



Nanotoxicity- Health Hazardous Nanoparticles In Environment

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Abstract:

Modern society welcoming new emerging technology 'nanotechnology' while scientists and researchers, industries which are directly related to nanomaterials are them. Use of nanoparticles have showed in various field benefits in a wide range of applications, however, the effects of exposure to nanoparticles on health are related with the production and use of nanoparticles. The Human being have always been come in contact to tiny particles via dust, storms, volcanic ash, and other natural processes and enter to the body. In human physiological structure there is a protective system which save us from harmful particles. In the physiological system, there are also a particular arrangement which remove or fight with tiny hazardous microorganisms present in the body includes viruses and non-biological particles. Human activities like burning wood, coal for various purposes, smoke from industries and vehicles transportation has produced harmful particulate pollution. In the present era as nanotechnology is growing rapidly, nanoparticles which are adversely affect human health, are releasing in the environment in large scale. Because of nanosized, properties of nanoparticles change drastically. As compare to macromolecules, inhaled nanoparticles cannot be easily removed by the protecting mechanisms in the lung, causing lung damage, and that nanoparticles can spread through the blood circulation, lymphatic, and nervous systems to many tissues and organs, including the brain. This review paper focuses nanoparticles offer various benefits in a range of applications, significant threats to humans and to understand the toxic effect of nanoparticles smaller than cells in size, can be easily enter in human body and can damage bodily system and structure and cannot function properly.

Keywords: Nanoparticle, Dust, Forest, Nanotoxicity, Environment, Health

Introduction:

Nanoparticles are tiny particles ranging from 1 to 100 nm (nm) in size. They are used in a wide range of applications and can be categorized into four types: 1) Inorganic-based nanoparticles, 2) Carbon-based nanoparticles, 3) Organic nanoparticles, and 4) Composite-based nanoparticles. Inorganic nanoparticles include different metal and metal oxides. Carbon-based nanoparticles include fullerene, graphene, carbon nanotubes, carbon black, and carbon fiber. Organic-based nanoparticles are derived from organic materials without carbon, whereas

composite nanoparticles are combinations of various nanoparticles. From last two decades, nanoparticles have drawn great attention due to their use in consumer products, medicine, health, textiles, cosmetics, soil, and aquatic environments. water treatment, environmental remediation, cancer therapy, radiology. This growing attention and expansive usage of nanoparticles is due to specific characteristics unveiled by such particles due to their small size and large surface area. These unique qualities though advantageous, can create certain risks to living organisms. Every human being come in contact to nano

particles as one breath. In real sense, every organism on Earth continuously come in contact with nano particle willingly or unwillingly. Most of the time, man unseen these nanoparticles. Nanoparticles present in the environment are in the form of dust or microorganism. The most toxic microorganisms are viruses, which attack on human body and disturb the physiological function and affect men wellbeing condition systems adversely. The chemical composition of viruses produce the common cold or flu, which are the abnormal symptoms of biochemical conflict between viruses and bodily immune systems. A recent studies show that nano and micro-organisms play a vital role in many chronic and uncured diseases. Nanoparticles have the capacity to enter the human body and travel through human body with the help of circulatory system. Though natural activities like volcano have produced nanoparticles, advanced synthetic processes also prepare materials with structure and engineered at the nanometer scale. The tiny nano particles contain hundreds of atoms, with dimensions at the scale of nanometers. They are rather good competent with the size of microorganisms, like HIV virus size is 100 nm in diameter, and which may be referred as nano microorganisms like viruses, many nanoparticles can come in contact with the lung or expose to skin and enter the circulatory and lymphatic systems of men and animals, reaching most bodily tissues and organs, and damaging cellular and organelle processes and causing disease. The toxicity of each of these materials depends greatly, however, upon the particular arrangement of its many atoms. [1,2,5]

Nanoparticles in Nature:

Nature is a treasure of amazing materials with unique properties and characteristics. Nanoparticles are tiny particles that are present everywhere in nature, from the air we breathe to the water

we drink. They are available in various forms, such as metals, minerals, and organic matter. Nanoparticles can be created from natural sources like Volcanic eruptions, Forest fires, Soil erosion. Volcanic ash contains nanoparticles that can affect the environment and human health. Forest fires set free nanoparticles into the air and causes air pollution. Soil erosion can lead to the release of nanoparticles into water sources. [3,4]

There are several types of natural nanoparticles including Metal nanoparticles like copper, silver, and gold, Mineral nanoparticles like clay and silica, Biological nanoparticles such as plants and animals, micro-organisms. Natural nanoparticles play a vital role in shaping our environment. Their impact spread over the Water cycle, Soil quality and Air quality. Nanoparticles can involve in the formation of clouds and precipitation. Nanoparticles can impact soil fertility and plant growth. Nanoparticles can contribute to air pollution and affect human health. Air quality has been greatly affected because of large quantity of nano particles has been released through transportation, production industries and human activities like burning charcoal and natural calamities such as dust storms, volcanic eruptions and forest fires worldwide. These nanoparticles are noticeable from satellite. Particulate matter and airborne particles of dust and soot ranging from the micro-to nanoscale can also be detected by spectroscopic study. Nanoparticles present in the air, affect the entire planet's energy balance because they both absorb radiation from the sun and scatter it back to space. In conclusion, natural nanoparticles are an essential part of our environment, and their impact on our ecosystem is substantial. Understanding the sources, types, and environmental importance of natural nanoparticles is helpful to understand the complexity of our natural world. [6,7]

Adverse Health Effects of Dust Nanoparticles:

Dust nanoparticles are produced by various natural processes including Desert storms and dust devils that can raise massive amounts of dust particles into the air, which can then be carried over long distances. Dust storms are the largest single source of environmental nanoparticles the deserts. The size of particles produced during a dust storm varies from 100 nm to several microns. Volcanic eruptions can release vast amounts of ash and dust particles into the atmosphere and deteriorate the air quality and human health. Soil erosion release dust particles into the air, particularly in areas with poor land management practices. [8]

Dust nanoparticles produce by storms, volcanoes, and soil erosion can have rigorous adverse health effects. These tiny nanoparticles can penetrate deep into the lungs, causing inflammation and damage. When inhaled, dust nanoparticles can access to respiratory issues, such as bronchitis, asthma, and chronic obstructive pulmonary disease. They can even reach the alveoli, the smallest air sacs in the lungs, causing irreversible damage.

Openness to dust nanoparticles can induce cardiovascular disease, including heart attacks, strokes, and arrhythmias. The particles can cause inflammation in the blood vessels, form plaque and elevate blood pressure. Recent studies show that dust nanoparticles can even cross the blood-brain barrier, can cause neurological damage and increased risk of neurodegenerative diseases, such as Alzheimer's and Parkinson's. Outdoor air pollution, including dust nanoparticles, as carcinogenic to humans. Prolonged exposure to these particles can increase the risk of lung cancer and other types of cancer. [8,9]

To protect from the adverse health effects of dust nanoparticles, it's essential to monitor air quality regularly.

Track air quality indexes and take necessary precautions and required action when air pollution is very high. When outdoor use of masks, goggles and protective clothing during dust storms or volcanic eruptions work as a safeguard to protect health. One can avoid outdoor activities during periods of high dust nanoparticle concentrations stay indoor for safety. By sustainable land management practices that reduce soil erosion and promote ecosystem health are the necessary action for human health. [5,9]

Health Effects of Forest Fires:

Forest fires have been a noticeable natural activity for human being. Forest fire spread ash and smoke over thousands of square miles and lead to an increase of nanoparticles causes air pollution. Recent studies showed that during forest fires, medical complications increase more than 50% in the affected regions. Specialty cardiopulmonary conditions have been largely affected. Forest fires release plenty of nanoparticles into the atmosphere and cause adverse health risks to humans and wildlife. These nanosized particles, ranging between 1-100 nanometers, can enter deep into the lungs, causing inflammation and damage. [7,10]

The nanoparticles liberate during forest fires can aggravate respiratory problems like bronchitis, asthma, and chronic obstructive pulmonary disease. Persistent exposure to these particles can cause irreversible lung damage. The toxicological impact of forest fire nanoparticles can also elevate the risk of cardiovascular disease, including heart attacks, strokes, and arrhythmias. These particles can cause swelling in the blood vessels, formation of plaque and increased blood pressure. Forest fire nanoparticles can even cross the blood-brain barrier, leading to neurological damage and increased risk of neurodegenerative diseases. Forest fire nanoparticles, as carcinogenic to humans.

Prolonged exposure to these particles can increase the risk of lung cancer and other types of cancer. [11]

To reduce the adverse health effects of forest fire nanoparticles, it's essential to monitor air quality indexes and take necessary precautions. Wear masks and protective clothing when outdoors during forest fires. Sustainable forest management practices to reduce the risk of forest fires and promote ecosystem health. If air cleaner is used by the society there will be less hazardous health effects on the lower respiratory tract because most of the fire-related death are due to respiratory problems related to smoke inhalation and not necessarily burns. [12]

Health Effects of Indoor Air:

Man generally spend much of their times indoor, indoor pollution directly affect our health. Indoor air can be more polluted than outdoor air. Humans activities produce abundant amount of particulate matter indoors. Textile fibers, skin particles, spores, minning, chemical, smoke from candles, cooking, and cigarettes are the great sources of generation of nanoparticles. These nanoparticles spread through and enter from outdoor to indoor through door and ventilation systems. Indoor nano particles are tiny particles that are present in the air inside homes, buildings, and other enclosed spaces. These nanoparticles can enter through various sources, including cooking, cleaning, and construction activities. Indoor nano particles can have serious health effect. Cooking activities, such as frying and baking, can release nano particles into the air. Cleaning products and activities, such as vacuuming and dusting, can also release nano particles. Construction activities, such as drilling and sawing, can release nano particles into the air. Some furniture and decor items, such as carpets and upholstery, can release nano particles. Wood burning is great soruce of nanoparticles and assumed to

be benign to the environment simply because wood is a renewable source. Indoor nano particles can exacerbate respiratory problems, Cardiovascular Disease, Neurological Damage, Cancer Risk. [13]

To reduce exposure to indoor nano particles proper ventilation systems should be installed to remove nano particles from the air. Modern air purifiers should be used to remove nano particles from the air. Minimum use of strong chemicals for cleaning and construction activities is also one of the best preventive measures. Products that are designed to reduce nano particles, such as nano-particle-reducing paints and furniture should be applied in regular activities. [14]

Conclusion:

The presence of nanoparticles in our environment and everyday nanoproducts has created serious problems about human health. The recent studies show that nanoparticles can have hazardous effects specially when inhaled, ingested, or absorbed through the skin.

Nanoparticles can produce reactive oxygen species, generate to oxidative stress and cellular damage. Nanoparticles can increase inflammatory responses, produce respiratory and cardiovascular problems. Some nanoparticles can cause DNA damage, increasing the risk of genetic mutations and cancer.

Formation of regulatory frameworks to assure safe handling, use, and disposal of nanoparticles. Execution of safety measures to reduce exposure to nanoparticles, such as using personal protective equipment and ventilation systems. Continuous efforts in research and development to understand toxicity of nanoparticles and develop safer alternatives. Continuety to investigate the toxicological effects of nanoparticles on human health and develop safer nanoparticles with reduced toxicity and improved biocompatibility are also the

measures to curtail nano toxic effect on human health. It is also necessary to educate the people about the potential risks and benefits of nanoparticles.

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