LEARNING FACILITATING MATERIALS

NATIONAL PROFICIENCY LEVEL 2

TRADE AREA: **CASHEW PROCESSING**

UNIT 5

MANUAL RAW CASHEW NUT PROCESSING

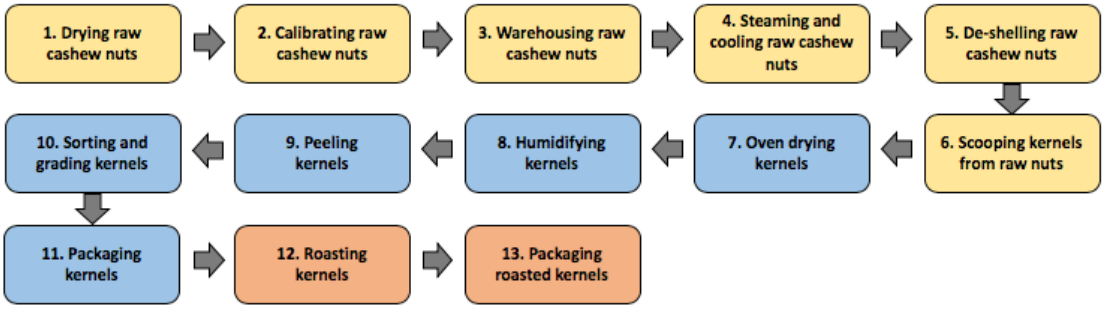
This publication has been produced with the assistance of the Ghana Skills Development Initiative (GSDI) III, a project implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in cooperation with the Council for Technical and Vocational Education and Training (COTVET) on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), co-funded by the European Union (EU) and the Swiss State Secretariat for Economic Affairs (SECO). The contents of this publication are the sole responsibility of GIZ and COTVET and can in no way be taken to reflect the views of the stakeholders.

UNIT INTRODUCTION

Welcome to Unit 5 of your learning journey in manual raw cashew nut processing. This guide explains the main steps in the manual raw cashew nut processing process.

The flow chart below shows the entire processing process in 13 steps and will guide you throughout this unit:

- Yellow: Raw cashew nut processing
- Blue: Cashew kernel processing
- Orange: Cashew kernel roasting



In this unit, you will learn about steps 1 to 8. The learning material covers five sub-units:

1) Pre-treatment of raw cashew nuts (Step 1 to 4)
2) De-shelling raw cashew nuts (Step 5)
3) Scooping cashew kernel (Step 6)
4) Oven drying cashew kernel (Step 7)
5) Humidification of cashew kernel while oven drying (Step 8)

Each sub-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 produce high-quality cashew kernels for the domestic and international market. The better the quality of your kernels, the higher your processing margins! If you produce high-quality cashew kernels, you can build a stable customer base.

Even though, this learning material provides essential information on manual raw cashew nut processing for National Proficiency Level 2, you should also look out for new information, innovations and technological advances during your practical work that expand your knowledge and skills.

Are you ready to start your cashew learning journey? Let's start!

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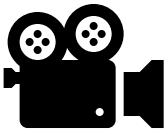


WATCH VIDEO

SELF ASSESSMENT

WELL DONE!

TAKE A BREAK!

ABBREVIATIONS

Here are some commonly used abbreviations.

°C	Degree Celsius
cm	Centimetre *(1 cm = 10 mm)*
CNSL	Cashew Nut Shell Liquid
g	Gram *(1 kg = 1000 g)*
kg	Kilogram *(1000 g = 1 kg)*
kg/cm^2	Kilogram or Kilogram Force per Square Centimetre (Pressure Unit)
m	Meter *(1 m = 100 cm)*
mm	Millimetre *(10 mm = 1 cm)*
MT	Metric Tons *(1 MT = 1000 kg)*
RCN	Raw Cashew Nuts

1. DEMONSTRATE SKILLS IN PRE-TREATMENT OF RAW CASHEW NUT

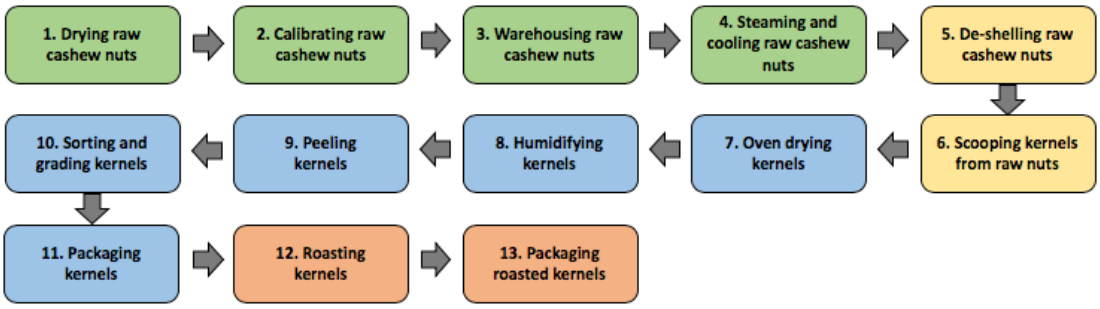
a) Explain pre-treatment of raw cashew nut

Pre-treatment covers all processes from raw cashew nut drying to steaming of raw cashew nuts.

Pre-treatment involves four (4) steps:

1. Drying
2. Calibrating
3. Warehousing
4. Steaming and cooling of raw cashew nuts

The green fields indicate the steps of the processing process you are currently studying.



For more information on pre-treatment, watch video on *Cashew Processing in Ghana* from Minute 0:00 to 1:08, watch video on *Cashew Nut Processing – Peace Corps Ghana* from Minute 1:34 to 2:22, and watch video on *African cashew processing* from Minute 1:38 to 2:40.

Source: GIZ/ComCashew – Steamed and air-cooled raw cashew nuts ready for de-shelling

b) State the importance of pre-treatment

Pre-treatment is important because it prepares the raw cashew nuts for de-shelling, which is the most difficult part in raw cashew nut processing. It is important to follow each step thoroughly to obtain a high-quality cashew kernel after for de-shelling.

1. **Drying:**
   - Dry raw cashew nuts to a moisture content of maximum 9 %, which is ideal for warehousing
     - The moisture content of maximum 9 % prevents deterioration of the raw cashew nuts during storage
   - Dry raw cashew nuts on a clean concrete floors or tarpaulins spread on a flat surface
   - Modern drying methods involve the use of drying machines that run on electricity

Only well-dried raw cashew nuts are calibrated and bagged in jute sacs for warehousing and use throughout the year.

Source: GIZ/ComCashew – Drying of raw cashew nuts on concrete floors

2. Calibrating:

- Calibration is the process of grouping raw cashew nuts into different sizes according to their diameter
- Calibration is important in order to adjust the cutting blades of the manual de-shelling equipment and/or the mechanical de-shelling machines according to the size of the raw cashew nuts in the processing line
- Calibration is important in order to process only same-sized raw cashew nuts at once and therefore calibration:
    - increases de-shelling efficiency
    - reduces breakage during de-shelling
    - assures even drying during oven treatment
    - facilitates grading of cashew kernels

If the raw cashew nuts are well calibrated and the cutting blades are adjusted according to the size of the raw cashew nuts in the processing line, the processing yield is higher.

Yield in cashew processing refers to the amount of whole white kernels obtained (in grams, kg or MT) in comparison to the total amount of RCN processed.

Source: GIZ/ComCashew – Calibrating raw cashew nuts and bagging in jute bags

3. <u>Warehousing:</u>

- Processors must secure their raw cashew nuts during the cashew harvest season from January to May/June every year
- Proper warehousing is important to ensure that the raw cashew nuts maintain a high-quality throughout the storage period of up to one year
- Proper warehousing prevents damage to the raw cashew nuts by insect pests and other microorganisms
- Raw cashew nuts should be stored in jute bags in a ventilated warehouse and arranged in stacks to:
    - facilitate stocktaking and counting of bags
    - prevent humidity gain from the floor
    - reduce heat

Source: GIZ/ComCashew – Storing raw cashew nuts in a ventilated warehouse

4. <u>Steaming:</u>

- Heat treatment eases the separation of the kernel from the shell
- Heat treatment is important because it concentrates the cashew nut shell liquid (CNSL) into a jelly-like fluid to reduce the corrosive effect of CNSL on the hands of factory staff during manual de-shelling

Source: GIZ/ComCashew – Steaming of raw cashew nuts in preparation for de-shelling

c) State the factors to consider in pre-treatment

In the calibration process, the raw cashew nuts are separated into different sizes with the help of an electric calibrator.

The five (5) most common sizes used for calibrating (grouping) raw cashew nuts are:

- 18 mm
- 20 mm
- 22 mm
- 24 mm
- more than 24 mm

After calibration, store the dried raw cashew nuts in jute bags according to the calibrated sizes with a standard net weight of 80 kg per bag.

During warehousing:

- Arrange the 80 kg jute bags in stacks on pallets
  - It is advisable to use wooden pallets on the floor as a thermal insulator and to prevent the dried raw cashew nuts from absorbing moisture through the cooling of the floor
- Group 80 kg bags with the same-sized raw cashew nuts on the pallets
- Label each stack with the size of the calibrated raw cashew nuts with information on source of origin and initial date of storage to ensure traceability
- Place the stacks in 1.5 m distance to the walls
- Keep a minimum of 1.5 m space between the roof of the warehouse and the top of the stacks to avoid excessive heating and scorching of the raw cashew nuts.

This storage technique enables visible counting of the bags and facilitates control of the stock throughout the year.

The warehouse must be well ventilated to minimise humidity and be equipped with fire extinguishers.

Source: GIZ/ComCashew – Storing raw cashew nuts in jute bags in a ventilated warehouse

There are three (3) methods for heat treatment:

1. Steaming
2. Drum roasting
3. Oil bath roasting

Steaming raw cashew nuts in a boiler is the most common method for heat treatment:

- Steam raw cashew nuts to soften the shells until they become brittle and easy to cut (de-shell).
- After steaming, spread the raw cashew nuts evenly on a clean surface for cooling and air-drying for 2 - 3 days.

The steaming time, pressure and temperature (°C), depends on the type of boiler used for heat treatment of raw cashew nuts.

Consult your in-company facilitator for detailed instructions!

Make good use of cashew nut shells!
Use cashew nut shells to fire the boiler to steam raw cashew nuts.

Source: GIZ/ComCashew – Raw cashew nut shells used to fire the boiler

d) State the uses of pre-treatment equipment

The following tools and equipment are required for pre-treatment:

- **Raw Cashew Nut Calibrator** to group and store raw cashew nuts according to different sizes in **Jute Bags**

Source: http://www.mekongmachine.com/product/raw-cashew-cleaning-calibration-machine/

- **Water Heater** and **Steam Boiler** for heat treatment of raw cashew nuts to soften the shells until they become brittle and easy to cut

Source: https://www.tradeindia.com/fp2036979/Steam-Boiler-For-Cashew-Nut-Processing.html

- **Shovel** to fill the water heater with firewood, briquettes and cashew nut shells for steaming

Sources: https://kentandstowe.com/Our-Products/Digging/Stainless-Steel-Pointed-Spade

- **Wheel Barrow** to transport the steamed raw cashew nuts to the drying site

Source: https://www.coopsuperstores.ie/Garden/Garden-Tools/Garden-Wheelbarrow/Build-It-Galvanised-Wheelbarrow-100lt-1773313

- **Rubber Boots** to protect your feet during pre-treatment

Source: https://www.lamps2udirect.com/garden-and-outdoor-lighting/full-length-green-wellington-boots-uk-size-11-euro-size-45/143256

- **Gloves** to protect your hands during pre-treatment

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

e) Outline the procedure for pre-treatment

Use the checklist to follow steps 1 to 10 in pre-treatment of raw cashew nuts. Rate your own performance critically and honestly after you have completed each activity.

 Excellent  Okay  Try Again

Activities	Rating
1. Ensure raw cashew nuts are well dried on concrete floors or tarpaulins with a maximum moisture content of 9 %	
2. Pour the dried raw cashew nuts in the calibrator and place jute bags under each hole	
3. Calibrate raw cashew nuts according to sizes: 18mm, 20mm, 22mm, 24mm and more than 24 mm.	
4. Once the jute bags are filled up to 80 kg, close the jute bags with a needle and a nylon thread.	
5. Store jute bags according to their calibrated size in a ventilated warehouse and mark them with their calibrated size and source of origin.	
6. Pick bags of calibrated raw cashew nuts from the warehouse and fill same-sized raw cashew nuts into the steamer.	
7. Use briquettes and cashew nut shells to heat the boiler and to generate steam.	
8. Steam the raw cashew nuts according to the required time, pressure and temperature (°C) Caution! Steam exits the steaming chamber	
9. Take out steamed raw cashew nuts from the steaming chamber and transport them to the cooling floor.	
10. Cool raw cashew nuts for 2 to 3 days before transferring them to the de-shelling section.	

The harder you work for something, the greater you will feel after you have achieved it.

f) Pre-treat raw cashew nut

Practical Exercise: Go to the processing factory for your apprenticeship and conduct pre-treatment of raw cashew nuts.

Source: GIZ/ComCashew – Firing steamer for heat treatment of raw cashew nuts

SELF ASSESSMENT

1. Explain pre-treatment of raw cashew nut.

2. State the importance of pre-treatment.

3. State the factors to consider in pre-treatment.

4. Outline the procedure for pre-treatment.

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

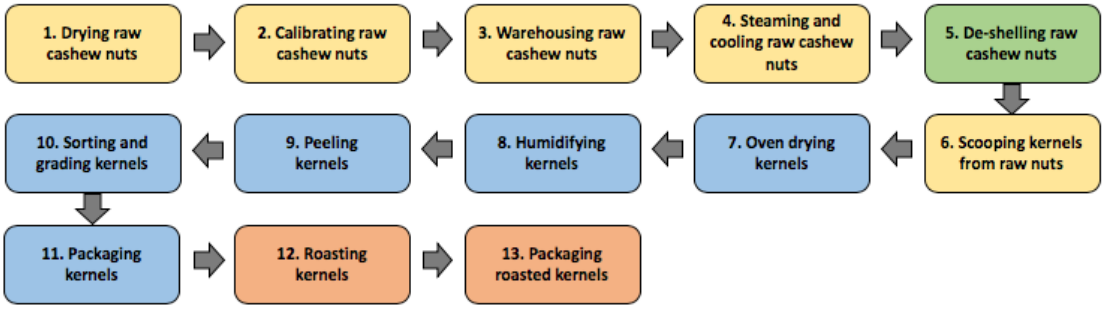
2. DEMONSTRATE SKILLS FOR DE-SHELLING RAW CASHEW NUT

a) Explain de-shelling of raw cashew nut

De-shelling is the process of separating the kernels from the raw cashew nut shells. De-shelling is also known as shelling, cutting or cracking the cashew nut shell open to obtain the kernel.

For de-shelling raw cashew nuts, you can use manually-operated machines or (semi-) mechanised de-shelling machines to cut the cashew nut shell open.

The green field indicates the step of the processing process you are currently studying.



For more information on de-shelling, watch video on *Cashew Processing in Ghana* from Minute 1:10 to 1:46, watch video on *Cashew Nut Processing – Peace Corps Ghana* from Minute 2:24 to 3:11, watch video on *African cashew processing* from Minute 2:40 to 3:29.

Source: GIZ/ComCashew – Manual de-shelling section

b) State the importance of de-shelling

De-shelling is the most important step in the processing process. The objective of de-shelling is to obtain the highest percentage of whole/complete kernels and to prepare them for easy peeling.

In manual de-shelling, you must be precise and accurate to avoid kernel breakage in order to increase your kernel outturn.

Experienced workers de-shell 40 - 50 kg of raw cashew nuts per 8-hour shift and have a kernel outturn of more than 90 % of whole kernels.

Experienced workers acquired 10 - 15 kg of cashew kernels in an 8-hour shift.

Manual de-shelling is labour-intensive but offers formal employment and stable incomes for people living in rural communities, especially for women. At the moment, manual de-shelling tends to be more efficient in producing higher percentages of kernels compared to mechanical processing.

Source: GIZ/ComCashew – Manual de-shelling in cashew processing factory

c) State the factors to consider in de-shelling

In manual de-shelling, the equipment consists of two blades and a handle or leg-operated lever:

- Before inserting the raw cashew nut, adjust the cutting blades according to the size of the calibrated raw cashew nuts in the processing line.
- Check the spring strength and pull the cutting blade in its original position.
- Use your hand to insert the raw cashew nut in the gap between the two blades.

The position of the nut is important to reduce breakage. The objective is to cut the shell without cutting or damaging the kernel inside.

- Pull the handle or leg-operated lever to bring the blades closer together in order to cut into the shell.
- After cutting, the nut falls in a collection bowl

In some cases, the cashew kernel is loose and can be removed by hand during de-shelling. In other cases, the kernel is stuck in the cashew shell and moves to the scooping section.

In de-shelling, use three (3) different trays for sorting:

1) Cashew shells → send to pre-treatment section as biofuel for the boiler
2) Cashew kernels → send to drying and humidification section
3) Cashew kernels still in the shell → send to scooping section

- The nuts are weighed, and de-shelling volumes are recorded for economic monitoring of processing activities and to assure profitability of the processing business.
- Record keeping also helps with knowing which workers are doing well (to be given bonuses) and who needs further training.

Cashew shells can be used to:

- extract cashew nut shell liquid (CNSL)
- press and produce fuel briquettes
- generate energy in big processing units with high volumes of cashew shell
- sell to companies that use large boilers such as cement factories

In manual de-shelling, use rubber gloves to protect your hands from the corrosive CNSL. You can also use vegetable and seed oils such as coconut oil, castor seed oil or sunflower oil.
CNSL stains your clothes. Wear a work uniform during de-shelling.

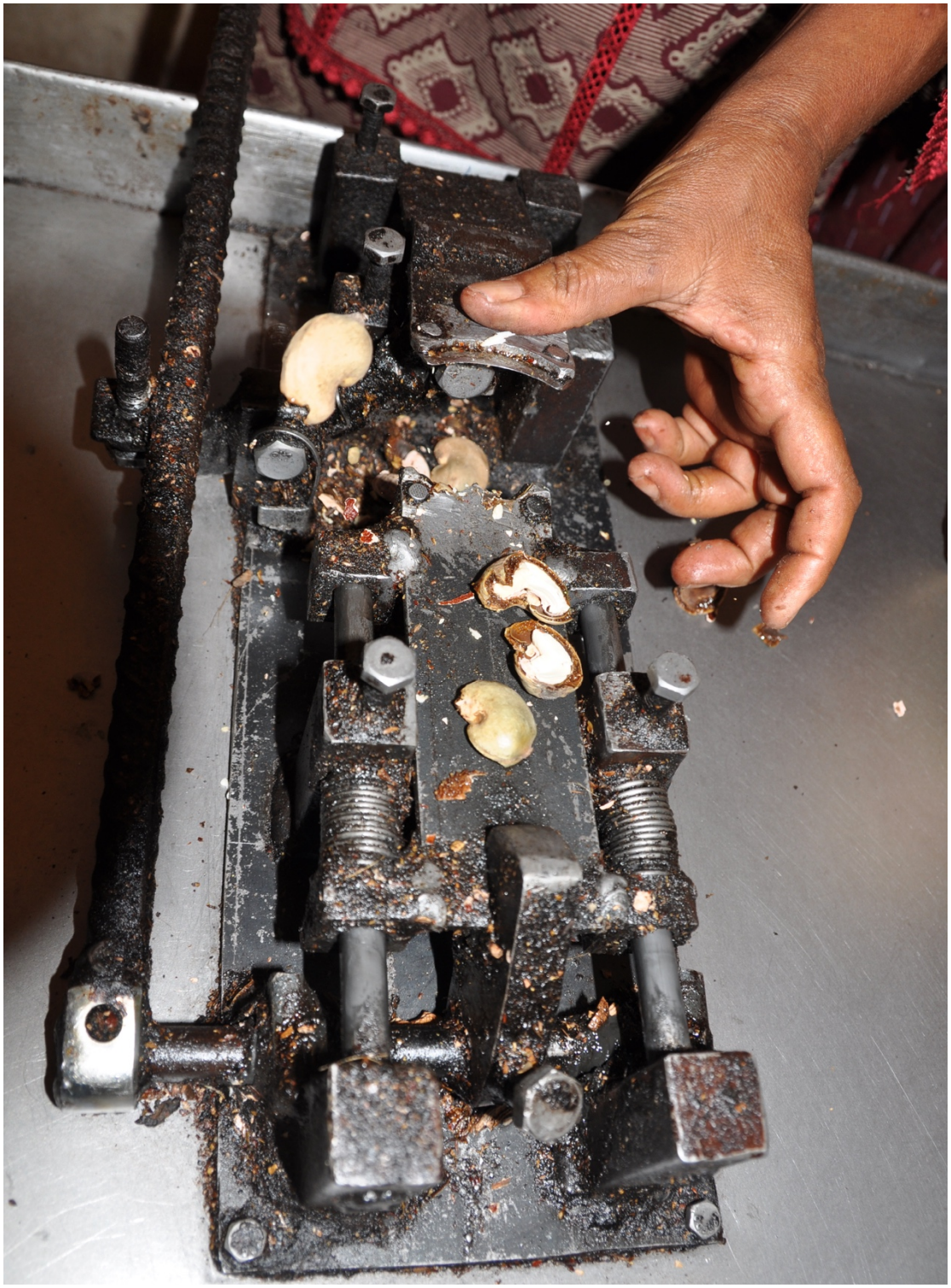
Precaution against the effects of CNSL on workers hands:

- Dip your hands in oil every 10 - 15 minutes to avoid contact of CNSL with skin
- Wipe the CNSL off your hands before applying new oil because the CNSL on your hands will contaminate the fresh oil in the bowl
- Assure regular hand washing with soap and water throughout the day

d) State the uses of de-shelling equipment

The following equipment are required for de-shelling:

- **Manual Hand Shelling Machine** to crack raw cashew nuts open.
  - Do not cut into the cashew kernel to increase your kernel outturn!
  - Ensure that you obtain whole kernels



Source: GIZ/ComCashew – Manual de-shelling equipment by hand

- **Mechanical Shelling Machines** such as **'Buddhi' Machines** for semi-automated de-shelling of raw cashew nuts
    - Load the raw cashew nuts into the funnel on the left side of the machine
    - The machine cuts each raw cashew nut individually
    - After cutting, shells and kernels fall into a plastic container and must be sorted according to:
        - Kernels
        - Shells and
        - Kernels still attached to the shell are scooped by factory staff

Source: GIZ/ComCashew – Buddhi Machines for de-shelling raw cashew nuts

e) Outline the procedure for de-shelling

Use the checklist to follow steps 1 to 9 in de-shelling. Rate your own performance critically and honestly after you have completed each activity.

 Excellent  Okay  Try Again

Activities	Rate
1. Adjust the blades according to the size of the calibrated raw cashew nuts in the processing line	
2. Check the spring strength and pull the cutting blade in its original position	
3. Apply vegetable or seed oils to protect your hands from the corrosive cashew nut shell liquid	
4. Use your hand to insert the raw cashew nut in the gap between the two blades	
5. Position the nut well between the blades to ensure efficient shelling and to reduce kernel breakage	
6. Pull the handle or leg-operated lever to bring the blades closer together in order to cut into the shell. Do not cut into the cashew kernel!	
7. Use your hands to separate loose cashew kernels from the shell. Place kernels in a separate tray	
8. Place empty cashew shells in a different tray	
9. Place cashew shells with in-shell kernel in a third tray for scooping	

Sometimes we are tested not to show our weakness, but to discover our strength.

f) De-shell raw cashew nut

Practical Exercise: Go to the processing factory for your apprenticeship and de-shell raw cashew nuts.

SELF ASSESSMENT

1. Explain de-shelling of raw cashew nut.

2. State the importance of de-shelling.

3. State the factors to consider in de-shelling.

4. Outline the procedure for de-shelling.

Congratulations! You have completed the second set of questions. Perfection is not always attainable, but if we chase perfection we can catch excellence! Let's move on to the next chapter.

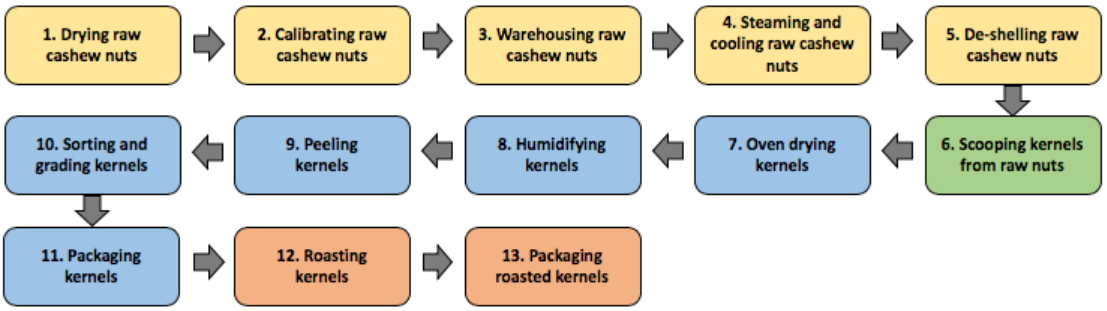
3. DEMONSTRATE SKILLS FOR SCOOPING CASHEW KERNEL

a) Explain scooping of cashew kernel

After de-shelling, some kernels remain attached to the shell and must be removed by factory staff. Scooping is process of removing the cashew kernel from shell with the help of a sharp needle - the scooping tool.

Manual scooping is the most effective way to obtain the whole kernel from the cashew nut shell.

The green field indicates the step of the processing process you are currently studying.



For more information on scooping, watch video on *Cashew Processing in Ghana* from Minute 1:45 to 2:04, watch video on *Cashew Nut Processing – Peace Corps Ghana* from Minute 2:46 to 3:04, watch video on *African cashew processing* from Minute 2:40 to 3:07.

Source: GIZ/ComCashew – Female employee conducting scooping in cashew processing factory

b) State the importance of scooping

Scooping is an important activity in raw cashew nut processing, because manual scooping increases the amount of whole kernels that can be obtained from the cashew nut shell. Processors want to achieve the maximum number of whole kernels, because the market value for whole kernels is higher than for broken kernels.

After cracking the raw cashew nut open, the whole kernel or smaller pieces are sometimes stuck in the shell. The challenge is in recovering the whole kernel that is sticking to the shell. Manual scooping increases the chances to obtain the whole kernel from the shell.

Scooping is a labour-intensive, slow and tedious process. Experienced workers scoop minimum 80 kg of raw cashew nuts in an 8-hour shift, this is 17 kg of kernels per day. Experienced scoopers can obtain maximum 90 – 95 % of whole kernels from the shells.

Another mechanical option to remove the cashew kernel from the nut shell is the use of air blowers and shakers to separate the light shell pieces from the kernels.

<u>Once scooping is completed:</u>

- the kernels are weighed, and kernel volumes are recorded for economic monitoring of processing activities and to assure profitability of the processing business.
- record keeping also helps with knowing which workers are doing well (to be given bonuses) and who needs further training.

Source: GIZ/ComCashew – Cashew kernels with testa skin after scooping

Precaution against the effects of CNSL on workers hands:

- Dip your hands in oil every 10 - 15 minutes to avoid contact of CNSL with skin
- Wipe the CNSL off your hands before applying new oil because the CNSL on your hands will contaminate the fresh oil in the bowl
- Assure regular hand washing with soap and water throughout the day

c) State the factors to consider in scooping

In manual scooping, place the un-scooped raw cashew nuts in one hand and use your other hand to remove the kernel with a sharp needle.

The objective of scooping is to obtain clean and whole kernels without any cracks.

Perfect your scooping skills to ensure a high percentage of whole kernels.

Use the scooping needle to ensure that you do not damage the kernel. Be careful, the needle is sharp. Do not poke yourself!

In scooping, use three (3) different trays for:

1) Cashew shells → send to pre-treatment section as biofuel for the boiler
2) Cashew whole kernels → send to drying and humidification and thermal shock section
3) Cashew broken kernels → send to drying and humidification and thermal shock section

In manual scooping, use rubber gloves to protect your hands from the corrosive CNSL. You can also use vegetable oils such as coconut oil, castor seed oil or sunflower oil.

CNSL stains your clothes. Wear a work uniform during de-shelling.

d) State the uses of equipment for scooping

The following tools, materials and equipment are required for de-shelling:

- Use a **sharp needle** to scoop the cashew kernel out of the cashew nut shell.

Source: http://www.asyl-immenstadt.de/1-st%C3%BCck-2-st%C3%BCcke-5-st%C3%BCcke-holz-griff-n%C3%A4hahle-hand-stitcher-leder-leinwand-schuh-reparatur-werkzeug-punch-n%C3%A4hen-nadel-haken-werkzeug-ali-76572635.html

- Wear **Rubber Gloves** to protect your skin from the corrosive cashew nut shell liquid (CNSL)

Source: https://my.rs-online.com/web/p/disposable-gloves/0484221/

- Apply **Castor Oil** to protect your skin from the corrosive cashew nut shell liquid (CNSL)

Source: https://chiltanpure.com/product/castor-oil-price-skin-hair-food-pakistan/

- Store and transport cashew kernels in **Storage Boxes** within the factory

Source: GIZ/ComCashew – Plastic boxes to store and transport cashew kernels within the factory

- Place the cashew kernels in different **Stainless-steel Bowls** directly after scooping

Source: GIZ/ComCashew – Metal bowls to grade cashew kernels

e) Outline the procedure for scooping

Use the checklist to follow steps 1 to 5 in scooping cashew kernels from the shell. Rate your own performance critically and honestly after you have completed each activity.

Excellent Okay Try Again

Activities	Rate
1. Place the un-scooped raw cashew nuts in one hand	
2. Place the needle between cashew nut shell and cashew kernel as a lever	
3. Scoop the whole kernel out of the shell and place it in a tray	
4. Place the shell in a separate tray	
5. If you broke the kernel, place the smaller pieces in another tray	

Every challenge is an opportunity.

Source: GIZ/ComCashew – Cashew shells and kernels for scooping

f) Scoop cashew kernel

Practical Exercise: Go to the processing factory for your apprenticeship and scoop cashew kernels from the cashew nut shells.

Source: GIZ/ComCashew – Scooping cashew kernels

SELF ASSESSMENT

1. Explain scooping of cashew kernel.

2. State the importance of scooping.

3. State the factors to consider in scooping.

4. State the uses of equipment for scooping.

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

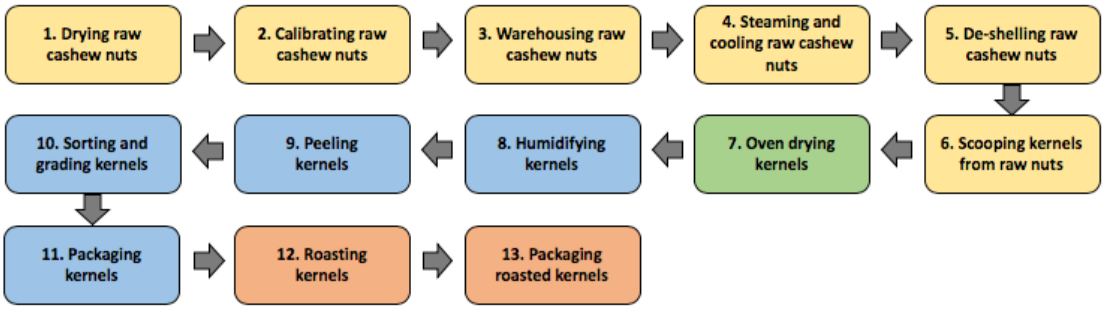
4. DEMONSTRATE SKILLS FOR OVEN DRYING CASHEW KERNEL

a) Explain oven drying of cashew kernel

After removal from the shell, there is still an inner reddish skin or testa that remains on the nut. The objective of the oven treatment is to prepare the removal of the testa and enable easy peeling.

The temperature (°C) and duration for drying cashew kernels depend on the type of oven that is used for drying raw cashew nuts. Consult your in-company facilitator for detailed instructions!

The green field indicates the step of the processing process you are currently studying.



For more information on oven drying, watch video on *Cashew Nut Processing – Peace Corps Ghana* from Minute 3:13 to 3:34

Source: GIZ/ComCashew – Oven drying in cashew processing factory

b) State the importance of oven drying

The importance of heating cashew kernels is to reduce the moisture content in the cashew kernel and to loosen the testa skin around the cashew kernel (through thermal shock treatment) to facilitate peeling. The process flow for thermal shock consists of three main steps: 1) heating in the oven, 2) steam treatment to provoke a thermal shock and 3) oven heating again. Oven heating, also referred to as oven drying, reduces the moisture level and loosens the testa. The thermal shock treatment makes the testa brittle. After every stage the kernels are cooled down naturally. A humidifier can be added after the second oven heating in order to restore the moisture level. This is optional but can be considered a must in case of mechanical peeling.
Cashew kernels are dried in the oven until the moisture content is between 2 - 4.5 %.

c) State the factors to consider in oven drying

Consider the following factors during oven drying:

- Load the kernels on trays, preferably wire trays to allow air ventilation during heating
- Do not crowd the trays to ensure uniform drying
- Mount the trays with cashew kernels on trolleys and move them into the heating chamber
- Maintain the inside temperature of the chamber uniformly to preserve the original colour of the cashew kernels
    - Non-uniform heating might result in scorching
- The maximum temperature of the hot chamber should not exceed 85 °C to ensure that cashews do not burn / scotch
- Ensure air circulation inside the chamber for uniform drying
    - In case the oven type does not allow uniform heating, move the position of the kernels in intervals of 2 - 3 hours by churning them.
    - Switch the trays from top to bottom and bottom to top to ensure uniform drying.

Source: GIZ/ComCashew – Cashew kernels with testa skin before oven drying

d) State the uses of equipment for oven drying

The following equipment are required for oven drying:

- The most common, conventional and specially-designed oven used for oven drying cashew kernels is called **Borma Oven**.

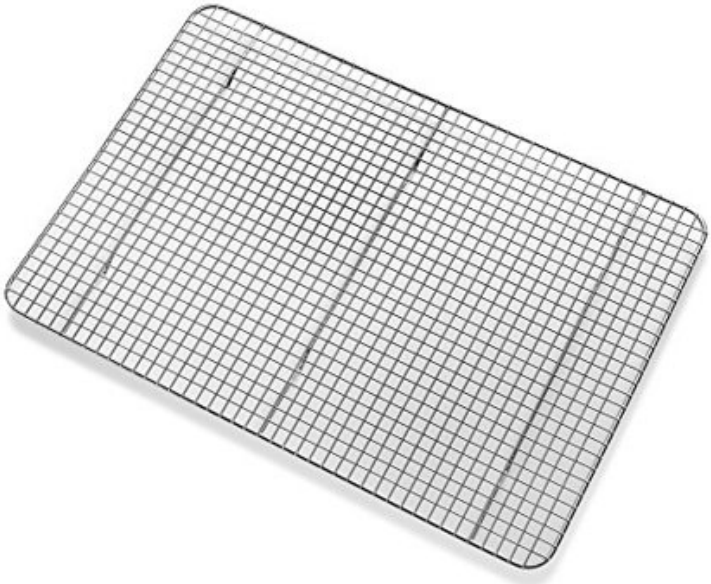
Source: https://www.indiamart.com/proddetail/cashew-hot-house-borma-dryer-13999180388.html

The best performing ovens work electrically; have electronic temperature control and enable uniform heating. It is highly recommended to use such a modern electric oven. Uniform heating reduces the number of scorches and facilitates peeling. Especially in the case of mechanized peeling, uniform heating makes a large difference in terms of obtaining wholes.

The output of the oven section depends on the oven losses. Losses are caused by scorched kernels and can be limited by proper and uniform heating treatment. The oven loss should be max 6 %.

The main technological evolutions on ovens relate to energy saving, uniform drying and electronic control of temperature and time. Continuous dryers include a cooling tunnel and humidifier in order to assemble all steps into one machine. This new type of dryer is most appropriate for larger volumes although smaller scale models are also available.

- Pour cashew kernels on **wire metal trays** for uniform drying



Source: https://www.walmart.com/ip/Bellemain-Cooling-Rack-Baking-Rack-Chef-Quality-12-inch-x-17-inch-Tight-Grid-Design-Oven-Safe-Fits-Half-Sheet-Cookie-Pan/234932728

- Pour cashew kernels on **wire metal trays with wooden or metal frames** for labelling cashew kernels

Source: GIZ/ComCashew – Oven drying on wire trays with wooden frame

e) Outline the procedure for oven drying

Use the checklist to follow steps 1 to 7 in oven drying. Rate your own performance critically and honestly after you have completed each activity.

 Excellent  Okay  Try Again

Activities	Rate
1. Load cashew kernels on trays (6 - 8 kg in a tray) and spread out in a thin layer of 5 to 10 cm.	
2. Sort the wholes from pieces and put them on separate trays. This allows for more uniform heating.	
3. Move the trays on trolleys into the heating chamber	
4. Set the oven temperature at 80 to 85 °C, do not exceed 85 °C.	
5. Keep the kernels in the oven for 7 - 8 hours	
6. In case the oven type does not allow uniform heating, move the position of the kernels in intervals of 2 - 3 hours by churning them	
7. Move the trolleys out of the heating chamber to cool down the kernels naturally for 1 - 2 hours	

Don't stop when you are tired. Stop when you are done.

Note: All timings and temperatures are subject to change as per equipment used. Slight change can be noticed with different locations and equipment. Consult your in-company facilitator for detailed instructions!

f) Oven-dry cashew kernel

Practical Exercise: Go to the processing factory for your apprenticeship and dry cashew kernels in an oven.

SELF ASSESSMENT

1. Explain oven drying of cashew kernel.

2. State the importance of oven drying.

3. State the factors to consider in oven drying.

4. Outline the procedure for oven drying.

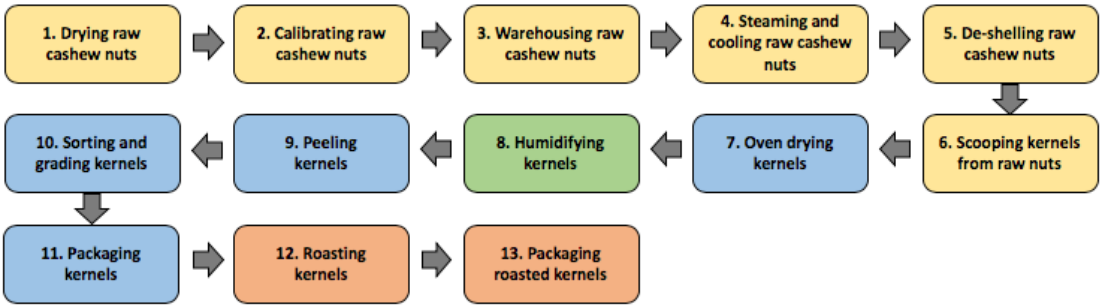
Great success, you are almost done! Let's tackle the last chapter.

5. DEMONSTRATE SKILLS IN HUMIDIFICATION OF CASHEW KERNEL WHILE OVEN DRYING

a) Explain humidification in cashew kernel oven drying

Humidification is the treatment of cashew kernels with water mist or steam after drying to increase the moisture content of the cashew kernel.

The green field indicates the step of the processing process you are currently studying.



b) State the importance of humidification in oven drying

Humidification is important because the process restores the moisture level of the kernels after they have been dried during oven heating. Humidification is a must in case of mechanized peeling as it reduces the number of broken kernels. Humidification is most often performed in a separate chamber equipped with an electric humidifier at the end of the oven heating process.

The ideal moisture content of the cashew kernels during peeling is 4 - 5 %.

If the moisture content is below 4 - 5 % during peeling, the percentage of the broken cashew kernels will increase because the kernel is brittle.

Humidification is important to increase the moisture content of the cashew kernels to facilitate peeling and to prevent breakage during peeling.

c) State the factors to consider in humidification

Consider the following factors during humidification:

- Use the same trolleys, mounted with trays of cashew kernels during humidification that you already loaded for oven drying
- Do not crowd the trays with cashew kernels
- Ensure uniform humidification

Remember! Oven-drying, and humidification are interlinked.

The process of oven-drying and humidification is called thermal shock and involves up to seven (7) steps:

1. First oven drying for 7 - 8 hours, at 80 - 85 °C. Do not exceed 85° C
2. Natural cooling for 1 - 2 hours
3. Thermal Shock / Steaming for 7 - 8 minutes, at a steaming pressure of 8 – 10 kg/cm^2
4. Natural cooling for 1 - 2 hours
5. Second oven-drying for 1 - 2 hours, at 80 - 85 °C. Do not exceed 85° C
6. Natural cooling for 1 - 2 hours
7. Humidification for 1 - 3 hours until the moisture level is restored to 4 - 5 %

Contraction and expansion through the thermal shock process loosens the testa skin from the kernel:

- Drying reduces the moisture content of the kernels and results in the contraction of the testa
- Humidification increases the moisture content and causes expansion of the testa

d) State the uses of equipment for humidification

The following equipment are required for oven drying:

- A **modern thermal shock system**, that combines drying and humidification in the same chamber.

- **Metal trolleys** are used to transport the cashew kernels on **wire metal trays** between sections in the processing factory.

Source: http://www.cashewmachines.com/humidifier/cashew-kernels-humidifier/

Three equipment are needed: 1) drying oven, 2) thermal shock chamber equipped with a steam generator, and 3) electric humidifier. Workers facilitate the flow across the chambers. The kernels are usually loaded on trays and moved along the different installations/chambers.

The kernels are kept in trolleys and humidified in a closed room. The humidification period depends on the atmospheric conditions and the moisture level of kernels. The treatment time therefore varies.

More modern thermal shock systems combine drying and humidification in the same chamber for thermal shock – hot and cold shock of cashew kernels to facilitate easy removal of the testa skin from the kernel.

Some processors use cool artificial water mist to treat cashew kernels, humidify them (moisturized by water mist) by means of electrical humidifiers. Some factories do not use this process of humidification to avoid the quality loss of the kernels. Instead of humidification they use dry cooling.

e) Outline the procedure for humidification

Use the checklist to follow steps 1 to 9 in humidifying (thermal shock) cashew kernels. Rate your own performance critically and honestly after you have completed each activity.

 Excellent  Okay  Try Again

Activities	Rate
1. After the first oven drying, move the trolleys in the thermal shock chamber (6 - 8 kg of kernels in a tray) for steaming	
2. Increase the pressure of the steam to 8 - 10 kg/cm^2 and open the steam valve. Control pressure gauge. The pressure should not drop below 4 kg	
3. Steaming time is approximately 7 - 8 minutes	
4. Open the door after 7 - 8 minutes and cool down naturally for 1 - 2 hours	
5. For the second oven-drying, move the trolleys in the oven again and set the oven temperature at 80 - 85 °C, let it not exceed 85 °C	
6. Keep the kernels in the oven for 1 - 2 hours	
7. Open the door after 1 - 2 hours and cool down naturally for 1 - 2 hours	
8. Move the kernels in the humidification chamber and switch on the humidifier	
9. Keep the kernels in the chamber for 1 - 3 hours until the moisture level is restored to 4 - 5 %	

Our greatest weakness is giving up. The most certain way to succeed is always to try one more time.

Note: All timings and temperatures are subject to change as per equipment used. Slight change can be noticed with different locations and equipment. Consult your in-company facilitator for detailed instructions!

f) Undertake humidification of cashew kernel while oven drying

Practical Exercise: Go to the processing factory for your apprenticeship and humidify cashew kernels.

SELF ASSESSMENT

1. Explain humidification in cashew kernel oven drying.

2. State the importance of humidification in oven drying.

3. State the factors to consider in humidification.

4. Outline the procedure for humidification.

Congratulations! Well done! You have completed this unit successfully.

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