

## Nanotechnology around Human life: A Review

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**Abstract**— The Nanotechnology is a brand new way of organizing matter at nano scale measured in nanometers. In this evaluation article we've got offered the most exceptional contributions of researchers in the subject of nanotechnology. This review article also focuses on not only advantages but also disadvantages of nanotechnology on human life and surrounding. The applications of nanotechnology in Cosmeceuticals, Pharmaceutical, remedy, conversation, genomic, robot, electronics, Electricity and surroundings are mentioned in detail. The nanotechnology is also used in Agriculture in shape of agrochemicals, pesticides and herbicides. Their positive and negative factors may be studied. Nanotechnology also used in polymer composite substances, Carbon nanotube, and excessive-electricity rechargeable battery systems, thermoelectric substances for temperature manipulate, thin films for smart solar panels, Nanostructured ceramic coatings, Nanotechnology-enabled lubricants and engine oils to reduce wear and tear, Nanoscale titanium dioxide and zinc oxide in sunscreen and in construction industry. Nanotechnology has a extensive variety of applications in textile industry for developing smart clothes equip with fitness tracking sensors. Thin film nanotechnology might be used as a coating in eyeglasses and on screens of laptop, mobile etc. Using nanotechnology stronger, lighter, greater durable and extra reactive electrical conductors can be made. The poisonous effect of Nanomaterial's is an especially demanded research field international in recent times. The efforts on behavior and toxicity of different classes of nano substances in the surroundings have additionally been studied.

**Keywords** — Nanomaterial, sensor, toxicity, nanotube, surrounding

### 1. INTRODUCTION

Nanotechnology is the take a look at of the problem on  $10^{-9}$  variety. Nanotechnology offers with the problem of length between 1-100 nanometers in all dimensions[1]. Nanotechnology makes the material stronger, lighter, smaller, quicker, and more long

lasting. Nanotechnology has the capability to construct the high performance merchandise[2]. The physicist Richard Feynman turned into the first to invent the term nanotechnology on December 29, 1959. According to National science Foundation, Nanotechnology is the capability to recognize, manipulate and manage matter at the level of individual atoms and molecules [3]. Science and engineering are the number one operators of worldwide technological competition. Cutting-edge technology based at the unifying functions of nature at the nano scale contributes a new basis for innovation, expertise, and integration of technology [4]. Nanotechnology is sometimes proffered as a popular cause technology because in its advanced version it will have enormous effect on nearly all regions of society and all industries [5]. There may be a longitudinal procedure of convergence and divergence in widespread areas of engineering and science [6]. For instance the convergence of sciences at macro scale became meant at some stage in the Renaissance, and it turned into latterly accompanied by means of slender disciplinary specialization (NDS) in science and engineering inside the 18th-19th centuries [7,16]. The convergence on the Nanoscale reached its brawn in year 2000, and an estimation of a divergence within the nano gadget architectures in the next a long time[8,15]. In this segment, a short overview is provided approximately the branches of nanotechnology [9,10]. A number of Nanotechnology products are to be had and nevertheless an impressive quantity of researches are happening in research laboratories and universities [11]. Nanotechnology branches are being developed that could bang the worldwide market for mineral, non-gasoline commodities and agricultural [12]. Presently, Nanotechnology is characterized as revolutionary area in terms of its influence on commercial applications[13,14]. Nanotechnology gives possibly solutions to several issues the usage of emanating nano strategies. Depending on the robust inter panel person of nanotechnology there are numerous research fields and numerous capability programs that includes

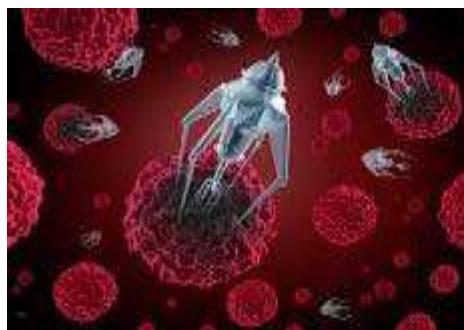
nanotechnology. Here are a few branches where nanotechnology has been applied [4,15].

## 2. Uses of Nanotechnology

Uses of nanotechnology include:

### 2.1) Nanotechnology in Medical Field

**Medical and life-science applications** can also prove to be the maximum beneficial markets for nanotechnologies, with "lab-on-a-chip" devices already being manufactured and animal testing and early scientific trials beginning on nanotechniques for drug delivery[1].



Picture 1 (source - supply medicaldevice-network.Com)

Nanotechnology gives the opportunity to observe and engage with cells at the molecular and cellular scales in actual time, and during the earliest stages of the improvement of a sickness[4].

#### Drug delivery

This could be the most worthwhile application of nanotechnology in remedy, or even usually, over the next two decades. Drugs want to be blanketed throughout their transit through the frame to the target, once a drug arrives at its destination; it needs to be released at an appropriate rate for it to be effective. This technique is known as encapsulation, and nanotechnology can improve each the diffusion and degradation allowing the drug to travel efficiently to the target and be released in an most desirable manner[6].



Photograph 2 (supply - Ama-assn.Org)

#### Hearing and vision

Nano and related micro technologies are getting used to increase a brand new generation of smaller and doubtlessly more powerful gadgets to devices to restore lost vision and hearing[2]. A method uses a miniature video camera attached to a blind person's glasses to capture visual signals and process them by a microcomputer worn on the belt and transmitted to an array of electrodes placed in the eye[7]. For hearing, an implanted transducer is strain-outfitted onto a bone within the internal ear, inflicting the bones to vibrate and circulate the fluid within the internal ear, which stimulates the auditory nerve. The implant captures and interprets sounds into electric powered pulses transmitted by wire thru a tiny hole made in the center ear.

### 2.2) Nanotechnology in Food & Agriculture -

The most stated nano-agricultural tendencies are: Nanoseeds, Nanoparticle pesticides, Nanofeed for Chickens, Nano meals, Nano packaging, meals safety via Nanosensors[8].

#### Nanogenetic Manipulation of Agricultural Crops

Nano biotechnology gives a brand new set of tools to manipulate the genes the usage of nanoparticles, nanofibers and nano pills. Atomic engineering should permit the DNA of seeds to be rearranged if you want to acquire one-of-a-kind plant properties together with coloration, boom season and yield[11]. Nanofiber arrays with capacity applications in drug delivery, crop engineering and environmental monitoring can deliver genetic cloth to cells fast and effectively[9]. The other thrilling application of bionanosensors is to lessen pollen infection in wind pollinated vegetation. Nano-coating of seeds the use of elemental sorts of Zn, Mn, Pa, Pt, Au, Ag will now not most effective

defend seeds but reduces the requirement of factors to a ways less portions than finished nowadays.

### Agricultural Diagnostics, Drug Delivery and Nanotechnology

Nanoscale serves as carriers and provide on board chemical detection and choice taking ability for self-regulation. Those clever systems supply specific quantities of drugs or vitamins or different agrochemicals required. Silicon (Si) is understood to be absorbed into flora to increase disorder resistance and stress resistance via promoting the physiological activity and growth of plants. Silver in an ionic country reveals excessive antimicrobial activity[20].

#### Nano-Biosensors and Agriculture

Nano sensors with immobilized bio receptor probes which are selective for goal analyte molecules are referred to as nano biosensors. Nanosensors provide the advantage of being small, portable, touchy with real-time monitoring, quantitative, reliable, accurate, unique, reproducible and robust and stable that could overcome the deficits of present sensors[19]. Soil temperature and moisture is of extreme significance in agriculture.

#### Nanopesticides and Nanoherbicides

Traditional strategies to govern the pathogens and pests have affected each the environment and economic system of farmers[17]. Pesticides inside nanoparticles are being evolved that can be timed-launch or have launch linked to an environmental trigger. The blessings of nano application are comparable: less herbicide is required to acquire the weed reduction results desired.

#### Nano-Bio farming

Nanotechnology can beautify plants yield and dietary values and may add value to plants or environmental remediation[14]. Particle farming is one such field, which yields nanoparticles for business use with the aid of developing plant life in described soil.

#### 2.3) Nanotechnology in the filed of Energy

Breakthroughs in nanotechnology may want to offer technologies that might make contributions to world-huge strength safety and supply. The main challenges wherein nanotechnology ought to contribute are:

decrease the costs of photovoltaic sun power tenfold,



Image three (source - Nano.Gov)

acquire business photocatalytic reduction of CO<sub>2</sub> to methanol[4],

Create a business process for direct photo conversion of light and water to provide hydrogen,

Create new lightweight materials for hydrogen storage for pressure tanks, liquid hydrogen vessels, and an without difficulty reversible hydrogen chemisorption machine[1],

broaden strength cables, superconductors or quantum conductors made of latest nano materials to rewire the power grid and allow long-distance, continental or even global electric energy transport, additionally decreasing or eliminating thermal sag screw ups, eddy current losses and resistive losses by means of replacing copper and aluminum wires[3],

Create super strong, lightweight substances that may be used to improve strength performance in automobiles, planes and in area travel; the latter, if combined with nanoelectronics based totally robotics, likely permitting area solar structures on the moon or in space[5],

Develop Nanomaterial's and coatings so as to enable deep drilling at lower costs to tap energy resources, which include geothermal warmth, in deep strata[12],

#### 2.4) Nanotechnology in Semiconductors and computing -

##### Metal Oxide Nanoparticles

Positive metal oxide nanoparticles own photo catalytic capacity, electric conductivity, UV absorption and photo oxidizing capability against

chemical and biological species[3]. Research regarding those nanoparticles specializes in antimicrobial, self-decontaminating and UV blocking features for both military protection tools and civilian health products[16].

### **Carbon Nano Tubes (CNT)**

Carbon nano tubes are allotropes of carbon having a cylindrical nanostructure. Those cylindrical carbon molecules possess amazing power and precise electrical residences[4]. Those novel residences cause those to drastically useful in numerous packages in electronics, nanotechnology, optics, materials science, in addition to in architectural fields. Their very last utilization, but, can be confined by using their capacity toxicity [11]. Self assembled Nanolayers

In the longer-term destiny, self-assembled nanolayer (SAN) coating may additionally project conventional fabric coating[18].

Recording the use of nanolayers and dots, flat-panel displays, wi-fi era, new devices and techniques across the whole range of conversation and statistics technology, factors of lots to tens of millions upgrades in both data storage ability and processing speeds and at decrease value and stepped forward power efficiency in comparison to offer digital circuits[20].

### **Thin Nano films**

Numerous Nanoscale substances can be used in thin films to cause them to water repellent, self-cleansing, anti reflective, UV or IR- resistant, antimicrobial, anti-fog, Scratch resistant or electrically conductive. Programs of Nano films encompass pc show, cameras and eyeglasses [11].

### **Nano scale Transistors**

A transistor is a semiconductor electronic device used to amplify or switch electronic signals and electrical power. In transistors, a small amount of energy is used as a gate to control the drift of larger quantity of strength. Greater the number of transistors are embedded within the computer, the extra will be energy[9]. Transistors sizes have been reducing each day, so laptop have grown to be more effective. Sun glasses are using defensive and anti reflective ultra thin polymer coatings. Nanotechnology additionally offers scratch-resistant coatings based totally on nanocomposites

that are transparent, ultra-thin, easy to care for, wells suited for daily use and reasonably priced[16].



Photo four (source - weblog.Ansi.Org)

**Sports** activities gadget manufacturers also are turning to nanotech. A high-performance ski wax, which produces a hard and rapid-gliding floor, is already in use. The extremely-thin coating lasts longer than traditional waxing systems. Tennis rackets with carbon nanotubes have elevated torsion and flex resistance[20]. The rackets are extra inflexible than contemporary carbon rackets. Long-lasting tennis-balls are made with the aid of coating the internal core with clay polymer nanocomposites and have twice the lifetime of traditional balls[19].

**Chemical compounds and substances:** catalysts that increase the strength performance of chemical vegetation and enhance the combustion efficiency (consequently reducing pollution emission) of motor vehicles, super-hard and tough drill bits, "smart" magnetic fluids for vacuum seals and lubricants

**Space exploration:** lightweight space cars, monetary energy technology and control, ultra small and capable robotic structures[13]

### **2.5) Nanotechnology in Environmental field –**

As nanotechnologies circulate into huge-scale manufacturing in lots of industries, it's far as only a rely of time earlier than gradual in addition to unintentional releases of engineered nanoparticles into the environment occur[2]. Programs like beauty merchandise or food components can be diffuse sources of nanoparticles. In addition, sure programs which include environmental remediation with the help of nanoparticles ought to result in the deliberate introduction of nanoparticles into the surroundings. Selective membranes which can clear out contaminants or even salt from water, nanostructured traps for eliminating pollution from commercial effluents, characterization of the

results of nanostructures in the environment, renovation of commercial sustainability through sizeable discounts in materials and energy use, reduced resources of pollution, elevated opportunities for recycling[8].

## 2.6) Nanotechnology in Cosmetics

Range of workforce and customers exposed to nanoparticles are escalating because of growing production and alertness of the huge variety of cosmeceuticals products that comprise nanomaterials[10]. Sunscreens and cosmetics based on nanotech are already extensively used. For sunscreens, mineral nanoparticles together with titanium dioxide provide several advantages. Traditional chemical UV safety suffers from its terrible lengthy-term stability[2]. Titanium dioxide nanoparticles have comparable UV safety assets as the bulk cloth, but lose the cosmetically unwanted whitening as the particle size is reduced. For anti-wrinkle lotions, a polymer pill is used to move energetic sellers like nutrients[3].

## 2.7) Nanotechnology of Living Things

**Nanoparticles and nanostructures in plant life:** timber natural fibers are composites of cellulosic-fibrils at the Nanoscale stage. The handiest forms of nanometer-sized cellulosic-fibrils are 100-1000 nm long, containing both crystalline and amorphous segments. Plant surfaces, in particular leaves, incorporate nanostructures which are used for severa functions including bugs sliding [1], mechanical stability [19], improved seen mild and dangerous UV reflection and radiation absorption respectively [11,19]. The maximum famous nanostructure property in flowers is the super hydro phobicity in lotus leaves that helps in self-cleaning and top notch-wettability of the leaves [13].

## Nanoparticles and nanostructures in insects

Insect wing membranes are produced from constructing materials with 0.5  $\mu\text{m}$  to 1 mm thickness [12]. Moreover, the insect wings are formed by using a complicated vein machine which offers advanced stability to the complete wing structure [3-15]. Long chain crystalline chitin polymer is the basic framework of insect wings that provides membrane assist and lets in for bearing forces on them at some stage in flight [2,17]. Moreover, the colours of butterflies are attributed to their fine wing structure. Certainly, the literature reveals that they own nanostructures in multilayers

which act as diffraction gratings, induce interference, and consequently iridescence [8].

## Nanoparticles and nanostructures in animals and birds

The lovely color patterns of peacock feathers are also recognized to be due to the cross-sectional arrangement of their feather frills. Mollusk shells include nacre that is a hierarchical nanocomposite[5]. Nacre is designed by way of alternating micrometer-sized and sub-micrometer CaCO<sub>3</sub> aragonite platelets, which can be separated by way of a skinny layer of bio-macromolecular glue[9]. More desirable stiffness, impact resistance, strength, and toughness are a number of the mechanical houses that permit the usage of nacres unique layout[17].

## Nanoparticles and nanostructures inside the human body

The human body consists of nanostructures without which regular function of the frame is not possible. It's far shaped by nanostructures consisting of bones, enzymes, proteins, antibodies and DNA. Even some works categorize bone as a Nanomaterial made out of hierarchical inorganic nanohydroxyapatite and natural collagen [4]. Moreover, microorganisms along with viruses and micro organism are nanostructures that may cause diseases in humans.

## 2.8) Nanotechnology in textile field.

Nanoscale emulsification, even and precise manner offer an exceptional stage of textile overall performance regarding stain-resistant, anti-static, hydrophilic, wrinkle resistant and reduce evidence residences. The photograph catalytic activity of TiO<sub>2</sub> and MgO nanoparticles can destroy down harmful chemical compounds and organic agents[3]. Completing with nanoparticles can convert fabric into sensor-based materials[12]. If nano crystalline piezo ceramic particles are incorporated into fabrics, the finished fabric can convert exerted mechanical forces into electrical alerts enabling the monitoring of bodily functions along with heart rhythm and pulse, If they're worn subsequent to skin[19]. Destiny projects include high-tech garments with additional digital functionalities, so-known as clever clothes or wearable electronics. Those could consist of sensors to reveal body capabilities or release[20].



Photo five (supply - Buddhajeans.Com)

**2.9) Nanotechnology in Construction.** Nano-molecular structures to make asphalt and concrete more resistant to water ; materials to block ultraviolet and infrared radiation; substances for cheaper and sturdy housing, surfaces, coatings, glues, concrete, and warmth and mild exclusion; and self cleaning for windows, mirrors and bathrooms[3].

### **3. Disadvantages of Nanotechnology:**

The most important disadvantages of nanotechnology for its short commercialization are:

### **3.1 Dust storms and cosmic dirt:**

Astronomical observations (in particular infrared spectroscopy) and direct stardust evaluation all through area missions and meteorite collections determined that the massive collection of carbide, oxide, nitride, silicate, carbon, and natural-based NMs are the principle additives of stardust [4]. Electromagnetic radiation, dramatic temperature, pressure gradients, physical collisions and shock waves help in energizing and forming NPs in space [14]. Research supported through satellite images found out that dust storms in single vicinity can migrate the nano and micro-sized minerals and anthropogenic pollution to hundreds of kilometers far away from their origin. Dust with a particle length above 0.4 mm is typically not explosive[13]. Surroundings (high persistence) and that could pay attention in fatty tissues (high capability for bioaccumulation) are of particular concern[18]. The fullerenes are one form of synthetic nanoparticle that is being produced by means of tons every year. Big lipid peroxidation (oxidation of fat) turned into located in the brain of the animals after publicity to 0.5 ppm uncoated nC60[20].



Photo 6 (source - Twitter.Com)

### **3.2 Volcanic eruptions:**

Eruption of volcanoes ends in the propulsion of a sizeable amount of aerosols and great particles into the environment with sizes ranging from micrometers to several nanometers [6-7]. Particulate particles from volcanic eruptions affects human, animal, and plant sports via blocking off and scattering the sunlight[9]. The volcanically erupted debris might also possess heavy metals which can be toxic to human beings [6]. The quick-time period effects of debris from volcanic eruptions encompass nostril, throat, eye and skin irritations and bronchial signs[12].



Picture 7 (supply - Britannica.Com)

### 3.3 forest fires and ocean water evaporation:

Ash and smoke are released with the aid of those forest fires and may unfold over long distances, affecting the standard of ambient air quality by increasing the number of small particles in the air [5]. Smoke containing very small debris can get worse pre-present cardiopulmonary situations in patients [7]. Sea salt aerosols are a special form of herbal NPs fashioned because of water evaporation and ejection of wave-produced water droplets from seas and oceans into the ecosystem [8].



Image 8 (supply - Foresttech.Occasions)

### 3.4 Nanoparticles from diesel and engine exhaust:

Amongst the types of car exhaust, diesel engines release 20-130 nm sized debris whereas gas engines release 20-60 nm sized particles [8,9]. More than 90% of carbon NPs present inside the ecosystem are diesel-generated debris [2]. The hazardous effect of automobile exhaust depends at the composition of the particulate mixture [4]. The effects showed that the presence of carbon nanotubes in cells can cause granulomatous reactions, oxidative stress and infection, mainly to fibroplasia and neoplasia in lungs[6].

### 3.5 Cigarette smoke and constructing demolition:



Image9(source- Newindianexpress.Com)

Cigarette smoke has a complex composition in the form of NPs starting from 10–700 nm [10]. Further, nano- and microparticulates smaller than 10 µm are released into the atmosphere while large homes are demolished [13]. Apart from constructing debris, lead, glass, respirable asbestos fibers and other poisonous particles from household substances are released as nanosized debris around the site of constructing demolition [10]. Cigarette smoke can lead to chronic respiration contamination, cardiovascular ailment, pancreatic cancer [4], genetic alterations [15], center ear disease and exacerbated bronchial asthma [1].

### 3.6 Nanoparticles in biomedical and healthcare merchandise:

Silver NPs were used in various packages including air sanitizer sprays, wet wipes, meals storage packing containers, shampoos, and toothpastes [11]. The tremendous research said that Ag NPs established a size, morphology, and dosage-based higher cytotoxicity to human beings and animals cells than asbestos [9,11].

### 3.7 Nanomaterial toxicity

Foreign substances are normally blocked by way of human pores and skin, while organs vulnerable to foreign substances encompass the lungs and gastrointestinal tract. NPs are akin to viruses in size. As an instance, the diameter of the human immunodeficiency virus (HIV) particle is at the order of a 100 nm [4]. NPs that are inhaled can easily attain the bloodstream and other sites in the human body inclusive of the liver, heart or blood cells. It is significant to mention that the toxicity of NPs depends on their origin. Lots of them appear to be safe and others have advantageous fitness outcomes [7]. As a consequence, irreversible oxidative stress, organelle damage, asthma, and most cancers can be due to NPs depending on their composition. The general acute poisonous consequences resulting from publicity to NPs and nanostructured substances consist of reactive oxygen species era, protein denaturation, mitochondrial disconcertion and perturbation of phagocytic capabilities[20]. Apart from penetration, electrostatic expenses, van der Waals forces, interfacial tension results and steric interaction of NPs bind with cell additives and reason mobile loss of life [6]

Toxicity of nanoparticles immensely depends on range of factors like floor properties, coating, structure, length, and potential to combination and those factors can be altered and manipulated inside the production procedure[20]. Nanoparticles having terrible solubility had been shown to reason cancer and might show off greater suggested toxicity [17]. Toxicity also relies upon on the chemical composition of nanoparticles that is absorbed on the pores and skin [18].

All materials, from arsenic to desk salt are toxic to cells, animals or people at a few exposure degrees[19]. Toxicological research of fibrous and tubular nanostructures have shown that at

extraordinarily excessive doses of these substances are related to fibrotic lung responses and result in infection and an extended danger of carcinogenesis. Singlewalled carbon nanotubes (SWCNT) had been proven to inhibit the proliferation of kidney cells in cellular subculture with the aid of inducing cellular apoptosis and lowering cell adhesive potential. In addition, they reason irritation in the lung upon instillation[20]. Carbon nanoparticles to affect the integrity of the blood-brain barrier as well as exhibit chemical outcomes in the mind have also been studied[16].

Nanoparticles can impair the ability of macrophages to phagocytose and clear particles, and this may make contributions to inflammatory reactions, surface characteristics of the debris[19]. It's far viable that durable, biopersistent nanoparticles might also acquire in the frame, in particular inside the lungs, in the mind and in the liver[18].

#### 4. Conclusion and Future Perspective

Use of nanotechnology ought to allow fast advances in agricultural research, including reproductive science and technology so one can produce massive quantity of seeds and culmination unaffected by using season and duration, and disorder prevention and remedy in plant life. Clever sensors and smart transport structures will help the rural enterprise combat viruses, spores and other crop pathogens. Nanostructured catalysts could be to be had a good way to growth the efficiency of insecticides and herbicides, permitting on call for measured doses to be used. Within the future, Nanoscale gadgets could be used to make agricultural structures clever. The common demanding situations related to commercializing nanotechnology, are: excessive processing prices, problems inside the scalability of R & D for prototype and business production and issues approximately public belief of environment, fitness and safety problems.

Nanotechnology is the science of tiny particles. These days, many of scientists and engineers are finding new methods to use nanotechnology to improve the world. There are various applications of nanotechnology along with electronics, biology, chemical engineering and robotics electronics. With the aid of the assist of nanotechnology, doctors detecting disorder at its earliest tiers and treating illness together with coronary heart

disorder, cancer and diabetes with extra effective and more secure drug treatments. Even though there are many studies demanding situations in advance, nanotechnology already is producing a significant variety of favorable substances and pointing to improvement in lots of fields. It has opened medical Inquiry to the level of nanoparticles and offers a global of recent opportunities.

The toxicity profiling of NMs is noticeably demanded research vicinity worldwide nowadays. However, research improvements have observed a few acute toxic results of nanosized particles in residing systems. From this review article, it is able to be stated that NMs from anthropogenic sports and engineered NMs in purchaser merchandise are able to cause toxic effects in living creatures. Moreover, emerging NPs, including viral NPs and nanozymes, must be subjected to rigorous cytotoxicity exams to establish benign mechanisms of application and dosage levels. Great research in the discipline of nanotoxicology and strict laws by government companies are essential to become aware of and avoid poisonous NPs in future.

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