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JOINT POC 202207

EBNet Environmental Biotechnology

Engineering and Physical Sciences Research Council

Biotechnology and Biological Sciences Research Council

Pure biomethane - rather than biogas - from a single waste stream

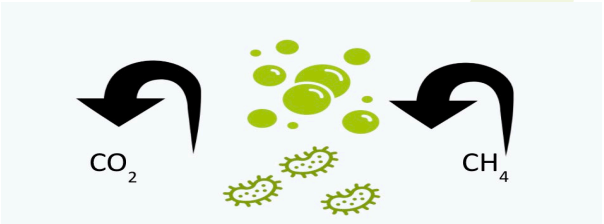
THE RESEARCH

Separation is one of the most challenging aspects of any recycling process, and anaerobic digestion (AD) of wastes is no exception. AD plants produce biogas, a mixture of methane and CO_2. The problem here is two-fold: firstly, biogas upgrading processes can consume 2-13% of the energy produced; secondly 1-4% of the methane can be lost in the off-gas, and it has 28-34 times the global warming potential of CO_2.

Through understanding the state of the art and building on thermodynamic insights, we developed a combined AD and bioelectrochemical reactor set-up which produced higher methane concentrations in the off-gas. The approach is deceptively simple: it allows the thermodynamically favourable biological reactions to proceed as normal; but separates the places in which the stages of this reaction occur, and thus the gaseous products, producing pure bio-CH_4 in one compartment and bio-CO_2 in another compartment of the same reactor.

By using bioelectrochemical membrane technology to manipulate the bioreactor space for a mixed microbial community, we can deliberately and intelligently separate the functionality and outputs of the microbes.

We would like to further develop the technology to work towards pure methane on one side, pure CO_2 on the other. This has the potential to be a simple retrofittable upgrade to all AD reactors which would then deliver improved environmental protection and enhanced resource recovery.



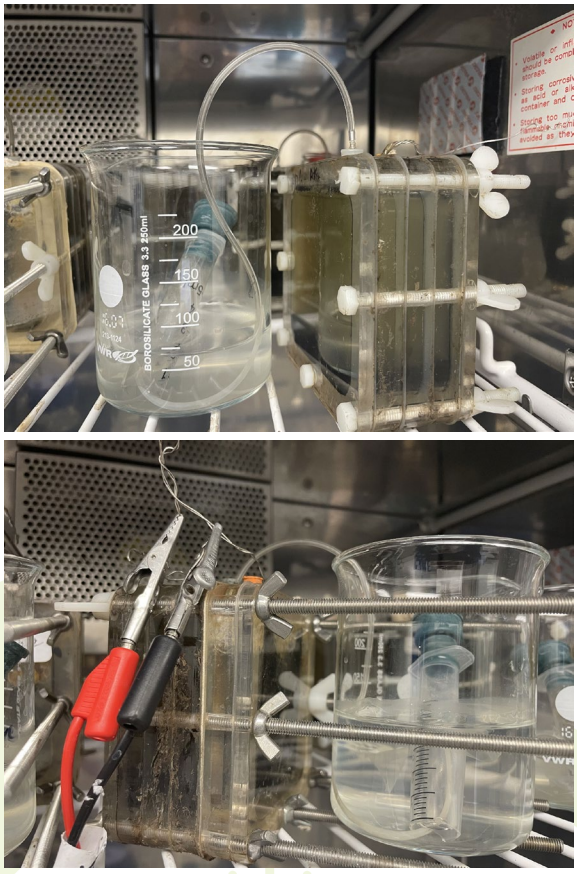


Fig.1. MEC-AD reactor set-up. Top: Stand-alone AD reactor with tubing to collect methane. Bottom: MEC-AD reactor separated by a CEM membrane with tubing to collect gas from the AD side and connected to a Pico logger for voltage measurement.

"These POC grants allow us to explore risky and interesting ideas with a view to taking the ideas further if they work. We gained valuable insights in this project which will help the development of bioelectrochemical menthane production technologies."
- Dr Elizabeth Heidrich, Newcastle University