

Directed Drug Delivery: A Multidisciplinary Problem

International Journal of Advanced Multidisciplinary Research 2(4): (2015) 1-13

International Journal of Advanced Multidisciplinary Research (IJAMR)
ISSN: 2393-8870
www.ijarm.com

Review Article

Chitosan Nanoparticles based Drug Delivery: an Update

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Abstract

Keywords

Nanotechnology,
Chitosan Nanoparticles,
Drug delivery carriers.

Nanotechnology is the "creation of functional devices in the nanometer range and the exploitation of the unique properties of these devices in various fields". Nanoparticles are one of the building blocks in nanotechnology. In recent years, nanotechnology and polymers have captivated a tremendous interest in many areas such as the pharmaceutical industry and therapeutic innovation among others. Chitosan is a versatile natural polymer which offers a valuable tool to novel drug delivery system in present scenario due to its inherent biological properties. They are potentially good drug delivery carriers due to their reduced size, better stability, low toxicity, least expensive, simple and mild preparation methods and their versatile routes of administration. Chitosan also have immense structural possibilities for chemical and mechanical modification due to the presence of reactive functional hydroxide and amine groups. Chemically modified chitosan have increased attention for their wide pharmaceutical applications. Therefore, considerable research efforts have been directed towards developing safe and efficient chitosan nanoparticulate based drug delivery systems. The present review outlines the major new findings on the pharmaceutical applications of chitosan nanoparticulate based drug delivery systems published over the past decade. This review is an insight into exploitation of various properties of chitosan to encapsulate drug. Various techniques used for their preparation, drug loading, drug release characteristics, applications and usefulness of these systems in delivering the bioactive molecules will also be discussed. It has been realized that research activities on chitosan nanoparticulate drug delivery systems have increased at the rapid rate.

Introduction

The discovery and development of drug has always been highly challenging, laborious and expensive process. Most of the drugs fail to achieve favorable clinical outcomes in the clinical phase as they do not reach the target site of action. New drug delivery technologies are revolutionizing the drug discovery, development and creating research and development (R&D) focused pharmaceutical industries to increase the momentum of global advancements¹. Drugs are generally administered through oral, parenteral and topical routes. The oral route is considered the most convenient, safe and economical method for drug administration, because of its non-invasive nature. In parenteral route, the drug is introduced directly across the body's barrier defenses into the systemic circulation. However, these administrations are irreversible and may cause pain, fear, local tissue damage, and infections.

Topical application is used when a local effect of the drug is desired. Topical application may be either trans-dermal or mucosal. In trans-dermal, the drug is directly applied to the skin. The rate of absorption of drug can vary markedly, depending on the physical characteristics of the skin at the site of application as well as the lipid solubility of the drug. In mucosal, drug is administered to any mucosal membrane like nose, ear, eye, colon etc. These surfaces are used to deliver the drug for a prolonged period of time at a controlled rate by use of mucoadhesive agent. Therefore, to develop a drug delivery system that optimizes the pharmaceutical action of a drug while reducing its toxic side effects *in vivo* is a challenging task. In this regard, novel drug delivery systems (NDDS) have many benefits, which include improved efficacy, reduced toxicity, improved patient compliance and

1

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