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BLEACHING FIBER

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The present invention relates to a method of bleaching natural and artificial fibers and/or filaments and more particularly to a method of bleaching such fibers and/or filaments with alkaline solutions containing hydrogen peroxide at room temperature.

Heretofore it has been deemed necessary to subject natural or artificial fibers to immersion in peroxide in bleaching processes in order to effect the desired results, necessitating the use of various bleaching solutions, addition of compounds to the bath, expensive and cumbersome apparatus and usually prolonged heating.

In my present invention I am able to bleach either animal or vegetable fibers readily and expeditiously with a minimum of equipment and without the necessity of prolonged immersion or heating. The bleached fibers obtained are of an exceptional whiteness, possess in most cases enhanced physical properties such as greater tensile strength, better "handle" and freedom from injury or tenderness. In the treatment of certain classes of fibers, they are left in excellent condition heretofore thought impossible on a practical scale since the action of the bleaching solution is effected at normal or room temperatures and this eliminates the catalytic effects which take place at elevated temperatures in peroxide solutions.

In accordance with my invention, the goods after they have been preliminarily cleaned or treated according to the usual known practices as for instance souring, scouring, desizing, boiling, desulphurizing, degumming or other usual preliminary cleaning actions, or preliminarily treated with alkaline or acid hypochlorite solutions, alkaline or acid sulphite solutions, hydrosulphites, permanganates, chromates, chlorates, and similar oxidizing or reducing agents, are treated with an alkaline solution of hydrogen peroxide at room or normal temperature by any method whereby the fabric or fiber whether as raw stock, carded, spun, woven, knitted or felted, is thoroughly wet out or saturated with the desired bleaching solution. This step will usually include a saturation of the goods, such as by immersion or immersions in the bleaching solution, and an elimination of the surplus bleaching solution above that necessary to saturate the same by any well known means as for instance by squeezing or hydroextracting or by any known device or method, or the goods are saturated by any other convenient methods and permitted to stand in the saturated condition until the desired bleached result is obtained. This desired bleached condition is obtained after a period of from several minutes or up to 24 hours or more whereupon the goods are rinsed or the residual solution otherwise removed. It will, of course, be understood that the surplus bleaching solution squeezed or hydroextracted from the goods may be returned to the main bulk of the bleaching solution and thereafter used to bleach further batches of goods.

To those who are acquainted with bleaching procedures, it will be understood that in some cases a preliminary treatment of the fiber is not necessary, as my process will be effective on fibers as they appear naturally or come from certain manufacturing processes without the preliminary cleaning or chemical treatment.

A composition of bath which I have found effective in bleaching animal fibers or filaments, whether in the raw state or as prepared goods, contains an alkali in addition to water and hydrogen peroxide. This alkali may include materials acting as stabilizers for the hydrogen peroxide solution and may include, among others, silicates of soda, phosphates such as sodium pyro-phosphate, tri-sodium phosphate, di-sodium phosphate, sodium-bicarbonate and borax. It will, of course, be understood that additional chemicals or stabilizers, not necessarily alkaline in character, may be added to the bath, and other alkaline materials used to obtain the desired alkalinity of the solution. These may include the materials mentioned above as well as the usual and well known alkaline substances used in bleaching operations such as caustic soda, soda ash, ammonia, etc. Depending upon the type of goods, their previous treatment and history, bleaching assistants may also be included in the bath and among them may be mentioned soaps, sulphonated oils, solvents of various kinds and "wetting-out" agents.

As a typical example of a solution suitable for bleaching animal, vegetable or artificial fibers, I have effectively bleached such fibers with a formulated solution containing:

Water	gals	90
Silicate of soda 42° Bé	lbs	5 to 25
Hydrogen peroxide, 100 volume	gals	10

The hydrogen peroxide used in the above formula is a commercial product wherein one volume of the hydrogen peroxide will, upon decomposition into water and oxygen, produce one hundred

volumes of oxygen gas at standard temperature and pressure.

The goods are saturated with the bleaching solution, the surplus bleaching solution above that necessary to saturate the goods is removed and the goods permitted to stand in the saturated condition until the desired degree of bleaching is effected. I have found that piece goods may be effectively bleached after saturation by winding them upon rolls. The saturated goods may be stacked, piled or stored in any convenient manner in a box, bin or movable container or even on the floor of or in any suitable chamber.

Effective hydrogen peroxide bleaching is very often obtained in accordance with my invention by subjecting the goods to a double treatment. This is more particularly true in those cases where yarn is treated which would, in accordance with the older and well known methods of bleaching require a double hydrogen peroxide "boil" such as is done in the bleaching of certain types of cotton yarn.

The first steep is carried out with a solution containing, as an example:

In 1000 ccs. or 1 liter of the aqueous solution

Caustic soda	gs.	10
Silicate of soda (42° Bé.)	ccs.	30
Hydrogen peroxide 100 volume	ccs.	20

The goods are saturated with this bleaching solution, the excess of the solution expressed or eliminated whereby the goods retain from 50 to 130% or more of their original weight, or the goods saturated by any other convenient method. They are then permitted to stand in this saturated condition from 8 to 16 hours, although the time may fall without these limits depending upon the type of goods, concentration of the chemicals in the solution, then rinsed and subjected to a second steep in a solution of the following composition:

Caustic soda	gs.	20
Silicate of soda (42° Bé.)	ccs.	60
Hydrogen peroxide 100 volume	ccs.	40
Water to make 1000 ccs. of solution		

The goods are saturated and treated in a manner similar to that described for the first steep, the steeping operation requiring 2 to 12 hours. The goods are then thoroughly rinsed with water and dried and finished in the usual manner.

In many cases where the cotton contains a considerable amount of impurities such as motes, cotton seeds, stains, dirt and other undesirable foreign matter, it is advisable to boil the goods at first either at an atmospheric or higher pressure with alkaline solutions in the usual way. It is also advisable sometimes, especially in cases where the goods contain a considerable amount of size, to remove the size according to one of the usual methods. Preliminary treatment with "wetting-out" agents which might be used in the boil will help to produce a more even and uniform result on the goods when they are subsequently bleached by my method.

My process is adaptable for use in bleaching goods containing colored portions (cotton, linen, etc.). I have found in practical operation that if the goods are given one or more treatments with a solution of the composition described above the danger of bleeding or fading of colors is very considerably minimized.

Goods which have been mercerized may be bleached by my process without removing caustic soda remaining in the goods after they come from the mercerizing machines. This will also eliminate the usual souring of such goods.

In case of linen, ramie, jute, artificial silk and other natural or regenerated vegetable fibers I have found a steep at room temperature effective wherever a hot prolonged boil with alkaline peroxide would formerly have been necessary to obtain a desirable bleach. I have found that my process eliminates many preliminary, intermediate or final steps, in the wet processing of all fibers.

The process is also adaptable to bleaching of wood and other pulp such as is used in the paper or related industries. It also is suitable for bleaching unified artificial products made or manufactured from vegetable or related materials, such as cellophane, nitrocellulose, collodion and others.

In the bleaching of wool, as for instance wool top, the top, whether scoured or unscoured, is saturated with a suitable peroxide bleaching solution, the surplus removed, as for example by hydro-extraction, and the saturated top allowed to bleach at room temperature until the desired shade is obtained which may require from several minutes to several hours depending upon the character of the wool and its previous treatment and on the type and concentration of bleaching solution. In the case of wool I have found it advantageous to use a bleaching solution made in accordance with the following composition which is illustrative and not limitative. It will be understood that any alkalis or combinations of alkalis that do not render the solution so alkaline as to tender or yellow the goods may be used.

Water	gals.	90
Pyrophosphate	lbs.	2 to 10
Ammonia (aqueous)	lbs.	2 to 10
100 volume peroxide	gals.	10

I have found that very effective bleaching is obtained upon real silks, mohairs, alpaca, camel hairs, in fact all animal fibers, by subjecting to the same treatment and bleaching solution as described above for wool. It will, of course, be understood that goods containing mixtures of any of the above fibers such as silk and cotton, silk and wool and others can be treated by my process to produce similar excellent results.

From the results of my experiments, I have found that variations in strength and concentration of the added chemical may be made over a rather wide range depending upon the type of goods being treated and upon their previous history and treatment. In general, where the concentration of the alkaline materials is increased above those quantities given in the examples, less hydrogen peroxide need be used and vice versa. Further, it will be understood that although I have specifically illustrated the improved bleaching process by mentioning hydrogen peroxide, I have found that certain other chemicals developing active oxygen in such solutions may be used by making the proper substitution, due regard being had for the quantity of available oxygen; as materials suitable for such substitution I may mention sodium peroxide and the per salts such as perborates, per carbonates, per silicates and persulfates among others. It will be noted that I have illustrated bleaching solutions so high in alkalinity and peroxide that were such solutions used in the present methods of bleaching animal and vegetable fibers such fibers would be injured to such an extent as to render them

commercially valueless if they are not actually destroyed. Prolonged circulation of such solutions over or contact of the goods with solutions of the high concentrations that I recommend is to be avoided as by saturating the goods to produce the damp condition, I have sufficient active bleaching solution in contact therewith to carry the bleaching action to the desired point at room temperature without the dangers to which excess of such reagents would subject the fibers.

The term "room temperature" is used herein to describe a range of temperature normally encountered in a plant and may be as high as 115° F. Where such high temperatures are encountered, the time of steeping will be less than that required at lower temperatures in order to obtain a full or standard white.

In all bleaching operations, the most difficult and dangerous problem is that of obtaining the maximum whiteness without injury to the fibers. Thus where it is desired to obtain a full white or complete bleach, say for instance a 100% bleach, it is usually rather a simple problem, irrespective of the method of bleaching used to obtain a 75% bleach; the real difficulty is to effect the last 25% action to get the 100% bleach without damaging the goods. By my method, full bleaching to effect the 100% bleach is obtainable readily in a few hours without the necessity of using heat during the bleaching action or of using expensive liquid circulating apparatus.

Where the term "high concentration of peroxide" is used in the claims, a concentration of peroxide is meant wherein the amount of peroxide, calculated as hydrogen peroxide, is greater than about 1% of hydrogen peroxide.

The term "moist condition" or "damp condition" as used in the claims means a condition where the goods contain at least 50% by weight of liquid but are not immersed in the liquid.

I claim:

1. The process of bleaching goods of the group consisting of artificial, animal and vegetable fibers which comprises saturating the fibers with a bleaching solution comprising a high concentration of peroxide, eliminating the excess of the bleaching solution from the fibers so that the goods are damp, thereafter stacking the goods to maintain the fibers damp, and permitting the fibers to bleach in the damp condition.

2. The process of bleaching goods of the group consisting of artificial, animal and vegetable fibers which comprises incorporating sufficient bleaching solution containing a high concentration of peroxide in the fibers to render the same damp, thereafter stacking the goods to maintain the fibers damp and permitting the fibers to bleach in the damp condition.

3. The process of bleaching goods of the group consisting of artificial, animal and vegetable fibers which comprises incorporating sufficient bleaching solution containing a high concentration of peroxide in the fibers to render the same damp, thereafter stacking the goods to maintain the same moist but out of contact of additional bleaching solution and permitting the fibers to bleach in the damp condition.

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