

“Redevelopment of plastic recycling machine”

Dr. Dhananjay R. Ikhar¹, Akshay D. Yelne², Nilay S. Raut³, Pratik D. Raut⁴, Swapnil A. Tarale⁵,
Vaibhav N. Mitkar⁶, Vaibhav N. Jawalkar⁷, Kunal N. Miskin⁸

¹HOD, Mechanical Engineering, DMIETR, Maharashtra, India.
^{2,3,4,5,6,7,8}Student of Mechanical Engineering, DMIETR, Maharashtra, India.

ABSTRACT

The main purpose of this study is to design and fabricate existing plastic recycling machine for production of strings and granules for any domestic use. Plastic recycling is an increasingly important issue in today's society. The number of plastics and their variation with additives has increased lately, affecting in turn the possibilities for plastic material recycling. The intention for doing this is to have more plastic material recycled rather than incinerated and energy recovered. This study deals with a conceptual investigation and development of an automatic plastic recycling plant. On Comparing with the previous plastic recycling machine, there is an addition of extra heating elements on nozzle. The certain modification in crusher has been incorporated in recycling machine which serve two purposes i.e. to get continuous product with quality and to crush the plastic bottles easily.

Keywords: PET bottle recycling, Additives added to improve quality of plastic, Common thermoplastic, Reduce pollution.

1. Introduction

The main objective of this thesis work is to provide a description of manufacturing of redevelopment of plastic recycling machine. Since plastic is a non-biodegradable product and cannot be dumped in the ground, plastic recycling is a very important issue in protecting the nature.

There are four types of plastic recycling:-

- (1)Primary
- (2)Secondary
- (3)Tertiary
- (4)Quaternary

1. The primary way of recycling plastic is as a product. By using product second hand or when someone don't need that. If it can be used then it's recycling as a product, or by reconstructing a plastic like by making some paintings by coloring, we can make the product life durable.
2. Secondary way of recycling plastic is that plastic used as fencepost and as sub products that can be used as a substitution to wood. Plastics can also be use as raw materials for making new plastic.
3. Tertiary process is that which involves producing basic chemicals and fuels from plastic.
4. Final process of recycling is quaternary. It is used rapidly now a days. This process uses the energy from plastic by burning. It is widely used because of high heat content of most plastics.

Recycling is the reprocessing of used materials to a new form from its original state or sometimes destined for disposal of solid state. This is called post-consumer recycle and another type of recycling process, which is created as normal part of the scarp from a manufacturing process, is plant recycle. [C. C. Ugoamadi and O. K. Ihesiulor, Optimization of the Development of a Plastic Recycling Machine.] Recycling means the reprocessing and refabrication of a material that has been used and discarded by a consumer and that otherwise would be destined as solid waste. This type of recycle is called post-consumer recycle, as opposed to recycle that is created as a normal part of scrap from a manufacturing process.

2. Objective

- The objective of a project is to recycle a thermoplastic to reduce the solid plastic waste.
- To utilize the plastic from domestic and industrial waste to reproduced useful components like paper weight, plastic string, granules, etc.
- Innovative use of scrap machinery.

3. Fabricated view



Figure no. 1- Fabricated view

4. Construction

- Hexagonal shaft to rotate the blades of crusher effectively.
- Bearing is used for the free rotation of shaft
- Gear is used to mesh the shaft.
- Addition of extra heating element on nozzle to adjust the temperature.
- High performance switches to sustain the temperature of electrical board.
- For proper transmission of torque belt is used.
- To reduce RPM & Torque transmission of crusher Pulley. (bigger size) is used.
- Housing to fix the bearing for further its free movement.
- Other components as it is which are previously used.

5. Working

- Start the motor which is attached to gear box with the help of belt , After 20 min of heating.
- Feed the bottles into crusher and start the motor which also attached the crusher with the help of belt.
- With the help of slope, the crushed particles transferred towards the hopper.
- Crushed particles are feed into the barrel.

- These small particles move forwards with the help of rotating extrusion shaft.

6. Design Specification

Crushing Force -

$$T = Fc \times r$$

Where,

T= Torque of shaft (Nm)

Fc = Crushing force (N)

r = radius of blade (mm)

$$24.86 = Fc \times 0.016$$

$$Fc = 1553 \text{ N}$$

Crushing Power Required -

$$P = 2\pi NT/60$$

Where,

P=Power Required (KW)

T=Torque of shaft (Nm)

$$P = 2\pi \times 671 \times 24.86/60$$

$$P = 1746.8 \text{ watt}$$

$$P = 1.74 \text{ KW}$$

Sr. No.	Type	Value
1.	Power	P = 1.95KW
2.	Force	F = 1743N
3.	Crusher Shaft	T = 27.8Nm D = 27mm
4.	Pulley	L = 42mm
5.	Belt	L = 1864.9mm
6.	Extrusion Shaft	D = 25mm

Table No. 1 Design specification

7. Result

- Plastic granules can be produced at temperature range of (185-190) °C when molten plastic directly pour into water.
- The machine converts a waste plastic into recycle plastic which can be used in plastic industry.
- We can produce a huge varieties of product by using injection moulding techniques or die.
- By adjusting the temperature of heating element using universal temperature controller following result is obtained:





Sr. No.	Temperature(°C)	Product type	Behavior of plastic
1	163		Unburned plastic
2	175		Semi-unburned plastic
3	185		Finished recycled plastic
4	197		Molten plastic

Table No. 2 Behavior of plastic

8. Future Scope

- The machine can be used for manufacturing of small products like paper weight, toys, and other daily needed products.
- The machine can implement in the society, colleges, apartments etc. which will reduce the plastic waste and pollution in country.
- It can be used for production of plastic bricks and benches.
- Recycled plastics pellets can be turned into fabrication of cloths.
- As per BBC News, plastics roads also can be made from recycled plastic which will be helpful to save the planet and paving stone also can be made from recycled plastic.
- Plastic yarn which is used for decoration purposes is made from plastic.

9. References

- Guidance and information support regarding this machine.
- Prof B.D. Shiwalkar (Ex Professor of Mechanical Engineering, Visvesvarya National Institute of Technology). "Design Data For Machine Element". Denett Publication, 2015 Edition.
- Singh, N. et al. Recycling of plastic solid waste: a state of art review and future application. Composites B 115, 409–422 (2016).
- Esha Shah, Rajaram. "Plastic Recycling In Bangalore, India." Waste Advisers on Urban Environment and Development. Date: Dec 1997
- AkanshaPimpalgaonkar, MansiJha, Nikita Shukla, KajalAsthana. (Electronics and telecommunication department, SSIPMT, Raipur, India.). "A Precision Temperature Controller Using Embedded System." International Journal of Scientific and Research Publication, Volume 03, Issue 12, December 2013.
- Prof. Kusekar S.K, Morajkar, Assistant Professor Department of Mechanical Engineering, A.G.P. I.T.Solapur, Maharashtra, India. "Design & Development of Plastic Recycling Machine by Using FEA". International Research Journal of Engineering and Technology. (2009)