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Radiopharmaceuticals for diagnostic and therapy in modern nuclear medicine

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In nuclear medicine methods the early diagnostics and detection of malignancies is an important problem. To obtain information about functional, anatomic, metabolic processes in the tumors or in the metastatic nodes one can effectively use the different radiopharmaceuticals. These substances have a mixture of a biochemical agent and of a radionuclide which emits gamma-quants (methods of Single Photon Emission Computed Tomography) or positrons (methods of Positron Emission Tomography). The diagnostic information provided by radiopharmaceuticals (radionuclide imaging) has to be reflected all physiologic and pathologic conditions within the human body.

The other greatest challenge in nuclear medicine methods is to target delivering of the corresponding radiopharmaceuticals to the cancer cells for the next non-surgical treatment of all tumors. Also the quantity of radiopharmaceuticals used in diagnostic imaging procedures and targeted therapy should be realize a principle of "as low as reasonable achievable", in particular in pediatric field [1]. The combining of radionuclide imaging methods with methods of radionuclide therapy to Theranostics, it can give us an excellent result for the treatment and diagnosis of a cancer with minimal side effects. In this case we have to investigate the proton induced nuclear reactions (with the evaporation of one or more nucleons in the final stages) for production of new medical radionuclides which are used for effective early diagnosis and treatment of various localized oncological tumors [2].

Therefore in present work the experimental and theoretical studies of the (p,n) reaction excitation functions for medium mass nuclear systems from 114Sn to 124Sn with production of the antimony radionuclides in final channels in the energy range 6-20 MeV were carried out. Such antimony radionuclides can emit Auger electrons, which is very perspective for use in precision targeted therapy due to their short radii of action and high energies of transfer and also can emit gamma-quants which are registered by the modern Single Photon Emission Computed Tomography. Therefore one can consider these radionuclides as the prospective for the Theranostics methods. For investigated reactions the processes and mechanisms of antimony radionuclides formation were considered and their cross-sections have been obtained.

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2. V. I. Zherebchevsky, et al., Bulletin of the Russian Academy of Sciences: Physics, Vol. 80, No. 8, 888–893 (2016)

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