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The BIOFOS-LoC: Microring resonator based biophotonic system for food analysis

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Current methodologies for detection of food contamination based on heavy analytical tools cannot guarantee a safe and stable food supply. The reasons are the complexity, the long time to result (2-3 days) and the cost of these tools which limit the number of samples that can be practically analyzed at food processing and storage sites. The need for screening tools that will be still reliable but simple, fast, low cost, sensitive and portable for *in situ* application is thus urgent. The BIOFOS project, an EC-funded FP7-ICT project, addresses this need through a high added value, reusable biosensor system based on optical interference and lab on a chip (LoC) technology. To do this, BIOFOS combines the most promising concepts from the photonic, biological, nanochemical and fluidic parts of LoC systems, aiming to overcome limitations related to sensitivity, specificity, reliability, compactness and cost issues. BIOFOS relies on the ultra low loss TriPleX photonic platform in order to integrate on a 4×5 mm^2 chip 8 microring resonators, a VCSEL and 16 Si photodiodes and achieve a record detection limit in the change of the refractive index of 5•10-8 RIU. To support reusability and high specificity, it employs aptamers as biotransducers, targeting at the reusability of the chips for 30 successive cycles. Advanced surface functionalization techniques were used for the immobilization of aptamers and new microfluidic structures were introduced for the sample pre treatment and the regeneration process. At the same time, novel techniques for the optimization of target analyte binding and increase in the recorded signal were developed which can be applied to all relevant miniaturized biosensor systems that aim to quantify a biological recognition event which is most of the times almost at the system noise level by amplifying it. BIOFOS assembled the parts in a 5×10×10 cm^3 package for a sample in result out, multianalyte biosensor. The system is in the process of being validated in real settings against antibiotics, mycotoxins, pesticides and copper in milk, olive oil and nuts, aiming at detection below the legislation limits and time to result only 5 minutes. It also targets lactose in lactose free milk. Based on the reusability concept, BIOFOS also aims at reducing the cost per analysis by at least a factor of 10 in the short and 30 in the midterm, paving the way for the commercial success of the technology.

Biography

G Tsekenis received his BSc (Hons) degree in Biochemistry and Genetics in 2004 from the University of Nottingham, UK and his PhD in Biotechnology and Biosensor Development from the University of Cranfield, UK in 2008, where he was involved in the development of three electrochemical immunosensors for clinical and food applications. His first placement as a Post-doctoral Research Fellow was at the Biomedical Research Foundation of the Academy of Athens, Greece, where he was engaged in biomarker discovery through the use of proteomics. Since then, he has been involved in a further two EC-funded projects, for the last of which he was WP leader, for the development of surface tension and photonic-based DNA-based sensors and aptasensors. He has co-authored 13 peer-reviewed articles. His research interests include surface functionalization techniques and bio-nanotechnology for biosensor development, drug delivery and tissue engineering.

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