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Research Article

SYNTHESIS OF ZINC OXIDE NANOPARTICLES FROM LEAF EXTRACT BY GREEN SYNTHESIS METHOD

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ABSTRACT

Nano ZnO was synthesized by green approach employing leaf extract of Moringa oleifera and Vitex negundo leaves. Synthesized nanoparticles were characterized through UV–Visible spectroscopy, Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). The UV absorption spectra reveal that the sample has better optical transparency and have sufficient transmittance. From the FTIR spectrum confirmed the functional group responsible for zinc oxide nanoparticles. The SEM analysis shows the synthesized nanoparticles are hexagonal shape.

INTRODUCTION

Nanoparticles are gaining importance in various fields such as health, biomedical science, chemicals industries, food & feed cosmetics, environmental, drug and gene delivary, energy science, electronics mechanics and space industries. [1-2] Design of processes that reduces or eliminates generation of hazardous substances is the key principle for sustainable chemistry. Developing green methods for synthesizing nanoparticles is a major focus of present research scenario. [3-7] Available literature forecasts that the nanoprticle synthesis using medical plants, micro-organisms and algae and other as source has been unexplored and underexplorited.

Experimental Procedure

Preparation of leaf Extract

A Fresh leaves of Vitex Negundo and Moringa Oleifera were collected and washed several times with distilled water. 20g of leaves were cut into small pieces and crushed into the mortar and the crushed leaves are put into the beaker containing 200ml of distilled water. The solution is allowed to stirrer for 30minutes with temperature 90°c using a magnetic stirrer. After that, the extract is filtered using Whatmann filter paper.

For the synthesis of nanoparticles, Vitex Negundo and Moringa Oleifera leaves extract (100ml) was taken and heated to 200°c with stirring Zinc acetate dehydrate $Zn(CH_3CO_2)_2.2H_2O$ (0.3g)was added to the solution and stirrer continuously. Next sodium hydroxide pellets (0.2g) are dissolved in 10ml of distilled and mixed with the solution. The paste thus obtained was heated in solution at 200°cfor 2 hours in hot oven. After 10minutes stirrering the solution is kept in hot air oven for 2 hours with 200°c heat the solution is completely dried. Nano ZnO was obtained as dried powder is grained by using mortar. [17-18]

Flow Chart

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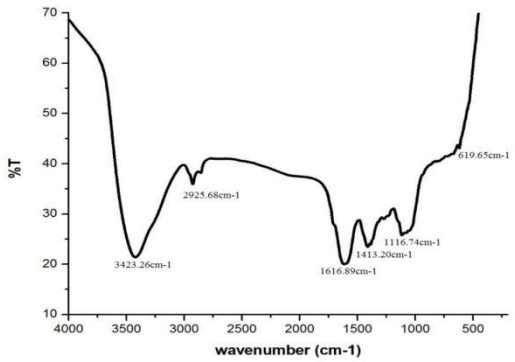
Characterization: The UV absorption spectra reveal that the sample has better optical transparency and have sufficient transmittance. From the FTIR spectrum confirmed the functional group responsible for zinc oxide nanoparticles. The SEM analysis shows the synthesized nanoparticles are hexagonal shape.

RESULTS AND DISCUSSION

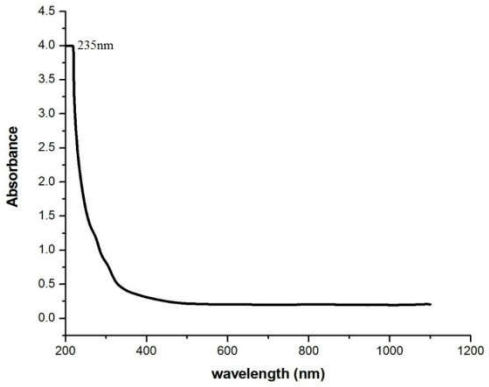
Fourier Transform Infrared Spectroscopy (FTIR)

The FTIR Spectrum studies are to identify the functional group synthesized compounds. The fundamental mode of vibration at 3423.26cm^{-1} is corresponding to the O – H stretching of hydroxyl compounds. 2925.68cm^{-1} was C – H stretching alkanes. The peak 1616.89cm^{-1} is attributed to the carboxyl group C=O stretching vibration. 1413.26 correspond to C – C stretching vibration of aromatic ring. The infrared study reveals the presence of aromatic ring proteins and amide bonds have a strong ability for the formation and covering of metal nanoparticles [14]. The peak at 1116.74cm^{-1} assigned to C – O group of esters. The spectrum depicted band at 619.65cm^{-1} is assigned to metal oxygen stretching of ZnO. This result indicates the successful production of ZnO nanoparticles.



Ultraviolet -Visible Spectroscopy (UV)

UV – Visible absorption spectrum of the ZnO nanoparticles is shown in the figure. The wavelength ranges from 200 – 1100nm by using spectrophotometer at the room temperaturein order to analysis the absorption band of Moringa oleifera and Vitex negundo of ZnO nanoparticles.



UV – visible absorption spectral analysis

The figure shown a broad absorption band located at around 200 – 400nm. Originating from transition of ZnO nano crystalline of absorption band is around 235nm.

The band gap or energy gap (E_g) of ZnO is found by the following relation,

$$\mathbf{E_g = hc/\lambda}$$

Where,

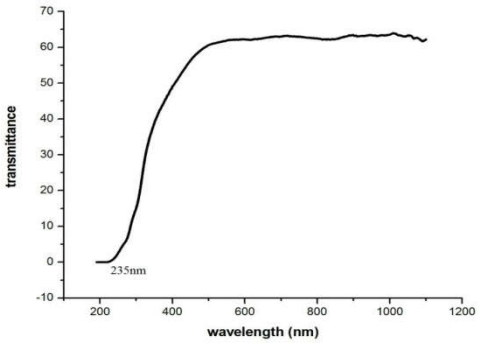
h – Plank constant (6.625×10^{-34} JS)
c –The velocity of light (3×10^{8} m/s)
λ – The wavelength material (nm)

From the UV – Visible graph, the band gap is obtained as 5.2eV.

Transmittance

In the figure shows the transmittance graph. From the transmittance curve the cut of wavelength is 200 – 300nm. The transmittance curve is exposes that the transmittance of the ZnO nanoparticles is 62%, which is useful for device application.

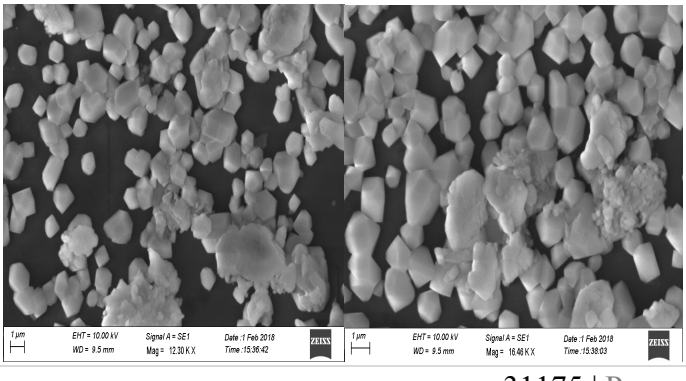
The optical absorption spectrum gives valuable information about the structure of the molecule because the absorption of UV – Visible involves promotion of electron in π – π* orbitals from the ground state to higher energy state.

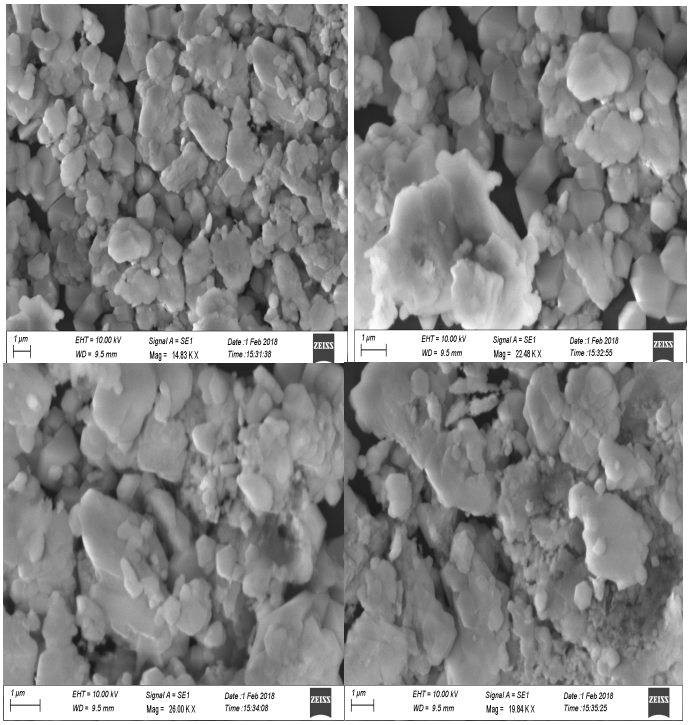


UV-Visible transmittance spectral analysis

Scanning Electron Microscopy (SEM)

The SEM image of ZnO nanocrystalline particles produced by Green synthesis method is shown in figure. The SEM analysis is used to determine the size of the nanoparticles. The SEM image showed hexagonal shape nanoparticles at low magnification. At high magnification that hexagonal shape changed to cluster form and the particle size is 30 – 40nm.





SEM image of ZnO nanoparticles

CONCLUSION

ZnO nanoparticles are prepared with the help of green synthesis method by using leaves extract of Moringa Oleifera and Vitex negundo. FTIR results confirm the presence of functional group such as hydroxyl, alkanes, carboxyl group in ZnO nanoparticles. From the UV – visible spectroscopic study the energy band gap value is 5.2eV at 235nm. The SEM image showed hexagonal shape nanoparticles. I have a plan to take Antibacterial activity in future.

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