Genetically Modifying Wild Type K12 E. coli for the MtrC Gene for Production of Cytochrome C and Microbial Fuel Cell Application

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With environmental disasters affecting poorer, disadvantaged communities in disproportionate amounts, solutions that are accessible (i.e. low-cost and abundant resources) are important for targeting those most in need. Microbial Fuel Cells (MFCs) are bioelectrochemical devices that depend on the transport of cytochromes, iron-based proteins, across microorganisms' cell membranes as a means of transporting electrons to the outside of the cell. These transported electrons can be used for human electricity production. Current work is focused on increasing the efficiency of these systems. The organism Shewanella oneidensis naturally produces cytochromes as coded for by the gene mtrC. This strain of Shewanella has highly complex protein systems that make the microorganism difficult to manipulate and study to increase efficiency. Wild-type (WT) K12 Escherichia coli, a cheap, thoroughly-researched, microorganism, has the potential of operating as a successful electron source in MFCs. This research project attempts to successfully insert the mtrC gene into wild-type K12 E. coli to create a high-efficiency organic substrate for application in MFCs that is low-cost and accessible for the communities most heavily affected by the climate crisis. In the experiment, the transformation of the plasmid containing mtrC into the E. coli of interest via heat shock transformation protocol and electroporation protocol was conducted. Gel electrophoresis processes and growth in the presence of antibiotic kanamycin were conducted. Additional metrics including the reproduction rate of the transformed E. coli and CO2 emission levels of the E. coli were measured. Results from experiments displayed the successful transformation of the mtrC gene into the WT K12 E. coli.