BIOMECHANICAL TESTING OF HYDROGEL DRESSINGS BASED ON SODIUM ALGINATE/ POLY(VINYL ALCOHOL)/ALOE VERA AND CONTAINING DRUG-LOADED INTO NANOCARRIERS

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Introduction

The basic concept of application of wound dressing is based on the maintenance of moisture around the wound and the optimal absorption ability of the exudates from the wound surface which plays a critical role in the wound healing process. Accordingly, hydrogel materials are highly effective in the treatment of wounds. Sodium alginate (SA) presents high biocompatibility, hydrophilicity, and bacterial activity making it one of the most widely used polysaccharides polymers for hydrogel films preparation. However, alginate hydrogels may demonstrate undesirable mechanical properties, which significantly restricts their use as wound dressings. From this principle, the poly(vinyl alcohol) (PVA) has been utilized to improve the physical and clinical properties of blended polymeric materials. Recent developments in skin tissue therapy, tend to modify hydrogel materials with therapeutic agents capable of sustained and controlled compounds delivery to the wound site to promote the healing process [1-3].
In this research, a bio-hybrid hydrogel system, containing sodium alginate/polyvinyl alcohol and *Aloe vera* incorporating with the system of nanocarrier-active substances (salicylic acid, hydrocortisone, or fluocinolone acetonide), is presented as a potential skin dressing to accelerate wound healing.

Materials and Methods

In this work, the system of thermosensitive nanocarrier – drug was incorporated into SA/PVA hydrogel with *Aloe vera* content, were developed using chemical crosslinking method. Briefly, aqueous solution containing 2% (w/v) SA and 5% (w/v) PVA and 2% (w/v) of *Aloe vera* as well as poly(ethylene glycol) diacrylate (PEGDA, Mn=700 g/mol) and glycerine were thoroughly mixed. To prepare the hybrid system, pre-made drug-nanocarrier were introduced into the hydrogel precursor. After that, the prepared mixtures were heated and 4.4% (v/v) of ammonium persulfate were added. The properties of system of nanocarrier-drug-loaded hydrogel membranes such as the gel fraction, surface morphology and the static stretching test have been conducted.

Results and Discussion

The study showed that addition of salicylic acid (SA sample) noticeably decreased the gel fraction from 68% to 60%. It suggests that SA- drug system might reduce the entanglement reaction and consequently the gelation process is reduced slightly. The presence of hydrocortisone (H) or fluocinolone acetonide (F) does not significant changes in the hydrogels gelation process while the introduction of SA-F drug system lowers the value of the gel fraction to 62%.
The stretching tests shows the slight impact of added drugs on the mechanical properties of bio- hybrid hydrogel systems. All of the tested films are characterized by a medium elongation values of around 24–32% at break. As shown in FIG. 1 the lower elongation at break value was observed for hydrogel containing salicylic acid system while the addition of fluocinolone acetonide drug increased the tested parameter by approx. 6%, which makes it more flexible than a hydrogel without a drug.

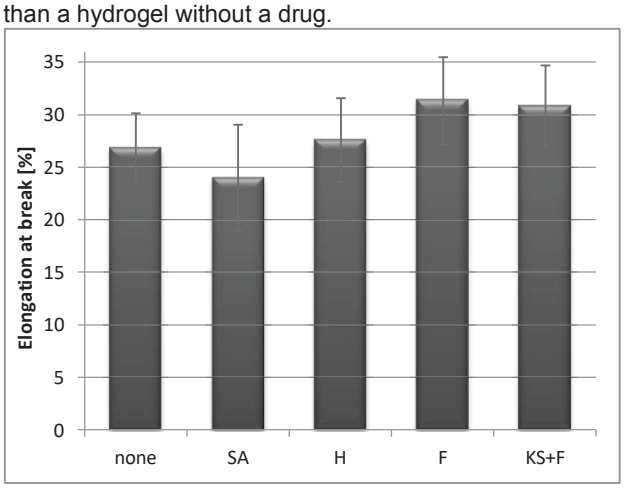

FIG. 1. Elongation at break in static stretching test of hydrogels.

Conclusions

1. SA/PVA/AV hydrogel films loaded with salicylic acid, hydrocortisone, or fluocinolone acetonide were obtained by chemical crosslinking method.
2. The SA/PVA/AV hydrogel membranes loaded with salicylic acid exhibited lower crosslinking density compared to films without drug system.
3. In the light of stretching tests, the introduction of nanocarrier-drug system into SA/PVA hydrogel with *Aloe vera* matrices did not reduce the mechanical parameter and thus the structure of the hydrogels is not disturbed.
4. Therefore, the system of nanocarrier-drug-loaded hydrogels based on sodium alginate/poly(vinyl alcohol) and *Aloe vera* are promising materials forwound dressing applications.

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