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SIZING AND FINISHING COMPOSITIONS

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The present invention relates to the treatment of textiles and, more particularly, to compositions and methods for improving the physical characteristics of fibrous materials, such as yarns, threads, paper and cloth fabrics to render the material permanently more valuable for many uses. The invention resides in the provision of new and useful compositions adapted to be applied to fibrous materials, such as textiles, and in the method of utilizing said compositions to impart permanently altered physical characteristics to the materials which are treated.

The compositions of this invention may be used as a size or finish for improving, among other characteristics the hand or feel of the material and also to increase the weight and body of the material treated therewith. This treatment of the material generally is accompanied by an improvement in texture and appearance and in some instances the compositions also may have a smoothing and binding effect upon the surfaces of the yarns and threads of which the fabrics are formed. The use of the compositions as a sizing or finishing material, however, may not be regarded as the primary function thereof in view of additional advantages in the use of the compositions as described hereinafter.

In addition to a sizing or finishing effect, the compositions of this invention are adapted to be used to impart a crispness or stiffness and springiness to the fabrics. As a result the textiles treated in accordance with the invention acquire a characteristic appearance, such as that possessed by organdies or other fabrics of the type widely used where stiff fabrics are desired, such as in the manufacture of curtains and the like.

It is an important advantage of the invention that the compositions applied to the fabrics may be rendered water-insoluble to such an extent that they are resistant to ordinary aqueous treatment and, in particular, are rendered permanently fixed to the fabric or other material notwithstanding repeated laundering. As a result, a repeatedly laundered fabric treated in accordance with the invention will retain crispness as well as the desirable body or weight over long periods of time without any necessity for the repeated use of stiffening material.

The formation of a water-insoluble coating having the characteristics described above, has an additional effect of preventing shrinkage of the materials treated. Conventional fabrics and other materials frequently undergo dimensional changes due to laundering or other liquid treatment, and it is an additional advantage that textiles treated in accordance with the invention are stabilized against shrinkage.

Moreover the compositions may be rendered water-insoluble by the mere application of heat which, if desired, may be a separate processing step or may be accomplished simultaneously with the use of heat during the operation of conventional finishing or sizing processes. The subjection of the materials to a moderate heat suffices to bring about a coaction of the materials, which renders substantially the entire composition water-insoluble.

Although in the preferred form of the invention the compositions after application to the fabrics are rendered water-insoluble, the compositions may be applied to the fabrics in a water-insoluble state. As a result, the compositions when applied preferably are in the form of an aqueous solution or dispersion which permits them to be easily applied to the fabric or other material in a form which is preferred by most manufacturers and permits the use of conventional apparatus. With respect to the use of conventional apparatus, it will be apparent that no difficulty will be experienced from gumming up of the compositions on the machines, and cleaning thereof is readily accomplished with water alone.

The use of water-dispersible compositions also makes it possible to apply the compositions to all types of synthetic fibers, and latex or other rubber-containing textiles, without any danger of dissolution or chemical attack, such as might result from the use of the organic solvents that have been resorted to in the prior art when crisp finishes are desired.

It is an advantage of the invention that the preferred compositions are relatively inexpensive, which renders the use of the compositions economical and, in view of the many advantages, preferable to ordinary materials heretofore used.

The coating compositions of the invention contain as the principal ingredients starch, a water-soluble potentially water-insoluble urea-aldehyde compound, and a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient.

With respect to the principal ingredients listed above, the major ingredient in amount is an amylaceous substance. The term "amylaceous substance" is used herein to denote any of the readily available commercial forms of starch, particularly those adapted for application to textiles, whether of root or other origin, and unmodified or modified with heat or chemicals but

which still retain their amylaceous character. However, in general, it has been found not desirable in most cases to use the modified starches which are characterized by an extremely high degree of solubility (before gelatinization), such as those approaching the solubility of dextrine. The use of such materials is not excluded, however, as in some cases highly solubilized starches or starch derivatives such as dextrine may be desired. Particularly desirable results have been obtained by the use of a starch which has been acylated to form, for example, acetylated starch. For convenience and simplicity of presentation, the invention will be described herein utilizing starch, but it is intended that the description shall also apply to the use of other amylaceous substances.

It is preferred to utilize an amount of starch which is at least 50% of the total amount of the principal ingredients and this may be increased if desired to as high as 90%. The use of a large amount of starch is desirable from a cost standpoint. The starch is used primarily to increase the weight and body of the fabric and the amount of starch which is used in the compositions of this invention is determined for the most part by the type of finished fabric desired.

The polyvinyl compositions which may be used in forming the compositions of this invention preferably comprise the polyvinyl alcohols which are water-soluble and commercially available for textile treatment. The polyvinyl alcohols referred to herein include those in the usual commercial form, and are white solids which are readily soluble in water. They are prepared in many cases from the esters or other compounds and accordingly, in commercial form, are admixed more or less with quantities of other polyvinyl compounds such as the esters. Although the polyvinyl compounds present with the polyvinyl alcohol may be water-insoluble by themselves, the mixture is substantially entirely water-soluble. To insure that the composition will be entirely water-soluble, it is preferable to utilize a polyvinyl composition which consists of a major portion of a water-soluble polyvinyl alcohol. The amount of substitution of other polyvinyl compounds for polyvinyl alcohol will be determined mainly by how closely the characteristics of such other polyvinyl compounds approach those of polyvinyl alcohol.

As to the commercial water-soluble polyvinyl alcohols, desirable results have been obtained by the use of a mixture of polyvinyl alcohols of medium and high viscosity. The polyvinyl alcohol of medium viscosity has a viscosity in the neighborhood of 24 centipoises in a 4% aqueous solution at 20° C. whereas a polyvinyl alcohol of high viscosity has a viscosity in the neighborhood of 55 centipoises under the same conditions of measurement.

The amount of such polyvinyl compound which is used should not be less than about 5% of the total principal ingredients, inasmuch as for smaller amounts the effect of crispness and springiness obtained by the use of the compositions is materially decreased.

The urea-aldehyde compounds, which it is preferred to use, are the partial condensation products of urea and an aldehyde reactive therewith which, for example, may be formaldehyde. The condensation is carried out to an extent short of the formation of a water-insoluble product. In the case of urea and formaldehyde this would be, for example, a methylol urea compound, such as dimethylol-urea.

Although formaldehyde, in general is the most convenient to use in forming the urea-aldehyde compound, any aldehydes which are reactive with urea to form a water-soluble but potentially water-insoluble resinous compound may be utilized. In addition to formaldehyde, they would include such compounds, for example, as crotonaldehyde, acetaldehyde and acrylicaldehyde and polymers and analogs of the aldehydes, such as trioxymethylene paraformaldehyde, paraldehyde and hexamethylene tetramine.

The amount of urea-aldehyde condensation product which is utilized should not be less than 5% of the total principal ingredients in order to obtain the desired permanence and water-insolubility resulting from the subsequent heat treatment of the materials. In general, it is preferred to use an amount of the urea-aldehyde condensation product which is substantially equal to the amount of polyvinyl compound. Either of these ingredients may vary, however, within a relatively wide range, but in general, it is preferred that neither of these ingredients shall exceed the other by more than 50%.

If desired, modifying agents such as sulfonated or sulfated oils and alcohols, or any of the known interface modifying agents may be utilized to improve the flow characteristics of the composition. In general it is possible to add any of the well known materials heretofore used for rendering compositions more amenable to textile processing operations.

Referring to the above discussed preferred amounts of the principal ingredients, it will be noted that a composition preferably will contain at least 50% of a starch, at least 5% of polyvinyl alcohol and at least 5% urea-aldehyde condensation product. In other words, the preferred ranges of these ingredients are 50 to 90% starch and the remainder, i. e., 50 to 10% comprising polyvinyl compound and urea-aldehyde condensation product neither of which exceeds the other by more than about 50%. As a specific example, a preferred composition containing 65 parts of starch will contain 35 parts of the other principal ingredients in equal amount, i. e., approximately 17½ parts each of polyvinyl compound and dimethylol urea. Either of these other ingredients, however, may vary between the range of 10 to 25 parts in order to obtain preferred results.

The compositions are prepared by mixing the principal ingredients with an amount of water sufficient to dissolve and disperse said ingredients and which amount may be increased depending upon the viscosity and concentration desired. The mixture thereupon is heated moderately from 140 to 150° F. i. e., enough to cause the starch to become dispersed, such as by swelling or gelatinizing. Modifying agents may be added, either prior or subsequent to such heating. The resulting solution thereupon may be applied to the fabrics by any well known conventional coating processes such as by dipping, or application with brushes, rolls, and the like. The coated fabrics subsequently are dried at an elevated temperature of preferably within the range of 225° to 260° F. As a result of the use of this elevated temperature, the coating becomes insolubilized upon the fabric.

While the insolubilization may be brought about with heat alone, it may be preferred to facilitate the insolubilization by chemical means.

If desired, for example, the presence of formaldehyde or a decrease in the pH value may be utilized to increase the rate of insolubilization. All such modifications are intended to be included within the scope of the invention.

It is not intended to limit the invention to any particular theory of how the urea-aldehyde reaction product, the polyvinyl compounds, and the starch become permanently bound to the fabric. There is some evidence to indicate that this may result from a chemical coaction between the starch and the urea-aldehyde, the polyvinyl alcohol or the urea-aldehyde or all three, but it may be limited to a physical coaction of the materials or a combined physical and chemical action. In any event, it is apparent that some coaction takes place which renders the composition into a unitary material which is permanently secured to the fabric even when subjected to repeated launderings and the like.

It will be apparent that the invention may be susceptible to many variations by one skilled in the art and all such variations are intended to be included within the scope of the following claims.

We claim:

1. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least about 5% of a water-soluble urea-aldehyde condensation product, and at least about 5% of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient.

2. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least about 5% of a water-soluble urea-aldehyde condensation product, and at least about 5% of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, said urea-aldehyde condensation product and said polyvinyl composition being present in substantially equal amounts.

3. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least about 5% of a water-soluble urea-aldehyde condensation product, and at least about 5% of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, said urea-aldehyde condensation product and said polyvinyl composition being present in amounts such that neither exceeds the other by more than 50%.

4. A composition of matter that is adapted to be applied to textile materials in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least about 5% of a water-soluble urea-aldehyde condensation product, and at least about 5% of a water-soluble polyvinyl alcohol.

5. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least about 5% of a water-soluble urea-formaldehyde condensation product, and at least about 5% of a water-soluble polyvinyl alcohol.

6. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least about 5% dimethylol urea, and at least about 5% of a water-soluble polyvinyl alcohol.

7. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an acetylated starch, at least about 5% of a methylol urea, and at least about 5% of a water-soluble polyvinyl alcohol.

8. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising as the principal ingredients, an amylaceous substance, a water-soluble urea-aldehyde condensation product, and a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, said amylaceous substance being present in an amount of at least 50% and not over 90% of said principal ingredients, and said remaining ingredients being present in an amount whereby neither exceeds the other by more than 50%.

9. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising as the principal ingredients, an amylaceous substance, a water-soluble urea-aldehyde condensation product, and a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, one hundred parts of said principal ingredients comprising 50 to 90 parts amylaceous substance, at least 5 parts of said urea-aldehyde condensation product, and at least 5 parts of said polyvinyl composition.

10. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising as the principal ingredients, an amylaceous substance, a water-soluble urea-aldehyde condensation product, and a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, one hundred parts of said principal ingredients comprising 50 to 90 parts amylaceous substance, and the remaining ingredients in an amount such that neither exceeds the other by more than 50%.

11. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising as the principal ingredients, an amylaceous substance, a water-soluble urea-aldehyde condensation product, and a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, one hundred parts of said principal ingredients comprising 50 to 90 parts of amylaceous substance and 10 to 50 parts of said urea-

aldehyde condensation product and said polyvinyl composition in substantially equal amounts.

12. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising as the principal ingredients, an amylaceous substance, a water-soluble urea-formaldehyde condensation product, and water-soluble polyvinyl alcohol, said amylaceous substance being present in an amount of at least 50% and not over 90% of the principal ingredients, and said remaining ingredients being present in an amount such that neither exceeds the other by more than 50%.

13. An aqueous dispersion of a composition of matter that is adapted to be applied to textile material and insolubilized thereon to render textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% of a water-soluble urea-aldehyde reaction product.

14. A method of imparting permanent crispness and stability against shrinkage to textiles comprising applying thereto an aqueous dispersion of 50 to 90 parts of an amylaceous substance, at least 5 parts of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, and at least 5 parts of a water-soluble urea-aldehyde condensation product, and thereafter heating to a temperature of at least 225° F.

15. A method of imparting permanent crispness and resistance to shrinkage to textiles comprising applying thereto an aqueous dispersion of a composition comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% of a water-soluble urea-aldehyde condensation product, and thereafter insolubilizing the composition on the fabric by means of heat.

16. A method of imparting permanent crispness and resistance to shrinkage to textiles comprising applying thereto an aqueous dispersion of one hundred parts of a composition containing 50 to 90 parts of an amylaceous substance, and the remainder a water-soluble polyvinyl alcohol and a water-soluble condensation product of urea and formaldehyde in amounts such that neither exceeds the other by more than 50%, and heating to a temperature at which the applied materials become insolubilized on the textile.

17. A method of treating textiles to impart a permanent crispness and resistance to shrinkage thereto, comprising applying thereto a composition of matter comprising an aqueous dispersion of at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% dimethylol urea, and thereafter heating the textile to a temperature of at least 225° F.

18. A method of treating textiles to impart a permanent crispness and resistance to shrinkage thereto, comprising forming an aqueous dispersion of a composition containing 50 to 90% of an amylaceous substance, at least about 5% of a water-soluble polyvinyl alcohol, and at least about 5% of a water-soluble urea-aldehyde condensation product, applying said dispersion to the textiles, and thereafter heating to a temperature at which the materials become insolubilized on the textiles.

19. A method of improving the physical characteristics of textiles comprising dispersing in water a composition containing at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% of a water-soluble condensation product of urea and an aldehyde, said polyvinyl alcohol and said urea-aldehyde condensation product being present in substantially equal amounts, applying the resulting dispersion to the textile, and thereafter heating to a temperature of at least 225° F. to insolubilize the composition on the textile.

20. A textile fabric characterized by a permanent crispness and stability against shrinkage when subjected to repeated launderings comprising a fabric having insolubilized thereon in situ a composition comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble urea-aldehyde condensation product, and at least 5% of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient.

21. A textile fabric characterized by a permanent crispness and stability against shrinkage when subjected to repeated launderings, comprising a fabric having a composition insolubilized thereon from an aqueous dispersion thereof, said composition comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% dimethylol urea.

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CERTIFICATE OF CORRECTION.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, lines 16 and 17, for "water-insoluble" read --water-soluble--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of January, A. D. 1946.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.

aldehyde condensation product and said polyvinyl composition in substantially equal amounts.

12. A composition of matter that is adapted to be applied to textile material in an aqueous medium and to be insolubilized thereon in situ to render the textile material permanently crisp and resistant to shrinkage, comprising as the principal ingredients, an amylaceous substance, a water-soluble urea-formaldehyde condensation product, and water-soluble polyvinyl alcohol, said amylaceous substance being present in an amount of at least 50% and not over 90% of the principal ingredients, and said remaining ingredients being present in an amount such that neither exceeds the other by more than 50%.

13. An aqueous dispersion of a composition of matter that is adapted to be applied to textile material and insolubilized thereon to render textile material permanently crisp and resistant to shrinkage, comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% of a water-soluble urea-aldehyde reaction product.

14. A method of imparting permanent crispness and stability against shrinkage to textiles comprising applying thereto an aqueous dispersion of 50 to 90 parts of an amylaceous substance, at least 5 parts of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient, and at least 5 parts of a water-soluble urea-aldehyde condensation product, and thereafter heating to a temperature of at least 225° F.

15. A method of imparting permanent crispness and resistance to shrinkage to textiles comprising applying thereto an aqueous dispersion of a composition comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% of a water-soluble urea-aldehyde condensation product, and thereafter insolubilizing the composition on the fabric by means of heat.

16. A method of imparting permanent crispness and resistance to shrinkage to textiles comprising applying thereto an aqueous dispersion of one hundred parts of a composition containing 50 to 90 parts of an amylaceous substance, and the remainder a water-soluble polyvinyl alcohol and a water-soluble condensation product of urea and formaldehyde in amounts such that neither exceeds the other by more than 50%, and heating to a temperature at which the applied materials become insolubilized on the textile.

17. A method of treating textiles to impart a permanent crispness and resistance to shrinkage thereto, comprising applying thereto a composition of matter comprising an aqueous dispersion of at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% dimethylol urea, and thereafter heating the textile to a temperature of at least 225° F.

18. A method of treating textiles to impart a permanent crispness and resistance to shrinkage thereto, comprising forming an aqueous dispersion of a composition containing 50 to 90% of an amylaceous substance, at least about 5% of a water-soluble polyvinyl alcohol, and at least about 5% of a water-soluble urea-aldehyde condensation product, applying said dispersion to the textiles, and thereafter heating to a temperature at which the materials become insolubilized on the textiles.

19. A method of improving the physical characteristics of textiles comprising dispersing in water a composition containing at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% of a water-soluble condensation product of urea and an aldehyde, said polyvinyl alcohol and said urea-aldehyde condensation product being present in substantially equal amounts, applying the resulting dispersion to the textile, and thereafter heating to a temperature of at least 225° F. to insolubilize the composition on the textile.

20. A textile fabric characterized by a permanent crispness and stability against shrinkage when subjected to repeated launderings comprising a fabric having insolubilized thereon in situ a composition comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble urea-aldehyde condensation product, and at least 5% of a water-soluble polyvinyl composition containing polyvinyl alcohol as the major ingredient.

21. A textile fabric characterized by a permanent crispness and stability against shrinkage when subjected to repeated launderings, comprising a fabric having a composition insolubilized thereon from an aqueous dispersion thereof, said composition comprising at least 50% of an amylaceous substance, at least 5% of a water-soluble polyvinyl alcohol, and at least 5% dimethylol urea.

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