Evaluation of tomato waste feedstocks for microbial fuel cells

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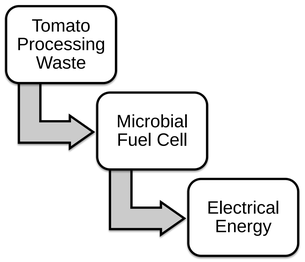
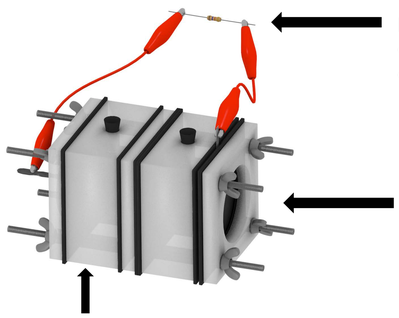
INTRODUCTION

- Microbial Fuel Cells (MFCs) are self-contained devices that use bacteria to convert organic compounds directly into electrical energy.
- The purpose of this research was to determine if an MFC could be used to generate electricity from different tomato processing waste streams.
- Research question: *How do different tomato waste streams affect power production in microbial fuel cells?*



MICROBIAL FUEL CELL DESIGN



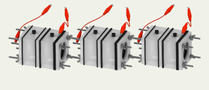
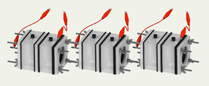
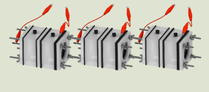
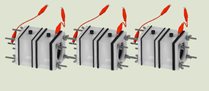
External Resistor
- 1000 Ohm Rating
- Provides External Resistance

Air Cathode
- Platinum Catalyzed
- Coated with PTFE
- Drives Electron Flow

Carbon Brush Anode
- Electrically Conductive
- Allows growth of biofilm

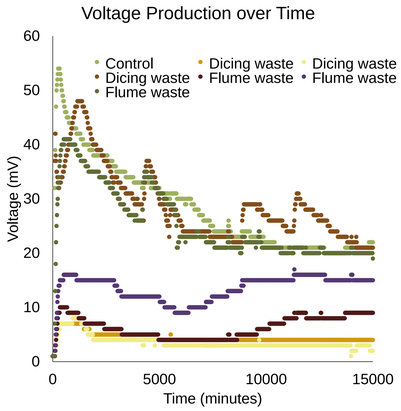
EXPERIMENTAL SETUP

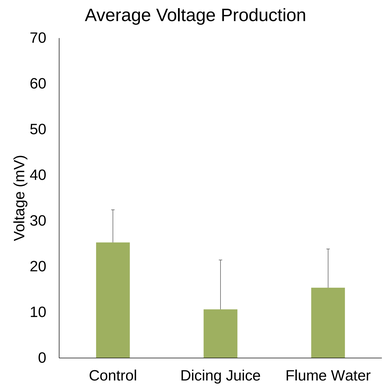
- MFCs fed with tomato dicing juice, flume water, or deionized water
- Voltage datalogger measured the voltage output over time
- Negative Control MFC fed with deionized water

	No Buffer Solution	Phosphate Buffer (pH 7)
Control (Ch. 1)		
Dicing Juice (Ch. 2-4)		
Flume Water (Ch. 5-7)		

VOLTAGE PRODUCTION WITHOUT BUFFER

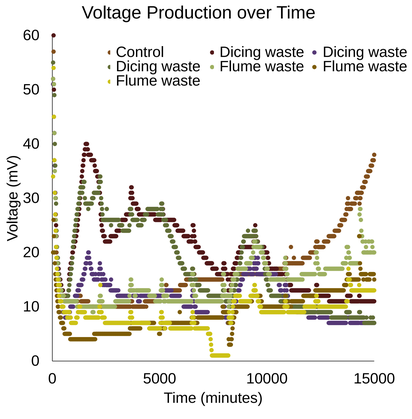
- Voltage measured over time at 50% loading rate without added buffer
- Gas production and high variability observed

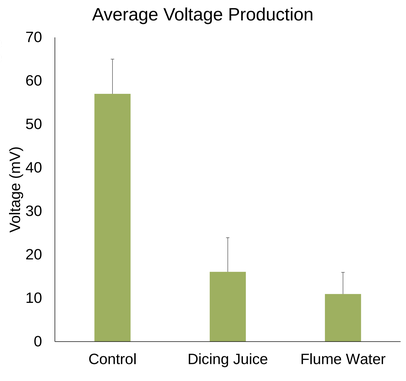




VOLTAGE PRODUCTION WITH PHOSPHATE BUFFER

- Voltage measured over time at 10% loading rate with PBS buffer
- No gas production and lower variability

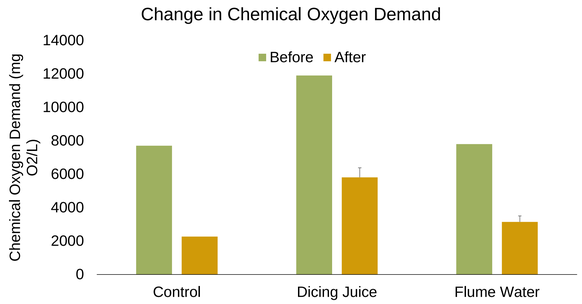




CHANGES IN CHEMICAL OXYGEN DEMAND

Chemical Oxygen Demand (COD)

- Measures overall oxidizable materials (feedstock strength)
- Changes in chemical oxygen demand should correlate with voltage output
- Calculations of COD made both before and after for each group
- Similar change in COD observed for each experimental group
- Differing voltage outputs indicate differing unit efficiencies
- Fermentation is occurring, but decreased exoelectrogenic activity



CONCLUSIONS

- Tomato wastes can be used in MFCs, but exoelectrogens may be inhibited
- Voltage production is variable
- Phosphate buffer may enhance longevity of system
- COD may not the best predictor of voltage output
- Power production may rely on other factors besides pH
- Optimization of operating parameters is necessary

FUTURE DIRECTIONS

- Identify inhibitory compounds in tomato waste streams
- Develop alleviation strategies
- Optimize COD of feedstock
- Optimize buffer for pH and buffering capacity
- Centrifuge inoculant to remove excess COD
- Slow the enrichment time for better bioconversion capabilities

CONTACT INFORMATION

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