INFLUENCE OF ADDITIVES IN SPINNING DOPE AND SPIN BATH TEMPERATURES ON STRUCTURE AND PROPERTIES OF ACRYLONITRILE TERPOLYMER FIBERS

by

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CERTIFICATE

This is to certify that the thesis entitled "INFLUENCE OF ADDITIVES IN SPINNING DOPE AND SPIN BATH TEMPERATURES ON STRUCTURE AND PROPERTIES OF ACRYLONITRILE TERPOLYMER FIBERS", being submitted by Ms. M. Surya Kumari, 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 her. Ms. Surya has worked under my guidance and supervision and has fulfilled the requirements for the submission of the thesis.

The results obtained 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.

Bajaj

Prof. (Miss) P. Bajaj,
Thesis Supervisor

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ABSTRACT

Fiber forming acrylonitrile terpolymers having acrylonitrile, vinyl acetate or methyl acrylate, and sodium methallyl sulfonate as a third comonomer, were hydrolysed employing sulfuric acid and sodium hydroxide as hydrolysing agents. The extent of hydrolysis was restricted to DMAc solubility so that the hydrolysed products could be used as an additive in the spinning dope in order to study their effect on moisture sorption and dyeability of the fibers. FT-IR, NMR and X-ray techniques have been used to establish the mode of hydrolysis of the acrylonitrile terpolymers, and the effect of comonomer on the extent of hydrolysis.

Hydrolysed products of AN-VA-sodium methallyl sulfonate with a degree of hydrolysis ~0.104, 0.367 and 0.450 and the polar materials such as secondary cellulose acetate, polyvinyl acetate, polyvinyl pyrrolidone and glycerol were used as spinning dope additives in the wet-spinning of the AN-VA-Sodium methallyl sulfonate spinning dopes. Spinning has been carried out on a laboratory scale unit, using dimethyl acetamide:water mixture (45:50 v/v) in the coagulation bath with temperatures ranging from 10 to 60°C. Density, X-ray orientation, X-ray crystallinity, sonic modulus, moisture sorption, water retention and tensile properties of these fibers were measured. The physico-mechanical properties of these fibers are related to the gel-fiber structure and the fracture morphology of the fibers.

Thermal properties of the blend fibers have been studied through DSC, TGA and TMA techniques. Thermal stabilization of the fibers has been carried out to establish the structural changes occurring during the oligomerization of blend fibers. FT-IR spectroscopy was employed to detect the structural changes. The dyeability of the fibers has been studied using three basic dyes, i.e., Basacryl Golden Yellow XGFL, Panacryl Brilliant Red 2B and Methylene Blue 2B. The rate of dyeing was determined and the diffusion coefficients have been related to the molecular size of the dye molecules as well as to the structure of the blend fibers. The light-and color-fastness data of the dyed fibers have also been presented.

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