Chemical modification of chitosan nanoparticles with gadolinium diethylenetriaminepentaacetic acid for magnetic resonance imaging

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Abstract: Chitosan as a natural carbohydrate polymer has been widely used in food processing and bioengineering industries. Due to its unique biological and chemical properties such as biodegradability, biocompatibility, and polycationicity, Chitosan has great potentials in a range of biomedical applications as a carrier for controlled drug and gene delivery. In this work, the modified chitosan nanoparticles with gadolinium diethylenetriaminepentaacetic acid (Gd-DTPA), magnetic resonance imaging (MRI) contrast agent, were prepared by one step ionotropic gelation. The formulations of chitosan were varied from 0.5 and 1 mg/ml using 0.1, 0.3 and 0.5 %w/v dextran. The diameter, polydispersity index (PDI) and surface charge of the obtained particles were investigated by dynamic light scattering (DLS). The particle morphology was observed by scanning electron microscope (SEM). The binding of Gd-DTPA to chitosan was confirmed by colorimetric assay and Gd concentration was measured by atomic absorption spectroscopy (AAS). Particle sizes were in the range of 300-400 nm and the concentration of Gd was 6.2 ± 1.5 mg/g particle. The release profile of Gd-DTPA in PBS pH 7.4 indicated that less than 1.2% Gd-DTPA was released from nanoparticles within 24 hours. According to the results, chitosan nanoparticles modified Gd-DTPA could be used for further MRI studies.

Keywords: Chitosan; Gd-DTPA; Nanoparticles