# A STUDY ON SUITABILITY OF RECYLED POLYETHYLENE TEREPHTHALATE FOR 3D PRINTING FILAMENT

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN ADVANCED MANUFACTURING AND AUTOMATION ENGINEERING IN THE DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

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# A STUDY ON SUITABILITY OF RECYCLED POLYETHYLENE TEREPHTHALATE FOR 3D PRINTING FILAMENT

**LEONARD MUTIVA BANDE**

**A Thesis Submitted in Partial Fulfillment for the award of the degree of**

**Master of Science in Advanced Manufacturing and Automation Engineering**

**in the Dedan Kimathi University of Technology.**

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**DECLARATION**

This research is my original work and to the best of my knowledge, it has not been presented for a degree award in this or any other university

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This research proposal has been submitted to the School of Engineering, DeKUT, with our approval as the supervisors:

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## ABSTRACT

The 3D printing technology utilizes three-dimensional computer aided design (CAD) drawings to manufacture 3D objects. This technology has attracted growing interest due to the possibilities it can bring to the world economy by changing how goods are manufactured. Commonly used 3D printing filaments are acrylonitrile butadiene styrene (ABS) and Polylactic acid (PLA), but they are very expensive and not environment friendly. There is great concern about how the filament should be made from recycled materials and be eco-friendly. In this research recycled polyethylene terephthalate (PET) was used to produce a 3D printing filament.

In this research the recycled waste PET materials was converted into high value and useful products such as dog bones test samples, 3D printing filaments, mobile robot chassis, drone blades etc. Through mechanical recycling of PET waste, the obtained granules were extruded into a filament. The American Society for Testing and Materials (ASTM) standard dog bones were printed from a reprap printer to test mechanical and thermal characteristics. The mechanical and thermal properties of recycled PET such as melt flow, tensile strength, Young modulus, and yield strain were observed to go along with the printed PLA filament parameters.

It was found that recycled PET has melt flow index=2.85g/10min, Tensile strength=35.7 Mpa, Young's modulus=2457 Mpa, melting temperature=250°C, extruding temperature=250°C-260°C. These parameters compares with those of PLA that hasmelt flow index= (2.4-4.3) g/10min, Tensile strength= 50-55 Mpa, Young's modulus= 3500 Mpa, melting temperature= (120-190)°C, extruding temperature=160°C-220°C.

Thus, recycled PET present an alternative filament that is cheaper, environmental friendly, and locally available. This study contributes to the larger ecological issue of environmental conservation by using plastics scattered in the communities to make useful products. Another contribution is on absorption of the 3D printing technology by lowering the cost of the printing filament and providing local solution with local materials.