

Summary of the doctoral dissertation

“Assessment of the impact of road traffic on the content of rare earth elements in selected herbaceous plants species”

The main goal of the doctoral dissertation was to assess the efficiency of phytoextraction of rare earth elements (REEs) by selected herbaceous plants species growing along the roads of Wielkopolska region. Due to the complexity of this issue, attention was focused on determining the share of light and heavy REEs in the total amount of these elements accumulated by plants. Moreover, a preliminary assessment of the way of their uptake and distribution inside the plant depending on the species was made. The research was also extended to identify potential sources of REEs close to the roads and to determine the correlation between the intensity of road traffic, the concentration of rare earth elements in the soil and their content in herbaceous plants.

Studies were carried out based on research material collected near the selected roads in Wielkopolska region. The experimental material consisted of 7 species of herbaceous plants: *Achillea millefolium* L., *Artemisia vulgaris* L., *Cichorium intybus* L., *Papaver rhoeas* L., *Taraxacum officinale* F. H. WIGG, *Trifolium repens* L., and *Tripleurospermum inodorum* (L.) Sch. Bip., but also soils samples collected near roads and road dust. Due to identifying potential sources of REEs near the roads, summer and winter car tires, brake pad materials and asphalt parts were also analyzed.

It was unequivocally found that light REEs dominate the total amount of these elements, both in soils and in herbaceous plants. The reduction in the efficiency of REEs phytoextraction for the studied plant species was correlated with a decrease in the concentration of these metals in the soil and the distance from the road edge. *Taraxacum officinale* was the only one among the studied plant species to show a significant correlation between the concentration of REEs in the soil and its content in its biomass, while *A. vulgaris* and *P. rhoeas* were characterized by an effective translocation of REEs to leaves, emphasizing the practical characters of studies. Cerium and neodymium were the dominant light REEs among the determined REEs, while erbium was in the heavy REEs group. It is worth emphasizing that the correlation between road traffic and the concentration of REEs in the soil pointed to the potential risk of transporting this group of elements to plants and different areas from the road.

The obtained results also indicated that the primary source of REEs related to road traffic was the abrasion of asphalt due to its mass and the content of elements. Despite the lower content of REEs but greater weight, car tires release more significant amounts of REEs during their abrasion than the brake pad materials.

Key words: metals accumulation; asphalt; phytoextraction; traffic intensity; brake pad materials; rare earth elements; road dust; herbaceous plant species; perennial plants; traffic pollution

Patrycja Mieczek