Sarex

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Saraquest

Exclusive Insight

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Chemistry Behind Good Feelings

Contents

Sequestering Agents - *Sequesterant For Hard Water*

What are Sequestering Agents?

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. They form molecules in which the ions are held so securely that they can no longer react. Sequestering agents are also known as chelating agents. A chemical sequestering agent surrounds another molecule or atom and holds it "in seclusion". In this process, the chemical sequestering agent hides the molecule or atom and prevents it from interfering into chemical reactions.

Role of Sequestering Agents in Textile Wet processing

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.

Cotton fabric is usually bleached by treatment with hydrogen peroxide under alkaline conditions in order to achieve a satisfactory level of whiteness through oxidation of coloured impurities. The trapped iron residues in the fabric acts as catalyst in this process and causes H_2O_2 to undergo homolytic fission to two hydroxyl radicals (OH•). This metal ions causes abnormal decomposition of H_2O_2.

The rate of decomposition may be so high that cellulose is converted into oxy-cellulose. The oxy-cellulose thus produced becomes visible in form of tiny holes commonly addressed as iron pin-holes in the industry. Fabrics comprising pinholes results into poor mechanical properties and are rejected as waste and are the cause of major concern to textile processing organizations.

Some sequestering agents like sodium tri poly-phosphate and sodium hexa meta phosphates are specially useful in scouring as they not only sequester calcium and magnesium but also cleanse the equipment and filters from any clogging. However, they hydrolyze at higher temperatures and therefore have limited use. EDTA (Ethylene di-amine tetra acetic acid) is another sequestering agent that fixes calcium and magnesium in an alkaline medium however it cannot sequester ferric ions.

Oxalic acid treatments will remove ferric ion but it is more hazardous, as the chance of fabric tendering is high if proper precautions are not taken. The presence of metals as salts of iron, copper, zinc, manganese, tin, aluminium etc., in the dye bath also are highly undesirable as it adversely affects the tone and brightness of the colour.

Need to sequester the Calcium and Magnesium ions

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 characteristic properties of Sequestering agents are (i) Not all sequestering agents posses the same sequestering power & (ii) Specific metal chelating efficiency. Some sequestering agents are better for masking ferric ions where as some are used for masking calcium ions. The capacity of sequestering agent is generally denoted by the binding capacity of calcium and the binding capacity if iron.

Looking at the overall scenario of the need of sequestering agents to overcome the deleterious effects in the scouring and bleaching bath, Sarex has developed series of sequestering agents with different chelating efficiencies.

Unique Features of Saraquest-W (Conc):

- An HEDP (1-hydroxyethane 1,1-diphosphonic acid) based sequestering agent.
- High power sequestering agent in powder form specially developed for scouring and bleaching of cotton and polyester/cellulosic blends.
- High chelating action for calcium, magnesium and iron under alkaline conditions and at high temperature.
- Prevents precipitation of insoluble hydroxides and carbonates which are formed due to alkali used in scouring and bleaching.
- It also chelates iron impurities preventing catalytic damage and pin-hole marks during peroxide bleaching.
- It has neutral pH so can also be used in dyeing.

Unique Features of Quest-AMP:

- An ATMP Acid based (Amino trimethylene phosphonic acid) sequestering agent for scouring, bleaching and dyeing of cellulosic and its blends.
- Good chelating action for calcium, magnesium and iron under alkaline conditions and high temperature.
- It can also be used for water treatment.

Unique Features of Ironstrong (Conc):

- High iron chelating capacity.
- Effectively chelates Fe+++ and hence prevents it from interfering with the chemical processing of textile material.
- Prevents pinholes and catalytic damage of cotton in peroxide bleaching.
- Applicable in bleaching and scouring process.

Unique Features of Hiquest-CA (Conc):

- A polymeric based sequestering agent with higher calcium chelation efficiency for textile wet processing.
- Should be applied in textile treatment bath whenever a high calcium content may have negative influence in textile processing.
- Posses good dispersing action.

Ion sequestering efficiencies of various Sequestering Agents

		Ca chelation value (pH12) (mg $CaCO_3$/gm)	Fe chelation value (pH 11.5-12) (mg of Fe/gm)
HEDP based	Saraquest-W (Conc)	600 - 680	1350 - 1450
ATMP based	Quest-AMP	350 - 420	50 - 100
High Fe chelation	Ironstrong (Conc)	280 - 320	1800 - 1850
High Ca chelation	Hiquest-CA (Conc)	1200 - 1500	–

Ketoprep-LA (Conc) - *Low Caustic Bleaching Aid*

Cotton is the most important natural fibre whose consumption is constantly increasing day by day. Natural cotton is hydrophobic and coloured. Scouring is a purifying treatment of textiles. The objective of scouring is to reduce the amount of impurities sufficiently to obtain level and reproducible results in dyeing and finishing operations.

Scouring of cotton textiles is an essential treatment in textile wet processing in order to get high absorbency. During scouring, waxes and other hydrophobic materials are removed from the cotton fibres. Conventionally, scouring is done with hot aqueous solution of caustic (NaOH) to remove hydrophobic components from the primary wall (e.g. pectin, protein and organic acids) and the cuticle (waxes and fats). Though alkaline scouring is effective and cost effective process, it is inefficient because it consumes large quantities of water and energy.

Also, Hydrogen peroxide (H_2O_2) is most popular oxidant used to remove natural colourant of cotton fibres. Generally, combined scouring and bleaching is carried to make cotton fibre hydrophilic and white. Conventionally, scouring and bleaching is done with aqueous solution of caustic and H_2O_2 at boil.

The conventional pre-treatment process of cotton requires strong alkali viz. caustic soda for bleaching. The main reason to use this strong alkali is to get high absorbency. Further, during dyeing also there is strong alkali used for fixation. This also gives additional harshness to the fabric.

Higher consumption of caustic leads to increased Total Dissolved Solids (TDS).

To overcome these drawbacks, Sarex has introduced a product **Ketoprep-LA (Conc)**, a new bleaching aid which requires less caustic during bleaching.

Unique Features:

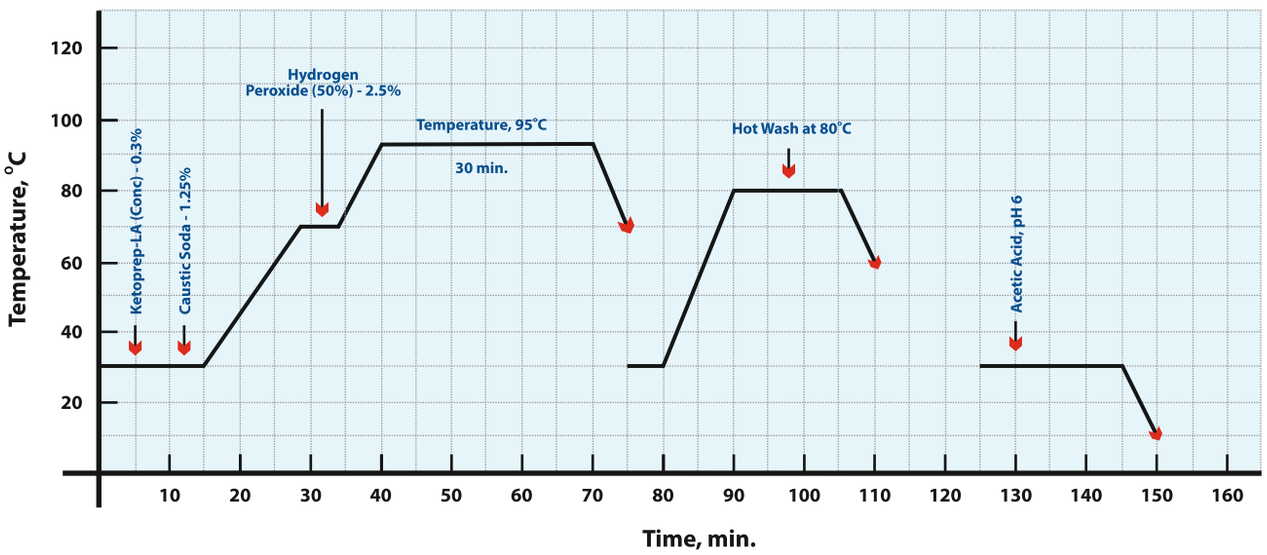
- Novel bleaching aid for cotton requiring less caustic soda for bleaching.
- Most suitable for delicate cotton fabric as it retains the fabric strength.
- An all in one product thus no need to add other auxiliary during bleaching.
- Lower chemical consumption and less inventory requirement.
- It is easily dosable.
- Low caustic required, hence less Total Dissolved Solids (TDS) & less Chemical Oxygen Demand (COD) in the effluent.

Mechanism of Action:

In combined scouring and bleaching process, hydrogen peroxide decomposition is faster due to high caustic concentration which reduces the fabric strength considerably. Ketoprep-LA (Conc) acts as a catalyst in the bleaching process and activates peroxide at low concentration of caustic soda. Hydrogen peroxide decomposition at low caustic concentration is well controlled thus causes less damage to the cotton fabric.

Application Process:

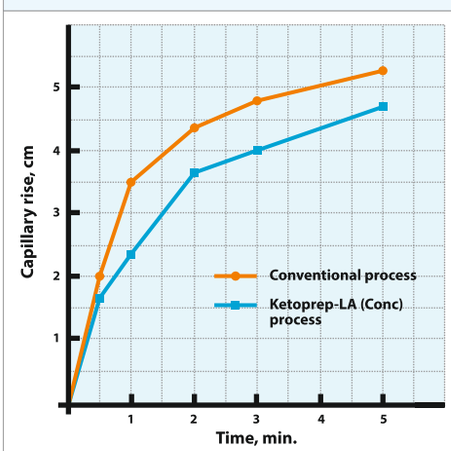
Flow Diagram for Combined Scouring and Bleaching Process



Results:

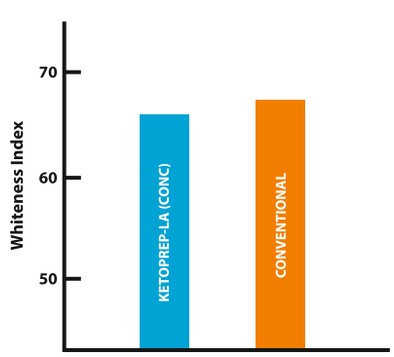
CONVENTIONAL PROCESS		KETOPREP-LA (CONC) PROCESS	
Caustic flakes : 2% Celldet-R : 0.50% Sarastabil-MRS : 0.25% Saraquest-AO : 0.50% Hydrogen Peroxide (50%) : 2.50%			Caustic flakes : 1.25% Ketoprep-LA (Conc) : 0.3% Hydrogen Peroxide (50%) : 2.50%
Whiteness Index	**73**	**73**	**Whiteness Index**
Absorbency	**Instant**	**Instant**	**Absorbency**

Fabric absorbency, Capillary rise



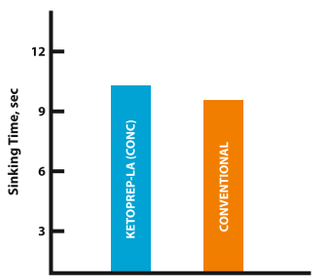
Absorbency is comparable with Conventional bleaching

Fabric Whiteness Index (W.I)



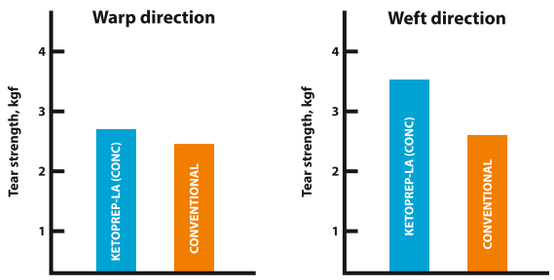
W.I is comparable with Conventional bleaching

Fabric Absorbency, Sinking test



Ketoprep-LA (Conc) bleached fabric sinks equally fast as Conventional bleached fabric

Fabric Tear Strength Comparison



Ketoprep-LA (Conc) process achieves better Tear strength than Conventional bleaching process

Economics and Savings:

ITEMS	CONVENTIONAL PROCESS		KETOPREP-LA (CONC) PROCESS		SAVINGS
	Name	Dosage	Name	Dosage	
Chemical Cost	Caustic soda	2%	Caustic soda	1.25%	**Substantial reduction in consumption which brings down the chemical cost by 15-20%**
	Wetting agent	0.50%	Ketoprep-LA (Conc)	0.3%	
	Sequestering agent	0.50%	Hydrogen Peroxide (50%)	2.50%	
	Hydrogen Peroxide (50%)	2.50%			
	Peroxide stabilizer	0.25%			

Conclusions:

Substantial reduction in auxiliary consumption which brings down the chemical cost by 15-20%.

Heflor-CI (Conc) - *Metal Corrosion Inhibitor*

Wet processing of garments is gaining importance now-a-days. Apart from washing and cleaning, it can impart artistic and innovative look to the garments. Today innovative processing of garments such as antimicrobial, wrinkle-free, water resistant, moisture management finishes leads to their value addition. Besides, different effects viz., distressed or worn-out looks, stone-washed, soft handle, creasing can be imparted. There are various types of effects achieved by different garment washing methods, such as bleach wash, stone wash, enzyme wash, sand wash, etc. These effects attract the immediate attention of consumers and are in demand by fashion industry. Aesthetic value addition by the application of a fashion treatment make a garment more appealing. Garment processing is an emerging technology which is governed by the latest trends in fashion and provides higher earnings.

Bleach Wash

Stone Wash

Enzyme Wash

Sand Wash

Fashion industry utilizes metal trims such as buckles, zippers, eyelets, rivets, buttons, or snaps to impart a contemporary look to a garment. These metal accessories, on contact with concentrated chemicals during processing, can get corroded, eventually affecting aesthetic properties of the garment. Metal corrosion may cause staining on the adjacent fabric or material and also affect the function and appearance of the metal trim, e.g. buckle, metal hook. Corrosion is the destruction of metal materials resulting from chemical or electrochemical reactions during processing or with the environment. Rusting, the formation of iron oxides, is a well-known example of electrochemical corrosion.

This type of damage typically produces oxide(s) or salt(s) of the original metal, and results in a distinctive orange colouration. Corrosion can also occur in materials other than metals such as ceramics or polymers. Corrosion degrades the material's strength, appearance, and functionality.

Such rusting, discolouration of fabric and impaired functionality of metal accessories is unacceptable at customer end. It is important to realize that corrosive attack on a metal can only occur at the surface of the metal, hence any modification of the surface or its environment can change the rate of corrosive reaction. Corrosion processes, being surface reactions, can be controlled by products known as inhibitors which adsorb on the reacting metal surface.

With the development of the garment industry, the new materials, new techniques as well as the washing process and post-treatment of the ready-to-wear products have witnessed increasing diversification. A wide range of products are developed for garment wash to achieve various effects. However, garment washing may have an adverse effects on the quality of metal accessories attached to them if special care is not taken, making them fail to reach the standards as expected and reduce their service life regardless of the superior quality materials they are made from. The copper alloy will react with such chemicals as the acid, alkali, oxidizing agent, reducing agent and sulfide, which will result in the discolouration and rusting of metal.

Keeping in view the customer's problem, Sarex has developed **Heflor-CI (Conc)** which is a passive inhibitor for metal corrosion when it comes in contact with chemicals. This product protects metal from corrosion during processing/dyeing of garments with metal buttons/zips, especially made up of alloy.

Unique Features:

- Protects zippers / buttons from corrosion during garment washing.
- Prevents stain formation on garments due to metal accessories.
- Wide pH stable (stable from pH 3 - 13).
- Corrosive and passive inhibitor for metal.
- Does not affect shade of dyed garments.

Recommended procedure:

0.5-1.0 g/l Heflor-CI (Conc) to be added at room temperature before addition of dye.

Note:

- Heflor-CI (Conc) can be directly dosed in machine.
- Heflor-CI (Conc) not to be used with chlorine-based oxidizing products.

Test Methods:

The corrosion resistance properties can be assessed by below testing methods.

- ASTM B117:2009 - Standard practice for operating Salt spray (Fog) apparatus
- ASTM D2059 - Standard test method for resistance of zippers to salt spray (Fog)
- ISO 9227:2006 - Corrosion test in artificial atmospheres : Salt spray tests
- ISO 7384:1986 - Corrosion tests in artificial atmosphere : General requirements

Sarakol-738 - *Economical Washing-Off Agent*

Economical Washing-off agent for Reactive dyes

Reactive dyes are extensively used for dyeing of cellulosic fibres because of their excellent wash fastness properties which arises from covalent bond formation between dye and fibre. Dyeing of cellulosic fibres takes place with reactive dyes under alkaline conditions however this alkaline conditions also facilitates reaction of reactive group with the dye liquor, resulting in hydrolysis of the dye. This hydrolyzed dye has affinity for the fibre via hydrogen bonding and Van der Waals interactions, but is not covalently bonded and as such exhibits poor wash fastness. Washing of reactive dyed fabrics is more complex. It is very difficult to remove the unreacted / unfixed dye from the fabric due to the presence of electrolytes. This hydrolyzed dye must be removed by rinsing and using an appropriate washing-off agent in order to retain the fastness properties.

The washing-off efficiency would depend upon the amount of unfixed dye and ease of removal of unfixed dye. The washing–off agent should facilitate the diffusion of unfixed dye molecules from the fibre into the water.

Solution from Sarex:

Sarex has developed an economical washing-off agent **Sarakol-738** available in powder form and easily dilutable. It is recommended to use in batch process as well as in continuous process. Sarakol-738 helps in easy removal of hydrolyzed reactive dyes at the end of dyeing process.

Unique features:

- Good dispersing action.
- Keeps the hydrolyzed dye and unfixed dye dispersed in the dye bath and does not allow to re-deposit on the fabric.
- Does not form complex with dyestuffs hence colour yield or tone is not affected.

Application:

100% Cotton knit fabric was dyed with 4% C.I. Reactive Red 141 and washing-off was done as per the recipe mentioned below :

Sarakol-738	: 0.3 - 0.8 g/l
Kalium-NNS (Conc)	: 0.1 - 0.2 g/l (optional)
Bath pH	: 7
Temperature	: 90 -95 °C
Time	: 10-30 min

- Residual salt concentration should be less than 2 g/l before washing-off.
- Repeat soaping in fresh bath for dark and problematic shades.
- Carry out fixation for dark and problematic shades.

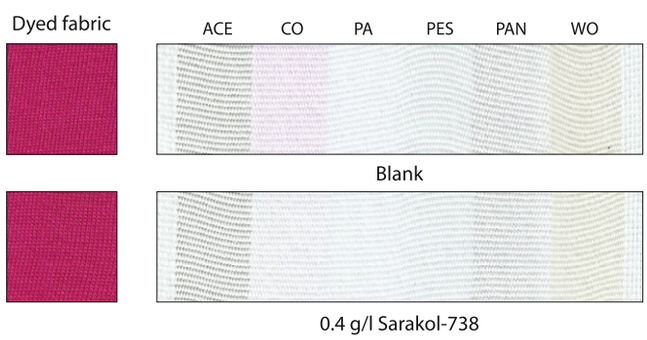
Results:

Washing-off carried out in presence of hard water (150 ppm).

4% C.I. Reactive Red 141

Soaping carried out in Hard water (150 ppm)

Washing fastness : ISO 105 C10



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

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