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TREATMENT OF WOOL AND THE LIKE

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4 Claims (Cl. 8—115.6)

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This invention relates to the treatment of materials consisting wholly or partly of wool at any suitable stage from the raw material to the finished products such as yarns, fabrics, garments and the like, an object of the invention being the reduction of the normal tendency of the materials to shrink and to increase its resistance towards abrasion and thus improve its wearing properties.

The form of shrinkage referred to is that which is commonly described as felting and is accompanied by a progressive closing together and thickening of the material with an accompanying loss of area when alternate compression and relaxation is applied to the material under conditions similar to those which exist in household washing or in a laundering machine. It does not apply to a particular form of shrinkage commonly described as relaxation which is caused by the release of mechanical stresses when for the first time a material is immersed in water.

It has been proposed to increase the crease-resisting properties of textile materials by impregnating them with a solution of a urea-formaldehyde type of condensation product of relatively low molecular size such as a methanol urea type of compound and completing the condensation in the fabric by heating in an ager in the presence of hydrochloric acid gas.

The present invention provides a process for the treatment of materials consisting wholly or partly of wool wherein the material is treated with a strong solution of methylol urea (i. e. the condensation product between an equivalent molecular ratio of urea and formaldehyde produced on standing of the reagents in neutral solution for several hours) squeezed and after drying cured at a temperature between 80° C. and 135° C., the treated material is thereafter treated with a solution of a strong mineral acid, squeezed, rinsed and after drying cured at between 90° C. and 135° C.

Preferably the first curing is carried out at a temperature not exceeding 110° C. in order to avoid any danger of damaging the wool. However, the temperature should be as near the top point of the range 90 to 110° C. as possible. Again, in the second curing the preferred range of temperature is between 90 and 110° C. but the temperature within this range is not nearly so critical, and good results are obtained even in the lower part of the range.

A resin deposit which cannot be removed by scouring of between 10 to 15% calculated on the weight of the wool is thus obtained. The deposit

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is completely removed by refluxing with dilute mineral acid. The material is almost completely unshrinkable and the abrasion resistance is increased by more than 50%. Preferably the solution of methylol urea is of at least 50% concentration by weight. Preferably also we use as the acid sulphuric acid of between N and 2N concentration although satisfactory results can be obtained with concentrations as low as N/10.

The mechanism of the process probably consists in the formation of a layer of resin on the surface of the wool fibres which modifies the frictional properties of the latter. It is now generally agreed that it is the peculiar frictional properties of wool, due to which a fibre has less friction in one direction than in another, which causes the type of shrinkage referred to herein. It is, however, necessary that the deposit should be firmly and evenly deposited on the fibre surface. This is achieved by the first cure. Here in the absence of acid the monomethylol urea does not polymerise on heating, but it is believed that the substance combines with groups in the wool having a reactive hydrogen group (e. g. amino groups known to be present in wool).

The group thus fixed on to the wool then polymerises with unreacted methylol urea in the presence of acid giving a polymer which is chemically anchored to the wool.

Thus, if there is no first cure and the wool after impregnation is treated with the acid and then cured, a deposit is formed which does not produce a large measure of unshrinkability unless more than 20% of resin calculated on the weight of the wool is deposited. But the handle obtained is then very harsh and full.

Also, if a solution of methylol urea which contains a substance which liberates acid on heating such as ammonium chloride is used to impregnate the wool, a resin deposit is formed immediately after a first cure which must, however, be carried out at a temperature above 100° C. and preferably above 120° C. A deposit of at least 20% calculated on the weight of the wool must be produced in the wool to give a substantial measure of unshrinkability. With proportions of resin greater than 12–15% calculated on the weight of the wool, the wool loses its softness and becomes stiff and harsh. Thus, the mere fact that a considerable weight of resin has been attached to the wool does not mean that shrink resistance will be obtained.

If, however, the process is carried out according to this invention—namely by a two cure method—a deposit of 10–12% of resin calculated

on the weight of the wool gives a large measure of unshrinkability without becoming very harsh. In every case the amount of resin deposited was determined after a light scour so as to remove loose polymer. Wool treated according to this invention does not lose more than a small fraction of the resin deposited in any amount of subsequent scouring.

The time necessary for curing is not important so long as it is in excess by a few minutes over the time necessary to dry the fabric. It is not necessary to isolate the methylol urea and a solution of 40% formaldehyde and an equivalent amount of urea at approximately pH 7 after standing for several hours is very satisfactory for impregnation and may be diluted to half strength, although full strength gives usually better results. The strength of resin solution used depends on the type of fabric employed and the amount of solution retained after padding. It is preferable to use the strongest solution so as to have the least amount of liquid possible after padding. The ratio of formaldehyde to urea may be increased but no improvement in the treatment is thereby obtained except in so far as a small amount of formaldehyde is often lost by evaporation and thus it is advantageous to have a small excess.

To improve the feel of the material it should be thoroughly scoured which removes excess resin not firmly fixed and a cation active or other softening agent may be added to improve the feel.

Instead of the normal hot air oven the curing of the fabric may be carried out in an infra-red oven so long as the temperature of the fabric is between 90 and 110° C.

The following examples illustrate how the process of the invention may be carried into effect:

Example 1

A solution containing 30% by weight of formaldehyde and 60% by weight of urea was neutralised with ammonia and allowed to stand for 6 hours at room temperature. Knitted all wool fabric wetted out prior to the immersion (or instead a wetting agent may be added to the above solution) was passed through the solution and dried and then heated for 2 minutes at 110° C. The fabric was then passed through a 2N sulphuric acid bath for a period of time sufficient to ensure complete penetration; the fabric was then thoroughly rinsed to remove any acid left in it, dried and heated for 2 minutes at 100° C. Fabric thus treated had an area shrinkage of 5.2% as opposed to untreated fabric which shrank 28%.

Example 2

The process of Example 1 was repeated but using a light weight plain weave wool flannel.

Example 3

The process of Example 1 was repeated but using all wool single 48 yarn.

Example 4

Four pairs of grey half hose were immersed in a solution prepared as described in Example 1 but diluted to half strength. The socks were squeezed between rollers, dried and cured at 110° C., immersed in 2N sulphuric acid in the presence of a wetting agent, i. e. Calsolene Oil (a sulphonated fatty substance sold by Imperial Chemical Industries, Ltd.), rinsed thoroughly and cured again at 110° C. The shrinkage of socks treated in this way when washed in a washing machine was reduced to half that of untreated socks. It is not necessary to scour the socks before treatment (i. e. the 3% of oil present in the wool does not interfere with the process).

Similar results to those described in the above examples are obtainable by using materials consisting of mixtures of wool with other fibres instead of pure wool.

The term "woollen material" as used in the appended claims relates to material consisting wholly or partly of wool and the term "methylol urea" as used in the appended claims means the condensation product between an equivalent molecular ratio of urea and formaldehyde produced on standing of the reagents in neutral solution for several hours.

What we claim is:

1. A process for the treatment of woollen material which comprises treating woollen material with a solution of methylol urea containing at least 25% of methylol urea, squeezing the treated material, drying the squeezed material, curing the dried material at a temperature of between 80° C. and 135° C. for between about one and five minutes, treating the cured material with a solution of a strong mineral acid to polymerize the methylol urea, squeezing the thus treated material, rinsing the squeezed material, drying the rinsed material and curing the dried material at a temperature of between 90° C. and 135° C. for between about one and five minutes.

2. A process for the treatment of woollen material which comprises treating woollen material with a solution of methylol urea containing at least 25% of methylol urea, squeezing the treated material, drying the squeezed material, curing the dried material at a temperature of between 80° C. and 135° C. for between about one and five minutes, treating the cured material with a solution of sulphuric acid of a concentration between N and 2N to polymerize the methylol urea, squeezing the thus treated material, rinsing the squeezed material, drying the rinsed material and curing the dried material at a temperature of between 90° C. and 135° C. for between about one and five minutes.

3. A process for the treatment of woollen material which comprises treating woollen material with a solution of methylol urea containing at least 25% of methylol urea, squeezing the treated material, drying the squeezed material, curing the dried material at a temperature of between 80° C. and 110° C. for between about one and five minutes, treating the cured material with a solution of a strong mineral acid to polymerize the methylol urea, squeezing the thus treated material, rinsing the squeezed material, drying the rinsed material and curing the dried material at a temperature of between 90° C. and 135° C. for between about one and five minutes.

4. A process for the treatment of woollen material which comprises treating woollen material with a solution of methylol urea containing about 25% of methylol urea, squeezing the treated material, drying the squeezed material, curing the dried material at a temperature of between 80° C. and 135° C. for about one to five minutes, treating the cured material with a

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solution of a strong mineral acid to form a resinous polymer, squeezing the thus treated material, rinsing the squeezed material, drying the rinsed material and curing the dried material at a temperature of between 90° C. and 110° C. for about one to five minutes.

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