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STUDY OF NANOPARTICLES AND ITS IMPACT FOR HUMAN ANDENVIRONMENT

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Abstract:

It has been observed that Today's society has become completely based on nanomaterials because nanomaterials are proving to be very effective due to their minimum size, therefore they are vital to function and have a strong impact on all areas such as engineering, communication, and medical field, environment, cosmetic and coatings. Although much of nanotechnology is still in the research and development phase, nanomaterials are expected tobe used in a wide variety of applications.

Currently, nanotechnology revolutionizing both the scientific and industrial communities due to their applications in the fields of medicine, environmental protection, energy, and space exploration. Despite the evident benefits of nanoparticles, there are still open questions aboutthe influence of these nanoparticles on humans and the environment. This is one of the critical issuesthat must be addressed soon.

Nanoparticles are the domain of interdisciplinary and complex, involving the simultaneous use of knowledge in several areas, research in the field of nanomedicine and nanotechnology allows a deeper understanding of human health and the environment. The various forms of nanotechnology have the potential to make a very significant impact on society. New health risks possibly involve quite different mechanisms of interference with the physiology of human and environmental species.

Keywords: Nanoparticles, Environment, Nanometric scale, cosmetic and coatings etc.

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1. Introduction

Nanotechnology is emerging as a multi-disciplinary science for the development of new products using engineered NMs and many benefits are expected from the ongoing research in nanotechnology, serious concerns are being expressed about the potential hazards that nanoparticles (NPs) can pose to the environment, ecosystems and human health. Since significant physical and chemical property alters as the particle size is reduced to the nano range (typically 1–100 nm), the biological property of engineered nanoparticle (ENPs) may also be altered from their bulk counterparts. Several analyses and assessments in the past few years on the hazardous risks of NMs have shown the adverse effects of many nano-products on the environment, aquatic organisms and human beings.

Nowadays, nanotechnology is rapidly expanding with new applications in different fields. For instance, nano-engineering brings new opportunities for progress in healthcare, energy, environmental protection, construction, agriculture food processing, and other fieldsby developing nanomaterials, nanostructures and nano-systems.

The environmental implications of nanotechnology are quickly becoming an area of research that is becoming increasingly important from a sustainability perspective. There are currently only a small number of scientific studies available that examine the effect that nanoparticles have on the surrounding environment. However, it is necessary to assume thatdue to the exceptional qualities that they possess. There is no doubt that nanoparticles will cause damage to the surrounding environment. Nanotechnology has contributed to society's welfare well and moulded the nature of modern living. It has the potential to significantly alter societal dynamics, economic conditions, and human life.

2. Environmental concerns nanoparticles:

Manufactured nanoparticles will enter the environment through intentional releases as well as unintentional releases such as atmospheric emissions and solid or liquid waste streams from production facilities. In addition, nanomaterials in paints, fabrics, and personal and health care products, including sunscreens and cosmetics, enter the environment proportional to their use. The emission of nanomaterials will ultimately deposit on land and water surfaces. Nanomaterials reaching in the land have the potential to contaminate soil and migrate into surface and ground waters. Particles in solid wastes, wastewater effluents, direct discharges or accidental spillages can be transported to aquatic systems by wind or rainwater runoff. The biggest release in the environment can come from spillages associated with the transportation of

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manufactured nanomaterials from production facilities to other manufacturing sites, and intentional releases for environmental applications.

The Nanoparticle's exposure to our environment occurs through inhalation, ingestion, penetration through the skin, and injection. Inhalation is considered the primary route of exposure to humans and therefore the presence of Nanoparticles in the air is regarded as a significant health hazard. Most of the properties that arise in Nanoparticles are due to the size confinement which increases the surface area for a similar volume exponentially and changes the particles' chemical and physical properties. These changes can heighten the reactivity and toxicity of Nanomaterials regardless of other factors like composition and shape. NMs smaller than 100 nm can easily penetrate cells, ~40 nm can enter nuclei, and below 35 nm can cross the blood-brain barrier [1-2]. Because nanoparticles have superior surface activity and can be applied to the production of particles with various functions, they are extremely important for the future development of sophisticated material technologies. On the other hand, this superior activity of nanoparticles is a cause of trouble from the perspective of safety and does not always have a positive influence on the environment. Attention must also be paid to the impact on health. Nevertheless, all technologies have negative aspects, and by overcoming these kinds of problems, we will be able to utilize the superior characteristics of nanoparticles for practical purposes.

2.1 Nanomaterials in Food Nanosensors:

Nanomaterials are used as sensors to detect contamination and regulate the food environment. They can detect microbial and other food contaminants. Therefore, they are used as sensors in food production and at packaging plants. They can monitor the condition of food during transport and storage. They can detect nutrient deficiency in edible plants, and dispensers containing nutrients can deliver them to plants when needed. Therefore, nanomaterials can be used as nanosensors and nanotracers with almost unlimited potential by the food industry.

2.2 Various Applications of Nanoparticles:

Nanoparticles have significant applications in different sectors such as the environment, agriculture, food, biotechnology, biomedical, medicines, etc. like; for the treatment of waste water environment monitoring as a functional food additive and as an antimicrobial agent [3-6].

(a) Nanoparticle as a sensor:

Nanoparticles have been employed in sensors for a variety of applications including detecting analytes at very low concentrations, detecting and separating pathogens, detecting and capturing cells, and detecting molecular and cellular functions.

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(b) Electronics & IT applications:

Nanotechnology has greatly contributed to major advances in computing and electronics, leading to faster, smaller, and more portable systems that can manage and store larger and larger amounts of information. It also provides printable and flexible electronics and magnetic nanoparticles for data storage. Nowadays, nanochemists are working in medical organic chemistry, polymer chemistry, product synthesis, and other fields. They rely on a wide range of options for preparing and creating nanomaterials with electronic, magnetic, photochemical and chemical properties and their mechanical system are interpretable and explainable within the infinitesimal space. Nanotechnology is changing significantly in the field of electronics, especially regarding computers, telecommunications and optics [7-10].

(c) Medical and Healthcare applications:

Nanotechnology is already broadening the medical tools, knowledge, and therapies currently available to clinicians. Nanomedicine, the application of nanotechnology in medicine, draws on the natural scale of biological phenomena to produce precise solutions for disease prevention, diagnosis, and treatment.

(d) Energy Applications:

Nanotechnology is finding application in traditional energy sources and is greatly enhancing alternative energy approaches to help meet the world's increasing energy demands. Many scientists are looking into ways to develop clean, affordable, and renewable energy sources, along with means to reduce energy consumption and lessen toxicity burdens on the environment.

As in Wind Energy, the implementation of nanotechnology into wind energy applications is bringing together different methodologies and techniques to handle more effectively a number of the good challenges facing the science of wind engineering. the foremost critical part of this accomplishment is to stimulate a harmonious integration of scientific and technological endeavours.

(e) Environmental Remediation:

Nanotechnology can help improve energy efficiency, there are also many ways that it can help detect and clean up environmental contaminants. As in

Groundwater Contamination

- Pump and Treat
- Chemical Oxidation
- Biological Amendment
- Permeable Reactive Barriers
- Air Sparging

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Soil Contamination

- Capping
- Biopiles / Landfarming
- Chemical / Biological Amendment
- Soil Washing
- Thermal
- Soil Vapor Extraction

(f) Nanomaterials in Nanophotonic:

Nanophotonics are associated with some specific technologies like Optical Engineering (OE), Electrical Engineering (EE) and nanotechnology by using light including silicon-based semiconductors. Nano-photonics is all about the manipulation and emission of light (both far-field and near-field) using nano-scale materials. Particularly promising market opportunities for nano-photonics include improving the light output of high brightness light emitting diodes (LEDs) reducing the manufacturing cost of solar cells, identifying better fluidic sensor solutions, and commercializing novel displays.

2.3 Other applications of nanoparticles in artificial intelligence:

(a) Al Nanoparticles as Propellants:

Al nanoparticles of various sizes are being used for the production of compounds for rocket propellent. Al nanoparticles have found applications in various fields such as military as coolant and fuel for rockets, heat resistant layer of aircraft, corrosion, and automobiles.

(b) Al Nanoparticles as Energetic Materials:

Al nanoparticles are extensively used for military purposes as energetic materials. They are used in explosives to enhance the temperature of the reaction and elevate the energies of the bubbles in weapons used under the water. Aluminium nanoparticles have applications as constituents of explosives and propellants for rockets [11].

(c) Immunotherapy:

Al nanoparticles are found to exhibit the ability to induce autophagy. Induction of autophagy is the principal objective of vaccines for next generation and immunotherapy, this is due to the main aspect of autophagy in the introduction of the antigens to the T-lymphocytes. Aluminium nanoparticles conjugated to cysteine peptidase A as well as B were utilized as vaccination for leishmania to activate the process of autophagy in macrophage cells. The conjugated form of Al nanoparticles demonstrated the expeditious internalization via macrophages infected with leishmania consequent to administrating Al nanoparticles [12].

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3. Conclusion:

Nanotechnology has opened doors of technology for us which we did not even know were there. Nanotechnology is becoming more and more real and there is a need for discussion about the possible advances and impacts of technology on the environment. Nanotechnology can cause significant changes to air quality, water quality, and sustainable energy generation. It can help us to repair the environment and save it. Metal nanoparticles (NPs) have many potential applications in various fields, including electronics, energy storage, catalysis, and medicine. However, there are also several challenges and potential future directions for developing and using metal NPs. The technological revolutions, as often witnessed in the past, take time. Our analysis shows how the initial academic excitement around nanoparticle application has become a more disciplined and systematic research field. Nanoparticles, considered a "new" word in early 2030, has become a classical technical term, part of standard teaching in universities and well-integrated into everyday language. Nanoparticle research has found its position as a recognized discipline; hence, we expect the field to continue thriving, with even more fuel as nanoparticles are now globally available.

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