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A STUDY OF MICROBIAL FUEL CELL PERFORMANCE FOR METAL FRACTION IN BIOCHAR ELECTRODES

PAWAR RAHUL KANTILAL

Research Scholar, Ph. D. in Civil Engineering
Mansarovar Global University, Bilkisganj, Sehore, M.P.

ABSTRACT

Microbial Fuel Cells (MFCs) are gaining attention for their ability to generate bio-energy while also serving in environmental remediation, including the use of biochar electrodes enriched with metal fractions. Biochar, a carbon-rich material derived from the pyrolysis of organic biomass, is used as an electrode in MFCs because of its high surface area, porosity, and conductivity. When biochar electrodes are infused with metal fractions, such as iron, nickel, or cobalt, the electron transfer between bacteria and the electrode is significantly enhanced. The presence of metal ions can facilitate the formation of a more conductive biofilm and increase the efficiency of electron capture and transport. This modification improves the overall performance of the MFC, resulting in higher power density and better stability of the electrochemical process. Moreover, metal-fractioned biochar electrodes can enhance the degradation of organic substrates in wastewater, boosting both energy recovery and treatment efficiency. The structural and surface properties of biochar, combined with the catalytic activity of the metal components, create a synergistic effect, optimizing microbial interactions and electron flow. However, the long-term stability and environmental impact of metal-infused biochar remain areas of concern. Ongoing research focuses on optimizing metal content, understanding microbial compatibility, and ensuring the sustainability of this technology.