

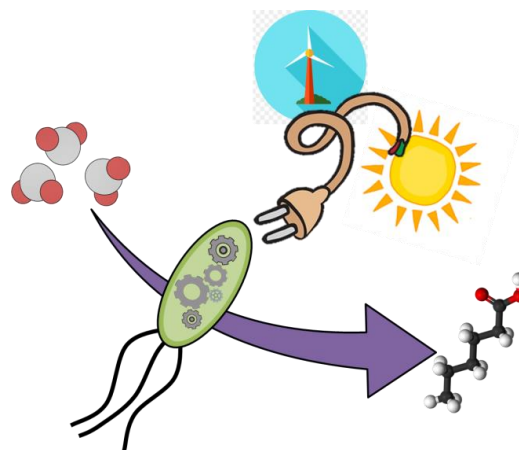
Microbial electrosynthesis from CO₂ reactor design

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Earth's biosphere and human society are being threatened by climate change and the inevitable depletion of fossil resources. This challenge to modern civilisation can be overcome by migrating towards a complete circular economy, recycling and eliminating waste to create a closed-loop system. A technology that has the potential to overcome the aforementioned issues is microbial electrosynthesis (MES). This technology relies on the ability of electroactive microorganisms to accept electrons from an electrode and use them to catalyse the reduction of carbon dioxide into industrially relevant products (i.e. alcohols, carboxylic acids). Renewable electricity powers the technology, effectively storing electrons into chemicals of interest. To date, MES reactors have been based on the H-type electrochemical cell system. These reactors are rather simple and were mainly used to investigate the fundamentals of the technology. However, the use of non-optimized lab-scale reactors and a lack of knowledge on both the limiting steps of the system and its performance at a larger scale is impeding the technology to make a leap towards its full-scale implementation.

Therefore, to push MES to an industrial level, a deep understanding of all factors that limit reactor efficiency and a clever way to overcome scalability issues must be combined and applied during the design part. In this context, this PhD project aims to design, develop, and assess novel process configurations and operations to overcome process limitations and produce value added chemicals with bioelectrochemical systems using CO₂ as sole carbon feedstock. Both experimental and mathematical approaches will be used to tackle this challenge.



Schematic representation of MES from CO₂ to valuable organics using renewable energy and minimal amount of water (green oval represents a microorganism)