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DESIGN OF PAPER-BASED ANALYTICAL DEVICES FOR CHEMICAL AND BIOCHEMICAL ASSAYS OF BIOMARKERS IN BIOLOGICAL FLUIDS OF NON-INVASIVE COLLECTION

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Microfluidic paper-based analytical devices (µPADs) are innovative diagnostic tools that combine microfluidic principles with paper substrates to offer simple, portable, and cost-effective solutions. Because they use capillary action, µPADs do not require external pumps or power sources. Colorimetric reactions can be performed directly on paper, allowing for the immediate visual detection and quantification of chemical and biochemical parameters, as health biomarkers. The coloured product can be scanned and quantified through digital image processing, converting colour intensity into absorbance units. These measurements then correlate with the concentration of the individual biomarkers, like glucose and urea, among others, enabling real-time, quantitative analysis with no need for complex equipment. These features make µPADs ideal for point-of-care applications as low cost, portable, ease to use and disposable devices. Recently there also has been an increased interest in the use of saliva and urine as a biological sample for diagnosis and monitorization of several health conditions, since they are more convenient and reduce patient discomfort compared to traditional blood sampling. Non-invasive sample collection is also easier to handle in field settings. It lowers infection risk, making it highly valuable for low-resource environments, remote areas, and situations where rapid, on-site diagnosis is crucial.

This work aimed to combine µPADs' strengths and the benefits of non-invasive sample collection to develop disposable microfluidic devices for rapid, real-time diagnosis of biomarkers in saliva and urine. The designed devices are intended to be an alternative diagnosis tool to complement, not replace, conventional blood analysis. The developed work, focused on optimizing these devices to cover the dynamic concentration ranges of target analytes and minimize matrix interferences in the diagnostic fluids, aiming for high accuracy and reproducibility. Such innovations could significantly improve personalized medicine, early disease detection, and preventive healthcare by making diagnostics more accessible and efficient, especially where traditional laboratory facilities are unavailable or impractical.

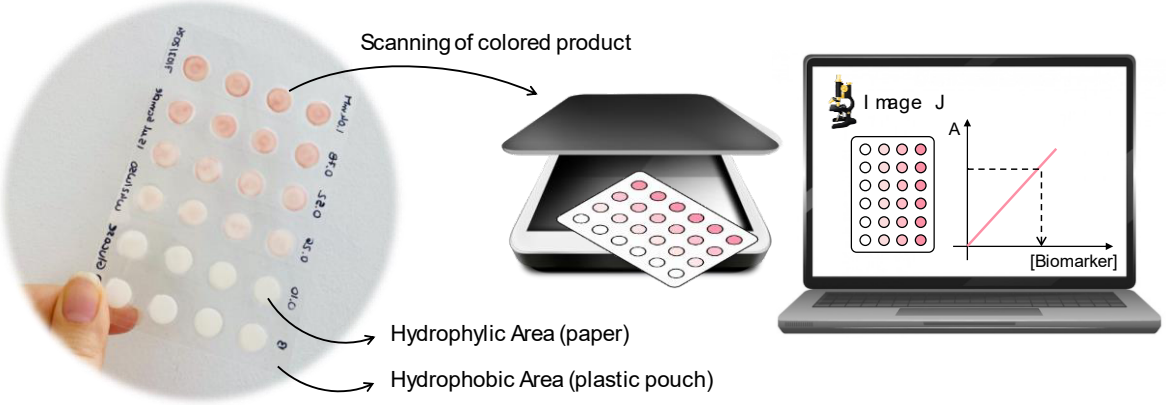

Fig.1. Schematic representation of a microfluidic paper-based analytical device and determination procedure.

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