ABSTRACT

Gold nanoparticles (AuNPs) are nanoscale materials with superior physical and chemical properties, including a high atomic number (Z = 79) and large electron density, making them potential candidates as contrast agents in medical imaging. Alginate as a synthesis medium plays an important role in stabilizing and enhancing the biocompatibility of AuNPs, while the Pulsed Laser Ablation in Liquid (PLAL) method offers a clean synthesis free of chemical reducing agents and produces high-purity nanoparticles. One imaging modality that could benefit from AuNPs is Computed Tomography (CT-Scan), which is widely used for its ability to produce detailed anatomical images, yet has limitations in distinguishing soft tissues with relatively similar densities. Iodine-based contrast agents currently in common use have several drawbacks, including nephrotoxicity risk and short circulation time, necessitating a safer alternative. This study aimed to synthesize alginate-based gold nanoparticles using the PLAL method, characterize their physical properties, and evaluate their effectiveness as an in vitro CT-Scan contrast agent. Gold nanoparticles were synthesized in alginate solution media with concentration variations of 0.3%, 0.5%, and 0.7% using an Nd:YAG laser at 1064 nm with an energy of 80 mJ, a frequency of 10 Hz, and a pulse width of 7 ns. Characterization was carried out using FESEM-EDX, XRD, UV-Vis Spectrophotometry, and FTIR. The contrast agent test was performed using CT-Scan with iodine solutions of 50 ppm, 100 ppm, and 150 ppm as comparisons, analyzed based on Hounsfield Unit (HU), Signal-to-Noise Ratio (SNR), and Contrast-to-Noise Ratio (CNR) values. Characterization results showed that the gold nanoparticles had a dominant size in the nanometer scale, contained Au as the main element, possessed a face-centered cubic (FCC) crystal structure, exhibited optical absorption peaks at 521–524 nm, and contained alginate functional groups that acted as stabilizers. CT-Scan results showed that the AuNPs 0.7% sample had the best performance, with HU, SNR, and CNR values of 12.761, 9.020, and 9.420, respectively, outperforming iodine solutions at the concentrations tested in vitro. Based on these results, alginate-based gold nanoparticles have potential as an alternative CT-Scan contrast agent candidate and require further investigation before clinical application.

***Keywords**: gold nanoparticles, alginate, PLAL, CT-Scan, contrast agent, HU, SNR, CNR*