ABSTRACT

Cotton has excellent properties such as higher water absorbency, moisture regain etc. It is comfortable to wear and easy to dye. For these reasons, the apparel industry is predominantly based on cotton. Reactive dyes are becoming increasingly popular for dyeing cellulosic fibres because of their wide shade range, brilliant shades, ease of application and excellent wet fastness properties. These are all the factors which increase the use of reactive dyes in apparel end use.

Nowadays consumers are more sophisticated than ever. They are concerned not only at style and comfort, but also for easy care and durability. Market studies indicate that consumers make many purchase choices based on colour. Therefore, a fabric’s ability to retain its original colour is one of the most important properties of a textile product. For customer acceptance and appreciation the washing, rubbing and light fastness of the dyestuffs used for dyeing the garments are essential. Due to the strong covalent bonds between reactive dyestuff molecules and cellulose polymer functional groups, their colours are highly resistant to washing and rubbing. Light fastness is another important property limiting the life cycle of dyed textile materials. Most reactive dye manufacturers, while providing information on fastness properties of the dyes in their shade cards, do not mention anything about the fastness of combination shades. Usually when two or more dyes are used for a
combination shade, the light fastness of the combination is governed by the lowest value of the individual dye.

The light fading is due to photo degradation of dyes by ultraviolet light induced unimolecular decomposition and visible light-induced photoxidation. These are the two most important pathways of light fading. With the above mechanism of fading in the background, the present work concentrates on minimizing fading of dyed material by ultraviolet light and visible light.

Though reactive dyes have good wet fastness properties, their light fastness characteristics are only moderate. Methods to improve light fastness have to be evolved in order to have quality fabric. In this work, factors of light fastness and methods to improve the light fastness of reactive dyed fabrics are analysed.

Factors that influence the light fastness are the change in linear density of yarn, fabric structure, pretreatment methods, dyeing methods, dye structure and finishing chemicals. The effect of these factors on light fastness properties is analysed.

Finer yarn shows better light fastness than the coarser yarn. The reason may be that the fibre used for making finer yarn is well matured and longer in length but coarser yarn has immature and short length cotton fibres.

The plain fabrics and single jersey fabrics have uniform surface structure which gives better light fastness than the wavy structured fabrics
like pique and twill fabrics. The reason may be the uniform surface share energy faster than the wavy rough surface fabric.

Light fastness of pale shade fabrics is improved by pretreating the fabric by semi bleaching and mercerized-semi bleaching methods. The complete removal of natural colour is the reason for better light fastness of semi bleached fabric.

The exhaust and pad-batch dyeing of cotton fabric produce better light fastness than pad-humidity fix dyeing. The pad-humidity fix dyeing results in surface dyeing and the alkaline pH with high temperature reduces the stability of chromophore to light.

It is also observed that no significant effect of reactive group of dyes on light fastness. Light fastness of reactive dye depends on chromophore and substitution group. The azo chromophore dyes have lower light fastness, metal complex and anthroquinone chromophore dyes have better light fastness. Sulphonic acid group in reactive dye is only for the solubility of dye. They do not have any impact on light fastness significantly. All finishing treatments studied here show reduction in light fastness.

Visible light requires oxygen to degrade the dyes. It can be minimized by the usage of antioxidants like gallic acid, vitamin C and cafeic acid that absorb the oxygen radicals available for photo degradation. The ultraviolet light is another important cause for fading of dyes and this reaction does not require oxygen. The ultraviolet absorbers phenyl salicylate and benzophenone are used to minimize the effect of ultraviolet rays.
The most efficient additives for C.I. Reactive Yellow 84 and C.I. Reactive Red 22 are vitamin C and gallic acid. For C.I. Reactive Blue 198, all the UV absorbers and antioxidants show a great improvement in the light fastness.

Combined application of antioxidants and ultraviolet absorbers treatment shows significant improvement in the light fastness. Treatment with Phenyl salicylate and vitamin C combination gives most significant improvement in the light fastness of dyed fabric. Stability of the finish after ten wash cycles is found to be good with pad-dry-cure chemical application method.