## From Polyester Hard Water Drives a Surge in Microplastic Shedding

Researchers investigated whether anti-microplastic fiber (MPF) coatings can effectively reduce the release of microplastics from polyester fabrics during hand washing.

They found that the coating reduced MPF release, but its effectiveness depended on fabric type and water quality. The coating reduced MPF release by up to 92 for green polyester and approximately 30% for black polyester.

MPFs, typically defined in the broader literature as microplastic fibers less than 5 mm, are a major contributor to marine microplastic pollution, with synthetic textile laundering responsible for approximately 35% of the microplastics found in the ocean.

The growth of fast fashion has intensified this issue, posing ecological threats to marine life, including coral reefs and fish, which can experience growth inhibition and genetic damage. Human exposure to MPFs is also associated with respiratory problems and other health issues.

### Study

Researchers tested the performance of an existing MPF-reducing coating during hand washing to assess how different water sources affect the amount and size of fibers released from polyester fabrics.

Two 100% polyester fabrics (green and black) were tested. Each fabric was prepared as 15 × 15 cm swatches, either uncoated or coated using a two-layer process.

The first layer involved applying a primer solution of 3-aminopropyltriethoxysilane (APTES) in toluene, followed by hydrolysis, cleaning, and plasma treatment.

The second layer, polydimethylsiloxane (PDMS), was applied through vapor deposition to create a low-friction surface, aiming to reduce MPF shedding.

Each fabric swatch was washed manually on a bamboo washboard for 5 minutes using 1 L of water at approximately 25°C, containing standard detergent. Three water types were used: deionized (DI), tap, and Lake Ontario water, each differing in TDS content.

The wash effluent was filtered through 12 µm nylon filters, dried, and analyzed under a microscope to count and measure MPFs.

### Coating Performance Across Fabric Types

Two-layer coatings substantially reduce MPF release from green polyester by 77 to 92% across various water types, but only decrease black polyester fiber emissions by 26 to 37%. The reduction for black polyester in DI water was modest and not statistically significant (p equals 0.052), whereas reductions in tap and lake water were substantial.

For green polyester, the coating's efficacy clearly decreased as TDS increased, but for black polyester, there was no consistent relationship between water hardness and performance.

Black polyester without coating still sheds about 60% fewer microplastics than green polyester.

## Surface Contamination and Coating Adhesion

FTIR analyses revealed pre-existing silicone contamination, while XPS identified fluorine contamination on the green polyester, which may have affected coating adhesion. The authors note that the black polyester's technical back already contained a silicone-based finish, which lowered its baseline shedding and made the added PDMS coating appear less effective relative to this altered starting point.

Air permeability and fibre failure mechanisms remained unaffected by the composition of the coating or washing water, confirming that differences in MPF release were primarily linked to water chemistry rather than fabric damage.

## Coating Limitations and Practical Implications

The PDMS coating effectively reduced MPF emissions, particularly from green polyester, but its performance was hindered by surface contamination and water hardness. These findings highlight that water composition plays a key role in MPF pollution, even during manual washing.

## Conclusion

Future research should quantify MPF mass loss across different water chemistries and explore more robust coatings suitable for real-world textiles.

The results have practical implications for manufacturers, policymakers, and consumers regarding MPF mitigation, wastewater filtration standards, and the design of textile materials.

## Source:

https://www.news-medical.net/news/20251112/Hard-water-drives-a-surge-in-microplastic-shedding-from-polyester-study-finds.aspx