Development of a Portable Optical Sensor for the Evaluation of MIP Dye-Displacement Assays in the Context of Food Screening

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Abstract: This research aims to develop a portable optical biosensor for the quality assessment in food products. A flow cell, with the integration of Molecular Imprinted Polymer (MIP) technology, provides a colour displacement assay in the presence of the target molecule. A passive flow cell design based on capillary forces ensures the handling of the fluids. A built-in mini spectrometer analyses the colour intensity which relates to the presence of the target analyte. Depending on the MIP-manufacturing on different analytes, the sensor is versatile in the detection of different targets; the focus will be laid on food safety and traceability.

Keywords: MIP-based Biosensor, Portable, Optical, Food Screening

Introduction

Traceability and food screening are fundamental parts to ensure the quality, safety, and authenticity of the food we consume. However, the standard analytical methods are associated with some general challenges: high-cost, method portability, need for skilled personnel, can involve complex procedures, and may involve lengthy measurement steps. Therefore, within recent years, there has been an increase in the development of methods utilising handheld and portable devices. (*1*, *2*)

In this work, an optical biosensing device is developed using a Molecularly Imprinted Polymer (MIP)-based dye displacement assay. This assay comprises of dye-filled MIPs, which in presence of the target analyte, based on competitive MIP-binding, releases the dye into the solution. As a result, the colour-reaction indicates the presence of the target analyte. (*3*)

This research aims to develop a portable, easy-to-use, and fast sensing device for the on-site detection in liquid samples. Depending on the MIP-manufacturing on different analytes, the sensor is versatile in the detection of different targets.

Results and Discussion

In this study, a fluidic flow cell (Figure 1) was developed to easily perform the dye-displacement assay. A standardized MIP-containing filter can be set up, ensuring a generalized measuring setup. Liquid samples can be inserted via the inlet, which are automatically and passively flown towards the sample-colour measuring area. Capillary forces and wetting of paper are the main driver for the fluid flow.

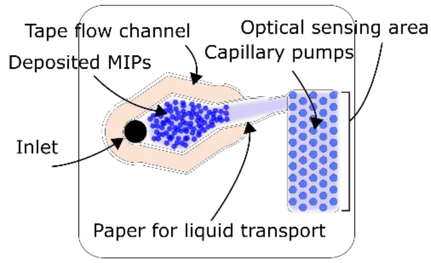

Figure 1: *Flow cell in which the liquid sample can be inserted to perform the dye-displacement assay.*

The flow cell can entirely be inserted into the newly developed optical measuring device. The sensing device comprises of a printed circuit board which regulates the built-in spectrophotometer (BO-HAMA-C12880-V2) and a LED. The device can be connected to a computer for data analysis.

Conclusions

This research demonstrates the use of an integrated MIP-based dye-displacement assay into a fluidic flow cell for the detection of a target analyte. The displaced dye is detected via an optical sensor, which is part of a portable measuring device.

References

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