HEXAGON - A Journal of Scientific Communications

Vol 01, August 2015, Pp : 39-42

Study Of Tensile Property Of Muga And Eri Silk (Normal)

Chandrama Kalita
HOD, Dept. of Physics
SBMS College, Sualkuchi

ABSTRACT

Among all the silk varieties golden yellow Muga silk (*Antherea assama*) is the most elegant strong and durable which is indigenous to the North Eastern Region in general and Assam. The amount of water held within a fibre can have a considerable influence on its tensile properties. Silk has moisture region of 10% at 65%, relative humidity and 23.8% at 95% relative humidity. The tensile parameters of Eri and Muga fibres are study in this paper and found that the elongation, average tenacity g/den and initial modulus g/den of Muga and Eri are 34.51, 35.80, 4.96, 5.54 and 1.54 and2.47 respectively.

Key Words : Tenacity, Normal

INTRODUCTION :

TENSILE PROPERTIES OF FIBRES:

The mechanical properties of textile fibres, the response to applied force and deformations, are probably their most important properties technically, contributing both to the behaviour of fibres 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 behaviour under forces and deformations applied along the fibre axis.

Fibres 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 valancy 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 a network elastic properties of the fibres.

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 configurational changes caused by chain straightening and these changes add an entropy term to the elastic force within the fibre.

MATERIALS & METHOD :

Materials :

Muga and Eri cocoons the basic materials for the present investigation were collected from Sualkuchi and Ramdia.

METHODS:

Tensile properties of Muga & Eri fibre under normal condition is studied with the help of an electronically operated tensile tester.

INSTRUMENTATION:

The instrument used for determining the tensile properties was a computerized Fafegraph M Tensile Tester .A schematic diagram of the basic principles of the instrument is given in Fig no 1. The instrument is provided with two electronically operated grips in a vertical alignment ,one above the other,at a a distance of 10 mm.The upper grip is stationary and the lower grip is allowed to move downwards by the application of a force at a constant rate. This function is carried out with the help of a drive unit. The specimen to be measured is placed in between the two grips.

SPECIMEN MOUNTING:

The FAFEGRAPH Mis a very sensitive instrument and the measurement of tensile strength of the fibre specimens were carried out in the single filament form.

A small bundle of finely prepared fibre was taken and about 3 cm long pieces were cut from the bundle .Single filament of the fibre were carefully separated from that cut pieces.

MEASUREMENT:

The application of force on the specimen was carried out by the instrument upto the breakage the filament. As soon as it breaks ,the instrument automatically stops and resets for next operation.

The denier of different samples were determined experimentally as stated in the next article and values were fed into the computer for calculation of tensile parameters.

The elongation of the fibre specimen was measured in terms of percentage of the original length. Thus, the force –elongation curves obtained may be considered as stress-strain curves for the fibre samples.

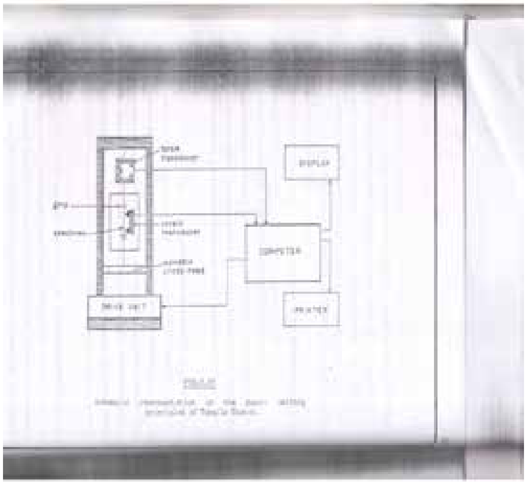

Fig 1: Systematic representation of the basic working principles of tensile tester

RESULT AND DISCUSSION :

Tensile properties of Eri and Muga fibres under normal condition .

FORCE-ELONGATION CURVES FOR NORMAL ERI AND MUGA FIBRES:

The force-elongation curves for normal (degummed) Eri and Muga fibres displayed in Fig. 2 different tensile parameters obtained from the curves for the fibres are given in Table.

Tensile parameters of Eri and Muga fibres :

Samples	Elongation	Average tenacity g/den	Initial modulus g/den
1. Eri	34.51	4.96	1.54
2. Muga	35.80	5.54	2.47

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

The stretching of a fibre involves two main processes, viz., bond stretching and chain straightening.

Before a bond contributes to the extension of a fibre, it must be oriented in the direction of the fibre axis. Hence the tensile property of a fibre is dependent most closely on the total amount of crystalline material in a preferred direction. The close packing of macromolecules which favours the formation of strong hydrogen bonds between the peptide groups of neighbouring chains and high order of orientation of crystallites. The initial modules for Eri is the low due to its lower value of crystallinity between the two fibres as observed in our X-ray diffraction study.

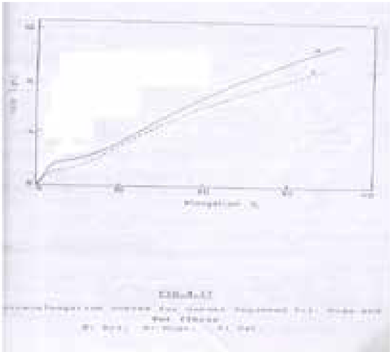

Fig. No. 2 : Force elongation curves for normal degummed Eri and Muga fibres

The extensibility of a fibre is based on the mobility of the chains in the amorphous regions of the structure. Fibres possessing higher degree of crystallinity exhibit lower extensibility. As such, the elongation percent and tenacity for Muga fibre are found to be lower than those for Eri fibre.

The fibres under study possess a short range of elastic limit. They yield at an extension of about 2% and beyond this point they show greater extensions per unit increase in load thereby resulting in flattening of the force-elongation curves. This flow behaviour of the fibres is followed by a hardening, which may ascribed to the reinforcement of the fibres resulting from orientation of the amorphous regions. Eri fibre, having the lowest crystallinity, is much favoured by the amorphous contributions and as much its force-elongation curve is highly flattened.

The tenacity and elongation percent of Muga fibre are found to be high and a considerable flattening of the force-elongation curve is observed though Muga fibre possesses the higher degree of crystallinity between the two fibres as observed in our X-ray diffraction study. This anomalous tensile behaviour of Muga fibre may be ascribed to the spirelling the fibrils about the fibre axis like wool keratin. On applications of an external force, these spriels unfold and thus give rise to a considerable extension in length and flattening of force-elongation curve.

REFERENCES

1. Trogus C, and Hess K, *Biochem Z* 269-376 ,1933
2. Wada Y, *Dielect Relat Mol Processes*, 3, 143 ,1977
3. Debye S P and Scherrer P , *Physik Z* , 17, 277, 1916 and 18, 291 1917
4. Mecke R , *Discussions Farad Soc*, 9,161, 1950
5. Akerlof GC, and Oshery H T , *J Am Chem Soc* 72, 2844, 1950
6. Tager A , *Physical Chemistry of Polymers (MIR Publishers-Moscow)* pp279, 1972
7. Smyth C P, *Encyclopedia of Physics* (Van Nostrand and Reinhold Corp.–NY) pp726 1974
8. Rahman N, Women in the weav ing industry, *Ph. D Thesis* ,Department of Economics, Dibrugarh University, Dibrugarh, Assam, 2000,
9. Anonymous, Survey Report, Directorate of Sericulture and Weaving, Government of Assam, 1980