Biodegradable wet-spun fibers as a delivery platform for Nisin Z controlled release: antibacterial features against *Staphylococcus aureus*

The Organization for Economic Cooperation and Development predicted that 2.4 million people in Europe, North America and Australia may die from infections caused by resistant microorganisms in the next 30 years, with an associated economic cost of approximately US$3.5 billion per year. *S. aureus* – a common opportunistic pathogen resistant to multiple antibiotics – induced infections are among the most prevalent, being on the front of the line of the WHO concerns. Here, we report the modification of sodium alginate (SA) and gelatin (GN) microfibers, produced via wet-spinning technique, with Nisin Z, an antimicrobial peptide with a significant antibacterial activity against Gram-positive bacteria and low toxicity in humans. Wet-spun SA/GN microfibers were successfully produced at a 70/30% v/v polymer ratio, by extrusion within a calcium chloride ($CaCl_2$) 2wt% coagulation bath. SA-free fibers were obtained through chemical modification within PBS concentrated solutions and subsequently, SAGN and SA-free fibers were crosslinked with glutaraldehyde (labeled as SAGNCL and GNCL, respectively). Finally, Nisin Z was functionalized onto all the fibers at an average concentration of 178 μg/mL, via adsorption technique. Fibers were characterized via Fourier transform infrared spectroscopy, thermal analysis and brightfield microscopy, their degradation profile at physiological conditions (SBF, 28 days) and the Nisin Z release profile from the fibers were analyzed, and their effect against S. aureus was detected via time-kill kinetics assessments. SAGNCL and GNCL loaded with Nisin Z microfibers were capable of progressively eliminating the bacteria, reaching an inhibition superior to 99% after 48 h of culture. The Nisin Z-modified SA and SAGN were not as effective, losing their antimicrobial action after 6 h of incubation. Bacteria elimination was consistent with the release kinetics of Nisin Z from the fibers. Overall, data revealed the potential of Nisin Z in fighting S. aureus-induced infections, while loaded onto biodegradable crosslinked polymeric scaffolds.