ISSUE BRIEF

# Microplastics Mitigation/Removal/Treatment in the Plastic Recycling Process

September 2023

## Issue Overview

The Journal of Hazardous Material Advances published an article in May 2023 that detailed a study of microplastics in the wastewater of a plastics reclaiming plant in the United Kingdom.[1]

This study found residual microplastics in measurable quantities in the wastewater after this plant's mechanical filtration process and concluded that further processing of the wastewater to remove microplastics would be appropriate. The study did not identify any further processing of the wastewater or where the wastewater was being discharged to—important factors when evaluating the entire water treatment process. Media reports raised concerns about the presence of microplastics in wastewaters of all plastics recycling plants.

[1] Brown, E., MacDonald, A., Allen, S., & Allen, D. (2023, May 1). The potential for a plastic recycling facility to release microplastic pollution and possible filtration remediation effectiveness. Journal of Hazardous Materials Advances. https://www.sciencedirect.com/science/article/pii/S2772416623000803?via%3Dihub

## Introduction

This paper provides information on the wastewater treatment processes typically used in North American plastic reclaiming plants and identifies best manufacturing practices to prevent microplastics from entering the environment.

## The Plastic Recycling Process

Post-consumer plastic recycling entails the following:

### Sorting:

After collection from households and businesses, the whole containers are sorted at Material Recovery Facilities (MRFs). Various mechanical and electrical devices direct the packages into material-specific streams that are then baled and sold in truckload quantities to reclaimers. These reclaimers further sort the whole packages prior to further processing. Up to this point in the process, the items remain intact.

### Cutting:

The whole packages are cut into plastic flakes with a high-speed grinder or a similar machine. Most of the flakes created in the grinding phase range from 3 to 16 mm in size but a fraction are < 3mm and are termed "plastic fines."

**Reclaimers attempt to avoid creating plastic fines which reduce yield and profitability.**

### Washing and Drying:

The flake is aggressively washed, separated by density, rinsed, dried, and further melted and treated. These processes, and the conveyance of the flake between them, are mechanically intensive and can break the flakes into fines. The number and size of fines created depends on the washing technology and the type of plastic being recycled. The most common practice is to employ a filter within each process step to capture and remove fines from the internal wash water. The water is conserved and recirculated in each step before being discharged to the reclaimer's water treatment facility as illustrated in Figure 1. Plastic fines captured by the filters in the steps above are either sold to processors that can use them or brought to a sanitary landfill. Examples of processors that typically purchase fines include insulation manufacturers and chemical recyclers.

### Discharge Water:

The water discharged from the washing and drying process (washing line) contains small particles of dirt, paper, glass, and plastic fines. In wastewater treatment (WWT) terminology, these are called Total Suspended Solids (TSS). The reclaimer's on-site WWT facility treats the wastewater from the washing line before the water exits the reclaimer's facility. The water then enters the sewer system and, finally, the municipal or regional WWT facility (the town's sewer treatment plant). The function of the reclaimer's WWT system is to prepare the water being discharged into the sewer system so that it meets all applicable local, state, and federal regulations and is acceptable for the local municipal wastewater treatment facility.

The other common considerations for the WWT are Biological Oxygen Demand (BOD) and pH. Typically, the reclaimer's WWT adjusts the pH of the water in the same way a swimming pool pH would be adjusted—by adding acid or base. The reclaimer's WWT next step addresses TSS in a process called Dissolved Air Floatation (DAF), which removes solids of all materials and sizes. The DAF process adds a flocculant to the water so that solids attract each other and clump together in a form called flock. Next, micro

air bubbles are added, which bind to the flock to make it float. The flock can then be skimmed off the top and sent to a centrifuge or filter press to remove the liquid. The liquid from the centrifuge or filter press is returned to the beginning of the reclaimer's wash process. Nearly all North American plastic recycling facilities that use water utilize this process.[2]

Some municipal water treatment facilities require the BOD to also be reduced. In this case, the reclaimer's WWT facility includes a process to treat BOD that is similar to the municipality's WWT: the water is placed in a tank with bacteria that consumes the BOD. This process does not remove solids.

All final water discharge is directed to the sewer system. Water from North American plastics reclaimers is not discharged directly to an open water source. The plant works closely with the municipal wastewater treatment facility to monitor discharged water quality (Figure 2).

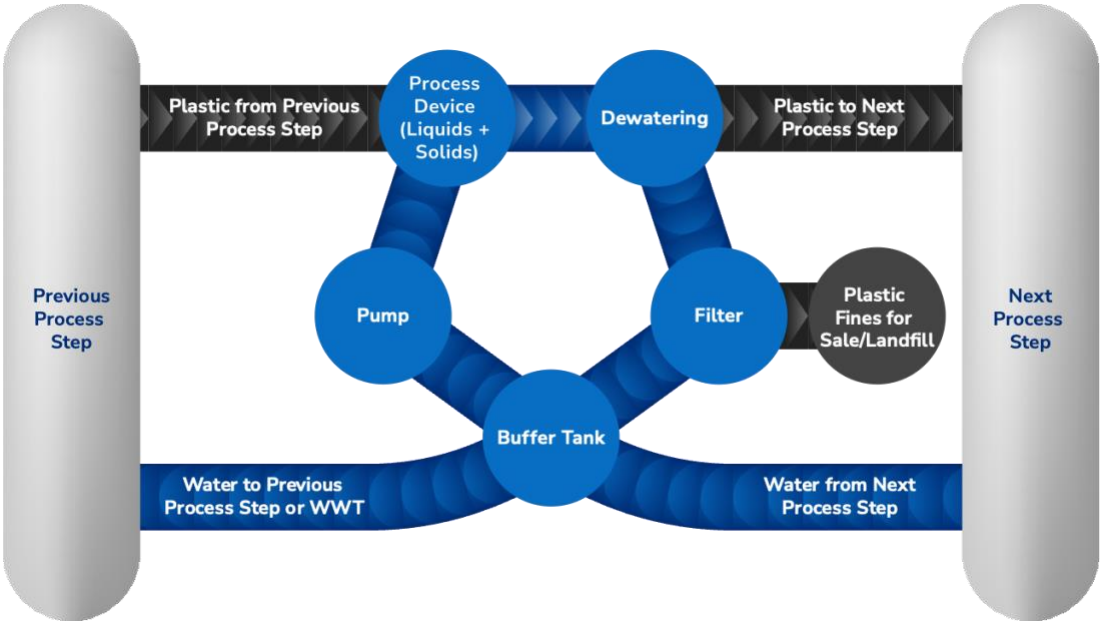


**FIGURE 1. A TYPICAL WATER LOOP**

*Note: There are multiple loops in a system. Recirculating water throughout the recycling process conserves this valuable natural resource.*

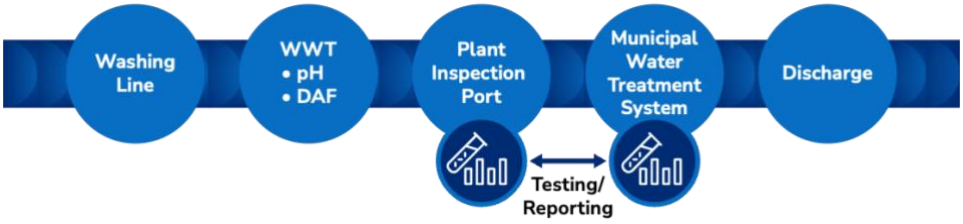


**FIGURE 2. A TYPICAL PLASTIC RECYCLING SYSTEM WATER DISCHARGE PROCESS**

*The reclaimer and municipal wastewater treatment facility work together to monitor discharged water quality.*

[2]*Kemco Systems (2023, September 5). Dissolved Air Flotation. Kemco Systems. https://www.kemcosystems.com/technology/wastewater-recovery/dissolved-air-flotation/#:~:text=What%20is%20DAF%3F,pressure%20in%20a%20flotation%20tank.*

## Best Practices

APR encourages recyclers to use best manufacturing practices to ensure microplastics generation is minimized. Any microplastics generated should be captured, treated properly, and not released into the environment:

1. Sharpen or replace grinder blades frequently in order to minimize the amount of plastic fines created.
2. Work closely with your municipal water treatment facility and communicate often.
3. Use sealed containers to transport loose plastic fines, flake, and pellets. For more detailed information refer to Operation Clean Sweep.[3]
4. Install concrete or asphalt under all areas where resin spillage may occur including rail loading areas and pneumatic conveying systems.
5. Promptly address all resin spills.
6. Install storm water containment systems with resin removal devices.

[3]American Chemistry Council, Plastics Industry Association (2023, September 5). *Operation Clean Sweep Program Manual*. Plastics Industry Association https://www.opcleansweep.org/wp-content/uploads/OCS-Manual.pdf