WASHING MACHINE FILTERS REDUCE MICROFIBER EMISSIONS TO ECOSYSTEMS

BACKGROUND

Microfibers, anthropogenic fibers (< 5mm), are the most prevalent type of microplastic and other anthropogenic particle in the environment. Plastic, cotton, and other microfibers from textiles contaminate surface water[1], deep sea[2], freshwater and marine sediment[3], wildlife[4] (including seafood[5-6]), and drinking water[7]. Laboratory studies show microfibers - including plastic (e.g., nylon and polyester) and natural (e.g., cotton and rayon) - can cause negative effects to animals[8-10], and often contain harmful chemicals[11], some of which are known toxics[12].

Microfibers are known to shed from textiles, including clothing. Clothes laundering is a major source of microfibers to the environment and washing machine filters are a known solution to the issue.

Many studies show that hundreds of thousands (up to 18 million) microfibers are released during every wash cycle[13-15]. Once released, microfibers travel via wastewater to wastewater treatment plants, where microfibers can be enter into the environment. An estimated 4.8 million tonnes of synthetic microfibers have entered water bodies and terrestrial environments since 1950[16]. It is estimated that in California alone, 2.2 kilotons (4.9 million lbs) are generated from apparel washing each year[17]. The high land application rate of biosolids leads to large microfiber emissions to land in California[17].

Several technologies are available to reduce microfibers from laundry. Washing machine filters have been studied as a potential mitigation strategy[18-19]. Experiments show that washing machine filters are effective at capturing microfibers in laboratory experiments[18] and in field studies[20].

Other sources of microfibers include clothes dryers, carpets, upholstery, cigarette butts, and other woven materials (e.g., disposable masks, wet wipes, sanitary products). Currently, the relative contribution from these sources is unknown.

HIGHLIGHTS

- Research shows that washing machine **filters capture up to 89%** of microfibers[18]

- Filters installed in washing machines leads to a **significant reduction in microfibers** at wastewater treatment plants[20].

- Widespread deployment of washing machine filters into homes is an **effective solution** to prevent microfiber emissions.

Microfibers shed from washing machines captured in a 100 μm filter

5 GYRES SCIENCE TO SOLUTIONS

The Nature Conservancy

Ocean Conservancy

A single load of laundry can release 18 million microfibers, which contaminate our:

OCEAN

LAND & FARM FIELDS

RIVERS
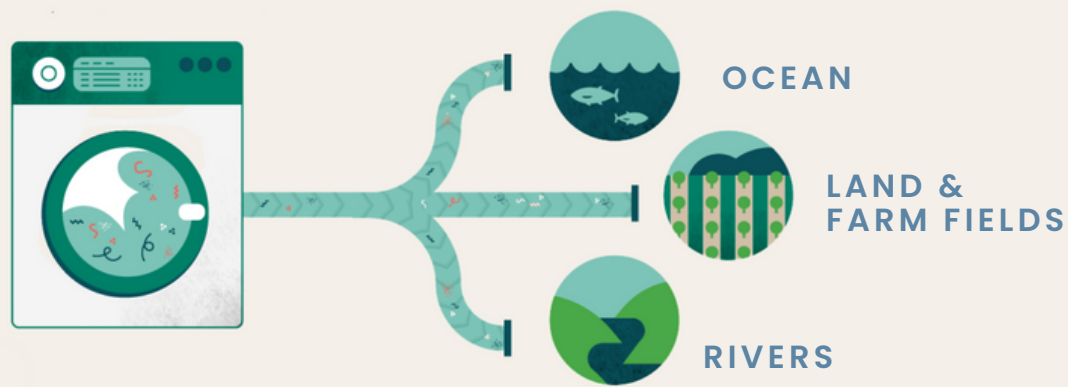
POLICY RECOMMENDATIONS

- Legislation requiring built-in washing machine filters that capture microfibers in wash water. This could include a microfiber emission cap or a minimum pore size set at a level that is most effective for catching microfibers (e.g., 100 μm).

- Provide funding for further research on other sources of microfibers (e.g., dryers, upholstery) to the environment.

CURRENT PROGRESS

- France passed 2020-105-Article 79 to require built-in washing machine filters by 2025.

- Several jurisdictions have introduced filter bills (e.g., Ontario Bill 279, UK Bill 205)

- Connecticut Passed HB 5360 (Public Act 18-181) and established a working group to address synthetic microfiber pollution.

- Microfiber shedding test method AATCC TM212-2021, for the textile industry to test microfiber shedding in laundering.

SUMMARY

Whereas, microfibers are ubiquitous pollution in the environment, and

Whereas, there is scientific evidence suggesting microfibers cause harm, and

Whereas, to date, the largest documented source of environmental microfibers is washing machines, and

Whereas, findings indicate washing machine filters divert the majority of microfibers released during laundering and significantly reduce loadings to the environment, therefore,

Scientific evidence supports policy that implement filters, thereby reducing microfiber emissions to the environment.

AB 1628 (McKinnor) would require all new washing machines in California to have a microfiber filter. This is a solution that is cost and energy efficient and has the potential to dramatically reduce the microfibers entering the environment.

This policy brief was prepared by Dr. Lisa Erdle*
*updated from a 2021 brief by Lisa Erdle, Dorsa Nouri Parto, David Sweetnam, Sam Athey, and Chelsea Rochman

(1) Kashiwabara, L. M. et al. Marine Pollution Bulletin 2021, 165, 112148. (2) Hamilton, B. et al. Mar. Ecol. Prog. Ser. 2021, 675, 23–33. (3) Ebrahim, A. et al. AJUR 2022, 19 (3), 27–35. (4) Michishita, S. et al. Environmental Pollution 2023, 316, 120548. (5) Baechler, B. R. et al. Limnology and Oceanography Letters 2020, 5 (1), 54–65. (6) Rochman, C. M. et al. Scientific Reports 2015, 5 (August), 1–10. (7) Danopoulos, E. et al. PLoS ONE 2020, 15 (7 July), 1–23. (8) Au, S. et al. Environmental Toxicology and Chemistry 2015, 34 (11), 2564–2572. (9) Watts, A. J. R. et al. Environmental Science and Technology 2015, 49 (24), 14597–14604. (10) Mateos-Cárdenas, A. et al. Science of the Total Environment 2021, 753. (11) Lacasse, K.; Baumann, W. Textile Chemicals; Springer-Verlag: Berlin/Heidelberg, 2004. (12) Schellenberger, S. et al. Environmental Science and Technology 2019, 53 (24), 14329– (13) De Falco, F. et al. Environmental Science and Technology 2020, 54 (6), 3288–3296. (14) Galvão, A. et al. Environ Sci Pollut Res 2020, 27 (21), 26643–26649. (15) Napper, I. E. et al. Marine Pollution Bulletin 2016, 112 (1–2), 39–45. (16) Gavigan, J. et al. PLoS ONE 2020, 15 (9 September). (17) Geyer, R. et al. Environmental Pollution 2022, 298, 118835. (18) McIlwraith, H. K. et al. Marine Pollution Bulletin 2019, 139 (December 2018), 40–45. (19) Napper, I. E. et al. Science of the Total Environment 2020, 738. (20) Erdle, L. M. et al. Frontiers in Marine Science 2021.