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Opinion Article

Nanotechnology Based on Protein Drug Developments

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DESCRIPTION

The nanomedicine era has lately undergone a transformation thanks to the crucial function of protein-based nanostructures. Due to their size and larger surface area, which causes them to be more reactive to other molecules, protein nanoparticles have proven to be the main catalyst for changing the properties of many conventional materials. Better biocompatibility, biodegradability, and surface modification options are all features of protein nanoparticles. Proteins like albumin, gelatin, whey protein, gliadin, legumin, elastin, zein, soy protein, and milk protein can be used to create these nanostructures. They can be made by emulsification, desolvation, complicated coacervation, and electrospray, among other methods. Particle size, particle shape, surface charge, drug loading, determining drug entrapment, particle structure, and in vitro drug release are the characterization criteria of protein nanoparticles. Eminent researchers have investigated and documented a wide range of protein nanoparticle applications *via* various routes of administration, which are covered in the current review along with the patents issued for protein nanoparticles as drug delivery vehicles.

Research and technology advancements at the atomic, molecular, and macromolecular sizes have dramatically increased in recent years, enabling the controlled manipulation and analysis of structural ranges from 1 to 100 nm. Nanoparticles fall under the category of colloidal drug delivery systems, which act as a single entity in terms of their characteristics and mode of transportation. These are used as medication delivery systems to enhance cellular as well as systemic absorption. Because they have a higher surface area per weight than microparticles and are therefore more effective drug carriers, nanoparticles have become the main cause of changes in the characteristics of many conventional materials.

Liposomes, inorganic nanoparticles, dendrimers, magnetic nanoparticles, nanocrystals, and nanotubes are some of the different types of nanoparticulate systems. Other types include polymeric nanoparticles, polymeric micelles, solid nanoparticles, lipid-based nanoparticles, such as solid lipid nanoparticles (SLN), nanostructured lipid carriers (NLC), and lipid drug conjugates (LDC), as well as The nanoparticles are created using a variety of components, including proteins, lipids, polymers, and polysaccharides. The size of the nanoparticle, the intended drug release profile, the qualities of the drug, such as solubility and stability, and the nature of the material, such as biodegradability and toxicity, are some parameters for choosing the matrix material for nanoparticles. Due to their low toxicity and biodegradability, biopolymer-based nanoparticles, particularly protein nanoparticles, are being actively exploited in medicines and nutraceuticals.

Proteins are a class of natural proteins that demonstrate special qualities and functions in the production of biological components. Gelatin, protein, and albumin are all sources of different nanomaterials. These nanoparticles are relatively simple to manufacture, and their size can be easily monitored. They also offer significant qualities such biodegradability, nonantigenicity, metabolizable, surface modification, and better stability when stored *in vivo*. These particles can form covalent bonds with drugs and ligands . Protein nanoparticles can be combined into biodegradable polymer in the form of microspheres for controlled and sustained release in a variety of targeted therapies, which would include pulmonary delivery, cancer therapy, cancer therapy, and immunizations.

The main goal when creating a nanoparticle drug delivery system is to regulate the particle size, surface area, and surface characteristics so that the nanoparticles carrying the necessary amount of drug demonstrate desired pharmacological activity by releasing actives to produce site-specific action. Protein nanoparticles can be used in both health and material sciences and offer a number of distinctive capabilities. Because of their amphiphilicity, which enables the nanoparticles to interact with both the drug and solvent, they are suggested as the best material for the creation of nanoparticles. Biodegradable, metabolizable, and readily responsive to surface alterations, nanoparticles made from natural proteins can be attached with drugs and other ligands. They can be created from different proteins, such as water-soluble proteins (e.g., bovine and human serum albumin) as well as insoluble protein (e.g., zein and gliadin). The evaluation of protein and synthetic nanoparticles.

Comparing artificial and protein nanoparticles. Numerous benefits of protein nanoparticles include their capacity to lower

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toxicity, accelerate medication release, increase bioavailability, and offer superior formulation options. Protein nanoparticles can exhibit superior efficacy at low doses and can also lessen a person's body's innate medication resistance. Additionally, it is possible to increase the medication's surface area and rate of drug dissolution when it is embedded in a nanoparticle. Oral administration, venous administration, and inhalation are only a few of the delivery methods for nanoparticles. The medicine must be preserved and protected while being absorbed into the system without causing any chemical reactions. Numerous methods have been found to accomplish this, including modulating the choice of matrix constitution and achieving site specificity.

CONCLUSION

The technique can be used for several routes of administration and the nanoparticles can enhance the solubility and stability of encapsulated medications by attaching targeting labels to the surface of the particles. Every single item in the cosmos has some positive and negative elements, as is the law of nature. These are a few issues with protein nanoparticles since they can interact with living things, causing toxicity to depend on chemical composition, and their unpredictable molecular size can further alter the system's delivery. The biological behaviour of nanoparticles in terms of *in vivo* distribution at the organ and cellular levels is fundamentally poorly understood. Due to their small size, nanoparticles have significant free energies. Agglomeration and aggregation result from this. Due to their sluggish biodegradation, nanoparticles may be harmful to the system and make dose adjustments more difficult. This contains both the advantages and disadvantages of protein nanoparticles.