

## What are microfibers?

- Microfibers are thread-like materials less than 5mm in length. Those derived from synthetic or semi-synthetic materials are considered a kind of microplastic ([Marine Pollution Bulletin](#), [Environmental Toxicology & Chemistry](#)).
- It has been estimated that every year, approximately 6.5 million metric tons of microfibers are released into the environment globally ([Journal of Hazardous Materials](#)). That's equivalent to 32.7 billion t-shirts entering the environment each year.

## Sources

### Clothing and textiles

- The textile industry produces microfibers at each step of the production process, including spinning, weaving, cutting, sewing, and especially, the wet-processing and dyeing stages ([Environmental Chemistry](#)).
- Microfiber shedding also occurs from normal clothing wear. It has been estimated that the rubbing of clothing and fabrics during use can release up to 640,000 fibers per gram of material ([Science of the Total Environment](#)).
- 18 million microfibers may be released from a single load of laundry ([Environmental Science and Pollution Research](#)). One study reported 5.6 million metric tons of synthetic microfibers have been released from apparel washing from 1950 to 2016, with half of this amount emitted in the last 10 years ([PLOS ONE](#)).
- Tumble drying may cause a 3.5x increase in microfiber shedding compared to washing, where microfibers are released from dryer vents directly into the environment ([Environmental Science and](#)

[Pollution Research](#), [PLOS ONE](#)). In only 15 minutes, tumble drying can release over half a million microfibers into the air ([Environmental Science and Technology Letters](#)).

- Textiles with loose construction such as fleece may shed more, whereas high-twist yarns comparatively shed fewer microfibers ([Environmental Science and Pollution Research](#); [Environmental Science and Technology](#)). One study found that polyester fleeces released 6x more microfibers per wash than woven nylon ([PLOS ONE](#)).
- Higher washing temperatures and longer washing times increase microfiber release and shedding ([Environmental Pollution](#)).

### Cigarettes

- It is estimated that each cigarette butt is made of over 15,000 microfibers. Every year, cigarette butt pollution releases roughly 300,000 tons of microfibers into the environment ([Science of The Total Environment](#)). That's the equivalent to over 1 billion t-shirts entering the environment each year.
- Microfibers from cigarette butts can contain more than 4,000 toxic chemicals including tar, heavy metals such as arsenic and lead, and other harmful substances ([Waste Management](#)).
- Since 1986, Ocean Conservancy's International Coastal Cleanup volunteers have collected nearly 60 million cigarette butts from beaches and waterways.

### Other sources

- It is estimated that billions of microfibers can be released per disposable face mask as it degrades in the aquatic environment ([Science of the Total Environment](#)). According to Ocean Conservancy's [Pandemic Pollution Report](#), nearly 110,000 personal protective items were removed from beaches and waterways in the second half of 2020 alone.

- Disposable wet wipes made from polyethylene terephthalate (PET) and cellulose, PET or polypropylene (PP), and menstrual pads are also sources of microplastic fibers in the environment ([Water Research](#); [Environmental Challenges](#)).

## Environmental Impact

- Many scientific studies report that microfibers are the most common microplastics in environmental samples and in some studies, represent over 90% of all microplastics ingested by marine animals ([Environmental Pollution](#); [Environmental Pollution](#); [Marine Pollution Bulletin](#); [Environmental Chemistry Letters](#), [Marine Pollution Bulletin](#)).
- Researchers have found that 34.8% of all microplastics in the ocean are from synthetic textiles ([IUCN](#)).
- Ingestion of microfibers by wildlife has been associated with reduced food consumption, reduced energy for growth, and altered gene expression ([Water](#)). In some species, microfibers can also block digestive tracts, cause insufficient nutrient absorption, and internal damage ([Environmental Science and Technology](#)).
- Microfibers are produced with synthetic chemicals and have been shown to absorb and carry pollutants. These chemicals can then be passed on to wildlife when ingested ([Marine Pollution Bulletin](#)).
- Microfibers from washing machines end up in biosolids from wastewater treatment, which are often used to fertilize animal feed crop fields, spreading microplastics on these lands ([Current Opinion in Environmental Science & Health](#)).

## Human Health

- Recent estimates reveal adult humans likely take in over 320,000 microplastics per year ([Environmental Science & Technology](#)).
- Inhalation of airborne microplastic particles is a major route for human exposure to these pollutants. Humans may inhale up to 170 microplastics a day, most of which are likely microfibers ([Environmental Science & Technology](#)).
- Inhaled microfibers have been found in lung tissues, where they can cause inflammation, cell

and tissue damage, or respiratory lesions ([Science of the Total Environment](#); [Science of the Total Environment](#)). Bacteria and pathogens can also be found on the surface of microplastics and, when ingested by animals and humans, have the potential to spread disease ([Trends on Food Science and Technology](#); [Trends in Microbiology](#)).

## Solutions

- The installation of washing machine filters is an effective way to reduce microfiber pollution at the source. Studies comparing microfiber capture products found built-in or in-line filters reduce microfiber loss into wastewater by up to 87% ([PLOS ONE](#), [Science of the Total Environment](#); [Marine Pollution Bulletin](#)).
- When tested in 10% of households in a small community, washing machine filters were shown to significantly reduce microfibers in wastewater by up to 2.7 million microfibers per week. ([Frontiers in Marine Science](#)).
- Legislation to mitigate microfiber pollution has passed in France, requiring the installation of filters in all new washing machines by January 2025 ([Ministry of Ecological Transition](#)).
- Educational campaigns, deposit schemes, and smoking bans in sensitive environments to address cigarette litter can help decrease microfiber pollution generated from cigarette butts ([Journal of Hazardous Materials](#)).
  - Ocean Conservancy [helped pass HB105](#) in Florida which enables municipalities to ban smoking on local beaches, reducing microfiber pollution.
- Improvements to textile properties are another area of opportunity to reduce microfiber pollution. Textile manufacturers could prioritize products with high-twist fibers with high tensile strength and avoid mechanically finished fabrics like fleece ([Environmental Science and Pollution Research](#)).
- Individuals can help decrease laundry microfiber emissions by washing clothing in colder water, shorter wash cycles, and air-drying instead of tumble-drying ([PLOS ONE](#)).