Patented July 18, 1950 2,515,170

UNITED STATES PATENT OFFICE

2,515,170

PAD DYEING

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No Drawing. Application January 27, 1947, Serial No. 724,704

10 Claims. (Cl. 260—15)

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This invention relates to the dyeing of textiles and is particularly concerned with the use in the dyeing of fabrics and textile materials of a composition comprising a dispersion of a water-insoluble pigment in an aqueous solution containing a water-soluble heat-precipitable alkyl cellulose, a water-soluble thermosetting resin, and a hydrophilic glycoside which may be either a water-soluble nonheat-precipitable cellulose ether or a mannogalactan flour.

In our copending application, Serial No. 627,798, filed November 9, 1945, of which the present application is a continuation-in-part, we have disclosed the use in the pad-dyeing of textiles of a dye bath comprising a pigmented aqueous solution of a water-soluble heat-precipitable alkyl cellulose such as methyl cellulose, and a water-soluble thermosetting resin. The use of this pad-dyeing composition involves simply applying the pigmented dye bath to the fabric to be dyed, heating the fabric to a temperature just sufficient to precipitate or gel the alkyl cellulose, and thereafter further heating the fabric to dry it and to insolubilize the resin. By reason of the precipitation or gelation of the alkyl cellulose during the initial heating to which the fabric is subjected, excellent control and effective prevention of migration and flocculation of the pigment during the subsequent heating of the fabric to vaporize the water and to set the resin are obtained; and a level, even dyeing and a uniform, good color value are produced in the finished fabric.

The utilization of this heat-precipitable alkyl cellulose system has been found to involve certain difficulties under some operating conditions, however. As pointed out in our copending application, the dye bath should contain a sufficient amount of water-soluble heat-precipitable alkyl cellulose so that migration and flocculation of the pigment on drying can be satisfactorily controlled; and relatively large amounts are usually required for this purpose. In the case of methyl cellulose, for example, the concentration preferably ranges from about 1 to 3% by weight; although lower concentrations can be used, in general from 0.25 to 0.5% by weight is the lowest amount that is practicable.

Special heating techniques are necessary to effect the precipitation or gelation of the alkyl cellulose, which should be precipitated or gelled before any substantial or appreciable vaporization of the water takes place. Except in the case in which a water-soluble salt such as a sulfate, tartrate or phosphate is added to the dye bath to lower the precipitation or gelation temperature of the alkyl cellulose, the padded fabric cannot be satisfactorily dried by passage over the customary steam-heated drying cans or through a low-temperature drying oven. Moreover, with a decrease in the concentration of the alkyl cellulose, difficulty is encountered in obtaining satisfactory control of the migration and flocculation of the pigment on drying unless undue precautions are taken in the precipitation of the alkyl cellulose.

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Relatively severe curing conditions are required for insolubilization of the thermosetting resin. Generally, it is necessary to subject the dried fabric to a temperature of at least 350 to 400° F. for a period of 2 to 3 minutes to obtain satisfactory fastness to washing. The padded fabric, moreover, cannot be printed with a vat or an azo color prior to the resin-curing stage because it is not rendered sufficiently wash-fast on drying to withstand the required acid- or steam-aging.

We have now discovered that these difficulties can be largely eliminated or substantially alleviated by incorporation of a hydrophilic glycoside, which may be either a water-soluble nonheat-precipitable cellulose ether or a mannogalactan flour, in such a pigmented aqueous dye bath. The inclusion of such a hydrophilic glycoside in this dye bath permits satisfactory control of migration and flocculation of the pigment on drying to be obtained with concentrations of the heat-precipitable alkyl cellulose considerably less than that which would otherwise be necessary. Careful heating of the wet dyed fabric to effect precipitation or gelation of the alkyl cellulose prior to any appreciable vaporization of the water is no longer essential, and effective prevention of pigment migration and flocculation is obtained by passage of the padded fabric directly over steam-heated drying cans or through a low-temperature drying oven. Much less severe conditions are required to insolubilize the resin and passage of the fabric over steam-heated drying cans or through a low-temperature drying oven accomplishes satisfactory curing of the resin. Moreover, the fabric is rendered sufficiently wash-fast by passage over such drying cans or through such a drying oven so that it can be printed with a vat or an azo color and subjected to the required acid- or steam-aging treatment prior to curing of the resin. A crisp finish can also be imparted to the dyed fabric without subjection thereof to the customary starch treatment.

The present composition comprises a dispersion of a water-insoluble pigment in an aqueous solution of a water-soluble heat-precipitable alkyl cellulose, a water-soluble thermosetting resin, and a hydrophilic glycoside which may comprise either a water-soluble nonheat-precipitable cellulose ether or a mannogalactan flour. Advantageously, the nonheat-precipitable cellulose ether comprises a water-soluble hydroxyalkyl cellulose ether, preferably hydroxyethyl cellulose ether; and the mannogalactan flour comprises a vegetable gum such as guar flour or locust bean

gum. Preferably, the heat-precipitable alkyl cellulose comprises a water-soluble lower alkyl cellulose such as methyl cellulose.

As is the case with the pad-dyeing composition described in our copending application, any pigment can be incorporated into the present composition provided it is sufficiently light-fast, does not bleed to any substantial extent in dry-cleaning solvents such as naphtha and carbon tetrachloride, and is sufficiently resistant to soap. Suitable pigments include the phthalocyanines, various metal oxides, carbon black, water-insoluble vat and azo dyestuffs, and the like. The particular pigment selected for a given dyeing operation will depend not only on its dispersibility and on the required color of course, but also on the nature of the finished goods.

Similarly, any water-soluble thermosetting resin can be employed in the preparation of the present pigmented composition provided that the resulting heat-converted resin is sufficiently resistant to washing and is substantially insoluble in dry-cleaning solvents and provided that no objectionable stiffness is imparted to the dyed fabric by the heat-set resin. Moreover, since the heat-set resin serves in part as a binder to fix the pigment to the fabric, it must be capable of doing so even when only a small amount thereof is incorporated in the dyeing composition.

Typical water-soluble heat-setting resins suitable for the present purpose comprise water-soluble thermosetting urea-aldehyde resins including water-soluble thermosetting urea-formaldehyde resins and water-soluble thermosetting modified urea-formaldehyde resins, particularly water-soluble polyhydric alcohol-modified urea-formaldehyde resins, water-soluble thermosetting malamine-aldehyde resins including water-soluble thermosetting melamine-formaldehyde resins and water-soluble thermosetting modified melamine-formaldehyde resins, particularly water-soluble polyhydric alcohol-modified melamine-formaldehyde resins, and water-soluble thermosetting mixed urea-melamine-aldehyde resins including water-soluble thermosetting urea-melamine-formaldehyde resins and water-soluble thermosetting modified urea-melamine-formaldehyde resins, particularly water-soluble polyhydric alcohol-modified urea-melamine-formaldehyde resins.

Other water-soluble heat-setting resins, meeting the above requirements, such as water-soluble thermosetting phenol-formaldehyde resins and polyvinyl alcohol-aldehyde resins can also be used, however. As with the pigment, the choice of the particular water-soluble heat-setting resin employed will be governed to a large extent by the nature of the finished fabric. Moreover, in some cases the reactants from which the water-soluble resin is derived may themselves be incorporated in the composition and the resin subsequently formed therefrom.

As explained in our copending application, the alkyl cellulose utilized in the present composition must be water-soluble and must possess the further property of being soluble in water at low, ordinary room temperatures but insoluble in water at temperatures much above room temperature. As is well known, an aqueous solution of such a water-soluble alkyl cellulose, upon being heated to a few degrees above room temperature, forms a precipitate. Depending on the concentration of the particular alkyl cellulose, this precipitate appears either as a finely dispersed solid or as a gel, the former resulting on the heating

of very dilute aqueous solutions and the latter on the heating of more concentrated solutions. In either event, on lowering of the temperature, the precipitated alkyl cellulose redissolves, the formation of the precipitate being reversible. (Unless otherwise specified, the term "precipitate," as used hereinafter in this specification, includes the term "gel.")

The particular temperature at which precipitation or gelation of the aqueous solution of such a heat-precipitable alkyl cellulose takes place is dependent not only on the particular alkyl cellulose employed but also on the concentration of the alkyl cellulose solution and on the viscosity type of the alkyl cellulose. In general, there is a lower limit of concentration for an aqueous solution of a given alkyl cellulose of a given viscosity type below which no appreciable gelation takes place on heating, the precipitate in such case appearing as a finely dispersed solid. As will become apparent hereinafter, however, the concentration of the heat-precipitable alkyl cellulose in the present composition advantageously falls within the range in which precipitation rather than gelation occurs.

Any of the water-soluble alkyl celluloses whose water solutions possess the property of precipitating on heating, particularly the water-soluble heat-precipitable lower alkyl celluloses, may be employed in the present composition. We have had particular success with the water-soluble heat-precipitable methyl and ethyl celluloses, especially methyl cellulose. Water-soluble heat-precipitable methyl cellulose contains approximately between 1.3 and 2.6 methyl groups per glucose unit, and the corresponding ethyl cellulose contains about 0.8 to 1.3 ethyl groups per glucose unit. The raw material from which a given alkyl cellulose is derived and the manner in which it is prepared exert, as is well known, some influence on the water-solubility and the heat-precipitability of such alkyl cellulose. As already indicated, however, the particular alkyl cellulose employed must be both water-soluble and heat-precipitable.

The hydrophilic glycoside incorporated in the present composition comprises a water-soluble nonheat-precipitable cellulose ether or a mannogalactan flour. Such cellulose ether, unlike the heat-precipitable alkyl cellulose, however, must be soluble in water both at room temperature and at elevated temperature, i. e., its aqueous solution should not form a precipitate upon being heated above room temperature. Any cellulose ether that is both water-soluble and nonheat-precipitable, particularly the water-soluble nonheat-precipitable hydroxyalkyl cellulose ethers such as hydroxyethyl cellulose ether, can be employed in the present composition. Especially satisfactory results have been obtained with water-soluble nonheat-precipitable hydroxyethyl cellulose ether. Other water-soluble nonheat-precipitable cellulose ethers such as water-soluble nonheat-precipitable methyl cellulose ether and water-soluble nonheat-precipitable carboxymethyl cellulose ether can also be used, however.

The mannogalactan flour can conveniently be derived from a natural source and advantageously comprises a vegetable gum or flour, the chief constituent of which is the polysaccharide mannogalactan. This polysaccharide is a high molecular weight carbohydrate which, on hydrolysis, yields mannose and galactose. Typical examples of such a flour include guar flour and locust bean (carob) gum. Only those vegetable gums or

flours of which the polysaccharide comprises the major or chief constituents are satisfactory for the present purpose, however. Other vegetable gums or flours, even though containing a small amount of mannogalactan, such as ordinary starch, gum karaya, gum tragacanth, and sodium alginate do not yield the present results.

In the preparation of the present composition, the water-soluble heat-precipitable alkyl cellulose, the water-soluble thermosetting resin, a resinification catalyst if one is to be included in the final composition, and the hydrophilic glycoside are dissolved in water in the desired concentrations. The resulting solution is then diluted with further water if necessary, and an aqueous paste or dispersion of the pigment is stirred into the resulting mixture to provide the desired dye bath. The pigment may be prepared in paste form by mixing a precipitate of the pigment, e. g., a press cake thereof, and a suitable dispersing agent with sufficient water to form a paste of the desired consistency and then grinding the mixture until the pigment is in a finely divided condition; or the pigment may be otherwise prepared in a readily dispersible form.

The several ingredients may, however, be admixed in any other suitable manner, care being taken that the pigment is properly dispersed in the final composition. For example, separate solutions of one or more of the water-soluble heat-precipitable alkyl cellulose, the water-soluble thermosetting resin, and the hydrophilic glycoside may be prepared; and such solutions and the pigment dispersion may be admixed in any appropriate order.

Our pigment-dyeing composition can be readily applied to a fabric by means of a pad-dyeing operation, the fabric to be dyed being immersed therein and then passed through the customary rollers for removal of the excess dyeing composition. The dyed fabric is then subjected to heat in order to precipitate the heat-precipitable alkyl cellulose, to vaporize the water, and to insolubilize the resin.

In contrast to the procedure required with the composition described in our copending application, the dyed fabric can be dried by passage directly over conventional drying equipment such as steam-heated drying cans maintained at a temperature in the range of 210 to 250° F. or through a drying oven maintained at a temperature on the order of 250° F. No migration or flocculation of the pigment takes place during such drying, and the dried fabric presents an evenly dyed appearance. Quick heating of the dyed fabric to initially precipitate the heat-precipitable alkyl cellulose prior to any appreciable vaporization of the water is not necessary.

Similarly, insolubilization of the resin can be effected under much less severe conditions than those required in the process of our copending application. A satisfactorily wash-fast product can be obtained by further passage of the dried fabric over the drying cans or through the drying oven utilized in the drying step. We have found that conditions no more severe than on the order of three minutes at 250° F. are necessary for effective curing of the resin. The dried fabric can, of course, be cured at higher temperatures, in which case the time required to complete the cure is materially less.

Only a relatively small amount of the water-soluble heat-precipitable alkyl cellulose as compared to the amount generally included in the composition of our copending application is required to produce the results obtained with the present composition. Advantageously, the concentration of the alkyl cellulose ranges from about 0.05 to about 0.15% by weight although satisfactory control of migration of the pigment on drying can be obtained in some cases with concentrations as low as 0.02% by weight. At concentrations below 0.02%, however, the finished fabric begins to evidence undesirable pigment migration. Higher concentrations of alkyl cellulose can also be used; at concentrations in excess of about 0.25% by weight, however, a gradual decrease in the degree of low-temperature fastness of the dried fabric becomes apparent. Moreover, there is no particular advantage in using much higher concentrations.

The effective control of migration and flocculation of the pigment obtained upon drying of a fabric dyed with the present low-alkyl cellulose composition appears to be due to the presence of the hydrophilic glycoside. Although the heat-precipitation characteristic of the alkyl cellulose appears to play a part in the control of the migration and flocculation obtained, it alone is not responsible for such results; for, as already indicated, no effective control of such migration and flocculation is obtained upon drying of a fabric dyed with a pigmented aqueous dispersion containing such a water-soluble alkyl cellulose alone in the concentrations preferably employed in carrying out the present process. On the other hand, a fabric dyed with an aqueous pigment dispersion containing the hydrophilic glycoside alone exhibits migration and flocculation of the pigment. The heat-precipitable alkyl cellulose and the hydrophilic glycoside apparently coact of cooperate in some manner, the nature of which is not fully understood; for both are necessary for the production of a level, even dyeing, and only with both is effective control of pigment migration possible. A mixture of nonheat-precipitable methyl cellulose ether and nonheat-precipitable hydroxyethyl cellulose ether, for example, does not serve the purpose; again, a mixture of nonheat-precipitable sodium carboxymethyl cellulose ether and nonheat-precipitable hydroxyethyl cellulose ether does not prevent migration of the pigment on drying.

The less severe conditions required for the curing of the resin similarly appear to be due to the presence of the hydrophilic glycoside. Why the hydrophilic glycoside exerts this desirable effect on the curing of the resin is not known. That it does is clear, however; for, in its absence, as in the alkyl cellulose system described in our copending application, a higher temperature or a longer time or both are necessary to obtain the same comparative cure of the resin. It may be that the hydrophilic glycoside and the resin react in some manner; for, as the amount of hydrophilic glycoside such as water-soluble nonheat-precipitable hydroxyethyl cellulose ether is increased, the amount of resin remaining constant, the resulting dyed fabric exhibits a marked increase in wash-fastness.

An important feature of our invention is that, in those cases where a dyed fabric having a certain amount of initial crispness or stiffness is desired, the separate starch-finishing treatment customarily employed for this purpose can be eliminated. In imparting such a crisp feel to a fabric in accordance with the present procedure, we treat the fabric to be dyed with a composition containing an amount of hydrophilic glycoside sufficient to provide the desired crispness in the finished fabric and subject the wet dyed fabric to heat

sufficient to dry the fabric and to set the resin. We have had particular success in this respect with pad-dyeing compositions containing the higher viscosity nonheat-precipitable cellulose ethers such as those hydroxyethyl cellulose ethers having a viscosity in excess of about 1,000 centipoises (viscosity of a 2% aqueous solution at 20° C.) Moreover, even though this crispness tends to disappear during subsequent laundering of the fabric, the color value of the dyed fabric remains substantially unimpaired.

The proportion of the hydrophilic glycoside in the present composition may vary widely, the amount used depending in part on the particular hydrophilic glycoside employed, the viscosity desired in the padding liquor, the type of fabric being dyed and the nature of the finished product. Sufficient hydrophilic glycoside should be used, of course, to insure the desired control of pigment migration and flocculation on drying. Generally, however, a concentration within the range of about 0.25 to 3% by weight is sufficient to produce the desired results. Unless an unusually stiff hand is desired in the finished fabric, no particular advantage is gained in using greater amounts. Where it is desired to produce a fabric having a crisp hand, an amount of hydrophilic glycoside on the order of at least 1% by weight is generally necessary to produce a satisfactory result.

The color value of a fabric dyed in accordance with the present invention is substantially independent of the viscosity type of alkyl cellulose. With the alkyl cellulose system of our copending application, there is a gradual decrease in the color value as the viscosity type of the alkyl cellulose is increased. In the present composition, however, any viscosity type of alkyl cellulose can be used, care only being taken that a smooth homogeneous solution is obtained with the higher viscosity types. For convenience, however, we prefer to use the low and medium viscosity types, e. g., in the case of methyl cellulose, those types having a viscosity substantially lower than 1,500 centipoises (average viscosity of a 2% aqueous solution at 20° C.).

Where the hydrophilic glycoside comprises a nonheat-precipitable cellulose ether, the viscosity type does not appear to have any significant effect on the control of pigment migration and flocculation obtained with the present composition or on the color value of a fabric dyed therewith. A greater degree of crispness or stiffness in the finished fabric is obtained, however, as the viscosity of such a cellulose ether is increased particularly when such cellulose ether comprises a hydroxyalkyl cellulose ether; and, as already indicated, where such a characteristic is desired in the final product, we prefer to utilize the higher viscosity types of hydroxyethyl cellulose ether in our present composition. Especially good results have been obtained with a water-soluble nonheat-precipitable hydoxyethyl cellulose ether having a viscosity in excess of 1,000 centipoises.

The concentration range of the water-soluble thermosetting resin depends on a number of factors such as the particular resin employed, the type of fabric being dyed, the depth of shade, and the degree of wash-fastness desired. In general, the lower limit of concentration depends on the minimum ratio of resin to pigment required to give the wash-fastness desired in the finished fabric. The upper limit of concentration depends on the maximum stiffness permissible in the finished fabric. Concentrations as low as on the order of a few tenths of a per cent by weight can be used where only cheap dress goods of moderate wash-fastness are being produced, for example. Generally, however, the preferred range of resin concentration is on the order of 0.5 to 10% by weight, the particular concentration employed depending largely on the nature of the particular application.

A special advantage of the present system is that the dyed fabric can be printed with a vat or an azo color immediately after being dyed. Drying on the steam cans or in the low-temperature oven imparts a degree of wash-fastness adequate to withstand the subsequent acid- or steam-aging. In addition, where acid-aging is used, the resin may be sufficiently cured so that the customary curing step may be dispensed with.

Various types of fabrics can be dyed by means of our improved composition, and the application of our invention is not limited to the dyeing of any particular fabric. Excellent control of migration and flocculation of the pigment with the production of an evenly dyed fabric is obtained equally well whether the fabric being dyed is composed of natural fibers such as cotton, flax, wool and hair fibers, of synthetic fibers such as regenerated cellulose, cellulose acetate, polyamide, protein polymer, vinyl polymer, and the like fibers, of inorganic fibers such as glass, mineral, or metal fibers, or of mixtures of such fibers. Furthermore, the application of our process is not limited to the usual types of woven or knitted fabrics but may also be used to dye pile fabrics, paper, or fabrics made by processes such as combing, matting, or felting, e. g., a fabric composed of loosely meshed cotton fibers bonded together by the localized application of a resin. The present invention, moreover, is equally applicable whether a light or a heavy fabric is being dyed. (The term "fabric" as used in the claims includes all these various types of materials as well as yarns, to the dyeing of which our invention is also applicable.)

The following examples are typical illustrations of the application of our invention:

Example 1

A padding liquor containing 1.5% by weight of nonheat-precipitable hydroxyethyl cellulose ether, 0.08% by weight of heat-precipitable methyl cellulose, 0.4% by weight of resin, and 0.1% by weight of pigment is prepared by mixing together the following ingredients (parts by weight in this and other examples):

3% aqueous solution of high-viscosity water-soluble nonheat-precipitable hydroxyethyl cellulose ether	50.0
5% aqueous solution of 25 cps. water-soluble heat-precipitable methyl cellulose	1.6
Water	47.2
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	0.8
25% water-extendible dispersion of iron oxide red	0.4
	100.0

A fabric, for example, printed cotton dress goods, is padded with this liquor on a two-roll padder. The padded fabric is passed over a series of steam-heated cans to precipitate the methyl cellulose and to dry the fabric. Finally, the resin is cured and the fabric is finished by exposing the dried fabric for one minute in a housed tenter maintained at a temperature of 350 to

380° F. This combination dyeing and finishing operation produces an evenly dyed fabric having a relatively stiff hand and good crock-fastness. The wash-fastness of the finished fabric is satisfactory for cheap dress goods.

Example 2

A padding liquor containing 0.5% of nonheat-precipitable carboxymethyl cellulose ether, 0.1% of heat-precipitable methyl cellulose, 0.5% of resin, and 0.25% of pigment is prepared by mixing together the following ingredients:

5% aqueous solution of low-viscosity water-soluble nonheat-precipitable sodium carboxymethyl cellulose ether	10.00
5% aqueous solution of 25 cps. water-soluble heat-precipitable methyl cellulose	2.00
Water	85.75
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	1.00
20% water-extendible dispersion of a vat yellow (Color Index Prototype No. 105)	1.25
	100.00

A fabric, for example, cotton dress goods, is pad-dyed with this liquor. The wet dyed fabric is passed directly through a gas-fired hot-flue oven maintained at a temperature of about 350° F. to precipitate the methyl cellulose and to cure the resin. This procedure gives an evenly dyed fabric with considerable hand and is suitable for cheap dress goods.

Example 3

A pad liquor containing 1.0% of nonheat-precipitable hydroxyethyl cellulose ether, 0.1% of heat-precipitable ethyl cellulose, 0.5% of resin and 0.5% of pigment is prepared from the following ingredients:

3% aqueous solution of high-viscosity water-soluble nonheat-precipitable hydroxyethyl cellulose ether	33.33
10% aqueous solution of medium-viscosity water-soluble heat-precipitable ethyl cellulose	1.00
Water	60.92
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	1.00
20% water-extendible dispersion of phthalocyanine blue	1.25
10% water-extendible dispersion of a vat blue (Color Index No. 1113)	2.50
	100.00

A fabric, for example, cotton dress goods, is pad-dyed with this liquor and is then dried by passage over steam-heated drying cans. The dried fabric is printed with stabilized azo colors or with a combination of such colors and pigment colors and is again dried on steam-heated drying cans. The printed fabric is next passed through an acid ager to develop the printed colors and to cure the resin and is then soaped and washed in the manner customary for stabilized azo prints. Finally, the fabric is finished by exposure for one minute in a housed tenter maintained at 350° F. An evenly dyed fabric with a crisp hand and a good fastness to laundering and crocking is obtained.

Example 4

A pad liquor containing 0.5% of nonheat-precipitable hydroxyethyl cellulose ether, 0.1% of heat-precipitable methyl cellulose, 0.5% of resin and 1.25% of pigment is prepared by mixing together the following ingredients:

10% aqueous solution of low-viscosity water-soluble nonheat-precipitable hydroxyethyl cellulose ether	5.0
10% aqueous solution of low-viscosity water-soluble heat-precipitable methyl cellulose	1.0
Water	78.5
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	1.0
50% aqueous solution of diammonium hydrogen phosphate	2.0
10% water-extendible dispersion of a vat blue (Color Index No. 1113)	12.5
	100.0

A fabric, for example, a rayon sports goods is padded with the above pad liquor on a three-roll padder. The wet dyed fabric is then passed over a series of steam-heated drying cans, and finally for one minute through a curing oven maintained at 300° F. An evenly dyed fabric with a satisfactory fastness to laundering and crocking is obtained.

Example 5

A padding liquor containing 0.5% of locust bean gum, 0.1% of heat-precipitable methyl cellulose, 0.5% of resin and 0.2% of pigment is prepared by mixing together the following ingredients:

2% aqueous solution of locust bean gum	25
10% aqueous solution of low-viscosity water-soluble heat-precipitable methyl cellulose	1
Water	69
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	1
5% aqueous solution of diammonium hydrogen phosphate	2
10% water-extendible dispersion of a pigment prepared by coupling para-nitro-ortho-toluidine with the ortho-toluidide of beta-oxy-naphthoic acid	2
	100

A fabric, for example, cotton dress goods, is padded with the above padding liquor on a two-roll padder. The wet dyed fabric is passed directly to an oven maintained at 275° F. to dry the fabric and to cure the resin. This procedure gives an evenly dyed fabric with a hand suitable for cheap dress goods.

Example 6

A padding liquor containing 1.0% of guar flour, 0.1% of heat-precipitable methyl cellulose, 0.25% of resin and 0.25% of pigment is prepared from the following ingredients:

2% aqueous solution of guar flour	50.00
10% aqueous solution of low-viscosity water-soluble heat-precipitable methyl cellulose	1.00
Water	45.25
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	0.50
5% aqueous solution of diammonium hydrogen phosphate	2.00
20% water-extendible dispersion of carbon black	1.25
	100.00

A fabric, for example, cotton dress goods, is padded with this liquor on a three-roll padder. The padded fabric is dried and the resin is cured by passage over a series of high-pressure steam-heated drying cans. This procedure gives an evenly dyed fabric with a crisp hand and a fastness to laundering and crocking satisfactory for cheap dress goods.

Example 7

A padding liquor containing 0.75% of guar flour, 0.25% of nonheat-precipitable hydroxyethyl cellulose ether, 0.1% of heat-precipitable methyl cellulose, 1.0% of resin and 0.5% of pigment is prepared from the following ingredients:

2% aqueous solution of guar flour	37.5
10% aqueous solution of medium-viscosity-water-soluble nonheat-precipitable hydroxyethyl cellulose ether	2.5
10% aqueous solution of low-viscosity water-soluble heat-precipitable methyl cellulose	1.0
Water	50.0
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	2.0
5% aqueous solution of diammonium hydrogen phosphate	2.0
10% water-extendible dispersion of a dyestuff prepared by coupling 5-nitro-2-amino-anisole with 3-oxy-naphthoic-alpha-naphthalide	5.0
	100.0

A fabric, for example, cotton dress goods, is padded with this liquor on a two-roll padder. The wet fabric is dried on steam-heated drying cans and is finished by passage through a housed tenter maintained at about 300° F. This procedure gives an evenly dyed fabric with a crisp hand and with good fastness to laundering and crocking.

Example 8

A padding liquor containing 1.0% of nonheat-precipitable methyl cellulose ether, 0.1% of heat-precipitable methyl cellulose, 0.5% of resin and 1.25% of pigment is prepared by mixing together the following ingredients:

10% aqueous solution of water-soluble nonheat-precipitable methyl cellulose ether	10.00
10% aqueous solution of low-viscosity water-soluble heat-precipitable methyl cellulose	1.00
Water	79.75
50% aqueous solution of water-soluble polyhydric alcohol-modified melamine-formaldehyde resin	1.00
5% aqueous solution of diammonium hydrogen phosphate	2.00
20% water-extendible dispersion of copper phthalocyanine green	6.25
	100.00

A fabric, for example, rayon sports goods, is padded with the above liquor and the wet dyed fabric is dried and the resin is cured by passage through an oven maintained at 300° F. An evenly dyed fabric with good fastness to laundering and crocking and having a full and soft hand is obtained.

Our pigment-dyeing composition, as already indicated, can be conveniently applied to a fabric by a padding operation. Other methods of applying the pigment-dyeing composition can also be employed, however; for example, the dyeing composition can be applied to a fabric by forming a thin film thereof on a roll-coating machine and then transferring the film to the fabric.

We claim:

1. A dyeing composition comprising a dispersion of a water-insoluble pigment in an aqueous solution of a water-soluble thermosetting resin, a water-soluble heat-precipitable alkyl cellulose, and a hydrophilic substance selected from the group consisting of water-soluble nonheat-precipitable cellulose ethers and mannogalactan flours containing a major proportion of mannogalactan, the proportion of the thermosetting resin being between 0.5 and 10% by weight based on total composition, that of the heat-precipitable alkyl cellulose between 0.02 and 0.25% by weight based on total composition, and that of the hydrophilic substance between 0.25 and 3% by weight based on total composition.

2. The dyeing composition as claimed in claim 1, in which the hydrophilic substance comprises a water-soluble nonheat-precipitable hydroxyalkyl cellulose ether.

3. The dyeing composition as claimed in claim 2, in which the water-soluble nonheat-precipitable hydroxyalkyl cellulose ether comprises a water-soluble nonheat-precipitable hydroxyethyl cellulose ether.

4. The dyeing composition as claimed in claim 1, in which the hydrophilic substance comprises locust bean gum.

5. The dyeing composition as claimed in claim 1, in which the hydrophilic substance comprises guar flour.

6. The method of evenly pigment-dyeing a fabric without migration and flocculation of the pigment on drying, which comprises applying to the fabric a dispersion of a water-insoluble pigment in an aqueous solution of a water-soluble thermosetting resin, a water-soluble heat-precipitable alkyl cellulose, and a hydrophilic substance selected from the group consisting of water-soluble nonheat-precipitable cellulose ethers and mannogalactan flours containing a major proportion of mannogalactan, the proportion of the thermosetting resin being between 0.5 and 10% by weight based on total dispersion composition, that of the heat-precipitable alkyl cellulose between 0.02 and 0.25% by weight based on total dispersion composition, and that of the hydrophilic substance between 0.25 and 3% by weight based on total dispersion composition, and thereafter heating the fabric to dry it and to insolubilize the resin.

7. The method of evenly pigment-dyeing a fabric as claimed in claim 6, in which the hydrophilic substance comprises a water-soluble nonheat-precipitable hydroxyalkyl cellulose ether.

8. The method of evenly pigment-dyeing a fabric as claimed in claim 7, in which the water-soluble nonheat-precipitable hydroxyalkyl cellulose ether comprises a water-soluble nonheat-precipitable hydroxyethyl cellulose ether.

9. The method of evenly pigment-dyeing a fabric as claimed in claim 6, in which the hydrophilic substance comprises locust bean gum.

10. The method of evenly pigment-dyeing a

fabric as claimed in claim 6, in which the hydrophilic substance comprises guar flour.

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