



Spider Silk - Structure, Properties and Spinning

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ABSTRACT

Many of the natural fibers offer excellent properties suitable for various applications in apparel and non-apparel areas. Spider silk is a filamentous natural protein fiber produced by the spiders. Dragline silk produced by the spider offers superior properties than many of the natural and synthetic fibers. The natural spinning process, chemical composition, structure and properties of spider silk had remained mystery for a long time. Systematic attempts made in the biological aspects, structure of the silk proteins have become fruitful in spinning and regenerating this wonder fiber.

Keywords: Dragline, Major Ampullate, Nephila, Interphase, Beta sheet

INTRODUCTION

The term silk normally refers to a wide range of continuous filaments spun by the several species of Lepidoptera and Arthropoda, used for building structures for various purposes including prey capture. Silk filaments spun by spiders and silkworms are found to possess superior properties than other silk producing insects and more than 2500 orb weaving species exist worldwide [1 - 4]. Spiders have six or seven sets of glands, each producing different fiber and these glands remained undifferentiated, early in the evolution [4 - 7]. The spinnerets, microscopic tubes originating from glands, are classified into major, minor ampullate and the term "ampulla" is used to describe the distal part of the secretary zone [8]. Unlike synthetic polymers, the biopolymers are composed of numerous monomers arranged in a strictly

controlled manner [9]. Many attempts have been made continuously in the past to harvest and convert spider silk filaments into fabric form [4, 10, 11].

SPIDER WEB AND TYPES OF SPIDER SILK

Prior to the exploration of the structure and properties of spider silks, construction and design of webs have been the major area of focus [3, 4, 12 - 34]. The spider webs can take a variety of forms but the most common type is the orb web. Different families of spiders like *Araneus*, *Nephila* builds orb-web and other families of spiders construct tangle and sheet webs [33, 35]. Orb-web spiders invest little energy in searching the prey and majority in silk synthesis and construction of the webs. Fig. 1 shows various threads and the web constructed by the orb-weaving spiders- *Araneus* and *Nephila*.