

Design of a Multifunctional Press Machine for Cocopot Production

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Article Information	ABSTRACT
Article History Received : March 06, 2025 Revised : March 20, 2025 Published : April 10, 2025 Keywords: <i>Coconut fiber;</i> <i>Cocopot;</i> <i>Press machine.</i>	Coconut fiber has properties that are durable, strong friction, not easily broken, waterproof, resistant to fungi and pests such as termites or rats. Because of this, coconut fiber can be used as handicraft products that have aesthetic value and high selling value. One of the products is cocopot or polybag replacement coconut fiber pot. At this time, the supporting tools in the cocopot production process are still rarely used, especially for MSMEs. To streamline the production process then made the design of multifunction press machine cocopot printer. The methods used in this design are data collection carried out by literature study and observation, making design sketches, making 2D and 3D designs using the Solidworks 2021 application, design validation, monitoring the tool manufacturing process, and evaluation. Cocopot multifunction printer press machine designed to have frame dimensions of 1180mm x 450mm x 745mm with frame material used is UNP iron measuring 80 x 40 x 5 mm. The resulting product is a coconut coir pot with a uniform thickness and is used instead of a polybag with a pot thickness of 1-2mm and is worth selling. This cocopot printing press machine has two different types of press working principles, namely by using a roller press to flatten coconut fiber and a printing press using molding that is driven using an electropneumatic system. The design of the machine is intended to form a cocopot with a tube shape measuring 120mm in diameter with a height of 140 mm.

INTRODUCTION

Coconut (*Cocos nucifera* L.) is a plant that has many uses from all parts of the plant, ranging from roots, stems, leaves, and fruits can be used as human needs that have high economic value. Coconuts are spread in tropical countries, especially Indonesia (Putera et al., 2019). One part of coconut that is often used is coconut. Coconut fruit or more specifically, coconut pulp is usually processed into various kinds of food dishes until it is made into medicine. Subang Regency, West Java is one of the areas that has the spread of coconut trees used for food needs. This is in accordance with data on the distribution of coconut plants in Subang Regency, according to the Central Statistics Agency of Subang Regency In 2020, Subang Regency can produce coconut plants from coconut plantations measuring 2,530 hectares (BPS Kabupaten Subang, 2020). Because of the large use of coconut pulp, a lot of coconut fiber is wasted and becomes waste. Coconut coir is a fibrous part of the coconut plant, coconut coir is on the outermost part of the coconut fruit and usually has a thickness of about 5cm. Coconut coir consists of husks, fibers and husks. Coconut fiber is one of the parts of coconut fiber that is often used and developed into a more functional material (Putera et al., 2019).

Coconut coir has properties that are durable, strong to friction, not easily broken, waterproof, resistant to mold and pests such as termites or rats (Aji, 2021). Coconut coir also contains several compounds of lignin, cellulose, nitrogen, water and ash. So coconut coir has strong properties, biodegradable and environmentally friendly properties, so it can help reduce the use of single-use plastics that contribute to the global waste problem. Based on the explanation above, coconut fiber has many advantages and uses for life. So that in overcoming the scattered coconut fiber waste, several products from coconut fiber are made. One example is the making of cocopot (Abdullah Azzaki et al., 2020). Cocopot or coconut coir pot is one of the plant pots that has even water absorption so that it can make it easier for plant roots to grow and spread in all directions (Astriani et al., 2021). The use of cocopot is one of the solutions to the problem of plastic waste from the use of polybags which can cause environmental pollution (Ananda, 2021). Cocopot has a high aesthetic value so that it can be a decoration and attraction for buyers (Ulfa et al., 2023). Coconut coir which has the property of being able to absorb water and nutrients, and is environmentally degraded, makes coconut coir one of the best planting media to use (Darma Jaya & Ghani Ilmannafian, 2019).

In making cocopot, coconut coir goes through several processes. Coconut coir is processed through the process of dividing the coir using a chopping machine, then continued with the process of sifting coconut coir. Here the coir that has been chopped using a machine is separated from the large and small coir. After sifting, the coir is then given a mixture of latex glue or rubber glue and then dried by drying in the sun. Next, the coir is molded into a pot. In the printing process, this is still done manually, namely by forming coconut coir like a pot by connecting sheets of coir sheets that have been sun-dried and then given latex glue and then dried again, because this is why the size of the coir pot and its thickness are not uniform, and making this cocopot takes days. Therefore, it is necessary to make appropriate technology in producing cocopot. One of them is the manufacture of a cocopot printing press. The use of appropriate technology press machines (TTG) in producing cocopot, especially in the production process in an MSME, is very rare. One of them is found in MSMEs coconut fiber artisans in Subang Regency who still use several manual tools in the production process. So that supporting technology is needed such as the use of a cocopot press machine to streamline the resulting products that will be traded later.

Press machine is a machine that processes the formation with the technique of crushing a material into the desired shape (Nasution & Nur, 2016). Another type of press machine working principle is to sort a material. The system used in the press process is the use of pneumatic and roll system. Electropneumatics is a system that combines electrical technology with pneumatic technology. Pneumatics, which use compressed air as a prime mover (actuator), function in conjunction with control systems that utilize electrical or electronic signals to operate them (Saputra et al., 2022). Pneumatic work system will run a fluid system in the form of compressed air to create motion (Sofnivagi & Razi, 2020). An electropneumatic printing press is a machine that uses a combination of Electrical and pneumatic technology to perform a pressing or molding process. This machine is usually used in industry to produce goods with high precision and efficiency (Razi, 2024), while the rolling press machine is a mechanical device used to narrow or extend the material by pressing it between two wheels or split rotation (Murdiyanto & Redationo, 2015).

The design process is an activity that involves describing, planning, and arranging or combining several separate elements into a perfectly functioning whole (Fariyanto & Ulum, 2021). The purpose of system design is to create prototypes that fit the needs of users and produce designs that minimize errors in data processing (Astuti, 2018). This study was conducted to determine the design carried out in the process of making a press machine with two types of press that is press using electropneumatics and using a roller press so that it can perform two types of work in producing cocopot. At the time of the design process using Solidworks 2021 software. This application is a development of engineering Technology in the form of 3D Mechanical CAD program developed by Dassault Systems Solidworks Corp. SolidWorks is generally used by small design and manufacturing companies that focus on the production of sheet metal products, piping systems, and wiring for electronic equipment (Dwi et al., 2021).

RESEARCH METHODS

The research was conducted through several stages in the process of designing a multifunction press machine cocopot printer that includes two work processes in one machine. Here are the stages performed.

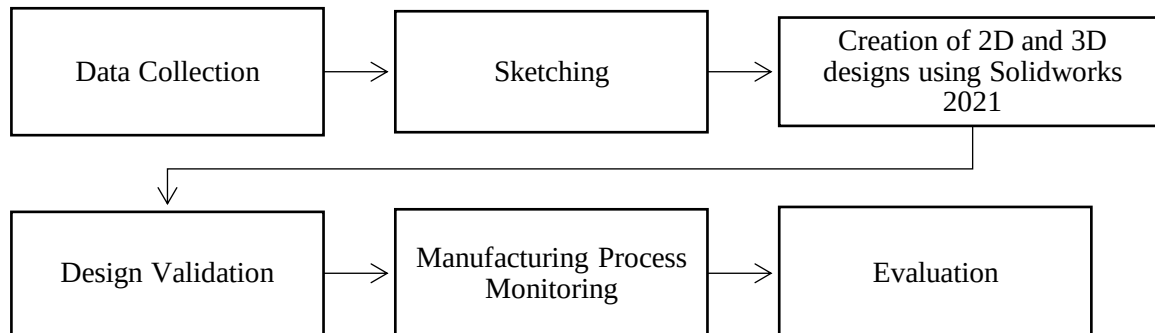


Figure 1. Troubleshooting Methods

The problem-solving methods carried out in the process of designing the cocopot printer multifunctional press machine are as follows:

a. Data Collection

Data collection was carried out by conducting observations and interviews with one of the MSMEs artisans of coconut waste in Subang Regency who did not have appropriate technology in the production process of making cocopot and some of the production processes still used manual supporting tools such as coconut coir press roll machines. In addition, data collection was carried out by study literature from various scientific sources.

b. Sketching

Sketching is the initial description of the machine that will be made later. Sketching is done manually using stationery and there is temporary dimensional planning.

c. Creating 2D and 3D Designs using Solidworks 2021

The design starts from the machine frame, machine components consisting of cocopot printing press machine components and rolling press machines. After that, each part of the design is then assembled into a single machine. Here the design is made in detail in each part so that it can produce an output in the form of a design document that has been made.

d. Design Validation

In the design validation process, the design that has been made is then checked and validated by the validator. If it has not reached the validation stage, then the design needs to be re-evaluated in the engine design making part.

e. Monitoring of Manufacturing Process

Monitoring or monitoring in the process of manufacturing machines or manufacturing machines is carried out to ensure that the manufacturing process is in accordance with the validated design.

f. Evaluation

In this process, all stages are evaluated by conducting engine performance tests. The resulting product is in the form of a cocopot with a thickness of 1-2mm close to the

polybags that are traded in the market. If the condition of the machine is still not in accordance with the design, the stages will be reviewed to the design department.

RESULTS AND DISCUSSION

The research process in designing a multifunctional press machine for cocopot printers is carried out to collect data to find out the components and materials in the design. Data collection was carried out in one of the MSMEs processing coconut coir and a literature study was carried out. After obtaining the data, a sketch of the machine design and design creation was made using the Solidworks 2021 application. In the design process, the design takes into account the technical and ergonomic of the machine that will be made. The 2D design that has been made is then made into 3D which is divided into several detailed parts and then the parts are assembled. The design of the cocopot printer multifunction press machine is as follows.

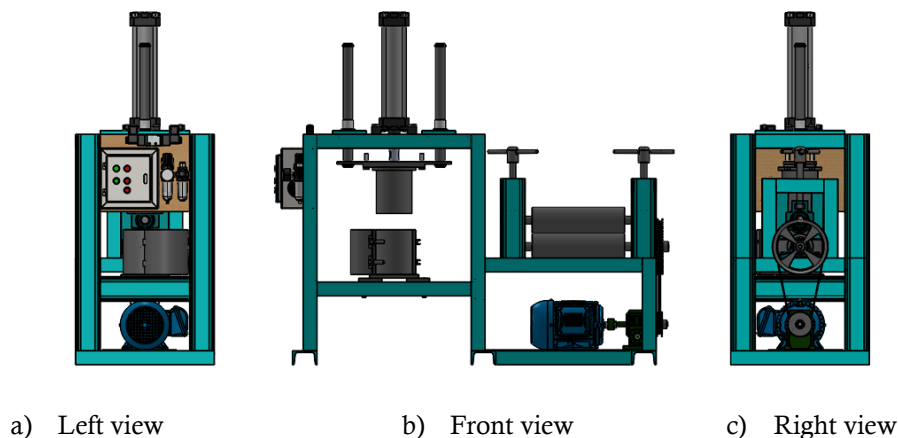
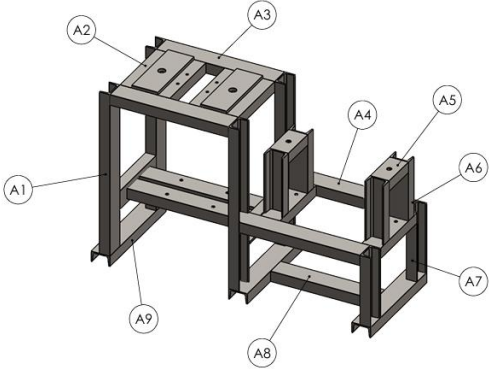
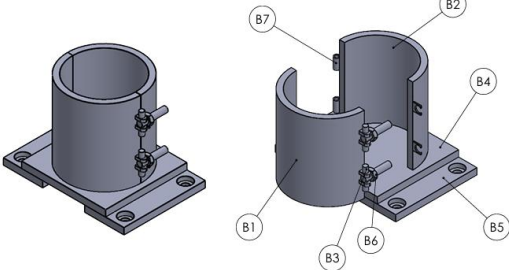
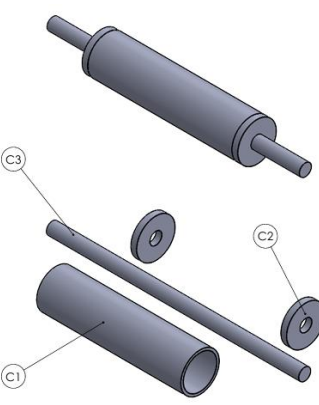


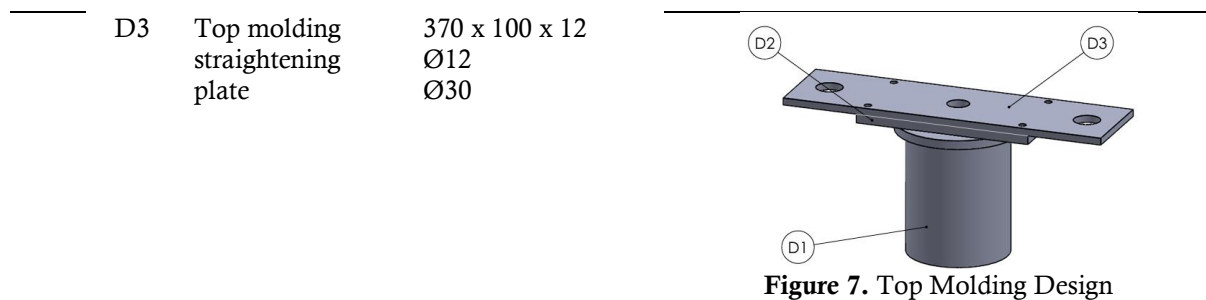
Figure 2. 2D Design of Multifunction Press Machine Cocopot Printer

Tabel 1. Components of Multifunction Press Machine Cocopot Printer

No	Item	Part Components	Dimensions (mm) / Specification	Design
1	1	Frame	1180 x 450 x 745	
	2	Panel Box	290 x 250 x 12	
	3	Holder		
	4	Panel Box	185 x 98 x 196	
	5	Air Service Unit		
	6	Solenoid Valve	Double Solenoid Valve 5/2	
	7	Double acting cylinder	L400mm	
	8	Cylinder Piston	P300mm x Ø bore 40mm	
	9	Top Molding	Øtop 140, Øbottom 115 x 150	
	10	Straightener Molding	Ø 30 x 400	
	11	Bottom Molding	Øout 135 x Øin 120 x 140	
	12	Flange Bearing	Ø30	
	13	Bearing Holder	38,25 x 12 x 150	
	14	Roller Press	Ø 80 x 300	
	15	Handle Roller	M12	
	16	UCP Bearing	UCP 205 Ø25	

Figure 3. 3D Design of Multifunction Press Machine Cocopot Printer

	16	UCT Bearing	UCT 205 Ø25	
	17	Pulley driven	Ø 15,24 (6")	
	18	Drive pulley	Ø 5,08 (2")	
	19	Reducer speed	Ratio 1/30	
	20	Electric Motor	1 Phase 1HP	
	21	Drive Belt	Tipe V	
2	A1		700	
	A2		290	
	A3		500	
	A4		550	
	A5		155	
	A6	Engine Frame	255	
	A7	UNP 80 (80 x 40 x 5)	300	
	A8		440	
	A9		450	
3	B1	Bottom Molding A	Ø 1=135, Ø 2=120 T = 140	
	B2	Bottom Molding B	Ø 1=135, Ø 2=120 T = 140	
	B3	Molding Locks	M12	
	B4	Molding Stand A	160 x 155 x 12	
	B5	Molding Stand B	75 x 155 x 12, Ø12	
	B6	Lock Nut	M12	
	B7	Hinge	Ø 6 x 20	
4	C1	Roller	Ø 80 x 300	
	C2	Roller Cover	Ø 80 x Ø 25 x 12	
	C3	As Roller	Ø 25 x 525	
5	D1	Top Molding	Øout 135 x Øin 120 x 140	
	D2	Top Molding Cover	200 x 100 x 12 Ø12	



Main Frame Machine

The main frame of the engine uses UNP iron material with a size of 80 x 40 x 5mm (Fauzia et al., 2023). The dimensions of the machine frame are 1180 x 450 x 745mm which consists of several parts of UNP iron pieces that have been cut using a hand grinding machine and then assembled by welding using the SMAW welding type. The main frame functions as a support for machine components such as pneumatic cylinders, upper molding, lower molding, rollers, bearings, electric motors and reducers.

Roller Press

Roller press is one of the components used in one of the functions of the press machine in producing cocopot products. The roller used in the press machine uses iron pipe material with a diameter of 80mm and a length of 300mm. The roller cover uses a plate with a thickness of 10mm by a diameter of 80mm and has a hole for the roll shaft of 25mm. The roll shaft used uses a diameter of 25mm with a length of 525mm totaling two pieces, one of which is a roll driven by a pulley from an electric motor and a reducer to flatten coconut coir. The parts are then assembled by SMAW welding.

Printing Molding

The molding used in the cocopot molding process uses two pieces of molding, namely upper molding and lower molding. Molding functions as a printer for flaked coconut coir. The bottom molding uses iron pipe material with an inner diameter of 120mm and a height of 140mm with a molding stand measuring 235 x 155 x 24mm which is welded using SMAW welding. The top molding uses solid iron with a diameter of 115mm and a length of 150mm. The top molding can be replaced with a printer because the top molding uses bolts to connect to its pneumatic straightening plate.

Working Principle of Multifunction Press Machine Cocopot Printer

Multifunction press machine cocopot printer is a machine that can perform 2 types of press process in producing cocopot. Coconut coir that has been mixed with latex glue and then flaked to make cocosheet using roller press components. In press roller press, the roller works by utilizing the power of a 1-phase electric motor / an important component in various sectors of industry and everyday life with 1 HP (Tahir et al., 2022). The rotation of the electric motor is then transmitted to the speed reducer with a ratio of 1/30 to reduce the rotation of the electric motor. The resulting damper rotation is then transmitted to the drive pulley and the pulley is driven using a drive belt. The size of the drive pulley has a diameter of 2" and the drive pulley has a diameter of 6" which then produces a lower rpm rotation of 15.5 rpm. The results of the analysis Amrullah & Nainggolan (2022) of the rotation of the roller in accordance with the research of coconut coir roller pemipih machine to be used as cocosheet has the number of rpm is 10.12 rpm. The rotation that has been produced accentuates the torque greater than the speed of the roller so that the machine can be used in the coir laminating process before entering the molding process.

The coir that has been flaked then goes into the printing process using an electropneumatic press process with the main power in the form of compressed air from the compressor. The electropneumatic system used uses a double-acting cylinder (Alfiando, 2016) with a tube size of 400mm and a piston length of 300mm. The force required in the molding process is equal to 50N.

The flattened sheet coconut coir is then deposited on the bottom mold, when pressing the ON button on the box panel, the compressed air directly moves the piston and the upper mold to press the sheet coconut coir into a pan shape. After the upper mold down, then click the die button will raise the upper mold back up. To take the results of the pot can open the bottom mold by removing the nut.

As the name implies, multifunction press machine cocopot printer is a machine that can produce a product in the form of cocopot by using two different press components. the advantages of this machine are that it can do two jobs at the same time, the molding used can be changed in accordance with the wishes of the partner, and can increase the level of cocopot production in MSMEs. but there are some shortcomings in the machine, namely the large area of the pressing roller so that the cocosheet results only have a width of 30mm and at the time of taking the product that has been in the press must remove the molding lock underneath.

CONCLUSION

Multifunctional press machine cocopot printer is one of the appropriate technology machines (TTG) that can be used in the process of making coconut fiber into a polybag replacement pot. In the design process, several thapan were carried out, including data collection by observation at MSMEs of coconut fiber craftsmen and literature studies. Then the process of making machine sketches, making 2D and 3D designs using Solidworks 2021 software to produce detailed design design documents, then the image validation process is carried out by a validator which if there are still revisions, then the process of making 2D and 3D designs must be repeated. If the design has been validated then it goes into the process of machine-building manufacturing monitoring and evaluation.

This machine has 2 types of press in its working principle, namely the press roller pemipih coconut fiber and press printer using an electropneumatic system. The main components in this machine consist of Main Frame, upper molding, lower molding, roller press, electropneumatic system, and transmission system consisting of electric motor, reducer, pulley, and Vbelt. The multifunctional cocopot press machine is an innovative Appropriate Technology (TTG) designed to transform coconut fiber into environmentally friendly polybag replacement pots. The development process involves meticulous steps, such as data collection through observations at MSMEs, literature studies, sketching, and producing detailed 2D and 3D designs validated by experts. Once approved, the designs lead to machine manufacturing with monitoring and evaluation. Utilizing a dual-press system—roller press for flattening and electropneumatic press for printing—this machine integrates key components like the main frame, molding system, roller press, and electropneumatic mechanisms powered by an efficient transmission setup. This ensures precise and effective production, promoting sustainability and innovation.

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