

## Design and Fabrication of degradable cups making machine

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**ABSTRACT:** In our daily life we may find a lot of problems related to the pollution, especially the earth pollution. We are encouraging lot of instant products which are made of plastics because of lower cost and requirements. These plastic products not degradable in earth. The disposable plates which are made of thermocol and materials such as plastics, ceramics are land pollutant materials, they will not decompose into the earth. To avoid the above said problem need to use natural type raw materials which easily decompose. Areca nut tree, which has leaves of big size and confine that leaf into desired shape by using the die equipment. Design of machine was done in CATIA software and fabrication was done by using different joining methods like welding and bolt & nuts. Real time testing was carried out at different temperatures.

**KEYWORDS:** CATIA, Cups making machine.

### I. Introduction

Plastic is a material that Earth cannot digest. Every bit of plastic ever produced still exists and will be here with us for hundreds of years. Once in the environment, plastic breaks down into smaller and smaller particles that attract toxic chemicals, are ingested by wildlife on land and in the ocean, and contaminate our food chain. The fig 1.1 shows how plastics are seriously affecting life of living beings. The bird in the figure is decomposed completely but plastics still do not decomposed.



**Fig.1. Decomposed body of bird with plastics**

As the magnitude and the human health implications of our plastic pollution problem are better understood, there is more and more buzz about plastics that are bio-based, biodegradable, or compostable. Many eco-minded people see in them an easy solution to our plastic pollution problems. The reality, however, is not that simple.

### Problem with plastics

Many plastics release vinyl chloride and other harmful gases or contain phthalates that can lead to cancer, birth defects, and lung and liver disease. Some plastics are right out in the open, like the ones found in our TVs, computers, telephones, coffeemakers, water bottles, and food containers. But some plastics show up in places where you might least suspect them, in carpeting, chewing gum, cosmetics, mattresses, sanitary napkins, polyester clothing, tissues, toilet paper, and upholstery.

### Areca nut Leaf Sheath as Alternative

This project is all about a small attempt to protect the Earth from pollution. In spite of today's technological developments, we miserably failed to control the pollution. Even though there are a number of practices to control it, we have achieved a very small, so there is a greater need to remove these stumbling blocks for continual natural growth of our surroundings. We proposed wastage conversion as the key to control the Earth pollution to large extent. We observe lot of Earth pollution through plastic usage, especially temporary dinner plates at parties and occasions. These are one of the major causes of the Earth pollution.



**Fig. 2 Areca nut Leaf Sheath**

We selected areca nut leaf sheath (extension of the leaf) is the better alternative of the dinner plates made of plastics and thermocol sheets. Areca nut is an important horticultural crop in Assam. The leaf of areca nut tree is not used for any productive purpose at present except burning as natural fuel in the villages. It is a hard material and has good tensile strength. It does not have the manure value as it takes more time for naturally decomposing. Its calorific value is also found to be low.

## II. Methodology



**Fig.2. Process flow chart**

## II.I. Components of cups making machine

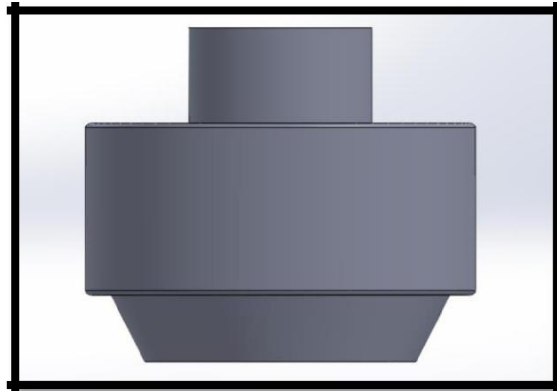


Fig.3. Circular Punch

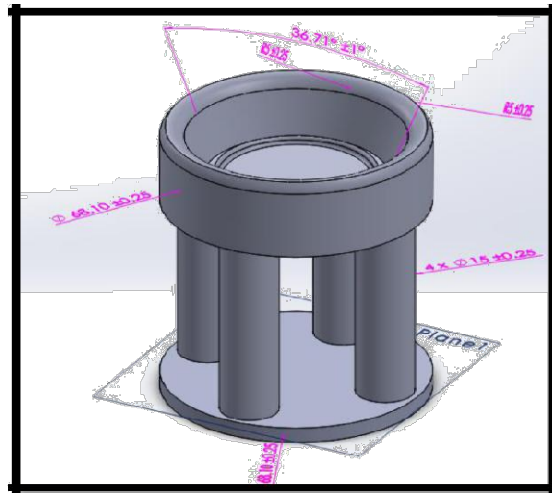


Fig.4 Circular Die

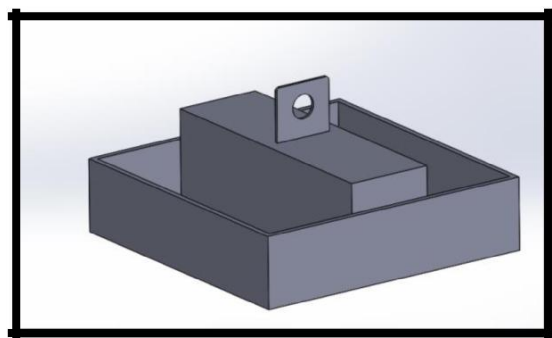
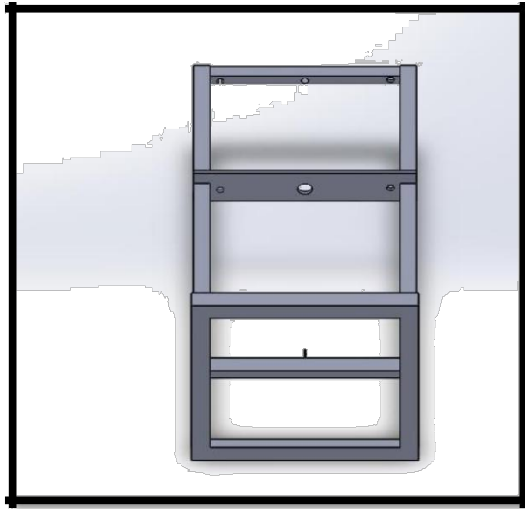
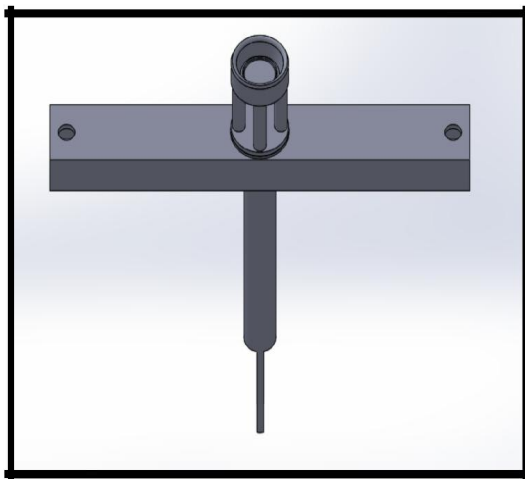


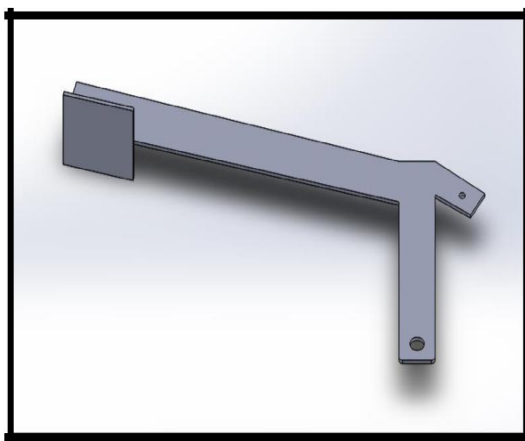
Fig.5. Lower frame



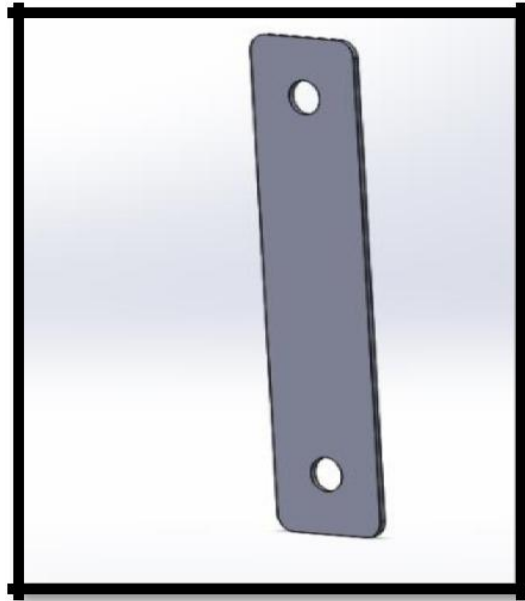
**Fig.6. Outer frame**



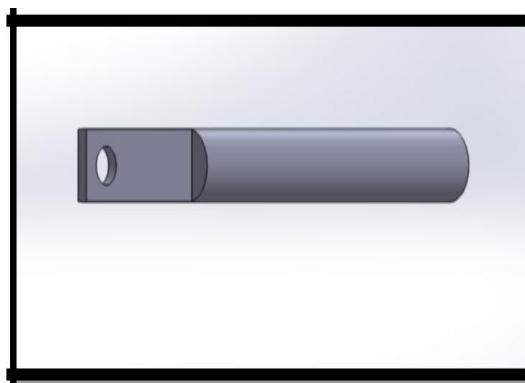
**Fig.7. Movable frame**



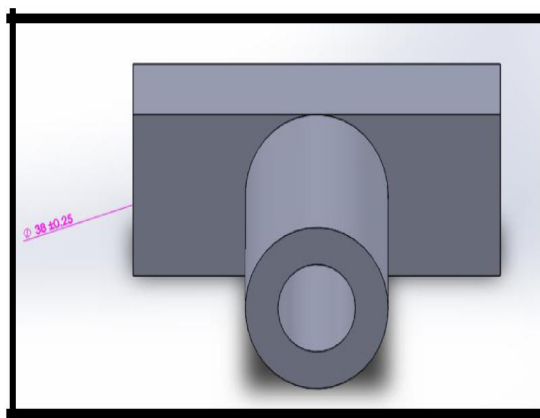
**Fig.8. Pedal operated lever**



**Fig.9. Plate linkage**

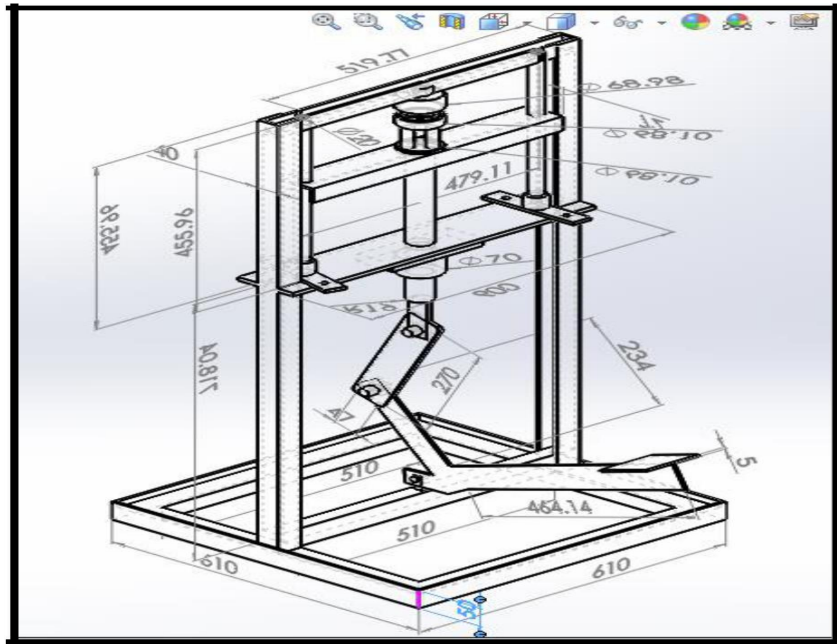


**Fig.10. Toggle plate**



**Fig.11. Guide block**





**Fig.12. 3D representation of cups making machine**

## Assembling



**Fig.13. Fabrication model**

### III. Results and Discussions

The effect of temperature has been investigated at six different temperatures viz. at, 70C, 80C, 90C, 100C, and 110C. The above temperatures were maintained for a particular operation at different period of time. Temperature of both the die and punch and the time of operation for the production of a 4 inch diameter plate are shown in Table.1 and Table.2 for a pedal type machine. Series of laboratory experiments were carried out to evaluate the effect of temperature and moisture content on the sheath plates. The effect of temperature, moisture content and time of operation has been investigated on degradable cups. The value of the above parameters for good quality product are found to be in the following ranges

Upper die Temperature: 110-115 C  
Lower Die Temperature: 35-45 C  
Moisture content of raw areca nut sheath: 14-17%  
Time of production: 40 seconds to 60 seconds

In addition to the above, strength of the sheath has also been investigated. This is found to be 1500-1800 N in the sheath direction and 86 N in the transverse direction. The increase of moisture content leads to the development of fungus on the surface of the raw material as a result of which destroy the quality of the raw material and as well as final product. The control of temperature of the die-punch during operation seems to be important. It is also seen that moisture content and temperature varies with machine to machine. Finally, it is observed that, the regulation of these parameters is very essential for quality product. Further, this study will help in designing a high performance machine for areca nut leaf plate manufacturing.

#### Optimum temperature condition

We have conducted experiments on the basis of trial and error method. The following results have been obtained. We assumed the conditions of sheath at constant ambient temperature limits. We have placed temperature controlling to regulate the current in heating coil. We have used thermostat equipment to sense the temperature of the die and regulate it with the knob that had been arranged on thermostat plug.

The Tab.6.1 and 6.2 are the results of experiments on pedal operated machine at different room temperatures viz. at 34<sup>0</sup> and 32<sup>0</sup>.

**Table.1. Quality of sample obtained from machine at different temperatures (Room Temperature: 32<sup>0</sup>C)**

Sample	Time of soaking in water(minutes)	Temperature of dies		Time	Remarks
		Upper die	Lower die		
1	3min	80 0C	45 0C	1 min	Good quality and Products were obtained with samples 3 and 4.
2	6min	80 0C	45 0C	3 min	
3	8min	110 0C	45 0C	1 min	
4	10min	110 0C	45 0C	3 min	

**Table.2. Quality of sample obtained from machine at different temperatures (Room Temperature: 34<sup>0</sup>C)**

Sample	Soaking time (minutes)	Temperature of dies		Time (minutes)	Remarks
		Upper die	Lower die		
1	3 min	70 0C	40 0C	1 min	Sample 5 shows the best quality.
2	5 min	80 0C	40 0C	1 min	
3	6 min	900C	40 0C	1 min	
4	8 min	1080C	40 0C	1 min	
5	10min	1100C	40 0C	1 min	

#### IV. Conclusion

The components of cups making machine was designed by using CATIA software. The fabrication was done by using different joining methods. The real time testing was done at different temperatures of dies and soaking time. In testing observed properties of cups at optimal temperature.

#### V. References

- [1]. Colette Wabnitz1 & Wallace J. Nichols, "Plastic Pollution: An Ocean Emergency", Marine Turtle Newsletter No. 129, 2010 - Page 1
- [2]. Amrita Prasad Adhikary "An Earth-friendly Solution to Disposable Dinnerware", page no.6, PEP-ID The University of Texas at Austin
- [3]. Katie Drummond, "Top 5 Suspected Everyday Carcinogens in the American Cancer Society's Scary New Report," AOL News, last modified July 25, 2010.
- [4]. R.Raghu pathy R.Viswanathan,CT.Devas, "Quality of paper boards from areca nut leaf sheath", page-82(2002)99-100, ELSEVIER Bioresource technology.
- [5]. Hanumanthswamy B. C., Shashidhar K. C., "Conversion of areca leaf sheath into ecofriendly plates", Vol 3, No 1 (2014) > Adivappar, a case study of remunerative micro enterprise International Journal of Trade & GlobalBusiness Perspectives © Pezzottaite Journals.Nagarajappa Adivappar,.
- [6].Pankaj Kalita, U. S. Dixit, P. Mahanta and U. K. Saha., "A novel energy efficient machine for plate manufacturing from areca nut palm leaf sheath", vol 67,oct 2008,pp.807-811, journal of scientific & industrial research.
- [7].Pankaj Kalita, U. S. Dixit, P. Mahanta and U. K. Saha., "Effect of moisture and temperature on areca nut leaf sheath products", Proceedings of the 3rd BSME-ASME International Conference on Thermal Engineering 20-22December, 2006, Dhaka, Bangladesh"
- [8].figure 2.5, 2.6 Pankaj Kalita, U. S. Dixit, P. Mahanta and U. K. Saha., "Effect of moisture and temperature on areca nut leaf sheath products".
- [9].Figure 2.3, 2.4 Amrita Prasad Adhikary,"An Earth-friendly Solution to Disposable Dinnerware" PEP-ID The University of Texas at Austin.