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Vol. 9, Issue 33, Jan 2016

Saraquest

Exclusive Insight

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Chemistry Behind Good Feelings

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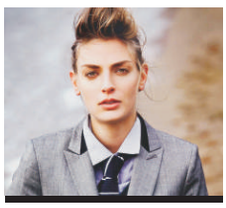

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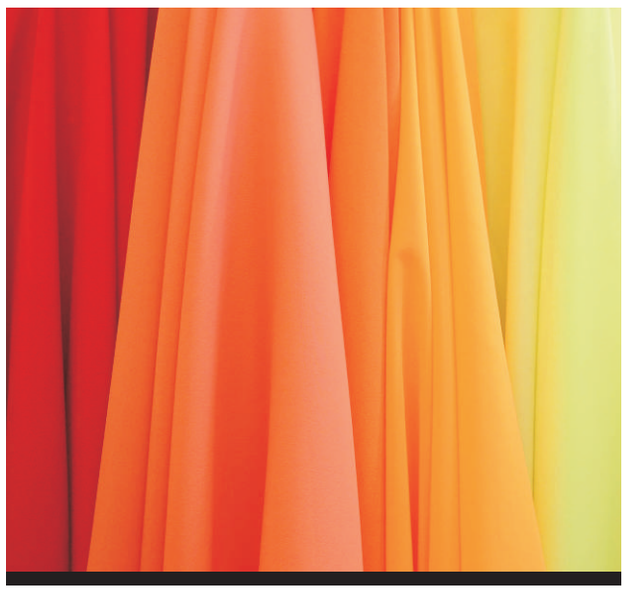
Leveling cum diffusion accelerator for polyester

Dyewell-480



The dyeing of polyester fibres with disperse dyes is a process of dye transfer from liquid solvent (water) to a solid organic solvent (fibre). Disperse dyes are added to water with a dispersing agent to form an aqueous dispersion. The disperse dyes transfers from dye liquor to the fibre. The application of heat to the dye liquor increases the energy of dye molecules and accelerates the dyeing of textile fibres.

Heating of dye liquor swells the fibre to some extent and assists the dye to penetrate in the fibre polymer system. Thus the dye molecule goes into the amorphous regions of the fibre. The fibre polymer system and dye molecules are held by hydrogen bonds and Van Der Waals' force.

The dyeing of polyester with disperse dyes is considered to take place in following simultaneous steps:

- Diffusion of dye in solid phase into water by segregation of dye molecules is often described as a diffusion-controlled process. The diffusion phase includes convective transfer through the liquor adsorption and molecular diffusion into fibre which is the rate-determining step. This diffusion depends on dispersibility and solubility of dyestuff and is aided by the presence of dispersing agents and increasing temperature. Dyeing is faster using diffusion accelerators thereby improves the fibre accessibility at higher temperatures above 100 °C to increase the dye diffusion rate.
- Adsorption of the dissolved dye from the solution onto the fibre surface. This dyestuff adsorption by fibre surface is influenced by the solubility of the dye in the dye bath and that in the fibre. Diffusion of the adsorbed dye from the fibre surface into the interior of the fibre substance towards the centre. In normal condition, the adsorption rate is always higher than the diffusion rate and this is the governing step of dyeing.

In the high temperature phase of the dyeing process, another important property of dyes is migration, or tendency to level out. The levelness of dyeing depends on the rate at which the dye is taken up by the fibre and the extent of migration at the recommended dyeing temperature. The leveling capacity of a dye is its ability to even out variations by the dye distribution in the substrate. To get level dyeing, it is essential to add a product which can allow unlevel dyed fabric to level out so that dyeing looks even.

Sarex has tenaciously developed **Dyewell-480** which allows the dye to diffuse all over on the fabric so that dye gets evenly distributed on the fabric.

Unique Features:

- Low foaming leveling cum dyeing accelerator with diffusion and dispersing property for high temperature polyester dyeing.
- Excellent migration properties enables to achieve level dyeing.
- Good diffusion properties allows disperse dyestuffs to diffuse uniformly in polyester fabric.
- Enables to shorten the dyeing process time by increasing the rate of heating.
- Prevent ring dyeing.

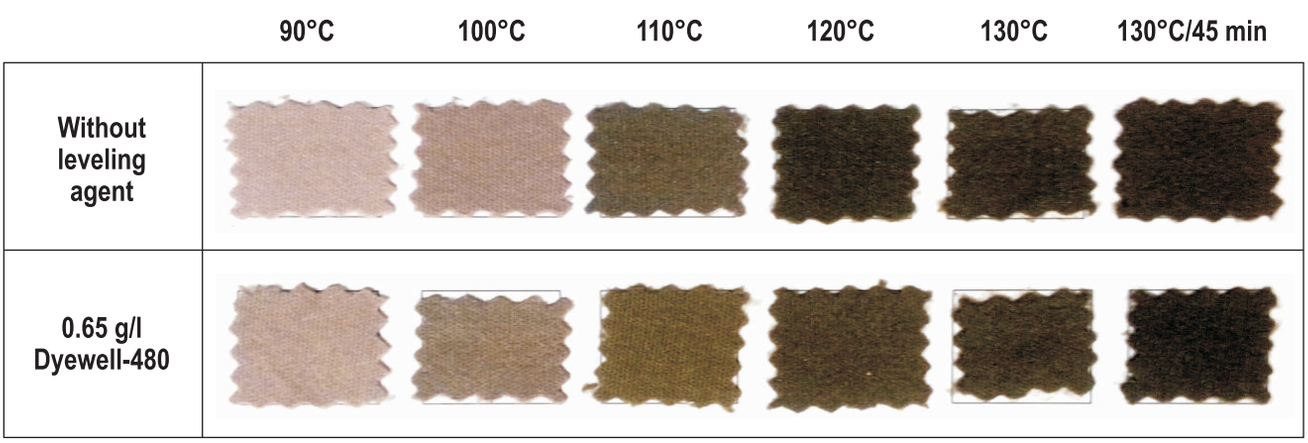
Recommended dosage:

In exhaust dyeing of polyester tops, fibre, yarn and fabrics, set the bath with
0.6-1.5 g/l Dyewell-480
0.5-1.0 g/l Saracid-RS (Acid buffer) and pH 4.5-5.5
Circulate at 60°C for 5-10 min, add dyestuff dispersion and start dyeing with increased rate of heating and dye at recommended temperature.

For correction of faulty dyeing & leveling:
1.0-2.0 g/l Dyewell-480
1.0-2.0 g/l Saracid-RS (Acid buffer) and pH 4.5-5.5
10-20% dyestuff of the original recipe
Treat at 130°C for 40-60 min
Drain and reduction clear.

Results:

Substrate: 100% Polyester knits ready for dyeing
0.3% Disperse Red 167 + 0.3% Disperse Blue 79 + 0.3% Disperse Yellow 211
0.65g/l Dyewell-480, pH 4.5, Liquor ratio 1:20.
Dyeing was started at 40°C and samples were removed at 90°C, 100°C, 110°C, 120°C, 130°C and 130°C for 45 min.



The above results shows that dyeing at various temperatures obtained tone-in-tone in presence of Dyewell-480 than in absence of leveling agent.

Non-ionic Water & Oil Repellent

Careguard-6NI

The ability of a garment to protect from the weather has been important for thousands of years. Today there is a high demand for functional textiles showing oleophobic and hydrophobic characteristics e.g. oil and water repellent. Hydrophobicity and oleophobicity is the ability of a surface to repel water and oil respectively. This ability is determined by both the surface roughness and the surface free energy.

For a liquid to spread on a material it must have a surface energy lower than the surface free energy of that material. To achieve a hydrophobic surface the surface free energy must therefore be lower than 72 mN/m of water. To achieve an oleophobic surface, the surface free energy must be even lower since most oils have a surface tension around 20-30 mN/m. Only with fluorocarbon polymers low enough surface energy can be achieved.

Chemically fluorocarbon polymers, also known as Perfluroalkylacrylate copolymer and its fundamental structure resemble acrylic resins. The relatively low reactivity and high polarity of the carbon-fluorine imparts unique characteristics to fluorocarbon polymers. Fluorocarbon polymer are applied by the normal pad-dry-cure technique, where in the substrate align the fluorocarbon segments of the polymers, there by reducing the tendency of soil, oil and water to adhere to the fibres of the substrates.

Fluorocarbon polymers typically include a fluorinated component and a non fluorinated polymeric back bone. The fluorinated part called the perfluoroalkyl group is common to all fluorochemical protectors. Greater the number of fluorine atoms attached to the carbon atoms and the more closely packed, they are, the better the water repellency. The non fluorinated part forms a backbone to the fluorochemical making it more durable to the fibre.

Long-chain fluorocarbon polymers often contain residual raw materials and trace levels of long-chain perfluoroalkyl acids (PFAAs) as impurities. The residual raw materials and the product themselves may degrade in the environment to form long-chain PFAAs. Long-chain PFAAs including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) have been shown to be persistent in the environment, have long elimination half-life in wildlife and humans, and have toxicological properties of concern. Short-chain fluorinated chemistries are promoted as having favourable health and environmental properties.

Sarex has developed a new generation non-ionic short-chain fluorocarbon polymer **Careguard-6NI** which is an environment friendly alternative to long-chain fluorocarbon polymers. It imparts durable water and oil repellency on natural and synthetic substrates without affecting the original hand of fabric.

Unique Features:

- Based on C6 chemistry.
- Non-ionic charge offers good compatibility with finishing chemicals.
- No tailing during pad application.
- Suitable for a polyester, cotton, nylon, wool and their blends.
- Performance is very close to C8 fluorocarbon polymers in all aspects.
- Durable to multiple home laundering.
- Does not affect fabric handle.
- Can be applied by padding, foam and spray process.
- PFOA below detectable limit.

Recommended dosage:

Pad application

Careguard-6NI	: 50-80 g/l
Acetic acid	: 0.5 g/l
Isopropyl alcohol (IPA)	: 5 g/l
Pick-up	: 65-70 %
pH	: 4.0-4.5
Drying	: 100-120°C,
Curing	: 150°C, 5 min. OR 160°C, 3 min. OR 170°C, 1 min.

Note:

Addition of 5-10 g/l Crosslink-SC (Conc) is recommended for achieving higher durability. Water and oil repellent finish can be combined with resin finish using 30g/l Saralink-ULF + 6g/l $MgCl_2$ + 20g/l Saralube-2975.

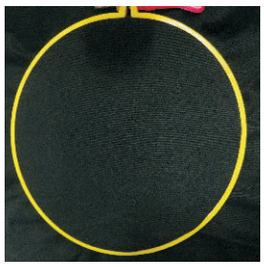
Results:

Recipe	*Initial		*After 20 washes	
	Oil	Spray	Oil	Spray
Cotton bottom weight:				
60 g/l Careguard-6NI + 5 g/l IPA + 0.5g/l Acetic acid	5	100	4	80
100% Polyester:				
60 g/l Careguard-6NI + 5 g/l IPA + 0.5g/l Acetic acid	5	100	4	90

*Rating given as per M&S P23 and M&S C50 test method

Spray test (M&S P23)

Untreated



Treated

Oil repellency (M&S C50)

Treated

Cotton bottom weight

Untreated

Treated

Treated

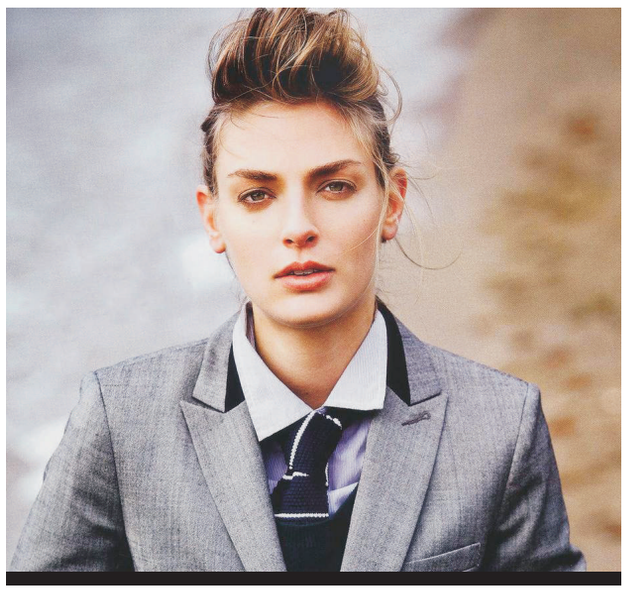
100% Polyester

Corrective measures to achieve optimal repellency

Water repellency	Oil repellency	Possible causes	Remedial measures
Low	Low	Under cured	a. Reduce stenter speed b. Raise temperature
Low	Low	Low loading level	a. Adjust recipe b. Increase pick up
Low	High	Residual wetting agent, Residual alkali	a. Rinse fabric b. Make fabric pH 6-7
High	Low	Wrong selection of softener or defoamer	a. Check compatibility b. Wash fabric
High	High	Correct preparation + correct curing Excellent Performance	

Cationic Silicone softener

Polysoft-55



Softeners plays an important role in finishing process of textile fabrics. A piece of fabric after pretreatment and dyeing processes will not be appealing to wearer without softener. The application of silicone softeners converts harsh fabric into a soft pleasant fabric with a high degree of wearing comfort. Silicones achieve a variety of effects, such as softness, hydrophilicity/hydrophobicity, dimensional stability, elasticity. Innovative hydrophilic silicone softeners imparts softness and absorption properties to fabric and optimizes the moisture balance.

One of the important features of silicone softeners is their effectiveness at lower concentrations to achieve the desired properties. Silicone softeners generally consist of linear aminopolydimethylsiloxanes with a viscosity of 100–100,000 cps. The basic units generally differs in the chain length, the number of functional side groups and the chain ends (capped or reactive). Silicones used as textile softeners can be polydimethylsiloxanes, amido/amino functional silicones, hydroxy functional silicones, silicone polyethers, epoxy polyether silicones etc.

Generally, amino modified silicones are used in textile industry as amino groups provide better affinity to textile fibres. The end group of the amino silicone polymer may be hydroxyl, methoxy, ethoxy groups to improve reactivity but if the end group is methyl group then the polymer is non-reactive. The high bonding affinity of the amine polymers makes them more substantive to fabrics than the other silicone polymers. The aminofunctional side groups optimize the distribution of the silicone on the fibre surface and thus ensure maximum softness.

Amino functional silicones tend to yellowing due to the oxidation of amino groups in the presence of air, heat and light energy, results in the formation of azoxy compounds. To prevent yellowing amino groups are modified by blocking these groups. Amido functional silicones have limited range of viscosities and nitrogen content. The advantage of amido silicones are highly effective softening, hydrophilicity and minimum yellowing.

Polydimethylsiloxanes, amino and amido functional silicones are emulsified with suitable emulsifying agents. All emulsifying agents concentrate at and are located adsorbed onto the oil water interface to provide a protective barrier around the dispersed droplets. In addition to this protective barrier, emulsifiers stabilize the emulsion by reducing the

interfacial tension of the system. Some agents enhance the stability by imparting a charge on the droplet surface thus reducing the physical contact between the droplets and decreasing the potential for coalescence. The emulsion characteristics in particular their particle size and the surfactant system play a critical role both in terms of deposition on the fabric and the stability in the final product. The specific morphology of the emulsion depends on the surfactant used and processing procedures.

Micro emulsions typically have a particle size below 100 nm which can penetrate into the substrate and can also deposit onto fabric fibres. Macro emulsions deposit on the surface of the fabric. Cationic type of emulsions provides very high level of deposition and non-ionic emulsions have good stability. The textile finishing process especially on Jet and soft flow machines require versatile softeners which have excellent bath compatibility and stability to high-shear forces under the extreme conditions.

Keeping in view of versatile application demand by textile finishers, **Sarex** has developed a new generation cationic silicone softener **Polysoft-55** which works very well on 100% polyester, polyester rich blends, polyester/viscose suitings and denim. It imparts very good surface smoothness and body break on the treated substrate. It is recommended to use after dyeing.

Unique Features:

- Imparts both inner softness and surface smoothness on treated fabric.
- Can reduce caustic during weight reduction process of P/C blend.
- Shear stable therefore suitable for jet dyeing and soft flow machines.
- Suitable for pad as well as exhaust application.

Recommended dosage:

Pad application		**Exhaust application**	
Polysoft-55	: 10-30g/l	Polysoft-55	: 1-3%
Pick-up	: 65-70%	Bath pH	: 5.0-6.0
Bath pH	: 5.0-6.0	Temperature	: 40-50°C
Drying	: 130-160°C	Time	: 20-30 min

Shade enhancer for Elastane on Polyamide/ Elastane blends

Flexdye-ELA

Polyamide offers exceptional value and performance as the textile fibre of choice. Polyamide has wide range of textile applications, such as apparel, sportswear, swimwear, casual wear, fashion wear and hosiery. In the market polyamide is preferred over polyester as:

- Fabrics can be dyed easily at atmospheric pressure in multiple designs and colours
- Higher strength
- Softer touch
- Lighter weight and more elegant texture

Elastane/Lycra/Spandex is a modern synthetic fibre known for its exceptional elasticity, hence its prevalence in athletic attire as well as in apparel designed for comfort. The material is extremely comfortable, lightweight and supple. It imparts stretchiness for underwear, lingerie, sportswear and outerwear garments and in other stylish attire, such as dancewear and club wear.

Relatively small percentages of elastane fibre is added to knit fabrics of polyamide type to provide stretch and recovery to the fabrics and the garments made from them. For fabrics that are knit on circular, or weft, knitting machines the elastane is normally added as a bare yarn. Subsequent to knitting, the fabric is preset, scoured, dyed, and then heat set.

There is a strong market trend towards the use of elastane fibres. Polyamide in combination with elastane needs a lower heat-setting temperature, which favours the retention of elastane properties. Combined with elastane, polyamide offers good stretch-fit properties.

Different types of dye such as acid dyes and metal complex acid dyes can be used for dyeing of polyamide fibres. Generally acid dyes which are anionic do not dye elastane fibres properly under mild dyeing conditions, and elastane fibres are slightly tinted. The wet fastness achieved on Polyamide/elastane blends is usually lower than on 100% polyamide because the dyes used for polyamide stain the elastane, and this stain subsequently washes out during test.

To overcome this problem, **Sarex** has developed innovative product **Flexdye-ELA** which increases the affinity of acid dye molecules towards elastane fibres thereby providing higher colour build up especially black shades with good wet fastness on Polyamide/elastane blends.

Unique Features:

- Solves the problem of "Grin through" of undyed elastane fibre.
- Develops solid shade in Polyamide/elastane fabrics.
- No adverse effect on light and wet fastness.
- Ensures stable and reproducible shades.

Recommended dosage:

Step-1: Prior to dyeing

1-2% Flexdye-ELA is applied initially in acid bath (pH 4.5) at 50°C for 20 min prior to dyeing.

Step-2: Dyeing

Dyeing can be performed in the same bath of Step-1.

Note: For critical case with poor compatibility, it is recommended to drain the bath of Step-1 and start the dyeing in fresh bath.

Results:

Step-1: Treat Polyamide/Lycra blended Ready for dye garment (innerwear) with 2% Flexdye-ELA + 1 % Acetic Acid for pH 4.5 at 50°C for 20 min prior to dyeing.

Step-2: Dyeing is performed in the same bath of Step-1 by adding 4% Levaset Black B (Black acid dye) + 1% Supergen-MX (Levelling agent) at 98°C for 30 min. Drain the bath followed by cold and warm rinse.

Fabric	Colourant strength %	dE	h	L
Dyed without Flexdye-ELA	100	-	262.776	20.385
Dyed with 2% Flexdye-ELA	121	2.184	264.283	18.210

Flexdye-ELA treated fabric dyed with Black dye shows even dyeing with an improvement in colourant strength and solid black shade while fabric dyed without Flexdye-ELA shows grey shade.

Dyed without Flexdye-ELA

Dyed with 2% Flexdye-ELA

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