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Separation, preconcentration of lanthanum from monazite and its determination by ¹³⁸La using non-destructive γ ray

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Abstract

A method developed for separation preconcentration and determination of Lanthanum elements which consists of mainly two isotopes, the stable La-139 and the radioactive La-138 with its half life 1.05×10^{11} years. The stable isotope La-139 is being the most abundant ratio $99.911 \pm 0.001\%$ while La-138 has only $0.089 \pm 0.001\%$ abundance ratio. Lanthanum-138 also has two main gamma ray energy lines one at 788.4 and the other at 1435.8 keV which were using for the determination of La-139 by Hyper Pure Germanium detector, HPGe. Based on this method, the percent of La-139 has been calculated with high precision in a synthetic samples. The results were compared with inductively coupled plasma- mass spectroscopy, ICP-MS, technique. The detection limit was calculated as MDA (minimum detection activity) and it has been found to be equal 1.46 Bq/kg for La-138 at 788.4 Kev and 1.52 Bq/kg at 1435.8 Kev gamma ray energy lines with mean value 1.49 Bq/Kg. Application of that method was successfully applied for the determination of lanthanum in natural sample; Monazite. The developed method was based on new chemical steps; precipitation and solvent extraction for such crude specimen monazite sample, for the lanthanide determination was established. Where, the precipitation method is used for removal of Th (IV) and U (VI) and the solvent extraction is used for removal of Ac from REEs. Molar Solution HDEHP in benzene was applied to extract REEs and Actinium, Ac, from 0.1M HNO₃ while the 0.2M HNO₃ is used to stripe Ac leaves REEs in the organic phase. Therefore, lanthanum in the residual REE was accurately determined.

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