

(様式 5)

2022 年 09 月 30 日  
Year Month Day

## 学位 (博士) 論文要旨

(Doctoral thesis abstract)

論文提出者 (Ph.D. candidate)	工学府博士後期課程 生命工学 専攻 (major) 2016 年度入学(Admission year) 学籍番号 16831104 氏名 Maya Fitriana (student ID No.) (Name)
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論文題目 (Title)	Electrochemical lactate sensor using lactate oxidase from <i>Aerococcus viridans</i> and phenazine derivatives as the mediator
論文要旨 (2000 字程度) (Abstract(400 words)) ※欧文・和文どちらでもよい。但し、和文の場合は英訳を付すこと。 (in English or in Japanese)  Recently, the development of second-generation electrochemical enzyme sensors is one of the most popular among the first- and third-generation enzyme sensors. In this sensor type, the artificial electron acceptor or mediator was used to transfer electrons from enzyme cofactor to the electrode. Thus, a mediator is the most important element in this sensor type next to the enzymes. The enzyme sensors employing mediator offering some advantages such as: 1) no more dependent with dissolved oxygen, which is often fluctuate in samples and leads to the inconsistency of the measurement results; 2) allowing lower application potential, thus minimizing the effect of redox interferences. Furthermore, the effectivity of the measurements can be achieved when utilizing the suitable mediator in coupled with the enzymes.  I studied the application of mediators derived from phenazine derivatives. In the first study, I characterized the electron mediators for lactate oxidase derived from <i>Aerococcus viridans</i> ( <i>AvLOx</i> ) by evaluated the response currents of mimicked disposable blood lactate sensor employing three popular mediators: ferricyanide, 1-methoxy-5-methylphenazine methylsulfate (mPMS), or hexaammine ruthenium(III). The results showed that the relatively uncharge mPMS is the most effective mediator for <i>AvLOx</i> , exhibits a wide linear range and a high sensitivity; the strong negative charge ferricyanide is less effective than mPMS but does utilized by <i>AvLOx</i> , and the strong positive charge hexaammine ruthenium(III) was not utilized as a mediator by <i>AvLOx</i> because of the repulsion by the local charge of <i>AvLOx</i> surface.	

In the second study, I employed 1-methoxy-5-ethylphenazine ethylsulfate (mPES), a new mediator that currently commercially available. With its high stability in wide range of pH, it is expected to improve the storage stability of disposable lactate sensor based on *A<sub>v</sub>L<sub>0</sub>x*. As expected, the lactate sensors showed stable for 48 days after storage at 25 °C. The mPES can also be utilized as a mediator by other popular enzyme sensors such as glucose dehydrogenase (GDH), glucose oxidase (GOx), and fructosyl peptide oxidase (FPOx).

Lastly, a new redox mediator, thiol-reactive (trPES) was firstly applied to modified with *A<sub>v</sub>L<sub>0</sub>x* cysteine mutants and provided quasi-direct electron transfer to the modified *A<sub>v</sub>L<sub>0</sub>x*. One of the *A<sub>v</sub>L<sub>0</sub>x* cysteine mutants showed the highest response currents toward lactate. This study determined the best position to modified *A<sub>v</sub>L<sub>0</sub>x* with trPES. The response currents observed in modified trPES-*A<sub>v</sub>L<sub>0</sub>x* cysteine mutants are obtained from intramolecular electron transfer. I showed that trPES can also be applied to other oxidoreductase such as GDH.

(英訳) ※和文要旨の場合(400 words)