1 Literature

1.1 Background

1.1.1 Microbial fuel cells.

- Textbook full of information on the subject
- Useful for providing context to the subject as a whole
- Future ideas
- Written by someone with plenty of real world experience
- Gave definitions and explanations for the commonly found acronyms

1.1.2 Microbial Electrochemical and Fuel Cells 2016

- Need to skim over this one
- Will take awhile
- Could have a look at a journalistic review or something as well

1.2 Review Papers

1.2.1 Developments in microbial fuel cell modelling

- "Interest has significantly increased in recent decades"
- MFC modelling tends to be neglected
- Introduces the comprehensive type of models
- Anode based
- Cathode based
- Mentioned parameters that are important:
  - Biofilm thickness
  - Fuel flow rate and concentration
  - Temperature (mentions experimental ranging from 15-40 degrees C)

1.2.2 A Review on solid oxide fuel cell models

- No useful information whatsoever
- I think I should exclude this from my literature review

1.2.3 Models for Microbial Fuel Cells: A critical review

- Biofilm thickness matters
- Different models make different assumptions (no shit)
- Doesn't talk about flow rate at all
- INDICATION: Models don't focus on temperature or flow rate
- Therefore my title has a USP

1.3 Modelling Papers

1.3.1 A 1D mathematical model for a microbial fuel cell

- BACKGROUND
- Model correctly predicted how substrate concentration adn temperature affect biofilm thickness and cell performance
- Modelled temp ranges of 20,30 and 40 degrees
- Still got USP for lower temperatures

1.3.2 A two-population bio-electrochemical model of a microbial fuel cell

- "Energy from organic waste cannot be recovered using traditional methods"
- This is because it has a complex composition and is usually very dilute
- Model based on anode and focuses on bio-chemical reactions there
  - Therefore, assumes cathode reaction rate is non-limiting
- Demonstrates influence of organic load and external resistance on the MFC power output and long term performance
  - Experiments from 35 - 60 days
  - Adjusted influent acetate concentration between 275 - 2550 mg-S L-1
  - External resistance set between ~10-25 ohms above Rint as well as 5 ohms (below Rint)
- Validated with experimental results
  - Plots of simulated vs measured results show the models follows the patterns of behavior of MFCs
  - Results look pretty good based off graphical comparisons

1.3.3 Modelling and simulation of two-chamber microbial fuel cell

- "Modelling remain scarce"
- Claims cathodic reaction is the rate limiting step
- Flow has an effect on power
- Artificial wastewater
- Useful for scale-up
- Claims reducing feed flow could increase power

1.3.4 A generalized whole-cell model for wastewater-fed microbial fuel cells

- Mentions a lit review that found COD removal efficiency can be between 5-99% depending on operating conditions.
- Experimental work featured municipal wastewater
- Whole cell model so anode and cathode
- Model assesses after the startup phase of 32 days

1.3.5 Electricity generation and modeling of microbial fuel cell from continuous beer brewery wastewater

- COD removal efficiency of 40-43% classed as good enough for wastewater treatment
- Low flow-rates considered in experimental work
- Most detailed wastewater description
- Cell operated between 20-28 degrees C

1.4 Experimental Only Work

1.4.1 Investigation of key parameters influence on performance of direct ethanol fuel cell

- Not strictly about MFCs
- Was included in research to provide insight on fuel cells as a whole
- This includes the key parameters that affect them
- Useful to compare to MFCs
- States that higher flow-rates lead to increased performance
- States that higher temperatures increased voltage for a given current density

1.4.2 Power generation from wastewater using single chamber microbial fuel cells (MFCs) with platinum-free cathodes and pre-colonized anodes

- Operated for 26 weeks
- We don't want biofilm growth on cathode due to increased proton transfer resistance
- Colonized with wastewater - University of Connecticut wastewater treatment plant
- Doesn't talk about flow
- Operated at 30 degrees

1.4.3 Continuous electricity production from artificial wastewater using a mediator-less microbial fuel cell

- Mediator is used to separate out cathodic and anodic fluids
- Anode volume of 20 ml so probably some scale-up issues
- Best result obtained at 35 degrees
- Power stably generated over 2 years