WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Fabrication of Plastic Shredder Machine

[1]Vikramshimha Dora, [2]P. Venkatesh, [3]S. Sai Yugendhar, [4]S. Prasanth, [5]D. Sai Kumar, [6]Mr. J. Ramesh Naidu

[1,2,3,4,5] U. G Scholars, Dept. of Mechanical Engineering, Raghu Engineering College, Dakamarri, Visakhapatnam, AP, India
[6]Assistant Professor, Dept. of Mechanical Engineering, Raghu Engineering College, Dakamarri, Visakhapatnam, AP, India

ABSTRACT:

The Use of plastic is increasing day to day life in present scenario which causes a serious environmental issue, for this purpose we need to make eco-friendly environment by recycling possible waste plastic. To solve this issue already exist highly operated machines but they are too costly. Therefore, in our project, we decided to design and construct a plastic shredder machine that is affordable and light in weight. Therefore, the goal of this project is to treat plastic garbage as inexpensively as possible by decreasing where it is produced in order to reduce manpower costs.

The project describes the experimentation of plastic bottle cutting machines and analysis of mechanism used in the machine. . To make waste management simpler, a plastic bottle cutter is a device used to cut the plastic into little pieces. The major goal of our research is to develop a low-cost plastic shredding machine using a single shaft mechanism and a power supply that can benefit Micro, Small, and Medium Enterprises.

Frame, hopper, electric motor, and shredder setup are some of the mechanical and electrical components used in the plastic shredder machine to accomplish this concept. This equipment is used to separate the plastic into tiny, atypically formed flakes that can be treated further. Recyclables reclaim the raw materials, which aid in the making of new plastic product

Key words : plastic shredder, plastic waste, catia, waste management

I. INTRODUCTION

A shredder is a machine used for reducing the size of all kinds of material and invented by Vincent Earl Par Industrial shredders are available in a wide range of sizes, designs, and uses.The shredder is frequently used to separate materials into different sizes or to lower the transportation costs associated with recycling, but one of its main uses is to upgrade the material by shredding metals, plastics, aluminium, metal, and vehicles. as waste materials such as municipal solid waste or nuclear waste, medical waste, hazardous waste including common garbage. Some examples of materials that are commonly shredded are tires, metals, car wreck, woods, plastics, leathers, papers and garbage. Shredders help humans manage waste for recycling and other purposes.

The use of shredding machine can reduces the amount of waste sent to landfills and incinerators. It conserves natural resources such as timber, water and minerals and increases economic security by tapping a domestic source of materials. The use of shredding machine can also prevents pollution by reducing the need to collect new raw materials and also saves energy.

The reduction motor is connected to a motor that is used for the shredding process, which involves cutting down scrap by operating the blade at a fixed speed. On the other hand, using shredder blades with tiny serrated edges to cut the plastic directly is difficult. Since the creation of the shredding method, plastic scrap has undergone many processing steps to reduce its strength to the point where it may be easily cut. Before shredding, the following procedures are carried out: Shredding, autoclaving, and incineration. However, the autoclaving and cremation processes degrade the quality of the product that will be shredded. Specifically, the variation in Serrated edges composed of strong tool steel with greater surface area provide quality during the shredding process. The blade has a maximum thickness of 5mm. As a result, the shredded bits that are produced after shredding have a thickness of less than or equal to 5mm. There is no need to heat treat the items because their size is equivalent to or less than 5mm, which preserves the material's quality. Thus, the injection moulding machine can be fed with these components immediately. Because the items are not exposed to high temperatures during the moulding process, the finished product is of great quality. Since the grade doesn't change much with this process, the recycled product can be used more frequently than before.

Components of Shredding machine:

The components used in shredding machine as follows

Worm Gear Wheel

Power Transmission System

Bearing

Single Phase Induction Motor

Blade

Shaft

Spur Gear

Sprocket and Chain

Stand

1.1 Problem Statement:

One of the most significant and essential processing phases in the sheet metal industry is the punching or pressing process. If this operation is carried out manually, it lengthens the production process, costs more money, and compromises worker safety. Therefore, automatic punching machines are created in order to increase production and safety. One can have more control over this procedure by automating it. Reducing the lead time for production, cutting costs, and improving worker safety are all desirable outcomes. The goal is to reduce labour effort, increase workplace safety, produce goods in a shorter amount of time at a higher profit, and decrease reliance.

1.2 Scope:

This project is limited to the scope as follows;

1. Design and Fabrication of Mini Plastic Shredder Machine
2. Test-run and verify the Machine.
3. suggest the safe protection during process.
4. Reduce the plastic.

As a solution, a medium-sized machine has been developed

II. LITERATURE SURVEY

Sustainable waste management of post-recycling municipal solid wastes (MSW) is an important component in the green movement toward a cleaner, environmentally conscious society. Waste-to-Energy (WTE) power plants have potential to significantly reduce the amount of landfilled refuse while producing a carbon neutral form of heat and power, However, ; the average capital investment for a new WTE facility ranges from $7,500 to $9,000 per installed kW of capacity, nearly three times that of coal fire power plants. There exists a need to considerably reduce the cost of such facilities in order to bring them into the mainstream of solid waste management. This report examines how size reduction and homogenization of the raw MSW stream can potentially improve WTE operating characteristics while decreasing capital investments.

Chemical rate and heat transfer theories indicate that the productivity of a moving grate WTE boiler should be enhanced by means of pre-shredding the MSW, thus reducing the average particle size, homogenizing the feed, and increasing its bulk density by an estimated 30%. Smaller particle sizes enhance reaction kinetics and flame propagation speed, due to the higher surface to volume ratio, and thus lower the amount of combustion air needed to meet the required combustion rates. Minimizing the primary combustion air supply rate lowers the total amount of flue gases and can result in decreased costs of the Air Pollution Control system.

Smaller and more homogeneous particles increase bed mixing coefficients and reduce retention time required for complete combustion. The benefits realized through the pre-processing of MSW by means of modern shredding equipment were evaluated quantitatively both for the traditional High-Speed, Low-torque (HSLT) hammer mills and the new generation of LSHT shear shredders. The shearing mechanism utilized in these low rpm devices produce a more uniform particle distribution at a lower energy cost per ton MSW processed than hammer mills of the same capacity.

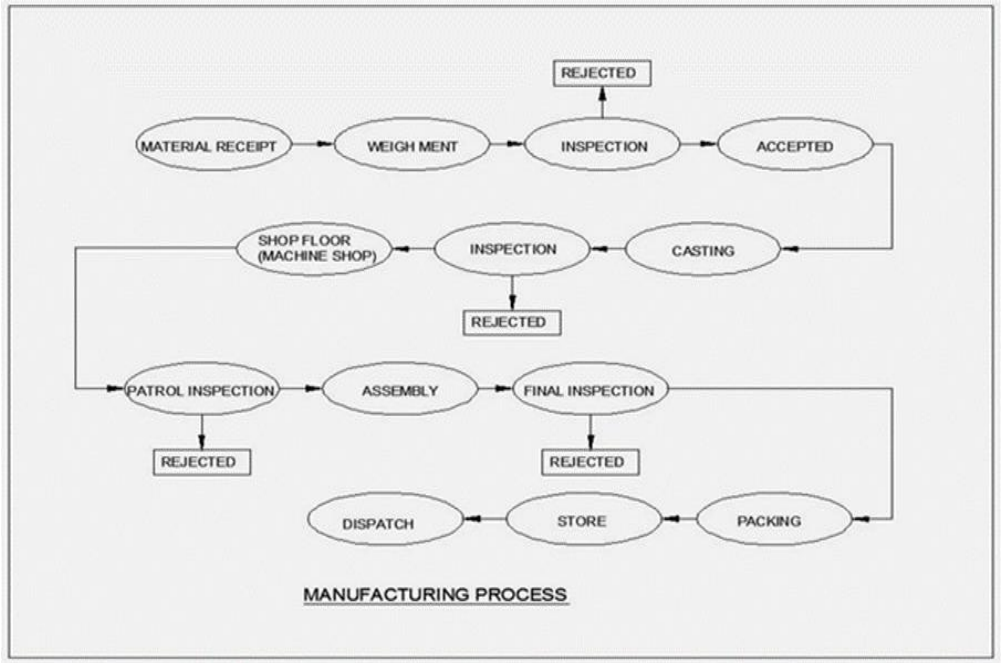
The integration of size reduction systems into the typical flow sheet of WTE facilities has been hindered by the high frequency of fires, explosions, and ejected material from hammer mill grinders. The low shaft speed of the shear shredders has reduced the occurrence of fires and explosions while nearly eliminating ejected materials, allowing for safer and more reliable adaptation into new and existing WTE facilities. The most important criterion in the adoption of pre-shredding MSW for grate combustion will require that economic and energy benefits of pre-shredding be clearly greater than the conventional operation of combusting as received MSW. At an average WTE electrical production of 650 kWh per metric ton of MSW processed, the required 3-11 kWh/ton for LSHT devices is less than 2% and should be more than accounted for by improved combustion efficiency in the WTE plant. The addition of a shredding system in a medium sized WTE plant will increase the O&M from current costs by roughly 10%, not including the benefit

of lower maintenance due to improved distribution of thermal stresses on the grate and in the boiler. Finally, for the capital cost of a new WTE facility in the range of $8000 per kW of capacity, the initial investment in shredding and fuel handling equipment will increase capital costs by about 2% from current values. It should be determined on a case-by-case basis whether the addition of pre-shredding equipment may increase capacity and decrease maintenance sufficiently to cover capital and operational costs as well as lower overall cost of operating the facility.

Manufacturing processes:

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

Manufacturing process is basically a complex activity, concerned with people who've a broad number of disciplines and expertise and a wide range of machinery, tools, and equipment with numerous levels of automation, such as computers, robots, and other equipment. Manufacturing pursuits must be receptive to several needs and developments.



1.1 Manufacturing process

Firstly we need to selecting the elements based on our requirement

- Model design is done by using CATIA V5 software
- After that we select the material used for different parts of shredding machine
- Analysis is done to our model by using ANSYS software.
- After analysis if any modification is needed we will do and if it is completed we will go to fabrication.
- The fabrication will be done and produce parts like blades, shafts, side plates, table, etc.
- After fabrication we will assemble the parts and observe the capacity of the machine.

A Plastic Shredder is a mechanical device used to cut plastic into Undefined flakes, we design this project for recycling of plastic, Recycling Reduces the waste Management Solution. Machines Available for Recycling are costlier and setup is also high, to overcome this Problems we developed Plastic shredder machines, with this machines individual start the recycle setup without skill. This Deals with design and Fabrication Mini Shredder Machine depends on various Parameters, Study of Manufacturing is very important aspect in order to carry out this project.

The materials used are as follows:

Sl.	No. PARTS	Qty.	MATERIAL
1	AC motor	1	-
2	Worm gear	1	C.I

3	Spur gear	2	C.I
4	Blades	12	M.S
5	Bolts & Nuts	-	M.S
6	Shaft	2	M.S
7	Bearing	4	Steel
8	Chain and sprocket	1	M.S
9	Bearing Cap	4	M.S
10	Fixed Plates	14	M.S
11	Hopper1	M.S	
12	Frame stand	1	M.

2.4 Working:

The experimental setup of our project consists of a frame on which the entire components are mounted. The plastic cutter is present at the center which is delivered motion with the help of a motor and the worm drive. Also at the top of the plastic cutter, a plate is mounted which helps to prevent the scattering of the plastic while the plastic crushing operation. The worm drive is supplied with power with the help of an AC motor and by using the chain drive. The chain is preferred since it is highly economical.

The plastic is placed in its position and the switch is turned on. Hence the motor is started and supplies power to the plastic cutter**.**

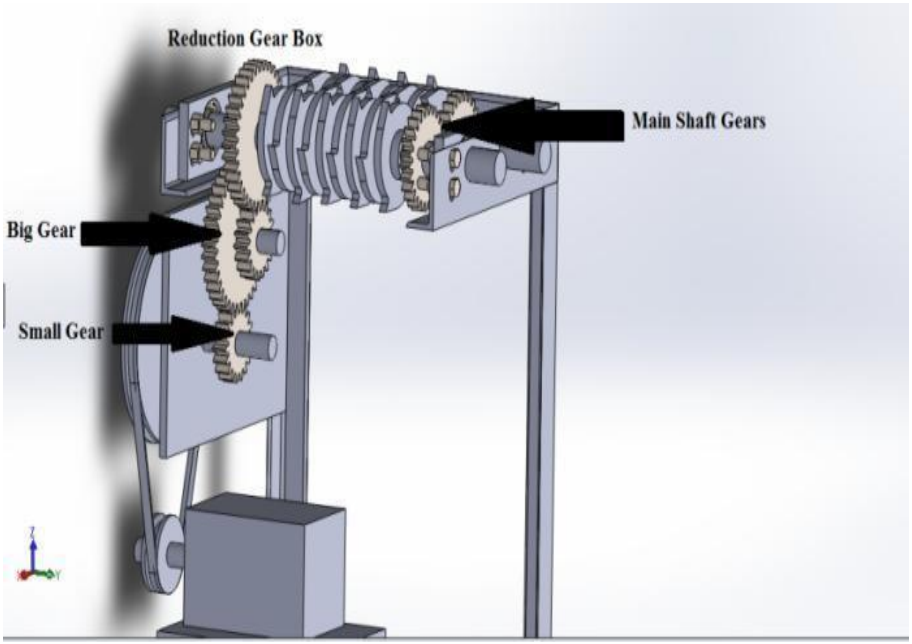


Fig 4.2 Deign of machine

2.5 Design Calculation:

1. Assume there's 2 load on blade in the same time (during rotating and shred plastic)

Force = O u-plastic X A blade edge Force = 44.82 Mpa x 1mm² = 4.48 N Stress Analysis Results Max Stress 1.5 Mpa → Blade Material S30C

Torque blade = Force x Radius blade Torque Blade = 2(4.48 Mpa) x 75mm 1 Blade give load about 6.75 Nm

1 Shaft has 6 blade that give a torsion to shaft, and there's 12 blade cut in the same time (based on configuration)

Torque shaft = (Torque Blade X Total blade cut) Torque shaft = (6.75 x 8) = 54 Nm

Torque Drive shaft = 108 Nm → Load To Prime Mover Power Needed = Torque drive shaft X Revolution Drive shaft Power Needed = 108Nm x 57 rpm (0.00014) = 0.8 hp

Electric motor efficiency is about 80% so net Power Needed is about 1 2.Design Of Ball Bearing

Bearing No. 6204

Outer Diameter of Bearing (D)	=	47 mm
Thickness of Bearing (B)	=	14 mm
Inner Diameter of the Bearing (d)	=	20 mm

r_1=Corner radii on shaft and housing

r_1=1(From design data book)

Maximum Speed=14,000 rpm (From design data book)

Mean Diameter (dm)=(D + d) / 2 = (47 + 20) / 2

dm = 33.5 mm

Spring index (C) = (D /d)

= 12 / 2

C = 6

3.Wall Stress Factor

$$Ks = \frac{4C - 1}{4C - 4} + \frac{0.65}{C}$$

$$= \frac{(4 \times 6) - 1}{(4 \times 6) - 4} + \frac{0.65}{6}$$

Ks = 1.258

FUTURE SCOPE:

Design of the multi Shaft Shredder machine & Blades has successfully completed with required design calculation. The Required level RPM of Motor also analyzed and find out as per the project of Shredding Machine. In this project Design of single Shaft Shredding Machine and Blades is completed with Catiav5 software and the blades and shredding machine is analyzed in future with the use of ANSYS software. And calculate the stack up calculation of the blades assembly.

III. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

We are proud that we have completed the work with the limited time successfully. The DESIGN AND FABRICATION OF PLASTIC SHREDDER is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed a ―PLASTIC SHREDDER‖ which helps to know how to achieve low cost automation. The application of plastic crushing got smooth operation. By using more techniques, they can be modified and developed according to the applications.

REFERENCES

M. Spilka, A. Kania, R. Nowosielski. 0TIntegrated recycling technology,0T Journal of Achievements in Materials and Manufacturing Engineering, Volume 31 Issue 1 November 2008 P. 97, 98.

Puttaraj MH, Shanmukha S ―Utilization of Waste Plastic In Manufacturing Of Plastic-Soil Bricks.‖International Journal of Technology Enhancements and Emerging Engineering Research (2005) 2: 2347-4289.

E.K. Orhorhoro, A.E. Ikpe and R.I. Tamuno Performance Analysis of Locally Design Plastic Crushing Machine for Domestic and Industrial Use

Metin E, Erozturk A, Neyim C ―Solid Waste Management Practises and Review of Recovery and Recycling Operations in Turkey.‖ Waste management (2003) 23: 425-432

B. Bieda, The role of thermal treatment in an integrated waste management, Proceedings of International Conference ―Waste Recycling‖, Cracow, 2005, P. 104-113.

SophieVan den Berg, Master's thesis MSc. Partner in Development Adviser Solid Waste Management & Recycling January 2009.

R. J. Crawford, Plastics Engineering, 3P rdP Edition. 1998, p. 245-250.

Hopewell, Robert Dvorak and Edward Kosior. "Plastics recycling: challenges and opportunities".Phil. Trans. R. Soc. B (2009) 364, P. 2115–2126. [9] M. P. Groover, Fundamentals of Modern Manufacturing (Materials, Processes, and Systems) Fourth Edition P. 267- 307.

Instruction manual. CBW Granulators. Models 1012, 1018 and 1024 P. 11-36 [11] Mr. V.B.Bhandari, ―Design of machine element‖, Tata Mc- Graw Hill Publication, 3rd Edition 2010