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Synthesis of Magnesium Oxide Nanoparticles by Using Green Method

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Abstract: *Nowadays, nanotechnology is commodious, emerged, and evolutionary field. To disseminate the knowledge of physical-chemical and biological phenomena and processes in nanoparticle structure that have a range between 1 - 100 nm size and exhibit improved, novel properties. Due to their smaller size and high surface area, it shows a great destructive and remarkable property. The MgONPs has the potential to revolutionize a diverse range of applicable fields like health care and manufacturing. Magnesium oxide nanoparticles are synthesized by different methods like physical-chemical and green but due to their non-toxic, non-hazardous, and eco-friendly property scientists are fascinated by the green method. The preparation of nanoparticles is characterized by various instruments like XRD to measure average crystallite size, FESEM for morphological study, UV-Vis for analyzing absorption pattern, FTIR for analyzing functional group, TEM for morphological crystallographic information. In this study as compared to the physical and chemical methods, the green method is best for the synthesis of magnesium oxide nanoparticles.*

Keywords – MgO nanoparticles, Green synthesis

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I. INTRODUCTION

Today nanotechnology is very growing fast. In the field of nanotechnology, there are various unique researches completed. Recently nanoparticle synthesis is among the most interesting in the scientific field than others. The researchers are attracted to the field of nanotechnology. They are studying and focusing on the various application of nanoparticles. There are various characteristics of nanoparticles and these characteristics are widely spread all over life. In the field of nanotechnology, the research has newly invented the exciting method and material to synthesis the nanoparticles (Renata Dobrucka et al., 2016). Nanotechnology is a promising field to the scientist or researcher to keeping improvement in various fields (Silva. G.A.et al., 2004). The nanoparticles' structural range is between 1 - 1000 nm and they are interacting with subgroup 1 - 100 nm this is known as a nanoparticle. The nanoparticles are classified into various types due to their size, shape, properties. The nanoparticles are found in different structures like flat, conical, hollow, spiral (Ravindra Pratap Singh et al., 2020). The researchers are attracted to the field of nanotechnology, in the past decade's lot of attention attracted to metal and metal oxide due to their withstand and harsh process means it is stable in any condition. Due to the unique size and the property the prepared nanoparticles have a variety of applications in all fields like medical, automobile and all engineering fields, agriculture, drug delivery, catalysis, and environmental remediation. Synthesis of the MgO nanoparticles gives us a new route in the area of nanotechnology & gives unique characteristics compared to others (Govindasamy Sharmila et al., 2019). The nanoparticle properties are an advantage in various fields.

The magnesium oxide nanoparticles are attracted to the scientist as compared to other metal oxide nanoparticle because of they possesses high hardness, high purity, high melting point, non-toxic nature, high strength, good functionality, recycling activity (Ravindra Pratap Singh et al., 2020). The MgONPs is very important, it has various properties, they are prepared widely in variable particle size and shape, they are in the crystal structure, simple stoichiometry, high ionic character. It has a high specific surface and reactivity as compared to other nanoparticles like TiO2, silver, copper. (Mary Vergheese et al., 2018). MgO nanoparticles appear in white powder form after their synthesis. The magnesium oxide nanoparticles due to their high surface reactivity, high chemical, and thermal stability they are used in sensors, catalysis, Paints, etc (Rizwan Wahab et al., 2007). The synthesis of magnesium oxide nanoparticles is cost-effective, eco-friendly, biodegradable and it has wide application in bone regeneration. It has antimicrobial and antibacterial activity (Ravindra Pratap Singh et al., 2020). They have a wide range of applications in Agriculture seed treatment, seed germination. The magnesium oxide nanoparticles are an essential mineral element for plants and non-toxic to organisms. The researchers are also focusing on the use of magnesium oxide nanoparticles in the treatment of cancer (V.

Mohanasrinivasan et al., 2017). The magnesium oxide nanoparticles used in wood chips and shaving them make soundproof, lightweight, refractory fiberboards (S.Lidivn Daisy et al., 2015). The magnesium oxide nanoparticles have bactericidal activity against *Staphylococcus aureus, E.coli*, and aggressive plant pathogens such as *Ralstonia solanacearum* (Govindasamy Sharmila et al., 2019).

For the synthesis of magnesium oxide nanoparticles, there are various methods present. They are physical, chemical, and green methods. The physical and chemical methods are highly cost & toxic chemicals are required, expensive equipments are required. And the green method is pollutant-free, non-toxic, cost-effective, biodegradable. The green method is environmentally friendly. In the synthesis of MgO, plant extract, leaves, fruits, etc. are used and the method is easy to make and nonhazardous to animals and humans.

Properties –

- The magnesium oxide nanoparticles (MgONPs) have dimensions ranging between 1-100nm. In recent times MgONPs are attracted by researchers due to their excellent properties compare to bulk metals.
- Due to Good dispensability, colloidal stability, biological media, internalization efficiency, and low toxicity they have large biomedical applications.
- MgO nanoparticles are ultra-fine nanoscale particles, they have a high surface area and show the great destructive adsorbant property for a toxic chemical agent.
- The MgONPs are very insoluble in soil.
- The synthesized MgONPs have good catalytic activity in the reduction of methyl orange(MO) and they also exhibit very good antioxidant properties. MgONPs are highly ionic nanoparticles with extremely high surface area. They have also unusual crystalline morphology due to the characteristic structure of MgONPs they possess unique, optical, electronic, magnetic, thermal, mechanical,&chemical properties.
- Due to the physicochemical characteristics they change in seed germination, growth performance, and quality of a plant.
- It is a good antibacterial agent. MgONPs show some various properties but it shows some other properties like high chemical stability, high photocatalytic activity, high electrical permittivity, non-toxic nature which makes them unique.
- Due to small size and the higher surface area they can interact with biomolecules and are also used in DNA labeling, drug delivery, sensors, etc.
- The particle size of MgO decreases, the relative no. of surface atoms increases, and this activity increases. The molecular weight of MgO is 40.305 gm/mol. The hydrogen bond donor count of MgO is zero and the acceptor count is 1. The boiling point of MgO is 36000C and the melting point is 28000C and also it has poor solubility of water. The relative density of MgO is 3.6. MgONPs possess high hardness, high melting &boiling point, high purity, it is odorless & non-toxic also. MgONPs appear in white powder form. It is thermodynamically stable at pressure 116 GPa.The bandgap of Magnesium oxide is 7.8. The refractive index of Magnesium oxide is 1.7355. the dipole moment is 6.2 -6.6 D. heat capacity of Magnesium oxide is 37.25+/- mole, and standard molar entropy is 26.95 +/- J.mol-1.K-1. Gibbs free energy of Magnesium oxide is -569.3 KJ/mol.
- MgO nanoparticles are refractory i.e. they are stable physically and chemically. It has high thermal and low electrical conductivity.
- The MIC (Minimum Inhibitory Concentration), and MBC (Minimum Bactericidal Concentration) of MgO particle is 200 and 250 micro gm/ml.
- MgONPs belongs to the high-temperature ceramics group, also it has excellent insulating property. Magnesium oxide is stable up to ca.2300° C in an oxidizing atmosphere and up to ca.1700° C in a reducing atmosphere. The dielectric constant (30Hz-1MHz) is 11. Mg starts to decompose at 360° C.
- MgO is one of the most intensively studied material because of purely ionic nature and simple cubic rock.

II. SYNTHESIS

Physical method –

In these methods, the sol-gel method is mostly used because it is a cheap and low-temperature technique. The chemicals required for the formation or synthesis of magnesium oxide nanoparticles are magnesium nitrate, deionized water, sodium hydroxide, methanol also Digital pH meter, magnetic stirrer, beaker, funnel, stirrer, filter paper, test tube, dropper. UV-visible spectrophotometer, FTIR machine, Transmission The MgONPs are synthesized by three methods like physical, chemical, and biological or green method. synthesis of MgONPs is done by various physical methods like sol-gel, hydrothermal, flame spray pyrolysis, combustion aerosol synthesis, chemical gas phase deposition. electron microscope (TEM), X-ray diffractometer (XRD) instruments were used. These were synthesized using magnesium nitrate as a precursor. Firstly, 0.2 M magnesium nitrate was mixed in 100 ml of distilled water. Then, 0.5M NaOH solution was added

to the Mg(NO3)2 solution (which was prepared earlier) added dropwise with continuous stirring for 30 min.

High energy ball milling -

The high energy ball milling is a simple technique and has the ability or high potential to produce materials quantity in a ton. This high-energy ball milling process is a process that is used to produce nanocrystalline particles of material in powder form. Also, this technique is used to produce metals with their particle size ranging between 4 to 26 nm. It is the process in which a mixture of powder is mixed in a ball mill. This ball mill is nothing but high-energy collision from balls. High energy ball milling is also called mechanical alloying which produces fine and same-sized nanoparticles. In this process, chemical reactions usually take place like changes in reactivity or buy-in during the chemical reactions during milling. But this method has some problems like contamination from milling or atmosphere. The producer of the fine powder can be intimated to bulk form for its large scale used such as hip implants and bone screws. This high-energy ball milling has several advantages of being inexpensive and this is easily scaled up to produce large quantities of materials. If the milling process is done in presence of oxygen or nitrogen the oxides for nitrides are produced.

Flame spray pyrolysis –

It is versatile, highly complex, and used for the rapid synthesis of MgONPs. MgO nanoparticles were prepared via a quick precipitation route using magnesium nitrate and hexamethylenetetramine (C6H12N4) as reagents. In the typical procedure, a stock solution of 1M solution of hexamethylenetetramine was prepared by dissolving a suitable quantity of distilled water. Similarly, 1M Magnesium nitrate solution was prepared by dissolving in distilled water. Both solutions were mixed under magnetic stirring for 10 min at room temperature. After this procedure, the prepared solution was loaded in a chamber of spray pyrolysis. The reaction unit was a flame-spray apparatus consisting of high-pressure gas assisted nozzle, which is made of a capillary tube with an outer diameter of 1mm (inner diameter 0.6 mm) and an opening diameter is of 1.2mm. The spray was evaporated by supporting flamelets. The flow rate of the dispersion of solution was controlled by a flow controller. The product was collected on a SiO2 substrate. The prepared sample was characterized by X-ray diffraction (XRD), transmission electron microscopy(TEM), and UV-Vis spectroscopy. The X-ray diffraction pattern was recorded using a Rigaku mini flex-II diffractometer with CuK alfa radiation in the range 300-900. The morphology and grain size of the sample was observed by using TEM, UV-Vis spectrum was recorded on Perkin Elmer UV spectrophotometer in the range 2001100nm in a solution of MgO nanoparticles dispersed in double-distilled water. Synthesis of MgONPs by the biological or green method is considered as safe environment friendly, low cost, and completely degrade toxic chemicals.

Chemical method –

Synthesis of MgONPs by a chemical method like sol-gel processing, hydrothermal, wet chemical method, chemical precipitation method, etc. In these methods, the sol-gel method is mostly used because it is a cheap and low-temperature technique. The chemicals required for the formation or synthesis of magnesium oxide nanoparticles are magnesium nitrate, deionized water, sodium hydroxide, methanol also Digital pH meter, magnetic stirrer, beaker, funnel, stirrer, filter paper, test tube, dropper. UV-visible spectrophotometer, FTIR machine, Transmission electron microscope (TEM), X-ray diffractometer (XRD) instruments were used. These were synthesized using magnesium nitrate as a precursor. Firstly, 0.2 M magnesium nitrate was mixed in 100 ml of distilled water. Then, 0.5M NaOH solution was added to the Mg(NO3)2 solution (which was prepared earlier) dropwise with continuous stirring for 30min.

Hydrothermal method -

It is a one-step process used for powder synthesis, combustion produces a large surface area product and requires low energy inputs. Synthesis of MgONPs via the simple hydrothermal method by MgSO4 requires ethylenediamine and hydrazine as reagents. The products were characterized by XRD, SEM, TEM, and EDAX. Different parameter's effect on product's size and morphology was investigated. Different mole ratios of MgSO4 were solved in 50 ml distilled water and then ethylenediamine with 1- 6 mole ratio in comparison to Magnesium source was added dropwise to above solution with vigorous stirring. After stirring the solution for 30 min, 0.42 ml hydrazine was dissolved in 50 ml distilled water and added to the reaction. Finally, the reagents were transferred to an autoclave with 500 ml capacity. Autoclaved at 1400-180oC for 6-30 hours and cooled gradually at room temperature. The obtained precipitate was centrifuged and washed many times with distilled water and pure ethanol used for removing possible by-products and then dried at 80oC for 10 hr. To form the MgO powders, the obtained precipitates were heated at 800°C for 8 hr. in a furnace.

By wet chemical method –

Magnesium nitrate and sodium hydroxide are used as precursors in presence of soluble starch as a stabilizing agent in the wet chemical method. Starch act as a stabilizing agent and also prevents the storage of nanoparticles. Starch solution (0.1%) was prepared in 100 ml of distilled water and 12.83 gm of Mg(NO3)2,0.1M were added to the above solution. The solution was kept under constant stirring using a magnetic stirrer for the complete dissolution of contents. After complete dissolution, 4gm (0.2M) sodium hydroxide solution (total volume - 25 ml) was added drop by drop along the sides of the container and stirred for 2 hrs, and placed for 24 hrs. The supernatant liquid was discarded carefully and the remaining solution was centrifuged for 10 min. at 10,000 rpm at 25°C. The centrifugated solution was washed three times using distilled water to remove the by-products and the excess starch that bound with the nanoparticles. Magnesium hydroxide precursors were placed in a furnace at 300°C for 2 hours to get MgO nanoparticles.

By the chemical precipitation method -

Magnesium Chloride and Sodium hydroxide have been dissolved in 100 ml distilled water separately. Stir them separately for half-hour using a magnetic stirrer for constant stirring. Solution of Magnesium Chloride is mixed together by using the magnetic stirrer for one and half hours. Then NaOH solution is added to the mixture of MgCl2 drop by drop with burette at room temp. and stirred well. After 30 minutes milky white color precipitate of magnesium oxide is formed. After filtration and drying white precipitate gets collected.

Green method –

In the green method synthesis of MgONPs is done by orange fruit waste through the green method, from mushroom extract, from neem leaves, and Trigonella foenum-graecum leaf extract.

Synthesis of MgONPs **by orange fruit** -

The synthesis of MgONPs by orange fruit waste procedure consists of three simple steps: (i) Preparation of Orange Peel extract (ii)Preparation of Magnesium nitrate solution and (iii) Green synthesis MgONPs. Firstly Orange peel was collected and converted into the powdered form by crushing. 10 gm of orange peel powder and 100ml of distilled water were taken into a 250ml beaker. The solution was refluxed for 1hr. The extract was filtered with the help of Whatman filter paper. A magnesium nitrate solution was prepared by adding 5g of magnesium nitrate in 100ml deionized water. Peel extract was added into the magnesium nitrate solution and then sodium carbonate solution was added dropwise into it. The magnesium nitrate solution was reduced to Magnesium oxide which was indicated by color change. Particle formation takes place within the solution and stirring was continued for 4 hrs by using a magnetic stirrer. The pH of the solution was maintained at 12 by the addition of sodium carbonate solution. In this period, nanoparticle formation occurs and they were settled at the bottom of the flask. After that, the solution was centrifuged for 5 min. at 5000 rpm/min. Then, nanoparticles were filtered and air-dried for overnight.

The synthesis of MgONPs by mushroom extract –

Twenty-five grams of fresh Mushrooms were taken and washed several times with distilled water to remove any organic impurities present in it, and then, the crushed pieces and 250 mL of distilled water were taken into 2L. beaker thoroughly stirred for 30 min followed by filtration process using Whatman filter paper. Here, the mushroom extract is used as the reducing and stabilizing agent for the synthesis of MgONPs. Above prepared mushroom extract taken with an aqueous solution of 0.1 M magnesium acetate solution and kept for 2 hr on stirring the temperature maintained at 400C. The change of color takes place within 30 min from a colorless to light brown color in the presence of magnesium acetate. After that, the mixture is transferred to a hot plate to carry out biocombustion process. The resultant products were calcined at 4000C for 4 hr. to get MgONPs.

Synthesis of MgONPs by neem leaves –

The green synthesis method is used to synthesis the MgONPs using the precursors such as Magnesium nitrate and Neem (Azadirachta indica) leaf extract has been used as reducing agents. To prepare Neem leaves extract; 5 g of Neem leaves were washed continuously with distilled water and dried for 15-20 min. at room temperature. The extract solution was prepared by boiling dried leaves in a 500ml beaker consists 200 ml of distilled water for one hour at 100̊ C. Freshly prepared Neem leaf extract was used for the synthesis of MgONPs. Freshly prepared extracts alone have been used throughout the study. In the experiment, 5 ml of fresh leaves extract and 20ml of distilled water were added to a 250ml beaker and heated at 600C. 5 gm of Magnesium Nitrate is added to the solution and heated at 80oC with continuous stirring for 4 hr. The Mg(NO3)2 ions were reduced to Magnesia or MgO nanoparticles by using Neem leaf extract. The formation of Magnesium

oxide nanoparticles (MgONPs) has been observed by the color change of the solution from yellow to yellowish-brown color.

Synthesis of MgONPs by *Trigonella foenum-graecum* -

Double distilled water was used for the preparation of the solution in this method. Green leaves of *Trigonella foenum-graecum* (fenugreek) were collected. The roots of the plant *Trigonella foenum-graecum* (fenugreek) were cut. The leaves of the plant were washed continuously using tap water, followed by distilled water wash 2-3 times. The leaves were allowed to dry under shade for nearly 3-4 days. The obtained dry leaves were ground well and made into powder. The leaf powder was used for the preparation of the leaf extract. 5g of the powder was taken and 200 ml of the distilled water was added to a clean 500 ml beaker. It was stirred continuously at 600C for an hour, cooled to room temperature, and filtered using the Whatman filter paper. The color of the extract was observed to the pale green. 30 ml plant extract was taken in a 500 ml beaker and 150 ml freshly prepared 5mM Magnesium nitrate solution was added drop by drop using a burette and 1M NaOH was also added dropwise with vigorous stirring for 2hr. at a temperature of 80℃. With the addition of Magnesium nitrate solution, a sharp change in color from pale green to brown was observed confirming the formation of Mg(OH2) nanoparticles. Then the solution was centrifuged, the precipitate was washed with ethanol several times to remove the impurities and dried in the oven for 8 hours. It is finally calcined in the Muffle furnace at 600℃ for 4 hours and pale yellow colored MgO nanoparticles were obtained. In the green method biomolecules present in the plant extract act as reducing and capping agents. The formation of MgONPs are done by a various instrument like UV-Visible spectrophotometry, Scanning electron microscopy(SEM), Energy dispersive X-ray analysis (EDX), Transmission electron microscopy(TEM), X-Ray diffractometry(XRD), Fourier transform infrared spectroscopy(FTIR).

The synthesis of magnesium oxide nanoparticles by different methods such as physical-chemical and green synthesis in the physical and chemical method the Chemicals are used for the synthesis of magnesium oxide are toxic and hazardous to the environment as well as human and animal. For the synthesis, a large number of costly equipment are required. Other than this green method is an eco-friendly and alternative method for Synthesis. In this method Plant extract microorganisms, bacteria fungi are used. Also, this method is an eco-friendly low-cost pollution-free method. The green synthesis method is suggested to use because it is a safe technique for synthesis.

III. CHARACTERIZATION

UV-visible spectroscopy (UV-Vis) -:

UV-visible spectroscopy is used to discuss the optical properties of a sample. Monochromatic light is passed through the sample and the amount of light being absorbed by the sample is measured. Uv-Vis spectroscopy follows Beer-Lamberts law which states that absorption is directly proportional to the incident radiation and concentration of a solution.

Fourier Transform Infrared Spectroscopy (FTIR) -:

It is a technique used to obtain an infrared spectrum of absorption of a sample that may be in any form (solid, liquid, or gas). The goal of FTIR is used to measure how well a sample absorbs light at a different wavelength. FTIR measurement of MgO nanoparticles shows various peaks at different levels which correspond to a particular functional group and stretch present in it.

X-ray Diffraction(XRD) -:

XRD is a conventional technique used for phase identification of a sample possessing crystallinity. It also provides a piece of information on unit cell dimensions. The resulting material is homogenized, and composition is determined. It is based on Bragg's law which relates the wavelength of radiation with the diffraction angle and lattice spacing in a crystalline sample.

Transmission Electron Microscope(TEM) -:

It is used to determine the size of a nanoparticle. TEM is a microscopic technique in which a beam of light is passed through an ultra-thin object. TEM determines the quality, size, shape, and density of nanoparticles at high resolution. The nanoparticle can have different shapes, but nanoparticles of magnesium oxide are circular in shape. In the green synthesis of MgONPs different plant parts were used for extraction like leaves, stem, flower synthesis, wet chemical method, chemical precipitation method, etc. The chemical synthesis method is expensive and has various health and environmental risks.

In this instrument UV-Visible spectrophotometry used for showing sharp adsorption band, SEM is used to identify crystalline morphology of MgONPs, TEM used for identification of particle size and structure of MgONPs also used for confirmed formation of MgONPs, using FTIR, properties of MgONPs were

investigated and XRD indicates the crystallinity and crystal size of MgONPs. MgONPs are obtained from seawater, brines, by mining from magnesite deposits. The production of Magnesium oxide from Magnesite began over 100 years ago in Austria.

MECHANISM -

- Due to their excellent property, smaller size, large surface area they are used in biotechnology, sensors, medical, optical devices, catalysis, DNA labeling, drug delivery, etc.
- MgONPs are used in the fabrication of nano-scale electronic and optoelectronic devices. It is also used to increase in thermal stability of the polymer.
- Due to the antibacterial activity of MgONPs they are used in rice fields as an antibacterial agent to increase crop productivity.
- Various sized MgONPs gave the greatest enhancement in seed germination.
- Using *Lactobacillus species* MgONPs acts on human Leukemia cells for detection and treatment of cancer.
- It also affects plants like maize for seed germination, growth of roots, performance, and quality of plants.
- The MgoNPs show antimicrobial activity against various plants and act as antioxidants and show the photocatalytic property.
- Magnesium oxide nanoparticles were used as cure activators for polychloroprene rubber. Mgo effectively inhibits grain growth in ceramics and improves their fracture toughness by transforming the mechanism of crack growth at the nanoscale.
- The etching of personal protection equipment(PPE) fibers contains MgONPs and these particles make them more effective in the degradation of methyl parathion.
- The MgONPs possesses statistically significant concentration dependant antibacterial activity. Direct attachment of og MgONPs to the bacterial cell causes physical injury to the cell membrane and decreased motility & biofilm formation ability of R. solanacearum causes reduction in tobacco bacterial wilt index.
- In cows Sodium bicarbonate and Magnesium oxide are known for repairing the milk fat depression observed on restricted roughage rations. Themechanism bywhich Mg increases milk fat concentration at rumen & tissue level. Most studies suggested it act as a buffer or neutralizer in the rumen or intestine. It increases the digestibility of dry matter in a dairy cow. MgO supplementation increases triglyceride uptake and also increases lipoprotein lipase activity by the mammary gland.
- Primary experimental studies say that Magnesium plays a beneficial role as a regulator of thrombosis. Oral magnesium treatment inhibits PDT(platelet dependant thrombosis) in patients with stable CAD(coronary artery disease).
- The hardness of tablets prepared without MgO decreased over time, on the other side tablets prepared with a range of MgO levels in the unpackaged state were stored at 400C with a relative humidity of 75% up to 14 days.
- In the Tobacco plant MgO enhanced plant growth and increase peroxidase activity and the Mg has taken up tobacco roots and translocase to shoot and leaves to increase the chlorophyll content and stimulate growth. The MgO influenced the growth of tobacco seed and seedlings whether NPS was taken up and translocated in tobacco plant tissue and changes in the plant cell.

APPLICATION-

- The MgONPs have a wide range of biomedical and pharmaceutical applications. They have been applied in catalysis, toxic waste remediation, paints, refractory and superconducting product, semi-conductor and catalytic devices as well as, they are used in antibacterial activities.
- The MgONPs have excellent applications in biomolecular detection, diagnosis, and microelectronics. They are used in a variety of areas like cosmetic, biomedical, energy, environment, and material application.
- They are used in seed germination for growth, performance, chaining quality of the plant, crop improvement, etc.
- The MgONPs are used to increase in fresh and dry biomass and biosynthesized MgONPs effects variously sized root nodules of a plant.
- It can be used in the agriculture field due to their antimicrobial activity, they are used in rice fields to increase productivity.
- Nowadays, some researchers started to focus on the use of MgONPs in the cancer field but, none of them have the use of biological synthesized MgONPs for the treatment of cancer.
- After many research attempts and extensive property of MgONPs, the Food and Drug Administration(FDA) recommended it as safe material to use in medical fields. It has excellent bactericidal property *against Staphylococcus aureus, E.Coli,* and also against plant pathogen *Ralstonia solanacearum*.

- It has antibacterial activity against plant pathogen.
- Magnesium oxide is used as a model system for investigating the vibrational properties of the crystal. Magnesium oxide is extensively used in soil and groundwater remediation, wastewater treatment, drinking water treatment, air emission treatment. It is used on anticocking agents, canned peas, frozen dessert.
- It is used in electrical insulators in tubular construction heating elements. Construction material is used as fireproofing material in construction material. It is used as oxide barriers in spin tunneling devices.
- Mgo is packed around transuranic waste at the waste isolation piolet plant to control the solubility of radionuclides. It is also used as a protective coating in plasma displays. Its major use is in kitchen electrical stoves.
- MgONPs are applied to control the initial burst release by the modification of the matrix structure.
- The MgO is produced in the hard form for sheathed heaters, or in crushable form for thermocouple cables, heating cables, fire-resistant cables, and glow plugs. It is also applicable mineral insulation in cables. Due to its thermomechanical property, it is used in brake lining. It is used in heat-resistant electrical cable.
- We use MgO as a model system for investigating reflection TDS (thermal diffuse scattering) due to its harmonic behavior as well as its mechanical and dynamic stability, also it is used as a model material system. The pressed MgO is used as an optical material.
- Crystalline pure MgO is available commercially and has small use in infrared optics. MgO plays an important role in commercial plant fertilizer and as animal feed. Caustic magnesium is used to remove heavy metals and silicate from wastewater. An aerosolized solution of MgO is used in library science and collections management for the deacidification of risk paper items.
- MgO is used in dietary supplements for humans and animals also. MgO particles are hygroscopic in their powder form In medicine Magnesium is used for the relief of heartburn and sour stomach, as an antacid, magnesium supplement. It is also used to improve symptoms of indigestion.
- Rock climbers use MgO for perspiration purpose of their hands to keep them moisture-free. MgO has several attractive characteristics like fire resistance, termite resistance, moisture resistance, mold, and mildew resistance. MgO is mostly used in refractory industries. It is used as a reference white color in the colorimeter.
- Magnesium oxide is mainly produced from the calcination of magnesite which is a process similar to the production of lime from limestone.
- MgONPs has a very high melting point and low heat capacity which makes them a suitable candidate for insulation capacity. The MgONPs act as destructive adsorbant for chemical and this property increase with decrease in MgO size.
- MgO Nanoparticles can be used for the construction of functional nanostructure and the investigation of surface reactivity.
- MgO can be used in fuel can because it can inhibit corrosion.
- MgONPs were used in agriculture, in Bacteroides, and in micronutrients to increase the quality of crop and child motility and mal. Nutrition.

IV. CONCLUSION

This study aims that synthesis of magnesium oxide nanoparticles using the green method. Magnesium oxide nanoparticles have useful applications in various fields like agriculture, medicine, ceramic, electronics, etc. The influence of various parameters checked and various optimised conditions were studied. Comparative study is done by various characterization techniques like XRD, UV - vis, FTIR, SEM to confirm the presence of magnesium oxide nanoparticles. From the above study, result reveals that the green synthesis method is one of the best method than others. Also study concluded that, MgONPs are significantly important as well as economically.

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