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Importance of Nanosponges and its Applications in Drug Delivery System

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Perspective

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ABOUT THE STUDY

A specific type of nanoparticle known as a nanosponge is a synthetic polymer that contains carbon. They can be used to target small amounts of materials or toxins for absorption because of their porous structure, which has pores that are roughly 1-2 nanometers in size. In medicine, nanosponges are frequently employed as ways for administering precise doses of medication, for detoxifying, or for mending wounds after trauma. In environmental applications, they can be used to remove metal deposits from the environment or filter water to clean up ecosystems. Because of their small size, they can easily move through fluids like blood or water, swiftly locating and eliminating undesired material. In order to increase the effectiveness of nanosponges when injected into the body, they are frequently made synthetically but frequently also contain natural components. In terms of application, nanosponges outperform microsponges because their smaller size causes less disruption to the system in which they are used, lowering the likelihood of failure or negative outcomes. Since "nano" precedes the word, it is implied that objects of this size are measured on a scale of 10 metres-9 metres.

DeQuan Li and Min Ma initially used the term "cyclodextrin nanosponges" to describe nanosponges. This phrase was employed because -cyclodextrin is cross-linked with organic diisocyanates. This structure contains an insoluble network with a high inclusion constant. Using a cross-linking agent, natural cyclodextrins react to create these polymers.

Delivering drugs

The use of nanosponges as medication delivery systems for the treatment of cancer and infectious disorders is being studied. They can transport countless medicinal molecules. They can conceal themselves in the immune system, which employs immune cells to fight off and remove foreign substances from the body.

Pharmacokinetic problems, inadequate water solubility, and limited bioavailability are among the main challenges with recently created chemical entities. When employing traditional medicine dose forms, this result in challenges. These issues can be solved by nanosponges because of their unique capacity to entrap and release both hydrophilic and hydrophobic medicines due to their porous shape. These small sponges move throughout the body until they approach the appropriate targeted site. Where they adhere to the surface and release the medications under controlled control. The application of nanosponge technology in medication delivery *via* oral, parenteral, and topical administration methods is now being extensively researched. This could involve elements like volatile oils, genetic materials, proteins and peptides, and antineoplastic medicines.

Combat antimicrobial resistance

Nanosponges with membrane coatings could be utilized to remove toxins from blood and combat antibiotic resistance. Nanosponges will retain toxins that harm red blood cells because they are covered in live cells. Toxins are carried to the liver where they are broken down after being absorbed by the sponges, which renders them incapable of harming the cells.

Reduction in brain injury

Experimental studies using mice have demonstrated that nanosponges can lessen brain or head injury-related edoema. When an injury occurs, the surrounding tissue swells and immune cells rush to the damaged area. Because the brain is enclosed within the cell and has nowhere to move, the racing immune cells that result from a head injury can create swelling in the brain, which can be dangerous because pressure in the head can be harmful because the brain is confined within the cell. According to research, immune cells can be diverted from rushing to the brain by injecting nanoparticles into the head, which will lessen swelling