Symp A3

Development of Microbial Fuel Cells : Effects of Initial Carbon Sources and Environmental Shocks

미생물을 이용한 연료전지의 개발 : 초기 탄소원 및 환경쇼크의 영향

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Microbial fuel cells comprising various microorganisms and mediators have been developed and the effect of initial carbon sources and environmental stresses was examined to optimize the fuel cell performance.

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. In particular, galactose showed 63% coulombic efficiency in a biofuel cell after *P. vulgaris* was cultured in a trehalose-containing medium. This 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 source.

Also a study was performed to examine the effect of temperature and ethanolic stresses on the coulombic efficiency of a microbial fuel cell. The conventional-type fuel cell containing Gram-negative bacteria, *Proteus vulgaris,* was investigated as a model system. From current output measurements, it was found that the coulombic yields were altered by environmental stresses such as temperature shock or ethanol treatment to the bacteria. While high-temperature or ethanolic shock led to a remarkable decrement in coulombic output, the low-temperature shock induced a slight increase in microbial fuel cell efficiency. These results indicate that the membrane fluidity is considerably affected by the environmental stress, which in turn affects the electron transfer process through the bacterial cell membrane to and from the electrode. Markedly different electrochemical behaviors were observed depending on the environmental stress. A reciprocal relationship between coulomb output and the ratio of saturation/unsaturation of fatty acids has been observed.