

# Effect of selected organic acids on degumming and properties of tassar silk

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■ **ABSTRACT** : Present study was conducted to find out the effect of organic acid on the degumming of oak tassar silk fabric. Degumming of tassar silk fabric was done with tartaric acid, oxalic acid and citric acid at different pH, and for different duration to find out most appropriate conditions for degumming. Selected physical properties of oak tassar silk fabric was evaluated. Tartaric acid was found to give the best result followed by oxalic acid and citric acid for degumming silk. Weight, thickness, per cent drape coefficient and strength of tassar silk fabric increased whereas stiffness of fabric decreased.

■ **KEY WORDS**: Degumming, Oak tassar, Stiffness, Drapability, Strength

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Tassar, one of the varieties of natural silk, stands next to the mulberry silk in production as well as quality in the world. Tassar accounts for 4 per cent of total raw silk production in the country (Das and Chaudhary, 1993). A major undesirable constituent part of silk is silk gum or sericin. Oak tassar contains about 15 per cent of total mass of sericin which is removed by degumming. Removing the gum improves the sheen, colour, hand and texture of the silk. Silk is degummed with high pressure water, acid, alkali, soap, and synthetic detergents. In addition, enzymatic and foam degumming is also carried out. In case of acid, both mineral and organic acids are used for degumming purpose. Organic acids are comparatively less harmful than mineral acids. In the present study, effect of selected organic acids on degumming of silk was carried out to find out the optimum parameters for degumming of oak tassar silk.

## ■ RESEARCH METHODS

### Material :

100 per cent oak tassar spun silk fabric was selected for the study. Fabric was purchased from Arani Handloom, Bhagalpur, Bihar. For acid degumming, oxalic acid, tartaric acid

and citric acid were selected.

### Degumming of tassar silk fabric :

To remove gum from raw oak tassar silk fabric, following variables were selected :

- Organic acids- Tartaric acid, citric acid, oxalic acid.
- Time- 30 minutes, 45 minutes, 60 minutes.
- pH - 4, 5, 6.

The degumming bath was made with required chemicals and water. Silk fabric was put into the solution, the temperature was raised up to the required degree and run for selected time period as mentioned above. After treatment, fabric was washed, squeezed and dried (Mishra *et al.*, 1993).

### Assessment of weight loss :

The degumming was assessed in terms of loss in weight of substrate using the following formula:

$$\text{Per cent weight loss} = \frac{W_1 - W_2}{W_1} \times 100$$

where,

$W_1$  = Weight of sample before degumming.

$W_2$  = Weight of sample after degumming.

**Determination of physical properties of tassar silk fabric :**

Thickness, weight, fabric count, tearing strength, stiffness, drapability of the control and degummed fabric were determined.

**RESEARCH FINDINGS AND DISCUSSION**

Preliminary data of tassar silk fabric *i.e.* weight, fabric count and thickness have been shown below :

Weight (Ounce /square yard)	Thickness (mm)	Fabric count (No. of threads/ square inch)
1.62	0.39	55.2×28

**Weight loss in degummed tassar silk fabric :**

Result in per cent weight loss of degummed silk is given

in Tables 1, 2 and 3.

It is evident from Table 1 that when tassar silk was treated with oxalic acid at pH 4, weight loss increased continuously as the time of treatment increased from 30 minutes to 60 minutes. At pH 5 also, similar trend was observed that is increase in weight loss with increase in time of treatment. Per cent weight loss was almost similar at pH 4 and 5. When pH of acid solution was increased to 6, significant increase in weight loss was found. However, on increasing the time of treatment from 30 min to 60 min, little further increase was seen.

Data given in Table 2 show that weight loss increased when pH of tartaric acid solution was increased from 4 to 6. Considerable weight loss was observed at pH 6. It was also observed that as time of treatment was increased from 30 min to 60 min, weight loss increased progressively. In comparison

Table 1 : Effect of oxalic acid on weight loss				
Sr. No.	pH	Per cent weight loss		
		30 minute	45 minute	60 minute
1.	4	16.5	18.98	19.6
2.	5	16.9	17.7	18.9
3.	6	22.9	23.2	23.6

Table 2 : Effect of tartaric acid on weight loss				
Sr. No.	pH	Per cent weight loss		
		30 minute	45 minute	60 minute
1.	4	11.11	12.3	16.6
2.	5	14.00	15.00	16.52
3.	6	21.4	26.4	27.3

Table 3 : Effect of citric acid on weight loss				
Sr. No.	pH	Per cent weight loss		
		30 minute	45 minute	60 minute
1.	4	15.0	21.0	24.0
2.	5	14.5	18.4	22.56
3.	6	8.75	11.34	16.6

Table 4 : Geometrical properties of tassar silk fabric treated with tartaric acid (pH 5)				
Time of treatment	Thread count (Number of threads /inch)		Thickness (mm)	Weight (ounce/ square yard)
	Warp	Weft		
0 min	49	24	0.39	1.62
30 min	52	25	0.48	1.80
45 min	52	25	0.52	1.90
60 min	53	25	0.53	1.90

Table 5 : Effect of tartaric acid on selected properties of tassar silk fabric (pH5)					
Time of treatment	Stiffness (Bending length in cm)		Drapability (% drape coefficient)	Tearing strength (g)	
	Warp	Weft		Warp	Weft
0 min	1.76	2.30	77	2560	3225.6
30 min	1.20	1.99	58	5606.4	5081.6
45 min	1.16	1.83	53	6182.4	5504
60 min	1.17	2.00	54	6144	5414.4

to oxalic acid, effect of tartaric acid at pH 4 and 5 was less noticeable but at pH 6, it was more pronounced.

Table 3 shows that degumming with citric acid also resulted in weight loss. Treatment of silk at pH 4 caused more weight loss than at pH 5 and 6.

According to Chopra and Gulrajni (1994), the degumming action was apparently due to the hydrolysis of protein at certain specific amino acid residue. Acids specifically attack aspartic acid and glutamic acid residues which are found in much higher proportion in sericin than in fibroin. Tassar silk contains approximately 15-16 per cent sericin. Greater loss in weight indicated loss of fibroin also when duration of treatment was increased.

#### Physical properties of tassar silk fabric treated with tartaric acid :

Tassar silk contains approximately 15-16 per cent gum. Tartaric acid at pH 5 was most effective in removing gum from fabric. Therefore, effect of only tartaric acid at pH 5 on properties of fabric was studied. Findings presented in Tables 4 and 5 show properties of silk fabric treated with tartaric acid at different pH 5 for different timings.

It is evident from Table 4 that the fabric count of control fabric was  $49 \times 24$ . It increased slightly after degumming the silk fabric. It was observed that thickness of tassar silk fabric increased substantially after degumming. Likewise weight of silk fabric increased after degumming. The reason is that after removal of sericin from fabric, it shrinks which causes increase in fabric count which in turn increases weight and thickness of fabric. ANOVA was calculated to find out the significance of difference in properties of treated tassar silk fabric. Effect of varying treatment time on thickness was found significant ( $F=6.54, P<0.05$ ). Effect on others properties was not found significant.

The value of bending length of the tassar silk fabric after degumming has been shown in Table 5. It was found that the stiffness decreased after degumming. It decreased continuously as time of treatment increased from 30 minutes to 45 minutes. Stiffness of degummed sample decreased because removal of sericin makes silk fabric soft. Decrease in stiffness after degumming is due to removal of gum sericin. It is well known that gum imparts harshness to the silk fabric. Difference

in stiffness of fabric treated with tartaric acid for different duration was not found significant as F calculated (2.02) was less than critical value of F (4.76).

Per cent drape co-efficient values of gummed and degummed showed that drapability of fabric enhanced noticeably after degumming. Drapability of degummed sample improved because of reduction in stiffness of silk. Effect of varying time of treatment on drapability was found significant ( $F=94.5, P<0.01$ ).

From Table 5 it was observed that strength of silk fabric increased considerably after degumming. Almost 250 per cent increase was seen. Presence of gum reduced mobility of yarns when tearing force was applied in case of untreated fabric. After removal of gum, mobility of yarn increased. This resulted in grouping of yarns on application of tearing force which increased strength. Significant difference was found in tearing strength of fabric treated with tartaric acid for different time ( $F=172.55, P<0.01$ ). Gupta *et al.* (1992) also recorded the effect degumming pH on properties of silk fabric.

#### Conclusion :

Thus, it can be said that tartaric acid degumming treatment gave the best result among three acids. Moreover, it made tassar fabric soft and pliable with less bending length, improved drapability and strength.

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