Sarex

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Saraquest

Exclusive Insight

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CHEMISTRY BEHIND GOOD FEELINGS

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Textile Chemical Manufacturing

"Customer Delight" is the key strategy of **Sarex Chemicals** as its main motto is to provide solutions to the customers rather than selling products.

Sarex Chemicals is a bluesign® system partner. Most of the products offered by Sarex are REACH Pre-Registered and more than 100 products are GOTS certified. Moreover, Sarex also has been accredited by :

- **ISO 17025 : 2017** (NABL Certified Laboratory)
- **ISO 45001 : 2018**
- **ISO 14001 : 2015**
- **ISO 9001 : 2015**

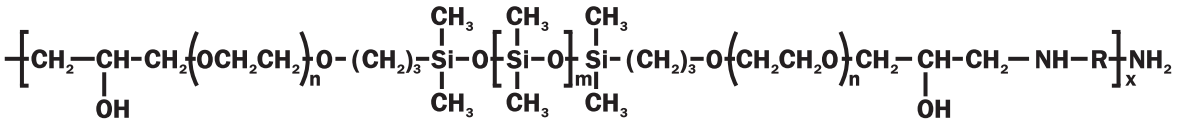
BLOCKED **SILICONES**

BLOCKED SILICONES

Elitesoft-7414 (Conc), Ultimosoft-Z (Conc), Hydrosoft-654

Polysiloxanes (IUPAC) or silicones are macromolecules that consist of a backbone of alternating silicon and oxygen atoms. Two alkyl moieties are attached to the tetravalent silicon in the chain. In case of the most popular and common polysiloxane, poly(dimethylsiloxane) (PDMS), these organic side chains are simply methyl groups. With this structure, silicones represent a unique hybrid of organic and inorganic components. Silicones exhibit a number of unique and extraordinary features that strongly distinguish them from all other kinds of known polymers. Silicones are synthetic organosilicon polymers containing repeated R_2SiO units held by Si-O-Si linkages. These compounds have general formula $(R_2SiO)_n$ where 'R' is the methyl or aryl group. The most obvious differences of polysiloxanes compared to other polymers are their bond lengths and angles. The inequality of the backbone angles plays a crucial role with respect to chain conformation. More significant than the actual bond angles, is their high flexibility. Silicones are chemically inert i.e. resistant to oxidation, thermal decomposition or to attack by organic reagents. Silicones being surrounded by non-polar alkyl group, are water repelling in nature. They are heat resistant and have high dielectric strength i.e. have good electrical insulating properties. In order to take advantage of the unique properties of polysiloxanes, attempts have been made to co-polymerize them with different monomers. The essential goal in all these approaches is the effective combination of the silicone-specific features with those of the other polymer to obtain materials with a new set of properties. More convenient strategies are often used to create amphiphilic siloxane block copolymers that can be used as emulsifiers, foam stabilizers, or the like. All in all, silicone block copolymers have always been of great interest both academically and industrially up to today because of their intriguing properties and their high application potential. Linear silicone block copolymers containing nitrogen-containing functional groups, polyether groups, as well as silicone groups are useful in silicone softener applications for textiles. These linear silicone block copolymers are particularly advantageous in textile applications by having an adjustable hydrophilicity and improved chemical compatibility. A lower concentration may be used on fabrics than a solution that does not contain the linear silicone block copolymer.

Chemical Structure of Block Silicone:



BLOCKED **SILICONES**

Following are some of the general characteristics of Blocked Silicones in Textiles:

1. Blocked silicones are new generation softeners.
2. Since they are shear stable, they can be applied on fabric using high turbulence machine such as soft flow, jet, garment drum machine etc.
3. Blocked silicones exhibits better alkaline stability than conventional silicones.
4. Imparts very good inner softness, surface smoothness and body break on the treated substrates.
5. Suitable for cellulosic, synthetics, viscose and its blend with synthetics.
6. Ideal for terry towels and cotton knits imparting extra soft handle
7. Does not impair the original hydrophilicity of fabric.

Some of the new developments on Blocked silicones, **Elitesoft-7414 (Conc), Ultimosoft-Z (Conc)** and **Hydrosoft-654**, from Sarex will be described in this article.

UNIQUE FEATURES

Elitesoft-7414 (Conc):

- Newly developed hydrophilic, block modified, self emulsifiable silicone oil.
- Imparts soft and fluffy handle to knit and woven substrates made up of cellulosic and synthetic.
- Excellent hydrophilic property.
- Easy to dilute as it does not require emulsifier for dilution.
- Applicable by exhaust as well as by padding method.

Ultimosoft-Z (Conc):

- Ultimosoft-Z (Conc) is a cost effective, block modified organic silicone oil.
- Imparts smooth and super slick handle on Cotton, Polyester, Nylon and Polyester/Cotton (P/C) fabrics.
- Gives excellent results on Synthetic and their blends.
- Easy to dilute as it does not require any emulsifier for dilution. Since it is shear stable, it can be applied on fabric using high turbulence machine such as soft flow.
- Applicable by exhaust as well as by padding method.

Hydrosoft-654:

- Hydrosoft-654 is a blocked silicone softener.
- Imparts very good softness on the treated fabrics.
- Suitable for all substrates however imparts excellent results on Terry towels.
- Applicable by exhaust and padding technique.

BLOCKED **SILICONES**

PRODUCT APPLICATION AND PERFROMANCE DATA

	Elitesoft-7414 (Conc)	Ultimosoft-Z (Conc)	Hydrosoft-654
Physical Nature	Colorless clear to hazy viscous liquid	Light yellow liquid	Straw white to off white liquid
Ionic nature	Non ionic	Non ionic	Non ionic
Oil/ Emulsion	**Oil** (self emulsifiable)	**Oil** (self emulsifiable)	**Emulsion** (Ready to use)
Substrates	Cellulosic and Synthetics	Cotton, Polyester, Nylon and P/C fabrics	Terry Towels
Key features	- Imparts soft and fluffy handle on fabric - No emulsifier required for dilution	- Imparts smooth and slick handle on treated fabrics - No emulsifier required for dilution	- Super soft handle on Terry towels
Dosages	10-50 g/l (20%)	10-50 g/l (20%)	15-60 g/l
Chemical description	Multivariate copolymerization block modified silicone softener	Self-emulsified block silicone oil	Blocked silicone chemistry
Hydrophilic/Hydrophobic	Hydrophilic	Hydrophobic	Hydrophilic
Shear stability	Stable	Stable	Stable
Temperature stability	Stable	Stable	Stable
pH stability, pH 4, 7 & 10	Stable	Stable	Stable

SARAKOL-**AD**

SARAKOL-AD
Multifunctional auxiliary in Reactive dyeing and Process thereof

Water is the basic necessity for treating textile materials in wet processing industry. The textile industry is one of the major consumers of water; consuming a huge amount of water in various processing steps, such as pretreatment, dyeing, printing, and finishing. Rinsing and washing operations alone consume enormous amounts of water. Almost all dyes and chemicals are applied to the textiles in water baths. Water consumption is far greater than the amounts of fibres processed. Water from almost all sources contains various types of contaminations like, calcium and magnesium ions (hardness), alkalinity, heavy metal ions (iron, copper, manganese etc.), chlorine, various anions (sulphide, fluoride etc.), suspended matter, dissolved solids etc. Hardness is generally referred to the presence of calcium and magnesium ions in water. In the textile wet processing, water quality plays a significant role in determining the final shade of the fabric, consistency and production efficiency. One of the essential factors in influencing the dye house water quality is its hardness which is expressed in $CaCO_3$ equivalent. The unit of measurement is parts per million (ppm). If the amount of hardness in water is less than 60 ppm, it is regarded as soft water. If the amount of hardness is more than 180 ppm, it is termed as hard water. Hard water is generally undesirable in the dyeing process since it may cause dye precipitation, promoting dye aggregation, which results in certain dyeing defects such as uneven dyeing, colour specks and loss of depth. In addition, hard water may interfere with the solubility of dye, alter the colour of the dye and adversely affect colour appearance of textile products.

Amongst many classes of textile dyestuffs, the reactive dyes contribute about 50% of the total market share due to their wide-ranging shade gamut, flexibility in application, and the outstanding fastness properties. Reactive dyeing essentially has two stages. In the first stage, the dye is adsorbed onto the cellulosic substrate through hydrogen bonding and Vander Waals interactions. Dyes are applied from aqueous solutions with electrolyte which is needed to overcome the long range repulsion forces operating between anionic dyes and the negative ζ-potential acquired by cotton surface in aqueous media. Without electrolyte addition, adsorption of dye on the fibre will not occur, and with dyes such as reactive dyes, which are very soluble in water, a high amount of electrolyte is required in the dyeing process. Alkalinity is also one of the influential factors for conventional reactive dyeing of cotton fabrics. They rely on alkaline condition to have a reaction with the hydroxyl group of cellulose, mostly by nucleophilic substitution or addition reaction to form covalent bonds. However, the competing reaction of the dye with hydroxide ions in the dye bath is prominent which may produce a hydrolyzed, non reactive form of the dye, leading to serious environmental problems due to the production of coloured effluent discharge after soaping and washing-off processes. The wash-off and subsequent effluent treatments, to remove the resultant colour pollution, can account for up to 50% of the total cost of reactive dyeing. The amount of water used in the wash-off process, a process involving over seven separate rinsing stages, is not uncommon. High volumes of water and numerous repeated individual wash-off stages

are often required to dilute the electrolyte and alkali concentration in the wash-off bath. A wash-off process might include a cold water wash, hot water wash, soaping followed by subsequent hot and cold water rinses.

Right-first-time (RFT) dyeing concept in textile dyeing sector was first introduced in the year 1970. This term is used to define the dyeing efficiency and how one can dye a fabric. If the dyeing process is completed properly without any fault and there is no need to put the dyed fabric into the bath to get the proper shade then this dyeing is called RFT dyeing. The benefits of achieving the right-first-time are very significant including, for instance, reduction in water and energy consumption, reduction in effluent generation, reduce time consumption, reduction in cost, increase productivity and increase profit. Right-first-time dyeing is a difficult and daunting task for a dyer and requires great control over dyeing parameters such as quality of dyestuff and auxiliaries, concentration of salt and alkali, time and temperature, and water quality. The hardness of water is particularly a critical factor in shade matching and it can prevent dye-houses from achieving a high level of right-first-time production. The dissolved calcium, magnesium and iron salts in hard water may react with dyes, forming undesirable precipitates, which yields impure shades and give spots on the fabrics being dyed. Hard water, when used for washing purposes, does not lather freely with soap. On the other hand, it produces sticky precipitates of calcium and magnesium soaps. The formation of such insoluble and sticky precipitate continues till all calcium and magnesium salts present in water are precipitated. Moreover, precipitates of calcium and magnesium soaps adhere to the fabrics. The sticky precipitate adheres on the fabric giving spots and streaks which will eventually hamper quality of final fabric. Therefore, the lack of right first time dyeing are very frequent and leads to the necessity of corrective reprocessing such as re-dyeing or stripping which unnecessarily increases the additional consumption of resources such as dyestuff and auxiliaries, time, and also increases the cost of production. Corrective reprocessing also consumes additional water, energy and generates more effluent. With this background, Sarex has developed a multifunctional auxiliary, **Sarakol-AD**, which will effectively perform in presence of hard water. Sarakol-AD, to some extent, will help to achieve the right first-time dyeing. The use of Sarakol-AD at various stages in textile wet processing will save the extra washing and rinsing baths which would otherwise be mandatory for wet processing operations in hard water.

UNIQUE FEATURES

- Sarakol-AD is a washing off agent for reactive dyed and printed cellulosic fibres and their blends effective in presence of electrolyte.
- It improves the solubility of reactive dyes under adverse conditions of dyeing's such as low liquor ratio, hardness in water, poor solubility of dyestuff.
- Preferential sequestering action on calcium hence prevents precipitation of reactive dyes in presence of calcium.
- Good dispersing properties with reactive and direct dyes enabling level dyeing.
- Good dye bath conditioner for package dyeing.
- Does not complex with dyestuffs hence colour yield or tone of the fabric is not affected.

MATERIALS AND METHODS

Materials	: 100% Cotton fabric
Chemicals	: Sarakol-AD
Dyestuff	: C.I. Reactive Red 152, C.I. Reactive Orange 122

APPLICATION

To study the Dispersing efficiency of Sarakol-AD in hard water – Reactive dye dissolution

Reactive dye solution (0.5% C.I. Reactive Orange 122) was prepared in 500 ppm hard water in absence and presence of 1.5% Sarakol-AD. The Reactive dye molecules tends to precipitate in presence of hard water.

The precipitation formed in the dye solution was checked by drop test on whatmann filter paper. Formation of dye precipitate indicates the salting out of reactive dyes because of calcium salts present in hard water. If no precipitation observed, it indicates that reactive dye molecules are in active form.

To study the Washing-off efficiency of Sarakol-AD in hard water

Dyeing of cotton fabric was carried out with 6% C.I. Reactive Red 152 as per the standard procedure. After the completion of dyeing process, the fabrics were subjected for washing off treatment with Sarakol-AD. The washing off efficiency of the fabrics were then evaluated by performing the laundry test in 150 ppm calcium hardness. The fabrics were run in the 150 ppm hard water at 90°C for 30 min. keeping MLR - 1:20. The staining on adjacent white fabric was checked and assessed.

RESULTS

Dispersing efficiency of Sarakol-AD in presence of Hard water

Dispersing efficiency of Sarakol-AD in presence of 500 ppm Hard water

Blank **1.5% Sarakol-AD**

From the above image, it could be clearly seen that the reactive dye has been precipitated in 500 ppm hard water in absence of Sarakol-AD, whereas the reactive dye solution prepared in hard water containing 1.5% Sarakol-AD does not show precipitation which indicates the efficiency of Sarakol-AD. Sarakol-AD protects the dyestuff from precipitation in presence of hard water.

Washing off efficiency of Sarakol-AD in presence of hard water

The washing off efficiency of Sarakol-AD was evaluated in 150 ppm hard water. The staining on adjacent white fabric was checked after completing the soaping treatment.

Performance of Sarakol-AD in presence of 150 ppm Hard water

Blank **0.75 g/l Sarakol-AD** **0.5g/l Sarakol-AD** **0.3g/l Conventional**

From the photograph it could be seen that in both the conditions, Sarakol-AD is performing efficiently which indicates that multiple rinsing steps after dying which are currently being practiced, could be avoided leading to saving in huge amount of water and energy resources.

CROSSPRINT-**CL (CONC)**

CROSSPRINT-CL (CONC)
Crosslinking Agent
For Pigment Printing

Coloration is a value added treatments for most textile materials which includes dyeing and printing processes. Dyeing is a process of applying color to the whole substrate. From the view of coloration, printing is a partial dyeing on fabrics to form an attractive pattern. The resulting multicolored patterns have attractive and artistic effects which enhance the value of the fabrics much more than the plain dyed ones. Coloration could be achieved with either dyes; by dyeing or printing in aqueous solution; or with pigment by using a print paste.

Pigment printing is not only the oldest but also the easiest printing method as far as simplicity of application is concerned. The use of pigments for printing of textile substrate 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. More than 80% of the printed goods are based on pigment printing due to its obvious advantages, such as versatility, ease of near final print at the printing stage itself, applicable to almost every kind of fibre or mixture and the ability to avoid any washing processes after fixation. Pigments offer great flexibility in processing, as they require no after-treatment other than drying and curing. The ease of handling also accounts for increase in pigment usage for solid shade dyeing and garment dyeing of textile substrates.

Textile pigments are defined as coloured organic substances which do not solubilize in water or other solvents easily and require a binding agent to hold them on the textile fibre. Pigments have no affinity to cotton and no mechanism to bond with the fibre. Organic pigments can be dispersed with a surfactant in water and this dispersion is then blended with a water soluble or a water based emulsion of a polymerizable resin. The water is removed by drying and the polymerization is produced by heat. Therefore, when a pigment is applied to a fabric, it is done so in conjunction with a binder. The binder selected must perform several functions in order to produce a low cost, coloured, desirable, and sellable textile.

In pigment printing, insoluble pigments, which have no affinity for the fibre are fixed onto the textile with binding agents in the pattern required. This description is perhaps over simplified, but it does obviously set pigments apart from dyes that are absorbed into the fibre and fixed as a result of reactions specific to the dye. Printing paste is the main constituent of printing which enables the formation of the predefined patterns. The printing paste for pigment printing generally contains pigments, emulsifiers, binders, softeners, thickeners, antifoaming agents and crosslinking agents. It is therefore necessary to give individual consideration to each of the printing paste constituents. All the above constituents are not used simultaneously in any pigment printing paste. Depending on the class of pigment used and style of printing employed, suitable component are selected in making the printing paste. Binders and crosslinkers play important role in pigment printing achieving optimum

CROSSPRINT-**CL (CONC)**

fastness properties. Currently, pigment printing is perhaps the most commonly and extensively used technique for printing textiles. However pigment printing has a few problems viz., relatively high temperature cure, stiff hand and poor crock fastness of printed goods. These disadvantages are related to binder and crosslinkers used. Thus, to improve the quality of pigment goods, the overall properties of the binders and crosslinkers need to be improved.

Most of the pigment printing binders in the market are macromolecule copolymers that are formed by emulsion polymerization processes from vinyl based monomers. They contain hydrophilic sections which make them dispersible in print paste formulations and the side chain functional groups, some of which are capable of forming films by crosslinking reactions.

Crosslinking agents are the glue that gives structure to the binder film. Crosslinking is the process of chemically joining two or more molecules by a covalent bond. Crosslinking agents or crosslinkers are molecules that contain two or more reactive ends capable of chemically attaching to specific functional groups. One such product developed by Sarex is **Crossprint-CL (Conc)**. Crossprint-CL (Conc) is a formaldehyde free crosslinking agent for pigment printing. It is particularly effective for prints taken on knitted, cellulosic fabrics, polyester/cotton, polyester/viscose and polyamides fabrics. Addition of Crossprint-CL (Conc) to a pigment paste enhances its fastness properties especially wet rubbing fastness. It contains several reactive sites which helps the bonding of binder polymeric chain on the textiles fibres. It is formaldehyde free and hence suitable for the application on kids wear.

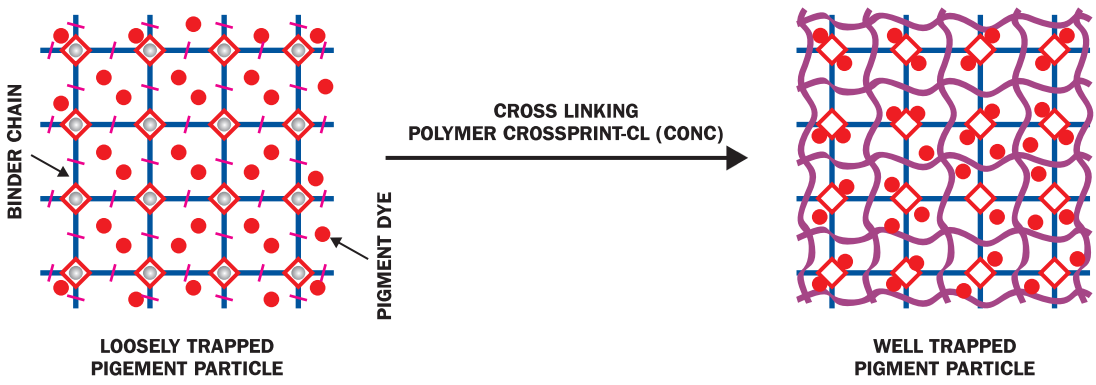
UNIQUE FEATURES

- Crossprint-CL (Conc) improves wet rubbing fastness of fabric printed with pigment dyes.
- It is formaldehyde free crosslinking agent thus suitable to use for kids wear.
- Since it is an additive in print paste, there is no compatibility problem during finishing.
- It does not impair the handfeel of pigment printed fabric.
- It does not affect the runnability of print paste thus do not reduce printing speed on rotary machine.

MECHANISM OF ACTION

Pigment printing uses binders which on curing form long chain polymer which entrap the pigment dye. But due to no self cross-linking property of binder, these pigments are loosely held and may come out during rubbing. Crossprint-CL (Conc) has property that it crosslinks the binder chains and thus help in holding the pigment particles more strongly and improves its rubbing fastness.

Schematic diagram of crosslinking with Crossprint-CL (Conc)



CROSSPRINT-**CL (CONC)**

RESULTS

Without Crossprint-CL (Conc)

With 2% Crossprint-CL (Conc)

Results of Rubbing fastness with Crossprint-CL (Conc)

Cotton fabric printed with following recipe:

Pigment emulsion	: 7%
Synthick-P328	: 2-2.5%
Cellbind-ECO	: 20%
Urea	: 5%
Crossprint-CL (Conc)	: 2%

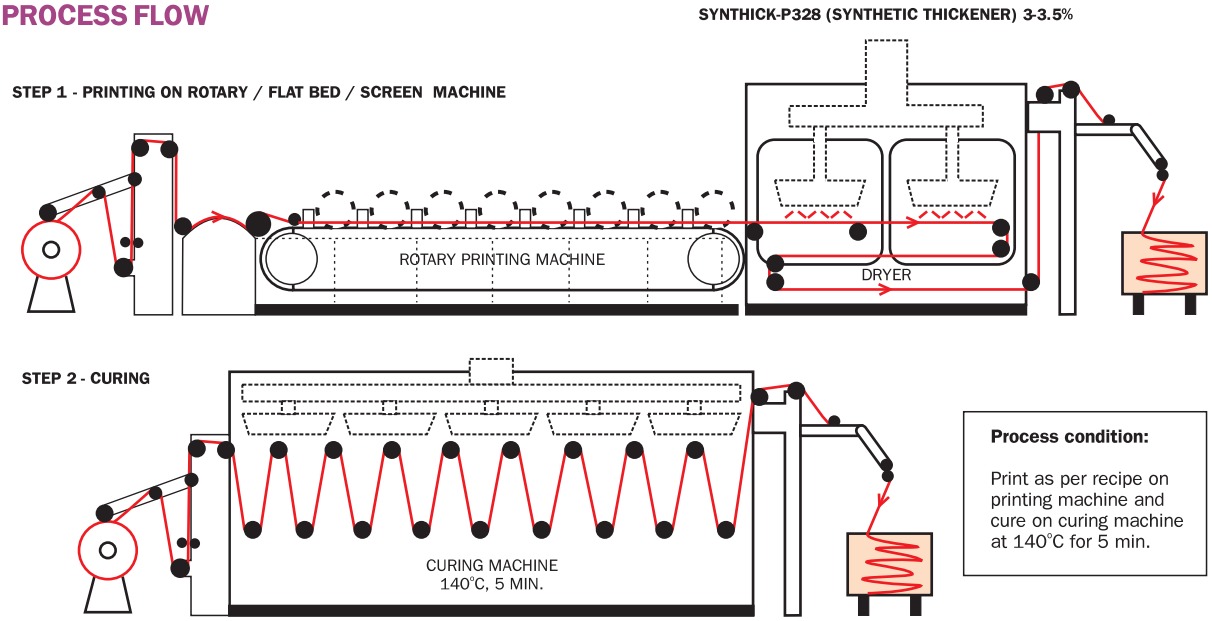
Print → Dry → Cure at 140°C for 5 min.

The results shows significant improvement in wet rubbing fastness with the use of Crossprint-CL (Conc)

APPLICATION PROCESS

Pigment emulsion	: x %
Synthick-P328	: 2-2.5%
Cellbind-ECO	: 8-20%
Urea	: 5%
Crossprint-CL (Conc)	: 1-2%

PROCESS FLOW



CONCLUSIONS

Fabric printed with Crossprint-CL (Conc) shows no shade change or dullness. The feel of the printed fabric is same as other pigment printed fabrics. Treatment is durable to multiple home launderings. No reduction in light fastness observed with use of Crossprint-CL (Conc).

C E R T I F I C A T I O N S

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