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Separation of Actinium-225 from Lanthanides Using High Pressure Ion Chromatography

Actinium-225 is an important radioisotope for targeted alpha therapy applications and can be used for the treatment of several different cancer types such as, gliomas, leukemias, lymphomas, and melanomas. The 225Ac decay chain yields a net of four α particles, which have a high linear energy transfer. The α particles deposit their energy in 70 100 μm tracks, effectively targeting the binding site while limiting the destruction of surrounding healthy tissue. The high energy and large particle size also make α particles likely to cause double strand breaks in DNA. Current methods of production of 225Ac include 229Th derived material and chemical processing of irradiated thorium targets. This results in the production of 225Ac that has a high level of contaminating radiometals. Separation of 225Ac from the contaminating lanthanides is particularly challenging due to their similar chemical properties and charge. The goal of this research is to use high pressure ion chromatography to develop an effective separation of lanthanides and organic media from 225Ac at tracer level activity. After loading 225Ac and Ln(III) onto a sulfonated polystyrene divinylbenzene resin, α hydroxyisobutyric acid (α HIBA) and HCl are serially used to separate Ln(III) from 225Ac. The organic acid complexes with Ln(III) preferentially over Ac(III). After the Ln(III) is removed from the resin, low molarity HCl is introduced to the resin to flush the organic acid. When the eluent matrix has been fully converted to HCl, the molarity of HCl is increased to elute the 225Ac from the resin. We have developed a successful method that achieves 225Ac separation of >99% with minimal α HIBA contamination.

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