2021 Summer Undergraduate Research & Creative Achievements Forum

Optimization of Printing Parameters for Low Molecular Mass Polymers: 4D Printing of Low Printability Materials

Lin Research Lab

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The Problem

PGDA	poly(glycerol dodecanoate) acrylate
PEG-DDA	poly (ethylene glycol dodecanedioic acid)

PGDA

T_{trans} at 22.5 to 43.6°C

98% recovery at 37°C

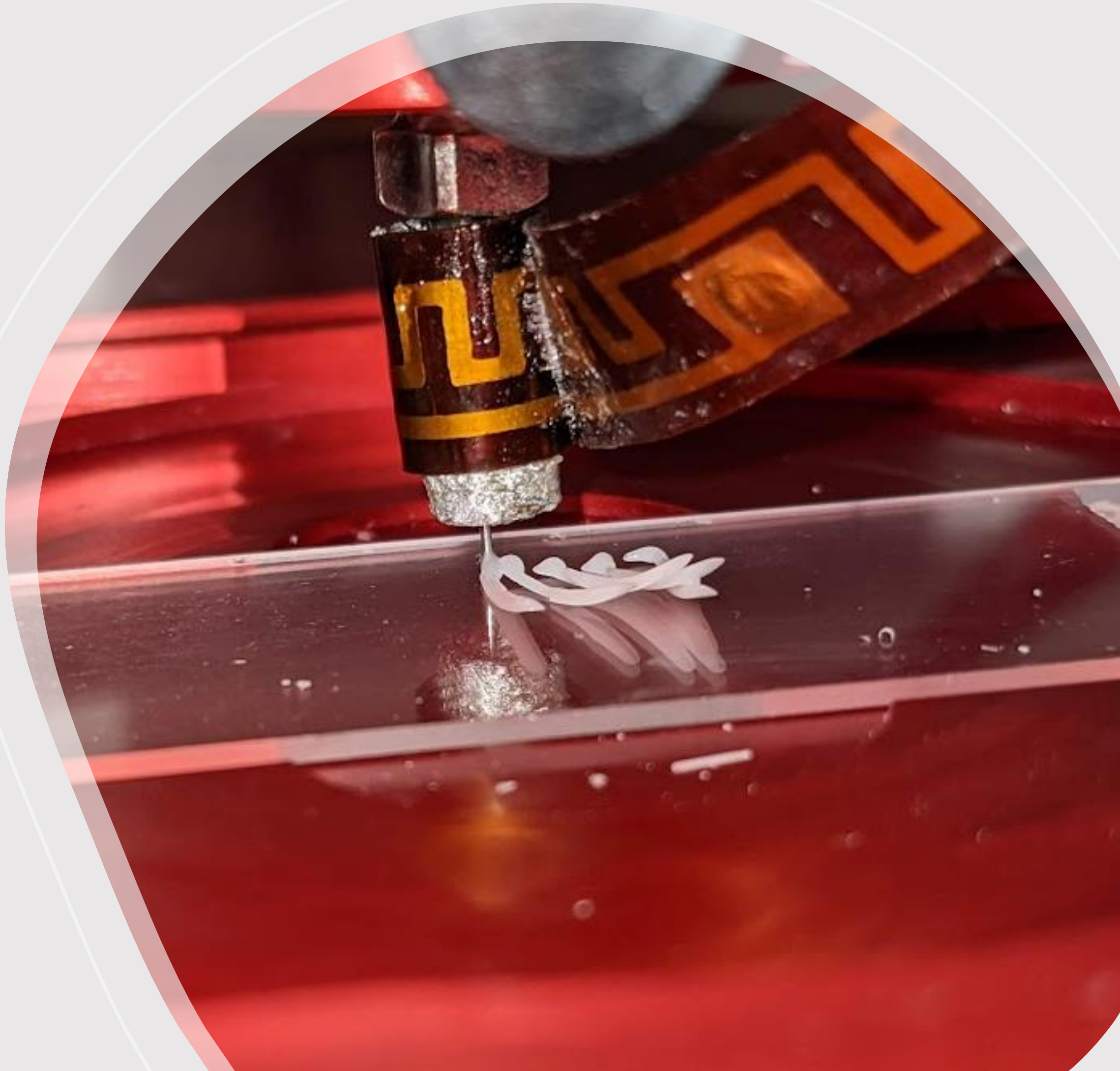
Biocompatible

[7]

NOT

PRINTABLE

PEG-DDA

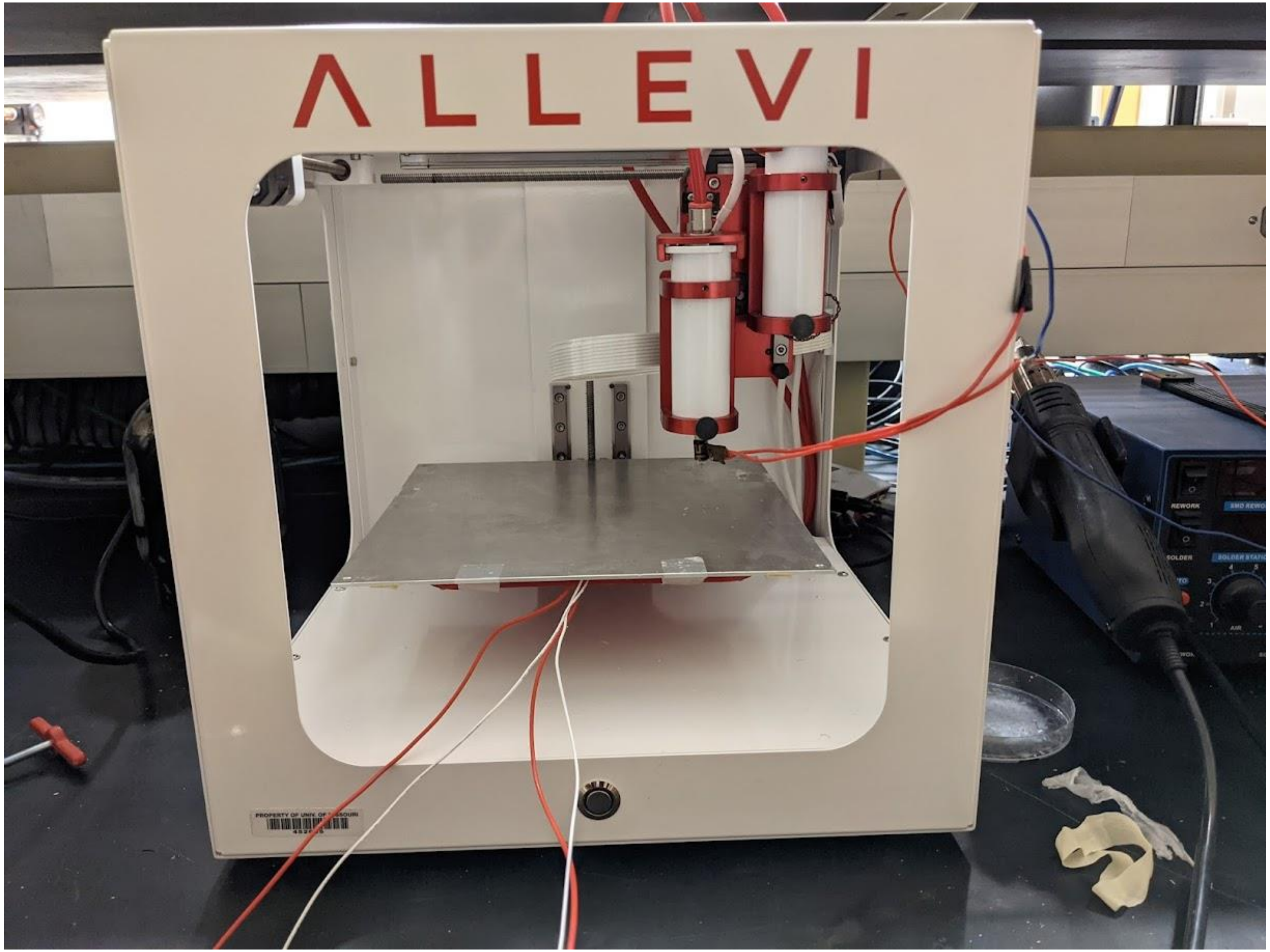


PGDA

REASONS

1. Low-molecular mass
2. Lack of functional groups

The Proposal


ALLEVI

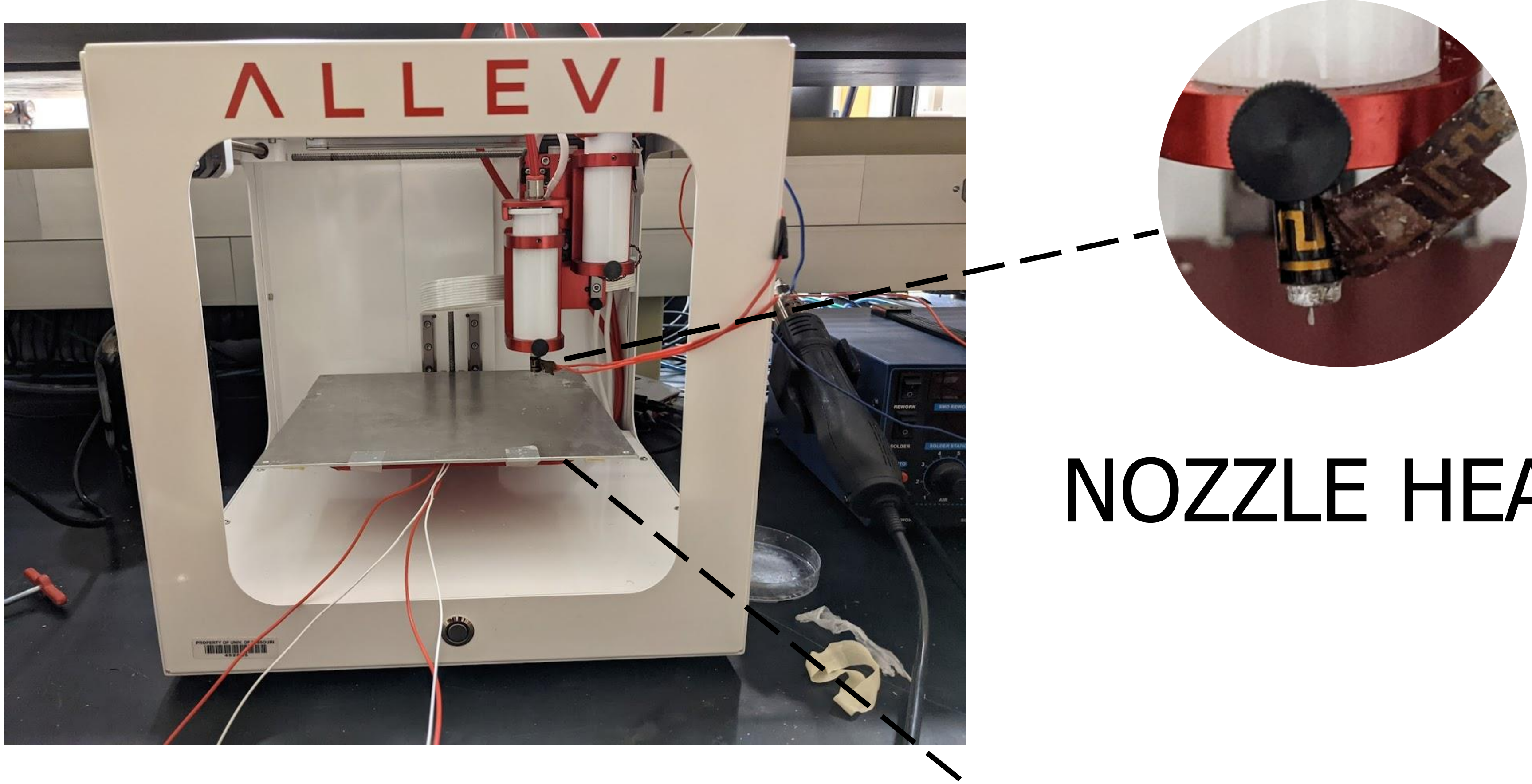
ADJUST…

Temperature

Pressure

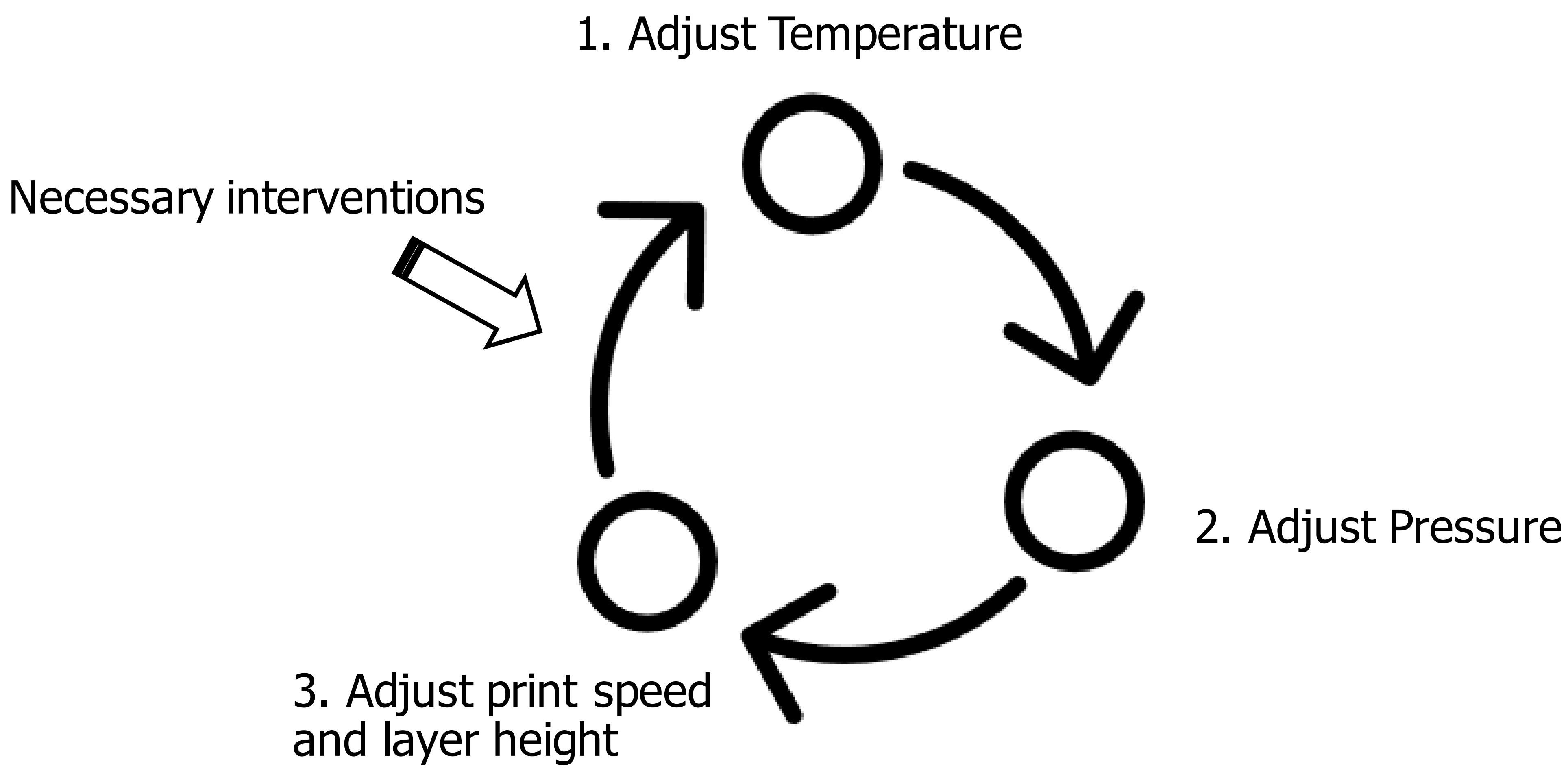
Print speed

Layer height


ALLEVI
NOZZLE HEATER
HEATED BED

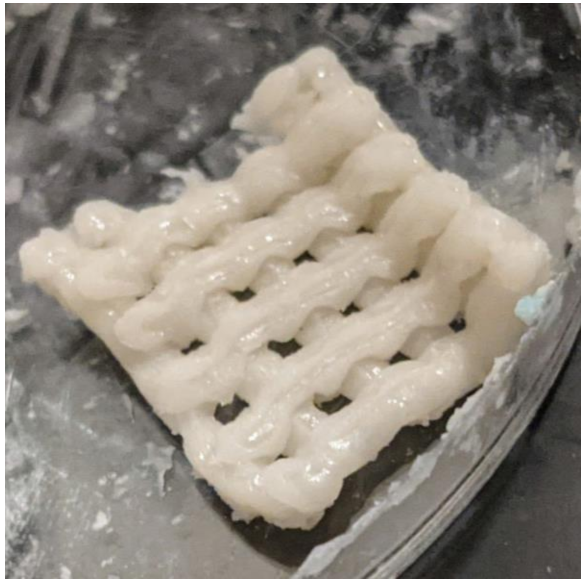

electronic
diener

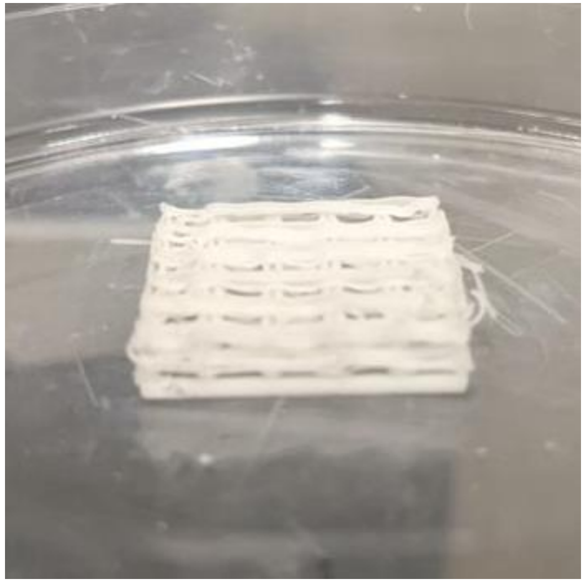
SPECIFIC METHOD



RESULTS

RESULTS





PGDA

PEG-DDA

IMPLICATIONS

LARGEST EFFECT

TEMPERATURE

PRINT SPEED

SURFACE TENSION

References

[1] Niklas Kretzschmar et al. “Mechanical properties of ultraviolet-assistedpaste extrusion and postextrusion ultraviolet-curing of three-dimensionalprinted biocomposites”. In:3D Printing and Additive Manufacturing6.3(2019), pp. 127–137.

[2] Saman Naghieh and Daniel Chen. “Printability–a key issue in extrusion-based bioprinting”. In:Journal of Pharmaceutical Analysis(2021).

[3] Liqun Ning and Xiongbiao Chen. “A brief review of extrusion-based tissuescaffold bio-printing”. In:Biotechnology journal12.8 (2017), p. 1600671.

[4] Jesse K. Placone and Adam J. Engler. “Recent advances in extrusion-based3D printing for biomedical applications”. In:Advanced healthcare materials7.8 (2018), p. 1701161.

[5] Andrea Schwab et al. “Printability and shape fidelity of bioinks in 3Dbioprinting”. In:Chemical reviews120.19 (2020), pp. 11028–11055.

[6] Qingzhen Yang, Bin Gao, and Feng Xu. “Recent advances in 4D bioprint-ing”. In:Biotechnology journal15.1 (2020), p. 1900086.

[7] Cheng Zhang et al. “4D printing of shape-memory polymeric scaffoldsfor adaptive biomedical implantation”. In:Acta Biomaterialia122 (2021),pp. 101–110.

Questions?