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Preliminary results of the theranostic 47Sc cyclotron proton-induced production with enriched 48Ti, 49Ti and 50Ti targets

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The scientific community interest in the production of the theranostic 47Sc, as underlined in the IAEA Coordinated Research Project (CRP) on 67Cu, 47Sc and 186Re [1], is due to its medically favourable decay characteristics (Eγ=159.381 keV Iγ=68.3%, Eβ-,mean=162.0 keV Iβ-=100%) suitable for therapeutic purposes and SPECT cameras for diagnosis. Moreover, 47Sc has a quite long half-life (T1/2 = 3.3492 d) allowing the radiolabelling operations for radiopharmaceuticals production but also the monitoring of the biodistribution of monoclonal antibodies, paving the way to radioimmunotherapy applications.
In case of medical applications it is crucial to optimize the production of 47Sc, to avoid as much a possible the co-production of contaminant isotopes. At INFN-LNL (Istituto Nazionale di Fisica Nucleare-Laboratori Nazionali di Legnaro), in the framework of the LARAMED project (LAboratory of RAdionuclides for MEDicine) [2], the most favourable conditions for the cyclotron-based production of this radioisotope using proton beams are investigated. The study of the 47Sc production employing enriched 48Ti target is carried out as part of the PASTA project (Production with Accelerator of Sc-47 for Theranostic Applications), funded by INFN for the years 2017/2018 [3, 4]. Instead, the use of enriched 49Ti and 50Ti targets is an aim of the REMIX project (Research on Emerging Medical radIonuclides from the X-sections), funded by INFN for the years 2021/2023. The enriched targets are manufactured at INFN-LNL through the use of the HIVIPP technique (HIgh energy VIbrational Powder Plating) [5]. Since the LARAMED bunkers are still under completion, irradiation runs are performed at the ARRONAX facility (Nantes, France) where a similar high-energy and high-intensity cyclotron able to provide a 70 MeV proton beam is operating [6].
In this work the preliminary results of the production cross-sections using enriched 48Ti, 49Ti and 50Ti targets are presented and compared. Considering the goal of the medical application, not only 47Sc but also the contaminants'cross-sections are examined, since they can contribute to the radiation deposited in the human body. Particular attention is paid to the Sc-isotopes which cannot be chemical separated with a focus on 46Sc, whose half-life (T1/2 = 83.79 d) is longer than 47Sc one. Results are also compared with the previous literature data where available.

[1] A. Jalilian et al. 2021 IAEA Activities on 67Cu, 186Re, 47Sc Theranostic radionuclides and Radiopharmaceuticals, Current Radiopharmaceuticals.
[2] J. Esposito et al. 2019 LARAMED: a LAboratory for Radioisotopes of MEDical interest, Molecules 24(1), 20 - 10.3390/molecules24010020.
[3] G. Pupillo et al. 2019 Production of 47Sc with natural vanadium targets: results of the PASTA project, Journal of Radioanalytical and Nuclear Chemistry 297(3) - 10.1007/s10967-019-06844-8
[4] G. Pupillo et al. 2019 Preliminary results of the PASTA project (2019) Colloquia: EuNPC 2018, IL NUOVO CIMENTO 42 C 139 - 10.1393/ncc/i2019-19139-1
[5] H. Skliarova et al. (2020) HIVIPP deposition and characterization of isotopically enriched Titanium-48 targets for nuclear cross-section measurements, Nuclear Inst. and Methods in Physics Research, A.
[6] F. Haddad et al. 2008 ARRONAX, a high-energy and high-intensity cyclotron for nuclear medicine, European Journal of Nuclear Medicine and Molecular Imaging, 35:1377-1387.

Author: MOU, Liliana (INFN-LNL)

Co-authors: HADDAD, Ferid (4Nantes University and GIP ARRONAX); PUPILLO, Gaia (INFN-LNL); DE DOMINICIS, Lucia (INFN-LNL); CAMPOSTRINI, Matteo (INFN-LNL); CISTERNINO, Sara (INFN-LNL); RIGATO, Valentino (INFN-LNL)

Presenter: MOU, Liliana (INFN-LNL)

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