



Rare earth elements in rice samples in Australian market from different origins

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Rare earth elements, also known as lanthanides, are comprised of seventeen elements including lanthanum (La) to lutetium (Lu) in the periodic table⁽¹⁾. Despite their increased utilisation, little attention is given to them as emerging environmental contaminants and their associated health risks. The concentration of these elements in urban and agronomic soil is critical and may trigger bioaccumulation in plants and may enter the food chain. Also, the consumption of fertilizers in agricultural practices on a larger scale is a significant challenge. The REEs enriched fertilizers are a risk factor for contamination in soil and food⁽²⁾. However, there is very limited data in the literature regarding the occurrence of these elements in a staple food such as rice. Thus, this study is aimed at quantification of REEs in 64 rice samples imported from different countries (Australia, India, Italy, Pakistan, Sri Lanka, Thailand, and Vietnam, including polished, brown, and parboiled) and sourced locally and consumed by the Australian population by using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The average concentration of REEs in Australian, Thailand and Vietnamese rice samples were quantified at 0.013- 2.974 µg/kg, 0.012-3.113 µg/kg, 0.009-0.919 µg/kg, respectively and were lower than other countries. The highest average concentrations of REEs were found in Pakistan (0.299-128.2 µg/kg), India (0.063-20.574 µg/kg), and Sri Lankan (0.022-11.522 µg/kg) rice samples imported to Australia. Scandium (Sc) and yttrium (Y) were found in the range of 107.463- 85.961 µg/kg. The pattern of light REEs (LREE) was more abundant than heavy REEs (HREE). This study did not include field experiments to find the translocation factors of REEs from soil to different parts of plant bodies, thus cannot establish the correlation between fertilizers and REEs concentration in rice grains. However, this study presented the general interpretation of REEs quantification in rice grains from different countries. The outcome of this study includes filling the subsequent knowledge gaps in analysing REEs in rice. This study also indicated the need to establish regulatory policies and monitoring programs for this type of staple cereals, aiming at promoting public health.

Keywords: Lanthanides Exposure; Emerging contaminants; Australian rice; Public Health

Ethics Declaration

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