Journal of Fiber Bioengineering and Informatics 7:3 (2014) 339–348
doi:10.3993/jfbi09201404

Raw Silk Quality Index Comparison between Electronic Tester and Seriplane Test System

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Received 28 Janurary 2014; accepted (in revised version) 12 June 2014; available online 23 September 2014

Abstract

A new electronic tester consisting of capacitive sensors and optical sensors is now introduced into raw silk inspection. Compared with the traditional seriplane test, the quality indices change a lot. In assessing the yarn evenness, the electronic tester measures the coefficient of variation of the raw silk size (CV_{even}%, $CV_{5\ m}$%, $CV_{50\ m}$%), while the seriplane uses evenness II. In assessing the yarn defects, the electronic tester measures the slubs, thick places and thin places, SIE (small imperfection element), while the seriplane test uses cleanness and neatness. However, raw silk users who have been used to the seriplane test report want to know how to interpret the electronic test indices, they want to be convinced by knowing the correlation between the indices of the two test systems. In this study 50 lots of raw silk are sampled and tested by the two test systems, and the correlation coefficients of the corresponding indices are computed and analyzed. The result shows that there are significant correlation between evenness II and $CV_{5\ m}$%, a strong correlation between cleanness and slub by the optical sensor, a strong correlation between neatness and SIE by both the capacitive and the optical sensor, and a strong correlation between neatness and the thick and thin places by optical sensor. The result confirms the substitution of the electronic test for seriplane test in future from the technical viewpoint.

Keywords: Electronic Tester for Raw Silk; Seriplane Test; Defects; Yarn Evenness

1 Introduction

Decades ago, seriplane test was often used to inspect textile yarns. However, this kind of test

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method mainly relies on the examiner's subjective judgment and experience [1], thus the test results have low repeatability. Under such circumstance, the automatic testing method was proposed, and experts had made great efforts to study the automatic test method. Generally the following methods, the capacitive method [2], the CCD (Charged Coupled Device) digital image processing method [1, 3], and the photoelectric method [2, 4], are developed to test the defects and evenness of yarns automatically.

The Switzerland Uster Company has developed a series of Uster testers using the capacitive method. At present, the Uster yarn evenness tester has been greatly used in cotton, wool, and chemical fiber industry except for the silk industry. In 1991, an automatic testing and grading draft based on the Uster-III yarn evenness tester was submitted to the conference of International Silk Association (ISA), but failed to pass. One of the reasons is that the Uster tester is not fit for raw silk test. In the raw silk test by Uster tester, much sericin is rubbed off the silk filament, which affects the results greatly, and the test efficiency is also low. Most importantly some studies [5-7] have found that there were great differences between the test results of the Uster tester and seriplane test, and that during the test of the raw silk faults and imperfections, the Uster tester cannot get the same quality information as the seriplane test [6]. No obvious correlation between cleanness by seriplane test and neps by Uster tester, and no obvious correlation between neatness and total imperfections were found [7].

For the next decades, there were no universal raw silk test standards in the international raw silk trade, which brought many difficulties and disputes in the international silk trade. Thus during the period, experts continued to study for a good method to test the defects and evenness of raw silk yarns automatically [8-10]. A new test means for raw silk using capacitive sensors and optical sensors altogether was developed by the Japanese Keisoki Company. Using this technique, China and Italy have developed a new electronic tester for raw silk, and this tester has been put into use for many years [11]. As there are 12 spindles in the tester, 12 samples can be tested at the same time, while the Uster-III tester can only test one sample at the same time, the test efficiency is highly enhanced. The tested silk yarns can be collected by a winding device, while the Uster-III tester cannot collect the yarns without damage. Thus the electronic tester is greatly valued by the global silk industry. An international work group including experts from 8 countries is now developing an ISO standard on the test method under ISO directives.

However, with the introduction of the new electronic test method for silk inspection, the raw silk buyers or the twisted yarn manufacturers have to face a different raw material quality report, as the two test systems have different test principles and methods, the test indices are consequently different. In the seriplane test the quality information of raw silk defects are mainly expressed by the indices of cleanness and neatness, the evenness information are mainly expressed by the indices of evenness II and evenness III. And correspondingly, in the electronic test the defects and evenness information are expressed by the indices of small slub, big slub, thick places and thin places, Small Imperfection Elements (SIE), coefficient of variation of the raw silk size (CV_{even}%, $CV_{5\ m}$%, $CV_{50\ m}$%) . Thus, some companies, for example, the France company Hermes who uses a great deal of high quality silk in their ties, scarves, and silk bags, are against the ISO draft on the new electronic test just because they are familiar with the seriplane report, and are not sure if the electronic tester is as reliable as the seriplane test. Under such circumstance, this study focuses on studying the intensity of the correlation between the corresponding quality indices of the two test method, and tries to reveal the reason for their correlation extent by comparing the definition or test rules of the indices of the two different test systems, and thus to convince the raw silk downstream manufacturers that the new electronic