TexUV-C: Microbiological Characterization of Post-Consumer Textiles as a Basis for Automated Decontamination in Mechanical Recycling Processes

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Abstract

With the introduction of mandatory recycling for post-consumer textiles, mechanical fiber recycling is gaining increasing importance as an ecologically and economically promising recovery pathway. Since post-consumer textiles are predominantly collected unsorted via public collection containers, they are subject to uncontrolled microbial contamination. To date, no binding threshold value for the microbial load of post-consumer textiles exists. UV-C radiation and ozone are already applied for surface disinfection. However, an automated decontamination solution for the industrial textile recycling process is still lacking. Uncontrolled microbial growth and proliferation can result in odor formation, infection risks, and skin irritation, thereby constituting an obstacle to safe, high-quality fiber recycling.
The aim of this work is to systematically assess the initial microbiological contamination of post-consumer textiles in order to derive the cleaning requirements as well as suitable approaches for a subsequent integration of UV-C/ozone treatment into the mechanical recycling process. In addition, a demonstrator for the decontamination of recycled fibers is being designed.

Within an experimental study design, contact samples of post-consumer textiles of varying material composition and garment type were collected using RODAC plates (sheep blood agar) at standardized positions on the fabric surfaces, incubated, and evaluated for the number of colony-forming units (CFU). The sum, mean (μ), and standard deviation (σ) of the CFU counts were determined.

Of 284 samples examined, 16 (5.6%) showed no detectable microbial growth, while 4 samples (1.4%) exceeded 150 CFU. Twenty-two samples (7.7%) exceeded the threshold value defined by DIN EN ISO 13795-1 for surgical clothing, as well as the threshold value for food-industry and hospital textiles defined by Vossebein (Prakt. Arb.med. 2008; 13: 12–14).
The results provide an initial quantitative estimate of the cleaning requirements for post-consumer textiles and establish the microbiological data basis for the design and positioning of UV-C/ozone treatment within the recycling process, as well as for the derivation of future quality standards for recycled fibers.

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