개선된 실크 정련 공정에서의 세리신 회수

이태상, 홍영기, 배기서
충남대학교 섬유공학과

The Recovery of Sericin at Improved Scouring Process of Silk Fabric

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1. Introduction

Natural silk is formed by two proteins ; the crystalline fibroin (inside the silk thread) and amorphous sericin (as a tube outside the thread). The degumming process is used th eliminate the external sericin prior to dyeing ; generally it makes use of soaps at pH 10.

Sericin is the protein constituent that "gums" together the fibroin filaments of cocoon silk. It constitutes about 25% of the weight of the cocoon, is soluble in hot water and "gels" on cooling. The removal of sericin from raw silk, known as degumming, is a simple but important process usually employing hot dilute soap or alkaline solution and occasionally dilute acids or enzymic methods.

During degumming, alkali is taken up by the sericin and the free acid from the soap is formed ; this may be deposited on the fiber , reducing the rate of degumming and protecting it from hydrolysis. Alkali is often added to maintain or restore the pH of the baths, but it is rarely used alone, since it leaves the silk rather harsh in handle. If complete sericin removal is required as for printing, sodium carbonate may be added.

If the pH of the bath exceeds 11, the fibroin is attacked.

Recently, According to the development of electrolysis, we can be obtained the electrolytic reduction water(above pH 11) and electrolytic oxidation water (below pH 2).

The aim of this work was to study a degumming process using electrolytic water and a possibility of sericin recovery.

The new degumming process used electrolytic water operates at 95℃ for 2hr. without any reagents. The wastwater of this process are formed by a solution of sericin in water. This conditions suggest the study of a possible recovery of this

protein (sericin) which has an amino acid composition suitable for many used in cosmetics, textile finishing agents, animal feeding, etc.

2. Experiments

The new degumming process is based on the use of electrolytic water without any reagents ; mainly electrolytic reduction water(pH 11.6), at 95℃ temperature and 1~2 hours in the bath which is designed for silk fabrics in the laboratory. In order to compare with characteristics of degumming silk fabric, manufacturing process have been adopted at the same condition.

The sericin solution at room temperature is a partially gelled liquid with high viscosity dependent on temperature, content, molecular weight, and pH. The content of the sericin was measured with a HEWLETT PACKARD Vectra ES/12 spectrophotometer at 290nm, and the molecular weight of sericin was measured by SDS Polyacrylamide gel electrophoresis method.

The degumming rate(%) is calculated from weight loss of raw silk.

The hand value of silk fabrics was measured with KES-01~04.

3. Results and Discussion

3.1 The pH changes of the electrolytic water

The electrolytic water was made by the electrolysis apparatus(Boin Groval LTD.Korea) consists of electrolytic reduction water and electrolytic oxidation water. The pH changes of the electrolytic water was provided in Fig1~2. As shown in figure, the pH of the electrolytic water is not very much change during the 10 days.

Therefor, we can expect that the electrolytic water be adopted for textile wet process, especially silk degumming process.

3.2 The effect of degumming

Raw silk does not possess the luster and softness for which this fiber is noted. The sericin which coats the filaments gives a rather harsh handle and must be removed in order to bring out the supple and lustrous qualities. its removal is delayed to a suitable stage in the manufacturing sequence depending on the product which is required.

Degumming of silk is carried out just below the boil in soap solution with or without the addition of alkali according to the quality of the fiber. The new vapor degumming process is adopted on the use of purified water at 120-130℃ and pH 6-7. At 130℃ the whole sericin is solubilized. But this process does not

give as good a handle as soap degumming.

The effect of treating temperature and treating time in the degumming of silk using electrolytic water are shown in fig.3~4. It is suggested that the silk be gummed for 1~2 hour with electrolytic reduction water

(pH 11.6) at 95℃ in the manufacturing sequence depending on the product which is required.

The degumming process must be carried out at the treating time and treating temperature which seems to be necessary for the dissolution of the sericin.

3.3 The moleculat weight of the silk recovery

In the silk manufacturing sector, a large volume of wastwater containing proteins (mainly sericin), salts are produced in the degumming process of both yarn and fabrics made from natural silk. Sericin represents, on the contrary, a valuable by-product that can be used in cosmetics and pharmaceutical production.

To reduce treatment costs and pollute and at the same time to recover sericin, using of the electrolytic water can be suggested in the degumming process and the textile wet process.

Much less work has been done in determining the molecular weight of sericin compared with fibroin. Sprague reported a range of values from 130,000 to 200,000 daltons for 15 different polypeptides extracted from different regions of the gland. On the other hand, Gamo et al. have report ed values for sericin of 80,000-310,000 daltons for 5 polypeptides secreted by five different regions of the gland. Although amino acid analyses of the various polypeptides are similar in many respects to values obtained for whole sericin, they do not appear to relate to the composition of sericin fractions obtained from raw silk by hot water dissolution.

The molecular weight of sericin extracted with electrolytic water was measured by electrophoresis method. The test results are reported in fig.5. A : The molecular weights of sericin obtained from raw silk by sodium carbonate dissolution are small, less than 5,000, B : The average value of the molecular weights of sericin by distilled water dissolution is about 47,000, C : the average value of sericin by electrolytic water dissolution is about 70,000 .

3.4 The characteristics of degumming silk fabrics

The KES data of degumming silk fabrics shows Fig. 6

Laboratory and field experiments show that the hand value of silk fabrics degummed with electrolytic water is similar to the values of silk fabrics degummed with soap/alkali solution(conventional method).

It means that degumming process using electrolytic water is usable.

4. Conclusions

The degumming process using electrolytic water is available to reduce treatment costs and pollute and at the same time to recover sericin.

5. References

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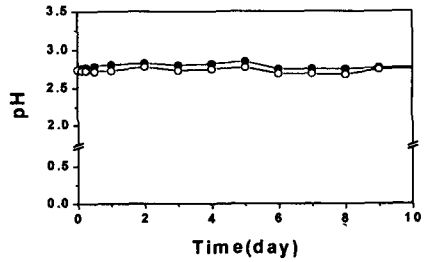

Fig. 1 Effect of stock time at pH in electrolytic oxidation water
● : bath with opening
○ : bath with closing

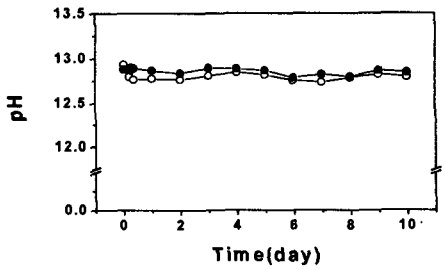

Fig. 2 Effect of stock time at pH in electrolytic reduction water
● : bath with opening
○ : bath with closing

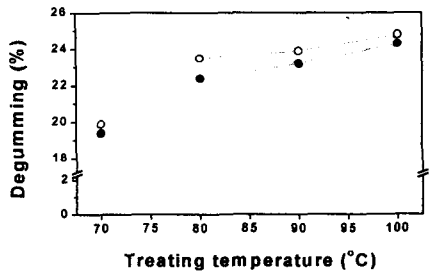

Fig. 3 Effect of treating temperature in the degumming of silk fabrics at 2hrs
● : Electrolytic reduction water
○ : Na_2CO_3 aqueous solution

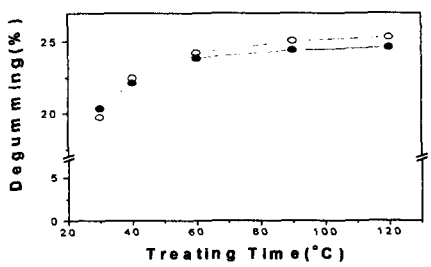

Fig. 4 Effect of treating time in the degumming of silk fabrics at 95℃
● : Electrolytic reduction water
○ : Na_2CO_3 aqueous solution

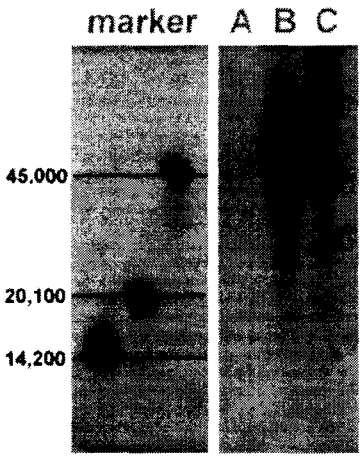

fig. 5 Photograph of electroporesis for molecular weight of sericin
A : scoured by Na_2CO_3 aqueous solution
B : scoured by destilled water
C : scoured by electrolytic reduction water

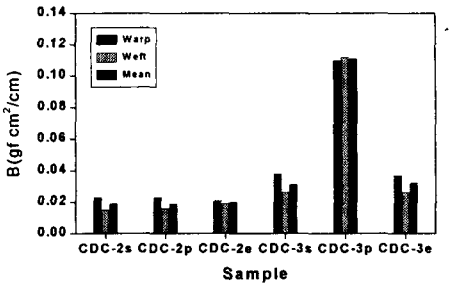

Fig. 6 The KES bending data of degummed silk fabrics