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A SHORT OVERVIEW ON AQUASOMES

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ABSTRACT: -

In the last few decades, nanobiotechnology grown as a novel approach for those drugs that face challenges to deliver in conventional dosage forms. Nanoparticles, liposomes, niosomes, quantum dots and aquasomes are some main different types of nano-biotechnologically developed carrier system. The aquasomes are one of the emerging approach and ideal choice of drug delivery comprises of the nano-particulate self-assembled carrier system. In the development of ceramic nanoparticles, aquasomes confirmed as a significant drug delivery system. Aquasomes are the three-layered structure, fabricated from the solid crystalline core, coated with carbohydrates on to which biologically active drug molecules are adsorbed. The solid core confers the structural stability, whereas the polyhydroxy oligomer coating protects against dehydration and confers stability to active drug molecules. Formulations of aquasomes are mainly administered by parenteral route but new studies suggest that it could also be administered by oral, other routes also. Aquasomes delivers their bioactive molecules via a combination of particular targeting molecular shielding and sustained release process. Hydroxyapatite core-based aquasomes are broadly used for the preparation of implants. Aquasomes possess properties of maintaining conformational integrity, and a high degree of surface exposure, which is successfully targeted for the delivery of peptide molecules such as insulin, haemoglobin; enzymes like serratio- peptidase and also aid in targeting vaccine and gene to specific sites. The present article is an attempt to navel on the possible revolutionary applications of aquasomes. Aquasomes are biodegradable nanoparticles that deposited more in liver and muscles. Zeta potential also help in the measure the storage, stability determine and absorption of sugar over the core.

Key Words: Nanobiotechnology, Aquasomes, Carrier system, Novel drug delivery

INTRODUCTION: -

The word Aquasomes are made up of two words “Aqua” which means water and “Somes” which means cell. It simply means that aquasomes are nanoparticulate system which has properties like water. They are said to be nanoparticulate system because of their size which is in nanometer. Their size range is about 60- 300nm. So “aquasomes” are carbohydrate stabilized nanoparticles of the core which was first developed by Nir Kossovsky in 1995. Alternatively, aquasomes are termed as “Bodies of Water”, their water like properties support and sustain fragile biological molecules such as polypeptide and proteins.

BODIES OF WATER: - Water like properties. Protect and preserve fragile biological molecules. ′ Maintain conformational integrity as well as high degree of surface exposure in targeting of bio-active molecules.

DEFINITION

Aquasomes are three-layered spherical structures comprising:

- A ceramic core for structural stability.
- Carbohydrate coat that prevents dehydration and stabilizes biochemical drugs.
- Absorbed biochemical drugs such as proteins

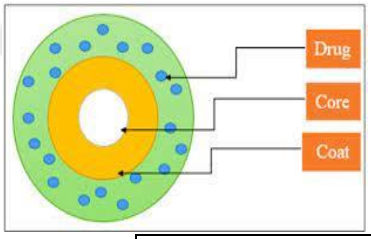

Fig1: - Aquasomes structure

PROPERTIES OF AQUASOMES: -

- These carriers also protect the drug/antigen/protein from harsh pH conditions and enzymatic degradation, thus requiring lower doses.
- The mechanism of action of aquasomes is governed by their surface chemistry.
- Exhibit the physical properties of colloids.

- The main objective of preparing aquasomes is to protect bio-actives.
- Aquasomes maintain molecular conformation and optimum pharmacological activity.

ADVANTAGE OF AQUASOMES: -

- ❖ Increases therapeutic efficacy of pharmaceutically active agents.
- ❖ Avoid multiple-injection schedule.
- ❖ Offer favourable environment for proteins.
- ❖ Used for various imaging tests.
- ❖ Novel carrier for enzymes such as DNAses and pigment/dyes.
- ❖ Act as a vaccine delivery system.

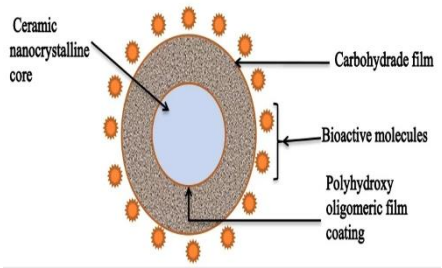

Fig2: -Different part

DISADVANTAGE OF AQUASOMES: -

It is expensive
Care should be taken in production of carriers.
Leaching and aggregation of prolong storage.
If the drug is poorly absorbed, may cause burst release in the body that cause toxicity.

PREPARATION: - Simple and straight forward approach with minimum solvent usage. No homogenization steps. 3 steps of preparation by using the principle of assembly: -

1. Preparation of the core –
   i. Co precipitation
   ii. Self-Precipitation
   iii. Sonication
   iv. PAMAM
2. Carbohydrate coating of core
3. Immobilization of drug molecule.

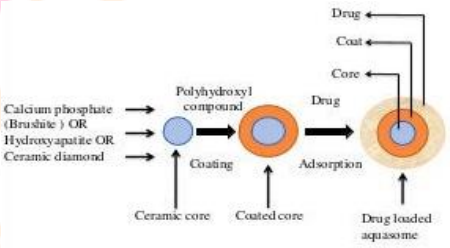

Fig3: - Preparation

PREPARATION OF THE CORE

Co-precipitation: -

Diammonium hydrogen phosphate (0.19 N) solution drop wise added to calcium nitrate solution (0.32 M)

three necked flasks containing a reflux condenser, a thermometer fitted with a CO2 trap and a charge funnel. Stirr magnetically for 4-6 days at 75 °C & pH 8-10.

Then, filter the precipitate, washed & dried overnight at 100 °C followed by sintering to 800–900 °C.

Self-Precipitation: -

Adjust simulated body fluid containing sodium chloride (134.8 mM), potassium chloride (5.0 mM), sodium hydrogen carbonate (4.2 mM), calcium chloride (2.5 mM), disodium hydrogen phosphate (1.0 mM), magnesium chloride (1.5 mM), and disodium sulfate (0.5 mM) to pH 7.26 every day with hydrochloric acid.

Transfer the solution to a series of 100 ml polystyrene bottles, seal it tightly & kept at 37±1 °C for one week.

Filter the precipitate, thoroughly washed with double distilled water & dried at 100 °C.

Sonication: -

Slowly add solution of disodium hydrogen phosphate to solution of calcium chloride under sonication at 4 °C for 2 h.

Separate the precipitate by centrifugation & decant the supernatant.

Wash the precipitate, re-suspend in distilled water & filter through membrane filter.

PAMAM: -

Carboxylic acid terminated half generation poly (amidoamine) (PAMAM) used.

Forms amorphous hydroxyapatite cores with a mixture of calcium phosphate.

CARBOHYDRATE COATING OF CORE: -

Coating materials-

Cellobiose, citrate, pyridoxal-5- phosphate, sucrose and trehalose.

Adsorption method: -

Add of polyhydroxy oligomer to a dispersion of meticulously cleaned ceramics in ultra-pure water.

⬇

Sonicate & lyophilize it.

⬇

Remove excess & readily desorbing carbohydrate either by stir cell ultrafiltration or by dialysis method.

IMMOBILIZATION OF DRUG MOLECULE: -

Prepare the solution of drug with known concentration in suitable buffer.

⬇

Disperse the coated particles in it.

⬇

Keep the dispersion overnight at low temperature or lyophilize it.

EVALUATION PARAMETER OF AQUASOMES: -

Evaluation parameter for core material-

Size distribution: - Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) techniques are used for particle size distribution and morphological analysis.

structural analysis: - Fourier transform infrared spectroscopy (FT-IR) spectroscopy used for determining structural analysis.

Crystallinity: - X-ray diffraction study is performed.

Carbohydrate coating: It is identified by Colorimetric analysis

Glass transition temperature: - Differential Scanning Calorimetry (DSC) studied used to analyse the glass transition temperature of carbohydrates and protein.

APPLICATION OF AQUASOMES: - Deliver all sensitive biochemical drug.

Insulin and Insulin mimetics delivery

As oxygen transporter

Delivery of antigens

Delivery of enzymes

Delivery of gene

Delivery of Non-Protein Molecules

Fig4: - Application

CONCLUSION: -

Thus, it can be concluded that Aquasome represent one of the simplest yet a novel drug delivery system based on fundamental principle of self-assembly. Aquasomes based strategy provides pharmaceutical scientists with new hope for the delivery of a wide range of bioactive molecules and in the effective possible treatment of various disease. To prepare an aquasomes spherical nanoparticles, high frequency and sonication required. It is also better than liposomes. And also, we also deliver the drug via the TDDS route.

REFERENCES

- Gupta AK, Gupta D, Gupta V. Aquasomes: A Self-Assembled Nano-Particulate Carrier System. Int J Cur Res Rev. 2021 Feb;13(4):44-52.
- Banerjee S, Sen KK. Aquasomes: A novel nanoparticulate drug carrier. Journal of Drug Delivery Science and Technology. 2018 Feb;1(43):446-52.
- Goud BB, Mamatha I, Sharma JV, Gupta AV. Aquasomes–An Overview. International Journal of Research in Engineering, Science and Management. 2021 Dec;12.4(12):35-8.

- Chandra D, Yadav KK, Singh VK, Patel A, Chaurasia S. An overview: The novel carrier for vesicular drug delivery system. World J Pharm Res 2014;3(6):1299-322.
- Swain S, Beg S, M. Babu S. Liposphere's as a novel carrier for lipid-based drug delivery: current and future directions. Rec Pat Drug Deliv Formula 2016;10(1):59–71.
- https://www.slideshare.net/PAYALBORAWAKE/aquasomes-236518357 (Accessed on 31.05.2022)
- Parashar A. Literature review on aquasomes A drug carrier system. Indian J Med Res Pharma 2017 Nov; 4(11):27-30.
- Rojas-Oviedo I, Salazar-Lopez RA, Reyes-Gasga J, Quirino-Barreda CT. Elaboration and structural analysis of aquasomes loaded with indomethacin. European journal of pharmaceutical sciences. 2007 Nov 1;32(3):223-30.

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