

## Cockle Cleaning Machine

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DOI: <https://doi.org/10.30880/mari.2021.02.01.030>  
Received 11 November 2020; Accepted 01 January 2021; Available online 03 February  
2021

**Abstract:** Cockles are one of the popular protein choices that are often used in the preparation of dishes in Malaysia. However, since the cockles naturally live buried in mud and sediment, the cleaning process of the dirt from its shell can be quite tricky. In this study, the small size of the cockle cleaning machine with a capacity of 2 kg was designed for home and small business use purposes. This manual machine consists of main components, including water container, perforated drum, cleaning brush, shaft, and hand lever. The dirty cockles should be inserted into the drum through the open end section before it covered by the end cap. When the hand lever attached to the drum is rotated clockwise, the cleaning brush on the shaft will be rotated together and will rub and remove dirt on the cockles' shell surface. The water that is put in the cleaning container up to a specific water level will then help the cleaning process of removing this dirt. With the conceptual design that can be offered by this cockles cleaning machine, hopefully, it will benefit homemakers, restaurants, and related businesses in the future.

**Keywords:** Shellfish, Cockle, Shellfish Cleaning Machine.

### 1. Introduction

Cockles are one of the popular choices of protein commonly used in dish preparation, either as a main course or as add-ons to the food dishes in Malaysia and the Southeast Asia region. Boiled cockles, grilled cockles, rendang cockles, and sambal cockles are some of the main cockle dishes that are popular in Malaysia apart from being used in dishes such as laksa, char kuey teow, and the noodle menu. Other than being used freshly by housewives or restaurants in cooking, cockles are also usually processed into frozen form by the frozen food industries. Temperature and handling can ensure that it can last longer and can be marketed and exported abroad by the industry involved.

The species of *Anadara Garnosa* or blood cockles is a common species of cockles that can be found in Malaysian waters [1], especially on the west coast areas of Peninsular Malaysia and some areas in Sabah [2]. Although the production of cockles in Malaysia has decreased from 40 454 tonnes in 2014 to only 16 642 tonnes in 2018 the cockles farming is still one of the major marine aquaculture activities in Malaysia [3]. Even in 2005, cockle demand reached its peak at an astounding production of 100 000 tones [4], which makes it a multi-million-ringgit industry in Malaysia that year.

The species of *Anadara Garnosa* can be found in areas of clean sand, muddy sand, mud or muddy gravel or living in sediments or at a depth of not more than 5 cm from the surface of the sediment [5]. It can be described physically as roughly circular shell, having ribs radiating from the hinge with a very rough surface skin. These species are the largest of the bivalves and distinctive due to their symmetrical shell, and the size typically can reach until 9 cm in length [6]. However, typically they will be harvested when the size have attained a marketable size of 24 to 30 mm [6].

Before the cooking process, the cockles need to be cleaned to get rid of all the dirt. However, due to its natural environment that is within soft mud and fine sand, the cleaning process of the cockles becomes harder and time-consuming. Typically, in the cleaning process, the cockles need to be soaked in water while the shell of the cockles need to be scrubbed to make sure the residue left the shell, so it is ideal for cooking. This process sometimes consumes a lot of energy and time. Hence in this study, small but practical size of cockle cleaning machine was designed to accommodate for home, and small business used purposes.

### 1.1 Conventional Cleaning Methods

Cockles' natural habitation is typically burrowed in sand or mud from mid to low tide on protected shores. The dirt from the mud and sediment tend to stick to its outer shell due to its rough shell surface. For the cockles obtained from sandy waters, the level of dirt may be less than that of those obtained in muddy coastal areas. However, these cockles usually need to be cleaned before being marketed. Some of the fishermen typically using a water spray to clean the dirt, but some cockles sellers sell it in extremely dirty conditions without being cleaned first.

This dirt needs to be removed before the cockles can be boiled or cooked. There are several traditional or conventional methods commonly used in Malaysia to clean the cockles. Most of the methods used some types of plants and basic cooking ingredients for the cleaning process.

One of the most popular and suggested ways of cleaning the cockles is by using the lemongrass. Lemongrass needs to be slightly crushed before it mixed with the cockles. It then needs to be soaked and stirred in the water for a few minutes. The dirty water then needs to be removed and replaced, and the process needs to be repeated several times until the shell of the cockles looks more cleaner. This method is said to be more effective with the use of a cold bath added with salt on the water mixture. The papaya or tapioca leaves can also be used as a substitute for lemongrass for this same method.

Banana fronds are also among the ingredients that are often used to clean these cockle shells. The tip of the banana frond must repeatedly be applied to the soaked cockles until the dirt comes out of the shell surface. It then needs to be rinsed with the clean water, and the process needs to be repeated several times until the shell of the cockles looks cleaner.

In traditional methods, the use of natural plants in a cockle cleaning process can help remove dirt from the surface of the cockle shells. However, this method is usually not very efficient as it requires more time and energy consumption, especially if it involves high levels of dirt.

## 1.2 Shellfish Cleaning Machine

Shellfish cleaning machines are developed to facilitate the cleaning work of shellfish with a rough kind of skin surfaces such as cockles and oysters. These commercial machines are found to be non-existent or almost non-existent in the Malaysia market. However, there are commercial products that have been developed abroad, especially for the oyster cleaning process. Since cockles are one kind of shellfish like oysters, the oysters' concept and principle could be applied to the cockle's cleaning machines.

The oyster cleaning machines typically can be found at seafood industries or specialist processing equipment since the machines' cost is too expensive to afford. The innovation is based on the task of creating a shellfish cleaning device that allows a cleaning process that does not involve significant labor and staff costs, which is therefore inexpensive and therefore makes it possible once again to sell shellfish for consumption and enjoyment at an acceptable price, distinguished by the absence of any active chemical ingredients [7].

Figure 1 shows the oyster cleaning machine produced by Geelgog Machinery [7]. This oyster cleaning machine is mainly composed of the motor, transmission system and has a long and big size of the brush roller. Most of the material used for this machine is durable since the machine's body is made with high-quality SUS304 stainless steel, which fully meets the demand for exported food hygiene. The cleaning rod is made of nylon line, and the stripper is from hardened material. The machine's design is simple to make it easy to clean the machine after processing, and the wheels provided are to ease the movement of this 220 kg machine. With the size of 1600 x 730 x 840 mm, this machine can serve the cleaning process of oysters up to 800 kg per hour.



**Figure 1: Oyster Cleaning Machine and its brush [7]**

The shellfish cleaning machine by Genyond Machinery [8] shown in Figure 2 using rotary drum washing machines as a working principle. The shellfish will be washed by the spraying water and scrubbed by the scrubbing brush that attached at the rotary drum. This machine is composed of reduction box, motor, roller, support, wheel, water tank, hopper, cover plate, motor rack and other components. This machine can be used not only for cleaning all types of shellfish but also for washing the fruits and vegetables. The size of 2100 x 860 x 850 mm and weight 360 kg requires a big space to accommodate the shellfish up to 1500 kg/hr. Since this machine used water spray for the cleaning process, most of the components are made from high-quality SUS304 stainless steel to prevent it from rust.



**Figure 2: The shellfish cleaning machine by Genyond Machinery [8]**

Other than that, the oyster cleaning machine from Baixin [9] (Figure 3) is designed employing a metal belt with high-pressure water from the spray system. A metal belt is functions to carry the oyster from the starting cleaning process to the next process to reduced second pollution until the end of processing. The conveying belt also can be adjusted based on actual needs. The equipment consists mainly of the rack, electrical transmission gear switches and spray pipes. The oysters need to be put into the sink to completely dispersed, tumbling dry and transferred under the influence of high pressures water flow and bubble action while net holes will collect the soil floating in the water.

This industrial machine has a dimension of 1600 x 730 x 840 mm while the weight is above 2800 kg. The capacity of oyster that can be cleaned for this machine in one time are up to 100 until 1800 kg/h and the heating source can choose either electric or natural gas.



**Figure 3: BIAXIN Oyster Cleaning Machine [9]**

The ultrasonic cleaning machine from Hongle [10] as shown in Figure 4 is another example of a machine used to clean the raw material of shellfish or cockles which used the principle of the dishwasher. This ultrasonic cleaning machine adopts the principle of ultrasonic cleaning and has a reliable cleaning effect since it is used ultrasonic to clean the raw material of shellfish. This ultrasonic cleaning machine only used just water with some appropriate solvent and types of soiling present to enhance the effects. Ultrasonic cleaning uses cavitation bubbles induced by high-frequency pressure wave to agitate the liquid. The agitation produces high concentrations of contaminants adhering to substrates such as metal, mud and others. During the cleaning process, cockles must not be allowed to rest on the bottom of the device, as this will avoid cavitation on the part of the non-solvent material. This machine is quite smaller than the other machines with the size of 1800 x 800 x 800 mm. The length and capacity of this machine can also be customized based on the customer's actual needs request.

This machine is not too complex and did not have a lot of mechanical components. The weight of this machine is around 80 to 90 kg, which is lighter than the other machines. This machine is also made from high-quality SUS304 stainless steel with a thickness of 2.5 mm for vibrator part and 2 mm for the other parts. The advantage of this ultrasonic cleaning machine is it clean faster than conventional cleaning process.



**Figure 4: The ultrasonic cleaning machine from Hongle [10]**

Most of the machines discussed are large which is more suitable for the industrial purposes and needs a larger space for storage. Most of the machines used a similar principle in cleaning the shellfish with rotating components like drum or cleaning brush. Most of them used a spray water system to facilitate the cleaning process. For this study, it is very clear to have a suitable size to be used for daily used at home or small seafood restaurants or industries.

## 2. Product Development Process

A product's development process is very important to achieve a satisfactory result. It represents the flow of the product design process. Typically, it involves the process of identification of needs, generating ideas, evaluating, and choosing the ideas before we come up with the design analysis and details design of the product

The target for this product is to use daily at home, seafood restaurants or small frozen industries, so it is very clear to have a suitable size for that purpose. After some study and observation, the appropriate weight is for the cleaning machine is about 2 to 3 kg. It is quite suitable for a household.

The machine needs to be operated manually without using any electrical motor. So it needs the mechanical hand lever to perform the rotation operation. The number of components can be reduced, which can simplify the design of the machine and ease the maintenance work.

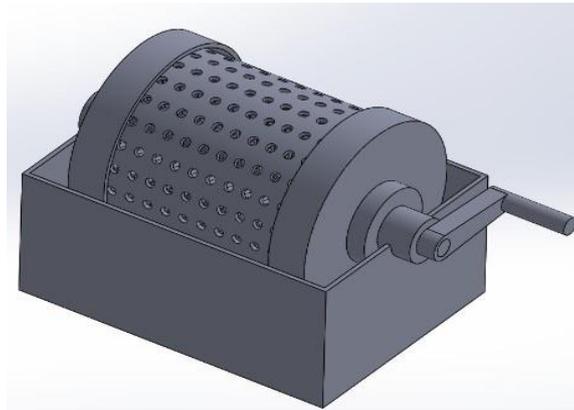
The insertion process into the cleaning compartment should be easier. The main shaft rotates freely and requires some cleaning components like a brush to rub the dirt from the cockles. The material used for the components must be able to withstand the wet environment and must be lightweight to reduce the total weight of the machine.

## 3. Result and Discussion

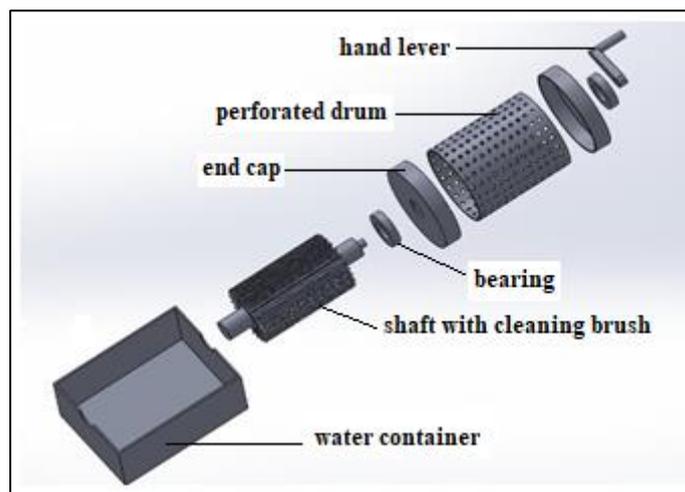
This manual machine uses a hand lever to operate it and does not involve any use of electricity. It consists of main components, including water container, perforated drum, cleaning brush, shaft, hand lever, and bearings. Water containers with a size of 34 cm long, 25.3 cm wide and 15 cm high use to place cleaning water and as a shaft holder. The perforated drum with 8 inches diameter and 25 cm long use to place the dirty cockles that can fit around 2 kg of cockles. A cleaning brush attaches to the shaft

held by the bearings at both ends of the shaft to help the rotating motion. There is a hand lever connected to the shaft to provide the rotation to the shaft and cleaning brush during the cleaning process.

Figures 5 and 6 show the final design and the exploded drawing of the cockle cleaning machine designed using SolidWorks. Most of the components like water container, drum, and end cap are suggested to be made from the polymer to reduce the total weight of the machine other than it is good due to its resistance to rust and corrosion.



**Figure 5: Final Design of Cockle Cleaning Machine**



**Figure 6: Exploded Design of Cockle Cleaning Machine**

For the cleaning process, the dirty cockles need to be inserted into the drum through the open end section before it covered by the end cap. When the hand lever attached to the drum is rotated clockwise, the cleaning brush on the shaft will be rotated together and will rub and remove dirt on the cockles' shell surface. The water that is put in the cleaning container up to a specific water level will then help the cleaning process of removing this dirt. The dirty water needs to be drained and refilled, and the cleaning process must undergo several times until the cockles look cleaner as desired.

#### **4. Conclusion**

The small size of the cockle cleaning machine is successfully designed with a capacity of 2 kg. This cockle cleaning machine is very convenient for household or small business purposes because of its mobility and compact in size. Apart from that, it involves simple operation, easy maintenance, and

requires small space for placement and storage besides not requiring electricity to operate it. Apart from cockles, it can also be used to clean other similar shellfish such as mud creeper (sea snails), etc. With all the key characteristics that this cockle cleaning machine could offer, hopefully, it will benefit many people in the long run.

### Acknowledgement

The authors would like to thank the Center for Diploma Studies, Universiti Tun Hussein Onn Malaysia for its support.

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