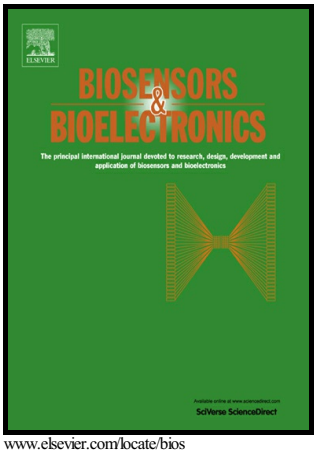

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Integration of biosensors into digital microfluidics: impact of hydrophilic surface of biosensors on droplet manipulation

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Abstract

Several studies have been performed on the integration of biosensors into digital microfluidics (DMF). Despite the general success in their detection capabilities, there are still two challenges associated with the integration of biosensors into DMF: 1) complete removal of the droplet containing the analytes from the sensing surface; and 2) biochemical regeneration of the biosensor involving detaching the target analyte from the receptor after each round of sensing. The latter is case dependent and the solution can vary from one application to another. Our research aims at addressing the former, the solution to which is applicable to all biosensors integrated to DMF. This paper presents a thorough characterization of the hydrophilic surface of the biosensor in terms of wettability and geometry, taking into account the overall configuration of the DMF platform. Consequently, we identify the optimal geometry of the sensing surface and the DMF platform providing successful removal of the target droplet from the sensing surface after detection. Based on the results, the gap height is suggested to be chosen at the upper limit of the applicable range. Also, the biosensor, patterned on the device top plate, is recommended to be designed with a high aspect ratio and aligned with the center of the actuating electrode. As a proof of concept, the optimum configuration is implemented on a DMF platform with an interdigitated capacitive biosensor to detect different concentrations of *Cryptosporidium*, for which it is shown that the sample droplet is removed successfully from the superhydrophilic surface of the biosensor.

Keywords: Digital microfluidics; Biosensor; Hydrophilic surface; Capacitive detection.