

UNITED STATES PATENT OFFICE

2,292,433

DYEING PROCESS

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No Drawing. Application May 2, 1940,
Serial No. 332,967

10 Claims. (Cl. 8—24)

This invention relates to the coloring of textile materials and relates more particularly to a process of coloring yarns, filaments or fabrics comprising organic derivatives of cellulose.

An object of this invention is to dye textile materials comprising organic derivatives of cellulose in a rapid and economic manner.

Another object of this invention is to dye said textile materials comprising organic derivatives of cellulose with dyestuffs which when applied in the ordinary manner have little or no affinity for organic derivatives of cellulose.

Still another object of this invention is to dye mixed textile materials containing other materials besides organic derivatives of cellulose with dyestuffs which ordinarily have no affinity for organic derivatives of cellulose so that a dyeing of the organic derivative of cellulose may be obtained without affecting the other materials or, if desired, the entire mixed material may be dyed uniformly.

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

In the dyeing of textile materials it is frequently desired to dye materials which are composed of more than one type of fiber. Such textile material may be composed of yarns of organic derivatives of cellulose mixed with yarns of other fibers such as cotton, reconstituted cellulose, natural silk and wool. In some cases it is desired to dye these mixed materials a single color, while in other cases it is desired to obtain differential color effects by dyeing one type of fiber in the mixed material one color and leaving the remaining fiber or fibers uncolored. In some instances, this may be done by choosing dyes which have an affinity for one of the materials and little or no affinity for the others. This procedure is limited, however, by the fact that of the dyestuffs which are commercially available, relatively few which are otherwise acceptable from the standpoint of fastness to light, washing, rubbing, scouring, etc., exhibit any sharp distinctions in the type of fibers they will dye and in the types they will leave untouched. As a result the number of colors available for use in obtaining such differential color effects is definitely limited. It is, therefore, obvious that any process which will make available classes of dyestuffs for the differential dyeing of organic derivatives of cellulose mixed with other fibers is an important advance in the art.

I have now discovered that acid dyestuffs which are generally used for the dyeing of wool, and

which ordinarily show practically no affinity for organic derivatives of cellulose, may now be used for dyeing cellulose derivative materials and particularly for the differential dyeing of mixed materials containing organic derivatives of cellulose to color the organic derivative of cellulose and yet leave the other materials uncolored and unstained. According to my process, a material such as a yarn made from wool mixed with staple fibers of an organic derivative of cellulose is treated with an aqueous dye bath containing an acid wool dyestuff and a water miscible organic solvent having little or no solvent action on the organic derivative of cellulose. By this procedure one would ordinarily expect the wool contained in said mixed material to be dyed by said acid wool dyestuff and the cellulose acetate to remain uncolored. However, this process of dyeing was found to leave the wool undyed and unstained by the acid wool dyestuff while the organic derivative of cellulose, for which said dyestuffs normally show substantially no affinity, were dyed desirable deep shades which are very fast to light, scouring, washing and rubbing.

While my process is eminently suitable for the differential dyeing of organic derivatives of cellulose when mixed with other textile materials, by suitable variations in the composition of the dye bath it is possible not only to dye the organic derivative of cellulose material but also to dye the materials which are mixed with it as well, and thereby obtain a mixed material uniformly dyed in a solid shade. This may be accomplished by adding a water miscible lower aliphatic acid to the dye bath containing the acid wool dyestuff and the organic solvent. By the addition of such an acid to the dye bath both the organic derivative of cellulose material and the animal fiber material mixed therewith, such as wool or silk, are dyed at the same time. In this manner a uniformly dyed mixed wool-cellulose derivative or silk-cellulose derivative textile material may be obtained, as a result which has been heretofore obtainable with difficulty and only after an elaborate and complicated procedure.

The organic solvents for the dyes suitable for use in accord with my invention are preferably water-soluble and should have substantially no solvent power for the organic derivatives of cellulose which are being dyed. They should, however, have a slight swelling action on said organic derivatives of cellulose which enables the dyestuff to penetrate more rapidly. Organic solvents which may be mentioned as particularly desirable are the aliphatic alcohols such as

methyl, ethyl, propyl and isopropyl alcohol. The use of organic liquids having strong solvent power for the organic derivatives of cellulose should be avoided since the use of such solvents in substantial amounts has a destructive effect on the organic derivatives of cellulose contained in the mixed material.

As pointed out above, where it is desired to obtain a uniform shade on a mixed wool-cellulose derivative material or a mixed silk-cellulose derivative, the dye bath is modified by adding certain acids thereto. The acids which may be added should be miscible with water and are organic in character, preferably of the lower aliphatic series. Acids such as acetic acid and formic acid are particularly suitable for use in my process. The concentration of acid maintained in the dye bath may vary from 1.0% to about 15.0%, depending upon the particular dyestuff used and the character of the mixed material being dyed. By suitably varying the acid concentration of the dye bath it is possible not only to dye all the fibers in the mixed material but to control the depth of shade to which each fiber is dyed. In this manner a pleasing two-tone effect of light and dark shades may be obtained.

The presence of water in the dye bath is advantageous and water may comprise up to about 50.0% by volume but from about 45.0% to about 50.0% is preferable. Very desirable results are obtained when ethyl alcohol mixed in equal parts by volume with water is used as the solvent.

The dyestuffs suitable in my process are those acid dyes generally used for the dyeing of wool and which have no substantive affinity for organic derivatives of cellulose. Examples of such acid dyes which may be used are Wool Blue GL (Color Index No. 833), Alizarine Light Green 2GS (Color Index No. 1078), Alizarine Fast Violet R (Color Index No. 1073), and Alizarine Direct Blue A. The amount of the dyestuff used in the dye bath will, of course, vary with the depth of the shade desired, but generally I prefer to use about 1 part to about 10 parts by weight of dyestuff to each thousand parts by volume of the dye bath.

The temperature at which the dye bath is maintained in dyeing these mixed materials will vary with the solvent medium employed as well as with the dyestuff being used. In some instances the dye bath may be maintained at about room temperature while in other instances the dye bath is preferably maintained at temperatures of from 25° C. to about 60° C. Periods of immersion varying from about 5 minutes to about 1 hour are generally preferred.

The material may be dyed in the form of hanks or skeins of yarn but preferably is dyed in the form of packages. Likewise, mixed materials in the form of fabrics may be dyed and the desired differential effects obtained.

The organic derivatives of cellulose which may be used in my process may be cellulose esters or cellulose ethers. Such esters may be cellulose acetate, cellulose propionate and acetate-butyrate, while such suitable ethers may be ethyl cellulose, methyl cellulose and benzyl cellulose.

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

Example I

Hanks of a yarn composed of a mixture of cellulose acetate staple fiber and wool are immersed in 10 times their weight of a dye bath containing 2 grams per liter of Wool Blue GL dis-

solved in a 50:50 mixture by volume of ethyl alcohol and water. The hanks are moved about in the dye bath maintained at room temperature for about 30 minutes. After removal from the bath the excess liquid in the hanks is then drained off and the hanks centrifuged and dried. The hanks are then washed in a $\frac{1}{2}$ gram per liter soap solution at 50° C. and finally scoured in a soap solution at 50° C. Upon examination it is noted that the cellulose acetate is dyed a full blue shade while the wool is left perfectly white. The mixed yarn may likewise be dyed in package form in this manner and the same desirable results obtained.

Example II

A mixed wool and cellulose acetate yarn in package form is immersed in a dye bath containing 40 parts by volume of ethyl alcohol, 15 parts by volume of acetic acid, 45 parts by volume of water and 2 grams per liter of Wool Blue GL. The dye bath is maintained at 30° C. and the liquid is circulated through the packages for about 45 minutes. The dye liquid retained in the packages is drained, and a soap solution at about 50° C. containing about $\frac{1}{2}$ gram of soap per liter is circulated through the packages. After washing and scouring it is noted that both the cellulose acetate and the wool are dyed uniformly to an even blue shade.

Example III

A yarn of mixed cellulose acetate and real silk in package form is immersed in a dye bath containing 40 parts by volume of ethyl alcohol, 15 parts by volume of formic acid, 45 parts by volume of water and 2 grams per liter of Wool Blue GL. The dye bath is maintained at about 30° C. and is circulated through the packages for about one-half hour. The excess dye liquid is removed from the packages and a dilute soap solution is circulated through the packages at about 50° C. The mixed yarn is dyed uniformly and both the cellulose acetate and silk are dyed to a level and even full blue shade. Mixed real silk and cellulose acetate yarns may also be dyed in hank or skein form.

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

Having described my invention what I desire to secure by Letters Patent is:

1. Method for the coloration of a mixed material containing fibers of an organic derivative of cellulose and animal fibers, which comprises applying to said material a dyebath that has no solvent power for the organic derivative of cellulose but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the organic derivative of cellulose when applied from an aqueous bath, said organic liquid medium comprising a water miscible organic acid, a neutral water miscible organic liquid which is a solvent for the dye and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the organic derivative of cellulose and animal fibers is effected.

2. Method for the coloration of a mixed material containing fibers of cellulose acetate and animal fibers, which comprises applying to said material a dyebath that has no solvent power for the cellulose acetate but has a slight swelling

action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising a water miscible organic acid, a neutral water miscible organic liquid which is a solvent for the dye and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and animal fibers is effected.

3. Method for the coloration of a mixed material containing fibers of cellulose acetate and wool fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising a water miscible organic acid, a neutral water miscible organic liquid which is a solvent for the dye and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and wool fibers is effected.

4. Method for the coloration of a mixed material containing fibers of an organic derivative of cellulose and animal fibers, which comprises applying to said material a dye bath that has no solvent power for the organic derivative of cellulose but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the organic derivative of cellulose when applied from an aqueous bath, said organic liquid medium comprising a water miscible lower aliphatic acid, a neutral water miscible organic liquid which is a solvent for the dye and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the organic derivative of cellulose and animal fibers is effected.

5. Method for the coloration of a mixed material containing fibers of cellulose acetate and animal fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising a water miscible lower aliphatic acid, a water miscible alcohol which is a solvent for the dye and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and animal fibers is effected.

6. Method for the coloration of a mixed material containing fibers of cellulose acetate and wool fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which

has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising a water miscible lower aliphatic acid, ethyl alcohol and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and wool fibers is effected.

7. Method for the coloration of a mixed material containing fibers of cellulose acetate and wool fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising a water miscible lower aliphatic acid, methyl alcohol and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and wool fibers is effected.

8. Method for the coloration of a mixed material containing fibers of cellulose acetate and wool fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising a water miscible lower aliphatic acid, propyl alcohol and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and wool fibers is effected.

9. Method for the coloration of a mixed material containing fibers of cellulose acetate and wool fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising acetic acid, ethyl alcohol and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and wool fibers is effected.

10. Method for the coloration of a mixed material containing fibers of cellulose acetate and animal fibers, which comprises applying to said material a dye bath that has no solvent power for the cellulose acetate but has a slight swelling action on the same and comprising a solution in an organic liquid medium of an acid dyestuff which has at most slight affinity for the cellulose acetate when applied from an aqueous bath, said organic liquid medium comprising formic acid, ethyl alcohol and an amount of water, if any, not exceeding 50% by volume of the dye bath, whereby substantial dyeing of both the cellulose acetate and animal fibers is effected.

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