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GREEN SYNTHESIS OF ZINC OXIDE NANOPARTICLE USING COCOS NUCIFERA FLOWER MILK EXTRACT

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Abstract*:* The synthesis of Zinc Oxide nano particle using Cocos Nucifera Flower Milk Extract has been illustrated in detail. The increasing demands for the nano particles applications open up new areas in the process of its synthesis. We deals with a green synthesis in this study using cocos nucifera flower milk extracts. The coconut flower milk extract was found efficient for synthesis of zinc oxide nano particles. It is eco-friendly and convenient one. The green synthesized zinc oxide nano particle were characterized by (UV) Ultraviolet visible spectroscopy, (FTIR) Fourier transfer infrared spectroscopy, (PA) Particle size analyzer , (XRD) X-ray diffraction, and Antimicrobial Test Analysis. These are used in the treatment of kidney stones, diabetics, thyroid problem, weight loss . It is anti-inflammatory medicine.

Key words: Zinc Oxide, Cocos Nucifera, Green Synthesis, UV, FTIR, XRD, Particle size analyzer, Antimicrobial Activity.

I. INTRODUCTION

Nanotechnology is emerging as a rapidly growing field with its application in science & technology for the purpose of manufacturing new materials at the nanoscale level. Nanotechnology has gained massive applications in the fields of biology pharmacology and medicine. In recent years, the biosynthesis method using plant milk extract has received more attention than other various method. Because it in eco-friendly, reduce energy consumption, intended to eliminate toxic waste and to use ecological solvents. Zinc oxide is an global community faces significant challenges with regard to energy and the environment. Hence it is used medical field such as imaging, drug delivery, antibiotics and bio medical detection. Scientists and engineers have developed innovative techniques in nanotechnology and materials science, particularly in eco-friendly synthesis of metal oxides to address these challenges. This review discusses current trends in eco-friendly synthesis and technological applications of zinc oxide (ZNO) nanostructures beyond the biomedical field mostly presented in the literature. Synthesis methods of zinc oxide synthesis have attracted researchers due to their non-toxic versatility and environmentally friendly nature.

Zinc oxide nanoparticles (NPs) possess unique optical and thermal characteristics, a wide band gap, high excitation binding energy and are generally recognized as safe and effective, contributing to their broad range of applications. This review also explores the mechanism of zinc oxide Nanoparticle formation. Cocos nucifera is ayurvedic plant which is used to treatment kidney stones, diabetics, thyroid problem, weight loss . It is anti-inflammatory medicine. The aim of the present study was to investigate the antimicrobial activity of synthesized ZnO nanoparticles using aqueous leaf extract of Cocos Nucifera.

II. MATERIALS AND METHODOLOGY

Cocos nucifera flower were collected from the field located in Dindigul district. Zinc oxide was purchased from the authorized Laboratory centre. The experiment was conducted at Sakthi College PG research Laboratory of physics Oddanchatram at Dindigul district. All chemicals and reagents are of analytic grade and used without further purification. Coconut were first domesticated by the Austronesian peoples in Island southeast Asia and were spread during the Neolithic via their seaborne migrations as far east as pacific Islands and as far west as Madagascar and the Comoros. Cocos nucifera plant flowers shows anti-inflammatory activity due to occurrence of various of active phytoconstituents and it could be a source of new active drug compounds. It controls premature graying of hair and baldness.

Preparation Of Cocos Nucifera Flower Milk Extract

The coconut flower were dehusked and creaked open using a knife. Then coconut flower milk squeezed to milk extract using mortar and pestle. The milk extract was collected **(50m**l) into the beaker. Then the milk extract was heated in hot plate for **2 minutes (70°C)**. Then it was filtered with the use of filter paper and stored for the further assessment.

Synthesis Of Zinc Oxide Nanoparticle

The ZnO nanoparticle were synthesized by using 0.5 M of zinc oxide in 100 ml of distilled water. Then the solution was stirred at 220 rpm/sec for 2 hour without heating. The solution was adding drop wise 50 ml cocos nucifera flower milk extract as a precipitating agent. The beaker containing the mixture was stirred at 440 rpm/sec for about 2 hours without heating. There is a **PH level** change while comparing the zinc oxide solution before **6** and after **7** adding in milk extract. Then the prepared mixture has kept freely without any disturbance for 24 hours. Then it was dried with a muffle furnance at 100°C for 4 hours After complete drying the ZnO nanoparticles obtained were scraped and stored for further characterization. There is a light color change from light brown to dark brown. The prepared nanoparticle was characterized to analyze the properties of zinc oxide nanoparticle.

III .Characterization Techniques

Ultraviolet visible spectroscopy

UV spectroscopy uses ultraviolet light to determine the absorbency of a substance. In simple terms, the technique maps the interaction between light and matter and measures. As matter absorbs light it undergoes either excitation or de-excitation. Which generates what is known as a spectrum. This allows scientists to measure the rate at which a beam of light weakness after passing through a substance.

Fourier Transform Infrared Spectroscopy (FTIR)

Fourier transform infrared spectroscopy (FTIR) is a largely used technique to identify the functional groups in the beam of infrared radiations. An infrared spectroscopy measured the absorption of IR radiation made by each bond in the molecule and as a result gives spectrum which is commonly designated as % of transmittance versus wave number (cm^{-1}). A diverse range of materials containing the covalent bond absorbed electromagnetic radiation.

X-Ray Diffraction

Using X-ray diffraction phase analysis was studied. This average crystalline size of the nanoparticle were calculated based on Debye's Scherer's equation.

$$D = K\lambda/\beta COS\theta$$

D = is the nanoparticle crystalline size

K =represents the Scherer constant(0.98)

λ= wavelength of incident beam

β = full width at half maximum (FWHM)

Θ = Bragg's law

The synthesized zinc oxide sample shows major respectively. The below table shows than the interplaner distance and FWHM of corresponding zinc oxide nanoparticle. The average or estimation crystalline size is about in x-ray diffraction.

Particle size analyzer

Particle size analyzer are used to determine the size and distribution of particles making up a material. Particle size analyzer are used in numerous fields for research and development, manufacturing and for quality control and product testing.

Anti-Microbial

Antibiotic is a type of antimicrobial substance active against bacteria. It is the most important type of antibacterial agent for fighting bacterial infections, and antibiotic meditations are widely used in the treatment and prevention of such infections. They may either kill or inhibit the growth of bacteria. A limited number of antibiotics also possess antiprotozoal activity. Antibiotics are not effective against virus such as the common cold or influenza drugs which inhibit growth of viruses are termed antiviral drugs or antiviral rather than antibiotics. They are also not effective against fungi, drugs which inhibit growth of fungi are called antifungal drugs.

Determination of antibacterial activity by disc diffusion method

The disc diffusion method is used to evaluate the antibacterial activity of the sample. Ten ml of Mueller-Hilton agar medium was poured into sterile Petri dishes (diameter 60 mm) and inoculated with test organism. Sterile filter paper disc loaded with various concentrations of sample of 60, 80 and 100 µg/ml were placed on the top of Mueller-Hilton agar plates. Filter paper disc loaded with 5 µg of amoxicillin was used as positive control. The plates were incubated at 37 ºC for 24 hours and the zone of inhibition was recorded in millimeter and the experiment was repeated twice.

Determination of antifungal activity by disc diffusion method

Disc diffusion method in order to test the antifungal activity of sample against test pathogens was carried out. In Petri dishes (60 mm) filled with Sabouraud's dextrose agar (SDA) and seeded with a 0.3 ml of test organism, a sterile filter paper disc (diameter 6 mm, whatsman paper no.3) was placed. The sterile disc was impregnated with 10 µl of samples at varying concentration of 60, 80 and 100 µg/ml respectively. The zones of growth inhibition around the disc were measured after 24 h of incubation at 37ºC. while, Fluconazole was used as a positive control.

IV. Result And Discussion

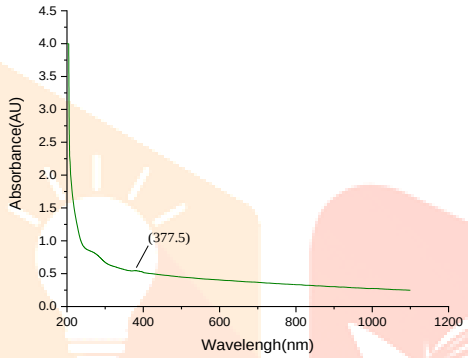
UV Visible Spectroscopy

The UV visible light at wavelength ranging from 200-1200 nm was used to evaluate the light absorption characteristics of ZNO nanoparticles. The UV visible spectra of ZNO and milk extract in an aqueous solution at room temperature. The absorption peaks obtained for the samples in the range of **peak 377.5 (nm**) the corresponding **absorption range is 0.546965209 U.**

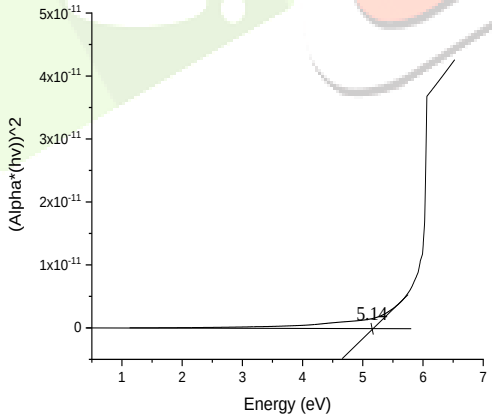
The condition band energy is calculated from the Einstein's photon energy equations.

$$E = hc/\lambda \text{ max}$$

The band gap energy of zinc oxide has calculated to be **5.14 eV.**



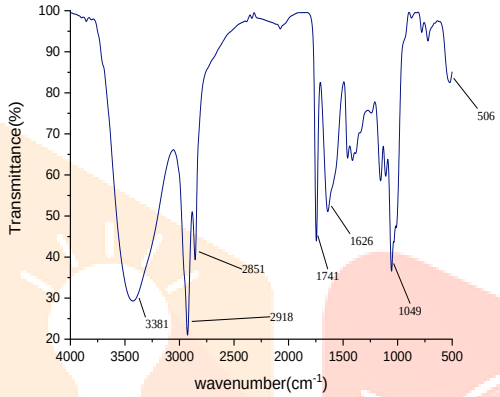
UV Visible Spectroscopy



UV Visible Spectroscopy Of Band Gap Energy

Fourier transform infrared spectroscopy (FTIR)

Fourier transform infrared (FTIR) spectra were recorded using an FT-IR spectrometer. FTIR spectroscopy is used to study the change in chemical composition, impurity content and interaction between different species. FTIR spectrum is used to calculate various **functional groups** which present in the ZNO nanoparticle and also used determine the absorption range. The FTIR spectra of the ZNO nanoparticles which were synthesized by precipitation method. The wave number **506 cm^{-1}** represents stretching vibration C-I (strong). The wave number **1049 cm^{-1}** represents stretching vibration CO-O-CO (very strong). The wave number **1626 cm^{-1}** represents stretching vibration C=C (medium). The wave number **1741 cm^{-1}** represents stretching vibration C-O (very strong). The wave number **2851 cm^{-1}** represents stretching vibration C-H (medium).The wave number **3381 cm^{-1}** represents stretching vibration Bonded N-H/C-H/O-H (strong).

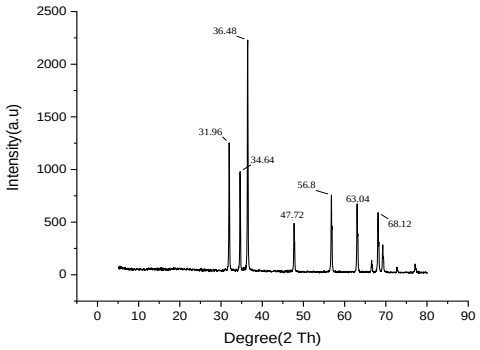


Fourier transform infrared spectroscopy (FTIR)

X-Ray Diffraction

Using X-ray diffraction phase analysis was studied. This average crystalline size of the nanoparticle were calculated based on Debye's scherer's equation.

The obtained structure was compared with TCPDS data. The synthesized ZNO sample shows **7 major peaks** 31.96, 34.54, 36.48, 47.72, 56.8, 63.04, 68.12 respectively. The below table shows then the interplaner distances and FWHM of corresponding 2Ɵ values of zinc oxide nanoparticles. Its XRD value of **d-spacing in2.464Å and crystalline size 0.9999 (nm).**



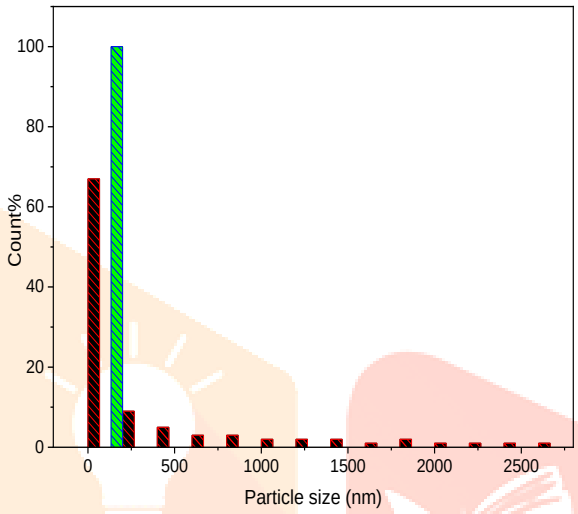
X-Ray Diffraction

Particle Size Analyzer

Particle size analyzer are used to determine the size and distribution of particles making up a material. Particle size analyzer are used in numerous fields for research and development, manufacturing and for quality control and product testing.

It works on the principle that when a beam of light (a laser) is scattered by a group of particles, the angle of light scattering is inversely proportional to particle size.

Average - 226.7 : 200.0



Particle size analyzer (PSA)

Distribution Width SPAN = $\frac{D90-D10}{D50}$

$\frac{479.30-51.40}{151.50}$ = **2.824 (Width)**

Distribution rati : $\frac{D90}{D10} = \frac{479.30}{51.40} =$ **9.3249**

Then the **Distribution are large.**

Mean Value - 100.86 (nm)

ANTI-MICROBIAL ACTIVITY

Collection of test pathogens

T he antibacterial and antifungal activity of sample were exhibited against one gram negative bacterial strains **Escherichia coli** (MTCC 443) and for fungal culture used in the study are **Candida albicans** (MTCC 183) were prepared as test organisms. All the bacterial strains were purchased from the Microbial Type Culture and Collection (MTCC) at Chandigarh, India and the fungal strains from National Chemical Laboratory (NCL), Pune, Maharashtra, India.

Determination of antibacterial activity by disc diffusion method

The disc diffusion method is used to evaluate the antibacterial activity of the sample. Ten ml of Mueller-Hilton agar medium was poured into sterile petri dishes (diameter 60 mm) and inoculated with test organism. Sterile filter paper dics loaded with various concentrations of sample of 60, 80 and 100 µg/ml were placed on the top of Mueller-Hilton agar plates. Filter paper disc loaded with 5 µg of amoxicillin was used as positive control. The plates were incubated at 37 ºC for 24 hours and the zone of inhibition was recorded in millimeter and the experiment was repeated twice.

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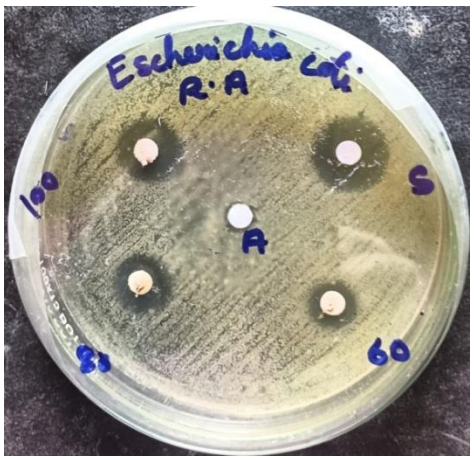
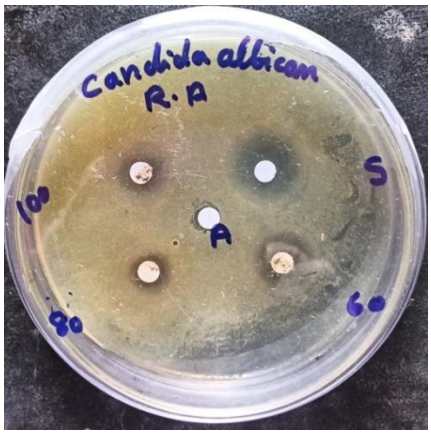
Disc diffusion method in order to test the antifungal activity of sample against test pathogens was carried out. In Petri dishes (60 mm) filled with Sabouraud's dextrose agar (SDA) and seeded with a 0.3 ml of test organism, a sterile filter paper disc (diameter 6 mm, whatmann paper no.3) was placed. The sterile disc was impregnated with 10 µl of samples at varying concentration of 60, 80 and 100 µg/ml respectively. The zones of growth inhibition around the disc were measured after 24 h of incubation at 37ºC. while, Fluconazole was used as a positive control.

Table-1: In Vitro Anti-microbial activity of samples

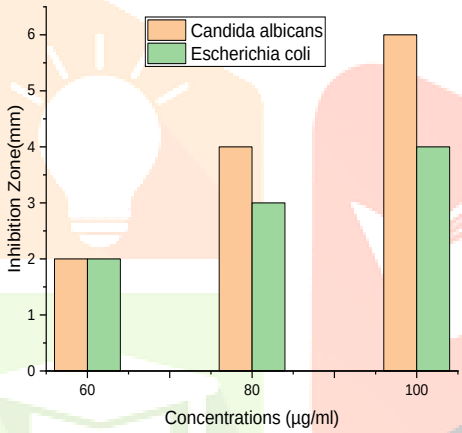
Concentrations (µg/ml)	**Organisms/Zone of inhibition (mm)**	**Organisms/Zone of inhibition (mm)**
	Escherichia coli	***Candida albicans***
60	2	2
80	4	3
100	6	4



Escherichia coli



Candida albicans



Anti- microbial activity of graph

CONCLUSION

The obtained zinc oxide nanoparticles were characterized to evaluate physical, chemical and structural behavior of UV Visible Spectroscopy, Fourier Transform Infrared Spectroscopy, Particle Size Analyzer, X-Ray Diffraction And Anti-Microbial Activity.

The UV absorption peaks obtained for the samples in the range of **377.5. (nm) for zinc oxide** corresponding **absorption range is 0.546965209 U.** The UV band gap energy of zinc oxide has calculated to be **5.14 eV.** The FTIR **Functional group** wave number **3381 cm^{-1}** represents stretching vibration Bonded N-H/C-H/O-H (strong) to The FTIR **Functional group** of wave number **506 cm^{-1}** represents stretching vibration C-I (strong).

The XRD synthesized ZnO the below table shows then the inter planer distances and FWHM of corresponding 2Θ values of Zinc Oxide nano particles. Its XRD value of **d-spacing in2.464Å and crystalline size 0.9999 (nm).** Particle Size Analyzer result is distribution ratio **9.3249** then the **Distribution are large.** The anti-microbial activity dilution susceptibility testing methods gives the range E.coil, Candida albicans, ZnO result. The Cocos Nucifera Flower Milk Extract are used in the treatment of kidney stones, diabetics, thyroid problem, weight loss . It is anti-inflammatory medicine. The Zinc Oxide were successfully synthesized Using Cocos Nucifera Flower Milk Extract.

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