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Abstract

Determination of Lanthanides and trace elements in geological samples using Inductively Coupled Plasma Mass Spectrometry (ICPMS) Technique.

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Chemical analysis of geological samples plays vital role for mineral investigation, mineral exploration, geochemical mapping etc. Several methods are there to determine concentration of trace elements and lanthanides in geological samples. LIN et al. [1] reported a method for multi-element analysis of rock reference samples using mixture of acids. Begum et al. [2] determined trace and rare earth elements in marine sediment reference materials using closed and open acid digestion techniques followed by ICPMS measurement. But a simple, rapid, precised and accurate method is required to quantify the lanthanides and trace elements in geological samples at crustal abundance level. Saha et al. [3] reported the quantification of lanthanides using fusion technique followed by ICPMS measurement. An extensive study has been made on quantitative estimation of rare earth and trace elements in geological samples using inductively coupled plasma mass spectrometry technique. Interferences on analyte atoms due to isobaric, polyatomic and doubly charged mass ion are carefully investigated. In this work a detailed study was also made for optimization of operating parameters. A simple and rapid method has been developed for accurate determination of 14 lanthanides and 29 trace elements in soil and sediment samples at ppb level by ICPMS.

In the present study, 0.1g sample was fused in platinum crucible at 1000^0C using a mixture of lithium metaborate and tetra borate. The fused mass was extracted with 8% nitric acid and volume was made up to 250 ml in volumetric flask maintaining 2% nitric acid and 10 ppb indium/rhodium as internal standard. The internal standard was used here to take care of instrumental drift. Present authors also investigated acid decomposition method for determination of these elements. Recovery of lanthanides and few refractory elements was observed to be incomplete and inconsistent. In case of fusion method, recovery for all the elements from soil and sediment samples was found to be very good.

The efficiency of the proposed method was checked analyzing eight Chinese certified reference materials of soil and sediments. A very good agreement was found between certified and observed values of the elements. The limit of quantification varied from 0.02 μg/g to 1.00 μg/g. Precision was below 10% RSD. The method is simple, rapid, precised, accurate and cost effective.

References:

[1] LIN S et al. (2000) Anal Sci 16: 1291-1296

[2] Begum Z et al. (2007) At Spectrosc 28(2):41-50

[3] Saha M C et al. (2015) At Spectrosc 36(3):109-115