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10
Developments in recombinant silk and other elastic protein fibers for textile and other applications

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Abstract: The ability to manipulate genes and their products by recombinant DNA has signaled a number of new possibilities for the production of modified or new fibrous biopolymers or protein-based polymers with a combination of strength and elasticity similar or even superior to that of synthetic high-tech fibers. Biotechnological approaches offer the opportunity to replace existing chemical or mechanical processes for a cleaner production technology than conventional procedures, which cause severe pollution problems from textile effluents.

Key words: recombinant DNA, fibers, silks, collagens, elastin-like polymers, resilin.

10.1 Introduction

Nature is replete with structural materials in the form of fibers and biocomposites that have attained remarkable levels of efficiency and performance through eons of evolutionary selection (O'Brien *et al.*, 1998). Although these natural polymers remain, in some cases, commercially important because of their cost, functionality and consumer preferences, those shortcomings associated with quality variations along with their hydrophilic nature and low thermal stability have led to them being replaced by synthetic polymers with more desirable properties (Kalia *et al.*, 2009). With the advent of organic and petroleum-based chemistry in the early 20th century, natural polymers have been increasingly substituted by synthetic polymers and fiber development that, years ago, resulted in a family of new products, such as nylon, polyester, acrylic, aramid, spandex, olefin resins and fibers, with superior tensile strength and stress–strain behavior (O'Brien *et al.*, 1998). A new class of 'engineered' peptide-based biopolymers that has attracted much attention, consists of materials deriving from two scientific developments: the increasing understanding of protein structure–function, which provides peptide motifs that are useful for the design of repetitive,

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