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ORAL PRESENTATION - TiO₂ nanoparticles as vehicles of ²¹²Pb and ²²⁵Ac for internal radiotherapy

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There are only a few a-particle emitting radionuclides that have properties suitable for developing therapeutic radiopharmaceuticals. Unfortunately, all available a-emitters have serious disadvantages: 211At forms weak bond with carbon atoms in the biomolecule and in the case of 212Bi, 213Bi and 226Th short half-life often limits the application of these nuclides. However, the short half-life of 212Bi and 213Bi could be effectively lengthened by binding the parent radionuclide 212Pb (t1/2 = 10.6 h) or 225Ac (t1/2 = 10 d) to a biomolecule, thereby effectively extending the use of short half-life 212Bi and 213Bi. In addition, 212Pb/212Bi and 225Ac/213Bi in vivo generator delivers much greater dose per unit of administered activity compared to 212Bi and 213Bi alone.

In our studies we investigated the properties of TiO2 nanoparticles as potential carriers of 212Pb/212Bi, 225Ac/213Bi generators. The TiO2 nanoparticles have special properties like high specific surface and high affinity for certain cations like mentioned Pb2+, Bi3+ and Ac3+, which are useful during the labelling process. Commercially available (P25 Degussa) and synthesised in our laboratory nanoparticles were used in experiments. The nanoparticles were characterized by SEM and NanoSight techniques.

We obtained high yields of labelling (ca. 99%) anatase nanoparticles in case of 212Pb and 225Ac. Afterwards, the stability of labelled nanoparticles was tested in 0.9 % NaCl,

10-3 M EDTA, solutions of biologically active substances (cysteine, glutathione) and human serum. The leakage of 212Pb or 225Ac and their daughter radionuclides was not significant in any of solutions, even when the incubation time was extended to 24 hours. The obtained results show high stability of labelled nanoparticles and allow to begin further experiments, which are based on modification of the surface by silane compounds which enable binding the biomolecules.

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