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3,303,051

**PROCESS OF CONDITIONING CELLULOSE ACETATE WITH HYDROXYETHYLCELLULOSE****Julien Paul, Tiverton, R.I., assignor to United Merchants and Manufacturers, Inc., New York, N.Y., a corporation of Delaware****No Drawing. Filed Apr. 5, 1963, Ser. No. 270,808****9 Claims. (Cl. 117—62.1)**

This invention relates to processes of dyeing and/or printing cellulose acetate yarns and fabrics and, more particularly, to the pretreatment of cellulose acetate yarns and fabrics to condition them so that they readily and uniformly receive dyes, especially dyes for which they normally have little substantivity and/or affinity.

In this specification all percentage values are given on a weight basis.

Textiles—namely, yarns and fabrics composed wholly or partially of cellulose acetate fibers or filaments—cannot by presently known techniques be colored—i.e., dyed or printed—employing many of the available dyes such as the reactive dyes. In many cases, it is impossible to attain an identical hue on yarns and fabrics containing cellulose acetate fibers along with other fibers—such as, for example, cotton fibers. Nor is it possible to dye or print on cellulose acetate yarns and fabrics employing, for example, the reactive dyes commercially available which dyes are now popular because of the bright colors, fast to washing and sunlight, produced thereby on fibers, chiefly cellulosic, which have a marked affinity therefor. For example, attempts to color a mixture of cotton and cellulose acetate fibers a bright turquoise shade by heretofore known techniques results in failure because the acetate portion of the yarn or fabric will always be duller than the cotton. There are no bright turquoise dyestuffs in the dispersed dyestuff range which have to be used to color the cellulose acetate and hence it is not feasible with presently available techniques to produce bright uniform turquoise shades on blends of cotton and cellulose acetate. The difficulty of uniformly coloring such blends is also compounded by the further difficulty of obtaining equal fastness properties with the two ranges of dyestuffs which must be used. The fastness properties of the dyestuffs on each fiber can differ widely with respect to resistance to exposure to light, water, solvents and other such influences. Each fiber can also require a different method for the final fixation of the dyestuff, hence the processing of yarns and fabrics composed of blends of fibers by heretofore known techniques is invariably much more complex than it is for yarns and fabrics composed of fibers all of the same chemical composition.

One method which has been proposed as a solution for these difficulties is the coloration of such fabrics and yarns by applying thereto either an oil-in-water or water-in-oil pigmented emulsion. While this method does produce uniformly colored yarns and fabrics it leaves much to be desired. The resulting yarn or fabric is usually stiffened considerably and if the blended yarn or fabric has a high proportion of synthetic fibers it usually has poor fastness to dry cleaning, solvent spotting and rubbing. The range of hues producible by such pigmented printing and dyeing techniques also leaves much to be desired and bright hues,

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as a general rule, cannot be produced by presently available pigmented emulsions.

By cellulose acetate, as used herein, is meant cellulose diacetate (Celanese) and cellulose triacetate (Arnel and Tricel).

It is the principal object of this invention to provide a process for conditioning the surface of yarns and fabrics composed of all cellulose acetate or containing at least 10% of cellulose acetate, so that they can be uniformly and readily dyed and/or printed to produce pleasing effects including bright hues heretofore not obtainable, and particularly can be colored with dyestuffs for which cellulose acetate normally has little or no affinity.

Other objects and advantages of this invention will be apparent from the following detailed description thereof.

In accordance with this invention the cellulose acetate containing yarns or fabrics including such yarns or fabrics composed wholly of cellulose acetate, is coated before dyeing or printing with an aqueous alkali solution of hydroxyethylcellulose and the coating thus produced coagulated to form a water-insoluble hydroxyethylcellulose firmly bonded to the cellulose acetate fibers, which water-insoluble hydroxyethylcellulose has surprisingly good substantivity and/or affinity for readily available dyestuffs such as the reactive dyes, vat dyes, azoic dyes, naphthol shades, chrome dyes, direct dyes and sulfur dyes, applied by conventional dyeing techniques. Cellulose acetate blends containing fibers of markedly different dye characteristics when treated by the process of this invention are dyed or printed with uniform coloration in bright colors, and the colorations possess good fastness properties to light, heat, water, solvents, abrasion, etc.

The coagulated and regenerated hydroxyethylcellulose provides a cellulosic surface over the cellulose acetate yarn or fabric which is receptive of dyes used in dyeing or printing cellulosic materials. The hydroxyethylcellulose used is produced by reacting alkali cellulose with ethylene oxide so that from 2% to 10% advantageously from about 2% to about 5% of ethylene oxide is actually combined with the alkali cellulose as disclosed more fully in United States Patent 2,847,411, granted August 12, 1958. The preferred hydroxyethylcellulose is that sold commercially under the trademark "Ethylose" which has an ethylene oxide content of about 4.0% and has the hydroxy groups evenly distributed along the cellulose chain and evenly substituted with ethyl substituents, the degree of substitution being about 0.15. Films produced as herein described are remarkably resistant to swelling in water, have good affinity for dyestuffs and result in colored products which are fast to washing, sun, abrasion and dry cleaning.

The concentration of hydroxyethylcellulose in the solution applied to the cellulose acetate textile can be varied from 2% to 8%. A preferred concentration for this solution is about 5%. The amount of alkali metal, e.g., sodium or potassium hydroxide, in this solution to obtain proper solubility of the hydroxyethylcellulose is from 5% to 9%, preferably about 6.25%. Preferably the solution also contains a small amount of an amphoteric detergent, desirably from 0.1% to 1%. Thus the hydroxyethylcellulose solution contains from 2% to 8% hydroxy-

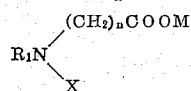
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ethylcellulose, from 5% to 9% alkali metal hydroxide, preferably from 0.1% to 1% amphoteric detergent, and the rest water. A preferred solution contains:

	Percent
Hydroxyethylcellulose -----	5.00
Sodium hydroxide -----	6.25
Amphoteric detergent -----	0.25
Water -----	88.5
Total -----	100

As the amphoteretic detergent, the alkali metal, e.g., sodium or potassium salt of a C<sub>10</sub> to C<sub>18</sub> aliphatic imidazole carboxylic acid is preferred. This amphoteric surfactant is available commercially under the trade name "Uniterge K." It has the surprising property of promoting the penetration and distribution of the hydroxyethylcellulose into and around the fibers and/or filaments of cellulose diacetate and cellulose triacetate. Other amphoteric detergents which can be used are:

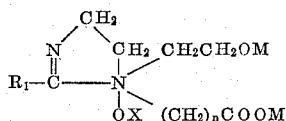
(A) Deriphat, such, for example, as sodium N-lauryl β-aminopropionate; these compounds have the formula:



in which R<sub>1</sub> is an alkyl group containing from 8 to 19 carbon atoms; n is an integer from 1 to 2; M is sodium, potassium, ammonium, monoethanolamine, diethanolamine or triethanolamine; and X is hydrogen or an ethoxyoxylated group having from 1 to 20 carbon atoms.

(B) The alkali metal salts of the ethoxylated acyl alkyl amines, in which the ethoxylated groups have from 1 to 20 carbon atoms, preferably 10 to 15, exemplified by Triton QS-15.

(C) The Miranols, which are compounds having the formula:



in which R<sub>1</sub> is an alkyl group having from 8 to 19 carbon atoms; n is an integer from 1 to 2; M is sodium, potassium, ammonium, monoethanolamine, diethanolamine or triethanolamine; and X is hydrogen or an ethoxyoxylated group having from 1 to 20 carbon atoms.

The solution is prepared at temperatures below 77° F. A portion of the water can be added as ice to facilitate production of the solution. Lower temperatures facilitate dissolution of the hydroxyethylcellulose. At temperatures above 77° F. there is a tendency for gelation to take place. The amphoteric detergent is dissolved in water while agitating. The amphoteric nature of this surfactant insures good stability in the alkaline medium necessary to dissolve the hydroxyethylcellulose and provides for a good wetting action of the hydroxyethylcellulose on the textile material. It also facilitates the dispersion of the hydroxyethylcellulose when added to the water containing the amphoteric detergent. After a good dispersion is obtained the sodium hydroxide is added followed by the addition of about one-fifth the water content as ice. The use of ice accelerates solution and also improves the filterability of the solution. After filtration the solution can be used but it is preferred to allow it to age for about 24 hours. Such aging lowers the viscosity of the solution thereby making it easier to apply to the textile material.

The hydroxyethylcellulose solution thus prepared can be applied in any conventional manner such as by spraying, coating or padding. The amount of hydroxyethylcellulose solution deposited on the textile can vary between 10% to 100% of the textile material's weight. A preferred amount is approximately 80% based on the dry weight of the textile.

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After the application of the hydroxyethylcellulose solution to the cellulose acetate yarns or fabrics, the latter is treated to convert the hydroxyethylcellulose to a water-insoluble form. Preferably, but not necessarily, the regeneration is preceded by a steaming treatment. Such steaming is effected by introducing the textile material impregnated with the hydroxyethylcellulose into a steaming chamber maintained at a temperature of 200° F. to 250° F. and exposing it to this atmosphere for approximately 10 seconds to 50 seconds. Preferred steaming conditions are about 240° F. with a dwell time of 30 seconds. This steaming causes the hydroxyethylcellulose solution to more thoroughly penetrate into the cellulose acetate. At the steaming temperatures, the viscosity of the hydroxyethylcellulose decreases by approximately 2000 centipoises to 3000 centipoises, probably followed by some gelation of the deposited hydroxyethylcellulose. Such gelation at this stage is not detrimental but is advantageous in preventing loss of hydroxyethylcellulose during the subsequent coagulating and regenerating treatment.

The deposited hydroxyethylcellulose, whether or not subjected to a steaming treatment, can be coagulated and regenerated by a number of methods. The regeneration can be accomplished through the removal of the alkali metal hydroxide either through neutralization, dehydration, gelation through heating, followed by washing, or a combination of any of the foregoing. Coagulants and regenerants which can be used are as follows:

(A) Alkaline coagulants:

- (1) Sodium hydroxide solution of mercerizing strength, i.e., 20% to 30%
- (2) Solutions of sodium carbonate
- (3) Solutions of sodium bicarbonate
- (4) Solutions of ammonium sulfate
- (5) Solutions of borax
- (6) Solutions of trisodium phosphate
- (7) Solutions of disodium phosphate
- (8) Solutions of sodium silicate

(B) Acid coagulants:

- (1) Solutions of water soluble acids such as
  - (a) Sulfuric acid
  - (b) Phosphoric acid
  - (c) Acetic acid
  - (d) Formic acid
- (2) Solutions of acid salts or salts and acid such as—
  - (a) Sodium sulfate and sulfuric acid
  - (b) Sodium phosphate and phosphoric acid
  - (c) Aluminum sulfate and sulfuric acid
- (3) Vapors of various acids such as—
  - (a) Carbon dioxide gas
  - (b) Acetic acid vapor
  - (c) Formic acid vapor

Treatment with acid media effects neutralization of the alkali metal hydroxide with consequent precipitation of the hydroxyethylcellulose in water-insoluble form.

(C) Neutral coagulants:

- (1) Solutions of ammonium salts—
  - (a) Ammonium sulfate solution
  - (b) Ammonium sulfate and sodium sulfate solution

(D) Heat:

- (1) Hot air
- (2) Infra red
- (3) Steam

Except for coagulating and regeneration procedures described in class D, all of the procedures are best conducted at temperatures of from 40° C. to 60° C. Class D procedures are carried out at any convenient temperature controlled by the heating medium used. In all cases the coagulation and regeneration procedure effects pre-

cipitation of the hydroxyethylcellulose in a form which bonds with the fibers of the textile material.

Coagulation and regeneration should in all cases be followed by rinsing with water or by neutralizing or acidifying, and rinsing to remove by-products such as salts and excess acid or alkaline materials.

A preferred neutralization procedure is the use of a solution of ammonium sulfate and sodium sulfate at a temperature of 50° C. Equally good results can be obtained using a solution of 10% sulfuric acid and 15% sodium sulfate at 50° C. Such solutions produce hydroxyethylcellulose films on the fibers of the cellulose acetate textile materials with the least amount of stiffening and with a minimum tendency to reswell upon subsequent exposure to water.

The thus treated cellulose acetate textile materials can be dyed with commercially available dyestuffs used for cellulosic materials, employing conventional dyeing and/or printing techniques used with such dyestuffs and with the production of uniform colorations fast to washing, dry cleaning, solvent spotting and rubbing on the textile materials, including yarns and fabrics composed of blends of different fibers having markedly different dye affinities. Typical suitable dyestuffs are listed below:

## (A) REACTIVE DYES

	Part I C.I.
Procion Yellow 6 G.....	C.I. Reactive Yellow 1.
Cibacron Brilliant Yellow 3G.....	C.I. Reactive Yellow 2.
Levafix Yellow 4 G.....	C.I. Reactive Yellow 10.
Drimarene Yellow Z-3 GL.....	C.I. Reactive Yellow 11.
Remazol Golden Yellow Y.....	No Color Index No.
Procion Brilliant Orange G.....	C.I. Reactive Orange 1.
Cibacron Brilliant Orange G.....	C.I. Reactive Orange 2.
Drimarene Orange 2-G.....	Reactive Orange 6.
Remazol Brilliant Orange RR.....	No Color Index No.
Procion Brilliant Red 2 B.....	C.I. Reactive Red 1.
Cibacron Brilliant Red 3 B.....	C.I. Reactive Red 4.
Reactone Red 2 B.....	C.I. Reactive Red 17.
Remazol Brilliant Red BB.....	No Color Index No.
Procion Purple H 3 RS.....	C.I. Reactive Violet 1.
Cibacron Violet 2 R.....	C.I. Reactive Violet 2.
Remazo Red Violet R.....	No Color Index No.
Drimarene Violet Z-RL.....	C.I. Reactive Violet 3.
Procion Blue 3 G.....	C.I. Reactive Blue 1.
Procion Brilliant H 7 G.....	C.I. Reactive Blue 3.
Cibacron Brilliant Blue BR.....	C.I. Reactive Blue 5.
Drimarene Blue ZGL.....	C.I. Reactive Blue 16.
Remazol Brilliant Blue R.....	No Color Index No.
Levafix Brilliant Blue RR.....	C.I. Reactive Blue 12.
Levafix Brilliant Green IB.....	C.I. Reactive Green 1.
Procion Brilliant Green 2 B.....	No Color Index No.
Cibacron Brown 3 GR.....	C.I. Reactive Brown 1.
Procion Brown H 4R.....	No Color Index No.
Procion Black HN.....	No Color Index No.
Cibacron Black BG.....	C.I. Reactive Black 1.
Remazol Black B.....	No Color Index No.
Drimarene Black Z BL.....	C.I. Reactive Black 4.
Levafix Grey IG.....	C.I. Reactive Black 2.

## (B) VAT DYES

	Part I	Part II
Ponsol Flavone GC.....	C.I. Vat Yellow 2.....	67300
Algol Orange RFN.....	C.I. Vat Orange 5.....	73335
Ciba Brilliant Pink R.....	C.I. Vat Red 1.....	73360
Indanthrene Scarlet 2G.....	C.I. Vat Red 14.....	71110
Sandothrene Violet 4NR.....	C.I. Vat Violet 1.....	60010
Ciba Blue 2 B.....	C.I. Vat Blue 5.....	73065
Indanthrene Brilliant Green B.....	C.I. Vat Green 1.....	59825

## (C) AZOIC DYES

	Part I	Part II
Rapidogen Yellow G.....	C.I. Azoic Yellow 1.....	37610/37090
Rapidogen Orange RFN.....	C.I. Azoic Orange 3.....	37558/37010
Rapidogen Red G.....	C.I. Azoic Red 6.....	37520/37090
Rapidogen Violet B.....	C.I. Azoic Violet 1.....	37505/37165
Rapidogen Blue B.....	C.I. Azoic Blue 6.....	37505/37175
Rapidogen Green B.....	C.I. Azoic Green 1.....	37585/37175
Rapidogen Black Brown T.....	C.I. Azoic Brown 16.....	37605/37120
Rapidogen Black 3G.....	C.I. Azoic Black 4.....	None

## (D) NAPHTHOL SHADES

Naphthol AS-RL.....	Part I, New C.I. 11; Part II, New C.I. 37535, and
5 Fast Red B Salt.....	Part I, New C.I. 5; Part II, New C.I. 37125.
Naphthol AS-ITR.....	Part I, New C.I. 12; Part II, New C.I. 37550, and
Fast Red ITR Salt.....	Part I, New C.I. 42; Part II, New C.I. 37150.
10 Naphthol AS-L3G.....	Part I, New C.I. 33; Part II, New C.I. 37620, and
Fast Red AL Salt.....	Part I, New C.I. 36; Part II, New C.I. 37275.
Naphthol HB.....	Part I, New C.I. 16; Part II, New C.I. 37605, and
15 Fast Orange GC Salt.....	Part I, New C.I. 2; Part II, New C.I. 37005.
Naphthol AS-RL.....	C.I. given above, and
Fast Red RL Salt.....	Part I, New C.I. 34; Part II, New C.I. 37100.
Naphthol AS-PH.....	Part I, New C.I. 14; Part II, New C.I. 37558, and
20 Fast Red AL Salt.....	C.I. given above.
Naphthol AS-PH.....	C.I. given above, and
Fast Orange RD Salt.....	Part I, New C.I. 49.
Naphthol AS-BS.....	Part I, New C.I. 17; Part II, New C.I. 37515, and
25 Fast Scarlet RN Salt.....	Part I, New C.I. 13; Part II, New C.I. 37130.

## (E) CHROME DYES

	Part I	Part II
(1) Chrome Luxine Yellow 5G.....	None.....	None
(2) Chromocitronine R.....	C.I. Mordant Yellow 26.....	22880
(3) Chrome Fast Orange RL.....	C.I. Mordant Orange 37.....	18730
(4) Chrome Fast Red NL.....	None.....	None
(5) Printing Chrome Brown DS.....	None.....	None
(6) Panduran Blue B.....	None.....	None
(7) Panduran Turquoise.....	None.....	None
(8) Panduran Green G.....	None.....	None
(9) Chrome Luxine Green S.....	Mordant Green 3.....	None
(10) Novochrome Fast Grey N.....	None.....	None

## (F) DIRECT DYES

	Part I	Part II
Fastusol Orange LS GL-CF.....	C.I. Direct Orange 59.....	None
Fastusol Red L4 BL-CF.....	C.I. Direct Red 79.....	29065
Pontamine Fast Blue 4 GL.....	C.I. Direct Blue 78.....	34200

## (G) SULFUR DYES

	Part I	Part II
55 Sodyesul Liquid Yellow E-CF.....	C.I. Solubilized Sulfur Yellow 4.....	53125
Sodyesul Liquid Green BG-CF.....	C.I. Solubilized Sulfur Green 16.....	None
Sodyesul Liquid Black 4G-CF.....	C.I. Solubilized Sulfur Black 1.....	53185

In the examples given below the cellulose acetate was first conditioned by the following typical four-step procedure:

65 **Step 1.**—The cellulose acetate fabric is impregnated with a solution of 5% hydroxyethylcellulose, .25% "Uniterge K," 6.25% sodium hydroxide and 88.50% water. This impregnating step can be conducted in a conventional two bowl textile padder, at room temperature. The expression of the padder is set so that the textile material absorbs approximately 80% of its dry weight of the impregnating solution.

70 **Step 2.**—This optional, but preferred, step consists of steaming the textile material from Step 1 in a continuous horizontal steamer at 250° F. for 30 seconds.

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*Step 3.*—In this step the regeneration and coagulation of the hydroxyethylcellulose film is conducted in a conventional 8-compartment open washer. Each compartment is filled with solutions in accordance with the descriptions which follow:

## Compartment 1:

Ammonium sulfate	percent	15
Sodium sulfate	do	5
Water	do	80
Temperature	° F	122

This provides a neutral bath.

Compartment 2: Overflowing cold water.

## Compartment 3:

Sulfuric acid conc.	percent	5
Sodium sulfate	do	10
Water	do	85
Temperature	° F	122

In this compartment neutralization of the caustic soda employed in Step 1 is effected to convert the hydroxyethylcellulose to an insoluble form.

Compartment 4: Overflowing cold water.

## Compartment 5:

Sodium carbonate	percent	0.25
Temperature	° F	180

## Compartment 6:

Sodium carbonate	percent	0.25
Temperature	° F	180

In compartments 5 and 6 excess acid used in compartment 3 is neutralized.

Compartment 7: Overflowing cold water.

## Compartment 8:

Hot water.  
Temperature 180° F.

*Step 4.*—After completion of Step 3 the textile material has a pH of about 7 and is dried in any conventional manner such as through the use of drying cylinders, and enclosed tenter frame or a loop dryer.

The textile material is now ready for printing or dyeing with dyestuffs normally used for cellulose, such as those above disclosed, by use of any conventional application techniques.

The following examples are given to illustrate this invention. It will be appreciated that this invention is not limited to these examples.

*Example I*

A textile material consisting of 50% cellulose diacetate (Celanese) and 50% cotton was pretreated according to the methods of this invention as has been previously described. It was then printed by conventional methods using a roller printing machine and an intaglio engraved roller with a paste of the following composition:

	Percent
Procion Brilliant Blue H7GS	5
Urea	15
Sodium alginate thickening	35
Sodium meta nitro benzene sulfonate	1
Sodium bicarbonate	1.5
Water	62.5

After printing the textile material was steamed for five minutes, rinsed, soaped and dried. A uniform turquoise blue print was obtained on both the cotton and cellulose acetate portions of the textile material. This shade was fast to washing and was commercially acceptable. A comparison print made on the untreated textile material was much inferior in appearance, and the cellulose acetate portion was completely white. The Procion dye used in the print paste is a derivative of cyanuric chloride, manufactured by Imperial Chemical Industries Ltd., and requires the presence of hydroxyl groups on the fiber for fixation of the dye to occur.

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*Example Ia*

This example was a substantial duplication of Example I except that it involved the treatment of a textile material consisting of 50% cellulose triacetate (Arnel) and 50% cotton.

*Example II*

The textile material used in Example I was dyed by impregnating on a two bowl padder with the following solution containing a Cibacron dye and possessing one reactive group:

	Percent
Cibacron Brilliant Orange G	2
Urea	10
Sodium alginate thickening	10
Sodium meta nitro benzene sulfonate	1
Sodium carbonate	1.5
Water	75.5

After impregnation the textile material was dried and fixation of the dye was carried out by heat treating, in a conventional textile curing oven, for three minutes at a temperature of 230° F. The material was then washed and dried. The textile material thus processed was dyed a bright uniform orange shade. A textile material not pretreated, on the other hand, when dyed in the same manner had only the cotton fibers dyed with the cellulose acetate fibers substantially free of color.

*Example III*

4% Remazol Red Violet R was printed as in Example I on the same textile material. After fixation by steaming and following rinsing, washing and drying, an examination indicated that the fabric was uniformly colored in the printed areas.

*Example IV*

A fabric consisting of 100% cellulose triacetate (Arnel) was treated as hereinabove described to produce thereon a regenerated and coagulated film of hydroxyethylcellulose. It was then dyed by impregnating it on a conventional textile padder with a solution of the following composition:

	Percent
Procion Brilliant Orange G	2
Urea	20
Keltex (3% solution of sodium alginate)	5
Ludigol (sodium meta nitrobenzene sulfonate)	1
Sodium bicarbonate	1.5
Water	70.5

The fabric was then dried and the fixation of the dyestuff was carried out by heating the fabric at 250° F. for 3 minutes. The fabric was then rinsed and soaped to remove any unfixed dyestuff.

A uniform orange shade resulted. For comparative purposes an untreated piece of cellulose triacetate (Arnel) was also dyed in the same manner. The untreated cellulose acetate fabric was practically colorless.

*Example IVa*

This example was substantially the same as Example IV except for the substitution of a fabric consisting of 100% cellulose diacetate for the cellulose triacetate used in Example IV. The results were the same, namely, the cellulose diacetate was dyed a uniform orange shade.

It will be noted that the newer fiber-reactive dyestuffs derived, for example, from cyanuric chloride, vinyl sulphone and tri and tetrachloro pyrimidine can be used with excellent results in dyeing and/or printing cellulose acetate yarns and fabrics treated in accordance with this invention. These dyes are not suitable for application to cellulose acetate yarns and fabrics not pretreated as herein disclosed. These dyestuffs require the presence of hydroxyl groups within the fiber for fixation of the dye-

stuff to occur through the formation of a covalent bond. Unless the fiber dyestuff reaction occurs, these dyes will have no acceptable fastness properties and will be easily removed from the fiber during washing, as invariably carried out following the dyeing or printing of the textiles. The fixation of these dyestuffs on fibers, containing no hydroxyl groups, or on fibers containing relatively few hydroxyl groups, which are not capable of reaction because of inaccessibility through steric hindrance, is of great commercial importance. Through the use of these dyestuffs on cellulose acetate textile materials treated in accordance with this invention, it is possible to obtain shades on cellulose acetate containing fabrics which heretofore had not been attainable.

The fabrics and yarns thus produced which in the case of blends are composed of cellulosic fibers blended with cellulose acetate, including cellulose diacetate, cellulose triacetate and saponified diacetate have a continuous film of water-insoluble hydroxyethylcellulose bonded thereto. The amount of hydroxyethylcellulose film on the material is from 4% to about 7%, preferably about 5%, based on the dry weight of the cellulose acetate yarns or fabrics heated.

It will be understood that this invention is not to be limited by the above examples or the disclosure herein except as defined by the appended claims.

What is claimed is:

1. The process of conditioning cellulose acetate yarns and fabrics to render them receptive to dyes having affinities for cellulosic materials, which process comprises applying to the cellulose acetate yarns and fabrics an alkaline solution of hydroxyethyl cellulose produced by reacting alkali cellulose with ethylene oxide so that from about 2% to about 10% by weight of ethylene oxide is combined with the alkali cellulose, said alkaline solution consisting essentially of from about 2% to about 8% by weight of said hydroxyethyl cellulose, from about 5% to about 9% alkali metal hydroxide and the rest substantially entirely water; and thereafter coagulating and regenerating the hydroxyethyl cellulose thus applied to the yarns and fabrics to convert it to a water-insoluble film bonded to the yarns and fabrics.

2. The process as defined in claim 1, in which the alkaline solution of hydroxyethyl cellulose contains from 0.2% to 1% of an amphoteric detergent and the solution is applied to the yarns and fabrics in an amount to deposit from 10% to 100% by weight of the hydroxyethyl cellulose solution on the yarns and fabrics based on the weight of said yarns and fabrics.

3. Cellulose acetate yarns and fabrics, having an affinity for dyestuffs for dyeing cellulosic materials, produced by the process of claim 1.

4. The process as defined in claim 1 in which the yarns and fabrics treated with said alkaline solution of hydroxyethylcellulose is steamed at a temperature from 220° F. to 250° F. for from 10 seconds to 50 seconds prior to coagulating and regenerating the hydroxyethylcellulose.

5. The process as defined in claim 2 in which the

amphoteric detergent is the alkali metal salt of a C<sub>10</sub> to C<sub>18</sub> aliphatic imidazoline carboxylic acid.

6. The process as defined in claim 1 in which the coagulation and regeneration of the hydroxyethylcellulose is effected by treatment with an alkaline solution of sufficient strength to precipitate the hydroxyethylcellulose as a water-insoluble film on the cellulose acetate yarns and fabrics.

7. The process as defined in claim 1 in which the coagulation and regeneration of the hydroxyethylcellulose is effected by treatment of the yarns and fabrics containing the alkaline solution of hydroxyethylcellulose with an acid to neutralize the alkalinity of the hydroxyethylcellulose solution on the cellulose acetate yarns and fabrics and effect the precipitation of the hydroxyethylcellulose in a water-insoluble form to produce the said film of hydroxyethylcellulose on the cellulose acetate yarns and fabrics.

8. The process as defined in claim 1 in which the coagulation and regeneration of the hydroxyethylcellulose applied to the cellulose acetate yarns and fabrics is effected by heating the said yarns and fabrics to effect precipitation of the hydroxyethylcellulose in a water-insoluble form, and thus produce the film of hydroxyethylcellulose bonded to the cellulose acetate yarns and fabrics.

9. The process as defined in claim 1 in which the hydroxyethylcellulose is produced by reacting an alkali cellulose with ethylene oxide so that about 2% to 5% by weight of ethylene oxide is combined with the alkali cellulose, and applying such solution of hydroxyethylcellulose containing about 5% hydroxyethylcellulose, about 6.25% sodium hydroxide, about 0.25% of a sodium salt of a C<sub>10</sub> to C<sub>18</sub> aliphatic imidazoline carboxylic acid in an amount to deposit on the cellulose acetate yarns and fabrics about 80% by weight of said solution based on the weight of said yarns and fabrics.

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