



Textile Uses for Dow Chelating Agents

Chelating agents are important tools in all phases of textile processing. Since use in controlling hardness ions and trace heavy metal ions is so varied, only a few of the many applications are discussed.

Scouring Stages

Chelating agents, when employed in all cleansing and preparation stages of a textile finishing operation, perform one or both of the following functions:

- Increase cleaning stage effectiveness
- Remove metal ions that are harmful in subsequent bleaching and dyeing operations.

VERSENE™ 100 Chelating Agent is recommended for the control of:

- Hardness ions above pH 6.0.
- Most divalent heavy metal ions throughout the pH range.
- Ferric ions to below pH 8.0.

Either VERSENOL™ 120 Chelating Agent or Triethanolamine 99 should be considered for ferric iron control at higher pH levels. Based on these considerations, the following recommendations are appropriate:

Cotton

Acid scours: 0.2-0.3% VERSENE 100 (on weight of fabric [O.W.F.]) to remove iron stains.

Wool

Raw wool scouring: 0.3-0.6% VERSENE 100 or VERSENEX™ 80 Chelating Agents

(O.W.F.) added at the second or third soap bowl in the scouring train. Piece goods scouring: 1-2 pounds of VERSENE 100 added to the “dolly” washer in the actual scour. Following scour, close the gates and add 1-2 pounds VERSENE 100 for regeneration of lime soaps and drop bath without further rinse. VERSENE Chelating Agent may be omitted in the scour if present in the fulling soap.

Silk

Degumming bath: 1-2% VERSENE 100 (O.W.F.) to increase soap effectiveness.

Rayon

Scouring: 1% VERSENE 100 (O.W.F.) for hardness ion control.

Boil-off: 0.1-0.4% VERSENE 100 (O.W.F.) to control calcium and magnesium scale.

Synthetic Fabrics

0.5% VERSENE 100 (O.W.F.) plus sodium hydrosulfite at 140-180°F (60-82°C) to strip mordant iron and heavy metals.

Bleaching Stages

Heavy metal ions (Cu^{+2} , Mn^{+2} , Fe^{+3}) cause the catalytic degradation of hydrogen peroxide and other peroxygen compounds used for textile bleaching. In addition to loss of bleaching compound, fiber tenderization results where the mordant/metal-induced catalytic degradation occurs in the fiber.

reduces catalytic degradation and fiber tenderization, resulting in a more stable bleach bath and goods having higher, more uniform tensile strength. Reduction in bleaching costs can also result.

For example, adding VERSENEX 80 at 0.10-0.15% (O.W.F.) to the peroxide saturator in continuous two-stage bleaching of cotton fabric changes the bleach bath composition by:

- Enabling reduction of the peroxide level by 15-20%.
- Enabling reduction of the sodium silicate level from 1.0-0.75% (O.W.F.); additional caustic soda is required to maintain the alkalinity.

These changes, when compared to the previous formula, result in:

- Equivalent brightness.
- Lower ash content.
- Reduced fiber degradation as indicated by lower fluidity values.

Note: In introducing DTPA into a peroxide-containing solution, it is desirable to have DTPA present as its calcium or magnesium chelate. If the hardness level in the dilution water is not sufficient, then salts such as CaCl_2 or MgSO_4 can be added.

Dyeing Stages

Because dyestuffs are sensitive to divalent and trivalent metal ions, the presence of hardness ions (magnesium and calcium), iron, and copper causes problems in textile dyeing. Precipitates may form, and dye shades will vary. Dyes may also contain metal complexes, so the chelating agent chosen should be the one that will not affect the dye composition.

Disperse Dyes

Heavy metal ions such as copper and iron at low parts per million (<1) can be very detrimental to disperse dyes. These metal ions can cause dye shade variation and precipitate formation, which appears as "blue stain" on the fabric. Either VERSENE™ 100 or VERSENOL™ 120 at a level of 0.2-0.5% (O.W.F.) can prevent these problems. It should also be noted that disperse dyes themselves often contain large and varying amounts of heavy metal ion contaminants resulting from lignin sulfonate dispersants used in their formulation. The negative effects of these metal ion contaminants can be counteracted through the addition of a chelating agent.

Vat Dyes, Direct Dyes

Hardness (magnesium and calcium) ions decrease the rubfastness and color yield with these dyes; heavy metal ions (iron and copper) cause substantial dulling and changes in shade. VERSENE 100 Chelating Agent at 0.25-1.0% (O.W.F.) can eliminate the problems caused by the hardness ions and copper; VERSENOL 120 Chelating Agent will also deactivate the iron in this alkaline system. Further brightness and rub-fastness are by using VERSENE 100 Chelating Agent in the soaping-off liquors.

Naphthols

Traces of iron and copper ions catalyze the decomposition of the diazotized amine; magnesium and calcium ions form insoluble salts with naphthol dyes. Use of 0.25-1.0% VERSENE 100 Chelating Agent (O.W.F.) is recommended for both hardness and heavy metal ion control. The chelating agents should be added to the naphtholation bath before applying the naphthol base to the goods. In

addition, VERSENE 100 product should be used in the soaping-off operation for improved brightness.

Acetate Dyes

Poor color yield and "speckling" caused by lime soap formation in acetate dye baths are eliminated by using 1.0% VERSENE 100 (O.W.F.) in the dye bath. Improved leveling and dispersing are obtained and brighter, more uniform colors result.

Sulfur Colors

The use of 0.2-0.3% VERSENE 100 (O.W.F.) in the sulfur dye bath prevents bronzing and crocking. This material reduces color variation and improves color distribution throughout the stock.

Chrome Dyes

Heavy metal ions, particularly iron, copper, and nickel, form complexes with the dyestuff, drastically changing the shade and colorfastness of the dye-chromium complex. Use of 1.0-1.5% VERSENE 100 (O.W.F.) prevents formation of the dye-contaminating metal ion complex. Chrome dyes are seldom affected by VERSENE 100 because the chromium chelate, while extremely stable, is quite slow in forming. However, chromium dyestuffs vary widely in the stability of the dye-chromium complex, and preliminary tests are suggested to insure color is unaffected by the addition of a Dow chelating agent.

Metalized Dyes

Chelating agents are not recommended for this application.

Color Stripping from Dyed Fabrics

Dow chelating agent is used in stripping baths to inactivate metal ion contamination caused by corrosion of the equipment. More uniform and effective stripping then results. The following stripping bath formulas are suggested:

Cotton, Rayon – a formulation of 0.5% caustic soda, 1.0% sodium hydrosulfite, and 0.25% wetting agent (all based on weight of solutions), plus 0.5-1.0% VERSENE 100 Chelating Agent (O.W.F.).

Wool, Silk – addition of 0.5-1.0% VERSENE 100 (O.W.F.) in an acid bath (pH 5.5-7.0) containing zinc hydrosulfite at 160-180°F (71-82°C).

Miscellaneous Textile Uses

Fatty Finishes

VERSENE 100 Chelating Agent (0.1-0.5%) helps to prevent discoloration and rancidity of finish due to metal-caused catalytic oxidation.

Fulling Soaps

VERSENE 100 product at 1-2 ounces per gallon of soap prevents lime soap formation.

Printing Paste

VERSENE 100 product at 0.5-1.0% in the paste formula prevents precipitation.

Rayon Manufacture

Addition of 0.01-0.1% VERSENE 100 Chelating Agent to the viscose dissolves metal silicates and carbonates, and improves filterability. Washing freshly spun viscose rayon in a 0.05-0.20% solution of VERSENE 100 prevents grayness caused by lead sulfide precipitation, tenderization of the cord resulting from precipitation, and subsequent oxidation and hydrolysis of zinc sulfide.

Resin Treatment

VERSENE 100 Chelating Agent at 0.25-0.50% (O.W.F.) in the monomer bath prevents premature polymerization and improves resin fixation, abrasion resistance, and physical properties of the finished fabric.

Rubberizing

Before latex impregnation, washing of the fabric in a bath containing 0.1% (O.W.F.) VERSENE 100 Chelating Agent removes trace metals, preventing discoloration and instability of the finish.

Starch Finishes

Addition of VERSENE 100 Chelating Agent at 0.1-0.5% helps to prevent dulling of starch finishes.

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