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DYEING OF ORGANIC DERIVATIVES OF CELLULOSE

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This invention relates to an improved process for the treating of yarns, threads, articles etc., made wholly or partially from organic cellulose esters or ethers, whereby the dyeing of the cellulose ester or ether is more efficiently effected. It is more particularly directed to the treatment of yarns, threads etc., made from cellulose acetate, but applies also to the treatment of fabrics and textiles containing cellulose acetate.

The principal object of this invention is to provide a simple and effective process for the dyeing of yarns, threads, fabrics etc., of organic cellulose esters and ethers, whether the same be in loose form, tightly wound on cops, bobbins etc., or knitted, knotted or woven. Another object of this invention is to provide a process for the even dyeing of organic cellulose derivatives by using organic solvents to dissolve the dyestuffs to be utilized.

It is well known that yarns, threads, articles etc., can be dyed from aqueous solutions by using water soluble dyes. While such dyeing may give fairly good colorings, they are not of commercial value because of the fact that materials so dyed have a very poor fastness to washing and/or light.

As a result of this fugitive quality of such water soluble dyes, a series of dyes, insoluble in water, was devised which would give shades fast to light and/or scouring when dyed on materials made from organic cellulose esters or ethers. These new dyestuffs for organic esters and ethers of cellulose are applied to the material to be dyed by means of aqueous dispersions using Turkey red oil and/or other dispersing agents. While such dispersions give very good results on materials easily reached or in actual contact with the dye—that is, where the yarn is in hank form or the material is coarsely knitted or woven—they do not possess sufficient penetrative powers to properly and evenly dye tightly knotted material or yarns, threads etc., on cops, bobbins etc. Thus, for example, if a heavy twisted cord of cellulose acetate artificial silk be tightly knotted and the knot dyed with an aqueous dispersion of para nitro benzene azo dimethylaniline it will be found that the outer portions of the knot are dyed a much deeper shade than the inner portions—in fact some of the inner portions may be entirely undyed.

This uneven dyeing is probably due to the fact that the dyestuffs, not being in solution, are filtered out from the dye liquid as it passes through the very minute holes of the material. These pores or holes are large enough to permit the passage of the water therethrough but are not large enough to permit the dispersed particles of the dyestuff to pass. (This is merely suggested as a possible explanation for the low penetration of dispersed dyes and the applicant does not wish to be bound thereby.) Because of this low penetrating power of such dispersions it has been virtually impossible to successfully and evenly dye yarns or threads of organic cellulose derivatives when on cops, bobbins, pirns etc. For similar reasons difficulty was encountered in dyeing fabrics made of such materials when all portions of the fabric were not easily accessible to the dye solution.

The applicant has now discovered a process whereby the above mentioned difficulties may be overcome. He has discovered that if the dyes are dissolved in certain organic solvents and in this form applied to the fibers, fabrics or articles made with organic cellulose derivatives, unexpected results are obtained. Such solutions have very good penetrative powers and as a result are very valuable when it is desired to dye cellulose derivatives in yarn or thread form when wound on cops, bobbins, etc. The latter are found to be more evenly dyed throughout than has been heretofore possible.

The following solvents are given as indicative of the types of solvents which can be used in the applicant's process but the applicant's process is not to be considered as limited to the solvents enumerated:

Aromatic hydrocarbons such as benzene, toluene, xylene, etc.; derivatives of unsaturated and saturated hydrocarbons such as dichlorethylene, trichlorethylene, perchlorethylene, ethylenedichloride etc.; alcohols such as ethyl alcohol, methyl alcohol, pro-

pyl alcohol, amyl alcohol, butyl alcohol etc.

If desired, mixtures of the above solvents can also be used, such as a mixture of benzene and xylene or, ethylene dichloride and toluene, etc.

In the dyeing of organic derivatives of cellulose on cheeses or pirns etc., the following methods, as well as others, may be employed:—

1. The air is preferably extracted from the cheese or pirn by evacuation. After all the air is practically removed the dyestuff, dissolved in one of the above solvents, or a mixture of these solvents is allowed to enter. The steps of evacuation and running in of the dye solution are repeated until equilibrium is reached.

2. The yarn or thread is wound on a perforated bobbin or cheese. The dyestuff, dissolved in an organic solvent, is caused to pass throughout the cheese until equilibrium is reached. Where desirable, pressure may be utilized to more quickly effect an even distribution of the dyestuff solution.

Cops, pirns, cheeses, fabrics, textiles etc., dyed by either of the above methods were found to be evenly dyed throughout. In contra-distinction, cops, etc., similarly treated with aqueous dispersions of dyestuffs were found to be unevenly dyed, the outer portions being dyed a much deeper shade than the inner portions, with some of the latter totally undyed.

Where a red dyeing of the organic cullulose derivatives is desired, 1-hydroxy-4 amino anthraquinone can be used; for blue, methyl amino anthraquinone can be employed. Where an orange color is sought p-nitro-benzene-azo-dimethyl aniline will be found to give good results. The above dyestuffs are merely cited as illustrations and the invention is not to be considered as limited to these particular dyes or the classes represented by them.

A material advantage resulting from the applicant's process is the fact that the temperature of the dye bath need not be raised. Quite rapid dyeings of the organic cellulose derivatives are effected when the dyeing operations are carried on in the cold—that is, at atmospheric temperatures. This results in an appreciable saving in the fuel consumption and at the same time prevents undue loss of the solvent through excessive evaporation caused by elevated temperatures.

The process can be carried out in the cold, that is, at ordinary temperatures with all dyes and organic solvents but with some solvents the temperature may be raised if it is so desired. Whether the temperature of the dye bath can be raised will depend on the swelling or solvent powers of the dye solution on the cellulose derivative. Where the dye solvent employed, has marked solvent or swelling powers such as for example ethylene dichloride or dichlor-ethylene, the temperature should not be raised. Where the dye solvent employed has marked swelling powers it is advisable to dilute the same with another dye solvent or solvents whose swelling powers are less marked.

The term dyeing as used in the claims is to be interpreted as including within its scope, printing, stencilling etc. The term "organic derivative of cellulose" as used in the claims is intended to include those compounds of cellulose that are formed by the substitution of an organic radical for one or more hydrogen atoms and/or hydroxyl radicals in the cellulose molecules. Also the claims are to be construed as embracing the treatment of fabrics and textiles as well as yarns and threads which are specifically claimed.

Having described my invention, what I claim and desire to secure by Letters Patent is:—

1. A process of dyeing organic derivatives of cellulose which comprises treating an organic derivative of cellulose with a water insoluble dyestuff disolved in an organic solvent.

2. A process of dyeing organic esters of cellulose which consists in treating an organic ester of cellulose with a water insoluble dyestuff dissolved in an organic solvent.

3. A process of dyeing cellulose acetate which consists in treating the cellulose acetate with a water insoluble dyestuff dissolved in an organic solvent.

4. A process of dyeing organic derivatives of cellulose which consists in treating an organic derivative of cellulose in yarn or thread form and wound on cops, bobbins etc., with a water insoluble dyestuff dissolved in an organic solvent.

5. A process of dyeing organic esters of cellulose which comprises treating an organic ester of cellulose in yarn or thread form and wound on cops, bobbins etc., with a water insoluble dyestuff dissolved in an organic solvent.

6. A process of dyeing cellulose acetate which comprises treating cellulose acetate in yarn or thread form and wound on cops, bobbins etc., with a water insoluble dyestuff dissolved in an organic solvent.

7. A process of dyeing organic derivatives of cellulose which consists in treating an organic derivative of cellulose in yarn or thread form and wound on cops, bobbins etc., with a dyestuff dissolved in a homogeneous liquid containing ethylene dichloride.

8. A process of dyeing organic esters of cellulose which comprises treating an organic ester of cellulose in yarn or thread form and wound on cops, bobbins etc., with a dyestuff dissolved in ethylene dichloride.

9. A process of dyeing cellulose acetate

which comprises treating cellulose acetate in yarn or thread form and wound on cops, bobbins etc., with a dyestuff dissolved in a homogeneous liquid containing ethylene dichloride.

10. A process of dyeing organic esters of cellulose which comprises treating, in the cold, an organic ester of cellulose, in yarn or thread form and wound on cops, bobbins etc., with a dyestuff dissolved in a homogeneous liquid containing ethylene dichloride.

11. A process of dyeing cellulose acetate which comprises treating, in the cold, cellulose acetate in yarn or thread form and wound on cops, bobbins etc., with a dyestuff dissolved in a homogeneous liquid containing ethylene dichloride.

12. A process of dyeing organic esters of cellulose which consists in treating, in the cold, such an ester in yarn or thread form and wound on cops, bobbins etc., with a solution of methyl amino anthraquinone in a homogeneous liquid containing ethylene dichloride.

13. A process of dyeing cellulose acetate which consists in treating, in the cold, cellulose acetate in yarn or thread form and wound on cops, bobbins etc., with a solution of methyl amino anthraquinone in a homogeneous liquid containing ethylene dichloride.

14. A process of dyeing organic esters of cellulose which comprises treating, in the cold, such an ester of cellulose in yarn or thread form and wound on cops, bobbins etc., with a dyestuff dissolved in a homogeneous mixture of ethylene dichloride and trichlorethylene.

15. A process of dyeing cellulose acetate which consists in treating, in the cold, cellulose acetate in yarn or thread form and wound on cops, bobbins etc., with a homogeneous solution of methyl amino anthraquinone in a mixture of ethylene dichloride and trichlorethylene.

16. Process of dyeing cellulose acetate in yarn or thread form and wound on cops, bobbins, etc. comprising placing said cops, bobbins, etc. in a closed vessel, extracting the air therefrom by evacuation, and then entering a homogeneous solution of a dye-stuff in an organic solvent.

17. Process of dyeing cellulose acetate in yarn or thread form and wound on cops, bobbins, etc. comprising placing said cops, bobbins, etc. in a closed vessel, extracting the air therefrom by evacuation, and then entering a homogeneous solution of a dye-stuff in an organic solvent containing ethylene chloride.

In testimony whereof, he has hereunto subscribed his name.

WILLIAM WHITEHEAD.