POSIDON

POLLUTED SITE DECONTAMINATION PCP

ENVIT

Project Phase Abstract

POSIDON has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.776838

Public Description of the Project

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Bidder Details	Type/ size of legal entity	Place of performance of contract activities	Logo
Main contractor ENVIT Ltd. Tržaška cesta 330 1000 Ljubljana Slovenia Neža Finžgar 00386 41 344 198 neza.finzgar@envit.si	SME	% of contract value allocated to main contractor: 50% % of activities for the contract performed by the main contractor in EU Member States or countries associated with Horizon 2020: 100 %	
Other consortium member(s) (if applicable) ARHEL Ltd. Pustovrhova ulica 15 1210 Ljubljana – Šentvid Slovenia Marko Gerl 00386 5 992 4819 info@arhel.si	SME	% of contract value allocated to contractor ARHEL: 50% % of activities for the contract performed by contractor ARHEL in EU Member States or countries associated with Horizon 2020: 100 %	

Project abstract *(4000 characters maximum)*

The aim of project proposal is to develop novel two-stage remediation method for sustainable and cost-efficient removal of Pb, As, heavy fractions of petroleum (PH) and polyromantic hydrocarbons (PAHs) from contaminated soils.

In the Stage I the ethylenediamine tetraacetate (EDTA) will be used for ex situ on site soil extraction and removal of Pb and other toxic metals by chelation. EDTA forms strong surface iron-chelate complexes, replaces As from the binding sites on soil Fe (oxy)hydroxides and causes non-reductive

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dissolution of Fe (oxy)hydroxides and As release. Imposing reducing conditions by addition of Na dithionite enhances As release by reductive dissolution of As bearing Fe (oxy)hydroxides. EDTA and process waters will be recycled in a closed process loop. The alkalinity imposed by lime (CaO) destabilizes EDTA chelates with toxic metals. Consequently, toxic metals are replaced in the EDTA chelate by Ca and participate from the reaction as insoluble hydroxides. To shift the chemical equilibrium further towards product formation the alkaline adsorption of released toxic metals on polysaccharide materials (waste paper) is introduced for the substitution/ adsorption/ precipitation reaction. The alkaline part of the process yields the majority of recycled EDTA. The remaining EDTA is recycled in insoluble acidic form after addition of sulfuric acid. Excess SO_4^{2-} from the acidic and Ca^{2+} from the alkaline process forms insoluble gypsum ($CaSO_4$) which is removed with the remediated soil (patents US 9108233B2, EP 3153246B). The PH and PAHs will be simultaneously extracted from soil using surfactants. Arsenic, PH and PAHs will be removed from process waters simultaneously with Pb and other toxic metals by undisclosed patentable process. No waste water or other emissions will be generated from Stage I of novel remediation method.

EDTA / Na dithionite / surfactant soil washing and Pb, As, PH and PAHs removal in Stage I of novel two-stage remediation method will preserve soil as living and productive natural substrate. The residues of dithionite, PH and PAHs in Stage I soil will be further removed by in situ bioremediation in Stage II. For bioremediation the spent mushroom compost available after production of edible ligninolytic fungi, slow oxygen releasing compounds and phytomanagement will be applied. Residual PH and PAHs will be mostly biodegraded. Fungal ligninolytic enzymes also induce partial oxidation (radicalisation) of aromatic rings of PAHs and co-polymerisation with soil organic matter until chemical identity of recalcitrant PAHs is lost.

Overall the following characteristics will distinguish our unique, novel two-stage remediation method from currently commercially available remediation technologies and will be exploited and pointed out in our further commercialisation plans:

- Efficiency. Our novel two-stage remediation method is designed to remove the three most urgent and omnipresent categories of soil pollutants: Pb (and other toxic metals), As and recalcitrant organic pollutants:
- Sustainability. Our novel method preserves soil as a living natural substrate, soil functions and ecosystem services.
- Versatility. Our novel method enables the treatment of soils with very different properties, from sandy to more clayish soil types.
- Environmental safety. Our novel method generates no waste waters and produces no toxic emissions – it is suitable for deployment in sensitive i.e. urban environments.
- On site operation. Our novel method requires no existing infrastructure and can be deployed directly on brownfields / contaminated sites to reduce the soil transportation cost.
- Cost efficiency. Our method recycles the main reagent (EDTA) / process waters and uses low cost auxiliary materials (quick lime, Na-dithionite, sulfuric acid, waste paper, surfactant, mushroom compost etc.).

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