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PAD DYEING OF CELLULOSE DERIVATIVE FABRICS WITH AN ALCOHOLIC SOLUTION FOLLOWED BY PADDING WITH AN AQUEOUS THIOCYANATE SOLUTION

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This invention relates to the dyeing of textile materials and relates more particularly to the dyeing of textile materials comprising filaments and fibers having a basis of cellulose acetate or other organic derivative of cellulose.

An object of this invention is to provide an improved process for the dyeing of cellulose acetate or other organic derivative of cellulose textile materials by mechanical impregnation methods.

Another object of this invention is to provide a process for the dyeing of cellulose acetate or other organic derivative of cellulose fabrics in a continuous manner whereby said fabrics are dyed rapidly in full, level, well-penetrated shades.

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

In the dyeing 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 materials made of or containing filaments or fibers of cellulose acetate, or other organic derivatives of cellulose, it has been found that these materials are dyed more slowly than other textile materials since they are less absorbent and the dyebath does not penetrate them as rapidly or as completely as it does other textile materials. To obtain deep, level shades on fabrics, for example, long periods of immersion and manipulation are usually necessary. In some instances, after dyeing by mechanical impregnation methods, the dyed fabric must then be topped to the desired shade on a winch or jig. Topping to shade is necessary where the fabric is imperfectly penetrated by the dyestuff during the initial mechanical impregnation. Usually, the mechanical impregnation of the fabric with the dyestuff is followed by a light scouring to remove any free dyestuff, after which the fabric is then topped to shade. Where solvent dyeing methods involving mechanical impregnation are employed in order to speed up the dyeing operation, a rapid drying of the dyed fabric is necessary before any final scouring or finishing operation in order to obtain fast colorations which do not wash down to lighter shades. Elimination of the initial scouring, topping, and intermediate drying operations to obtain satisfactorily dyed fabrics would result in a considerably more economical process.

We have found that cellulose acetate or other organic derivative of cellulose textile materials, such as fabrics, for example, may be dyed rapidly in deep, fast and level shades by mechanical impregnation methods, employing aqueous alcoholic solutions of dyestuffs having an affinity for said organic derivative of cellulose materials without resort to scouring, topping or intermediate drying. In accordance with our novel process, these advantageous results are achieved if the fabric is first dyed with an aqueous alcoholic solvent dyebath and is then padded directly with a relatively concentrated aqueous solution of an inorganic swelling agent for the organic derivative of cellulose textile material. By this improved process, the organic derivative of cellulose textile materials may be dyed rapidly in level, well-penetrated shades which do not wash down to lighter shades when they are subjected to scouring operations during the final finishing. Thus, the organic derivative of cellulose textile material may be dyed directly with a minimum degree of manipulation by employing two baths, one comprising the aqueous alcoholic solvent dye bath and the other an aqueous solution of the desired swelling agent. Suitable mechanical impregnating means are employed, preferably a padding mangle, to apply both the dye liquor and the swelling agent to the textile material. The material being dyed is first passed through the dyebath and then through the nip of a padding mangle after which it is led through the aqueous solution of the swelling agent and then finally through the nip of a second padding mangle.

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As examples of suitable inorganic swelling agents for the cellulose acetate or other organic derivative of cellulose materials which may be employed in accordance with our novel process, there may be mentioned salts of thiocyanic acid such as, for example, ammonium thiocyanate, sodium thiocyanate and potassium thiocyanate. Optimum results are obtained, however, when employing sodium thiocyanate. In accordance with our novel process relatively concentrated aqueous solutions of the inorganic swelling agent are employed, namely, solutions containing from 10 to 25% by weight of the swelling agent at a temperature of 25 to 35° C. When employing aqueous solutions of sodium thiocyanate as the swelling agent, solutions containing from 15 to 20% by weight of said swelling agent are preferably employed.

Any suitable lower aliphatic alcohol may be employed in forming the dyebath. Most advantageously, we employ those alcohols which are solvents for the dyestuffs and which exert at least a swelling or softening action on the organic derivative of cellulose materials. While we prefer to employ ethyl alcohol in forming the dyebath,

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 are suitable. The proportion of alcohol employed in forming the dyebath will vary depending upon the particular alcohol or particular mixture of alcohols used. We have found that optimum results are obtained when the lower aliphatic alcohol comprises at least 60% by weight of the dyebath.

Various dyestuffs for the organic derivative of cellulose materials may be employed. The dyestuffs are preferably direct dyeing dyestuffs, for example, those dyes which produce their ultimate shade on the material being dyed without any pretreatment or after-treatment designed to affect a chemical change in the structure of the dye or the character of the material being dyed. Preferably, we use a direct dyeing dyestuff, such as, for example, 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 usual methods for applying said acid dyestuffs. Those dyes which are relatively insoluble in water and which are usually applied to organic derivative of cellulose materials in a dispersed form are also satisfactory. Any suitable mixture of these classes of dyestuffs may also be employed.

The amount of dyestuff dissolved in the dyebath depends upon the ultimate shade desired in the material being dyed, the amount varying from 0.1 to 6.0% based on the weight of the material being dyed.

While the dyebath and the aqueous solution of the swelling agent may be applied to the organic derivative of cellulose textile materials by spraying or by any other convenient method of mechanical impregnation, padding yields the most satisfactory results. Thus; as a continuous process, a fabric may be unwound from a roll, passed through the solution of a dyestuff, and then between nipping rolls of a padding mangle which are adjusted to permit the desired amount of dye liquor to be retained on the fabric. After the dyebath has been applied, the fabric may be passed over skying rolls and then into an aqueous solution of the swelling agent. On leaving the bath containing the swelling agent, the fabric is again passed through the nipping rolls of a padding mangle and then washed directly with an aqueous scouring bath. The fabric may be processed through the baths and padding mangles at speeds ranging from 15 to 45 yards per minute. The length of the baths may be adjusted so that the fabric is immersed in the dye liquor and the swelling bath for from 1 to 5 seconds.

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, are 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 obtained a desired shade since topping is eliminated.

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 cellullose 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. Mixed materials containing organic derivatives of cellulose and yarns or fibers of other materials such as cotton, silk, wool or regenerated cellulose may also be dyed by our process 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 example is gixen:

Example

2 parts by weight of Alizarin Cyanine Green GHN (color index No. 1078) are dissolved in 100 parts by weight of a 70% by weight aqueous solution of ethyl alcohol to form the desired dyebath. A cellulose acetate fabric is pad-dyed with this dyebath at a temperature of 30° C. at a speed of 25 yards per minute, being immersed in the dyebath for 3 seconds. The nip of the padding mangle is adjusted so that the fabric retains about 70% of its weight of the dye liquor on leaving the rolls of the pad. After passing over intermediate skying rolls, the dyed fabric is passed directly into a swelling agent comprising a 20% by weight aqueous solution of sodium thiocyanate at 30° C. The fabric leaving the solution of the swelling agent is then passed into the nip of a second padding mangle to insure thorough penetration. The fabric is then rinsed and dried. The fabric is dyed a level, well-penetrated medium green shade.

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 textile materials having a basis of an organic derivative of cellulose selected from the group consisting of cellulose esters and cellulose ethers in level, well-penetrated shades, which comprises padding a textile material having a basis of an organic derivative of cellulose with a direct dyeing dyestuff in an aqueous medium consisting of an aqueous solution of a lower aliphatic alcohol, and then, as a separate step, padding the dyed organic derivative of cellulose textile material directly and without drying and washing with a relatively concentrated aqueous solution of a salt of thiocyanic acid which is a swelling agent for the organic derivative of cellulose material.

2. Process for the coloration of textile materials having a basis of an organic derivative of cellulose selected from the group consisting of cellulose esters and cellulose ethers in level, well-penetrated shades, which comprises padding a textile material having a basis of an organic derivative of cellulose with a direct dyeing dyestuff in an aqueous medium containing at least 60% by weight of a lower aliphatic alcohol, and then, as a separate step, padding the dyed organic derivative of cellulose textile material directly and without drying and washing with a relatively concentrated aqueous solution of a salt of thiocyanic acid which is a swelling agent for the organic derivative of cellulose material.

3. Process for the coloration of textile materials having a basis of cellulose acetate in level, well-

penetrated shades, which comprises padding a textile material having a basis of cellulose acetate with an acid dyestuff in an aqueous medium containing at least 60% by weight of ethyl alcohol, and then, as a separate step padding the dyed cellulose acetate textile material directly and without drying and washing with a relatively concentrated aqueous solution of a salt thiocyanic acid which is a swelling agent for the cellulose acetate material.

4. Process for the coloration of textile materials having a basis of cellulose acetate in level, well-penetrated shades, which comprises padding a textile material having a basis of cellulose acetate with an acid dyestuff in an aqueous medium containing at least 60% by weight of ethyl alcohol, and then, as a separate step, padding the dyed cellulose acetate textile material directly and without drying and washing with an aqueous solution containing 10 to 25% by weight of a salt of thiocyanic acid which is a swelling agent for the cellulose acetate material.

5. Process for the coloration of textile materials having a basis of cellulose acetate in level, well-penetrated shades, which comprises padding a textile material having a basis of cellulose acetate with an acid dyestuff in an aqueous medium containing at least 60% by weight of ethyl alcohol, and then, as a separate step padding the dyed cellulose acetate textile material directly and without drying and washing with a relatively concentrated aqueous solution of sodium thiocyanate.

6. Process for the coloration of textile materials having a basis of cellulose acetate in level, well-penetrated shades, which comprises padding a textile material having a basis of cellulose acetate with an acid dyestuff in an aqueous medium containing at least 60% by weight of ethyl alcohol, and then, as a separate step, padding the dyed cellulose acetate textile material directly and without drying and washing with an aqueous solution containing 10 to 25% by weight of sodium thiocyanate.

7. Process for the coloration of textile materials having a basis of cellulose acetate in level, well-penetrated shades, which comprises padding a textile material having a basis of cellulose acetate with an acid dyestuff in an aqueous medium containing 70% by weight of ethyl alcohol at a temperature of about 30° C., and then, as a separate step, padding the dyed cellulose acetate textile material directly and without drying and washing with an aqueous solution containing about 20% by weight of sodium thiocyanate at a temperature of about 30° C.

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