INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Skin, the largest organ of human body provides physical protection against biological, mechanical, thermal and chemical assaults. However, chronic exposure of skin to ultraviolet (UV) radiations depletes enzymatic and non-enzymatic antioxidants and elevates the production of reactive oxygen species (ROS) that leads to skin damage. Supplementation or topical delivery of potential exogenous antioxidants protect the skin against pollutants and UV radiation-induced damage. Most of the exogenous antioxidants get oxidized by exposing to air and UV radiations as well as cause adverse effects. Hence, there is a need for potent antioxidants that could protect the skin against UV radiation-induced oxidative damage, photoaging and hyperpigmentation without causing adverse side effect to the skin. Silk sericin (SS) is known to possess antioxidant activity along with other biological attributes. The properties of SS depends on the amino acid composition and associated secondary metabolites. They vary based on the source of the sericin and with their extraction methods. In the present thesis work, we have systematically explored the biological properties of SS obtained from the cocoons of endemic silk variety of Assam, India [*Antheraea assamensis* (AA)] along with *Bombyx mori* (BM) and *Philosamia ricini* (PR). SS extracted from cocoons of AA, BM and PR by five different extraction methods were assessed for physicochemical properties and antioxidant activity. The physicochemical characterization revealed that the molecular weight (10 to 220 kDa), secondary structural conformation of SS isolates and total content of associated secondary metabolites varied based on the extraction methods. SS isolates obtained using alkali-degradation method protected the L929 cells from H_2O_2 induced oxidative damage. SS extracted from the cocoons of all three silk varieties using alkali-degradation method were further used

to explore their anticancer activity and protective effect against UV radiation-induced oxidative damage, photoaging and hyperpigmentation. Human cancer (A431, SAS and MCF-7) cells treated with 4 mg/mL of SS displayed 50% reduction in their viability. Redox imbalance induced in cancer cells by SS treatment caused cell cycle arrest at the sub-G1 phase, depleted mitochondrial membrane potential (in MCF-7 cells) and resulted in apoptotic cell death. Western blotting analysis revealed that AA sericin (AAS) treatment upregulated Bax (in A431 cells) and downregulated Bcl-2 (in SAS and MCF-7 cells) protein expression in cancer cells. HaCaT cells treated with AAS prior to UV irradiation showed better protection against UVA and UVB radiation-induced oxidative damage than PR sericin (PRS) and BM sericin (BMS), respectively. *In vivo* results suggested that AAS protected SKH-1 female hairless mouse against UVB radiation-induced oxidative damage by upregulating intracellular glutathione activity, preventing DNA fragmentation and lipid peroxidation. Incubation of hyaluronidase and elastase with AAS inhibited their 50% activity. PRS and AAS post-treatment enhanced collagen production in UVA and UVB irradiated HDF cells by upregulating procollagen (Col1α1 and Col1α2) gene expression and downregulating MMP-1 gene expression. AAS post-treatment also downregulated gelatinase expression in both UVA and UVB irradiated HaCaT cells. Incubation of mushroom tyrosinase with AAS and PRS inhibited its 50% activity. SS (AAS and PRS) pretreatment significantly reduced cellular melanin and ROS production in UV irradiated melanocytes than SS untreated cells. AAS treatment before UVA and UVB irradiation significantly inhibited tyrosinase activity. AAS was selected and used in the preparation of skin care formulation and its rheological properties were assessed. Rheological studies showed that the skin care formulation prepared by the addition of AAS into the basic formulation minimally affected its flow properties. AAS embedded cream would be used as a potential skin care cream as a potential therapeutic to protect the skin against UV radiation-induced inflammation, oxidative damage of epidermal keratinocytes, aging, wrinkling and prevents skin roughness and enhances skin elasticity and moisture content.