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GREEN SYNTHESIS OF ZINC OXIDE USING ALOE VERA LEAVES: STRUCTURAL AND OPTICAL CHARACTERIZATION REVIEWS

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Abstract:

This work is to review the previous, current and latest findings on the structural and optical properties of the ZnO nanoparticles formed by the various green synthesis methods. Each method involves a different chemical reaction, and it affects the quality of the ZnO formed on the substrates. Zinc oxide (ZnO) is a wide and direct semiconductor with a wurtzite crystal structure. Nano-scaled ZnO as today has been synthesized through green synthesis using natural plant extract as an effective 'reducing agent' of the metal precursor, has been reported to be a cleaner and environment-friendly alternative to the physical and chemical methods. The Final Year Report is based on the green synthesis and the main physical optical properties of pure ZnO nanoparticles synthesized by a completely green chemistry process using the natural extract of Aloe Barbadensis Miller (Aloe Vera) Leaf Extract to bio-reduce the zinc precursor. Different zinc precursor concentration is known to affect particle size as well as on the optical properties such as surface morphology, porosity, particle size and polymeric properties of ZnO nanoparticles. The green synthesis of NPs ZnO use is much better and affordable because the process provides more eco-friendly, economical, free toxic, and easy to compose rather than chemical and physical methods. The main characteristics and the applications of these synthesized zinc oxide are also reported by using different analysis equipment to be a focus on such as X-Ray Diffraction (XRD) Analysis, Field Emission Scanning Electron Microscopy (FE-SEM), Fourier Transform Raman (FT-Raman), Photoluminescence Spectra (PL).

***Keywords*:**

nanotechnology; zinc oxide; green synthesis; morphology; aloe vera

Objectives:

- To compile the best green synthesis using Aloe-Vera leaves for fabricating the high quality of ZnO nanoparticles.
- To report the past, current and latest of structural and optical properties of ZnO using Aloe Vera leaves.

Methodology:

For collecting data for this study, a systematic and extensive search was conducted for reviewed academic articles published from past, current and latest, with extra information provided from external sources such as institutional and market-research sources. The search is conducted by several sets of keywords in various academic databases. The database that includes: Science Direct, Research Gate, JSTOR, SpringerLink, and Elsevier, including the keywords, "aloe vera green synthesis", "zinc oxide nanoparticles", "Raman spectra", "SEM microscopy", "photoluminescence", "XRD spectrum", "photoluminescence", "production of zinc oxide", "aloe vera properties". The results were related and is cited and referenced in this paper for brevity.

To further support the reviewed studies, literature and data from a major international research institute, and references from institutional report have been included to access on publicly reviewed statistics and information. The uses of various and multiple resources expand and ensure different perspectives. The issues presented in the paper applied to zinc oxide nanoparticles by using aloe vera leaves.

Results:

The Effect of pH on Zinc Oxide Structure

In this review, we present a systematic analysis of ZnO nanostructure morphological variation by varying the pH of the precursor solution through the green solution process. ZnO nanorod morphology differs markedly from sheetlike to rod-like zinc oxide structure. Due to the diffraction patterns at all pH levels correlate well with regular ZnO [27]. Crystallinity and nanostructures have been confirmed by high-resolution electron microscopy transmission (SEM) and selected area electron diffraction pattern, suggesting that the structure has evolved along with an ideal lattice fringe [24]. It can be concluded that the structure's size/morphology can be be tailored by variance in pH. Lower pH will be ideal for obtaining 2D structure where, because of higher pH values, rod-like structure will be produced. The pH solution does not affect the consistency of the substance as observed from X-ray diffraction pattern and FTIR spectroscopy significantly. Besides, the optical properties (UV-vis spectroscopy) of the grown samples were also shown to have good optic properties compared to the bulk ZnO under different conditions.

The Effect of Temperature on Zinc Oxide Structure

At higher temperatures, due to agglomeration, the size of the zinc oxide nanoparticles increases. Raman spectra bands at extend explicitly indicate that the solution contains zinc oxide. Upon making the high peaks annealed. The FTIR converted radiation to zinc oxide. Also, the amount of zinc precursors being converted to zinc oxide depends on the temperature of the annealing process [72]. Optical transmittance data were used to determine the optical properties of the ZnO nanoparticles. For commodity optical band, temperature PL spectrum displays a strong UV band. Optical transmittance data were used to determine the optical properties of the ZnO nanoparticles. The crystalline consistency also can be improved by heat treatment of the crystals in an O2 atmosphere due to the effects of oxygen entering the crystal lattice, thereby increasing the stoichiometric proportion of the sample and reducing the vacancies of oxygen in ZnO. For commodity optical band, temperature PL spectrum displays a strong UV band [23].

The Effect of Precursor Concentration on Zinc Oxide Structure

The concentration of the precursor effect on the structural, morphological and optoelectrical properties was investigated. X-ray diffraction patterns show that the samples are poly-crystalline with a preferential orientation. SEM analyzes however reveal that film morphology depends significantly on the concentration of the precursor, outlining mechanisms governed by nucleation and/or growth. Based on the next layer built to be deposited in a stacked structure, it has been shown that roughness increases with increasing precursor concentration while wet capacity can be adjusted by adjusting the precursor concentrations [71]. The present optical transmittance spectrum curves of ZnO films with different concentrations of precursors suggest that the films are highly transparent in the visible field. The opto-electrical analyzes in the studies also show that films that demonstrate higher electrical conductivity also have better photosensitive properties compared to concentration variations [60].

Conclusion:

As a conclusion, numerous studies note the possibility of using a green synthesis to obtain ZnONPs when aloe vera is used. In addition, the studies cited here suggest that given their source, these substrates act as reducing and stabilizing substances, or as chelating substances. It is interesting to note that parameters such as temperature conditions, reaction time, pH, and concentrations, in addition to the difference between the compositions found in biological extracts, significantly alter the final properties of the synthesized nanoparticles. Between these parameters, the concentrations of both biological extract and zinc source and also the pH, temperature of mixture and concentration of zinc precursor play a major role in the final properties of ZnONPs obtained using the green path, according to the cited literature. Although the complexity of biological substrates still poses a challenge to evaluate the green synthesis of nanoparticles, further investigations on the mechanism of formation of the biological synthesis of ZnONPs are necessary to achieve a better understanding of the chemical processes and reactions that occur during the synthesis. It seems that the green synthesis process, which is important for the large-scale production of ZnONPs, will be regulated and optimized with the designation of the described mechanism. Therefore, the rapidly advancing understanding of green synthesis