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Green Synthesis and Characterisation of Magnesium Oxide (Mgo) Nanoparticles

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ABSTRACT

In materials Science, "Green 'Synthesis has gained extensive attention as a reliable, Sustainable and Eco- friendly protocol for Synthesizing a wide range of materials/ nanomaterials including Metal/metal oxides, Nanomaterials, Hybrid materials and bioinspired materials. As such green Synthesis is regarded as an important tool to reduce the destructive effects associated with the traditional methods of synthesis for nanoparticles commonly utilized in laboratory and industry.

Nanoscale metals are widely used in many fields such as environment, medicine, and engineering that synthesis of nanoscale metals is a timely topic. At present, nanoscale metals are mainly synthesized by chemical methods that have unintended effects such as environmental pollution, large energy consumption, and potential health problems. Green Synthesis of nanoparticles has many potential applications in environmental and biomedical fields, Green Synthesis aims in particular at decreasing the usage of toxic chemicals. The use of biological materials such as Plants is usually safe. Plants also Contain reducing and Capping agents.

At present Work, the Magnesium oxide was synthesized by Green synthesis method from Magnesium Nitrate $Mg(NO_3)_2$ using Neem (Azadirachtaindica) Leaf extract.

Keywords: Nanoparticles, Green Synthesis, Eco-friendly

I. INTRODUCTION

Nanotechnology is the branch of science which deals with the examination of materials in Nano range, generally between 1 to 100 nm. It is a science that works at the nanoscale and gives various focal points to the diverse fields of science Green synthesis techniques make use of moderately pollutant free chemicals to synthesis Nanoparticlesembrace the use of benign solvents (such as water) as a natural extract. Green chemistry helps to reduce pollution. It is a very clean Synthesis method and it does not produce any type of waste products which is harmful for the nature. Though physical and chemical methods are trendier for nanoparticles synthesis, we may use the biogenic fabrication because it is eco-friendly. We used Nanoparticles for the Synthesis due to their smaller size and volume ratio of nanoparticles using its surface area exhibits remarkable and novel properties. and methodical applications in the field of biotechnology, sensors, medical, catalysis, optical devices, DNA labelling, drug delivery and they are rewardingly treated as a bridge between bulk material and atomic and molecular structures.

MgOnanoparticles have found fabulous applications in bimolecular detection, diagnostics, and microelectronics. Green synthesis of MgO nanoparticles were agreed out using Neem leaf extract for the eco friendly development of novel technologies, Recently, nanoparticles (NPs) have attracted a lot of attention because of their use in a variety of areas such as electronic, cosmetic, biomedical, energy, Environmental, catalytic and material applications. The large increase in the of use of NPs has stimulated researchers to know the applications of Nps in plant growth. Limited studies have been reported on both the positive and negative effects of NPs on plants.

Researches have reported both positive and negative evidences for the mechanism. Moreover, the toxicity of NPs depends on their properties, test organism species and surrounding conditions. Bulk MagnesiumInthis article, it is shown that Magnesium Oxide (MgO) is insoluble in soil; however, plant roots have the ability to solubilise MgO in the vicinity. In the increased surface-to-volume ratio of nano-MgO, which was prepared by Green Method in our laboratory and characterised, was found very suitable for seed germination. This could be observed visually in Solanumlycopersicum and Cicer arietinum seed germination.

II. METHODS USED FOR SYNTHESIS:

1. GreenSynthesis

Green synthesis of nanomaterials refers to the synthesis of different metal nanoparticles using bioactive agents such as plant materials, microorganisms, and various bio wastes including vegetable waste, fruit peel waste, eggshell, agricultural waste, and so on. The growing need to develop "green" and economical synthesis systems for metal nanoparticles has prompted researchers to explore the use of microorganisms, plant extracts, and other biomaterials. The involvement of natural bioactive agents in the synthesis of metal nanoparticles greatly reduces the risk of environment pollution. Green synthesis of nanoparticles and their applications give an insight into the synthesis of nanoparticles utilizing natural rou

- **Material Used:**

Although most cameras use electronic flashes, magnesium metal is often contained in cameras that use flash bulbs. A thin strip of magnesium metal inside the bulb. When the Magnesium alloys are used in power tools, such as the reciprocating saw here. Flash is ignited, the magnesium strip catches fire. It burns with a very bright white light. The light form the bulb illuminates a scene for the photograph.

A common use of magnesium metal is in firework displays include some brilliant flashes of very white light. Those flashes are produced by the burning of magnesium metal

Magnesium in commonly alloyed with other metals magnesium and aluminium, for instance, are two metals that combine to form alloys that are very strong and resistant to corrosion (rust).. But they less than steel alloys with similar properties.

Strength and low density are important in the manufacture of airplanes, automobiles, metal luggage, ladders, shovels and other gardening equipment. Racing bikes, skis, nice cars, camera, and power tools A typical magnesium alloy contains about 90 percent magnesium. 2 to 9 percent aluminium, and small amount of zinc and manganese.

The Material Magnesium oxide

Magnesium oxide (MgO) magnesia, is a white hygroscopic said mineral that occurs naturally as periclase and is a source of magnesium.

I has an empirical formula of MgO and consists of a lattice of Mg2+ ando-ions held together by ionic bonding. Magnesium hydroxide forms in the presence of water (MgO+H2O-----Mg(OH)2), but it can be reversed by heating it to separate moisture: Magnesium oxide was historically known as magnesia alba (literally, the white mineral from magnesia-other sources give magnesia alba as (MgCO3), to differentiate it from magnesia negra, a black mineral containing what is now known as manganese. While "Magnesium oxide" normally refers to MgO. Magnesium peroxide MgO2 is also known as compound. According to evolutionary crystal structure prediction, MgO is used thermodynamically stable at pressure above 500 GPa. Because of its stability, MgO is used as a model system for investigating vibrational properties of crystals.

An inorganic compound that occurs in nature as the mineral periclase. In aqueous media combines quickly with water to form magnesium hydroxide. It is used as an antacid and mild laxative and has many non medicinal uses. Magnesium oxide is the oxide salt of magnesium combines with water to form magnesium hydroxide which reacts chemically to neutralize or buffer existing quantities of stomach acid; stomach- content and intra-esophageal pH rise, resulting in ad in part of osmotically mediated water retention, which subsequently stimulates peristalsis. In addition, magnesium ions may behave as calcium antagonists in vascular smooth muscle. Magnesium oxide is a white solid, often found as a powder. When fine particles of magnesium oxide are dispersed in air, whether directly or when generated by the burning or cutting of magnesium metal, the resulting magnesium oxide fume is an inhalation hazard.

Properties of Magnesium Oxide:

Magnesium oxide nanoparticles can be applied in electronics, catalysis, ceramics, petrochemical products, coatings and many other fields. Magnesium oxide nanoparticles can be used along with wood chips and shaving to make materials such as sound-proof, light-weight, heat-insulating and refractory her board and metallic ceramics.

The potential applications of magnesium oxide nanoparticles are as follows:

1) High temperature dehydrating agent used for the production of silicon steel sheer, high- grade ceramic material, electronic industry material, adhesive and additive in the chemical raw material.
2) Electric insulating material for making crucible, smelter, insulated conduit, electrode bar, and electrode sheet.
3) High-frequency magnetic-rod antenna, magnetic device filler, Insulating material filler and various carriers used in radio industry.
4) As a fire retardant used for chemical fiber and plastics trades.
5) In refractory fibre and refractory material, magnesite-chrome brick, filler for refractory coating, refractory and insulating instrument. electricity, cable optical material, material for steel-smelling furnace and other high-temperature furnaces, hearing material and ceramic base plat.
6) Fuel additive, cleaner, antistatic agent and corrosion inhibitor.

Applications of Magnesium Oxide:

MgO is prized as a refractory material, i.e. a solid that is physically and chemically stable at high temperature. It has two useful attributes; high thermal conductivity and low electrical conductivity. "By far the largest consumer of magnesia worldwide is there fractory industry, which consumed about 56% of the magnesia in the

United States in 2004, the remaining 44% being used in agricultural, chemical construction, environmental, and other industrial applications MgO is used as a basic refractory material for crucibles it is a principal fireproofing ingredient in construction materials. As a construction material, magnesium oxide wallboards have several attractive characteristics; fire resistance, termite resistance Moisture resistance, mold and mildew resistance, and strength.

Uses of Magnesium Oxide:

MgO is one of the components in Portland cement is dry process plants Magnesium oxide used extensively in the soil and groundwater remediation, wastewater treatment, drinking water treatment air emissions treatment and wastetreatment Industries for its acid buffering capacity and related effectiveness Stabilizing dissolvedheavy mental species.

Many heavy metals species, such as lead and cadmium are most soluble in water acidic pH (below 6) as well as highpH (above 11). Solubility of metals of metals affects bioavailability of metals affects bioavailability of indigestion

III.EXPERIMENTAL METHODS

- **Material and Methodology**

Present investigations is focused on the synthesis of the magnesium oxide the green synthesis method is used to synthesis the MgO of the magnesium oxide the green synthesis method is used to synthesis the MgONOPs using the precursor materials such as a magnesium nitrate and neem (Azadirachtaindca) leaf extract has been used as reducing agent to synthesis the corresponding Nps.

- **Preparation of neem leaf extract**

To prepare the neem leaves extract 15 gm of Neemleaves is washed properly in two to three times and chopped it and dried for 20-30 minutes at room temperature The extract solution was prepared by boiling and then drying leaves in 500 ml beaker consist 350 ml double distilled water for one hour at 100c. Freshly prepared neem lead extract was used for the synthesis of MgONps. After cooling down the extract was filtered by what man No. filter paper. Freshly prepared extracts alone have used throughout the study.

- **Synthesis of Mgo Nanoparticles**

In the experiment 20 ml fresh neem extract and 80 ml double distilled water was added to 500ml beaker and heated at 60 0c andafter some time 20 gm of Magnesium nitrate was added and heated at 800with continuous stirring for 260 min by using magnetic stirrer with hot plate. The magnesium nitrate ionswere reduced to magnesia or Magnesium oxide nanoparticles by using Neem leaves extract. The formation ofmagnesium oxide nanoparticles(MgONPs) have been observed by change of the solution form yellow to yellowish- brown colour

Characterisation

The sample was characterized by two methods,

I. Instrumentation Andworking Of Uv Spectroscopy

Instrumentatioin and working of UV spectroscopy can be studied simultaneously. Most of the modern UV spectrometers consist of the following parts Light Source, Monochromators, Sample and reference., Detector, Amplifier, Recording &Devices.

- Applications

In different fields such as astronomy molecular biology chemistry and biochemistry, spectrophotometers are commonly used. Specification applications include measuring the concentration of substances such as protein DNA or RNA bacterial or RNA bacterial cell formation and enzymatic reactions

II. XRD Method

X-ray diffractograms of nano-materials give an abundance of data from phase creation to crystallite estimate, from cross section strain to crystallographic introduction, XRD is non-contact and non-destructive, which makes it ideal for in situ studies [Citation27].

Other techniques for characterization of NPs are EDS and DLS, the energy dispersive spectroscopy (EDS) is used to separate the characteristic X-rays of different elements into an energy spectrum, is used for detection of elemental composition of metal NPs. Dynamic light scattering analysis of incident photons is used to determine the surface charge and the hydrodynamic radius of the NPs

Crystals are regular arrays of atoms whilst X-ray can be considered as waves of electromagnetic radiation Crystal atoms scatter incident X-rays, primarily through interaction with the atoms electrons This phenomenon is known as elastic scattering the electron is known as the scatter. A regular array of scatters produces a regular array of spherical waves. In the majority of directions, these waves cancel each other out through destructive interference, however, they add constructively in a few specific directions, as determined by bragg's law:

Where d is spacing between diffracting planes Θ is the incident angle is an integer and λ is the beam wavelength. The specific directions appear as spots on the diffraction pattern called reflections. Consequently, X-ray diffraction patterns result from electromagnetic waves impinging on a regular array of chatterers.

X-ray are used to produce the diffraction pattern because their wavelength, λ, is often the same order of magnitude as the spacing, d, between the crystal planes (1-100 angstroms).

Applications

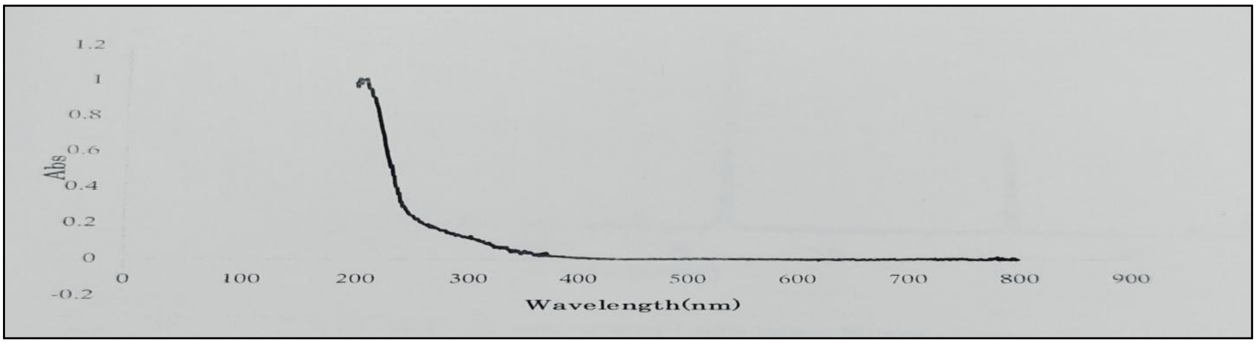
- Thin –film analysis
- Lattice parameter determination
- Purity/ quality control of materials
- Determination of Crystallinity of polycrystalline materials
- Particle size determination

IV. RESULT AND DISCUSSION

To confirm of formation of nano-particles, the sample was characterized by UV-VIS Spectroscopy, and by using XRD the crystalline structure and size of the sample were identified.

UV-VIS spectra of MgO nanoparticles:

UV spectral analysis of sample was done in wavelength range of 100-800 nm. The peak was obtained at 201 nm. The UV spectrum of Magnesium oxide nanoparticles are shown in figure.



X-Ray Diffraction Studies (XRD)

X-ray diffraction or XRD is used for phase analysis, crystalline variants, and to study the grain and particle size of nanomaterials. X-ray diffraction spectroscopy as a rapid analysis technique is used to identify the type of material as well as its phase and crystalline properties.

A white coloured Mgo nanoparticles were obtain as powder and the result of the XRD showed the structure was found to be cubic in nature. Debye Scherer's formula is used to find the particle size of synthesises Mgo nanoparticles $D= k \lambda/(ß * \cos \Theta)$ (where D is the crystal size, k= 0.94) and the size was found.

V. CONCLUSION

Magnesium oxide was synthesized by Green synthesis method from Magnesium Nitrate Mg(NO3)2 using Neem (Azadirachtaindica) Leaf extract. The influence of various parameters. Stirring temperature, concentration of Neem Leaf extract and calcinations temperature were also checked and condition were optimized for the synthesis of Magnesium oxide nanoparticles. The synthesis of magnesium oxide nanoparticles isinvestigating by using the characterization techniques such as XRD and UV to confirm the presence of Magnesium oxide nanoparticles. The green synthesised that the germination process was influenced by magnesium oxide nanoparticle

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