

Stability Study of Hydrogel Based on Sodium Alginate/Poly (Vinyl Alcohol) with Aloe Vera Extract for Wound Dressing Application

Authors : Klaudia Pluta, Katarzyna Bialik-Wąs, Dagmara Malina, Mateusz Barczewski

Abstract : Hydrogel networks, due to their unique properties, are highly attractive materials for wound dressing. The three-dimensional structure of hydrogels provides tissues with optimal moisture, which supports the wound healing process. Moreover, a characteristic feature of hydrogels is their absorption properties which allow for the absorption of wound exudates. For the fabrication of biomedical hydrogels, a combination of natural polymers ensuring biocompatibility and synthetic ones that provide adequate mechanical strength are often used. Sodium alginate (SA) is one of the polymers widely used in wound dressing materials because it exhibits excellent biocompatibility and biodegradability. However, due to poor strength properties, often alginate-based hydrogel materials are enhanced by the addition of another polymer such as poly(vinyl alcohol) (PVA). This paper is concentrated on the preparation methods of sodium alginate/polyvinyl alcohol hydrogel system incorporating Aloe vera extract and glycerin for wound healing material with particular focus on the role of their composition on structure, thermal properties, and stability. Briefly, the hydrogel preparation is based on the chemical cross-linking method using poly(ethylene glycol) diacrylate (PEGDA, $M_n = 700$ g/mol) as a crosslinking agent and ammonium persulfate as an initiator. In vitro degradation tests of SA/PVA/AV hydrogels were carried out in Phosphate-Buffered Saline (pH - 7.4) as well as in distilled water. Hydrogel samples were firstly cut into half-gram pieces (in triplicate) and immersed in immersion fluid. Then, all specimens were incubated at 37°C and then the pH and conductivity values were measurements at time intervals. The post-incubation fluids were analyzed using SEC/GPC to check the content of oligomers. The separation was carried out at 35°C on a poly(hydroxy methacrylate) column (dimensions 300 x 8 mm). 0.1M NaCl solution, whose flow rate was 0.65 ml/min, was used as the mobile phase. Three injections with a volume of 50 μ l were made for each sample. The thermogravimetric data of the prepared hydrogels were collected using a Netzsch TG 209 F1 Libra apparatus. The samples with masses of about 10 mg were weighed separately in Al₂O₃ crucibles and then were heated from 30°C to 900°C with a scanning rate of 10 °C•min⁻¹ under a nitrogen atmosphere. Based on the conducted research, a fast and simple method was developed to produce potential wound dressing material containing sodium alginate, poly(vinyl alcohol) and Aloe vera extract. As a result, transparent and flexible SA/PVA/AV hydrogels were obtained. The degradation experiments indicated that most of the samples immersed in PBS as well as in distilled water were not degraded throughout the whole incubation time.

Keywords : hydrogels, wound dressings, sodium alginate, poly(vinyl alcohol)

Conference Title : ICBC 2021 : International Conference on Biomedical Chemistry

Conference Location : Rome, Italy

Conference Dates : December 13-14, 2021