



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 9, Issue 11, November 2020

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 7.512**

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)

# Synthesis and Characterization of zinc oxide nanoparticles extracted from leaf of *Simarouba glauca*

Sruthi Rajan<sup>1</sup>, Dr. Manoj Narayanan<sup>2</sup>

Faculty, Department of Food Technology, Saintgits College of Engineering, Kottayam, India<sup>1</sup>

Associate Professor, Department of BT and BCE, Sree Buddha College of Engineering, Kerala, India<sup>2</sup>

**ABSTRACT:** Biosynthesis of nanoparticles interceded by lessening and balancing out specialists; for example, polyols created by a few plant animal groups is a cleaner and eco-accommodating technique. These polyols can be separated effectively and utilized in the biosynthesis of nanoparticles. In this exploration, the concentrate of the leaves of *Simarouba glauca* was utilized as a lessening and balancing out specialist for the blend of attractive iron nanoparticles at room temperature. The response arrangement demonstrated an assimilation top somewhere in the range of 300 and 400 nm in UV-Vis spec which affirmed the presence of nanoparticles. The nanoparticles size is portrayed by TEM and the morphology was described by SEM with EDX. The glass like structure and surface adjustment was described by XRD and FT-IR.

**KEYWORDS:** Acid hydrolysis, Nanoparticles, Photocatalysis, *Simarouba glauca*, Scanning Electron Microscopy, Transmission electron microscopy, Zinc oxide nanoparticles, X-Ray Diffraction.

## I. INTRODUCTION

Nanotechnology is the mechanical development in 21st century. Different inquires about and improvements are rising in this field from the earliest starting point of its introduction to the world. A noteworthy commitment is its advancement of nano materials. They are for the most part nano measured particles whose size extents from couple of 100-1000 nanometers. Metal nanoparticles have great highlights, for example, synergist, optical, attractive and electrical properties. Because of their morphology, dissemination and littler size they have high surface region to volume proportion [1.2]. Because of the developing need of nanoparticles looks into have been behind utilizing green strategies for the combination of different nano particles. Concoction blend strategies, for example, sol-gel process, substance precipitation, warm techniques and so forth delivers certain poisonous synthetic which get adsorbed at first glance which may effectsly affect medicinal applications. Chemicals utilized as a part of those strategies likewise deliver harmful side-effects. Natural methodologies utilizing microorganisms and plants or plant separates for metal nanoparticles are dependably the recommended technique. Amalgamation of nanoparticles utilizing microorganisms includes huge procedure of keeping up cell societies, intra cell combination and decontamination steps. Consequently green amalgamation strategy is favored over as ordinary techniques are expensive and dangerous. [3.4].

The plant *Simarouba glauca* belongs the family *Simaroubacea* is distributed throughout India. The different parts of the plant are used in Indian traditional medicine for treatment of various diseases. To the best of our knowledge, biological approach using leaf extract of *Simarouba glauca* has been used for the first time as a reducing material as well as surface stabilizing agent for the synthesis of spherical-shaped ZnO-NPs. The structure, phase and morphology of synthesized product were investigated by the standard characterization techniques.

## II. EXPERIMENTAL PROCEDURE

### A. Collection of plant materials

Fresh leaves of *Simarouba glauca* were collected from the campus of Sree Buddha College of Engineering and the leaves are washed using distilled water a part of it was kept in shade for drying for around a week. The fresh leaves are used for water extraction whereas the dried powder is kept for further usage.



Fig 1. Leafs of Simarouba glauca collected from the campus

### B. Preparation of leaf extract

10 g fresh leaves were cut and boiled in 100ml of distilled water for around 20 minutes at 60<sup>0</sup> C until the color of the aqueous solution turns from watery to yellow then the extract was filtered using Whatmann filter paper No.1. The extract was stored in a refrigerator in order to be used for further experiments.



Fig 2. Water extract

### C. Preparation of zinc oxide nanoparticle

For the preparation of zinc oxide nanoparticles 10ml of the extract was mixed with 20ml of 0.05M zinc acetate dehydrate solution maintained at a pH of 12 and the mixture was stirred on a magnetic stirrer for around 2 Hrs. Then the solution was centrifuged and the white residue was transferred on to a petriplate and the solution was kept in a hot air oven for around 8-12 Hrs and the white powder was later obtained. The material was mashed in a mortar-pestle so as to get a finer nature for characterization. [8]



Fig 3. Synthesised ZnO nanoparticles

### D. Characterization of Zinc oxide nanoparticles

- **Structural characterisation:** In order to get exact information about the crystal structure, surface morphology, particle size etc. the following characterisation techniques are applicable.
  - XRD (X-ray Diffraction)
  - SEM (Scanning electron microscope)
  - TEM (Transmission electron microscope)
- **Optical characterization:** As we know zinc oxide has wide range of application in the field of optoelectronics devices on putting the sample to following characterisation techniques gives information related to optical properties.

- UV-Visible Spectroscopy
- Fourier Transform Infrared Spectroscopy (IR)

### III. RESULTS AND DISCUSSION

#### A. UV-Vis identification of nanoparticles

The synthesized ZnO nanoparticles were initially identified using UV-Vis Spectrophotometer. A peak ranging between 340 and 380 nm was obtained which indicates the presence of ZnO nanoparticles.

#### B. FTIR Analysis

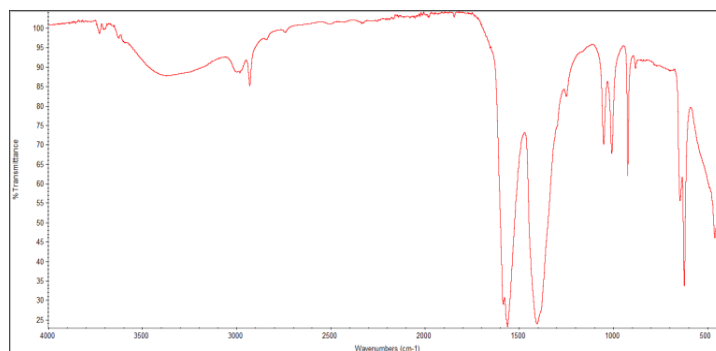


Fig 4. FTIR Spectrum of ZnO nanoparticles

The IR spectrum was taken using a Perkin Elmer FT –IR instrument operating at a resolution of 4000–400 cm<sup>-1</sup> in the percent transmittance mode. In addition to the absorption bands of the biomolecules used as reduction and stabilization (capping) agents, the absorption peak at various wavelength indicates the presence of ZnO nanoparticles.

#### C. X-Ray Diffraction (XRD) Analysis

XRD spectrum of the as prepared ZnO nanoparticles was carried out using  $2\theta$  values ranging from 10 to 80° the  $2\theta$  values with (hkl) plane at 31.5°, 34.2°, 36.1°, 47.4°, 56.5°, 62.8°, 67.8°, 68.9° and 76.9° were observed. The spectrum confirms the hexagonal zinc oxide structure for ZnO nanoparticles.

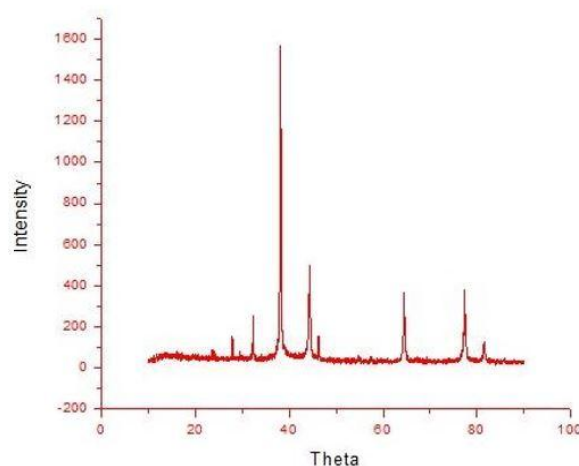


Fig 5. XRD of ZnO nanoparticles

#### D. Scanning Electron Microscopy (SEM) Analysis

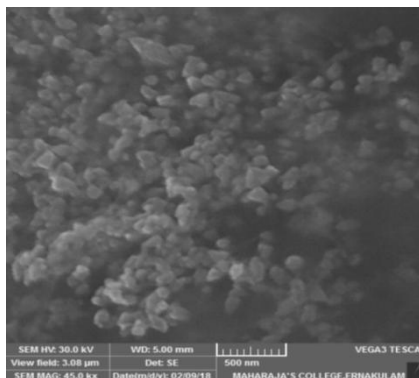


Fig 6. SEM images of ZnO nanoparticles

The physicochemical properties of *Simarauba glauca* acts as a bio template which prevents the particles formed from aggregating. SEM image by green synthesis method explains the external morphology of the ZnO nanoparticles. The SEM images of ZnO nanoparticles indicate a small amount of agglomeration of the nanoparticles with a possible networked structure. [8,9].

#### E. Transmission electron microscopy (TEM) Analysis

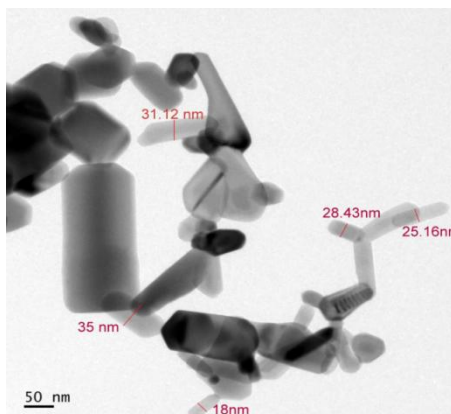


Fig 7. TEM images of ZnO nanoparticles

The TEM image of ZnO nanoparticles clearly shows that the particles are rod hexagonal in shape and the size of the nanoparticles ranges from 30-45nm. [8]

### III. CONCLUSION

Nanotechnology is sometimes referred to as a general-purpose technology. It plays an important role in resolving or reducing many of the problems involving water purification and quality. There are already various promising nanotechnologies for application in water treatment technology. However, the current cost of nanotechnologies prevents their use for large scale water treatment applications. Hence, there is a need for developing a low-cost technology, which allows the effective removal of pollutants from water without releasing nanoparticles into the purified water. While current water treatment methods are well established and adequate for meeting today's requirements, new or modified processes will be needed in the future in response to various environmental and business drivers. Future methods will need to use less chemicals and energy, produce less residual, cope with deteriorating and variable source waters, emerging contaminants, and operate at a lower cost.

It has been proved enough that ZnO nanoparticles have the ability to mineralize pesticides. But, the supporting materials for zinc oxide nanoparticles are yet to be explored. Incorporating nanoparticles onto solid supports will be useful for increasing the lifetime, activity and usability of the particles. Studies shows that cellulose acetate membrane can also be used as support for nanoparticles in pesticide removal.

#### IV ACKNOWLEDGEMENT

The authors profusely thank the Chairman, the Principal and the Head of the Department of Biotechnology and Biochemical Engineering and all the faculties of the department of Sree Buddha College of Engineering, Pattoor for their continual encouragement and support to carry out this work.

#### REFERENCES

- [1] Ashwani kumar, Vishwa Rawat, Amardeep and Vikas kumar, Comparative evaluation of phytochemicals in Methanolic and Ethanolic leaf extracts of Anticancer paradise Tree Simarauba glauca, volume5(2016) pp. 679-686
- [2]. Kumari Smita, S.K. Sarangi, K. Manjunath, Phytochemical analysis of leaf extracts of antihyperglycemic medicinal plants, Int J Pharma Bio Sci 2017 October, 8(4), pp 212-218
- [3]. Vijayalakshmi A, Masilmani K, Nagarajan E and Ravichandiran V, In vitro anti oxidant and anti cancer activity of flavonoids from Cassia Tora linn leaves against human breast carcinoma cell lines, Der pharma chemical, 2015,7(9), 122-129
- [4]. Joby jose, Sudheesh Sudhakaran, Sumesh Kumar T.M, Sony Jayaraman, E. Jayadevi Variyar, A comparative evaluation of anticancer activities of flavonoids isolated from Mimosa Pudica, Aloe vera and Phyllanthus Niruri against Human breast carcinoma cell line (MCF-7) using MTT assay, volume 6, issue 2,2014, 319-322
- [5]. Mahesh Chand Meena, Vidya Patni, Isolation and Identification of flavonoid "Quercetin" from Citrullus colocynthis Schard. Asian J. Exp.Sci.2008, 22(1), 137-142
- [6]. Mahesh AR, Ranganath MK, Harish kumar DR, Enrichment of flavonoids from the methanolic extract of Boerhaavia Diffusa Roots by partitioning Technique. Res.J.Chem.Sci, 2013, 3(1), 43-47
- [7]. Sathish Kumar T, Sampath M, Sivachandran S.V, Shanmugam S, Rajasekaran P, Optimal process for the extraction and identification of flavanoids from the leaves of Polyalthia Longifolia using L16 orthogonal design of experiment, International Journal of Biological and Chemical Sciences 2009, 3, 736-745
- [8]. Vidya Ca, Shilpa Hirematha, M N Chandraprabhab, M A Lourdu Antonyraja , Indu Venu Gopala, Aayushi Jaina and Kokil Bansa, Green synthesis of ZnO nanoparticles by Calotropis Gigantea , vol 4, No 4, Aug 2014
- [9]. M. Jančíková, r. Janiš, j. Krejčí, i. Hauerlandová Department of Fat, Surfactant and Cosmetics Technology Tomas Bata University in Zlín nám. T. G. Masaryka 275 Zlín, Zinc Oxide Nanoparticles in Cosmetic Products , 2016
- [10]. N. Savage, Mamadou Diallo, Jeremiah Duncan, Anita Street and Richard Sustich, Nanotechnology Applications for Clean Water, William Andrew Inc. (2009).
- [11]. S. Nair and T. Pradeep, Extraction of Chlorpyrifos and Malathion from Water by Metal Nanoparticles, J. Nanosci. and Nanotechnol., 7, 1-7 (2007).
- [12]. A. S. Nair, R. T. Tom, V. R. Rajeev Kumar, C. Subramaniam and T. Pradeep, Chemical Interactions at Noble Metal Nanoparticle Surfaces-catalysis, Sensors and Devices, Cosmos., 3, 3103-124 (2007).
- [13]. S. Nair and T. Pradeep, Halocarbon Mineralization and Catalytic Destruction by Metal Nanoparticles, Current Sci., 84, 12 (2003).
- [14]. A. S. Nair, R. T. Tom and T. Pradeep Detection and Extraction of Endosulfan by Metal Nanoparticles, J. Environ. Monit., 5, 363-365 (2003). 16
- [15]. T. Pradeep, Polyurethane foam Coated with Silver Nanoparticles, Indian Patent, 20070608, Application No. 891/CHE/2004 (2004).
- [16]. S. Nair and T. Pradeep (2007) Extraction of Chlorpyrifos and Malathion from Water by Metal Nanoparticles, J. Nanosci. and Nanotechnol., Vol 7, Pages: 1-7. 37.
- [17]. A. S. Nair, R. T. Tom, V. R. Rajeev Kumar, C. Subramaniam and T. Pradeep (2007) Chemical Interactions at Noble Metal Nanoparticle Surfaces-catalysis, Sensors and Devices, Cosmos., Vol 3, Pages: 103-124. 38.
- [18]. D. C. Look (2001) "Recent advances in ZnO materials and devices," Mat. Sci. Eng. B, Pages: 380-383. 39.



- [19]. J. E. Nause (1999) "ZnO broadens the spectrum," III-Vs Review Vol 12. 40. J. E. Nause (2005) "Fluorescent substrate offers route to phosphor-free LEDs,"
- [20]. J. Comp. Semicond, Vol 3, Pages: 11- 29. 41. C. Coskun, D. C. Look, G. C. Farlow and J. R. Sizelove (2004), "Radiation hardness of ZnO at low temperatures," Semicond. Sci. Technol. Vol 19, Pages: 752-754.



**INNO**  **SPACE**  
SJIF Scientific Journal Impact Factor

**Impact Factor:  
7.512**

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
**INDIA**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details