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Nanomaterial Application for Healthy Environment

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Abstract:

Nanotechnology is very effective at removing pollutants in the field of air, water, and wastewater. The techniques for treating pollution detection that have been created using nanotechnology include nanoadsorbents, nanofiltration, nanocatalysts, nanoparticles, and nanosensors. Nanoparticles can be used to synthesize several types of nanomaterials with a range of benefits. Nanomaterials applications have advanced significantly as a result of the disciplines of materials in explosive expansion. Novel nanomaterials can be designed and synthesized to provide improved performance in applications related to the environment. The intensified human activities are shaking the environment balance and human health by nourishing with large quantities of anthropogenic unsafe toxic elements which pollute water, atmosphere, and soil and subsequently intimidate public health of human beings. Therefore, nanostructured materials can be used to handle any environmental issue, such as extremes in temperature or high wear, severe corrosive conditions, and environmental pollution. In order to handle the most recent developments in nanomaterials and their applications, knowledge distribution is crucial.

Introduction:

Nanotechnology is one of the most promising strategies for revolutionizing environmental cleanup. It is characterized as a set of emerging breakthroughs that function on the size of nanometers. Nanometer (particularly, between 1 and 100 nm) to make devices, systems, and materials principally with novel functionalities and properties qualities by manipulating matter's structure and size. Because of its potential, nanotechnology has gained widespread traction [1-4].

Applications that span several disciplines such as energy, medicine and pollution treatment that is making astounding forecasts. Conservative remediation transformation and improvement approaches. Various advances, including deposition Photo catalytic deposition (PD), precipitation (DP), and chemical vapour CVD (chemical vapor deposition), wet chemical technique, chemical solution hydrothermal processes, thermal treatments, and chemical degradation and sol-gel. Nanomaterials have been observed to be beneficial for synthesizing several types of nanomaterials with distinct advantages over their larger counterparts. The exceptional traits thermal, mechanical, optical, and electromagnetic [5-7]. The morphological and structural characteristics of nanoparticles provide them with useful types for a variety of applications where they can be used as nano adsorbents, nano membranes, disinfectants, and nano sensors are all examples of nonmaterials. Furthermore, various efforts to make more were published refined nanostructure (for example, nanorods, nanowires, nanobelts, nanofibers etc.) . In order to improve the versatility of nanomaterials and to conquer all of the obstacles that stand in their way applications.

Applications: The water industry: Nanotechnology can be used to clean waste water and drinking water, as well as to remediate groundwater. Furthermore, many of the following approaches for commercialized applications and products are in the development or testing stages.

Filtration or Separation: Nanomembranes are one of the most advanced cutting-edge technologies. Because inorganic ceramics and organic polymers are suitable membrane materials for water treatment [5-6] Nanotechnology has the potential to greatly contribute to the creation of cleaner, greener technologies with considerable environmental and health benefits [6]. Nanotechnology techniques are being researched for their potential to provide pollution management and mitigation solutions, as well as to enhance the effectiveness of existing environmental clean-up approaches [7]. Nanotechnology may aid the environment by lowering energy consumption during manufacturing and production processes, allowing items to be recycled after use, and creating and employing ecologically acceptable materials [8]. Nanotechnology now has enormous promise for tackling sustainability challenges, but we must also consider the impact on the environment and human health [9-10].

Nanomaterial in the environment: Two primary environmental domains can be distinguished by the application of nanotechnology: Area of nanotechnology-based environmental pollution monitoring: Continuous monitoring of environmental pollution is one of the most crucial and fundamental requirements for the control of environmental pollution. In order to reduce pollution, environmental organizations have established rules and regulations for food and industry. Maintaining continuous control over sources of pollution is a challenging, intricate, and time-consuming undertaking [10-11].

There are two primary environmental domains where nanotechnology is being applied: Domain of employing nanotechnology for environmental pollution monitoring: Continuous environmental pollution monitoring is one of the most crucial and fundamental requirements for environmental pollution control. Environmental organizations now regulate industry and food through environmental laws and standards. It takes a lot of effort, complexity, and time to continuously control sources of pollution. These days, nanosensors allow for point-by-point, inexpensive monitoring of the target areas' contamination status [11-12].

Waste Water:

Groundwater remediation and waste water and drinking water treatment are both possible using nanotechnology. Additionally, a large number of the following methods for products and applications that are commercialized are being developed or tested.

Nanotechnologies offer benefits as well as drawbacks. But although advantages are well established, risks have been well studied by a large number of scholars. The risk-benefit ratio must be considered when determining whether or not to utilize NPs; on the other hand, because to the potential harm NPs may do to the environment and public health, their usage should be strictly regulated. There's a great need for balance to fit between the two. While too strict regulations may impede new scientific and technical developments, extremely loose regulations may cause serious environmental deterioration [11].

Applications of Nanotechnology

After nearly twenty years of basic research on nanoscience and more than fifteen years of focused R&D under the NNI, applications of nanotechnology are realizing the promise of nanotechnology to enhance society in unexpected and expected ways.

Nanotechnology is considerably advancing and even transforming a number of economic and technological fields, such as information technology, homeland security, healthcare, energy, transportation, food safety, and environmental research. Below is a sampling of the ever-growing list of benefits and applications for nanotechnology [12].

- Standard Materials and Practices
- Many of the benefits of nanotechnology stem from its capacity to alter the structures of materials at exceedingly small sizes in order to achieve certain properties, greatly increasing the toolkit that materials scientists have at their disposal. In addition to many other attributes, remediation of the environment.
- By quickly and inexpensively detecting and treating water contaminants, nanotechnology may be able to contribute to the supply of inexpensive, clean drinking water.
- •By causing chemical reactions that render the pollutants harmless, nanoparticles are being produced to clean up industrial water contaminants in ground water. Compared to alternatives that call for pumping water out of the ground for treatment, this process would be less expensive.

Conclusion:

Materials of various sorts, including inorganic, carbonaceous, and polymeric nanoparticles, can be effectively utilized for an array of environmental applications. The amount of material required to implement efficient remediation, and whether it is beneficial to recover the remediation nanomaterial (recycling). We have included an overview of diverse nanomaterials that have been used for healthy environment. A wide range of research projects have been started to the usage of nanotechnology, issues with its application for healthy environmental have not yet been resolved. Despite the fact that some materials capacity to be recycled has been explained. Once the materials have been used for pollutant collection or degradation, even with the fact that the mechanisms by which the various nanotechnologies are well understood. Since an effort to accept a companionable treatment technology to clean up all the wastes which are left behind the industrialized revolution, it accounts basically compared the applications of auspicious nanotechnology to conservative approaches in ecological and health remediation. Furthermore, this review also emphasized the obstacles which restrict the applications of nanomaterials and subdue the benefits of their unequaled virtues; such difficulties comprise conditions of adjacent environments such as humidity, particle agglomeration, temperature, and separation complications.

References:

1. Shatkin JA, & Kim B. (2015) Cellulose nanomaterials: life cycle risk assessment, and environmental health and safety roadmap. Environmental Science: Nano. 2(5), pp. 477–499.

2. Asif M, Salman MU, & Anwar S. (2022). Renewable and nonrenewable energy resources of Pakistan and their applicability under current scenario of Pakistan. OPEC Energy Review.

3. Asif M, Sharf B, & Anwar S (2020) Effect of heavy metals emissions on ecosystem of Pakistan. Indonesian Journal of Social and Environmental Issues (IJSEI). pp. 160–173.

4. Viswanath B, & Kim S (2017) Influence of nanotoxicity on human health and environment: the alternative strategies. In Reviews of environmental contamination and toxicology. Rev Environ Contam Toxicol.;242: pp. 61–104.

5. Chen C, & Wang H. (2016) Biomedical applications and toxicology of carbon nanomaterials. John Wiley & Sons.

6. Boverhof DR, Bramante CM, & Butala JH (2015) Comparative assessment of nanomaterial definitions and safety evaluation considerations. Regul Toxicol Pharmacol. 73(1) pp. 137–150.

7. Han J, Xiong L, & Jiang X (2019) Bio-functional electrospun nanomaterials: From topology design to biological applications. Progress in Polymer Science; 91: pp. 1–28.

8. Boyes WK, Thornton BLM, , & Al-Abed SR (2017) A comprehensive framework for evaluating the environmental health and safety implications of engineered nanomaterials. Crit Rev Toxicol.;47(9): pp. 771–814.

9. Yousuf S, Donald A, & Hassan A (2022) A review on particulate matter and heavy metal emissions; impacts on the environment, detection techniques and control strategies. MOJ Eco Environ Sci,;7(1): pp. 1–5.

10. Asif M, Saleem S, & Tariq A, Pollutant emissions from brick kilns and their effects on climate change and agriculture. ASEAN Journal of Science and Engineering. 2021;1(2):135–140.

11. Upadhyayula V.K.K., Deng S., Mitchell M.C, & Smith, G.B. (2009) Application of carbon nanotube technology for removal of contaminants in drinking water: a review, Sci. Total Environ. 408 pp. 1–13

12. S. Forruque, M. Mofijur, N. Rafa, A. Tasnim, S. Chowdhury, M. Nahrin, A.B.M. S. Islam, & H. Chyuan, (2022) Green approaches in synthesising nanomaterials for environmental nanobioremediation : technological advancements , applications ,benefits and challenges, Environ. Res. 204 pp. 111967.