# Application of Electro-chromic Tungsten Oxide Nano Wires to Determine Bioelectrogenesis in Microbial Fuel Cells

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**ABSTRACT**

The production of wastewater and energy requirement will never be discontinued till the human being is on earth. Microbial fuel cells (MFC), furnished with different electrode materials and bacterial inoculum are the advance technology for biological conversion of chemical energy of the waste organic matter in to electricity. The electrogenic microbial populations, those are capable of moving electrons to solid phase materials like electrodes, are the key research subject of above technology. Thus MFC, having this population have been shown to be effective for solid/liquid waste remediation with the added benefit of generating electricity. Domestic wastewater or sludge is the most popular inoculums for MFCs. Apart from sludge, various other sources like soil, cow dung, pure cultures, sand, mining soil etc. are used in MFCs to make microbial biofilm. However, there is no existing method to check whether the electrogenic microbes are present in the MFCs system even after their inoculation in the reactor.

The MFCs required 0–8 days for current generation depending on the inoculum source. Technologies related to sensing electrochemically active bacteria can make it easy to select proper inoculum for Anodic chamber of MFC, thus it can enhances reliability and sustainability of the MFC start-up and operation. In this study, $WO_3$ nano fibers are synthesized by the hydrothermal method to evaluate electrochemical property of microbial population by way of chromatic changes. Sodium tungstate dihydrate and sodium chloride treated with hydrochloric acid were used to synthesize crystalline nano $WO_3$, using Teflon autoclave at 180 degree for 16 hours.

The structural and morphological characterization of tungsten oxide nano fibers was done using XRD and FESEM, respectively. The chromatic changes in the inoculated sample after addition of electro-chromic nano $WO_3$, produced significant blue color due to extracellular electron transfer of electrogenic bacteria. Therefore, this is the rapid detection technique which can be accomplished in a test tube to determine electrogenic property of microbial populations in the inoculum used in MFCs. This kind of rapid identification of electrogenic microorganism will make selection of suitable inoculum for MFC to expedite its start-up and harvest more power in terms of direct electricity using organic wastewater or waste slurries as fuel. This is the first effort of external identification of electrogenic activity and further efforts are on for standardization of this test protocol.

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