

Developing a new type of multimodal theragnostics

Nanotechnology is one of the most improving area in the 21. century, which results are used in medicine, too. It has extremely wide field of use, they are utilized for the transport of drug molecules, in vivo imaging as contrast agent for diagnostic and therapeutic purposes, as well. During my research, I took part in the development of a new type of multifunctional nano-sized contrast agent family, which can apply to hibrid imaging modality, combining multiple or simultaneous SPECT, PET, CT, MRI and optical imaging.

The nanoparticle is based on Prussian blue dye, which has optimal structure to link certain metals without any chelator molecules, hence our workgroup found it suitable to develop a multimodal teragnostic family. It's based on the earlier patented idea. I aimed at developing an inert, stable particle family of reproducible size, form and quantity. In my work I examined the relationship between formal characteristics of nanoparticles (size, shape) and the synthesis parameters (pH, temperature, incubation time). The size and shape of the particles were determined with dinamic light scattering (DLS) and atomic force microscopy (AFM). We tested the chelate binding capacity of our sample with 201Tl isotop, and the efficiency of this process was observed by chromatography. The contrast of Prussion blue was registered in NanoPET/MRI system by in vitro MRI measurement.

The DLS results showed, we could change the size of Prussion blue particles within the range of 20 to 120 nm reproducibly. In the stability test also proved that the geometric parameters during 6 weeks did not change significantly. The results of AFM measurement have shown that the particles hadn't spherical symmetry all the time, and the measured values were smaller than the hydrodinamic diameters, which were registered by DLS. The isotop binding study showed, that the particles connect to 201Tl isotop in 98 %. The MRI measurements of the particles - later in vivo measurements - showed adequate T1-weighted contrast.

In summary, we can state, that my experiments resulted a successfull synthesis method to produce a stable Prussion-blue radioactive metal-isotop complex, with well-definied size and without using any chelator.

List of publications: PPA US 61/299357 (Patent Application) The patent application contains only the theroretical idea of nanoparticle, in this wasn't proved experimentally neither the synthesis, nor the viability.