VISVESVARAYA TECHNOLOGICAL UNIVERSITY
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PROJECT REPORT ON

"SILK FIBROIN PROTEIN BASED BIOMATERIALS"

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ABSTRACT

Fibroin is a family of filament core protein synthesized exclusively by silk worm, Bombyx mori. Fibroin is the principal water insoluble protein (i.e. 78% of the weight of raw silk) with a highly oriented and crystalline structure. Fibroin has a low proportion of amino acids residues with large side chains in silk. It is a macromolecular protein of 300-450kDa. It is a valuable biomacromolecule protein having moisture absorption, antioxidant, UV protective properties, bio-compatibility, mechanically superior and offers a wide range of properties. The reeling waste (grade A) contains a vast amount of silk fibers which has fibroin protein. This waste silk is used to recover the fibroin protein for the production of biomaterials.

In this study an effective technique has been used for extraction of fibroin from waste silk. Fibroin was extracted by the successive methods of degumming, dissolving and dialysis to obtain various fibroin based biomaterials like film, hydro gel, and powder. Natural material like Soap nut, mild alkali soap (Facia soap), sodium silicate and enzymes were effectively used for degumming and among which enzymes resulted in higher degumming loss(near to standards) and we had no degradation of fibroin. This silk is dissolved in different molar concentration (9.0, 9.3, and 9.5) of lithium bromide, in which 9.3M lithium bromide is found to give optimum extraction of fibroin protein. Recovery was done by using dialysis bag with a molecular cutoff 12kDa. This fibroin solution is used to produce various biomaterials (film, gel and powder). The obtained film is treated with different ratio of methanol to water (50:50, 80:20 and 100%) and tested in universal tensile strength tester to determine tensile behavior. It was found that 50:50 methanol treated film showed better tensile properties comparatively. When films were tested for microscopic examination under Axiostar Plus Transmitted-Light Microscope, a uniform surface of the film was observed in 50:50 methanol treated film. Microscope examination of fibroin powder showed 3D crystal structure and uniform distributions of crystals with differing particle size and shape. In addition, acidification of obtained silk protein solution also results in a highly porous silk gel which may find application as useful biomaterials.

Results suggest that the fibroin is a valuable protein in production of biomaterials. Silk reeling waste can be suitably modified to convert into useful biomaterials such as film, gel, powder and scaffold etc.