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ROLE OF NANOTECHNOLOGY IN ENVIRONMENTAL POLLUTION CONTROL*

Shrijan Sharma[1], Priyanshu Ranjan Sahu[1], Shreyash Zombade[1], Surabhi Sahu[1], Sushma Dubey[1*]

[1]Department of Biotechnology, Kalinga University, Naya Raipur, C.G, India-492101

Abstract

Nanomaterials are generally considered to be materials with at least one dimension of 100 nanometers or less, or materials with an internal structure of 100 nanometers or less. This page is all about the nanotechnological tools like nano filters, nano sensor, nanoparticles tools and the functional uses for the reduction of pollution. Also about some details for pollution due to the discussion role plays by itself in daily life. And pollution is becoming the major causes for harmfulness of human body leading to various diseases.

Keywords: Nanomaterials, Nanometer, Pollution, Nanoparticle, Nanotechnology.

Introduction of Nanotechnology

Nanotechnology and the environment – is this a Janus relationship? There is great hope that nanotechnology applications and products will lead to a cleaner and healthier environment. [24] Nanotechnology is defined as research and development at the atomic, molecular or macromolecular scale. Nanoparticles are considered the basis of nanotechnology and refer to objects with at least one dimension of 100 nm [1]. Nanomaterials can be used to clean contaminated soil and groundwater in landfills. It has become an extremely promising field in several human domains. Since the emergence of nanoscales, many scientific fields have been developing their work in this area, which contribute to the development of nanoscience. [23]

Nanoparticles can be used in environmental devices such as sensors. It can interact with toxic substances and organic compounds, increasing or decreasing their toxicity.

Nanoparticles can absorb pollutants, reduce the concentration of free pollutants around cells and reduce the effects of pollutants. Major definition of Nanotechnology can be defined as the science and engineering involved in the design, synthesis, characterization and application of materials and devices whose smallest functional organization in at least one dimension is on the scale of nanometers or one billionth of a meter. [19] It represents a megatrend and has become a universal technology. A 2000 executive action, the National Nanotechnology Initiative, was formalized by the 21st Century Nanotechnology Research and Development Act of 2003. [20]

Introduction for Pollution

Pollution is one of the major issue counts over the world. Since the mid-twentieth century, studies on human development and the impact on pollution have improved both in quantity and quality. Many studies have shown that some pollutants have a negative impact on human development, especially pregnancy development. [15]. Many other types of pollutions which have great impact in destroying the entire cities, states, countries. Air pollution includes all types of air pollutants that affect urban waterways, acid rain, sewage treatment, pesticides, oil spills, food waste, and more. [16]

Pollution is defined as the introduction of harmful substances or gases into the natural environment and can be used in many ways, including air, water, soil and noise. [17]

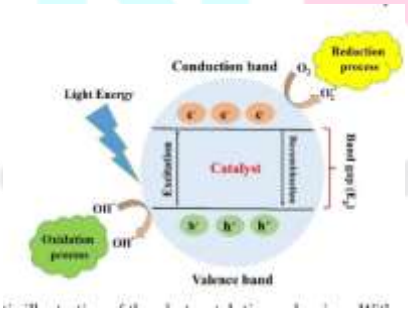
Types of Environmental Pollution

Types of pollution generally classified by environment include air pollution, water pollution and soil pollution. Nowadays, people are worried about some pollution such as noice pollution, light pollution and sound pollution. All forms of pollution have negative effects on the environment and wildlife and often affect people's health and well-being [2]. Also consists of noise pollution, thermal pollution, and radioactive pollution. Nanotechnology is effective in removing and monitoring pollutants in air, water and wastewater areas. Nano adsorbents, nanofiltration, nano photocatalysts, magnetic nanoparticles and nano sensors are some of the methods developed to use nanotechnology for water and wastewater treatment, air and pollution detection.

Mechanisms of nanotechnology

Nanomaterials can adsorb various pollutants in the air. Additionally, some semiconductor nanomaterials can be used for p hotocatalytic purification. Pollution control can also be achieved with nanostructured membranes whose pores are small enough to separate various pollutants from the air. Nanomaterial sensors are also used to detect pollutants such as hy drogen sulfide, sulfur dioxide and nitrogen dioxide.[3] New properties of nanomaterials offer the ability to interact with complex biological functions in new ways – operating at the various scales of biomolecules [21] Nanotechnology can expand agricultural production and support the food industry through applications of these unique properties. Nano sensors are able to detect microbes, moisture and toxic pollutants at very small levels. Organic pesticides and industrial pollutants can be degraded into harmless and often useful components through a process called photocatalysis using metal oxide semiconductor nanostructures. [25]

1. Nano adsorbents: Adsorption is one of the most important technologies in the purification of paint and heavy metal wastes. Nanomaterials have unique physical and chemical properties. A very important point is t hat most of the atoms with high chemical activity and adsorption capacity are on the surface of nanomaterials. [4] Mostly use in water pollution for attracting heavy metals.
2. Nanofiltration: Nanofiltration combines the removal of worthless substances at the nanoscale by the action of chemicals and membranes. Removal of uncharged material will be the result of so-called ultrafiltration. [5] Nanofiltration is basically use as filtration of bigger molecules more than 100nm.
3. Nano photocatalysts: It is used in nano form not in bulky form due particles which are nano in size with high surface area in it. Majorly used for water pollution. Basically light absorption takes place to form electron hole pairs, excited charges separates, all the charges and holes transfer to surface of photocatalyst for redox reactions.(convert pollutant to harmless products)



4. Nano sensor : In low concentration harmful pollutant can be detected (in very critical concentrations). The effectiveness of nano sensors in detecting gases such as nitrogen dioxide (NO2), sulfur dioxide (SO2) and hydrogen sulfide (H2S) was analyzed. [18]

Factors Affecting Nanotechnology

Factors which affects nanotechnology can be pore size the particle other than that the environment which include

temperature, pH, pressure, time and more. This all changes or disturbs the nanoparticle by quantity and quality as well. For example lets take pH as affecting for nanoparticles after change in pH it take particles to coagulate or flocculate. If change in temperature take place (increases in temperature) then the nanoparticles changes the size (increase in size of particles). Several factors, such as the method used for synthesis, pH, temperature, pressure, time, particle size, pore size, environment, and proximity, greatly affect the quality and quantity of synthesized nanoparticles and their characterization and applications. [22]

Pollution relating nanotechnology

There are many particles which are less than size 100nm which can not be easily detected by naked eye and it has to be filtered from environment to make surrounding pollution free. In the advance world nanotechnology helps in many ways. The advancement of technologies in this era leads to face many pollution types as well as population. Nanotechnology is being researched to provide new solutions for a clean environment and improve the performance of modern technologies. Technology is also exploring ways to combat pollution by reducing the release of pollutants or preventing their formation.[6] Nanostructured materials are used as biosensors to monitor and identify different compounds. Using nanoparticles may have advantages over traditional methods due to their larger surface area. Specific and electronic properties of some nanoparticles as adsorbents for pollutants. Many nanomaterials have adsorbent properties depending on their size. [7] In the field of membranes and filters, promising advances have been reported in many natural nanoporous materials (such as zeolites) used in water or oil long before these filters were delivered to nanotechnology Filtration and Processing. [8] For water nanoparticle play specific role.

One of the best methods available is nanomaterials with improved compatibility, capacity and selectivity towards heavy metals and other contaminants. The advantages of using nanomaterials are higher reactivity, greater surface contact and better performance. There are many examples of nanoparticles and nanomaterials that can be used in water purification, such as zeolites, carbon nanotubes (CNTs) Excerpt 12, self-assembled monolayers of mesoporous support, biopolymers, single enzyme nanoparticles, zerovalent metal (ZVI), et c. nanoparticles and others. [9] An advanced method that can be used is nanomaterials, with enhanced affinity, capacity and selectivity for heavy metals and other contaminants. The advantages of using nanomaterials are their higher reactivity, larger surface contact and better disposal capability. There are several examples of nanoparticles and nanomaterials that can be used for remediation of water, e.g. zeolites, carbon nanotubes (CNTs) Citation12, self-assembled monolayers on mesoporous supports, biopolymers, single-enzyme nanoparticles, nanoparticles of zero valent iron (ZVI), among others. [9] Nanomaterial also consist of nano sorbents, carbon nanotube, nanofibers, graphene, nano dendrimers, nanomembranes as well as nano catalysts. [11]

Why we should use Nanotechnology for pollution control

1. We have used traditional methods such as landfilling, landfilling, pyrolysis and incineration for waste management, but these methods are time-consuming, expensive, inefficient and ineffective, good for the environment. [11] Instead of which we can better use nanotools and technologies.
2. Nanotechnology has many new ideas to reduce waste in many processes, such as improving manufacturing processes, reducing hazardous chemicals, reducing carbon emissions and reducing the use of biodegradable plastics.[9]

Nanotechnology and air pollution

Due to the industrialization of human life, NOx, SOx, CO etc. The production of pollutants continues. Current methods to control these pollutants have limitations, including some that are not cost-effective and others that produce harmful products. Air also consist of other harmful gases from factories, and other burned areas. Most of these methods cannot remove small particles from the environment. Therefore, lower prices must be provided to solve this problem. Nanotechnology is a method currently used in the world in this regard. The creation of nano sensors, nano catalysts, nanocomposites, nano filters, and nano biomaterials are examples of using nanotechnology to solve environmental problems to reduce pollution. [12]

Nanotechnology and water pollution

When adding heavy metals such as Ni, Co, Pt, Hg, etc in water, water get contaminated easily. To clean this water, in

urben areas water is boiled and the minute particles left over (nanoparticles). To treat this particles most commonly used method in nanotechnology is adsorption of metal. The adsorbed molecules are often labeled as adsorbates. They have great potential for new, improved and faster cleaning methods to remove organic and inorganic contaminants such as heavy metals and micropollutants. [13]

Nanotechnology and soil pollution

As the environment is getting worst and polluted soil is also getting damaged/ polluted with the acts of human-made activities like pesticide showing with hundreds of harmful chemicals in it. Where Nano biological remediation is an effective technique that uses plants and bacteria to neutralize pollutants, ultimately improving soil quality and reducing pollution. These processes can remove, store or reduce pollutants by destroying the soil.[14]

Conclusion

As there is more and more uses of nanotechnologies and tools in our day to day life, we can conclude that the nanoparticles, nano sensors and other nano detecting filtrating tools are necessary for reduction of pollution percentage in this world. All the tools can be more or less helpings in the decrease of pollutant. Nanomaterials has to be filtered, adsorbed from the polluted areas.

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