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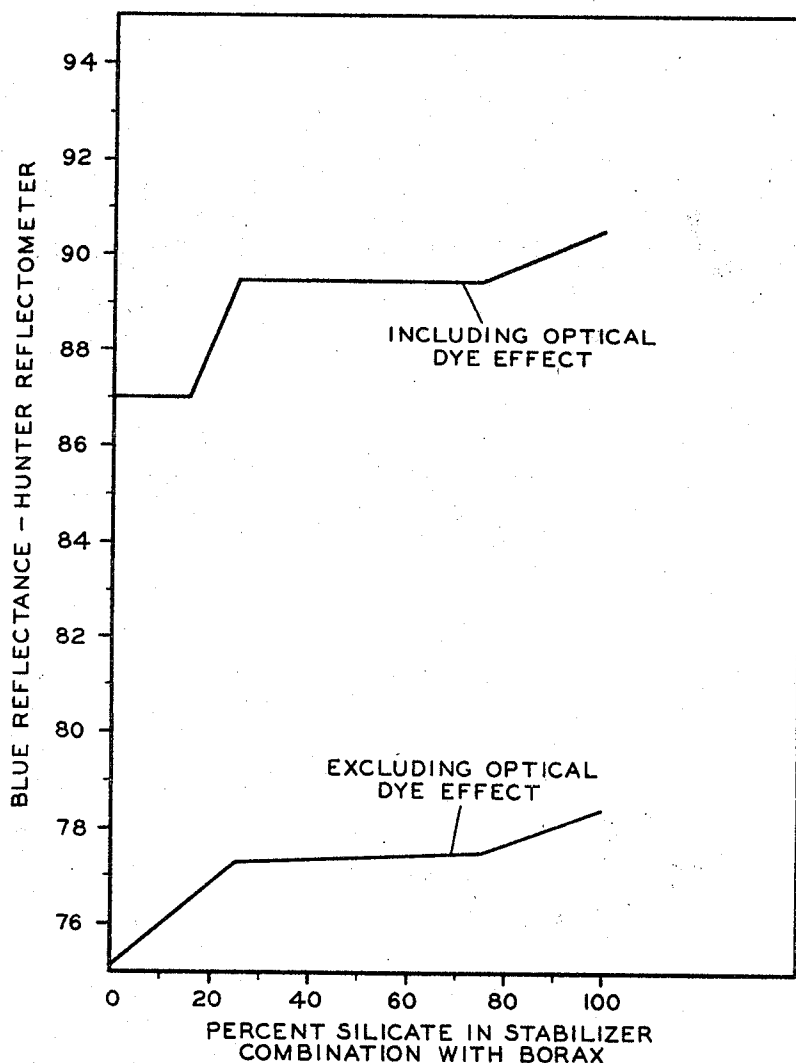
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BORAX-SODIUM SILICATE STABILIZERS FOR PEROXIDE BLEACHING

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BRIGHTNESS RESULTS OBTAINED WITH
VARIOUS COMBINATIONS OF BORAX-SILICATE
STABILIZER



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BORAX-SODIUM SILICATE STABILIZERS FOR PEROXIDE BLEACHING

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6 Claims

ABSTRACT OF THE DISCLOSURE

Invention relates to a bleaching composition and method for bleaching cotton knit goods employing a bleaching composition comprising 2.5 to 3.5 grams per liter of hydrogen peroxide, from about 1 to 6 grams per liter of sodium hydroxide, 6 to 9 grams per liter of borax and a sufficient amount of sodium silicate solution to provide in the bleaching composition from about 0.75 to 1.60 grams per liter SiO_2 and not more than an equal amount of Na_2O derived from said silicate solution.

Alkaline peroxide bleaching solutions must generally be stabilized to prevent excessive decomposition of the peroxide since such decomposition is wasteful, results in poor bleaching and may cause damage to the goods being bleached. Many variances dictate the selection of a particular stabilizer since it has a direct effect not only on the peroxide but on the properties of the bleached fabric product as well.

Bleaching of cotton cloth is not a matter of simply improving the whiteness of the cloth but also involves other properties which are equally as important as whiteness. Cloth can be bleached to a high degree of whiteness by drastic treatment, but good quality cloth should have the following properties: (1) low fluidity, a measure of degradation of the cloth; (2) excellent absorbency, a physical property of the goods which relates to the ability to take up certain liquids into the fibers and which is important in determining the suitability of the fabric for particular uses, particularly when the fabric is to be dyed; and (3) freedom from moths which are seed fragments remaining in the cotton after ginning. The ultimate aim in the bleaching industry is obviously to prepare products which exhibit all of these desirable properties.

Sodium silicate, employed in peroxide bleaching compositions, while being the most effective in giving good overall properties, is frequently objectionable because it presents the serious problem of scaling of equipment which causes bruise marks or tearing of the fabric being bleached. Silicates are also deposited in the fabric which are difficult to remove and subsequently give rise to dyeing difficulties. As a result of these difficulties, the industry has turned to such stabilizers as borax as a substitute for or in combination with sodium silicate. However, bleaches stabilized with borax alone are less effective than sodium silicate-stabilized bleaches in that they produce poorer brightness and slightly poorer mote removal. In the prior combinations wherein borax was substituted for only a small portion of sodium silicate, a large amount of sodium silicate was still present and failed to solve the problem of scaling and silicate deposition. There is therefore a continued need for efficient stabilizers in peroxide bleaching.

It is, therefore, an object of this invention to provide bleaching solutions which will produce fabrics having high absorbencies and brightnesses, low fluidities and good mote removal while substantially reducing the scaling of equipment and deposition of silicates on the cloth.

It is a further object of the invention to provide an efficient bleach composition for bleaching cotton knit

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goods which contains a reduced amount of sodium silicate.

Other objects and advantages will be apparent as the invention is hereafter described in detail.

The above objects are realized by providing a bleaching composition comprising about 2.5 to 3.5 grams per liter of hydrogen peroxide, from about 1 to 6 grams, preferably 3 to 4 grams per liter of sodium hydroxide, 6 to 9 grams per liter of borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$) and sufficient sodium silicate to provide in the bleaching composition from about 0.75 to 1.60 grams per liter, preferably 0.80 to 1.1 grams per liter SiO_2 and not more than an equal amount of Na_2O derived from said silicate solution. It has been found that the resulting peroxide bleach is not only superior to the corresponding bleach stabilized with borax alone, but additionally makes it possible to retain substantially the desirable properties received with sodium silicate while substantially reducing the scaling of equipment and deposition of silicates.

The above compositions are the result of the unexpected discovery that the brightness obtained when employing borax-sodium silicate mixtures is not a linear function of the amount of sodium silicate present in the solution. As illustrated in the drawing, wherein 42° Bé. sodium silicate is employed, the brightness obtained, excluding the optical dye effect, drops one unit as the 42° Bé. sodium silicate content is reduced from 100 to 75%. Then from 75% to 25% 42° Bé. sodium silicate there is a plateau in the curve. Below 25% 42° Bé. sodium silicate the brightness falls off rapidly. The most desirable properties and minimum scaling and deposition result when proportions are employed corresponding to the plateau of the curve. While the reasons for the properties received when operating within this plateau are not known, the improved properties are not the result of the additive effect of the properties of the two stabilizers as will be shown below. The explanation appears to best lie in some coaction or cogeneric effect between borax and sodium silicate within the recited range which does not occur when employing larger amounts of sodium silicate.

For illustrative purposes, the bleaching solutions are employed in a process substantially as disclosed in U.S. Patent 3,142,531 issued July 28, 1964 to S. M. Rogers. The cotton goods are immersed in a bath of an aqueous wetting-out solution containing an optical brightening agent and wetting agent and are then placed in a kier, without rinsing, and bleached with the bleaching composition of this invention.

The brightness of the bleached cotton knit goods was determined using a Hunter D40 Reflectometer using the blue filter.

The capillary absorbency is determined by the following procedure: 1/2-inch strips of conditioned cotton goods, cut in wale direction, are fastened without stretching between prongs projecting from the edge of two disks, spaced about 6 inches apart by means of a supporting rod passing through the center of each disk. The assembly is then placed in a vertical glass cylinder containing 1-1/2 inches of distilled water. At the end of 5 minutes as determined by a stopwatch started simultaneously with placing the assembly in the cylinder, the height of the water absorption in the cotton strips is measured by means of a transparent scale attached to the outside of the cylinder by flexible bands. The zero point is adjusted to the water level and each 1/16 inch rise of water in the fabric is equivalent to 1 point of absorbency. The absorbency test is carried out at 73° F. and a relative humidity of 50%. A capillary absorbency of 25-30 is acceptable and absorbency above 30 is rated excellent.

A measurement of degradation or modification of the cotton fibers due to the chemicals used is very effectively

determined by determining the fluidity of the cotton cellulose dissolved in cuprammonium solution according to a standard procedure as specified in A.A.T.C.C. Test 82-1961. The fluidity values are measured in rhes, reciprocal poises, with values of about 6 being indicative of the degradation of cotton fibers and values below 4 being indicative of superior strength of the fibers.

Mote removal is determined by a visual examination.

The following comparative examples illustrate the invention. The procedure and compounds employed were the same in each case with the variation of amounts as indicated. Seventy grams of greige jersey cotton knit goods having a weight of 2.2 sq. yds./lb. were used. The goods were wet-out in a solution of 3.00 g.p.l. of an isooctyl phenyl polyethoxy ethanol ("Triton X-100") and 0.696 g.p.l. of stilbene disulfonate optical brightener ("Leucophor BS"), for 3 minutes at 180° F. Without washing, the goods were squeezed to a 200% wet pick up and piled in a glass kier. A bleach solution containing 10.00 g.p.l. of 35% hydrogen peroxide, 12.00 g.p.l. of a stabilizer and 1.13 g.p.l. of sodium hydroxide was added, the liquor to cloth ratio in this addition being 1.2:1. The knit goods were bleached for 5 hours at 180° F. Following bleaching, the kier was drained and the goods were given 5-minute circulating rinses with separate portions of hot water, cool water, 2.0 g.p.l. NaHSO₃ and 0.7 g.p.l. NaHSO₃ after which the goods were removed from the kier and washed and dried on pin frames in a forced circulation oven.

TABLE*

Example	1	2	3	4	5	6	7	8	9	10
G.p.l. 42° B _é sodium silicate solution providing	12		9	6	3	2.4	1.8	3	3	3
G.p.l. sodium silicate	4.45		3.32	2.22	1.11	.88	.67	1.12	1.12	1.12
G.p.l. of Na ₂ O	1.27		.94	.64	.32	.25	.19	.32	.32	.32
G.p.l. of SiO ₂	3.18		2.38	1.58	.79	.63	.48	.80	.80	.80
G.p.l. Borax (Na ₂ B ₄ O ₇ ·10H ₂ O)		12	3	6	9	9.6	10.2	8.1	7.2	6
Percentage ratio of silicate solution to borax in stabilizer mixture	100/0	0/100	75/25	50/50	25/75	20/8	15/85	27/73	29.4/70.6	33.3/66.7
Brightness including optical	90.6	87.0	89.5	89.5	89.5	88.1	87	89.3	88.1	88.8
Brightness excluding optical	78.4	75.1	77.5	77.4	77.3	76.9	76.1	77.3	77.2	77.2
Absorbency (Wale)	53	51	52	53	54	51	48	51	55	55
Fluidity (Rhes)	2.0	2.2	1.8	1.8	1.7	1.7	1.7	1.8	1.5	1.5
Mote removal rating	Good+	Good	Good	Good	Good	Good	Good	Fair	Fair	Fair

*Average results of three replicate trials.

Comparison of the results of Examples 1 to 7 shown in the preceding table and the drawing shows that while borax-stabilized bleach gives a brightness of about 3 units lower than the sodium silicate-stabilized bleach, the borax-silicate mixture containing only 25% silicate which is equivalent to only 0.3 weight percent of the bleach solution gives a brightness only 1 unit lower than silicate-stabilized bleach which corresponds to 1.20 weight percent of the bleach solution. With less than 25% sodium silicate, the brightness values drop off sharply to those obtained with borax alone. Examples 8 to 10 illustrate that the borax content can be cut even lower in the combination with good brightness results although sacrificing somewhat the level of the mote removal properties received. In all instances within the described range, the problems of scaling and of silicate deposit, were substantially eliminated.

It is readily apparent from the foregoing that this invention provides a useful, efficient and economical solution to the problem of retaining the advantages of sodium

silicate-stabilized bleach compositions while substantially eliminating the disadvantages normally encountered.

I claim:

1. A bleaching composition for cotton knit goods consisting essentially of from 2.5 to 3.5 grams per liter of hydrogen peroxide, 1 to 6 grams per liter sodium hydroxide, 6 to 9 grams per liter of borax and sufficient sodium silicate solution to provide in the bleaching composition from about 0.75 to 1.60 grams per liter SiO₂ and not more than an equal amount of Na₂O derived from said silicate solution.

2. A composition according to claim 1 wherein said bleaching solution consisting essentially of about 7.2 to 8.1 grams per liter borax and sufficient sodium silicate solution to provide about 0.80 to 1.1 grams per liter of SiO₂ and from 0.32 to about 0.65 gram per liter of Na₂O derived from said silicate solution.

3. A composition according to claim 1 wherein said composition consisting essentially of about 6 grams per liter of borax and sufficient sodium silicate solution to provide about 1.60 grams per liter of SiO₂ and about 0.64 gram per liter of Na₂O derived from said silicate solution.

4. A bleaching composition for cotton knit goods consisting essentially of about 3.5 grams per liter of hydrogen peroxide, 1 gram per liter sodium hydroxide, 9 grams per liter of borax and 3 grams per liter of sodium silicate solution to provide about 0.80 gram per liter of SiO₂ and about 0.32 gram per liter of Na₂O derived from said silicate solution.

5. A method of bleaching cotton knit goods consisting essentially of subjecting said goods to the action of a bleaching composition as defined in claim 1.

6. A method of bleaching cotton knit goods comprising subjecting said goods to the action of a bleaching composition as defined in claim 4.

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