Sarex

Vol. 13, Issue 45, Jan 2019

# Saraquest

Exclusive Insight

Chemistry Behind Good Feelings

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# Chelatin-SA

## Sugar Acrylate Sequestering Agent

A sequestering agent is a substance that removes ions from a solution system by forming a complex that does not have chemical reactions with the ion which is removed. Sequestering agents are commonly used for removing water hardness.

The presence of alkaline earth metals (calcium and magnesium) and other heavy metals have a significant effect on the degree of success which is achieved in the sequence of preparation, dyeing and washing-off during the processing of cotton and its blends. Potential problems include physical and chemical damage (including pin holes) in the cotton during preparation, reduced depth of shade, dulling of colours, unlevel dyeing, poor colour reproducibility and reduced fastness properties during dyeing. These can give rise to customer complaints and a reduction in the level of right-first-time (RFT) production obtained with an increase in cost for reprocessing resulting in loss of economy, loss of productivity, revenue and profitability.

Sequestering agent is used in textile wet processing for minimizing the negative effect of calcium, magnesium, ferric ions which are present in hard water. Cotton fibre/fabric also contains varying quantities of metal traces (iron, copper) which mainly comes from fertilizers and insecticides. Also, the iron content of caustic soda may exceed to 100 mg/lit. There are many routes through which the metal traces enters in the wet processing operation.

**Potential sources of metallic impurities in wet processing:**

- Water quality
- Impurities in cotton
- Reactive dyes
- Chemicals
- Substrate

The most undesirable impurities in Fibre, Common salt, Glauber salt, Caustic Soda and Soda ash are the di-and tri-valent cations, viz., $Ca^{++}$, $Mg^{++}$ $Cu^{++}$, $Fe^{+++}$ etc. These ions increase hardness of the process bath and generate iron oxides in the bath. Calcium and Magnesium ions present in the hard water reacts with natural soaps generated during the alkaline scouring to form waxy substance on the textile material which creates patchy dyeing and discolouration of the fibre. This waxy substance also deposits on the machinery surface. This is termed as Lime soap deposits. The ferric oxide with cellulose creates small pinhole on the fibres also damages the machinery by scale formation in the nozzles and base. Fabrics comprising pinholes results into poor mechanical properties and are rejected as waste and are the cause of major concern to textile processing organizations. To overcome these deleterious effects in the scouring and bleaching bath, adequate amount of sequestrant must be used. Sequestrants prevent di-and tri-valent metal ions, viz., $Cu^{++}$, $Fe^{+++}$ , $Mn^{++}$,$Ca^{++}$, $Mg^{++}$ etc. from interfering with the chemical processing of the textile material. It prevents catalytic damage of cellulosic fibres in bleaching bath during hydrogen peroxide bleaching.

Calcium and magnesium ions also reduce the solubility of anionic dyes, causing reactive dyes to aggregate or even precipitate onto the fibre. Aggregated and certainly precipitated dyes cannot migrate or diffuse, usually remain on the fibre surface as particulate deposits. This causes lower colour yield, unlevel dyeing, spots and stains (which are difficult to remove), change of shade and even contamination of machines. Pthalocyanine turquoise dyes and tri-phendioxazine blues and some reactive orange dyes are particularly susceptible in this respect.

In Dye-bath, $Ca^{++}$, $Mg^{++}$, $Fe^{+++}$ attack the dye molecules and forms aggregates of molecules which deposits on the fabric as dye spots and also they prevent the reaction process. Dye bath sequestrants should be of different strength than that of the scouring and bleaching baths sequestrants because, some dyes have metal compounds and if powerful chelating agents are used, then it will attack the metal compound of the dye.

There are several classes of chelating agents however the choice of chelating agent depends to a great extent upon the conditions under which it is applied.

**The five main classes of sequestering agents used in the textile industry are:**

- Amino carboxylic acid base products
- Phosphates and Phosphonates
- Hydroxy carbroxylates
- Polyacrylates
- Sugar acrylates

In this article, properties and performance of **Chelatin-SA** which is a sugar acrylate based sequestering agent will be discussed.

**Unique Features:**

- Chelatin-SA is a biodegradable multifunctional auxiliary based on Sugar acrylate.
- Acts as an efficient sequestering, dispersing (protective colloid) agent for pretreatment, dyeing and printing.
- Single product for sequestering and stabilization in bleach bath.
- Exhibits high chelation value for calcium and iron, even at pH values of 9-11, hence suitable for scouring, bleaching and washing off.
- Very well biodegradable in contrast to conventional poly acrylate based sequestering agent.
- Caustic dosage in bleaching recipe can be reduced by 30% leading to lower TDS.
- It also exhibit no de-metalizing effect on metal-containing dyestuffs and are non-foaming. It is ideally recommended in pretreatment for desizing, scouring and bleaching and as dye bath conditioner during the cellulosic dyeing.

**Experimental:** Experiment to study the efficacy of Chelatin-SA.

**To sequester Ferric ion present in water:**

1. **Beaker A :** Take 500 ppm Ferric ion solution + 1% Celldet-R (nonionic detergent)
2. **Beaker B :** Take 500 ppm Ferric ion solution + 1% Celldet-R (nonionic detergent) + 3g/l Chelatin-SA
3. RFD fabric is soaked in Beaker A and Beaker B. Half squeezed and kept in Polyethylene bag overnight.

Fabric soaked in beaker without Chelatin-SA shows Iron stains on the fabric (Blank)

Fabric soaked in beaker containing Chelatin-SA shows very less Iron stains as compared to Blank

*Chelatin-SA effectively chelates Ferric ion present in the water and do not allow it to deposit on the fabric.*

**To sequester Ferric ion present on the fabric:**

Fabric with Iron stains is subjected to bleaching using:

1. **Beaker A :** 2g/l Caustic + 2g/l Hydrogen Peroxide
2. **Beaker B :** 2g/l Caustic + 2g/l Hydrogen Peroxide + 3g/l Chelatin-SA

2g/l Caustic + 2g/l Hydrogen Peroxide



2g/l Caustic + 2g/l Hydrogen Peroxide + 3g/l Chelatin-SA

*Fabric bleached in presence of Chelatin-SA shows better stain removal as compared to Caustic and Hydrogen peroxide alone.*

**In combined scouring and bleaching of cotton and blends by batch process:**

| | | |
|---|---|---|
| Chelatin-SA | : | 0.4-0.5% |
| Celldet-R | : | 0.35-0.5% |
| Caustic Flakes | : | 1.25-1.5% |
| Peroxide (50%) | : | 2.0-2.5% |

Treat at 98°C for 45 mins or 110°C for 20-25 mins.

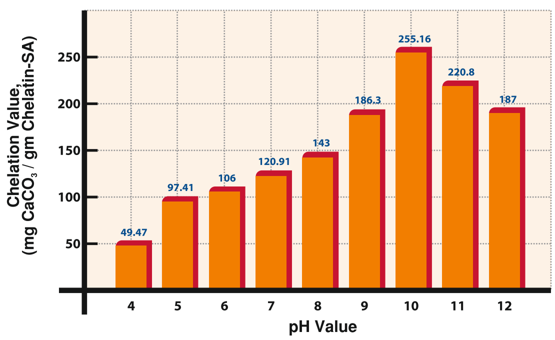
**Dyeing:**

| | | |
|---|---|---|
| Exhaust Application | : | 0.5 to 1.0g/L Chelatin-SA |
| Continuous Application | : | 3.0 to 5.0g/L Chelatin-SA |

**Results:**

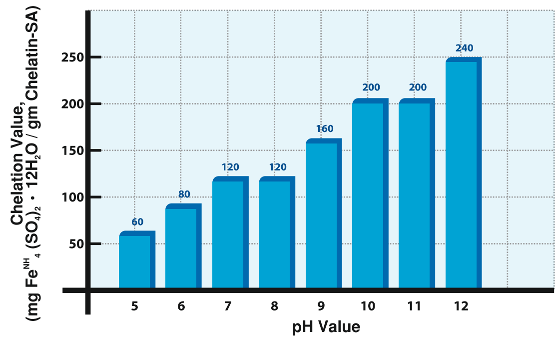
## Chelation values

**Calcium Chelation Value**



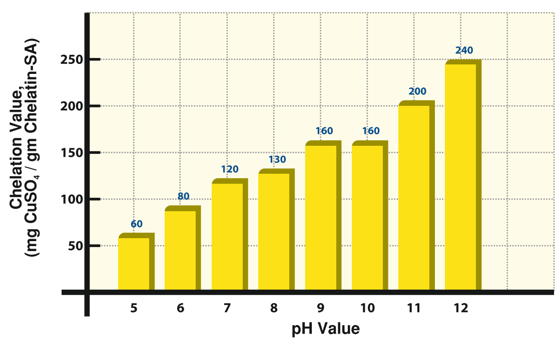

Calcium binding capacity of Chelatin-SA

**Iron Chelation Value**



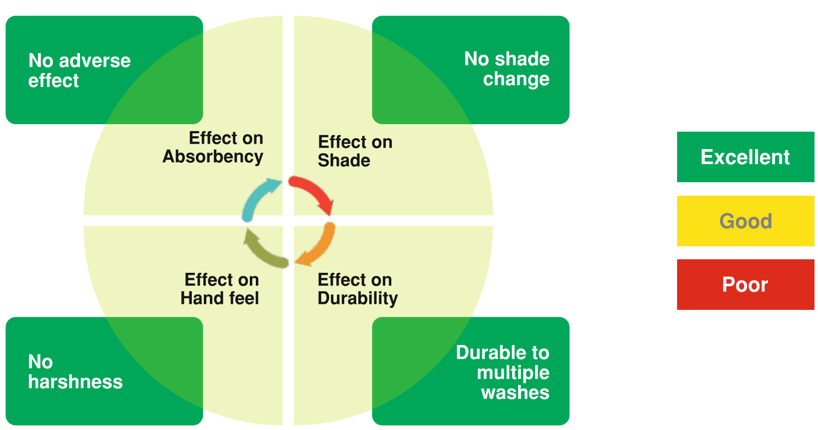

Iron binding capacity of Chelatin-SA

**Copper Chelation Value**



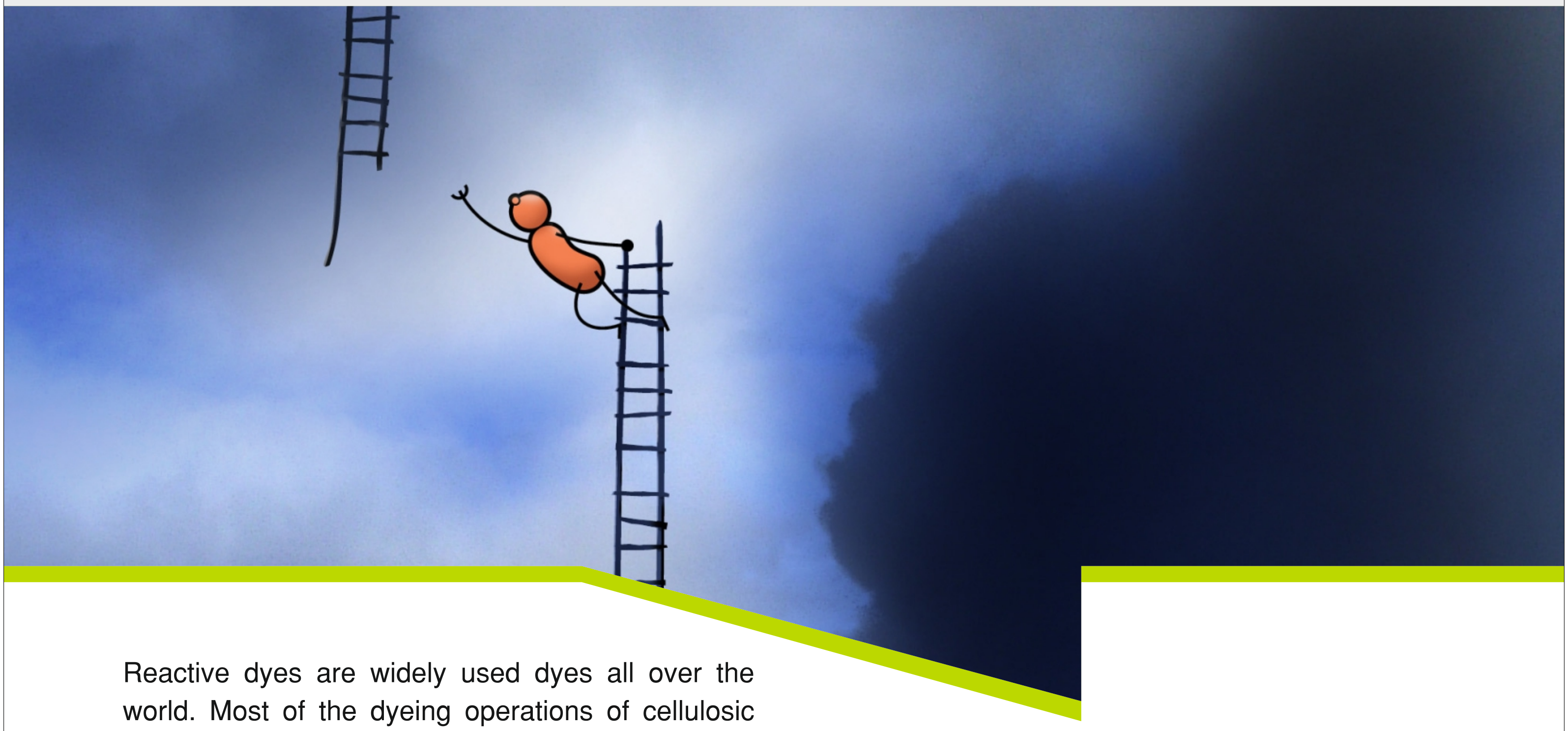

Copper binding capacity of Chelatin-SA

## Treatment effect on fabric



# Feda-SH (MOD)

## Soda Ash Replacement in Reactive Dyeing



Reactive dyes are widely used dyes all over the world. Most of the dyeing operations of cellulosic fibres are done by reactive dyes which have the worldwide acceptance to the dyeing technologists. The textile material when introduced in the dye liquor, the dye gets exhausted on the cellulosic fibre in the presence of Glauber salt at neutral pH. During this stage, the dye is absorbed by the fabric as a result of "salting out" effect of the salt which had been added. The salting out step places the dye molecules in very close proximity to the molecules of the fabric, but the dye is not yet held fast to the fibres of the fabric.

After the absorption of dye on the fabric, there is a reaction step, during which an alkaline material is added to promote a chemical reaction between the dye and the fabric. Amount of alkali is the key factor in fixation of reactive dye. Under alkaline conditions, fixation is carried out in which covalent bond forms between reactive sites of fibre and dye molecule however this alkaline condition also facilitates the reaction of reactive group with the dye liquor resulting in deactivation or hydrolysis of the dye. Normally, soda ash is used as the most commonly used alkali in the dyeing bath. Soda ash (sodium carbonate) is believed to be the best as a reaction promoter, giving high dye yields with minimal hydrolysis. It also works across the entire range of reactive dyes and is therefore the most general answer to pH adjustment. The important point is not the type or amount of alkali, but the pH of the bath.

The role of alkali is to cause acidic dissociation of some of the hydroxyl groups in the cellulose, and it is the cellulosate ion (Cell-O-) that reacts with the dye. In general, the lower the reactivity of the reactive groups of the dye towards the alkaline cellulose, the higher the final dyeing temperature and higher the final pH of the dye bath. Though water is the competitor for reaction with the dye, cellulosic fibre takes part in the reaction for most of the time. It is because the substantivity of a reactive dye to fibre is much greater than the attraction of it to the water.

Hydrolysis of the dye is slower than the reaction with the alkaline cotton but it is significant and reduces the efficiency of the fixation process. In conventional reactive dyeing, high concentrations of electrolytes are required to enable the adsorption of the dyes. Even with substantial amounts of salt added, the fixation rate of most reactive dyes on cotton is still relatively low, especially when deep shades such as black’s are attempted. Thus, there are high concentrations of dyes and electrolytes remaining in the wastewater of dyeing and they may cause serious environmental problems. In case of deep shade, it requires higher amount of alkali for higher pH to increase exhaustion and fixation which is done by using soda ash only.

Dye fixation on cellulosic fibres is generally low, often less than 70%. The large amount of unfixed and hydrolyzed reactive dyes in wastewater may cause serious environmental problems since they are water-soluble and cannot be easily removed by conventional treatment systems. Also, the affinity for cotton for most of the reactive dyes is poor since both reactive dye and cotton carry anionic charges in water. High concentrations of electrolytes are required to help exhaust the reactive dyes. For dark shades with conventional reactive dyeing, the concentrations of electrolytes added can be as high as 100 g/L. Most of the electrolytes remain in the effluent after dyeing and they may also cause an environmental problem if dye house effluent is discharged without treatment. Under this circumstances, substitute of soda ash in dyeing of cotton fabric with reactive dyes can be used. As less amount of substitute product can be used to produce better colour yield, the pH of wash liquor after dyeing can be reduced which facilitates the post-dyeing neutralization process.

**Solutions from Sarex:**

Sarex has developed a Soda ash substitute **Feda-SH (MOD)**. It is an alkali buffer which reduces hydrolysis of dye which enables dye-fibre interaction at lower dosage.

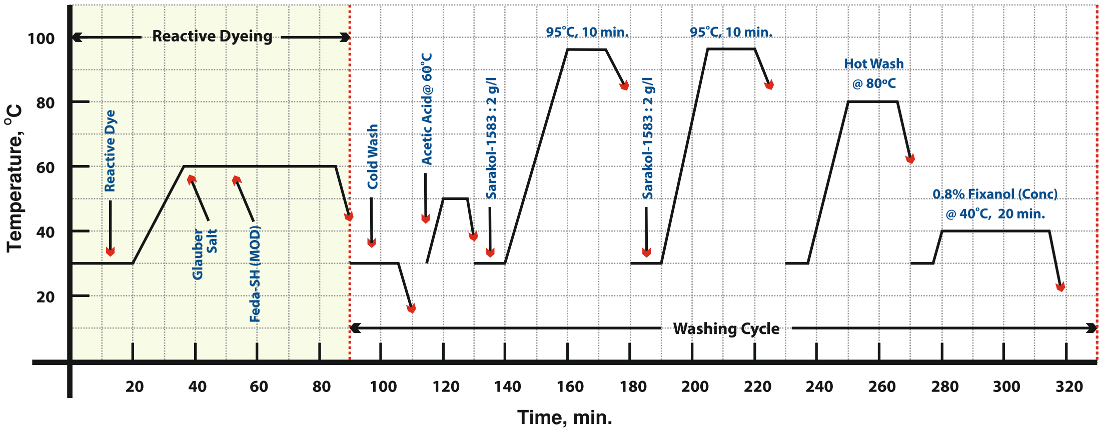
In this study, cotton fabric was dyed with reactive dyes using soda ash and its lower amount of Feda-SH(MOD). The colour yield and fixation efficiency were compared. After dyeing, pH of the wash liquor was compared in both cases. Colour uniformity and washing fastness test of the dyed fabric were also compared in both cases.

**Unique Features:**

- Cost effective alkali buffer for the replacement of soda ash and sodium silicate in Reactive dyeing.
- Requires 1/4$^{th}$ dosage of soda ash during dyeing.
- Posses good solubility in water therefore does not give powdery deposition in machines or on roller.
- Due to its lower dosage in dyeing, ultimately reduction in effluent load.
- No adverse effect on Reverse Osmosis (RO) membrane.
- It can be applied by dosing system at 20% concentration.

**Application:**

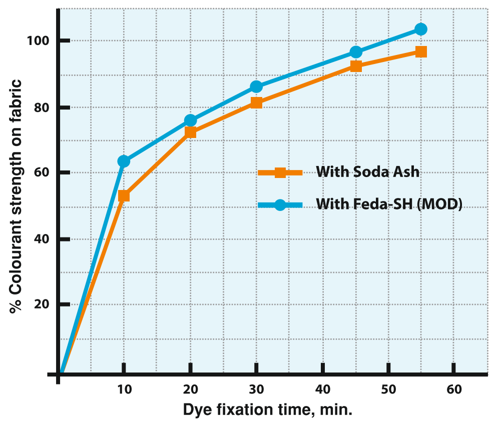
**Exhaust Dyeing Process - Jiggers, Soft Flows, Winch, Yarn & Fibre Dyeing and Other Batch Machines**



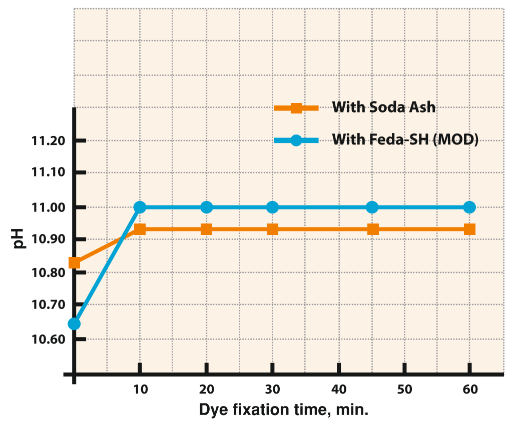

| Depth of Shade | Dosage of Feda-SH (MOD) |
|---|---|
| 0.50% | 2.5 g/l |
| 0.6-2% | 3-4 g/l |
| 2.1% and above | 4.5-5.5 g/l |
| Dark T.blue shade | 5 g/l Feda-SH(MOD) with 1 g/l Caustic soda |
| Deep black | 5 g/l Feda-SH (MOD) with 2 g/l Caustic soda |

**Results:**

## Effect of Dye Fixation Time on Dye Uptake and Dyebath pH




Dye uptake on fabric with Feda-SH (MOD)
is almost same as that of Soda ash

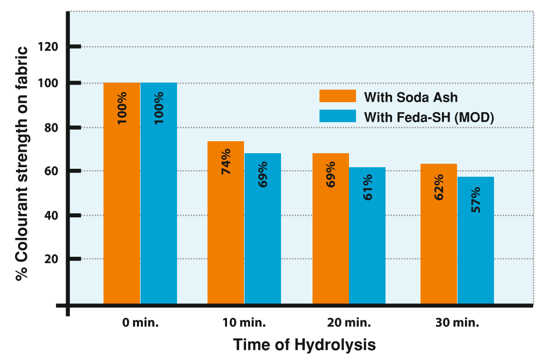



1/4[th] dosage of Feda-SH (MOD) shows similar pH values as Soda ash
with increase in the dye fixation time

## Dye Hydrolysis data of Feda-SH (MOD) and Soda Ash:

The dye solution (without fabric) was allowed to hydrolyze at dyeing temperature for 0, 10, 20 and 30 min. Dyeing was carried out in these hydrolyzed dye solutions for 45 min. The drop in colourant strength value of the fabrics were observed.

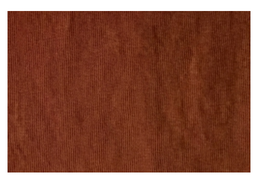
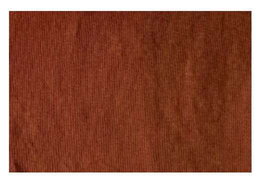
The study shows that the hydrolysis behaviour of dye with Feda-SH (MOD) and Soda ash is similar.




## Shade and Depth obtained with Feda-SH (MOD) and Soda Ash

| With Soda ash | With Feda-SH (MOD) |
|---|---|
|  |  |

**1% Combination shade**

| With Soda ash | With Feda-SH (MOD) |
|---|---|
|  |  |

**4% Combination shade**

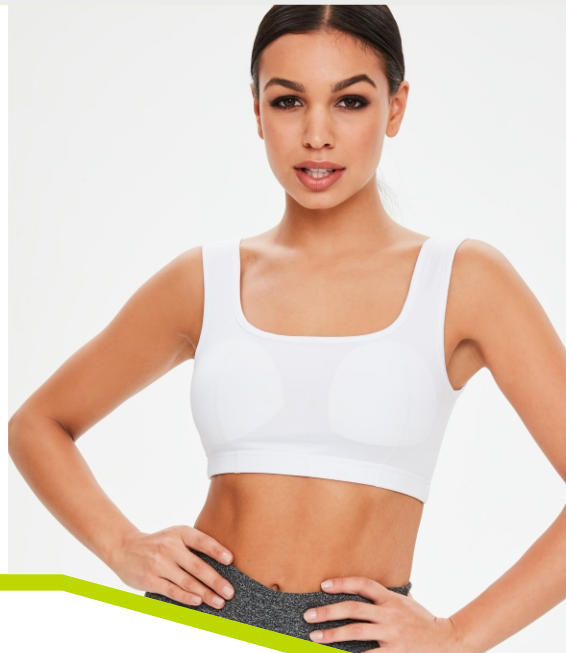
Dyeing obtained with Feda-SH (MOD) is almost same as that obtained with Soda ash

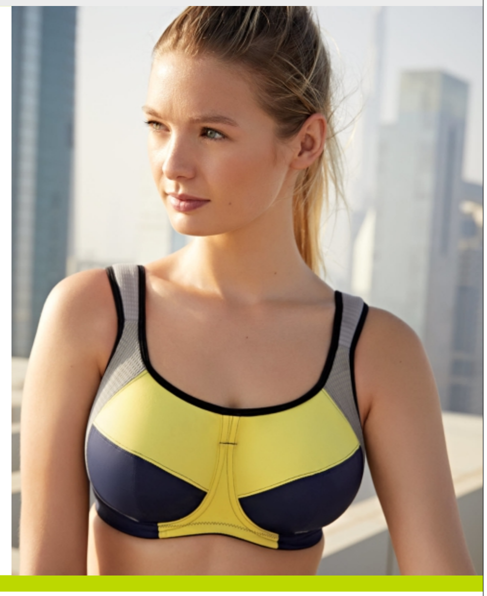
## Economics and Savings

| ITEMS | CONVENTIONAL PROCESS | | FEDA-SH (MOD) PROCESS | | SAVINGS |
|---|---|---|---|---|---|
| | Name | Dosage | Name | Dosage | |
| **1. Chemical Cost** | Dyeing with Reactive Dyes<br>Glauber salt<br>Soda ash<br>Acetic acid | X%<br>20 - 80 g/l<br>10-20 g/l<br>1 g/l | Dyeing with Reactive Dyes<br>Glauber salt<br>Feda-SH (MOD) process<br>Acetic acid | X%<br>20 - 80 g/l<br>2.5 - 5g/l<br>1 g/l | **The dosage of Feda-SH (MOD) is 1/4[th] of Soda ash hence there is about 5% saving in dyeing cost and considerable reduction in inventory.** |
| **2. Utilities** | The utilities consumption with Feda-SH (MOD) is same as with Soda ash | | | | |

# Sarascour-RG (Conc)

## Yellowness Preventer Due to Heat Setting





**What is Heat Setting ?**

Heat-setting is a heat treatment by which shape retention, crease resistance, resilience and elasticity are imparted to the fibres. It also brings change in strength, stretchability, softness, dyeability and sometimes on the colour of the material. All these changes are connected with the structural and chemical modifications occurring in the fibre. Heat setting is the process applicable to fabrics made from synthetic fibres like nylon, polyester in which the fabric is subjected to the action of high temperature for a short time to make it dimensionally stable so that the garments made from such fabrics retain their shape on washing and ironing.

**Why Heat Setting is required ?**

The main objective of heat setting process is to ensure that fabric do not alter their dimensions during use. This process is for the stabilization of synthetic fibres so they do not shrink on heating. Heat setting operation is crucial for fabrics made up of synthetic fibres since it grants excellent dimensional stabilization and crease-proof properties, maintained till the fabric is exposed to temperatures exceeding the heat setting one. The setting temperature used is above Tg. In heat setting, inter-chain bonds such as hydrogen and dipole bonds, break. This allows the molecular chains to move and adopt new stress-free positions. New intermolecular bonds then forms with the fabric in a relaxed condition at the setting temperature. After cooling, the polymer molecules in the filaments become frozen in place. The new bonds are stable up to the heat setting temperature.

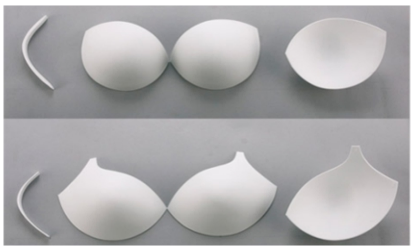
White or light-colored textile made of nylon and elastic fibres as well as related combination fabric becomes yellow easily. Yellowing may happen at every stage such as the dyeing and finishing process, storing or hanging in the showcase or even at home. There are many reasons which may cause yellowing like the material itself may become yellow easily, or the chemicals used on the fabric (residual oil or softener) may become yellow easily too.

**Reasons for Fabric Yellowing:**

- Impurities such as spinning lubricants / oils and emulsifiers in Greige fabric leads to increased yellowing tendency.
- Heat-setting of wet fabric will also caused increased yellowing.
- Direct heated stenters produce NOx fumes by oxidation of nitrogen. These fumes are attacking the oils and the fibres during the setting operation, thereby causing yellowing.
- Moulding of fabrics (viz., women's sports bra) leads to yellowing.

**Moulding of finished fabrics (viz., women's sports brassieres):**

Polyamide/Elastane blends are susceptible to yellowing during moulding. Early attempts to produce moulded bra cups typically involved moulding of nylon fabric. However, with nylon it is difficult to override the partial heat set which is applied when the fabric is produced.



As a result, when nylon fabrics are moulded and heat set, it is necessary to approach the melting point of the nylon in order to override the partial heat set, resulting in a high incidence of yellowing and the fabric becoming brittle. This has made nylon commercially undesirable for moulding bra cups. Mouldable fabric must have enough fabric stretch in the wale and course (warp and weft) directions in order to prevent the non-elastic fibres (i.e., nylon or polyester) from cutting and rupturing the spandex fibres as the fabric is stretched during moulding.

**Solutions from Sarex:**

Looking at the shortcomings of nylon fabric to endure to heat setting temperatures, Sarex has came to the rescue with the product **Sarascour-RG (Conc)** which will enhance the thermal stability and will reduce the tendency for Polyamide or Polyamide/Elastane goods to yellow during the heat-setting and moulding processes.

**Unique Features:**

- Sarascour-RG (Conc) is an Anti thermal yellowing agent to prevent yellowing of fabrics and knits made from Polyamide, Polyamide/ Elastane, Polyester and Polyester/Elastane during heat setting, finishing and moulding.
- Suitable for finishing of pale shades as well as for fabrics treated with optical brightening agents.
- Also prevents oxidation of end amino groups of polyamide during heat treatment as well as yellowing due to NOx fumes in direct heated stenter.
- It will minimize the curling edges of the fabric.

**Application:**

**Padding Process :**

Sarascour-RG (Conc) : 5-10 g/l
Pick-up : 65-70%
Bath pH : 4.5-5.0
Heat setting : 180-190°C

The anti-yellowing effect was evaluated by whiteness and yellowing index values.

**Results:**

| | **Unfinished** | | **Finished with 5-10 gpl Sarascour-RG (Conc)** |
|---|---|---|---|
| | As is fabric | Passed through stenter at 180°C | Passed through stenter at 180°C |
| Samples |  |  |  |
| Whiteness Index (W.I) | 79 | 27 | 56 |
| Yellowness Index (Y.I) | 2.18 | 17 | 9.87 |

The results showed that the anti-thermal-yellowing agent could enhance the decomposition temperature and hinder the thermal-oxidative degradation of polyamide. Besides, the whiteness values of the fabric treated with Sarascour-RG (Conc) is distinctly higher than that of untreated fabric.

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

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