NANOTECHNOLOGY FOR DETECTION OF BIOMOLECULES AND FABRICATION OF BIOACTIVES PLATFORMS

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Scientific topic: Biotechnology and Biochemical Engineering

Innovation in Materials and Molecular Engineering's Group (IMEM-UPC) has recently fabricated new nanomaterials, based on conducting polymers, with potential applications in biochemical engineering **[1]**. Poly(N-methylpyrrole) [PNMPy] core-shell particles with controlled thickness have been prepared using the Layer-by-Layer assembly technique and polystyrene particles **[2]**. The system imitate the membrane-bound packets called vesicles and responsible for the dopamine storage [Figure 1]. The development of sensors to measure the dopamine concentration in a single synapse is currently getting special attention because of the necessity of understanding the mechanisms that provoke neurological disorders, like Parkinson's disease and schizophrenia, and which is essential to achieve their complete control.

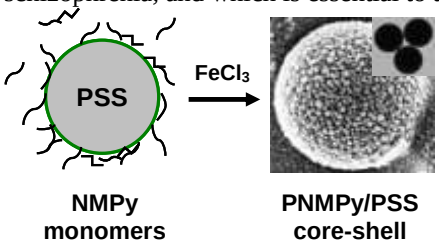

Figure 1. PNMPy hollow spheres with shell thickness of 30 nm used for detection of dopamine molecules.

On the other hand, IMEM has started the fabrication of a new kind of free-standing nanomenbranes, which have been achieved by mixing poly(3-thiophene methyl acetate) (P3TMA), a semiconducting polythiophene derivative, and poly(tetramethylene succinate) (PE44), a biodegradable polyester; as bioactive platforms for tissue regeneration [Figure 2]. Enzymatic degradation essays indicated that the ultra-thin films are biodegradable due to the presence of the aliphatic polyester, which degrades very efficiently, and have semi-conducting properties depending on the conducting polymer concentration. Successful adhesion and proliferation assays with epithelial cells validate the use of the nanofilms as bioactive substrates for tissue regeneration.

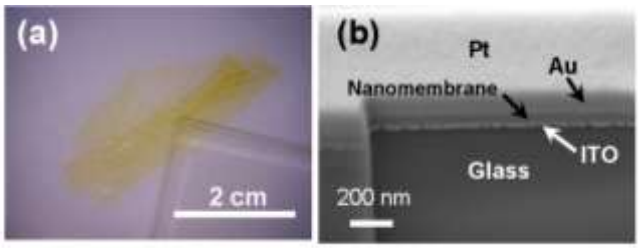

Figure 2. (a) Image of one free-standing P3TMA/PE44 nanomembrane dispersed in ethanol and (b) SEM image of cross-sectional nanomembrane view showing the thin thickness and porosity of the film.

Moreover, the possibility of large scale fabrication, combined with the simplicity of the processes, makes LbL-self assembly and nanomembrane preparation **[3]** technologies very attractive for many applications in biomedical field.

ACKNOWLEDGEMENTS

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REFERENTES: [1] Martí, M.; Fabregat, G.; Estrany, F.; Alemán, C.; Armelin, E. *J. Mat. Chem.* **2010**, *20*, 10652. [2] Decher, G. *Science* **1997**, *277*, 1232. [3] Watanabe, H.; Ohzono, T.; Kunitake, T. *Macromolecules* **2007**, *40*, 1369.