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FIP8309 OR 2,173,474
CATION OF TEXTILES & FIBERS

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BLEACHING

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6 Claims. (Cl. 8—111)

This invention relates to a process of bleaching natural and artificial fibres of all types. More specifically the invention relates to a process of bleaching such natural or artificial fibres with a solution, preferably an acid solution, of hydrogen peroxide.

The method of bleaching in accordance with this invention is adapted for the bleaching of any type of natural or artificial fibre, as, for example, animal fibres such as wool and silk, vegetable fibres such as cotton and linen, and artificial fibres such as filaments of cellulose (rayon) or cellulose acetate. These natural and artificial fibres may be bleached in accordance with this invention either as raw stock or as carded, spun, woven, knitted or felted to form a fabric.

Heretofore it has been assumed that hydrogen peroxide was only effective in the bleaching of fibres of this character under alkaline conditions, and it is generally stated that acid bleaching is unsatisfactory both because of deterioration of the product or of the bleaching solution, or because of the impossibility of obtaining a satisfactory bleach.

I have found, however, that under certain conditions, which will be hereinafter described in detail, it is possible to bleach natural and artificial fibres of the character outlined above by the use of acid, aqueous solutions of hydrogen peroxide, and to obtain by such bleaching procedure not only a more satisfactory product, but one which can be produced at much less cost than by any other form of bleaching. The product produced by bleaching with acid solutions of hydrogen peroxide in accordance with my invention possesses a higher degree of whiteness than that produced by any other method of bleaching with hydrogen peroxide, and the procedure in accordance with my invention is much more economical than other methods of bleaching with hydrogen peroxide, more particularly in that, first, the stability of the bleaching bath is much greater, with consequent lower cost of chemicals per unit of material bleached, and the step of rinsing the fibres after treatment with the hydrogen peroxide solution, heretofore necessary in all full bleaching operations involving hydrogen peroxide, is not necessary in accordance with my invention, with consequent considerable saving in time and labor.

The improved bleaching process in accordance with my invention involves essentially the saturation of the fibres or fabric to be bleached with an acid solution of hydrogen peroxide at a temperature not substantially in excess of 100° F., the removal of excess solution from the saturated material, the maintenance of the thus treated material in moist condition, i. e., moistened by that portion of the bleaching solution not removed, for a sufficient period of time for the bleaching action to be completed, and the final drying of the treated material, if desired, without rinsing.

The acid solution of hydrogen peroxide used for bleaching in accordance with this invention will advantageously have a hydrogen peroxide concentration, measured in volumes, of from about one and one-half to about twenty-four volumes. (The designation of the concentration of hydrogen peroxide in terms of "volume" is conventional. The term refers to the number of volumes of oxygen gas at N. T. P. which will be produced upon decomposition of one volume of the hydrogen peroxide solution into water and oxygen. Thus, one volume of a 1-volume solution of hydrogen peroxide will produce one volume of oxygen gas at N. T. P., while one volume of a 10-volume solution will produce ten volumes of oxygen at N. T. P.). The use of a hydrogen peroxide solution of lower concentration than one and one-half volumes does not ordinarily produce satisfactory bleaching in accordance with my invention, and when the concentration of hydrogen peroxide solution is increased above fourteen volumes, the color of the bleached product, although satisfactory, is somewhat pinkish in shade. With increase in concentration of the hydrogen peroxide solution from two volumes up to fourteen volumes, the whiteness of the bleached product increases, so that preferably, in accordance with my invention, a hydrogen peroxide solution having a concentration of from six to fourteen volumes will be employed.

The hydrogen peroxide solution used may be made acid by the addition of any stable acid such as, for example, sulfuric acid, phosphoric acid, hydrochloric acid, etc. The acid will desirably be used in quantity sufficient to give the solution of hydrogen peroxide a pH value of from 4.0 to 7. If the hydrogen peroxide solution has a higher acidity than pH 4, the rate of decomposition of the solution increases, and likewise the whiteness of the product obtained by the bleaching decreases. Similarly, the rate of decomposition of the bleaching bath increases and the whiteness decreases when the acidity of the hydrogen peroxide solution used falls below a pH of about 5.5, although satisfactory results can be obtained with an acidity as low as even pH 6.5 or 7. Preferably, however, in accordance

with my invention, for the best results in bleaching and greatest economy, the hydrogen peroxide solution used will have a pH value of 4.5–5.5.

The temperature of the bleaching solution must in no case substantially exceed 100° F., since I have found that at higher temperatures the bleaching action is substantially completed during the saturation step; and accordingly, the benefits of the slow bleaching action obtained in the moist material in accordance with my invention are not realized. Below this temperature limit the temperature of the solution is not so critical, although with higher temperatures the rate of decomposition of the solution increases without any compensating advantages. Accordingly, I prefer to use a temperature below 90° F., and indeed in most cases of from about 50° F. to about 60° F., although this is primarily for purposes of economy; and the bleaching procedure in accordance with my invention may, as indicated, be carried out at considerably lower or higher temperatures than those indicated above as most preferable, so long as the temperature does not substantially exceed 100° F.

As indicated, in bleaching the natural or artificial fibres or fabrics made therefrom in accordance with my invention, the material to be bleached will be immersed in an acid solution of hydrogen peroxide of the character indicated maintained at a temperature not substantially above 100° F. for only a brief period of time, sufficient to thoroughly saturate the material with the solution. This period may be as short as one minute, or perhaps as long as five minutes. The material will then be removed from the bath and the excess solution removed from the material and returned to the bath, as by squeezing or centrifuging, so as to obtain a product which is only moistened with the bleaching solution. The moistened product will be permitted to remain in this condition for a sufficient length of time for the bleaching action to become completed, a period which will average about twelve hours but may run as high as twenty-four hours, and in some instances may be complete in as short a period as two hours.

The temperature of the material during this aging treatment is not very critical, although I have noted that at temperatures below 40° F. a lesser degree of whiteness is obtained, and likewise at temperatures about 110° F. the degree of whiteness obtained is somewhat less. Accordingly, I prefer to have the aging treatment carried out at a temperature of about 50° to about 80° F.

When the aging treatment is completed, the material may be directly dried without first being rinsed. This is distinctly novel, since in no full bleaching treatment with which I am familiar is it possible to dry the material after it has been treated with the bleaching solution without first thoroughly rinsing it to remove all traces of such solution. Obviously the ability to dry the bleached material directly as in accordance with my invention is a great advantage in saving labor and handling costs. Of course, it is to be understood that if desired the bleached material after the aging step has been finished may be rinsed without departing from the scope of my invention, but such rinsing is not necessary in order to obtain a final product of the desired degree of whiteness, stability, and neutrality.

The following examples give the composition of bleaching solutions which I have found to be extremely satisfactory in the bleaching of animal fibres such as, for example, wool, in accordance with my invention:

Solution No. 1

Water	gallons	1000
Hydrogen peroxide (100-volume)	do	22
Sulfuric acid (concentration: 96%)	pound	1

This solution will have a hydrogen peroxide concentration of two volumes and a pH of approximately 6.0.

Solution No. 2

Water	gallons	1000
Hydrogen peroxide (100-volume)	do	222
Sulfuric acid (concentration: 96%)	pounds	2

This solution will have a hydrogen peroxide concentration of 20 volumes and a pH of approximately 4.0.

Solution No. 3

Water	gallons	1000
Hydrogen peroxide (100-volume)	do	111
Sulfuric acid (concentration: 96%)	pounds	1½

This solution will have a hydrogen peroxide concentration of 10 volumes and a pH of approximately 5.0.

While the bleaching may be carried out in accordance with my invention by a batch procedure, the invention is peculiarly adapted for continuous bleaching. Thus, the material to be bleached, after being passed through successive baths in which it is scoured, washed and rinsed, may be passed directly to a tank or other container containing an acid solution of hydrogen peroxide of the character specified, from which tank it may be passed out through squeeze rolls, which will remove the excess solution and, for example, placed upon a slowly moving conveyor, upon which it will remain for such period of time, as, for example, twelve hours, as is required for the bleaching action to be completed, and from which conveyor it will be discharged directly to a dryer. Obviously the continuous bleaching treatment may be effected in many other ways; and since continuous bleaching as such is old and forms no part of the present invention, it is thought to be unnecessary to refer in any greater detail to such procedure beyond pointing out that, because of the fact that it is only necessary to immerse the material in the bleaching bath in accordance with my invention for an extremely short period of time, the process is peculiarly adapted to continuous bleaching.

It will be understood, of course, that the material to be bleached, before being placed in the bleaching bath, in accordance with my invention may be given any usual preliminary treatment as scouring, boiling, washing, rinsing, etc., which is customary in the bleaching art. I have found that an enhanced bleaching action is effected in accordance with my invention if the fibres, before they pass into the bleaching bath comprising an acid solution of hydrogen peroxide, are very slightly alkaline in character. The alkalinity in no case should be sufficient to alter the acid character of the bleaching bath or cause the material after it has passed through the bleaching bath to remain alkaline. This effect may be most easily accomplished where a preliminary washing or rinsing is involved by adding a mild alkali, as, for example, sodium carbonate, to the rinsing

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bath in, for example, a proportion of about one-quarter pound sodium carbonate to one hundred gallons of water.

The method of bleaching in accordance with this invention, while adapted for the bleaching of all natural and artificial fibres or fabrics made therefrom, is especially adapted for the bleaching of animal fibres such as wool; and I have found that I am able to obtain, when bleaching raw wool in accordance with my invention, a higher degree of whiteness than may be obtained by any other method of bleaching heretofore used in the art.

It will be appreciated that the details and examples hereinbefore set forth are illustrative only and in no way limit the scope of my invention as herein broadly described and claimed.

This application is filed as, and constitutes, a continuation-in-part of my copending application Serial No. 217,225, filed July 2, 1938.

What I claim and desire to protect by Letters Patent is:

1. The process of bleaching materials of the group consisting of animal, vegetable, and artificial fibres which comprises wetting the material at a temperature not substantially in excess of 100° F. with a sufficient quantity of an acid, aqueous solution of hydrogen peroxide to render the material moist, maintaining the material moist for a period of not less than two hours and until the bleaching action is substantially complete, and then drying the material.

2. The process of bleaching wool which comprises wetting the wool at a temperature not substantially in excess of 100° F. with a sufficient quantity of an acid, aqueous solution of hydrogen peroxide to render the wool moist, maintaining the wool moist for a period of not less than two hours and until the bleaching action is substantially complete, and then drying the wool.

3. The process of bleaching materials of the group consisting of animal, vegetable, and artificial fibres which comprises wetting the material at a temperature not substantially in excess of 100° F. with a sufficient quantity of an acid, aqueous solution of hydrogen peroxide, having a pH value of from about 4.5 to about 5.5 and a peroxide strength measured in terms of "volume" of from about 6 to about 14 volumes, to render the material moist, maintaining the material moist for a period of time not less than two hours and until the bleaching action is substantially complete, and then drying the material.

4. The process of bleaching wool which comprises wetting the wool at a temperature not substantially in excess of 100° F. with a sufficient quantity of an acid, aqueous solution of hydrogen peroxide, having a pH value of from about 4.5 to about 5.5 and a peroxide strength measured in terms of "volume" of from about 6 to about 14 volumes, to render the wool moist, maintaining the wool moist for a period of time not less than two hours and until the bleaching action is substantially complete, and then drying the wool.

5. The proces of bleaching materials of the group consisting of animal, vegetable, and artificial fibres which comprises continuously passing the material into a bleaching bath comprising an acid, aqueous solution of hydrogen peroxide maintained at a temperature not substantially in excess of 100° F., continuously removing the material from said bath after a short immersion therein, removing excess solution carried by the material so as to leave it merely moist, maintaining the material moist for a period of not less than two hours and until the bleaching action is substantially complete, and then drying the material.

6. The process of bleaching materials of the group consisting of animal, vegetable, and artificial fibres which comprises wetting the material at a temperature of from about 50° F. to about 60° F. with a sufficient quantity of an acid, aqueous solution of hydrogen peroxide to render the material moist, maintaining the material moist for a period of not less than two hours and until the bleaching action is substantially complete, and then drying the material.

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