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P23: Surface modification of bacterial cellulose membranes for microfluidic applications

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Abstract

Although the great advances in medicine, there are still many limitations related to materials that can interact with the human body and its cells. One of the major challenges is developing biocompatible materials that can be used to skin repair treatments, tissue regeneration, inflammation, and wound treatments, among other problems. The most critical step to explore new materials development still remains in the interactive surface cell-contact to different biomaterials[1]. Bacterial cellulose (BC) has attracted the attention of many in this field due to its advantageous characteristics being biodegradable, non-toxic, non-carcinogenic, and biocompatible with the human body. This polymer could be the future of regenerative medicine and for that, it is necessary to continue exploring their properties and possible treatments that can improve them. The work reports the functionalization of bacterial cellulose (BC) membranes with a view to their application in microfluidic devices for the growth of epidermal cells. Here, is proposed a surface modification with Parylene C deposition by chemical vapor deposition (CVD), and consecutively optimized oxygen (O_2) plasma pre-treatment and sulfurhexafluoride (SF_6) plasma treatment in a reactive ion etching (RIE) system. Parylene C is a transparent polymer to the naked eye with an excellent permeation barrier for liquid and gaseous types, required for this kind of application. This chemically inert, biocompatible, biostable, flexible, hydrophobic and resistant polymer, has been extensively used for several applications, including for medical devices and implants[2]. This proposed technique[3] produce a surface roughness and enhances the intrinsic hydrophobicity of Parylene-C, by giving not only hydrophobic but superhydrophobic behavior on surface membranes, without altering the material bulk (bacterial cellulose) properties. The best results were obtained by deposition of 10 g of parylene-C, pre-treated with O_2 plasma for 10 min, and then SF_6 plasma for 1 min. After all the optimization processes a superhydrophobic contact angle was obtained, approximately 155 degrees and remained hydrophobic during 15 days of wettability tests. This work present exceptional results and investigates the ability of the modified bacterial cellulose by integrating them into a chip to support the growth of epidermal cells.

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