

## **Bioelectro-catalytic valorization of dark fermentation effluents by acetate oxidizing bacteria in bioelectrochemical system (BES)**

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### **Abstract**

Biovalorization of dark fermentation effluent (DFE) in a microbial fuel cell (MFC) was studied using the biocatalyst enriched from farm manure. The MFC performance was evaluated in terms of power density, substrate degradation, energy conversion efficiency and shifts in system redox state with operation time and organic loading rate (OLR). Higher power density of  $165 \text{ mW m}^{-2}$  ( $12.5 \text{ W m}^{-3}$ ) was observed at OLR I, which dropped to  $86 \text{ mW m}^{-2}$  at OLR II and  $39 \text{ mW m}^{-2}$  at OLR III. The substrate degradation was also higher at OLR I (72%) and diminished with increasing the OLR. The pH showed rapid drop and fluctuations initially when shifted to DFE but adapted over time. Higher coulombic efficiency was observed (48% at OLR I) contributing to a total energy conversion of 11%, which is higher compared to the available literature. However, the MFC performance declined at higher OLR with respect to all the performance indicators. DFE consisted of residual sugars from first stage process along with the volatile fatty acids (VFAs) and alcohols, which contributed for the generation of organic acids with their simultaneous consumption and led to VFA increment in spite of COD removal. Cyclic voltammograms along with the derived electro-kinetics supported the observed shifts.

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