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DYEING OF FABRICS COMPRISING CELLULOSE ACETATE WITH AN ALCOHOL-THIOCYANATE SWELLING MIXTURE

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1

This invention relates to the coloration of organic derivative of cellulose textile materials, and relates more particularly to the coloration of organic derivative of cellulose textile materials by processes involving the application of mechanical impregnation methods.

An object of our invention is to provide an improved process for the dyeing of organic derivative of cellulose textile materials.

Another object of our invention is the provision of a solvent dyeing process for organic derivative of cellulose materials involving the application of mechanical impregnation methods, which process is not only rapid but highly economical as well.

A further object of our invention is the provision of a process particularly adapted to the dyeing of organic derivative of cellulose textile materials employing dyestuffs which, when applied by the usual methods, do not possess any pronounced affinity for organic derivative of cellulose materials.

Yet another object of our invention is the provision of a solvent dyeing process for the dyeing of organic derivative of cellulose materials which eliminates the necessity of rapid drying of the dyed materials before the latter may be washed and finished and which yields dyed materials exhibiting unusual resistance to acid fading.

Other objects of our invention will appear from the following detailed description.

In the coloration of textile materials it is most advantageous, from an economic point of view, to effect the desired coloration of the textile material in as short a time and with as little handling of the material as possible. When dyeing organic derivative of cellulose materials, it has been found that these materials are dyed more slowly than other textile materials since they are less absorbent and the dye liquor in the dye bath does not penetrate them as rapidly or as completely as it does other textile materials. Many dyestuffs when applied to organic derivative of cellulose materials yield satisfactory dyeings in deep, non-fugitive shades only after long periods of immersion and manipulation. In some instances, where solvent dyeing methods are employed in order to speed up the dyeing operation, a rapid drying of the dyed organic derivative of cellulose material is necessary in order to obtain fast colorations which will not wash down to lighter shades on subsequent scouring.

We have now discovered that organic derivative of cellulose materials may be dyed rapidly in deep, fast, level shades by mechanical impregna-

2

tion methods employing aqueous alcoholic solutions of dyestuffs for said organic derivative of cellulose materials, without the necessity of subjecting said dyed materials to the step of rapid drying before the materials may be washed and finished. In accordance with our novel process, the drying step may be eliminated and fast dyeings obtained directly if the dyebath employed for dyeing the organic derivative of cellulose materials comprises an aqueous alcoholic solution of the desired dyestuff containing an inorganic swelling agent for the organic derivative of cellulose material and, preferably, in addition thereto a lower aliphatic acid. Employing such dyebaths and applying them by mechanical impregnation methods enables the organic derivative of cellulose materials to be dyed very rapidly. The dyed materials may be washed or scoured immediately after dyeing without suffering from any appreciable loss in color. This substantial advantage greatly increases dyeing efficiency which is reflected by the marked increase in the capacity of the plant which is achieved with greatly reduced cost. Furthermore, it has been observed that the organic derivative of cellulose materials dyed by the process of our invention exhibit greatly improved resistance to acid fading.

As examples of inorganic swelling agents for the organic derivative of cellulose materials, there may be mentioned the salts of thiocyanic acid such as ammonium thiocyanate, sodium thiocyanate and potassium thiocyanate. Optimum results are achieved employing sodium thiocyanate. The inorganic swelling agent may be present in amounts of from 1.0 to 3.0% on the weight of the dyebath. Preferably, we employ from 1.8 to 2.2% by weight.

The lower aliphatic alcohols which are suitable for use in forming the dyebath are those alcohols which are solvents for the dyestuffs employed and which exert at least a swelling or softening action on the organic derivatives of cellulose. While we prefer to employ ethyl alcohol in the dye liquor, other alcohols such as methyl alcohol, propyl alcohol, isopropyl alcohol, n-butyl alcohol, secondary butyl alcohol, tertiary butyl alcohol, n-amyl alcohol, secondary amyl alcohol and tertiary amyl alcohol, or mixtures of these alcohols may be used. The amount of the alcohol used in the dye liquor will vary depending upon the alcohol or alcohols used. We have found that optimum results are obtained when the lower aliphatic alcohol comprises at least 60% by weight of the dyebath. Any suitable lower aliphatic acid may be employed in the dyebath. Examples of

these acids are acetic acid, propionic acid and butyric acid. The acid may be employed in amounts varying from 1 to about 8% by weight, optimum results being achieved when the acid is present in the dyebath in amounts of from 2.0 to 5.0% by weight.

Various dyestuffs for organic derivative of cellulose materials may be employed. The dyestuffs may be direct dyeing dyestuffs, for example, those dyes which produce their ultimate shade on the material being dyed without any pre- or after-treatment designed to effect a chemical change in the structure of the dye or the character of the material being dyed, or the dyes may be dyestuffs such as the sulfuric acid esters of leuco vat dyestuffs which are applied in colorless form and are oxidized back to the colored form after being applied to the organic derivative of cellulose materials. The direct dyeing dyestuffs may be acid dyes which are ordinarily used for the dyeing of wool and which do not possess any substantial affinity for organic derivative of cellulose materials when applied by the methods usually employed for applying said acid dyestuffs, as well as those dyes which are relatively insoluble in water and which are usually applied to organic derivative of cellulose materials in the form of aqueous dispersions. Mixtures of these dyestuffs may also be employed. When the direct dyeing dyestuffs are applied to organic derivative of cellulose textile materials by mechanical impregnation methods in alcoholic solutions containing a lower aliphatic acid and an inorganic swelling agent, in accordance with our process, the resulting dyeings are of uniform depth and unusual brilliance and may be obtained with a relatively short immersion time. Preferably, when employing sulfuric acid esters of leuco vat dyes in accordance with our novel process, the lower aliphatic acid is advantageously omitted from the dyebath to avoid any premature oxidation of the leuco dye. The washdown of the shade in subsequent washing and finishing operations is considerably less in the case of fabrics dyed by our novel process than in the case of fabrics dyed by prior processes. Furthermore, many shades obtained are considerably faster to acid fading than the shades obtained by prior processes employing the same dyestuffs. Especially advantageous results may be obtained when dischargeable acid dyestuffs are employed. Fabrics which have been dyed with dischargeable acid dyes may then be discharge printed employing hydrosulfite discharging agents and, if desired, the discharged area may be simultaneously illuminated by employing any suitable dyestuff in the discharge composition as, for example, the vat dyestuffs. Fabrics dyed with dischargeable acid dyestuffs and then discharged with or without illumination also exhibit unusual resistance to acid fading. Another very substantial advantage of our novel process lies in the fact that the formation of warp streaks, a fault frequently observed when employing acid dyestuffs, is very greatly minimized and no longer presents any particular problem.

The amount of dyestuffs dissolved in the dyebath will, of course, vary with the final shade desired in the material which is being dyed and may be from as low as 0.01% up to 5.0% based on the weight of the material to be dyed.

The dyebath may be applied to the organic derivative of cellulose textile materials by padding, spraying or by other convenient method of mechanical impregnation. Thus, as a continuous process, a fabric may be unwound from a roll,

passed through a solution of the dyestuff, then between nipping rolls of a padding mangle which are adjusted to permit the desired amount of dye liquor to be retained in the fabric, and the fabric then subjected directly to washing or scouring. In the case of fabrics dyed with the sulfuric acid esters of leuco vat dyes, however, the fabric is immersed in a suitable oxidizing bath to oxidize the leuco dye to the colored form prior to washing. The duration of the immersion of the fabric in the dye liquor is relatively short and may be from 1 to 6 seconds. If desired, the fabric may be processed through the padding mangle at speeds ranging up to 60 yards per minute.

Our process is applicable not only to the dyeing of fabrics but particularly valuable results are obtained when other organic derivative of cellulose textile materials such as staple fiber, in the form of a top or roving, is dyed in accordance with our invention. Not only may more uniform dyeings be obtained but, as in the case of fabrics, increased production may be achieved along with a substantial reduction in the amount of dyestuff necessary to obtain a desired shade.

The organic derivative of cellulose fabrics, staple fiber yarns or other textile materials dyed in accordance with our process may have a basis of cellulose esters or cellulose ethers. Examples of cellulose esters are cellulose acetate, cellulose propionate, cellulose butyrate, and mixed esters such as cellulose acetate-propionate and cellulose acetate-butyrate, while examples of cellulose ethers are ethyl cellulose and benzyl cellulose. The materials may be mixed materials containing organic derivatives of cellulose and yarns or fibers of other materials such as cotton, silk, wool or regenerated cellulose and in this way differential dyeings may be obtained where the dyes used have an affinity for only one of the components of the mixed textile material.

In order further to illustrate our invention but without being limited thereto the following examples are given:

Example I

A mixture comprising 17 parts by weight of 1-methylamino-4-iso-propylamino-2-carboxy-amide-anthraquinone, 2.25 parts by weight of 2-chlor-4-nitro-6-brom-benzene-azo-dioxyethyl-metachlor-aniline and 0.75 part by weight of 1-hydroxy-4-amino-anthraquinone are dissolved in a solvent bath comprising 532 parts by weight of ethyl alcohol, 31.5 parts by weight of acetic acid, 20 parts by weight of sodium thiocyanate and 298 parts by weight of water to form the dyebath. A cellulose acetate fabric is pad dyed employing this dyebath at a rate of 20 yards per minute and is dyed a dark gray-blue color. The dyed fabric is washed immediately while still wet from the dyeing operation and no change in shade results from the washing.

Example II

25 parts by weight of Azo Rubinol 3GP (an acid dye) are dissolved in a mixture comprising 266 parts by weight of ethyl alcohol, 15.75 parts by weight of acetic acid, 10 parts by weight of sodium thiocyanate and 149 parts by weight of water to form the dyebath. A cellulose acetate fabric of sharkskin weave is pad dyed with this dyebath at a rate of about 20 yards per minute and the fabric is dyed a red shade. The dyed fabric is washed with water immediately without loss of color and exhibits excellent light fastness.

Example III

A mixture of 15 parts by weight of Xylene Milling Blue GL (Color Index No. 833), 2.5 parts by weight of 2-chlor-4-nitro-6-brom-benzene-azodioxethyl-meta-chlor-aniline and 0.5 part by weight of 1-hydroxy-4-amino-anthraquinone are dissolved in a mixture of 532 parts by weight of ethyl alcohol, 31.5 parts by weight of acetic acid, 20 parts by weight of sodium thiocyanate and 298 parts by weight of water to form the desired dyebath. A scoured cellulose acetate fabric is pad dyed with this dyebath at the rate of 20 yards per minute and washed with water immediately after dyeing. The dyed fabric exhibits excellent resistance to light and acid fading.

Example IV

10 parts by weight of Ponsol blue BF (a leuco vat dye in sulfuric acid ester form) are dissolved in 400 parts by weight of ethyl alcohol and 20 parts by weight of sodium thiocyanate dissolved in 500 parts by weight of water are added to the alcoholic solution. A fabric woven of cellulose acetate and regenerated cellulose yarns is padded with the above dyebath and then passed directly into a 0.3% aqueous solution of sodium nitrite containing 0.1% of sulfuric acid maintained at 35° C. The fabric is dyed an even shade of blue by this treatment and is then washed, neutralized, scoured and dried. By varying the proportions of alcohol and water in the dyebath very desirable cross-dyed effects may be produced. The dyed fabric is very resistant to light and acid fading.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Process for the coloration of organic derivative of cellulose textile materials, which comprises mechanically impregnating such textile material with a solution of a dyestuff capable of dyeing the organic derivative of cellulose material in an aqueous medium comprising at least 60% by weight of a lower aliphatic alcohol and as an inorganic swelling agent for the organic derivative of cellulose material from 1.0 to 3.0% by weight of a salt of thiocyanic acid and immediately washing the wet textile material.

2. Process for the coloration of cellulose acetate textile materials, which comprises mechanically impregnating such textile material with a solution of a dyestuff capable of dyeing the cellulose acetate material in an aqueous medium comprising at least 60% by weight of a lower aliphatic alcohol, and as an inorganic swelling agent for the cellulose acetate material from 1.0 to 3.0% by weight of a salt of thiocyanic acid and immediately washing the textile material.

3. Process for the coloration of a cellulose acetate textile material, which comprises mechanically impregnating such textile material with a solution of a direct dyeing dyestuff for the cellulose acetate material in an aqueous medium comprising at least 60% by weight of a lower aliphatic alcohol and containing from 2.0 to 5.0% by weight of acetic acid and from 1.0 to 3.0% by weight of sodium thiocyanate and immediately washing the wet textile material.

4. Process for the coloration of a cellulose acetate textile material, which comprises mechanically impregnating such textile material with a solution of a direct dyeing dyestuff for the cellulose acetate material in an aqueous medium comprising at least 60% by weight of ethyl alcohol and containing from 2.0 to 5.0% by weight of acetic acid and from 1.0 to 3.0% by weight of sodium thiocyanate and immediately washing the wet textile material.

5. Process for the coloration of cellulose acetate material in a fabric containing cellulose acetate fibers and other fibers, which comprises padding the fabric with an aqueous solution of a direct dyeing dyestuff for the cellulose acetate material comprising at least 60% by weight of a lower aliphatic alcohol and containing from 1.0 to 8.0% by weight of a lower aliphatic acid and from 1.0 to 3.0% by weight of a salt of thiocyanic acid which is a swelling agent for the cellulose acetate material and immediately washing the wet textile material.

6. Process for the coloration of a cellulose acetate textile material, which comprises immersing such textile material for from 1 to 6 seconds in a solution of a direct dyeing dyestuff for the cellulose acetate material in an aqueous medium comprising about 60% by weight of ethyl alcohol, from 2 to 5% by weight of acetic acid and from 1 to 3% by weight of sodium thiocyanate, padding the dyed textile material, and then washing the wet textile material immediately after padding.

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