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Production of ^{135}La by proton irradiation of enriched ^{135}Ba 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 radio-tracer technique. ^{135}La ($T_{1/2} = 19.4 \text{ h}$) was chosen as a typical representative element (radionuclide) for the rare earth elements. The isotope can be produced by the nuclear reaction $^{135}\text{Ba}(p,n)^{135}\text{La}$ at a cyclotron. We used our recently installed cyclotron Cyclone® 18/9 (IBA) by irradiation of the isotope enriched ^{135}Ba (94.9%). The $[^{135}\text{Ba}]\text{BaCO}_3$ 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 $[^{135}\text{Ba}]\text{BaCO}_3$ was dissolved with 2 ml 0.095 M nitric acid. The separation of the radionuclide ^{135}La and the target material ^{135}Ba was performed by ion exchange chromatography with Ln-Resin-C (TRISKEM). The target solution was eluted on the resin and the resin was washed four times with 2 ml 0.095 M nitric acid to remove the ^{135}Ba . Afterwards, the ^{135}La was stripped by triple washing of the resin with 6 M nitric acid. The combined ^{135}La solutions were evaporated to dryness and the residue was dissolved in 0.1 M nitric acid. The detection of ^{135}La was done by liquid scintillation counting. The target material was recovered by evaporating the ^{135}Ba fractions to dryness, dissolving the residue with water and precipitation of the carbonate by bubbling with carbon dioxide.

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