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Nano Technology and Medocal Appliction

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ABSTRACT

In the present work Over the past three years, the number of companies in the nano- industry in China has increased to more than 200 companies. China has unique advantages over other industrialized countries, including low labor costs, no barriers for new technologies, a large amount of foreign investment capital, low currency rates, low taxes, government support, and the large domestic market where there are more than 1.3 billion consumers. All these reasons combined lead to the prosperity of the industry in China, including the nanoscale industry. The tremendous technological development was the unique feature of the twentieth century that we let us before a few years ago, and experts agreed that the most important technological development in the last half of the current century is the invention of silicon electronics. Its development led to the emergence of the so-called microchips, which led to a technological revolution in all fields, such as communications,computers, medicine, and others. Until the year 1950 there were only black and white televisions, and there were only ten computers in the whole world. There were no mobile phones, digital watches, or the Internet, all of these inventions are thanks to the small slices that ledto The increase in demand for it due to its low prices, which facilitatedits entry into the manufacture of all consumer electronics that surround us today. And over the past few years, a new term has cometo light that has thrown its weight on the world.

1.1 Nanotechnology

Nanotechnology in our time occupies a prominent place in the lives of various peoples, and directly affects the comprehensive development of all societies. This promising technology heralds a huge leap in various branches of science, and optimists believe that it will cast a shadow over all areas of modern science and the global economy. It was not surprising that the medicine, medicine and healthcare sector was at the top of the list of interests and applications of nanotechnology, which harnessed all basic sciences and tamed all modern technologies for the sake of human health and happiness, and took us towards new horizons that humanity has dreamed of for many centuries. Nanotechnology promises many medical applications related to accurate diagnosis and high-efficiency treatment, as well as many applications in the field of health care, as facing the deadliest diseases such as cancer diseases will be possible within the coming years, God willing, through Nano medicine medicine, which began a lot of its research and experimental applications in many research centers around the world. The interaction of nanotechnology with biochemistry, genetics, genetics and molecular biology had the deepest impact on the development of diagnostic methods and early detection of diseases and health problems with accurate knowledge of the causes leading to disease, and this naturally led to a major technological breakthrough in the pharmaceutical industry and the innovation of new methods. It is effective in drug delivery processes to specific cells of the body and alone by providing modern and advanced techniques to conquer cancer and defeat it in a localized manner without the slightest surgical intervention, as well as innovations related to the subject of tissue culture engineering in the human body, especially in the field of gum and dental medicine and surgery, the need has become. To scientific research in our present time is more severe than ever before, as the world is in a frantic raceto reach the largest possible amount of accurate and fruitful knowledge that guarantees the comfort and well-being of the human being. Given the importance of nanotechnology, nations are competing – according to their scientific capabilities and directions, through the activities of scientific institutions, government and commercial agencies, to contribute to the support and development of various fields of their applications, especially the medical field.The medical applications of nanotechnology are the most important applications of this technology among all the applications expected of this modern technology, due to its direct link with human life and health. Nanomedicine has made pioneering steps that lead the world to a comprehensive medical revolution, represented by changing the entire concept of traditional treatment methods, developing diagnostic techniques and early detection of diseases and tumors. Nanotechnology is a world of which we do not know much, and nanotechnology is not yet complete. From this standpoint, we have tothink carefully and without rush about this modern technology thathas entered our lives, in all its aspects and its widest gates, and we do not care only about the privileges, developments and achievements. [2][3][4] Problem Statement

Loss or failure of an organ or tissue is one of the most frequent, traumatic and costly problems in healthcare. Tissue engineering has likely generated a need for researchers to turn to multidisciplinary methods to solve this long-standing problem in medicine. Advances in medicine have been kept pace with the increasing interactions between many disciplines such as biology, materials science and engineering, which have led to advances in diagnosis and monitoring and the emergence of implanted devices and tissue grafts. In addition,medicine has continued to advance, the number of survivors of severe disorders and injuries has increased, the number of patients receiving and waiting for these crucial treatments has increased, and the needfor alternative therapies has become clearly evident. Clinicians have been a powerful force for innovation in medicine. The origin of tissueengineering stems from the needs of surgeons to regenerate functionally active tissues to replace those caused by wounds, birth defects, or various pathological developments. Current methods of replacing organs and tissues mainly use autografts or sallografts: a graft from an individual of the same type, or metallie devices. These effective methods are associated with clear limitations including disease of the donor side. These limitations also underscore the importance of the timely development and successful translation of therapies based on principles of tissue engineering. Historically, internists have also worked on more complex treatments, from pharmacological management of small molecules to the useof Proteins, DNA and other macromolecules to organs outside the body in order to replace lost cell function or lost tissue. Cell-based

therapies have become desirable for their ability to perform many complex biochemical functions. Thus, these challenging problems in clinical medicine have continually inspired scientists and clinicians in their search to uncover the biological mechanisms to invest in a patient's bed. Our research, in collaboration with the Vacanti Group, has begun in the search for an alternative for patients awaiting liver transplants. Together, we discussed ways to extend the concept ofcell seeding to three-dimensional seeding in an attempt towards complete organ replacement. Our collaboration led to published workdescribing the use of synthetic, resorbable, polymeric meshes for cell transplantation (Vacanti et al. 1988) (cell transplantation). This method has been adopted by a number of chemical engineers and others working in the field of synthetic polymers, influencing many inthe use of similar techniques with degradable polymers. Many have turned their skills in biology or engineering towards tissue engineering, and have seen that as exciting in the academic sector as itis in the private sector. Tissue engineering research enjoys a large influx of private sector funding, due to the early tendency of federal agencies to fund research that is supposed to be a priority on the one hand and on the other hand due to the contemporary wave of corporate investment in biotechnology. From the mid-1980s to the end of the millennium, more than $ 2.5 billion was invested worldwide in research and development, and more than 20% of that money was provided by the private sector. At the end of the year 2000, more than 70 companies had participated in research, development and / or manufacturing in the field of tissue engineering. They spend an estimated $ 600 million annually, and nearly 300 full-time scientists and support personnel have been employed, while the two products have received FDA approval (Lysaght and Reyes 2001). In the first decade of the twenty-first century, scientific advances continue at a steady pace. Federal agencies have become increasingly powerful in sponsoring this field, both in the United States and abroad, not only by increasing funding, but also by sponsoring workshops and studies and helping to definethe future of this field; More importantly, the complexitiesand challenges of living tissue engineering have become fully understood, and research has gone deeper than ever before in innovation and technology. Particularly towards stem cell, developmental biology and nanotechnology (Ingber et al., 2006; Vunjak – Novakovic and Kaplan 2006) (nanotechnology). The scientific basis for engineering functional tissues is more complex than ever before. In this chapter,we will briefly review a number of important achievements in this field from its inception to the present day, including cells, cell carriers, scaffolds, and motivating factors. To tissue – inducing factors and only of all bioreactors; [2]

1.2 Research objectives

It is a scientific technology aimed at diagnosing and treating diseases and injuries, preventing them and relieving pain, through the use of biotechnology, genetic engineering and nanoscale materials,and the adoption of complex automated systems and nanorobots to do so. The principle of nanotechnology depends on the use of nanotechnology for early detection and preparedness at the cellular and molecular level. Nanoan medicine is as capable of using certain nanoparticles to increase the accuracy of diagnosis methods that use human and human tissue samples, and take advantage of many important analyzes at the sub-cell. Nanoan medicine is also aimed at establishing devices capable of examining the human body for early research on diseases and measuring the amount of toxic molecules andcancer cells within and deal with nanomedicine aims to reach a valuable set of research tools in addition to useful devices in therapeutic clinics in the near future. The National Nanotechnology Initiative expects that new commercial applications in drug delivery will be found, which may include advanced drug delivery systems, in addition to New therapies, as well as internal imaging, and neuroelectronic interfaces and other sensors associated with nanoelectronics are another active target of research in this area;[3]

2.1 Nanomedicine

"Nanomedicine" is considered one of the most important fields of application of nanotechnology, and even the greatest of it because of its direct link with human life and health. The recent development in nanotechnology has helped change the medical rules used in preventing, diagnosing and treating diseases in form, and we are now living in the era of nanomedical technology, Nanotechnology, for example, provides new methods for drug carriers inside the human body, capable of targeting different cells in the body, as well as facing the most deadly diseases such as cancer, which began many and its experimental applications in many research centers around the world. As for the nanosensors, it can be implanted in the brain to enable the quadriplegic person to move and walk. ”) It isclear that this technology has changed the traditional view of treating diseases, and opened great hopes for the treatment of many diseases, which made researchers see that nanomedicine It is the medicine of the future. For this reason, countries are racing and clearly heading for the taking over of this technology, a view of its promising medical applications with great economic returns. " It is worth noting that during the past few years, and as a result of rapid and proficient progress

in the field of nanotechnology research, exciting breakthroughs have been achieved, represented by the creation of advanced types of characterization devices that have been employed in order to understand and analyze the structure and compositionof the human DNA and viruses alike. This naturally led to knowledge of the behavior of diseases and viruses, the mechanics of their movement and their movements within the body, and knowledge of the methods and tricks that they take toattack its cells, at the level of one nanometer (part of a billionth of a meter)

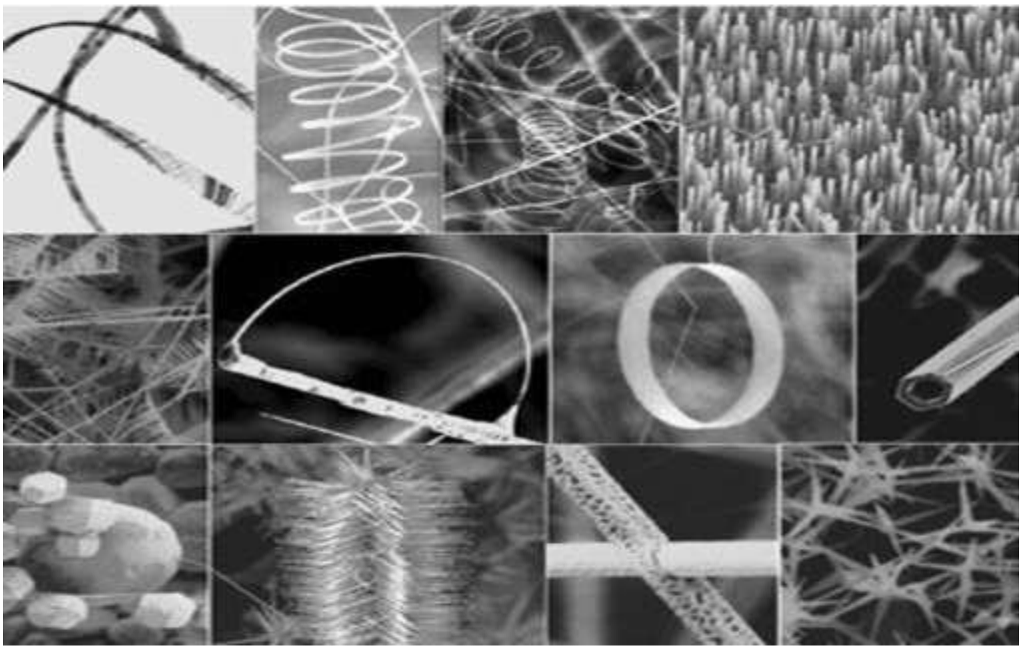
.[5][6]

2.2 History

Since ancient times humans have used nanoscale without knowing, many peoples have used some of nanomaterials and techniques that can be considered nanoscale, in coloring, coating and others. It was used in certain industries to give it special qualities, such as bright colors or great durability of swords and others. Recently, this science has become one ofthe pioneering sciences that helped establish and pave it a groupof scholars with distinct and revolutionary products and ideas. Historical background on nanoparticles, nanoscale or theuse of particles and nanostructures in industry is not new, as it has been used since ancient times in certain industries that gave it special characteristics that until recently remained a secret of secrets, as they were revealed by modern nanoscale devices. For example, but not limited to, we cite some ancient industries that nanoscale entered into without knowing owners claim that they are using nanotechnology . The oldest known example is the Roman king's cup (Lykurgus), which dates back to the fourth century AD, which is now in the BritishMuseum in London, and which changes color depending on the angle of light on it, and it was discovered that this cup contains gold nanoparticles . The Greeks mixed gold nanoparticles with glass, making vessels that change color according to the angle of incidence of rays on them as well. In the Middle Ages,glassmakers and craftsmen in Europe used colloidal gold nanoparticles in coloring and in the manufacture of precious vessels, and the windows of churches were characterized by changing their colors due to these nanoparticles. The photographic technique that was known in the eighth and nineteenth centuries AD relied on the production of imaging films and films made of silver nanoparticles sensitive to light . As for the Arabs and Muslims, they had a fortune from this technique as well, which is the Damascene sword, the true legend. He talked about its strength and durability and there is no embarrassment. He used this amazing sword with superstrength in the period 900-1750 AD , as it was famous for him to cut swords. The other and that it was of great durability and did not withstand any other sword, but even was able to cut the rock, and the enemies believed that it had magical power, and they sought bitterness to obtain the secret of its manufacture, but their attempts went unheeded and the craft remained a monopoly inherited by children from the parents. This sword was one of the weapons of the Battle of Hattin. And recently, by using a scanning electron microscope,the presence of carbon nanotubes known to be powerful has been discovered and the rigidity in the composition of thissword, which resulted from the heat treatment of the sword during the manufacturing process, and thus the veil of the mystery that baffled minds for more than a thousand years was removed.

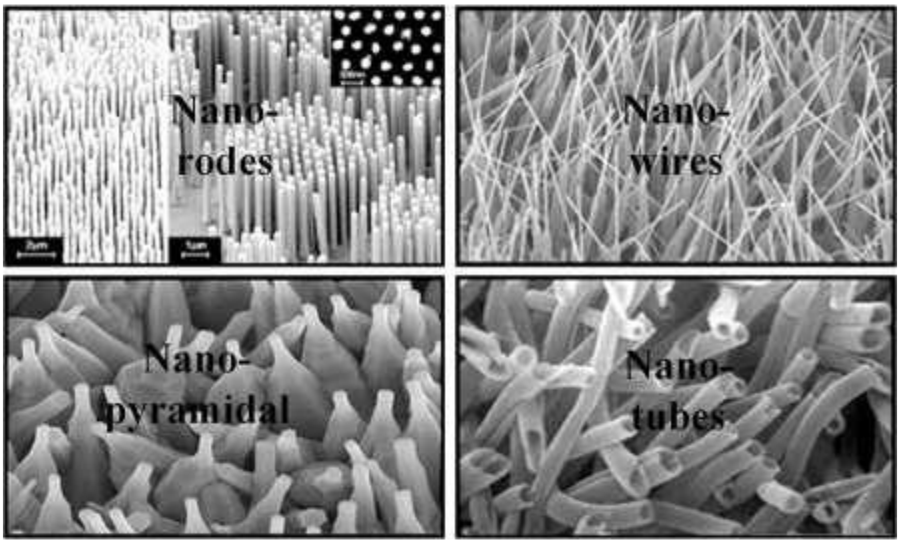
2.3 Forms of Nanomaterials

Nanomaterials (NMs) are among the most advanced materials in current technology. The nature, composition, and classification of nanomaterials or nanoparticles are of colossal importance for their practical application , is show in blow figure.



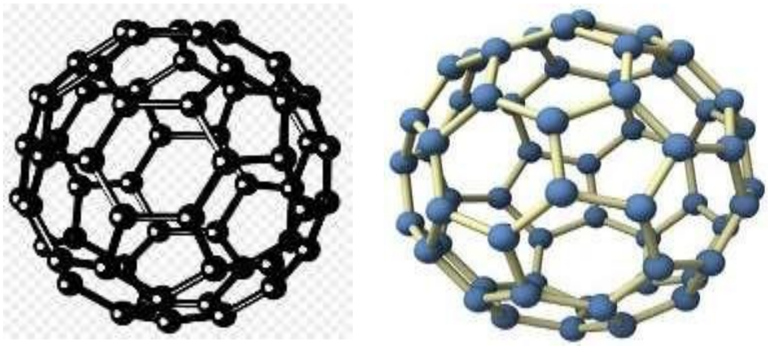
Different types of Nanomaterials (NMs)One-dimensional

nanostructures such as nanowires,nano-needle, nano-rod , and nano-tube have attracted growing interest for different applications and are promising candidates for preparation of advanced devices. In addition, the sensors based on 1D nanostructures attracted a great deal of attention and showed higher sensitivity and improvement capability compared with the other film materials, all of these properties of 1D nanostructures because of their[7], is show in blow figure.



Real images of different types of 1D nanostructures
Folorin

Another strange nanoscale structure of carbon, which is amolecule made up of 60 carbon atoms, symbolized by thesymbol C60, was discovered in 1985 AD. The folorin moleculeis spherical in appearance and quite similar to a football that has12 pentagonal and 20 hexagonal shapes. Since the discovery ofhow to manufacture Folorin in 1990, it has been prepared in commercial quantities. It was also possible to obtain moleculeswith a different number of carbon atoms, such as C36, C48 andC70, but scientists showed special interest in the C60molecule. This composition was named volurin, after the inventor and architect R. Buckminster Fuller, is show in blow figure.

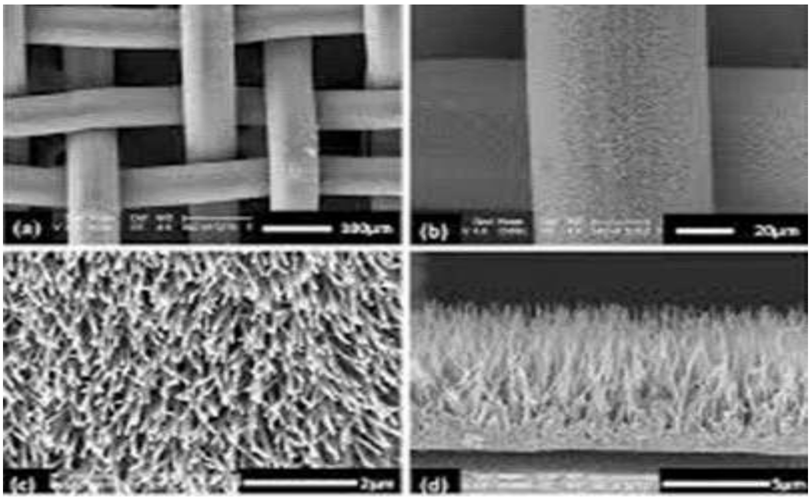


Fuller.60 carbon atoms

2.3.1 Nanoballs

Among the most important of these are carbon nanoballs, which belong to the category of volurines, from C60, but they

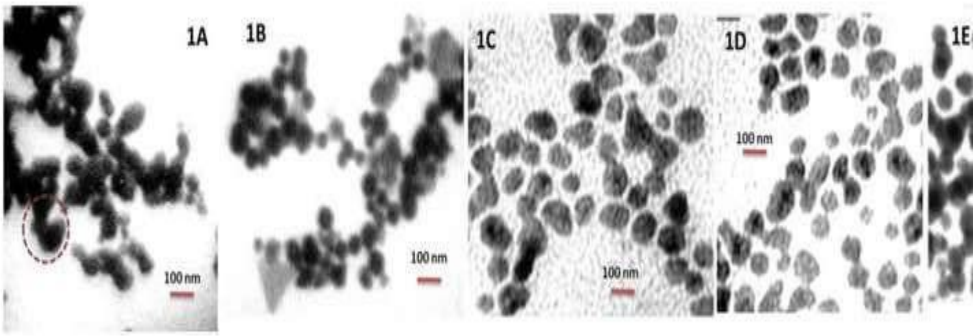
differ slightly from them in structure as they are multi- shells. Unlike nanoparticles, they are also hollow in the center, while there are no gaps on the surface as they are in multi- coated nanotubes. And because their structure resembles an onion, scientists have called them "onions" (Bucky), and the nanoscale balls may have a diameter of 500 nanometers ormore, is show in blow figure .



Nanoballs of nanomaterials

2.3.2 Nanoparticles

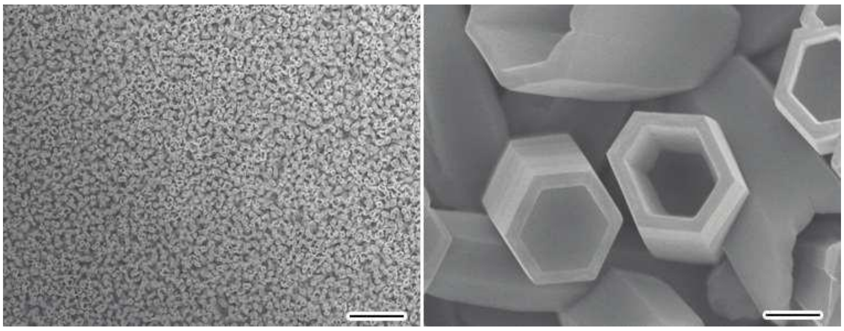
Although the word (nanoparticles) is recently used, these particles have been present in manufactured or natural materials since ancient times . Nanoparticles can be defined as a microscopic atomic or molecular cluster whose number ranges from a few atoms (a molecule) to a million atoms, bound together almost spherically with a radius of less than 100 nanometers, is show in blow figure.



Nanoparticles

2.3.3 Nanotubes

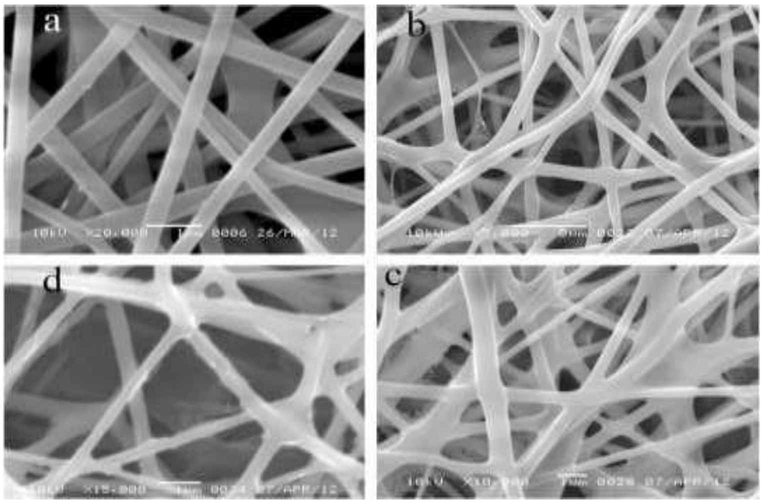
Nanotubes are sometimes made of inorganic materials such as metal oxides (vanadium oxide, manganese oxide), boron nitride and molybdenum. They are similar in structure to carbon nanotubes, but are heavier and not as strong as carbon nanotubes. Carbon nanotubes, which were discovered in 1991 CE, are more important due to their symmetrical structure, exciting properties, and wide uses in industrial, scientific, and microelectronic devices and biomedical devices[10], is show in blow figure.



Nanotubes

Nanofibers

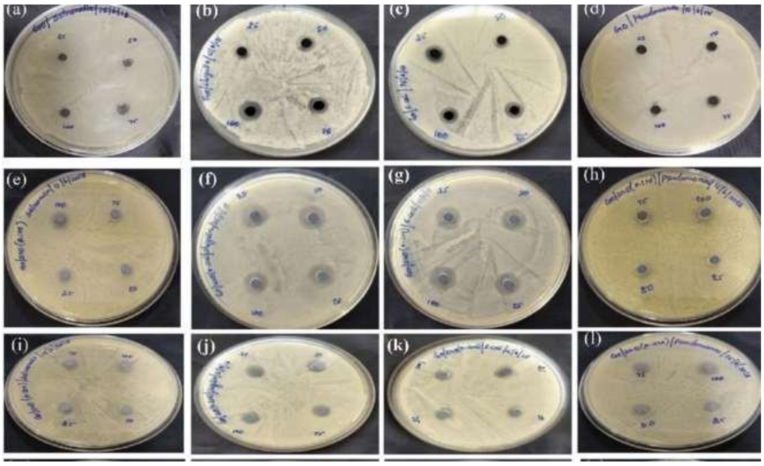
Nanofibers have received a lot of attention recently for their industrial applications. Several forms have been discovered, such as hexagonal and helical fibers and corn- shaped fibers. The side portion of a blasted or tubular nanofiber has a hexagonal shape, for example, not a cylindrical one. One of the most popular nanofibers is those made ofpolymer atoms. The ratio of surface area to volume is large in the case of nanofibers, as well as for nanotubes, as the number of surface atoms is large compared to the total number, and this gives these fibers distinct mechanical properties such as hardness, tensile strength and others, which qualifies them without competitors to be used as filters in purifying liquids or gases[11] , is show in blow figure.



Nanofibers

2.3.4 Nanocomposites

They are materials to which nanoparticles are added during the manufacture of these materials, and as a result, the nanomaterial shows a great improvement in its properties. For example, the addition of carbon nanotubes alters the electrical and thermal conductivity properties of the material. The addition of other types of nanoparticles may improve optical and dielectric properties, as well as mechanical properties such as stiffness and strength, is show in blow figure.



Nanocomposites

2.4 Nano Partials Measurement and Spectroscopy

Nanomaterials are among the most advanced materials incurrent technology. The nature, composition, and classification of nanomaterials or nanoparticles are of colossal importance for their practical application.

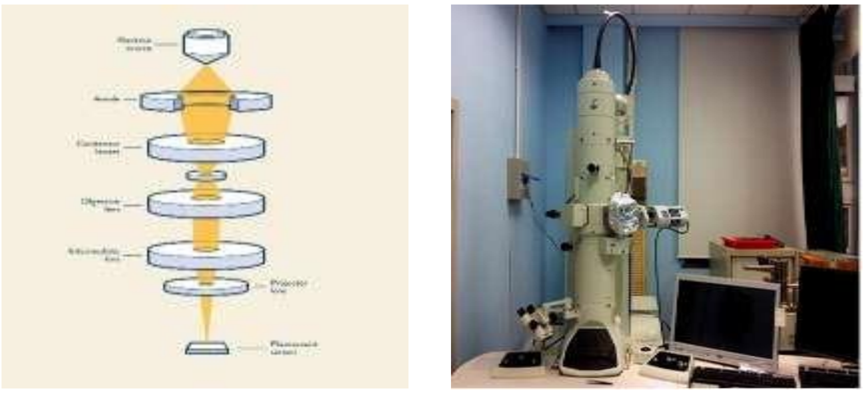
2.4.1 Mransmission Electron Microscopy (TEM)

2.4.2 Atomic force microscopy (AFM)

2.4.3 Scanning Electron Microscope (SEM)

2.4.4 Field Emission Scanning Electron Microscope(FESEM)

Mransmission Electron Microscopy (TEM) Carrier electron microscopy (TEM), which also uses a beam of electrons to inspect and select samples, and while a scanning electron microscope examines the surface of samples and characterizes their surface characteristics, a transmission electron microscope has the ability to penetrate the sample placed in the path. The electronic beam coming from the source of generating electronic rays located above the place where the sample is placed and penetrates it, is show in blow figure.



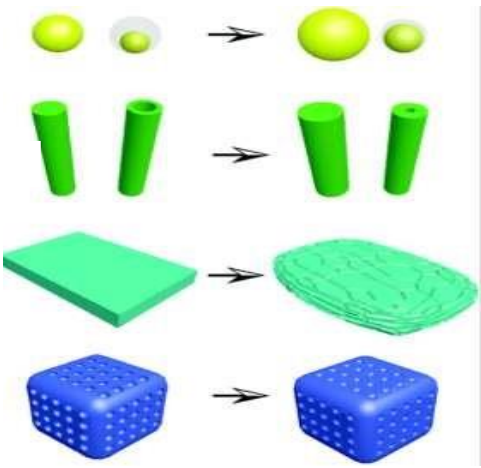
Mransmission Electron Microscopy (**TEM**)

2.5 Classification of nanomaterials

Materials are classified according to the number of dimensions that are not in the nanometer range. That is, the materials are divided into four sections:

Zero-dimensional materials. (One-dimensional materials). (Two-dimensional materials). (Three-dimensional materials).

In the last 10 years, scientists have come a long way in research on these materials. All dimensions are smaller than 100 nanometers. Examples of such materials are the (quantum dots) that have recently entered the transistor industry and somesolar cells, is show in blow figure.



0D Quantum Dots

1DOne Dimensional

2D
Two Dimensional

3DThree Dimensional

Schematic illustration of the nanostructures types

2.6 Characteristics of nanomaterials

1. Mechanical properties: Mechanical properties come on topof the properties that benefit from reducing the size of the material grains, and the presence of large numbers of atoms on the faces of its outer surface, such as the hardness of the mineral. The more materials and their alloys, the greater their resistance to facing the loads on them.

2. Melting point The melting point values of the material are affected by reducing the dimensions of the dimensions of its grains. For example, the melting point of gold is 1064 degrees Celsius, and if we reduce the gold grains, theirmelting point decreases by 200 degrees Celsius.

3. The chemical properties of the chemical properties are closely related, just like the rest of the physical and chemicalproperties of materials that change with the change of the material size to the nanoscale, if the nanoparticles are homogeneous and similar. Volume, their inte raction increases

2.7 Physical properties: The degree of a substance is affected by the dimensions of its grains. Gold fusion in its normal size is1064 degrees at its temperature, less than 500 degrees after the miniaturized grains to 1.35 nm;.

2.8 Methods for classifying nanomaterials

Nano-materials deal with very fine structures: a nanometer is a billionth of a meter (1nm = 10-9 m). This indeedallows us to think in both the 'bottom up' or the 'top down' approaches to synthesize nanomaterials, i.e. either to assemble atoms together or to dis-assemble (break, or dissociate) bulk solids into finer pieces until they are constituted of only a few atoms. This domain is a pure example of interdisciplinary work encompassing physics, chemistry, and engineering up to medicine. The methods of preparing nanomaterials can be classified into two basic methods that include different methods. The first method is a bottom-top method in which the components of the materials are minimized with a self-assembly procedure in order to reach a nanoscale composition of materials. Stable structures of larger size; As for the second method, it is top-down and depends on the initial structures of a larger size that can be controlledduring the preparation of nanomaterials, and accordingly we will mention several methods of preparing nanomaterials that fall within these two methods. Several physical and chemical methods under specific growth conditions at low and high temperatures are used for growth of nanostructures.

There are two main ways to fabrication nano-materials;

1- Top-down Method: Top-down method is reduced in size of material from large size to smallest size or nano-scale.

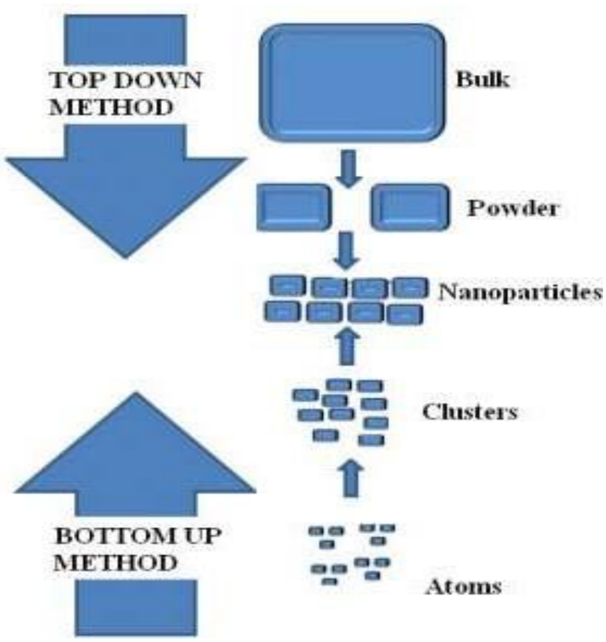
These require to create smaller material by using larger ones totheir assembly. These techniques include;

i) Mechanical Grinding

ii) Pulls Laser Deposition

2- Bottom-up Method: The bottom-up method is build larger structures of nano-materials by atom or molecule. These techniques include;

i) Thermal Evaporation Using Tube Furnace Tube Furnace, is show in blow figure.



Schematic illustration of the preparative methods ofnanopartic

3.1 General Applications

The applications of nanotechnology, commonly incorporate industrial, medicinal, and energy uses. These include more durable construction materials, therapeutic drug delivery, and higher density hydrogen fuel cells that are environmentally friendly. Being that nanoparticles and nanodevices are highly versatile through modification of their physiochemical properties, they

have found uses in nanoscale electronics, cancer treatments, vaccines, hydrogen fuel cells, and nanographene batteries. Recent advances in nanoscience and nanotechnology intend new and innovative applications in the food industry. Nanotechnology exposed to be an efficient method in many fields, particularly the food industry and the area of functional foods. Though as is the circumstance with thegrowth of any novel food processing technology, food packaging material, or food ingredient, additional studies are needed to demonstrate the potential benefits of nanotechnologies and engineered nanomaterials designed for use in foods without adverse health effects. Nanoemulsionsdisplay numerous advantages over conventional emulsions due to the small droplets size they contain: high optical clarity,
excellent physical constancy against gravitational partition and droplet accumulation, and improved bioavailability of encapsulated materials, which make them suitable for food applications. Nano-encapsulation is the most significant favorable technologies having the possibility to ensnare bioactive chemicals. This review highlights the applications of current nanotechnology research in food technology and agriculture, including nanoemulsion, nanocomposites, nanosensors, nano-encapsulation, food packaging, and propose future developments in the developing field of agrifood nanotechnology. Also, an overview of nanostructured materials,and their current applications and future perspectives in food science are also presented. Nanoscience and nanotechnology areinnovative scientific advancements that have been introduced only in this century. Their utilizations in food and agriculture productions are almost modern compared with that of medicine delivery and pharmaceuticals. Nanotechnology has developedas the scientific advancement to grow and transform the entire agrifood area, with the potential to elevate global food production, furthermore to the nutritional value, quality, and safety of food (Sekhon 2014; Chung et al. 2017).Nanotechnology uses in food science are going to influence the most important aspects of food manufacturing from food protection to the molecular synthesis of new food products and ingredients (Pathakoti et al. 2017). Nanotechnology is expected to facilitate the following development stage of genetically altered crops, input to the production of animal and fisheries, chemical insecticides and precision farming methods. Precision farming is one of the most important techniques utilized for increasing crop productivity by monitoring environmental variables and applying the targeted action (Chen and Yada 2011). Food endures a variability of post-harvest- and processing-persuaded changes that affect its biological and biochemical maquillage. Thus, nanotechnology development in the areas of biochemistry and biology could also affect the foodmanufacturing (Sozer and Kokini 2009; Jain et al. 2016). There is a need to develop simpler, faster, more sensitive and low-cost approaches for the observation and quantification of impurities in foods. Within the past decade, with remarkable advances in nanoscience, nanotechnology-enabled sensors and systems have been increasingly used to develop rapid and noninvasive methods of detection of food contaminantsNanoscience and nanotechnology have become highly popular in the last few years.

The nanoobjects of importance include quantum dots and nanocrystals of metals, semiconductors, oxides and other materials as well as one-dimensional nanostructures such as nanotubes and nanowires. Synthesis, characterization andapplications of these nanomaterials are being explored widely. Typical of the novel applications of nanomaterials that are emerging include single molecule electronics based on nanotubes and nanowires, nanocatalysis and biological sensors using nanocrystals or nanotubes. One-dimensional nanostructures of materials have received great attention since the discovery of the carbon nanotubes. Nanomedicine involves utilization of nanotechnology for the benefit of human health and well being. The use of nanotechnology in various sectors of therapeutics has revolutionized the field of medicine where nanoparticles of dimensions ranging between 1–100 nm are designed and used for diagnostics, therapeutics and as biomedical tools for research. It is now possible to provide therapy at a molecular level with the help of these tools, thus treating the disease and assisting in study of the pathogenesis ofdisease.

Nanotechnology is an inherently interdisciplinary field that has generated significant scientific and engineering interest in recent years. Nanomaterials can be found everywhere in nature and have been part of the environment since our planet was created about 4.5 billion years ago. The impact of nanotechnology in all areas of science and technology is evident. Nanotechnology increases the strengths of many materials and devices, as well as enhances efficiencies of monitoring devices, remediation of environmental pollution andrenewable energy production. While these are considered as thepositive effect of nanotechnology, there are certain negative impacts of nanotechnology on environment in many ways, such as increased toxicological pollution on the environment due to the uncertain shape, size and chemical compositions of some of the nanotechnology products (or nanomaterials). It can be vital to understand the risks of using nanomaterials, and cost of the resulting damage. It is required to conduct a risk assessment and full life-cycle analysis for nanotechnology products at all stages of products to understand the hazards of nanoproducts and the resultant. knowledge that can then be used to predict thepossible positive and negative impacts of the nanoscale products. Choosing right, less toxic materials (e.g. graphene) will make huge impacts on the environment. This can be very useful for the training and protection of students, as well as scientists, engineers, policymakers and regulators working in the field.

Nanotechnology refers to an emerging field of science that includes synthesis and development of various nanomaterials. Presently, different metallic nanomaterials are being produced using copper, zinc, titanium, magnesium, gold, alginate and silver. Due to their incredible properties, production of nanomaterials has been constantly evolving over the last few years for manifold applications in chemical surface processes, chemical industry, environmental pollution monitoring, agriculture, smart materials, sensors, nanoscale biostructures, energy capture and storage, magnets, fabrication, electronics, optical and biomedical fields. Nanostructured materials (NSMs) are divided into nanoparticles (NPs), nanotubes (NTs), nanocomposites (NCMs) and nanowires (NWs). Nanoparticle technologies have great potentials, being able to convert poorly soluble, poorly absorbed and labile biologically active substance into promising deliverable substances. Nanoparticles are applied as delivery systems, e.g. for drugs or bioactive food ingredients. They are designed to target drugs to specific organs or to increase the bioavailability of bioactive food ingredients that may have a health impact. Nanomedicine has tremendous prospects for the improvementof the diagnosis and treatment of human diseases. Use of microbes in biosynthesis of nanoparticles is an environmentally acceptable procedure. Nanomedicine is the application of nanotechnology (the engineering of tiny machines) to the prevention and treatment of disease in the human body. Nanomaterials can impart antibacterial and anti-odour functionality on human skin in powder, gel, stick or spray underarm products. It has also antimicrobial and anti-irritant properties. This discipline is in its infancy. It has the potentialto change medical science dramatically in the twenty-first century.

The expanding availability of a variety of nanostructures with properties in the nanometer size range has sparked widespread interest in their use in biotechnological systems, including the field of environmental remediation. Nanomaterials can be used as catalysts, adsorbents, membranes, water disinfectants and additives to increase catalytic activity and capability due to their high specific surface areas and nanosize effects. Thus, nanomaterials appear promising for new effective environmental technologies. Definitely, nanotechnology applications for site remediation and wastewater treatment are currently in research and development stages, and innovations are underway. The synthesis of metallicnanoparticles has been intensively developed not only due to itsfundamental scientific interest but synthesis of nanoparticles is a relatively new eco-friendly and promising area of research with considerable potential for expansion. On the other hand, chemical synthesis occurs generally under extreme conditions (e.g. pH, temperature) and chemicals used may have associated environmental and human health impacts. The use of microorganisms during the biosynthesis of metallicnanoparticles and their unique properties that make them good candidates for many applications, including

Food: Nanotechnology provides a range of solutions to engineering and scientific challenges> In the food field, the vital industry to manufacture high quality safe food through the use of means that have bearing capacity; where nanotechnologycan be applied in the fields of food production, processing, safety and packaging, it may improve the covering and packaging process using nanocomposites by adding anti- bacterial agents directly to the surface of the laminated tape, and the nanocomposites may increase or decrease the gas permeability process in the different filling layers according to What is needed in different products, in addition to that, it improves the heat resistance and mechanical properties, and reduces the oxygen transfer rate

Cosmetics: this is one of the fields of applications ofnanotechnology in condoms from the sun's rays, the traditionalmethod of protection from ultraviolet rays is prescribed from Lack of long-term stability; Except that the sunscreens based on particles metallic nanostructures, including titanium dioxide,provide more advantages, as the nanoparticles of titanium dioxide have a comparable effect in the property of protecting from the sun's ultraviolet rays as it is the same with bulk materials, but it loses the unwanted whitening process of other preparations. Constructions: Nanotechnology has the power to increase the construction rate and make it a faster, cheaper and more versatile process. The automation process of nanotechnology may allow construction to create structures and buildings ranging from advanced homes to massive skyscrapersmuch faster and at a much lower cost.

Filters: As a result of using nanotechnology applications, refineries producing materials, including steel and aluminum, will be able to remove and eliminate any impurities in the materials they produce.

Manufacture of vehicles: Just as in spacecraft manufacturing, lighter, stronger materials are a great asset in making vehicles and cars that are faster and safer. Combustion engines also benefit from parts that are rigid and heat-resistant

3.2 Medical Application

Nanomedicine is the medical application of nanotechnology. Nanomedicine ranges from the medical applications of nanomaterials and biological devices, to nanoelectronic biosensors, and even possible future applicationsof molecular nanotechnology such as biological machines. Current problems for nanomedicine involve understanding the issues related to toxicity and environmental impact of nanoscale materials (materials whose structure is on the scale of nanometers, i.e. billionths of a meter). Functionalities can be added to nanomaterials by interfacing them with biological molecules or structures. The size of nanomaterials is similar to that of most biological molecules and structures; therefore, nanomaterials can be useful for both in vivo and in vitro biomedical research and applications. Thus far, the integration of nanomaterials with biology has led to the development of diagnostic devices, contrast agents, analytical tools, physical therapy applications, and drug delivery vehicles. Nanomedicine seeks to deliver a valuable set of research tools and clinically useful devices in the near future. The National Nanotechnology Initiative expects new commercial applicationsin the pharmaceutical industry that may include advanced drug delivery systems, new therapies, and in vivo imaging. Nanomedicine research is receiving funding from the US National Institutes of Health Common Fund program, supporting four nanomedicine development centers. Nanomedicine sales reached $16 billion in 2015, with a minimum of $3.8 billion in nanotechnology R&D being invested every year. Global funding for emerging nanotechnology increased by 45% per year in recent years, withproduct sales exceeding $1 trillion in 2013. As the nanomedicine industry continues to grow, it is expected to havea significant impact on the economy.[1]

4.1.1 Nanotechnology in health and medicine

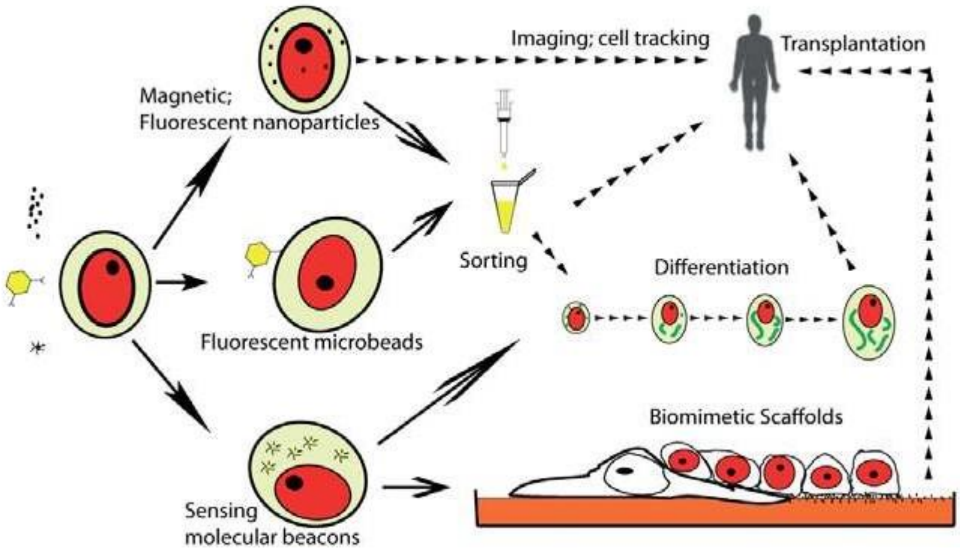
Even today various disease like diabetes, cancer, Parkinson's disease, Alzheimer's disease, cardiovascular diseases andmultiple sclerosis as well as different kinds of serious inflammatory or infectious diseases (e.g. HIV) constitute a highnumber of serious and complex illnesses which are posing a major problem for the mankind. Nanomedicine is an applicationof nanotechnology which works in the field of health and medicine. Nano-medicine makes use of nano materials, and nano electronic biosensors. In the future, nano medicine will benefit molecular nanotechnology. The medical area of nano science application has many projected benefits and is potentially valuable for all human races. With the help of nano medicine early detection and prevention, improved diagnosis, proper treatment and follow-up of diseases is possible. Certain nano scale particles are used as tags and labels, biological can be performed quickly, the testing hasbecome more sensitive and more flexible. Gene sequencing has become more efficient with the invention of nano devices like gold nano particles, these gold particles when tagged with short segments of DNA can be used for detection of genetic sequencein a sample. With the help of nanotechnology, damaged tissue can be reproduced or repaired. These so called artificially stimulated cells are used in tissue engineering, which might revolutionize the transplantation of organs or artificial implants.Advanced biosensors with novel features can be developed withthe help of Carbon nano tubes. These biosensors can be usedfor astrobiology and can throw light on study origins of life. This technology is also being used to develop sensors for cancer diagnostics. Though CNT is inert, it can be functionalized at the tip with a probe molecule. Their study uses AFM as an experimental platform.

i. Probe molecule to serve as signature of leukemia cellsidentified.

ii. Current flow due to hybridization will be through CNTelectrode to an IC chip.

iii. Prototype biosensors catheter development.

Nanotechnology has made excellent contribution in the field, is show in blow figure.



Nanotechnology applications in stem cell biology andmedicine

of stem cell research. For example, magnetic nanoparticles (MNPs) have been successfully used to isolate and group stem cells. Quantum dots have been used for molecular imaging and tracing of stem cells, for delivery of gene or drugs into stem cells, nano materials such as carbon nano tubes, fluorescent CNTs and fluorescent MNPs have been used. Unique nanostructures were designed for controllable regulation of proliferation and differentiation of stem cells is done by designed unique nano structures. All these advances speed up the development of stem cells toward the application in regenerative medicine. The recent applications of nanotechnology in stem cell research promises to open new avenues in regenerative medicine. Nanotechnology can be a valuable tool to track and image stem cells, to drive their differentiation into specific cell lineage and ultimately to understand their biology. This will hopefully lead to stem cell-based therapeutics for the prevention, diagnosis and treatment of human diseases .

Nano devices can be used in stem cell research in tracking and imaging them. It has its applications for basic science as well astranslational medicine. Stem cells can be modulated by mixing of nano carriers with biological molecules. Nano devices can be used for intracellular access and also for intelligent delivery and sensing of biomolecules. These technologies have a great impact in stem cell microenvironmentand tissue engineering studies and have a great potential for biomedical applications ;[14][15]

4.1.2 The applications of nano particles in drug delivery

The applications of nano particles in drug delivery Abraxane, is albumin bound paclitaxel, a nano particle used for treatment of breast cancer and non-small- cell lung cancer (NSCLC). Nano particles are used to deliver the drug with enhanced effectiveness for treatment for head and neck cancer, in mice model study ,which was carried out at from Rice University andUniversity of Texas MD Anderson Cancer Center. The reportedtreatment uses Cremophor EL which allows the hydrophobic paclitaxel to be delivered intravenously. When the toxic Cremophor is replaced with carbon nano particles its side effects diminished and drug targeting was much improved and needs a lower dose of the toxic paclitaxel .

Nano particle chain was used to deliver the drug doxorubicin to breast cancer cells in a mice study at Case Western Reserve University. The scientists prepared a 100 nm long nano particle chain by chemically linking three magnetic, iron-oxide nano spheres, to one doxorubicinloaded liposome. After penetration of the nano chains inside the tumor magnetic nanoparticleswere made to vibrate by generating, radiofrequency field which resulted in the rupture of the liposome, thereby dispersing the drug in its free form throughout the tumor. Tumor growth was halted more effectively by nanotechnology than the standard treatment with doxorubicin and is less harmful to healthy cells as very less doses of doxorubicin were used .

Polyethylene glycol (PEG) nano particles carrying payload of antibiotics at its core were used to target bacterial infectionmore precisely inside the body, as reported by scientists of MIT. The nano delivery of particles, containing a sub-layer of pH sensitive chains of the amino acid histidine, is used to destroy bacteria that have developed resistance to antibiotics because of the targeted high dose and prolonged release of the drug. Nanotechnology can be efficiently used to treat

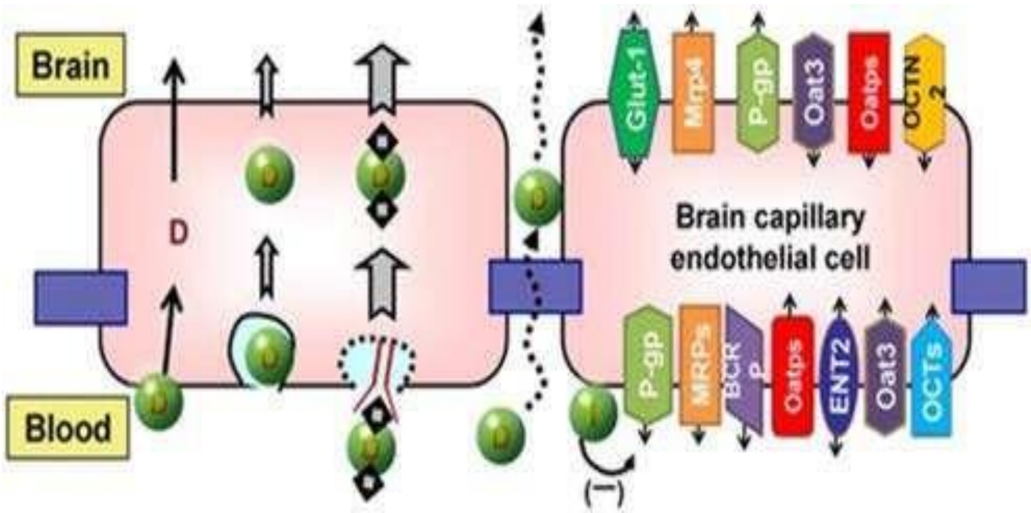
various infectious diseases .

Researchers in the Harvard University Wyss Institute have usedthe biomimetic strategy in a mouse model . Drug coated nano particles were used to dissolve blood clots by selectively binding to the narrowed regions in the blood vessels as the platelets do . Biodegradable nanoparticle aggregates were coated with tissue plasminogen activator, tPA, were injected intravenously which bind and degrade the blood clots. Due to shear stresses in the vessel narrowing region dissociation of the aggregates occurs and releases the tPA-coated nano particles. The nano therapeutics can be applied greatly to reduce thebleeding, commonly found in standard thrombosis treatment. The researchers in the University of Kentucky have created X-shaped RNA nano particles, which can carry four functional modules. These chemically and thermodynamically stable RNAmolecules are able of remaining intact in the mouse body for more than 8 hours and to resist degradation by RNAs in the blood stream. These X-shaped RNA can be effectively performing therapeutic and diagnostic functions. They regulate gene expression and cellular function, and are capable of binding to cancer cells with precision, due to its design. ‘Minicell’ nano particle are used in early phase clinical trial for drug delivery for treatment of patients with advanced and untreatable cancer. The minicells are built from the membranes of mutant bacteria and were loaded with paclitaxel and coated with cetuximab, antibodies and used for treatment of a varietyof cancers. The tumor cells engulf the minicells. Once insidethe tumor, the anti-cancer drug destroys the tumor cells. The larger size of minicells plays a better profile in sideeffects. The minicell drug delivery system uses lower dose of drug and has less side-effects can be used to treat a number of differentcancers with different anti-cancer drugs .

Nano sponges are important tools in drug delivery, due to their small size and porous nature they can bind poorly-soluble drugs within their matrix and improve their bioavailability. They can be made to carry drugs to specific sites, thus help to prevent drug and protein degradation and can prolong drugrelease in a controlled manner.[16][17]

4.1.3 Nanotechnology in the treatment ofneurodegenerative disorders

One of the most important applications of nanotechnology is in the treatment of neuro degenerative disorders . For the delivery of CNS therapeutics, various nano carriers such as, dendrimers, nano gels, nano emulsions, liposomes, polymeric nano particles, solid lipid nano particles, and nano suspensions have been studied. Transportation of these nano medicines has been effected across various in vitro and in vivo BBB models by endocytosis and/or transcytosis, and early preclinical successfor the management of CNS conditions such as, Alzheimer's disease, brain tumors, HIV encephalopathy and acute ischemic stroke has become possible. The nanomedicine can be advancedfurther by improving their BBB permeability and reducing their neurotoxicity, is show in blow figure

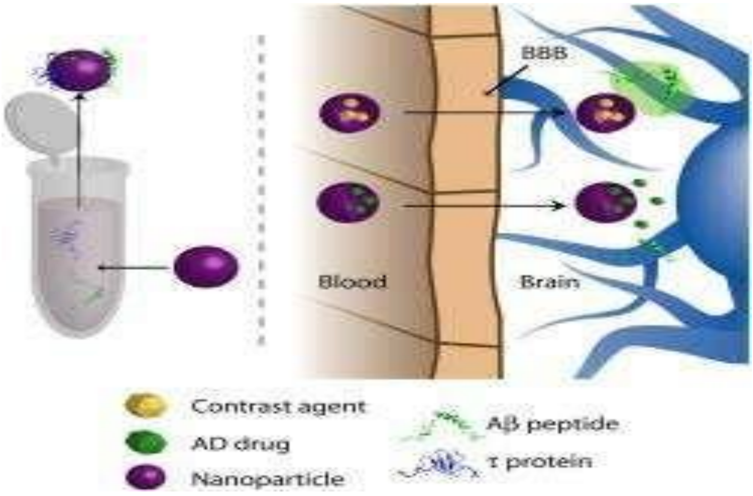


Delivery of nano medicine to CNS through BBB.

Parkinson's disease: This can improve current therapy of Parkinson's disease (PD). Parkinson's disease (PD) is the secondmost common neurodegenerative disease after Alzheimer's disease and affects one in every 100 persons above the age of65 years, PD is a disease of the central nervous system; neuro inflammatory responses are involved and leads to severe difficulties with body motions. The present day therapies aim toimprove the functional capacity of the patient for as long as possible but cannot modify the progression of the neurodegenerative process. Aim of applied nanotechnology is regeneration and neuro protection of the central nervous system (CNS) and will significantly benefit from basic nanotechnologyresearch conducted in parallel with advances in neurophysiology, neuropathology and cell biology. The efforts are taken to develop novel technologies that directly or indirectly help in providing neuro protection and/or a permissive environment and active signaling cues for guided axon growth. In order to minimize the peripheral side-effects of conventional forms of Parkinson's disease therapy, research is focused on the design, biometric simulation and optimization ofan intracranial nano-enabled scaffold device (NESD) for the site-specific delivery of dopamine to the brain, as a strategy. Peptides and peptidic nano particles are newer tools for various CNS diseases.

Nanotechnology will play a key role in developing new diagnostic and therapeutic tools. Nanotechnology could providedevices to limit and reverse neuro pathological disease states, to support and promote functional regeneration of damaged neurons, to provide neuro protection and to facilitate the delivery of drugs and small molecules across the blood–brain barrier. For the delivery of CNS therapeutics, various nanocarriers such as dendrimers, nano gels, nano emulsions, liposomes, polymeric nano particles, solid lipid nano particles, and nano suspensions have been studied. Transportation of these nano medicines has been effected across various in vitro and in vivo BBB models by endocytosis and/or transcytosis, and early preclinical success for the management of CNS conditions such as, Alzheimer's disease, brain tumors, HIV encephalopathy and acute ischemic stroke has become possible.Future development of CNS nanomedicines needs to focus on increasing their drug-trafficking performance and specificity

for brain tissue using novel targeting moieties [18][19], is show in blow figure.



Use of nano particles in Alzheimer's disease

4.1.4 The clinical application of nanotechnologyin operative dentistry

Nanotechnology aims at the creation and utilization of materialsand devices at the atomic, and molecular level, supra molecular structures, and in the exploitation of unique properties of

particles of size 0.1 nm to 100 nm. Nano filled composite resin materials are believed to offer excellent wear resistance, strength, and ultimate aesthetics due to their exceptional polishability and luster retention. In operative dentistry, nano fillers constitute spherical silicon dioxide (SiO2) particles with an average size of 5-40 nm. The real innovation about nano fillers is the possibility of improving the load of inorganic phase. The effect of this high filler load is widely recorded in terms of mechanical properties. Micro hybrid composites with additional load of Nano fillers are the best choice in operative dentistry. It is expected that in near future, it would be possible to use a filler material in operative dentistry, whose shape and composition would closely mimic the optical and mechanical characteristics of the natural hard tissues (enamel and dentin). Italso explains the basic concepts of fillers in composite resins, scanning electron microscopy and energy dispersive spectroscopy evaluation, and filler weight content. Nanocomposite resins are non-agglomerated discrete nanoparticles that are homogeneously distributed in resins or coatings to produce nanocomposites have been successfully manufactured by nano products Corporation. The nanofiller used is aluminosilicate powder with a mean particle size of 80 ran 1:4 M ratio of alumina to silica and a refractive index of
1.508. These nano composites have superior hardness, flexural strength, modulus of elasticity, decreased polymerization shrinkage and also have excellent handling properties particle size of 80 ran 1:4 M ratio of alumina to silica and a refractive index of 1.508 .[20][21]

4.1.5 Delivery of drugs to cells

An application is currently being developed that involves theuse of nanoparticles to deliver drugs, heat, light, or other materials to specific types of cells (such as cancer cells). Particles are designed to be attracted to diseased cells; This enables direct treatment of these cells. This technique reduces damage to healthy cells in the body and allows early detection disease.[24]

Treat wounds and infections

Researchers at the University of Wisconsin have shown a bandage that applies electrical pulses to the wound using electricity produced by the nanogenerators worn by the patient.

4.1.6 Treatment of bleeding

For shock patients suffering from internal bleeding, another method is needed to reduce blood loss; So researchers at ChaseWestern Reserve University are developing polymer nanoparticles. They act as artificial platelets; Laboratory tests have shown that injecting these artificial platelets significantly reduces blood loss

4.1.7 Stem cells

North Carolina State University researchers are developing a method to deliver cardiac stem cells to damaged heart tissue.To increase the amount of stem cells that are delivered to the tissues

Conclusion

The nanotechnology is the technology of the future. This promising technology has begun to enter all medical, industrial,electronic and military fields, and it also carries solutions to many environmental, health and technical problems. Masteringall fields of nanotechnology requires the harnessing of tremendous research efforts with a tremendous human cadre with advanced skills, as well as the huge financial supportrequired to cover the expenses of the various aspects of that. Infact, nanotechnology is relatively modern, and therefore it is noteasy for a country to enter all its corridors and mastery in it, andthe difficulty and challenge increases for less advanced countries with weaker capabilities, and accordingly, the localization of nanotechnology requires focusing on specific areas in line with The directions and objectives of the national development plans and the various sectoral plans and policieson the one hand, and the available human expertise takes into account the technical transfer on the other hand, whether within

institutions of higher education and scientific research oroperating in the productive and service sectors.

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