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Redox cycling as efficient signal enhancement tools for biotechnology and health care

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Amplified measurement technology for proteins or genes is highly challenging in both bioelectronics and early medical diagnosis. Sensitive and quantitative methodologies are mostly seeking by biotechnology and healthcare sector and conventional electrochemical ELISA as bio-recognition platform gained high popularity due to its high specificity in antibody to antigen, simplicity in enzyme to antibody and its simple operating principle. But insufficient signaling readout, long incubation time and narrow detection window from the bio-recognition event greatly limits its practicability. To amplify the signal, though increasing enzyme label concentration, multi-enzyme labeling and nano-catalytic support showed positive feedback but the preparation and features of multi-enzyme labels or nano-catalysts limit its practical realization. The purpose of this study is to offer redox cycling as efficient signal enhancement concepts that keep the simplicity of the electrochemical ELISA. Repetitive generation of signaling species by relatively low electro-active oxidant/reductant/redox enzyme from electro-inactive substrate is possible through non-enzymatic and enzymatic redox cycling. Moreover further enhancement is also possible through connecting redox mediator as well following outer sphere to inner sphere redox reaction. The utilization of those strategies in bio-recognition platform achieved improved sensitivity and detection ranges. Importantly the electrochemical interference of real sample present in the system can significantly be avoided by simply optimizing the applied potential for detection signal. Redox cycling as signal enhancement concept already demonstrated its effectiveness through lots of applications in terms of its ultra-sensitivity and dynamic range. The compatibility of redox cycling to generate signal from micro-patterned electrode and to strip device too highlighted its significance in commercialization for POCT. So it is highly recommended that with proper industrial support, commercialization of this concept based bio-sensing platform through portable and cost effective device for untrained personnel of the third world countries will immerse its high significance on biotechnology and health care sector.

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