NANOMATERIALS USED IN THE FIELD OF MEDICINE

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ABSTRACT: Nanomaterials can be defined as materials possessing, at minimum, one external dimension measuring 1-100nm.Nanomaterials can occur naturally, be created as the by-products of combustion reactions, or be produced purposefully through engineering to perform a specialised function. Nanomedicine involves the use of nanotechnology for clinical applications and holds promise to improve treatments. Recent developments offer new hope for cancer detection, prevention and treatment. Personalized Medicine (PM) aims to revolutionize cancer therapy by matching the most effective treatment to individual patients. Nanotheranostics comprise a combination of therapy and diagnostic imaging incorporated in a nanosystem and are developed to fulfill the promise of PM by helping in the selection of treatments, the objective monitoring of response and the planning of follow-up therapy.

CUVINTE CHEIE: nanomaterials, nanomedicine, nanotechnology, nanosystem

1. Introduction

The topic of this paper is the following topic of discussion -What are nanomaterials and what is their purpose in medicine-?

Nanomaterials are chemicals or materials whose particles are at least 1 to 100 nanometers in size. Due to the fact that, at the same volume, the specific surface area is larger, nanomaterials may have different characteristics from those of the same material without nanometric structure. Therefore, the physicochemical properties of nanomaterials may differ from those of bulk substances or larger particle.

The topic is approached with interest, it represents an overview, oriented both to the knowledge of the term NANOMATERIALS and to the knowledge of their functions.

The information is gathered from sources carefully studied by specialists in the field.

The paper is based on the structure, language and instructions learned in the information technology course.

2. What are nanomaterials?

The term nanoscale refers to the size of 10-9 meters. It's the billionth part of a meter. Thus, particles whose external size or internal structure size or surface structure size is in the range of 1nm to 100nm are considered to be nanomaterials. These materials are invisible to the naked eye. The materials science approach of nanotechnology is being considered for nanomaterials. At this scale, these materials have unique optical, electronic, mechanical, and quantum properties compared to their molecular-scale behavior.

3. Classification of nanomaterials

The classification of nanomaterials depends mainly on their morphology and structure, they are classified into two major groups as consolidated materials and nanodispersions. Enhanced nanomaterials are further classified into several groups. One-dimensional dispersive Nano systems are called

Nanopowders and Nanoparticles. Here nanoparticles are further classified as nanocrystals, nanoclusters, nanotubes, supermolecules, etc. For nanomaterials, size is an important physical attribute.

Nanomaterials are often classified according to their nanoscale size. Nanomaterials whose all three dimensions are nanomatically scale and which show no significant difference between the longest and shortest axes are called nanoparticles. Materials with their two nanoscale sizes are called Nanofibers. Empty nanofibers are known as nanotubes, and solid ones are known as nanorods.

Based on the phases of matter contained in nanostructured materials, they are classified as nanocomposite, nanofoam, nanoporous and nanocrystalline materials. Solid materials that contain at least one physically or chemically distinct region with at least one nanoscale-sized region are called Nano Composites. Nanofoams contain a liquid or solid matrix, filled with a gaseous phase and one of the two phases is nanoscale in size.

4. What are the properties of nanomaterials?

Nanotechnologies make it possible to obtain innovative materials and devices with new properties.

1. Crystalline structure

The crystal structure of the nanoparticles is different from that of the macrocrystalline material: - the zirconium oxide nanoparticles are tetragonal / cubic (the equilibrium structure is monoclinic).

2. Electronic structure

The electronic band structure changes at the nanoscale: - in the TiO2se nanoparticles there is a change in the width of the forbidden band (in the sense of decreasing it); - Hg nanoparticles <2 nm show non-metallic conduction.

3. Optical properties

The optoelectronic behavior of nanoparticles is different from that of densified material: - The wavelength of the emitted light depends on the particle size at the nanometer scale.

4. Diffusion

Atomic diffusion in nanoparticles is different from that in materials with crystalline micro-grains: - exponential dependence on particle size; - surface effects.7.

5. Solubility

Substances that are not micrometrically soluble may become nanometrically soluble.

6. Mechanical properties

The mechanical properties of nanocrystalline materials are very different:

- dislocations influence the ductility and mechanical strength of microcrystalline materials; - the slippage of the dislocations determines the appearance of the deformations and eventually the destruction of the solid body;
- dislocation activity decreases as the size of crystalline grains decreases;
- dislocations are absent in nanocrystals with dimensions of 10-20 nm.

5. What are nanorobots?

Early diagnosis and guidance of cancer drugs, biomedical tools, surgery, pharmacokinetic monitoring (a branch of pharmacology that studies the phenomena involved in the processes of absorption, distribution, transformation and elimination of drugs from the body) of diabetes and health care.

Nanotechnology offers a wide range of new technologies for the development of customized solutions that optimize the delivery of pharmaceutical products. Today, harmful side effects of treatments, such as chemotherapy, are usually the result of drug delivery methods that do not indicate high accuracy in target cells. That's why Harvard researchers were able to create nanoparticles, which they filled with chemotherapy drugs. These particles are attracted to cancer cells. When a nanoparticle encounters a

cancer cell, it adheres to it and releases the drug into the cancer cell. This directed method of administering drugs has the potential to treat cancer patients and at the same time avoid adverse effects (usually associated with improper administration of drugs).

Fig.2. Nanorobot

Another useful application of nanorobots is to help repair tissue cells along with white blood cells. Recruitment of inflammatory cells or white blood cells to the affected area is the first reaction of the injured tissues. Due to their very small size, nano-robots could attach to the surface of recruited white blood cells, shorten their path through the walls of blood vessels and reach the affected area, where they can aid in the repair process. of tissues. Certain substances may also be used to speed up recovery.

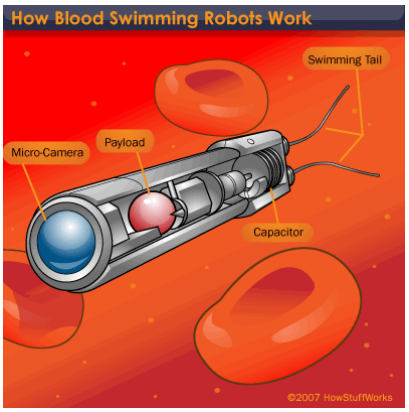

Fig.3. Nanorobot components

6. What are the advantages of molecular nanotechnology?

With the stated goal of eradicating all common diseases known in the 20th century, pain and suffering, nanomedicine is the main weapon of war, especially in areas where traditional medicine has proved insufficient. The advantages of molecular nanotechnology in all branches of medicine are many, here are the most obvious:

-possibility of more accurate and faster diagnosis of diseases
-accelerated effects of treatments by targeting them even on diseased cells
- reducing the danger of side effects by protecting areas where treatment is not necessary
-verifying the progress of the treatment by following the behavior of the treated organs
- tests performed directly on diseased organs

But the extraordinary elements introduced by nanomedicine are nanorobots. Tiny particles, with dimensions between 0.5 and 3 microns, formed mainly of carbon, but also of hydrogen, oxygen, nitrogen,

sulfur, fluorine, silicon, nanorobots are introduced directly into the bloodstream in which they "paddle" diligently to diseased organs or which must be analyzed.

7. Conclusions

Before medicine progressed, until the Middle Ages and until the end of this period, the only method that doctors believed could cure a person was a small incision in the arm area to allow blood to flow.

With the evolution of technology, nanotechnology has emerged that has been introduced into medicine, resulting in nanomedicine. It is looking for ways to cure people with certain diseases from the onset of the disease at the molecular level, so that it can no longer spread.

The introduction of nanorobots into medicine would revolutionize the world of medicine and completely change life on earth. The introduction of a nanorobot into a human body would have many advantages, namely: it would walk in the human body and go immediately to the cells where there would be problems and would repair them immediately without giving the virus a chance to evolve, there would be no need for surgery, there would be a healthier population, diseases that are common today, probably would no longer exist and this technology would increase a person's life rate.

Sitography:

[1]. https://www.dreamstime.com/vector-illustration-cartoon-flat-nanorobots-blood-concept-logo-background-medicine-future-science-futuristic-image119517679
https://www.shutterstock.com/ro/search/nanorobot
[2]. https://electronics.howstuffworks.com/nanorobot.htm
[3]. https://euon.echa.europa.eu/ro/future-of-nanomedicines
[4]. https://www.diamondprotect.ro/blog/nanomedicina-rezultat-uluitor-al-nanotehnologiei
[5]. https://easyengineering.ro/tehnologiile-viitorului-nanotehnologia/
[6]. https://www.e-antropolog.ro/2014/08/nanotehnologia-in-medicina-nanomedicina/
[7]. http://journal.managementinhealth.com/index.php/rms/article/view/99/220
[8]. https://www.e-antropolog.ro/2014/08/nanotehnologia-in-medicina-nanomedicina/