Oxygen allows Shewanella oneidensis MR-1 to overcome mediator washout in a continuously fed bioelectrochemical system

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Details

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Abstract

Many bioelectrochemical systems (BESs) harness the ability of electrode-active microbes to catalyze reactions between electrodes and chemicals, often to perform useful functions such as wastewater treatment, fuel production, and biosensing. A microbial fuel cell (MFC) is one type of BES, which generates electric power through microbial respiration with an anode as the electron acceptor, and typically with oxygen reduction at the cathode to provide the terminal electron acceptor. Oxygen intrusion into MFCs is typically viewed as detrimental because it competes with anodes for electrons and lowers the coulombic efficiency. However, recent evidence suggests that it does not necessarily lead to lower performances—particularly for the model organism *Shewanella oneidensis* MR-1. Because flavin-mediated electron transfer is important for *Shewanella* species, which can produce this electron shuttle endogenuously, we investigated the role of flavins in the performance of pure-culture BESs with *S. oneidensis* MR-1 with and without oxygen. We found that oxygen increases current production more than twofold under continuously

fed conditions, but only modestly increases current production under batch-fed conditions. We hypothesized that oxygen is more beneficial under continuously fed conditions because it allows *S. oneidensis* to grow and produce flavins at a faster rate, and thus lowers flavin washout. Our conclusions were supported by experiments with a flavin-secretion deficient mutant of *S. oneidensis*. Biotechnol. Biotechnol. Bioeng. 2014;111: 692–699. © 2013 Wiley Periodicals, Inc.

Involved units

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