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METHOD OF WASHING ARTIFICIAL SILK

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This invention relates to the manufacture of artificial silk and more particularly to a process of washing freshly coagulated or spun artificial silk produced in a wet process wherein an acid is used in the coagulating bath.

In the manufacture of artificial silk from viscose, the solution is spun into a coagulating bath and the thread wound to form a package. If the bobbin method of spinning is used, the package comprises a bobbin of artificial silk. On the other hand, if the bucket or pot method of spinning is employed, the package comprises a cake of artificial silk. In both of these methods the freshly coagulated silk contains sulphur which it is necessary to remove. This is usually effected after the artificial silk has been dried and skeined. Before the artificial silk is dried, the acid present or adhering to the thread must be removed, since it tends to degrade the artificial silk, especially during the drying operation. The acid is therefore removed while the artificial silk is in its freshly coagulated, semi-gelatinous or gel condition by washing with water.

The most commonly used method comprised the spraying or dripping of water over a number of bobbins or cakes arranged in tiers on racks. Frequently, the cakes where fitted with metallic inserts to prevent distortion during washing, though this was not essential.

At the beginning this method of drip washing quickly removed a large proportion of the acid and functioned efficiently. As the washing continued, the efficiency of the acid removal decreased, whereby it became very difficult and uneconomical. It was not uncommon to permit the washing to be carried out for 12 to 18 hours and to use as much as 55 gallons of water per pound of artificial silk. Even with this large amount of water it is doubtful if the last trace of acid was removed. Nevertheless, even though other methods of washing have been attempted to be used, none superseded it and it remained the standard practice.

The drip washing, as above described, has been attempted to be improved by the use of liquids under pressure or vacuum, by centrifugal washing and by other means. Processes were proposed in which the freshly coagulated threads containing acid were immediately treated with alkali to neutralize the acid. This operation produced salts in the artificial silk, which, by crystallization during drying, would break the fine filaments. Thus, the salts had to be removed prior to drying. Usually, an excess of alkali was used and it, too, especially if caustic soda were used, had to be eliminated prior to drying. The removal of the salts together with the excess alkali required at least as much time, if not more, than the removal of the acid. Thus, this method, even though it was a very expensive procedure, did not reduce the time element nor render it commercially practical.

It has been found that the acid adhering to or present in freshly spun artificial silk coagulated in an acid bath can be quickly and efficiently removed by washing it with water as long as the economic removal of the acid warrants, and then washing it with a solution containing a compound which reacts with the acid forming water-soluble salts.

It is, therefore, an object of this invention to provide a method of washing freshly spun artificial silk, coagulated in an acid bath which comprises washing the same with water for as long as the economic removal of the acid warrants and then washing with a solution containing a compound which reacts with the acid forming the water-soluble salts.

Another object of this invention is to provide a method of washing freshly spun artificial silk coagulated in an acid bath which comprises washing the same with water for as long as the economic removal of the acid warrants and then washing with a dilute ammonium hydroxide solution.

Other objects will appear from the following description and appended claims.

In carrying out one modification of the method constituting this invention, cakes produced in the bucket process are placed

on the rods of a washing rack. The cakes, if desired, may be first fitted with metallic inserts to prevent distortion of the cakes during the washing, though this is not essential to the successful operation of the method. If no inserts are used and the cakes are placed directly on the rods, they may, due to the weight of the water, become deformed into what is known as flat cakes. After the cakes have been arranged on the wash rack, water is then sprayed or dripped over the rack in the usual manner. At the beginning of the operation the water efficiently removes a large proportion of the acid. As the washing continues, the removal of the acid becomes more and more difficult. Soon a time is reached when a relatively large quantity of water is used and only a very small proportion of the acid is removed. At this stage of the process the water drip washing is interrupted or stopped and a wash liquor containing a compound which reacts with the acid to form water-soluble salts is used, the latter being washed out as the process continues.

In carrying out the above method, it has been found that the regular drip washing with water may be advantageously and economically used for about 2½ hours. During this time a very large proportion of the acid is removed. Subsequent to this, water functions inefficiently and is uneconomic. Therefore, at this stage, a solution containing a compound reacting with the acid and forming water-soluble salts is used. Such a wash will satisfactorily remove substantially all the acid present and salts formed therein in about 1 hour. Thus, the entire process of washing the cakes takes 3½ hours with a water consumption of approximately 16 gallons per pound of artificial silk.

Various compounds may be used in the process. For example, sodium hydroxide, ammonium hydroxide, sodium acetate, sodium formate, pyridine, aniline and the like may be used. Preferably, a compound is used which is volatile and is capable of reacting with the acid in the bath forming water-soluble salts which are removed during the washing. After the removal of the salts, any of the compound remaining will be volatilized during the drying operation. The compounds may be used in various concentrations. An aqueous solution containing 0.015% ammonium hydroxide produces satisfactory results.

It is obvious that this process is independent of temperature and that any reasonable temperature may be used. It is also to be understood that this process may be used for the washing of artificial silk produced by any process involving the use of acid coagulating baths and that it may be successfully operated on bucket cakes, bobbins, skeins or any other form of freshly spun artificial silk.

The method constituting this invention reduces the time of washing freshly coagulated artificial silk from approximately 12 to 18 hours to 3½ hours. It reduces the consumption of water from 55 gallons of water per pound of artificial silk to 16 gallons per pound of artificial silk. This saving of water, of course, results in a large saving in operating expenses. The reduction in time permits the use of a smaller wash house. Also, since one of the causes of degradation of artificial silk is due to the time of washing, the instant method materially and substantially reduces the degree of degradation. Furthermore, by the method above described all the acid is removed. No trace of acid remains in the artificial silk as in the method used prior to this invention. If an excess of compound is used and it is not entirely eliminated by washing, it will be volatilized in the drying operation.

Though the above method has been particularly described with respect to drip washing, this invention is not limited thereto. The method comprising this invention may be successfully practiced in conjunction with other methods of washing, such as pressure washing, vacuum washing, centrifugal washing and the like.

I claim:

1. A method of washing freshly spun artificial silk coagulated in an acid bath which comprises washing the same with water as long as the economic removal of the acid warrants and then washing with a solution containing a compound which is volatile and reacts with the acid forming water-soluble salts.

2. A method of washing freshly spun artificial silk coagulated in an acid bath which comprises washing the same with water as long as the economic removal of the acid warrants and then washing with a dilute solution containing ammonium hydroxide.

3. A method of washing freshly spun artificial silk coagulated in an acid bath which comprises washing the same with water for as long as the economic removal of the acid warrants and then washing with a solution containing 0.015% of ammonium hydroxide.

In testimony whereof, I have affixed my signature to this specification.

THOMAS F. BANIGAN.