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COMPOSITION AND METHOD FOR WASHING TEXTILES

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The present invention contributes to the art of laundering and cleansing textile goods. It relates to a composition and method for washing and laundering textile materials, particularly mixtures of fabrics and the like textile goods that have been dyed different colors and particularly in the washing together of colored and white fabrics so as to avoid the undesirable effects of "dye migration" from one fabric to another, especially from colored fabrics to white ones during their simultaneous laundering.

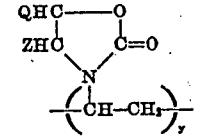
When textile fabrics and the like (including cloth and other textile manufactures) are being washed or laundered in domestic or commercial installations, it is ordinarily considered prudent to separate the white and colored goods and to wash them in individual batches. The reason for this, as is well known, is that many colored or dyed textile fabrics tend to release small quantities of the dyestuff during a washing process wherein they are cleansed. Such released dyestuff is likely to be absorbed by other fabrics or textile goods that are present in the same wash liquid. As a result of this dye migration or dye bleeding, white and light colored fabrics and other goods are likely to be stained to such a degree that they are spoiled and may have to be discarded.

The overcoming of such a situation in laundering operations would be of important practical significance. It would be a boon not only to housewives, but to commercial laundries as well. Tremendous amounts of textile materials, including fabric, clothing, bedding, table coverings, towels and other goods are washed daily. Considerable quantities of soap and synthetic detergents are required and employed for such purposes. Many remedies for dye-bleeding have been suggested. For example, acetic acid is frequently used to prevent bleeding of dye from colored woolen fabrics. Furthermore, dyestuff manufacturers have been diligent in their efforts to produce washfast dyes capable of being more strongly bonded or attached to the fibers colored therewith. Despite this, however, a completely effective solution to the problem involved has not heretofore been proposed or made available.

It would be advantageous, and it is the chief aim and concern of the present invention, to provide a new and highly efficacious composition and method for the washing and laundering of textile fabrics that would permit mixed handling of various colored fabrics and other dyed textile goods in the same washing bath as well as the simultaneous washing as a single batch in the same bath of white and colored textile materials without difficulties of the indicated and well known variety due to dye migration or bleeding. It would be a corollary advantage of commensurate magnitude and it is also an object of the invention, to provide such a composition and method capable of being utilized on an economical and easily handled basis.

In accordance with the practice of the present invention, an improved composition for the washing of mixed batches of colored or colored and white textile fabrics and other textile goods comprises a mixture of a synthetic detergent or soap material suitable for conventional

laundering purposes with an N-vinyl-2-oxazolidinone polymer of the general structure:



(I)

wherein Q and Z independently are hydrogen or methyl, with the limitation that at least one of said substituents is methyl, and y is a plural integer of considerable magnitude, such as one that is in excess of 10 and usually in excess of 100 or so to as high as 1,000–2,000 and higher.

Advantageously, the composition is prepared so as to contain in the admixture only a minor proportion of the N-vinyl-2-oxazolidinone polymer with the synthetic detergent or soap constituent. More advantageously, the composition is comprised of between about 0.1 and 15 weight percent, preferably from about 2 to 6 percent, based on the weight of the soap or detergent in the composition, of the incorporated N-vinyl-2-oxazolidinone polymer. The quantity of the polymer of Formula I incorporated in the laundry composition is relatively immaterial, as a general rule, so long as an amount is provided therein which is adequate to materially prevent dye migration during the laundering operations in which it is employed and the composition contains an adequate quantity of the soap or detergent to accomplish the intended laundering purpose.

While it is generally beneficial for the soap or detergent to be utilized in powder, flake or liquid form, such materials in solid form (that is to say in other than powders or the like finely divided bulks and flakes) may also be prepared in accordance with the present invention. Thus, bar soaps and detergents may be so constituted with marked advantage. As is indicated in the foregoing, the N-vinyl-2-oxazolidinone polymer may be incorporated in and mixed with any desired soap or detergent material conventionally employed for domestic and commercial laundry purposes. As an illustration, any of the detergents suitable for such purpose that are mentioned in "Synthetic Detergents and Emulsifiers—Up to Date III" by John W. McCutcheon, printed in 1955, by McNair-Dorland Co., Inc., of New York and reprinted from "Soap and Chemical Specialties" for July, August, September and October 1955, may be utilized. These include those under the trademarks "Dreft" (made from a base of the sodium salt of lauryl alcohol sulfonate), "Fab" (an alkyl aryl sulfonate plus binders), "Glim," "Joy," "Oxydol," "Tide," "Trend" (an alkyl aryl sulfonate plus binders), "Vel" (the ammonium salt of a sulfated monoglyceride) and the like. Likewise, conventional laundry soaps which, chemically, are combinations of fats (such as palmitin, stearin, olein, etc.) with alkalis (i.e., sodium for solid soaps and potassium for liquid soaps), including "Ivory" (neutral soap of high purity made from specially selected oils and fats), "Lux," "Fels-Naphtha," and the like or equivalent soaps may also be utilized in the practice of the present invention. As indicated in the foregoing, the compositions should contain an adequate quantity of the soap or detergent to permit their use in the conventional manner thereof. Those who are skilled in the art will have little difficulty in determining suitable proportions for meeting such end, taking into account the normal desired quantities and concentrations of the soap or detergent that are required in the wash liquid in order to effectively achieve the desired washing and laundering action.

The method of the present invention comprises adding to an aqueous washing or laundering bath for textile fabrics a quantity of an N-vinyl-2-oxazolidinone polymer

of the above described type in proportions consistent with those indicated in the foregoing and performing the washing operation with the benefit of such composition.

Practice of the present invention permits colored fabrics or colored and white fabrics to be washed together in the same laundry treatment with substantially if not completely minimized dye bleeding or dye migration and practically complete, if not entire, avoidance of fabric staining due to such causes. This simplifies the washing operation considerably and saves time, effort, water and detergent or soap for the purpose. The invention is adapted to be practiced on either the domestic or commercial level with equal effectiveness and benefit. The washing may be accomplished with benefit of practice of the present invention even when oxygen, chlorine or other bleaches are employed in the soap or detergent-containing wash liquid or when water softeners, including polyphosphates etc., are incorporated in the wash water to facilitate its cleansing action.

The N-vinyl-2-oxazolidinone polymers are adapted to accomplish the indicated advantages by reason of their exceptional affinity for and preferential absorbing ability of dye-stuffs of practically all classes, including vat, soluble vat, sulfur, acid, basic, direct, the various metallized dyestuffs, etc. Such dyestuffs, by way of didactic illustration, as Brilliant Green Crystals, Sulfanthrene Red 3B, Amacel Scarlet BS, Naphthol ASMX, Fast Red TRN Salt and Immedial Bordeaux G are readily absorbed by the N-vinyl-2-oxazolidinone polymers. Other dyestuffs, by way of further illustration, that are readily assimilated by the polymers include such mordant-acid dyes as Alizarine Light Green GS and Brilliant Alizarine Sky Blue BS PAT; such basic dyes as Brilliant Green Crystals, Du Pont Methylene Blue ZK, and Rhodamine B Extra S; such vat dyestuffs as Midland Vat Blue R Powder, Sulfanthrene Brown G Paste, Sulfanthrene Black PG Dbl., Sulfanthrene Blue 2B Dbl. Paste and Sulfanthrene Red 3B Paste, Indigosol Green IB Powder, a soluble vat dyestuff; such acetate dyes as Celliton Fast Brown 3RA Extra CF, Celliton Fast Rubine BACF, Artisil Direct Black FKZ, Artisil Direct Navy SR, Artisil Direct Red 3BP, Celanthrene Pure Blue BRS 400 percent, Celanthrene Red 3RB Conc., Acetamine Orange 3R Conc. and Acetamine Yellow N; B-Naphthol-2-chloro-4-nitroaniline, an azoic dye; such sulfur dyes as Katigen Brilliant Blue GGS High Conc. and Indo Carbon CLFS; and premetallized dyestuffs including Cibalan Yellow GRL and Supralan Blue NB and the like.

In this regard, insofar as the present invention is concerned, the N-vinyl-2-oxazolidinone polymers may literally be characterized as functioning in the laundry baths as "liquid fibers" due to the manner in which they act in competing with the insoluble fibers of the textile material for assimilation of the migrating or bleeding dye colors. In this way, the N-vinyl-2-oxazolidinone polymer preferentially absorbs the dyestuffs to prevent them from staining other fabrics.

Although it has been suggested to utilize other water soluble polymer resins as dyestripping agents, employment of these compounds for the purposes of the present invention has been found to be relatively ineffective and unsatisfactory. Thus, poly-N-vinyl-2-pyrrolidone (PVP) is mentioned as being capable of preventing dye bleeding in "Melliand's Textile Berichte" 32, 53–56 (1951). In particular, the use of PVP does not provide results at all near commensurate with those which may be obtained through use of the N-vinyl-2-oxazolidinone polymers in the practice of the present invention.

As indicated, either poly-N-vinyl-5-methyl-2-oxazolidinone (PVO—M, wherein Q in Formula I is methyl and Z is hydrogen), or poly-N-vinyl-4-methyl-2-oxazolidinone (wherein Z in Formula I is methyl and Q is hydrogen) that are equivalent for the present purpose may be utilized as the dye absorbing agent in the composition and method of the present invention in order to attain the

indicated benefits and realize the desired ends. Advantageously, the normally solid polymer that is utilized as a dye absorbing agent for the present purposes is a high polymer having a Fikentscher K-value of at least about 5. More advantageously, the N-vinyl-2-oxazolidinone polymer employed has a Fikentscher K-value between about 10 and 100. Most advantageously, its K-value is from about 10 or 15 to 75. The Fikentscher K-value of a polymeric substance is a quantity, as has been defined by Fikentscher in "Cellulosechemie" 13, 60 (1932), that represents an approximate measure of the weight fraction of a given sample of polymer in an infinitesimal molecular weight range. According to a concept that is widely acceptable to those skilled in the art, it may be said in corollation in an exponential manner, to the mean average molecular weight that obtains in a given sample of a polymer susbtance.

The N-vinyl-2-oxazolidinone polymers that are utilized in the practice of the present invention are moderately hygroscopic polymeric materials. PVO—M is readily soluble in water, in any concentration, excepting that it exhibits an inverse solubility phenomenon in plain water at temperatures commencing at about 40° C. However the presence of soaps or synthetic detergents in the water ordinarily tends to raise the cloud point of PVO—M to a substantial degree and frequently result in the complete avoidance of such phenomenon. Despite the solubility or insolubility of the anti-dye bleeding polymeric agents used in the practice of the present invention, satisfactory results are obtained at any temperature of operation. It is relatively immaterial whether the N-vinyl-2-oxazolidinone polymer is in solution or not, since the dye attracting polymers are satisfactorily operative and effective in either situation. Furthermore, especially under laundering conditions, the usual agitation of the wash baths tends to maintain the polymer in uniform dispersion therethrough even under conditions when it is insoluble therein. The polymeric agents are easily and readily rinsed from the washed fabrics in the course of the conventional washing operation during their laundering. No difficulty is experienced with residues of the N-vinyl-2-oxazolidinone polymer on the fabric or other textile goods that have been treated.

PVO—M is generally obtainable as a white powder which is free from perceptible odor. PVO—M is disclosed in the copending application of Wilhelm E. Walles, William F. Tousignant and Thomas Houtman, Jr., having Serial No. 696,317 (now U.S. 2,919,279) which was filed on November 14, 1957, for "N-Vinyl-X-Alkyl-2-Oxazolidinone Compounds." Besides their excellent capabilities for preventing or minimizing dye bleeding in the practice of the present invention, the N-vinyl-2-oxazolidinone polymers have other beneficial effects on the soap or detergent wash formulations in which they are incorporated. For example, they exhibit a pronounced tendency to reduce the irritating and sensitizing propensity towards human skin of most of the synthetic detergent laundry compositions. In addition, due to their slight hygroscopicity, their compatibility with washing powders of either the soap or synthetic detergent variety is excellent.

In order to further illustrate the invention, several pieces of cotton fabric having individual dimensions of 2 x 4 inches obtained from a light sheeting grade of regular quality stock were dyed in the conventional manner to a dark blue shade of color with Direct Black AT (no Color Index), a direct dye obtained from General Dyestuff Company division of General Aniline & Film Company. Each of the samples of dyed fabric were then attached to separate 2 x 4 inch pieces of standard test fabric which were made up of individual ribbons of cloth prepared separately from wool, viscose rayon, silk, cotton, acetate rayon and nylon. Each of the pieces of dyed cotton goods and the test fabrics were then given a standard washing test in a launderometer according to

A.A.T.C.C. Wash Test No. 2. In this test the fabric to be tested and the washing solution are tumbled together in a jar containing steel balls for 30 minutes at 120° F. A bath factor (weight ratio of washing solution to fabric) of about 50:1 was employed. Each of the washing solutions were prepared with 0.5 percent by weight, based on the weight of the solution, of "Ivory" soap. One of the test samples designated "A" was subjected to the test with an unmodified solution of the soap. Another, designated sample "X" was washed with a solution containing 0.05 percent by weight of K–20.2 PVO—M. For purposes of comparison, a third sample (sample "Z") was washed in the soap solution containing about 0.05 percent by weight of X–30 PVP. After completion of the wash tests, each of the samples were carefully examined for evidence of dye migration or discoloration in the ribbons of diverse fabric attached to the dyed cotton cloth. The results are set forth in the following Table I.

TABLE I

Effect of N-Vinyl-2-Oxazolidinone Polymers in Minimizing Dye-Bleeding

Sample	"A"	"X"	"Z"
Wool	[1] 0	0	0.
Viscose rayon	Blue	Vanishingly Slight Pink.	Noticeable Pink.
Silk	0	0	0.
Cotton	Blue	Vanishingly Slight Pink.	Blue.
Acetate Rayon	0	0	0.
Nylon	0	0	0.

[1] 0 indicates no color change.

As is apparent from the foregoing, the dye in the cotton blank bled onto the viscose rayon and cotton but did not migrate into the other test fabrics. The use of PVP did not alter this undesirable dye migration. On the other hand, PVO—M prevented the bleeding almost completely. It should be taken into account that the physical attachment of the test samples introduced a relatively rigorous condition of testing.

In order to further illustrate the invention, the foregoing experimentation was duplicated excepting to conduct the wash tests under more severe conditions at 160° F. for 45 minutes. In addition, according to A.A.T.C.C. Wash Test No. 3, about 0.2 percent by weight of sodium carbonate (Na_2CO_3) was added to each of the wash liquids which contained the same quantities of soap and polymer additive (excepting for the blank). The results are set forth in the following Table II.

TABLE II

Effect of N-Vinyl-2-Oxazolidinone Polymers in Minimizing Dye-Bleeding Under Severe Conditions of Washing

Sample	"A'"	"X'"	"Z'"
Wool	[1] X	X	X.
Viscose Rayon	Dark Blue	Very Light Blue.	Dark Blue.
Silk	Pink	0	0.
Cotton	Dark Blue	Very Light Blue.	Dark Blue.
Acetate Rayon	do	0	0.
Nylon	X	X	X.

[1] X indicates complete disintegration of test fabric.

As is apparent, the PVP was not effective for viscose or cotton even though it was moderately effective for silk and slightly effective on the acetate rayon. The PVO—M was entirely effective for silk and acetate rayon and fairly effective for viscose rayon and cotton. It should be borne in mind, incidentally, that the usual laundering conditions are much milder than those effected in the foregoing very severe tests.

Identical results are obtained when the above tests are repeated with wash liquids containing normal quantities of sodium hypochlorite bleach or pyrophosphate water softener ("Calgon"), or both.

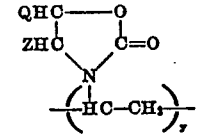
Results similar to the foregoing are also obtained when the present invention is practiced to launder with any textile cleansing soap or synthetic detergent other varieties of textile fabrics and goods dyed with other varieties of dyestuffs, including any of those or their equivalents mentioned in the foregoing and conventionally employed for the coloration of textile materials such as Amacel Scarlet BS, an acetate dye (American Prototype No. 244) and Calcodur Pink 2BL, a direct dye (Color Index 353).

By way of still additional illustration, a separate mixture of soap powder ("Ivory Snow") was mixed in a ratio of about 10 parts of soap powder to one part of polymer with PVO—M. This mixture remained free-flowing and entirely useable even after having been left in shallow depths in open beakers for periods of a month under conditions of normal humidity (about 50–60 percent average relative humidity at room temperature). In contrast, when the same formulation was made with PVP, the composition converted to a hard, unuseable block within about 10 hours as a result of moisture pick-up from the air by the highly hygroscopic polymer.

Since many changes and alterations in the practice of the present invention can be entered into without departing from its intended spirit and scope, it is to be understood that all the foregoing specification and description be interpreted as being illustrative and demonstrative of the invention and not limiting thereof.

What is claimed is:

1. A detergent composition consisting essentially of (1) a textile cleansing detergent material for laundry use selected from the group consisting of fatty acid soap and synthetic organic non-soap detergents that are adapted for laundry use and (2) between about 15 and about 0.1 weight percent, based on the weight of detergent in the composition, of a water-soluble N-vinyl-2-oxazolidinone polymer of the structure:



where Q and Z are independently selected from the group consisting of hydrogen and methyl with the limitation that at least one of said substituents must be methyl and *y* is an integer having a positive value of at least about 10.

2. A solid composition according to claim 1.

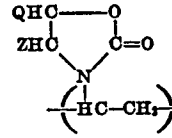
3. A liquid composition according to claim 1.

4. The detergent composition of claim 1, wherein said N-vinyl-2-oxazolidinone polymer is poly-N-vinyl-5-methyl-2-oxazolidinone.

5. A flake composition according to claim 2.

6. A powder composition according to claim 2.

7. In the method of laundering colored textile materials and goods dyed with a dyestuff selected from the group consisting of vat, soluble vat, sulfur, acid, basic, direct and metallized dyestuffs in an aqueous wash bath with a textile cleansing laundering agent in said bath selected from the group consisting of soap and synthetic organic non-soap detergents that are adapted for laundry use, the improvement comprising adding to said wash bath during said laundering between about 0.1 and 15 percent, based on the weight of the laundering agent in said wash bath, of a water-soluble N-vinyl-2-oxazolidinone polymer of the structure:



wherein Q and Z are independently selected from the group consisting of hydrogen and methyl with the limita-

tion that at least one of said substituents must be methyl and y is an integer having a positive value of at least about 10.

8. The method of claim 7, wherein said N-vinyl-2-oxazolidinone polymer is added at the start of said laundering.

9. The method of claim 7, wherein said N-vinyl-2-oxazolidinone polymer is poly-N-vinyl-5-methyl-2-oxazolidinone.

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