ABSTRACT

Enzymatic hydrolysis on polyester fibres improves the hydrophillicity and solves the problems pertaining to the ecological issues of Textile Industry. The enzyme Lipase hydrolyses ester linkages in polyester (PET) fibres and yields 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 hydrophillicity of the PET fabrics.

Most of the earlier research works focused on surface modification of PET fabric with alkali but studies on the behaviour of the fabric, the presence of functional groups, shear, and compression properties of treated and dyed fabrics were scanty. 100% polyester and 67/33 polyester/cotton blended fabrics both woven and knitted with plain and single jersey structures respectively 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 enzyme were estimated and the treatment parameters like concentration, pH, temperature, treatment time on weight loss of the fabrics are evaluated. The optimum treatment conditions are derived using Box-Behnken design (BBD) for the optimisation of analytical method. The activities of the enzyme were also varied to know their 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 effects of the treatment on hygroscopic properties on water vapour permeability, wicking height and drop test time of the fabric were evaluated. The surface morphology of the fabrics treated with alkali and lipase were 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 crystalline and amorphous nature of the treated fabrics is identified through the X-ray diffraction pattern of the fabrics.

The enzyme treated polyester and polyester/cotton blended fabrics were subjected disperse dyeing under high temperature pressure mainly for the polyester dyeing. The polyester/cotton blended fabrics were subjected to two bath dyeing technique using disperse (polyester) and reactive (cotton) dyes. The fabrics were 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 alkali and lipase treated fabrics were dyed separately and the effects on the dye exhaustion, colour strength, colour difference, colour uniformity, lightness value and colour fastness were 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 sublimation printing variables like strokes, paper weight, temperature and time were changed to understand the effect of colour pickup on the fabrics. These printing parameters were optimised 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 and enzyme treated dyed fabrics were 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 on low fibre degradation without compromising the fabric properties. The treatment effect on fabric properties like, tensile, shear and compression properties along with fabric comfort properties like bending, crease recovery, air permeability, drape and abrasion resistance were determined. The effects on change in enzyme concentration on these properties were also estimated.