EFFECT OF SODIUM ALGINATE/POLY(VINYL ALCOHOL) RATIO AND *ALOE VERA* EXTRACT AMOUNT ON SELECTED CHARACTERISTICS OF HYDROGEL MATRIX INTENDED FOR BIOMEDICINE

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Introduction

The wound healing mainly depends on the use of proper dressing techniques and adequate material. As maintaining an optimal moisture level and proper gas circulation as well as the ability to absorb excess exudate by the dressing, hydrogels are currently the most widely studied group of chemical compounds used in a new generation of wound dressing systems [1,2]. Alginate hydrogels constitute a group of materials which are applied to the skin in case of wounds with difficulty healing, as gelation of alginates ensures less noticeable pain while the dressing changes and the moist environment leads to rapid wound healing. In turn, poly(vinyl alcohol) possesses desirable properties such as nontoxicity, biocompatibility, chemical and mechanical resistance, and it exhibits high hydrophilicity with a high degree of hydrolysis. Currently, there is also noticed a trend to modify the hydrogel matrix with substances of natural origin, mainly extracted from plants. *Aloe vera* is one of the plants widely used in medicine, due to a broad health-promoting properties [1-4].
The presented paper focuses on the analysis of the effect of sodium alginate (SA)/poly(vinyl alcohol) (PVA) ratio and *Aloe vera* (AV) extract amount on selected physicochemical and structural properties of hydrogel matrices as a base for further modifications which will eventually lead to design the modern dressing materials.

Materials and Methods

In order to obtain SA/PVA/AV hydrogels through chemical crosslinking method, 2% SA, 5% PVA, 2% *Aloe vera* extract and 1% persuphate ammonium solutions were prepared. The appropriate amounts of such-prepared solutions, as well as constant amount of poly(ethylene glycol) diacrylate (PEGDA, Mn=700 g/mol) and glycerine (G) were utilized. The series of hydrogels with varied SA/PVA ratios (1:1; 2:1; 3:2, v/v) and different *Aloe vera* contents (1, 5, and 10%, v/v) were prepared. The analyses of the resultant hydrogels included determination of the swelling behaviour, degradation tests in distilled water and PBS solution at 37°C, temperature close to human body temperature. Moreover, the matrices were subjected to spectroscopic (FTIR) and microscopic (SEM) analysis.

Results and Discussion

A significant effect of the volume ratio of the main components of the tested hydrogel matrices on the behaviour in simulated body fluids was observed. The study showed that an increase in the proportion of alginates in the matrix leads to an increased and abrupt absorption of the fluid, resulting from the unique absorption properties of this type of materials. On the other hand, decreasing the SA content in the matrix provides a smooth and gradual swelling process, which suggests that any introduced active substances will be absorbed and released from the matrix in a controlled manner. It appears that the SA/PVA ratio, 1:1 appears to be the best choice for the characteristics studied. An example of the swelling ratio is presented in FIG. 1. The matrices with high plant extract content behave similarly - 10% content causes sudden and dynamic changes in the degree of swelling, pH and conductivity of the materials. It can negatively influence the prediction of therapeutic substances released from such matrices. Lower contents of *Aloe vera* extract cause more static change of tested parameters.
The FT-IR analysis confirmed the presence of absorption bands characteristic for all used components and microscopic images indicate the successful crosslinking of the materials.

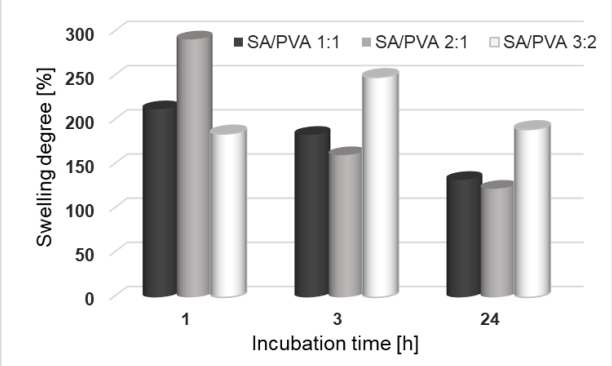

FIG. 1. The swelling degree in PBS solution of the SA/PVA/AV hydrogels with 5% of aloe amount and varied SA/PVA ratio.

Conclusions

The results obtained allow to draw the following conclusions:

1. Obtained hydrogel materials are characterized by a comparable level of swelling degree, however, the higher SA content and applying the 10% of aloe extract caused we observed that the structure is softer and characterized by low gel strength and therefore, the modified matrix can absorb a higher amount of fluid.
2. The degradation in water and PBS solution investigations allow concluding that the obtained SA/PVA/AV hydrogels are, in general, stable in time and pH value mainly depends on aloe extract content.
3. On the basis of FT-IR spectra of samples modified with different amounts of the extract, we noticed that their chemical structure is not influenced directly, even with 10% of extract content.
4. In accordance with presented preliminary analysis of physicochemical properties, it can be statement that the obtained materials can be used for further studies on a new approach to dermal wound healing.

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