Studies on the behavior of tetravalent metal ions in different media with respect to radiopharmacy

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This thesis is devoted to the study of sorption behavior of high oxidation number ions in different physical-chemical systems. This research may allow for the establishment of new separation methods for radionuclides and radionuclide generator systems.

The modern trend of nuclear medicine is theranostic. It is defined as the use of radiopharmaceuticals based on a radioisotope of the same element for both treatment and diagnosis of diseases (for example, ^{90}Y and ^{86}Y). Using analogs of the elements is often beneficial (for example, ^{68}Ga and ^{177}Lu). It determines the relevance of study the elements "group" chemistry.

In nuclear medicine number of four valent elements can be used: ^{45}Ti, ^{69,71}Ge, ^{89}Zr, ^{117m}Sn, $^{203,\ 212}$Pb, $^{226,\ 227}$Th. Radionuclide generators based on the IV group elements play an important role in nuclear medicine: ^{44}Ti$\rightarrow^{44}$Sc, ^{68}Ge$\rightarrow^{68}$Ga, ^{86}Zr$\rightarrow^{86}$Y, ^{95}Zr$\rightarrow^{95}$Nb, ^{113}Sn$\rightarrow^{113m}$In, ^{172}Hf$\rightarrow^{172}$Lu, ^{229}Th$\rightarrow^{225}$Ra$\rightarrow^{225}$Ac, ^{227}Ac $\rightarrow^{227}$Th$\rightarrow^{223}$Ra. On the one hand, four valent elements form very stable complex compounds, on the other hand, they hydrolyze readily.

Target irradiation will be performed with a proton beam in the energy range 60-660 MeV at the Phasotron of DLNP JINR. Novel sorbents for radionuclide separation and some chelators will be prepared at DNC CTU. These sorbents, chelators and elution media will be characterized and tested at both facilities.