

# Nebiat Sisay, Chemistry

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## **Separation of radiolanthanides by high performance liquid chromatography**

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Studies were carried out to develop a method for the separation of radiolanthanides using high performance liquid chromatography (HPLC). Radiolanthanides are essential for radiotherapy and/or imaging of cancer and their metastases. Specifically, a method was developed to separate lutetium-177 ( $^{177}\text{Lu}$ ) from samarium-153 ( $^{153}\text{Sm}$ ) using a cation-exchange column on the HPLC.  $^{177}\text{Lu}$  and  $^{153}\text{Sm}$  are obtained through neutron activation of  $^{176}\text{Lu}$  and  $^{152}\text{Sm}$  respectively at the University of Missouri-Columbia Research Reactor. A good separation of Lu-177/Sm-153 allowed us to decide on the selection and conditions of solvents to be used for other lanthanides. Additionally, studies were also carried out for the separation of promethium-149 ( $^{149}\text{Pm}$ ) from cold neodymium-148 ( $^{147}\text{Nd}$  used as a radioactive trace). As Pm and Nd are located next to each other on the periodic table their very similar chemical properties pose a challenge in performing a complete separation. For example, varying the concentration and pH of solvents,  $\alpha$ -hydroxy- $\beta$ -methylbutyric acid ( $\alpha$ -H- $\beta$ -MBA) and  $\alpha$ -hydroxy isobutyric acid ( $\alpha$ -HIBA), can effectively produce good chromatographic separation of the lanthanides. High purity germanium counting was used to analyze the fractions of the isolated  $^{149}\text{Pm}$  from  $^{147}\text{Nd}$ . Solvent pH was determined to be the dominant factor in obtaining a good separation of lanthanides by HPLC.