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Saraquest

Exclusive Insight

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Chemistry Behind Good Feelings

Contents

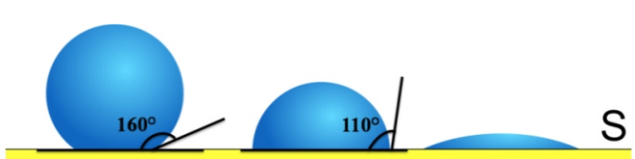
Careguard-314 - *Water Repellent for Polyamides*

Expectations from textile materials have increased immensely in modern time. Easy care properties such as oil, water and stain repellent properties come to the forefront in many apparel and technical textile applications. Easy care concept not only includes minimization of ironing but also effortless cleaning of garments and also to protect the garments from various oil and water based stains in day to day use. Chemical manufacturers like Sarex have made significant advances in finishing processes of fabrics to protect them from oily stains and water.

Oil and water repellency are among the most common functional properties necessary for protective clothing. Oil water repellent finishing on textile fabrics are mostly imparted by the incorporation of low surface energy compounds. These compounds form a thin hydrophobic layer on the surface of a textile material, which changes its hydrophilic nature to hydrophobic. Water repellency is achieved using different products, but oil repellency is attained only by fluorocarbon polymers. The intend of this finish is that drops of oil and water should not spread on the surface of the textiles and not wet the fabric and roll off immediately.

Traditionally, silicone compounds, resins based on melamine, urea derivatives and paraffin emulsion containing zirconium and aluminum were applied by pad-dry-cure method to achieve water and oil repellency. Nowadays, fluorine based compounds are used to impart durable oil and water repellent finish on textile substrates.

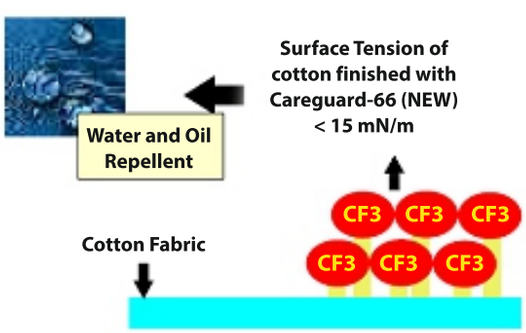
Chemically, fluorocarbon polymers are perfluroalkylacrylate copolymer and its fundamental structure resembles acrylic resins. Fluorocarbon polymers are special class of polymers which represent an indispensable part of the technology of oil and water repellent finishing. Fluorocarbons contains carbon and fluorine bonds throughout the chain which leads to relatively low reactivity and high polarity which imparts unique characteristics to fluorocarbon polymers. This fluorocarbon when applied on the textile substrates forms a thin film around the fibres which strongly reduces the free energy of the fibres, accompanied by the increase of the contact angle of liquids on its surface.



If the critical surface tension of solid is greater than or equal to the surface tension of liquid, the liquid will wet the fabric. If the critical surface tension of the solid is less than the surface tension of the liquid, the fabric will repel the liquid. The surface tension of water at 20 °C (72 mNm^{-1}) is 2-3 times greater than the surface tension of oils (20-22 mNm^{-1}). Therefore, oil repellent finishes using PFCs (Surface tension = 13-15 mNm^{-1}) always achieve water repellency.

Per-fluorinated compounds typically include a fluorinated component and a non fluorinated polymeric back bone. The fluorinated part is called the

perfluoroalkyl group which is common to all fluorochemical protectors and the non fluorinated part consist of an extender which forms a backbone to the fluorochemical making it more durable and acts as a adhesive to bond the fluorochemical part to the fibre. The important feature of the polymeric back bone is it's capability of forming a durable film on the surface of the fibre. The repellency achieved on the fabric, depends upon the number of fluorine atoms attached to the carbon atoms, packing of the structure, i.e. if the carbon atoms are closely packed it will give better repellency and on the linearity of the polymer, i.e. the carbon atoms arranged in a linear manner will give better performance than the branched.



The fluorine based oil and water repellents used, generally contains perfluorooctanoic acid (PFOA), an impure substance which is hard to break down due to its stable chemical structure, and there have been concerns about the negative impact of its accumulation in the body and the external environment. Taking this into consideration, primarily the U.S. and European countries among many others are tightening their restrictions on fluorine-based water repellent agents and chemicals manufacturers have been working on the development of replacement technologies.

The concerns associated with long-chain PFAAs ("C8") has led to shift towards shorter perfluoroalkyl chains (also termed "C6"). Chemically, short-chain fluorinated chemistries are closely related to long-chain homologues and are produced using perfluoroalkyl raw materials that are not expected to break down in the environment into PFOA and PFOS. Short-chain fluorinated durable water repellent chemistry is now promoted by the textile industry as having comparable repellency and other performance attributes to long-chain chemistry.

Understanding the above requirement of manufacturing environmental friendly fluorocarbons and keeping in mind the performance concerns of the end users, Sarex has developed an Oil and water repellent finishing agent which can be applied on various substrates to meet the customers requirements.

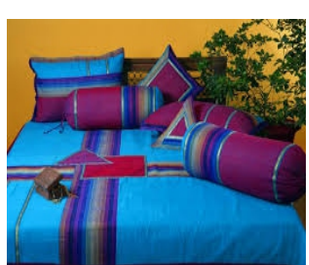
Careguard-314 is a C6 based oil and water repellent which is cost effective and which gives excellent water repellency on synthetic fibres and specially on nylon fabrics. It is used prior to coating so that the polymer does not penetrate to the other side of the fabric and thus keeping the fabric flexible.

Unique Features:

- Durable to multiple home launderings
- No Roller build-up
- Suitable for high speed finishing
- Excellent results on synthetic fabrics

Market share of the oil and water repellent finished fabric can be divided into three categories; Apparel 40 % (work wear, rainwear, uniform, and outerwear), Technical textile 30% (military, non-woven, and medical), and Home textile 30% (curtain, furniture, upholstery, and bed linen). Following are some of the application areas where, oil and water repellent finishes are essential -

Rain Wear



Home furnishing

Apparels

Tents

Application:

A 100% cotton, polyester and polyamide fabrics were selected to impart oil and water repellent finishing. The fabric selected were washed with 1gpl Saragen-DAM to remove any impurities from the surface of the fabric. The fabrics were then finished with C6 based oil and water repellent developed by Sarex, using padding application with 70% expression. The fabric was dried at 130°C for 2 min, followed by curing at 160°C for 3 min. The pH of the padding bath was kept acidic i.e.4.5-5.5 using acetic acid.

AATCC 118-Oil repellency test:

Drops of eight selected liquid hydrocarbons of different surface tensions were placed on a treated fabric and observed for wetting. The oil repellency grade of the fabric is the highest numbered test liquid which does not wet the fabric surface with the highest achievable grade being 8. This test method is used to detect the presence of a finish capable of imparting a low energy surface on the treated fabric.

Standard test liquids

AATCC oil repellency grade number	Oil Name
0	None (Fails Kaydol)
1	Kaydol (AATCC) / Nujol (M&S)
2	65:35 Kaydol: n-hexadecane by volume
3	n-hexadecane
4	n-tetradecane
5	n-dodecane
6	n-decane
7	n-octane
8	n-heptane

ATCC 22-Water repellency spray test:

The surface wetting resistance of the treated fabrics were tested using water repellency spray test method. The treated and un-treated fabrics were stretched tight in an embroidery hoop, held at a 45° angle in the test apparatus and sprayed with 250 ml of water through a specified spray head from a height of 150 mm. The size of the wetted pattern which depends on the relative repellency of the fabric is compared to a standard chart of fabric water repellency ratings of zero (0), 50, 70, 80, 90 and 100. A rating of zero (0) is assigned if the fabric's surface is completely wetted by water, whereas a rating of 100 corresponds to no wetting of water on the surface of the fabric.

Spray test ratings

Rating	Evaluation
100	No sticking or wetting of upper surface
90	Slight random sticking or wetting of upper surface
80	Wetting of upper surface at spray points
70	Partial wetting of whole of upper surface
50	Complete wetting of whole of upper surface
0	Complete wetting of whole upper and lower surfaces

AATCC 193- Water/alcohol solution resistance test:

Drops of a selected series of water/alcohol solutions of different surface tensions were placed on a treated fabric surface and observed for wetting. This test method was used to evaluate the effectiveness of the finish in imparting a low surface energy on the surface of the treated fabric.

Results:

The treated fabrics were tested for their oil and water repellency and spray rating and their results were tabulated as below. The treated fabrics were also washed thrice to confirm for its durability.

Table 1 shows the results of oil, water and spray rating on cotton, polyester and polyamide fabric treated with Careguard-314. It is evident that Careguard-314 shows excellent water repellency and average oil repellency initially and after 3HL. Careguard-314 is developed specially for achieving water repellency on nonwoven substrates and other woven fabrics which will be coated subsequently.

Table 1 Oil, Spray and water drop rating on various substrates treated with Careguard-314

Substrates	Conc	Initial			After 3 HL		
		Oil	Spray	Water Drop	Oil	Spray	Water Drop
		AATCC 118	AATCC 22	AATCC 193	AATCC 118	AATCC 22	AATCC 193
100% Polyester	11gpl	1	100	5	0	100	4
100% Polyamide	11gpl	1	100	4	0	80	4
100% Cotton	17gpl	0	100	4	0	100	4

Note: *Please note that the concentration of the fluorocarbons in the above experiments were selected with an aim to achieve optimum results using minimum concentration. The end users can use higher concentration for better durability and performance according to their needs.*

Conclusion:

Moving from long chain to short-chain fluorinated chemistries is a complex process that requires an in-depth research and Sarex following its objective to provide environmental friendly solutions is at the forefront to swing its focus to manufacture C6 based fluorocarbons which gives results close to C8 based fluorocarbons.

Heloprep-GC *- Time, Water & Energy saving*

"ECOLOGY" is a scientific study of the relationship between the living organisms and their relationship with natural environment.

This concept has to be given due consideration in the field of textiles. The emergence of industrialization and urbanization aggravates the situation of increasing demand for water. Currently, the Indian textile industry consumes 200–300 m^3 of water per ton of the processed textiles also generating a huge quantum of wastewater. The wastewater that is discharged contains appreciable quantities of organic and inorganic chemicals which have to be treated to comply with the norm set by the pollution control board and other environmental organizations.

'Sustainable development', 'environment and development', 'green banking' and 'green economics' signals a perceptible shift that has taken place over the last three decades, whereby development is more than ever before being planned to reverse natural resource destruction and conserve a healthy environment.

Pretreatment of cotton is mainly concerned with the removal of natural as well as added impurities from the fabric and also need to be obtained a good absorbency and whiteness with minimum decrease of strength of fabric by utilizing lowest chemical, energy and time as well as water by using several chemical processes. Desizing, scouring and bleaching are the three stages of conventional pretreatments of woven cotton fabrics, whereas scouring and bleaching are the two stages of knitted cotton goods.

Desizing is a typical process in pretreatment by which size materials are removed from cotton woven fabrics, cotton blends and all grey synthetic materials which contain sizes. Oils and fats are removed by saponification reaction from cotton fabric when it is heated with a solution of sodium or potassium hydroxide. They are hydrolyzed into glycerol and the salt of the fatty acid. The progression of removing colored impurities from greige fabric as completely as possible is called bleaching and change the fabric in an entirely white state with minimum or no damage to the fabric. Large amount of water and energy is consumed by conventional pretreatment processes, so it is absolutely necessary to minimize the energy and water consumption. If it is possible to combine these three processes in a single step that will be

lower the number of operations or reducing the time of reaction as well as reduction of water consumption. Using a multifunctional scouring agent seems to be an attractive option in the field of pretreatment process in textile industry.

With this thought, Sarex has developed a novel, biodegradable, all-in-one pretreatment product **Heloprep-GC** which is suitable for bleaching of cellulosic substrates and its blends. Heloprep-GC possess very good sequestering and peroxide stabilization properties, hence addition of sequestering agent and peroxide stabilizer is not required in treatment bath. The bleached fabric exhibits very good whiteness index, absorbency and instant rewetting properties.

Unique Features:

- Novel, biodegradable, all-in-one product which is suitable for bleaching of cellulosic substrates and its blends.
- Possess sequestering and peroxide stabilization properties, hence addition of sequestering agent and peroxide stabilizer is not required in treatment bath.
- Bleached fabric exhibits very good whiteness index, absorbency and instant rewetting.
- Bleached yarn shows reduced coefficient of friction, improves strength and reduces hairiness to a certain extent.
- Suitable for Auto dosing / dispensing.
- Low BOD/COD and TDS in effluent bath.

Application:

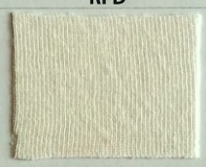
Recipe for Ready for Dyeing (RFD)

Heloprep-GC process		Conventional process	
Heloprep-GC:	**0.8%**	Celldet-R:	**0.5%**
Saracrease-HG (Conc):	**0.1%**	Sarastabil-MRS:	**0.2%**
Caustic flakes:	**1.25-1.5%**	Saracrease-HG (Conc):	**0.1%**
H_2O_2 (50%):	**2.5%**	Caustic flakes:	**2%**
		H_2O_2 (50%):	**2.5%**
95 - 98°C, 30 min.			

Recipe for Ready for Full white

Heloprep-GC process		Conventional process	
Heloprep-GC:	**1.2%**	Celldet-R:	**0.5%**
Saracrease-HG (Conc):	**0.1%**	Sarastabil-MRS:	**0.6%**
Caustic flakes:	**2.0-2.5%**	Saracrease-HG (Conc):	**0.1%**
H_2O_2 (50%):	**6%**	Caustic flakes:	**3%**
		H_2O_2 (50%):	**6%**
95 - 98°C, 60 min.			

Results:

	RFD	Full White
Heloprep-GC process		
	W.I. = 73+ Absorbency = Instant	W.I. = 85+ Absorbency = Instant
Conventional process		
	W.I. = 73+ Absorbency = Instant	W.I. = 85+ Absorbency = Instant

RFD : Ready for dyeing, W.I.: Whiteness Index

Conclusion:

The results clearly indicates that the performance of Heloprep-GC is equivalent to the conventional process. Heloprep-GC reduces the treatment process, save time and retain maximum strength thereby increase the efficiencies of the bleaching process leading to conservation of energy with higher production rates.

Pigment Printing Package - *You think.. We print !!*

Textile printing is the branch of textile wet processing industry and is becoming increasingly popular for all fibres and varieties of fabrics as well as garments. Basically, printing is a form of dyeing in which the colours are applied to specified areas instead of the entire fabric. The resulting multicolored patterns have attractive and artistic effects which enhance the value of the fabrics much more than the plain dyed ones.

Printing of cellulosic fibres are considered to account for more than 70% of all printed substrates and pigment printing is a major method. The use of pigments for printing of textile products has dramatically increased over the last 50 years. Pigments are used to produce printed products for a number of end uses including apparels, home furnishing, crafts and nonwoven articles. Over 18 billion liner yards of printed fabric produced worldwide each year, about 50% of this yardage is pigment printed.

Printing paste is the main constituent of printing which enables the formation of the predefined patterns. Printing paste contains Pigments, Thickeners, Binders, and Auxiliaries., Thickeners and Binders being the main components. It is therefore necessary to give consideration to these printing paste constituents.

Pigments:

Pigments are substance in particular forms. They are essentially insoluble in the media into which they are incorporated and are mechanically dispersed in order to modify the colour and light scattering properties of such media. Ancient Chinese used pigments for colouring textile by the block pigment printing method. Pigment printing was on rise in the 18th century however it met with limited success due to inadequacy of the binder as a fixing agent for pigment on the fabric and relatively poor pigment dispersion available at that time.

Thickeners:

Thickeners used in textile printing are high molecular weight compounds giving viscous pastes in water. These impart stickiness and plasticity to the printing paste so that it can be applied to a fabric surface without spreading and be capable of maintaining the design outlines even under high pressure. Their main function is to hold or adhere the dye particles in the desired place on the fabric until the transfer of the dye into the fabric and its fixation are complete.

Synthetic thickening agents are molecular substances, generally co-polymers of unsaturated organic acids, such as acrylic and maleic acids. They swell very considerably in water. Owing to their technical and economic advantages, these highly efficient products are becoming more important in textile printing and they have already become indispensable in solvent free pigment printing. More recently, synthetic thickening agents have also begun to be used in polyester printing.

Synthetic thickening agents have the following properties;

- High degree of purity
- Rapid preparation of the stock thickening
- Simple printing recipe
- Good running properties
- Optimum depth of shade and brilliance of the prints
- Excellent stability of the print paste

Binders and Fixers:

During the earlier stages of the development of binders for use in pigment printing, polyvinyl acetate was considered a good binder. However, it was realized that it produced too stiff handle. On other hand, Acrylate resins gave soft effects but pigments bound with them were not fast to rubbing. Binders are high molecular weight film forming agents produced by the polymerization of simple intermediates initially present in the paste in a homogeneous, dissolved or dispersed state. After evaporation of the solvent or other liquid vehicle, heating produces a thin coating or film. The film, several microns in thickness, encloses the pigment particles and adheres to the fibre.

In pigment printing, insoluble pigments, which have no affinity for fibres, are fixed on to the fibres with binding agents or binders. Binders and fixers play important role in pigment printing in achieving optimum fastness properties. Depending upon the properties required in the binding film (softness, elasticity, plasticity, solvent stability), binders can be tailor-made by choosing suitable base product. The binder used in the pigment printing process is usually based on styrene-butadiene, styrene acrylate or vinyl acetate acrylate copolymer. Pigment printing technology of textiles has been applied widely because of its simple operation techniques, complete color and excellent fastness. Generally, poly-acrylate, polybutadiene, polyvinyl acetate and polyurethane all can be used as pigment printing binder. Very small amounts are required to achieve the desired properties, which offer cost effective textile operations and ensure negligible environmental impact.

Below is the brief information on the Thickener and Binder which are developed by Sarex for application in pigment printing.

Cellbind-213 : Soft Binder for Textile printing

Cellbind-213 is an APEO/NPEO free binder for pigment printing of cellulosic and synthetic fabrics. A very soft type high fastness and self-cross linked binder, suitable for pigment printing and imitated reactive printing to various fabrics such as cotton, towel, T/C and polyester fabrics. It imparts very good fastness and rubbing fastness. The printed fabric exhibits sharp and bright prints with soft hand feel similar to reactive dye printing.

Synthick P-328 : Synthetic thickener for Pigment printing

Synthick P-328 is a highly concentrated thickener for pigment printing for cotton and synthetic fibres. It disperses readily in water. Imparts brilliant colour yield on the printed fabric.

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