Waste, bacteria, and electricity: building the photo-electro-biorefineries of the future

María José García López

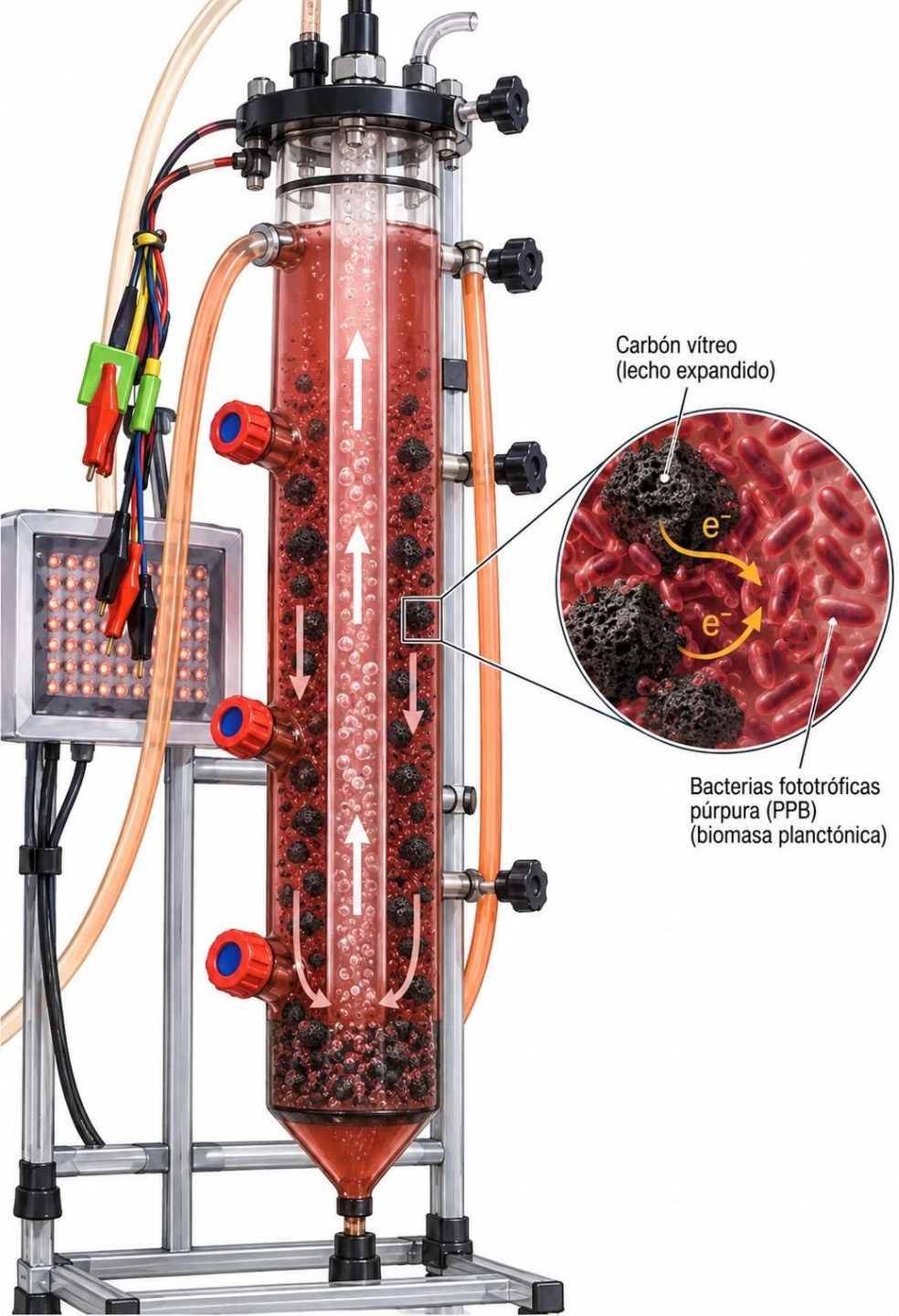
II Jornadas de Jóvenes Investigadores del ITPS

ITPS

Universidad Rey Juan Carlos

SUSTAINABLE NUTRITION PURPLE4LIFE

GIQA



Can we transform CO_2 into high-value molecules using electricity?

WHY?

CO_2



↑ Concentration promotes Global climate change

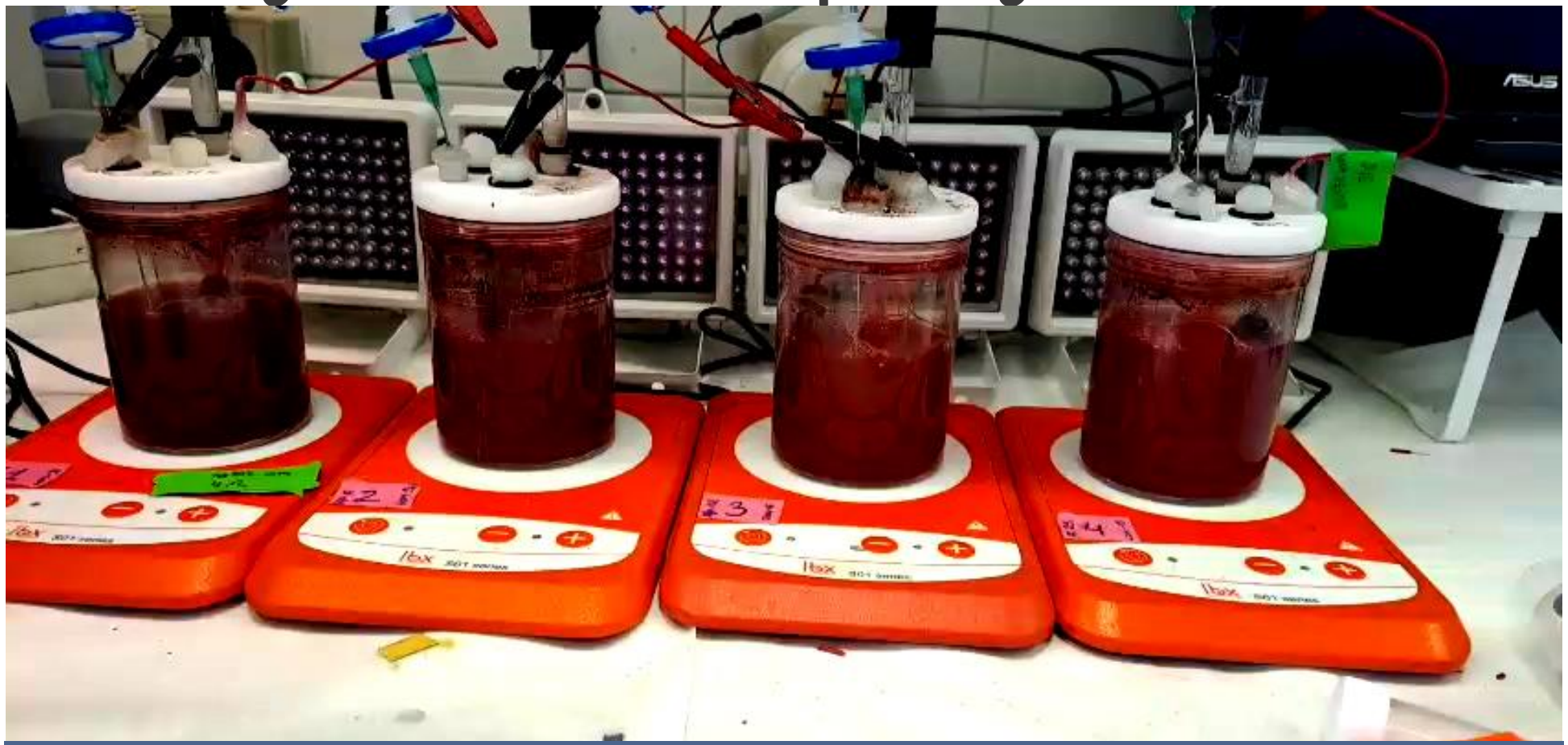


It originates from the combustion of fossil fuels for the production of heat, light, and energy.

limits the use of certain renewable energy

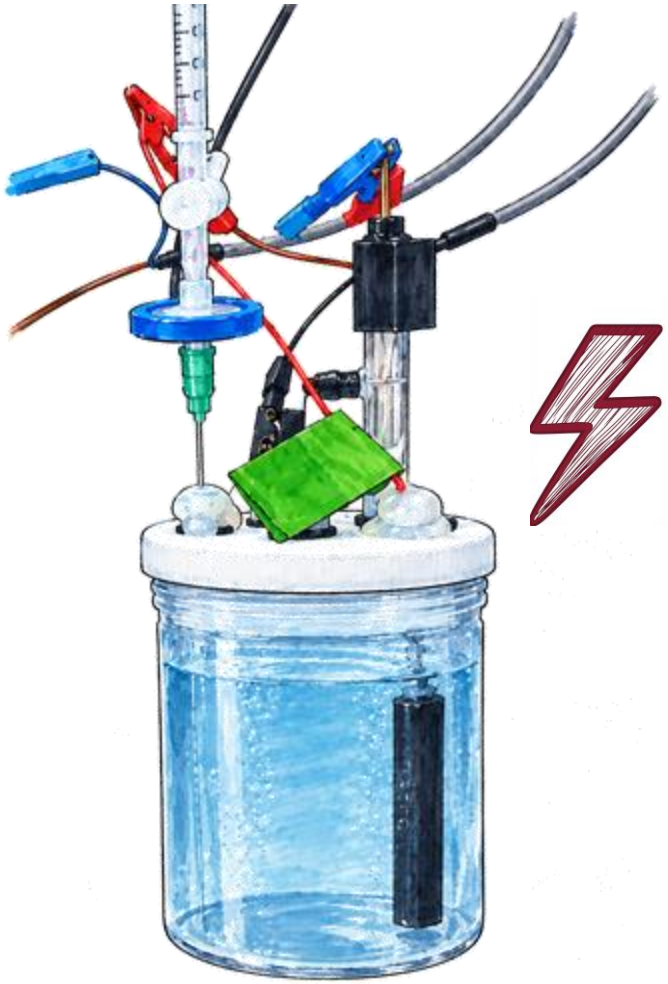


The driving force and the protagonists of this story



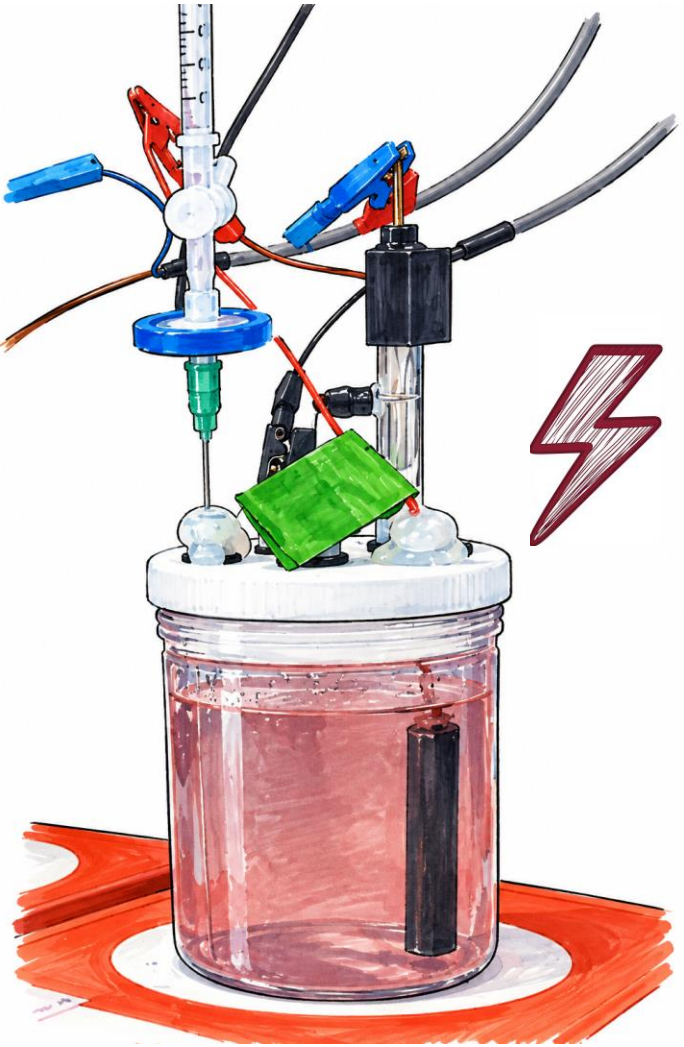
Purple Phototrophic Bacteria

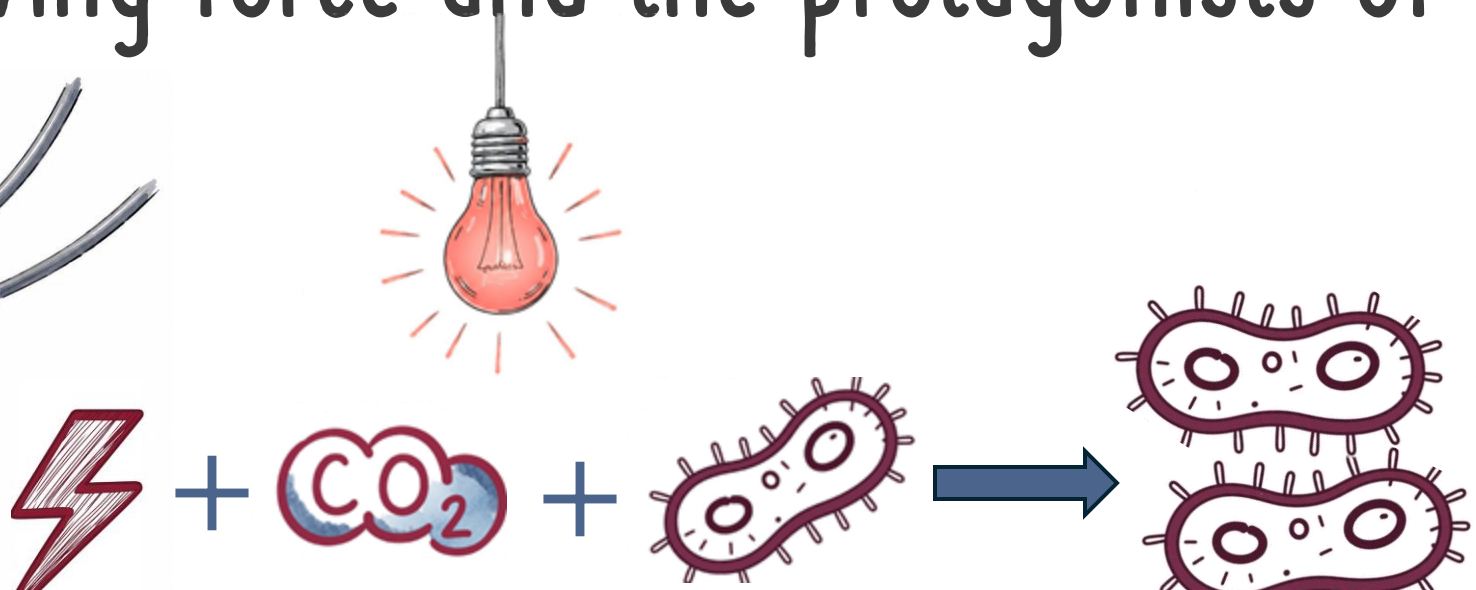
Bioelectrochemistry: driving force and the protagonists of this story

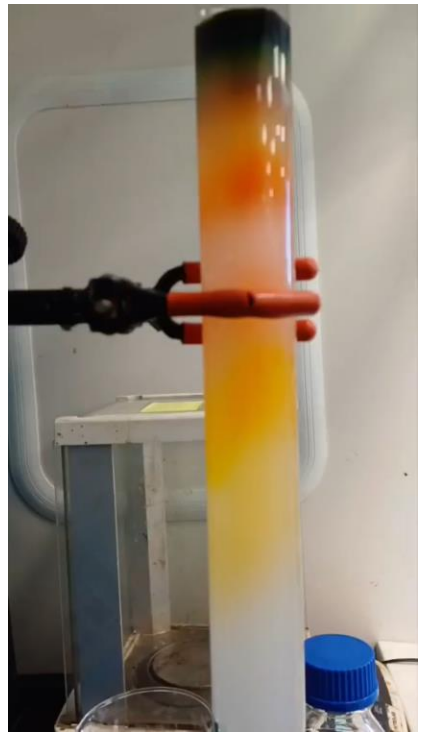




The driving force and the protagonists of this story

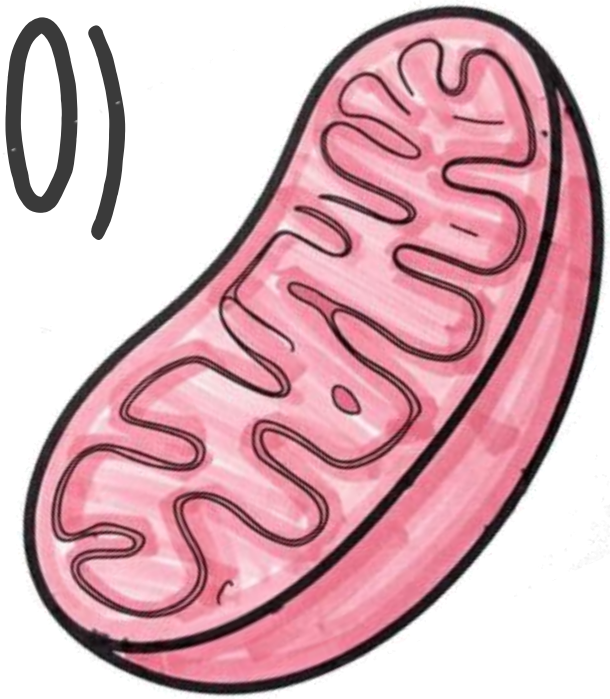






Focus on CoQ10!!

Coenzyme Q10 (CoQ10)



What does it promote and what is its function?

- ATP synthesis in the electron transport chain
- Protection of DNA, proteins, and membranes from oxidative damage
- Regeneration of vitamins C and E
- Regulation of apoptosis

Where is it found in the body?

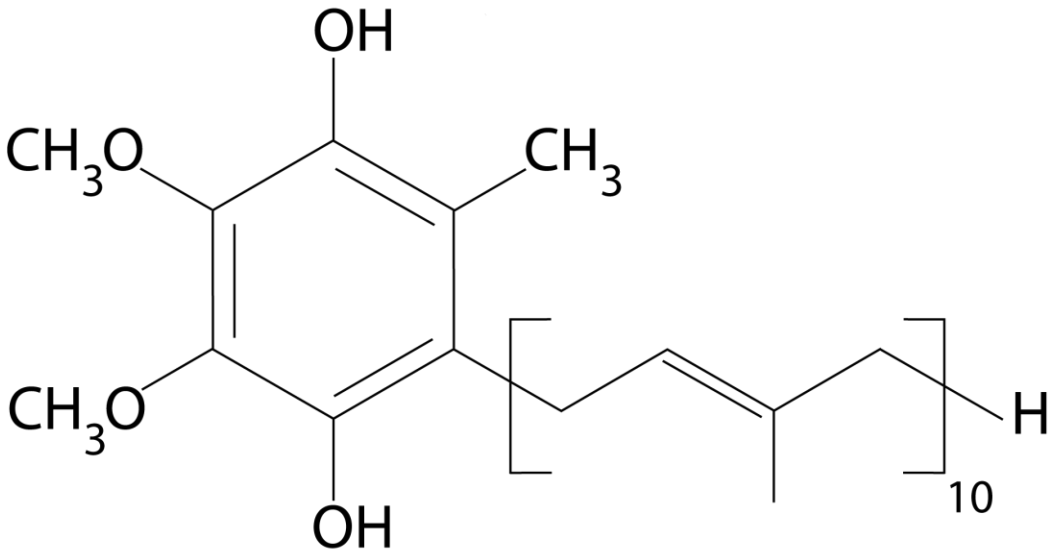
- In all cell membranes
- High-functioning organs: heart, kidneys, liver, and muscles
- inner mitochondrial membrane
- In the blood: It circulates transported by lipoproteins (VLDL, LDL, and HDL), which it protects from oxidation.

Main Therapeutic Benefits

Cardiovascular Health:Reduce serious cardiovascular events in patients with heart failure.

Migraine: It may reduce the frequency, duration, and severity

Athletic Performance: It may help reduce oxidative stress and muscle damage.



Coenzyme Q10 (CoQ10)



Wh… …mote and what is its function?

- P… …lectron transport chain
- ot… …oteins, and m… …nage
- eg… …ins C and …
- eg… …is

W… …the bod…

- …ns: heart …
- …embrane
- …tes transp… …,
- …otects fron…

M… …enefits

Co… …Reduce serious cardiovascular events in patients with heart failure.

Migraine: It may reduce the frequency, duration, and severity

Athletic Performance: It may help reduce oxidative stress and muscle damage.









Coenzyme Q10 (CoQ10)



Wh…mote and what is its function?

- P… …lectron transport chain
- ot… …oteins, and m… …mage
- eg… …ins C and…
- eg… …is

W… …the bo…

- …ns: heart…
- …embrane…
- …tes transp…
- …otects fron…

M… …enefits

Co… …Reduce serious cardiovascular events in patients with heart failure.

Migraine: It may reduce the frequency, duration, and severity

Athletic Performance: It may help reduce oxidative stress and muscle damage.

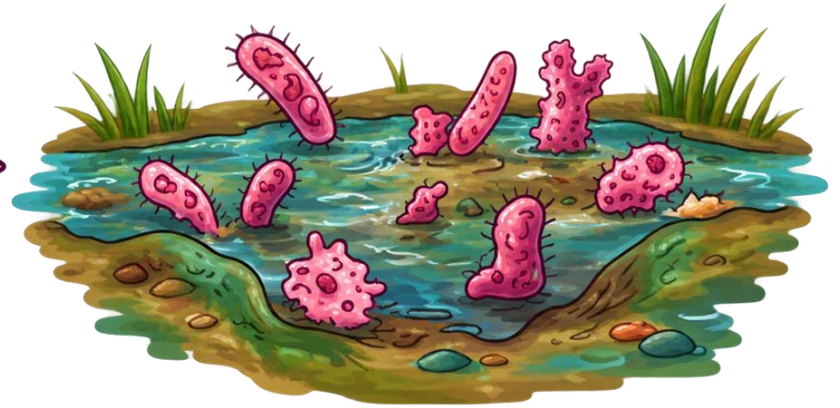
710,08 € / 1kg





Moving to the lab...



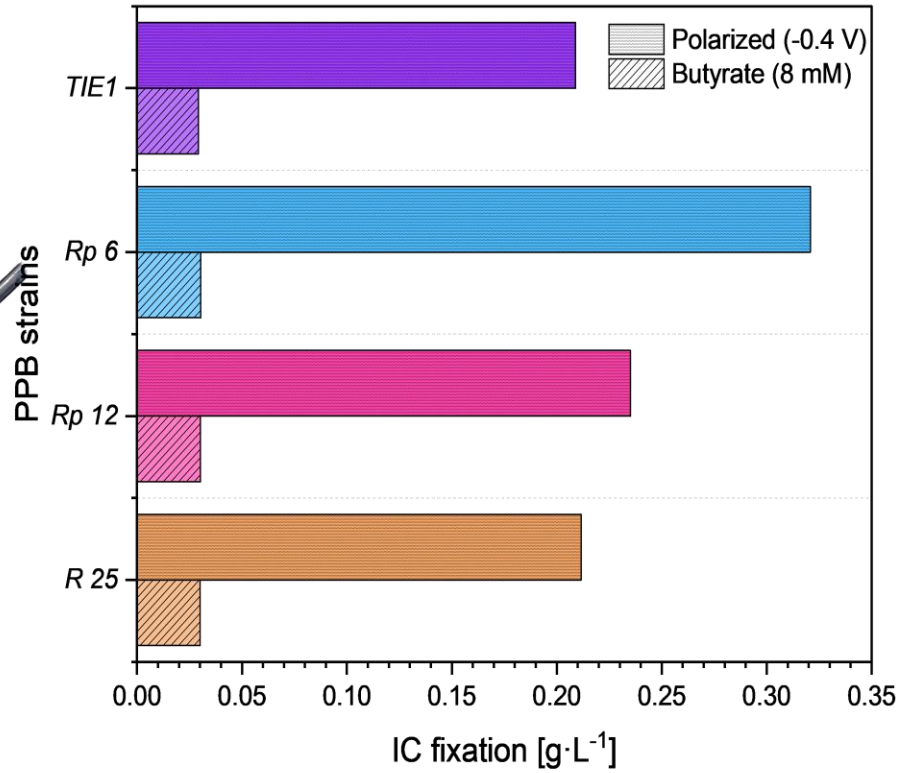


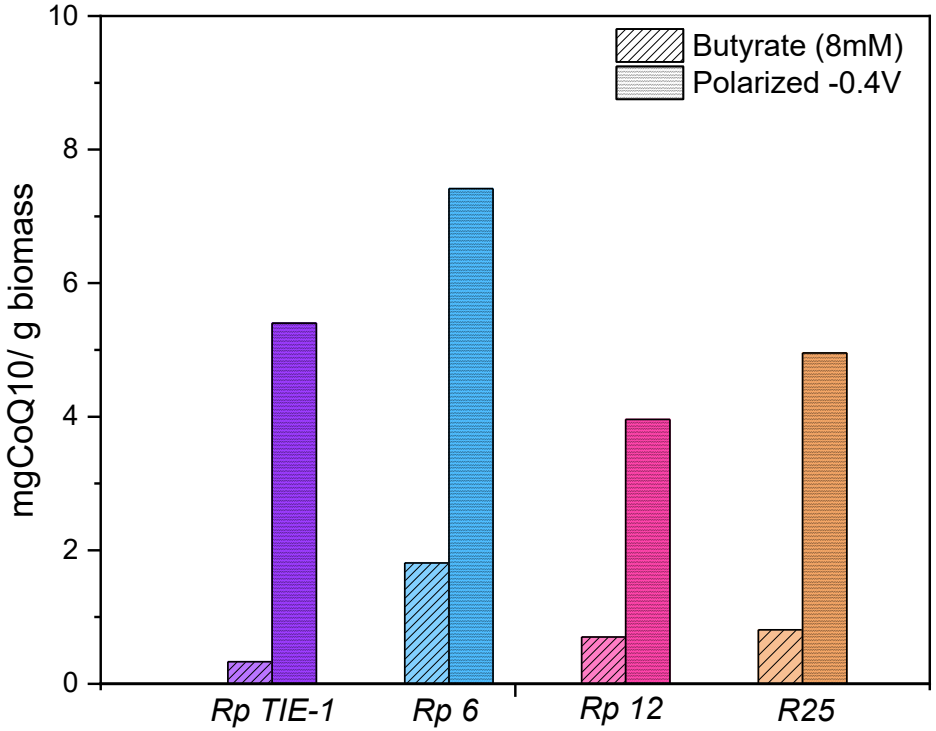
Reference strain (Rp TIE-1)

Enviromental Strain from piggery wastewater

What have we achieved?







Cathodic polarization enabled PPB to convert biogas ---
-CO_2 levels (≅ 40%) into biomass, with *Rp 6* fixing up to 1.18 g $CO_2 \cdot L^{-1}$, equivalent to the CO_2 contained in 1.6 L of biogas.



Electroactivity represents a promising strategy to simultaneously upgrade biogas and enhance the production of high-value nutraceuticals (>700 €/kg)

THANKS FOR YOUR ATTENTION!!

María José García López II Jornadas de Jóvenes Investigadores del ITPS

ITPS Universidad Rey Juan Carlos SUSTAINABLE NUTRITION PURPLE4LIFE GIQA