

UpRegulex[®] – Sericin Peptides from Silk Protein

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Abstract

Sericin is the short chain molecule that acts as the “glue” that provides silk fibres with their tensile strength and stability. Our research has developed peptide fractions of these molecules that exhibit long term anti-ageing benefits. The beneficial changes in gene expression are presented. Further studies, both *in vitro* and *in vivo* have also been conducted. Together, the data presents a convincing case for the use of these peptides in anti-ageing products as well a potential for use in scar reduction technologies.

Introduction

Silk protein, the structural component of the silkworm cocoon, consists of two major fractions, fibroin and sericin. Fibroin is the large molecular weight fibrous protein consisting of a core of heavy and light chains linked together with a sericin glycoprotein fraction via disulphide bonds. This protein configuration imparts tensile strength to fibroin. This protein is valued in numerous industrial applications for its water absorbency, thermotolerance, insulation, dyeing affinity and lustre. However, with reference to the topical treatment of human skin, the glycoprotein sericin has recently become the more important fraction of silk protein. Found in sutures, wound dressing, cell culture mediums, skin moisturizers, hair products and, more recently, anti-cancer applications, its unique, non-toxic biocompatibility with human skin tissues has prompted its global use in the cosmetic industry ⁽¹⁾.

Sericin is a family of adhesive glycoprotein consisting of at least four chemically distinct but structurally similar protein moieties that make up approximately thirty percent of the total protein in a silkworm cocoon. They act together to form an occlusive glue-like gel in the silkworm cocoon, sealing the fibroin sac from the outer environment. Sericin glycoprotein is water-soluble as they contain a large percentage of hydrophilic amino acids, in particular serine. Sericin is highly tolerant to heat, chemical modification and hydrolysis due to solubility, amino acid composition and three-dimensional structure (partial *beta* sheet) ⁽¹⁾.

Previous Biological Studies on Sericin Protein

As it bears a compositional resemblance with natural moisturizing factor (NMF), which is also abundant in serine,

the moisturizing benefits of sericin have been previously studied. Results have shown that topical application of sericin leads to a decrease in skin impedance and increased hydration of epidermal cells ⁽²⁾. The photoprotective effect of sericin as an antioxidant protein on UVB-induced acute damage in mouse skin via reduction of oxidative stress and COX-2 activity has also been demonstrated ⁽³⁾. Furthermore, protection against tumour production (in the 7,12-dimethylbenz (alpha) anthracene (DMBA)-initiated and 12-O-tetradecanoylphorbol 13-acetate (TPA)-promoted mouse skin tumourogenesis model) has been postulated and results suggest a suppression of oxidative stress, inflammatory responses and TNF-alpha activity ⁽⁴⁾. The anti-apoptotic effect of sericin in a UVB (30 mJ/cm²)-irradiated human keratinocyte model was also studied and pre-treatment with sericin was reported to suppress bax expression, up-regulate the expression of bcl-2, and prevent the activation of caspase-3 ⁽⁵⁾. In an UVB-treated keratinocyte model, both the inhibition of tyrosinase activity and the inhibition of intracellular hydrogen peroxide generation were induced through pre-treatment with sericin, suggesting that sericin probably prevents mitochondrial damage ⁽⁶⁾.

UpRegulex[®] – Hydrolyzed Sericin in an Enhanced MLV Delivery System

To expand our understanding of the beneficial effects of sericin protein on human skin, a proprietary hydrolyzed fraction of the protein, UpRegulex[®] (INCI name: Water (and) Butylene Glycol (and) Phospholipids (and) Hydrolyzed Sericin) was developed and further tested. As the hydrophilicity of the peptide fraction leads one to predict inefficient permeation across the *stratum corneum*, the sericin peptides were encapsulated in an enhanced multilayer vesicle lipid dispersion. It should be noted that this lipid dispersion has been previously shown to possess its own photoprotective benefits to the skin. Therefore, the data presented herein reflect the combination of Sericin – MLV effects and not those of sericin alone. The product is available from the co-authors' company. Initially, the peptide – MLV fraction was evaluated using DNA microarray technology on full thickness epidermal skin substitutes. The results were then analyzed and used to develop other assays to determine if those effects of the sericin – MLV complex predicted from the microarray results were realized.