

Carved palm oil waste for crafts

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Abstract. Oil palm plant that is no longer productive must be cut down and regenerated. Research on the utilization of palm oil stem waste has been carried out. However, this utilization uses complex techniques and methods that require large costs. Among them is the method of impregnation by adding additional substances into the waste stem with a certain pressure. In this research, palm oil waste is not used as a building material, but rather as a room divider so it does not receive too much weight. The burden is received only from the mass of the material itself. In this research, palm oil wood waste will be split and cut into blocks and boards. Then the palm stems are carved using computer numerical control (CNC) carving. Furthermore, the results of the carvings are finished using a water-based wood finishing system. The machining parameters used for the manufacture of this carving product with a speed of 22,000 RPM and a feeding speed of 10 mm/s. The carved products produced are quite good in terms of shape and reduplication. This product has also been tested in an open space for 1 year with satisfactory results and found no parts eaten by termites and wood powder.

1. Introduction

A huge amount of oil palm trunks were made available during replanting activities to replace the unproductive oil palm trees in Indonesia. The area of oil palm plantations is currently spread in almost all provinces in Indonesia. Riau Province in 2018 with an area of 2.49 million hectares is a province that has the largest oil palm plantations. Followed by successive provinces of West Kalimantan covering an area of 1.49 million ha, North Sumatra covering an area of 1.47 million ha, Central Kalimantan Province covering an area of 1.22 million ha, South Sumatra with an area of 1.02 million ha, and other provinces. In total there are 12.3 million hectares of oil palm plantations in [1]. Oil palm plants have an age limit of productivity for up to 25 years. However, this age number can be drastically reduced if the plant is exposed to harmful pests and diseases, especially if attacked by *Ganoderma fungus*, then at around 5 years of age, when productivity is quite high, palm oil will certainly experience a decline in production until finally, the oil palm tree will die for a short time [3]. In 2018, there were 270,168 hectares of damaged oil palm plantations. If the population of oil palm plants is 136 palm trees/ha, it can be estimated that 36,742,868 trees must be cut down annually. From the aforementioned set of issues, the purpose of this activity is to increase the added value and competitiveness of palm oil waste products through preservation techniques and diversified innovation in the development of product design for interiors by utilizing local wisdom motifs as outlined in carving products and environmentally friendly finishing techniques to improve product performance. There are some methods to increase hardness, such as filling with epoxy [7]. Another method which is more popular called impregnation [9]. This impregnation

process has been developed by using its shell as the filler [10]. But all those techniques need a lot of money and technology.

In this study, the authors will make carvings on palm oil stems without a hardening process. We use CNC which allows the manufacture of wood carvings that have poor quality. In this research, we will also look for a more optimal CNC feeding speed with good quality carving results. CNC was originally intended only for working on metal media. However nowadays with the needs of the community, it is also designed to work on other materials such as wood. In general, CNC designed for working on wood media has 3 main axes. The spindle on a CNC can move in the x, y, and z axis direction. CNC is proven to be able to make more consistent engraving [11] and can cut processing time [5]. CNC has also been used in non-commercial wood and plantation waste wood [8]. In fact, using CNC for wood materials is not as easy as imagined. Many parameters must be count for this work. These parameters can affect the quality of the wood surface [4]. From all of those parameters, feeding speed has a very strong effect on the quality of the engraving results [2].

2. Materials and methods

2.1 Materials and equipment

The main raw material used in this study is oil palm stems from research plantations in Piyungan, Yogyakarta (figure 1). The main equipment used is planner machine and CNC router machine in the wood, rattan, and bamboo laboratories, Center for Crafts and Batik, Ministry of Industry at Sidobali road, Yogyakarta.



Figure 1. Logging of oil palm trees.

2.2 Fabricating process

Palm trees that have been cut down will be split and cut into sheet boards and beams. The board will be cut to 80 cm long, 20 cm wide, and 3 cm thick. For blocks will be cut with a size of 5x5 cm and 1 meter long. The next process is drying. All wood material will be put into the drying oven. The wood is heated in the oven at 70°C for 1 week until the desired dryness level is between 12-14%. After the drying process, the wood is put back in the warehouse until it becomes stable at room temperature (figure 2). The next step is the design and manufacture of engraving products using CNC (figure 3).



Figure 2. Oil palm wood after drying process.



Figure 3. CNC in the wood laboratory, Yogyakarta.

3. Result and discussion

3.1 Carving result

The carving design which has been made is the kawung batik motif. Carving on palm oil wood uses CNC with a V-shaped chisel with a diameter of 6 mm. Initially, the design was made in a 2-dimensional form (figure 4). Then the selected design will be made in 3 dimensions (figure 5) and converted into G-code so that it can be read by a CNC machine. The software used is V-carve. While the software to drive CNC is MACH-3.

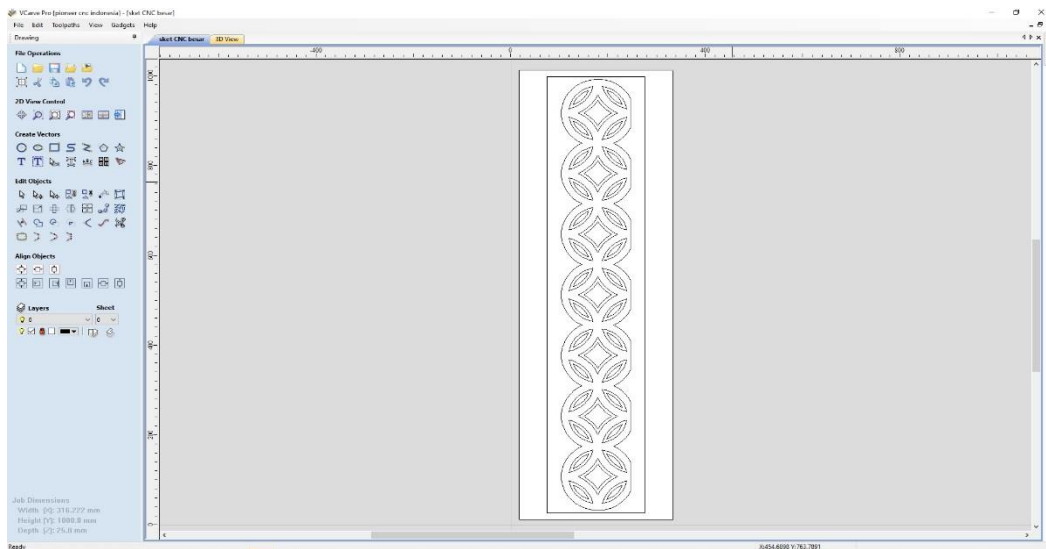


Figure 4. Design 2D.

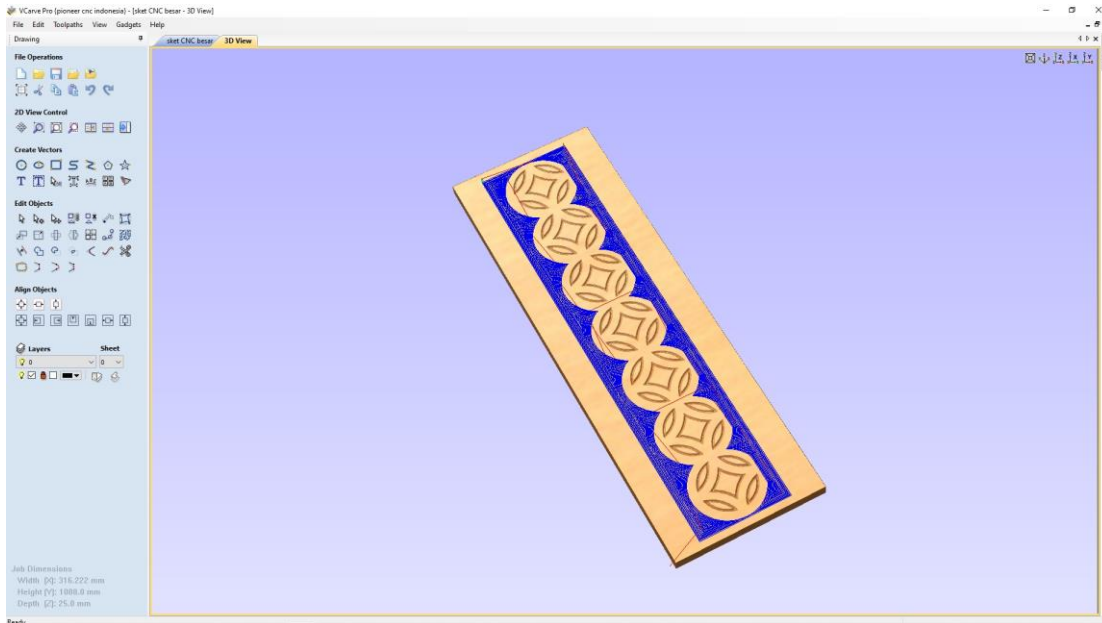


Figure 5. Design 3D.

3.2 Finishing result

The results of carving on palm oil (figure 6) then finished using a water-based system, which means that we use water as a solvent. Initially, palm oil is given a basic color so that it has the same color. Furthermore, we put bioduco top coat to protect the product from the weather (figure 7).



Figure 6. Carved palm oil.



Figure 7. Finished palm oil.

3.3 Durability

The carved oil palm has been put in a showroom since October 2018 until now. The product had been checked regularly to see if there was any defect. As the result, there was no defect happened to this product. This product is not eaten by termites at all. This product is also not moldy. This shows that the oil palm stem is quite durable and can be used as an interior product for more than 2 years.

4. Conclusion

This research proves that oil palm stem can be processed using a CNC machine. The shape of the carving can be made diversely and even complicated shapes. The palm oil stem can be used as a substitute for interior products, especially products that do not receive heavy loads such as room dividers and others. The durability of this product is more than 2 years.

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