Development of nanoporous membranes dedicated to insulin delivery for the treatment of diabetes using an eco-efficient approach

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ABSTRACT:

16 lines or 300 words

The DECAPES project aims at developing a semi-permeable membrane by electrospinning, a process allowing the fabrication of nanofibrous membranes from polymer solution subjected to a high electric field. This membrane is subsequently integrated into a cellular encapsulation device resulting to a "bioartificial" pancreas intended to restore normal insulin production for type 1 diabetic patients. The membrane must allow nutrients, glucose, and oxygen to enter into the bioartificial pancreas to provide the necessary environment for the survival and activity of the encapsulated cells which in turn produce insulin. These secreted molecules can then exit the device through the pores of the membrane. On the other hand, the molecules of the immune system cannot enter the device, preventing the rejection of the cells contained in the medical device (figure 1).

In this context, the PhD project is based on the development of a polymer membrane with controlled pore size by "green electrospinning", using only water as solvent [1]. One of the major challenges is to reduce the pore size of the membrane to less than 100 nm preferentially. To achieve this, an innovative strategy is the development of a composite membrane by involving a thermoplastic polymer and a water-soluble polymer as a sacrificial element, whose melting temperature is lower than that of the thermoplastic polymer. After a thermal compression, the water-soluble fibers will generate a continuous nanoporous pathway along the thermoplastic molten membrane. A water wash will finally remove the water-soluble fibers and keep the nanoporous traces of the polymer membrane in a controlled way.

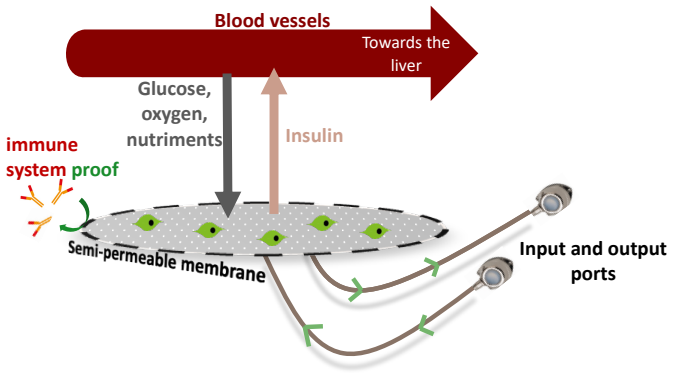

Figure 1 Explanatory scheme of a cell macro-encapsulation device

Reference

[1] Stoiljkovic, A. et al. (2007) Polymer, 48 (14), 3974-3981