TEST OF PRODUCTION OF ^{198}Au WITH THE USE OF LINEAR MEDICAL ACCELERATOR APPLIED IN THE TYPICAL RADIOTHERAPY.

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Application of radioisotopes is an important subject in the pharmaceutical sciences. Targeted radiotherapy with radionuclides has several advantages over external beam radiotherapy, including the possibility of selectively delivering higher doses to the tumor and treating multiple metastases.

A isotope of ^{198}Au decays with a half – life of 2.7 days to stable ^{198}Hg by emission of β particles of maximum energy 960 keV and γ – rays of energies 412 keV, 680 keV and 1.09 MeV [1]. The successful method to the production a isotope of ^{198}Au is the ^{197}Au(n,γ)^{198}Au neutron capture reaction that take place in nuclear reactor. Its thermal neutron activation cross section is fairly high (σ = 98.8b) [2,3]. A typical sample weight for irradiation in a nuclear reaction is limited to less than gram due the high activities produced radioisotopes.

A quite new approach to the production of ^{198}Au is the application of linear medical accelerators used in the typical radiotherapy in oncological centers. The investigations were performed with the use of two medical linacs Clinac 2300 EX and Clinac TrueBeam by Varian installed in the center of oncology in Gliwice (Poland). The photons generated in such medical linac cause the photonuclear reactions (γ,n), (γ,2n). The targets made of the natural gold were irradiated with the use of high – energy therapeutic 20 MV X-ray beam. The ^{nat}Au radioisotope decaying to ^{198}Au originated from the neutron capture reaction:: ^{nat}Au(n, $\bar{\sigma}$)^{198}Au. This reaction is induced by thermal neutrons originating from photonuclear reaction mainly in the massive components of an accelerators head. The influence of the irradiation conditions (i.e. a radiation field size, a location of the target in relation to the beam central axis etc.) on amount of the produced ^{198}Au was investigated. The spectral measurements were carried out by means of the germanium and Ge(Li) detector.

The ^{198}Au radioisotope produced with the use of linear medical accelerator is characterized by the relatively small activity. The obtained maximum specific activity in the saturation state was 140 kBq/g. Such specific activity is not enough to apply the tested method for the large - scale production of the ^{198}Au. However, it can be useful in case of any critical situation in the ^{198}Au production.

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