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Synthesis and Characterization of Lanthanum Nanoparticles by *Anethum Graveolens* (Dill) Leaf Extract

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ABSTRACT

Anethum Graveolens is a herb used extensively as an additive in chicken feed to help in enhancing the performance, immune reaction and fitness of broiler chickens. The herb consists of various volatile secondary metabolites which are bioactive compounds which helps in their daily food regime. This present work is aimed at synthesizing and characterizing Lanthanum-nanoparticles (LaNps) by using *Anethum Graveolens* (Dill) leaf. LaNps has been synthesized by various methods and characterized by using UV-Vis spectral analysis, Fourier infra-red, X-ray diffraction and SEM analysis.

Keywords: Lanthanum Nanoparticles, Synthesis, *Anethum Graveolens*, Characterization, X-ray diffraction and SEM analysis.

INTRODUCTION

Nanoparticles have specific and unique modified physical and chemical properties as compared to its macro scaled counterparts[1,2]. Emergence of Nanotechnology has attracted researchers in various fields of technology and industries[3]. Nanoparticles bridge the gap between the bulk fabric, atomic and molecular structures. Nanoparticles finds its use in medicine, pharmacy and dentistry and other fields due to their unique physical and chemical properties such as optical, magnetic, mechanical and conductance[4]. Excessive use of antibiotics has led to microbial resistance, due to which, many researchers have focused on improvement of novel and powerful antimicrobial retainers[5,6]. Several studies have confirmed the antibacterial activity of Ag-Nps against a wide range of microorganisms[7,8]. As a result, it may turn out to be a promising compound in development of Novel antimicrobials[9]. *Anethum Graveolens* is a seed spice and an important aromatic herb used in control of diabetes mellitus, usually known as “Dill seed”. It is widely found in Mediterranean region, South West Europe and South West Asia[10]. *Anethum Graveolens* has many healing effects. It is used as a carminative, digestive and as a tranquilizer. It has also been used in ancient times

in treating stomach ailments, colic, hiccups, bad breath, flatulence and hemorrhoids.

Anethum Graveolens has been used extensively in Ayurvedic medicine as a spice and essential oil. It has various volatile components such as Carvone, which is the main component. Along with this, it has α-phellandrene, dill-ether, flavonoids, myristicin, limonene, eugenol, anethole, coumarins, triterpenes, phenolic acids and umbelliferones.

Anethum Graveolens contains distinctive pharmacological effects like anti-cancer, anti-gastric, anti- inflammatory, anti-oxidant, anti-microbial, anti-spasmodic and mucosal protective effects[10,11,12].

MATERIAL AND METHODS

The *Anethum Graveolens* leaves, seeds and stems is washed with sterile distilled water and crushed to fine pieces. This is then filtered through Whatmann filter paper no. 1. The filter paper is discarded and the filterate is used to extract the essential oil by the process of distillation. The extract obtained from distillation is treated with Lanthanutrate to obtain lanthanum nanoparticle, Lanthanum nitrate also acts as a precursor in the synthesis of lanthanum nanoparticle. The nanoparticle thus obtained is then dispersed in deionised water to remove any unwanted organic molecules, which gets dissolved in water. The dispersed nanoparticle is then filtered and the filtrate is rejected. The Lanthanum nanoparticle thus obtained is then incubated at 37^0C. The resultant nanoparticle is then used for characterization.

Characterization of Lanthanum nanoparticles

UV-Vis spectral analysis: The principle of UV-Visible spectroscopy is based on the absorption of ultra violet light or visible light by chemical compounds which results in the production of distinct spectra. When these chemical compounds absorb ultraviolet radiations, it undergoes excitation. This causes it to jump from ground state to an excited state. It is important to know that the difference in the energies of the ground state and the excited state of the electrons is always equal to the amount of ultraviolet radiation or visible radiation absorbed by it, resulting in the production of spectrum. UV-Visible photometer is procured from Systronics. A aliquot of the sample is subjected to the UV-Visible spectrophotometer to obtain a spectrum in the range 200 to 800nm.

SEM analysis of Lanthanum nanoparticles

Scanning electron microscopy (SEM) is a test process that scans a sample with an electron beam to produce a magnified image for analysis. The signals generated during this analysis produces two dimensional image and produces information about the sample. It mainly describes the texture, chemical composition and orientation of the samples under investigation. The SEM used for analysis is Jeol version jsm-6390lv SEM system. The film used for analysis were prepared on a carbon coated copper grid by using a small quantity of the Lanthanum nanoparticle.

FTIR Spectrophotometer

The nanoparticle is dried and powdered and is subjected to FTIR (Schimadzu Japan) spectrophotometer for analysis. The analysis indicated the formation of Lanthanide nanoparticles.

X-ray diffraction analysis

The X-ray diffraction analysis were obtained from Bruker, D-8 Venture , Germany, which operated at a voltage of 40 KV.

RESULTS AND DISCUSSIONS

UV-Vis Spectra Analysis: The density of Lanthanum nanoparticles was confirmed by obtaining the UV-Vis spectrum of the Lanthanide nanoparticle solution with a high absorption at 212.2nm; and the concentration details reveal that the particles were scattered by monochromatic light.The electronic spectrum of Lanthanum

nanoparticles is shown in Fig. 1. The absorption band 212.2nm can be assigned to the conversion of the intra-ligand aromatic $\pi \rightarrow \pi^*$ aromatic ring n - π^* nitrate. There is a change in the field of view due to d^0 electron configuration in Lanthanum (III). UV-Visible spectroscopy is a simple and quick way to confirm the formation of Lanthanide nanoparticles.

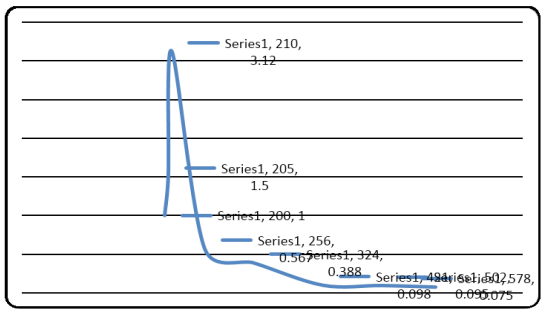


Fig.1. UV-spectra of LaNPs

FTIR Analysis

FTIR is used to identify the biomolecules present in the Dill plant extract, such as peptides, which helps in reducing LaNPs and is also used as a capping reagent for the reduced LaNPs[13,14,15,16]. The typical FTIR spectrum for mixed LaNPs and Dill leaf extraction is shown in (Fig. 2). Strong absorption peaks are identified at 3309 cm^{-1} from the extension of the NH-band (amino groups) or OH-band (hydroxyl group) due to the phenols of Dill plant extract. The absorption peak of 2916.37 cm^{-1} can explain the vibration of CH in alkanes. A strong band observed at 1599 cm^{-1}, is due to -NH_2 groups of amino acids. The peaks at 1443.83 and 1243 cm^{-1} explains CH vibrations due to ketonic group and CO group respectively. A strong band identified at 1035 cm^{-1} is due to PO-stretching. Also LaNPs showed strong absorption peaks at 686, 1531, 1675, 2348, and 3753 cm^{-1}; A band with a strength of 686 cm^{-1} is due to -CH- without vibration bending the plane with ethylene systems replaced by -CH = CH- (cis). A strong band at 2348 cm^{-1} is due to a silver-linked CN-bond from natural sources[17] indicating the presence of NPs in the sample. A height of 1675 cm^{-1} represents a C=O extension of the proteins or peptides formed as a capping agent found in dill leaf extraction. Finally, the presence of a solid peak at 3753 cm^{-1} is due to amines and is an evidence of the presence of peptides in LaNPs.

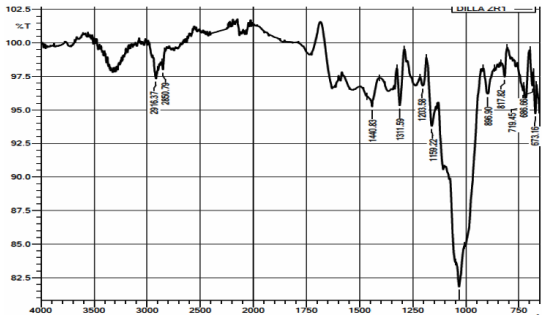


Fig. 2. IR Spectra of LaNPs

SEM analysis

SEM analysis confirmed that the Lanthanum nanoparticles produced in this study were nano size. They are round in shape and have a polidispersing distance of about 10.4nm (Fig. 3-6). Nanoparticles did not mix after ten days. This suggests that Dill leaf extract can act as a reducing and stabilizing agent.

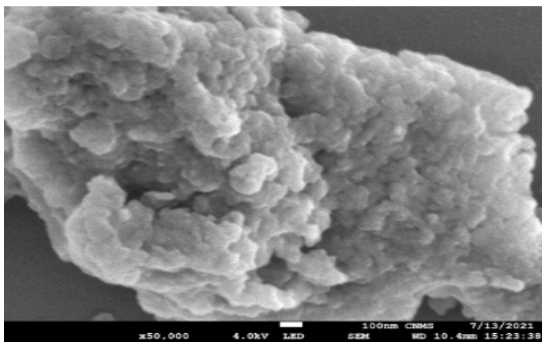
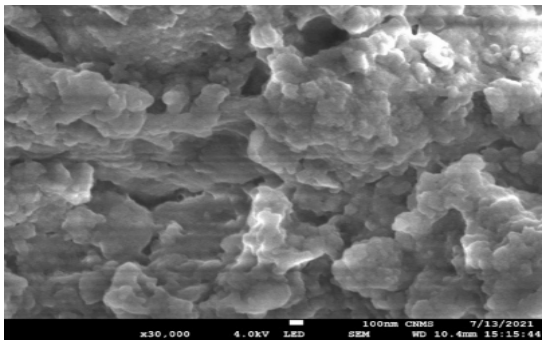


Fig. 3.



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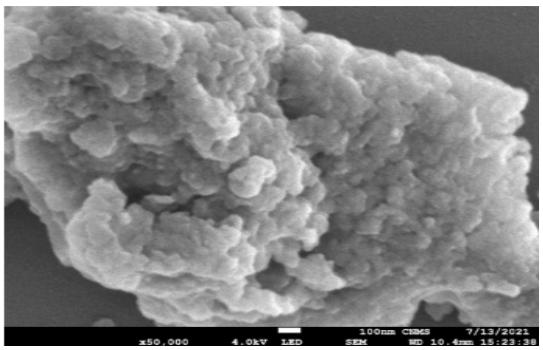

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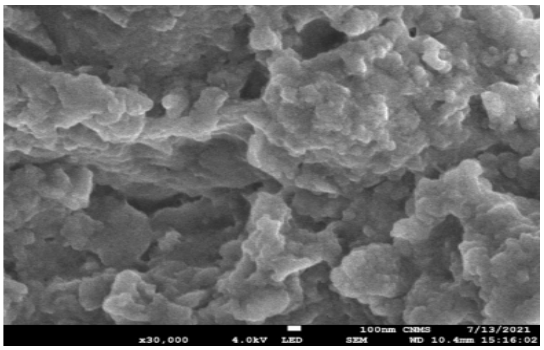

Fig. 6.

XRD analysis of LaNPs

The crystalline nature of the Lanthanum nanoparticles was clearly analyzed using XRD patterns. Separated peaks of Lanthanum nanoparticles appear at 28.29, 41.85, 48.1 and 72.0 (Fig. 7). Non-allocated sets of 111, 200, 220, 311 aircraft were also stored compared to JCPDS data.

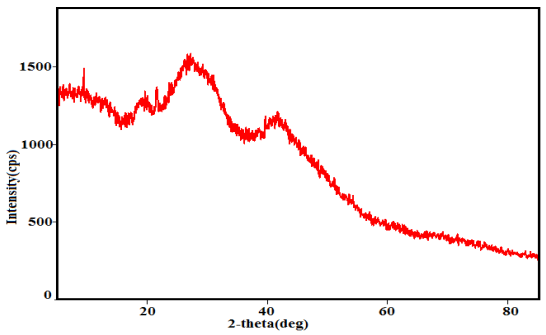

Fig. 7. XRD of LaNPs

CONCLUSION

In the field of nano-biotechnology, phytosynthesis of nanoparticles has been used to produce nutritious, inexpensive materials, containing stable nanoparticles which is of great importance to its widespread application in the field of electronics, medicine and agriculture. In the current context, nanotechnology helps in promoting progress in all aspects of life, which is why, the phytosynthetic method of nanoparticles synthesis will emerge as one of the safest and most advanced among the conventional methods.

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Conflict of interest

The author declare that we have no conflict of interest.

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