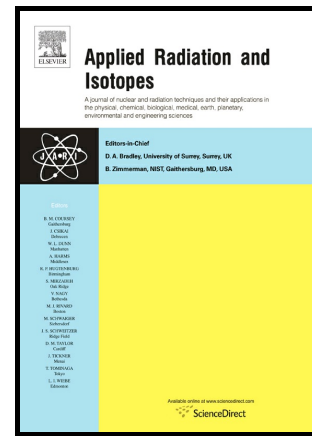


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Isolation and Purification of Protactinium-231

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Abstract

Protactinium-231 is one of the lesser known actinides, yet the measurement of this radionuclide is central to dating studies in both paleoclimate and nuclear forensics measurements; furthermore, it is important as the immediate parent nuclide of the ²²⁷Ac decay chain. In this paper, we present the preparatory work for an upcoming CCRI(II) supplementary comparison of this radionuclide. The material used in this work was of poorly known provenance, and it was necessary to carry out a chemical purification of this material prior to use. A new extraction chromatography resin, TK 400, which has been developed for the separation of ²³¹Pa, was tested at NPL. The aims of the work were achieved; the recovery of ²³¹Pa was ~85 %, the decay products were recovered in good yield (~95 %) and stable element impurities were removed.

Keywords: Protactinium, extraction chromatography, nuclear forensics, radiochronometry

1] Introduction

Protactinium is an element that has received relatively little attention since it was discovered in 1913 (Fajans and Göhring, 1913), mainly due to there being little use for this element – although ²³¹Pa was briefly considered as suitable material for a fission weapon. There are four isotopes of protactinium that may be encountered, and these are set out in Table 1. Protactinium-231 presents some unique measurement challenges due to the nature of its chemical behaviour, for which there is a single systematic study (Brown and Maddock, 1963), the complexity of its decay scheme and the generally unsatisfactory state of the decay data of this radionuclide.

Although protactinium is part of the actinide series of elements, its chemical properties are closer to those of niobium and tantalum. In common with niobium and tantalum, protactinium is chemically stable in aqueous solution when it is complexed by either fluoride, sulphate or

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