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The potential application of Polymeric Nanoparticles in different cancer treatments

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Abstract

Polymeric nanoparticles (NPs) are colloidal systems within the size range from 1 to 1000 nm where active agents are entrapped, dissolved, encapsulated or adsorbed onto the constituent polymeric matrix. These materials are important for biomedical applications and are frequently used as drug delivery systems (DDSs). Polymeric-based NPs could be used in cancer therapy, among others. This review will discuss the use of different polymeric NPs for various cancer treatments.

Nowadays chemotherapy is the common treatment approach for treating cancer. This technique uses tiny harmful molecules to interact with DNA and kill cancer cells, but they can also afflict healthy tissues. By enhancing drug efficacy, reducing toxicity, and maintaining a relatively high concentration of the drug in the target, the use of polymeric-based NPs as DDSs has a considerable potential to increase the efficacy of cancer chemotherapies. Next, three examples of polymeric NPs will be discussed for their potential application in different types of cancer treatments.

Firstly, Kong et al. reported a promising application of a chemo-photothermal therapy strategy for breast cancer treatment.[1] They synthesized docetaxel (DTX)-loaded aptamer (Apt)-polydopamine (pD) NPs with star-shaped cholic acid functionalized poly(*ε*-caprolactone-ran-lactide) [CA-(PCL-ran-PLA)] copolymers as the targeting DDS. Also, they demonstrated the strong therapeutic effects by performing in vivo antitumor tests.

Secondly, Sanna et al. developed encapsulated (−)-epigallocatechin3-gallate (EGCG) NPs targeted with small molecular entities for prostate cancer prevention.[2] In this work, they showed that EGCG had effective antiproliferative action in vitro and significantly increased tumour growth suppression in mouse xenograft model experiments in comparison with the native compound.

Lastly, Xin et al. analysed poly-(ethylene glycol)-co-poly(ε-caprolactone) (PEG-PCL) copolymer NPs modified with Angiopep-2 (ANG-PEG-NP) to develop a dual targeting DDS for glioma treatment.[3] ANG-PEG-NP was proposed to improve the penetration across the Blood-Brain Barrier (BBB) and into the tumour tissue. Within the work, they tested the efficacy and safety of the polymeric NPs system obtaining favourable results which indicate the potential use of the dual targeting NPs as DDS for glioma treatment.

To conclude, although long clinical analyses are needed to apply polymeric NPs to practical use, these systems show strong potential as DDSs in several cancer treatments to improve the active agent biodistribution in target tissues or organs and avoid damaging healthy cells.

References

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