THE BIODEGRADABLE ERGONOMIC SYRINGE

By: Angela Dunham, Marisela Gonzalez, Nathan Hager, Gillian Williams, Grayson Wong

INTRODUCTION & METHODS

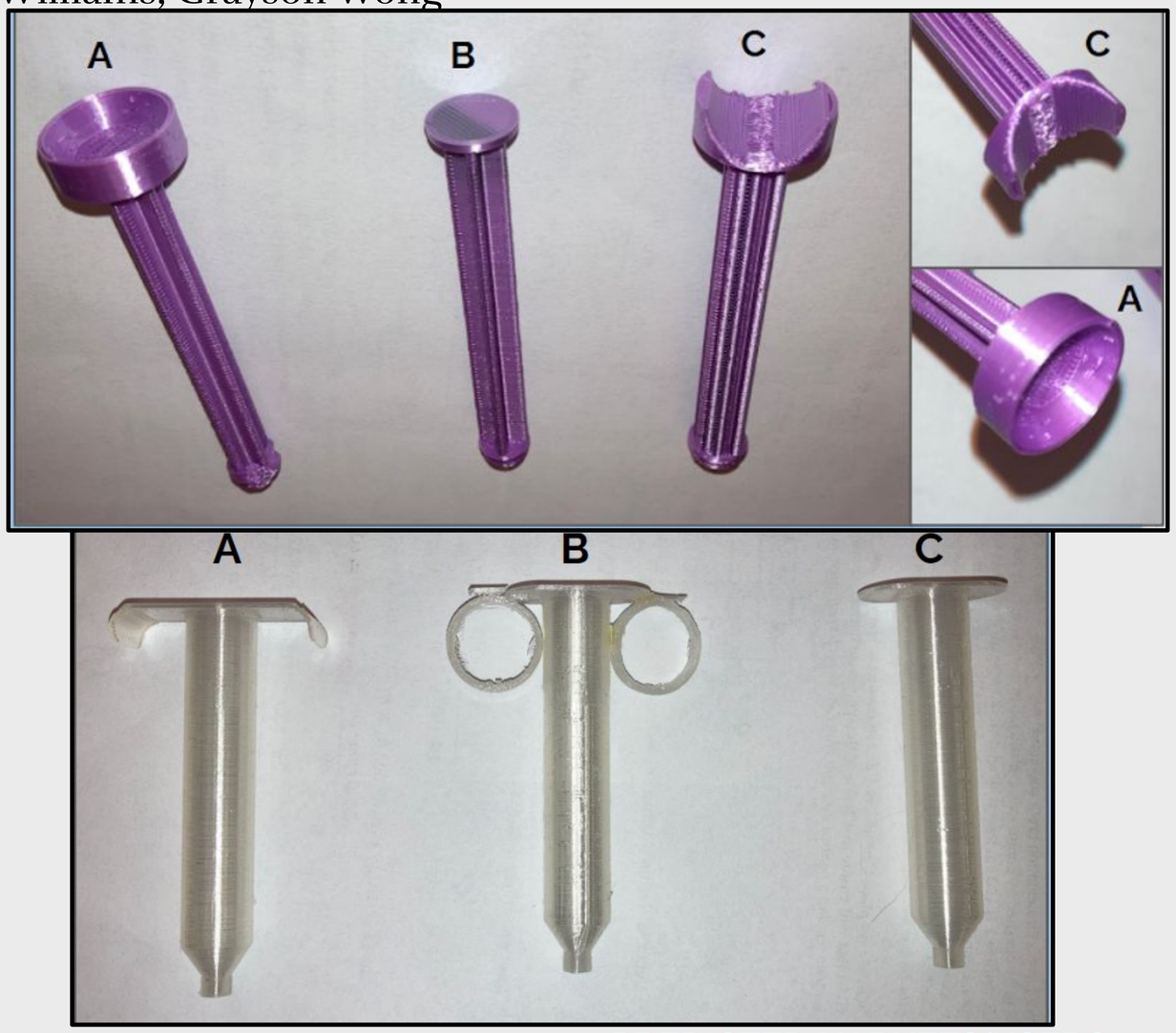
Introduction

- Current syringes present many problems, to the environment and to the consumer. Single use plastic is a major contributor to ocean pollution and non-biodegradable single use syringes add a large volume of plastic to the environment that won't degrade for centuries. Additionally, the small handles on current syringes are not designed with the human hand in mind and can make it difficult for people with limited mobility to self-inject. While latex is biodegradable, syringes with latex based gaskets can even cause an adverse reaction to people with latex allergies. Upon seeing these problems with current syringes in the market we decided to address these problems holistically, designing a product that is biodegradable, ergonomic, and conscious of latex allergies.

Methods

- SolidWorks used for 3D modeling of the syringe prototypes and for stress modeling. Degradation testing was performed in an OSU lab. Focus testing was conducted with a total of 8 users, which was limited due to COVID-19 restrictions and concerns. The individuals used in focus testing ranged from fellow students to medical personnel.

Oregon State University



ENVIRONMENTAL IMPACTS

- 16 Billion syringes are used each year
- Yearly waste generated from insulin syringes alone is around 600,000 Kg
- Medical waste pollution leads to sharp injuries and soil contamination
- Polypropylene take 20-30 years to degrade
- PolyLactic Acid takes 90 days to degrade 80%

PREDICTED MARKETS/USERS

- Hospitals and medical practitioners
- At-home users (used for self-injecting medications such as insulin and avonex)
- Veterinarians and Humanitarian Efforts
- Research facilities

CONCLUSION & FUTURE DIRECTIONS

Conclusions

- We were able to successfully 3D print our syringes with biodegradable PLA. Our final model design had finger loops and a half pipe thumb grip, overall improving the ergonomic design of the product. Through cost analysis we determined a retail cost of $1.25 with a $0.88 unit revenue per syringe giving is a total unit profit of $0.29.

Future Work

- For industrial design, the syringe will be injection molded to improve upon texture and structural integrity issues.
- Minimizing production costs for industrial production.

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References

- Luo, Y., Lin, Z., & Guo, G. (2019). Biodegradation Assessment of Poly (Lactic Acid) Filled with Functionalized Titania Nanoparticles (PLA/TiO2) under Compost Conditions. *Nanoscale research letters*, *14*(1), 56. https://doi.org/10.1186/s11671-019-2891-4
- "Health-Care Waste." *World Health Organization*, World Health Organization, www.who.int/news-room/fact-sheets/detail/health-care-waste.