

ABSTRACT

Nowadays, one of the biggest concerns that permanently keep the attention of main important sectors of human society is health. Modern medical science is compromised with not only providing good adequate treatments but also effective specific solutions for each type of disease or human pathology.

In this direction, innovative approaches like tissue engineering or regenerative medicine, controlled drug delivery systems and nanomedicines emerge to bring alternatives to situations hard to solve with conventional treatment and strategies, including the replacement of damaged or diseases tissues and/or organs.

Specifically, this research is mainly aimed to design a combined system for controlled, stable and localized release of therapeutic agents that are able to exert their effect selectively on the area that warrants treatment.

This construct will have enough versatility to be adapted to almost any kind of treatment, from cancer to tissue regeneration, always that the key requirement of the treatment was the need to provide the treatment of localized, stable and controlled manner.

With the purposes of making easier the understanding as well as the design of the system, I was decided, for the proof of concept, to use drugs and materials with known activity applied on tissue regeneration and for the treatment of chronic wounds.

The system in question consists of three main elements:

- 1) The first element is the **polymer conjugates of therapeutic agents**, which contribute to increasing the selectivity of the therapeutic action of the drug, as well as improved stability, bioavailability and biocompatibility thereof. If the drug is hydrophobic, conjugation contributes to increase its solubility in water, and in the case of proteins used as therapeutic agents, the combination helps reduce the body's immune response, increasing the chance of successful of the treatment.
- 2) The second element are the biodegradable **polymeric microparticles**, which in this case act like encapsulation agents for polymeric conjugate , thus allowing to have a second control point in the release kinetics of the therapeutic agents . Simultaneously, the microparticles also play a role in modifying the texture of the final construct, ascribing mechanical and physicochemical properties that help to improve some biological properties of the final material, such as the affinity, adhesion and cell proliferation.
- 3) The third element consists of a **nanoporous membrane** made of a biodegradable polymer by electrospinning, which constitute the unifier element of the whole system. This membrane provides manageability to the construct and is itself the last point of control in the release kinetics of the therapeutic agent or agents. Besides, it must be biocompatible and stable at ambient conditions, since this probably is going to be exposed to the environment while protecting the wound, in the case of this kind of application.

These three elements, which themselves are complex systems separately, are systematically combined to achieve a synergistic

relationship between them so that each one power the qualities of the other two.

The resulting construct was characterized and it demonstrated to have characteristic properties that can be used as a control parameter during manufacture of this new material. Also, preliminary biological studies developed “in vitro” indicated that the proposed system may be a good candidate for deeper studies as alternative treatment for chronic wounds and other pathologies that require localized administration for long periods of time.