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Effects of Precursor Concentration on the size of green synthesized ZnO Nanoparticles using Phoenix Dactylifera.L Leaves.

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Abstract

Green synthesis of metal nanoparticles is an interesting issue of nanoscience due to its simplicity and eco-friendliness. The present study describes a cheaper, non-toxic and simple route for biosynthesis of zinc oxide nanoparticles using Phoenix Dactylifera.L extracts. Since the experimental conditions of this procedure play vital roles in the size of the nanoparticles, five runs were made to investigate the effect of precursor concentration on the size of green synthesised nanoparticles. The ZnO nanoparticles were characterized by X-Ray Diffractometer (XRD) to identify the crystal structure and the size using debye scherrer equation, Fourier Transform Infra-Red (FT-IR) spectroscopy and UV-Vis Spectrophotometer. The diameter of the ZnO nanoparticles resulted from the concentrations of 0.2g, 0.4g, 0.6g, 0.8g and 1g, were 16, 18.25, 20, 22.25, and 24.69 nm, respectively.

Keywords: Green synthesis, nanoparticles, XRD, ZnO, size, Phoenix Dactylifera.L.

1. Introduction

There are many conventional zinc oxide (ZnO) nanostructure synthesis routes employing the chemical and physical methods, which require particular set-up, high cost, high temperature-pressure conditions, and nonecological chemicals.

The aim of these developments is to allow the use of toxic chemicals and reduce energy consumption by using simple, rapid, and safe routes. Green synthesis strategies for the ZnO nanostructures could be summarized as biosynthesis (natural extract-based, microorganism-based, and biomolecule-based) and nontoxic chemical synthesis (water-based, calcination, solvent-free, and ionic liquid).[1]

In these synthesis methods, size and shape of the compounds change depending on the synthesis parameters, such as the reactant concentration, time and temperature PH solution ,ionic strength ,the anions ,the surfactant ,and the nature of iron salts. [2]

In this work we have attempted to explore the effects of changes in the concentration of precursor used in the synthesis of ZnO nanoparticles at the level of size.

2. Experimental Procedure

The leaves of Phoenix Dactylifera.L are washed with tap water and then with distilled water.

Then we grind them (100g) and then soak them in distilled water (1L). In addition, an agitation of 350 rpm is made for one day. Filtering the liquid with cotton using a TC 501 v pump (SPARK MAX). Preparation of mass concentration samples respectively 0.2g of Zinc acetates / 100 mL of extract, 0.4g of Zinc acetates / 100 mL of extract, 0.6g of Zinc acetates / 100 mL of extract, 0.8 g of Zinc acetates / 100 mL of extract and 1 g of Zinc acetates / 100 mL of extract. Heating to (85 ° C) with stirring (350 rpm) for 1 hour and drying at (100 ° C) for one day.

Distilled water is added to the sample and left in the EZ Swing 3K centrifuge machine (2800 rpm) for 5 minutes three times replacing the liquid with distilled water then it was left to dry it for 1 day.

Then They are left at 500 ° C for 03 hours in Wisd annealing furnace.

3. Results and Discussion

X-ray diffraction analysis

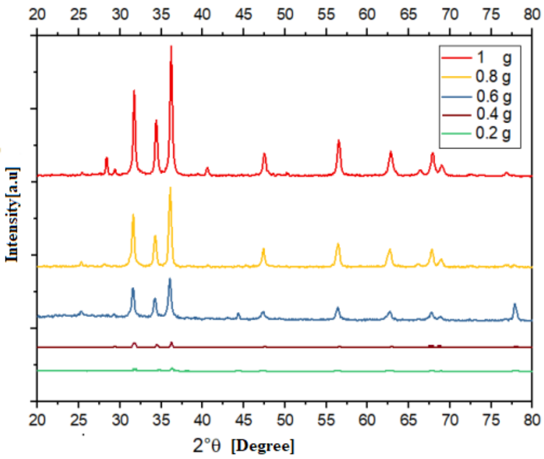

Fig1. XRD patterns of zinc oxide nanoparticles obtained by green synthesis method using different concentrations of precursor.

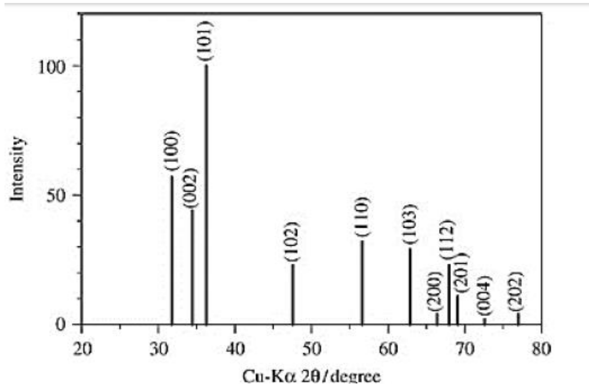

Fig 2. XRD patterns of zinc oxide (JCPDS 36-1451).[3]

The fig1 shows that the peaks are placed approximately at the same horizontal.Coordinates (or 2ɵ) in figure.2 (reference figure[3]). It is clear that the picks intensity increases when the zinc acetate concentration increases which causes an increscent on the particles size.
The particles size was calculated using Debye Scherrer equation, the results of these calculations for the simples 0.2g, 0.4g, 0.6g, 0.8g and 1g, were 16, 18.25, 20, 22.25, and 24.69 nm, respectively.

Simple	Size (nm)
0.2 g	16
0.4 g	15.25
0.6 g	20
0.8g	22.25
1 g	24.69

Table 1. size results of the calculated samples.

Fourier Transform Infra-Red (FT-IR) spectroscopy

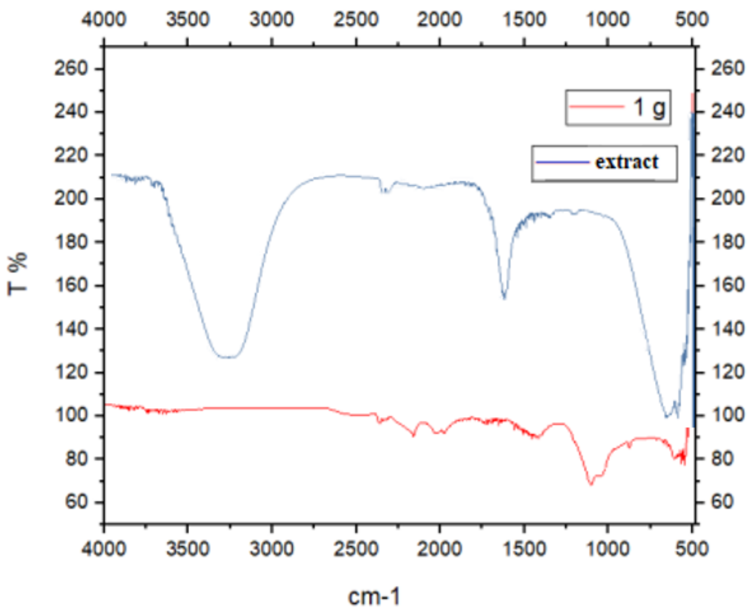

Fig 3. FTIR patterns of zinc oxide nanoparticles at 1g concentration and Phoenix Dactylifera.L Leaves extract.

Fourier transform infrared spectroscopy (FT-IR) provides information on the functional grouping of nanoparticles from the vibration modes of the bonds present in zinc oxide and in the surface organic layer.

The nanoparticles NPs (0.02 g / 100 ml), NPs (0.04 g / 100 ml), NPs (0.06 g / 100 ml), NPs (0.08 g / 100 ml) and NPs (1 g / 100 ml) were characterized by FT-IR, and compared with Phoenix Dactylifera.L extract.
We can globally distinguish three distinct zones whose absorbance bands can be attributed to the alkyne chains (in the mode of vibration stretching at (2260-2100 cm-1), to the groups (C − O) of alcohols (1250-970 cm- 1) and to the bonds (Zn − O) (800-400 cm-1) in zinc oxide. [4]

UV-Vis spectroscopy

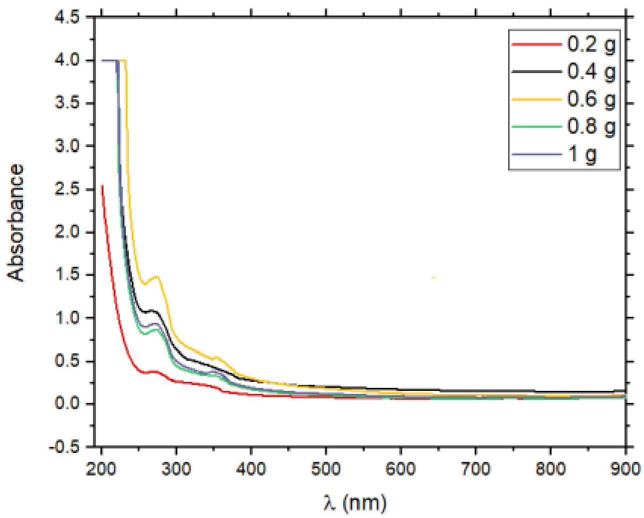

Fig 4. UV-Vis patterns of zinc oxide nanoparticles obtained by green synthesis method using different concentrations of precursor.

The optical properties of nanoparticles synthesized by Dactylifera phoenix extract. L synthesized at 85 ° C are shown in Figure III.14. The figure shows that the diffuse reflectance of nanoparticles in UV-Visible, we notice a wide absorption band in the whole spectral range especially between 330 and 400nm.
However, the NPs of the synthesized ZnOs reveal a continuous absorption in the visible range of 300 to 800 nm without any strong absorption peak. [5]

4. Conclusion

Zinc oxide nanoparticles has been successfully prepared green synthesis method using palm leaves . The prepared zinc oxide Nps has a hexagonal wurtzite structure. Results showed the variation of the mass amount of Zinc precursor allows us to strictly control the size and shape of the zinc oxide, which is suitable for large scale production.

References

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