TECHNICAL TUESDAYS

POLYESTER AND ITS BLENDS – PART VI

REF: TT/ AUGUST 2020 / WK 2

Dyeing Mechanism of Polyester fiber

Polyester is highly crystalline and hydrophobic fiber. Therefore, dyes with large molecules cannot penetrate into these types of fiber. Also, these fibers have no chemically active group and cannot combine with positively or negatively charged dyes. Hence, polyester fibers are dyed with non-Ionic disperse dyes. These dyes mainly contain azo or anthraquinone groups and do not have cationic or anionic groups within the structure. These are sparingly soluble in water and are dispersed with the help of a dispersing agent in the dyebath. The dye bath is heated which swells the fiber and helps the dye to penetrate into it. The dye molecules are held by hydrogen bonds and Van Der Waals' force.

Dyeing takes place through different steps.

- Dissolution/Dispersion of the dye molecules in the dyebath.
- Diffusion of the dissolved/dispersed dye molecules from the dyebath to the fiber.
- Adsorption of the dye molecules onto the surface of the fiber.
- Diffusion of the dye molecules within the fiber.

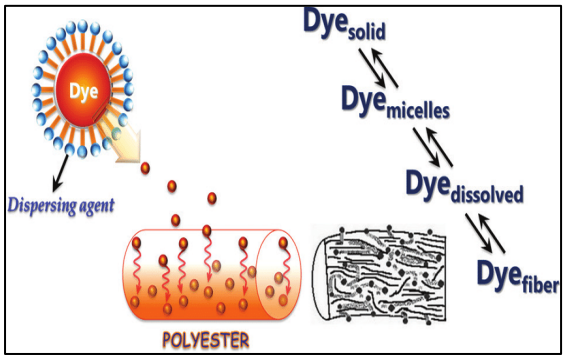

Fig 1.1 Disperse Dyeing mechanism

Ref: researchgate.net

Key notes

- Disperse dyes have good wash fastness properties.
- Disperse dyes are very fast to light.
- Fabric dyed with certain blue and violet AQ based disperse dyes fades in nitrous oxide.

After dyeing, dye molecules accumulate at the surface of the dyed fiber. To remove these unabsorbed dyes, a washing off treatment using an alkaline (NaOH) solution of Sodium hydrosulfite or hydrose is given to the dyed fiber. This washing off treatment is called reduction clearing. In the case of azo disperse dyes, reduction clearing breaks the azo bond producing colorless amino compounds. Whereas,

in the case of anthraquinone or AQ based disperse dyes; the dyes are converted into colorless, water-soluble form.

Fig 1.2 Reduction clearing mechanism of Azo and AQ disperse dyes

Ref: textiletuts.com

High Temperature Dyeing of Polyester fiber

This method is also known as HTHP or high temperature high pressure dyeing. This dyeing method is used for highly crystalline synthetic fiber Polyester and their blends. High temperature helps the fiber to swell, so that dye molecules penetrate the fiber polymer system.

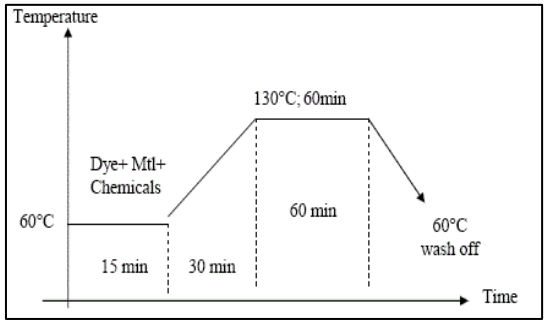

Fig 1.3 Flow diagram of High temperature dyeing

Ref: textilelearner.blogspot.com

Initial dyeing temperature, rate of heating and duration of dyeing are key factors in this process. These process parameters should be maintained as per recommendations. This will result into good exhaustion of dyes, uniform dyeing and shade consistency.

Besides this, selection of disperse dyes to develop a shade is very important. The dyes with similar dyeing characteristics should be selected. So that even dyeing can be achieved.

.....To be continued.....

UNSCRAMBLE THE JUMBLE WORDS
NOISFUFID
ROPSNOTIDA
ERACRRI
DUTCNOIRE EARNGILC

Last week`s Answers: 1) CRIMPING 2) DELUSTERANTS 3) LUBRICANTS 4) EMULSIFIER

Wishing you a great week ahead!

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