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A Review on Lipid based Nanoparticles

WalunjPrajot*, SaidTejal* ,Gunjal Sakshi, Kanade Vedant, Korde Savita, Hodgar Sachin,

Department of Pharmaceutical Chemistry Vidya niketan Institute of Pharmacy & Research Centre, Bota 422602
Department of Pharmaceutical Biotechnology Sanjivani College of Pharmaceutical Education Research,Kopergaon, Maharashtra, 423603, India

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ABSTRACT:

In recent years,various nanotechnology platforms in the area of medicinal biology including both diagnostics and therapy , have gained remarkable attention .

Moreover, research and development of engineered multifunctional nanoparticles as pharmaceutical drug carries have spurred exponential growth in application to medicine in the least decade . Design principle of these nanoparticles ,including nano-emulsion , dendrites , nano-gold ,liposomes, drugs carrier congujates antibody drug complex are magnetic nanoparticle,,are primarily based on unique assemblies of synthetic of,natural ,or biological components ,including but not limited to synthetic polymers , metal ion ,oils ,and lipids as there building blocks .Among these ,lipid- based nanoparticles bear the advantages of being the least toxic for in vivo application,and significant progress has been made in the area of DNA/RNA and drug delivery using lipid-based nano assemblies .In this review ,we will primarily focus on the recent advances and updates on lipid-based nanoparticles .For RNAi have yielded successful advances in vivo and to an extent in clinical trial lipid-based nanoparticles ,such liposomes or micelles , have been used expensively in recent decades as drug carrier vechiles .A relatively new and promising application of lipid nanoparticles is their used as multimodal MR contrast agents. Lipids are amphiphilic molecules with both a hydrophobic and a hydrophilic part,which spontaneously assembled into aggregates in an aqueous environment. In these aggregates ,theamphiphiles are arranged such that hydrophobic parts cluster together and the hydrophilic parts face the water. In the low concentration regime ,a wide variety of structure cane be formed, ranging from spherical micelles to disks or liposomes .

Key words: liposomes, hydrophilic, amphiphiles, Nano-gold, metal ion

INTRODUCTION:

A Nano particals is a small particals that range between 1 to 100 nanometer in size. Undetectable By the human eyes ‘ nanopaericals can exhibit significantly different physical and chemical properties to their counter parts. Nano particals are naturally produced by many cosmological, geological ,meterologica l, and biological processes .

A significant fraction (by number,if not by mass) of interplanetary dust, that is still falling on the earth at the rate of thousands of tons per year, is in the Nanopartical range ;and the same is true of atmospheric dust particles. Many viruses have diameters in nanoparticles range.

Solids lipid nanoparticles or lipid nanoparticles are nanoparticles composed of lipids .they are a novel pharmaceutical drugs delivery system and a novel pharmaceutiucal formulation .LNPs as a drug delivery vehicle were first approved in 2018 for the siRNA drug onpattro.

LNPs became more widely known in late 2020 as some COVID -19 vaccines that used RNA vaccine technology coat the fragile mRNA strands with PEGylated lipid nanoparticle as there delivery vehicle (including both the modern and the Pfizer-BioNTech COVID-19 vaccine).

A solid lipid nanoparticle is typically spherical with an average diameter between 10 and 1000 nanometer.

Solid lipid nanoparticle possess a solid lipid core matrix that can solubilize lipophilic molecules .the lipid core is stabilized by surfactants (emulsifiers).the emulsifier used depends on administration routes and is more limited for parenteral administrations .In its 2012 proposed terminology for biological related polymers,the IUPAC defined a nanoparticles as “a particles of any shape with dimension in the $1x10^{-9}$ and $1x10^{-7}$ m range”.

This definition evolved from one given by IUPAC in 1997 .Nanoparticles are usually

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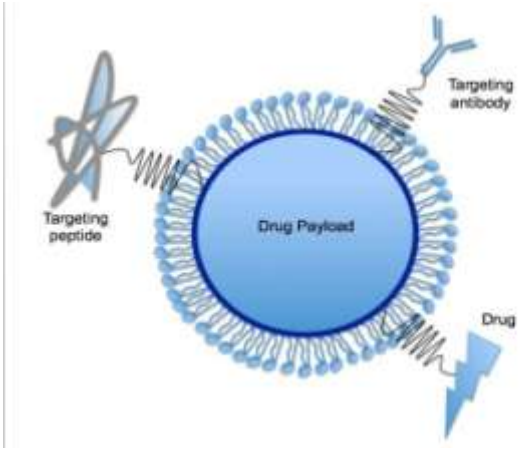
distinguished from micro particles(1 to 1000 micronmeter),"fine particles"(sized between 100 and 2500 nm),and "coarse particles "(ranging from 2500 to 10000 nm),because there smaller size drives very different physical or chemical properties, like colloidal properties and ultrafast optical effects or electrical properties .

Types of nanoparticles:
Nanoparticlesca n be classified into different types according to the size , morphology , physical and chemical properties. Some of them are .
Carbon-based nanoparticles,
Ceramic nanoparticles.
Metal nanoparticles,
Semiconductor nanoparticles,
Polymeric nanoparticles,
Lipid based nanoparticles

Lipid-based nanoparticles:
Lipid nanoparticles are the most clinically advanced non- viral gene delivery system. Lipidnanoparticles safely and effectively deliver nucleic acid , overcoming of major barrier preventing the development and used of genetic medicines.



Application of nanoparticles:

Application of lipid based nanoparticles:

Their current application in oncology has revolutionized cancer treatment by improving the antitumor activity of several chemotherapeutic agents. For example, the earliest approved liposomal drugs wasDoxil, a lipid nanoparticles formulation of the antitumor agent doxorubicin, which is used to treat ovarian cancer.
Types of Lipid- based nanoparticles:
Liposomes
Lipid nano emulsion,
Solid lipid nanoparticles,

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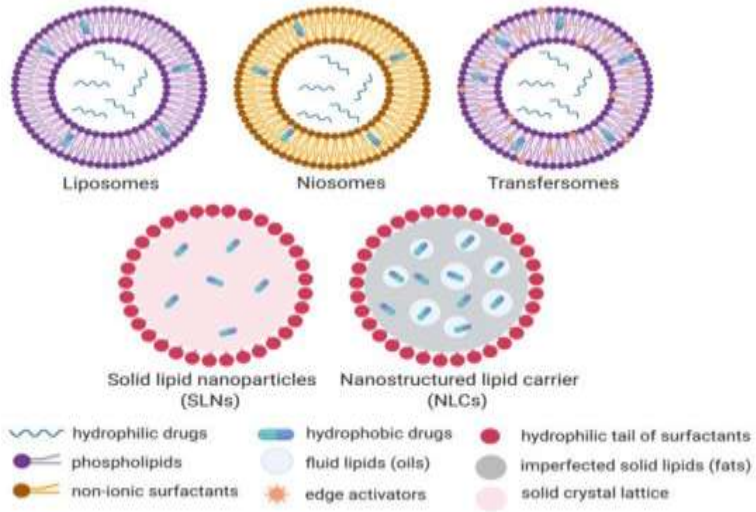
Lipid nanoparticles,

Nanostructure lipid carrier .



Application:

Lipid based NPs (LBNPs) Constitute of broad and diverse group of nanoparticles that are particularly relevant in BreC treatment.

Lipid nanoparticles have successfully entered in the clinic for the delivery of the mRNA ; in particular , lipid nanoparticles –mRNA vaccines are now in clinically used against corona virus diseases 2019 (COVID -19). This marks a milestone for m RNA therapeutics.

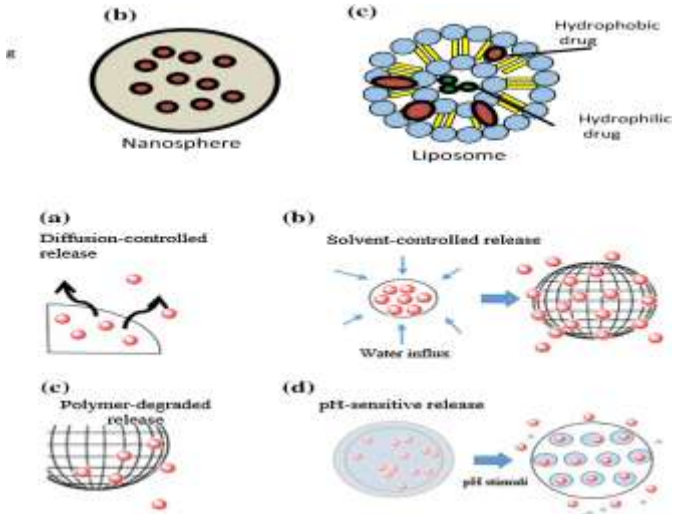
Advantages:

Lipid nanoparticles have many advantages in comparison to other particulate system such as the ease of large- scale production biocompatible and biodegradable nature of material, low toxicity potentials, possibility of controlled and modified drug release ,drug solubility enhancement.

Disadvantages:

SLNs have also some disadvantages; because of their perfect crystalline structure, they have **low drug loading efficiency** and the possibility of drug expulsion due to the crystallization process during the storage conditions. Another drawback is initial burst release which usually occurs with these formulations.

Mechanism of lipid nanoparticles for drug delivery systems:



Due to their small size and large surface area, drug nanoparticles show increase solubility and thus enhanced bioavailability, additional ability to cross the blood brain barrier (BBB), enter the pulmonary system and be absorbed through the tight junctions of endothelial cells of the skin .

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