

NANOTECHNOLOGY IN MODERN SCIENCE AND TECHNOLOGY

Kychkyruk Olga

Candidate of Chemical Sciences,

Associate Professor

Ivaniuk Daria

Student

Department of Chemistry

Ivan Franko Zhytomyr State University, Ukraine

Nanotechnology is a branch of science and technology that deals with the creation, research and use of materials and devices at the nanometre (1-100 nm) level. It is also an interdisciplinary field that combines physics, chemistry, biology, materials science and engineering to manipulate matter at the molecular and atomic levels [1].

The development of nanotechnology began with Richard Feynman's idea of 'looking down' at atoms and molecules, which was announced in 1959. The first practical steps in this area were taken in the 1980s with the invention of scanning tunnelling microscopes, which allow the manipulation of individual atoms [2]. Since then, the development of such technologies has opened up new horizons for creating materials with unique properties [3].

They are used to develop new methods of diagnosis, treatment and drug delivery. For example, nanoparticles can be used to accurately detect cancer cells or deliver drugs directly to a tumour [4]. They enable the creation of miniaturised components for mobile devices, chips and sensors with increased performance and reduced power consumption [1].

Nanomaterials play an important role in the development of new materials for solar panels, batteries and fuel cells, which can improve efficiency and reduce energy consumption. Carbon nanotubes (in particular, graphene) are used to create highly resistant materials, lightweight and ultra-strong composites [5].

The use of nanotechnology in water filtration, air purification and the restoration of polluted ecosystems can achieve high efficiency in the fight against pollution. Prospects include significant advances in the creation of new types of electronic devices, biomaterials, and environmentally friendly technologies [3].

Technical challenges include the difficulty of scaling up nanotechnology processes, the existence of production facilities only at the commercial level, and ways to integrate nanomaterials into existing technologies. Economic challenges are related to the high costs of developing and manufacturing nanoproducts. Ethical challenges arise from potential risks to human health and the environment, which require careful monitoring and regulation [4].

Nanomaterials can have potentially toxic properties if used uncontrollably. Therefore, there is a need for careful monitoring of their use. Therefore, the use of nanotechnology in biomedical research and in the creation of nanorobots raises ethical questions about potential changes in the human body.

Given the ongoing development of this field, the future of nanotechnology looks promising. They promise significant advances in creating new materials, improving existing technologies and solving global problems, such as the energy crisis and treating serious diseases. They open up new horizons for science and technology. However, it is important to continue research and development with environmental, safety and ethical considerations to ensure the safe and effective use of these technologies in the future [4].

References

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