Sarex

Vol. 18, Issue 66, Oct 2024

Saraquest

Exclusive Insight

CHEMISTRY BEHIND GOOD FEELINGS

www.sarex.com

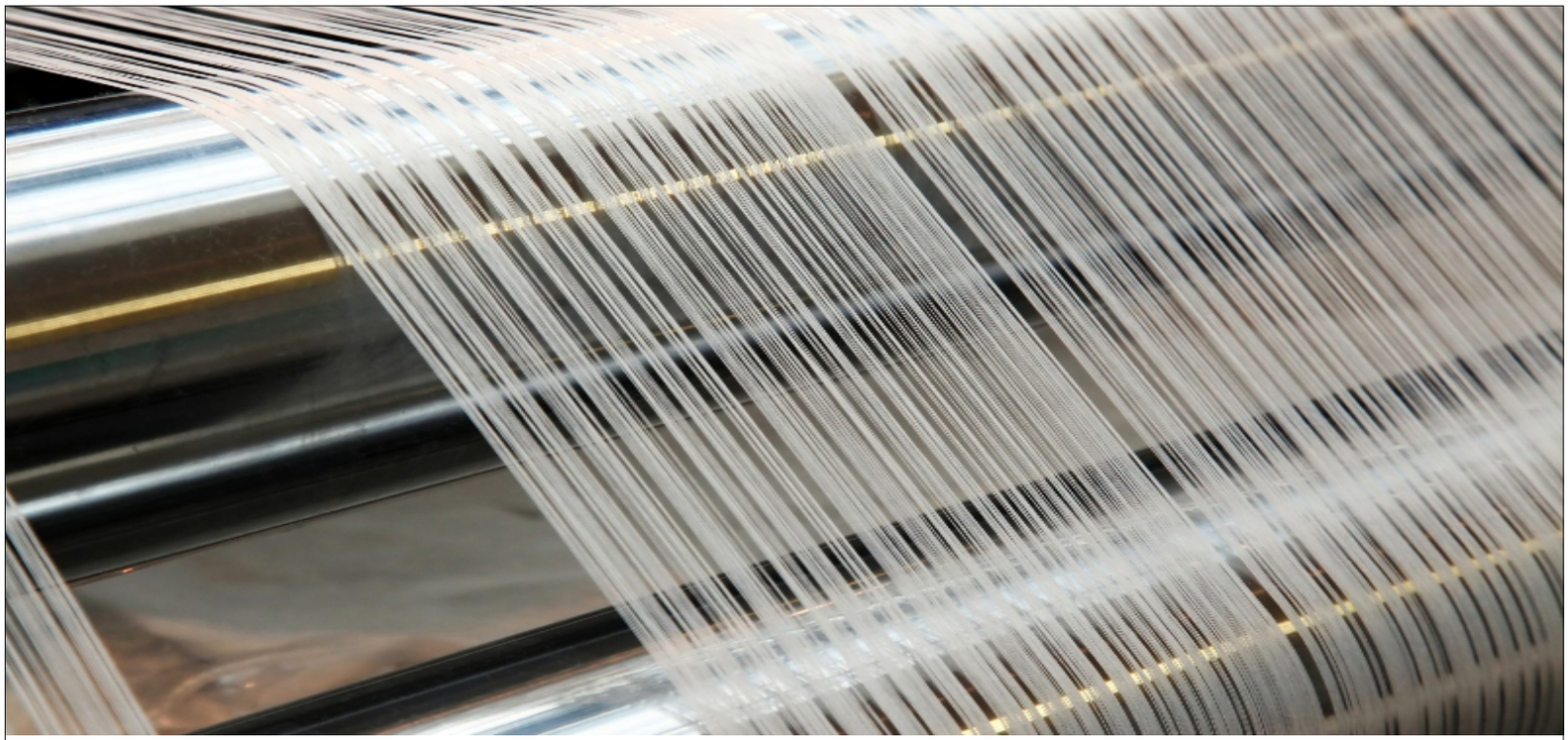
TEXTILE CHEMICAL MANUFACTURING

"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**

TABLE OF CONTENTS



DESIZE-770

High Performance Textile Desizing Enzyme

Desizing is the process in which the sizing materials are removed from the warp yarns of the woven fabrics. Warp yarns are coated with sizing agents prior to weaving in order to reduce their frictional properties, decrease yarn breakages on the loom and improve weaving productivity by increasing weft insertion speeds. In order to avoid abrasion of the weaving instruments (i.e., reed, shuttle) on the warp threads, the warp threads are sized. To keep them smooth, softeners and preservatives (to avoid mildew attack at long and damp stocking) are additionally added. If the sizes are present, they may hinder dyeing, printing and finishing processes. Desizing must be done before the other wet processes of bleaching, mercerizing, dyeing, printing or finishing are carried out. Desizing of cotton fabric can be accomplished by physical, chemical or combination of physical and chemical mechanism, viz., rot steeping, acid steeping, treatment with enzyme and oxidising agents. In desizing, the starches and polymers that are applied, which are insoluble, are converted into water soluble compound to ease their removal. This is accomplished by transferring the starch into their simple sugars or simple water soluble polymers. The synthetic sizes used for man-made fibres are generally water soluble and they are removed during the scouring operation. Desizing, irrespective of what the desizing agent is, involves impregnation of the fabric with the desizing agent, allowing the desizing agent to degrade or solubilise the size material, and finally to wash out the degradation products. The methods and chemicals used for desizing depend on the type of sizing agent used.

Starch is one of the most commonly used sizing agent that is made from natural raw ingredient. It is relatively inexpensive and readily available. Starch and its derivatives account for over 75% of all sizing agents used around the world. Conventionally, starch sizes were usually removed by applying acids, however microbial enzymes are now gaining more interest as an alternative de-sizing agent.

Enzymatic desizing is the classical desizing process of degrading starch size on cotton fabrics using enzymes. Enzymes are complex, organic, soluble bio-catalysts, formed by living organisms that catalyze the chemical reaction in biological processes. Enzymes are quite specific in their action on a particular substance. A small quantity of enzyme is able to decompose a large quantity of the substance it acts upon. Enzymes are usually named by the kind of substance degraded in the reaction it catalyzes. Amylases are the enzymes that hydrolyses and reduce the molecular weight of amylose and amylopectin molecules in starch, rendering it water

soluble, enough to be washed off from the fabric. Amylase is a hydrolytic enzyme which catalyzes the breakdown of dietary starch to short chain sugars, dextrose and maltose. Amylase specifically hydrolyzes and reduces the molecular weight of amylose and amylopectin molecules in starch without affecting the cellulose. There are three types of amylases: bacterial, malt and pancreatic. These enzymes are produced by the fermentation process, which occurs when the starched fabric, stored in wet conditions at slightly elevated temperatures, i.e. warm temperature, becomes infected by micro-organisms. The function of these enzymes is to convert the insoluble starch into water-soluble starch known as 'Dextrin', short chain sugars. These Dextrin's, being water-soluble, are easily removed by washing with water. The available product range of amylases (α-amylases, β-amylases, glucoamylase and iso-amylase) allow desizing to be performed at a temperature ranging from 20 to 115°C.

Amylases can be isolated from all living systems including animals, plants and microorganisms however microbial enzymes are preferred for industrial needs. Microbial amylases have various advantages over other sources such as cost-effectiveness, reliability, predictability, high stability, and eco-friendly behavior. Among industrially important enzymes, amylases are important as these were the first to be produced at an industrial scale and commercialize for various purposes. Enzymatic desizing is commercially utilized in the process houses of textile industries for removal of starch from the sized cotton substrates. The desizing of cotton with enzymes is an eco-friendly process which does not cause any harm to the cotton cellulose. These industrially important enzymes are used in various sectors. In the paper and pulp industry, amylase enzyme is used to modify starch molecules during paper coating process. Similarly, amylase is used in fermenting agricultural crops sugar to produce bioethanol which is an alternative to crude oil. In the food sector, amylase is used extensively in baking, brewing, digestive aids, cake production, and juice preparations. Most importantly amylase is used in the detergent and textile industry to remove starch residues from fabric.

Desizing, scouring and bleaching are preparatory stages for wet-processing treatments like dyeing, printing and finishing on cotton fabrics. The removal of sizes from fabric threads that are applied during the weaving process to prevent yarn from damage and breakage is known as de-sizing. Chemicals such as alkalis, acids, or oxidizing agents are often used to remove these sizing material from the fabric. However, these chemicals not only eliminate non-cellulosic contaminants but also they cause the cloth to lose weight and strength. Furthermore, these compounds cause wastewater to have high COD, BOD, and TDS levels. Enzyme technologies, such as the usage of amylases, result in the breakdown of starch into dextrin and simpler glucose units, resulting in a more environmentally friendly production process.

Sarex is offering a product **Desize-770**, an alpha amylase enzyme to replace fabric pre-treatment processes. Mild reaction conditions during Desize-770 treatment make the process more eco-friendly. Desize-770 primarily hydrolyse microscopic seed-coat fibres that adhere to fibre fragments, allowing for the simple removal of leftover seed-coat fragments during the chemical bleaching process. This article gives an overview of desizing of cotton fabric with Desize-770, an amylase enzymes along with the mechanism, application procedure and techniques for determining their effectiveness.

UNIQUE FEATURES

- High temperature stable, bacterial α-amylase based desizing agent specially recommended for desizing of fabrics sized with starch and water soluble cellulose derivatives.
- Stable up to pH 9 and can be combined with bio-scouring.
- Wide range pH stability.
- Shorter batching time and hence better productivity.
- Applicable by exhaust, pad-roll and pad-batch methods.

MECHANISM

The functioning of Desize-770 during desizing occurs by initial wetting of the substrate and pH buffering followed by swelling, penetration, cracking and destabilization of size layers; after which the attack of enzymes on the size layer takes place resulting in the conversion of water insoluble starches into water soluble products, which are finally removed during washing.

APPLICATION PROCESS

Exhaust Application

Desize-770	: 1-3%
Celldet-R	: 0.3-0.5%
Saraquest-W (Conc)	: 0.15-0.2%
Temperature	: 50-80°C, pH 6-7

- Load grey fabric.
- Add Celldet-R and Saraquest-W (Conc).
- Adjust pH 6-7 and add Desize-770.
- Run for 2-4 ends followed by hot wash (2 ends) and cold wash.

Pad-Roll Application

Desize-770	: 1.5-3 g/l
Celldet-R	: 3-4 g/l
Saraquest-W (Conc)	: 1.5-2 g/l
Sarakol-NF	: 1.5-2 g/l
Padding temp.	: 80°C, pH 6-7
Pad - roll	: 6-8 hr at 70-80°C

- Pad at 70-100% expression.
- Desize-770 to be added after adjustment of pH and temperature of padding liquor.
- At the end of batching period, fabric to be given hot wash and cold wash.

Pad-Batch Application

Desize-770	: 1.5-3 g/l
Celldet-R	: 3-4 g/l
Saraquest-W (Conc)	: 1.5-2 g/l
Sarakol NF	: 1.5-2.0 g/l
Padding temp.	: 60-70°C

- Pad-batch for 8-12 hr.
- Pad at 70-100% expression.
- Desize-770 to be added after adjustment of pH and temperature of padding liquor.
- At the end of batching period, fabric to be given hot wash and cold wash.

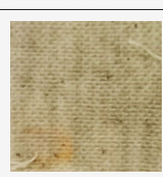
DESIZING EFFICIENCY IN TERMS OF TEGEWA RATINGS

With starch sizes, the iodine reagent (Iodine+ Potassium Iodide) produces a coloured complex of intense violet blue colour. The coloured complex formed is a two-dimensional complex, where iodine, the linear chain, is included in a two-dimensional structure of the starch. This test is practical because it directly indicates either the presence of the starch by a characteristic deep blue colouration or the absence of the starch by a yellowish orange or no colouration on the fabric.

PERFORMANCE DATA

The fabric treated with Desize-770 was stained with iodine solution and the degree of desizing was evaluated on the basis of violet scale (TEGEWA) calibrated from 1 to 9 as a reference. Rating 1 is poor, and a 9 rating is the best which indicates complete removal of size. For effective desizing of the fabric, grade 6 or more is required.

Pad Batch Application - Desizing efficiency

	TEGEWA ratings		Absorbency	Sinking
Blank fabric (Without desizing)	1		>2 min.	>2 min.
1.5g/l Desize-770	6		23-24 sec.	9-10 sec.

CONCLUSION

Enzymatic desizing is the most widely practiced method of desizing starch. The advantage of Desize-770, is that it is specific for starch, removing it without damaging the fabric. Sizing is necessary to ensure that yarns are adequately protected during weaving as the modern looms operate at very high speeds, causing excessively high abrasion to the yarn. To ensure that fabric is well prepared for dyeing and further processing, all size must be removed adequately and uniformly. Desize-770, an α-amylase enzyme can be effectively used for the removal of starch. Textile industry is identified as a key sector where opportunities available for adapting enzyme based products is high however the current awareness of biotechnology is low. Enzymes are emerging in a big way in the field of textile wet processing and Desize-770, an α-amylase enzyme can be put to use in a much bigger way for textile processing applications.

BIOSCOUR-731

Bio-scouring of Cotton with Pectinase Enzyme

An effective pretreatment of cotton is the basis for even and reproducible results in the dyeing and finishing industries. The pretreatment of cotton serves to eliminate natural fibre impurities as well as removal of sizes applied on the warp before weaving. The aim of the treatment is to achieve a good absorbency on the textiles and a high level of desizing. This is usually done in three steps., Desizing, Alkaline scouring and Bleaching. These traditional processes require large amounts of caustic soda and textile auxiliaries. Alkaline scouring of cotton is a mature technology and has become standardized over the two hundred years of its development and practice.

Scouring is the removal of non-cellulosic material present on the surface of the cotton. Raw cotton contains about 90% of cellulose and the remaining 10% constitutes the non-cellulosic components such as waxes, pectin's, proteins, fats, lignin-containing impurities and coloring matter. The aim of the cotton preparatory process is to remove the hydrophobic and non-cellulosic components and produce highly absorbent fibres that can be dyed and finished uniformly. The scouring step improves the wettability of the fabric and normally uses alkalis, such as sodium hydroxide. This chemical, to a certain extent, attack the cellulose, leading to reduction in strength and loss of fabric weight. Furthermore, the resulting wastewater has a high COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand) and salt content, increasing the load of waste-water effluents. With the increasing requirement for textile industries to reduce pollution in textile wet processing, the use of enzymes in the chemical processing of fibres and textiles is rapidly gaining wider recognition because of their non-toxic and eco-friendly characteristics. Enzymes were discovered in the second half of the nineteenth century, and since then, are routinely used in many environmentally friendly and economic industrial sectors. There is increasing demand to replace some traditional chemical processes with biotechnological processes involving microorganisms and enzymes such as pectinases, xylanases, cellulases, laccases and ligninases.

Enzymatic scouring presents an opportunity to effectively achieve the desired changes in cotton's surface structure and its subsequent absorbency properties by a means that gives possibilities for less environmental impact and significant energy savings. In traditional pretreatment processes, large quantities of chemicals and auxiliaries are released into the sewage. Enzymatic treatment, i.e. bio-scouring, provides an environmentally friendly alternative. The main enzyme

class used in bio-scouring is pectinases. They are used to specifically remove pectin lattice, the biological glue, on the surface of the fibre. In particular, pectin lyases and pectate lyases are used in bio scouring. Pectinases help to remove interfering fibre components from the cotton without the need for large amounts of alkali or high treatment temperatures. The pectin can easily be removed from the primary cell wall of the cotton fibre by enzymatic decomposition. Bio-scouring with pectinases is an environmentally friendly enzymatic method which replaces these traditional processes. The bio-scouring allows cotton to be treated under very mild conditions. Enzymatic or bio scouring, leaves the cellulose structure almost intact, preventing cellulose weight and strength loss. Bio scouring has a number of potential advantages over traditional scouring. It is lower BOD, COD, TDS (Total Dissolved Solids), performed at neutral pH, which reduces total water consumption, the treated yarn/fabrics retain their strength properties, the weight loss is reduced or limited compared with processing in traditional ways, and it increases cotton fibre softness.

With this background, Sarex has introduced a new product **Bioscour-731**, a bio-scouring agent for textile processing. Following are some of the key features of this product.

UNIQUE FEATURES

- Milder conditions of processing, low consumption of utilities, excellent absorbency in goods.
- No oxy-cellulose formation and less strength loss because of absence of heavy alkali in bath.
- Uniform removal of waxes results in better levelness in dyeing.
- Fabric is softer and fluffier than conventional scouring, ideal for terry towel/knitted goods
- Low TDS in discharge effluent.

APPLICATION PROCESS

Recipe - 1

- Set the bath with 0.75% Bioscour-731 + 0.75% Celldet-R.
- Treat the fabric at 55°C, 20 min. In the same bath, add 0.3% Chelatin-SA. Raise the temperature to 95°C and continue the treatment for further 20 min. and then drain the bath.
- Complete the process by giving cold wash and then proceed for drying.

Recipe - 2

- Set the bath with the recipe of 0.75% Bioscour-731 + 0.5% Celldet-R.
- Treat the fabric at 55°C, 20 min. In the same bath, add 1-2% Caustic + 0.3% Chelatin-SA + 1.5-2% H_2O_2. Raise the temperature to 98°C and continue the treatment for further 20 min. and then drain the bath.
- Complete the process by giving hot wash at 80°C for 10 min. followed by cold wash and then proceed for drying.

Note

1. For Fabric, add 1-2% Saracrease-HG Conc (1:20 dil.)
2. For Package dyeing, add 0.3-0.5% Sarakol-NF

CONCLUSION

The mild reaction conditions offered by Biosocur-731 treatment provides an environmentally friendly alternative. The bio scouring process with Bioscour-731 results in textiles being softer than those scoured in the conventional sodium hydroxide process. Scouring with Bioscur-731 makes it possible to effectively scour fabric without negatively affecting the fabric or the environment. Bioscour-731 processing provides many advantages, such as reduced water and wastewater costs, reduced treatment time and lower energy consumption because of lower treatment temperature.

SARAKOL-OBS (P)

Stable alternative for Sodium hydrosulphite

Sodium hydrosulphite also known as sodium dithionite or hydros, has a formula of $Na_2S_2O_4$ with a weak sulfurous odour. It is a sodium salt of dithionous acid. It is a white crystalline powder and exists in both the anhydrous and dehydrated forms. It has a powerful reducing capacity and allows vat dyes to be reduced readily at room temperature. It can also be used as antioxidants in hair treatment processes. Sodium hydrosulphite is being used in the textile industry as a reducing agent for dyeing vat and sulphur dyes; as a reduction clearing agent for fabrics dyed with disperse dyes; as a decolorizing agent for reactive dyed fabrics; as a bleaching agent for wool, silk and polyamide fabrics; etc.

With the given advantages of sodium hydrosulphite, there are various shortcomings associated with this chemical. Sodium hydrosulphite is stable when dry, but will slowly be oxidised by air. Even with the absence of air, it will be deteriorated and hence it cannot be kept for long and has a comparatively shorter shelf life. When sodium hydrosulphite is wet and in the absence of oxygen, it is unstable and will be decomposed to sodium thiosulphate and sodium bisulfite. Various handling problems are inherent in its use such as unstable storage life in powdered form, generation of obnoxious sulphurous acid gas, adsorption of moisture, generation of heat when in contact with water and possibility of ignition. Although it is stable under most conditions, it will decompose in hot water and in acid solutions. Furthermore, since it decomposes very quickly in aqueous solution, there is an added disadvantage of requiring several times more than its theoretical amount. Its decomposition in chemical solution during storage, for use in continuous dyeing of vat and sulphur vat dyes is also so high as to present considerable difficulties in maintaining its concentration.

Vat dyes are applied by using sodium hydrosulphite (sodium dithionate) as reducing agent and sodium hydroxide as an alkali. Some by-products of sodium hydrosulphite are acidic in nature, necessitating overdosing of sodium hydroxide over stoichiometric requirement. A few of the by-products formed are sulphur compounds like Na_2S and NaHS, which pollute air through the formation of H_2S. At the same time, the salts of sulphur in the form of sulphate and sulphites (Na_2SO_3, $NaHSO_4$, Na_2SO_4, $Na_2S_2O_3$) contaminate sewage, lower its pH and show corrosive action on concrete pipes. Other problems associated with the use of sodium hydrosulphite are its cost and low storage stability.

To overcome these problems, Sarex is introducing a new product **Sarakol-OBS (P)**, as a stable alternative to sodium hydrosulphite. It can be used either alone or in sequence to bleach recycled pulps. It is strong reducing agent and is thus effective in removing dyes. In such application, Sarakol-OBS (P) is more effective than sodium hydrosulfite.

UNIQUE FEATURES

- High redox potential and can be used in place of sodium hydrosulphite during textile dyeing and printing.
- Non hygroscopic and very stable storage life.
- No odour.
- Free from caking.
- Can be effectively used for stripping of Reactive dyes.
- Can be used as a Reducing agent during vat and sulphur dyeing.
- Can be used in discharge printing and in the Bleaching of wool.

APPLICATION

- **Reduction clearing by Exhaust process:**
  Sarakol-OBS (P) : 0.4- 1 gpl
  Caustic soda flakes : 1-2 gpl
  Soaping agent : 1-2 gpl
  70-90°C, 20-40 min.

- **Stripping of Reactive dyes:**
  Sarakol-OBS (P) : 60 gpl
  Caustic soda flakes : 60 gpl
  Pad-Steam at 100°C for 1 min followed by washing.

- **Step bleaching of Wool:**
  Sarakol-OBS (P) : 0.5-1%
  MLR : 1:4,
  70-80°C, 30-60 min.

- **Reduction clearing in Continuous process:**
  Sarakol-OBS(P) : 60 gpl
  Caustic soda flakes : 60 gpl
  Pad-Steam at 100°C for 1 min followed by washing.

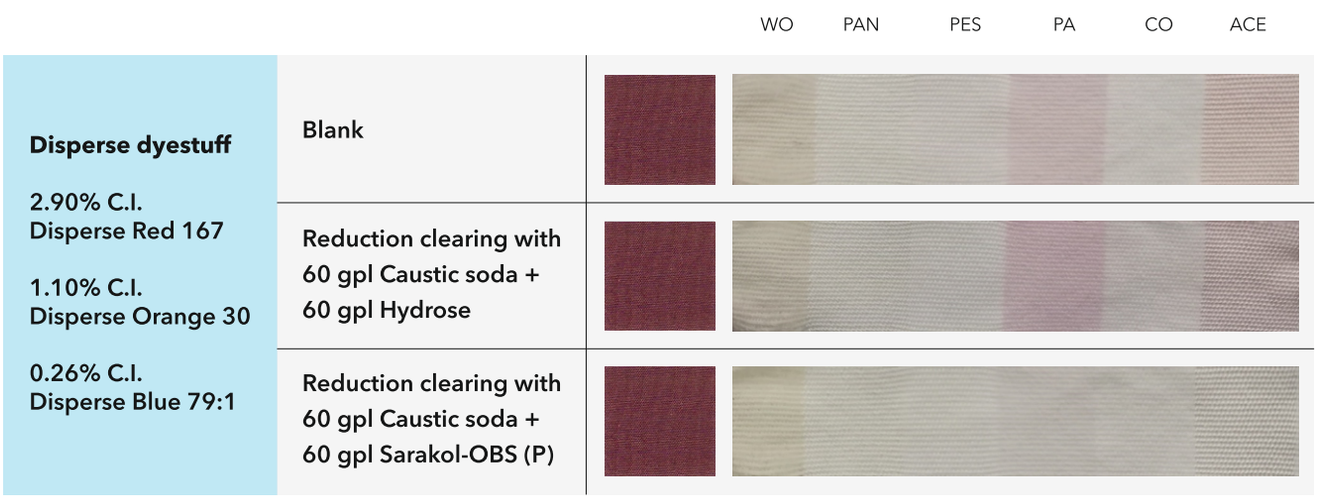
- **Continuous bleaching of Wool:**
  Sarakol-OBS (P) : 0.5-1%
  Steaming at 100-102°C for 5-10 min.

Note:
If MLR is more than 1:4, slightly more dosage of Sarakol-OBS (P) is required.

PERFORMANCE

- **Reduction clearing of Disperse dyed Polyester fabric by Pad-Steam method**

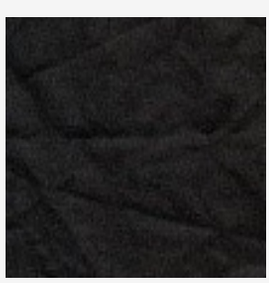
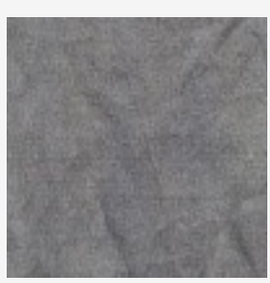
C/F to Washing - ISO 105 C2S - 60°C



WO : Wool, PAN : Acrylic, PES : Polyester, PA : Nylon, ACE : Acetate

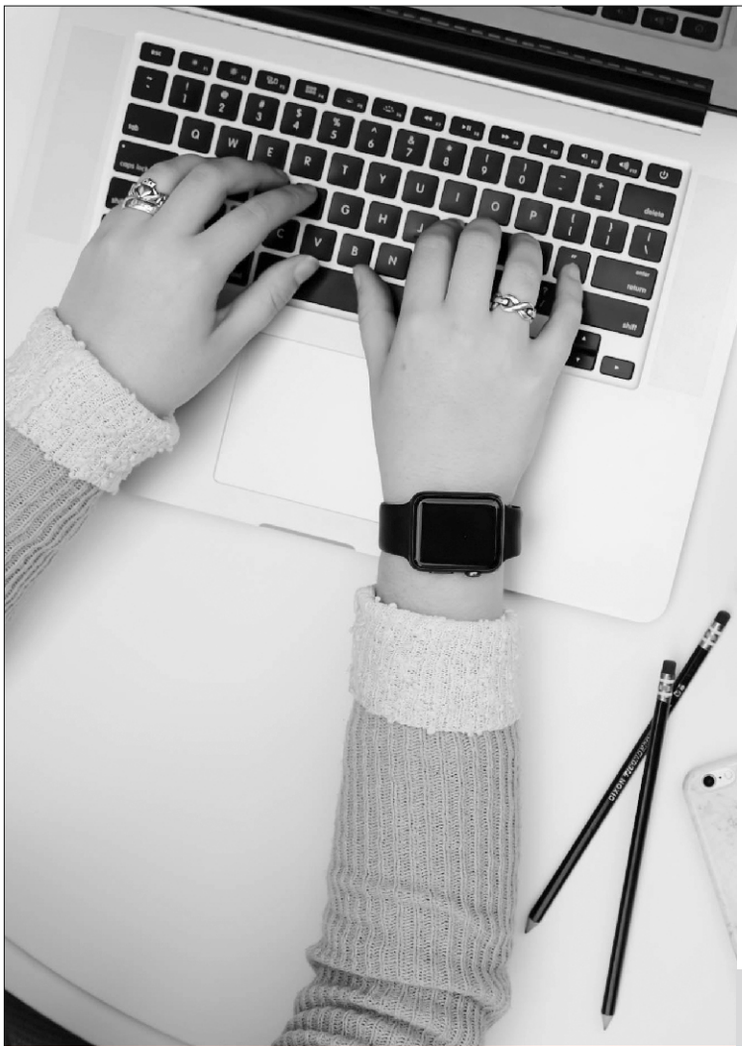
- **Stripping action of Sarakol-OBS (P) against Conventional Caustic soda - Hydrosulphite process**

Reactive dyestuff : C.I. Reactive Red 195 (2% Shade)		
		
Original dyed fabric	Stripping with : 60 gpl Caustic soda + 60 gpl Hydrose	Stripping with : 60 gpl Caustic soda + 60 gpl Sarakol-OBS (P)

Reactive dyestuff : Reactive Black GDN (6% Shade)		
		
Original dyed fabric	Stripping with : 60 gpl Caustic soda + 60 gpl Hydrose	Stripping with : 60 gpl Caustic soda + 60 gpl Sarakol-OBS (P)

RESULTS

From the above results, the efficacy of Sarakol-OBS (P) is clearly visible. Sarakol-OBS (P) would be an ideal choice to be placed against the conventional sodium hydrosulphite. Sarakol-OBS (P) has high redox potential, good heat stability, easy operation and transportation and storage convenient. It widely applies in reducing vat and sulphur dyes during dyeing, wool and silk bleaching, disperse dyes reduction clearing.



Sarex

Sarex stands for quality products!

Company

Corporate Office:
501 - 502, Waterford,
'C' Wing, C D Barfiwala Marg,
Juhu Lane, Andheri (W),
Mumbai - 400 058, India.

Plants:
N-129, N-130, N-131,
N-132 & N-232, MIDC,
Tarapur - 401 506, India.

Phone & Fax

+91 (22) 6128 5566
+91 (22) 4218 4218

+91 (22) 4218 4350

Web Info.

tcexn@sarex.com
tcexp@sarex.com

www.sarex.com

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

bluesign SYSTEM PARTNER

OEKOTEX

ROADMAP TO ZERO

GOTS

M&S

ISO 9001:2015

ISO 14001:2015

ISO 17025:2017

ISO 45001:2018

THREE STAR EXPORT HOUSE