FLAME RETARDANT FINISHES FOR POLYESTER/CELLULOSIC BLEND FABRICS

by

S. CHAKRAPANI

DEPARTMENT OF TEXTILE TECHNOLOGY

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CERTIFICATE

This is to certify that the thesis titled "FLAME RETARDANT FINISHES FOR POLYESTER/CELLULOSIC BLENDS FABRICS", being submitted by Mr. S. Chakrapani, 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 bonafide research work carried out by him. Mr. S. Chakrapani has worked under our guidance and supervision, and has fulfilled the requirements for the 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.

Prof. N.K. Jha
Chemistry Department,
Indian Institute of Technology,
New Delhi-110016.

Prof. (Miss) P. Bajaj
Textile Technology Department
Indian Institute of Technology, Delhi
New Delhi-110016.

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S. Chakrapani

(S. CHAKRAPANI)

TO THOSE INNUMERABLE LIVES LOST TO THE FURY OF FLAMES

ABSTRACT

Plain-weave cotton and polyester/cellulosic blends were flame retarded using P-N, Sb-X and P-Sb-X FR systems. IR spectral investigations of the FR-treated samples were conducted to identify the structures formed on the fabric. Thermal studies were carried out to examine the pre-ignition interactions in the FR-treated systems. Flame retardancy of the samples was evaluated by measuring their oxygen index (OI), burning rates and resistance to surface ignition.

In the P-N system of flame retardants, N-methylol agents, viz., urea-formaldehyde (UF), trimethylolmelamine (TMM), dimethylol ethylene urea (DMEU), and dimethylol dihydroxy ethylene urea (DMDHEU) were applied as post-treatments to study their effect in enhancing the FR properties of phosphorylated cotton and polyester/cellulosic blends. UF was found to be effective on cotton, when used as a post-treatment and also when applied in a single step with diammonium phosphate, in enhancing the OI of the system.

Phosphorylated polyester/viscose blend fabrics were also post-treated with $ZrOCl_2/Sb_2O_3$, $TiOSO_4$, and Na_2SnO_3 to improve their resistance to deactivation by hardness ions. The post-treated fabrics were subjected to four hard-water

laundering cycles using 220 ppm hard-water. All these metal complexing agents rendered the phosphorylated blend resistant to deactivation by hardness ions throughout the four cycles of wash.

Antimony-halogen systems - triphenyl stibine dibromide, its tribromophenol and pentachlorophenol derivatives, and Sb_2O_5/tetrahalophthalic anhydrides - were evaluated on cotton, polyester, phosphorylated and control polyester/viscose blend fabrics. Sb_2O_5/tetrabromophthalic anhydride post-treatment of phosphorylated polyester/viscose blend recorded the highest OI encountered in the entire investigation. The structural response of the control and FR-treated polyesters/viscose blend fabrics to exposure to a standard flame were investigated by scanning electron microscopy.

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