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Involvement of Nanotechnology in Drug Delivery Systems

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Commentary

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ABOUT THE STUDY

In an ideal world, the Nano particulate drug delivery system would selectively concentrate in the essential organ or tissue while also penetrating target cells to deliver the bioactive chemical. It has been suggested that passive or antibody-mediated active targeting could accomplish organ or tissue accumulation, while intracellular delivery could be mediated by specific ligands or cell-penetrating peptides.

As a result, a Drug Delivery System (DDS) should be multifunctional and responsible for turning on and off specific tasks as necessary. Another crucial requirement is that the multifunctional Drug Delivery Systems various features be optimally coordinated. Thus, if a system is to be built that can provide the combination of reliability allowing for target accumulation and specific cell surface binding, two requirements must be met: first, the half-life of the carrier in the circulation must be long enough and the internalisation of the Drug Delivery System by the target cells must be fast enough to prevent carrier degradation and drug loss in the interstitial space.

One of the most difficult considerations in medication delivery is the intracellular transport of bioactive compounds. Liposomes and micelles are Nano particulate Drug Delivery System that are widely utilised to improve the efficacy of drug and DNA delivery and targeting. So very few successful attempts to transfer various drug carriers directly into the cell cytoplasm, avoiding the endocytic pathway in order to preserve pharmaceuticals and DNA from lysosomal degradation, hence improving medication efficiency and DNA incorporation into the cell genome.

The development of a Drug Delivery System (DDS) designed in such a way that a nonspecific cell-penetrating function is covered by the organ/tissue-specific delivery will be attainable. When the protecting polymer or antibody attached

to the surface of the DDS *via* the stimuli-sensitive bond accumulates in the target, it should disassociate under the action of local pathological conditions such as abnormal pH or temperature, revealing the previously hidden second function and allowing subsequent delivery of the carrier and its cargo inside cells.

Depending on the application, alternative drug delivery methods can be designed for improved therapeutic efficiency while minimising systemic toxicity and side effects. When compared to conventional drug delivery systems, SDDS has various advantages. Traditional controlled release systems depend on a predetermined drug release rate irrespective of the environmental conditions at the time of application. Supersaturating drug delivery systems, on the other hand, is based on the release-on-demand technique, which allows a drug carrier to release a therapeutic drug only when it is needed in response to a specific stimulation.

Self-regulated insulin delivery devices that can respond to changes in the environmental glucose level are the best example of supersaturating drug delivery systems. Polymeric micelles have been one of the most frequently used SDDSs. Many polymeric micelles made up of hydrophobic and hydrophilic polymer blocks have been created. They have been discovered to dissolve water-insoluble medicines at high concentrations, such as doxorubicin or paclitaxel. When delivered to the body, drug release from polymeric micelles is typically dependent on simple diffusion, micelle block breakdown, or micelle disruption by body components.

The loaded drug's release kinetics can be adjusted by altering the breakdown rate of hydrophobic polymer blocks; however the degradation rate is frequently slow, the loaded drug is released through diffusion from polymeric micelles. This slow release by passive diffusion may not be desirable as the polymeric micelles reaching the target site need to release their contents fast.