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Depending on the Initial Culture Conditions
미생물 연료전지의 제작과 초기배양조건에 따른 성능시험

김남준, 최영진, 정선호, 김성현*
건국대학교 미생물 공학과, *건국대학교 화학과

Microbial fuel cells comprising the microorganism *P. vulgaris*, thionin as a mediator, and various mono- and disaccharides in an anodic compartment have been developed. A cathodic compartment containing a Pt electrode and $Fe(CN)_6^{3-}$ was separated from an anode by the Nafion membrane. From absorbance-time measurements, it was found that the absorbance of thionin was not altered by the addition of *P. vulgaris,* even in the presence of sugars. However, thionin was effectively reduced when *P. vulgaris* was present. These results differ substantially from the case of safranine O, a phenazine-derivative, indicating that thionin takes up electrons during the metabolic oxidation processes of carbohydrates. Maximum fuel cell efficiency was observed at 37 ℃, optimum temperature for the growth of *P. vulgaris,* and 0.5 V cell voltage was obtained, which indicates that the metabolism of the microorganism directly affects the efficiency. Thionin concentration was closely related to cell performance. When the charging-discharging characteristics were tested with glucose, galactose, sucrose, maltose, and trehalose as carbon sources, galactose was found to give the highest coulombic efficiency. Cell performance was almost fully recovered with only small degradation when glucose and sucrose were used in the repetitive operation. Current was maintained nearly twice as long for sucrose than in the case of glucose.

The fuel cell efficiency depended on the carbon source in the initial medium of the microorganism. Maltose and trehalose were not utilized substantially by *P. vulgaris*, however, their presence in the initial medium resulted in enhanced cell performance. Particularly, galactose showed 63% coulombic efficiency in a biofuel cell after *P. vulgaris* was cultured in a trehalose-containing medium. This work demonstrates that optimum utilization of carbon sources by microorganisms, which leads to the maximization of the fuel cell performance, is possible simply by adjusting initial carbon sources.