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Mini Review

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Significance of Nano-Biotechnology as Drug Delivery Vehicle

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Abstract

Materials in the nanoscale range are used as diagnostic instruments or to deliver therapeutic compounds to specific targeted locations in a controlled manner in the relatively young field of nanomedicine and nano delivery systems. Through the site-specific and target-oriented administration of precise medications, nanotechnology provides numerous advantages in the treatment of chronic human diseases. Chemotherapeutic agents, biological agents, immunotherapeutic agents, and other exceptional uses of nanomedicine have been observed recently in the treatment of a wide range of illnesses. This study provides an updated overview of recent developments in the field of nanomedicines and nano-based drug delivery systems by closely examining the identification and use of nanomaterials to enhance the effectiveness of both new and old medications.

Keywords: Nanoscale range; Therapeutic compounds; Nanodelivery systems; Immunotherapeutic agents; Nano medicine; Nanomaterial

Introduction

Humans have been using natural plant-based products as treatments for a wide range of illnesses since ancient times. Based on customs and knowledge from the past, modern medications are mostly made from herbs. Natural resources provide around 25% of the main medicinal chemicals and their derivatives that are now on the market. New drug discoveries start with natural molecules that have diverse chemical bases. In the field of natural product-based drug development, creating synthetically accessible lead compounds that closely resemble their counterparts' chemistry has been popular recently. Natural products have many amazing qualities, including decreased toxicity, astonishing chemical variety, and chemical and biological capabilities with macromolecular precision [1, 2].

Description

Nanotechnology has revolutionized various fields, including drug delivery. Using nanotechnology, scientists can design and fabricate nanoscale materials and structures with unique properties that make them highly suitable for delivering drugs to specific targets in the body. Here's how nanotechnology serves as a promising drug delivery vehicle:

Targeted delivery

Nanoparticles can be engineered to target specific cells, tissues, or organs in the body, thereby reducing off-target effects and improving the therapeutic efficacy of drugs. Targeting can be achieved through surface modifications or functionalization with ligands that bind selectively to receptors overexpressed on diseased cells [3].

Improved pharmacokinetics

Nanoparticles can enhance the pharmacokinetic properties of drugs by prolonging circulation time, protecting them from degradation, and promoting their accumulation at the target site. This can lead to reduced dosing frequency and decreased side effects .

Enhanced solubility

Many drugs have poor solubility, which limits their bioavailability and therapeutic efficacy. Nanoparticles can encapsulate hydrophobic drugs and improve their solubility, allowing for easier administration and better absorption.

Controlled release

Nanoparticles can be engineered to release drugs in a controlled manner, allowing for sustained or triggered release profiles. This controlled release can enhance therapeutic outcomes, reduce dosing frequency, and minimize side effects associated with rapid drug release.

Multifunctionality

Nanoparticles can be designed to carry multiple therapeutic agents, targeting ligands, imaging agents, and/or stimuli-responsive components, enabling multifunctional drug delivery platforms for personalized medicine and combination therapies.

Penetration of biological barriers

Nanoparticles possess unique size-dependent properties that enable them to penetrate biological barriers such as the blood-brain barrier, mucosal barriers, and tumor interstitium, facilitating drug delivery to otherwise inaccessible sites.

Imaging and diagnosis

Certain nanoparticles can serve as contrast agents for various imaging modalities, allowing for real-time monitoring of drug distribution and therapeutic response. This facilitates personalized treatment regimens and optimization of drug delivery strategies. Examples of nanotechnology-based drug delivery systems include liposomes, polymeric nanoparticles, dendrimers, micelles, and inorganic nanoparticles such as gold nanoparticles. These platforms are continually being refined and customized to address specific challenges in drug delivery and improve therapeutic outcomes for various diseases, ranging from cancer to neurodegenerative disorders.

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Conclusion

Initially, the main goals of using nanotechnology in medicine were to improve the medications' solubility, absorption, bioavailability, and controlled release. Even though the search for pharmacologically active compounds in natural sources is less popular today than it was fifty years ago, and even though the discovery of nanodrugs is fraught with uncertainty, improving the effectiveness of known natural bioactive compounds through nanotechnology has become a standard practice. Novel natural biomaterials have been in high demand because to their low toxicity, biodegradability, biocompatibility, and easy availability. Beyond discovering natural biopolymers such as polysaccharides and proteins, one of the most cutting-edge research areas nowadays is the study of how to increase their stability in biological matrices and industrial processing environments by using methods like crosslinking.

References

1. Aguilar A, Borrell A, Reijnders PJH (2002) Geographical and temporal variation in levels of organochlorine contaminants in marine mammals. Mar Environ Res. 53: 425-452.
2. Boon JP, Sleiderink HM, Helle MS, Dekker M, van Schanke A, et al. (1998) The use of a microsomal in vitro assay to study phase I biotransformation of chlorobornanes (Toxaphene®) in marine mammals and birds: possible consequences of biotransformation for bioaccumulation and genotoxicity. Comp Biochem Physiol C. 121: 385-403.
3. Brown TM, Ross PS, Reimer KJ, Veldhoen N, Dangerfield NJ, et al. (2014) PCB related effects thresholds as derived through gene transcript profiles in locally contaminated ringed seals (*Pusa hispida*). Environ Sci Technol. 48: 12952-12961.
4. Cadieux M, Muir D, Beland P, Hickie BE (2015) Lactational transfer of polychlorinated-biphenyls (PCBs) and other organochlorines in St. Lawrence beluga whales (*Delphinapterus leucas*). Arch Environ Contam Toxicol.
5. Das K, Siebert U, Gillet A, Dupont A, Di-Poi C, et al. (2008) Mercury immune toxicity in harbour seals: links to in vitro toxicity. Environ Health. 7: 52.
6. De Swart RL, Ross PS, Vos JG, Osterhaus ADME (1996) Impaired immunity in harbour seals (*Phoca vitulina*) exposed to bioaccumulated environmental contaminants: review of a long-term feeding study. Environ Health Perspect. 104: 823-828.
7. Dupont A, Siebert U, Covaci A, Weijs L, Eppe G, (2013) Relationships between in vitro lymphoproliferative responses and levels of contaminants in blood of free-ranging adult harbour seals (*Phoca vitulina*) from the North Sea. Aquat Toxicol. 142: 210-220.
8. Fossi MC, Marsili L, Casini S, Bucalossi D (2006) Development of new tools to investigate toxicological hazard due to endocrine disruptor organochlorines and emerging contaminants in Mediterranean cetaceans. Mar Environ Res. 62: 200-204.
9. Freeman HC, Sangalang GB (1977) A study of the effects of methyl mercury, cadmium, arsenic, selenium, and a PCB (aroclor 1254) on adrenal and testicular steroidogeneses in vitro, by the gray seal *Halichoerus grypus*. Arch Environ Contam Toxicol. 5: 369-383.
10. Gauthier JM, Dubeau H, Rassart E (1999) Induction of micronuclei in vitro by organochlorine compounds in beluga whale skin fibroblasts. Mutat Res. 439: 87-95.