Innovative Toolbox for Microbiome-based Soil Remediation

MIBIREM

PROJECT SUMMARY

Contaminated sites pose a significant risk to humans and the environment. Innovative cleaning technologies are needed to remediate these sites and remove contaminants such as cyanides, hexachlorocyclohexane (HCH) and petroleum hydrocarbons (PHC).

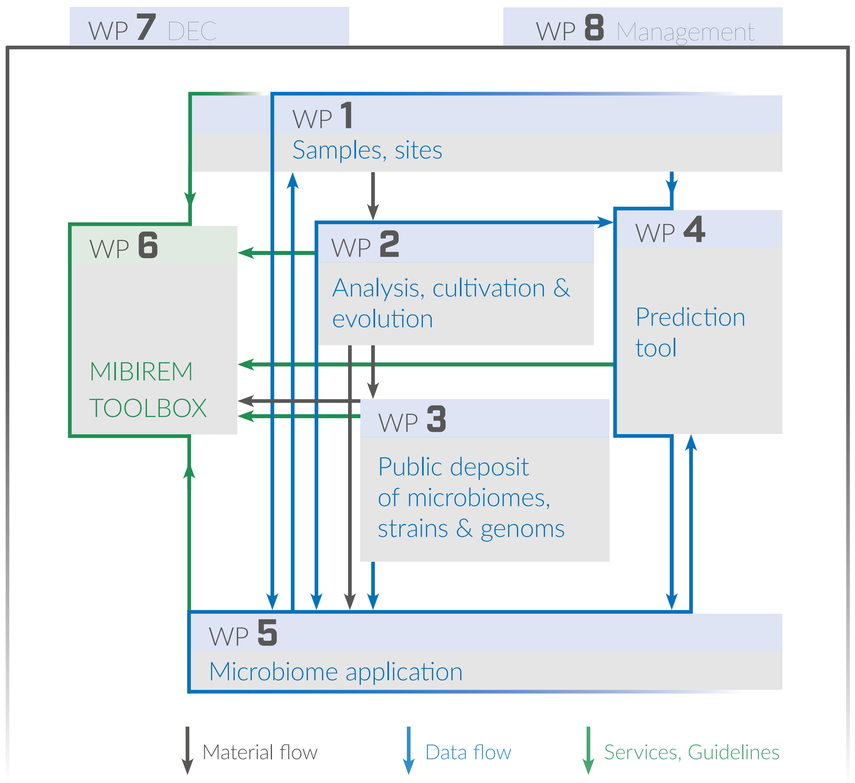
Bioremediation uses living organisms like bacteria and other microbes, to digest and neutralise environmental contaminants. Like the microbiome (=community of microorganisms in a particular environment) in the gut, which supports the body in digesting food, microbiomes in contaminated sites can produce enzymes that degrade organic contaminants in soil and groundwater.

The MIBIREM project will exploit microbiomes by developing a unique and innovative technological toolbox for microbiome-based bioremediation to clean up contaminated sites across Europe.

Approach for microbiome analysis & bioremediation application

Biological methods using bacteria for degradation of organic contaminants are an under-exploited alternative to conventional remediation methods; they are slower but more cost effective and eco-friendly: no net water extraction; no waste and no on-site treatment plant or transport (CO_2-footprint).

To implement this the unique **'MIBIREM approach'** has been designed, detailing all necessary steps as depicted in the graphic.



Samples from contaminated sites will be taken to analyse the microbiome (metagenome) together with standard physico-chemical site assessment. Microbiomes active in degradation will be identified and characterised through bac-traps, community analysis, enrichment cultures, degradation tests in microcosms, functional shotgun sequencing and stable isotope probing (SIP). Single bacterial strains will be isolated from active microbiomes, sequenced to better characterise them and then deposited. In parallel degrading microbiomes will be further improved by laboratory evolution and selected strains combined in artificial microbiomes. Whole microbiomes will also be deposited. A **prediction tool** will be developed based on the combined hydrogeological, chemical, geophysical and biological data to better understand and guide bioremediation. This tool will then be used together with the most promising microbiomes for upscaling and pilot tests in the field. The services, resources and protocols developed and applied will be combined in the **innovative MIBIREM TOOLBOX.**

MIBIREM is focusing on industrial or other non-agricultural land where contaminations are local, but highly concentrated. Post-project, the MIBIREM approach and the TOOLBOX can be applied for other applications of bioremediation.

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OBJECTIVES

1 Make sample taking & treatment, site selection & access, plus data management easy and comparable through harmonised methods and protocols.

2 Enable access to highly active degraders in the microbiome by identifying, analysing, isolating and cultivating them.

3 Facilitate access to bioremediation bacteria & microbiomes, their genomic information and metadata by sequencing and publicly depositing them.

4 Support decision-making on whether and how bioremediation can be applied through an IT modelling tool which integrates microbiological, chemical, hydrological and physical data & processes.

5 Bring microbiomes into application by large scale analysis of their degradation potential & safety, scale-up production & processes and field tests.

6 Ensure that the MIBIREM toolbox fulfils regulatory requirements and addresses market needs.

IMPACT

- Bioremediation is 20-50% cheaper than current practice
- Bioremediation emits 70-90% less CO_2 emissions than conventional remediation technologies
- The bioremediation market has huge potential, growing 105% faster than the conventional remediation market
- 20,000-26,000 sites in Europe are suitable for immediate bioremediation

PROJECT FACTS

- Start: 1 October 2022
- End: 31 March 2027
- Duration: 4.5 years
- Consortium: 11 partners
- Funding programme: Horizon Europe
- EU funding: €6 Mio.

PARTNERS

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