Title : Microfluidics Paper-based Analytical Device for Fluorescence Determination of Hydrogen peroxide based on Thiamine-Hematin Reaction

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ABSTRACT

Hydrogen peroxide (H_2O_2) determination is an essential in clinical and biochemical applications, particularly in diagnostics. H_2O_2 serves as a crucial signaling molecule, its overproduction leads to oxidative stress, causing significant cellular damage to DNA, proteins, and lipids. This research aims to develop a rapid and cost-effective microfluidic paper-based analytical device (μPAD) for H_2O_2 detection based on fluorometric reaction of thiamine (Vitamin B1) and hematin. In this system, hematin is utilized as a peroxidase mimic to decompose H_2O_2, which in turn oxidizes thiamine into fluorescent thiochrome. The developed device exhibited a linear range of 1 - 30 μM with a regression coefficient (R^2) of 0.9961. A limit of detection (LOD), calculated based on $3SD_{blank}$, was 2.5 μM. Furthermore, the μPAD was applied for the detection of lactate via lactate oxidase enzyme. Based on the incubation with enzyme, the linear range of 10 - 100 μM lactate with a coefficient of determination (R^2) of 0.9980 can be obtained with the LOD of 10.0 μM (defined as the lowest detectable concentration within the linear range). The developed μPAD shows great potential for future application in on-site analysis and point-of-care testing.

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