Green Synthesis And Evaluation of Zinc Nanoparticles of Peppermint Leaves

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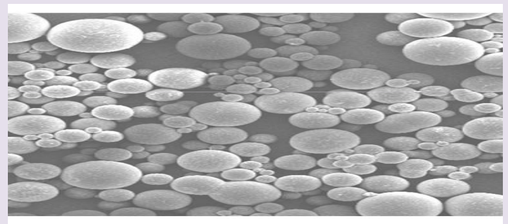

Abstract

In new era of science “Nanotechnology” which is involved in manipulation of atoms and molecules has shown great potential in all fields of sciences. Nanotechnology deals with nanoparticles in range between size 1 to 100 nm in diameter, due to small size and high surface area eventually increases the state of activity. This research focuses on metal and metal oxide nanoparticles and mainly on green synthesis and evaluation of copper nanoparticles by UV, SEM and XRD. Green synthesis of zinc and zinc oxide (Zn and ZnO) is economically beneficial and eco-friendly. XRD of zinc nanoparticles characteristic peaks for pure ZnO were observed in the XRD patterns confirming the formation of ZnO NPs synthesized by using Peppermint leaf extract and zinc oxide. Furthermore, XRD analysis also showed that all the diffraction peaks fit well. SEM of zinc nanoparticles image shows round shapes in which the particles are also found to be inclined together due to the presence of more capping agent that stabilizes the nanoparticles.

Introduction

Recently, biomedical nanomaterials have received more concerns because of their prominent biological characteristics and biomedical applications. With the development of nanomaterials, metal oxide nanoparticles show promising and far-ranging prospect for biomedical field, especially for antibacterial, anticancer drug/gene delivery, cell imaging, bio sensing, and so on.Zinc oxide nanoparticles shows diverse morphologies and it shows impressive antibacterial activity around wide ranges of bacteria. Previous reports revealed by decreasing particle size, the antibacterial activity of zinc oxide nanoparticles increases and also increases with increasing powder concentration. By targeting the specific sites of cancer cells, nanoparticle-based drug delivery could reduce the overall number of drugs used and thus minimize undesirable side effects. Due to its peculiar properties zinc nano particles are used in the pharmaceutical industry, the food industry, in diagnostics, orthopedics, drug delivery, as anticancer agents, and have ultimately enhanced the tumor-killing effects of anticancer drugs. ZnO NPs are attractive due to their low toxicity and biodegradable characteristics. ZnO NPs have acquired tremendous interest in cancer drug delivery. Different types of drugs such as doxorubicin, paclitaxel, curcumin, and baicalin or DNA fragments could be loaded onto the ZnO NPs to show better solubility, higher toxicity compared with individual agents, and effective delivery into cancer cells

Materials and methods

Mint leaves obtained commercially from a local in Vadodara and authenticated by PIAS, Parul University, Vadodara, Gujarat.

Peppermint Consist of Dried Leaves and Flowering Tops of *Mentha Piperita* belongs to family Labiatae.

Preparation of Extract:

Fresh mint leaves were taken and washed thoroughly. ➡ **Then the leaves were soaked for time interval of 24 hours in methanol solution** ➡ **When bright green color observed the extract was collected from the solution containing leaves**

Preparation Of Zinc Nano Particles:

Zinc oxide powder weighing 2 grams was taken and in 1000 ml beaker, 600 ml of deionized water was taken.

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To that 600 ml of water, 2 grams of Zinc oxide powder was added and stirred by hands until the powder was dissolved in the solution.

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60 ml of mint extract which was previously prepared was taken and mixed with the silver nitrate solution.

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Then this solution was stirred for about 45 minutes with the help of magnetic stirrer. After time interval of 45 minutes the presence of nanoparticles were checked by using a laser light.

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Passing of the straight beam of laser light through the solution detected the presence of Zinc nanoparticles

Evaluation of Zinc Nanoparticles:

Yield of nanoparticles
Drug content/surface entrapment/ drug entrapment
Percentage drug entrapment
Particle size
Particle shape
Zeta potential
Differential Scanning Colorimerty (DSC)
Atomic Force Microscopy (AFM)

Discussion

Figure 1 Strong absorption bands of the biosynthesized samples were observed from UV-visible spectra in the range of 450–465 nm which corresponds to the characteristic band of ZnO nanoparticles [17]. Absence of any other absorbance peak in the spectra confirms that the synthesized products are pure ZnO NPs. Furthermore, it is reported that the peak positions of UV-visible spectra are related with size of nanoparticles and blue shifted as the crystal size of the nanoparticles decreased

Figure 2 shows the XRD pattern of ZnO nanoparticles synthesized using zinc oxide and pippermint leaf extract. The formation of biosynthesized ZnO NPs was also confirmed by X-ray diffraction measurements. The diffraction peaks appeared at a 2θ value of ≈11.11°, 12.80°, 28.05°, 30.87°, 32.80°, 33.38°, 37.83°, 44.60°, and 58.21° corresponding to (196.70), (236.87), (194.93), (122.95), (617.62), (440.90), (70.42), (96.21), and (239.82) crystal planes, respectively. The characteristic peaks for pure ZnO were observed in the XRD patterns confirming the formation of ZnO NPs synthesized by using Pippermint leaf extract and zinc oxide. Furthermore, XRD analysis also showed that all the diffraction peaks fit well with the hexagonal wurtzite structure of ZnO NPs as required

The results indicate that the reaction product is composed of high purity zinc nanoparticles, and the composition obtained from EDS analysis of the normalized spectrum was zinc (51.40%), oxygen (28.35%), Aluminium (4.38%), Silica (0.91%) and Clorine(14.96%). Additionally, the presence of highly pure ZnO is also confirmed by X-ray diffraction

Results

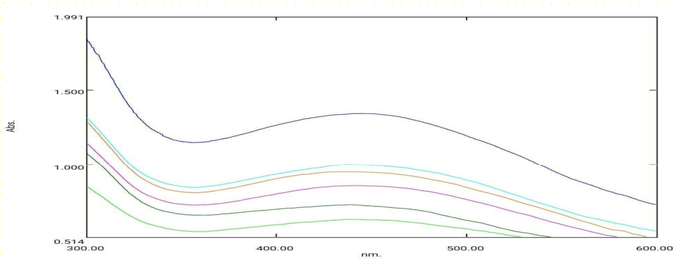
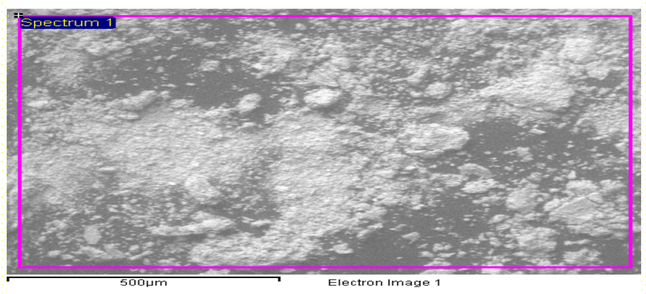


Figure 1 - UV-VIS spectroscopy for Zinc nanoparticles synthesized using *Aqueous*



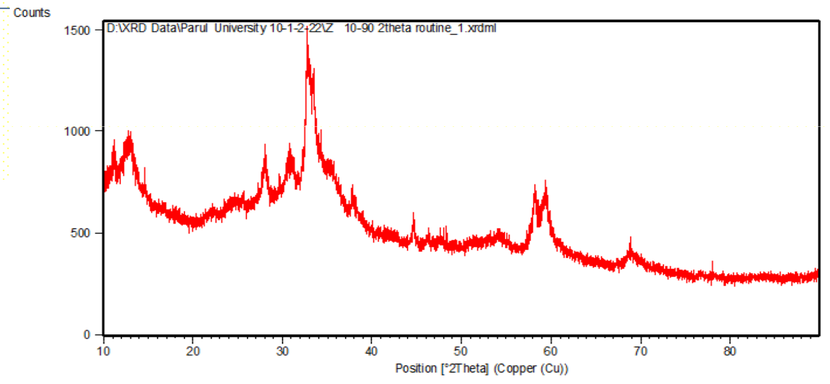


Figure 2 (a) & (b) - XRD pattern of ZnO nanoparticles synthesized using *Aqueous mint leaf extract*

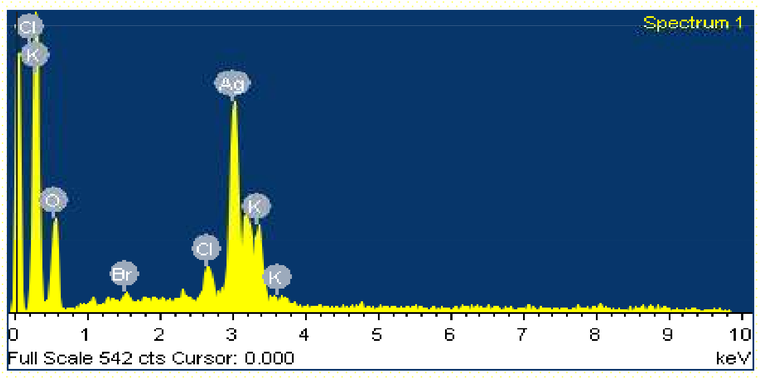


Figure 3 (a) & (b) - SEM micrograph of Zinc nanoparticles synthesized by using the leaf extract of *Aqueous mint leaf extract.*

Conclusion

ZnO NPs were successfully synthesized from leaf extract of pippermint for the first time through a simple, cost-effective, ecofriendly, and green approach. This showed pippermint could potentially be used as an effective reducing and capping agent for biological synthesis of ZnO NPs. The biosynthesized ZnO NPs were characterized using techniques such as XRD, SEM and UV-Vis.The crystallinity of the biosynthesized ZnO NPs was proved from XRD analysis, and the analysis showed that all the diffraction peaks fit well with the hexagonal structure. SEM analysis showed that the morphology of the biosynthesized ZnO NPs was predominantly round-shaped structures were observed. The Absorbance of Zinc Nanoparticles were determined from UV-Vis. Further, the biosynthesised ZnO nanoparticles using Pippermint leaf extract have proved themselves to be an effective anticancer agent.

References

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