WASHING MACHINE FILTERS REDUCE MICROFIBER EMISSIONS TO AQUATIC ECOSYSTEMS

MICROFIBERS 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 the Great Lakes[1,2], deep sea[3,4], remote mountain peaks[5], wildlife[6-8] (including seafood[9]), and drinking water[10]). Laboratory studies show microfibers - including plastic (e.g., nylon and polyester) and natural (e.g., cotton and rayon) - can cause negative effects to animals[11-13], and often contain harmful chemicals[14], some of which are known toxics[15].

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 of microfibers are released during every wash cycle[16-17]. 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[18].

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

KEY FINDINGS

- Previous research shows that washing machine **filters capture up to 89%** of microfibers[20].

- Our new study found a **significant reduction in microfibers** at a local wastewater treatment plant after installing washing machine filters in ~10% of homes in a community[21].

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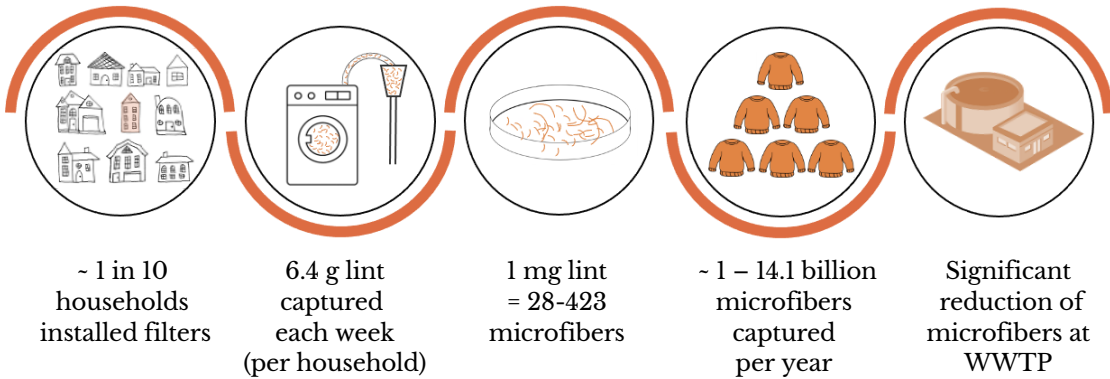

Microfibers shed from washing machines captured in a 100 µm filter

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.

PARRY SOUND, ONTARIO

PARRY SOUND

Results from **97 washing machine filters** added in a community in Ontario:

~ 1 in 10 households installed filters

6.4 g lint captured each week (per household)

1 mg lint = 28-423 microfibers

~ 1 – 14.1 billion microfibers captured per year

Significant reduction of microfibers at WWTP

If filters were installed in **every household**:

TORONTO
1.17 million households

12 - 166 trillion microfibers captured per year

LOS ANGELES
3.32 million households

30 - 468 trillion microfibers captured per year

POLICY RECOMMENDATIONS

- Legislation requiring built-in washing machine filters that capture microfibers that could include a microfiber emission cap or a minimum filter pore size set at a level that is most effective for catching microfibers (e.g., 100 μm).
- Providing tax credit to consumers that retrofit machines with after-market filters.
- Legislation requiring laundry filters to be required in industrial textile facilities, as well as commercial, public, and institutional laundry facilities.
- Provide funding for further research on other sources of microfibers (e.g., dryers) to the environment and mitigation strategies.

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., California AB 622, Ontario Bill 279, and US BreakFreeFromPlastic Bill).
- 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
- US passed the Save Our Seas Act 2.0 establishing the first federal microfiber definition and the creation of standardized monitoring.

CONCLUSIONS

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, our 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 or management options that implement filters, thereby reducing microfiber emissions to the environment

This policy brief was prepared by: Lisa Erdle, Dorsa Nouri Parto, David Sweetnam, Sam Athey, and Chelsea Rochman

1. Ballent, A., Corcoran, P. L., Madden, O., Helm, P. A. & Longstaffe, F. J. Mar. Pollut. Bull. 110, 383–395 (2016). **2.** Grbić, J., Helm, P., Athey, S. & Rochman, C. Water Res. 174, 115623 (2020). **3.** Woodall, L. C. et al. R. Soc. Open Sci. 1, 140317–140317 (2014). **4.** Sanchez-Vidal, A., Thompson, R. C., Canals, M. & De Haan, W. P. PLoS One 13, e0207033 (2018). **5.** Allen, S. et al. Nat. Geosci. 12, 339–344 (2019). **6.** Brookson, C. B., de Solla, S. R., Fernie, K. J., Cepeda, M. & Rochman, C. M. Can. J. Fish. Aquat. Sci. 76, 2156–2163 (2019). **7.** Munno, K., Helm, P. A., Rochman, C., George, T. & Jackson, D. A. (2021). doi:10.1111/cobi.13794 **8.** Nelms, S. E., Galloway, T. S., Godley, B. J., Jarvis, D. S. & Lindeque, P. K. Investigating microplastic trophic transfer in marine top predators. Environ. Pollut. 238, 999–1007 (2018). **9.** Rochman, C. M. et al. Sci. Rep. 5, 1–10 (2015). **10.** Danopoulos, E., Twiddy, M. & Rotchell, J. M. PLoS One 15, 1–23 (2020). **11.** Au, S. Y., Bruce, T. F., Bridges, W. C. & Klaine, S. J. Environ. Toxicol. Chem. 34, 2564–2572 (2015). **12.** Watts, A. J. R., Urbina, M. A., Corr, S., Lewis, C. & Galloway, T. S. Environ. Sci. Technol. 49, 14597–14604 (2015). **13.** Mateos-Cárdenas, A., O'Halloran, J., van Pelt, F. N. A. M. & Jansen, M. A. K. Sci. Total Environ. 753, (2021). **14.** Lacasse, K. & Baumann, W. Textile Chemicals. (Springer-Verlag, 2004). **15.** Schellenberger, S. et al. Environ. Sci. Technol. 53, 14329–14338 (2019). **16.** De Falco, F., Cocca, M., Avella, M. & Thompson, R. C. Environ. Sci. Technol. 54, 3288–3296 (2020). **17.** Napper, I. E. & Thompson, R. C. Mar. Pollut. Bull. 112, 39–45 (2016). **18.** Gavigan, J., Kefela, T., Macadam-Somer, I., Suh, S. & Geyer, R. PLoS One 15, (2020). **19.** Napper, I. E., Barrett, A. C. & Thompson, R. C. Sci. Total Environ. 738, (2020). **20.** McIlwraith, H. K. et al. Mar. Pollut. Bull. 139, 40–45 (2019). **21.** Erdle LM, Parto DN, Sweetnam D, Rochman CM. Washing Machine Filters Reduce Microfiber Emissions: Evidence From a Community-Scale Pilot in Parry Sound , Ontario. Front Mar Sci. (2021).