



DOCTORAL RESEARCH TOPIC:

Nano-phytoremediation of soil heavy metals
using energy crops

RESEARCH FIELD:

Environmental Engineering (T 004)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

Soil heavy metal (HM) pollution is a global environmental problem that poses a critical threat not only to the state of ecosystems but also to humans (Huang et al., 2019). HM can be controlled with permissible limit values, but unfortunately HM can have adverse effects even when maximum allowable concentration are not exceeded. When solving environmental pollution problems, it is necessary to apply advanced management technologies, environmental engineering, nature-based solutions (NBS) are increasingly being relied upon. One of the methods of managing such contaminated soils is phytoremediation. Compared to traditional methods, it has economic and energetic advantages, and has a lower impact on the environment. In order to solve the issue of contaminated biomass disposal and reduce financial costs, an integrated sustainable method is proposed, which complies with the principles of the circular economy, combining the cleaning process with the biomass's conversion into energy, i.e. i.e. the use of energy crops (Wang et al., 2019). A big advantage is that soil intended for growing energy crops is not subject to national legal limit values related to the amount of HM.

When nanotechnologies are applied further to enhance the phytoremediation process, a novel approach known as nano-phytoremediation is created. Various nanoparticle additives (e.g. CuO, TiO₂) can improve biomass growth of energy plants (due to improved biochemical parameters), increase HM bioavailability and cleaning efficiency, reduce duration. However, the practical application is not well studied, there is a great lack of information about the effect of nanoparticles on the efficiency and energy potential, the duration of the process. There is also a need for more scientific research on this topic, since the use of phytoremediation of energy plant monocultures poses a risk of soil degradation (Pandey et al., 2016).

The purpose of the research is to investigate how selected nanoparticles can improve the phytoremediation of soil contaminated with heavy metals using energy plants.

Tasks:

1. To investigate how nanoparticles affect the bioavailability of heavy metals.
2. To investigate the influence of nanoparticles on plants growth.
3. To investigate the effect of nanoparticles on the efficiency of phytoremediation.
4. To prepare recommendations for soil HM nano-phytoremediation.

SCIENTIFIC SUPERVISOR:

Dr. Marius Praspaliauskas
Laboratory of Heat-Equipment Research and Testing

Lithuanian Energy Institute
Breslaujos 3, 44403 Kaunas
Lithuania

Marius.Praspaliauskas@lei.lt

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