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APPLICATIONS OF NANOTECHNOLOGY IN DRUG DEVELOPMENT

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ABSTRACT

Nanotechnology is concerned with the study of smaller structures with sizes from 0.1 to 100 nm. Is a specialty that will change the fate of the pharmaceutical industry in the near future. This includes various fields such as biophysics, molecular biology, biotechnology and his subfields of medicine Cardiology, Ophthalmology, Endocrinology, Oncology, Immunology, etc. Pharmacies develop new drug delivery systems that can overcome the short comings from conventional drug delivery systems

INTRODUCTION:

Nanotechnology is very small structures. Pharmaceutical Nano technology deals with the formation and development of small structures such as atoms, molecules or compounds with sizes 0.1 to 100 nm. These structures can be further developed into specialized devices with the required properties and characteristics [1].The application of nanotechnology in pharmacy is helping formulate more advanced drug delivery systems and is therefore an important and powerful tool Alternative to conventional dosage forms. Pharmaceutical nanotechnology is his specialty that will change the fate of the pharmaceutical industry in the near future. Pharmaceutical nanotechnology helps combat multiple diseases by detecting disease-associated antigens and microbes and viruses Cause disease [2-5].Pharmaceutical nanotechnology has played a very important role in overcoming some drawbacks of conventional dosage forms such as tablets, capsules, etc. Conventional forms have poor bioavailability, low patient compliance, and low bioavailability. It has drawbacks such as low cytotoxicity and damage to healthy cells, which have been addressed in pharmaceutical nanotechnology [6-10].

Pharmaceutical Nanosystems

a) Polymeric nanoparticles: have a size range of 10-1000 nm, are biocompatible and biodegradable, and provide complete drug protection. Polymeric nanoparticles are used as carriers for the controlled and sustained delivery of drugs [11,12].

b) Dendrimers: dendrimers are less than 10 nm in size and are produced by controlled polymerization. Theseare highly branched monodisperse polymer systems. Dendrimers are used for controlled drug delivery and targeted drug delivery to macrophages and liver [13-14].

c) Metallic nanoparticles: Metallic nanoparticles are colloids of gold and silver with a size of less than 100nm, which are very small and therefore have a large surface area, high bioavailability and stability, making them ideal as drugs. They are used for drug and gene delivery, sensitive diagnostic assays, thermal ablation, and enhanced radiotherapy. span class='highlighted color-2'>>

d) Polymeric micelles: They have a size range of 10-100 nm with high drug entrapment nature and bio stability. They are of high diagnostic value and are used for active and passive targeted delivery of drugs. span class='highlighted color-2'>>

e) Liposomes: These are phospholipid vesicles with a size range of 50-100 nm with features of good biocompatibility and entrapment efficiency. They are used for passive and active delivery of genes, proteins, and peptides.

Pharmaceutical Nanomaterials: Various materials that play an important role in pharmaceutical nanotechnology are:

Nanomaterials: These are biomaterials used for surface modification or coating that help improve the biocompatibility and bioavailability of a variety of other materials.

Nanocrystalline Materials: These are manufactured to act as replacements for materials with poor bioavailability, solubility and other properties.

Nanostructured Materials: These are machined shapes with specialized shapes and functions, including nano and micro electromechanical systems, microfluidics, and microarrays.

Applications of pharmaceutical nanotechnology

a) Drug delivery systems: Conventional drug delivery systems have various limitations such as lack of specificity, higher metabolic rate, cytotoxicity, high dose requirements, and poor patient compliance, which are overcome by drugs. can. Delivery system formulated according to Principle of Pharmaceutical Nanotechnology

b) Diagnostics: Molecular imaging characterizes and quantifies biological processes in organisms, including gene expression, protein-protein interactions, signal transduction, cellular metabolism, and both intra- and intercellular transport Science.

c) Drug Discovery: Pharmaceutical nanotechnology plays an important role in drug discovery and development as it contributes to improving properties such as solubility and bioavailability of active drugs and excipients.

1. Nanomedicine for Cancer: Cancer is one of the leading causes of death worldwide, ranking second in developing countries, with an increasing incidence over time. Current cancer treatment strategies are based on surgery, radiotherapy, and chemotherapy, with chemotherapy showing greater efficacy, mainly for treating more advanced stages of cancer. Despite this large response, anticancer drugs are administered in larger doses to give the appropriate final concentration in the target tissue or organ, and this process is repeated with each cycle of chemotherapy. Although the introduction of new drugs into cancer therapy has greatly improved patient survival, there are still some biological barriers that impede drug delivery to target cells and tissues. Clearance from the human body. In addition, cancer has a small subset of cancer cells, cancer stem cells (CSCs), which, like normal stem cells, can self-renew, give rise to heterogeneous populations of daughter cells, and proliferate increase. Because standard chemotherapy targets rapidly dividing cells, the majority of non-stem cells in tumors, CSC often appears relatively resistant to these agents. normal tissue side effects (e.g. nephrotoxicity, neurotoxicity, cardiotoxicity) and the development of Multidrug resistance (MDR) mechanisms in cancer cells result in decreased drug concentrations at target sites and poor tumor accumulation. . Decreased efficacy as a result may be associated with patient relapse .span class='highlighted color-1'>>To overcome these problems and further improve the efficacy of chemotherapeutic agents, less toxic and more targeted therapies against cancer cells are needed, i.e. New drugs, drug delivery systems (DDS), and gene delivery systems. Nanotechnology is the manipulation of matter at the atomic, molecular, and supramolecular levels and includes the design, fabrication Characterization and application of various nanoscale materials that enable new technological advances. Of medicines Enabling nanomedicine .Drug development and optimization Nanoparticle-based delivery approaches address. Early detection of cancer cells and/or specific tumor biomarkers and improved efficacy of applied therapiesMajor biomedical applications of nanoscale materials areGenexol-PM® (Samyang Biopharmaceuticals Corporation, Jongno-gu, Seoul,Korea), Abraxane® (Celgene Corporation, Inc., Berkeley Heights, NJ, USA), Myocet ®. (SopherionTherapeutics Inc., Princeton, NJ, USA) and Oncaspar® (Enzon Pharmaceuticals Inc., Bridgewater, NJ, USA) are approved for the treatment of cancer. Use of nanoparticles for cancer therapy can be based on specific properties such as nanoparticle size, surface texture, potential for different specific ligands on the nanoparticle surface. The excellent Surface properties and other physico-chemical properties characteristics of nanoparticles too develop valuable systems for the qualitative or quantitative detection of tumor cells. Cancer cells are targeted using two different strategies: passive targeting and active targeting. Passive targeting of tumor cells with nanoparticles on EPR effect facilitated by angiogenic vasculature with defective vasculature, inadequate lymphatic flow, resulting in Accumulation in tumor cells compared to normal cells higher. Increased drug accumulation in tumors stroma Feasible with nanoparticles 10-fold or more greater than drug alone. This mode of delivery is in the middle of the circulation of nanoparticles based on blood flow, size, and surface texture, and nanoparticles About the degree of angiogenesis. Despite increased drug accumulation within tumors, this strategy may be targeted for such mechanisms based on the controversial impact of EPR action on drug externalization , which promotes broad distribution throughout the tumor. Raises some concerns about specificity Such lack of targeting specificity is achieved by functionalizing the nanoparticle surface with various functional entities such as antibodies and other biomolecules recognize specific surface antigens or specific biomarkers. Implementation of led to further innovation active targeting tumor cell. The choice of target depends on its abundance on the cell surface, its uniqueexpression and, consequently, on its ability to internalize the nanoconjugate. Although active targeting is not believed to be directly related to the total number of nanoparticles accumulated in tumors, it does affect nanoparticle uptake via receptor-mediated internalization, leading to Enhances the efficacy of anti-tumor agents through intracellular targeting. Active targeting may be a potential route for Polymeric nanoparticles for delivering chemotherapeutic agents to cancer cells thus is currently one of the major vectors for DDS development. Receptor 1. These conjugates were delivered to highly metastatic human breast cancer cells. The authors observed efficient downregulation of PAR-1 mRNA and protein levels and reduced metastatic potential of cancer cells. Design the former for specific purposes, such as gene knockdown, rerouting of alternative splicing, or modulation of signaling pathways, by allowing each short nucleic acid to hybridize to cargo DNA covalently attached to AuNPs can. shRNA, which targets Mcl-1L mRNA to xenograft tumors in a mouse model, and showed an approximately 5% decrease in protein expression, which is sufficient to induce apoptosis of xenograft tumor cells. These studies did not require a targeting strategy as they were performed in vitro or in vivo by injecting the conjugates directly into the tumor. However, systemic delivery generally requires additional targeting moieties to improve therapeutic efficacy and reduce off-target effects. Lu et al. carry Au nanocages that target the folate receptor (overexpressed in many cancers) and siRNAs that target NFkBp65, which encodes a transcription factor critically involved in tumor formation and progression used his. They injected these constructs intravenously into nude mice bearing HeLa cervical cancer xenografts and observed significantly higher tumor uptake of targeted conjugates. non-targeted conjugates. They further exploited the photothermal properties of Au nanocages to achieve controlled cytoplasmic delivery of siRNA upon irradiation with NIR light and observed efficient effects Downregulation of NF-κB p65 only upon irradiation of tumors with near-infrared light .

2. Applications of Nanomaterials in the Food Industry

Nanotechnology has great potential to improve and create new food concepts beyond the capabilities of the current field. This is applicable to all aspects of the food sector including agriculture, food processing, food packaging and dietary supplements. Food packaging can be designed to prevent microbial invasion or to alert consumers via nanosensors when food is no longer edible. Food can also be made healthier for consumers through nanotechnology. However, such scientific breakthroughs should not be used when the public is uncertain about the technology. Application to packaging is now more accepted than application to the food itself. Confidence issues arise in relation to naturalness. Nevertheless, nanotechnology is projected to become increasingly important in the future span class='highlighted color-3'>> Much research is still needed in nanotechnology, especially for food applications. Nanomaterials in food can be described as both 'soft' and 'hard'. Soft nanomaterials are formed from natural food ingredients or components during processing. Examples include homogenized milk, ricotta cheese, and coenzyme Q10 (used in dietary supplements). But for Food Standards Agency (FSA), hard nanomaterials are a bigger issue. Such substances insoluble and little known about their properties. Among other things, metals are characterized hard nanomaterials. According to the Financial Services Agency Novel Foods Regulation (Regulation (EG) No. 258/97) requires the latest approval of nanotechnology foods and processes.

CONCLUSION

Nanotechnology plays an important role in biomedicine and medicine. Nanomaterials are efficient tools for improving the agricultural and pharmaceutical industries. They are used for plant protection, plant enhancement, drug delivery, biosensors, and more. Although they exhibit Variety of activities, must have nano-toxicological effect determined. A variety of factors may contribute to the adverse effects of nanomaterials. Therefore, studies are required to clarify involving knowledge and issues. An understanding from both the industry and consumer perspectives, how to detect Nanomaterial Exposure Levels, and implecations of long-term consumer exposure. If these issues are properly addressed, the public can begin. Accept the use of nanomaterials for industrial purposes.

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