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Opinion Article

Designing, Classification and Applications of Biomedical Nano Materials

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DESCRIPTION

Nanomaterial design has now risen to the top of the research agenda, with the goal of creating specialized applications in biological sectors. Indeed, recent trends in the literature reveal a dearth of in-depth studies that especially highlight current knowledge based on nanomaterial design and manufacture. Size, shape, surface charge, and microstructures are all critical elements to consider since they affect Nanoparticle Performance (NPs). These factors are also shown to be influenced by the procedures used to create them. The principles, sample preparation methods, and achieved results of the characterization techniques utilized to investigate these nanomaterial's are all somewhat diverse.

As a result, the goal is to provide an in-depth overview of contemporary trends in nanomaterials for biomedical engineering, with a focus on nanomaterial selection, preparation methods/instruments, and characterization techniques utilized in nanomaterial design. Tissue regeneration, medicine administration, and wound healing are only a few of the key applications of these nanomaterials that are briefly reviewed. Filling this information gap will lead to a greater understanding of the function of nanomaterial design and future larger-scale applications, both in terms of potential and challenges.

Drug delivery, water purification, data management, and the production of nanoscale materials for healthcare and other industrial purposes have all been demonstrated to benefit from nanotechnologies. The technologies entail either scaling up from a single collection of Nano Particles (NPs) or refining/diminishing bulk materials to a desired nanoscale to create and regulate material properties at the nanometre scale.

Nanotechnologies also deal with managing the shape and size of particles in nanometre-scale materials like NPs to arrange, represent, construct, and use structures, devices, and systems. Nanotechnologies have clearly emerged for a variety of vital applications, spanning from natural sciences to medical and space exploration. Today, nanoscale-organised materials and equipment can be developed and used in a variety of ways.

Nanotechnologies have also sparked the rise of a new area known as nanomedicine, which focuses on improving or changing disease remediation, treatment, and prevention at the cellular level of the human body. The majority of these methods include the use of nanostructured materials in conjunction with biological subjects.

The ability to change the properties of these nanomaterials in a systematic manner by regulating their structures and properties at the nanoscale makes them a very appealing candidate for use in the diagnosis, treatment, and regeneration of biological systems. Different nanostructures have also been investigated to determine their characteristics and potential applications in biosensors. Nanotubes, nanofibres, Nano rods, NPs, and thin films are all used in these structures. The use of nanoparticles in biosensors allows for a variety of new transduction breakthroughs in the study of various chemicals in vivo.

Classification of nanostructures

- Nano spheres
- Nano rods
- Nano stars
- Nano Core–Shells
- Nanotubes
- Quantum Dots
- Nano bubbles
- Nano crystal and Nano cube Structures

Applications of nanomaterial's

Particle size distribution, diameter, and shape are critical factors for evaluating developed NPs, and they may be assessed using a variety of characterization approaches.

A zetasizer, scanning electron microscopy (SEM), transmission electron microscopy (TEM), and atomic force microscopy (AFM) are some of the techniques used to determine particle diameter, shape, and dispersion phase.

Nanotechnology has undoubtedly had a considerable impact in the biomedical field, resulting in amazing achievement in the

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development of a diverse range of usable nanomaterial's for a variety of medical applications.

A few NP features have improved as critical criteria for controlling the capacity of designed NPs, and they should be employed to further future efforts.

These attributes include particle shape, microstructure, diameter, and charges on its surface, all of which can be modified by choosing the right method (for example, seeding growth process), materials, and preparation instrument.

CONCLUSION

To acquire a complete picture of the proposed NPs, these properties should be investigated using a mix of the aforementioned characterization approaches; however, sample preparation for these investigations can be difficult for some NPs.

As a result, scientists are being asked to develop basic and straightforward characterization approaches in order to keep this subject moving forward.

Finally, bringing some industrial concepts to the realm of nanomaterial-based biomedical applications, such as Quality by Design (QbD), and fostering mixed teaming from industry people are important.