The Search for Microplastics in an Urban Stream

Karen Hicks*, Dr. Kang Xia**

*NSF-RET fellow, Virginia Tech (Home Institution: Glenvar High School, Roanoke County Schools)

** Virginia Tech, Department of Crop and Soil Environmental Science

NSF RET Site: WaterECubedG

Abstract

Plastics are a part of our daily lives. They are components of the clothes we wear, the cars we drive and the packaging for our food. As the plastics break down, either as a part of normal wear and tear, or as part of the decomposition process, particles and fibers are released into the environment. This project was designed to determine the occurrence of microplastics in an urban stream using simple techniques and equipment applicable to a high school setting. Sediment samples were collected at several sites along Stroubles Creek on the Virginia Tech campus. The sediment samples were sieved, and the fine sediment was run through an elutriation tube to separate the plastics from the soil. The material collected was further treated with a 3.3M sodium iodide solution and centrifuged to separate the lighter plastic material from heavier sediment materials. Examination of the lighter materials under a 2X and a 10X power microscope identified suspected microplastic particles. Further examination of sediment samples needs to be conducted using a 40X or higher power microscope. Digestion of biological matter using peroxide oxidation could assist in verifying the material isolated is plastic. Sampling for microplastics in the water column needs to be conducted to determine the plastic abundance.

Research Objectives

- To build a cost effective and easy to operate sampling device to separate microplastic particles from sediment
- To determine occurrence of microplastics in two urban streams (Fig. 1-3)
- To transfer this research to high school students to monitor occurrence of microplastics in the Little Bear Creek, Roanoke River, and the Chesapeake Bay

Figure 1: Little Bear Creek

Figure 2: floating debris in the duck pond

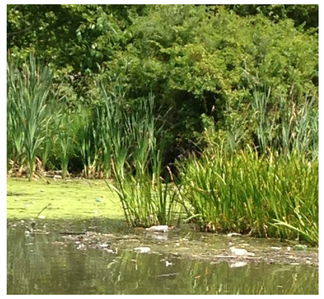

Figure 3: Virginia Tech Duck Pond

Research Methods

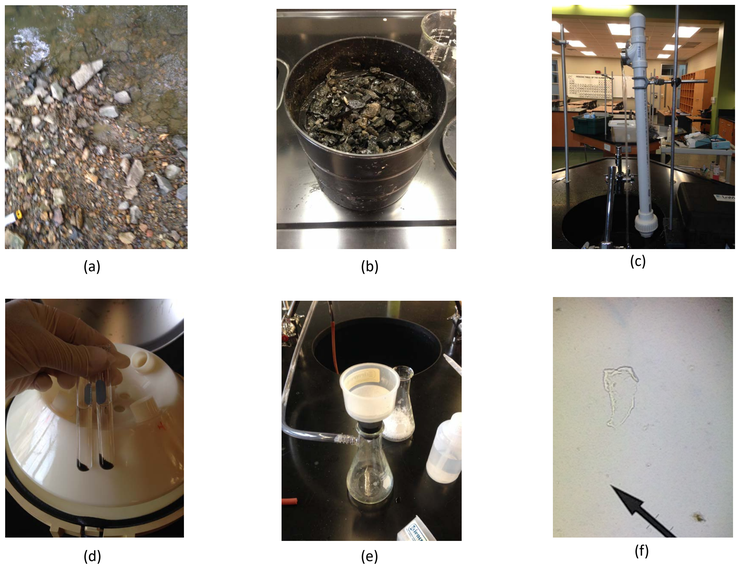

Figure 4: collection site (a); sieve (b); elutriation tube (based on Claessens et al, 2013) (c); centrifuged samples (d); vacuum filtration (e); suspected microplastic particle (f)

- Sediment samples were collected from the edges of the VT duck pond and Stroubles Creek (Fig. 3, Fig. 4a)
- Samples were dried and sieved to remove large rocks and organic matter (Fig. 4b)
- Sediment was run through the elutriation tube to separate lighter plastic particles from heavier soil material (Fig. 4c)
- The lighter materials were rinsed from the elutriation filter, mixed with 6.0 mL 3.3 M NaI, and centrifuged (Fig. 4d)
- The supernatant was filtered (Fig. 4d) and the materials left on the filter paper were subjected to microscopic inspection for microplastics (Fig. 4f)

Future Research

- Determine optimal flow rate for elutriation tube for sand and sediment (Figure 5)
- Determine best filter screen size to retrieve particles with minimum clogging
- Positively identify plastic particles using >40X power microscope

Figure 5: water flow through elutriation tube with 35 micron filter

Learning Module

- The learning module will be used throughout the year, inserting material as the related material is covered. Students will collect data in several locations. There is a small creek (Little Bear Creek, Fig. 1) on the high school campus and the school is close to several sites on the Roanoke River. Planning is underway to take a group of students to the Chesapeake Bay to allow students to see how local activities impact downstream communities.

- **High School Courses**
  - ✓ College Bound Chemistry
  - ✓ Pre-AP Chemistry
  - ✓ AP/Dual Chemistry (VWCC)

- The student will:
  1- define water quality
  2 - list the parameters of water quality testing
  3 - use appropriate technology to test the parameters
  4 - will compare and contrast the water quality at several sites
  5 - investigate the impact local activities have on water quality at sites downstream

- Virginia SOLs covered:
  - CH.1: a-j, CH.2: h, CH.3: a,c,f, CH.4: c,d, CH.5: a-c,f, CH.6: a,b

- **Virginia Western Community College**
  - CHM 5, CHM 111, CHM 112
  - Concepts and ideas learned through the NSF-RET experience will be used to help students make connections between the concepts covered in class and applications in the real world

Reference

Claessens, M., Van Cauwenberghe, L., Vandergehuchte, M. B., & Janssen, C. R. (2013). New Techniques for the detection of microplastics in sediments and field collected organisms. Marine Pollution Bulletin, 70, 227-233.

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