Volume-7,Issue-4, (April-17)
ISSN (O) :- 2349-3585

DESIGN AND FARICATION OF PLASTIC WASTE SHREDDER MACHINE

Dr.M.MUTHUKUMARAN[1],P.MURASOLI MARAN[2], M.PORUL SELVAM[3], S.SARAVANA KUMAR[4], C.PRAVEEN[5]

Department of Mechanical engineering,SNS College of Engineering,Coimbatore

Abstract—The scope of this project was to design and development of Shredder machine focus on plastic wastes to prepare the new product. The project began with collection of information and data on user lifestyle and current process by which they perform their job. Concept was developed considering the safety factor users operating environment and maintenance. Considering the users' needs and buying capacity, a prototype was fabricated. The machine consists of single-phase motor, spur gear assembly, structural frame, duct and cutter. The machine frame is built using mild steel and tungsten carbide is used for cutter tip preparation. The power from the electrical motor is transmitted to cutter shaft through a belt drive. The shred particle can be converted into the new product. Burning of plastic waste are also reduced and pollution controlled

Keywords— reduce plastic waste

I INTRODUCTION

It would be difficult to imagine our modem world without plastics. Today they are an integral part of everyone's lifestyle with applications varying from common place domestic articles to sophisticated scientific and medical instruments. Plastic can take more than 500 years to decompose. Nowadays designers and engineers readily turn to plastics because they offer combinations of properties not available in any other materials. Plastics offer advantages such as lightness, resilience, resistance to corrosion, colour fastness, transparency, ease of processing, etc., and although they have their limitations, their exploitation is limited only by the ingenuity of the designer. The term plastic refers to a family of materials which includes nylon, polyethylene and PTFE just as zinc, aluminium and steel fall within the family of metuls. This is an important point because just as it is accepted that zinc has quite different properties from steel, similarly nylon has quite different properties from PTFE. Few designers would simply specify metal as the material for a particular component so it would be equally unsatisfactory just to recommend pZustic. This analogy can be taken still further because in the same way that there are different grades of steel there are also different grades of, say, polypropylene. In both cases the good designer will recognise this and select the most appropriate material and grade on the basis of processability, toughness, chemical resistance, etc. It is usual to think that plastics are a relatively recent development but in fact, as part of the larger family called polymers, they are a basic ingredient of animal and plant life. Polymers are different from metals in the sense that their structure consists of very long chain-like molecules. Natural materials such as silk, shellac, bitumen, rubber and cellulose have this type of structure. However, it was not until the 19th century that attempts were made to develop a synthetic polymeric material and the first success was based on cellulose

.

II PROBLEM DESCRRIPTION

Plastic pollution involves the accumulation of plastic products in the environment that adversely affects wildlife, wildlife habitat, or humans. Plastics that act as pollutants are categorized into micro, meso, (or) macro debris, based on size. The prominence of plastic pollution is correlated with plastics being inexpensive and durable, which lends to high levels of plastics used by humans. It is slow to degrade in naturally. Plastic pollution can unfavorably affect lands, waterways and oceans. Living organisms, particularly marine animals, can also be affected through entanglement, direct ingestion of plastic waste, or through exposure to chemicals within plastics that cause interruptions in biological functions.

Humans are also affected by plastic pollution, such as through the disruption of the thyroid hormone axis or hormone levels. In the UK alone, more than 5 million tonnes of plastic are consumed each year, of which an estimated mere 24% makes it into recycling systems. That leaves a remaining 3.8 million tonnes of waste, destined for landfills.[5][6] Plastic reduction efforts have occurred in some areas in attempts to reduce plastic consumption and pollution and promote plastic recycling.

Objective

- The scope of the project is to reduce the burning of plastic waste and control the environmental pollution.
- To reduce plastic waste place into landfills.

III PARTS DESCRIPTION

3.1 SHAFT

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it

3.2. SINGLE PHASE MOTOR

single-phase electric power is the distribution of alternating current electric power using a system in which all the voltages of the supply vary in unison. Single-phase distribution is used when loads are mostly lighting and heating, with few large electric motors. A single-phase supply connected to an alternating current electric motor does not produce a revolving magnetic field; single-phase motors need additional circuits for starting, and such motors are uncommon above 10 kW in rating.Single phase AC power systems peak in voltage at 90° and 270°. A cycle completes at 360°. Because of the rises and falls in voltage, power is not delivered at a constant rate. In contrast, in a three-phase system, the currents in each conductor reach their peak instantaneous values sequentially, not simultaneously; in each cycle of the power frequency, first one, then the second, then the third current reaches its maximum value. The waveforms of the three supply conductors are offset from one another in time (delayed in phase) by one-third of their period. When the three phases are connected to windings around the interior of a motor stator, they produce a revolving magnetic field; such motors are self-starting.The primary difference between single phase and three phase AC power is the constancy of delivery." .

3.3 GEAR ASSEMBLY

Spur gear teeth are manufactured by either involute profile or cycloidal profile. Most of the gears are manufactured by involute profile with 20° pressure angle. When two gears are in mesh at one instant there is a chance to mate involute portion with non-involute portion of mating gear. This phenomenon is known as interference and occurs when the number of teeth on the smaller of the two meshing gears is less than a required minimum. To avoid interference we can have undercutting, but this is not a suitable solution as undercutting leads to weakening of tooth at its base. In this situation Corrected gears are used. In corrected gears Cutter rack is shifted upwards or downwards.

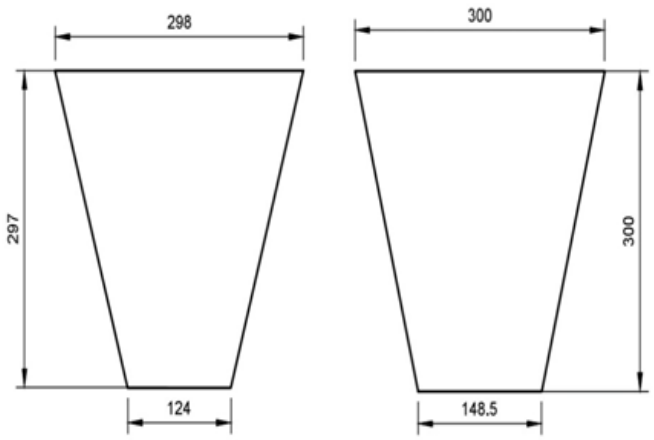
3.4 BLADE

A blade is the portion of a tool, weapon, or machine with an edge that is designed to puncture, chop, slice or scrape surfaces or materials. A blade may be made from a flaking stone, such as flint, metal (usually steel), ceramic, or other material. Blades are one of humanity's oldest tools, and continue to be used for combat, food preparation, and other purposes. In our project Blade is used as a cutter. The cutter is used to cut plastic waste are dump into the hopper. The waste plastic is slightly come under the cutter assembly. Cutter cut the plastic waste into the small particles. They are three type of Blades are used to cut plastic. All Blades are made of Mild steel material. But their dimension and

ISSN:-2349-3585 |www.ijrdt.org

size can be different. Outside diameter of the Blade is 120mm and Thickness of the blade is 5mm.

3.5 HOPPER



BOTTOM:

LENGTH: 148.5mm

BRETH: 124mm

TOP:

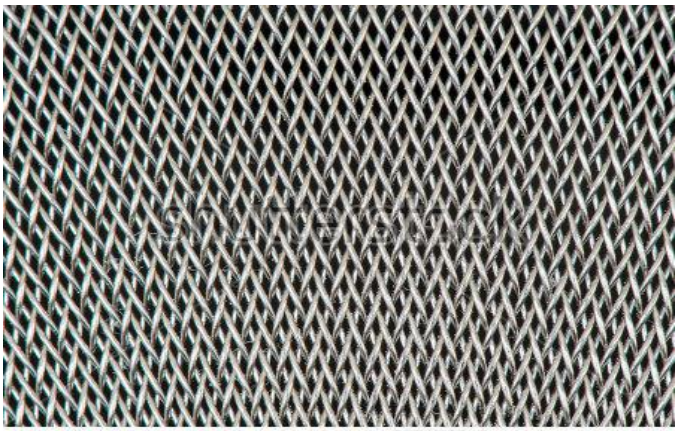
LENGTH: 300mm

BRATH: 298mm

A storage container used to dispense granular materials through the use of a chute to restrict flow, sometimes assisted by mechanical agitation. A storage container used to collect granular materials designed to easily dispense these materials through the use of gravity. If the hopper is placed top of shredder machine. The waste particle is put into hopper. Due to gravity and suction of blades the plastic is slightly go to the cutter assembly. Hopper is made of mild steel. Top of the hopper breath is large and bottom of the hopper breath is less when compare to the top side.

3.6 SIEVE

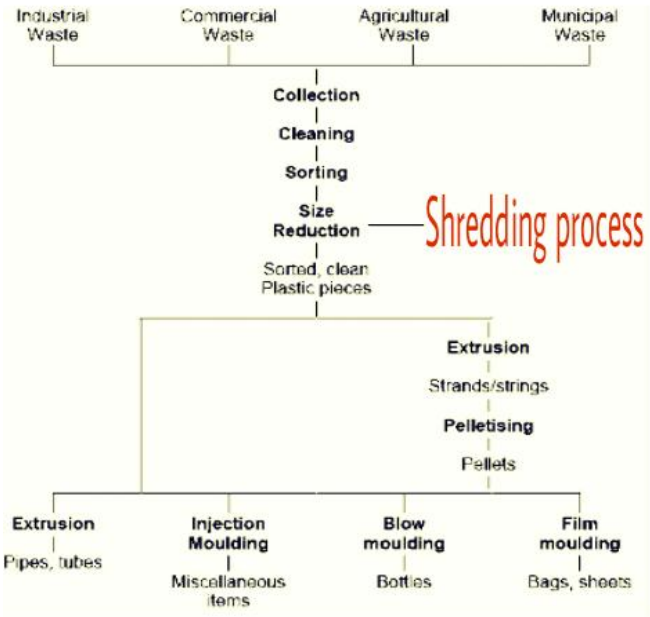
A sieve, or sifter, is a device for separating wanted elements from unwanted material or for characterizing the particle size distribution of a sample, typically using a woven screen such as a mesh or net or metal.



IV. MODEL AND WORKING PRINCIPLE

4.1 SHREDDING PROCESS

Shredding process is to reduce size of the plastic wastes into the small size. The plastic wastes are collected from the different kind of places. These are particularly sorted based on the thickness and the types of plastics. This separation is achieved by the use some grades of plastics. Once these processes are completed the plastic wastes are cutter into small scraps (i.e shred) by manually.



4.2. WORKING PRINCIPLE

Types of plastic wastes are sorted as per the size of shredder machine. Once The power supply unit is turned on , the machine blades are rotated. The plastic wastes are put into the hopper of the shredder machine. These are shredded by the shredding machine blades in a various sizes based on the size of blade configurations. The size of output wastes can be also determined and modified by the adjustment of a machine

attachment called MAILLES. Once the wastes are shredded into strips forms they are cleaned, chemicals and additives are added. These waste shredded plastics are reused to form different products by various operations (I.e. moldings, compression process).

V DESIGN CALCULATION

5.1 DESIGN OF SHAFT

The material choosen for shaft is C40 STEEL having Shear stress Design Based on Strength against static load Shear strength , ()=65N/mm2Shaftlenghtbetweenof two edge=30mm Torsional Moment, (Mt) = $(\pi/16)\times l^3\times()$=344593.4Nm

5.2 DESIN OF MOTOR

The rpm of the motor is 2800 rpm.but the machine was designed based on the load conditions 70rpm is inought to withstand the load From the above details we find the rpm of the motor $344593.4=P\times60/(2\pi N)$ N=55.4~70rpm

5.3 DESIGN OF SIEVE

Length of the sieve=180mm

Breadth of the sieve=149mm

Radius of the curve, r=70mm

Diameter of the shape holes=4mm

Area of the sieve, $A=(l\times b)+(\pi r^2/2)-[(\pi d^2/4)\times30]$

$A=180\times149+(\pi\times70^2/2)-[(\pi\times4^2/4)\times30]$

=3414.9mm

VI PRODUCT DEVELOPMENT

From the objective of our project is mainly considered for reducing the plastic wastes from the society as well as in eco friendly .but conversion of scraps into the raw materials by the following ways,By the use of extruder machine the scraps are melted at 280 degree calculus .At the time the additives are added for the purpose of changes to the color of scraps. These elements are added in a ratio about 100:1100 denotes kg of scraps, 1 denotes kg of coloring agent.The name of this additive is called MASTER BATCH. These are in various colors and it increases the strength, hardness of the plastic wastes into usable raw materials. It is shown in figure.

6.1 COMPANY EXHIBIT

From the survey taken from SRI MAHERAAJ POLYMERS MANUFACTURING IN PLASTIC RAW MATERIALS PP,HD,LD.These survey is based on the small calculatioms it as follows,Number of labours=10 Working hours=8hours

The cutting of plastic wastes into scrap by manually in 8hours=300kg Cost of workers for 8 hour=8×200=Rs.1600

Cost of workers per month=1600×26=Rs.31200 Number of labours need for operating the shredder=1 Number of working hours=8 hours The cutting of plastic wastes into scraps per hour =45 kg The cutting of plastic wastes into scraps for 8 hour =360 kg From the above results our project is suitable for that plastic recycling process and it is an economical machine for that process of plastic recycling process.Similarly the survay taken from our college canteen,These survey based on the plastic waste disposal from canteen Burning of plastic wastes per day = 3kg Burning of plastic waste per month = 78 kg for 26 days After sorting process reusable plastic waste =50kg Due to the recycle of plastic waste from our project the environmental pollution are reduced and the plastic wastes are successfully recycled.

6.2 MERITS

- Burning of plastic waste will be reduced.
- Environmental pollution can be reduced.
- By reducing the need of conventional waste disposal and it reduce the greenhouse gas emission.
- Recycling minimize the waste place in the landfills.
- Recycling spreads awareness to the environmental.
- Recycling process to save the earth.
- Our project not only based on economical ways it is also useful for the society and ecofriendly way.
- It reduces the labour requirement.

6.3 APPLICATIONS

- Shredder machine is mostly suitable for small plastic recycling industries.
- By the application of moulding process,these raw materials are converted into various products (i.e chair,water bottles,home applications,etc.,
- By the application of compression machine the plastics raw materials are perfectly shaped into new products based on the reqirements.
- The shining raw materials are used in the electonic applications i.e switch,wires etc.

CHAPTER –VII RESULT AND DISSCUSION

- The prototype of an plastic waste shredder machine which works on the principle of shredder mechanism was

ISSN:-2349-3585 |www.ijrdt.org

successfully designed and fabricated. Experimental analysis was successfully performed on the prototype. The results obtained from the experiment areas follow.

- Prototype of an shredder machine which works on the principle of shredder mechanism was successfully manufactured.
- It uses electricity as its input. It reduce the labor reqirement,and the plastic wastes are successfully recyclable, which was the primary goal.
- The prototype creates no pollution and is eco- friendly.
- The suitable for plastic recycling process.
- Shaft and blade speed is controlled by the suitable motor and gear box.
- Maximum kg360 of plastics can be converted into scraps at 70 rpm for aninputcurrentof1.2A for 8 hours.
- The efficiency and the outcome of the shredder machine was less than what was expected. The reason for less efficiency and the outcome are
- Blades of the shredder machine are not perfect .The blades are not machined in a CNC machine. It was wound with hands on gas cutting process. So blades are not tight. The blades generated less torque over the plastic waste and it will not be as strong as expected.
- There might be some misalignments and it might cause a drop in output.
- But our project idea is successfully executed for the process of recycling plastic wastes from the society in a eco friendly way.

CHAPTER –VII CONCLUSION

The plastic waste recycling shredder machine has various advantages over the manual scrap cutting process. The main advantage is it reduce labour requirements. This results in no pollution which is very desirable in the present day situation. As there is no heartening process followed during shredding process. This eliminates the need for a cooling system. As electrical energy is used to rotate the blades of the machine, so the design needs simple arrangements. Also by use of materials like mild steel, stainless steel we can increase the life of the machine blades. Also the electrical transmission system can be used in the engine by the suitable electrical motor. Less noise is produced during working.

REFERENCE

1) Hardesty, Britta Denise; Chris Wilcox (2015). "Eight million tonnes of plastic are going into the ocean each year". The Conversation. Retrieved 21 February 2015.
2) Jambeck, Jenna, Science 13 February 2015: Vol. 347 no. 6223; et al. (2015). "Plastic waste inputs from land into theocean".Science.347(6223):768771.doi:10.1126/science .1260352. PMID 25678662. Retrieved 21 February 2015.
3) Creton C (February 24, 2017). "Molecular stitches for enhanced recycling of packaging". Science. 355 (6327): 797–798. doi:10.1126/science.aam5803.
4) Eagan JM; et al. (February 24, 2017). "Combining polyethylene and polypropylene: Enhanced performance with PE/iPP multiblock polymers". Science. 355 (6327): 814–816. doi:10.1126/science.aah5744.
5) Fleischman T. "Polymer additive could revolutionize plastics recycling". cornell.edu. Cornell University. Retrieved 23 February 2017.
6) http://www.plasticsrecycling.org/images/pdf/market_development/APR_Design_Guide_Exec_Summary2014.pdf
7) http://www.plasticseurope.org/plastics-sustainability-14017/zero-plastics-to-landfill/waste-pre-treatment-and-sorting.aspx. Retrieved 2015.7.8