Attachment of Microbes to LDPE Plastic Following Chemical Treatments

Diana Miguel Final Reflection Report

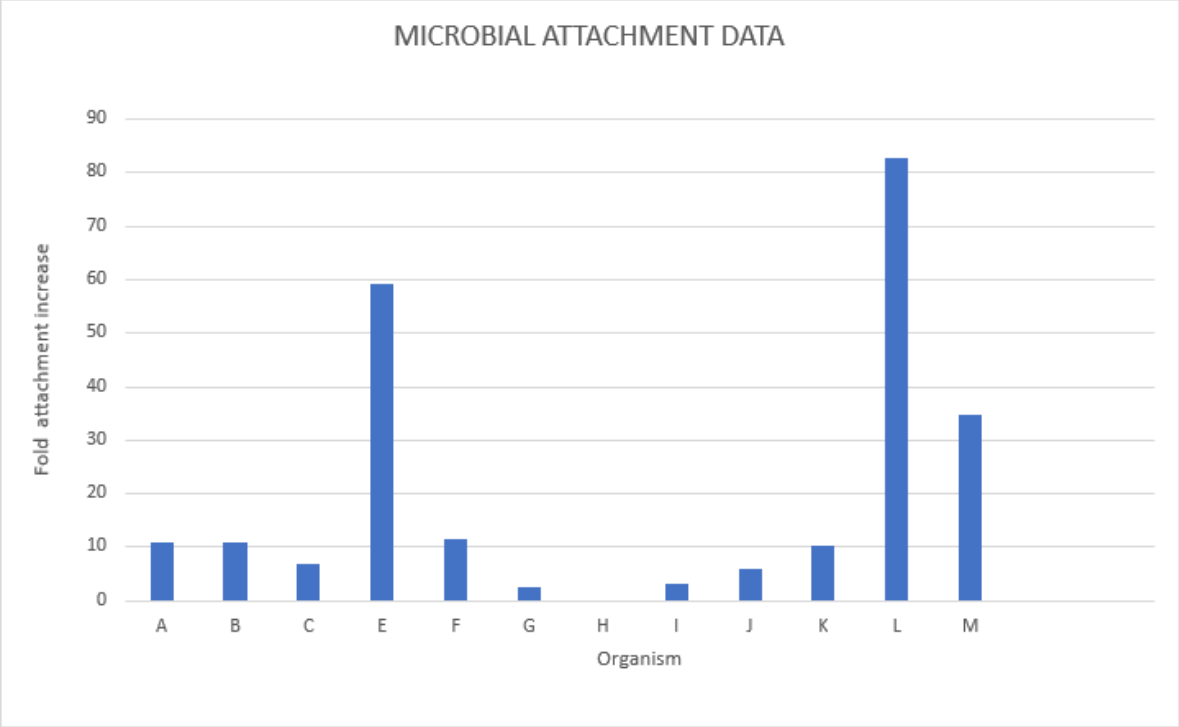
Plastic pollution is a global problem that impacts land, water, and air. Over the last fifty years the increase in plastic consumption has raised many environmental issues. Plastic in the ocean may harbor human bacterial pathogens (Marine Env. Res. 2016, 120:1). Plastic may also harbor persistent organic pollutants such as polychlorinated biphenyls (PCBs, Env. Sci. Technol. 2012 47:1646) which may enter the food web and have a harmful impact on human health. Low density polyethylene (LDPE) is the most abundant plastic pollutant.

Oxidation of LDPE by chemical treatments can reduce the length of the polymers and may increase microbial attachment and degradation. One study showed that when plastic was treated with nitric acid, a chemical oxidant, and later exposed to different microbes, the structure of the plastic was changed (Polymer Testing 2012, 31, 1094). Studies in the NIU Department of Biological Sciences used nitric acid and other chemical treatments of plastic. FT-IR spectroscopy was then used to determine the amount of plastic oxidation. Plastic was treated with 35 different combinations of chemicals, including acids, bases, and a pro-oxidant.

The most oxidized plastic, as well as untreated plastic were used in microbial attachment studies. In these studies, a violet dye was used to stain microbes that attached to the plastic. More staining showed more microbial attachment to LDPE discs. Identical microbes and communities of different microbes were tested for attachment to LDPE discs. Many of the microbes attached to plastic as they grew in liquid nutrients for two

to three weeks. The *Lecanicillium* fungus showed the highest level of attachment to the plastic. More attachment to plastic was seen following chemical treatment for a strain of *Streptomyces* bacteria that was isolated from the NIU lagoon. A previous study reported that *Streptomyces* could degrade plastic (Bioresour. Bioprocess. 2017, 4:15).

The graph below shows that *Lecanicillium* fungus (L) showed strong attachment to untreated plastic. *Streptomyces* bacteria (E) showed strong attachment to plastic exposed to chemical treatment with hydrogen peroxide and a hydrophobic pro-oxidant. Overall, this is a very important project to continue. It may help reduce plastic pollution of our beautiful planet.



Since my arrival as a transfer student to NIU I have managed to stay active and committed with my involvement activities on and off campus. I understand that my contributions and involvement will enhance my professional and academic success. I

have learned to make NIU and the DeKalb community my home away from home, I realized that I was in for a change. For once a change that was not bad. Being involved has helped me develop skills that I did not even know I had. It has given me a sense of belonging in the Biology Department. As my senior year comes to an end, I'm glad that I was given the opportunity to experience doing undergrad research. Having the opportunity to be a SEF student has impacted my academic experience and gave me the confidence and potential to challenge myself to new things and grow more within my field. I hope upcoming students get involved and get out of their comfort zone. I want to thank my mentor Dr. Grayburn for his shared knowledge and for giving a double minority woman and Latina like myself the opportunity to enhance leadership skills. Thank you SEF!