

High purity elemental separation technique for LREEs from silicate matrix

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Rare earth elements (REEs) are difficult to separate from each other due to their similarity in chemical characters. Elemental separation is essential for isotopic analysis in thermal ionisation mass spectrometry or multi-collector inductively coupled plasma mass spectrometry to generate precise and accurate isotopic data. REE isotope geochemistry can be limited for the want of an efficient method which can prepare and analyse several REEs from rare materials such as minerals, xenoliths, or extra-terrestrial material, as well as bulk silicate rock samples. We have developed a technique, improving on previous efforts (i.e., Kagami & Yokoyama, 2016), which can separate La, Ce, Nd and Sm as well as Ba from a single aliquot of sample using two columns and minimum processing time. We have used miniaturised columns to efficiently process small amount of material while minimising the possibility of contamination. We have used AG50W-X8 from BioRad® and Ln spec resin from Eichrom® to efficiently separate the REEs from each other. The eluent used is a mixture of dilute HNO₃ (0.2M) and NaBrO₃ (20mM) which is very effective in separating LREEs, especially Ce from Nd. Previous works have used similar approaches to separate Ce from Nd, but with concentrated HNO₃ (~10M) which is difficult to work with due to its corrosive nature which damages lab equipment and is dangerous to handle on regular basis. Methods with conc. HNO₃ also require an extra step to separate LREEs (i.e., La, Nd, Sm) from each other. The merit of the dilute mixture is that it can elute the individual LREEs in a single step and with high degree of separation between REEs. This method can easily be combined with other elemental separation techniques such as Pb-Sr or Hf separation technique to use the same sample aliquot for measurement of these isotopes, thus reducing wastage of sample material. Results show > 90% recovery yield for all of the target elements with accurate values for ¹⁴³Nd/¹⁴⁴Nd isotopic ratios for GSJ basalt standard JB-2. The method is relatively fast and cost effective, as well as showing high purity and recovery yield and is suitable for processing rare silicate material as well as bulk rocks.

Reference:

Kagami, S., & Yokoyama, T. (2016). Chemical separation of Nd from geological samples for chronological studies using ¹⁴⁶Sm–¹⁴²Nd and ¹⁴⁷Sm–¹⁴³Nd systematics. *Analytica Chimica Acta*, 937, 151–159. <https://doi.org/10.1016/j.aca.2016.07.004>

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