Important Role of Nanotechnology for Environment

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Abstract

Nanotechnology play an important role in the development of new methods, tools and, techniques to solve specific quantitative and qualitative environmental problems. In the field of air, water and wastewater, nanotechnology has high efficiency for removing pollutants and detecting them. The direct and indirect effects of nanotechnology on the environment and air pollution can be studied from different aspects. The prospects for using this new technology are very broad. Today, nanotechnology is mentioned in the world as a key and influential technology in science, technology and industry. Nanotechnology utilizes a variety of knowledge and technologies such as physics, chemistry, biology and engineering. The production of nanomaterials, nanotubes, nanocomposites, nanofilters and nanoparticles are examples of the use of nanotechnology to build systems and significant applications in environmental issues .

1. Introduction

The direct and indirect effects of nanotechnology on the environment and air pollution can be studied from different aspects. The prospects for using this new technology are very broad. Today, nanotechnology is mentioned in the world as a key and influential technology in science, technology and industry. Nanotechnology utilizes a variety of knowledge and technologies such as physics, chemistry, biology and engineering. The production of nanomaterials, nanotubes, nanocomposites, Nano filters and nanoparticles are examples of the use of nanotechnology to build systems and significant applications in environmental issues. Several chemical companies are developing polymer materials reinforced with nanoparticles. These new materials can replace metal parts in the automotive industry. Extensive use of nanocomposites can reduce the consumption of 1.5 billion litres of gasoline in the life of one year of vehicles and reduce carbon dioxide-related pollution by more than 5 billion kg per year. The production of nanocomposites using nanotechnology has led to the production of highly durable and lightweight raw materials that are able to replace heavy metal parts and significantly reduce the weight of equipment and auto parts and consequently significantly reduce energy consumption and ultimately reduce air pollution. Also, preventing the emission of 2 million tons of carbon compounds and saving billions of dollars in energy are pleasant consequences of using semiconductor manufacturing technology using Nanotechnology is in the field of lighting, which in turn will reduce air pollution Biofuel cells that use nanotechnology in their production have

the ability to convert biochemical energy directly into electrical energy. These cells use microorganisms and enzymes that replace the metal of ordinary cells. The special and desirable characteristics of these cells are that they use wastes such as carbon dioxide and human wastewater. On the other hand, some believe that the use of nanotechnology itself could lead to new environmental problems such as new toxic substances and related biological hazards. The aim of this study was to investigate the effect of nanotechnology on the environment, especially to study pollutants and their treatment methods using nanotechnology.

2. Nano sensors for Environment.

Increased process control, ecosystem monitoring, and environmental decision-making occur when pollutant detection technology is more available and cheaper. Fast and accurate sensors that are able to detect pollutants at the molecular level increase the human ability to support sustainable human health and the environment. A sensor is essentially a type of energy converter that can detect certain properties or phenomena of physical, chemical, mechanical, etc. in its surroundings and display it as an output signal (usually as an electrical or optical signal). Accordingly, various sensors have been developed in various fields and have found many applications. One of the most popular sensors today is Nano sensors. Nano sensors are basically chemical, physical or biological sensors in nanoscale that can measure changes in the nanoscale with very high sensitivity and accuracy, qualitatively or quantitatively. High sensitivity, high detection power and the ability to measure several species simultaneously are the most important characteristics that have led to very wide confidence in the data obtained from sensors and Nano sensors.

A. Air pollution in environment

The entry of any particle, biological molecule, or harmful compound of solid, liquid, or gas into the atmosphere that poses a risk to the system, harms or diseases living organisms and affects the ecosystem of an area is known as air pollution. This type of pollution can originate from human or natural resources and is divided into two primary and secondary categories.

1. Primary pollutants are usually produced by a natural process such as a volcanic eruption or an abnormal process such as the combustion of fossil fuels and include substances such as carbon monoxide, sulphur and nitrogen oxides, volatile organic compounds, and so on.

2. Secondary pollutants, on the other hand, do not enter the atmosphere directly and are formed by the reaction of primary pollutants with each other, such as peroxyacetyl nitrate, which is produced by the reaction of nitrogen oxides and volatile organic compounds.

B. Emission of toxic gases

Emission and distribution of deadly and toxic gases is one of the dangers of everyday industrial life. Unfortunately, warnings in the industry are often too late to detect such leaks. The carbon nanotube (CNT) sensors are made of single-layer nanotubes about 1 nm thick and can absorb toxic

gas molecules. They are also able to detect a small number of deadly gas molecules in the environment. The researchers claim that these sensors will be used to detect war biochemical gases, air pollutants and even organic molecules in space.

C. Pollution due to heavy metal ions

Scientists have long realized that exposure to particulate matter and heavy metals can cause health problems and diseases such as heart disease, lung cancer and more. In urban areas, the size of airborne particles is typically around 100–300 nm; While heavy metals can be found in different concentrations. Also, heavy metals cannot be broken down by microorganisms, meaning they are not biodegradable. The many problems caused by the presence of heavy metal ions in water, soil, and air make it even more tangible that sensors need to be developed that can detect heavy metal ions before their concentrations reach hazardous levels.

3. Polluted Water and wastewater treatment

Today, nanotechnology is used to produce ceramic and polymer membranes in water treatment. These nanoscale membranes include ceramic membranes coated with catalytic and zeolite nanoparticles, organic-inorganic hybrid nanocomposite membranes, and biomimetic membranes. Bio-mimic membranes include biopolymer membranes containing protein molecules, carbon nanotube membranes, and block copolymer membranes with equivalent porosity. The performance of these membranes is improved based on water permeability, selectivity of contaminant molecules and mechanical strength. In general, biomimetic membranes have very little commercialization potential despite excellent performance. While nanocomposite membranes, in addition to high efficiency in water treatment, are now mass-produced. Zeolite and catalytic membranes, in addition to low to moderate improvements in the performance of conventional membranes, have very little use in water treatment.

3 (A). Nanofilters

Another important application of nanotechnology in the environment is the use of Nano filters in water and wastewater treatment. The membrane used in the Nano filtration process usually repels large molecules and, compared to other methods, is able to purify well water or surface water well with less energy. This process is able to remove a variety of bacteria, viruses, pesticides, pollutants of organic origin and calcium and magnesium salts from the water.

Due to the fact that no chemicals are used in the Nano filtration process to soften the water, so it's negative environmental effects are far less than conventional chemical methods.

3 (B). Nanotubes and nanofiber

Carbon nanotubes are the first generation of Nano-products to be discovered and introduced to the world in 1991. Nanotubes are made by wrapping granite sheets with a honeycomb-like structure.

These pipes are very long and thin and have stable, strong and flexible structures. Nanotubes are the strongest known fibres and are 1–100 times stronger than the weight unit of steel and can replace conventional ceramics and even metals in aircraft, gears, bearings, machine components, medical devices, sports equipment and industrial food production equipment.

4. Porous Nano polymers

When hydrophobic organic pollutants enter the soil through water, they are easily absorbed by water-insoluble solid particles and separated from the water. The phenomenon of adsorption and disposal of such pollutants from water to soil and from soil to air is very complex and depends on several factors such as solubility in water, water in the soil network and the competition of different soil components to absorb these particles. When there is more than one hydrophobic molecule in the environment, the pollutant molecules attach to the body that most closely resembles them chemically. For this reason, porous Nano polymers, which are very similar to pollutant molecules, are the most suitable means for separating this type of organic pollutants from water and soil. In general, the environmental applications of these nanostructures are: separation of organic pollutants from drinking water, treatment of effluents of industrial units such as nuclear power plants for reuse of treated effluents

5. Nanotechnology to prevent pollution

At present and future, nanotechnology has attracted a lot of attention. This technology has raised great hopes not only among researchers but also between governments and artisans to solve existing problems. One of the major problems in the world today is energy supply and environmental protection. On the one hand, fossil fuels are running out, and on the other hand, their use has led to environmental pollution. One of the most promising ways to provide clean and sustainable energy as well as control and treat pollution is to use nanotechnology.

Pollution prevention refers to the reduction of pollution sources and other methods that effectively use raw materials, energy, water and electricity and other sources to reduce or eliminate waste. Nanotechnology offers many new strategies to reduce pollution in various processes, including improving production processes, reducing hazardous chemicals, reducing greenhouse gas emissions, and reducing the use of plastics and replacing plastics with biodegradable materials.

Green production

The production process is always accompanied by a wide range of waste materials that are harmful to the environment. Ideally, the production process should be designed to minimize the use of raw materials and waste generation and energy consumption. Green production is a common name that broadly covers the methods and technologies to achieve these goals [. Green production includes the development of environmentally friendly industrial processes, for example, the design of water-based processes and their replacement with organic solvent-based processes, as well as the

reduction of hazardous substances, the development of green chemicals that are less harmful to the environment, and the use of processes with less energy consumption.

6. Role of nanomaterial in the environment

The application of nanotechnology can be divided into two main areas of the environment:

Field of monitoring of environmental pollutants using nanotechnology: One of the important and basic needs in relation to environmental pollution control is continuous monitoring of environmental pollution. Collection of data related to pollution in each region, the type of pollution, the extent of the spread of pollution, and as a result, an appropriate strategy will be determined to deal with it. Today, environmental organizations have set environmental laws and standards for industries and food to control pollution. Continuous control of pollution-producing sources is a difficult, complex and time-consuming task. Today, Nano-sensors make it possible to monitor the contamination status of the target areas point by point at low cost and on a large scale. Nano sensors consume less energy and can operate for a long time at low voltage without the need for a direct power source and transmit information wirelessly.

Environmental pollution elimination using nanotechnology: The biggest environmental challenge is the elimination of pollution in nature. These pollutants include air, soil and water pollution, which in the short and long term have devastating effects on the environment and human health. Removal of pollutants from the environment is very difficult due to its wide range. On the other hand, the elimination of contamination at the source and sources of contaminants is very important. In many countries, various methods have been used to reduce air, water and soil pollution in the environment. The use of nanotechnology makes it possible to reduce many air pollutants in cities and industries to a reasonable level, treat industrial and urban effluents in the best possible way to prevent water pollution, and minimize soil pollutants.

11. Conclusion

In the field of air, water and wastewater, nanotechnology has high efficiency for removing pollutants and detecting them. The direct and indirect effects of nanotechnology on the environment and air pollution can be studied from different aspects. The prospects for using this new technology are very broad. Today, nanotechnology is mentioned in the world as a key and influential technology in science, technology and industry. Nanotechnology is the science of arranging atoms to form new molecular structures and create new materials. Provides. The division of nanotechnology in different branches and disciplines is more related to the application of products of this technology in each discipline. Nanotechnology in the field of physics, chemistry and chemical processes can play an important role in the electricity and energy industry. Carbon nanotubes are capable of selectively absorbing gas in a stream containing a mixture of gases. This ability of nanotubes to be used to remove hazardous gases as well as environmental pollutants as well as other industrial purposes can be used.

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