A newly enzyme-immobilization method for an enzyme-based biofuel cell

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Environment-friendly bioelectrical cells such as minimized biofuel cell may prove to be attractive alternative energy supply sources for nano-microelectronic devices and biosensors. Enzyme-based biofuel cells are capable of functioning at moderate temperatures. However, electrical biocatalysts have a low activity and electrical power. In this study, the effect of a novel enzyme immobilization method on the anodic electrical properties of an EFC were investigated under ambient conditions. The anodic system contained a gold electrode, pyrroloquinoline quinone (PQQ) as the electron transfer mediator, lactate dehydrogenase, β-nicotinamide adenine dinucleotide (NAD^+) as the cofactor, and lactate as the substrate. The anodic electrical properties were increased as the result of a novel enzyme-immobilization method. Lactate, NAD^+, or $CaCl_2$, which can influence enzyme activation, were used to prevent covalent bond formation near the active site of the LDH during enzyme-immobilization. The protection of the active site of the LDH using this novel enzyme-immobilization method increased the stability of the LDH, which led to high power production (142 uW/cm^2) in a basic EFC.