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Silk proteins for biomedical applications: bioengineering perspectives

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Abstract

Biomaterials of either natural or synthetic origin are used to fabricate implantable devices, as carriers for bioactive molecules or as substrates to facilitate tissue regeneration. For the design of medical devices it is fundamental to use materials characterized by non-immunogenicity, biocompatibility, slow and/or controllable biodegradability, non-toxicity, and structural integrity. The success of biomaterial-derived biodevices tends to be based on the biomimetic architecture of the materials. Recently, proteins from natural precursors that are essentially structural and functional polymers, have gained popularity as biomaterials. The silks produced by silkworms or spiders are of particular interest as versatile protein polymers. These form the basis for diverse biomedical applications that exploit their unique biochemical nature, biocompatibility and high mechanical strength. This review discusses and summarizes the latest advances in the engineering of silk-based biomaterials, focusing specifically on the fabrication of diverse biomimetic structures such as films, hydrogels, scaffolds, nanofibers and nanoparticles; their functionalization and potential for biomedical applications.

Keywords: Silk, biomedical applications, films, scaffolds, hydrogels

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