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Post-decay processes in radiopharmaceutical precursors studied via nuclear spectroscopy

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Modern radiopharmaceuticals are actively used for diagnostics and therapy in nuclear medicine. The concept of a modern radiopharmaceutical allows incorporating radionuclides with similar properties to the same precursors. Radiopharmaceutical precursor and its stability play a major role in applicability of such a drug. Post-decay processes, namely Auger and conversion electron emissions, may

cause a change in local environment which can lead to release of the daughter from the radiopharmaceutical and, therefore, difficulties in its application.
The present work highlights several medically relevant isotopes – 44Sc and 111In coupled with the chelators. 44Sc (t1/2 = 4.04 h) is a radiometal with favourable decay properties for positron emission tomography (PET) and 111In (t1/2 = 2.8 d) is already in the clinical use for diagnostics via single photon emission computed tomography (SPECT). Moreover, 111In is a well-established probe nucleus in perturbed angular correlation of γ-γ rays (PAC), which allows for the study of hyperfine interactions and, hence, is a unique technique when analysing post-decay processes in radiopharmaceutical precursors. Also, the study demonstrates feasibility of 44mSc/44gSc radionuclide generator induced by post-decay processes. The radionuclide generator yield was measured by γ-spectroscopy and equals to 9.8±1.0%. This result indicates the influence of post-decay processes on the initial chelate complexes for the elements with medium Z and significantly changes the overall trend.

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