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Important Factors that Affect the Textile Finishing

Methods of wet application of finishes on fabrics are mostly either by exhaustion techniques or by padding concentrated solution and depend on the substrate and the feasibility of adopting either of the processes.

Applications by foam applicator by spray techniques are common in the case of made up garments. Whereas padding method of application is feasible for all softeners, exhaust method of application is possible only where the softener has good substantivity. However high substantivity could cause tailing in a pad box application

Softeners are the most employed finishing agents either by themselves or along with other body builders/modifiers. Majority of the softeners are cationic. Cationic reactive softeners based on amino silicones play very important role to provide the lubricity to facilitate better sewability and also permanency to the finish.

The fabric substrate pH, the stability of the bath pH, the ionic character of the residual chemicals that may be left behind from the previous treatment, incomplete or variation in drying, yellowness, high TDS/ hardness can all influence different finishes differently.

Influence of pH of the bath and residual alkalinity

Residual alkalinity on substrate cotton can upset the bath pH and cause problems, where finishes requiring acid pH are employed like in cationic and resin finishes.

Cationic softeners

The quaternized cationic finishing agents in solution have positively charged hydrophobic tail and negatively charged hydrophilic anion head. The cellulose acquires negative potential (Zeta potential) when wetted out and attracts the positively charged hydrophobic tail, thus providing a bulky oily film anchored on the surface. In an alkaline pH the cationic quaternary compound will have less propensity to 'ionize' and thus stand at a disadvantage to be attached to the cotton fabric substrate.

On the other hand, from an exhaust bath, the speed of exhaustion of the cationic finishing agent on to cotton fabric depends on the strength of the positive charge it carries. This, in turn, depends on the pH. At lower pH, cationic softeners carry relatively higher positive charge and therefore are exhausted more rapidly even in cold. At pH 4-5 the exhaustion is almost total. This high rate of exhaustion on cotton is also very undesirable, since it tends to develop uneven spots/stains on the fabric surface. This is due to rushing and exhaustion of the softeners into sites that are easily penetrated and relatively less or none is available for sites that are more difficult to penetrate.

Therefore the pH conditions need to be established for different softeners based on the temperature and M:L ratio (Material to Liquor Ratio).
Fabric construction and geometry also will influence ease/difficulty to penetrate. Conditions- generally weakly acidic, recommended by the manufacturers/suppliers of the softeners to achieve uniform and even exhaustion provide the necessary guidance. The exhaust time shall be 20 to 30 minutes normally.
In the case of cationic amino functional siloxanes, the cross-linking/electrometric film formation of the siloxanes on the surface of the fabric and its reactivity with the cellulose will also be impaired. Thus, the inadequate coverage of the film on the fabric surface will result in inadequate feel. The durability to wash will be affected by decreased/absence of reactivity of the end Hydroxyl group of the siloxane with 'OH' of cellulose due to disturbance to pH.
Alkaline pH conditions can also destabilize/break the emulsion and cause silicone oil marks on the fabric. Secondly, the variation in pH (particularly falling on the alkaline side) on the fabric across the width/length can cause differential exhaustion on the fabric surface. Accordingly the performance in terms of the actual 'finish' characteristics like softness, lubricity, feel, drape etc. and wash fastness also will vary. It is recommended that both the fabric substrate and the bath are maintained slightly acidic with safe organic acids.
Incomplete removal of anionic soaps and detergents normally used in the earlier soaping operations result in the cationic finishing agent forming a complex with the anionic soap/detergent and cause precipitation and thus diminish the softening effect. This point is often neglected. Proper rinsing cycle after soaping is to be provided to minimize this problem.

Finishes requiring acid release catalysts

In the case of finishes requiring acid releasing catalysts for the cross linking with the cellulose and polymerization in the subsequent curing, alkalinity on the fabric would neutralize the same and thus stall the chemical reaction of the finishing agent. Variation in pH of the substrate would therefore correspondingly affect the consistency and uniformity of polymerization of the resin matrix/cross-linking on the substrate and consequently reflect on the performance parameters like CRA/DP ratings/wash fastness etc.
The temperature and dwell time are the other two important factors that need to be controlled besides pH for any given catalyst employed.
The flame retardant finish, resin/silicon applications a various other reactant finishes require specific heat treatments and catalysts.
It is therefore necessary to neutralize the fabric substrate fully and the bath pH brought down to the recommended acidic pH and maintained. Neutralization of the substrate needs careful planning and execution.