International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

Plastic Recycling and Reuse Machine to Level Cavity/Holes on Road

Ajay Mahawadiwar* Nilay Bhagat, Alkesh Shende, Adarsh kantak, Aman Atram

Department of Mechanical Engineering, G. H.Raisoni University, Saikheda
**Asstt. Professor. Department of Mechanical Engineering, G. H.Raisoni University, Saikheda*

Abstract

The plastic recycling and reuse machine is a machine designed to help fill the holes or cavities on roads by using melted plastic bags or sacks to fill the cavities in the asphalt. The objective of this project is to develop a user friendly and low cost pothole filling machine. The machine would help repair potholes on Indian roads and also help in reducing the amount of plastic waste by reusing it for the repairing of the roads. This report highlights and discusses the findings, methodology and results of this prototype.

Keywords: Potholes, plastic recycling and waste, pavement

I. INTRODUCTION

India is one of the fastest developing countries in the world. The road network is gigantic in India which is needed for commercial and private transportation. The condition of the roads deteriorates over time as the vehicles commute on them on a daily basis, due to which potholes are created over the course of a certain time when the road is being used. Potholes are a depression in a road surface, usually asphalt pavement, where traffic has removed broken pieces of the pavement. They are usually the result of water in the underlying soil structure and traffic passing over the affected area, bad weather conditions, rainwater seeping into the underlying soil structure of the asphalt, improper maintenance and insufficient pavement thickness. These issues need to be addressed in order to avoid the risk of traffic accidents and to ensure the safety of the people commuting through the road on a daily basis.

II. OBJECTIVES

The main objective of this project to create a machine that will fill cavities in the potholes by using melted plastic.This project aims to provide an updated survey of the various thermoplastic polymers in order to obtain recyclable materials for various industrial and indoor applications. The aim of this project is also to successfully study and repair the potholes that are caused on the road surfaces which can be harmful if left unattended.

III. LITERATURE STUDY

1. Design and fabrication of pothole repairing machine using plastic waste in mixes: The project created a manually operated machine which cleans the potholes on the roads and discharges the required amount of concrete to fill the potholes and do a levelling process on the discharged concrete using a roller. The major goal of this project was to reduce plastic trash by developing a machine that was tiny, lightweight, and easy to run in both rural and urban locations.

Figure 1: pothole filling machine using waste in mixes

2. Pothole Filling Vehicle Using Waste Plastic: This project proposes a pothole filling vehicle to be made and implemented to fill the potholes by using plastic as a filler material. A shredder is used to shred waste plastic gathered from numerous sources such as apartments, schools, and civic personnel. After that, the shredded portions are placed in bags for about a week to allow the moisture to evaporate. The pothole can be detected using a sensor. The use scrap plastic as a filler material to fill in this pothole was done.

3. Simulation of Pothole Filling Machine: A simulation for a pothole filling system is presented in this research. It is proposed that a Cartesian robot work on the rack and pinion mechanism. For an actual viscous bituminous emulsion used for pothole repair, the transitory time to transfer from one point to another is taken into account, and the time for pouring is determined. The simulation can also properly predict the time it will take to fill the pothole, allowing for better workforce management and less material waste.

4. Design and Fabrication Recycling of Plastic System: This project aimed at fabricating a plastic recycling machine that uses the application of shredding or crushing the plastic components in order to recycle

them. The system drive, box, hopper, and three blade rotating cutter are the four basic pieces of a plastic machine shredder/crusher.

5. Design & Development of Plastic Recycling Machine by Using FEA: This project deals with the manufacturing of a pneumatically operated injection plastic moulding machine. Different variety of products were made just by changing the die design and patterns. A polythene recycling machine was designed and manufactured to collect and dispose the littered waste materials which are found on the urban and rural areas.

6. Methods of Recycling, Properties and Applications of Recycled Thermoplastic Polymers: This study focuses on providing an updated survey about the main thermoplastic polymers to obtain recyclable materials for different types of industrial and household applications.

IV. METHODOLOGY

To achieve the objective of this project the work is outlined as given below:

1. First step is to develop and initiate the Design, construction and working of the machine to be made.
2. First the designing of the project model is done on 2 dimensional view to understand the working of the machine and then a 3 dimensional model is made.

The machine will be fabricated in such a way that the plastic bags will be allowed to enter the combustion chamber by the help of a conveyor system and they will be burned inside the chamber which results in formation of the slurry material that is to be used to fill the cavity or holes in the roads.

The conveyor system will move by the help on an electric motor which is situated at the back of the machine. A belt is attached on to the motor shaft which is connected to the end of the conveyor system. The shaft moves by electric motor resulting in rotation of the belt around the shafts which moves the conveyor system and allows the plastic bags to move and enter the combustion chamber. An induction coil is attached inside the combustion chamber of the machine which increases the temperature to a suitable point at which the plastic can get melted. The plastic bags falls on this electric coil and the melting process begins. An insulation material is used to avoid wastage of heat and to further aid the melting of the plastic. The molten material is allowed to exit the combustion chamber via and outlet which is present on the side of the machine body. Once the material exits the combustion chamber it is then shifted into the mixing chamber where it is properly mixed into a homogenous mixture suitable for using it as a filling material for the cavity on roads.

Material selection for the machine is as follows:

Components such as mild steel sheet, pulley, conveyor system, combustion chamber, glass fibre insulation, bearings, electric motor, induction coil, mixing chamber were fabricated and assembled for the machine.

Sr. No.	Item description	Material specification	Quantity
1	Outer body, heating chamber, and melting chamber	Mild steel	As per design
2	Ball bearings for wheels	Stainless steel	4 no.
3	Induction heating coil	standard	1 no.
4	Pulley	Standard size	1 no.
5	Conveyor belt	Rubber/nylon/fabric	1 no.
6	Electric motor	standard	1 no.
7	Molten metal outlet valve	Standard	1 no.
8	Mixing chamber	steel	1 no.
9	Outlet for mixing chamber	standard	1 no.

V. DESIGNING OF THE MODEL

The designing of the model was done in both 2D and 3D.

First the 2D model diagrams were made to understand the basic principles needed to be implemented while fabricating the machine.

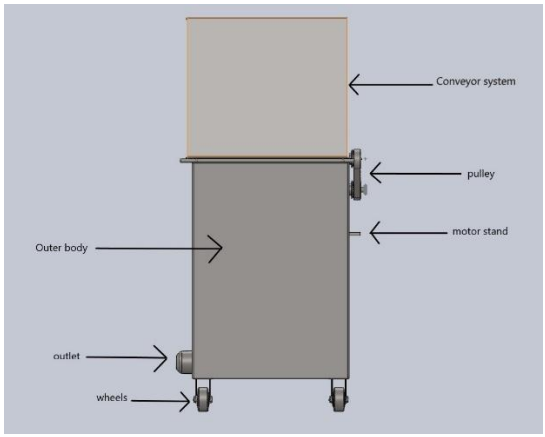

Figure 2: front view of the machine in 3D

The above picture shows the front view of the model.

It has labelled parts such as conveyor system, the outer body, pulley, motor stand, outlet, and wheels.

The motor is not added in this since it is located at the back side of the machine and cannot be seen from the front view.

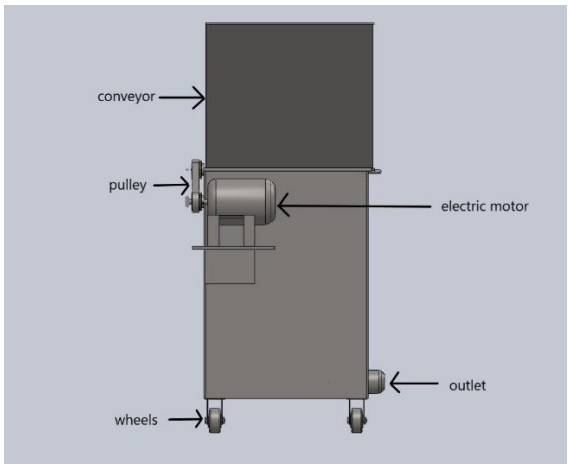

Figure 3: back view of the machine

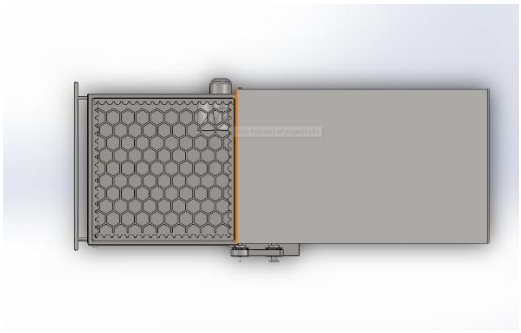

Figure 4: top view of the machine

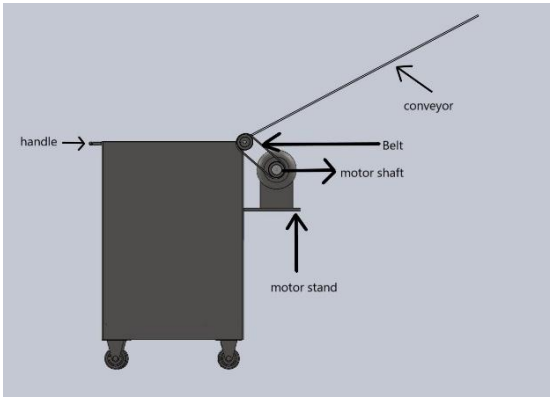

Figure 5: side view

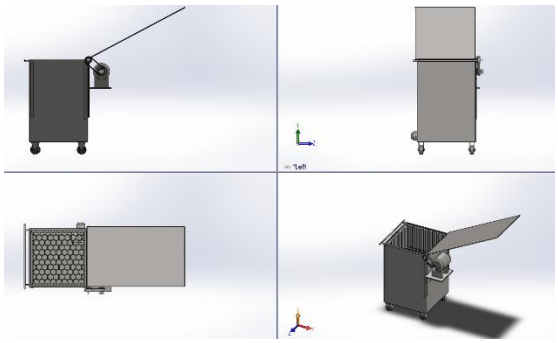

Figure 6: four view of the model

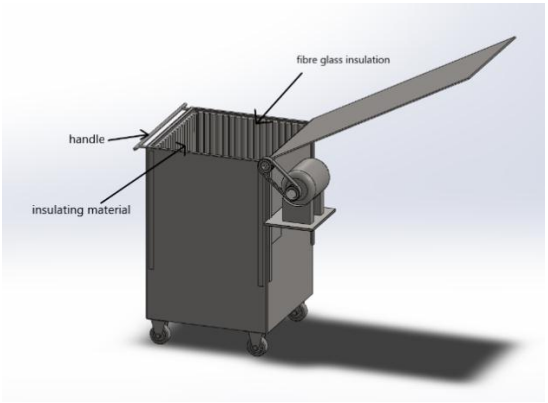

Figure 7: isometric view

VI. Fabrication of the model

During the fabrication stage of the project model, various processes such as sheet cutting, welding, assembly of parts and study of the materials to be used was done during its course.

Material identification and collection is the first step taken while fabricating the model.

Materials such as stainless steel sheet, pipes are chosen to build the outer body structure of the machine.

For the outer body stainless steel is used whose melting point is in the range of 1400 to 1450 °C.

Sheet cutting operation:

The type of sheet used in fabricating the outer body is mild steel sheet.

Once the materials are selected the fabrication moves on to the sheet cutting operation where a stainless steel sheet is cut in order to make the outer body. A total of 6 sheets of identical dimensions are cut to make the outer body.

Pipe cutting and welding operation:

For this operation 4 square pipes are cut at the length of 1000mm and 8 square pipes are cut at 550mm×550mm which are welded at the top and bottom corners of the body which acts as the frame of the main body to give it support.

4 of these 8 pipes are welded at the top of the body and 4 at the bottom of the body. For the welding operation the type of welding done is electric welding.

Fabrication of conveyor system:

A conveyor system is made for the machine so that the plastic bags can slide on it and enter the combustion chamber of the machine where is gets melted by an induction coil.

The dimensions of the conveyor are taken in accordance to the dimensions of the outer body of the machine. A single wheel pulley is mounted on the shaft of the motor and conveyor on which the rubber belt is fitted.

Outlet:

An outlet is made on the left side of the machine to let the molten plastic out of the combustion chamber.

A slope is made inside the machine so that the molten matter is able to collect near the outlet and get poured out of it with ease. The slope is welded at an angle of 65 degree perpendicular to the left side of the machine.

Due to this the slope helps the molten metal get collected without getting spilled below the machine and it enables it to go out of the outlet.

Insulation of the combustion chamber:

One of the biggest challenges faced during this project is that we need to maintain the internal temperature of the combustion chamber and avoid or minimise heat loss from it so that the molten plastic does not get solidified and stick on the induction coil. This would make it a big inconvenience for the plastic to be used for the further processes.

To overcome this obstacle during the making of the machine the idea of an insulating material was implemented. An insulating material needs to be added inside the machine body which will cover the inside walls of the machine from all four sides creating an insulating surface which will trap the heat inside the body and will not let it escape out thus making use of that wasted heat to further improve the melting of the plastic bags and maintain it at a certain temperature.

The insulating material used is fibreglass or glass fibre filter cotton.

Other parts like wheels are assembled onto the machine by the help of welding.

For the wheels a total of four ball bearings are used which are welded onto the machine's bottom surface.

Below are the images of the machine in fabrication phase:

Figure 8: horizontal view of the machine

Figure 9: vertical view of the machine

From the figure it can be seen that the machine is in fabrication phase.

From the top there is an opening given for the placing of a conveyor system which is attached to the corners of the body.

Inside the machine the slope structure is given so that the molten plastic get accumulated on the side of the machine and goes out of the outlet.

VII. CONCLUSION

The main objective of this project was to build a user friendly and low cost plastic recycling machine that fills the potholes or cavities on roads by using molten cement plastic sacks or bags.

The thesis discusses about the declining quality of the roads in India because of the occurrences of potholes in them and it puts a light on the pollution caused by plastic on the ecosystem.

The machine would help to repair potholes on roads by using melted plastic sacks of bags and use them as a filler material for the cavities in the road, thereby making it safer for people to drive on it while will help in reducing the amount of accident happens due the potholes and uneven road surfaces. The project also helps in reducing the plastic waste and put it to reuse to repair the potholes.

Studies on the previous works were done in order to gain an understanding of the issues we are dealing with as we work on making the model.

The thesis moves on to the designing of the model which talks about the methodology used to create the model which is used as a blueprint for the fabrication of the machine. Screenshots of the model are added in the thesis which will give the reader a fair idea of how the system is supposed to look.

Furthermore the report explains the tools required while fabricating the machine and also talks about the strategies implemented to build the machine. The methodologies are material needed for the project are clearly stated in the report. The engineering standards to which the project adheres to has also been addressed.

All the steps are described clearly with the descriptive diagrams, tables and images of the machine.

REFERENCES

[1] Patil A., Sawant M.B., SalunkeV. V., Goyal K. S., Jadhav R.G.,"Design and fabrication of pothole repairing machine using plastic waste in mixes": IJSDR | Volume 4, Issue 4 Apr. 2019 (P371-374)

[2] Nachivanekar A., Mujawar A., Mungi M. , NagdeveV.,"Pothole Filling Vehicle Using Waste Plastic" IJSDR | Volume 4, Issue 4 Apr. 2019 (P235-238)

[3] Aftab Q., Yadav V., Nadeem Shaikh N Tabish Shivania Amol Khatkhatea "Simulation of Pothole Filling Machine" Int. Conf. on Global Technology Initiatives(2018) (P.1-5)

[4] Jassim M., Darewan A., Ali Z., Ali K., Hassan M. "Design and Fabrication Recycling of Plastic System"Inter J of Scientific & Engineering Research, Volume 7, Issue 5, May-2016(P.1471-1486)

[5] Kusekar S.K, Morajkar C.E, Kashid S.N, Hipparkar K.S, Deshpande V.S. Design & "Development of Plastic Recycling Machine by Using FEA". IRJET Volume: 02 Issue: 02 | May-2015 (P.184-190)

[6] Mădălina Elena Grigore (2017). Methods of Recycling, Properties and Applications ofRecycled Thermoplastic Polymers. Recycling,doi:10.3390/recycling2040024 www.mdpi.com/journal/recycling,2017 (P.1-11)

VIII. AUTHORS PROFILE

NAME: AJAY MAHAWADIWAR
Assistant professor
Mechanical engineering department
G.H Raisoni University, Saikheda

Mr. Nilay Bhagat is a student of G.H Raisoni University, Saikheda. He is currently pursuing B.Tech (Mechanical) degree.

Mr. Alkesh Shende is a student of G.H Raisoni University, Saikheda. He is currently pursuing B.Tech (Mechanical) degree.

Mr. Adarsh Kantak is a student of G.H Raisoni University, Saikheda. He is currently pursuing B.Tech (Mechanical) degree.

Mr. Aman Atram is a student of G.H Raisoni University, Saikheda. He is currently pursuing B.Tech (Mechanical) degree.