

# Design and Fabricate a Tender Coconut Cutting Machine

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## ABSTRACT

Coconut water (*Cocos nucifera*) is high in minerals and a wonderful source of nutrition. Due to its great nutritional content and certain potential medicinal effects, it is becoming increasingly popular in the beverage sector. Coconut water spoils mostly owing to the presence of bacteria and enzymes. By eliminating bacteria and inactivating enzymes in the sample, spoiling can be avoided. Due to its increased efficacy in inactivating microorganisms and enzymes and lower cost of operation, conventional heat treatment has been increasingly essential in inactivating enzymes and bacteria in recent years. . The experiment was carried out at IIT Kharagpur's Agricultural and Food Engineering Department. Physicochemical properties of tender coconut water (*Cocos nucifera*) were investigated after thermal treatment (pH, total soluble solids (TSS), titrable acidity, total colour difference, and turbidity). Temperature (80, 85, 90, 95 oC) and treatment duration were the process conditions for thermal treatment (2.5, 5, 7.5, 10 min). The findings revealed that thermal treatment had no influence on pH, TSS, or titrable acidity of TCW, but had a substantial ( $p < 0.0001$ ) effect on total colour difference and turbidity. The findings were also compared to published physicochemical parameters of tender coconut water following UV-C light treatment. The findings suggested that heat treatment causes more loss of quality features than UV-C treatment. In all coconut-producing countries, coconut water is the most nutritious and healthy beverage. Coconut water is used in folk medicine to minimise the harmful effects of nicotine and alcohol on male reproductive function, however there is no direct proof for this. The goal of this study was to see how tender and mature coconut water affected nicotine-induced changes in sperm quality, spermatogenic cell density, testicular marker enzyme activity for spermatogenesis, and male testosterone levels.

**Keywords:** agriculture; coconut cutting and thermal treatment

## 1. INTRODUCTION

The goal of this project is to improve the efficiency of coconut cutting with less effort and manpower while also increasing the rate of cutting coconuts. This project eliminates any potential hazards associated with chopping the coconut. This machine is a portable gadget that may be readily transported due to its light weight. This machine has a lengthy lifespan. Aside from that, the drain tube has a lengthy lifespan. In comparison to previous coconut cutting methods, it required less upkeep. Only the blades' sharpness has to be checked. This project will give you a rough understanding of how to create a new machine using these instruments. Our project's goal is to design and build a tender coconut cutting machine. This machine's goal is to gather tender coconut water in a sanitary manner with minimal waste. The attachment is designed to hold a variety of sensitive coconut sizes. A cutter with a long handle makes cutting sensitive coconut a breeze. The sliced piece of sensitive coconut is also collected in a bin. On the upper side, there is a stainless steel nozzle with a 20-degree taper angle. Tender coconut is pressed against the taper portion of the nozzle, allowing a free flow of tender coconut water to settle at the bottom. For simple transportation, the entire system is equipped with rollers. Hospitals, retail malls, hotels, and



roadside stores can all benefit from our idea. The machine ensures a clean environment. Because the old cutting procedure or task for cutting coconuts is too difficult and requires more energy, this type of idea was developed to better working conditions. It will be extremely beneficial to anyone who wishes to start their own business in the coconut juice industry. This approach will help him increase his business pace while also increasing the quality of his juice, which is coconut water. One of the primary objectives of the current invention is to provide a machine for cutting one coconut after another, so that one machine may supply a large number of workers with the task of extracting the coconut.

### **Problem statement**

To shorten the time it takes to chop sensitive coconut. In the context of mass production. Operated by someone with less experience. To create a low-cost, efficient mechanism. This machine works with efficient pre-processing. Using sophisticated manufacturing techniques, more work may be done in terms of aesthetics, material, and weight reduction. This project was undertaken in order to create a promotional strategy for a new innovation and raise public awareness about the affordable availability of a tender coconut cutting machine on the market.

### **Contributions**

- To improve teamwork capabilities.
- To improve one's design abilities.
- To improve one's ability to secrete the tender coconut cutting machine material
- To investigate the process of producing the tender coconut cutting machine.
- The novelty in such forms of fresh thinking is that it increases the ease with which work can be completed by incorporating various mechanisms and engineering procedures.

## **2. Literature Survey**

The major design parameters and their optimum settings were determined in this investigation. The angle between the body knife's cutting edge and the Y-axis perpendicular to the fruit's rotational axis (X-axis) was  $76^\circ$ ; the angle between the shoulder knife's cutting edge and the X-axis was  $56^\circ$ ; and the knife angle between the knife and the XY-plane was  $61^\circ$  [1]. A coconut de-shelling machine having two cutters positioned on the same shaft and driven by gears. The machine de-shelled the fruits without causing nut breakage, and its average deshelling efficiency was doubled, allowing it to de-shell 300 coconuts each hour. All of the materials utilised in the construction of this machine are of standard quality and were purchased locally. The cost of creating one unit of the equipment is projected to be \$22,000. (Rs.22,000) [2]. The invented gadget can punch a hole in a sensitive coconut to drink the water while also cutting the coconut in half to extract the meat. Punching force was found to be at 178N, while cutting green tender requires 645N. A simple lever and spring mechanism is used to construct the machine. The new machine was proven to be both faster and more portable than the existing traditional approach [3]. The static and dynamic analysis of a climbing machine are presented in this study. The climbing model's field experiments were conducted on the trunk of a coconut tree, and the best climbing rate attained was 0.3 m in 1.6 seconds. An embedded processor board was used to assess the climber's manoeuvrability [4]. Coconut water, taken from the nut, is obviously easier to handle, but it is also extremely vulnerable to biological and chemical damage. The industry already uses thermal treatment with chemical additives, but other technologies like micro- and ultrafiltration are not yet commercially accessible. Taste, scent, and colour (all linked to enzyme processes) are difficult to manage regardless of the technique [5]. To remove fibre from coconut, this machine uses a

gear mechanism in which two barrels revolve in opposite directions. Cutting pins are put into indexed holes to separate fibre and give the coconut shell linear motion [6]. The recovery of oil and food-grade protein from fresh coconuts was explored using an aqueous technique. Separation of oil from fibre, instability of an oil-in-water emulsion, and recovery of a protein product with low oil content were all linked to efficient oil recovery for economic reasons [7]. Coconut is unique in that it has hundreds of uses that no other oil seed or horticulture crop can match. Coconut goods and by-products can be used in a variety of commercial applications. Coconuts are both a food and an oil seed crop. It also serves as a source of fibre, wood, and fuel. Many states in the country grow coconut palms as a beverage crop [8]. The strength of coconut fibre reinforced composites decreases as the amount of fibre increases, indicating inefficient stress transfer between the fibre and matrix. The stiffness factor has the same effect on the dynamic properties of the composite, with the natural frequency decreasing as the volume of coconut fibre increased [9]. Coconut protein concentrates (CPC) derived from fresh coconut meat and commercially dried coconut meat were evaluated and compared to other protein sources [10].

### 3. Methodology

The choice of steel material is critical since the project will not perform properly if the wrong material is used. Proper machining sequence, outstanding stability, shock resistance, corrosion resistance, high tensile strength, high hardness, and better toughness are all essential needs of tender coconut cutting machine.

**Table 1** dimensions of bill material

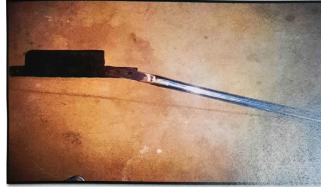
Bill of materials	QTY	Dimensions
1. Ms square tube	3nos	25.4x6096x2
2. Ms plate	Ino	125x50x5
3. Ms plate	Ino	400x200x1
4. Stainless steel tube	Ino	DIA 175
5. Spring steel plate	Ino	500x100x10.

Milling is the machining technique of removing material from a work piece with rotary cutters by advancing (or feeding) the cutter into the work piece in a specific direction. In addition, the cutter can be held at an angle to the tool's axis. Milling encompasses a wide range of activities and machinery, ranging from small single pieces to huge, heavy-duty gang milling operations. It's one of the most used methods for producing custom parts with tight tolerances. A variety of machine tools can be used to mill. The milling machine was the first type of machine tool for milling (often called a mill). Milling machines became machining centres after the introduction of computer numerical control (CNC). Automatic tool changers, tool magazines or carousels, CNC capability, coolant systems, and



enclosures are added to milling machines. Vertical machining centres (VMCs) and horizontal machining centres (HMCs) are the two types of milling centres (HMCs).

### 3.1. Cutter

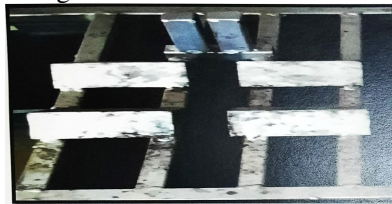


**Fig 1** shows the cutter

Spring steel (EN 47) is used to make the cutter, which has a high yield strength. When employed in the oil hardened and tempered condition, EN47 is appropriate for oil hardening and tempering. The cutter has a long handle to make cutting easier. EN47 spring steel has strong wear and abrasion resistance as well as spring properties. Angle milling is used to sharpen the cutting edge of the cutter. When hardened, EN47 has exceptional toughness and shock resistance, making it an ideal alloy spring steel for parts that are subjected to stress, shock, and vibration.

### 3.2. Coconut holding fixture

Fixture is used to support the process and secure the tender coconut in a specified area or orientation. The holding fixture is constructed of mild steel. The fixture can efficiently handle a variety of sizes and shapes of tender coconut. The attachment is made with a L angle so that the tender coconut can be readily held. The L angles create a v block-like structure around the coconut.

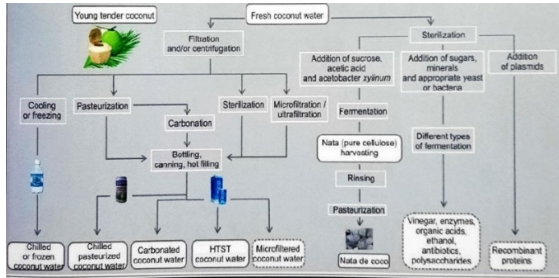


**Fig 2** shows the tender coconut holding fixture

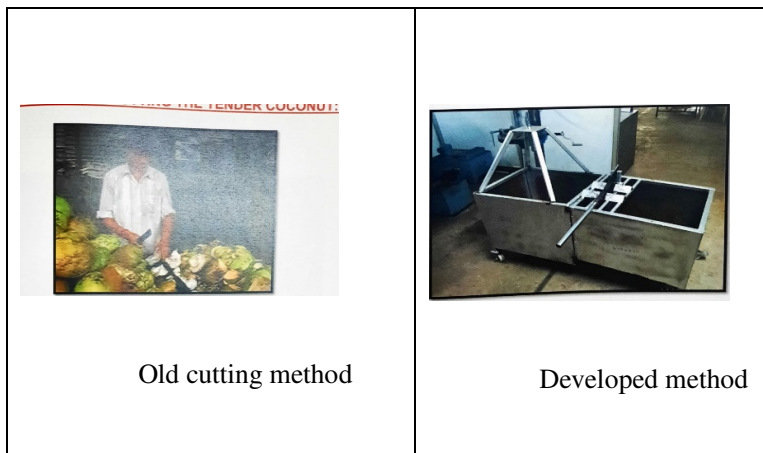
## 4. Results and discussion

The goal of this project is to improve the efficiency of cutting delicate coconuts with less work and manpower while also increasing the rate at which they are chopped. This project eliminates any potential hazards associated with chopping the coconut. This machine is a portable gadget that may be readily transported due to its light weight. This machine has a lengthy lifespan. In comparison to previous coconut cutting processes, it required less maintenance. Coconut water is the liquid endosperm inside a young coconut. It contains no fat and is low in calories. Apart from vitamin C and carbohydrates, the main minerals present in coconut water include sodium, potassium, phosphorus, chloride, and magnesium (Magda, 1992; Campos et al., 1996; Nadanasabapathy and Kumar, 1999). Coconut water has anticarcinogenic qualities (Sylianco et al., 1992) and can be used as a dehydrating solution both orally and intravenously, with the latter being utilised in cases of extreme dehydration (Magat and Agustin 1997; Falck et al., 2000). It is in high demand, especially during the summer. It's

extremely good for diarrhoea sufferers, and it's also a great tonic. The availability of coconut water



has expanded as a result of the processed green coconut water, and producers are selling it at a fair price. The purpose of this study was to find a way to preserve green coconut water so that it may be readily transported and distributed throughout the country. Coconuts are grown for their water kernels and soft jelly, both of which offer health and nutritional benefits that consumers appreciate. The water and kernel are known to help thin and emaciated people gain muscular mass, heal sore throats, and alleviate stomach ulcers. Coconuts are beneficial to diabetics and anyone who have kidney problems. The water can be used to make a refreshing drink or mixed into cocktails. The dwarf coconut plant is valuable and important economically. This factsheet will give growers and potential producers the information they need to grow the crop.



**Fig 2** shows difference between old and new cutting method

Coconut shell charcoal is made by scraping a supply of air from the shells of fully matured coconuts. Activated Carbon: Shell charcoal is converted to activated carbon during the activation process, which is employed in solvent recovery procedures. Husk by-products include: Fiber makes up around 30%. A superior substrate for mushroom development was found to be coconut bunch waste, leaf stalk mixes of leaf stalk and coir pith in ratio of the husk, while coir dust makes up the other 70%. Manure (mulch material) is made from coir pith.

**Fig 3** shows coconut process

It is the art of calculating the cost before manufacturing or producing a tender coconut cutting machine to gather tender coconut water in a sanitary manner. This method was used to determine the approximate cost of the project in progress. The project's anticipated cost is RS.8,000.

**Table 2 material cost**

SL.NO	DESCRIPTION	AMOUNT IN RS
1.	Mild Steel	300
2.	Stainless Steel	1200
3.	Spring Steel	550
4.	Castor Wheel	450
Total		2500

**Table 3 machining cost**

SL.NO	DESCRIPTION	AMOUNT IN RS.
1.	Sizin	575
2.	Lathe o eration	250
3.	Millin o eration	375
4.	Drillin o eration	300
5.	Oil Hardenin	750
6.	S raPaintin	1200
7.	MIG Weldin	1000
Total		4450/-

**Table 4 other cost**

S.NO	Description	Amount In Rs.
1.	Trial Cost	200
2.	Tender Coconut	250
3.	Report Cost	450
4.	Travelling Cost	300
Total		1200/-

The tender coconut production costs the freshness of the field, discrepancy in

cutting machine trial RS.8150/- in total. Due to there is a little estimation. Simple

assembly parts and a comprehensive frame structure have matured the tender coconut cutting machine. The cost of the machine is estimated using the weight of the tender coconut and the holding fixture designed by the basic system. It is completely different from the previous way and the current method, and it is significantly safer and more effective to operate. It is dependable, strong in nature, and competitive in terms of machine design and pricing. It is the art of calculating the cost before

manufacturing or producing a tender coconut cutting machine to gather tender coconut water in a sanitary manner. This method was used to determine the approximate cost of the project in progress. The project is expected to cost RS.8,000. The main purpose is to use a machine to cut tender coconut. Cutting the tender coconut is extremely difficult and dangerous. The tender coconut machine was created to address these danger issues. Cutting the tender coconut will be quite tough in most cases. Cutting the tender coconut can be made simple. The tender coconut machine will create a hole for drinking tender coconut water. The Young Tender Coconut market could be a solution for regional markets, but future study on fruit preservation, particularly in the coating and packaging industries, would be required. Thermal treatment with chemical additions is already employed in the coconut water sector, but other technologies such as micro- and ultrafiltration are not yet accessible on an industrial scale for coconut water. Coconut water obtained through a drain tube appears to be a natural healthy beverage and a decent substitute for manufactured sports drinks. Despite the dearth of scientific information about this raw resource, its market continues to grow globally.

## 5. Conclusion

This machine is primarily designed to chop coconuts and make holes in them using a stainless steel drain tube. The most important feature of this machine is that it minimises the time it takes to chop the coconut, and it can also cut out a variety of fruits. Multiple people can do the two tasks at the same time, and no additional equipment is necessary. The designed machine is inexpensive enough to be employed in small restaurants and shops, mostly in hospitals. This will undoubtedly increase the output of tender coconut cutting machines throughout the country, and new applications may emerge in the future. The manual coconut shell cutter is a sophisticated method for cutting coconuts in a simple manner. This will reduce human effort and eliminate the risk of manual operation-related accidents. It lowers the work's operational costs. In comparison to previous methods, this project is quite effective and beneficial in the current schematic method. The goal of this project is to save more time. Cut the coconut and punch the coconut to solve these challenges. It is more efficient than the current method. Human effort is nearly removed, while output rises. This device is simple to assemble and disassemble. Simple tools for the shell cutter can be used to replace spare parts (bolts and nuts) for proper clamping. High efficiency when compared to typical punching and splitting methods. Simple to use and requires no experience. The cost of the product is reasonable for tender coconut merchants.

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