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Bismuth-based nanoparticles novel anticancer drug delivery

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Nanotherapeutics is an emerging field that is used to solve several limitations of traditional drug delivery systems. Nanoparticles are an important aspect of nanotherapeutics against cancer and other diseases. For drug delivery, nanoparticles are designed in a way that they can penetrate the body tissue to attain improved biodistribution. Nanoparticles are formulated in a way that they can carry active anti-tumour drugs (chemotherapeutics) to the cancer cells. The nanoparticle drug delivery systems do not affect normal cells but target only cancerous cells because of their enhanced permeability and retention property. The nanoparticles’ specificity is enhanced by conjugating them with the specific ligand or antibody directed against the selected over-expressed antigen or epitope of the tumour cells. Also, nanoparticles help in reducing the drug resistance capability of tumour cells. The bismuth-based nanoparticles have shown promising results towards biomedicine. Particularly, bismuth oxyhalides and bismuth chalcogenides-based nanoparticles have been reported to enhance drug delivery in cancer patients. Bismuth is non-toxic, highly stable and versatile in terms of shape and size and has a large surface area, which enhances the fabrication property of nanoparticles. Bismuth is used for the fabrication of many varieties of nanoparticles and it incorporates many properties to the nanoparticles. For instance, bismuth increases the half-life of circulation of nanoparticles in the bloodstream, reduces toxicity which is generally caused by nanoparticles and also increases the colloidal stability. There are a few limitations of nanoparticles as drug carrier systems, such as instability in circulation, very poor oral bioavailability and improper distribution in tissues. With cost-effective bismuth-based nanoparticles, these limitations could be overcome. Their advantageous antibacterial effects, bone regeneration potential, and possible tumour growth suppression under NIR laser radiation have shown a new model for their clinical translation in the future.

Keywords: Nanotherapeutics, Nanoparticles, Bismuth-based nanoparticles, Bismuth oxyhalides, Bismuth chalcogenides, Drug carrier systems

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