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LEARNING FACILITATING MATERIALS

NATIONAL PROFICIENCY LEVEL 2

TRADE AREA: CASHEW PROCESSING

UNIT 7

**CASHEW APPLE PROCESSING MACHINE  
OPERATIONS AND MAINTENANCE**





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## UNIT INTRODUCTION

Welcome to Unit 7 of your learning journey in cashew production. This guide explains the main steps involved in operating and properly maintaining the Cashew Apple Juice Extraction Machine.

The right handling and maintenance activities involved with the Cashew Apple Juice Extraction Machine has a lot of benefits; do you agree, and can you name a few?

If you follow the steps for operating and maintaining the Cashew Apple Juice Extraction Machine in the right sequence, you will not only be efficient in producing high-quality cashew apple juice, but also secure your safety in its use. Do not miss a step! Apply your knowledge and skills accurately to achieve a safe product for your customer and a safe working experience for yourself.



In this unit, you will learn about the main steps involved in the operation and maintenance of cashew apple juice extraction machines. The learning material covers four sub-units:

- 1) Description of the working principle of the apple juice extraction machine
- 2) Identification of the major parts of the juice extraction machine
- 3) Normal operation of the juice extraction machine
- 4) Preventive maintenance activities to be carried out on the extraction machine

Each unit contains theoretical and practical exercises. Each module includes written materials, visuals as well as self-assessments to test your knowledge and skills.

The benefit of learning this information is to ensure safe and efficient use of the juice extraction machine and assure continuous production of high-quality cashew apple juice. Remember that the meticulous application of knowledge and skills from this unit impacts your personal safety and the quality of your final product.

It is important to use and maintain your cashew apple juice extraction machine properly as you will learn from this unit. This will ensure that it will last long and provide you an efficient process and good quality product.

Even though this learning material provides essential information on operating and maintaining cashew apple juice extraction machine for the National Certificate Level 1, you should also look out for new information, innovations and technological advances during your practical work to expand your knowledge and skills.

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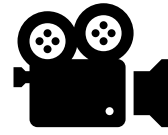
LEARNING  
OBJECTIVES



ATTENTION



PRACTICALS  
HANDS ON



WATCH VIDEO



SELF ASSESSMENT



WELL DONE!



TAKE A BREAK!

## ABBREVIATIONS

Here are some commonly used abbreviations.

<b>SOP</b>	Standard Operating Procedure
<b>PPE</b>	Personal Protective Equipment
<b>GMP</b>	Good Manufacturing Practices
<b>RCN</b>	Raw Cashew Nuts
<b>PM</b>	Preventive Maintenance
<b>PLC</b>	Programmable Logic controller

## 1. DEMONSTRATE SKILLS FOR OPERATING THE CASHEW APPLE JUICE EXTRACTION MACHINE

### a) Identify parts of a cashew apple juice extraction machine

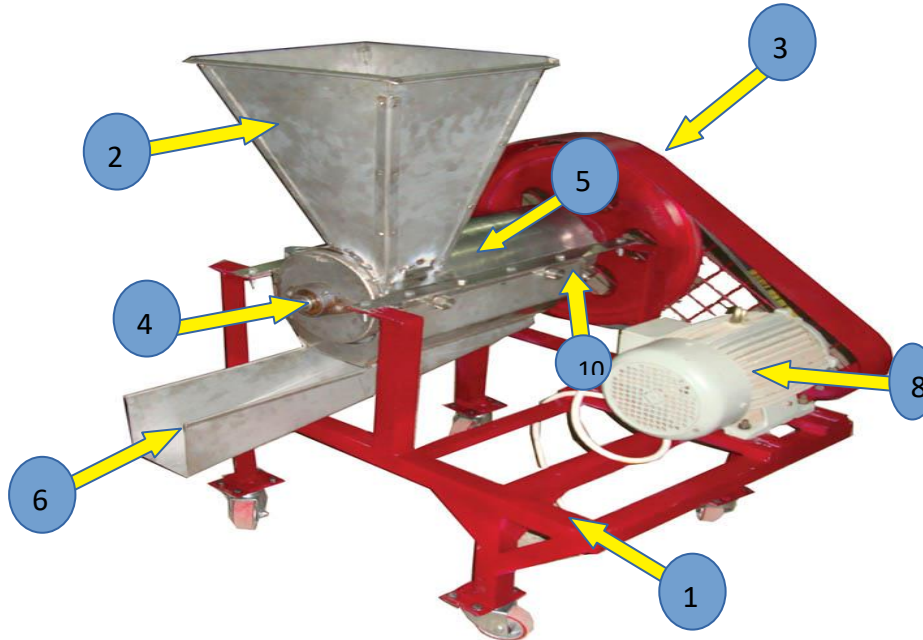


Figure 7.1. Mechanised Juice extractor – Screw Press. Source: <http://www.intermech.ws/products.htm>



Figure 7.2. Hand Operated Juice Extractor – Piston Press. Source: [indiamart.com](http://indiamart.com) – hand operated cashew apple screw press

Cashew apple juice extraction machine is simply a device that is used to crush cashew apple in order to draw out liquid contents from cashew apples. This extracted liquid is called cashew apple juice. Whether hand operated or mechanised, the extraction machine basically works as a press. This means that it works to apply pressure on the cashew apples to crush them for the juice to come out. The machines considered in this section are known as press. The manual machine shown is called a Piston Press and the mechanised one is called a Screw Press.

### **Major parts of a cashew apple juice extraction machine**

To ensure the proper and easy use of a machine, operators must be able to identify and understand the use of the various parts of the machine.

In reference to Figure 7.1 and 7.2 above, the major parts of cashew apple juice extraction machine are as follows:

1. **Main machine frame:** the structure that supports other components of the machine
2. **Hopper:** the container that receives cashew apple and discharges them to the bottom for pressing. In the manual machine, cashew apples are put directly into the press cage.
3. **Hand Wheel:** the part that is used to manually turn the screw shaft in both clockwise and anti-clockwise directions.
4. **Screw Shaft:** threaded shaft that is turned to apply pressure to cashew apples to crush them. Note that this is covered in the mechanised machine in figure 7.1.
5. **Press cage:** enclosure for screw shaft against which cashew apples are pressed by the screw shaft. As shown in the manual machine, this has perforations to allow juice only to pass without the fibre.
6. **Chute:** the sloping channel slide for transporting cashew juice from the press cage to a receiver
7. **Sieve:** stainless steel wire mesh that is used to strain out solid particles that may have escaped from press cage with the cashew apple juice. In the mechanised machine, this is found in the internal portion of the press cage.
8. **Drive motor:** this is an electric component that rotates to turn the screw shaft in a mechanised machine.
9. **Piston:** This is typically found in manual machines. It is a cylindrical part at the end of the screw shaft that moves up and down linearly when hand wheel is turned. This applies pressure uniformly unto cashew apples to crush them.(see Figure 7.3). This is inside the part labelled 5 in Figure 7.1
10. **Pressure Cone:** end plate of press cage from which fibre residue of cashew apple exits after juice is pressed out. This in manual machines is essentially the bottom of the press cage.

**b) Explain the Working Principle of an Extraction Machine**

All machines make use of certain mechanisms in order to achieve their purpose. Therefore, the parts of the machine work together in a certain order to achieve that purpose.

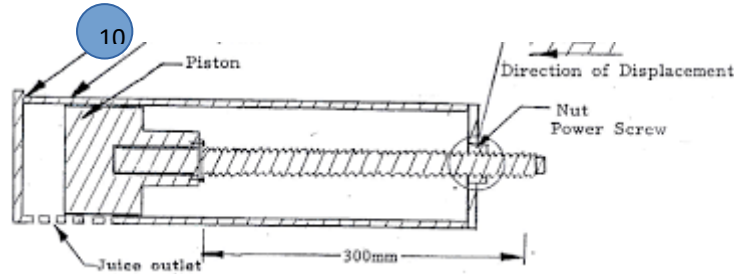


Figure 7.3. Schematic diagram of a manual cashew apple juice press.

Source: <http://citeseerx.ist.psu.edu/viewdoc/download?oi=10.1.1.540.2079&rep=rep1&type=pdf>

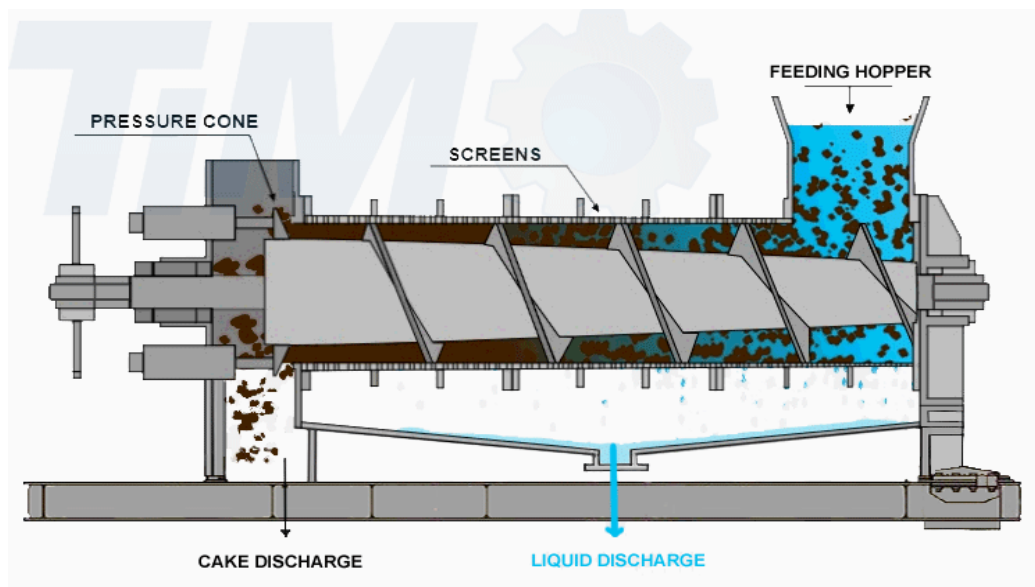


Figure 7.4. Schematic diagram for mechanised cashew apple juice press – screw press.

Source:

<https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwjSoqiTqabKAhVECxoKHeXvDFUQjhx6BBAgBEAI&url=http%3A%2F%2Fshredding-machine.com%2Findex.php%2Fproduct%2Fdewatering-screw-press%2F&sig=AOvVaw2AhKuzUqO4hRAauDtEW2m0&ust=1567107638521889>



Knowing and understanding the working principle of the juice extraction machine will help operators and technicians to properly use and maintain it.



Can you think of whether the above statement is true or false?

**The working principle of the cashew juice extraction machine is as follows:**

- In manual machines such as shown in figure 7.2, the rotation of the handle results in the movement of the screw shaft into the press cage. As the shaft moves, the piston presses against sliced cashew apples in the container producing enough pressure to crush cashew apple slices. As the pressing action of the piston crushes the apple slices against the perforated press cage, juice comes forth from the cashew apples which is sieved and collected for further processing.
- In mechanised machines like in figure 7.1, rotating worm shaft gear (screw shaft) moves the cashew apples along the press cage from hopper end. As cashew apples move, the space between press cage and screw shaft narrows or tappers towards the pressure cone. The reduction in volume along the length of the press cage causes increase in pressure on the cashew apples against the press cage walls towards the pressure cone. This increase in pressure causes cashew apples to be crushed to release juice for collection.



The goal of apple juice extraction machines may be the same, but the mechanism involved may differ from machine to machine. Can you identify the different mechanisms in figures 7.1 & 7.2 based on their working principles?



Visit the following YouTube site on the internet to watch a video on how the screw press works:

<https://www.youtube.com/watch?v=5R7uplNna2w>

### c) State the Maintenance Practices of an Extraction Machine

The maintenance of every machine is very important to the state of the machine. Good maintenance practices ensure that the machine will last long and be productive, as well as work safely to protect users. Regular maintenance also ensures that the quality of produce from the machine is maintained. When a machine is faulty, it is said to have failed or broken down.

Maintenance activities are carried out while the machine is in good working condition, so that it does not break down unexpectedly or impact the quality of apple juice negatively. Such maintenance activities are referred to as Preventive Maintenance activities. Most machine manufacturers include these activities in machine manuals and specify their frequency of maintenance, thus whether daily, weekly, monthly or whichever period intervals they must be carried out.



Cultivate the habit of reading through machine manuals if they are available and stick to the directions and instructions that the manufacturer gives for maintaining the machine.



Maintenance Technicians must be in the right Personal Protective Equipment (PPE), which must include hand gloves and hairnets, when handling machine parts that come in direct contact with the cashew apple.

#### **Below Are maintenance Practices for the Cashew Apple juice extractor**

##### **Daily Preventive Maintenance (PM) Activities**

1. Visually inspect machine paying attention to main structure and other major parts for defects, wear and tear, and loose fasteners (bolts, screws). Inspect wire mesh for dents, scratches and cracks. Tighten all loose fasteners
2. Remove sieve and brush off any sticking fibre after each production.
3. Remove hopper to give access to inside of main container. Wash hopper with clean warm water and mild food grade detergent at the end of each production day
4. Wash and clean press cage with warm water and mild food grade detergent, gently brushing the internal walls, screw shaft and corners at the end of each production day
5. Wash sieve in warm water at the end of each production day and air dry in clean area

## Weekly PM Activities

1. Clean off old grease from screw stem with clean tissue (the point of the nut power screw shown in figure 7.3)
2. Use food grade grease to lightly lubricate the screw stem.
3. For mechanised systems, inspect motor belts to ensure it is well-tensioned.)
4. Move handle (wheel) in alternating sequence of clockwise and anticlockwise directions to ensure moving parts are operating freely
5. Check to ensure piston is firm in position. Tighten if loose

*Everything you need to accomplish your goals is already in you! Keep on working hard.*

### d) Outline the procedure for operating a Cashew Apple Juice extraction machine



Figure 7.5. Using a manual Cashew Juice Extractor.

Source: [www.africancashewalliance.com](http://www.africancashewalliance.com) 3

The proper use of a cashew apple juice extraction machine has many advantages. These are associated with safety of personnel, the proper output of the machine, how long the machine will last for its owners and the quality of product from the machine to ensure it is not harmful to consumers.

As already stated about the maintenance practices, every machine manufacturer will normally add a manual which gives users the right way of using the machine.

In addition, as noted, it is important for owners and users to ensure that the manual is read and understood before using the machine.



Paying good attention to and following the steps given on how to properly use a cashew apple juice extraction machine will ensure it is safe for use and assure quality of the product.

**A typical step-by-step process involved in operating and properly using cashew apple juice extraction machine is as follows:**

1. Pour cashew apples into machine hopper to fill up press cage.
2. Ensure a clean juice receiver is positioned under chute (press cage in manual machines) to collect pressed out juice.
  - Turn handle in clockwise direction to move piston and continue to turn until threaded shaft has fully moved into cylinder.
  - In mechanised machines, press the start button to turn the motor on.
3. Turn handle in anticlockwise direction to withdraw piston from chute end of the main container.
4. Remove press (screw shaft with handle and piston as a complete structure) and scoop out fibre residue into assigned container. Brush internal walls of any sticking fibre.
  - In mechanized machines, cashew fibre comes out automatically as screw shaft continues to work.

### e) Operate a Cashew Apple Juice Extraction Machine



Practical Exercise: Go to a juice extraction machine and follow the steps given to operate.

Use the checklist to follow the stated steps operating a cashew apple juice extraction machine. Rate your own performance critically and honestly after you have completed each activity.



Excellent



Okay



Try Again

Cashew apple juice extractor operation	Rate
1. Pour cashew apples into machine hopper to fill up press cage.	
2. . Remove hopper to give access to inside of main container. W Ensure a clean juice receiver is positioned under chute (press cage in manual machines) to collect pressed out juice. <ul style="list-style-type: none"> <li>○ Turn handle in clockwise direction to move piston and continue to turn until threaded shaft has fully moved into cylinder.</li> </ul> In mechanised machines, press the start button to turn the motor on	
3. Turn handle in anticlockwise direction to withdraw piston from chute end of the main container	
4. Remove press (screw shaft with handle and piston as a complete structure) and scoop out fibre residue into assigned container. Brush internal walls of any sticking fibre	
5. In mechanized machines, cashew fibre comes out automatically as screw shaft continues to work	

*Everything you need to accomplish your goals is already in you! Keep on working hard.*

**f) Maintain the Cashew Apple Juice Extraction machine**



Practical Exercise: Go to a juice extraction machine and go through the the given checklist for its maintenance. Remember to tick against every activity once you complete it.

Use the checklist to follow the stated steps in maintaining cashew apple juice extraction machine. Rate your own performance critically and honestly after you have completed each activity.



Excellent



Okay



Try Again

Daily Preventive Maintenance (PM) Activities	Rate
1. Visually inspect machine paying attention to main structure and other major parts for defects, wear and tear, and loose fasteners (bolts, screws). Inspect wire mesh for dents, scratches and cracks. Tighten all loose fasteners.	
2. Remove sieve and brush off any sticking fibre after each production.	
3. Remove hopper to give access to inside of main container. Wash hopper with clean warm water and mild food grade detergent at the end of each production day.	
4. Wash and clean press cage with warm water and mild food grade detergent, gently brushing the internal walls, screw shaft and corners at the end of each production day.	
5. Wash sieve in warm water at the end of each production day and air dry in clean area.	
Weekly PM Activities	Rate
1. Clean off old grease from screw stem with clean tissue (the point of the nut power screw shown in figure 7.3)	
2. Use food grade grease to lightly lubricate the screw stem.	
3. For mechanised systems, inspect motor belts to ensure it is well-tensioned.	
4. Move handle (wheel) in alternating sequence of clockwise and anticlockwise directions to ensure moving parts are operating freely.	
5. Check to ensure piston is firm in position. Tighten if loose.	

Everything you need to accomplish your goals is already in you! Keep on working hard.



## SELF ASSESSMENT

1. Outline the working principle of the cashew apple juice extraction machine.

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2. State the steps involved in maintaining the cashew apple juice extraction machine

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3. Outline the step by step process involved in operating the cashew apple juice extraction machine.

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*Well done! You have completed the first set of questions. This is very encouraging. Let's move on to proceed on your cashew apple processing learning journey.*

## 2. DEMONSTRATE SKILLS FOR OPERATING JUICE PROCESSING MACHINE

### a) Identify parts of a cashew apple juice processing machine

Apple juice processing involves a few steps after juice extraction. These include pre-heating, de-aeration, homogenisation, formulation, heat treatment (also known as pasteurisation), bottle filling and sealing, labelling, cooling and storage. All these processes involve certain activities which all contribute to obtaining the final product. In this section, we will learn about the heat treatment machine also called the pasteurisation machine.



Take note of the processes listed above and make time to learn about them. You can find useful information on the internet.



Figure 7.6. Pasteurizer

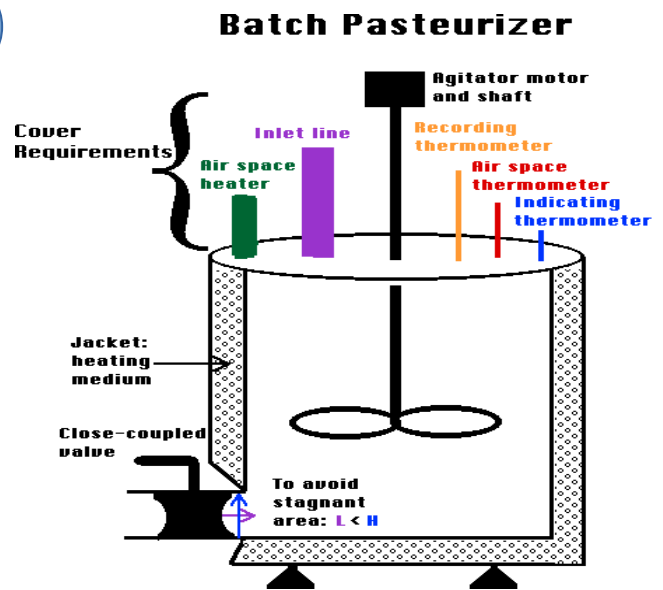


Figure 7.7. Schematic diagram

**Figure 7.6.** Pasteurizer. Source:

<https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwilyO789qbKAhUP-YUKHSd2BFwQjhx6BAGBEAI&url=https%3A%2F%2Fwww.indiamart.com%2Fproddetail%2Fstainless-steel-mixing-tank-20509664012.html&psig=A0vVaw3TnoBl8h27qYoajKUWMXyA&ust=1567128559644985>

**Figure 7.7.** Schematic diagram of a pasteurizer.

Source: <https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwi9h9Kw-abkAhUBixokHfIDDLkQjhx6BAGBEAI&url=https%3A%2F%2Fwww.uoguelph.ca%2Ffoodscience%2Fbook%2Fexport%2Fhtml%2F1912&psig=A0vVaw17dQrW3FdDSRm3QQ3vXhKN&ust=1567129204746677>



## Major parts of a cashew apple juice processing machine – Pasteurisation Machine:

To ensure the proper and easy use of a machine, operators must be able to identify and understand the use of the various parts of the machine.

1. The major parts of cashew apple juice pasteurization machine are as follows:
2. Agitator Motor and Shaft with stirrer: This rotates to stir the juice in the main tank. Some may come installed with what is called Variable Frequency drives, which allow you to increase or decrease the speed of rotation of the motor and hence, stirrer.
3. Gauges: Instruments that show temperature in tank (and pressure for steam heating mediums).
4. Heating medium: The means by which the juice is heated to the required temperatures. This can either be electric heating or steam.
5. Valve: regulates and directs the flow of juice into tank or from tank (inlet and discharge) Pump: the device for moving juice from tank or to tank.
6. Manhole: opening usually at the top of tank for product transfer and access into the tank
7. Tank: the main container for holding juice for pasteurisation.



Some machines have Programmable Logic Controllers (PLCs) which regulate heating by controlling valves. Are you familiar with a PLC?



Considering the heating medium in Figure 7.7, electric heating will imply that the jacket will contain what is called electric heating coils. Heating by steam will require steam supply line with valves to allow steam in and out of the medium.

### **b) Explain the working principle of a processing machine: Pasteuriser**

Pasteurisation, also known as thermal pasteurisation, is a method of preserving food which extends its shelf life. By heating the tank to temperatures between 65°C and 95°C, and stirring the juice in the tank to ensure uniform distribution of heat in the juice, what are known as vegetative cells of unwanted pathogenic and spoilage microorganisms are made inactive. Simply put, juice in the tank is heated to specified temperatures in order to slow down the rate at which it will expire.



Read over the working principle of the Pasteuriser and think over it carefully. Do you notice that heating is a traditional method of preserving most food items? Can you identify a few?

### c) State the Maintenance Practices of a Cashew Juice Processing Machine: Pasteuriser

As noted in (1) above, the habit of reading through machine manuals if they are available and sticking to directions as given by the manufacturer is essential to maintaining the machine properly. It is also important for maintenance technicians to take the necessary precautions, like being in the right PPEs, before they work on the Pasteuriser.



An important notice with this machine is that because it works with high temperatures, technicians must ensure that it cools down well enough before working on the heating parts. Again, basic PPEs like hand gloves, overalls and hairnets must be worn. Examples are shown in Figures 7.8 and

7.9



Figure 7.8 Hand Gloves

Source: <https://pksafety.com/pip-atg-maxiflex-cut-resistant-glove-34-8743-12-pairs/>



Figure 7.9: Overall for Mechanics

Source: <https://www.yarmo.co.uk/standard-boilersuit-2802/>

**The main preventive maintenance activities to be carried out on cashew apple juice pasteurizer are the following:**

#### **Daily PM Activities**

1. Visually inspect machine paying attention to main structure and other major parts for defects, wear and tear, and loose fasteners (bolts, screws). Inspect wire mesh for dents, scratches and cracks. Tighten all loose fasteners
2. When machine is in operation, check for leakages from pumps, valves and joints. If there are any, rectify them after the process. Also check that the gauges are functioning properly
3. Wash inside the tank (and juice transfer pumps and pipelines if installed) thoroughly with hot water after each production day.
4. Clean the outside of the tank of dust and other such items with a clean rag and water.

#### **Weekly PM Activities**

1. Inspect the shaft and stirrer to ensure that the stirrer is firmly in place. Tighten if loose
2. Check heating medium to ensure that it is working properly, and all related components are intact.
  - For electric heating, check heating coils connections
  - For steam heating, check steam lines and lagging

## Annual PM Activities

1. Inspect motors and pumps to ensure they rotate freely.
2. Calibrate all gauges to ensure they are working well

### d) Outline the Procedure for operating a Cashew Apple Juice processing machine



Paying good attention to the following steps given on how to properly use a cashew apple juice processing pasteurizer will ensure it is safe for use and assure quality of end product. It will also ensure the machine lasts long and is productive.

#### **A typical step-by-step process involved in operating and proper use of the cashew apple juice pasteurizer is as follows:**

1. Transfer extracted cashew apple juice into the main tank. If feed pumps are installed to transfer juice into tank, make sure that product inlet valves are open before running the pump. This is to prevent excessive pressure from building-up in the transfer pipes. Such excessive pressure can lead to the pump overheating and/or damage of the pump seals resulting in pump breakdown.
2. If juice transfer must be done manually, open the manhole and pour juice using clean utensils and ensure that operators are in the right PPEs.
3. Start the agitator motor to begin stirring the juice.
4. Start the heating medium.
  - If electric heating, press the required start button.
  - If steam heating, open the steam valve and ensure that the condensate valve is also open.
5. Observe the temperature gauge carefully until it reaches the required temperature level and stop heating
  - by putting the electric heater off or
  - by closing the steam supply valve as the case may be
6. Keep the agitator motor running for the stipulated period required for the pasteurisation process.
7. When the process is complete, begin to transfer the juice to the next process by opening the discharge valve or starting transfer pump (as the case may be).

### e) Operate Cashew Apple Juice Processing Machine



Practical Exercise: Go to a juice pasteurisation machine and follow the steps given to operate.

Use the checklist to follow the stated steps in maintaining the cashew apple juice Pasteurisation machine. Rate your own performance critically and honestly after you have completed each activity.



Excellent



Okay



Try Again

Daily PM Activities	Rate
1. Transfer extracted cashew apple juice into the main tank. If feed pumps are installed to transfer juice into tank, make sure that product inlet valves are open before running the pump.	
2. If juice transfer must be done manually, open the manhole and pour juice using clean utensils and ensure that operators are in the right PPEs.	
3. Start the agitator motor to begin stirring the juice	
4. Start the heating medium. <ul style="list-style-type: none"> <li>○ If electric heating, press the required start button.</li> <li>○ If steam heating, open the steam valve and ensure that the condensate valve is also open.</li> </ul>	
5. Observe the temperature gauge carefully until it reaches the required temperature level and stop heating <ul style="list-style-type: none"> <li>○ by putting the electric heater off or</li> <li>○ by closing the steam supply valve as the case may be</li> </ul>	
6. Keep the agitator motor running for the stipulated period required for the pasteurisation process.	
7. When the process is complete, begin to transfer the juice to the next process by opening the discharge valve or starting transfer pump (as the case may be).	

*Remember: everything you need to accomplish your goals is already in you. Keep going*

**f) Maintain Cashew Apple juice Processing Machine.**



Practical Exercise: Go to a juice pasteurisation machine and go through the the given checklist for its maintenance. Remember to tick every activity completed

Use the checklist to follow the stated steps in maintaining the cashew apple juice Pasteurisation machine. Rate your own performance critically and honestly after you have completed each activity.



Excellent



Okay



Try Again

Daily PM Activities	Rate
1. Visually inspect machine paying attention to main structure and other major parts for defects, wear and tear, and loose fasteners (bolts, screws). Inspect wire mesh for dents, scratches and cracks. Tighten all loose fasteners.	
2. When machine is in operation, check for leakages from pumps, valves and joints. If there are any, rectify them after the process. Also check that the gauges are functioning properly	
3. Wash inside the tank (and juice transfer pumps and pipelines if installed) thoroughly with hot water after each production day.	
4. Clean the outside of the tank of dust and other such items with a clean rag and water.	
Weekly PM Activities	Rate
3. Inspect the shaft and stirrer to ensure that the stirrer is firmly in place. Tighten if loose	
4. Check heating medium to ensure that it is working properly, and all related components are intact. <ul style="list-style-type: none"> <li>○ For electric heating, check heating coils connections.</li> <li>○ For steam heating, check steam lines and lagging</li> </ul>	
Annual PM Activities	Rate
1. Inspect motors and pumps to ensure they rotate freely.	
2. Calibrate all gauges to ensure they are working well.	

*Remember: everything you need to accomplish your goals is already in you. Keep on working hard.*



## SELF ASSESSMENT

1. Outline the working principle of the pasteurisation machine.

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2. State the steps involved in maintaining the cashew apple juice pasteurisation machine.

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3. Outline the step by step process involved in operating the pasteurisation machine.

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*Congratulations! You have completed the second set of questions.  
Let's move on to the next chapter.*

### 3. DEMONSTRATE SKILLS FOR OPERATING CASHEW PRODUCT PACKAGING EQUIPMENT

#### a) Identify parts of cashew product packaging equipment

The final stage in the cashew apple juice processing is packaging. To ensure product safety, aseptic filling is used. In which specially designed machines are used to fill and cap the containers into which the juice is filled. If such a machine is not available, it is recommended that the juice is filled into pre-sterilized bottles.

A hand-operated volumetric liquid filling machine can be used to fill bottles with cashew apple juice.

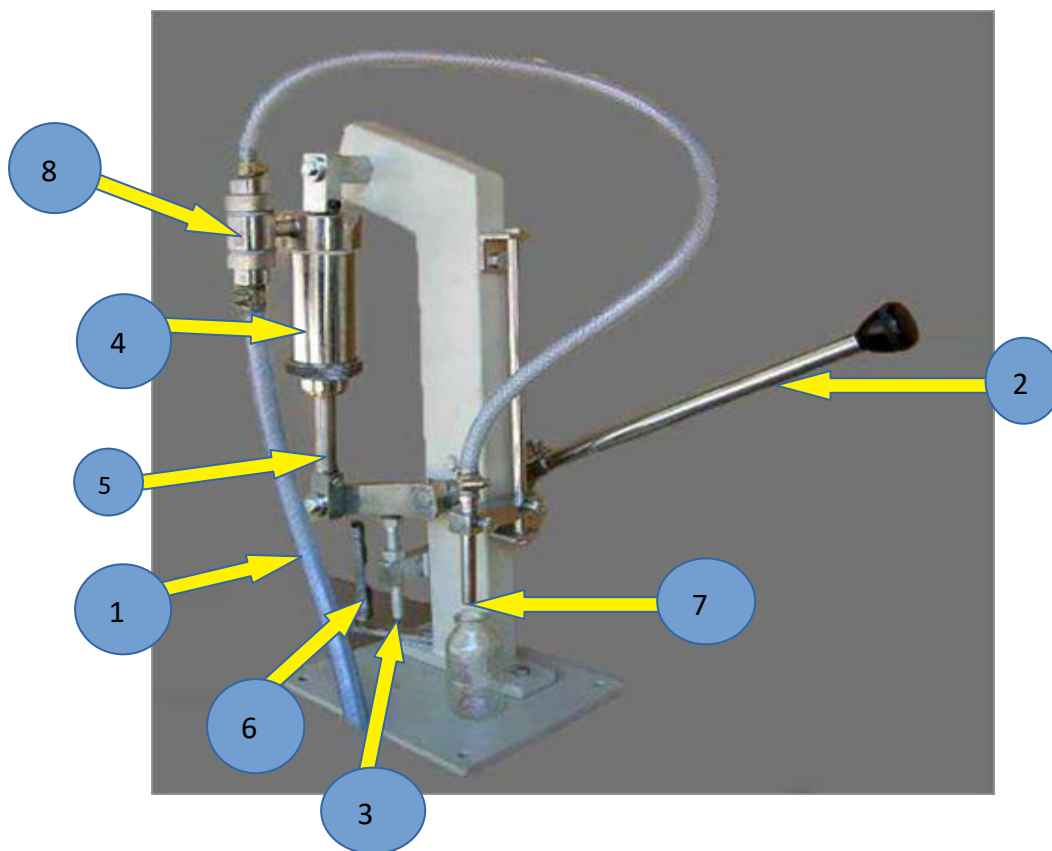


Figure 7.10 Hand-Operated Volumetric Liquid Filling Machine. Source: <https://www.google.com/url?sa=i&source=imgres&cd=&cad=rja&uact=8&ved=2ahUKEwi99cGZg6fkAhXOzYUKHZG7BWsQjhx6BAgBEAI&url=http%3A%2F%2Fwww.oilfillingmachne.net%2Fliquid-filling-machine.html&psig=AOvVaw2QiF1-cukl-AKg0jtbVGc4&ust=1567131843999785>





Figure 7.11: Manual Cashew apple juice packaging machine

Source: GIZ/ComCashew

**Major parts of a cashew apple juice Hand-Operated Filling Machine:**

**For the machine to be used properly and easily, operators must be able to identify and understand the use of the various parts of the machine.**

The major parts of Hand-Operated Filling machine are as follows:

1. **Inlet pipe:** This is inserted into the cashew apple juice container through which juice is sucked.
2. **Handle:** the bar that is moved up and down several times to move the piston up and down to cause suction effect at the inlet pipe. The up and down movement is called a stroke. The distance from up to down is adjustable and equals a set volume discharged from the machine.
3. **Stroke/Volume Adjusting nut and bolt:** normal bolt and nut that is turned clockwise or anticlockwise to increase or decrease stroke distance respectively, and hence, volume per stroke.
4. **Syringe:** Stainless steel tube with a nozzle and piston for sucking in and ejecting juice into bottles through outlet pipe.
5. **Piston:** Cylindrical component that moves in and out of the syringe to draw and discharge juice.
6. **Spring:** Elastic object that pulls the piston back to the down position after every stroke.
7. **Outlet pipe/nozzle:** the discharge point inserted into bottle to fill juice.
8. **Valve body:** contains inlet and outlet openings which regulate and direct the flow of juice into tank or from tank (inlet and discharge).

## b) Explain the working principle of packaging equipment

Cashew apple juice bottling and capping represent the final stage in the cashew apple juice process. To maintain product quality and safety in manually operated machines, it is always recommended that pre-sterilised bottles and crowns are used.

The juice filling machine works like a syringe. The movement of the handle causes the piston to move up and down the stainless-steel tube. When the handle is pushed down, the piston moves up and when the handle moves up, the piston moves down. Every downward movement of the piston causes a suction effect at the inlet pipe sucking juice through the pipe and through an inlet orifice or opening of the valve into the syringe. When the piston moves up, the juice is pumped from the syringe through an outlet orifice or opening of the valve through the outlet pipe/nozzle to be discharged into the bottle.

Notice that the valve openings do not all open at the same time. This means that at the time



- when juice is sucked through the inlet orifice, the outlet orifice is automatically closed and will not open.
- when juice is being discharged through the outlet orifice, the inlet orifice is automatically closed and will not open.

This is possible because of non-return or unidirectional valves in the valve body which allows juice to pass through them in only one direction.

## c) State the maintenance practices of packaging equipment

**Below are the maintenance practices of the cashew apple juice packaging machine.**

### Daily PM Activities

1. Disassemble machine and syringe to clean thoroughly in hot water
2. Sterilise the syringe, tubes/pipes and valve with alcohol of about 70% concentration
3. Inspect whole machine to ensure all parts are in good condition.
4. Clean the outside of the tank of dust and other such items with a clean rag and water.



It is always important to keep the machine as clean as possible. Also note that cleaning in hot water should normally be done first before sterilisation in alcohol as this will help the equipment to dry faster and keep it more hygienic.

**d) Outline the procedure for operating packaging equipment**

A typical step-by-step process involved in operating and properly using cashew apple juice packaging machine is as follows:

1. Insert the clean inlet pipe into the juice container.
2. Set the volume to be filled as per the bottle size.
3. This is done as follows:
  - a. Untie (turn anti-clockwise) volume adjusting nut and bolt.
  - b. Turn bolt clockwise to increase volume or anticlockwise to decrease volume.
  - c. Move the handle to fill trial bottles and adjust until desired volume is reached.
  - d. When desired volume is reached, tighten the nut (turn clockwise until it becomes firm on bar holding the bolt firmly in position). This adjusts the stroke distance of piston in the downward or suction direction.
4. Position bottles at the filling station and insert discharge nozzle into bottle and fill as per set volume.
5. Keep filling until batch is completed.

**e) Operate cashew product packaging equipment**



Practical Exercise: Go to a juice packaging machine to operate it. Remember to tick against every activity once you complete it.

Use the checklist to follow the stated steps in operating the cashew apple juice packaging machine. Remember to rate your own performance critically and honestly after you have completed each activity.



Excellent



Okay



Try Again

Steps in operating cashew apple packaging machine	Rate
Ensure the packaging equipment is clean 1. Insert the clean inlet pipe into the juice container	
2. Set the volume to be filled as per the bottle size.  This is done as follows: <ul style="list-style-type: none"> <li>○ Untie (turn anti-clockwise) volume adjusting nut and bolt.</li> <li>○ Turn bolt clockwise to increase volume or anticlockwise to decrease volume.</li> <li>○ Move the handle to fill trial bottles and adjust until desired volume is reached.</li> </ul>	
3. When desired volume is reached, tighten the nut (turn clockwise until it becomes firm on bar holding the bolt firmly in position). This adjusts the stroke distance of piston in the downward or suction direction	
4. Position bottles at the filling station and insert discharge nozzle into bottle and fill as per set volume.	
5. Keep filling bottles until batch is completed.	

*Remember: everything you need to accomplish your goals is already in you. Keep on working hard.*

**f) Maintain cashew product packaging equipment**



Practical Exercise: Go to a juice packaging machine and go through the the given checklist for its maintenance. Remember to tick against every activity once you complete it.

Use the checklist to follow the stated steps in maintaining the cashew apple juice packaging machine. Remember to rate your own performance critically and honestly after you have completed each activity.



Excellent



Okay



Try Again

Daily PM Activities	Rate
1. Disassemble machine and syringe to clean thoroughly in hot water.	
2. Sterilise the syringe, tubes/pipes and valve with alcohol of about 70% concentration.	
3. Inspect whole machine to ensure all parts are in good condition.	
4. Clean the outside of the tank of dust and other such items with a clean rag and water.	

*Remember: everything you need to accomplish your goals is already in you. Keep on working hard.*



## SELF ASSESSMENT

1. Explain the working principle of cashew apple juice packing machine.

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2. Name the major parts of cashew apple juice machine and state their uses.

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3. What is the most important maintenance practice to be carried out on the cashew apple juice packaging equipment?

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*You are making great progress! You have completed another set of questions. Take a break or go ahead and start with the next chapter.*