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SERICEOUS FIBERS

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This invention relates to the treatment of textile fibers, specifically cellulosic fibers or those fibers of vegetable origin. It involves particularly the treatment of cellulosic fibers whereby they are modified appreciably in their properties and appearance and have imparted to them characteristics which resemble silk in many respects.

In my copending application Ser. No. 534,989, filed May 10, 1944, I have described the treatment of cellulose fibers with aqueous solutions of alkylolamine-copper complex, such solutions being substantially free or devoid of alkali metal hydroxides. I have observed that if a small proporiton of an alkali metal hydroxide be dissolved in such an aqueous solution then the latter becomes a solvent for silk fibers but not (at least in the ordinary meaning of the term solvent) for cellulose fibers. It should be noted that this property of an aqueous solution of an alkylolamine-copper complex containing a small proportion of alkali metal hydroxide is quite different from that of an aqueous solution of an ammonia-copper complex containing a small proportion of an alkali metal hydroxide in that the latter type of aqueous solution is a solvent for either silk fibers or cellulose fibers. I have observed also that cellulose fibers may be impregnated with sericeous material by dissolving silk fibers in an aqueous solution of an alkylolamine-copper complex containing dissolved alkali metal hydroxide, saturating or impregnating the cellulose fibers with such a solution, and afterwards treating the saturated or impregnated cellulose fibers with an aqueous solution of an acidic agent thereby dissolving the alkylolamine-copper complex and the alkali metal hydroxide. Cellulosic fibers which have been treated in the manner indicated I designate as sericeous fibers as they exhibit to a marked degree some of the properties which are characteristic of silk.

The cellulosic fibers suitable for my purpose may be used in the unbleached or bleached condition. If desired, prior to treatment with the sericeous material, the bleached or unbleached fibers may be subjected to a mercerizing operation. It is preferable that the cellulosic fibers, before treatment according to this invention, be given an alkali boil or treated in some other appropriate manner whereby extraneous materials, such as sizing, are removed from them.

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In all instances, the cellulosic fibers after treatment with the silk solution possess a firmer and fuller feel and when in the form of woven goods or cloth they often exhibit a smoother texture. In the case of mercerized fibers, particularly those which have been subjected to a mercerizing operation involving the application of tension, there is some delustering effect secured by the treatment as herein disclosed. Bleached but not mercerized fibers, after being sericized according to my invention, may exhibit a slight luster or silk-like appearance. If unbleached fibers are treated in accordance with my invention, then they become lighter in color, the extent or degree of this effect depending upon the proportion of sericeous material which is impregnated in the fibers. Cellulosic fibers which have been treated by my process often exhibit an enhanced or increased adsorption property for acid and basic dyes and in many cases also for substantive dyes. On the other hand, sericeous fibers show a decreased adsorptive power for vat dyes.

The aqueous solutions of alkylolamine-copper complexes can be prepared by the addition of an alkylolamine to an aqueous solution of a water-soluble copper salt. The quantity of amine should be sufficient to dissolve completely the water-insoluble copper hydroxide which is formed as the first reaction product upon addition of the amine. The resulting solution is blue in color, the depth of color depending upon the proportion of copper salt in solution. Next, sufficient alkali metal hydroxide is dissolved in the liquid to react with all alkylolamine salt present (as a result of interaction between copper salt and alkylolamine) and to furnish the desired proportion of free or uncombined alkali metal hydroxide.

Another method of preparing solutions suitable for my purpose comprises the following steps: dissolving the copper salt in water, precipitating copper hydroxide by addition of sodium or potassium hydroxide or other suitable agent, filtering the precipitate and washing it substantially free of salts and/or precipitating agent, and then dissolving the precipitate in an aqueous solution of the alkylolamine. In this manner there is obtained an aqueous solution of alkylolamine-copper complex substantially free of alkylolamine salts and also of other salts. In this

solution then is dissolved the necessary or desired proportion of alkali metal hydroxide.

Preferably the proportion of free or uncombined alkali metal hydroxide should be small, say from about 0.5 per cent to about 4 per cent. An excess of alkylolamine over that required to keep all the copper in solution may be present. Apparently the proportions of free alkali metal hydroxide and alkylolamine-copper complex determine the quantity of silk which will be dissolved by the aqueous solution. By varying these two factors, the concentration of dissolved silk may be varied over quite a wide range. I have noted that silk appears to be insoluble, or substantially so, in an aqueous solution of only the alkylolamine-copper complex even though a considerable excess of the alkylolamine may be contained therein. Dissolution of a small quantity of alkali metal hydroxide in the aqueous solution (of alkylolamine-copper complex) causes the latter to become a solvent for silk.

After the aqueous solution of alkylolamine-copper complex and alkali metal hydroxide is prepared, silk in the form of, say, thread or cloth is dissolved therein. If the latter (i. e., cloth) is employed, it may be cut into small pieces thereby greatly increasing the rate of dissolving. Preferably the silk should be well boiled, that is substantially free of any silk gum. Also, it should be substantially devoid of weighting materials, such as tin salts. If desired, the silk may be subjected to a bleaching operation prior to dissolution in the aqueous solution of alkylolamine-copper complex.

Cellulose fibers may be impregnated with silk solutions in any convenient manner. For example, the cellulose fibers in the form of yarn or cloth may be immersed in the solution, or the latter may be allowed to percolate slowly through a mass of cellulose fibers. Any method is suitable whereby the fibers are thoroughly wetted and saturated with the solution of alkylolamine-copper complex containing dissolved silk.

After the fibers are saturated with the aqueous solution, they may be drained or pressed gently to remove adhering liquid, and then immersed in an aqueous solution of an acidic agent. The latter should be one that will react with and that will form water-soluble salts with the alkaline substances and the copper compounds adsorbed by the cellulose fibers. Examples of acidic agents which are suitable for my purpose are hydrochloric, acetic and sulfuric acids, sodium or potassium acid sulfate. The quantity of acidic agent in the aqueous solution should be at least equal to that necessary for complete reaction with the alkaline substances and copper compounds adsorbed by the cellulosic fibers. However, for easy operation an excess of the agent may be present in solution as it (acidic agent) afterwards may be removed from the fibers by washing with water. Furthermore, while the cellulosic fibers are immersed in the aqueous solution it is desirable that they be worked gently, thereby keeping the aqueous solution from becoming locally neutral or even alkaline. After treatment with the acid solution the fibers are washed well with water and dried.

The following examples will illustrate my invention though I do not wish to be limited by them. It will be understood that the cellulosic fibers in each instance were given an alkali boil or other appropriate treatment to remove sizing and like materials before being subjected to the operations described. Silk cloth was employed and this was substantially free of silk gum and of weighting materials.

Example 1.—An aqueous solution of an alkylolamine-copper complex was prepared by dissolving copper chloride in water, adding monoethanolamine in sufficient quantity to furnish a clear blue solution, and then diluting with water until the concentration of the solution was equivalent to 2 g. of the copper salt ($CuCl_2 \cdot 2H_2O$) per 100 cc. of solution. To the latter were added sodium hydroxide in the proportion of 2 g. per 100 cc. of liquid. This quantity of alkali metal hydroxide was sufficient to react with the dissolved alkylolamine salt and to give a solution containing substantially 1 per cent sodium hydroxide. To this solution was added silk in the proportion of 0.6 part of the latter to 20 parts of liquid, and the mixture stirred at room temperature until all silk had dissolved.

A sample of commercially bleached and mercerized cotton yarn was immersed in a portion of the silk solution for 1 hour at room temperature. Afterwards the cotton was removed from the solution, pressed gently to eliminate unadsorbed liquid and then immersed in an aqueous solution of sulfuric acid. The quantity of acid was considerably in excess of that required to react with all alkali (alkylolamine and alkali metal hydroxide) and copper compounds adsorbed by the yarn. The latter then was washed well with water and air-dried. This treated sample of bleached and mercerized yarn, as compared with the untreated material, possessed a light cream color and a slight silky appearance but was not quite as bright and lustrous. Also, the treated fibers were somewhat stiffer and firmer in feel.

The treated sample and also one of the untreated yarn were colored in the following manner: Separate baths were prepared consisting of 50 parts of water to 1 part of textile material and 3 per cent (based on weight of fibers) of a yellow substantive dye. After the latter had dissolved, each sample was immersed in its respective dye bath at room temperature for 3.5 hours. Afterwards, each sample was rinsed twice with cold water (using the same volume of liquid in each instance), wrung as dry as possible and then air-dried. The sample of yarn previously treated with the silk solution was somewhat lighter though brighter in color and did not exhibit as much sheen or luster as the other sample.

Example 2.—An aqueous solution of silk was prepared as in Example 1 with the modification that silk was used in the proportion of 1 part to 20 parts of alkylolamine-copper complex solution.

A sample of unbleached cotton yarn was immersed in this solution, while kept at room temperature, for 1 hour. The yarn then was removed, pressed gently and immersed in dilute aqueous sulphuric acid. While in the acid solution, the yarn was worked gently to prevent the liquid from becoming locally neutral or even alkaline. The quantity of sulfuric acid present was in considerable excess of that required to react with all alkaline bodies and copper compounds adsorbed by the cotton fibers. Next, the textile material was washed well with water, and air-dried. In this instance there was little difference in appearance between the treated yarn and the untreated material, though the former was somewhat stiffer and possessed a harder feel.

The above treated sample and also one of the original cotton goods (untreated) were dyed separately, using in each case 50 parts of water to 1

part of yarn and 1 per cent (based on weight of cellulosic fibers) of a red basic dye. The samples were worked in the baths at room temperature for 5 minutes, and then the baths were heated over a period of 30 minutes to a temperature of 55° C. Afterwards, the baths were allowed to cool slowly to room temperature. The samples were removed and rinsed twice with cold water, each time employing the same proportion of water, and then air-dried.

It was noted that the yarn containing sericeous material adsorbed the dye much more rapidly than the other, even at room temperature. It was observed also, after completion of the dyeing operation and drying of the fibers, that the treated cotton was red in color while the untreated cotton was much less colored being only a light crimson.

Example 3.—An aqueous solution of alkylolamine-copper complex was made by dissolving cupric chloride in water, adding 2-amino-2-methyl-1,3-propanediol in small portions until a clear blue liquid was obtained, and then diluting the solution with water until the concentration of the solution was equivalent to 3 g. of $CuCl_2 \cdot 2H_2O$ per 100 cc. Sodium hydroxide then was dissolved in this solution in the proportion of 2.5 g. per 100 parts of liquid. This procedure furnished a solution of alkylolamine copper complex containing substantially 1.1 per cent uncombined alkali metal hydroxide.

Next, silk was dissolved in the liquid in the proportion of 1 part to 22 parts of liquid.

A sample of bleached cotton cloth and one of bleached linen cloth were covered separately with the above solution of silk and kept immersed therein at room temperature for 21 hours. Afterwards, each sample was removed from the liquid, pressed gently and treated with dilute aqueous acid (sulfuric) in the manner indicated previously. The portions of cloths were washed well with water and air dried. Each of the impregnated samples was a light cream in color and possessed a firmer feel than the corresponding untreated material.

A portion of the bleached and treated cotton cloth and also one of the bleached untreated cloth were dyed separately, using 50 parts of water per 1 part of cloth and 2 per cent (on weight of cloth) of a red acid dye. Each sample was immersed in the respective bath for 5 minutes at room temperature, and then the temperature of the baths was increased slowly over a period of 30 minutes to 50° C., and maintained at this temperature for 20 minutes. At the end of this time the baths were allowed to cool slowly to room temperature. The samples were removed, rinsed once with cold water, pressed to eliminate unadsorbed liquid, and air-dried. The impregnated sample of cloth was a rose red in color while the non-impregnated or untreated sample was a light pink. The greater adsorptive capacity of the impregnated sample for the acid dye was very marked.

Example 4.—A dye bath was prepared by admixing a green vat dye (in paste form) with water in the proportion of 1.8 parts of paste to 1000 parts of water and to this aqueous mixture adding 6 parts of sodium carbonate and 9 parts of sodium hyposulfite ($Na_2S_2O_4$). The mixture was stirred until all salts were dissolved and then allowed to stand for 30 minutes before using.

A portion of the impregnated bleached cotton cloth from Example 3 and a sample of the corresponding untreated bleached cotton cloth were dyed separately, using in each instance 50 parts of the solution of vat dye to 1 part of cloth. Each sample was immersed in the liquor for 30 minutes, then removed and allowed to drain for 30 minutes while exposed to the atmosphere. Next, the samples were washed well with water and dried. In this instance it was noted that the impregnated cloth was a very light shade of green and the non-impregnated cloth was much darker in color.

Analogous results were obtained when the impregnated bleached linen cloth of Example 3 and a portion of the original bleached linen cloth were dyed in like manner with the same vat dye. A second dyeing of these linen samples darkened the color of each, although that of the impregnated sample still remained the lighter shade.

Example 5.—Copper sulfate was dissolved in water, triethanolamine was added until a clear dark blue solution was obtained, and the latter diluted with water until the copper concentration was equivalent to 7.5 g. of $CuSO_4 \cdot 5H_2O$ per 100 cc. Sodium hydroxide was dissolved in this solution in the proportion of 4 g. per 100 parts of liquid. This procedure yielded an alkylolamine-copper complex solution containing about 1.6 per cent uncombined alkali metal hydroxide.

Silk was dissolved in this liquid in the proportion of 1.3 parts to 20 parts of solution.

Bleached cotton yarn was immersed for 1 hour at room temperature in a portion of the silk solution. Afterwards, the excess or unadsorbed liquor was drained from the goods, the latter pressed gently and then immersed and worked in a dilute aqueous solution of sulfuric acid until all copper compounds and alkaline bodies adsorbed by the yarn had been dissolved. Next, the cotton was washed with water and air-dried. This treated sample was a light cream in color as compared with the initial untreated yarn and also had a much firmer and more solid feel.

The treated bleached material and a sample of the original bleached fibers were dyed separately using in each instance a dye bath consisting of 40 parts of water to 1 part of textile material and 4 per cent (based on weight of sample) of a blue substantive dye. The cellulosic material was worked in the dye bath for 5 minutes at room temperature, and then the temperature of the bath in each case was raised to 60° C. over a period of 20 minutes, held at that temperature for 10 minutes, and then allowed to cool slowly to room temperature. Each sample then was washed well with cold water and air-dried.

It was noted that the treated yarn was much darker in color and that the individual threads or strands in the skein appeared to be more tightly twisted as compared with the untreated yarn. The treated yarn also had a firmer feel resembling somewhat that of linen. It was observed after the dyeing operation was completed that the bath employed in dyeing the treated cotton was much lighter in color than the other dye bath, thus indicating clearly a much better exhaustion or adsorption of the dye stuff.

Example 6.—In this instance the textile material was bleached cotton cloth which had been dyed a light blue color with indigo. A portion of this cloth was immersed in an aqueous alkylolamine-copper complex solution containing dissolved silk as prepared in Example 5. During

immersion of the sample, the solution was maintained at room temperature. After 1.5 hours, the cloth was removed from the liquid, pressed, treated with dilute aqueous sulfuric acid to eliminate alkali and copper complex, washed with water and air-dried. This treated portion was much firmer in feel, considerably stiffer and not so pliable as the untreated fabric.

Both the treated and untreated fabrics were dampened with water and subjected to a pressing operation with the application simultaneously of mild heating. This operation greatly reduced the stiffness and increased the pliability of the treated cloth. The latter, however, still retained a firmer and fuller feel as compared with the untreated material. Of the two samples, the impregnated one was very slightly lighter in color.

Example 7.—The excess alkylolamine-copper solutions remaining after treatment of samples in Examples 5 and 6 were combined, and commercially bleached and mercerized cotton yarn was immersed in the liquor for 75 minutes at room temperature. The yarn then was removed, drained, and immersed in an excess of dilute aqueous hydrochloric acid, and afterwards washed well with water and air-dried. The treated material was a light cream color, less lustrous than the original yarn, appeared to have a tighter twist and was firmer in feel and somewhat stiffer.

This treated sample and also one of the bleached and mercerized but untreated yarn were dyed separately, using in each instance a dye bath consisting of 40 parts of water to 1 part of cloth and 4 per cent (on weight of yarn) of a red basic dye. The samples were worked for 5 minutes in their respective baths at room temperature, and then the temperature (of the baths) was increased to 60° C. over a period of 20 minutes and held at that temperature for 15 minutes. Afterwards, the baths were allowed to cool slowly to room temperature, the samples removed therefrom, rinsed once with cold water, and then permitted to drain and air-dry. The treated yarn was a deep red in color while the other was a light cerise.

Example 8.—In a portion of the alkaline solution of alkylolamine-copper complex solution from Example 5 was dissolved 6 percent by weight of silk. A sample of unbleached linen cloth was saturated with this solution and then a slight excess of the liquid added. The cloth was worked in this small amount of liquid at room temperature for 45 minutes, then immersed and worked gently in dilute aqueous hydrochloric acid. Next, the fabric was washed well with water and air-dried. Due to this treatment it was very distinctly lighter in color than the original untreated cloth.

This treated sample as well as one of the untreated linen cloth were dyed separately, using in each instance a dye bath consisting of 100 parts of water per 1 part of cloth and 2 per cent (on weight of cloth) of a red basic dye. The samples were worked for 10 minutes in the respective baths at room temperature, then the temperature (of the baths) was increased to 60° C. over a period of 30 minutes, and kept at that temperature for 10 minutes. Afterwards the baths were allowed to cool slowly to room temperature. The samples then were removed, rinsed once with cold water, and air-dried.

The untreated sample was a light dull cerise in color, while the treated one was a bright clear cherry red. The treated fabric also possessed a smoother feel.

Example 9.—To an aqueous solution of cupric sulfate was added aqueous sodium hydroxide in sufficient quantity to precipitate all of the copper as cupric hydroxide. The latter was filtered, washed well with water and dissolved in aqueous 2-amino-2-methyl-1-propanol. The resulting solution was diluted with water until its concentration was equivalent to 2.5 g. $CuSO_4 \cdot 5H_2O$ per 100 cc. Potassium hydroxide was dissolved in this solution in the proportion of 2 parts of alkali metal hydroxide to 100 parts of solution.

Silk then was dissolved in the above solution of alkylolamine copper complex in the ratio of 2 parts of silk to 100 parts of solution.

Unbleached cotton yarn was immersed for 30 minutes at room temperature in the liquor containing dissolved silk, afterwards drained, pressed, gently and treated with dilute aqueous hydrochloric acid to eliminate alkaline bodies and copper compounds adsorbed by the yarn. The latter was washed with water and dried. The treated cotton fibers were distinctly lighter in color than the untreated fibers.

Treated and untreated samples of the yarn were dyed separately, using 70 parts of water per 1 part of yarn and 3 per cent of a red acid dye. In each instance sufficient acetic acid was added to the bath to make it distinctly acid in character. The samples were worked in the respective baths at room temperature for 5 minutes, and then the temperature of the baths was raised to 60° C. over a period of 25 minutes. Afterwards, they were allowed to cool slowly to room temperature. Each sample was rinsed once with water and then dried. The untreated yarn was a light brownish red in color while the treated yarn was a clear red in color.

From the foregoing disclosures it will be seen that my invention comprises impregnating cellulosic fibers with an aqueous solution of an alkali metal hydroxide and an alkylolamine-copper complex in which solution are dissolved silk fibers, and then treating the impregnated cellulosic fibers with an aqueous solution of an acidic agent which removes alkali metal hydroxide and alkylolamine copper complex from the cellulosic fibers as water-soluble salts, thereby leaving the cellulosic fibers impregnated with sericeous material.

The amino compounds suitable for my purpose, as previously mentioned, are alkylolamines and, as their name indicates, are hydroxy-amino derivatives of saturated hydrocarbons. Monoethanolamine, diethanolamine and triethanolamine are examples of alkylolamines which I may employ. It should be noted that such compounds are either monohydroxy or polyhydroxy amines and furthermore they are either a primary, secondary or tertiary amine. Alkylolamines containing more than one amino group per molecule are not precluded.

For ease in preparing a solution of the alkylolamine-copper complex, water-soluble copper salts such as the chloride, acetate, sulfate and the like, or water-insoluble compounds such as the hydroxide or oxide, are generally used. Water-insoluble copper salts such as the phosphate, carbonate, basic carbonate or oxalate may be dissolved in an aqueous solution of the alkylolamine and the resulting solution, after dissolution of the alkali metal hydroxide, may be employed as a solvent for silk. However, with the last-named solutions some difficulty may be experienced in one step of my process, namely, in washing the impregnated cellulosic fibers with a dilute aqueous solution of an acidic agent, as it may prove troublesome to remove the water-insoluble cop-

per salt completely from the cellulosic fibers. When such water-insoluble salts are employed it will be desirable in some instances to treat the solution of alkylolamine-copper complex (before dissolving the alkali metal hydroxide therein) with an agent which will precipitate the troublesome anion. For example, if copper phosphate be dissolved in an aqueous solution of an alkylolamine, the solution may be treated with the required quantity of calcium oxide or barium hydroxide and the phosphate ion precipitated as calcium or barium phosphate.

As pointed out previously, the quantity of silk which may be dissolved in the aqueous solution of alkali metal hydroxide and alkylolamine-copper complex appears to be dependent upon the concentration of the hydroxide and of the complex. For many purposes I find it convenient to employ a saturated solution of silk. However, I do not wish to be limited to such solutions as those having a less concentration of silk can be employed. The extent or degree to which it is desired to alter or change the properties and/or appearance of the cellulosic fibers will determine largely the concentration of the silk solution.

The concentration of the aqueous solution of acidic agent employed in washing the impregnated fibers can vary between very wide limits and depends to a large extent upon the particular agent used. The limitations which I place on this step of my process are: (1) the acidic agent should be one which will react with the alkali metal hydroxide and with the alkylolamine-copper complex to yield only water-soluble salts; (2) the concentration of the aqueous acidic solution should be great enough to prevent the solution from becoming locally neutral or even alkaline while the impregnated cellulosic fibers are immersed and gently worked therein; and (3) the concentration of the aqueous solution of acidic agent should not be sufficiently great as to effect any deleterious or harmful action on the cellulosic fibers or the sericeous material impregnated therein.

I have noted that the aqueous solution of alkali metal hydroxide and alkylolamine-copper complex in which are dissolved silk fibers may be diluted with a considerable volume of water without precipitation of the dissolved silk taking place. For this reason, cellulosic fibers impregnated with the alkaline alkylolamine-copper complex solution of silk should be immersed in an acidic solution in which the quantity of acidic agent and its concentration are maintained at all times sufficiently great to react immediately with the alkaline bodies adsorbed by the cellulosic fibers, and thereby effect precipitation of sericeous material within the fibers. Otherwise, a considerable proportion of the solution of sericeous material may be removed from the impregnated fibers when the latter are brought into contact with water.

Cellulosic fibers which are suitable for my purpose include cotton, linen and the like. Regenerated cellulose may be employed also. The fibers, as previously stated, may be bleached and/or mercerized prior to treatment according to this invention. Dyed fibers also can be treated by my process, particularly those fibers containing a dye which is not readily affected by the alkaline copper solution.

What I claim is:

1. The process for treating cellulose fibers which comprises impregnating said fibers with an aqueous solution of an alkali metal hydroxide and

an alkylolamine-copper complex and in which solution are dissolved silk fibers, the proportion of said alkali metal hydroxide being not less than about 0.5 per cent and not more than about 4 per cent the weight of said aqueous solution, washing said impregnated fibers with an aqueous solution of an acidic agent yielding water-soluble salts on reaction with said alkylolamine-copper complex and said alkali metal hydroxide, and removing substantially all of said acidic agent and said water-soluble salts from said cellulose fibers.

2. The process for treating cellulose fibers, according to claim 1, in which the alkali metal hydroxide is sodium hydroxide.

3. The process for treating cellulose fibers, according to claim 1, in which the alkali metal hydroxide is potassium hydroxide.

4. The process for treating cellulose fibers which comprises impregnating said fibers with an aqueous solution of an alkali metal hydroxide and a monohydroxy alkylolamine-copper complex and in which solution are dissolved silk fibers, the proportion of said alkali metal hydroxide being not less than about 0.5 per cent and not more than about 4 per cent the weight of said aqueous solution, washing said impregnated fibers with an aqueous solution of an acidic agent yielding water-soluble salts with said alkylolamine-copper complex and said alkali metal hydroxide, and removing substantially all of said acidic agent and water-soluble salts from said cellulose fibers.

5. The process for treating cellulose fibers, according to claim 4, in which the monohydroxy alkylolamine-copper complex is monoethanolamine-copper complex.

6. The process for treating cellulose fibers which comprises impregnating said fibers with an aqueous solution of an alkali metal hydroxide and a polyhydroxy alkylolamine-copper complex and in which solution are dissolved silk fibers, the proportion of said alkali metal hydroxide being not less than about 0.5 per cent and not more than about 4 per cent the weight of said aqueous solution, washing said impregnated fibers with an aqueous solution of an acidic agent yielding water-soluble salts with said alkylolamine-copper complex and said alkali metal hydroxide, and removing substantially all of said acidic agent and said water-soluble salts from said cellulose fibers.

7. The process for treating cellulose fibers, according to claim 6, in which the polyhydroxy alkylolamine-copper complex is diethanolamine-copper complex.

8. The process for treating cellulose fibers, according to claim 6, in which the polyhydroxy alkylolamine-copper complex is triethanolamine-copper complex.

9. A bath for impregnating cellulose fibers comprising an aqueous solution of an alkali metal hydroxide and an alkylolamine-copper complex containing dissolved silk fibers, the proportion of said alkali metal hydroxide being not less than about 0.5% and not more than about 4% of the weight of said aqueous solution.

10. A bath for impregnating cellulose fibers comprising an aqueous solution of an alkali metal hydroxide and a monohydroxy alkylolamine-copper complex containing dissolved silk fibers, the proportion of alkali metal hydroxide being not less than about 0.5% and not more than about 4% of the weight of said aqueous solution.

11. A bath for impregnating cellulose fibers which comprises an aqueous solution of an alkali metal hydroxide and a polyhydroxy alkylolamine-

copper complex containing dissolved silk fibers, the proportion of said alkali metal hydroxide being not less than about 0.5% and not more than about 4% of the weight of said aqueous solution.

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