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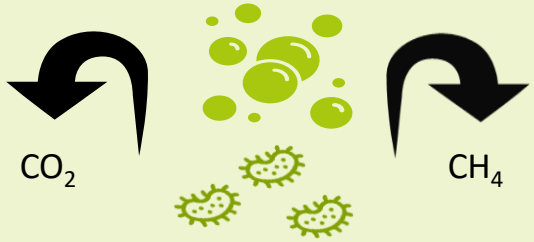
Pure biomethane - rather than biogas - from a single waste stream

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 problems of this are two-fold: firstly, more energy must be spent on biogas upgrading processes costing 2-13% of energy produced; secondly 1-4% of the methane is lost in the off gas, it has 28-34 times the global warming potential of CO_2.

Through understanding of the state of the art and building on thermodynamic insights, we developed a combined AD and bioelectrochemical reactor setup which produced more concentrated levels of methane in the off gas. The approach is deceptively simple, allows the thermodynamically favourable biological reactions to proceed as normal, but separates the places in which the stages of this reaction occur, thus separating 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 will 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.



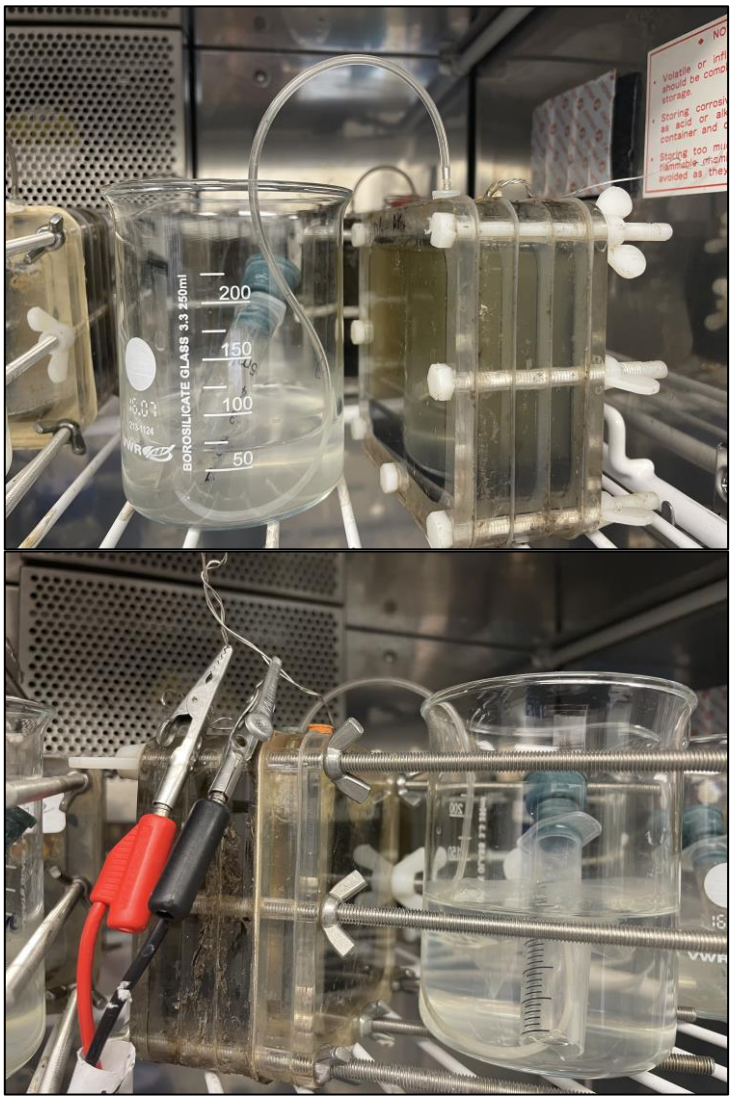


Fig.1. MEC-AD reactor setup: Top: Stand-alone AD reactor connected to a tubing to collect methane gas. Bottom: MEC-AD reactor separated by a CEM membrane connected to a tubing to collect gas from the AD side and connect to a Pico logger for voltage measurement.

"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