

DEVELOPMENT AND CHARACTERIZATION OF AN ALGINATE-HYALURONIC ACID HYDROGEL FOR SKIN WOUND HEALING

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INTRODUCTION

The encapsulation of Mesenchymal Stem Cells (MSCs) into a hydrogel provides a promising future in diverse biomedical applications. MSCs provide a regenerative wound healing microenvironment due to their capacity to produce and secrete growth factors and cytokines that enhance granulation tissue formation, angiogenesis and reduce inflammation, which result in accelerated wound closure¹⁻². Hydrogels are three-dimensional hydrophilic polymeric able to retain large amounts of water or biological fluids. Hydrogels possess similar structure to the extracellular matrix (ECM) and they are used in regenerative medicine due to their biocompatibility and their capability to act as a growth medium³. Hyaluronic acid (HA) is a non-sulfated glycosaminoglycan; it is also the main element of ECM. For this reason and have been investigated due to their biocompatibility, biodegradability and hydrophilic character. HA also lacks gelation abilities, thus it is used in combination with natural gelling agents such as alginate (A)⁴.

OBJECTIVES

The aim of this work was the development and *in vitro* characterization of an alginate-hyaluronic acid based hydrogel for wound healing applications.

MATERIALS AND METHODS

1. PREPARATION OF THE A-HA HYDROGEL

A-HA pre-gel solution was elaborated by dissolution of both autoclaved polymers in deionized water at concentrations of 2% and 1% (w/v), respectively. Then, 1×10^6 cells/mL was added on the pre-gel solutions and mixed until complete homogenization. Finally, 1% of 100 mM CaCl₂ was added to obtain the hydrogel.

2. PHYSICOCHEMICAL CHARACTERIZATION OF A-HA HYDROGEL

POROSITY ANALYSIS

SWELLING TEST

IN VITRO DEGRADATION ANALYSIS

RESULTS AND DISCUSSION

The swelling ratio value was around 1500% (Fig. 1). The swelling behavior in wound healing can promote the transportation of nutrients and provide mechanical resilience to the delivery systems and the biological site of action. Degradation rate about 90% was reached in 300 min (Fig. 2). The degradation of the hydrogel should be progressive and takes place simultaneously with the restoration of the new tissue. The calculation of the porosity resulted in values of 52%. It is an important characteristic of hydrogel because this highly porous structure allows and promotes nutrient transport, and facilitates cell proliferation and differentiation, which involves cell migrations.

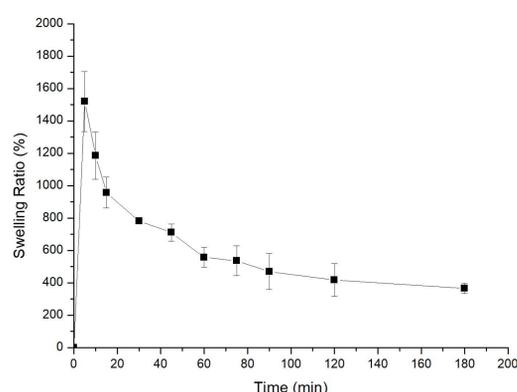


Fig. 1. Swelling ratio of A-HA hydrogel at pH 7.4 and 37 °C. Values represents mean \pm SD (n=3).

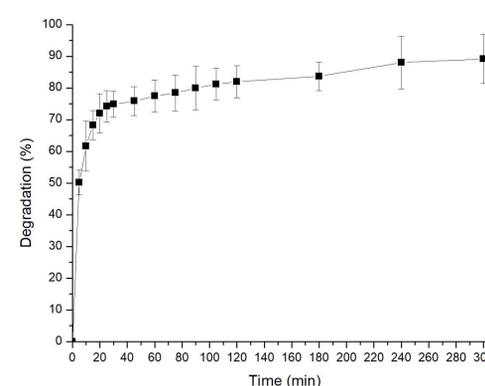


Fig. 2. Degradation percentage of A-HA hydrogel at pH 7.4 and 37 °C. Values represents mean \pm SD (n=3).

CONCLUSION

These results confirm that this hydrogel present optimal characteristics to promote cell adhesion, proliferation and differentiation, thus it could be proposed as a suitable vehicle for cell delivery in tissue regeneration.

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