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Green Synthesis of Zinc Oxide Nanoparticles Using *Azadirachtaindica* Leaves Extract and its Characterization and Application in the Degradation of Methylene Blue

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Abstract: ***Use of plant materials has been considered a green route and a reliable method for the synthesis of nanoparticles owing to its environmental friendly nature. Hence an attempt has been made to synthesize the Zinc oxide nanoparticle using aqueous neem (Azadirachtaindica) leaf extract. The aqueous leaf extract acts as a solvent with manifold roles as promoter, stabilizer and template for the synthesis of nanoparticles. The synthesized ZnO nanoparticle was characterized using SEM analysis andXRD analysis.The synthesized ZnO nanoparticles were pure, predominantly spherical in shape with size ranging from 9.6 to 25.5 nm. The biosynthesized ZnO nanoparticles showed photocatalytic activity under the UV light enhancing the degradation rate of methylene blue (MB), which is one of the main water- pollutant released by textile industries. The biosynthesized ZnO nanoparticles showed photocatalytic activity under the UV light enhancing the degradation rate of methylene blue (MB), which is one of the main water- pollutant released by textile industries.***

Keywords: Green Synthesis, Neem LEAF (Azadirachtaindica) Extract, ZnO Nanoparticle, and SEM

1. Introduction

The science and engineering technology of nanosystems is one of the most exigent and fastest growing sectors of nanotechnology. In the recent years, due to the advancement in Science and technology researchers haveattempted to synthesize nanoparticles within the size range of 100 nm and this extensive research and concern on nanoparticles is widening due to their potential application in wide areas ofscience and technology. ZnO belongs to the class of metal oxides, which is characterized by photo catalytic and photo-oxidising capacity against chemical and biological species. Each nanoparticle contains only about 3-107atoms/molecules.

Synthesis using bio-organisms is congruent with the green chemistry principles. "Green synthesis" of nanoparticles makes use of environmental friendly, non-toxic and safe reagents Spherical ZnO NPs has been synthesized using milky latex of Calotropisprocera and apart from this ZnO particle with high stability and spherical shape have also been synthesized using *Azadirachtaindica extract*.

Neem is a fast growing tree that can reach a height of 15-20 metres (49-66 ft) and rarely 35-40 metres. It is evergreen, but in severe drought it may shed most of its leaves or nearly all leaves. The branches are wide and spreading.

2. Materials and Methods

Zinc acetate dehydrate [Zn $(CH_3COO)_2 2H_2O$,Sodium hydroxide(NaOH) Biosynthesis of ZnO nanoparticles using Azadirachtaindica leaf extract

Azadirachta Indica
The leaves was washed several times with distilled water and dried in a dark room. The obtain chemicals were used without further purification as it is of analytical grade throughout the experiment double distilled water used.

Preparation of Azadirachta Indica Leaves extract
20gm of dried leaves and stems of neem was weight out and to it 1000ml of the double distilled water was added, it was stirred for about 20mins in a magneticstirrer at room temperature. After stirring, it was filtered using whatman filter paper no.4 and followed by centrifuged to settle down the unwanted solids. Extract is used for the preparation of ZnO nanoparticles.

Environmental benign preparations of zinc Nanoparticles
1% (W/V) of ZnO nanoparticles was prepared by dissolving 1gm of Zn $(CH_2COO)H_2O$ was dissolved in 100ml of double in 100ml of double distilled water: it was stirred for 20mins.To the above solution 10 ml of the Azadirachtaindica leaves extract was added and the mixture was stirred for about 3 hrs. The formation of the particles can be seen within 1 hr. The solution was aged for 12 to 13 hrs, nanoparticles prepared were centrifuged and washed with double distilled water twice. Nanoparticles were collected, dried at 60˚c in an oven.

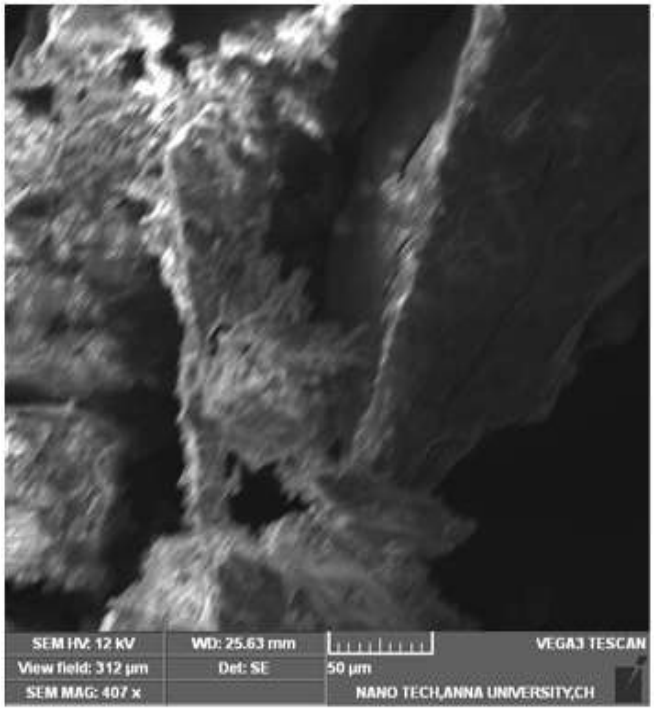
Characterization of ZnO Nanoparticles
Scanning Electron Microscope: In the present work, SEM machine was employed to study the morphology of synthesized nanoparticles. The experiment was performed at an accelerating voltage of 20 kV. The slide was coated with platinum and after the platinum coating, the SEM image was taken.SEM images of the obtained ZnO nanoparticles. The

synthesized ZnO nanoparticles were agglomerated with a particle size ranging from below 100-190 nm.

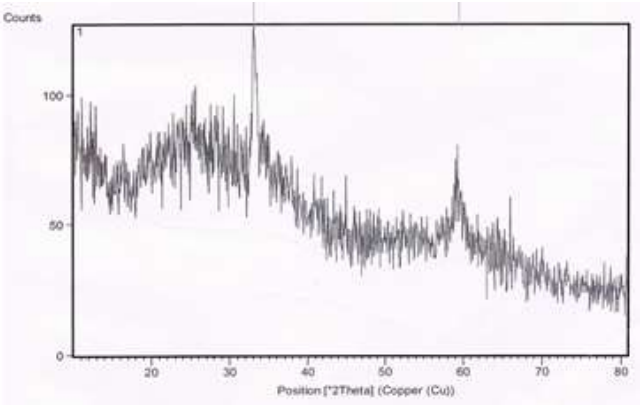
XRD Analysis
ZnO nanoparticle were examined by X-ray diffractometer. The powdered metal was sticked in the cubes of XRD and then result was taken in the equipment.

3. Results and Discussion

SEM: SEM studies provided further insight into the morphology and size details of the ZnO nanoparticle. The results of the SEM studies on Zinc Oxide Nanoparticles synthesized using neem (Azadirachtaindica) leaves extract. revealed the formation of stable Zinc oxide nanoflakes and spindle shaped nanoparticles The size of the ZnO nanoparticles synthesized using neem (Azadirachtaindica) leaf extracts were recorded to be 50 µm.



XRD:
X-ray diffraction is a versatile, non –destructive analytical method for identification and quantitative determination of various crystalline forms, Known as 'phases' of compound present in powder and solid samples. Diffraction occurs as waves interact with regular structure whose repeat distance is about the same as the wavelength. For example light can be diffracted by a grating having scribed lines spaced on the order of a few thousand angstroms, about the wavelength of light. It happens that X-ray have wavelengths on the order of a few angstroms, the same as typical inter –atomic distances in crystalline solids. That means X-ray can be diffracted from minerals which, by definition are crystalline and have regularly repeating atomic structures. When certain geometric requirements are X-ray sattered a crystalline solid can constructively interfere,



Peak List: (Bookmark 3)

Pos. [^{0}2Th.]	Height [cts]	FWHM Left [^{0}2Th.]	d-spacing [Å]	Rel. Int. [%]
33.0299	56.23	0.3936	2.71203	100.00
59.3374	22.88	1.1808	1.55750	40.69

Inpresence of methylene blue the absorbance are given below

Time	Absorbance (OD)
0	0.29
5	0.26
10	0.25
15	0.24
20	0.22
25	0.21
30	0.19
35	0.17
40	0.11

In absence of methylene blue the absorbance values were constant

4. Conclusions

The present study reports green eco-friendly and inexpestive approach for the biosynthesis of znonano particles using the leaf extract of azadirachtaindica which acts as an effective reducing and stabizing agent. The bio synthesized zno nanoparticles were of size9.6-25.5nm spherical in shape. SEM studies revealed the formation of nanoflakes and spindle shaped nanoparticles and their size were 50 µm. Thus the progress of green chemistry with the use of plants in the synthesis of nanoparticles has engrossed a great attention. Owing to bountiful advantages associated with this eco-friendly nature, it has been explored as a powerful catalyst for several organic transformations. This research opens with a short course on how to synthesize Zinc oxide nanoparticle in a natural scale. Thus to pursue a healthy life and space it is imperative to develop a green synthetic approach to obtain nanomaterials targeted on different applications.

References

[1] Meruvu S., Hugendubler L., Mueller E. (2011) Regulation of adipocyte differentiation by the zinc finger protein ZNF638. *Journal of Biological Chemistry*, 286(30), 26516-23.

[2] Manoj K., Sukumar D., Amit K., Sinha M.P., (2013) Determination of nutritive value and mineral elements of five leaf chaste tree and malbar nut (adhatodavasicanees) *Academic Journal of Plant Sciences* 6 (3), 103-108.
[3] Manoj K., Amit K., Sukumar D., Sinha M. P., (2013) Photochemical screening and antioxidant potency of adhatodavasica and vitexnegunda. *The bioscan*, 8(2), 727-730.
[4] Facts about Malbar nut (Asticiaadhatoda), Encyclopedia of life, retrieved 03/01/2013.
[5] Linares S., Gonzalez N., Gomez E., Usubillaga A., Darghan E., (2005)Effect of the fertilization, plant density and time of cutting on yield and quality of the essential oil of CymbopogoncitratusStapf; *Rev. Fec. Agron, (LUZ)* 22, 247-260.
[6] Padalia R. C.; Verma R. S.; (2011) Comparative volatile oil composition of four ocimum species from north india, *Nat. Prod. Res*. 25(6), 569-75.
[7] Maribel G. G., Jean D., Stephan G. (2009) Synthesis of silver nanoparticles by chemical reduction method and their antibacterial activity, *International Journal of Chemical and Bimolecular Engineering*, 2(3), 104-111.
[8] Buazar F., Bavi M., Kroushawi F., Halvani M., Khaledi-Nasab A., Hossieni S.A., (2016) Potato extract as reducing agent and stabiliser in a facile green one-step synthesis of ZnOnanoparticles,*Journal of Experimental Nanoscience*, 11 (3), 175-184.
[9] Janaki A. C., Sailatha E., Gunasekaran S., (2015) Synthesis, characteristics and antimicrobial activity of ZnO nanoparticles, *SpectrochimicaActa Part A: Molecular and Biomolecular Spectroscopy*, 144, 17-22.
[10] Yang X., Geng D., Weng L. J., Han Y., Yang W. J., (2012) Green Synthesis of Silver Nanoparticles Using Chitosan for 4-Nitrophenol Reduction", *Advanced Materials Research*, 479, 332-335.