

Calcium ion cross linked HEC/SA/HA hydrogel: Fabrication, Characterization and Wound Healing Applications

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Abstract : The aim of this study is to prepare a novel antibacterial wound healing hydrogel based on hydroxyethyl cellulose/ Sodium alginate/ hyaluronic acid (HEC/SA/HA) and Ag nanoparticles, which is cross-linked via Ca²⁺ ions. The aim of the study is to obtain a hydrogel compound using green chemistry that helps to heal the wound faster and better. The properties and structure of the hydrogel have been tested to include swelling ratio, vitro degradation, antibacterial and antifungal activity and wound healing tests. It was also characterized via UV-Vis, FTIR, TEM, TGA and tested after it was fabricated by freeze-drying technique. The characteristic peak of UV-Vis spectra revealed the formation of AgNPs in the compound at 411 nm. The FTIR curves showed new peaks that confirmed the oxidation of HEC and also showed the chemical interaction of the three polymers with AgNPs and Ca²⁺. The TEM images presented monodispersed of AgNPs with their size ranging (8.2 to 32 nm). The results from these studies showed that the hydrogel has an excellent performance in swelling ratio and vitro degradation. Furthermore, the wound healing activity of the hydrogel was examined via measuring the closure of wound and the second group treated with hydrogel revealed a significant healing activity compared to the control group. The hydrogel activity against bacteria and fungi was also measures for 72 h and the results showed excellent performance. These results suggested that the cross-linked hydrogel based on (HEC/HA/SA) with AgNPs might be a promising dressing for wounds.

Keywords : hydrogels, wound healing, hydroxyethyl cellulose, sodium alginate, Ca²⁺ cross-linking, hyaluronic acid

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