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DEVELOPMENT OF A NEW METHOD FOR OBTAINING A RADIOPHARMACEUTICAL BASED ON RA-223 FOR MEDICAL PURPOSES USING ALUMINUM OXIDE (III) AS A SUBSTANCE WITH HIGH SORPTION PROPERTIES

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Malignant neoplasma cases in Russia in 2023

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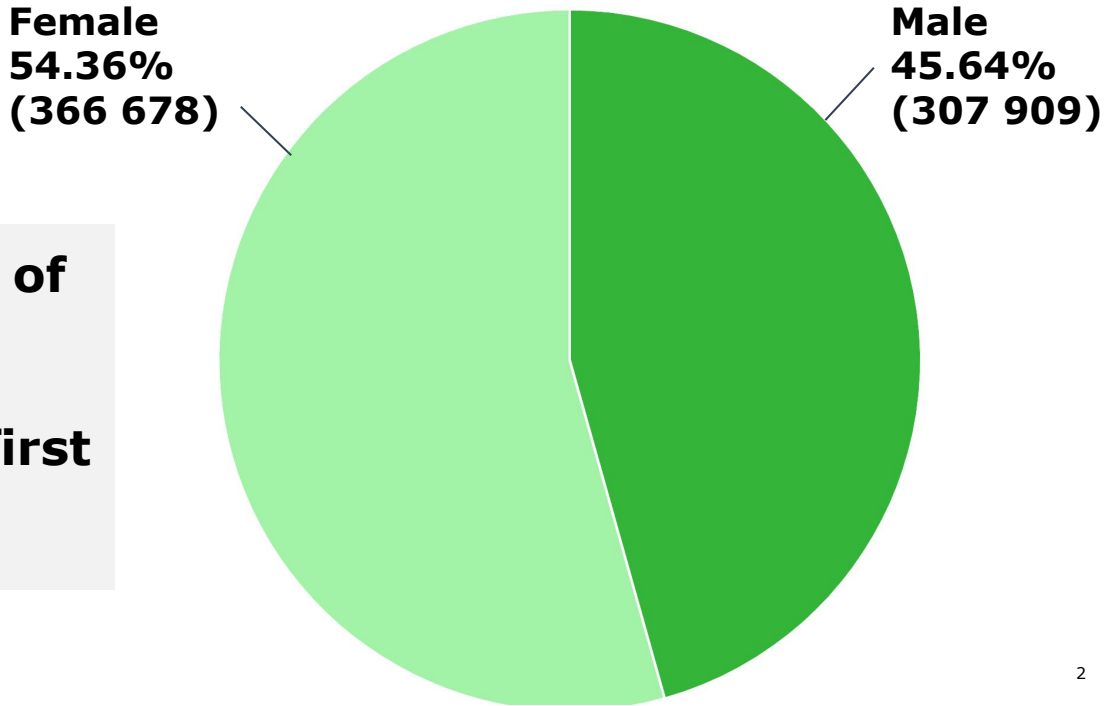
In 2023 674 587 cases of malignant neoplasms were detected for the first time in the Russia



The structure of incidence of malignant neoplasms in the male population of Russia in 2023

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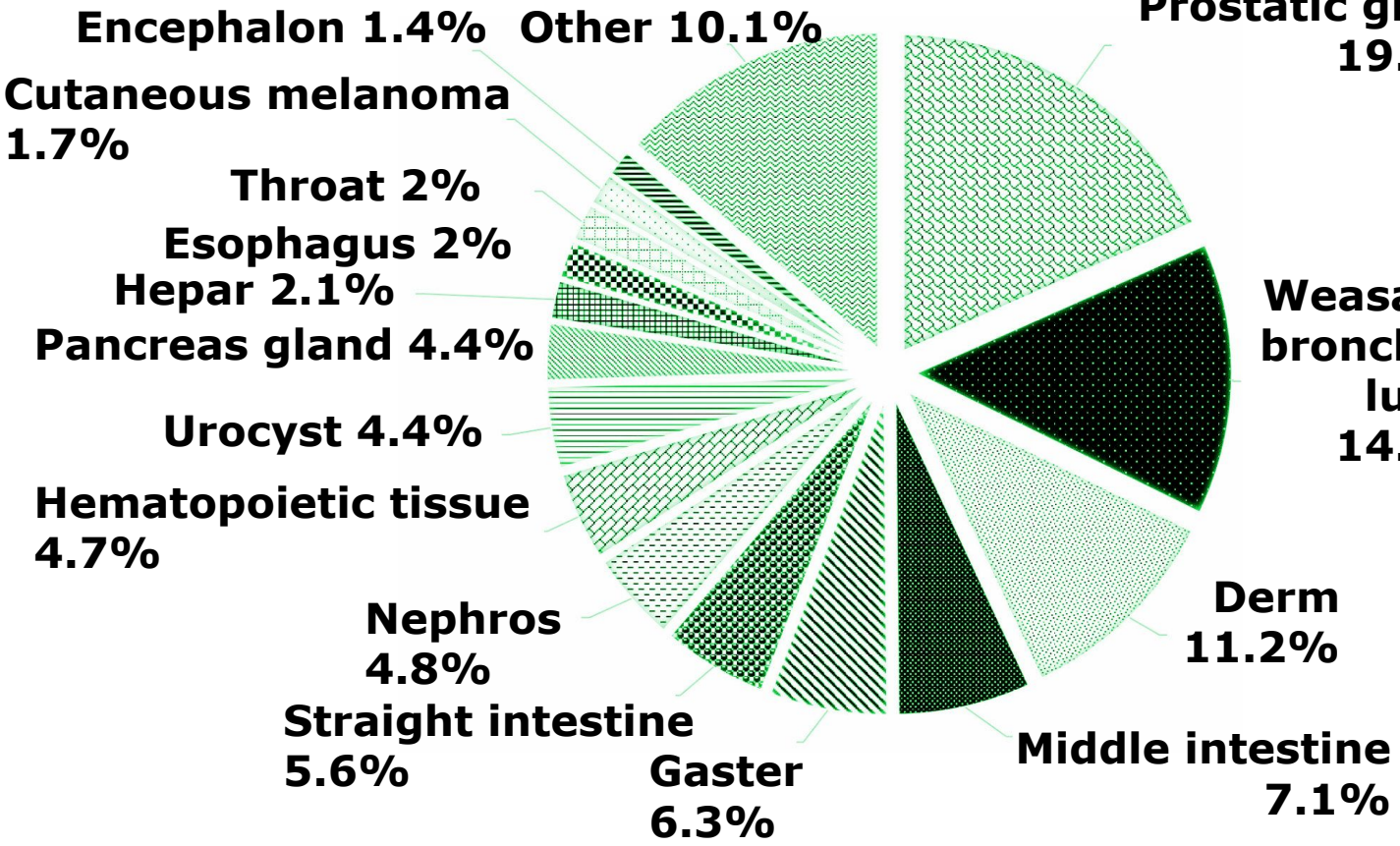

For what purposes is radium-223 used?

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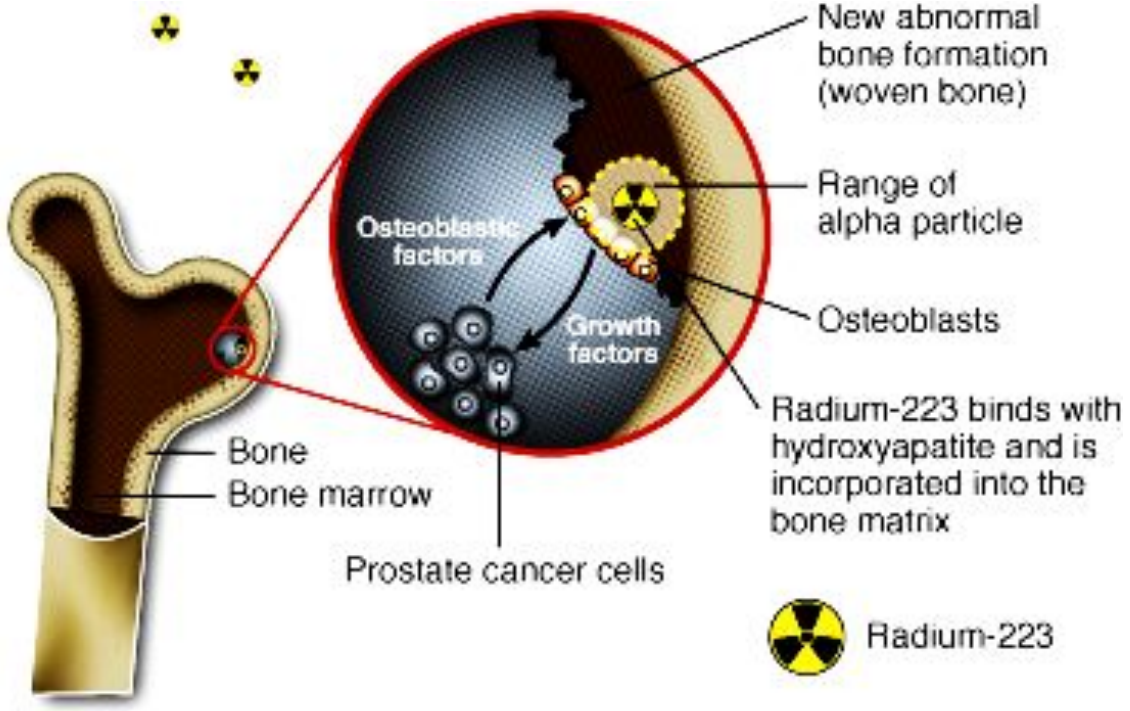
One of the promising isotopes for radionuclide therapy of osseal metastases in castration-native prostate cancer is the isotope Ra-223.



Relevance

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The generator method of obtaining radium-223 from actinium-227 is widely used. Due to the huge demand for this radionuclide, new promising methods for its production are being developed.

$$^{227}Ac(\beta\ 98{,}9\ \%) \rightarrow {}^{227}Th(\alpha\ 100\ \%) \rightarrow {}^{223}Ra$$

PURPOSE

To develop a new and promising method for producing a radiopharmaceutical based on Ra-223 using aluminum oxide (III) as a substance with high sorption properties.

THEORY OF NEW TECHNOLOGY

$$Rn^{222} + {}^{1}n = Rn^{223};$$

$$Rn^{223} + {}^{1}_{1}e = Fr^{223};$$

$$Fr^{223} + {}^{1}_{1}e = Ra^{223}.$$

Stages of the experiments

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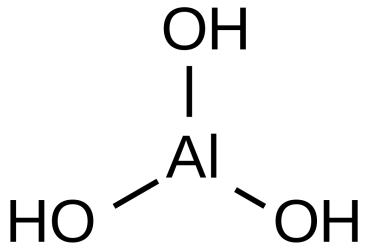
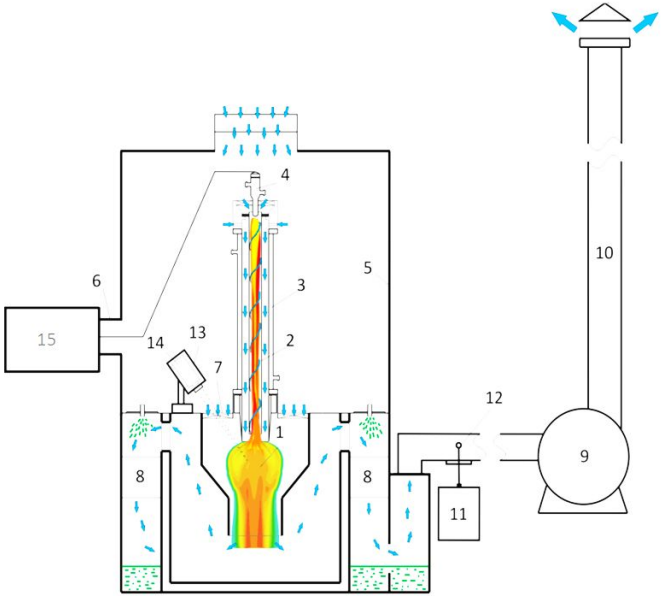
- **Preparation of the sorbent;**
- **Plasma-chemical synthesis;**
- **Creation of the target;**
- **Irradiation with a high-energy neutron flux;**
- **Gamma-spectrometric analysis;**
- **Sorption of the desired isotope;**



Pic. 1 - Chemical structure of aluminium oxide (III)

Pic. 3 - Gamma-ray spectrometer



Pic. 2 - The scheme of plasma-chemical synthesis

A derivatographic analysis

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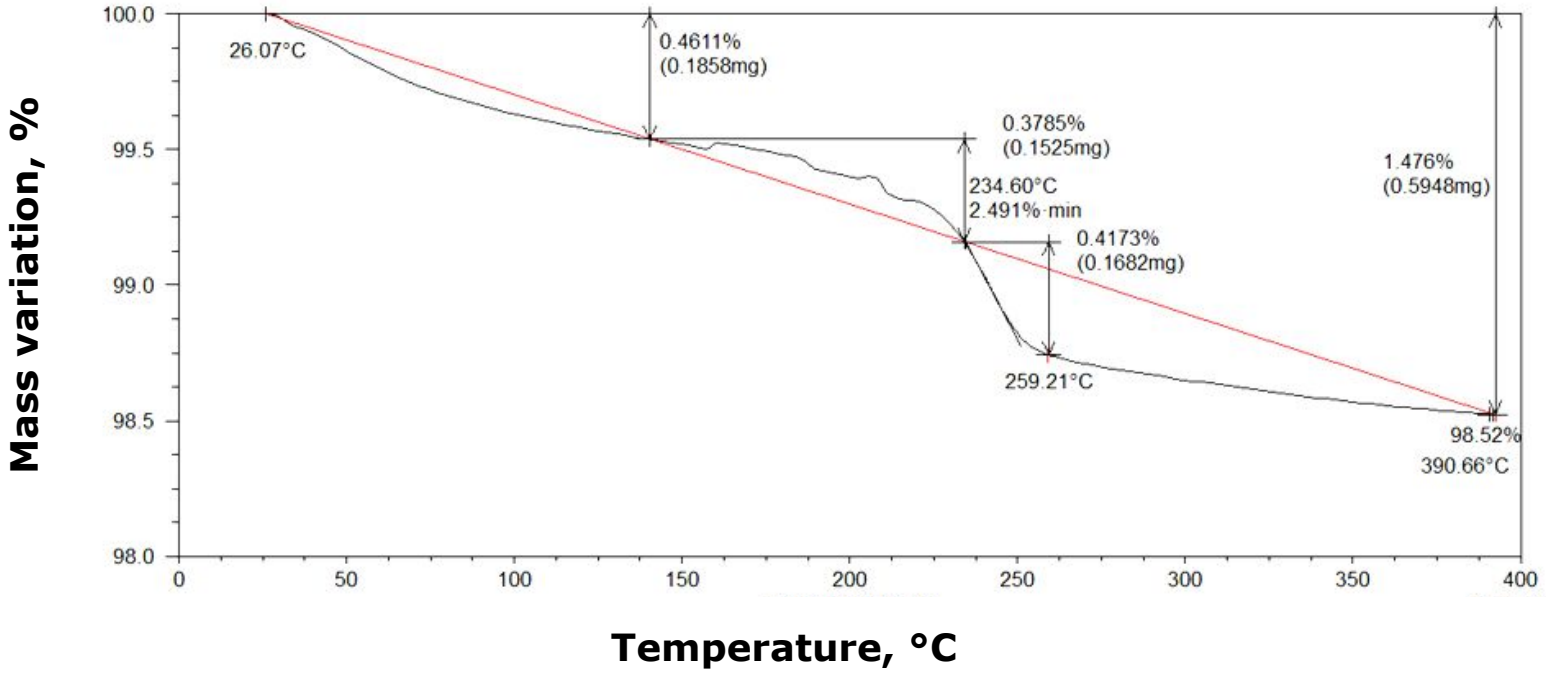
A dry sorbent with high sorption properties was taken as a result of this stage.



Plasma-chemical synthesis

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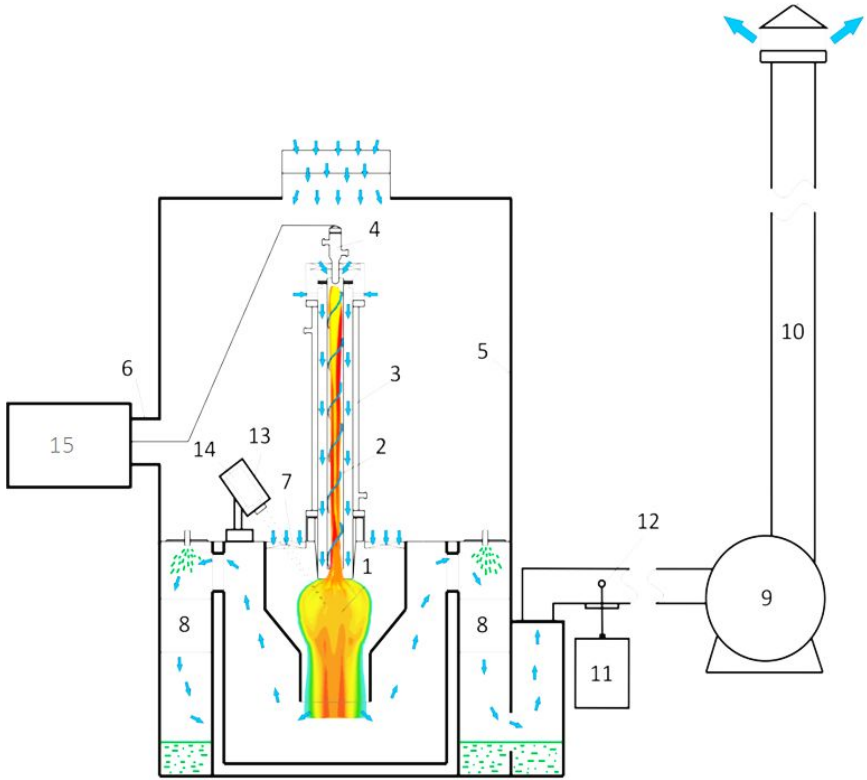
After undergoing plasma-chemical treatment sorbent will serve as raw material for the formation of a target unit.



The scheme of plasma-chemical synthesis

Experiments in unique module

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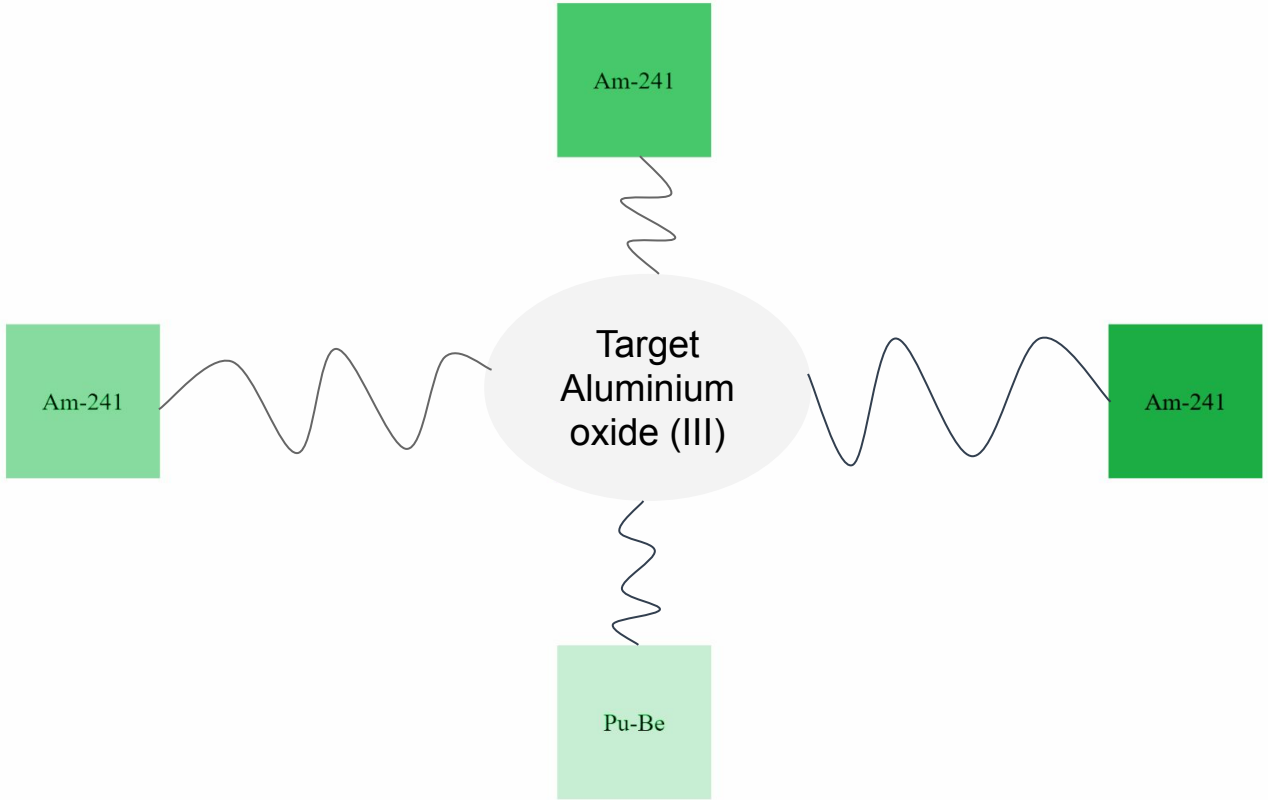

The result of gamma-spectrometric analysis

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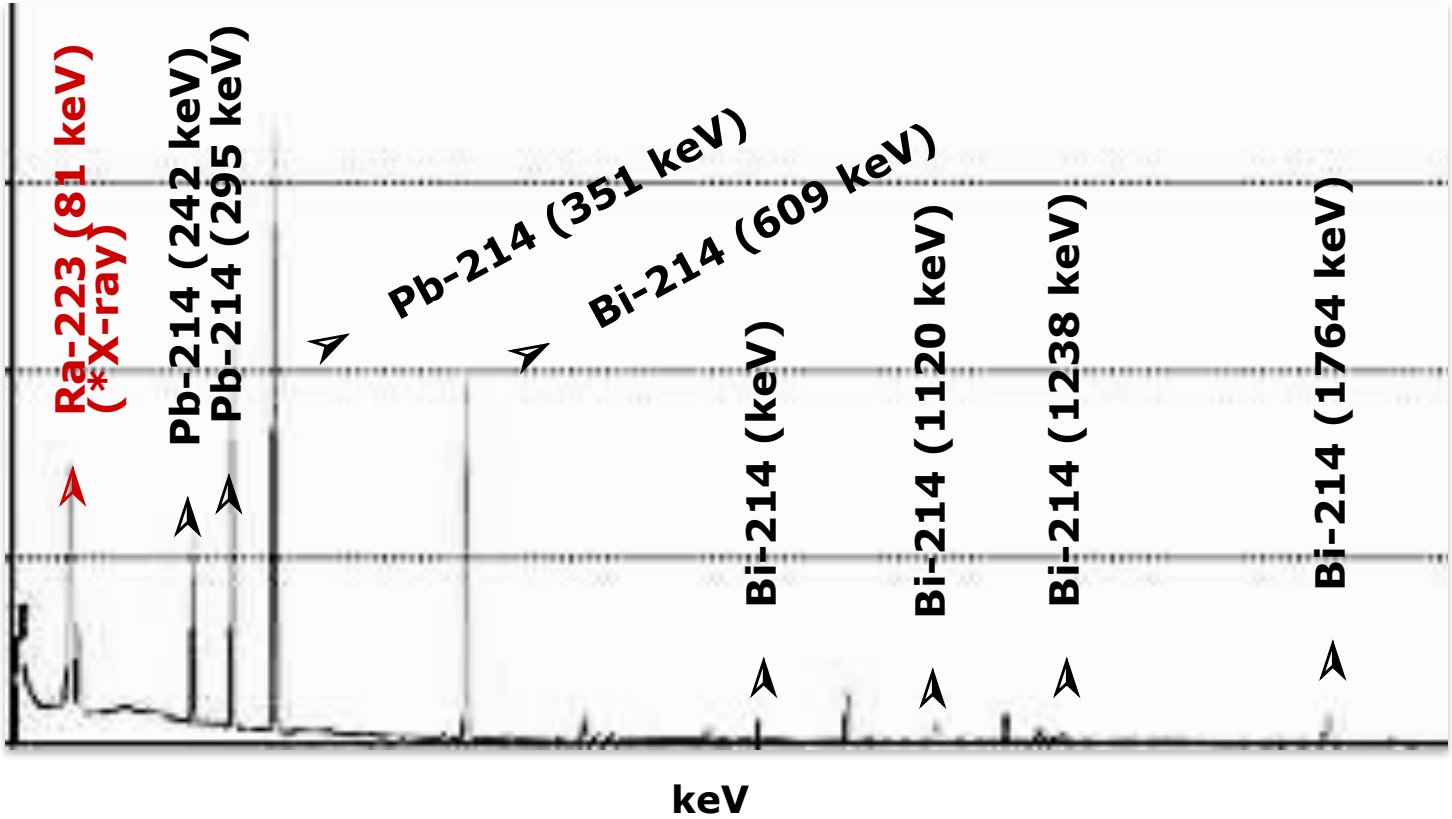

Experimental results

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Radium-226 with gross activity about 0,83 Bq and thorium-227 with gross activity about 0,21 Bq, which is a parent nucleus of the decay of radium-223, were identified in low concentration during the gamma-spectrometric analysis.

Isotope	Activity, Bq
BI-214	3167.27
PB-214	2162.59
RA-226	0.83
TH-227	0.21

Plans for technology development

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It’s necessity to conduct similar experiments with a higher neutron flux density to produce a higher concentration of the isotope radium-223 at the operating nuclear reactor located at Tomsk Polytechnic University.

Pic. 5 - Tomsk Research Nuclear Reactor

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