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BLEACHING PROCESS

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ABSTRACT OF THE DISCLOSURE

Textile fibers bleached with solutions of chlorocyanuric acids, salts or complexes are soured by contact with an aqueous acidic solution containing hydroxy ethylidene diphosphonic acid, sodium hexametaphosphate, ethylene diamine tetraacetic acid, nitrilotriacetic acid, alkali metal salts of the foregoing acids or mixtures of these compounds as well as the sulfite salts conventionally utilized in souring solutions. The process provides fibers characterized by improved appearance and reduced heat sensitivity.

BACKGROUND OF THE INVENTION

This invention relates to an improved process for bleaching textile materials.

More specifically, this invention is concerned with bleaching processes of the type employing chlorocyanuric acid, salts and complexes as the bleaching agent. Generally, commercial bleaching processes utilizing such agents comprise contacting the fabric to be bleached with a bath containing the agent at temperature, pH, and concentration conditions selected in accordance with the skill of the art depending upon the particular bleaching agent, the textile material, and the degree of bleaching required. Following the bleaching step, the fibers are subjected to an antichlor or "souring" step which comprises contact with a bath containing a sulfite salt to neutralize and/or remove chlorine from the fibers.

SUMMARY OF THE INVENTION

It is an object of this invention to improve processes of the type described so as to enhance the appearance of the fibers treated and decrease their sensitivity to heat.

These objects are accomplished by including hydroxy ethylidene diphosphonic acid, sodium hexametaphosphate, ethylene diamine tetraacetic acid, nitrilotriacetic acid, alkali metal salts of the foregoing acids, or mixtures of these compounds in an aqueous acidic (pH less than 7) souring bath in addition to the sulfite salts conventionally utilized therein. The invention will be understood from the following description of the preferred embodiments.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention described herein constitutes an improvement in conventional commercial processes for bleaching textile fibers with chlorocyanuric acid, salts, and complexes.

Such processes are applicable to any chlorine bleachable textile fibers which may be in the form of slivers, tops, yarns, or fabric.

The fibers are contacted with an aqueous solution of dichlorocyanuric acid, trichlorocyanuric acid, alkali metal salts thereof, complex compounds such as [(mono-tri-

chloro,)tetra-(monopotassium dichloro,)]penta-isocyanurate or (trichloro,)(monopotassium dichloro,)di-isocyanurate disclosed in U.S. Patent 3,150,132 or mixtures thereof according to procedures familiar to those skilled in the bleaching art. In accordance with conventional practice, the bleaching solution may contain various stabilizers for the bleaching agent, surfactants, sequestering agents and the like. The bleaching agent will generally be present in a concentration sufficient to provide 100–1500 parts/million by weight, or more, of available chlorine. The optimum concentration depends upon the textile to be bleached, contact time employed in particular process (usually 10 to 60 minutes), pH (usually 3 to 10.5), temperature (usually 20–100° C.), and degree of bleaching required (less severe bleaching may be required if the textile is to be dyed).

Although information regarding the bleaching step has been set forth to facilitate an understanding of this invention, this step, per se, is well understood in the art and no limitation on the present invention is to be implied from the specific information set forth.

It is pointed out that commercial bleaching operations involve removal of natural fiber color and/or stains and discolorations developed in fiber processing. Therefore, more severe conditions in terms of available chlorine concentration, are required than in household or commercial laundry operations designed to remove less tenacious applied stains. These more severe conditions require the use of a "souring" step to neutralize or remove excess bleaching agent. In the souring step, the fibers, after bleaching, are contacted with an aqueous acidic souring bath containing a sulfite salt such as sodium sulfite or sodium bisulfite.

In accordance with this invention, at least 0.05% and preferably at least 0.1 to 2% by weight of hydroxy ethylidene diphosphonic acid, sodium hexametaphosphate, ethylenediamine tetraacetic acid, nitrilotriacetic acid, alkali metal salts of the foregoing acids, or mixtures of the foregoing is incorporated in the souring bath as a supplemental ingredient in addition to the conventional souring agent or agents. With the exception of the addition of such supplemental agent to the souring bath, the souring operation is carried out in a conventional manner.

The use of such supplementary agent has a twofold beneficial effect. First, fiber appearance as compared to fibers soured in a bath containing no supplement agent, is superior. Further, heat sensitivity (a tendency of the fibers to yellow when exposed to heat, for example in drying, ironing or storage) is reduced.

The practice of the invention and the advantages provided thereby is further illustrated by the following examples.

EXAMPLES I–III

Identical samples of fabric woven from acrylic fibers are bleached by contact for 30 minutes at 195° F. with an aqueous solution containing sufficient trichlorocyanuric acid to provide about 785 parts/million by weight available chlorine. The pH of the bleaching baths is adjusted from 3 to 6 as shown in Table 1 below by use of phosphoric acid or sodium hydroxide. The samples are then rinsed with water acidified to a pH of 3.0 with H_3PO_4. The samples are then soured for 10 minutes in a bath containing the ingredients shown in Table 1 below, and rinsed.

Appearance characteristics of the fabric as measured with a Gardner Color Difference Meter are reported in Table 1. In the table, b^+ is a measure of fabric yellowness and low b^+ numbers are indicative of superior appearance. W is a measure of whiteness and a high W number is desired. The Y.I. number is a measurement indicative of fabric yellowing after exposure to a temperature of 365° F. for 1 minute. A low Y.I. number indicates low heat sensitivity and is therefore desired. The differences in the numbers reported are significant since they represent visually observable differences in fabric appearance.

TABLE 1

		Bleaching pH											
		3			4			5			6		
	Souring bath ingredients	b+	W	Y.I.	b+	W	Y.I.	b+	W	Y.I.	b+	W	Y.I.
Example:													
I	2 grams/liter $NaHSO_3$	1.1	89	0.189	1.0	89	0.190	1.0	89	0.188	1.1	89	0.188
II	2 grams/liter $NaHSO_3$, 2 grams/liter sodium hexametaphosphate.	0.9	90	0.170	0.7	91	0.166	0.6	91	0.167	0.7	91	0.172
III	2 grams/liter $NaHSO_3$, 2 grams/liter 51% hydroxy ethylidene diphosphonic acid.	0.7	91	0.168	0.5	91	0.160	0.5	91	0.161	0.5	91	0.183

Example I above is representative of a bleaching process employing a conventional souring operation. It is seen that improved results are obtained by the process of this invention as represented by Examples II and III.

EXAMPLE IV

The procedure of Examples I–III are repeated using a souring bath containing 2.5 gms./liter $NaHSO_3$ and 3 gms./liter ethylene diamine tetraacetic acid. The sample shows superior appearance and lower heat sensitivity than an identical sample soured in a bath containing only 2.5 gms./liter $NaHSO_3$.

EXAMPLE V

The procedure of Examples I–III is repeated using a souring bath conttaining 3 gms./liter Na_2SO_3 and 3 gms./liter nitrilotriacetic acid. The bleached sample shows superior appearance and lower heat sensitivity than an identical sample soured in a bath containing only 3 gms./liter Na_2SO_3.

EXAMPLE VI

The procedure of Examples I–V is repeated with samples of polyester/cotton fabric and cotton broadcloth being substituted for the acrylic fabric. Similar improvements in the appearance and heat sensitivity of these fabrics are obtained.

EXAMPLE VII

Identical samples of acrylic fiber fabrics are bleached by contact for 40 minutes at 150° F. with a solution containing sufficient dichloroisocyanuric acid to provide an available chlorine content of about 500 parts/million by weight. The samples are then rinsed and soured with souring baths containing ingredients shown in Examples I–III. The samples soured in baths containing sodium hexametaphosphate or hydroxyethylidene diphosphonic acid are superior in terms of appearance and heat sensitivity to samples soured in baths conttaining only $NaHSO_3$.

EXAMPLE VIII

The procedure of Example VII was repeated with the exception that a sufficient quantity of a mixture of [(monotrichloro,) tetra - (monopotassium dichloro,)] di-isocyanurate and (trichloro,) (monopotassium dichloro,) di-isocyanurate to provide an available chlorine concentration of 500 parts/million by weight is substituted for the dichloroisocyanuric acid. Similar results are obtained.

Although this invention has been illustrated by reference to specific embodiments, various modifications within the scope of the appended claims will be apparent to those skilled in the art.

What is claimed is:

1. In a process of bleaching chlorine bleachable textile fibers by contacting said fibers with an aqueous acidic solution of a bleaching agent selected from the group consisting of dichlorocyanuric acid; trichlorocyanuric acid; alkali metal salts of said acids; [(mono-trichloro,) tetra-(monopotassium dichloro,)] penta - isocyanurate; (trichloro,) (monopotassium dichloro,) di-isocyanurate; (trichloro,) (monopotassium dichloro,) di-isocyanurate; and mixtures thereof and thereafter souring said fibers by contacting said fibers with a souring bath which is an aqueous solution of a sulfite salt souring agent, the improvement wherein said souring bath additionally contains at least .05% by weight of a supplemental ingredient selected from the group consisting of hydroxy ethylidene diphosphonic acid, ethylenediamine tetraacetic acid, nitrilotriacetic acid, alkali metal salts of said acids, sodium hexametaphosphate, and mixtures thereof.

2. The process of claim 1 wherein said souring bath contains at least 0.1% by weight of said supplemental ingredient.

3. The process of claim 2 wherein said supplemental ingredient is hydroxy ethylidene diphosphonic acid.

4. The process of claim 2 wherein said supplemental ingredient is ethylene diamine tetraacetic acid.

5. The process of claim 2 wherein said supplemental ingredient is sodium hexametaphosphate.

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