Material Safety Data Sheet (MSDS)

Silk Fibroin Protein Solution

Grade

Laboratory Grade
Pharmaceutical Grade

Description

The product composes of the protein, fibroin, extracted from silk fiber (Thai domestic race, *Bombyx mori CV. Nangnoi Srisaket 1*) in purified water. Natural structures of the protein composed of mixed secondary structures as shown in the table below (Chankow et al, 2017).

Secondary structures	Approximated contents (% by FTIR analysis)	
	Natural silk cocoon fiber (degummed)	The extracted fiber protein in water
Helix	8.5	9.96
Tyrosine side chain	4.2	5.79
Radom coils	12.4	23.27
Turns	15.8	16.87
Beta-sheet	59.1	44.12

The extraction process temporarily destabilized beta-sheet structure and make the protein soluble in water. However, the regeneration of beta-sheet structures could be simultaneously occurred over a period of storage, and the process can be accelerated by temperature or physical stresses. Faster induction of the beta-sheet structure could be done by the treatment of alcohols or acetone. Due to its unique structure, silk fibroin has high mechanical properties, compared to other biocompatible proteins. It degrades slowly at physiological condition (up to 3 moths -2 years depending on preparations and site of used). *In vitro* degradation was reported to be accelerated in protease XIV, alpha-chymotrypsin enzymes (Numata ea al, 2010).

The pale yellow color of the product is due to natural color of the Thai silk race.

Applications

Recommend to use as a biomaterial for food, cosmetics, pharmaceutical stabilizers, controlled release carriers, membranes, scaffolds, biodevices, and research uses.

Certified Standards

ISO13485
ISO17025
ISO 14644-1:2015(E) Class5, Class 7 and Class 8 Cleanroom
ISO9001

Properties

Biological source	Thailand's domesticated *Bombyx mori* silkworm
Form	Pale yellow colored solution (in sterilized water)
Mol wt	100-350 kDa (SDS PAGE)
Concentration	20 mg/mL (1.96% by wt.)
Purity	>99.9 % (Kieldahl)
Density	1.02-1.04 g/ml
Zeta Potential	-3.81 to -3.95 (at pH7.4, 25 ^{o}C, in Deionized water)
pH	6.0-6.6 (at 25 ^{o}C, in Deionized water)
Viscosity	2.0-2.3 cP (at 25 ^{o}C, in Deionized water)
Td	264.8 ^{o}C

Biological Tested

Tests		**Results**	**Ref. Standard**
Sterility [1]	Anaerobic Bacteria	Negative	Ref. Negative = no growth of microorganisms occurs, Positive = growth of microorganisms occurs
	Aerobic Bacteria	Negative	
	Fungus Mycobacteria	Negative	
Endotoxin [2]		<0.1 EU/ml	Endotoxin limit < 20 EU/ml (USP 41, 161)

Note: 1 is Automate Hemoculture method, 2 is Limulus Amebocyte Lysate (LAL) / Kinetic Turbidimetric Method

Storage

Ship in	Dry ice
Storage condition	4 °C, no shaking
Storage time	Up to 3 months at 4 °C
	Up to 1 years at -20 °C but some precipitations might occur upon thawing

Preparation Note

Quick freezing or thawing are not recommended. Gently mix with other component if needed. Do not shake, vortex or pipet vigorously. Fibroin is a protein with mixed secondary structures. The beta-plate sheet structure of protein is water insoluble, protein aggregation will likely occur upon shear or temperature stress.

The solution could be freeze dried for longer storage and re-solubilized in Hexafluoroisopropanol (HFIP) solutions (Danielle et al, 2011). Although these solutions could depolymerize the peptide chains of the protein.

Safety Information

RID/ADR RID certification for packing/transport: NON-HAZARDOUS for all modes of transport
Flash Point: Not applicable
Toxicity: None (ISO10993-5 tested)

Documents

Certificate of Analysis (COA), can be downloaded at www.bemhru-chula.com

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Publications

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