RESEARCHERID
THOMSON REUTERS

[NCRAES-2019]

ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

PLASTIC RECYCLING PLANT

Prof. Sunilkumar Patil*[1], Sohail Khan[2], Kevin Koli[3], Avinash Kotian[4] & Prashant Sharma[5]

[*1]H.O.D, Department of Mechanical Engineering, Bharti Vidyapeeth's College of Engineering, Lavale, Pune, India

[2345]Student, Department of Mechanical Engineering, Bharti Vidyapeeth's College of Engineering, Lavale, Pune, India

ABSTRACT

The main purpose of our study is to design and fabricate cost effective plastic recycling machine for granule products for plastic industries. As these plastic industries were based on export and imports as well as they wear having financial barriers to install highly sophisticated and advance recycling machine. The main aim of the project is to make a portable and eco-friendly environment by recycling of waste plastic. To implement this concept of machine is introduced. Machine works on combination of three processes to fulfill requirement. First step is to separation of waste plastics according to classification of plastic. In second step separated plastic feed to shredder in which plastic granules are formed. In third and last step the Shredded plastic is feed into the compression machine and then it is heated at a certain temperature in the oven, where the plastic is melted and by applying force through the screw jack the molten plastic takes the shape of the mould.

Keywords: *Plastic, Hopper, Shredder, Compression moulding, Screwjack, Recycling.*

I. INTRODUCTION

Plastic is a material consisting of wide range of synthetic or semi-synthetic organic compounds that are malleable and can be molded into solid objects. Mainly it is classified into two types are as follows.

1) Thermoplastic
2) Thermosetting plastic

Thermoplastic is highly recyclable plastic also called a thermo-softening plastic. It further classified into a seven types and denoted by various symbols. PET, HDPE, LDPE, PP, PS, PVC, & OTHER. Analysis of data shows a rising consumption in plastic. 13 million metric tones of plastic wasted every year in INDIA and every next year increased by 9mn. To overcome this recycling is the best option to reduce waste plastic. In INDIA recycling rate of plastic is 60% per year.

We have created two machines to recycle plastic the machine are desigh based on traditional industrial concept. The underlying principle behind the machine is same except the shredder. The machines apply heat to the plastic, plastic melts, gets pressed in to the mould and it is finally cooled to regain its solid state. Thats all the magic behind recycling.

ISSN 2348 – 8034
Impact Factor- 5.070

II. METHOD & MATERIAL

Collecting:
It is essential to always have enough plastic waiting to be sorted, shredded and worked with in order to run the workspace effectively. Plastic at this stage is still mixed and dirty. Workspaces have one collection bag (with appropriate signage) outside of the space for people to drop plastic and one inside to be sorted in different types- this cycle enables a continuous process. When the collection bag outside is full the team should bring it inside and replace it with another empty collection bag. Once inside the bag has to be emptied from the plastic and sorted as soon as possible. When the bag outside is full again the process is repeated. This cycle should run at all time to ensure a smooth operation of the workspace.

Sorting:
The sorting system is a crucial element for all recycling activities. A thorough and precise sorting effort guarantees smoother processes, better products and easier maintenance. An efficient sorting system allows the team to know exactly what plastic type is being used, which is crucial in order to figure out its melting temperature and set the machines correctly to run the workspace efficiently.

Shredding:
Once the plastic is sorted by their specific plastic type it's time to shred it. At this stage,bigger plastic objects are chopped into small granulate to reduce its size, enable washing, store more efficiently and be used with the other machines. It is good practice at this stage to separate plastic by colour

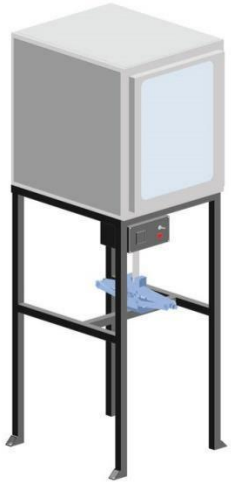
Washing:
Plastic needs to be clean before undergoing recycling processes. We always recommend people the bring plastic clean. Dust, dirt and impurities will cause problems to Precious Plastic machines and processes. Dirty plastic can result in extra maintenance, breakdowns, problematic productions and low-quality products.

Storing:
Once the plastic is dry it can be stored in the provided buckets. Ideally, buckets should be stackable, strong and transparent so you can see the colour and nature of the plastic.

Figure:

Seven types of plastic

Shredder



Compression moulding

ISSN 2348 – 8034
Impact Factor- 5.070

III. LITERATURE SURVEY

We took the references from a website and research paper published by a organization called as preciousplastic.com the website suggest the various methods to design and create a plastic recycling machine and how to use the waste plastic to create various parts and shapes

Research paper published by the university of Cambridge suggesting that the use of plastic recycling plants and the need for recycling of plastics and how they are affecting the environment

The Indian plastic industry is among the fastest growing ones. According to a 2017 knowledge paper by FICCI, a business and industry lobby, Indian plastic processing industry saw compounded annual growth rate of 10% between 2010 and 2015. Annual plastic consumption is expected to increase from 12 million tonnes to 20 million tonnes by 2020.

There has been an effort to encourage the alternative uses for plastic waste. The use of 10 to 15 % of plastics in road construction is one such use. Recycling, reuse, or alternative use of plastic waste can help reduce the amount of virgin plastic produced.

However, this is not enough to address the planet's plastic pollution problem.

IV. RESULT & DISCUSSION

Shredder required 2HP motor and 1440 Rpm
Given data

Power (P)=2HP
2HP=1500 watt
P=1500 watt
Given material
EN8
Syt=550Mpa

Factor of safety (FOS) = 2

SOLUTION: -
Torque from motor :- 9940Nmm
Force required to rotate blade

T= r×F r= Radius of Blade.
9940= 60×F T=Motor Torque.
F=165N F= Force required to rotate the shaft.

Actual Torque required
T= r×F

=60×165
T= 6300N.m

The allowable shear stress for shaft
$\tau(max) < 0.3$ syt
$\tau(max) < 0.3 \times 550$
$\tau(max) < 165$ mpa

ISSN 2348 – 8034
Impact Factor- 5.070

τ/R=T/J
τ=2.10mpa
J=0.1202×d^4 ..... (As Shaft is Hexagonal)
J=0.1202d

R=d/2

Now Bending Strength

σb =Syt/2
=550/2

σb =275mpa
Actual Bending strength

σb = 32M/ πd^3

According to standard dimension d=27mm

The diameter of Shredder shaft is 27 mm.
From design data book …

M= 346.533×10^3

σb =32×346.533×10^3/π×(27) ^{3}

σb = 179.33mpa

Gearbox reading:-
Gearbox used ratio as 30:1

So RPM we get due to ratio is 48RPM at output.

Compression Machine:-

Material	Temp	Time	Weight
PP	200°	40 min	425g
HDPE	200°	40 min	425g
PS	220°	40 min	425g

V. CONCLUSION

The main purpose and the goal behind making this project is to avoid the recreation of plastic polymers rather using the waste plastic and saving fuel energy as well as avoiding the pollution in environment

This project is handy and can be installed in any location or locality through which plastic recycling can be done.

This project will help to recycle the plastic through less cost and using low energies and making using of man power to recycle the plastic

This project will help to create awareness of plastic recycling

VI. ACKNOWLEDGEMENTS

The success of our project was not due to our project work alone, but also due to interest help and able guidance offered to us by the staff members of Mechanical Engineering Department.

It is our duty to acknowledge with gratitude the help rendered to us by these individuals, without whom we would not been able to carry out project to best of our ability and to the satisfaction of our superior.

First and foremost, we wish to record our sincere gratitude to our beloved principal, Dr. R.N. Patil BVCOEL, Pune for his constant support and encouragement in preparation of this report and for making available library and laboratory facilities needed to prepare this report.

We would also like to thank Dr. S.R. Patil, Head of Mechanical Engineering Department, BVCOEL, for his valuable support and guidance throughout the period of this project.

We also express our gratefulness to our project co-ordinator, Prof. A. Datarkar. Also, we would like to express our special gratitude and thanks to our project guide.

Prof. S.R. Patil, for guiding us in investigations for this project and in carrying out experimental work. Our numerous discussions with him were extremely helpful. Their contributions and technical support in preparing this report are greatly acknowledged.

VII. FUTURE SCOPE

AIPMA (All India Plastics Manufacturers' Association) estimates that the plastic consumption will increase to 20 million tonnes a year in 2020 from the current 8 million tonnes a year in India. "Plastics is one of the biggest contributor to India's GDP with the growth rate of 12%-15% per annum, it houses over 50,000 manufacturers and employees of over 40 lakh workers in the plastics industry. Apart from covering the plastic industry comprehensively at Plastic vision India 2018, our aim is to highlight the demands with the government and motivate policy changes that better the growth of the industry. We appeal for Technology Upgradation Fund (TUF) like status for the plastic industry from the government," said Anand Oza, President, AIPMA.

REFERENCES

1. *https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data*
2. *https://www.researchgate.net/publication/268079134_PLASTICS_WASTE_MANAGEMENT_IN_INDIA_AN_INTEGRATED_SOLID_WAST E_MANAGEMENT_APPROACH*
3. *https://www.forbes.com/sites/uhenergy/2018/03/12/plastics-recycling-could-the-future-be-in-india/#7851209842e1*
4. *https://economictimes.indiatimes.com/industry/ indl-goods/svs/paper-/-wood-/-glass/-plastic/-marbles/our-plastic-pollution-problem/articleshow/64420276.cms*
5. *http://www.polymerjournals.com*
6. *http://library.iugaza.edu.ps/thesis/118020.pdf http://www.mekanex.se/produkter/komponenter*
7. */axelkopplingar/klokopplingar*
8. *Snäckväxel – kvadratisk. (n.d.). Retrieved November 14 2016 from http://www.mekanex.se/produkter/vaxlar/snack vaxlar/standard/*
9. *Black, A. (n.d.). The Ins and Outs of Worm*
10. *Gears. Retrieved November 14, 2016 from http://www.machinerylubrication.com/Read/10 80/worm-gears*