Energy recovery from a high strength wastewater.

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Stream

The Industrial Doctorate Centre for the Water Sector

Introduction

Activated sludge (AS), the current wastewater treatment, is an energy intensive process. Although effective, it does not harness the energy contained within wastewater. Bioelectrochemical systems are an alternative technology to AS, as they simultaneously recover energy while treating the wastewater.

Aims:

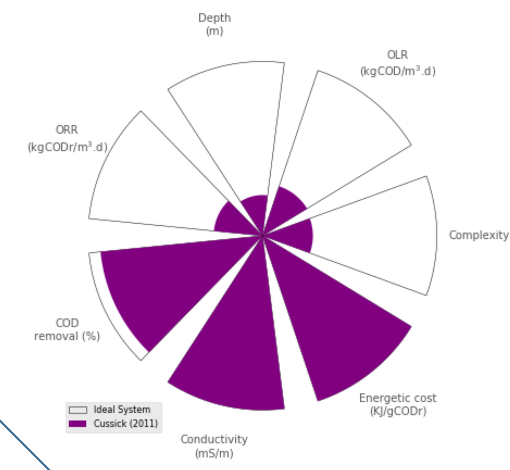
- *Identify how far away the current systems are from industry*
- *Maximise energy recovery*
- *Run a pilot-scale bioelectrochemical system on site*

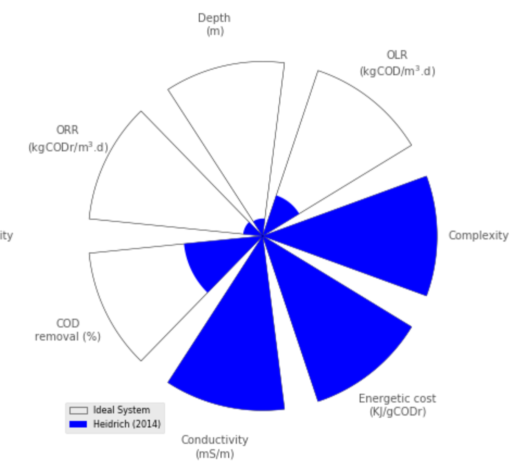
Two types of bioelectrochemical systems:

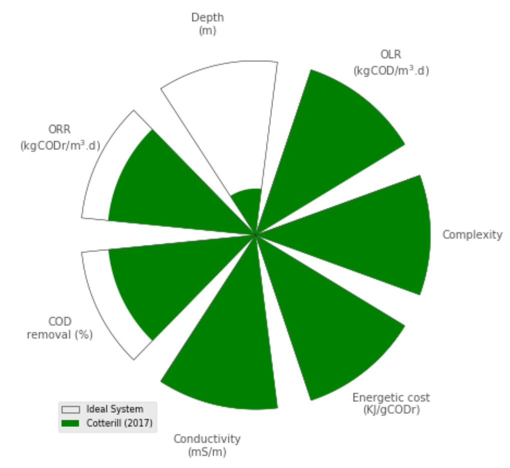
- **Microbial electrolysis cells (MECs)**
  - *Energy recovery in the form of hydrogen*
- **Microbial fuel cells (MFCs)**
  - *Energy recovery in the form of electricity*

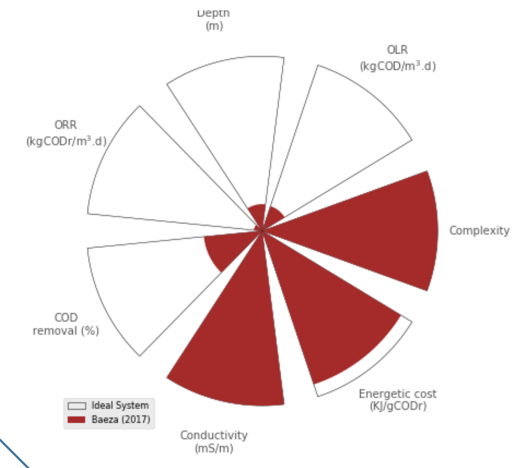
How far from reality?

Bioelectrochemical systems are far from ready for industry. A review of the four published pilot-scale MECs has been done by comparison with an "Ideal" system which could replace activated sludge (AS).





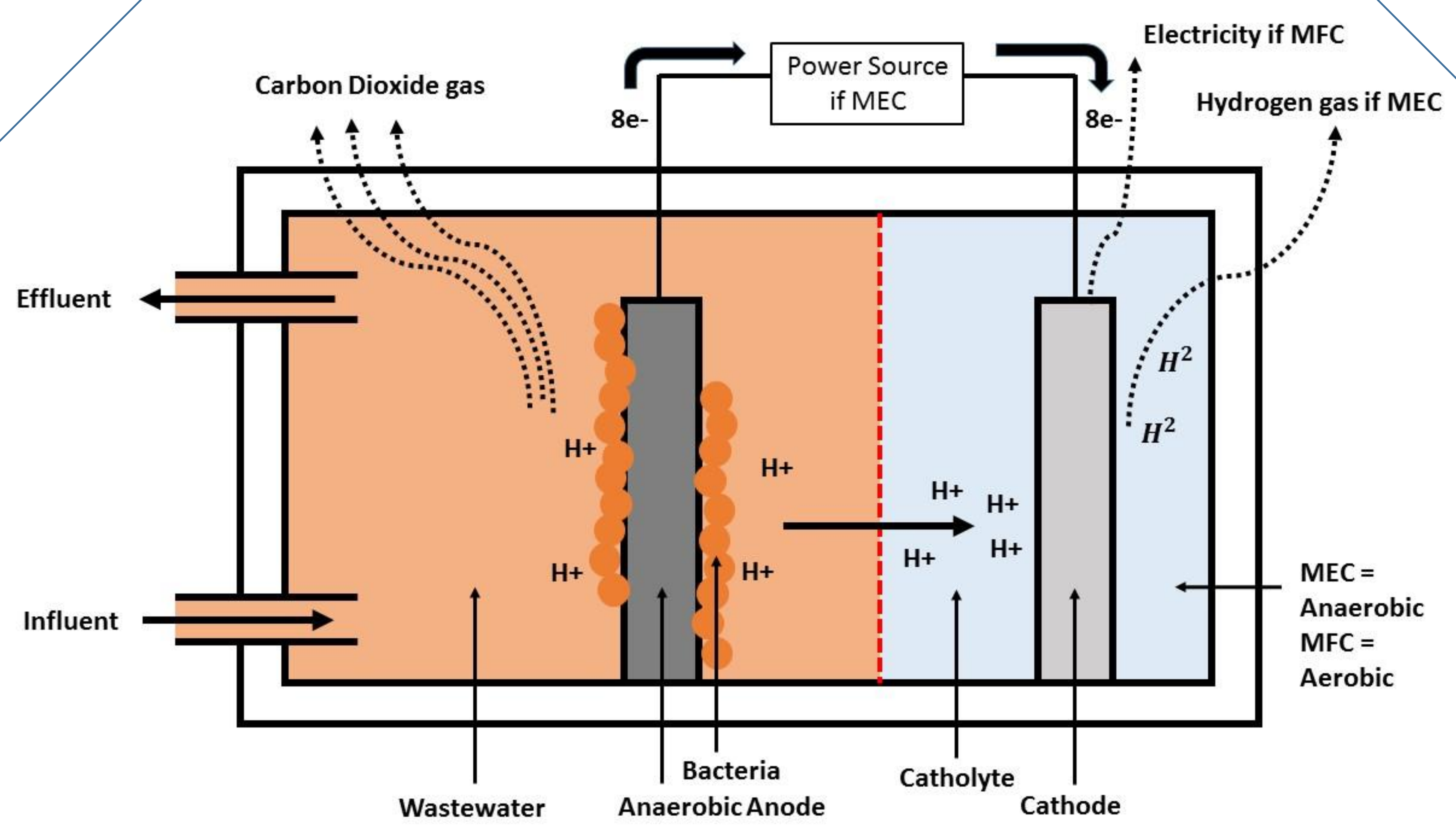




Ideal system based on:

- *Wastewater complexity*
- *COD loading rate*
- *Conductivity*
- *Reactor size*
- *Treatment rate*
- *Effluent quality*
- *Energetic treatment cost*

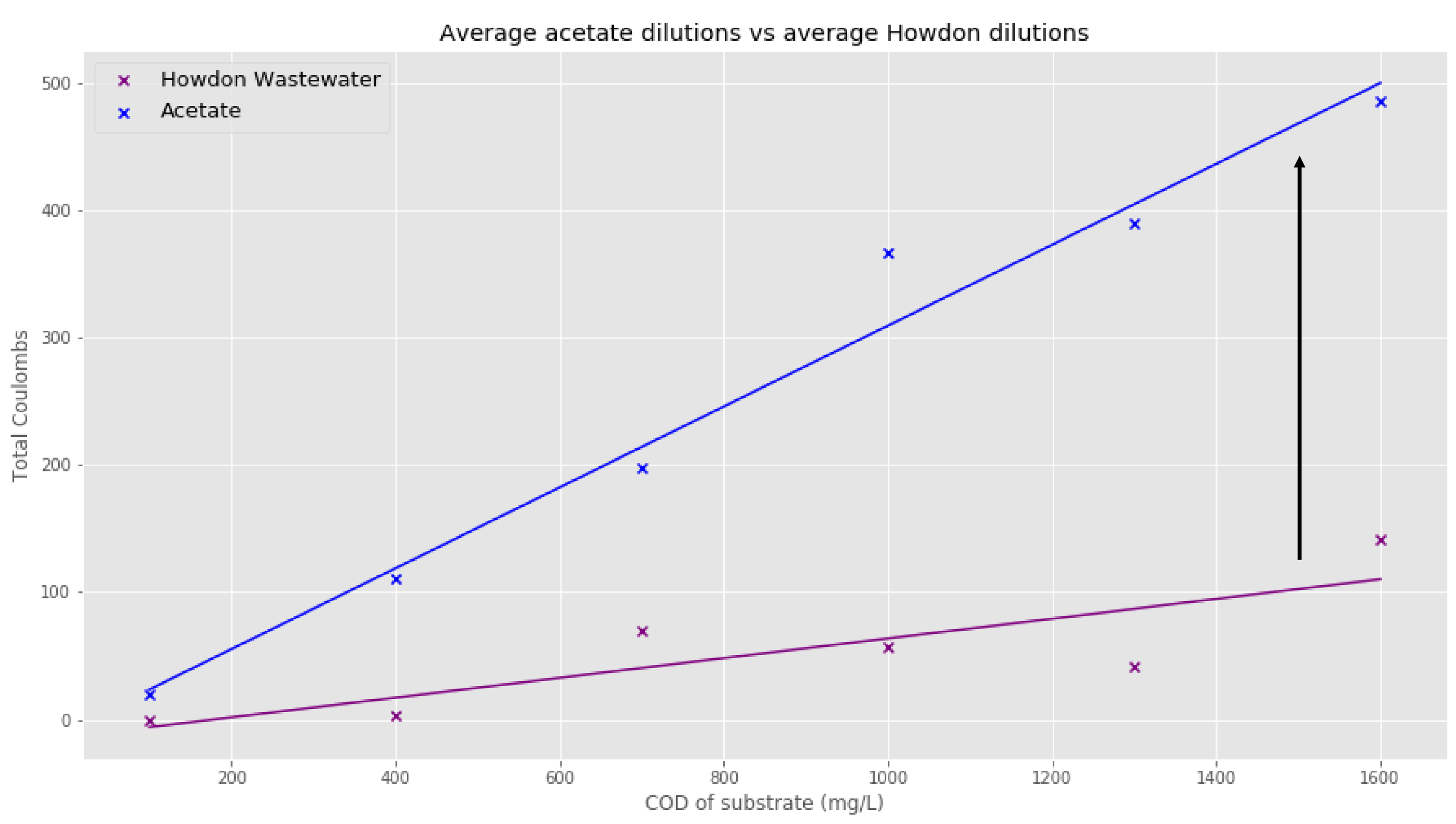
Bioelectrochemical systems



1. Electrochemically active microorganisms on the anode (biofilm) oxidise organics in wastewater
2. Transfer electrons to anode, protons flow to cathode
3. Electrons and protons form water (MFC) or hydrogen (MEC)
4. Movement of electrons produces a current

Maximising energy recovery

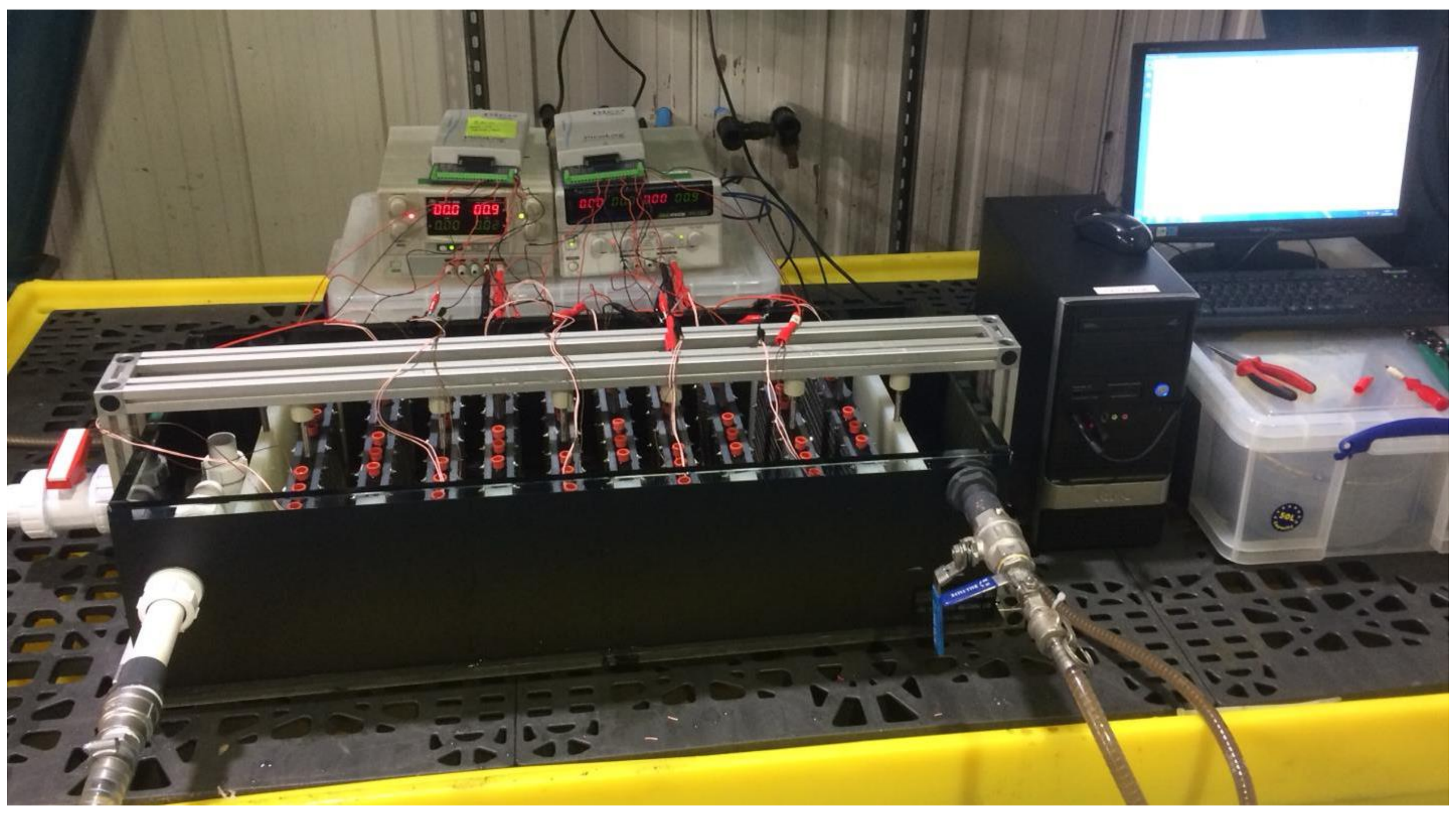
- 28 MFCs ran simultaneously
- 14 with acetate as the substrate, at 7 different COD values, ran in duplicates
- The equivalent done with high strength wastewater
- Aims to find the rate limiting step underway by improving hydrolysis and fermentation



Continuous fed pilot-scale MEC

- 36L continuous flow MEC
- Using return liquor for high COD
- Hydrogen recovery

- High COD increases energy recovery
- Any reduction in COD is financially beneficial
- Does not have to meet discharge standards (internal loop)



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