

Synthesis and Characterization Zinc Oxide Nanoparticles Using Plant Extra

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Abstract: This study used orange leaf extract with zinc chloride as precursor to success fully create zinc oxide nonparties (ZnO). Were synthesized and characterized by various techniques such as x-ray diffraction(XRD),and field emission scanning electron microscopy (FE-SEM).XRD confirmed the crystalline nature for (ZnO)nano particles with a crystal size calculated using the Debye-Scherrer equation estimated to be183.79 nm-FE-SEM image showed that the ZnO have spherical-shape.

Introduction

Nanoparticles of metal oxides are a valuable material that has various applications in optical mechanical and electrical devices, gas sensors, catalysts, cosmetics and sunscreens(1). 2 More chemical and physical methods were used to prepare the nanoparticles. However, there are a number of methods that have disadvantages including toxic solvents, the use of high energy consumption, hazardous products... etc., so there is a fundamental need to develop environmentally friendly methods for the synthesis of metallic nanoparticles. The development of environmentally friendly technologies in the synthesis of materials is of great importance to expand their biological applications. At present, various types of green nanoparticles with welled fined chemical composition, size and morphology have been synthesized by various methods and their applications have been explored in many innovative technological fields (2) The regenerative nature of the plant extracts, the environmentally friendly aqueous medium and the moderate reaction conditions make the method useful over other hazardous methods. In recent years, various plant extracts and products have received attention due to their energy efficiency, low cost, and nontoxic behavior in the approach to synthesise metallic nanoparticles (3)

Zinc oxide nanoparticles (ZnO) Zinc oxide (ZnO) is one such important metal oxide NPs which has gained scientific spotlight currently. The unique set of characteristics of ZnO.NPs such as catalysis, medicinal effects, photochemical capability, fungicidal, antibacterial and UV 3 filtration has made ZnO.NPs as a multifunctional agent and more promising for wastewater remediation (4) . Although ZnO.NPs could be prepared by a variety of methods for example chemical precipitation, solvothermal, hydrothermal, microwave, sonication, etc. Green synthesis of ZnO.NPs using plant-derived products is an essential part of this biosynthesis category. The method primarily involves the production of the NPs using extracts derived from these plant parts, with or without the application of temperature and coprecipitation agents. While the process chemistry of the NPs preparation is too complex, principally the different enzymes and phytochemicals present in the extract facilitate the reduction/oxidation of the precursor to ZnO NPs (5) . A wide spectrum of metabolites available in these plant derived extracts are rich anti-oxidants which readily reduce the precursor molecule to zinc ions and subsequently to ZnO.NPs.

Material and Method

Zinc oxide nanoparticles was prepared using orange Leaves Extract denoted as: (CLE.ZnO.NPs) and it was the adsorbent in this work.

From a rural area of Diyala governorate, orange leaves are collected, and then using tap water, they are cleaned from suspended dirt, then washed with distilled water several times and dried. With an electric grinder, it is ground, and stored away from moist are. (5gm) of the orange leaves powder was poured in a flask and 400 ml of deionized water was added to it; then, it was heated for (2h) at (70) °C. It was cooled to room temperature, and filtrated and the extract centrifuged for four minutes at the speed of (1600) rpm to remove biomaterials and then stored at room temperature until being used.

Preparation of Zinc Oxide nanoparticle

In (400 ml) of deionized water (0.3) gm. of zinc chloride was dissolved with continuous stirring and then (10) ml of the plant extract was added gradually with constant stirring at room temperature, where the color changed to light yellow, in the next step, the temperature of the solution was raised to 80C 0 and adjust the pH of the mixture by adding approximately (10 ml) from sodium hydroxide solution. Then it is filtered and washed several times with deionized water and added absolute ethanol to remove impurities and then dried in an oven at a temperature of (80C 0) for a period of (2) hour. calcination of Zn(OH)₂ in Furnace at (600)C 0 for six hours to obtained zinc oxide nanoparticles(ZnO.NPs).

Preparation Sodium hydroxide solution

To make the (0.2M)of sodium hydroxide (NaOH)solution ,(0.8g)of NaOH was weighed and put into a (100m L) volumetric flask, which was filled up to the mark with D.W.

Result and discussion

XRD analysis The crystal structure and phase identification of the zinc oxide nanoparticles are identified from the X-ray diffraction pattern. The XRD spectra of the synthesized ZnO-NPs is show in Figure(1) Braggs diffraction peaks for ZnO-NPs is observed at 38.32°, 44.475°, 64.575°, and 77.525°, in 111,200,220,and 311, respectively, the averages crystallite sizes of calculated to be about using Scherer-equations.

$$D = 0.94\lambda / \beta \cos \Theta$$

Where, D is represent size of particles(nm),

λ Is the wave length of the XRD (Cu K α =1.54056 ° A),

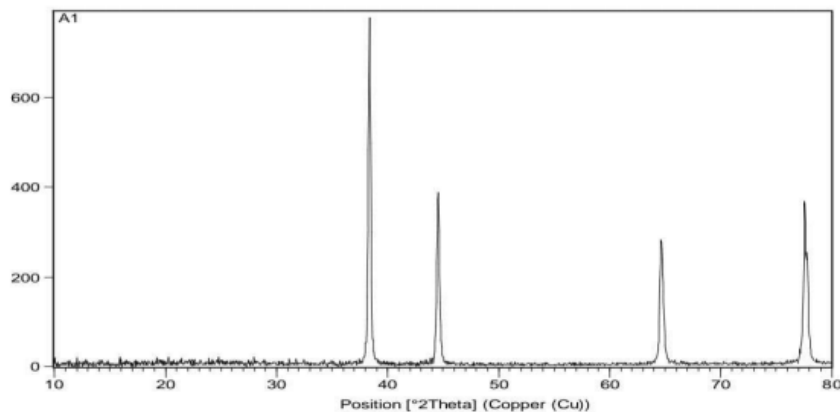
β is the full width of the XRD peak at half height,

(Θ) is the Bragg-angle.

The absence of impurities was revealed by the X-ray diffraction pattern, which demonstrated that pure had been successfully synthesized. The results obtained of XRD analysis are in agreement with the previously published research demonstrating the cubic-structure of zinc.

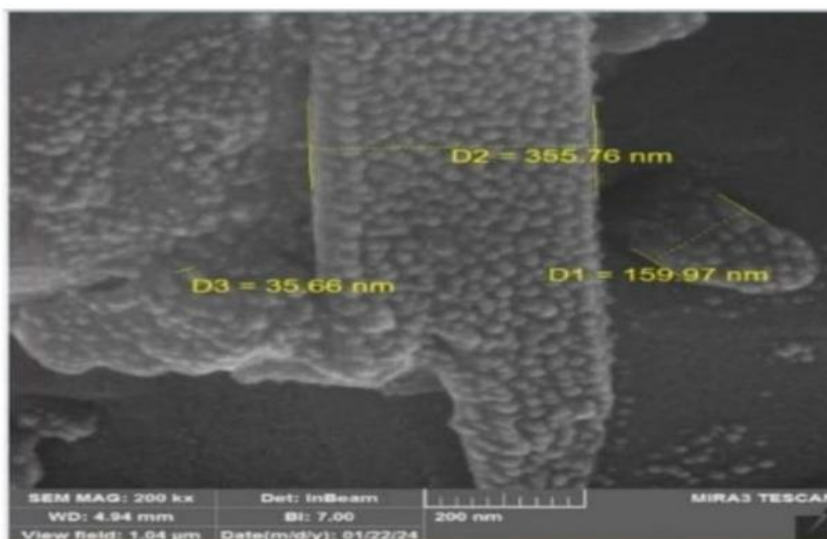
Table (1)show XRD data of ZnO-NPs

Pos.[°2 θ]	FWHM	Hkl	D.nm	D.nm average
38.316	0.246	111	35.72	38.69
44.462	0.246	200	36.45	
64.59	0.344	220	28.52	
77.49	0.196	311	54.09	



Figure(1) XRD pattern of ZnO

The image of FE-SEM showed the surface morphology of zinc oxide nanoparticles, the results in Figures refer to zinc oxide nanoparticles(ZnO-NPs) derived from zinc chloride. Figure (2) shows the SEM image of the synthesized zinc oxide nanoparticles (ZnO-NPs)with spherical in shape and average size about 186 nm



Figure(2): FE-SEM image of ZnO

The spectrum of ZnO-NPs powder were recorded, as shown in the Figure shows various bending and stretching band viz, 3309 cm^{-1} , the broad band at $(3309)\text{ cm}^{-1}$ was related to the presence of O-H group. The band at $(544)\text{ cm}^{-1}$ is related to Zn-O bond, thus confirming the presence of Zn-O [6].

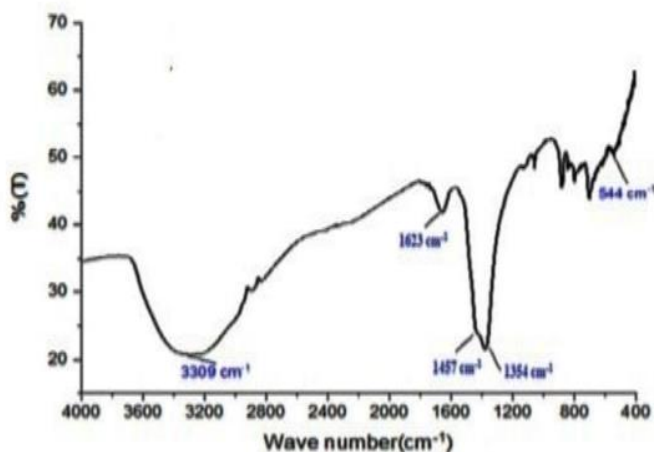


Figure (3): FTIR spectra of ZnO

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