1. Raziskovalna organizacija (*Research organisation)*:

Univerza v Ljubljani, *Biotehniška fakulteta*

2. Ime in priimek mentorja (*Name and surname of a mentor*):

Domen Leštan

3. Področje znanosti iz šifranta ARRS (*Primary research field*):

4 BIOTEHNIKA, 4.03 Rastlinska produkcija in predelava, 4.03.02 Tla in mikroklima

4. Kontaktni e-naslov mentorja (*Contact of a mentor)*:

domen.lestan@bf.uni-lj.si

5. Kratek opis programa usposabljanja (*Short description of the program)*:

SLO: Varnost, kakovost in ekosistemski servis s kovinami onesnaženih tal po remediaciji

Onesnaženost tal z nevarnimi kovinami je pereč svetovni okoljski in zdravstveni problem zato že dve desetletji intenzivno potekajo raziskave učinkovitih metod remediacije. Tehnologije na osnovi kelatnega liganda etilendiamin tetraacetata (EDTA) so se izkazale kot potencialna možnost za trajnostno remediacijo tal zaradi nizke toksičnosti EDTA, visoke učinkovitosti odstranjevanja kovin iz tal oziroma zmanjšanja njihove biodostopnosti in relativno nizke cene kelatnega liganda. Razvili in mednarodno patentirali (Leštan (2015) US Patent 9108233) smo tehnologijo remediacije pri kateri se v pH gradientu reciklira in v zaprti procesni zanki uporabi tako EDTA kot očiščene procesne vode. Vendar pa remediacija vpliva in spremeni funkcioniranje tal. Tla so samo-organiziran sistem, kjer se strukture in procesi medsebojno podpirajo. V remediiranih tleh bi na primer invazivne vrste lahko neenakomerno ojačale specifične funkcije tal na način, ko tla ne bi bila več sposobna vzdrževati dinamičnega ravnotežja. Motnje v specializiranem mutualističnem prehrambenem spletu bi v pranih tleh lahko zmanjšale ekološko učinkovitost izrabe naravnih virov. Življenje v tleh je zgoščeno v poroznih prostorih; pranje tal zmanjšuje naravno strukturiranost, ki je pomembna za talne organizme. Program usposabljanja MR na te aspekte remediacije tal deloma odgovarja s sledečimi raziskovalnimi cilji:
1.) Z remediacijo tal z EDTA učinkovito zmanjšati koncentracijo onesnažil in tveganja zaradi onesnaženosti.
3.) Zagotoviti in raziskati okoljsko varnost remediiranih tal.
4.) Vzpostaviti zdrav (agro)ekosistem, sposoben vzdrževanja talne flore in favne.
5.) Raziskati proizvodnjo hrane in rastlinskega vigorja na remediiranih tleh.
6.) Raziskati zmožnost remediiranih / revitaliziranih tal za izvrševanje ekosistemskih funkcij in servisa.
V raziskavah bomo uporabili s Pb onesnažena karbonatna tla iz Mežiške doline in kisla tla iz Podkloštra v Avstriji.

ANG: Safety, quality and ecosystem services of toxic metals containing soils after remediation

Soil contamination with metallic contaminants is a persistent world-wide environmental and human health problem. Intensive search for effective remedial solutions has been undergoing in past two

decades. Ethylenediamine tetra-acetate (EDTA)-based washing technologies emerged as potential soil-preserving option because of low EDTA toxicity, high efficiency for toxic metal removal and bioaccessibility stripping and relatively low price. We developed and internationally patented (Lestan (2015) US Patent 9108233) soil remediation technology in which chelant (EDTA) and cleansed process waters are recycled and reused in a closed cycle. However, soil functions are altered and disturbed in remediated soils. Soils are a self-organising systems where structures and processes mutually reinforce themselves. Invasive species, for example, may disproportionally enhance one function in a way that the soil system no longer sustains its dynamic equilibrium. Disturbance of specialised mutualistic food webs in washed soil could lower the efficiency of feeding on natural resources. Life in soil is concentrated in a porous spaces; soil washing decreases natural soil structural porosity, which is important for soil organisms. The following objectives of the Ph.D. research program will in part address these aspects:

1.) To effectively relieve contaminated soils of pollutants and potential hazards using EDTA remediation technology.
2.) To impose and assess the environmental safety of remediated soil.
3.) To re-establish a healthy (agro)ecosystem capable of supporting flora, fauna, and microbial life.
4.) To study food production and assess plant fitness on remediated soil.
5.) To assess ability of remediated/revitalised soil to perform multiple ecosystem functions and services.

The Pb contaminated calcareous soil from Meza Valley, Slovenia, and acidic soil from Arnoldstein, Austria, will be used in experiments.