CIC biomaGUNE: CIF: G-20788840· Parque Tecnológico de San Sebastián · Pº Miramón 182· 20014 San Sebastián (Gipuzkoa)· Tel.: + 34 943 00 53 00· Fax: + 34 943 00 53 01· info@cicbiomagune.es ·www.cicbiomagune.es

CIC biomaGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

seminar

Wednesday, 10th February, 9.30am, Online

Host: Prof. Maurizio Prato

3D structures based on carbon materials and conducting polymers for electroresponsive cell culture

Antonio Dominguez-Alfaro
Carbon bioNanotechnology group, CIC biomaGUNE
Innovative Polymers group, POLYMAT

The field of tissue engineering requires the development of tridimensional scaffolds that simulate the complexity of living entities. Thus, new and innovative materials with soft mechanical properties, controlled shape, porosity and biocompatibility are actively searched in this area. Moreover, focus on electroactive cell, conductivity of the material plays an important role in cell proliferation, morphology and interconnectivity, among others.[1]

Poly (3,4-ethylenedioxythiophene), or commonly known as PEDOT, is one of the most used conducting polymers due to his high conductivity, stability and biocompatibility. However, very little is reported about tridimensionality due to present important structural limitations.[2] Therefore, this thesis has address the challenge of manufacturing 3D structures based on PEDOT using different secondary supporters as carbon nanotubes (CNTs) or polyesters.

In this work, we have adapted two known route used to polymerize PEDOT: chemical and electrochemical polymerization. Thus, we have modulated a vapor phase reaction[3] and electrochemical reaction[4] using tridimensional templates to produce self-standing structures composed of PEDOT and CNT. In the third approach, we have developed a new PEDOT-graft-Polylactide copolymer that could be 3D printed by direct ink writing by melting extrusion.

We present the application of these methodologies in the manufacturing of 3D structures controlling properties such as composition, porosity, conductivity, mechanical toughness and biocompatibility for electroactive cells cultures such as neurons and cardiomyocytes.

---

1. Fabbro, A. *et al.* Spinal cord explants use carbon nanotube interfaces to enhance neurite outgrowth and to fortify synaptic inputs. *ACS Nano* **6**, 2041–2055 (2012).
2. Alegret, N., Dominguez-Alfaro, A. & Mecerreyes, D. 3D Scaffolds Based on Conductive Polymers for Biomedical Applications. *Biomacromolecules* **20**, 73–89 (2019).
3. Dominguez-Alfaro, A. *et al.* Tailored Methodology Based on Vapor Phase Polymerization to Manufacture PEDOT/CNT Scaffolds for Tissue Engineering. *ACS Biomater. Sci. Eng.* **6**, 1269–1278 (2020).
4. Dominguez-Alfaro, A. *et al.* Toward Spontaneous Neuronal Differentiation of SH-SY5Y Cells Using Novel Three-Dimensional Electropolymerized Conductive Scaffolds. *ACS Appl. Mater. Interfaces* **12**, 57330–57342 (2020).