

ABSTRACT

DISSERTATION: MICROPLASTICS CHEMICAL CHARACTERIZATION, REGIONAL DISTRIBUTION, AND EFFECTS ON BIOTA

STUDENT: MATHEW DUANE SIMPSON

DEGREE: DOCTOR OF PHILOSOPHY

COLLEGE: SCIENCE AND HUMANITIES

DATE: MAY 2024

PAGES: 230

This dissertation provides an in-depth analysis of the environmental effects of microplastics, with a focus on nurdles (pre-production microplastics) and microfibers. The opening section provides an overview of the pervasive nature of microplastic, and the current methodology used to describe its environmental impact. Chapter 1 identifies the physical weathering characteristics of microplastics from marine and freshwater coastlines using an attenuated total reflectance Fourier infrared spectrometer (ATR-FTIR). This chapter suggests that standard sample preparation methods may not be necessary for large (> 1 mm) microplastic identification and explores the impact of environmental substances on the accuracy of the analysis. Chapter 2 evaluates the impact of virgin and aged microfibers on plant growth. Through the analysis of biomass, chlorophyll content (Soil Plant Analysis Development values), water retention capability, and biochemical impacts, it was determined that the presence of microfibers has the potential to result in acute impacts on aquatic plant health and ecosystem function. Chapter 3 focuses on the distribution of nurdles along the Lake Michigan shoreline, analyzing the correlation between pollution sources and nurdle presence. Through statistical modeling, this chapter demonstrates the impact of local plastic manufacturers on nearby coastlines. The findings of this dissertation conclude that there is a clear need for further research into

microplastic pollution mitigation and environmental impact. Overall, this dissertation provides a comprehensive resource for understanding the impact of primary microplastic pollution and challenges we face regarding their management.