Single Chamber MFC: Role of Extracellular Phosphate in Heavy Metal Precipitation

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Microbial fuel cells (MFC) are a more renewable, cost efficient, and a more effortless form of energy production. MFC take advantage of specific ion producing exoelectrogenic bacteria (G.sulfurreducens), which create conductive, current producing, biofilms through carbon-based electrodes. This provides a novel approach to solving both energy crisis' and environmental heavy metal pollution. Due to their anaerobic behavior, these microbes have the potential to 'respirate' heavy metals, leaving them immobile and insoluble. Compared to organic reduction, exoelectrogenic bacteria can alternatively precipitate heavy metals with sustained power output through extracellular phosphate precipitation. This research engineers a new strain of exoelectrogenic bacteria using inactive E.coli plasmids, and also explored the effect of extracellular phosphate on G.sulferreducens' ability to deal with heavy metal cations with simultaneous energy production. A micro single chamber MFC was also developed to further test bacterial behavior on a 'wool' carbon anode to compare exoelectrogenic properties from pure G.sulferreducens cultures and mixed 'wild' cultures. G.sulferreducens was made competent via a standard calcium chloride buffer and transformed using assorted E.coli plasmids in hopes to create a plasmid saturated strain of G.sulfurreducens. After transformation, the G.sulferreducens displayed 2.96*10^11 extracellular phosphate groups per cell verses the previous 4.62*10^10 E-PO4/Cell; this is a 540% increase in available extracellular phosphate. Due to this modification, the bacteria strain can display an increased tolerance to most microtoxins. More of what we consider toxic trash can now be fuel for this new generation of bacterial batteries.

Awards Won:

Third Award of $1,000