Nanotechnology innovations in the field of biomedical equipment production and healthcare

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1 INTRODUCTION

The idea of nanotechnology was first addressed in 1959, in which the physicist and Nobel Prize winner Richard Feynman, proposed the following assumption "why can't we write the twenty-four volumes of the Encyclopedia Britannica on the head of a pin?", relating it to the use of machines to build smaller machines down to the molecular level (Feynman, R. P. 1960). In this context, the word nanotechnology, from the dictionary - a method that allows the subdivision or generation of tiny bodies and particles - or, still, its prefix "nano" refers to the idea of something small, reduced, diminutive and that present different physical and chemical properties emerges as a scientific principle of interest (Bayda, et al., 2020).

With the advance of research in nanotechnology there was a potential growth of innovations in several areas, among them: electronics manufacturing, logistics facilities, differentials in agriculture, renewable energy sources, among others. However, the most prominent area of progress is in the health area, which mainly covers the biomedical equipment sector, bringing great improvements to the diagnosis, treatment, and disease prevention sector.

At this juncture, there are numerous nanodevices that can be cited as examples: carbon nanotubes that are used for DNA mutation detection and disease detection through protein biomarkers, nanocrystals for formulation improvements for drugs with low solubility, nanoparticles that are used in MRI and ultrasound with contrast agents, among countless others (Khalid, et al., 2013).

In this context, the present work aims to approach the innovations in the application of nanotechnology in biomedical and health care equipment.

2 OBJECTIVE

The present work aims to conduct a literature review on nanotechnology innovations, focusing on the production of biomedical and health care equipment, especially considering the most recent updates on the subject.

3 METHODOLOGY

This is a literature review, developed with the collection of data and analysis of different published articles related to the theme of nanotechnology applied to the health area, and especially to the production of biomedical equipment used in the diagnosis, treatment, and disease prevention sector, using the following keywords: nanotechnology, nanoscience, biomedicine, biomedical equipment, health, and medicine. The articles included were preferably those dealing with the subject and available *online*. In addition, we considered articles in Portuguese or English that covered the keywords in question.

4 DEVELOPMENT

In this work, it was possible to verify that nanotechnology is able to circumvent some of the limitations of conventional diagnostic techniques, with the use of nanostructures. Moreover, several nanoparticles have shown promise in the diagnosis of infectious diseases, including fluorescent nanoparticles (semiconductors with high fluorescence capacity, *quantum dots*), magnetic and metallic nanoparticles (gold and silver nanoparticles, iron nanoparticles, copper and cobalt nanoparticles, among others) have been employed for imaging, screening and detection of numerous infectious microorganisms (Tallury et al., 2010).

As described in (Wang et al., 2017) the contact surface and volume of nanostructures become suitable for incorporating other targeting molecules, implementing improvements in real-time detection results using smaller volumes of samples collected from patients. Furthermore, the tools associated with nanodiagnostics can be valuable for disease diagnosis in areas with more scarce resources, such as in developing countries.

Among all the demonstrated applications of nanotechnology, in Brazil, the development of nanotechnology products applied to medicine is still concentrated in universities and research centers, being reported through national and international articles or theses (Cancino, et al., 2014). However, there is still a wide range of areas associated with improvements and new products both in the area of biomedical equipment and health that can still be worked on in general, to improve the health sector, especially the Unified Health System (SUS) in Brazil.

5 CONCLUDING REMARKS

The growth of nanotechnology in the health area has been exponential, leveraging several axes of nanomaterials. The most commonly used and addressed in the work were the nanoparticles, nanocrystals, carbon nanotubes, among others. These nanomaterials are applied in biomedical equipment, with emphasis on diagnostics, treatment, and disease prevention. The main objective of

diagnostics is to initiate treatment of diseases as quickly and effectively as possible, thus reducing risks to patients and improving health conditions and quality of life.

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