

Bioresorbable Composite Fibers with Controlled Release of Antibacterial Drugs for Wound dressing Applications

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Wounds with tissue loss include burn wounds, wounds caused as a result of trauma, or as secondary events in chronic ailments such as diabetic ulcers and pressure sores. Several categories of products have become available to use during the evolution of wound dressings. These are transparent films, hydrocolloids, alginate dressings and hydrogel-type dressings. Silver-impregnated dressings were designed to provide controlled release of silver to the wound, in order to inhibit microbial growth. The major drawback associated with these available dressing solutions is the need to remove the dressing consequently causing pain and possibly harming the vulnerable underlying skin. Furthermore, some clinicians raise concerns regarding the safety issues related to the silver ions that are included in most of these products. The research conducted by us addressed these issues.

Novel antibiotic-eluting composite fibers designed for use as basic wound dressing elements were developed and studied. These structures were composed of a polyglyconate core and a porous poly(DL-lactic-co-glycolic acid) shell loaded with one of three antibiotic drugs: mafenide acetate, gentamicin sulphate and ceftazidime pentahydrate. The shell was prepared by the freeze-drying of inverted emulsions. The fiber investigation focused on the effects of the emulsion's formulation on the shell microstructure and on the resulting profile of drug release from the fibers. Albumin was found to be the most effective surfactant for stabilizing the inverted emulsions and also to have a beneficial holdup effect on the release kinetics of the hydrophilic antibiotic drugs, especially mafenide acetate, probably through a specific interaction. An increase in the organic:aqueous phase ratio, polymer content or molecular weight of the host polymer resulted in a decrease in the burst release and a more moderate release profile due to changes in shell microstructure. The first two parameters were found to be more effective than the third. The diverse release profiles obtained in the current study and the good mechanical properties indicate that our new composite fibers have a good potential for use in wound healing applications.