Design and Construction of an Ice Cubes Machine with Diagonal Blade

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Abstract: Fish is one of the fishery products which has a very high source of protein and fish is also a commodity that rots easily, so fish needs extra careful handling to maintain its quality after being removed from fresh water and sea water. The preservation process is the method most often used to extend the shelf life of fish and fish products. To reduce increasing air pollution, the author aims to create an appropriate technological tool, namely an ice cube chopping machine that uses an electric motor. In this research, an ice cube chopper was designed with a diagonal blade position with a length of 1700mm, width 450mm and height 1200mm. The ice used is block ice. In the first study, the highest force from the knife was 7.90 kg/minute / 8 Kg and the lowest force was 4.98 kg/minute with an average force of 14.8 kg/minute.

1 INTRODUCTION

Indonesia as an archipelagic country has almost 2/3 of its area in the form of ocean. The large area of the ocean brings a lot of fishery product capabilities to Indonesian citizens, especially residents who are in coastal areas and have a livelihood as fishermen. According to data from an article by the Ministry of Maritime Affairs and Fisheries (KKP) as of 2020, there are 5.08 million people in Indonesia working as fishermen (Aan Supriatna, 2016).

The demand for fish supplies as a food source continues to increase from year to year. Easy and fast characteristics of fish damaged, making it require quick and careful treatment from the moment it is caught from the aquatic environment. In general, fresh, or wet fish is generally processed for distribution to the public using WS to maintain its quality. Marine products such as fish, shrimp, shellfish, and others are highly susceptible to spoilage.

To increase efficiency and productivity in the fisheries sector, a variety of equipment and machines are needed that can be used to support human work. These equipment and machines can be considered a form of technology that corresponds to needs, able to change manual systems to automatic with various types of mechanisms.

As time goes by, there is an opportunity to produce an ice cube crushing machine using an electric motor as the driving force so that the quality and shape of the ice cubes are even better for preserving fish.

2 LITERATURE REVIEW

2.1 Ice

Ice cubes in block form are a variety of ice that have various dimensions and are generally used for the purpose of preserving food ingredients such as seafood (fish, shrimp, squid, etc.) and drinks. The use of reverse ice cubes should not be mixed directly with food or drinks, because its function is more focused on scientifically cooling and preserving food and drink ingredients.

To maintain fish freshness for a longer period by inhibiting or stopping the activity of microorganisms that can cause spoilage. When fish is preserved, changes will occur in the characteristics of fresh fish, including the aroma, taste, shape, and consistency of the meat. The fish preservation process has two different approaches, namely traditional preservation, and modern preservation.

Therefore, ice block production has become a popular choice for several entrepreneurs and fishermen who have just completed the fishing

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process. In order to produce the best quality ice that suits your needs, a block ice crushing machine was created.

From the basic description of ice cube theory above, you can find out the types of ice cubes, namely:

2.2 Ice Cube

This form of ice in the form of blocks is generally easy to find when visit various markets and restaurants. This is because the need for ice cubes is very high in various restaurants, so many people choose to use ice cubes. A block of ice can fill a container used for preserving fish.

Figure 1: Ice Cube.

2.3 Tool Design

Ice Crushing Equipment is a type of machine dedicated to processing ice crushing with efficiency. This machine is capable of carrying out its duties at high speed when crushing ice blocks. Therefore, using this machine will significantly simplify and speed up the process of crushing ice blocks.

Figure 2: Cube Ice Chopping Machine.

2.4 Types of Preservation

Fish is a perishable food ingredient, so ways are needed to increase the freshness of fish and extend the shelf life of fish-based preparations. Preservation and processing not only apply to large-sized fish (economical fish), but small-sized fish can also be processed into other products (Annissa Mutia, 2022).

There are several methods that can be used to maintain durability food, both through modern approaches and simpler methods. These methods vary in level of difficulty and method, but the main goal of food preservation is to slow the growth of microorganisms in food. Listed below are several techniques for preserving:

2.4.1 Cooling

This technique is known as one of the most common methods and is often used by people in both rural and urban areas. The basis and principle of this cooling method involves placing food in a chamber or container with a very low temperature. Fishermen often use containers filled with ice to preserve the fish they catch. Ice is the best cooling medium. By providing sufficient ice to the fish, the temperature of the fish can be reduced to around 0º C. At this temperature the activity of bacteria and enzymes can be inhibited (Aan Supriatna, 2016).

2.4.2 Fumigation

The smoking method involves placing food in a container or box and then hitting smoke from the bottom. Although this smoking technique is not able to keep food in a preserved state for a long period of time, it usually needs to be combined with a salting and drying approach to achieve optimal results.

2.4.3 Salting

This last method involves the use of table salt, also known as sodium chloride, for food preservation purposes. This technique is known as salting. Table salt has properties that can inhibit the growth and development of spoilage microorganisms in food. Salting is a traditional method used to preserve fish. The aim of preserving fish is to reduce the water content in the fish's body, reducing the opportunity for bacterial growth. In order to achieve quality preservation results, certain steps need to be followed. This includes keeping ingredients and equipment clean, choosing clean salt, and using fresh fish.

2.5 Blade

The central part of the ice block chopping machine which plays a crucial role is the blade. The knife's main function in the ice chopping process is to crush part of the ice block. Usually, cutting knives made from non-stainless-steel materials can oxidize quickly if they are exposed to water or moisture and

left in that condition. Therefore, when not in use, cutting tools need to be stored dry or in an area that has dry air circulation and is protected from exposure to rainwater.

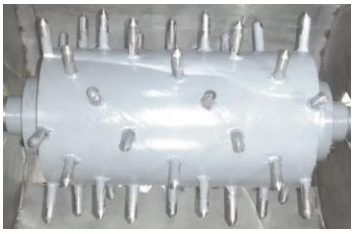


Figure 3: Blade.

2.6 Electric Motor

An electric motor is a device that functions to convert electrical energy into mechanical energy. This mechanical energy is applied to move components such as pump impellers, blowers, compressors, and for the process of lifting materials. Apart from being used in household contexts such as mixers, electric drills and fans, electric motors also play an important role in the industrial sector. In industry, electric motors are sometimes nicknamed "work horses" because it is estimated that around 70% of industrial electricity consumption is contributed by these motors.

2.7 Transmission

The main function of the transmission is to transmit movement from the blade to the electric motor. In an ice cube chopper with a diagonal blade position, the transmission system used involves a pulley and a V-belt.

Figure 4: Electric Motor.

2.8 V-Belts

V-belts are a refinement of the flat belt concept, with a design designed to handle greater tension. The advantage of this belt lies in its ability to handle greater pulling forces, as well as being able to withstand friction better, so that the risk of slippage can be minimized (Koesoemawardani, D., 2020). V belts are often used both in industry and in vehicles. The V-shaped structure of this belt allows the belt to be clamped tightly in the pulley groove, increasing friction force, and allows greater torque to be transferred before slip occurs.

Figure 5: Belt.

2.9 Pulleys

A pulley is a circular tool whose sides are encircled by ropes, belts, and chains to achieve rotational movement (spinning) with the aim of lightening the load, changing direction, and obtaining other mechanical benefits.

Figure 6: Pulley.

3 RESEARCH METHODOLOGY

3.1 Design and Build Methodology

From January to March 2023, a literature analysis study was carried out. The manufacture of the Ice Cube Chopper Machine with a Diagonal Blade Position took place at the Beting Kebon Baru workshop, North Jakarta between March, and June 2023. The stages included planning, fabrication and testing the device.

3.2 Ice Cube Cutter Machine Concept

Ice Cube Chopper Machine is a modern tool for chopping ice cubes using electricity. This ice block chopping machine generally uses an electric motor as its main drive and can convert electrical energy into mechanical energy.

3.3 Tool Making

The steps in implementing the equipment stages involve selecting materials, as well as the process of making and testing the Ice Cube Chopper Machine. In the construction process, lightness and resistance to corrosion are the main factors in material selection. The production stages include assembling components, making a diagonal blade, and making a funnel where the ice cubes enter.

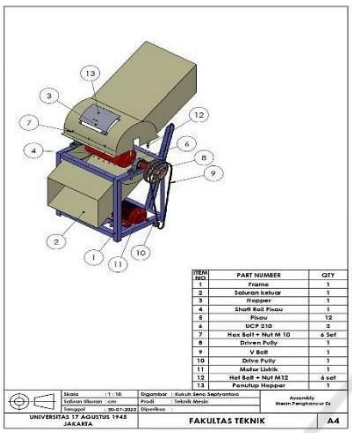


Figure 7: Tool Design.

3.4 Performance Test

Performance tests are carried out to determine the success of the design process carried out. Performance testing was carried out 3 times with varied shifts by shifting the blade.

The steps in the performance test are as follows:

1. Prepare ice in the form of blocks
2. Prepare measuring instruments and record measurement results
3. The chopping machine is started via an electric motor.
4. Measure the pulley rotation when there is no load and when it is loaded.
5. Put the ice block into the funnel.
6. After that, record the results of chopping the ice.

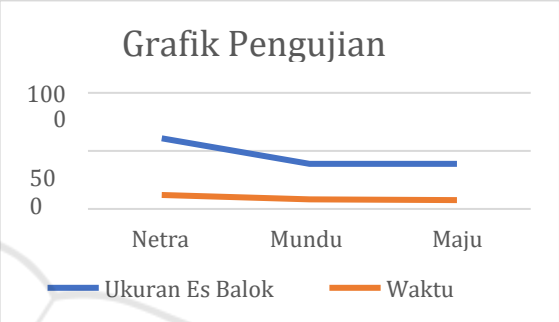
3.5 Data Collection Process

The data collection process is carried out by weighing the ice blocks to be chopped and when testing the performance of the machine each time it is tested, setting the shift of the blade, pulley and driving motor. Then put the ice cubes into the chopping funnel to do the chopping. During the chopping process, measurements are made. The variables measured include the shape of the ice chunks, the change in pulley speed when it is unloaded and when it is loaded, as well as calculating the ice chunks produced.

4 CALCULATIONS AND DISCUSSION

Testing took place in workshops and at home, the following is the data taken:

Table 1: Test Charts.



From the test results, the lowest ice chopping results were obtained, namely 4.98 kg/minute with a time of 83 seconds with a block size of 608 cm, while the highest ice chopping results were 7.86 kg/minute with a time of 76 seconds with a block size of 388 cm, for average. -The average yield of chopped ice is 14.8 kg/minute.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

From the design and research that has been carried out, namely an ice cube chopper using a diagonal knife, the following conclusions can be drawn:

1. Making an ice cube chopping tool requires selecting components that need to calculate material efficiency, material strength, material specifications and impact on the environment as well as ease of obtaining them.
2. To design this ice chopper, you need to calculate the equipment, namely calculating the pulley, V-belt, and electric motor.
3. The construction form of this tool is simple with a length of 1700mm, width 450mm and height 1200mm. The design of this ice chopper consists of a frame, shaft, knife cylinder and electric

motor.

4. From the test results data, the lowest ice chopping results were obtained, namely 4.98 Kg/minute and the highest ice chopping results, namely 7.90Kg/minute.

5.2 Suggestion

From the research and design of an ice cube chopping machine with a diagonal blade position for further research. The research suggestions for developing this ice cube chopper are:

1. The design of this tool needs to be developed with greater power so that the ice chopping gets more precise time.
2. More research needs to be done on electric motor power so that it can be further developed to more modern power.
3. In the process of using this ice chopping machine, the safety of its work is further improved, and the method of chopping ice must not be under pressure and an ice support must be installed.
4. A switch should be installed so that it can cut off electricity and be more efficient.
5. To pay more attention to the safety of the tool.
6. In the process of cleaning the ice cubes, drain it from the bottom of the chopper.

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