NON-INVASIVE CONTINUOUS MONITORING OF ION BIOMARKERS FOR THE STUDY OF NEURODEGENERATIVE DISEASES BY EXPLOITING PRINTED ION-SELECTIVE SENSORS

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Background

Real-time measurement and monitoring of ions within solutions are in high demand in various fields, including medicine, water and soil monitoring. So, noninvasive monitoring of ion concentrations in human biofluids by exploiting electrochemical sensors is a powerful technique that has been gaining increasing interest in recent decades. Altered values of ion components within the human body can lead to physiological changes, compromising patient health.

Objectives

The goal of the research project is to build an ion-selective sensor through a special 3D printer, Aerosol Jet Printing (AJP). This involves monitoring of ions of our interest and applicability in different areas, such as monitoring of particular diseases, water, soil and air monitoring. Interoperability of the sensor is ensured by the different structures and chemical characteristics of the ion-selective membrane, which allows selectivity of the electrochemical cell.

Methodologies

Sensors will be designed in collaboration with electronic engineers. Different inks and substrates will be selected and used to make ion-selective sensors. Different processing techniques will be evaluated and compared based on various parameters, such as resolution, processing time, process complexity (including in this parameter the need for high temperatures or toxic chemicals in the manufacturing process), cost of the overall technique, and environmental impact. Various measurements will be made, including optical measurements, profilometric (or geometric) measurements, and electrical measurements. In addition, tests necessary to quantify the morphological characteristics of the sensors will be performed in the laboratory.

Fig. 1. Different types of ion-selective sensors printed in AJP and wearable sensors.

Expected Results and Impact

The main expected results include the printing of the complete sensor, its miniaturization, and the evaluation of improved metrological characteristics compared with sensors already on the market. This makes it possible to develop fully integrated sensors within the human body to monitor specific diseases that are still untreatable today.