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PROCESS FOR FINISHING RAYON FABRICS

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This invention relates generally to a process and composition for finishing rayon fabrics and more particularly relates to a process and composition for improving the hand and wash and wear characteristics of regenerated cellulose fabrics.

Regenerated cellulose fabrics are widely used for a variety of wearing garments. Several factors which have somewhat limited their use are that they do not possess very high crease recovery and they are not very suitable for wash and wear uses. It has been proposed that good crease recovery and good wash and wear characteristics may be obtained by impregnating the fabric with a compound capable of forming resinous material and/or capable of reacting with the cellulose upon application of heat in the presence of a catalyst.

This material is normally applied to the fabric by immersing the same in an aqueous solution or dispersion of the monomer or precondensates of the resinous material. Following drying, the treated fabric is cured in the presence of a catalyst in order to polymerize the compound to an insoluble form or react it with the cellulose. Thereafter, the fabric is usually scoured to remove excess resin and residual catalyst. Since the fabric may be in an acid condition after curing, the scouring is preferably accomplished with an alkaline detergent. Thereafter the fabric is finally dried under controlled tension.

One difficulty which has been experienced with resinous finishes of this type has been that they impart to the rayon fabrics a thin, sleazy hand which for wearing apparel is undesirable. It has been proposed that "hand builders" may be incorporated into the finish to impart to the fabric a firmer and more cotton-like hand. However, these have not been particularly successful because they usually are not durable to repeated launderings. In addition, they usually exert an adverse effect on the crease recovery and wash and wear characteristics of the resin-treated fabrics.

It is, therefore, an object of the present invention to provide a process for improving the properties of regenerated cellulosic fabrics that are free of the difficulties of the prior art.

It is a further object of the present invention to provide a process for improving the hand, crease-recovery, and wash and wear characteristics of rayon fabrics.

It is another object of the present invention to provide a composition for finishing regenerated cellulosic fabrics that does not present the difficulties of the prior art.

A further object of the present invention is to provide a composition for finishing rayon fabrics that improves the hand, crease recovery, and wash and wear characteristics of the fabrics.

Other objects and advantages of the present invention will become apparent from a reading of the following detailed description.

In accordance with the present invention, the aforesaid objects are accomplished by impregnating regenerated cellulosic fabrics with a thermosetting resin-forming substance or crosslinking agent and a high viscosity propylene glycol alginate. Thereafter, the fabric is heated to cure the resinous material or crosslinking agent. The fabric is then preferably scoured and dried under tension at a predetermined width.

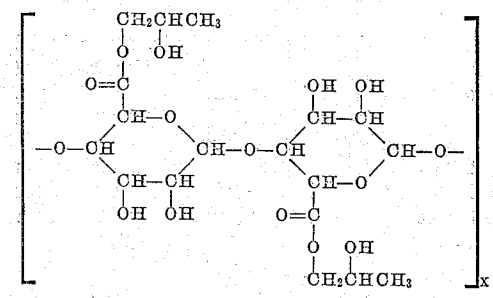
These fabrics possess a firm and cotton-like hand which

is durable to repeated launderings. In addition, the crease recovery and wash and wear characteristics are not sacrificed and thus permit the fabric to be classed as a "minimum care" fabric.

Examples of the thermosetting resin-forming components or crosslinking agents of this novel finish include formaldehyde, glyoxal, alpha-hydroxyadipaldehyde, dimethylol formamide, ethyleneurea condensate of hexamethylene-diamine, and dimethylol ethylene urea or their equivalents in their various and modified forms. The amount used depends upon the dimensional stability, crease recovery, and wash and wear characteristics desired in the ultimate fabrics and the particular compound employed, and is easily determined by those skilled in the art. In general, it will be between about 2 to 25%, based on the weight of the finishing composition. It has been found, for example, that when dimethylol ethylene urea is used, it is preferred that the finishing composition contain about 10 to 20% by weight of this substance.

An appropriate curing catalyst for the resin-forming substance or crosslinking agent is preferably added in small amounts to the finishing composition. This is usually about 0.1 to 2% by weight. Suitable catalysts, for example, include acetic acid, tartaric acid, oxalic acid, lactic acid, aluminum chloride, magnesium chloride, zinc chloride, zinc nitrate hexahydrate, ammonium chloride, ammonium sulfate, ammonium phosphate, organic amine hydrochloride salts, and others.

The propylene glycol alginate that is preferred by this invention is a high viscosity alginate. A 1% solution of the alginate will have a viscosity at 25° C. of about 400 centipoises and a 2% solution will have a viscosity of about 7,000 centipoises. Other propylene glycol alginates of lower viscosity may be used with diminishing results. The alginates are prepared by reacting propylene glycol with alginic acid and a process for their preparation is described in U.S. Patent No. 2,426,125. They are compounds which correspond to the following general formula:



wherein x is a whole number of about one hundred to about several hundred. In general, the propylene glycol alginate content of the bath will be between 0.2 and 3%, based on the weight of the bath.

The fabric will normally take up about 60 to 100%, based on its own dry weight of an impregnating liquid. Therefore, the amount of the resin or crosslinking agent retained on the fabric will be about 1.2 to 25%, based on the weight of the fabric, and the add-on of the alginate will be about 0.1 to 3%.

Regenerated cellulose fabric may be treated by this composition in a conventional manner, as for example, by immersing the fabric in the bath or spraying the same onto the fabric. It is preferred to immerse the fabrics in the treating composition, remove and dry the same at a temperature of about 100 to 250° F. Thereafter, the fabric is heated at a higher temperature to cure the resin. This curing temperature will, of course, depend upon the particular type of resin being used, but is generally about 250 to 400° F. The duration of the drying

and curing steps also depends upon the resin used and generally will be 3 to 5 minutes and 0.5 to 3 minutes, respectively.

Normally, the next step is to wash and scour the fabric without tension in a bath containing a wetting agent and an alkaline detergent, preferably at a temperature of about 140° F. After removing the washing solution, the fabric is dried under controlled tension conditions.

A wetting agent such as Triton X-100 or a similar one may also be added to the resin bath in very small amounts, for example, 0.05 to 1.5%, based on the weight of the composition.

The temperature at which the resinous composition is applied to the fabrics is not critical. Usually, it will be between 60 and 90° F.

The fabric so produced has excellent properties. The dimensional stability of the fabric after repeated washing and drying is highly satisfactory. Also, the fabrics have a firm, cotton-like hand and excellent crease recovery and wash and wear characteristics.

This invention will be further described with reference to the following specific examples, it being understood that these are offered merely for the purpose of illustration and are not to be construed as limiting the scope of this invention.

The following examples in illustrating this invention utilize various test results. The measurements are conducted in accordance with standard tests; for example, the breaking strength is measured by the raveled strip method, ASTM D39–49; the crease recovery by the Monsanto tester, ASTM D1295–53T and the tearing strength by the Elmendorf tester, ASTM D1424–59. In addition, the wash and wear rating is obtained by comparison with the Monsanto plastic "Wash 'N Wear" standards, using overhead lighting incident on the fabrics at an angle of approximately 20°. The results reported represent the average of judgments of three observers on the fabrics themselves, and on photographs of the fabrics. The ratings are given on a scale of 1 to 5, with "1" representing a very wrinkled fabric and "5" representing an almost smooth material. Note that some fabrics were rated higher than 5.0, since they were, in fact, smoother than the Monsanto standard for a rating of 5.

The hand was judged subjectively by a panel of 3 observers. The samples were rated on a scale of 1 to 5, as follows: 1, untreated rayon (least cotton-like); 5, untreated cotton (cotton-like). The judgments encompassed both stiffness and surface character. Note that some treated rayon samples were rated higher than 5, since they were judged to be stiffer or rougher than the untreated 80 x 80 cotton used as the standard for a rating of 5.

Example I

A treating solution was prepared which contained 15.6 percent of dimethylolethylene urea, 0.27 percent of Triton X–100 (a non-ionic wetting agent sold by the Rohm and Haas Company) and 1.21 percent of zinc nitrate hexanhydrate (all by weight), the remainder being water. A sample of 81 x 66 white rayon challis was immersed in this solution, padded to a wet pick-up of 85 percent of the fabric weight, dried for 3 minutes at 120° F., and cured for 3 minutes at 320° F. The fabric was then laundered with a 0.1 percent solution of a built anionic detergent to remove residual reagents. The dry add-on after laundering was found to be 13.3%. The crease recovery of the treated sample was 73% in the dry state (65% relative humidity) and 56% in the wet state. The fabric had a dry warp breaking load of 42 pounds, a tearing strength of 540 grams in the warp and 620 grams in the filling, a wash and wear rating of 5.1 and a subjective hand rating of 2.0.

The original untreated fabric was immersed in water, dried, and was found to have a crease recovery of 52%, a hand rating of 1.0, and a warp breaking load of 48 pounds. The warp tearing strength was 1260 grams and the filling tearing strength was 1340 grams.

Example II

A sample of 81 x 66 white rayon challis was treated in a manner similar to that described in Example I, except that the tearing bath contained 1.3% by weight of Kelcoloid HV (propylene glycol alginate, high viscosity) as a hand builder. In preparing the treating bath, the propylene glycol alginate was first dissolved in water, and the solution was then added with stirring to a solution containing the required amounts of dimethylolethylene urea and Triton X–100 wetting agent; the zinc nitrate hexahydrate was added last in solution form. The concentrations of reagents in the final treating bath were 1.3% of propylene glycol alginate, 0.27% of Triton X–100, 15.6% of dimethylolethylene urea and 1.21% of zinc nitrate hexahydrate.

The treated rayon challis had a dry add-on of 14.5%, a wash and wear index of 5.2 and a hand rating of 2.7.

Example III

A treating bath was prepared which contained 16.0% by weight of dimethylolethylene urea, 1.22% of zinc nitrate hexahydrate, and 0.27% of Triton X–100, the remainder being water. A sample of 86 x 76 dyed spun rayon fabric was immersed in this solution, padded to a wet pick-up of 75% of the fabric weight, dried for 3 minutes at 120° F. and cured for 3 minutes at 320° F. The fabric was then laundered with 0.1% solution of a built anionic detergent to remove residual reagents. The dry add-on after laundering was 12.0%. The crease recovery of the treated fabric was 77% in the dry state and 62% wet. It had a dry warp breaking strength of 49 pounds, a tearing strength of 1230 grams in the warp and 790 grams in the filling, a wash and wear index of 5.3 and a subjective hand rating of 1.0.

Example IV

A sample of the same fabric was treated in a manner similar to that described in Example III, except that 1.34% by weight of Kelcoloid HV (propylene glycol alginate) was included in the treating bath, the precautions for mixing the bath being those described in Example II. The treated fabric had a dry add-on of 13.0%. The crease recovery was 76% in the dry state and 58% in the wet condition. The warp breaking load was 49 pounds. The subjective hand rating was 2.2, and the wash and wear index was 4.8. The tearing strength in the warp direction was 1230 grams while the filling tearing strength was 840 grams.

Example V

A sample of the same 86 x 76 spun rayon fabric was treated in a manner similar to that described in Example IV, except that 1.2% by weight of Kelcoloid HV (propylene glycol alginate), 14.1% of dimethylolethylene urea, 1.0% Triton X–100, and 0.81% by weight of zinc nitrate hexahydrate were used in the treating bath. The sample was padded to a wet pick-up of 83% of the fabric weight, and the dry add-on was 12.5%. The crease recovery of the treated fabric was 76% in the dry state and 65% wet. The warp breaking load was 46 pounds. The subjective hand rating was 1.3 and the wash and wear index was 4.3. The tearing strength in the warp direction was 1180 grams while the tearing strength in the filling direction was 880 grams.

Example VI

A treating solution was prepared which contained 12.6% by weight of dimethylolethylene urea, 0.25% of Triton X–100, and 1.01% of zinc nitrate hexahydrate catalyst. A sample of 81 x 66 white rayon challis was immersed in this solution, padded to a wet pick-up of

92% and treated as in Example I. The dry add-on after laundering was 11.5%. The crease recovery of the treated sample was 75% in the dry state and 55% wet. The warp breaking load was 42 pounds.

The subjective hand rating was 1.6 and the wash and wear index was 4.4. The tearing strength in the warp direction was 600 grams while the filling tearing strength was 560 grams.

The original untreated fabric was immersed in water, dried, and was found to have a crease recovery of 66%, a hand rating of 1.0, and a warp breaking load of 1450 grams while the filling tearing strength was 1170 grams. The wash and wear rating was 1.0.

Example VII

A sample of 81 x 66 white rayon challis was treated in a manner similar to that described in Example VI, except that 1.05% by weight of Kelcoloid HV (propylene glycol alginate) was used in preparing a solution similar to that described in Example II. The treated sample had a dry add-on of 13.3%. The crease recovery of the treated sample in the dry state was 71%; the crease recovery of the treated fabric in the wet state was 54%. The warp breaking load was 43 pounds. The subjective hand rating was 2.3 and the wash and wear index was 4.4. The tearing strength in the warp direction was 840 grams, while the tearing strength in the filling direction was 670 grams.

Example VIII

A sample of 81 x 66 white rayon challis was treated in a manner similar to that described in Example VII, except that the wet pick-up was 103% of the weight fabric. The dry add-on after laundering was 14.1%. The crease recovery of the treated fabric was 71% in the dry state and 66% wet. The warp breaking load was 41 pounds. The subjective hand rating was 5.3 and the wash and wear index was 4.9. The tearing strength in the warp direction was 660 grams, while the filling tearing strength was 610 grams.

Example IX

A sample of 81 x 66 white rayon challis was treated in a manner similar to that described in Example VII, except that 2.1% by weight of Kelcoloid HV (propylene glycol alginate) was used and the wet pick-up was 102% of the weight of the fabric. The dry add-on after laundering was 14.5%. The crease recovery of the treated fabric was 67% in the dry state and 69% in the wet condition. The warp breaking load was 42 pounds. The subjective hand rating was 5.0 and the wash and wear index was 3.3. The tearing strength in the warp direction was 730 grams, while the filling tearing strength was 720 grams.

Example X

A sample of 81 x 66 white rayon challis was treated in a manner similar to that described in Example VII, except that 0.52% by weight of Kelcoloid HV (propylene glycol alginate) was used and the wet pick-up was 96% of the weight of the fabric. The dry add-on after laundering was 12.8%. The crease recovery of the treated fabrics was 67% in the dry state and 61% wet. The warp breaking load was 44 pounds. The subjective hand rating was 3.0 and the wash and wear index was 4.5. The tearing strength in the warp direction was 610 grams, while the filling tearing strength was 550 grams.

It can readily be seen from the foregoing examples, that this process and composition improve the hand, crease recovery, and wash and wear characteristics of regenerated cellulosic fabrics without a sacrifice in any one of these properties.

It should be understood that many modifications may be made in this invention without departing from its spirit and scope which is to be limited only by the following claims.

What is claimed is:

1. A process for improving the properties of regenerated cellulosic fabrics which comprises impregnating regenerated cellulose fabrics with a compound that is a crosslinking material, a catalyst therefor, and with a propylene glycol alginate, and subsequently curing said compound.

2. A process according to claim 1 wherein said compound is dimethylolethylene urea.

3. A process according to claim 1 wherein a 1% solution of said alginate has a viscosity at 25° C. of about 400 centipoises.

4. A process for improving the properties of regenerated cellulose fabrics which comprises impregnating said fabrics with an aqueous liquid containing about 2 to 25%, by weight of a compound that is a thermosetting resin-forming material, a catalyst therefor and about 0.2 to 3% of a high viscosity polypropylene glycol alginate, then drying the impregnated fibers and heating the fabric to cure the compound.

5. A treating composition for improving the properties of regenerated cellulose textile fabrics comprising an aqueous liquid containing a compound that is a crosslinking agent, a catalyst therefor, and a propylene glycol alginate.

6. A composition according to claim 5 wherein said compound is dimethylolethylene urea.

7. A treating composition for improving the properties of regenerated cellulosic fabrics comprising an aqueous liquid containing about 2 to 25% of a thermosetting resin-forming material, a catalyst therefor and about 0.2 to 3% of a high viscosity propylene glycol alginate.

8. A composition according to claim 7 wherein a 2% solution of said alginate has a viscosity at 25° C. of about 7,000 centipoises.

9. A composition according to claim 7 wherein said catalyst is zinc nitrate hexahydrate.

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