Raw Silk Properties

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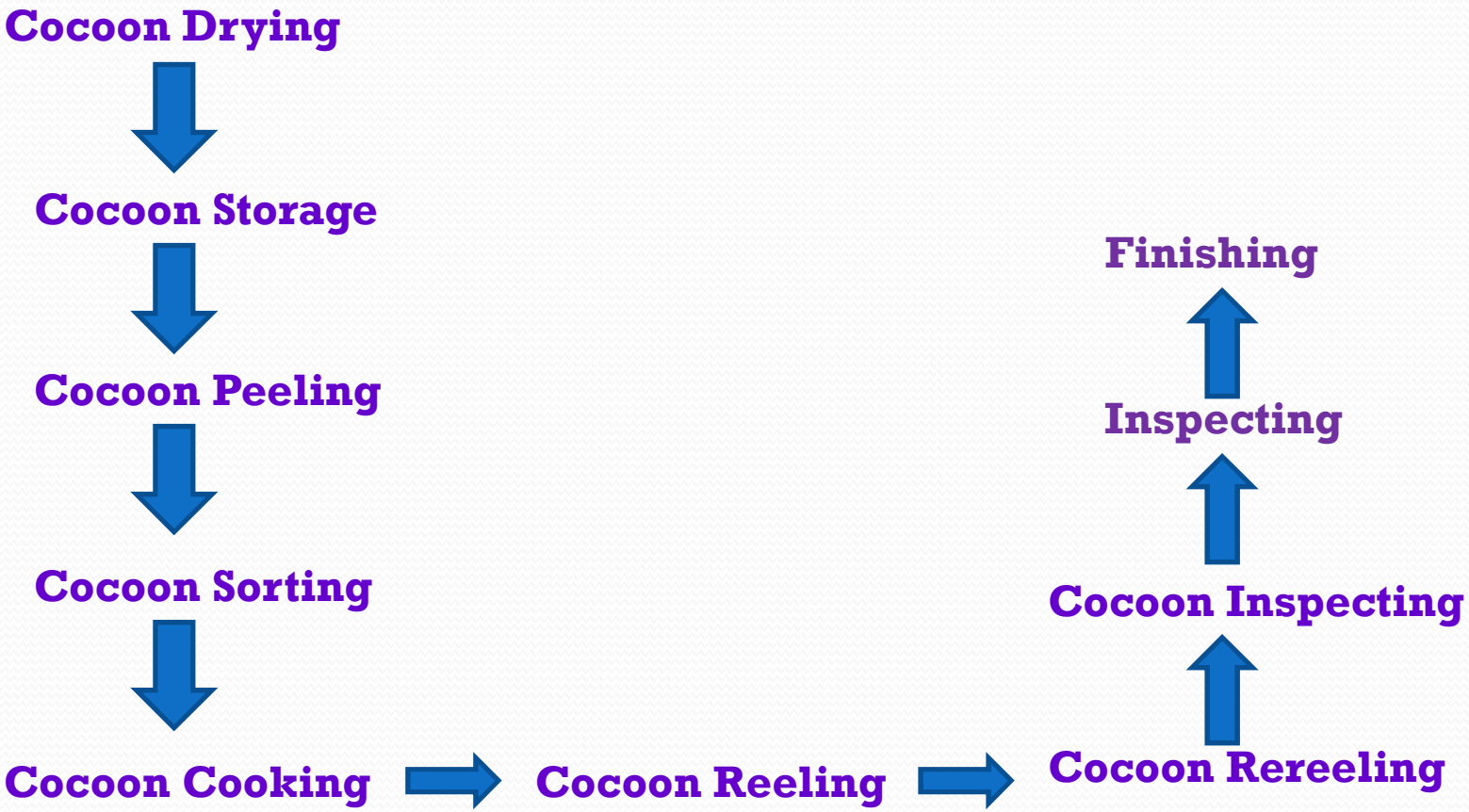
Steps of Post Cocoon Technology



Types of Cocoon Stifling

Sun Drying

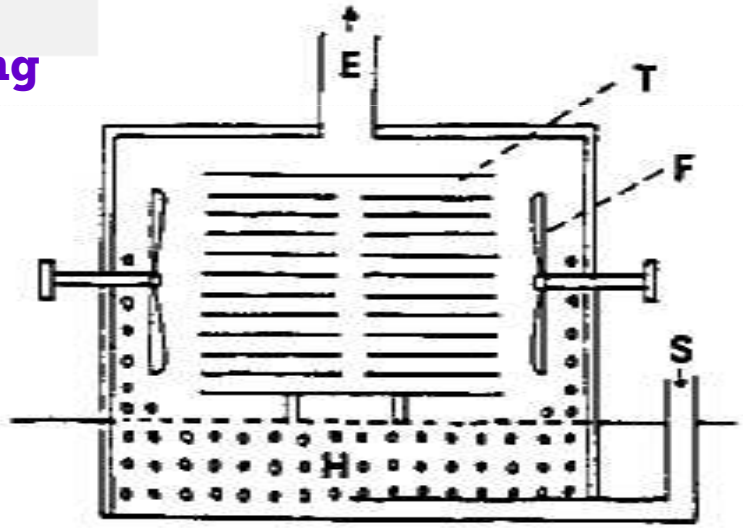
2.Barrel Steaming

1.Basket Steaming

3.Chamber Steaming

B.Yamato Hot Air Drying Chamber

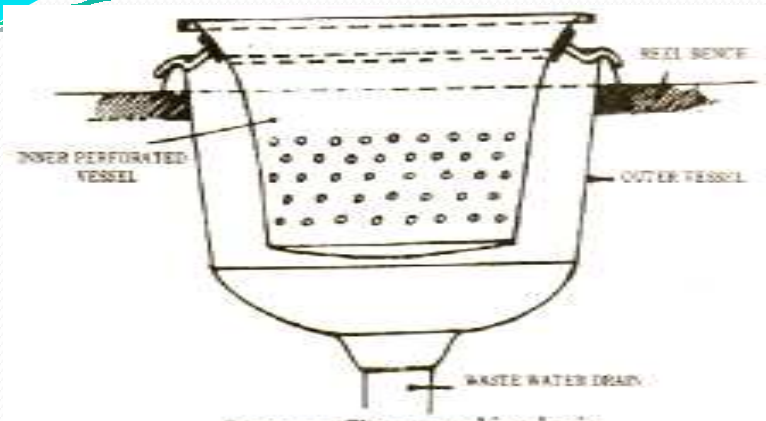
(Conveyer Type)



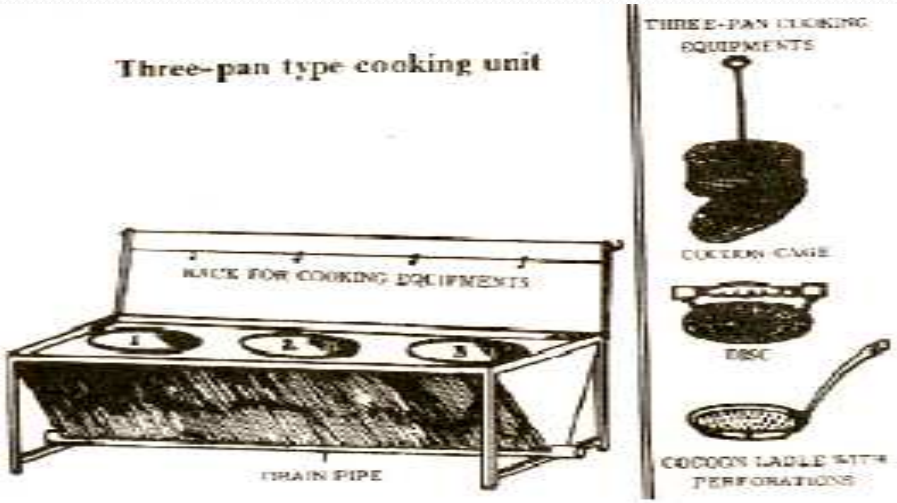
A.Hot Air Drying Chamber

(For Batch Type)

Types of Cocoon Cooking

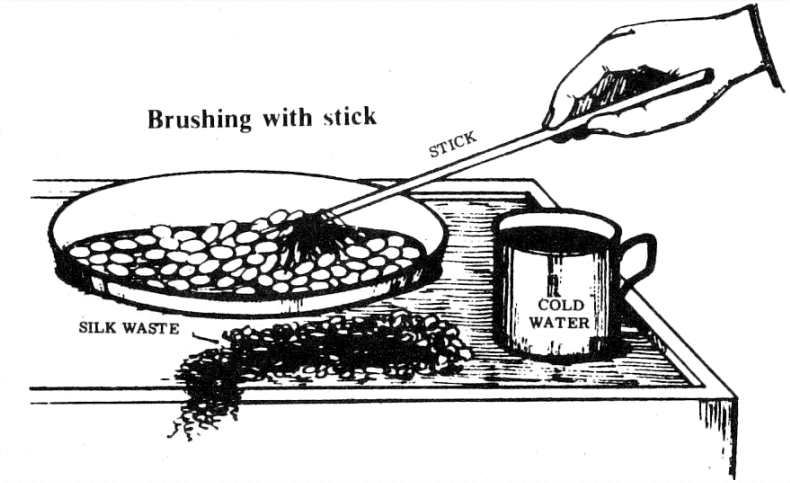


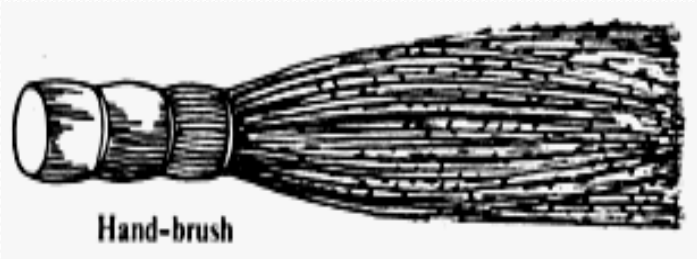
Open pan filature cooking basin

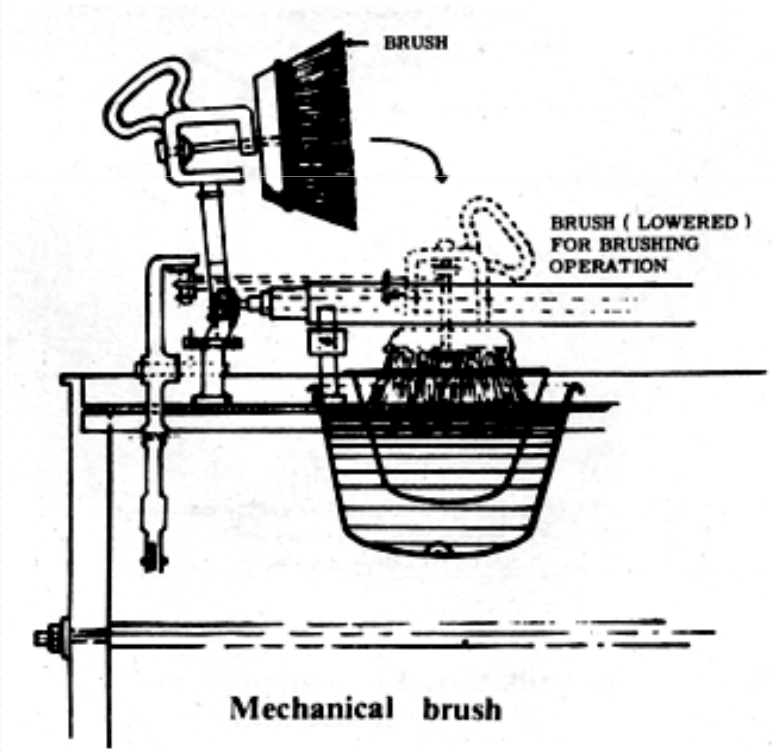


Pressurized Cocoon Cooking Machine

Cocoon Brushing Methods







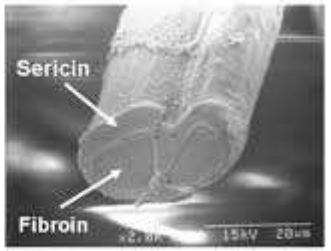
Cocoon Reeling Methods

SILK HANKS

LASING OF SILK HANKS

Twisted silk skein

- **The silk filament though apparently single is actually composed of two filaments, stuck together and covered by sericin.**



Cross-sectional image of a cocoon

- **In some varieties sericin looks coloured due to a mixture of colouring pigments in it. By a process of degumming, sericin can be separated from the brins. The amount of sericin varies from 22-30 % according to varieties of cocoons.**

Commercially important physical and chemical properties

Length of Bave

- **The length of filament varies. Generally univoltines and the bivoltines have 1000 to 1400 m of which about 75-80 % is reelable. The multivoltines contain only about 350 to 600 m of which hardly 50 per cent is reelable.**

- **The newly evolved m v hybrids produce better cocoons with longer length of bave between 500 to 800 m of which over 60 per cent can be reeled.**

Size of Bave

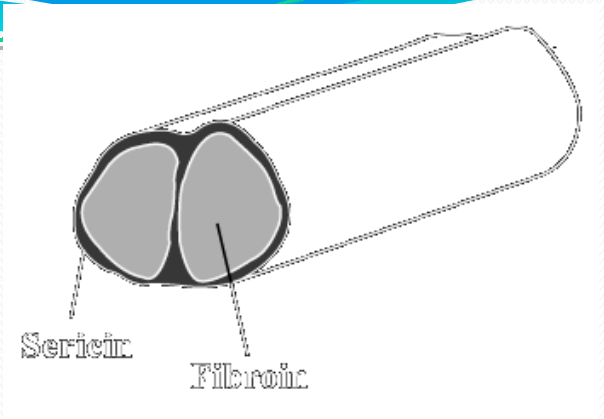
The size of the silk thread, is expressed by the term Denier. The size is not constant throughout. The filament in the floss is thicker than middle and the inner most pelade layer. This reduction in size is gradual. The average diameter of the bave is 15-20 microns for the univoltine and bivoltine races whereas for multivoltine races it is 6-14 microns.

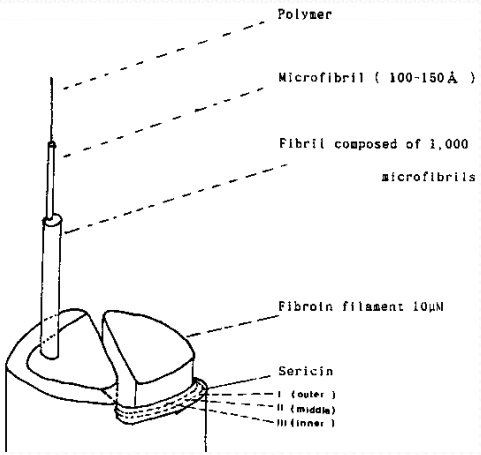
$$D = \frac{\text{weight of the silk X 9000}}{\text{Length of the silk}}$$

Microscopic Examination of the Bave

- Longitudinal view: shows that the surface of the sericin layer is irregular and lumpy in places. Even under the covering of sericin, the inner brins can be seen as two smooth and transparent cylinders of fairly uniform thickness. Frequently the two brins are clearly separated for considerable lengths though the intervening spaces are filled with sericin.
- Cross section: The bave from the floss layer is slightly elliptical, the middle compact shell, is more circular. The bave from the pelade is fine, and distinctly flat and ribbon like.

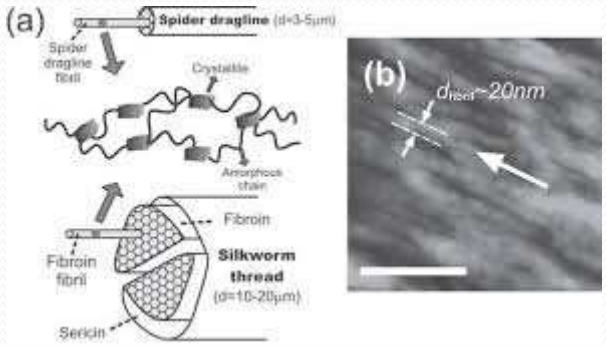
  The enclosed brins, however, appear as equilateral triangles with rounded off angles, facing each other at their flat sides.





X-ray of Silk

- **Photographs show definite X-ray spots, indicate that fibroin is crystalline in structure, are less than one tenth of a micron long and a few thousandths of a micron thick.**
- **A single fibre is therefore made up of an incredibly large number of crystals with the result the sum total of all the surface area of the crystals is very much more than the outer visible surface of the fibre.**



Hygroscopic Nature

- **Silk is very hygroscopic and is capable of absorbing up to 30 per cent of its weight of moisture. But when bone dry silk is kept for a specified time in a standard atmosphere having 65 per cent humidity at 25°C, the silk absorbs only 11 percent of its weight if the silk is raw and 10 per cent if it is in degummed condition.**

Tensile Strength (withstand pulling pressure**)**

- **Silk has enormous tensile strength with a breaking load of nearly 5000 kg per cm^3 or as much as 4 g per denier. It has an elongation of about 20 per cent of its original length before breaking.**
- **Tenacity** (indicates the quantity of weight a given fibre can support before breaking): **of silk varies with the breeds of cocoons and, in the same cocoon, the tenacity per denier increases from the exterior to the interior of the cocoon while the elasticity varies inversely. Degummed bave has greater tenacity than raw bave.**

Density of Silk

Raw silk has a density of 1.33 where as degummed silk has a density of 1.25. Although these are the accepted standards of density, it is not absolutely constant for all varieties of silk but within small limits it varies with the breed of cocoons. About 65 per cent of the volume of silk is solid and about 35 per cent vacuoles.

Degumming Losses

Sericin which is the soluble portion of the bave forms between 22-30 per cent of the whole weight. As sericin is unevenly distributed in the bave, the percentage of loss is not uniform in all segments of the bave.

Scroop

This refers to the crackling sound emitted when the fibre is squeezed or pressed. The well known "rustle" of silk fabrics is due to the property of scroop.

The scroop of silk however is not an inherent property but acquired in the manufacturing process by treating in a bath of dilute acetic or tartaric acid and drying without washing.

Electrical Properties

Silk is a poor conductor of electricity and accumulates a static charge by friction, which at times renders it difficult to handle in the manufacturing process. The charge can be dissipated by high humidity or by maintaining 65 per cent R.H. at 25°C. Owing to its insulating properties silk is extensively used for covering wire in electrical apparatus.

Effect of Light

Silk is sensitive to ultra violet light. It loses as much as 50 per cent of its strength after six hours exposure to ultra violet light.

Scoured (degummed) silk requires a much shorter time for tendering. Silk in the form of fabric is readily damaged by sunlight.

Effect of heat

If white silk is heated in an oven at 110.5°C for 15 minutes it begins to turn yellow. Above 170°C silk disintegrates and on burning, it gives out an empyreumatic odour.

Action of Water

- **Strength decreases about 20 per cent when wet but regains the original strength upon drying. The fibre swells, but does not dissolve when steeped in warm water.**
- **Dissolved substances present in the water are also absorbed along with the water. It is for this reason in most modern silk mills water is softened by the zeolite process and the hardness reduced practically to zero.**

Action of Acids

- **Concentrated sulphuric and hydrochloric acids dissolve silk.**
- **If silk is treated with strong sulphuric acid for only a few minutes, then rinsed and neutralized, the fibre contracts from 30 to 50 per cent in length and loses its lustre, and no further damage is done. This is taken advantage of in creping of silk fabrics.**

Action of Acids

The action of nitric acid is peculiar as it produces a bright yellow colour on silk which can be removed by treatment with a boiling solution of stannous chloride. But when silk is treated for one minute with nitric acid of sp. gr. 1.33 at a temperature of 45°C, the silk acquires a bright yellow colour which is permanent and fast also to light.

Action of Acids continued...

- **Silk absorbs a large amount of tannic acid from a cold solution and as much as 25 per cent of its own weight from a hot solution. Tannic acid is used as a mordant in weighting of silk.**

Action of Acids continued...

- **Formic acid and acetic acid have no injurious effect on silk unless heated. When silk is treated at ordinary temperature with 90 per cent formic acid, it swells, contracts and becomes gelatinous in about two to three minutes. When silk in this condition is rinsed in water it returns more or less to its original condition and on drying becomes stiffer and more lustrous, without loss of tensile strength. This method is sometimes used for improving the lusture of inferior silks**

- **Action of Alkalies**

Silk is not sensitive to dilute alkalies, but the lusture of the fibre is dulled.

When treated with strong hot alkalies such as caustic soda or caustic potash, silk fibre dissolves.

Ammonia and alkaline soaps dissolve only the sericin. Continued boiling in such soaps for a prolonged period, however, affects fibroin.

- **Action of Metallic Salts**

Silk has great affinity for metallic salts. This characteristic is the basis for the process of silk weighting. Stannic chloride is commonly used for weighting unless the material is to be dyed black. From eight to ten per cent of tin salt is absorbed from a cold solution of stannic chloride.

Black silk is often dyed and weighted by using log-wood and iron salt.

If the weighting has been properly done, slightly more than one fourth of the weight lost in degumming may be added without noticeable injury to the fabrics.

- **Action of Dye Stuffs**

Silk has a greater affinity for dye than any other textile fibre. It absorbs dyes at a low temperature.

Being a protein, it possesses both acid and basic properties and therefore can be dyed with basic or acid dyes.

Acknowledgements

to

I. INTERNET

II. SERICULTURE MANUAL 3. SILK REELING, FAO, ROME 1987.