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A matched quadruplet of terbium radionuclides for nuclear imaging and radionuclide therapy

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Abstract content
   (Max 300 words)

Terbium offers four clinically useful radionuclides with complementary physical decay characteristics, namely Tb-149, Tb-152, Tb-155 and Tb-161. The identical chemical characteristics of these radionuclides allow the preparation of radiopharmaceuticals with identical pharmacokinetics, useful for positron emission tomography (PET, using Tb-152), single-photon emission tomography (SPECT, using Tb-155), alpha-particle radionuclide therapy (using Tb-149 labelled compounds) and beta/Auger radionuclide therapy (using Tb-161 labelled compounds). Terbium is the only element in the periodic table that offers this unique matched quadruplet of radionuclides, suitable for all modalities of nuclear imaging and radionuclide therapy. All four radionuclides are currently being evaluated in preclinical studies for the diagnosis and treatment of so-called FR-positive tumours. For this purpose, small animals containing human tumour xenografts are used.

Only Tb-152 and Tb-155 can be produced with a cyclotron. Large-scale production of Tb-161 is possible with a nuclear reactor. Proton-induced spallation reactions followed by an online isotope separation process are used to produce Tb-149. Currently, the only facility producing Tb-149 in sufficient quantities for purposes of experimental and preclinical studies is the ISOLDE facility at CERN. Until recently, almost no production data existed for these radionuclides. Excitation functions for the cyclotron production of Tb-152 and Tb-155 have been measured simultaneously but independently at iThemba LABS and at the National Institute of Radiological Sciences (NIRS), Chiba, Japan and published in the same paper. This made an immediate comparison possible as well as validation of the data. This work will be briefly discussed as well as aspects of the initial results of the preclinical studies.

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