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Editorial

Improved wound dressing: Novel approaches

As the guest editor of this special issue of the International Journal of Pharmaceutics, it is my honor to introduce the topic "*Improved Wound Dressing: Novel Approaches.*" The purpose of this special issue is to highlight the combined application of nanotechnology and biomaterials science for obtaining wound dressings with desired properties. I expect this special issue containing 10 manuscripts to be of great interest for researchers from the medical and technological fields, opening new directions for the design of nano-engineered materials to inhibit microbial colonization and to potentate the efficiency of the current therapeutic agents.

The paper authored by Chifiriuc et al. highlights the role of polymicrobial biofilms in the occurrence and evolution of wound infections and healing, also presenting the current and future preventive and therapeutic strategies used for the management of polymicrobial wound infections.

An overview about traditional dressings and current approaches to improve them is contributed by Mogosanu et al. Dressings play an important role in the management of wounds and burns. The use of three-dimensional polymeric scaffolds for cell targeting is already a common strategy for tissue engineering. The use of biocompatible and biodegradable natural/synthetic polymers will substantially contribute to the development of novel types of wound dressings with large scale applications in the biomedical area and especially for the regenerative medicine.

Next, Liakos et al., reveal the importance of natural polymeric composite films (made of essential oils dispersed in sodium alginate), in the anti-microbial and anti-fungal therapy. Elicriso italic, chamomile blue, cinnamon, lavender, tea tree, peppermint, eucalyptus, lemongrass and lemon oils were encapsulated in the films as potential active substances. Antimicrobial tests were conducted on films containing different percentages of EOs against *Escherichia coli* bacteria and *Candida albicans*, and the films were characterized as effective or not. Such diverse types of essential oil-fortified alginate films can find many applications mainly as disposable wound dressings but also in food packaging, medical device protection and disinfection, or indoor air quality improvement materials.

An extensive report in the development of a novel biocompatible, resorbable and bio-active wound dressing prototype is presented by Grumezescu et al. The authors use anionic polymers and 10 nm magnetic structures loaded with usnic acid for the development of novel, multifunctional porous materials used in tissues regeneration, as antimicrobial substances releasing devices, providing also a mechanical support for the eukaryotic cells adhesion, and exhibiting the advantage of low cytotoxicity on human progenitor cells.

Wang et al. reveal the successful fabrication of iron oxide-chitosan particles using a microfluidic technique in one step. This proposed method provides an alternative way for generating non-spheroids particles. The length and diameter of the synthesized particles were both controllable by tuning the flow rate of the dispersed phase. Compared with other approaches, the main advantages of this approach are: (i) magnetic chitosan microparticles can be obtained in one step; (ii) uniform-sized iron-oxide loaded chitosan microparticles can be fabricated; and (iii) simple and easy control of the particle diameter by varying the flow rate of the dispersed and continuous phases can be made.

In the next paper, Vasile et al. describe an easy method to incorporate ZnO nanoparticles in a chitosan solution in a weight ratio up to 12:1. The obtained gel has a high water content (99.33% weight), but also high consistency, as it does not flow, and can be cut with a knife, and retain its shape. The incorporation of therapeutic agent loaded ZnO nanoparticles in chitosan solution yields a three-component gel, with a slow release rate of the drug. Most important, the system is fully scalable to any other soluble drug, as the entire solution remains trapped in the ZnO-chitosan gel. In addition, for the ZnO-chitosan nanopowder authors reported an unusual high intensity for the UV emission band, property that can be further used in various medical fields like photodiagnosis or biosensing.

Another approach in developing improved wound dressings with antimicrobial properties is given in the second paper authored by Grumezescu et al. This report presents a novel silica hybrid nanostructure, for the improved release of topical antibiotics, used in the treatment of *Staphylococcus aureus* infections. The prepared nanostructure has significantly improved the anti-staphylococcal activity of bacitracin and kanamycin sulfate, as demonstrated by the drastic decrease of the minimal inhibitory concentration of the respective antibiotics loaded in the silica nanostructure. These results, correlated with the high biocompatibility of this porous structure, are highlighting the possibility of using this carrier for the local delivery of the antimicrobial substances in lower active doses, thus reducing their cytotoxicity and side-effects.

An interesting study about biomimetic nanostructured matrix by using various extracellular matrixmolecular layers to create a biomimetic and biocompatible environment for realizing neuronal guidance in neural regeneration medicine is presented by Lu et al. Silicon-based substrates possessing nanostructures were modified using different extracellular matrixproteins and peptides to develop a biomimetic and biocompatible environment for studying neural behaviors in adhesion, proliferation, and differentiation. Their results demonstrate that the three substrates used permitted

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a good development and differentiation of neurons, depending on the incorporated peptide. Furthermore, they report the fabrication of the topological nanostructure-patterned wafer coated with laminin, which successfully manipulated the extension and direction of neurites by using more than 80 μm of a single soma. This approach demonstrates the potential as a facile and efficient method for guiding the direction of single axons and for enhancing neurite outgrowth in studies on nerve regenerative medicine.

The paper of Iliescu et al. describes a novel nanocomposite based on montmorillonite and sodiumalginate beads as drug carriers. The structure and surface morphology of the hybrid and composite materials were established by means of X-ray diffraction (XRD), IR spectroscopy (FT-IR), thermal analysis (TG-DTA) and scanning electron microscopy (SEM). The nanocomposite materials were tested *in vitro* in simulated intestinal fluid (pH 7.4, at 37 °C) in order to establish if upon the delivery of the drug is sustained and can represent an alternative to the existing systemic therapy. The *in vitro* drug release test results clearly suggested that prepared nanocomposites were able to control the release of therapeutic agents by making it sustained, without any burst effect, and by reducing the released amount and the release rate. The nanocomposite beads may be a promising drug delivery system.

Wu et al. report that *D. tosaense* regulated atopic dermatitis in mouse model. They used ethyl acetate extraction of *D. tosaense*, which was used to protect these mice from the TNCB-induced skin lesions simulating atopic dermatitis. Their results indicate that the administration of *D. tosaense* can modulate cytokine expression and T cell subpopulations by regulating mast cell infiltration and thus alleviate the atopic dermatitis.

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