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Reducing Microfiber Pollution through Mandatory Filtration Standards for New Washing Machines

Executive Summary

Synthetic textile microfibers are one of the largest sources of microplastic pollution in California's marine ecosystems. Microfibers represent over 90% of all microplastics consumed by marine wildlife, and ingestion of microfibers by animals is harmful to wildlife and ecosystems at large. Each year, up to 48.5 million pounds of microfibers enter California's lands and waters from washing machines. The use of in-line filters on residential washing machines to capture microfibers is a practical, near-term solution that has been proven by lab and field studies to capture the majority of these microplastics before they enter the wastewater system. This brief seeks to address the issue of microfiber pollution by offering concrete recommendations for a California mandate that is enforceable, cost-conscious, and aligned with manufacturing timelines.

Background

Microfibers are tiny (<5 mm) threads of plastic shed from synthetic textiles during washing and many ultimately end up in the ocean. Microfiber pollution represents 34.8% of all plastic pollution in the oceans, but represents over 90% of all microplastics ingested by marine animals. Ingestion of microfibers by animals has been shown to reduce food consumption, reduce energy for growth, alter gene expression, and block digestive tracts. Humans who consume seafood also consume these microfibers, and research has shown that microfibers are the most common type of microplastic pollution found in human organs.

Plastic debris and microfibers have been observed across most marine habitats, from coastal estuaries to the open ocean and benthic sediments at the bottom of the ocean. The persistent nature of plastics and their inability to degrade on meaningful ecological timescales means that this is both a current and a future concern, as plastics will continue to accumulate in the environment without breaking down.

Once in the environment, microfibers are all but impossible to clean up. Washing of synthetic textiles in home or commercial washing machines is the primary way that synthetic textile microfibers find their way into marine environments. Multiple studies indicate high per-wash emissions (millions of fibers per load) and that washing is a major pathway for synthetic microfiber release into wastewater. Every year, 6.5 million metric tons of microfibers are released into the environment globally -

this is equivalent to 32.7 billion t-shirts. A single load of household laundry can release 18 million microfibers which are washed away as wastewater, many of which will end up in the ocean.

While policies to require filtration of microfibers from washing machines are relatively new, they are gaining momentum. In 2020 France adopted a circular-economy law that mandates microfiber filters on all new washing machines sold beginning in 2025, and similar requirements have since been introduced in other European countries. Oregon and New Jersey both introduced bills on this topic this year, and the Fighting Fibers Act was introduced in both the U.S. House and Senate to mandate microfiber filtration nationally. California, historically a leader in plastics regulation, previously considered such a mandate in 2023. AB 1628 (2023) would have mandated microfiber filters on new washing machines sold in California. It was passed by both chambers with broad legislative support, but was returned unsigned by Governor Newsom who cited insufficient research and potential costs to consumers. Since then, studies have strengthened scientific consensus that textile washing is a major source of microplastic pollution and that capturing microfibers during laundering is one of the most effective and immediate strategies for reducing environmental risks.

Issue Analysis

The Ocean Protection Council's (OPC) 2021 report Microplastic Pollution in California identified microfibers, such as those that are shed during the washing of synthetic textiles, as the highest priority type of plastic pollution to address. The small size of the particles increases potential exposure through ingestion for both animals and humans and results in greater potential for systematic exposure and toxic effects. Microfibers from synthetic textiles are the second-largest source of marine microplastic pollution (after tire and road wear particles) and they are the most common type of microplastic ingested by marine animals.

While wastewater treatment plants are the primary way that microfibers are removed from wastewater, their removal from wastewater does not truly remove them from ecosystems. Approximately 70-90% of all microfibers are removed from wastewater during water treatment in the form of biosolids that are then applied to agricultural lands as fertilizer, spreading microfibers directly on crop lands where they can leach into groundwater and agricultural runoff, eventually running into the ocean. Increasing the microfiber retention efficiency at wastewater treatment plants would simply shift this microfiber pollution to terrestrial environments. Furthermore, the application of biosolids on agricultural lands facilitates a directional flow of microfibers from higher-income urban

counties to lower-income rural communities. There is also growing research indicating that microfibers from biosolids are entering crops grown on these lands, which results in human consumption of microplastics. For these reasons, it is more effective to remove microfibers before they enter the wastewater system.

Adoption of in-line filters for washing machines prevents microfibers from entering wastewater treatment plants and the environment. Peer-reviewed studies and agency reports show that well-designed filters can retain up to 90% of microfibers before they ever enter the wastewater system. Field deployment of filters in community pilot studies have found substantial reductions in microfibers at wastewater treatment plants when even a portion of households used in-line microfiber filters on washing machines. Full adoption of in-line filters in washing machines would decrease annual synthetic microfiber emissions to natural environments by 79% and is anticipated to be more effective than strategies to remove microfibers from wastewater. Filters reduce the load of microfibers to wastewater systems, lowering the potential for environmental release via effluent or biosolids.

Shedding of synthetic microfibers during washing has increased in recent years and is expected to continue increasing as more and more clothes are made from synthetic materials. In the last ten years, approximately 11.2 million metric tons of synthetic fibers were shed globally - more than double the amount shed in the preceding 66 years. In 2019 as much as 2.2 kilotons (kt) of synthetic microfibers were generated by apparel washing in California alone, which is a 26% increase since 2008. Without intervention, annual synthetic microfiber emissions in California's natural environments are expected to continue increasing.

Policy Recommendations

To address the increasing issue of microfiber shedding during the textile washing, California state legislators should develop a mandate for all residential washing machines in California to include in-line filters specifically designed for microfibers. A new machine mandate would be easiest to implement because it avoids retrofit logistics for existing machines, making it less administratively complex and requiring less state-allocated funding. Mandating filters on all new washing machines sold in California would require minimal investment from the State and would be a cost-effective way to reduce microfiber pollution. In order to ensure success of the mandate, the legislature should require:

- **All new washing machines sold in California as of a certain date must include an in-line filter that captures at least 80% of all microfibers that result from**

textile washing. While AB 1628 (2023) used a mesh size ceiling to measure microfiber capture, recent scientific studies support the use of a performance-based standard instead. Mandate the use of an approved test method that would be developed no later than 18 months after the adoption of the policy.

- **Ensure the phase-in timeline for this policy reflects manufacturing lead times.** Manufacturing lead times for new washing machines are approximately 3-5 years, and thus the new policy should go into effect no sooner than 3 years from the date of adoption.

- **Require manufacturers to certify compliance with filtration requirements and provide test data.** Enforcement of this standard should mirror appliance energy efficiency programs, with State agencies auditing and spot-checking this reporting. Civil penalties should be defined for noncompliance.

- **Filters should carry clear labeling that indicates maintenance intervals, disposal instructions, and expected microfiber capture performance.** Require manufacturers to provide accessible instructions and design for ease-of-cleaning with tool-free filter access. Develop a product rating system similar to the Energy-Star system that considers both ease of use and filter performance to help consumers choose.

Further Reading

- Ocean Protection Council. 2021. Microplastic Pollution in California: A Precautionary Framework and Scientific Guide to Assess and Address Risk to the Marine Environment.
- Geyer, Roland, et. al. 2021. Quantity and fate of synthetic microfiber emissions from apparel washing in California and strategies for their reduction. Environmental Pollution.
- Ocean Conservancy. 2023. Fact Sheet: Microfiber Facts and Figures.
- Emenike, Ebuka Chizitere, et. al. 2023. From oceans to dinner plates: The impact of microplastics on human health. Heliyon.

Authorship

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