Discussion and Conclusion:

Section IV: Discussion

The data clearly displays a significant increase in cellulose yield after replacing the culture medium with a food source alternative, whether it be store bought pineapple juice, or mango peel extract. The overarching goal was to determine how effective this change in culture media will change the amount of yield produced. After looking at both the store-bought pineapple juice and the mango peel extract, it was a definitive pattern that the yield of cellulose increased as concentrations of food were added to the culture medium. A T-test was run on the samples of 50% mango and 50% HS Media vs 100% HS Media to determine whether adding mango peels to the media will influence the cellulose yield. The null hypothesis was that the mango peels have no effect on weight while the alternative hypothesis was that the mango peels do influence the weight of the cellulose. The p-value from the T-test was 0.000264 and with a significance level of 0.05, the p-value was much less than 0.05, supporting the alternative hypothesis stating that the mango peels did have an impact on how much cellulose was produced. Another important factor to analyze were the results from the XRD. The goal of using this device was to see whether the crystallinity property was retained even after changing the culture medium. Because the graphs had peaks that lined up at the same x-values (same degree tilts), that helped determine the conclusion that they have the same crystallinity so they could be the same produced cellulose, with the same kinds of mechanical properties. This is important to know because it adds to the point that it is a good replacement, and it has a lot of properties that make it so appealing.

One of the biggest challenges was deciding on which fruits to use as culture mediums and which ones would provide a higher yield. Of course, checking properties like its sugar level would help with the matter, but how I addressed it was reading through a lot of literature and searching for similar testing strategies. After narrowing it down, I still had three options, mango, banana, and pomegranate;

however, after growing the bacteria in the incubator for two days, the banana and pomegranate mediums didn't make a significant amount of cellulose, so they weren't used in future experiments. A T-test was used because we are comparing. This is important to note because it provides sufficient justification to say that the implementation of mango peels really does have a statistically significant difference and therefore, it impacts the yield of cellulose.

A lot of the testing strategies are like past work and how they went about it. That being said, my research is more centered around that sustainability aspect too. Typical strategies have long and thorough sterilization processes. For my project, the food source can be made at home if you'd like, which just makes the whole process more accessible to people. Just knowing all these separate mechanical properties are retained to a certain extent even after changing the culture media is helpful to know if this shift in mediums were to be implemented.

Future Research

Future research includes running biocompatibility assays with cellulose grown with the mango peel medium. This would be helpful in determining this specific cellulose's usability in the biomedical field and whether or not the change in culture medium hinders its applications in the field. The goal is to see that its applications are not hindered, rather retained. This would show that a less expensive and more sustainable option can still be used in the same ways as before. Overall, future research would lie in discovering more about its biomedical aspects and how specific properties that impact its biocompatibility are in the mango peels media cellulose.

Section V: Conclusion

The goal of this project was to implement using food wastes that can be found in typical households to substitute as a culture media to produce bacterial cellulose. This would be a strong way of reducing the costs to grow the bacteria as well as increase sustainability. To begin preliminary research,

store bought pineapple juice was utilized as a culture medium and the weights of cellulose produced between the pineapple medium and the typically used HS medium were averaged and then compared to one another. From this preliminary research, it was clear that replacing the culture medium increased cellulose yield which was enough information to support further research. Further testing included simulating real food waste by taking the peels of various fruits and extracting liquid to use as culture mediums. Right off the bat, the banana and pomegranate peel extracts failed to grow the bacteria effectively; however, the mango peel extract was able to grow the bacteria effectively.

From there, a XRD was run on a mango peel media cellulose sample and a HS media cellulose sample to compare the crystallinity graphs. By comparing where the peaks in the graph lied for both, the peaks being created at the same angles as shown in the previous graph suggest that the cellulose produced by the mango peel media may be the same as the cellulose produced by the HS media. This is important to note because having similar crystallinity graphs says a lot about the potential of similarities between mechanical properties such as tensile strength. Finally, similar to the preliminary data process, more mango peel media cellulose samples were cultured, and their average wet masses were compared to the average wet masses of HS Media cellulose samples. There was a drastic increase in cellulose yield from 100% HS Media to 50% HS Media and 50% mango peel extract. This information paired with the similarity in crystallinity graphs add to the overarching idea that there are a variety of benefits that come with replacing the culture media with an alternative food source, mango peels in particular. Not only is it more cost-friendly, but it is also more sustainable while retaining mechanical properties of the HS medium cellulose.