Section IV: Discussion

Overall, it can be seen that my final prototype did accomplish most of my objectives. The product is customizable in its strength, color, and with its ability to hold a sticker, and it has medium levels of strength and flexibility.

Some limitations that come with this prototype are based in the fact that its strength is still lacking when compared to plastic. It is also untested against food and makeup products which was the original goal of this project.

When looking at the t-test, which was performed to look for a relationship between force and displacement, it was found that they were related with a $p>0.0001$. This means that when force is applied to the bioplastic, it begins to stretch which is important since allowing it to stretch raises the amount of force it can take, as it allows for some give within the material. This is also important because plastic is often able to bend and stretch without breaking.

My work fits into past studies due to the fact that it is also working with bioplastic with a starch base. It differs with the actual make up of my prototype which utilizes different materials and different starches as the base. One of my competitors, NatureWorks' plastic differs from my materials which was part of the intention of this project. As mentioned earlier, NatureWorks' plastic is made from PLAs which are costly to compost (Barrett, 2020). This change shows an improvement that comes from my project as the materials don't cost as much to decompose.

Future Research

In the future, I hope to be able to test this bioplastic for how long it will take to degrade, how it will react to transportation, and if it can be replicated on a larger scale. Looking at how the bioplastic degrades and how long that will take can help us to understand if this bioplastic will truly help with the problem of pollution. Looking at how it will react to transportation will help to determine if this

bioplastic prototype will be able to be used as packaging for things which need to be transported, such as food or makeup products. Looking at how the bioplastic can be tested on a larger scale can help to determine if the use of my bioplastic could really make sense for companies.

Section V: Conclusion

The overall objective of this project was to engineer a bioplastic material which is fully customizable in its shape and color, is able to hold a sticker, and is able to hold up to 10 N of strength pulling on it. Through various prototyping, the current final prototype was made which consists of rice water, vinegar, cornstarch, and glycerin. This was then tested for strength, flexibility, how water resistant it was, its customizability, and its ability to hold a sticker. Through these tests it was found that the bioplastic was able to hold 10 N of force being applied on it as well as 20 lbs being placed upon it. It was also found that it was able to stretch 19.306 mm and that it was able to be customized into different shapes and colors. While this project doesn't have a perfect bioplastic product, it can be used in future research to show the importance of adding multiple starches into bioplastic and how that will affect the strength of the bioplastic. Bioplastic is an important next step in eradicating the use of plastic which is so prevalent in our world. Through this project I hope to help in moving us that next step forward into a greener tomorrow.