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A Review on Chitosan Nanoparticles in Cancer Treatment

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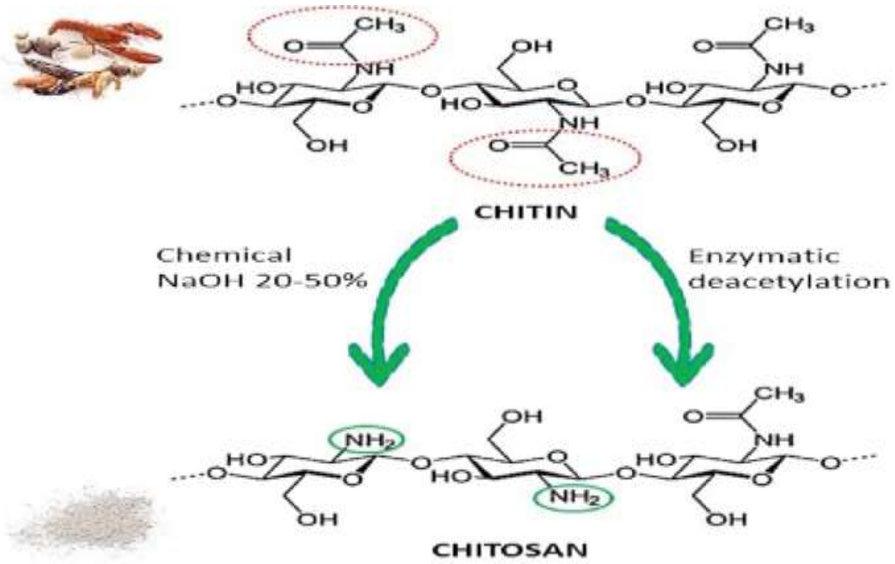
ABSTRACT:
The use of chitosan-based nanoparticles for creating new release systems with improved bioavailability, increased specificity and sensitivity, and reduced pharmacological toxicity of drugs. Nowadays, effective cancer treatment is global problem, and recent advances in Nano medicine are of great importance. Special attention was put on the application of chitosan nanoparticles in developing new system for anticancer drug delivery.Pre-clinical and clinical studies support the use of chitosan based nanoparticles in Nano medicine. Breast cancer remains one of the world's most dangerous diseases because of the difficulty of finding cost-effective and specific targets for effective & efficient treatment methods. Biodegradability and biocompatibility properties of chitosan-based nanoparticles have good prospects for targeted drug delivery systems. ChNPs can transfer various antitumor drugs to targeted sites via passive and active targeting pathways. The modification of ChNPs has attracted the researcher to the loading of drugs to targeted cancer cells.

Keywords:Chitosan,Nanoparticles,Biodegradability,Biocompatibility,

INTRODUCTION:

Chitosan is the denomination given to a range of polymers obtained from chitin, a natural polysaccharide composed of β-(1,4)-linked N-acetyl glucosamine units . The most common sources of chitin include fungi and the exoskeleton of crustaceans and insects. The transformation of chitin into chitosan is achieved by deacetylation. The process can be either chemical, using a strong solution of sodium hydroxide (25–50%) or high temperature (90–120 ºC), or biochemical, using deacetylases. It is well established that cancer has become one of the most serious threat to human health. It is estimated that there will be 12 million cancer deaths worldwide in 2030.1 Especially in China, as a developing country with a large population, cancer incidence and death rates keep rising year by year due to environmental pollution.



Mechanism of chitosan nanoparticles on cancer cell

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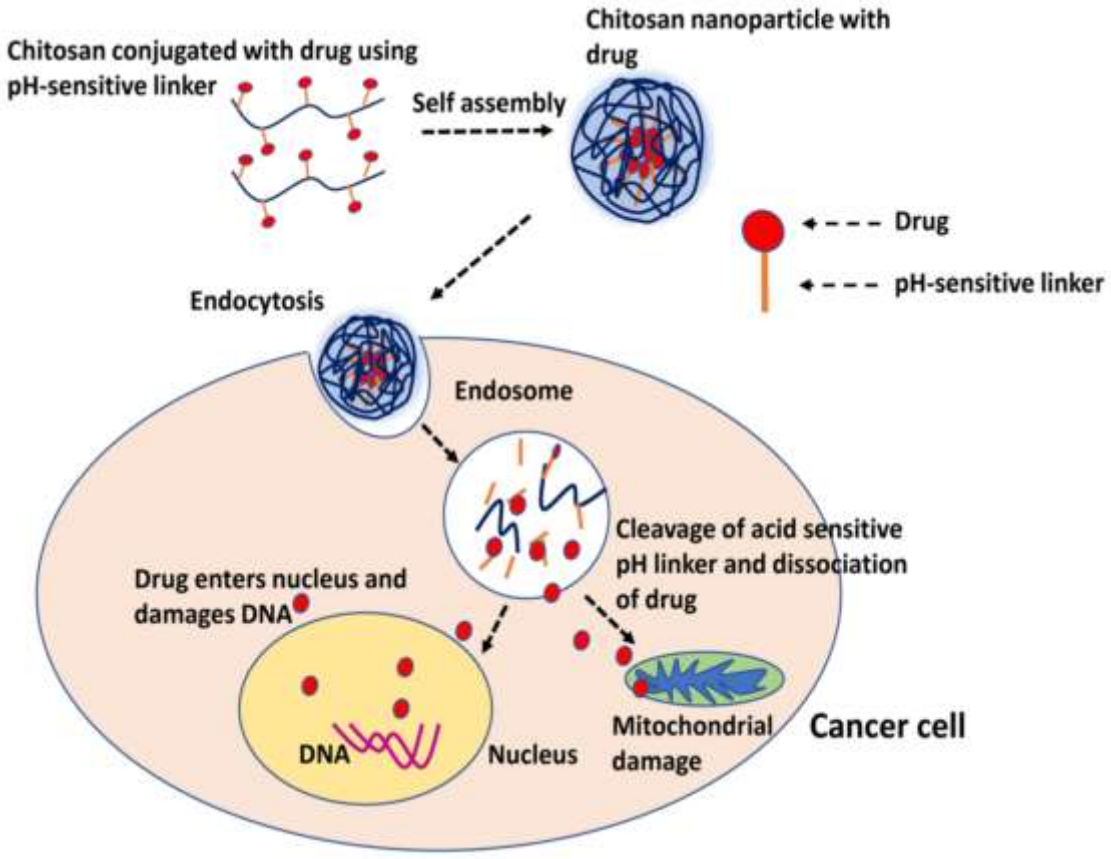

Preparing method of chitosan nanoparticles:

NPs are particulate dispersions or solid particles with a size range of 1-1000 nm. Methods such as ionic cross linking; covalent cross linking, reverse micellar method can be used for the preparation of chitosan NPs.

1.Ionic cross-linking method In this method ionic cross-linking is achieved by aggregation of chitosan or its derivatives with oppositely charged macromolecules or in the presence of ionic crosslinking agent. Tripolyphosphate is the most commonly used cross-linking agent. There is a formation of gels due to ionic linkage, therefore this method is also known as ionic-gelation method8 as outlined in Figure 2. Chitosantripolyphosphateionotropic gelation is used for the preparation of estradiol (E2)-loaded chitosan NPs which have zeta potential equal to +25.4 mV and an average size equal to 269.3±31.6 nm.

2. Covalent cross-linking method In this method there is formation of covalent bonds between chitosan or its derivatives and the functional cross-linking agent. Commonly used agents include polyethylene glycol, glutaraldehyde or monofunctional agents.9

3. Reverse micellar method In this method, an aqueous solution of chitosan is added to an organic solvent containing a surfactant. Agitation is done simultaneously. Water is added to maintain the mixture in an optically transparent microemulsion phase. The amount of water is increased to obtain NPs of larger size as shown in Figure 3. Chitosan NPs prepared by this method have been used for encapsulation of doxorubicin dextran conjugate.

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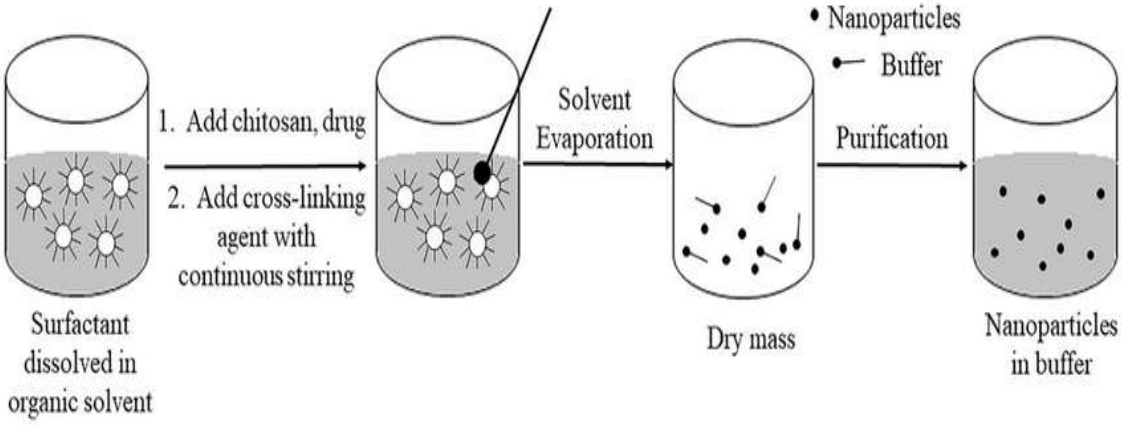

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