

# Development of a Novel Thermosensitive Chitosan-PDEAAm IPN and Its Characterisation as a Potential Wound Dressing

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**Abstract.** A novel interactive and thermoresponsive interpenetrating polymer network wound dressing which is mostly transparent, permeable to oxygen, and easily stripped from a wound bed, was synthesised by a rapid photopolymerisation and crosslinking of DEAAm in the presence of chitosan. To our knowledge, these study and results provide the first evaluation and optimisation of a UV-polymerised chitosan-PDEAAm IPN composite film for wound dressing application. FTIR spectroscopy and DSC analysis were used to characterise the resulting films. The films exhibited adequate mechanical properties to be used as a wound/burn dressing and from the MDSC and swelling studies were found to switch from slightly hydrophilic to a highly hydrophilic surface upon subjection to solution at a lower temperature. This thermosensitive property allows the dressing to be easily detachable and enables frequent dressing change if desired or removal without causing further injury to healing tissues. There was no significant difference in the oxygen permeability values and mechanical properties, although the mechanical properties could be slightly improved upon. The results from the water sorption tests are in the typical and desired ranges for commercial wound dressings, and even better than some currently available in the market. The results showed that the DCG 20-77.5-2.5 chitosan-PDEAAm composite film had the best potential to be employed as a moist wound dressing due to its high water content compared to the other compositions. This means it has the capacity to retain a moist environment over a wound for much longer thereby facilitating the healing process. It also has a high WVTR value ( $895.2 \pm 117$  g/m<sup>2</sup>/day), similar to that of DCG 20-75-5 ( $909.6 \pm 168$  g/m<sup>2</sup>/day) which suggests that these chitosan-PDEAAm membranes would be suitable for lightly to moderately exuding wounds. The peel adhesion test results showed that the films can swell and become less adhesive at lower temperatures. A cold pack can be placed over the film prior to dressing removal, it swells and detaches easily from a wound site, thus, helping to prevent the secondary injury usually associated with dressing changes/removal. The ease of removal of the chitosan-PDEAAm dressing from a wound site due to its switchable hydrophilicity further enhances its potential application. Gentamicin-loaded chitosan-PDEAAm dressings showed excellent inhibition towards the growth of *S. aureus* and *P. aeruginosa*, hence confirming the efficacy of the antibiotic was not compromised by the films' preparation process. This inhibitory effect on bacterial viability can significantly improve the wound healing process compared with gauze control or a conventional hydrogel dressing without drug.