

Prototype of an Eco-Friendly Dish Portable Mold

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Abstract: *This research work is about the manufacture of a portable mold prototype in scale that can be used for the manufacture of plates made of compound of residue eco-friendly farmer for preliminary tests at the Technological University of Tlaxcala. For the drawing of parts of the prototype, it was used a mechanical design software called Solid Works taking as reference the text by writer Enrique Maya Ortega called "Design of Plastic Injection Molds with Recurrent Engineering". Subsequently by using the software CURE the size of the pieces of the mold were reduced in a 20%. Once this was done, it was used PLA filament to print these the components in a 3D printer. The excess of waste of each part was removed and then the sizes were checked and finished. At the end, all pieces of the mold prototype were assembled. To perform the operation tests, wet pasta was added to the mold in order to make a plate of compound of residue eco-friendly farmers, having as result an easier molding pressure, and a faster drying of the dish, showing with this that technology can help to the manufacture of ecological products.*

Keywords: prototype, mold, printer, manufacture, scale

1. Introduction

One of the main problems at the global level is the pollution and one of the most polluting materials is the styrofoam, which is presented in many products. Currently the use of styrofoam has led to a large amount of pollution since, on one hand, it generates too much garbage and on the other hand, carbon monoxide.

In recent years there has been a need for organic products of daily consumption. In this sense, the search of other biodegradable materials that help to reduce pollution.

That's why we are working on the production of a prototype mold which will be mounted on a die cutter that will manufacture the organic dishes. For the drawing of the mold was used SolidWorks software. Subsequently, the Cura program modified to reduce the size of the parts of the mold on a 3D plane.

Finally, all the parts of the prototype mold were printed with a 3D printer and PLA filament. Then they were assembled to get the final prototype. Later, the prototype was coupled to an electromechanical system of die in order to the preliminary tests of dimensions, the finished of part, and tightness by adding pasta to the mold. All this to verify if the best position of the pasta in the mold, this is in ball, drops, oval or flattened.

2. Survey of Literature

Currently in the CDMX the average consumption of polystyrene is 148 thousand tonnes per year including containers, packaging and packing, as well as for the construction (apparent consumption). It is estimated that domestic consumption of EPS is 65 per cent for the packing and packing and 25 per cent for the manufacture of disposables. For the construction sector are reused 15 thousand tons annually in Mexico. There are companies like

Mexico Dart that encourages the recycling of styrofoam pos consumption. Figure 1.

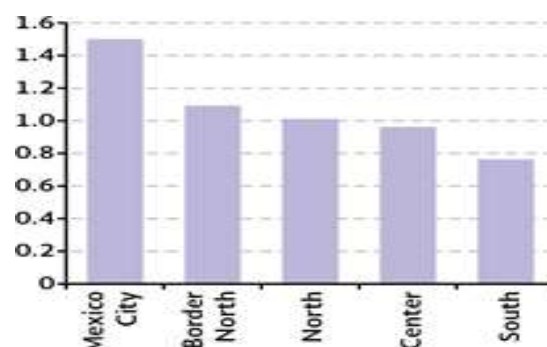


Figure 1: Consumption of plastic in Mexico kilo per person in different parts of the country

The die-cutting process was the result of the Industrial Revolution. In the mid-1800, began to make their mark on the way in which products are manufactured. The embossed introduced products in standard sizes for the mass population.

Die cutting machines used for the first time in homes and schools were smaller than professional machines versions. But with the evolution of technology, die cutting hand tools, as well as small table machines were introduced. These machines were able to mass production of handicrafts and decorations related to the school available to a wide variety of people.

3. Method

Construction of parts

For the implementation of the project which consists in the manufacture of a prototype portable mold for ecological dish made of a paste made from biodegradable agricultural waste. The measures of real disposable dish which WE worked as a base are taken

for the manufacture of the mold. Figure 2.

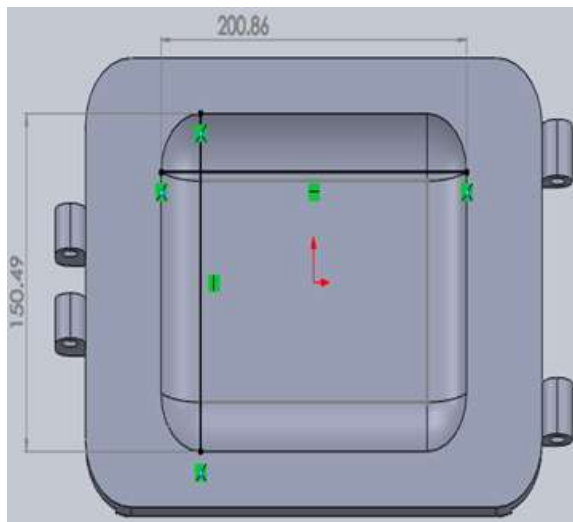


Figure 2: The dish measures

Each of the 5 pieces that formed the prototype were drawn with SolidWorks.

In the manufacturing process is modelled each of the parts to real measures, the most important parts in the drawing of the mold are the basis and cover which give shape to the dish.

Already completed the modeling of all the components of the mold in the software is final assembly checking its correct operation and the correct adjustment of the parts. Figure 3.

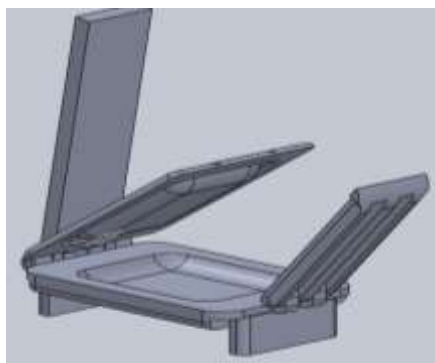


Figure 3: Final Assembly of the mold.

Conversion to cure software.

To perform the printing of all components CURA software help to print and reduce parts at a level of 40%.

The print area is a three-dimensional representation of the volume of printing from the printer. This is the space that we have to print and we can not exceed its limits, since they would be outside the limits of printing real of the printer. Figure 4.



Figure 4: CURA software for printing pieces.

Print pieces

Explanation of tests

We make the impression of the main base (male) which will place the pasta, the main base is fixed, it has no movement and he is responsible for giving shape to the dish.

Subsequently carry out printing the upper base (female) which has movement and to exert pressure on the compressed pasta shaping the dish along with the main base, by removing excess paste by drains the upper base.

We make the impression of the handle which is responsible for pressuring the upper base (female) to be down and compress the pasta.

Finally we make the impression of the supports of the main base. Figure 5.



Figure 5: 3D printer.

Performance tests

A punch is a mechanical equipment which is operated manually by exerting pressure on the upper base with a crank which descends to the main base by compressing the paste which is located in the center of the main base, the other end account with a ball that 20 kg to activate it falls on the crank giving form to the plate with the shape of the mold having a constant pressure.

Having already made parts is to check sizes and finishes, first joining the main base with the upper base. Figure 6.

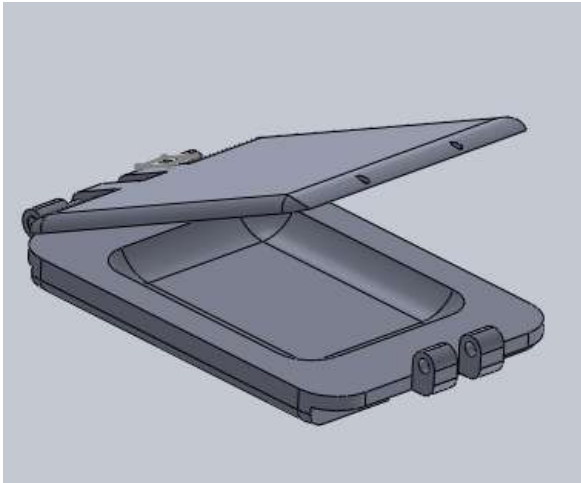


Figure 6: First Assembly

Bearing Assembly of the two first parts assemble the handle of force to the main base. Figure 7.

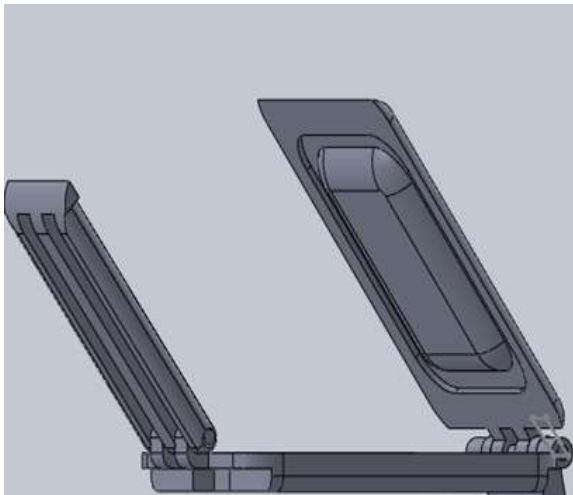


Figure 7: The crank Assembly.

Then assemble the counterweight to the main base. The counterweight has a weight of 20 kg to have a more uniform compression of the Paste on all the mold. Figure 8.

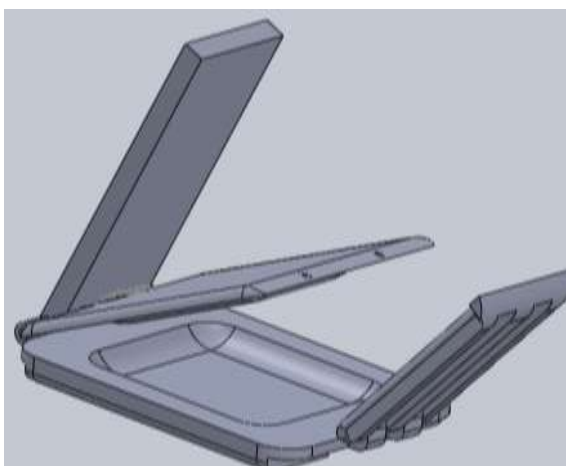


Figure 8: The counterweight Assembly.

Were finally assembled the main base stands. Obtaining the final Assembly of the prototype of portable cast assembled in

a system of stamping machine, to then start the performance tests. Figure 9.

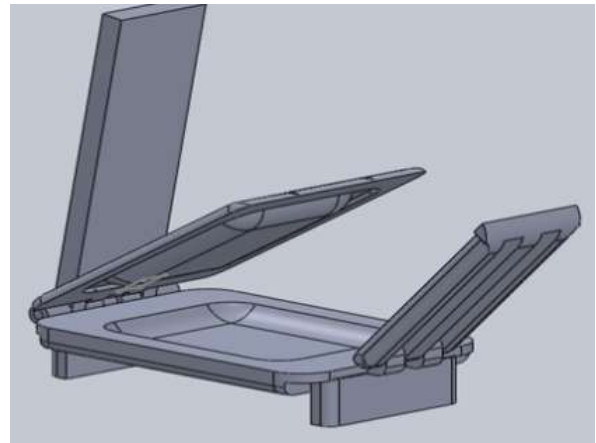


Figure 9: Final assembly.

Unmolding

Pressing, once the pasta has been compressed into the molds, the bases must be separated molds. This is done during the unmolding.

Which develops as two streams of production Parallels, which at some point come together to shape and finish the piece. It consists of five stages, which are:

1. Mix preparation
2. Molding
- 3 Fusion
- 4 Discharge
- 5 Unmolding, cleaning and finishing.

To perform the unmolding dish die cutting is sprayed vegetable oil in the main base and the upper base. This is to prevent the pasta from sticking to the mold surface.

Put the pasta in the center of the mold.

Pasta with the upper base is compressed so that it takes the form of the dish.

Compression is maintained for two minutes to achieve the consistency of paste.

4. Results

For the placement of the earth on the mold is looking for the best position either in the form of gout, ball, oval or flattened to get the best compression and is more consistent. The end result of the prototype mold laptop was to obtain a manual machine which facilitated the production of organic dishes to get the drying time of the mixture of agricultural biodegradable compound which varies depending on the material you are working with.

The pressure is a measure of how much force is exerted on each unit of surface. As well, we calculated the weight of 10 kg on 10.2 cm² of surface area resulting in 0.0980 kg/cm² of pressure for the perforations on the plate. The other test was conducted with 15 kg on 10.2 cm² of surface area resulting

in 1,470 kg/cm² of pressure. The last test was conducted with 20 kg on 10.2 cm² of surface area resulting in 1,960 kg/cm² of pressure.

The latter being the most suitable for the compression of the different biodegradable materials with you are working because it allows the correct distribution of the material stamped on the main base and the top. The use of this manual puncher is simple as well as their transport and maintenance because it does not have complex components.

Table of compression with various materials.

Force	Pressure	Material	Thickness
10 kg	0.980 kg/cm ²	-Masa -Engrudo	6mm 6mm
15 kg	1.470 kg/cm ²	-Masa -Engrudo	5mm 5mm
20 kg	1.960 kg/cm ²	-Masa -Engrudo	5mm 5mm

5. Conclusions

With this prototype of portable troqueladora biodegradable plates can be made with different organic miscellanies which help to reduce the uncel consumption.

This work leaves many educations since it includes several subjects studied along the career that expire with its target which is to facilitate to the pupil srealizing research works for its development.

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