SAFETY PROFILE EVALUATION OF ELECTROSPUN NANOFIBERS INCORPORATING LACTOBIONIC ACID

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INTRODUCTION: Lactobionic acid (LBA) is a natural preservative known for its antibacterial properties. Biocompatible and biodegradable polymers are increasingly used in material development due to their safety and environmental benefits. Poly(vinyl alcohol) (PVA) is a hydrophilic synthetic polymer valued for its biocompatibility, biodegradability, chemical and thermal stability, and non-toxic nature. Electrospun nanofibers are particularly attractive for active food packaging applications because they enable the controlled release of encapsulated bioactive compounds. In this context, various bioactive agents have been explored to enhance the antimicrobial functionality of packaging materials. OBJECTIVE: This study aimed to produce and characterize LBA-PVA nanofibers, assess their antibacterial and antioxidant activities, and perform toxicological evaluations. The primary goal was to determine their suitability for application in food packaging. MATERIALS AND METHODS: Nanofibers were fabricated by electrospinning from polymeric solutions containing 10% (100 mg/mL) and 15% (150 mg/mL) PVA, both supplemented with 1.5 mg/mL of LBA. Control nanofibers without LBA were also produced. Surface morphology was analyzed using scanning electron microscopy (SEM). Antimicrobial activity was tested using agar diffusion assays, while antioxidant activity was assessed by ABTS radical scavenging method. Toxicity evaluations included hemoglobin release testing, the Ames mutagenicity test and cytotoxicity tests: colony formation assay for cell survival, MTT assay for cell viability, and agar diffusion cytotoxicity testing on L929 cells, following ISO 10993-5. RESULTS AND CONCLUSION: All formulations successfully produced nanofiber mats with diameters ranging from 295.5 to 553.2 nm. LBA-loaded nanofibers inhibited *Staphylococcus aureus* growth and demonstrated antioxidant activity, with TEAC values

of 690.3 µM (PVA10%+LBA) and 798.7 µM (PVA15%+LBA). All samples showed hemolysis rates below 2%, classifying them as non-hemolytic. The Ames test confirmed that LBA, PVA10, and PVA10+LBA nanofibers did not induce mutagenicity in TA98 and TA100 strains. Cytotoxicity tests on PVA10%+LBA revealed no significant effects on cell survival or viability. Considering the commercial potential of these nanofibers in food packaging or as active materials, analyses were conducted in accordance with ISO 10993-5:2009 standards, to follow standard methods of analyses. In conclusion, LBA-PVA electrospun nanofibers were successfully developed, exhibiting antimicrobial, antioxidant, and non-toxic properties, indicating strong potential for use in active food packaging applications.

KEYWORDS: nanofibers; lactobionic acid; antibacterial activity; antioxidant activity; toxicological evaluation

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