

## CARBON DIOXIDE REMOVAL TECHNOLOGIES (CDR-T):

# MICROBIAL CO<sub>2</sub> FIXATION (MCO<sub>2</sub>)

## REVOLUTIONIZING AGRICULTURE: HARNESSING MICROBIAL POWER FOR CARBON REMOVAL

As the world grapples with the urgent challenge of climate change, two primary strategies emerge: the crucial reduction of emissions at their source, and the increasingly vital removal of existing CO<sub>2</sub> from the atmosphere. This second strategy, known as Carbon Dioxide Removal (CDR), is gaining traction through a range of innovative technologies. This paper highlights one of the most promising and natural solutions: Microbial CO<sub>2</sub> Fixation (MCO<sub>2</sub>).

### WHAT IS MCO<sub>2</sub>?

Microbial CO<sub>2</sub> Fixation (MCO<sub>2</sub>) is a nature-positive technology that leverages the innate power of microorganisms to capture atmospheric CO<sub>2</sub> and convert it into liquid and solid organic and inorganic carbon compounds within the soil. While plants fix CO<sub>2</sub> through photosynthesis, a vast and often untapped potential lies in the soil's microbiome. Certain microorganisms utilize specialized biochemical pathways to draw down carbon, effectively acting as a natural carbon sink (Berg, 2011). Advanced microbial biostimulants (such as ekofertile® plant and microfertile® plant) are designed to enhance this very process, turning agricultural land into a powerful engine for carbon sequestration while simultaneously boosting crop health and yield.

### HOW DOES THE MCO<sub>2</sub> PROCESS WORK?

The MCO<sub>2</sub> process begins with the production of powerful microbial bio-stimulants. Using eco-friendly methods like bioleaching (e.g., InnoBioTech®), we accelerate the breakdown of natural minerals, transforming them into a rich, bioavailable nutrient solution. This process not only solubilizes essential minerals but also cultivates a diverse consortium of beneficial microorganisms and their metabolites.

The resulting biostimulant is a potent soil activity enhancer. Once transported to farmers and applied via spraying, it revitalises the soil ecosystem. The introduced microbes enhance nutrient availability, stimulate plant growth, and, most importantly, drive the process of capturing atmospheric CO<sub>2</sub> and converting it into long-lasting soil organic and inorganic carbon.



### WHAT IS THE CARBON SEQUESTRATION POTENTIAL OF MCO<sub>2</sub>?

The capacity of soil microbes to fix carbon is significant and measurable. Research indicates that heterotrophic CO<sub>2</sub> fixation in soils can range from 2.8 to 36.5 mg CO<sub>2</sub>/m<sup>2</sup> per hour, depending on soil conditions such as pH (Šantrůčková et al., 2005). According to the IPCC1, once captured through soil carbon sequestration practices, carbon can be stored for timeframes ranging from decades to centuries, making MCO<sub>2</sub> a durable CDR solution. By actively managing and amplifying the soil microbiome, we can significantly accelerate and maximize this natural carbon removal process.

### WHAT IS THE ECONOMIC VALUE FOR FARMERS?

MCO<sub>2</sub> is not just an environmental solution; it's an economic opportunity. With an estimated cost of ~€1.10 per litre and application rates of 10-200 litres per hectare, this technology is highly accessible.

The return on investment is compelling:

- Substantial Cost-Benefit: Farmers can see a return up to 10 times higher compared to conventional inputs.
- Reduced Input Costs: Cuts the need for agrochemicals by up to 50%.

- New Revenue Streams: Potential to earn €30–300 per hectare in carbon credits.
- Enhanced Yield & Resilience: Leads to healthier crops, higher yields, and improved drought and disease resistance.

## WHAT ARE THE ADDITIONAL CO-BENEFITS?

The advantages of implementing MCO<sub>2</sub> extend far beyond carbon capture:

For Farmers:

- Increased sugar and protein content in crops.
- Faster crop development and higher yields.
- Enhanced resistance to disease and drought.
- Improved efficiency of agrochemicals.

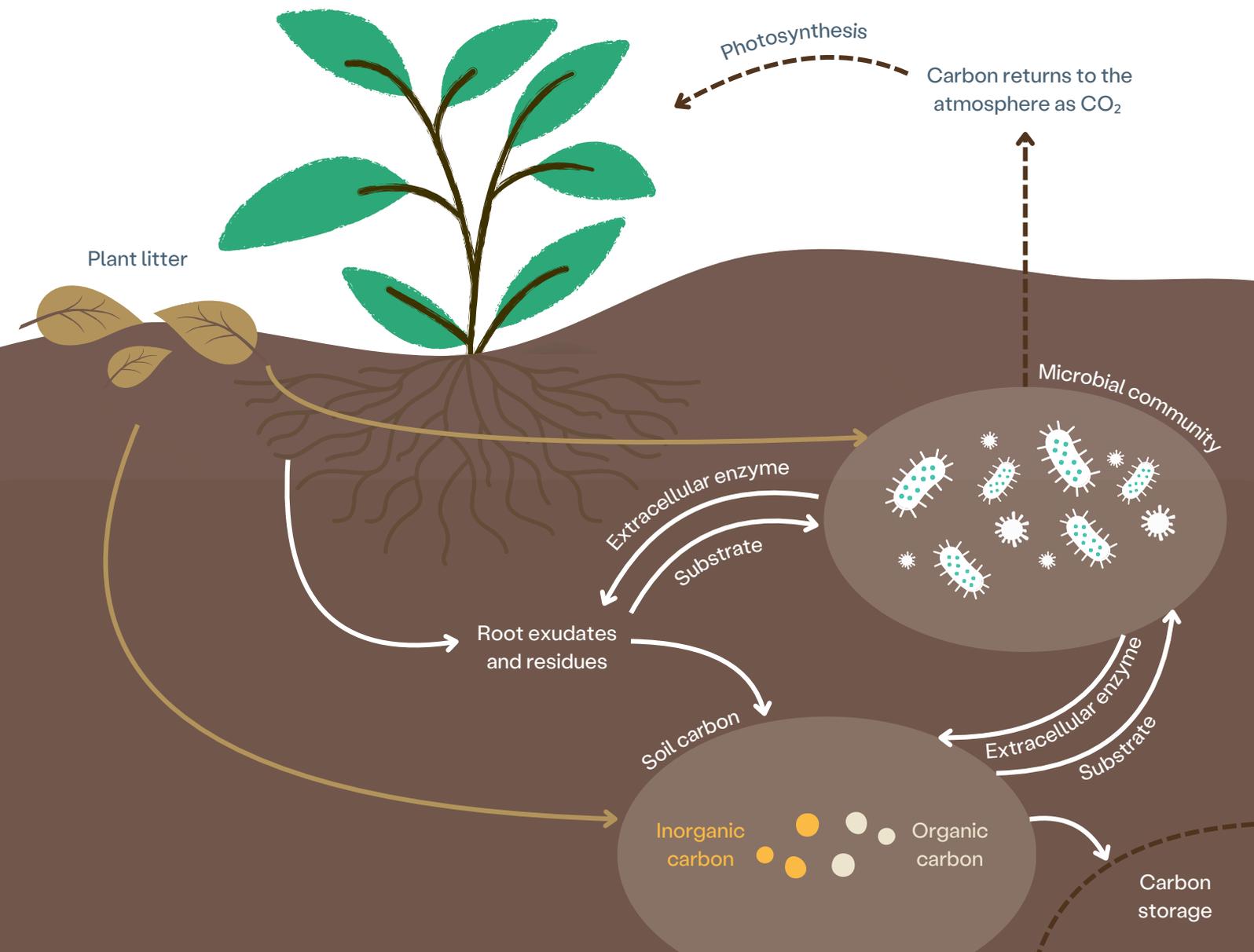
For the Mining Sector:

- Provides a new, ecological processing pathway (bioleaching) to increase the value and purity of mineral products.

These positive effects are measurable and verified, contingent on the correct application of the biostimulant. The primary consideration for implementation is water management, as the process requires adequate water for application.

## PIONEERING THE FUTURE: THE C-SINK PROJECT

C-SINK is an EU-funded initiative at the forefront of building a standardized and transparent European market for Carbon Dioxide Removal. As part of this mission, the project is conducting real-world case studies on farmlands across Germany, Slovakia, and Croatia. These sites, with their varied climates and soil types, are being inoculated with diverse microbial consortia (up to 1000 species) produced via bioleaching. The goal is to rigorously quantify and optimize the mechanisms of soil carbon sequestration through MCO<sub>2</sub>.



## REFERENCES

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C-SINK– FACTSHEET LECTURE 2 (Level 2)  
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