

## **Glue Injection Molding for Bamboo Fibre Pot Making Machine**

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**Abstract:** Pots are a container that is commonly used to cultivate plants or flowers. Plastic plant pots have disadvantages, such as fading and brittleness when exposed to the sun, and the plastic cracking easily. Whenever plastics pots exposed to the sun can leak chemicals into the soil. Since there are various issues that arise as a result of using plastic pots, such as pollution and its disadvantages, the study encourages the development of biodegradable pots. This material can easily be planted with the plants in the soil, and the container will ultimately dissolve. Thus, this study is to identify the optimum and design of glue injection moulding machine for fibre bamboo pots by using Morphological chart and S.C.A.M.P.E.R method. Both methods identify the generating idea, concept selection mechanism and fabrication process for the glue injection molding process. The methods and procedures used to develop, assess, and examine data in order to get results that may be utilized to support this research are referred to methodology. Through getting the raw materials to testing and analysing the outcomes, the flow chart represented the steps in the process. In conclusion, the finding of this research is important including fabricating knowledge to understanding the development of a new product fabricated and in order to produce an innovative product to increase the production of fibre bamboo pots in the future.

**Keywords:** Biodegradable Pots, Glue Injection Molding, Pots

### **1. Introduction**

A pot is a type of container used for growing plants or flowers. Pots have recently been used to transfer plants or flowers to a new location, beginning with seeding. Some materials have been used for plant containers. Ceramic pots, wooden containers, metal planters, plastic plant pots, fibre glass containers, concrete planters, and fabric pots are all examples of plant containers. The type of pots that will be used to contain plants is one of the most important factors to consider when growing plants. Both glazed clay pots and plastic pots have been popular types of housing. Both materials have some advantages and disadvantages. [1]

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Plastic plant pots have a disadvantage in that they fade and become brittle when exposed to sunlight, and the plastic cracks easily. Once exposed to the sun, plastic materials will leach chemicals into the soil. [2] Plastics production, which began only six decades ago, has grown to 8.3 billion metric tonnes, the majority of which is used in disposable products that end up as waste. [3]

Fast action needed to solve the waste problem is by manufacture materials such biodegradable materials that can substitute plastic as pot to reduce plastic pollution. Since there is some problem that ascend by using plastic plants pots such as waste and it disadvantages, the study encourage manufacturing of biodegradable pots.

### 1.1 Problem statement

High demand of requires high production on planting pot production rate from the industry. It is estimated 15.00 % - 48.00 % show respondent of biodegradable pots have high interest and willingness to pay additional prices charges depend on the kind of the pots. Especially for edible and vegetable plants consumers showed the willingness to pay within the range of the additional costs of producing plants in biodegradable pots. [4]

These projects are aware of the effect on the environment, these researches are actively searching for new ways to safely minimize, reuse, and recycle. When it comes to the planting, using biodegradable plant pots is a simple way to help the environment while still caring for our green mates, and it can have some unexpected benefits. In manufacturing for the biodegradable pots need to ensure the glue uniform distributed to the fibre bamboo. The glue is not well in distributed around the bamboo fibre pot in the gluing process. The glue need to distribute around the bamboo fibre in a proper way and will attached to the fibre pot balanced.

### 1.2 Literature review

The glue injection molding for bamboo fiber pot making machine are covered by the various types of biodegradable pots that available and also go over the gluing method in further detail.

- The type of biodegradable pots that are the same as bamboo fiber pots is including coconut coir, peat pots, EnvirocArc and Fertilepots.
- The most obvious advantage of biodegradable pots over regular ones is that they're more environmentally friendly. There is no trash, or at least none that can't be reabsorbed into the soil right once and the pots are constructed from a variety of environmentally friendly raw items.
- Despite the fact that bamboo has become an old and traditional building material, it is nevertheless widely used today. As shown in the Table 1 is the bamboo species and its use in Malaysia. [5]
- Mechanical and chemical process is the two primary categories of process which used obtain bamboo fibres. Both procedures begin with splitting of bamboo strips, which is followed by either mechanical or chemical processing, depending on how the bamboo fibres will be used. [6] Extraction of rough and fine bamboo fibre show in figure 1.

**Table 1: Commercial bamboo species often used in Malaysia**

Species	Local Name	Uses
<i>Bambusa Blumeana</i>	Buluh duri	Chopstick, tooth picks, Furniture, musical instrument
<i>Bambusa heterostachya</i>	Buluh galah/tilan	Poles, frames. Skewer sticks
<i>Bambusa vulgans</i>	Buluh minyak/gading	Ornamental. Shoots as food

<i>Dendrocalamus asper</i>	Buluh beting/bisa	Higo materials, chopstick
<i>Gigantochloa wrayi</i>	Buluh beti/raga	Handcraft blinds, skewer sticks
<i>Sxhizostachyum grande</i>	Buluh semeliang/semenyeh	Frames, leaves used for wrapping Chinese glutinous rice dumpling

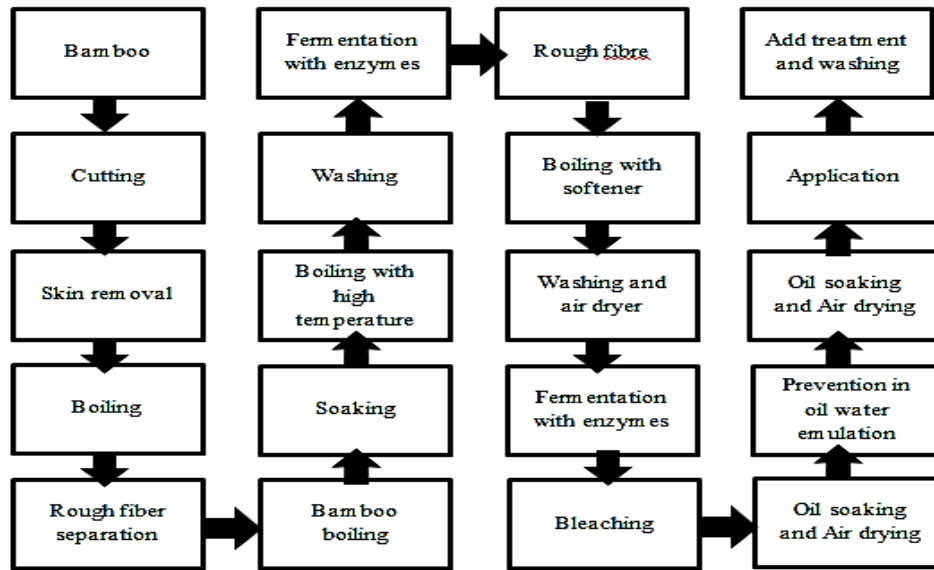


Figure 1: Extraction of rough and fine bamboo fibre

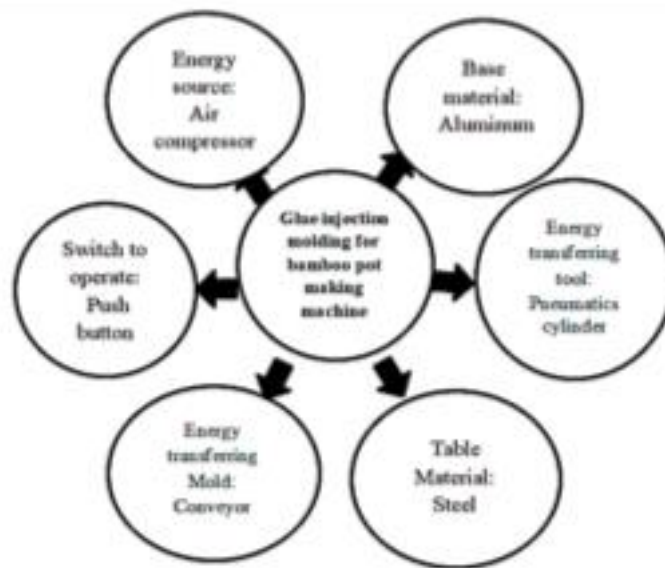
## 2. Materials and Methods

The machine structure and pneumatic circuit were designed based on previous research with improvements on safety requirements and production productivity. The study of materials, standard parts, and pneumatic system components is important to develop the machine capable.

### 2.1 Concept generation

To find the best aspect for the system, the functionality that will be applied to glue injection system was brainstormed. All of the possibilities were examined so that a suitable solution could be preferred to construct a new generation concept. As a result, appropriate and efficient functions and options were developed in order to make a better choice for the optimal glue injection system for this project.

There is evidence that brainstorming can be done fast using the S.C.A.M.P.E.R checklist methodology to create new ideas. S.C.A.M.P.E.R stands for Substitute, Combine, Adapt, and Magnify, Put to Other Use, Eliminate, and Rearrange. After using S.C.A.M.P.E.R., the concept map for a glue injection molding for bamboo planting pot-making machine is shown in the Figure 2. [7]



**Figure 2: Concept map of design product of glue injection molding**

## 2.2 Morphological chart

A morphology chart is a tool which represents a variety of design options. It also assists in the research of the all relationships in multidimensional difficulties. Morphological analysis is a technique for generating new designs.

Morphological charts also provide users an idea of the size given design space exists. Predicated on a function analysis, a morphological chart, also termed as a table. The functions have been stated on the left side of the chart, while several mechanisms that can be employed to fulfill the functions stated are represented on the right side. It's a tool that helps individuals come up with new ideas. The final concept selection for Glue injection molding for bamboo fibre pot making machine shows in Table 2.

**Table 2: The final concept selection for Glue injection molding for bamboo fibre pot making machine**

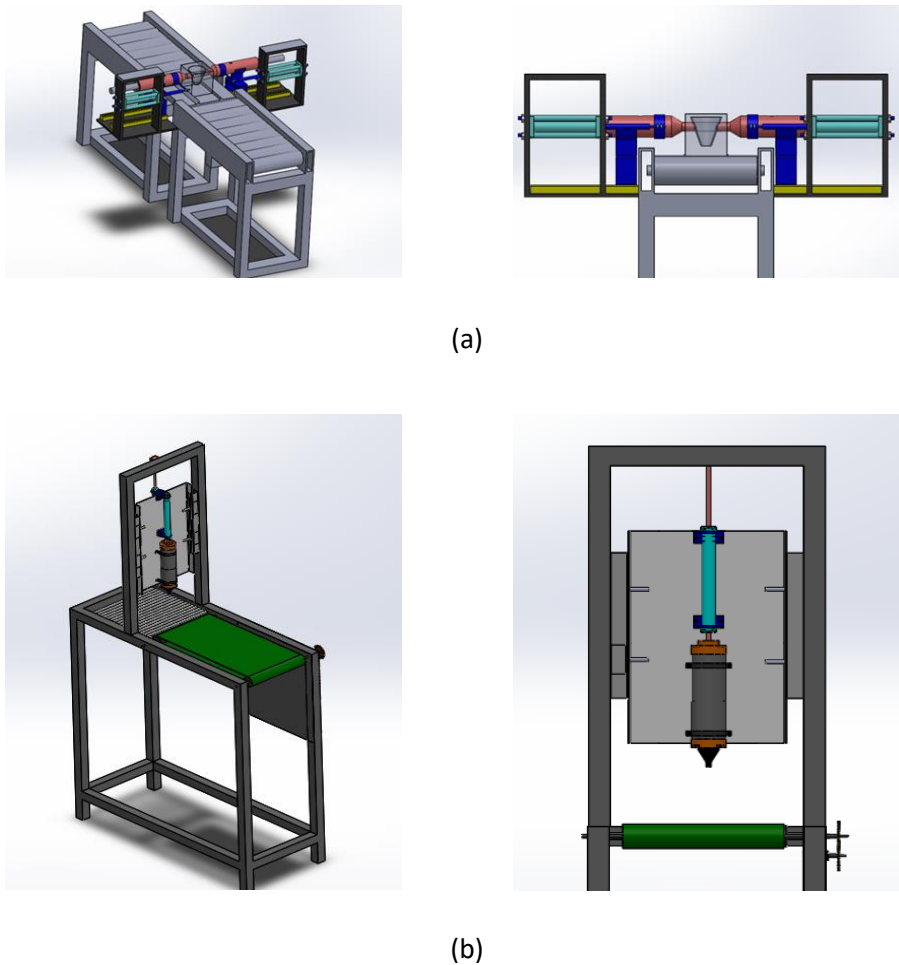
No	Function	Mechanism
1	Energy source	Air compressor
2	Base material	Aluminium
3	Energy transferring Mould	Conveyor
4	Energy transferring Tool	Pneumatic cylinder
5	Table material	Steel
6	Switch to operate	Push button

## 2.3 Detailed machine design

Based on the concept in Table 2, two 3D model designs were created using SolidWorks software to explain the complete description of the machine, consisting of its shape, dimensions, number of parts, and specifications. Figure 3 shows the model's design for this purpose.

The first model was shaped like a wing and attached to the machine table framework on both sides. Two pneumatic cylinders are used to move the injection barrel forward as well as backward according to the design system. The glue is then injected into bamboo fibre mold by two additional pneumatic cylinders. It's required 2 glue injection barrel in the first model. A horizontal movement of the glue injection molding was designed in the first model.

The second model was created with the most cost-effective manufacture in consideration. The models' final design only consists of simply two pneumatic cylinders to move the plate and to inject glue into the bamboo fibre pot mold. This just required a glue injection barrel that attached to an “n” shape plates. The second model was designed as a vertical movement to it.



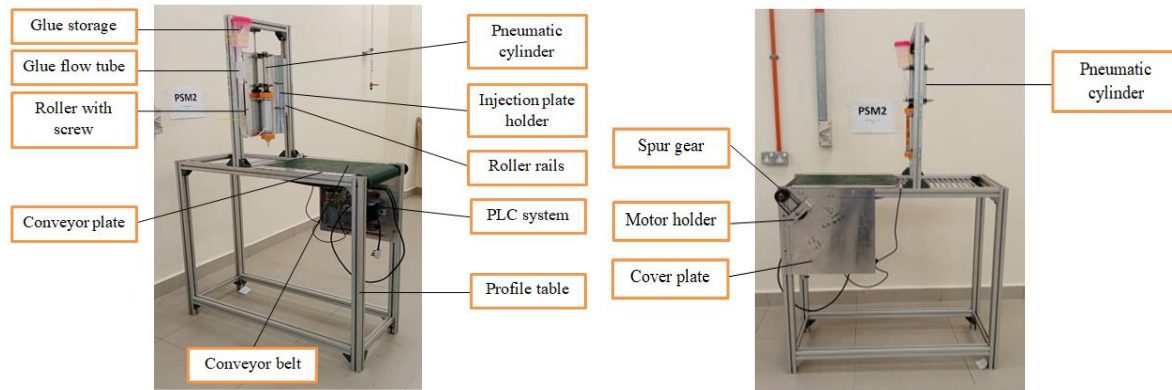
**Figure 3: Models design; (a) first model (b) second model**

### 3. Results and Discussion

The overall analysis of the Glue injection machine produced will be discussed in detail and comparison made with existing studies. In the development of the semi-automatic glue injection molding for bamboo fibre pot making machine, the analysis was made in relation to the conventional production process of the bamboo fibre pot. In addition, the engineering analysis was performed on the machine such as feasibility test, design and dimensions of the machinery involved. Overall the function system works well, but the system for the glue injection machine didn't move.

### 3.1 Final design of Glue injection molding for bamboo fibre pot making machine

Objective 1, "propose a gluing process mechanism for biodegradable pots," this machine focuses on the process of glue insertion, while the process of filling the glue into the bamboo fibre pot mould is done by a semi-automatic machine. With a weight of roughly 30 kg, a table dimension of 998 mm x 360 mm, and a structure of 998 mm × 360 mm, the semi-automatic glue injection molding were fabricated. Figure 4 shows the result for actual design of glue injection molding machine.



**Figure 4: Actual design of glue injection molding**

### 3.2 Discussion

The flow chart depicted the steps in the process, from obtaining the raw materials to testing and analysis of the results. To achieve solutions that exceed the study goals and scope, each stage or method should be completed properly. The process began with design stage and ended with the first designs of the project. Method is essential since it is the guideline that must be followed in order to accomplish the study's activities. All of the process selection leads to the final design of the project.

Based on the results, the second design has been selected as the final design for the glue injection molding for bamboo fibre pot making machine as the cost for fabricating are more cheapest and more easily to operate that the first design.

## 4. Conclusion

This research study has been successful and achieved the objectives as previously set. The design concept of a glue injection molding for bamboo fibre pot making machine was determined. Based on the design concept, the mechanism for glue injection machine provided the elements that help to make the gluing process easier and safer. The function system works well, although the glue injection system not moving. Every stage has been completed in the proper sequence in order to produce a decent product. From product design to material selection, everything is taken care of. The material has been viewed from a feminist perspective before fabricating a product, which materials are available, how much they cost, and so on.

### Acknowledgement

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