INTERNATIONAL UNIVERSITY LIAISON INDONESIA

THESIS PROPOSAL

Effects of different 3D Printer Nozzles Material on 3D printing Polylactic Acid (PLA) and its Abrasive derivatives

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By

Andika Bramantio Wicaksono

11201902005

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In

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1. **General Statement of Problem Area**

   The problem to be examined involves the performance of each 3D printing nozzles materials in printing the polylactic acid (PLA) and its abrasive derivative products

2. **Research Purpose**

   The primary purpose of this research paper is to study how different types of 3D Printing Nozzle Materials could have affected the whole process of 3D printing of Polylactic Acid (PLA) and its derivative. One of the reasons people want to use a different type of nozzle for their 3D prints rather than a standard brass nozzle offered by the manufacturer

3. **Research Problem**

   There are several facets of the research problems:

   3.1) The standard brass nozzle from the 3D printer manufacturer is not enough for printing Abrasive Material Printing

   3.2) The Abrasive Material can cause some diameter inconsistencies printing abrasive materials for a longer duration

4. **Significance of Study**

   The study is significant for several reasons.

   4.1) First, Since the standard 3D printer has a brass nozzle from the standard manufacturer that sometimes can be troublesome when printing 3D printing abrasive material, especially for long time usage.

   4.2) Second, the study will address the issues regarding the problem with the brass nozzle and why it needed to be changed to print Abrasive Material

5. **Theoretical Perspective**

   The theoretical perspective for the proposed studies is the material used to make each nozzle. During production, each nozzle was made using high-accuracy and tight fabrication machines. Although some of the nozzles may possess a high thermal conductivity to print faster, and some might be made using a low thermal conductivity however a longer endurance compared to the standard-made one.

A basic PLA or PLA+ that were commonly found on 3D printers anywhere usually isn't going to be a problem since it was made using pure plastics. The problem with abrasive materials is they were made by mixing standard polymers with a very hard fiber. Sometimes the mixture of very hard fiber tends to have a higher melting point than the polymer itself which can cause a jam and eventually lead to wear which can enlarge the nozzle diameter size.

6. Research Questions and Hypothesis

6.1 Questions

Question #1: What is the purpose of changing the nozzle type of a 3D printer?

Question #2: What is an abrasive material and why even 3D printing with it?

Question #3: Is the more expensive nozzle that is used to print abrasive material doing any better compared to the cheaper and more commonly found nozzle?

6.2 Hypothesis

Hypothesis #1: The harder a 3D printer nozzle material can perform better compared to the softer material nozzles in terms of printing an abrasive material

Hypothesis #2: The weaker nozzle tends to wear faster and cause inconsistencies than can cause awful output results

7. Methodology

The study will investigate some of the most common abrasive-ready type nozzles that can be found on the market, as well as the standard brass nozzle that is used commonly in 3D printing with the following parameters.

PRINTING PARAMETERS	VALUE
Nozzle Diameter	0.4mm
Layer Thickness	0.2mm
Nozzle Temperature	Varying between 215°C-250°C
Bed Temperature	Varying between 30mm/s-50mm/s
Infill Pattern	Zig-Zag
Infill Density	25%
Filament Brand	Esun PLA+, Esun Wood, CCTREE Bronze PLA, Sunlu Carbon Fiber
Nozzle Branding	Creality, Mellow
Nozzle Types	-Brass -Stainless Steel

	-Hardened Steel

8. Design and Instrumentation

The research will use the longitudinal study design. The data collection method is by using an Arduino uno that has been attached to a Thermocouple Type K. By using the Excel feature of streaming all the data required to capture the temperature changes.

The Test will be consisting of printing some 3D printing models at a time for each of the nozzles that were specifically made to test the 3D printer such as:

1. Benchy Boat (A General 3D printing test benchmark)
2. Temperature Tower (To Find the best temperature for printing material with certain specific nozzles)

The sampling approach for this study will be a systematic sampling method

The sample for each print will be printed at least 2x using the same nozzle and the same material sample to ensure the consistency of the results.

The expected sample would be approximately to be 24 3D-printed samples

9. Data Analysis

The data analysis for this research will be conducted using Microsoft Excel. The data then will be processed into several statistical graphs, such as line graphs, columns, etc.

10. Proposed Advisor

I propose Dipl.-Ing Sentot Wahjoe Goeritno, M.Si, and Dipl.-Ing Maralo Sinaga as my advisor and co-advisors for my proposed thesis

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