United States Patent Office 3,534,454
Patented Oct. 20, 1970

3,534,454

PROCESS OF PRODUCING NON-WOVEN FABRICS FROM MODIFIED COLLAGEN FIBERS

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No Drawing. Filed Feb. 7, 1969, Ser. No. 797,687
Int. Cl. D04h 18/00
U.S. Cl. 28—72.2 2 Claims

ABSTRACT OF THE DISCLOSURE

A process for the production of modified collagen fibers from a split hide comprising the steps of immersing a split hide in lime-milk for more than 8 days, subjecting the immersed split hide to a bating treatment with Bacillus protease, treating the bated hide with a solution of 10% sodium chloride and 10% calcium chloride to remove the foreign matter, proteins and mucoids therefrom, thereby loosening the bundles of fibers of the hide, treating the hide with formaldehyde and a fish oil in which hydrogen peroxide is dissolved to modify a part of the amino group of the collagen fibers, treat-in the split leather to loosen mechanically the fibers, and pressing the resulting leather against needle-cloth to disintegrate it into modified collagen fibers.

The present invention relates to a process for the production of modified collagen fibers from split hides and to a process for the production of non-woven-fabrics from such collagen fibers.

It is one object of the present invention to provide a process for the production of modified collagen fibers from split hides having poor utility taken from the shoulder or belly portion, comprising the steps of subjecting the hide to a bating treatment with Bacillus protease thereafter modifying a part of the amino group in the hide with formalin and a fish oil in which hydrogen peroxide is dissolved to impart water-absorbability, water-retention and some degree of heat-stability, and disintegrating the thus-treated hide into modified collagen fibers. It is another object of the present invention to provide a process for the production of non-woven collagen fabrics having a particularly high water-absorbability by blending the above-obtained modified collagen fibers with natural or artificial fibers to form a web and, taking advantage of the heat-shrinking quality of the fibers, felting the resulting web mechanically.

Heretofore, the present inventor has conducted research into the process for preparing chrome collagen fibers from chrome split leather or collagen fibers from split leather. However, the chrom collagen fibers obtained from the treated chrome split leather are inferior in water-absorbability due to the leather having been modified by chrome, and, therefore, the use of the fibers is limited. On the other hand, fibers obtained from the untreated leather exhibit high water-absorbability, but, since the leather has not been modified, the fibers undergo heat-changes and become gelatinized, and, therefore, are defective as raw materials for industrial use.

The modified collagen fibers obtained in accordance with the process of this invention are soft and exhibit excellent water-absorbability, good water-retention and ability to be dyed which are superior to those of any other fibers. The non-woven fabrics made from the fibers are similar to buckskin in apperance, and exhibit the same characteristics as chamois leather, but are higher in water-draining than the chamois leather.

It is another object of the present invention to provide a process for easily producing modified collagen fibers from hides of poor utility, the fibers being white in color and easily dyeable, having water-absorbability, water-retention and some degree of heat stability, and, therefore, being valuable in practical use.

It is yet another object of the present invention to provide a process for easily producing non-woven collagen fabrics particularly superior in water-absorbability, by blending the above modified collagen fibers with other appropriate fibers.

The raw material comprising split hide is first immersed in a lime-milk, thereby loosening the bundle of collagen fibers. The lime acts chemically on the hide to allow the peptide bonds which mainly constitute the collagen fibers to undergo changes by hydroxy ions during the first four days, and as a result the collagen fiber bundle remarkably loosens. It is preferable therefore to conduct the liming of the split hide for more than 8 days (Okamura and Kawamura; Japanese Journal of Zoo-Techanical Science, pp. 38, 385, 1967).

The split hide thus limed is then deashed with ammonium chloride and thereafter subjected to a bating treatment with a high-unit Bacillus protease to cleave the foreign matter, proteins and mucoids, from the collagen bonds. The thus treated hide is thoroughly washed with water and then treated with a 10% solution of sodium chloride and a 10% solution of calcium chloride, whereby the foreign matter, proteins and mucoids, can substantially be removed from the hide. It is necessary that the above treatment for removing the foreign matters is carried out after the bating treatment. The thus treated hide is then dashed completely with ammonium chloride and washed with water.

The resulting split hide is next treated with formalin and a fish oil in which hydrogen peroxide is dissolved to modify a part of the amino group, as in the case of oil tanning, and thereafter dried. Any excess fish oil is removed from the hide with a non-ionic surface active agent, and thereafter the hide is half-dried, followed by loosening the fiber bonds thereof by mechanical means such as staking, beating and the like.

The leather is then pressed in a conventional manner against a roll covered with needle-cloth and is disintegrated. The disintegration produces white modified collagen fibers of about 4 to 5 cm. in length and high water-absorbability characteristics.

The modified collagen fibers obtained in this manner are then blended with natural or artificial fibers having relatively good water-absorbability, for example, staple fibers, in the proportion of about 60%:40% by weight, and the resulting blend is fed into a Rando-feeder and then into a Rando-webber to form an unoriented web, which is then needle-punched about 600 times per 1 $cm.^2$ by a fiber locker to cause the fibers to mutually entwine, whereby the web becomes mechanically strong. To cause the web to further entwine strongly, the web is felted by taking advantage of the heat-shrinkability of the modified collagen fibers. That is, since the modified collagen fibers in the web are heat-shrunk by about one-fourth of their original length when the web is immersed in warm water at 85 to 95° C., the punched web can be felted by effecting the above heat-shrinking and mechanical steps, simultaneously. The resulting felt material is shaped and finished by buffing the surface thereof lightly to produce non-woven collagen fabrics.

The fabrics obtained in the above manner are white in color and superior in water-absorbability, and, if desired, can easily be dyed with dyestuffs such as acidic, direct metallized and reactive dyestuffs and the like which are commonly employed in the dyeing of leather.

The process of the present invention is further illustrated by the following examples, although not limited thereto.

EXAMPLE 1

A split hide was immersed in a saturated lime-milk for 10 days and was thereafter washed with water. The hide was then rotated in a drum with ammonimu chloride and water in the amount of 30% and 200% (based on the weight of the hide) before washing with water, respectively, for about 30 minutes, thereby deashed and thereafter subjected to a batting treatment in the drum with 1% of Bacillus protease (200 pu./mg.) and 200% of warm water at 35° C. The hide was rotated in the drum with 300% of a 10% sodium chloride solution for 6 hours, then allowed to stand in the drum overnight and thereafter washed with water for 30 minutes. The hide was again rotated in the drum for 6 hours with 300% of a 10% aqueous solution of calcium chloride which had been adjusted to pH 8.0 with aqueous ammonia, then allowed to stand overnight in the drum and thereafter further rotated for one additional hour. The split hide thus treated was then washed with water to effect deashing.

The modification of a part of the amino group in the split hide treated as above is explained hereinbelow. The additional amounts of the agents are indicated with percentages based on the weight of the treated split hide.

The split hide treated in accordance with the above was first placed in a drum with about 175% of water and about 40% of sodium chloride and, after being rotated for 5 minutes, water in the amount of 10% and formalin in the amount of about 1.5% were added to the drum in three-portions at 10-minute intervals. The drum was then rotated for 6 hours, and the immersing solution of the hide in the drum was adjusted to pH 7 with sodium bicarbonate. The drum was again rotated for 30 minutes, and the split hide was allowed to stand overnight in the immersed condition.

The above treated split hide was then rotated in the drum with about 150% of water, about 15% of codfish oil, 1.5% of hydrogen peroxide and 0.3% of soda ash; the modified split hide was then dried and thereafter treated as described below (the additional amounts of the agents being indicated by percentages of the weight of the dried hide).

The dried modified split leather was next charged into a drum together with 1000% of warm water at 45° C., about 3% of soda ash and about 2% of Pertex, then rotated for two hours, and thereafter washed with water for 20 minutes. The split leather was again charged into the drum with a fresh solution consisting of 1000% of water, about 3% of soda ash and about 2% of Pertex and, after being rotated for 60 minutes, washed with water for 20 minutes. The split leather thus treated was dried and then wetted back to about 45% moisture content, and the fiber bonds of the split leather were then loosened by mechanical means such as staking, beating and the like.

The modified split leather treated in the above manner was then pressed against a rotating roll, covered with needle-coth, and having a diameter of 6 inches and a width of 10 inches to provide white modified collagen fibers having a length of about 4–6 cm. and having superior water-absorbability characteristics.

EXAMPLE 2

The modified collagen fibers obtained in accordance with the process of Example 1 and staple fibers of about 3 cm. in length were fed in the proportion of 70%:30% into a Rando-feeder and then into a Rando-webber to form an unoriented web, which was then needle-punched 600 times per 1 cm.^{2} by a fiber locker. The resulting web was immersed in warm water at 50° C. and, after the bath temperature was gradually increased to about 90° C., bathed for about 20 minutes at that temperature, whereby taking advantage of the heat-shrinkability of the fibers, the web was felted by its heat-shrinkage as well as by mechanical means.

The resulting felt material was throuoghly washed with water and then dried by means of a hot-air circulating dryer (at 80° C.), and both surfaces of the felt were finish-shaped by buffing to obtain non-woven fabrics. The fabrics thus obtained were white and soft, exhibited superior water-absorbability qualities and were superior in water-draining to those of the chamois leather.

Split hides herein are defined as hides such that the amino group contained therein is not given a modification treatment. Modified split leather are hides such that the amino group has been given a modification treatment.

While I have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense.

I claim:

1. A process of producing modified collagen fibers from a split hide comprising the steps of

immersing a split hide in lime-milk for more than 8 days,

subjecting the immersed split hide to a bating treatment with Bacillus protease,

treating the bated hide with a solution of 10% sodium chloride and 10% calcium chloride to remove the foreign matter, proteins and mucoids therefrom, thereby loosening the bundle of fibers of said hide,

treating the resulting hide with formaldehyde and a fish oil in which hydrogen peroxide is dissolved to modify a part of the amino group of the collagen fibers, constituting a split leather,

treating the split leather to loosen mechanically the fibers thereof, and

pressing the resulting leather against needle-cloth to disintegrate it into modified collagen fibers.

2. A process of producing non-woven fabrics from modified collagen fibers obtained as set forth in the process of claim **1**, comprising the steps of

adding natural or artificial fibers to said modified collagen fibers, to obtain a mixture of fibers,

feeding said mixture of fibers into a Rando-feeder and then into a Rando-webber to form an unoriented web,

needle-punching said unoriented web to entwine the fibers strongly,

felting the web by mechanical means and by the heat-shrinkability of the fibers, and

buffing the surfaces of the resulting felt.

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U.S. Cl. X.R.

8—94.11; 162—2