Sarex

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Saraquest

Exclusive Insight

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**

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CHELATIN-SA

Phosphorous Free Sequestering Agent

What are Sequestering agents?

Sequestering agents are a class of chemicals that have the ability to chelate metal ions. The chelating agent, like a crab's "chela", clamps down on the metal ion, and the chelating agent and the metal ion form a chelate. It is an organic compound capable of linking metal ions or molecules together to form complex ring-like structures known as chelates.

Industrially used sequestering agents include sequestration to form stoichiometric complexes with metal ions, de-flocculation to disperse solids in solution, scale inhibition to prevent and remove scale deposits in the process, high temperature and rapid pH hydrolytic stability to maintain the stability of the solution. In addition, sequestering agents soften hard water by dispersing organic and inorganic compounds, promoting cleaning power, preventing corrosion and complexing metal ions in water in various industrial processes. When impurities such as metal ions and organic decomposition products are contained in the water, problems such as deterioration of whiteness, pin hole generation, and re-attachment of contaminants occur in the refining process and problem such as color discoloration, solubility of dye, dispersibility, etc. in the dyeing process.

It causes problems of disproportionation and tarring due to deterioration. Most of the sequestering agents used are EDTA (Ethylenediamine Tetra acetic acid sodium salt), DTPA (Diethylenetriamine pentaacetic acid penta sodium salt), DTPMPA (Diethylenetriamine penta Methylenephosphonic acid hepta sodium salt), which are nitrogen and phosphorous based, because of their functional effect despite the environmental damage of water pollution caused by structural characteristics that are difficult to decompose. Phosphate based and polyphosphonate based metal ion sequestrant are organic phosphates, and their chemical main chains, phosphorus and carbon, are highly stabilized, resulting in relatively poor biodegradability and eutrophication in water.

Sequestering agents such as polyphosphate which are used industrially, have a great advantage in sequestering power, however their decomposition products are nitrogen (N) with the disadvantage of poor biodegradability which causes pollution of river waters. Also it contains a large amount of phosphorus, causing eutrophication and algal red tides due to these nutrients. Water eutrophication caused by the discharge of wastewater containing phosphorus and nitrogen has led to enhanced wastewater discharge restrictions. To protect water resources and meet sustainable

development requirements, higher demands have been put forward to produce more "Green" bio-based, water treatment agents. As such, the development of environmentally friendly water treatment agents and technologies has become the focus of many scientific studies.

The phosphate free sequestering agent market size is expected to develop revenue and exponential market growth at a remarkable CAGR during the forecast period from 2023–2030. The growth of the market can be attributed to the increasing demand for Phosphate free sequestering agent owning to the Textile Industry, Printing and Dyeing Industry, Paper Industry, Water treatment industry applications across the global level.
Sugar acrylate, a green water treatment agent, has become a research hotspot because of its very good scale inhibition against calcium carbonate and corrosion inhibition. Based on the efficient utilization of water resources, environmental protection, and greenness of water treatment technologies, Sarex has developed a phosphorus-free and nitrogen free sequestering agent, **Chelatin-SA.**

Chelatin-SA is an environmental friendly sequestering agent that is free from nitrogen and phosphorus in the molecular structure starting from Sugar based alcohol as a natural base. It possess very good biodegradability and is employed in a wide range of applications due to its multi-functionality. It can chelate dissolved metal ions to soften water quality, inhibit corrosion of cooling water and prevent scale formation by dispersing organic and inorganic materials. It does not contain nitrogen and phosphorus therefore, water pollution can be minimized. Chelatin-SA, can replace STPP (Sodium Tripolyphosphate) which is a phosphorus containing chelating agent. Compared to EDTA-Na4 (Ethylenediamine Tetra acetic acid sodium salt), DTPA-Na5 (Diethylenetriamine penta acetic acid pentasodium salt), DTPMPA-Na7 (Diethylenetriamine penta methylene phosphonic acid hepta sodium salt) which are phosphorus based sequestering agents, it has very good chelation power, hydroxide dispersibility of metal ions and fibre whiteness.

UNIQUE FEATURES

- Chelatin-SA is a Phosphorous free and Nitrogen free, biodegradable sequestering agent.
- Suitable for Cotton and Polyester / Cotton blend fabric.
- It is stable over wide range of pH from 2-12.
- Exhibits chelating efficiency for calcium and iron even at pH values of 9-11, hence suitable in pre-treatment, dyeing and after treatment.
- It has excellent demineralizing and stabilizing properties and thus it can be used in the scouring process to remove impurities.
- Can be used along with wetting agent for grey boiling.
- In dyeing, it can be used as a sequestering agent and as a dispersing cum leveling agent.
- For dark shades, scouring can be carried out using only Chelatin-SA and wetting agent at 95°C.
- Caustic dosage in bleaching can be reduced by 10-15% leading to lower TDS.
- Can be used along with a soaping agent to avoid precipitation in the bath.
- Increase the durability of optic white in home laundring.
- Calcium Chelation value : 140 - 180 mg $CaCO_3$/gm at pH 12
- Iron chelation value : 200 - 240 mg Fe/gm at pH 11.5-12

EXPERIMENTAL

Experiment to study the Chelation efficacy of Chelatin-SA

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

1. **Beaker A :** Take 500ppm Ferric ion solution + 1% Celldet-R (nonionic detergent)
2. **Beaker B :** Take 500ppm Ferric ion solution + 1% Celldet-R (nonionic detergent) + 3g/l Chelatin-SA

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 ions present in the water and does 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.

- **To study the Dispersing efficiency of Chelatin-SA in hard water**

Reactive dye solution (0.5% C.I. Reactive Orange 122) was prepared in 500 ppm hard water in absence and presence of Chelating agent. 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 dye molecules are in active form.

Blank

1% Chelatin-SA

0.5% Phosphorous based chelating agent

From the above image, it could be clearly seen that the reactive dye has been precipitated out in 500 ppm hard water in absence of Chelating agent. Whereas the reactive dye solution prepared in hard water containing 1% Chelatin-SA does not show precipitation while with 0.5% Phosphorus based sequestering agent still shows precipitation. This clearly indicates the efficiency and high suitability of Chelatin-SA in dyeing.

- **To study the Washing-off efficiency of Chelatin-SA**

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 Chelatin-SA. The staining on adjacent white fabric was checked and assessed.

The Reactive washing off efficiency of Chelatin-SA was evaluated against conventional washing off agent. The staining on adjacent multifibre strip was checked after the completing the soaping treatment.

From the photograph it could be seen that Chelatin-SA also works effectively as a reactive washing off agent.

CONCLUSION

Based on the experimental observations, Chelatin-SA is found to be an excellent sequestering agent possessing very good chelation efficiency, outstanding dispersion property and very good reactive washing off property. Since it as a phosphorous and nitrogen free, it is environmental friendly sequestering agent with good biodegradability, satisfying the current customer demand.

SARADYE-677

Rapid Dyeing Agent For Polyester

In the past decade, world production of polyester staple has grown on an average rate of 6.5% per annum. Global production of polyester staple is expected to rise by an average of 5.4% per year through 2025 compared to 4.1% for other fibers. World production of polyester filament has increased by an average of 8.2% per annum during the past decade. Global filament production is expected to grow at an average annual rate of 7.2% through 2025.

Also the global disperse dyes market is poised to witness substantial growth in the coming years, driven by the rising demand for colouring thermoplastic fibres such as polyester, triacetate, nylon, and other synthetic materials. The market is expected to experience significant growth due to the increasing demand for synthetic and polyester fabrics in a wide range of colours across various end-user industries. The textile sector, as well as the leather, paint and coatings, and plastic industries, are projected to contribute to the growing demand for disperse dyes.

Textiles made up of polyester as self or in blends are extensively used in apparel - suiting, shirting, jackets, sports-wear, work-wear, ladies dress material and home furnishings, and as blankets, furniture upholstery, curtains and other products. The colouration of textiles, be it by dyeing or printing, is an important aspect of the production process and adds value. The specific requirements of colour shade hue and its fastness properties are major quality parameters demanded by end users. So, the contribution of dyestuff pigment industries in wet processing operations is enormous. The global estimated potential of textile dyes and pigment is US$ 5 billion. Currently, polyester occupies a major share in global use of textile substrates as it accounts for more than 50% of the global textile fiber market irrespective the end application. Lot of polyester needing to be pre-washed, dyed and finished, packed and distributed to customers all around the world. This automatically build's up pressure on dye house manager for increasing the productivity while speeding up the process without compromising the dyeing quality. The current situation gives an opportunity to a textile chemical manufacturer to develop an auxiliary which will enable level dyeing under rapid dyeing condition.

In polyester dyeing the liquor is usually heated-up as slow as possible in order to achieve a constant absorption of the disperse dyes and a level dyeing of the goods. Normally, polyester is dyed with low heating rates of 2-3°C/min. up to a temperature of 80°C and only 1°C/min. until the HT dyeing temperature is reached.

Understanding the requirement, Sarex has developed an auxiliary, **Saradye-677**, which is a special leveling agent used during rapid dyeing of polyester. This product will enable level dyeing during rapid dyeing process reducing the duration of entire dyeing process.

Saradye-677 is a highly effective levelling agent specifically developed for the rapid dyeing of polyester. The product enables rapid dyeing of polyester at high heating rates with no adverse effect on the levelness of dyeing thereby saving time, water, energy and cost. Suitable for critical shades or combination dyestuffs. Suitable for yarns and piece goods and all textile forms. This dyeing auxiliary supports the migration of the dyestuff into the fibre. In the HT dyeing range at 130°C, the product has a leveling effect.

During the heating phase, Saradye-677 shows a retarding effect, which causes a gradual exhaustion of the disperse dyestuff onto the polyester fibres. As a result, even at elevated heating rates of up to 5°C/min., the dyes can exhaust evenly onto the goods.

UNIQUE FEATURES

- Enables Rapid dyeing of polyester.
- Much shorter heating up time.
- Improved quality with increased productivity.
- Very good leveling and migration capacity.
- Excellent dispersion property with improved production quality.
- Implementation of reduction clearing in the cooling down dyebath.
- No restrictions concerning types of textile (yarn, piece, floc) and dyeing machines (jet, beam, apparatus, HT-jigger).

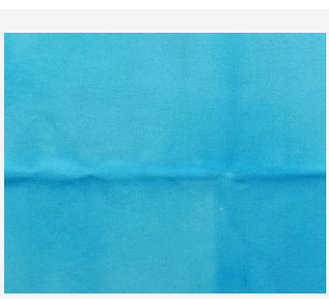
APPLICATION

Recommended dosage of Saradye-677: 1-2 g/l

Conventional Method	Rapid Dyeing Method
30-60°C – 5°C/min. - 6 min.	30-90°C – 5°C/min. - 12 min.
60-110°C – 3°C/min. - 17 min.	90-120°C – 3°C/min. - 10 min.
110-130°C – 0.5°C/min. - 40 min.	120-130°C – 1.5°C/min. - 7 min.
Total - 63 min.	**Total - 29 min.** **(Approximate saving – 34 min.)**

RESULTS

Polyester dyeing with temperature gradient 5°C/min.



Blank

1.6% Saradye-677

From the images, it can be clearly seen that polyester dyeing in presence of Saradye-677 gives uniform and level dyeing even at high heating rates.

In synthetic fibres, polyester production is hitting top position in the world and the demand of it is increasing day by day. It is highly desirable to shorten dyeing time by speeding up the dyeing process and achieving significant exhaustion of the dyebath at the earlier stages of the dyeing. Saradye-677 helps in achieving rapid dyeing without impairing the reproducibility and levelness of the dyeing's further saving the time and thereby increasing the productivity.

SARASOL-AMC

Anti-migrating Agent

In dyeing of a hydrophobic synthetic fibre, a dye sometimes undergoes migration during the drying process, making a uniform dyeing difficult. In thermosol dyeing, where a polyester cloth is padded with a disperse dye, dried and thereafter subjected to a dry heat treatment at a high temperature., it is necessary that the dried fabric after padding should appear uniform and should be free from any un-levelness. Even if a uniform drying is applied, there is this problem that the disperse dye undergoes migration, resulting in occurrence of an uneven dyeing. In case of dyeing a cellulosic cloth, e.g., cotton and hemp, a uniformly applied dyeing solution sometimes undergoes migration in the drying process. For example, in dyeing a cellulosic cloth with a reactive dye according to the pad dry cure method, migration of a dye based on uneven drying in the drying process occurs, resulting in occurrence of an uneven dyeing. Also in the dyeing according to the vat steam process using a vat dye, the migration of a dye in the drying process causes a defective dyeing. In order to address these defective dyeing's resulting from migration of a dye, addition of a viscosity intensifier e.g. sodium alginate has been adopted. However, sodium alginate is expensive and its effect is not yet fully satisfactory. Taking into account the problem faced by the dyeing industry about the uneven dyeing caused due to migration of dyes which has been uniformly applied to the cloth in the preceding stages, Sarex has developed a product Sarasol-AMC, an anti-migrating agent. **Sarasol-AMC** when added in the dyeing bath, slows down the ability of dyestuff to spread into a fabric thereby controlling the dye particle movement during pre-drying phase.

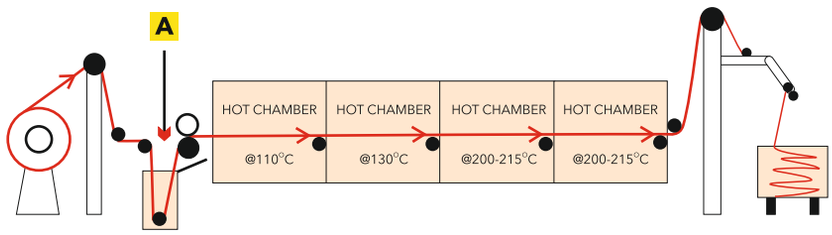
UNIQUE FEATURES

- Anti-migrating agent developed for continuous dyeing of cotton, polyester/cotton as well as polyester/viscose fabrics.
- It prevents migration of dyestuffs during intermediate drying so that shade variation in the front and back as well as centre-selvage is prevented.
- High viscosity with lowest anionicity.
- Suitable for reactive, disperse, pigment and vat for continuous dyeing.
- Does not interfere in shade development and can be easily washed-off.

APPLICATION

Disperse Dyeing : Thermosol Process

Pad → Dry and Thermosol on Hot flue as per the temperature chart

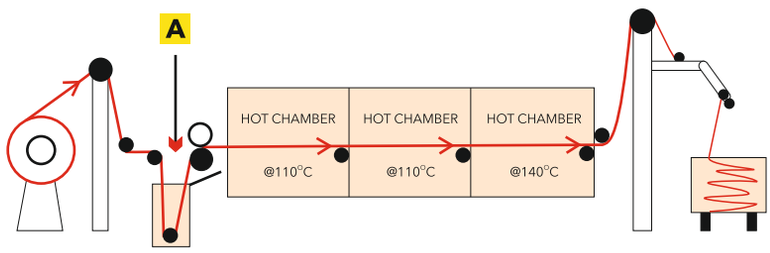


A Recipe

Disperse dye	: x g/l
Sarasol-AMC (Anti-migrating agent)	: 10-20 g/l
Saragen-SO (Dispersing agent)	: 5-10 g/l
Acetic acid	: 2 g/l
Celldet-R (Wetting agent)	: 0.5 g/l

Reactive Dyeing: Pad → Dry → Pad → Steam (PDPS)

Pad → Dry → Followed by development on pad steam

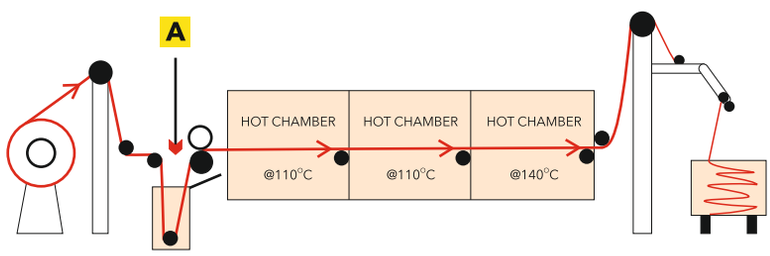


A Recipe

Reactive dye	: x g/l
Super R Salt (Mild oxidising agent)	: 10 g/l
Urea	: 20-50 g/l
Sarasol-AMC (Anti-migrating agent)	: 5-10 g/l
Celldet-R (Wetting agent)	: 0.5 g/l

Pigment Dyeing : Pad → Dry → Cure

Pad → Dry → Followed by finishing on stenter with softener

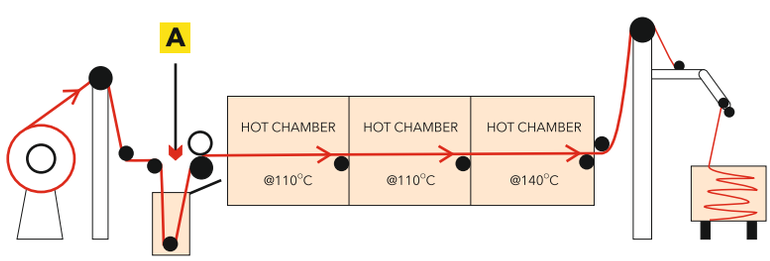


A Recipe

Pigment dye	: x g/l
Sarasol-AMC (Anti-migrating agent)	: 10-20 g/l
Dyeing binder	: 20-40 g/l
Saralink-ULF (Resin)	: 10 g/l
MgCl2	: 15 g/l
Celldet-R (Wetting agent)	: 2 g/l

VAT Dyeing : Pad → Dry → Pad → Steam or Jigger Development

Pad → Dry → Followed by development on Pad-Steamer OR on Jigger machine



A Recipe

Vat dye	: x g/l
Saragen-SO (Dispersing agent)	: 5 g/l
Celldet-R (Wetting agent)	: 2 g/l
Sarasol-AMC (Anti-migrating agent)	: 10-20 g/l

PERFORMANCE DATA

The efficiency of Sarasol-AMC was evaluated by AATCC Test method - 140-2006. This test method provides a means of assessing the migration propensity of a pad liquor system containing dyes or pigments, subsequently referred to as colorants, and which may also contain different types and amounts of migration inhibitors. When drying conditions are not constant and/or uniform, uneven migration may occur, causing shade variations during a run, or shade differences between the face and back, or between side and centre of the fabric.

Polyester/Cotton blend fabric was impregnated with disperse dye and auxiliaries and then padded and dried by partially covering with a watch glass allowing the migration to occur. The degree of migration was evaluated by visual examination of the covered and uncovered portions.

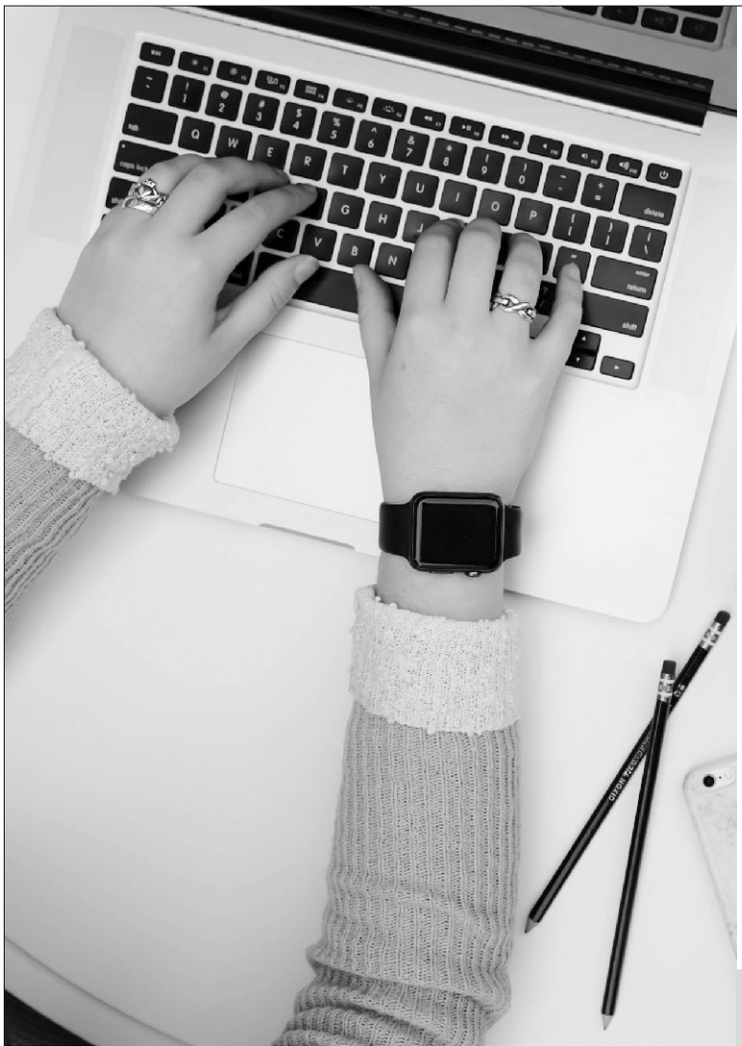
PRODUCT PERFORMANCE

Without Sarasol-AMC

With 10 g/l Sarasol-AMC

Substrate : Polyester / Cotton (67:33)
Dyestuff : C.I. Disperse Red 167 (7 gpl)
% Pick-up : 65%
Thermofixation : 200 °C, 45 sec.

From the performance photograph, the efficiency of Sarasol-AMC is clearly visible which substantially prevents the occurrence of an uneven dyeing by slowing down the migration ability of dyestuff during the pre-drying process.



Sarex

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