



The Potential for Improving Medical Textiles with Cyclodextrin Inclusion Compounds

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ABSTRACT

Cyclodextrins (CDs), 1,4 - α -linked cyclic starches containing 6 (α -CD), 7 (β -CD), and 8 (γ -CD) glucose units, are water soluble molecular bracelets, with hydrophobic interiors and hydrophilic exteriors. They are widely known for their ability to serve as hosts in the formation of both soluble and solid crystalline inclusion complexes (ICs) with a large variety of non-covalently included guest molecules. Recently we have demonstrated that a wide range of high molecular weight polymers, as well as small-molecule guests may be included in the host CD channels and cavities of their CD-ICs. These CD-IC crystals melt at high temperatures ($\sim 300^\circ$ C) and effectively screen their included guests from environmental influences. For example, crystalline CD-ICs may even be formed with polymer and small-molecule guests that are liquids in their pure bulk states. In polymer-CD-ICs the CD bracelets pack to form parallel stacks with narrow continuous channels (~ 0.5 - 1.0 nm in diameter), where the included polymer guests reside in highly extended conformations and are segregated from neighboring included polymer chains. Coalescence of guest polymers from their CD-ICs, which can be accomplished with a solvent for CD that is a non-solvent for the guest polymer or by treatment with an amylase enzyme, results in their consolidation into bulk samples with morphologies that are uniquely different from those normally obtained by consolidation from their disorder-ed solutions and melts. As a consequence, we have found their crystallinities, miscibilities with other polymers and small-molecules, and the phase separation of their block copolymers can be controlled by coalescence from their CD-IC crystals. Here we offer an assessment of the potential for using polymer materials processed with CD-ICs as a means to improve medical textiles, including applications such as the controlled delivery of drugs and genes and for fabricating anti-bacterial sutures, wound dressings, and implants.

Keywords: anti-bacterial sutures, wound dressings, implants

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