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AQUASOMES –A NOVELVESICULAR DRUG DELIVERY SYSTEM

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ABSTRACT:

Aquasomes are one of the most recently developed delivery mechanism to different sites for bioactive molecules such as peptides, proteins, hormones, antigens, and genes. Aquasomes are circular, with particle size of 60300 nm. Aquasomes are spherical particles formed from calcium phosphate or ceramic diamond coated with a polyhydroxy oligomeric film and acting as a network of nanoparticulate carriers, but rather than a pure nanoparticle. There are three layers of self-assembled structures consisting of a solid phase nanocrystalline core coated with oligomeric film adsorbing biochemically active molecules with or without modification... It is commonly used in implant preparation. Aquasomes used as RBC replacements, vaccines for viral antigen delivery and as a targeted method for intracellular gene therapy. The behavior and responsiveness of enzymes to molecular conformation made aquasomes a novel carrier of enzymes such as DNAs and pigments. This article discusses the concepts of self-assembly, the difficulties of preserving pairs of immobilized surfaces with both conformational integrity and biochemical operation. Successfully the delivery system was used to distribute insulin, hemoglobin, and enzymes such as serrati peptidaseetc.

KEYWORDS: Nanoparticulate, Nanocrystalline

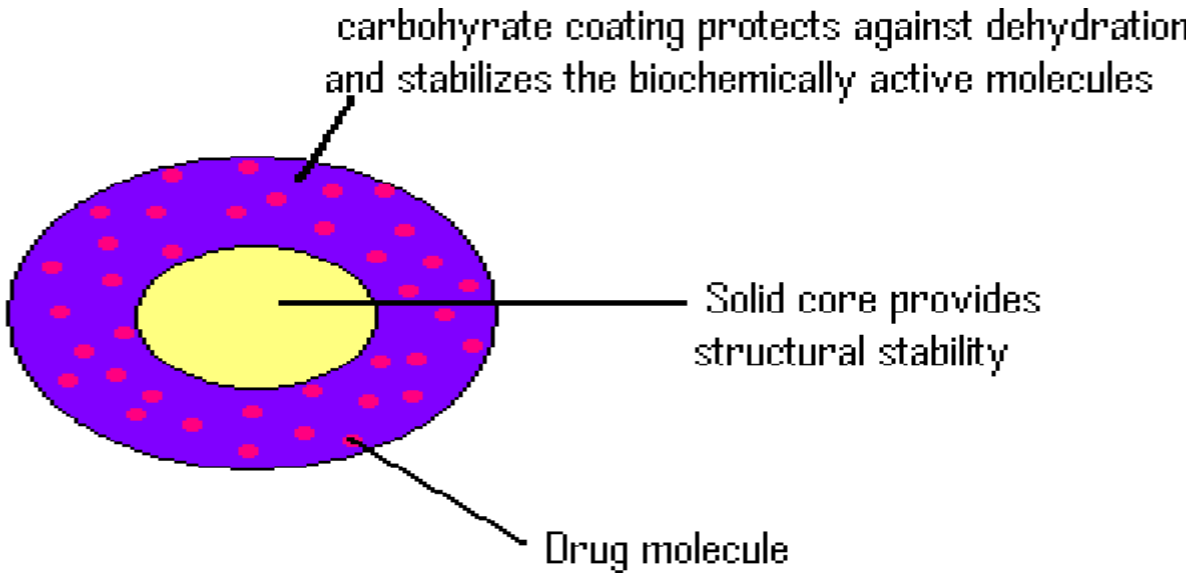
INTRODUCTION:

Novel techniques have developed in the last few years to obtain nanoparticles with complex functionalized characteristics with drugs that have changed the direction of drug delivery. Aquasomes are nanoparticulate carrier systems that are coated with oligomeric film instead of simple core nanoparticles on which biochemically active molecules are adsorbed with or without alterations.

Aquasomes are near to water bodies and their associated properties protect and maintain fragile biological molecules and use this capacity to retain conformational integrity and high surface exposure to target bioactive molecules such as peptide and protein hormones, enzymes, antigens genes at different locations, and face problems such as solvent compatibility.

Macromolecule's key self-assembly molecule is regulated by three physicochemical processes, i.e.

- Interaction between charged group the interaction of charged group facilities long-range self-assembly sub group charge group approach.
- Hydrogen bonding and dehydration effect, hydrogen bonding helps to suit and stabilize secondary protein structure like alpha helices and beta sheets in base pairs.
- Protein structural stability in biological system, defined by the interaction of charged group and hydrogen bonds.



The ceramic nanoparticles that have stabilized carbohydrates are also known as aquasomes. The particle size is less than 1000 nm, for parenteral administration. Aquasomal conformation integrity used as a red blood cell replacement , viral antigen delivery vaccines evoking the right antibody, and as a targeted method for intracellular gene therapy .

ADVANTAGES OF AQUASOMES:

- Aquasomes preserves the structural veracity of drug particles and their biochemical constancy.
- Aquasomes possess colloidal properties.
- Aquasomes suspension contains biodegradable nanoparticles in the colloidal range, and high chances of muscle and liver accumulation.
- Aquasomes, because of its water-like properties, provides a medium for maintaining the conformational integrity and biochemical stability of bioactive.
- As a vaccine delivery system, aquasomes-based vaccines provide several advantages.
- Both cellular and humeral immune responses can be triggered to antigens adsorbed on aquasomal surfaces.

PROPERTIES:

- Aquasomes water, such as the preservation of bio-active conformation integrity and biochemical stability.
- Aquasomes due to their size and structure stability, free of reticuloendothelial clearance or deterioration due to certain environmental challenges.
- Aquasomes possess massive size and active surface area and therefore be filled efficiently with significant quantities of agents by ionic, non-covalent bonds, van der waals and entropic forces.

RATIONAL AQUASOME BEHIND DEVELOPMENT:

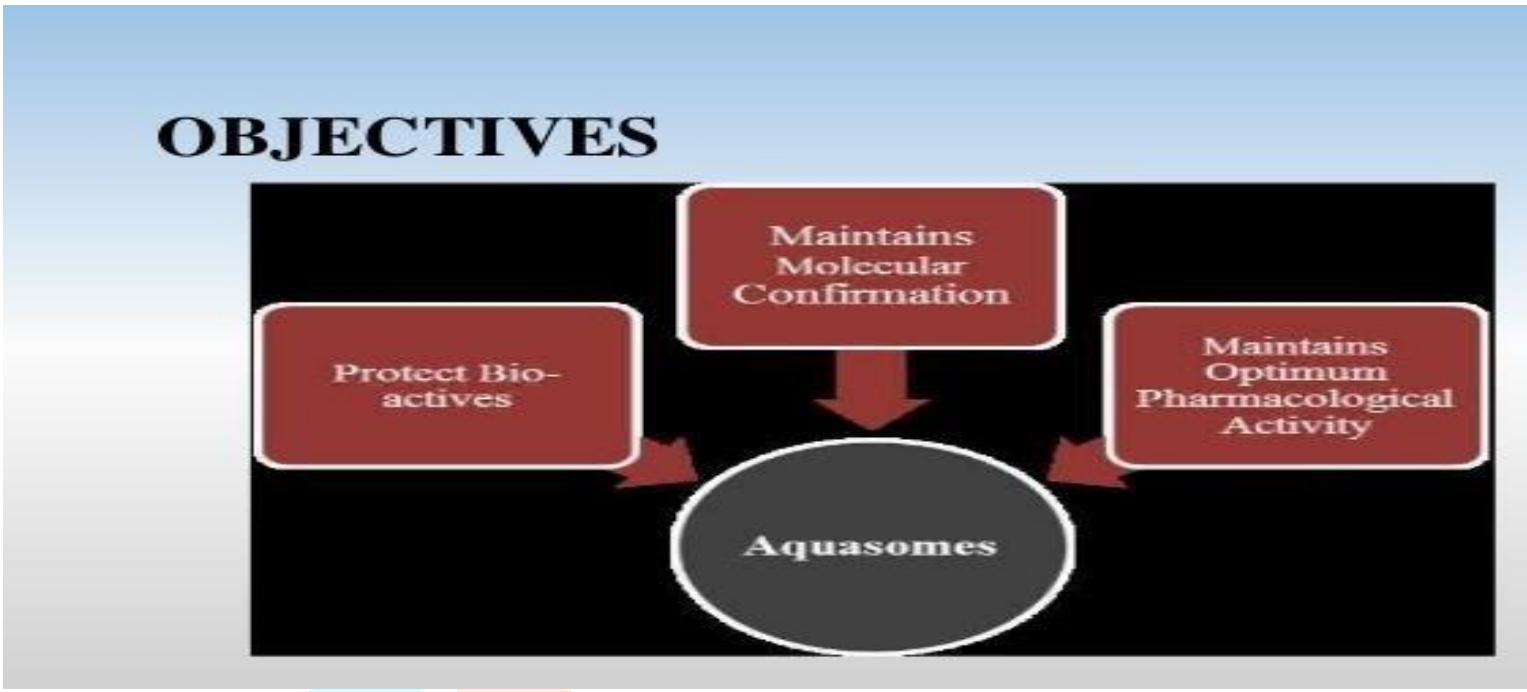
There are many reasons behind the creation of this novel drug delivery system, some of which are defined as natural material:

- professions such as prodrug, macro molecules, and liposomes that are meant to have biological limitations.
- The drug delivery mechanism adjusts underlying biophysical limits, fatigue, and conformational changes.
- There are some inherent structural biophysical limits, which are identical to sugar.

MATERIALS USED AND ITS IMPORTANCE:

Both polymers and ceramics can be used for the preparation of nanoparticles. Polymers use albumin, gelatin or acrylates, and diamond fragments, brushite and tin oxide nuclei can be used as ceramics. Ceramic materials were widely used because ceramics.

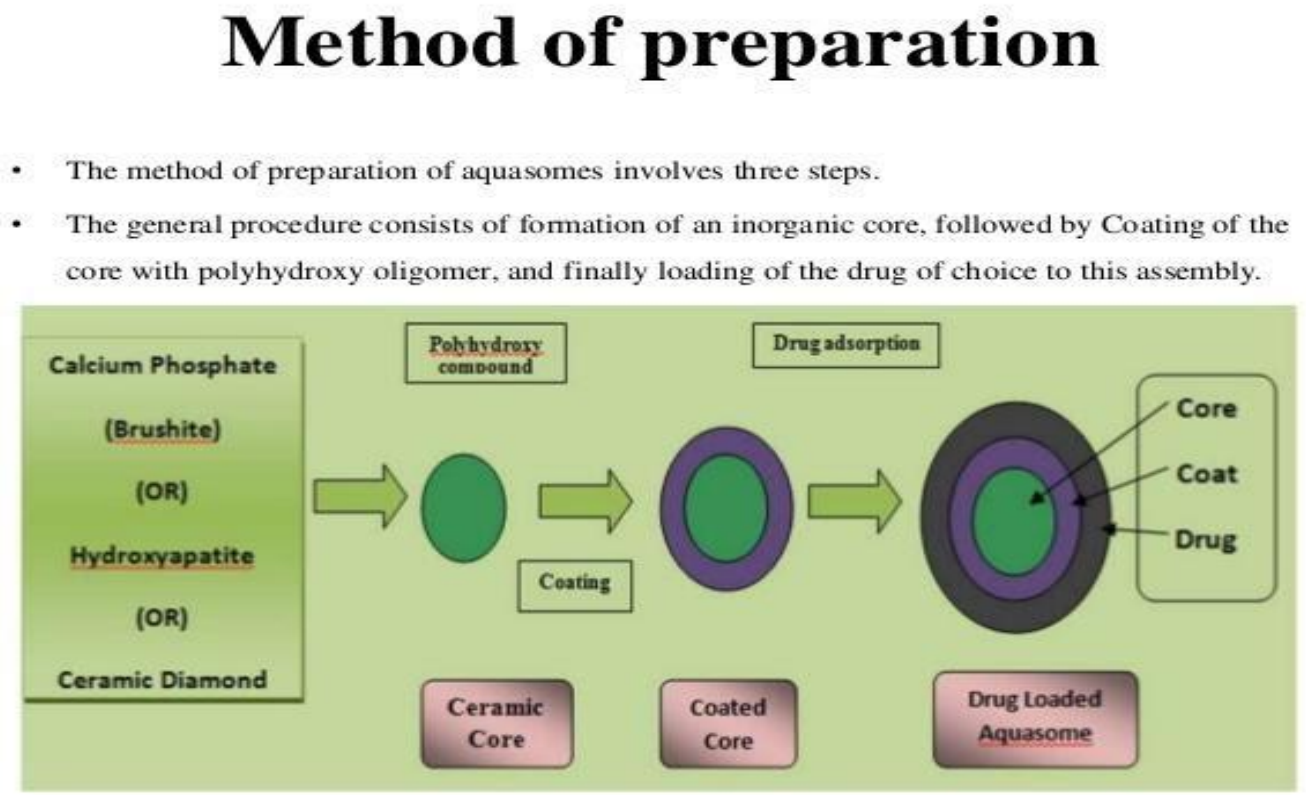
OBJECTIVES:



ROLE OF DISACCHARIDES:

Carbohydrate fulfils the aquasomal objective among three layers of aquasomes. The hydroxyl groups on oligomers interact with pol and charged groups of proteins. Such hydroxyl group-rich disaccharides help remove the water in the protein around polar residues, preserving integrity in the absence of water.

METHOD OF PREPARATION OF AQUASOMES:



The general process consists of an inorganic core formation, which is coated with lactose forming the polyhydroxylated core which is finally charged by model product. By using the concept of self-assembly, the aquasomes were prepared in three steps i.e., core preparation, core coating, and drug molecule immobilisation.

1. Preparation of the core:

The first phase of aquasomes preparation is ceramic core producing. The method of preparing ceramic core depends on the choice of core materials. Colloidal precipitation and sonicated, inverted sputtering of rnagnetron, plasma condensation, and other processes may render these cores. The high degree of order also means that the surface exhibits high surface energy in favor of binding polyhydroxy oligomeric surface film. Two commonly used ceramic cores are diamond and calcium phosphate.

2.Carbohydrate coating:

The second stage involves coating the surface of ceramic cores with carbohydrate. There are a variety of processes enabling the carbohydrate coating to epitaxially adsorb on the surface of the ceramic nano-crystalline cores. Excess carbohydrate is extracted and readily desorbed, and ultra-filtration cell stirring. Cellibose, citrate, pyridoxal-5-phosphate, sucrose, and trehalose are the widely used coating materials.

3.Immoblization of drug molecule:

The surface-modified nano-crystalline cores provide the solid phase for a wide variety of biochemically active molecules for the subsequent nondenaturing self-assemblage. Partial adsorption will load up the medication.

EVALUATION OF AQUASOMES:

Size and shape:

After negative staining of the phosphotungstic acid solution, the morphological analysis of the prepared structure is performed using a transmission electron microscope. The mean distribution of particle size is calculated by a photon using an apparatus and SEM autosizer IIC.

Glass transition temperature:

DSc experiments have been widely used to study carbohydrate and protein glass transition temperatures. The rubber-state transformation can be calculated using a DSc analyser.

OTHER EVALUTION PARAMETERS:

In vitro drug release studies:

The loaded drug's in vitro release kinetics is calculated to test drug release patterns from aquasomes by incubating drug loaded aquasomes at 37c with continuous stirring in a buffer of appropriate PH.

Drug loading efficiency:

This check is performed to ensure the amount of drug that is attached to the aquasomal surface.

The antigen-loading efficiency for the aquasomes:

Accurately weight formulations of antigen-loading aquasomes were suspended in tritonx-100 and incubated for 1hr in wrist shaker. Samples are then BCA methods which set a blank formulation of unloaded aquasomes. Antigen loading is represented by the unit weight of particles of aquasomes [g sample antigen / mg.

APPLICATIONS OF AQUASOME:

1. Aquasomes are replaced by red blood cells, haemoglobin is immobilized on the surface of the oligomer because the haemoglobin release of oxygen is conformationally sensitive. By reducing this toxicity, the concentration of haemoglobin exceeded 80 per cent.
2. Aquasomes used as vaccines for the viral antigen delivery, i.e. Epstein barr and immune deficiency virus must be activated to elicit the appropriate vaccine therapy antibody.
3. Aquasomes were used for active targeted intracellular gene therapy, a five-layered structure containing the therapeutic gene portion of the ceramic nucleus.
4. Aquasomes for the delivery of pharmaceuticals, i.e. insulin, developed because the drug action is similar in conformity.

5. Aquasomes are used to distribute enzymes such as DNAase and pigments since the activity of the enzyme fluctuates with molecular conformation and pigment cosmetic properties.

CONCLUSION:

Aquasomes, self-assembled surface-modified nanocrystalline ceramic cores, appear to have potential and promising carriers capable of maintaining the structural integrity of protein pharmaceuticals and carrier for the delivery of wide range molecules including viral antigens, haemoglobin and insulin, thereby promoting a better therapeutic effect.

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