# UNDERSTANDING THE DEPTH OF THE PLASTICS PROBLEM

# THE FACTS ON PLASTIC ARE SINKING IN.

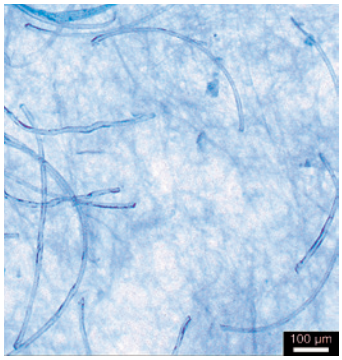
According to the United Nations Environment Program, plastics are the largest, most harmful, and most persistent form of ocean debris, accounting for at least 85 percent of total marine waste[1]. And the volume is growing every year, with the amount of plastic waste entering aquatic ecosystems projected to nearly triple from 9-14 million tons per year in 2016 to 23-37 million tons per year by 2040[1].

These plastics are wreaking havoc on marine systems and can cause a wide range of biological, economic, and societal impacts on marine life and humans[1]. That's why Cotton Incorporated is dedicated to learning more about this global problem and finding solutions.

## TINY FIBER, BIG PROBLEM.

Microplastic waste in the oceans is a particularly relevant environmental problem to the textile industry. Microfibers—particles generally smaller than 5 mm—are generated every time a piece of fabric is worn or washed[2], and synthetic microfibers are unable to biodegrade under wastewater treatment conditions[3]. Consequently, with each laundry cycle, synthetic microfibers could be discharged into our waterways. While all fabrics shed microfibers, synthetic fabrics like polyester or nylon generate microfibers that are classified as microplastics, which can be significantly more damaging due to their persistence and inability to biodegrade[3,4]. Research shows these microplastics contribute to growing pollution in the earth's water supply[1] .

**MICROPLASTICS ARE FOUND IN THE FOOD CHAIN, FROM FISH TO DRINKING WATER[1].**




**HOW TINY IS TINY? THESE POLYESTER MICROFIBERS AVERAGE 0.58 MM IN LENGTH, ACCORDING TO RESEARCH CONDUCTED, AND ARE OFTEN UNDETECTABLE TO THE EYE.**

# CONCERN IS RISING.

Based on Cotton Incorporated's Lifestyle Monitor™ research, the number of consumers aware of microplastic pollution has grown to 45%, up from 27% in 2018. Among those who are aware of the issue, 65% recognized that clothing made from synthetic materials, like polyester, impacts the problem of microplastic pollution[8].

According to the CCI & Cotton Incorporated 2023 Global Sustainability Survey[9]:

> **7 in 10 global consumers said sustainability influences their apparel buying decisions**

> **87% of consumers believe cotton is safe for the environment, while only 41% hold the same belief about Polyester.**

**GET THE FACTS:**

**One credit card's worth of microplastics is consumed per person, per week on average[5].**

**35% of ocean microplastic pollution is caused by synthetic textiles[6,7].**

# DIGGING DEEPER.

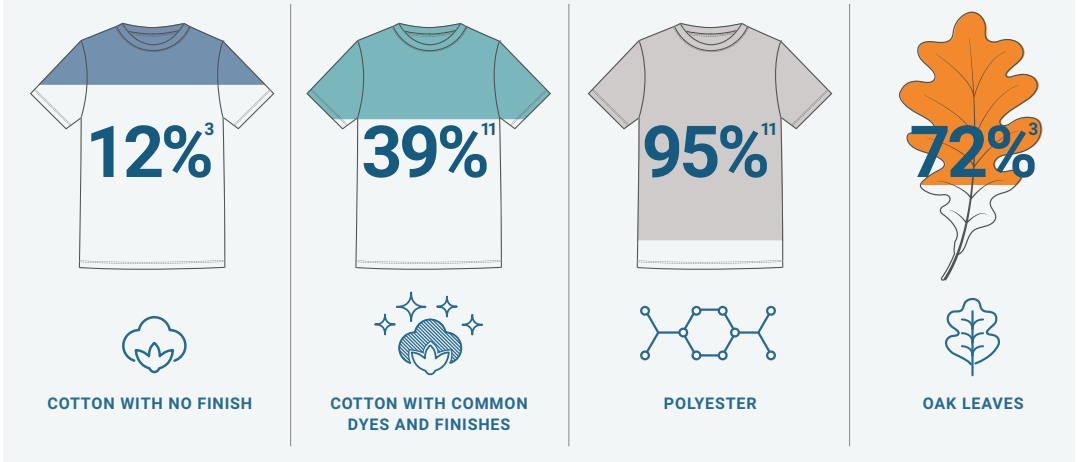
For over a decade, Cotton Incorporated has been at the forefront of research into textile biodegradability. The findings consistently demonstrate that cotton fibers biodegrade significantly faster and more completely than synthetic alternatives in a variety of environments[3,4]. Whether in aquatic settings such as wastewater, freshwater, or saltwater, or in terrestrial conditions like compost and soil, cotton biodegrades far more rapidly than petroleum-based textiles like polyester, which exhibit minimal to no degradation in any of these environments[3,4].

When tested in different aquatic environments most cotton samples degraded by more than 60% in less than 20 days.

- In freshwater, 77% of cotton microfibers will break down while microfibers from cotton/ polyester blended garments only break down by 33%, and polyester microfibers have no appreciable biodegradation[4].
- In seawater, there is a similar disparity, with cotton microfibers degrading by 49% versus 4% for polyester[4].

## TEXTILE FIBERS VERSUS AN OAK LEAF:

**WHAT'S LEFT AFTER A MONTH IN WASTEWATER CONDITIONS?**




Cotton Incorporated continued its research with North Carolina State University to dig deeper and determine whether commonly used textile finishes influence the high degradation rates of cotton microfibers. The results indicated that although the initial biodegradation rate was impacted by the type of finish and dye, each cotton fiber sample underwent significant biodegradation, regardless of finish type. In fact, when compared to an oak leaf, cotton with softener, MCC, water repellant, no finish and with dye, all biodegraded faster than an oak leaf[11].

More recently, Cotton Incorporated and North Carolina State University investigated the environmental impact of microfibers, and other materials that are commonly flushed, that end up in the wastewater stream. This study examined the biodegradation of cotton microfibers, wood pulp-based toilet tissue paper, flushable wipes, and polypropylene-based nonwoven wipes in various water environments. The research revealed that cellulosic microfibers from cotton apparel biodegrade more rapidly than those from toilet tissue paper under all tested conditions while synthetic materials like polypropylene did not appear to degrade at all[12]. The high biodegradability of cotton and cellulosic materials suggests that choosing natural fibers over synthetic alternatives can contribute to reducing the accumulation of non-biodegradable waste in our environment.

COTTON MICROFIBERS READILY BIODEGRADE IN AQUATIC ENVIRONMENTS WHEREAS POLYESTER MICROFIBERS DO NOT[3].

## TURNING THE TIDES WITH COTTON.

Research like this continues to enhance our understanding of the plastic pollution problem and points towards natural fibers like cotton playing a role in the global solution.

How can you help? Sourcing apparel, home fabrics, and household products that are made from natural fibers such as cotton, are some of the ways that the industry can lower the amount of synthetic microplastics entering the environment. Learn more at CottonWorks.com.

Cotton Incorporated



Sources: 1. United Nations Environment Programme (2021). From Pollution to Solution: A Global Assessment of Marine Littler and Plastic Pollution. Nairobi. 2. Zambrano, M. C., Pawlak, J. J., Daystar, J., Ankeny, M., Cheng, J. J., & Venditti, R. A. (2019). Microfibers generated from the laundering of cotton, rayon and polyester based fabrics and their aquatic biodegradation. Marine Pollution Bulletin, 142 (November 2018), 394–407. https://doi.org/10.1016/j.marpolbul.2019.02.062 3. Zambrano, M. C., Pawlak, J. J., Daystar, J., Ankeny, M., Goller, C. C., & Venditti, R. A. (2020). Aerobic biodegradation in freshwater and marine environments of textile microfibers generated in clothes laundering: Effects of cellulose and polyester-based microfibers on the microbiome. Marine Pollution Bulletin, 151(January). https://doi.org/10.1016/j.marpolbul.2019.110826 4. Li, Lili & Frey, Margaret & Browning, Kristie. (2010). Biodegradability Study on Cotton and Polyester Fabrics. Journal of Engineered Fibers and Fabrics. 5. Kala Senathirajah et al. (2021). Estimation of the Mass of Microplastics Ingested – A Pivotal First Step towards Human Health Risk Assessment. Journal of Hazardous Materials 404: p. 124004, https://doi.org/10.1016/j.jhazmat.2020.124004. 6. Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN. 7. World Economic Forum. (2016). The New Plastics Economy: Rethinking the future of plastics. 1–36. http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf. 8. Cotton Incorporated 2023 Lifestyle Monitor Survey. 9. CCI & Cotton Incorporated's 2023 Global Sustainability Survey. 10. Textile Exchange. (2023). Materials Market Report. Textile Exchange (p. 10). 11. Zambrano, M. C., Pawlak, J. J., Daystar, J., Ankeny, M., & Venditti, R. A. (2021). Impact of dyes and finishes on the aquatic biodegradability of cotton textile fibers and microfibers released on laundering clothes : Correlations between enzyme adsorption and activity and biodegradation rates. Marine Pollution Bulletin, 165(January), 112030. https://doi.org/10.1016/j.marpolbul.2021.112030 12. Smith, M. M., Zambrano, M., Ankeny, M., Daystar, J., Pires, S., Pawlak, J., and Venditti, R. A. (2024). Aquatic aerobic biodegradation of commonly-flushed materials in aerobic wastewater treatment plant solids, seawater, and lakewater, BioResources 19(1), page 1160. DOI: 10.15376/biores.19.1.1150-1164