AbstractID: 13393 Title: Imaging characterization of nanoparticles in micro CT system

Purpose: In recent years, various nanoparticles have been identified as excellent contrast agent in x-ray imaging for small animal experiments. To better evaluate and quantify their potential imaging roles, we used a commercially available micro CT system with different imaging settings to study their imaging properties.

Method and materials: Micro CT system used in this work is a commercial imaging scanner and a CCD camera is installed as the x-ray photon detector. Gold (AuNP) and superparamagnetic iron oxide (SPIO) nanoparticles were fabricated and prepared in test tubes with various concentrations. The average size of AuNPs and SPIOs were determined from transmission electron microscopy to be 1.5 and 50 nm. AuNP samples were prepared in five test tubes with concentrations of 4, 8, 12, 16, and 20 mg/mL. SPIO samples were also in test tubes with concentrations of 2, 4, 6, 8, and 10 mg/mL. For comparison purpose, we also prepared iodinated contrast medium in test tubes with various concentrations. Notice that iodinated contrast medium has been widely used in current clinical x-ray imaging applications for years.

Results: For the concentration of 20 mg/cc at the imaging setting of 30, 40, 50, 60, 70, and 80 keV, linear attenuation coefficients for AuNPs are 0.06329, 0.04282, 0.03362, 0.02798, 0.02292, and 0.01951 cm^{-1}; SPIOs are 0.03506, 0.02504, 0.01995, 0.01664, 0.01432, and 0.01294 cm^{-1}; and iodinated contrast medium samples are 0.03352, 0.02468, 0.02110, 0.01830, 0.01591, and 0.01432 cm^{-1}. Other quantities including CT numbers and scatter-to-primary ratios were also quantified for nanoparticle samples. Experiments were repeated three times and estimated errors were less than 1.0%.

Conclusion: From our micro CT imaging measurement, nanoparticles show promising indication as an excellent contrast agent in x-ray imaging. However, we need to further investigate their related biological consequences such as cell toxicity before nanoparticles can officially enter clinical applications.