Study of Physical Properties of Muga and Eri with the Help of Xrd (Undegummed)

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Abstract

X ray diffraction is a basic method for detecting the presence and determining the amount of crystallinity and orientation in a material having crystalline entity. It has become an extremely important factor in defining special relationship in polymer systems.In the field of textile materials Xray analysis finds and ever -increasing use for examining their structural behaviours.This method is used for obtaining informations about the fibre structure at the molecular and super molecular levels and helps to evaluat the degree of crystallinity or orientation of crystallities and the size of the fibres.

Silk culture is a traditional cottage industry rooted in the life and culture of Assam. Eri (Endi) and Muga silk are considered to be indigenous origin and found only in Assam and the foothills of Meghalaya. Endi culture has always remained as a subsidiary occupation of Indo-Mongoloid and Tibeto-Burman ethnic groups of the Brahmaputra valley (i.e The Assam plains) and the adjacent hill areas. Endi silk worm (Philosomis ricini) derivers its name from the castor oil plants (Ricinus communis) called 'erra' in Assamese. Muga silk worm is unique specific of semi domesticated scricigenous insect endemic to the North Eastern region of India particularly Assam. The climate condition of this region is well suited for the silk worms and their host plants. So people of this region have traditional practice as cottage industries of rearing the silk worms and spinning of fibres from their cocoons, since time immemorial. Thus the Muga and Eri fibres have a great impact on the socio-economic aspect of this region.

The aim of paper is to find out some physical property of undegummed Muga and Eri silk with the help XRD.

The average crystalline dimension (L) of MUGA and ERI are found to be 13.1(Å) and 14.6 (Å) respectively.The value of L for Muga is more then Eri and it is calculated with the help of formula.

And degree of crystallity (K) of different simples (Muga and Eri) under study is calculated by measuring the the areas of measurement, and crystalline amorphous section under the corresponding X_Ray diffractogram with the help of the equation

$K=100\ S_C/s$

Where Sc area under the crystalline field that is area of diffractogram maximum.

S=total area under the diffractogram

And it is found the value Muga is 55.8% and Eri is 41%

The degree of Muga is more than Eri.

Key Notes:

X-rd, undegummed.

INTRODUCTION

Muga, the golden silk is a wonderful gift of nature, known for its glossy fine texture and durability. Due to its low porosity, the Muga yarn cannot be bleached or dyed and its natural golden color is retained. This silk can be hand-washed with its luster increasing after every wash. The silk is obtained from semi domesticated silk worm viz. *Antheraea assamensis*. The Muga mekhela-chador is a traditional dress of Assamese women for Bihu dances and weddings. It is in demand in Japan to make kimonos, and also high demand in countries like U.S., Greece, Germany, South Africa and France. The golden-yellow Muga silk of Assam has been granted Geographical Indication (GI) registration by the GI Registry in Chennai. It has been identified as a silk of given quality, reputation and characteristic, attributable to the geographical area of Assam since time immemorial.

Eri silk, also known as *Endi* or *Errandi*, is a spun from open-ended cocoons, unlike other varieties of silk. Eri silk is the product of the domesticated multivoltine silkworm, *Samia ricini* that feeds mainly on castor leaves. This silk behaves like cotton and warmth like wool. Due to its coarseness, eri silk yarn can be blended with other yarns and made suitable for manufacturing of all varieties of fabrics, lighter to heavy fabrics, inner ware, dress material, ornamental fabric, thicker fabric like chadder, wall hangings, furnishings and hosiery fabric etc.

North Eastern Region of India with tropical to temperate climate holds indomitable positions in the global sericultural map having all the four varieties of silk viz. Mulberry, Oak Tasar, Eri and Muga. Sericulture in this region provides gainful occupation to nearly about 1.80 lakh families. However, the strength of the region lies mainly with muga and eri culture. Eri culture is mainly practiced in Assam,

Meghalaya, Arunachal Pradesh, Nagaland and Manipur of North East India. Of course, now-a-days this culture is spreading to certain non-traditional states of India viz., Andhra Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Tamil Nadu, Karnataka, Maharashtra, Uttaranchal, Uttar Pradesh, Jharkhand, Bihar, West Bengal, Orissa and Sikkim. The largest share (above 90%) of eri silk production of India is contributed from N.E. India and it shares 77% of the total non-mulberry raw silk produced in the country.

In producing golden yellow muga silk, Assam, the easternmost state of the Indian Union, has the unique distinction, though wild counterpart of muga silkworm is found in the foothills of Meghalaya, Nagaland and Arunachal Pradesh. A good number of allied species of Antheraea are also found in NE India in their natural habitat.

Silk culture is traditional cottage industry rooted in the life and culture of Assam. Sericulture in Assam comprises mulberry (pat) and non -mulberry silkworm culture.

The latter includes endi, muga, and oak-tassar. Endi and muga silks are considered to be of indigenous origin and found only in Assam and the foot-hills of Meghalaya. Oak-tassar culture is recent introduction in some temperate of zones of Northeastern region especially in Manipur. The commercial prospect of which are yet to be ascertained. Endi culture has always remained as a subsidiary occupation of Indo-Mongoloid and Tibeto-Burman thenic groups of the Brahmaputra valley (i.e. the Assam plains) and the adjacent hill areas. It is carried out traditionally by the rural and tribal womenfolk in their leisure hours. Endi silkworm (Philosamis ricint) derives its name from the castor oil plant (Ricinus communis) called era in Assamese, on which it is usually fed .Endi cocoon is open at one end for which the silk does not form into a containuous filament. Hence, the cosoon is spun not reeled. The coarse, durable endi cloth is regared as the silk of the poor . The status of endi clothes in the folk life of Assam can easily be gauged from an old Assamese proverb, dair pani, erir kani, which implies that while curd cools, endi cloth warms up a person.

Muga worm (*Antheraea assama*) is basically a wild variety. It is commonly fed on som (*Persea bombycina*) tree in Upper Assam and sualu (*Litsea monopetela*) in Lower Assam. Mejankari (*Littsea cubeba*), pan chapa (*Magnolia sphenocarpa*) dighlati (*Listsea salicifolia*) are secondary host plants. Muga silk general is rich golden yellow or light brown in colour depending on the host plant on which the worms are fed and the season. Most of the cocoons are purchased ultimately by the traders of Sualkuchi (in Kamrup district of Lower Assam) where commercial reeling and weaving are done almost as a monopoly. Though the bulk of the rearing is done in Upper Assam, the womenfolk there reel a very small quantity of cocoon to utilize in their looms for household use. The most important Muga cocoon rearing villages lie in Lakhimpur,

Dibrugarh, Sibsagar and Jorhat districts. The items of dress made out of muga is Assamese women's apparel (riha, mekhela, chadar) saree and wrapper. Mulberry silk industry in Assam is also pretty ancient. The climate condition of Assam is favourable for mulberry culture. Mulberry silk locally pat, is produced by a silkworm known as Bombyx mori, which feeds solely on mulberry (*Morus indica*) leaves. Hence, the name of the silk the mulberry yarn reeled by the rural folk are primarily meant for domestic consumption. The commercial weavers purchase every year about 25,000 kg of twisted mulberry silk from Karnataka. Mulberry silk is light and cool; has sheen and is strong; delicate and resilent. It is used in Assam primarily for manufacturing items of dress such as mekhela, chadar, riha, saree, wrapper, dhoti and men's upper garment.

MATERIALS AND METHOD

Materials-The cocoons of Muga and Eri the basics material for the present investigation is collected from Sualkuchi and Ramdia.

Extraction and degumming of fibre-For degumming some cocoons were boiled in sodium carbonate solution for about one hour and fibres from the cocoons were extracted after removing the floss. These fibres, mostly from the middle portion of the cocoons. The fibres so prepared were used as degummed samples.

Preparation of silk gland sample-Silk glands of the silk worms were carefully extracted after dissection. The glands were then dried at room temperature without giving any tention or pressure of them. When completely dried the material of the glands was finnaly ground in a mortar and then passes through a hundred mesh sieve.The powdered glands material (particles size ~2 micrometer) was preserved in a desicator for used in x ray diffraction studies.

Counter Diffraction Technique-In counter diffractometer technique , the pattern of dispersed x -rays diffracted from planes of different spacings of the specimen are scanned by a radition detector which is moved either continuousely or in steps across the pattern. Several detecting devices are available and each in turn can be used with a wide vatiety of auxiliary electronic circuits. The most commonly used detector is the Geiger-Muller counter ,the use of which was first described by Geiger and Muller[69].

The scanning mechanism and the specimen holders are not greatly affected by the type of detector used and the same basic instrument is suitable for a variety of applications.

The diffractometer directly measures the intensity of x-rays diffracted at any particular angle 2θ.The dependence of the diffracted rays on the angle 2θ is continu-

ously recorded in the graphical form with the help of a strip- chart recorder.

By measuring the spacings between the corresponding symmetric maxima on the diffraction pattern (diffractogram), 2θ values can be determined and hence the interplanar spacings(d) can be evaluated.

X-ray diffractometer analysis helps to determined the degree of crystallinity of the specimen under study from the measurement of areas under the diffractograms. The degree of crystallinity percent (k) is given by the relation-

$K = 100Sc/S$.....(1).

Where, Sc=area of the crystalline field, ie, areas of the diffractogram maximums.

S = total area under the diffractogram.

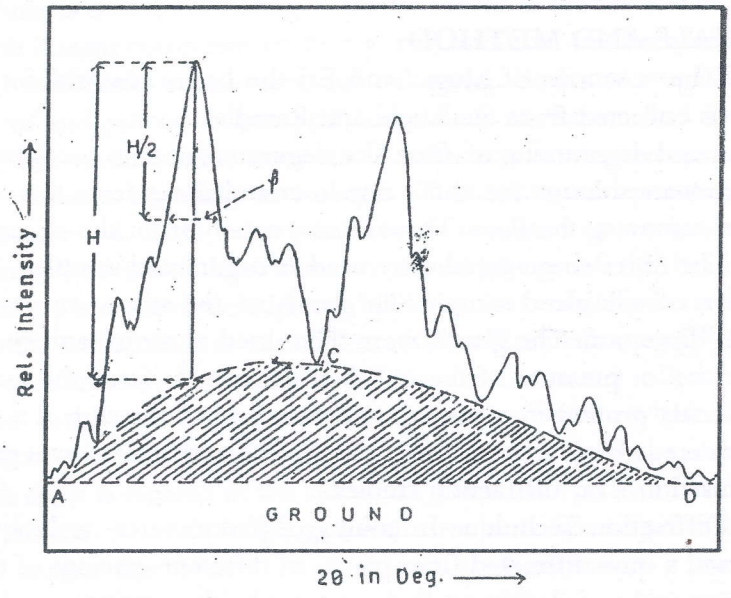


FIG.1

Diagramatic representation of the measurement of the broadening of intensity line from X-ray diffractogram.

The diffractogram gives relative intensities in terms of its height from the base line .Thus a measure of the crystalline intensity can be obtained from the heights of the diffractogram peaks.

The diffractograms also facilitate to account for the crystalline dimensions of the specimen. The average crystallite dimension Lis given by-

$L=K\lambda/\beta\cos\theta$.....(2)

Where K=factor of crystalline shape .For unknown crystalline spape,this factor is usually assumed as 0.9

Λ = wave length

β = Line broadening

θ = Bragg angle

The broadening of the line, β (mm) is determined at the level of half the height of the intensity curve maximum in the crystalline section. Each line of the diffractogram corresponds to the size of the crystallite in a certain crystallographic direction.By messuring several dimensions of the crystallites in space,it is possible to draw the general shape of the crystallites.

Adiagramatic represation of the measurement of β is displayed in fig (1). Where the three sections -the crystalline, amorphous and dispersion(ground) are outlined on the diffractogram. The area under section while the areas of the diffractogram maximums result to the crystalline section.

RESULT AND DISCUSSION

The aim of my paper is to study the degree of crystalllinity ,interplaner spacing ,and relative intensity with the help of x ray diffraction. For interplaner spacings using BRAGG'S equcation

$2d\sin\theta = n\lambda$ .....(3)

Which is Bragg's equcation were d = distance between two parallel crystal plans.(interplanar distance)

θ = angle between incident ray and lattice plane (BRAGG'S Angle)

n = order of reflection (=1, 2, 3.....)

λ = wave length of the incident ray beam

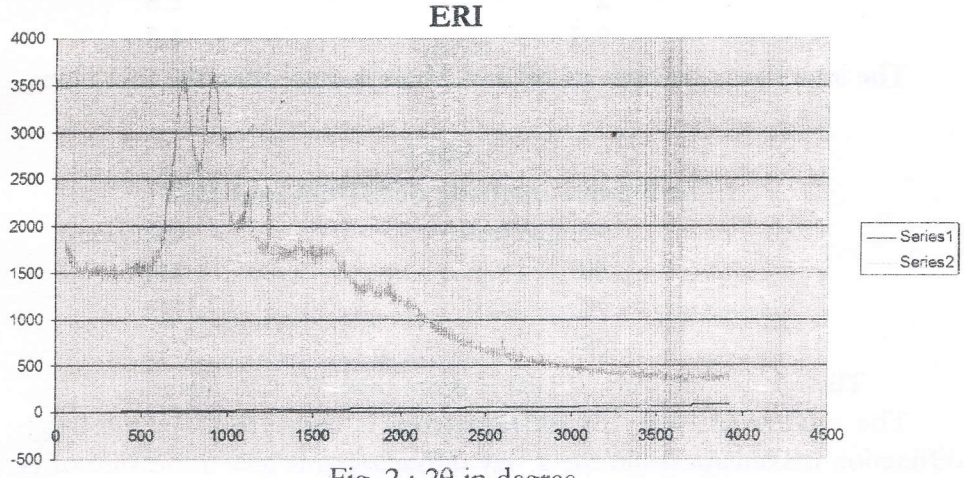
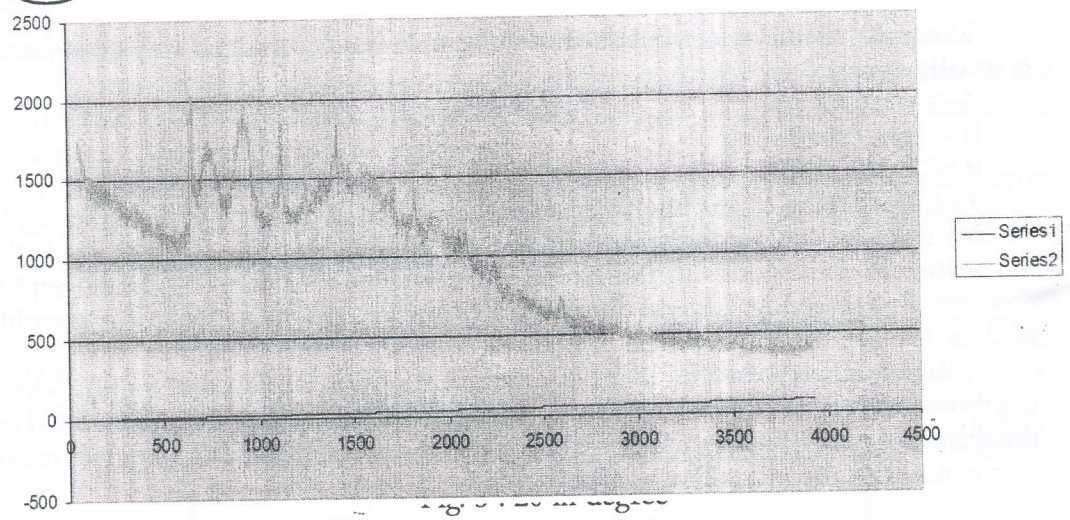


Fig. 2 : 2θ in degree

XRD OF ERI FIBRES



XRD OF MUGA FIBRES

The x ray diffractogram for ERI and MUGA fibres under undegummed condition are displayed in fig 2 and 3

The interplanar spacing for fibres obtained from the diffractogram are

TABLE--1

Interplanar spacing (Å)for Muga and Eri

MUGA	ERI
1.3	3.1
2	1.8
5.3	4.3

The interplanar spacings of MUGA fibres is more than the ERI fibres.

TABLE-2

The relative intensity of MUGA and ERI :

MUGA (mm)	ERI (mm)
80	110
90	111
88	74

The relative intensity of ERI is more than MUGA fibres .

The relative intensity of diffractogram is measure from the height of the diffraction maxima(peaks)in the x -ray diffractograms give a measure of crysallinity of the fibre sample.

The value of average L of Muga is = 13.1 amstrong and for Eri is = 14.6 A° using equation (2)

The broadening of the line β(mm) is determined at the level of half the height of the intensity curve maximum in the crystalline section.

Degree of crystallinity (k) of the fibre samples.

MUGA Undegummed = 55.8%

And for ERI = 41%

Using equation (1)

The Muga fibre has been found to posses higher degree of crystallinity than ERI.

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