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Targeted Delivery of Doxorubicin by Nanoparticles for Effective Treatment of Breast Cancer

Diksha Nayyar

Delhi Institute of Pharmaceutical Sciences and Research

Email ID: serviceheb@gmail.com

Abstract:

A variety of variables impede the journey of conventional chemotherapeutic medications from the point of administration to the point of action, including insufficient bioavailability, unequal distribution in critical organs, and low therapeutic indices. Therefore, there is a requirement of repeated doses to achieve effective therapeutic response, resulting in undesirable side effects. Nanoparticles have been used to deliver anti-cancer medications in recent decades in an attempt to boost therapeutic potency while lowering side effects. Several nanoplatforms have been developed that use tumour cell characteristics to offer better physicochemical attributes and pharmacokinetic profiles, allowing for more drug delivery and controlled release to the desired location. In tumour cells, a number of receptors are overexpressed on the surface, such as EGFR, estrogen receptor, folate receptor, biotin receptor, etc. To this front, breakthroughs have been achieved in the design and fabrication of targeted nanoparticles by conjugating homing devices such peptide, ligand on the surface of nanomaterials to drive nanoparticle-drug complexes towards these overexpressed receptors to target tumour cell with minimal damage to healthy cells. While there are a number of issues with the usage and manufacture of nanotherapeutics, including efficacy issues, unpredictable side effects, variability in production, high cost, scalability problems, yet researchers believe that there is still promise for the development of unique customized nanotherapeutics in the future.

Keywords: breast cancer; chemotherapy; nanoparticle; doxorubicin; passive targeting; active targeting; ligands; receptor targeted drug delivery; nanotherapeutics; combination therapy; challenges

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