Therapeutic Feasibility of Various Diseases using Holmium-166 Chitosan Complex

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Chitin, (poly-β (1-4)-N-acetyl-D-glucosamine) has been regarded as being a potential resource, since it is a useful aminopolysaccharide analogue to cellulose structurally, and is naturally abundant, especially in the cuticle of marine crustacean.

Deacetylation of chitin by alkaline hydrolysis yields chitosan which is one of the few natural cationic polyelectrolytes. Chitin, chitosan and their derivatives have found a wide variety of application in both industrial and medical fields. In particular, they are suitable for biomedical and pharmaceutical applications since they are almost non-toxic, antigentically inactive, and biocompatible and biodegradable in both animal and plant tissues.

Most of the application researches have been focused on chitosan because the free amino groups contribute polycationic, chelating and dispersion forming properties along with ready solubility in dilute acetic acid.

Turning out attention to the this well known characteristics of chitosan, we have doveloped new radiotherapeutic agent based on lanthanide radionuclides such as ^{153}Sm. ^{165}Dy, ^{166}Ho, and ^{169}Er. Among these radionuclides, ^{166}Ho was chosen as typical one because it has ideal nuclear characteristics(half-life : 26.8hr, max. β-enery : 186 MeV with 81 keV γ-energy readily detectable by γ-camera) and also can be readily produced from ^{165}Ho whose natural abundance is 100%(enriched target) by ^{165}Ho(n, γ)^{166}Ho reaction in research reactor.

Holmium-166 chitosan complex (^{166}Ho-CHICO) can be readily produced by mixing acidic chitosan solution with ^{166}Ho(NO_3) solution at room temperature with high labelling yield(> 99%).

Pre-clinical studies with ^{166}Ho-CHICO was found to be very promising for internal radiotherapy on a standpoint of in-vivo stability and selective uptake in target organ(lesion) determined by whole-body autoradiograpy.

Internal radiotherapy with ^{166}Ho-CHICO was found to be effective in patients such as hepatocelluar carcinoma, peritoneal metastases, cystic brain Lumor, and rheumatoid knee synovitis.

In conclusion, the ease with which ^{166}Ho-CHICO can be made in quantitative yield and its high in-vivo stability and selective uptake in lesion made it new attractive agent for internal radiotherapy.