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A Review On: Nano Particle Formulations, A Novel Drug Delivery System

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ABSTRACT

Nanotechnology is gaining popularity in the medical field right now. Nanotechnology is branch of science that focuses on the preparation, characterization, and application ofnanoscale molecules with sizes ranging from 1 to 100 nanometers in a variety of fields. Nano particle are with shape like spherical, round, triangular, pentagonal. Nanoparticle formulations are stable in nature, and they can be made via a biological process. Nanoparticle formulations are designed to target certain cells while avoiding non-targeted cells. Nano particle formulations have small size particle or molecule which gives large surface area and hence increases solubility of the formulations because of these pharmaceutical companies use nano particle formulations to improve solubility, stability, bioavailability, and pharmacokinetic qualities in some circumstances. Nano particle formulations may be used to treat cancer, to diagnose disorders, and treat patients with fewer negative side effects and risks.The purpose of this review is to list the different types of nano particle formulations as well as the methods used for formulation and evaluation.
Index Terms - Nano emulsion, Nanosponge. Nano sphere, nano suspension, nanocapsule, nano crystal prepration methods, evaluation parameters, applications.

INTRODUCTION

"Nanotechnology has gained huge attention over time."[1] "Nanoparticle are solid submicron sized that may be biodegradable or non-biodegradable. Nanoparticle having size range 1 nm to nm made up of carbon, metal, metal oxide or organic matter."[1,1] "The applications of nanoparticlenanotechnology in medicine could create a remarkable change in diagnosis and treatment of disease in the future."[2]

There are several type of nano formulations Nano emulsion, Nano sponge, Nano sphere, Nano capsule, Nanocrystal, Nano suspension. These are formulations which are made by using nanoparticle for novel drug delivery system. These are of different size and shape and structure. Nanoparticle are used in targeted drug delivery because of their small size and provide large surface area which enhance the solubility of poorly soluble drug and enhance the bioavailability of drug.

NANOEMULSION

"Nanotechnology refers to technological advancements on the Nano scale, which usually ranges from 0.1 to 100 nano meters. Nano emulsions have been studied extensively as drug delivery devices.Nano emulsions are a thermodynamically stable isotropic system in which two immiscible liquids (water and oil) are combined to produce a single phase using appropriate surfactants or a droplet diameter in the range of nanometers0.5-100 um is a measurement of the distance between two points."[3]"They are the most advanced nanoparticle systems for the regulated or sustained administration of active pharmaceuticals and therapeutic targeting."[4]"Advanced strategies for delivering and enhancing the bioavailability of hydrophobic medicines and medications with a high first pass metabolism are nanoemulsion drug delivery devices.Nanoemulsion drug delivery systems are lipid-based formulations that boost the solubility and bioavailability of hydrophobic medicines and bioactive food ingredients."[5]

"The size of Nano emulsion droplets is typically 20-200 nm, with a narrow distribution. O/W type (oil dispersed in aqueous phase), water-in-oil (W/O) type (water dispersed in oil phase), and bi-continuous (micro domains of water and oil are interdispersed within the system) are the most recent classifications for nanoemulsions.An adequate combination of surfactants and/or cosurfactants stabilises the interface in all three types of nanoemulsions."[6]
"These nanoemulsion systems have large interfacial areas and stabilities, which protect molecules from harsh environmental conditions while also increasing their stability.Drugs can be delivered via mucosal and transdermal routes using nanoemulsion devices. As a result, these methods can significantly increase bioavailability."[5]

NANOSPONGE

"Nano sponge technology is newer and rising technologies that use a targeted medication delivery system to deliver the drug to the specified location during a controlled manner.Nano sponges are a type of fabric that have a tiny, sponge-like structure with a narrow hollow that is a few nanometres wide and only one metre in diameter."[7]"The three-dimensional polyester scaffold (backbone) or network made of nano sponges will deteriorate spontaneously.To create Nano sponges, these polyesters are combined with a cross linker during a solution."[8]

"The term "nano sponge" describes minuscule sponges having a porous structure."[9] "They will bind poorly soluble prescription drugs among the matrix and improve their bioavailability by ever-changing the pharmacokinetic characteristics of drug molecules because of their small size and porous structure. Nano sponge may be a revolutionary technique to cancer treatment that permits for regulated drug distribution. Nano sponge may be a new cancer drugs delivery device. Encapsulating nanoparticles, complexing nanoparticles, and conjugating nanoparticles area unit all sorts of encapsulating nanoparticles that encapsulate the drug molecule among the core by numerous ways of connection."[8]

"Nano sponges area unit nanoparticles having a core that may encapsulate a high variety of healthful compounds. These minuscule particles area unit capable of transporting each lipotropic and hydrophilic chemical, likewise as enhancing medication molecule solubility."[10] "Nano sponges area unit insoluble in water and organic solvents as compared to alternative nanoparticles. They are administered through oral, parenteral, topical."[11]

NANO SUSPENSION

"A pharmaceutical nano suspension is a very finely colloidal, biphasic, dispersed solid drug particle in an aqueous vehicle with a particle size of less than 1m."[12]"Solid particles in nano suspensions typically have a particle size distribution of less than one micron, with an average particle size ranging between 200 and 600 nanometers."[13]

"A nano suspension not only solves the problem of poor solubility and bioavailability, but it also changes the drug's pharmacokinetics, improving its safety and efficacy. The nanosuspension formulation method is best for substances with a high log P value, melting point, and dosage. Nanosuspension has been shown to improve adsorption and absorption, which could lead to lower doses in convectional oral dosage forms."[14-15]

The pace of flooding of the active substance rises as a result of higher solubility, and therefore the most plasma level is achieved quicker. This method is effective for substances that are poorly soluble, porous, or both."[16]

NANO CAPSULE

"A Nanocapsule is a spherical, hollow nanoparticle with a diameter of less than 200nm into which a desired substance can be inserted."[17]"Nano capsules are nonmetric structures that have an inner core and an outer shell. Nano capsules have been classified as lipid nano capsules, which have an oily core stabilizedby PEGylated amphiphilic molecules, or polymeric nano capsules, which have an oily nucleus stabilized by a polymeric shell."[18]

"Nano capsules differ from conventional nanoparticles in that their core and shell are highly defined, whereas the latter do not.Nano capsule were originally thought to be good transporters for lipophilic medicines because of their lipid core. Because of their ability to release medications, nano capsules are considered active vectors; their subcellular size allows for larger intracellular vectors. They can also help to increase the stability of active ingredients."[2,2]"When ingested through various mucosal routes, nano capsules can increase the bioavailability of a range of drugs.Nano capsules can be utilized as smart medications that only bind to specific cells and have specialized chemical receptors. This receptor gives the medicine its 'smart' properties, allowing it to target cancer or sickness.Nano capsules that can be used to target anti-cancer medications to tumors while avoiding negative effects on healthy tissue."[19]

"Two types of polymers, such as natural and synthetic polymers, may be employed in the production of nanocapsules.Natural polymer like muscle fiber, enzyme,protein and polysaccharides. Theknown natural polymers used in pharmacy are carrageenan, acacia, chitosan, gelatin, guar gum, and agar. Synthetic polymer isman-made polymer. Some synthetic polymer are used in industries are like Teflon in non-sticky pan,nylons in textile and fabrics, polyvinyl chloride in pipe, Bakelite for electric switch."[20]

"The nano capsule is employed in a variety of sectors, including drug delivery in tumors, as nano capsule Bandages to Fight Infection, as a liposomal nano capsule in Food Science and Agriculture, and as a self-healing material.To lessen drug toxicity and increase drug stability, nanocapsules are used as drug delivery systems for a variety of drugs through a variety of routes of administration, including oral and parental."[21]

NANOCRYSTALS

"Pure solid drug particles with a mean diameter of less than 1000nm are known as drug nanocrystals. The name drug nanocrystal indicates that the discrete particles are crystalline, however they can alternatively be partially or fully amorphous, depending on the manufacturingbecause of the enhanced surface area to volume ratio and improved dissolving rate associated with nano sizing, nano crystalline drug technology increases the solubility of hydrophobic medicines."[23]

"Nano crystal drug formulations, also known as nano crystal colloidal dispersions (NCDs), have been demonstrated to be stable in suspensions. The dispersions serve as a foundation for rapid scale-up and production of extremely stable and commercial products."[24-25] "Nano crystals are employed as a physical approach to improve medication molecule pharmacokinetics and bioavailability. They've been employed in vivo to keep the drug entity safe in the bloodstream."[26]"Nanocrystal formulations have several major advantages, including increased oral bioavailability, improved dose proportionality, reduced food effects, compatibility for all modes of administration, and the potential of sterile filtering due to the smaller particle size range".[27]

NANOSPHERE

"Nano spheres are particles with a diameter ranging from 10 to 200 nanometers. Nano spheres can be either amorphous or crystalline in form, and they can protect drugs from enzymatic and chemical destruction. The tiny capsule of drug store house is called vesicles and the solid skeleton structure is called Nano spheres. Albumin nanospheres, modified starch nanospheres, gelatin nanospheres, polypropylene dextran nanospheres, and polylactic acid nanospheres are examples of biodegradable Nano spheres."[28]"Nano spheres can be amorphous or crystalline in form, and they can protect drugs from enzymatic and chemical degradation. Essentially, the medicine is dissolved, entrapped, encapsulated, or linked to a polymer matrix. The medication is physically and evenly disseminated in the polymer matrixsystem."[29-33]

"It can be separated into biodegradable nano spheres and non-biodegradable nano spheres based on biodegradability. Albumin nano spheres, modified starch nano spheres, gelatine nano spheres, polypropylene dextran nano spheres, and polylactic acid nano spheres are examples of biodegradable nano spheres. Polylactic acid is the only polymer approved for human usage as a controlled-release agent, according to current literature reports on non-biodegradable nano spheres. In addition, in recent years, there have been numerous reports of immunological nano spheres and magnetic nano spheres"[34-35].

FORMULATIONS AND METHOD OF PREPRATION

Table no: 1

Sr.no	Formulation	Method of Preparations
1	NANO EMULSION	a-High pressure homogenization b-Micro fluidization c-Solvent evaporation technique d-Spontaneous emulsification e-Ultra sonication
2	NANO SPONGE	a-Hyper cross linked β cyclodextrins b-Emulsion solvent method c-Solvent used method d-Ultrasound-assisted synthesis e- Loading of drug into nano sponge
3	NANO SUSPENSION	1)Bottom up technology 2)Top down technology a-High pressure homogenization b-Milling c-Micro emulsion template d- Melt emulsification e-Dry co-grinding
4	NANO CAPSULE	a-Nano precipitation

		b-Emulsion solvent method c-Emulsion coacervation method e-Layer-by-layer f-Double emulsification method g-Drug release h-Polymer-coating method
5	NANOSPHERE	a-Emulsification polymerization b-Solvent evaporation technique c- Solvent displacement technique d-Phase inversion temperature method
6	NANOCRYSATL	1)Bottom up technology a-Nano precipitation 2)Top down technology a-High pressure homogenization b-Milling 3)Top down and bottom up 4) Spray drying 5) Other techniques used for the production of drug nano crystal a-Rapid expansion from a liquid b-Nano pure XP technology c-Spray Freezing into liquid technology

FORMULATION METHOD'S

High-pressure homogenization-(used for Nano emulsion, Nano suspension, Nano crystal)
A high-pressure homogenizer/piston homogenizer is used to generate Nano emulsion, Nano withextremely small particle sizes (up to 1nm).

Micro fluidization-(used for nano emulsion)
"A micro fluidizer device is used in the patented mixing technique known as "micro fluidization". The product is forced into the interaction chamber, which is made up of small channels termed "micro channels," by a high-pressure positive displacement pump (500-20000 psi). The product passes through the micro channels and impinges on the impingement area, resulting in very small submicron particles. To make a coarse emulsion, the two solutions (aqueous phase and oily phase) are combined and homogenised in an inline homogenizer. The coarse emulsion is treated further in a micro fluidizer to produce a stable Nano emulsion. The coarse emulsion is repeatedly pushed through the microfluidizer's interaction chamber until therequired particle size is achieved. After that, the bulk emulsion is filtered under nitrogen to remove big droplets, resulting in a homogeneous Nano emulsion."[36-39]

Ultra sonication-(used for Nano emulsion)
"In this methodology, a premixed emulsion is agitated at a frequency of twenty rate, reducing the scale of the droplets to nano droplets. The ensuing emulsion is then pushed through a high shear region, leading to uniformly sized droplets. This technology uses a vessel to stay the temperature in restraint.

During supersonic emulsification, sonotrodes, additionally referred to as sonicator probes, used electricity quartz crystals as energy sources. These sonotrodes shrink and expand once alternating electrical voltage is applied. once the sonicator tip makes contact with the liquid, it causes cavitation, that results in the collapse of vapour cavities generated within the liquid. once a drop size of but zero. is needed, this approach is often used. Shi et al. used Associate in nursing supersonic emulsification method with a frequency of twenty-five rate to form Associate in Nursing emo-loaded Nano emulsion with a mean diameter of 10-30 nm."[40]

Hyper cross linked cyclodecxtrins-(used for nanosponge)
"Nano sponges are constructed from materials that produce non-porous molecules called cyclodextrins, which are transporters for drug release. These cyclodextrins are hyper-cross-linking agents that build multiple networks in micro networks or can even be spherical in shape with many networks of protein channels, pores, and other molecules. Based on the chemicals included in them, these cross linkers stabilise the sponge with specific surface charge density, porosity, and pore diameters. The cross linker's aid in the retention of Nano sponges at various acidic and even neutral pH levels."[41]

Method of emulsion solvent-(used for nano sponge)
"Ethyl cellulose and polyvinyl alcohol, in various quantities, are the major polymers employed in this process. The dispersed phase is created by combining ethyl cellulose with the available medication, which has been dissolved in 20ml of dichloromethane. The continuous phase drop wise addition is made by dissolving polyvinyl alcohol in 150 mL of distilled water. The mixture is then allowed to agitate for around 2 hours at 1000rpm. Nano sponges are collected, filtered, and dried in an oven for about a day before being kept in desiccators."[42]

Bottom up technology-(used for nano suspension, nano crystal)
"Bottom-up technology is defined as starting at the molecular level and progressing through molecular association to the production of a solid particle. That is, we are talking about traditional precipitation approaches that include lowering the solvent quality, such as pouring the solvent into a non-solvent, decreasing the temperature, or a combination of both. In pharmaceutical chemistry and technology, precipitation is a well-known process."[43]

Dry co-grinding-(used for nano suspension)
"Wet grinding techniques with a pearl ball mill are wont to create nano suspensions for an extended time. Dry edge processes will currently be wont to create nano suspensions. once dispersing during a liquid medium, stable nano suspensions area unit created by dry grinding weak soluble medicine with soluble polymers and copolymers. several weak soluble medicines, like Procardia, antimycotic, and glibenclamide, manufacture mixture particles once stabilized with sodium dodecyl sulphate and polyvinyl pyrrolidone, in line with Itoh et.al."[44-46]

Solvent evaporation-(used for nano capsule, nano sphere)
"The initial approach for the preparation of nanoparticles was solvent evaporation in which polymer solutions were created in the presence of a solvent. The emulsions and volatile solvents were created by previously, it was done with dichloromethane and chloroform, but currently it is done with substituted by ethyl acetate, which has a significantly greater performance. To obtain polymeric particles with toxicity profile of less than the size is 500 nm. The emulsion is made during the preparation process.transformed into a suspension of nanoparticles on The solvent is evaporated, and the solution is then permitted to percolate during the continuous phase emulsion to carry out traditional ways, e.g. Oil-in-water (o/w) and double emulsions are examples of single emulsions.(water-in-oil)-in-water, (w/o)/w areexamples of emulsions. Highspeed homogenization or other techniques are used in these methods.Continuous magnetic stirring at room temperature or under reduced pressure results in the creation of solidified Nanosized particles, which are collected by ultracentrifugation, washed to remove surfactants, and finally lyophilized."[47-50]

Emulsification polymerization-(used for nano sphere)
"Polymeric substances like polymethylmethacrylate and polyethylcyanoacrylate area unit blended for emulsification polymerisation, whereas surface polymerisation of polyalkylcyanoacrylate is another polymerisation. Monomers are polymerized to produce Nanospheres in an aqueous solution during the polymerization process. Basically, the medicine is introduced into the polymerization media by dissolving it in it or by adsorption onto the Nanospheres once the polymerization is complete. After that, Nano spheres are purified by centrifugation or resuspension surfactant is added in an isotonic surfactant free media to remove stabilisers and for polymerization."[51-52]

Nano pure technology-(used for nano crystal, nano suspension)
"Another method for manufacturing nano crystals that utilises the piston-gap homogenizer is the Nano pure technology, which was invented and is owned by Pharm Solution GmbH/Berlin. High-pressure homogenization in non-aqueous or low vapour pressure dispersion media achieves effective particle reduction. This is especially useful if the nano suspension is eventually going to be turned into traditional dosage forms like pills and capsules. By lowering the water content in the dispersion, the required drying stage can be avoided or completed at gentler settings, a medium that is helpful for temperature-sensitive pharmaceuticals."[53-55]

EVALUATION PAPRAMETER FOR FORMULATIONS

Table no: 2

Sr. No.	Formulations	Evaluation parameter
1	NANO EMULSION	i- DyeSolubilization ii- Conductance Measurement Dilatability Test iii- Measurements of Dynamic Light Scattering iv- Index of polydispersity v- Analyze the phases vi- Analysis of Particle Size vii- Measurement of interfacial tension viscosity viii- Index of Refraction ix- Transmission Electron Microscopy (TEM)

		x- Skin Permeation Studies in Vitro xi- Studies of Thermodynamic Stability
2	NANOSPONGE	i- Determination of particle size ii- Index of polydispersibility (PDI) iii- Potential zeta iv- Microscopy investigations of Nano spongeloading efficiency (percentage) v- Solubility research vi- Infrared spectroscopy (IR spectroscopy) is a technique vii- Diffractometry with X-rays
3	NANO SUSPENSION	i- Size distribution of particles ii- The structure of crystals iii- Saturation solubility iv- dissolution velocity v- pH Value Viscosity Measurement vi- Zeta Potential vii- Nano suspension Biological Performance Stability in Vivo
4	NANO CAPSULE	i- Capsule size analysis ii- Thermal stability of capsules iii- Capsule - Zeta-potential measurement Shell wall thickness iv- Capsule fills content analysis
5	NANOSPHERE	i- Estimation of amount of drug incorporated
6	NANOCRYSATL	i- Size and Particle Size Distribution ii- Morphology and Shape iii- Crystalline State of Particle Surface Charge

EVALUATION PARAMETRS

Particle size determination-(used for nano emulsion, nano sponge, nanocrystal)
"Nano particle formulation particle size is an important parameter in the optimization process. The drug's particle size can have an impact on its release as well as its solubility. The instrument, laser light diffractometry, or a Zeta seizer can be used to determine particle size. To investigate the effect of particle size on drug release, the cumulative percentage drug release from nanoparticles of various sizes can be plotted versus time. Particles bigger than 30 m can have a gritty feel, hence particles between 10 and 25 μm are preferable for topical medication administration."[56-57]

Refractive index-(used for nano emulsion)
"The index of refraction describes however lightweight travels through a fabric and the way clear a nano emulsion is .The index of refraction (n) of a media is outlined because the magnitude relation of the wave speed (c) within the reference medium to the wave part speed (vp) within the medium: n=c/vp. AN Abbes kind measuring instrument set to 250.5° are often wont to verify the nano emulsion's index of refraction by inserting a drop of nano emulsion on a slide and scrutiny it to the index of refraction of water (1.333). once the index of refraction of a nano emulsion is up to that of water, the nano emulsion is claimed to be clear."[58-59]

Surface morphology-(used for nanoemulsion, nano suspension, nano sponge, nano crystal)
"The shapes and surface structures of nanoparticles play an important role in utilizing their characteristics. Spherical, flat, cylindrical, tubular, conical, and irregular shapes with crystalline or amorphous surfaces with uniform or imperfections on the surface are some of the shapes. Electron microscopy imaging techniques like as SEM and TEM are commonly used to determine the surface. Particles in the liquid phase are deposited on a surface and analyzed, whilst particles in the gaseous phase are captured electrostatically or by filtration for electron microscope imaging."[60]

Surface charge-(used for nano suspension, nano sponge, nano crystal)
"A nanoparticle's interactions with the target are governed by its surface charge or charge. Typically, a visual symbol potentiometer is used to measure the stability of the dispersion of surface charges during a very solution."[61]

Crystallography-(used for nano sponge, nano crystal)
"The study of the arrangement of atoms and molecules in crystal solids is known as crystallography. To evaluate the structural arrangement of nanoparticles, powder X-ray, electron, or neutron diffraction is used to determine the crystallography."[62]

Interfacial tension-(used for nano emulsion)
"The production and characteristics of nanoemulsions can be studied by measuring interfacial tension. The coexistence of surfactant phase or middle-phase nanoemulsions with aqueous and oil phases in equilibrium corresponds to very low values of interfacial tension. The spinning-drop apparatus is used to determine ultralow interfacial tension. Interfacial tensions are measured by rotating a low-density phase drop in a cylindrical capillary filled with high-density phase and evaluating the form of the drop."[63]

Poly dispersibility- (used for nano sponge)
"The poly dispersibility index (PDI) is a measurement of particle size distribution variation in terms of breadth or spread. The PDI is calculated using a dynamic light scattering instrument. A higher PDI value implies that the sample has a larger particle size distribution and is polydisperse, whereas a monodisperse sample has a low PDI.

The following equation can be used to compute PDI.
PDI = average of d/d
Where d Avg is the average particle size given by MV (nm) in the particle size data sheet, and SD is the width of the distribution."[64]

Infrared spectroscopy (IR spectroscopy)-(use for nano sponge)
"In the solid state, IR spectroscopy is utilized to estimate the interaction between drug molecules and drug and nanosponge.

If a small portion of the drug molecule is encapsulated in complex less than 25% band and assigned to include part of another molecule that is designated by bands in the spectrum of nanosponges, the IR changes. Some medicines with carbonyl or sulfonyl groups have a restricted applicability for IR. The information provided by an IR research is for a functional group that contains a medication."[65]

Transmission Electron Microscopy with High Resolution (HRTEM)-(used for nano capsule)
"The shell/core structure of the nanocapsules is clearly visible in the detailed morphology of the corresponding nanocapsules investigated using high-resolution transmission electron microscopy."[66]

Drug loading into a nanosponge-(used for nano sponge)
"First, the nano sponges designed for drug delivery ought to be processed to attain a mean particle size of but 500nm. To avoid the formation of aggregates, the nano sponge's area unit adorned in water for a amount of your time before being sonicated. natural process is employed to separate the mixture fraction from the merchandise suspension.The sample is dried by freeze drying after the supernatant from the completed product is separated."[67]
"In alternative words, a nano sponge binary compound suspension is formed and distributed over a amount of your time with steady stirring. Solvent evaporation or freeze-drying area unit accustomed manufacture nano sponge solid crystals. within the complexation with the medication, the nano sponge crystal structure is extraordinarily vital. The drug loading in crystalline nano sponge is on top of in Para crystalline nano sponge. Drug loading happens as a mechanical mixture instead of Associate in nursing inclusion complicated in nano sponges with a poor crystalline structure."[68]

APPLICATION OF NANO PARTICAL FORMULATIONS

Cancer Therapy using Nano emulsions
"Nano emulsions can be utilized as a vehicle in cancer treatment to extend the time between intramuscular and intratumoral injections (W/O systems). It also improves transdermal medication delivery by increasing the transfer of anti-cancer pharmaceuticals through the skin via lymphatic permeation and it is a non-irritant system."[69-70]

Nano emulsion in Cell Technology
"The transport of oil-soluble compounds to mammalian cell cultures using nano emulsion is a novel approach. The delivery mechanism is based on a nano emulsion with phospholipids to stabilize it. These nano emulsions are clear and can be sterilized by passing them through 0.1 mm filters. The cells readily absorb the nano emulsion droplets. As a result, the encapsulated oil-soluble compounds have a high bioavailability in cultured cells. Better uptake of oil-soluble supplements in cell cultures, improved growth and vitality of cultured cells, and the ability to conduct toxicity tests on oil-soluble medications in cell cultures are all advantages of employing NEs in cell culture technology."[71]

Role of Nano suspension in Bioavailability
"The drug's low oral bioavailability could be related to its low solubility, permeability, or stability in the gastrointestinal tract (GIT). Nano suspensions tackle the twin challenges of weak solubility and poor permeability across the membrane, resulting in improved bioavailability. Oral administration of naproxen nanoparticles resulted in an AUC (0–24 h) of 97.5 mg/h/l, compared to 44.7 mg/h/l for Naprosyn suspensions and 32.7 mg/h/l for naproxen tablets augmentation."[72]

Pulmonary administration of Nano suspension

"For lung delivery, aqueous nano suspensions can be nebulized utilizing mechanical or ultrasonic nebulizers. Because of their small size, each aerosol droplet is expected to contain at least one drug particle, resulting in a more equal distribution of the drug in the lungs. They also improve adhesion 172. July-September 2009 issue of Asian Journal of Pharmaceutics.

Nano suspension technology causes a longer residence period, according to Arunkumar et al. An ultrasonic nebulizer was used to successfully nebulize budesonide medicinal nanoparticles."[73]

Antiviral treatment by using Nanosponge

"Drugs are targeted with nano sponges in the nose and lungs. It uses nano carriers to carry antiviral drugs to the lungs or nasal passages, allowing it to target viruses that can cause RTI, such as influenza and rhinovirus.Zidovudine and Saquinavir are two drugs that utilize nano carriers."[74-75]

Self-Healing Materials using Nanocapsules

"Polymeric coatings, adhesives, microelectronic components, and structural composites can all be damaged over a wide range of length scales. Large-scale damage (such as that caused by a projectile or a blast) is difficult to repair and, when possible, necessitates the employment of bonded composite patches over the effective area. However, for smaller-scale crack damage, self-healing polymers have been used to produce a revolutionary technique of autonomic restoration. The healing agent microcapsules must be strong, have a long shelf life, and have great bonding to the host material."[76-77]

Nuclear Nano capsules, a New Cancer Weapon

"Chemists have discovered a way to bundle some of nature's most potent radioactive particles into DNA-sized tubes of pure carbon, which they plan to use to target tiny tumors and even single leukemia cells."[78]

Nano spheres for drug delivery in the brain

"For the development of new medications, the most essential element in the central nervous system is the blood brain barrier (BBB), which is characterized by impermeable endothelial cells with tight junctions, enzyme activity, and active transport systems."[79]

"Essentially, the BBB only allows for selective chemical trafficking. As a result, if we use nano spheres to deliver targeted drugs, they will interact with the BBB's particular receptor-mediated transport system. Polysorbate 80/LDL,for example, is capable of delivery. As a result, medications that can't easily cross the BBB can do so with the help of nano spheres."[80-84]

Topical drug nano crystals for ocular delivery

"Topical drug nano crystals for ocular delivery are the most used approach for treating ocular disorders. Some of the most frequent dosage forms for localized medication administration in the eyes are solutions, suspensions, ointment, and various drug delivery devices such as inserts, implants, and gelling systems. Due to different anatomical and pathophysiological barriers inherent in the eye, most of the above-mentioned traditional and innovative dosage formulations have low ocular bioavailability. Nano crystals have a number of advantages over traditional ocular dosage forms, including lower doses, longer retention times, lower systemic toxicity, higher drug concentrations in the infected area, and suitability for medicines that are weakly water soluble."[85]

CONCLUSION

Nano technology in nowadays growing in medicinal sector. Nano particleformulations are used in medicinal sector for enhancing solubilty, stability, bioavaibility and pharmacokinetic property in some case. Nano particle formulations use in beneficially cancer treatment, diagnosis of desiseas, treatment with fewer side effects and by avoiding toxic effects.

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