Spring 5-1-2020

What is with all the plastic garbage everywhere and where does it go?

Edward Kostelnik
eddie.kostelnik@valpo.edu

Julie Peller
Valparaiso University

Steven Kaylor
Valparaiso University, steven.kaylor@valpo.edu

Katherine Smith
Valparaiso University, katherine.smith@valpo.edu

Linh Tran
Valparaiso University, linh.tran@valpo.edu

See next page for additional authors

Authors

Edward Kostelnik, Julie Peller, Steven Kaylor, Katherine Smith, Linh Tran, Brayden Pollvogt, Maggie Heinz, Ben Sekuloski, Maia Wygle, Alex Salto, and Drake Shearer

What Is with all the plastic garbage everywhere and where does it go?

***Faculty Sponsor:** Dr. Julie Peller*

***Student Contributors:** Maggie Heinz, Steven Kaylor, Edward Kostelnik, Brayden Pollvogt, Alex Salto, Ben Sekuloski, Drake Shearer, Katherine Smith, Linh Tran*

Valparaiso University

QUESTION

What are the various types and amounts of waste plastics in the local environment and county compost of the Salt Creek Watershed of Porter County, IN?

INTRODUCTION

Over 8 billion metric tons of plastic materials have been manufactured.[1] Plastic pollution, both macro- and micro-plastics, have been accumulating in the environment, due to the non-biodegradable property of the materials. The plastics litter the roadsides, yards, farm fields, creeks, and larger natural environments like the oceans. Plastic waste migrates through the environment in many ways. This study investigates the local plastic problem and how it relates to the Porter County compost, created mostly from the roadside collection of leaves.For this study, local compost was collected and analyzed and was compared to local plastic pollution collected in the Salt Creek Watershed in the Porter County area.

Figure 1: Plastic waste in the environment in Northern Illinois.

FAST FACTS

-Humans have produced more than **8.3 billion tons** of plastic since 1950, when wide-scale production and use began.
-Only **nine percent** of all plastic is recycled in US.
-Half of all plastic produced is designed to be used only once.
-Scientists predict that the ocean will contain more plastic than fish in **2050**, if current plastic consumption and waste trends continue.

METHODS

Both micro- and macro-plastics were collected from both the local composting site and along/around roads throughout the Salt Creek Watershed of Porter County, IN. The macroplastic samples from the Salt Creek watershed and composting site were quantified and classified by recycling numbers and Infrared Spectroscopy. Microplastics were examined by sieving the compost with two and five micron sieves. A solution of Zinc Chloride (1.4 g/mL) was used to separate the microplastics via density separation. It was then further processed via H_2O_2/UV advanced oxidation to eliminate natural organic material and isolate the microplastics.

Figure 2: The sampling locations of the roadside plastic collected and analyzed.

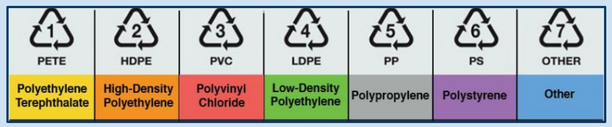

Figure 3. Plastic identification codes according to the chemical makeup.

ANALYSIS

Fourier transfer infrared spectrometer (FTIR)

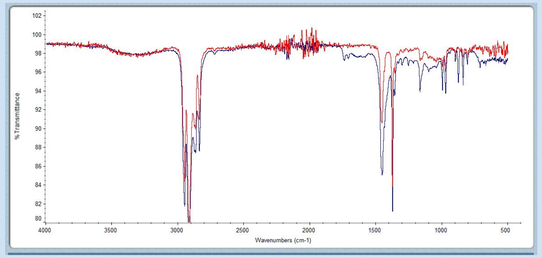

Figure 4: Overlapping FTIR spectra of known PP and a straw sample.

An FTIR was used to obtain spectra for the pieces of waste plastic that did not have a labeled recycling code. Spectra of known samples were collected for comparisons to the unknowns. After careful analysis and comparison, the unknown samples could then be classified into categories that matched their spectra.

Stereomicroscopy for microplastics analysis

Figure 5.: Microfibers under stereomicroscope at 10x.

RESULTS

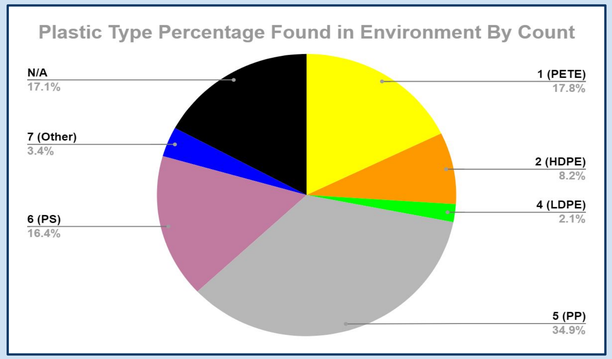

Figure 6. Plastic waste collected at the marked locations in Figure 2 shown as percentages in relation to their plastic resin identification code. See Figure 3.

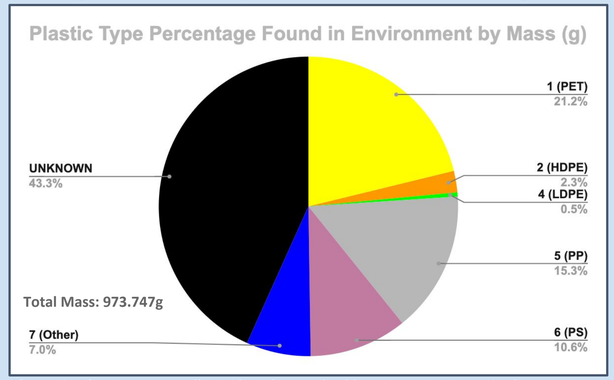

Figure 8. Plastic waste collected at the marked locations in Figure 2 shown as percentages by mass in relation to their plastic resin identification code. See Figure 3.

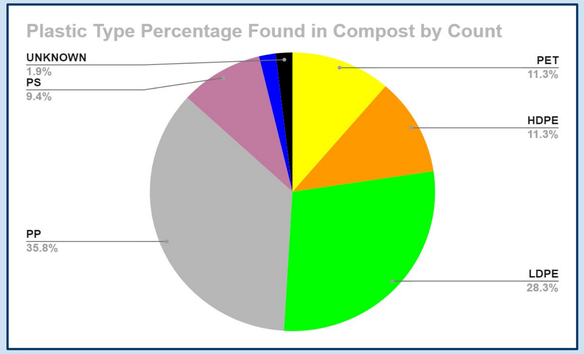

Figure 7: Plastics collected and identified in compost samples shown by percentage by count.

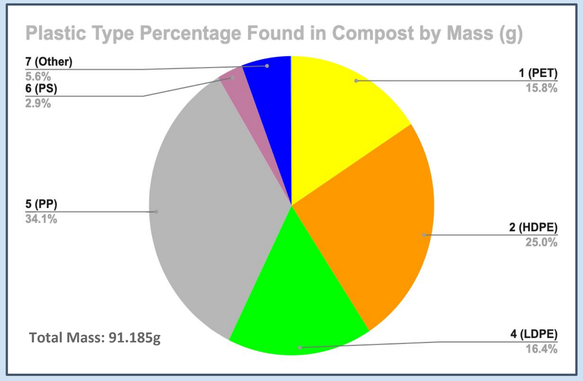

Figure 9: Plastics collected and identified in compost samples shown by percentage by mass.

Table 1. Categorization by use of plastics recovered from the field, calculated by number of pieces.

Broad Categorization	Plastic samples	Percentage
Packaging	cup, lid, bottle, cigarette plastic, wrapper, can etc.	51.5
Household products	spray, coffee stirrer, toothbrush holder, tray, food container, etc.	10.5
Electronic & Auto part	oil filter, electric wire, string, usb, etc.	10
Straw	straws	7
Styrofoam	plate, cup, food box, etc.	6
Others	microfibers, pieces of plastic, mixed plastics, etc.	15

Figure 10: Collected plastic waste from the environment in Northwest Indiana.

CONCLUSIONS

- Polypropylene(PP) and Low density polyethylene(LDPE) are the most common plastics found in compost. Polypropylene(PP) and polyethylene terephthalate(PET) were the most common plastics found on the roadside in the Salt Creek area.
- The data shows that plastic waste in compost corresponds to plastic collected in the environment throughout Salt Creek.
- It was also seen that certain microplastics and microfibers were present and very prevalent in the compost samples showing that microplastic pollution is transferred and created in compost. Since the county compost is used by many residents, the transfer of the pollutants grows.
- Overall it was confirmed that plastic pollution is found everywhere, in compost and throughout our watershed, and more preventative measures need to be in place to stop its creation and spread.

REFERENCES

1. Geyer, R.; Jambeck, J.R., Lavender Law, K. Production, use and fate of all plastics every made. *Sci. Adv.* **2017**, 3.
2. https://www.unenvironment.org/interactive/beat-plastic-pollution/

ACKNOWLEDGEMENTS

The class is appreciative of the KnowIndiana funding, Valparaiso University Department of Chemistry, Porter County Recycling and Solid Waste Deparment and Sarah Lisac.