PHYSICAL PROPERTIES OF SILK YARN USED IN WEAVING KABBUA FABRIC

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Abstract: *Kabbua* is a unique and distinctive silk or thread fabric made up of four patterns, Ikate, Khit, Chok, and Tew. The purpose of this study was to compare the physical properties of samples of silk yarn used in the weaving of Kabbua in three provinces, Ubon Ratchathani, Sisaket, and Petchaboon. A 56.25 meter long sample of silk yarn from each of province was weighed to determine its denier value. Surface morphologies were characterized by scanning electron microscope photographs of degummed silk fiber. Results show the denier values of Ubon Ratchathani, Sisaket, and Petchaboon were 130.2, 79.0, and 97.3 respectively. These results indicated the silk from Ubon Ratchathani was the strongest at 3.77 g/D but it was the worst in elongation. According to scanning electron microscope photographs, the surface morphology of the sample from Petchaboon was the smoothest.

1. Introduction

There are a number of garment factories located in North-East Thailand, many producing Kabbua fabric, a textile made from thread or silk that has four distinctive patterns, Ikate, Khit, Chok, and Tew (Figure 1). Kabbua is strongly identified with the province of Ubon Ratchathani.

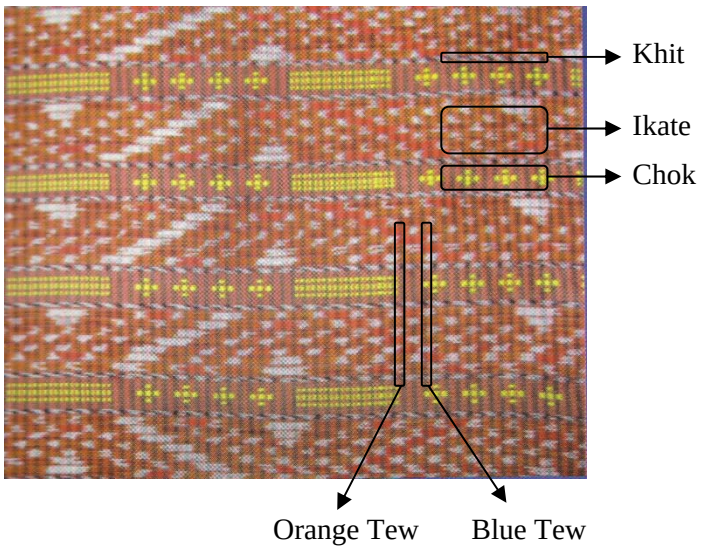

Figure 1: *four components of Kabbua Fabric*

A group of people in the village of Ban Bon in Ubon Ratchathani recently made the decision to weave Kabbua from silk. Yellow cocoons of native Thai silkworms were reeled by hand, producing a distinctive silk yarn. However, it was found that there was an insufficient food supply of mulberry leaves for the silk worms, raising concerns about the quality of the silk. Generally, the silk yarn from the provinces of Sisaket and Petchaboon has been of higher quality than that from Ubon Ratchathani and has been used as the weft and that from Ban Bon in Ubon Ratchathani has been used as the warp.

A good standard of fabric quality is important to textile producers and consumers because it ensures freedom from defects, uniform structure and appearance, and reliable performance during production and for consumers. It also influences product cost, suitability for the target market, and consumer appeal and satisfaction. Defects in fabric decrease its quality and performance.

Denier is the term used to define the diameter or fineness of natural and synthetic fibers and is presented as the weight in grams of a 9000-meter length of fiber or yarn. Smaller numbers indicate smoother fibers and larger numbers coarser fibers. Strength is the ability to resist stress and is expressed as tenacity (grams per denier). Breaking tenacity is the number of grams of force required to break a fiber. Stronger and smoother fibers mean increased durability due to the molecular structure. Elongation is the ability to be stretched, extended, or lengthened and varies with dryness and temperature. Raw silk should have an elongation of 18-23% of its original length [1]. Varieties of silk that have low elongation stretch less under force. The end uses of the fabric are in the manufacture of apparel and furnishing items that receive heavy use, such as work clothes and heavy-duty upholstery fabrics [2]. This study was designed to investigate and compare the quality of silk yarn of Ubon Ratchathani, Sisaket, and Petchaboon.

2. Objectives

To explore the differences in the quality of silk yarn from Ubon Ratchathani, Sisaket, and Petchaboon in terms of yarn number, tensile strength, elongation, and surface morphology.

3. Method

Materials

Samples of silk yarn from Ubon Ratchathani, Sisaket, and Petchaboon were purchased. Each sample was 56.25 meters in length. Raw silk fibers were obtained after the reeling of cocoon threads of *B. mori*. silkworms.

Measurements

The tensile properties of strength and elongation were measured with a Lloyd Tensilon Machine (LR 5K) using standard techniques at 22 °C and 65% at a gauge length of 10 cm. Each value reported was the average of 3 measurements. Scanning electron microscopy (SEM) observations were carried out by a JEOL 5410 LV microscope operating at low voltage (15 kV). Single silk fibers were mounted on an aluminum stub and sputter-coated with gold for 60 s (SPI Module Sputter Coater) to prevent charging.

4. Results

Table 1: *Physical properties of silk yarn from Ubon Ratchathani, Sisaket, and Petchaboon*

Source of silk yarn	Denier	Tensile strength (g/D)	Strain (%)
Ubon Ratchathani	130.2	3.77	12.7
Sisaket	79.0	3.64	13.9
Petchaboon	97.3	3.31	13.3

Table 1 presents the physical properties of denier, tensile strength, and strain of the samples of silk yarn from Ubon Ratchathani, Sisaket, and Petchaboon. The silk yarn from Ubon Ratchathani had the lowest result for strain but denier and tensile strength were higher than the samples from Sisaket and Petchaboon. This indicated that Ubon Ratchathani's silk

yarn had rough fibers due to high denier, high durability because of high tensile strength, and low stretch due to low elongation. In comparison, the silk yarn from Sisaket was the smoothest fiber shown by low denier result. Products manufactured from this silk yarn would be of lighter weight than those made from silk yarn from Ubon Ratchathani and Petchaboon and would have better stretch properties.

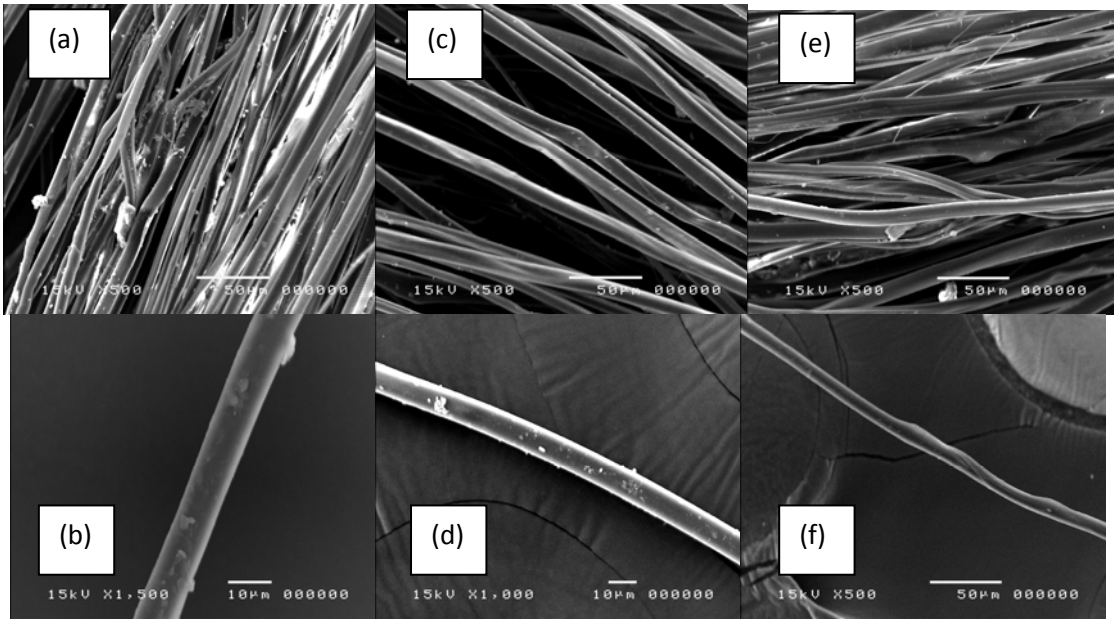

Figure 2: *SEM photographs of the silk yarn from Ubon Ratchathani (a-b), Sisaket (c-d), and Petchaboon (e-f)*

Surface morphologies shown by SEM photographs of degummed silk fiber indicated that the silk fiber from Petchaboon (Fig. 2e-f) was the smoothest compared to those from Sisaket (Fig. 2c-d) and Ubon Ratchathani (Fig. 2a-b). The Petchaboon silk yarn had had sericin removed resulting in smooth, clean fiber with no residual silk sericin contamination. The silk yarns from Sisaket and Ubon Ratchathani contained granular deposits and were rough due to the silk being degummed with hot water [3].

5. Conclusion

This research compared the physical properties, denier, strength, elongation, and surface morphology of samples of silk yarn from three provinces. It was found that the sample from Ubon Ratchathani had the highest strength but was the lowest performer in elongation, making it appropriate for products requiring durability, such as work clothes and heavy-duty upholstery fabrics. SEM images showed that the sample from Ubon Ratchathani was rough due to gum deposits.

References

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