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Journal of Biomedical Engineering and Medical Devices

Editorial

Editorial: Biodegradable liposome-encapsulated hydrogels for Biomedical

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EDITORIAL

Hydrogels

Hydrogels are three-dimensional hydrophilic networks with proven potential for applications in medicine and pharmaceutics. Biopolymer-based hydrogels clearly provide some advantages in terms of biocompatibility and biodegradability over synthetic polymers. Hydrogels are able to easily encapsulate and release various hydrophobic and hydrophilic therapeutic molecules, including nucleic acids, proteins and antibodies, in a controlled release manner, because of their inherent properties.

Over the past few decades, the development of novel approaches for drug delivery, tissue engineering and Nano biotechnology has been stimulated by synthetic progress towards the manufacture of new polymeric materials that react to external stimuli (e.g. temperature, light and pH). This responsiveness to the environment induces substantial changes in the physicochemical and self-assembling properties of such macromolecular systems, which can be used to facilitate the encapsulation/release of active molecules. Indeed, there are several examples in the literature where synthetic polymers have been used in conjunction with small drugs, either as therapeutic macromolecules or as drug delivery vehicles.

Polymeric hydrogels are hydrophilic 3D polymer networks that, close to body tissues, can absorb significant quantities of water. This property enables hydrogels to encapsulate and protect therapeutic molecules against rapid degradation, making them useful for pharmaceutical and medical purposes. Their capacity to release trapped therapeutic molecules in a well-controlled manner is another valuable aspect of many polymeric hydrogels. This property is generally regulated by passive processes of diffusion and may also depend on additional variables (e.g., cross-linking degrees, hydrogel mesh sizes, stimuli-sensitive hydrogel capacity, etc.).

Liposomes

One of the most used Nano structures for encapsulating drug molecules is liposomes (self-assembled lipid vesicles). These kinds of non-viral carriers have been one of the most researched drug delivery mechanisms for therapeutic applications to date, owing to their nanometer scale. The field of liposomes has undergone substantial changes since its emergence in the 1960s with regard to the production of novel receptive vesicles with at least one lipid bilayer and their use in hyperthermia processes for cancer treatment.

To date, a good number of encapsulation techniques have been recorded where liposomes are used. An elegant and recent method, for example, consists of adding various forms of nanoparticles (e.g., gold and silver nanoparticles, SPIOs or lipid vesicles) and using liposomes as models to obtain the resulting 'liposome-nanoparticle' combinations. We have been able to achieve systems that have increased their biocompatibility and colloidal stability through the methodology used in the synthesis of these constructs. For the preparation of "liposome-virus" and "liposome-quantum dot" hybrids, other methods were also created. The use of liposomes in medicinal, diagnostic and theranostic applications has been enabled by these novel approaches.

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Received: January 04, 2021; **Accepted: January** 18, 2021; **Published:** January 21, 2021

Citation: Venkat R (2021) Editorial: Biodegradable liposome-encapsulated hydrogels for Biomedical. J Biomed Eng & Med Dev. 6:142.