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Advancements in Nanoparticle-mediated Drug Delivery System

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Description

Materials in the nanoscale range are used as diagnostic instruments or to deliver therapeutic compounds to specific targeted regions in a controlled manner in nanomedicine and nano delivery systems, which is a relatively young but fast emerging discipline. By delivering precise medications to specified locations and targets, nanotechnology provides numerous advantages in the treatment of chronic human diseases. The use of nanomedicine (including chemotherapeutic medicines, biological agents, immunotherapeutic agents, etc.) in the treatment of various diseases has recently seen a number of notable applications [1,2].

Future cancer treatments hold a lot of potential thanks to the development of nanomaterials for drug delivery, which offer the chance to avoid the negative effects of systemic medication administration and harm from tumour excision. The effectiveness of today's nano medicines, however, is not notably superior than that of the original medicinal therapies. The crucial factor is that nanoparticle medications enter the tumour vasculature, staying close to the blood vessels and failing to complete the drug delivery process by entering the tumour tissue or tumour cells. The development of nano-drugs is being hampered by the ineffectiveness of drug penetration into malignancies [3].

When compared to conventional chemotherapy, nano-drug delivery systems can deliver therapeutic medications to target cells safely and effectively, preventing severe toxicity in patients and unintended effects on healthy cells. However, in clinical settings, nano-drugs have only been demonstrated to lessen the toxicity and side effects of medications and have not been found to significantly increase efficacy in comparison to conventional drug administration techniques. The primary cause of the unsatisfactory efficacy is that the drugs do not easily undergo intracellular drug entry or release and do not well penetrate into the cells and tissues of tumours located far from blood vessels, especially in hypoxic regions. In general, chemotherapy medications offer anti-tumor effects [4].

The creation of nanoparticles has grown into a wide range of clinical applications in recent years. In order to pass biological obstacles that vary across patient groups and diseases, including those that are systemic, microenvironmental, and cellular, nanoparticles have been produced. Precision treatments, in which individualised approaches have increased therapeutic efficacy, has also been successful in overcoming this patient heterogeneity. However, the development of nanoparticles still prioritises universal delivery platform optimization. Precision medicine is becoming a reality thanks to the increasingly precise engineering of lipid-based, polymeric, and inorganic nanoparticles, which enables more individualised medication delivery [5].

Conclusion

Pharmaceutical corporations are reluctant to spend more money on natural product-based drug discovery and drug delivery systems despite the benefits, preferring to search through libraries of chemical compounds instead to find new medications. Natural substances are, however, currently being tested for the treatment of a number of serious illnesses, including as cancer, diabetes, cardiovascular, inflammatory, and microbiological diseases. This is mostly due to the special benefits that natural medicines provide, such as reduced toxicity and side effects, low cost, and strong therapeutic potential. However, employing natural chemicals as medication is more difficult due to worries about their biocompatibility and toxicity. Because of these issues, numerous natural substances are failing to pass the clinical testing phases.

Conflict of Interest

None.

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