

BIOREMEDIATION SYSTEMS EXPLOITING SYNERGIES FOR IMPROVED REMOVAL OF MIXED POLLUTANTS

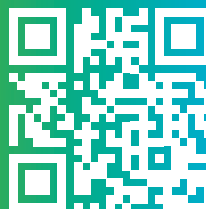


NEWSLETTER

ISSUE 4, AUGUST 2024

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1. BIOSYSMO SHORT UPDATE FROM COORDINATOR



BIOSYSMO INTERVIEW

**Dr. Sara Gil
Guerrero**



We are excited to welcome Dr. Sara Gil Guerrero as the new project coordinator for the BIOSYSMO project. Sara has an extensive background in computational chemistry and chemoinformatics, particularly in their application to biotechnology. As part of her work at IDENER, she previously contributed to the BIOSYSMO project with the ecotoxicity evaluation of pollutants of interest using *in silico* methodologies, as part of an integrated task with partners from UBU and LEITAT.

As we reach the 24-month milestone, Sara's leadership promises to drive the project toward its ambitious goals, ensuring impactful and sustainable outcomes for environmental health. In this issue, Sara shared with us her vision, strategies, and insights, highlighting the innovative approaches that are shaping the future of bioremediation through BIOSYSMO.

Question 1:

Now that the project has completed two years of progress, what specific topics and areas of research are the team currently focusing on?

As BIOSYSMO enters its third year, the project is transitioning from foundational research to applying and

refining its bioremediation strategies in real-world settings. With significant progress in developing computational models, optimising microbial consortia, enhancing plant-microbe interactions, and advancing bioelectrochemical systems (BES), the focus is now on practical applications. This involves testing the effectiveness of these biosystems in degrading pollutants from water, soil, and sediments, validating them through lab trials, and extending the best approaches to field trials for sustainable pollution removal. A key emphasis is on refining these systems using advanced computational models based on integrative databases, Hidden Markov Models (HMM), and genome-scale reconstructions, which are essential for simulating community-level interactions and guiding biosystem refinement. The project also aims to assess the ecological and economic impacts of these strategies, ensuring they can be scaled and adapted to various contaminated sites for broader environmental application.

Question 2:

As the project enters its third year, what are the most significant challenges that have emerged, and how have these shaped the research and collaboration within the consortium?

During the first two years of the BIOSYSMO project, the consortium faced several significant challenges that shaped the research direction and deepened collaboration among partners. One of the primary challenges was the logistical complexity of coordinating work across more than 13 polluted sites in five countries. Managing the collection and analysis of contaminants from these diverse locations required extensive planning

1. BIOSYSMO SHORT UPDATE FROM COORDINATOR

and communication, with TAUW, UBFC, CIIMAR, and UBU playing key roles in logistics, while CNRS developed interlaboratory protocols to ensure consistent and comparable analytical results. Another challenge was creating an integrative database, led by IDENER, which involved harmonising dispersed and inconsistent data from various public repositories into a coherent and usable resource, demanding close collaboration among partners specialising in computational tools and data management. The development of bioremediation systems also presented unique challenges, particularly in integrating efforts across partners. For example, creating synergistic biosystems, such as those combining fungi with genetically modified poplar or aggregating microbial consortia, required significant cooperation, facilitated through partner stays and exchanges that promoted hands-on collaboration and effective knowledge transfer. Streamlined cooperation among CIIMAR, UBFC/UFC, LEITAT, ICL, UBU, and UPM was vital in overcoming these obstacles. Additionally, BSY tackled the challenge of adapting Life Cycle Assessment (LCA) methodologies to these innovative bioremediation systems, focusing on refining databases and ensuring accurate environmental and economic impact assessments, crucial for validating the project's sustainability and scalability. Beyond these technical challenges, effective communication and dissemination have been essential, with EXELISIS and AXIA leading efforts to ensure BIOSYSMO's findings reach a wide audience, maintaining the project's visibility and fostering stakeholder engagement.

Question 3:

How do you envision the next steps in the project, and what key milestones do you hope to achieve as BIOSYSMO moves forward?

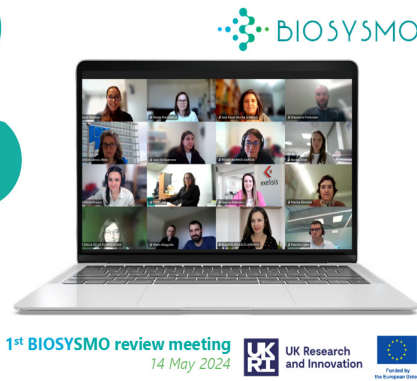
As BIOSYSMO progresses, the next steps will focus on demonstrating the practical effectiveness of the developed bioremediation technologies in real-world environments. A key milestone will be the successful execution of field trials, which will test the scalability and adaptability of the systems optimised in the lab. These trials are essential for refining the technologies and ensuring they perform well in diverse and uncontrolled conditions. As BIOSYSMO moves forward, expanding partnerships and engaging with stakeholders will be crucial to facilitating the transition from research to real-world application, ensuring that the innovations developed can be effectively implemented in various contaminated sites and are ready for broader adoption.

Question 4:

As the project moves into its next phase, what strategies are being employed to ensure the effective dissemination and practical application of the research findings across industry and academia?

The BIOSYSMO project is actively ensuring the dissemination and practical application of its research findings through key strategies, including participation in the Bioremediation Cluster, a network that unites leading environmental remediation projects. This involvement has fostered collaborations, such as with the MIBIREM project, enhancing knowledge exchange and innovation. BIOSYSMO has also contributed to policy briefs that tackle regulatory challenges, particularly concerning GMOs and microorganism inoculation. These briefs, shared with European regulatory bodies and industry leaders, advocate for supportive policies that enable the safe and effective deployment of advanced bioremediation technologies, thus bridging scientific research with industry practices and environmental policy.

2. REPORTING PERIOD 1 MILESTONE REACHED

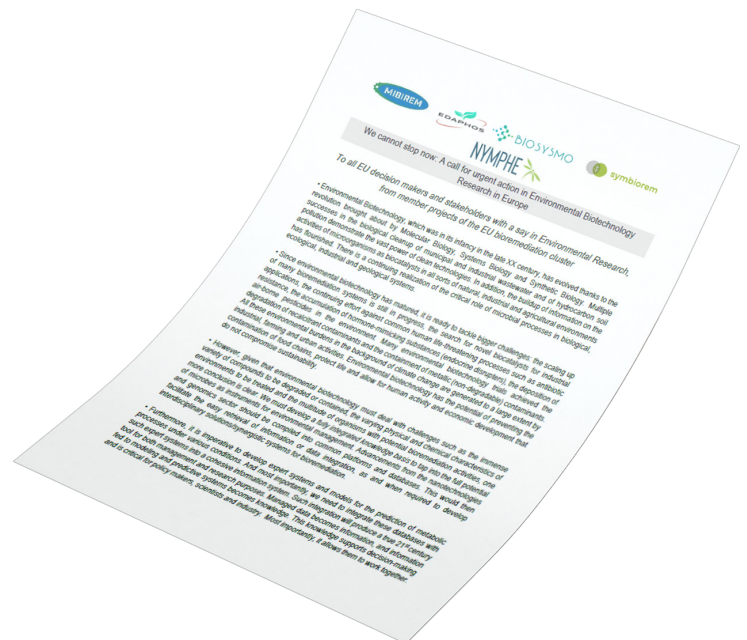


After a successful review meeting that took place online on 14th of May 2024, the BIOSYSMO team is pleased to announce that the periodic report has been successfully submitted. The team efficiently addressed all the necessary minor adjustments requested by the project officer, ensuring the report met the required standards. Concluding the first reporting period marks a significant milestone for the project. The team is enthusiastic about this achievement and eager to continue advancing the next stages of research and collaboration, driving BIOSYSMO closer to its overarching goals.

3. EU BIOREMEDIATION CLUSTER RELEASES A POLICY BRIEF

The EU bioremediation cluster through the collaboration of five key projects: MIBIREM, EDAPHOS, BIOSYSMO, SYMBIOREM, and NYMPHE, has recently developed a policy brief. This document explores the progress and potential of environmental biotechnology, which has been significantly enhanced by advances in molecular, systems, and synthetic biology. It highlights the urgent need for comprehensive databases and expert systems to integrate bioremediation data and strategies effectively.

The brief also emphasises the importance of increased funding for environmental biotechnology, recognising its essential role in public health, economic growth, and sustainability. It advocates for a stronger focus on bioremediation in EU research programs to ensure Europe remains a leader in this critical field, thereby preventing brain drain and maximising the benefits of green technologies.



The policy brief is announced on BIOSYSMO website [HERE!](#)

4. COLLABORATION WITH THE HORIZON RESULTS BOOSTER



HORIZON RESULTS BOOSTER

The BIOSYSMO Project, as part of the EU Bioremediation Cluster are working with the Horizon Results Booster service to enhance the dissemination and impact of their innovative bioremediation research. This European Commission service assists projects in maximising the visibility of their results by refining communication strategies, improving outreach, and engaging stakeholders. The collaboration aims to highlight real-world applications of bioremediation technologies for environmental issues like soil, water and groundwater contamination.

The Horizon Results Booster (HRB) will provide the cluster support to enhance its visibility and impact through six key

services: capacity building to improve communication and stakeholder engagement skills; creation of an engaging overview video to visually highlight projects' achievements; development of a concise overview fact sheet summarising key findings; assistance in designing a unified joint logo and name for cohesive branding; tailored content creation, including a custom fact sheet showcasing bioremediation success stories; and social media campaign support, by designing templates to ensure consistent and professional outreach across platforms. These services collectively aim to strengthen the dissemination and public engagement of the cluster's results.



5. BIOSYSMO SIGNS COLLABORATION AGREEMENT WITH MIBIREM

MIBIREM



BIOSYSMO and **MIBIREM** have formed a strategic partnership to enhance their research efforts in bioremediation technology development. This collaboration focuses on advancing (meta)genomic and (meta)transcriptomic studies of hexachlorocyclohexane degradation in environmental matrices, and potentially extends to the bioremediation of petroleum

hydrocarbons and cyanides. The partners will also engage in joint communication and dissemination activities, including cross-promotion on various platforms and co-authoring publications. Confidentiality and intellectual property rights are carefully managed, ensuring that all proprietary information and technologies are protected.

A few words about MIBIREM Project

The EU-funded MIBIREM project is focused on utilising microbiomes for the bioremediation of contaminated sites across Europe. The project aims to develop an innovative technological toolbox that harnesses the power of microbiomes to degrade soil and groundwater contaminants. This toolbox will include advanced molecular methods for monitoring, isolating, cultivating, and preserving entire microbiomes, providing new, effective ways to clean up environmental pollutants.



CHECK OUT THE MIBIREM'S **INFORMATIVE VIDEO** AND THEIR **LATEST NEWSLETTER**.

6. BIOSYSMO released the EU bioremediation cluster video

EXELISIS, the BIOSYSMO dissemination manager, has produced and released a video offering an overview of the EU bioremediation cluster projects. This video effectively summarises the six cluster projects (MIBIREM, EDAPHOS, BIOSYSMO, SYMBIOREM, ISLANDR and NYMPHE), showcasing the collaborative efforts and innovative approaches within the cluster. It highlights the key focus of each project and presents their logos, serving as a powerful tool to engage a wider audience, and raise awareness of the cluster's collective impact. The cluster agreed to share this video promoting the cluster workshop organised on 20th June, during the BIOBIO 2024 conference. The video can be found **HERE**.



7. BIOSYSMO TEAM ATTENDING MAJOR EVENTS

XIX OLIMPIADA AUTONÓMICA DE BIOLOGÍA DE CASTILLA Y LEÓN

On March 8, 2024, the University of Burgos hosted the Awards Ceremony for the “XIX Olimpiada Autonómica de Biología de Castilla y León” (19th Regional Biology Olympics). The event saw the participation of 256 high school students. As part of the ceremony, Dr. Rocío Barros, head of the ICCRAM-EST Research Group, delivered a talk titled “Toxin-eating bacteria,” which was closely related to the BIOSYSMO Project.



JOŽEF STEFAN OPEN DAY



On March 23, 2024, Jožef Stefan Institute (JSI) organised the Jožef Stefan Open Day as part of the annual “Stefan’s Days,” which celebrates the birthday of the renowned Slovenian physicist Jožef Stefan. The event concluded a week of activities and was held with the cooperation of various research departments and centers. It was open to the general public, offering insight into multidisciplinary research fields and the latest scientific advancements.

ENCONTRO DE INVESTIGAÇÃO JOVEM DA U.PORTO CONFERENCE

CIIMAR participated in the IJUP - Encontro de Investigação Jovem da U.Porto Conference, held from May 8 to 10, 2024, in Porto, Portugal. During this event, CIIMAR was actively involved in two poster sessions, where young researchers from the institute presented their latest findings. This conference serves as a platform for early-career researchers to showcase their work, exchange ideas, and engage with peers in various scientific disciplines.



7. BIOSYSMO TEAM ATTENDING MAJOR EVENTS

BIOBIO 2024

CIIMAR, UBFC, LEITAT, UBU, and IDE, actively participated in the BioBio 2024 - 7th International Symposium on Biosorption and Biodegradation/Bioremediation, held from June 16 to 20, 2024, in Prague, Czech Republic. This prestigious event brought together leading experts, researchers, and organisations to discuss the latest advancements in biosorption, biodegradation, and bioremediation technologies.



X NATIONAL SYMPOSIUM ON CONTROL OF SOIL DEGRADATION AND RECOVERY



The Universidad de Burgos (UBU) organised this year the X National Symposium on Control of Soil Degradation and Recovery (CONDEGRES), held from June 24-27, 2024, in Burgos, Spain. IDENER actively participated in the conference representing BIOSYSMO along with UBU. A poster and oral presentation were shared with the research community, alongside the distribution of promotional materials, including conference USB sticks.

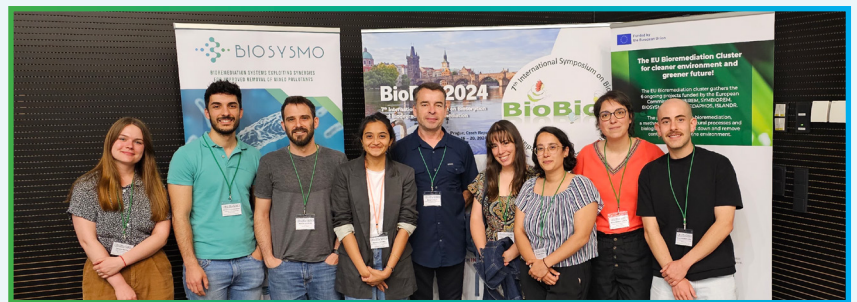
ENCONTRO NACIONAL CIÊNCIA 2024

CIIMAR participated in the Encontro Nacional Ciência 2024 conference, which took place from July 3-5, 2024, in Porto, Portugal. During the event, CIIMAR presented its cutting-edge research through a dedicated poster session. This event allowed CIIMAR to showcase its latest findings and contributions in the fields of marine and environmental science, fostering discussions and collaborations with other researchers within the Portuguese scientific community.



8. CLUSTER WORKSHOP AT THE BIOBIO 2024 (20 JUNE, 2024)

A workshop was organised by the EU Bioremediation Cluster, during the BioBio 2024 conference in Prague taking place between 16-20 June 2024. The workshop was organised on June 20, 2024, in plenary session. This event brought together our projects, namely BIOSYSMO, SYMBIOREM, MIBIREM, NYMPHE, EDAPHOS, and ISLANDR, while providing a platform for discussing recent advancements in bioremediation technologies. It featured presentations on cutting-edge research, case studies, and practical applications, followed by an expert roundtable aimed at fostering collaboration among EU bioremediation projects. Dr. Akanksha Mishra presented the BIOSYSMO project during the workshop.



During the conference a wide participation from the BIOSYSMO consortium was also reported with CIIMAR, UBFC, LEITAT, UBU, and IDE, participating with several oral and poster presentations.

**FOR THE EVENT A COMMON
DISSEMINATION BANNER WAS RELEASED
BY THE CLUSTER**

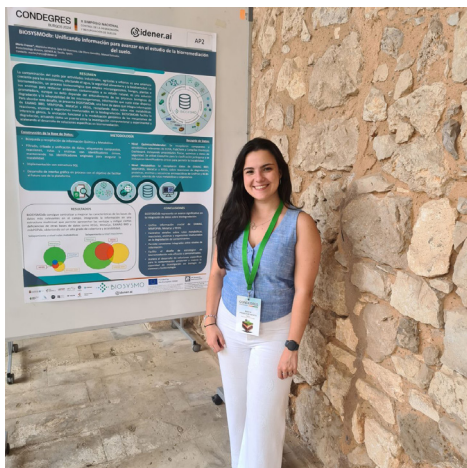


9. OUR PARTNER UBU ORGANISING THE CONDEGRES CONFERENCE



The University of Burgos (UBU) organised the Condegres Conference 2024, an important event focused on the control of soil degradation and recovery. This national symposium, held from June 24-27 in Burgos, Spain, brought together experts, researchers, and stakeholders to discuss innovative approaches, share research findings, and explore solutions for soil conservation. UBU's involvement underscores its commitment to advancing knowledge and promoting sustainable practices in

environmental management, furthering the impact of the BIOSYSMO project and related initiatives. BIOSYSMO participated in the dissemination corner of the conference with sponsorship. i.e. providing USB sticks to all conference participants. Moreover, Mrs Marta Franco de Benito, senior researcher at IDENER, attended physically the event where she presented the progress made in development of the BIOSYSMO database for constructing effective effective bioremediation systems for soil decontamination.



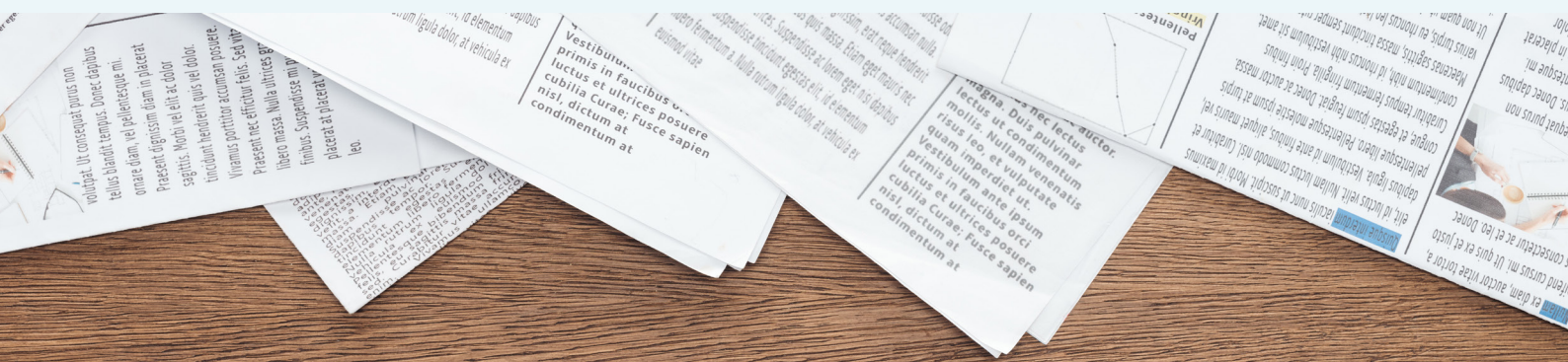
10. NEW BIOSYSMO PUBLICATION

A new publication was released by **TAUW GMBH** titled: Biostimulation of sulfate reduction for in-situ metal(loid) precipitation at an industrial site in Flanders, Belgium. Colleagues successfully stimulated native sulfate-reducing bacteria under high sulfate conditions, switching from iron-oxidising to strictly anoxic conditions using organic substrates. This triggered sulfate reduction, leading to in-situ removal of metal(loids) through the formation of biogenic mineral sulfides, confirmed by stable isotope analysis and mineralogical studies. Microbial amplicon sequencing and shotgun metagenomics identified the genus *Desulfosporosinus* as the primary sulfate reducer, showcasing its crucial role in the bioremediation process.

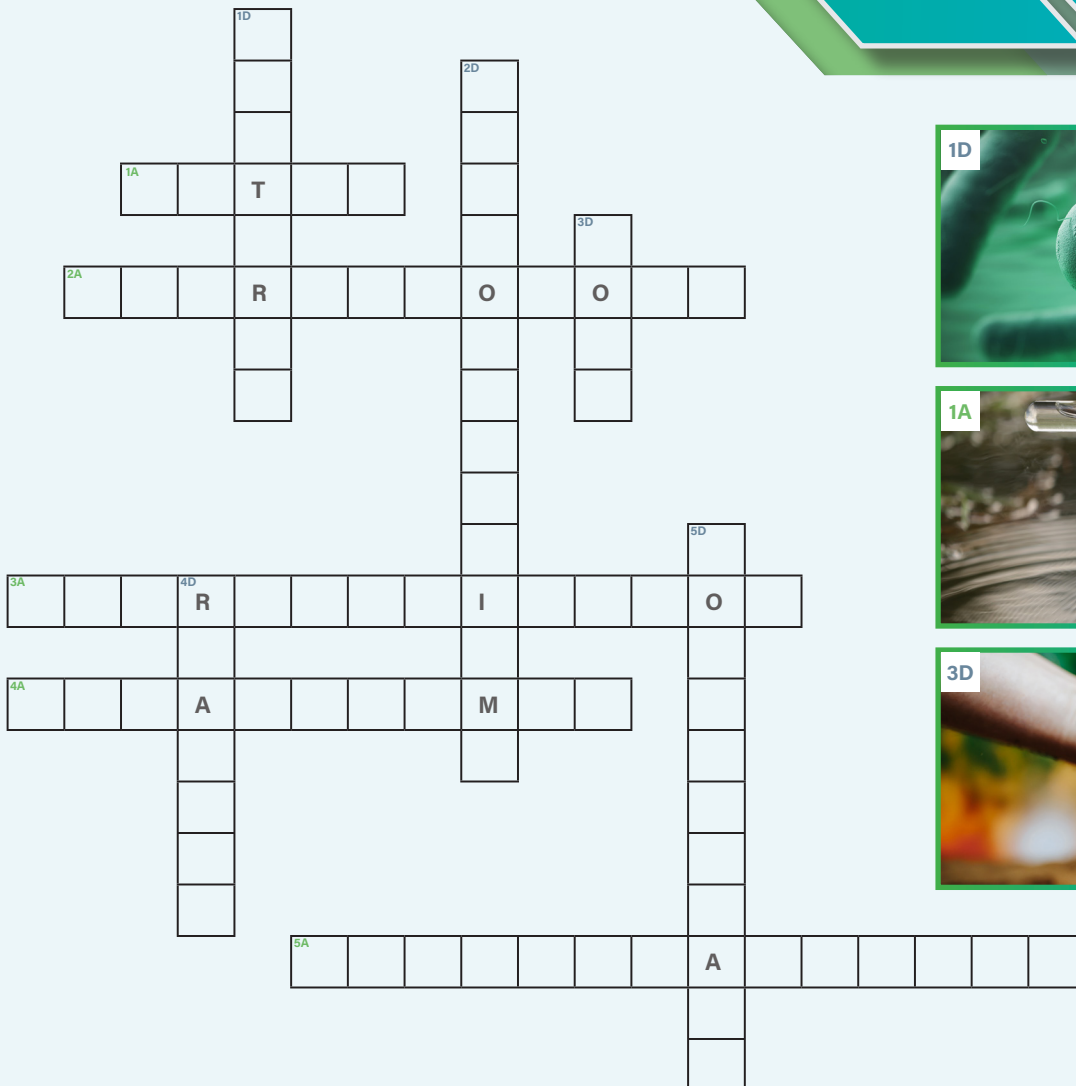


All publication deriving from the BIOSYSMO project can be found [here](#).

Moreover, a **BIOSYSMO Zenodo Community** is established to facilitate the open access sharing of research outputs and data generated by the BIOSYSMO project.



11. CROSSWORD TIME



Across

1A Often acting as a solvent but also as a transport medium for contaminants.

2A The science studying the microorganisms and their role in ecosystems.

3A BIOSYSMO focuses on this type of environmental cleanup using microorganisms.

4A Microorganisms are studied at this molecular level in BIOSYSMO.

5A The biological breakdown of pollutants through microbial activity.

Down

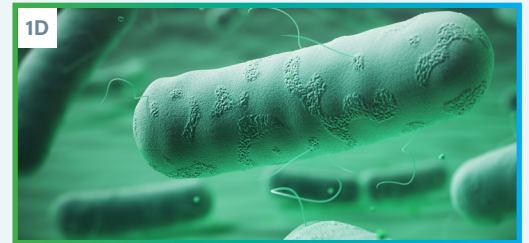
1D Small single-celled organisms used in BIOSYSMO for environmental remediation.

2D The living organisms used to achieve the environmental cleanup under BIOSYSMO project, that may exist in colonies of cells.

3D BIOSYSMO project focuses on the cleanup of this type of environment as well.

4D BES- _ is used for simultaneous treatment of complex pollutant mixtures.

5D A harmful substance introduced into the environment



12. MEET THE BIOSYSMO CONSORTIUM



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