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Investigating the Impact of Nanotechnology in Reducing Air and Environmental Pollution: A Review

Hemat Haji Mohammad[1*], Mohammadi Fida Mohammad[2], and Rishten Nik Mohammad[3]

[1]Department of Civil, Faculty of Geology and Mines Engineering, Ghazni Technical University, Ghazni, Afghanistan

[2]Department of Physics, Faculty of Education, Ghazni University, Ghazni, Afghanistan

[3]Department of Natural science, Faculty of Geology and Mines Engineering, Ghazni Technical University, Ghazni, Afghanistan

*Corresponding author email: enghemat555@gmail.com

ABSTRACT

Environmental pollution has a great impact on human health, ecosystem and financial development. The direct and indirect effects of nanotechnology on the environment and air pollution can be investigated from different aspects. The prospect of using this new technology is very wide. Today, in the world, nanotechnology is known as a key and influential technology on science, technology and industry,Nanotechnology uses various sciences and technologies such as physics, chemistry, biology and engineering. Nanotechnology is the science of building new materials atom by atom with desired properties, which is still at the beginning of its journey in the world and a very bright future is predicted for it among the many achievements of this technology is its application in the production, transmission, consumption and storage of energy with high efficiency and reducing environmental pollution, which creates a tremendous transformation in this field. It is expected that in the next 55 years, the world population will grow by 55% and the consumption of energy and materials will grow by 255%. So far, rising levels of production and consumption have countered our achievements in more efficient and cleaner technologies. Among these things, we can mention the production of urban solid waste, environmental effects caused by vehicles and air pollution, nanotechnology can contribute to reducing pollution or energy consumption of products. Air pollution is a change in the natural characteristics of the atmosphere due to chemical substances, dust or biological factors. Depletion of stratospheric ozone layer due to Air pollution has long been recognized as a danger to people's health and the earth's ecosystems.

Keywords: Air pollutants, Environment, Nano technology, Nanoparticles, Nano sensor, Toxic materials

INTRODUCTION

The world is facing significant environmental challenges like improving the standard of air, soil, and water. Currently, industry is that specialize in detecting pollutants (from chemical spills, fertilizer and pesticide run-off), improving industrial and mining sites, treating contaminants and stopping further pollution. A potential solution to those problems is to use nanomaterials (Borani, 2011). there are both positive and negative impacts on the environment thanks to nanotechnology, the use of this new technology is very wide, today in the world nanotechnology is mentioned as a key and influential technology on science, technology and industry (Khadimi, 1395). Nanotechnology uses various sciences and technologies such as physics, chemistry, biology and engineering. Despite the fact that nanotechnology has not been used industrially in the field of environment, many believe that this technology can provide new ways to improve and promote environmental technologies (Dehkardi, 2016). Air pollution is a change in the natural characteristics of the atmosphere due to chemical substances, dust or biological factors. Depletion of stratospheric ozone layer due to Air pollution has long been recognized as a danger to people's health and the earth's ecosystems. This air pollution may be natural (such as the activity of volcanoes), or Artificial pollution which is mainly caused by the activity of vehicles and factories. (Mori & Yasuda, 2009). Nine 9 million people die every year due to air pollution, 32% of them are in developed countries. in some countries, the number of people who die as a result of this factor is more than the victims of traffic accidents. This mortality is specifically related to asthma, bronchitis, shortness of breath, heart attack and various respiratory allergies (Abdali, 1933). Air pollution can have long-term and short-term harmful effects on human health in various ways, The effect of air pollution on different people is different. Some people are more vulnerable to air pollution than others. Young children and the elderly are more affected by air pollution than others. nanotechnology is used in cleaning and purifying

water and can also be used to clean the air from toxic gases such as CO, VOC and dioxin using nanotubes, gold nanoparticles and other absorbents (Rasana, 2016).

1-Pollutants: The most important pollutants that are produced through human activities include the following: Carbon monoxide ,Sulfur oxides, Nitrogen oxides, Volatile organic compounds Volatile aromatic compounds, Suspended particles ,Chlorofluorocarbons,Toxic metals such as Lead (Pb) Mercury (Hg)mercury Cadmium (Cd) Arsenic (As) Chromium (Cr) Nickel (Ni) Copper (Cu) Aluminum (Al) Thallium (Tl) Beryllium (Be),Tropospheric ozone, Radioactive pollution ammonia (Khadimi, 1395).

Air pollution: One of the important and fundamental needs in relation to environmental pollution control is the continuous monitoring of air pollution Nano-filters: Nanotechnology has facilitated the development of advanced air filters with nanoscale pores. These filters can effectively capture particulate matter, pollutants, and even microoorganisms from the air, improving indoor and outdoor air quality. This results in more effective conversion of harmful emissions, such as nitrogen oxides (NOx) and carbon monoxide (CO), into less harmful substances (Rasana, 2016).

Emission and Controlling exhaust and other gases

The release of deadly and toxic gases is one of the daily risks of industrial In fossil power plants, The way to control and know how to burn is to test and analyze the combustion exhaust gases, exhaust gases are controlled by sensors. As long as the sensor is more accurate and can constantly provide sufficient and accurate information, and of course, it is within the control of the operator, in addition to air and smoke, control of water and other fluids in the power plant, the pressure of pressure vessels, the force applied to sensitive parts under stress also helps to control the various movements of the power plant and reduce possible damages, To achieve this goal, sensitive Nano sensors should be used, With the use of nanotechnology, gas sensors can be produced that are much more accurate and have the ability to respond quickly. (Mosdad Taghni, 1932)

Environmental Nano sensors

A Nano sensor is a very small device that is able to identify and respond to physical stimuli at the scale of one nanometer. Nano sensors have found many applications in various sciences, including the environment, which will be mentioned below.

2- Nano composites

The production of nanocomposites using Nano technology has led to the production of very resistant and light raw materials that can replace heavy metal parts and significantly reduce the weight of equipment and car parts, and subsequently significantly reduce energy consumption and ultimately reduce air pollution. follow Preventing the release of 220 million tons of carbon compounds and saving 122 billion dollars in energy is one of the pleasant consequences of using semiconductor production technology using nanotechnology in the field of lighting, which will reduce air pollution (Rasana,2016).

3-Nano crystals

Increasing the problem of carbon dioxide in the air is one of the basic problems in the world. Modi's hope is that the day will come when we don't need to use fossil fuels and breathe in air free of carbon dioxide and pollution. Researchers at Melody Oak Reed University have succeeded in making nanocrystals to make us fashionable in having a clean air The nanocrystal acts as a catalyst, If the filters consisting of these nanocrystals can be made at a more reasonable price and installed in the chimneys, the release of carbon dioxide in the air can be prevented to a large extent. Diesel engines (diesel burning) are among the most important sources of air pollution with nitrogen oxides. Researchers at the Pacific Northwest National Laboratory are investigating nanomaterials that can be used in filters to prevent the release of organic vapors from factories (Borani, 2011).

4- Nanotubes absorbing toxic gases

Carbon nanotubes are the first generation of nano products that were discovered and offered to the world in 1331. Nanotubes are obtained by wrapping granite sheets with a honeycomb-like structure. These tubes are very long and thin and They have stable, resistant and flexible structures. Nanotubes are the strongest known fibers and are 122 times stronger than the unit weight of steel and can replace ordinary ceramics, aluminum and even metals in the construction of airplanes, gears, bearings, machine components, medical devices, sports

equipment and industrial food production devices, Recent studies suggest that carbon nanotubes be used for biological purposes such as crystallization, proteins, and making bioreactors and biosensors, carbon nanotubes are the most suitable means for absorbing toxic pollutants such as dioxin, they have a very high price, (Bhushan, 2010).

5- Nano porous polymers

When hydrophobic organic pollutants enter the soil through water, they are easily absorbed by solid particles insoluble in water and separated from water. The phenomenon of absorption and removal of these pollutants from water to soil and from soil is very complex and depends on several factors such as the state in water, the water in the soil network and the competition of different soil components to absorb these particles, by using cyclodextrins as the main components of these polymer materials, a new class of organic polymers with very fine pores (the diameter of the pores of these compounds is about 2.0 to 1.0 nm) have been produced. Such porous Nano polymers are able to increase the concentration Reduce pollutants in drinking water to a few parts per trillion (ppt) (Jamir, 2009).

6- Nano powders

Nano powders are highly active materials that are melted or alloyed at low temperatures. These powders are used in injection molding processes Covering different surfaces are used. A type of Nano-structured powder that contains aluminum particles, if added to rocket solid fuels, increases their burning intensity by two times. Add this Powder to kerosene accelerates its combustion and thus reduces the production of various pollutants. the capability of Nanotechnology which means that these methods can be used to protect the environment in the not-so-distant future and along with the use of natural resources with the help of advanced technologies, it is possible to reach a sustainable interaction with nature and ultimately sustainable development (Zelini, 2012).

7-Nano technology to absorb toxic gases

In the environment, it can be solved by Nano technology. For example, the use of nanotechnology in the purification and removal of toxic gases is the process of absorbing CNTs and gold particles. CNTs consist of a hexagonal arrangement of carbon atoms in the graphite layer that surrounds the axis of the tube, the high resistance of CNTs against oxidation is useful for adsorbent regeneration at high temperature. CNTs, both single-walled nanotubes (SWNTs) and multi-walled nanotubes (MWNTs), are unique molecules that have a one-dimensional structure, thermal stability, and exceptional chemical properties. (Kulkarni, 2008).

These nanomaterials have shown that they have good potential as superior adsorbents for the removal of various types of organic and inorganic pollutants both in the water environment and in the air. the capacity to absorb pollutants by CNTs is mainly due to the pore structure and the existence of a wide range of functional groups on the nanotube surface, which can be obtained by chemical or thermal treatment to adapt CNTs in order to have a desired performance, their electronic properties and unique structures have attracted (Bhushan, 2010).

CONCLUSION

Due to the fact that in recent years, countries are peaking in the field of Nano research, it seems reasonable to use Nano technology as a strong support in the direction of large programs, the capabilities of nanotechnology means that these researches can be used to preserve the environment in the not-so-distant future, and along with the use of natural resources, with the help of advanced technologies, it is possible to have a sustainable interaction it came with nature. nanotechnology is used in cleaning and purifying water, this technology can also be used to clean air from toxic gases such as CO, VOC and dioxin using nanotubes, gold nanoparticles and other adsorbents. the role of nanotechnology in all dimensions is undeniable, another aspect of this ability is the possible risks associated with the use of nanotechnology products, therefore, while emphasizing the importance of nanotechnology, it is necessary to prepare and compile regulations for the safe and healthy use of Nano products so that all nanotechnology activities can be controlled and monitored based on them.

The results of this study showed that published articles in the field of nanotechnologies in the field of environmental health were few, Due to the positive impact of nanotechnology on environmental health in developed countries, it is recommended that scientists, professors, researchers and even students of environmental health in developing countries, expand their nanotechnology knowledge through interdisciplinary

and regional and international partnerships, Reduce and eliminate environmental pollutants such as water, air and food pollution and other sub-sectors of environmental health.

Nanoparticles may have unique toxicological properties compared to their larger counterparts. Their small size can allow them to penetrate biological barriers more easily, raising concerns about their potential toxicity to living organisms.

The increasing use of NMs also leads to an increased production of waste and residues, with the relevant exposure of operators in the building sector. Approximately 60% of nanomaterials are used in medical-pharmaceutical or industrial applications (e.g., in the textile and electronics industries) with several industrial processes which can lead to waste streams resulting from the cleaning of production chambers , Studies have also shown that certain nanoparticles may have adverse effects on aquatic organisms, soil organisms, and even human health if exposure occurs.

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