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Accumulation of rare earth elements in plants native to the acid mine drainage area (Poland) and its potential application

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The acid mine drainage areas represent a type of environment enriched in rare earth elements (REE) caused by an increased mobility of REE at a low pH of water and soil. Rare earth elements are not essential to plants and may cause reduced biomass in native plants. A typical total REE concentration in a reference plant is 1131 µg/kg. However, there are substantial differences in REE levels among the plant species. The purpose of this study was to compare the REE concentrations in plant samples collected at different sites in the acid mine drainage area in south-central Poland with typical REE content in plant material and to assess their REE accumulation potential. Twenty-six samples of above-ground parts of four vascular plant species *(Juncus effusus, Matricaria chamomilla, Salix alba* and *Tussilago farfara*) and two moss species (*Pleurozium schreberi and Drepanocladus aduncus*) were collected in 2015 and 2016 in the study area. The samples were rinsed with distilled water, air-dried, ground and digested in a closed microwave system using HNO_3 (1:1)/H_2O_2 solution in the ratio of 8 ml/1 ml. The digested samples were analyzed for REE using ICP-QMS instrument (model ELAN DRC II, PerkinElmer). Accuracy of the measurement was assessed with two plant-matrix reference materials: NIST 1573a (Tomato leaves) and NIST 1575a (Pine needles). Most of the plant samples showed total REE concentrations in the range of 69–3413 µg/kg. Only two moss samples and one sample of vascular plant (*T. farfara*) were extremely enriched in REE (23, 066-28, 133 µg/kg). The study showed that plants growing in temporary submerged conditions more efficiently took up and accumulated an excessive amount of REE. High levels of REE in moss species showing high ion adsorption/desorption capacities may be important for reclamation of abandoned tailings piles by revegetation or REE recovery.

Biography

Agnieszka Gałuszka is an Environmental Geochemist specializing in geochemical background assessment. Her research interests focus on determination of trace elements in different environmental samples (e.g. waters, soils, sediments, plants etc.) and on pinpointing possible sources and the fate of these elements in the environment with the emphasis on anthropogenic pollution. Her publications cover a wide range of topics from case studies on environmental quality oriented issues, acid mine drainage, mineralogy, to green analytical chemistry.

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