



Waste Water – Microplastics – Filtration of Nodules

CHALLENGE STATEMENT

- One pathway for microplastics that are used in our households to enter the environment is through wastewater. Microplastics can be released from cosmetics, such as facial scrubs and toothpaste, from detergents used in laundering and dishwashing, from plastics flushed down the toilet (e.g., disposable contact lenses, feminine hygiene products, wet wipes) and even from our clothes during washing. Municipal wastewater treatment plants can capture up to 99% of outgoing microplastics through skimming and settling mechanisms. However, the fraction that is not captured equates to billions of microplastics being discharged daily, directly into aquatic ecosystems.
- Design a technology or method to improve capture of microplastics in outgoing wastewater. Consider solutions that could work in households and/or at industrial or municipal wastewater treatment plants. When designing, consider cost, materials, feasibility and ease of use.





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TAKE THE FOLLOWING STEPS TO DEVELOP YOUR PROJECT:

1. Identify Waste Water stream concerns

- Explore the different types of microplastics that enter the wastewater stream.

2. DATA GATHERING

- The microplastics generated from different sources have different physical and chemical properties, such as size, shape, density. These differences can affect how easily they can be captured by different methods (i.e., filtration, settling). When designing, consider how effectively your technology or method can capture different types of microplastics.



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TAKE THE FOLLOWING STEPS TO DEVELOP YOUR PROJECT (CONTINUED):

3. SCENARIO COMPARISON

- Washing machine filters:

<https://www.youtube.com/watch?v=xSMx-7GZIFU>

<https://www.youtube.com/watch?v=XK9UGN3JEHU>

**There are other washing machine filter designs worth studying, such as the X-Filtra, Filtrol, PlanetCare, and Lint-LUVR.*

- Clumping solutions:

<https://www.youtube.com/watch?v=iuOd4aGzHjQ>

<https://www.youtube.com/watch?v=-XCLZcfxxGM>

Some technologies that have been designed are inspired by designs found in nature, such as the [Cora Ball](#) based on coral or [manta ray-inspired surface filters](#).

4. TO BE SOLUTION

Emphasize the advantages in which the realization of your project will bring with respect to the current situation.

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BACKGROUND & KEY CONCEPTS:

- Wastewater is a well-known pathway for microplastics (plastic particles <5 mm) to enter aquatic environments. [Sources of microplastics](#) to wastewater are varied and include [improper disposal of plastic products](#), such as feminine hygiene products, contact lenses and wet wipes. [Cosmetics](#), such as toothpaste and exfoliants, and detergents can also contain microplastic spheres and irregularly-shaped fragments. Laundering is another major source of microplastics to wastewater. When we wash our clothes, small plastic fibers are shed from synthetic clothing materials (e.g., polyester fleece and nylon) into wastewater.

- The configuration of wastewater treatment facilities may vary slightly, but generally include primary treatment, which utilizes mesh screens to remove large items, and secondary treatment, to remove organic materials through settling and introduction of microorganisms. Wastewater then generally undergoes a disinfection process prior to being discharged as final effluent. Approximately 50% of global wastewater is treated in wastewater treatment facilities.



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BACKGROUND & KEY CONCEPTS:

- Municipal wastewater treatment facilities are generally effective at removing microplastics through skimming and settling processes, up to [99% removal](#) in some cases! However, the fraction of microplastics that are not captured equates to billions of microplastics discharged directly into aquatic ecosystems daily.



- A number of technologies and methods have been designed to capture microplastics in wastewater prior to their release from the environment. These include solutions in the home, such as washing machine filters, laundry bags and balls. When deployed on a community-scale, [researchers have shown](#) that washing machine filters can significantly reduce microplastics in wastewater. Other solutions focus on municipal wastewater treatment innovations, including surface skimmers and clumping agents.



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REFERENCES:

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- Environmental Pollution article on microplastic discharge from wastewater treatment facilities:
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- Beat the Bead article on microplastic use in rinse-off cosmetics:
<https://www.beatthemicrobead.org/wp-content/uploads/2022/06/Plastic-TheHiddenBeautyIngredients.pdf>
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