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IMPREGNATION OF COTTON MATERIALS

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The present invention relates to the impregnation of cellulose materials such as cloth, thread, paper, etc. which comprises swelling the material with for instance a mercerizing bath preliminary to the impregnation thereof with an organic solvent solution of a cellulose ester or ether.

Heretofore cotton threads or filaments have been subjected to a shower or spray of a cellulose derivative solution which process resulted merely in a product comprising a core of the cellulose material entirely surrounded by a coating of the cellulose derivative, however, the amount of impregnation of the cellulose material, if any, was merely incidental to that coating operation.

One object of my invention is to prepare a cotton material which has been impregnated with a solution of a cellulose derivative in the sense that the cellulose derivative will be uniformly distributed therethru. Another object of my invention is to provide a process of preparing impregnated cotton material in which the cotton material is preliminarily prepared to be highly susceptible to the subsequent treatment with an organic solvent solution of a cellulose derivative. A further object of my invention is to provide a process for preparing a cotton material treated with a cellulose derivative solution which differs from prior art processes which disclose the formation of a skin only on the surface of the fiber without any appreciable impregnation taking place.

I have found that a satisfactorily impregnated cotton material may be formed upon its treatment with an organic solvent solution of a cellulose ester or ether if the cotton material is first subjected to a swelling treatment. I have found that this swelling of the fibers of the cotton is best obtained by a mercerization treatment. I have found that after this swelling treatment in the aqueous bath, it is important that the fiber be not dried but dehydrated with an organic solvent, preferably that employed for dissolving the cellulose derivative to form the solution which is subsequently applied thereto. It is of course recognized that if any of the organic solvents which may be employed do have a swelling action on cotton material, this dehydration step would be unnecessary, altho at the present time no such organic solvent is known. I have found that the product resulting from my invention is a material more resistant to water than the original cotton material and in addition possesses a high lustre thereby enhancing the appearance of the original material.

My process comprises first preliminarily subjecting the cotton material to be impregnated to the action of a swelling agent such as by a mercerization treatment. For example the cotton may be placed in a dilute (5–25% alkali) aqueous solution of an alkali metal hydroxide and may be allowed to remain therein and soak for a few hours, the time of treatment, of course, varying with the concentration. If an aqueous or some other swelling agent not compatible with the cellulose derivative solution later to be applied, is used, the fiber after the mercerization treatment must be washed to free the fibers of the liquid employed for the mercerization. This washing may be with water to remove all of the swelling agent from the fibers. This washing is followed by a dehydration of the cotton material such as by means of an organic solvent to remove substantially all of the moisture therefrom. It is important however that this dehydration is not a drying as the fibers should be wet with the organic solvent which was employed to expel the water. It is preferred that the organic solvent used be the one which is employed as the solvent for preparing the cellulose derivative solution which is to be applied to the material. The thus swelled and dehydrated, but not dry, cotton material is then ready to be impregnated with an organic solvent solution of a cellulose ester such as cellulose acetate, cellulose acetate propionate or cellulose acetate stearate or a cellulose ether such as ethyl cellulose or benzyl cellulose. A plasticizer is usually added to this solution.

This impregnation is best accomplished by immersing the cotton material in a dilute solution of the cellulose derivative for a time depending on the viscosity and penetrating speed of the solution. After the cotton material is thoroughly impregnated thruout it may be removed from the cellulose derivative solution, the excess solution may be removed therefrom and the solvent is then removed such as by evaporation. The product formed if the starting material was thread is eminently suited for use for electrical insulation. If the starting material was a cotton cloth or fabric the resulting product is an imitation linen while a water-resistant paper is produced when paper is employed as the starting material. Obviously the products of my invention may be employed in various other capacities especially where a moisture resistant material of this nature is desired.

The following example illustrates the application of my invention to the preparation of a moisture-resistant thread.

Cotton thread was immersed in a 15% aqueous sodium hydroxide solution at 10° C. for 4 hours. The thread was then washed with water until the alkali was thoroughly removed whereupon the thread was washed with acetone to remove the water present therein. It was then immersed in a 2% solution of cellulose acetate in acetone for about half an hour, was centrifuged and dried.

In the process of my invention various equivalents may be employed. For instance instead of cotton other cellulose material such as paper and the like may be employed as the material to be impregnated. As pointed out above various organic cellulose derivatives other than cellulose acetate such as cellulose acetate propionate, cellulose acetate butyrate, cellulose butyrate, cellulose acetate stearate, ethyl cellulose, benzyl cellulose etc. may be employed as the impregnating material.

In the present process any organic solvent which is a solvent for the cellulose derivative employed will be suitable providing this solvent can be separated from the material after impregnation thereof. A volatile solvent such as acetone is for this reason preferred. Other solvents which would come into use in this connection, the sole criterion being whether the cellulose derivative is soluble therein, are: ethylene chloride, propylene chloride, methyl acetone, methyl acetate, ethylene chloride-methyl alcohol etc.

Other swelling agents than aqueous sodium hydroxide such as aqueous potassium hydroxide, suggest themselves as of value in the present invention supplementary to or as an equivalent of aqueous sodium hydroxide.

The concentration of the solution of the organic derivative of cellulose which is employed for impregnating the cellulose material may be varied as desired by the individual operator however it is preferred that this solution be quite dilute so that it will have a low viscosity and a good penetrating value.

The term "organic derivative of cellulose" employed herein refers to the compounds resulting from the combination of cellulose with organic compounds to form for example cellulose ethers or organic acid esters of cellulose.

I claim as my invention:

1. The process of impregnating a cotton material with an ether or an organic acid ester of cellulose which comprises swelling the material with dilute aqueous alkali, washing the material with water, removing the water therefrom with a non-aqueous liquid and, while the material is still wet with the non-aqueous liquid, treating it with an amount of a dilute solution of an ether or an organic acid ester of cellulose, in an organic solvent, sufficient to impregnate the material.

2. The process of impregnating a cotton material with cellulose ether which comprises swelling the material with dilute aqueous alkali, washing the material with water, removing the water therefrom with a non-aqueous liquid and, while the material is still wet with the non-aqueous liquid, treating it with an amount of a dilute solution of cellulose ether, in an organic solvent, sufficient to impregnate the material.

3. The process of impregnating a cotton material with an organic ester of cellulose which comprises swelling the material with dilute aqueous alkali, washing the material with water, removing the water therefrom with a non-aqueous liquid and while the material is still wet with the non-aqueous liquid, treating it with an amount of a dilute solution of an organic ester of cellulose, in an organic solvent, sufficient to impregnate the material.

4. The process of impregnating a cotton material with a cellulose acetate stearate which comprises swelling the material with dilute aqueous alkali, washing the material with water, removing the water therefrom with a non-aqueous liquid and, while the material is still wet with the non-aqueous liquid, treating it with an amount of a dilute solution of a cellulose acetate stearate, in an organic solvent, sufficient to impregnate the material.

5. The process of impregnating a cotton material with an ether or an organic acid ester of cellulose which comprises swelling the material with dilute aqueous alkali, washing the material with water, removing the water therefrom with acetone and, while the material is still wet with the acetone, treating it with an amount of a dilute solution of an ether or an organic acid ester of cellulose, in an organic solvent, sufficient to impregnate the material.

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