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HERBERT PLATT, OF CUMBERLAND, MARYLAND, ASSIGNOR TO CELANESE CORPORATION OF AMERICA, A CORPORATION OF DELAWARE

PROCESS OF TREATING FABRICS

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This invention relates to the treatment of yarns or fabrics made of or containing organic esters of cellulose such as cellulose formate, cellulose acetate, cellulose propionate, etc. whereby the creasing of such materials is avoided.

An object of this invention is to treat fabrics containing organic esters of cellulose in such a manner that when they are subsequently subjected to dyeing operations, the creasing or wrinkling of the fabric will be avoided.

Another object of my invention is to partially saponify cellulose ester fabrics, thereafter dyeing the same in any desired manner. Other objects of my invention will appear in the following detailed description.

In dyeing certain classes of fabrics, it has been difficult to obtain a finished product free from creases. This necessitated the employment of special machines and processes which were not only cumbersome but also were not uniformly successful. Thus it has been considered inadvisable to dye certain types of cellulose ester fabrics on a winch due to the excessive creasing which resulted from such a dyeing operation.

I have now found that this objectionable creasing can be eliminated if the fabric to be dyed is first subjected to a surface saponification and then dyed on a winch in the usual manner. This unexpected result is most noticeable in such fabrics as are wet out with difficulty, because of their construction or because of their composition. Thus fabrics containing high twist yarns such as crepes are eminently suited for treatment in accordance with the present process. The surface saponification of the cellulose ester present in the fabric no doubt facilitates the wetting out of the fabric and this in turn prevents the formation of creases.

The manner in which the surface saponification is effected is immaterial in so far as the present invention is concerned. I have found that the tendency of certain fabrics to crease is overcome even though the degree of saponification obtained is comparatively slight.

The alkaline bath used for partially saponifying the cellulose acetate contained in the fabric or yarn may be either of low concentration or of high concentration depending on the temperature of treatment. If an alkaline solution of low concentration is used, higher temperatures may be employed in the process, whereas if alkaline solutions of high concentrations are used low temperatures of treatment are employed. If a solution of intermediate concentration is employed, intermediate temperatures of treatment should be used.

The saponifying bath may contain any suitable alkali or alkaline salt for producing hydroxyl ions in aqueous solutions. Of the alkalis suitable, sodium hydroxide and potassium hydroxide may be mentioned. Examples of alkaline salts are sodium or potassium carbonates, sodium or potassium phenolate, sodium or potassium sulphite, sodium or potassium silicate, or tri-sodium phosphate. In order to promote intense surface saponification of the yarn containing the organic ester of cellulose, buffer salts or modifying agents such as soap, sodium acetate, borax or alcohol, etc. may be added to the saponifying bath.

When alkaline solutions of low hydroxyl concentration are employed, the bath should contain at least 0.2 grams of sodium hydroxide or the equivalent amount of other alkaline substances per liter of solution, when temperatures of 80° C. are employed. While I do not limit myself to the specific concentrations, I have found that solutions having a hydroxyl ion content corresponding to 0.4, 0.5, 0.6 or 0.7 grams of sodium hydroxide per liter, give eminently satisfactory results. The temperature of the bath is maintained at 60° to 90° C. and preferably at about 80° C. However, after saponification of the cellulose acetate textile material had been initiated, the saponifying bath may contain less sodium hydroxide, since saponification then proceeds in a bath containing hydoxyl ions in amounts corresponding to less than 0.2 grams of sodium hydroxide per liter. The saponification may proceed to any desired extent, say 3% or 5 to 10% or more. These percentages represent the percent of

weight the cellulose acetate has lost through the saponification treatment.

The addition of a soap to the saponifying bath is of great advantage in promoting level saponification of the organic esters of cellulose material, and also the presence of the soap in the saponifying bath tends to help to cause the saponification to be concentrated on the surface of the yarn containing the organic esters of cellulose, which causes desirable dyeing properties. While the proportions of soap to the solution may be varied within wide limits, I have found that the presence of 0.5 grams to 10 grams of soap per liter of solution produces satisfactory results.

In one mode of carrying out my invention with the use of solutions containing alkali in low concentrations, the goods are scoured in an open bath on strings or in any suitable machine such as a jig, with a bath containing olive oil soap for an hour or two. The goods may then be removed from the bath and saponified in a separate bath containing fresh water and alkali, but they are preferably saponified directly in the general scouring bath by the addition of a requisite amount of caustic soda. In one mode of partially saponifying the fabric containing the organic ester of cellulose with an alkaline solution of low concentration, the fabric is immersed in a bath of such large volume that it contains sufficient alkali to cause the desired degree of saponification but which is not of such concentration to exceed the maximum permissible concentration of alkali material at the temperature to be employed. Thus for example, in saponifying a fabric consisting wholly of cellulose acetate of approximately 54% acetyl value, I have found that a bath of up to 120 to 180 times the weight of the fabric can advantageously be used, and that such bath should preferably contain an amount of caustic soda to the extent of 4 to 8% of the weight of the fabric, when a bath temperature of 80° C. is used.

Obviously, if the fabric or yarn contains other organic esters of cellulose or an alkaline material other than caustic soda is used, or if the temperature of the bath is other than 80° C., the proportions will be varied accordingly. Likewise it is apparent that when smaller amounts of alkaline material are used the volume of the saponification bath may be correspondingly decreased.

In another mode of carrying out my invention when alkaline solutions of low concentrations are employed, the fabric containing the yarns of cellulose acetate is treated in an alkaline bath of comparatively small volume and containing a relatively small amount of caustic soda. As the saponification proceeds, further quantities of caustic soda are added in small increments, until the desired degree of saponification has taken place. Until the operator has gained sufficient experience, it is preferable to check up the amount of caustic soda in the bath by titration with sulphuric acid to insure that the amount of caustic soda added is not sufficient to cause the saponifying bath to have a concentration exceeding the maximum permissible degree.

When concentrated alkaline solutions are used, the concentration of the alkali solution preferably corresponds to from 5 to 20% of caustic soda by weight. I have found that the use of 10% caustic soda solution is suitable for causing the cellulose acetate fabric to take direct cotton dyes in a satisfactory manner. However, if it is also desired to increase the safe ironing temperature, a 20% caustic soda solution is preferred, since by the use of this solution the safe ironing temperature of a cellulose acetate fabric is increased from 220° C. to 260° C. or above. However, no great advantage from the dyeing point of view is obtained by using a caustic soda solution of greater than 10% concentration. The saponifying bath may also contain such assistants as soap, sodium acetate, etc. The alkali solution may be applied to the fabric containing the organic esters of cellulose in any suitable manner. However, I prefer to apply the caustic soda when applied in comparatively concentrated solution to the fabric by padding the caustic solution onto the fabric and then permitting the same to stand for an appreciable length of time as will be described below. The temperature of treatment is preferably room temperature and should not exceed 35° C. for obtaining the best results.

The fabric or yarn containing the organic ester of cellulose when treated with a saponifying solution by any of the above described methods is intensely saponified on the surface of the yarn. By "intense surface saponification" is meant the concentration of saponification of the cellulose ester material on the surface of the yarn, while the interior of the yarn is very little affected and, therefore, consists essentially of cellulose esters. This is indicated by the fact that when cellulose acetate fabrics are treated in accordance with the above described methods, the solubility of the fabric in acetone is relatively high, and the fabric may be dyed with cotton dyes because of the fact that the surface of the yarn is essentially reconstituted cellulose or approximately so.

Thus the cellulose acetate fabric to be saponified can be plaited. A woven fabric consisting wholly of cellulose acetate yarn is plaited and strung, and is then immersed in a bath in which the ratio of water to fabric is between 130 to 1 to 160 to 1. This bath contains soap to the extent of one gram per liter of bath and the bath temperature is maintained at 80° C. The fabric is treated

in this soap bath for three-quarters of an hour.

The fabric is then raised out of the bath, caustic soda in an amount equal to 6% of the weight of the fabric is added to the bath. and after the solution is homogeneous, the fabric is then immersed in the bath and is treated therein for approximately three hours while the bath temperature is maintained at 80° C. The fabric is then lifted, washed off in water at 60° C., and then may be dyed in the manner set forth below.

If it is desired to saponify the fabric with a concentrated alkali solution, the fabric can be padded through rolls that are covered with several thicknesses of heavy cotton lapping or other absorbent material, using a bath containing 100 parts of water and 10 parts of caustic soda. The caustic soda solution is at room temperature, and the fabric is given two runs through the pad. The nip on the pad is arranged so that the fabric picks up an amount of solution equal to its own weight. After the second run on the pad, the roll of fabric is allowed to run 15 minutes, and the solution is then very lightly extracted on the roll. The fabric with the remaining solution is allowed to stand overnight at room temperature. In carrying out this process, it is important to give due heed to the strength of the caustic soda solution and to the temperature of treatment, which should preferably not exceed 35° C. Likewise it is of importance that the fabric should be batched with a minimum amount of tension, and that the caustic soda solution should be allowed to remain on the fabric for a period comparable to that of overnight. After standing overnight, the fabric is rinsed in water and is ready for dyeing.

This second process of saponification can be modified as desired by making up a bath of 100 parts of water and 5½ parts of caustic soda, with some thickening agent added if desirable. The fabric is then padded through rolls, giving it one run through the pad. The nip is so arranged that the fabric picks up an amount of solution equal to its own weight. The fabric is then immediately passed over and around rotating drums or cans that are heated to about 70° C. until the fabric is dry. The fabric may then be immediately dyed.

The foregoing examples are but a few methods of treating a fabric to saponify the same preparatory to dyeing the fabric. I have found that all of these methods impart to the fabric a property of being easily wetted out, which enables the same to be dyed on a winch without becoming creased or if the fabric is creased while in the greige, the creases are eliminated. This is a decided advantage for it has been necessary heretofore to dye most of the heavy fabrics on an Etoile or Star machine. This not only prolonged the time of dyeing but also necessitated the use of false selvedges on the fabric to avoid string marks. After the fabric has been saponified, in any desired manner, it is vacuum extracted and dried in a stove. The fabric may then be dyed on the winch in any suitable dye bath without any creasing of the fabric resulting. If desirable the fabric before being saponified may be scoured in a boil off tank and subjected to a delustering operation.

As an illustration of my invention the following example is given. The quantities set out are based upon the treatment of 85 lbs. of crepe marocain fabric, made from yarns of cellulose acetate.

The fabric is folded and strung along on a plaiting machine in one yard plaits and on this particular type of fabric, 4 to 5 plaits are strung together and 4 strings are used across the piece. The fabric is first scoured for one-half hour at 80° C. in a boil-off tank containing 6800 liters of water to which 120 liters of a 10% olive oil soap solution and 30 liters of a dispersion of xylene in Turkey-red oil have been added. If it is desired to deluster the fabric the temperature of the bath is raised to 87° C. and maintained at that temperature for about one-half hour.

The temperature of the bath is now dropped to 80° C., the fabric raised out of the bath on a lifting frame and 2300 grams of caustic soda added and the whole is stirred. After the soda is dissolved the fabric is reintroduced and the goods worked at 80° C. for about 3 hours, when the fabric is tested to determine the degree of saponification. The fabric is then vacuum extracted, dried in a stove and then dyed at 80° C. on a winch in any suitable dyeing bath containing ½ gram per liter of olive oil soap and 4 cc. per liter of a dispersion of xylene in Turkey-red oil. The goods are then run over a vacuum extractor dried in a stove or machine, steamed a little on the tenter and then subjected to light calendering or button breaking if necessary. The fabric is found to be evenly dyed and entirely free of creases, even though the fabric in the greige may have shown creasing.

While the above example described the process as applied to crepe marocain, a flat crepe, the invention is not limited to this particular type of fabric. Any crepe fabric and most any other heavy fabric containing organic esters of cellulose and which is subject to creasing can be treated in accordance with this invention to overcome this objectionable feature. Thus, for example, tricot fabric and milanese fabric may also be treated in accordance with this process. The process can be applied to any such types of fabric whether the same is made entirely of cellulose acetate or other organic esters of cellulose or mixtures of such cellulose esters

with each other or with other classes of yarns. Also the specific method of saponifying the fabric may be changed without departing from the spirit of my invention.

The process above outlined will serve not only to prevent creasing of the fabric during the dyeing operations but will also remove any creases which the fabric in the greige possessed. The process will also serve to increase the resistance of the fabric to hot pressing. Where the normal luster of the fabric is desired, the delustering step outlined in the example may be omitted.

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

1. Process of treating fabrics containing organic esters of cellulose which comprises subjecting the fabric to partial saponification, drying the same and then thoroughly wetting out the fabric and dyeing the fabric on a winch.

2. Process of treating fabrics containing cellulose acetate which comprises subjecting the fabric to partial saponification, drying the same and then thoroughly wetting out the fabric and dyeing the fabric on a winch.

3. Process of treating crepe fabrics containing organic esters of cellulose which comprises subjecting the fabric to partial saponification, drying the same and then thoroughly wetting out the fabric and dyeing the fabric on a winch.

4. Process of treating delustered fabrics containing cellulose acetate which comprises partially saponifying the delustered fabric, drying the saponified fabric and then thoroughly wetting out the same and dyeing the thus treated fabric on a winch.

5. Process of treating delustered crepe fabrics containing cellulose acetate which comprises partially saponifying the delustered fabric, drying the saponified fabric and then thoroughly wetting out the same and dyeing the thus treated fabric on a winch.

6. Process of treating delustered fabrics containing organic esters of cellulose which comprises partially saponifying the delustered fabric, vacuum-extracting and drying the thus treated fabric, wetting out the fabric and subjecting the same to a dyeing operation on a winch.

7. A process for eliminating creases from fabrics in the greige containing organic esters of cellulose which comprises saponifying the surface of the yarns of the cellulose ester, drying the partially saponified fabric and then dyeing the fabric on a winch.

8. In the process of dyeing fabrics containing organic esters, of cellulose, the steps of partially saponifying the fabric and then drying it prior to dyeing the same on a winch.

9. In the process of dyeing fabrics containing cellulose acetate, the steps of partially saponifying the fabric and then drying it prior to dyeing the same on a winch.

10. In the process of dyeing fabrics containing organic esters of cellulose, the step of saponifying the surface of the yarns comprising said fabric and then drying said fabric prior to dyeing the same on a winch.

11. In the process of dyeing fabrics containing cellulose acetate, the step of saponifying the surface of the yarns comprising said fabric and then drying said fabric prior to dyeing the same on a winch.

In testimony whereof, I have hereunto subscribed my name.

HERBERT PLATT.