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Review Article

An Overview of Nanogel –Novel Drug Delivery System

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A B S T R A C T

Nanogels are innovative drug delivery system that can play an integral part in pointing out many issues related to old and modern courses of treatment such as nonspecific effects and poor stability. Biomedical and pharmaceutical applications of Nanogels have been explored for tissue regeneration, wound healing, surgical device, implantation, and peroral, rectal, vaginal, ocular, and transdermal drug delivery. Nanogels are proficiently internalized by the target cells, avoid accumulating in nontarget tissues thereby lower the therapeutic dosage and minimize harmful side effects. Nanogels may be defined as highly cross linked nano-sized hydrogels ranges from 20-200 nm. They can be administered through various routes, including oral, pulmonary, nasal, parenteral, intra-ocular etc. They have a high degree of drug loading capacity and it shows better permeation capabilities due to smaller size. Nanogels are the novel drug delivery systems for both hydrophilic and hydrophobic drugs.

Keywords: Nanogel, Novel Drug Delivery, Mechanism

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INTRODUCTION

Nanogels may be defined as highly cross linked nano-sized hydrogel systems that are either co-polymerized or monomers which can be ionic or non-ionic. The size of Nanogels ranges from 20-200 nm. Nanogels are known to exhibit great qualities that contribute to the drive towards it as a delivery system[1].They include remarkable thermodynamic stability, elevated capacity of solublilization, relatively low viscosity, and capability of undergoing vigorous sterilization technique[3].Nanogels may entrap drugs and biological molecules. Therefore, they can be vastly employed in protein and gene delivery. The particle size and surface properties can be manipulated to avoid rapid clearance by Phagocytic cells, allowing both passive and active drug targeting. Controlled and sustained drug release at the target site, improving the therapeutic efficacy and reducing side effects[4].

Drug loading is relatively high and may be achieved without chemical reactions; this is an important factor for preserving the drug activity. Ability to reach the smallest capillary vessels, due to their tiny volume, and to penetrate the tissues either through the paracellular or the transcellular pathways. Highly biocompatible and biodegradable. Nanogel dispersions have a larger surface area which is important for *in vivo* applications. Nanogels have sizable drug loading capacity, low buoyant density and high dispersion stability in aqueous media. Nanogels show promise as a suitable nanomedicine carrier as compared to other nanoparticles especially in terms of drug loading[5].

PROPERTIES OF NANOGELS

Biocompatibility and Degradability-

Nanogel is madeup of either natural or synthetic polymers. They are highly biocompatible and biodegradable thereby avoiding its accumulation in the organs. Chitosan, ethyl cellulose, methyl cellulose and various polysaccharide-based polymers like dextran, pullulan and dextrin can be used to prepare the Nanogel. Polysaccharides are mostly carbohydrate-based polymers, formed of repeating monosaccharide units linked by glycosidic bonds. These polymers are stable, non-toxic, hydrophilic and biodegradable in nature[6].

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Review Article

A Review on - Theranostics: An Approach to Targeted Diagnosis and Therapy

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ABSTRACT

Emerging as a targeted, safe, and efficient pharmacotherapy is the approach of theranostics, which focuses on patient centered care. It is a combination of diagnosis and therapeutics. Theranostics is a new field of medicine which combines specific ttargeted therapy based on specific targeted diagnostic tests. With a key focus on patient centered care, theranostics provides a transition from conventional medicine to contemporary personalized and precision medicine approach. The latest theranostics paradigm involves using nanoscience to unite diagnostic and therapeutic applications to form a single agent, allowing for diagnosis, drug delivery and treatment response monitoring. The theranostics medicine can achieve systemic circulation, evade host defenses and deliver the drug and diagnostic agents at the targeted site to diagnose and treat the disease at cellular and molecular level.

Keywords: Diagnosis, therapy, theranostics, nuclear medicine, nanomedicine

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INTRODUCTION

Theranostics literally means portmanteau of therapeutics and diagnostics. Theranostics combines therapy and diagnostics to establish more specific and individualized therapies for various pathologies, and to bring about a union of diagnostic and therapeutic applications into a single agent thus leading to a promising therapeutic paradigm involving diagnosis, drug delivery and monitoring of treatment response.[1] theranostics is a holistic transition from trial and error medicine to predictive, preventive and personalized medicine leading to improved quality care of pharmacotherapy.[2] It uses specific biological pathways in the human body, to acquire diagnostic images and also to deliver a therapeutic dose of radiation to the patient. A specific diagnostic test shows a particular molecular target on a tumour, allowing a therapy agent to specifically target that receptor on the tumor, rather than more broadly the disease and location it presents. This contemporary form of treatment moves away from the one-medicine-fits-all and trial and error medicine approach, to offering the right treatment, for the right patient, at the right time, with the right dose, providing a more targeted, efficient pharmacotherapy in the form of theranostics. The premise behind theranostics is to take advantage of specific biological pathways in the human body to enable the acquisition of diagnostic images. The transformation of these digital images will increase the probability that the targeted therapeutic dose of radiation will reach the disease state and limit the damage to the surrounding healthy tissues. This approach of using a specific diagnostic test identities a particular molecular target on tumor cells to allow a therapeutic agent to bind to the receptor sites and specifically target the regions in the tumor volume.

Mainly for medical purposes: theranostic nanomedicine means colloidal nanoparticles ranging in sizes from 10 to 1000nm (1μm). They consist of macromolecular materials/polymers in which the diagnostic and therapeutic agents are adsorbed, conjugated, entrapped, encapsulated for diagnosis and treatment simultaneously at cellular and molecular level.[3]

Conceptuals of Theranostics

Theranostics helps in the management of various diseases and cancer therapeutics. Cancer therapy greatly relies on conventional radiotherapy and chemotherapy in which anti cancer drugs are taken by the cancer cells at high proliferative rate. The drawbacks of conventional therapy is that the normal cells also get affected by chemotherapeutic action resulting in several side effects.The idea of using a radioactive compound for diagnostic imaging, target-expression confirmation, and

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An Overview of Pharmaceutical Co-Crystal

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ABSTRACT

Pharmaceutical co-crystals are nonionic supramolecular complexes and supramolecular chemistry. Pharmaceutical co-crystal consists of active pharmaceutical ingredients and coformers. Pharmaceutical co-crystals can be employed to improve vital physicochemical characteristics of a drug, including solubility, dissolution, bioavailability and stability of pharmaceutical compounds while maintaining its therapeutic activity. Co-crystals can be constructed through several types of interaction, including hydrogen bonding, pi-stacking, and vander Waals forces. Pharmaceutical co-crystals could play a major role in the future of API formulation. Pharmaceutical co-crystal can be improvement future aspect problems related physicochemical properties of API.

Key words: Pharmaceutical co-crystal, Co-crystallization, coformers, Hydrogen bonding.

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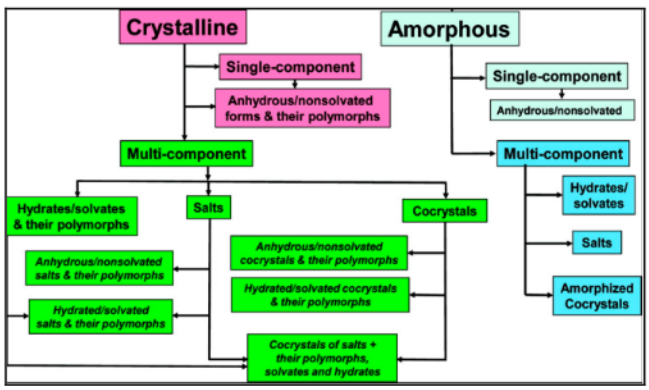
INTRODUCTION

Many active pharmaceutical ingredients (APIs) have not been developed in formulations due to low aqueous solubility, which causes low bioavailability of drugs. Researchers have developed various approaches to enhance the solubility of drugs, which lead to improvement in the bioavailability[1] Size reduction, solid dispersion, complexation, salt formation, nanoparticles, self-emulsifying drug delivery system (SEDDS), addition of co-solvents, nano-suspension and emulsion and co-crystal formation[3]. crystal engineering as —the understanding of intermolecular interactions in the context of crystal packing and in the utilization of such understanding in the design of new solids with desired physical and chemical properties[4].

CO-CRYSTALS

The term "co-crystal" and design rules of hydrogen bonding of an organic co-crystal were first reported by Etter[5,6]. Co-crystals incorporate pharmaceutically acceptable guest molecules into a crystal lattice along with the API. Co-crystals have regained attention as attractive alternate solid forms for drug development. Co-crystallization with pharmaceutically acceptable (GRAS) compounds does not affect pharmacological activity of API but can improve physical properties, such as solubility, hygroscopicity, compaction behavior. Co-crystallization is a result of competing molecular associations between similar molecules, or homomers, and different molecules or heteromers[7,8]. Hydrogen bonds are the basis of molecular recognition phenomena in pharmaceutical systems and are responsible for the generation of families of molecular networks with the same molecular components (single component crystals and their polymorphs) or with different molecular components (multiple component crystals or co-crystals) in the crystalline state[8].

SOLID FORMS OF API



The components in a co-crystal exist in a definite stoichiometric ratio, and assemble via non-covalent interactions such as hydrogen bonds, ionic bonds, π-π or van der Waals interactions rather than by ion pairing.

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Review on Pharmaceutical Quality by Design (QbD)

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ABSTRACT

Pharmaceutical Quality by Design (QBD) is a systematic approach to development that begins with predetermined objectives and emphasizes the understanding of production and processes and process control, based on sound science and quality risk management. Quality purchasing design (QBD) is emerging to increase the promise of providing safe and effective medicines to customers and promises to improve the efficiency of product quality. Quality means eligibility for use. The quality of the medication means that the product provides therapeutic benefits to the label reproducible and free from contamination on the label. In vivo or in vitro performance test can be evaluated for drug production. Dinette by Quality guarantees the performance of the product in vitro and the performance of the in vitro product in the in vivo product. So the quality design is related to the product.

KEYWORDS: Quality-by-design, design space, risk management, ICH guidelines.

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INTRODUCTION

Quality by Design (QbD) is a concept first outlined to the designing for quality and innovation is one of the three universal processes of the Juran Trilogy, in which Juran describes what is required to achieve breakthroughs in new products, services, and processes. While Quality by Design principles have been used to advance product and process quality in industry, and particularly the automotive industry, they have also been adopted by the U.S. Food and Drug Administration (FDA) for the discovery, development, and manufacture of drugs.

Quality by design is A Quality System for managing a product's lifecycle, a regulatory expectation, intended to increase process and product understanding and thereby decrease patient risk, a multifunctional exercise, Design of Experiment (DoE) and Design Space.[1]

The word "quality" as having two meanings: first, the presence of features that create customer satisfaction; second, the reliability of those features. Failures in features create dissatisfactions, so removing failures is the purpose of quality improvement, while creating features is the purpose of quality by design. Juran's process seeks to create features in response to understanding customer needs. These are customer-driven features. The sum of all features is the new product, service, or process.

Designing for quality and innovation is one of the three universal processes of the Juran Trilogy, in which Juran describes what is required to achieve breakthroughs in new products, services, and processes. While Quality by Design principles have been used to advance product and process quality in industry, and particularly the automotive industry, they have also been adopted by the U.S. Food and Drug Administration (FDA) for the discovery, development, and manufacture of drugs.[2]

The Quality by Design model consists of the following steps:[2]

- Establish the project design targets and goals.
- Define the market and customers that will be targeted.
- Discover the market, customers, and societal needs.
- Develop the features of the new design that will meet the needs.
- Develop or redevelop the processes to produce the features.

Principle of QbD [3]

- Risk and knowledge based decisions
- Systematic approaches process development
- Continuous Improvement
- This leads to "capable" processes.