# STUDIES ON FALSE-TWIST TEXTURING OF DIFFERENT TYPES OF POLYESTER YARNS

*By*

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*of the degree of*

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# CERTIFICATE

This is to certify that the thesis entitled "**Studies on False-Twist Texturing of Different types of Polyester Yarns**" being submitted by Mr. Soumyen Kumar Pal to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy, is a record of bonafide research work carried out by him. Mr. Soumyen Kumar Pal has worked under our joint 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 full to any other University or Institute for the award of any degree or diploma.


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*Dedicated to*

*My Grandmother*

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# ABSTRACT

Production of polyester fibre has rapidly increased since its introduction in the world market in 1950s. Continuous research work to improve performance and versatility has led to the development of many new polyester fibres amongst which microfibre and cationic dyeable poly(ethylene terephthate) fibre are noteworthy commercial exploited examples. The texturing behaviour of these new fibres has been studied. Draw ratio, D/Y ratio, first heater temperature and heater contact time have been varied during texturing of POY polyester yarns on SDS 600C draw-texturing machine. Box and Hunter statistical experimental design has been adopted to prepare samples. The textured yarn properties examined include tensile, crimp and dyeing properties. In addition to these, yarn quality in terms of broken filaments and tight spots has also been studied. X-ray diffractometer, Polarising microscope, Sonic modulus tester, Differential scanning calorimetry have been used for analysing the structural properties of fibres. Observed changes in properties of textured yarns have been explained on the basis of structural studies.

Study on the effect of texturing variables on the properties of microfibre polyester reveals that the crystalline content in microfibre yarns after texturing is lower than that of normal polyester, while orientation is higher. Tenacity and crimp contraction are poorer in

textured microfibre polyester yarns as compared to textured normal polyester yarns. Dye uptake of microfibre polyester is found to be lower. Broken filaments are more in microfibre polyester than in case of normal polyester. To reduce incidence of broken filaments in microfibre polyester, draw ratio should be reduced.

Study on the effect of texturing variables on cationic dyeable polyester (CDPET) yarn reveals that the crystallinity as well as orientation is less in CDPET yarn due to presence of bulky $-SO_3Na$ group in the polyester fibre. The tensile properties are poorer in CDPET as compared to normal polyester. It is found that the tenacity of CDPET increases upto $190^{o}C$ followed by decrease with further increase in heater temperature. The crimp stability is less in CDPET than that of normal polyester. Dye uptake is more in CDPET as compared to normal polyester. Broken filaments are higher in case of CDPET.

With increasing DMS salt content in CDPET, the crystalline fraction, orientation and crystal size decreases, which, in turn, results in lower mechanical properties. Tenacity, crimp contraction and crimp stability reduces with increase in DMS salt content in CDPET. The dyeability of CDPET with both disperse dyes and cationic dyes improves with increase in DMS salt content. The DMS salt content should be less than 1.5 mol percent in CDPET to get a fibre with good dyeability as well as satisfactory mechanical properties.

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