Journal of Nanomaterials and Molecular Nanotechnology

Perspective A SCITECHNOL JOURNAL

Emerging Technologies in Nanotechnology

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Received date: 25 January, 2023, Manuscript No. JNMN-23-92376;

Editor assigned date: 27 January, 2023, Pre QC No. JNMN-23-92376 (PQ);

Reviewed date: 10 February, 2023, QC No. JNMN-23-92376;

Revised date: 17 February, 2023, Manuscript No. JNMN-23-92376 (R);

Published date: 24 February, 2023, DOI: 10.4172/2324-8777.1000345

Description

Nanotechnology research is still in its infancy. Nonetheless, advancements are being made in the study and development of nanomaterials' potentially advantageous qualities, which could be crucial in the production of novel and evolving applications for mineral resources. A set of tools called nanotechnology enables business to create nanomaterials and nanostructures with unique features. Mineral commodities in their nanoscale form are being investigated, researched, and produced for new nanotechnology uses. Research on the environmental, human health, and safety issues that unavoidably result from the development of a new technology is ongoing at the same time.

With the exception of a few nanomaterials (CNTs, copper, silver, and zinc oxide), processing and appropriate commercial-scale production procedures, high manufacturing costs, product pricing, and environmental, human health, and safety concerns are obstacles to broad usage. There will be new uses developed for well-known mineral commodities, regardless of whether nanotechnology ushers in a tidal wave of change or is merely a long-term technological evolution. The ability to modify matter at the nanoscale to produce more complex nanomaterials will advance with further research and development, providing new opportunities for business that will alter the flow and usage of mineral commodities as well as the materials and products that are used.

Integrative technologies

A growing amount of trustworthy data of all forms may now be produced quickly and affordably because to the significant advancements in bio-nanotechnology. They primarily consist of biomolecular information that provides several viewpoints on the observed biological processes, whether physiological or pathological; hence, taking them all into account can highlight novel insights on intricate patho-physiological events.

On the other hand, as Information and Communication Technologies (ICT) have advanced, so have data mining and machine learning techniques, which have made it simpler to process the vast amounts of generated data, automatically annotate them, and build repositories for their storage and public accessibility. A significant amount of biomolecular data is being generated, in particular, by the advancement of sequencing techniques and the production of new tools for automatic high-throughput analysis and annotation.

Nanosized particles

When compared to bigger particles of the same composition, nanoscale particles and surface features typically differ in their bioactivity, solubility, and antibacterial properties. Nanotechnology makes use of these features. Inverse linear analysis of particle size cannot therefore be used to infer changes in characteristics; instead, the nanomaterials must be tested *in vitro* and *in vivo*. The creation of nanoparticle fillers to enhance the aesthetics of dental composite has been the main goal of nanotechnology in dentistry. These days, there are more applications for nanotechnology.

Nanotechnology is being employed in biomimetics to produce materials that encourage the remineralization of hard tissues. The formation, replacement, or repair of oral tissues through self-assembly of parts is an example of a biomimetic process. Nanoparticles are utilised to modify dental implant surfaces on dental implants and related devices in order to affect the host response at the cellular and tissue levels. The methods utilised to produce nanotextured, thin-film, biocompatible coatings for implant surfaces include pulsed laser deposition, sputter coating, and ion-beam-assisted deposition. To enhance the interaction with the surrounding apical tissue, these approaches thin the coating layer and increase the specific surface area and responsiveness.

Metals like silver and ceramic powders like silica and titanium dioxide are examples of significant nanoparticles. In restorative resins, bonding resins, and prosthetic resins, *in situ*-produced silver nanoparticles have been shown to be highly successful at inhibiting a variety of biofilm-forming bacteria without impairing manipulation, curing, mechanical qualities, or other performance properties. In dentistry, silica nanoparticles are already widely used in composites and toothpastes. Titanium nanoparticles are frequently employed as dental material pigments, however they lack Ag's more potent antibacterial properties.

Citation: *Zhimin C (2023) Emerging Technologies in Nanotechnology. J Nanomater Mol Nanotechnol 12:1.*