# Effective Segregation and Utilization of Industrial Waste

Abdul Mannan Khan Saudagar[1], Chinmay Deshpande[2],Faizanahmad Sangolli[3] , MohammedAbuzer Khanzade[4], V Prashant[5], Dr Rajendra M Galgali[6]

[1,2,3,4]*Student, Department of Mechanical Engineering, S G Balekundri Institute of Technology, Belagavi*

[5]*Assistant Professor, Department of Mechanical Engineering, S G Balekundri Institute of Technology, Belagavi*

[6]*HOD, Department of Mechanical Engineering, S G Balekundri Institute of Technology, Belagavi*

*Abstract -* **Solid waste are a kind of waste which is difficult to dispose of due to its composition and physical Characteristics and having a bulk load of moisture it's has a wide range of heating value. Waste management involve basic steps as collection, transport, processing, recycle or Disposal. In this Project we can separate the industrial shop floor waste particles such as plastics, leaves, metal chips and small pieces of stone and wood. The bigger particles can be separated manually before feeding the waste to the hopper. Then the waste fell on to a belt which driven by a motor. As the waste processes ahead on the belt light particles get collected on a tank which is placed on the left side on the belt. This is achieved by a blower which is placed opposite to the tank. The remaining particles will be almost stone, wood and metal chips. And the remaining particles move further on the belt and it reaches the end of the belt. The end of the belt has a magnetic drum which is used to separate the metal chips and the remaining particle that's stone are collected on another tank which is placed on the end of the belt. This is how we can separate the shop floor waste.**

*Index Terms—* **Industrial Waste, Solid Waste, Segregation, Recycling, Utilization.**

## I. INTRODUCTION

Industrial waste is the waste that is produced by the industry. The waste includes metal scraps, plastic waste, dirt and gravel etc. These wastes are considered useless to the industry during manufacturing process. Industrial waste can be solid or semi solid also, it can be toxic or nontoxic in nature. Most of the times the industrial waste is mixed with the municipal waste which can be dangerous to domestic animals around that keep on feeding from municipal waste and also it gets difficult to segregate the waste.

Solid wastes are very hard to dispose(burn) due to the very high changing type of the waste material in terms of its contents and actual characteristics, moving across a wide range of moisture contents and bulk densities, which results in a wide range of heating standards. Waste management involves the collection, transportation, processing, recycling and disposal of waste material. The scavengers on refuse dumps in its crude form and in its most state of the art form by computer guided machine in a plant. It has many different constituents which are cardboards and paper, textiles and metals, vegetable matter and rubbers/ plastics.

To solve the problem of the sorting of the wastes, processes is based on air classification, magnetic separation, density separation, etc. are used with various levels of techniques introduced in the operations. Sorting waste is the process of using machines to sort wastes into the different categories is called the mechanical waste. These machines use different mechanisms in a recommended sequence, to sort the waste while being connected by the conveyor belts in this project, we will be able to separate the waste particle such as plastics, leaves, metal chips, and papers, small pieces of stones and wooden pieces.

The bigger size of waste can be separated manually before or after feeding it into the hopper .the waste is being dumped into the hopper and then the waste is made to fall onto the belt. The belt is being rotated with the help of motor as the motor is made to rotate at less speed, and as the waste starts moving forward after covering a certain distance the light particles get collected in the tank which is placed towards the left of the belt and fan opposite direction of the tank which is being made to rotate at higher rpm which helps the light particles to rush in the tank.

The remaining waste which is being left is almost the stones and the metal chips, and this waste as the belt moves further at a slower speed at the other end of the belt magnetic drum is being placed which helps us to separate the metal particles, in case if any metal particles are left those also will be collected by placing magnets nearer to another tank, the stones of course get collected in tank. In this way we will be able to separate out waste particles.

## II. STATEMENT OF THE PROBLEM

This study is to determine the main problem, what are the plans, procedures to segregate and separate industrial solid waste inside waste management(solid). Specifically, it tries to answer the issues mentioned below.

- Waste management facilities, which are already in short supply due to growing population, it increases volume of waste generated. This puts pressure on facilities.
- Industrial waste is growing at higher pace and needs utmost attention for safety of environment
- Industrial Waste separation leads to reduce the time of production and results in clean technology
- Proper waste separation and disposal
- Garbage Collection
- Cleaning Maintenance Consistency

## III. OBJECTIVES OF THE PROJECT

- To remove and segregate the waste materials.
- To design the machine in convenient manner to separate the solid waste.
- Machine should be economically design.
- Handling of machine should be easy.
- Establish quantities and composition of waste for the different land use sectors
- Project future quantities of waste generation in India.
- Investigate the potential for recycling
- Estimate cost and revenue of managing generated.
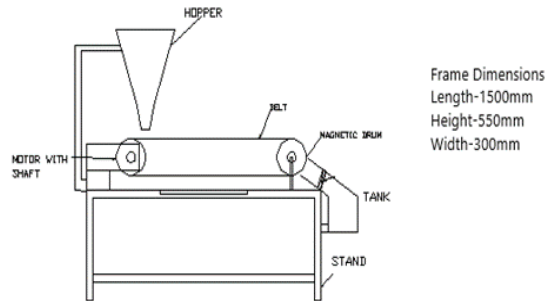
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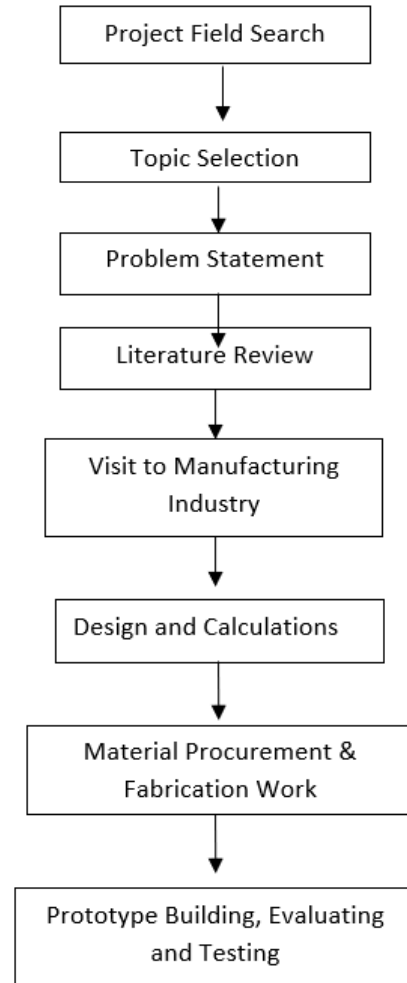


## V. METHODOLOGY

In this project we will be able to separate the waste particle such as plastics, leaves, metal chips, and papers, small pieces of stones and wooden pieces. The bigger size of waste can be separated manually before or after feeding it into the hopper .the waste is being dumped into the hopper and then the waste is made to fall onto the belt. The belt is being rotated with the help of motor.

As the motor is made to rotate at less speed, and as the waste starts moving forward after covering a certain distance the light particles get collected in the tank which is placed towards the left of the belt and fan opposite direction of the tank which is being made to rotate at higher rpm which helps the light particles to rush in the tank.

The remaining waste which is being left is almost the stones and the metal chips, and this waste as the belt

moves further at a slower speed at the other end of the belt magnetic drum is being placed which helps us to separate the metal particles, in case if any metal particles are left those also will be collected by placing magnets nearer to another tank, the stones of course get collected in tank. In this way we will be able to separate out waste particles.



Frame Dimensions
Length-1500mm
Height-550mm
Width-300mm

## VI. COMPONENTS USED

| SL NO | PARTS |
|-------|-------|
| 1 | Motor |
| 2 | Battery |
| 3 | Drum Shaft |
| 4 | Belt Conveyor |
| 5 | Bearings |
| 6 | Sheet Metal Hopper |
| 7 | I-shape beams |
| 8 | Blower |
| 9 | Magnets |
| 10 | Gears |

## VII. THE EXPECTED CONTRIBUTION OF THE PROJECT

- Waste free Production.
- Simple to construct, mature technology, and easy for maintenance.
- During solid waste management no manual work is needed or required
- Machine availability round the year.
- There is no problem regarding fuel transportation.
- There is no consumption of any fossil fuels
- The Waste separation is done day and night without any interruption
- Maximum utilization of energy.
- Easy operation with less power consumption
- No fuel storage is required as it works on electricity.

- The machine can separate light weight and heavy weight particles.
- The shortage of labor for cleaning and waste picking can be reduced to some extant

This project will be helpful to solve some of the problems related to Industrial solid waste separation which are crucial for good and safe production.

- Safety in handling
- No much physical effort required.
- Can run whenever the currents are off.

## VIII. CALCULATIONS

Design.of.shafts:
Force acting on the shafts = 30.00 N
Shear strength of the shaft :
$\sigma s$ = force/area
$380/2/2 = (30/(\frac{\pi}{4}d^2)$
d = 2.00mm.
Taking 6.00mm hence the design of the shaft is safe it can the load of the entire machine easily.
crushingstress on the shaft.
Stress = load /area
$380/2/2 = 30/(\pi \times L \times D)$
$95 = 30/(\pi \times 1.5D \times D)$
D = 0.822mm
Taking 6.00mm
The calculated value of D = 0.822mm, we are taking 6.00mm hence the design is safe.

Torque on Fan Motor :
Motor speed = N = 1500 rpm
Power = 15 watts
$P = 2\pi TN/60$
$T = 60 \times P/2\pi N.$
$T = 60 \times 15/2 \times \pi \times 1500$
T = 0.0955N-m
$T = 0.0955 \times 1000$ N-mm.
Force Affecting upon the shaft of the fan motor
Diameter of shaft "d" = 8.00mm

Torque developed by motor :
$T = F \times r$
$F = T/r = 95/4$
F = 23.755 N

Gears Design :
Power 15 watts    14.5 degrees (FDI)
Speed of pinion $N_1$=60rpm
$Z_1$=54 teeth
$Z_2$=135teeth
$I = Z_2/Z_1$
$I = 135/54$
$I = 2.52$

Gear speed :.
$N_2$= $N_1/I$
$N_2$=60/2.52
$N_2$=24.00 rpm
Stress in gear and pinion.
$Sd_1$=140.00Mpa-(pinion).
$Sd_2$ = 90.00Mpa-(gear).

Lewis Form Factor :
$Y_1$= 0.124-(0.684/Z1)
= 0.124-(0.684/54)
= 0.1113
$Y_2$ = 0.124-(0.684/Z2)
= 0.124-(0.684/135)
= 0.1189

Torque Developed :
$T_2$=(955*$10^4$*Cs*Power)/$N_2$
= (955*$10^4$1.255*0.0155)/24.00
= 7.46*$10^3$ N-mm.

Mean Velocity :
Vm=(3.1422*N2*d2)/(1000*60)
= (3.1422*24.0*m*Z2)/( 1000*60)
= (3.1422*m*24.0*135)/( 1000*60)
Vm=0.1699m .

Velocity Factor :
Kv = (3/(Vm + 3))
= (3/ (0.169m + 3))
Lets assume β= 4.00.

Module:
$M^3$=(2$T_2$)/(($\pi^2$*β*$Y_2$*$Z_2$*$Sd_2$*K v)
=(2*7.46*1000)*(3+0.169m)/($\pi^2$*4*0.1189*135*90*3)
= 0.64 =1.00mm

IX.  CONCLUSION

- Finally, we can conclude that, our project can separate industrial shopfloor waste.
- And we can go for further process of recycling or disposal. By this it will reduce significant time needed for separation of waste. and we successfully designed and built the machine for it.
- This is just an initiating idea for waste management further this can be developed more with
- Significant technology. like IOT, sensors and machine learning. one of our limitations was we can only segregate solid waste not the wet waste

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