



# Recycling Plastic Waste into 3D Printing Filament

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## Introduction

The necessity for a device that facilitates the conversion of plastic bottles into 3D filament is motivated by many significant factors. From the environmental side, the worldwide level of plastic pollution has reached concerning proportions, presenting significant environmental hazards. This project aims to recycle plastic bottles into 3D printing filament.

Literature have shown that the characteristics of the plastic bottles that are made polyethylene terephthalate (PET) do not change after recycling, and it remains strong after recycling. Hence, making it a suitable material for 3D printers.

Items	O-PET	R-PET
Melting temperature (°C)	258–260	235–245
Intrinsic viscosity (dLg <sup>-1</sup> )	0.65–0.68	0.50–0.78
Bulk density (tcm <sup>-3</sup> )	0.70–0.75	0.30–0.35
Carboxyl end group value (mol/t)	≤30	≤45
Size (mm×mm×mm)	4×4×2.5	Irregular flake

Figure: Characteristics of plastic before and after recycling [1]

## Methodology

The process of recycling plastic bottle involves conditioning the bottles, using the preparation device, and then producing the filament as shown in the figure below.

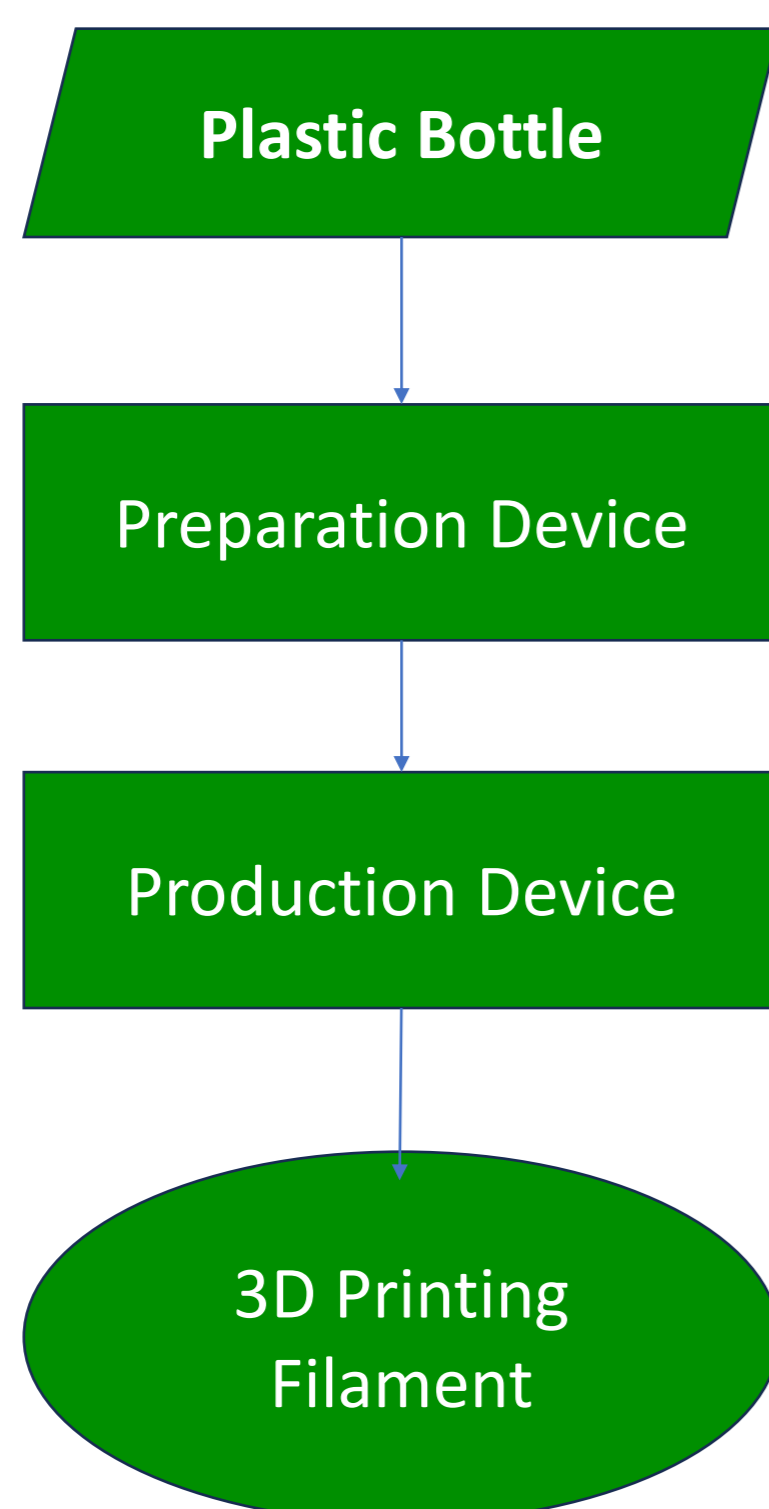
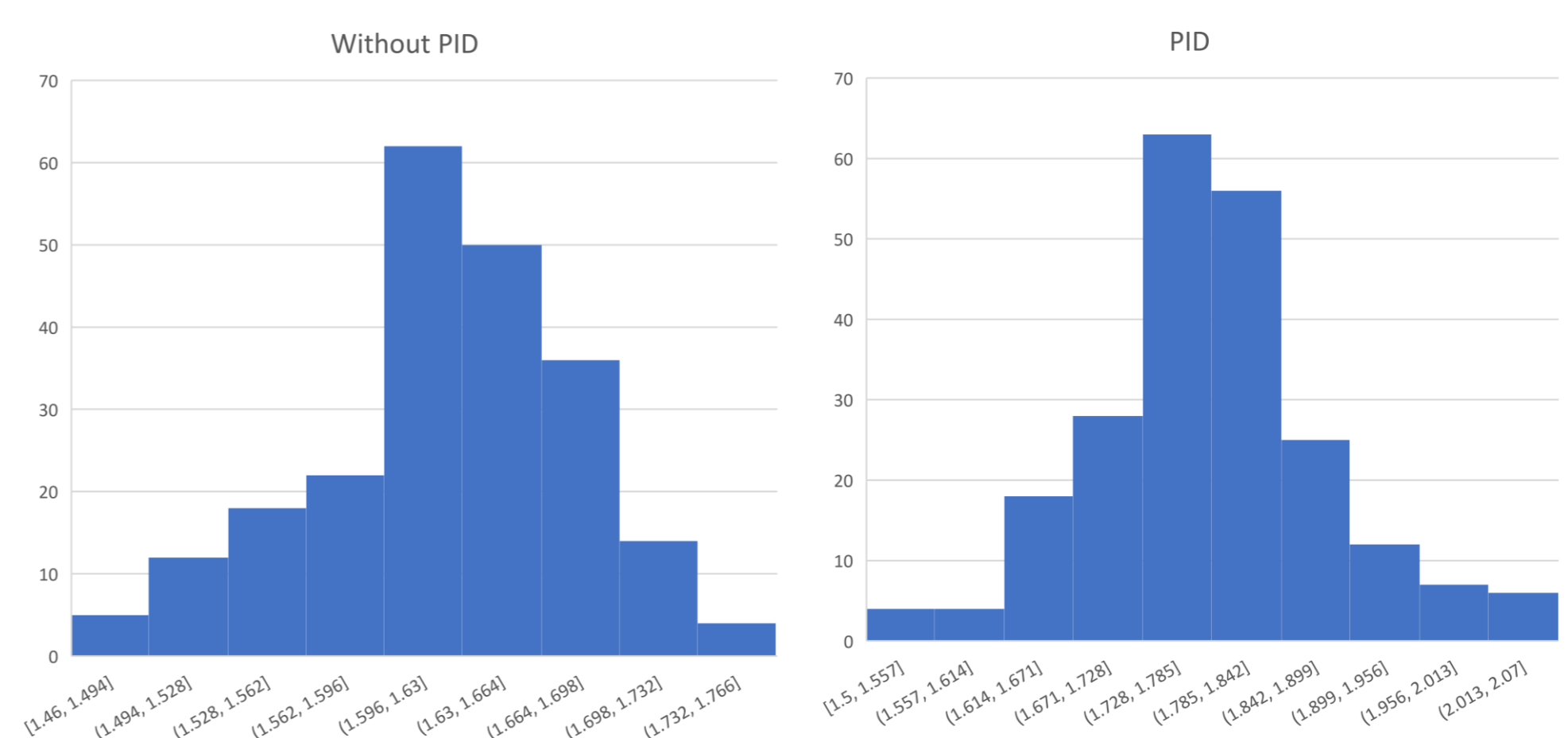
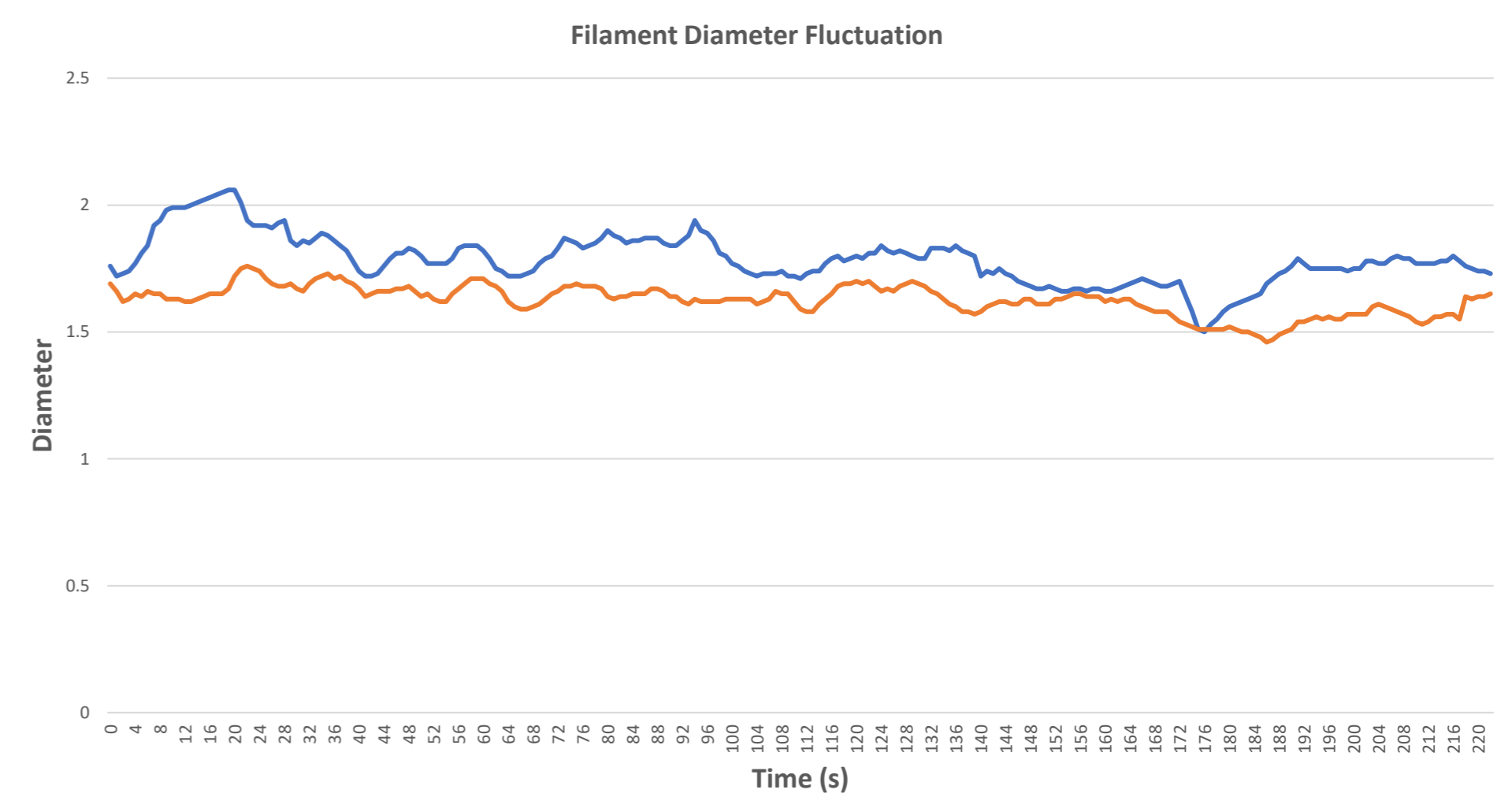
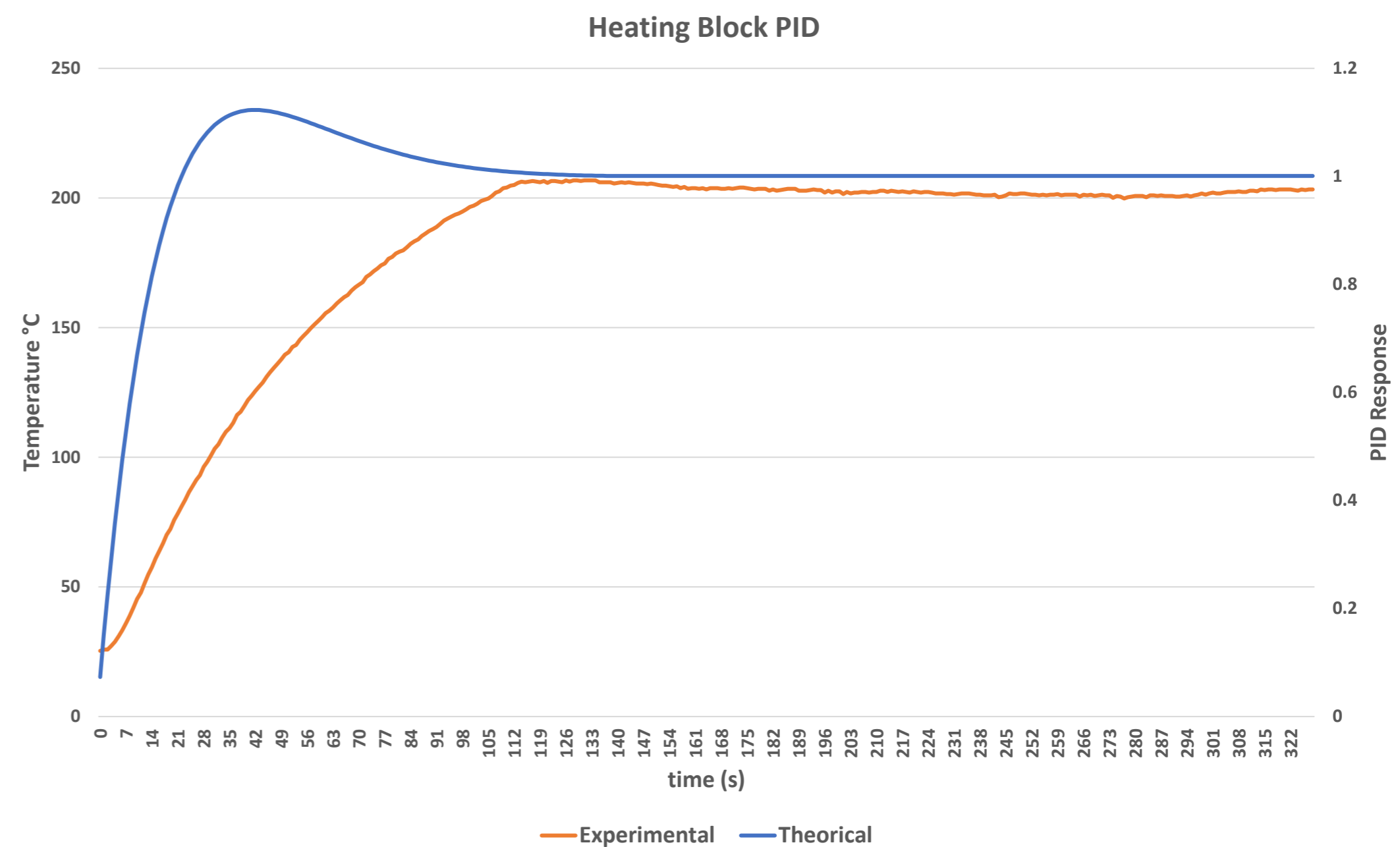


Figure: Recycling Process

The preparation phase requires a heating source that operates at 400 degrees Celsius, while the production phase requires a heating sources that operates at around 200 degrees Celsius. PID controllers will be used to control the fluctuation of the temperature.

## Results

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## Conclusion

In conclusion, the device successfully meets all the specified criteria, achieving a mean diameter of 1.781 with a standard deviation of 0.09. In contrast, without the implementation of the PID controller, the device records a mean diameter of 1.62 and a standard deviation of 0.05. These statistics clearly indicate that the integration of the PID controller is essential to ensure the quality and consistency of the filament diameter.

## References

[1] Z. Jiang et al., "Preparation and properties of bottle-recycled polyethylene terephthalate (PET) filaments," Textile Research Journal, vol. 89, no. 7, pp. 1207–1214, Apr. 2018, doi: 10.1177/0040517518767146.