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Bio Fabrication and Characterization of Zinc Nanorods from *Aloe vera*.

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Abstract: ***A single step environnemental friendly approach is employed to synthesis Zinc nano particles/ rods using Aloe vera. Synthesized ZnNps are analyzed by using PSA, UV-visible, Scanning Electron Microscope (SEM) and Energy Dispersive X-ray spectroscope (EDX). The formation of nanoparticles/ rods was confirmed by color change from bluish to green and the surface Plasmon absorption band was measured by the UV-Visible spectroscopy. SEM analysis of the synthesised Zinc nanorods are clearly distinguishable and are measured <99 nm in size. The EDX spectra show the purity of the material. Synthesis is conventional and found to be efficient in terms of reaction time as well as cost effective.***

Keywords: Aloe vera, PSA, EDX, SEM analysis, Zinc nano particles.

1. Introduction

Nanotechnology is a potentially beneficial field with tremendous implications for society, industry and medicine. The uses of nano-sized particles are even more remarkable [1]. They are mostly prepared from noble metals like Gold, Silver, Platinum, Zinc and Palladium [2]. They find applications in various fields like medicine, electronics, textile, cosmetics, and so forth. The plant mediated synthesis is rapid, low cost, eco- friendly and for safer human therapeutic uses [3]. Many reports are available on biogenesis of Silver nanoparticles using several plant extracts such as *Ocimum americanum*[4], *Desmodium* [5], *Morinda citrifolia* [6], *Ocimum tenuiflorum* green and purple[7] and Zinc nanoparticles from *Acalypha indica* [8], *Calotropis gigantea*[9], *Cassia auriculata*[10], plant latex of *Calotropis procera* [11] etc.

*Aloe vera*is used in traditional medicinal plant belongs to the family Xanthorrhoeaceae and can be grown as an ornamental plant. In Ayurvedic medicine it is called Kathalai. It is a stem less, short succulent plant species growing to 60-100 cm tall, leaves are thick and fleshy, green to grey-green. The margin of the leaf is serrated and has small white teeth. They also exhibit wide range of therapeutic effects like antibacterial, anti fungal and anti oxidant activities. *Aloe vera* gel is also used commercially as an ingredient in yogurts, beverages, and some desserts. Aloe vera might be effective in reducing blood glucose in diabetic patients and in lowering blood lipid levels in hyperlipidaemia. It might be useful as a treatment for genital herpes and psoriasis . *Aloe vera* leaves contains phyto-chemicals like such lectins, anthraquinones and anthraquinone glycosides [12].

Here, we report an inexpensive, eco-friendly, rapid synthesis of Zinc nanoparticle/ rods by reduction process using gel extract of Aloe vera leaves.

Figure 1: Aloe vera plant and gel from leaf

2.2 Preparation of leaf extract

10 grams of Fresh Aloe vera gel directly extracted from the plant along with 100 ml double distilled water were taken in 250 ml glass beaker and boiled for 5 minutes at 90^0C. The extract was cooled to room temperature and filtered with Whatman No 1 filter paper. The filtrate was centrifuged for 10 minute at 10000 rpm; the supernatant was collected and stored at 4^0C.

2.3 Preparation of Super saturated solution of $ZnCl_2$

Accurate concentration of $ZnCl_2$ super saturated solution (Merck India Ltd) was prepared at ambient temperature by dissolving $ZnCl_2$ in 100 ml double distilled water.

2.4 Nano biosynthesis

In the single step green synthesis, 5 ml of leaf extract was added to 25 ml of super saturated aqueous solution$ZnCl_2$ and heated up to 90^0 C for 5 minutes, the color change was observed (Figure.2), which stand as a preliminary identification of the formation of Zinc nanoparticles/rods, The Zinc nanoparticles /rods solutions thus obtained were purified by repeated centrifugation at 10000 rpm for 15 minutes. The supernatant was transferred to a clean dry beaker for further settlement of particles. The sample so obtained was used for further characterization.

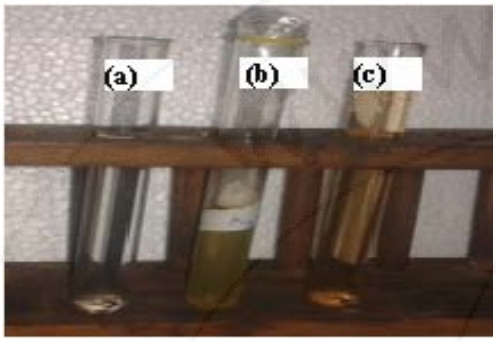

Figure 2: a. Zinc chloride solution, b. Aloe vera gel extract, c. Nano solution colour change from yellow to brown.

3. Characterization

Synthesized Zinc nano particles /rods were initially characterized by taking small aliquot of sample in to UV-Visible spectrophotometer absorption spectra at 300-700 nm using Shimadzu UV-1800 spectrophotometer. Scanning electron microscopic (SEM) analysis was done using Zeiss, EV-18 model. A thin film of the sample was prepared on carbon coated copper grid by placing small amount of the sample on the grid. Then the film on the SEM grid was allowed to dry using mercury lamp for 5min.Energy Dispersive X-ray analysis (EDX) was carried out on Zeiss EV-18 model. The peaks obtained from EDX gives the element composition of the sample. Particle Size Analyser (PSA) was carried out using HORIBA Scientific nano particle analyser SZ-100.

4. Results and Discussion

The present study emphasizes the use of Aloe vera gel for the Synthesis of Zinc nanorods. Studies have indicated that biomolecules like protein, phenols, and anthroquinones only play a role in reducing the ions to the nano size, but also play an important role in the capping of the nanoparticles. / rods.

4.1 UV-Visible spectral analysis

The nanoparticles/rods were preliminarily characterized by UV-Visible Spectroscopy, which is proved to be a very useful technique for the analysis of nanoparticles. As the leaf extracts were mixed with the aqueous solution of the Zinc chloride and it was changed from Yellow to gold colour (Figure.2) due to excitation of the surface plasma vibrations indicate the formation of the Zinc nanoparticle/rods. The UV spectrum absorption is recorded at 308 nm (Figure.3).

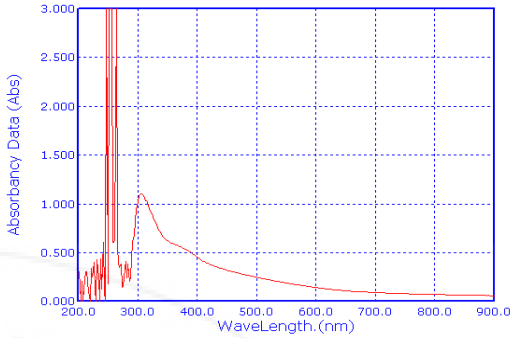

Figure 3: UV spectrum of Zinc nanorods of Aloe vera gel extract.

4.2 SEM analysis

The SEM image shows high density Zinc nanoparticles synthesized from the leaf extract, further confirmed the development of Zinc nano structure. The SEM image shows the formation of rod shaped nano particles. They were clearly distinguishable and the diameter of rod is 66.77 nm and the length 910.3 nm (figure. 4).

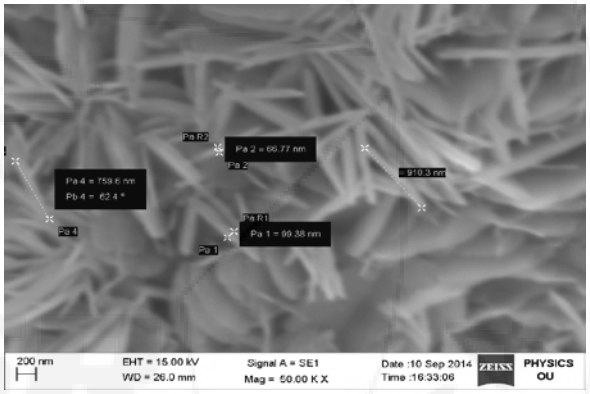

Figure 4: SEM image of Zinc nanorods of Aloe vera gel extract.

4.3 EDX analysis

The EDX spectra show the purity of the material and the complete chemical composition of synthesized Zinc nanoparticles/ rods. In the present synthesis EDX analysis shows 99.8% purity of the Zinc nanorods produced by Aloe vera gel (figure. 5). It revealed high percent of Zinc which indicate the purity of the synthesized sample.

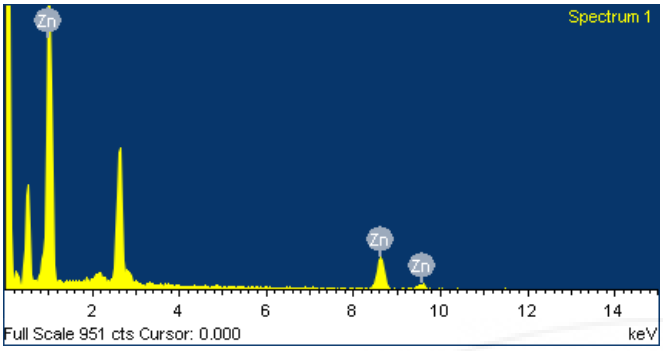

Figure 5: EDX analysis of Zinc nanorods of Aloe vera gel extract.

4.4 PSA analysis

The PSA analysis shows the average of the synthesized Zinc nanoparticles / rods. In the present synthesis PSA analysis shows the average particle size 63.4 nm of the Zinc nanorods (figure 6) produced by Aloe vera gel.

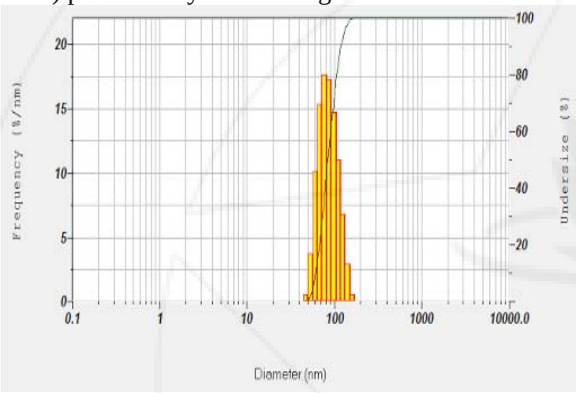

Figure 6: PSA analysis of Zinc nanorods of Aloe vera gel extract.

5. Conclusion

The present study reveals that the plant species is a good source for the synthesis for Zinc nanoparticles /rods at a faster rate. The formation for Zinc nanoparticles / rods was confirmed the colour change within 30 minutes. The bio reduced Zinc nanoparticles / rods were characterized using UV-Vis, SEM, PSA techniques. In the present study, we have investigated the bio-fabrication of Zn nanorods using aqueous gel extract of Aloe vera. Colour change of the reaction solution and UV-Vis spectra confirmed the formation of Zn nanoparticles / rods. SEM studies showed that the size ranging from 66 nm and 99 nm with the spherical shape and their crystalline nature. The method was unique, cost effective to biosynthesized nanoparticles /rods and other nanocomposites from the natural resources. Still more clinical trials need to be conducted to support its therapeutic used.

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Authors Profile

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