The Potential for Microplastics in Reclaimed Water and Residual Solids: A Study of Population Effect on Microplastic Concentration

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Introduction

- Wastewater from sewage plants has been looked to be reused for irrigation, and reclaimed solids for compost; however, this may introduce microplastics (MPs) to soil and water systems.
- Wastewater treatment techniques have proven effective in removing MPs, however results vary and a complete system has not been tested to see their fate.
- The Amherst Water Treatment Plant is a closed system, so we were able to reliably test each part of the system, from source to effluent.

Methods

- Filtered sample using a vacuum and 5micron steel filter
- Used a peroxide digestion to clean the sample (1-4 times)
- Filtered again and rinsed with methanol
- Moved from beaker to IR-Reflective Microscope slides.
- Imaged for microplastics using an 8700 LDIR.

Results

- The sewers contained large amounts of microplastics, mainly near the Worcester dining commons, and the life sciences lab, but all saw high amounts of microplastics.
- The amount of microplastics seen throughout the wastewater treatment process decreased throughout the process.
- The population effect will be tested two weeks after move-in date for students.

Conclusion

- Microplastics enter the sewage systems and appear in untreated and treated wastewater. The type, and size of microplastic differs depending on where the sample was collected.

Future Research

- Continue research looking into population size and MPs found in wastewater
- Look at water samples going directly to fields for irrigation
- Determine where in the treatment process MPs are removed.

Is microplastic concentration in wastewater dependent on population size? What are the sources and fate of different polymer microplastics?

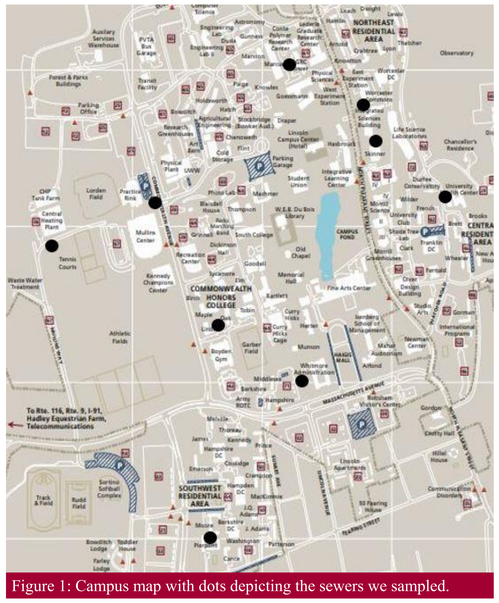


Figure 1: Campus map with dots depicting the sewers we sampled.

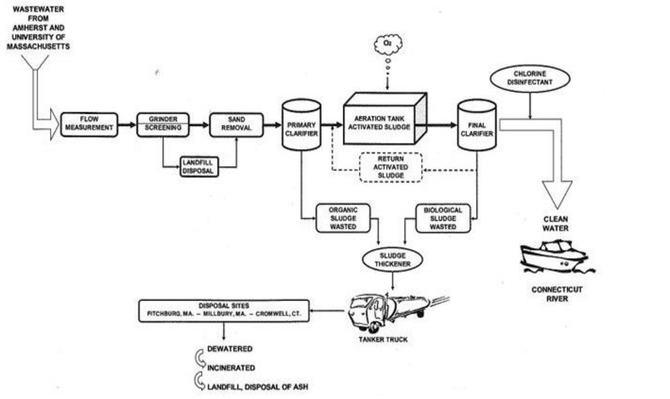
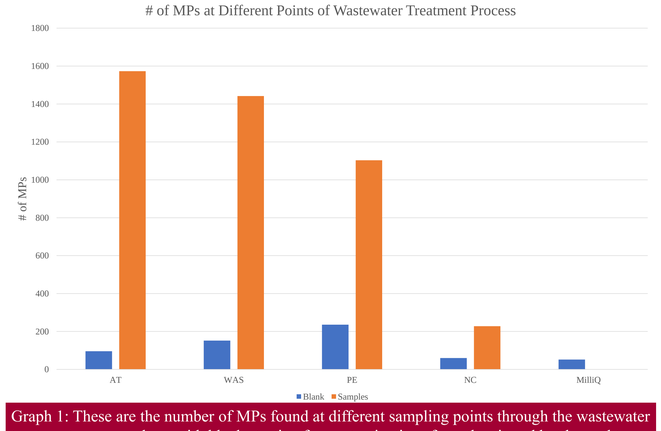
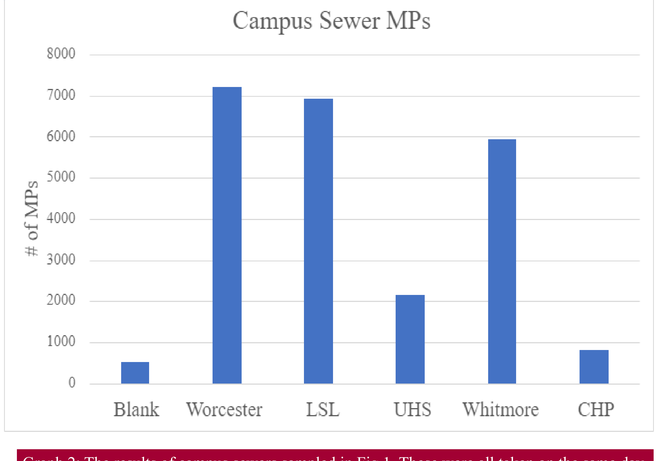


Figure 2:Wastewater treatment process at Amherst Wastewater Treatment Facility with dots representing where we sampled in the process

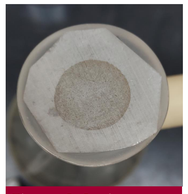
Figure 3:The primary effluent settling tanks at the Amherst Wastewater Treatment Facility in 1979. The aeration basin for can be seen behind.



Graph 1: These are the number of MPs found at different sampling points through the wastewater treatment process, along with blanks testing for contaminations from the air and bottle used to contain the samples.



Graph 2: The results of campus sewers sampled in Fig 1. These were all taken on the same day, in the summer before students moved in.



Figures 5: 5-micron filter after filtration of a sample. The larger organic and inorganic molecules remain.

Figure 4: Vacuum filtration set up with a removable 5-micron stainless steel filter

Figure 6: Kevley slide with sewer sample prepared.

Figure 7: Screenshot of a sample being analyzed in the Agilent 8700 LDIR. Sample was taken from the sewer next to the Physical Plant at Umass Amherst.

Figure 8: Polymers of interest for the different sample types, grouped by size.