STUDIES ON MODIFICATION OF SILK WITH UV RADIATION

By

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DEPARTMENT OF TEXTILE TECHNOLOGY

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to the

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IIK - Radiation effect

This Work is Dedicated to .....

My Beloved Mother

CERTIFICATE

This is to certify that the thesis entitled **"STUDIES ON MODIFICATION OF SILK WITH UV RADIATION"** being submitted by **Mr. S.Periyasamy,** to the **Indian Institute of Technology, Delhi** for the award of the degree of **Doctor of Philosophy** in the **Department of Textile Technology,** is a record of bona fide research work carried out by him. Mr. S.Periyasamy has worked under our guidance and supervision, and fulfilled the requirements for submission of the thesis.

The results contained in this thesis have not been submitted, in part or in full, to any other University or Institute for the award of any degree or diploma.

Deepti 19/9/07

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S. Periyasamy

ABSTRACT

Surface treatment of mulberry silk was carried out using an excimer lamp emitting monochromatic light at 172 nm. Changes in physicochemical properties of silk, as a result of irradiation were characterized and studied by high resolution scanning electron microscope and atomic force microscope. Irradiation led to creation of surface nanopores of 100 nm ×10 nm dimensions on silk, and the size of nanopores continued to increase with irradiation time. Wettability and wickability of silk improved significantly at an irradiation time of 5 min. Chemical changes were studied by carbonyl group estimation. The mechanism for the physicochemical changes has been attributed to the action of high energy photon, atomic oxygen and ozone. Effect of irradiation on weight loss, tensile strength, and crystallinity was found to be insignificant. Wettability and wickability improved significantly even when the silk was irradiated on only one side. Lamp geometry and distance of fabric from the excimer lamp influenced the irradiation effects significantly. Wetting and wicking results of samples irradiated with excimer lamp were similar to those of samples treated with Dielectric Barrier Discharge (DBD) plasma.

Silk fabric with outer face having hydrophobic property and inner face having hydrophilic property was prepared by single side irradiation of silk fabric that had been previously finished with fluorocarbon based finish. The air permeability and bending length of the treated fabric were least affected while the crease recovery and UV, protection improved noticeably.

In another study, the silk fabric was treated with silver nanoparticles produced by chemical reduction method. The nanoparticle size decreased with increase in stirring speed and decrease in process temperature. Smaller particles were formed when the silver nitrate was reduced by glucose as compared to that formed by reduction with

hydrazine. Silk fabrics treated with silver hydrosol of 40 ppm produced at 5°C and 60 ppm produced at 40°C showed 100% antimicrobial activity against gram-positive bacterium *Staphylococcus aureus*. The treated fabric showed 100% antimicrobial activity up to 5 washing cycles and then it decreased.

Table of Contents