Design and Development of Plastic Recycle Machine

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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 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 crusher in which plastic dissect are formed. In third and last step the crushed plastic feed in to the extrusion hopper and then it feed in to barrel by using extrusion shaft as a feeding mechanism. Barrel is provided with heating elements which gives required heat to barrel to form mold and whose temperature is controlled by universal temperature controller as per type of plastic. Mold further feed in to cavity to form required product.

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1. 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. 5.6 million metric tones of plastic wasted every year in INDIA and every next year increased by 10%. To overcome this recycling is the best option to reduce waste plastic. In INDIA recycling rate of plastic is 9205 metric tons per day.

2. OBJECTIVE:-

i. The objective of a project is to recycle a thermoplastic to reduce the solid plastic waste.

ii. To utilize the plastic from domestic and industrial waste to reproduced useful component like paper weight, plastic string etc.

iii. Innovative use of scrap machinery.

3. CONSTRUCTION:-

Our machine contain following component:

- Crusher with hopper.
- Slope for feeding crush plastic.
- Water jacket for cooling purpose.
- Gear box to reduced revolution of extrusion shaft.
- Barrel for direction purpose.
- Extrusion shaft for feeding.
- Heating elements for heating purpose.
- Nozzle for output.
- Cooling system to cool output.
- Belt for torque transmission.
- Pulleys for torque transmission.
- 1.5 HP motor to run the crusher.
- 1 HP motor to run extrusion process.
- 220 volt submersible pump to circulate water.
- Switches to control inputs.
- Wire for electrical connection.

- Universal Controller Temperature to control temperature of heating elements.

4. WORKING:-

The working of machine has three phase .At the first waste plastic is collected at collected zone . After that the waste plastic is separated according to the classification. In second phase the collected waste plastic is feed in to crusher hopper , then the main supply is started and heating of barrel is starts before 15minute so that required heat will acquired by the barrel thought switch . The heating elements are provided at the barrel and the heating of element is controlled by the universal temperature controller. The temperature range set about 220°c. The temperature range is set according to the type of plastic. The controller range can be varies according to the sensor. In this machine J-TYPE sensor is used for the range 200 to 300°c.

In third and last phase the crusher supply is stared thought switch and crush plastic is feed in to the extrusion hopper. The feeding mechanism is there in which extrusion shaft is used. It has a gradually increasing diameter due to which the plastic crush is feed with compression. The semi liquid molten is come out thought the nozzle. Also barrel provided with the water jacket assembly to restrict heat to pass towards hopper and gear box assembly. At the end a plastic wire like string is obtained. Also small product can be manufactured according to the cavity.

5. DESIGN SPECIFICATION:-

SHAFT : Crusher required 1.5HP motor and 671Rpm

Given data

Power (P)=1.5HP

1.5HP=1119 watt

P=1119 watt

Given material

IS C-30 soft (SAE 1030)…… [T-II-7 , page no-39]

Sut=527Mpa

Syt=296Mpa

Factor of safety (FOS) = 6

SOLUTION: -

According to ASME code …….[T-XI-1 , page no-109]

The allowable shear stress for shaft

$\tau_{(max)}$ <0.3 syt or <.018 sut

$\tau_{(max)}$<0.3×296 or <0.18×527

$\tau_{(max)}$<88.88 mpa or <94.86 mpa

select minimum value ,

$\tau_{(max)}$=88.88 mpa

but for factor of safety

the allowable shear stress is

$\tau_{(max)}$=88.88/FOS

$\tau_{(max)}$=88.88/6

$\tau_{(max)}$=14.81 mpa

now, as we know

load factor (Kl)=1.75

$P=2\times\pi\times N\times T/60\times 1.75$

$1119=2\times\pi\times 671\times T/60\times 1.75$

T=27.86Nm.

Now we have,

$T=\pi/16\times \tau_{(max)}\times d^3$

$27.86\times 10^3=\pi/16\times 14.81\times d^3$

d=24mm

According to standard dimension…….[T-A-1 , page no-182]

d=28mm

The diameter of crusher shaft is 28 mm.

PULLEY : According to required RPM

We have

$N_1/N_2=D_2/D_1$

N_1=1440(driver)

N_2=?

D_2=191mm

D_1=89mm

$1440/N_2=191/89$

N_2=671RMP

We have diameter of shaft is 28mm

According to driven pulley

D_2=191mm

From design data book ……[T-XV-7 , page no-159]

1) Type of construction=web construction
2) Section =`A' section

3) Hub diameter , $D_h=1.5d_s+25mm$

$= =1.5\times28+25$

$=67mm$

4) Length , $L_h=1.5\times d_s$

$=1.5\times28$

$=42mm$

5) Rim thickness , $t=0.375\times\sqrt{D}\times3$

$=0.375\times\sqrt{191}\times3$

$=8.81mm$

6. FABRICATED VIEW:-

7. CONCLUSION:-

Using currently available information and data on plastic recycling, temperature control and various mechanical parameter machines has been developed. Due to a simple design, use of low cost and scarp component. The machine is developed is lesser cost as compared to another conventional machines. Hence the low cost plastic recycling machine is successfully developed which can benefits for reducing a plastic waste.

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