Small Particles, Big Problems: The Fight Against Microplastic Pollution

Tuan Nguyen

English Language Learning and Acquisition Department, Douglas College

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Tina Fusco

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Imagine accidentally consuming a credit card's worth of plastic every week. Microplastics are found almost everywhere on the planet, from the highest peaks of Mount Everest to the deepest depths of the Mariana Trench, and people have been eating as much microplastic as a credit card every week without even realizing it (United Nations, 2021). Microplastics are considered a global issue due to their negative impact on the environment, marine life, ocean ecosystems, and human health. Microplastics are tiny plastic particles, typically smaller than 5 millimeters in size, that result from the breakdown of larger plastic waste or are manufactured for specific uses, such as in cosmetics, synthetic clothing, and industrial processes. They are commonly found in oceans, rivers, and soil. This problem became widespread in the 1940s with the appearance of synthetic fibers, which were made from plastic. These synthetic materials were cheap to produce and comfortable, leading to increased clothing production using plastics. By the 1950s, the plastics industry saw significant growth, which led to an explosion in plastic production and usage. Since then, a massive amount of plastic has been created, with estimates of around 8.3 billion tons produced by humans (Geyer et al., 2017). Statistics show that an estimated 5.25 trillion pieces of plastic debris are in the ocean. This number increases by about 11 million metric tons per year and could grow to 29 million metric tons over the next 20 years (Beachapedia, n.d.). Research published in 2015 shows that microplastics are consumed by plankton and other marine creatures, entering the food chain and eventually reaching humans through seafood consumption (Rochman et al., 2015). While some efforts have been proposed to combat this phenomenon, such as bans on single-use plastics, recycling, and consumer education, these measures are still not enough. Fortunatelly, with constant efforts along with the advancement technology, more effective solutions have been discovered. These solutions provide a more sustainable way to overcome microplastic pollution. Microplastic pollution can be addressed at various stages of its lifecycle, such as preventing its release through washing machine filters, capturing it in water with treatment wetlands, and breaking it down with bioremediation.

To reduce microplastic pollution, the first step is preventing its release at the source. Therefore, installing washing machine filters has become an effective solution for reducing the release of harmful particles into the environment. Microplastics are tiny plastic particles that often enter waterways through household activities, such as washing clothes made of synthetic fabrics (Vox, 2019). These microplastics, which are smaller than 5mm, are difficult to capture in traditional wastewater treatment systems, and their accumulation in oceans and rivers poses a significant threat to marine life and ecosystems. According to a study in 2016, laundry is one of the largest sources of microplastic pollution, with over 700,000 fibers being shed during a single wash cycle (Napper & Thompson, 2016). Installing washing machine filters has been suggested as a effective solution to mitigate this issue by trapping these microplastics before they are released into the water system. The filters are designed to capture fibers that break off from synthetic fabrics such as polyester, nylon, and acrylic (Abourich, 2024). This method significantly reduces the amount of microplastics entering the aquatic environment, therefore limiting their negative effects. Furthermore, another study highlights that adding filters to washing machines could contribute to the efforts to reduce plastic pollution (Erdle et al., 2021). Their research shows that installing these filters can reduce the amount of microplastics entering the water by up to 80%. This highlights the potential of washing machine filters in preventing microplastic pollution. Although there are still some limitations to this solution due to the high cost of the filter, the long-term benefits outweigh the disadvantages. By adding these filters into washing machines, individuals can contribute to the reduction of environmental contamination. As a result, washing machine filters offer an accessible and effective solution for reducing the release of microplastics, therefore mitigating their harmful impact on the environment and aquatic life.

After microplastics enter wastewater systems, treatment wetlands play a crucial role in capturing and reducing microplastics from wastewater through natural filtration and biological processes. According to a study published in 2023, Treatment wetlands has been shown to be effective in reducing microplastics with an efficiency between 88% to 98%, by taking advantage of the role of vegetation to trap and retain microplastics (Cabrera et al., 2023). The dense root systems of macrophytes (large, aquatic plants) in horizontal subsurface flow and floating plant systems create a physical barrier that captures microplastics while also promoting the formation of biofilm, which enhances adsorption and biodegradation. The study also found that microplastic concentrations in horizontal subsurface flow and floating plant systems wetlands were reduced from 20.3 microplastic particles per liter (MP/L) and 8.4 MP/L to 0.58 MP/L and 0.17 MP/L, respectively, demonstrating their effectiveness in trapping microplastics (Cabrera et al., 2023). Additionally, another study published in 2024 highlights that microplastics in conventional wastewater treatment plants are mainly trapped in sewage sludge, which may later contribute to environmental pollution if not managed properly (Bodzek et al., 2024). Treatment wetlands help mitigate this problem by trapping microplastics in the roots and gravel, preventing them from re-entering the aquatic system. Furthermore, bacteria and worms present in treatment wetlands also help degrade microplastics through biodegradation processes, reducing their impact on the environment (Lwanga et al., 2018). However, treatment wetlands still have some limitations, such as requiring large land areas and slower processing time. Despite these challenges, their ability to filter pollutants and support biodiversity still makes them a sustainable solution. The natural retention and degradation mechanisms in Treatment wetlands make them a promising eco-friendly solution for addressing the growing concern of microplastic pollution. By incorporating treatment wetlands into existing wastewater treatment systems, it is possible to significantly reduce microplastic contamination.

Once microplastics are captured, bioremediation offers a promising solution to break them down by using bacteria and earthworms to degrade plastic waste. As microplastic pollution continues to threaten ecosystems, researchers are exploring the role of bacteria in accelerating the breakdown of plastic. In their study, they investigated the potential of bacteria from the gut of the earthworm named *Lumbricus terrestris* to degrade low-density polyethylene (LDPE), which is a common type of microplastic (Lwanga et al., 2018). Researchers found that bacteria isolated from earthworm guts, specifically from the phylum *Actinobacteria* and *Firmicutes*, could significantly reduce LDPE particle size in a microcosm experiment. After 21 days, 60% of the LDPE microplastics had decayed in the presence of these bacteria, while no degradation occurred in gamma-sterilized soil without bacteria. This highlights the role of gut bacteria in breaking down long-term plastic waste. Furthermore, another study emphasized that various soil microorganisms, including bacteria and fungi, can degrade different types of plastics using enzymes such as *laccase*, *esterase*, *peroxidase*, and *hydrolases* (Thapliyal et al., 2024). These enzymes break down the larger plastic chains into smaller units, which are ultimately mineralized into CO2, H2O, and CH4. This process indicates that bacteria in the soil environment can contribute to the degradation of microplastics, helping to reduce their negative impact on the environment. While offering a promising approach to mitigate microplastic pollution, bioremediation still faces some challenges in implementation. Nevertheless, its long-term advantages outweigh these drawbacks, making it a feasible and effective solution. Overall, the research highlights the potential of bioremediation as an innovative approach to mitigate plastic pollution, therefore offering a sustainable solution to accelerate microplastic degradation.

The fact is that microplastic pollution is a growing global concern that threatens marine life, ecosystems, and human health. These tiny plastic particles have spread to every corner of the planet, from our oceans to the food we consume, negatively impacting the environment and human health. While efforts such as washing machine filters, treatment wetlands, and bioremediation provide promising and effective solutions, the fight against microplastics still requires continuous innovation as well as widespread implementation. Without action, microplastic pollution will get worse, exacerbating its impact on biodiversity and the environment. To mitigate this crisis, governments, industries, and individuals need to collaborate to raise awareness and reduce the use of plastic products. Ultimately, the fight against microplastic pollution is not just about cleaning up the environment, it's also about protecting the future of our planet.

References

Abourich, M., Bellamy, A., Ajji, A., & Claveau-Mallet, D. (2024, August). Washing machine filters to mitigate microplastics release: Citizen science study to estimate microfibers capture potential and assess their social acceptability. *Environmental Challenges, 16*, 100984. https://doi.org/10.1016/j.envc.2024.100984

Beachapedia. (n.d.). *Plastic pollution facts and figures.* https://beachapedia.org/Plastic_Pollution_Facts_and_Figures

Bodzek, M., Pohl, A., & Rosik-Dulewska, C. (2024). Microplastics in Wastewater Treatment Plants: Characteristics, Occurrence and Removal Technologies. *Water (20734441), 16*(24), 3574. https://doi.org/10.3390/w16243574

Cabrera, D. C., Wang, Q., Martín, M., Rajadel, N. O., Rousseau, D. P. L., & Hernández-Crespo, C. (2023). Microplastics occurrence and fate in full-scale treatment wetlands. *Water Research, 240*, 120106. https://doi.org/10.1016/j.watres.2023.120106

Erdle, L. M., Nouri, P. D., Sweetnam, D., & Rochman, C. M. (2021). Microplastic pollution and potential ecological impacts in the world's oceans. *Frontiers in Marine Science, 8*, 777865. https://doi.org/10.3389/fmars.2021.777865

Eriksen, M., Lebreton, L. C. M., Carson, H. S., Thiel, M., Moore, C. J., Borerro, J. C., Galgani, F., Ryan, P. G., & Reisser, J. (2014, December 10). Plastic pollution in the world's oceans: More than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. *PLOS ONE, 9*(12), e111913. https://doi.org/10.1371/journal.pone.0111913

Geyer, R., Jambeck, J. R., & Law, K. L. (2017, July 19). Production, use, and fate of all plastics ever made. *Science Advances, 3*(7), e1700782. https://doi.org/10.1126/sciadv.1700782

Interesting Engineering. (2020, April 10). *How plastic is destroying our environment and what to do about it* [Video]. Youtube. https://www.youtube.com/watch?v=G8MO_8Zfu3Q

Lwanga, H. E., Thapa, B., Yang, X., Gertsen, H., Salánki, T., Geissen, V., & Garbeva, P. (2018). Decay of low-density polyethylene by bacteria extracted from earthworm's guts: A potential for soil restoration. *Science of the Total Environment, 624*, 753–757. https://doi.org/10.1016/j.scitotenv.2017.12.144

Mulhern, O. (2021, November 19). *How many marine animals die from plastic each year?* Earth.Org. https://earth.org/data_visualization/how-many-marine-animals-does-ocean-plastic-kill/

Napper, I. E., & Thompson, R. C. (2016, November 15). Release of synthetic microplastic plastic fibres from domestic washing machines: Effects of fabric type and washing conditions. *Marine Pollution Bulletin, 112*(1–2), 39–45. https://doi.org/10.1016/j.marpolbul.2016.09.025

Rochman, C. M., Tahir, A., Williams, S. L., Baxa, D. V., Lam, R., Miller, J. T., Teh, F.-C., Werorilangi, S., & Teh, S. J. (2015, September 24). Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. *Scientific Reports, 5*, 14340. https://doi.org/10.1038/srep14340

Taylor, M. L., Gwinnett, C., Robinson, L. F., & Woodall, L. C. (2016, September 30). Plastic microfibre ingestion by deep-sea organisms. *Scientific Reports, 6*, 33997. https://doi.org/10.1038/srep33997

Thapliyal, C., Priya, A., Singh, S. B., Bahuguna, V., & Daverey, A. (2024). Potential strategies for bioremediation of microplastic-contaminated soil. *Environmental Chemistry and Ecotoxicology, 6*(117–131). https://doi.org/10.1016/j.enceco.2024.05.001

United Nations. (n.d.). *Fact sheet: Pollution in the ocean*. United Nations Sustainable Development. https://sustainabledevelopment.un.org/content/documents/Ocean_Factsheet_Pollution.pdf

United Nations. (n.d.). *In images: Plastic forever*. United Nations. https://www.un.org/en/exhibits/exhibit/in-images-plastic-forever

Vox. (2019, February 25). *Why these plankton are eating plastic* [Video]. Youtube. https://www.youtube.com/watch?v=beUhzQAkanM