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Production of 135La by proton irradiation of enriched 135Ba and purification by ion exchange chromatography

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The global demand for the rare earth elements has been dramatically enlarged. Therefore, it needs a detailed understanding in ore chemistry and separation methods. To simulate these processes, we will use the radiotracer technique. 135La (T1/2 = 19.4 h) was choosen as a typical representative element (radionuclide) for the rare earth elements. The isotope can be produced by the nuclear reaction 135Ba(p,n)135La at a cyclotron. We used our recently installed cyclotron Cyclone® 18/9 (IBA) by irradiation of the isotope enriched 135Ba (94.9%). The [135Ba]BaCO3 was pressed in an aluminium holder with a diameter of 3 mm and a depth of 300 µm . The target was covered by a 100 µm thick aluminium foil to avoid loss of the material during irradiation. The irradiation was done at a beam of 18 MeV protons and a current of 20 µA for 7 hours. After cooling for 2 hours the [135Ba]BaCO3 was dissolved with 2 ml 0.095 M nitric acid. The separation of the radionuclide 135La and the target material 135Ba was performed by ion exchange chromatography with Ln-Resin-C (TRISKEM). The target solution was eluated on the resin and the resin was washed four times with 2 ml 0.095 M nitric acid to remove the 135Ba. Afterwards, the 135La was stripped by triple washing of the resin with 6 M nitric acid. The combined 135La solutions were evaporated to dryness and the residue was dissolved in 0.1 M nitric acid. The detection of 135La was done by liquid scintillation counting. The target material was recovered by evaporating the 135Ba fractions to dryness, dissolving the residue with water and precipitation of the carbonate by bubbling with carbon dioxide.

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