MULTICOMPONENT WOUND DRESSING

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ABSTRACT

This works describes the antimicrobial (antibacterial and antiviral) performance of a multicomponent fabric for wound dressing. The fabric comprises a scaffold of plasma activated polyester (PES), enveloped in a matrix of chitosan (CH) containing silver nanoparticles (AgNPs) and the zeolite mordenite (MOR). The antimicrobial efficacy of the cumulative addition of each of these components was evaluated.

INTRODUCTION

The development of antimicrobial medical fabrics has never been subjected to such a high and urgent demand. Silver nanoparticles (AgNPs) have been transversely used in a multitude of applications that required an antimicrobial effect. Nevertheless, the indiscriminate application of AgNPs has been subjected to controversy, particularly due to their unsettled cytotoxicity, their ability to cross the blood brain barrier, and finally their negative environmental impact (Liao, 2019; Park, 2009). A simple strategy to minimize all these impacts is to avoid the release of AgNPs form their matrix, to reduce the cytotoxicity, prevent their systemic release and facilitate waste management.

This work envisages the evaluation of antimicrobial activity of the application of natural products, in particular a matrix and a zeolite, as strategies to prevent the release of AgNPs from a composite fabric. For the antimicrobial assessment, two different model bacteria and a model bacteriophage were used. Staphylococcus aureus represents a Gram-positive coccus, widely renowned as a nosocomial pathogen. Escherichia coli, is considered as model Gram-negative bacterium, with some strains known to cause grievous food infections. MS2 bacteriophage comprises a capsid architecture similar to SARS-CoV-2 and its genome is also composed of RNA.

RESULTS AND CONCLUSIONS

The results from the antimicrobial activity are described in Table 1.

Table 1 Antimicrobial activity evaluated through shake flask (incubation 5 h). Units are expressed in Log reduction of colony forming units per mL (CFU mL-1) for bacteria and Log reduction of plate forming units (PFU mL-1)

Microorganism	*S. aureus*	*E. coli*	MS2
PES	0.77	0.15	0.20
PES+CH+AgNPs	0.72	1.68	1.27
PES+CH+AgNPs +MOR	0.85	1.07	1.22

This study displays the potential of the multicomponent fabrics against MS2 bacteriphage and the Gram-negative bacterium. However, both formulations did not display any antibacterial activity against S. aureus. Therefore, further improvements are mandatory to considerably enhance both bactericidal efficacy, and its antiviral activity.

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