

# **MICROBIAL FUEL CELL COUPLED ANAEROBIC WASTEWATER TREATMENT**

By

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## CERTIFICATE

This is to certify that the thesis entitled “*Microbial Fuel Cell Coupled Anaerobic Wastewater Treatment*” being submitted by **Mr. Surajbhan Sevda** is worthy of consideration for the award of the degree of Doctor of Philosophy. The thesis has been prepared under my supervision and guidance in conformity with the rules and regulations of Indian Institute of technology Delhi and is a record of the original bonafide research work. The results presented in this thesis have not been submitted in part or full to any other universities or institutes for the award of any other degree or diploma.

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## ABSTRACT

The microbial fuel cell (MFC) is a sustainable technology that can directly produce electricity while treating wastewater. This is a novel type of reactor that uses microbial electrocatalysis to achieve redox conversions of organic and inorganic substrates present in the waste streams.

In this study, different types of MFC reactor configuration such as dual chamber MFC, biocathode MFC and air cathode MFC have been designed to understand the wastewater treatment efficiency and bioelectricity production. The impact of industrial wastewater on MFC operation was also studied. The MFCs were operated under batch, fed-batch and continuous mode of operation. For studying the improvements in the proton exchange rates, from anodic to cathodic chamber, three different membranes, namely Nafion 117<sup>®</sup>, Zirfon<sup>®</sup> and Fumasep<sup>®</sup> were tested. Agar salt bridge, a low cost proton exchange membrane alternative, was also tested for its efficiency in the MFC operation.

An air cathode MFC was characterized in continuous mode, to determine intrinsic properties for suitable performance and scalability. Effect of various external resistance with a fixed hydraulic retention time (HRT) and various HRT with a fixed external resistance in an air cathode MFC were studied and simultaneously analyzed the EIS response for the same to deeply understand the MFC mechanism.

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