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This summer I was able to continue the amazing opportunity I had last year to become an intern at Polytechnic Institute of New York University, NYU-poly for short, under Dr. Richard Gross for a second year. At NYU-poly, my partner Lawrence Lin and I researched for new ways to strengthen bioplastics to replace petroleum-based plastics, which contain Bisphenol-A, a known influence for the onset of Breast Cancer. On my first day at the lab, I was nervous because I did not know if everyone would be the same as last year and if I actually remembered everything that I did last year. However, it turned out that only a few people were really different than before and I was able to take some time to remember everything with the help of my mentors. This was especially helpful since at some points we worked together for the first few days. They also were ready to help us no matter what the time was. Dr. Gross himself was very helpful in giving us suggestions when we were at a crossroads or at a road block in or project.

On the very first day, Dr. Gross went straight to business and reminded us that we would be working with Cellulose Nanowhiskers in an effort to strengthen bioplastics. Cellulose Nanowhiskers, CNWs for short, are the micro-fibers that help build up cellulose molecules. Our main idea was to use CNWs to strengthen current bioplastics making them more favorable than current Petroleum-based plastics which contain Bisphenol-A, or BPA for short. This way we could prevent the spread of plastics that use BPA.

BPA is a commonly used polymer often used to make petroleum-based plastics. In fact, every year, 8 billion pounds of BPA itself are produced. It is most commonly used in the plastics that are in plastic bags, water bottles, and receipts. It is also used in epoxy resins as well. From recent studies, it has been seen that BPA is an endocrine disruptor which affects the body's hormones. In recent years, it has been seen that certain animals which even have low quantities of BPA were more likely to contract breast cancer and those with high doses were almost certain to develop breast cancer.

The main goal of green chemistry, the type of chemistry that Dr. Gross's lab focuses on, is prevention. This means that scientists work to prevent different harmful chemicals and carcinogens from being exposed to people, especially when some people might be at risk for infection. For example, it is against green chemistry to use certain acids and bases when enzymes instead could be used. Also, renewable sources, such as trees and plants, should be used more than non-renewable sources, such as petroleum.

To counteract the use of BPA, my partner and I decided to modify cellulose so that it could be used to strengthen the bioplastics, plastics which are developed without BPA. Bioplastics are created with starches, cellulose and biopolymers and so as a bonus decompose faster than petroleum-based plastics. We modified the cellulose by using different organic acids through a process known as Fischer esterification. After we modified the cellulose we were to strengthen the plastics by blending them with the modified cellulose. Polycarbonates are molecules of carbonate, carbon double-bonded to oxygen, attached to each other. Poly-Butylene Succhinate-co-Adipate (PBS-A) is a type of polycarbonate and bioplastic that is used commercially today, but due to its unfavorable properties, such as the fact that it melts above 80 degrees Celsius, only for purposes such as the storage of cold liquids or foods. The goal of my partner and me was to add modified CNWs to the mix to create a blend that would strengthen the properties of PBS-A. If we could create stronger bioplastics, hypothetically, we could start to replace petroleum-based plastics in use today, such as in plastic water bottles, with newly strengthened bioplastics.

To start off our experiment, we decided that we would look into the usage of different organic acids so that we could modify the cellulose so that it would blend better within bioplastics. The current method used today is acid hydrolysis in which harmful sulfuric acid is used to tear apart the cellulose nanowhiskhers, which leaves behind damaging waste products. With the more novel method that we used in this experiment, only organic acids, which produce wastes that can be disposed of safely due to the fact that they degrade, are used to both degrade the cellulose and modify it to be used. First, we would take some of the cellulose, obtained from the Ramie plant, and we would purify it from all of its impurities. We would then use organic acids to break up the cellulose and modify it. We then tested the cellulose to see if it had been modified with help from our mentors. We have also tested whether it is possible that some of the cellulose would be able to dissolve into the different plastics by using similar substances to the cellulose.

While we were in the lab, my partner and I had unforgettable experiences. Most of the time when we were waiting for our reactions to finish, which sometimes took 3 to 6 hours, or when we finished work for the day, we would go downstairs and play some basketball, especially with some of the other kids who came from other programs. Often when it was time for lunch, we would look around the rest of the city to see what there was to see and then usually find a nice restaurant to go to. Even while we were working in the lab, I would get into some very interesting discussions with the rest of the interns about random things such as pop culture and the latest news events going on around the world.

I loved going to NYU-Poly for both of these summers and completing this internship. I would really like to thank the Great Neck Breast Cancer Coalition and all the people in it for allowing me to have such a life-changing opportunity. Though we accomplished much in these years, my partner and I believe there is still a lot more to be done to aid in the prevention of breast cancer. I believe green chemistry is a valid road to achieve the total goal of prevention.