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Alginate based platforms for cancer targeted drug delivery

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There are three proposed techniques for targeting cancer cells, namely passive targeting, receptor-based targeting and stimulus-responsive targeting.   In passive targeting, nanocarriers extravasate through leaky tumour fenestrations and lead to accumulation and retention at the tumour site. For example, doxorubicin (DOX) loaded poly (lactic-co-glycolic acid) nanoparticles coated with alginate are prepared using the layer-by-layer method. They have a significant effect on treating sarcoma tumours associated with lower toxicity when compared to free DOX. Cisplatin, which is an anticancer agent, is coupled with gold nanoparticles. This complex is then conjugated with an alginate hydrogel network, yielding an anticancer drug in an alginate hydrogel (ACA) nano complex. It improves anticancer efficiency in cancer chemotherapy. It also enhances antitumour activity when compared to free drugs. In receptor-based targeting, one of the receptor ligand complexes is epidermal growth factor receptor (EGFR), which controls major cellular signalling networks like cell proliferation, apoptosis, differentiation and adhesion. Cisplatin modified liposome is conjugated with alginate to form CS-EGF-Lip, which specifically targets ovarian cancer cells. It improves anticancer efficacy by increasing the delivery of cisplatin into ovarian cancer tissues. Thus, EGFR ligand-modified alginate-based platforms could specifically target EGFR-expressing tumours via receptor-mediated endocytosis, thereby increasing anticancer efficacy.   Lastly, the stimuli responsive drug delivery works based on changes around the tumour micro-environment, such as a harsh redox environment and certain types of enzymes. In response to these stimuli, CS-EGF-Lip releases the drug in the desired site. Redox response targeting is considered ideal for tumour targeting as there is a significant difference in the levels of glutathione between cancer cells and normal cells. An example includes DOX-loaded reduced glutathione/trypsin-responsive nanogels (~100 nm) prepared from human hair keratin and alginate. They were found to be efficiently internalised in B16 and 4T1 cells. DOX loaded nanogels exhibit better antitumour effects and lower side effects than free drugs. In all the above successful experiments, alginate-based drug delivery systems act as effective vehicles for the targeted delivery of drugs in anti-cancer treatment. This increases our attention towards alginate based drug delivery systems, which should be studied further in detail to produce valuable cancer drug carriers out of the same.

Keywords: Alginate, Drug delivery, Targeted therapy, Cancer

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