Development of a Platform Technology Using Paper-Based Cantilever Valves for Detection of Biological Markers

Microfluidic paper-based analytical devices (μPADs) have witnessed a great extent of innovation over the past decade developing new components and materials assisting the diagnosis of different diseases and sensing of a wide range of biological, chemical, optical, and electrochemical phenomena. The novel paper-based Bi-Material Cantilever (B-MaC) is one of the major components that allows autonomous loading and control of multiple fluid reagents required for the accurate operation of paper-based microfluidic devices. This work will introduce a platform with functional components fabricated on paper allowing multi-step actuation to control capillary flow. Integrating these components in a topologically specific channel network forms a complete fluidic logic circuit to accept two or more fluids. When entering the network, fluid moves in designated channels which can initiate the actuation of the cantilever and thus, the flow of another fluid. This process results in the sequential loading of multiple reagents, passing a fixed detection zone. The sequential actuation enables the platform to perform biomarker detection that needs at least two sequentially loaded reagents. The major outcome of this work is that the developed platform will be of great use to perform autonomously enzyme-linked immunosorbent assays (ELISA) by untrained citizens who will have a rapid and handheld sensor to detect biomarkers.