



European
Circular Economy
Stakeholder Platform

#EUCircularTalks

Bioremediation

as an effective tool
for a clean environment



September 2023 - REPORT

Introduction

Bioremediation is an effective tool for the circular economy due to its ability to address environmental pollution while promoting resource recovery and sustainability. Bioremediation employs living organisms, such as bacteria, fungi, or plants, to break down or neutralize pollutants in the environment. By utilizing natural processes, bioremediation can restore contaminated sites, including soil, water, and air, to their original or improved condition. This restoration reduces the negative impact of pollution, conserves ecosystems, and enhances biodiversity, all of which are crucial components of the circular economy.

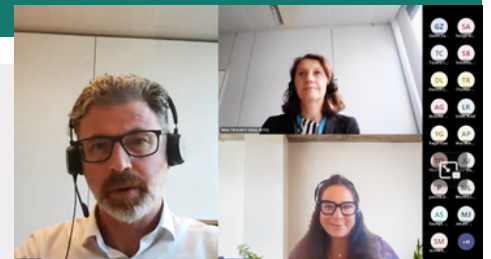
Many pollutants found in the environment contain valuable resources that can be recovered and reused. Bioremediation can facilitate the extraction of these resources from contaminated materials. For example, microorganisms can be used to extract metals from industrial waste or wastewater, allowing for the recovery of valuable metals that can be reintroduced into the production cycle. This approach minimizes waste generation, reduces the need for new resource extraction, and contributes to a more circular use of resources.

Bioremediation offers an environmentally friendly alternative for treating and managing various types of waste, including organic waste, petroleum products, and hazardous materials. Microorganisms can metabolize organic compounds, such as oil spills or agricultural residues, converting them into less harmful substances.

Unfortunately it is not a well-known solution so we aim to build awareness and educate a broad audience about Bioremediation efficiency and advantage.

Format of the debate

The debate was divided into two parts.



The first was educative, presenting the **Bioremediation principles and techniques** used to remove pollutants from soil and water by remarkable experts from various academic institutions.

Giulio Zanarli, Associate Professor from the University of Bologna, gave the opening remarks. Presentation of the subsequent techniques followed his presentation:

- Biomodeling microbiome solutions, Prof. **Marco Candela** (PhD), Department of Pharmacy and Biotechnology, University of Bologna, Italy
- Vermiremediation, **Marcus Horn**, Professor for Soil Microbiology, Leibniz University of Hannover (presentation)
- Electrobioremediation, **Sebastià Puig**, Assoc. Prof., Universitat de Girona (presentation)
- The inherent capacity of surrounding macrophytes and their hidden allies for phytoremediation, **Blanca Velasco Arroyo**, University of Burgos (presentation)
- Bioremediation of Polluted Freshwater: A Symbiotic Relationship between Mussels and Macrophytes on a Floating Platform, Dr **Tiziana Centofanti**, ALCHEMIA NOVA, Austria (presentation)

Dr **Silvia Maltagliati** from DG RTD and **Cillian Lohan** from the European Economic and Social Committee brought the policymaking aspect to the event.

The second part was a panel discussion with coordinators of four Horizon Europe projects in the field: Nympe, MIBIREM, Symbioreme, Blosysmo.

Awareness/opinion questions to the audience

During the event, the organisers asked four questions to the audience. The questions and the results fed in the expert panel discussion.

1. Have you heard of the term "bioremediation" in relation to soil health and good water quality?

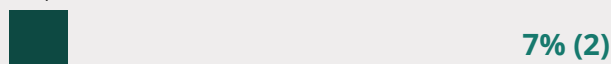
Yes and I'm familiar with its applications



Yes, but I'm not entirely sure what it entails



No, I haven't heard of it before



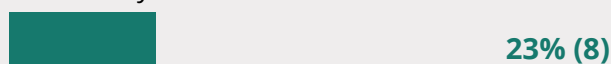
27 responses

2. How concerned are you about pollutants (industrial pollutants, pesticides, heavy metals and hazardous chemicals) and their impact on the environment, especially soil and water?

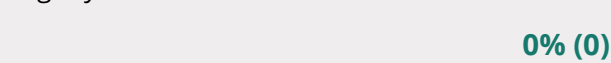
Very concerned



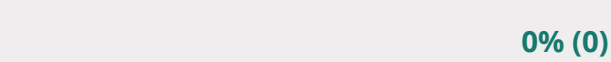
Moderately concerned



Slightly concerned



Not concerned



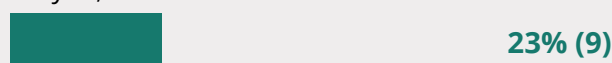
34 responses

3. Do you believe that bioremediation, the use of living organisms, bacteria, and plants to clean contamination, can be an effective solution for cleaning up contaminated soil and improving water quality?

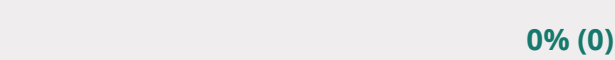
Yes, I believe it's a promising approach



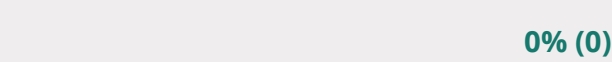
Maybe, but I have reservations



I'm undecided



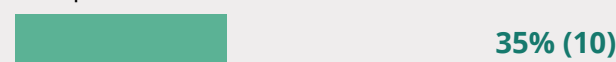
No, I don't think it is effective



39 responses

4. How much trust do you have in the safety and effectiveness of bioremediation methods?

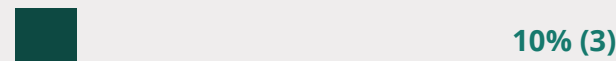
Complete trust



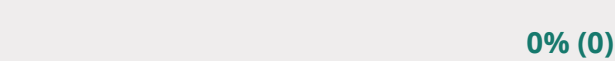
Some trust, with reservations



I'm uncertain



Little trust



28 responses



Questions from the audience to the panel experts

During the #EUCircularTalks events, the audience can use the chat to ask their questions directly. Hereunder are some of the questions. Panel experts covered most of the questions during their presentations or the follow-up discussion.

Recording of the session and all presentations are available from the [event webpage](#).

- What is special in your Horizon project, could you describe what is the main research behind, what distinguish it?
- Are Bioremediation methods safe for the environment?
- What are the barriers for commercial implementation? What should be done to support scaling up this solution?
- Do you think that government agencies should invest more in bioremediation research and implementation as bio-based technologies?
- What is your opinion regarding using genetically modified organisms (GMOs) to improve and accelerate bioremediation processes?
- How do these approaches meet the needs of developing countries in Asia and Africa?
- Which industries will this be of benefit for?
- How can these processes restore long-time synthetic fertilized soils and wipe toxic residuals? How to test it?
- What do we know about the energy balance of bioremediation versus traditional methods, and eventual sub-products generated, e.g. carbon dioxide and other gases linked with greenhouse effects?



Main takeaways

- Bioremediation relies on natural processes and biologics to break down and remove contaminants from the environment, making it a **safe and sustainable method** for cleaning up contaminated sites.
- IT is a safe, effective method which can be competitive with conventional techniques to **remove pollutants** from the environment
- Bioremediation is **cost-effective**: compared to traditional remediation methods, such as excavation and disposal, bioremediation can be more cost-effective, reducing overall project costs.
- Bioremediation helps to **restore ecosystems** affected by pollution, such as wetlands, streams, and forests. It improves ecosystem health and supports biodiversity.
- Bioremediation supports a circular economy approach to resource management by **recovering valuable resources** from contaminated soil or water.
- There is still more research needed to develop scaling-up solutions and improve the efficacy of various techniques.
- It still uses pilot sites and is far from using it on a mass scale. There is a need for effective exploitation and promotion of bioremediation solutions.
- Very important is ensuring the continuity of the projects with founding, proper multidisciplinary research teams and broad stakeholders' involvement.

Conclusions

Bioremediation is an up-and-coming technique to tackle environmental pollution, but still needs further research. Some development is required for scaling up and implementation on a broad mass scale.

The majority needs to become more familiar with this area of science and its potential solutions for a clean environment. For those aware, there are still some concerns regarding efficiency and safety. Safety measures and environmental issues must be taken seriously, and the general public needs more education.

In the EU, there is good cooperation between different research centres in the field. We see good cooperation and support among various projects on Bioremediation in the Horizon project.

Although there is little partnership with other parts of the world, little is known about bioremediation development outside the EU.

Thanks to our organisers and panelists

- Agnieszka Sznyk, INNOWO
- Giulio Zanaroli, Associate Professor, University of Bologna
- Dr. Silvia Maltagliati, Policy Officer, DG RTD
- Cillian Lohan, European Economic and Social Committee
- Prof. Marco Candela (PhD), Department of Pharmacy and Biotechnology, University of Bologna
- Marcus Horn, Professor for Soil Microbiology, Leibniz University of Hannover
- Sebastià Puig, Assoc. Prof., Universitat de Girona
- Blanca Velasco Arroyo, University of Burgos
- Dr. Tiziana Centofanti, ALCHEMIA NOVA, Austria
- Giulio Zanaroli, UNIBO, NYMPHE Coordinator
- Dr. Thomas Reichenauer, MIBIREM Scientific Coordinator
- Dr. Leire Ruiz Rubio, SYMBIOREM coordinator
- Lila Otero, BIOSYSMO coordinator

12 Sep 2023



Bioremediation as an effective tool for a clean environment

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Scope: EU
Organising Body: INNOWO Biosysmo
SYMBIOREM ECLAS
Electra MIBIrem Nympha Greener

Bioremediation, the process of using living organisms to break down environmental pollutants, has real potential for the circular economy. It could help address environmental pollution while promoting resource recovery and sustainability.

The process also supports more circular use of resources, minimises waste generation and reduces the need for resource extraction.

On 12 September, the ECESP Leadership Group on Bioeconomy will bring together an expert panel to discuss ways to clean up the environment using this nature-based solution and achieve zero-pollution. Participants will learn how to reduce microplastics and pharmaceuticals contamination in the soil and water. Our experts will present innovative bioremediation solutions and how to implement them sustainably.

<https://bit.ly/45UnAnc>