INFLUENCE OF REWORKABLE WASTE ON YARN QUALITY

Pamela Strause, Dr. Clarence Rogers, and Wei Tian
School of Textiles, Fibers, and Polymer Science
Clemson University
Clemson, SC

Abstract

The following is a preliminary study dealing with the effects of reworkable waste on yarn tenacity. Yarn was produced on the Uster Quickspin system. Samples without reworkable waste and with a blend of different types and amounts of waste were made for comparison. Including reworkable waste in a bale mix lay down may have a detrimental effect on yarn quality. With the addition of a combination of reclaimed fibers, reginned fibers, and opening room waste a 3% to 6% reduction in tenacity was observed. However, the various blends of waste were not found to be significantly different from each other.

Introduction

Reworkable waste refers to potentially good fibers which have been kicked out of the system. These fibers may be recovered and put back into the system. In manufacturing the goal is to produce the required yarn quality at the lowest possible cost. Since a large portion of yarn cost is due to fibers, it may be desirable to use the waste created during production. A few issues need to be addressed before considering the use of reworkable waste. One should be aware of the source, or production, of waste and how to effectively utilize reworkable waste.

Waste is produced at almost every stage of manufacturing. Generally, waste may be divided into three categories, namely, dirty, clean, and hard. Examples of dirty waste may include card flats, blow room waste, and ginning waste. Clean waste usually refers to sliver, noil, and pneumafil. Finally, hard waste is comprised of twisted roving, yarn and fabrics.

Before utilization, some reworkable waste needs to be cleaned or opened. Dirty waste needs to be sent through a cleaning operation before reuse. For clean waste a simple opening procedure may be sufficient for re-entry of the fibers into the system. On the other hand, specialized opening is required for hard waste.

After addressing the issue of waste preparation, now the focus turns to how much waste and what type of waste may be added without having a detrimental effect on yarn quality? This is the focus of the following study.

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Materials and Methods

For this preliminary reworkable waste study an 18 Nec 100% cotton yarn was produced. The waste used can be mainly classified as dirty waste which was processed prior to the study. The sources of waste included reclaimed fibers from carding, opening room waste, and reginned fibers. Part 1 of the study consisted of a 20 bale lay down. Various amounts of reclaimed and reginned fibers were added to the "pure" cotton fibers. In Part 2 of the study a 30 bale lay down was used along with waste from an extractor, opening room and ginning. The amounts of reworkable waste added were based on a mill's potential utilization of waste. For both parts 1 and 2 a sample was made without waste for comparative purposes.

For production the Uster Quickspin system was employed. To start, 5.25 gram samples were passed through the Uster MDTA 3 with Rotorring 3 twice. The sliver was then put through the open-end single spinning unit. Four packages were made for each combination. The Statimat single-end tester was used to measure the tenacity of the yarns. Every package was tested 30 times. The average tenacity for each trial was then recorded.

A separate trial was run to compare the Uster Quickspin system to conventional open-end spinning. Clemson University's manufacturing facilities were employed for this part of the study. The settings on the Uster were made to match the conventional production equipment. Four packages were produced on each system. The tenacity was measured (30 times per package) with the Statimat single-end tester.

Results and Discussion

For Part 1 and 2 there was a significant difference between the "pure" cotton yarn tenacity and those with waste added. The blend combinations and measured yarn tenacity are shown in Tables 1 and 2, respectively. The difference in tenacity between the samples with and without waste for part 1 ranged from 3% to 6%. For part 2 the difference between the "pure" samples and those with waste ranged from 4% to 6%. Although the total percent of waste was higher for part 2 than part 1 (23% vs. 15%) the effect on tenacity was similar. Since the fibers and waste used for part 2 came from a totally different source than part 1 it may be inappropriate to conclude that the percent of waste added is not significant. A more suitable conclusion may be that reworkable waste has an effect on yarn tenacity. The extent that each type and amount of waste effects the yarn quality needs to be further studied.

In the final part of the study fibers from the same source were spun on the Uster Quickspin system and conventional manufacturing equipment. As illustrated in Table 3, the average yarn tenacity, as well as the minimum and maximum values were almost identical. The conclusion from this brief study is the Uster Quickspin system may be a valid tool for simulating conventional spun yarn properties.

References

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Table 1. Yarn tenacity for part 1 of the reworkable waste study.

	Combinations:			**Tenacity**
Trial	**Cotton**	**Reclaimed**	**Reginned**	**(g/den)**
1	100.0%			1.39
2	95.0%	5.0%		1.35
3	85.0%	10.0%	5.0%	1.34
4	85.0%	7.5%	7.5%	1.33
5	90.0%	5.0%	5.0%	1.31
6	85.0%	15.0%		1.31

Table 2. Yarn tenacity for part 2 of the reworkable waste study.

		Combinations:			**Tenacity**
Trial	**Cotton**	**Regin**	**Open Room**	**Extractor**	**(g/den)**
1	100.0%				1.32
2	76.7%	3.3%	3.3%	16.7%	1.27
3	80.0%	3.3%		16.7%	1.26
4	80.0%	3.3%	3.3%	13.3%	1.25
5	80.0%		3.3%	16.7%	1.24

Table 3. Yarn tenacity for Uster Quickspin vs. Conventional Manufacturing equipment.

Production	**Tenacity (g/den)**		
Equipment	**Average**	**Minimum**	**Maximum**
Quickspin	1.24	0.86	1.58
Conventional	1.24	0.98	1.59