Clean Clothes, Dirty Oceans: Microplastic fiber emissions from synthetic fabrics

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The textile industry is a major contributor to microplastic pollution, responsible for up to 35% of primary microplastics released into the environment—primarily through household laundering. The Ellen MacArthur Foundation estimates that one-third of all primary microplastics in the oceans originate from textile washing, projecting 22 million tonnes of microfibers to enter marine ecosystems between 2015 and 2055. This study quantified microplastic fibers (MPFs) emissions from ten synthetic fabric samples—acrylic, polyamide, polyester, recycled polyester, and polypropylene—washed under standardized conditions. The influence of raw material, fabric properties (structure, basis weight, thickness), and washing stage (pre-wash vs. soaping/rinsing) was systematically analyzed.

Across all tests, 468–2405 MPFs were released per sample. Normalized emission rates were consistently higher during the pre-wash phase (2–17 MPF g^{-1} min^{-1}) than during the main wash (1–9 MPF g^{-1} min^{-1}), suggesting that omitting pre-washing could halve total emissions. Woven fabrics released up to 55% more MPFs than equivalent knitted fabrics. Yarn diameter and fabric thickness showed strong positive correlations with fiber release ($r > 0.85$). Recycled polyester emitted 31% more MPFs than virgin polyester due to polymer chain degradation during thermal-mechanical recycling.

These findings offer a robust comparative assessment of MPF shedding, emphasizing the importance of fiber type, structural characteristics, and laundering practices. The results advocate for material-conscious textile design, discourage unnecessary pre-washing, and highlight the need to improve recycling processes to mitigate microfiber release from recycled fibers. These insights inform sustainable innovation in textiles, and consumer behavior.