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A PRINTED POTENTIOMETRIC WEARABLE SENSOR FOR pH MONITORING IN SWEAT

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Nowadays, one of the hot topics in medical and bioanalytical field is the development of continuous, non-invasive, and easy to use sensing devices for biomarkers monitoring. Highly improved by the use of high technologies, wearable sensors have gained a primary role in the continuous and ubiquitous monitoring of people health state. Exploiting flexible electronics, smart materials and low-power working devices, wearable sensors can be easy produced, thanks to reduced barriers to technology accessibility and cost decreasing, unleashing the potential for simplified healthcare procedures. So that, sport activities monitoring and healthcare can be easily achieved by the end-user, allowing for the delivering of a detection platform at any time and any location, with positive implications for the monitoring of vital biomarkers during a physical performance as well as the treatment of chronic disease conditions. In order to create such user-friendly wearable devices, automatic and passive system have been fabricated, exploiting wireless technologies (i.e. Near Field Communication (NFC) or Bluetooth Low Energy (BLE)) for data transmitting, electrochemical techniques (i.e. potentiometry and amperometry) for analyte detection and printed electronic circuits for components communication [1,2]. It is clear that, the several components of the whole sensing platform, namely an efficient data collector and transmitting system, a small power supply (if necessary) and a miniaturized sensor, must be embedded in the same flexible substrate (i.e. PET), to create a small-size wearable sensor applicable on the body, namely the skin surface.
Herein, we developed a miniaturized wearable sensor for pH sweat real-time detection during a physical activity (Figure 1). The device consists of a low-cost fabricated screen-printed electrode (SPE), for pH detection by potentiometric measurements, closely integrated in a flexible Radio frequency identification (RFID) antenna working in the UHF band (868-960 MHz), for data transferring to an external receiver. Moreover, an electronic chip enabling the data storage, signal elaboration and wireless communication to a remote reader. Both the electronic and analytical components were embedded on a flexible Kapton substrate allowing for the fabrication of a small-sized and flexible sensor, applicable on epidermal surface.
In order to create a sensitive layer to the H^+ concentration in sample, the surface of the SPE was modified with a metal oxide compound, by electrodeposition of a solution containing iridium oxide. First, several parameters for the sensor optimization were studied, namely

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number of scans and potential window for the metal electrodeposition, interferences study and pretreatment procedure for stability enhancement. After, a calibration curve was obtained by potentiometry measurements of standard solutions, with a linear response in the range between pH 4 and pH 8 and a regression equation equal to y = -0.069 x + 0.72, R^2= 0.989. Finally, pH was detected in real sample, i.e. sweat sample, obtaining a value of 5.2, in agreement with normal sweat values, equals to 4.5-6.

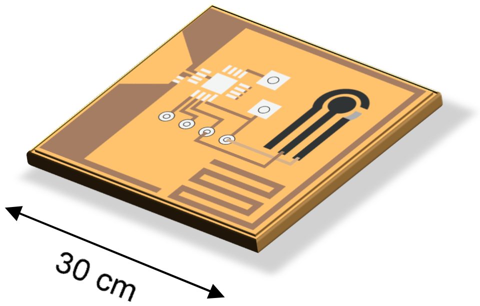

Figure 1. Picture of the developed wearable sensor

References

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