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Review Paper

A Review on Nanosponges in Modern Drug Delivery Systems

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ABSTRACT

A new family of nanoporous materials called nanosponges is made up of minuscule particles having nanometer-sized voids. These structures are made of a three-dimensional porous network that may encapsulate medicinal molecules by cross-linking biodegradable polymers like polyesters or cyclodextrins. Nanosponges' special shape allows for regulated and targeted drug release while also improving the solubility, stability, and bioavailability of poorly soluble medications. There are several ways to give them, including as topical, oral, parenteral, and inhalation methods. For use in pharmaceutical and biological applications, a variety of nanosponges have been produced, including those based on β-cyclodextrin, carbon-coated metallic nanosponges, silicon nanosponges, hyper-crosslinked polystyrene nanosponges, and titanium. High drug loading capacity, greater stability, less irritation, and increased therapeutic efficacy are further benefits of nanosponges. They are employed in cancer treatment, chemical sensing, protein delivery, environmental purification, and cosmetic formulations in addition to medication delivery. The structure, preparation techniques, assessment criteria, benefits, drawbacks, and many uses of nanosponges in contemporary pharmaceutical research are all highlighted in this study...

INTRODUCTION

A contemporary kind of material known as "nano-sponge" is composed of minuscule particles with a small cavity of a few nanometers. The nano-sponges are a three-dimensional polyester network or scaffold that can break down organically. To create nano-sponges, these polyesters are combined with a crosslinker in a solution. In this case, the polyester degrades somewhat in the body because it is often biodegradable. When the nanosponges' scaffold disintegrates, the loaded drug molecules are released in an unfavorable way[1].Nano-sponges are microscopic, mesh-like structures that have the potential to transform the treatment of several illnesses. Preliminary research indicates that this technology can deliver medications for breast cancer up to five times more

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effectively than traditional approaches. The nano-sponge is roughly the size of a virus and has a naturally biodegradable polyester "backbone," or scaffold structure. This implies that the medication can be delivered on a predetermined timetable when it disintegrates in the body. For a considerable amount of time, targeted medication delivery systems have been an endeavor to attain the desired result. Initially, the Nanosponge drug delivery technology was limited to topical distribution; now, in the twenty-first century, nanosponges may be administered orally or intravenously (IV)[2].

Characteristics of nanosponges 3

- These tiny structures' primary benefit is their water solubility, which promotes the body's distribution of less soluble drugs.
- They have a highly amphoteric nature and can include both hydrophilic and lipophilic components.
- They help remove contaminants from water, much as a nano mediator that delivers drug molecules for biological functions.
- They are more adept at trapping and are less toxic.
- They have the proper degree of flexibility, are more graceful, and are more stable.
- They are neither allergic nor carcinogenic, and they help to lessen inflammation.
- They may be used as materials for prolonged or even continuous release for 12 or 24 hours by including an immiscible liquid.
- Particles that are spherical and submicron in size are even produced when liquid is turned into powder.
- They are more stabilized, have a longer shelf life, and are shielded from air and oxygen. They have greater therapeutic qualities depending on the dosage.

Merits [5]

- This technique reduces adverse effects and offers ingredient trapping.
- Better stability, more elegance, and more freedom in the formulation.
- From PH 1 to PH 11, these compositions remain stable.
- These formulations are stable at temperatures as high as 130°C and work well with the majority of vehicles and additives.
- These are self-sterilizing since bacteria cannot fit through their typical pore size of 0.25 nm.
- Drugs that are weakly soluble have enhanced solubility and bioavailability.
- Drug delivery that is location-specific.
- This system provides a large range of products to be processed as well as typical negative effects.
- Enhanced formulation flexibility, attractiveness, and stability.
- Nanosponge systems don't cause irritation.

Demerits [5]

- Only tiny molecules are present in nanosponges.
- Rely only on loading capacities
- Only depends on the loading capacity.
- Rather of huge molecules, small molecules are involved.
- Dose dumping may occur.
- There might be a delay in release.
- While nanosponges may encapsulate tiny molecules, they are not appropriate for bigger molecules.

Nanosponges: Types [4]

1. A nanosponge based on beta-cyclodextrin
2. Metallic nanosponges covered with carbon
3. Particles of silicon nanosponge
4. Polystyrene Nanosponge with a hypercross link
5. Nanosponges Based on Titanium

1. Beta-Cyclodextrin Based Nanosponges

- Made from β-cyclodextrin, a cyclic oligosaccharide.
- Cross-linked with agents like diphenyl carbonate or carbonyldiimidazole.
- Highly porous structure that can trap drug molecules.

Applications

- Drug delivery (especially poorly soluble drugs)
- Controlled drug release
- Removal of toxins from the body
- Cosmetic formulations

Advantages

- Biocompatible
- Non-toxic
- Good inclusion complex formation

2. Carbon-Coated Metallic Nanosponges

- Metallic nanoparticles (like gold, silver, or iron) coated with a porous carbon layer.
- Carbon coating improves stability and adsorption capacity.

Applications

- Catalysis
- Environmental pollutant removal
- Sensors
- Energy storage systems

Advantages

- High surface area
- Chemical stability
- Enhanced catalytic activity

3. Silicon Nanosponge Particles

Made from porous silicon nanostructures.

Large internal pore network that can load drugs or biomolecules.

Applications

- Targeted drug delivery
- Imaging and diagnostics
- Cancer therapy

Advantages

- Biodegradable
- High drug loading capacity
- Good biocompatibility

4. Hyper Cross-Linked Polystyrene Nanosponges

- Prepared from polystyrene polymers with extensive cross-linking.
- Produces a rigid porous polymer network.

Applications

- Drug delivery systems
- Adsorption of organic pollutants
- Chromatography

Advantages

- Very high surface area
- Excellent adsorption capacity
- Chemical stability

5. Titanium Based Nanosponges

- Usually made from titanium dioxide (TiO_2) nanostructures with sponge-like porosity.

Applications

- Photocatalysis
- Antibacterial surfaces
- Environmental purification
- Drug delivery research

Advantages

- Photocatalytic activity
- High stability
- Antimicrobial properties

Methods of Preparation of Nanosponges5

1. Melt Method
2. Ultra- Sound Assisted Synthesis Method
3. Emulsion Solvent Evaporation Method
4. Emulsion Solvent Diffusion Method
5. Quasi- Emulsion Solvent Diffusion Method
6. Hyper Cross-linked β Cyclodextrin Method

Melt method

In a China dish, the required amount of β-cyclodextrin, 100 mg of medication, and barium carbonate were added. This combination in a China dish is put in a hot air oven that has been preheated to between 60°C and 70°C for one hour. A transparent solution is formed by heating PVA in 100 milliliters of distilled water in a water bath. Ten milliliters of the cooled PVA solution are gradually added to the China dish removed from the hot air oven while it is being continuously mixed in a magnetic stirrer at 70 degrees Celsius. A spatula is used to gather the semi-dried material that results from the solution evaporating, and the sample is utilized for more research.

Ultrasound- assisted synthesis method

A methanol solution was added to a drug. 0.75 ml of glutaraldehyde is introduced to a beaker containing β-cyclodextrin. This is put in an ultrasonicator set at 40°C, and the drug is administered gradually over the course of two hours. After the turbidity forms, the product is filtered and cleaned with distilled water. The NS is dried for 30 minutes at 60°C in a hot air oven till it turns into a powder.

Emulsion solvent evaporation method

There are two stages to the process: an organic phase and an aqueous phase. The organic phase is made up of 20 milliliters of dichloromethane (DCM) and 100 milligrams of ethyl cellulose in a beaker. For the aqueous phase, 100 milliliters of distilled water are mixed with the necessary amount of polyvinyl alcohol powder. The organic phase is added dropwise using a syringe for approximately two hours while the aqueous phase is placed in a digital mixer and spun at a speed of 1000 to 2000 rpm. `After that, the dispersion medium was placed on a magnetic stirrer that was thermostatically stabilized. The solution was then allowed to gently evaporate while being continuously stirred until it had entirely evaporated. The nanosponges' byproduct is collected and kept in an airtight container.

Emulsion solvent diffusion method

In a beaker with 20 milliliters of dichloromethane (DCM), a certain amount of drug is combined with ethyl cellulose to create the organic phase. For Aqueous phase, the required quantity of Poly vinyl alcohol is dissolved into100ml of distilled water, with the help of a water bath at 60°C – 70 °C until a clear solution is formed. Following the preparation of the solutions for both phases, the organic phase is added dropwise using a syringe for about two hours while the aqueous phase is placed in a digital mixer and spun at a speed of 1000 rpm.

After that, the dispersion medium was placed on a magnetic stirrer that was thermostatically stabilized. The solution was then allowed to gently evaporate while being continuously stirred until it had entirely evaporated. After filtering the resultant dispersion using filter paper, the residue is dried in a China dish in a hot air oven set between 40°C and 50°C for two hours. An airtight container is used to package and preserve the finished product.

Quasi emulsion solvent diffusion method

In a beaker, a certain amount of Eudragit RS 100 polymer is combined with drug and dichloromethane (DCM). Mix 100 milliliters of distilled water with powdered polyvinyl alcohol in a separate beaker. Using a syringe that is held in a digital mixer and spun at 1000 rpm for three hours, the scopolamine solution is added gradually, drop by drop. After filtering the mixture, the resulting nanosponges are dried for 30 minutes in a hot air oven and kept in an airtight container.

Hyper cross-linked beta-cyclodextrin method

The hyper cross-linked β-cyclodextrin approach was used to create nanosponges with varying

crosslinker concentrations. To accomplish total dissolution, anhydrous β-cyclodextrin was introduced to a round-bottom flask containing anhydrous dimethyl sulfoxide. After adding diphenyl carbonate, the mixture was left to react at 100°C for four hours. The translucent block of hyper-cross-linked β-cyclodextrin was coarsely crushed after condensation polymerization was finished, and sufficient deionized water was added to eliminate dimethyl sulfoxide. Ultimately, Soxhlet extraction with ethanol was used to eliminate any remaining byproduct or unreacted reagent. The resulting white powder was then dried overnight at 60°C in an oven before being pulverized in a mortar. The resulting fine powder was dissolved in water. After being collected, the colloidal portion that was still suspended in water was lyophilized.

Chemicals used for the synthesis of nanosponges

The key components utilized in the creation of nanosponges are

Polymers: Methyl β-cyclodextrin, alkyloxy carbonyl cyclodextrin, 2-hydroxy propyl β-cyclodextrin, α-cyclodextrin, β-cyclodextrin, and hypercross-linked polystyrenes.

Co-polymers: Hydroxyl propyl methyl cellulose, ethyl cellulose, poly vinyl alcohol, poly (methyl methacrylate) (PMMA), and poly (δ-valerolactone-co-allyl-δ-valerolactone).

A polar solvents: Ethanol, methanol, dimethylformamide, dimethyl sulfoxide, dimethylacetamide.

Cross-linkers: Diphenyl carbonate, diaryl carbonate, hexamethylene diisocyanate, carbonyl diimidazole, carboxylic acid dianhydride, toluene-2, 4-diisocyanates, epichlorhydrin, pyromellitic anhydride, dichloromethane, poly amido amine.

Mechanism of drug release from nanosponges

The active ingredient is supplied to the vehicle in an encapsulated form since the nanosponges have an open structure and no continuous barrier enclosing them. Until the vehicle becomes saturated and equilibrium is reached, the encapsulated active material can freely flow from the particles into the vehicle. The active ingredient's carrier becomes unsaturated as soon as the product is applied to the skin, upsetting the balance. Therefore, until the vehicle is either absorbed or dried, the transfer of active chemicals from nanosponge particles into vehicles begins at the epidermis. The release of the active ingredient persists in the skin for a considerable amount of time even after the nanosponge particles are retained on the stratum corneum.

Factors influencing Nanosponge formulation

1. Type of drugs:

Drug molecules must weigh between 100 and 400 in order to be complexed with nanosponges. Drug compounds include less than five condensed rings. The solubility of water is less than 10 mg/ml.

2. Temperature

The way medications and nanosponges interact can be affected by temperature changes. The apparent stability constant of the drug/nanosponges combination often decreases with increasing temperature. This may be due to the potential reduction of hydrophobic and van der Waals contact forces between drugs and nanosponges.

3. Type of polymer

The kind of polymer used can affect both the manufacturing and performance of nanosponges. For complexation, the cavity size of nanosponges should be appropriate for a drug molecule of a particular size. The melting point of the material is lower than 250°C.

4. Method of preparation

The method the drug is placed onto the nanosponges can affect the complexation between the drug and the nanosponges. Although a method's effectiveness varies depending on the drug and polymer, freeze drying has been shown to be the most successful strategy for drug complexation in many situations.

Evaluation parameters

1. Solubility Studies

One method for figuring out a drug's solubility and bioavailability is inclusion complexes. This method is the most popular for examining nanosponges' inclusion complexes. The degree of completion may be shown by the phase solubility diagram. To ascertain the medication's pH, the solubilization process, and the variables affecting drug solubility, solubility experiments are conducted.[6]

2. Particle size and polydispersity index

The diameter of the particles is one of the most important parameters in determining the size of nanosponges. The PDI is a measure of variation or dispersion within the particle size distribution. The PDI value of polydisperse samples is higher than that of monodisperse samples, indicating a larger dispersion of particle sizes. Three techniques are available for assessing the particle size and polydispersity index (PDI): dynamic light scattering using a 90 Plus particle sizer equipped with MAS OPTION particle sizing software, laser light diffractometry, or Malvern Zeta sizer. This makes it possible to determine the mean diameter and polydispersity index.[7]

3. Loading Efficiency and Percentage yield

By deducting the quantity of unentrapped drug from the total amount of drug, the loading efficiency of the nanosponge may be computed. The quantity of untrapped medication can be estimated using an appropriate analytical technique. Among the methods used to separate unentrapped medications include dialysis, gel filtration, and ultra centrifugation. The following is how the loading efficiency is calculated:

Loading efficiency = actual drug content / Theoretical yield× 100

The percentage yield of the sponges can be determined from the initial weight of the sponges and to the final weight of sponges.

Percentage yield = Practical mass of nanosponges/ Theoretical mass (polymer +drug) ×100

4. Determination of true density

With the use of an ultra-pycnometer and helium gas, the density of the nanosponges can be measured. After completing a mean repeat, the mean value may be determined. [4]

5. Zeta Potential

The surface charge of a nanosponge is measured using a zeta sizer. SEM and TEM Used for morphological characterization and to determine shape of particles.

6. Fourier transforms infrared spectroscopy (FTIR)

This may also be used to assess whether a functional group is present. Solubility Studies The phase solubility approach used to investigate inclusion complexation, where the impact of a nanosponge on the drug's solubility may be investigated, has been described by Higuchi and Connors' model. Phase solubility indicates the degree of complexation.

7. X-ray diffractometry

For solid moieties containing inclusion complexes, powder X-ray diffractometry is primarily used. Numerous physical characteristics of a material can be revealed via sponge diffraction patterns. The addition or expansion of peak patterns is a sign

of complexity. The peaks make it easier to differentiate between basic and sophisticated organisms.

8. In Vitro Release Studies

Drug release from nanosponge may be measured using a dissolving equipment USP xxiii with a modified basket constructed of 5m stainless steel revolving at 150 rpm. In order to guarantee sink conditions, the dissolving medium is selected after taking the actives' solubility into account. An appropriate analytical procedure can be used to analyze a sample from the dissolving media. Generally speaking, depending on the formulation, Franz diffusion cells can also be utilized [8].

9. Characterization of Nanoparticles

The following techniques can be used to describe inclusion complexes that develop between the drug and nanosponges. Thermo-analytical techniques Thermo-analytical techniques ascertain if the drug material changes prior to the nanosponge's thermal disintegration.

10. Microscopy studies

The microscopic features of the drug, nanosponges, and product (drug/nanosponge complex) may be investigated using scanning electron microscopy (SEM) and transmission electron microscopy (TEM). X-ray diffractiometry and single crystal X-ray structure studies show that the development of inclusion complexes is indicated by the difference in the crystallization state of the raw materials and the product observed under an electron microscope.

11. Thin layer chromatography (TLC)

TLC is a method that may be used to distinguish evaporative or non-volatile mixtures. This method helps identify the creation of a complex between a drug and nanosponges if the Rf value of a certain drug molecule falls within an acceptable range.

Applications

Nanosponges have several potential applications in the field of nanotechnology because of their biocompatibility and flexibility. Nanosponges have a wide range of uses.

1. Nanosponges for Drug Delivery

Because of their nanoporous structure, nanosponges can advantageously carry water insoluble drugs (Biopharmaceutical Classification System class-II drugs). These complexes can be used to increase the dissolution rate, solubility and stability of drugs, to mask unpleasant flavors and to convert liquid substances to solids[10]. Nanosponges can carry the water-insoluble drug because of their tiny porous structure. To increase the dissolution rate, solubility and permeability of drug nanosponges complexes play a major role. This is reported that β-cyclodextrine based nanosponges are three or five times more effective to deliver the drug to the targeted site. Nanosponges are generally solid in nature and can be prepared for oral, parental, topical and inhalation dosage form. For the preparation of tablet, capsule i.e. oral administration the nanosponges complexes are dissolved in a suitable excipient like lubricants, diluents and anti-cracking agent.

2. Oral Delivery

The complex can be dispersed in a matrix of diluents, excipients, lubricants, and anti-caking agents for oral administration in the form of capsules or tablets. Acetyl salicylic acid, anonsteroidal anti-inflammatory drug (NSAID) classified as a BCS class III drug, was used tocreatenano sponges for use in an oral drug delivery system

3. Topical Delivery

Components of nano sponges can be used topically as a cream or gel. It was thought that resveratrol-loaded nanosponges might improve medication penetration on pig skin in vitro. The capacity of

nano sponges to improve guest molecule absorption by the skin may also contribute to their increased solubility at the skin's surface. [11].

4. Nano sponge as Chemical Sensors

The nanosponge, which are a kind of metallic oxide, functions as a chemical sensor in the very sensitive detection of hydrogen nanosponge titania. Less nanosponge components are available for topical application as a gel or cream. It was thought that resveratrol-loaded nanosponges might improve medication penetration on pig skin in vitro. The capacity of nanosponges to improve guest molecule absorption by the skin may also contribute to their ability to boost solubility at the skin's surface. impediment to electron transport due to the lack of a contact point in the nanosponge structure, which leads to increased 3D interconnected nanosponge titania that is sensitive to H2 gasTo address the issue of high volatility and low solubility, Salehi et al. developed β-cyclodextrin nanosponges of D limonene. [11]. The findings indicated that limonene nanosponges may be added to meals and that β-cyclodextrin nanosponges are an appropriate carrier for hydrophobic and sensitive chemicals. The bactericidal activity of encapsulated limonene was greater than that of free limonene, and the minimum inhibitory concentration of free limonene was much reduced following encapsulation in β-cyclodextrin nanosponges.

5. Nanosponges for cancer therapy

The distribution of anticancer drugs is now the most difficult task in the pharmaceutical industry due to their poor solubility. According to one report, nanosponge complexes are three times as efficient than direct injections at slowing tumor development. The drug-loaded nanosponge exposes a targeting peptide that binds firmly to the tumor receptor's radiation-induced cell top layer. When nanosponges come into contact with a tumor cell, they adhere to its surface and begin releasing the medication molecules. Targeting medication delivery has the benefit of producing a more potent therapeutic impact at the same dosage with fewer adverse effects. [12].

6. Nanosponges for delivery of protein

Bovine serum albumin (BSA) was employed as a model protein to investigate the encapsulating ability of β-cyclodextrin-based nanosponges. Because the protein solution of bovine serum albumin (BSA) is unstable, it is kept in lyophilized form. When proteins are lyophilized from their original structure, they might become denatured. Maintaining the protein's original structure and long-term storage both before and after processing is a significant challenge for protein creation and formulation. Nanosponges can improve the stability of proteins like bovine serum albumin (BSA), which is delivered using cyclodextrine. Additionally, enzyme immobilization, protein encapsulation, controlled administration, and stabilization have all been accomplished with nanosponges. [13].

CONCLUSION

Because of its porous shape, high drug loading capacity, and capability for targeted and controlled drug release, nanosponges are an emerging and promising drug delivery technique in nanotechnology. They reduce adverse effects and increase therapeutic efficacy by increasing the solubility and bioavailability of poorly soluble medications. Designing nanosponges for various medicinal purposes is made flexible by a variety of preparation techniques and polymers. Nanosponges have demonstrated promise in cancer treatment, protein stability, environmental cleaning, and chemical sensing in addition to drug transport. Ongoing research is anticipated to address some obstacles, such as limited encapsulation of big compounds and potential

dosage dumping. All things considered, nanosponges have enormous potential for the future creation of sophisticated and effective therapeutic systems.

REFERENCES

1. Swaminathan S, Vavia PR, Trotta F, Cavalli R, Tumbiolo S, Bertinetti L, Coluccia S. Structural evidence of differential forms of nanosponges of beta-cyclodextrin and its effect on solubilization of a model drug. Journal of inclusion phenomena and macrocyclic chemistry. 2013 Jun;76:201-11.https://doi.org/10.1007/s10847-012-0192-y.
2. Shaikh, A., Kalam, I., Moiz, S. M., & Shabbir, M. S. M. (2025). A Comphrensive Review on Nano Sponge as Drug Delivery System.International Journal of Research in Pharmacy and Allied Science,3(6), 160-171
3. Sneha R. Jagtap, Omprakash G. Bhusnure, Imran N. Mujewar, Sachin B. Gholve VBP. Nanosponges: A Novel Trend for Targeted Drug Delivery. J Drug Deliv Ther. 2015;8(7):213–24.
4. Rashee N, Krishna K, Smitha.K. K, . N. A Very Instantaneous & Novel Delivery of Nanosponges. Am J PharmTech Res. 2018;8(2):87–98.
5. Tiwari K, Bhattacharya S. The ascension of nanosponges as a drug delivery carrier: preparation, characterization, and applications. J Mater Sci Mater Med. 2022;33(3).
6. Bhowmik H, Venkatesh DN, Kuila A, Kumar KH. Nanosponges: A review. Int J Appl Pharm. 2018;10(4):1–5.
7. Gedam SS, Basarkar GD. Nanosponges: An Attractive Strategy for Enhanced Therapeutic Profile. J Pharm Sci Res. 2019;11(6):2479–87.
8. Upendra C, Khodakiya AS. Topical Nano sponge Gel : New Hope. Int J Pharm Biol Sci. 2020;10:120–4.
9. Jadhao UT, Sayali RP, Gunesh DN, Shital SD, Sneha LS. Formulation and evaluation of nanosponge gel containing ketoconazole. Innov Pharm Pharmacother. 2021;15–24.
10. Y. Pawar, A., R. Jadhav, K., Rao, J. B., Tapkir, A. D., Malpure, P. S., & Bachhav, R. S. (2022). Development and Characterization of Griseofulvin. Nanosponges to Enhance Bioavailability: Pharmaceutical Science-Pharmaceutics. International Journal of Life Science and Pharma Research, 12(5), P99-P111. https://doi.org/10.22376/ijpbs/lpr.2022.12.5.P99-111.
11. Maghimaa M, Suresh Sagadevan, Punna Rao Suryadevara, Hari Hara Sudhan, Gowri Sankara Rao Burle, Janne Ruokolainen, Vinod Kumar Nelson, Kavindra Kumar Kesari,Cytotoxicity and targeted drug delivery of green synthesized metallic nanoparticles against oral Cancer: A review, Inorganic Chemistry Communications, Volume 173,2025, 113806, ISSN 1387-7003, https://doi.org/10.1016/j.inoche.2024.113806
12. Naga SJ, Nissankararao S, Bhimavarapu R, Sravanthi S, Vinusha K. Nanosponges: a versatile drug delivery system. Int J Pharm Life Sci 2013;4:2920-5.
13. Güngör S, Erdal MS, Aksu B. New formulation strategies in topical antifungal therapy. J Cosmet Dermatol Sci Appl 2013;3:56.

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