

UNITED STATES PATENT OFFICE

LEO WALLERSTEIN, OF NEW YORK, N. Y., ASSIGNOR TO WALLERSTEIN COMPANY, INC.,
OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

PROCESS FOR DEGUMMING SILK

No Drawing.

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This invention relates to a process for degumming silk.

weak alkaline bath may be employed, as for instance a weak solution of sodium carbonate or bi-carbonate, ammonium hydroxide or ammonium carbonate.

The especial object of the invention is to provide a process which will be more economical than the processes heretofore practiced and which may be carried out in practice with ordinary care without danger of injury to the silk.

After the silk has been sufficiently washed, it may be removed from the bath and the soap solution extracted or pressed out in any suitable manner. As, for example, by a wringer or a centrifuge. While this rinsing or washing bath is desirable, it is not absolutely essential and may be dispensed with.

In prior United States Letters Patent No. 1,227,525, granted to Boidin and Effront, is described a bacterial liquor prepared by cultivating bacteria having the characteristics of the species subtilis or mesentericus, or both, in a wort or mash rich in nitrogen, such for instance as can be derived from soy cake.

After the bath, however, when the bath is used or if the bath is dispensed with, the silk is immersed in a bath or solution of the bacterial liquor containing the sericin dissolving enzyme. The strength of the solution employed, of course, depends upon the dissolving power of the bacterial liquor, which, however, can be easily determined by test. As a general rule, a solution of from 1 to 10 parts of such bacterial liquor of standard or commercial strength to 100 parts of water is a satisfactory dilution. The optimum hydrogen ion concentration of the bath corresponds to a pH of 7.0-7.6, and a satisfactory working temperature is between 40° to 60° C.

I have discovered that such bacteria produce or secrete an enzyme which has the property of dissolving or hydrolyzing sericin and that this liquor contains such enzyme. My invention broadly considered comprises a process or treatment of silk in skeins or other unmanufactured form or in fabrics, with such bacterial liquor under conditions which effect the dissolving or hydrolyzing of the sericin content in the silk. I am thus able to effect in an economical manner a thorough degumming of the silk without injury thereto, my process also improving the "feel" or texture of the material treated.

As a specific example of carrying out the invention, the silk may be first subjected to the action of a weak soap solution, as for instance a solution containing $\frac{1}{4}$ to $\frac{1}{2}$ per cent. by weight of soap. While the amount of soap solution relatively to the amount of silk treated may vary and need only be such as to permit of convenient washing and working of the silk, it is desirable to so proportion the bath that the total soap content therein will be about 1 to 2 per cent. by weight of the raw silk to be treated. This bath is kept at a convenient temperature, as for instance 50° to 90° C., and the raw silk is allowed to remain in the bath for a short time, a few minutes usually being sufficient. The object of the use of this bath is to wash the silk for the purpose of removing any surface dirt, grease, or other impurities that can be readily removed by washing.

Instead of the soap solution, some other

It is desirable to stir the bath at intervals and to work over the silk in the usual way so as to make sure that the solution comes into intimate contact with all parts of the silk. The time that the silk is under treatment in the bath depends upon the strength of the bath, but generally the silk is kept in contact with the solution for from 1 to 2 hours, at the end of which time it is removed from the bath and subjected to a rinsing bath of warm water in which it is thoroughly rinsed in any suitable way.

Instead of rinsing in water, the silk may be rinsed or even boiled in a weak soap solution. The action of this step is to remove the last layer of the gum or small amounts of gum that may still adhere to the silk fibers, thus improving the lustre and "feel" of the silk.

Under some circumstances, the silk to be treated may be kept in the bacterial liquor bath for a considerable length of time, as for instance 8 to 12 hours, or even longer in

cases where a weak sericin dissolving bacterial liquor is used. Where the silk is subjected to such prolonged treatment, it is advantageous to add suitable antiseptics to the bath, as for instance phenol or beta naphthol, and such antiseptics may, if desired, be added to the bacterial liquor to prevent spoilage, or the development of undesirable microorganic growth.

It is, of course, to be understood that variations in the proportions and time of treatment may be necessary and may be made where the bacterial liquor varies from normal or commercial standard, and these may be easily determined by simple preliminary tests.

In another example of carrying out the process, the bacterial liquor bath itself may contain soap instead of using the preliminary soap bath heretofore described. The quantity of such soap will vary with the concentration of the bacterial liquor, the higher the concentration of the liquor the larger proportion of soap can be used. As an example, the bath may contain from $\frac{1}{3}$ to 1 per cent. by weight of a neutral soap. Where the soap is added to the bath, care should be taken that the bath does not become too alkaline to interfere with the proper action of the sericin dissolving enzyme. The hydrogen ion concentrate corresponding to a pH of 7.5-8.0 has been found to give satisfactory results. This addition of soap to the bath assists in producing a cleaner and softer feeling silk and is, therefore, advantageous for this reason.

In another way of carrying out the process, the silk may be immersed in the bacterial liquor bath for only a short time, say from a few seconds to a few minutes, and after this immersion the saturated silk or silk fabric is allowed to lie in a moist and warm atmosphere until the enzymatic action has proceeded to a point where the gum is dissolved or hydrolyzed so that it can be, by subsequent treatment, readily washed out from the silk or the fabric. Where the process is carried out in this fashion, plain warm water, or preferably warm water to which a small amount of soap has been added, is used for this washing out.

Under certain conditions, it has also been found advantageous to immerse the silk or silk fabric to be degummed for a very short time in boiling water, that is, from a few seconds to a few minutes, the silk then being immersed in the bath containing the sericin dissolving bacterial liquor.

The above process of degumming silk is of special advantage in the degumming of fabrics which are woven partly of silk and partly of rayon or artificial silk. Such fabrics, particularly those containing threads or filaments of cellulose acetate, are unfavorably affected by the boil-off with soap, and pro-

longed boiling in soap solution is particularly harmful to threads of cellulose acetate, as it hurts their lustre and wearing qualities.

In carrying out the process as so far described, the bacterial liquor used is of the standard or commercial strength. Instead of using this bacterial liquor, however, a concentrated enzyme may be prepared from the bacterial liquor, as for instance by evaporating in a vacuum at a low temperature, or by salting out by means of ammonium sulphate or any other concentrating means which does not destroy the activity of the enzyme. When such concentrated preparation is used, it is, of course, sufficiently diluted, the dilution depending upon the desired sericin dissolving power of the preparation.

What is claimed is:

The process of degumming silk which comprises subjecting the silk fiber for a short time to the action of a bacterial liquor solution which is produced by cultivating bacteria which produce or secrete an enzyme having the property of dissolving or hydrolyzing sericin, removing the silk from the solution, exposing the silk to action of moist warm air until the desired amount of degumming has occurred, and washing the silk.

In testimony whereof, I have hereunto set my hand.

LEO WALLERSTEIN.