Quality evaluation of nanotechnological hydrogels containing tacrolimus for the treatment of psoriasis.

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Introduction

Tacrolimus (TAC) is one of the main immunosuppressive drugs used to treat autoimmune diseases that affect the skin, such as psoriasis. However, therapy can be hampered due to its high lipophilicity, limiting permeation in regions with hyperkeratotic plaques. The use of lipid core (NC) nanocapsules containing encapsulated tacrolimus can be an alternative to increase its apparent solubility and promote its incorporation in the hydrogel, facilitating treatment adherence. In addition, studies on the use of nanoencapsulated drugs for topical administration have shown the importance of the semi-solid dosage form, such as pectin hydrogels, to improve drug permeation and retention and improve sensory characteristics in comparison to traditional presentations (1). It indicates that pectin hydrogels containing LNC to transport TAC via the topical route may become an alternative to existing presentations. Thus, the present work aims to develop pectin hydrogels as carriers of polymeric nanocapsules containing tacrolimus to treat psoriasis.

Experimental section

After obtaining by self-assembling using the solvent displacement method, the formulations with drug and without drug were incorporated into the pectin hydrogel (PEC/LNC-TAC and PEC/LNCb respectively). The parameters analyzed were particle diameter, SPAN, pH, and drug content. To study stability against storage at room temperature, pH and content were analyzed at times 0, 7, 14 and 21 days. The viscosity was determined using a rotational viscometer. The experiments were performed in duplicate.

Results and Discussion

The hydrogels showed a glossy, homogeneous, and white appearance, corresponding to the color of the LNC. The tacrolimus content in the hydrogel approached 100%. PEC/LNCb had a slightly larger diameter of 285±16.97nm, while PEC/LNC-TAC's mean diameters were 231.50±37.48nm. Furthermore, polydispersity (SPAN) was 1.68 ± 0.27 and 1.60±0.42, respectively. These indicated that the presence of the drug does not change physical properties related to particle size. Both hydrogels showed acid pH, 4.29±0.08 and 4.21±0.08, respectively. The slightly acidic formulations are most suitable for dermal use as there will be no disturbance of the acid mantle of normal human skin (2). As for stability, there were no significant changes in the period studied (content remained close to 100%, and the average pH around 4). These results agree with previous studies that studied the stability at room temperature of LNC with PCL and indicated the stability of hydrogels. Regarding the viscosity analysis, PEC/LNCb presented changes in viscosity as a function of speed and the hydrogels were classified as non-Newtonian fluids. Moreover, it was possible to observe increased viscosity in the pectin hydrogel containing the polymeric nanocapsules, this behavior characterizes shear thinning (or pseudoplastic) fluids (3). This increased viscosity can be related to the increased amount of polymer in the formulation containing the nanocapsules present (PEC/LNCb).

Conclusions

The hydrogel obtained showed quality characteristics suitable for topical application and stability for 21 days. Thus, this study opens possibilities for future efficacy evaluations against psoriasis in vitro and in vivo models.

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