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LAUNDRY SIZE FOR POLYESTER-COTTON BLENDS OF FABRIC

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6 Claims

ABSTRACT OF THE DISCLOSURE

An improved laundry size for fabrics composed of polyester and cotton fibers is described. The aqueous size contains unmodified starch, thermoplastic polymeric emulsion, a surfactant and a laundry sour. The size imparts a finish and a stiffness to fabrics containing blends of cotton and polyester which hereto was not obtainable by conventional laundry sizes.

BACKGROUND

(1) Field of the invention

This invention relates to laundry sizes and more particularly to laundry sizes designed especially for modern fabrics which are a blend of cotton and polyester fibers.

(2) Description of the prior art

It has been traditional in the laundry industry to finish the laundered product with a starch treatment for improved appearance. Today, in the laundry industry, colloidal sizing or starching is the general rule rather than the exception because there is little work coming into the modern laundry that will not be improved by sizing. Sizing increases flat abrasion, increases warp and filling tensile strength, and renews pattern definition, resulting in a fabric that looks, feels and stands up better. Starch or sizing also lays the nap and lint, makes for better ironing, and in general provides the various benefits of starch treatment.

The starch is a very important item in total supplies used in a laundry. Use of poor quality starch or improper use of the starch can cause considerable trouble. Because of the great variety of materials to be starched, different methods employed, and variation in plant conditions, preparation and use procedures should be in accordance with manufacturers' instructions. Variations in manufacturing processes produce many different types of starch, each suited to some special type of work. Heretofore, the actual preparation of the starch solution was an individual proposition which was peculiar to each laundry. With the advent of modern fabrics based on a blend of various fibers, the traditional starch or laundry sizing proved not to be completely satisfactory due to the different characteristics exhibited by synthetic fibers. Thus, a starch composition having enhanced flowability, consistency and stability which contains starch, souring agents and surfactants while being ideally suited to cotton fabrics has not been completely satisfactory when used with cotton-synthetic fiber blends.

Therefore, it is an object of this invention to provide a sizing composition for use in laundries which will satisfactorily stiffen, strengthen and improve the appearance of fabrics comprised of cotton and polyester fibers. It is another object of this invention to provide a process for the preparation of a cotton-polyester fiber size. These and other objects will become apparent from the following description and examples plus the appended claims.

SUMMARY OF THE INVENTION

In accordance with this invention, there is provided an improved size for fabrics comprised of a mixture of cotton and polyester fibers consisting essentially of (1) unmodified starch, (2) thermoplastic polymeric emulsion, (3) surfactant, (4) water and (5) a laundry sour. The foregoing size can be conveniently prepared by charging to a reactor containing water, surfactant and unmodified starch to form a slurry at an elevated temperature, adding the thermoplastic emulsion to said slurry and mixing therein, adding and mixing in the laundry sour and then cooling the thus prepared size followed by discharging the size from the reactor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In general the size formulation of this invention consists of an unmodified starch, a laundry sour chemical, a thermoplastic polymeric emulsion, a surfactant and water. Other ingredients may also be included in the size formulation for special purposes. For example, dye, perfume, compatible antimicrobial and germicidal agents or stain repellent chemicals. For the purposes of this invention, starch includes those derived from corn, wheat, rice, grain, sorghum, waxy grain sorghum, waxy maize and tapioca or mixtures thereof. Excluded from this description are starches which have undergone hydrolysis of some type and usually referred to in the laundry trade as a modified starch as well as material which has been fractionated from whole starch. Preferably the starch will be a corn starch. Based on total weight of the size composition, the size composition of this invention will contain from about 0.1 to about 10.0 weight percent of starch.

The thermoplastic polymeric emulsion utilized in this invention is an emulsion (or dispersion or latex) of a thermoplastic homopolymer or copolymer in tiny discrete finite particle forms dispersed in an aqueous system. Typically the thermoplast will have a particle size of from about 0.1 or 0.2 to about 3.0 or 5.0 microns in diameter. The typical emulsion will be comprised of from about 40 or 45 percent to about 60 or 65 weight percent of polymer with the balance being water except for a very slight minor amount of surfactant and/or any oxidant necessary to protect the emulsion until it is used. The typical polymeric emulsion of this invention is a polyvinyl acetate emulsion or latex and will preferably have a total solid content of from about 50 to about 60 weight percent. Based on total weight of the size composition, the size will contain from about 20 to about 80 weight percent of thermoplastic polymeric emulsion.

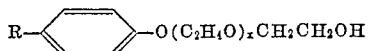
Generally, any of the sours used in the laundry industry at the present time may be used in the compositions of this invention. The laundry sours are made from acetic acid, glycolic acid, oxalic acid, sodium acid fluoride, sodium silicofluoride, ammonium acid fluoride, ammonium silicofluoride, zinc silicofluoride and mixtures thereof. Stock compositions of laundry sour may also be used. For example, solutions of ammonium silicofluoride or ammonium silicofluoride plus a small amount of ammonium acid fluoride may be made up so as to contain about 80 pounds of sour per 100 gallons. Of this 80 pounds of sour, 10 to 20 pounds may be ammonium acid fluoride. The laundry sour will comprise about 0.5 to about 5 weight percent of the size of this invention.

The surfactant or surface-active agent used in the composition of the present invention can be any anionic or nonionic surfactant or mixtures of surfactants that add stability, fluidity and penetration characteristics to the size composition. The surfactant is utilized in an amount from about 0.1 to about 3.0 weight percent.

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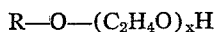
Examples of the surfactants or surface-active agents that can be used in the composition of this invention include:

(1) The polyoxyethylene condensates of monoalkylated phenols represented by the formula



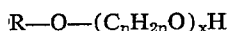
where R is an alkyl group containing from about 6 to 20 carbon atoms, and x is an integer from about 5 to 30;

(2) Ethylene oxide adducts of straight-chain primary alcohols represented by the formula



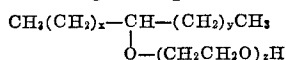
where R—O— is the residue of a hydrophobic alcohol containing from 8 to 22 carbon atoms, and x is an integer from 3 to 19 such that the ethylene oxide content is from 35 to 85 weight percent;

(3) Surface-active agents derived from straight-chain primary alcohols represented by the formula



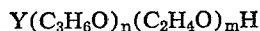
where R—O— is the residue of a hydrophobic alcohol containing 8 to 22 carbon atoms, n is both 2 and 3 in a single molecule, and x is an integer from about 3 to 19, indicating the total number of oxyalkylene radicals in the molecule;

(4) Surface-active agents represented by the formula



where x and y are integers such that the hydrophobic portion is a mixture of straight chains containing from 10 to 16 carbon atoms and z is from about 3 to 9;

(5) Conjugated polyoxyalkylene compounds as described in U.S. Pat. 2,677,700 and which correspond to the formula



where Y is the residue of an organic compound having from about 1 to 6 carbon atoms and one reactive hydrogen atom, n has an average value of at least about 6.4 as determined by hydroxyl number, and m has a value such that the oxyethylene portion constitutes from 10 to 90 weight percent of the molecule; and

(6) Polyoxyalkylene compounds conforming to the generic formula



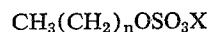
where Y is the nucleus of an organic reactive hydrogen compound containing x reactive hydrogen atoms and having up to 6 carbon atoms, x is an integer, P is a hydrophobic polyoxyalkylene chain having an oxygen/carbon atom ratio of not more than 0.40, the molecular weight of P and the value of x being such that the molecule, excluding E, has a molecular weight of at least about 400 to 900 and up to about 25,000 and E is a hydrophilic heteric polyoxyalkylene chain which (a) contains oxyethylene groups and at least 5% by weight of higher molecular weight oxyalkylene groups having at least 3 carbon atoms in their structure and (b) has an average oxygen/carbon atom ratio of greater than 0.40, E being present in the composition to the extent that it constitutes from 5 to 90 weight percent of the total composition. These compounds are more particularly described in U.S. Pat. No. 3,101,374.

The surfactants represented by the formula under group (3) above are prepared (1) by reacting a mixture of ethylene oxide and propylene oxide, or (2) by sequentially reacting propylene oxide and then ethylene oxide, or (3) by sequentially reacting at least two mixtures of ethylene oxide and propylene oxide where each of the mixtures to be reacted contain different ethylene oxide to propylene oxide ratios, with a mixture of straight chain alcohols containing from about 8 to 22 carbon atoms, preferably 12 to 17 carbon atoms, in the aliphatic chain. Thus the surfactants represented by the formula under

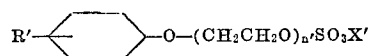
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group (3) above may have either a heteric or a block structure depending upon the method of preparation. The surfactants having heteric structure will possess random distribution of oxyethylene and oxypropylene groups attached to the alcohol residue. The surfactants containing the block structure will contain an ordered arrangement of oxypropylene and oxyethylene groups attached to the alcohol residue. It is also to be understood that these surfactants may be cogeneric mixtures, that is, the surfactants are a series of closely related homologues obtained by condensing a plurality of oxide units with an alcohol or mixture of alcohols.

Anionic surface-active agents can also be used as the surfactant in the composition of this invention. Typical of such anionic surface-active agents are alkyl sulfonates, alkyl aryl sulfonates, amides of sulfosuccinic acid, alkyl esters of sulfosuccinic acid, alkylphenoxypolyethoxyethyl sulfates, fatty alcohol sulfates, and the like. Preferred anionic surface-active agents are those selected from (1) alkyl aryl sulfonates in which the alkaryl group contains from 12 to 20 carbon atoms, (2) fatty alcohol sulfates of the general structural formula



in which n is an integer from 7 to 17, and x is selected from hydrogen, sodium, potassium, magnesium and ammonium, (3) alkylphenoxypolyethoxyethyl sulfates of the general structural formula



in which R' is an alkyl group containing from 8 to 10 carbon atoms, n' is an integer from 2 to 5, and X' is selected from hydrogen, sodium, potassium, magnesium, and ammonium, and mixtures of these anionic surface-active agents.

Alkyl aryl sulfonates which may be used are those derived from benzene, naphthalene, diphenyl, and diphenylmethane, and include among others: sodium and potassium hexyl-, hexyl-, octyl-, nonyl-, decyl-, hendecyl-, dodecyl-, tridecyl-, and tetradecylbenzene sulfonate. The alkyl group may comprise either a straight or branched chain. A preferred alkyl aryl sulfonate comprises the sodium salt of an alkyl benzene sulfonate containing an average of 16 carbon atoms.

Suitable alkylphenoxypolyethoxyethyl sulfates include sodium and potassium octyl-, nonyl-, and decylphenyl-, di-, tri-, tetra-, and pentaethyleneglycol sulfate, and the like. The alkyl group of these compounds may comprise either a straight or branched chain. A preferred material is sodium ditertiarybutylphenyldiethyleneglycol sulfate.

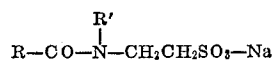
Among the anionic surface-active agents which have been found to be particularly useful in the process of this invention are the fatty alcohol sulfates, typical of which are sodium and potassium octyl-, nonyl-, decyl-, hendecyl-, dodecyl-, tridecyl-, tetradecyl-, pentadecyl-, hexadecyl-, heptadecyl-, and octadecylsulfate. Sodium lauryl sulfate is a preferred fatty alcohol sulfate for the purposes of this invention.

Suitable alkyl esters of sulfosuccinic acid (alkyl sulfonates) may be represented by the formula



where R is an alkyl radical containing from about 10 to 20 carbon atoms. Examples of the alkyl sulfo-esters are oleic acid ester of sodium isethionate. These compounds are more particularly described in U.S. Pat. No. 1,881,172.

Suitable amides of sulfosuccinic acids (alkyl sulfonamides) may be represented by the formula



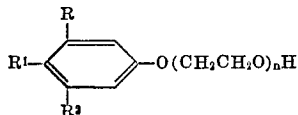
where R is an alkyl radical containing from 10 to 20 carbon atoms and R' is an alkyl radical containing from 1 to 6 carbon atoms. The preferred alkyl sulfo-amides

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are sodium N-methyl-N-tall oil acid taurate, sodium N-methyl-N-oleoyl taurate, sodium N-methyl-N-coconut oil acid taurate, and sodium N-methyl-N-palmitoyl taurate. These compounds are more particularly described in U.S. Pat. No. 1,932,180.

The disclosures of the above-noted U.S. patents which more particularly describe certain of the surface-active agents that can be used in the instant invention, are hereby incorporated by reference into the instant disclosure.

The polyoxyethylene adducts of monoalkylphenol are represented by the formula of group (1) above. The polyoxyethylene adduct of a polyalkylated phenol may be represented by the formula



where R is hydrogen or an alkyl radical having from about 1 to 12 carbon atoms, R¹ and R² are alkyl radicals having from about 6 to 16 carbon atoms, and n has a value from about 10 to 40. The preferred surfactant mixture is more fully discussed in Canadian Pat. No. 698,560.

Based on the total weight of the invented size composition, the size will contain from about 5 to about 70 weight percent of water. Included within the foregoing amount of water is the water used, if any, in preparing starch slurries or dispersions and laundry sour solutions.

As mentioned previously in addition to the foregoing materials, optional materials may be added to the size of this invention so as to give desirable aesthetic or anti-septic properties to the garments finished with the invented size. Typical of such additional materials are germicides and antimicrobial agents, dyes such as blueing or optical brighteners to improve the appearance of the garment or perfumes and essential oils such as lemon oil to further enhance the aesthetic acceptability of the finished garment.

The size of this invention is readily prepared in conventional laundry products manufacturing equipment. Simple equipment such as open kettles equipped with stirring means, heating and cooling means and a convenient method for discharging the prepared size will suffice.

The size is prepared by charging to the reactor or open kettle the requisite amount of water (after due allowance having been made for the water contained within any ingredient which is more convenient to handle in a slurry form), and surfactant. The water-surfactant temperature is then elevated to a temperature between about the gell point of the starch slurry and about 200° F. and preferably 180°–200° F., and unmodified starch in slurry form is added. The gell point of the starch slurry varies with the type of starch, e.g. corn, wheat or rice, but is typically about 160° to 175° F. The heating is then terminated. Thereafter, the thermoplastic polymeric emulsion is added to the slurry with mixing. After a uniform dispersion is obtained the laundry sour is added. After incorporation of the laundry sour and any desirable aesthetic modifier or other modifiers, the thus prepared size is cooled, preferably to a temperature between 65 to 100° F. and discharged from the kettle.

The following examples are included to illustrate the preparation of the compositions of the present invention but are not considered to be limiting. Unless otherwise specified all parts are parts by weight and all temperatures are degrees Fahrenheit.

EXAMPLE I

Six size formulations using equivalent weights of raw materials and following the same preparatory steps were prepared by altering the order of addition of the raw materials. In each case the surfactant (4 parts) was a non-ionic surfactant of the alkyl aryl alkylene oxide type, the

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sour (26 parts) a commercial sour comprised of sodium and ammonium silicofluorides, and the polyvinyl acetate polymer emulsion (744 parts) having a total solids content of 55%. The starch (93.3 parts) was corn starch slurried with 128 parts of water. Initially 967 parts of water charged to the kettle. The various orders of addition are shown in Table I below.

TABLE I

Size No. 1	Size No. 2	Size No. 3
Water	Water	Water
Surfactant	Polymer	Sour
Sour	Surfactant	Surfactant
Starch	Starch	Starch
Polymer	Sour	Polymer
Size No. 4	Size No. 5	Size No. 6
Water	Water	Water
Starch	Starch	Surfactant
Surfactant	Surfactant	Starch
Sour	Polymer	Polymer
Polymer	Sour	Sour

After 10 days of laboratory storage time at ambient temperature, only the formulation prepared by procedure listed under Size No. 6 remained in a stable and fluid condition.

EXAMPLE II

A size was prepared by adding surfactant and dispersing in water having a temperature of 100° F. The temperature was increased to 190° F. and the starch slurry added. The mixture was then cooled to 170° and polymeric emulsion and laundry sour were added. The mixture was cooled to 100°, discharged, and stored. After 26 days of storage time, the mixed size had retained its stability and fluidity (materials were as defined in Example I).

EXAMPLE III

A size similar to the size of Example II was prepared with the exception that 50% more starch was used. When discharged from the kettle, it was noted that the size was extremely viscous.

EXAMPLE IV

Following the procedure of Example II, a 500-gallon batch of the size was prepared. After two months warehouse storage in 30-gallon drums, the size composition had retained its stability. When a pump was installed in a drum containing the size formulation, it was dispensed in a fluid and uniform condition by employees of a commercial laundry.

In the same commercial laundry, a 50-pound load of polyester cotton blend fabric dress shirts were placed in a 60-pound washer. Forty-eight ounces of the size formulation was added to the washer and the wheel was run for five minutes at 80° F. with a six-inch water level. An extraction time of three minutes followed. The shirts subsequently were pressed on a regular shirt unit and exhibited excellent body and stiffness. Two subsequent loads were sized with this size formulation with equally excellent results.

EXAMPLE V

Polyester cotton blend fabric garments were soaked 10 minutes in a solution of the size of Example II made up by dispersing 2 ounces of size in each gallon of water. The garments were removed, wrung out by hand and placed on hangers, then allowed to pass through a steam air finishing chamber (Sussman). The finish on the garments as they were delivered from the steam area were stiff with body.

By way of comparison, an ordinary prior art commercial starch formulation (unmodified starch, sour and water) was used following the procedure of this example. The finished obtained on the garments was unacceptable and did not meet the standards for a commercial laundry finished article.

7 EXAMPLE VI

An 800-pound load of polyester cotton blend fabric aprons were sized with ten quarts of the size of Example II for 5 minutes in 120° followed by an 8-minute extraction operation. The aprons were preconditioned to 20% moisture content and then finished through an industrial type flat work iron. A very acceptable body and finish was obtained, which was not obtainable with any other type of starch used.

The foregoing examples and methods have been described in the foregoing specification for the purpose of illustration and not limitation. Many other modifications and ramifications will naturally suggest themselves to those skilled in the art based on this disclosure. These are intended to be comprehended as within the scope of this invention.

Having thus described the invention, what is desired to claim and secure by Letters Patent is:

1. An improved size for fabrics comprised of a mixture of cotton and polyester fibers consisting essentially of

- (1) an unmodified starch in the amount of from about 0.1 to about 10 weight percent,
- (2) polyvinyl acetate emulsion in the amount of from about 20 to about 80 weight percent,
- (3) an anionic or nonionic surfactant in the amount of from about 0.1 to about 3 weight percent,
- (4) laundry sour in the amount of from about 0.5 to about 5 weight percent, and
- (5) water in the total amount of from about 5 to about 70 weight percent.

2. The size according to claim 1 wherein the starch is unmodified corn starch.

3. The size according to claim 2 wherein the surfactant is an alkyl aryl oxyalkylated nonionic surfactant.

4. The process for preparing the size of claim 1 comprising the steps of

- (1) charging to a reactor containing water, surfactant

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and an unmodified starch to form a slurry at a temperature between about 165° and 200° F.,

(2) adding the thermoplastic polymeric polyvinyl acetate emulsion and laundry sour with mixing to said slurry,

(3) continuing mixing the mixture of step 2 until a uniform size is obtained,

(4) cooling the thus prepared size to a temperature of about 65° to about 100° F. and discharging from said reactor.

5. The process of claim 4 wherein said slurry in step 1 is heated at a temperature between about 180° and 200° F.

6. The process of claim 5 wherein said slurry in step 1 is prepared by admixing said surfactant and said water, elevating the temperature of said admixture and then admixing said starch.

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U.S. Cl. X.R.

117—139.5 A, C+R