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Review on Nanoparticles Novel Drug Delivery System

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ABSTRACT: For the past few years, there has been a considerable research on the basis of Novel drug delivery system, using particulate vesicle systems as such drug carriers for small and large molecules. Nanoparticles, Liposomes, Microspheres, Niosomes, Pronisomes, Ethosomes, Proliposomes have been used as drug carrier in vesicle drug delivery system. Nanotechnology refers to the creation and utilization of materials whose constituents exist at the nanoscale; and, by convention, be up to 100 nm in size.. Nanoparticles are being used for diverse purposes, from medical treatments, using in various branches of industry production such as solar and oxide fuel batteries for energy storage, to wide incorporation into diverse materials of everyday use such as cosmetics or clothes, optical devices, catalytic, bactericidal, electronic, sensor technology, biological labelling and treatment of some cancers. Various polymers have been used in the formation of Nanoparticles. Nanoparticles have been improving the therapeutic effect of drugs and minimize the side effects. Basically, Nanoparticles have been prepared by using various techniques as such dispersion of preformed polymers, polymerization of monomers and ionic gelation or co-acervation of hydrophilic polymer. Nanoparticles have been evaluated by using parameters of drug entrapment efficiency, particle shape, drug release stud**y.**

Keywords: nanoparticles, drug delivery, targeting, drug release

I. INTRODUCTION

In the novel drug delivery systems (NDDS), there are various novel carriers which have advantage over conventional dosage forms. Conventional dosage forms show high dose and low availability, in-stability, first pass effect, plasma drug level fluctuations and rapid release of the drug. NDDS is one of the important tool expanding drug markets in pharmaceutical industry. NDDS can minimize problems by enhancing efficacy, safety, patient compliance and product shelf life.

Nanoparticles are of current interest because of an emerging understanding of their possible effects on human health and environmental sustainability, and owing to the increasing output of man-made nanoparticles into the environment. Nanoparticles are used in many different applications and created by many different processes.

Particles having diameter in range between 10-100 nm are known as Nanoparticles. They are used as targeted delivery system for delivery of small and large molecules by changing their pharmacodynamics and pharmacokinetic properties. They can be defined as system which contain active ingredient dissolved, encapsulated or adsorbed in matrix material which are used as target delivery system. To see the effect of drug in target tissue, to increase stability against degradation through enzymes and for solubilisation at intra-vascular route nanoparticles have been used. During the designing of nanoparticle some control has to take in care such as their release pattern, their size and surface properties which determine site-specific action at optimal rate with right dose regimen.

Nanoparticles are sub-nano sized colloidal structure of synthetic or semi synthetic polymer. The first reported nanoparticles were based on non-biodegradable polymeric system (polyacrylamide, polymethyl-methaacrylate, polystyrene). The polymeric nanoparticles can carry drug(s) or proteineous substances, i.e. antigen(s). These bioactives are entrapped in polymer matrix as particulates or solid solution or may bound to particle surface by physical adsorption or chemically. The drug(s) may be added during preparation of nanoparticle or to the previously prepared nanoparticles.

Defination:Nanoparticles are defined as particulate dispersions or solid particles with a size in the range of 10-1000nm.The drug dissolved, entrapped, encapsulated or attached to nanoparticles

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matrix. Nanoparticles (including nanospheres and nanocapsules of size 10-200 nm) are in the solid state and are either amorphous or crystalline.

PREPARATION OF NANOPARTICLES

Nanoparticles can be prepared from a variety of materials such as proteins, polysaccharides and synthetic polymers. The selection of matrix materials is dependent on many factors
Including
a) Size of nanoparticles required;
b) Inherent properties of the drug, e.g., aqueous solubility and stability;
c) Surface characteristics such as charge and permeability;
d)Degree of biodegradability, biocompatibility and toxicity;
e) Drug release profile desired; and
f) Antigenicity of the final product.

Nanoparticles have been prepared most
Frequency by three methods:
1) Dispersion of preformed polymers;
2) Polymerization of monomers;
3) Ionic gelation or coacervation
of hydrophilic polymers

ADVANTAGES

1. They are biodegradable, non- toxic, site specific and capable of being stored for at least one year.
2. They are capable of targeting a drug to a specific site in the body by attaching targeted ligands to surface of particles or use of magnetic guidance.
3. They offer controlled rate of drug release and particle degradation characteristics that can be readily modulated by the choice of matrix constituents.
4. Drug loading is high and drugs can be incorporated into the systems without any chemical reaction; this is an important factor for preserving the drug activity.
5. They offer better therapeutic effectiveness and overall pharmacological response/unit dose.
6. The system can be used for various routes of administration including oral, nasal, parentral, intra-ocular etc.

DISADVANTAGES

1. Presents bioacceptibility restrictions.
2. Difficult to manufacture in large scale.
3. Due to their small particle size and large surface area can lead to particle-particle aggregation, making physical handling of nanoparticles difficult in liquid and dry forms.
4. Small particle size and large surface area readily result in limited drug loading and burst release. These practical problems have to be overcome before nanoparticles can be used clinically or commercially made available.
5.The present work is a step towards development of nanoparticulate drug delivery system, surface modification issues, drug loading strategies, release control and potential applications of nanoparticles.

TYPES OF NANOPARTICLES

Following are the types of nanoparticles
1) Solid lipid nanoparticles (SLNs)
2) Liposomes
3) Nanostructured lipid carriers (NLC)
4) Fullerenes
5) Nanosphere and Nanocapsule

Solid Lipid Nanoparticles (SLNs)

Solid lipid nanoparticles (SLNs, sLNPs), or lipid nanoparticles (LNPs), are nanoparticles composed of lipids. They are a novel pharmaceutical drug delivery system (and part of nanoparticle drug delivery), and a novel pharmaceutical formulation.

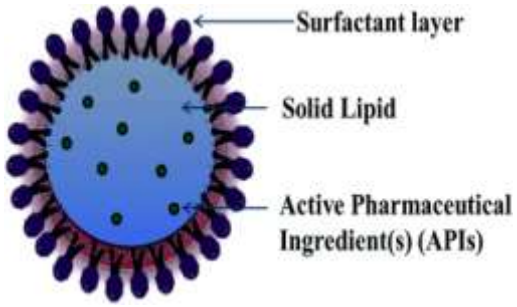

Fig 1Solid Lipid Nanoparticles (SLNs)

Liposomes

Liposomes are a novel drug delivery system (NDDS), they are vesicular structures consisting of bilayers which form spontaneously when phospholipids are dispersed in water. They are microscopic vesicles in which an aqueous volume is entirely enclosed by a membrane composed of lipid bilayers.

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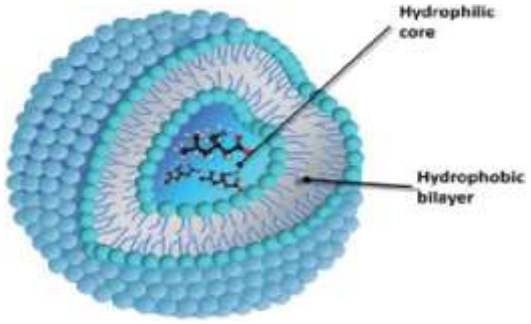

Fig 2Liposomes

Nanostructured lipid carriers (NLC)

Nanostructured lipid carriers (NLCs) are drug-delivery systems composed of both solid and liquid lipids as a core matrix. It was shown that NLCs reveal some advantages for drug therapy over conventional carriers, including increased solubility, the ability to enhance storage stability, improved permeability and bioavailability, reduced adverse effect, prolonged half-life, and tissue-targeted delivery.

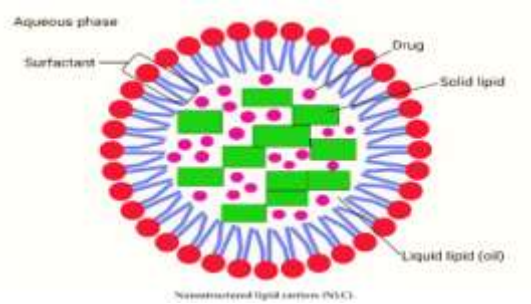

Fig 3Nanostructured lipid carriers (NLC)

Fullerenes

A fullerene is any molecule composed entirely of carbon, in the form of a hollow sphere, ellipsoid, or tube. Spherical fullerenes are also called buck balls, and cylindrical ones are called carbon nanotubes or buck tubes. Fullerenes are similar in structure to the graphite, which is composed of stacked grapheme sheets of linked hexagonal rings, additionally they may also contain pentagonal (or sometimes heptagonal) rings to give potentially porous molecules. Buckyballclusters or buck balls composed of less than 300 carbon atoms are commonly known as endohedral fullerenes and include the most common fullerene, buckminsterfullerene, C60.

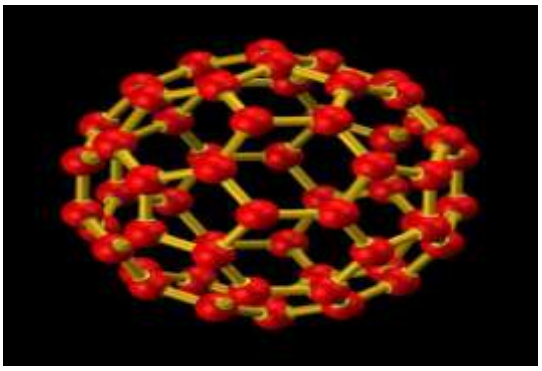

Fig 4Fullerenes

Nanosphere and Nanocapsule

Nanospheres and nanocapsules are small vesicles used to transport drugs. Nanospheres are typically solid polymers with drugs embedded in the polymer matrix. Nanocapsules are a shell with an inner space loaded with the drug of interest. Both systems are useful for controlling the release of a drug and protecting it from the surrounding environment.

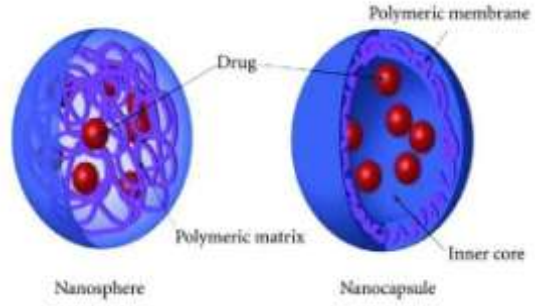

Fig 5Nanosphere and Nanocapsule

Nanoparticles Cancer Therapy

The NPs used in medical treatment usually have specific sizes, shapes, and surface characteristics as these three aspects have a major influence on the efficiency of the nano-drug delivery and thus control therapeuticefficacy. NPs with a diameter range of 10 to 100 nm are generally considered suitable for cancer therapy, as they can effectively deliver drugs and achieve enhanced permeability and retention (EPR) effect. Smaller particles can easily leak from the normal vasculature (less than 1–2 nm) to damage normal cells and can be easily filtered by kidneys (less than 10 nm in diameter) , while particles that are larger than 100 nm are likely to be cleared from circulation by phagocytes . Moreover, the surface characteristics of NPs can influence their bioavailability and half-life.

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For instance, NPs that are coated with hydrophilic materials such as polyethylene glycol (PEG) lessen the opsonisation and therefore avoid clearance by the immune system . Therefore, NPs are generally modified to become hydrophilic, which increases the time period of drugs in circulation and enhances their penetration and accumulation in tumors. Collectively, the various characteristics of NPs determine their therapeutic effect in cancer management.

II. MATERIALS & METHOD

1. Articles associated with Nanoparticles and also associated with drug delivery process were reviewed.

2.Manual and Electronic search of literature published in English was done**3.**A literature including journals articles, international guidelines were explored and so on.

4.The Articles were taken from sites such as Pubmed, Google Scholar,(Through access to the Collage library) and the internet search.

5. From the previously published articles we collected, and summerize and study all the necessary points regarding nanoparticles and novel drug delivery system.

6. All the literature was specially studied for novel drug delivery system and nanoparticles taken in to consideration.

III. PURPOSE OF STUDY

a) The purpose of study to developed suitable drug delivery system that distribute the therapeuticallyactive drug molecule to side of action.

b)To study action of drug without affecting healthy organ and tissue

c)To study different types of nanomolecule

d)To reduce the upcoming ADRs in futuree)To understand the different types of Pharmacovigilance systems.

f) To achieve desired pharmacological response at targeted side with minimum side effects.

(ex. cancer therapy.)

IV CONCLUSION

The present review article conclude that nanoparticles represent a promising drug delivery system of controlled and targeted release. The emergence of nanotechnology is likely to have a significant impact on drug delivery sector, affecting just about every route of administration from oral to injectable. And the payoff for doctors and patients should be lower drug toxicity, reduced cost of treatments, improved bioavailability, and an extension of the economic life of proprietary drugs. This would allow earlier and more personalized diagnosis and therapy, improving the effectiveness of drug treatments and reducing side effects. In addition, nanoparticles are a promising platform technology for the synthesis of molecular-specific contrast agents. Nanoparticulate systems have great potentials, being able to convert poorly soluble, poorly absorbed and labile biological active substance into promising deliverable drugs. Generally nanoparticle have relatively higher intracellular uptake compared to microparticles and available to a wide range of biological targets due to their small size and relative mobility.

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