NOVEL EFFECTS IN GARMENT PROCESSING AND VALUE ADDED FINISHES

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The garment industry's new drive towards high value added products is prompted by increasing competition from other countries. Current size of apparel industry is 45 Billion US$, which is 40% of the world market, highest amongst the other potential segments - Technical Textiles (18%), Home Textiles (20%). Whrldwide chemical consumption in apparel segment is around 60%. Chemicals play a very significant role be it giving a class of touch through the effects colorful prints to soft handle, from easy care to nano finish and so on.

Garment Industry is developing textiles with smart functioning using new chemical products to provide extra comfort and increased performance. For example, EASY CARE properties for garments which require minimum ironing and resist soiling and staining, ANTIMICROBIAL finishes for leisure and sportswear to prevent odor problems generated by bacteria and so on.

With a shift to consumer centric thinking, trend in the supply chain, wherein it's buyers and retailers with whom the decision making rests, process houses and chemical suppliers are constantly striving to innovate or develop new products/concepts for the market and some of these innovations are discussed in the paper.

Key words: *Consumer centric thinking, Garment industry, World market.*

INTRODUCTION

Garment Finishing though is synonymous word for the process in Denim industry called "Washing Effects", has now extended to the processing of whole range of ready garments from shirt, T-shirt, trouser, jacket to all types of clothing. In apparels, chemicals are widely used to add value to garments through effects varying from various feels such as soft, supple, dry feel, bouncy feel etc. and/or to adding to the functionality and durability of the garment such as water-oil repeallant finish, wrinkle free finish, moisture management, stain protection, to name a few.

MOISTURE MANAGEMENT / HYDROPHILIC FINISH

Ever since synthetic fibres became popular for clothing purposes, there has been the desire for a finish to change the hydrophobic character of these fibres. The main reason was to improve the wearing comfort. Hence the necessity to improve synthetic fibres with regard to their absorbency.

Area of textile finishing where improving the absorbency is still one of the main considerations are sportswear, some of which is also made with functional jersey with hydrophobic synthetic fibres on the inside and hydrophilic cellulosic fibres on the outside. The mode of action consists of the finest fibrilled microfibres (PES, PA or PP) transporting the moisture rapidly from the skin through the capillary interstices to the absorbent outer layer. In this way the textile layer of synthetic fibres next to the skin remains dry (Fig. 1).

After dyeing the hydrophobic synthetic fibres usually exhibits no absorbency. Only after application of a suitable hydrophilic agent can the material fulfill its function. This significantly increases the speed at which the moisture is spread to the hydrophilic outer layer and thus considerably accelerates drying.

Wrinkle Free Treatment

By applying resins it is possible to improve specific properties of cellulosic fibres. Examples of this kind are the improvement in crease recovery, dimensional stability, non-iron, reduced pilling and particularly with knit goods an improved

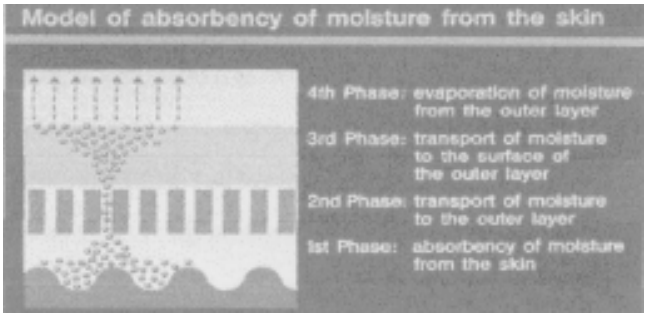

Fig. 1. Model of absorbency of moisture from the skin.

appearance after several washes. For successful resin finishing, it is absolutely essential that the goods are well prepared and the recipes and processes are adhered to and monitored exactly.

The wrinkle free treatment package comprises of a low formaldehyde resin, silicones and polyethylene emulsion. This treatment involves chemical application of the elements comprising of this package through a cross linking effect that prevents the formation of creases and wrinkles which result in easy to iron fabric. Resins do however also have several effects on the fibres. Resins reduce the (tear) strength of cotton. The extent of the loss depends on a wide variety of factors such as

- Amount and type of resin applied;
- Amount and type of catalyst;
- Curing conditions;
- Quality of cotton;
- Processes preceding finishing and possible damage etc.

Tensile strength losses up to 30-45% could be expected. For the so-called non-iron finishes, it is therefore often necessary to use qualities with a higher initial strength than for normal softening finishes. In this connection, it should be mentioned that the tensile strengths is not normally improved by the additives and softeners used. According to Elmendorf the tear resistance can however be influenced and maintained at the level of the unfinished goods or even improved by optimum selection of the softeners and additives.

Water / Oil Repellant Finish

This finish gives hydrophobic features to the substrate. There are three main product groups for this finish

- Metal salt paraffin dispersion;
- Polysiloxane;
- Fluorocarbon polymers.

When finishing with these products, the surface of the goods must be covered with molecules in such a way that their hydrophobic radicals are ideally positioned as parallelly as possible facing outwards. Aluminium salt paraffin dispersions are positively charged products due to the trivalent aluminium salt. This produces a counterpolar charge on the fibre surface which is significant for the adsorption of the product. After drying, the fat radicals form a so-called "brush" perpendicular to the fibre surface which prevents water drops from penetrating into the fibre (Fig. 2). Polysiloxanes form a fibre-encircling silicone film with methyl groups perpendicular to the surface. The oxygen atoms are facing towards the fibre. The film formation and direction of the methyl groups are responsible for the hydrophobic properties of the finish.

Fluorocarbon polymers also form a film where the fluorocarbon radicals are perpendicular to the fibre axis thus prevent wetting of the fibre surface. Their high hydrophobic and oleophobic action is explained by the extremely low interfacial tension of the flurocarbon chain towards all chemical compounds. When finishing with these products, the surface of the goods must be covered with molecules in such a way that their hydrophobic radicals are ideally parallel and facing outwards.

While paraffin dispersions and polysiloxanes only provide hydrophobic effects, the fluorocarbon products also exhibit oleophobic action. On synthetic fibres in particular, the hydrophobic and oleophobic action of fluorocarbons is excellent. Fluorocarbons and also distinctly superior to the other products with regard to washing and cleaning durability (Fig. 3).

UV Protection

Fabric treated with UV absorbers ensures that the clothes deflect the harmful ultraviolet rays of the sun, reducing a person's UVR exposure and protecting the skin from potential damage. The extent of skin protection required by different types of human skin depends on UV radiation intensity and

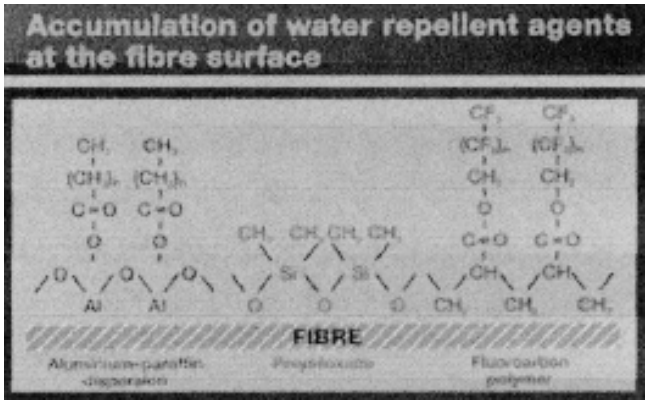

Fig. 2. Accumulation of water-repellent agents on the fibre surface.

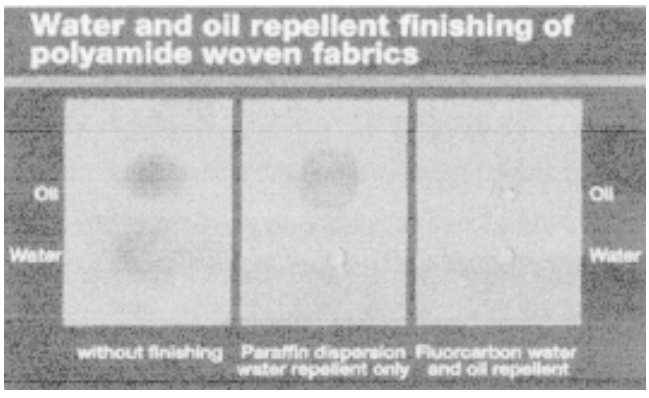

Fig. 3. Water and oil repellent finishing of polyamide fabric.

distribution with reference to geographical location, time of day, and season. This protection is expressed as SPF (Sun Protection Factor), higher the SPF value better is the protection against UV radiation.

Table - 1: SPF Value Based UV Protection Classification.

SPF	%UV Trans-mission	UV Protection Category
10-19	5.1-10	Moderate
20-29	3.4-5.0	Good
30-49	2.0-3.0	Very Good
50 & above	<2	Excellent

The SPF value of textile depends on fibre type, the fabric construction (porosity and thickness), and the finish. It means that transmission, absorption and reflectance nature of textile influences SPF value. It provides vital information about the fabric's sun protection ability.

In order to achieve the required UV-protection level using right choice of UV-absorbers and applying it properly the use of UV absorbers is a must for cellulosic minimizing the risk to lose UV-protection of garments while in use. By using UV absorbers, exposure of the textile to UV lights is reduced on the one hand as well as the intensity of the transmitted UV light on the other. Good skin protection is achieved by the textile itself with a sufficient weight of fabric. But the desired protective function is achieved by achieved by means of an additional finish. An UV absorber can be applied either during fibre manufacture or in the final finish which also offers the same degree of protection.

Anti-Microbial Finish

The inherent properties of textile fibres provide room for the growth of micro-organisms. The structure and chemical process may induce the growth, but it is the humid and warm environment that aggravates the problem further. Antimicrobial finish is applied to textile materials with a view to protect the wearer and textile substrate itself. Anti-microbial finish provides the various benefits of controlling the infestation by microbes, protect textiles from staining, discoloration, and quality deterioration and prevents the odor formation.

Anti-microbial agents can be applied to the textile substrates by exhaust, pad-dry-cure, coating, spray and foam techniques. The application of the finish is now extended to textiles used for outdoor, healthcare sector, sports and leisure.

Soil Release Finish

Soil release finish facilitate removal of waterborne and oil stains from fabrics such as polyester and cotton blends and fabrics treated for durable press, which usually show some resistance to stain removal by normal cleaning processes. This finish is especially suitable for sportswear, underwear, uniforms and work wear etc.

Flame Retardant Finish

Use of flame retardants helps prolongating the time needed to fully develop the fibre by reducing the flame propagation. Depending on the application, the flame retardant finishing of fabrics can always be divided into wash-resistant or non-wash resistant finishing. In case of apparels, non-permanent flame retardant finish is possible at the garment stage because of constraint in the application techniques involved. These non-durable finishes are however fast to dry cleaning, but not to repeated launderings.

Finishing with Softeners

The softeners can be roughly classified in two groups:

- Non-permanent softeners which can be removed fairly easily by washing;
- Permanent softeners which still exhibit a distinctly soft handle even after several washes.

Typical representatives of the non-permanent softeners are products based on fatty acid derivatives. They mainly consist of relatively small molecules with a molecular weight of less than 1000. Through this composition, these products provide a more or less hydrophobic effect. They import an outstanding soft handle to virtually all types of fibre.

There is a certain connection between the ionic character and type of handle of most softeners, i.e.

- Cationic softeners generally provide the best soft handle which is distinguished by a flowing, bulky character'
- Anionic and nonionic softeners usually exhibit slightly less soft effects with a smooth, often filling handle character;
- Amphoteric products provide an effect which lies approximately between those of these two groups.

Their hydrophobic or hydrophilic properties also have an effect on the handle character of the finished textiles:

- Softeners with a hydrophobic effect impart a pleasant, voluminous, often slightly fatty handle;
- Softeners with hydrophilic properties usually provide much drier handle which is often felt to be less soft.

The influence of the ionic character and hydrophilic or hydrophobic behaviour on the handle effect of a softener is generally also observed with the permanent softeners. This group consists usually of polymers with a molecular weight larger than 1000. As a rule they have reactive groups and they deposit themselves like a film on the textile

fibres. The most commonly used permanent softeners are Polysiloxane. Interesting effect variations have been achieved through modification of the basic model of the Polysiloxane. By introducing amino groups in the Siloxane molecule, a significant increase in the soft handle effect has been achieved. At present amino-functional silicon elastomers are the most efficient softeners in the field of textile finishing.

Polyurethane softeners also provides interesting, permanent handle variations. They are based on special reactive polyurethanes Polyurethane softeners provide an elastic handle on virtually all types of fibre. On microfibres they produce a characteristic rubbery handle.

The handle effects obtainable with softeners depend not only on the chemical character, but also on their position in the textile. If the softener is attached mainly on the outside of the yarns, then it is the primary effect of the chemical character which is felt moist, dry, fatty, oily, smooth, rubbery, etc. However, if the softener is able to penetrate into the yarn between the individual fibres, a secondary handle effect is obtained: so-called "inner softness" produced by the reduction in fiction between the individual fibres.

INNOVATIVE CONCEPTS

Clariant's new concepts based on nanotechnology such as ease release, quick wick, rare care, finishes further improve the functionally of the textile by imparting the various properties such as Soil release, anti-pilling effect, water/oil repellency, hygiene effect, easy care and odour free effect. For example LT Cure Process for high DP rating of 3.5+especially in finer quality. Effect tables from Clariant generally show the customer the special features (protection, comfort, care) which textile is finished with and the customer can understand the garment quality, effect and added value.

Clariant's other innovations based on 3-E concept offering 3 immediate benefits of Efficiency, Ecology and Economy include

- Black Magic - "No Rinse" process for discontinuous bleaching, exhibits the following advantages

  Efficiency

  Maximal absorbency

  High degree of whiteness

  No cellulose degradation

  Better uniformity

  Better dyeability

  Economy

  Less water, time and energy consumption

  Higher machine productivity

  Ecology

  No rinsing needed

  No neutralization needed

Less alkaline amount and bio-killing of residual peroxide with enzymes

- Ant-Ox - Pre-treatment process to remove iron contamination and prevent pin-hole damages;
- Easy-prep - a multipurpose system for efficient and economical scouring and bleaching;
- SWIFT Process - new dyeing process for PES/Cotton Blends, offering the advantage of very high wet fastness levels with minimum water consumption etc.
- Pad-Ox Process - A new dyeing process with Diresul RDT dyestuffs offering an outstanding advantage of "minimal water consumption".
- Vagabundo Process with Optisul T Liq, solubilised Sulphur dyestuffs for Garment and Knit fabrics. Some of the important characteristics are –
  1. anionic nature;
  2. soluble in water;
  3. practically no affinity for cellulosic fibre;
  4. sulphide free dyestuff.

NEW POSSIBILITIES IN BLUE DENIM

Diresul Indiblue RDT Liquid Dyestuffs are used for new effects on Denim. Continuous and Discontinuous dyeing procedures are possible with Diresul Indiblue RDT-R and Diresul Indiblue RDT-G Liq.

Advantages being –

- Suitable for all wash-down effects currently applied in Blue Denim;
- Special effects in Bottoming / Topping and Denim Overdyeing Processes;
- Good overall fastness properties;
- Wide shading flexibility;
- No yellowing effect during storage if dyed at pale shade;
- Ecological dyeing system using pre-reduced and low sulphide content dyestuff;
- Fulfilling all Ecolabelling requirements.

CONCLUSION

In order to add value in the garments, different types of finishes are adopted. These finishes include moisture management, wrinkle free, wateri/oil repellant, UV protection, anitimicrobial, flame retardant, etc. The application of nanofinishes has also been growing to obtain better level of performance properties. Ecology and Fashion are also the driving factors for the adoption of these innovative technologies. ■