

„Where Nanotechnology and Nanomedicine meet – Applications and Potential Risks“

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Abstract

Most definitions describing concept of nanotechnology includes control, understanding, design, imaging, measuring and manipulating matter at dimensions between 1 and 100 nanometers. Nano-structure poses unique physical, chemical and biological properties exclusively due to its nanoscale dimensions, significantly different from the properties of bulk materials and single atoms or molecules. Gravity loses impact and importance, surface tension and Van der Waals constants has more importance in system of nano particles. Extremely small size enables nano particles to enter the human body through usual or unusual routes, pass through cell membranes, cross the blood-brain barrier and access new sites, interact with DNA or small proteins at different levels, in blood or within organs, tissues or cells.

Nowadays nanotechnology is being used in a range of applications, with potential to be applied at any stage in food industry: production, processing, packaging, labelling, transporting, tracing, keeping the quality of food product and extend the product shelf-life.

The use of nanotechnologies to solve medical problems can dramatically improve the quality of life. Nanomedicine has the potential to enable early detection, prevention and significantly improve diagnosis, treatment and follow-up of many diseases.

Based on nano (bio) senzors, rapid and sensitive detection of pathogenic bacteria and trace levels of viruses in small sample volumes and lower costs than current in-use technologies are developed. Early detection enables accurate and prompt treatment. Likewise, sensors to detect biofilm formation by bacteria on surfaces are developing

Over 70 products are under clinical trials, covering important diseases including cardiovascular, neurodegenerative, musculoskeletal and inflammatory (such as cancer, atherosclerosis, diabetes, eye diseases, antimicrobial resistance, tissue engineering, Alzheimer disease, arthritis). Nanomedicine delivered over 70 products, including nano-delivery, pharmaceuticals, imaging, diagnostics and biomaterials. Researchers have developed "nano-sponges" that absorb toxins and remove them from the bloodstream, absorb free radicals, monitor the level of nitric oxide (which indicate inflammation, important to monitor inflammatory diseases) in the bloodstream.

Nanomedicine is understood to be a key enabling instrument for targeted and regenerative medicine by delivering of drugs (increases efficiency and minimizes side effects), treatments, implantable devices, early diagnosis of cancers, accurate cancer imaging, cancer therapy and drug delivery.

Multy drug resistant microorganisms present one of the most serious and increasing global, public health threat. This problem causes approximately 25,000 deaths each year and over 1.5 billion expenses in healthcare and productivity losses in Europe. New strategies to combat MDR are urgently needed and nanomaterials

are very promising approach. Metal nanomaterials (silver, gold, copper, titanium, zinc, magnesium, cadmium and alumina) possess unique antimicrobial activities. Silver ions showed strongest bactericidal effect.

Regenerative medicine based on tissue engineering is currently a great exciting challenge for science and industry.

Nanoparticles are also used to stimulate the body's innate repair mechanisms, artificial activation and control of adult stem cells and to deliver vaccine, allowing a stronger immune response

Nanomedicine provides important new tools to deal with the grand challenge of an ageing population.

Future applications of nanomedicine will be based on the ability to build nanorobots. These nanorobots could be programmed to repair specific diseased cells („genetic surgery“), functioning in a similar way to antibodies in our natural healing processes and elimination of bacterial infection. Intense research is going on to make changes in the DNA structure of human beings as it can bring about a way to cure gene-related diseases.

Risks of nanotechnology are still unknown and unpredictable.

Potential problem with is the lack of knowledge and understanding the impact these products will have on the nanoscale. Initial scientific studies showed negative effects on living organisms and a potential for serious threat to human health in connection with disposal of nanowaste and environmental contamination. Scientists are primarily concerned with toxicity, characterization and exposure pathways.

Number of ethical and societal concerns raised, ranging from possible health risks of using or consuming nanoenabled products, intellectual property rights governing them, and the new challenges they may raise.

There are concerns that strong economic competition may be taking precedence over scientific prudence when it comes to public health and the potential dangers of nanotechnology.

However, currently the benefits of nanomedicine definitely outweigh the risks.

Key words: antimicrobial, ions, nanoparticles, nanomedicine, nanotechnology.