

# A Simple and Cost-effective Microfluidic Paper-Based Biosensor Analytical Device and its Application for Hypoxanthine Detection in Meat Samples

Montita Mooltongchun<sup>1</sup> & Siriwan Teepoo<sup>1</sup>

<sup>1</sup>*Department of Chemistry, Faculty of Science and Technology, Rajamangala University of Technology Thanyaburi, Pathum Thani 12110, Thailand*

\* *Corresponding email: (siriwan@mail.rmutt.ac.th)*

## Abstract

In this paper, we combined lab-on-paper technology with biosensor techniques to fabricate a new analytical tool for hypoxanthine detection. The combination of these two technologies produces a quick, selective, and cost-effective analytical metrology for detection of hypoxanthine in meat samples. The paper-based colorimetric biosensor was developed based on dienzyme catalytic reactions. In presence of hypoxanthine, xanthine oxidase (XOD) catalyzes to form hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). Then H<sub>2</sub>O<sub>2</sub> couples with o-dianisidine in the presence of horseradish peroxidase (HRP), resulting in a brown color. The color intensity of the detection zone on the paper was imaged using a scanner. For quantitative analysis of hypoxanthine, the images of the colorimetric results were analyzed with ImageJ software using a blue histogram. Under optimum conditions, the developed paper-based biosensor was found to detect hypoxanthine with a detection limit of 1.8 mg L<sup>-1</sup> and a quantitative limit of 6.1 mg L<sup>-1</sup>. The proposed assay exhibited a linear dynamic in the range of 5–40 mg L<sup>-1</sup>. The analysis time was 5 min for triplicate measurement. This method was further evaluated by measuring the recovery of hypoxanthine added to meat samples. Finally, this method was applied to detect hypoxanthine in fresh and processed meat samples, and the results were validated against spectrophotometric detection, showing good accuracy. This simple method is cost-effective and requires no advanced instruments, offering an alternative to conventional methods.

**Keywords:** Microfluidic paper-based analytical device, Biosensor, Hypoxanthine, Meat sample.