

# Application of Nanotechnology in Different Area

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## Abstract

Nanomaterials have been produced by physical, chemical, or biological synthesis methods. Applications of nanotechnology in different areas such as nano electronics, agricultural sciences, medical, water purification solar system, energy conversion, Environmental and industries are included in this review chapter.

**Keyword:** Nanotechnology, nanomaterial, application, different field.

## Introduction

Nanoscience is the study, and nanotechnology is used of the familiar properties of materials smaller than 100nm nanometers to create new useful objects. This work is made possible by being able to manipulate structures at the size –scale of atoms [1]. Nanotechnology is an emerging ,interdisciplinary area of research with important commercial application. Nanomaterials or nano structured materials in atom /molecule ,with at least one dimensions is in the range of 1nm to 100nm. The exponential growth of nanomaterials stems are originated from their new physical properties ,one of the most important aspects of nanomaterial is their optical properties including linear and nonlinear absorption [2]. Different properties of nanomaterials are extremely promising for technological, nanoelectronics, nanophotonics ,biomedicine ,information storage , communication ,energy conversion ,catalysis ,environmental protection[3].

## Synthesis

To create nanomaterial synthesis with specific size, shape, dimensions, and structure, an assortment of methods has been used. The synthesis of nanomaterial may be done in two main methods: top-down and bottom-up. These methods are further separated into many groups according on the operations and reaction circumstances [4].

## Application of nanotechnology in different area

Nanotechnology application in different area of such as shown fig.1. Many of the unique properties of nanomaterials are extremely promising for emerging

technological applications, including nanoelectronics, agricultural sciences, medical, water purification solar system Industries biomedicine, information storage, communication, energy conversion, catalysis, environmental protection, and space exploration [5,6].



*Fig.1: Application of Nanotechnology in different area*

### **1. Applications of Nanotechnology in Consumer Applications**

Nanotechnology is a growing scientific field with applications in many different areas, including in consumer. The production of consumer show in fig.2. Such uses of nanotechnology in nano print, nano cream. nano tyre, fiber, nano polish, cloths etc consumer to miniaturize components do not in themselves pose any threats to human health.

### **2. Applications of Nanotechnology in Electronics**

Materials created and manufactured to have structural characteristics with at least one dimension of 100 nanometers or less are usually referred to as nanomaterials. Numerous nanomaterials are already being employed in electronics, either for research and development or for commercial reasons [7]. Silver nanoparticles and carbon nanotubes are among the most widely employed nanomaterials for electrical and electronic devices, as are quantum dots and carbon nanotubes for surface coatings. Several current and future applications of nanomaterials in electronics shown in fig.3.

- i. Next generation computer chips.
- ii. Phosphors for high-definition TV.

- iii. Low cost flat panel displays.
- iv. High energy density batteries.
- v. High sensitivity sensors.
- vi. High power magnets.
- vii. Longer lasting medical.



*Fig.2: Applications of Nanotechnology in consumer*



*Fig.3: Applications of Nanotechnology in Different Electronics Device*

### 3. Applications of Nanotechnology in agriculture

These days, as the population grows, there is a greater need for food, raising concerns about food safety. In the realm of agriculture and the food chain, nanoscience has become one of the most inventive technologies [8]. In the agrifood sector, nanomaterials can be used as nano formulations for crop enhancement, in crop protection for disease detection, in nano devices for plant genetic modification, in plant disease diagnostics, etc. To enhance the growth and development of agricultural food plants, a variety of nanoparticles—mostly made

of metals and carbon—have been used. In order to secure sustainable food and agriculture, nanomaterials have shown promise in plant protection through genetically engineered crops that create plant disease resistance against pathogen infections. With reduced contact to the environment, nano encapsulation offers the benefit of safer handling and more effective use of insecticides, fertilizers, and vaccinations, ensuring eco-protection [9]. Nano fertilizers offer unique qualities including ultrahigh absorption which is a method to supply the soil with necessary critical nutrients gradually, therefore avoiding.

#### **4. Applications of Nanotechnology in Drug delivery**

Because of their distinct optical characteristics, simplicity of synthesis, and chemical stability, Au nanoparticles (NPs) have attracted technological attention. Applications for the particles in biomedicine include medication administration, chemical sensing, [10] biological imaging, and cancer therapy. The two distinct controlled release methods of drugs associated with NPs—one sustained (i.e., diffusion-controlled and erosion-controlled) and the other stimuli-responsive (i.e., pH-sensitive, enzyme-sensitive, thermoresponsive, and photosensitive)—are described in detail. These methods demonstrate how NPs function as therapeutic gene delivery to synthesis proteins of interest in targeted cells and as targeted delivery of medicines to treat cancer cells.

#### **5. Applications of Nanotechnology in Water purification**

Nanoparticles can purify irrigation water, reducing the risk of crop contamination and improving crop yield. Using NPs in agriculture can improve crop yields, reduce agriculture's environmental impact, and improve food products' safety and quality [11].

#### **6. Applications of Nanotechnology in Nano food**

Nano food is defined as food that has been grown, produced, processed, or packaged using nanotechnology methods or instruments. It doesn't refer to food that has been atomically altered or made using nanotechnology. While there are aspirational ideas about utilizing nanotechnology to create molecular meals, this is not feasible in the near future [12]. Rather, nanotechnologists are more hopeful about the possibility of altering the current food production system, guaranteeing the safety of food items, and fostering a culture of healthy eating. Through the use of specific additives and advancements in the body's digestion and absorption of food, they also seek to boost the nutritional value of food.

#### **7. Application in covid-19 vaccine**

Because they stop vaccine ingredients from clumping together, deteriorating, or denaturing, nanoparticles can assist immunization formulations remain stable [13]. For instance, antigens or other vaccine ingredients can be encapsulated in

nanoparticles to prevent deterioration during transportation and storage, so preserving the efficacy of immunization.

## **8. Environmental Applications**

Nanotechnology is being utilized to remediate the environment and lessen its toxicity burden [14]

- a. Alternatives based on nanoscience are being investigated to transform waste heat into useful electrical power in power plants, houses, cars, computers, etc.
- b. By quickly and affordably detecting and treating water contaminants, nanotechnology may be able to assist address the need for inexpensive, safe drinking water.
- c. By use of chemical processes that detoxify contaminants, nanoparticles are being produced to remove industrial water pollutants from ground water.
- d. Scientists are looking into particles like carbon nanotubes, mesoporous, and dendrimers to explore how their distinct physical and chemical characteristics may be used to the cleaning of various

## **9. Energy Applications**

Nanotechnology is being used to provide sustainable, inexpensive, and clean energy sources as well as ways to lower energy usage [15]:

- a. Nanotechnology is already being used to develop many new types of batteries that are lighter, more efficient, have a higher power density, hold electrical charge longer, and charge more quickly.
- b. Nanotechnology can be integrated into solar panels to convert sunlight into electricity more efficiently, promising inexpensive solar power in the future.
- c. To boost the amount of power that windmills can produce, carbon nanotube-containing epoxy is being utilized to create windmill blades that are stronger, lighter, and longer than conventional blades.
- d. Researchers are investigating carbon nanotube “scrubbers” and membranes to separate carbon dioxide from power plant exhaust.
- e. In order to reduce transmission power loss, researchers are creating wires using carbon nanotubes that will have far less resistance than the high-tension cables now utilized in the electric grid.

## **Conclusion**

The present review has given further evidence to this issue and it has tried to address what all the potential application in different area impacts of the technology might be. Many different areas have been greatly impacted by nanotechnology, which has provided creative solutions in the areas of energy, agriculture, electronics, medicine, and environmental preservation. Its capacity

to control matter at the nanoscale has produced innovations like more effective electronics, cleaner energy systems, improved crop production, and targeted drug delivery. It is anticipated that the technology's multidisciplinary applications will expand as it develops, tackling intricate global issues.

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