Development of a New Curcumin-Loaded Hallow Nanocapsule as a Potential Radioprotective Agent

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Summary: People may be exposed to ionizing radiation during radiotherapy, radionuclides in nuclear medicine, or experience uncontrolled exposure to radiation from nuclear weapons and radiologic terrorism. In order to prevent damages are caused by radiation, developing of radioprotective agents is necessary. Radioprotectors are administrated before radiotherapy or during nuclear incident to reduce the side effects in healthy tissues. In this work Chiotsan/alginate nanoparticles encapsulating curcumin (CUR@ $(Chi/Alg)_n$)was prepared to be used for sustained release of Curcumin as a probable radioprotective agent.

Methods- Results: Preparation of curcumin-loaded hollow nanocapsules was done by layer-by-layer (LBL) aggregation of chitosan and alginate natural polymers using calcium carbonate nanoparticles as the victim core. The result of this process was the production of CUR@ $(Chi/Alg)_n$ nanoparticles. Different physicochemical and biological characterization tests were done. Results showed that Curcumin was successfully encapsulated in nanocapsules with the Encapsulation Efficiency (EE) of 91.02% and Drug Loading Content (DLC) of 27.51%. Administration of various doses of the nanoparticles to mices, followed by 2 and 4Gy gamma irradiation, in order to evaluate radioprotective effect showed that administration of CUR@ $(Chi/Alg)_n$ before gamma irradiation reduced frequency of micronuclei and therefore clastogenic effects of radiation. The dose reduction factor (DRF) was calculated and showed a mean DRF=1.9, which is indicative of a high radioprotective property of this agent.

Conclusions: The fabricated nanoparticles have had good encapsulation efficiency, good release kinetics and very low surface roughness, which make them a powerful tool in the drug delivery systems. These nanoparticles could be considered as a sustained drug delivery system of Curcumin as a radioprotective agent in order to modify its sparing solubility in water and poor bioavailability. Moreover, modifications on nanoparticles composition could be useful to achieve a long-term prolonged release profile.

Reference: Evaluation of radioprotective effect of curcumin conjugated albumin nanoparticles.

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