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Electrochemical Biosensor Based on NAD(P)H-dependent Quinone Reductase for Rapid and Efficient Detection of Vitamin K_3

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Vitamin K refers to a group of vitamins that play an important role in blood coagulation and regulation of bone and vascular metabolism. However, vitamin K3 may give severe side effects in animals and humans when improperly added to food and feed due to its toxicity. An electrochemical biosensor was developed based on the YaiB NADPH-dependent quinone reductase from Lactococcus lactis (YaiB) to achieve rapid and redox probe-free detection of vitamin K3. First, the ability of the carbon electrode to distinguish between 1,4-benzoquinone and hydroquinone was developed. Then, YaiB immobilized at the electrode to work as a bioreceptor was engineered and its sensitivity and specificity to reduce vitamin K3 was demonstrated. Finally, the biosensor's practical potential was tested directly in spiked milk samples achieving quantification of the vitamin K3 for 15 minutes. The limit of detection was 0.18µM and 0.86 µM in buffer and milk, respectively.

Keywords: Enzymatic sensor; Carbon Screen Printed Electrode; Voltammetry; Food quality; Vitamin detection.