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Fabrication of Paper And Plastic Shredder Machine

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ABSTRACT

The most common thing used in today's world is Plastic. Plastic is the lightweight, durable as well as inexpensive material. It can be mold easily into different products for use. But, after use it causes very serious and harmful effects to the environment as well as the landfill space. Plastic bottles make up approximately 11% of the content landfills, causing serious environmental consequences. The plastic waste globally constitutes more than 60% of the total global municipal solid waste (MSW), 22% were recovered and 78% disposed. Around 4% of the world oil and gas production, non-renewable resource is used as a feedstock for plastic and further 3 to 4% is expended to provide energy for their manufacture. these facts indicates that our current use of plastic is not sustainable. Recycling of waste plastics helps to recover the material which can be used to make new products. For this, first it must be converted into a fine grains for further processing and transportaion. This is the reason behind the development of paper and plastic shredder machine to recycle the waste paper and plastics found in the surrounding.

Keywords - Development, paper, plastic, shredder machine, waste.

1. INTRODUCTION

Paper and plastics are an important part of our day to day life since last few decade. They are the most commonly used today. They comes in five mejor categories like the Polyethylene terephthalate (PET), the High density polyethylene (HDPE), the Polyvinylchloride (PVC),

The Polypropylene (PP) and the Low density polyethylene (LDPE). Current levels of their usage and disposal generate several environmental problems. Plastic is not a biodegradable product so that it causes very harmful effect on our environment and it makes the landfill space and rivers polluted. Around 4% of the world oil and gas production, non-renewable resource is used as a feedstock for plastic and further 3 to 4% is expended to provide energy for their manufacture.This information shows that our current use of paper and plastic is not sustainable. But the plastic is a reusable material which can be used to make new products by recycling process.

For making recycled products first it convert into a small grains by shreddeing. It is suitable for the transportation and further processing to make new products like containers, plastic lumbers and particle boards, e.t.c. the paper and plastic shredder mschine that reduces used plastic bottles to smaller particle sizes to enhance its portability, easiness and readiness for use into another new product. The design of this machine is taken from method of scissors to cut material into small form. this method were applied in the machine by fabricating the cutting blades to cut the waste plastics and papers. The shredder machine comprises major components, namely; the shredder unit, power and transmission unit and machine frame.

LITERATURE REVIEW

Joseph Y. Ko presented a shredder machine in 2000. It had a automatic feeding mechanism to shred the material. This machine were able to shred 20 sheets in single feed with approx. 9 inches width. Knife roller were use to cut the paper strips.

Ming Hui Ho. presented paper shredder machine which had two rotary cutters having multiple blades. The blades were distributed in non-equiangular manner. This machine had a disadvantage, if the amount of shredded paper increased, the shredder did not work properly because of the simultaneous engagement of multiple blades with the paper and the shredded paper stuck in the shredder.

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METHODOLOGY

The primary and important thing was the study of the components of shredder machine. The components of this machine includes feeding unit, power unit, machine frame and shredder unit. One of the important element of this machine was blades. So next step was to focus on research and study of the blade design and material selection.

The material of the Blades required for the machine is mild steel which is treated with Nitriding heating process to make the material hard for cutting the plastic and paper. The cutting blades are 150 mm in diameter and 10 mm thick. The feeding unit is made of 2 mm thick mild steel plate and the dimension of 228 mm × 270 mm through which the plastic and paper fed into the shredder machine. The shredder unit where the plastic or paper are cut into small particles consist of two shafts having 40 mm diameter. Each shaft having different length of 362 mm and 508 mm respectively.

After the study and selection of the material for different components, next step was to create software based virtual model. This is necessary to find errors and final visualisation of the machine. It helps to make the machine more accurately. After satisfying result of the prototype, final fabrication will start and required modification can be done in existing design.

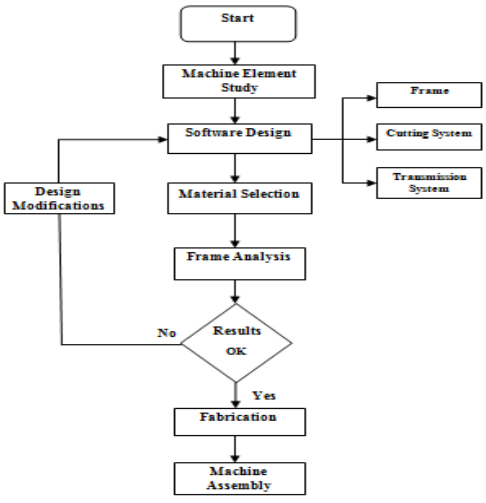

Fig.- Methodology

MACHINE CONSTRUCTION

First part of the construction of machine is to make cutting system including Shaft, Blades, Frame.

Blades:-

The design of cutting blade made on the CREO PARAMETRIC software as shown in fig. The cutting blade has round shape having four cutting egdes and a hexagonal shaped hole is in the middle to mount on the main shaft for move together. The blades are used to shredd material in vertical direction. The material of blade is mild steel with heat treatment process. 20 blades required with 10 mm thickness and 51^0 of cutting angle.

Fig.- Model of blade and manufactured sample

Main Shaft:-

Shafts used in machine acts as a holder to hold the blades in the middle of the machine. The shape of the shaft is hexagonal and both ends are rounded to fix the shafs in the frame of machine. The material of the shaft is mild steel and the minimum distance of two parallel side is 34.50 mm.

Fig.- Shaft Model used in machine

In this machine we used two shaft with different length. One shaft had long length and another

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had short length. The length of the long shaft is 508 mm which is used to connect the machine with the transmission system. And another shaft's length is 362 mm.

ASSEMBLY OF SHAFT AND BLADES

This assembly consist of the blades, shaft, washers and gears. Material used for washer is MS and it is in the ring form. The function of the washer is to maintain the distance of two blades and to lock the blades in such a way that they do not move during the operation. The requirement of such washers are 20.

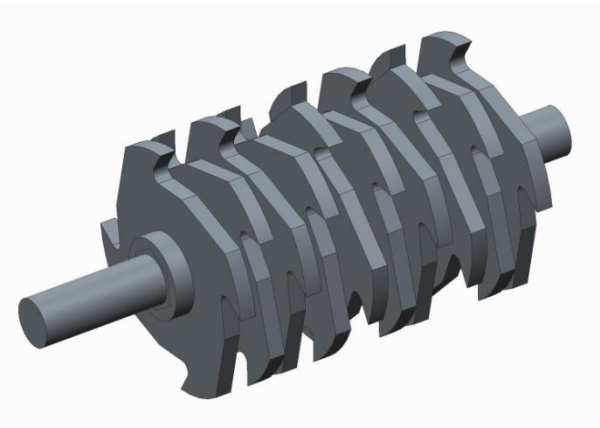

Fig.- Shaft Assembly

Fig.- Shredder Box Assembly

POWER TRANSMISSION

Transmission system consist of two elements, one is motor and other is reduction gearbox. The motor used to provied power is a three phase motor which rotate at 1440 rpm. The reduction gearbox used to minimise the rotation of the output shaft connected to the machine. To transmite the power from motor to blade shaft assembly at low rpm reduction gearbox placed in the middle of motor and machine. Output shaft of the motor linked with small shaft of gearbox and the shaft of the machine is kinked with large diameter shaft as shown in given figure.

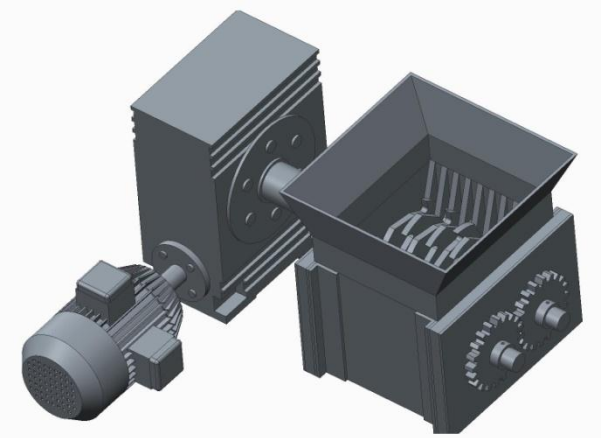

Fig.- Power Transmission

RESULT

1. At the machine speed of 360 rpm the shredding performance with a result of 53.6% shredding achievement while the average shredded paper particle size is 7.05 mm^2 and 12.23 mm^2 for plastic bottle.

2. Throughout capsity of machine at 360 rpm is 31.67 kg approx. and average particle size is 12.3 mm^2

CONCLUSION

The plastic shredding machine is widely used n industries for the plastic waste management. By using this plastic shredding machine the overall costing of recycling process get reduced. It require less labor work and there is no

requirement of skilled labour in industry. In recycling process of plastic waste. It reduces the process time in industry.

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