



Fabrication of Plastic Compression Molding Machine

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Abstract: Plastics are inexpensive, lightweight and durable materials, which can readily be moulded into a variety of products that find use in a wide range of applications. Plastic is one of the materials mostly used in the modern world. Being light weight and durable plastic is being widely used for various purposes and it has now become an integral part of our daily life. The plastic products that we mostly use are non-bio degradable and hence after use, these are ultimately used for filling our landfills. As a consequence, the production of plastics has increased rapidly and the current levels of their usage and disposal generate several environmental problems. Hence, these waste plastics are to be effectively utilised. Recycling is one of the most important actions currently available to reduce these impacts. The Plastic compression molding machine can be used to recycle and reuse these plastics. The compression molding is a process of molding the material in a confined shape by applying heat and pressure. The process is followed by three steps – preheating, pressurizing and cooling. These recyclable plastic wastes are made into bricks. Depending upon the shape of the die, different products can be made. The Machine helps in bringing down the plastic wastes in landfills which is primarily responsible for environmental pollution. Most common recyclable plastic products are beverage packaging widely used for water, soda, cool-drinks and juice, plastic bags and plastic containers used for packing food products.

Keywords: Plastic wastes, bricks, recycling, compression molding.

I INTRODUCTION

The quantum of solid waste is ever increasing due to increase in population, developmental activities, changes in life style, and socio-economic conditions, Plastics waste is a significant portion of the total municipal solid waste (MSW). It is estimated that approximately 10 thousand tons per day (TPD) of plastics waste is generated i.e. 9% of 1.20 lacs TPD of MSW in the country. Plastics are made from limited resources such as petroleum, and huge advances are being made in the development of technologies to recycle plastic waste among other resources. Plastics are non-biodegradable, synthetic polymers derived primarily from petro-fossil feedstock and made-up of long chain hydrocarbons with additives and can be moulded into finished products. These polymers are broken in presence of suitable catalyst, into monomers such as ethylene, propylene, vinyl, styrene and benzene. These monomers are then chemically polymerized into different categories of plastics. Plastics are generally categorised as Thermoplastics and Thermoset Plastics. Thermoplastics can be heated up to form products and then if these end products are re-heated, the plastic will soften and melt again. These include PET, HDPE, LDPE, PP, PVC, PS etc.

Thermoset plastics can be melted and formed, but once they take shape after they have solidified, they stay solid and, unlike thermoplastics cannot be re-melted. These include Multilayer and Laminated Plastics, Bakelite, Polycarbonate, Melamine, Nylon etc. Mechanical recycling methods to make plastic products and feedstock recycling methods that use plastic as a raw material in the chemical industry have been widely adopted, and awareness has also grown recently of the importance of Thermal recycling as a means of using plastics as an energy source to conserve petroleum resources. The world's annual consumption of plastic materials has increased from around 5 million tons in the 1950s to nearly 100 million tons today. Plastics constitute approximately 3-7% of municipal waste. Presently, municipal garbage disposal departments bury the plastics along with other materials in landfill without even recognizing its ill effects. Municipal solid waste in India contains 1-4% by weight of plastic waste. Looking at the volume of plastic waste generated in India, there is urgent need for proper plastic waste management. This work is centre on plastic waste management via compression molding.

Compression molding is a well known technique to develop variety of products. It is a closed molding process with high pressure application Solid plastic waste can be recycled by the process of compression molding and this will not only reduce environmental pollution as a result of plastic waste but it will also lead to production of useful plastic materials for both home and industrial use.



II PLASTIC COMPRESSION MOLDING MACHINE

A Plastic Compression Molding machine was fabricated within the limitations. It essentially consists of a cylindrical heater, temperature controller, framework with car jack and a mold box. The components and working is explained as follows.

A. CYLINDRICAL HEATER

This unit is basically a ceramic heater which is clamped to a cylindrical box. The ceramic heater has a number of ceramic plates attached to some coils of metal that heat up in the same way as a coil heater, but the plates absorb the heat and release it into the air. They are quicker than coil heaters and they take less time to cool down once they are switched off. Also the ceramic heaters are usually not very large and they are in fact quite portable. The mold is placed in the cylindrical box so that the plastic waste gets melted. The heating in the model ranges from 0 to 400°. The heater is connected to a temperature controller where its temperature is regulated.



Fig. 1 Cylindrical heater

B. TEMPERATURE CONTROLLER

As the name implies, a temperature controller is an instrument used to control temperature. It is a proportional–integral–derivative controller (PID controller). The temperature controller takes an input from a temperature sensor and has an output that is connected to a control element such as a heater. To accurately control process temperature without extensive operator involvement, a temperature control system relies upon a controller, which accepts a temperature sensor such as a thermocouple as input. It compares the actual temperature to the desired control temperature, or set point, and provides an output to a control element.



Fig. 2 Temperature controller



C. FRAMEWORK WITH CAR JACK

The framework accommodates the mold box with cylindrical heater. It is made of mild steel to provide enough stability. The framework is provided with a car jack to rise and the lower the mold box. This helps in applying a compressive force onto the melted plastic.



Fig. 3 Framework with car jack

D. MOLD BOX

The mold box is provided with a press on top to apply compressive force. Shape of the bricks is molded using Brick molding box. It creates an attractive transition. Brick molding not only creates an attractive transition, but also covers the gap. Brick molding typically has a block-like profile. The plastic waste is heated in the mold boxes compartment. And then compacted and cooled to produce plastic bricks.



Fig. 4 Mold box



III METHODOLOGY

A. COMPRESSION MOLDING

Compression molding is a major technology in the plastic industry, and is one of the original processing methods for manufacturing plastic and its components. The technology has evolved from the production of the simple things like combs and buttons to major consumer, industrial, medical, and aerospace products. In fact, it was widely used in the bakery industry for cookie or cake molding before plastic materials existed. Although it is also applicable to thermoplastics, compression molding is commonly used in manufacturing thermoset parts. The raw materials for compression molding are usually in the form of granules, putty like masses. The main concept of plastic molding is placing a polymer in a molten state into the mold cavity so that the polymer can take the required shape with the help of varying temperature and pressure. The mold is then closed and pressure is applied to force the materials to fill the cavity. A ram is often utilized to produce sufficient force during the molding process. The heat and pressure are maintained until the plastic is used.

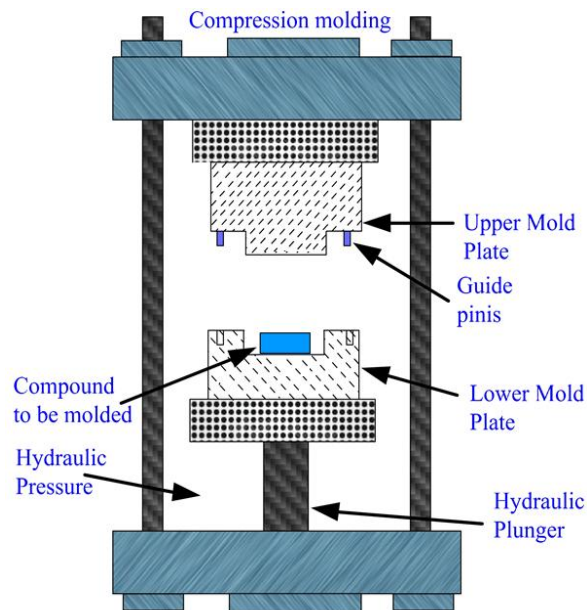


Fig. 5 Compression molding method

B. OPERATION OF COMPRESSION MOLDING

The operations required to produce plastics products by compression molding include:

1. Mold preparation.
2. Heating the material up to melting point.
3. Pressurizing the material in the mold.
4. Cooling and ejecting the product from the mold.
5. Machining the product to the required dimensions.

C. PRIMARY FACTORS OF COMPRESSION MOLDING

There are four major primary factors in a successful compression molding process:

1. Type and quantity of material being used.
2. Heating techniques and duration.
3. Pressure applied to the mold, and
4. Cooling techniques and time.

IV RESULTS AND DISCUSSIONS

Fabrication of Plastic Compression Molding Machine was completed successfully. The Machine was tested and bricks were manufactured. Plastic recycling is taking place in a significant pace in India. The plastic wastes were obtained from BBMP recycling unit, Yelahanka. These plastic wastes were recycled using Plastic Compression Molding Machine. This machine can also be used to produce different products depending upon the type of mold. This helps in safe disposal of large amounts of plastic wastes. The prototype of the model was completed and the same was tested for its successful performance.



Fig. 6 Prepared Specimen

V CONCLUSION

This project aims at effectively converting waste plastic into useful products like bricks and many more products depending upon the mold. Environmental pollution can be effectively reduced and it further decreases the problem of waste plastics in the society. Rather than dumping the waste plastics going into the landfill, it can be converted into useful products at a much lower cost after undergoing certain specific processing. It also avoids the widespread littering of plastic wastes and protects the environment.

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