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Impacts of Nanotechnology on Environment: Review

Pratima Singh
Department of Physics, D.A-V .College, Kanpur-208001, U.P., India

ABSTRACT
Nanotechnology increases the strength of some materials and devices and enhances efficiency of monitoring devices, remedy of environmental pollution, and production of renewable energy. While it is considered to be the positive effect of nanotechnology, there are certain negative effects of nanotechnology on environment in many ways. It increases toxicological effects on the environment due to the uncertain shape, size, and chemical compositions of the nanomaterials. It can be difficult to understand the risks of using nanomaterials and effects of the resulting harms. It is required to perform an analysis for nanotechnology products at all stages to understand the hazards of nanomaterials. The resultant knowledge can then be used to predict the possible positive and negative impacts of the nanomaterials, impacts on the environment can be positive by choosing right and less toxic materials. This can be very useful by the training the scientists, engineers and policymakers working in this field in positive way.
Keyword: *Nanotechnology, nanomaterial, environment.*

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INTRODUCTION

Nanotechnology uses the unique properties of nanomaterials which have at least one dimensional size of a material between 1 nm to 100 nm to produce nanoscale components, devices and systems [1]. Applications using nanotechnology contains manufacturing various products, measuring, imaging and manipulating material on the nanoscale. Nanotechnology is interesting by scientists in the fields of nanocomposites, biocomposites, optical, biomedical, and electronic manufacturing [2]. Nanomaterials are currently being developed fastly and one novel application includes polymer based composite materials which can be used in the aircraft and wind energy fields. Nanoparticle has relatively larger surface area per unit mass which is the important factor to increase mechanical properties, physical and chemical properties.

Nanotechnological devices consume less energy and reduce material wastes and help in monitoring the problems. Nanotechnology can also be considered to reduce and prevent the toxicity of nanoparticles in environment more effectively [3]. There are certain areas of manufacturing nanomaterials recently beneficial from the development of nanotechnology. The use of nanomaterial into a coating material resulting in the need for only one layer as a result of which it does not require a multifunctional film coating. The applications for a graphene based coating are to apply it to a blade used in wind turbines and on the body of an airplane. It preserves the weight increasing efficiency. Polymer composite materials compared with traditional structural materials made of metals having a reduced weight, high specific mechanical properties and high resistance to environmental effects. Polymer composites with nanoparticle reinforcement to composite materials offer engineers and scientists many choices to tailor the material properties to fit design specifications. Nanoparticle includes nanofibers, buckyballs, carbon nanotubes, and grapheme etc. Nanodevices can also be made by using nanotechnology and are used in many applications such as in sun glasses, sun screens, semiconductors and sports equipments. Nanotechnology can provide future solutions for many environmental problems. It also creates negative impacts on the environment. Therefore, evaluation of the positive and negative impacts of nanotechnology is essential for the safety of society and environment on the earth.

POTENTIAL ENVIRONMENTAL EFFECTS

Nanomaterials have larger surface area than the bulk materials which can cause more destruction to the human being and environment in comparison to the bulk materials. Therefore the potential risk to the society due to nanoparticles has attracted national and international attentions of scientists, engineers and policymakers working in this field. Nanoparticles are beneficial to tailor the properties of polymeric composite materials and environment in air pollution monitoring and also to help reduce material consumption .By using nanotechnology it is possible to apply a nanoscale coating on materials. The material will last longer and retain the initial strength longer. Carbon nanotube has been used to increase the performance of data information system. There are some considerations of potential risks needed to be considered using nanoparticles. The major problems of nanomaterial are the nanoparticle analysis methods. By the improvement of the nanotechnology, new and novel nanomaterials are gradually being developed. The materials vary by shape and size which are very important factors to determine the toxicity of the nanomaterials.

Lack of information and ways of characterizing nanomaterials make existing technology very difficult to detect the nanoparticles in air for the protection of the environment. Information of the chemical structures are a critical factor to determine toxicity of the nanomaterials and minor changes of chemical function group could drastically change properties of nanomaterials. Good experimental design in advance of manufacturing a nanotechnology based materials can reduce the material wastes. Carbon nanotubes have applications in many materials for memory storage, electronic, batteries etc. Some scientists have concerns about carbon nanotubes because of unknown harmful impacts to the human being by inhalation into body .Initial data suggests that carbon nanotubes have similar toxicity as asbestos fiber [4]. Lam et al. and Warheit et al. examined pulmonary toxicological evaluation of single-wall carbon nanotubes [5]. Warheit found multifocal granules were produced when rats were exposed to single-wall carbon nanotubes [6].

As new nanoscale materials are becoming smaller this is more difficult to detect toxic nanoparticles from waste. This waste may contaminate the environment. Nanoparticles may interact with environment in many ways. It may be attached to a carrier and transported in underground water by contaminants or organic compound etc. Possible aggregation will allow for conventional transportation to sensitive environments where the nanomaterials can break up into colloidal nanomaterials. There are general methods that nanomaterials can be emitted into atmosphere [7]. Nanoparticles are emitted into air directly from the source known as primary emission and are the main source of contamination of the environment. Nanoparticles are developed in advance of the toxic assessment by scientists. Many of the nanoparticles are soluble in water and are difficult to separate from waste if handled inappropriately .Waste product including nanomaterials can cause environmental problems if disposed in wrong manner.

POSITIVE EFFECTS ON ENVIRONMENT

Nanotechnology provides potential economic, societal and environment benefits. Nanotechnology has the potential to help in reducing the human footprints on the environment by providing solutions for energy consumption, pollution, and green gas emissions. Nanotechnology offers the potentials for significant environmental benefits. It includes cleaner and more efficient industrial processes, improved technologies to detect and eliminate pollution by improving air, water and soil quality, high precision manufacturing by reducing amount of waste, clean abundant power via more efficient solar cells. It also includes removal of greenhouse gases and other pollutants from the atmosphere, decreased need for large industrial plants .It contains remediating environmental destructions. The nanoscale products which utilize nanomaterials in an industrial or research use can benefit the environment in several ways.

NEGATIVE EFFECTS ON ENVIRONMENT

Considering of the environmental effect and risk associated with nanotechnology is very limited and inconsistent. The potential environmental harm through nanotechnology can be summarized in following ways. High energy requirements for synthesizing nanoparticles are causing high energy demand. Dissemination of toxic nanomaterials are originating environmental harm .It contains lower recovery and lower recycling rates. Environmental implications of other life cycle stages are also unclear.

EDUCATIONAL ISSUES

Industry and education including schools, colleges, and universities will have to respond to the change in dynamical and compositional workforce. It is necessary to change curriculum to match changes in society

with the help of science, technology. Organized education and training systems to college students and researchers in laboratories is a key factor to reduce the negative impacts of nanotechnology.
Developing new nanotechnology training centers and providing safety seminars and conferences could not only benefit the students but also engineers, industrial manufactures and scientists working in this field. Public media is an important way to make popular the information about nanomaterials and to educate public to know the advantages and disadvantages of nanomaterials for the commercial products which contains nanomaterials.

CONCLUSION

Nanotechnology will develop in continuous manner undoubtedly. It can be a beneficial to the society and improve the environment in various ways. Nanoscale materials will make the products better in terms of functionality, weight saving, less energy consumption and a more clean environment. Shortcomings always exist with new unproven technology. Nanomaterials may help to clean certain environmental wastes but pollute environment in other ways. Choosing the right and novel nanomaterials in right manner is one of the most important parameter for the future direction of nanotechnology. Ethics of participants in this field need to be defined before the commercial use of nanotechnology.

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