63° SIMPOSIO AFI
RIMINI 5·6·7
GIUGNO2024

Associazione Farmaceutici Industria
Società Scientifica

TITOLO (maiuscolo)

VALORIZATION OF AGRI-FOOD WASTE FOR THE DEVELOPMENT OF AN INNOVATIVE BIO-BASED MEDICAL TEXTILE

Autore (i)

Gianni Pecorini,[1] Rita Nasti,[2] Erika Maria Tottoli,[1] Martina Tamburriello,[1] Bianca Battistini,[1,2] Ida Genta,[1] Bice Conti,[1] Rossella Dorati[1]

Ente di appartenenza

[1] Department of Drug Sciences, University of Pavia, Via Torquato Taramelli, 12, 27100, Pavia (PV), Italy.
[2] Department of Political and Environmental Sciences, University of Milan, Via Giovanni Celoria, 2, 20133 Milano (MI), Italy.

Riassunto

Carattere: ARIAL
Corpo: 10
Interlinea: 1

The field of medical textiles, commonly referred to as med-tech, has emerged because of the convergence of textile technology and medical science. A pivotal factor driving the growth of this sector is the investigation and discovery of innovative materials derived from renewable sources to progressively substitute petroleum-based materials [1]. Agri-food waste represents an excellent renewable resource due to their availability, accessibility, and affordable price [2]. It allows for the extraction of value-added bioactive products suitable to be employed in the food, cosmetic, and biomedical industry [3]. This study aimed to evaluate the suitability of cutin (Cut), a secondary raw material (SRM) obtained from wasted tomato peels and showing antibacterial properties [4], for the development of sustainable and biodegradable devices for medical applications. The work involved the combination of Cut with a medical-grade poly(L-lactide)-*b*-poly(ε-caprolactone) (PLAPCL) block copolymer to obtain a non-woven textile that can be used for diversified products, such as surgical masks, patch for wound healing, and in controlled release solutions.
Cut was isolated by a green purification process, with a purity of >90% necessary for obtaining a SRM with a purity level suitable for use in the biomedical field. Rheological experiments were conducted on polymer solutions to identify the ideal concentration for electrospinning. Additionally, a suitable solvent capable of effectively dissolving the polymer and easily blending with the solution was chosen. Electrospinning technique was employed for the development of PLAPCL (PL) and PLAPCL-Cut (PL-Cut) textiles and a morphological (SEM), mechanical (tensile test), biological characterization (MTT assay and antimicrobial activity). The stability of the developed devices in different environments was also evaluated through GPC analysis.
PLAPCL solutions in (dichloromethane (DCM) at 15 %w/v presented optimal rheological properties to be processed through electrospinning to obtain PL textiles. Electrospinning parameters were optimized for the fabrication of PL and PL-Cut non-woven textile. Electrospun textiles morphological characterization indicated that they are made of randomly dispersed, homogeneous fibers with a mean diameter of 1.0 ± 0.2 µm, and a mean pore size of 2400 ± 700 µm². The fabricated PL-Cut prototypes presented an elastic modulus of 27 ± 2 MPa and an elongation at break of about 300 % with no significant differences with the PL textile due to their loading with Cut. The devices resulted also to be stable for a month in simulated physiological fluids as determined by GPC analysis. Metabolic activity (MTT) assay revealed that NHDF (normal human dermal fibroblasts) viability values was higher than 70 % up to 48 h of incubation in the device's extracts confirming their biocompatibility and it was also determined the textile intrinsic antimicrobial activity against *E. coli* and *S. aureus*.
The study highlights the technological potential of agri-food waste residues to involve in bio-medical applications. Additionally, the production process of bio-based medical textile is solid and reproducible, and the prototypes showed excellent morphology, mechanical properties, stability, and biocompatibility resulting suitable for medical applications such as the development of surgical face masks or for wound healing.

[1] P. D. Venkatraman *et al.*, Woodhead Publishing, 2023: 31-70.
[2] I Tarchi *et al.*, Food Bioscience, 2024: 10.1016/j.fbio.2024.103751.
[3] A. Sarker *et al.*, Sustainable Food Technology, 2024: 48-69.
[4] R. Escorcio *et al.*, ACS Sustainable Chemistry and Engineering, 2022: 11415-11427

IMPORTANTE: inviare il testo in formato (word o pdf) editabile e NON in formato immagine.

Autore di riferimento da contattare per ulteriori informazioni:

Nome e Cognome: Gianni Pecorini

E-mail: