# A Review on Synthesis of ZnO nanoparticles using plant extract

**[1]Gitanjali Kale, [2]Dr.Aruna Vinchurkar**
[1]Research Student, [2]Associate Professor
[1]Dr Babasaheb Ambedkar Marathwada university, Aurangabad,
[2] Govt Institute of Science, Aurangabad
Email - [1] gitanjalikale23@gmail.com , [2] vinchurkar@gmail.com,

***Abstract:*** *Today nanotechnology is intensifying unbelievably communicate and has infinite applications in about the whole thing we do. The medicine we take, food we eat, chemicals we use, car we drive and much more. Comfort level of human life style can be more superior because of advanced research and development in the field of nanomaterials. Now day's different process of synthesis of ZnO nanoparticles are in progress. In this paper we are briefing synthesis of ZnO nanoparticles by plant extract. Plant extract plays vital role in synthesis of metal nanoparticles as they are reducing & capping agents. Such a green, environment friendly approach is not only cost effective but also beneficial over conventional physiochemical methods*

***Key Words:*** *Nanotechnology, Nanomaterials, plant extract, ZnO.*

## 1. INTRODUCTION:

A range of engineering materials are considered a great deal for their properties in their nano form. Surface activity in nano form is increases diverse than in bulk form due to increased surface area. The nanosized inorganic components can exhibit interesting size-dependent properties, such as optical and electrical properties. Zinc oxide (ZnO) nanoparticles (or quantum dots), among nanosized metal oxides are of great interest and have been extensively investigated recently. ZnO nanoparticles has a wide band gap (3.4 eV) and large exciton binding energy (60 meV). ZnO nanoparticles, also shows visible light transmittance, UV absorption, and moderately high refractive index[12]. So they are found to be useful in a broad range of applications such as optoelectronic devices, dye-sensitized solar cells, catalysts, and sensors. There are several works on syntheses, physicochemical properties, and applications of ZnO nanoparticles.

## 2. LITERATURE REVIEW:
## SYNTHESIS USING PLANT EXTRACT:-

### 2.1 Citrus aurantifolia :-

Researcher use 50 ml Citrus aurantifolia leaves extract boiled at 60-80 degree Celsius using magnetic stirrer. 5 gram of zinc nitrate was added to solution as temperature reached 60 degree Celsius, reduced up to yellow colored paste obtain. Collected paste annealed at 400 degree Celsius for 2 hours. UV-visible spectrum used for studying optical properties of prepared ZnO nanoparticles, which gives intensive absorption in ultraviolet band about 300-1100 nm & absorption wavelength at 208 & 215 nm of ZnO. Zno nanoparticles obtained in spherical shape in range of 9-10 nm. [1]

### 2.2 Cheilocostus speciosus:-

Leave exract of Cheilocostus speciosus mixed with zinc nitrate in equal proportion,annealed at 120 degree celesius for 5 hour,centrifuged at 5000 rpm for 15 minutes. Pellet dried in hot air oven at 80 degree celesius for 2 hours to obtain dry powder of zinc nanoparticles.[2]

### 2.3 Hibiscus rosa-sinensis:-

Researcher collects leaf extract of Hibiscus rosa-sinensis used as reducing material & stabilizing agent for zno nanoparticles synthesis. Leaf extract prepared by dried leaves mixed with double distilled water. Boil this mixture for 1 hour until colour of solution obtained yellowish. For synthesis,50ml of Hibiscus rosa-sinensis leaves extract boiled to 60-80 degree celesius using magnetic stirrer. 5 gram of zinc nitrate added to this mixture boiled upto yellow paste obtained which annealed 120 minutes at 400 degree Celsius. XRD analysis shows good agreement with Der Pharma Chemica,2013,J/3):265-270.[3]

### 2.4 Punica Grantum:-

Punica grantum peels powder weighing 5 gram were thoroughly washed in DDW & mixed in 100 ml DDW & filter, used as extract for nanoparticle synthesis. 50 ml of Punica Grantum peels extract boiled to 60-80 degree celesius using stirrer with addition of 5 gram of zinc nitrate. This reduced to deep yellowish colour paste annealed in oven at 90 degree Celsius for 8 hours.[4]

### 2.5 Aleo-vera:-

0.25 gram of zinc acetate dissolve in water in which 4 ml of aloe-vera extract added dropwise to maintain pH of solution NaOH added. White precipitation obtained washed with distilled water & dried in oven at 60 degree Celsius.[5]

**2.6 Neem:**

Zinc acetate of 0.5 M dissolved in ethanol. NaOH added to maintain 11.5 pH of solution. With magnetic stirrer, neem extract added to zinc nitrate solution with 500-600 rpm. Solution stir for 1 hour having temperature maintain 60 degree Celsius. After 24 hours, filter solution, supernatant discarded & precipitate washed with ethanol, dried and zno nanoparticle synthesized.[6]

**2.7 Ocimum Tenuiflorum:-**

10gm of dried leaves mixed with 100 ml distilled water, boiled for 10 min. This mixture solution. Filtered using filter paper. 50 ml Ocimum tenuiflorum leaf exctract boiled at 60-80 degree celesius using stirrer in which 5 gram of zinc nitrate added when temperature reach at 70 degree Celsius. Paste obtained dried at 100 degree celesius for 40 minutes,yellow coloured powder obtained.[7]

**2.8 Passiflora edulis (Passion fruit):-**

Researcher uses 5 gram of finely chopped plant material boiled in 50 ml of distilled water for 5 minutes,filter & stored for further process. 10 ml of zinc nitrate solution,10 ml of broth solution & 10 ml consists of 9 ml of 1mM zinc nitrate solution & 1 ml of plant extract containing three boiling tube used. Synthesized zinc oxide nanoparticles used for further analysis like UV-visible spectroscopy. [8]

**2.9 Mimosa pudica leaves and coffee powder:-**

Dry leaves of mimonso pudica mixed with ethanol solvent followed by filtration and drying to get soft powder. Same procedure apply for preparation of coffee extract. Zinc nanoparticles synthesized by mixing 20 ml of zinc acetate with 0.2 gram of extract in ethanol solvent stirring for overnight.[9]

**2.10 latex of Euphorbia Jatropa:-**

Redox mixture(1 gram of zinc nitrate+10 ml distilled water+2ml latex) stir with help of magnetic stirrer kept in preheated muffle furnace at 450 degree Celsius. The final white powder was kept for calcination at a temperature of 750 degree C for 2 h in the muffle furnace. [10]

**2.11 Limonia acidissima:-**

Twenty grams of fresh leaves were washed with tap water then dried, finely cut, and soaked in 100-mL water and boiled at 60 C for 1 h. The leaf extract cool at room temperature, filtered and stored at 4 C. Along with 95ml zinc nitrate solution,5 ml of extract added at 80 degree Celsius for 10 minutes maintaining pH 10 by adding 0.1 N HCL or 0.1 N NaOH. Reduction of zinc ions to zinc nanoparticles was observed after 72 h. [11]

**3. MATERIALS:**

**APPLICATIONS:-**

| Sr. no | Local Name | Biological Name | Part | source | Application and morphology |
|---|---|---|---|---|---|
| 1 | Key lime | Citrus aurantifolia | leaves extract | zinc nitrate | Spherical shape(9-10nm) |
| 2 | crêpe ginger | Cheilocostus speciosus | leaves extract | zinc nitrate | Antimicrobial and anti-diabetic property. |
| 3 | Chinese hibiscus | Hibiscus rosa-sinensis | leaves extract | zinc nitrate | Antibacterial and 25nm |
| 4 | pomegranate | Punica Grantum | peels powder | zinc nitrate | Antimicrobial. Spherical and square like structure in range of 50-100nm |
| 5 | Aleo-vera | Aleo-vera | leaves extract | zinc acetate | Photo catalytic degradative ability. Hexagonal structure with 22.18nm |
| 6 | Neem | Neem | leaves extract | zinc acetate | Bioapplication. Size 25nm |
| 7 | tulasi | Ocimum Tenuiflorum | leaves extract | zinc nitrate | Hexagonal Shape,11-25nm |
| 8 | Passion Fruit | Passiflora edulis | leaves, stem & flower | Zinc Nitrate hexahydrate | Development of drugs in medical field and fertilizers in various crops. |
| 9 | shy plant | Mimosa pudica leaves and coffee powder | Leaves extract | zinc acetate | Photocatalytic activity.Wurtzite and hexagonal phase with |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | crystallite size of 27.14 and 46.94A resp |
| 10 | nettlespurge | Euphorbia Jatropa | latex | zinc nitrate | High power application, white LED. Size in between 6-21nm. |
| 11 | elephant-apple | Limonia acidissima | leaves extract | zinc nitrate | Antimicrobial activity. Size in between 12-53nm |

## 4. CONCLUSION:

Green synthesis of ZnO nanoparticle is more advantageous over physicochemical method due to cost effective, environmental friendly approach. ZnO nanoparticle synthesis using different part of plants. Plant extract consider as novel approach due to large number of diversity available in nature.

**Disclosure statement:**

The authors declare that they have no conflict of interest.

## REFERENCES:

1. Ramesh P.et.al. Synthesis of zinc oxide nanoparticle from fruit of citrus aurantifolia by chemical and green method,Asian journal of phyomedicine and clinical research. 2(4), A189-195.
2. Akash Koli, (2015): Biological synthesis of stable zinc oxide nanoparticle and its role as anti-diabetic and anti-microbial agents, international journal of Academic Research, ISSN:2348-7666: Vol.2,Issue-4(1), october-december,.
3. R.Sharmila Devi,R. Gayathri, Green synthesis of Zinc Oxide nanoparticles by using Hibiscus rosa-sinensis, international journal of current engineering and technology, E-ISSN 2277-4106,P-iSSN 2347-5161.
4. Vijaylaxmee Mishra,Richa Sharma, (2015), Green synthesis of Zinc Oxide Nanoparticles using fresh peels extract of punica grantum and its antimicrobial activities, international journal of pharma research and health sciences, volume 3(3), ,694-699.
5. Elizabeth Varghese and Mary George,(January 2015), Green synthesis of zinc oxide nanoparticles, international jounal of Advance Research in science and engineering,IJARSE,Vol.No.4,Issue No.01,.
6. Anjali Oudhia, Pragya Kulkarni, Savita Sharma, Green synthesis of ZnO nanotubes for Bioapplications, International Journal of Advanced engineering Research and studies, E-ISSN2249-8974.
7. Sagar Raut,Dr.P.V.Thorat, Green synthesis of Zinc oxide nanoparticles using Ocimum Tenuiflorum leaves, International Journal of science and research(online):2319-7064.
8. M.Manokari, Mahipal Shekhwat, (2016), Production of zinc oxide nanoparticle using extract of Passiflora edulis Sims. f. flavicarpa Deg. WSN 47(2) 267-278.
9. Is Fatimah, Rizqi Yulia Pradita (2016) , Plant extract mediated of ZnO nanoparticles by using ethanol extract of Mimosa pudica leaves and coffee powder,4th international conference on Process engineering and advanced materials,148, 43-48
10. M.S. Geetha,H. Nagabhushana, (2016), Green mediated synthesis and characterization of ZnO nanoparticles using Euphorbia Jatropa latex as reducing agent, Journal of Science: Adavanced materials and devices 1301-310.
11. Bheemangouda N. Patil, Tarikere C. Taranath, Limonia acidissima L. (2016) , leaf mediated synthesis of zinc oxide nanoparticles: A potent tool against Mycobacterium tuberculosis International Journal of microbiology5, 197-204
12. Chayannan Petchthanasombat, (1 March 2012) Synthesis of zinc oxide-encapsulated poly(methyl methacrylate)–chitosan core–shell hybrid particles and their electrochemical property, Journal of Colloid and Interface Science. Volume 369, Issue 1, , 52–57