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γ-Ray-Radiation-Scissioned Chitosan as a Gene Carrier and its Improved in vitro Gene Transfection Performance

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Chitosan (CS) has long been expected to be an ideal gene carrier for its high biosafety.[1] However, the low transfection efficiency of the raw chitosan-based vector has long been a problem troubling the researchers in medicine due to its poor water solubility, low electric charge density, dissociation problem, and other disadvantages.[2] In this work, CS with low molecular weight (MW) were prepared through the γ-ray radiation on the acetic acid solution of CS. The CS chains were scissioned under the γ-ray radiation. When the absorbed dose was above 30 kGy, the MW decreased about an order of magnitude, i.e. from the original 3.5 × 105 g·mol-1 to 9.0×104 g·mol-1 (30 kGy) and 5.0×104 g·mol-1 (50 kGy). The γ-ray-radiation-scissioned CS can effectively bind with plasmid (pEGFP) through complex coacervation method, forming pEGFP/γ-ray-radiation-scissioned CS complex particles with a size of 200 ~ 300 nm. The complex particles has a good stability and little cytotoxicity. The γ-ray-radiation-scissioned CS can protect pEGFP from being digested by DNase I according to the gel electrophoresis analysis. The in vitro gene transfection efficiency of the pEGFP/γ-ray-radiation-scissioned CS complex particles were investigated by fluorescence microscope and flow cytometry. The results showed that the gene vectors using γ-ray-radiation-scissioned CS as the carrier will possess better gene transfection efficiency than those using natural high-MW CS as the carrier. The higher the absorbed dose, the smaller the MW of CS and the better transfection efficiency of the corresponding gene vector. This work provides a green and simple method on the preparation of CS-based gene vectors with high efficiency and biosafety.

[1] J.M. Dang, K.W. Leong, Advanced drug delivery reviews, 2006, 58, 487.

[2] S. Mao, W. Sun, T. Kissel, Advanced drug delivery reviews, 2010, 62, 12.

Country/Organization invited to participate

China

Primary author: Ms WANG, Mozhen (Department of Polymer Science and Engineering, University of Science and Technology of China, China)

Presenter: Ms WANG, Mozhen (Department of Polymer Science and Engineering, University of Science and Technology of China, China)

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