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**Research Article**

# PEG FUNCTIONALIZED MAGNESIUM OXIDE NANOPARTICLES USING ALOEVERA EXTRACT

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**ABSTRACT**

Rapidly expanding research in nanotechnology has led to exciting progress in versatile tool of medical and biological applications. The preparation and biological applicability of nobel metal nanoparticles with mono-disperse size distribution and arbitrarily variable size and geometry has attracted considerable interest. In the present work, Magnesium oxide nanoparticles are synthesized by green synthesis method by using magnesium sulphate as a precursor and eco friendly and non toxic aloevera leaf extract as a reducing and stabilizing agent. It was found that magnesium oxide nanoparticles acts as a very good adsorbant and helps in removal of toxic metal ions due to this property its used in water purification. Metal oxide vibrational frequencies and crystalline size of these synthesized nanoparticles were studied using UV-VIS, FTIR, SEM and XRD analysis.



## INTRODUCTION

Nowadays, researchers have developed exciting new materials in nanosize to progress the unique and tunable properties of the applied materials (Sahoo *et al*.2007). Due their small size, nanoparticles exhibit novel material properties, which are significantly different from those of their bulk counterparts (Bindhu *et al*. 2016). Green synthesis provides more advantages over physical methods and chemical methods because very cost effective, easy processed scalable for large scale production. This method not required high temperatures, high pressure, costly equipment and hazards chemicals. In addition the synthesis of NPs using biological means especially plants is biocompatible, as they secrete functional biomolecules which actively reduce metal ions. Magnesium oxide is an inorganic element having thermal stability high surface reactivity, very good heat resistance (N John sushma *et al*. 2015) MgO nanoparticles has been used in wide range of applications such as catalysis, adsorbents, toxic waste remediation. It is used in medical field for the relief of heartburn, sore stomach, bone regeneration and tumor treatment. (Ziad *et al*. 2016).

### *Exper Imental Procedure*

### *Preparation of Aloe Vera Leaf Extract*

To prepare the leaf extract of Aloe vera plant, leaves (50 g) were thoroughly washed, dried and finely chopped. The finely chopped material was allowed to boil for 30 min at 80 °C with 200 mL of de-ionized water in a 250-mL flask and then cooled down to room temperature. The resulting solution is passed through a f ilter paper to remove any solid particles and then again filtered through a Whatman filter paper. The filtrate is stored at 4 °C as a stock for the synthesis of MgO nanoparticles.

### *Synthesis of MgO nanoparticles*

To synthesis the MgO nanoparticles, dissolve Magnesium Sulphate in 200 ml of water. 100 ml of Aloe vera leaves extract and NaOH solution was added drop wise under constant stirring. The mixture was subjected to stirring for half hour continuously. In this process nanoparticles were formed.

### *Functionalization of MgO nanoparticles*

In order to produce PEG capped MgO NPs, 0.3ml of PEG were added to the 'as synthesized' MgO NPs solutions at room temperature. After the required amount of PEG was added, the solution was stirred at room temperature for 2 hrs to allow for

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complete exchange of the Aloe vera molecules with PEG. After washing PEG-capped Mgo NPs were dried at 100°C and calcinated at 500°C for 4 hours.

## RESULT AND DISCUSSION

### *UV-Vis analysis of MgO nanoparticles*

UV-visible absorption spectroscopy is widely being used techniques to examine the optical properties of nanosized particles. UV-Vis absorption spectrum of magnesium oxide nanoparticles synthesized by green method is shown in figure. Size reduction was observed which may be due to the abundant availability of biomolecules in the plant extract. UV-Vis absorption spectra reveal that the synthesized MgO nanoparticle shows an absorption peaks at 281 nm which indicates the formation of MgO nanoparticles no other peaks were observed in the spectrum indicating the high purity of the synthesized magnesium oxide nanoparticles. Incident light creates oscillations in conduction electrons on the surface of the nanoparticles and electromagnetic radiation is absorbed. The maximum wavelength of the absorption peak indicates the particle size.

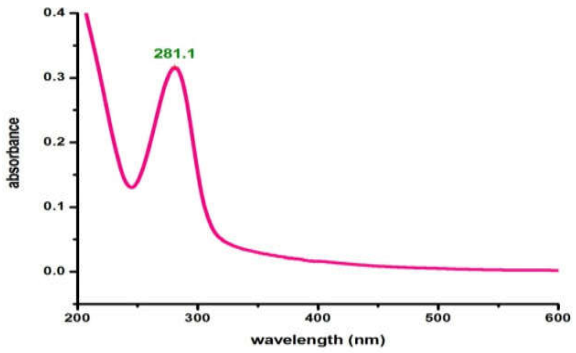


**Fig 1** UV-Vis spectrum of MgO nps

The band gap of MgO nanoparticles was calculated by using the plancks's formula

$$E = hc/\lambda$$

Where,

h is planck's constant($6.62\times10^{-34}$ $m^2kgs^{-1}$)
c-velocity of light($3\times10^{8}$ $ms^{-1}$) and
λ-wavelength of light.

The band gap of magnesium oxide nanoparticles from aoevera extract was found to be 2.83 eV reported earlier[6].

### *UV-Vis Spectral Analysis of PEG Functionalized MgONPs*

Figure shows the optical absorption spectrum for PEG functionalized MgO nanoparticles. The SPR Peak for the PEG capped MgO nanoparticles are 309 nm which the peak is slightly shifted compared to before capping ($\lambda_{max}$ = 281 nm). It may indicate that the PEG containing surfactant is capped on the MgO nanoparticles surface.

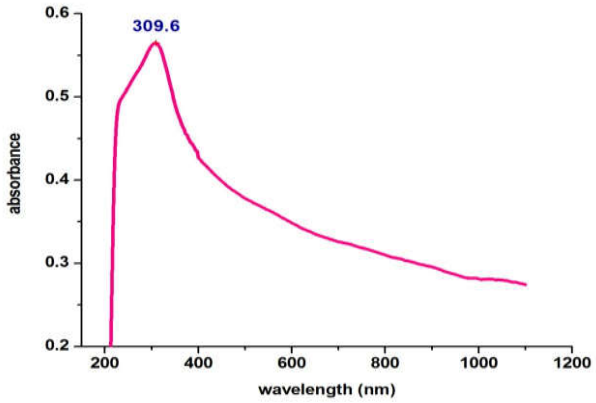


**Fig 2** UV-Vis spectrum of PEG capped MgO nps

### *FTIR Analysis of MgO nanoparticles*

The FTIR spectroscopy is performed in order to quickly establish the presence and absence of the various vibration modes present in synthesized particles. The figure shows the FTIR spectrum of the MgO nanoparticles acquired in the range 500-4000 $cm^{-1}$. Various modes of vibration are observed different regions of FTIR spectrum.

The peaks at 427 and 619 $cm^{-1}$ observed in the spectrum indicate the presence of metal oxide linkage (MgO). The broad and intense band at 3415 $cm^{-1}$ indicates the presence of stretching vibrations of (O-H stretch) groups of water. 1632 $cm^{-1}$ peak explore the amines( bend), the peak exit at 1441 $cm^{-1}$ (O-H bending), The band near 1130 $cm^{-1}$ ketons (C-C stretch.

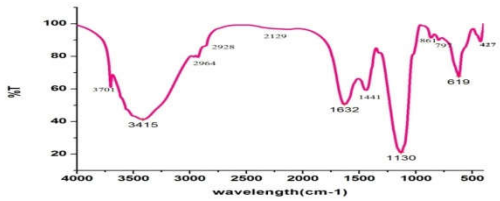


**Fig 3** FTIR spectrum of MgO nps

### *Morphology analysis of MgO nanoparticles*

A typical SEM image of green synthesized MgO nanoparticles formed is displayed in figure observed at different magnifications. High resolution SEM images show the presence of nanoparticles. MgO nanoparticles show mixed morphology of both rod and flake like structures.

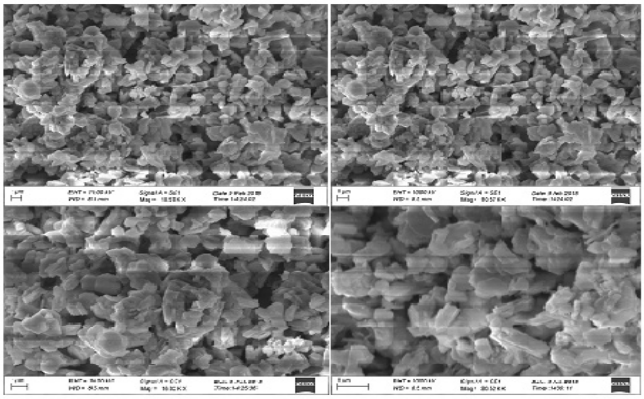

**Fig 4** SEM image of synthesized MgO nanoparticles

### *XRD Analysis*

Figure shows the powder X-Ray diffraction of MgO nanoparticles synthesized by the Aloevera extract after the complete reduction of $Mg^{2+}$ to $Mg^{0}$. The XRD spectra of as synthesized nanoparticles was carried out using XRD for 2θ values ranging from 10 to 80° using CUKα radiation at λ = 1.5406 A°. It is observed that diffraction peaks occurred at 28.719°, 39.346°, 57°, 44.336° then these magnesium lines were indexed at (111), (002), (602), (402) respectively. The (JCPDS No 721427) which matches with the obtained data.

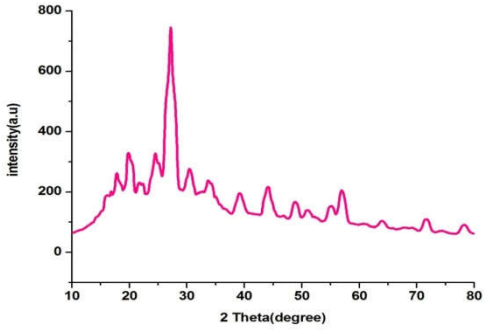


**Fig 5** XRD Spectrum of synthesized MgO nanoparticles

## CONCLUSION

Mgo nanoparticles were successfully synthesised by using Aloevera extract as reducing agent and PEG as capping agent. The synthesized nanoparticles were functionalized by PEG during the functionalization process electrostatically weak metal nanoparticles could be covalently bonded with the capping agent molecule. The synthesised nano particles were characterized by using UV-vis spectroscopy, scanning Electron Microscopy, Fourier Transform Spectroscopy and X-ray diffraction analysis this characterization results confirmed the prepared nanoparticles were in the nanoscale range. In UV spectral studies, the presence of single and narrow peak due to SPR indicates that the $\lambda max$ gives the approximate idea about size of the nanoparticles. The band gap of magnesium oxide was found to be 2.83ev. The SEM analysis shows that the nanoparticles cluster and rod shape. FTIR Studies reveals the various functional groups present in the sample and the peaks at 427 and 619 $cm^{-1}$ observed in the spectrum indicate the presence of metal oxide linkage (MgO). In this study, synthesis of MgO Nps in neutral aqueous solution at gentle temperature offers a green and non toxic procedure which is attractive for biological and medically related application.

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