SURFACE CHARACTERIZATION OF OPTICAL BIOSENSORS FOR DETECTION OF HARMFUL SUBSTANCES IN FOOD

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Optical biosensors, offering a label-free detection and suitable for miniaturization, in aim of lab-on-chip devicesare a great opportunity for a food quality control. An example of an application of optical biosensors for detection of harmful substances infood is a lab-on-chip device developed in the framework of the FP7 UE funded project Foodsniffer coordinated by NCSR Demokritos, Greece. This biosensing platform is based on Broad-Band Mach-Zehnder interferometric biosensors which are integrated among all electronic and photonic components in a single silicon chip (Fig. 1).On-chip MZIs biosensors enable a label-free multi-analyte detection in real-time based on specific binding between analyte and antibodies on the surface of the one of interferometer arms. The application ofthis optoelectronic biosensor was demonstrated for a food quality assessment such as detection of bovine κ-casein in goat milk[1] and mycotoxins detection in beer [2]. In laboratory an immunological detection of harmful substances in fluids could be realized by a convenient optical technique of White Light Reflectance Spectrometry [3]. The quality of biomolecular layer formed, for an analyte capturing from examined fluid, on the biosensing surface (here sensing arm of MZI) is crucial for a proper biosensor performance. Therefore, the evaluation of a capturing molecules surface density, their biological activity and surface resistance to non-specific adsorption is extremelyimportant. For this purpose a number of surface sensitive techniques could be applied such as AFM, ellipsometry, XPS and TOF-SIMS. TOF-SIMS technique which offersa sensitive analysis of surface molecular composition and high-resolution chemical surface imaging is especially valuable. In this presentation an application ofsurface science techniques for optimization of biofunctionalization protocols for detection of κ-casein [4], ochratoxine A [5] and fungicide thiabendazole [7] by on-chip MZIs biosensorsis presented. The biosensor interface characterization revealed phenomena affecting biosensor performance such as non-uniform molecules distribution or partial molecules desorption.

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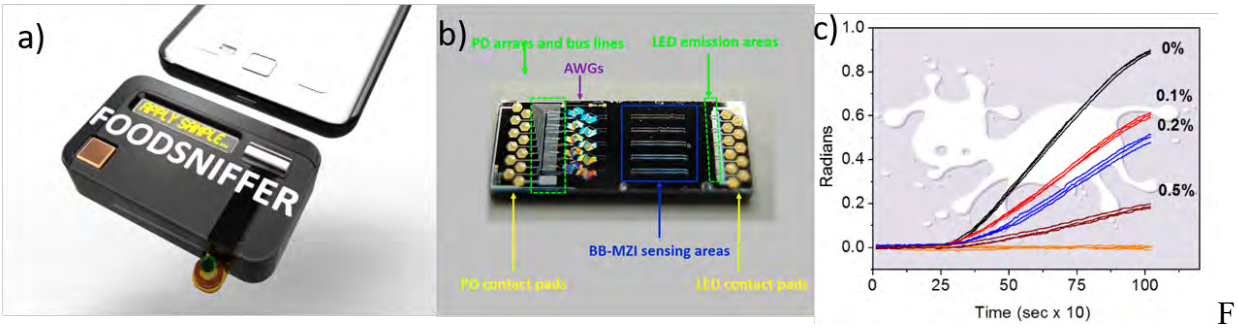

Fig.1.(a) An idea scheme of Foodsniffer device. (b) A photo of optoelectronic chip[8]. (c) An application of on-chip MZI biosensors for detection of goat milk adulteration with bovine milk.