Exoelectrogens in Microbial Fuel Cells Toward Bioelectricity Generation: A Review

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ABSTRACT

Exoelectrogens are catalytic microorganisms competent to shuttle electrons exogenously to the electrode surface without utilizing artificial mediators. Diverse microorganisms acting as exoelectrogens in the fluctuating ambience of microbial fuel cells (MFCs) propose unalike metabolic pathways and incompatible, specific proteins or genes for their inevitable performance toward bioelectricity generation. A pivotal mechanism known as quorum sensing allows bacterial population to communicate and regulates the expression of biofilm-related genes. Moreover, it has been found that setting the anode potential affects the metabolism of the exoelectrogens and hence the output of MFCs. Microscopic, spectrometry investigations and gene deletion studies have confirmed the expression of certain genes for outer-membrane multiheme cytochromes and conductive pili, and their potential roles in the exoelectrogenic activity. Further, cyclic voltammetry has suggested the role of multifarious redox-active compounds secreted by the exoelectrogens in direct electron transport mechanisms. Besides, it also explores the various mechanisms of exoelectrogens with genetic and molecular approaches, such as biofilm formation, microbial metabolism, bioelectrogenesis, and electron transfer mechanisms from inside the exoelectrogens to the electrodes and vice versa.

KEYWORDS: Microbial fuel cell; exoelectrogens; electricity production; c-type cytochromes; microbial nanowires

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