TEX4WOUNDS – Development of advanced textile materials for wound care

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Introduction/Resume

Wounds can be described as interruptions of the continuity of a tissue, caused by any type of physical, chemical, or mechanical trauma, or triggered by a medical condition.

Taking into account the context and the social and economic impact of wounds on patients, caregivers and health systems, as well as the technological evolution, cost, constraints and difficulties in using dressing materials, the TEX4WOUNDS consortium intends to develop a range of advanced devices to provide an effective and cost-effective wound care response.

Textiles combine characteristics that constitute great advantages in the development of new dressing products, such as strength, extensibility, flexibility, air and moisture permeability, high surface area and high absorption capacity. Moreover, they are highly tunable: can be produced into three-dimensional structures, using a great variety of fibers (or filaments) and in any shape and geometry. Also, textiles provide the possibility of functionalization by different techniques and with many bioactive molecules.

Objectives

The main goal of this project is the development of a range of products, based on new textile architectures, for the cleaning and the treatment of wounds.
The novel textile structures will be produced by terry-weave knitting, and will include functional fibers. The structures will also be impregnated with natural bioactive additives with relevant properties for wound care.

To this end, 2 groups of devices will be developed:

1) A dressing material for cleaning and debridement with two distinct faces - a softer one (with possibly an additive) and a rougher one (for mechanic debridement);

2) A dynamic, multilayered, absorbent and healing-promoting dressing material - It will be developed in two concepts, according to the type of wound:

a) Laminated structure dressing: for superficial and shallow wounds with an average high amount of exudate;

b) Core structure dressing: for deep, local wounds with a medium to high amount of exudate.

Development

Different textile structures have been produced, with distinct architectures, grammages and fiber combinations. These samples suffered four processing steps: (1) washing, (2) autoclave, (3) half-bleaching, (4) half-bleaching followed by autoclave.

All samples were characterized at all processing steps, regarding their interaction with fluids: fluid absorption capacity, fluid retention capacity, wicking and their water vapor permeability. This allowed us to understand the effect of the processing steps on the textiles characteristics and properties. All these parameters need to be taken into consideration when choosing the textiles that will be used in the production of the dressing materials. The textile fibers were also observed by Scanning Electron Microscopy, SEM (Figure 1).

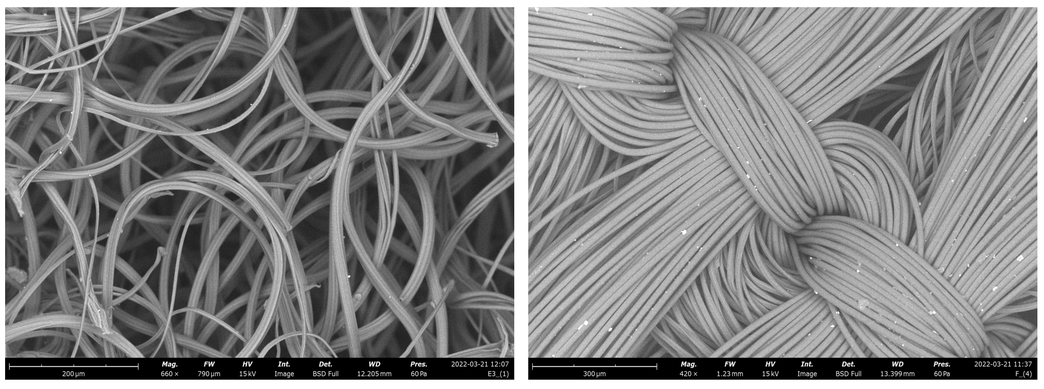

Figure 1. Representative images of textile samples acquired by SEM.

Regarding the additives, our research is focused on natural based bioactive substances, such as plant extracts (in the liquid and powder form) and oils.

These substances possess a wide range of properties, from antimicrobial, antioxidant and anti-inflammatory activity, to moisturizing and regenerative capacity.

Studies with the interest extracts are already in motion. Different encapsulation methods are being tested and the resulting capsules are being impregnated onto the textiles, using several impregnation methods.

Next steps will focus on studying the release profiles of the encapsulated biomolecules, considering varying external factors such as pH, temperature and , moisture levels.

The choice of the right additives for each material, as well as the concentration to be used in the final product will rely on the above mentioned tests, as well as the biocompatibility assays that will be performed using Human Dermal Fibroblasts (HDF's).

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