Development of fully bioresponsive printed sensors: exploring the electronic tongue concept for specific analytes

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Abstract

In healthcare systems there are different procedures in order to detect some irregular parameters for the patients, thereby allowing the detection and early treatments of certain diseases or medical conditions. Self-diagnostic systems are being increasingly implemented, in order to increase the responsiveness of health services, but also to allow a more comfortable and confidential care service for all patients. Furthermore, the development of new devices and sensors able to provide a real-time answer to this problem are an increasing concern for different stakeholders in the health services.

The development of organic electronics and consequently the development of sensors based in organic polymers, raised the interest of the scientific community, which, motivated by these multifunctional and low cost materials started to develop bioresponsive sensors for different applications, including the medical field, and for detection of different analytes.

This work is focused in the development of printed and organic bioresponsive sensors based on the electrical response of a conductive polymer, PEDOT:PSS. A pre-industrial approach was considered, using printing technologies such as screen printing and roll-to-roll (R2R) slot die, in order to develop and manufacture the printed sensors at a low cost, taking them closer to the market.

The developed and tested sensors are composed by carbon microelectrodes, with different geometrical parameters, processed by screen printing, and coated with PEDOT:PSS organic film by R2R slot die technique. After the fabrication process, the sensors were characterized morphologically, by optical microscopy, atomic force microscopy and profilometry analysis. The printed bioresponsive sensors were also tested for their electrical behavior when exposed to different analytes, with focus on two gynecological pathologies analytes.