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AQUASOMES: A NOVEL DRUG CARRIER SYSTEM

Jadhav Shubham Sambhaji[1], Mr Tushar Gaikwad[2]

[1]Author, B. Pharm last year, Late Narayandas Bhavandas Chabada Institute of Pharmacy Raigaon, Satara

[2]Co-Author, B. Pharm last year, Late Narayandas Bhavandas Chabada Institute of Pharmacy Raigaon, Satara

ABSTRACT

In past years, Nano biotechnology has emerged as a fresh solution for medications that are challenging to distribute in traditional pharmaceutical formulations. Only just few good example of Nano-biotechnologically generated carrier systems include nanoparticles, liposomes, noisome, quantum dots, and aquasomes.Aquasomes are a special variant of medication delivery system that is made up of nanoparticles that ego. Infrastructure of transport in the development of new drugs, aquasomes have shown to be a useful drug delivery mechanism. Nanoparticles made of ceramic. Aquasomes are composed of three layers of solid material. Adsorption Comprising physiologically active drug molecules on a carbohydrate-coated crystalline core The sturdy foundation The stability is provided by the polyhydroxy oligomer coating, while the protection is provided by the polyhydroxy oligomer coating. Dehydrating. Aquasome formulations are usually given intravenously, however current research suggests that this isn't always the case. Indicates that something is beginning to change. Other governance methods are also available. Aquasomes have a variety of applications. To distribute their bioactive compounds, they used a combination of molecular shielding and an extended release approach. Insulin, hemoglobin, and enzymes have been effectively delivered using the delivery mechanism.serratiopeptidese, etc.

1. INTRODUCTION

Nir Kossovsky was the first one to discover aquasomes. These really are three-layered ego microparticles delivery systems. All of those are spherical and have a size distribution of 60-300nmin. These have a main Nano crystalline core that is covered with polyhydroxyoligomers and chemically diverse molecules are adsorbed on top of it. Aquasomes are sometimes known as "water bodies" because of their water-like qualities that shield and preserve fragile biological components, along with their ability to maintain structural stability and a large surface area exposure. Non-covalent and ionic bonds ego these three layers. The carbohydrates that stabilize ceramic nanoparticles are referred to as "aquasomes."

2. OBJECTIVES

Aquasomes preserve bioactive molecules. Many different transporters are used, such as Prodrugs and liposomes, however they are vulnerable to harm. There are negative interactions between the medicine and the carrier in such circumstances. Carbohydrate coating inhibits a detrimental, denaturing interaction between medication and solid carriers, and aquasomes have been shown to be an effective carrier. The molecular shape and pharmacological activity of aquasomes are maintained.

Natural stabilizers in aquasomes, such as different polyhydroxy sugars, operate as deydroprotectants, keeping molecules in a dry solid form and protecting them from denatured proteins caused by changes in aqueous state, pH, temperature, solvent, or salt. An active molecule possesses distinctive three-dimensional structure, as well as freedom of internal molecular rearrangement generated by bulk motion molecular freedom. When dried, protein undergoes permanent denaturation and becomes volatile in aqueous solution.

3. PREPARATION OF AQUASOMES METHOD

Aquasome production is thought to be a simple and straightforward method that requires little solvent and also no processing. In principle, the technique begins with the production of an inorganic core that is then coated in carbohydrate to form a polyhydroxylated core, which would then be loaded with protein, antigen, or medication. The ego approach is used to make aquasomes in 3 stages.

1. Inorganic core formation: It entails the construction of a ceramic core, with the method varying depending on the materials used. Calcium phosphate and diamond are the two most prevalent ceramic nuclei.

a) Alternating current reactive thermionic sputtering can be used to make non-crystalline tin oxide core ceramics. This involves sputtering 3 inches of ultrapure tin in a high pressure gas mixture of organ and oxygen. In the gas phase, ultrafine particles produced. These small particles are then collected in copper tubes that have been chilled to 77°K with nitrogen flowing through them.

b) Self-assembled non-crystalline brushite (calcium phosphate dihydrate): A mixture of disodium hydrogen phosphate (Na2HPO4) and calcium chloride can be made via colloidal precipitation and sonication (CaCl2).

c) Diamond nanoparticles in Nano-crystalline carbon ceramic: They is used for a variety of purposes. After ultra-cleaning and sonication, the core is synthesized. The unifying trait of diverse cores is that they too are crystalline, measuring between 50 and 150 nm when incorporated into synthesis methods, and exhibiting exceptionally clean and sensitive species. Composites are the most commonly used for core fabrication because of their structural regularity.

2. Carbohydrate coating: the ceramic cores are covered with carbohydrates in the second stage. Under sonication, carbohydrates are added to an aqueous dispersion of the cores. Coating has been completed. After that, they're lyophilized, which causes irreversible carbohydrate adsorption on the ceramic surface. Centrifugation is used to eliminate the unabsorbed carbohydrates. Cellobiose, citrate, pyridoxal-5-phosphate, sucrose, and trehalose are the most commonly used coating materials.

3. Drug immobilization: This is the final stage in the aquasome manufacturing process. Partial adsorption is used to load drugs onto coated particles. At such a sufficient pH buffer, a solution of known drug concentration is created. The covered nanoparticles were distributed and maintained at a low temperature overnight for drug loading or lyophilized. Following the acquisition of a drug-loaded formulation (i.e. aquasomes). The resulting mixture is subsequently characterised to use a variety of techniques.

4. PROPERTIES

- They generate issues due to their size and high integrity.
- The huge size and utilization of existing of aquasomes are well-known. Non-covalent, ionic bonds, van der Waals forces, and entropic forces can all be used to load aquasomes with appropriate amounts of chemicals.
- The surface chemistry of aquasomes controls their molecular mechanism.
- Aquasomes' water-like features include a platform for maintaining bio-active structural integrity and biochemical stabilization.
- Aquasomes use a mix of methods to deliver the active medicine, including precise targeting, molecule shielding, and gradual and prolonged releasing.

Advantages:

- Aquasomes increase the therapeutic efficiency of the pharmaceutically active ingredient while also preventing phagocytosis and degradation.
- Aquasomes systems serve as reservoirs for the continual or pulsatile delivery of therapeutic molecules, reducing the need for numerous injections.
- Aquasome-based vaccines provide a number of advantages as a vaccine delivery technology. Antigens adsorbing on aquasomes have the ability to activate cellular and humeral immune responses.
- Multi-layered aquasomes conjugated with bio recognition molecules such as antibodies, nucleic acid, and peptides, often known as biological tags, could be utilised for a variety of imaging assays.
- Proteins do not become denaturalized in the presence of these nanoparticles because they provide a good conditions for protein.
- Due to its enzyme concentration and molecular orientation sensitivity, aquasome is a one-of-a-kind transporter for enzymes including DNase and pigment/dyes.

5. APPLICATIONS

1. Insulin delivery: Regarding injectable insulin delivery, Cherian et al. created aquasomes with a calcium phosphate ceramic center. Disaccharides including cellobiose, trehalose, and pyridoxal-5-phosphate were used to wrap its center. Its medication was then put onto such particles using an adsorption process. Albino rats were used to test the in vivo performance of several aquasome insulin compositions. Apart from cellobiose-coated particles, all formulations resulted in a sustained drop in blood glucose. Pyridoxal 5-phosphate–coated particles were found to be more effective than aquasomes covered with trehalose or cellobiose in lowering blood glucose.

2. Enzyme delivery by mouth: Rawat et al proposed using a Nano sized ceramic core based method to deliver the acid-labile enzyme serratiopeptidase by mouth. Colloid precipitation with sonication at room temperature was used to make the Nano core. After that, the enzyme was adsorbed onto the core, which was coated with chitosan under steady stirring. By enclosing the enzyme-loaded core in an alginate gel, the enzyme was further preserved. Particles were spherical in shape, with an average diameter of 925 nm, as revealed by TEM images. The particles' enzyme loading efficiency was determined to be around 46%.

3. Antigen delivery: Adjuvants commonly employed to boost antigen immunity have a tendency whether to change the antigen's structure by absorption or protect the functional groups. As a result, Kossovsky et al proved the success of a specific synthetic polymer ceramic antigen transport

vehicle. Inside an aqueous dispersion, these nanoparticles were made up of a diamond substrate coated with a glassy carbohydrate (cellobiose) layer as well as an immunologically active surface molecule. Such aquasomes (5–300 nm) exhibited conformational stability and also a top rate of protein antigen surface exposure. Diamond, as an elevated material, was indeed the original selection of cellobiose adsorption and adhesion.

4. Medication delivery: Oviedo and colleagues created indomethacin-loaded aquasomes by forming an inorganic calcium phosphate center wrapped inside a lactose layer and then adsorbing indomethacin as a reduced drug. X-ray powder diffractometry, TEM, and SEM have been used to characterize the aquasomes for strength and function, grain size, and shape. The particle size of drug-loaded aquasomes was determined to be between 60 and 120 nanometers. Aquasomes' spherical shape was confirmed using SEM and TEM methods.

5. Gene delivery: Aquasomes can be investigated for gene transfer. It depicts a visually appealing delivery mechanism that is loaded with genetic code. Aquasomes safeguard and preserve the structural integrity of the gene segment, according to research. A five-layered composition for regenerative medicine has been suggested, consisting of a ceramic Nano crystalline core, a polyhydroxyl oligomeric film coating, a noncovalently bound therapeutic gene fragment surface, an extra carbohydrate film, and a designed to target layer of stereo chemically preserved viral protein complexes. The aquasome vehicle would provide all of the benefits of viral vectors while also significantly reducing the chance of irrelevant integrated and coordinated.

6. CONCLUSION

Aquasomes are the most basic novel drug carriers and biodegradable colloidal spectrum novel drug delivery transporters. That is defined as self-idea. M such innovative methods are ideal for drugs that are difficult to distribute in typical dose forms. Aquasomes have a strong core that provides structural strength and just a covering that defends against dehydration. Other than parenteral administration, these aquasomes formulations could be administered orally. Aquasomes have higher biological activity and are less sensitive to drugs. Because of the carbohydrate layer, this is possible. These carbohydrate coatings on aquasomes aid to preserve spatial features by preventing a harmful interaction among medication and transport.

Pharmaceutical scientists now have fresh hope for such delivery of a large range of bioactive chemicals and the successful treating a wide variety of ailments thanks to aquasomes strategy. This can transport a wide variety of chemicals, such as viral antigens, hemoglobin, insulin, enzymes, and other biomolecules.

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