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Advanced Drug Delivery System for Improvement in Drug Delivery Technology

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Abstract

Drugs delivery systems are designed to maximize drug efficacy and minimize side effects. Improvement in drug delivery technology make drug use safer and more convenient for patients. The physical and chemical differences in the micro-environments of healthy and diseased tissues enable the intelligent design of stimulus-induced drug particles. Intelligent micro and nanoscale systems can maximize therapeutic efficacy in a number of ways. It enables rapid detection and response to disease states at the point of care, preserving physiologically healthy cells and tissues and thereby improving patient well-being. Better quality of life. Drug delivery system like liposome, micelles and polymers are discussed in this review paper.

Keywords

Drug delivery; Liposomes; Micelles Polymer

Introduction

Drug delivery systems are designed to maximize drug efficacy and minimize side effects. Improvements in drug delivery technology make drug use safer and more convenient for patients. The last 70 years have

seen incredible advances in drug delivery technology, including. Systems for long-term, localized, and targeted delivery over months to years. However, given the future technologies needed to overcome many physicochemical barriers to the development of new formulations and biological unknowns to treat various diseases, progress is approaching the next stage [1].

Drug Delivery System "DDS" "A formulation or device that provides an API in a side-based application or that provides timely (i.e., immediate, delayed, or sustained) release of an API. The system itself is pharmaceutically active. Not, but increases the effectiveness and/or safety of the API that carries it.

The physical and chemical differences in the micro environments of healthy and diseased tissues enable the intelligent design of stimulus-induced drug particles. The development of innovative formulations, such as drug particle size (nano to millimeter), micro to nano encapsulated drug particles, and the design of micro compartments to improve drug water solubility and bioavailability, are significant advances in current drug delivery technologies.

It is an important aspect tracking different types of physicochemical stimuli enables controlled release of drugs at target sites, overcoming many adverse effects of conventional drug delivery systems (CDD) [2].

Each API has a therapeutic window (TW) for specific indications. TW is defined by the safe and effective plasma concentration range of the drug. The width of TW is determined by a lower bound for efficacy and an upper bound for no apparent side effects [3]. The total plasma concentration of drug is expressed as the sum of the free molecule, the drug bound to carrier proteins such as albumin or lipoproteins, or when injected as a nano medicine in a delivery vehicle. nano medicine refers to nano-sized carriers for APIs such as liposomes, micelles, and polymer-drug conjugates. Drug efficacy and toxicity occur as a result of the pharmacological actions of the free API or possibly its active metabolites [4].

For tight TW APIs, drug infusion is an option to meet the time window by adjusting the infusion rate and is most commonly practiced in hospitals. A portable infusion pump is a viable tool for outpatients. A first-generation DD technology (DDT) has been presented to meet his TW for a specific drug by controlling or altering the drug release rate from the DDS over time. DDTs based on this relatively simple concept have brought much success to oral drugs and implantable DDSs because of their convenience and reduced toxicity [5,6].

Intelligent micro- and nanoscale systems can maximize therapeutic efficacy in a number of ways. It enables rapid detection and response to disease states at the point of care, preserving physiologically healthy cells and tissues and thereby improving patient well-being. Better quality of life.

This new class of "smart therapeutics" consists of intelligent, responsive delivery systems designed to perform a variety of functions such as detection, isolation, and/or delivery of therapeutic agents to treat disease. Point. Liposome technology was first described by Bangham in 1964 and was originally called 'Bangosomes'. Gregoriadis first proposed the use of liposomes for drug delivery in 1971. Polymeric micelles were described by Tuzar and Kratochvil in 1976. Block and graft copolymers have been used to build polymeric micelles, and in 1985 he Ringsdorf discussed the interaction between polymeric micelles and cells or modeled synthetic membranes Despite liposomes and polymeric micelles [7].

Liposomes are spherical organic nanoparticle formations composed of a lipid bilayer containing an aqueous core and an impermeable outer lipophilic phospholipid. Aqueous centers are entrapped to encapsulate water-soluble active ingredients for transport, ensuring their arrival at the target area [8]. Aqueous intermediates keep the polar segments of the molecule connected to the polar environment and protect the non-polar segments. The outer shell surrounding the watery core is made of fat called the phospholipid bilayer [9]. A bilayer phospholipid layer helps transport lipid-soluble drugs to the lipid-soluble layer of the cell membrane Conventional liposomes usually contain biogenic phospholipids and lipids such as monosialoganglioside, 1,2-distearolyl-sn-glycero-3-phosphatidylcholine, egg phosphatidylcholine and sphingomyelin. Liposomal formulation is a method for classifying liposomal vesicles of various shapes. Liposomes can be divided into three groups. multilamellar vesicles (MLV), small unilamellar vesicles (SUV), and large unilamellar vesicles [10]. MLVs are composed of numerous lipid layers separated by aqueous solutions. Preparation is voluntary. MLVs are formed by gentle shaking. Small unilamellar vesicles or large unilamellar vesicles vary in size and arise from homogenization of MLVs by a single lipid layer. Liposomes are composed of cholesterol, phospholipids, and active drug molecules [11] The site of drug encapsulation is determined by the drug's optimal environment. By understanding the phospholipid composition of liposomes, we can better understand the location of drugs required for transport. Phospholipids consist of a hydrophobic tail (two fatty acids with 10-20 carbon atoms) and a hydrophilic head (a phosphate attached to a water-soluble molecule). Lipids can range in size from 25 nm to 5000 nm as fine fatty substances. Therapeutic, liposomes can help improve drug potency, stability, controlled release, multipath delivery, and tissue targeting, and reduce unwanted drug toxicity. Liposomes have long been investigated as vesicles that can be engineered to target endogenous barriers that tend to repel foreign substances.

Liposomes have emerged as a viable means of drug delivery to transport drugs that cannot cross the blood-brain barrier. Liposomes are used as components for nanoparticle drug delivery. Because it is biocompatible. It also has the ability to cross the blood-brain barrier and deliver both lipophilic and hydrophilic therapeutics to brain cells. Studies point to the importance of liposome-based drug delivery in the treatment of neurodegenerative diseases. The idea is to encapsulate drugs in appropriately designed liposomes to produce a response to therapy. Several surface modifications of liposomes have also been investigated to create clinical path to the management of Alzheimer's disease [12].

Advanced Drug Delivery Systems in the Management of Cancer discusses recent developments in nanomedicine and nano-based drug delivery systems used in the treatment of cancers affecting the blood, lungs, brain, and kidneys. Cancer therapy remains one of the greatest challenges in modern medicine, as successful treatment requires the elimination of malignant cells that are closely related to normal cells within the body. Advanced drug delivery systems are carriers for a wide range of pharmacotherapies used in many applications, including cancer treatment. The use of such carrier systems in cancer treatment is growing rapidly as they help overcome the limitations associated with conventional drug delivery systems. Some of the conventional limitations that these advanced drug delivery systems help overcome include nonspecific targeting, systemic toxicity, poor oral bioavailability, reduced efficacy, and low therapeutic index. The need for advanced drug delivery systems in oncology and cancer treatment is established.

Micelles are widely used as drug delivery vehicles for various molecules such as small hydrophobic drugs, proteins and genes. Compared to other drug delivery strategies, micelles have two unique advantages. The first is its relatively small size. The hydrodynamic size of micelles is typically less than 50 nm Smaller particle sizes (e.g. <100 nm) when considering the physiological pore size of the body's vasculature (e.g. renal glomerular pores, endothelial junctions in healthy tissues, tumors, cancerous tissues, etc.) Nanomedicine using is suitable for blood flow, tissue penetration and cellular uptake Recent findings indicate the desirability of sub-50 nm drug formulations to achieve the collective results of deeper tumor tissue penetration and more efficient cancer cell internalization and cellular response. Therefore, small micelles can significantly improve the in vivo performance of encapsulated drugs, with improved permeability and retention resulting in higher accumulation at target sites (such as tumor tissue) [13].

Despite their advantages, a fundamental limitation of micelles as drug carriers is their low stability to environmental changes. If the concentration is below the critical micelle concentration (CMC), the micelles can dissociate. This is typical when micellar formulations are injected into the blood. Disruption of micelles due to dilution of micelles in the blood or other factors such as protein binding can lead to sudden release of previously encapsulated drugs into the bloodstream. Such premature drug release may negate the potential benefits of carefully optimized drug carriers. This includes high drug load, prolongation of blood circulation by EPR, and targeting ability. This can result in unfavorable biodistribution of the drug and therapeutic outcomes similar to those of unprotected (non-encapsulated) drugs [14].

Polymers have played an integral role in the advancement of drug delivery technology by providing controlled release of therapeutic agents in constant doses over long periods, cyclic dosage, and tunable release of both hydrophilic and hydrophobic drugs [15]. Polymers are being used extensively in drug delivery due to their surface and bulk properties. They are being used in drug formulations and in drug delivery devices. These drug delivery devices may be in the form of implants for controlled drug delivery.

Conclusion

Drug delivery systems are designed to maximize drug effect and reduced side effects. Improvements in drug delivery technology make drug use safer and more convenient for patients. Liposome, micelles and polymers each has specific advantage and uses is now increasing worldwide.

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