

ABSTRACT – OPTIMIZING RECYCLING EFFICIENCY OF WOOL AND WOOL BLENDS FOR SUSTAINABLE TEXTILE PRACTICES

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Abstract:

The textile industry, a vital contributor to the global economy, grapples with the stark reality of being the second largest polluter worldwide. Annually, approximately 1 billion garments are manufactured, with 30% discarded outright as unworn items, while the remaining are disposed of following brief periods of use. Increased public awareness, driven by the educational work of non-governmental organizations, is promoting the change towards sustainability.

The Professorship of Textile Technologies at Chemnitz University of Technology stands at the forefront of sustainable initiatives, currently engaging in a research venture centered on the recycling of Pre- and Post-Consumer Waste. This undertaking initially targets the intricate domain of Pre-Consumer Waste, focusing particularly on textiles crafted from wool and wool blends, such as Wool-Silk blends. The overarching objective is to promote the evolution of a fully closed raw material cycle, where 100% of waste remains within the recycling loop.

Initial stages of the research project involves meticulous examination of the fiber length within the waste material. Parameters such as sorting, textile orientation prior to cutting, surface design, and binding methods profoundly influence subsequent fiber length. Additionally, the research includes an in-depth investigation into different material lengths to determine the optimal length for achieving maximal fiber length in the shredding process. Samples ranging from 1 cm to 10 cm of pre-consumer material of wool and silk were examined, revealing that the optimal length for the cutting process is 6 cm to 7 cm, where the fiber length ranges from 70.6 mm to 73.4 mm, ensuring maximal fiber length in the shredding process. Nevertheless, the maximal fiber length is also depended on the pattern type (Figure 1).

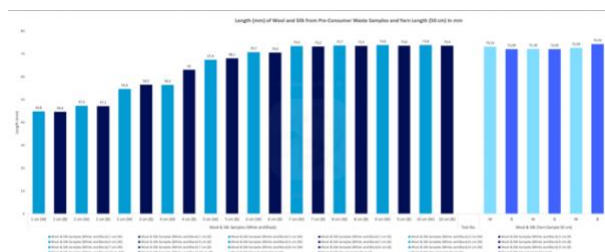


Figure 1 Length (mm) of Wool and Silk Pre-Consumer Waste Samples with Rib Pattern (1x1) from 1 cm – 10 cm (Left), Yarn Length (mm) of 50 cm Wool and Silk yarn (raw material) (right).

A systematic exploration of various parameters in the cutting and tearing processes follows to maximize fiber length in recycled yarns. Laboratory spinning equipment processes the recycled fibers into yarn, facilitating a comprehensive comparison of yarn parameters—encompassing fiber length, yarn count, twist, tensile strength, and elongation—with those of the original materials. The experiment aims to attain a recycling rate of 100%.

Through delving into the intricacies of recycling Pre-Consumer Wool Waste and exploring key parameters, this research endeavors to establish new standards for closed-loop recycling. It advocates for a circular economy and promotes new sustainable practices within the textile industry.

Keywords: Textile recycling, Pre-Consumer Waste, Wool blends, Fiber length optimization, Circular economy, Sustainability

Acknowledgements:

We express our gratitude to SAB for their generous support through the State Funding PhD Program.