United States Patent Office 3,113,928 Patented Dec. 10, 1963

3,113,928

METHOD OF BLEACHING FIBROUS MATERIAL

Richard C. Davis and Donald C. Wood, St. Joseph, Mich., assignors to Whirlpool Corporation, a corporation of Delaware

No Drawing. Filed Feb. 12, 1960, Ser. No. 8,211
3 Claims. (Cl. 252—187)

This invention relates to a method of bleaching fabric.

It has long been customary in bleaching fabrics to use various well known types of chlorine containing bleaches. These have long been known in the art and are widely used. It has been observed, however, that the use of chlorine containing bleaches sometimes has certain harmful effects. Thus, successive uses have been observed to yellow a white resin treated fabric and sometimes the fabric is weakened and destroyed by an acid action. The usual cause of these two occurrences is that the chlorine is often retained in the fabric to give a yellow appearance and then is slowly released later to form hydrochloric acid which in the presence of moisture weakens and rots the fabric.

These harmful results have been particularly severe with wash and wear fabrics, and particularly wash and wear cotton fabrics, where a cured resin on the fabric gives it its wash and wear characteristics. By wash and wear is meant clothes that can be washed and upon drying are ready to wear with no or very little ironing.

The resins in wash and wear fabrics, and particularly wash and wear cottons, are usually nitrogenous and include such resins as urea formaldehyde, melamine formaldehyde, triazine formaldehyde, triazone formaldehyde, cyclic ethylene urea formaldehyde and acetal resins. Two resins that are most used commercially and that are most effected by the use of chlorine bleaches are melamine formaldehyde and urea formaldehyde resins.

The nitrogenous resin retains chlorine from the chlorine containing bleach and this chlorine often reacts with the nitrogen compound to form a chloramine or chloramide. This reaction of the chlorine not only prevents a successful bleach but also causes a distinct and intense unsightly yellowing of the fabric which is particularly noticeable when the material is a white fabric. Then, during subsequent ironing or storage or wearing the chlorine is released from the resin to weaken and destroy the fabric. This release is slow so that the effect lasts for a considerable time.

The methods and compositions of this invention prevent or greatly reduce the yellowing and the fabric destroying effect of the use of the chlorine containing bleaches.

One of the features of this invention therefore is to provide an improved method of bleaching fabric with a chlorine containing bleach to prevent substantial attack on the fabric by the chlorine.

Another feature of the invention is to provide an improved aqueous bleaching solution that includes a chlorine containing bleach.

Other features and advantages of the invention will be apparent from the following description thereof.

In preventing the above-described harmful effects of the use of a chlorine bleach on fabrics, and particularly on wash and wear cotton fabrics, an amine is associated with the bleach. This amine which is either an aliphatic amine or an alkanolamine or an aliphatic or aromatic ether of an alkanolamine combines chemically with the chlorine as it has a greater affinity for the chlorine than does the material and particularly the resin on the fabric.

Although the chlorine from the bleach is tied up chemically by the amine, it is still available for bleaching action.

The preferred amine is an alkanolamine with the alkyl radical being of relatively low molecular weight, preferably of 2–6 carbon atoms. Typical alkanolamines are

monoethanolamine, diethanolamine, triethanolamine, N-methyl ethanolamine, N-methyl diethanolamine, dimethyl ethanolamine, N,N-diethyl ethanolamine, N-butyl ethanolamine, N,N-dibutyl ethanolamine, N,N-diisopropyl ethanolamine, N-aminoethyl ethanolamine, N-ethyl diethanolamine, benzyl dimethylamine, dimethylamine, phenyl ethanolamine, monoisopropanolamine, diisopropanolamine, mixed isopropanolamines, dibutyl isopropanolamine, morpholine, N-methyl morpholine N-(2-hydroxyethyl)morpholine, 2,6-dimethyl morpholine, N-ethyl morpholine, N-aminopropyl morpholine, N-aminoethyl morpholine and cyclic amines such as piperazine derivatives.

Typical amines are any of the aliphatic amines having an available reactive hydrogen atom. As a necessary characteristic of the amine or ether of this invention is its ability to react with the chlorine from the chlorine containing bleach and is preferably a liquid at ordinary temperatures, and because of the simplicity of the reaction involved and the simplicity of the fundamental requirements of the amine or ether (having a reactive hydrogen and capable of binding chlorine) it is obvious to those skilled in the art to select the required aliphatic amine, alkanolamine or aliphatic or aromatic ether of an alkanolamine. The amine or ether may be incorporated with the chlorine containing bleach or bleaching solution or may be incorporated with the detergent. It may also be used in any other manner desired such as a separate additive to the laundry or bleaching water.

There is no necessity of describing further a wash and wear fabric as these are well known and widely used. However, it may be said that a cotton fabric, for example, is treated with a heat curable resin such as any of those listed above or others and then the resin heat cured to give the fabric a glossy type coating which stiffens the fabric and gives it the ability to recover after deformation.

Example

A section of ordinary white wash and wear cotton fabric of a commercial type containing melamine formaldehyde resin was washed with a solution containing 0.3% of a commercial laundry detergent, specifically sodium lauryl sulfate, 0.015% monoethanolamine and ½ ounce per gallon of 5.25% sodium hypochlorite solution, all percentages being by weight of the solution. Other detergents may be used if desired such as alkyl aryl sulfonate, nonyl phenol ethylene oxide condensate and the like. The fabric was washed and bleached for ten minutes at a solution temperature of 125° F. The fabric was then rinsed at 100° F. for five minutes and finally tumble dried in a commercial dryer until dry to the touch. This same washing and bleaching followed by the same rinsing and drying was repeated. The fabric was hot ironed after each bleaching. Then, the fabric was soaked overnight in the same solution as described above except that the temperature was approximately 70° F. In addition a mustard stain was placed on the fabric to determine whether or not the chlorine of the bleach was readily available for efficient bleaching.

The reflectance values of the fabric before and after each treatment were as follows:

	Rd.	*a*	*b*
Original	89.5	−2.5	+3.8
After 1st Wash	89.0	+1.0	+3.2
After 2nd Wash	91.0	+0.6	+2.6
After Overnight Soak	86.5	+1.5	+1.6

The reflectance data given above was obtained by the use of a Gardner color difference meter. This meter is a reflectance type color difference meter capable of determining the degree of whiteness, the degree of red or green, and the degree of blue or yellow of the fabric tested. An

increasing degree of the "Rd." reading indicates an increasing degree of whiteness. The plus reading of the "*a*" readings indicates the fabric tested is on the "red" side while a minus reading indicates the fabric is on the "green" side. The "*a*" reading is not as important normally as the "*b*" reading. A positive "*b*" reading indicates the fabric is on the "yellow" side while a minus reading, which is normally desired for white fabrics, indicates the fabric is on the "blue" side. A more technical description of this instrument is set forth in Hunter Patent 2,574,264, issued November 6, 1951. The marked drop in yellowing as reflected by the decreasing "*b*" values is contrary to what would occur if the resin were not protected by the amine. The fact that the reduction in yellowing occurred showed that the amine protected against the bad effects of chlorine retention. Furthermore, the last "*b*" value shows that the mustard stain was almost completely eliminated, indicating that the bleach was still quite efficient in its operation. Also, the extensive overnight soaking shows that the amine is not consumed during the reaction but is still available for protection of the fabric.

In order to illustrate the effect where no amine is present, a series of six washings, dryings and ironings under the same conditions as given above was repeated with the same washing solution but containing no amine. The measurements here were as follows:

	Rd.	*a*	*b*
Original Fabric	90.4	+0.4	+3.0
Wash No. 1	90.6	+0.6	+3.7
Wash No. 2	87.6	+0.4	+4.5
Wash No. 3	87.0	−0.8	+6.4
Wash No. 4	86.7	−0.8	+7.9
Wash No. 5	85.8	−0.9	+10.2
Wash No. 6	84.8	−0.9	+11.5

As is seen from the increasing "*b*" values, the cotton fabric follows the expected course and becomes increasingly yellow with repeated bleachings.

The compositions and methods described herein also have been found to protect optical fluorescent dyes from chlorine degradation. Typical optical dyes or brightening agents are illustratively identified by Colour Index Nos. 40630; 36900; 40600; 40620; 40605; 49015; 40640 and 45550. The formulations for these Colour Index numbers appear in volume 2 of the four volume set of Colour Index compiled by the Society of Dyers and Colourists and the Association of Textile Chemists and Colourists, printed and bound by Percy Lund, Humphries & Co., Ltd., Bradford, England.

The compositions and methods of this invention also prevent dye stripping of chlorine-sensitive direct-dyed fabrics. Thus, when a cotton fabric containing 1.0% Calcodur resin fast blue (36FL 44211–01) was washed with the washing solution of the above example there was no visible fading. However, when the same washing solution was used under similar conditions but without the amine, there was very extensive fading. Similar results were obtained with cotton fibers containing direct fast blue (36FN 100% 44211–01 CR–4811–124).

Having described our invention as related to the embodiments set out herein, it is our intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. The method of bleaching a fibrous material containing a chlorine sensitive dye, comprising: subjecting said material to an aqueous solution of a water soluble hypochlorite bleach containing a member of the group consisting of aliphatic amines and alkanolamines, said member being of low molecular weight to be water soluble, being present in an amount of at least 0.005% by weight of the bleach on a dry basis and having an available hydrogen for reacting with the chlorine of said hypochlorite bleach.

2. The method of bleaching a fibrous material containing a chlorine sensitive dye, comprising: subjecting said material to an aqueous solution of a sodium hypochlorite bleach containing an aliphatic amine, said amine being of low molecular weight to be water soluble, being present in an amount of at least 0.005% by weight of the bleach on a dry basis and having an available hydrogen for reacting with the chlorine of said sodium hypochlorite bleach.

3. The method of bleaching a fibrous material containing a chlorine sensitive dye, comprising: subjecting said material to an aqueous solution of a sodium hypochlorite bleach containing an alkanolamine, said alkanolamine being of low molecular weight to be water soluble, being present in an amount of at least 0.005% by weight of the bleach on a dry basis and having an available hydrogen for reacting with the chlorine of said sodium hypochlorite bleach.

References Cited in the file of this patent

UNITED STATES PATENTS

2,810,717 Lamborn ---------- Oct. 22, 1957