Single Chamber MFC: Filtration of Arsenic with an Exoelectrogenic Biofilm

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Microbial fuel cells (MFC) are a more renewable, cost efficient, and more effortless form of energy production. MFC take advantage of specific ion producing exoelectrogenic bacteria (G.sulfurreducens) to conduct current through multiple electrodes. This provides a novel approach to solving both energy crisis' and heavy metal pollution in drinking water. The creation of a biofilm around a high surface area anode creates a portable and semi-permanent bacterial culture that can act as a renewable battery and filter. This may reduce heavy toxins such as arsenic, a growing issue to many developed/industrialized areas like Bangladesh or Argentina. This research explores the effect of inorganic arsenic on MFC biofilm development and efficiency. Using a 500ml reactor with a wool carbon anode and a PVDF-AC air cathode, MFC reactors (3) used a standard media recipe (Arnold et. al 2014) inoculated with G.sulfurreducens and were sealed in an anaerobic condition. MFC efficiency was collected and charted in mV. Reactor media was eventually swapped for pseudo-media of varying arsenic concentrations. Media before MFC exposure was later compared to media from after the MFC to show change in arsenic concentrations. G.sulfurreducens tested positive for unfazed filtration of arsenic (0.5mM) but operated at 77% efficiency when exposed to a higher concentration of arsenic (1mM). This research discovered the mobilization of arsenic inside G.sulfurreducens, and demonstrated heavy metal filtration with simultaneous energy production inside single chamber MFC.

Awards Won:
Third Award of $1,000