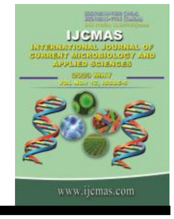
Int.J.Curr.Microbiol.App.Sci (2023) *12*(05): 164-168

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 12 Number 5 (2023)**
Journal homepage: http://www.ijcmas.com



Review Article https://doi.org/10.20546/ijcmas.2023.1205.023

Insights into the Biotechnological Applications of Nanotechnology

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Keywords

Nanotechnology, Environmental Science, Agriculture, Food safety

Article Info

Received: 01 April 2023
Accepted: 02 May 2023
Available Online: 10 May 2023

A B S T R A C T

Nanotechnology is helping to significantly improve, even revolutionize, many areas of Technology like Information Technology, Energy, Environmental Science, Medicine, Home Security Location, Food Safety and Transportation, and many other areas. Today's nanotechnologies exploits current advances in Chemistry, Physics, Science Materials, and Biotechnology and to creating new materials to have properties uniqueness because of their structures are defined by at the nanometre scale of. This article summarizes the various applications of nanotechnology over the past few decades. This review looks at current aspects of “nanotechnology”. It gives a brief description of the nanotechnology and its application in various fields includes medicine, computer, robot, food technology and solar cell, etc. It also deals with the future prospects of Nanotechnology.

Introduction

In general, nanotechnology deals with structures ranging in size from 1 to 100 nanometres in at least one dimension and involves modifying or growing materials at that size (Tharanya *et al.,* 2015). It makes the material lighter, stronger, faster, smaller and more durable. Nanotechnology force capacity to frame components of molecules size and precision machines.

In other words, "nanotechnology" refers to the artificial ability of building things from the bottom up. In 1959, Physicist R. Feynman considered this theoretical possibility. According to the National Science Foundation, nanotechnology is the ability to understand, manipulate and control matter at the level of individual atoms and molecules.

Nanotechnology has recently emerged as an elementary discipline of science that explores the interaction of synthetic and biological materials.

Nanotechnology is currently employed as a tool to exploit the darkest avenues of medical sciences to combat dreadful diseases caused by drug resistant microbes (Durairasu *et al.,* 2017a,b). Modern science based on the unifying characteristics of nature at the nanoscale provides a new basis for innovation, integrating knowledge and technology.

Nanotechnology or Nanoengineering

Nanoengineering is the branch of nanotechnology practices on the scale of nanometers. The name "Nanotechnology" is derived from the nanometer, a unit of measurement equivalent to a billionth of a meter. Nanotechnology has newly emerged as an elementary partition of science that sightsees the interface at cellular level between synthetic and biological entities with the aid of nanoparticles. Nano is a Greek word synonymous *to dwarf* signifying exceedingly small (Kushwaha *et al.,* 2015).

The word "nano" is commonly used to designate one billionth of a meter or 10-9. Nanoparticles are clustered atoms ranging in the size between 1–100 nm. An extensive range of nano-phasic and nano-structured particles are being fabricated globally with an objective of developing clean, nontoxic and eco-friendly technologies. Nanobiotechnology, the combination of biotechnology and nanotechnology greatly focuses on the improvement of the environmental benign biogenic approach and technology for synthesis of nanomaterials (Durairasu *et al.,* 2017a,b).

Green nanotechnology

Green nanotechnology is an offshoot of nanotechnology that improves the environmental sustainability. This includes creating green nanoproducts and then using those nanoproducts to support sustainability. The goal of green nanotechnology is to reduce future risks to the environment and human health associated with the use of nanotechnology products and to encourage the replacement of existing hazardous products available with more eco-friendly nano products. For instance, Solar cell, Nano sanitary and water treatment applications are based on green nanotechnology. Nanoparticles produced by a biogenic enzymatic process are far superior, in several ways, to those particles produced by chemical methods. The biogenic approach for the synthesis of nanoparticles is thought to be clean, nontoxic and environmentally acceptable "green chemistry" procedure. Nanomedicine is a burgeoning field of research with tremendous prospects for the improvement of the diagnosis and treatment of human diseases (Li *et al.,* 2011).

Applications of Nanotechnology Medicine and Sensors Application

Molecular imaging for early detection, in which sensitive biosensors made of nanoscale components (e.g., nano-cantilevers, nanowires, and nano-channels) can recognise genetic and molecular events and report them, offering the potential to detect rare molecular signals associated with cancer.

Multifunctional therapies in which a nanoparticle serves as a platform for targeting cancer cells and delivery of an effective treatment while minimising risk to normal organs (Guo *et al.,* 2014; Kim *et al.,* 2014). Microfluidic chip-based Nano labs capable of monitoring and controlling individual cells, as well as Nano size probes capable of tracking the movement of cells and individual molecules as they move about in their environs, are examples of research enablers. Nanotechnology has the potential to revolutionise a wide range of industries. (Liu *et al.,* 2015; Raspa *et al.,* 2015; Tam *et al.,* 2014).

Transportation Applications of the Future

Nano-engineering of steel, concrete, asphalt, and other cementation materials, as well as their recycling forms, holds significant potential for enhancing the performance, resiliency, and longevity of roadway and transportation infrastructure components while lowering their cost.

New systems may include unique characteristics, such as the ability to create or transport energy, into classic infrastructure materials. Nanoscale sensors and gadgets may provide cost-effective long-term structural monitoring of bridges, tunnels, trains, parking structures, and pavements (Agzenai *et al.,* 2015; Firoozi *et al.,* 2015; Singh and Sangita, 2015, Sobolev, 2015).

Environmental Protection through Nanotechnology

Highly toxic chemical compounds have been synthesised and released into the environment in recent decades. Pesticides, fuels, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) are among these constituents. In comparison to organic molecules that decay quickly after being introduced into the environment, some mixed chemical compounds are very recalcitrant to biodegradation by indigenous bacteria. As a result, toxic chemical compounds have become one of the most severe challenges in the modern world. Contaminated soil and ground water management is a serious environmental hazard. The presence of high quantities of a variety of pollutants in soils, sediments, and surface and ground waters has an impact on human health (Karthika *et al.,* 2015).

Remedial Technology by Nanomaterials

Nanomaterials for Remediation

Nanoparticles can be made of many materials and in various shapes such as spheres, rods, wires, and tubes. Nanotechnology is a new advanced technology that is being used to solve environmental challenges. As a result of innovative nanotechnology development, such as nanosorbents, nanocatalysts, bioactive nanoparticles, nanostructured catalytic membranes, and nanoparticle enhanced filtration, there is an once-in-a-lifetime opportunity to replace all costly and limited conventional water treatments. Second, the molecular level manipulations used in nano particle production make it easier to incorporate desirable structural and functional properties (e.g., surface area, pore size, structure, and surface functional groups) on the adsorption surface.

Nanoparticles *in situ* application

The method of application for nanoparticles is usually site-specific and depends on the geology of the treatment zone as well as the manner in which the nanoparticles will be injected. The most direct injection route makes use of existing monitoring wells, piezometers, or injection wells. Recirculation is a technology that involves infusing nanoparticles into up gradient wells while extracting groundwater from down gradient wells. The recovered groundwater is combined with more nanoparticles before being re-injected into the injection well.

Food and Agriculture Applications of Nanotechnology

The current world population is about 6 billion, with Asia accounting for half of it. A huge proportion of people in developing nations endure daily food shortages as a result of environmental damage or political instability, whereas there is a food surplus in the industrialised world. The goal for developing countries is to produce drought and pest resistant crops that maximise output. The food sector in industrialised countries is driven by customer demand, which is currently for fresher and healthier meals. This is major business; for example, the food industry in the United Kingdom is thriving, with an annual growth rate of 5.2%, and demand for fresh food has climbed by 10 % in recent years. The EU envisions a "knowledge-based economy," and as part of that vision, it intends to maximise the potential of biotechnology for the benefit of the EU economy, society, and the environment. There are new problems in this industry, such as increased demand for healthy, safe food, increased disease risk, and threats to agricultural and fishery productivity from changing weather patterns. However, developing a bio economy is a difficult and time-consuming task in the convergence of diverse fields of science. Nanotechnology has the ability to transform the agricultural and food industries by providing new tools for production.

According to the review in this paper, nanotechnology has the potential to be the key to a completely new world in the domains of food and agriculture, building materials, mechanical, medicinal, and electrical engineering. Although replication of natural systems is one of the most promising areas of modern technology, scientists are still grappling with its astounding intricacies. Furthermore, nanotechnology and nanomaterials are a rapidly expanding area of research in which new properties of materials on the nano-scale can be used for the benefit of industrial and a number of capable developments exist that can potentially modify the service life and life-cycle cost of construction infrastructure to create a new world in the future.

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How to cite this article:

Reshma Girirajan, Rajalakshmi Balaji, Vijayanand Selvaraj and Hemapriya Janarthanam. 2023. Insights into the Biotechnological Applications of Nanotechnology. *Int.J.Curr.Microbiol.App.Sci.* 12(05): 164-168.
doi: https://doi.org/10.20546/ijcmas.2023.1205.023