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Biomarkers monitoring with specially-designed microfluidic paper-based devices as disposable, on-hand, real-time analysis

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The quality of bathing waters must be considered an issue of public health and the increasing number of bathing water-related infections worldwide, including Europe in recent years are of major concern. The determination of biomarkers is as emerging issue due to their direct relationship with the biological quality assessment. There is a lack of low cost, robust, disposable, safe, ease to use methods. So, search for faster, user friendly, ready-to-use, and still accurate monitoring techniques has been increasing. The idea of an on hand solution for instant analysis is appealing and has been gaining relevancy. In this scenario, microfluidic paper-based analytical devices (μPADs) can be a novel approach as an attractive alternative to the current monitoring techniques. The concept is based upon the microfluidics through the cellulose fibers and the setting of hydrophobic/hydrophilic interfaces for microflow manipulation. Using colorimetric reactions, the analyte concentration can be correlated to the colour intensity, which can be measured with a flatbed scanner and computer software [1]. The use of digital scanning as detection process has enabled to maintain the accuracy and reliability of the analysis in opposition to other paper-based visual indication techniques, with a positive/negative or concentration range response.

Overall, the analytical performance of the μPADs makes them quite attractive for rapid on-site analysis in many fields, namely environmental and biological samples. The μPADs small dimensions, inexpensive materials, minimal consumption of both reagents and sample, and ease of operation, makes them ideally suited for unskilled operators. An overview of the advantages and limitations of this emerging quantification method is presented, highlighting the versatility of μPADs.

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Immunochemical assays of protein biomarkers for authenticity and composition control of meat and dairy foodstuffs

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Control of food composition and content of main used sources of its preparation is essential analytical task to ensure safety and confirm quality. The identification of animals used to prepare meat and dairy products is the most important question in this control due to risks of the presence of ad hoc, low grade and allergenic components. The common analytical practice in authenticity and composition control for foodstuffs is based on complicated techniques (PCR, chromatography, microscopy, etc.) and so cannot provide wide and operate control. In this regard, new tools for controlling sources of food raw materials and confirming their authenticity should be developed to give possibility of rapid screening, including point-of-demand testing without analyzing samples in specialized laboratories.

The report presents the development of immunoanalytical systems for detection of meat and dairy raw materials in food and non-meat additives in meat products. An important issue that determines the applicability of immunodetection in food control is the stability of detected biomarkers after enzymatic and heat treatment in the course of technological processing of foodstuffs. The report includes screening of potential protein candidates for this purpose based on proteomic data. The advantages of troponins, thermostable biomarkers of muscle tissues, for meat authentication were shown. The specificity of various antibodies to troponins was tested. An enzyme-linked immunosorbent assay (ELISA) of troponin I was developed and characterized for analytical purposes. It was found that this ELISA allowed distinguishing mammalian (beef, pork, lamb, horse) and bird (chicken, turkey, duck) meat sources. For dairy raw materials and soy protein added to various foodstuffs, the effect of the enzymatic treatment on immunodetection has been investigated. Immunoassays with one-site (competitive) and two-site (sandwich) immune recognition were compared and the best solutions were chosen for the control of either native protein molecules or sum of various forms of the processed protein. Possibility to accelerate the assays by their implementation in kinetic mode was evaluated. The comparison of assay regimes and multifactorial optimization were implemented for the developed ELISAs of troponin, beta-lactoglobulin, casein, and soybean trypsin inhibitor. The assay techniques with a total duration of 30-40 min have been proposed. The applicability of lateral flow immunoassay (LFIA) based on the use of membrane carriers with immobilized immunoreactants were considered. Ap-