BIOGRAPHY

I'm Stefania Villani and I'm currently a PhD student at the University of Salento.
In 2022 I received my master's degree in Medical Biotechnology and Nanobiotechnology at the University of Salento, with an experimental thesis in Applied Microbiology and Nanobiotechnology on developing a biobased nanocomposite material with antibacterial properties. In 2023 I won a PhD scholarship in Materials and Structural Engineering and Nanotechnology of the Department of Engineering for Innovation of the same institution. In 2024, I was a visiting PhD student at the Luxembourg Institute of Science and Technology (LIST) in Luxembourg, where I learned the lab practices of cell culture for nanotoxicology studies. My research focuses on developing biomaterials for biomedical applications by studying their biocompatibility and antibacterial properties.

Characterization of bacterial cellulose-neem-hypericum oil wound care paste *in vitro* and in *Galleria mellonella in vivo* model

ABSTRACT

Surgical wound infections represent a global health emergency because of the spread of antibiotic-resistant bacteria. In this context, nanotechnologies help the optimization of strategies for managing skin lesions with antibacterial and antibiofilm activity.
In this work, we developed a biobased formulation made with bacterial cellulose nanofibers obtained through a green fermentation process, combined with a mixture of neem and hypericum oils, commonly used in the cosmetic field (1).
The resulting bacterial cellulose-based paste has been physicochemical characterized, and its biocompatibility has been assessed. *In vitro* antibacterial assays showed that the bacterial cellulose-based paste has biofilm detachment capabilities against *Pseudomonas aeruginosa* and *Staphylococcus aureus*, two of the most common microorganisms able to colonize the wound site. The efficacy of the treatment was also evaluated *in vivo* using *Galleria mellonella* larvae as a burn wound infection model, observing an increase in the survival percentage of the injured and infected larvae treated with our formulation, compared to untreated individuals.
The most common antibacterial treatments that exploit the bactericidal action of agents such as antibiotics or metal nanoparticles are associated with a certain risk of developing antibiotic resistance. The innovative aspect of this formulation, however, is the detachment action of bacterial biofilms, which contributes to a faster process of tissue regeneration without inducing antibiotic resistance. Furthermore, in this study, the involvement of *G. mellonella* larvae as a model of burn wound infection allowed a preliminary evaluation of the safety and efficacy of the formulation, contributing to the development of a more complex system than traditional *in vitro* ones, but limiting the involvement of mammalian models, in line with the 3Rs principle.
These results, supported by further investigation, could lead to the development of a biobased formulation to be applied on skin lesions for antibacterial treatments.

(1) https://doi.org/10.1016/j.carpta.2024.100431