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TREATMENT OF NYLON FOR MODIFYING
ITS DYEING AFFINITY

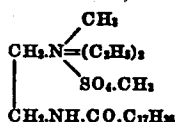
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This invention relates to the treatment of nylon and in particular to the modification of the dyeing affinity thereof for direct cotton dyestuffs in an acid dyeing bath. By my invention I am able to obtain both dyeing and reserve effects.

I have found that by treating nylon with a direct cotton dyestuff in an acid dyebath in the presence of a cationic soap, I can obtain improved dyeing or reserve effects, depending on the quantity of cationic soap present during the treatment. Under the term "cationic soap" I mean those compounds which exhibit properties similar to the normal soaps of commerce, that is to say, they are ionised surface-active compounds and are strong depressors of surface tension, but contrary to the normal soaps contain the surface-active group in the cation. Of examples of such cationic soaps I mention cetyltrimethylammonium iodide, monostearyl-asym.-diethyl-ethyl-ene-diamine methosulphate of the formula:



cetylpyridinium bromide and octadecyloxymethylpyridinium chloride.

When only a small proportion, say between about 0.1 per cent and 1.0 per cent of the cationic soap, calculated on the weight of the nylon, is present during the treatment with the dyestuff, improved dyeing effects are obtained, in that dyeing takes place more quickly and deeper shades and better exhaustion of the dyebath are obtained. If quantities of the cationic soap, equal to two or more per cent, say five per cent, of the weight of the nylon are present during the treatment with the dyestuff, the nylon loses more or less of its power to absorb direct cotton dyestuffs from an acid dyebath. I wish it to be understood, however, that the degree of inhibition of absorption of the dyestuff will vary according to the particular direct cotton dyestuff used, and to the amount of dyestuff present in the bath; also to the particular cationic soap employed and to the amount of this used. In general, I have found that the presence of 5 per cent of a cationic soap, as already defined, calculated on the weight of nylon, will almost completely inhibit the absorption on nylon of most direct cotton dyestuffs from an acid dyebath.

I believe that the reason why a small quantity of the cationic soap increases, while a larger quantity decreases, the dyeing effect can be explained as follows, but I do not bind myself in any way to this theory. I believe that both the

nylon and the anion of the dye are capable of attracting the cation of the soap, and that in the competition for the cations in solution these latter are most readily attracted by the fibre.

- 5 If, therefore, a comparatively small quantity of the soap cations are present, these will be practically all absorbed by the nylon. Then in the boiling dyebath the dye is gradually combined with the cationic agent and since this is present on the fibre the later becomes dyed with a dye-anion-soap-cation complex. If the concentration of the cationic soap be increased beyond the point at which the nylon fibre becomes saturated, the remaining cations will remain in solution and on introduction of a dyestuff to such a bath containing a large excess of cationic soap molecules in solution, the dye-anion-soap-cation complex is formed and this is not absorbed by the nylon, either because these large complex molecules 20 diffuse very slowly and require a very prolonged treatment to be absorbed by the nylon or possibly both the nylon when saturated with cationic molecules and also the dye-anion-soap-cation complex particles are positively charged, thus 25 hindering absorption. Possibly both these reasons play their part in inhibiting the dyeing of the nylon.

- When increasing the dyeing affinity of nylon according to my present invention, I can allow the nylon, for instance in the form of fabric, to soak in an aqueous solution of a cationic soap, then rinse lightly in water to remove excess of the cationic soap, so that the fabric retains at least 0.1 per cent and not more than 1.0 per cent of the cationic soap calculated on the weight of the nylon, and then with or without drying at 100° centigrade dye with direct cotton dyestuffs, such for instance as Chlorazol Fast Pink BK (Colour Index No. 353) and Chlorazol Black BH (Colour Index No. 401). Instead of pretreating the nylon with the cationic soap, I can carry out my present invention by dyeing with direct cotton dyestuffs under acid conditions in a dyebath containing a small amount of cationic soap, preferably not exceeding 1 per cent calculated on the weight of the nylon being dyed.

My present invention is particularly valuable in that by its use some direct cotton dyestuffs can be applied to nylon within a practical time, whereas in the absence of the cationic soap excessively long times of dyeing are required to reach economic exhaustion of the dyebath.

The inhibition of the nylon for direct cotton dyestuffs in an acid dyebath can be brought about according to this invention by carrying out the dyeing in the presence of a larger quantity of the cationic soap, employing such a quantity of

this latter that at least 2 per cent and preferably a larger quantity calculated on the weight of the nylon, is present during the dyeing process. For instance nylon fabric can be pretreated with the cationic soap and then subjected to the dyeing process, care being taken that when the fabric is introduced into the dyebath, it carries with it at least 2 per cent of the cationic soap, of which if the theory above propounded be correct probably only a portion is combined with the nylon. Or the nylon fabric, without pretreatment with the cationic soap, can be dyed in a dyebath containing the requisite quantity of cationic soap. Or these two procedures can be combined and the nylon fabric can be pretreated with a small quantity, say 1 per cent, of the cationic soap and then introduced into the dyebath containing a further quantity of the soap.

This property of inhibiting the absorption of direct cotton dyestuffs by nylon is particularly valuable when it is desired to produce two-tone or tone-in-tone effects on mixed fabrics containing nylon and another fibre, such as, for example, viscose, since it is possible to produce a medium-to-deep shade on the viscose, while the nylon remains at the most only faintly tinted.

The following examples will serve to illustrate how the invention may be carried out in practice but it is not restricted to these examples. The quantities of each ingredient, unless otherwise stated, are in respect of one hundred parts of nylon and the liquor to fibre ratio is 50:1.

Example 1

A length of a 100 per cent nylon fabric is soaked, at room temperature, for 20 minutes in a solution containing 30 grams of cetylpyridinium bromide and 30 cubic centimetres of 80 per cent acetic acid in each litre of distilled water. The fabric is then removed, lightly rinsed in cold water and treated in a dyebath containing 1 part of Chlorazol Fast Pink BK and 7.5 parts of 80 per cent acetic acid for one hour at 95° to 100° centigrade. The fabric is dyed a full shade of pink while the dyebath is exhausted.

Example 2

A length of an all-nylon fabric is soaked, at room temperature, for 20 minutes in a solution containing 30 grams of mono-stearyl-*asym.*-diethyl-ethylenediamine methosulphate, and 30 cubic centimetres of 80 per cent acetic acid in each litre of distilled water. The fabric is then removed, lightly rinsed in cold water and treated in a dyebath containing 1 part of Chlorazol Black BH and 7.5 parts of 80 per cent acetic acid for 1 hour at from 95° to 100° centigrade. A full shade on the fabric and good exhaustion of the dyebath are obtained. In this example the mono-stearyl-*asym.*-diethyl-ethylenediamine methosulphate may be replaced by an equal quantity of the product sold under the registered trade-mark "Sapamine KW conc." (Society of Chemical Industry in Basle).

Example 3

An all-nylon fabric is entered at a temperature of 90° centigrade into a dyebath containing 1 part of Chlorazol Fast Pink BK, 7.5 parts of 80 per cent acetic acid and 0.15 part of cetylpyridinium bromide and dyeing continued at a temperature of from 95° to 100° centigrade for 1 hour. A strong shade of pink is obtained while the dyebath is completely exhausted.

Example 4

A 100 per cent nylon fabric is entered into a dyebath containing 1 part of Chlorazol Fast Pink BK, 7.5 parts of 80 per cent acetic acid and 0.25 part of the product sold under the registered trade-mark "Sapamine KW conc." (Society of Chemical Industry in Basle) and dyed for 1 hour at from 95° to 100° centigrade. A full shade of pink is obtained and the dyebath is exhausted.

Example 5

A length of an all-nylon fabric is padded through a solution containing 30 grams of the product sold under the registered trade-mark "Sapamine KW conc." (referred to in the list of "Textile Assistants" in "Silk and Rayon" 1936, page 954 as a cation-active fatty product e. g. diethylamine ethyl oleyl amide



in which the anion (Cl) is inactive) (Society of Chemical Industry in Basle) and 30 cubic centimetres of 80 per cent acetic acid in each litre of distilled water, squeezed evenly so that it retains between 60 and 70 per cent of its own weight of padding liquor and then dried at just under 100° centigrade. The so-treated nylon is then treated in a bath containing 1 part of Chlorazol Fast Pink BK and 7.5 parts of 80 per cent acetic acid for 1 hour at from 95° to 100° centigrade. The nylon is only very slightly tinted, while untreated nylon similarly dyed is more strongly dyed.

Example 6

A 100 per cent nylon fabric is treated with 0.5 part of Diphenyl Blue M2B, 300 per cent (Colour Index No. 406), 7.5 parts of 80 per cent acetic acid and 5 parts of the product sold under the registered trade-mark "Sapamine KW conc." (Society of Chemical Industry in Basle) for 1 hour at from 95° to 100° centigrade. The fabric is only very slightly tinted, whereas similar treatment in the absence of "Sapamine KW conc." gives a medium blue shade.

Example 7

A length of a nylon warp viscose crepe weft fabric, containing equal weights of nylon and viscose yarn, is treated in a bath containing 0.5 part of Diphenyl Blue M2B 300 per cent, 7.5 parts of 80 per cent acetic acid and 5 parts of cetylpyridinium bromide and 15 per cent of common salt (calculated on the volume of liquor) for 1 hour at from 95° to 100° centigrade. The common salt is added in three equal amounts during the course of the dyeing operation—the first portion at the end of the first quarter, the second at the end of the second quarter, and the last portion at the end of the third quarter period. After rinsing the dyed fabric in cold water and drying, it is noted that the nylon threads are merely slightly stained, while the viscose threads are dyed a medium blue shade.

What I claim is:

1. A process of dyeing nylon fibres with a direct cotton dyestuff from an acid dyebath which comprises dyeing in the presence of from 0.1 to 1.0 per cent of a cationic soap.

2. A process of dyeing nylon fibres with a direct cotton dyestuff from an acid dyebath which comprises pretreating the nylon with from 0.1 to 1.0 per cent of a cationic soap, rinsing and then dyeing with a direct cotton dyestuff from an acid dyebath.

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