

“Design & Fabrication of Plastic Strip Machine”

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Abstract :-

This research focuses on the design and fabrication of a plastic strip machine that converts commonly discarded plastic materials into uniform plastic strips for reuse in manufacturing and creative applications. The machine is engineered to melt and extrude plastic waste through a controlled heating and shaping mechanism, using components such as a variable-speed motor, heated barrel, screw conveyor, and precision die. Key design parameters, including barrel temperature range, extrusion speed, strip width control, and cooling system efficiency, were systematically analyzed and optimized.

The project emphasizes the use of cost-effective materials and locally available components to ensure the machine's accessibility and affordability for small-scale or community-level recycling units. Detailed CAD modeling and simulations were conducted to validate mechanical performance, followed by fabrication and testing of the prototype. The machine successfully processed plastic types such as PET, HDPE, and PP, producing high-quality, consistent strips suitable for 3D printing filament, weaving plastic fabric, or use in prototyping and educational tools.

This study not only contributes to the growing field of plastic recycling technologies but also promotes the concept of a circular economy by transforming waste into valuable resources. The machine offers a scalable solution for local recycling initiatives, educational institutions, and small-scale entrepreneurs seeking to reduce environmental impact through innovative material repurposing.

Key Words:- PET bottles, Cutting, Design, Machine, Environment, Plastic waste, Packaging, recycling.

1. Introduction:-

The present paper discusses the design, and analysis of a cutting machine developed for reusing plastic strips to create useful products. In industrial applications, plastic strips are commonly used in packaging materials and box strapping. Typically, such strips are produced using a hot air gun; however, the presence of impurities in the plastic material can disrupt the process,

resulting in defective strips and material wastage. Conventional reuse of waste plastic strips often involves a softening cycle, which is both time-consuming and costly.

This project aims to address these limitations by designing a low-cost, efficient machine capable of processing waste plastic—particularly PET bottles—into reusable strips within a short period. The machine utilizes components such as pressure rollers, cutting blades, and a hot air gun to facilitate smooth feeding and precise cutting of the plastic material into strips. The motivation behind this initiative is the widespread and environmentally detrimental disposal of plastic, particularly PET, which is not biodegradable and often left unused.

By repurposing waste plastic bottles into strips, the machine supports sustainable practices and reduces plastic pollution. The produced plastic strips can be repurposed for various household and industrial applications, including use as substitutes for string, wire, and packaging straps. Furthermore, these strips can be employed in manual crafts

such as basket-making, mat weaving, and sewing or loom-based activities. Post-cutting processes such as heat forming can further enhance the usability of the strips by eliminating the material's shape memory and allowing it to be molded into new forms with specific technical properties.

This project contributes a practical and environmentally friendly solution for plastic waste reuse, offering significant benefits in terms of cost reduction, material recovery, and versatility in applications.

2. Design of Components :-

I. CUTTER BLADE: A blade is the portion of a tool, weapon with an edge that is designed to chop, slice and scrape surfaces or any materials. It is made of steel.

II. Hot Air Gun: A heat air gun is a device used to produce a stream of hot air, at temperatures between 100 °C and 500 °C (200-932 °F) which can be held by hand.

III. Ressure Rollers: Pressure rollers are type of rollers used for compacting materials such as plastic, iron metals sheets and other sheets metals, etc. There are different pressure roller such as cylindrical rollers, grid rollers, etc

IV. DC Gear Motor: This is 12V 60 rpm DC motor used to run the pressure rollers with the help of pinion and chain sprocket. Winding Material: Copper Poles Material: Silicon Steels Magnet Type: Permanent Magnet Brushes Used: Carbon Brushes 2Shaft: Steel Body Cover: Aluminum Lead: Aluminum Diameter of Shaft = 8mm

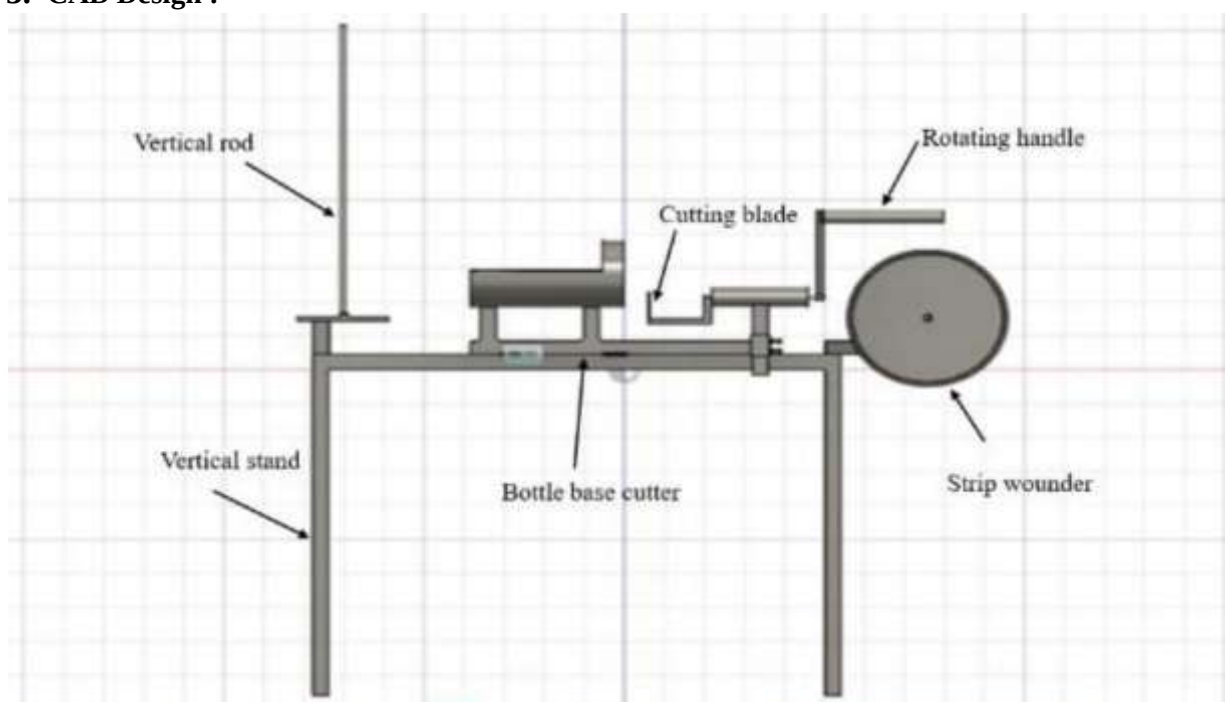
V. Switchedmode Power Supply : An SMPS (switch mode power supply) is an electronic power supply that incorporates a switching regular to convert electrical power efficiently SMPS convert or transfer AC or DC source of current to DC load.

VI. Cycle Chain : A cycle chain is a roller chain which is used for power transmission, it is used to transfer power from pinion gear to sprocket attached to pressure roller. Its length is 12 inch long

VII. Pinion: Pinion used in plastic strip making machine is having 10 teeth and its inner bore diameter is 8 mm made up of steel.

VIII. Sprocket: A Sprocket used is having 20 teeth and its inner bore diameter is 34 mm and made up of mild steel

3. CAD Design :-



1.1 CAD Model 1

4. Design Calculations:-

Power (P) = 24 W

Speed of motor (N) = 50 RPM Load factor (Kl) =1.75

Td = 8.021 N.m

$\sigma_{\max}$ = 88.8 MPa

shaft diameter = d = 7.71 mm

Power (P) = 37 W

Speed of motor (N) = 65 RPM Load factor (Kl) =1.75

Td= 9.51 N.m

$\sigma_{\max}$ = 88.8 MPa

shaft diameter = d = 8.17 mm

Power (P) = 32 Watt

Speed of motor (N) = 60 RPM Load factor (Kl) =1.75

Td = 8.912 N.m

$\sigma_{\max}$ = 88.8 MPa

shaft diameter = d = 7.99 mm $\approx$ 8mm

Sr. No.	Input Data	Output Data				Shaft Diameter (Mm)
	Speed (RPM)	Power (WATT)	$\sigma_{\max}$ (MPa)	Torque (N.m)	Shaft Material	
1	50	24	88.8	8.021	SAE1030	7.71
2	65	37	88.8	9.51	SAE1030	8.14
3	60	32	88.8	8.912	SAE1030	8

5. Advantages :-

1. low cost required to manufacture.
2. No or negligible maintenance is required.
3. very easy to operate
4. It is lighter in weight.
5. Less power consumption.
6. Less number of mechanical moving parts, hence less friction and gives higher accuracy.
7. Converting waste polluting plastic bottles in useful product.

6. Conclusion:-

There are many wastes in environment increasing day by Day which need to be reduced that are harm to the human life. This paper presents PET bottle are used and disposed on a large scale and may be industrially recycled. The current project enables plastic bottle to be cut into strip and immediately used as a prime material for verity of uses. The strips thus obtained helps to solve domestic problem. We are making the machine inside this social economic content to give elective reaction to this issue. The need is to give suitable technologic response that will enhance activities concerning collection and sell of domestic trash and /or to the necessities of other socially vulnerable sector (unemployed, disables, base community undertaking).

7. References:-

- Gedam, S., Sharma, S., Shahu, R., & Ninawe, A. P. (2020). “ Plastic Bottle Strip Cutting Machine - An Approach”. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 8(IX).
- Vaggar, G. B., Sameer, M., Chitragar, M., Sharif, M. R., & Kareem, A. (2022). “Plastic Extrusion Machine: A Review. ” International Journal of Engineering Research & Technology (IJERT), 11(06).
- T.M Coelho, J.A.Gobbo Jr.(2011).“PET containers in Brazil: Opportunities and challenges of a logistics model for post--- consumer waste recycling.” Resources Conservation and Recycling.
- Miguel Friedenbach, Buenos Aires (AR) May 13, 2004, “Tool For cutting Used Containers of Recyclable Plastic Material into Ribbons”
- A Khoironil, S Anggoro.2019 Community behavior and single-use plastic bottle consumption. Doctoral Program of Environmental Sciences, Diponegoro University
- Kazisemon ,Mohammad milad dec 2019 “developing a model for a recycling plastic bottle into synthetic fiber,” international university of business agriculture and technology.
- Mullah Irfan Faiyyaj, Rushabh, Pradip, Adarsh Institute of Technology, Vita. Shivaji University, Kolhapur “Design and Development of Plastic Shredding Machine,” International Journal of Engineering Technology Science and Research. Volume 4, Issue 10 October 2017.
- Foolmaun RK, Ramjeawon T. “Life cycle assessment (LCA) of PET bottles and Comparative LCA Of Three Disposal Options In Mauritius.” Journal Environment And Waste Management 2008;2(1/2):125–38