

Microplastics of textile origin in the environment

How do textile structure and textile care contribute?



When textiles are washed and dried, fiber fragments are released into the environment.

Photo: © Carlos Albuquerque 2018

*„10 washing cycles result
in a total fiber release of
50-600 mg/kg of textile.*

*Loading the washing
machine to capacity
reduces fiber release.“*

Prof. Ellen Bendt, Niederrhein University
of Applied Sciences

Outdoor and sports clothing is predominantly made of polyester. During domestic laundry, fiber fragments measuring < 5 mm are released from the polyester. Although up to 95% of these are retained in local wastewater treatment plants, relevant quantities still enter surface waters via wastewater, where they can accumulate [Zhang et al., 2021]. The textile properties and washing parameters influence this release.

Release of textile microplastics during laundry

A high proportion of the microplastic fibers found in water bodies consists of polyester, and this is largely caused by the household washing of outdoor and sports clothing. Washing parameters such as duration, temperature, mechanical action, and detergent/softener all influence the washing effect and vary depending on the washing task and load, in order to achieve a high washing effect while protecting the wash load. Material abrasion and impurities are removed from the textiles and are transferred to the wash water. Fiber release is particularly high in the first wash and adds up to 50-600 mg/kg textile in 10 washes. The use of tumble dryers also causes loose fiber fragments to become detached and to accumulate in the dryer sieves.

Optimization in the production and processing of textiles can reduce the discharge of microplastics

The fiber output from textiles is influenced by many factors such as the type of yarn used, textile construction, and finishing (e.g., raising). When processing fabric into garments, cut design, tailoring, and joining technology (e.g., sewing, gluing, laser welding) all play a role. Modifications to these parameters can reduce the discharge of microplastics, but often affect the material properties and thus the function and performance value.



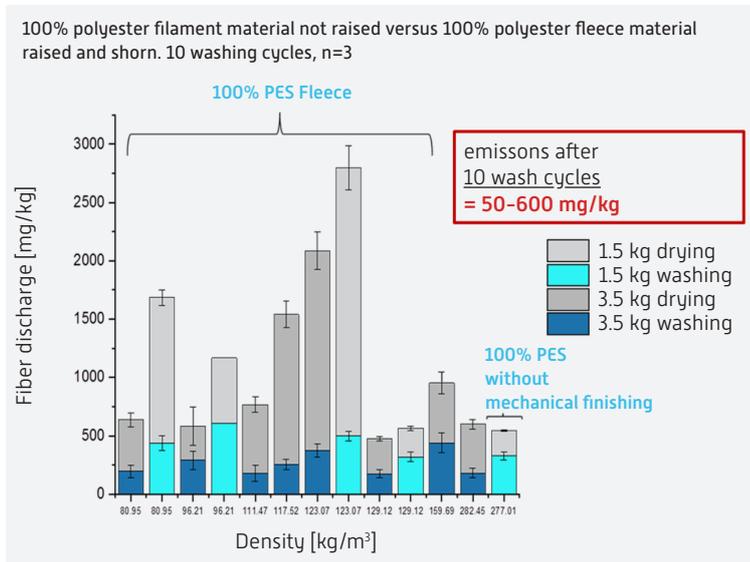
The wash water is filtered using a filter cascade (1.5 mm - 5µm pore size) and fibers are collected and analyzed by size.

Photo: © Carlos Albuquerque 2018

Research on the formation, release, and prevention of microplastics of textile origin

The project „Textile Mission“ at the Niederrhein University of Applied Sciences investigated different parameters that lead to an increased discharge of microplastic fibers from textiles during household laundry. In addition to washing

parameters that can be influenced by consumers themselves, manufacturing parameters also contribute to fiber discharge. Solutions to reduce fiber discharge through adapted manufacturing processes were being developed in collaboration with the project partners.



Fiber discharge after 10 household laundry and 10 tumble dryer cycles for 100% PES fleece fabrics with and without mechanical finishes.

Graphic: © Niederrhein University of Applied Sciences, FTB 2019

Filling the washing machine to capacity and shortening the washing cycle reduce the discharge of microplastics

The washing parameters also influence particle release: while an increased spin speed (1200 instead of 900 rpm) has no effect, a shorter wash cycle (quick wash) results in lower fiber discharge into the wash water. A larger load in the washing machine is associated with lower mechanical stress on the laundry and results in reduced fiber discharge.

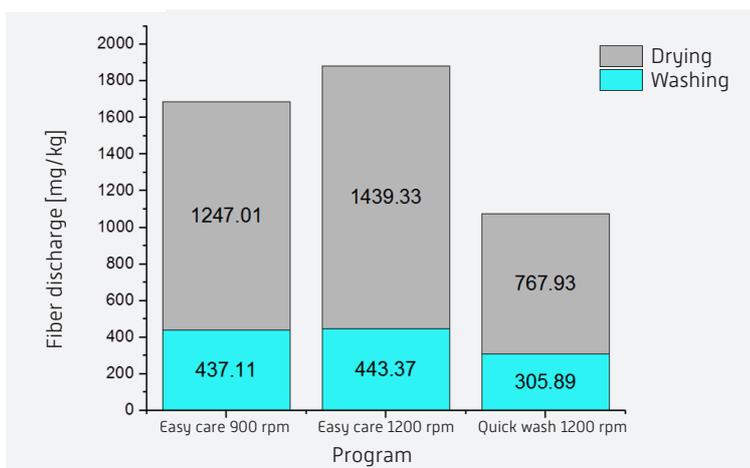


Illustration of the fiber discharge with different washing programs and/or increased spinning speed.

Graphic: © Niederrhein University of Applied Sciences, FTB 2019

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