CONTENTS

CHAPTER 1

Introduction

Plastic can be reused in various sectors like marketing, manufacturing, transportation etc. In the construction sector, we can use the plastic waste on plastic is a very useful substance in our daily life work, but after the use of plastic it is very difficult for us to dispose of it because it is a non- biodegradable substance. After its usage it is a hazardous material. Plastic is a new engineering material in which researchers take more interest in investing their time and money because it has a wide scope to enhance the usage of plastic in different work. The properties of plastic are unique, and it can mix with every kind of material. Plastic is a composition of synthetic and semi synthetic organic compounds. They are malleable and ductile and remold into any solid substance. Plastic is used in various objects which we use in our daily life like polythene, plastic cups, furniture, bags, packaging of food and other accessories, drinking containers, bottles, frames, basins etc. We need to use better advanced techniques and methods to dispose plastic waste properly; otherwise, the time is not too far away where we see it as a big challenge for us to dispose it.

In India, we use incinerators to dispose the plastic waste in which plastic waste burns on high temperature. The gases which evolve during this burning process pollute air and water. Due to this, many people get affected and suffer from many harmful diseases. Researchers suggest that if plastic is not disposed of soon, it can sustain for 4500 years without degradation.

Now, these days the rate of plastic use keeps increasing. So, the collection of plastic waste increases at a rapid a very large scale after recycling it, which means the problem of plastic waste can be removed for a long time period. It seems to be a more practicable and efficient method to solve this problem. In construction field, many types of tiles are used like - clay tiles etc. In this project we try to us plastic based tiles which have better characteristics than any other type of tiles. Plastic sand tiles are cheaper than normal tiles. People can easily afford The properties of plastic are unique and it can mix with every kind of material.

Plastic is a composition of synthetic and semi synthetic organic compounds. They are malleable and ductile and remold into any solid substance. Plastic is used in various objects which we use in our daily life like polythene, plastic cups, furniture, bags, packaging of food

and other accessories, drinking containers, bottles, frames, basins etc. We need to use better advanced techniques and methods.

To dispose plastic waste properly; otherwise, the time is not too far away where we see it as a big challenge for us to dispose it.

In India, to dispose of plastic garbage, which burns at a high temperature, we utilize incinerators. This burning process produces gases that damage the air and water. As a result, a great number of people are impacted and experience various hazardous ailments.

According to research, plastic can persist for 4500 years without degrading if it is not disposed of right away. Now, the use of plastic is growing at an increasing rate. Therefore, after recycling, the amount of plastic waste being collected is growing quickly and on a very big scale. Numerous varieties of tiles, including clay tiles, are utilized in the construction industry. In this project, we try to use plastic-based tiles because they have superior qualities to other types of tiles. Tiles made of plastic sand cost less than regular tiles. People can afford it easily tiles of this kind. Plastic trash in households is significant and keeps growing over time. Every country has a different waste composition since socioeconomic factors, consumption habits, and trash management policies all have an impact, but, plastics make up a large portion of waste. Polyethylene, polypropylene, polyethylene terephthalate, and polystyrene make up most of the plastic trash.

1.1 Plastics

Polymers have a variety of essential qualities that, when utilized singly or collectively, significantly and steadily contribute to the needs of construction. Long-lasting and corrosion-proof. Energy-saving good insulation against the cold, heat, and sound. It has a longer lifespan and is more affordable. Maintenance-free (minimized need for painting, for example) Clean and hygienic. The following different types of plastics are available: Polyethylene Terephthalate, High-Density Polyethylene, Polyvinyl Chloride, Low-Density Polyethylene, Polypropylene, and Polystyrene. A plastic bottle is a bottle made of high-density plastic, according to the classification of plastic. Liquids like water, soft beverages, motor oil, cooking oil, medications, shampoo, milk, and ink are frequently stored in plastic bottles. Small bottles to huge carboys are available in a variety of sizes. Consumer blow molded containers frequently include built-in handles or are designed to be easier to hold. When plastic was first developed in the 19th century, common materials like ivory, rubber, and shellac were initially replaced with it.

Commercial usage of plastic bottles began in 1947, but prices remained high until high-density polyethylene was released in the early 1950s. Due to their small weight, affordable production, and lower shipping costs when compared to glass, they swiftly gained favour with businesses and consumers.

1.2 Management of solid waste in the context of India

The sources of solid waste and the concerns surrounding its management are covered in this section. The massive population of the nation is to blame for the enormous amount of solid garbage. Compostable materials make up most of the solid waste (51–53%), followed by recyclables (17–18%), which have a moisture content of 46.76%. Figure 1 displays the pace at which various solid wastes are produced in India6. The generated solid waste has a calorific value of roughly 1700–1800 kcal/kg and a C/N ratio of almost 32. However, as indicated in Fig., only a small portion of the generated solid waste is used for composting. Although there are numerous technologies for the treatment of municipal solid trash and the recovery of energy from garbage, a sizeable portion of the generated solid waste is unrelentingly thrown over or into land in an unfavorable manner. Therefore, it has been determined that municipal solid waste management is insufficient, ineffective, and difficult. The "Waste to Energy and Waste Management Market in India-2018" research carefully explores the underlying potential connected to economies of scale, market trends, obstacles, and industry outlook. The paper outlines strategies for keeping tabs on plastic trash and offers ways to keep it out of landfills for safe disposal. The possibility for recycling different solid wastes is depicted in Fig. The study makes predictions about the threat brought on by solid waste and offers suggestions for managing its production effectively. Synthetic lightweight aggregate technology, polymer concrete, etc., are a few techniques that are essential for managing plastic waste and have been discussed. Additionally, the investigations hypothesis that modifications at the worksite have an impact on sectors involved in the recycling of plastic waste and examine some of the crucial variables in plastic manufacture.

1.3 Problems and obstacles in managing solid waste.

The many waste sectors, including waste generation, insufficient garbage collection, transport, treatment, and disposal procedures, provide substantial issues for solid waste management. Along with inefficient garbage collection practices, the pace of waste generation has rapidly increased during the past few decades. The logistic service is insufficient and ineffective for transporting the created garbage. It involves controlling how the solid waste is transferred from the source to the washbasin. Solid waste entry and exit from a trash dump to a treatment facility and vice versa are challenging to manage due to ineffective waste logistic channels.

The operating efficiency of the waste-to-energy systems for energy recovery is weak since roughly 2-3% of the energy is used to process the waste. The problem can be solved by switching from mechanical to biological waste treatment. To oversee the waste treatment methods, qualified and certified employees must be on hand. Any waste has to go to a junkyard, which is likewise a costly operation (handling, logistics, and environmental safety considerations, for example).

CHAPTER- 2

Literature Survey

Plastic is essential to modern living. Plastic is used in many aspects of daily life, including toys, bags, tables, TV boxes, water bottles, etc. Thus, the plastics mentioned above are solid by nature. People throw away plastic in the open after using it. Numerous studies have found that disposing of plastic requires roughly 300 years.

It has been destructive for thousands of years, not only to human existence but also to the planet. Unwanted compounds and chemicals are present. Burning plastic releases harmful materials, noxious fumes, and odors. We are attempting to lessen the damaging impacts of plastic on the environment by using plastic in the construction business. We are putting a lot of effort into using plastic trash as a raw material to make tiles.

Plastic is a nonbiodegradable synthetic polymer that can be molded into completed goods. It is constructed of long chain hydrocarbons plus additives and is generally obtained from fossil fuel feedstock. We will gather solid plastic, break it into minuscule fragments, and then reassemble the substance. After that, a binding agent is added to the plastic, and the homogeneous mixture is poured into a mould. After a period, the material has set, and we are left with high-quality tiles.

To maintain a healthy and clean ecosystem, plastic garbage should be removed from the environment as soon as feasible.

Stones, line, rocks, marbles, and other sorts of earthy materials are used to make the tile. But if we substitute waste plastic and certain chemical binders for these traditional materials, the strength, durability, elasticity, and flexural strength improve. Plastic tile manufacture takes less time than other types of manufacturing. China is now using this idea, although it proved to be uncommon in India. Comparing plastic tiles to regular tiles, the plastic tiles perform better and offer more benefits.

This literature review seeks to give a general overview of the manufacture of plastic tiles in India, as well as an analysis of the major driving variables. Due to their adaptability, durability, and environmental advantages, plastic tiles have attracted a lot of attention recently.

To provide a thorough overview of the plastic tile manufacturing business in India, this survey combines data from several sources, including academic journals, industry reports, and government publications.

A description of plastic tiles and their benefits Manufacturing of plastic tiles is important in India Manufacturing Process raw resources used to make plastic tiles Process of injection moulding.

2.1 Extrusion technique

Process of compression moulding Techniques for surface treatment and finishing Key Elements Affecting the Production of Plastic Tiles the selection and sourcing of raw materials equipment and machinery needed Standardization and quality control Environment-related factors Consumption of energy and sustainability.

2.2 Market research: Size of the market now and growth rates Plastic tile demand and consumer preferences. Competitive environment and key players in the sector opportunities for worldwide markets and exports

2.3 Opportunities and Challenges

Framework for regulations and policies management of garbage and recycling innovation and technological breakthroughs approaches to the circular economy may be possible. A case study

Successful Indian manufacturers of plastic tiles sustainability-focused projects and innovative manufacturing techniques in future Perspectives. Key Elements Affecting the Production of Plastic Tiles. The choice of raw materials, their source, and quality control are essential. The use of machinery and equipment is crucial in the production process. energy usage and environmental sustainability considerations.

2.4 Market research: India's plastic tile business is expanding steadily. Plastic tile demand and consumer preferences are rising. Significant players and export potential.

2.5 Opportunities and Challenges: - the regulatory and policy environment has an impact on industrial development. Challenges and possibilities are presented by trash management and recycling. The sector can advance thanks to technological developments and innovation a case study successful Indian manufacturers of plastic tiles sustainable projects and innovative production techniques.

2.6 Future Perspectives: - Prospects for the plastic tile business and emerging trends. Areas for advancement in research and development. Partnerships and cooperation can faster growth.

2.7 About Injection Moulding: - A manufacturing procedure called injection moulding uses molten material to create items by injecting it into a mould. Numerous materials, primarily metals (for which the procedure is known as die-casting), glasses, elastomers, confections, and most frequently thermoplastic and thermosetting polymers, can be used in injection moulding. The part's materials are fed into a heated barrel, mixed (with the aid of a helical screw), and then injected into a mould cavity, where they cool and solidify to fit the cavity's shape.

Using a ram or screw-type plunger, liquid plastic or rubber material is forced into a mould cavity during the injection moulding process, where it hardens into a shape that follows the contour of the mould. Both thermoplastic and thermosetting polymers are most frequently processed using it, while the amount of the former is utilized far more frequently. Due to their propensity for injection moulding, thermoplastics are widely used. These materials are simple to recycle, adaptable for a broad range of applications, and able to soften and flow when heated.

The process of injection moulding can be divided into the following steps:

2.8 Material preparation: The raw material is first melted and then mixed with additives, such as colorants or lubricants.

Injection: The molten material is injected into the mould cavity under high pressure.

Cooling: The molten material cools and hardens in the mould cavity.

Ejection: The moulded part is ejected from the mould.

The cycle time for injection moulding is typically in the range of a few seconds to a few minutes. The cost of injection moulding depends on several factors, including the size and complexity of the part, the type of material used, and the volume of production.

A multitude of items, including are produced using the versatile and effective manufacturing method known as injection moulding.

Automobile parts and appliances

Furniture, electronics, and medical equipment

Toys: - With excellent precision and reproducibility, injection moulding is a highly automated technique that can create complicated products. It may be used to generate a wide range of materials and is a cost-effective procedure for high-volume manufacturing.

2.9 The following are some benefits of injection moulding:

High production rate: Injection moulding is a highly automated technique that can swiftly and effectively create huge volumes of components.

High accuracy: Repeatable and accurate products may be produced via injection moulding.

The following are some drawbacks of injection moulding:

Significant tooling costs: Injection moulding can have significant tooling costs, particularly for complicated products.

Significant setup expenses: Injection moulding setup expenses can be significant, particularly for short production runs.

Waste: Scrap material and flash produced during injection moulding can amount to a large quantity of waste.

Due to the usage of energy and chemicals, injection moulding may have a major negative impact on the environment.

In general, injection moulding is a flexible and effective manufacturing technique that may be utilized to create a wide range of goods. It may be used to generate a wide range of materials and is a cost-effective procedure for high-volume manufacturing. However, the price of the tooling a setup costs can be high, and the environmental impact can be significant.

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CHAPTER 3

Objectives

1. To have increased reliability, productivity, and uptime for injection moulding machine.

2. To achieve optimal utilization of plastic injection moulding machine.

3. To determine the most suitable plastic material to conduct this process and the time duration.

4. To provide an Injection Moulding Machine to reduce human fatigue.

5. To provide more compatible with the operator.

6. To make a machine which is simple in design and easy to operate.

7. To reduce the maintenance cost.

CHAPTER 4

Methodology

The following steps were used to process the different types of plastic waste:

Plastic collection: Waste plastics for recycling were gathered all throughout the city where we can get easily in the city dump yard.

Manual sorting: Each form of plastic trash was segregated from the others, and undesired elements were taken out of the waste, such as the plastics that are usually adhered to the bottle skin and the bottle caps in the case of waste plastic bottles.

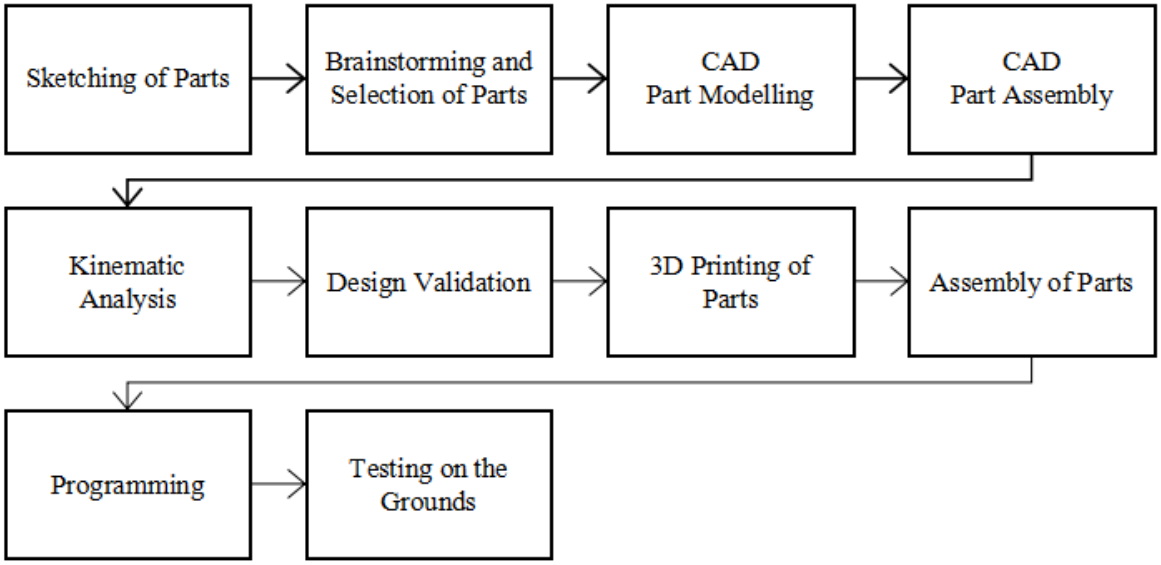
Chipping: After being separated, the different plastic debris was chopped into smaller pieces.
Cleaning: The chips were then cleaned to get rid of any glue, paper labels, dirt, and product remains that may have been present.

Melting: Plastic trash from various elements is chosen, then it is crushed, weighed, and melted at its melting point (150–170°C) in a container.

Demolding: After the mould has been thoroughly prepared, it is either cooled with air or submerged in water. The tile is taken out of the mould once it has cooled. The floor tile is now complete and has a nice top surface finish.

TESTING: Once all the above operations are done then it is taken for testing, where it is tested for its strength, temperature etc.…

This project shall be accomplished according to the flowchart given below:



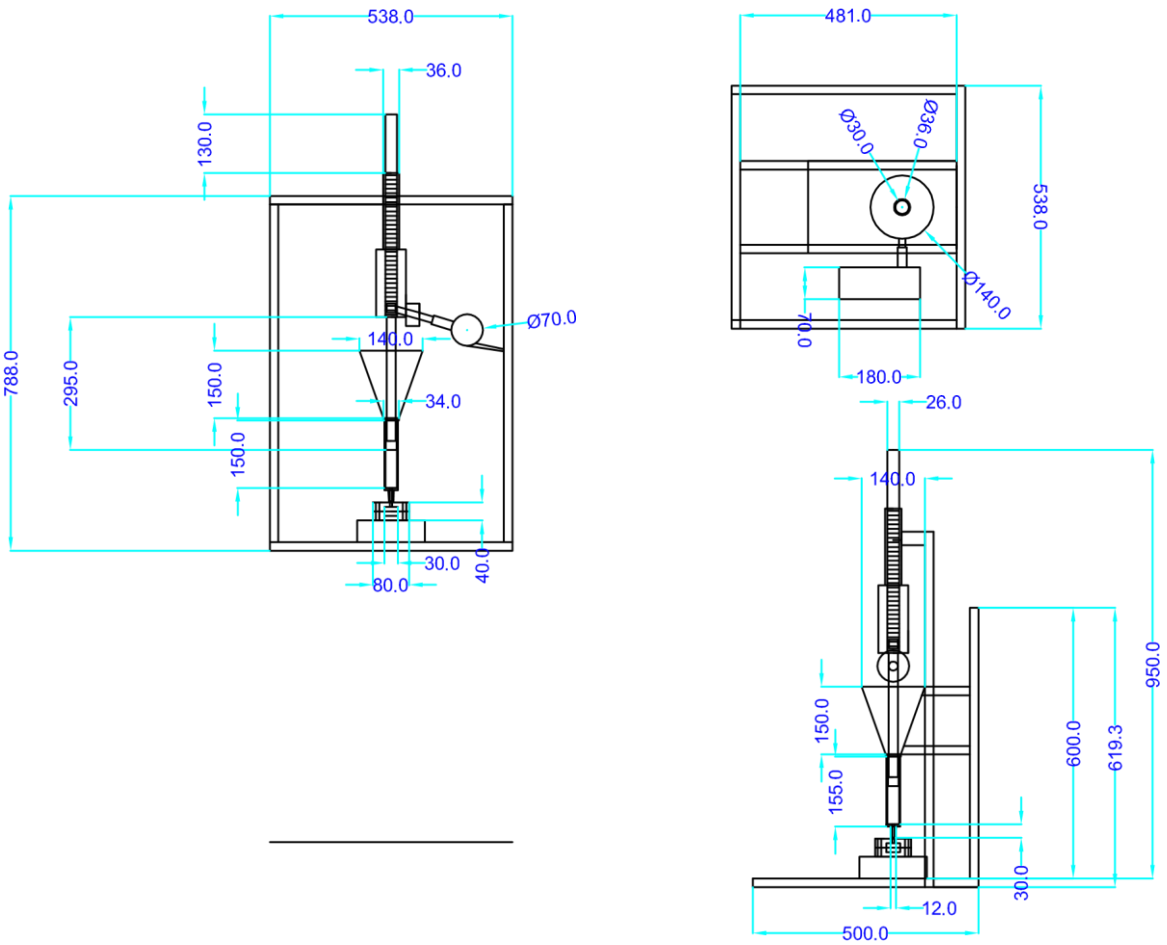


Figure 1: 2D Models

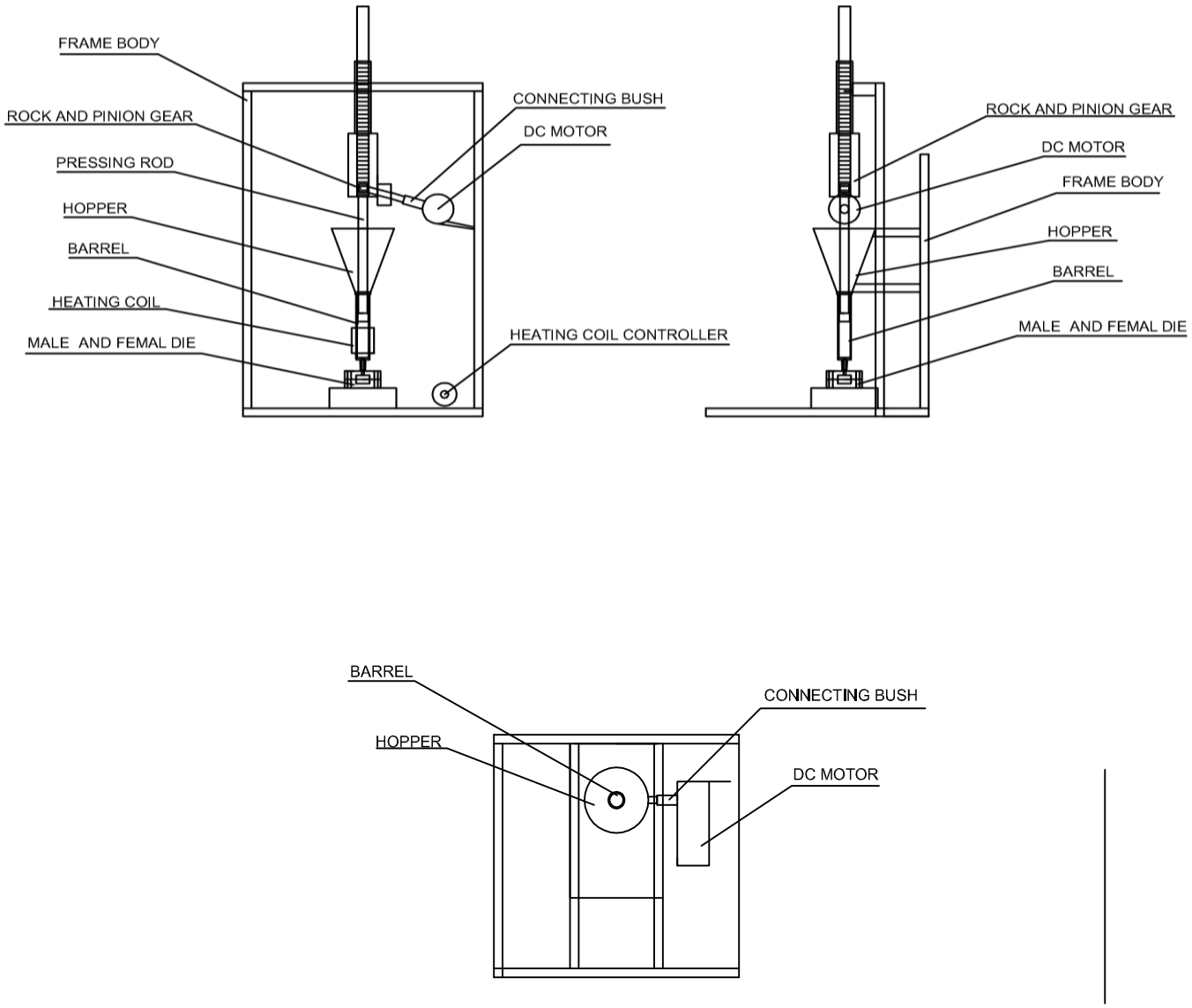


Figure 2: Model

Cost Estimation

Cost estimation can be described as an act of predicting the financial outlays necessary to produce a product. This prediction encompasses all expenditures associated with the design and manufacturing process, including costs related to pattern making, tool making, and a portion of general administrative and selling expenses. In essence, there are two primary categories of cost estimation.

Material Cost Estimation

The entire amount needed to gather the raw materials, which must then be processed or manufactured to the desired size and functionality of the components, is provided by the material cost estimation. These resources are separated into two groups.

1. Material for Fabrication

For the component to work properly, the material is obtained in raw form and manufactured or processed to completed size.

2. Standard Purchased Parts

This covers components like fasteners, screws, motors, batteries, solar panels, etc. that were easily accessible on the market. a list with prices listed by estimation that includes the weight of the raw materials, the cost per kilogram for the manufactured parts, and the quality, size, and standards of the parts.

Machining Cost Estimation

This cost estimate tries to predict all costs, except material costs, that might be associated with manufacturing. The calculation of the cost of produced parts should only be done after carefully weighing all factors, including the labor, materials, and factory services needed to produce the desired part

Cost Estimation Table

Table of Cost Estimation Table

Sl. No	**COMPONENT NAMES**	**MATERIAL**	**QUANTITY**	**COST (Rs.)**
1	Main Frame	Mild Steel	1	1500
2	Heating Coil	Copper	1	2000
3	Hopper	Mild Steel	1	500
6	Wires	Copper	4	500
7	Motor	Induction Motor	1	3000
8	Battery	Battery	1	2000
9	Charger for Battery	Charger	1	450
10	Shaft	Mild Steel	1	2000
11	Mould	Mild Steel	1	1000
12	Barrel	Mild Steel	1	800
13	Fillets	Plastic	4	1600
14	Labor Cost	-	-	3000
15	Travel	-	-	1500
	TOTAL ESTIMATED COST			**19,850**

4.1 Working Principle

The injection-moulding process is best suited for producing articles made of thermoplastic materials. Here, the equipment cost is relatively high, but the main attraction is the amenability of the injection-moulding process to a high production rate. In injection molding, a definite quantity of molten thermoplastic material is injected under pressure into a relatively cold mold where it solidifies to the shape of the mould.

The injection – moulding machine is shown in the process consists of feeding the compounded plastic material as granules, pellets, or powder through the hopper at definite time intervals into the hot horizontal cylinder where it gets softened. Pressure is applied through a hydraulically driven piston to push the molten material through a cylinder into a mould fitted at the end of the cylinder. While moving through the hot zone of the cylinder, a device called torpedo helps spread the plastic material uniformly around the inside wall of the hot cylinder sand thus ensures uniform heat distribution. The molten plastic material from the cylinder is then injected through a nozzle material from the cylinder is then injected through a nozzle into the mould cavity.

The mould used, in its simplest form, is a two-part system. One is a movable part and the other stationery. The stationary part is fixed to the end of the cylinder while the movable part can be opened or locked on to the stationary part. By using a mechanical locking device, the mould is properly held in position as the molten plastic material is injected under a pressure as high as 1500kg/cm. The locking device must be very skillfully designed in order to withstand high operating pressures. Furthermore, a proper flow of the molten material to the interior regions of the mold is achieved by preheating the mould to an appropriate temperature. Usually, this temperature is slightly lower than the softening temperature of the plastic material undergoing moulding.

After the mould is filled with the molten material under pressure, it is cooled by cold water circulation and then opened to eject the molded article. The whole cycle could be repeated several times manually of in an automated mode.

4.2 Main Parts of injection moulding machine model

In an injection molding machine, each part plays an important role. Including all the parts, some are mainly used according to their function of parts depending on types of process to make it regular in operation. Here we are studying some useful function parts.

Fabrication: - A channel in vertical size holds rack, pinion, bearing cup &shaft. A base. Channel is also important which gives support to the vertical channel by welding in L-size. Base channel holds the vice which holds the various type of dies.

Vice- This is made up of steel, which has an external square thread, it moves to & fro by meshing internals are threads of boss. this fix on the base channel. The square threaded spindle can be slid by handle.

Shaft- It is made up of steel, having a keyway to fit in gear & shaft so that it can be rotated with gear on both sides of gear two ball bearing are mounted on the right-hand side of operator. There is handle which is tight with bolt arrangement to main shaft due to which rack moves up &down. This way rack gives strong to inject the plastic material.

Gear-It is also known as pinion which is made up of mild steel. It is having teeth externally which meshed with the teeth of rack. This is fitted with key.

Rack-This is the main part which is slide up & down due to rotary motion of gear it will convert in reciprocating motion of rack will apply force on the molten plastic material so the material will inject through nozzle into the die.

Nozzle-It is lower part of cylinder. This has external v-thread of cylinder. The molten material of plastic injected to the die from nozzle hole when rack applied force on the material. It is made of mild steel.

Cylinder- It is made of mild steel. It is having throughout hole on one side of cylinder means on top of cylinder by threading. On the lower part of the cylinder a nozzle is fitted.

Coil-This is an electrical heating instrument. This coil is covered in a cylinder. Supply is given & to the coil so the inside plastic material will go to molten stage.

Cup(hopper):-A cup is on the top of the cylinder. This rack lower part bored so the rack slides through this hole of cup. This cup is made of mild steel. Through which spring can be compressed &material will fill up in cylinder.

4.3 There are following steps in Injection molding

Clamping: - An injection molding machine consists of clamping and injection units. The clamping unit is what holds the mold under pressure during the injection and cooling. Basically, it holds the two halves of the injection mould together.

Injection: -At the beginning of which the plunger at upward position of feed hopper, and the granules of the molding compound are free to drop into the feed cylinder. The injection stroke starts as the plunge moves from upward to downward forcing the accumulated granules into the heating cylinder, where they are converted into the heating cylinder. Where they are converted into the heating cylinder. Were they are converted into a fluid mass. The plunger not in cylinder but also displaces the fluid material at the nozzle and forces in into the closed mould cavity.

Dwelling: -The dwelling phase consists of pause in the injection process. The molten plastic has been injected into mould and pressure is applied to make sure all the mold cavities are filled. Were the molded product is formed to their true shape and proper density. The pressure is maintained long enough for the product to cool and become hard; the heat of the plunger is then returned to the upward position and new granulation is free to drop through the hoper into the feed cylinder.

Mould opening: -The clamping unit opened which separates the two valves of mould after the pressure is relative both mould members is unlocked and her moveable member is moved away from the fixed member, carrying the finished product with it.

Ejection: - An ejection rod and plate eject the finished piece from the mould. The unused spruces and runners can be recycled from use again in future moulds. Molding by injection process is rapidly performed. The molding m/c may be operated at six shots per minute, although slower speed prevails since product molding product by injection. This machine is primarily determined by the length of time required to cool and ser the material in the mould.

CHAPTER 5

Plastic Material

5.1 Types of Plastic Materials

Thermoplastics: - Thermoplastics are plastics that do not undergo chemical change in their composition when heated and can be molded again and again. They are easily molded and extruded into films, fibers, and packaging. Examples include polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC).

2 Thermosetting Plastics: - Thermosetting plastics which are formed by heat process but are then set (like concrete) and cannot change shape by reheating. They are hard and durable. Thermosets can be used for auto parts, aircraft parts and tires. Examples include polyurethanes, polyesters, epoxy resins and phenolic resins.

5.2 Polypropylene Materials

Poly propylene, a synthetic resin built up by the polymerization of propylene. Poly propylene is molded or extruded into many plastic products in which toughness, flexibility, light weight, and heat resistance are required. Polypropylene(pp), also known as poly propene, is a thermoplastic polymer used in a wide variety of applications including packaging and labeling, textiles (e.g., Ropes, thermal under wear and carpets), stationery, plastic parts and reusable containers of various types, laboratory equipment, loudspeakers, automotive components, and polymer bank notes.

Polypropylene has a variety of different unique properties that makes it invaluable in applications, where rigidity and stiffness are needed. As a result, polypropylene Is Used in everything from plastic containers to wall siding laminates.

Characteristics

Light in weight, Excellent resistance to stress and high resistant to cracking (i.e., it has high tensile and compressive strength).High operational temperatures with a melting point of 160°C Excellent dielectric properties. Non-toxic. Easy to produce, assembly and an economic material. It is often used in applications where rigidity and stiffness are needed. When polyethylene is incapable of providing mechanical properties that are specified, in many cases, it is polypropylene that takes its place.

5.3 Dry waste:

Any garbage that will not rot or decompose over time and has little to no moisture content is often referred to as dry waste. Given the absence of food ingredients, dry waste can also be referred to as inorganic or nonbiodegradable trash. Both recyclable and non-recyclable materials fall under this category. Items like as inclusion in dry waste containers, garments, plastic, wood, glass, metals, and various types of paper. The capacity for dry garbage on site is 10 TPD.

Figure 3: Dry waste

5.4 Wet waste:

Wet waste is biodegradable waste and includes cooked and uncooked food, fruits, vegetables peels, flower waste, and other organically decomposable waste. This waste is collected daily and can be handed over in a green bin. On site, the capacity of wet waste is 15 TPD. In 1 tone, the 700 to 800 kg/day dry waste or wet waste transfer on site.

Figure 4: Wet waste

5.5 Domestic waste:

Domestic waste includes our organic and inorganic refuse from residential area. Organic waste consists of food waste, paper, cardboard, rubber, plastic, and yard waste. Inorganic waste of metals ,glass,oil etc…

Figure 5: Domestic Waste

5.6 Commercial waste: Commercial garbage is made up of a lot of papers, cardboard, plastic, glass, and packaging materials and is produced by commercial sources such as shops, offices, and warehouses.

Figure 6: Commercial waste

5.7 Waste from Industry: Industrial waste is the word used to describe waste produced during manufacturing of consumer items, agricultural commodities, and other products.

Figure 7: Waste from Industry

CHAPTER 6

CONCLUSION

Due to its low cost, this working model can be successfully inducted in small scale molding units and can be used to manufacture small plastic components at an acceptable cycle rate with in an effective cost component.

- The use of plastic in the construction industry is a growing trend, as it offers a number of advantages over traditional materials, such as durability, lightweight, and resistance to fire and pests.
- The combination of plastic and tiles or bricks can create a more durable and aesthetically pleasing surface than either material on its own.
- The use of plastic in construction can help to reduce the amount of waste sent to landfills, as plastic can be recycled and reused.
- The use of plastic in construction can help to improve the energy efficiency of buildings, as plastic is a good insulator.
- Overall, the use of plastic in the construction industry is a promising development that has the potential to reduce the environmental impact of building materials and improve the quality of construction projects.

In addition to the points above, the conclusion could also discuss the following:

- The challenges of using plastic in construction, such as the need to ensure that the plastic is properly recycled and disposed of.
- The future of plastic in construction, and how the technology is likely to evolve in the coming years.

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