

## Environment, Climate change and Nanotechnology

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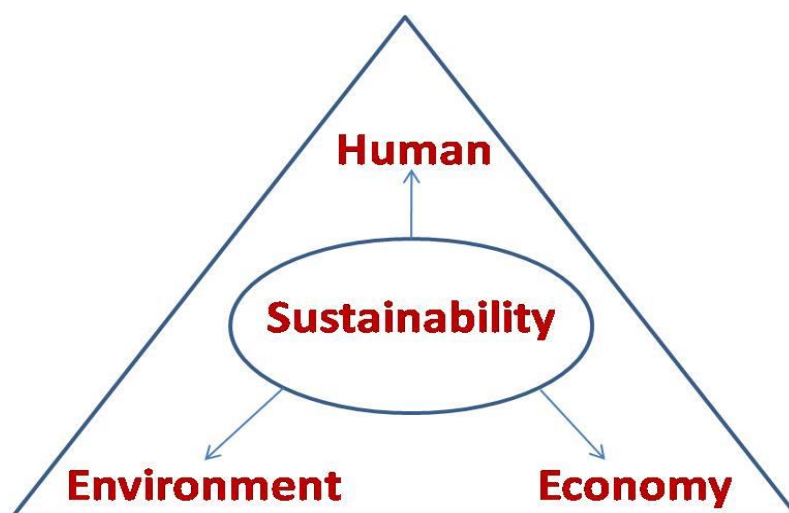
### Abstract

In this work, we are summarizing the various environmental issues. Global warming and climate change are the major environmental concerns to deal with. The prime cause of global warming and climate change are greenhouse gases produced by various sources. Air, water and soil pollutions are other important concerns. Moreover, they adversely affect our ecosystem. Nanotechnology has shown potential wide range of applications in every field. This technology show great promise to combat the environmental issues by using the nanomaterials. This study tries to present possible the nanotechnology-based methods to create the nanomaterials for promotion of sustainable environment and to solve the problems arising due to climate change.

**Keywords:** Climate change, Environment, Nanotechnology, Nanocomposites, Nanocatalyst.

### Introduction

Our life on the Earth is endangered by the countless worldwide problems such as environmental pollution, climate changes, energy crisis, etc. Sustainable development is that which provides all the present needs without compromising the ability of future generations to meet their own needs[1,2]. Environmental sustainability is our accountability to preserve natural resources. It is our duty to defend global ecosystems to sustain physical condition and health for next generation. Social system supports human existence, earth's ecosystem supports human life and human system supports human's health. All three are related to each other, and hence sustainability. The three pillars of sustainability are people, economic and environment. Therefore, it is necessary to consider about environment, people and economy. So without affecting the environment and ecosystem, greatest challenge for mankind is to provide a good healthy life conditions to all human being.



**Fig.1. Sustainability and its pillar**

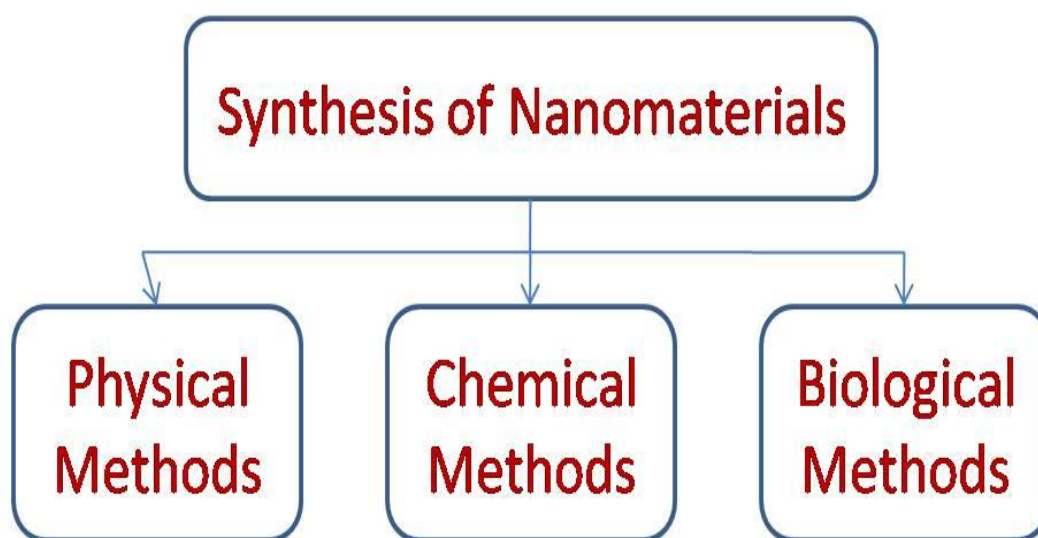
Advances in nanotechnology make it promising for health of environmental and benefits of sustainability. In last few decades, Nanotechnology has found wide applications in many fields such as medical, chemical, physical, sensor technology, renewable energy, communications, etc.[3-6]. However, this technology can have unintentionally side effects on environment health leading to make negative impact on earth's ecosystem. Therefore, taking the advantages of this technology, it is necessary to examine the possible implications on environment and ecosystem. In this study, we have tried to summarize the environmental issues, their effect on climate, positive and negative outcomes of environmental nanomaterials.

1. **Effect of climate change:** - We see climate changes as a severe threat for human kind as well as other living things. In this changing climate, production of agricultural crops might extremely be reduced. In future, these changes will trigger major shift in distribution of agricultural crop. Environmental pollution is also very serious risk to our health and to entire ecosystem. This pollution can also affect the quality and quantity of crops yield globally. Therefore, there is a crucial need to develop and improve the polluted lands to reduce the gap between worldwide consumption and worldwide food production. Furthermore, in last few decades, climate change has also been realized as a consequence of increase of global average temperature and CO<sub>2</sub> concentration in atmosphere [7-9]. Greenhouse gases such as CO<sub>2</sub> are the major reason for increasing the earth's temperature, resulting in global warming. Natural greenhouse gases and industrial greenhouse gases, both enhances the depletion of ozone layer, and consequently resulting in damaging the environment by affecting the human life and their health. Besides, they will also affect the entire ecosystem in near future by damaging the environment by melting the glaciers, erosion of coast area, floods, pollutants, and in many other ways [10-12]. This will change the whole system on earth.

We will see hot air and ocean resulting in altering the ocean currents, raising the sea level which will obviously result in severe weather conditions. The impacts of climate changes will negatively affect the environment by damaging the marine ecosystem and biodiversity, change in temperature will result in change of seasons, melting of glaciers will raise the sea level. These will affect the agricultural system. As season system and weather system will be changed, it will affect the agriculture crop productivity by damaging the quality and quantity. Rise in sea level or drought will affect the soil fertility and hence this will be other challenging factors. Climate change will also affect the human health system. As temperature rise, heat induced mortality is seen in Europe, allergic pollens is seen in Northern Hemisphere, deprived diet and increased cases of psychological health have become known to us due to climate change [13]. Many humans and living being have to move from their origin due to severe weather conditions arising of climate change. Also marine biodiversity and ecosystem is also damaged by the climate change, and hence many species have reached to the danger of extinction. Forest fires are now very often, and species living in forest are very hard to overcome and survive these events. Thus we find that we, human beings, and our activities are directly responsible for climate change, and climate change disturbs the ecosystem affecting each sectors such as health, agriculture, social, tourism, industry, and economy.

2. **Benefit of nanotechnology in environmental science:-** Over the last few decades, nanotechnology has been explored for their unique and improved properties than that of bulk particles. Now-a-days, lot of work is directly and indirectly linked to nanotechnology research. The same particle, for example gold, behaves and shows different property in nanosize than that of bulk counterparts. All this is as a consequence of increased surface area than the volume. And due this, nanomaterials show unique and excellent optical, magnetic, electrical and catalytic properties than their bulk counterparts, and hence they can be utilised in many applications. Nanotechnology is an emerging and new technology. Tuning of size and shape of these

nanomaterials leads in almost every important application in medical, industrial, electronics, environmental, energy, catalysis, material science etc [14]. Basically, the word *Nano* means *dwarf*. The particles with at least one dimension between 1 and 100 nm is termed as nanomaterials. Based on the dimensions of nanoscale (<100 nm), nanomaterials can be classified in zero-dimensional nanomaterials (all the three dimensions are in the nanoscale range), one dimensional nanomaterial ( two dimension are in nanoscale range) and two-dimensional nanomaterials (any one dimensions are in nanoscale range). Based on this classifications, few types of nanomaterials are nanoparticles, nanorods, nanotubes, nanowires, nanofilms, nanosheets, etc. these nanomaterials shows different size, morphology and properties. Metal nanoparticles, metal oxide nanomaterials, polymeric nanomaterials, carbon nanotubes or semiconductor nanomaterials are few of them. These nanomaterials are prepared by broadly two methods: 1. Top-down approach and 2. Bottom-up approach.



**Fig.2. Flow chart of synthesis method of nanomaterials**

Metal nanomaterials are prepared by chemical method by using reducing agent. High surface area of nanomaterials makes them highly reactive and enhanced their adsorption ability. These properties make metal nanoparticles suitable for bioimaging and environmental studies. [15]. Semiconductor nanomaterials can be metallic or non-metallic properties and extensively used in photocatalysis and electronic devices. High adsorption ability makes them useful for gas sensing device. Based on novel optical properties of nanomaterials, they are used in optoelectronic materials, LCDs and LEDs.

The importance of nanotechnology to address the challenges for environmental sustainable development can be understood by taking the consideration as in nanotechnology, less material is required and hence less water, less energy, less wastage. Nanosensors can quickly and accurately measure the effects of human activities on environment. Also, nanotechnology provides numerous solutions to minimize the damage on environment. Renewable energy increases the efficiency of clean energy production. Thus nanotechnology can come as saviour in environmental sustainable growth in waste management, air pollution, water scarcity and nanomaterial safety. In addition, nanomaterials have shown great potential in developing sustainable implements to change the conservative tools in respective fields. The larger surface area of nanomaterials can have advantage of better reaction with other materials. Also their high adsorption ability can be applicable to

transport clean energy and adsorb greenhouse gases [16]. In bioimaging, metallic nanoparticles have been applied. In agriculture, better production of crops is possible using nanomaterials based fertilizers and pesticides and hence is potential in restoring ecosystem balance.

In environment, pollution is major problem. Pollution in air, water and soil makes it unhealthy for human being. Consequences of this, people are suffering from various diseases, global warming, climate change, etc. Nanomaterials with high surface area, high reactivity, sensitivity and unique properties make it important rescuer to deal with environmental problem. Controlling the size of nanoparticles, nanomaterials based product can be used to control water pollution, air pollution and soil pollution. As we can see, nanotechnology has major positive applications for mankind to make their life easy.

However, one concern of nanomaterials cannot be ignored and that is toxicity of nanomaterials. Some nanomaterials have shown properties differently at nanoscale and hence when they are prepared at nanoscale, it can be more toxic than macro particles. These toxic nanomaterials when interact with human body or plant or animal body, they can show toxicological effects leading to damaging the respiratory system and indigestion system. Silver nanoparticles are widely used in water filtration and cosmetic products, so they can cause harm to aquatic environment. Long and large exposure of nanomaterials to human body can cause harm to human health.

Therefore, monitoring and assessment of use of nanomaterials to human body need to be tested extensively and improvement is required. There is no doubt that nanotechnology has been emerged as great technology with applications in every field. Yet it needs some important guidelines and regulations to use it safely. The department of science and technology (DST) in India has given "Guidelines and Best Practices for Safe Handling of Nanomaterials in Research Laboratories and Industries". In addition, government needs to make strong law and policies for waste management arising due to nanotechnology and use of toxic nanomaterials like in other developed nations.

**Conclusion:-** This is high time to take seriously the impacts of climate change, global warming and other environmental issues. All those methods and techniques which affect the environment, we should chose those conservative methods to minimize the pollution and global warming. We have witnessed that emerging nanotechnology have potential to give sustainable solutions. The nanomaterials are used alternative methods to sustain and maintain the balance of environment. Owing to their unique properties, nanomaterials have vast applications in the field of medicine, power generation, environmental sustainable, wastewater treatment, greenhouse gas confiscation. Moreover, this nanotechnology technique can be used as sustainable techniques to combat the effects of climate change.

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