs as well as its intermediate do not lead to any bioaccumulation of zinc in major organs, when administered with and without anupan. Both, NPs and intermediate do not cause any deleterious effects on kidney and liver as indicated by blood biochemistry and SPECT studies. However, the intermediate perturbs antioxidant status more and affects the platelet turnover, in comparison with bhasma. On 28 day treatment, the NPs treated animals show prominence of TH1 mediated immune response whereas, intermediate treated animals show prominence of TH2 mediated immune response.

STRUCTURAL ANALYSIS

Figure 1 shows the XRD pattern ZnO NPs synthesised by the above outlined procedure. All the diffraction peaks of samples adopt hexagonal wurtzite structure with phase group P63mc(186). There were no diffraction peaks corresponding to $Zn(OH)_2$ or any other impurities. Particle sizes of the Jasad Bhasam samples were calculated from the broadening of the different peaks by using Scherrer formula. The average diameter of the particle was calculated as 8.1nm for sample respectively where the Bohr exciton radius of ZnO NPsis 2.3 nm [8].

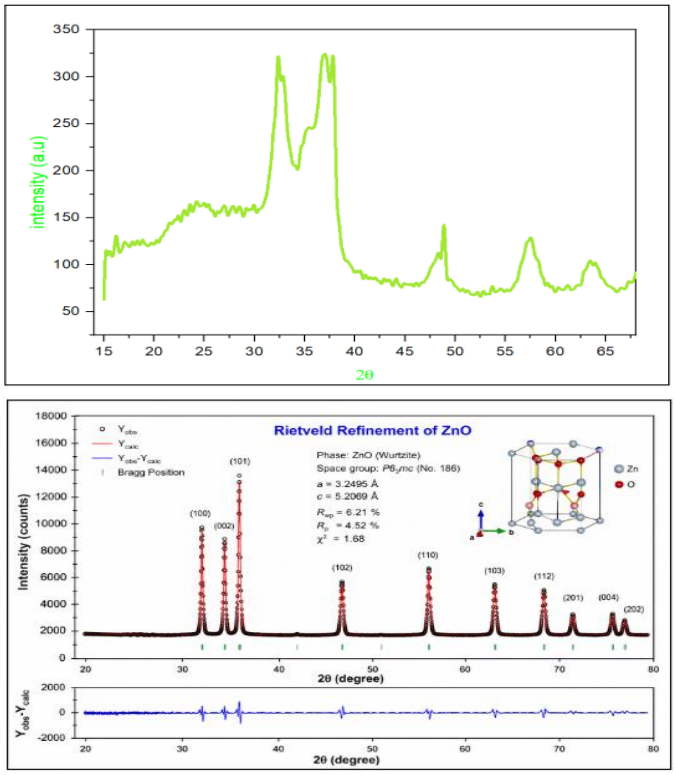

FIG.1: XRD SPECTRA ZNO NPS SAMPLE

OPTICAL CHARACTERIZATION

The upper part of Fig 2 shows UV- Vis spectra for the synthesized Jasad Bhasma, prepared from Zinc acetate with wavelength ranging from 280-600 nm. The spectra of ZnO NPs microwires different ratio of Vasa extract capping agent dispersed in ethanol, exhibit well cleared exciton peak and absorption onset. Absorption onset of sample has onset at 360 in the absorption spectra shows an obvious blue shift from bulk Jasad Bhasma, which were shown at 382nm. All the absorption characterizations were carried out one hour after the synthesis. (9) Photo luminescence properties of ZnO NPs microwires dispersed in ethanol were also investigated in Fig 2. All the spectra have two emission peaks. One is a relatively weak UV emission peak in the 360-380 range, which is near to absorption onset, and is interpreted as band edge emission. Second is a broad trap emission peak, maxima ranging from 520 to 535 which is in the green luminescence region. This broadness of trap emission is ranging from 440 to 700nm. Both the band edge emission peaks and trap emission peaks are shifted towards the lower energy side corresponding to absorption shift.(10)

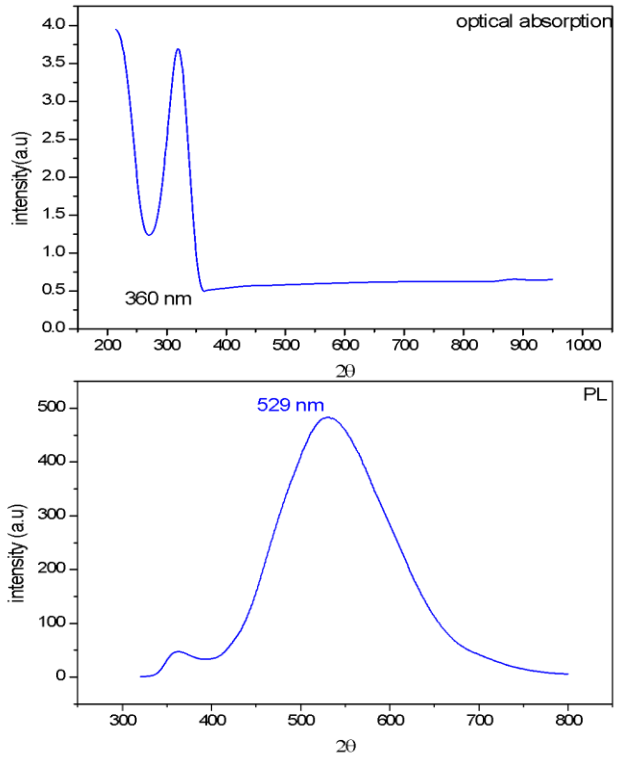

FIG.2: UV-VISIBLE ABSORPTION & PHOTO LUMINESCENCE SPECTRA OF ZNO NPS SAMPLE.

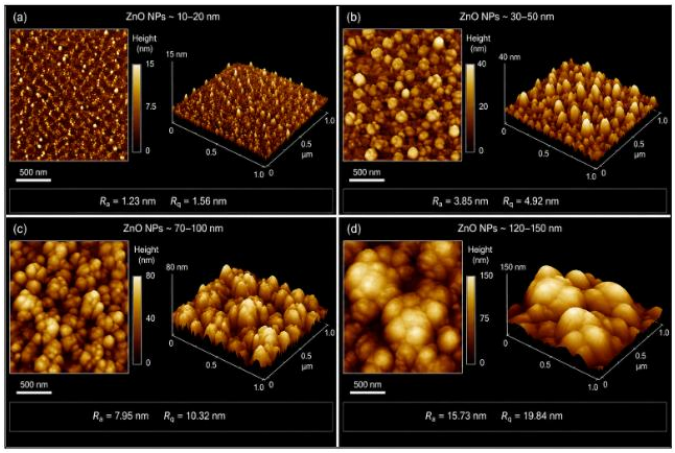

FIG.3. ROOM TEMPERATURE AFM IMAGES OF ZNO NPS SAMPLE

The morphological analysis was carried out using atomic force microscopy (AFM). Figure 3(a) shows an image of the ZnO NPs microwire. Note that the grown microwires can have different shapes and sizes because the chemical route process is a highly random growth process. Some defects, such as dislocations or stacking faults, are found, indicating that the ZnO NPs microwire is crystalline. (11) AFM micrograph of the as synthesized fresh ZnO NPs microwire and aged for 30 days in dried ethanol is shown in fig 3 (b). while the fresh samples shows the smaller cluster size , the corresponding aged forms agglomerate to form clusters of larger size the high resolute AFM image of fresh sample, shows the average cluster size of the ZnO NPs quantum dots is 6 nm is near to the average particle size calculated from the broadening of the XRD spectra, indicating that fresh samples forms clusters of individual particles.the ageing effect on morphology of ZnO NPs revealed a continuous clusterisation of the nanoparticles to a cluster size of 20 to 30 nm .(12)

CONCLUSION

In conclusion ZnO NPs microwires were successfully produced at room temperature via a Chemical bath deposition process. The SEM and XRD results show the high quality of the ZnO NPs microwire crystal structure. Good optical properties also shown in the results of ZnO NPs

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