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STUDY OF TENSILE PROPERTIES OF MUGA AND ERI SILK FIBRES IN WINTER SEASON.

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Abstract:

Muga and *Eri* silk is mostly composed of the insoluble protein fibroin, coated by a smaller amount of a water-soluble protective gum (sericin), including small amounts of other substances. The shinning appearance of the silk is due to the triangular prism –like structure of the silk fibre, which allows silk cloths to refract incoming light at various angles, so producing different colors. In addition to clothing silk is used for a variety of uses, including upholstery, wall coverings, rugs, bedding and wall hangings. The aim of this paper is to study of tensile properties of Muga and Eri silk in Winter season. The value of tensile strength of Muga and Eri silk in winter season is 295.4×10^{-13}dyne /cm^2 and for Eri silk it is 636.94×10^{-13} dyne /cm^2.

Index Terms :- Tensile, Shinning

INTRODUCTION:

Tensile strength

- Capacity of a material or structure to without loads bending to elongation, resists tension (being pulled apart) measured by the maximum stress that a material can withstand while being stretched or pulled before breaking.
- It is a measurement of the force required to pull something, such as rope wire or a structure such as rope wire or a structural beam to the point where it breaks.
- The tensile strength of a material is the maximum amount of tensile stress that it can take before failure for example breaking. There is three typical definition of tensile strength.

- Yield strength—the stress a material can with stand without permanent deformation .This is not sharply defined point's .Yield strength is the stress which will cause a permanent deformation of 0.2% of the original dimension.
- **Ultimate strength**— the maximum stress a material can withstand.
- **Breaking strength**- The stress coordinates on the stress—strain curve at the point of the rupture.
- Tensile strength is the maximum load that a material can support without fracture when being stretched divided by the original cross section area of the material. Tensile strength have dimension of force per unit area and in the English system of measurements are commonly expressed in unit of pounds per square inch. When stress less than the tensile strength are removed a material returns with completely or partially to its original shape and size. As the stress reaches the value of the tensile strength, however a material.
- The property by virtue of which a body tends to recover its original configuration (shape and size) on the removal of the deforming force is called electricity.

Stress

- It is defined as the restoring force per unit area. If F is the restoring force acting on area "A" Then

STRESS= F/A Its units are dyne per cm square.

There are two types of stress

Normal stress- Stress is called a normal stress if the restoring force acts at right angle to the surface.

Tangential stress-Stress is said to be tangential if the restoring force acts in a direction parallel to the surface

Strain-When a deforming force is applied to a body, its configuration (lengths, volume or shape) undergoes a change.

There are three types of strain Longitudinal strain-It is defined as the ratio between the change in lengths to its original lengths.

- Longitudinal strain ==Δl/L

Volumetric strain= It is defined as the ratio between the change in volume to its original volume Δv/V

Shear strain—it is defined as the angle turned by a line originally perpendicular to the fixed face.

- Hooke's law= stress is proportional to strain.
- Co-efficient of elasticity—stress/strain= units is dyne/cm^2
- Young's modulus of elasticity = normal stress/ longitudinal strain= Fl/Alδ
  - Bulk modulus = normal stress/volumetric stress=Fδ/a/-v/V negative sign Indicate that an increase in pressure (δp positive) result in a decrease in volume (δv negative)

- Modulus of rigidity **(η)** = tangential stress/ shear strain (**College physics, K.N Sharma and Sameer Kalita, pp 105-107)**
- **Tensile Properties of Fibres (*Muga* and *Eri* Silk)**
- The mechanical properties of textile fibers, the response to applied force and deformations, are probably their most important properties technically, contributing both to the behavior of fibers in processing and to the properties of the final product. Because of their shape, the most standard and in many applications the most important properties are their tensile properties - their behavior under forces and deformations applied along the fibre axis.
- Fibers consist essentially of long chain molecules in which comparatively simple groups of atoms are joined together by a condensation or addition polymerization reaction to form a long chain of atoms joined by primary valance linkages. The degree to which the individual molecules can bend, stretch or coil is restricted by the mutual interaction of active groups along the molecule. In most cases the intermolecular forces are in the nature of secondary bonds as hydrogen bonds or van der Wall's forces.
- Silk filaments consist of polypeptide proteins. These proteins may be expected to show intensive inter-chain secondary bonding through the –CO- and –NH- groups but the possibilities are considerably restricted by the side chains, consisting of amino acid residues which occur so frequently along the main chains sufficiently to allow for their accommodation. The polypeptide chains can interact by means of their side-chains to form 'salt-linkages' (ionic in nature) or covalent linkages. These linkages give rise to network elastic properties of the fibers.
- Stretching a fibre by an externally applied load may involve two main processes which may be called bond stretching and chain straightening. Before a bond can contribute effectively to the extension of a fibre, it must be oriented in the direction of the fibre axis and shorter 'chains of bonds' will orient first. The breaking of one bond may allow the stress to pass to another in parallel with it. Reformation of a broken bond is possible when the fibre is released. The breaking and building of bonds involve internal energy changes but these will be mixed up with configurationally changes caused by chain straightening and these changes add an entropy term to the elastic force within the fibre.
- Tensile strength is the capacity of a material or structure to withstand leads bending to elongation, resists, tension (being pulled apart) measured by the maximum stress that a material can withstand while being stretched can pulled before breaking.
- It is a measurement of the force required to pull something's such as rope wire or a structural beam to the point where it breaks.
- The tensile strength of a material is the measurement of amount of tensile stress that it can take before failures for example breaking.

. Tensile strength is the maximum load that a material can support without fracture. When bearing stretched divided by the original cross sectional area of the material. Tensile strength has dimensions of force per unit area and in the English system of measurement is commonly expressed in unit of pounds per square inch often abbreviated to PSI. When stresses less than the tensile strength are removed a material returns either completely or partially to its original shape and size. As the stress reaches the value of the tensile strength, however a material, if elective, that has already begun to flow plastically rapidly form a constructed origin called a neck, where it then fractures.

- **MATERIAL AND METHODS:**

- Muga and Eri cocoons, the basic materials for the present investigation, were collected from central silk board (Regional Muga and Research station) Boko, Kamrup and Nalbari (Dhamdhama).

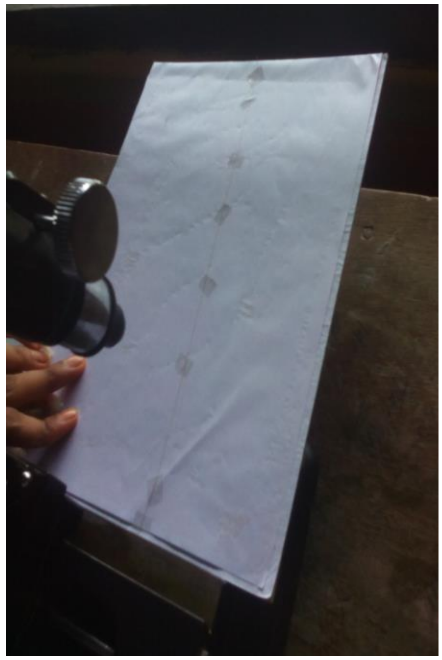
Travelling Microscope

- A travelling microscope is an instrument for measuring length with a resolution typically in the order of .o1 mm. The precision is such that better quality instruments have measuring scales made from Invar to avoid misreading due to thermal effects. The instrument comprises a microscope mounted on two rails fixed to a part of a very right bed. The position of the microscope can be varied coarsely by sliding along the rails, or finally by turning a screw. The eyepiece is fitted with fine cross-hairs to fix a precise position, which is then read off the venire scale. The purpose of the microscope is to aim at reference makes with much higher accuracy than in possible using the naked eye. It is used in laboratories to measure the refractive index of liquid using the geometrical concepts of ray optics. It is also used to measure very short distance precisely for example the diameter of capillary tube. This mechanical instrument has now largely been superseded by electronic.

Diagrammatic representation of study of tensile strength with the help of travelling microscope

- An optically based measuring devices that are both very much more accurate and considerably cheaper to produce proper results.
- Travelling microscope consists of a cash iron base with machined vet top surface and is fitted with three leveling screws.
- A metallic carriage, clamped to a spring loaded bar slides with its attached venire and reading lens along an inlaid steep of metal scale. The scale is divided in half millimeters. Five adjustments are made by means of a micrometer screw for taking accurate reading. Both venire reading to 0.01 mm or 0.02 mm. Microscope with its track and pinion attachment is mounted on a vertical slide, which too runs with an attached venire along the vertical scale. The microscope is free to rotate in vertical plane. The vertical grid bar is coupled to the horizontal carriage of the microscope for holding objects a horizontal stage made of a milk conolite sheet is provided in the base.
- **Used**
- Travelling microscope is used to determined small distance to an accuracy of .oo1 cm. The measurement principle is based on the principle of venire. In a typical travelling microscope the main scale division is of magnitude .05 cm each and the venire scale contains 50 divisions.
- **How to measure the radius of silk-**
- For determination of radius of silk along the horizontal direction in a stand with the help of a rubber cork to place and hold the fibers. Rotate the microscope so that it is horizontal and in one with the tips of the fibers. Now looking upper through the microscope, turn the focusing screw to get a clear image of the silk. Now adjust the microscope in such a way that the vertical crosswire coincides with the left end of the fibers.

Determination of radius of Eri



Determination of radius of muga silk

- In the horizontal scale look the zero of the venire, and find out the division on the main scale just before the zero mark. Note it as the MSR.
- Now look carefully at the venires. Any one of the fifty lines will come exactly in line with one if the lines of the main scale. The division on their venire are the venire scale reading noted in the observation table. Now move the telescope horizontally to focus on the right end of the silk. Again, take the reading as before. Repeat the experiment by moving the telescope vertically coinciding the horizontal crosswire with top and bottom and now the readings are taken on the vertical scale.

Table of tensile strength of Muga and Eri silk in winter season

Table 4.9 Muga silk in winter season

Mass (gm)	Length (cm)	Elegonation
O	12.147	.003
5	12.150	.009
10	12.159	.012
15	12.147	.131
20	12.010	.895

25	12.905	
30		

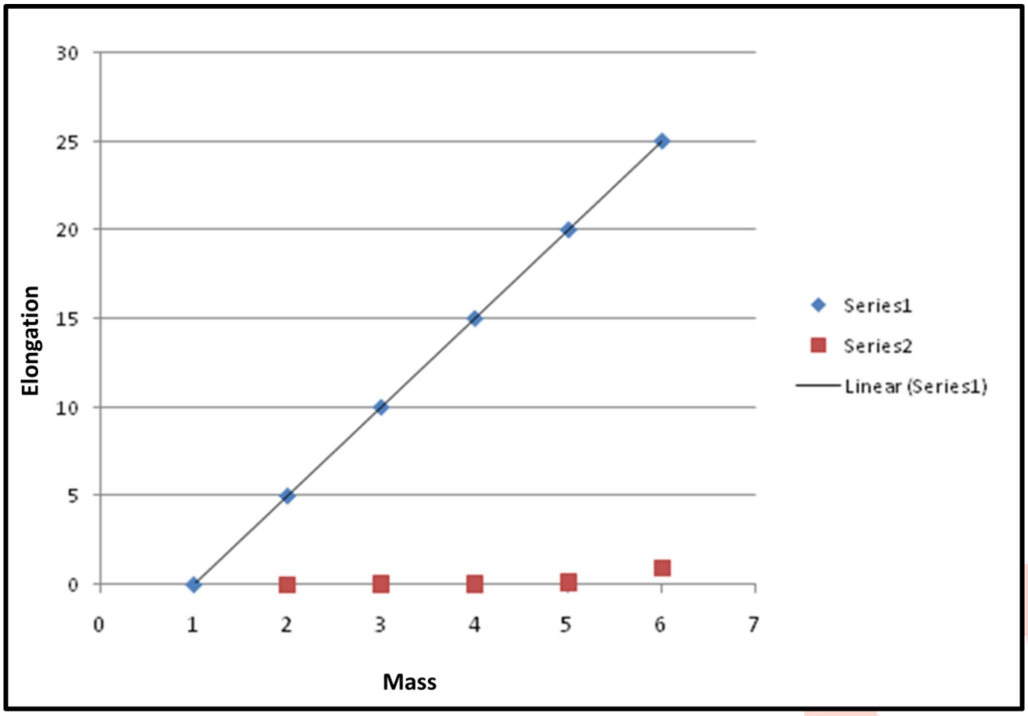


Fig. 4.11 Mass-elongation curves (Muga) in winter season

Table 4.10 Eri silk in winter season

Mass (gm)	Length (cm)	Elongation
0	12.810	
5	12.745	.204
10	12.575	.034
15	12.541	.115
20	12.460	.036
25	12.424	.114
30	12.310	

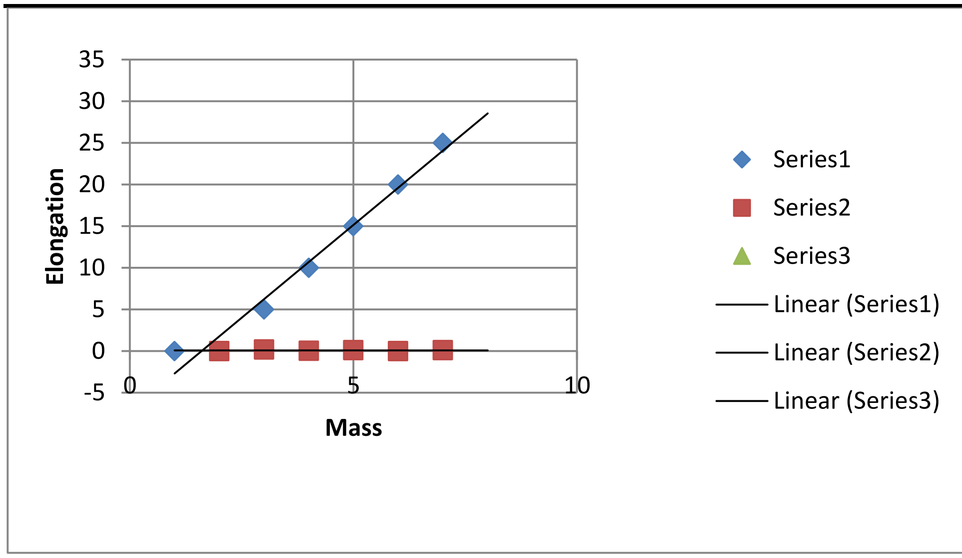


Fig. 4.12 Mass-elongation curves (Eri) in winter season

The value of tensile strength of Muga and Eri silk in winter season is $295.4x10^{-13}$dyne /cm^2 and for Eri silk it is $636.94x10^{-13}$ dyne /cm^2.

The Mass-elongation curve for Muga and Eri are comparatively straight. The steepness of a curve may be taken as a measure of the strength of the fibre. The Eri, fibre has low value recorded under study.

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