# SILK SERICIN BASED MATRICES FOR TISSUE ENGINEERING


## *Abstract*

Silk protein sericin is hydrophilic, macromolecular globular glycoprotein synthesized in the middle silk gland of the silkworms. The various biological activities of sericin make it a potential material for pharmaceuticals and biomedical use. However sericin of the cocoons is mostly discarded as waste in silk industries during degumming process of silk fibres. The aim of this study is to utilize sericin as biocompatible biopolymer for biomedical applications. Anti-tyrosinase, melanogenesis and wound healing effect of sericin from mulberry, non mulberry and Sericin Hope silkworm cocoons are investigated. The results suggest that sericin obtained from different extraction method have different response towards anti-tyrosinase, anti melanogenesis and wound healing activity. Porous three dimensional hydrogel matrices are fabricated composed of sericin and carboxymethyl cellulose. SS-CMC matrices show good performances in terms of mechanical strength, swelling, stability and cell proliferation. They can be used as cellular wound dressing material due to lack of toxicity against human keratinocytes (HaCaT) and lack of immunogenicity *in vitro.* Three dimensional tissue engineered construct of sericin is developed using co-culture of keratinocytes and fibroblasts. The histological analysis demonstrates a multi-layered stratified epidermal layer of uninhibited keratinocytes. Presence of involucrin, collagen IV and the fibroblast surface protein in immune-histochemical stained sections of co-cultured matrices indicate the significance of paracrine signaling between keratinocytes and fibroblasts in the expression of extracellular matrix protein for dermal repair. Functionalization of metallic implant titanium with silk protein sericin is investigated and to analyze combinatorial effects, sericin immobilised titanium is further conjugated with integrin binding peptide sequence Arg-Gly-Asp (RGD). Osteoblast-like cells are cultured on sericin and sericin/RGD fictionalized titanium and are found viable on pristine titanium. The findings demonstrate that the sericin immobilised titanium are potentially useful bioactive coating material for titanium-based medical implants. Microcapsules composed of sericin and alginate core with an outer chitosan shell are prepared and proposed for live cell encapsulation for potential therapeutic applications. The encapsulation of hepatocytes cells within microcapsules results in high cell viability and uniform cell distribution with enriched population of metabolically and functionally active cells.