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CONCEPTUAL APPROACH: GREEN NANOMATERIALS USING GREEN NANOTECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

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Abstract

Nowadays, as Population is increasing day by day this growth leads to many environmental problems such as Pollution, carbon emission, Environmental imbalance which further leads to Global warming. So, to Tackle with these problems and as awareness towards sustainable society is growing "Green energy" and Green materials for manufacturing is gaining predominant Recognition. Nanotechnology plays significant role in many fields such as medical, portable electronics and majorly in Electric Vehicles. So currently nanomaterials are gaining vital recognition in all manufacturing processes. Using these nanomaterials, improvement in performance and and proliferation in productivity is achieved and this overall impact enhanced the proliferation of industries. But these nanomaterials are not environmental friendly; as manufacturing process involves certain amount of chemical processes so nanomaterials produce some hazardous elements or pollutants which can make adverse impact on environment, so use of green nanomaterials is very significant for maintaining environmental balance. These green nanomaterials are based on green nanotechnology in which materials that used in nanomaterials are not harmful to environment. This green nanotechnology enables nanomaterials not only to ameliorate the overall performance but also in most environmental friendly way that is keeping environment clean. This green nanotechnology can be the one of the best approach towards clean sustainable development. This paper mainly focuses on role of green nanotechnology for obtaining green nanomaterials which makes possible to obtain environmental friendly nanomaterials. Green nanomaterials plays significant role in mitigating environmental problems and helps for keeping environment clean. Green energy plays vital role in energy security, sustainable development and overall social, economical development.

Keywords: *- Green Energy, Green Materials, Green Nanomaterials, Green Nanotechnology, Sustainable development.*

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1. INTRODUCTION

As Nanotechnology has myriad amount of advantages and applications it makes possible to measure, observe, Manufacture materials or things on an atomic molecular scale. Nanomaterials have large surface to volume ratio which is the most significant characteristic; that tends to enhance applications of nanomaterials to larger extent. Sometimes there occur certain disturbances due to large surface area of nanomaterials particularly it occurs on the outer surface of the nanomaterial; so, this leads to cause abnormalities in outer layer composition which further affect on chemical composition of nanomaterial. Also, due large size on the nanomaterial it causes changes in physical, chemical, mechanical, electrical properties which during manufacturing process yields hazardous chemicals that catastrophic for environment. So, to mitigate this problem "Green Nanotechnology" approach is best and most suitable. In this "Green Energy" and "Green Chemistry" are two significant concepts on which green nanotechnology works predominantly. To obtain nanomaterials that will be not hazardous for environment or eco-friendly we can say; from environmental resources is the significant aspect of this Green Nanotechnology. As we know nanomaterials are made up of different metals so these can be synthesised to obtain environmental friendly green nanomaterials from bacteria, yeast, plants, vitamins, fungi etc. Various methods for obtaining these green nanomaterials but based on green nanotechnology and green energy biosynthesis is the most suitable approach.

2. IMPORTANT FACTORS FOR SYNTHESIS OF NANOMATERIALS

Biosynthesis of nanomaterials is the most suitable approach to obtain environmental friendly nanomaterials. As nanomaterials are made up of metals and these metals are amalgamation of different physical and chemical properties. So, during manufacturing process it extracts catastrophic chemical which can leads to environmental degradation. For mitigating this problem green synthesis of metal nanomaterials plays crucial role. Which is the concept based on green nanotechnology. Certain aspects need to be taken into recognition in order to produce stable nanomaterials by using organisms.

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I. **Efficacy of organism**: It is predominant to recognize significant properties of organism. So that biosynthesis process will give required result of stable and well characterized nanoparticles. Myriad number of plants have ability to detoxify the metal nanoparticles this will ensure the stable production of nanomaterial.

II. **Favourable conditions for proliferation of cells and enzyme**: For effective growth of cells some factors such as temperature, nutrients, size, pH, strength etc are significant. Which are beneficial for appropriate growth of cells.

III. **Conducive conditions for reactions**: For production of the nanomaterials to the larger extent there are two significant factors which needs to be taken into recognition. First is production rate and second is extraction rate or yield rate. Along with that atmospheric factors are very crucial for effective production of nanomaterials. Other important atmospheric factors are also considered ultrasound, microwave radiation.

3. SYNTHESIS OF NANOMATERIALS BASED ON GREEN NOTECHNOLOGY

Synthesis Of nanomaterials which is consist of organisms such as bacteria, fungi, yeasts, plants is called green synthesis which is based on Green chemistry Furthermore this Green chemistry is based on approach called as Green Nanotechnology. This approach is the interconnection between nanotechnology and microbiology; further this approach enables for producing green nanomaterials using environmental friendly nontoxic materials which ameliorates nanomaterial productivity as well as overall sustainability.

- **Fungi**: It has important characteristics and advantages for synthesis nanoparticle. As it contains enzymes, proteins that has ability to lessen components present on surface of cell. Many studies denote that fungi synthesis is vital in obtaining nanomaterials which are made up of different metals such as Ag, Cu etc.
- **Plants**: Plants play significant role in detoxification of heavy metals.so these plants can be used to obtain nanomaterials using photosynthesis. Plants are getting appreciable recognitions as they act as a most environmental friendly resource to obtain and synthesis nanomaterials. This can be alternative technique to chemical synthesis in which toxic chemicals are yields and this leads to degradation of environment. Recent research denoted that yields or extract from green tea leaves and vajradanti roots used to obtain nanomaterials which are applicable in medical field.
- **Yeast**: Yeast can be successfully used to obtain nanomaterials. Many metal nanomaterials such as gold and silver can be obtained using extracts from nanomaterials. So Yeast also play vital role in production of green nanomaterials.
- **Bacteria**: Bacteria also used in synthesising nanomaterials. They have significant ability to skilfully control the process. From previous research it is denoted that TiO2 nanomaterial also synthesizes using bacteria. So these also can be used to synthesized heavy metal nanomaterial.
- **carbohydrates**: Carbohydrates are one of the most promising Resource to synthesize nanomaterials. Due to its chemical structure and other important properties they are used in the fabrication and manufacturing of nanomaterials. One of the best and most promising example is from research it was found that hydroxypropyl cellulose can be used in manufacturing of metal nanomaterials such as gold, silver.

For this various atmospheric parameter were considered at the time of synthesis.

- **Vitamins**: As there are various vitamins such as vitamin B, C, D, E. These vitamins have idiosyncratic structure along with significant chemical properties this allow them to used in manufacturing of nanomaterials with high stability and efficacy.
- **Starch**: Starch has gained predominant recognition because of its significant properties. It can be used as a nontoxic, environmental friendly agent for nanomaterial synthesis. It was found during research that Ag2O nanomaterial can be prepared by using mixture of starch and AgNO3.This process was carried out even in the absence of chemicals. So, starch can be used as biopolymer for preparation of nanomaterials with stability and efficacy.

So, from all the resources for nanomaterial synthesis discussed till now are playing crucial role in manufacturing and fabricating metal nanomaterials. All these resources are made up of nontoxic, non-hazardous elements and also, they all have idiosyncratic characteristics which enables them to the production of green nanomaterials. As synthesis process does not contain any chemicals. So that helps in protection of environment. These resources not only play vital role in producing green nanomaterials but also ameliorates overall synthesis process. So biosynthesis process using green energy has gaining appreciable recognition and attention day by day.

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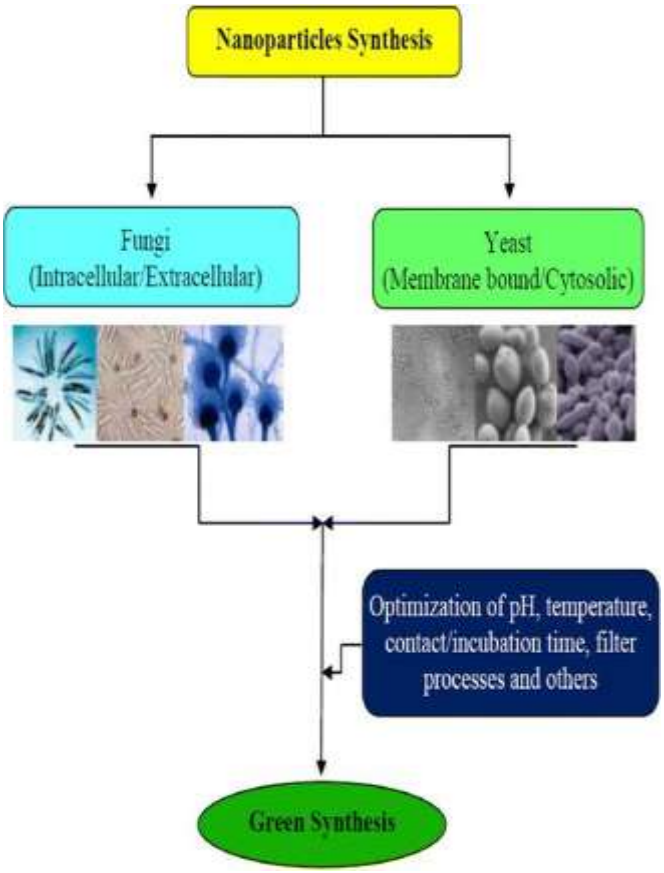

4. GREEN NANOTECHNOLOGY AND SUSTAINABLE DEVELOPMENT

Proliferation of industrialization paly vital role in enhancing frugality of any nation. But as we know that many equipment consists of nanomaterials which are made up of various metals. these during manufacturing extract some hazardous chemicals which can affect on environment which leads to environmental problems like pollution, carbon emission and indirectly this also affect on plants animals and human. So, to mitigate this problem and prevent environment from degradation. Green Nanotechnology is significant and most suitable approach. The term sustainable development implies that development caused due to advanced technology but keeping environment clean. Green Nanotechnology uses green energy approach for using synthesis of nanomaterials these resources ensures nontoxic, non-hazardous synthesis for environment. As main aspect of this green nanotechnology concept is utilization of resources for producing nanomaterials that don't have any adverse effect on environment. Green Nanotechnology has become most suitable approach and best replacement of existing chemical synthesis process. Green Energy has vital contribution in various field such as making clean energy, keeping environment clean. Also, it has significant contribution in achieving clean energy demand for industrial, nonindustrial applications along with that it helps in ameliorating social, economical factors. Furthermore, Green Energy play significant factor in sustainable development and overall stability. This green technology concept is also widely used in desalinate water, biomedical applications. Green nanotechnology has myriad number of advantages and applications.

5. ADVANTAGES OF GREEN NANOMATERIALS AND GREEN NANOTECHNOLOGY

- It helps in minimizing surface area of nanoparticles with the use of green energy resources.
- Green nanotechnology prevents environment from hazard and toxicity.
- It helps to keep environment clean.
- It ameliorates the performance of nanomaterials in most environmental friendly way.
- It enhances efficacy of nanomaterials.
- This approach is beneficial to environment directly or indirectly.
- This Green Nanotechnology contribute in energy security, Energy conservation.
- This Green Nanotechnology enables synthesis of nanomaterials without use of chemicals.
- Green Nanotechnology has become best and most suitable alternative to synthesis of nanomaterials.

6. CONCLUSION

This paper mainly focuses on Green Nanotechnology, Green Nanomaterials, Green Energy and green synthesis of nanomaterials and together how energy from environment, green energy, green resources are used for obtaining, manufacturing, synthesising the nanomaterials. Clean energy, Clean environment demands can be meet by using green nanotechnology. Also, green nanotechnology plays vital role in sustainable development in all aspects such as social, economical. This not only enables to synthesize nanomaterials with efficacy but also it helps to prevent environment from toxic and hazardous materials. Nowadays as industries are growing day by day this green nanotechnology approach is becoming significant as awareness towards green energy is enhancing day by day. So, this Green Nanotechnology will play crucial role in nearer future, as It can contribute in energy conservation, energy security, clean energy. This concept has applications in both industrial and non-industrial field and it consequently playing crucial role in stability and sustainable development of world. To obtain stable, well characterized, highly efficient results Green Nanotechnology is significant so main goal of this concept is to obtain required result of nanomaterials in environmental friendly manner; that will ensure overall stability and sustainable development.

FUTURE SCOPE

Green Nanotechnology can be used in batteries in electric vehicles; that will ameliorate the battery performance. Green nanotechnology can be implement in industries where most of the metal nanoparticles present. Green energy can be used

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in all application whether it is industrial or nonindustrial; this will be beneficial for environment. Small size, small surface area, high efficiency all these parameters can be achieved by the successful use of green nanotechnology. It can be useful for small scale as well as large scale applications. As fossil fuel, Natural gas, coal are non-renewable resources Recent analysis stated that. Nowadays almost 84% man is dependent on these resources. So energy conservation will be vital in nearer future so Green Energy will play vital role. Environmental problems like pollution, global warming can be prevented if awareness towards green energy increase. Green energy is the most suitable alternative to non-renewable sources; this can lead to reduce dependencies on non-renewable sources. Green Nanotechnology will play significant role in nearer future in all fields.

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