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# Production of High Specific Activity Radiolanthanides for Medical Purposes using the Szilard-Chalmers method

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Radioactive lanthanides have become an important imaging, diagnostic and therapeutic tool in the medical field. For example, the neutron rich samarium isotope of 153Sm has been proven to have desirable characteristics for treatment of bone cancer. However, for medical purposes, the radioactive lanthanide isotope must be produced at high specific activity, i.e. low concentration of inactive carrier, so they are both beneficial for therapy and the concentration of the metal ions does not exceed the maximum sustainable by the human body. The objective of our research is to produce radioactive lanthanides with high specific activity in a small-scale research reactor using the Szilard-Chalmers method. Our preliminary experimental results show a decrease of 34% in the amount of Lanthanide needed for a typical medical procedure. We propose an innovative experiment setup to instantaneously separate the radioactive recoil product formed during irradiation from the bulk of non-radioactive ions. The instant separation prevents the recoiled radioactive nucleus from reforming its original bonds with the target matrix and chemically separates it from the non-radioactive target matrix, resulting in a carrier free radiolanthanide with increased specific activity. We will present methods for preparation and synthesis of the material used for irradiations and the results of enrichment factors and extraction yields in radioactive lanthanide solutions. We will also investigate degradation by ionizing radiation that occurs during neutron activation to determine the stability of the target material during irradiations. The obtained results will be compared to previously published methods and their corresponding results.

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