

**A STUDY ON IMPROVING COLOURATION OF
POLYESTER AND POLYESTER / COTTON BLENDED
FABRICS USING LIPASE ENZYME TREATMENT**

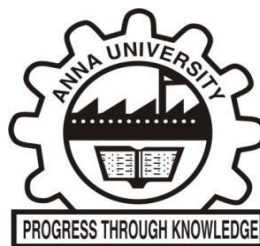
A THESIS

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CERTIFICATE

The research work embodied in the present Thesis entitled “**A Study on Improving Colouration of Polyester and Polyester/Cotton Blended Fabrics using Lipase Enzyme Treatment**” has been carried out in the Department of Textile Technology, PSG College of Technology, Coimbatore. The work reported herein is original and does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion or to any other scholar.

I understand the University’s policy on plagiarism and declare that the thesis and publications are my own work, except where specifically acknowledged and has not been copied from other sources or been previously submitted for award or assessment.

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ABSTRACT

Enzymatic Hydrolysis on synthetic fibers enhances the hydrophilicity and solves the concerns regarding the environmental issues of Textile Industry. Lipase hydrolyses ester linkages in Polyethylene Terephthalate (PET) and produces polar hydroxyl and carboxylic groups. The use of low cost commercial Lipases for PET hydrolysis is a possible way to environmental friendly finishing of PET fabrics. The present investigation focuses more on lipase enzyme hydrolysis. This research work investigates the conditions of the treatment of PET fabrics with commercial Lipase to improve the hydrophilicity of the PET fabrics.

Most of the earlier research work focused on enzymatic modification of PET fabric but studies about the behavior of the fabric, the presence of functional groups, shear and compression properties of treated and dyed fabrics are scanty. 100% polyester and 67/33 polyester/cotton blended fabrics both woven and knitted with plain weave and single jersey structures have been selected for this research work. The concentration of alkali and enzymes are varied to know the effect on the weight loss of the fabrics. Lipase enzymes with different activity levels are selected for this particular research work.

The hydrolytic activities of the enzymes are estimated and the enzyme treatment parameters like concentration, pH, Temperature, Treatment time on weight loss of the fabrics are evaluated. The optimum treatment conditions are derived using box benken statistical method. The activities of the enzyme are also varied to know its effect on

weight loss and hydrolytic activity. The effect of enzyme treatment conditions on the hygroscopic properties of polyester, polyester/cotton blended fabrics both woven and knitted are considered for this particular research work.

The treatment effect on hygroscopic properties of the fabric like water vapour permeability, Wicking height and drop test time are evaluated. The surface morphology of the alkali and lipase treated fabrics are studied through scanning electron microscope(SEM).The presence of functional groups on the enzyme treated fabrics are identified through Fourier Transform Infrared Spectroscopy (FT-IR) . The crystallinity and amorphous nature of the treated fabrics are identified through X-ray diffraction pattern of the fabrics.

The enzyme treated polyester and cotton blended fabrics are subjected to dyeing using disperse dyes for polyester with high temperature high pressure dyeing. The polyester/cotton blended fabrics are subjected to two bath dyeing technique using disperse and reactive dyeing method. The fabrics are dyed with Cyan, Magenta, Yellow and Black shades to know the treatment effect on various colours. The relative unlevelness index values of the treated fabrics are estimated to know the levelness of dyeing. The fabrics of alkali treated and lipase treated fabrics are dyed separately and the treatment effect on dye exhaustion, colour strength, colour difference, Colour uniformity, Lightness value and Colour fastness characteristics are evaluated.

The lipase enzyme treated fabrics were subjected to sublimation printing. The treatment effect on colour pickup of polyester and polyester/cotton blended fabrics were

analysed by measuring the colour difference values. The printing parameters like number of strokes, sublimation paper GSM, fusing temperature and fusing time were varied to know the effect of colour transmission. These printing parameters were optimized using Taguchi parametric design approach to derive the optimum printing parameters which ultimately reduces the consumption of inks and energy needed for curing the printed fabrics.

The physical properties of alkaline treated and enzyme treated dyed fabrics are tested to know the effect of treatment on various properties. The alkali treatments degrade the fabric surface and influence the physical properties of the fabrics effectively. Lipase treatment offers specific action with low fibre degradation without compromising the fabric properties. The treatment effect on fabric properties like, Tensile, low stress mechanical properties along with fabric comfort properties like bending, crease recovery air permeability, drape and abrasion resistance are determined. The effects on change in enzyme concentration on these properties are also estimated.