LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2024

DOCTORAL RESEARCH TOPIC:

The effects of environmentally friendly biological additives on the efficiency of phytoremediation of metal-contaminated soil and recovery of the health of soils

RESEARCH FIELD:

Environmental Engineering (T 004)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

Heavy metals soil pollution has become a serious threat to the environment and human health. Soil contamination by heavy metals alter soil functioning and health impairing the provision of ecosystem services. Heavy metals enter the environment by natural as well as anthropogenic processes. Industry, transport, agricultural fertilizers and pesticides, municipal and industrial waste, wastewater and sewage sludge are the main anthropogenic metal sources. Globally there are more than 10 million sites contaminated with heavy metals (US EPA, 2014). In Europe, more than 2.8 million potentially contaminated sites are estimated, of which ~342,000 requiring remediation and most of these sites are contaminated with heavy metals (Panagos et al., 2013; Payá Pérez and Rodríguez Eugenio 2018).

Variety of different technologies are used for the remediation of heavy metals contaminated sites including chemical, physical and biological methods. Traditional methods are costly, could cause secondary pollution and/or exhibit negative impact on soil properties rending the soil useless for plant growth (Lim et al. 2016). The success of remediation encompasses heavy metal removal from the soil and the recovery of soil health, defined as the ability of the soil to perform its functions. Therefore, sustainable contaminated soil remediation management should contribute to EU soil strategy for 2030 and are critical to achieving SDGs (Lal et al. 2021).

Phytoremediation has been recognized as cost effective and environmentally friendly method for contaminated soils remediation, however it is restricted by long duration, species sensitivity to pollution, plant performance and biomass production, environmental factors. To overcome these limitations and accelerate remediation different approaches could be used. However not all of them are sustainable, environmentally friendly and contributing to soil heath recovery.

The main aim of this research will be to determine the possibilities and regularities of using various environmentally friendly additives (e.g., biochar, microorganism inoculums, surfactants) to increase the efficiency of phytoremediation of metal-contaminated soil and restore soil health. Combining the cleanup of contaminated areas with the processing of the obtained biomass into bioenergy and the restoration of the soil health not only reduces soil pollution, improves its health, but also solves the issue of contaminated biomass disposal, which significantly reduces the financial costs of remediation.

The main objectives:

- Investigate the effects of various environmentally friendly additives (e.g., biochar, microorganism inoculums, surfactants) on phytoremediators and soil;
- Determine the effect of various environmentally friendly additives (e.g., biochar, microorganism inoculums, surfactants) on the efficiency of heavy metal remediation;
- Evaluate the impact of various environmentally friendly additives (e.g., biochar, microorganism inoculums, surfactants) on soil health during the phytoremediation process. Soil health assessment will be based on physico-chemical and ecotoxicological indicators.

SCIENTIFIC SUPERVISOR:

Dr. Jūratė Žaltauskaitė
Laboratory of Heat-Equipment Research and Testing

Lithuanian Energy Institute
Breslaujos 3, 44403 Kaunas
Lithuania

Jurate.Zaltauskaite@lei.lt

More information and the full list of offered PhD topics available at our website

https://www.lei.lt/en/phd-studies/