

Preparation and Characterization of Dendrimer-Encapsulated Ytterbium Nanoparticles to Produce a New Nano-Radio Pharmaceutical

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Abstract : Dendrimers are good candidates for preparing metal nanoparticles because they can structurally and chemically well-defined templates and robust stabilizers. Poly amidoamine (PAMAM) dendrimer-based multifunctional cancer therapeutic conjugates have been designed and synthesized in pharmaceutical industry. In addition, encapsulated nanoparticle surfaces are accessible to substrates so that catalytic reactions can be carried out. For preparation of dendrimer-metal nanocomposite, a dendrimer solution containing an average of 55 Yb+3 ions per dendrimer was prepared. Prior to reduction, the pH of this solution was adjusted to 7.5 using NaOH. NaBH₄ was used to reduce the dendrimer-encapsulated Yb+3 to the zerovalent metal. The pH of the resulting solution was then adjusted to 3, using HClO₄, to decompose excess BH₄⁻. The UV-Vis absorption spectra of the mixture were recorded to ensure the formation of Yb-G5-NH₂ complex. High-resolution electron microscopy (HRTEM) and size distribution results provide additional information about dendrimer-metal nanocomposite shape, size, and size distribution of the particles. The resulting mixture was irradiated in Tehran Research Reactor 2h and neutron fluxes were 3×10¹¹ n/cm².Sec and the specific activity was 7MBq. Radiochemical and chemical and radionuclide quality control tests were carried. Gamma Spectroscopy and High-performance Liquid Chromatography HPLC, Thin-Layer Chromatography TLC were recorded. The injection of resulting solution to solid tumor in mice shows that it could be resized the tumor. The studies about solid tumors and nano composites show that ytterbium encapsulated-dendrimer radiopharmaceutical could be introduced as a new therapeutic for the treatment of solid tumors.

Keywords : nano-radio pharmaceutical, ytterbium, PAMAM, dendrimers

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