ELECTROSPUN FIBRES OF AN ELASTIN-LIKE POLYMER FUNCTIONALIZED WITH AN ANTIMICROBIAL DOMAIN

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ABSTRACT

This work describes the production and characterization of nanofibres of a functionalized elastin-like recombinamer (ELR). The polymer was functionalized with an antimicrobial peptide domain by means of recombinant DNA technology and processed by electrospinning. The electrospun fibres were characterized for their morphology, physical-chemical, antimicrobial and cytotoxicity properties. The electrospun membranes showed no cytotoxicity against skin-related cell lines, suggesting the potential applicability of these materials for skin tissue engineering.

INTRODUCTION

The increase in healthcare-associated infections and antibiotic-resistant microorganisms demands the search not only for new antimicrobial compounds but also for antimicrobial materials. These advanced materials need to have the ability to kill microorganisms without damaging human tissues. Due to advances in synthetic biology it is now possible to create novel biopolymers by reengineering the molecular structure such as by fusion of active domains with a structural component (Araújo, 2009; Rodríguez-Cabello, 2005). This assembly approach, through concatenation of gene blocks encoding a specific property, allows the design of a plethora of different combinations and represent the basis for the development of recombinant protein-based polymers (rPBPs). Antimicrobial peptides (AMPs) are small molecules that occur as part of the innate defense mechanism in many organisms. The combination of AMPs with rPBPs can be explored for the development of advanced antimicrobial materials able to overcome infections and biofilm formation. Also, depending of the material solubility it is possible to fabricate fibre meshes by electrospinning (Machado, 2013).

In this work, we have processed by electrospinning a new functional rPBP by combining in the same polypeptide chain a synthetic cationic AMP and an elastin-like recombinamer displaying thermoresponsive properties.

RESULTS AND CONCLUSIONS

Nanofibre meshes were obtained by electrospinning CM4-A200 dissolved in formic acid with a concentration of 20% (w/v). Morphological analysis by scanning electron microscopy (SEM) revealed fibres without bead defects with a mean diameter of 148 ± 31 nm (Figure 1a). The thermal degradation profile was characterized by a beginning of thermal decomposition at XX ºC and a maximum point of degradation at XX ºC, with effective thermal decomposition at XXX ºC. Remarkably, the electrospun fibre mats showed to be stable in solution *per se* without the need to use any chemical crosslinking agents. The produced CM4-A200 fibre mats showed no cytotoxicity against keratinocytes (NCTC 2544 cell line) or normal human skin fibroblasts (BJ-5ta cell line) after 72 h of contact with material extracts/leachables (Figure 1b).

These results present good indications for the potential use of CM4-A200 fibre mats for skin applications.

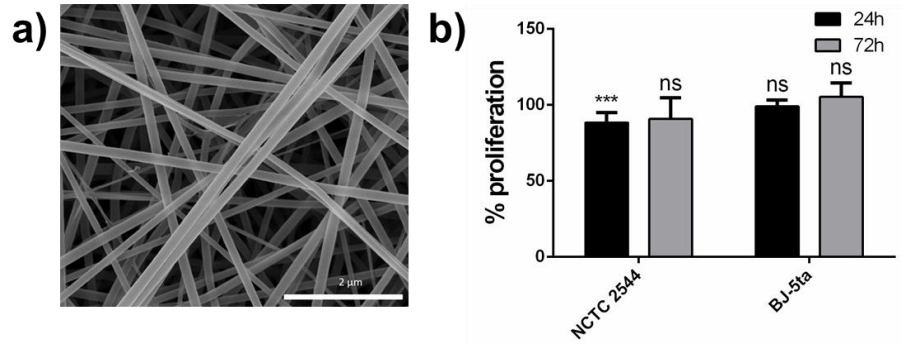

Figure 1. a) SEM micrographs of electrospun CM4-A200 fibres; b) Cell viability of two different cell lines after indirect contact with CM4-A200 fibres for 24 and 72 h.

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