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2,993,747

SHRINKPROOFING WOOL TEXTILES WITH TRICHLOROCYANURIC ACID OR DICHLOROCYANURIC ACID AND MIXTURES THEREOF

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No Drawing. Filed Feb. 18, 1955, Ser. No. 489,290

8 Claims. (Cl. 8-127.6)

The present invention relates to a process of treating wool, and it more particularly relates to wool stabilization, that is, the treatment of wool to render it resistant to shrinking and felting.

It has been proposed heretofore to treat wool materials such as wool or woolen fabrics and yarns with a solution of chlorine gas in water or with aqueous solutions of sodium hypochlorite or calcium hypochlorite or sodium p-toluene-sulfochloramine at various pH values and containing various buffering agents. Potassium permanganate has also been suggested in combination with aqueous sodium hypochlorite. Processes of the above type have been described in the following U.S. Patents: U.S. Patent No. 1,781,415 to Leighton B. Smith et al., issued November 11, 1930; U.S. Patent No. 2,429,082 to Francis M. Stevenson et al., issued October 14, 1947; U.S. Patent No. 2,457,033 to Harry F. Clapham et al., issued December 21, 1948; U.S. Patent No. 2,466,695 to Daniel Frishman et al., issued April 10, 1949; U.S. Patent No. 2,590,390 to Christopher Earland et al., issued March 25, 1952; and U.S. Patent No. 2,671,006 to John H. McLauchlan, issued March 2, 1954. The prior art processes have not been completely satisfactory, however, since the use of prior art chlorinating agents has resulted in uneven chlorination, with resultant uneven or non-uniform dyeing characteristics, or a harshening of the wool, or a loss in tensile strength and wearing qualities of the wool, or a yellowing of the wool, or various or all combinations of these disadvantages.

It is one object of this invention to provide an improved process of treating wool to render it resistant to shrinking and felting.

It is a further object of this invention to treat wool materials with a chlorinating agent which gives a desirable shrinking and felting resistance to the wool while minimizing the disadvantages or adverse effects of the prior art wool chlorinating agents referred to above.

Still further objects and advantages of this invention will be apparent from the following description and the appended claims.

The process of this invention is carried out, in general, by treating wool materials such as raw stock, tops, yarns or fabrics with an aqueous solution or suspension of trichlorocyanuric acid or mixtures thereof with dichlorocyanuric acid until the wool material attains the desired amount of resistance to shrinking and felting and subsequently drying the wool material. However, prior to drying it is preferred to remove the chlorocyanuric acids referred to above and/or their decomposition products from the wool material by washing or rinsing with an aqueous medium such as water or by subjecting the wool material to the action of an antichlor or reducing agent such as sodium sulfite or sodium metabisulfite followed by washing or rinsing with water.

A wide variety of wool materials may be treated in accordance with the process of this invention including wool or woolen woven or knit fabrics, raw stocks, tops, yarn and the like. The treatment of tops or unspun wool fibers is particularly advantageous since the wool fibers are whitened and rendered shrink resistant in one operation. However, the process of this invention is not restricted to treatment of all wool materials as indicated

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above, but is also applicable to the treatment of fabrics or yarns or fibers which are composed only partly, for example, down to 30%, of wool fibers. In such instances the other fibers are preferably composed of fibers which are not adversely affected by the trichlorocyanuric or dichlorocyanuric acids, for example, cellulose fibers such as cotton, regenerated cellulose or saponified cellulose acetate fibers and the like.

The wool material may be dyed prior to or after the treatment, but it is preferred to carry out the treatment prior to the dyeing of the wool material.

The aqueous treating solution or suspension employed may be acidic, neutral or alkaline. In the case of neutral or alkaline solutions or suspensions, particularly those having a pH between about 6.5 and 9.5, it is sometimes desirable to use a buffering agent such as those employed in the prior art referred to above, for example, borax (sodium tetraborate) or a mixture thereof with sodium bicarbonate. The treating solution or suspension may also contain other additives heretofore employed in the chlorination of wool. The pH of the treating solution or suspension is desirably within the range of about 0.25 to 9.5, and it may be buffered, as desired, so as to give any particular pH value within such range. However, it is desirable to employ an acidic treating solution preferably having a pH between 0.5 and 3.

The chlorocyanuric acid used is trichlorocyanuric acid (also known as 1,3,5-trichloro-2,4,6 trioxo-1,3,5 triazine) or a mixture of trichlorocyanuric acid and dichlorocyanuric acid preferably a mixture containing at least 50% by weight of the former. However, it is preferred to employ trichlorocyanuric acid as this particular acid has solubility properties, and other desirable physical properties and chemical properties, which appear to make it most suitable for the process of this invention.

The solubility of the foregoing chlorocyanuric acid in water varies with the particular acid or mixture used and the pH and temperature of the aqueous medium. In general, the solubility increases with temperature, at least up to a temperature of about 35° C., and the solubility also increases with increasing pH, being greater in alkaline solutions than in acidic solutions. For example, trichlorocyanuric acid has a solubility of only about 0.2% by weight in water at 6° C., about 1% by weight at 20° C. and about 1.9% by weight at 29° C. These solubilities are somewhat lower at temperatures of 20 and 29° C. in acidic solutions, and somewhat higher in alkaline solutions. Mixtures of dichlorocyanuric acid and trichlorocyanuric acid have solubility characteristics somewhat similar to trichlorocyanuric acid. However, the solubility of trichlorocyanuric acid or of mixtures of trichlorocyanuric acid and dichlorocyanuric acid is an apparent solubility because these materials appear to decompose in water to form hypochlorous acid and cyanuric acid and/or a lower chlorinated cyanuric acid. This decomposition or hydrolysis is accelerated in alkaline solutions or with increased temperatures so that when the chlorine which is formed or released is, for some reason, no longer in equilibrium with the cyanuric acid or lower chlorocyanuric acid or reacts with a material present such as wool, more of the trichlorocyanuric acid or mixtures of trichlorocyanuric acid and dichlorocyanuric acid appears to dissolve.

In the treatment of wool with the chlorocyanuric acids described above in an aqueous medium, the chlorocyanuric acid employed may be completely in solution or partly in solution in which case the remainder is usually present in suspension or as a dispersion. The portion that is in apparent solution gradually releases available chlorine which reacts with the wool thus permitting more of the chlorocyanuric acid to dissolve or decompose until the desired amount of chlorine has reacted with the wool.

This controlled release of available chlorine is believed to account for the advantageous properties of the chlorinated wool material as compared to the chlorinated wool material obtained by treatment with other chlorinating agents. Irrespective of any theory involved or given herein, it is possible in accordance with the present invention to obtain wool materials which not only have good resistance to shrinking and felting, but also dye uniformly, have a good hand and do not undergo a marked loss in tensile strength or wearing qualities as a result of the treatment.

The amount of trichlorocyanuric acid or mixture of trichlorocyanuric acid and dichlorocyanuric acid employed will vary to some extent depending on the amount of shrinkage and felting resistance which it is desired to impart to the wool materials. For most purposes, the use of trichlorocyanuric acid or a mixture of trichlorocyanuric acid and dichlorocyanuric acid in an amount sufficient to provide from about 1 to 8% of available chlorine, based on the wool material, is adequate. However, when maximum shrinkage and felting resistance is desired, it is recommended that the amount used be sufficient to provide about 3 to 8% of available chlorine, based on the wool.

The treating solution or suspension may be employed at various temperatures, the particular temperature used being governed to a large extent by convenience and the avoidance of damage to the wool material. Ordinarily, the temperature of the treating solution is between about 5 and 30° C., preferably between 15 and 25° C., but temperatures up to 75° C. may be used in some instances.

Other commonly used additives to wool treating baths may be used in conjunction with chlorocyanuric acid to gain dual effects. As for example, hydrogen peroxide, sodium perborate, phosphoric acid and its alkali metal salts, oxalic acid; softening agents such as fatty acid compositions; mothproofing agents such as sodium silicofluoride, etc.; and resinous solutions and dispersions; wetting agents; etc.

A further understanding of the process of this invention will be obtained from the following illustrated example which is intended to illustrate the invention but not to limit the scope thereof, parts and percentages being by weight.

Example

One hundred parts of clean wool tops are immersed in an aqueous solution of 5 parts of trichlorocyanuric acid in 1000 parts of water at 20° C. This solution has a pH of about 3.5 and contains about 4.25% of available chlorine, based on the wool tops. The wool tops are immersed in the solution until the solution does not contain available chlorine for further reaction with the wool. The wool is then removed from the solution, treated with a dilute aqueous solution of sodium sulfite, rinsed with water and finally dried. When the wool tops are made into a yarn which is then knitted to form a sock, the resulting sock is resistant to shrinkage and felting and possesses wool fibers having, without material change, all of the desirable properties of the original untreated wool material.

In carrying out the process of the example, the rate of reaction of the chlorine available in the trichlorocyanuric acid with the wool may be increased by adding hydrochloric or other mineral acids to the solution to lower the pH down to about 2 or slightly lower. This procedure is advantageous in some instances.

The example illustrates the application of the treating solution to the wool material by immersing the latter in the solution. However, it is believed apparent that this application of the solution to the wool material is only one of a variety of procedures which are available and apparent to those skilled in the art to which this invention pertains.

What is claimed is:

1. A process of treating a textile material consisting

essentially of wool fibers which comprises contacting said material with an aqueous dispersion having a pH of from about 0.25 to about 9.5 and a temperature of from about 5° C. to about 75° C. consisting essentially of water and a substance selected from the group consisting of trichlorocyanuric acid and a mixture of trichlorocyanuric acid and dichlorocyanuric acid, until said material becomes resistant to shrinking and felting.

2. A process of treating a textile material consisting essentially of wool fibers which comprises contacting said material with an acidic aqueous dispersion having a pH of not less than 0.25 and a temperature of from about 5° C. to about 75° C. consisting essentially of water and trichlorocyanuric acid until said material becomes resistant to shrinking and felting.

3. A process as in claim 2, but further characterized in that textile material is composed entirely of wool.

4. A process of treating a textile material consisting essentially of wool fibers which comprises contacting said material with an aqueous dispersion having a pH of from about 0.5 to about 3.0 and a temperature of about 5° C. to about 75° C. consisting essentially of water and a substance selected from the group consisting of trichlorocyanuric acid and a mixture of trichlorocyanuric acid and dichlorocyanuric acid consisting of at least 50% by weight of trichlorocyanuric acid, until said material becomes resistant to shrinking and felting.

5. A process of treating a textile material consisting essentially of wool fibers which comprises contacting said material with an aqueous dispersion having a pH of from about 0.5 to about 3.0 and a temperature of about 5° C. to about 75° C. consisting essentially of water and trichlorocyanuric acid, until said material becomes resistant to shrinking and felting.

6. A process of treating all wool textile materials which comprises contacting said materials with an aqueous solution having a pH of about 6.5 to about 9.5 and a temperature of about 5° C. to about 30° C. consisting essentially of water, trichlorocyanuric acid and a buffering agent, said solution containing from about 3 to about 8% available chlorine based on said textile materials, until said materials become resistant to shrinking and felting.

7. A process of treating all wool textile materials which comprises contacting said materials with an aqueous solution having a pH of about 0.5 to about 3 and a temperature of about 5° C. to about 30° C. consisting essentially of water and trichlorocyanuric acid in an amount sufficient to provide from about 3 to about 8% available chlorine, based on said textile materials, until said materials become resistant to shrinking and felting.

8. A process of treating a textile material consisting essentially of wool fibers which consists essentially in the step of contacting said material with an aqueous dispersion having a pH of from about 0.25 to about 9.5 and a temperature of from about 5° C. to about 30° C. consisting essentially of water and a substance selected from the group consisting of trichlorocyanuric acid and mixtures of trichlorocyanuric acid and dichlorocyanuric acid consisting of at least 50% by weight of trichlorocyanuric acid, said substance being present in said dispersion in an amount sufficient to provide from about 1 to about 8% available chlorine based on the wool fibers, for a time sufficient to render said material resistant to shrinking and felting while otherwise retaining the desirable properties of said wool fibers.

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