University of Mysore

YUVARAJA'S COLLEGE

(Autonomous)

Mysuru – 570 005

Graduate Course – Semester and CBCS Scheme

SERICULTURE

A
E – BOOK
FOR
PAPER - DSE 4 LAB

SILK TECHNOLOGY

Editor

Dr. H.B. MAHESHA
Associate Professor and Head
Department of Sericulture
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Editor acknowledges all scientists who have pioneered and contributed information used in this e – book.

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Experiment No. 1: Categorization of Cocoons.

Aim: To categorize different types of cocoons.

Introduction: Generally every cocoon lot contains many types of defective cocoons like double, flimsy, melted, stained, urinated, *etc*. The production of such defective cocoons depending upon the method of rearing, climatic conditions during rearing and spinning, type of mountages, transportation of cocoons, handling of cocoons *etc*. The per cent age of these defective cocoons may occur to an extent of about 10 % of the lot.

These inferior cocoons are not suitable for economic reeling and also decreases the quality of silk yarn produced. Therefore, before reeling process these inferior cocoons should be sorted out and reeled separately.

Requirements: Cocoon lots, Blade, Balance, plastic containers, *etc*.,

Procedure:

Categorization of the cocoons can be done in two methods.

1. By number
2. By weight

Based on the visual and tactile test, separate various types of cocoons by hand picking and record the number as well as weight of cocoons in each type. Then calculate the per cent age of each type by following formulae.

$$\text{Per cent age of particular type by number} = \frac{\text{Number of particular type of cocoon} \times 100}{\text{Total number of cocoons}}$$

$$= \_\_\_\_\_ \ \%$$

$$\text{Per cent age of particular type by weight} = \frac{\text{Weight of particular type of cocoon} \times 100}{\text{Total weight of cocoons}}$$

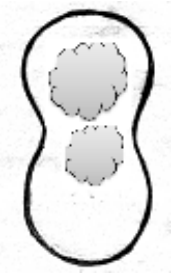
= _____ %

Report: The give cocoon lot contains _____ and _____ % of defective cocoons by number and weight respectively.

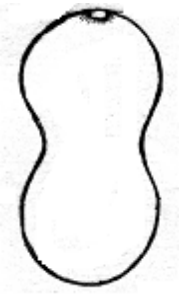
General Appearance of Cocoons

Good Cocoon

Stained Cocoon



Urinated Cocoon

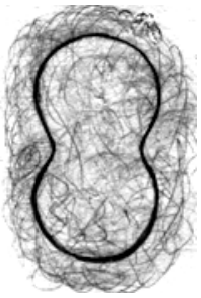


Uzi infested Cocoon

Moth emerged Cocoon

Melted Cocoon

Flimsy cocoon



Flossy Cocoon

Deformed Cocoon

Double Cocoon

Undersized Cocoon

Observations and Calculations:

Sl. No.	Type of Cocoon	Number of Cocoons	Percentage by Number	Weight of Cocoons (gm)	% by Weight
1	Good Cocoon				
2	Stained Cocoon				
3	Urinated Cocoon				
4	Uzi infested Cocoon				
5	Moth emerged Cocoon				
6	Melted Cocoon				
7	Flimsy Cocoon				
8	Flossy Cocoon				
9	Thin end Cocoon				
10	Deformed Cocoon				
11	Double Cocoon				
12	Thin Shell Cocoon				
13	Undersized Cocoon				
	Total		----		----

Experiment No. 2: Stifling of Cocoons/Determination of Degree of Drying of Cocoons.

Aim: To determine the degree of drying in the given cocoon sample.

Requirements: Cocoon lots, Balance, metal containers/trays, *etc.*,

Procedure:

Weigh the given lot of cocoons and this is considered as initial weight (W_1). Then keep the weighed cocoons in an oven at 90 °C. After one hour take out the cocoons and record the weight (W_2). After recording the weight, keep the cocoons in the oven at same temperature. Repeat the same procedure for W_3, W_4 and W_5. Calculate the moisture loss percentage by using the following formula.

$$\text{Moisture Loss Per cent age} = \frac{\text{Initial Weight} - \text{Final Weight X 100}}{\text{Initial Weight}} = \_\_\_\ \%$$

Observations and Calculations:

Breed	Initial Weight (W_1)	After 1 hours		After 2 hours		After 3 hours	
		Final Weight (W_2)	Driage %	Final Weight (W_3)	Driage %	Final Weight (W_4)	Driage %
CSR_2							
Cross Breed							

Report: ____, ____, ____ and ____ are the moisture loss % after 1st, 2nd, 3rd, and 4th hour of drying at 90°C respectively.

Experiment No. 3: Determination of Reeling Water pH.

Aim: To determine the pH of the reeling water samples using pH paper and pH meter.

Introduction: pH of water indicates the hydrogen ion concentration in water. It is expressed as negative logarithm of hydrogen ion concentration in moles/liter at given temperature. The pH scale extends from zero (very acidic) to 14 (very alkaline) with 7 corresponding to exact neutrality at 25°C. Ph can be measured calorimetrically or electrometrically.

Colorimetric method is used only for rough estimation. It can be done by using pH paper. The hydrogen electrode is absolute standard for the measurement of pH. The standard pH required for cocoon reeling 6.9 $\pm$ 0.3 (B.H. Kim, 1983)

Requirements: Standard buffer solutions, pH paper, pH meter, beakers, thermometer and reeling water samples.

Procedure using pH paper:

1. Dip the pH paper in the sample.
2. Compare the colour with that of colour given on the wrapper of pH paper booklet.
3. Note down the pH of the sample along with its temperature.

Procedure using pH meter:

1. Follow the manufacturer's operating instructions.
2. Dip the electrode in the standard buffer solution of known pH.
3. Switch on the power supply and standardize the instrument using the calibration knob.

4. After calibrating again, wash the electrode and dip in the standard buffer solution of pH 7. Note down the reading; if it is 7, the instrument is calibrated. If not calibrate it again.
5. Take the reeling water sample whose pH is to be determined in a beaker and adjust the temperature knob in such a way that the temperature of the solution as that in dial.
6. The reading indicated the pH of the water.
7. Record the reading and wash the electrode with distilled water for second reeling water sample.

Observations:

Water Sample	pH	
	pH Paper	pH Meter
1. Bore well water		
2. Cauvery Water		

Report: Of the given water samples, sample number __ is suitable for cocoon cooking and reeling.

Experiment No. 4: Determination of Reeling Water Alkalinity.

Aim: To estimate the total alkalinity of the given reeling water sample.

Introduction: Total alkalinity of water is the measure of water to neutralize a strong acid. The alkalinity of the water is generally due to the presence of salts of carbonate, bicarbonate, phosphate, borate, silicate *etc*., with hydrogen ion in the free state. However, most of the water is rich in carbonates and

bicarbonates with little concentration of other ions. The standard alkalinity required for cocoon reeling is 30 ± 10 ppm (B.H. Kim, 1983).

Requirements: Reeling water samples, methyl orange, 0.1 N HCl, *etc*.,

Procedure: Take 50 ml of water sample in a conical flask and add 2-3 drops of methyl orange and titrate against 0.1N HCl taken in a burette until the pink colour appears. Repeat the titration to get concordant values. Calculate the total alkalinity using the following formula.

Total alkalinity =

$$\frac{\text{Volume of HCl rundown X Normality of the HCl X 1000 X 50}}{\text{Volume of water taken in ml}} = \_\_ \text{ mg/lt.}$$

Observations and calculations:

Sample No. 1

	Trial No. 1	Trial No. 2	Trial No. 3
Initial burette reading			
Final burette reading			
Volume of HCl rundown			

Report: Total alkalinity of the given water sample is _____ mg/liter.

Experiment No. 5. Cocoon Cooking.

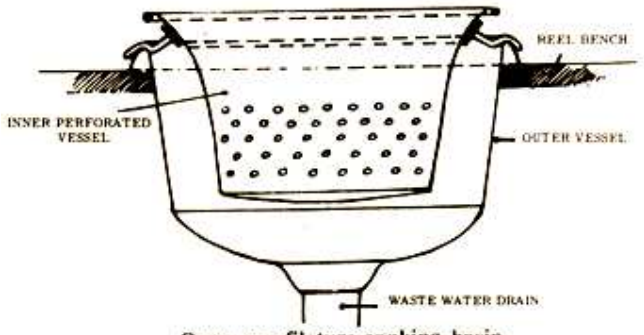
Aim: To cook the given cocoon for reeling.

Introduction: The sericin or the silk gum present on the cocoon filament keeps them together compactly in the shell. This is softened with hot water or steam, so that the filament can be wound on the reel without breaks or entanglement. This process is called cocoon cooking. There are different methods of cooking to suit the different reeling systems. Important among them are cooking for float reeling and for sunken reeling.

Requirements: Cocoon lots, cooking vessels, ladle, *etc*.,

Procedure for Open Pan Method:

1. Weigh the given cocoons along with pupa and floss. This gives the total weight of the cocoons.
2. Dip the cocoons in warm water for 2-3 min. Then introduce the cocoons in to boiling water bath and cook them for 2-3 min depending upon the quality of the cocoons or until the cocoons become dull in colour and soapy to touch.
3. After proper cooking transfer them in to a basin congaing the water maintained 40-45ºC temperature. Now brush the cocoons to remove outermost layer of floss and to get single filament.
4. Then attach the single filament on the reel of the epprouvette and reel with a constant speed until the cocoons are completely exhausted.



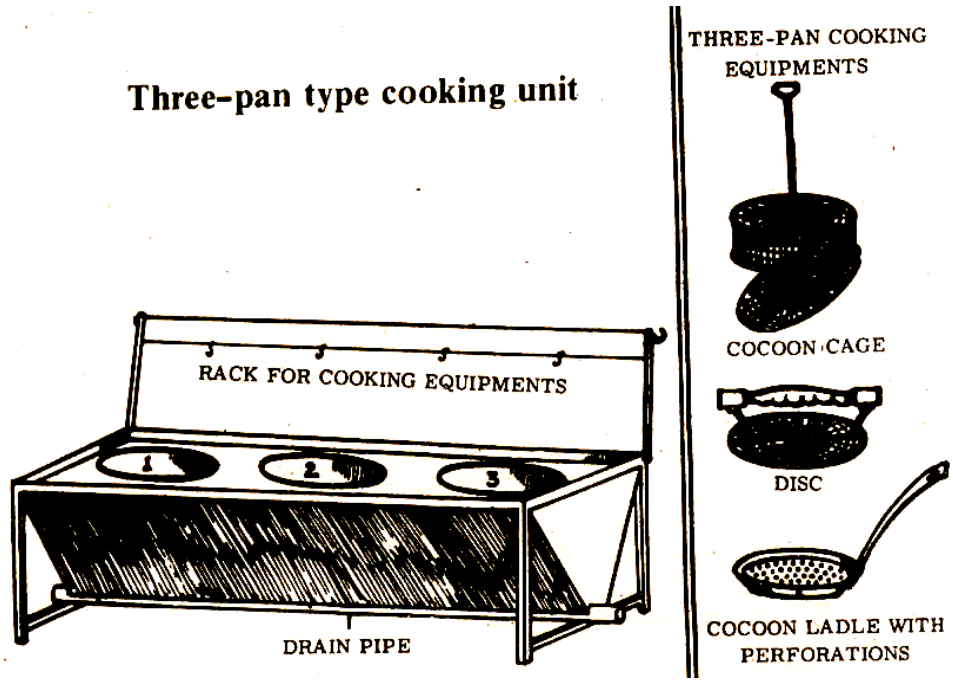
Open pan filature cooking basin

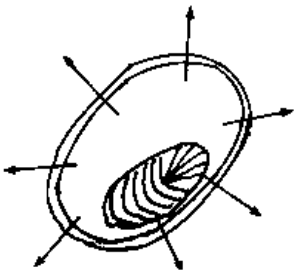
Open Pan Cooking Vessel

Procedure for Three Pan Method:

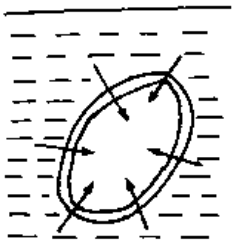
1. Weigh the given cocoons along with pupa and floss. This gives the total weight of the cocoons. Load /fill these cocoons in a cocoon cage as shown in the figure.
2. Dip the cocoons in warm water for 2-3min. Then introduce the cocoons in to first water bath having the temperature of 90-95°C for 60 seconds.
3. Then briskly transfer from first basin to second basin having the temperature of 60-65°C for 30-40 seconds.
4. Later briskly transfer the cocoons from second basin to third basin having the temperature as in case of first basin and cook for 2-3 min depending upon the quality/hardness of the cocoon.
5. Then after proper cooking, transfer them in to water bath having the temperature of 40-45°C for brushing.

Reel the cocoons from both open pan and three pan cooking systems using a mono cocoon reeling unit. Record and report the observations.

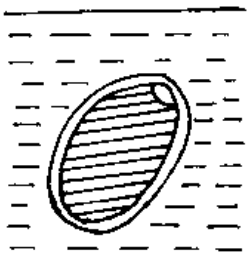




In the first basin at 90-95°C, cocoon cavity air get heated, expands and comes out of the cocoon.



In the second basin at 60-65°C, cocoon cavity air get cooled, Condenses, so water gets in to cocoon cavity.



In the third basin at 90-95°C, all the layers get uniform cooking.

Experiment No. 6: Commercial Characters of Cocoons.

Aim: To determine the cocoon weight, shell weight, shell per cent age and floss per cent age of the given cocoons.

Introduction: Though the cocoon contains floss, shell, pupa and its larval skin, cocoon weight, shell weigh, shell percentage is the most important traits from the point of reelable silk. Therefore, determination of these commercial characters is the most important parameters to be considered for price fixation in cocoon markets.

Requirements: Cocoon lots, blade, balance, plastic containers, *etc*.,

Procedure:

1. Weigh the given cocoons along with pupa. This gives the total weight of the cocoons. Calculate the average weight of the cocoon.
2. Remove the floss, note down the weight and calculate average weight of the floss.
3. Cut open the cocoon, takeout the pupa and larval skin, and record the weight of the shell to determine the average weight of shall and also pupa.
4. From these observations, calculate shell % and floss % from the following formulae.

$$\text{Shell Per cent age} = \frac{\text{Weight of the shell X 100}}{\text{Weight of the cocoon}} = \_\_\_\_\_ \%.$$

$$\text{Floss Per cent age} = \frac{\text{Weight of the floss X 100}}{\text{Weight of the cocoon}} = \_\_\_\_\_ \%.$$

Observations and Calculations:

1. Weight of five cocoons (A) = ___ gm.
2. Average weight of the cocoon (A/5) = ___ gm.
3. Weight of 5 floss (B) = ___ gm.
4. Average weight of the floss (B/5) = ___ gm.
5. Weight of 5 pupae (C) = ____ gm.
6. Average weight of the pupa (C/5) = ___ gm.
7. Weight of 5 shells (D) = ____ gm.
8. Average weight of the shells (D/5) = ____ gm.

Report: The _____ and _____ is the shell % and floss % respectively.

Experiment No. 7: Determination of Filament Length, Denier, Renditta and Reelability by Reeling on Epprouvette.

Aim: To estimate the filament length, denier, renditta, reelability of the given cocoon sample.

Introduction: Though the cocoon contains floss, shell, pupa and silkworm larval skin, shell weigh is the most important trait from the point of reelable silk. Therefore, determination of these commercial characters like filament length, renditta, denier and reelability are the most important parameters to be considered for price fixation in cocoon markets.

Requirements: Hot water bath, thermometer, epprouvette, balance, cocoon sample *etc*.,

Procedure:

1. Weigh the given cocoons along with pupa and floss. This gives the total weight of the cocoons.
2. Dip the cocoons in warm water for 2-3 min. Then introduce the cocoons in to boiling water bath and cook them for 2-3 min depending upon the quality of the cocoons or until the cocoons become dull in colour and soapy to touch.
3. After proper cooking transfer them in to a basin congaing the water maintained 40-45ºC temperature. Now brush the cocoons to remove outermost layer of floss and to get single filament.
4. Then attach the single filament on the reel of the epprouvette and reel with a constant speed until the cocoons are completely exhausted. While reeling note down number of breaks and epprouvette reading for individual cocoons.

Observations and Calculations:

1. Total weight of five cocoons (A) = ___ gm.
2. Average weight of the cocoon (A/5) = ___ gm.
3. Total length of the filament ($C_1 + C_2 + C_3 + C_4 + C_5$) = ____(C) meters.

[*Eg*., C_1 = Number of revolutions (meter reading) x 1.125 (circumference) = ___ meters]

4. Average filament length C/5 = ___ (D) meters.
5. Total number of breaks = ____ (E).
6. Average number of breaks E/5 = ___ (F).
7. Total weight of the reeled silk = ____ (G) gm.
8. Average weight of reeled silk G/5 = ____ (H) gm.

$$\text{Denier} = \frac{\text{Weight of the reeled silk (G) X 9000}}{\text{Total length of the reeled silk (C)}} = \_\_\_\_\_ \text{ (I).}$$

$$\text{Renditta} = \frac{\text{Weight of the cocoons (A)}}{\text{Weight of the raw silk (G)}} = \_\_\_\_\_ \text{ (J).}$$

$$\text{Reelability} = \frac{\text{Number of cocoons reeled (G) x 100}}{\text{Number of ends fed (5) + Number of breaks (E)}} = \text{(K) \%.}$$

Report: The given cocoon sample contains **C** meters of filament length, **I** denier, **J** renditta and **K %** of reelability.

Experiment No. 8: Study of Charaka, Cottage Basin, Multiend Silk Reeling Machine, Semi Automatic and Automatic Reeling Machine.

Field Visit - Demonstration

Experiment No. 9: Degumming of Raw Silk/Cocoon Shell.

Aim: To find out sericin content in the given raw silk sample.

Introduction: Since the natural silk possesses colouring matter, wax, fat and inorganic materials and such materials should be removed from the raw silk yarn. Otherwise it leads to difficulties in dyeing.

Requirements: Heater, vessel, glass rod, thermometer, balance, glass wares, neutral soap flakes, soda ash *etc*.,

Procedure:

1. Weigh the given raw silk sample and note down the weight as W_1 g.

2. Prepare the degumming bath in the ratio of 1:40 (1portion is raw silk and 40 is distilled water/ soft water)
3. Add neutral soap flakes and soda ash at the rate of 7g/l and 1g/l respectively and keep it for heating.
4. Raise the temperature to boiling level and introduce the raw silk and treat for 1 h at this temperature. Constant stirring of raw silk is necessary while working.
5. After an hour take out the material, wash it in running water thoroughly to remove the soap and soda.
6. Again keep the material in soft water and give a hot wash for 30 min to remove the traces of soap and soda.
7. After hot wash, wash the silk in running water thoroughly and dry at room temperature under shade. After complete drying, weigh the degummed silk and note down the weight asW_2 g.
8. Find out the degumming loss by using the following formulae.

Degumming loss in % = $\frac{W_1-W_2 \text{ X}100}{W_1}$ = ____ %.

Fibroin per cent age= 100 – Sericin per cent age= ___ %.

Observations and Calculations:

Weight of the raw silk = _____ (W_1) gm.

Weight of the degummed silk = _____ (W_2) gm.

Liquor ratio 1:40 *i.e.*, W_1 X 40 = ---- ml of water (a)

Soap 7gm/l = $\frac{7 \text{ X } a}{1000}$ = ___ gm.

Soda 1gm/l = $\frac{1 \text{ X } a}{1000}$ = ___ gm.

Degumming loss = $\frac{W_1-W_2\ X100}{W_1}$ = ____ %.

Fibroin per cent age= 100 – Sericin per cent age = ___ %.

Report: The sericin and fibroin % in the given raw silk material is _____ and _____ % respectively.

Experiment No. 10: Study of Silk Fabric Manufacturing Unit- Power & Handloom- Identification of Weaving Defects.

Field Visit - Demonstration

Experiment No. 11: Bleaching of Silk.

Aim: To determine the bleaching loss in the given silk sample.

Introduction: H_2O_2 is a soft chemical used as bleaching agent. It is an aqueous solution with 30-50% concentration. H_2O_2 becomes more stable in acidic media.

The chemical reaction involves disassociation of H_2O_2 in the form of perhydroxyl ion in the alkaline media which further disassociates in to O, OH^+ and O^+. The perhydroxyl ion or even atomic oxygen is responsible for the oxidation affect on the organic colouring matter present in silk and thus for bleaching effect.

Requirements: Heater, vessel, thermometer, balance, glass wares, H_2O_2, EDTA, liquid ammonia, *etc*.,

Procedure:

1. Weigh the given silk sample and note down the weight as W_1 g.
2. Prepare the bleaching bath in the ratio of 1:20 (1portion is silk and 20 is distilled water/ soft water)
3. Add H_2O_2, liquid ammonia and EDTA at the rate of 20ml/l, 1g/l and 1ml/l respectively and keep it for heating.
4. Introduce the material, raise the temperature to 60°C and treat the material for 1 h at this temperature. Constant stirring is necessary while working.
5. After an hour take out the material, wash it in running water thoroughly to remove the soap and soda.
6. Again keep the material in soft water and give a hot wash for 30 min.
7. After hot wash, wash the silk in running water thoroughly and dry at room temperature under shade. After complete drying, weigh the bleached silk and note down the weight asW_2 g.
8. Find out the bleaching loss by using the following formula.

$$\text{Bleaching loss in \%} = \frac{W_1 - W_2 \times 100}{W_1}$$

Observations and Calculations:

Weight of the silk = _____ (W_1) g

Weight of the bleached silk = _____ (W_2) g

Liquor ratio 1:20 *i.e*., W_1 X 20 = ----- ml of water (a)

Volume of H_2O_2 20ml/liter = $\frac{20X\ a}{1000}$ = ___ ml.

Volume of EDTA 1gm/liter = $\frac{1 \text{ X } a}{1000}$ = ___ gm.

Volume of liquid ammonia 1ml/ liter = $\frac{1 \text{ X } a}{1000}$ = ___ ml.

Bleaching loss = $\frac{W_1\text{-}W_2 \text{ X}100}{W_1}$ = ___ %.

Report: The bleaching loss in the given silk material is _____ %.

Experiment No. 12: Dyeing of Silk Cloth/Filament.

Aim: To get required colour on silk.

Requirements: Heater, vessel, thermometer, balance, glass wares, degummed silk, different dye stuffs, glauber's salt, acetic acid *etc*.,

Preparation of Dye Solution: In order to prepare 1% shade, dissolve exactly 1% of dye powder on the basis of silk weight in required amount of water. Make a clear paste without any dye granules before preparing final solution.

Procedure:

1. Weigh the given degummed silk sample and note down the weight as W_1 g.
2. Prepare the dye bath with dye solution by taking required amount of water (*i.e*., at the ratio of 1:40) and glauber's salt (10%).
3. Start the dyeing at room temperature and raise the temperature to 40°C gradually. Work the material for 15 min at 40°C.

4. After 15 min take out the material from the dye bath and add required amount of acetic acid stir the solution and again dip the material into dye bath.
5. Raise the temperature to 90-95°C and work for about 45-60 min.
6. If the colour is not exhausted in the dyeing bath, add some additional amount (2%) of acetic acid and continue the dyeing.
7. After 45-60 min take out the material, wash it in cold water and dry under shade.

Observations and Calculations:

Weight of the degummed silk = _____ (W) g

Liquor ratio 1:40 *i.e.*, W X 40 = ____ ml of water

Glauber's salt @ 10% = $\frac{10X\ W}{100}$ = ___ gm.

Acetic acid @ 4% = $\frac{4\ X\ W}{100}$ = ____ ml.

Dye Stuff

1. Orange 1% = $\frac{1XW}{100}$ = ___ gm.

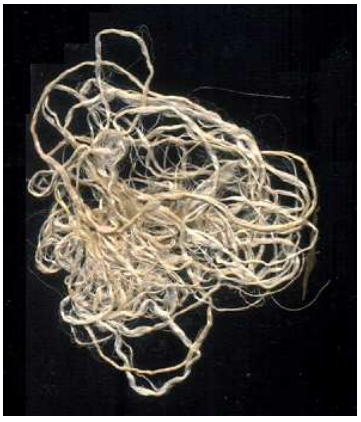
2. Green 2% = $\frac{2XW}{100}$ = ____ gm.

3. Red 3% = $\frac{3XW}{100}$ = ____ gm.

Experiment No. 13: Identification of Different Types of Silk Wastes.

Aim: To identify wastes of silk industry.

Introduction: Different types of silk wastes are identified by observing the characteristic features of each type. Apart from the defective cocoons, another grade of silk waste, which is a bye product of silk industry referred to floss, cookers waste *etc*. These are the raw material for spun silk industry.

Floss: The outer most layer of the cocoon is called floss. This layer is entangled and does not yield continuous filament**.** In case of bivoltiine it is white in colour and coloured in case of multivoltine. These are raw material used in spun silk industry	
Cookers Waste: This grade produced during cocoon cooking followed by brushing, constitutes outer most layer i.e., floss. This grade has more sericin when compared to other grade wastes. It is 2nd grade waste.	

Reelers Waste: It is produced during reeling i.e., while feeding the ends, knotting of threads etc.,. It is not hard as in case of cookers waste. It is considered as 1st grade waste. Sericin content is less when compared to other grades. Also, the wastes produced during the process of silk throwing comes under this grade.	
Basin Waste/Refusal: It is a waste left out in the bottom of the reeling basin while reeling. It constitutes palade layer. It is 3rd grade waste. The sericin content is very less and filaments are very thin.	

Experiment No. 14: Pupal Oil Extraction.

Aim: To extract the oil in the given pupal sample.

Introduction: The dried pupal powder contains water (11.1%), fat (29.57%), protein (48.98 %), glycogen (4.65%), chitin (3.35%), ash (2.17%), vitamins and others components (3.7%). The above data shows that the pupa is a very good source of fat and protein. The pupal oil extraction is very simple

process. The dried and clean pupal powder is first soaked in solvents like hexane, chloroform, petroleum, ether *etc*., in a closed bottle followed by filtering and evaporating the solvent. These solvent vapors can be condensed and reused. Extraction of oil can be done in hot or cold condition. But as hot extraction method gives more quantity of oil, cold extraction method is not generally used.

Requirements: Heater, vessel, balance, glass wares, pupal sample, petroleum ether *etc*.,

Procedure:

1. Take 100 g of pupal powder in an air tight bottle and add 200 ml of petroleum ether. Keep it for 24 hours.
2. After 24h filter using filter or double layered muslin cloth in to a separate beaker and evaporate at 50-60°C in a water bath.
3. After evaporating the solvent, crude pupal oil remains in the beaker. Now record the weight of the oil and calculate the % of oil obtained using the following formula.

Observations and Calculations:

Weight of the pupal powder = _____ (W) g

Volume of petroleum ether at 1:2 ratio = W X 2 = _____ ml

Weight of the empty bottle = _____ (W_1) g

Weight of the bottle with oil = _____ (W_2) g

Weight of the oil = $W_1 - W_2 = W_3$ g

Pupal Oil % = $\frac{W_3 \text{ X}100}{W}$ = ____ %.

Report: The given sample contains _____ % of oil.

Experiment No. 15: Identification of Textile Fibers.

Aim: To identify different textile fibers by physical and chemical tests.

Introduction: The identification of textile fibers is an important step in textile industry. A number of methods are available for characterization of the structural, physical and chemical properties of the fibers. Various methods are used for fiber identification like microscopic methods, solubility, heating, burning method, density and staining *etc*.,

In this experiment few fibers of both natural and synthetic fibers are given.

1. **Test for Cotton**

Sl. No.	Experiment	Observation	Inference
1.	**Physical Test**		
a	**Microscopic Test** i. Lengthwise Appearance ii. Cross Section	 Fully Mature flat ribbon like, twisted at some end. Smooth surface with central hallow space Kidney/bean shaped	
b	**Burning Test**	The yarn does not shrink while approaching the flame and ignite upon contact, burns rapidly. Smell of burning paper. Residue is pale gray.	

2.	**Chemical Test**		
	i. Concentrated H_2SO_4 + Sample at room temperature ii. Concentrated H2SO4 + sample and boil on a flame	Colour changes to light yellow Dissolves	
	i. Concentrated HCl + sample at room temperature ii. Concentrated HCl + sample and boil on a flame	Colour changes to light yellow Dissolves	
	i. Concentrated HNO_3 + sample at room temperature ii. Concentrated HNO_3 + sample and boil on a flame	Colour changes to light yellow Partially dissolves	
	i. Concentrated Acetic acid + sample at room temperature ii. Concentrated Acetic acid + sample and boil on a flame	Unchanged Unchanged	
	i. Concentrated Acetone + sample at room temperature ii. Concentrated Acetone + sample and boil on a flame	Unchanged Unchanged	
	i. 5 % NaOH + sample at room temperature ii. 5 % NaOH + sample and boil on a flame	Unchanged Unchanged	Cotton is Confirmed

2. Test for Wool

Sl. No.	Experiment	Observation	Inference
1.	**Physical Test**		
a	**Microscopic Test** i. Lengthwise Appearance	Surface with	

	ii. Cross Section	overlapping scales. The individual fibers are greatly thicker tapered at the ends. Slightly elliptical, sometimes circular.	
b	**Burning Test**	The yarn curls away from the flame while approaching the flame. It slowly ignites, burns slowly on flame and extinguished when removed from the flame. Odor similar to that of hair burn. Residue is irregular and crushed easily.	
2.	**Chemical Test**		
	i. Concentrated H_2SO_4 + Sample at room temperature ii. Concentrated H2SO4 + sample and boil on a flame	Colour changes Dissolves	
	i. Concentrated HCl + sample at room temperature ii. Concentrated HCl + sample and boil on a flame	Colour changes to yellow Colour changes brown to violet brown	
	i. Concentrated HNO_3 + sample at room temperature ii. Concentrated HNO_3 + sample and boil on a flame	Colour changes to yellow Dissolves	
	i. Concentrated Acetic acid + sample at room temperature	Unchanged	

	ii. Concentrated Acetic acid + sample and boil on a flame	Unchanged	
	i. Concentrated Acetone + sample at room temperature ii. Concentrated Acetone + sample and boil on a flame	Unchanged Unchanged	
	i. 5 % NaOH + sample at room temperature ii. 5 % NaOH + sample and boil on a flame	Unchanged Unchanged	Wool is Confirmed

3. Test for Silk

Sl. No.	Experiment	Observation	Inference
1.	**Physical Test**		
a	**Microscopic Test** i. Lengthwise Appearance ii. Cross Section	 Smooth, transparent, length is continuous. Round or rounded triangle	
b	**Burning Test**	The yarn shrinks away from the flame while approaching and burns slowly. The odor is similar to hair or feather burning. Residue is round shiny black beads that can be crushed easily.	
2.	**Chemical Test**		
	i. Concentrated H_2SO_4 + Sample at room temperature ii. Concentrated H2SO4 +	Colour changes Dissolves	

	sample and boil on a flame		
	i. Concentrated HCl + sample at room temperature ii. Concentrated HCl + sample and boil on a flame	Dissolves Dissolves	
	i. Concentrated HNO_3 + sample at room temperature ii. Concentrated HNO_3 + sample and boil on a flame	Colour changes to light yellow Dissolves	
	i. Concentrated Acetic acid + sample at room temperature ii. Concentrated Acetic acid + sample and boil on a flame	Unchanged Unchanged	
	i. Concentrated Acetone + sample at room temperature ii. Concentrated Acetone + sample and boil on a flame	Unchanged Unchanged	
	i. 5 % NaOH + sample at room temperature ii. 5 % NaOH + sample and boil on a flame	Unchanged Fiber becomes smooth and shiny	Silk is Confirmed

4. Test for Acrylic

Sl. No.	Experiment	Observation	Inference
1.	**Physical Test**		
a	**Microscopic Test** i. Lengthwise Appearance ii. Cross Section	 Bright, straight, smooth and having a feel of wool. Round	
b	**Burning Test**	Fiber melts when it	

		approaches the flame. When it is on the flame it shrinks, fuses and burns. Residue is black, irregular beads. Odor is like burning thermocoal.	
2. Chemical Test			
	i. Concentrated H_2SO_4 + Sample at room temperature ii. Concentrated H2SO4 + sample and boil on a flame	Dissolves Dissolves	
	i. Concentrated HCl + sample at room temperature ii. Concentrated HCl + sample and boil on a flame	Dissolves Dissolves	
	i. Concentrated HNO_3 + sample at room temperature ii. Concentrated HNO_3 + sample and boil on a flame	Colour changes to light yellow Dissolves	
	i. Concentrated Acetic acid + sample at room temperature ii. Concentrated Acetic acid + sample and boil on a flame	Unchanged Unchanged	
	i. Concentrated Acetone + sample at room temperature ii. Concentrated Acetone + sample and boil on a flame	Unchanged Unchanged	
	i. 5 % NaOH + sample at room temperature ii. 5 % NaOH + sample and boil on a flame	Unchanged Unchanged	Acrylic is confirmed

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References

1. Sericulture Manual 3, FAO, Rome 1986.