Electrospun nanofibers based sensors in the context of health monitoring

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Summary

The third goal of the Sustainable Development Goals of the United Nation is named “Good Health and well-being”. One of the strategies to reach this goal consist in the actuation of a new approach of medicine, defined as the personalized medicine. The European Alliance of Personalized Medicine describe this approach as “The right prevention and treatment for the right person at the right time.” In this context, engineering has a lot to afford through the creation of personalized devices, organ on a chip, personalized implants, cells engineering, genomics and biomaterials.

This thesis concentrates in the development of personalized devices. These devices can be divided in two categories: *i)* wearable devices, for real time information about the patient heath status; *ii)* point-of-care (POC) mostly used for diagnosis.

One important component of these devices are the sensors since they are the entry point of the information about the patient in the device. The key challenges about these sensors are their flexibility, high sensitivity, biocompatibility and easy scale up.

To rise these challenges, in my thesis, I propose nanofibers (NFs) developed as sensitive materials into sensors. Indeed, through the high surface-to-volume ratio and the nanostructuration of the NFs, the requirements of high sensitivity and flexibility can be fulfilled. Moreover, we choose electrospinning as the NFs fabrication method for the easiness of the process that lead to an easy scale up and the possibility to select proper biocompatible materials.

In my thesis, I developed a multi-sensing platform based on poly(ethylene oxide)/poly(3,4-ethylenedioxythiophene):poly(styrene sulfonate) for pH and joint bending analysis for rehabilitation application as a wearable device. Moreover, I evaluated its evolution in a wire form. For what concern the development of POC for tumor biomarker, I studied the possible integration of NFs to increase the sensitivity of the devices.