Spring 2015

The Effect of Microplastic Fibers on the Freshwater Amphipod, Hyalella Azteca

K J. Talley
*Clemson University*

S Y. Au
*Clemson University*

S J. Klaine
*Clemson University*

Follow this and additional works at: [https://tigerprints.clemson.edu/grads_symposium](https://tigerprints.clemson.edu/grads_symposium)

**Recommended Citation**


This Poster is brought to you for free and open access by the Research and Innovation Month at TigerPrints. It has been accepted for inclusion in Graduate Research and Discovery Symposium (GRADS) by an authorized administrator of TigerPrints. For more information, please contact kokeefe@clemson.edu.
The Effect of Microplastic Fibers on the Freshwater Amphipod, *Hyalella azteca*

K.J. Talley³, S.Y. Au¹,² and S.J. Klaine²,³

¹Graduate Program in Environmental Toxicology, ²Institute of Environmental Toxicology, Clemson University, Pendleton, SC, ³Department of Biological Sciences, Clemson, SC

Abstract

Microplastics (MPs) are a growing and persistent contaminant in aquatic ecosystems. There is a wide variety of shapes that MPs can take, with fibers being the most prominently found in marine systems. Few studies have investigated the toxicological implications of MP exposure to freshwater organisms, and none so far has quantified the effect that fibers, as compared to spherical particles, may have on aquatic organisms. A 42-day chronic exposure to polypropylene MP fibers (0 – 22.5 MPs/mL) was conducted in order to investigate potential effects on mortality, growth, reproduction, and egestion times. Significant mortality was only observed at the highest concentration (22.5 MPs/mL). Growth and reproduction are also significantly less than the control at all exposures to MP fibers, with no making pairs forming at all concentrations greater than 5.63 MP/mL. Interestingly, gut clearance times after exposure to MP fibers is also greater at concentrations greater than 5.63 MP/mL. Delays in reproduction and growth may result from deficiencies in nutrient uptake. This study provides further insight on how the shape of MPs may hold significant implications on their toxicity to aquatic organisms.

Methods

- **Potential Pathways for MP Transport and Biological Interactions**
  - Colloidal delivery
  - Ingestion by zooplankton and fish
  - Absorption of MPs
  - Sedimentation of high density polymers
  - Biodegradation
  - Biodegradation in marine sediments

- **42-Day Chronic Exposure**
  - 4 Treatments: 0, 5.63, 11.25, and 22.5 MP/mL
  - 10 Acute Exposures
  - 4 Treatments: 0, 22.5, 45, and 90 PP
  - Biotic/Trichoplusia ni, and 3 Reps/Tr
  - Destructive Sampling: Day 10, 28, 41

- **Objectives**
  1. Evaluate the acute toxicity of polypropylene microplastic fibers to *Hyalella azteca*.
  2. Evaluate the chronic toxicity of polypropylene microplastic fibers to *Hyalella azteca*.

- **Hypothesis**
  - MPs will have adverse effects on the amphipods, specifically in regards to reduced growth and reproduction.
  - MPs will have adverse effects on the amphipods by way of increased mortality and egestion times.

- **Results**
  - **Survivorship**
    - **Day 10**: There was a significant decrease in survivorship at concentrations greater than 11.25 MP/mL.
    - **Day 28 and 42**: There was a significant decrease in survivorship at concentrations greater than 5.625 and 11.25 MP/mL.

  - **Gut Residence Time**
    - **Day**
      - **10**: There was a significant increase in gut residence time at concentrations greater than 11.25 MP/mL.
      - **28 and 42**: There was a significant increase in gut residence times at concentrations greater than 11.25 MP/mL.

  - **Reproduction**
    - **Day**
      - **10**: There was a significant decrease in reproduction at concentrations greater than 5.63 MP/mL.
      - **28**: There was a significant decrease in reproduction at concentrations greater than 11.25 MP/mL.
      - **42**: There was a significant decrease in reproduction at concentrations greater than 11.25 MP/mL.

  - **Growth**
    - **Day**
      - **10**: There was a significant decrease in growth at concentrations greater than 5.63 MP/mL.
      - **28**: There was a significant decrease in growth at concentrations greater than 5.63 MP/mL.
      - **42**: There was a significant decrease in growth at concentrations greater than 5.63 MP/mL.

- **Discussion**
  - Decreased Food Uptake:
    - Previous studies show that when zooplankton ingest microplastics, their consumption of algae decreased as a response to MP exposures (Cole et al., 2013).
    - This lack of dietary food could lead to a wide variety of indirect effects (reduced growth to ultimately death).
  - MP Ingestion Aggregation in the Gut:
    - Reduced growth may result from the blockage of uptake channels/veins in the gut track, potentially impacting:
      - Growth, reproduction, and survival behavior (Derraik, 2002).
  - Impacts of Growth on Reproduction:
    - Smaller females have smaller brood sizes (number of neonates) (Strong et al., 1972).
  - MP Egestion:
    - As MP exposures to zooplankton increases, MP egestion time also increases.

- **Conclusions**
  - There were significant decreases in survival at concentrations greater than 11.25 MP/mL.
  - Growth:
    - **Day 10**: There was a significant decrease in growth at concentrations greater than 11.25 MP/mL.
    - **Day 28 and 42**: There was a significant decrease in growth at concentrations greater than 5.625 and 11.25 MP/mL.
  - Gut Residence Time:
    - **Day**
      - **10**: There was a significant increase in gut residence time at concentrations greater than 11.25 MP/mL.
      - **28 and 42**: There was a significant increase in gut residence times at concentrations greater than 11.25 MP/mL.
  - Reproduction:
    - **Day**
      - **10**: There was a significant decrease in reproduction at concentrations greater than 11.25 MP/mL.
      - **28**: There was a significant decrease in reproduction at concentrations greater than 11.25 MP/mL.
      - **42**: There was a significant decrease in reproduction at concentrations greater than 11.25 MP/mL.

- **Acknowledgements**

- **References**

- **Future Work**
  - Future research endeavors could span looking into:
    - The mechanism of action or hindrance on the uptake of nutrients caused by MP ingestion.
    - Fiber capacity as contaminant carriers.