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Production and optimization of $^{198/199}$gold nanoparticles for potential use in cancer therapy

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Radiopharmaceuticals are used to diagnose and treat a number of diseases such as bone cancer and non-Hodgkin's lymphoma. A radiopharmaceutical typically consists of a targeting molecule that selectively targets certain tumors. The targeting molecule is labeled with a radioactive atom(s) that delivers a dose of radiation to the tumor. The radioactive properties of Au-198 (β^- = 0.96 MeV; γ = 411 KeV) and Au-199 (β^- = 0.45 MeV; γ = 158 KeV) with their beta (therapeutic) and gamma (imaging) emission make them valuable candidates for both therapeutic and imaging applications. Gold nanoparticles have several properties that make them particularly interesting for use in radiopharmaceuticals. They are stable in vivo, have multiple atoms per particle and are small enough in size to deliver a radioactive dose directly to cancer cells. The purpose of this study was to gain a better understanding of the binding properties of the nanoparticles with reducing and stabilizing agents. This knowledge will aid in future attempts to label the particles with various antibodies and peptides for tumor targeted delivery of the drug. Next, investigate the relationship between particle size and the amount of reducing agent used was studied with varying amounts and types of carbohydrate stabilizers. Our goal is to establish a library of nanoparticles with varying sizes that can be conjugated with different biomolecules that are selective for receptors over expressed by the diseased tissue. In future studies we also plan to pursue an indirect method of preparing radioactive Au-199 nanoparticles at carrier free levels from beta decay of Pt-199.